

Wisconsin Great Lakes Chronicle
2020



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FOREWORD

Governor Tony Evers

Dear Readers,

Wisconsin Great Lakes Chronicle reflects the challenges and celebrates the successes of our coastal communities and residents. Our 2020 edition gives us an opportunity to share some of both.



Over the last several years many Wisconsin communities have experienced firsthand the challenges climate change has brought us. With more extreme weather events and more regular episodes of high precipitation, families and communities have had to roll up their sleeves and work together to rebuild, especially in Wisconsin's coastal communities. Homeowners, businesses and local communities are seeking ways to become more resilient to coastal hazards, as they confront higher lake levels and ongoing threats of erosion and flooding. Collaborative efforts, like the Southeastern Wisconsin Coastal Resilience Project, provide opportunities to expand on local efforts to identify risks, plan and improve responses to flooding, erosion and storm events.


While communities strive to become more resilient for the path ahead, we must address the source of these challenges. That's why I created

the Governor's Task Force on Climate Change, chaired by Lieutenant Governor Mandela Barnes. This group is tasked with developing strategies to mitigate and reverse the impacts of climate change on our communities by assessing research, reviewing the actions of local and tribal communities working to address climate change, working with educational institutions, and listening to Wisconsinites share their stories of what's happening in their own backyards. In addition to the Task Force, I created the Office of Sustainability and Clean Energy to lead our state in addressing climate change by partnering with other state agencies and developing a clean energy plan. For too long leaders have been ignoring science, and frankly we can't afford to do it any longer.

Even as we face challenges along our Great Lakes and throughout the state of Wisconsin, we have reasons to celebrate. In addition to our efforts around climate change, we also established the first ever Office of Outdoor Recreation in Wisconsin to enhance and support Wisconsin's outdoor recreation economy which supports thousands of jobs and communities throughout the state. One such community that is a destination for outdoor recreation throughout the year is the Apostle Islands National Lakeshore. With sea caves, lighthouses, beaches and trails, the park exemplifies all the beauty Wisconsin

has to offer and provides a wonderful spot for Wisconsinites and visitors to explore each year. This year we are celebrating the 50th anniversary of the Apostle Islands being designated a National Lakeshore. With support from Senator Gaylord Nelson, the Apostle Islands were designated as a national lakeshore on September 26, 1970. Today, our National Park Service continues to connect visitors to the natural and cultural resources within the park. Their efforts are supported by individuals and organizations like the Friends of the Apostle Islands National Lakeshore, which began in 2002 and continues to support and enhance the park.

Among the priorities I have established for this state as Governor and as Chair of the Conference of Great Lakes and St. Lawrence Governors and Premiers are those to ensure the protection of our vast and valuable natural resources, like the Apostle Islands. It is time for us to deliver on the promise to our kids that we're leaving them with a better life and world than the one we inherited and to ensure the protection of Wisconsin's beautiful lakeshores for generations to come. There is much work left to do and I look forward to continuing the important work of protecting our Great Lakes now and into the future, together.



The cooperation of multiple partners and thousands of hours of effort turned Saxon Harbor's devastation into a gem.

SAXON HARBOR RESTORATION

Eric Peterson

In a few short hours on the evening of July 11, 2016, life changed for many people in Northern Wisconsin. Torrential rains brought a 1,000-plus year flood that wiped out roadways and other critical infrastructure across the northwestern counties. In Iron County, Saxon Harbor at the shore of Lake Superior and the mouth of Oronto and Parker Creeks sat directly in the path of these raging floodwaters. A bustling campground and marina a week prior became an unrecognizable disaster area when the floodwaters subsided.

A Federal Disaster Declaration allowed the US Federal Emergency Management Agency (FEMA) to assist local communities with rebuilding efforts. Many projects were quickly developed and critical reconstruction efforts were completed, but Saxon Harbor was not among them. Saxon Harbor recovery efforts would take time due to the loss of a county highway, bridge, campground and marina, and a federally designated harbor of refuge filled with sediment. FEMA, Wisconsin Emergency Management, the US Army Corps of Engineers (USACE), the County's insurance carrier, the Wisconsin Department of Transportation (WisDOT), the Federal Highway Administration and Iron County would all share in the financial responsibility to rebuild Saxon Harbor.

Before work began on reconstruction efforts, Iron County secured grant funding from the Wisconsin Coastal Management Program (WCMP) to survey the public on the future

of the harbor. The online survey produced an overwhelmingly positive response to rebuild Saxon Harbor and brought to light areas that could be improved at the facility. The public wanted the marina rebuilt, the campground located as close to the marina as possible, beach access and day-use amenities.

2017 was spent establishing reconstruction plans and areas of financial responsibility. By late 2017, WisDOT and the Federal Highway Administration planned to relocate the bridge further upstream over Oronto Creek and construct the new roadway where the campground once sat. The 40' span bridge would be replaced with a new 104' three-span bridge allowing a greater area for Oronto Creek to pass beneath.

The US Army Corps of Engineers received an appropriation to dredge the federal channel within the harbor of refuge extending into the north basin of the marina from Lake Superior. Iron County won multiple grants to improve facilities that were deemed outside of the scope of the disaster and therefore ineligible for FEMA funds. The County's engineering team, led by Foth Infrastructure & Environment, LLC, worked diligently to complete design and bid documents for these improvements along with the complete reconstruction and dredging of the marina. Additionally, Wisconsin Administrative Code, floodplain regulations and local zoning required that the campground be rebuilt at a different location.

With designs completed, permits in place and the schedules of multiple contractors coordinated, reconstruction finally began in late February 2018. Iron County's contractor worked on Oronto and Parker Creeks to re-establish the streambed and armor the banks with tons of rip rap to return flow to Lake Superior. Saxon Harbor became a very busy construction zone as winter released its grip on the Northwoods.

In May, the USACE dredge contractor began work within the federal channel. This contractor was also awarded the contract to dredge the remainder of the marina that is the responsibility of Iron County. By summer's end, approximately

51,000 cubic yards of sediment was removed from Saxon Harbor. In June, the contractor for the WisDOT project forged ahead and the new roadway and bridge opened in August.

