

State of Michigan

Saginaw River/Bay Area of Concern



Background

Saginaw Bay is a southwestern extension of Lake Huron, located in the east central portion of Michigan's lower peninsula. The boundaries of this Area of Concern (AOC) include the entire 35 km length of the Saginaw River and all of Saginaw Bay (2,960 km² or 1,143 square miles) out into its interface with open Lake Huron at an imaginary line drawn between Au Sable Point and Point Aux Barques. Over half of the land use in the region is agricultural. The primary urban and industrial centers are Flint, Saginaw, Bay City and Midland.

The Saginaw Bay Watershed is one of Michigan's most diverse areas—it's rich resources support agriculture, manufacturing, tourism, outdoor recreations, and a vast variety of wildlife. It is also Michigan's largest watershed (8,709 square miles in size) and includes all or part of 22 counties and is America's largest contiguous freshwater coastal wetland system. The watershed drains approximately 15% of Michigan's total land area.

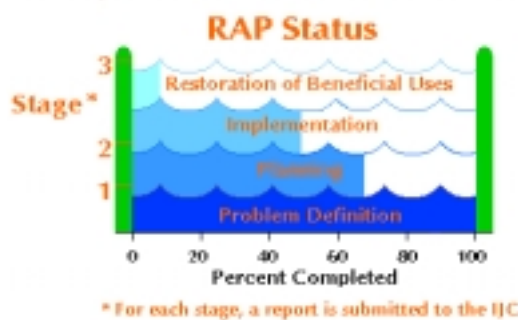
Contaminated sediments, fish consumption advisories, degraded fisheries and loss of significant recreational values are the major reasons for this Area of Concern designation. These problems are mainly caused by high amounts of soil erosion, excessive nutrients such as phosphorus and nitrogen entering the water, and contaminated sediments. Saginaw Bay priorities include remediation of PCB contaminated sediment, nonpoint pollution control, wetland restoration, and habitat restoration.

RAP Status

The Saginaw River/Bay Remedial Action Plan (RAP) process began in July 1986. After several drafts, the initial RAP document was completed in September 1988. Substantial progress has been made since then, with over two-thirds of the actions identified in the 1988 RAP having been implemented. Development of an updated Saginaw River/Bay RAP document occurred in 1994. Meanwhile, extensive efforts continue on the coordination and implementation of ongoing activities and in seeking funding for, and ways to implement, the remaining actions.

The *Measures of Success* report (2001) provides a foundation for redirecting and refocusing efforts. It recommends a list of targeted restored conditions that should be viewed as steps toward delisting of the Saginaw Bay/River AOC.

Preparation of the updated Saginaw River/Bay RAP is being done through the committee structure of the Partnership for the Saginaw Bay Watershed. The bulk of the technical work is being conducted by Public Sector Consultants.



Beneficial Use Impairments

Beneficial use impairments in the Saginaw River/Bay AOC are caused by cultural Eutrophication (nutrients), toxic substances, bacterial contamination, and sedimentation. There are a variety of sources that continue to contribute contaminants to the Saginaw River and Bay, including sediment bedload and transport, industrial and municipal discharges, combined sewer overflows, contaminated sediments in the river and bay bottom, urban and agricultural nonpoint source runoff, old waste disposal sites, and atmospheric deposition.

Restrictions on Fish & Wildlife Consumption:

Saginaw River/Bay watershed is the largest watershed in the state. Waterbodies which presently have fish consumption advisories include: Saginaw River (entire length), Saginaw Bay, Bad River, Caro Impoundment, Caff River, Cheboyganing Creek, Flint River (below Flint), Holloway Reservoir (Genesee Co.), Kawkawlin River, Pine River (Alma Impoundment and downstream of Alma Dam), Sanford Lake (Midland Co.), Shiawassee River (below Owosso, Byron to Owosso, South Branch M-59 to Byron), Tawas River, Thompson Lake (Livingston Co.), Thread Creek, Tittabawassee (below Midland), and Topico Wetland.

