DRAFT

SUSTAINING
MICHIGAN'S WATER HERITAGE

A Strategy for the Next Generation

– DRAFT –

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Vision

Michigan's water resources support a healthy environment, healthy citizens, vibrant communities and sustainable economies.

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Introduction

Water defines Michigan. It is deeply rooted in the state's culture, heritage and economy. With more than 11,000 inland lakes, 76,000 miles of rivers, 6.5 million acres of wetlands and more than 3,200 miles of freshwater coastline—the longest in the world—leveraging the power and presence of this treasured natural resource and ensuring its long-term sustainability are critical to advancing Michigan's prosperity.

Clean, abundant freshwater is a competitive advantage for Michigan and it is growing in importance. At the beginning of 2015, the World Economic Forum in its global risk report identified water crisis as the number one risk influencing the global economy.[1] Michigan's water resources are vitally important for agricultural production, irrigation, drinking water, electric utilities, mining, manufacturing and water supply to lakes and streams that support valuable fish, waterfowl and wildlife populations. Michigan's abundant water assets and research capabilities, in addition to its highly-skilled talent, economic development expertise, innovation and invention, and powerful tourism and business marketing brand, are pivotal drivers for attracting business creation and investment.

With this abundance comes a deep sense of responsibility and stewardship - but Michigan has not always treated its water with a sense of care. Today, the state is slowly returning to a level of aquatic health in many waterways and lakes necessary to fully support diverse fish and wildlife and meaningful recreation in many communities. Through longstanding public and private partnerships and tremendous investment of time and resources, communities are making significant progress in cleaning up legacy contamination.

But that is just the beginning. The ability to achieve Michigan's vision for its water resources depends on a strategic, collaborative ecosystem-based plan that monitors the health and condition of our water resources, invests in water-related infrastructure, uses water more thoughtfully and efficiently to grow sustainable economies, reconnects communities to water, and fosters a water ethic and culture of stewardship.

Michigan's Water Strategy - An Ecosystems Approach

The forthcoming Water Strategy takes an ecosystem approach, focused on the fact that Michiganders are a part of the ecosystem in which we live and therefore have an effect on the health of our water resources. The Strategy recognizes the core values identified with water are four fold: economic, environmental, social and cultural. All are equally important. Communities across Michigan recognize the value of water quality improvement activities supported through state and federal investments. According to Brookings Institution and Grand Valley State University, restoring water quality and shorelines respectively result in a 3-to-1 and 6.6-to-1 return on investment in the form of increased property values and local economic development and improved ecosystem health and quality of life.

The value of water is not exclusively economic nor is it solely environmental, though without a healthy environment, human uses are diminished and fish and wildlife perish. Social value is represented as how water forms a basis for activity and time with friends and family, and how these uses create joy and memories. Cultural value is about identity and affinity to place: where we choose to live and why; who and what we identify with; and where our stories, myths and beliefs come from. For Michiganders, water – and especially the Great Lakes – forms a core part of identity and culture.

The approach recognizes that each of these four values needs to be addressed in balance with the others. They temper and mold each other; they exist together and may require compromise, accommodation and limits. This approach is reflected in the Strategy through its goals, outcomes and recommendations.

A Roadmap to Achieve the Vision

The Water Strategy outlines a 30-year vision shaped by a desire for high-quality, accessible water resources protected by and for present and future generations based on the question asked in multiple forums around the state: *"What do you want Michigan and Michigan's water resources to look like and do over the next generation?"* Throughout the development of the Strategy, Michiganders said they care deeply about the Great Lakes, rivers and inland lakes, groundwater, and water in general. It is this caring that ultimately drives the ability to support, choose, manage and fund the requirements of healthy water. To that end, the Strategy recognizes that decisions made now regarding infrastructure, technology, monitoring and water literacy will set the course for decades.

Great Lakes, Water and Governance

The Great Lakes and Michigan water resources have long been recognized as a valuable resource fundamental to our way of life by federal and provincial governments, tribal nations and the eight states within the basin. The Great Lakes region has long-standing governance and institutional structures, organizations and other formal and informal mechanisms focused on protecting, restoring and maintaining the integrity of this vast water resource. These include the International Joint Commission, Great Lakes Water Quality Agreement, Great Lakes–St. Lawrence River Water Resource Compact Agreement, Council of Great Lakes Governors, Great Lakes Commission, Great Lakes Fishery Commission and many others. As a result, decisions made with regard to Michigan's water resources are subject to collaboration, consultation, oversight and regulation under a complex framework of regional governance structures and federal, state and tribal laws.

Government-to-government relationships are an important part of the governance landscape in Michigan as recognized by the 2002 Government-to-Government Accord between the state of Michigan and the federally recognized Indian tribes within the state's borders. For generations, the Indian tribes have resided in the Great Lakes region and

depended on the Great Lakes and Michigan's inland lakes, rivers, streams and groundwater for their way of life. These water resources provide food, transportation and drinking water, in addition to fulfilling many cultural purposes.

Exploitation of native fisheries, wildlife and forests during Michigan's emergence as the manufacturing center of the nation created great wealth and a high quality of life, but also devastated native fish populations, impacted water quality, and left a complex and costly legacy of contamination. Federal, state, tribal and local regulation and restoration programs have made substantial progress in addressing this legacy. This network of programs and actions has been instrumental in reaching toward the goals of ensuring drinkable, swimmable, and fishable waters as established in Michigan's Natural Resource and Environmental Protection Act, Safe Drinking Water Act, the federal Clean Water Act, and cleanup statutes such as the Environmental Remediation and Leaking Underground Storage Tank Act. In addition to these efforts, recent investments by the federal government through the Great Lakes Restoration Initiative have accelerated efforts to clean up and restore our water resources and fish and wildlife populations, and to improve quality of life in many communities.

Government-to-government relationships, statutes, regulations and management programs all play a critical and complementary role to the actions recommended in the Water Strategy. Driving progress toward the goals and the outcomes will depend on harnessing this complex framework of governance, institutions, and regulations to continue to build durable relationships and collaboration around common interests.

Strategic Action

The Water Strategy charts a course by providing recommendations and identifying strategic actions to:

Protect and Restore Aquatic Ecosystems – Michigan needs more integrated, holistic approaches to managing water on and across the landscape, including groundwater, which support healthy ecological systems and hydrologic integrity at the watershed scale.

Ensure Clean and Safe Waters – Michigan needs to protect and restore water quality to ensure ecosystem function and support current and future human uses of Michigan's surface and groundwater resources.

Create Vibrant Waterfronts – Michigan needs an emphasis on water resources as assets in state, regional and community planning efforts to create vibrant and sustainable communities, a robust recreation and tourism industry, and a thriving environment and economy.

Support Water-Based Recreation – Michigan needs to create greater opportunity for access to water resources through water trails and appropriate public access.

Promote Water-Based Economies – Michigan needs to collectively build robust multi-sector and multidisciplinary public-private partnerships between business, industry, academia, private capital and government. These partnerships will link ideation, invention and innovation, research and development, capital investment and end users. This approach will bring technologies to the market to better manage and solve water challenges in Michigan and across the globe. Directed research and development to address specific water challenges should provide the basis for forming a new paradigm of collaboration.

Invest in Water Infrastructure – Greater and consistent investments are needed in water-related infrastructure improvements to address aging and deteriorating systems that are now causing water quality issues and public health concerns. The people of Michigan also need to better recognize the connection between investments in water infrastructure systems and the benefits it provides, including delivery of safe drinking water, management of stormwater and wastewater, enhanced recreational opportunities, and healthy ecosystems and economies.

Monitor Water Quality – Michigan needs to develop and fund a coordinated, long-term monitoring strategy to provide baseline and trend information about surface and groundwater quality and quantity. This information is necessary to base decisions and best direct actions and future investments to support healthy people, ecosystems, communities and economies.

Build Governance Tools – Michigan needs to build new models of governance at the local and regional level to address increasingly complex and intractable problems facing Michigan's water resources. Implementation efforts will require not just state agencies, but a wide array of individuals, organizations, businesses, industries and tribal and local governments across the state to continue to build on this multi-stakeholder collaborative approach.

Inspire Stewardship for Clean Water – Most importantly, Michigan residents need greater opportunities to learn about water. Michigan is surrounded by 20 percent of the world's fresh surface water, and with that comes a deep ethical obligation to be good and thoughtful stewards of this global treasure. A shared water ethic will guide Michigan into the future and ensure our children and future generations will have the same or better quality of life than we have today. The durability of this Strategy and ensuring the health of our water resources for generations to come depends on creating a culture of stewardship through lifelong education about water.

We call on all people of Michigan to be thoughtful and engaged stewards of our water resources.

Water Strategy Framework

The Water Strategy is organized around nine goals and outcomes designed to ensure the viability and sustainability of Michigan's water resources over time, while placing Michigan on the path to achieving its water vision in a way that builds economic capacity while sustaining ecological integrity of this crucial resource for future generations.

The Water Strategy includes 62 recommendations that are a set of interconnected ideas to drive a new relationship between Michigan's communities, governments, and residents to solve complex water challenges and create greater opportunities for economic and social well-being. The recommendations are designed to drive performance and behavior change, address barriers and contribute toward achieving the desired outcomes. The ability to achieve the stated goals and outcomes will require both the implementation of recommendations in the Strategy and continued implementation of the entire suite of existing water-related programs and initiatives, some of which are noted in Appendix 3.

The Strategy includes an Implementation Plan (Table 2) comprised of recommendations, a lead actor charged with implementation and an implementation metric to measure progress toward accomplishing the recommendation. A wide host of actors and agents across the state, including governments, tribal nations, nonprofits, industry, businesses, individuals, and local and regional philanthropies will need to be involved. Therefore, the Water Strategy is not a specific action plan only for government, though there are many actions that government can and should take. Rather, it is a strategy for all people of Michigan, believing that together, we can have a positive impact on the future of the state.

Additional recommendations were identified during the development process as important to achieving outcomes but are of lessor priority and are included in Table 3.

Measures of Success

The Strategy includes measures of success intended to examine system response over time as a result of the collective impact of implementation of the Water Strategy recommendations and other efforts already underway by state, federal and local governments and partners to rebuild healthy aquatic systems, clean water and vibrant economies. Achieving success will require integrating planning strategies for water resources with local units of government, unifying plans between the state, regions and local units of governments, and collaborating with stakeholders. Additionally, success will require an integrated process for adapting to new science and understanding of complex issues, evaluating progress, and making course corrections necessary to achieve outcomes.

Table 1: Water Strategy Priority Recommendations and Measures of Success

Table 1 highlights 22 key priority recommendations as a subset of the 62 recommendations in the Water Strategy. These recommendations address the most critical and imminent issues facing Michigan's water resources as well as some of Michigan's greatest opportunities to enhance our economy and strengthen the relationship people have to water. Key recommendations were identified based on input received during the development of the Strategy.

Measures of success are included to measure progress toward achieving outcomes as a result of the implementation of all of the Water Strategy recommendations and other efforts already underway by state, federal and local governments and partners.

Protect and Restore Aquatic Ecosystems		
	Goal 1: Michigan's aquatic ecosystems are healthy and functional.	
	Outcome: Aquatic ecosystems are resilient and diverse	
	Key Recommendations	Measures of Success
	▪ Prevent introduction of new AIS and control established populations. ▪ Develop a comprehensive strategy to prevent nuisance and harmful blue green algal blooms. ▪ Achieve a 40% phosphorus reduction in the western Lake Erie basin. ▪ Promote green infrastructure, low impact development and green spaces to rebuild hydrologic integrity and address storm water.	▪ Brook trout are present and thriving with no net loss of cold water habitat due to water withdrawals and habitat manipulations. ▪ Sturgeon are considered rehabilitated in 10% of streams targeted for rehabilitation in Michigan's Lake Sturgeon Rehabilitation Strategy. ▪ Lake trout are naturally reproducing and supporting wild fish-based fisheries in Lakes Superior, Huron, and Michigan. ▪ Appropriate reduction in nuisance and harmful algal blooms. ▪ Waters of the state meet Water Quality Standards for being swimmable, fishable and drinkable. ▪ Reduction in annual volume of untreated sewage discharges. ▪ Reduce the number of designated use impairments due to wet weather discharges.

Ensure Safe and Clean Water

Goal 2 – Michigan's water resources are clean and safe.

Outcome: Surface and groundwater are managed to support sustainable human uses and ecological function.

Key Recommendations	Measures of Success
▪ Protect drinking and source water from contamination and spills. ▪ Pass a statewide sanitary code and inspection requirements. ▪ Secure long-term funding to accelerate clean-up of contaminated sites. ▪ Establish priorities and address emerging pollutants of concern.	▪ 100 percent of the population has safe drinking water with no reported violations of health-based standards. ▪ No drinking water advisories, beach closures or aquatic life impairments due to harmful algal blooms. ▪ No designated use impairments due to failing on-site wastewater systems. ▪ No new designated use impairments due to emerging pollutants of concern

Create Vibrant Waterfronts

Goal 3 – Michigan communities use water as a strategic asset for community and economic development.

Outcome: Economic and community development plans and efforts fully leverage water assets to create great places to live, work and play.

Key Recommendations	Measures of Success
▪ Leverage water resource assets at state, regional and local level to create sustainable economic opportunities. ▪ Support investments in commercial harbors and ports and address long-term maritime infrastructure needs.	▪ All community and economic development plans integrate water resource assets.

Support Water-based Recreation

Goal 4 – Michigan's water resources support quality natural resources, recreation and cultural opportunities.

Outcome: Waters of the state are world renowned for recreational pursuits such as hunting, fishing, boating and swimming.

Key Recommendations	Measures of Success
▪ Expand real-time monitoring of beaches. ▪ Prioritize investments in recreational harbors to address long-term infrastructure needs. ▪ Develop and implement a water trails system.	▪ 30% increase in water-based recreation and tourism. ▪ 90% of the population has convenient access to swimmable and fishable water. ▪ By 2020, 100% of the state's recreation harbors will have an infrastructure asset management plan to ensure a safe harbor.

Promote Water-based Economies

Goal 5 – Michigan has a strategic focus on water technology and innovation to grow sustainable water-based economies.

Outcome: Policies and innovative technologies are developed and adopted to grow and promote sustainable water-based economies.

Key Recommendations	Measures of Success
▪ Accelerate water technologies to solve water problems using an entrepreneurial business-led initiative. ▪ Establish voluntary water efficiency targets for all major water dependent sectors.	▪ Michigan is recognized as a place to invest and locate a business because of its support for sustainable water technologies, water conservation, and high quality of life. ▪ Increase in percentage of economic output per gallon of water utilized.

	▪ Develop a water conservation and reuse strategy.	▪ Increase in water sector employment and earnings at the statewide and county level.
Invest in Water Infrastructure	**Goal 6 - Michigan invests in infrastructure and supports funding to maintain clean water and healthy aquatic ecosystems.**	
	Outcome: People support investment of both public and private funding of Michigan water resources.	
	Key Recommendations	Measures of Success
	▪ Establish a long-term Water Fund to achieve Water Strategy goals including water infrastructure management.	▪ Sustained funding is in place to implement the Water Strategy and achieve the goals of the Strategy. ▪ Outcome-based asset management plans are implemented and progress is achieved toward true cost of service for water utilities.
Monitor Water Quality	**Goal 7 - Michigan has integrated outcome-based monitoring systems that support critical water-based decisions.**	
	Outcome: Monitoring systems are in place at a scale and frequency to ensure water quality and quantity are maintained to support diverse uses and values.	
	Key Recommendations	Measures of Success
	▪ Implement a pilot water resource decision framework. ▪ Support groundwater and surface water monitoring.	▪ Achieve a net stabilization of groundwater depth across the state. ▪ Long-term monitoring strategies are being implemented.
Build Governance Tools	**Goal 8 - Michigan has the governance tools to address water challenges and provide clean water and healthy aquatic ecosystems.**	
	Outcome: Policies, organizational and institutional structures are in place to achieve goals and outcomes of the strategy.	
	Key Recommendations	Measures of Success
	▪ Create an integrated system for managing water at the local level to achieve water quality and quantity outcomes. ▪ Retain full authority to continue to manage Michigan's water resources.	▪ By 2030, achieve a 40% reduction in number of designated uses or impaired waters.
Inspire Stewardship for Clean Water	**Goal 9 – Michigan citizens are stewards of clean water and healthy aquatic ecosystems.**	
	Outcome: Individuals and communities understand their responsibility for and make informed and responsible decisions regarding water resources.	
	Key Recommendations	Measures of Success
	▪ Integrate water literacy into state of Michigan curriculum standards.	▪ Increase the number of citizens with knowledge and understanding of water literacy principles. ▪ Michigan citizens support funding for water and implementation of the Water Strategy.

PROTECT

and restore aquatic ecosystems

Chapter 1: Protect and Restore Aquatic Ecosystems

Goal: Michigan's aquatic ecosystems are healthy and functional.

Outcome: Aquatic ecosystems are resilient and diverse.

Healthy, functional ecosystems purify air and water, provide habitat for fish and wildlife, support natural resource-based economies, serve as buffers from flooding, and support recreational activities. All long-term, sustainable uses of water depend on intact ecological and hydrologic systems. Ecosystems link living organisms with the non-living components of their environment like the water, soil, and air. While the Strategy focuses on the water component of ecosystems, it recognizes that changes in the make up or distribution of organisms, disturbances on the land or in the air also impact water and that the management of water on and across the landscape or hydrology directly affects those systems.

For example, the introduction of aquatic invasive species (AIS) in the Great Lakes region has been a major challenge to the resiliency and diversity of aquatic ecosystems. The presence of invasive species combined with nutrient runoff can have devastating impacts on fisheries and other aquatic life, disrupt the ecology of lakes and streams as well as contribute to nuisance aquatic plant growth and algae blooms. In a few areas of the Great Lakes, nuisance algal growths have been associated with botulism outbreaks, "muck" (organic debris) washing up on beaches, and impacts to drinking water systems. Some nuisance algal growths have also been characterized as harmful algal blooms (HABs).

The practice of moving water off the landscape as quickly as possible has resulted in both positive and negative consequences. Since the mid-1800s, Michigan has developed more than 35,000 miles of public drains, serving more than 17 million acres of agricultural and urban lands and roadways. These drains provide benefits by removing excess storm water, preventing damage from flooding, improving soil productivity, and enabling residential and commercial development. However, these extensive drainage systems were designed without consideration of the long-term consequences of modifying the natural hydrology.

In addition, other hydrologic modifications like storm drains and extensive impervious surfaces contribute to less infiltration and increased surface water runoff and flow, resulting in increasingly "flashy" streams. These cause stream bank erosion and increase sediment loads, transporting nutrients that impair aquatic life. The loss of infiltration can reduce vital recharge of aquifers and reduce base flow to streams. In rural areas, infiltration to deeper depths is interrupted by tile drains designed to conduct water away

from fields. These changes can pollute receiving waters, impact aquatic life that depends on groundwater-fed streams during summer months, and affect human groundwater use.[2]

Changing weather events will also require changes in water management. While Michigan's future climate is unclear, variability in precipitation from year-to-year is large. Despite lower than average lake levels during the past decade, total annual precipitation has increased in the Great Lakes basin by 4.5 inches from 1915 to 2004, with 4.2 of those inches occurring from 1955 to 2004.[3] The intensity of extreme weather events leads to more rapid runoff, greater flashiness in streams, sediment loadings and flooding events. Current infrastructure capacity was not designed to effectively handle this increase.

The Water Strategy focuses on reducing threats to aquatic ecosystems and implementing watershed-based approaches to restore hydrologic integrity and improve aquatic ecosystem resiliency. Holistic watershed-based approaches that slow the movement of water across the landscape, increase infiltration capacity, reduce erosion, sediment, nutrient flow and wastewater discharges, and increase aquifer recharge are needed for long-term preservation of Michigan's hydrology.

Prevent Introduction of and Manage Aquatic Invasive Species

Since the 1800s, more than 182 nonindigenous aquatic organisms, including animals, plants, bacteria and viruses, have colonized the Great Lakes ecosystem, forever altering its ecology. The introduction of AIS into the Great Lakes and inland waters has caused significant damage to the state's natural resources and many human uses.

Impacts include Eurasian water milfoil clogging inland lakes, the devastating effects of sea lamprey on fish communities, round gobies taking bait, and water fleas snagging fishing lines. Of particular note, invasive mussels have disrupted the energy flow, nutrient cycling and food web which has resulted in changes in fish communities and have contributed to nuisance aquatic plant growth and algae blooms. The intensive filtering activities of zebra and quagga mussels have greatly increased water clarity, allowing the long filamentous algae known as Cladophora, as well as other types of algae, to grow to nuisance levels in areas where it previously did not occur. When Cladophora dies and breaks loose, it creates conditions ripe for the production of the botulinum toxin in Great Lakes sediments by creating the very low oxygen conditions required by Type E botulism spores to become active. Type E botulism outbreaks have resulted in the death of waterbirds and fish kills. While there are no management options currently available for broad-scale control of zebra and quagga mussels, there are ongoing efforts to evaluate the efficacy of new management options such as the biocide Zequanox, a naturally occurring bacteria being tested to specifically control zebra and quagga mussel populations.

Michigan has led the region for decades in focusing on prevention of new introductions and minimizing impacts of established invasive species. To combat the introduction of new AIS and minimizing the impacts of established ones, Michigan developed the second state AIS

management plan in 1996, later updating it in 2013. It provides a comprehensive strategy outlining new actions and enhancing existing efforts to prevent and control AIS in Michigan waters, including continued support for separation of the Great Lakes and Mississippi watersheds. In addition, the Michigan Department of Natural Resource's Fisheries Division Strategic Plan, *Charting the Course: Fisheries Division's Framework for Managing Aquatic Resources*, provides specific actions to support healthy aquatic ecosystems and sustainable fish populations. It also provides strategic assessments and tools to inform decision-making. However, more is needed. Long-term mandates for the prevention of new invasive species into the basin will depend on a collaborative approach.

Recommendations

Prevent the introduction of new AIS and control existing AIS populations in accordance with the Michigan Aquatic Invasive Species Management Plan.

Work with other Great Lakes states and provinces to harmonize aquatic invasive species prevention, early detection processes, and response actions across the Great Lakes region.

Accelerate research and solutions to identify mechanisms of food web disruption and changes of nutrient flows in the Great Lakes with a focus on the effects of invasive species.

Reduce Occurrence and Impacts of Harmful and Nuisance Algal Blooms

Nuisance algal blooms are increasingly a problem in the Great Lakes and have been documented in some inland waters. Some algal blooms are dominated by blue-green algae also known as cyanobacteria that produce harmful toxins and these blooms are characterized as harmful algal blooms (HABs) based on concentrations of toxins produced. The most common algal toxins are Microcystin, Anatoxin-a, Cylindrospermopsin, and Saxitoxin. For example, the toxin Microcystin is produced by the cyanobacteria *Microcystis*. HABs occur when Microcystin exceeds the World Health Organization's non-drinking water guideline of 20 ug/l or drinking water criteria of 1 ug/l in water bodies with drinking water intakes. However, state agencies will likely adopt new criteria as additional information becomes available.

The presence of these toxins are known to impact human health and aquatic life can cause closures of drinking water systems and beaches, including a well-publicized HAB in western Lake Erie in 2014 that prompted Toledo officials to shut down the drinking water system and a few areas in Michigan. Health symptoms commonly associated with algal toxin exposure include nausea, skin rashes, gastro-intestinal distress, numbness and fatigue.[4] These toxins can also kill fish and other aquatic life. The most commonly monitored algal toxin in Michigan is Microcystin; however, MDEQ is evaluating monitoring protocols for other toxins.

Algal blooms are caused by many factors, including excessive inputs of nutrients, usually phosphorus and to a lesser extent nitrogen. Meteorological conditions can also play a role

in determining algal bloom severity and seasonal dynamics. For example, the occurrence and duration of extreme weather events, such as heavy rainfall and droughts, may influence the development of algal blooms by intensifying the magnitude and timing of nutrient delivery from the watershed.[5] In addition, changes in the food web caused by the introduction of invasive species can change the way nutrients are partitioned in the environment or change environmental conditions enough to trigger algal blooms. Physical factors affecting water temperature, light penetration and water column mixing may also contribute to create potentially favorable conditions for algal blooms.

Addressing agricultural point and nonpoint sources of sediment and nutrients that have been identified as a major source of the pollutants in recent western Lake Erie Basin studies conducted in both Michigan and Ohio is one step to combating HABs. These opportunities include promoting changes in the use of phosphorus through mechanisms like the 4R Program (Right Source, Right Rate, Right Time, Right Place), implementation of the Michigan Agriculture Environmental Assurance Program (MAEAP) suite of practices, restoration of grasslands and wetlands, use of vegetative filter strips, and use of technologies like precision farming and implementing no-till and conservation tillage techniques to reduce run-off.

However, the biggest challenge remains the lack of a comprehensive understanding of the cause of HABs in Michigan's waters. For example, HABs that are capable of producing toxins are not limited to nutrient rich waters and can be found in nutrient poor waters like oligotrophic lakes. It is not possible to tell visually (including via satellite), by taste or by odor whether a bloom is a HAB. Additional work must be done in order for state, federal and local partners to make strategic decisions to determine best possible solutions to address the problem. A strategy to prevent HABs should be developed, involving a broad set of state, federal and local partners and including conducting additional monitoring and data collection to improve the understanding of the cause of HABs and inform models and actions to achieve the desired water quality and public health outcomes.

Recommendations

Develop a comprehensive strategy to prevent nuisance and harmful blue green algal blooms.

Achieve a 40% phosphorus reduction in the western Lake Erie basin.

Develop harmful algal toxin water quality criteria and implement a real-time monitoring strategy for Michigan's Great Lakes drinking water intakes and public recreation locations threatened by harmful algae.

Support the development of a national drinking water advisory or action level target for harmful algal toxins.

Integrate Water Knowledge into Local Land-Use Planning

Land-use planning is inextricably linked to healthy aquatic ecosystems, a clean and available water supply, and protection from natural occurrences that can damage property. In Michigan, decisions about how the land can be used are made at the local level through master planning and zoning ordinances. Communities use these tools to plan and guide the character of the community and influence the local economy.

However, local community and economic development planning is based on political boundaries and jurisdictions, not along watershed boundaries. To be effective, these planning tools should consider activities that adversely affect water quality and quantity, such as extreme weather events, throughout their watershed and incorporate best management practices into transportation, infrastructure and zoning regulations and other community development planning to minimize impacts on local water resources.

Recommendations

Incorporate planning for wet weather extremes and increased variability into state, regional, and community planning.

Provide technical assistance and develop technical tools and training programs for communities, local officials and water stakeholders to inform and improve their water literacy and help them integrate water impacts into local land-use planning and decisions.

Build Resiliency into Riparian Systems

One of the most direct ways to positively influence water quality and aquatic habitat is to restore, create and improve riparian areas. Riparian areas, or land area adjacent to a stream or lake, provide critical ecosystem services and benefits for lakes and rivers, including:

- Reducing runoff by acting as a barrier and protecting against erosion and nonpoint source pollution
- Absorbing contaminants
- Moderating water temperature through shading
- Serving as a greenway corridor for birds, mammals, amphibians and reptiles
- Contributing leaves, woody debris and other organic matter as foundation for the food web and providing in-stream habitat for fish and other aquatic organisms
- Providing pleasing recreational corridors or viewscapes

Accelerated erosion and sedimentation problems occur in rivers throughout Michigan as a result of lack of riparian management. In some watersheds, lack of upstream riparian filter strips or buffers results in the need for increased downstream dredging at river mouths for boat access and international shipping. Hardening of the riparian zones, lack of shade due

to deforestation, and a lack of continuity in riparian areas all contribute to increased stream temperatures, resulting in declines of fish and wildlife habitat.

Currently a patchwork of regulations, including watershed management plans, best management practices, state programs and landowner incentives, are used to manage riparian zones. The success of many voluntary programs, however, is contingent on a well-informed and cooperative landowner. To maximize benefits, a more holistic watershed approach is needed for riparian area management. Taking a broad approach starting upstream and working downstream to the mouth of the river can have comprehensive impacts on aquatic ecosystems, international shipping, and river recreation. In addition, the interest in waterfront development combined with the need to decrease management costs (dredging) and reduce impacts of extreme weather events provides an opportunity to better define science-based actions and consciously manage riparian areas throughout Michigan.

Recommendation

Develop tools and guidance related to shoreline and riparian ecology and management and provide necessary technical support and training to municipalities, watershed-based organizations and landowners to achieve full benefits of riparian areas.

Restore Hydrologic Connectivity

Michigan has more than 2,500 dams, the majority of which are nearing or have exceeded their design life. Federal, state and local governments as well as conservation organizations are removing dams that provide little to no natural resource value to reconnect streams and rivers. However, challenges exist including: ownership questions (74 percent of dams are privately owned), financial burdens, social views on dam removal and value of impoundments behind dams. Additionally, careful considerations must be made to prevent the upstream movement of unwanted invasive species and downstream movement of contaminated sediment trapped behind dams.

Despite these challenges, federal, state and locally funded efforts have achieved progress in restoring connectivity. As examples, dam removal and river restoration projects are re-envisioning the role of the Boardman, Cass and Huron Rivers. These restoration efforts create greater opportunity for recreation and economic development by connecting water and place within communities.

Recommendations

Remove or improve dams that are no longer safe or ecologically, economically or socially viable to protect public safety and create healthy connected aquatic systems.

Focus river and stream restoration efforts on addressing small hydrological impediments like culverts to create connectivity and restore stream stability.

Manage Groundwater Withdrawals

Michigan's water resources are vitally important for agricultural production, irrigation, drinking water, electric utilities, mining, manufacturing and water supply to lakes and streams that support valuable fish, waterfowl and wildlife populations. Despite the large volumes of surface and groundwater in Michigan – more than one quadrillion gallons by some estimates – there is growing concern about its use and about groundwater withdrawal effects on environmental function and integrity. Groundwater use and value is increasing, and the state must invest in the information and decision systems to realize groundwater's full value, promote its wise use, and protect its hydrological and ecological integrity.

Groundwater is an important resource for commercial, industrial, domestic, and public supply purposes. Most of Michigan's large groundwater withdrawals, however, are for agricultural irrigation. More than 2,500 high-capacity irrigation groundwater wells have been registered for installation during the past four years. These wells greatly enhance economic development (in particular agricultural productivity), ensure against drought conditions and augment high-value crop production. However, as farmers and others develop more high-capacity irrigation wells, the odds of interfering with nearby domestic wells and surface water systems like rivers and lakes also increase.

Michigan has developed the Michigan's Water Withdrawal Assessment Tool to help the state manage groundwater withdrawals. A new or increased high-capacity well must be evaluated using the groundwater tool before installation. The Groundwater Tool is specifically designed to assess the likelihood of an adverse impact of withdrawals on nearby streams, rivers and fish communities. Michigan's Water Use Advisory Council, established by MDEQ in 2012, completed its assessment of Michigan's water management framework, including the Water Withdrawal Assessment Tool, and issued a series of recommendations to MDEQ in December 2014. The recommendations are now under departmental review and assessment. The development of a robust and effective water management program for the state will be an ongoing, iterative process and the insights and recommendations such as the ones in the council's report will continue to help shape the development of that process.

Recommendation

Refine and improve the water withdrawal assessment process to ensure sustainable use of water resources and that high priority is given to incorporating existing and new data and models to better represent local and regional water resources and surface water/groundwater interactions.

Improve Water Management in Urban Landscapes

In urban areas impervious surfaces like roads, buildings and parking lots prevent rainfall from penetrating the soil. As natural vegetation is removed and these surfaces increase, the

amount of evapotranspiration and groundwater recharge decreases. This causes increased runoff, stream channel erosion, buried river bottoms due to silt and sediment, reduced or lost habitat, and aquatic species decline. Aging infrastructure and ill-managed or improperly managed stormwater runoff also contributes to sewer overflows, affecting water quality, ecological systems, creating human health risks, and negatively impacting the enjoyment of water resources.

As municipalities struggle to address aging infrastructure and capacity issues, opportunities exist to transition away from grey to green infrastructure. Green infrastructure can increase a community's resiliency to severe weather events by increasing infiltration and absorption of water. This reduces flooding risk, decreases surface runoff into lakes and streams, and reduces impacts of aging systems. Many communities are considering developing green infrastructure such as wetlands, bioswales, green spaces and buffer strips, as well as man-made infrastructure like rain gardens. Overcoming barriers to green infrastructure such as limited funding mechanisms, regulatory and permitting requirements, institutional and organizational capacity, and lack of understanding of design and maintenance requirements will be necessary to improve water management and address stormwater.

Recommendations

Provide technical and financial support to communities to plan and implement green infrastructure techniques and low-impact development while preserving natural spaces in the design of new developments, redevelopments and road projects to ensure responsible stormwater management and improve hydrology.

Modernize road and highway planning and infrastructure to effectively accommodate stormwater runoff and infiltration needs, thereby reducing the costs and impacts of flooding.

Enhance financial and technical support of local stakeholder efforts to develop and implement watershed management plans to restore impaired waters, protect high-quality waters, and develop and utilize local water resource assets.

Use existing authority to work with local unit of governments with stormwater discharge or stormwater-related hydrologic impairments in their waterways to establish Phase II stormwater plans for impaired water bodies.

Improve Water Management in Rural Landscapes

Michigan's $5.5 billion drainage infrastructure sustains some of the most productive agricultural land in the world and became the key component to developing land for residential, commercial, industrial and transportation purposes. However, the historical land changes that led to this productivity, such as the draining of wetlands, dredging and straightening of rivers and streams, converting streams to drains, and deforestation, have resulted in degraded water quality and aquatic ecosystems.

The agricultural community understands the importance of water resource conservation and is continuously considering new methods for managing water, including restoring hydrology, enhancing soil's capacity to retain and infiltrate rainfall, and allowing for aquifer recharge. New science and technological advancements are also impacting agricultural water management with research in areas such as identifying the most efficient irrigation timing and amounts for crops in dry weather conditions, water reuse for irrigation, and reducing nutrient loss via tile lines.

The federal Agriculture Act of 2014 commonly known as the Farm Bill is also providing resources to enhance conservation practice implementation in Michigan to address nutrients and sediment. Other initiatives are underway such as the newly formed regional and community-led Healthy Waters Working Farms that combines conservation practices and farmland preservation to keep Michigan's rivers and lakes clean while keeping the best farmland working.

It is critical that governments, academia and industry collaborate to develop new tools, processes, and systems to help local officials, landowners, agricultural producers, and others who impact the rural landscape to take actions to improve water resources. The Natural Resource Working Group has concluded that the establishment of collaborative partnerships to support learning and adaptation is needed to foster community-based natural resource management. Engaging the rural community as a whole in deciding what behaviors should change to maintain and improve water quality, and determine what actions would be necessary to encourage behavior change, are necessary to drive performance toward desired outcomes on the landscape.

Recommendation

Eliminate impairments in priority watersheds that have degraded water quality and/or aquatic ecosystems due to nutrient runoff and soil erosion. Engage landowners through a collaborative and adaptive community-based natural resource management process to identify local actions to change behaviors and solutions to achieve those outcomes. Failure to achieve demonstrable outcomes within established timeframes could trigger additional measures.

ENSURE

clean and safe water

Chapter 2: Ensure Clean and Safe Water

Goal: Michigan's water resources are clean and safe.

Outcome: Surface and groundwater are managed to support sustainable human uses and ecosystem function.

Clean, safe water is fundamental to Michigan's economy and to ensuring high-quality places to live, work and play. It is equally fundamental for functioning and sustainable aquatic systems.

Michigan faces complex challenges in addressing water resource issues because of a wide range of historic and ongoing activities such as deposition of mercury, legacy pollutants (i.e. polychlorinated biphenyls (PCBs)), chemical contamination, nonpoint sources of excessive sediment and nutrients (i.e. phosphorous), harmful algal growth, changing climate, urban and rural runoff, hydrologic impairment of rivers and streams, contaminated sediment, and invasive species. All of these things continue to stress drinking water supplies, groundwater resources, aquatic systems, water-based recreation, and local economies.

During the past 100 years, water resource concerns have shifted largely from regulating activities such as effluent pollution and dredge and fill to focus on water resource challenges caused by multiple stressors that require both traditional and new regulatory solutions. Protecting and restoring water quality is critical to ensure ecosystem function while supporting current and future human uses of Michigan's surface and groundwater resources.

Protect Drinking Water Supplies

Ensuring adequate and safe drinking water for all of Michigan's nearly 10 million residents and visitors is essential to protecting public health. The state has more than 10,500 public water systems, of which roughly 8,500 utilize untreated or largely untreated high-quality groundwater sources. In addition, Michigan has more than 1 million private domestic wells, more than any other state in the U.S.

While public water supplies are subject to oversight and frequent inspections to ensure sanitary conditions, individual residential water well owners are responsible for maintenance of their own wells. Construction of private wells is primarily handled at the local level and overseen by a rigorous permitting program. Improper well siting and construction and maintenance, however, are known contributors to drinking water contamination. Broken well caps and contamination sources placed near wells are some of the problems that put drinking water and groundwater at risk. Therefore, planning for appropriate residential and public drinking water well placement, coupled with proper

well construction by a Michigan-registered drilling contractor, are the foundation for safe and reliable drinking water. In addition, periodic inspections of private drinking water wells are needed to ensure sanitary conditions.

Another risk to Michigan's water resources are the estimated 2 million improperly abandoned wells. These abandoned wells can act as a direct conduit between the surface and underlying aquifers as well as between aquifers. These conduits can result in surface contaminants flowing into private or public drinking water supplies.

The lack of statewide regulations or controls on the installation of closed-loop geothermal borings poses additional risks. Improperly located or constructed closed-loop geothermal borings have the same potential to harm aquifers as improperly abandoned water wells. Many vertical geothermal borings are installed at the same depths as drinking water wells, but have no regulatory oversight to ensure installation does not create a direct conduit for contaminants to reach the aquifer.

In many areas of the state, nitrate contamination is a concern. In Michigan, the U.S. Geological Survey regards nitrate-N levels of more than 2 milligrams/liter in water as a sign that human-related nitrate sources have adversely affected the water. In rural areas, elevated levels of nitrate can be associated with animal manure and agricultural fertilizers. Septic systems can also serve as a source of nitrate contamination, though that risk is minor if the systems are designed and maintained for nitrogen removal and water wells are properly sited, constructed and maintained.

Additionally, businesses and industries generate wastes that can threaten groundwater quality if not handled properly. Groundwater contamination resulting from improper waste disposal and chemical handling threatens public health and the environment, resulting in significant cleanup costs to businesses. In addition, contamination of public water supplies can result in high costs to public water suppliers and taxpayers to provide alternative water or replace contaminated drinking water supplies.

Further, the release of oils, chemicals, salts and polluting materials from human activities and industrial sites can impact water. A majority of these releases can be prevented through regulatory programs, but releases still occur unexpectedly. Appropriate response actions to control, mitigate and remediate these releases are critical to minimize harm to Michigan's surface and groundwater.

Recommendations

Protect drinking and source water areas by:

- *Continuing to ensure remediation activities address the long-term impact on drinking water sources*
- *Identifying and diligently protecting source water protection areas*
- *Assisting well owners with identifying potential water well vulnerabilities*

- *Focusing resources on contamination sources with the highest potential for causing contamination of drinking water supplies, including chemical storage facilities*
- *Enhancing the drinking water geographic information system database and making information available across MDEQ programs and to local public health department environmental health personnel*
- *Supporting mapping of local groundwater conditions in partnership with well contractors and others who collect groundwater information*

Develop a plan for aquifer protection that addresses geothermal construction and proper abandonment of wells.

Establish inspection requirements for residential wells, including testing wells for nitrates, bacteria and arsenic.

Develop a spill and communication strategy and organize an incident command approach to prevent, prepare for and respond to environmental disasters and chemical releases.

Properly Maintain On-Site Wastewater Systems

Michigan has about 1.3 million on-site wastewater systems (septic systems) that serve as permanent wastewater infrastructure for more than 30 percent of homes and businesses. At least 30,000 of these are commercial and community subsurface disposal systems treating sanitary wastewater with flows up to 10,000 gallons per day. Since more than half of new single-family homes are built with on-site wastewater systems, this reliance will continue to expand. However, no central system exists that tracks these on-site systems' precise locations, conditions or risks to sources of water. Adequately managed on-site wastewater treatment systems are a cost-effective and long-term option for meeting public health and water quality goals, but the key to their use is in proper siting, adequate management and maintenance.

Currently, local health departments in only 11 Michigan counties conduct inspections of on-site wastewater systems at the time of real estate transactions. These counties report that the number of systems in some manner of failure or improper operations averages about 10 percent but ranges as high as 23 percent. Assuming an average failure rate of 10 percent across the state, at least 130,000 systems discharging a total of 31 million gallons per day could be experiencing operational problems and adversely affecting local waterways and groundwater. Since local health departments issue only about 5,000 replacement permits annually for existing systems that have failed, there are likely a significant number of unidentified, failing systems statewide.

Michigan is the only state without a specific law related to individual or small-quantity on-site wastewater treatment systems. The systems are regulated to some degree, but the regulatory focus is largely on siting and construction of new systems and not on maintenance, system performance or condition. A combination of local codes and state

criteria have contributed to a non-uniform patchwork of regulatory control over conventional septic tank and drain field siting, design and construction. A 2014 MDEQ stakeholder process concluded the state should develop science-based standards for site suitability, design, operation and maintenance, as well as requirements for oversight and inspection for all systems after construction. In addition, homeowner education about proper on-site system maintenance is needed and a state-facilitated loan mechanism to financially assist homeowners with on-site replacement should be explored. To date, this work has not been completed, and the Legislature has not passed such a statute.

Recommendations

Develop and implement a uniform statewide sanitary code that is flexible and provides standards for site suitability based on risk.

Establish a long-term sustainable funding source to support on-site wastewater programs at the state and local levels and to assist financially distressed owners of private on-site wastewater systems with repair and replacement costs.

Establish inspection requirements for residential on-site wastewater systems.

Develop marketing and education campaigns and outreach tools directed at homeowners regarding on-site wastewater management and maintenance and funding opportunities to assist with repair and replacement.

Clean Up Legacy Contamination

Michigan's historic industrial and commercial activities left many areas of legacy contamination. Some of the worst contamination problems in Michigan's waters still exist at superfund sites and in Areas of Concern (AOCs). In addition, the state suffers from more than 8,500 leaking underground storage tank sites and more than 9,700 other sites of environmental contamination. Common sources of contaminants include hazardous substance releases, contaminated sediments, atmospheric deposition, industrial discharges, sewage treatment plant discharges, combined sewer overflows, nonpoint source pollution and runoff from industrial sites. These sources of contamination threaten aquatic life, create an economic drag on communities, and prevent opportunities for use and enjoyment of Michigan's water.

Twelve of Michigan's original 14 AOCs remain on the list of formally designated areas of legacy contamination under the Great Lakes Water Quality Agreement. Today, 33 of the sites' 111 beneficial uses have been restored, with several more in the process of being formally assessed. Michigan recently celebrated the successful delisting of Deer Lake in Marquette County and White Lake in Muskegon County; all of their beneficial uses have been restored.

Public funds play a vital role in addressing contaminated sites where no responsible party exists or has the ability to fund cleanup activities. These funds are used to investigate the

extent of contamination, evaluate and abate the risks associated with the hazardous substances present, and perform cleanup activities to protect the public and environment. They are also used to leverage private resources, stretching their impact. Funding programs like the GLRI (which must be funded annually and therefore is not a certainty), Great Lakes Legacy Act Program, Clean Michigan Initiative Bond, Brownfield redevelopment programs, and Leaking Underground Storage Tank cleanups contribute to Michigan's transformation. Their dollars turn blighted, unusable contaminated properties into opportunities for investment and revitalization in communities.

However, except for the GLRI, these funding sources are now nearly depleted. Continued advocacy for these important federal and state funding programs is needed to continue this transformational work. Critical cleanup efforts are still needed in Michigan to address other areas with significant contamination, including several areas within the Detroit River, the lower reach of the Rouge River, Velsicol Chemical on the Pine River in St. Louis and PCBs in the River Raisin, the Kalamazoo River, in the Ten Mile Drain on Lake St. Clair and in Torch Lake in Houghton County. While several of the locations mentioned above are currently under ongoing corrective action, work at many locations on the Detroit River and the lower section of the Rouge River are just beginning. Michigan cannot afford to give up the progress that it has made to this point, and there is more work to be done.

Recommendation

Secure a long-term funding source to accelerate the cleanup of legacy contaminated sites.

Prevent Environmental Impacts from Emerging Contaminants

New and emerging pollutants like antibiotics, endocrine disruptors found in fire retardants, rocket fuel, industrial wastes, existing and new pharmaceuticals, plastic microbeads, and pesticides and their metabolites are all now detected in the environment. The risk to humans, wildlife and the environment from any one of these, let alone the combination of them, is not well understood.

Effective removal varies based on the type of chemical and individual treatment system. Current wastewater treatment systems and drinking water plants are not designed to remove many of these new and emerging pollutants which can accumulate in waterways and cause harm.

Michigan uses surface water monitoring programs to identify and assess emerging pollutants. The state also relies on EPA's drinking water standard setting process, which includes periodic monitoring for new contaminants to determine how often the substance is identified, at what levels, and if a standard should be established to provide appropriate public health protection. Efforts should be taken to reduce environmental impacts from emerging contaminants through safe disposal, reuse or recycling, the use of technologies, product redesign or discontinued use.

Recommendations

Pass comprehensive legislation phasing out the use and sale of microbeads in Michigan.

Establish research priorities for emerging pollutants of concern in partnership with Michigan's research universities to:

- *Better understand potential ecological and human health impacts*
- *Adapt monitoring protocols to detect concentrations, fate and transport*
- *Recommend standards for protection of human health and the environment*
- *Develop technologies to remove such pollutants from manufacturing processes*

CREATE

vibrant waterfronts

Chapter 3: Create Vibrant Waterfronts

Goal: Michigan communities use water as a strategic asset for community and economic development.

Outcome: Economic and community development plans and efforts fully leverage assets to create great places to live, work, and play.

Michigan's abundant water resources including its coasts, harbors, rivers, lakes and streams make many communities desirable places to live, work and play. Historically, Michigan's waterfronts supported industries such as shipbuilding, power production, lumber yards, tanneries and chemical production. Many communities developed commercial centers with their backs to the water. As industries abandoned the waterfront, many became eyesores and the public's connection to water as a community asset was lost.

But initiatives such as the federal Clean Water Act, corresponding state water regulations, strong local champions, and recent investments from the GLRI have turned polluted waters into thriving systems. As a result, communities began to rediscover their waterfronts and reimage their communities focusing on their water resources. Water is once again playing a pivotal role in transforming communities' economies and is reflected in their values and desires.

Integrate Water Assets into All Planning Initiatives

Including water assets in community development reestablishes the connection between citizens and the outdoors, building a sense of place and improving overall quality of life. The way people relate to water in their community can drive ecological, economic and social outcomes. A stronger understanding of this relationship is needed to assist communities with economic and community development through proper land-use planning and form-based design.

By understanding this relationship, communities can more effectively integrate water as a strategic asset, maximize economic and social capital, strengthen the relationship people have to water, and avoid potential challenges with conflicting or unaligned policies or actions. Ultimately, creating greater opportunities to interact with local water resources can help foster a water conservation ethic in individuals and the community.

Research shows people are willing to pay more to locate to areas with access to clean water and good environmental quality.[6] Residents drawn to these environmentally attractive places help communities create more wealth and more jobs. Studies by the Brookings Institution and Grand Valley State University show a 3-to-1 and 6.6-to-1 return,

respectively, on investments in restoring water quality and shorelines in the form of increased property values and local economic development.

Recommendation

Emphasize water resources as assets in state, regional and community planning efforts to provide appropriate sustainable protection and fully leverage community-based economic opportunities.

Foster Community Leadership to Reconnect Communities to Water

Fully leveraging water assets will require fostering community leadership and local champions. These leaders, both inside and outside of government, should fashion a comprehensive, community-informed vision, strategy and implementation plan for stitching water into the fabric of their communities. The strategy and implementation plan must balance both economic opportunities and environmental protection to ensure sustainability. Communities such as Alpena have embraced their maritime heritage with partnerships between the community and the National Oceanic and Atmospheric Administration's Thunder Bay Sanctuary. Grand Rapids is reimagining its relationship with the Grand River through its plans to reinstate its namesake rapids. The magnificent Detroit River transformation has been under way for nearly a decade under the leadership of the Detroit Riverfront Conservancy. Many other communities including Marquette, Flint, Kalamazoo, Battle Creek, Traverse City, Boyne City and Petoskey have also refocused the role that their waterfronts play in their community's vibrancy. Their experiences provide powerful case studies to share with other Michigan communities.

Recommendations

Host an annual mayor's summit focused on creating high quality communities that leverage strategic water assets.

Provide in-depth technical assistance to support communities with developing and implementing community visions and strategies for waterfront redevelopment, access and use.

Create Sustainable Commercial Ports and Harbors

Maritime trade use of the state's deep-water commercial ports is essential to Michigan, regional economies and many coastal communities. Investment in physical infrastructure is needed to maintain access to Great Lakes commercial ports while ensuring they are deep enough to accommodate commercial shipping vessels; this requires regular dredging. Michigan, however, has neither received nor dedicated adequate dredging funding. However, the maintenance of channels, ports and harbors is only partially the responsibility of the state and federal government and therefore needs to be incorporated into the business models of maritime companies.

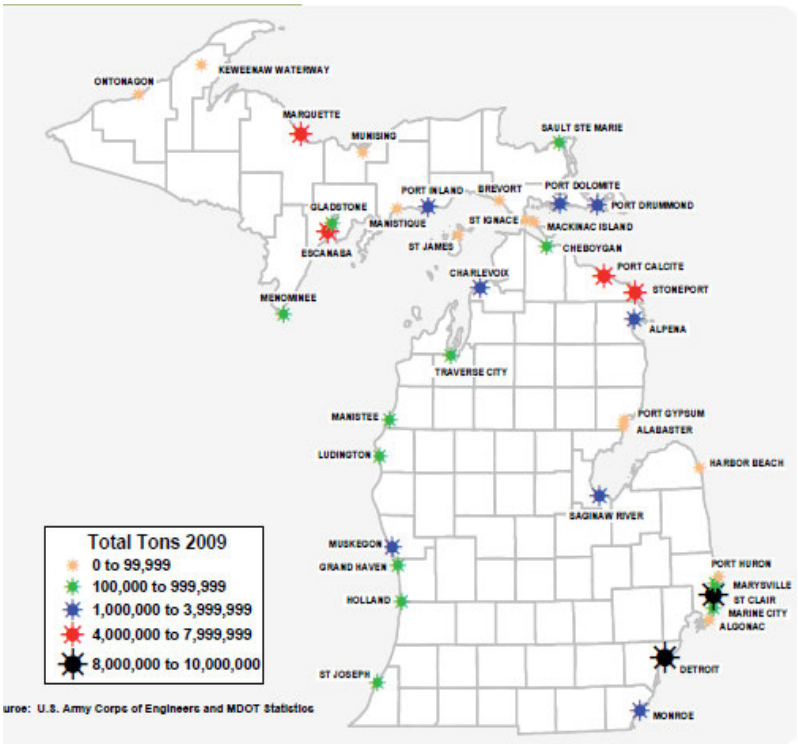

Figure 1: Cargo ports and tonnage
Courtesy of the Michigan Freight Plan

There are several on-going initiatives focused on commercial ports. Great Lakes and Canadian leaders have begun a region-wide assessment of maritime infrastructure, long-term funding, and management through their Great Lakes Maritime Initiative.[7] Also the Great Lakes International Trade and Transport Hub (GLITTH) initiative, a joint effort managed through Michigan State University and the University of Halifax, attempts to leverage Detroit's and Port Huron's infrastructure assets to make southeast Michigan the largest international trade gateway in the country.

Major ports like Fisher Port in Saginaw, Muskegon Lake, and the Ports of Detroit and Monroe are all using public and private investment to reestablish or upgrade port infrastructure. But significant opportunities to develop Michigan's ports as multimodal transportation hubs remain. In addition, few of the state's commercial ports currently receive or ship agricultural products; this potential growth area could significantly benefit both sectors.

Recommendation

Prioritize investments around strategic economic assets of commercial harbors and long-term sustainable infrastructure.

SUPPORT

water-based recreation

Chapter 4: Support Water-Based Recreation

Goal: Michigan's water resources support quality natural resources, recreation and cultural opportunities.

Outcome: Waters of the state are world renowned for water-based recreational pursuits such as hunting, fishing, boating and swimming.

Michigan's four Great Lakes, 11,000 inland lakes, 76,000 miles of rivers and streams, and 3,200 miles of freshwater coastline provide abundant water-based recreation opportunities, making Michigan a great place to live and play while also supporting a thriving tourism industry. However, challenges and opportunities exist in sustaining and expanding the state's water-based recreational opportunities.

Improve Beach Health

Beaches are among the fondest memories of Michiganders' summer vacations. But pathogens such as *E. coli* threaten this treasured asset. The Great Lakes and inland public beaches are monitored for pathogens on a voluntary basis by local health departments, supported by MDEQ which awards grants for this purpose. In 2013, 98 beaches reported 162 incidents of *E. coli* exceeding accepted water quality standards, causing advisories or closures. While the durations were typically short, usually one or two days, any closure impacts recreation and tarnishes the state's image. Causes of beach contamination include releases from wastewater treatment plants, sewer overflows, leaking septic systems, runoff from agricultural operations, and excessive wildlife on beaches. These causes are addressed in other sections of the Water Strategy; however, additional real-time beach monitoring data is also needed to provide timely advisories that protect public health.

Recommendation

Expand the use of real-time monitoring and source tracking techniques at high-risk beaches by local health departments, counties, communities and universities and address sources of beach contamination.

Address Fish Consumption Advisories

Michigan continues to need guidelines on safe fish consumption amounts because of ongoing and historical deposition of persistent, bio-accumulative toxic (PBTs) pollutants like mercury, PCBs and banned pesticides such as DDT. Addressing sources of ongoing deposition and sites of legacy of contamination is critical to restore human use and enjoyment of fishery resources.

In some cases, global sources are contributing to atmospheric deposition of mercury and other PBTs and will require a state, regional and national approach to reduce emissions.

Michigan's participation in national and regional efforts to eliminate anthropogenic mercury use and releases is critical to having an impact on this global problem. The MDEQ's 2008 Mercury Strategy report estimated most of the mercury released into the environment is released into the air, with a smaller amount being released directly to water and land. A 2002 inventory estimated about 7,000 pounds of mercury were emitted into the air in Michigan that year. About 37 percent was from coal combustion and about 30 percent was from the purposeful use of mercury. This estimate has been used to establish a baseline for measuring progress toward reducing emissions. Between 2002 and 2011, ongoing pollution prevention activities, permitting and regulations resulted in mercury air emission reductions of 1,000 to 2,000 pounds of mercury. Coal-fired power plant retirements and use of additional coal combustion control equipment may eventually reduce mercury emissions in Michigan by 80 to 90 percent.

Although atmospheric deposition of Hg, PCBs and other PBTs cause most of the fish consumption advisories in Michigan, the most restrict advisories are caused by site specific legacy issues. Examples include the "do not eat" advisory covering all species of fish downstream of the former Velsicol site on the Pine River and covering all species of fish on the Kalamazoo River between Morrow Dam and Lake Allegan because of past practices at paper mills. Some restriction advisories have been successfully removed in Michigan's AOCs due to restoration efforts over the last several decades. The GLRI has enabled rapid progress toward restoring human uses of fishery resources. Sustained support for the GLRI is needed to continue progress.

Recommendation

Continue national and regional coordination of mercury reduction activities, such as implementation of the Great Lakes Mercury in Products Phase-Down Strategy and the Great Lakes Mercury Emission Reduction Strategy.

Ensure Sustainable Recreational Harbors

Michigan has more than 80 recreational harbors that contribute significantly to the quality of life and economic vitality of host communities. In addition, the harbors also help support Michigan's $4 billion boating industry.[8] Unfortunately many harbors are in poor or failing condition and limited financial resources hamper sustainability.

The Department of Natural Resources completed an inventory and condition assessment of recreational harbor infrastructure in 2014. Additional research, planning and prioritization are needed to identify critical sources of sediment that diminish the value of the harbor and increase maintenance costs, prioritize long-term capital investment needs, and create strategies to market harbors.

A multi-agency and university partnership is also conducting assessments to evaluate the complexity of the issues facing harbors while developing community guidance to ensure sustainability. Too often communities have not realized the full economic and social value

of their harbors; rarely are they integrated into community and economic development plans. This integration is necessary for prioritizing and leveraging capital investments. Variable lake levels, infrastructure condition and depreciation, access, boating trends and future use of the harbor all need to be considered to ensure harbor and marina sustainability.

Recommendations

Prioritize infrastructure needs for repair and upgrade of public recreational harbors and their landside access.

Establish a harbor town program and improve marketing of harbors. The program should work with MDEQ to identify and address sources of upstream sediment, including sediment reduction and relocation strategies.

Increase Access to Lakes, Rivers and the Great Lakes

Since water plays such a pivotal role in many Michiganders' lives, access has always been a priority. In 1939, the Legislature first earmarked funds to purchase water frontage to improve access for fishing and boating. Since then, more than 1,200 public launching sites have been developed for boaters. The Natural Resource Trust Fund remains an important part of providing recreational opportunities, including access to Michigan's waters. But with more than 11,000 lakes and thousands of miles of rivers, streams and Great Lakes coastline, significant gaps in access remain. The 2013 Department of Natural Resources Managed Public Lands Strategy and the Great Lakes Water Trail Plan both recognized this need. Of course, protection of ecologically sensitive areas needs to remain foremost when addressing access gaps.

Recommendation

Work with local partners to provide public access every five miles on the Great Lakes, on all priority lakes more than 100 acres in size and every five miles on navigable water, as environmentally appropriate.

Designate Water Trails

Michigan has endless opportunities for establishing a spectacular water trail system. Much of the framework for such a system already exists, and some water trails have recently been developed on several rivers using existing access sites, harbors of refuge and waterside campsites. Statewide criteria for designating a trail is needed, including level of difficulty, distance between access sites, and trail amenities such as nearby campgrounds, restaurants and restrooms.

Recommendation

Work with stakeholders to develop and implement a designated water trail system for inland waterways and along the coast.

PROMOTE

water-based economies

Chapter 5: Promote Water-Based Economies

Goal: Michigan has a strategic focus on water technology and innovation to grow sustainable water-based economies.

Outcome: Policies and innovative technologies are developed and adopted to grow and promote sustainable water-based economies.

*T*he Great Lakes and Michigan's water in general, have played a defining role in the state's economy starting with fur trading and continuing with the lumber boom, agriculture, manufacturing and tourism. Michigan should leverage this past experience by marketing its strategic advantages as the Great Lakes state, growing leadership and harnessing talent in research and development, accelerating innovation in water technology, and optimizing water efficiency. Michigan and other places across the globe face complex challenges in addressing water quality and quantity concerns. The state is well-positioned to be a powerhouse for solving these complex problems and grow its economic opportunities around water in a manner that ensures good stewardship of the resource. Collaboration among industry, regulators, economic developers and academia directing water research and development is the right place to start.

Market Michigan's Strategic Advantages

Part of Michigan's appeal is its availability of freshwater and ability to manage water-related risks. Currently, Michigan hosts about 350 companies that provide technology, goods, and services related to the supply, treatment, distribution, storage, transport, recycling, rehabilitation and conservation of water. As a recent University Research Corridor analysis highlighted, more than one out of five jobs in the state are strongly linked to water, a number that does not include outdoor recreation and tourism, which alone contribute $10 billion to the economy annually.[9]

The recognition of water as central to healthy systems, people and economies is growing. Electric utilities, mining, steel manufacturing, and the food and agricultural sector potentially face high costs as a result of water scarcity across the nation, due to the high capital costs for alternative supplies, reliance on a small number of assets and their relatively large volume of water use. Water-intensive companies in water-stressed areas are at the highest risk of experiencing production disruptions, stranded assets, increased capital costs and community conflicts over shared resources.

Water is a key factor in the economic health of many corporations and therefore a significant and knowable element in overall corporate stock price and volatility. In a 2015 survey, the World Economic Forum ranked water crises first as a critical risk to the global

economy.[10] According to a Pacific Vox survey of 50 Fortune 500 companies from a broad cross-section of industries nationwide, concern about water scarcity has grown dramatically during the past five years. By 2018, 86 percent of the companies expect to consider water availability in their site selection, up from 37 percent in 2008.[11]

Water is now seen as a factor in the movement of trillions of dollars of capital and investment. Researchers, financial managers, investors and corporations are beginning to fully understand how water contributes to or mitigates risks throughout the business cycle. A key challenge that investors face is how to quantify and value financial risks from regulatory, physical and reputational impacts from water. The University of Michigan is conducting innovative research about water risk and corporate behavior, but further research is needed about the value the state's water resources can add to managing water-related risk, stock price volatility and overall financial performance.

Recommendation

Market the state's competitive advantage as a highly attractive place for business creation and investment because of our abundant natural water assets, water research capabilities, highly skilled talent, economic development expertise, and powerful tourism and business-marketing brand.

Optimize Efficient Use of Water in Business, Utilities and Municipalities

If Michigan's abundant clean water supply is efficiently managed, the state's economic capacity can grow while ensuring water stewardship. In a state with generally abundant water resources, it is difficult to appreciate that water is not disposable and that every drop is valuable. There are some areas of the state experiencing localized water scarcity, where this appreciation needs to spread across the state to ensure the sustainability of this precious resource. All Michiganders have an obligation to be good and thoughtful stewards of this global treasure by using water more thoughtfully and efficiently.

Under the Great Lakes Compact Agreement, each state is required to establish water conservation measures on each water use sector; however, limited data is available on current water use for each sector beyond gross numbers and anecdotal information. Without goals or objectives, we cannot evaluate progress in reducing water use impacts and determine if improvements are needed.

Nevertheless, some progress toward conservation is underway. Businesses are beginning to focus efforts around water sustainability to improve their bottom line and comply with environmental standards. Others are recognizing the importance of water globally and are beginning to work more holistically outside corporate walls. For example, Ford Motor Company, Consumers Energy, General Mills, Amway and Dow are all deeply engaged in water management as part of their corporate sustainability and operational programs, many of which have set aggressive water efficiency targets. Consumers Energy set a water

reduction target of 20 percent between 2012 and 2020. Ford Motor Company set a goal of reducing its water footprint by cutting the amount of water used per vehicle by 30 percent globally between 2009 and 2015.

The Great Lakes and St. Lawrence Cities Initiative (GLSLCI) also urged cities to participate in the GLSLCI Water Conservation Framework to help meet its commitment of reducing water use within city limits by 15 percent in total water usage by 2015 using 2009 water consumption levels as a baseline.

Conservation makes not just social sense, but business sense. Water is heavy, requiring a significant amount of energy to move through the system. Measureable water loss can be attributed to leaking and poorly maintained municipal infrastructure. In addition, cleaning and purifying water for drinking water, manufacturing and discharge is very costly. Nationally, between 4 percent and 13 percent of all energy is used to pump and treat water, for waste management, or for industrial and commercial processes.

For businesses and industries that require water use as a core part of their operations, energy (and cost) savings can happen in two ways: increasing the efficiency of pumping and treating water, or by reducing the total use of water per capita per industrial or municipal process. Capital asset management planning and infrastructure upgrades should reflect these goals.

Wastewater reuse through energy generation also provides economic opportunities. Innovative solutions to wastewater management can minimize water and energy footprints. Firms like Moore and Bruggink have reengineered Greenville's wastewater treatment facility to produce its own energy, reducing costs and energy consumption by more than 30 percent.[12]

In addition to using less water through efficiency measures, water reuse should be explored in situations where potable water quality is not required and risk for cross-contamination is low. This must be done with critical attention to public health and infrastructure. Michigan should develop standards, protocols and strategies to protect public health and preserve surface water and groundwater resources while facilitating rain and grey water reuse in appropriate situations.

Recommendations

Establish voluntary water efficiency targets for all major water sectors to reduce water use impacts and costs.

Promote innovative technologies that reduce cost and water loss or convert waste products to usable materials.

Develop a water conservation and reuse strategy for the state that incorporates the use of green infrastructure, grey water systems and energy production and includes recognition programs.

Fund a pilot project, through a competitive bid process, for the initiation and evaluation of a new model for wastewater management. This pilot program will assess the opportunities and barriers to creating a "Water Resources Utility of the Future" focused on:

- *Reclaiming and reusing water*
- *Extracting and finding commercial uses for nutrients and other constituents*
- *Capturing waste heat and latent energy in biosolids and liquid streams*
- *Generating renewable energy using its land and other assets*
- *Using green infrastructure to manage stormwater and improve urban quality of life*

Optimize Efficient Use of Water for Agriculture

Agriculture is another example of a major water user in Michigan that has made significant advancements to improve efficiency. Water, energy and food are inextricably linked. Growing populations, improving technologies, high crop prices and specialty crops like seed corn have led to expansion of irrigation and agriculture production into regions of the state where it was once unfeasible. Biotechnology advances, especially shorter-season crop varieties, and climatological and meteorological changes with accompanying longer growing seasons make farming in the northern part of the state a more viable opportunity.

As agriculture continues to grow in Michigan, there will be greater pressure on aquifers and more potential for use conflicts. More intensive use of land will require greater management of water. While total agricultural water use is increasing, the efficiency of the transformation of water into crops is also increasing. There are opportunities for agriculture to use more sophisticated irrigation delivery and water management systems to reduce water use per unit output. Continued efforts to increase efficiency can reduce conflicts in localized areas that have water shortages, reduce related energy costs, and reduce water use impacts. There are many synergies and trade-offs between water and energy use and food production. The goal is not necessarily to reduce water use, but to reduce the impacts of agricultural water use on ecological systems and to use it more judiciously.

Aquaculture is another area that could thrive based on Michigan's plentiful water supply and high water quality. In a world demanding ever-increasing amounts of high-quality fish and protein, growing the state's aquaculture industry will require significant innovation in water technology. In particular, industry and the state should continue to support closed-loop or recirculating systems. Lowering energy costs of production, improving water filtration and strengthening supply chains for commercial aquaculture systems will enable the industry to grow substantially in an ecologically responsible fashion.