Work also began to build the framework around the marina. Preformed, interlocking concrete panels were used to form the marina basins and provide retaining walls to backfill areas that had been washed away. WCMP came through again with grant funding to study alternatives to protect the outfall of Oronto and Parker Creeks into Lake Superior. The Foth engineering team completed this study and funding options will be evaluated for future construction.

The contract for marina improvements and reconstruction was awarded In November 2018. Construction began almost immediately as the contractor worked throughout the winter in freezing conditions to meet deadlines that would allow Iron County to open the marina for use as quickly as possible. With favorable conditions in late spring and throughout the summer, and with few delays, construction was completed in August. Iron County held a soft opening over Labor Day weekend 2019. Within two days of reopening, more than forty boats were docked in the marina and the public was able to get a look at what the new facility would offer.

It is hard to believe that what took only a few hours to destroy could turn into more than four years to rebuild. The cooperation of multiple agencies, grant programs, state and federal legislators and thousands of hours of effort have finally turned the devastation into a gem. This spring, the marina was full of boaters and day users enjoyed the Lake Superior shoreline. The new campground was completed over the summer. If you find yourself in Iron County, be sure to take the short drive north of US 2 and see what can be done when everyone pulls together.

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The Great Lakes have experienced periods of low and high water levels over the past 25 years.

GREAT LAKES HIGH WATER LEVELS

Deanna Apps

In recent years, the Great Lakes basin has experienced persistent wet conditions and water levels have risen to near or above record high levels. Water levels on the Great Lakes are measured as an elevation above sea level based on the International Great Lakes Datum of 1985, and daily lake-wide average water levels are computed using a network of water level gauges for each lake. This allows for a measurement based on still water and is not influenced by local conditions caused by meteorological forcings, such as wind.

Daily lake-wide average water levels are averaged at the end of the month to calculate monthly mean water levels. This is the main water level dataset that is released by the US Army Corps of Engineers (USACE), which is coordinated with Environment and Climate Change Canada (ECCC). The coordinated period of record for this dataset is 1918 to 2019. Monthly mean water levels in 2020 are considered provisional until the end of the calendar year when data is coordinated with ECCC.

Water level fluctuations are driven by changing weather patterns and the resulting impact on the water supply to the lakes. The three main components that influence water supply to the lakes are precipitation over the lakes, runoff to the lakes, and evaporation off the lakes. Other factors that need to be considered are inflows to the lakes and outflows out of the lakes through connecting channels. These also play a part in the water

balance of each lake, but overall Mother Nature and weather patterns have the largest impact on water level changes.

Throughout the year, water levels typically follow a seasonal cycle based on hydrological conditions. Water levels are usually at their seasonal low during the winter when the ground is typically frozen and snow accumulates in the region. In the late winter or early spring, water levels begin their seasonal rise due to increased precipitation and enhanced runoff from snowmelt. During the summer or early fall, the lakes usually experience their peak level for the year as increased sunshine helps to warm the lake surface water. The fall and early winter are typically the period of seasonal decline on the lakes as a result of increased evaporation.

The highest evaporation rates occur when cold dry air moves over a relatively warm lake surface. Larger temperature differences between the air and surface water cause increasing rates of evaporation, which is why during the fall and early winter, lake levels typically decline. While the lake is ice free, the opportunity for evaporation to occur will exist, but once ice forms, evaporation will cease.

There have been periods of both high and low water throughout the recorded period of monthly mean water levels dating back to 1918. On the upper lakes of Superior and Michigan-Huron, a period of low water occurred from the late 1990s

to the early 2010s and water levels were well below average. A wet pattern began and water levels started to climb beginning in 2013. By 2015, water levels were back above their long-term annual average level and have since continued to rise annually and remain well above average.

Persistent wet conditions over the last several years have caused water levels to rise to near or above record high water levels. The 60-month period from January 2015 to December 2019 was the wettest five-year period on record in the Great Lakes basin since records began in 1895 (US data only from NOAA National Centers for Environmental Information). Many locations across the region experienced their wettest year on record in 2019 with the states of Wisconsin, Michigan and Minnesota all experiencing their record wettest year (NOAA NCEI). Some locations such as Green Bay, Wisconsin, experienced back to back record wet years after surpassing their 2018 record in 2019.


These record wet conditions have culminated in record high water levels on the Great Lakes. In 2019, record high monthly mean water levels were experienced on Lakes Superior, St. Clair and Erie from May to September, while Lake Ontario also set new record high monthly mean water levels in the months of June and July. Lakes Michigan-Huron did not set a monthly mean record high water level in 2019, but was within an inch of record high levels in multiple months.



However, a marginal seasonal decline in Lakes Michigan-Huron during the fall and winter of 2019-2020 has led to monthly mean water level records in the beginning of 2020. Lakes Superior, St. Clair and Erie have also experienced record high water levels in 2020. For the rest of 2020, water levels are forecast to remain high and near or above record high levels, especially if wetter conditions continue. Even with drier conditions over the next six months, water levels are expected to remain above average.

The Great Lakes have experienced periods of low and high water levels over the past 25 years. Scientists and coastal managers will continue to monitor Great Lakes levels and attempt to plan for impacts from future fluctuations.

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High water levels are causing Great Lakes coastal communities to work together to become more resilient.

SOUTHEASTERN WISCONSIN COASTAL RESILIENCE PROJECT

Adam Bechle

In 2020 with all of the Great Lakes at or near record-high water levels, it is hard to remember back to 2013 when the major concern was whether some Great Lakes would ever escape a decade of record low water levels. Over the past seven years, trillions of gallons of water and a number of large coastal storms have shown the Great Lakes two opposite extremes. Once wide beaches are now mostly underwater and letting waves lap directly onto bluffs and in some cases homes.

Concerns at ports and harbors have shifted from not having safe water depths for vessel navigation to inundated infrastructure. In the face of these challenges, Great Lakes coastal communities are striving to become more resilient so that they can respond, adapt and ultimately bounce back from whatever the lakes throw at them.

