# Section 905(b) Reconnaissance Study

# Final Report

# Western Lake Huron Basin Watershed Study, Michigan

**May 2012**

**United States Army Corps of Engineers**
**Detroit District**

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# 1. Study Authority

This Reconnaissance Study (also known as a Section 905(b) study) was prepared under the authority of Section 110 of the River and Harbor Act of 1950 (PL 81-516), as amended by Section 102 of the River and Harbor Act of 1966 (PL 89-789); according to guidance provided in Section 905(b) of the Water Resources Development Act (WRDA) 1986 (PL 99-662).

Section 110 of the River and Harbor Act of 1950, (PL 81-516) allows the Army to conduct preliminary examinations and surveys and states:

> *The Secretary of the Army is hereby authorized and directed to cause preliminary examinations and surveys to be made at the following named localities, the cost thereof to be paid from appropriations heretofore or hereafter made for such purposes:* Provided, *That no preliminary examination, survey, project, or estimate for new works other than those designated in this title or some prior Act or joint resolution shall be made:* Provided further, *That after the regular or formal reports made as required by law on any examination, survey, project, or work underway or proposed are submitted, no supplemental or additional report or estimate shall be made unless authorized by law:* Provided further, *That the Government shall not be deemed to have entered upon any project for the improvement of any waterway or harbor mentioned in this title until the project for the proposed work shall have been adopted by law:* Provided further, *That reports of surveys on beach erosion and shore protection shall include an estimate of the public interests involved, and such plan of improvement as is found justified, together with the equitable distribution of costs in each case …*

Section 110, as amended by Section 102 of the River and Harbor Act of 1966, authorizes the Army to conduct surveys of the Great Lakes. Section 102 states:

> *The Secretary of the Army is hereby authorized and directed to cause surveys to be made at the following named localities and subject to all applicable provisions of Section 110 of the River and Harbor Act of 1950:*
>
> *… Great Lakes, particularly Lake Ontario and Lake Erie, in connection with water supply, pollution abatement, navigation, flood control, hydroelectric power, and related water resources development and control.*

Section 905(b) of the Water Resources Development Act (WRDA) 1986 (PL 99-662) prescribes the basic purpose and objectives for a reconnaissance study as authorized by Section 110, as amended. Section 905(b) states:

> *Before initiating any feasibility study under subsection (a) of this section … the Secretary (of the Army) shall first perform, at Federal expense, a reconnaissance study of the water resources problem in order to identify potential solutions to such problem in sufficient detail to enable the Secretary to determine whether or not planning to develop a project should proceed to the preparation of a feasibility report. Such reconnaissance study shall include a preliminary analysis of the Federal interest, costs, benefits, and environmental impacts of such project, and an estimate of the costs of preparing the feasibility report. The duration of a reconnaissance study shall normally be no more than twelve months, but in all cases is to be limited to eighteen months.*

Detailed procedures for the development of a 905(b) study for the reconnaissance phase of a water resources study by the Corps are prescribed in Engineer Regulation (ER) 1105-2-100. The 905(b) study

for the Western Lake Huron Basin (WLHB) watershed has been developed in accordance with Section 905(b) of WRDA 1986 and associated regulations.

Funds in the amount of $490,000 were made available from fiscal year (FY) 2010 and 2011 appropriations under the Great Lakes Restoration Initiative (GLRI) to conduct the 905(b) study for the WLHB. WLHB was approached as an expanded watershed-based 905(b) study involving a very large and diverse study area (8,700 square miles) with multiple individual coastal watersheds, multiple wide-ranging issues, and multiple local political jurisdictions and potential project sponsors. The study also involved a much greater degree of agency coordination and stakeholder involvement than would normally occur in a typical 905(b) study. Eight community meetings and one agency technical meeting were held to solicit feedback on key problems and potential solutions in the study area. Hence, the study cost was substantially higher than would be expected for a traditional, more narrowly focused 905(b) study (typically $100,000 to $200,000).

# 2. Study Purpose

The purpose of the reconnaissance phase study is to review water resource problems and opportunities in the WLHB study area, consistent with the study authority, and to determine if there is a Federal (Corps) interest in participating in a cost-shared, feasibility phase study (or studies) to investigate and recommend plans and projects that warrant Federal participation. "Federal interest" means that a proposed project or remedy to a watershed problem or impairment falls within a Corps "mission area" (i.e., ecosystem restoration, flood risk management, commercial navigation, hydropower, or storm damage reduction). It should be noted that this study also recognizes and includes remedial actions (potential projects) for watershed impairments that do not fall under Corps authorities (Federal interest) or that may be addressed by other Federal, state, or local agencies or other stakeholder groups.

Section 110, as amended provides broad authority to address not only ecosystem restoration, but also Great Lakes water resource problems related to "traditional" Corps mission areas (e.g., navigation, flood risk management, etc.). This reconnaissance study is GLRI funded and, consistent with GLRI, focuses on restoration initiatives. Several non-restoration issues were identified in the course of preparing this study. The non-restoration issues are herein noted, however, as part of this study, those items will not be addressed for further examination.

In response to the study authority, this reconnaissance study was initiated in May 2011. Based on investigations conducted during the reconnaissance phase, this study found that there is a Federal interest in further study at various locations in the WLHB. The purposes of this Section 905(b) study are to document the basis for this finding and to establish the scope of any resultant feasibility phase. As the document that traditionally establishes the scope of a feasibility study, the Section 905(b) study will be used as the chapter of the Project Management Plan that presents the reconnaissance overview and formulation rationale.

# 3. Location of Study, Non-Federal Sponsor (NFS), and Congressional Districts

## 3.1 Location

The overall study area is the WLHB, which includes 22 counties and encompasses 20 individual watersheds in Michigan. The WLHB has a total drainage area of approximately 8,700 square miles (22,533 square kilometers; Figure 1). Overall, the area is heavily forested, sparsely populated, scenically beautiful, and economically dependent on its natural resources. Land use in the WLHB watershed is dominated by forest and agriculture, with the principal urban/industrial areas located in Midland and

Saginaw Counties. The study area is entirely within US waters and territories, but the receiving water body for the WLHB watershed, Lake Huron, is shared with Canada. Thus, this Section 905(b) study considers the binational nature of Lake Huron resources, as well as pertinent binational studies, plans, and agreements to protect and restore those resources.


**Figure 1. Location of the Western Lake Huron Basin.**

Given the very large and highly diverse WLHB study area and the availability of substantial documentation already developed by Federal, state, and non-government organizations on natural resource conditions in the WLHB, the study team elected to place the geographic focus of the 905(b) study on those areas within the WLHB with the highest probability for water resource problems directly affecting Lake Huron and, in particular, the two designated Areas of Concern (AOC), Saginaw River/Bay and the St. Marys River. These AOCs are discussed in more detail below. The following fifteen (15) counties within the WLHB (shaded areas in Figure 1) served as the principal geographic focus for this

study: Chippewa, Mackinac, Cheboygan, Presque Isle, Alpena, Alcona, Iosco, Arenac, Bay, Tuscola, Huron, Sanilac, St. Clair, Midland, and Saginaw. With the exception of Midland and Saginaw Counties, these represent the coastal counties in Michigan that directly border Lake Huron. Midland and Saginaw Counties represent a large portion of the lower Saginaw River watershed and are among the more highly urbanized areas draining into Saginaw Bay/western Lake Huron. In addition, much of the river portion of the Saginaw River and Bay AOC lies within Saginaw County.

Placing a principal focus on these fifteen coastal and near-coastal counties did not limit the study team from considering critical water resource problems and opportunities in the upstream portions of the WLHB watersheds that could be identified as a result of the literature review or stakeholder input during the 905(b) study. Problems and opportunities beyond the principal geographic focus area in the WLHB were considered by the study team based on their relative significance and compelling stakeholder input (summarized in Section 5.2).

In the WLHB study area, the two specific AOCs are the Saginaw River and Bay and the St. Marys River. Across the Great Lakes Basin, there are 43 AOCs defined by the United States-Canada Great Lakes Water Quality Agreement (Annex 2 of the 1987 Protocol) as "geographic areas that fail to meet the general or specific objectives of the agreement where such failure has caused or is likely to cause impairment of beneficial use of the area's ability to support aquatic life" (GLIN 2011). These two AOCs are briefly described below; more details on the issues in these AOCs, relative to identifying water resource problems and opportunities for this study, are presented in Section 5.3.

**Saginaw River/Bay AOC.** The Saginaw Bay area, in the east central portion of Michigan's Lower Peninsula, is a southwestern extension of Lake Huron. The boundaries of the Saginaw River/Bay AOC are the entire 22-mile length of the Saginaw River, beginning at the confluence of the Shiawassee and Tittabawassee Rivers, and all of Saginaw Bay (1,143 square miles, or 2,960 square kilometers), out into its interface with open Lake Huron at an imaginary line drawn between Au Sable Point and Point Aux Barques (Figure 2). This diverse area supports agriculture, manufacturing, tourism, and outdoor recreation; it also supports a variety of wildlife. Saginaw River/Bay was listed as an AOC due to contaminated sediments, fish consumption advisories, high bacteria, nutrient enrichment (e.g., phosphorus), sedimentation, degraded fisheries, and loss of significant recreation values (MDNR 1988). The AOC currently has the following ten beneficial use impairments:

- Restrictions on fish and wildlife consumption
- Eutrophication or undesirable algae
- Degradation of fish and wildlife populations
- Beach closings
- Degradation of aesthetics
- Bird or animal deformities or reproduction problems
- Degradation of benthos
- Degradation of phytoplankton and zooplankton populations
- Restriction on dredging activities
- Loss of fish and wildlife habitat

**Figure 2. Location of the Saginaw Bay AOC.**

**St. Marys River AOC.** The St. Marys River, at the border between Canada and the Upper Peninsula of Michigan, is 70 miles (112 kilometers) of waterways that connect Lake Huron to Lake Superior. The AOC, which is a "Bi-national AOC," extends from the head of the river at Whitefish Bay (Point Iroquois - Gros Cap), downstream through the St. Joseph Channel to Humburg Point on the Ontario side, and to the straits of De Tour on the Michigan side (Figure 3). Water quality, sediment, and biota impairment remain due to historical point source discharges. Contaminants of concern are oils and greases, suspended solids, metals, phenols, ammonia, bacteria, and PAHs. As a result of industrial and municipal discharges, sediments have become contaminated with toxics, such as arsenic, cadmium, chromium, copper, cyanide, and lead. The St. Marys AOC currently has the following ten beneficial use impairments:

- Restrictions on fish and wildlife consumption
- Eutrophication or undesirable algae
- Degradation of fish and wildlife populations
- Beach closings
- Fish tumors or other deformities
- Degradation of aesthetics
- Bird or animal deformities or reproduction problems

- Degradation of benthos
- Restriction on dredging activities
- Loss of fish and wildlife habitat

**Figure 3. Location of the St. Marys River AOC.**

In summary, this Section 905 (b) study principally focuses on addressing water resource problems and opportunities on the U.S. side of the lake in the watersheds closest to the Lake Huron shoreline or areas that drain directly into the lake. Specifically, the study area associated with this reconnaissance study includes fifteen counties in the WLHB: Chippewa, Mackinac, Cheboygan, Presque Isle, Alpena, Alcona, Iosco, Arenac, Bay, Midland, Saginaw, Tuscola, Huron, Sanilac, and St. Clair. The study area includes the entire extent of each of the two designated AOCs.

## 3.2 Non-Federal Sponsor (NFS)

As a key element of the process to identify and compile water resource problems and opportunities in the WLHB study area and potential measures to address them, the study team sought to engage stakeholders (as described in Section 5.2) to help identify prospective organizations, such as state agencies and local government entities, with both the qualifications and willingness to serve as NFS for a Corps study/project or for technical assistance from the Corps. Through this stakeholder involvement process and direct contact with organizations that expressed interest in supporting or participating in Corps activities to address these challenges, potential NFSs were identified and Letters of Intent to cost-share feasibility phase investigations were sought for those studies determined to be in the Federal interest. The potential NFS for each of the feasibility phase activities stemming from this 905(b) study are identified and discussed in Section 5.7 and in Table 5.

## 3.3 Congressional Districts

The study area lies in following US Congressional Districts (Figure 4):

Michigan 1st District – Representative Dan Benishek (R)
Michigan 4th District – Representative Dave Camp (R)
Michigan 5th District – Representative Dale Kildee (D)
Michigan 10th District – Representative Candice Miller (R)

In addition, the study area is served by both US Senators Carl Levin (D) and Debbie Stabenow (D).

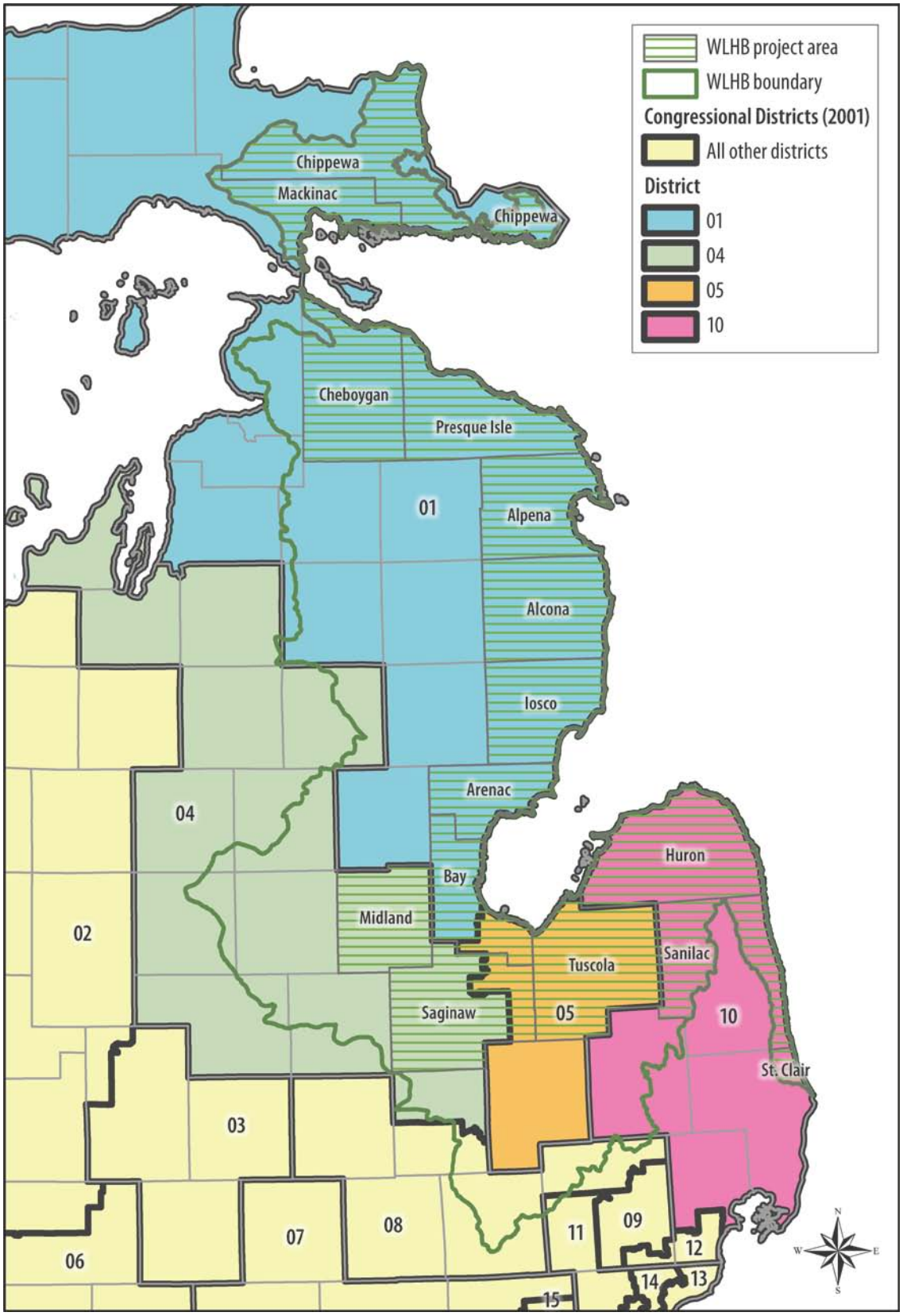


**Figure 4. US Congressional Districts in the WLHB study area.**

# 4. Prior Reports and Existing Projects

## 4.1 Prior Corps Reports and Existing Projects in the Study Area

The Corps has a long history of water resource and related activities in the WLHB study area. The following paragraphs briefly describe relevant prior reports and existing projects in the study area, as well as pertinent studies and projects that are underway.

### 4.1.1 Multipurpose Project

**4.1.1.1 St. Marys River.** The St. Marys River flows southeasterly between Michigan and Ontario, Canada and connects the eastern end of Lake Superior with the northern end of Lake Huron. The Federal project, which has been authorized by numerous acts between 1870 and 1986, provides for maintaining navigation channels at 27.5-28.5 feet deep in the St. Marys River and in the Lake Superior and Lake Huron approaches thereto; for constructing and operating four locks and two canals; for constructing a hydropower plant of 14,000-kilowatt capacity (45,000-kilowatt ultimate capacity); for constructing anchorage areas in the river above and below the locks; and for constructing various other works in conjunction with the project. The project also is the site of a visitor's center and park handling nearly 500,000 visitors annually (USACE Detroit District 2011a).

### 4.1.2 Navigation

**4.1.2.1 Cheboygan Harbor.** Cheboygan Harbor is at the mouth of the Cheboygan River, which empties into western Lake Huron about 16 miles southeast of the Straits of Mackinac Bridge. The project was authorized by the River and Harbor Acts of June 2, 1896; March 2, 1907; August 26, 1937; May 17, 1950; and October 21, 1964. The project provides for channel maintenance, including a turning basin and a rubble mound breakwater. Commercial docks, which are used primarily for receiving petroleum products, are along the river. Cheboygan Harbor is also the home port of the US Coast Guard's (USCG) only US heavy ice-breaking resource, the cutter *Mackinaw*, which also plays a key role in buoy tending in spring and fall. The harbor provides for the only ferry service to Bois Blanc Island. The ferry carries people, cars, trucks, commodities, and mail. Approximately four to five ferry trips are made daily from early spring through late fall (USACE Detroit District 2011b).

