

CASE
STUDY

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A New Day for the River Raisin

A long-term effort to restore the River Raisin in southeast Michigan helps revitalize the City of Monroe, with the area seeing both environmental and economic benefits.

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Restoration of the River Raisin Area of Concern

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Native people called it *Nummasepee* or the *River of Sturgeon*. The French who colonized the area in the late 1600s called it *La Rivière au Raisin* or the *River of Grapes*, in recognition of the trees along the river draped in vines heavy with wild grapes. Today in recognition of this French history, we refer to it as the River Raisin, and hope that someday the sturgeon will return to its waters.

The River Raisin is located in southeast Michigan, with its watershed overlapping five Michigan counties and dipping into a small portion of northern Ohio. Conversely, the boundary of the River Raisin Area of Concern (AOC), the area of the River Raisin most impacted by human-made contaminants, is located entirely within the City of Monroe, Michigan. The AOC boundary is defined as the lower 2.6-mile (4.2-kilometer) stretch of the River Raisin, downstream from Dam No. 6 at Winchester Bridge in the city, extending one-half mile (0.8 kilometer) into Lake Erie following the Federal Navigation Channel and along the nearshore zone of Lake Erie, both north and south, for one mile (one kilometer).

The River Raisin AOC was designated as one of 43 Great Lakes AOCs in 1985 through

the International Joint Commission. These geographic areas have experienced environmental degradation resulting in significant impaired beneficial uses. At that time, the Michigan Department of Natural Resources (MDNR), in cooperation with the U.S. Environmental Protection Agency (USEPA), committed to developing a remedial action plan (RAP) to restore these impaired beneficial uses.

Like in many areas of the Great Lakes, industrial development, including paper mills and automotive manufacturing, left behind a legacy of pollution. The initial River Raisin RAP identified the following problems: heavy metals and polychlorinated biphenyl (PCB) contamination of the sediments and water column; sediment input from nonpoint sources outside of the AOC; and PCB contamination of fish (MDNR 1987). Because of PCB contamination, a fish consumption advisory had been issued by the Michigan Department of Public Health. The fish contamination and consumption advisory and the contamination of river sediments were identified as the primary impaired uses in the AOC, and the 1987 RAP focused on these issues. In all, nine of the possible 14 beneficial use impairments were identified.

RAP Development in the Spirit of Adaptive Management

The initial Stage 1 RAP was originally developed to reach agreement on problem definition, including use impairments, and causes. It was completed in 1987. In the spirit of adaptive management, where assessments are made, priorities set, and action taken in an iterative fashion for continuous improvement, the RAP was updated periodically (Table 1). The RAP process placed a high priority on implementing concurrently both necessary studies and remedial and preventive actions. Actions to restore impaired beneficial uses have always been paramount. To ensure local ownership of the RAP, the MDNR and the Michigan Department of Environmental Quality (MDEQ) have organized many public meetings, helped organize a River Raisin Public Advisory Council, and worked with the River Raisin Watershed Council, the City of Monroe, and many others.

Municipal Wastewater Treatment

The Monroe Metropolitan Wastewater Treatment Plant (WWTP) is a publicly owned treatment works dedicated to providing the efficient transportation and treatment of wastewater from the Monroe Metropolitan Area. The plant provides activated-sludge, secondary treatment to all wastewater to degrade all organics and remove nutrients. In the spirit of continuous improvement to protect the environment, the WWTP has gone through four major phases of updates to the facility and collection system at a cost of more than \$55 million. The goals of these improvements were to improve system reliability, reduce collection system inflow and infiltration, reduce high energy costs, and maintain sewer rates, while eliminating sanitary sewer overflows and bypasses that can contribute to environmental problems like elevated phosphorus discharges and algal blooms.

Phase 1 was completed in 2010 and cost \$12.5 million. The project primarily included plant equipment replacement.

Phase 2 was a state-mandated improvement that cost \$9 million. This project was completed in 2013 and included construction of a building addition to house new switchgear, a standby generator capable of running the whole plant, and a new Supervisory Control and Data Acquisition (SCADA) control room. Other improvements included dual motor control centers and dual