To support communities in building resilience to coastal hazards, the Wisconsin Coastal Management Program (WCMP), the University of Wisconsin Sea Grant Institute, the University of Wisconsin-Madison Department of Civil and Environmental Engineering and the Southeastern Wisconsin Regional Planning Commission (SEWRPC) are collaborating on a three-year project funded by the NOAA Regional Coastal Resilience Grants program.

This project is focused on helping coastal communities in Southeastern Wisconsin better plan and prepare for coastal hazards through networking across the region on these issues,

furthering the understanding of coastal erosion, creating educational resources on resilient practices and providing technical assistance on resilience opportunities. While the geographic focus of this effort is Kenosha, Racine, Milwaukee and Ozaukee counties, recommendations from this effort are already being taken statewide.

This project formed the Southeastern Wisconsin Coastal Resilience Community of Practice which brings local officials, scientists and outreach specialists together to learn about, share experiences with and develop approaches to address coastal hazard issues. This community of practice has met throughout the region to discuss topics like Lake Michigan water levels, bluff failure processes and funding options for hazard mitigation. We have also had field trips to coastal bluffs and boat tours of the shoreline accompanied by coastal engineering and geology experts. Perhaps most importantly, the community of practice provides an opportunity for members to network and discuss their coastal hazard issues and projects with each other.

To better understand coastal erosion that affects the region, historic bluff and shoreline recession—or landward retreat—has been mapped using historic aerial photos. This information has been incorporated into county hazard mitigation plans and can be used by local governments and homeowners to inform decisions along the coast. From a scientific perspective, the data is being compared with historic water level and wave data

to better understand the drivers of recession across the region's different shoreline and bluff types. Leveraging previous WCMP investments, all of the data from this work is publicly available to view or download from the Wisconsin Shoreline Inventory and Oblique Photo Viewer websites.

A series of publications are being created to provide guidance on resilient practices for bluffs, beaches and waterfront infrastructure. For example, a Property Owner's Guide to Protecting Your Bluff will help homeowners manage their bluffs holistically to address the many factors that combine to cause bluff failure, like wave erosion, groundwater seepage, surface water runoff, frost heave and human activities. This top-down approach to bluff management includes redirecting water drainage away from the edge

of the bluff top, enhancing native vegetation, reinforcing the bluff face and considering options to slow wave erosion if necessary. As this and other guidance documents are published, they will be shared through the community of practice to help get this information to local governments and their coastal residents.

A Coastal Resilience Self-Assessment was also developed to help communities identify opportunities to build their resilience to coastal hazards. This assessment serves to guide users through a variety of options to address coastal hazards ranging from strategies like land use planning, local ordinances and public outreach to physical actions such as shore protection structures and stormwater management. Funding was available through the grant for communities

to implement some of their top priority actions. These ongoing local projects include the design of resilient shore protection, coastal vulnerability assessments and coastline management plans. As these projects progress, relevant lessons learned by the communities will be shared with the community of practice.

The work of this regional project has laid the groundwork for efforts to build coastal resilience throughout the state. Steps are being taken to create similar community of practice networks for local governments in Northeastern Wisconsin and along Lake Superior. The Coastal Resilience Self-Assessment is also being used by the City of Bayfield and will likely start conversations about coastal resilience throughout Northeastern Wisconsin.

As the drastic seven-year swing from record low water levels to record high water levels has demonstrated, coastal communities need to anticipate changing conditions and balance risks while they plan and prepare for the possible conditions they may face on the Great Lakes. While there is much work ahead, the resources, relationships and momentum generated by this project are another step forward in building Wisconsin's resilience to coastal hazards.

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Sheboygan River has a bright future thanks to restoration efforts, monitoring and local leadership.

SHEBOYGAN RIVER AREA OF CONCERN

Stacy Hron and Kendra Axness

The Sheboygan River Area of Concern (AOC) is healing after nearly a decade of concerted efforts by partners to remediate pollution and restore the river's habitat. These efforts set a course for revitalization which continues today as others undertake additional habitat restoration projects and capitalize on economic development opportunities provided by a cleaner river.

The lower fourteen miles of the Sheboygan River are designated as a Great Lakes Area of Concern, or AOC. AOCs are Great Lakes rivers and harbors that suffered the most severe environmental harm as a result of industrialization and land use changes in the first part of the twentieth century. The United States and Canada designated 43 AOCs under the 1987 update of the Great Lakes Water Quality Agreement, an agreement established in 1972 between the two countries to clean up and restore the Great Lakes.

The Sheboygan River was designated an AOC due to pollution of river sediments by PCBs and PAHs, chemical compounds released from industries and that do not break down in the environment. In addition to being designated in the international agreement, these pollutants also led to several areas on the river being designated federal Superfund sites. Superfund is the common name for the Comprehensive Environmental Response, Compensation and Liability Act of 1980, a federal law designed to clean up sites contaminated with hazardous substances.

Contaminated sediments resulted in fish and waterfowl that are not safe to eat and impaired use of harbor areas due to dredging restrictions. Moreover, the problem was compounded because dredging contaminated sediment is considerably more expensive than dredging clean sediment. Pollution and loss of habitat harmed wildlife, fish, bottom-dwelling aquatic life and plankton populations. The AOC designation was also due to high levels of runoff pollution and sedimentation which at one time caused nuisance algal blooms.

In Sheboygan, local companies stepped up beginning in 2006 to remediate the worst of legacy pollution; that is, pollution that existed before modern environmental laws were enacted. With leadership from the Wisconsin Department of Natural Resources (DNR) Office of Great Waters, state and local partners leveraged those cleanup activities to do a much larger and more holistic cleanup and restoration with Great Lakes Restoration Initiative funding provided by the United States Environmental Protection Agency (EPA).

Strong partnerships among local, state and federal partners enabled a significant amount of work to be done to address the AOC impairments in a relatively short time. From 2011 to 2013, four major sediment projects were completed which removed PCBs, PAHs, heavy metals and other contaminants while also deepening the channel in the harbor and lower river for boating. More than

400,000 cubic yards of contaminated sediment were removed in approximately 20,000 dump truck loads.