**4.1.2.2 Alpena Harbor.** Alpena Harbor is at the mouth of the Thunder Bay River, which empties into Thunder Bay, Lake Huron. The harbor is 100 miles southeast of Cheboygan Harbor, Michigan. The Thunder Bay River has its source in Montmorency and Alpena Counties, Michigan. The project was authorized by the River and Harbor Acts of September 19, 1890; March 2, 1919; September 22, 1922; August 30, 1935; and October 27, 1965. The project provides for a bay channel, an entrance channel, a river channel, a turning basin, and a breakwater. Several commercial docks, which are used primarily for receiving coal and petroleum products, are along the river. There is a cement production facility next to the outer harbor area. A municipal marina basin is about one-quarter mile southwest of the river channel mouth (USACE Detroit District 2011c).

**4.1.2.3 Saginaw River.** The Saginaw River begins at the confluence of the Tittabawassee and Shiawassee rivers southeast of Saginaw, Michigan (Saginaw County) and generally runs north through the southeast corner of Bay County before it empties into Saginaw Bay, approximately 90 miles north of Detroit. The Saginaw River channel is a Federally authorized commercial navigation project. The entire channel extends from deep water, 14 miles out in Saginaw Bay of Lake Huron at the north end of the channel, through the mouth of the Saginaw River and 22 miles upstream to Saginaw (USACE Detroit District 2011d). Project depths range from 27 feet in Saginaw Bay to 16.5 feet at the head of navigation in Saginaw.

Dredged material for the lower Saginaw River portion of the project (from deep water in Saginaw Bay to a point about 4.7 miles upstream from the mouth of the Saginaw River) is placed in the Saginaw Bay confined disposal facility (CDF). Constructed in 1978 under Section 123 of the River and Harbor Act of 1970 (PL 91-611), the CDF consists of a 284-acre site with capacity of approximately 10,000,000 cubic yards. As the Bay CDF approached its dredged material capacity in 1995, a dredged material management plan (DMMP) was conducted for the lower Saginaw River. The DMMP, approved in May 1997, included a recommendation for raising the dikes of the Bay CDF to extend its life for another 20 years. The dikes were raised in 2002 for the northern half of the facility only. Dredged material capacity of the Saginaw Bay CDF was based on the lower Saginaw River only and was not designed to include dredged material from the upper Saginaw River. The DMMP preparers also determined that it is not cost effective to transport dredged material from the upper Saginaw River to the Saginaw Bay CDF (USACE Detroit District 2005).

A Phase II DMMP study for the upper Saginaw River was completed in July 2004 (with an addendum in September 2005). The channel limits of the upper Saginaw River DMMP study are from a point 4.7 miles upstream of the entrance of the Saginaw River, upstream to the confluence of the Shiawassee River and Tittabawassee River, at Saginaw River's mile 22 in the city of Saginaw (covering about 17.3 miles of navigation channel). The DMMP study evaluated several alternatives to contain an estimated 3.1 million cubic yards of dredged material expected over 20 years. The study authors recommended development of a CDF on a 281-acre tract, known as the Zilwaukee Township site, west of the Saginaw River and approximately 11 miles upstream of its mouth (USACE Detroit District 2005). Construction of the CDF was completed in August 2007.

**4.1.2.4 Recreational Harbors.** There are 15 Federally authorized navigation projects in the WLHB study area that are classified as recreational harbors (Table 1 and Figure 5). These harbors for recreational watercraft often serve additional functions and provide unique benefits that further support maintenance and the continued viability of these harbors, including the following (USACE 2008):

- Harbors of refuge—The study area contains five designated harbors of refuge that provide protection for recreational craft during severe weather. Without these maintained harbors, boating accidents and casualties would likely escalate, as would the costs for USCG search and rescue operations.
- USCG facilities—USCG search and rescue stations are strategically located at two of these shallow draft recreational harbors in the WLHB study area, Tawas Bay and Harbor Beach. These facilities are not only crucial to the public safety function performed by the USCG but also contribute economically to their host communities in goods and services purchased.
- Ferry and subsistence services—Three harbors are identified as locations for ferry services, performing important transportation system functions, in addition to their recreation benefits. One harbor is classified as a subsistence harbor to island communities.

The summary of recreational harbors in the study area in Table 1 includes a matrix depicting the additional functions that these recreational channels may serve.


**Figure 5. Location of recreational harbors in the WLHB.**

**Table 1. Corps recreational harbors in the WLHB study area, depicting other important functions and services that these harbors may provide.**

| Recreational Harbors in the WLHB Study Area | County (Michigan) | Harbor of Refuge | USCG Facilities | Ferry and Subsistence Services |
|---|---|---|---|---|
| Au Sable Harbor | Iosco | X | | |
| Bayport Harbor | Huron | | | |
| Caseville Harbor | Caseville | | | |
| Detour Harbor | Chippewa | | | X |
| Hammond Bay Harbor | Presque Isle | X | | |
| Harbor Beach Harbor | Huron | | X | |
| Harrisville Harbor | Alcona | | | |
| Lexington Harbor | Sanilac | | | |
| Mackinac Island Harbor | Mackinac | | | X |
| Mackinaw City Harbor | Cheboygan | | | X |
| Point Lookout Harbor | Arenac | X | | |
| Port Austin Harbor | Huron | X | | |
| Port Sanilac Harbor | Sanilac | X | | |
| Sebewaing Harbor | Huron | | | |
| Tawas Bay Harbor | Iosco | | X | |

**4.1.2.5 Mackinac Island Harbor, Harbor Breakwater, Section 107 Study (Mackinac Island, Mackinaw County).** This project site is on the south shore of Mackinac Island. The study is being prepared in accordance with Section 107, 1960 River and Harbor Act (PL86-645), as amended (Small Navigation Projects; see Section 5.6.2.1 for more information on the Section 107 program). The project would involve construction of an eastern breakwater extension to protect the inner harbor from strong southeast storm surges. Mackinac Island depends on water transportation and is accessible from the mainland of northern Michigan only across the often rough waters of Lake Huron.

A preliminary assessment and detailed draft project management plan (PMP) has been prepared for the feasibility phase study. Upon coordinating and executing a feasibility cost sharing agreement (FCSA) with the NFS, a detailed project report to evaluate the project could be initiated. However, the NFS has indicated it is not positioned to provide the required cost-share match for the feasibility phase study. As of September 2011, the project is on hold until the NFS can provide the non-Federal share for the feasibility phase study (USACE Detroit District 2011e).

**4.1.2.6 Port Sanilac Breakwater, Section 111 Study (Port Sanilac, Sanilac County).** Port Sanilac Harbor is in eastern Michigan on Lake Huron. The study has been performed in accordance with Section 111, River and Harbor Act of 1968 (PL 90-483), as amended (Prevention or Mitigation of Shore Damage Caused by Federal Navigation Projects; see Section 5.6.2.1 for more information on the Section 111 program). Preliminary investigations were conducted to determine if there are any possible damages to the outlying shoreline next to the harbor attributable to the Federal navigation project and, if so, what mitigation measures may be appropriate. A more detailed investigation would be required to further evaluate the conditions, but this would require non-Federal cost sharing. No additional work will be done at the harbor under this authority, and this study has been terminated (USACE Detroit District 2011f).

### 4.1.3 Flood Risk Management (formerly Flood Control or Flood Damage Reduction)

**4.1.3.1 Saginaw River Basin Flood Control Project (Bay and Saginaw Counties).** The project for flood protection, Saginaw River Basin, Michigan, was authorized by Section 203 of the Flood Control Act of 1958 (PL 85-500). The Saginaw River Basin, including its tributaries (the Tittabawassee, Shiawassee, Flint, and Cass Rivers) drains 6,260 square miles in the east-central part of Michigan and empties into Saginaw Bay. The authorized project provided for improvements in the Saginaw River Basin for flood control and other purposes and was composed of eight distinct project elements, summarized as follows:

- At Sanilac Flats, provide for major drainage improvements by channel improvements on the Middle and South Branches of the Cass River, including a short reach of East Branch. This feature of the Saginaw River Basin project was deauthorized by Section 1002 of WRDA 1986 (PL 99-662).
- At Vassar on the Cass River, provide flood protection of areas on the north and south sides of the river by channel improvement, levee construction floodwalls, modifications to Moore Drain, and related work. This feature of the Saginaw River Basin project was subsequently deauthorized, in accordance with the provisions of Section 1001(b)(2) of WRDA 1986 (PL 99-662). Section 364 of WRDA 1999 (PL 106-53) reauthorized the Cass River project at Vassar, but the project has not been constructed.
- At Frankenmuth on Cass River, provide flood protection of areas on the north side of the river by channel improvement, levee construction, and related work.
- At Flint on the Flint River, provide flood protection of areas on both sides of the main stem of the Flint River and its tributaries, Swartz and Thread Creeks, by channel improvement, bridge alterations, floodwall and levee construction, and related work. Section 329 of WRDA 1996 (PL 104-303) modified the authorized project to include design and construction of an inflatable dam on the Flint River.
- At Corunna on the Shiawassee River, provide flood protection by channel improvement, levee construction, and related work. This feature of the Saginaw River Basin project was deauthorized by Section 1002 of WRDA 1986 (PL 99-662).
- At Owosso on the Shiawassee River, provide flood protection by channel improvement. This feature of the Saginaw River Basin project was deauthorized by Section 1002 of WRDA 1986 (PL 99-662).
- At Midland on the Tittabawassee River, provide flood protection through nonstructural (permanent evacuation) measures. This project was reclassified to the inactive category on December 15, 1982.
- At Shiawassee Flats along the lower reaches of the four principal tributaries of Saginaw River, provide flood protection, including fish and wildlife areas, by channel improvement, levees, lateral reservoirs with control structures, and related work. The project included special local cooperation conditions related to providing lands for the project due to the inclusion of fish and wildlife features. Further, before any flood control features at Shiawassee Flats would be constructed, the Secretary of the Army and Secretary of the Interior would be required to agree on a plan for operating fish and wildlife areas to ensure the required degree of controlled storage of flood-waters, while preserving the maximum fish and wildlife benefits. This feature of the Saginaw River Basin project was subsequently deauthorized, in accordance with the provisions of Section 1001(b)(2) of WRDA 1986 (PL 99-662). Section 364 of WRDA 1999 (PL 106-53) reauthorized the Shiawassee Flats project, but it has not been constructed.

The authorization for each of these project elements contained explicit local cooperation requirements for project sponsors. Only the Frankenmuth and Flint portions of the project have been completed (Secretary of the Army 1991).

**4.1.3.2 Cass River Flood Control Project, Section 216 Study (Frankenmuth, Saginaw County).** The Corps completed the Cass River project (part of the authorized Saginaw River Basin Flood Control Project) in 1965 to protect the city of Frankenmuth, Michigan, from floods associated with the Cass River. The flood control project included the construction of flood walls and levees. Recently, the Federal Emergency Management Agency conducted studies, which prompted a revision to the flood insurance rate map for the Frankenmuth. The revised flood insurance rate maps changed the flood designation of the downtown area, which will necessitate flood proofing existing buildings and restricting future expansions in the downtown area. The Corps will conduct a Review of Completed Projects Reconnaissance Study under the authority of Section 216 of the 1970 Flood Control Act (PL 91-611). Section 216 studies review operations of completed projects, when found advisable due to changed physical, economic, or environmental conditions. The study preparers will review the effectiveness of the completed flood control project and, as appropriate, identify possible solutions to ensure the project is providing the appropriate level of flood risk management.

Corps' operation and maintenance (O&M) funding is being used in FY 2011 to initiate the reconnaissance phase study, which includes preparation of a reconnaissance report based on review of the Cass River project, a PMP, and a FCSA. Upon execution of the FCSA, the cost-shared feasibility study will be initiated using general investigations funding (USACE Detroit District 2011g).

**4.1.3.3 Sebewaing Flood Control Project (Sebewaing, Huron County).** Floods occurred in 1934, 1935, and 1938 in the Sebewaing River Basin, as the result of much more rapid runoff from the upper basin due to the drainage system. In Section 3 of the River and Harbor of 1941 (PL 77-228), Congress authorized the Corps to provide flood protection to Sebewaing. Construction of a 11,000-foot levee, in partnership with the Sebewaing River Inter-County Drain Commission as the local sponsor, was started in 1945 and was completed in 1948. It extended from the junction of the Columbia and State drains to the outlet at Saginaw Bay, about three-quarters of a mile downstream of the railroad bridge. The Corps is responsible for project maintenance and is undertaking a major rehabilitation/reconstruction effort to maintain the designed level of flood risk reduction.

**4.1.3.4 Kawkawlin River Section 205 Flood Control Project (Bay County).** The Kawkawlin River drains an irregularly shaped area of about 220 square miles in Bay, Gladwin, Midland, and Saginaw Counties in east-central Michigan and discharges into Saginaw Bay, two miles northwest of Saginaw River. The flood control project was constructed under the authority of Section 205 of the Flood Control Act of 1948 (PL 80-858; see Section 5.6.2.1). The project provides for deepening about 1.8 miles of river channel, between the river mouth and Euclid Street Bridge; adding two 45.9-foot spans to the Detroit and Mackinac Railway Bridge; placing riprap on the channel bottom through the Euclid Street Bridge, existing piers at the Henry Street Bridge and Detroit, and the Mackinac Railway Bridge; and relocating a number of utilities. WRDA of 1986 (PL 99-662) modified the flood control project on the Kawkawlin River to provide that the Federal share of the cost of O&M of the project shall be 50 percent (Secretary of the Army 1991).

It should also be noted that in the 1990s there was a congressional request to dredge the mouth of the Kawkawlin River at Bangor Township. This was a one-time O&M dredging that required a decision document to justify the project.

### 4.1.4 Ecosystem Restoration

**4.1.4.1 Frankenmuth Dam Fish Passage, Section 506 Project (Frankenmuth, Saginaw County).** This project is being pursued under Section 506 of the WRDA of 2000 (PL 106-541, as amended, Great Lakes Fisheries and Ecosystem Restoration [GLFER] Program; see Section 5.6.2.2 for more detail on the Section 506 program). The Frankenmuth Dam is on the Cass River in the City of Frankenmuth, approximately 20 miles south of Lake Huron's Saginaw Bay. The Cass River originates in Tuscola County in east-central Michigan near Cass City. The Cass River's watershed encompasses 848 square miles and lies within the Saginaw Bay watershed. The concrete Frankenmuth Dam is approximately 240 feet long with a structural height of 14 feet and was built in the 1850s to supply water to a local mill. Although walleye and lake sturgeon are the species targeted by the Michigan Department of Natural Resources (MDNR) and the Partnership for the Saginaw Bay Watershed, a fish passage at the Frankenmuth Dam would also increase habitat connectivity for a variety of other species, including white sucker, white bass, smallmouth bass, channel catfish, northern pike, and steelhead. Connecting river habitat for these species would benefit the overall diversity of Cass River and Saginaw Bay watershed species. The non-Federal partner is the City of Frankenmuth.

A preliminary restoration plan has been approved and a concept design has been completed. Existing funds are being used to complete the feasibility-level planning and design, to prepare an environmental assessment, and to obtain project review and approval. Upon feasibility phase approval, detailed design will begin. Provided that a suitable design can be completed, a contract for construction could be awarded using FY 2013 Great Lakes Restoration Initiative (GLRI) funds. Current working estimate for the project is $3,100,000.

**4.1.4.2 St. Marys River Habitat Restoration, Section 506 Project (Sault Ste. Marie, Chippewa County).** Past modifications to incorporate commercial shipping in the St. Marys River have greatly altered its aquatic habitat. The area adjacent to Neebish Island was once a valuable rapid habitat used as a spawning area for fish. Without this project the area would continue to be unproductive as a spawning area. In the west project site, old building foundations could be removed, a channel could be excavated, and a culvert could be installed to allow water to flow behind the existing rock piles over the natural rock-rubble/cobble substrate. The east project site would require modifying the eastern remnants of the upper dam. A portion of the upper dam could be removed, and culverts could be placed under the roadway. A channel could then be excavated to allow water to flow behind the existing rock piles over the natural rock rubble/cobble substrate. The goal of this project is to restore water flow over the rock-rubble/cobble substrate to provide critical habitat for a number of fish and invertebrate species. The non-Federal partner is Michigan Department of Natural Resources (MDNR), Fisheries Division, Northern Lake Huron Management Unit.

In November 2003, the Corps Great Lakes and Ohio River Division (LRD) office approved a Section 1135 preliminary restoration plan (see Section 5.6.2.1). The project is being pursued under the GLFER authority. FY 2010 Energy and Water Development Appropriations Act funds were used to reevaluate the project. Initial hydraulic modeling indicated that only limited benefits may result from the creation of additional habitat areas. As a result, further coordination with the State of Michigan is being pursued. The estimated cost of the project was originally envisioned to be about $2,500,000 in 2011.

**4.1.4.3 Thunder Bay Reef Restoration, Estuary Restoration Act of 2000 Project (Alpena, Alpena County).** The proposed project is being pursued under the authority of the Estuary Restoration Act of 2000 (PL 106-457; see Section 5.6.2.2 for more detail on this authority). The project site is in Thunder Bay on the western shore of Lake Huron, next to Alpena in Alpena County. Cement kiln dust waste, a by-product of cement production, was historically stockpiled on the adjacent shoreline and was disposed of on the bottomlands of Lake Huron beginning in the 1950s. It is estimated that the cement kiln dust pile

has altered approximately 80 acres of shoreline and lake bottom, including areas of reef. Removal of the submerged cement kiln dust is not an option because it appears to have partially hardened into a contiguous mass, the removal costs are prohibitive, and there is concern about some of the material becoming resuspended during a removal operation. The plan for restoration was to add cobble/rubble material on top of or next to the impacted area to replicate natural reef conditions. The Michigan Department of Environmental Quality (MDEQ) partnered with the Federal government to construct this project in 2011.