YEAR	ACTIVITY
1985	Commitment by Michigan and USEPA to develop and implement a RAP for River Raisin
1987	Stage 1 RAP Completed
1998	River assessment conducted
2002	RAP Update published
2003-2004	MDEQ and USEPA conduct post-navigational dredging study
2004	Coastal Zone Management grant awarded to Monroe for field assessment
2005-2006	PCB sludge excavated from Lagoon 1 and adjacent area, and properly disposed
2006	RAP Update published
2006	Monroe's Commission on the Environment and Water Quality established
2009	RAP Update published
2010	MDEQ released updated guidance for delisting AOCs
2012	Stage 2 RAP published <i>Degradation of aesthetics</i> removed as an impaired use
2012	North River Raisin Wetland Enhancements
2012	Sterling Island Habitat Restoration
2012-2013	Low Head Dam Improvements
2013	<i>Eutrophication or undesirable algae</i> and <i>beach closings</i> removed as impaired uses
2015	Ford Marsh Restoration Project
2015	<i>Loss of fish and wildlife habitat</i> and <i>degradation of fish and wildlife populations</i> beneficial uses restored
2016	PCB Contaminated Sediment Remediation Project completed
2016	All remedial actions identified for use restoration in the RAP implemented

Table 1. A chronology of RAP activities to restore impaired beneficial uses in the River Raisin AOC.

power feeds to critical equipment to meet the USEPA's reliability guidelines, site fencing, site access improvements, site lighting, electrical and instrumentation work for installation of a SCADA system for process control, and monitoring.

Phase 3 was completed in 2014 at a cost of \$18 million in response to another state mandate. These improvements included a new 7-million-gallon retention basin and a 16-million-gallon-per-day wet weather pumping facility and related wet weather appurtenances. The retention basin included a new wet well/dry well pumping facility for flushing and dewatering the basin. Phase 3 also included the rehabilitation of 500 manholes in the collection system. This not only extended the life of the manholes, but also reduced inflow and infiltration during wet weather events. By reducing inflow and infiltration, the plant not only improved plant and collection system flow capacity, it also reduced operational costs through more efficient equipment that resulted in lower sewer rates.

Phase 4 upgraded several remaining critical components such as the failing dewatering system, aging pumping stations, and the heating system dating back to the 1930s. A comprehensive self-funded \$10.4 million program with more than \$355,000 in energy and operational savings, as well as anticipated \$53,000 in energy optimization incentives, was completed in 2016. The culmination of this collaboration addressed many of the plant's critical infrastructure needs, all without an associated rate increase. A cost-effective funding mechanism using an

Energy Saving Performance Contract, paid for by low-interest Qualified Energy Conservation Bonds, was used. Upgrades included the sludge dewatering system, heating system rehabilitation, settled wastewater pumps, two lift station rehabilitations, lighting and occupancy controls, power factor correction, UV disinfection, and cover and facility weatherproofing.

Other collection system improvements, like lining of sewers, were also made since 2001 at a cost of approximately \$5.5 million. Lining extends the service life of existing sewers, reduces inflow and infiltration, and reduces tree-root intrusion, which can cause collection system backups.

Ongoing studies and future projects will continue the goal of eliminating sanitary sewer overflows and bypasses that can contribute to environmental problems.

Contaminated Sediment Remediation

The River Raisin AOC was originally designated an AOC in 1985, primarily due to PCBs in sediments (Table 1). In 1997, Ford Motor Company removed 20,000 m³ of highly PCB-contaminated sediment from the AOC, under USEPA order at a cost of \$6 million. From



Contaminated sediment remediation in the lower River Raisin. Credit: USEPA.

1998-2002, USEPA and MDEQ performed post-remediation sediment monitoring, finding that high levels of PCBs remained in both the sediments and in fish tissue. PCB contamination of the sediments is responsible for four of the beneficial use impairments: degradation of benthos, restrictions on fish and wildlife consumption, bird or animal deformities or reproductive problems, and restrictions on dredging activities.

In 2012, the U.S. Army Corps of Engineers performed a strategic navigational dredging project that removed 52,750 m³ of PCB-contaminated sediment at a cost of \$800,000. Additional sediment remediation took place in 2012-2013 and 2016 under the Great Lakes Legacy Act (GLLA), in partnership with Ford Motor Company and MDEQ. Methods employed included mechanical dredging, hydraulic dredging, and capping. In total, 95,350 m³ of PCB-contaminated sediment were removed and disposed (completed in 2016) at a cost of \$36.3 million. MDEQ and Ford provided cash and in-kind services of more than \$15.4 million under the GLLA cost-sharing agreement. The contaminated sediment was transported to a disposal facility certified to handle contaminated material in Wayne County, Michigan. Partners in the project included USEPA, MDEQ, and Ford Motor Company.

Monitoring studies of the benthic conditions are now underway to determine the efficacy of the 2016 contaminated sediment remediation and the related ecosystem response.