To improve habitat, five projects were implemented to restore native plants to approximately 34 acres along more than 18,000 feet of shoreline. A sixth project involved in-stream habitat restoration. Other pollution was addressed over many years by several partners through efforts including wastewater treatment plant upgrades, agricultural practices to reduce soil erosion and runoff, and reduced phosphorus content in detergents and lawn fertilizer.

Following these projects, the DNR and others are monitoring to verify that the ecosystem is recovering as hoped, and the signs so far are promising. Scientists studied fish, aquatic insects, nesting birds, waterfowl, tree swallows, bats, mussels, herptiles and mink. Results show that the system is overall doing better than before, although fish tissue sampling has shown that more time is needed for the ecosystem to recover because of the persistence of PCBs in fish tissues.

Additional restoration activities are happening through the Natural Resource Damage Assessment (NRDA) process which provides funding to compensate the public for the injury to natural resources from the pollution associated with Superfund sites. Projects will restore habitat and improve fish passage between Lake Michigan



and spawning habitat; other projects will improve recreational access. The NRDA funds provide an opportunity to go above and beyond the AOC restoration work.

While the ecosystem continues to recover, economic revitalization is occurring as well. A 2018 case study published by the Great Lakes Commission and the Council of Great Lakes Industries documents how City of Sheboygan and Sheboygan County officials are capitalizing on a cleaner river to bring new residential development and business to the river corridor. The study reported that “new housing developments have proliferated along Sheboygan’s waterfront, representing an investment of \$37 million.” Local officials also reported greater water-based recreation and increasing numbers of millennials residing in the city and county since the AOC projects were completed.

This study shows that people are reconnecting with the Sheboygan River and harbor now that the burden of toxic sediments has been cleaned up. Removing the historical pollution has improved water quality and is helping these waters and their inhabitants to heal. With continued restoration through NRDA projects, monitoring to assess if AOC goals have been achieved and local leadership for continued revitalization of the waterfront, the Sheboygan River has a bright future.

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Renard Island is one of few places in the Green Bay metropolitan area that provides direct access to the waters of the bay.

RENARD ISLAND MASTER PLAN

Mark Walter

Just 800 feet off the shoreline of the City of Green Bay sits a manmade island waiting to become a place for the public to use and enjoy. The island, now known as Renard Island, was created in 1977 through a partnership between Brown County, the Port of Green Bay (Port) and the US Army Corps of Engineers (Corps) as a 55-acre dredged material disposal facility. Renard Island sits on a legislative lakebed granted by the State of Wisconsin to Brown County for disposal of material dredged from the annual maintenance of the Green Bay Harbor and navigation channel.

From 1979 to 1996, the island was filled with more than 2.7 million cubic yards of PCB-contaminated dredge material but remained uncapped. In 2002, the Port received funding from the Wisconsin Coastal Management Program (WCMP) to develop a Closure Plan for the island. Eventually, the Port, Corps and Wisconsin Department of Natural Resources (WDNR) agreed to a plan detailing construction of a cover to protect human health and the environment.

Beginning in 2010, the Port and Corps began the process of closing the island and installing an engineered soil cap. As part of the closure process, the Corps built a causeway to access the island. In 2010, Brown County received a Great Lakes Restoration Initiative grant to begin capping the island and moving capping material from the Port's Bay Port Dredge Material Storage Facility to Renard Island. From 2011 to 2014, clean dredged material was placed on the island as a

final cap shaped to meet the requirements of the approved Closure Plan. In 2015, the WDNR approved the final cap and in 2017 the Corps transferred ownership of the causeway and island to Brown County.

Upon receiving ownership, the County began to look at end-use options for public enjoyment of the island. In 2016, the Port convened the Renard Island Working Group of stakeholders including Brown County, the City of Green Bay, WDNR, the University of Wisconsin-Green Bay, adjacent landowners, agencies and other interested individuals to examine options for developing Renard Island. In 2018, the Port received a WCMP grant with matching funds provided by McDonald Lumber, NEW Water and WPS to complete an End-Use Plan.

The Port subsequently hired a consultant to work with the Renard Island Working Group to guide the development of a strategic master plan. The Working Group provided input on the development of the plan, reviewed draft materials and advised the Port throughout the planning process. The consultant conducted a market feasibility analysis, estimated capital and operating costs, undertook a construction feasibility and permitting analysis, and examined funding opportunities and other key considerations. After more than eighteen months of work and numerous public meetings, the Brown County Board adopted the final Renard Island Strategic Master Plan on December 18, 2019.

Renard Island offers a unique opportunity for public access that is missing in the Green Bay area. The island is one of the only places in the Green Bay metropolitan area that provides direct access to the waters of the bay. With this idea in mind, the Renard Island Strategic Master Plan includes designs for small projects that will provide access to the bay and can be implemented over time. The design includes a mix of recreational amenities such as fishing piers, recreational trails and viewing areas as well as connections to nearby Bay Beach Amusement Park.

Three master plan alternatives were developed during the planning process. First, Eco Island focused on creating a series of natural habitats on the island and its shoreline for visitors to passively observe and enjoy. Exploration Island introduced a variety of destination spaces nestled into rolling landforms. Finally, Active Island featured a marina and retail/concessions facilities intended to complement the amusement theme at the adjacent Bay Beach Amusement Park and draw visitors to the island as an active waterfront destination unique to the Green Bay area.