**4.1.4.4 Flint River Flood Control Project, Section 216 Study (Flint, Genesee County).** Upstream of the principal focus area for this WLHB study, another study is underway. This feasibility study is under the authority of Section 216 of the Flood Control Act of 1970 (Review of Completed Projects). The purpose is to review the Flint River project (completed in 1966) for opportunities to restore the Flint River ecosystem and nurture a sustainable environment in the project area. The Flint River is in the Saginaw River/Bay watershed. The focus area for this study is the Flint River, between North Grand Traverse Street and North Chevrolet Avenue in downtown Flint. The existing project consists of concrete lined along the river bottom and banks, which have affected the natural ecosystem. FY 2010 GLRI funds were used to complete the reconnaissance report. The report was approved by Great Lake & Ohio River Division. Currently, the Sponsor does not have funding to execute the cost-share agreement for the feasibility study. The NFS is the City of Flint, Michigan (USACE, Detroit District 2011i).

### 4.1.5 Other Corps Studies

**4.1.5.1 Saginaw River Shoreline Protection.** Section 105 of WRDA of 1990 (PL 101-640) authorized the Secretary (of the Army) to undertake a project for shoreline protection along the Saginaw River in Bay City, Michigan, at a total estimated cost of $6,105,000. A reconnaissance study was completed in August 1992 to determine the feasibility of implementing stream bank erosion and flood protection measures at eight sites along the Saginaw River at Bay City. The study was terminated in FY 1993 because of an absence of significant erosion or stream bank problems or substantial damage to public structures, roads or other facilities (USACE, Detroit District 1993).

**4.1.5.2 Sebewaing River Sediment Transport Modeling Study, Section 516(e) Study (Great Lakes Tributary Modeling Program).** In December 2007, the Corps, Detroit District, completed a study for the Sebewaing River Basin, in accordance with Section 516(e) of the WRDA of 1996 (PL 104-303). The study's purpose was to provide tools for local communities and basin stakeholders to facilitate soil conservation and sedimentation reduction, with the goal of reducing sedimentation in Federal harbors and AOCs, eventually leading to removal of their impaired status. The Sebewaing River Sediment Transport Study had four objectives to meet this goal: (1) develop a geographic information system (GIS) of watershed features affecting sediment delivery and transport; (2) develop a watershed sediment budget; (3) conduct a riparian buffer analysis using GIS to identify and prioritize potential riparian areas for implementing sedimentation reduction best management practices; (4) provide support for numerical model development and analysis (USACE Detroit District 2007).

**4.1.5.3 Saginaw River and Bay Sediment Transport Modeling Studies, Section 516(e) Study (Great Lakes Tributary Modeling Program).** These models, completed in1999 and 2000, have been used to evaluate the feasibility of using sediment traps to reduce navigational dredging of the Saginaw River.

## 4.2 Relevant Reports and Projects by Others

In addition to the Corps projects conducted in the WLHB, there are numerous agencies and organizations working within the WLHB at various scales to identify challenges and potential solutions. For developing

the WLHB watershed reconnaissance study, the Corps has compiled a list of reports and projects in the WLHB developed by other agencies and organizations (see Appendix A). Some of these reports look at Lake Huron from a binational perspective, which exceeds the scope of the WLHB watershed reconnaissance study but still provides information on the study area. Other reports examine issues and solutions at a subwatershed scale. Brief overviews of several key reports developed by other agencies and organizations compiled for the WLHB watershed reconnaissance study are provided below.

**Lake Huron Binational Partnership 2008-2010 Action Plan**. Since 2002, the Lake Huron Binational Partnership has coordinated lakewide environmental activities. The Partnership consists of the EPA, Environment Canada (EC), MDEQ, and Ontario's Ministries of the Environment and Natural Resources. Although the EPA's Great Lakes National Program Office categorizes the Partnership's Action Plan as a Lakewide Management Plan, the partnership states that it is different because of its focus on priority areas (e.g., AOCs) and on-the-ground activities. The purposes of the action plan are to provide information on environmental trends, to identify priority issues, and to promote actions for implementation over the next two years. It also tracks progress on issues related to the past action plan period. Chapter 8 of the action plan identifies high-priority actions for the 2008-2010 management cycle, including a description of the action, the associated responsible party, and the status (ongoing, completed, new).

**State of the Lakes Ecosystem Conference (SOLEC)**. This is a biennial conference hosted by the EPA and EC in response to the binational Great Lakes Water Quality Agreement. The 2008 SOLEC focused on the nearshore environment. The presentation on Lake Huron made during this conference provided an overview of the current conditions and trends, with a particular focus on Lake Huron's beaches. The presenters addressed the issue of muck that covers the shoreline in the Saginaw Bay area and some shoreline areas in Ontario, as well as bacterial contamination. The most recent SOLEC occurred in October 2011.

**The Sweetwater Sea: An International Biodiversity Conservation Strategy for Lake Huron**. The strategy, released in 2010, is the product of a two-year planning process that involved more than 100 agencies and organizations from around the Lake Huron basin. The many goals of this process included developing shared strategies for protecting important areas and addressing threats, promoting coordination of biodiversity conservation, and providing a framework to support measuring, managing, and reporting biodiversity conservation. The strategy includes a representative group of Lake Huron's biodiversity features, an inventory and ranking of threats to Lake Huron's biodiversity, identification of priority biodiversity conservation areas for implementation, and suggested next steps to implement recommendations.

**Environmental Objectives for Lake Huron: A Report of the Environmental Objectives Working Group of the Lake Huron Technical Committee, Great Lakes Fisheries Commission.** This 2007 document was developed in response to a directive contained in the Great Lakes Fisheries Commission's A Joint Strategic Plan for Management of Great Lakes Fisheries. The directive required all lake committees to develop fish community objectives (FCOs) and environmental objectives (EOs) for each lake. EOs are intended to describe the biological, chemical, and physical needs of desired fish communities. This document contains the EOs for Lake Huron, including Georgian Bay and North Channel. It summarizes the major impediments to achieving the Lake Huron FCOs. Challenges to developing quantifiable endpoints for environmental conditions include such factors as a lack of information and an incomplete knowledge of environment/fish community relationships. This document provides an overview of the Lake Huron FCOs and the process for developing the EOs. The four EOs presented in the document address spawning and nursery habitat, shoreline processes, food web structure and exotics, and water quality.

**The Michigan Department of Environmental Quality Biennial Remedial Action Plan Update for Michigan's Portion of the St. Marys River Area of Concern.** Every two years, MDEQ prepares brief status reports on recent remedial actions and assessments in AOCs in the form of remedial action plan (RAP) updates. As of March 2012, MDEQ completed the most recent update for the St. Marys River AOC RAP. The original RAP was prepared in 1992, with previous updates in 2003, 2007, and 2009. According to these RAP documents, 10 of 14 beneficial uses were impaired in the St. Marys River AOC. RAP updates track progress toward removing beneficial use impairments (BUIs). The assessment conducted for the 2007 St. Marys AOC RAP update showed that the 10 beneficial uses remain impaired.

**The Michigan Department of Environmental Quality Biennial Remedial Action Plan Update for the Saginaw River/Bay Area of Concern.** As described above, MDEQ prepares brief status reports on recent remedial actions and assessments in AOCs in the form of RAP updates. In 2008, MDEQ prepared a RAP update for the Saginaw River/Bay AOC. The original RAP for the Saginaw River/Bay AOC was prepared in 1988, with updates in 1995, 2000, 2002, 2008, and most recently March 2012. Currently, there currently are 10 BUIs identified for the Saginaw River/Bay. As a result of the 2008 RAP update, two of the original 12 BUIs (tainting of fish and wildlife flavor, and restrictions on drinking water consumption or taste and odor problems) have been removed.

**GLRI-Funded Projects.** In addition to the WLHB 905 (b) study, the GLRI has funded a number a projects in the WLHB study area aimed at restoration of the Great Lakes ecosystem. These projects address one or more of the five urgent issues in the Great Lakes, as outlined in the GLRI action plan, which covers fiscal years 2010 through 2014. Those issues are:

- Cleaning up toxics and areas of concern
- Combating invasive species
- Promoting nearshore health by protecting watersheds from polluted runoff
- Restoring wetlands and other habitats
- Tracking progress and working with strategic partners

Ongoing GLRI-funded projects are summarized in Table 2. This list is based upon a query of the GLRI web site (http://greatlakesrestoration.us/) and includes GLRI projects in the WLHB area funded in FYs 2010 and 2011. This list is intended to present a representative list of other restoration activities being pursued in the WLHB study area under the GLRI. Some of the projects are site-specific, and others have a more regionally-based scope. The list is fairly comprehensive but does not capture some restoration-related activities in WLHB that may be funded under a variety of other programs.

**Table 2. GLRI-Funded Projects, FY 2010 and 2011 (GLRI 2011)**

| Project Name | Lead Organization | Problem Addressed | Project Location | Designated AOC |
|---|---|---|---|---|
| Enhanced St. Marys River Sea Lamprey Control | Great Lakes Fishery Commission | Invasive species | St. Marys River | St. Marys River |
| St. Marys River Fishery Habitat Restoration | Corps (see Section 4.1.4.2) | Habitat restoration | St. Marys River | St. Marys River |
| Tribal Capacity Building – Sault Ste. Marie Tribe | Sault Ste. Marie Tribe of Chippewa Indians | Strategic partnerships | NA | St. Marys River |
| Sustainable Approach for Wetland Diversity | Loyola University of Chicago/Buffalo Niagara Riverkeeper | Invasive species | Michigan Upper Peninsula | St. Marys River watershed |
| Eurasian Watermilfoil Strategic Biological Control Program | Les Cheneaux Watershed Council | Invasive species | Michigan Upper Peninsula | St. Marys River watershed |
| Early Detection and Treatment of Great Lakes Phragmites | Michigan State University | Invasive species | NE Lower Michigan | NA |
| Silver Creek Culvert Replacement on Beach Grove Hwy | US Fish and Wildlife Service | Habitat restoration | Ocqueoc River watershed, Michigan | NA |
| Silver Creek Culvert Replacement on Church Hwy | US Fish and Wildlife Service | Habitat restoration | Ocqueoc River watershed, Michigan | NA |
| Miller Creek Dam Removal | US Fish and Wildlife Service | Habitat restoration | Hillman, Michigan | NA |
| Lake Huron Lake Trout and Lake Sturgeon Restoration | US Fish and Wildlife Service | Habitat restoration | Alpena, Michigan | NA |
| Upper Great Lakes Stream Connectivity and Habitat Initiative | US Fish and Wildlife Service | Habitat restoration | Various | NA |
| AuSable River Fish Passage Barrier Inventory and Assessment | US Fish and Wildlife Service | Habitat restoration | AuSable River watershed, Michigan | NA |
| Rifle River Watershed Nonpoint Implementation Project | Huron Pines | Sediment & nutrient management | Rifle River watershed, Michigan | Saginaw River/Bay watershed |
| Tribal Capacity Building – Saginaw Chippewa Tribe | Saginaw Chippewa Indian Tribe | Strategic partnerships | NA | Saginaw River/Bay |
| Saginaw Bay/Lake Huron Land Policy Project | Michigan State University | Strategic partnerships | Various | Saginaw River/Bay watershed |
| Nayanquing Point Coastal Wetland Project | Ducks Unlimited, Inc. | Habitat restoration | Saginaw Bay | Saginaw River/Bay |
| Innovative Phragmites Control Strategic – Great Lakes | US Geological Survey | Invasive species | NA | NA |
| Van Hove Coastal Wetland Restoration | Ducks Unlimited, Inc. | Habitat restoration | Saginaw Bay | Saginaw River/Bay |
| Sebewaing River Watershed, Sediment Reduction | Michigan Department of Agriculture and Rural | Sediment management/habitat | Huron County, Saginaw Bay | Saginaw River/Bay |

| Project Name | Lead Organization | Problem Addressed | Project Location | Designated AOC |
|---|---|---|---|---|
| | Development | restoration | | watershed |
| Pigeon River Corridor Sediment Reduction Project | Pigeon River Intercounty Drainage Board | Sediment management | Pigeon River/Saginaw Bay | Saginaw River/Bay watershed |
| Joint Venture – Shiawassee Flats Floodplain | Ducks Unlimited, Inc. | Habitat restoration | Saginaw County | Saginaw River/Bay watershed |
| Shiawassee Flats Wildlife and Fish Habitat Restoration | US Fish and Wildlife Service | Habitat restoration | Shiawassee River | Saginaw River/Bay watershed |
| Fish Passage at Frankenmuth Dam | City of Frankenmuth/Corps (see Section 4.1.4.1) | Habitat restoration | Frankenmuth, Michigan | Saginaw River/Bay watershed |
| Flint River Section 216 Study | Corps (see Section 4.1.4.4) | Habitat restoration | Flint, Michigan | Saginaw River/Bay watershed |
| Swartz Creek Watershed Sediment Reduction | Michigan Department of Agriculture and Rural Development | Sediment management | | Saginaw River/Bay watershed |

NA – Not applicable

# 5. Plan Formulation

During a study, six planning steps that are set forth in the Water Resource Council's Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies (Principles and Guidelines) are repeated to focus the planning effort and eventually to select and recommend a plan (project) for implementation. The six planning steps are 1) specify problems and opportunities, 2) inventory and forecast conditions, 3) formulate alternative plans, 4) evaluate effects of alternative plans, 5) compare alternative plans, and 6) select recommended plan. The iterations of the planning steps typically differ in the emphasis that is placed on each of the steps. In the early iterations, those conducted during the reconnaissance phase, the step of specifying problems and opportunities is emphasized. However, the other steps are not ignored because the initial screening of preliminary plans that results from the other steps is very important to the scoping of the follow-on feasibility phase studies. The subparagraphs that follow present the results of the initial iterations of the planning steps that were conducted during the reconnaissance study. This information will be refined in future iterations of the planning steps that will be accomplished during the feasibility phase.

## 5.1 National Objectives

The national or Federal objective of water and related land resources planning is to contribute to National Economic Development (NED) consistent with protecting the nation's environment, in accordance with national environmental statutes, applicable executive orders, and other Federal planning requirements. Contributions to NED are increases in the net value of the national output of goods and services, expressed in monetary units. These contributions are the direct net benefits that accrue in the project area and the rest of the nation.

A second national objective for water and related land resources planning (national ecosystem restoration [NER]) has been established in response to legislation and administration policy, beginning with the WRDA of 1986 and subsequent WRDAs. The Corps' objective in ecosystem restoration planning is to

contribute to NER, whose outputs are increases in the net quantity and quality of desired ecosystem resources. Measurement of NER is based on changes in ecological resource quality as a function of improvement in habitat quality and quantity and is expressed quantitatively in physical units or indexes (but not monetary units). These net changes are measured in the project area and in the rest of the nation. Single purpose ecosystem restoration plans are formulated and evaluated in terms of their net contributions to increases in ecosystem value (NER outputs), expressed in nonmonetary units. By policy, the plan that provides the greatest NED or NER benefits, as determined during the evaluation process, is the default recommended plan for implementation.

Multipurpose plans that include both traditional water resource project outputs (e.g., navigation and flood risk management) and ecosystem restoration shall contribute to both NED and NER outputs. In this latter case, a plan that trades off NED and NER benefits to maximize the sum of net contributions to NED and NER is usually recommended (ER-1105-2-100).

This Section 905(b) study identifies water resource problems and opportunities for which cost-effective solutions can be developed to meet one or both of these national objectives.

## 5.2 Agency and Public Involvement

Extensive public participation was undertaken as part of the 905(b) study. The purposes of the effort were 1) to obtain a current understanding of the most pressing issues facing the WLHB, 2) to allow the public to voice opinions, 3) to determine existing partnerships and foster the development of new ones, 4) to fill in gaps in the literature regarding ongoing projects, 5) to identify local projects, and 6) to initiate the process of determining local cost-share partners to undertake feasibility studies.

Nine meetings were conducted in July and August 2011. Announcements went out six weeks to a month before the meetings through a variety of vehicles, including local newspapers, the Great Lakes Information Network (GLIN) list-serve, and website postings (see Appendix B for a copy of the meeting announcement and other information relevant to the public meetings). A project website (http://www.lre.usace.army.mil/_kd/go.cfm?destination=Page&Pge_ID=2417) was also established to allow citizens who could not attend a public meeting to obtain information on the project.

The initial meeting was held in Bay City with technical stakeholders that work in the project area, including such agencies as the Michigan Office of the Great Lakes, US Fish and Wildlife Service (USFWS), Natural Resource Conservation Service (NRCS), MDEQ, and MDNR; tribal representatives; and key academic experts. Subsequent community-based meetings were held in Sault Ste. Marie, Cheboygan, Alpena, East Tawas, Bay City, Midland, Port Austin, and Port Sanilac. In all, about 180 people attended these community-based meetings, with attendees ranging from county officials (e.g., Drain Commissioners), mayors, congressional staff members, nonprofit community and environmental organizations, agricultural and business representatives, and interested citizens. A list of participants can be found in Appendix B.

In some cases, stakeholders came to the meetings prepared to share specific recommendations to address water resource problems they deemed important to the local communities. These recommendations were captured along with those identified during the review of existing reports and studies. (A general overview of stakeholder input on problems and opportunities in the WLHB is provided at the end of Section 5.3.) The detailed list of identified projects is in Section 5.7, presented and organized on the basis of a preliminary screening process to determine if those problems/opportunities can be addressed under an existing Corps authority/program (i.e., Federal Interest), by way of a more detailed cost-shared Corps feasibility study, referred to another agency for assistance, or eliminated from further consideration.

## 5.3 Problems and Opportunities

This section describes the needs in the WLHB watershed in the context of problems and opportunities that can be addressed through water and related land resource management. For an effective planning process, it is essential to be able to describe both the existing conditions relative to each identified problem or opportunity as well as the expected future conditions. It begins with a broad overview of the problems, and concludes by describing the method that the study used to narrow the list of projects developed to address the issues (opportunities).