Please Note: Since fish advisories change year to year, the Michigan Fish Advisory guide (published annually) should be consulted for restrictions and advisories. Be sure to check for general inland lake mercury advisories.

Degradation of Fish & Wildlife Populations:

Many changes in the fish populations of the bay and river began to occur in the early 1900s. Fish numbers were affected by (1) water pollution, (2) the introduction or invasion of exotic species like carp, rainbow smelt, and (later) alewife, and (3) dams blocking major spawning tributaries in both the Saginaw River watershed and other tributaries to the bay. There is also evidence that excessive commercial harvest exacerbated the drastic decline recorded for several species on into the mid-late 20th century. The total combined commercial fish harvest reported in 1974 of 1.4 million pounds was only 10 percent of the peak catch recorded in 1902.

| Use Impairments -- Saginaw River/Bay AOC | |
|---|---|
| √ Restrictions on fish and wildlife consumption | √ Restrictions on drinking water consumption, or taste and odor |
| √ Degradation of fish and wildlife populations | √ Beach closings |
| √ Bird or animal deformities or reproductive problems | √ Degradation of Aesthetics |
| √ Degradation of benthos | √ Degradation of phytoplankton and zooplankton populations |
| √ Restrictions on dredging activities | |
| √ Eutrophication or undesirable algae | √ Loss of fish and wildlife habitat |

Saginaw Bay historically contained the largest wetland/lake prairie complex in the Great Lakes region. Massive land use changes since the mid-1800s have significantly altered the quantity, diversity, and quality of habitat available to support wildlife. In addition, the manufacture, use and subsequent discharge of persistent toxic chemicals into the waters of the area have had a significant negative impact on the growth and survival of a number of fish-eating wildlife species. Further, habitat has been destroyed through the industrial development along the shorelines of the Saginaw River/Bay and the drainage of wetlands throughout the watershed. Of the estimated 462 km² (115,000 acres) of coastal wetlands that fringed the inner Saginaw Bay prior to settlement, only about 40,000 acres remained as of the early 1970s (Great Lakes Basin Commission, 1975).

Bird or Animal Deformities or Reproductive Problems:

Caspian terns in the bay have had an unusually high incidence of birth defects and poor reproductive success. Additionally, herring gulls have been monitored extensively in the Saginaw River/Bay area because they are year-round residents after reaching breeding age. As a top predator, they readily bioaccumulate organochlorines. Several organic compounds have been detected in eggs of herring gulls at Channel/Shelter Island.

Degradation of Benthos:

Saginaw Bay is a shallow region that once supported a rich riverine invertebrate bottom fauna, but underwent drastic changes in response to increased inputs of pollutants, primarily during the period from 1956 to 1978. High sediment oxygen demands eliminated many species of invertebrates that were replaced by pollution tolerant forms. Hence, the species composition changed from a mesotrophic to a eutrophic assemblage.

Restrictions on Dredging Activities:

PCBs contaminate the sediment in the AOC. Sediment contamination in the river is most significant immediately downstream of Saginaw and Bay City. The most contaminated bay sediments are north of the Saginaw River mouth. These sediments can release toxics and nutrients into the water if disturbed by dredging activities.

Eutrophication or Undesirable Algae:

Nutrient inputs lead to growth of nuisance species, such as blue-green algae, which threaten more desirable species by decreasing dissolved oxygen levels (eutrophication), and thereby alter the aquatic ecosystem.



Since the 1960s, Saginaw Bay waters have contained much higher levels of phosphorus than the remainder of Lake Huron, which has shifted the bay from a mesotrophic (middle of the productivity scale) to a eutrophic (high nutrient level, high productivity) system. When rapid eutrophication occurs, many beneficial uses associated with lower productivity levels are impaired.