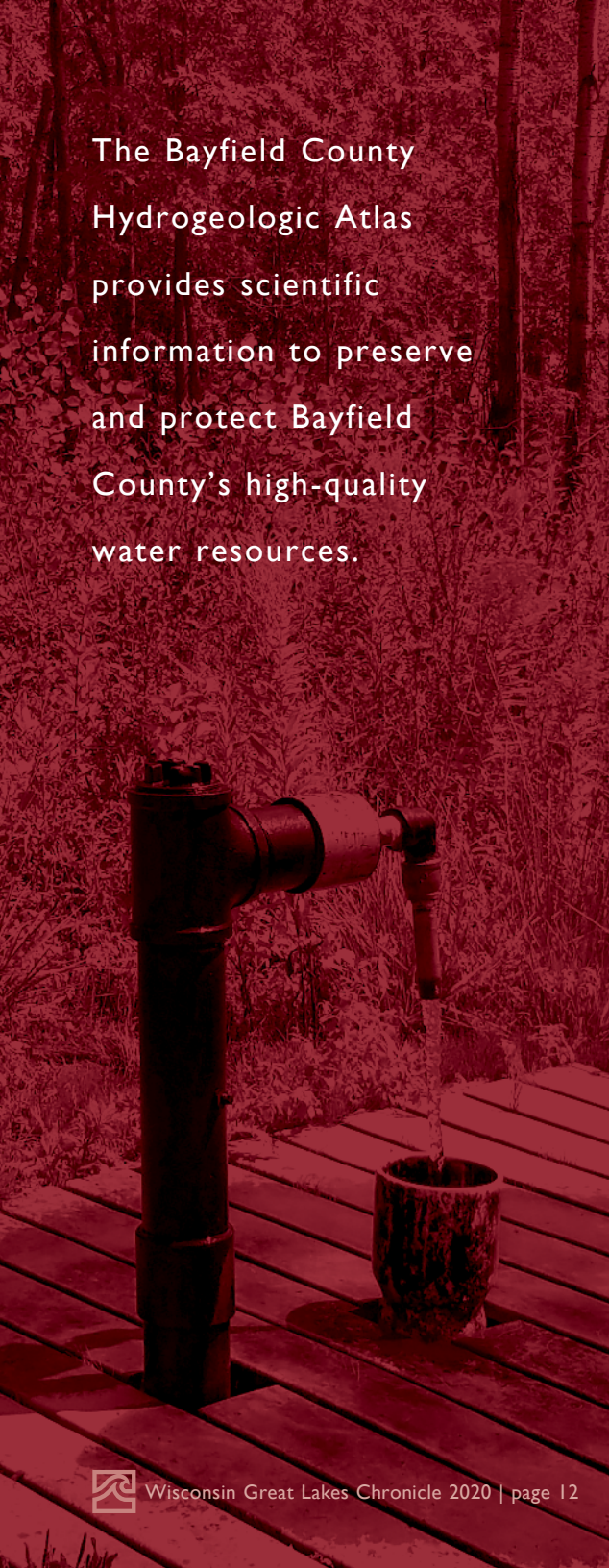
The final Renard Island Strategic Master Plan is a combination of the three alternatives and has something for everyone. A marina will offer transient dockage and seasonal slips. A promenade will feature shops, dining, concessions and a festival plaza space. The causeway will be improved and a surface lot will provide 300 parking spaces. Visitors will enjoy sculpted landforms, an interpretive overlook and tower, and fishing piers. Cobble habitat beaches and a sand beach for boat tie-ups and dog access will provide access to the water's edge.

Walkers will appreciate boardwalks, paved multi-use trails, primitive trails, a perimeter loop trail and winding trails. Softened edges and stepped stone revetment areas will provide water access and viewing. Programming will be offered in an open lawn space, and visitors will reserve picnic shelters and yurt camping facilities. Children of all ages will enjoy an adventure playground with zip-line.

The plan will act as a framework to help guide and identify future improvements on Renard Island. Implementation of the master plan will require significant funding and lots of community support over the coming years. The island's potential is just waiting to be realized.

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The Bayfield County Hydrogeologic Atlas provides scientific information to preserve and protect Bayfield County's high-quality water resources.

BAYFIELD COUNTY HYDROGEOLOGIC ATLAS

Mark Abeles-Allison

Bordering one of the largest freshwater lakes in the world, Bayfield County shares over 90 miles of Lake Superior shoreline with 966 inland lakes. Protection of water resources and quality are top priorities in Bayfield County where water impacts lives in profound ways.

Water quality and water resources saw a new focus in 2014 as large-scale concentrated animal farming was considered. There was a lot of discussion and debate about the economic impacts of a proposed large pig farm and how it would change the rural character of the county which is heavily dependent on tourism. People also discussed and debated concerns about the impacts to the environment and human health. With a population density of ten people per square mile, Bayfield County has 15,000 year-round residents on 1,500 square miles of land. Second homes, tourism and forestry are key economic drivers in Bayfield County.

The concentrated farming proposal prompted a moratorium on large-scale livestock facilities and the establishment of a Large-Scale Livestock Committee in June 2015. The Committee was charged with researching, analyzing and synthesizing scientific literature regarding the impact of large-scale livestock facilities on groundwater, surface water and air quality in Bayfield County. Further, the Committee was directed to report its recommendations on appropriate county-level regulatory approaches to the County Board.

Under the leadership of Fred Strand, Bayfield County Vice Chair, the Committee recognized the local economic and cultural importance of agriculture and was guided by the goals of having a thriving agricultural community and maintaining public health and safety and a healthy environment. The Committee organized its work around four primary issues: groundwater, surface water, microbiology, and air quality.

Over nine months, the Committee heard from seventeen professionals working in the field of livestock agriculture including researchers from the University of Wisconsin, the Wisconsin Geological and Natural History Survey, and the US Department of Agriculture. The Bayfield County Board of Supervisors adopted the Committee's findings of fact and recommendations, including:

- Implement a well-testing program to encourage well testing and repair.
- Establish a County-maintained database with well-drilling records and water test information.
- Develop a depth-to-bedrock map for Bayfield County to identify areas with less than twenty feet of soil to the bedrock.
- Analyze all known well-drilling records to identify wells with less than twenty feet of silty-clay till over water-bearing sand and gravel deposits.
- Develop a groundwater susceptibility map for Bayfield County to identify areas that have increased susceptibility to groundwater contamination.