### Watershed Conceptual Model

The factors affecting the health of the WLHB are varied and complex. One way to understand the interrelationship of these factors is to craft a conceptual model. The conceptual model designed for the WLHB (Figure 6.) presents a summary of the sources of stressors, impacts, and impairments identified through the watershed reconnaissance study process as high priorities. This conceptual model does not seek to characterize every factor at play in the WLHB, but those that were identified by a range of stakeholders through community meetings and existing literature. There are other conceptual models for Lake Huron that capture the complexity of this basin. For example, the 2010 Sweetwater Sea Technical Report presents seven conceptual models that focus on critical threats to biodiversity addressed in that report (i.e., invasive species; housing and urban development/shoreline alterations; climate change; dams and barriers; agricultural nonpoint source (NPS) pollution; urban and rural NPS pollution, and forestry NPS pollution). Many of the factors addressed in the Sweetwater Sea Technical Report were also identified through the WLHB watershed reconnaissance study. The goal of this conceptual model is to show at a high level how these factors interrelate, focusing on the stressors raised by the specific group of stakeholders participating in the process that raised a broad set of problems and concerns.

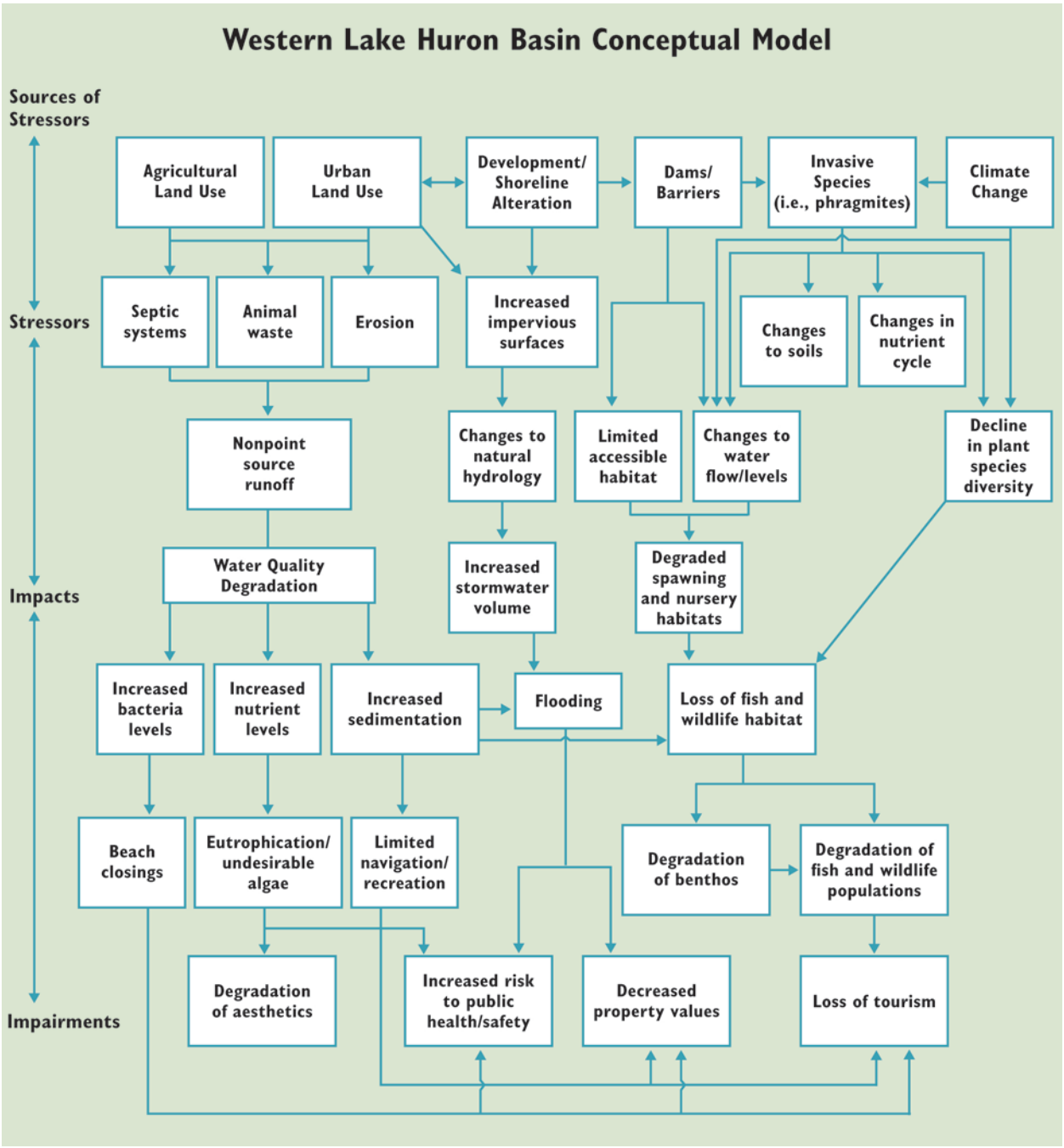


**Figure 6. WLHB watershed conceptual model.**

The top row of the model below presents six sources of stressors identified through the WLHB watershed reconnaissance study process. These sources are agricultural land use, urban land use, development and shoreline alteration, dams and barriers, invasive species, and climate change. These sources lead to stressors linked to physical changes in the WLHB, such as increased imperviousness, channelization, hardening of shoreline, and modifications to natural hydrology due to dams. Physical changes lead to a series of impacts related to water quality and quantity, as well as habitat quality and quantity. A combination of physical, chemical, and biological changes in the WLHB leads to a wide range of impairments. The identified impairments relate to the environmental health of the WLHB, as well as the socioeconomic health of the basin. Both types of impairments are of concern to WLHB stakeholders.

The problems have largely been summarized from information collected at the public involvement meetings and from The Nature Conservancy's *Sweetwater Sea: Technical Report* (SWS; The Nature Conservancy [TNC] 2010). Participants in the SWS identified the following problems, in ranked order, as major threats to the long-term health and viability of Lake Huron:

- Nonnative invasive aquatic and terrestrial species
- Housing and urban development, shoreline alteration
- Climate change
- Dams and barriers
- Agriculture, urban and rural, and forestry NPS pollution, resulting in bacterial contamination, algal blooms and fouling

For each problem, the existing conditions and the expected future conditions have been summarized from the SWS report and are described.

## 5.4 Existing Conditions

### Invasive Nonnative Aquatic and Terrestrial Species

Aquatic invasive species currently established and of management concern are species such as sea lamprey (*Petromyzon marinus*), zebra and quagga mussels (*Dreissena* spp.), round and tubenose gobies (*Neogobius* spp.), ruffe (*Gymnocephalus cernuus*), spiny water flea (*Bythotrephes longimanus*) as well as wetland plant species, including Eurasian water milfoil (*Myriophyllum spicatum*), purple loosestrife, and phragmites (LHBP 2008). Terrestrial invasive species, besides the wetland species listed above, that are established and of management concern include spotted knapweed (*Centaurea maculosa Lam*), common buckthorn (*Rhamnus cathartica*), sweet clover (*Melilotus alba*), soapwort (*Saponaria officinalis*), oxeye daisy (*Chrysanthemum leucanthemum*), lawn prunella (*Prunella vulgaris*), Canada bluegrass (*Poacompressa*), common St. John's wort (*Hypericum perforatum*), and emerald ash borer (*Agrilus planipennis Fairmair*). Invasive species are expected to continue to enter the Great Lakes (Ricciardi 2006), so additional attention needs to be directed toward species with a high risk for future introduction. Some of these high risk species have been identified, such as hydrilla (*Hydrilla verticillata*), Asian bighead (*Hypophthalmichthys nobilis*), and silver carp (*Hypophthalmichthys molitrix*; International Joint Commission 2009; US EPA 2008).

Aquatic and terrestrial invasive species negatively impact all biodiversity features (LHBP 2008). For nearshore zone and open water ecosystem features, invasive species impacts include physical changes in habitat (e.g., changes in invasive coastal wetland plants as spawning or rearing habitat, zebra mussel shells changing the character of spawning reef substrate), changes in water chemistry (e.g., nutrient cycling), and food web disruptions. These changes result in uncertainties for future fisheries management and have implications for native species restoration (TNC 2010). Impacts on coastal wetlands and coastal

terrestrial systems features are largely habitat alterations, especially where invasive plants may compete with, crowd out, and displace native plant community assemblages. These impacts also include food web changes and changes in soil and water chemistry. Coastal habitat changes and food web disruptions caused by invasive species have profound implications for native migratory fish and birds that rely on these coastal habitats for critical—and vulnerable—life-history stages. These include spawning and juvenile nursery habitat for fish and nesting and stopover habitats for birds. Finally, similar to coastal habitats, islands often have unique plant communities and assemblages that are compromised by the threat of invasive species.

It is generally recognized that preventing new introductions is economically and ecologically preferable to managing species after they have been introduced to Lake Huron. This is a challenge in that the suite of vectors and pathways of introduction for new species (and spread of species once introduced) are both diverse and many. While some vectors differ for aquatic and terrestrial species, in some cases their pathways overlap, such as with plant nurseries where terrestrial and aquatic plants are raised and sold. This challenge is exacerbated by the multiple audiences (decision makers, industries, and end-users) that are linked to the decisions and demands that accompany each vector and pathway. Aquatic invasive species continue to arrive in the Great Lakes at an estimated rate of one every eight months (Great Lakes Regional Collaboration 2005).

Eradicating established invasive species is not typically a realistic or feasible option (TNC 2010). The TNC (2010) recommends that efforts should primarily deal with preventing intrabasin movement of established species, increasing effectiveness of current control efforts where management tools and programs exist, researching and developing new tools and strategies for dealing with established invasive species, and mitigating impacts on native biodiversity.

## Urban Development and Shoreline Alterations

The threat of housing and urban development was rated very high in its potential impact on migrating birds, coastal terrestrial systems, coastal wetlands, and the nearshore zone (indeed, SWS participants deemed this threat as the most significant for nearshore zone biodiversity; TNC 2010). This is due in large part because there is very little undeveloped shoreline left in areas of high recreation value. Residential development is most dense in the southern portions of the basin and where road densities are generally high, but many other northern shoreline areas are at risk for additional shoreline development. Of particular concern are the continued loss, fragmentation, and potential degradation to the high quality and sensitive coastal wetlands of Saginaw Bay. There is also a general loss of breeding and staging areas for migratory birds due to encroachment on wetlands, and the nearshore zone and coastal wetland habitat has been fragmented or lost.

In contrast, the threat of shoreline alterations to coastal wetland and terrestrial and nearshore zone features is medium. TNC predicts that future shoreline alterations are likely to negatively impact 11 to 30 percent of coastal wetlands, while terrestrial and nearshore zone features are anticipated to be moderately to seriously degraded or reduced throughout their entire range (TNC 2010). Furthermore, it is assumed that the effects can technically be reversed and the features restored (TNC 2010). Although it may not be practical or affordable to restore natural conditions, with a commitment of necessary resources, the nearshore zone and coastal terrestrial systems features could likely be restored and the threat reversed.

One goal recommended by the TNC is that future management of urban development should harmonize shoreline land use planning, policy, enforcement, ecosystem processes, and biodiversity conservation among multijurisdictional agencies. This will result in less impervious surface, better stormwater management, and increased restoration and preservation of sensitive areas. Additionally, the TNC recommends that cumulative and distant environmental impacts be considered when regulating nearshore and coastal development. The current gap in information regarding the impacts of development and

fragmentation of shorelines should also be closed. By extension, public information and understanding of the value of shoreline habitat will be more prevalent.

## Dams and Barriers

Dams and barriers are hydropower dams, lowhead dams, road-stream, crossing/culverts, and water-control structures (e.g., locks and dikes). Dams and barriers pose the greatest threat to native migratory fish. The extent and irreversibility of this threat were considered high, while severity was ranked very high. For sturgeon, walleye, and mollusks, tributary habitats are a limiting factor to increasing population (Fielder et al. 2008). Most of the historic spawning areas for sturgeon are currently blocked by dams (Liskauskas et al. 2007). The Lake Huron Binational Partnership identified dams as "the single most important impediment to recovery of lake sturgeon" (LHBP 2008).

Dams and barriers were also ranked as a high threat to the nearshore zone. This zone is greatly affected by riverine inputs of nutrients and sediments, and dams and barriers alter the delivery (both timing and quantity) of these inputs. In addition, most Great Lakes river-spawning fish spend the remaining stages of their lives in the nearshore zone (Liskauskas et al. 2007); as a result, vastly suppressed populations of these species can result in broad shifts in nearshore zone community structure and food web interactions, due to lack of access to spawning habitat (Liskauskas et al. 2007). The extent and severity of this threat were ranked as high, and irreversibility was considered medium.

Similar to the observed impacts in the nearshore zone, but to a lesser degree, some coastal wetlands are sustained by riverine inputs of sediments. Hence, dams and barriers were ranked as a low threat to coastal wetlands. The severity and irreversibility were considered high for the impact of dams and barriers on coastal wetlands, but scope was low or limited.

The TNC report summarized two major contributing and conflicting factors driving threats from dams: pressures or influence to keep, install, and repair dams and barriers and pressures to remove or reduce effects of dams and barriers. In both cases, there is a lack of information in support of strategic and coordinated management of dams and barriers.

Maintaining dams and barriers or building new ones serve several societal and resource management needs, as follows:

- Controlling nonnative aquatic invasive species
- Generating hydropower
- Maintaining local values (which encompasses aesthetics, recreation, and water takings/diversion)
- Controlling upstream movement of toxics (perceived/potential risk to humans and birds, primarily by contaminated fish moving upstream to uncontaminated areas)

Maintaining dams and barriers in some instances is a management tool to control populations and spread of nonnative aquatic invasive species. It is motivated by current fisheries management needs, sport and commercial fisheries interests, and the needs of threatened and endangered species. Hydropower generation is driven by existing industry and the power grid as well as new pressures to pursue carbon-neutral forms of power generation.

Conversely, there are several reasons to remove or mitigate the negative impacts of dams and barriers:

- Fisheries management for economically important species and listed species
- Ecological restoration and ecosystem services
- Liability associated with dam failure (public safety, ecosystem impacts)

- Inappropriately installed and placed barriers.

In the future, dams will have to be managed by balancing these two major sets of needs.

## Agriculture, Urban and Rural, and Forestry (NPS) Pollution

In the Western Lake Huron Basin, NPS pollution most commonly results from sediment, nutrients, or chemicals, such as pesticides, antibiotics, or hormones (TNC 2010). Altered hydrologic conditions play a major role in contributing to high loadings of these pollutants and can directly cause NPS impacts, particularly at river mouths or on migratory fishes. Each of these pollutants is further compounded by altered hydrologic regimes in the basin, which generally increases the rate and volume of water transported downstream, and can play a major role in driving pollutant loadings. Altered hydrology from NPS sources also directly impacts biodiversity features. Factors contributing to increased sedimentation, nutrient pollution, altered hydrology, and other chemical pollution were divided into agricultural, urban/rural, and forestry sources.

NPS pollution poses the greatest threat to nearshore zone and coastal wetland features. For these biodiversity features, scope, severity, and irreversibility were all considered high. NPS pollution is clearly a major result of increased residential, urban, and agricultural land uses, leading to declines of biological integrity in the nearshore zone and coastal wetlands (Lougheed et al. 2001; Uzarski et al. 2005; Niemi et al. 2009).

While NPS pollution also impacts native migratory fish, it represents a more moderate threat to dams and barriers (TNC 2010). For example, walleye recovery in Saginaw Bay depends on access to spawning habitat that is unavailable above dams; however, much of that habitat is also impaired by sedimentation. Accordingly, addressing NPS sediment delivery to Saginaw Bay tributaries is also important to native migratory fish (MDNR 2009). Altered hydrology is particularly important as a direct stressor to native migratory fish since they spawn in rivers where the timing, extent, and variability of streamflow can greatly alter spawning habitat conditions.

Finally, NPS pollution also poses some threat to the Lake Huron open water ecosystem and some coastal terrestrial systems habitats. If agricultural and urban land uses expanded substantially, there is a risk that Lake Huron open water ecosystem nutrient regimes and food web structure could be impacted. However, currently NPS pollution impacts on the Lake Huron open water ecosystem are minimal (Dobiesz et al. 2005; EC and EPA 2007). Most coastal terrestrial communities are not appreciably threatened by NPS pollution; for those that are, such as coastal fens, NPS pollution can pose a substantial threat, resulting in habitat loss from sedimentation or altered community structure from nutrients (Detenbeck et al. 1999; Cohen and Kost 2008).

Agricultural NPS pollution results primarily from incompatible agricultural management practices and incompatible ditching and tiling, which are driven by large-scale socioeconomic factors (TNC 2010). More specifically, agricultural row crops have generally moved toward larger fields without fencerows or riparian vegetation and without seasonal vegetation cover (e.g., pasture or cover crops; TNC 2010). This has resulted in decreased water infiltration and increased runoff, as well as higher wind erosion and greater amounts of sediment and nutrients washing into streams. Additionally, one conclusion of the TNC study was that high density livestock has increasingly become an issue locally (e.g., Saginaw Bay, along Michigan's "thumb") because the waste is often applied to fields adjacent to waterways at incompatible concentrations or at times that are susceptible to high runoff. In the future more wide-spread adoption of best management practices to minimize impacts from these sources will be needed.

The TNC report also concluded that urban and rural NPS pollution results primarily from inputs from concentrations of septic systems, lawn fertilization, construction, impervious surfaces, and land drainage.

Septic systems become significant problems when they occur at high concentrations and when they are in disrepair. Given the prevalence of homes with septic systems along much of Lake Huron, septic systems are often an important local source of nutrients and other pollutants. Lawn fertilization may also be a significant source of phosphorus at some locations. Application of pesticides and herbicides in residential and agricultural areas also can contribute to NPS pollution. Like agriculture, urban land uses result in wetland drainage and ditching, which decreases assimilation capacity that wetlands normally provide and increases transport of pollutants to Lake Huron. Construction projects often contribute large amounts of sediment to streams. The resulting urban development (parking lots, structures, roads) increases impervious surfaces, which reduces infiltration and increases runoff, further altering hydrology and increasing the efficiency of transporting pollutants downstream.