Habitat

Considerable loss of fish and wildlife habitat has occurred within the boundary of the River Raisin AOC. Prior to 1946, this area was renowned for the hunting and fishing opportunities it had to offer. Once covered with mature hardwood forests and wetlands, the area was mostly cleared or filled and now supports a mixture of urban, suburban, and agricultural land uses (MDNR 1987). To restore some of the habitat that had been lost over the last century, numerous habitat restoration

projects have been implemented, including dam removal or retrofitting to support upstream fish migration (Table 2). In total, more than 300 acres (121 hectares) of aquatic habitat have been restored and an additional 23 miles (36.8 kilometers) of the River Raisin have been opened to fish migration and spawning.



Restored fish habitat in the lower River Raisin in Monroe, Michigan. Credit: Melanie Foose.

HABITAT PROJECT	BRIEF DESCRIPTION	DATE COMPLETED	COST
North River Raisin Wetland Enhancements	Lakeplain prairie restoration, shallow water marsh restoration, Hunt Club Marsh restoration, and Union Camp Marsh restoration (383 acres, or 155 hectares).	2012	\$2.978 million
Sterling Island Habitat Restoration	Stabilized shoreline and enhanced habitat.	2012	\$480,000
Low Head Dam Improvements	This project created gently sloping fish ladders and small boat access passage from Lake Erie to approximately 23 miles (37 kilometers) of the lower river. Phase I included modification of four low head dams downstream in Monroe and opened 3.5 miles (5.6 kilometers) of river channel for passage. Phase II added 19.5 miles (31 kilometers) of accessible river channel upstream to Dundee.	2012-2013	\$3.064 million
River Raisin AOC Aquatic Habitat Evaluation	MDNR mapped wetland habitat types in the areas north of the River Raisin. The goal was to identify, evaluate, and prioritize the remaining aquatic habitat within and immediately adjacent to the AOC for preservation through land acquisition, conservation easements, development agreements, or other mechanisms.	2011	\$72,000
Ford Marsh Restoration Project	Ford Marsh is part of the Detroit River International Wildlife Refuge. The marsh is located north of the River Raisin along the shoreline of Lake Erie. This project installed a water control structure to be able to manage water levels in support of restoration of 175 acres (71 hectares) of palustrine emergent wetland habitat.	2015	\$340,000
Sullivant's Milkweed Relocation	Sullivant's Milkweed is a state threatened species. In 2014, the MDNR and Michigan Department of Transportation transplanted 1,500 individuals of Sullivant's milkweed into areas of lakeplain prairie at Sterling State Park. These plants provide a vital food and nectar source for the Monarch butterfly.	2014	Not available
Flowering Rush Eradication	Flowering Rush is an invasive species that has formed dense stands within the River Raisin through the City of Monroe. In 2008, the City developed a program called the Flowering Rush Eradication Days (FRED).	Initiated in 2008	Not available

Table 2. A summary of habitat restoration projects implemented in support of removing “loss of fish and wildlife habitat” and “degradation of fish and wildlife populations” as beneficial use impairments.

Preliminary Fishery Assessment

Following the removal of two dams, installation of rock arch ramps at four other dams, and the creation of a bypass channel around the six-foot Veterans Park Dam, studies were performed by the City of Monroe and MDNR to determine how the fish of the River Raisin and Lake Erie were benefiting from these projects. Two seasons of data from fishery assessments show that some fish are using the new fish passage structures to access a longer stretch of the river.

In addition, MDNR's Fisheries Division has also found two species never encountered between the Waterloo and Grape Dams at Raisinville Road: gizzard shad and blackside dace. Of note is the presence of gizzard shad, a migratory species and a strong indication that the Waterloo Dam bypass channel is functioning and providing a means for Great Lakes fish to migrate into the upper River Raisin.

The agency has also reported the presence of logperch and redhorse suckers above the dams, meaning that they are coming from Lake Erie. It also anticipates seeing an increase in some sport fish species that historically were present (e.g., smallmouth bass and northern pike), as well as potential new species moving up the river past the dam sites and becoming available to anglers (e.g., white bass, muskellunge, and possibly walleye). This has the potential to also benefit Lake Erie stocks. Anglers have reported that steelhead numbers have also increased above some of the