- Identify abandoned wells and rate the risk to groundwater or identify fields with highest likelihood of groundwater contamination and look for abandoned and existing wells first.
- Utilize groundwater flow maps and groundwater susceptibility mapping to design groundwater monitoring programs for sited livestock facilities.
- Consider risk management strategy options as a condition of a permit issued

These recommendations were the pre-cursor to the Bayfield County Hydrogeologic Atlas project, a cooperative effort between Bayfield County, the Wisconsin Coastal Management Program (WCMP) and the Wisconsin Geological and Natural History Survey. UW-Madison Extension, Land Records, Public Health and Administration Departments were actively involved within Bayfield County.

This Hydrogeologic Atlas project took place over five years in three phases. In 2015 and 2016, work focused on hydrogeologic cross sections and water table elevation maps in agricultural regions of Bayfield County. Work on a countywide well database, water well construction analysis and a water table elevation map was completed in 2017. The last phase began in 2018 and focused on developing a Groundwater Susceptibility Map unique to Bayfield County. Final maps for the susceptibility composite map were delivered in 2019 and are currently on display in the Courthouse main corridor.



Bayfield County maps were compiled utilizing data developed over the term of the project. Several different maps provided the base for the susceptibility map. A depth to bedrock map characterizes the depth and thickness of aquifers. A depth to water table map shows depths in increments to more than 150 feet below the surface. The groundwater recharge map, developed with soil and land use maps and rainfall and temperature records, shows estimates of the rate of groundwater replenishment across Bayfield County.

Synthesized together, these maps create the Bayfield County Groundwater Susceptibility map illustrating areas of the county where groundwater is naturally well-protected from contamination and areas that are more susceptible to contamination. Shallow depth to bedrock, shallow depth to water, and high groundwater recharge all increase the susceptibility of an aquifer to groundwater contamination. These conditions increase the ease with which contaminants at the surface can reach the water table.

The Susceptibility Map shows areas of highest susceptibility in the sandy uplands where coarse sediments drive rapid groundwater recharge, and near the Lake Superior shore and in southern Bayfield County where shallow fractured bedrock is present. The final project document, the Bayfield County Hydrogeologic Atlas, can be viewed at <https://wgnhs.wisc.edu/pubs/000967>.

This project was made possible with funds from Wisconsin Coastal Management, the Wisconsin Department of Natural Resources and Bayfield County. Locally, the Bayfield County Land Records Office and the Bayfield County Health Department partnered to make this project happen. The Bayfield County Hydrogeologic Atlas provides scientific information to property owners and community planners so Bayfield County's high-quality water resources can be preserved and protected.

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The outsized economic impact of outdoor recreation is possible because Wisconsin cares for and invests in its treasured freshwater assets.

OFFICE OF OUTDOOR RECREATION

Mary Monroe Brown

The Great Lakes and outdoor recreation have long-standing partnerships in boating, fishing and swimming. Water-based activities are one of the most popular recreation activities for Wisconsinites with 49% reporting participation in fishing and more than half reporting participation in boating or swimming, according to the 2019 Statewide Comprehensive Outdoor Recreation Plan.

With 1,000 miles of freshwater coast in Wisconsin, the Great Lakes are immediately accessible to half of the state population that lives within their basin. Population centers also boast some major tourist attractions, both natural and man-made. Port cities have long been a hub of commerce and manufacturing from charter fishing to shipbuilding. Ten state parks, a National Scenic trailhead and numerous wildlife and natural areas preserve the beauty of these freshwater wonders. These facets, in addition to activities like boating, fishing and swimming, are each a piece of the outdoor recreation economy in which Wisconsin is positioned to grow.

In 2019, Wisconsin's Office of Outdoor Recreation was established to do just that. An emerging trend across the nation, Wisconsin's was the fourteenth of seventeen state outdoor recreation offices created to date. Underscoring the importance of the state's plentiful natural assets, outdoor recreation in Wisconsin contributes \$7.8 billion to the state's gross domestic product and supports

over 93,000 jobs that provide nearly \$3.9 billion in wages and salaries, according to the US Bureau of Economic Analysis.

While each office is unique in its structure, Wisconsin's office seeks to create alignment and collaboration among a vast and diversified list of stakeholders. A shared mission to support and uplift the outdoor recreation industry and its partners for the economic and overall well-being of Wisconsin and its residents is envisioned through the Office's four tenets: Invite, Connect, Thrive and Protect.

Invite residents, visitors, businesses and workforce talent to live, work and play in Wisconsin—to experience the state's natural places and vast outdoor recreation offerings—to stimulate economic development.

Connect people to Wisconsin's natural places and outdoor recreation opportunities through access and education with a focus on inclusion.

Thrive when active lifestyles and outdoor recreation are promoted to create healthy individuals and communities and provide additional economic impacts in the health sector.

Protect Wisconsin's invaluable natural assets by encouraging outdoor recreation and connection to place, necessary elements in the journey to preserving healthy lands and waters through personal stewardship.

Lake Michigan, Lake Superior and the communities along their shores are unquestionably key areas prime to play a role and reap the benefits of an expanded outdoor industry.

Before the COVID-19 pandemic, the national gross domestic product (GDP) of outdoor recreation was outpacing other major industries like motor vehicles and pharmaceuticals. That 2017 study by the US Bureau for Economic Analysis also showed the industry grew faster than the general economy, and the same was true for Wisconsin at the state level.

Wisconsin's Department of Natural Resources states annual sport fishing on Lakes Michigan and Superior attract 250,000 anglers who bring in \$252 million to Wisconsin's economy. Last year, over 184,000 people visited Lake Superior's

Apostle Islands National Lakeshore according to the National Park Service. These freshwater assets are the foundation of the \$3 billion tourism industry of lakeshore counties.

While it is unknown what a post-pandemic economy will look like, one thing has become increasingly clear: Getting outside has never felt so important to so many people. During the COVID-19 closures, the outdoors remained essential. In record numbers, people were outside on walks, at parks, on bike rides or playing with their children. The Outdoor Industry Association stated in April, "If the last month is any indication of Americans' continued or renewed desire to get outside, we know that having places to recreate or find solace resonates deeply across the country." We feel the same holds true for Wisconsinites.