Poorly planned urban development into rural and undeveloped areas, particularly prior to prohibitions of combined sewer systems, is a significant cause of urban development related environmental problems (TNC 2010). Pollution from combined sewer overflows (CSOs) and sanitary sewer overflows is considered point-source pollution and so was not addressed as part of NPS pollution. CSOs and sanitary sewer overflows contribute to localized pollution in Lake Huron, including as a potential major source of bacterial contamination (LHBP 2008). But even in problem areas, nonpoint sources contribute most to nutrient pollution (Saginaw Bay Coastal Initiative 2009; He and DeMarchi 2010). Widespread programs aimed at addressing all of these sources will need to be implemented in the future.

According to the TNC, forestry NPS pollution comes from incompatible practices that result in significant base soil exposure or compaction. This leads to increased sedimentation or runoff (or both) into tributaries. Examples are large clear-cuts, significant forest clearing in or near riparian areas, excessive soil disturbance from heavy equipment use or from dragging logs on slopes or in riparian areas, and poorly designed stream crossings. Better implementation of forestry best management practices that minimize these impacts will largely address forestry NPS sources.

## 5.5 Future Without Project Conditions

As thoroughly described above, several significant water resources and other impairments within the Basin exist and are worsening as time progresses. Without a reversal of these trends through awareness and action on several levels, conditions are expected to gradually worsen (aside from local efforts to the contrary) without Federal and stakeholder participation along with larger partnership efforts.

The TNC (2010) recognized that there is a number of "emerging chemical issues," and this indicates that we might be underestimating their impacts on aquatic ecosystems and communities. These chemicals include pesticides, pharmaceuticals, hormones, and other organic contaminants (Kolpin et al. 2002). While these chemicals are clearly having some impacts (Jobling et al. 1998; Hayes et al. 2003; Blazer et al. 2007), there is currently a paucity of information on the extent of the problem, both in terms of distribution of areas with significant concentrations and the ecological/biological impacts. Much work is needed in the Great Lakes before determining the relative influence and contributing factors for these emerging chemical issues.

### Climate Change

Global climate change is expected to lead to six major types of changes in Lake Huron: (1) increased annual averages in air and surface water temperatures (with greater extremes in hottest temperatures), (2) increased duration of the stratified (thermocline) period, (3) changes in the direction and strength of wind and water currents, (4) flashier precipitation (increases in the intensity of storms and drier periods in between), (5) decreased ice cover/greater water surface evaporation/larger lake effect snow events, and (6) changes in lake levels (TNC 2010). Also of importance to be considered are changes in plant, fish and

wildlife community composition and distribution within the basin, including the distribution and advancement of invasive species into the basin. Clearly, these factors interact with one another, further complicating our ability to anticipate climate change trends and impacts, making this a serious, albeit uncertain, threat. The risk and uncertainty to project performance and sustainability attributable to potential climate change impacts is now required to be addressed in the feasibility phase report for each particular study location.

The TNC concluded that opportunities and associated strategies for managing for climate change generally fall into two categories: direct impacts of climate change on biodiversity features and indirect impacts of climate change on biodiversity features by exacerbating other critical threats. These indirect impacts are likely to be some of the more promising areas for climate change adaptation strategy development. This is because we often have tools and methods in place to help abate these threats, and we may most easily be able to redouble those efforts as these threats become more pronounced due to climate change. For example, actions such as those that lead to shifts in land use or increases in water extraction could lead to increased stress on lake ecosystems. Also, one key threat to the health and biodiversity of the Great Lakes is the conveyance of pollutants, nutrients, and sediments into nearshore zones during storms. We already know that to restore many Great Lakes habitats, we need to reduce these kinds of inputs and that much of our infrastructure (e.g., that for stormwater and sewage) and farm practices need to be improved. Climate change increases the urgency of these needs.

In contrast, it is often more challenging to address climate change's direct effects, although we can certainly help ensure that ecosystems are as connected and resilient as possible so that species can move and remain viable under current and future climate conditions.

## Applicability of the Great Lakes Water Quality Agreement – AOCs and RAPs

As indicated earlier in this report, the WLHB study area is in the purview of the Great Lakes Program (led by the EPA) and the Binational Great Lakes Water Quality Agreement, which call for RAPs to restore and protect beneficial uses of Great Lakes resources within designated AOCs (IJC 2011).

Table 3 presents the 14 BUIs in the Great Lakes that are identified in the Binational Agreement and depicts those that are applicable to the two AOCs in the WLHB study area.

**Table 3. Great Lakes Water Quality Agreement BUIs applicable to the Saginaw River/Bay AOC and St. Marys River AOC.**

| Great Lakes Areas of Concern<br>BUIs | Saginaw River and Bay AOC | St. Marys River AOC |
|---|---|---|
| Restrictions on fish and wildlife consumption | X | X |
| Tainting of fish and wildlife flavor | X* | |
| Degradation of fish and wildlife populations | X | X |
| Fish tumors and other deformities | | X |
| Bird or animal deformities or reproduction problems | X | X |
| Degradation of benthos | X | X |
| Restrictions on dredging | X | X |
| Eutrophication or undesirable algae | X | X |
| Restrictions on drinking water consumption or taste and odor problems | X* | |
| Beach closings | X | X |
| Degradation of aesthetics | X | X |
| Added costs to agriculture or industry | | |
| Degradation of phytoplankton and zooplankton populations | X | |
| Loss of fish and wildlife habitat | X | X |

* BUI has been removed

Contaminated sediments, fish consumption advisories, degraded fisheries, and loss of significant recreational values was the major reasons for the Saginaw River and Bay AOC designation. These problems were mainly caused by high amounts of soil erosion, excessive nutrients (e.g., phosphorus and nitrogen) entering the water, and contaminated sediments. Saginaw River and Bay priorities have included remediation of sediment contaminated with polychlorinated biphenyls, nonpoint pollution control, wetland restoration, and habitat restoration (EPA 2011b).

In the St. Marys River AOC, beaches have been periodically closed due to elevated bacteria levels. Aesthetic degradation has also occurred due to oil slicks and floating algae scum. The St. Marys rapids spawning habitat is reduced but is still productive. Significant loss of fish and wildlife habitat has occurred along both sides of the river as a result of shoreline alteration, industrialization, urbanization, agricultural impacts, and shipping. Initially, priorities for the St. Marys River AOC included restoring urban tributaries on both sides of the border, cleaning up the Cannelton Tannery Superfund site, controlling sea lampreys, eliminating combined sewer overflows, and forming a strategy for contending with contaminated sediments (EPA 2011a). The Cannelton Tannery site has been cleaned up, and sea lamprey issues are no longer being addressed under the AOC program.

## Opportunities

The main goals of the Section 905(b) study are to determine if water resources problems and opportunities in the WLHB warrant Federal participation in a feasibility study and to define the Federal (Corps) interest. Another aspect of the opportunities identification process is to see where additional improvements could be made, "above and beyond" meeting the basic management of an identified problem (impairment). The method used to fulfill these goals combined a literature review with extensive public outreach. The rationale for this approach was that the literature would document the current conditions (2000 to present) and would have developed actions to address the identified problems, while public outreach would fill in the gaps (e.g., ongoing studies and literature that was missed), as well as update the project team about changes in the watershed. Furthermore, public outreach helped the team to better understand local priorities and to identify potential local cost-share sponsors. The following paragraphs elaborate on each of the method sections.

With a study area of over 8,700 square miles and more than twenty subwatersheds and two AOCs, the volume of literature was large (over 1,200 documents). Therefore, the study team decided to focus only on those documents that contain action items targeted at addressing problems. The remaining ninety or so documents fell into two categories: 1) multicounty documents, such as the Sweet Water Sea (TNC 2010) and the Lake Huron Binational Partnership 2008-2010 action plan, and 2) smaller-scale papers, such as the Au Sable River Assessment (Zorn et al. 2001) and the Kawkawlin River Watershed Management Plan (2011). These were reviewed prior to the community meetings to understand the scope and nature of previous work in the study area.

## WLHB Stakeholder Input on Problems and Opportunities (2011)

Public outreach, as described in Section 5.2, was designed to elicit site-specific information on local problems as well as projects thought to be able to address them. Stakeholders were organized into small groups and given a 2.5- by 5-foot map of their local area. They were asked to write directly on the map and to discuss the issues and projects among themselves. A project team member was at each table, facilitating the stakeholder discussions and recording relevant information to supplement the notes on each map. Information collected from the meetings was transcribed into notes and used to compile a list of potential projects (see Section 5.7 for details).

Through the process of WLHB stakeholder meetings in July and August 2011, some overarching water resource problems and needs consistently surfaced from agencies and stakeholders across the WLHB

study area. These expressed problems, and needs were generally consistent with those documented from the existing and ongoing studies and plans in the Great Lakes area, and specifically in the WLHB study area, as summarized in the preceding paragraphs. In summary, the specific problems and opportunities of concern to WLHB stakeholders that tend to persist across the entire study area are as follows:

- **Invasive species, most particularly phragmites, across the entire study area.** Agencies and stakeholders said that these species are significantly displacing important fish and wildlife habitats and impacting views and aesthetic values along the coast and in near-coastal waterways. Agencies and stakeholders are seeking to develop effective strategies for managing and controlling these destructive invasive species.

- **Erosion and sedimentation issues in inland waterways and coastal watersheds.** These issues are generally the result of poor land management practices on agricultural and urban lands. Erosion and sedimentation have impacted the habitat value and water quality in streams and waterways and has resulted in excessive delivery of sediment into Saginaw Bay and western Lake Huron. One of the most persistent areas of concern identified by agencies and stakeholders is the problem of muck deposits in nearshore areas across the WLHB. These deposits generate concerns about water quality as well as aesthetic and recreational impacts associated with the use of beaches.

- **Loss of fish habitat and declining fisheries.** In addition to erosion/sedimentation impacts on fish habitat, loss of stream connectivity, barriers to fish movement, degraded water quality, and loss of wetlands along streams and along the coast have had significant negative impacts on aquatic species.

- **Navigation restrictions.** Across the study area, numerous concerns were expressed by stakeholders that harbors are in need of maintenance dredging. In addition, the configuration of protective structures at several harbors is perceived to be the source or cause of circulation, sedimentation, and water quality problems in or down drift of the harbors.

- **Contaminated sediments.** Concerns persist about the impact of contaminated sediments, both inside and outside of navigation channels across the study area, particularly in the lower Saginaw River watershed.

- **Need for technical guidance and planning assistance.** In many cases, agencies and stakeholders were interested in various types of assistance with water resource challenges to help them make better resource management decisions on a day-to-day basis. The technical guidance/planning assistance needs were mapping and GIS support; development of resource management plans and strategies; development of model ordinances and guidelines for decision makers; modeling and other technical assessment tools and methods; and training (e.g., effective stream crossing techniques and best management practice implementation).

The specific list of problem areas and study/project opportunities presented below in Section 5.7 include potential solutions where applicable, as developed from the literature review and stakeholder outreach. The list was compiled and screened to determine those that would not fit applicable Corps authorities, those that could be addressed by Corps small project and technical assistance authorities, and those that may be eligible and more appropriate for detailed general investigations feasibility level study. That screening process also is described in Section 5.7.

## 5.6 Planning Goals and Objectives

The study authority, as amended, enables consideration of a broad array of potential water challenges in the WLHB study area. The WLHB basin is large and highly diverse from a land use, geographic, and demographic perspective. Further, a wide array of water resource problems and opportunities has already been identified in the basin as a result of numerous previous and ongoing studies and planning efforts. Consequently, the list of potential problems and opportunities compiled for consideration under the Corps program in this reconnaissance study is extensive. The national objectives of NED and NER are general statements and are not specific enough for direct use in plan formulation. Planning goals were established to provide a basis for screening the problems and opportunities to help identify those that would be appropriate for feasibility level investigations.

The overarching planning goal for the WLHB 905(b) study is to identify and recommend water resource projects, consistent with Corps water resource authorities and priority mission areas, which will restore ecological function in aquatic habitats and support economic well-being in Western Lake Huron Basin watersheds and adjacent areas of Lake Huron. A secondary goal is to insure that projects identified in this study complement and leverage GLRI goals and funding and the RAPs for the St. Marys River and Saginaw River and Bay AOCs. Planning objectives for this 905(b) study were defined as follows:

- Reestablish more naturally functioning hydrologic and geomorphic conditions in WLHB watersheds with critical erosion and sedimentation problems to conserve aquatic resources, reduce sediment loads to Lake Huron, and reduce nutrient and bacteria (and other pollutant) loading in watersheds and Lake Huron.
- Reduce shoreline erosion along Lake Huron that may be impacting important aquatic resources and habitats and existing infrastructure.
- Restore or improve aquatic and wetland habitat conditions where critical losses have occurred or are expected to occur in the future.
- Restore conditions to improve fish passage and movement within WLHB watersheds.
- Contribute to delisting pertinent BUI in the Saginaw Bay AOC and the St. Marys River AOC, s.
- Address appropriate channel improvement needs and long-term dredged material management planning needs within the WLHB study area.
- Reduce flood risk in areas prone to flood damages within the WLHB study area.
- Reduce the effects of invasive species on aquatic habitats and their functions in the study area.

Upon narrowing the field of problems and opportunities down to one or more specific study proposals that fit within Corps authorities and that warrant detailed feasibility level investigations, site-specific or watershed-specific planning objectives will be developed. These planning objectives will represent desired positive changes in the without-project conditions, relative to the affected resources.

## 5.7 Planning Constraints

Unlike planning objectives that represent desired positive changes, planning constraints represent restrictions that should not be violated during the formulation, evaluation, and selection of detailed plans. The planning constraints identified herein represent general constraints or limitations on the formulation of plans to address the problems and opportunities identified in this 905(b) study. As specific feasibility level study proposals are developed, planning constraints will be refined and augmented to more directly reflect conditions at the study site(s) or within the pertinent watershed being investigated. The general planning constraints identified in this 905(b) study are as follows:

- Plans for ecosystem restoration will not induce flooding or exacerbate flooding conditions in the study area.
- Plan for ecosystem restoration will avoid adversely affecting navigation activities and associated infrastructure in the study area.
- Plans will be consistent with overarching plans and strategies associated with the GLRI.
- Plans will be consistent with RAPs for the Saginaw River and Bay AOC and the St. Marys AOC.
- Plans will be consistent with the goals, objectives, and provisions of various state natural resource related plans, including the Michigan Coastal Management Program.
- Plans will be consistent and compatible with local land use plans, zoning ordinances, and pertinent watershed management plans.

## 5.8 Measures to Address Identified Planning Goals and Objectives

### 5.8.1 Management Measures

For feasibility level investigations, a management measure is a feature or activity at a site, which addresses one or more planning objectives. A wide variety of measures are considered, some of which will not be determined to be feasible due to technical, economic, or environmental constraints. Each measure is assessed and a determination made regarding whether it should be retained in the formulation of alternative plans. A general description of the measures considered in this Section 905(b) study is presented below, and results of the evaluation of these measures are presented in subsequent sections of the report.

**No Action.** The Corps is required to consider the option of "No (Federal) Action" as one of the alternatives in order to comply with the requirements of the National Environmental Policy Act. No Action is the most likely condition expected to exist in the future and assumes that no project would be implemented by the Federal government to achieve the planning objectives. Under No Action, conditions for most of the problems identified in the WLHB study area would be expected to decline further over time. No other planned Federal involvement would be expected. Without Federal government participation, activities already planned and funded by local interests may be implemented, but projects could be delayed or reduced in scope as a result. These activities by local interests would become part of the "Without Project Condition," which forms the basis from which all other alternative plans are compared and evaluated.

**Nonstructural.** A number of nonstructural measures may be considered for the study area to address the planning objectives. These nonstructural measures may include studies, modeling, monitoring, and related efforts (short of a full-blown feasibility level study) that provide technical information and management plans and strategies to assist Federal, state, and local decision makers in protecting and restoring important ecosystems, reducing flooding risk, or producing other tangible benefits. More specifically, these measures may include watershed studies and management plans, stream modeling, biological surveys and studies, baseline sampling and long-term monitoring, and pilot studies for sediment remediation and habitat restoration. These studies may be performed independently by other entities (e.g., Federal, state, or local government, nongovernment organization, etc.) or in partnership with the Corps under several standing Corps authorities to provide technical assistance (see Section 5.6.2).

For ecosystem restoration projects developed using a watershed-based approach, a variety of nonstructural measures may be implemented separately, or in concert with certain structural measures, to restore or improve ecological function. Potential nonstructural measures may include implementation of a wide variety of best management practices on the landscape (e.g., drain tile disablement, filter strips, no-till farming, bio-swales, and rain gardens), removal and treatment of invasive species to establish

natural conditions, restrictive zoning and ordinances, and acquisition of fee interest in lands or easements to protect critical natural areas in the watershed. Implementation of such features as restrictive zoning and ordinances as well as land acquisition for habitat protection could contribute to ecosystem protection and restoration objectives but would not generally be eligible for Federal participation. NFS's could implement these types of measures in conjunction with Corps ecosystem restoration projects.

The Corps role in ecosystem restoration is achieved by modifying hydrologic and hydraulic conditions in order to produce restoration outputs (or benefits). Any non-structural measures explicitly for water quality purposes that are incorporated into a Corps ecosystem restoration project must be essential to the successful ecological function and performance of the restoration project to be eligible for Federal participation. Implementing stand-alone measures solely for water pollution abatement purposes would not be consistent with Corps ecosystem restoration policies. Water quality improvement may also occur as a secondary or incidental benefit of a Corps ecosystem restoration project.

For flood and coastal storm risk management projects, potential nonstructural measures may include relocation of structures and critical infrastructure, flood proofing, restrictive zoning and ordinances, and evacuation planning.

**Structural.** Numerous opportunities may exist to implement structural measures to address problems and opportunities in the study area. Such opportunities will be fully evaluated during feasibility level investigations determined to be appropriate as a result of this Section 905(b) study. These include coastal and shoreline protection and restoration features, stream bank stabilization and erosion control features, wetland and aquatic habitat restoration features, structural measures to reduce flood risk, and navigation improvements.