Efficient use of water also affects the processing and manufacturing supply chain. Companies like Kellogg, MillerCoors and General Mills are focusing efforts around water sustainability by working with the agricultural community to implement best practices, such as efficient delivery of water to crops, efficient use of water, and impact accountability. In areas with water scarcity issues like Texas, Colorado and other western states, technological advancements are reducing pressure on aquifers with inadequate recharge. Establishing targets for water efficiency in areas with localized water stress may reduce the potential for conflict.

Recommendation

Establish voluntary water efficiency targets for agriculture in areas of existing or potential water stress.

Accelerate Innovation in Technologies to Solve Water Challenges

Michigan can advance the technology, science, research and education required to improve water management. These water technologies can be an economic driver for the state. To capture its share of the global water technology sector, predicted to reach $1 trillion annually by 2020, Michigan must nurture an environment that fosters water entrepreneurs, supports a high-performing water technology sector, and leverages the state's innovation, research, development and extensive manufacturing capabilities.

Michigan faces a number of complex challenges regarding water quality and quantity but the state also has a history of developing innovative water technologies to help meet those challenges while exporting those technologies to global markets. Different water sectors – municipal, agriculture, manufacturing and industry – all have specific needs requiring technological solutions such as maximizing water efficiency, minimizing water loss, meeting more rigorous discharge standards, and dealing with new forms of contamination from emerging chemicals and pharmaceutical products. A recent report on Michigan's Blue Economy by the Michigan Economic Center and Grand Valley State University Annis Water Resources Institute highlights examples of successful efforts to develop and deploy cutting-edge water technologies to address some of these needs and challenges.[13]

Michigan has the ideas and research; academia, businesses, and end users need to align goals and desired outcomes for technologies to actually reach the market. Focusing on innovation in water technologies does not represent a philosophical change to the state's approach to economic development but rather recognizes the importance of aligning interests, making clear statements about priorities, and connecting the pieces together to drive entrepreneurial innovation. By building robust public-private partnerships, Michigan can link innovation, research and development, capital investment, entrepreneurialism, and end users to achieve desired environmental, economic and social outcomes. When an accelerator of public and private funding is combined, ideas can move more quickly from design to deployment and markets.

Recommendation

Create a strategic focus on water innovation to attract and accelerate new technologies to market through a business led council comprised of private investors, entrepreneurs, corporations, public agencies and universities to better manage water challenges in Michigan and worldwide.

INVEST

in water infrastructure

Chapter 6: Invest in Water Infrastructure

Goal: Michigan invests in infrastructure and supports funding to maintain clean water and healthy aquatic ecosystems.

Outcome: People support investment of both public and private funding in Michigan's water resources.

The state's infrastructure – roads, commercial ports, drinking water systems, sewer systems, energy plants, transmission systems and recreational facilities – form the backbone of the economy. All water withdrawn from the Great Lakes, groundwater, rivers, and lakes for any purpose passes through some form of water infrastructure; it is a complex system. A functioning water infrastructure system keeps the state running.

Improve Understanding of the True Cost of Water

Most people think of their monthly water bill as the cost they pay for water. But in reality, water, as a natural resource, is actually free for any purpose and for any amount used by any entity, public or private, as long as its use does not degrade the resource. Water is free to those who want water to drink, to businesses that use it in industrial processes, to those that bottle it for consumption and to homeowners who water their lawn. The economic value of water is nearly infinite, but for Michiganders it is a free, shared resource to use for all kinds of human purposes. While water as a resource may be free, there are costs associated with managing Michigan's water resources to ensure that water is of high quality and available for human uses.

Through their water bills, Michiganders instead pay for the infrastructure to deliver safe drinking water and carry away and treat waste, and for the operating costs, like energy, to treat and condition water and maintain infrastructure. Those outside the area of a municipal water supply system pay for well construction, treatment if necessary, the pump and the energy used to supply water to the tap. In addition, the cost of infrastructure to supply water is contained in the final price of all commodities and services.

Water's cost is determined by volume-based pricing that allows the collection of revenues to pay for infrastructure and operations used to deliver water. Under this scenario, there is often a lower per unit, usually gallons, fee on water for higher volume users and amounts. Water rates are commonly skewed in such a way that users pay less as volumes rise, because the price is pegged to infrastructure costs and not to the value of water itself. In some instances, this can act as a complicating factor when trying to achieve water use reduction or conservation, as conservation equates to lower revenues for municipalities.

A customer's use of less water does not necessarily or directly equate to lower operational costs of infrastructure. There is still a substantial cost to have safe drinking water delivered at adequate quantities and pressures whenever the tap is opened and to have fire protection available at the curb within the reach of a standard fire hose in event of an emergency.

Michigan has a long experience and legal history of not putting a commodity price on water, thus keeping water a free resource, and an important element of the state's economic and social well-being and stability. During public outreach for the Water Strategy, many residents suggested either putting a fee on water for all or some groups of water users – in its simplest form, a per gallon charge for water as it comes from the environment. Some suggested that only some types of water users, like agriculture, water bottlers or industrial users should pay a per gallon fee for withdrawing water. Others suggested all users should pay a surcharge or a per gallon fee for the use of water, regardless of user or purpose. Given that Michigan's citizens and businesses withdraw more than 4.2 trillion gallons per year, equivalent to the amount of precipitation that falls on the U.S. per day, even a tiny surcharge or access charge would add up quickly. The economic logic may make sense in the abstract, but it does not currently fit the culture and history of water and water use in the state.

Conversely, some argued that adding a price to water, even as an access charge versus a price on water per se, would commodify the resource, when it has historically been a public good or a public trust resource. Maintaining the ability to manage and ensure the sustainability of the water resources of Michigan and the Great Lakes is of utmost value to the state and the region, and even though a revenue stream could be created from a volume or access charge on water, the values potentially compromised under this scenario are too great to lose. However, there is still a compelling and growing need for investments in water and water infrastructure and for administrative and programmatic support in order for the state to meet its long-term vision for healthy, functional systems and prosperity.

To address the gap between actual investment need and public perception of that need, Michigan should launch a public education campaign to improve residents' understanding of the economic, environmental and social benefits of clean water, linking the investments necessary to achieve the benefits. If the public wants clean beaches and good water quality – and they say they do – public support of water infrastructure investments is critical. While we do not seek to facilitate a volumetric surcharge on water access, if that is something the public would ultimately support, then it would add to the options for funding long-term infrastructure and desired outcomes.

Water rates have historically been low and water both plentiful and affordable in most Michigan communities. Detroit's recent water shutoffs, the loss of urban population in other communities, and an overall increase in domestic water conservation has put a

sharper focus on water rates, affordability, and the ability to continue to fund aging infrastructure costs. There is currently no statewide assessment of shut-off practices or policies that relate to affordability and water access for human use.

Recommendations

Implement a communication strategy focused on messages that link the relationship between investments in water infrastructure and clean water as well as the benefits infrastructure provides for drinking water, recreation, cultural and economic opportunity.

Utilize pricing and funding strategies to support infrastructure improvements while allowing for water conservation.

Evaluate current community practices regarding providing water to financially distressed customers to ensure all citizens have affordable access to water for drinking and sanitation.

Invest in Water Infrastructure

One of the biggest challenges facing communities is aging, deteriorating infrastructure systems with more operational needs than financial resources to meet them. Poor infrastructure degrades the value of water, results in costly efforts to mitigate impacts, and creates or increases drag on the economy.

In a perfect world, users of the system would pay for the cost of service. Rates would consider operation and maintenance costs as well as long-term capital investment needs. Unfortunately, rates in Michigan are typically set by elected officials who have political difficulty charging rates necessary to maintain infrastructures.

Asset management planning, performed properly, would support municipalities' efforts to optimize future costs and collect revenues sufficient to operate and maintain the system. Since 2013, some large municipal wastewater treatment plants have been required to develop an asset management plan as part of their nonpoint source discharge elimination standard (NPDES) permit; however, this requirement doesn't apply to all water utilities. Outcome-based asset management planning that includes more efficient use of resources can result in cost efficiencies that can be used to address capital costs while keeping rates affordable.

Communities can realize cost efficiencies to manage water infrastructure systems and to meet the needs of the future by increasing efficiencies in the delivery and treatment of water through implementation of energy efficiency measures, the use of technologies and a combination of grey and green infrastructure. A more integrated systems approach can improve water management, reduce energy costs and result in savings for communities as opposed to investing in traditional methods which typically have higher capital investment costs.

If communities continue to use traditional methods to manage infrastructure, conservative estimates range in the billions to improve stormwater, drinking water and wastewater management systems over the next 20 years. Although a large majority of these costs are not the responsibility of federal or state government, the state needs to implement a long-term strategy to sustain state water programs, including funding to maintain critical regulatory oversight programs, water quality monitoring and provide assistance to communities to local water infrastructure. In addition, the state should explore a variety of options to close the widening gap between existing funding sources and future revenues needs, including incentivizing asset management planning, state bonding and borrowing options, dedicated capital and trust funds, public-private partnerships, insurance and leveraging, private equity, and service area consolidation. Without adequate funding, Michigan's economy, aquatic ecosystems and quality of life will be diminished.

Recommendations

Incentivize and require outcome-based asset management planning for all public water utilities that includes more efficient use of resources.

Establish sustainable funding mechanisms to achieve Water Strategy goals including water infrastructure management.

Develop an Enterprise Budget for Water

The state needs to complete an enterprise budget to more fully understand the complex relationships between water, infrastructure needs and funding across all entities, including state agencies, federal agencies, local municipalities, drain commissioners and inter-county drain boards. An enterprise budget is a theoretical budget – not a responsibility budget – that portrays revenue and expenditures regardless of agency or governmental unit. The four principle revenue sources related to water in the state – federal, state and local revenues and fees, and private revenues – should be included in the enterprise budget as shown in Figure 2. This budget will also assist in understanding how to maximize the sustainability of the funds used to support water infrastructure and state programs.

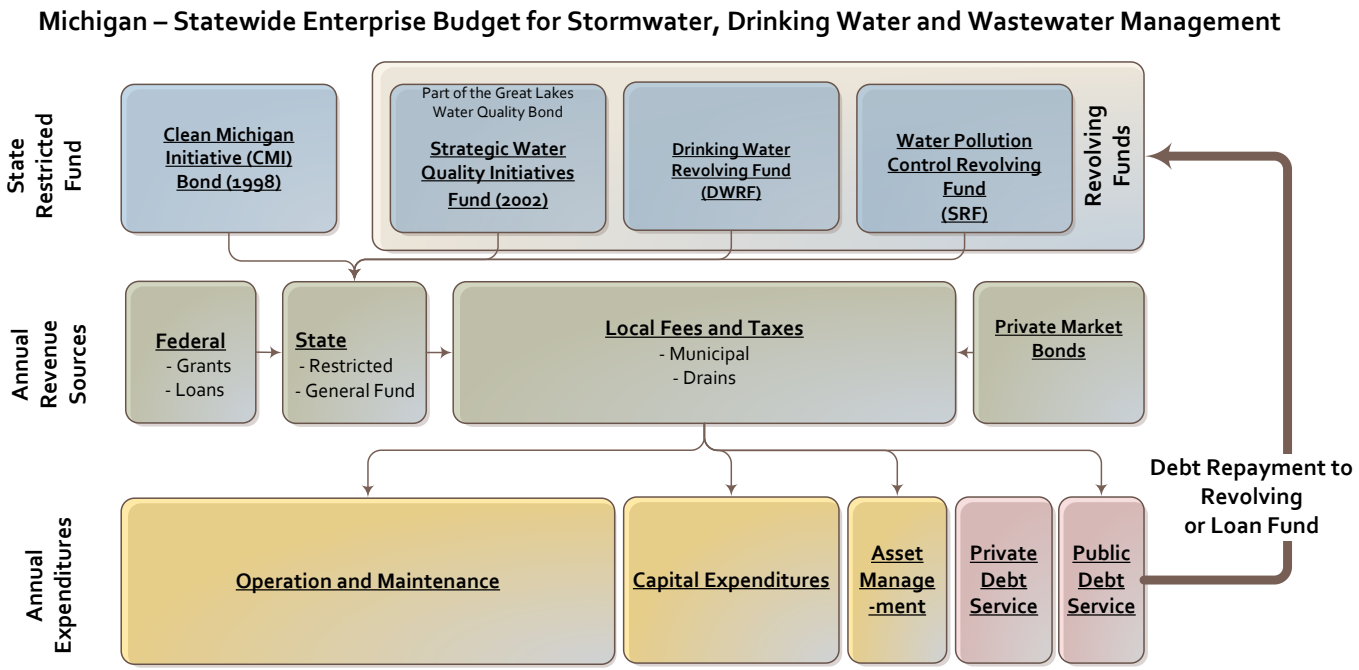

Figure 2: Conceptual statewide enterprise budget for stormwater, drinking water and wastewater.

Recommendation

Develop an "enterprise budget" to better understand the complex relationships between managing water, infrastructure needs and funding.

MONITOR

water quality

Chapter 7: Monitor Water Quality

Goal: Michigan has integrated outcome-based monitoring systems that support critical water-based decisions.

Outcome: Monitoring systems are in place at a scale and frequency to ensure water quality and quantity are maintained to support diverse uses and values.

Michigan's water presents undeniable economic growth opportunities, but appropriate monitoring to integrate economic, environmental, social and cultural data is critical to achieving this goal.

Michigan's current monitoring programs do not incorporate all components of the ecosystem and face significant funding challenges. Lack of systems-based monitoring approaches and inadequate data collection impede economic growth, detection of environmental and human health threats, and evaluation of program effectiveness. We must improve monitoring efforts and critically assess progress achieved across economic, ecological, social and cultural outcomes. The results should be used to determine how to best direct and connect management actions and future investments.

Build Integrated, Outcome-Based Monitoring Systems

Michigan needs to develop an integrated, water-based monitoring system that builds on collected data to create logical connections in an overall information system. This integrated system should include quality and quantity monitoring, condition assessment, modeling, and forecasting tools for the entire water cycle. It should be made publicly available and used by government and other organizations to better communicate the benefits of healthy water systems to residents and communities.

Monitoring practices have traditionally measured some, but not all, of the components of the ecosystem. It has narrowly focused on the ecological condition of fish, wildlife and water, compliance performance, and human health while placing less emphasis on outcomes related to system and economic performance, social and cultural impacts, and environmental factors.

In 2014, the University Research Corridor completed the first economic analysis that estimated the economic, social and cultural performance of water.[14] This approach is consistent with efforts undertaken by the Council of Great Lakes Governors and Premiers to develop systems-wide accounting and monitoring. A recent effort, called "Blue

Accounting," seeks to integrate monitoring systems across ecological, use and social values at the Great Lakes scale. An integration of these components is shown in Figure 3.

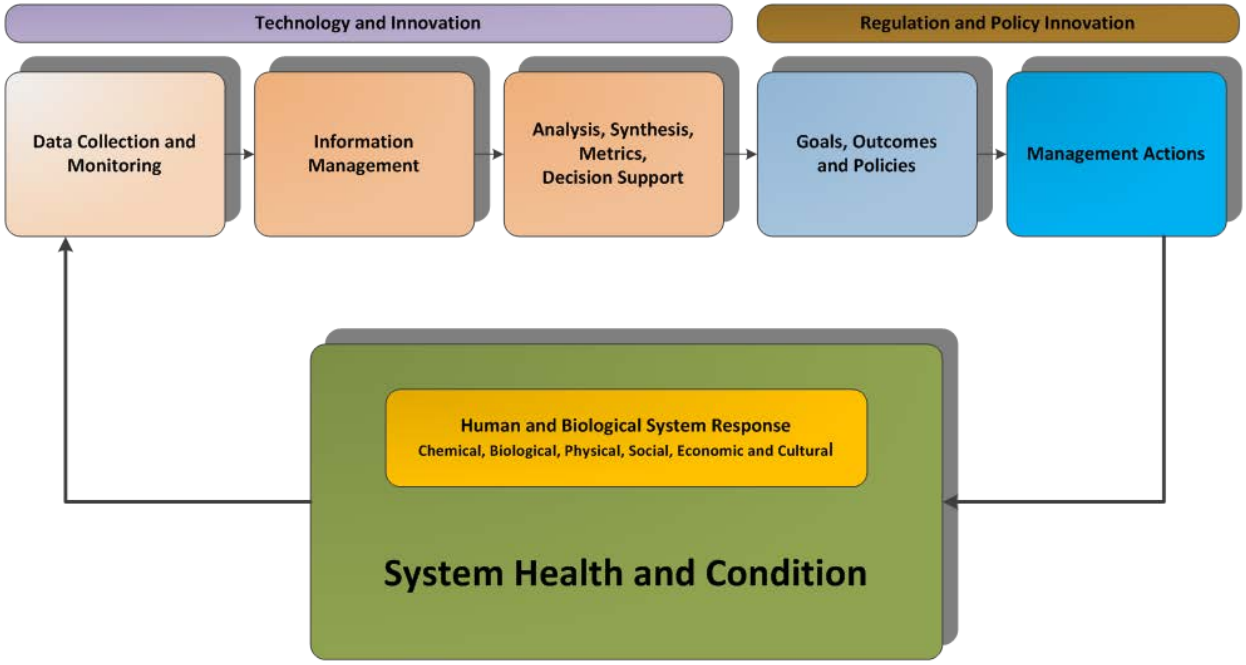

Figure 3. A schematic representation of an integrated system of monitoring and accounting.

Recommendation

Implement a pilot decision-support framework that includes monitoring, data and information, and analytical tools. This framework will assess ecological, economic, social and cultural values and outcomes at local and regional watershed scales.

Support Funding for Monitoring

Comprehensive monitoring of surface and groundwater is expensive and therefore typically funded piecemeal; however, if water quality is not maintained, public health, ecosystems, businesses and recreation suffer.

Michigan's Surface Water Monitoring Strategy focuses on achieving four goals:

- Determine whether water quality standards are being met
- Measure water quality trends
- Evaluate the effectiveness of water programs
- Identify emerging water quality issues

The 1998 Clean Michigan Initiative (CMI), a $675 million environmental and recreation bond, dedicated about $3 million per year to surface water quality monitoring. This bond is nearly depleted, and an alternative, long-term, stable source of funding for surface water monitoring needs to be identified.

Some critical components of the Surface Water Monitoring Strategy are currently not adequately funded by CMI or any other funding source including stream flow monitoring and microbial health.[15] Data that link microbial health to site-specific land-use, wastewater management, manure management and hydrology are limited. For example, this information is critical for future management actions and investments such as how and when specific sources of *E. coli* trigger beach closures. In addition, better data management systems that include geospatial information are needed to enable integration of existing and new monitoring data at spatial scales.

Michigan lacks a coordinated and comprehensive strategy for monitoring groundwater quality and quantity to improve understanding of this valuable resource, reduce threats of contamination, and guide better investments and decisions. Monitoring and mapping the stores and flows of groundwater and use patterns to account for its use, removal from the environment, effects on aquatic systems, and its return to the environment is critical to understanding and ensuring sustainable use of groundwater resources.

The state needs to secure a long-term funding strategy for groundwater monitoring and management. Current efforts are funded and managed by an array of sources, resulting in fragmented monitoring approaches.

Recommendations

Develop a coordinated, comprehensive monitoring strategy for groundwater quantity and quality, including a data management system.

Develop a long-term, sustainable funding source for groundwater and surface water quality and quantity monitoring that is continually improved with new technologies.

BUILD

governance tools

Chapter 8: Build Governance Tools

Goal: Michigan has the governance tools to address water challenges and provide clean water and healthy aquatic ecosystems.

Outcome: Policies, organizational and institutional structures are in place to achieve the goals and outcomes of the strategy.

Water resource management in Michigan is facing increasingly complex problems that will require new and different knowledge and approaches that broaden participation in governance. Governance, as defined by Kooiman[16], is "arrangements in which public and private actors work to solve societal problems, create societal opportunities, and design the societal institutions within which governing actions take place."

Work led by Michigan State University in the late 2000s, Critical Conversations about Environmental and Natural Resource Governance[17] , concluded "A new model [of governance] may well require that individuals and groups beyond traditional state government structures play important roles in implementing management initiatives and monitoring outcomes."

This work was informed through an extensive set of conversations facilitated by the MDEQ's Environmental Advisory Council, which concluded that "Michigan will benefit from a new model of environmental and natural resource governance that benefits from collaborative efforts to develop agreed-upon outcomes, focuses on prioritization and relative public health/environmental risk, encourages innovation, provides for continuous improvement, promotes performance above minimal compliance, and engages voluntary environmental stewardship."

This effort also concluded that what worked in the past to manage the environment might not be sufficient to address new and changing challenges with diminishing resources. This does not mean that old tools need to be discarded. Instead, the existing regulatory framework needs to be augmented alongside new tools and new approaches.

Facilitate Community-Based Dialogue and Water-Related Vision Development

The Strategy focuses on actions at the community level to develop vision, create collaborations and find local champions that can galvanize local unity. The ultimate goal is to marshal the financial and human resources to drive the vision ahead. Many regions and communities are already engaged in this important planning and implementation work, while others are just beginning. Through the community conversations conducted as part

of this strategy development and generously supported by the C.S. Mott Foundation (Appendix 2e), communities are seeking help in two ways:

- Forming and designing their community vision relative to water and their water assets
- Identifying tools and resources to fulfill that vision

Community, regional and statewide foundations are central to supporting this effort. These organizations need to work together to support community planning around water. The state, through its grant-making capacity, collaborative programs, networks and outreach efforts, needs to support and augment these local efforts.

Recommendations

Enhance the understanding, knowledge and skill set of communities to facilitate and support community-based dialogue and water-related vision development.

Create a statewide Water Fellows Program and Network to build community leadership capacity and to inform critical local leaders about how to leverage water resource assets to build community and economic vitality.

Align Resources, Tools and Regulatory Framework to Achieve Outcomes

Water resources are managed at various scales and by many levels of government. State-level regulations and policies establish performance expectations for managing important water and water-related resources. Great Lakes region-level regulations manage water diversions and flows and help prevent evasive species introductions such as Asian Carp through the Chicago Area Waterways System. Other regulations are national in scope.

Management of water resources at the local level is also important. Much of the state's rainfall and runoff is managed at the county and inter-county scale through county drain commissions and inter-county drainage districts. A thoughtful review of Michigan's existing tools, resources and regulatory framework for managing water at the local level is necessary to address emerging water problems that don't respond to traditional approaches methods. New approaches such as collaborative watershed governance may be needed to more effectively manage water across the landscape to achieve desired water quality and quantity outcomes. Partnerships, collaborative decision making and joint project implementation at the watershed scale that involve government, business, the building industry, agriculture, and environmental and other stakeholder organizations are a few examples of this approach.

Recommendation

Evaluate and implement necessary changes to laws including state and local land-use statutes as well as the drain code to create a more integrated, watershed based system for managing water at the landscape level and achieving water quantity and quality outcomes.

Retain Regulatory Tools

The state's water resources, as well as communities and businesses dependent on these resources, benefit from Michigan's authority to implement the provisions of the Clean Water Act, including Section 404 pertaining to wetlands and Section 402 pertaining to pollution control. Through state laws, Michigan maintains consistency with federal laws related to management of its wetland, lake and stream resources, and creates streamlined permitting systems to address Michigan-specific issues. Recent changes to several water resource laws have caused some to question whether Michigan's water resources would be "better off" if authority to regulate these resources was returned to the federal government. Others believe the cost for retaining federal authority is too great, but don't fully understand the cost to business for less permitting certainty and long processing times. Given that water and water resources are of critical and strategic importance to the state, it is in the state's long-term interest to exercise authority and autonomy over their thoughtful management.

Recommendation

Retain full authority under the Clean Water Act to continue to manage Michigan's own water resources.

Ensure the Water Strategy is Durable Over Time

The Water Strategy is not only about what government does or funds, but about what Michiganders do collectively to support healthy systems, human use and enjoyment, and a growing water economy. In order to ensure the Water Strategy is durable over time and across administrations, the elements of the Strategy need to be fully integrated into decision processes, governance structures, and the culture of state and local governments, other organizations, and individuals. Where Michigan places the nexus of responsibility for decision-making, whether on individuals, local governments or the state, matters. What goals residents and leaders focus on matters. How the state governs water quality, quantity and use matters.

Ensuring sustainability of the Water Strategy and its long-term implementation will depend on how the various recommendations get adopted by various actors or organizations and get funded, supported and realized. If the critical elements of this Strategy are not adopted and deeply engrained into ongoing decision-making processes, then little will come of them over time. Adaptive management approaches are needed to evaluate progress and make necessary course corrections to achieve desired outcomes.

Recommendation

Create an Interdepartmental Water Team to unite agencies to ensure a cohesive common strategy around implementation of the Water Strategy. The team will establish a process for stakeholder collaboration, criteria for setting implementation priorities, identifying cross-agency joint projects, and an approach to assess and evaluate progress achieved against the metrics and outcomes.

INSPIRE

stewardship for clean water

Chapter 9: Inspire Stewardship for Clean Water

Goal: Michigan citizens are stewards of clean water and healthy aquatic ecosystems.

Outcome: Individuals and communities understand their responsibility for and make responsible decisions regarding water resources.

Stewardship is about supporting and maintaining the things we hold dear and about our ability to create valued legacy and heritage. Throughout development of the Strategy, Michiganders said they care deeply about the Great Lakes, about rivers and inland lakes, and about water in general. Stewardship is also about the ability of that care to persist over time within the state's communities and culture. It is one of the most important aspects of the Strategy, because it creates the backbone of our use and enjoyment of water in the state for generations.

Improve Water Literacy and Use of Place-Based Education

Michigan is blessed with abundant water resources, yet most citizens do not have a basic understanding of fundamental water literacy principles. During development of the Strategy, people across the state expressed the concern that many people do not know what a watershed is, or that they live in a watershed. As the Great Lakes state, Michigan should have water literacy principles as part of its K-12 curriculum standards.

Place-based education uses the elements of local community and environment as a starting point for teaching and learning, emphasizes hands-on, inquiry-based, real-world experiences, and, ideally, involves direct collaboration with community partners. This approach to education emphasizes the assets and context of the community and its place as part of a broader learning framework. The benefits of place-based education include powerful learning, a healthy, supportive school culture, sustainable partnerships between schools and communities a greater appreciation of the environment, and more frequent and effective acts of stewardship. Integrating freshwater systems into place-based educational experiences is critical to building literacy and stewardship for Michigan's water resources.

Recommendations

Integrate water literacy principles into place-based education and State of Michigan curriculum standards tied to Science, Technology, Engineering and Math (STEM) principles across all grade levels.

Develop a survey tool to assess behaviors and attitudes toward Michigan's water resources to assess changes over time.

Increase Volunteerism and Community Engagement

One of the key aspects of stewardship within a community is whether residents are willing and able to volunteer their time to better their water resources. Communities that exhibit strong stewardship characteristics have more individuals and groups engaged with the community and tend to support measures that drive good water management practices, such as environmental cleanups and funding programs. The focus on building stewardship and care can thus translate directly into long-term benefits to the community and the state and heighten engagement.

Recommendation

Expand opportunities to engage citizen volunteers and participation, such as the Michigan Clean Water Corp (MiCorps) program, in gathering water quality and quantity data, in restoration, in providing access and in maintenance of important water-related resources.

Table 2. Water Strategy Implementation Plan

Table 2 provides a five year implementation plan for the Water Strategy. It includes all 62 recommendations from the Water Strategy, an implementation metric for each recommendation and identifies a lead actor(s) responsible for initiating, convening, facilitating or implementing the recommendation.

Goal 1: Michigan's aquatic ecosystems are healthy and functional.			
Outcome: Aquatic ecosystems are resilient and diverse.			
#	**Recommendation**	**Implementation Metric**	**Lead Actor**
1	Prevent the introduction of new aquatic invasive species and control existing populations of aquatic invasive species in accordance with the Michigan Aquatic Invasive Species Management Plan.	By 2020, the ecological separation of the Great Lakes basin and the Mississippi River basin, especially in the Chicago Area Waterways system has been initiated.	State and federal agencies, Nongovernmental organizations (NGOs), local units of governments, individuals
2	Work with other Great Lakes states and provinces to harmonize aquatic invasive species prevention, early detection processes and response actions across the Great Lakes region.	By 2016, implement a pilot project with Ontario and interested states to evaluate and pursue areas of harmonization.	State agencies
3	Accelerate research and solutions to identify mechanisms of food web disruption and changes of nutrient flows in the Great Lakes with a focus on the effects of invasive species.	By 2017, a minimum of three new research projects will be established for the purposes of evaluating nutrient shifts in Great Lakes food webs to help focus appropriate management, social, and economic responses.	Universities
4	Develop a comprehensive strategy to prevent nuisance and harmful algal blooms.	By 2017, develop a strategy to prevent harmful algal blooms and HABs based on desired outcomes.	MDEQ, local public health departments
5	Achieve a 40% phosphorus reduction in the western Lake Erie basin.	Pending finalization and/or agreement with Annex 4 Water Quality Workgroup.	MDEQ, MDARD
6	Develop harmful algal toxin water quality criteria and implement a real-time monitoring strategy for Michigan's Great Lakes drinking water intakes and public recreation locations threatened by harmful algae.	By 2020, increase by 20% the number of people served by drinking water suppliers using surface water sources with real-time monitoring equipment installed to provide early warning of potential public health threats. By 2020, develop harmful algal toxin assessment criteria.	MDEQ

		By 2020, implement a real-time monitoring strategy for Michigan's Great Lakes drinking water intakes and public recreation locations threatened by HABs.	
7	Support the development of a national drinking water advisory or action level target for harmful algal toxins.	Work with federal agencies to develop a national advisory target.	MDEQ
8	Incorporate planning for wet weather extremes and increased variability into state, regional and community planning.	Best management practices are reviewed every five years and updated (if necessary) to reflect climatic changes such as changes in rainfall frequency, duration or intensity.	State, regional governmental entities, communities
9	Provide technical assistance and develop technical tools and training programs for communities, local officials and water stakeholders to inform and improve their water literacy and help them integrate water impacts into local land-use planning and decisions.	By 2020, develop a public official water literacy measurement. By 2020, develop a training module for local elected officials and decision-makers on the connection between land-use planning and zoning and the siting and approval of new projects. By 2020, develop a training module for local elected officials and decision-makers on the merits and benefits of asset management planning.	Universities, regional government and planning organizations, MDEQ
10	Develop tools and guidance related to shoreline and riparian ecology and management and provide necessary technical support and training to municipalities, watershed-based organizations and landowners to achieve full benefits of riparian areas.	By 2020, develop a baseline for the current research and educational capacities. • Coordinate to pinpoint areas of capacity expansion. • Develop tools, guidance and training on best practices. • Determine need to update guidance and training materials.	MDNR, MDEQ
11	Remove or improve dams that are no longer safe or ecologically, economically or socially viable to protect public safety and create healthy, connected aquatic systems.	By 2020, address all dams most at risk of failure.	MDEQ, MDNR
12	Focus river and stream restoration efforts on addressing small hydrological impediments like culverts to create connectivity and restore stream stability.	By 2020, increase the number of small hydrologic impediments that are restored over a baseline established in 2015.	NGOs and local units of governments

13	Refine and improve the water withdrawal assessment process to ensure sustainable use of water resources and that high priority is given to incorporating existing and new data and models to better represent local and regional water resources and surface water/groundwater interactions.	By 2016, develop a list of priority Water Use Advisory Council recommendations and an implementation plan.	MDEQ, MDNR, MDARD
14	Provide technical and financial support to communities to plan and implement green infrastructure techniques and low-impact development while preserving natural spaces in the design of new developments, redevelopments and road projects to ensure storm water management and improve hydrology.	By 2020, increase the number of attendees to green infrastructure conferences, applications for projects, amount of grant dollars awarded to projects incorporating green infrastructure or low-impact development, and number of programs incentivizing green infrastructure projects and the number of Michigan communities that are recognized for green infrastructure projects and strategies over a baseline established in 2015.	MDEQ, MDOT, MDNR, Michigan State Housing Development Authority, MEDC
15	Modernize road and highway planning and infrastructure to effectively accommodate storm water runoff and infiltration needs, thereby reducing the costs and impacts of flooding.	By 2020, increase the number of Michigan's new road and highway projects designed to better accommodate storm water runoff and infiltration needs over a baseline established in 2015.	MDOT, local road and highway commissions
16	Enhance financial and technical support of local stakeholder efforts to develop and implement watershed management plans to restore impaired waters, protect high quality waters, and develop and utilize local water resource assets.	By 2018, increase the number of grants, training and educational opportunities on the development and implementation of watershed management plans over a baseline established in 2015.	MDEQ
17	Use existing authority to work with local units of government with storm water discharge or storm water-related hydrologic impairments in their waterways to establish Phase II storm water plans for impaired water bodies.	By 2020, increase the number of water bodies with storm water plans in place to address designated use impairments caused by storm water discharges and hydrologic impairments over a baseline established in 2015.	MDEQ, MDNR
18	Eliminate impairments in priority watersheds that have degraded water quality and/or aquatic ecosystems due to nutrient runoff and soil erosion. Engage	By 2018, identify priority watersheds. Develop performance standards to cover statewide land-use activities.	MDEQ, MDARD

	landowners through a collaborative and adaptive community-based natural resource management process to identify local actions to change behaviors and solution to achieve those outcomes. Failure to achieve demonstrable outcomes within established timeframes could trigger additional measures.	Agricultural land-use will directly follow MAEAP guidelines and participation criteria to remain consistent with the state's recent efforts. Concurrently develop the escalated "additional actions" triggered once a watershed has been determined to be impaired. By 2018, develop regional action teams with protocols for working with landowners. Educate collaborative teams on existing regulations and enforcement mechanisms allowed in their regions. By 2020, collaborative processes are in place with plans to achieve water quality outcomes in priority watersheds.	
Goal 2: Michigan's water resources are clean and safe.			
Outcome: Surface and groundwater are managed to support sustainable human uses and ecological function.			
#	**Recommendation**	**Implementation Metric**	**Lead Actor**
1	Protect drinking and source water areas by: • Continuing to ensure remediation activities address the long-term impact on drinking water sources • Identifying and diligently protecting source water protection areas • Assisting well owners with identifying potential water well vulnerabilities • Focusing resources on contamination sources with the highest potential for causing contamination of drinking water supplies, including chemical storage facilities • Enhancing the drinking water geographic information system database and making information available across MDEQ programs and to local public health department environmental health personnel • Supporting mapping of local	By 2020, address IT security issues, such as firewall and server capacity, to make information publically available. By 2020, develop educational materials to encourage residents with private drinking water wells to test new wells prior to use for nitrates and arsenic and to test wells prior to sale or transfer for bacteria, nitrates and arsenic. By 2020, develop an interface to effectively and efficiently track and monitor for groundwater contamination, and implement data tracking.	MDEQ, local health departments

	groundwater conditions in partnership with well contractors and others who collect groundwater information.		
2	Develop a plan for aquifer protection that addresses geothermal construction and proper abandonment of wells.	By 2016, convene a stakeholder work group to develop draft legislation to regulate closed-loop geothermal construction. By 2020, develop educational materials for comland-usemunity water systems and local health departments to increase plugging rates of abandoned wells when municipal water mains are extended.	MDEQ
3	Establish inspection requirements for residential wells, including testing wells for nitrates, bacteria and arsenic.	By 2020, implement a statewide requirement for periodic inspections of drinking water quality.	Legislature
4	Develop a spill and communication strategy and organize an incident command approach to prevent, prepare for and respond to environmental disasters and chemical releases.	By 2016, implement the pipeline strategy currently being developed under the leadership of MDEQ and the Attorney General.	MDEQ, MDNR, MDARD, Michigan State Police, Department of Technology, Management and Budget
5	Develop and implement a uniform statewide sanitary code that is flexible and provides standards for site suitability based on risk. Establish a long-term, sustainable funding source to support onsite wastewater programs at the state and local levels and to assist financially distressed owners of private on-site wastewater systems with repair and replacement costs.	By 2020, every county health department has an inventory and assessment of private, single-family home water supplies and all septic systems. By 2020, secure a long-term funding source to complete the inventory and to assist distressed owners.	Legislature
6	Establish inspection requirements for residential on-site wastewater systems.	By 2020, implement a statewide requirement for periodic inspections of on-site septic system performance for properties with on-site wastewater systems.	Legislature
7	Develop marketing and education campaigns and outreach tools directed at homeowners' on-site wastewater management and maintenance and funding opportunities to assist with repair and replacement.	By 2020, increase the number of entities implementing outreach campaigns directed at homeowners on septic management.	NGOs, local units of government,

8	Secure a long-term funding source to accelerate the cleanup of legacy contaminated sites.	By 2027, close and remove 7,500 sites from the 201 Facilities Inventory, National Priority List, Leaking Underground Storage Tank Site database and designated Areas of Concern.	Legislature
9	Pass comprehensive legislation phasing out the use and sale of microbeads in Michigan.	By 2017, comprehensive legislation phasing out the use and sale of microbeads is signed into law.	Legislature
10	Establish research priorities for "emerging pollutants of concern" in partnership with Michigan's research universities to: • Better understand potential ecological and human health impacts • Adapt monitoring protocols to detect concentrations, fate and transport • Recommend standards for protection of human health and the environment • Develop technologies to remove such pollutants from manufacturing processes	By 2016, increase the number of evaluations and risk assessments completed, new standards developed, and monitoring protocols developed.	MDEQ, Michigan Department of Community Health
Goal 3: Michigan communities use water as a strategic asset for community and economic development.			
Outcome: Economic and community development plans and efforts fully leverage water assets to create great places to live, work and play.			
#	**Recommendation**	**Implementation Metric**	**Lead Actor**
1	Emphasize water resources as assets in state, regional and community planning efforts to provide appropriate, sustainable protection and to fully leverage community-based economic opportunities.	Increase walkability score of waterfront communities to measure the effect of economic activity and investment on or near water in a community, watershed or region.	MSDHA, MEDC, MDEQ, MDNR regional governments, local units of government
2	Host an annual mayor's summit focused on creating high-quality communities that leverage strategic water assets.	Increase in property values as a result of increased economic activity and investment on or near water in a community, watershed or region.	Mayors
3	Provide in-depth technical assistance to support communities with developing and implementing community visions and strategies for waterfront redevelopment, access and use.	Increase in the number of communities participating in Redevelopment Ready Communities Program.	Regional and interagency teams

4	Prioritize investments around strategic economic assets of commercial harbors and long-term, sustainable infrastructure.	By 2020, increase the percentage of commercial traffic and other economic activity at Michigan's commercial ports over a baseline established in 2015.	MDOT, MDNR, MDEQ's Office of the Great Lakes, Governor's Office of Public-Private Partnerships, commercial maritime interests, local planning professionals
Goal 4: Michigan's water resources support quality recreation and cultural opportunities.			
Outcome: Waters of the state are world renowned for recreational pursuits such as hunting, fishing, boating and swimming.			
#	**Recommendation**	**Implementation Metric**	**Lead Actor**
1	Expand the use of real-time monitoring and source tracking techniques at high risk beaches by local health departments, counties, communities and universities, and address sources of beach contamination.	By 2020, all of Michigan's water meets total and partial body contact designated uses with no closures or advisories. Real time monitoring at all high-risk beaches.	MDEQ, local health departments, local units of government, universities
2	Continue national and regional coordination of mercury reduction activities, such as implementation of the Great Lakes Mercury in Products Phase-Down Strategy and the Great Lakes Mercury Emission Reduction Strategy.	Reduce the mercury levels in edible portions of Great Lakes, inland lakes and stream fish to below 0.35 parts per million by 2020.	MDEQ, MDCH
3	Prioritize infrastructure needs for repair and upgrade of public recreational harbors and their landside access.	By 2020, increase the number of recreational harbors with asset management plans over a baseline established in 2015.	MDNR, Waterways Commission, MDEQ, MDOT
4	Establish a harbor town program and improve marketing of harbors. The program should work with MDEQ to address sources of upstream sediment, sediment reduction and relocation strategies.	By 2017, establish a harbor town program.	MDNR
5	Work with local partners to provide public access every five miles on the Great Lakes, on all priority lakes over 100 acres in size and on every five miles of navigable water, as environmentally appropriate.	Public access every five miles on the Great Lakes and on all priority inland lakes larger than 100 acres.	MDNR
6	Work with stakeholders to develop and implement a designated water trail system for inland waterways and along the coast.	By 2020, a designated a water trail system has been established by the MDNR.	MDNR, local units of governments, , NGOs

Goal 5: Michigan has a strategic focus on water technology and innovation to grow sustainable water-based economies.			
Outcome: Policies and innovative technologies are developed and adopted to grow and promote sustainable water-based economies.			
#	**Recommendation**	**Implementation Metric**	**Lead Actor**
1	Market the state's competitive advantage as a highly attractive place for business creation and investment because of our abundant natural water assets, water research capabilities, highly skilled talent, economic development expertise, and powerful tourism and business-marketing brand.	Increase the number of water-dependent companies and investments locating in Michigan. Specifically track aquaculture technology and related opportunities.	MEDC
2	Establish voluntary water efficiency targets for all major water sectors to reduce water use impacts and costs.	By 2020, develop a baseline for water usage, data collection and definitions to inform development of water conservation goals and objectives. Collect data for two years. Increase by 20% the number of businesses, industries, and municipalities with water efficiency within their water management plans.	Water use sectors
3	Promote innovative technologies that reduce cost and water loss, or convert waste products to usable materials.	By 2020, increase the number of new, innovative and cost-effective technologies, pilot projects, and startups are commercialized, come to market and result in connections with end users to reduce costs and water consumption, or convert waste products to usable materials and produce energy over a baseline established in 2015.	MDEQ, MDARD, MEDC
4	Develop a water conservation and reuse strategy for the state that incorporates the use of green infrastructure, grey water systems, and energy production that includes recognition programs.	By 2018, develop a water conservation and reuse strategy that identifies major sectors by water use and their locations.	MDEQ, MDARD, MDOT
5	Fund a pilot project, through a competitive bid process, for the initiation and evaluation of a new model for wastewater management. This pilot program will assess the opportunities and barriers to creating a "Water Resources Utility of the Future," focused on:	By 2017, pilot project is funded.	Legislature

	• Reclaiming and reusing water • Extracting and finding commercial uses for nutrients and other constituents • Capturing waste heat and latent energy in biosolids and liquid streams • Generating renewable energy using its land and other assets • Using green infrastructure to manage storm water and improve urban quality of life		
6	Establish voluntary water efficiency targets for agriculture in areas of existing or potential water stress.	By 2017, develop a baseline for water usage, data collection and definitions to inform development of water conservation goals and objectives in areas of existing or potential water stress. Collect data for two years. Establish targets. Increase in the number of water stressed regions that have water efficiency plans and water efficiency targets by 2020.	MDARD
7	Create a strategic focus on water innovation to attract and accelerate new technologies to market through a business-led council comprised of private investors, entrepreneurs, corporations, public agencies and universities to better manage water challenges in Michigan and worldwide.	By 2020, increase the number of new, innovative and cost effective technologies, pilot projects, and startups that are commercialized, come to market and result in connections with end users to solve water problems over a baseline established in 2015.	MDEQ, MEDC, MDNR, MDARD
Goal 6: Michigan invests in infrastructure and supports funding to maintain clean water and healthy aquatic ecosystems.			
Outcome: People support investment of both public and private funding of Michigan water resources.			
#	**Recommendation**	**Implementation Metric**	**Lead Actor**
1	Implement a communication strategy focused on messages that link the relationship between investments in water infrastructure and clean water and the benefits infrastructure provides for drinking water, recreation, and cultural and economic opportunity.	By 2017, implement a communication strategy focused on connecting economic, environmental, social and cultural values to Water Strategy outcomes.	NGOs, MDEQ, MDCH

2	Utilize pricing and funding strategies to support infrastructure improvements while allowing for water conservation.	By 2020, increase the number of communities that have pricing and funding strategies as part of their asset management plans to support infrastructure improvements over a baseline established in 2015.	Local units of government, water utilities
3	Evaluate current community practices regarding providing water to financially distressed customers to ensure all citizens have affordable access to water for drinking and sanitation.	By 2017, increase the number of communities that have practices in place to ensure financially distressed customers have access to water for drinking and sanitation over a baseline established in 2015.	Local units of government, water utilities
4	Incentivize and require outcome-based asset management planning for all public water utilities that includes more efficient use of resources.	By 2020, require all major NPDES-permitted dischargers to develop and implement asset management planning for each system. By 2020, require all municipal community water suppliers serving more than 1,000 people to develop and implement asset management planning for each system.	MDEQ
5	Establish sustainable funding mechanisms to achieve the Water Strategy goals including water infrastructure management.	By 2020, implement a long-term funding strategy to achieve goals of the Water Strategy and support existing Quality of Life Agency programs and policies.	State agencies, Legislature
6	Develop an "enterprise budget" in order to better understand the complex relationships between managing water, infrastructure needs and funding	By 2016, develop an enterprise budget for water to inform the long-term funding strategy.	MDEQ
Goal 7: Michigan has integrated outcome-based monitoring systems that support critical water-based decisions.			
Outcome: Monitoring systems are in place at a scale and frequency to ensure water quality and quantity are maintained to support diverse uses and values.			
#	**Recommendation**	**Implementation Metric**	**Lead Actor**
1	Implement a pilot decision support framework that includes monitoring; data and information; and analytical tools for assessing ecological, economic, social and cultural values and outcomes at local and regional watershed scales.	By 2017, fund and implement a water resource decision support framework that provides information about the integration of ecological, economic, social and cultural values and outcomes.	MDEQ, MDNR, MDCH, MDARD

2	Develop a coordinated, comprehensive monitoring strategy for groundwater quantity and quality, including a data management system.	By 2018, implement a long-term groundwater monitoring strategy that provides information sufficient to assess status and trends in quality and predict impacts from groundwater withdrawal.	MDEQ
3	Develop a long-term, sustainable funding source for groundwater and surface water quality and quantity monitoring that is continually improved with new technologies.	By 2018, fund and implement surface water and groundwater monitoring strategies that provide information sufficient to assess water quality and quantity status and trends, and detect emerging issues.	Legislature
Goal 8: Michigan has the governance tools to address water challenges and provide clean water and healthy aquatic ecosystems.			
Outcome: Policies, organizational and institutional structures are in place to achieve goals and outcomes of the Strategy.			
#	**Recommendation**	**Implementation Metric**	**Lead Actor**
1	Enhance the understanding, knowledge and skill set of communities to facilitate and support community-based dialogue and water-related vision development.	By 2016, work with community foundations and private foundations to support community-based dialogues.	Community and private foundations
2	Create a statewide Water Fellows Program and Network to build community leadership and inform critical local leaders about how to leverage water resource assets to build community and economic vitality.	By 2016, establish and implement a Water Fellows Program.	Private philanthropy
3	Evaluate and implement necessary changes to laws including state and local land-use statutes as well as the Michigan Drain Code to create a more integrated, watershed based system for managing water at the landscape level and achieving water quantity and quality outcomes.	By 2016, create an ad hoc external advisory body to evaluate existing laws and statues including the Drain Code and local land-use statutes. By 2018, panel should provide recommendations to the Directors.	MDEQ and MDARD Directors
4	Retain full authority under the Clean Water Act to continue to manage Michigan's own water resources.	Continue assumption of federal programs under the Clean Water Act.	MDEQ
5	Create an Interdepartmental Water Team to unite agencies to ensure a cohesive common strategy around implementation of the Water Strategy. The team will establish a process for stakeholder collaboration, criteria for setting implementation priorities, identifying cross agency joint	By 2015, create interdepartmental water team. By 2015, put a working agreement in place to establish implementation priorities, a process for stakeholder collaboration, and an adaptive	MDEQ, MDNR, MDARD and MEDC Directors

	projects and an approach to assess and evaluate progress achieved against the metrics and outcomes.	management approach to evaluate progress achieved against metrics and outcomes.	
Goal 9: Michigan citizens are stewards of clean water and healthy aquatic ecosystems.			
Outcome: Individuals and communities understand their responsibility for and make informed and responsible decisions regarding water resources.			
#	**Recommendation**	**Implementation Metric**	**Lead Actor**
1	Integrate water literacy principles into place-based education and state of Michigan curriculum standards tied to Science, Technology, Engineering and Math (STEM) across all grade levels.	By 2016, develop a strategy to integrate freshwater literacy principles into place-based education and state curriculum standards.	MDEQ, MDNR and Department of Education, State Board of Education
2	Develop a survey tool to assess behaviors and attitudes toward Michigan's water resources to assess changes over time.	By 2016, develop a Gant chart that encompasses all implementation activity timelines. Develop clear metrics about stewardship related to: • Ability to fund water quality infrastructure • Measuring the community's connection to local water assets • Knowledge of, and affinity for, local waters • Metrics of volunteerism and local philanthropy that support a community's vision for water and water-related assets • Measuring actual progress versus planned	MDEQ, MDNR, Universities
3	Expand opportunities to engage citizen volunteers and participation, such as the Michigan Clean Water Corp (MI Corps) program, in gathering water quality and quantity data, in restoration, providing access and maintenance of important water-related resources.	By 2016, develop a list of participants and define engagement levels. Track progress toward increasing engagement levels.	MDEQ, MDNR

Table 3: Other Recommendations Identified During the Development Process

	Goal 1: Michigan's aquatic ecosystems are healthy and functional.	
	Outcome: Aquatic ecosystems are resilient and diverse.	
#	**Recommendation**	**Lead Actor**
1	Conduct research to assess natural and social systems that comprise Michigan's Great Lakes shorelands. Include patterns of shoreline development, coastal wetland habitats, beach structures, local revenues generated from shoreland development, and use and costs incurred from development. Determine the taxpayer (public) versus insurance (private) burden of coastal damage and flooding scenarios.	Universities
2	Develop a detailed toolbox of options to provide long-term funding for storm water management, including providing support for the creation of storm water utilities.	Michigan Municipal League
3	Develop a database and conduct a statewide inventory of county and inter-county drains as well as public road and highway-dedicated drainage, including maintenance intervals and associated costs.	MDARD, drain commissioners, county road agencies, MDOT, MDEQ
4	Enhance the efforts initiated by the state parks system to incorporate green infrastructure within design and operations plans for state-owned properties like parks, roadways, prisons and schools.	DTMB
5	Develop the "Healthy Waters, Working Farms: For Future Generation Initiative," a pilot public-private partnership and locally led effort to protect farmland and address water quality, farmland preservation, and fish and wildlife habitat through a system of permanent easements and a network of conservation practices on private working lands in areas with high-priority water quality concerns.	MDEQ, MDARD, NGOs
Goal 2: Michigan's water resources are clean and safe.		
Outcome: Surface and groundwater are managed to support sustainable human uses and ecological function.		
#	**Recommendation**	**Lead Actor**
1	Promote USDA rural development funding to high-priority areas with high rates of septic system failure to replace or to maintain old septic systems or provide resources to connect to public wastewater treatment systems, if available.	MDARD
2	Establish a non-federal funding mechanism to leverage federal Great Lakes Legacy Act funds to continue the remediation of contaminated sediments in Areas of Concern by 2018.	Legislature
3	Provide water supply intake locations and information to environmental response companies upon request, and notify communities and drinking water plants that may be impacted by spills.	Legislature, MDEQ

4	Require decentralized wastewater treatment systems be included in planning for state funding of wastewater infrastructure improvements and extensions.	MDEQ, Legislature
Goal 3: Michigan communities use water as a strategic asset for community and economic development.		
Outcome: Economic and community development plans and efforts fully leverage water assets to create great places to live, work and play.		
#	**Recommendation**	**Lead Actor**
1	Ensure common water resources and adjacent land resources are managed in harmonious ways in communities and regions through coordination and collaboration to protect water resources while facilitating waterway-appropriate public use, commercial and amenity development, and recreation.	Local units of government, Regional governmental entities
Goal 4: Michigan communities use water as a strategic asset for community and economic development.		
Outcome: Waters of the state are world renowned for recreational pursuits such as hunting, fishing, boating and swimming.		
#	**Recommendation**	**Lead Actor**
1	Implement recommendations developed in partnership with Michigan Sea Grant, National Weather Service, the Great Lakes Research Center at Michigan Technological University and others to improve information for beachgoers on wave conditions and dangerous near-shore currents. Information should be available and accessible at beaches through a variety of media, including smart devices.	MDNR, MDEQ, local units of government
2	Complete the state's harbor of refuge system.	MDNR
3	Invest in innovative and technological advancements to lower the cost and frequency of dredging.	U.S. Army Corp of Engineers
Goal 5: Michigan has a strategic focus on water technology and innovation to grow sustainable water-based economies.		
Outcome: Policies and innovative technologies are developed and adopted to grow and promote sustainable water-based economies.		
#	**Recommendation**	**Lead Actor**
1	Researchers should seek funding to extend research and quantification of the risk profile water plays in corporate profitability and performance volatility. Differentiate the state and the Great Lakes from other regions of the country for financial managers and investors.	Universities
2	Expand the University Research Corridor's inventory of Michigan's water-related industries to include other water-related sectors, such as tourism and recreation, and conduct an inventory of water research projects at Michigan universities to further define and identify the scope of Michigan's water sector.	Universities

3	Direct funding of studies conducted through the Agriculture Partnership Wastewater Workgroup to develop new technologies and best management practices to address tile lines and water management, and pilot and evaluate the adoption of innovative methods for nutrient management from tile line discharges. Existing institutional structures should be used to connect end users with technologies to ensure implementation of effective water management techniques and technologies.	MDARD
4	Create a coordinated public-private program of education and incentives to promote efficient use and conservation of water.	MDEQ, MDCH
5	Collaborate with the National Science Foundation International to set a framework for gray water and water reuse applications to protect public health and minimize risk. Modify applicable building and plumbing codes to allow for the adoption of water reuse strategies.	MDEQ, MDARD, MDCH
6	Use all available tools and create new ones, including existing and new funding opportunities, to attract technology providers to address specific water quality and quantity issues, and develop strategies to connect end users with technologies. Incentivize and invest in areas including but not limited to: • Increasing technology innovation capacity in the application of rapid response E. coli testing for surface waters • Developing a market to attract innovative technology developers for low-cost, environmentally sound sediment remediation, sediment removal, reuse and disposal • Developing low-cost methods of remediating pollutants that falls outside of traditional regulatory system • Researching treatment technologies to prevent introduction and spread of invasive species by ballast water • Developing technology to address special challenges facing food processors • Developing technology to address water issues associated with fracking • Developing technology to further improve green infrastructure design and maximize infiltration capacity and/or water retention • Increasing technology innovation capacity in treatment technologies to reduce phosphorus loading from municipal systems • Developing efficient technologies to remove and separate nitrogen and phosphorus through permeable membranes for use in anaerobic digestion • Increasing technology and innovation that addresses the intersection of energy, water and food systems • Increasing energy efficiency and water quality recirculation systems for aquaculture and aquaponics for urban, closed-cycle food production systems • Developing technologies to enable higher efficiency water delivery systems and water conservation, including work on advanced drain tile management systems	MDEQ, MEDC, MDARD, MDNR

Goal 7: Michigan invests in infrastructure and supports funding to maintain clean water and healthy aquatic ecosystems.		
Outcome: People support investment of both public and private funding of Michigan water resources.		
#	**Recommendation**	**Lead Actor**
1	Continue to advocate for Great Lakes Restoration Initiative funding and other federal programs that support the Great Lakes.	State agencies, NGOs, Local units of government
Goal 9: Michigan citizens are stewards of clean water and healthy aquatic ecosystems.		
Outcome: Individuals and communities understand their responsibility for and make informed and responsible decisions regarding resources.		
#	**Recommendation**	**Lead Actor**
1	Coordinate, deliver and support ongoing freshwater-focused professional development for Michigan's K-12 educators. Convene statewide summer seminars for Michigan K-12 educators where best practices in teaching core environmental education concepts can be refined and shared.	Nonprofit organizations

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Definitions and Acronyms

AIS - Aquatic Invasive Species - An invasive species is defined as a species that is not native and whose introduction causes, or is likely to cause, economic or environmental harm or harm to human health.

AOC - Areas of Concern - Are federally designated places where numerous uses of the areas (fishing, swimming, hunting, drinking water) have been impaired dues to historical contamination.

CAWS – Chicago Area Waterways System

CMI – Clean Michigan Initiative

DDT - A commonly used pesticide (Dicholorodiphenyltrichloroethane) that was banned in 1972 that has contributed to fish consumption advisories in the Great Lakes ecosystem.

MDEQ – Michigan Department of Environmental Quality

MDNR – Michigan Department of Natural Resources

Ecosystem - The complex set of relationships among living resources and their habitat

Evapotranspiration - How water is transferred from land to the atmosphere by evaporation from the soil and transpiration from plants.

Food web - The system of interlocking and interdependent food chains

4 R Nutrient Stewardship Program – A program that provides a framework to achieve cropping system goals, such as increased production, increase farmer profitability, enhanced environmental and improved sustainability. To achieve those goals, the 4R concept incorporates the **R**ight fertilizer source, **R**ight rate at the **R**ight time and in the **R**ight place.

Great Lakes – St. Lawrence River Water Resource Compact Agreement – An Agreement amongst the eight Great Lakes states as well as Ontario and Quebec to protect against wholesale diversions of water from the Great Lakes basin.

GLITTH – Great Lakes International Trade and Transport Hub

GLRI - Great Lakes Restoration Initiative

GLSLCI – Great Lakes and St. Lawrence Cities Initiative

Grey water - The relatively clean water from sinks, baths, and washing machines.

HAB – Harmful Algal Bloom - Algal blooms that produce concentrations of harmful toxins such as blue green algae or cyanobacteria.

Impaired waters – Under section 303(d) of the Clean Water Act, states, territories, and authorized tribes are required to develop lists of impaired waters. These are waters that are too polluted or otherwise degraded to meet the water quality standards set by states, territories, or authorized tribes.

Implementation metric – A tactical metric to measure progress toward accomplishing the recommendation.

MAEAP - The Michigan Agriculture Environmental Assessment Program is an innovative, proactive, and voluntary program that helps farms of all sizes and all commodities voluntarily prevent or minimize agricultural pollution risks administered by the Michigan Department of Agriculture.

MDARD – Michigan Department of Agriculture and Rural Development

Measures of Success – A measure of the improvement in environment, social or economic conditions overtime as a result of multiple actions.

MEDC – Michigan Economic Development Corporation

Nonindigenous - Fish or wildlife not native to a place.

NPDES – The National Pollutant Discharge Elimination System (**NPDES**) permit program controls water pollution by regulating point sources that discharge pollutants into waters of the United States.

Outcomes - The desired final end results.

PCB - Polychlorinated Bi-Phenyl

PBT – Persistent Bio-accumulative Toxin

URC - University Research Corridor - The formally created research cooperative comprised of the University of Michigan, Michigan State University and Wayne State University.

U.S. EPA – United States Environmental Protection Agency

Appendix 1

Water literacy principles - The understanding of water's influence on the individual and the individuals influence on water. An example of a water literacy principle is that bodies of fresh water are connected to each other and to the world.

WHO – World Health Organization

WLEB - Western Lake Erie Basin

Development Process and Engagement Strategy

To develop the Water Strategy, the OGL formed an interagency steering committee that included representatives from the MDEQ, MDARD, DNR and MEDC. The steering committee met throughout the development of the Strategy to brainstorm, evaluate recommendations, and review content and direction. Additionally, the Michigan State Housing Development Authority (MHSDA) and the MI Place Partnership Initiative helped develop and refine ideas about water and placemaking.

An additional, external advisory committee, called the Water Cabinet, informed the Strategy's broad goals and developed a set of long-term desired environmental, economic, social and cultural outcomes. The cabinet consisted of a diverse array of 25 individuals actively engaged in ensuring the long-term health, function and resiliency of Michigan's water resources and in encouraging and nurturing its economic and cultural values.

In order to reflect diverse public perspectives, the OGL also led an extensive public engagement effort, integrated tribal involvement and engagement, and invited a series of 10 experts to develop white papers providing key insights on solutions for emerging and challenging problems that Michigan faces related to its water resources.

The OGL also hosted "Water Dialogues" with 16 communities across the state, focused on understanding different communities' capacity to create and implement a vision for water resources. These facilitated conversations, supported by a grant from the C.S. Mott Foundation, helped develop implementation tactics for the Strategy, reinforce the themes and refine the focus of the Strategy.

The draft goals and outcomes were tested at 10 regional economic roundtable discussions to understand how current local and regional economic development efforts depend on water. These discussions ultimately contributed to the development of a suite of themes reflected in the Strategy.

Finally, the OGL made a concentrated effort to encourage broad public involvement and awareness of the draft Strategy. Outreach efforts included press releases, website postings, the State of the Great Lakes report, presentations, an informational Webinar, and 30-day public comment opportunities via the Website.

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Michigan's Water Strategy
Economic Regional Roundtable Discussion Summary

Background

During 2013, the OGL hosted Economic Regional Roundtable Discussions in each of the 10 Michigan Prosperity Regions in collaboration with the Michigan Department of Natural Resources, Michigan Department of Agriculture and Rural Development, and the Michigan Economic Development Corporation. The purpose of the economic roundtables was to discuss how local and regional economic development efforts currently depend on water and related resources, and to hear and understand how the participants feel these needs and opportunities will evolve in the future. In addition, OGL gathered input on the draft Water Strategy goals, outcomes, and regional and statewide issues. The discussions were held in Marquette, Traverse City, Gaylord, Grand Rapids, Saginaw, Flint, Lansing, Battle Creek, Adrian and Detroit. Please refer to Appendix A to see the list of participants.

With the help of local contacts, OGL invited roughly 25 economic and community development leaders actively engaged in water-related projects and issues to each discussion. Attendees reflected perspectives from academia, agriculture, business, industry, economic and community development, tribal nations, conservation, environmental, fishing, hunting, harbors, public health, local units of government, planning, philanthropy, recreation, and tourism.

Summary of Key Themes

Each economic roundtable was a three-hour discussion focused on economic development and water at the regional scale. Participants provided feedback on the goals and outcomes and brought forward several themes and ideas that should be reflected in the Water Strategy. Below is the summary of these key themes.

Michigan's available freshwater resources will become increasingly valuable as water resources become scarcer nationally and globally. Attendees were asked how their region's dependence on water will evolve during the next 30 years. Responses tended to focus on Michigan's abundance of the natural resource and the increasing value of water around the world. Participants felt that Michigan will become a more attractive place to live, work and play because of the availability of fresh water and opportunities for growing business and recreational opportunities. Participants recognized that groundwater recharge, water reuse and monitoring of water resources would become increasingly important in the future.

Michigan has the opportunity to become a leader in research and development of freshwater technologies. Participants identified a need for investments in the development of technology focused on protecting and restoring Michigan's water resources as well as helping address global water issues. They highlighted collaboration among business, industry, government and universities as a way to capitalize on water technology, innovation, research and development. Michigan's leadership in technologies would increase Michigan's economic capacity and would encourage others to look to the state for guidance on water issues.

Education of leaders and citizens about basic water principles is important to inform wise decision making and drive water-related stewardship. There was consensus among participants that the public needs to understand how to protect and care for the resource and must have the desire to do so. The public, legislators and youth must be educated about basic water principles and the hydrologic cycle to make educated and wise decisions. Participants recognized the need for storytelling about the evolution of water challenges in Michigan, progress made to address these challenges, and successes to increase stewardship of the resource. More place-based education is needed to build a sense of place, stronger connections to the resource and stewardship of water.

Public access to water resources was viewed as an important opportunity for economic development and improving quality of life. Some regions were very concerned that their lack of public access points inhibited economic development. Increased public access was also viewed as a way to connect people to the resource and nurture stewardship.

Marketing strategies should place a stronger emphasis on water assets and placemaking to attract talent, economic development and tourism. Participants agreed that marketing efforts could be better utilized on a regional scale to leverage unique assets within the state. Strategies that promote high-quality, water-based job opportunities; high quality of life amenities; and water-based recreational opportunities can attract youth and talented workers.

Balancing economic growth and environmental protection was identified as challenge for many regions. Demands for increased agricultural and industrial uses create challenges for protecting water resources. Growing economic capacity is dependent on the ability to maintain infrastructure and the health of our ecosystem.

Access to clean, affordable drinking water was important to most regions of the state.

The importance of the land and water interface needs to be recognized in planning and decision making. Planning, infrastructure, agriculture and other economic decisions must be made with an understanding of the impact on water resources. Watershed planning, infrastructure investments, and community and economic development planning need to be connected.

Investment in infrastructure maintenance and management was repeatedly expressed as a priority to the regions. Most areas had infrastructure that was 50-60 years old and needed more investment in the development of sustainable, green infrastructure.

Failing septic systems need to be addressed to protect water quality and public health. Participants were concerned with the public's lack of knowledge about septic system maintenance. Many failing septic systems could be addressed through public education about appropriate maintenance, as well as through local and state regulations such as point-of-sale inspections or the establishment of a statewide sanitary septic code.

Policies, regulations, investments and resources must be aligned and integrated at all levels to achieve regional and local goals. Many participants were concerned with how the Strategy aligned with other existing plans, compacts and policies and with how the state would ensure sustainability of the Strategy. The impacts of state policies and regulations on the implementation of community development and economic development plans needs to be better understood at the local level. In some cases, regulations at the regional or state level were noted as a barrier to implementation. Participants emphasized that planning and resolution of issues were best addressed at the local level.

Conflicts around water

OGL asked participants to discuss areas of water-related conflict, particularly those occurring in their region. Many participants identified the lack of knowledge or understanding of water issues and the causes of the issue as one source of conflict. Water issues were sometimes extremely complex and participants felt that decisions were sometimes made without a full understanding or adequate information about the problem and its causes. Further, conflict is often caused by a lack of alignment in policies and decision-making among different groups working on related issues. The impact of industry, agriculture and groundwater extraction on the integrity of the water resource was a source of conflict in regions with higher concentrations of industry or groundwater contamination. The responsibility of stormwater management was also a source of conflict in urban areas.

The conversation then focused on conflicts that may arise in the future and common organizations that assist with conflict resolution. Examples of future conflicts included

groundwater withdrawals, allocation of funding and resources, and the competing uses of water for agriculture, industry and recreation. Most conflicts, participants thought, originated with a lack of knowledge about the issue and a lack of a consistent and/or accepted conflict-resolution method. Groups mentioned as trusted agents to resolve conflict included Michigan State University Extension, DEQ and DNR. While all of the regions varied on their current capacity to resolve conflict locally, most participants agreed that conflict resolution should lie at the community level. Communities need to develop the capacity to resolve conflict and collaborate at the local level.