During the 1970s and 1980s, the Saginaw River added nearly two metric tons of total phosphorus per day to the bay, the largest contribution of phosphorus to the Great Lakes by any river in Michigan. The added phosphorus increased the growth of nuisance

blue-green algal that was likely responsible for the foul odors and poor taste of drinking water withdrawn from the bay. This added phosphorus is also linked to associated beach closings.

Restrictions on Drinking Water Consumption, or Taste & Odor Problems:

There has been a history of taste and odors in the drinking water taken from Saginaw Bay, with the problem particularly pervasive prior to 1980. The Saginaw/Midland water intake, which accounts for 85 percent of all drinking water taken from the bay, had significant taste and odor problems associated with its water during the 1970s. In the mid-late 1970s, test results at the Saginaw/Midland water intake exceeded the federal threshold odor standard. Water from the Bay City water intake also had severe taste and odor problems.

The serious taste and odor problems associated with water supplies withdrawn from the Saginaw Bay in the 1970s have been traced to two organisms that thrive under nutrient rich conditions: specifically, the blue-green algae aphanizomenon and actinomycetes, a common soil bacteria. High levels of nutrients were recorded in the period from 1974 to 1986. Nuisance algae blooms of the blue-green algae, microcystis, have occurred in the bay since 1994.

Beach Closings

High fecal coliform counts in the Saginaw River has been a major contributing factor to beach closings along the Saginaw River/Bay. The high counts were a direct result of combined sewer overflows (CSOs) in the following municipalities: Bay City, City of Essexville, City of Midland, City of Saginaw, Carrollton Township and Saginaw Township. In addition, the City of Flushing was responsible for untreated sewage discharge to the Flint River during wet weather periods.

Degradation of Aesthetics

Increased biological productivity in the Saginaw Bay during the 1970s and 1980s, primarily due to eutrophication, resulted in an increase in organic debris washing up on area swimming beaches. This consisted of decomposing algae, aquatic plants, and small invertebrate animals. The smell and unsightliness of this beach debris prompted citizen complaints and concern about pollution entering the bay.

Degradation of Phytoplankton and Zooplankton Populations

The phytoplankton flora of the bay, documented in the early 1980s, contained large populations of diatoms and green and blue-green algae, which indicated eutrophic or disturbed conditions. In addition, the seasonal cycle of phytoplankton abundance and major group dominance during the 1980s remained more typical of a hypereutrophic system than of one that was balanced and efficiently productive.

Loss of Fish and Wildlife Habitat

Significant habitat loss and degradation have occurred in the Saginaw River and Bay. Only about 17,800 acres of Saginaw's emergent coastal marsh vegetation remain of the 37,400 acres estimated to have existed prior to European settlement. Other habitat degradation includes the sedimentation of fish spawning reefs in Saginaw Bay, human development of riparian lands along Saginaw Bay and River, removal of bottom substrates by dredging, numerous impacts from exotic species, and anoxic bottom conditions. This habitat loss and degradation has impaired the reproductive success and growth of numerous aquatic and wildlife species.



Progress and Achievements

RAP Milestones:

- 2001: RAP update in progress. Preparation of the updated Saginaw River/Bay RAP is being done through the committee structure of the Partnership for the Saginaw Bay Watershed. The bulk of the technical work is being conducted by Public Sector Consultants.
- 1995: The Remedial Action Plan (RAP) and Updates DRAFT was completed.
- September 1988: *Stage One RAP* document completed.

Other Progress and Achievements:

2001

- The NRDA dredging of PCB contaminated sediments in the Saginaw river was completed.
- In 1998 and again in 2001, Ducks Unlimited received grants of \$774,750 and \$1,000,000, respectively, from the North American Wetlands Conservation Act on behalf of its partners to conserve wetlands and associated habitats in the Saginaw Bay watershed. These funds will be used to focus on protection and restoration of Great Lakes coastal marshes and their associated habitats along the Saginaw Bay shore, expansion of existing state and federal wildlife areas with the restoration of newly acquired lands where possible, and restoration and enhancement of small wetlands and associated uplands on private lands throughout the watershed.