For ecosystem restoration projects in a wide variety of degraded aquatic habitats and adjacent areas within the WLHB study area, measures that would be minimally intrusive or bioengineered and would tend to more closely mimic natural hydrologic and geomorphic processes are preferred. However, more intrusive, engineering measures may be appropriate for highly impacted and deteriorated stream or shoreline conditions in order to stabilize and manage erosion/sedimentation processes to enable recovery and promote restoration of ecological function. Removal of in-stream structures, such as dams and weirs, may be a preferred approach for restoration of more natural conditions but may not be practicable in all cases nor supported by local stakeholders.

Potential structural measures may include upstream detention/retention/infiltration trenches, in-stream structures (e.g., riffles, cross veins) for grade control/sediment management and aquatic habitat improvement, environmentally compatible bank protection and stabilization structures, sediment removal by mechanical excavation or dredging, off-stream sediment retention structures, new or modified water control structures for water level management for fish and wildlife habitat improvement, fish ladders and other structural modifications to improve fish passage, barriers to exotic species passage upstream, and modified or retrofitted structures to improve water circulation and water quality. With all potential structural measures, planting of native vegetation may be incorporated to more quickly and effectively reestablish native plant communities and restore ecological function and to discourage colonization by invasive plant species.

For flood risk management projects, potential structural measures include channel improvements, flood retention/storage areas, levees, and flow diversion structures and bypass channels. For coastal storm risk management projects, various potential structural measures to reduce storm impacts include shoreline stabilization structures, replenishment of shoreline sediments, and nearshore breakwaters.

**Separable Features.** Separable project features are single purpose components of a plan designed to address a specific management objective that could be implemented in conjunction with, but not integral

to, the recommended project plan. For example, recreation features could comprise a separable element of a plan, but navigation, ecosystem restoration, or flood risk management features could also be separable elements. These separable elements can be implemented as part of the Federal project if they are cost-effective and are determined to be in the Federal Interest. A "locally preferred plan" could include such separable features that may not be in the Federal Interest but might otherwise be acceptable to the Corps, provided the NFS agrees to fund the full cost of the separable project features. Recreation facilities are among the most common separable features and may include such components as boardwalks, observation platforms, dredging for recreational boating, or extra sand for recreation purposes. In some circumstances, limited recreation facilities may be eligible for Federal cost-sharing as part of a project, with structural features addressing ecosystem restoration, flooding, and navigation needs.

**Additional Measures for Complete Alternatives.** Additional management measures could be developed and combined with other measures to create alternative plans that more completely address one or more of the planning objectives of the feasibility study. Such secondary features to make an alternative more complete or functional could include specific dredging methods and improved interior drainage features.

### 5.8.2 Other Applicable Corps Water Resource Authorities/Programs

In addition to pursuing traditional feasibility level studies under its General Investigations program for larger scale and more complex and costly water resource challenges, the Corps has a number of specific authorities to address problems and opportunities with smaller projects at a more localized scale or to provide technical assistance to states, tribes, local governments, and environmental organizations.

**5.6.2.1 Continuing Authorities Program (CAP).** The CAP provides the Corps with the authorities to address water resource problems that are more limited in scope in partnership with local sponsors without the need to obtain specific congressional authorization for each project. Use of these authorities, where appropriate, would decrease the amount of time required to budget, develop, and approve a potential project for construction. Under the CAP, the Corps is authorized to construct small projects within specific Federal funding limits. The range of potential management measures to address flood risk management or ecosystem restoration problems and opportunities under the CAP would be the same as those described in Section 5.6.1 for feasibility level studies under the General Investigations program. The total cost of a CAP project (including studies, design, and construction) would be shared among the Federal government and a non-Federal sponsor. Each of these authorities and programs have specific and unique procedures and criteria related to such matters as cost-sharing percentages, credit for in-kind services, and Federal funding limits. The various project authorities under the CAP are summarized briefly below (and in Table 4). A more detailed description of each authority is provided at the following link on the Corps Detroit District web site: http://www.lre.usace.army.mil/_kd/go.cfm?destination=Page&Pge_ID=1409.

- **Section 205, Flood Control Act of 1948, as amended (Small Flood Risk Management Projects).** This authorizes the Corps to plan, design, and construct structural and nonstructural flood damage reduction (flood risk management) projects in partnership with non-Federal government agencies, such as cities, counties, special authorities, and units of state government. Projects are planned and designed under this authority to provide the same complete flood risk management project that would be provided under specific congressional authorizations. The maximum Federal cost for planning, designing, and constructing any one project is $7 million. Each project must be economically justified, environmentally sound, and technically feasible. Flood risk management projects are not limited to any particular type of improvement. Levee and channel modifications are examples of flood risk management projects constructed using the Section 205 authority.

- **Section 14, Flood Control Act of 1946, as amended (Emergency Streambank and Shoreline Protection).** This authorizes the Corps to study, design, and construct emergency stream bank and shoreline works to protect public structures and infrastructure, such as streets, bridges, schools, water and sewer lines, National Register sites, and churches, from damage or loss by natural erosion. The Federal cost limit on Section 14 projects is $1.5 million at any one site, including all study, design, and construction expenditures.

- **Section 208, Flood Control Act of 1954, as amended (Snagging and Clearing for Flood Control).** This provides authority for the Corps for channel clearing and excavation, with limited embankment construction by the use of materials from the clearing operation to reduce nuisance flood damages caused by debris and minor shoaling of rivers. The maximum Federal cost for the project development and construction is $500,000, and each project must be economically justified, environmentally sound, and feasible.

- **Section 107, River and Harbor Act of 1960, as amended (Small Navigation Projects).** This provides authority for the Corps to develop and construct small navigation projects. The Corps adopts a project for construction after detailed investigation clearly shows the engineering feasibility and economic justification of the improvement. Each project is limited to a Federal cost of not more than $7 million. This Federal cost limitation includes all project-related costs for feasibility studies, planning, engineering, construction, supervision, and administration. The Federal project can provide only general navigation facilities, including a safe entrance channel protected by breakwaters or jetties if necessary, anchorage basin, turning basin, and a major access channel leading to the anchorage basin or locally provided berthing area.

- **Section 103, River and Harbor Act of 1962 (Hurricane and Storm Damage Reduction).** This authorizes the Corps to study, design, and construct small coastal storm damage reduction projects, in partnership with non-Federal government agencies, such as cities, counties, special authorities, and units of state government. Projects are planned and designed under this authority to provide the same complete storm damage reduction project that would be provided under specific congressional authorizations. The maximum Federal cost for planning, design, and construction of any one project is $5 million. Each project must be economically justified, environmentally sound, and technically feasible. Hurricane and storm damage reduction projects are not limited to any particular type of improvement. Beach nourishment (structural) and flood proofing (nonstructural) are examples of storm damage reduction projects constructed under the Section 103 authority.

- **Section 111, River and Harbor Act of 1968 (Prevention or Mitigation of Damages caused by Federal Navigation Work).** This provides authority for the Corps to develop and construct projects for prevention or mitigation of damages caused by Federal navigation work. This applies to both publicly and privately owned shores along the coastline of the United States. Each project is limited to a Federal cost of not more than $5 million. This authority cannot be used to construct works for preventing or mitigating shore damage caused by riverbank erosion or vessel-generated wave wash, nor can it be used to prevent or mitigate shore damage caused by non-Federal navigation projects.

- **Section 1135, Water Resources Development Act of 1986, as amended (Project Modifications for Improvement to the Environment).** Under the authority provided by this law, the Corps may review and modify structures and operations of water resources projects constructed by the Corps for the purpose of improving the quality of the environment when such modifications are determined to be feasible. Projects must be in the public interest, cost effective, and limited to $5 million in Federal cost.

- **Section 204, Water Resources Development Act of 1992, as amended (Ecosystem Restoration Projects in Connection with Dredging).** This provides authority for the Corps to plan, design, and build projects to protect, restore, and create aquatic and ecologically related habitats in connection with dredging of authorized Federal navigation projects. Typically, these projects involve the beneficial use of dredged material from navigation channels to improve or create wetlands or waterfowl/shorebird nesting habitats.

- **Section 206, Water Resources Development Act of 1996, as amended (Aquatic Ecosystem Restoration).** Under the authority provided by this section, the Corps may plan, design, and build projects to restore aquatic ecosystems for fish and wildlife. Projects must improve the quality of the environment, be in the public interest, demonstrate cost effectiveness, and not exceed $5 million in Federal cost. Recreation projects, if justified, may be included in the total project, but they may not increase the Federal share of the total project by more than 10 percent. Additionally, projects should not be formulated for recreation, and recreation should not detract from ecosystem benefits.

Table 4. USACE Continuing Authorities Program

| Authority | Type of Project | Cost Share Federal/Non-Federal | Federal Project Limit |
|---|---|---|---|
| Section 205, 1948 Flood Control Act, as amended | Small flood damage reduction projects (formerly flood control) | 65%/35% | $7,000,000 |
| Section 14, 1946 Flood Control Act, as amended | Emergency stream bank and shoreline protection | 65%/35% | $1,500,000 |
| Section 208, 1954 Flood Control Act, as amended | Snagging and clearing for flood control | 65%/35% | $500,000 |
| Section 107, 1960 River and Harbor Act, as amended | Small navigation projects | Varies by depth | $7,000,000 |
| Section 103, 1962 River and Harbor Act, as amended | Small hurricane and storm damage reduction projects (beach erosion) | 65%/35% | $5,000,000 |
| Section 111, 1968 River and Harbor Act, as amended | Mitigation of shore damage attributable to navigation works | Costs are shared in the same manner as the project causing the erosion/shoaling. | $5,000,000 |
| Section 1135, 1986 Water Resources Development Act, as amended | Project modifications for improvements to the environment | 75%/25% | $5,000,000 |
| Section 204, 1992 Water Resources Development Act, as amended | Ecosystem restoration projects in connection with dredging | 75%/25% | $5,000,000 |
| Section 206, 1996 Water Resources Development Act, as amended | Small aquatic ecosystem restoration projects | 65%/35% | $5,000,000 |

**5.6.2.2 Corps Project/Technical Assistance Authorities.** The Corps has a number of other special project and technical assistance authorities that may be available to address water resource problems and opportunities in the WLHB study area. As with the CAP, each of these authorities and programs has specific and unique procedures and criteria related to such matters as cost sharing percentages, credit for in-kind services, and Federal funding limits. These special project/technical assistance authorities are enumerated and briefly described below; a more detailed description of each authority is provided at the following link on the Corps Detroit District web site: http://www.lre.usace.army.mil/_kd/go.cfm?destination=Page&Pge_ID=1409 .

- **Section 22, Water Resources Development Act of 1974, as amended (Planning Assistance to States).** This provides authority for the Corps to assist the states, local governments, and other non-Federal entities in preparing comprehensive plans for the development, use, and conservation of water and related land resources. Section 208 of the Water Resources Development Act of 1992 amended WRDA 1974 to include Native American tribes in the program, in accordance with the same provisions that apply to the states. The Planning Assistance to States Program is funded annually by Congress. Federal allotments for each state or Tribe from the nationwide appropriation are limited to $500,000 annually but typically are much less. Individual studies, of which there may be more than one per state or tribe per year, generally cost $25,000 to $75,000. These studies are cost shared on a 50 percent Federal/50 percent non-Federal basis.

- **Section 206, Flood Control Act of 1960 (PL 86-645), as amended (Floodplain Management Services [FPMS]).** The FPMS Program was developed by the Corps specifically to address the need of people who live and work in the floodplain to know about the flood hazard and the actions that they can take to reduce property damage and to prevent the loss of life caused by flooding. Its objective is to foster public understanding of the options for dealing with flood hazards and to promote prudent use and management of the nation's floodplains. The FPMS Program provides the full range of technical services and planning guidance that is needed to support effective floodplain management.
  - **General Technical Services.** The program develops or interprets site-specific data on obstructions to flood flows, flood formation, and timing and the extent, duration, and frequency of flooding. It also provides information on natural and cultural floodplain resources of note and flood loss potentials before and after the use of floodplain management measures.
  - **General Planning Guidance.** On a larger scale, the program provides assistance and guidance in the form of special studies on all aspects of floodplain management planning, including the possible impacts of off-floodplain land use changes on the physical, socioeconomic, and environmental conditions of the floodplain. This can range from helping a community identify present or future floodplain areas and related problems, to a broad assessment of which of the various remedial measures can be effectively used.

- **Section 506, Water Resources Development Act of 2000 (Great Lakes Fishery and Ecosystem Restoration Program).** This authorizes the Corps to participate in planning, engineering, design, and construction of projects to restore degraded ecosystem structure, function, and dynamic processes to a more natural condition. Such projects include the removal of low head dams as a way to improve water quality and fish and wildlife habitat. Projects require partnering with a non-Federal sponsor, which may be a public agency, state or local government, private interest, or nonprofit environmental organization. Generally, projects for study are selected and endorsed by an integrated panel of Federal and non-Federal Great Lakes ecosystem restoration experts.

- **Estuary Restoration Act (ERA) of 2000 (PL 106-457, Title I), as amended.** The purposes of the ERA are to promote the restoration of estuary habitat, to develop a National Estuary Habitat Restoration Strategy for creating and maintaining effective partnerships within the Federal government and with the private sector, to provide Federal assistance for and promote efficient financing of estuary habitat restoration projects, and to develop and enhance monitoring, data sharing, and research capabilities. Estuaries under the ERA include the Great Lakes. The ERA affects 30 states, the District of Columbia, Puerto Rico, Northern Mariana Islands, Virgin Islands, American Samoa, and Guam.

The ERA authorizes a program under which the Secretary of the Army can carry out projects and provide technical assistance to meet the restoration goal. Costs of projects funded under the ERA must be shared with non-Federal parties. Non-Federal responsibilities and project selection criteria are discussed in the ERA. The ERA established an Estuary Habitat Restoration Council, chaired by the Secretary of the Army, which consists of representatives of the National Oceanic and Atmospheric Administration, the EPA, the USFWS, the Department of Agriculture, and the Department of Army. There may also be one ex officio member appointed by the President. Funding is authorized to be appropriated to all of the Restoration Council member agencies for implementing projects. The Council's overall responsibilities are soliciting, evaluating, reviewing, and recommending project proposals for funding, developing a national strategy, reviewing the effectiveness of the strategy and providing advice on development of databases, monitoring standards, and producing reports required under the ERA. The Secretary of the Army may delegate projects with a Federal cost of less than $1 million to one of the other Council members to implement with its appropriated funds or other funds available to the agency.

- **Section 203, Water Resources Development Act of 2000, as amended (Tribal Partnership Program).** This provides authority for the Corps, in cooperation with Indian tribes and heads of other Federal agencies, to study and determine the feasibility of carrying out projects that will substantially benefit Indian tribes. The Tribal Partnership Program provides an opportunity to assist with water resources projects that address economic, environmental, and cultural resource needs through studies that may include flood damage reduction, environmental restoration, and protection and preservation of natural and cultural resources. On request, the Corps will cooperate with tribes to study water resources projects and such other projects as determined appropriate, primarily located on tribal lands.

- **Section 312, Water Resources Development Act of 1990, as amended in 1996 (Environmental Dredging).** Congress provided the Corps with the authority to remove contaminated sediments outside the boundaries of Federal navigation channels as part of the operation and maintenance on a navigation project. All environmental dredging is to be taken in consultation with the EPA.

  Contaminated sediments have been identified as a significant environmental problem in the Great Lakes and have been linked to the impairment of beneficial uses of Great Lakes waters at every one of the AOCs designated in the Great Lakes Water Quality Agreement. While 5 sites in the Great Lakes, including Saginaw River in the WLHB, have been identified for priority consideration, contaminated sediments have been dredged for environmental remediation at more than 30 Great Lakes sites under the Section 312 authority. At many other sites with contaminated sediments, remediation has become stalled for lack of funding, resources, or other reasons. Restriction to navigation dredging is one of the use impairments identified in the Great Lakes Water Quality Agreement. About half of the 4 million cubic yards of sediments dredged annually by the Corps from Federal navigation harbors and channels are contaminated. In many cases, environmental remediation of contaminated sediment has been considered or implemented inside or next to Federal navigation channels.

  The environmental dredging authority requires a cost-sharing partner, which may be a state, local, or tribal government. The cost-sharing formula for this authority is condition specific. If the removal of contaminated sediments outside the Federal navigation channel will reduce future costs for maintenance of the Federal navigation channel, dredging may be conducted at full Federal cost. If not, and the benefits from dredging outside the Federal channel are environmental, dredging (along with transportation and treatment) are cost-shared at 65 percent Federal and 35 percent non-Federal. In all cases, the costs for disposal are cost-shared at 65

percent Federal and 35 percent non-Federal. Congress directed that annual funding for this authority not exceed $20 million Corps-wide (USACE LRD 2011).

- **Section 401(a), Water Resources Development Act of 1990, as amended (Great Lakes Remedial Action Plans).** Section 401(a) is intended to provide technical support to states and local organizations in the development and implementation of RAPs at Great Lakes AOCs. A RAP is developed in three stages: Stage I identifies and assesses use impairments and identifies the sources of the stresses from all media in the AOC; Stage II identifies proposed remedial actions and their method of implementation; and Stage III documents evidence that uses have been restored. It is important to note that, in practice, these stages often overlap and that the RAPs often become iterative documents, representing the current state of knowledge, planning, and remedial activity in the AOC.

- **Section 516(e), Water Resources Development Act of 1996 (Great Lakes Tributary Modeling Program).** This authority enables the Corps to develop sediment transport models for tributaries to the Great Lakes that discharge to Federal navigation channels or AOCs. These models are being developed to assist state and local resource agencies in evaluating alternatives for soil conservation and nonpoint source pollution prevention in the tributary watersheds. The ultimate goal of this program is to support state and local measures that will reduce the loading of sediments and pollutants to tributaries, thereby reducing the need for and costs of navigation dredging and promoting actions for delisting Great Lakes AOCs.