Collaboration

OGL also asked participants if they saw any areas of potential collaboration to achieve the proposed goals and outcomes of the Strategy**.** In almost all of the regions, participants saw DEQ as a facilitator to assist in effective collaboration at the local level. They identified a strong culture of collaboration at the state, regional and community levels as necessary to achieving the Water Strategy's goals and outcomes. The creation and communication of a unifying vision statement in the Strategy would help guide communities. Diverse interest groups should work together using appropriate tools and resources to solve problems. Participants recognized opportunities to be more inclusive at the community level when working to come up with solutions. Furthermore, they recognized the large role agriculture and industry play in water usage without being brought in to the decision-making process.

Funding and resources

Participants also offered input on how the funding system should be structured to ensure capacity to fund the vital priorities that will be reflected in the Strategy. Financing and resource capacity was noted as critical to the achievement of the water strategy goals and outcomes. Some suggestions for raising funds included a charge for groundwater use, a rain tax or fee, and monetary incentives to encourage local funding. Regions also indicated that funds should come from a mix of public and private entities.

Regional Uniqueness

The economic roundtables were also intended to provide the OGL with an understanding of whether regional needs and opportunities around water were reflected in the draft goals and outcomes of the Strategy. Participants at regional meetings were asked how their region uniquely depends on water currently and in the future. In addition, participants were asked if their region's needs and opportunities around water were reflected in the draft water strategy goals and outcomes. The following sections highlight this regional distinctiveness from the participants' perspectives.

Region 1: Marquette
Participants highlighted the Upper Peninsula's unique water resources define the region and play an important role in its economy, including three Great Lakes watersheds, desirable state parks and high quality waters. A key theme expressed by the region was that economic activity has become much more diverse in the last decade in this region. In addition to the developed mining industry, tourism, fishing and paper industries have become increasingly important. About 30 percent of the region's economic base comes from the high abundance of raw materials that are available to these industries.

Participants in the Upper Peninsula expressed the importance of protecting pristine waters to prevent the need for remediation. High water quality and quantity was seen as vital to future economic development. To ensure thoughtful decision-making, they identified education of the public and young people on water and watershed principles as a priority. The group also noted an opportunity to better market the Upper Peninsula's water resources, state parks and other recreational opportunities in order to increase tourism and attract and retain young people.

Region 2: Traverse City
High quality water is extremely important to the Northwest Lower Peninsula because of growing recreational activities like kayaking, boating and swimming. However, this area faces some unique challenges with managing swimmer's itch in inland lakes and concerns about hydraulic fracturing. The region is also uniquely characterized by its strong leadership in planning and community development. Industrial features were purposefully placed in areas that would not be disruptive to the beauty or public use of natural resources.

The group anticipated the need to improve infrastructure management in order to handle the expansion of second homes, extreme weather and changes in water levels. Participants identified opportunities for water reuse and conservation in industrial use through the development of water technologies. Jobs related to this technology development were also seen as an avenue to attract and retain young talent.

Region 3: Gaylord
Northeast Michigan is uniquely characterized by an abundance of cold-water streams and rivers. More specifically, Otsego County is home to five major, pristine, cold-water river systems. Additionally, the group identified the growth of wild rice in inland lakes and commercial fishing on Lake Huron as important aspects of the region's culture. The group identified groundwater contamination and swimmer's itch on inland lakes as important issues of concern.

Tourism is an opportunity for future economic development in the region. Greater marketing of the region's abundant cold waters, shipwrecks, and fishing and boating recreational activities is needed to increase and attract visitors. Increasing local awareness of the value of the surrounding natural resources as well as educating the public and officials on land and water connections was important to participants. In addition, preserving Northeast Michigan's wetlands, high quality surface waters, and the quality and quantity of groundwater for drinking water will be important for future economic development and ecological health in the region.

Region 4: Grand Rapids

Participants saw high public access to water, the presence of five of the state's largest rivers, and higher population density as West Michigan's unique characteristics. Region 4 is self-sufficient on conflict management and has a unique culture of collaboration and innovation. Issues unique to West Michigan included: legacy contamination of the Kalamazoo River, which could become the largest superfund site in the U.S.; sewer overflows; impervious surfaces; and storm water management.

The group saw public education on the increasing value of water, water literacy principles, land and water connections, and individual impact on the resources as an important need. Further, they saw creating a culture of consciousness about water stewardship and sustainability as opportunities. The group also mentioned the need to involve a broader audience of diverse interest groups in the region's decision-making process. Another key theme expressed by Region 4 was the opportunity to expand the role of agriculture and industry in order to meet increasing demands for food and water in the future.

Region 5: Saginaw

Participants identified a world-class walleye fishery, a large coastal wetland system and the natural features of Saginaw Bay as characteristics unique to Region 5. However, the group mentioned that use of these resources for recreation is limited due to lack of public access. Saginaw is distinct from other northern Michigan regions because there is major focus on restoration of natural resources. Agribusiness was identified as a major sector in the bay area with major effect on water quality and use. Other issues identified included population loss, runoff into the bay and old infrastructure.

There was strong support to expand the bay region's tourism industry through the creation of increased accessibility to the bay, waterfront lodging, a casino, bird trails, and the cleanup of eutrophication and muck issues. The group noted that building a pier would improve visibility of the bay from the ground, and the creation of more boat and kayak launches would allow people to easily reach well-known fishing locations. Changing public perception by telling the story of improvements in water quality as a result of the

tremendous amount of work is important. Educating the public was noted as a regional need in order to create stewardship of the resource and to ensure that people focus on solving the right problems.

Region 6: Flint

The Flint group noted the region's longstanding focus on water from its dependence on the lumber, fur, automobile, manufacturing and agriculture industries. More recently, the city began to orient the community around the waterfront. Unique recreational characteristics Region 6 highlighted included bird trails, undeveloped and developed beaches, boating, fishing, and hunting. Regionally specific issues include old infrastructure on the water and traffic on the main roads.

Region 6 participants focused on the opportunity to market the area as a weekend vacation destination to recapture dollars locally instead of sending them "up north." More developed public access points, bird trails and the cleanup of old vacant industrial sites were mentioned as ways to build recreational desirability. Older infrastructure and groundwater contamination were mentioned as regionally specific issues.

Region 7: Lansing/Bath

The Lansing area saw its region as unique because of limited access to either inland lakes or the Great Lakes. This lack of abundant water features has spurred more careful stormwater management and restoration of the region's limited water resources. Further, the group mentioned that while there are some recreational activities such as swimming, kayaking and golfing, agriculture and industry dominate the region's water use. Groundwater was important to the region and was expected to grow in importance in the future.

Region 7 wanted to more effectively capitalize on water-related assets and recreational opportunities by improving quality and access to the resource. Partnerships with the universities presented opportunities to lead in the innovative solutions to maintain water in the system and protect groundwater as a source of drinking water. The group highlighted stormwater management and water reuse as major opportunities to retain water. Region 7 also noted that there are opportunities to encourage and expand innovative approaches to drive sustainability through better regulations, voluntary programs and market forces.

Region 8: Battle Creek

A key theme expressed in Southwest Michigan as a unique differentiator for the region is its dependence on agriculture. The region accounts for 70 percent of the state's irrigation, including more than 300,000 irrigated acres. Seed corn production is the major crop, but the group also mentioned that Berrien County is the second-most diverse agricultural

county in the nation because of the soils and climate. Another unique aspect emphasized in Region 8 is waterfront redevelopment opportunities that were previously neglected.

The group saw high agriculture capacity as an opportunity to address growing global food demand. The group also indicated that there is potential to market the region's recreational opportunities to increase tourism. Southwest Michigan identified the need to address contamination issues first, before removing dams, reconnecting rivers and promoting recreational opportunities. Participants also expressed a desire to improve public perceptions about water quality and educate citizens and public officials on land and water connections to ensure responsible decision-making.

Region 9: Adrian

Region 9's karst geology was identified as a major influencer of water quality unique from other parts of Michigan. The group also indicated that the region contains headwaters for many of Michigan's major rivers. Additionally, participants noted that their watershed hosts many acres of agriculture as well as artesian wells in Monroe County and parks. One other distinctive characteristic in Region 9 is a high rate of population growth and conversion of seasonal housing to year-round living.

The group emphasized the importance of addressing algae blooms in Lake Erie because they affect tourism, fisheries and water supplies. Additionally, continuing restoration initiatives like increasing river access was identified as a way to encourage economic development. Other opportunities mentioned included university engagement with water development research, attracting young professionals by reorienting communities around water resources, and increasing recreational opportunities through the development of more canoe and kayak rentals and water trails.

Region 10: Detroit

Unique regional attributes discussed included old infrastructure, an industry-driven economy, a number of universities, a dense population with a higher demand for water, a world-class fishery and a large port. The group also noted that there is limited public access to the water in Detroit and that the riverfront is underutilized. They saw Lake St. Clair's large boating and fishing industries as major recreational components of the region.

Southeast Michigan's universities were identified as having exceptional collaboration around the water sciences, creating an opportunity for the region and the state to become a leader in freshwater technologies. Stormwater and wastewater management were emphasized as potential beneficiaries of such research. Other opportunities for Southeast Michigan expressed by the group included capitalizing on unused capacity in existing infrastructure and increasing access to and marketing of the region's natural water assets for recreational use.

Feedback on Goals and Outcomes

To help attendees understand the Water Strategy's goals and outcomes, regional participants were asked to vote on the draft outcomes, choosing those that most closely reflected their region's priorities around water. Following the voting exercise, each region discussed which outcomes were selected and why. The outcomes were revisited later in the session and participants were asked if, based on the conversation, their region's views and priorities were reflected in the drafted outcomes. Participants were asked what they felt was missing from the drafted list, and were provided an opportunity to propose new outcomes. Please refer to Appendix B to review the goals and outcomes that were shared with the groups.

Voting and reflection on outcomes. The following outcomes were selected most often as priorities throughout the regions:

- Drinking water is safe and available
- Water infrastructure is well-designed and maintained to support recreational, economic, and cultural uses and values
- Groundwater is managed for human uses and environmental integrity
- Leaders at all levels support investment of both public and private funding in Michigan's water resources, reflecting individuals' value of a connection between a healthy environment, strong economy, and high quality of life

The following outcomes were selected least often as a regional priority:

- Great Lakes and inland beaches are safe for swimming
- Coastal and shoreline areas and infrastructure are compatible with ecological function and human use
- Aquatic life is managed for the resilience of aquatic ecosystem function and diversity
- Management practices recognize the land-water and hydrologic connections

Generally, participants commented that the outcomes selected least often had a more narrow focus than the ones that were most often selected. Additionally, prevention of invasive species, management through the utilization of a watershed approach and better conservation of water were issues that several participants wanted to see explicitly expressed in the outcomes. Newly proposed outcomes that received the most votes focused on funding and stewardship of the resource.

Overall, each of the regions noted that their main views and priorities were reflected in the goals and outcomes. The gaps or missing themes identified by participants were generally issues or threats to water resources, such as climate change and invasive species

management, and are more programmatic or tactical, given that they illustrate the way in which to get to a desired state or condition.

Appendix A: List of Roundtable Attendees

Economic Development Region 1
September 17, 2013 - Marquette
Northern Michigan University
Carl Lindquist, Superior Watershed Partnership
Ron Sundell, Northern Michigan University
James Cantrill, Northern Michigan University
Caralee Swanberg, Lake Superior Community Partnership
Gary LaPlant, Community Foundation of the Upper Peninsula
Karl Zueger, City of Marquette
Dr. David Watkins, Michigan Technological University
Ally Dale, Marquette County Conservation District
Jon Fosgitt, Compass Land Consultants
Dave Anderson, Copperwood Project
Phil Musser, Keweenaw Economic Development Alliance
Scott Gischia, Cleveland Cliffs
Curt Goodman, City of Marquette
Brent Ketzenberger, Cleveland Cliffs
Stacy Welling Haughey, MDNR
Steve Casey, MDEQ
JR Richardson, Traxys Power

Economic Development Region 2
September 25, 2013 – Traverse City
Northwest Michigan Works!
Megan Olds, Grand Traverse Regional Land Conservancy
Scott Gest, Northwest Michigan Council of Governments
John Sych, Grand Traverse County
Joseph H. Elliott, Grand Traverse Conservation District
Kevin McElyea, Grand Traverse County Drain Commissioner
Cindy Ruzack, Rotary Charities of Traverse City
Sarah U'Ren, Watershed Center Grand Traverse Bay
Amy Beyer, Conservation Resource Alliance
Treenen Sturman, Grand Traverse Conservation District
Tad Peacock, Benzie Conservation District
Hans VanSumeren, Northwestern Michigan College
Mark Breederland, Michigan Sea Grant
Trudy Galla, Leelanau County Planning
Dan Vogler, Michigan Aquaculture Association
Chuck May, Great Lakes Small Harbor Coalition
Greg Goudy, MDEQ
Brian Jankowski, MDEQ
Steve Hammon, Traverse City Golf and Country Club
Jim MacInnes, Owner of Crystal Mountain
Emily Myerson, Top of Michigan Trails Council
Jason Jones, Grand Traverse County Parks and Recreation
Don Coe, Michigan Department of Agriculture and Rural Development Commission
Tino Breithaupt, MEDC

Economic Development Region 3
September 24, 2013 – Gaylord
University Center
Curtis Chambers, Cheboygan County
Brad Jensen, Huron Pines
Lisha Ramsdell, Huron Pines
Jeff Ratcliffe, Otsego County Economic Alliance
John Walters, Pigeon River Country Advisory Council
Wayne R. Jonker, Kalkaska County Drain Commissioner
Dana Bensinger, Otsego County Community Foundation
Rick Harland, Grayling Charter Township
Craig Cotterman, Denton Township Supervisor
Vicki Springstead, Higgins Lake Foundation
Anne Meeks, Higgins Lake Foundation
Mark Copeland, Jay's Sporting Goods

Dawn Bodnar, Indian River Chamber of Commerce
Grenetta Thommasey, Tip of the Mitt Watershed Council
Robert Dixon, Grayling Township
Dave Waltz, Au Sable River Watershed Restoration Committee
Richard Deuell, Northeast Michigan Council of Governments
Lydia Murray, MEDC
Jeff Gray, Thunder Bay Marine Sanctuary

Economic Development Region 4
November 25, 2013 – Grand Rapids
DeVos Place
Mark Knudsen, Ottawa County Planner
April Scholtz, West Michigan Land Conservancy
Bill Byl, Kent County Drain Commission
Brad Boomstra, Kent County Drain Commission
Felicia Fairchild, Saugatuck and Douglas Convention and Visitors Bureau
David Rinard, Steelcase
Gabe Wing, Herman Miller
Kevin Larsen, H2Opportunities
Bob Kennedy, Commission Chair
Jonathon Jarosz, Heart of the Lakes
Gail Heffner, Calvin College/Plaster Creek Stewards
Nichol Demol, Trout Unlimited
Rick Chapla, The Right Place
Ed Garner, Muskegon Area First
Michelle Skedgell, Pierce Cedar Creek Institute
Dr. Hugh Brown, Pierce Cedar Creek Institute
Bonnie Hildreth, Barry Community Foundation
Patty Birkholz, League of Conservation Voters
Andy Guy, Governor Rick Snyder's Office of Urban Initiatives
Jan Urban Lurain, Spectra Data and Research
Jason Ball, Kuntzsch Business Services
Travis Williams, Outdoor Discovery Center Macatawa Greenway
Mike Wenkel, Potato Growers of Michigan Inc
Kara Wood, City of Grand Rapids
Rachel Hood, West Michigan Environmental Action Council
Vicki Luthy, Muskegon Public Health Department

Economic Development Region 5
October 3, 2013 – Saginaw
Saginaw Valley State University
Michael Kelly, Saginaw Bay Watershed Initiative Network
Dane Cramer, Ducks Unlimited
Carl Osentoski, Huron County Economic Development Corporation
Kimberly Mason, City of Saginaw
Trevor Edmonds, Saginaw Basin Land Conservancy
Dennis Zimmerman, Saginaw Bay Area of Concern
Zachary Branigan, Saginaw Basin Land Conservancy
Russ Beaubien, Spicer Group
David Karpovich, Saginaw Valley State University, Saginaw Bay Environmental Science Institute
Shirley Roberts, BaySail
Jane Fitzpatrick, East Michigan Council of Governments
Paul Strpko, Fisher Companies
Ray VanDriessche, Michigan Sugar Company
Tim Boring, Michigan State University Extension
Laura Ogar, Bay County Environmental Affairs and Community Development
Patti Stowell, Bay City Economic Development Corporation
Dr. Donald Uzarski, Institute for Great Lakes Research
Julie Spencer, Gratiot Conservation District Administrator
Trevor Keyes, Bay Future
Sheila Stamris, City of Frankenmuth Downtown Development Authority

Carey Pauquette, Saginaw Chippewa Indian Tribe
Michael Fisher, Saginaw Chippewa Indian Tribe
Peter W. Little, Gratiot County Parks and Recreation
Harry Leaver, Saginaw Valley State University, Center for Business & Economic Development
Bob Zeilinger, Cass River Greenways Committee
Joel Strasz, Bay County Health Department
Joseph Rivet, Bay County Drain Commissioner
Donald Schurr, Greater Gratiot Development
Scott Walker, Midland Tomorrow
Jennifer Humphries, MDARD

Economic Development Region 6
October 11, 2013 – Flint
Flint and Genesee Chamber of Commerce
Joe Stock, Lapeer County
Chris Bunch, Six Rivers Land Conservancy
Randy Maiers, St. Clair Community Foundation
Janice Karcher, Genesee Regional Chamber of Commerce
Doug Weiland, Genesee County Land Bank Authority
Mark Brochu, St. Clair County Parks & Recreation
Lori Eschenburg, Metropolitan Planning Commission
Jumana Vasi, Charles Stewart Mott Foundation
Mary Bohling, Michigan Sea Grant
Jason Hami, City of Marysville
Daugherty Johnson, City of Flint
Greg Alexander, Sanilac County Drain Commissioner
Janet VandeWinkle, Flint River Corridor Alliance
Jason Caya, Flint Area Reinvestment Office
Nadine Thor, Kettering University
Rafael Turner, Flint and Genesee Chamber of Commerce
Derek Bradshaw, Genesee County Metropolitan Planning
Danielle Lewinski, Center for Community Progress (Flint)
Tom Raymond, Lexington Village Manager
Rebecca Fedewa, Flint River Watershed Coalition
Steve Trecha, Integrated Strategies
Justin Sprague, Genesee Chamber of Commerce
Sheri Faust, Friends of the St. Clair River and Health Department
Marci Fogal, Blue Water Area Convention and Visitors Bureau
Jack Stock, Kettering University
Michael Freeman, Flint River Corridor Alliance
Amy McMillan, Genesee County Parks and Recreation
Justin Horvath, Shiawassee Economic Development Partnership

Economic Development Region 7
October 25, 2013 – Lansing
Bengel Wildlife Conservancy
Eric Pessel, Barry-Eaton Health Department
Liesl Eichler Clark, 5 Lakes Energy
James Byrum, Michigan Agri-Business Association
Michelle Napier-Dunning, Michigan Food & Farming Systems
Doug Buhler, Michigan State University, Michigan Agricultural Experiment Station
Sandy Gower, Ingham County Economic Development Corporation
Brad Garmon, Michigan Environmental Council
Brian Burroughs, Trout Unlimited
Laura Campbell, Michigan Farm Bureau
John Warbach, Michigan State University Land Policy Institute
Phil Hanses, Clinton County Drain Commission
Joseph Mion, Golder Associates
Phil Korson, Michigan Cherry Committee
Meghan Swain, Michigan Association for Local Public Health
Bill Maier, Board of Water and Light
Garrett Johnson, Michigan Nature Association
Tim Boring, Michigan Soybean Association

Regina Young, Barry-Eaton Health Department
Jim Zook, Corn Marketing Program of Michigan
James Byrum, Michigan Agri-Business Association
Abigail Walls, Michigan Forest Products Council

Economic Development Region 8
October 7, 2013 – Battle Creek
W. K. Kellogg Foundation
Tracy Bronson, Calhoun Conservation District
Ken Masumoto, Ken Masumoto Resources
Peter Terlouw, Southwest Michigan Land Conservancy
Dawn Dye, Calhoun County Visitors Bureau
Michael McCuistion, Edward Lowe Foundation
Robert Whitesides, Kalamazoo River Watershed Council
Robert Mason, Post Foods
Angela Myers, Battle Creek Community Foundation
Marcy Colclough, Southwest Michigan Planning Commission
Christine Hilton, City of Battle Creek Planning & Community Development
Ken Kohs, City of Battle Creek - Utilities Director
Lyndon Kelley, Michigan State University Extension
Joan Bowman, Global Food Protection Institute
Kelly Clarke, Kalamazoo County Land Bank Authority
John Gruchot, Berrien County

Economic Development Region 9
November 6, 2013 – Adrian
Lenawee Now
Dan Stefanski, River Raisin Area of Concern
Charles Londo, City of Luna Pier
Amy Torres, Jackson County Enterprise Group
Evan Pratt, Washtenaw County Water Resources Commissioner
Brian Jonckheere, Livingston County Water Resources Commissioner
Pamela McConeghy, Brighton Greater Chamber
Grant Bauman, Region 2 Planning Commission
Susan Smith, Economic Development Partnership of Hillsdale County
Christine Bowman, Hillsdale County Chamber of Commerce
Christie Cook, Community Action Agency
Shelby Bollwahn, Michigan State University Extension
Tim Lake, Monroe County Business Development Corporation
Ned Birkey, County of Monroe
Christopher Miller, City of Adrian
Martin Marshall, Lenawee County
James Van Doren, Lenawee Now
Jim Frey, Resource Recycling Systems
Richard Micka, River Raisin Public Advisory Council
Rich Weirich, Frenchtown Township
Tom Tarleton, Michigan Economic Development Corporation
Paula Holtz, City of Tecumseh
Keith McCormack, Hubbell, Roth, and Clark

Economic Development Region 10
October 21, 2013 – Detroit
SEMCOG
Tom Doran, Engineering Society of Detroit
Malik Goodwin, Detroit Economic Growth Corporation
Rebecca Witt, Greening of Detroit
Anne Vaara, Clinton River Watershed Council
Laura Rubin, Huron River Watershed Council
Gerard Santoro, Macomb County Planning
Tom Woidwode, Southeast Michigan Community Foundation
Jim Ridgway, Alliance of Rouge Communities
Bob Burns, Friends of the Detroit River
Lynne Seymour, Macomb County Public Works
Tim O'Brien, Sustainable Water Works
Joe Depinto, LimnoTech
Brian Tingley, City of Mount Clemens
Merrie Carlock, City of Southfield

Brandy Bakita Siedlaczek, City of Southfield
Michelle Selzer, DEQ
Heidi McKenzie, Ford Motor Company
Jim Wagner, City of Trenton
John Cole, Director of Mechanical Engineering, Albert Kahn Building
Erma Leaphart-Gouch, Sierra Club
Jay Richardson, Sustainable Water Works
Chris Dorle, Detroit Future City
Jim Nash, Oakland County Water Resources Commissioner
Sue F. McCormick, Detroit Water and Sewerage Department
Jamie Shea, Mission Throttle

Office of the Great Lakes Community Water Dialogues Project Report

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Chapter 1: Project Overview

Introduction

In November 2013, the Office of the Great Lakes (OGL) and Michigan United Conservation Clubs (MUCC) contracted both Kuntzsch Business Services, Inc. (KBS) and Spectra Data and Research, Inc. to conduct 16 Community Water Dialogues throughout Michigan. The project sought to accomplish four objectives:

- Provide the Office of the Great Lakes with an understanding of sixteen communities' vision for the future of their respective water resources
- Identify challenges to implementing these visions in different community types
- Identify opportunities to address common challenges
- Provide communities with a basic jumping off point from which to leverage water resources—if desired

Identification of Communities and Participants

In order to ensure appropriate identification of communities and participants, Community Profile and Participant Profile Matrices were developed to describe the key elements of a community and participant profile to be represented through the Water Dialogues. These matrices were employed to ensure adequate representation of communities and individual participants.

Community Profile

In order to ensure a reasonable representative and actionable sample of communities in which to conduct Water Dialogues, communities were identified to meet the following criteria:

- At least three communities from each area of the state (Upper Peninsula, Northern Lower Peninsula, Southwest Lower Peninsula, and Southeast Lower Peninsula) were represented
- At least one community from each prosperity region was represented
- At least four small, medium, and large communities were represented in addition to two urban core communities
- High-capacity and low-capacity communities were represented within each community type
- Communities that represent each of the water assets (e.g. rivers, streams, inland lakes, Great Lakes) and water-based industry types (e.g., extractive, dependent, recreational) were represented within each community type and area of the state

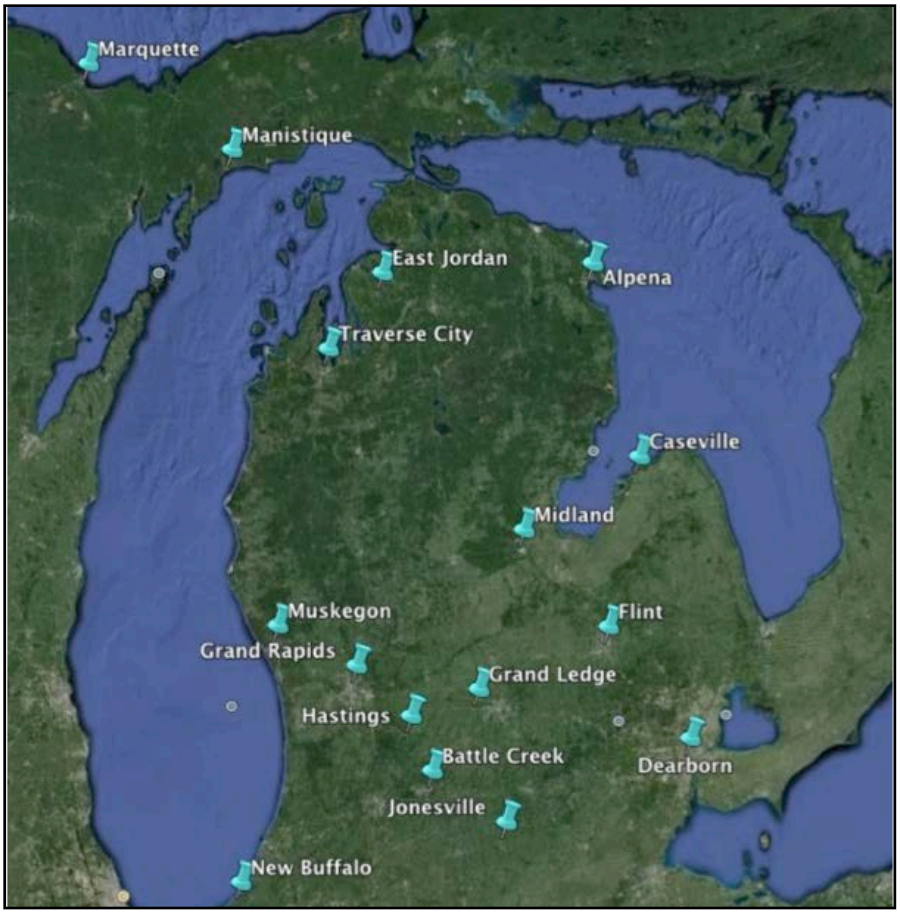
Table 1 summarizes the criteria considered when selecting communities. However, Community Capacity and Water-based Industry are not included in the table. Community Capacity is not identified in the table because it was simply too subjective to measure, especially prior to conducting sessions. Water-Dependent Industry is not listed because each industry type was found to be relevant in nearly all communities (see Chapter 2).

Table 1: Water Dialogue Session Information

Community	Area of State	Prosperity Region	Community Type	Water Assets	Date	# of Participants
Caseville	Eastern Lower	6	Small	River, Great Lakes	Mar. 14	14
Dearborn	Eastern Lower	10	Large	River	Feb. 11	11
Flint	Eastern Lower	6	Urban Core	River, Inland Lakes	Feb. 10	12
Grand Ledge	Eastern Lower	7	Medium	River	Jan. 7	12
Jonesville	Eastern Lower	9	Small	River	Feb. 18	8
Midland	Eastern Lower	5	Large	River, Inland Lake	Feb. 4	11
Alpena	Northern Lower	3	Medium	River, Great Lakes	Jan. 22	11
East Jordan	Northern Lower	2	Small	River, Inland Lake	Jan. 21	9
Traverse City	Northern Lower	2	Medium	Great Lakes, River	Feb. 5	15
Manistique	Upper Peninsula	1	Medium	Great Lakes, River	Jan. 14	5
Marquette	Upper Peninsula	1	Large	Great Lakes	Jan. 15	9
Barry County	Western Lower	4	Large	Rivers, Inland Lakes	Jan. 21	14
Battle Creek	Western Lower	8	Large	Rivers, Inland Lake	Feb. 12	8
Grand Rapids	Western Lower	4	Urban Core	River	Jan. 8	11
Muskegon	Western Lower	4	Large	Great Lakes, River	Jan. 22	17
New Buffalo	Western Lower	8	Small	Great Lakes	Feb. 12	7
					Total	**174**

Water Dialogue sessions were conducted between January 7th and March 14th, 2014 (see Map 1). Each session was planned for three hours and included a mix of presentation, individual input, and small group work. Great care was taken to ensure that participants represented community leadership in the broadest sense, and avoided participation from only the 'usual cast of characters'. The structure of each session drew from National Charrette Institute techniques as well as techniques developed by the Center for Creative Leadership.

Map 1: Water Dialogue Community Location



Participant Profile

Similar to the targeted and deliberate selection of communities, session participants were also targeted to represent specific perspectives of community leadership. Participants were sought that represented a range of characteristics, including, but not limited to:

- Diverse perspectives such as elected officials, community staff persons, tribal leaders, community residents, recreational users, industry workers, local business community leaders, faith-based leaders, regional interests, and economic development officials
- Differing levels of water-related subject matter knowledge
- Varied levels of engagement in their respective community
- Varying ages

In preparation for each Water Dialogue session, a significant amount of outreach work was conducted to engage participants with the desired characteristics. The level of outreach varied significantly with each session, but required significant targeted outreach to specific individuals given the project's short timeframe and the nature of the targeted population.

Community leaders and stakeholders identified by the project team were contacted first to gauge their interest in participating in such a session and also to provide contact information

for other community members that would have interest in the Water Dialogues. Additional follow-up was then conducted with additional community members identified by leaders and stakeholders. This preparation work set the stage for well-balanced conversations within each community and was critical to the overall success of the project.

Table 3 identifies participation by participant perspective and Figures 2 and 3 display the level of subject matter expertise and community engagement, respectively. Finally, Figure 5 details participation by age group.

Chapter 2: Survey Results

Pre-Survey

Each participant in the Water Dialogue Project was asked to complete a pre-workshop and a post-workshop exit survey. This section details results from pre-workshop surveys.

Once participants were identified (see Appendix A), they were emailed a link to an online survey and the link was again provided 24 hours prior to each Water Dialogue. Paper copies of the survey were also provided at each session. The pre-survey was designed to provide basic information about participants and their connection to community water resources.

Table 2: Respondents by Community

Community	# of Responses	# of Participants
Alpena	13	11
Barry County	10	14
Battle Creek	7	8
Caseville	6	14
Dearborn	11	11
East Jordan	8	9
Flint	8	12
Grand Ledge	12	12
Grand Rapids	12	11
Jonesville	5	8
Manistique	2	5
Marquette	10	9
Midland	7	11
Muskegon	14	17
New Buffalo	7	7
Traverse City	14	15
Total	145	174

The pre-survey set the stage for a meaningful dialogue at each session.

To begin, individuals were asked to identify which community and which perspective category they were representing. Table 2 provides the number of individuals who responded to the pre-survey for each respective community.

Table 3 displays the proportion of participants that fell into each perspective category. The categories that represented the largest proportion of individuals in the pre-survey were Community Residents (47%), Recreational Water Users (44%), and Community Leaders (26%). Please note that individuals were encouraged to check all categories that applied to them. A description of perspectives by community is included in Appendix B.

Table 3: Pre-Survey Perspective Category Totals

Perspective Represented	Pre-Survey Responses	% of Total Individuals
Community Resident	68	47%
Recreational Water User	64	44%
Community Leader	37	26%
Environmental Advocate	35	24%
Economic/Community Development Professional	26	18%

Table 3 Continued

Perspective Represented	Pre-Survey Responses	% of Total Individuals
Conservation Professional	24	17%
Appointed Official	21	14%
Local Business Owner	19	13%
Municipal Staff Person	16	11%
Elected Official	11	8%
Water-Based Industry Representative	12	8%
Active Member of Local Faith Community	11	8%
Regional or County Representative	11	8%
Industrial or Agricultural Water User	8	6%
Student	5	3%
Tribal Leader	0	0%
	Total # of Perspectives Identified	368
	Total # of Individuals Who Completed Survey	145
	Average Perspectives Per Individual	2.54

Figure 1 indicates that a large majority of participants (62%) are either currently employed in or engaged in a business or industry that depends on water resources.

As part of the pre-survey, respondents were asked to rate their knowledge of their community's water assets along with their level of engagement within the community. Responses to these questions are included in Figures 2 and 3, respectively.

Figure 1: Proportion of Individuals Dependent on Community Water Resources

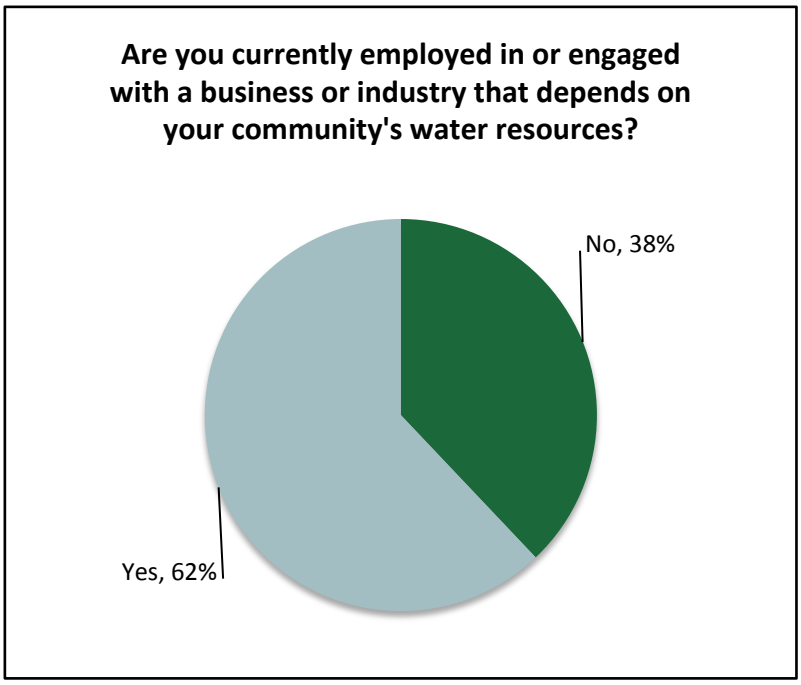


Figure 2 indicates that 77% of all survey respondents felt they were at least "Relatively Informed" when it comes to issues surrounding their community's water assets. Only 4% felt they had very limited knowledge of such issues.

When respondents were asked to classify their level of engagement within their community, 99% indicated they were at least "Somewhat Engaged". Only 1% of all respondents rated themselves as "Not Engaged".

Following these self-evaluative questions, respondents were asked to consider in what ways water is important to their respective community. Potential responses included human consumption, recreational use, agriculture, industry, tourism, business, public space, waste management, natural habitats / ecosystems, community pride, and sense of place / community character. Individuals were asked to select all uses they felt were applicable. Responses to this question are summarized in Figure 4.

Figure 2: Level of Knowledge Regarding Water Assets

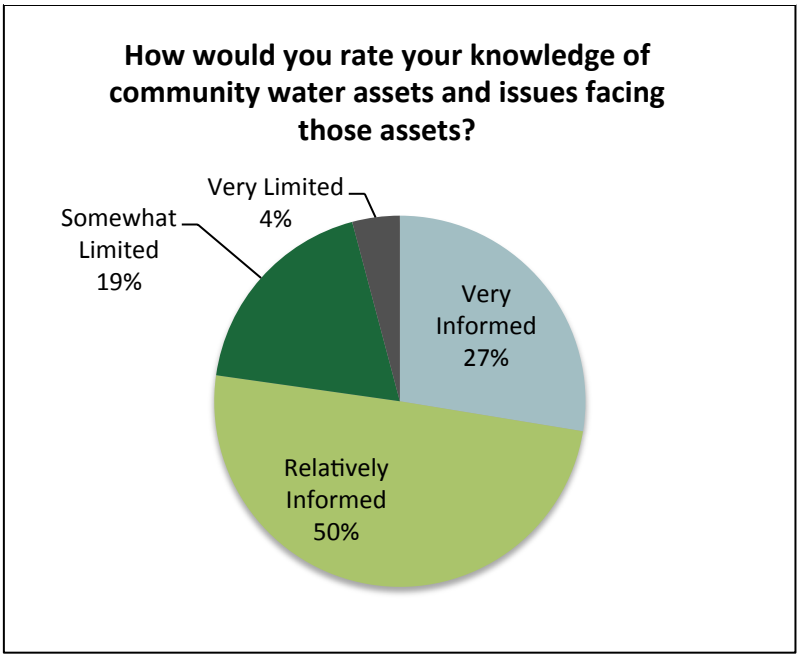


Figure 3: Level of Engagement within Community

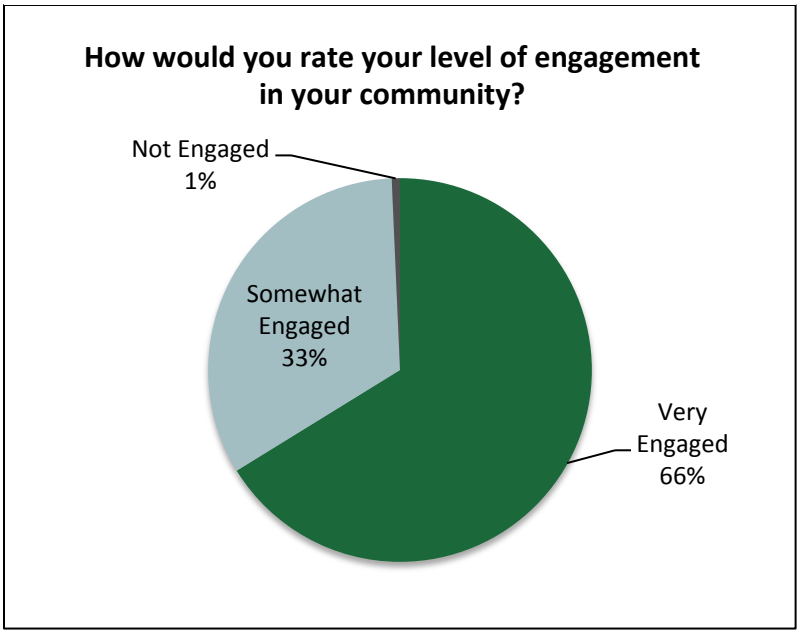
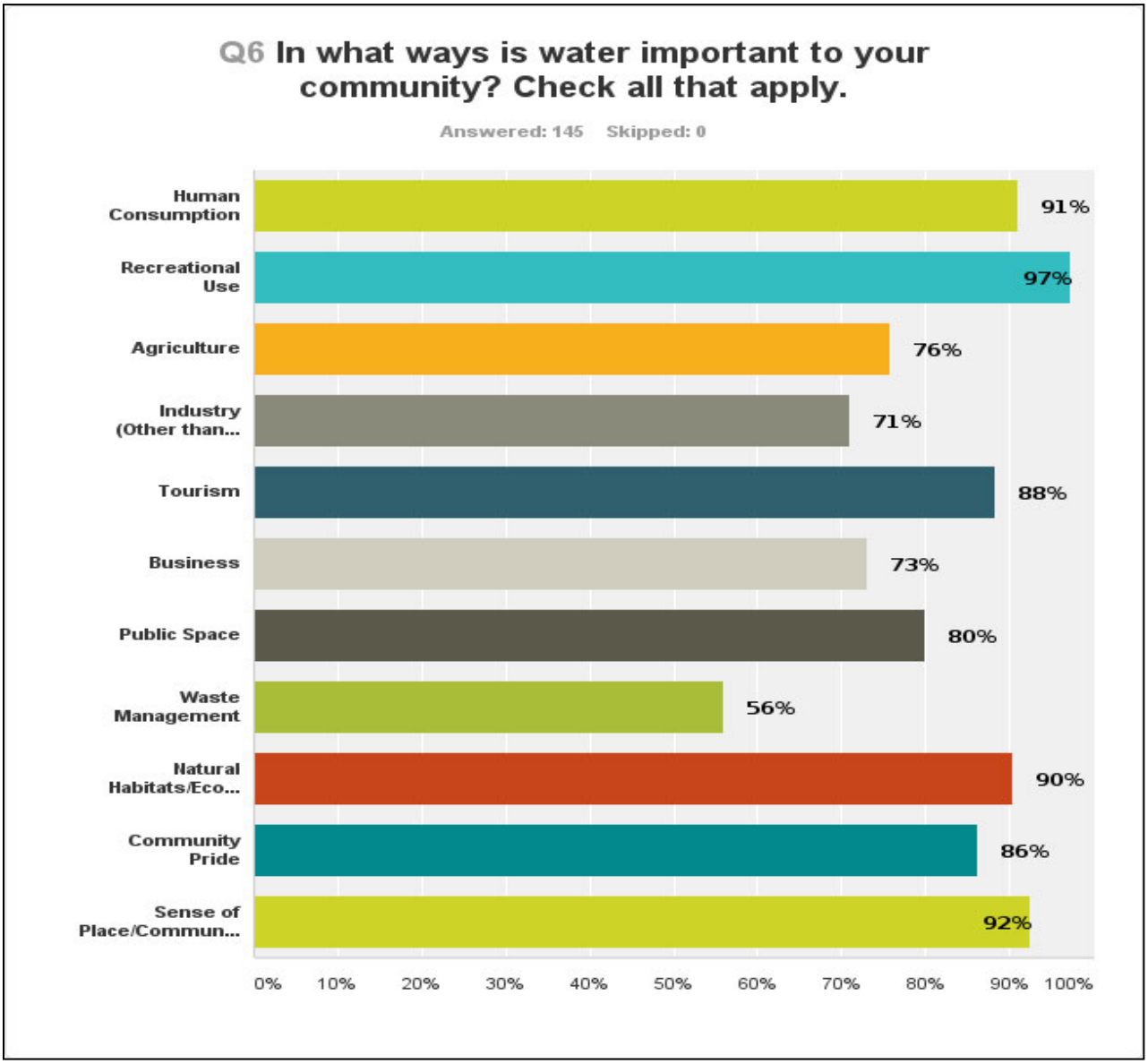


Figure 4 shows that potential uses for water identified in the pre-survey received votes from at least 50% of the respondents. Waste Management received the lowest number of responses at roughly 56%, while Recreational Use was the highest at 97%.

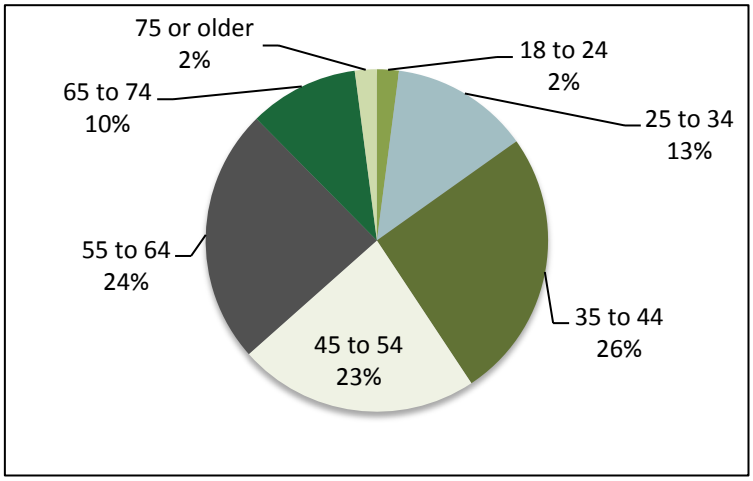
Figure 4: How is Water Important?



Finally, respondents were asked to provide their age. Figure 5 illustrates the age ranges of respondents to the pre-survey.

Approximately 75% of all respondents were between the ages of 35 and 64.

Figure 5: What is Your Age?



Exit Survey

Following the last organized activity of each session, participants were asked to provide general feedback and comments on the session. A total of 145 individuals responded to the exit survey, out of 174 total participants, giving the exit survey a response rate of 83.3%. Participants were asked the following questions:

- How satisfied are you with today's meeting?
- Was there something in particular that you wish was done differently during today's meeting?
- Are there any issues or concerns that were not identified today that you would like to identify for the group?
- On a scale of 1 to 5, 1 being not confident at all and 5 being very confident, how confident are you in your community's ability to capitalize on its water resources?

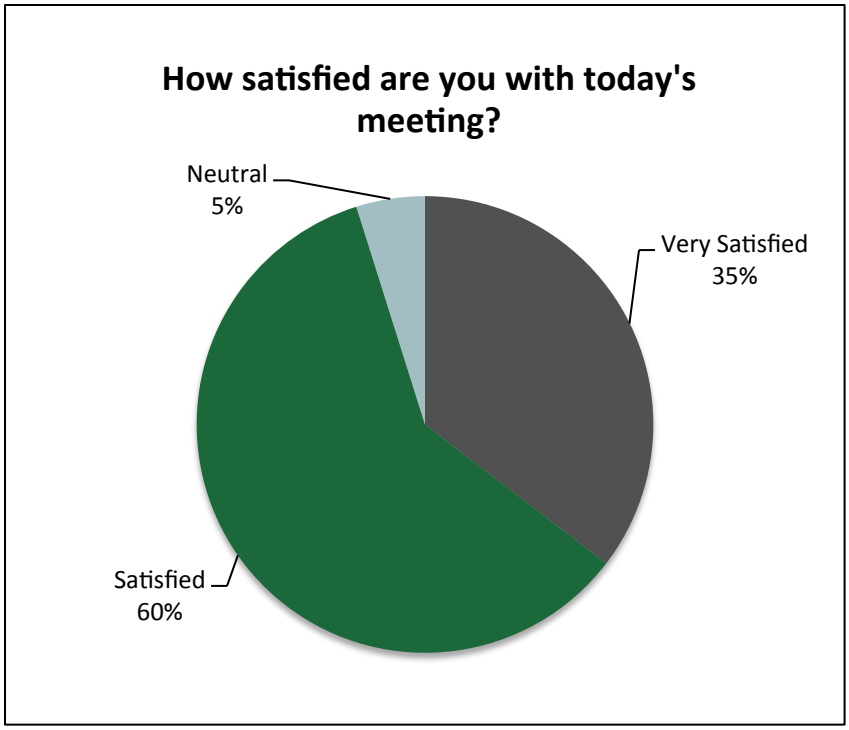
Participant Satisfaction

Figure 6 depicts the level of satisfaction of participants in all sessions. There were no responses from individuals that indicated they were "not satisfied" with the session. 95% of participants were either "satisfied" or "very satisfied' by the session.

What could be Done Differently?

Common themes from participants after completing the session were that more participants would have been beneficial to the session, many were curious how this individual session would be used to help create the statewide strategy, and many wished to see a follow-up meeting for further discussion. Detailed responses are included in each individual community report.

Figure 6: Exit Survey Level of Satisfaction



Issues or Concerns

Participants also identified common issues and concerns upon completion of the session. Many were concerned with the next steps to move from conversation to action. There was hope that the Office of the Great Lakes

would be able to provide implementation best practice resources.

Comparing Confidence: Before and After the Dialogue

The question "On a scale of 1 to 5, 1 being not confident at all and 5 being very confident, how confident are you in your community's ability to capitalize on its water resources?" was asked in both the pre-survey and exit survey. The purpose of this question was to measure any change in confidence as a result of the Water Dialogue session. Table 4 displays pre- and post-session confidence by community.

Table 4: Comparing Confidence

Community Name	Pre-Survey Average Confidence	Exit Survey Average Confidence	Difference
Alpena	3.54	4.00	+0.46
Barry County	3.60	3.75	+0.15
Battle Creek	3.57	3.57	0.00
Caseville	3.00	3.45	+0.45
Dearborn	3.82	4.15	+0.33
East Jordan	3.38	4.00	+0.62
Flint	3.13	3.75	+0.62
Grand Ledge	3.58	3.92	+0.34
Grand Rapids	4.08	4.50	+0.42
Jonesville	3.40	3.83	+0.43
Manistique	3.00	4.80	+1.80
Marquette	3.30	4.13	+0.83
Midland	3.57	4.00	+0.43
Muskegon	3.62	3.91	+0.29
New Buffalo	3.71	3.71	0.00
Traverse City	3.62	3.92	+0.30
All Communities, Average	3.50	3.96	+0.47

Session participants tended to feel more confident in their community's ability to capitalize on its water resources following the Community Water Dialogue. No communities were less confident after the session had occurred and community confidence increased an average of 0.47 points from pre-survey to exit survey. The community that experienced the greatest jump in confidence was Manistique, increasing from a 3.0 average in the pre-survey up to an average of 4.8 in the exit survey. Two communities saw no change from before to after the session; Battle Creek and New Buffalo.

Chapter 3: Water Dialogue Results

This chapter summarizes the data gathered during all 16 Water Dialogues. A representative from KBS or Spectra Data & Research, Inc. facilitated each session. Information is presented in the same order as it was gathered during each Water Dialogue session.

Vision

As a warm-up for other activities, participants were initially asked to complete the statement, "When I hear the words *[Insert Community]* and *water,* what I think of is…" KBS then categorized the responses as shown in Table 5. Responses to this question are displayed in Table 5:

Table 5: When I hear the words *[Insert Community]* and *water*

Response Category	Occurrences	Communities
Recreation	7	Barry Co, Caseville, East Jordan, Jonesville, Manistique, Midland, Muskegon
Pollution	5	Dearborn, Flint, Marquette, Midland, Muskegon
Beauty	5	Barry Co, Caseville, Manistique, Marquette, Muskegon
Drinking Water	5	Barry Co, Battle Creek, Caseville, Manistique, Midland
Fishing	5	Caseville, Flint, Marquette, Muskegon, New Buffalo
Quality	5	Barry Co, Caseville, Marquette, Midland, Traverse City
Economy	4	East Jordan, Manistique, Marquette, Muskegon
Tourism	4	Barry Co, Caseville, East Jordan, Muskegon
Opportunity	3	Alpena, Manistique, Traverse City
Accessibility	2	Jonesville, New Buffalo
Connectivity	2	Dearborn, Grand Rapids
Identity	2	Muskegon, Traverse City
Industry	2	Dearborn, Flint

Following the preliminary association exercise, participants were asked to think more fully about a vision for their community's water resources. Participants were asked to reflect on their first responses and consider the following: "Keeping your responses in mind, imagine you have been gone from this community for 20 years and have just returned. With the best hopes in mind for the community's water resources, how would you imagine your community's water resources as compared to today?" Participants were then directed to select a Visual Explorer (VE) Card that best represented their vision. Figure 7 depicts an example of VE Cards selected by participants at the Grand Rapids session.

Once a collage of images describing the vision for the future was established, participants were divided into small groups to identify the key elements of their vision. For example, most collages included pictures of recreational boaters and/or fishing, making *recreation*al *use* a key

element of these visions. Elements were then categorized into the common definitions identified in Table 6.

Figure 7: VE Cards selected in Jonesville

Table 6: Vision Element Definitions

Vision Element	Definition
Accessibility	Water resources must be accessible for all users; whether it is for recreation, industry, agriculture, or education
Recreation	Use of water for entertainment, including swimming, kayaking, boating, hiking, water trails, and going to beaches or harbors to enjoy the water resources
Balance	No single use for water should override the others. Everyone has a right to use the water and so compromises must be reached to accommodate all users.
Connectivity	Creating processes for bridging the gap between potential water users and water-related actions
Destination	A unique sense of place for a community based on an identity related to water
Economy	Agriculture, industry, tourism, and recreation related economic activity
Education	K-12 school programs, along with higher education and general education for residents related to water
Health	Water resources should provide for active lifestyles. Pollution should not be a concern.
Preservation & Protection	Ensure long term viability of community water resources
Quality & Quantity	Water should be clean and the supply adequate to support community needs
Sustainability	Ensuring that future generations have the ability to utilize water-related resources to meet their needs

Table 7 provides an overview of common vision categories across each community. Water quality and quantity were discussed most often, appearing in 12 community vision discussions. Accessibility and recreation were next, appearing in ten and eleven communities, respectively. All of the remaining categories were cited relatively equally, appearing in three to seven community vision discussions.

Table 7: Key Elements of Each Community's Vision

Community	Response Category										
	Access-ibility	Recrea-tion	Balance	Connec-tivity	Destin-ation	Economy	Education	Health	Preser-vation & Protection	Quality & Quantity	Sustain-ability
Alpena		X	X	X				X		X	X
Barry County	X		X			X		X	X	X	
Battle Creek	X	X		X						X	
Caseville		X							X	X	
Dearborn	X	X	X	X	X	X		X	X	X	
East Jordan		X	X						X	X	
Flint	X				X			X			
Grand Ledge		X					X			X	X
Grand Rapids	X	X			X					X	
Jonesville		X					X			X	
Manistique	X								X		
Marquette	X	X				X				X	
Midland	X	X								X	X
Muskegon	X		X	X		X	X		X	X	X
New Buffalo				X			X	X			
Traverse City	X	X		X		X			X		
Total	**10**	**11**	**5**	**6**	**3**	**5**	**4**	**5**	**7**	**12**	**4**

Throughout visioning exercises participants expressed surprise that developing consensus around a vision for the future of community water resources was relatively simple. Many political issues and differences between individuals were non-issues. As an overarching theme, there was a sense that a balance of uses was critical. In addition, it was clear in most communities that water presents an opportunity for both economic development and recreational tourism, both of which represent missed opportunities in many communities. With this understanding in mind, the session turned its focus toward transforming vision into action.

Generating Community Actions

Following development of a common vision for water resources, participants were asked to identify specific actions to be taken to implement the vision. First, participants identified ways that they, as individuals, could implement the vision. Next, participants identified ways that

other community members, as individuals, could alter their respective actions. Finally, participants identified ways that the community, collectively, could begin to implement the vision.

Individual responses to each of these questions were summarized into 18 common categories.[1] Table 8 provides a definition and example for each category.

Table 8: Categories for Community Action

Category	Definition	Example
Advocate	Devote skills to water-related causes in the community	Advocate for new funding sources, for government action, for local legislative change, or for water-based action
Be Open	Understanding that new ideas or change within the community is not always a negative	Be open minded to innovative funding discussions
Collaborate	Work with other entities to aggregate potential impact	Government and nonprofit organizations working together on water-related projects
Communicate	Encourage dialogue between interested parties	Discuss the importance of water resources with coworkers
Connect	Work to join stakeholders that may have mutual interests	Connect business and conservation efforts
Donate	Give money to causes or groups that support the vision	Donate to a water-based nonprofit
Educate	Inform children, friends, family, or interested community groups about water-related issues	Send water-related research to community leaders
Engage	Participate in community events to make your voice heard	Engage students to participate in a river cleanup
Find Funding	At a community scale, be proactive in seeking out new funding opportunities	Create a new storm water fee to increase community revenue
Legislate	When a need is identified within the community, act swiftly to address it via appropriate local legislation	Implement zoning changes to match Master Plan vision
Listen	Be open to the viewpoints of others and try to reach compromises	Listen to a fellow community member's idea that may be in opposition to yours

[1] Approximately 10% of all individual responses from the "Generating Community Actions" section (You, Others, and Community) and the "Developing an Action Strategy" section (How, Who, Funding, Barriers, Continued Success) were eliminated during the analysis phase because they were either not applicable to that category or illegible.

Table 8 Continued

Category	Definition	Example
Market	Devote time and resources to "selling" water-related programs or events	Develop a branding strategy associated with community water resources
Proactive	Identify and address potential problems before there are negative consequences	Improve waste treatment systems to avoid water quality problems
Promote	Spread the word about positive change within the community or to potential visitors	Use networking channels to inform others about potential uses of community water resources
Reduce Pollution	Do not contribute to contamination of community water resources	Do not dump harmful cleaning chemicals down the drain
Support	Ensure that organizations, programs, or projects have the resources they need to succeed	Help a community event with fundraising efforts
Use the Resources	Spend time using the community's water resources	Go kayaking with family
Volunteer	Donate personal time to community-based efforts	Offer to join a water-based nonprofit

What can You do Differently?

Participants were asked to consider what actions they could change, at the individual level, in order to have a positive impact on their community's water resources. Table 9 summarizes the main categories from these responses. Educating oneself or others was the overarching principle, while promoting interests and engaging more in the community was common as well.

What can Others, as Individuals, do Differently?

Next, participants discussed what other community members, as individuals, could do differently. Table 10 provides a summary of the common ideas from these discussions. Similar to Table 9, the common categories were educating oneself or others and engaging in the community.

Table 9: What can You do differently?

Category	Occurrences	Communities
Educate	25	Barry Co, Caseville, Dearborn, East Jordan, Grand Ledge, Grand Rapids, Jonesville, Manistique, Marquette, New Buffalo, Traverse City
Promote	15	Alpena, East Jordan, Midland, Muskegon, Traverse City
Engage	13	Alpena, Battle Creek, Dearborn, Flint, Grand Ledge, Grand Rapids, Midland, Traverse City
Volunteer	13	Alpena, Caseville, Dearborn, Grand Ledge, Flint, Traverse City
Stop Polluting	13	Barry Co, Caseville, Marquette, New Buffalo, Traverse City
Advocate	12	Barry Co, Battle Creek, Caseville, Flint, Muskegon, Traverse City
Connect	11	Caseville, Jonesville, Traverse City
Use the Resources	8	Battle Creek, Dearborn, East Jordan, Flint, Midland
Communicate	7	Alpena, East Jordan, Flint, Muskegon, Traverse City
Be Open	5	Grand Ledge, Grand Rapids, Manistique, Midland
Listen	4	Barry Co, Dearborn
Donate	1	Flint
Total	127	

Table 10: What can others do differently?

Category	Occurrences	Communities
Educate	17	Barry Co, Caseville, Dearborn, East Jordan, Grand Ledge, Grand Rapids, Jonesville, Muskegon, New Buffalo, Traverse City
Engage	16	Alpena, Barry Co, Flint, Grand Ledge, Jonesville, Midland, Muskegon, Traverse City
Stop Polluting	13	Barry Co, Flint, Grand Ledge, Jonesville, Marquette, Midland, Muskegon, New Buffalo
Connect	11	Alpena, Caseville, Dearborn, East Jordan, Flint, Grand Rapids, Jonesville, Marquette, Muskegon, Traverse City
Be Open	7	Barry Co, Grand Rapids, Marquette, Traverse City
Promote	7	East Jordan, Flint, Grand Rapids, Muskegon, New Buffalo
Use the Resources	6	Barry Co, Battle Creek, Grand Rapids, Marquette, Traverse City
Volunteer	6	Battle Creek, Dearborn, Jonesville, Manistique, Marquette, New Buffalo
Communicate	6	Battle Creek, East Jordan, Flint, Jonesville, Traverse City
Listen	6	Barry Co, Grand Ledge, Grand Rapids, Traverse City
Donate	5	Barry Co, Caseville, Marquette, Midland, Muskegon, Traverse City
Support	4	Flint, Grand Ledge, Jonesville, Muskegon
Total	104	

What can the Community, Collectively, do Differently?

Finally, session participants were asked to consider in what ways the community, collectively, could change its behavior. Table 11 summarizes the common responses in all sessions. The category that was discussed most often was "Legislation". Increased collaboration and innovative engagement were the next most common categories.

Table 11: What can the Community do differently?

Category	Occurrences	Communities
Legislate	21	Alpena, Barry Co, Battle Creek, Caseville, Dearborn, East Jordan, Flint, Grand Rapids, Jonesville, Marquette, Midland, Muskegon, New Buffalo, Traverse City
Collaborate	16	Alpena, Battle Creek, Caseville, Jonesville, Manistique, Marquette, Muskegon, New Buffalo, Traverse City
Engage	15	Alpena, Barry Co, Battle Creek, Caseville, Flint, Grand Rapids, Jonesville, Midland, Muskegon, New Buffalo, Traverse City
Marketing	12	Alpena, Barry Co, Battle Creek, East Jordan, Jonesville, Marquette, Midland, Muskegon
Proactive	11	Alpena, Barry Co, Battle Creek, Caseville, Jonesville, Manistique, Marquette, Muskegon, Traverse City
Find Funding	10	Alpena, Battle Creek, Grand Ledge, Grand Rapids, Jonesville, Manistique, Midland, Muskegon
Educate	10	Alpena, Caseville, East Jordan, Grand Ledge, Midland, Muskegon, New Buffalo, Traverse City
Be Open	8	Barry Co, Flint, Grand Ledge, Manistique, Midland, Muskegon
Stop Polluting	8	Barry Co, Caseville, Grand Ledge, Jonesville, Marquette, Muskegon, Traverse City
Support	5	Flint, Grand Ledge, Midland, Traverse City
Listen	1	Marquette
Total	117	

Developing an Action Strategy

After generating community actions for individuals and the community as a whole, participants were asked to identify one community action to discuss in greater detail. Each group was tasked with answering the following questions for each action selected:

- How would you implement this idea?
- Who would be responsible?
- How would it be funded?
- What are potential barriers to success?
- How would you ensure continued action / success?

Table 12 indicates which projects were identified and discussed in greater detail for each community. Please note that sessions with more participants were split into groups, and each group selected an individual action to discuss so the number of actions varies by community.

In total, 30 different actions were selected across the 16 communities. The selected actions varied on a community-by-community basis, although there were recurring themes. The main topics for action tended to fall into the following project types (the number in parenthesis indicates how many out of the total 30 actions fell into each category):

- Community engagement, awareness, education, and events (17)
- Regional collaboration efforts (6)
- Support for policies and plans (4)
- Incentives or funding efforts (3)

The above list is color-coded to match the projects identified in Table 12.

Table 12: All projects identified, by community

Community	Projects Identified
Alpena	Develop activities and businesses that incorporate water resources, Reduce plastic pollution in the community
Barry County	Engage individuals in water awareness, Increase community engagement
Battle Creek	Community festival / events on the water
Caseville	Encourage homeowners to pump septic fields annually to protect groundwater
Dearborn	Engage the community to create a vision for Rouge River, Increase public access for Rouge River, Incentivize green infrastructure implementation
East Jordan	Create a Lake Charlevoix Watershed Protection Plan
Flint	Start a "Community Jumps In" program, Trust in the Master Plan
Grand Ledge	Generate Dam funding, Support existing plans / development
Grand Rapids	Collaborate on efforts to improve efficiency, Increase community engagement and collaboration
Jonesville	Expand "Riverfest" to include discussions of water resources
Manistique	Maximize land and water usage
Marquette	Encourage outreach, education, and promotion to increase investment, Establish a regional water authority
Midland	Engage to develop a water resources plan, Promote community awareness of water resources
Muskegon	Regional water quality sampling and monitoring, Engage all communities in the Muskegon Region, Assess potential for regional water transportation opportunities
New Buffalo	Educate visitors on the value of water resources, Implement school system water education programs
Traverse City	Set community standards for environmental protection, Create a regional brand around water resources, Create a devoted funding mechanism for water resources

How would you implement this idea?

Table 13 summarizes responses to the question "How would you implement this idea?" by identifying common themes in implementation actions. Community events were mentioned the most often as an implementation strategy. Every time a community event was mentioned it was for a project that fell into the Community engagement, awareness, education, and events category. Marketing programs and education were the next most common action categories. Each of the six most common responses are directly related to community engagement.

Table 13: How would you implement this?

Action Category	Occurrences	Project Types			
		Community Engagement	Regional Collaboration	Support Policies & Plans	Incentives & Funding
Events	13	X			
Marketing	11	X		X	
Educate	10	X	X		
Identify stakeholders	8	X	X		
Collaborate	8	X	X		
Community Support	8	X	X	X	
Meetings	7	X	X	X	
Legislation	6	X			X
Funding	6			X	X
Find facilitator	3	X	X		
Volunteer	3	X			
Invest	2	X			X
Rebates / Discounts	2	X			X
Be Open	1	X			
Total	88				

Who would be responsible?

Table 14 summarizes to the question of who should be responsible for implementing each proposed project. The most common groups identified were local government, regional entities, and nonprofits or foundations.

Table 14: Who would be responsible?

Stakeholder Category	Occurrences	Project Types			
		Community Engagement	Regional Collaboration	Support Policies & Plans	Incentives & Funding
Local Government	16	X		X	X
Regional Entity	13	X	X		
Nonprofits	12	X		X	
Foundations	8	X			X
Citizens	7			X	
State Agency	6			X	
Colleges / Universities	5	X	X	X	
Local Businesses	5	X			X
Downtown Development Authority	4	X		X	X
K-12 schools	4	X	X		
Community Leader	4	X			
Chamber of Commerce	4	X		X	X
Convention & Visitors Bureau	3	X			
Parks & Recreation	3	X		X	
Tribal Groups	2	X			
Media	2	X			
Volunteers	1	X			
Total	99				

How would it be funded?

After discussing how the project would be implemented and who should be the responsible entity for implementation; session participants discussed how their respective projects could be funded. Table 15 contains the common funding mechanism categories along with the types of projects associated with each funding strategy. State Agency funds and private foundations were most common, with grants in general and community groups close behind.

What are potential barriers to success?

Session participants were asked to consider the barriers that could impede the progress of their potential project. The responses from each session were condensed into common barrier categories, included in Table 16. Funding and participation were the most commonly discussed barriers, with the political process also cited as a common barrier.