As we build out the Office during this uncertain time, it is exceptionally clear that a strong outdoor recreation economy will have a breadth of benefits for Wisconsin. While revenue is part of the picture, the ability to get residents and visitors outside is at the heart of our mission.

Perhaps a reflection for our work and our aspirations to partner with the Great Lakes, this interpretation of famed conservationist Aldo Leopold's thoughts by his biographer Curt Miene is fitting: "Water is not just an economic commodity, it is a necessity, and it involves ethical discussions of our relation to each other, to other species, and to future generations. Water responds to what we do. It reflects who we are, and what we prioritize."

The Great Lakes have long been a part of Wisconsin's outdoor story. The outsized economic impact of outdoor recreation in their lakeshore communities is only possible because Wisconsin cares for and invests in these treasured freshwater assets.

In the coming months, Wisconsin's Office of Outdoor Recreation looks forward to working with partners, stakeholders and the public to define the priorities that will be in service to growing a more resilient, inclusive and creative outdoor recreation economy around all of Wisconsin's outdoor assets.

Mary Monroe Brown is Director of the Wisconsin Department of Tourism Office of Outdoor Recreation. She can be reached at (608) 261-0341 or mmonroebrown@travelwisconsin.com.





2020 WISCONSIN COASTAL MANAGEMENT PROGRAM GRANTS

Project Name

Grantee

WCMP Award

Project Description

Contact

Coastwide

Regional Natural Areas and Critical Species Habitat Plan

Southeastern Wisconsin Regional Planning Commission

\$40,000

Update inventory of natural areas sites used by municipalities, government and conservation organizations.

Dr. Thomas S. Slawski, (262) 547-6721

Hazards Fellowship

UW Sea Grant Institute/UW Board of Regents

\$39,000

Support a one-year fellowship tackling science and policy challenges to increase coastal community resilience across the Great Lakes region.

Dr. Jennifer Hauxwell, (608) 263-4756

Wisconsin Harbor Town Travel Guide Project

Wisconsin Harbor Towns Association

\$30,000

Develop, update and print copies of a new Wisconsin Harbor Town Travel Guide to connect tourists with Wisconsin coastal communities and resources.

Mr. Jason Ring, (920) 686-3070

Northeast Coastal Resiliency Study

Bay-Lake Regional Planning Commission

\$29,851

Implement the first of a two-phase project to address coastal resiliency for three communities in the Bay-Lake Region.

Mr. Brandon Robinson, (920) 448-2820

Delivering Our Collective Messaging for a Healthy Lake Michigan

Lakeshore Natural Resource Partnership

\$27,500

Complete a water quality and Great Lakes literacy messaging campaign to raise awareness about storm water and nonpoint pollution.

Mr. Tom Mlada, (262) 573-8736

Technical Assistance

Northwest Regional Planning Commission

\$20,000

Support coastal management activities and technical assistance to local governments in the Lake Superior region.

Mr. Jason Laumann, (715) 635-2197

Technical Assistance

Bay-Lake Regional Planning Commission

\$20,000

Support coastal management activities and technical assistance to local governments in the Bay-Lake region.

Mr. Brandon Robinson, (920) 448-2820

Technical Assistance

Southeastern Wisconsin Regional Planning Commission

\$20,000

Support coastal management activities and technical assistance to local governments in the Southeast region.

Dr. Thomas Slawski, (262) 547-6721

Ashland County

Chequamegon Bay Cyanobacteria

Northland College

\$59,667

Implement Phase II of an experimental approach to identify sources of viable cyanobacteria propagules and conditions that lead to cyanobacteria blooms.

Mr. Matt Hudson, (715) 682-1481

Flood Risk Assessment and Mitigation

University of Wisconsin-Madison

\$52,647

Create a building inventory for northern Ashland County to help develop better flood mitigation plans.

Dr. Howard Veregin, (608) 262-6852

Kreher Park Public Access

City of Ashland

\$29,268

Redevelop the former Northern States Power Superfund site into a public multi-use recreational space for boaters, fisherman, tourists and the community.

Ms. Sara Hudson, (715) 685-1644

Unified Development Ordinance and Zoning Updates

City of Ashland

\$15,000

Update the Unified Development Ordinance and implement zoning changes within the waterfront area to provide coastal resource protection and water quality.

Ms. Megan McBride, (715) 682-7041

Bayfield County

Outdoor Recreation and Coastal Resources Planning

City of Washburn

\$26,880

Update the Comprehensive Plan and develop an Outdoor Recreation Plan.

Mr. Tony Janisch, (715) 373-6160

Restoring Habitat Along Washburn's Lakeshore

City of Washburn

\$15,750

Restore habitat through invasive species removal and control, native plantings, and trail infrastructure.

Mr. Tony Janisch (717) 373-6160

Brown County

East River Watershed Resiliency

NEW Water

\$52,120

Develop a flood study, community of practice and community-based watershed resilience framework for the East River Watershed.

Ms. Angela Kowalzek-Adrians, (920) 438-1072

Mueller Park Fishing and Boating Project

Village of Wrightstown

\$41,182

Construct a fishing pier/platform, sidewalk, kayak launch and expand parking.

Mr. Travis Coenen, (920) 532-5567

Coastal Flooding Pre-Disaster Mitigation Planning

Brown County

\$29,994

Work with five communities along the Bay of Green Bay to develop a coastal flooding pre-disaster mitigation plan and incorporate new FEMA data.

Mr. Devin Yoder, (920) 448-6488

ADA Accessible Kayak Launches

Village of Allouez

\$28,650

Install two ADA accessible kayak/canoe launches and docks on the East and Fox Rivers.

Mr. Chris Clark, (920) 448-2800

Cat Island Restoration & Management Plan

University of Wisconsin-Green Bay

\$17,396

Create an adaptable management plan to guide future Cat Island restoration activities.