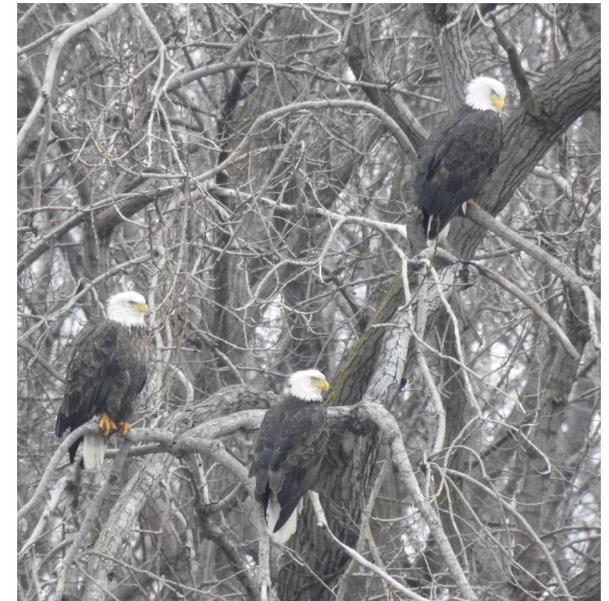
dams in recent years. Monitoring continues to be conducted by MDNR to track the fish community response to these habitat rehabilitation projects. Not only do the fish surveys provide good news for game and non-game fish species, but providing passage around these dams may also eventually positively impact native mussel species now that host fish species have more of the river to inhabit.

Return of Bald Eagles in Monroe County

Persistent toxic substances have impacted bald eagles throughout the Great Lakes region, including within the River Raisin watershed. The U.S. Fish and Wildlife Service (USFWS), MDEQ, and MDNR have been monitoring bald eagles throughout the state for more than 50 years. For 20 years, beginning in the late 1960s, no occupied bald eagle nests were reported in Monroe County (Figure 1). Bald eagle nesting in Monroe County was again documented in 1987 and steadily increased thereafter to the point where 14 occupied nests have been found in recent years (2013, 2014, and 2015). Bald eagle fledging success in Monroe County has shown a similar improvement with 15 or more bald eagles fledging in recent years (2012, 2013, and 2015; Figure 2).

Within the boundary of the AOC, there were three bald eagle nests in 2017. One of them produced three eaglets, while no attempts were made at the other two. However, in 2016, all

three of the nests were productive, resulting in four eaglets. Essential monitoring continues to track status and trends of bald eagles, including reproductive outcomes and contaminant exposures.



Eagle tours sponsored by DTE Energy and Detroit River International Wildlife Refuge at the mouth of the River Raisin. Credit: USFWS.

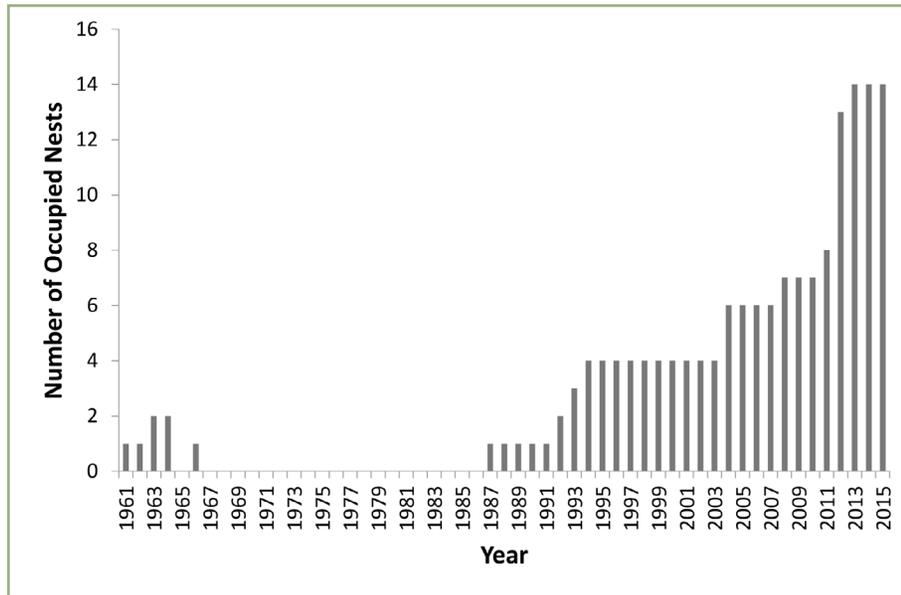


Figure 1. Occupied bald eagle nests per breeding site in Monroe County, Michigan. Data collected by USFWS, MDEQ, and MDNR.