Table 15: Identified funding sources

Funding Category	Occurrences	Project Types			
		Community Engagement	Regional Collaboration	Support Plans & Policies	Incentives & Funding
State Agency	10	X	X		X
Foundations	10	X		X	
Grants	9	X	X	X	X
Community Groups	8	X	X		
Local Government	7	X		X	X
Additional Tax	7	X		X	X
Private Corporations	6	X	X		
Fundraisers	5	X			
Public-Private Partnership	4		X	X	
User fees	3	X			X
Federal Agency	3		X		X
Colleges / Universities	2	X			
Crowd-Sourcing	1			X	
Parks & Recreation	1	X			
Convention & Visitors Bureau	1	X			
Bond	1				X
Total	78				

Table 16: Barriers to success

Barrier Category	Occurrences	Project Types			
		Community Engagement	Regional Collaboration	Support Policies & Plans	Incentives & Funding
Funding	17	X	X	X	X
Participation	17	X			
Political Process	14			X	X
Marketing / Communication	8	X	X	X	X
Public Perception	8	X	X		X
Personnel	6	X			X
Education	5	X	X		X
History	4	X			
Safety	3	X			
Total	82				

How would you ensure continued action / success?

Finally, session participants were asked to consider what was necessary for their project to enjoy long-term success. Table 17 highlights the common categories from these discussions. Continued commitment and leadership are the top items that individuals believed would allow for continued success.

Table 17: Strategies for continued success

Continued Success Category	Occurrences	Project Types			
		Community Engagement	Regional Collaboration	Support Policies & Plans	Incentives & Funding
Continued Commitment	8	X	X		X
Leadership	7	X	X	X	
Education	4	X			X
Prioritize	3	X	X	X	
Communication	3	X			
Collaborate	2	X			
Transparency	1			X	
Funding	1		X		
Total	29				

Chapter 4: Findings and Recommendations

This section summarizes findings and offers recommendations related to each portion of the Community Water Dialogues project. Findings are based on input received through the Water Dialogue sessions as well as survey results. Input from each community was summarized into categories,[2] with vision elements, actions to implement the vision, and tactics to accomplish each action categorized separately (see Chapter 3). Even though input topics were categorized separately, the same themes are reflected in each (e.g., community engagement).

Pre-Survey and Exit Survey

Participants in Water Dialogues were asked to complete a survey prior to the session in their respective community and also completed an exit survey following their session.

Findings

- Participants in the Water Dialogues were satisfied with the sessions. 95% of respondents to the exit survey were satisfied or very satisfied with the session and the remaining 5% were neutral.
- The most common perspectives represented in the sessions were community resident (47%) and recreational water user (44%). Following these, the most common perspectives were community leader (26%) and environmental advocate (24%). Overall, participation from students, members of the faith community, and tribal leaders was lower than desired. Tribal leaders attended three sessions (Traverse City, Battle Creek and New Buffalo), but did not complete the pre-survey.
- Participants tended to be of career age (73% were between the ages of 35 and 64) and many had a professional stake in their community's water resources (62%).
- Participants in Water Dialogue sessions were asked to rate their level of confidence in their community's ability to capitalize on its water resources in the pre-survey and exit survey. The two largest increases from pre-survey to exit survey confidence belonged to Upper Peninsula communities (Marquette and Manistique). Marquette's confidence increased by 0.83 points, and Manistique increased by 1.80 points. The next closest communities were East Jordan and Flint, both increasing by 0.62 points.

Community Vision

Participants in Water Dialogues were guided through an individual visioning exercise using Visual Explorer images and then instructed to identify three to five key elements of a common

[2] Due to the various sizes of groups in each community, and the relatively small size of each Water Dialogue group (the largest group was 17), the scale of support for individual ideas was not analyzed. Analyzing this information could be misleading, as a relatively small group of people in an individual community or communities could greatly influence the overall support for a particular idea over another. Instead, the focus is on common ideas identified across communities.

vision in groups of four to six individuals. Vision elements from each community were then tabulated.

Findings

- **Consistency of Vision:** Overall, the vision for the future of water resources in the 16 communities was relatively consistent.
    - Three themes were pervasive when participants were asked to identify key elements of their community vision for water: 1) Accessibility of water resources, 2) Recreational use of water, and 3) Ensuring adequate quantity and improved quality of water. At least one of these themes was expressed in 15 of the 16 communities and total, they account for over 40% of the vision elements identified in all communities.
    - Remaining vision elements were identified by between three and seven communities, and evenly dispersed between community types.
    - Some combination of maintaining the health of water resources, preserving and protecting water resources, and/or ensuring quantity and quality of water resources was cited in every community vision.
- **Ease Developing a Common Vision:** Agreeing to a common vision for water resources was not particularly challenging for participants. In most sessions, participants were surprised at the consistency of individual visions for the future of water resources and the relative ease of the exercise.
- **Little Focus on Economic Opportunity:** The potential for pure economic benefit from water was not a strong theme throughout the sessions. While there is similarity between the ideas of using water resources to create a destination and bolster the economy, even when combined these ideas were only sighted in approximately ½ of all communities. Furthermore, when economy was cited as a vision element, the idea of balance—ensuring that economic and industrial needs are balanced with environmental and recreational needs—was also cited 80% of the time.
- **Urban Core Communities Strive to be a "Destination":** Only three communities identified being recognized as a "Destination" as critical to their vision. Both urban core communities, Flint and Grand Rapids, were in this category.
- **Upper Peninsula and Economy:** When asked what participants thought when they hear the words "*[Insert Community]* and *water*", participants in both Upper Peninsula communities, Marquette and Manistique, indicated they thought of the economy as associated with their respective community. This was the only geographic association of communities in the visioning exercise.

Recommendations

- **Visioning as Conflict Resolution:** An important first step for communities struggling with a particular water issue is to establish a common vision for community water resources. Often, participants on opposite sides of a current water-related issue (e.g., dam removal versus repair) found their respective visions to be relatively similar. This new common

ground allowed them to approach issues with an eye toward impact on a shared vision for the future, rather than immediate actions and political ramifications.

- **Economic Potential of Water Resources:** More opportunities must be presented to communities to create positive sum solutions for generating economic benefit from water resources. In many communities, participants were uncomfortable with the idea of focusing on water resources as an economic engine in their vision due to fear of degrading the resource. More must be done to communicate opportunities to create new economic opportunity around Michigan's water resources while simultaneously enhancing community connection to resources and opportunities for preservation and protection.

Generating Community Actions

Following development of a common vision, participants were asked to respond to three questions:

1. What can you do differently to achieve the vision?
2. What can others do differently to achieve the vision?
3. What can the community, collectively do differently to achieve the vision?

Each individual responded to all three questions and responses were summarized within each small group into three separate action types (individual, others, and community). Responses to each question were then tabulated by community.

Findings

- **Individual Actions Focused on Advocacy:** When the question, "What can you do differently to achieve the vision?" was developed, it was anticipated that responses would focus on individual behavior change (e.g., use less water). However, participants in the Water Dialogues overwhelmingly identified advocacy activities rather than individual behavior change. Fifty-seven percent of all responses were categorized as educate, promote, engage, advocate, and communicate. In contrast, individual behavior changes (volunteer, stop polluting, use the resources, and donate) account for only 28% of responses.
- **Actions of Others were Mixed Between Behavior Change and Community Engagement:** When asked "What can others do differently to achieve the vision?" the focus was on community engagement, connecting with others, and education (42% of responses), which reflects a common theme in the sessions that the general public should be more engaged, but also that professionals must be more effective in community engagement. In response to this question, behavior changes were identified with a similar frequency as in the previous question, accounting for 29% of responses.
- **Community Actions Focused on Local Government and Nonprofit Organizations:** When asked "What can the community, collectively do differently to achieve the vision?" the focus was on the actions of local government and nonprofit organizations. The most common response was to legislate local change (18% of responses). There was also a focus on effective collaboration between organizations as well as pursuit of funding

(combined, 22% of responses). Again, the focus on outreach and engagement was repeated, with engagement, marketing, and education accounting for 32% of responses.

Recommendations

- **Water Resources Must be Promoted More Effectively:** Special attention must be paid to improving awareness and use of water resources as well as creating new opportunities for community engagement around water resources. This was a common theme throughout all action types (individual, others, and community) and was noted in all communities. There was a strong sense that community members were not fully aware of water resources within their community, which was often true of Water Dialogue participants as well.
- **Entities within Communities Must Collaborate More Effectively:** Implementing a long-term vision for water resources, even in a small community, requires involvement of many stakeholder organizations and levels of government. There must be a concerted effort to orient these groups around water to ensure community water resources are leveraged in a manner that balances economic opportunity with environmental protection and recreation.

Developing an Action Strategy

After identifying actions to be taken to achieve the vision, participants were asked to select, within small groups, at least one community action to develop more fully. Often, the action selected was a combination of two or more actions identified previously or a more refined version of an individual action. After the action was identified, participants were asked to respond to five questions:

1. How would you implement this idea?
2. Who would be responsible?
3. How would it be funded?
4. What are potential barriers to success?
5. How would you ensure continued action / success?

Findings

- **Community Engagement Actions were Most Common:** The actions selected to be developed more fully fit easily into four broad categories: 1) Community engagement, awareness, education and events; 2) Regional collaboration efforts; 3) Incentives or funding efforts; and 4) Support for policies and plans. A total of 30 distinct actions were identified in the Water Dialogue communities, of which 17 (57%) were categorized as community engagement. In many communities, this activity was not necessarily viewed as having the highest impact, but it was commonly seen as a necessary first step to moving toward more impactful actions that require community support. Community engagement related to water resources was also often seen as an action that is currently lacking in communities.

- **Other than Community Engagement, Actions are Inter-Related:** The other three actions commonly identified (regional collaboration, incentives and funding, and support for policies and plans) are strongly related. For example, regional collaboration creates opportunities for new funding and incentive mechanisms that can support implementation of existing policies and plans.
- **Community Actions by Community Type:** Medium sized communities (Alpena, Grand Ledge, Manistique, and Traverse City) were much less focused on Community Engagement actions when compared to the group as a whole. These communities identified eight total actions, and only three of these (37.5%) were community engagement related. Across all communities, 17/30 (56.7%) actions identified were tied to community engagement.
- **Recreation, Access, and Connectivity were Lost:** While these ideas were universally identified as vital in community visioning, they were not a point of emphasis when developing action strategies. In a few communities these actions were seen as longer-term and participants chose to focus on immediate actions in the Water Dialogue session. However, this represents a significant opportunity for communities to implement a vision that aligns directly with existing State programs and initiatives.
- **Community Engagement is a Key Element of Most Actions:** Holding events, identifying stakeholders, holding meetings, education, and marketing account for 56% of all responses to the question, "How would you implement this idea?"
- **Responsibility for Implementation is Diverse:** While local government was the most common response, the groups identified as responsible for implementation were diverse. Most actions included many responsible parties, but generally each included potential funders, potential leaders of the action, and key stakeholders.
- **Individuals are Willing to Participate, but Hesitant to Lead:** One of the major challenges for communities was determining who would be a champion for a given action. Participants could easily identify others and even volunteer to be engaged, but there was a great deal of hesitancy in identifying a champion for a project or initiative. This is partially due to the nature of the Water Dialogue sessions, but also reflects a lack of time and resources among participants and organizations.
- **Outside Funding is Necessary, but Communities are Willing to Develop Local Funding Sources:** The majority of potential funding sources identified are external (state agency, federal agency, grants, and foundations account for 41% of responses). However, many communities identified local sources of funding, including corporations or businesses, user fees, and community groups. A fair number of communities (7) also identified additional taxes as a funding source.
- **The Most Common Barriers to Success are Funding and Participation:** Funding and participation were identified as the most common barriers to success each was a barrier to success for 17 of the 30 actions identified.
- **Communities Must Address Local Barriers:** Participation, political process, and public perception account for 48% of barriers identified and were included in nearly every action. These are barriers that must be addressed at the individual community level, and

relate directly to the need for more effective community engagement around water resources.

- **Leadership is Needed to Ensure Continued Success:** Leadership, continued commitment, and prioritization account for 62% of all responses to ensuring continued success. This is especially important considering the challenge communities had in identifying a champion for actions.

Recommendations

- **Take Advantage of Opportunities for Community Engagement:** Many communities identified existing festivals and events that take place related to water resources, but do not necessarily focus on water resources as an opportunity for engagement and/or education. Support for more efforts of this type could have a significant impact on public perception of the importance of water resources and also serve to increase use of water resources. In general, support for community engagement efforts will be critical to ensure water resources are perceived as a critical community asset.
- **Focus Efforts on Re-Connecting Communities with Water Resources:** The common theme throughout all aspects of the Water Dialogue project was a need to re-connect communities with their water resources. Different communities are at various stages relative to this effort, but it was a unifying theme. Current State programs present excellent opportunities to help communities make these connections, both physically and psychologically. For example, focusing placemaking efforts on community water resources will ensure that residents have better access to water resources and take advantage of recreational opportunities. This in turn creates a stronger connection to water resources and builds a sense of stewardship.
- **Community Members Must be Encouraged to be a Champion:** Without a dedicated local champion, especially in smaller communities, many actions will not be possible and/or struggle to sustain over time. Individuals in communities, both in their professional or personal capacities, must be encouraged and incentivized to be a champion.
- **Align State Funding Resources to Support Water Resources:** State resources will be a critical element of implementation for building upon water resources. However, the activities necessary are not traditional activities funded by regulatory agencies. For example, placemaking and community engagement efforts are equally important to implementing community visions as water quality testing. Different state agencies must coordinate efforts around water resources to ensure funding is invested in a targeted manner to help communities effectively leverage water resources.
- **Use Water Resources as a Unifying Theme for Building Community Capacity:** Water Dialogue communities had remarkably consistent visions for the future of their water resources. This presents an opportunity for communities to unify around a common goal as a means of addressing local barriers (e.g., political process).
- **Develop Best Practice Examples of Local Funding Resources:** Communities are willing to fund efforts locally, but generally do not have a great deal of experience or strong examples to follow. Developing a few examples of successful community funding efforts

to support water resources would empower communities to implement their own vision.

Appendices

Appendix A: Full List of Participants

The table below showcases a full list of Water Dialogue session participants, along with the community name of the respective session each individual attended. In total, 174 individuals attended the sessions.

Name	Community
Matt Waligora	Alpena
Charles Wiesen	Alpena
Jackie Krawczak	Alpena
Jim Klarich	Alpena
Samuel Prentice	Alpena
Roger WItherbee	Alpena
Andrea Ania	Alpena
Hannah MacDonald	Alpena
Jeff Gray	Alpena
Richard Deuell	Alpena
Paul Rogers	Alpena
Andy Helmboldt	Battle Creek
Christine Hilton	Battle Creek
Doug Grosso	Battle Creek
Homer Mandoka	Battle Creek
Kevin Smith	Battle Creek
Susan Anderson	Battle Creek
Susan Scalabrino	Battle Creek
Tiffany Eichorst	Battle Creek
David Bouck	Caseville
David Bowman	Caseville
Tonya Harrinton	Caseville
Greg Renn	Caseville
Jamie Learman	Caseville
Jeff Smith	Caseville
Kenneth Rathje	Caseville
Larry Moss	Caseville
Nancy Moss	Caseville
Rich Bass	Caseville
Lakon Williams	Caseville
David Quinn	Caseville
Erpiz Krybie	Caseville
Roger Gauther	Caseville
Amy Mangus	Dearborn
Dave Norwood	Dearborn
Jim Ridgeway	Dearborn
John O'Reilly	Dearborn
Lila Amen	Dearborn

Name	Community
Orin Gelderloos	Dearborn
Rachel Viola	Dearborn
Sally Petrella	Dearborn
Sean Galloway	Dearborn
Tom Green	Dearborn
Liz Hendley	Dearborn
Kalmin D. Smith	Grand Ledge
Karla Chamberlain	Grand Ledge
Christopher Chamberlain	Grand Ledge
Tammy Foster	Grand Ledge
Bill Kane	Grand Ledge
Rev. Cindy Skutar	Grand Ledge
Terrance Augustine	Grand Ledge
Bob Doty	Grand Ledge
Pat Harrington	Grand Ledge
Amee King	Grand Ledge
Fred Cowles	Grand Ledge
Erin Campbell	Grand Ledge
David McGhee	Flint
Derrick Mathis	Flint
Jack Stock	Flint
Janet VanDeWinkle	Flint
Jennifer Acree	Flint
Jumana Vasi	Flint
Michael Freeman	Flint
Patrick Ryals	Flint
Rebecca Fedewa	Flint
Adrian Walker	Flint
Pardeep Toor	Flint
Katie Ross	Flint
Tom Cannon	East Jordan
Thurlow McClellan	East Jordan
Dr. John Richter	East Jordan
Tim Goodwin	East Jordan
Kay Harper	East Jordan
Mary Faculak	East Jordan
Rev. Bar Adams	East Jordan
Kelly Martin	East Jordan
Chris Yonkey	East Jordan
Rachel Hood	Grand Rapids
Mike Lunn	Grand Rapids
Carrie Rivette	Grand Rapids
Wendy Ogilvie	Grand Rapids
Kristi Klomp	Grand Rapids
Steve Faber	Grand Rapids
Karen McCarthy	Grand Rapids
Mike DeWilde	Grand Rapids
Joshua Lunger	Grand Rapids

Name	Community
Kelly Rice	Grand Rapids
Michael Posthumus	Grand Rapids
Joanne Barnard	Barry County
Emily Wilke	Barry County
Rachel Zergerius	Barry County
Michelle Skedgell	Barry County
Jim WIncek	Barry County
Jane Herbert	Barry County
Bonnie Hildreth	Barry County
Mark Hewitt	Barry County
Jim McManus	Barry County
Jeff Garrison	Barry County
Lori Phalen	Barry County
Dr. Sarah Syswerda	Barry County
Tim Girrbach	Barry County
Ben Geiger	Barry County
David Steel	Jonesville
Don Germann	Jonesville
Grant Bauman	Jonesville
Jerry Drake	Jonesville
Stuart Welden	Jonesville
Tim McLean	Jonesville
Ray Leising	Jonesville
Buddy Soash	Jonesville
Paul Garber	Manistique
Alan Barr	Manistique
Corey Barr	Manistique
Sheila Aldrich	Manistique
Julie Roscioli	Manistique
Bob Stafford	Midland
Carol Miller	Midland
Dan Cline	Midland
Dick Touvell	Midland
Doug Koop	Midland
Mike Hayes	Midland
Mike Kelly	Midland
Mike Quinnell	Midland
Noel Bush	Midland
Wally Mayton	Midland
Zack Bell	Midland
Kim Arter	Muskegon
Frank Peterson	Muskegon
Dennis Kirksey	Muskegon
Jill Emery	Muskegon
Ron Matthews	Muskegon
Cindy Larsen	Muskegon
John Koches	Muskegon
Joshua Croff	Muskegon

Name	Community
T. Arnold Boezaart	Muskegon
Terry Sabo	Muskegon
Greg Mund	Muskegon
Kathy Evans	Muskegon
Ed Garner	Muskegon
Bob Lukens	Muskegon
Ben Cross	Muskegon
Rich O'Neal	Muskegon
Delphine Hogston	Muskegon
Buzz Lail	New Buffalo
H. Jason Auvil	New Buffalo
Patrick Donnelly	New Buffalo
Robert Kemper	New Buffalo
Viki Gudas	New Buffalo
Matthew Bussler	New Buffalo
Marcy Colclough	New Buffalo
Brad VanDommelen	Traverse City
Brian Haas	Traverse City
Derek Bailey	Traverse City
Don Coe	Traverse City
Douglas DeYoung	Traverse City
Gary Howe	Traverse City
Harry Burkholder	Traverse City
Kathy Huschke	Traverse City
Megan Olds	Traverse City
Mike Wills	Traverse City
Phil Loew	Traverse City
Sarah Uren	Traverse City
Warren Call	Traverse City
John Noonan	Traverse City
Jonathan Campbell	Traverse City
Brad Neumann	Marquette
Michelle Jarvie Eggart	Marquette
David Stensaas	Marquette
Rhiannon Haller	Marquette
Caralee Swanberg	Marquette
Carl Lindquist	Marquette
Curt Goodman	Marquette
Heidi Gould	Marquette
Kevin Taylor	Marquette

Appendix B: Pre-Survey Perspectives by Community

Alpena		
Perspective Represented	# of Responses	% of Individuals
Elected Official	3	23%
Appointed Official		0%
Municipal Staff Person		0%
Tribal Leader		0%
Community Resident	7	54%
Recreational Water User	7	54%
Water-Based Industry Representative	2	15%
Industrial or Agricultural Water User	1	8%
Local Business Owner		0%
Community Leader	2	15%
Active Member of Local Faith Community		0%
Regional or County Representative		0%
Economic/Community Development Professional	3	23%
Conservation Professional	1	8%
Environmental Advocate	1	8%
Student	2	15%
Total Perspectives Identified	29	
# of Individuals That Completed Survey	13	
Average Perspectives Per Individual	2.23	

Battle Creek		
Perspective Represented	# of Responses	% of Individuals
Elected Official		0%
Appointed Official		0%
Municipal Staff Person	3	43%
Tribal Leader		0%
Community Resident	4	57%
Recreational Water User	1	14%
Water-Based Industry Representative		0%
Industrial or Agricultural Water User		0%
Local Business Owner		0%
Community Leader	1	14%
Active Member of Local Faith Community	1	14%
Regional or County Representative		0%
Economic/Community Development Professional		0%
Conservation Professional	2	29%
Environmental Advocate	1	14%
Student	1	14%
Total Perspectives Identified	14	
# of Individuals That Completed Survey	7	
Average Perspectives Per Individual	2.00	

Caseville		
Perspective Represented	# of Responses	% of Individuals
Elected Official		0%
Appointed Official	1	17%
Municipal Staff Person		0%
Tribal Leader		0%
Community Resident	3	50%
Recreational Water User	4	67%
Water-Based Industry Representative	1	17%
Industrial or Agricultural Water User		0%
Local Business Owner	1	17%
Community Leader		0%
Active Member of Local Faith Community		0%
Regional or County Representative		0%
Economic/Community Development Professional		0%
Conservation Professional	1	17%
Environmental Advocate		0%
Student		0%
Total Perspectives Identified	11	
# of Individuals That Completed Survey	6	
Average Perspectives Per Individual	1.83	

Dearborn		
Perspective Represented	# of Responses	% of Individuals
Elected Official	1	9%
Appointed Official	3	27%
Municipal Staff Person		0%
Tribal Leader		0%
Community Resident	3	27%
Recreational Water User	3	27%
Water-Based Industry Representative	1	9%
Industrial or Agricultural Water User	1	9%
Local Business Owner		0%
Community Leader	2	18%
Active Member of Local Faith Community	1	9%
Regional or County Representative	1	9%
Economic/Community Development Professional		0%
Conservation Professional		0%
Environmental Advocate	3	27%
Student	1	9%
Total Perspectives Identified	20	
# of Individuals That Completed Survey	11	
Average Perspectives Per Individual	1.82	

East Jordan		
Perspective Represented	# of Responses	% of Individuals
Elected Official		0%
Appointed Official	3	38%
Municipal Staff Person	2	25%
Tribal Leader		0%
Community Resident	5	63%
Recreational Water User	4	50%
Water-Based Industry Representative	1	13%
Industrial or Agricultural Water User		0%
Local Business Owner	2	25%
Community Leader	1	13%
Active Member of Local Faith Community	1	13%
Regional or County Representative		0%
Economic/Community Development Professional	1	13%
Conservation Professional	1	13%
Environmental Advocate	4	50%
Student		0%
Total Perspectives Identified	25	
# of Individuals That Completed Survey	8	
Average Perspectives Per Individual	3.13	

Flint		
Perspective Represented	# of Responses	% of Individuals
Elected Official		0%
Appointed Official	1	13%
Municipal Staff Person	1	13%
Tribal Leader		0%
Community Resident	3	38%
Recreational Water User	3	38%
Water-Based Industry Representative		0%
Industrial or Agricultural Water User		0%
Local Business Owner	1	13%
Community Leader	4	50%
Active Member of Local Faith Community	1	13%
Regional or County Representative		0%
Economic/Community Development Professional	1	13%
Conservation Professional	1	13%
Environmental Advocate	2	25%
Student	1	13%
Total Perspectives Identified	19	
# of Individuals That Completed Survey	8	
Average Perspectives Per Individual	2.38	

Grand Ledge		
Perspective Represented	# of Responses	% of Individuals
Elected Official	2	17%
Appointed Official	3	25%
Municipal Staff Person	1	8%
Tribal Leader		0%
Community Resident	8	67%
Recreational Water User	6	50%
Water-Based Industry Representative	2	17%
Industrial or Agricultural Water User		0%
Local Business Owner	3	25%
Community Leader	5	42%
Active Member of Local Faith Community	2	17%
Regional or County Representative	2	17%
Economic/Community Development Professional	1	8%
Conservation Professional		0%
Environmental Advocate	3	25%
Student		0%
Total Perspectives Identified	38	
# of Individuals That Completed Survey	12	
Average Perspectives Per Individual	3.17	

Grand Rapids		
Perspective Represented	# of Responses	% of Individuals
Elected Official		0%
Appointed Official		0%
Municipal Staff Person	2	17%
Tribal Leader		0%
Community Resident	4	33%
Recreational Water User	5	42%
Water-Based Industry Representative		0%
Industrial or Agricultural Water User	1	8%
Local Business Owner		0%
Community Leader	3	25%
Active Member of Local Faith Community		0%
Regional or County Representative		0%
Economic/Community Development Professional	3	25%
Conservation Professional	3	25%
Environmental Advocate	3	25%
Student		0%
Total Perspectives Identified	24	
# of Individuals That Completed Survey	12	
Average Perspectives Per Individual	2.00	

Jonesville		
Perspective Represented	# of Responses	% of Individuals
Elected Official	1	20%
Appointed Official	3	60%
Municipal Staff Person		0%
Tribal Leader		0%
Community Resident	3	60%
Recreational Water User	1	20%
Water-Based Industry Representative		0%
Industrial or Agricultural Water User		0%
Local Business Owner	2	40%
Community Leader	3	60%
Active Member of Local Faith Community		0%
Regional or County Representative	1	20%
Economic/Community Development Professional	1	20%
Conservation Professional		0%
Environmental Advocate		0%
Student		0%
Total Perspectives Identified	15	
# of Individuals That Completed Survey	5	
Average Perspectives Per Individual	3.00	

Manistique		
Perspective Represented	# of Responses	% of Individuals
Elected Official		0%
Appointed Official		0%
Municipal Staff Person	1	50%
Tribal Leader		0%
Community Resident	2	100%
Recreational Water User	1	50%
Water-Based Industry Representative		0%
Industrial or Agricultural Water User		0%
Local Business Owner	1	50%
Community Leader	1	50%
Active Member of Local Faith Community		0%
Regional or County Representative		0%
Economic/Community Development Professional	1	50%
Conservation Professional		0%
Environmental Advocate	1	50%
Student		0%
Total Perspectives Identified	8	
# of Individuals That Completed Survey	2	
Average Perspectives Per Individual	4.00	

Marquette		
Perspective Represented	# of Responses	% of Individuals
Elected Official		0%
Appointed Official	1	10%
Municipal Staff Person	2	20%
Tribal Leader		0%
Community Resident	5	50%
Recreational Water User	4	40%
Water-Based Industry Representative		0%
Industrial or Agricultural Water User		0%
Local Business Owner		0%
Community Leader	1	10%
Active Member of Local Faith Community	2	20%
Regional or County Representative	1	10%
Economic/Community Development Professional	4	40%
Conservation Professional	3	30%
Environmental Advocate	4	40%
Student		0%
Total Perspectives Identified	27	
# of Individuals That Completed Survey	10	
Average Perspectives Per Individual	2.70	

Midland		
Perspective Represented	# of Responses	% of Individuals
Elected Official	1	14%
Appointed Official		0%
Municipal Staff Person	1	14%
Tribal Leader		0%
Community Resident	5	71%
Recreational Water User	3	43%
Water-Based Industry Representative		0%
Industrial or Agricultural Water User	1	14%
Local Business Owner		0%
Community Leader	3	43%
Active Member of Local Faith Community		0%
Regional or County Representative		0%
Economic/Community Development Professional	2	29%
Conservation Professional	2	29%
Environmental Advocate		0%
Student		0%
Total Perspectives Identified	18	
# of Individuals That Completed Survey	7	
Average Perspectives Per Individual	2.57	

Muskegon		
Perspective Represented	# of Responses	% of Individuals
Elected Official	2	14%
Appointed Official		0%
Municipal Staff Person	1	7%
Tribal Leader		0%
Community Resident	3	21%
Recreational Water User	6	43%
Water-Based Industry Representative	3	21%
Industrial or Agricultural Water User		0%
Local Business Owner	2	14%
Community Leader	2	14%
Active Member of Local Faith Community	1	7%
Regional or County Representative	2	14%
Economic/Community Development Professional	4	29%
Conservation Professional	4	29%
Environmental Advocate	5	36%
Student		0%
Total Perspectives Identified	35	
# of Individuals That Completed Survey	14	
Average Perspectives Per Individual	2.50	

New Buffalo		
Perspective Represented	# of Responses	% of Individuals
Elected Official		0%
Appointed Official	2	29%
Municipal Staff Person	1	14%
Tribal Leader		0%
Community Resident	2	29%
Recreational Water User	4	57%
Water-Based Industry Representative	1	14%
Industrial or Agricultural Water User		0%
Local Business Owner	2	29%
Community Leader	2	29%
Active Member of Local Faith Community		0%
Regional or County Representative	3	43%
Economic/Community Development Professional	1	14%
Conservation Professional	1	14%
Environmental Advocate	2	29%
Student		0%
Total Perspectives Identified	21	
# of Individuals That Completed Survey	7	
Average Perspectives Per Individual	3.00	

Traverse City		
Perspective Represented	# of Responses	% of Individuals
Elected Official	1	7%
Appointed Official	3	21%
Municipal Staff Person	1	7%
Tribal Leader		0%
Community Resident	6	43%
Recreational Water User	6	43%
Water-Based Industry Representative	1	7%
Industrial or Agricultural Water User	3	21%
Local Business Owner	4	29%
Community Leader	3	21%
Active Member of Local Faith Community	1	7%
Regional or County Representative		0%
Economic/Community Development Professional	3	21%
Conservation Professional	2	14%
Environmental Advocate	3	21%
Student		0%
Total Perspectives Identified	37	
# of Individuals That Completed Survey	14	
Average Perspectives Per Individual	2.64	

Summary of Current Michigan Water Protection Activities

Existing regulatory authorities at the state, local and federal units of government provide for multi-scale and multi-dimensional water resources protection in Michigan. These programs have served for decades to protect, restore and revitalize water-based resources and will continue to play a key role in implementation of the Water Strategy. Following are descriptions of Michigan's key water protection, restoration and public health programs.

Aquatic Nuisance Control

The MDEQ has the authority under Part 33, Aquatic Nuisance Control, and Part 31, Water Resources Protection, of the NREPA, to regulate the chemical control of nuisance aquatic plants, algae and swimmer's itch. Each permit application must undergo a thorough review to assess the environmental impact to the water body and any human health and safety issues. A large majority of these treatments are carried out by commercial pesticide applicators licensed by the MDARD. The MDEQ works with the MDARD to ensure those treatments and the applicators comply with the requirements of the permits and the pertinent laws.

Program staff also review new chemical products proposed for use in Michigan waters, survey Michigan lakes to determine the composition of the native plant community and presence of exotic plant species, and seek to educate riparian property owners about the management of aquatic plants and a variety of related lake management issues.

Beach Protection

In Michigan, local health departments (LHDs) have jurisdiction to test and otherwise evaluate water quality at bathing beaches to determine whether the water is safe for swimming. The LHDs advise beach owners when beaches should be closed, and, if needed, the local health officer may petition the county circuit court to close a beach. Beach monitoring results and swimming advisories are available to the public on the MDEQ's statewide beach monitoring website, www.deq.state.mi.us/beach. Additionally, signs posted at bathing beaches state whether or not the beach has been tested for *E. coli*.

Since 2000, the MDEQ has provided grants to LHDs to support and augment beach monitoring throughout Michigan. These grants are funded by a combination of state CMI bond money and federal Beaches Environmental Assessment and Coastal Health Act

(BEACH Act) funds. The BEACH Act authorizes the EPA to award program development and implementation grants to eligible states, territories, tribes and local governments. These annual grants support microbiological monitoring of coastal recreation waters, including the Great Lakes, adjacent to beaches or similar public points of access. BEACH Act grants also support development and implementation of programs to notify the public of the potential exposure to disease-causing microorganisms in coastal recreation waters.

Biosolids

The treatment of municipal wastewater generates a residual sewage sludge that can be disposed through incineration or landfilling, or can undergo additional stabilization to become biosolids. Recycling biosolids on the land has proven to be a safe and cost-effective alternative for wastewater treatment plants. Biosolids contain essential macro- and micronutrients and make an excellent fertilizer or soil conditioner. The MDEQ encourages the use of biosolids to enhance agricultural and silvicultural production in Michigan, and even allows their use for some landscaping purposes. However, if biosolids are not properly handled, they can enter surface water or groundwater and degrade water quality. To prevent such problems, the land application of biosolids is a highly regulated activity.

The federal regulations contained in Title 40 of the Code of Federal Regulations (CFR), Part 503, Standards for the Use or Disposal of Sewage Sludge; and the Part 24 Rules, Land Application of Biosolids, of the NREPA, establish criteria for biosolids land application. NPDES and state groundwater discharge permits require management of biosolids and other residuals from wastewater treatment facilities. Permittees are required to develop and obtain MDEQ approval of a Residuals Management Program. The MDEQ has district staff dedicated to overseeing the Biosolids Land Application Program by inspecting the facilities generating biosolids and the land application sites.

Campgrounds

The campgrounds program is implemented by the MDEQ in cooperation with LHDs. The program requires campgrounds to obtain an annual license, based on an approved inspection, and construction permits for new facilities or modifications to existing facilities. The focus of the program is protecting public health and safety in accord with the provisions of Article 12, Part 125 of Michigan's Public Health Code, Public Act 368 of 1978, as amended, and the administrative rules adopted pursuant to the act. The potential risks to public health from campgrounds primarily include illnesses related to inadequate water supply facilities and improper wastewater treatment practices.

MDEQ licenses about 1,200 campgrounds each year – including those under state, county and private ownership. About 1,100 of those operate and maintain a privately owned

drinking water supply and wastewater treatment system. The permitting process includes submitting plans prepared by licensed professional engineers for construction of wastewater facilities, water supply and distribution facilities, and water treatment facilities. MDEQ performs an engineering review of plans to determine compliance with law and administrative rules, and if the plans are adequate, issues a permit for construction. Additionally, MDEQ contracts with the LHDs to perform annual inspections of each campground to determine continued compliance with the law and administrative rules.

Coastal Management

The Michigan Coastal Zone Management Program is one of more than 30 coastal programs established nationwide under the authority of the Federal Coastal Zone Management Act of 1972 (PL 92-583). The National Oceanic and Atmospheric Administration (NOAA) provides annual funding to these state programs for the protection, preservation and restoration of coastal cultural and natural resources. Michigan's Coastal Zone Management Program was established as a networked program in 1978 focused on improving administration of existing state shoreline statutes like the Shorelands Act, Submerged Land Act and Sand Dunes Act; providing substantial technical and financial assistance to local units of governments for creative coastal projects; and improving governmental coordination to reduce time delays, duplication and conflicts in coastal management decision-making.

Conservation Reserve Enhancement Program

The MDEQ works closely with the MDARD to implement the Conservation Reserve Enhancement Program, a federal-state-local conservation partnership designed to reduce significant environmental effects related to agriculture. The Conservation Reserve Enhancement Program is being implemented in four critical watersheds – Saginaw Bay, Macatawa River, River Raisin, and western Lake Erie basin – that see intense agricultural land use. The program's objectives are to improve and protect water quality and to promote and enhance wildlife habitat by providing incentives to Michigan citizens to implement conservation practices (required to be in past for 15 years.). Eligible conservation practices include grass plantings, filter strips, riparian buffer strips, field windbreaks and wetland restoration. The MDEQ also supplied Section 319 and CMI funds for livestock exclusion, implementation of Natural Resources Conservation Service approved conservation practices, Conservation Reserve Enhancement Program technical assistance, and permanent conservation easements. The program has so far enrolled nearly 74,000 acres of the 85,000 acre goal in the priority watersheds.

Contaminated Sediment

The Contaminated Sediment Program exists to coordinate and implement remediation at environmentally contaminated sites that impact water quality. Sites range from recent spills or losses of pollutants from accidents or poor facility operations to historic incidents where pollutants have been in the environment for many years. Some of these sites impact surface waters directly. Others impact surface waters through the movement of contaminated groundwater, through treatment and permitted discharge of contaminated groundwater, or through discharges of contaminated groundwater to treatment facilities. The MDEQ investigates sites of environmental contamination, makes recommendations regarding proposed site remediation and treatment, evaluates treatment proposals and pollutant discharges from remediation systems, and provides other technical and project management support as necessary. The program is funded by $25 million set aside in the CMI for the investigation and remediation of contaminated sediments in Michigan lakes, rivers and streams.

Drinking Water Contamination Investigation

The MDEQ assists LHDs in drinking water quality contamination investigations of known, potential or suspected groundwater contamination by providing consultation, analytical support, toxicological assessment, well construction design, well permitting activities and development of health advisories.

The MDEQ is responsible for administering well replacement activities when drinking water wells are found to be contaminated through no fault of the well owner. Water supply alternatives include temporary provision of bottled water, temporary provision of treatment devices if the concentration of contaminants exceeds body contact advisory levels, construction of a permanent replacement well to a protected aquifer, or connection to community water, if available. Connection to community water can include construction of a basic community water system, extension of water main or connection to an existing water main.

The MDEQ also administers the statewide drinking water monitoring program for water supplies located in areas of known groundwater contamination. Sites are reviewed on an annual basis for funding eligibility. Contracts are established annually with LHDs to collect water samples and report results to well owners at specified sites of groundwater contamination.

Appendix 3

Drinking Water and Wastewater Infrastructure Financial Assistance

The MDEQ, in conjunction with the Michigan Finance Authority, operates loan and grant programs that provide financial assistance to local units of government and public water suppliers for the construction of needed wastewater and drinking water infrastructure. These programs provide loan assistance at interest rates well below open market with the intention of supporting the department's goal of improved water quality and reducing the costs passed onto the users of water and wastewater systems. Debt service payments are returned to the loan funds and "revolved" as they are lent out again. The programs are:

- Clean Water State Revolving Fund (CWSRF): The CWSRF has been in operation in Michigan since 1989 and to date has tendered 527 loans totaling more than $4.3 billion. The CWSRF has played a critical role in the state's Combined Sewer Overflow (CSO) and Sanitary Sewer Overflow Control Programs, and will operate in perpetuity to provide assistance to wastewater system owners for ongoing capital improvement needs. In addition to financing Section 212 projects (Publicly Owned Treatment Works), the CWSRF can also fund Section 319 projects (nonpoint source pollution control projects). The fund is capitalized by an annual federal grant and a required state match, with potential access to proceeds from the sale of Great Lakes Water Quality Bonds.

- Drinking Water Revolving Fund (DWRF): The DWRF has been in operation in Michigan since 1998 and to date has tendered 266 loans totaling more than $816 million. Patterned after the CWSRF, the DWRF continues to play a critical role in furthering the MDEQ's public water system program and ensuring the protection of the health of Michigan residents served by public water supplies.

- Strategic Water Quality Initiatives Fund (SWQIF): The SWQIF program was created in 2002 and is capitalized solely by proceeds from the sale of Great Lakes Water Quality Bonds. The SWQIF can fund two specific kinds of projects not eligible for the CWSRF because the facilities constructed would not be in public ownership: (1) The on-site upgrade or replacement of failing septic tanks or tile fields; and (2) The removal of stormwater or groundwater from sanitary or combined sewer leads. Through fiscal year 2014, the SWQIF has tendered 21 loans totaling more than $24 million.

- Stormwater, Asset Management, and Wastewater (SAW) Program: The new state-funded SAW Program is making available up to $450 million of additional loan and grant financing to Michigan municipalities as defined in Section 5301 of Part 53,

Clean Water Assistance, of the NREPA. The SAW Program began in April 2014 and operates alongside the established CWSRF and SWQIF loan programs, thereby, increasing the total financing options available to support water pollution control efforts in Michigan.

SAW grants are available to assist with the development of 1) wastewater and stormwater asset management plans, 2) testing and demonstration of innovative stormwater and wastewater technologies, 3) planning, design and user charge development for wastewater and stormwater systems, or 4) stormwater management plans. To date, 207 grants totaling $171 million and one loan of $2 million have been awarded to Michigan communities.

Great Lakes Water Quality Agreement

The Great Lakes form a portion of the international boundary between the U.S. and Canada, and both countries have jurisdiction over their use. The first Great Lakes Water Quality Agreement between the two federal governments was developed in 1972 and established objectives and criteria for the restoration and enhancement of water quality in the Great Lakes system.

A revised Great Lakes Water Quality Agreement was signed in 1978, recognizing the need to understand and effectively reduce toxic substance loads to the Great Lakes. The 1978 Great Lakes Water Quality Agreement adopted general and specific objectives and outlined programs and practices necessary to reduce pollutant discharges to the Great Lakes system.

Under the 1987 Protocol that amended the 1978 Great Lakes Water Quality Agreement, the U.S. and Canadian governments identified 43 of the most polluted areas in the Great Lakes basin that had serious water quality problems known to cause Beneficial Use Impairments of the shared aquatic resources. These areas were formally designated by the two governments as AOCs. Five AOCs have been subsequently restored and delisted.

Ten of the original AOCs are exclusively under Michigan jurisdiction: Clinton River, Deer Lake, Kalamazoo River, Manistique River, Muskegon Lake, River Raisin, River Rouge, Saginaw River/Bay, Torch Lake, and White Lake. The Menominee River AOC is shared with Wisconsin, and the Detroit River, St. Clair River, and St. Marys River are binational AOCs. The latter AOCs are managed jointly by a binational governance structure created under the Four Agency Letter of Commitment (also called the Four Agency Agreement) signed on

April 17, 1998, by the Environment Canada, EPA, MDEQ and Ontario Ministry of the Environment.

The 1987 Protocol called for cleanup of the AOCs through the development of Remedial Action Plans. Each Remedial Action Plan is required to identify problems that have led to Beneficial Use Impairments, identify actions needed to restore the beneficial uses and provide documentation when beneficial uses are restored. Both federal governments play an active role in the implementation of the Remedial Action Plans. All of Michigan's 14 AOCs have completed Remedial Action Plans that are currently at various stages of implementation.

The 1987 and 2012 Protocols also required the development and implementation of Lakewide Action Management Plans (LAMPs) for each of the Great Lakes. The purpose of the LAMPs is to address critical pollutants and provide a strategy to protect and restore beneficial uses impacted in the open waters of each Great Lake. The EPA, in cooperation with other government and nongovernment agencies, has developed LAMPs for Lakes Erie, Michigan and Superior. Each LAMP includes an assessment of Beneficial Use Impairments, causes of the impairment and recommendations on actions necessary to restore the beneficial uses. In developing the LAMPs, stakeholders recognized the need to address other water quality issues unique to each Great Lakes basin. The LAMPs have been updated regularly, with summary reports issued every year.

A formal LAMP has not yet been developed for Lake Huron. Instead, the MDEQ, EPA, Environment Canada, Ontario Ministry of the Environment and Ontario Ministry of Natural Resources have formed the core of a Lake Huron Binational Partnership to coordinate environmental activities in the Lake Huron basin. The group developed a Lake Huron Binational Partnership Action Plan, which is to being converted into a LAMP.

Groundwater Discharge

The MDEQ's Groundwater Discharge Program regulates discharges to the ground through the development and issuance of permits and self-certifications. A "program review team" was established to develop and implement recommendations to improve the Groundwater Discharge Program. Some of these improvements include the conversion of the groundwater permit database into the NPDES Management System to increase permitting effectiveness, section procedure updates to consolidate and streamline groundwater permitting procedures, and review of the groundwater permit application to improve permit applications and decrease processing time.

Industrial Pretreatment

The MDEQ implements federal and state rules designed to limit pollution from industrial discharges to municipal wastewater treatment facilities. In 1983, the EPA approved Michigan's pretreatment program and formally authorized the state of Michigan to oversee the program.

To assure pollutant discharges are controlled, many municipalities are also required to develop and implement local industrial pretreatment programs as a condition of their NPDES permit. The municipal requirements take two forms: municipalities subject to industrial pretreatment program regulation with design flows greater than 5 million gallons per day must develop a federal industrial pretreatment program, while municipalities subject to industrial pretreatment program regulation with design flows less than or equal to 5 million gallons per day must develop a Michigan industrial pretreatment program.

Municipalities developing either type of industrial pretreatment programs are required to submit them to the MDEQ for review and approval. Subsequent changes to an approved local industrial pretreatment program, as well as periodic reports of local program operations, must also be submitted for review. MDEQ field staff conducts periodic inspections of local industrial pre-treatment programs to identify deficiencies and initiate actions necessary to assure effective operation. Information derived from inspections and reports submitted by the municipalities are entered into the NPDES Management System database.

Inland Lakes and Streams

The Inland Lakes and Streams Program is responsible for the protection of the natural resources and the public trust waters of the state's inland lakes and streams. The program oversees and regulates activities including dredging, filling, constructing or placing a structure on bottomlands, constructing a marina, interfering with natural flow of water, or connecting a natural or artificially created waterway to an inland lake or stream. The most common projects associated with inland lakes and streams regulated under Part 301, Inland Lakes and Streams, of the NREPA, include shore protection, permanent docks or boat hoists, beach sanding, and dredging or excavation. Other types of activities may also require permits.

National Pollutant Discharge Elimination System

Discharges to state surface waters from municipal, industrial and commercial facilities must be authorized by permit under the NPDES Program. The purpose of an NPDES permit

is to control the discharge of pollutants into surface waters of the state to protect the environment. The EPA delegated the program to Michigan in 1973, and the MDEQ is responsible for processing NPDES permits, which must be reissued at least every five years.

The MDEQ reissues all NPDES permits in each individual watershed in the same year. This approach allows the MDEQ to consider cumulative impacts of all dischargers on water quality in the watershed. As part of the permit issuance process, the MDEQ develops limits for pollutants to avoid a violation of water quality standards and ensure compliance with the treatment technology regulations of the Clean Water Act. The MDEQ then places draft permits containing pollutant limits and any appropriate special conditions on public notice, allowing the opportunity for public comment.

The MDEQ also issues permits for regulated storm water discharges to owners or operators of Municipal Separate Storm Sewer Systems (MS4s). A jurisdictional-based general permit, as well as the watershed-based general storm water permit, is used to provide permit coverage.

Michigan uses a general permit for industrial storm water discharges, which requires the permittee to have a certified storm water operator and prepare and implement a Storm Water Pollution Prevention Plan. The applicability of this permit includes storm water discharges associated with industrial activity as defined in the federal regulations, as well as from special use areas (state- or federally-mandated secondary containment structures; areas designated on Michigan's List of Sites of Environmental Contamination pursuant to Part 201, Environmental Remediation, of the NREPA; and other activities subject to federal storm water regulation where storm water monitoring is necessary on a case-by-case basis). Monitoring is required only from the special use areas. Industrial storm water general permits and Certificates of Coverage are reissued on a watershed-basis, with about one-fifth of the five-year permits reissued each year.

The MDEQ also implements the state's Combined Sewer Overflow Control Program, which has resulted in annual reductions of the volume of untreated combined sewage discharged to the surface waters of the state. Through implementation of this program, municipal water treatment facilities are eliminating or properly treating and disinfecting numerous combined sewer overflow discharges

Nonpoint Source Control

The NPS Program assists local units of government; nonprofit entities; and other state, federal and local partners restore impaired waters, protect high quality waters and reduce

NPS pollution statewide. To accomplish its protection and restoration goals, the program provides:

- Technical assistance to help organizations develop and implement Watershed Management Plans, including Best Management Practice selection, land use planning activities and engineering review of site plans;
- Information and education, including activities and tools created by the MDEQ and grantees, to educate people about NPS of pollution;
- Grants to implement WMPs;
- Compliance and enforcement; and,
- Monitoring and field investigations to identify NPS problems and evaluate the effectiveness of corrective or preventive actions.

About 140 Watershed Management Plans have been developed at the local level, most by local watershed groups utilizing MDEQ grants. Watershed Management Plans serve as guides for communities to protect and improve water quality.

Onsite Wastewater Treatment

The Onsite Wastewater Treatment program, administered by the MDEQ and LHDs, protects the public health and the groundwater of the state used for drinking water by assuring proper treatment of effluent from individual residential, community residential and commercial wastewater treatment systems utilizing subsurface dispersal.

All LHDs, through their sanitary codes, are responsible for issuing permits pertaining to wastewater discharges at private, single and two-family residences. Section 2435 of the Public Health Code, 1978 PA 368, as amended, allows LHDs to "adopt regulations to properly safeguard the public health and to prevent the spread of diseases and sources of contamination." To accomplish this, all LHDs have sanitary codes that address permitting requirements for onsite wastewater systems, which are intended to safeguard public health and the environment. There are an estimated 1.3 million onsite wastewater systems in Michigan, with about 40,000 servicing non-residential facilities.

For each jurisdiction, a local decision-making process involving the Board of Commissioners, the public and the LHD promulgates onsite wastewater treatment regulations establishing site suitability and design standards for single and two-family onsite wastewater treatment systems. Statewide MDEQ criteria for large onsite systems generating flows up to 10,000 gallons per day as well as MDEQ rules for proposed subdivisions and condominium developments complement these local environmental

regulations. Some variations in local and state regulations are caused by soils, natural geologic and environmental conditions.

Current state rules and guidelines related to onsite wastewater systems include MDEQ's "Michigan Criteria for Subsurface Sewage Disposal" and administrative rules "Onsite Water Supply and Sewage Disposal for Land Divisions and Subdivisions." The Michigan Criteria apply to sources other than single and two-family home systems with flows up to 10,000 gallons per day which receive sanitary wastewater. Administrative rules apply to all proposed subdivision lots, condominium units and other land divisions. These programs are conducted by authorized LHDs with MDEQ oversight.

Public Drinking Water Supply

There are about 11,000 public water supplies in Michigan, and about 1,400 are community water supplies that furnish drinking water year-round to residential populations of 25 or more. The remaining 9,800 are either a non-transient, non-community water supply or a transient, non-community water supply. A non-transient, non-community water supply serves 25 or more of the same people for at least 6 months out of a year; examples of these are schools, factories and businesses. A transient, non-community water supply serves 25 or more people at least 60 days out of a year; examples of these are motels, restaurants, golf courses, campgrounds and convenience stores.

The MDEQ and contracted LHDs are responsible for enforcing compliance with requirements in the Michigan Safe Drinking Water Act, 1976 PA 399, as amended (Act 399), at all of the public water supplies. Michigan also is a primacy state, meaning it has received authority from the EPA to enforce compliance with the National Drinking Water Standards at all its public water supplies.

All public water supplies must collect samples of their water on a set schedule and analyze the samples for contaminants. The sampling results are reviewed by MDEQ and the LHDs. If contaminants that exceed drinking water standards are present and confirmed by repeat samples, the supply must post notice to the public and, if required, issue a boil water or do not drink notice until the underlying problem is corrected and the drinking water tests free of contaminants.

MDEQ conducts sanitary surveys of all community water supplies at least every three years to ensure the supply is properly operated and maintained. A sanitary survey is a comprehensive evaluation of the entire supply to determine the ability of the supply to produce, treat and distribute adequate quantities of water to the public. During the survey,

staff review maintenance and operation practices and records to ensure drinking water produced meets all federal and state drinking water standards. Survey findings often lead to the identification of potential problem areas that can be corrected before they become significant issues. LHDs are required to conduct sanitary surveys at all non-community drinking water supplies at least once every five years.

One additional tool employed to ensure safe drinking water is requiring that public water systems are supervised by properly trained and certified operators. To that end, MDEQ administers a drinking water operator training and certification program. About 4,600 certified operators in Michigan provide oversight of public water systems. The MDEQ offers examinations twice a year, with about 1,400 applicants annually. To stay current with technology and regulations as well as maintain their certification, each operator must also meet continuing education requirements every three years. MDEQ partners with technical assistance providers to offer targeted training to enhance the capability of operators and assist in meeting continuing education requirements.

Septage Waste

Septage is a domestic waste pumped from septic tanks and portable toilets. With assistance from participating LHDs, the MDEQ's septage waste program regulates the septage hauling industry and septage disposal practices. Michigan has about 390 licensed septage waste haulers and 850 licensed septage waste hauling vehicles. Septage may be taken to a municipal wastewater treatment facility or may be applied to agricultural land. Farms must obtain a separate permit before septage waste can be land applied.

Soil Erosion and Sedimentation Control

The Soil Erosion and Sedimentation Control Program is administered under the authority of Part 91, Soil Erosion and Sedimentation Control, of the NREPA, by state, county and municipal agencies with oversight by the MDEQ. The MDEQ's major program responsibilities include training staff members of the Part 91 agencies in the proper administration and enforcement of Part 91 and conducting periodic audits of the administering agencies to ensure their Soil Erosion and Sedimentation Control Programs comply with Part 91.

Source Water Protection

The MDEQ's Source Water Assessment Program was developed in response to the 1996 amendments to the federal Safe Drinking Water Act to identify areas that supply public drinking water, inventory contaminants, determine susceptibility of the sources and inform

the public of the results. This process helps to prioritize susceptible systems to develop and implement source water protection activities.

The MDEQ also developed the Source Water Protection Program in response to 1986 amendments to the Safe Drinking Water Act. It is a voluntary program implemented on a local level through the coordination of activities by local, county, regional, state, and federal agencies. Although the program is voluntary, Public Water Supply Systems that participate in source water protection must develop a local Source Water Protection Program consistent with the guidelines established by the MDEQ. Local programs must designate local roles and responsibilities,, establish a Source Water Protection Area, identify potential sources of contamination within the area, develop strategies to manage potential sources and minimize threats to the supply system, develop contingency plans for water supply emergencies, identify procedures for the development of new well sites, and provide opportunities for public education.

Funding for local Source Water Protection Programs is available through a grant program that provides 50 percent of funds and must be matched with local funds.

To help evaluate the vulnerability of public water supplies relative to potential sources of contamination, the MDEQ developed the Michigan Groundwater Management Tool to assess groundwater flow regimes and identify the wellhead protection area for public water supply systems throughout the state. It is a groundwater modeling software system that provides for the mapping, display and analysis of groundwater flow direction. It can also be used by other MDEQ programs to analyze contaminant migration.

Well Construction

Michigan has about 1.1 million household drinking water wells, more than any other state in the country. Drinking water wells must be properly constructed and maintained both to protect the quality of the drinking water pumped by the well and to protect the aquifer from contamination. Michigan's well construction program assures drinking water wells are properly constructed, operated and decommissioned in a technically sound manner under the authority of Michigan's Public Health Code, Public Act 368 or 1978, Part 127, as amended.

The MDEQ annually registers well drilling contractors, pump installers, dewatering contractors and well drilling machines, and administers exams before the initial registration. The MDEQ also administers a comprehensive database, Wellogic, to store all drinking water well and pump records submitted by water well contractors since 2000.

Under contract, Michigan's LHDs implement the well construction program statewide by issuing well construction permits, reviewing drilling and plugging records, and conducting inspections to ensure wells are installed in conformance with state and local codes. LHDs also ensure that abandoned wells are properly plugged to prevent groundwater contamination. The MDEQ evaluates the performance of the LHDs in implementing the well construction program and provides compliance assistance and training to ensure successful implementation of the program.

Wetlands Protection

The MDEQ has administered a statewide wetland regulatory program for 30 years, including public education programs that encourage wetland preservation and restoration, cooperation with governmental and nongovernmental agencies to encourage the evaluation and management of wetlands on a local and watershed basis, and development of a monitoring and assessment program. Michigan's Goemaere-Anderson Wetland Protection Act was passed in 1979 and makes up Part 303 of the NREPA. It provides for the preservation, management, protection and use of wetlands; requires permits to alter wetlands; and provides penalties for illegal wetland alteration.

This act requires that persons planning to conduct certain activities in regulated wetlands receive a permit from the state before beginning the activity. Michigan's regulatory program generally requires mitigation for all wetland impacts, although the MDEQ staff may waive this requirement for projects impacting less than one-third acre if no reasonable opportunity for mitigation exists, or for projects having a basic purpose of creating or restoring wetlands. Mitigation may be considered only after the applicant has demonstrated avoidance and minimization of impacts, and it has been determined that a project is otherwise permitable. A mitigation proposal must result in no net loss of wetlands upon completion of a project. Financial assurances are required to ensure completion of any mitigation project that is not completed in advance of associated impacts. Mitigation sites must be permanently protected through a conservation easement.

Administrative rules defining the establishment and use of mitigation banks were promulgated in 1997. Fifteen mitigation banks are currently listed in Michigan's Wetland Mitigation Bank Registry, and a number of other mitigation bank sites are currently under consideration or development. Recent changes to state and federal laws have resulted in preference for wetland banks to mitigate for unavoidable losses to wetland resources. New legislation enacted in Michigan in 2013 developed a Wetland Mitigation Bank Funding Program to provide grants and low-interest loans to eligible municipalities interested in pursuing a wetland bank. In 2014, a total of $3 million was available for this program.

Michigan also has developed other regulatory and non-regulatory programs to manage Michigan's wetland resources, including:

- Part 303 authorizes regulation of wetlands by a local unit of government provided that the local unit uses Part 303's definition of wetlands and permit criteria. Currently, more than 40 communities in Michigan have local wetland protection ordinances.
- The MDEQ has organized and leads the Wetland Work Group, an informal interagency team including various state, federal and nongovernmental organizations concerned with wetland restoration and management.
- To encourage consideration of wetland issues, the MDEQ provides technical assistance to local watershed planning organizations and assists in locating areas with a high potential for wetland restoration. Using existing datasets and GIS technology, the MDEQ created a GIS layer that highlights these wetland restoration areas and ranks them by potential.
- The MDEQ developed a landscape-scale wetland assessment method to assist watershed groups in managing, protecting, and restoring wetlands in the context of watershed management planning. The MDEQ makes use of GIS data, including National Wetland Inventory maps, to provide an evaluation of wetland functions and make more effective decisions regarding the need for wetland protection, restoration or management in watershed.
- The MDEQ uses conservation easements that offer comprehensive and permanent protection to high-quality wetlands. Conservation easements are used to fulfill mitigation requirements or protect wetlands avoided during the planning of an authorized construction project.

Michigan's Wetland Protection Program was approved by the EPA in accordance with the requirements of Section 404(h) of the Clean Water Act in August 1984, making Michigan the first state to assume administration of Section 404. Although at least 34 states have their own wetlands program, only two states, Michigan and New Jersey, have been able to meet all the requirements to assume the Clean Water Act Section 404 Program in "traditionally navigable waters." The U.S. Army Corps of Engineers, retains Section 404 jurisdiction in these waters, including the Great Lakes, connecting channels such as the Detroit River, and river mouth areas.

To maintain Michigan's authorization under Section 404, state law must remain consistent with federal regulation, including exemptions, general permits, public notice procedures and review criteria. In addition to meeting these requirements, Michigan's law provides the

citizens of the state with a significant savings in time and money while providing efficient and effective protection of wetland, lake, and stream resources by clearly defining regulated wetlands, providing permitting timeframe requirements, and streamlining and consolidating permit review.

The MDEQ processes about 4,000 to 6,000 permit applications per year under Section 404. About 1,500 of these applications propose wetland impacts; the remainder propose to alter lakes and streams only. The MDEQ works with permit applicants to redesign proposals when necessary to avoid and minimize resource impacts. The MDEQ is currently working, under an EPA Water Permits Division Grant, to develop a comprehensive database for Michigan's Section 404 Program that will incorporate new technologies and methods for screening, evaluating and tracking impacts.

In 2008, the EPA published findings from a 10-year review of Michigan's Section 404 Program, and although they found Michigan's administration of the program was good, they identified changes needed to maintain federal consistency. These changes included administrative actions and procedures, revision of administrative rules, statute amendments to clarify exemptions, and updating the program Memorandum of Agreement. After working with stakeholders on the changes required to maintain the state program, Michigan's Legislature passed a new law in 2013 that includes many of the necessary changes for Michigan's 404 program as well as several other programmatic changes. The EPA is currently evaluating these changes to determine whether they are consistent with the Clean Water Act.

Public Comment

"**Sustaining Michigan Water Heritage, A Strategy for the Next Generation"** draft, dated June 4, 2015

Submitted by;
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July 22, 2015

I commend our state government agencies and those individuals behind the effort for bringing this very important issue forward to craft a proactive plan to preserve and protect our state's most valuable resource….water.

The report's vision statement, "Michigan's water resources support a healthy environment, healthy citizens, vibrant communities and sustainable economies" articulates the critical, but often over looked, need to protect this vital resource. As indicated in the report title, it is crucial that we take action now to protect and enhance those water resources, not only for current users, but as responsible stewards for future generations. The action plan outlined in the nine comprehensive goals, defines a set of priorities and details that support the vision statement.

While there are a few other potential water threats that may not be identified in the report, I suggest that another threat exists that has both direct and indirect negative impacts on our water resources, both surface and groundwater. *The pollutant is road salt*.

As a senior horticulturist at the University of Michigan I had the opportunity to chair a salt use reduction team from 1995 until I left in 2002. Our team had identified multiple problems associated with our existing salting program and were tasked with finding solutions to change these practices. Problems associated with road salt, at that time, were just beginning to surface and there were no clear solutions to strike the balance between public safety, existing budgets, and salt reduction goals that preserved the infrastructure and environment. Through research, extensive visits to other innovators, and our own trial and error efforts, we were ultimately able to obtain a 50% reduction of our ten year average salt use during the winter of 2001/2002.

Sadly, there continues to be enormous annual, and hence cumulative, contributions of road salt that are degrading environmental resources and are clearly implicated in the premature destruction of vital and costly infrastructure. In the winter of 2014/15 agencies responsible for state road maintenance used nearly 500,000 tons of salt on state roads alone. Additional salt used by counties, cities, and other public and private concerns, would increase that total to between 1.5 and 2 million tons per season. These quantities are down from years ago when state roads reached a high of 800,000 tons.

That said, there is still much work that could be done. Could a fifty percent reduction goal be attainable within the 30 year time frame in the report? With some effort and minimal investment, that goal might be achievable by 2020.

In 1991, Michigan State University hosted, perhaps the first of its kind, Road Salt Symposium which brought researchers together from all over the world to discuss the concerns being posed for

increasing road salt use. An outstanding compilation of that symposium was produced by Frank D'Itri. Following up on this problem recognition, in the early 90's, the late State Representative/Senator William Van Regenmortor proposed an environmental safety act that focused on identifying the problems associated with excess salt use and then sought alternative strategies by which both public safety, environmental and infrastructure interests could be served. In an attempt to gain unanimous support in his bill that failed, the approach sought input from multiple stakeholders who would be impacted by the effort. This model became the guide for a salt reduction process we undertook at the University of Michigan back in 1995. Michigan likely would be leading the nation in winter maintenance best practices and also not facing some of the burgeoning costs associated with transportation infrastructure failure had we heeded the advice of the late Senator. Compounding savings in future annual winter maintenance budgets could be redirected for more beneficial community needs.

Today, the knowledge base of problems associated with excess salt use has broadened significantly. Countless research reports have emerged in the last decade, shedding new light on how road salt either directly or indirectly has significant hidden costs, many of which are perhaps incalculable.

As a suggestion for an additional component of this draft report, a comprehensive road salt reduction strategy could be added to serve the vision and the goals identified in this report.

For the sake of rationale, a set of "what ifs" are outlined below:

What if……

- Increasing Chloride concentrations were associated or connected with aquatic invasive species proliferation, particularly algae?
- Increasing chloride concentrations, particularly in harbors receiving storm water runoff are the breeding ground and area for adaptation for aquatic invasive species?
- Increased salt concentration in both ground and surface water were contributing to the release of higher levels of heavy metals?
- Salts were damaging road side vegetation, impacting both its esthetic value (tourism) and its functional values (protecting soil from erosion, sequestering carbon and other air pollutants, aiding the water cycle, etc.)?
- Sodium levels in drinking water rise in drinking water? How might that affect human health?
- Excessive salt was destroying the natural bio swales and rain garden efforts installed to help clean and control storm water?
- High levels of sodium were impacting the sodium absorption ratio in cation exchange capacity in soils leading to compaction, negative plant impacts, and resulting inability of soils to function as intended?
- Salt contributed to complete lack of vegetation (soil too saline to grow anything) thereby leading to erosion and increased turbidity in streams and lakes?
- Excessive salt in fresh water is impacting the natural turning over process in lakes and smaller water bodies thereby affecting oxygen levels?
- Greater density saline water is accumulating at the bottom of water bodies impacting the entire food chain..bottom up.
- Salt concentration in wetlands and other amphibian breeding areas are so great that they are limiting amphibian populations? If so, how might this affect mosquitoes?
- Salt in ground water is accumulative? At what point might we reach EPA thresholds for both chlorides and sodium? How does this affect drinking water infrastructure?
- We could extend the useful life of our road and bridge investments thereby reducing the impact of construction processes and the need to raise taxes?

- Underground utility and energy conveyance system failures caused by road salt corrosion could be minimized?

These are examples of the potential problems that could be associated with road salting practices.

The men and women responsible for snow removal deserve our utmost respect. Public safety and mobility benefits which results from their efforts are an essential service. Enhanced road salt reduction efforts could actually improve this vital service and could be integrated in to this report. Such an effort could be incorporated into nearly all the nine goals outlined in the report.

As with every effort to create change there is a cost. Those entities responsible for winter maintenance are currently financially challenged and already face stiff regulatory demand. If this effort is to be successful, it will require investment in appropriate staffing levels, training, and new tools and new best practices. On a positive note, investment would quickly be offset as salt reduction goals are achieved. Future savings would continue to expand on many different fronts.

Having immersed myself in the research and field experience over the last 20 years, it has become clear that these goals are achievable. A recent June 2015 New Hampshire Department of Environmental Services published a report (http://des.nh.gov/organization/commissioner/pip/publications/ard/documents/r-wd-15-7.pdf) that highlights the nation's first Commercial Salt Applicators Certification program. I had the good fortune of being involved in the initial effort.

I welcome the opportunity to become a part of this process.

If you would like resources and references that support these concerns, they could be made available.