- **Section 729 Water Resources Development Act of 1986, as amended (Watershed Planning).** This authority enables the Corps to conduct watershed planning and preparing watershed plans. Watershed planning addresses problems, needs and opportunities within a watershed or regional context; strives to achieve integrated water resources management (IRWM); and, results in general, non-project specific, holistic plans or strategies to address those watershed needs. Watershed plans may recommend programs, and the initiation of site-specific project implementation studies. Note that this authority has historically received low limits of appropriated funds since authorized

## 5.9 Preliminary Screening of Problems/Opportunities and Potential Solutions for Further Feasibility Level Investigations

Information from the literature review and the public meetings was compiled and compared to narrow down the list of problems and opportunities and potential solutions to a manageable number. Each problem/opportunity on the list was considered for potential applicability to the 905(b) study authority and to other pertinent Corps authorities and programs. Unique identifying numbers were assigned to each potential project opportunity referenced to the specific public meeting during which the opportunity was first identified and/or discussed [Technical Stakeholder Meeting for agencies, NGOs, and academia (TS); community meetings at Sault Ste. Marie (SSM), Cheboygan (Che), Alpena (Alp), East Tawas (Taw), Bay City (BC), Midland (Mid), Port Austin (PA), or Port Sanilac (PS)]. Potential studies and projects to address the identified water resource problems and opportunities in the WLHB study area were evaluated and grouped into three tiers, based on their relevance to Corps authorities (i.e., Federal interest) and the nature of the measures most likely needed to address the problem/opportunity (e.g., project construction, watershed plan/study, planning assistance, and technical assistance). The primary outcome of this process was to identify studies and projects that would be in the Federal interest and implementable under Corps authorities. The three tiers are generally described as follows:

Tier 1 – implementable under an existing Corps authority and would likely involve constructed measures;

Tier 2 – implementable under an existing Corps authority and does not involve construction; and

Tier 3 – implementable by other organizations (eliminated from further screening and consideration herein). The results for each of the three tiers are discussed in more detail in the following paragraphs.

**Tier 1: Measures implementable under an existing Corps' authority and likely to involve constructed features.** These measures are those that would fit one or more of Corps' priority mission areas (navigation, flood risk management, and ecosystem restoration) and could be pursued under one of the following authorities: (1) a General Investigation Feasibility Study, in accordance with the authority for this 905 (b) study (Section 102, RHA of 1966); (2) Section 216 of the Flood Control Act of 1970 (Review of Completed Projects); or (3) one of the Corps' Continuing Authorities (see Section 5.6.2.1 above). Those study/project opportunities are presented in Table 5. In addition, a high percentage of these opportunities address one or more of the five GLRI focus areas and lie within the watersheds of either the St. Marys River AOC or Saginaw River and Bay AOC. For each of these opportunities, strong public and agency support was demonstrated in the technical stakeholders meeting in Bay City or one or more of the community stakeholders meetings held throughout the study area. Further, prospective NFSs either have already been identified and have confirmed their interest or are being sought for each opportunity presented in Table 5.

The 12 potential studies/projects identified in Table 5, with two exceptions, could be accomplished by way of the Corps Continuing Authorities Program. The table indicates which of the Continuing Authorities would be most applicable to each project. In some cases, more than one of those authorities may potentially apply. The most appropriate authority in those cases would be determined by the Corps at the initiation of the study, in consultation with the NFS. The two exceptions in Table 5 are: (1) a potential General Investigations Study to address coastal and tributary stream erosion and sedimentation issues in Eastern Sanilac County, Michigan (Project No. PS-4) and (2) a potential General Investigations Study to address ecosystem restoration and flood risk management issues in the Kawkawlin River watershed in Bay, Midland, and Gladwin Counties, Michigan. These potential studies are discussed in more detail in Section 5.9.

Implementation of opportunities identified in Table 5 depends on a number of factors, including commitment from a non-Federal entity that can meet the requirements to serve as an NFS, the timing and availability of Federal funding, and the timing and availability of non-Federal cost-share funding.

Detailed fact sheets on each Tier 1 study/project opportunity identified in Table 5 are included in Appendix C.

**Tier 2: Measures implementable under an existing Corps' authority which does not involve construction.** Tier 2 measures would generally be consistent with and at least indirectly support one or more of the Corps' priority mission areas and could be implemented under an existing Corps authority, but they would not be expected to lead to a project for construction. These measures include such activities as watershed management planning; water quality, hydrologic, and hydraulic modeling and preparation of implementation plans; installation of gauge stations and other field data collection; delisting of BUIs; and various other types of planning and technical assistance. As such, these measures will be pursued individually outside of this reconnaissance study process, using such Corps authorities and programs as Section 22 (Planning Assistance to States), Section 516 (Great Lakes Tributary Modeling Program), Floodplain Management Services, or the Corps' RAP authority. The Section 22 program requires non-Federal cost sharing, and the other program activities do not require it. Tier 2 opportunities are presented in Table 6. As discussed in Section 5.6.2.2, annual funding for the Section 22 program is limited. State agency or local government requests for assistance for Section 22 planning

assistance must be addressed to the designated Corps Detroit District Section 22 coordinator and coordinated through the state coordinator for the Corps' planning assistance program in MDNR.

A high percentage of these Tier 2 opportunities address one or more of the five GLRI focus areas and lie within the watersheds of either the St. Marys River AOC or Saginaw River and Bay AOC, as indicated in Table 6. For each of these opportunities, strong public and agency support was demonstrated in the technical stakeholders meeting in Bay City and one or more of the community stakeholders meetings held throughout the study area. Further, prospective NFSs either have already been identified and have confirmed their interest or are being sought for each opportunity presented in Table 6. Each of these Tier 2 planning or technical assistance opportunities will be pursued independently of this 905(b) study in accordance with the applicable Corps authorities and cost sharing provisions.

As indicated for Tier 1 projects, implementation of Tier 2 opportunities identified in Table 6 depends on a number of factors, including firm commitment from a non-Federal entity that can meet the requirements to serve as an NFS (if required), the timing and availability of Federal funding, and the timing and availability of non-Federal cost-share funding (if required).

**Tier 3: Measures Screened from Further Consideration under the WLHB Study / Implementable by Other Organizations.** During the screening process, Tier 3 measures were those that generally had merit with respect to various environmental issues in the study area but: (1) were not consistent with the Corps' mission areas, (2) did not fit one or more of the Corps' study/project authorities, (3) fit one of the Corps authorities but had insufficient stakeholder interest and no potential NFS, or (4) would likely be implemented more efficiently by another organization. Consequently, these opportunities were screened from further consideration and analysis in this reconnaissance study. These opportunities, identified in Table 7, generally would be more appropriately pursued through the programs of other Federal, state, or local government entities or through nongovernmental organizations. As noted in Table 7, many of the proposed study/project opportunities would be consistent with GLRI focus areas, and several would occur in the watershed of the St. Marys River AOC or the Saginaw River and Bay AOC or would directly benefit one of these AOCs.

**Table 5. WLHB Proposed Study/Project Opportunities**

**Tier 1 (Implementable under a Corps' authority – likely to involve constructed measures)**

| Project #* | Project/Study Opportunities | Potential Non-Federal Sponsor(s) | Applicability to Corps' Mission Areas | Within an AOC? | Support GRLI Focus Areas? | Stakeholder Support? | Applicable Authority/Program |
|---|---|---|---|---|---|---|---|
| SSM – 5 | *Ashmun Creek and Bay Ecosystem Restoration, Sault Ste. Marie, Michigan*<br><br>The potential project involves ecosystem restoration in the 2,558-acre Ashmun Creek watershed and potentially in Ashmun Bay along the St. Marys River. The project may involve measures to address erosion, bank failure, and high levels of sedimentation along Ashmun Creek and within the watershed in order to restore productive aquatic and riparian habitat and associated ecosystem function. The degradation in the watershed is a result of poor land and storm water management practices, extensive land development in the upper portion, and stream channel instability. The resulting impacts from these problems include loss of stream habitat for fish and wildlife, degraded water quality, and excessive sediment loading to Ashmun Bay. | City of Sault Ste. Marie<br><br>Chippewa-Ottawa Resource Authority | Ecosystem restoration | Tributary to St. Marys River AOC | Nearshore health and nonpoint source pollution<br><br>Sediment management<br><br>Habitat restoration | Yes<br><br>Chippewa / East Mackinac Conservation District<br><br>Chippewa County Health Dept.<br><br>Sault Tribe of Chippewa Indians<br><br>Bay Mills Indian Community<br><br>Lake Superior State Univ. | USACE – Section 206 program (Ecosystem Restoration) |
| Che-2 | *Thunder Bay River Ecosystem Restoration*<br><br>The potential project would involve improving water quality and fish and wildlife habitat in the Thunder Bay River Watershed, Thunder Bay, and Lake Huron by reducing sedimentation, reconnecting important habitat, and decreasing nutrient loading in the Thunder Bay River Watershed. The project would restore and protect the unique cultural and ecological features of the watershed and Thunder Bay by reestablishing habitat connectivity, restoring productive stream and riparian habitat, and implementing appropriate habitat restoration measures in Thunder Bay. It is estimated that nearly 200 tons of sediment enters the watershed annually from human induced sources such as road/stream crossings and eroding streambanks. | Huron Pines, Inc. (Letter of interest to USACE dated 11/14/2011 - see Appendix C) | Ecosystem restoration | No | Habitat restoration<br><br>Nearshore health and nonpoint source pollution | Yes<br><br>Local road commissions<br><br>NE Michigan Council of Governments (NEMCOG)<br><br>USFWS<br><br>Sea Grant<br><br>Local conservation partners | USACE – Section 206 program (Ecosystem Restoration)<br><br>or<br><br>USACE – Section 506 (GLFER) |

| Project #* | Project/Study Opportunities | Potential Non-Federal Sponsor(s) | Applicability to Corps' Mission Areas | Within an AOC? | Support GRLI Focus Areas? | Stakeholder Support? | Applicable Authority/Program |
|---|---|---|---|---|---|---|---|
| Che-5 | *Trout River Dam Rebuild/Replacement, Presque Isle County, Rogers Township, Michigan*<br><br>At present, the Trout River Dam is in a highly deteriorated condition. There are some problems with leakage around the dam and tree roots that affect the structure, but failure is not deemed to be imminent. The Trout River is a designated trout stream by Michigan DNR, and downstream of the dam is excellent trout and salmon habitat. Eventual dam failure would likely release a huge sediment load that would smother fish spawning habitat and aquatic insects which fish need for food, resulting in reduced trout and salmon survival.<br><br>The USFWS Sea Lamprey Control program does not want the dam to be removed or fail because it would make sea lamprey treatment much more difficult and expensive. A 1997 study estimated that, if the Trout River Dam was removed or failed, the cost to treat the river would more than triple, and the extent of stream requiring treatment would be eight times greater than at present.<br><br>Other opportunities to benefit fish and wildlife by replacing or rehabilitating the Trout River Dam include: retrofitting the dam with a structure to release water from a lower level in the pool, providing cooler water downstream to improve trout habitat and decrease sediment retention in the pond; adding a water level control mechanism to manage pool levels to benefit waterfowl (feeding and nesting); installing a lamprey free fish ladder on the dam to allow more trout and salmon to move upstream and spawn, thus increasing the populations of those fishes in the river and the Great Lakes over time. | Presque Isle Conservation District (Letter of interest to USACE dated 11/09/2011 – see Appendix C) | Ecosystem restoration | No | Habitat restoration<br><br>Nearshore health and nonpoint source pollution<br><br>Invasive species management | Yes<br><br>Presque Isle County<br><br>Trout Unlimited<br><br>USFWS<br><br>GLFC | USACE – Section 206 program (Ecosystem Restoration)<br><br>or<br><br>USACE – Section 506 (GLFER) |

| Project #* | Project/Study Opportunities | Potential Non-Federal Sponsor(s) | Applicability to Corps' Mission Areas | Within an AOC? | Support GRLI Focus Areas? | Stakeholder Support? | Applicable Authority/Program |
|---|---|---|---|---|---|---|---|
| Alp – 6 | *Alpena Township Flooding, Alpena, Michigan*<br><br>The potential project would involve measures to address flooding problems in Alpena Township (Fletcher Creek and adjacent watershed areas). Flooding events occurred in April 1998 and April 2011, causing damages to residences, businesses, roads, and other infrastructure. The Fletcher Creek watershed itself is relatively small (approximately 654 acres). There is strong evidence that, under larger flood events, water spills over from the Genschaw Drain Watershed into the Fletcher Creek watershed and exacerbates flooding problems.<br><br>The limestone bedrock geology in the area also complicates flooding conditions, impeding water infiltration over much of the area while other areas have bedrock cracks at the surface (called swallow holes) that drain large amounts of surface runoff into the subsurface aquifer. The total watershed area affected by flooding conditions in Alpena Township watersheds is about 9.5 square miles. | Alpena Township (Letter of interest to USACE dated 11/08/2011– see Appendix C) | Flood risk management | No | Not directly | Yes<br><br>Alpena County Drain Commission<br><br>City of Alpena, Michigan<br><br>NEMCOG | USACE – Section 205 program (Small Flood Control) |
| Taw-6 | *Rifle River Watershed Restoration, Arenac and Ogemaw Counties, Michigan*<br><br>The potential project would involve measures to address sediment and nutrient loading in the Rifle River Watershed in Arenac and Ogemaw Counties, Michigan for purposes of restoring productive aquatic and riparian habitats, and the associated ecological function of those habitats, to the watershed. Specific measures may include improvements along streambanks and at road/stream crossings, as well as implementation of best management practices at high priority sites in the watershed that would have the greatest positive impact on watershed resources. Huron Pines, Inc. recently completed a comprehensive resource inventory in the Rifle River Watershed to identify the most current threats to water | Huron Pines, Inc. (Letter of interest to USACE dated 11/14/2011– see Appendix C) | Ecosystem restoration | Tributary to Saginaw River/Bay AOC | Nearshore health and nonpoint source pollution/<br><br>Habitat restoration<br><br>Sediment management | Yes<br><br>County road commissions<br><br>County drain commissions<br><br>Rifle River Watershed Restoration Committee<br><br>Saginaw Bay Land Conservancy<br><br>Saginaw Bay RC&D | USACE – Section 206 program<br><br>or<br><br>USACE – Section 506 (GLFER) program (fisheries and fish habitat only) |

| Project #* | Project/Study Opportunities | Potential Non-Federal Sponsor(s) | Applicability to Corps' Mission Areas | Within an AOC? | Support GRLI Focus Areas? | Stakeholder Support? | Applicable Authority/Program |
|---|---|---|---|---|---|---|---|
| | quality and wildlife habitat.<br><br>The Rifle River drains a watershed of 396 square miles into Saginaw Bay, an EPA-designated AOC, and the mainstream has no large dams. Efforts to reduce sediment and nutrient loading in the river and its tributaries would have a positive impact on the overall water quality of Saginaw Bay and Western Lake Huron. The potential project would protect the high quality waters and ecological integrity of the Rifle River Watershed while maintaining the economic and cultural fabric of the communities that are dependent upon the health of these resources. | | | | | USFWS<br><br>Trout Unlimited (Mershon Chapter)<br><br>Local watershed groups | |
| BC- 1 | *Saganing River/Creek Watershed (Arenac County, Michigan) Ecosystem Restoration*<br><br>The potential project would involve actions to restore the aquatic ecosystem in the Saganing River/Creek watershed. . Feasibility level studies would consider measures to reestablish hydrologic conditions in the watershed that would support viable and productive aquatic and riparian habitats in the watershed, which are presently highly degraded for a variety of reasons. Aquatic habitat quality in the watershed has substantially declined and the system no longer supports a viable fishery. Stream has erosion / sedimentation issues and potential over drainage.<br>• No/minimal flow at points in the watershed at times (potential overdrainage)<br>• High sedimentation (total dissolve solids and total suspended solids)<br>• Loss of beneficial aquatic plant life<br>• DO below water quality standards (WQS)<br>• Proposed development near the shoreline<br>• No wastewater infrastructure<br>• Potential septic problem in the area | Saginaw Chippewa Tribe<br><br>Saginaw Bay Land Conservancy (Letter of interest requested from prospective partner(s) | Ecosystem restoration | Tributary to Saginaw River/Bay AOC | Nearshore health and nonpoint source pollution/<br><br>Habitat restoration | Yes<br><br>Arenac County<br><br>Saginaw Bay Land Conservancy | USACE – Section 206 program<br><br>or<br><br>USACE – Section 203 program (Tribal partnership Program)<br><br>or<br><br>USACE – Section 506 (GLFER) program (fisheries and fish habitat only) |
| BC – 4 | *Kawkawlin River Watershed, Bay, Midland, and Gladwin Counties* | Bay County Drain Commission | Ecosystem restoration | Tributary to Saginaw | Nearshore health and | Yes | USACE – General Investigations Feasibility |

| Project #* | Project/Study Opportunities | Potential Non-Federal Sponsor(s) | Applicability to Corps' Mission Areas | Within an AOC? | Support GRLI Focus Areas? | Stakeholder Support? | Applicable Authority/Program |
|---|---|---|---|---|---|---|---|
| | The potential project would address ecosystem and water quality problems experienced in a portion of the Kawkawlin River watershed due to excessive sedimentation. The potential project area within this 225 square mile watershed would focus on the area just above the confluence of the North Branch and South Branch at 8 Mile Road downstream to North Euclid Road. . Feasibility level studies would focus on identification and evaluation of measures that would restore the quality and functionality of stream and riparian habitats in the Kawkawlin River and across the watershed.<br><br>The Kawkawlin River watershed has experienced low flow to dry conditions in the summer and is plagued by excessive sedimentation issues, leading to backwater flooding of private property including agricultural lands during higher flow conditions. Excessive erosion and sedimentation has led to highly degraded wetland and aquatic habitat conditions in the watershed and decline of important fisheries. The proposed project in this stretch of the Kawkawlin River is not related to or dependent on an existing Corps Section 205 project in the Kawkawlin River, authorized in 1948, that occurred further downstream. | Bangor Township | Flood risk management | River/Bay AOC | nonpoint source pollution<br><br>Habitat restoration<br><br>Invasive species<br><br>Sediment management | Michigan DEQ<br><br>Midland County Drain Commission<br><br>Kawkawlin River Watershed Property Owners Association<br><br>Saginaw Basin Land Conservancy<br><br>Saginaw Bay WIN<br><br>Bay County Farm Bureau<br><br>Local communities | Study, under authority of Section 102, RHA of 1966<br><br>or<br><br>USACE – General Investigations, under the authority of Section 729, WRDA of 1986 (Watershed Planning)<br><br>The ultimate direction and scope of the study would be determined in conjunction with willing NFS(s) (TBD) |