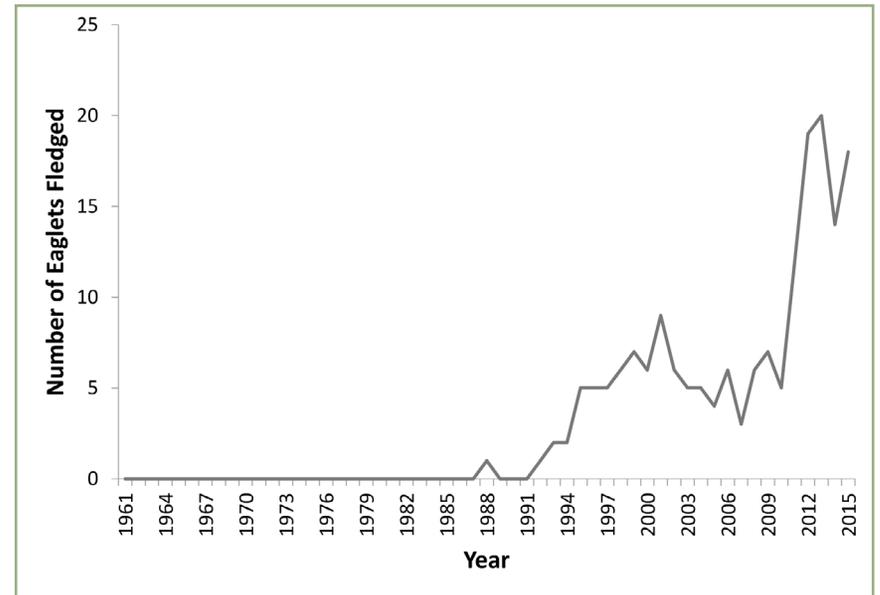


Figure 2. Number of eaglets fledged per year in Monroe County, Michigan, 1961-2015. Data collected by USFWS, MDEQ, and MDNR.

Other Wildlife Studies

In addition to several decades studying bald eagles throughout Michigan, scientists have also been studying a colony of herring gulls that nest at the Monroe Power Plant. Led by Dr. Keith Grasman of Calvin College, these studies began in 2010. Like bald eagles, herring gulls are vulnerable to contaminants in the environment. Unfortunately, productivity of this colony is variable, with some years indicating a stable population and some years showing diminished reproductive success. As only recently has another contaminated sediment remediation project been

completed for the River Raisin, avian studies will continue, and it is hoped that additional improvements in productivity, immune response, and a decline of contaminants in the blood of these animals will be found in the future.

Conclusions

All remedial actions identified for use restoration in the River Raisin RAP have now been implemented. Although these sediment remediation and habitat restoration projects have been completed, it will take time for the ecosystem to respond. Monitoring to

track ecosystem response, and ultimately use restoration, is underway. This significant remediation and restoration accomplished thus far was achieved through the transformative power of collaboration by communities who have worked for decades to reinvent their relationship with their river for a brighter economic, ecological, and recreational future.

In the lower River Raisin, you can now find the River Raisin National Battlefield Park, units of the Detroit River International Wildlife Refuge, Sterling State Park, and numerous trails. The City of Monroe has created a River Raisin Heritage Trail that links downtown Monroe to the National

Battlefield and Sterling State Park, and runs along two units of the Detroit River International Wildlife Refuge.

The River Raisin AOC cleanup provides proof that Great Lakes Restoration Initiative (GLRI) investments are delivering real, on-the-ground and in-the-water results. More than \$43 million in GLRI funding was provided to accelerate implementation of actions to restore the River Raisin AOC. The City of Monroe and its many partners will continue to revitalize this area as an historical, ecological, cultural, and economic destination of choice in southeast Michigan.

Lessons Learned

Work in AOCs is unpredictable. In the River Raisin AOC, a significant sediment remediation project was completed in 2012. Following that project, there was hope that all the contaminated sediments had been successfully remediated. However, upon further investigation and sampling, additional high levels of PCBs were found. In 2017, a second, large-scale sediment remediation project intended to get the last of the very high levels of PCBs in the sediments of the river was completed. Monitoring continues to determine if the PCBs were successfully remediated. The AOC program requires patience and dedication to keep working towards a goal of remediating all contaminated sediments, restoring habitat, and working with all public and private partners for a revitalized waterfront community.

This exercise in patience and dedication begins with the many members of the community who have been working tirelessly since the 1980s when the river was first designated as an AOC. These individuals bring knowledge, history, and compassion in working towards the goal of a cleaner and healthier River Raisin ecosystem. The revitalization of the river could not be accomplished without these individuals.

Another important lesson learned is that the Great Lakes Legacy Act and GLRI were essential in achieving the \$36 million sediment remediation project completed in 2016. The Great Lakes Legacy Act and GLRI were used to leverage cash and in-kind services from MDEQ and Ford Motor Company as part of a cost-sharing agreement. This was a good example of a public-private partnership for significant sediment remediation.