Thanks again for the opportunity to provide input to this important document.

Sincerely yours,

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DRAFT

SUSTAINING
MICHIGAN'S WATER HERITAGE

A Strategy for the Next Generation

– DRAFT –

Prepared by:

Michigan Office of the Great Lakes, *in Collaboration with*
Michigan Department of Environmental Quality
Michigan Department of Natural Resources
Michigan Department of Agriculture and Rural Development
Michigan Economic Development Corporation

May 29, 2015

Vision

Michigan's water resources support a healthy environment, healthy citizens, vibrant communities and sustainable economies.

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Introduction

Water defines Michigan. It is deeply rooted in the state's culture, heritage and economy. With more than 11,000 inland lakes, 76,000 miles of rivers, 6.5 million acres of wetlands and more than 3,200 miles of freshwater coastline—the longest in the world—leveraging the power and presence of this treasured natural resource and ensuring its long-term sustainability are critical to advancing Michigan's prosperity.

Clean, abundant freshwater is a competitive advantage for Michigan and it is growing in importance. At the beginning of 2015, the World Economic Forum in its global risk report identified water crisis as the number one risk influencing the global economy.[1] Michigan's water resources are vitally important for agricultural production, irrigation, drinking water, electric utilities, mining, manufacturing and water supply to lakes and streams that support valuable fish, waterfowl and wildlife populations. Michigan's abundant water assets and research capabilities, in addition to its highly-skilled talent, economic development expertise, innovation and invention, and powerful tourism and business marketing brand, are pivotal drivers for attracting business creation and investment.

With this abundance comes a deep sense of responsibility and stewardship—but Michigan has not always treated its water with a sense of care. Today, the state is slowly returning to a level of aquatic health in many waterways and lakes necessary to fully support diverse fish and wildlife and meaningful recreation in many communities. Through longstanding public and private partnerships and tremendous investment of time and resources, communities are making significant progress in cleaning up legacy contamination.

But that is just the beginning. The ability to achieve Michigan's vision for its water resources depends on a strategic, collaborative ecosystem-based plan that monitors the health and condition of our water resources, invests in water-related infrastructure, uses water more thoughtfully and efficiently to grow sustainable economies, reconnects communities to water, and fosters a water ethic and culture of stewardship.

Michigan's Water Strategy - An Ecosystems Approach

The forthcoming Water Strategy takes an ecosystem approach, focused on the fact that Michiganders are a part of the ecosystem in which we live and therefore have an effect on the health of our water resources. The Strategy recognizes the core values identified with water are four fold: economic, environmental, social and cultural. All are equally important. Communities across Michigan recognize the value of water quality improvement activities supported through state and federal investments. According to Brookings Institution and Grand Valley State University, restoring water quality and shorelines respectively result in a 3-to-1 and 6.6-to-1 return on investment in the form of increased property values and local economic development and improved ecosystem health and quality of life.

The value of water is not exclusively economic nor is it solely environmental, though without a healthy environment, human uses are diminished and fish and wildlife perish. Social value is represented as how water forms a basis for activity and time with friends and family, and how these uses create joy and memories. Cultural value is about identity and affinity to place: where we choose to live and why; who and what we identify with; and where our stories, myths and beliefs come from. For Michiganders, water – and especially the Great Lakes – forms a core part of identity and culture.

The approach recognizes that each of these four values needs to be addressed in balance with the others. They temper and mold each other; they exist together and may require compromise, accommodation and limits. This approach is reflected in the Strategy through its goals, outcomes and recommendations.

A Roadmap to Achieve the Vision

The Water Strategy outlines a 30-year vision shaped by a desire for high-quality, accessible water resources protected by and for present and future generations based on the question asked in multiple forums around the state: *"What do you want Michigan and Michigan's water resources to look like and do over the next generation?"* Throughout the development of the Strategy, Michiganders said they care deeply about the Great Lakes, rivers and inland lakes, groundwater, and water in general. It is this caring that ultimately drives the ability to support, choose, manage and fund the requirements of healthy water. To that end, the Strategy recognizes that decisions made now regarding infrastructure, technology, monitoring and water literacy will set the course for decades.

Great Lakes, Water and Governance

The Great Lakes and Michigan water resources have long been recognized as a valuable resource fundamental to our way of life by federal and provincial governments, tribal nations and the eight states within the basin. The Great Lakes region has long-standing governance and institutional structures, organizations and other formal and informal mechanisms focused on protecting, restoring and maintaining the integrity of this vast water resource. These include the International Joint Commission, Great Lakes Water Quality Agreement, Great Lakes–St. Lawrence River Water Resource Compact Agreement, Council of Great Lakes Governors, Great Lakes Commission, Great Lakes Fishery Commission and many others. As a result, decisions made with regard to Michigan's water resources are subject to collaboration, consultation, oversight and regulation under a complex framework of regional governance structures and federal, state and tribal laws.

Government-to-government relationships are an important part of the governance landscape in Michigan as recognized by the 2002 Government-to-Government Accord between the state of Michigan and the federally recognized Indian tribes within the state's borders. For generations, the Indian tribes have resided in the Great Lakes region and

depended on the Great Lakes and Michigan's inland lakes, rivers, streams and groundwater for their way of life. These water resources provide food, transportation and drinking water, in addition to fulfilling many cultural purposes.

Exploitation of native fisheries, wildlife and forests during Michigan's emergence as the manufacturing center of the nation created great wealth and a high quality of life, but also devastated native fish populations, impacted water quality, and left a complex and costly legacy of contamination. Federal, state, tribal and local regulation and restoration programs have made substantial progress in addressing this legacy. This network of programs and actions has been instrumental in reaching toward the goals of ensuring drinkable, swimmable, and fishable waters as established in Michigan's Natural Resource and Environmental Protection Act, Safe Drinking Water Act, the federal Clean Water Act, and cleanup statutes such as the Environmental Remediation and Leaking Underground Storage Tank Act. In addition to these efforts, recent investments by the federal government through the Great Lakes Restoration Initiative have accelerated efforts to clean up and restore our water resources and fish and wildlife populations, and to improve quality of life in many communities.

Government-to-government relationships, statutes, regulations and management programs all play a critical and complementary role to the actions recommended in the Water Strategy. Driving progress toward the goals and the outcomes will depend on harnessing this complex framework of governance, institutions, and regulations to continue to build durable relationships and collaboration around common interests.

Strategic Action

The Water Strategy charts a course by providing recommendations and identifying strategic actions to:

Protect and Restore Aquatic Ecosystems – Michigan needs more integrated, holistic approaches to managing water on and across the landscape, including groundwater, which support healthy ecological systems and hydrologic integrity at the watershed scale.

Ensure Clean and Safe Waters - Michigan needs to protect and restore water quality to ensure ecosystem function and support current and future human uses of Michigan's surface and groundwater resources.

Create Vibrant Waterfronts - Michigan needs an emphasis on water resources as assets in state, regional and community planning efforts to create vibrant and sustainable communities, a robust recreation and tourism industry, and a thriving environment and economy.

Support Water-Based Recreation – Michigan needs to create greater opportunity for access to water resources through water trails and appropriate public access.

Promote Water-Based Economies – Michigan needs to collectively build robust multi-sector and multidisciplinary public-private partnerships between business, industry, academia, private capital and government. These partnerships will link ideation, invention and innovation, research and development, capital investment and end users. This approach will bring technologies to the market to better manage and solve water challenges in Michigan and across the globe. Directed research and development to address specific water challenges should provide the basis for forming a new paradigm of collaboration.

Invest in Water Infrastructure – Greater and consistent investments are needed in water-related infrastructure improvements to address aging and deteriorating systems that are now causing water quality issues and public health concerns. The people of Michigan also need to better recognize the connection between investments in water infrastructure systems and the benefits it provides, including delivery of safe drinking water, management of stormwater and wastewater, enhanced recreational opportunities, and healthy ecosystems and economies.

Monitor Water Quality - Michigan needs to develop and fund a coordinated, long-term monitoring strategy to provide baseline and trend information about surface and groundwater quality and quantity. This information is necessary to base decisions and best direct actions and future investments to support healthy people, ecosystems, communities and economies.

Build Governance Tools – Michigan needs to build new models of governance at the local and regional level to address increasingly complex and intractable problems facing Michigan's water resources. Implementation efforts will require not just state agencies, but a wide array of individuals, organizations, businesses, industries and tribal and local governments across the state to continue to build on this multi-stakeholder collaborative approach.

Inspire Stewardship for Clean Water – Most importantly, Michigan residents need greater opportunities to learn about water. Michigan is surrounded by 20 percent of the world's fresh surface water, and with that comes a deep ethical obligation to be good and thoughtful stewards of this global treasure. A shared water ethic will guide Michigan into the future and ensure our children and future generations will have the same or better quality of life than we have today. The durability of this Strategy and ensuring the health of our water resources for generations to come depends on creating a culture of stewardship through lifelong education about water.

We call on all people of Michigan to be thoughtful and engaged stewards of our water resources.

Water Strategy Framework

The Water Strategy is organized around nine goals and outcomes designed to ensure the viability and sustainability of Michigan's water resources over time, while placing Michigan on the path to achieving its water vision in a way that builds economic capacity while sustaining ecological integrity of this crucial resource for future generations.

The Water Strategy includes 60 recommendations that are a set of interconnected ideas to drive a new relationship between Michigan's communities, governments, and residents to solve complex water challenges and create greater opportunities for economic and social well-being. The recommendations are designed to drive performance and behavior change, address barriers and contribute toward achieving the desired outcomes. The ability to achieve the stated goals and outcomes will require both the implementation of recommendations in the Strategy and continued implementation of the entire suite of existing water-related programs and initiatives, some of which are noted in Appendix 3.

The Strategy includes an Implementation Plan (Table 2) comprised of recommendations, a lead actor charged with implementation and an implementation metric to measure progress toward accomplishing the recommendation. A wide host of actors and agents across the state, including governments, tribal nations, nonprofits, industry, businesses, individuals, and local and regional philanthropies will need to be involved. Therefore, the Water Strategy is not a specific action plan only for government, though there are many actions that government can and should take. Rather, it is a strategy for all people of Michigan, believing that together, we can have a positive impact on the future of the state.

Additional recommendations were identified during the development process as important to achieving outcomes but are of lessor priority and are included in Table 3.

Measures of Success

The Strategy includes measures of success intended to examine system response over time as a result of the collective impact of implementation of the Water Strategy recommendations and other efforts already underway by state, federal and local governments and partners to rebuild healthy aquatic systems, clean water and vibrant economies. Achieving success will require integrating planning strategies for water resources with local units of government, unifying plans between the state, regions and local units of governments, and collaborating with stakeholders. Additionally, success will require an integrated process for adapting to new science and understanding of complex issues, evaluating progress, and making course corrections necessary to achieve outcomes.

Table 1: Water Strategy Priority Recommendations and Measures of Success

Protect and Restore Aquatic Ecosystems	**Goal 1: Michigan's aquatic ecosystems are healthy and functional.**	
	Outcome: Aquatic ecosystems are resilient and diverse	
	Recommendation	Measures of Success
	▪ Prevent introduction of new AIS and control established populations. ▪ Develop a comprehensive strategy to reduce nuisance and harmful blue green algal blooms. ▪ Promote green infrastructure, low impact development and green spaces to rebuild hydrologic integrity and address storm water.	▪ Brook trout are present and thriving with no net loss of coldwater habitat due to water withdrawals and habitat manipulations. ▪ Sturgeon are considered rehabilitated in 10% of streams targeted for rehabilitation in Michigan's Lake Sturgeon Rehabilitation Strategy. ▪ Lake trout are naturally reproducing and supporting wild fish-based fisheries in Lakes Superior, Huron, and Michigan. ▪ Achieve a 40% phosphorus reduction in the western Lake Erie basin. ▪ Waters of the state meet Water Quality Standards for being swimmable, fishable and drinkable. ▪ Reduction in annual volume of untreated sewage discharges. ▪ Reduce the number of designated use impairments due to wet weather discharges.
Ensure Safe and Clean Water	**Goal 2 – Michigan's water resources are clean and safe.**	
	Outcome: Surface and groundwater are managed to support sustainable human uses and ecological function.	
	Recommendation	Measures of Success
	▪ Protect drinking and source water from contamination and spills. ▪ Pass a statewide sanitary code and inspection requirements. ▪ Secure long-term funding to accelerate clean-up of contaminated sites. ▪ Establish priorities and address emerging pollutants of concern.	▪ 100 percent of the population has safe drinking water with no reported violations of health-based standards. ▪ No drinking water advisories, beach closures or aquatic life impairments due to harmful algal blooms. ▪ No designated use impairments due to failing on-site wastewater systems. ▪ No new designated use impairments due to emerging pollutants of concern

Create Vibrant Waterfronts

Goal 3 – Michigan communities use water as a strategic asset for community and economic development.

Outcome: Economic and community development plans and efforts fully leverage water assets to create great places to live, work and play.

Recommendation	Measures of Success
▪ Leverage water resource assets at state, regional and local level to create sustainable economic opportunities. ▪ Support investments in commercial harbors and ports and address long-term maritime infrastructure needs.	▪ All community and economic development plans integrate water resource assets.

Support Water-based Recreation

Goal 4 – Michigan's water resources support quality natural resources, recreation and cultural opportunities.

Outcome: Waters of the state are world renowned for recreational pursuits such as hunting, fishing, boating and swimming.

Recommendation	Measures of Success
▪ Expand real-time monitoring of beaches. ▪ Prioritize investments in recreational harbors to address long-term infrastructure needs. ▪ Develop and implement a water trails system.	▪ 30% increase in water-based recreation and tourism. ▪ 90% of the population has convenient access to swimmable and fishable water. ▪ By 2020, 100% of the state's recreation harbors will have an infrastructure asset management plan to ensure a safe harbor.

Promote Water-based Economies

Goal 5 – Michigan has a strategic focus on water technology and innovation to grow sustainable water-based economies.

Outcome: Policies and innovative technologies are developed and adopted to grow and promote sustainable water-based economies.

Recommendation	Measures of Success
▪ Accelerate water technologies to solve water problems using an entrepreneurial business-led initiative. ▪ Establish voluntary water efficiency targets for all major water dependent sectors. ▪ Develop a water conservation and reuse strategy.	▪ Michigan is recognized as a place to invest and locate a business because of its support for sustainable water technologies, water conservation, and high quality of life. ▪ Increase in percentage of economic output per gallon of water utilized. ▪ Increase in water sector employment and earnings at the statewide and county level.

Invest in Water Infrastructure

Goal 6 - Michigan invests in infrastructure and supports funding to maintain clean water and healthy aquatic ecosystems.

Outcome: People support investment of both public and private funding of Michigan water resources.

Recommendation	Measures of Success
▪ Establish a long-term Water Fund to achieve Water Strategy goals including water infrastructure management.	▪ Sustained funding is in place to implement the Water Strategy and achieve the goals of the Strategy.

		▪ Outcome-based asset management plans are implemented and progress is achieved toward true cost of service for water utilities.
Monitor Water Quality	**Goal 7 - Michigan has integrated outcome-based monitoring systems that support critical water-based decisions.**	
	Outcome: Monitoring systems are in place at a scale and frequency to ensure water quality and quantity are maintained to support diverse uses and values.	
	Recommendation	Measures of Success
	▪ Implement a pilot water resource decision framework. ▪ Support groundwater and surface water monitoring.	▪ Achieve a net stabilization of groundwater depth across the state. ▪ Long-term monitoring strategies are being implemented.
Build Governance Tools	**Goal 8 - Michigan has the governance tools to address water challenges and provide clean water and healthy aquatic ecosystems.**	
	Outcome: Policies, organizational and institutional structures are in place to achieve goals and outcomes of the strategy.	
	Recommendation	Measures of Success
	▪ Create an integrated system for managing water at the local level to achieve water quality and quantity outcomes. ▪ Retain full authority to continue to manage Michigan's water resources.	▪ By 2030, achieve a 40% reduction in number of designated uses or impaired waters.
Inspire Stewardship for Clean Water	**Goal 9 – Michigan citizens are stewards of clean water and healthy aquatic ecosystems.**	
	Outcome: Individuals and communities understand their responsibility for and make informed and responsible decisions regarding water resources.	Measures of Success
	▪ Integrate water literacy into state of Michigan curriculum standards.	▪ Increase the number of citizens with knowledge and understanding of water literacy principles. ▪ Michigan citizens support funding for water and implementation of the Water Strategy.

Chapter 1: Protect and Restore Aquatic Ecosystems

Goal: Michigan's aquatic ecosystems are healthy and functional.

Outcome: Aquatic ecosystems are resilient and diverse.

Healthy, functional ecosystems purify air and water, provide habitat for fish and wildlife, support natural resource-based economies, serve as buffers from flooding, and support recreational activities. All long-term, sustainable uses of water depend on intact ecological and hydrologic systems. Ecosystems link living organisms with the non-living components of their environment like the water, soil, and air. While the Strategy focuses on the water component of ecosystems, it recognizes that changes in the make up or distribution of organisms, disturbances on the land or in the air also impact water and that the management of water on and across the landscape or hydrology directly affects those systems.

For example, the introduction of aquatic invasive species (AIS) in the Great Lakes region has been a major challenge to the resiliency and diversity of aquatic ecosystems. The presence of invasive species combined with nutrient runoff can have devastating impacts on fisheries and other aquatic life, disrupt the ecology of lakes and streams as well as contribute to nuisance aquatic plant growth and algae blooms. In a few areas of the Great Lakes, nuisance algal growths have been associated with botulism outbreaks, "muck" (organic debris) washing up on beaches, and impacts to drinking water systems. Some nuisance algal growths have also been characterized as harmful algal blooms (HABs).

The practice of moving water off the landscape as quickly as possible has resulted in both positive and negative consequences. Since the mid-1800s, Michigan has developed more than 35,000 miles of public drains, serving more than 17 million acres of agricultural and urban lands and roadways. These drains provide benefits by removing excess storm water, preventing damage from flooding, improving soil productivity, and enabling residential and commercial development. However, these extensive drainage systems were designed without consideration of the long-term consequences of modifying the natural hydrology.

In addition, other hydrologic modifications like storm drains and extensive impervious surfaces contribute to less infiltration and increased surface water runoff and flow, resulting in increasingly "flashy" streams. These cause stream bank erosion and increase sediment loads, transporting nutrients that impair aquatic life. The loss of infiltration can reduce vital recharge of aquifers and reduce base flow to streams. In rural areas, infiltration to deeper depths is interrupted by tile drains designed to conduct water away

from fields. These changes can pollute receiving waters, impact aquatic life that depends on groundwater-fed streams during summer months, and affect human groundwater use.[2]

Changing weather events will also require changes in water management. While Michigan's future climate is unclear, variability in precipitation from year-to-year is large. Despite lower than average lake levels during the past decade, total annual precipitation has increased in the Great Lakes basin by 4.5 inches from 1915 to 2004, with 4.2 of those inches occurring from 1955 to 2004.[3] The intensity of extreme weather events leads to more rapid runoff, greater flashiness in streams, sediment loadings and flooding events. Current infrastructure capacity was not designed to effectively handle this increase.

The Water Strategy focuses on reducing threats to aquatic ecosystems and implementing watershed-based approaches to restore hydrologic integrity and improve aquatic ecosystem resiliency. Holistic watershed-based approaches that slow the movement of water across the landscape, increase infiltration capacity, reduce erosion, sediment, nutrient flow and wastewater discharges, and increase aquifer recharge are needed for long-term preservation of Michigan's hydrology.

Prevent Introduction of and Manage Aquatic Invasive Species

Since the 1800s, more than 182 nonindigenous aquatic organisms, including animals, plants, bacteria and viruses, have colonized the Great Lakes ecosystem, forever altering its ecology. The introduction of AIS into the Great Lakes and inland waters has caused significant damage to the state's natural resources and many human uses.

Impacts include Eurasian water milfoil clogging inland lakes, the devastating effects of sea lamprey on fish communities, round gobies taking bait, and water fleas snagging fishing lines. Of particular note, invasive mussels have disrupted the energy flow, nutrient cycling and food web which has resulted in changes in fish communities and have contributed to nuisance aquatic plant growth and algae blooms. The intensive filtering activities of zebra and quagga mussels have greatly increased water clarity, allowing the long filamentous algae known as Cladophora, as well as other types of algae, to grow to nuisance levels in areas where it previously did not occur. When Cladophora dies and breaks loose, it creates conditions ripe for the production of the botulinum toxin in Great Lakes sediments by creating the very low oxygen conditions required by Type E botulism spores to become active. Type E botulism outbreaks have resulted in the death of waterbirds and fish kills. While there are no management options currently available for broad-scale control of zebra and quagga mussels, there are ongoing efforts to evaluate the efficacy of new management options such as the biocide Zequanox, a naturally occurring bacteria being tested to specifically control zebra and quagga mussel populations.

Michigan has led the region for decades in focusing on prevention of new introductions and minimizing impacts of established invasive species. To combat the introduction of new AIS and minimizing the impacts of established ones, Michigan developed the second state AIS management plan in 1996, later updating it in 2013. It provides a comprehensive strategy outlining new actions and enhancing existing efforts to prevent and control AIS in Michigan waters, including continued support for separation of the Great Lakes and Mississippi watersheds. In addition, the Michigan Department of Natural Resource's Fisheries Division Strategic Plan, *Charting the Course: Fisheries Division's Framework for Managing Aquatic Resources*, provides specific actions to support healthy aquatic ecosystems and sustainable fish populations. It also provides strategic assessments and tools to inform decision-making. However, more is needed. Long-term mandates for the prevention of new invasive species into the basin will depend on a collaborative approach.

Recommendations

Prevent the introduction of new AIS and control existing AIS populations in accordance with the Michigan Aquatic Invasive Species Management Plan.

Work with other Great Lakes states and provinces to harmonize aquatic invasive species prevention, early detection processes, and response actions across the Great Lakes region.

Accelerate research and solutions to identify mechanisms of food web disruption and changes of nutrient flows in the Great Lakes with a focus on the effects of invasive species.

Reduce Occurrence and Impacts of Harmful and Nuisance Algal Blooms

Nuisance algal blooms are increasingly a problem in the Great Lakes and have been documented in some inland waters. Some algal blooms are dominated by blue-green algae also known as cyanobacteria that produce harmful toxins and these blooms are characterized as harmful algal blooms (HABs) based on concentrations of toxins produced. The most common algal toxins are Microcystin, Anatoxin-a, Cylindrospermopsin, and Saxitoxin. For example, the toxin Microcystin is produced by the cyanobacteria *Microcystis*. HABs occur when Microcystin exceeds the World Health Organization's non-drinking water guideline of 20 ug/l or drinking water criteria of 1 ug/l in water bodies with drinking water intakes. However, state agencies will likely adopt new criteria as additional information becomes available.

The presence of these toxins are known to impact human health and aquatic life can cause closures of drinking water systems and beaches, including a well-publicized HAB in western Lake Erie in 2014 that prompted Toledo officials to shut down the drinking water system and a few areas in Michigan. Health symptoms commonly associated with algal toxin exposure include nausea, skin rashes, gastro-intestinal distress, numbness and fatigue.[4] These toxins can also kill fish and other aquatic life. The most commonly

monitored algal toxin in Michigan is Microcystin; however, MDEQ is evaluating monitoring protocols for other toxins.

Algal blooms are caused by many factors, including excessive inputs of nutrients, usually phosphorus and to a lesser extent nitrogen. Meteorological conditions can also play a role in determining algal bloom severity and seasonal dynamics. For example, the occurrence and duration of extreme weather events, such as heavy rainfall and droughts, may influence the development of algal blooms by intensifying the magnitude and timing of nutrient delivery from the watershed.[5] In addition, changes in the food web caused by the introduction of invasive species can change the way nutrients are partitioned in the environment or change environmental conditions enough to trigger algal blooms. Physical factors affecting water temperature, light penetration and water column mixing may also contribute to create potentially favorable conditions for algal blooms.

Addressing agricultural point and nonpoint sources of sediment and nutrients that have been identified as a major source of the pollutants in recent western Lake Erie Basin studies conducted in both Michigan and Ohio is one step to combating HABs. These opportunities include promoting changes in the use of phosphorus through mechanisms like the 4R Program (Right Source, Right Rate, Right Time, Right Place), implementation of the Michigan Agriculture Environmental Assurance Program (MAEAP) suite of practices, restoration of grasslands and wetlands, use of vegetative filter strips, and use of technologies like precision farming and implementing no-till and conservation tillage techniques to reduce run-off.

However, the biggest challenge remains the lack of a comprehensive understanding of the cause of HABs in Michigan's waters. For example, HABs that are capable of producing toxins are not limited to nutrient rich waters and can be found in nutrient poor waters like oligotrophic lakes. It is not possible to tell visually (including via satellite), by taste or by odor whether a bloom is a HAB. Additional work must be done in order for state, federal and local partners to make strategic decisions to determine best possible solutions to address the problem. A strategy to prevent HABs should be developed, involving a broad set of state, federal and local partners and including conducting additional monitoring and data collection to improve the understanding of the cause of HABs and inform models and actions to achieve the desired water quality and public health outcomes.

Recommendations

Develop a comprehensive strategy to reduce nuisance and harmful blue green algal blooms.

Develop harmful algal toxin water quality criteria and implement a real-time monitoring strategy for Michigan's Great Lakes drinking water intakes and public recreation locations threatened by harmful algae.

Support the development of a national drinking water advisory or action level target for harmful algal toxins.

Integrate Water Knowledge into Local Land Use Planning

Land use planning is inextricably linked to healthy aquatic ecosystems, a clean and available water supply, and protection from natural occurrences that can damage property. In Michigan, decisions about how the land can be used are made at the local level through master planning and zoning ordinances. Communities use these tools to plan and guide the character of the community and influence the local economy.

However, local community and economic development planning is based on political boundaries and jurisdictions, not along watershed boundaries. To be effective, these planning tools should consider activities that adversely affect water quality and quantity, such as extreme weather events, throughout their watershed and incorporate best management practices into transportation, infrastructure and zoning regulations and other community development planning to minimize impacts on local water resources.

Recommendations

Incorporate planning for wet weather extremes and increased variability into state, regional, and community planning.

Provide technical assistance and develop technical tools and training programs for communities, local officials and water stakeholders to inform and improve their water literacy and help them integrate water impacts into local land-use planning and decisions.

Build Resiliency into Riparian Systems

One of the most direct ways to positively influence water quality and aquatic habitat is to restore, create and improve riparian areas. Riparian areas, or land area adjacent to a stream or lake, provide critical ecosystem services and benefits for lakes and rivers, including:

- Reducing runoff by acting as a barrier and protecting against erosion and nonpoint source pollution
- Absorbing contaminants
- Moderating water temperature through shading
- Serving as a greenway corridor for birds, mammals, amphibians and reptiles
- Contributing leaves, woody debris and other organic matter as foundation for the food web and providing in-stream habitat for fish and other aquatic organisms
- Providing pleasing recreational corridors or viewscapes

Accelerated erosion and sedimentation problems occur in rivers throughout Michigan as a result of lack of riparian management. In some watersheds, lack of upstream riparian filter strips or buffers results in the need for increased downstream dredging at river mouths for

boat access and international shipping. Hardening of the riparian zones, lack of shade due to deforestation, and a lack of continuity in riparian areas all contribute to increased stream temperatures, resulting in declines of fish and wildlife habitat.

Currently a patchwork of regulations, including watershed management plans, best management practices, state programs and landowner incentives, are used to manage riparian zones. The success of many voluntary programs, however, is contingent on a well-informed and cooperative landowner. To maximize benefits, a more holistic watershed approach is needed for riparian area management. Taking a broad approach starting upstream and working downstream to the mouth of the river can have comprehensive impacts on aquatic ecosystems, international shipping, and river recreation. In addition, the interest in waterfront development combined with the need to decrease management costs (dredging) and reduce impacts of extreme weather events provides an opportunity to better define science-based actions and consciously manage riparian areas throughout Michigan.

Recommendation

Develop tools and guidance related to shoreline and riparian ecology and management and provide necessary technical support and training to municipalities, watershed-based organizations and landowners to achieve full benefits of riparian areas.

Restore Hydrologic Connectivity

Michigan has more than 2,500 dams, the majority of which are nearing or have exceeded their design life. Federal, state and local governments as well as conservation organizations are removing dams that provide little to no natural resource value to reconnect streams and rivers. However, challenges exist including: ownership questions (74 percent of dams are privately owned), financial burdens, social views on dam removal and value of impoundments behind dams. Additionally, careful considerations must be made to prevent the upstream movement of unwanted invasive species and downstream movement of contaminated sediment trapped behind dams.

Despite these challenges, federal, state and locally funded efforts have achieved progress in restoring connectivity. As examples, dam removal and river restoration projects are re-envisioning the role of the Boardman, Cass and Huron Rivers. These restoration efforts create greater opportunity for recreation and economic development by connecting water and place within communities.

Recommendations

Remove or improve dams that are no longer safe or ecologically, economically or socially viable to protect public safety and create healthy connected aquatic systems.

Focus river and stream restoration efforts on addressing small hydrological impediments like culverts to create connectivity and restore stream stability.

Manage Groundwater Withdrawals

Michigan's water resources are vitally important for agricultural production, irrigation, drinking water, electric utilities, mining, manufacturing and water supply to lakes and streams that support valuable fish, waterfowl and wildlife populations. Despite the large volumes of surface and groundwater in Michigan – more than one quadrillion gallons by some estimates – there is growing concern about its use and about groundwater withdrawal effects on environmental function and integrity. Groundwater use and value is increasing, and the state must invest in the information and decision systems to realize groundwater's full value, promote its wise use, and protect its hydrological and ecological integrity.

Groundwater is an important resource for commercial, industrial, domestic, and public supply purposes. Most of Michigan's large groundwater withdrawals, however, are for agricultural irrigation. More than 2,500 high-capacity irrigation groundwater wells have been registered for installation during the past four years. These wells greatly enhance economic development (in particular agricultural productivity), ensure against drought conditions and augment high-value crop production. However, as farmers and others develop more high-capacity irrigation wells, the odds of interfering with nearby domestic wells and surface water systems like rivers and lakes also increase.

Michigan has developed the Michigan's Water Withdrawal Assessment Tool to help the state manage groundwater withdrawals. A new or increased high-capacity well must be evaluated using the groundwater tool before installation. The Groundwater Tool is specifically designed to assess the likelihood of an adverse impact of withdrawals on nearby streams, rivers and fish communities. Michigan's Water Use Advisory Council, established by MDEQ in 2012, completed its assessment of Michigan's water management framework, including the Water Withdrawal Assessment Tool, and issued a series of recommendations to MDEQ in December 2014. The recommendations are now under departmental review and assessment. The development of a robust and effective water management program for the state will be an ongoing, iterative process and the insights and recommendations such as the ones in the council's report will continue to help shape the development of that process.

Recommendation

Refine and improve the water withdrawal assessment process to ensure sustainable use of water resources and that high priority is given to incorporating existing and new data and models to better represent local and regional water resources and surface water/groundwater interactions.

Improve Water Management in Urban Landscapes

In urban areas impervious surfaces like roads, buildings and parking lots prevent rainfall from penetrating the soil. As natural vegetation is removed and these surfaces increase, the amount of evapotranspiration and groundwater recharge decreases. This causes increased runoff, stream channel erosion, buried river bottoms due to silt and sediment, reduced or lost habitat, and aquatic species decline. Aging infrastructure and ill-managed or improperly managed stormwater runoff also contributes to sewer overflows, affecting water quality, ecological systems, creating human health risks, and negatively impacting the enjoyment of water resources.

As municipalities struggle to address aging infrastructure and capacity issues, opportunities exist to transition away from grey to green infrastructure. Green infrastructure can increase a community's resiliency to severe weather events by increasing infiltration and absorption of water. This reduces flooding risk, decreases surface runoff into lakes and streams, and reduces impacts of aging systems. Many communities are considering developing green infrastructure such as wetlands, bioswales, green spaces and buffer strips, as well as man-made infrastructure like rain gardens. Overcoming barriers to green infrastructure such as limited funding mechanisms, regulatory and permitting requirements, institutional and organizational capacity, and lack of understanding of design and maintenance requirements will be necessary to improve water management and address stormwater.

Recommendations

Provide technical and financial support to communities to plan and implement green infrastructure techniques and low-impact development while preserving natural spaces in the design of new developments, redevelopments and road projects to ensure responsible stormwater management and improve hydrology.

Modernize road and highway planning and infrastructure to effectively accommodate stormwater runoff and infiltration needs, thereby reducing the costs and impacts of flooding.

Enhance financial and technical support of local stakeholder efforts to develop and implement watershed management plans to restore impaired waters, protect high-quality waters, and develop and utilize local water resource assets.

Use existing authority to work with local unit of governments with stormwater discharge or stormwater-related hydrologic impairments in their waterways to establish Phase II stormwater plans for impaired water bodies.

Improve Water Management in Rural Landscapes

Michigan's $5.5 billion drainage infrastructure sustains some of the most productive agricultural land in the world and became the key component to developing land for residential, commercial, industrial and transportation purposes. However, the historical land changes that led to this productivity, such as the draining of wetlands, dredging and straightening of rivers and streams, converting streams to drains, and deforestation, have resulted in degraded water quality and aquatic ecosystems.

The agricultural community understands the importance of water resource conservation and is continuously considering new methods for managing water, including restoring hydrology, enhancing soil's capacity to retain and infiltrate rainfall, and allowing for aquifer recharge. New science and technological advancements are also impacting agricultural water management with research in areas such as identifying the most efficient irrigation timing and amounts for crops in dry weather conditions, water reuse for irrigation, and reducing nutrient loss via tile lines.

The federal Agriculture Act of 2014 commonly known as the Farm Bill is also providing resources to enhance conservation practice implementation in Michigan to address nutrients and sediment. Other initiatives are underway such as the newly formed regional and community-led Healthy Waters Working Farms that combines conservation practices and farmland preservation to keep Michigan's rivers and lakes clean while keeping the best farmland working.

It is critical that governments, academia and industry collaborate to develop new tools, processes, and systems to help local officials, landowners, agricultural producers, and others who impact the rural landscape to take actions to improve water resources. The Natural Resource Working Group has concluded that the establishment of collaborative partnerships to support learning and adaptation is needed to foster community-based natural resource management. Engaging the rural community as a whole in deciding what behaviors should change to maintain and improve water quality, and determine what actions would be necessary to encourage behavior change, are necessary to drive performance toward desired outcomes on the landscape.

Recommendation

Eliminate impairments in priority watersheds that have degraded water quality and/or aquatic ecosystems due to nutrient runoff and soil erosion. Engage landowners through a collaborative and adaptive community-based natural resource management process to identify local actions to change behaviors and solutions to achieve those outcomes. Failure to achieve demonstrable outcomes within established timeframes could trigger additional measures.

Chapter 2: Ensure Clean and Safe Water

Goal: Michigan's water resources are clean and safe.

Outcome: Surface and groundwater are managed to support sustainable human uses and ecosystem function.

Clean, safe water is fundamental to Michigan's economy and to ensuring high-quality places to live, work and play. It is equally fundamental for functioning and sustainable aquatic systems.

Michigan faces complex challenges in addressing water resource issues because of a wide range of historic and ongoing activities such as deposition of mercury, legacy pollutants (i.e. polychlorinated biphenyls (PCBs)), chemical contamination, nonpoint sources of excessive sediment and nutrients (i.e. phosphorous), harmful algal growth, changing climate, urban and rural runoff, hydrologic impairment of rivers and streams, contaminated sediment, and invasive species. All of these things continue to stress drinking water supplies, groundwater resources, aquatic systems, water-based recreation, and local economies.

During the past 100 years, water resource concerns have shifted largely from regulating activities such as effluent pollution and dredge and fill to focus on water resource challenges caused by multiple stressors that require both traditional and new regulatory solutions. Protecting and restoring water quality is critical to ensure ecosystem function while supporting current and future human uses of Michigan's surface and groundwater resources.

Protect Drinking Water Supplies

Ensuring adequate and safe drinking water for all of Michigan's nearly 10 million residents and visitors is essential to protecting public health. The state has more than 10,500 public water systems, of which roughly 8,500 utilize untreated or largely untreated high-quality groundwater sources. In addition, Michigan has more than 1 million private domestic wells, more than any other state in the U.S.

While public water supplies are subject to oversight and frequent inspections to ensure sanitary conditions, individual residential water well owners are responsible for maintenance of their own wells. Construction of private wells is primarily handled at the local level and overseen by a rigorous permitting program. Improper well siting and construction and maintenance, however, are known contributors to drinking water contamination. Broken well caps and contamination sources placed near wells are some of

the problems that put drinking water and groundwater at risk. Therefore, planning for appropriate residential and public drinking water well placement, coupled with proper well construction by a Michigan-registered drilling contractor, are the foundation for safe and reliable drinking water. In addition, periodic inspections of private drinking water wells are needed to ensure sanitary conditions.

Another risk to Michigan's water resources are the estimated 2 million improperly abandoned wells. These abandoned wells can act as a direct conduit between the surface and underlying aquifers as well as between aquifers. These conduits can result in surface contaminants flowing into private or public drinking water supplies.

The lack of statewide regulations or controls on the installation of closed-loop geothermal borings poses additional risks. Improperly located or constructed closed-loop geothermal borings have the same potential to harm aquifers as improperly abandoned water wells. Many vertical geothermal borings are installed at the same depths as drinking water wells, but have no regulatory oversight to ensure installation does not create a direct conduit for contaminants to reach the aquifer.

In many areas of the state, nitrate contamination is a concern. In Michigan, the U.S. Geological Survey regards nitrate-N levels of more than 2 milligrams/liter in water as a sign that human-related nitrate sources have adversely affected the water. In rural areas, elevated levels of nitrate can be associated with animal manure and agricultural fertilizers. Septic systems can also serve as a source of nitrate contamination, though that risk is minor if the systems are designed and maintained for nitrogen removal and water wells are properly sited, constructed and maintained.

Additionally, businesses and industries generate wastes that can threaten groundwater quality if not handled properly. Groundwater contamination resulting from improper waste disposal and chemical handling threatens public health and the environment, resulting in significant cleanup costs to businesses. In addition, contamination of public water supplies can result in high costs to public water suppliers and taxpayers to provide alternative water or replace contaminated drinking water supplies.

Further, the release of oils, chemicals, salts and polluting materials from human activities and industrial sites can impact water. A majority of these releases can be prevented through regulatory programs, but releases still occur unexpectedly. Appropriate response actions to control, mitigate and remediate these releases are critical to minimize harm to Michigan's surface and groundwater.

Recommendations

Protect drinking and source water areas by:

- *Continuing to ensure remediation activities address the long-term impact on drinking water sources*
- *Identifying and diligently protecting source water protection areas*
- *Assisting well owners with identifying potential water well vulnerabilities*
- *Focusing resources on contamination sources with the highest potential for causing contamination of drinking water supplies, including chemical storage facilities*
- *Enhancing the drinking water geographic information system database and making information available across MDEQ programs and to local public health department environmental health personnel*
- *Supporting mapping of local groundwater conditions in partnership with well contractors and others who collect groundwater information*

Develop a plan for aquifer protection that addresses geothermal construction and proper abandonment of wells.

Establish inspection requirements for residential wells, including testing wells for nitrates, bacteria and arsenic.

Develop a spill and communication strategy and organize an incident command approach to prevent, prepare for and respond to environmental disasters and chemical releases.

Properly Maintain On-Site Wastewater Systems

Michigan has about 1.3 million on-site wastewater systems (septic systems) that serve as permanent wastewater infrastructure for more than 30 percent of homes and businesses. At least 30,000 of these are commercial and community subsurface disposal systems treating sanitary wastewater with flows up to 10,000 gallons per day. Since more than half of new single-family homes are built with on-site wastewater systems, this reliance will continue to expand. However, no central system exists that tracks these on-site systems' precise locations, conditions or risks to sources of water. Adequately managed on-site wastewater treatment systems are a cost-effective and long-term option for meeting public health and water quality goals, but the key to their use is in proper siting, adequate management and maintenance.

Currently, local health departments in only 11 Michigan counties conduct inspections of on-site wastewater systems at the time of real estate transactions. These counties report that the number of systems in some manner of failure or improper operations averages about 10 percent but ranges as high as 23 percent. Assuming an average failure rate of 10 percent across the state, at least 130,000 systems discharging a total of 31 million gallons per day could be experiencing operational problems and adversely affecting local waterways and groundwater. Since local health departments issue only about 5,000

replacement permits annually for existing systems that have failed, there are likely a significant number of unidentified, failing systems statewide.

Michigan is the only state without a specific law related to individual or small-quantity on-site wastewater treatment systems. The systems are regulated to some degree, but the regulatory focus is largely on siting and construction of new systems and not on maintenance, system performance or condition. A combination of local codes and state criteria have contributed to a non-uniform patchwork of regulatory control over conventional septic tank and drain field siting, design and construction. A 2014 MDEQ stakeholder process concluded the state should develop science-based standards for site suitability, design, operation and maintenance, as well as requirements for oversight and inspection for all systems after construction. In addition, homeowner education about proper on-site system maintenance is needed and a state-facilitated loan mechanism to financially assist homeowners with on-site replacement should be explored. To date, this work has not been completed, and the Legislature has not passed such a statute.

Recommendations

Develop and implement a uniform statewide sanitary code that is flexible and provides standards for site suitability based on risk.

Establish a long-term sustainable funding source to support on-site wastewater programs at the state and local levels and to assist financially distressed owners of private on-site wastewater systems with repair and replacement costs.

Establish inspection requirements for residential on-site wastewater systems.

Develop marketing and education campaigns and outreach tools directed at homeowners regarding on-site wastewater management and maintenance and funding opportunities to assist with repair and replacement.

Clean Up Legacy Contamination

Michigan's historic industrial and commercial activities left many areas of legacy contamination. Some of the worst contamination problems in Michigan's waters still exist at superfund sites and in Areas of Concern (AOCs). In addition, the state suffers from more than 8,500 leaking underground storage tank sites and more than 9,700 other sites of environmental contamination. Common sources of contaminants include hazardous substance releases, contaminated sediments, atmospheric deposition, industrial discharges, sewage treatment plant discharges, combined sewer overflows, nonpoint source pollution and runoff from industrial sites. These sources of contamination threaten aquatic life, create an economic drag on communities, and prevent opportunities for use and enjoyment of Michigan's water.

Twelve of Michigan's original 14 AOCs remain on the list of formally designated areas of legacy contamination under the Great Lakes Water Quality Agreement. Today, 33 of the

sites' 111 beneficial uses have been restored, with several more in the process of being formally assessed. Michigan recently celebrated the successful delisting of Deer Lake in Marquette County and White Lake in Muskegon County; all of their beneficial uses have been restored.

Public funds play a vital role in addressing contaminated sites where no responsible party exists or has the ability to fund cleanup activities. These funds are used to investigate the extent of contamination, evaluate and abate the risks associated with the hazardous substances present, and perform cleanup activities to protect the public and environment. They are also used to leverage private resources, stretching their impact. Funding programs like the GLRI (which must be funded annually and therefore is not a certainty), Great Lakes Legacy Act Program, Clean Michigan Initiative Bond, Brownfield redevelopment programs, and Leaking Underground Storage Tank cleanups contribute to Michigan's transformation. Their dollars turn blighted, unusable contaminated properties into opportunities for investment and revitalization in communities.

However, except for the GLRI, these funding sources are now nearly depleted. Continued advocacy for these important federal and state funding programs is needed to continue this transformational work. Critical cleanup efforts are still needed in Michigan to address other areas with significant contamination, including several areas within the Detroit River, the lower reach of the Rouge River, Velsicol Chemical on the Pine River in St. Louis and PCBs in the River Raisin, the Kalamazoo River, in the Ten Mile Drain on Lake St. Clair and in Torch Lake in Houghton County. While several of the locations mentioned above are currently under ongoing corrective action, work at many locations on the Detroit River and the lower section of the Rouge River are just beginning. Michigan cannot afford to give up the progress that it has made to this point, and there is more work to be done.

Recommendation

Secure a long-term funding source to accelerate the cleanup of legacy contaminated sites.

Prevent Environmental Impacts from Emerging Contaminants

New and emerging pollutants like antibiotics, endocrine disruptors found in fire retardants, rocket fuel, industrial wastes, existing and new pharmaceuticals, plastic microbeads, and pesticides and their metabolites are all now detected in the environment. The risk to humans, wildlife and the environment from any one of these, let alone the combination of them, is not well understood.

Effective removal varies based on the type of chemical and individual treatment system. Current wastewater treatment systems and drinking water plants are not designed to remove many of these new and emerging pollutants which can accumulate in waterways and cause harm.

Michigan uses surface water monitoring programs to identify and assess emerging pollutants. The state also relies on EPA's drinking water standard setting process, which includes periodic monitoring for new contaminants to determine how often the substance is identified, at what levels, and if a standard should be established to provide appropriate public health protection. Efforts should be taken to reduce environmental impacts from emerging contaminants through safe disposal, reuse or recycling, the use of technologies, product redesign or discontinued use.

Recommendations

Pass comprehensive legislation phasing out the use and sale of microbeads in Michigan.

Establish research priorities for emerging pollutants of concern in partnership with Michigan's research universities to:

- *Better understand potential ecological and human health impacts*
- *Adapt monitoring protocols to detect concentrations, fate and transport*
- *Recommend standards for protection of human health and the environment*
- *Develop technologies to remove such pollutants from manufacturing processes*

Chapter 3: Create Vibrant Waterfronts

Goal: Michigan communities use water as a strategic asset for community and economic development.

Outcome: Economic and community development plans and efforts fully leverage assets to create great places to live, work, and play.

Michigan's abundant water resources including its coasts, harbors, rivers, lakes and streams make many communities desirable places to live, work and play. Historically, Michigan's waterfronts supported industries such as shipbuilding, power production, lumber yards, tanneries and chemical production. Many communities developed commercial centers with their backs to the water. As industries abandoned the waterfront, many became eyesores and the public's connection to water as a community asset was lost.

But initiatives such as the federal Clean Water Act, corresponding state water regulations, strong local champions, and recent investments from the GLRI have turned polluted waters into thriving systems. As a result, communities began to rediscover their waterfronts and reimage their communities focusing on their water resources. Water is once again playing a pivotal role in transforming communities' economies and is reflected in their values and desires.

Integrate Water Assets into All Planning Initiatives

Including water assets in community development reestablishes the connection between citizens and the outdoors, building a sense of place and improving overall quality of life. The way people relate to water in their community can drive ecological, economic and social outcomes. A stronger understanding of this relationship is needed to assist communities with economic and community development through proper land use planning and form-based design.

By understanding this relationship, communities can more effectively integrate water as a strategic asset, maximize economic and social capital, strengthen the relationship people have to water, and avoid potential challenges with conflicting or unaligned policies or actions. Ultimately, creating greater opportunities to interact with local water resources can help foster a water conservation ethic in individuals and the community.

Research shows people are willing to pay more to locate to areas with access to clean water and good environmental quality.[6] Residents drawn to these environmentally attractive places help communities create more wealth and more jobs. Studies by the Brookings Institution and Grand Valley State University show a 3-to-1 and 6.6-to-1 return,

respectively, on investments in restoring water quality and shorelines in the form of increased property values and local economic development.

Recommendation

Emphasize water resources as assets in state, regional and community planning efforts to provide appropriate sustainable protection and fully leverage community-based economic opportunities.

Foster Community Leadership to Reconnect Communities to Water

Fully leveraging water assets will require fostering community leadership and local champions. These leaders, both inside and outside of government, should fashion a comprehensive, community-informed vision, strategy and implementation plan for stitching water into the fabric of their communities. The strategy and implementation plan must balance both economic opportunities and environmental protection to ensure sustainability. Communities such as Alpena have embraced their maritime heritage with partnerships between the community and the National Oceanic and Atmospheric Administration's Thunder Bay Sanctuary. Grand Rapids is reimagining its relationship with the Grand River through its plans to reinstate its namesake rapids. The magnificent Detroit River transformation has been under way for nearly a decade under the leadership of the Detroit Riverfront Conservancy. Many other communities including Marquette, Flint, Kalamazoo, Battle Creek, Traverse City, Boyne City and Petoskey have also refocused the role that their waterfronts play in their community's vibrancy. Their experiences provide powerful case studies to share with other Michigan communities.

Recommendations

Host an annual mayor's summit focused on creating high quality communities that leverage strategic water assets.

Provide in-depth technical assistance to support communities with developing and implementing community visions and strategies for waterfront redevelopment, access and use.

Create Sustainable Commercial Ports and Harbors

Maritime trade use of the state's deep-water commercial ports is essential to Michigan, regional economies and many coastal communities. Investment in physical infrastructure is needed to maintain access to Great Lakes commercial ports while ensuring they are deep enough to accommodate commercial shipping vessels; this requires regular dredging. Michigan, however, has neither received nor dedicated adequate dredging funding. However, the maintenance of channels, ports and harbors is only partially the responsibility of the state and federal government and therefore needs to be incorporated into the business models of maritime companies.

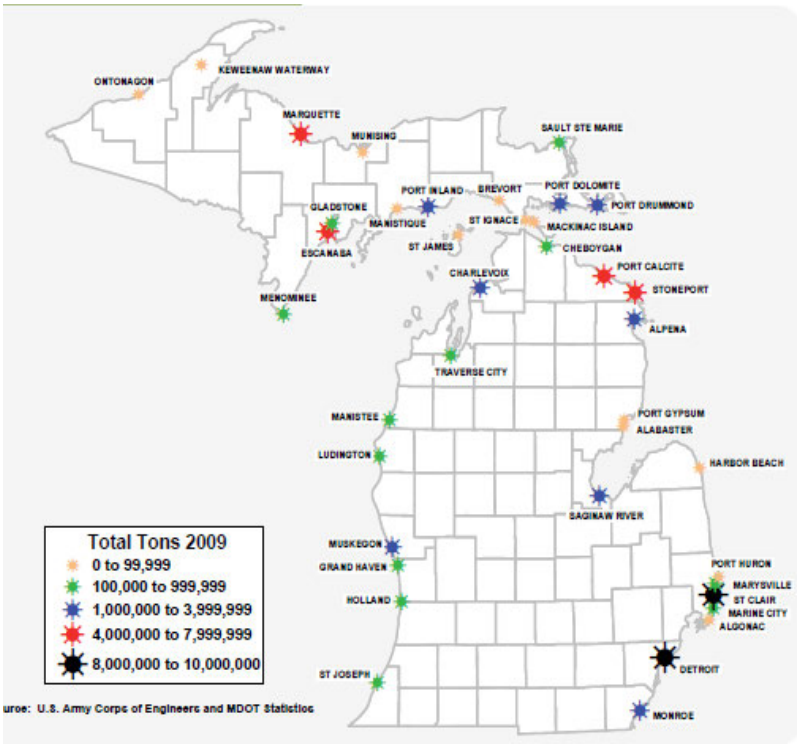

Figure 1: Cargo ports and tonnage
Courtesy of the Michigan Freight Plan

There are several on-going initiatives focused on commercial ports. Great Lakes and Canadian leaders have begun a region-wide assessment of maritime infrastructure, long-term funding, and management through their Great Lakes Maritime Initiative.[7] Also the Great Lakes International Trade and Transport Hub (GLITTH) initiative, a joint effort managed through Michigan State University and the University of Halifax, attempts to leverage Detroit's and Port Huron's infrastructure assets to make southeast Michigan the largest international trade gateway in the country.

Major ports like Fisher Port in Saginaw, Muskegon Lake, and the Ports of Detroit and Monroe are all using public and private investment to reestablish or upgrade port infrastructure. But significant opportunities to develop Michigan's ports as multimodal transportation hubs remain. In addition, few of the state's commercial ports currently receive or ship agricultural products; this potential growth area could significantly benefit both sectors.

Recommendation

Prioritize investments around strategic economic assets of commercial harbors and long-term sustainable infrastructure.

Chapter 4: Support Water-Based Recreation

Goal: Michigan's water resources support quality natural resources, recreation and cultural opportunities.

Outcome: Waters of the state are world renowned for water-based recreational pursuits such as hunting, fishing, boating and swimming.

Michigan's four Great Lakes, 11,000 inland lakes, 76,000 miles of rivers and streams, and 3,200 miles of freshwater coastline provide abundant water-based recreation opportunities, making Michigan a great place to live and play while also supporting a thriving tourism industry. However, challenges and opportunities exist in sustaining and expanding the state's water-based recreational opportunities.

Improve Beach Health

Beaches are among the fondest memories of Michiganders' summer vacations. But pathogens such as *E. coli* threaten this treasured asset. The Great Lakes and inland public beaches are monitored for pathogens on a voluntary basis by local health departments, supported by MDEQ which awards grants for this purpose. In 2013, 98 beaches reported 162 incidents of *E. coli* exceeding accepted water quality standards, causing advisories or closures. While the durations were typically short, usually one or two days, any closure impacts recreation and tarnishes the state's image. Causes of beach contamination include releases from wastewater treatment plants, sewer overflows, leaking septic systems, runoff from agricultural operations, and excessive wildlife on beaches. These causes are addressed in other sections of the Water Strategy; however, additional real-time beach monitoring data is also needed to provide timely advisories that protect public health.

Recommendation

Expand the use of real-time monitoring and source tracking techniques at high-risk beaches by local health departments, counties, communities and universities and address sources of beach contamination.

Address Fish Consumption Advisories

Michigan continues to need guidelines on safe fish consumption amounts because of ongoing and historical deposition of persistent, bio-accumulative toxic (PBTs) pollutants like mercury, PCBs and banned pesticides such as DDT. Addressing sources of ongoing deposition and sites of legacy of contamination is critical to restore human use and enjoyment of fishery resources.

In some cases, global sources are contributing to atmospheric deposition of mercury and other PBTs and will require a state, regional and national approach to reduce emissions. Michigan's participation in national and regional efforts to eliminate anthropogenic mercury use and releases is critical to having an impact on this global problem. The MDEQ's 2008 Mercury Strategy report estimated most of the mercury released into the environment is released into the air, with a smaller amount being released directly to water and land. A 2002 inventory estimated about 7,000 pounds of mercury were emitted into the air in Michigan that year. About 37 percent was from coal combustion and about 30 percent was from the purposeful use of mercury. This estimate has been used to establish a baseline for measuring progress toward reducing emissions. Between 2002 and 2011, ongoing pollution prevention activities, permitting and regulations resulted in mercury air emission reductions of 1,000 to 2,000 pounds of mercury. Coal-fired power plant retirements and use of additional coal combustion control equipment may eventually reduce mercury emissions in Michigan by 80 to 90 percent.

Although atmospheric deposition of Hg, PCBs and other PBTs cause most of the fish consumption advisories in Michigan, the most restrict advisories are caused by site specific legacy issues. Examples include the "do not eat" advisory covering all species of fish downstream of the former Velsicol site on the Pine River and covering all species of fish on the Kalamazoo River between Morrow Dam and Lake Allegan because of past practices at paper mills. Some restriction advisories have been successfully removed in Michigan's AOCs due to restoration efforts over the last several decades. The GLRI has enabled rapid progress toward restoring human uses of fishery resources. Sustained support for the GLRI is needed to continue progress.

Recommendation

Continue national and regional coordination of mercury reduction activities, such as implementation of the Great Lakes Mercury in Products Phase-Down Strategy and the Great Lakes Mercury Emission Reduction Strategy.

Ensure Sustainable Recreational Harbors

Michigan has more than 80 recreational harbors that contribute significantly to the quality of life and economic vitality of host communities. In addition, the harbors also help support Michigan's $4 billion boating industry.[8] Unfortunately, many harbors are in poor or failing condition and limited financial resources hamper sustainability.

The Department of Natural Resources completed an inventory and condition assessment of recreational harbor infrastructure in 2014. Additional research, planning and prioritization are needed to identify critical sources of sediment that diminish the value of the harbor and increase maintenance costs, prioritize long-term capital investment needs, and create strategies to market harbors.

A multi-agency and university partnership is also conducting assessments to evaluate the complexity of the issues facing harbors while developing community guidance to ensure sustainability. Too often communities have not realized the full economic and social value of their harbors; rarely are they integrated into community and economic development plans. This integration is necessary for prioritizing and leveraging capital investments. Variable lake levels, infrastructure condition and depreciation, access, boating trends and future use of the harbor all need to be considered to ensure harbor and marina sustainability.

Recommendations

Prioritize infrastructure needs for repair and upgrade of public recreational harbors and their landside access.

Establish a harbor town program and improve marketing of harbors. The program should work with MDEQ to identify and address sources of upstream sediment, including sediment reduction and relocation strategies.

Increase Access to Lakes, Rivers and the Great Lakes

Since water plays such a pivotal role in many Michiganders' lives, access has always been a priority. In 1939, the Legislature first earmarked funds to purchase water frontage to improve access for fishing and boating. Since then, more than 1,200 public launching sites have been developed for boaters. The Natural Resource Trust Fund remains an important part of providing recreational opportunities, including access to Michigan's waters. But with more than 11,000 lakes and thousands of miles of rivers, streams and Great Lakes coastline, significant gaps in access remain. The 2013 Department of Natural Resources Managed Public Lands Strategy and the Great Lakes Water Trail Plan both recognized this need. Of course, protection of ecologically sensitive areas needs to remain foremost when addressing access gaps.

Recommendation

Work with local partners to provide public access every five miles on the Great Lakes, on all priority lakes more than 100 acres in size and every five miles on navigable water, as environmentally appropriate.

Designate Water Trails

Michigan has endless opportunities for establishing a spectacular water trail system. Much of the framework for such a system already exists, and some water trails have recently been developed on several rivers using existing access sites, harbors of refuge and waterside campsites. Statewide criteria for designating a trail is needed, including level of difficulty, distance between access sites, and trail amenities such as nearby campgrounds, restaurants and restrooms.

Recommendation

Work with stakeholders to develop and implement a designated water trail system for inland waterways and along the coast.

Chapter 5: Promote Water-Based Economies

Goal: Michigan has a strategic focus on water technology and innovation to grow sustainable water-based economies.

Outcome: Policies and innovative technologies are developed and adopted to grow and promote sustainable water-based economies.

The Great Lakes, and Michigan's water in general, have played a defining role in the state's economy starting with fur trading and continuing with the lumber boom, agriculture, manufacturing and tourism. Michigan should leverage this past experience by marketing its strategic advantages as the Great Lakes state, growing leadership and harnessing talent in research and development, accelerating innovation in water technology, and optimizing water efficiency. Michigan and other places across the globe face complex challenges in addressing water quality and quantity concerns. The state is well-positioned to be a powerhouse for solving these complex problems and grow its economic opportunities around water in a manner that ensures good stewardship of the resource. Collaboration among industry, regulators, economic developers and academia directing water research and development is the right place to start.

Market Michigan's Strategic Advantages

Part of Michigan's appeal is its availability of freshwater and ability to manage water-related risks. Currently, Michigan hosts about 350 companies that provide technology, goods, and services related to the supply, treatment, distribution, storage, transport, recycling, rehabilitation and conservation of water. As a recent University Research Corridor analysis highlighted, more than one out of five jobs in the state are strongly linked to water, a number that does not include outdoor recreation and tourism, which alone contribute $10 billion to the economy annually.[9]

The recognition of water as central to healthy systems, people and economies is growing. Electric utilities, mining, steel manufacturing, and the food and agricultural sector potentially face high costs as a result of water scarcity across the nation, due to the high capital costs for alternative supplies, reliance on a small number of assets and their relatively large volume of water use. Water-intensive companies in water-stressed areas are at the highest risk of experiencing production disruptions, stranded assets, increased capital costs and community conflicts over shared resources.

Water is a key factor in the economic health of many corporations and therefore a significant and knowable element in overall corporate stock price and volatility. In a 2015

survey, the World Economic Forum ranked water crises first as a critical risk to the global economy.[10] According to a Pacific Vox survey of 50 Fortune 500 companies from a broad cross-section of industries nationwide, concern about water scarcity has grown dramatically during the past five years. By 2018, 86 percent of the companies expect to consider water availability in their site selection, up from 37 percent in 2008.[11]

Water is now seen as a factor in the movement of trillions of dollars of capital and investment. Researchers, financial managers, investors and corporations are beginning to fully understand how water contributes to or mitigates risks throughout the business cycle. A key challenge that investors face is how to quantify and value financial risks from regulatory, physical and reputational impacts from water. The University of Michigan is conducting innovative research about water risk and corporate behavior, but further research is needed about the value the state's water resources can add to managing water-related risk, stock price volatility and overall financial performance.

Recommendation

Market the state's competitive advantage as a highly attractive place for business creation and investment because of our abundant natural water assets, water research capabilities, highly skilled talent, economic development expertise, and powerful tourism and business-marketing brand.

Optimize Efficient Use of Water in Business, Utilities and Municipalities

If Michigan's abundant clean water supply is efficiently managed, the state's economic capacity can grow while ensuring water stewardship. In a state with generally abundant water resources, it is difficult to appreciate that water is not disposable and that every drop is valuable. There are some areas of the state experiencing localized water scarcity, where this appreciation needs to spread across the state to ensure the sustainability of this precious resource. All Michiganders have an obligation to be good and thoughtful stewards of this global treasure by using water more thoughtfully and efficiently.

Under the Great Lakes Compact Agreement, each state is required to establish water conservation measures on each water use sector; however, limited data is available on current water use for each sector beyond gross numbers and anecdotal information. Without goals or objectives, we cannot evaluate progress in reducing water use impacts and determine if improvements are needed.

Nevertheless, some progress toward conservation is underway. Businesses are beginning to focus efforts around water sustainability to improve their bottom line and comply with environmental standards. Others are recognizing the importance of water globally and are beginning to work more holistically outside corporate walls. For example, Ford Motor Company, Consumers Energy, General Mills, Amway and Dow are all deeply engaged in

water management as part of their corporate sustainability and operational programs, many of which have set aggressive water efficiency targets. Consumers Energy set a water reduction target of 20 percent between 2012 and 2020. Ford Motor Company set a goal of reducing its water footprint by cutting the amount of water used per vehicle by 30 percent globally between 2009 and 2015.

The Great Lakes and St. Lawrence Cities Initiative (GLSLCI) also urged cities to participate in the GLSLCI Water Conservation Framework to help meet its commitment of reducing water use within city limits by 15 percent in total water usage by 2015 using 2009 water consumption levels as a baseline.

Conservation makes not just social sense, but business sense. Water is heavy, requiring a significant amount of energy to move through the system. Measureable water loss can be attributed to leaking and poorly maintained municipal infrastructure. In addition, cleaning and purifying water for drinking water, manufacturing and discharge is very costly. Nationally, between 4 percent and 13 percent of all energy is used to pump and treat water, for waste management, or for industrial and commercial processes.

For businesses and industries that require water use as a core part of their operations, energy (and cost) savings can happen in two ways: increasing the efficiency of pumping and treating water, or by reducing the total use of water per capita per industrial or municipal process. Capital asset management planning and infrastructure upgrades should reflect these goals.

Wastewater reuse through energy generation also provides economic opportunities. Innovative solutions to wastewater management can minimize water and energy footprints. Firms like Moore and Bruggink have reengineered Greenville's wastewater treatment facility to produce its own energy, reducing costs and energy consumption by more than 30 percent.

In addition to using less water through efficiency measures, water reuse should be explored in situations where potable water quality is not required and risk for cross-contamination is low. This must be done with critical attention to public health and infrastructure. Michigan should develop standards, protocols and strategies to protect public health and preserve surface water and groundwater resources while facilitating rain and grey water reuse in appropriate situations.

Recommendations

Establish voluntary water efficiency targets for all major water sectors to reduce water use impacts and costs.

Promote innovative technologies that reduce cost and water loss or convert waste products to usable materials.

Develop a water conservation and reuse strategy for the state that incorporates the use of green infrastructure, grey water systems and energy production and includes recognition programs.

Fund a pilot project, through a competitive bid process, for the initiation and evaluation of a new model for wastewater management. This pilot program will assess the opportunities and barriers to creating a "Water Resources Utility of the Future" focused on:

- *Reclaiming and reusing water*
- *Extracting and finding commercial uses for nutrients and other constituents*
- *Capturing waste heat and latent energy in biosolids and liquid streams*
- *Generating renewable energy using its land and other assets*
- *Using green infrastructure to manage stormwater and improve urban quality of life*

Optimize Efficient Use of Water for Agriculture

Agriculture is another example of a major water user in Michigan that has made significant advancements to improve efficiency. Water, energy and food are inextricably linked. Growing populations, improving technologies, high crop prices and specialty crops like seed corn have led to expansion of irrigation and agriculture production into regions of the state where it was once unfeasible. Biotechnology advances, especially shorter-season crop varieties, and climatological and meteorological changes with accompanying longer growing seasons make farming in the northern part of the state a more viable opportunity.

As agriculture continues to grow in Michigan, there will be greater pressure on aquifers and more potential for use conflicts. More intensive use of land will require greater management of water. While total agricultural water use is increasing, the efficiency of the transformation of water into crops is also increasing. There are opportunities for agriculture to use more sophisticated irrigation delivery and water management systems to reduce water use per unit output. Continued efforts to increase efficiency can reduce conflicts in localized areas that have water shortages, reduce related energy costs, and reduce water use impacts. There are many synergies and trade-offs between water and energy use and food production. The goal is not necessarily to reduce water use, but to reduce the impacts of agricultural water use on ecological systems and to use it more judiciously.

Aquaculture is another area that could thrive based on Michigan's plentiful water supply and high water quality. In a world demanding ever-increasing amounts of high-quality fish

and protein, growing the state's aquaculture industry will require significant innovation in water technology. In particular, industry and the state should continue to support closed-loop or recirculating systems. Lowering energy costs of production, improving water filtration and strengthening supply chains for commercial aquaculture systems will enable the industry to grow substantially in an ecologically responsible fashion.

Efficient use of water also affects the processing and manufacturing supply chain. Companies like Kellogg, MillerCoors and General Mills are focusing efforts around water sustainability by working with the agricultural community to implement best practices, such as efficient delivery of water to crops, efficient use of water, and impact accountability. In areas with water scarcity issues like Texas, Colorado and other western states, technological advancements are reducing pressure on aquifers with inadequate recharge. Establishing targets for water efficiency in areas with localized water stress may reduce the potential for conflict.

Recommendation

Establish voluntary water efficiency targets for agriculture in areas of existing or potential water stress.