2000

- Preliminary development of the Saginaw River/Bay sustainable *Measures of Success* project was supported by the Watershed Initiative Network (WIN) and the Bay Area Community Foundation. The intent of the *Measures of Success* project is to develop environmentally sound restoration measures that are sensitive to the regional economy and community concerns. It was released in spring 2001.

1999

- Land use planning educational efforts for local official and planners using GIS technology took place.
- Fisheries concerns were addressed by fisheries biologists, wetland specialists and aquatic biologists who met with groups before and during project design.
- Water quality monitoring took place where subwatersheds converge.
- Continued pollution prevention/agricultural projects and educational outreach activities.
- Continued development of projects related to land use issues.
- Developed/distributed public educational materials relating to health and watershed issues.
- Communicated water resource issues to watershed residents.
- Completed enhancement of the area's tourism economy by improving birding opportunities.

Progress and Achievements: (continued)

1998

- The Natural Resources Damage Assessment Settlement (see below for details) for Saginaw River/Bay, resulting in a \$28.2 million settlement of issues regarding contamination of the Saginaw Bay and River, was signed November 24, 1998. The collaborative, innovative settlement will restore, enhance, and preserve the environment and ecology of the Saginaw Bay and River area. (Dredging, a primary component of the program, began in April 2000, and it is expected that implementation of the program will take about six years to complete.)

1995

- Report produced as a result of the joint Michigan DNR, NOAA, and USEPA studies on the Saginaw Bay Ecosystem with respect to zebra mussels.
- A study was conducted and a report made in respect to phosphorus retention of existing and restored wetlands in the Quanicassee River Watershed.
- A draft Biennial Report, Volumes 1 and 2, were completed.
- A second iteration of the Saginaw River/Bay RAP was prepared that describes the actions implemented since 1988; the current environmental status of, and goals for, Saginaw Bay and the watershed; the growth of the Saginaw RAP process; and the additional actions needed to move forward with the RAP effort. This draft 1995 Saginaw River/Bay RAP was developed jointly by numerous governmental agencies (local, state and federal), local governments, public organizations, and business representatives, through the committee structure of the Saginaw Bay National Watershed Initiative. The draft 1995 report focused on land use, nutrients, conventional water quality parameters, soil erosion/sedimentation, and upland habitat. It was envisioned that the 1997 biennial RAP would focus on toxic substances, contaminated sediments, and aquatic habitat.

One objective of the Saginaw River/Bay RAP process is to ensure that the programs and projects undertaken by participants are directed toward actions that will have the greatest benefit within the

watershed. In an effort to better define problem areas and sources of impacts, a subwatershed prioritization process was begun in late 1993. Simply put, the purpose of this process is to evaluate the 69 subwatersheds (into which the basin was divided for this purpose), based on the magnitude of resource impacts and the resource values in the subwatersheds, relative to each other and their impacts on the bay.

The initial subwatershed ratings presented in the draft 1995 RAP are based on technical data (water quality, biological communities,



Using sheet steel to help separate and solidify contaminated sediments is a technique used in the Pine River subwatershed.

hydrology, habitat, land use, etc.). It is envisioned that the technical ratings will eventually be combined with local community uses and goals for each of the subwatersheds. This will help assure that projects are implemented at locations where the actions are consistent with watershed uses and goals, and in areas where there is good likelihood of success for obtaining the desired environmental results.

Other Key Accomplishments:

- As a result of the Saginaw Bay Natural Resources Damage Assessment, about 345,000 cubic yards of contaminated sediments are being removed from five areas in the lower Saginaw River as part of a \$28.2 million natural resources damages settlement with General Motors Corp. and the cities of Bay City and Saginaw in 1998. The sediments, contaminated with polychlorinated biphenyls (PCBs), are being removed in the vicinity of Bay City and Essexville. Approximately 90 percent of the PCBs remaining in the lower river will be removed through this project. The work is expected to significantly reduce the level of PCB contamination associated with the river water and sediments, as well as with aquatic and terrestrial organisms in and around the river and Saginaw Bay. A 15-cubic yard

Photo courtesy Michigan Department of Environmental Quality

capacity environmental clamshell bucket is being used to remove the contaminated sediments for placement on barges.