In the River Raisin AOC, there is another level of commitment from the local governmental entity, the City of Monroe. In 2006, the city established the Commission on the Environment and Water Quality (COTE). The River Raisin AOC's Public Advisory Council was then nested under this commission, providing a permanent place for the council and ensuring that its work could continue through the AOC restoration process and for years to come. The work of the COTE includes all the AOC work and much more, including invasive species control of flowering rush in the River Raisin and outreach and education for water quality and other

environmental issues. Eventually, the River Raisin will be delisted as an AOC and when that occurs, the City of Monroe is already equipped to ensure that environmental advocacy projects, education, and even additional restoration already has a place of importance within the city's governmental structure.

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From Cleanup of the River Raisin to Revitalization of Monroe, Michigan

By Scott J. Bentley, Superintendent, River Raisin National Battlefield Park; Mark Cochran, Assistant to the City Manager & Economic Development Coordinator at the City of Monroe; and John H. Hartig, Great Lakes Science-Policy Advisor, International Association for Great Lakes Research

Resilient Monroe

Like many North American cities, Monroe, Michigan, has lost key industries and jobs, but also has unique assets that can be leveraged to create a different and more sustainable economy. Monroe’s master plan, titled “Resilient Monroe,” guides the future growth and development of the city in a fashion that supports resilience; that is, the capacity of a community to withstand and recover from a shock or serious misfortune without permanent disruption. The city’s goal, according to the master plan, is to develop into a vibrant urban center that preserves its history, while welcoming new development.

Key aspects of this plan include leveraging the city’s history and water resources. Monroe has 9 properties listed on the National Register of Historic Places, including three historic districts and six historic sites (Table 1). In addition, Monroe has significant water resources, including the River Raisin and its 1,072-square-mile (2,776-square-kilometer) watershed, and Lake Erie. The River Raisin flows directly through Monroe and empties into western Lake Erie.

Like many cities, for years Monroe turned its back on the river. More recently, the city has been developing trails like the River Raisin Heritage Trail to help improve public access to the waterfront for its citizens and to strategically link community, business, historical, and recreational assets.

The Resilient Monroe plan has prompted improved recreational access to the River Raisin in the downtown area, according to the city, with people clearly enjoying riverfront gathering places with views of the river. To increase recreational opportunities along the river, the Downtown Development Authority has begun looking into ways to extend, increase use, and improve safety and aesthetics of the downtown Riverwalk. According to the latest Parks Master Plan completed in 2017, the city is also planning to invest more than \$3.5 million in two of its riverside parks within the next 10 years: St. Mary’s Park in downtown Monroe and Mill Race Park on the city’s west side. Plans include the installation of nature paths, boardwalks, and a kayak and canoe launch.

Historic Districts
St. Mary’s Church Complex Historic District, built between 1835 and 1839
The East Elm – North Macomb Street Historic District, with houses dating from the 1820s to the 1920s
Old Village Historic District, which was platted in 1817
Historic Sites
Weis Manufacturing Company
Rudolph Nims House
George Armstrong Custer Equestrian Monument (“Sighting the Enemy”)
Governor Robert McClelland House
Sawyer House
River Raisin National Battlefield Park

Table 1. List of sites in Monroe appearing on the National Register of Historic Places.

The city also reports an increase in small-business owners and developers inquiring about property for residential, dining, and retail development opportunities along the riverfront. In 2018, a new restaurant is opening with an outdoor dining patio overlooking the river. Another dining establishment is relocating one block north to be closer to the river, again with a new outdoor patio overlooking the river. Further, existing building owners have improved the outside and rear of their buildings that face the river to help strengthen connections to the river and create a riverfront sense of place.

Monroe has long championed preserving its history and protecting and cleaning up the environment. The community’s response to the 1985 designation of the River Raisin as a Great Lakes Area of Concern serves as an example. Michigan and the federal government committed to development and implementation of a remedial action plan to restore all impaired beneficial uses.

Monroe rose to the challenge and has been actively involved in this cleanup effort for more than 30 years. The community has invested \$45 million to upgrade the Monroe Metropolitan Wastewater Treatment Plant. In addition, \$43.1 million has been spent on contaminated sediment remediation and nearly \$7 million on habitat restoration and dam removal to open the River Raisin an additional 23 miles for fish migration and spawning.

Today, all remedial actions deemed necessary for restoring uses have been implemented and monitoring is underway to confirm use

restoration. Bald eagles have returned to the watershed and the fishery has improved.