Accelerate Innovation in Technologies to Solve Water Challenges

Michigan can advance the technology, science, research and education required to improve water management. These water technologies can be an economic driver for the state. To capture its share of the global water technology sector, predicted to reach $1 trillion annually by 2020, Michigan must create an environment that fosters water entrepreneurs, supports a high-performing water technology sector, and leverages the state's innovation, research, development and manufacturing capabilities.

Michigan faces a number of complex challenges regarding water quality and quantity but the state also has a history of developing innovative water technologies to help meet those challenges while exporting those technologies to global markets. Different water sectors – municipal, agriculture, manufacturing and industry – all have specific needs requiring technological solutions such as maximizing water efficiency, minimizing water loss, meeting more rigorous discharge standards, and dealing with new forms of contamination from emerging chemicals and pharmaceutical products. Michigan has the ideas and research; academia, businesses, and end users need to align goals and desired outcomes for technologies to actually reach the market.

By building robust public-private partnerships, Michigan can link innovation, research and development, capital investment, entrepreneurialism, and end users to achieve desired environmental, economic and social outcomes. When an accelerator of public and private funding is combined, ideas can move more quickly from design to deployment and markets.

Recommendation

Create a strategic focus on water innovation to attract and accelerate new technologies to market through a business led council comprised of private investors, entrepreneurs, corporations, public agencies and universities to better manage water challenges in Michigan and worldwide.

Chapter 6: Invest in Water Infrastructure

Goal: Michigan invests in infrastructure and supports funding to maintain clean water and healthy aquatic ecosystems.

Outcome: People support investment of both public and private funding in Michigan's water resources.

The state's infrastructure – roads, commercial ports, drinking water systems, sewer systems, energy plants, transmission systems and recreational facilities – form the backbone of the economy. All water withdrawn from the Great Lakes, groundwater, rivers, and lakes for any purpose passes through some form of water infrastructure; it is a complex system. A functioning water infrastructure keeps the state running.

Improve Understanding of the True Cost of Water

Most people think of their monthly water bill as the cost they pay for water. But in reality, water, as a natural resource, is actually free for any purpose and for any amount used by any entity, public or private, as long as its use does not degrade the resource. Water is free to those who want water to drink, to businesses that use it in industrial processes, to those that bottle it for consumption and to homeowners who water their lawn. The economic value of water is nearly infinite, but for Michiganders it is a free, shared resource to use for all kinds of human purposes. While water as a resource may be free, there are costs associated with managing Michigan's water resources to ensure that water is of high quality and available for human uses.

Through their water bills, Michiganders instead pay for the infrastructure to deliver safe drinking water and carry away and treat waste, and for the operating costs, like energy, to treat and condition water and maintain infrastructure. Those outside the area of a municipal water supply system pay for well construction, treatment if necessary, the pump and the energy used to supply water to the tap. In addition, the cost of infrastructure to supply water is contained in the final price of all commodities and services.

Water's cost is determined by volume-based pricing that allows the collection of revenues to pay for infrastructure and operations used to deliver water. Under this scenario, there is often a lower per unit, usually gallons, fee on water for higher volume users and amounts. Water rates are commonly skewed in such a way that users pay less as volumes rise, because the price is pegged to infrastructure costs and not to the value of water itself. In some instances, this can act as a complicating factor when trying to achieve water use reduction or conservation, as conservation equates to lower revenues for municipalities.

A customer's use of less water does not necessarily or directly equate to lower operational costs of infrastructure. There is still a substantial cost to have safe drinking water delivered at adequate quantities and pressures whenever the tap is opened and to have fire protection available at the curb within the reach of a standard fire hose in event of an emergency.

Michigan has a long experience and legal history of not putting a commodity price on water, thus keeping water a free resource, and an important element of the state's economic and social well-being and stability. During public outreach for the Water Strategy, many residents suggested either putting a fee on water for all or some groups of water users – in its simplest form, a per gallon charge for water as it comes from the environment. Some suggested that only some types of water users, like agriculture, water bottlers or industrial users should pay a per gallon fee for withdrawing water. Others suggested all users should pay a surcharge or a per gallon fee for the use of water, regardless of user or purpose. Given that Michigan's citizens and businesses withdraw more than 4.2 trillion gallons per year, equivalent to the amount of precipitation that falls on the U.S. per day, even a tiny surcharge or access charge would add up quickly. The economic logic may make sense in the abstract, but it does not currently fit the culture and history of water and water use in the state.

Conversely, some argued that adding a price to water, even as an access charge versus a price on water per se, would commodify the resource, when it has historically been a public good or a public trust resource. Maintaining the ability to manage and ensure the sustainability of the water resources of Michigan and the Great Lakes is of utmost value to the state and the region, and even though a revenue stream could be created from a volume or access charge on water, the values potentially compromised under this scenario are too great to lose. However, there is still a compelling and growing need for investments in water and water infrastructure and for administrative and programmatic support in order for the state to meet its long-term vision for healthy, functional systems and prosperity.

To address the gap between actual investment need and public perception of that need, Michigan should launch a public education campaign to improve residents' understanding of the economic, environmental and social benefits of clean water, linking the investments necessary to achieve the benefits. If the public wants clean beaches and good water quality – and they say they do – public support of water infrastructure investments is critical. While we do not seek to facilitate a volumetric surcharge on water access, if that is something the public would ultimately support, then it would add to the options for funding long-term infrastructure and desired outcomes.

Water rates have historically been low and water both plentiful and affordable in most Michigan communities. Detroit's recent water shutoffs, the loss of urban population in other communities, and an overall increase in domestic water conservation has put a

sharper focus on water rates, affordability, and the ability to continue to fund aging infrastructure costs. There is currently no statewide assessment of shut-off practices or policies that relate to affordability and water access for human use.

Recommendations

Implement a communication strategy focused on messages that link the relationship between investments in water infrastructure and clean water as well as the benefits infrastructure provides for drinking water, recreation, cultural and economic opportunity.

Utilize pricing and funding strategies to support infrastructure improvements while allowing for water conservation.

Evaluate current community practices regarding providing water to financially distressed customers to ensure all citizens have affordable access to water for drinking and sanitation.

Invest in Water Infrastructure

One of the biggest challenges facing communities is aging, deteriorating infrastructure systems with more operational needs than financial resources to meet them. Poor infrastructure degrades the value of water, results in costly efforts to mitigate impacts, and creates or increases drag on the economy.

In a perfect world, users of the system would pay for the cost of service. Rates would consider operation and maintenance costs as well as long-term capital investment needs. Unfortunately, rates in Michigan are typically set by elected officials who have political difficulty charging rates necessary to maintain infrastructures.

Asset management planning, performed properly, would support municipalities' efforts to optimize future costs and collect revenues sufficient to operate and maintain the system. Since 2013, some large municipal wastewater treatment plants have been required to develop an asset management plan as part of their nonpoint source discharge elimination standard (NPDES) permit; however, this requirement doesn't apply to all water utilities. Outcome-based asset management planning that includes more efficient use of resources can result in cost efficiencies that can be used to address capital costs while keeping rates affordable.

Communities can realize cost efficiencies to manage water infrastructure systems and to meet the needs of the future by increasing efficiencies in the delivery and treatment of water through implementation of energy efficiency measures, the use of technologies and a combination of grey and green infrastructure. A more integrated systems approach can improve water management, reduce energy costs and result in savings for communities as opposed to investing in traditional methods which typically have higher capital investment costs.

If communities continue to use traditional methods to manage infrastructure, conservative estimates range in the billions to improve stormwater, drinking water and wastewater management systems over the next 20 years. Although a large majority of these costs are not the responsibility of federal or state government, the state needs to implement a long-term strategy to sustain state water programs, including funding to maintain critical regulatory oversight programs, water quality monitoring and provide assistance to communities to local water infrastructure. In addition, the state should explore a variety of options to close the widening gap between existing funding sources and future revenues needs, including incentivizing asset management planning, state bonding and borrowing options, dedicated capital and trust funds, public-private partnerships, insurance and leveraging, private equity, and service area consolidation. Without adequate funding, Michigan's economy, aquatic ecosystems and quality of life will be diminished.

Recommendations

Incentivize and require outcome-based asset management planning for all public water utilities that includes more efficient use of resources.

Establish sustainable funding mechanisms to achieve Water Strategy goals including water infrastructure management.

Develop an Enterprise Budget for Water

The state needs to complete an enterprise budget to more fully understand the complex relationships between water, infrastructure needs and funding across all entities, including state agencies, federal agencies, local municipalities, drain commissioners and inter-county drain boards. An enterprise budget is a theoretical budget – not a responsibility budget – that portrays revenue and expenditures regardless of agency or governmental unit. The four principle revenue sources related to water in the state – federal, state and local revenues and fees, and private revenues – should be included in the enterprise budget as shown in Figure 2. This budget will also assist in understanding how to maximize the sustainability of the funds used to support water infrastructure and state programs.

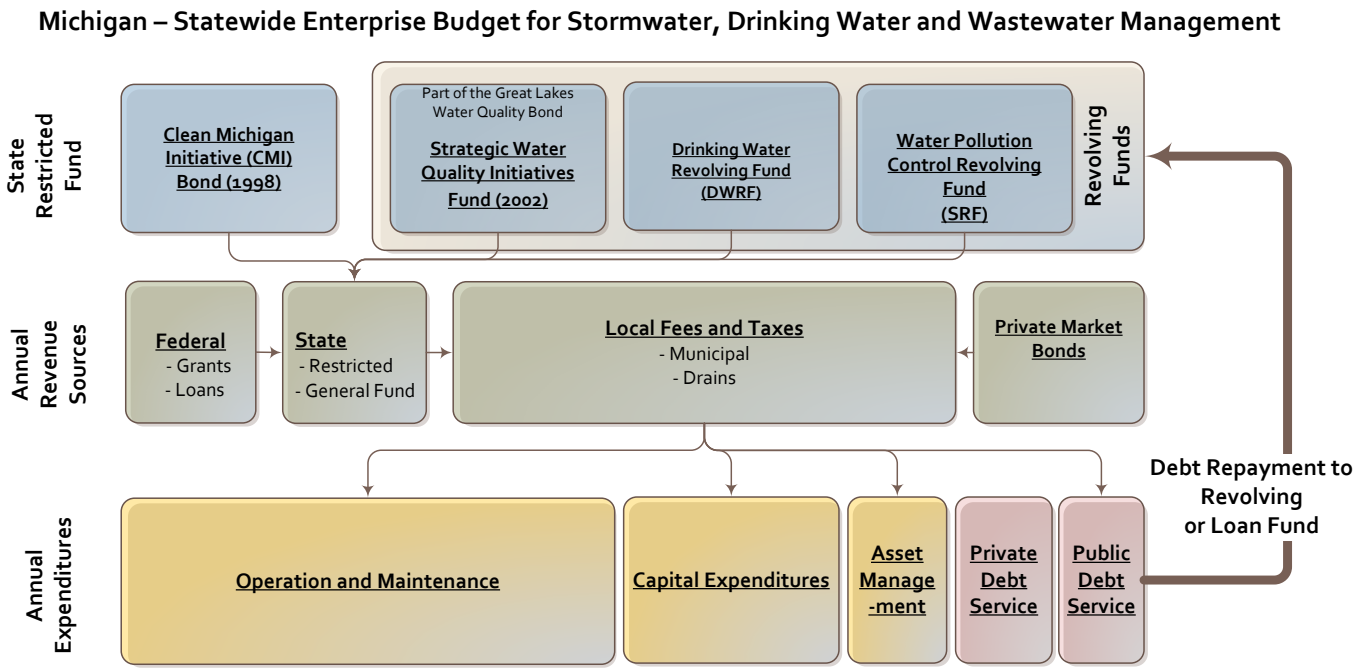

Figure 2: Statewide enterprise budget for stormwater, drinking water and wastewater.

Recommendation

Develop an "enterprise budget" to better understand the complex relationships between managing water, infrastructure needs and funding.

Chapter 7: Monitor Water Quality

Goal: Michigan has integrated outcome-based monitoring systems that support critical water-based decisions.

Outcome: Monitoring systems are in place at a scale and frequency to ensure water quality and quantity are maintained to support diverse uses and values.

Michigan's water presents undeniable economic growth opportunities, but appropriate monitoring to integrate economic, environmental, social and cultural data is critical to achieving this goal.

Michigan's current monitoring programs do not incorporate all components of the ecosystem and face significant funding challenges. Lack of systems-based monitoring approaches and inadequate data collection impede economic growth, detection of environmental and human health threats, and evaluation of program effectiveness. We must improve monitoring efforts and critically assess progress achieved across economic, ecological, social and cultural outcomes. The results should be used to determine how to best direct and connect management actions and future investments.

Build Integrated, Outcome-Based Monitoring Systems

Michigan needs to develop an integrated, water-based monitoring system that builds on collected data to create logical connections in an overall information system. This integrated system should include quality and quantity monitoring, condition assessment, modeling, and forecasting tools for the entire water cycle. It should be made publicly available and used by government and other organizations to better communicate the benefits of healthy water systems to residents and communities.

Monitoring practices have traditionally measured some, but not all, of the components of the ecosystem. It has narrowly focused on the ecological condition of fish, wildlife and water, compliance performance, and human health while placing less emphasis on outcomes related to system and economic performance, social and cultural impacts, and environmental factors.

In 2014, the University Research Corridor completed the first economic analysis that estimated the economic, social and cultural performance of water.[12] This approach is consistent with efforts undertaken by the Council of Great Lakes Governors and Premiers to develop systems-wide accounting and monitoring. A recent effort, called "Blue

Accounting," seeks to integrate monitoring systems across ecological, use and social values at the Great Lakes scale. An integration of these components is shown in Figure 3.

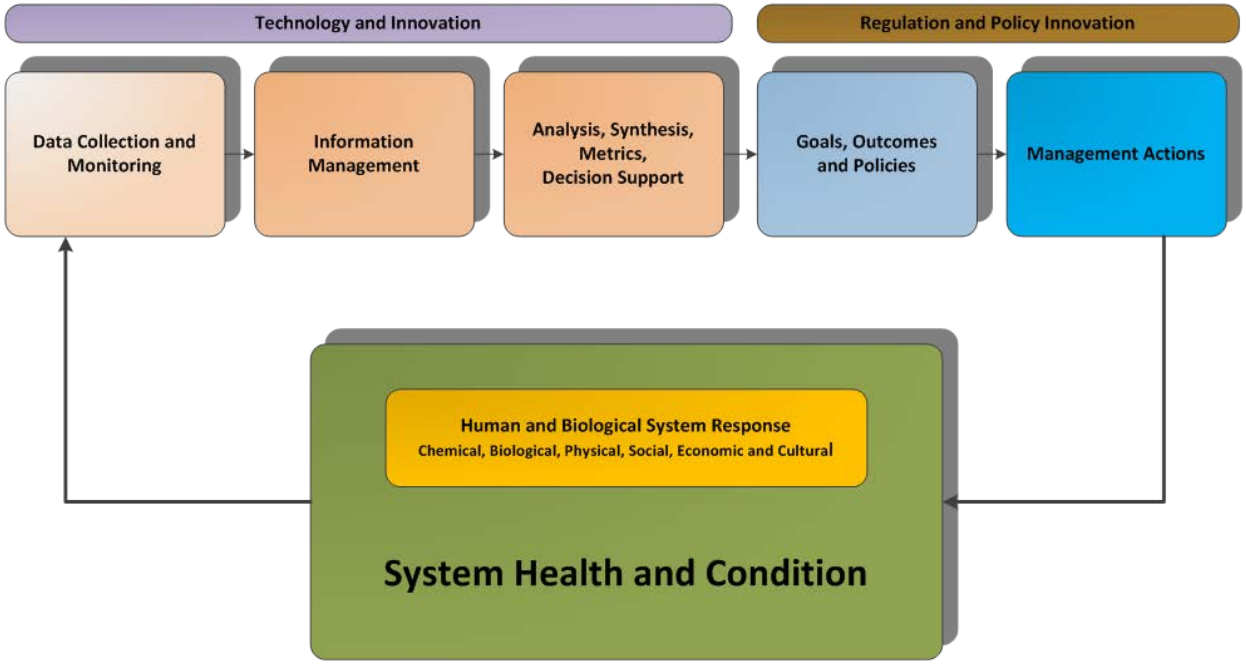

Figure 3. A schematic representation of an integrated system of monitoring and accounting.

Recommendation

Implement a pilot decision-support framework that includes monitoring, data and information, and analytical tools. This framework will assess ecological, economic, social and cultural values and outcomes at local and regional watershed scales.

Support Funding for Monitoring

Comprehensive monitoring of surface and groundwater is expensive and therefore typically funded piecemeal; however, if water quality is not maintained, public health, ecosystems, businesses and recreation suffer.

Michigan's Surface Water Monitoring Strategy focuses on achieving four goals:

- Determine whether water quality standards are being met
- Measure water quality trends
- Evaluate the effectiveness of water programs
- Identify emerging water quality issues

The 1998 Clean Michigan Initiative (CMI), a $675 million environmental and recreation bond, dedicated about $3 million per year to surface water quality monitoring. This bond is nearly depleted, and an alternative, long-term, stable source of funding for surface water monitoring needs to be identified.

Some critical components of the Surface Water Monitoring Strategy are currently not adequately funded by CMI or any other funding source including stream flow monitoring and microbial health.[13] Data that link microbial health to site-specific land use, wastewater management, manure management and hydrology are limited. For example, this information is critical for future management actions and investments such as how and when specific sources of *E. coli* trigger beach closures. In addition, better data management systems that include geospatial information are needed to enable integration of existing and new monitoring data at spatial scales.

Michigan lacks a coordinated and comprehensive strategy for monitoring groundwater quality and quantity to improve understanding of this valuable resource, reduce threats of contamination, and guide better investments and decisions. Monitoring and mapping the stores and flows of groundwater and use patterns to account for its use, removal from the environment, effects on aquatic systems, and its return to the environment is critical to understanding and ensuring sustainable use of groundwater resources.

The state needs to secure a long-term funding strategy for groundwater monitoring and management. Current efforts are funded and managed by an array of sources, resulting in fragmented monitoring approaches.

Recommendations

Develop a coordinated, comprehensive monitoring strategy for groundwater quantity and quality, including a data management system.

Develop a long-term, sustainable funding source for groundwater and surface water quality and quantity monitoring that is continually improved with new technologies.

Chapter 8: Build Governance Tools

Goal: Michigan has the governance tools to address water challenges and provide clean water and healthy aquatic ecosystems.

Outcome: Policies, organizational and institutional structures are in place to achieve the goals and outcomes of the strategy.

Water resource management in Michigan is facing increasingly complex problems that will require new and different knowledge and approaches that broaden participation in governance. Governance, as defined by Kooiman[14], is "arrangements in which public and private actors work to solve societal problems, create societal opportunities, and design the societal institutions within which governing actions take place."

Work led by Michigan State University in the late 2000s, Critical Conversations about Environmental and Natural Resource Governance[15] , concluded "A new model [of governance] may well require that individuals and groups beyond traditional state government structures play important roles in implementing management initiatives and monitoring outcomes."

This work was informed through an extensive set of conversations facilitated by the MDEQ's Environmental Advisory Council, which concluded that "Michigan will benefit from a new model of environmental and natural resource governance that benefits from collaborative efforts to develop agreed-upon outcomes, focuses on prioritization and relative public health/environmental risk, encourages innovation, provides for continuous improvement, promotes performance above minimal compliance, and engages voluntary environmental stewardship."

This effort also concluded that what worked in the past to manage the environment might not be sufficient to address new and changing challenges with diminishing resources. This does not mean that old tools need to be discarded. Instead, the existing regulatory framework needs to be augmented alongside new tools and new approaches.

Facilitate Community-Based Dialogue and Water-Related Vision Development

The Strategy focuses on actions at the community level to develop vision, create collaborations and find local champions that can galvanize local unity. The ultimate goal is to marshal the financial and human resources to drive the vision ahead. Many regions and communities are already engaged in this important planning and implementation work, while others are just beginning. Through the community conversations conducted as part

of this strategy development and generously supported by the C.S. Mott Foundation (Appendix 2), communities are seeking help in two ways:

- Forming and designing their community vision relative to water and their water assets
- Identifying tools and resources to fulfill that vision

Community, regional and statewide foundations are central to supporting this effort. These organizations need to work together to support community planning around water. The state, through its grant-making capacity, collaborative programs, networks and outreach efforts, needs to support and augment these local efforts.

Recommendations

Enhance the understanding, knowledge and skill set of communities to facilitate and support community-based dialogue and water-related vision development.

Create a statewide Water Fellows Program and Network to build community leadership capacity and to inform critical leaders about how to leverage water resource assets to build community and economic vitality.

Align Resources, Tools and Regulatory Framework to Achieve Outcomes

Water resources are managed at various scales and by many levels of government. State-level regulations and policies establish performance expectations for managing important water and water-related resources. Great Lakes region-level regulations manage water diversions and flows and help prevent evasive species introductions such as Asian Carp through the Chicago Area Waterways System. Other regulations are national in scope.

Management of water resources at the local level is also important. Much of the state's rainfall and runoff is managed at the county and inter-county scale through county drain commissions and inter-county drainage districts. A thoughtful review of Michigan's existing tools, resources and regulatory framework for managing water at the local level is necessary to address emerging water problems that don't respond to traditional approaches methods. New approaches such as collaborative watershed governance may be needed to more effectively manage water across the landscape to achieve desired water quality and quantity outcomes. Partnerships, collaborative decision making and joint project implementation at the watershed scale that involve government, business, the building industry, agriculture, and environmental and other stakeholder organizations are a few examples of this approach.

Recommendation

Evaluate and implement necessary changes to laws including state and local land-use statutes as well as the drain code to create a more integrated, watershed based system for managing water at the landscape level and achieving water quantity and quality outcomes.

Retain Regulatory Tools

The state's water resources, as well as communities and businesses dependent on these resources, benefit from Michigan's authority to implement the provisions of the Clean Water Act, including Section 404 pertaining to wetlands and Section 402 pertaining to pollution control. Through state laws, Michigan maintains consistency with federal laws related to management of its wetland, lake and stream resources, and creates streamlined permitting systems to address Michigan-specific issues. Recent changes to several water resource laws have caused some to question whether Michigan's water resources would be "better off" if authority to regulate these resources was returned to the federal government. Others believe the cost for retaining federal authority is too great, but don't fully understand the cost to business for less permitting certainty and long processing times. Given that water and water resources are of critical and strategic importance to the state, it is in the state's long-term interest to exercise authority and autonomy over their thoughtful management.

Recommendation

Retain full authority under the Clean Water Act to continue to manage Michigan's own water resources.

Ensure the Water Strategy is Durable Over Time

The Water Strategy is not only about what government does or funds, but about what Michiganders do collectively to support healthy systems, human use and enjoyment, and a growing water economy. In order to ensure the Water Strategy is durable over time and across administrations, the elements of the Strategy need to be fully integrated into decision processes, governance structures, and the culture of state and local governments, other organizations, and individuals. Where Michigan places the nexus of responsibility for decision-making, whether on individuals, local governments or the state, matters. What goals residents and leaders focus on matters. How the state governs water quality, quantity and use matters.

Ensuring sustainability of the Water Strategy and its long-term implementation will depend on how the various recommendations get adopted by various actors or organizations and get funded, supported and realized. If the critical elements of this Strategy are not adopted and deeply engrained into ongoing decision-making processes, then little will come of them over time. Adaptive management approaches are needed to evaluate progress and make necessary course corrections to achieve desired outcomes.

Recommendation

Create an Interdepartmental Water Team to unite agencies to ensure a cohesive common strategy around implementation of the Water Strategy. The team will establish a process for stakeholder collaboration, criteria for setting implementation priorities, identifying cross-

agency joint projects, and an approach to assess and evaluate progress achieved against the metrics and outcomes.

Chapter 9: Inspire Stewardship for Clean Water

Goal: Michigan citizens are stewards of clean water and healthy aquatic ecosystems.

Outcome: Individuals and communities understand their responsibility for and make responsible decisions regarding water resources.

Stewardship is about supporting and maintaining the things we hold dear and about our ability to create valued legacy and heritage. Throughout development of the Strategy, Michiganders said they care deeply about the Great Lakes, about rivers and inland lakes, and about water in general. Stewardship is also about the ability of that care to persist over time within the state's communities and culture. It is one of the most important aspects of the Strategy, because it creates the backbone of our use and enjoyment of water in the state for generations.

Improve Water Literacy and Use of Place-Based Education

Michigan is blessed with abundant water resources, yet most citizens do not have a basic understanding of fundamental water literacy principles. During development of the Strategy, people across the state expressed the concern that many people do not know what a watershed is, or that they live in a watershed. As the Great Lakes state, Michigan should have water literacy principles as part of its K-12 curriculum standards.

Place-based education uses the elements of local community and environment as a starting point for teaching and learning, emphasizes hands-on, inquiry-based, real-world experiences, and, ideally, involves direct collaboration with community partners. This approach to education emphasizes the assets and context of the community and its place as part of a broader learning framework. The benefits of place-based education include powerful learning, a healthy, supportive school culture, sustainable partnerships between schools and communities a greater appreciation of the environment, and more frequent and effective acts of stewardship. Integrating freshwater systems into place-based educational experiences is critical to building literacy and stewardship for Michigan's water resources.

Recommendations

Integrate water literacy principles into place-based education and State of Michigan curriculum standards tied to Science, Technology, Engineering and Math (STEM) principles across all grade levels.

Develop a survey tool to assess behaviors and attitudes toward Michigan's water resources to assess changes over time.

Increase Volunteerism and Community Engagement

One of the key aspects of stewardship within a community is whether residents are willing and able to volunteer their time to better their water resources. Communities that exhibit strong stewardship characteristics have more individuals and groups engaged with the community and tend to support measures that drive good water management practices, such as environmental cleanups and funding programs. The focus on building stewardship and care can thus translate directly into long-term benefits to the community and the state and heighten engagement.

Recommendation

Expand opportunities to engage citizen volunteers and participation, such as the Michigan Clean Water Corp (MiCorps) program, in gathering water quality and quantity data, in restoration, in providing access and in maintenance of important water-related resources.

Table 2. Water Strategy Implementation Plan

Goal 1: Michigan's aquatic ecosystems are healthy and functional.			
Outcome: Aquatic ecosystems are resilient and diverse.			
#	**Recommendation**	**Implementation Metric**	**Lead Actor**
1	Prevent the introduction of new aquatic invasive species and control existing populations of aquatic invasive species in accordance with the Michigan Aquatic Invasive Species Management Plan.	By 2020, the ecological separation of the Great Lakes basin and the Mississippi River basin, especially in the Chicago Area Waterways system has been initiated.	State and federal agencies, Nongovernmental organizations (NGOs), local units of governments, individuals
2	Work with other Great Lakes states and provinces to harmonize aquatic invasive species prevention, early detection processes and response actions across the Great Lakes region.	By 2016, implement a pilot project with Ontario and interested states to evaluate and pursue areas of harmonization.	State agencies
3	Accelerate research and solutions to identify mechanisms of food web disruption and changes of nutrient flows in the Great Lakes with a focus on the effects of invasive species.	By 2017, a minimum of three new research projects will be established for the purposes of evaluating nutrient shifts in Great Lakes food webs to help focus appropriate management, social, and economic responses.	Universities
4	Develop a strategy focused on improving the understanding of the causes of harmful algal blooms (HABs) to support strategic decisions on actions that can prevent HABs.	By 2017, develop a strategy to prevent HABs based on desired outcomes.	MDEQ, local public health departments
5	Develop harmful algal toxin water quality criteria and implement a real-time monitoring strategy for Michigan's Great Lakes drinking water intakes and public recreation locations threatened by harmful algae.	By 2020, increase by 20% the number of people served by drinking water suppliers using surface water sources with real-time monitoring equipment installed to provide early warning of potential public health threats. By 2020, develop harmful algal toxin assessment criteria. By 2020, implement a real-time monitoring strategy for Michigan's Great Lakes drinking water intakes and public recreation locations threatened by HABs.	MDEQ

6	Support the development of a national drinking water advisory or action level target for harmful algal toxins.	Work with federal agencies to develop a national advisory target.	MDEQ
7	Incorporate planning for wet weather extremes and increased variability into state, regional and community planning.	Best management practices are reviewed every five years and updated (if necessary) to reflect climatic changes such as changes in rainfall frequency, duration or intensity.	State, regional governmental entities, communities
8	Provide technical assistance and develop technical tools and training programs for communities, local officials and water stakeholders to inform and improve their water literacy and help them integrate water impacts into local land use planning and decisions.	By 2020, develop a public official water literacy measurement. By 2020, develop a training module for local elected officials and decision-makers on the connection between land use planning and zoning and the siting and approval of new projects. By 2020, develop a training module for local elected officials and decision-makers on the merits and benefits of asset management planning.	Universities, regional government and planning organizations, MDEQ
9	Develop tools and guidance related to shoreline and riparian ecology and management and provide necessary technical support and training to municipalities, watershed-based organizations and landowners to achieve full benefits of riparian areas.	By 2020, develop a baseline for the current research and educational capacities. • Coordinate to pinpoint areas of capacity expansion. • Develop tools, guidance and training on best practices. • Determine need to update guidance and training materials.	MDNR, MDEQ
10	Remove or improve dams that are no longer safe or ecologically, economically or socially viable to protect public safety and create healthy, connected aquatic systems.	By 2020, address all dams most at risk of failure.	MDEQ, MDNR
11	Focus river and stream restoration efforts on addressing small hydrological impediments like culverts to create connectivity and restore stream stability.	By 2020, increase the number of small hydrologic impediments that are restored over a baseline established in 2015.	NGOs and local units of governments
12	Refine and improve the water withdrawal assessment process to ensure sustainable use of water resources and that high priority is given to incorporating existing and new	By 2016, develop a list of priority Water Use Advisory Council recommendations and an implementation plan.	MDEQ, MDNR, MDARD

	data and models to better represent local and regional water resources and surface water/groundwater interactions.		
13	Provide technical and financial support to communities to plan and implement green infrastructure techniques and low-impact development while preserving natural spaces in the design of new developments, redevelopments and road projects to ensure storm water management and improve hydrology.	By 2020, increase the number of attendees to green infrastructure conferences, applications for projects, amount of grant dollars awarded to projects incorporating green infrastructure or low-impact development, and number of programs incentivizing green infrastructure projects and the number of Michigan communities that are recognized for green infrastructure projects and strategies over a baseline established in 2015.	MDEQ, MDOT, MDNR, Michigan State Housing Development Authority, MEDC
14	Modernize road and highway planning and infrastructure to effectively accommodate storm water runoff and infiltration needs, thereby reducing the costs and impacts of flooding.	By 2020, increase the number of Michigan's new road and highway projects designed to better accommodate storm water runoff and infiltration needs over a baseline established in 2015.	MDOT, local road and highway commissions
15	Enhance financial and technical support of local stakeholder efforts to develop and implement watershed management plans to restore impaired waters, protect high quality waters, and develop and utilize local water resource assets.	By 2018, increase the number of grants, training and educational opportunities on the development and implementation of watershed management plans over a baseline established in 2015.	MDEQ
16	Use existing authority to work with local units of government with storm water discharge or storm water-related hydrologic impairments in their waterways to establish Phase II storm water plans for impaired water bodies.	By 2020, increase the number of water bodies with storm water plans in place to address designated use impairments caused by storm water discharges and hydrologic impairments over a baseline established in 2015.	MDEQ, MDNR
17	Eliminate impairments in priority watersheds that have degraded water quality and/or aquatic ecosystems due to nutrient runoff and soil erosion. Engage landowners through a collaborative and adaptive community-based natural resource	By 2018, identify priority watersheds. Develop performance standards to cover statewide land use activities. Agricultural land use will directly follow MAEAP	MDEQ, MDARD

	management process to identify local actions to change behaviors and solution to achieve those outcomes. Failure to achieve demonstrable outcomes within established timeframes could trigger additional measures.	guidelines and participation criteria to remain consistent with the state's recent efforts. Concurrently develop the escalated "additional actions" triggered once a watershed has been determined to be impaired. By 2018, develop regional action teams with protocols for working with landowners. Educate collaborative teams on existing regulations and enforcement mechanisms allowed in their regions. By 2020, collaborative processes are in place with plans to achieve water quality outcomes in priority watersheds.	
Goal 2: Michigan's water resources are clean and safe.			
Outcome: Surface and groundwater are managed to support sustainable human uses and ecological function.			
#	**Recommendation**	**Implementation Metric**	**Lead Actor**
1	Protect drinking and source water areas by: • Continuing to ensure remediation activities address the long-term impact on drinking water sources; • Identifying and diligently protecting source water protection areas; • Assisting well owners with identifying potential water well vulnerabilities; • Focusing resources on contamination sources with the highest potential for causing contamination of drinking water supplies, including chemical storage facilities; • Enhancing the drinking water geographic information system database and making information available across MDEQ programs and to local public health department environmental health	By 2020, address IT security issues, such as firewall and server capacity, to make information publically available. By 2020, develop educational materials to encourage residents with private drinking water wells to test new wells prior to use for nitrates and arsenic and to test wells prior to sale or transfer for bacteria, nitrates and arsenic. By 2020, develop an interface to effectively and efficiently track and monitor for groundwater contamination, and implement data tracking.	MDEQ, local health departments

	personnel; and • Supporting mapping of local groundwater conditions in partnership with well contractors and others who collect groundwater information.		
2	Develop a plan for aquifer protection that addresses geothermal construction and proper abandonment of wells.	By 2016, convene a stakeholder work group to develop draft legislation to regulate closed-loop geothermal construction. By 2020, develop educational materials for community water systems and local health departments to increase plugging rates of abandoned wells when municipal water mains are extended.	MDEQ
3	Establish inspection requirements for residential wells, including testing wells for nitrates, bacteria and arsenic.	By 2020, implement a statewide requirement for periodic inspections of drinking water quality.	Legislature
4	Develop a spill and communication strategy and organize an incident command approach to prevent, prepare for and respond to environmental disasters and chemical releases.	By 2016, implement the pipeline strategy currently being developed under the leadership of MDEQ and the Attorney General.	MDEQ, MDNR, MDARD, Michigan State Police, Department of Technology, Management and Budget
5	Develop and implement a uniform statewide sanitary code that is flexible and provides standards for site suitability based on risk. Establish a long-term, sustainable funding source to support onsite wastewater programs at the state and local levels and to assist financially distressed owners of private on-site wastewater systems with repair and replacement costs.	By 2020, every county health department has an inventory and assessment of private, single-family home water supplies and all septic systems. By 2020, secure a long-term funding source to complete the inventory and to assist distressed owners.	Legislature
6	Establish inspection requirements for residential on-site wastewater systems.	By 2020, implement a statewide requirement for periodic inspections of on-site septic system performance for properties with on-site wastewater systems.	Legislature
7	Develop marketing and education campaigns and outreach tools directed at homeowners' on-site wastewater management and maintenance and funding opportunities to assist with repair and	By 2020, increase the number of entities implementing outreach campaigns directed at homeowners on septic	NGOs, local units of government,

	replacement.	management.	
8	Secure a long-term funding source to accelerate the cleanup of legacy contaminated sites.	By 2027, close and remove 7,500 sites from the 201 Facilities Inventory, National Priority List, Leaking Underground Storage Tank Site database and designated Areas of Concern.	Legislature
9	Pass comprehensive legislation phasing out the use and sale of microbeads in Michigan.	By 2017, comprehensive legislation phasing out the use and sale of microbeads is signed into law.	Legislature
10	Establish research priorities for "emerging pollutants of concern" in partnership with Michigan's research universities to: • Better understand potential ecological and human health impacts • Adapt monitoring protocols to detect concentrations, fate and transport • Recommend standards for protection of human health and the environment • Develop technologies to remove such pollutants from manufacturing processes	By 2016, increase the number of evaluations and risk assessments completed, new standards developed, and monitoring protocols developed.	MDEQ, Michigan Department of Community Health
Goal 3: Michigan communities use water as a strategic asset for community and economic development.			
Outcome: Economic and community development plans and efforts fully leverage water assets to create great places to live, work and play.			
#	**Recommendation**	**Implementation Metric**	**Lead Actor**
1	Emphasize water resources as assets in state, regional and community planning efforts to provide appropriate, sustainable protection and to fully leverage community-based economic opportunities.	Increase walkability score of waterfront communities to measure the effect of economic activity and investment on or near water in a community, watershed or region.	MSDHA, MEDC, MDEQ, MDNR regional governments, local units of government
2	Host an annual mayor's summit focused on creating high-quality communities that leverage strategic water assets.	Increase in property values as a result of increased economic activity and investment on or near water in a community, watershed or region.	Mayors
3	Provide in-depth technical assistance to support communities with developing and	Increase in the number of communities participating in	Regional and

	implementing community visions and strategies for waterfront redevelopment, access and use.	Redevelopment Ready Communities Program.	interagency teams
4	Prioritize investments around strategic economic assets of commercial harbors and long-term, sustainable infrastructure.	By 2020, increase the percentage of commercial traffic and other economic activity at Michigan's commercial ports over a baseline established in 2015.	MDOT, MDNR, MDEQ's Office of the Great Lakes, Governor's Office of Public-Private Partnerships, commercial maritime interests, local planning professionals
Goal 4: Michigan's water resources support quality recreation and cultural opportunities.			
Outcome: Waters of the state are world renowned for recreational pursuits such as hunting, fishing, boating and swimming.			
#	**Recommendation**	**Implementation Metric**	**Lead Actor**
1	Expand the use of real-time monitoring and source tracking techniques at high risk beaches by local health departments, counties, communities and universities, and address sources of beach contamination.	By 2020, all of Michigan's water meets total and partial body contact designated uses with no closures or advisories. Real time monitoring at all high-risk beaches.	MDEQ, local health departments, local units of government, universities
2	Continue national and regional coordination of mercury reduction activities, such as implementation of the Great Lakes Mercury in Products Phase-Down Strategy and the Great Lakes Mercury Emission Reduction Strategy.	Reduce the mercury levels in edible portions of Great Lakes, inland lakes and stream fish to below 0.35 parts per million by 2020.	MDEQ, MDCH
3	Prioritize infrastructure needs for repair and upgrade of public recreational harbors and their landside access.	By 2020, increase the number of recreational harbors with asset management plans over a baseline established in 2015.	MDNR, Waterways Commission, MDEQ, MDOT
4	Establish a harbor town program and improve marketing of harbors. The program should work with MDEQ to address sources of upstream sediment, sediment reduction and relocation strategies.	By 2017, establish a harbor town program.	MDNR
5	Work with local partners to provide public access every five miles on the Great Lakes, on all priority lakes over 100 acres in size and on every five miles of navigable water, as environmentally appropriate.	Public access every five miles on the Great Lakes and on all priority inland lakes larger than 100 acres.	MDNR

6	Work with stakeholders to develop and implement a designated water trail system for inland waterways and along the coast.	By 2020, a designated a water trail system has been established by the MDNR.	MDNR, local units of governments, , NGOs
Goal 5: Michigan has a strategic focus on water technology and innovation to grow sustainable water-based economies.			
Outcome: Policies and innovative technologies are developed and adopted to grow and promote sustainable water-based economies.			
#	**Recommendation**	**Implementation Metric**	**Lead Actor**
1	Market the state's competitive advantage as a highly attractive place for business creation and investment because of our abundant natural water assets, water research capabilities, highly skilled talent, economic development expertise, and powerful tourism and business-marketing brand.	Increase the number of water-dependent companies and investments locating in Michigan. Specifically track aquaculture technology and related opportunities.	MEDC
2	Establish voluntary water efficiency targets for all major water sectors to reduce water use impacts and costs.	By 2020, develop a baseline for water usage, data collection and definitions to inform development of water conservation goals and objectives. Collect data for two years. Increase by 20% the number of businesses, industries, and municipalities with water efficiency within their water management plans.	Water use sectors
3	Promote innovative technologies that reduce cost and water loss, or convert waste products to usable materials.	By 2020, increase the number of new, innovative and cost-effective technologies, pilot projects, and startups are commercialized, come to market and result in connections with end users to reduce costs and water consumption, or convert waste products to usable materials and produce energy over a baseline established in 2015.	MDEQ, MDARD, MEDC
4	Develop a water conservation and reuse strategy for the state that incorporates the use of green infrastructure, grey water systems, and energy production that includes recognition programs.	By 2018, develop a water conservation and reuse strategy.	MDEQ, MDARD, MDOT

5	Fund a pilot project, through a competitive bid process, for the initiation and evaluation of a new model for wastewater management. This pilot program will assess the opportunities and barriers to creating a "Water Resources Utility of the Future," focused on: • Reclaiming and reusing water • Extracting and finding commercial uses for nutrients and other constituents • Capturing waste heat and latent energy in biosolids and liquid streams • Generating renewable energy using its land and other assets • Using green infrastructure to manage storm water and improve urban quality of life	By 2017, pilot project is funded.	Legislature
6	Establish voluntary water efficiency targets for agriculture in areas of existing or potential water stress.	By 2017, develop a baseline for water usage, data collection and definitions to inform development of water conservation goals and objectives in areas of existing or potential water stress. Collect data for two years. Establish targets. Increase in the number of water stressed regions that have water efficiency plans and water efficiency targets by 2020.	MDARD
7	Create a strategic focus on water innovation to attract and accelerate new technologies to market through a business-led council comprised of private investors, entrepreneurs, corporations, public agencies and universities to better manage water challenges in Michigan and worldwide.	By 2020, increase the number of new, innovative and cost effective technologies, pilot projects, and startups that are commercialized, come to market and result in connections with end users to solve water problems over a baseline established in 2015.	MDEQ, MEDC, MDNR, MDARD

Goal 6: Michigan invests in infrastructure and supports funding to maintain clean water and healthy aquatic ecosystems.			
Outcome: People support investment of both public and private funding of Michigan water resources.			
#	**Recommendation**	**Implementation Metric**	**Lead Actor**
1	Implement a communication strategy focused on messages that link the relationship between investments in water infrastructure and clean water and the benefits infrastructure provides for drinking water, recreation, and cultural and economic opportunity.	By 2017, implement a communication strategy focused on connecting economic, environmental, social and cultural values to Water Strategy outcomes.	NGOs, MDEQ, MDCH
2	Utilize pricing and funding strategies to support infrastructure improvements while allowing for water conservation.	By 2020, increase the number of communities that have pricing and funding strategies as part of their asset management plans to support infrastructure improvements over a baseline established in 2015.	Local units of government, water utilities
3	Evaluate current community practices regarding providing water to financially distressed customers to ensure all citizens have affordable access to water for drinking and sanitation.	By 2017, increase the number of communities that have practices in place to ensure financially distressed customers have access to water for drinking and sanitation over a baseline established in 2015.	Local units of government, water utilities
4	Incentivize and require outcome-based asset management planning for all public water utilities that includes more efficient use of resources.	By 2020, require all major NPDES-permitted dischargers to develop and implement asset management planning for each system. By 2020, require all municipal community water suppliers serving more than 1,000 people to develop and implement asset management planning for each system.	MDEQ
5	Establish sustainable funding mechanisms to achieve the Water Strategy goals including water infrastructure management.	By 2020, implement a long-term funding strategy to achieve goals of the Water Strategy and support existing Quality of Life Agency programs and policies.	State agencies, Legislature

6	Develop an "enterprise budget" in order to better understand the complex relationships between managing water, infrastructure needs and funding	By 2016, develop an enterprise budget for water to inform the long-term funding strategy.	MDEQ
Goal 7: Michigan has integrated outcome-based monitoring systems that support critical water-based decisions.			
Outcome: Monitoring systems are in place at a scale and frequency to ensure water quality and quantity are maintained to support diverse uses and values.			
#	**Recommendation**	**Implementation Metric**	**Lead Actor**
1	Implement a pilot decision support framework that includes monitoring; data and information; and analytical tools for assessing ecological, economic, social and cultural values and outcomes at local and regional watershed scales.	By 2017, fund and implement a water resource decision support framework that provides information about the integration of ecological, economic, social and cultural values and outcomes.	MDEQ, MDNR, MDCH, MDARD
2	Develop a coordinated, comprehensive monitoring strategy for groundwater quantity and quality, including a data management system.	By 2018, implement a long-term groundwater monitoring strategy that provides information sufficient to assess status and trends in quality and predict impacts from groundwater withdrawal.	MDEQ
3	Develop a long-term, sustainable funding source for groundwater and surface water quality and quantity monitoring that is continually improved with new technologies.	By 2018, fund and implement surface water and groundwater monitoring strategies that provide information sufficient to assess water quality and quantity status and trends, and detect emerging issues.	Legislature
Goal 8: Michigan has the governance tools to address water challenges and provide clean water and healthy aquatic ecosystems.			
Outcome: Policies, organizational and institutional structures are in place to achieve goals and outcomes of the Strategy.			
#	**Recommendation**	**Implementation Metric**	**Lead Actor**
1	Enhance the understanding, knowledge and skill set of communities to facilitate and support community-based dialogue and water-related vision development.	By 2016, work with community foundations and private foundations to support community-based dialogues.	Community and private foundations

2	Create a statewide Water Fellows Program and Network to build community leadership and inform critical leaders about how to leverage water resource assets to build community and economic vitality.	By 2016, establish and implement a Water Fellows Program.	Private philanthropy
3	Evaluate and implement necessary changes to laws including state and local land-use statutes as well as the Michigan Drain Code to create a more integrated, watershed based system for managing water at the landscape level and achieving water quantity and quality outcomes.	By 2016, create an ad hoc external advisory body to evaluate existing laws and statues including the Drain Code and local land use statutes. By 2018, panel should provide recommendations to the Directors.	MDEQ and MDARD Directors
4	Retain full authority under the Clean Water Act to continue to manage Michigan's own water resources.	Continue assumption of federal programs under the Clean Water Act.	MDEQ
5	Create an Interdepartmental Water Team to unite agencies to ensure a cohesive common strategy around implementation of the Water Strategy. The team will establish a process for stakeholder collaboration, criteria for setting implementation priorities, identifying cross agency joint projects and an approach to assess and evaluate progress achieved against the metrics and outcomes.	By 2015, create interdepartmental water team. By 2015, put a working agreement in place to establish implementation priorities, a process for stakeholder collaboration, and an adaptive management approach to evaluate progress achieved against metrics and outcomes.	MDEQ, MDNR, MDARD and MEDC Directors
Goal 9: Michigan citizens are stewards of clean water and healthy aquatic ecosystems.			
Outcome: Individuals and communities understand their responsibility for and make informed and responsible decisions regarding water resources.			
#	**Recommendation**	**Implementation Metric**	**Lead Actor**
1	Integrate water literacy principles into place-based education and state of Michigan curriculum standards tied to Science, Technology, Engineering and Math (STEM) across all grade levels.	By 2016, develop a strategy to integrate freshwater literacy principles into place-based education and state curriculum standards.	MDEQ, MDNR and Department of Education, State Board of Education
2	Develop a survey tool to assess behaviors and attitudes toward Michigan's water resources to assess changes over time.	By 2016, develop a Gant chart that encompasses all implementation activity timelines. Develop clear metrics about stewardship related to: • Ability to fund water quality infrastructure • Measuring the community's	MDEQ, MDNR, Universities

		connection to local water assets • Knowledge of, and affinity for, local waters • Metrics of volunteerism and local philanthropy that support a community's vision for water and water-related assets • Measuring actual progress versus planned	
3	Expand opportunities to engage citizen volunteers and participation, such as the Michigan Clean Water Corp (MI Corps) program, in gathering water quality and quantity data, in restoration, providing access and maintenance of important water-related resources.	By 2016, develop a list of participants and define engagement levels. Track progress toward increasing engagement levels.	MDEQ, MDNR

Table 3: Other Recommendations Identified During the Development Process

	Goal 1: Michigan's aquatic ecosystems are healthy and functional.	
	Outcome: Aquatic ecosystems are resilient and diverse.	
#	**Recommendation**	**Lead Actor**
1	Conduct research to assess natural and social systems that comprise Michigan's Great Lakes shorelands. Include patterns of shoreline development, coastal wetland habitats, beach structures, local revenues generated from shoreland development, and use and costs incurred from development. Determine the taxpayer (public) versus insurance (private) burden of coastal damage and flooding scenarios.	Universities
2	Develop a detailed toolbox of options to provide long-term funding for storm water management, including providing support for the creation of storm water utilities.	Michigan Municipal League
3	Develop a database and conduct a statewide inventory of county and inter-county drains as well as public road and highway-dedicated drainage, including maintenance intervals and associated costs.	MDARD, drain commissioners, county road agencies, MDOT, MDEQ
4	Enhance the efforts initiated by the state parks system to incorporate green infrastructure within design and operations plans for state-owned properties like parks, roadways, prisons and schools.	DTMB
5	Develop the "Healthy Waters, Working Farms: For Future Generation Initiative," a pilot public-private partnership and locally led effort to protect farmland and address water quality, farmland preservation, and fish and wildlife habitat through a system of permanent easements and a network of conservation practices on private working lands in areas with high-priority water quality concerns.	MDEQ, MDARD, NGOs
Goal 2: Michigan's water resources are clean and safe.		
Outcome: Surface and groundwater are managed to support sustainable human uses and ecological function.		
#	**Recommendation**	**Lead Actor**
1	Promote USDA rural development funding to high-priority areas with high rates of septic system failure to replace or to maintain old septic systems or provide resources to connect to public wastewater treatment systems, if available.	MDARD
2	Establish a non-federal funding mechanism to leverage federal Great Lakes Legacy Act funds to continue the remediation of contaminated sediments in Areas of Concern by 2018.	Legislature
3	Provide water supply intake locations and information to environmental response companies upon request, and notify communities and drinking water plants that may be impacted by spills.	Legislature, MDEQ

4	Require decentralized wastewater treatment systems be included in planning for state funding of wastewater infrastructure improvements and extensions.	MDEQ, Legislature
Goal 3: Michigan communities use water as a strategic asset for community and economic development.		
Outcome: Economic and community development plans and efforts fully leverage water assets to create great places to live, work and play.		
#	**Recommendation**	**Lead Actor**
1	Ensure common water resources and adjacent land resources are managed in harmonious ways in communities and regions through coordination and collaboration to protect water resources while facilitating waterway-appropriate public use, commercial and amenity development, and recreation.	Local units of government, Regional governmental entities
Goal 4: Michigan communities use water as a strategic asset for community and economic development.		
Outcome: Waters of the state are world renowned for recreational pursuits such as hunting, fishing, boating and swimming.		
#	**Recommendation**	**Lead Actor**
1	Implement recommendations developed in partnership with Michigan Sea Grant, National Weather Service, the Great Lakes Research Center at Michigan Technological University and others to improve information for beachgoers on wave conditions and dangerous near-shore currents. Information should be available and accessible at beaches through a variety of media, including smart devices.	MDNR, MDEQ, local units of government
2	Complete the state's harbor of refuge system.	MDNR
3	Invest in innovative and technological advancements to lower the cost and frequency of dredging.	U.S. Army Corp of Engineers
Goal 5: Michigan has a strategic focus on water technology and innovation to grow sustainable water-based economies.		
Outcome: Policies and innovative technologies are developed and adopted to grow and promote sustainable water-based economies.		
#	**Recommendation**	**Lead Actor**
1	Researchers should seek funding to extend research and quantification of the risk profile water plays in corporate profitability and performance volatility. Differentiate the state and the Great Lakes from other regions of the country for financial managers and investors.	Universities
2	Expand the University Research Corridor's inventory of Michigan's water-related industries to include other water-related sectors, such as tourism and recreation, and conduct an inventory of water research projects at Michigan universities to further define and identify the scope of Michigan's water sector.	Universities

3	Direct funding of studies conducted through the Agriculture Partnership Wastewater Workgroup to develop new technologies and best management practices to address tile lines and water management, and pilot and evaluate the adoption of innovative methods for nutrient management from tile line discharges. Existing institutional structures should be used to connect end users with technologies to ensure implementation of effective water management techniques and technologies.	MDARD
4	Create a coordinated public-private program of education and incentives to promote efficient use and conservation of water.	MDEQ, MDCH
5	Collaborate with the National Science Foundation International to set a framework for gray water and water reuse applications to protect public health and minimize risk. Modify applicable building and plumbing codes to allow for the adoption of water reuse strategies.	MDEQ, MDARD, MDCH
6	Use all available tools and create new ones, including existing and new funding opportunities, to attract technology providers to address specific water quality and quantity issues, and develop strategies to connect end users with technologies. Incentivize and invest in areas including but not limited to: • Increasing technology innovation capacity in the application of rapid response E. coli testing for surface waters • Developing a market to attract innovative technology developers for low-cost, environmentally sound sediment remediation, sediment removal, reuse and disposal • Developing low-cost methods of remediating pollutants that falls outside of traditional regulatory system • Researching treatment technologies to prevent introduction and spread of invasive species by ballast water • Developing technology to address special challenges facing food processors • Developing technology to address water issues associated with fracking • Developing technology to further improve green infrastructure design and maximize infiltration capacity and/or water retention • Increasing technology innovation capacity in treatment technologies to reduce phosphorus loading from municipal systems • Developing efficient technologies to remove and separate nitrogen and phosphorus through permeable membranes for use in anaerobic digestion • Increasing technology and innovation that addresses the intersection of energy, water and food systems • Increasing energy efficiency and water quality recirculation systems for aquaculture and aquaponics for urban, closed-cycle food production systems • Developing technologies to enable higher efficiency water delivery systems and water conservation, including work on advanced drain tile management systems	MDEQ, MEDC, MDARD, MDNR

Goal 7: Michigan invests in infrastructure and supports funding to maintain clean water and healthy aquatic ecosystems.		
Outcome: People support investment of both public and private funding of Michigan water resources.		
#	**Recommendation**	**Lead Actor**
1	Continue to advocate for Great Lakes Restoration Initiative funding and other federal programs that support the Great Lakes.	State agencies, NGOs, Local units of government
Goal 9: Michigan citizens are stewards of clean water and healthy aquatic ecosystems.		
Outcome: Individuals and communities understand their responsibility for and make informed and responsible decisions regarding resources.		
#	**Recommendation**	**Lead Actor**
1	Coordinate, deliver and support ongoing freshwater-focused professional development for Michigan's K-12 educators. Convene statewide summer seminars for Michigan K-12 educators where best practices in teaching core environmental education concepts can be refined and shared.	Nonprofit organizations

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Definitions and Acronyms

AIS - Aquatic Invasive Species - An invasive species is defined as a species that is not native and whose introduction causes, or is likely to cause, economic or environmental harm or harm to human health.

AOC - Areas of Concern - Are federally designated places where numerous uses of the areas (fishing, swimming, hunting, drinking water) have been impaired dues to historical contamination.

CAWS – Chicago Area Waterways System

CMI – Clean Michigan Initiative

DDT - A commonly used pesticide (Dicholorodiphenyltrichloroethane) that was banned in 1972 that has contributed to fish consumption advisories in the Great Lakes ecosystem.

MDEQ – Michigan Department of Environmental Quality

MDNR – Michigan Department of Natural Resources

Ecosystem - The complex set of relationships among living resources and their habitat

Evapotranspiration - How water is transferred from land to the atmosphere by evaporation from the soil and transpiration from plants.

Food web - The system of interlocking and interdependent food chains

4 R Nutrient Stewardship Program – A program that provides a framework to achieve cropping system goals, such as increased production, increase farmer profitability, enhanced environmental and improved sustainability. To achieve those goals, the 4R concept incorporates the **R**ight fertilizer source, **R**ight rate at the **R**ight time and in the **R**ight place.

Great Lakes – St. Lawrence River Water Resource Compact Agreement – An Agreement amongst the eight Great Lakes states as well as Ontario and Quebec to protect against wholesale diversions of water from the Great Lakes basin.

GLITTH – Great Lakes International Trade and Transport Hub

GLRI - Great Lakes Restoration Initiative

GLSLCI – Great Lakes and St. Lawrence Cities Initiative

Grey water - The relatively clean water from sinks, baths, and washing machines.

HAB – Harmful Algal Bloom - Algal blooms that produce concentrations of harmful toxins such as blue green algae or cyanobacteria.

Impaired waters – Under section 303(d) of the Clean Water Act, states, territories, and authorized tribes are required to develop lists of impaired waters. These are waters that are too polluted or otherwise degraded to meet the water quality standards set by states, territories, or authorized tribes.

Implementation metric – A tactical metric to measure progress toward accomplishing the recommendation.

MAEAP - The Michigan Agriculture Environmental Assessment Program is an innovative, proactive, and voluntary program that helps farms of all sizes and all commodities voluntarily prevent or minimize agricultural pollution risks administered by the Michigan Department of Agriculture.

MDARD – Michigan Department of Agriculture and Rural Development

Measures of Success – A measure of the improvement in environment, social or economic conditions overtime as a result of multiple actions.

MEDC – Michigan Economic Development Corporation

Nonindigenous - Fish or wildlife not native to a place.

NPDES – The National Pollutant Discharge Elimination System (**NPDES**) permit program controls water pollution by regulating point sources that discharge pollutants into waters of the United States.

Outcomes - The desired final end results.

PCB - Polychlorinated Bi-Phenyl

PBT – Persistent Bio-accumulative Toxin

URC - University Research Corridor - The formally created research cooperative comprised of the University of Michigan, Michigan State University and Wayne State University.

U.S. EPA – United States Environmental Protection Agency

Appendix 1

Water literacy principles - The understanding of water's influence on the individual and the individuals influence on water. An example of a water literacy principle is that bodies of fresh water are connected to each other and to the world.

WHO – World Health Organization

WLEB - Western Lake Erie Basin

Development Process and Engagement Strategy

To develop the Water Strategy, the OGL formed an interagency steering committee that included representatives from the MDEQ, MDARD, DNR and MEDC. The steering committee met throughout the development of the Strategy to brainstorm, evaluate recommendations, and review content and direction. Additionally, the Michigan State Housing Development Authority (MHSDA) and the MI Place Partnership Initiative helped develop and refine ideas about water and placemaking.

An additional, external advisory committee, called the Water Cabinet, informed the Strategy's broad goals and developed a set of long-term desired environmental, economic, social and cultural outcomes. The cabinet consisted of a diverse array of 25 individuals actively engaged in ensuring the long-term health, function and resiliency of Michigan's water resources and in encouraging and nurturing its economic and cultural values.

In order to reflect diverse public perspectives, the OGL also led an extensive public engagement effort, integrated tribal involvement and engagement, and invited a series of 10 experts to develop white papers providing key insights on solutions for emerging and challenging problems that Michigan faces related to its water resources.

The OGL also hosted "Water Dialogues" with 16 communities across the state, focused on understanding different communities' capacity to create and implement a vision for water resources. These facilitated conversations, supported by a grant from the C.S. Mott Foundation, helped develop implementation tactics for the Strategy, reinforce the themes and refine the focus of the Strategy.

The draft goals and outcomes were tested at 10 regional economic roundtable discussions to understand how current local and regional economic development efforts depend on water. These discussions ultimately contributed to the development of a suite of themes reflected in the Strategy.

Finally, the OGL made a concentrated effort to encourage broad public involvement and awareness of the draft Strategy. Outreach efforts included press releases, website postings, the State of the Great Lakes report, presentations, an informational Webinar, and 30-day public comment opportunities via the Website.

State Agency Steering Committee Members

Mr. Jon W. Allan
Office of the Great Lakes

Mr. Bill Bobier
Michigan Department of Agriculture and Rural Development

Mr. William Creal
Department of Environmental Quality

Ms. Michelle Crook
Michigan Department of Agriculture and Rural Development

Mr. Robert Day
Department of Environmental Quality

Mr. James Dexter
Department of Natural Resources

Mr. Roger Eberhardt
Office of the Great Lakes

Ms. Emily Finnell
Office of the Great Lakes

Mr. James Johnson
Michigan Department of Agriculture and Rural Development

Ms. Lynelle Marolf
Office of the Great Lakes

Mr. Kenneth McFarlane
Michigan Department of Agriculture and Rural Development

Ms. Tammy Newcomb
Department of Natural Resources

Mr. Gil Pezza
Michigan Economic Development Corporation

Ms. Liane Shekter-Smith
Department of Environmental Quality

Ms. Donna Stine
Department of Natural Resources

Mr. Gordon Wenk
Michigan Department of Agriculture and Rural Development

Water Cabinet Members

Mr. David Armstrong
GreenStone Farm Credit Services

Mr. Rich Bowman
Michigan Chapter of the Nature Conservancy

Ms. Lisa Brush
The Stewardship Network

Ms. Laura Campbell
Michigan Farm Bureau

Ms. Marcy Colclough
Southwest Michigan Planning Commission

Ms. Becky Ewing
Rotary Charities of Traverse City

Mr. Brad Garmon
Michigan Environmental Council

Mr. Jerry Harte
Michigan Water Environment Association

Mr. Brad Jensen
Huron Pines

Ms. Christine Kosmowski
Calhoun County Drain Commissioner

Mr. Mike Kelly
The Conservation Fund

Ms. Sue McCormick
Detroit Water and Sewerage Department

Mr. Jimmie Mitchell
Little River Band of Ottawa Indians

Mr. Tim Neumann
Michigan Rural Water Association

Mr. Marc Smith
National Wildlife Federation

Dr. Jan Stevenson
Michigan State University

Mr. Andy Such
Michigan Manufacturers Association

Ms. Meghan Swain
Michigan Association for Local Public Health

Mr. Gildo Tori
Ducks Unlimited

Mr. Dennis West
Northern Initiatives

Mr. Guy Williams
G.O. Williams and Associates

Michigan's Water Strategy
Economic Regional Roundtable Discussion Summary

Background

During 2013, the OGL hosted Economic Regional Roundtable Discussions in each of the 10 Michigan Prosperity Regions in collaboration with the Michigan Department of Natural Resources, Michigan Department of Agriculture and Rural Development, and the Michigan Economic Development Corporation. The purpose of the economic roundtables was to discuss how local and regional economic development efforts currently depend on water and related resources, and to hear and understand how the participants feel these needs and opportunities will evolve in the future. In addition, OGL gathered input on the draft Water Strategy goals, outcomes, and regional and statewide issues. The discussions were held in Marquette, Traverse City, Gaylord, Grand Rapids, Saginaw, Flint, Lansing, Battle Creek, Adrian and Detroit. Please refer to Appendix A to see the list of participants.

With the help of local contacts, OGL invited roughly 25 economic and community development leaders actively engaged in water-related projects and issues to each discussion. Attendees reflected perspectives from academia, agriculture, business, industry, economic and community development, tribal nations, conservation, environmental, fishing, hunting, harbors, public health, local units of government, planning, philanthropy, recreation, and tourism.

Summary of Key Themes

Each economic roundtable was a three-hour discussion focused on economic development and water at the regional scale. Participants provided feedback on the goals and outcomes and brought forward several themes and ideas that should be reflected in the Water Strategy. Below is the summary of these key themes.

Michigan's available freshwater resources will become increasingly valuable as water resources become scarcer nationally and globally. Attendees were asked how their region's dependence on water will evolve during the next 30 years. Responses tended to focus on Michigan's abundance of the natural resource and the increasing value of water around the world. Participants felt that Michigan will become a more attractive place to live, work and play because of the availability of fresh water and opportunities for growing business and recreational opportunities. Participants recognized that groundwater recharge, water reuse and monitoring of water resources would become increasingly important in the future.

Michigan has the opportunity to become a leader in research and development of freshwater technologies. Participants identified a need for investments in the development of technology focused on protecting and restoring Michigan's water resources as well as helping address global water issues. They highlighted collaboration among business, industry, government and universities as a way to capitalize on water technology, innovation, research and development. Michigan's leadership in technologies would increase Michigan's economic capacity and would encourage others to look to the state for guidance on water issues.

Education of leaders and citizens about basic water principles is important to inform wise decision making and drive water-related stewardship. There was consensus among participants that the public needs to understand how to protect and care for the resource and must have the desire to do so. The public, legislators and youth must be educated about basic water principles and the hydrologic cycle to make educated and wise decisions. Participants recognized the need for storytelling about the evolution of water challenges in Michigan, progress made to address these challenges, and successes to increase stewardship of the resource. More place-based education is needed to build a sense of place, stronger connections to the resource and stewardship of water.

Public access to water resources was viewed as an important opportunity for economic development and improving quality of life. Some regions were very concerned that their lack of public access points inhibited economic development. Increased public access was also viewed as a way to connect people to the resource and nurture stewardship.

Marketing strategies should place a stronger emphasis on water assets and placemaking to attract talent, economic development and tourism. Participants agreed that marketing efforts could be better utilized on a regional scale to leverage unique assets within the state. Strategies that promote high-quality, water-based job opportunities; high quality of life amenities; and water-based recreational opportunities can attract youth and talented workers.

Balancing economic growth and environmental protection was identified as challenge for many regions. Demands for increased agricultural and industrial uses create challenges for protecting water resources. Growing economic capacity is dependent on the ability to maintain infrastructure and the health of our ecosystem.

Access to clean, affordable drinking water was important to most regions of the state.

The importance of the land and water interface needs to be recognized in planning and decision making. Planning, infrastructure, agriculture and other economic decisions must be made with an understanding of the impact on water resources. Watershed planning, infrastructure investments, and community and economic development planning need to be connected.

Investment in infrastructure maintenance and management was repeatedly expressed as a priority to the regions. Most areas had infrastructure that was 50-60 years old and needed more investment in the development of sustainable, green infrastructure.

Failing septic systems need to be addressed to protect water quality and public health. Participants were concerned with the public's lack of knowledge about septic system maintenance. Many failing septic systems could be addressed through public education about appropriate maintenance, as well as through local and state regulations such as point-of-sale inspections or the establishment of a statewide sanitary septic code.

Policies, regulations, investments and resources must be aligned and integrated at all levels to achieve regional and local goals. Many participants were concerned with how the Strategy aligned with other existing plans, compacts and policies and with how the state would ensure sustainability of the Strategy. The impacts of state policies and regulations on the implementation of community development and economic development plans needs to be better understood at the local level. In some cases, regulations at the regional or state level were noted as a barrier to implementation. Participants emphasized that planning and resolution of issues were best addressed at the local level.