- Saginaw Bay Natural Resources Damage Assessment provided protection of almost 1,700 acres of coastal wetland along Saginaw Bay and restoration of over 200 acres.
- The USDA and the State of Michigan are implementing a \$177 million Conservation Reserve Enhancement Program (CREP) to improve the water quality of the Saginaw Bay Watershed and many of the streams and rivers that feed into these bodies of water. CREP is a Federal-State conservation partnership program that targets significant environmental effects related to agriculture. It is a voluntary program that uses financial incentives to encourage farmers to enroll in contracts of 10 to 15 years in duration to remove land from agricultural production. The Michigan CREP has been designed to reduce the amount of sediment entering the Saginaw River by over 784,000 metric tons over the next 20 years. CREP will fund filter strips and riparian buffers to be planted next to streams, rivers, and drainage ditches to prevent sediment and pollutants from entering the water bodies. The Federal and state shares are \$142 million and \$35 million, respectively.
- Partnership for the Saginaw Bay Watershed completed a project to establish the criteria necessary to gauge the restoration of the Saginaw River/Bay Area of Concern. Funded by the Saginaw Bay Watershed Initiative Network (WIN) and the Bay Area Community Foundation the *Measures of Success* program established measurable and achievable parameters through the efforts of five separate task forces. The report focuses on the following impairment areas:
 - 1) bacterial contamination (coliform, E. coli, etc.),
 - 2) fisheries and fisheries habitat
 - 3) wildlife and wildlife habitat
 - 4) ecosystem degradation (including degraded benthos, phytoplankton and zooplankton and
 - 5) contaminated sediments.



Saginaw Bay lake sturgeon are successfully reproducing once again.

Targeted Restored Conditions from *Measures of Success: Addressing Environmental Impairments in the Saginaw River and Saginaw Bay*

Bacteria (contamination by microorganisms):

- Three consecutive years of testing for E. coli bacteria, an indicator of harmful microorganisms, confirm that the state water quality standards for full-body recreation are being met in the Saginaw River.
- No more than three swimming beach closures per year lasting no more than two days each on the Saginaw Bay. (Note: this has been achieved at least within Bay County, where routine sampling by the Bay County Health Department has demonstrated bacteria standards for full-body contact recreation are being met.)

Sediment Contamination (restrictions on dredging):

- The level of contaminants in Saginaw River/Bay sediments no longer imposes additional costs due to requirements for the removal, confinement, and remediation of dredge spoils.

Fisheries (habitat, fish populations, contaminant levels, and tainting):

- Dissolved oxygen levels in the river meet the state water quality standard of 5.0 mg/l during summer months.
- Critical coastal marsh areas are adequately protected.
- There is an increase in abundance of walleye in the bay, ultimately through natural reproduction, such that growth rates approximate more closely statewide averages for this species and reflect improved use of available forage in the bay.
- There is a sustained annual harvest of 750,000 pounds of yellow perch per year with increasing abundance of larger, faster growing individuals.
- There is documented evidence of natural reproduction of Lake Sturgeon in the Saginaw River.
- Levels of PCBs, and dioxins in walleye taken from the Saginaw River/Bay are equal to or less than the levels found in comparable fish taken from other areas of the Great Lakes not listed as AOCs.
- PCB and dioxin levels in fish tissues from caged fish studies in the Saginaw and Tittabawassee rivers indicate that former sources of these contaminants have been effectively controlled.