River Raisin National Battlefield Park

As part of its revitalization efforts, Monroe championed the establishment of the River Raisin National Battlefield Park (RRNBP) in 2009. The city and Monroe County Historical Society developed the River Raisin Heritage Corridor—East Master Plan (Heritage Master Plan) in partnership with the National Park Service (NPS) for RRNBP to generate a different and sustainable economy for Monroe. This Heritage Master Plan, which complements the city’s master plan, embraces an economic strategy that celebrates the past while leveraging the future. Designed to be transformative, it aims to reinvent Monroe as a national destination on par with Jamestown, Williamsburg, Charleston, Harpers Ferry, and Gettysburg.

Both the Resilient Monroe plan and the Heritage Master Plan view the cleanup and restoration of the River Raisin as an integral part of a vibrant community with a sustainable economy. These two plans work synergistically to better connect Monroe residents and visitors with historical sites like RRNBP; ecological sites like the Detroit River International Wildlife Refuge, Sterling State Park, and other waterfront parks; and business and cultural destinations. Figure 1 is a map of the River Raisin Heritage Trail showing these key linkages.

Economic Benefits

RRNBP is truly unique in that it is the only national park that is adjacent to an international wildlife refuge (i.e., Detroit River International Wildlife Refuge) and a state park (i.e., Sterling State Park). Annual attendance at the battlefield park has steadily increased from 36,206 people in 2011 to 238,813 in 2017 (Table 2). In total, 75.5% of the 2016 visitors were from outside of Monroe County, including 49 states (all but North Dakota) and 20 foreign nations.

YEAR	ATTENDANCE
2011	36,206
2012	50,667
2013	57,464
2014	55,281
2015	109,118
2016	202,375
2017	238,813

Table 2. Park attendance, 2011-2017 (National Park Service, 2018).

Economic benefits of RRNBP have been estimated using three different economic models, including an early National Park Service money generation model developed by Michigan State University (MSU), an improved model developed by MSU and a local economist, and a new Economic Impact Study model developed by National Park Service (Table 3). The range