Conflicts around water

OGL asked participants to discuss areas of water-related conflict, particularly those occurring in their region. Many participants identified the lack of knowledge or understanding of water issues and the causes of the issue as one source of conflict. Water issues were sometimes extremely complex and participants felt that decisions were sometimes made without a full understanding or adequate information about the problem and its causes. Further, conflict is often caused by a lack of alignment in policies and decision-making among different groups working on related issues. The impact of industry, agriculture and groundwater extraction on the integrity of the water resource was a source of conflict in regions with higher concentrations of industry or groundwater contamination. The responsibility of stormwater management was also a source of conflict in urban areas.

The conversation then focused on conflicts that may arise in the future and common organizations that assist with conflict resolution. Examples of future conflicts included

groundwater withdrawals, allocation of funding and resources, and the competing uses of water for agriculture, industry and recreation. Most conflicts, participants thought, originated with a lack of knowledge about the issue and a lack of a consistent and/or accepted conflict-resolution method. Groups mentioned as trusted agents to resolve conflict included Michigan State University Extension, DEQ and DNR. While all of the regions varied on their current capacity to resolve conflict locally, most participants agreed that conflict resolution should lie at the community level. Communities need to develop the capacity to resolve conflict and collaborate at the local level.

Collaboration

OGL also asked participants if they saw any areas of potential collaboration to achieve the proposed goals and outcomes of the Strategy**.** In almost all of the regions, participants saw DEQ as a facilitator to assist in effective collaboration at the local level. They identified a strong culture of collaboration at the state, regional and community levels as necessary to achieving the Water Strategy's goals and outcomes. The creation and communication of a unifying vision statement in the Strategy would help guide communities. Diverse interest groups should work together using appropriate tools and resources to solve problems. Participants recognized opportunities to be more inclusive at the community level when working to come up with solutions. Furthermore, they recognized the large role agriculture and industry play in water usage without being brought in to the decision-making process.

Funding and resources

Participants also offered input on how the funding system should be structured to ensure capacity to fund the vital priorities that will be reflected in the Strategy. Financing and resource capacity was noted as critical to the achievement of the water strategy goals and outcomes. Some suggestions for raising funds included a charge for groundwater use, a rain tax or fee, and monetary incentives to encourage local funding. Regions also indicated that funds should come from a mix of public and private entities.

Regional Uniqueness

The economic roundtables were also intended to provide the OGL with an understanding of whether regional needs and opportunities around water were reflected in the draft goals and outcomes of the Strategy. Participants at regional meetings were asked how their region uniquely depends on water currently and in the future. In addition, participants were asked if their region's needs and opportunities around water were reflected in the draft water strategy goals and outcomes. The following sections highlight this regional distinctiveness from the participants' perspectives.

Region 1: Marquette
Participants highlighted the Upper Peninsula's unique water resources define the region and play an important role in its economy, including three Great Lakes watersheds, desirable state parks and high quality waters. A key theme expressed by the region was that economic activity has become much more diverse in the last decade in this region. In addition to the developed mining industry, tourism, fishing and paper industries have become increasingly important. About 30 percent of the region's economic base comes from the high abundance of raw materials that are available to these industries.

Participants in the Upper Peninsula expressed the importance of protecting pristine waters to prevent the need for remediation. High water quality and quantity was seen as vital to future economic development. To ensure thoughtful decision-making, they identified education of the public and young people on water and watershed principles as a priority. The group also noted an opportunity to better market the Upper Peninsula's water resources, state parks and other recreational opportunities in order to increase tourism and attract and retain young people.

Region 2: Traverse City
High quality water is extremely important to the Northwest Lower Peninsula because of growing recreational activities like kayaking, boating and swimming. However, this area faces some unique challenges with managing swimmer's itch in inland lakes and concerns about hydraulic fracturing. The region is also uniquely characterized by its strong leadership in planning and community development. Industrial features were purposefully placed in areas that would not be disruptive to the beauty or public use of natural resources.

The group anticipated the need to improve infrastructure management in order to handle the expansion of second homes, extreme weather and changes in water levels. Participants identified opportunities for water reuse and conservation in industrial use through the development of water technologies. Jobs related to this technology development were also seen as an avenue to attract and retain young talent.

Region 3: Gaylord
Northeast Michigan is uniquely characterized by an abundance of cold-water streams and rivers. More specifically, Otsego County is home to five major, pristine, cold-water river systems. Additionally, the group identified the growth of wild rice in inland lakes and commercial fishing on Lake Huron as important aspects of the region's culture. The group identified groundwater contamination and swimmer's itch on inland lakes as important issues of concern.

Tourism is an opportunity for future economic development in the region. Greater marketing of the region's abundant cold waters, shipwrecks, and fishing and boating recreational activities is needed to increase and attract visitors. Increasing local awareness of the value of the surrounding natural resources as well as educating the public and officials on land and water connections was important to participants. In addition, preserving Northeast Michigan's wetlands, high quality surface waters, and the quality and quantity of groundwater for drinking water will be important for future economic development and ecological health in the region.

Region 4: Grand Rapids

Participants saw high public access to water, the presence of five of the state's largest rivers, and higher population density as West Michigan's unique characteristics. Region 4 is self-sufficient on conflict management and has a unique culture of collaboration and innovation. Issues unique to West Michigan included: legacy contamination of the Kalamazoo River, which could become the largest superfund site in the U.S.; sewer overflows; impervious surfaces; and storm water management.

The group saw public education on the increasing value of water, water literacy principles, land and water connections, and individual impact on the resources as an important need. Further, they saw creating a culture of consciousness about water stewardship and sustainability as opportunities. The group also mentioned the need to involve a broader audience of diverse interest groups in the region's decision-making process. Another key theme expressed by Region 4 was the opportunity to expand the role of agriculture and industry in order to meet increasing demands for food and water in the future.

Region 5: Saginaw

Participants identified a world-class walleye fishery, a large coastal wetland system and the natural features of Saginaw Bay as characteristics unique to Region 5. However, the group mentioned that use of these resources for recreation is limited due to lack of public access. Saginaw is distinct from other northern Michigan regions because there is major focus on restoration of natural resources. Agribusiness was identified as a major sector in the bay area with major effect on water quality and use. Other issues identified included population loss, runoff into the bay and old infrastructure.

There was strong support to expand the bay region's tourism industry through the creation of increased accessibility to the bay, waterfront lodging, a casino, bird trails, and the cleanup of eutrophication and muck issues. The group noted that building a pier would improve visibility of the bay from the ground, and the creation of more boat and kayak launches would allow people to easily reach well-known fishing locations. Changing public perception by telling the story of improvements in water quality as a result of the

tremendous amount of work is important. Educating the public was noted as a regional need in order to create stewardship of the resource and to ensure that people focus on solving the right problems.

Region 6: Flint

The Flint group noted the region's longstanding focus on water from its dependence on the lumber, fur, automobile, manufacturing and agriculture industries. More recently, the city began to orient the community around the waterfront. Unique recreational characteristics Region 6 highlighted included bird trails, undeveloped and developed beaches, boating, fishing, and hunting. Regionally specific issues include old infrastructure on the water and traffic on the main roads.

Region 6 participants focused on the opportunity to market the area as a weekend vacation destination to recapture dollars locally instead of sending them "up north." More developed public access points, bird trails and the cleanup of old vacant industrial sites were mentioned as ways to build recreational desirability. Older infrastructure and groundwater contamination were mentioned as regionally specific issues.

Region 7: Lansing/Bath

The Lansing area saw its region as unique because of limited access to either inland lakes or the Great Lakes. This lack of abundant water features has spurred more careful stormwater management and restoration of the region's limited water resources. Further, the group mentioned that while there are some recreational activities such as swimming, kayaking and golfing, agriculture and industry dominate the region's water use. Groundwater was important to the region and was expected to grow in importance in the future.

Region 7 wanted to more effectively capitalize on water-related assets and recreational opportunities by improving quality and access to the resource. Partnerships with the universities presented opportunities to lead in the innovative solutions to maintain water in the system and protect groundwater as a source of drinking water. The group highlighted stormwater management and water reuse as major opportunities to retain water. Region 7 also noted that there are opportunities to encourage and expand innovative approaches to drive sustainability through better regulations, voluntary programs and market forces.

Region 8: Battle Creek

A key theme expressed in Southwest Michigan as a unique differentiator for the region is its dependence on agriculture. The region accounts for 70 percent of the state's irrigation, including more than 300,000 irrigated acres. Seed corn production is the major crop, but the group also mentioned that Berrien County is the second-most diverse agricultural

county in the nation because of the soils and climate. Another unique aspect emphasized in Region 8 is waterfront redevelopment opportunities that were previously neglected.

The group saw high agriculture capacity as an opportunity to address growing global food demand. The group also indicated that there is potential to market the region's recreational opportunities to increase tourism. Southwest Michigan identified the need to address contamination issues first, before removing dams, reconnecting rivers and promoting recreational opportunities. Participants also expressed a desire to improve public perceptions about water quality and educate citizens and public officials on land and water connections to ensure responsible decision-making.

Region 9: Adrian

Region 9's karst geology was identified as a major influencer of water quality unique from other parts of Michigan. The group also indicated that the region contains headwaters for many of Michigan's major rivers. Additionally, participants noted that their watershed hosts many acres of agriculture as well as artesian wells in Monroe County and parks. One other distinctive characteristic in Region 9 is a high rate of population growth and conversion of seasonal housing to year-round living.

The group emphasized the importance of addressing algae blooms in Lake Erie because they affect tourism, fisheries and water supplies. Additionally, continuing restoration initiatives like increasing river access was identified as a way to encourage economic development. Other opportunities mentioned included university engagement with water development research, attracting young professionals by reorienting communities around water resources, and increasing recreational opportunities through the development of more canoe and kayak rentals and water trails.

Region 10: Detroit

Unique regional attributes discussed included old infrastructure, an industry-driven economy, a number of universities, a dense population with a higher demand for water, a world-class fishery and a large port. The group also noted that there is limited public access to the water in Detroit and that the riverfront is underutilized. They saw Lake St. Clair's large boating and fishing industries as major recreational components of the region.

Southeast Michigan's universities were identified as having exceptional collaboration around the water sciences, creating an opportunity for the region and the state to become a leader in freshwater technologies. Stormwater and wastewater management were emphasized as potential beneficiaries of such research. Other opportunities for Southeast Michigan expressed by the group included capitalizing on unused capacity in existing infrastructure and increasing access to and marketing of the region's natural water assets for recreational use.

Feedback on Goals and Outcomes

To help attendees understand the Water Strategy's goals and outcomes, regional participants were asked to vote on the draft outcomes, choosing those that most closely reflected their region's priorities around water. Following the voting exercise, each region discussed which outcomes were selected and why. The outcomes were revisited later in the session and participants were asked if, based on the conversation, their region's views and priorities were reflected in the drafted outcomes. Participants were asked what they felt was missing from the drafted list, and were provided an opportunity to propose new outcomes. Please refer to Appendix B to review the goals and outcomes that were shared with the groups.

Voting and reflection on outcomes. The following outcomes were selected most often as priorities throughout the regions:

- Drinking water is safe and available
- Water infrastructure is well-designed and maintained to support recreational, economic, and cultural uses and values
- Groundwater is managed for human uses and environmental integrity
- Leaders at all levels support investment of both public and private funding in Michigan's water resources, reflecting individuals' value of a connection between a healthy environment, strong economy, and high quality of life

The following outcomes were selected least often as a regional priority:

- Great Lakes and inland beaches are safe for swimming
- Coastal and shoreline areas and infrastructure are compatible with ecological function and human use
- Aquatic life is managed for the resilience of aquatic ecosystem function and diversity
- Management practices recognize the land-water and hydrologic connections

Generally, participants commented that the outcomes selected least often had a more narrow focus than the ones that were most often selected. Additionally, prevention of invasive species, management through the utilization of a watershed approach and better conservation of water were issues that several participants wanted to see explicitly expressed in the outcomes. Newly proposed outcomes that received the most votes focused on funding and stewardship of the resource.

Overall, each of the regions noted that their main views and priorities were reflected in the goals and outcomes. The gaps or missing themes identified by participants were generally issues or threats to water resources, such as climate change and invasive species

management, and are more programmatic or tactical, given that they illustrate the way in which to get to a desired state or condition.

Appendix A: List of Roundtable Attendees

Economic Development Region 1
September 17, 2013 - Marquette
Northern Michigan University
Carl Lindquist, Superior Watershed Partnership
Ron Sundell, Northern Michigan University
James Cantrill, Northern Michigan University
Caralee Swanberg, Lake Superior Community Partnership
Gary LaPlant, Community Foundation of the Upper Peninsula
Karl Zueger, City of Marquette
Dr. David Watkins, Michigan Technological University
Ally Dale, Marquette County Conservation District
Jon Fosgitt, Compass Land Consultants
Dave Anderson, Copperwood Project
Phil Musser, Keweenaw Economic Development Alliance
Scott Gischia, Cleveland Cliffs
Curt Goodman, City of Marquette
Brent Ketzenberger, Cleveland Cliffs
Stacy Welling Haughey, MDNR
Steve Casey, MDEQ
JR Richardson, Traxys Power

Economic Development Region 2
September 25, 2013 – Traverse City
Northwest Michigan Works!
Megan Olds, Grand Traverse Regional Land Conservancy
Scott Gest, Northwest Michigan Council of Governments
John Sych, Grand Traverse County
Joseph H. Elliott, Grand Traverse Conservation District
Kevin McElyea, Grand Traverse County Drain Commissioner
Cindy Ruzack, Rotary Charities of Traverse City
Sarah U'Ren, Watershed Center Grand Traverse Bay
Amy Beyer, Conservation Resource Alliance
Treenen Sturman, Grand Traverse Conservation District
Tad Peacock, Benzie Conservation District
Hans VanSumeren, Northwestern Michigan College
Mark Breederland, Michigan Sea Grant
Trudy Galla, Leelanau County Planning
Dan Vogler, Michigan Aquaculture Association
Chuck May, Great Lakes Small Harbor Coalition
Greg Goudy, MDEQ
Brian Jankowski, MDEQ
Steve Hammon, Traverse City Golf and Country Club
Jim MacInnes, Owner of Crystal Mountain
Emily Myerson, Top of Michigan Trails Council
Jason Jones, Grand Traverse County Parks and Recreation
Don Coe, Michigan Department of Agriculture and Rural Development Commission
Tino Breithaupt, MEDC

Economic Development Region 3
September 24, 2013 – Gaylord
University Center
Curtis Chambers, Cheboygan County
Brad Jensen, Huron Pines
Lisha Ramsdell, Huron Pines
Jeff Ratcliffe, Otsego County Economic Alliance
John Walters, Pigeon River Country Advisory Council
Wayne R. Jonker, Kalkaska County Drain Commissioner
Dana Bensinger, Otsego County Community Foundation
Rick Harland, Grayling Charter Township
Craig Cotterman, Denton Township Supervisor
Vicki Springstead, Higgins Lake Foundation
Anne Meeks, Higgins Lake Foundation
Mark Copeland, Jay's Sporting Goods

Dawn Bodnar, Indian River Chamber of Commerce
Grenetta Thommasey, Tip of the Mitt Watershed Council
Robert Dixon, Grayling Township
Dave Waltz, Au Sable River Watershed Restoration Committee
Richard Deuell, Northeast Michigan Council of Governments
Lydia Murray, MEDC
Jeff Gray, Thunder Bay Marine Sanctuary

Economic Development Region 4
November 25, 2013 – Grand Rapids
DeVos Place
Mark Knudsen, Ottawa County Planner
April Scholtz, West Michigan Land Conservancy
Bill Byl, Kent County Drain Commission
Brad Boomstra, Kent County Drain Commission
Felicia Fairchild, Saugatuck and Douglas Convention and Visitors Bureau
David Rinard, Steelcase
Gabe Wing, Herman Miller
Kevin Larsen, H2Opportunities
Bob Kennedy, Commission Chair
Jonathon Jarosz, Heart of the Lakes
Gail Heffner, Calvin College/Plaster Creek Stewards
Nichol Demol, Trout Unlimited
Rick Chapla, The Right Place
Ed Garner, Muskegon Area First
Michelle Skedgell, Pierce Cedar Creek Institute
Dr. Hugh Brown, Pierce Cedar Creek Institute
Bonnie Hildreth, Barry Community Foundation
Patty Birkholz, League of Conservation Voters
Andy Guy, Governor Rick Snyder's Office of Urban Initiatives
Jan Urban Lurain, Spectra Data and Research
Jason Ball, Kuntzsch Business Services
Travis Williams, Outdoor Discovery Center Macatawa Greenway
Mike Wenkel, Potato Growers of Michigan Inc
Kara Wood, City of Grand Rapids
Rachel Hood, West Michigan Environmental Action Council
Vicki Luthy, Muskegon Public Health Department

Economic Development Region 5
October 3, 2013 – Saginaw
Saginaw Valley State University
Michael Kelly, Saginaw Bay Watershed Initiative Network
Dane Cramer, Ducks Unlimited
Carl Osentoski, Huron County Economic Development Corporation
Kimberly Mason, City of Saginaw
Trevor Edmonds, Saginaw Basin Land Conservancy
Dennis Zimmerman, Saginaw Bay Area of Concern
Zachary Branigan, Saginaw Basin Land Conservancy
Russ Beaubien, Spicer Group
David Karpovich, Saginaw Valley State University, Saginaw Bay Environmental Science Institute
Shirley Roberts, BaySail
Jane Fitzpatrick, East Michigan Council of Governments
Paul Strpko, Fisher Companies
Ray VanDriessche, Michigan Sugar Company
Tim Boring, Michigan State University Extension
Laura Ogar, Bay County Environmental Affairs and Community Development
Patti Stowell, Bay City Economic Development Corporation
Dr. Donald Uzarski, Institute for Great Lakes Research
Julie Spencer, Gratiot Conservation District Administrator
Trevor Keyes, Bay Future
Sheila Stamris, City of Frankenmuth Downtown Development Authority

Carey Pauquette, Saginaw Chippewa Indian Tribe
Michael Fisher, Saginaw Chippewa Indian Tribe
Peter W. Little, Gratiot County Parks and Recreation
Harry Leaver, Saginaw Valley State University, Center for Business & Economic Development
Bob Zeilinger, Cass River Greenways Committee
Joel Strasz, Bay County Health Department
Joseph Rivet, Bay County Drain Commissioner
Donald Schurr, Greater Gratiot Development
Scott Walker, Midland Tomorrow
Jennifer Humphries, MDARD

Economic Development Region 6
October 11, 2013 – Flint
Flint and Genesee Chamber of Commerce
Joe Stock, Lapeer County
Chris Bunch, Six Rivers Land Conservancy
Randy Maiers, St. Clair Community Foundation
Janice Karcher, Genesee Regional Chamber of Commerce
Doug Weiland, Genesee County Land Bank Authority
Mark Brochu, St. Clair County Parks & Recreation
Lori Eschenburg, Metropolitan Planning Commission
Jumana Vasi, Charles Stewart Mott Foundation
Mary Bohling, Michigan Sea Grant
Jason Hami, City of Marysville
Daugherty Johnson, City of Flint
Greg Alexander, Sanilac County Drain Commissioner
Janet VandeWinkle, Flint River Corridor Alliance
Jason Caya, Flint Area Reinvestment Office
Nadine Thor, Kettering University
Rafael Turner, Flint and Genesee Chamber of Commerce
Derek Bradshaw, Genesee County Metropolitan Planning
Danielle Lewinski, Center for Community Progress (Flint)
Tom Raymond, Lexington Village Manager
Rebecca Fedewa, Flint River Watershed Coalition
Steve Trecha, Integrated Strategies
Justin Sprague, Genesee Chamber of Commerce
Sheri Faust, Friends of the St. Clair River and Health Department
Marci Fogal, Blue Water Area Convention and Visitors Bureau
Jack Stock, Kettering University
Michael Freeman, Flint River Corridor Alliance
Amy McMillan, Genesee County Parks and Recreation
Justin Horvath, Shiawassee Economic Development Partnership

Economic Development Region 7
October 25, 2013 – Lansing
Bengel Wildlife Conservancy
Eric Pessel, Barry-Eaton Health Department
Liesl Eichler Clark, 5 Lakes Energy
James Byrum, Michigan Agri-Business Association
Michelle Napier-Dunning, Michigan Food & Farming Systems
Doug Buhler, Michigan State University, Michigan Agricultural Experiment Station
Sandy Gower, Ingham County Economic Development Corporation
Brad Garmon, Michigan Environmental Council
Brian Burroughs, Trout Unlimited
Laura Campbell, Michigan Farm Bureau
John Warbach, Michigan State University Land Policy Institute
Phil Hanses, Clinton County Drain Commission
Joseph Mion, Golder Associates
Phil Korson, Michigan Cherry Committee
Meghan Swain, Michigan Association for Local Public Health
Bill Maier, Board of Water and Light
Garrett Johnson, Michigan Nature Association
Tim Boring, Michigan Soybean Association

Regina Young, Barry-Eaton Health Department
Jim Zook, Corn Marketing Program of Michigan
James Byrum, Michigan Agri-Business Association
Abigail Walls, Michigan Forest Products Council

Economic Development Region 8
October 7, 2013 – Battle Creek
W. K. Kellogg Foundation
Tracy Bronson, Calhoun Conservation District
Ken Masumoto, Ken Masumoto Resources
Peter Terlouw, Southwest Michigan Land Conservancy
Dawn Dye, Calhoun County Visitors Bureau
Michael McCuistion, Edward Lowe Foundation
Robert Whitesides, Kalamazoo River Watershed Council
Robert Mason, Post Foods
Angela Myers, Battle Creek Community Foundation
Marcy Colclough, Southwest Michigan Planning Commission
Christine Hilton, City of Battle Creek Planning & Community Development
Ken Kohs, City of Battle Creek - Utilities Director
Lyndon Kelley, Michigan State University Extension
Joan Bowman, Global Food Protection Institute
Kelly Clarke, Kalamazoo County Land Bank Authority
John Gruchot, Berrien County

Economic Development Region 9
November 6, 2013 – Adrian
Lenawee Now
Dan Stefanski, River Raisin Area of Concern
Charles Londo, City of Luna Pier
Amy Torres, Jackson County Enterprise Group
Evan Pratt, Washtenaw County Water Resources Commissioner
Brian Jonckheere, Livingston County Water Resources Commissioner
Pamela McConeghy, Brighton Greater Chamber
Grant Bauman, Region 2 Planning Commission
Susan Smith, Economic Development Partnership of Hillsdale County
Christine Bowman, Hillsdale County Chamber of Commerce
Christie Cook, Community Action Agency
Shelby Bollwahn, Michigan State University Extension
Tim Lake, Monroe County Business Development Corporation
Ned Birkey, County of Monroe
Christopher Miller, City of Adrian
Martin Marshall, Lenawee County
James Van Doren, Lenawee Now
Jim Frey, Resource Recycling Systems
Richard Micka, River Raisin Public Advisory Council
Rich Weirich, Frenchtown Township
Tom Tarleton, Michigan Economic Development Corporation
Paula Holtz, City of Tecumseh
Keith McCormack, Hubbell, Roth, and Clark

Economic Development Region 10
October 21, 2013 – Detroit
SEMCOG
Tom Doran, Engineering Society of Detroit
Malik Goodwin, Detroit Economic Growth Corporation
Rebecca Witt, Greening of Detroit
Anne Vaara, Clinton River Watershed Council
Laura Rubin, Huron River Watershed Council
Gerard Santoro, Macomb County Planning
Tom Woidwode, Southeast Michigan Community Foundation
Jim Ridgway, Alliance of Rouge Communities
Bob Burns, Friends of the Detroit River
Lynne Seymour, Macomb County Public Works
Tim O'Brien, Sustainable Water Works
Joe Depinto, LimnoTech
Brian Tingley, City of Mount Clemens
Merrie Carlock, City of Southfield

Brandy Bakita Siedlaczek, City of Southfield
Michelle Selzer, DEQ
Heidi McKenzie, Ford Motor Company
Jim Wagner, City of Trenton
John Cole, Director of Mechanical Engineering, Albert Kahn Building
Erma Leaphart-Gouch, Sierra Club
Jay Richardson, Sustainable Water Works
Chris Dorle, Detroit Future City
Jim Nash, Oakland County Water Resources Commissioner
Sue F. McCormick, Detroit Water and Sewerage Department
Jamie Shea, Mission Throttle

Office of the Great Lakes Community Water Dialogues Project Report

Kuntzsch
Business Services, Inc.
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Chapter 1: Project Overview

Introduction

In November 2013, the Office of the Great Lakes (OGL) and Michigan United Conservation Clubs (MUCC) contracted both Kuntzsch Business Services, Inc. (KBS) and Spectra Data and Research, Inc. to conduct 16 Community Water Dialogues throughout Michigan. The project sought to accomplish four objectives:

- Provide the Office of the Great Lakes with an understanding of sixteen communities' vision for the future of their respective water resources
- Identify challenges to implementing these visions in different community types
- Identify opportunities to address common challenges
- Provide communities with a basic jumping off point from which to leverage water resources—if desired

Identification of Communities and Participants

In order to ensure appropriate identification of communities and participants, Community Profile and Participant Profile Matrices were developed to describe the key elements of a community and participant profile to be represented through the Water Dialogues. These matrices were employed to ensure adequate representation of communities and individual participants.

Community Profile

In order to ensure a reasonable representative and actionable sample of communities in which to conduct Water Dialogues, communities were identified to meet the following criteria:

- At least three communities from each area of the state (Upper Peninsula, Northern Lower Peninsula, Southwest Lower Peninsula, and Southeast Lower Peninsula) were represented
- At least one community from each prosperity region was represented
- At least four small, medium, and large communities were represented in addition to two urban core communities
- High-capacity and low-capacity communities were represented within each community type
- Communities that represent each of the water assets (e.g. rivers, streams, inland lakes, Great Lakes) and water-based industry types (e.g., extractive, dependent, recreational) were represented within each community type and area of the state

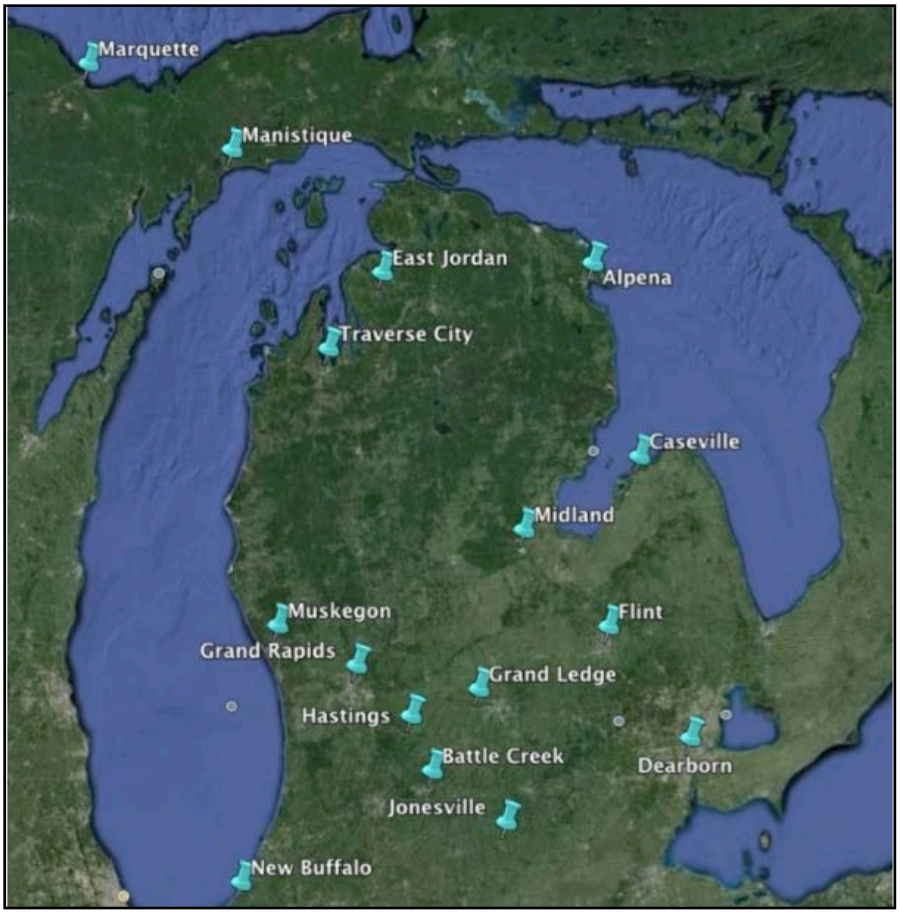
Table 1 summarizes the criteria considered when selecting communities. However, Community Capacity and Water-based Industry are not included in the table. Community Capacity is not identified in the table because it was simply too subjective to measure, especially prior to conducting sessions. Water-Dependent Industry is not listed because each industry type was found to be relevant in nearly all communities (see Chapter 2).

Table 1: Water Dialogue Session Information

Community	Area of State	Prosperity Region	Community Type	Water Assets	Date	# of Participants
Caseville	Eastern Lower	6	Small	River, Great Lakes	Mar. 14	14
Dearborn	Eastern Lower	10	Large	River	Feb. 11	11
Flint	Eastern Lower	6	Urban Core	River, Inland Lakes	Feb. 10	12
Grand Ledge	Eastern Lower	7	Medium	River	Jan. 7	12
Jonesville	Eastern Lower	9	Small	River	Feb. 18	8
Midland	Eastern Lower	5	Large	River, Inland Lake	Feb. 4	11
Alpena	Northern Lower	3	Medium	River, Great Lakes	Jan. 22	11
East Jordan	Northern Lower	2	Small	River, Inland Lake	Jan. 21	9
Traverse City	Northern Lower	2	Medium	Great Lakes, River	Feb. 5	15
Manistique	Upper Peninsula	1	Medium	Great Lakes, River	Jan. 14	5
Marquette	Upper Peninsula	1	Large	Great Lakes	Jan. 15	9
Barry County	Western Lower	4	Large	Rivers, Inland Lakes	Jan. 21	14
Battle Creek	Western Lower	8	Large	Rivers, Inland Lake	Feb. 12	8
Grand Rapids	Western Lower	4	Urban Core	River	Jan. 8	11
Muskegon	Western Lower	4	Large	Great Lakes, River	Jan. 22	17
New Buffalo	Western Lower	8	Small	Great Lakes	Feb. 12	7
					Total	**174**

Water Dialogue sessions were conducted between January 7th and March 14th, 2014 (see Map 1). Each session was planned for three hours and included a mix of presentation, individual input, and small group work. Great care was taken to ensure that participants represented community leadership in the broadest sense, and avoided participation from only the 'usual cast of characters'. The structure of each session drew from National Charrette Institute techniques as well as techniques developed by the Center for Creative Leadership.

Map 1: Water Dialogue Community Location



Participant Profile

Similar to the targeted and deliberate selection of communities, session participants were also targeted to represent specific perspectives of community leadership. Participants were sought that represented a range of characteristics, including, but not limited to:

- Diverse perspectives such as elected officials, community staff persons, tribal leaders, community residents, recreational users, industry workers, local business community leaders, faith-based leaders, regional interests, and economic development officials
- Differing levels of water-related subject matter knowledge
- Varied levels of engagement in their respective community
- Varying ages

In preparation for each Water Dialogue session, a significant amount of outreach work was conducted to engage participants with the desired characteristics. The level of outreach varied significantly with each session, but required significant targeted outreach to specific individuals given the project's short timeframe and the nature of the targeted population.

Community leaders and stakeholders identified by the project team were contacted first to gauge their interest in participating in such a session and also to provide contact information

for other community members that would have interest in the Water Dialogues. Additional follow-up was then conducted with additional community members identified by leaders and stakeholders. This preparation work set the stage for well-balanced conversations within each community and was critical to the overall success of the project.

Table 3 identifies participation by participant perspective and Figures 2 and 3 display the level of subject matter expertise and community engagement, respectively. Finally, Figure 5 details participation by age group.

Chapter 2: Survey Results

Pre-Survey

Each participant in the Water Dialogue Project was asked to complete a pre-workshop and a post-workshop exit survey. This section details results from pre-workshop surveys.

Once participants were identified (see Appendix A), they were emailed a link to an online survey and the link was again provided 24 hours prior to each Water Dialogue. Paper copies of the survey were also provided at each session. The pre-survey was designed to provide basic information about participants and their connection to community water resources.

Table 2: Respondents by Community

Community	# of Responses	# of Participants
Alpena	13	11
Barry County	10	14
Battle Creek	7	8
Caseville	6	14
Dearborn	11	11
East Jordan	8	9
Flint	8	12
Grand Ledge	12	12
Grand Rapids	12	11
Jonesville	5	8
Manistique	2	5
Marquette	10	9
Midland	7	11
Muskegon	14	17
New Buffalo	7	7
Traverse City	14	15
Total	145	174

The pre-survey set the stage for a meaningful dialogue at each session.

To begin, individuals were asked to identify which community and which perspective category they were representing. Table 2 provides the number of individuals who responded to the pre-survey for each respective community.

Table 3 displays the proportion of participants that fell into each perspective category. The categories that represented the largest proportion of individuals in the pre-survey were Community Residents (47%), Recreational Water Users (44%), and Community Leaders (26%). Please note that individuals were encouraged to check all categories that applied to them. A description of perspectives by community is included in Appendix B.

Table 3: Pre-Survey Perspective Category Totals

Perspective Represented	Pre-Survey Responses	% of Total Individuals
Community Resident	68	47%
Recreational Water User	64	44%
Community Leader	37	26%
Environmental Advocate	35	24%
Economic/Community Development Professional	26	18%

Table 3 Continued

Perspective Represented	Pre-Survey Responses	% of Total Individuals
Conservation Professional	24	17%
Appointed Official	21	14%
Local Business Owner	19	13%
Municipal Staff Person	16	11%
Elected Official	11	8%
Water-Based Industry Representative	12	8%
Active Member of Local Faith Community	11	8%
Regional or County Representative	11	8%
Industrial or Agricultural Water User	8	6%
Student	5	3%
Tribal Leader	0	0%
	Total # of Perspectives Identified	368
	Total # of Individuals Who Completed Survey	145
	Average Perspectives Per Individual	2.54

Figure 1 indicates that a large majority of participants (62%) are either currently employed in or engaged in a business or industry that depends on water resources.

As part of the pre-survey, respondents were asked to rate their knowledge of their community's water assets along with their level of engagement within the community. Responses to these questions are included in Figures 2 and 3, respectively.

Figure 1: Proportion of Individuals Dependent on Community Water Resources

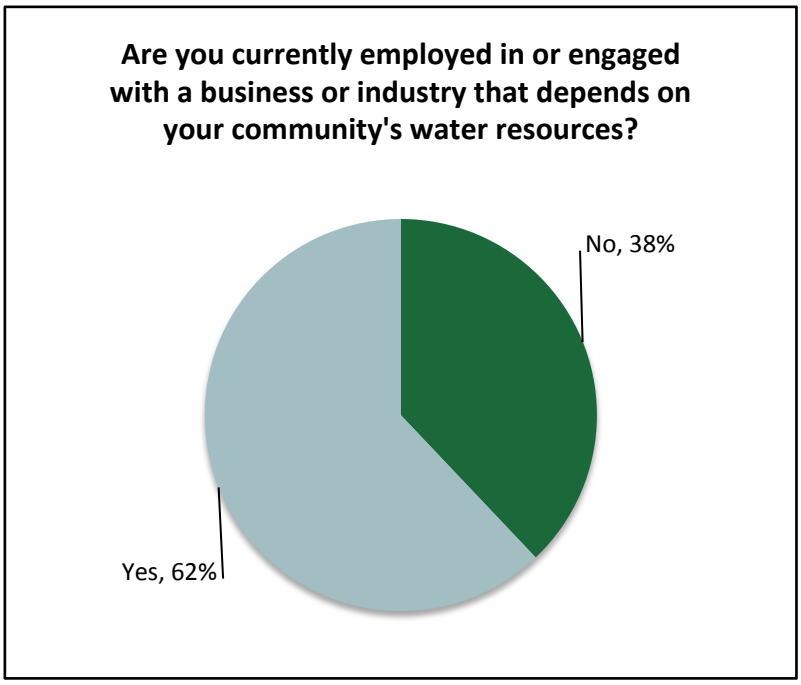


Figure 2 indicates that 77% of all survey respondents felt they were at least "Relatively Informed" when it comes to issues surrounding their community's water assets. Only 4% felt they had very limited knowledge of such issues.

When respondents were asked to classify their level of engagement within their community, 99% indicated they were at least "Somewhat Engaged". Only 1% of all respondents rated themselves as "Not Engaged".

Following these self-evaluative questions, respondents were asked to consider in what ways water is important to their respective community. Potential responses included human consumption, recreational use, agriculture, industry, tourism, business, public space, waste management, natural habitats / ecosystems, community pride, and sense of place / community character. Individuals were asked to select all uses they felt were applicable. Responses to this question are summarized in Figure 4.

Figure 2: Level of Knowledge Regarding Water Assets

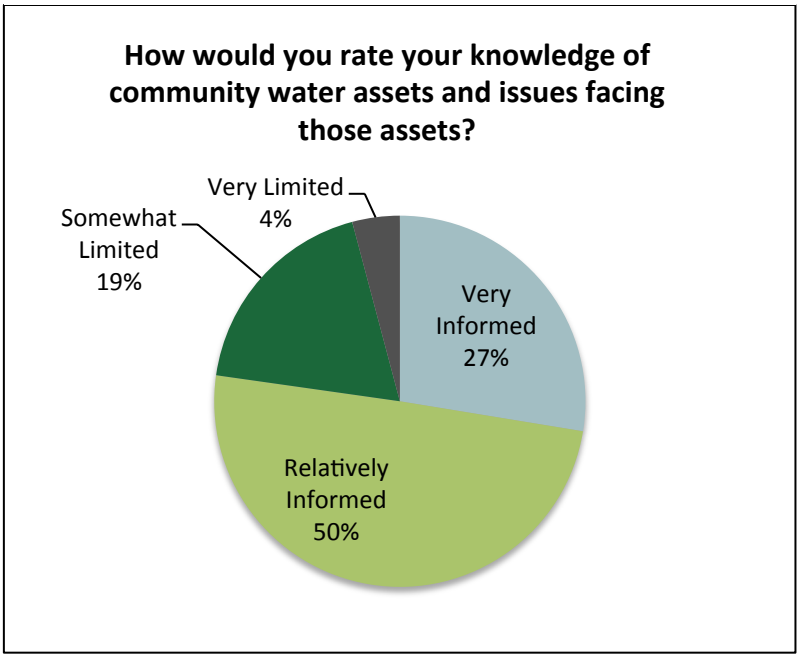


Figure 3: Level of Engagement within Community

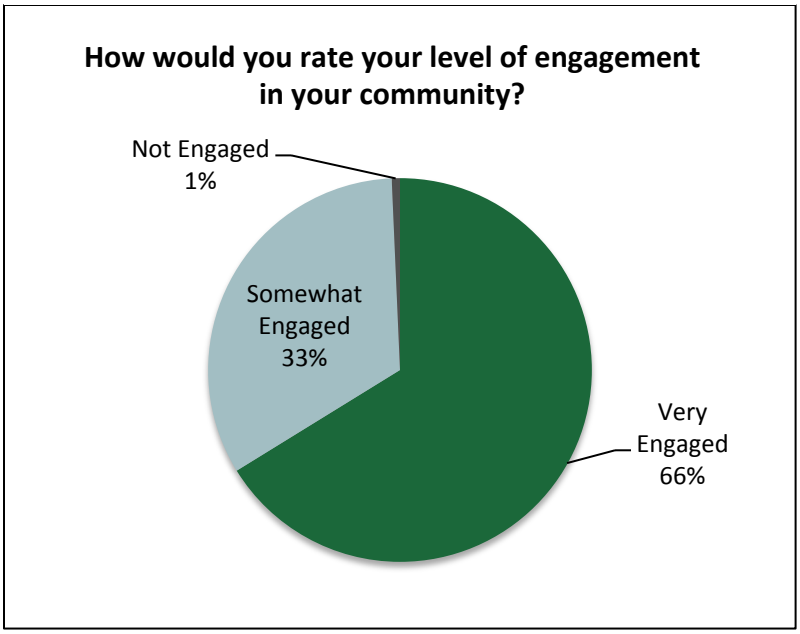
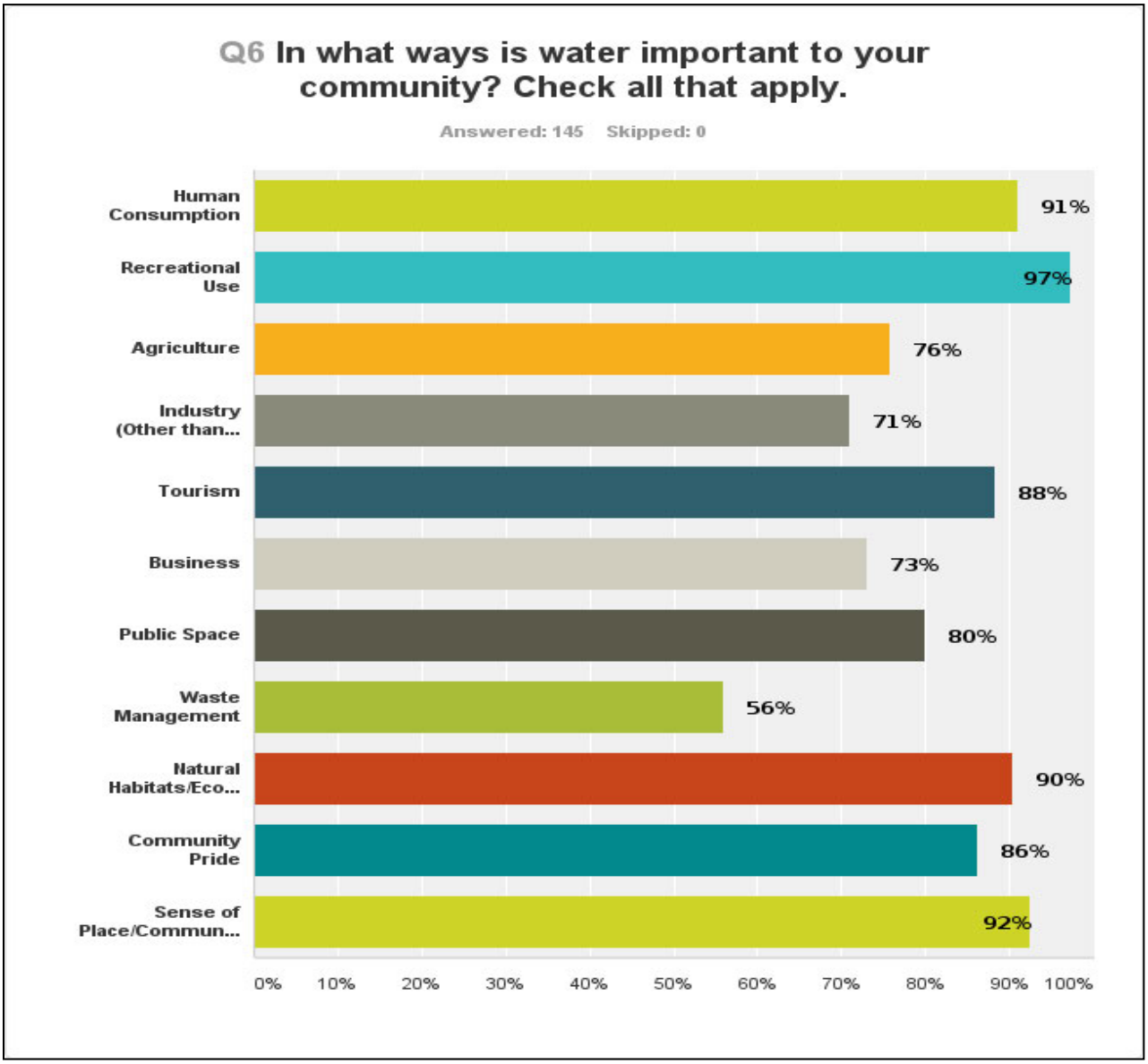


Figure 4 shows that potential uses for water identified in the pre-survey received votes from at least 50% of the respondents. Waste Management received the lowest number of responses at roughly 56%, while Recreational Use was the highest at 97%.

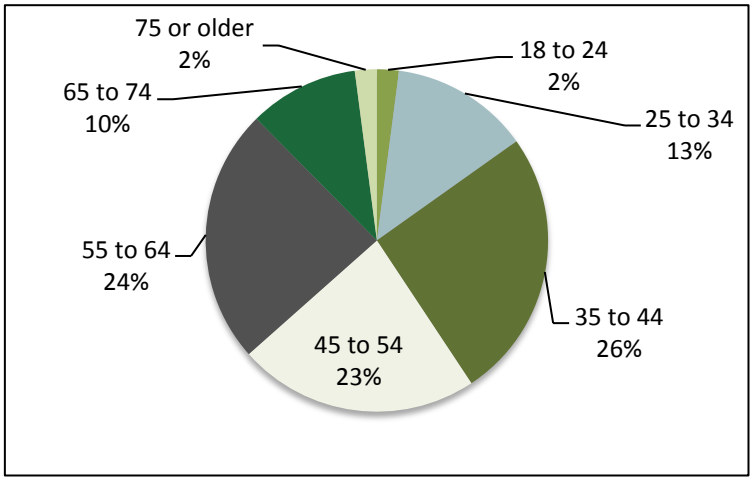
Figure 4: How is Water Important?



Finally, respondents were asked to provide their age. Figure 5 illustrates the age ranges of respondents to the pre-survey.

Approximately 75% of all respondents were between the ages of 35 and 64.

Figure 5: What is Your Age?



Exit Survey

Following the last organized activity of each session, participants were asked to provide general feedback and comments on the session. A total of 145 individuals responded to the exit survey, out of 174 total participants, giving the exit survey a response rate of 83.3%. Participants were asked the following questions:

- How satisfied are you with today's meeting?
- Was there something in particular that you wish was done differently during today's meeting?
- Are there any issues or concerns that were not identified today that you would like to identify for the group?
- On a scale of 1 to 5, 1 being not confident at all and 5 being very confident, how confident are you in your community's ability to capitalize on its water resources?

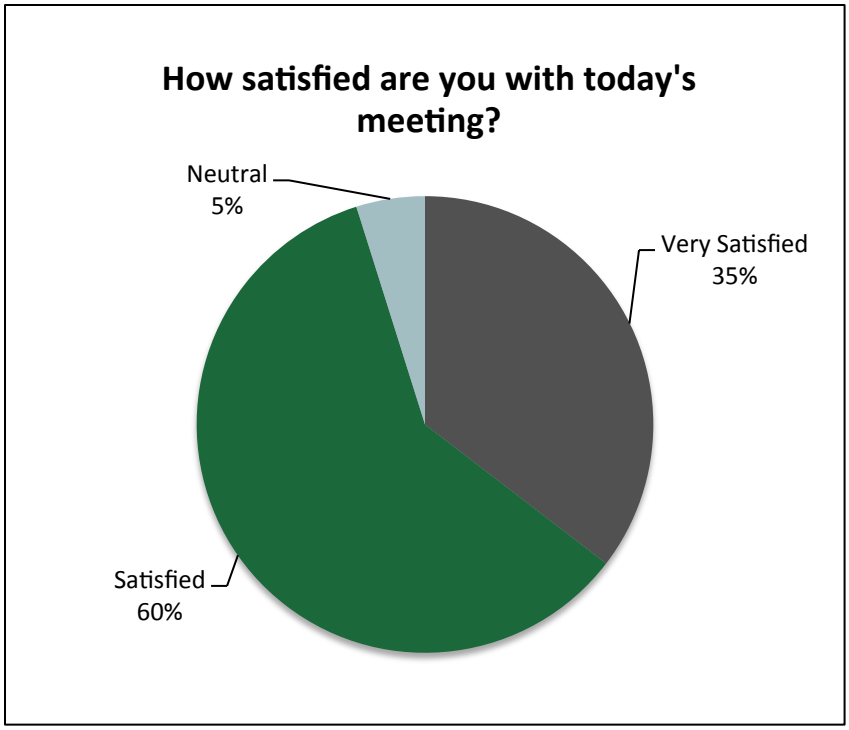
Participant Satisfaction

Figure 6 depicts the level of satisfaction of participants in all sessions. There were no responses from individuals that indicated they were "not satisfied" with the session. 95% of participants were either "satisfied" or "very satisfied' by the session.

What could be Done Differently?

Common themes from participants after completing the session were that more participants would have been beneficial to the session, many were curious how this individual session would be used to help create the statewide strategy, and many wished to see a follow-up meeting for further discussion. Detailed responses are included in each individual community report.

Figure 6: Exit Survey Level of Satisfaction



Issues or Concerns

Participants also identified common issues and concerns upon completion of the session. Many were concerned with the next steps to move from conversation to action. There was hope that the Office of the Great Lakes

would be able to provide implementation best practice resources.

Comparing Confidence: Before and After the Dialogue

The question "On a scale of 1 to 5, 1 being not confident at all and 5 being very confident, how confident are you in your community's ability to capitalize on its water resources?" was asked in both the pre-survey and exit survey. The purpose of this question was to measure any change in confidence as a result of the Water Dialogue session. Table 4 displays pre- and post-session confidence by community.

Table 4: Comparing Confidence

Community Name	Pre-Survey Average Confidence	Exit Survey Average Confidence	Difference
Alpena	3.54	4.00	+0.46
Barry County	3.60	3.75	+0.15
Battle Creek	3.57	3.57	0.00
Caseville	3.00	3.45	+0.45
Dearborn	3.82	4.15	+0.33
East Jordan	3.38	4.00	+0.62
Flint	3.13	3.75	+0.62
Grand Ledge	3.58	3.92	+0.34
Grand Rapids	4.08	4.50	+0.42
Jonesville	3.40	3.83	+0.43
Manistique	3.00	4.80	+1.80
Marquette	3.30	4.13	+0.83
Midland	3.57	4.00	+0.43
Muskegon	3.62	3.91	+0.29
New Buffalo	3.71	3.71	0.00
Traverse City	3.62	3.92	+0.30
All Communities, Average	3.50	3.96	+0.47

Session participants tended to feel more confident in their community's ability to capitalize on its water resources following the Community Water Dialogue. No communities were less confident after the session had occurred and community confidence increased an average of 0.47 points from pre-survey to exit survey. The community that experienced the greatest jump in confidence was Manistique, increasing from a 3.0 average in the pre-survey up to an average of 4.8 in the exit survey. Two communities saw no change from before to after the session; Battle Creek and New Buffalo.

Chapter 3: Water Dialogue Results

This chapter summarizes the data gathered during all 16 Water Dialogues. A representative from KBS or Spectra Data & Research, Inc. facilitated each session. Information is presented in the same order as it was gathered during each Water Dialogue session.

Vision

As a warm-up for other activities, participants were initially asked to complete the statement, "When I hear the words *[Insert Community]* and *water,* what I think of is…" KBS then categorized the responses as shown in Table 5. Responses to this question are displayed in Table 5:

Table 5: When I hear the words *[Insert Community]* and *water*

Response Category	Occurrences	Communities
Recreation	7	Barry Co, Caseville, East Jordan, Jonesville, Manistique, Midland, Muskegon
Pollution	5	Dearborn, Flint, Marquette, Midland, Muskegon
Beauty	5	Barry Co, Caseville, Manistique, Marquette, Muskegon
Drinking Water	5	Barry Co, Battle Creek, Caseville, Manistique, Midland
Fishing	5	Caseville, Flint, Marquette, Muskegon, New Buffalo
Quality	5	Barry Co, Caseville, Marquette, Midland, Traverse City
Economy	4	East Jordan, Manistique, Marquette, Muskegon
Tourism	4	Barry Co, Caseville, East Jordan, Muskegon
Opportunity	3	Alpena, Manistique, Traverse City
Accessibility	2	Jonesville, New Buffalo
Connectivity	2	Dearborn, Grand Rapids
Identity	2	Muskegon, Traverse City
Industry	2	Dearborn, Flint

Following the preliminary association exercise, participants were asked to think more fully about a vision for their community's water resources. Participants were asked to reflect on their first responses and consider the following: "Keeping your responses in mind, imagine you have been gone from this community for 20 years and have just returned. With the best hopes in mind for the community's water resources, how would you imagine your community's water resources as compared to today?" Participants were then directed to select a Visual Explorer (VE) Card that best represented their vision. Figure 7 depicts an example of VE Cards selected by participants at the Grand Rapids session.

Once a collage of images describing the vision for the future was established, participants were divided into small groups to identify the key elements of their vision. For example, most collages included pictures of recreational boaters and/or fishing, making *recreation*al *use* a key

element of these visions. Elements were then categorized into the common definitions identified in Table 6.

Figure 7: VE Cards selected in Jonesville

Table 6: Vision Element Definitions

Vision Element	Definition
Accessibility	Water resources must be accessible for all users; whether it is for recreation, industry, agriculture, or education
Recreation	Use of water for entertainment, including swimming, kayaking, boating, hiking, water trails, and going to beaches or harbors to enjoy the water resources
Balance	No single use for water should override the others. Everyone has a right to use the water and so compromises must be reached to accommodate all users.
Connectivity	Creating processes for bridging the gap between potential water users and water-related actions
Destination	A unique sense of place for a community based on an identity related to water
Economy	Agriculture, industry, tourism, and recreation related economic activity
Education	K-12 school programs, along with higher education and general education for residents related to water
Health	Water resources should provide for active lifestyles. Pollution should not be a concern.
Preservation & Protection	Ensure long term viability of community water resources
Quality & Quantity	Water should be clean and the supply adequate to support community needs
Sustainability	Ensuring that future generations have the ability to utilize water-related resources to meet their needs

Table 7 provides an overview of common vision categories across each community. Water quality and quantity were discussed most often, appearing in 12 community vision discussions. Accessibility and recreation were next, appearing in ten and eleven communities, respectively. All of the remaining categories were cited relatively equally, appearing in three to seven community vision discussions.

Table 7: Key Elements of Each Community's Vision

Community	Response Category										
	Access-ibility	Recrea-tion	Balance	Connec-tivity	Destin-ation	Economy	Education	Health	Preser-vation & Protection	Quality & Quantity	Sustain-ability
Alpena		X	X	X				X		X	X
Barry County	X		X			X		X	X	X	
Battle Creek	X	X		X						X	
Caseville		X							X	X	
Dearborn	X	X	X	X	X	X		X	X	X	
East Jordan		X	X						X	X	
Flint	X				X			X			
Grand Ledge		X					X			X	X
Grand Rapids	X	X			X					X	
Jonesville		X					X			X	
Manistique	X								X		
Marquette	X	X				X				X	
Midland	X	X								X	X
Muskegon	X		X	X		X	X		X	X	X
New Buffalo				X			X	X			
Traverse City	X	X		X		X			X		
Total	**10**	**11**	**5**	**6**	**3**	**5**	**4**	**5**	**7**	**12**	**4**

Throughout visioning exercises participants expressed surprise that developing consensus around a vision for the future of community water resources was relatively simple. Many political issues and differences between individuals were non-issues. As an overarching theme, there was a sense that a balance of uses was critical. In addition, it was clear in most communities that water presents an opportunity for both economic development and recreational tourism, both of which represent missed opportunities in many communities. With this understanding in mind, the session turned its focus toward transforming vision into action.

Generating Community Actions

Following development of a common vision for water resources, participants were asked to identify specific actions to be taken to implement the vision. First, participants identified ways that they, as individuals, could implement the vision. Next, participants identified ways that

other community members, as individuals, could alter their respective actions. Finally, participants identified ways that the community, collectively, could begin to implement the vision.

Individual responses to each of these questions were summarized into 18 common categories.[1] Table 8 provides a definition and example for each category.

Table 8: Categories for Community Action

Category	Definition	Example
Advocate	Devote skills to water-related causes in the community	Advocate for new funding sources, for government action, for local legislative change, or for water-based action
Be Open	Understanding that new ideas or change within the community is not always a negative	Be open minded to innovative funding discussions
Collaborate	Work with other entities to aggregate potential impact	Government and nonprofit organizations working together on water-related projects
Communicate	Encourage dialogue between interested parties	Discuss the importance of water resources with coworkers
Connect	Work to join stakeholders that may have mutual interests	Connect business and conservation efforts
Donate	Give money to causes or groups that support the vision	Donate to a water-based nonprofit
Educate	Inform children, friends, family, or interested community groups about water-related issues	Send water-related research to community leaders
Engage	Participate in community events to make your voice heard	Engage students to participate in a river cleanup
Find Funding	At a community scale, be proactive in seeking out new funding opportunities	Create a new storm water fee to increase community revenue
Legislate	When a need is identified within the community, act swiftly to address it via appropriate local legislation	Implement zoning changes to match Master Plan vision
Listen	Be open to the viewpoints of others and try to reach compromises	Listen to a fellow community member's idea that may be in opposition to yours

[1] Approximately 10% of all individual responses from the "Generating Community Actions" section (You, Others, and Community) and the "Developing an Action Strategy" section (How, Who, Funding, Barriers, Continued Success) were eliminated during the analysis phase because they were either not applicable to that category or illegible.

Table 8 Continued

Category	Definition	Example
Market	Devote time and resources to "selling" water-related programs or events	Develop a branding strategy associated with community water resources
Proactive	Identify and address potential problems before there are negative consequences	Improve waste treatment systems to avoid water quality problems
Promote	Spread the word about positive change within the community or to potential visitors	Use networking channels to inform others about potential uses of community water resources
Reduce Pollution	Do not contribute to contamination of community water resources	Do not dump harmful cleaning chemicals down the drain
Support	Ensure that organizations, programs, or projects have the resources they need to succeed	Help a community event with fundraising efforts
Use the Resources	Spend time using the community's water resources	Go kayaking with family
Volunteer	Donate personal time to community-based efforts	Offer to join a water-based nonprofit

What can You do Differently?

Participants were asked to consider what actions they could change, at the individual level, in order to have a positive impact on their community's water resources. Table 9 summarizes the main categories from these responses. Educating oneself or others was the overarching principle, while promoting interests and engaging more in the community was common as well.

What can Others, as Individuals, do Differently?

Next, participants discussed what other community members, as individuals, could do differently. Table 10 provides a summary of the common ideas from these discussions. Similar to Table 9, the common categories were educating oneself or others and engaging in the community.

Table 9: What can You do differently?

Category	Occurrences	Communities
Educate	25	Barry Co, Caseville, Dearborn, East Jordan, Grand Ledge, Grand Rapids, Jonesville, Manistique, Marquette, New Buffalo, Traverse City
Promote	15	Alpena, East Jordan, Midland, Muskegon, Traverse City
Engage	13	Alpena, Battle Creek, Dearborn, Flint, Grand Ledge, Grand Rapids, Midland, Traverse City
Volunteer	13	Alpena, Caseville, Dearborn, Grand Ledge, Flint, Traverse City
Stop Polluting	13	Barry Co, Caseville, Marquette, New Buffalo, Traverse City
Advocate	12	Barry Co, Battle Creek, Caseville, Flint, Muskegon, Traverse City
Connect	11	Caseville, Jonesville, Traverse City
Use the Resources	8	Battle Creek, Dearborn, East Jordan, Flint, Midland
Communicate	7	Alpena, East Jordan, Flint, Muskegon, Traverse City
Be Open	5	Grand Ledge, Grand Rapids, Manistique, Midland
Listen	4	Barry Co, Dearborn
Donate	1	Flint
Total	127	

Table 10: What can others do differently?

Category	Occurrences	Communities
Educate	17	Barry Co, Caseville, Dearborn, East Jordan, Grand Ledge, Grand Rapids, Jonesville, Muskegon, New Buffalo, Traverse City
Engage	16	Alpena, Barry Co, Flint, Grand Ledge, Jonesville, Midland, Muskegon, Traverse City
Stop Polluting	13	Barry Co, Flint, Grand Ledge, Jonesville, Marquette, Midland, Muskegon, New Buffalo
Connect	11	Alpena, Caseville, Dearborn, East Jordan, Flint, Grand Rapids, Jonesville, Marquette, Muskegon, Traverse City
Be Open	7	Barry Co, Grand Rapids, Marquette, Traverse City
Promote	7	East Jordan, Flint, Grand Rapids, Muskegon, New Buffalo
Use the Resources	6	Barry Co, Battle Creek, Grand Rapids, Marquette, Traverse City
Volunteer	6	Battle Creek, Dearborn, Jonesville, Manistique, Marquette, New Buffalo
Communicate	6	Battle Creek, East Jordan, Flint, Jonesville, Traverse City
Listen	6	Barry Co, Grand Ledge, Grand Rapids, Traverse City
Donate	5	Barry Co, Caseville, Marquette, Midland, Muskegon, Traverse City
Support	4	Flint, Grand Ledge, Jonesville, Muskegon
Total	104	

What can the Community, Collectively, do Differently?

Finally, session participants were asked to consider in what ways the community, collectively, could change its behavior. Table 11 summarizes the common responses in all sessions. The category that was discussed most often was "Legislation". Increased collaboration and innovative engagement were the next most common categories.

Table 11: What can the Community do differently?

Category	Occurrences	Communities
Legislate	21	Alpena, Barry Co, Battle Creek, Caseville, Dearborn, East Jordan, Flint, Grand Rapids, Jonesville, Marquette, Midland, Muskegon, New Buffalo, Traverse City
Collaborate	16	Alpena, Battle Creek, Caseville, Jonesville, Manistique, Marquette, Muskegon, New Buffalo, Traverse City
Engage	15	Alpena, Barry Co, Battle Creek, Caseville, Flint, Grand Rapids, Jonesville, Midland, Muskegon, New Buffalo, Traverse City
Marketing	12	Alpena, Barry Co, Battle Creek, East Jordan, Jonesville, Marquette, Midland, Muskegon
Proactive	11	Alpena, Barry Co, Battle Creek, Caseville, Jonesville, Manistique, Marquette, Muskegon, Traverse City
Find Funding	10	Alpena, Battle Creek, Grand Ledge, Grand Rapids, Jonesville, Manistique, Midland, Muskegon
Educate	10	Alpena, Caseville, East Jordan, Grand Ledge, Midland, Muskegon, New Buffalo, Traverse City
Be Open	8	Barry Co, Flint, Grand Ledge, Manistique, Midland, Muskegon
Stop Polluting	8	Barry Co, Caseville, Grand Ledge, Jonesville, Marquette, Muskegon, Traverse City
Support	5	Flint, Grand Ledge, Midland, Traverse City
Listen	1	Marquette
Total	117	

Developing an Action Strategy

After generating community actions for individuals and the community as a whole, participants were asked to identify one community action to discuss in greater detail. Each group was tasked with answering the following questions for each action selected:

- How would you implement this idea?
- Who would be responsible?
- How would it be funded?
- What are potential barriers to success?
- How would you ensure continued action / success?

Table 12 indicates which projects were identified and discussed in greater detail for each community. Please note that sessions with more participants were split into groups, and each group selected an individual action to discuss so the number of actions varies by community.

In total, 30 different actions were selected across the 16 communities. The selected actions varied on a community-by-community basis, although there were recurring themes. The main topics for action tended to fall into the following project types (the number in parenthesis indicates how many out of the total 30 actions fell into each category):

- Community engagement, awareness, education, and events (17)
- Regional collaboration efforts (6)
- Support for policies and plans (4)
- Incentives or funding efforts (3)

The above list is color-coded to match the projects identified in Table 12.

Table 12: All projects identified, by community

Community	Projects Identified
Alpena	Develop activities and businesses that incorporate water resources, Reduce plastic pollution in the community
Barry County	Engage individuals in water awareness, Increase community engagement
Battle Creek	Community festival / events on the water
Caseville	Encourage homeowners to pump septic fields annually to protect groundwater
Dearborn	Engage the community to create a vision for Rouge River, Increase public access for Rouge River, Incentivize green infrastructure implementation
East Jordan	Create a Lake Charlevoix Watershed Protection Plan
Flint	Start a "Community Jumps In" program, Trust in the Master Plan
Grand Ledge	Generate Dam funding, Support existing plans / development
Grand Rapids	Collaborate on efforts to improve efficiency, Increase community engagement and collaboration
Jonesville	Expand "Riverfest" to include discussions of water resources
Manistique	Maximize land and water usage
Marquette	Encourage outreach, education, and promotion to increase investment, Establish a regional water authority
Midland	Engage to develop a water resources plan, Promote community awareness of water resources
Muskegon	Regional water quality sampling and monitoring, Engage all communities in the Muskegon Region, Assess potential for regional water transportation opportunities
New Buffalo	Educate visitors on the value of water resources, Implement school system water education programs
Traverse City	Set community standards for environmental protection, Create a regional brand around water resources, Create a devoted funding mechanism for water resources

How would you implement this idea?

Table 13 summarizes responses to the question "How would you implement this idea?" by identifying common themes in implementation actions. Community events were mentioned the most often as an implementation strategy. Every time a community event was mentioned it was for a project that fell into the Community engagement, awareness, education, and events category. Marketing programs and education were the next most common action categories. Each of the six most common responses are directly related to community engagement.

Table 13: How would you implement this?

Action Category	Occurrences	Project Types			
		Community Engagement	Regional Collaboration	Support Policies & Plans	Incentives & Funding
Events	13	X			
Marketing	11	X		X	
Educate	10	X	X		
Identify stakeholders	8	X	X		
Collaborate	8	X	X		
Community Support	8	X	X	X	
Meetings	7	X	X	X	
Legislation	6	X			X
Funding	6			X	X
Find facilitator	3	X	X		
Volunteer	3	X			
Invest	2	X			X
Rebates / Discounts	2	X			X
Be Open	1	X			
Total	88				

Who would be responsible?

Table 14 summarizes to the question of who should be responsible for implementing each proposed project. The most common groups identified were local government, regional entities, and nonprofits or foundations.

Table 14: Who would be responsible?

Stakeholder Category	Occurrences	Project Types			
		Community Engagement	Regional Collaboration	Support Policies & Plans	Incentives & Funding
Local Government	16	X		X	X
Regional Entity	13	X	X		
Nonprofits	12	X		X	
Foundations	8	X			X
Citizens	7			X	
State Agency	6			X	
Colleges / Universities	5	X	X	X	
Local Businesses	5	X			X
Downtown Development Authority	4	X		X	X
K-12 schools	4	X	X		
Community Leader	4	X			
Chamber of Commerce	4	X		X	X
Convention & Visitors Bureau	3	X			
Parks & Recreation	3	X		X	
Tribal Groups	2	X			
Media	2	X			
Volunteers	1	X			
Total	99				

How would it be funded?