Ms. Amy Carrozzino-Lyon, (920) 465-5029



Douglas County

Comprehensive Plan Update 2020-2040

City of Superior

\$19,837

Update the City's Comprehensive Plan including coastal resources and hazard mitigation elements.

Mr. Jason Serck, (715) 395-7335

Kenosha County

Kenosha Dunes Groundwater Flow and Coastal Wetlands

University of Wisconsin-Madison

\$29,793

Complete groundwater seepage monitoring, coastal wetland assessment and characterization, education and public outreach for Kenosha Dunes.

Dr. Chin Wu, (608) 263-3078

Prairie Shores Beach Resource Management and Restoration Plan

Village of Pleasant Prairie

\$22,000

Design a shoreline restoration plan, habitat restoration plan and shoreline protection plan for Prairie Shores Beach.

Mr. John Steinbrink, Jr., (262) 694-1403

Kewaunee County

Kewaunee Lakefront Property Acquisition

City of Kewaunee

\$60,000

Acquire part of the Salmon Harbor Marina.

Dr. Fred Schnook, (920) 388-5000

Manitowoc County

All Hands On Deck: Creating an Inclusive Maritime Landscape

Maritime Museum

\$30,000

Increase access to and engagement with our waterways for people with disabilities by reducing cognitive, social and physical engagement barriers.

Ms. Cathy Green, (920) 684-0218

Comprehensive Plan Update

City of Two Rivers

\$26,000

Update the City Comprehensive Plan including a market-based feasibility study.

Mr. Greg Buckley, (920) 793-5532

Manitowoc River Watershed Trail

City of Manitowoc

\$18,000

Develop an inventory, story map and water trail plan for the Manitowoc River.

Mr. Marshall Black, (920) 686-6519

Marinette County

Comprehensive Plan Update

City of Marinette

\$20,500

Build on the City's recent river cleanup with increased emphasis on water levels, coastal hazards, resiliency and sustainability.

Mr. Steve Genisot, (715) 732-5139

Milwaukee County

MPS Schools Green Infrastructure

Milwaukee Public Schools

\$87,500

Develop detailed engineering documents, permitting and designs incorporating green infrastructure practices at five Milwaukee Public School sites.

Dr. Keith Posley, (414) 475-8001

Water Quality in a Coastal Urban Lagoon Environment

Milwaukee County Parks

\$78,022

Build on previous data collection efforts to develop a three to five-year project plan to improve water quality at Veterans Park Lagoon.

Mr. Ramsey Radakovich, (414) 257-4887

2021 Exhibit: Milwaukee's Water History

Milwaukee County Historical Society
\$48,500

Develop a Milwaukee Water History exhibit covering early development, local economy, recreation and preservation efforts.

Ms. Mame McCully, (414) 273-8288

Capital Asset Renewal Plan

Port Milwaukee
\$40,000

Develop a Capital Asset Renewal Plan for Port Milwaukee.

Mr. Larry Sullivan, (414) 286-8139

Future Freshwater Water Champions

Milwaukee Public Schools
\$25,000

Provide water-focused STEAM programming to students at five Milwaukee Public School sites to support connections to the Great Lakes.

Dr. Keith Posley, (414) 475-8001

Water Stories on Climate Change, Tourism and Public Project Collaborations

Reflo
\$25,000

Create and share interactive maps and short videos exploring the themes of climate change, tourism and public project collaborations related to Milwaukee waters.

Mr. Michael Timm, (414) 378-0945

Ozaukee County

Clay Bluffs Cedar Gorge Nature Preserve Acquisition

Ozaukee County Planning and Parks Department
\$125,000

Acquire 61 acres of undeveloped land along the Lake Michigan shoreline in Ozaukee County.

Mr. Andrew Struck (262) 284-8257

Lake Michigan Public Access: Phase II

Ozaukee County Planning and Parks Department
\$60,000

Continue construction of a passive public access to Lake Michigan along the 130-foot-high clay seepage bluff at Virmond County Park.

Mr. Andrew Struck, (242) 238-8275

Heart of the Harbor Pedestrian Plaza

City of Port Washington
\$40,000

Support a joint effort between the City and Port Washington Main Street, Inc. to create a gathering space/plaza connecting the historic downtown and lakefront/marina.

Mr. Rob Vanden Noven, (262) 268-4267

Racine County

Pike River Stream Bank and Riparian Buffer Restoration

Root-Pike Watershed Initiative Network (WIN)
\$31,861

Address the eroding Pike River streambank, remove invasive species and mitigate run-off to improve fishing and paddling areas.

Mr. Dave Giordano, (262) 898-2055

Turtle Creek Riparian Improvements

Root-Pike Watershed Initiative Network (WIN)
\$20,737

Develop construction documents for Turtle Creek streambank stabilization, habitat restoration and invasive species removal.

Mr. Dave Giordano, (262) 898-2055

Sheboygan County

Environmental Education Pilot Program

Visit Sheboygan STEAM, Inc.
\$50,000

Develop and implement an environmental education pilot program at the new STEAM Education Center in Sheboygan.

Dr. Amy Wilson, (920) 395-8709





ACKNOWLEDGMENTS

The Wisconsin Coastal Management Program was established in the Department of Administration (DOA) in 1978 under the Federal Coastal Zone Management Act. The program and its partners work to achieve balance between natural resource preservation and economic development along Wisconsin's Great Lakes coasts. The program thanks its principal federal partner, the National Oceanic and Atmospheric Administration, Office for Coastal Management, for the technical and financial support it provides on behalf of Wisconsin's coastal communities.

Wisconsin Coastal Management Program

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 WISCONSIN COASTAL
MANAGEMENT PROGRAM





Wisconsin Great Lakes Chronicle 2020 is dedicated to the 50th anniversary of the Apostle Islands National Lakeshore. The Apostle Islands National Lakeshore is committed to providing visitors a unique and unforgettable experience through management of natural and cultural resources, wise improvements and enhanced accessibility for all. Signed into law on September 26, 1970 under the leadership of Sen. Gaylord Nelson, the Lakeshore is a gift to the people of Wisconsin and the Great Lakes.