Targeted Restored Conditions: (continued)

Fisheries (continued):

- Taste and odor problems reported by anglers for any species taken from the Tittabawassee River downstream from Midland and the Saginaw River and Saginaw Bay represent less than 1 in 10,000 of the estimated total annual catch for that species for three consecutive years. In addition, no specific sites of fish tainting have been identified that would justify remedial action.

Wildlife (coastal marshes and contaminant levels):

- At least 60 percent of the coastal marsh areas (below the 585-foot contour) and adequate upland buffers representing essential fish and wildlife habitat is preserved through public ownership, covered under conservation easement, or otherwise protected under agreements with landowners.
- The most vulnerable portions of the remaining 40 percent of the essential coastal marsh areas are clearly identified so that governmental agencies, local conservation/environmental organizations, and concerned citizens can monitor their status, enhance enforcement of existing laws, and conduct public education programs to better protect these areas.
- The reproductive success of bald eagles in the Saginaw Bay area is equivalent to that found in other Lake Huron coastal areas in Michigan.
- PCB levels in herring gull eggs taken from Saginaw Bay area nest sites are not significantly higher than those found in other Lake Huron sampling locations.

Bay Ecosystem (eutrophication, benthic community, drinking water supplies):

- The average concentration of total phosphorus is 15 ug/l or less, in accordance with the supplement to Annex 3 of the 1978 Great Lakes Water Quality Agreement.
- Samples of mayfly nymphs collected in the open waters of Saginaw Bay exceeded 30/m² for two consecutive years, based upon established sampling methods.
- The nitrogen/phosphorus (N:P) ratio measured in Saginaw Bay is at least 29:1, indicating that conditions once favoring blue-green algal populations responsible for former taste and odor problems in drinking water withdrawn from the bay are no longer present.

Natural Resource Damages Settlement:

Dredging Project:

345,000 cubic yards of the most contaminated areas of the river are to be dredged. 204,000 cubic yards were dredged in 2000, and the project is scheduled for completion in 2001.

Habitat Protection and Restoration:

Over 1,600 acres have been acquired and are in public ownership, including most of Big and Little Charity Islands. 200-400 acres of coastal wetlands and lakeplain prairie are being restored in 2001-2002.



Green Point Environmental Learning Center:

Two rent-free 99-year leases have been provided to USFWS, including an interpretive center building and 80 acres of riparian and upland habitat. \$520,000 for additional restoration is to be provided in 2003. (Managed by Shiawassee National Wildlife Refuge.)

Tobico Marsh Restoration:

Restoration of water flow between Saginaw Bay and the marsh is being implemented in 2001-2002, and there is an emphasis on restoration of northern pike and yellow perch spawning.

Recreational/Educational Areas:

There are currently three areas with boat launches, nature-viewing opportunities, and interpretive signs. Bay City will operate and maintain two of the areas, and the MDNR will own and operate the third.

Restoration Account:

\$3,000,000 is to be provided to the Trustee Council starting in July of 2004. There is an emphasis on monitoring recovery and implementing additional restoration projects.

Cost Recovery:

Trustees were reimbursed for \$2,000,000 of their assessment costs.

Community Involvement

The Saginaw Bay Watershed Initiative Network (WIN) is a community-based, voluntary initiative that connects people, resources, organizations, and programs. The group works to improve the quality of life in the area by developing projects, supporting related organizations, and developing the region's identity as a sustainable community. WIN's emphasis is on supporting local projects. These projects link economic, environmental and community goals. A key part of the group's mission is to increase communication between existing efforts and to provide appropriate support to help address local priorities and provide regional benefits. The partnership includes communities, conservationists, foundations, and businesses working together to balance the region's economic, environmental, and social goals.



Numerous activities continue to be implemented by local groups. Spearheading these activities is the Partnership for the Saginaw Bay Watershed (PSBW). PSBW is a voluntary, membership-based coalition of public and non-governmental agencies, organizations, and individuals committed to sustaining or restoring the ecology of the Saginaw Bay Watershed, while ensuring economic viability. Toward that end, the Partnership promotes comprehensive resource management and educational services by facilitating inter-governmental coordination and public involvement, conducting studies, formulating public policy recommendations, providing advice to public officials and citizens, and undertaking various programs and projects to restore, protect and enhance Michigan's largest watershed.