After discussing how the project would be implemented and who should be the responsible entity for implementation; session participants discussed how their respective projects could be funded. Table 15 contains the common funding mechanism categories along with the types of projects associated with each funding strategy. State Agency funds and private foundations were most common, with grants in general and community groups close behind.

What are potential barriers to success?

Session participants were asked to consider the barriers that could impede the progress of their potential project. The responses from each session were condensed into common barrier categories, included in Table 16. Funding and participation were the most commonly discussed barriers, with the political process also cited as a common barrier.

Table 15: Identified funding sources

Funding Category	Occurrences	Project Types			
		Community Engagement	Regional Collaboration	Support Plans & Policies	Incentives & Funding
State Agency	10	X	X		X
Foundations	10	X		X	
Grants	9	X	X	X	X
Community Groups	8	X	X		
Local Government	7	X		X	X
Additional Tax	7	X		X	X
Private Corporations	6	X	X		
Fundraisers	5	X			
Public-Private Partnership	4		X	X	
User fees	3	X			X
Federal Agency	3		X		X
Colleges / Universities	2	X			
Crowd-Sourcing	1			X	
Parks & Recreation	1	X			
Convention & Visitors Bureau	1	X			
Bond	1				X
Total	78				

Table 16: Barriers to success

Barrier Category	Occurrences	Project Types			
		Community Engagement	Regional Collaboration	Support Policies & Plans	Incentives & Funding
Funding	17	X	X	X	X
Participation	17	X			
Political Process	14			X	X
Marketing / Communication	8	X	X	X	X
Public Perception	8	X	X		X
Personnel	6	X			X
Education	5	X	X		X
History	4	X			
Safety	3	X			
Total	82				

How would you ensure continued action / success?

Finally, session participants were asked to consider what was necessary for their project to enjoy long-term success. Table 17 highlights the common categories from these discussions. Continued commitment and leadership are the top items that individuals believed would allow for continued success.

Table 17: Strategies for continued success

Continued Success Category	Occurrences	Project Types			
		Community Engagement	Regional Collaboration	Support Policies & Plans	Incentives & Funding
Continued Commitment	8	X	X		X
Leadership	7	X	X	X	
Education	4	X			X
Prioritize	3	X	X	X	
Communication	3	X			
Collaborate	2	X			
Transparency	1			X	
Funding	1		X		
Total	29				

Chapter 4: Findings and Recommendations

This section summarizes findings and offers recommendations related to each portion of the Community Water Dialogues project. Findings are based on input received through the Water Dialogue sessions as well as survey results. Input from each community was summarized into categories,[2] with vision elements, actions to implement the vision, and tactics to accomplish each action categorized separately (see Chapter 3). Even though input topics were categorized separately, the same themes are reflected in each (e.g., community engagement).

Pre-Survey and Exit Survey

Participants in Water Dialogues were asked to complete a survey prior to the session in their respective community and also completed an exit survey following their session.

Findings

- Participants in the Water Dialogues were satisfied with the sessions. 95% of respondents to the exit survey were satisfied or very satisfied with the session and the remaining 5% were neutral.
- The most common perspectives represented in the sessions were community resident (47%) and recreational water user (44%). Following these, the most common perspectives were community leader (26%) and environmental advocate (24%). Overall, participation from students, members of the faith community, and tribal leaders was lower than desired. Tribal leaders attended three sessions (Traverse City, Battle Creek and New Buffalo), but did not complete the pre-survey.
- Participants tended to be of career age (73% were between the ages of 35 and 64) and many had a professional stake in their community's water resources (62%).
- Participants in Water Dialogue sessions were asked to rate their level of confidence in their community's ability to capitalize on its water resources in the pre-survey and exit survey. The two largest increases from pre-survey to exit survey confidence belonged to Upper Peninsula communities (Marquette and Manistique). Marquette's confidence increased by 0.83 points, and Manistique increased by 1.80 points. The next closest communities were East Jordan and Flint, both increasing by 0.62 points.

Community Vision

Participants in Water Dialogues were guided through an individual visioning exercise using Visual Explorer images and then instructed to identify three to five key elements of a common

[2] Due to the various sizes of groups in each community, and the relatively small size of each Water Dialogue group (the largest group was 17), the scale of support for individual ideas was not analyzed. Analyzing this information could be misleading, as a relatively small group of people in an individual community or communities could greatly influence the overall support for a particular idea over another. Instead, the focus is on common ideas identified across communities.

vision in groups of four to six individuals. Vision elements from each community were then tabulated.

Findings

- **Consistency of Vision:** Overall, the vision for the future of water resources in the 16 communities was relatively consistent.
    - Three themes were pervasive when participants were asked to identify key elements of their community vision for water: 1) Accessibility of water resources, 2) Recreational use of water, and 3) Ensuring adequate quantity and improved quality of water. At least one of these themes was expressed in 15 of the 16 communities and total, they account for over 40% of the vision elements identified in all communities.
    - Remaining vision elements were identified by between three and seven communities, and evenly dispersed between community types.
    - Some combination of maintaining the health of water resources, preserving and protecting water resources, and/or ensuring quantity and quality of water resources was cited in every community vision.
- **Ease Developing a Common Vision:** Agreeing to a common vision for water resources was not particularly challenging for participants. In most sessions, participants were surprised at the consistency of individual visions for the future of water resources and the relative ease of the exercise.
- **Little Focus on Economic Opportunity:** The potential for pure economic benefit from water was not a strong theme throughout the sessions. While there is similarity between the ideas of using water resources to create a destination and bolster the economy, even when combined these ideas were only sighted in approximately ½ of all communities. Furthermore, when economy was cited as a vision element, the idea of balance—ensuring that economic and industrial needs are balanced with environmental and recreational needs—was also cited 80% of the time.
- **Urban Core Communities Strive to be a "Destination":** Only three communities identified being recognized as a "Destination" as critical to their vision. Both urban core communities, Flint and Grand Rapids, were in this category.
- **Upper Peninsula and Economy:** When asked what participants thought when they hear the words "*[Insert Community]* and *water*", participants in both Upper Peninsula communities, Marquette and Manistique, indicated they thought of the economy as associated with their respective community. This was the only geographic association of communities in the visioning exercise.

Recommendations

- **Visioning as Conflict Resolution:** An important first step for communities struggling with a particular water issue is to establish a common vision for community water resources. Often, participants on opposite sides of a current water-related issue (e.g., dam removal versus repair) found their respective visions to be relatively similar. This new common

ground allowed them to approach issues with an eye toward impact on a shared vision for the future, rather than immediate actions and political ramifications.

- **Economic Potential of Water Resources:** More opportunities must be presented to communities to create positive sum solutions for generating economic benefit from water resources. In many communities, participants were uncomfortable with the idea of focusing on water resources as an economic engine in their vision due to fear of degrading the resource. More must be done to communicate opportunities to create new economic opportunity around Michigan's water resources while simultaneously enhancing community connection to resources and opportunities for preservation and protection.

Generating Community Actions

Following development of a common vision, participants were asked to respond to three questions:

1. What can you do differently to achieve the vision?
2. What can others do differently to achieve the vision?
3. What can the community, collectively do differently to achieve the vision?

Each individual responded to all three questions and responses were summarized within each small group into three separate action types (individual, others, and community). Responses to each question were then tabulated by community.

Findings

- **Individual Actions Focused on Advocacy:** When the question, "What can you do differently to achieve the vision?" was developed, it was anticipated that responses would focus on individual behavior change (e.g., use less water). However, participants in the Water Dialogues overwhelmingly identified advocacy activities rather than individual behavior change. Fifty-seven percent of all responses were categorized as educate, promote, engage, advocate, and communicate. In contrast, individual behavior changes (volunteer, stop polluting, use the resources, and donate) account for only 28% of responses.
- **Actions of Others were Mixed Between Behavior Change and Community Engagement:** When asked "What can others do differently to achieve the vision?" the focus was on community engagement, connecting with others, and education (42% of responses), which reflects a common theme in the sessions that the general public should be more engaged, but also that professionals must be more effective in community engagement. In response to this question, behavior changes were identified with a similar frequency as in the previous question, accounting for 29% of responses.
- **Community Actions Focused on Local Government and Nonprofit Organizations:** When asked "What can the community, collectively do differently to achieve the vision?" the focus was on the actions of local government and nonprofit organizations. The most common response was to legislate local change (18% of responses). There was also a focus on effective collaboration between organizations as well as pursuit of funding

(combined, 22% of responses). Again, the focus on outreach and engagement was repeated, with engagement, marketing, and education accounting for 32% of responses.

Recommendations

- **Water Resources Must be Promoted More Effectively:** Special attention must be paid to improving awareness and use of water resources as well as creating new opportunities for community engagement around water resources. This was a common theme throughout all action types (individual, others, and community) and was noted in all communities. There was a strong sense that community members were not fully aware of water resources within their community, which was often true of Water Dialogue participants as well.
- **Entities within Communities Must Collaborate More Effectively:** Implementing a long-term vision for water resources, even in a small community, requires involvement of many stakeholder organizations and levels of government. There must be a concerted effort to orient these groups around water to ensure community water resources are leveraged in a manner that balances economic opportunity with environmental protection and recreation.

Developing an Action Strategy

After identifying actions to be taken to achieve the vision, participants were asked to select, within small groups, at least one community action to develop more fully. Often, the action selected was a combination of two or more actions identified previously or a more refined version of an individual action. After the action was identified, participants were asked to respond to five questions:

1. How would you implement this idea?
2. Who would be responsible?
3. How would it be funded?
4. What are potential barriers to success?
5. How would you ensure continued action / success?

Findings

- **Community Engagement Actions were Most Common:** The actions selected to be developed more fully fit easily into four broad categories: 1) Community engagement, awareness, education and events; 2) Regional collaboration efforts; 3) Incentives or funding efforts; and 4) Support for policies and plans. A total of 30 distinct actions were identified in the Water Dialogue communities, of which 17 (57%) were categorized as community engagement. In many communities, this activity was not necessarily viewed as having the highest impact, but it was commonly seen as a necessary first step to moving toward more impactful actions that require community support. Community engagement related to water resources was also often seen as an action that is currently lacking in communities.

- **Other than Community Engagement, Actions are Inter-Related:** The other three actions commonly identified (regional collaboration, incentives and funding, and support for policies and plans) are strongly related. For example, regional collaboration creates opportunities for new funding and incentive mechanisms that can support implementation of existing policies and plans.
- **Community Actions by Community Type:** Medium sized communities (Alpena, Grand Ledge, Manistique, and Traverse City) were much less focused on Community Engagement actions when compared to the group as a whole. These communities identified eight total actions, and only three of these (37.5%) were community engagement related. Across all communities, 17/30 (56.7%) actions identified were tied to community engagement.
- **Recreation, Access, and Connectivity were Lost:** While these ideas were universally identified as vital in community visioning, they were not a point of emphasis when developing action strategies. In a few communities these actions were seen as longer-term and participants chose to focus on immediate actions in the Water Dialogue session. However, this represents a significant opportunity for communities to implement a vision that aligns directly with existing State programs and initiatives.
- **Community Engagement is a Key Element of Most Actions:** Holding events, identifying stakeholders, holding meetings, education, and marketing account for 56% of all responses to the question, "How would you implement this idea?"
- **Responsibility for Implementation is Diverse:** While local government was the most common response, the groups identified as responsible for implementation were diverse. Most actions included many responsible parties, but generally each included potential funders, potential leaders of the action, and key stakeholders.
- **Individuals are Willing to Participate, but Hesitant to Lead:** One of the major challenges for communities was determining who would be a champion for a given action. Participants could easily identify others and even volunteer to be engaged, but there was a great deal of hesitancy in identifying a champion for a project or initiative. This is partially due to the nature of the Water Dialogue sessions, but also reflects a lack of time and resources among participants and organizations.
- **Outside Funding is Necessary, but Communities are Willing to Develop Local Funding Sources:** The majority of potential funding sources identified are external (state agency, federal agency, grants, and foundations account for 41% of responses). However, many communities identified local sources of funding, including corporations or businesses, user fees, and community groups. A fair number of communities (7) also identified additional taxes as a funding source.
- **The Most Common Barriers to Success are Funding and Participation:** Funding and participation were identified as the most common barriers to success each was a barrier to success for 17 of the 30 actions identified.
- **Communities Must Address Local Barriers:** Participation, political process, and public perception account for 48% of barriers identified and were included in nearly every action. These are barriers that must be addressed at the individual community level, and

relate directly to the need for more effective community engagement around water resources.

- **Leadership is Needed to Ensure Continued Success:** Leadership, continued commitment, and prioritization account for 62% of all responses to ensuring continued success. This is especially important considering the challenge communities had in identifying a champion for actions.

Recommendations

- **Take Advantage of Opportunities for Community Engagement:** Many communities identified existing festivals and events that take place related to water resources, but do not necessarily focus on water resources as an opportunity for engagement and/or education. Support for more efforts of this type could have a significant impact on public perception of the importance of water resources and also serve to increase use of water resources. In general, support for community engagement efforts will be critical to ensure water resources are perceived as a critical community asset.
- **Focus Efforts on Re-Connecting Communities with Water Resources:** The common theme throughout all aspects of the Water Dialogue project was a need to re-connect communities with their water resources. Different communities are at various stages relative to this effort, but it was a unifying theme. Current State programs present excellent opportunities to help communities make these connections, both physically and psychologically. For example, focusing placemaking efforts on community water resources will ensure that residents have better access to water resources and take advantage of recreational opportunities. This in turn creates a stronger connection to water resources and builds a sense of stewardship.
- **Community Members Must be Encouraged to be a Champion:** Without a dedicated local champion, especially in smaller communities, many actions will not be possible and/or struggle to sustain over time. Individuals in communities, both in their professional or personal capacities, must be encouraged and incentivized to be a champion.
- **Align State Funding Resources to Support Water Resources:** State resources will be a critical element of implementation for building upon water resources. However, the activities necessary are not traditional activities funded by regulatory agencies. For example, placemaking and community engagement efforts are equally important to implementing community visions as water quality testing. Different state agencies must coordinate efforts around water resources to ensure funding is invested in a targeted manner to help communities effectively leverage water resources.
- **Use Water Resources as a Unifying Theme for Building Community Capacity:** Water Dialogue communities had remarkably consistent visions for the future of their water resources. This presents an opportunity for communities to unify around a common goal as a means of addressing local barriers (e.g., political process).
- **Develop Best Practice Examples of Local Funding Resources:** Communities are willing to fund efforts locally, but generally do not have a great deal of experience or strong examples to follow. Developing a few examples of successful community funding efforts

to support water resources would empower communities to implement their own vision.

Appendices

Appendix A: Full List of Participants

The table below showcases a full list of Water Dialogue session participants, along with the community name of the respective session each individual attended. In total, 174 individuals attended the sessions.

Name	Community
Matt Waligora	Alpena
Charles Wiesen	Alpena
Jackie Krawczak	Alpena
Jim Klarich	Alpena
Samuel Prentice	Alpena
Roger WItherbee	Alpena
Andrea Ania	Alpena
Hannah MacDonald	Alpena
Jeff Gray	Alpena
Richard Deuell	Alpena
Paul Rogers	Alpena
Andy Helmboldt	Battle Creek
Christine Hilton	Battle Creek
Doug Grosso	Battle Creek
Homer Mandoka	Battle Creek
Kevin Smith	Battle Creek
Susan Anderson	Battle Creek
Susan Scalabrino	Battle Creek
Tiffany Eichorst	Battle Creek
David Bouck	Caseville
David Bowman	Caseville
Tonya Harrinton	Caseville
Greg Renn	Caseville
Jamie Learman	Caseville
Jeff Smith	Caseville
Kenneth Rathje	Caseville
Larry Moss	Caseville
Nancy Moss	Caseville
Rich Bass	Caseville
Lakon Williams	Caseville
David Quinn	Caseville
Erpiz Krybie	Caseville
Roger Gauther	Caseville
Amy Mangus	Dearborn
Dave Norwood	Dearborn
Jim Ridgeway	Dearborn
John O'Reilly	Dearborn
Lila Amen	Dearborn

Name	Community
Orin Gelderloos	Dearborn
Rachel Viola	Dearborn
Sally Petrella	Dearborn
Sean Galloway	Dearborn
Tom Green	Dearborn
Liz Hendley	Dearborn
Kalmin D. Smith	Grand Ledge
Karla Chamberlain	Grand Ledge
Christopher Chamberlain	Grand Ledge
Tammy Foster	Grand Ledge
Bill Kane	Grand Ledge
Rev. Cindy Skutar	Grand Ledge
Terrance Augustine	Grand Ledge
Bob Doty	Grand Ledge
Pat Harrington	Grand Ledge
Amee King	Grand Ledge
Fred Cowles	Grand Ledge
Erin Campbell	Grand Ledge
David McGhee	Flint
Derrick Mathis	Flint
Jack Stock	Flint
Janet VanDeWinkle	Flint
Jennifer Acree	Flint
Jumana Vasi	Flint
Michael Freeman	Flint
Patrick Ryals	Flint
Rebecca Fedewa	Flint
Adrian Walker	Flint
Pardeep Toor	Flint
Katie Ross	Flint
Tom Cannon	East Jordan
Thurlow McClellan	East Jordan
Dr. John Richter	East Jordan
Tim Goodwin	East Jordan
Kay Harper	East Jordan
Mary Faculak	East Jordan
Rev. Bar Adams	East Jordan
Kelly Martin	East Jordan
Chris Yonkey	East Jordan
Rachel Hood	Grand Rapids
Mike Lunn	Grand Rapids
Carrie Rivette	Grand Rapids
Wendy Ogilvie	Grand Rapids
Kristi Klomp	Grand Rapids
Steve Faber	Grand Rapids
Karen McCarthy	Grand Rapids
Mike DeWilde	Grand Rapids
Joshua Lunger	Grand Rapids

Name	Community
Kelly Rice	Grand Rapids
Michael Posthumus	Grand Rapids
Joanne Barnard	Barry County
Emily Wilke	Barry County
Rachel Zergerius	Barry County
Michelle Skedgell	Barry County
Jim WIncek	Barry County
Jane Herbert	Barry County
Bonnie Hildreth	Barry County
Mark Hewitt	Barry County
Jim McManus	Barry County
Jeff Garrison	Barry County
Lori Phalen	Barry County
Dr. Sarah Syswerda	Barry County
Tim Girrbach	Barry County
Ben Geiger	Barry County
David Steel	Jonesville
Don Germann	Jonesville
Grant Bauman	Jonesville
Jerry Drake	Jonesville
Stuart Welden	Jonesville
Tim McLean	Jonesville
Ray Leising	Jonesville
Buddy Soash	Jonesville
Paul Garber	Manistique
Alan Barr	Manistique
Corey Barr	Manistique
Sheila Aldrich	Manistique
Julie Roscioli	Manistique
Bob Stafford	Midland
Carol Miller	Midland
Dan Cline	Midland
Dick Touvell	Midland
Doug Koop	Midland
Mike Hayes	Midland
Mike Kelly	Midland
Mike Quinnell	Midland
Noel Bush	Midland
Wally Mayton	Midland
Zack Bell	Midland
Kim Arter	Muskegon
Frank Peterson	Muskegon
Dennis Kirksey	Muskegon
Jill Emery	Muskegon
Ron Matthews	Muskegon
Cindy Larsen	Muskegon
John Koches	Muskegon
Joshua Croff	Muskegon

Name	Community
T. Arnold Boezaart	Muskegon
Terry Sabo	Muskegon
Greg Mund	Muskegon
Kathy Evans	Muskegon
Ed Garner	Muskegon
Bob Lukens	Muskegon
Ben Cross	Muskegon
Rich O'Neal	Muskegon
Delphine Hogston	Muskegon
Buzz Lail	New Buffalo
H. Jason Auvil	New Buffalo
Patrick Donnelly	New Buffalo
Robert Kemper	New Buffalo
Viki Gudas	New Buffalo
Matthew Bussler	New Buffalo
Marcy Colclough	New Buffalo
Brad VanDommelen	Traverse City
Brian Haas	Traverse City
Derek Bailey	Traverse City
Don Coe	Traverse City
Douglas DeYoung	Traverse City
Gary Howe	Traverse City
Harry Burkholder	Traverse City
Kathy Huschke	Traverse City
Megan Olds	Traverse City
Mike Wills	Traverse City
Phil Loew	Traverse City
Sarah Uren	Traverse City
Warren Call	Traverse City
John Noonan	Traverse City
Jonathan Campbell	Traverse City
Brad Neumann	Marquette
Michelle Jarvie Eggart	Marquette
David Stensaas	Marquette
Rhiannon Haller	Marquette
Caralee Swanberg	Marquette
Carl Lindquist	Marquette
Curt Goodman	Marquette
Heidi Gould	Marquette
Kevin Taylor	Marquette

Appendix B: Pre-Survey Perspectives by Community

Alpena		
Perspective Represented	# of Responses	% of Individuals
Elected Official	3	23%
Appointed Official		0%
Municipal Staff Person		0%
Tribal Leader		0%
Community Resident	7	54%
Recreational Water User	7	54%
Water-Based Industry Representative	2	15%
Industrial or Agricultural Water User	1	8%
Local Business Owner		0%
Community Leader	2	15%
Active Member of Local Faith Community		0%
Regional or County Representative		0%
Economic/Community Development Professional	3	23%
Conservation Professional	1	8%
Environmental Advocate	1	8%
Student	2	15%
Total Perspectives Identified	29	
# of Individuals That Completed Survey	13	
Average Perspectives Per Individual	2.23	

Battle Creek		
Perspective Represented	# of Responses	% of Individuals
Elected Official		0%
Appointed Official		0%
Municipal Staff Person	3	43%
Tribal Leader		0%
Community Resident	4	57%
Recreational Water User	1	14%
Water-Based Industry Representative		0%
Industrial or Agricultural Water User		0%
Local Business Owner		0%
Community Leader	1	14%
Active Member of Local Faith Community	1	14%
Regional or County Representative		0%
Economic/Community Development Professional		0%
Conservation Professional	2	29%
Environmental Advocate	1	14%
Student	1	14%
Total Perspectives Identified	14	
# of Individuals That Completed Survey	7	
Average Perspectives Per Individual	2.00	

Caseville		
Perspective Represented	# of Responses	% of Individuals
Elected Official		0%
Appointed Official	1	17%
Municipal Staff Person		0%
Tribal Leader		0%
Community Resident	3	50%
Recreational Water User	4	67%
Water-Based Industry Representative	1	17%
Industrial or Agricultural Water User		0%
Local Business Owner	1	17%
Community Leader		0%
Active Member of Local Faith Community		0%
Regional or County Representative		0%
Economic/Community Development Professional		0%
Conservation Professional	1	17%
Environmental Advocate		0%
Student		0%
Total Perspectives Identified	11	
# of Individuals That Completed Survey	6	
Average Perspectives Per Individual	1.83	

Dearborn		
Perspective Represented	# of Responses	% of Individuals
Elected Official	1	9%
Appointed Official	3	27%
Municipal Staff Person		0%
Tribal Leader		0%
Community Resident	3	27%
Recreational Water User	3	27%
Water-Based Industry Representative	1	9%
Industrial or Agricultural Water User	1	9%
Local Business Owner		0%
Community Leader	2	18%
Active Member of Local Faith Community	1	9%
Regional or County Representative	1	9%
Economic/Community Development Professional		0%
Conservation Professional		0%
Environmental Advocate	3	27%
Student	1	9%
Total Perspectives Identified	20	
# of Individuals That Completed Survey	11	
Average Perspectives Per Individual	1.82	

East Jordan		
Perspective Represented	# of Responses	% of Individuals
Elected Official		0%
Appointed Official	3	38%
Municipal Staff Person	2	25%
Tribal Leader		0%
Community Resident	5	63%
Recreational Water User	4	50%
Water-Based Industry Representative	1	13%
Industrial or Agricultural Water User		0%
Local Business Owner	2	25%
Community Leader	1	13%
Active Member of Local Faith Community	1	13%
Regional or County Representative		0%
Economic/Community Development Professional	1	13%
Conservation Professional	1	13%
Environmental Advocate	4	50%
Student		0%
Total Perspectives Identified	25	
# of Individuals That Completed Survey	8	
Average Perspectives Per Individual	3.13	

Flint		
Perspective Represented	# of Responses	% of Individuals
Elected Official		0%
Appointed Official	1	13%
Municipal Staff Person	1	13%
Tribal Leader		0%
Community Resident	3	38%
Recreational Water User	3	38%
Water-Based Industry Representative		0%
Industrial or Agricultural Water User		0%
Local Business Owner	1	13%
Community Leader	4	50%
Active Member of Local Faith Community	1	13%
Regional or County Representative		0%
Economic/Community Development Professional	1	13%
Conservation Professional	1	13%
Environmental Advocate	2	25%
Student	1	13%
Total Perspectives Identified	19	
# of Individuals That Completed Survey	8	
Average Perspectives Per Individual	2.38	

Grand Ledge		
Perspective Represented	# of Responses	% of Individuals
Elected Official	2	17%
Appointed Official	3	25%
Municipal Staff Person	1	8%
Tribal Leader		0%
Community Resident	8	67%
Recreational Water User	6	50%
Water-Based Industry Representative	2	17%
Industrial or Agricultural Water User		0%
Local Business Owner	3	25%
Community Leader	5	42%
Active Member of Local Faith Community	2	17%
Regional or County Representative	2	17%
Economic/Community Development Professional	1	8%
Conservation Professional		0%
Environmental Advocate	3	25%
Student		0%
Total Perspectives Identified	38	
# of Individuals That Completed Survey	12	
Average Perspectives Per Individual	3.17	

Grand Rapids		
Perspective Represented	# of Responses	% of Individuals
Elected Official		0%
Appointed Official		0%
Municipal Staff Person	2	17%
Tribal Leader		0%
Community Resident	4	33%
Recreational Water User	5	42%
Water-Based Industry Representative		0%
Industrial or Agricultural Water User	1	8%
Local Business Owner		0%
Community Leader	3	25%
Active Member of Local Faith Community		0%
Regional or County Representative		0%
Economic/Community Development Professional	3	25%
Conservation Professional	3	25%
Environmental Advocate	3	25%
Student		0%
Total Perspectives Identified	24	
# of Individuals That Completed Survey	12	
Average Perspectives Per Individual	2.00	

Jonesville		
Perspective Represented	# of Responses	% of Individuals
Elected Official	1	20%
Appointed Official	3	60%
Municipal Staff Person		0%
Tribal Leader		0%
Community Resident	3	60%
Recreational Water User	1	20%
Water-Based Industry Representative		0%
Industrial or Agricultural Water User		0%
Local Business Owner	2	40%
Community Leader	3	60%
Active Member of Local Faith Community		0%
Regional or County Representative	1	20%
Economic/Community Development Professional	1	20%
Conservation Professional		0%
Environmental Advocate		0%
Student		0%
Total Perspectives Identified	15	
# of Individuals That Completed Survey	5	
Average Perspectives Per Individual	3.00	

Manistique		
Perspective Represented	# of Responses	% of Individuals
Elected Official		0%
Appointed Official		0%
Municipal Staff Person	1	50%
Tribal Leader		0%
Community Resident	2	100%
Recreational Water User	1	50%
Water-Based Industry Representative		0%
Industrial or Agricultural Water User		0%
Local Business Owner	1	50%
Community Leader	1	50%
Active Member of Local Faith Community		0%
Regional or County Representative		0%
Economic/Community Development Professional	1	50%
Conservation Professional		0%
Environmental Advocate	1	50%
Student		0%
Total Perspectives Identified	8	
# of Individuals That Completed Survey	2	
Average Perspectives Per Individual	4.00	

Marquette		
Perspective Represented	# of Responses	% of Individuals
Elected Official		0%
Appointed Official	1	10%
Municipal Staff Person	2	20%
Tribal Leader		0%
Community Resident	5	50%
Recreational Water User	4	40%
Water-Based Industry Representative		0%
Industrial or Agricultural Water User		0%
Local Business Owner		0%
Community Leader	1	10%
Active Member of Local Faith Community	2	20%
Regional or County Representative	1	10%
Economic/Community Development Professional	4	40%
Conservation Professional	3	30%
Environmental Advocate	4	40%
Student		0%
Total Perspectives Identified	27	
# of Individuals That Completed Survey	10	
Average Perspectives Per Individual	2.70	

Midland		
Perspective Represented	# of Responses	% of Individuals
Elected Official	1	14%
Appointed Official		0%
Municipal Staff Person	1	14%
Tribal Leader		0%
Community Resident	5	71%
Recreational Water User	3	43%
Water-Based Industry Representative		0%
Industrial or Agricultural Water User	1	14%
Local Business Owner		0%
Community Leader	3	43%
Active Member of Local Faith Community		0%
Regional or County Representative		0%
Economic/Community Development Professional	2	29%
Conservation Professional	2	29%
Environmental Advocate		0%
Student		0%
Total Perspectives Identified	18	
# of Individuals That Completed Survey	7	
Average Perspectives Per Individual	2.57	

Muskegon		
Perspective Represented	# of Responses	% of Individuals
Elected Official	2	14%
Appointed Official		0%
Municipal Staff Person	1	7%
Tribal Leader		0%
Community Resident	3	21%
Recreational Water User	6	43%
Water-Based Industry Representative	3	21%
Industrial or Agricultural Water User		0%
Local Business Owner	2	14%
Community Leader	2	14%
Active Member of Local Faith Community	1	7%
Regional or County Representative	2	14%
Economic/Community Development Professional	4	29%
Conservation Professional	4	29%
Environmental Advocate	5	36%
Student		0%
Total Perspectives Identified	35	
# of Individuals That Completed Survey	14	
Average Perspectives Per Individual	2.50	

New Buffalo		
Perspective Represented	# of Responses	% of Individuals
Elected Official		0%
Appointed Official	2	29%
Municipal Staff Person	1	14%
Tribal Leader		0%
Community Resident	2	29%
Recreational Water User	4	57%
Water-Based Industry Representative	1	14%
Industrial or Agricultural Water User		0%
Local Business Owner	2	29%
Community Leader	2	29%
Active Member of Local Faith Community		0%
Regional or County Representative	3	43%
Economic/Community Development Professional	1	14%
Conservation Professional	1	14%
Environmental Advocate	2	29%
Student		0%
Total Perspectives Identified	21	
# of Individuals That Completed Survey	7	
Average Perspectives Per Individual	3.00	

Traverse City		
Perspective Represented	# of Responses	% of Individuals
Elected Official	1	7%
Appointed Official	3	21%
Municipal Staff Person	1	7%
Tribal Leader		0%
Community Resident	6	43%
Recreational Water User	6	43%
Water-Based Industry Representative	1	7%
Industrial or Agricultural Water User	3	21%
Local Business Owner	4	29%
Community Leader	3	21%
Active Member of Local Faith Community	1	7%
Regional or County Representative		0%
Economic/Community Development Professional	3	21%
Conservation Professional	2	14%
Environmental Advocate	3	21%
Student		0%
Total Perspectives Identified	37	
# of Individuals That Completed Survey	14	
Average Perspectives Per Individual	2.64	

Summary of Current Michigan Water Protection Activities

Existing regulatory authorities at the state, local and federal units of government provide for multi-scale and multi-dimensional water resources protection in Michigan. These programs have served for decades to protect, restore and revitalize water-based resources and will continue to play a key role in implementation of the Water Strategy. Following are descriptions of Michigan's key water protection, restoration and public health programs.

Aquatic Nuisance Control

The MDEQ has the authority under Part 33, Aquatic Nuisance Control, and Part 31, Water Resources Protection, of the NREPA, to regulate the chemical control of nuisance aquatic plants, algae and swimmer's itch. Each permit application must undergo a thorough review to assess the environmental impact to the water body and any human health and safety issues. A large majority of these treatments are carried out by commercial pesticide applicators licensed by the MDARD. The MDEQ works with the MDARD to ensure those treatments and the applicators comply with the requirements of the permits and the pertinent laws.

Program staff also review new chemical products proposed for use in Michigan waters, survey Michigan lakes to determine the composition of the native plant community and presence of exotic plant species, and seek to educate riparian property owners about the management of aquatic plants and a variety of related lake management issues.

Beach Protection

In Michigan, local health departments (LHDs) have jurisdiction to test and otherwise evaluate water quality at bathing beaches to determine whether the water is safe for swimming. The LHDs advise beach owners when beaches should be closed, and, if needed, the local health officer may petition the county circuit court to close a beach. Beach monitoring results and swimming advisories are available to the public on the MDEQ's statewide beach monitoring website, www.deq.state.mi.us/beach. Additionally, signs posted at bathing beaches state whether or not the beach has been tested for *E. coli*.

Since 2000, the MDEQ has provided grants to LHDs to support and augment beach monitoring throughout Michigan. These grants are funded by a combination of state CMI bond money and federal Beaches Environmental Assessment and Coastal Health Act

(BEACH Act) funds. The BEACH Act authorizes the EPA to award program development and implementation grants to eligible states, territories, tribes and local governments. These annual grants support microbiological monitoring of coastal recreation waters, including the Great Lakes, adjacent to beaches or similar public points of access. BEACH Act grants also support development and implementation of programs to notify the public of the potential exposure to disease-causing microorganisms in coastal recreation waters.

Biosolids

The treatment of municipal wastewater generates a residual sewage sludge that can be disposed through incineration or landfilling, or can undergo additional stabilization to become biosolids. Recycling biosolids on the land has proven to be a safe and cost-effective alternative for wastewater treatment plants. Biosolids contain essential macro- and micronutrients and make an excellent fertilizer or soil conditioner. The MDEQ encourages the use of biosolids to enhance agricultural and silvicultural production in Michigan, and even allows their use for some landscaping purposes. However, if biosolids are not properly handled, they can enter surface water or groundwater and degrade water quality. To prevent such problems, the land application of biosolids is a highly regulated activity.

The federal regulations contained in Title 40 of the Code of Federal Regulations (CFR), Part 503, Standards for the Use or Disposal of Sewage Sludge; and the Part 24 Rules, Land Application of Biosolids, of the NREPA, establish criteria for biosolids land application. NPDES and state groundwater discharge permits require management of biosolids and other residuals from wastewater treatment facilities. Permittees are required to develop and obtain MDEQ approval of a Residuals Management Program. The MDEQ has district staff dedicated to overseeing the Biosolids Land Application Program by inspecting the facilities generating biosolids and the land application sites.

Campgrounds

The campgrounds program is implemented by the MDEQ in cooperation with LHDs. The program requires campgrounds to obtain an annual license, based on an approved inspection, and construction permits for new facilities or modifications to existing facilities. The focus of the program is protecting public health and safety in accord with the provisions of Article 12, Part 125 of Michigan's Public Health Code, Public Act 368 of 1978, as amended, and the administrative rules adopted pursuant to the act. The potential risks to public health from campgrounds primarily include illnesses related to inadequate water supply facilities and improper wastewater treatment practices.

MDEQ licenses about 1,200 campgrounds each year – including those under state, county and private ownership. About 1,100 of those operate and maintain a privately owned

drinking water supply and wastewater treatment system. The permitting process includes submitting plans prepared by licensed professional engineers for construction of wastewater facilities, water supply and distribution facilities, and water treatment facilities. MDEQ performs an engineering review of plans to determine compliance with law and administrative rules, and if the plans are adequate, issues a permit for construction. Additionally, MDEQ contracts with the LHDs to perform annual inspections of each campground to determine continued compliance with the law and administrative rules.

Coastal Management

The Michigan Coastal Zone Management Program is one of more than 30 coastal programs established nationwide under the authority of the Federal Coastal Zone Management Act of 1972 (PL 92-583). The National Oceanic and Atmospheric Administration (NOAA) provides annual funding to these state programs for the protection, preservation and restoration of coastal cultural and natural resources. Michigan's Coastal Zone Management Program was established as a networked program in 1978 focused on improving administration of existing state shoreline statutes like the Shorelands Act, Submerged Land Act and Sand Dunes Act; providing substantial technical and financial assistance to local units of governments for creative coastal projects; and improving governmental coordination to reduce time delays, duplication and conflicts in coastal management decision-making.

Conservation Reserve Enhancement Program

The MDEQ works closely with the MDARD to implement the Conservation Reserve Enhancement Program, a federal-state-local conservation partnership designed to reduce significant environmental effects related to agriculture. The Conservation Reserve Enhancement Program is being implemented in four critical watersheds – Saginaw Bay, Macatawa River, River Raisin, and western Lake Erie basin – that see intense agricultural land use. The program's objectives are to improve and protect water quality and to promote and enhance wildlife habitat by providing incentives to Michigan citizens to implement conservation practices (required to be in past for 15 years.). Eligible conservation practices include grass plantings, filter strips, riparian buffer strips, field windbreaks and wetland restoration. The MDEQ also supplied Section 319 and CMI funds for livestock exclusion, implementation of Natural Resources Conservation Service approved conservation practices, Conservation Reserve Enhancement Program technical assistance, and permanent conservation easements. The program has so far enrolled nearly 74,000 acres of the 85,000 acre goal in the priority watersheds.

Contaminated Sediment

The Contaminated Sediment Program exists to coordinate and implement remediation at environmentally contaminated sites that impact water quality. Sites range from recent spills or losses of pollutants from accidents or poor facility operations to historic incidents where pollutants have been in the environment for many years. Some of these sites impact surface waters directly. Others impact surface waters through the movement of contaminated groundwater, through treatment and permitted discharge of contaminated groundwater, or through discharges of contaminated groundwater to treatment facilities. The MDEQ investigates sites of environmental contamination, makes recommendations regarding proposed site remediation and treatment, evaluates treatment proposals and pollutant discharges from remediation systems, and provides other technical and project management support as necessary. The program is funded by $25 million set aside in the CMI for the investigation and remediation of contaminated sediments in Michigan lakes, rivers and streams.

Drinking Water Contamination Investigation

The MDEQ assists LHDs in drinking water quality contamination investigations of known, potential or suspected groundwater contamination by providing consultation, analytical support, toxicological assessment, well construction design, well permitting activities and development of health advisories.

The MDEQ is responsible for administering well replacement activities when drinking water wells are found to be contaminated through no fault of the well owner. Water supply alternatives include temporary provision of bottled water, temporary provision of treatment devices if the concentration of contaminants exceeds body contact advisory levels, construction of a permanent replacement well to a protected aquifer, or connection to community water, if available. Connection to community water can include construction of a basic community water system, extension of water main or connection to an existing water main.

The MDEQ also administers the statewide drinking water monitoring program for water supplies located in areas of known groundwater contamination. Sites are reviewed on an annual basis for funding eligibility. Contracts are established annually with LHDs to collect water samples and report results to well owners at specified sites of groundwater contamination.

Appendix 3

Drinking Water and Wastewater Infrastructure Financial Assistance

The MDEQ, in conjunction with the Michigan Finance Authority, operates loan and grant programs that provide financial assistance to local units of government and public water suppliers for the construction of needed wastewater and drinking water infrastructure. These programs provide loan assistance at interest rates well below open market with the intention of supporting the department's goal of improved water quality and reducing the costs passed onto the users of water and wastewater systems. Debt service payments are returned to the loan funds and "revolved" as they are lent out again. The programs are:

- Clean Water State Revolving Fund (CWSRF): The CWSRF has been in operation in Michigan since 1989 and to date has tendered 527 loans totaling more than $4.3 billion. The CWSRF has played a critical role in the state's Combined Sewer Overflow (CSO) and Sanitary Sewer Overflow Control Programs, and will operate in perpetuity to provide assistance to wastewater system owners for ongoing capital improvement needs. In addition to financing Section 212 projects (Publicly Owned Treatment Works), the CWSRF can also fund Section 319 projects (nonpoint source pollution control projects). The fund is capitalized by an annual federal grant and a required state match, with potential access to proceeds from the sale of Great Lakes Water Quality Bonds.

- Drinking Water Revolving Fund (DWRF): The DWRF has been in operation in Michigan since 1998 and to date has tendered 266 loans totaling more than $816 million. Patterned after the CWSRF, the DWRF continues to play a critical role in furthering the MDEQ's public water system program and ensuring the protection of the health of Michigan residents served by public water supplies.

- Strategic Water Quality Initiatives Fund (SWQIF): The SWQIF program was created in 2002 and is capitalized solely by proceeds from the sale of Great Lakes Water Quality Bonds. The SWQIF can fund two specific kinds of projects not eligible for the CWSRF because the facilities constructed would not be in public ownership: (1) The on-site upgrade or replacement of failing septic tanks or tile fields; and (2) The removal of stormwater or groundwater from sanitary or combined sewer leads. Through fiscal year 2014, the SWQIF has tendered 21 loans totaling more than $24 million.

- Stormwater, Asset Management, and Wastewater (SAW) Program: The new state-funded SAW Program is making available up to $450 million of additional loan and grant financing to Michigan municipalities as defined in Section 5301 of Part 53,

Clean Water Assistance, of the NREPA. The SAW Program began in April 2014 and operates alongside the established CWSRF and SWQIF loan programs, thereby, increasing the total financing options available to support water pollution control efforts in Michigan.

SAW grants are available to assist with the development of 1) wastewater and stormwater asset management plans, 2) testing and demonstration of innovative stormwater and wastewater technologies, 3) planning, design and user charge development for wastewater and stormwater systems, or 4) stormwater management plans. To date, 207 grants totaling $171 million and one loan of $2 million have been awarded to Michigan communities.

Great Lakes Water Quality Agreement

The Great Lakes form a portion of the international boundary between the U.S. and Canada, and both countries have jurisdiction over their use. The first Great Lakes Water Quality Agreement between the two federal governments was developed in 1972 and established objectives and criteria for the restoration and enhancement of water quality in the Great Lakes system.

A revised Great Lakes Water Quality Agreement was signed in 1978, recognizing the need to understand and effectively reduce toxic substance loads to the Great Lakes. The 1978 Great Lakes Water Quality Agreement adopted general and specific objectives and outlined programs and practices necessary to reduce pollutant discharges to the Great Lakes system.

Under the 1987 Protocol that amended the 1978 Great Lakes Water Quality Agreement, the U.S. and Canadian governments identified 43 of the most polluted areas in the Great Lakes basin that had serious water quality problems known to cause Beneficial Use Impairments of the shared aquatic resources. These areas were formally designated by the two governments as AOCs. Five AOCs have been subsequently restored and delisted.

Ten of the original AOCs are exclusively under Michigan jurisdiction: Clinton River, Deer Lake, Kalamazoo River, Manistique River, Muskegon Lake, River Raisin, River Rouge, Saginaw River/Bay, Torch Lake, and White Lake. The Menominee River AOC is shared with Wisconsin, and the Detroit River, St. Clair River, and St. Marys River are binational AOCs. The latter AOCs are managed jointly by a binational governance structure created under the Four Agency Letter of Commitment (also called the Four Agency Agreement) signed on

April 17, 1998, by the Environment Canada, EPA, MDEQ and Ontario Ministry of the Environment.

The 1987 Protocol called for cleanup of the AOCs through the development of Remedial Action Plans. Each Remedial Action Plan is required to identify problems that have led to Beneficial Use Impairments, identify actions needed to restore the beneficial uses and provide documentation when beneficial uses are restored. Both federal governments play an active role in the implementation of the Remedial Action Plans. All of Michigan's 14 AOCs have completed Remedial Action Plans that are currently at various stages of implementation.

The 1987 and 2012 Protocols also required the development and implementation of Lakewide Action Management Plans (LAMPs) for each of the Great Lakes. The purpose of the LAMPs is to address critical pollutants and provide a strategy to protect and restore beneficial uses impacted in the open waters of each Great Lake. The EPA, in cooperation with other government and nongovernment agencies, has developed LAMPs for Lakes Erie, Michigan and Superior. Each LAMP includes an assessment of Beneficial Use Impairments, causes of the impairment and recommendations on actions necessary to restore the beneficial uses. In developing the LAMPs, stakeholders recognized the need to address other water quality issues unique to each Great Lakes basin. The LAMPs have been updated regularly, with summary reports issued every year.

A formal LAMP has not yet been developed for Lake Huron. Instead, the MDEQ, EPA, Environment Canada, Ontario Ministry of the Environment and Ontario Ministry of Natural Resources have formed the core of a Lake Huron Binational Partnership to coordinate environmental activities in the Lake Huron basin. The group developed a Lake Huron Binational Partnership Action Plan, which is to being converted into a LAMP.

Groundwater Discharge

The MDEQ's Groundwater Discharge Program regulates discharges to the ground through the development and issuance of permits and self-certifications. A "program review team" was established to develop and implement recommendations to improve the Groundwater Discharge Program. Some of these improvements include the conversion of the groundwater permit database into the NPDES Management System to increase permitting effectiveness, section procedure updates to consolidate and streamline groundwater permitting procedures, and review of the groundwater permit application to improve permit applications and decrease processing time.

Industrial Pretreatment

The MDEQ implements federal and state rules designed to limit pollution from industrial discharges to municipal wastewater treatment facilities. In 1983, the EPA approved Michigan's pretreatment program and formally authorized the state of Michigan to oversee the program.

To assure pollutant discharges are controlled, many municipalities are also required to develop and implement local industrial pretreatment programs as a condition of their NPDES permit. The municipal requirements take two forms: municipalities subject to industrial pretreatment program regulation with design flows greater than 5 million gallons per day must develop a federal industrial pretreatment program, while municipalities subject to industrial pretreatment program regulation with design flows less than or equal to 5 million gallons per day must develop a Michigan industrial pretreatment program.

Municipalities developing either type of industrial pretreatment programs are required to submit them to the MDEQ for review and approval. Subsequent changes to an approved local industrial pretreatment program, as well as periodic reports of local program operations, must also be submitted for review. MDEQ field staff conducts periodic inspections of local industrial pre-treatment programs to identify deficiencies and initiate actions necessary to assure effective operation. Information derived from inspections and reports submitted by the municipalities are entered into the NPDES Management System database.

Inland Lakes and Streams

The Inland Lakes and Streams Program is responsible for the protection of the natural resources and the public trust waters of the state's inland lakes and streams. The program oversees and regulates activities including dredging, filling, constructing or placing a structure on bottomlands, constructing a marina, interfering with natural flow of water, or connecting a natural or artificially created waterway to an inland lake or stream. The most common projects associated with inland lakes and streams regulated under Part 301, Inland Lakes and Streams, of the NREPA, include shore protection, permanent docks or boat hoists, beach sanding, and dredging or excavation. Other types of activities may also require permits.

National Pollutant Discharge Elimination System

Discharges to state surface waters from municipal, industrial and commercial facilities must be authorized by permit under the NPDES Program. The purpose of an NPDES permit

is to control the discharge of pollutants into surface waters of the state to protect the environment. The EPA delegated the program to Michigan in 1973, and the MDEQ is responsible for processing NPDES permits, which must be reissued at least every five years.

The MDEQ reissues all NPDES permits in each individual watershed in the same year. This approach allows the MDEQ to consider cumulative impacts of all dischargers on water quality in the watershed. As part of the permit issuance process, the MDEQ develops limits for pollutants to avoid a violation of water quality standards and ensure compliance with the treatment technology regulations of the Clean Water Act. The MDEQ then places draft permits containing pollutant limits and any appropriate special conditions on public notice, allowing the opportunity for public comment.

The MDEQ also issues permits for regulated storm water discharges to owners or operators of Municipal Separate Storm Sewer Systems (MS4s). A jurisdictional-based general permit, as well as the watershed-based general storm water permit, is used to provide permit coverage.

Michigan uses a general permit for industrial storm water discharges, which requires the permittee to have a certified storm water operator and prepare and implement a Storm Water Pollution Prevention Plan. The applicability of this permit includes storm water discharges associated with industrial activity as defined in the federal regulations, as well as from special use areas (state- or federally-mandated secondary containment structures; areas designated on Michigan's List of Sites of Environmental Contamination pursuant to Part 201, Environmental Remediation, of the NREPA; and other activities subject to federal storm water regulation where storm water monitoring is necessary on a case-by-case basis). Monitoring is required only from the special use areas. Industrial storm water general permits and Certificates of Coverage are reissued on a watershed-basis, with about one-fifth of the five-year permits reissued each year.

The MDEQ also implements the state's Combined Sewer Overflow Control Program, which has resulted in annual reductions of the volume of untreated combined sewage discharged to the surface waters of the state. Through implementation of this program, municipal water treatment facilities are eliminating or properly treating and disinfecting numerous combined sewer overflow discharges

Nonpoint Source Control

The NPS Program assists local units of government; nonprofit entities; and other state, federal and local partners restore impaired waters, protect high quality waters and reduce

NPS pollution statewide. To accomplish its protection and restoration goals, the program provides:

- Technical assistance to help organizations develop and implement Watershed Management Plans, including Best Management Practice selection, land use planning activities and engineering review of site plans;
- Information and education, including activities and tools created by the MDEQ and grantees, to educate people about NPS of pollution;
- Grants to implement WMPs;
- Compliance and enforcement; and,
- Monitoring and field investigations to identify NPS problems and evaluate the effectiveness of corrective or preventive actions.

About 140 Watershed Management Plans have been developed at the local level, most by local watershed groups utilizing MDEQ grants. Watershed Management Plans serve as guides for communities to protect and improve water quality.

Onsite Wastewater Treatment

The Onsite Wastewater Treatment program, administered by the MDEQ and LHDs, protects the public health and the groundwater of the state used for drinking water by assuring proper treatment of effluent from individual residential, community residential and commercial wastewater treatment systems utilizing subsurface dispersal.

All LHDs, through their sanitary codes, are responsible for issuing permits pertaining to wastewater discharges at private, single and two-family residences. Section 2435 of the Public Health Code, 1978 PA 368, as amended, allows LHDs to "adopt regulations to properly safeguard the public health and to prevent the spread of diseases and sources of contamination." To accomplish this, all LHDs have sanitary codes that address permitting requirements for onsite wastewater systems, which are intended to safeguard public health and the environment. There are an estimated 1.3 million onsite wastewater systems in Michigan, with about 40,000 servicing non-residential facilities.

For each jurisdiction, a local decision-making process involving the Board of Commissioners, the public and the LHD promulgates onsite wastewater treatment regulations establishing site suitability and design standards for single and two-family onsite wastewater treatment systems. Statewide MDEQ criteria for large onsite systems generating flows up to 10,000 gallons per day as well as MDEQ rules for proposed subdivisions and condominium developments complement these local environmental

regulations. Some variations in local and state regulations are caused by soils, natural geologic and environmental conditions.

Current state rules and guidelines related to onsite wastewater systems include MDEQ's "Michigan Criteria for Subsurface Sewage Disposal" and administrative rules "Onsite Water Supply and Sewage Disposal for Land Divisions and Subdivisions." The Michigan Criteria apply to sources other than single and two-family home systems with flows up to 10,000 gallons per day which receive sanitary wastewater. Administrative rules apply to all proposed subdivision lots, condominium units and other land divisions. These programs are conducted by authorized LHDs with MDEQ oversight.

Public Drinking Water Supply

There are about 11,000 public water supplies in Michigan, and about 1,400 are community water supplies that furnish drinking water year-round to residential populations of 25 or more. The remaining 9,800 are either a non-transient, non-community water supply or a transient, non-community water supply. A non-transient, non-community water supply serves 25 or more of the same people for at least 6 months out of a year; examples of these are schools, factories and businesses. A transient, non-community water supply serves 25 or more people at least 60 days out of a year; examples of these are motels, restaurants, golf courses, campgrounds and convenience stores.

The MDEQ and contracted LHDs are responsible for enforcing compliance with requirements in the Michigan Safe Drinking Water Act, 1976 PA 399, as amended (Act 399), at all of the public water supplies. Michigan also is a primacy state, meaning it has received authority from the EPA to enforce compliance with the National Drinking Water Standards at all its public water supplies.

All public water supplies must collect samples of their water on a set schedule and analyze the samples for contaminants. The sampling results are reviewed by MDEQ and the LHDs. If contaminants that exceed drinking water standards are present and confirmed by repeat samples, the supply must post notice to the public and, if required, issue a boil water or do not drink notice until the underlying problem is corrected and the drinking water tests free of contaminants.

MDEQ conducts sanitary surveys of all community water supplies at least every three years to ensure the supply is properly operated and maintained. A sanitary survey is a comprehensive evaluation of the entire supply to determine the ability of the supply to produce, treat and distribute adequate quantities of water to the public. During the survey,

staff review maintenance and operation practices and records to ensure drinking water produced meets all federal and state drinking water standards. Survey findings often lead to the identification of potential problem areas that can be corrected before they become significant issues. LHDs are required to conduct sanitary surveys at all non-community drinking water supplies at least once every five years.

One additional tool employed to ensure safe drinking water is requiring that public water systems are supervised by properly trained and certified operators. To that end, MDEQ administers a drinking water operator training and certification program. About 4,600 certified operators in Michigan provide oversight of public water systems. The MDEQ offers examinations twice a year, with about 1,400 applicants annually. To stay current with technology and regulations as well as maintain their certification, each operator must also meet continuing education requirements every three years. MDEQ partners with technical assistance providers to offer targeted training to enhance the capability of operators and assist in meeting continuing education requirements.

Septage Waste

Septage is a domestic waste pumped from septic tanks and portable toilets. With assistance from participating LHDs, the MDEQ's septage waste program regulates the septage hauling industry and septage disposal practices. Michigan has about 390 licensed septage waste haulers and 850 licensed septage waste hauling vehicles. Septage may be taken to a municipal wastewater treatment facility or may be applied to agricultural land. Farms must obtain a separate permit before septage waste can be land applied.

Soil Erosion and Sedimentation Control

The Soil Erosion and Sedimentation Control Program is administered under the authority of Part 91, Soil Erosion and Sedimentation Control, of the NREPA, by state, county and municipal agencies with oversight by the MDEQ. The MDEQ's major program responsibilities include training staff members of the Part 91 agencies in the proper administration and enforcement of Part 91 and conducting periodic audits of the administering agencies to ensure their Soil Erosion and Sedimentation Control Programs comply with Part 91.

Source Water Protection

The MDEQ's Source Water Assessment Program was developed in response to the 1996 amendments to the federal Safe Drinking Water Act to identify areas that supply public drinking water, inventory contaminants, determine susceptibility of the sources and inform

the public of the results. This process helps to prioritize susceptible systems to develop and implement source water protection activities.

The MDEQ also developed the Source Water Protection Program in response to 1986 amendments to the Safe Drinking Water Act. It is a voluntary program implemented on a local level through the coordination of activities by local, county, regional, state, and federal agencies. Although the program is voluntary, Public Water Supply Systems that participate in source water protection must develop a local Source Water Protection Program consistent with the guidelines established by the MDEQ. Local programs must designate local roles and responsibilities,, establish a Source Water Protection Area, identify potential sources of contamination within the area, develop strategies to manage potential sources and minimize threats to the supply system, develop contingency plans for water supply emergencies, identify procedures for the development of new well sites, and provide opportunities for public education.

Funding for local Source Water Protection Programs is available through a grant program that provides 50 percent of funds and must be matched with local funds.

To help evaluate the vulnerability of public water supplies relative to potential sources of contamination, the MDEQ developed the Michigan Groundwater Management Tool to assess groundwater flow regimes and identify the wellhead protection area for public water supply systems throughout the state. It is a groundwater modeling software system that provides for the mapping, display and analysis of groundwater flow direction. It can also be used by other MDEQ programs to analyze contaminant migration.

Well Construction

Michigan has about 1.1 million household drinking water wells, more than any other state in the country. Drinking water wells must be properly constructed and maintained both to protect the quality of the drinking water pumped by the well and to protect the aquifer from contamination. Michigan's well construction program assures drinking water wells are properly constructed, operated and decommissioned in a technically sound manner under the authority of Michigan's Public Health Code, Public Act 368 or 1978, Part 127, as amended.

The MDEQ annually registers well drilling contractors, pump installers, dewatering contractors and well drilling machines, and administers exams before the initial registration. The MDEQ also administers a comprehensive database, Wellogic, to store all drinking water well and pump records submitted by water well contractors since 2000.

Under contract, Michigan's LHDs implement the well construction program statewide by issuing well construction permits, reviewing drilling and plugging records, and conducting inspections to ensure wells are installed in conformance with state and local codes. LHDs also ensure that abandoned wells are properly plugged to prevent groundwater contamination. The MDEQ evaluates the performance of the LHDs in implementing the well construction program and provides compliance assistance and training to ensure successful implementation of the program.

Wetlands Protection

The MDEQ has administered a statewide wetland regulatory program for 30 years, including public education programs that encourage wetland preservation and restoration, cooperation with governmental and nongovernmental agencies to encourage the evaluation and management of wetlands on a local and watershed basis, and development of a monitoring and assessment program. Michigan's Goemaere-Anderson Wetland Protection Act was passed in 1979 and makes up Part 303 of the NREPA. It provides for the preservation, management, protection and use of wetlands; requires permits to alter wetlands; and provides penalties for illegal wetland alteration.

This act requires that persons planning to conduct certain activities in regulated wetlands receive a permit from the state before beginning the activity. Michigan's regulatory program generally requires mitigation for all wetland impacts, although the MDEQ staff may waive this requirement for projects impacting less than one-third acre if no reasonable opportunity for mitigation exists, or for projects having a basic purpose of creating or restoring wetlands. Mitigation may be considered only after the applicant has demonstrated avoidance and minimization of impacts, and it has been determined that a project is otherwise permitable. A mitigation proposal must result in no net loss of wetlands upon completion of a project. Financial assurances are required to ensure completion of any mitigation project that is not completed in advance of associated impacts. Mitigation sites must be permanently protected through a conservation easement.

Administrative rules defining the establishment and use of mitigation banks were promulgated in 1997. Fifteen mitigation banks are currently listed in Michigan's Wetland Mitigation Bank Registry, and a number of other mitigation bank sites are currently under consideration or development. Recent changes to state and federal laws have resulted in preference for wetland banks to mitigate for unavoidable losses to wetland resources. New legislation enacted in Michigan in 2013 developed a Wetland Mitigation Bank Funding Program to provide grants and low-interest loans to eligible municipalities interested in pursuing a wetland bank. In 2014, a total of $3 million was available for this program.

Michigan also has developed other regulatory and non-regulatory programs to manage Michigan's wetland resources, including:

- Part 303 authorizes regulation of wetlands by a local unit of government provided that the local unit uses Part 303's definition of wetlands and permit criteria. Currently, more than 40 communities in Michigan have local wetland protection ordinances.
- The MDEQ has organized and leads the Wetland Work Group, an informal interagency team including various state, federal and nongovernmental organizations concerned with wetland restoration and management.
- To encourage consideration of wetland issues, the MDEQ provides technical assistance to local watershed planning organizations and assists in locating areas with a high potential for wetland restoration. Using existing datasets and GIS technology, the MDEQ created a GIS layer that highlights these wetland restoration areas and ranks them by potential.
- The MDEQ developed a landscape-scale wetland assessment method to assist watershed groups in managing, protecting, and restoring wetlands in the context of watershed management planning. The MDEQ makes use of GIS data, including National Wetland Inventory maps, to provide an evaluation of wetland functions and make more effective decisions regarding the need for wetland protection, restoration or management in watershed.
- The MDEQ uses conservation easements that offer comprehensive and permanent protection to high-quality wetlands. Conservation easements are used to fulfill mitigation requirements or protect wetlands avoided during the planning of an authorized construction project.

Michigan's Wetland Protection Program was approved by the EPA in accordance with the requirements of Section 404(h) of the Clean Water Act in August 1984, making Michigan the first state to assume administration of Section 404. Although at least 34 states have their own wetlands program, only two states, Michigan and New Jersey, have been able to meet all the requirements to assume the Clean Water Act Section 404 Program in "traditionally navigable waters." The U.S. Army Corps of Engineers, retains Section 404 jurisdiction in these waters, including the Great Lakes, connecting channels such as the Detroit River, and river mouth areas.

To maintain Michigan's authorization under Section 404, state law must remain consistent with federal regulation, including exemptions, general permits, public notice procedures and review criteria. In addition to meeting these requirements, Michigan's law provides the

citizens of the state with a significant savings in time and money while providing efficient and effective protection of wetland, lake, and stream resources by clearly defining regulated wetlands, providing permitting timeframe requirements, and streamlining and consolidating permit review.

The MDEQ processes about 4,000 to 6,000 permit applications per year under Section 404. About 1,500 of these applications propose wetland impacts; the remainder propose to alter lakes and streams only. The MDEQ works with permit applicants to redesign proposals when necessary to avoid and minimize resource impacts. The MDEQ is currently working, under an EPA Water Permits Division Grant, to develop a comprehensive database for Michigan's Section 404 Program that will incorporate new technologies and methods for screening, evaluating and tracking impacts.

In 2008, the EPA published findings from a 10-year review of Michigan's Section 404 Program, and although they found Michigan's administration of the program was good, they identified changes needed to maintain federal consistency. These changes included administrative actions and procedures, revision of administrative rules, statute amendments to clarify exemptions, and updating the program Memorandum of Agreement. After working with stakeholders on the changes required to maintain the state program, Michigan's Legislature passed a new law in 2013 that includes many of the necessary changes for Michigan's 404 program as well as several other programmatic changes. The EPA is currently evaluating these changes to determine whether they are consistent with the Clean Water Act.

From:	Kyle Bredell
To:	mi-waterstrategy; Nicholas Joseph Schroeck; GLELC Detroit
Subject:	Draft Water Strategy Comments
Date:	Friday, August 28, 2015 3:19:23 PM
Attachments:	Water Strategy Comments.pdf

Please find enclosed comments to the DEQ's draft water strategy, as prepared on behalf of the Great Lakes Environmental Law Center.

Thank you,

Kyle Hampton Bredell
Student Attorney
Great Lakes Environmental Law Center
Detroit, MI

From: Drummond, Charles (C.)
To: mi-waterstrategy
Subject: Draft Water Strategy document comments
Date: Thursday, August 27, 2015 10:48:23 AM

I like that this draft does pay some attention to the issue of combined storm sewerage overflows, but I do not like that it doesn't seem to offer much in the way planned actions to correct the issues. I don't think we need more monitoring, or more ability to add chlorine to combined overflows as they occur, we need to correct the infrastructure so that overflows do not occur at the frequency that they currently do.

The thing that has puzzled me about this issue relates to the authority the state claimed with its use of Emergency Financial Manager legislation. In instances where EMFs are invoked, the state claims authority on the grounds that municipalities are a part of the state government. What is puzzling here and with the state's role in combined sewerage overflows in general, is that the state claims that it’s not their problem, it's the municipality's problem. From my admittedly pedestrian point of view, this looks like the state claiming authority without consistently taking responsibility.

I understand that it will probably take Billions in funding and potentially decades of work to really fix these issues ... a Water Strategy document like this one is precisely the place to get this issue headed in the right direction. It should include a strategy for developing the route toward actually fixing these problems.

Charles Drummond
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August 28, 2015

Office of the Great Lakes - DEQ
P.O. Box 30473-7973,
Lansing, Michigan 48909

Dear Director Allan:

Ducks Unlimited (DU) is pleased to provide our comments related to the draft Michigan Water Plan, and appreciated the opportunity to serve on the Water Council that played a role in the development of the plan. We recognize the enormous time and commitment by the Office of the Great Lakes in working with a vast and diverse set of stakeholders to shape a common vision for Michigan's water resources. For your information, Ducks Unlimited conserves, restores, and manages wetlands and associated habitats for North America's waterfowl. These habitats also benefit other wildlife and people.

Overall DU is pleased that Michigan is focusing on the biological, cultural and social relevance of the Great Lakes as necessary components for long-term ecological system health. The draft Michigan Water Plan is a great step forward that identifies significant goals, recommendations and measures of health that we believe provides a high level planning/accountability platform for the state. However, we also believe it could be significantly strengthened with additional clarity on: 1) more specificity on water resources, especially the mention and inclusion of wetlands, 2) the critically important role waters/wetlands play in sustaining our fish and wildlife resources, which in turn supports a several billion dollar fishing, hunting and outdoor recreation industry, 3) the roles and responsibilities of state agencies in implementing recommendations and measuring progress.

1) Wetlands – Although waters are used in a broad sense in the draft plan, many throughout the state do not equate waters with wetlands, or vice versa. This disconnect has resulted in millions of acres of wetlands destroyed because of the lack of understanding on the direct and indirect benefits to our water systems that wetlands provide. Because we believe this Water Plan has potential long term benefits and guidance to those that come after us, we think it is critical that wetlands be included and delineated so that we specifically and intentionally do what we can to conserve wetlands to ensure they provide the ecological goods and services to Michigan's groundwater, streams, rivers, ponds, lakes and of course, our Great Lakes.

   Therefore, we recommend that the draft plan include recommendations under Goal 1, 2, 4, 6, 8, & 9, at a minimum, that captures the importance and contributions of wetlands, including but not limited to: A) recommend a net gain in wetlands, especially in those regions faced with a wetland loss >50 percent, B) Recommend a no net loss of wetlands

in those areas <50 percent loss, C) retain MI DEQ's assumption of 404 CWA jurisdiction, D) maintain a strong state program on the conservation of Michigan wetlands through the Great Lakes Restoration Initiative, the N. Am. Wetlands Conservation Act, MI Wildlife Action Plan and other programs designed to protect, restore, enhance and manage wetlands.

2) Wetlands and Wildlife and Outdoor Recreation – wetlands provide essential breeding and nursery areas for many species of wildlife and fish, threatened and endangered species and species of special concern. Although the plan addresses fish to a minor extent, very little reference is made to wildlife (waterfowl, wading and songbirds, furbearers, amphibians, reptiles). The recreational impact of hunting and fishing alone in Michigan is a $4.8 billion dollar industry (more than the combined revenues of corn, soybeans and dairy products – the top three ag products!). We encourage recommendations that acknowledge the critical role our waters/wetlands play in the conservation of wildlife and fish, and outdoor based recreation.

3) The draft plan should include specifics about agency responsibilities in regards to carrying out recommendations and measures of success. Without any accountability, we are concerned that the recommendations and measures will remain sealed within the plan versus implemented in Michigan's Great Lakes watershed. A good model to follow is the DNR Wildlife Division's strategic plan and accompanying reports.

Thank you for the opportunity to provide comment. We look forward to working with the state on seeing the final plan and subsequently implementing "Sustaining Michigan's Water Heritage – A Strategy for the Next Generation".

Sincerely,

Gildo Tori
Director of Public Policy
DU- Great Lakes/Atlantic Region