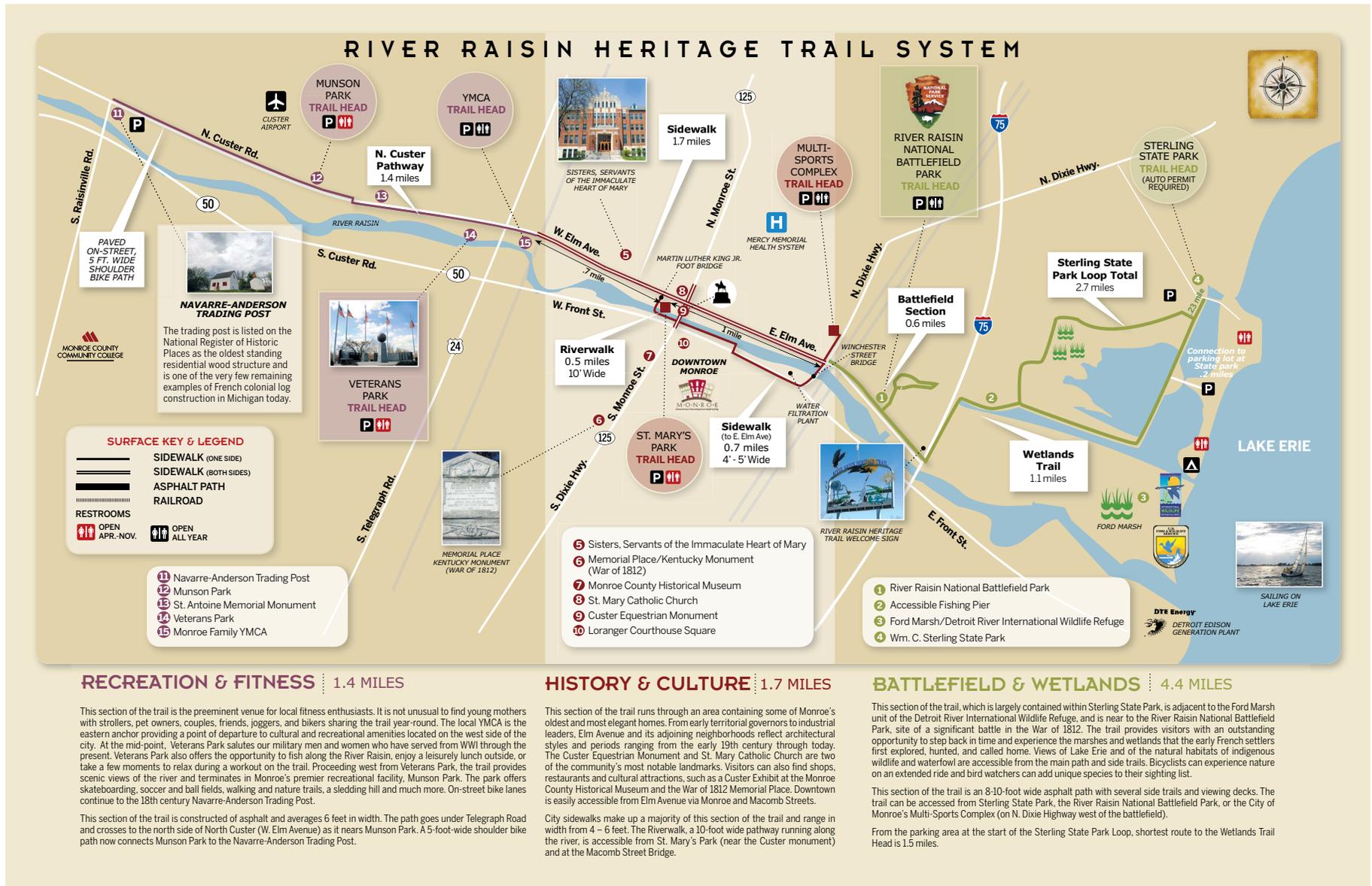


Figure 1. River Raisin Heritage Trail system linking Downtown Monroe with RRNPB, the Detroit River International Wildlife Refuge, Sterling State Park, historic districts and sites, waterfront parks, and cultural destinations.

of estimated economic benefits in 2016, based on the three different models, was \$4.78-\$16.4 million. The National Park Service (2017) Economic Impact Study estimate of \$16.4 million in 2016 is considered the most accurate estimate of economic benefits based on the best available model.

MSU, in partnership with RRNBP, projected that annual attendance will eventually reach approximately 635,000 (Table 3). In total, \$90.4 million will be spent on building and site improvements, and property acquisition. In addition, at this visitation rate the annual state and local economic impact is projected at \$31.6 million and \$21.9 million, respectively (Table 4).

In summary, this integrated approach to protecting the environment, celebrating history, enhancing the community, and furthering the economy is helping redefine Monroe from a Rust Belt city with a polluted river to a desirable urban community with outstanding natural resources, significant historical assets, a national park, an international wildlife refuge, a state park, and a growing, diverse Monroe economy. The cleanup of the River Raisin was an integral and essential part of this revitalization strategy.

MODEL	2011	2012	2013	2014	2015	2016
Griswold Consulting Group, LLC and MSU (2014)	\$1,917,216	\$2,662,729	\$3,029,502	\$2,914,414	\$3,742,224	\$6,005,493
NPS Money Generation Model (MSU, 2017; Stynes et al., 2009; Stynes, 2000)	\$1,527,372	\$2,121,294	\$2,413,488	\$2,321,802	\$2,981,286	\$4,784,346
NPS (2017) Economic Impact Study	No data	\$3,600,000	\$4,100,000	\$4,300,000	\$8,600,000	\$16,400,000

Table 3. Estimates of economic benefits of RRNBP based on three different models.

CATEGORY	AMOUNT
Projected annual visitors	635,000
COST	
Building and site improvements	\$80,924,000
Property acquisition	\$9,493,000
Total	\$90,417,000
IMPACT	
Annual state economic impact	\$31,616,000
Annual local economic impact	\$21,939,977
Jobs (full time equivalents)	303
BREAK EVEN POINT	
Years to recoup cost based on state economic return	2.85
Years to recoup cost based on local economic return	4.12

Table 4. River Raisin Heritage Corridor East Master Plan cost summary.

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*Cover photo courtesy of City of Monroe.
All monetary amounts are in US dollars.*

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The River Raisin case study is part of a larger project to evaluate achievements and lessons learned from 32 years of efforts to clean up Great Lakes AOCs. Case studies will be used to help sustain support for cleaning up AOCs and to inspire and motivate others to restore other degraded aquatic ecosystems.

Funding was provided by the Fred A. and Barbara M. Erb Family Foundation to the International Association for Great Lakes Research, which administers and oversees the project. The Erb Family Foundation is a philanthropic organization that nurtures environmentally healthy and culturally vibrant communities in metro Detroit and supports initiatives to restore the Great Lakes ecosystem.

The International Association for Great Lakes Research is a scientific organization made up of researchers studying the Laurentian Great Lakes, other large lakes of the world, and their watersheds, as well as those with an interest in such research. With its mission to promote all aspects of large lakes research and communicate research findings, IAGLR is uniquely positioned to foster the connection between science and policy, a connection vital for effective management and protection of the world's large lakes.

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