In addition, the Partnership for the Saginaw Bay Watershed (PAC) is revitalizing membership to develop a strategic plan for achieving goals starting with bacteria, followed by nutrient loadings, then toxics.

Schedule

Meetings:

- The Partnership for the Saginaw Bay Watershed (Saginaw River/Bay PAC) meets on the first Wednesday of the month, except near holidays, when some modification of the schedule may occur, i.e., meetings on the second Wednesday of January and July.

Outlook

The Saginaw River/Bay RAP process has been very successful to date and has moved forward at a rapid pace. Significant remedial actions are being taken, extensive studies are underway to fill important data gaps, and comprehensive coordination efforts continue among local, state, and federal organizations.

However, much remains to be done. As with most any issue, available funds are not sufficient for conducting desired levels of effort. Consequently, though many actions are currently being implemented, few of these are being fully implemented due to limited funds. A new problem, the colonization of Saginaw Bay by zebra mussels, has the potential to significantly impact biological communities and contaminant cycling in the Saginaw Bay. This may result in changing remedial actions over time.

Continued work is in progress, as well as developing future projects to restore, enhance, and protect the Saginaw River/Bay Watershed. Pollution prevention/agricultural projects and educational outreach activities are to be continued. Work will continue toward development of projects related to land use issues. Educational materials are to be developed, and water resource issues will be discussed with watershed residents. An additional objective is to enhance the area of tourism economy by improving birding opportunities. An additional goal is to revitalize partnership membership.

All the activity taking place within the scope of the Saginaw River/Bay RAP indicates:

- an enhanced interest in this area since inception of the RAP process; and
- a belief among local, state and federal organizations that this valuable natural resource can be significantly enhanced.

Outlook: (continued)

Restoring impaired beneficial uses will benefit indigenous aquatic life and wildlife, as well as the quality of life for basin residents. The support of local communities, the general public, the private sector, and local, state and federal agencies for the RAP to date is commendable. By continuing to work together, we can have a substantial impact on restoring impaired beneficial uses in Saginaw River and Bay.

Partners

- Partnership for the Saginaw Bay Watershed
- County Conservation Districts
- Michigan Department of Environmental Quality, Surface Water Quality Division
- Michigan Department of Environmental Quality, Office of the Great Lakes
- Michigan Department of Natural Resources
- Michigan Lakes and Streams Association
- Michigan State University Extension - Bay County
- Michigan Statewide Public Advisory Council
- Public Sector Consultants
- Saginaw Bay Watershed Initiative Network
- U.S. Environmental Protection Agency, Great Lakes National Program Office
- U.S. Fish and Wildlife Service
- Saginaw Valley State University

Research

WETNET, a cooperative school water quality monitoring and data management program used in the Saginaw Bay Watershed emphasizes hands-on learning, environmental stewardship and interactive computer mapping on the Internet.

Publications

- *Remedial Action Plan for the Saginaw River / Bay Area of Concern*
- *Measures of Success: Addressing Environmental Impairments in the Saginaw River and Saginaw Bay*, Public Sector Consultants, August 2000.
- *Saginaw River/Bay Area of Concern - Progress Report*, January 1994.

- “Watershed Initiative Promotes Local Action around Michigan’s Saginaw Bay”, Issue 32 (October 1993), *Nonpoint Source News-Notes*, U.S. Environmental Protection Agency.
- *Information Summary, Area of Concern: Saginaw River and Saginaw Bay*.
- *Saginaw Bay Watershed: A Strategy for Wetland Restoration*.
- *Historical Wetlands of the Saginaw Bay Watershed*.

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URL: <http://www.epa.gov/glnpo/aoc/sagrriver/sagrivr.html>