| Project #* | Project/Study Opportunities | Potential Non-Federal Sponsor(s) | Applicability to Corps' Mission Areas | Within an AOC? | Support GRLI Focus Areas? | Stakeholder Support? | Applicable Authority/Program |
|---|---|---|---|---|---|---|---|
| PA-4 | *Downtown Caseville Ecosystem Restoration Project*<br><br>The potential project involves restoration of an old oxbow of the Pigeon River in downtown Caseville, Michigan, immediately adjacent to the federally authorized Caseville Harbor project. The oxbow was originally bypassed in the mid-1800's to improve the efficiency of logging operations and to prevent logs and ice from lodging in the curves of the oxbow. Habitat in the old oxbow has become highly degraded over time by erosion and sedimentation, lack of circulation and flow, and the presence of invasive species (phragmites).<br><br>The proposed project would involve restoration of several acres of aquatic habitat for spawning and nursery areas, support the baitfish holding capacity of the Caseville Harbor area, improve habitat for other wildlife, and improve public access and use of the restored area. The project would reestablish a healthy freshwater ecosystem, promote natural hydrologic functions, and add to the aesthetic and recreational values in downtown Caseville. | City of Caseville (Letter of interest to USACE dated 11/14/2011– see Appendix C) | Ecosystem restoration | Tributary to Saginaw River/Bay AOC | Habitat restoration<br><br>Invasive species<br><br>Nearshore health and nonpoint source pollution | Yes<br><br>Huron County<br><br>Huron Conservation District<br><br>Pigeon River Intercounty Drainage Board<br><br>Huron County Building and Zoning Department<br><br>Caseville Downtown Development Authority and Chamber of Commerce | USACE – Section 206 program (Ecosystem Restoration)<br><br>or<br><br>USACE – Section 1135 program (may apply if impact resulted from construction or operation of the adjacent Caseville Harbor, or if the Caseville Harbor project could be modified to achieve desired environmental benefits)<br><br>or<br><br>USACE – Section 506 (GLFER) program |

| Project #* | Project/Study Opportunities | Potential Non-Federal Sponsor(s) | Applicability to Corps' Mission Areas | Within an AOC? | Support GRLI Focus Areas? | Stakeholder Support? | Applicable Authority/Program |
|---|---|---|---|---|---|---|---|
| PS-1 | *Lexington Harbor Environmental Restoration, Michigan*<br><br>Environmental problems being experienced in the harbor include: sedimentation; poor water quality; poor water circulation and flushing, and invasive species (phragmites and watermilfoil)). Village officials offered the following characterization of the problems in the harbor: "The build-up of sediment, contaminants, algae and invasive species is evident in the constant need of dredging and the use of frequent chemical applications to keep Lexington Harbor functional. The closing of the south harbor wall has trapped much of the flow, along with sand infiltration from the north wall."<br><br>Based upon the general characterization of the problems, it appears that they could be related to the harbor features as they were constructed or potentially could be improved by modifying the harbor features in a manner that would not adversely impact the authorized purpose or function of the harbor. The feasibility level study would identify appropriate water quality and habitat-based metrics to evaluate alternative solutions and recommend a proposed course of action. | Village of Lexington | Ecosystem restoration | No | Nearshore health and nonpoint source pollution<br><br>Habitat restoration | Yes<br><br>Port Authority<br><br>Sanilac County<br><br>Michigan Waterways Commission | USACE – Section 1135 (Project Modifications for Improvement of the Environment) |

| Project #* | Project/Study Opportunities | Potential Non-Federal Sponsor(s) | Applicability to Corps' Mission Areas | Within an AOC? | Support GRLI Focus Areas? | Stakeholder Support? | Applicable Authority/Program |
|---|---|---|---|---|---|---|---|
| PS-3 | *Doe Creek Watershed (St. Clair County) Ecosystem Restoration*<br><br>The potential project would involve measures to address erosion, bank failure, and high levels of sedimentation along Doe Creek and tributaries in St. Clair County, Michigan. The principal purpose of the project would be to restore productive aquatic and riparian habitats, and the associated ecological function, within Doe Creek and the overall watershed.<br><br>The degradation is a result of poor land management and storm water management practices in the watershed and stream channel instability. The resulting impacts from these problems include loss of stream habitat for fish and wildlife, damage to roads and culverts, and excessive sediment loading to Lake Huron. | St. Clair County, Office of Drain Commissioner (Letter of interest to USACE dated 11/09/2011– see Appendix C) | Ecosystem restoration | No | Habitat restoration<br><br>Sediment management<br><br>Nearshore health and nonpoint source pollution<br><br>Invasive species | Yes<br><br>Thumb Land Conservancy<br><br>NRCS<br><br>Michigan DNR Fisheries | USACE – Section 206 Program Ecosystem Restoration) |
| PS-4 | *Eastern Sanilac County Coastal Watersheds, Michigan*<br><br>The Eastern Sanilac County Coastal Watersheds encompass approximately 114,560 acres of predominately agricultural land located on the eastern edge of the "thumb" area of Michigan along about 40 miles of coastline. The potential project area has a series of small tributaries feeding into Lake Huron. Beaches at the outlets of the watersheds are used by residents and are important for tourism.<br><br>There are significant erosion problems along the coast of Lake Huron in the project area. Additionally, these tributary streams are experiencing significant erosion and sedimentation issues as they near the coast. These issues pose a major threat to Michigan Highway 25 and the associated infrastructure along the highway. Erosion is causing loss of fish and wildlife habitat and is resulting in heavy sediment deposition into Lake Huron. | Michigan DEQ<br><br>Michigan Dept. of Transportation | Coastal erosion and storm risk management<br><br>Ecosystem restoration | No | Nearshore health and nonpoint source pollution<br><br>Habitat restoration | Yes<br><br>Sanilac County Road Commission<br><br>Sanilac County Drain Commission<br><br>Sanilac County Conservation District | USACE – General Investigations Feasibility Study, under authority of Section 102, RHA of 1966<br><br>or<br><br>USACE – General Investigations, under the authority of Section 729, WRDA of 1986 (Watershed Planning)<br><br>The ultimate direction and scope of the study would be determined in conjunction with willing NFS(s) (TBD) |

| Project #* | Project/Study Opportunities | Potential Non-Federal Sponsor(s) | Applicability to Corps' Mission Areas | Within an AOC? | Support GRLI Focus Areas? | Stakeholder Support? | Applicable Authority/Program |
|---|---|---|---|---|---|---|---|
| TS – 8 | *Spaulding Drain (Ambrose Road) Ecosystem Restoration, Saginaw County, Michigan*<br><br>The opportunity involves stream stabilization and ecosystem restoration of about one-half mile of the Spaulding Drain that parallels Ambrose Road. Restoration may involve measures to address erosion, bank failure, and high levels of sedimentation along the Spaulding Drain. This section of the drain is immediately upstream of the Shiawassee National Wildlife Refuge (SNWR).<br><br>The edge of the drain abuts the road along this section, which has contributed to stream channel instability. The impacts from this problem include loss of stream habitat for fish and wildlife, degraded water quality, and excessive sediment loading to the SNWR, Saginaw River, and eventually to Lake Huron. Because of the stream channel instability, the future integrity of Ambrose Road in this reach of stream is questionable. The potential restoration project has strong local support. | Saginaw County Drain Commission<br><br>Saginaw County Road Commission | Ecosystem restoration<br><br>Steam bank protection | Tributary to Saginaw River/Bay AOC | Habitat restoration | Yes<br><br>Shiawassee National Wildlife Refuge<br><br>Saginaw County Conservation District | USACE – Section 206 program (Ecosystem Restoration)<br><br>USACE – Section 14 (Emergency Stream bank and Shoreline Protection) may be applicable regarding potential loss of Ambrose Road due to stream instability and erosion. |

*Project numbers assigned based on the meeting in which they were proposed: SSM – Sault Ste. Marie; Che – Cheboygan; Alp – Alpena; Taw – East Tawas; BC – Bay City; Mid – Midland; PA – Port Austin; PS – Port Sanilac; TS – Technical Stakeholder Meeting

**Table 6. WLHB Proposed Study/Project Opportunities**

**Tier 2 (Implementable under an existing Corps authority – would not involve construction)**

| Project #* | Project/Study Opportunities | Likely Partner(s) | Applicability to Corps' Mission Areas | Within an AOC? | Support GRLI Focus Areas? | Stakeholder Support? | Applicable Authority/Program |
|---|---|---|---|---|---|---|---|
| SSM-1 | Planning assistance<br>• Regional Master Plan<br>• Ordinance template to protect waterways<br>• Chippewa and Mackinac Counties | Eastern Upper Peninsula Regional Planning and Development Commission (EUPRPD) | Technical assistance - supports ecosystem protection and restoration | St. Marys River AOC watershed | Nearshore health and nonpoint source pollution<br>Habitat restoration | Yes | USACE – Section 22 program (planning assistance) |
| SSM-2 | Septic systems<br>• Unified Sanitary code to address SS<br>• Cedarville Area – north of Les Cheneaux Island<br>• Needed basinwide | EUPRPD<br>Les Cheneaux Islands Watershed (Council)<br>County Health Department | Technical assistance - supports ecosystem protection and restoration | St. Marys River AOC watershed | Nearshore health and nonpoint source pollution<br>Habitat protection and restoration | Yes | USACE – Section 22 program (planning assistance)<br>EPA - GLRI |
| Alp-1 | Water quality in Thunder Bay<br>• *E. coli*, muck, and algae. Water is "tanic"<br>• Stormwater from Alpena a problem<br>• IDEP has not been undertaken<br>• City Manager noted that a stormwater management master plan may be helpful | City of Alpena | Technical assistance - supports ecosystem protection and restoration | No | Nearshore health and nonpoint source pollution<br>Habitat protection and restoration | Yes | USACE – Section 22 program (planning assistance)<br>EPA – GLRI |
| Alp-2 | Watershed management plan for small tributaries that drain to Lake Huron<br>• Karst terrain<br>• Lots of sedimentation deposited in nearshore areas.<br>• Karst Conservancy program could be a partner | NEMCOG<br>MDNR | Technical assistance - supports ecosystem protection and restoration | No | Nearshore health and nonpoint source pollution<br>Habitat protection and restoration | Yes | USACE – Section 22 program (planning assistance)<br>EPA – GLRI |

| Project #* | Project/Study Opportunities | Likely Partner(s) | Applicability to Corps' Mission Areas | Within an AOC? | Support GRLI Focus Areas? | Stakeholder Support? | Applicable Authority/Program |
|---|---|---|---|---|---|---|---|
| Alp-5 | River mouth classification along the coastline<br>• Identifying each mouth's structure and function<br>• Document alterations that have occurred<br>• 1st step in goal of better management of river mouths for fisheries and human activities. | MDNR | Technical assistance - supports ecosystem protection and restoration | Could be applicable to St. Marys and Saginaw River/Bay watersheds | Nearshore health and nonpoint source pollution<br><br>Habitat restoration | Yes | USACE - Section 22 program (planning assistance) |
| Taw-1 | Excessive sand and sediment in lake and Tawas River<br>• Needs both source controls and dredging<br>• Possible drain<br>• Watermilfoil issues also. | Drain Commissioner<br>Saginaw Bay RC&D | Technical assistance - supports ecosystem protection and restoration | Saginaw River/Bay watershed | Nearshore health and nonpoint source pollution<br><br>Habitat restoration | Yes | USACE – Section 516 study<br><br>or<br><br>USACE – Section 22 program (planning assistance)<br><br>or<br><br>EPA - GLRI |
| Taw-2 | Au Gres River flooding<br>• At the mouth<br>• Unclear of specific project | Saginaw Bay RC&D<br><br>Huron Pines RC&D<br><br>Saginaw Bay WIN | Supports flood risk management | Tributary to Saginaw River/Bay AOC | Not directly | Yes | USACE - Section 22 program (planning assistance)<br><br>or<br><br>USACE – FPMS program |
| Taw-3 | Tawas Harbor shoreline<br>• Need study to determine best course of action<br>• Sand from the Tawas River scours shoreline | No local sponsor identified | Technical assistance | Saginaw River/Bay watershed | Nearshore health and nonpoint source pollution | Yes | USACE – Section 22 program (planning assistance), |
| BC – 2 | Septic System Revolving fund<br>• Two-step process: 1) identification and 2) remediation and education<br>• Currently there is a small fund in Bay County ($40K)<br>• Desire to expand to other counties (Huron, Arenac, Tuscola)<br>• Involves changes to ordinances and mapping | Bay County Health Dept. (BCHD)<br><br>Bay County Environmental Affairs and Community Development Dept.<br><br>Other county health departments | Supports ecosystem protection and restoration | Saginaw River/Bay watershed | Nearshore health and nonpoint source pollution<br><br>Habitat protection and restoration | Yes | USACE – Section 22 program (planning assistance) could provide technical assistance and guidance development in support of a revolving fund program. |

| Project #* | Project/Study Opportunities | Likely Partner(s) | Applicability to Corps' Mission Areas | Within an AOC? | Support GRLI Focus Areas? | Stakeholder Support? | Applicable Authority/Program |
|---|---|---|---|---|---|---|---|
| BC – 7 | Phragmites management<br><br>• Focus on coordination / prioritization / mapping<br>• Identified in numerous places<br>• Throughout shoreline<br>• Along Cheboyganing Creek (Portsmouth Township)<br>• Saginaw Basin Land Conservancy submitted a GLRI grant to do technical mapping<br>• Risk Assessment and Removal study submitted to GLRI, but not funded (unclear if this is related to the Saginaw Basin Land Conservancy GLRI grant application mentioned above; appeared on two different maps/groups) | Ducks Unlimited<br><br>The Nature Conservancy<br><br>Saginaw Bay WIN<br><br>Saginaw Basin Land Conservancy | Supports ecosystem protection and restoration | Saginaw River/Bay watershed | Invasive species<br><br>Habitat restoration | Yes | USACE – Section 22 program (planning assistance) |
| BC-14 | Saginaw River/Bay Watershed Area of Concern (AOC) Technical Report Findings Synthesis<br><br>The potential project would involve developing a summary of findings from the extensive collection of technical studies and reports on the Saginaw River/Bay watershed AOC. The goal would be to provide watershed stakeholders at all levels with easy access to the findings of these studies to ensure a common understanding of the outcomes of research and to help establish generally accepted trends on watershed health, including the AOC BUIs.<br><br>The product of this synthesis effort could support the development of watershed health indicators, similar to those used for the SOLEC. Indicators could demonstrate trends over time for a variety of parameters (e.g., phosphorus and sediment) and help illustrate restoration progress related to BUIs and other watershed goals. This effort could help with watershed education and outreach efforts and assist stakeholders in identifying and coordinating future research needs that build on existing research, avoid duplication of effort, and target | Bay County Environmental Affairs and Community Development Dept. | Supports ecosystem protection and restoration | Saginaw River/Bay AOC | Nearshore health and nonpoint source pollution<br><br>Habitat protection and restoration | Yes<br><br>Federal and state resource agencies<br><br>Local governments<br><br>Numerous recreation and conservation organizations | USACE – Section 22 program (planning assistance)<br><br>or<br><br>EPA - GLRI<br><br>NOTE: MDEQ (AOC Program) would be consulted before initiating this project or a project with a similar scope of work. MDEQ is currently considering performing a coordinated study along these lines for Saginaw Bay and Western Lake Erie. |

| Project #* | Project/Study Opportunities | Likely Partner(s) | Applicability to Corps' Mission Areas | Within an AOC? | Support GRLI Focus Areas? | Stakeholder Support? | Applicable Authority/Program |
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| | limited resources.<br><br>As new reports and studies become available, the format established through this project could be used to develop new abstracts and update indicators. The project could also illustrate where reports and studies might contain conflicting results, allowing watershed stakeholders to discuss the merits of each study and determine which set of findings should be used when discussing the health of the Saginaw River/Bay watershed. An initial effort could focus on technical reports and studies related to phosphorus and sediment to establish a process and a template for presenting findings and creating associated indicators to present trends. | | | | | | |
| Mid-1 | Culvert design study<br><br>• Mollusk eggs are deposited at the mouth of perched culverts and they do not survive.<br>• It is thought that bottomless culverts could solve problem<br>• Need to study design options | Drain Commissioners<br><br>MDEQ/MDNR<br><br>Saginaw Bay WIN | Supports ecosystem restoration | Could be applicable to St. Marys River and Saginaw River/Bay watersheds | Habitat protection and restoration | Yes<br><br>Central Michigan University | USACE – Section 22 program (planning assistance) |
| Mid-2 | Salt River hydrologic study<br><br>• There have been major hydrological changes to the Salt River<br>• Steve Kahl – Director of the Shiawassee National Wildlife Preserve might have hydrologic studies of area, including the Salt River<br>• Ecosystem and flood reduction | Drain Commissioner<br><br>Saginaw Bay RC&D | Supports ecosystem protection and restoration | Tributary to Saginaw River/Bay AOC | Nearshore health and nonpoint source pollution<br><br>Habitat restoration | Yes<br><br>Shiawassee National Wildlife Refuge | USACE – Section 22 (planning assistance) program |
| Mid-3 | Snake Creek flooding<br><br>• Largest source of flooding in the Midland area<br>• New FIS maps with new baseline flood elevations are available<br>• Sanford Lake dam is in area<br>• Ecosystem and flood reduction study needed | Drain Commissioner<br><br>Saginaw Bay RC&D | Supports flood risk management | Tributary to Saginaw River/Bay AOC | Not directly | Yes | USACE – Section 22 (planning assistance) program<br><br>USACE – FPMS program |

| Project #* | Project/Study Opportunities | Likely Partner(s) | Applicability to Corps' Mission Areas | Within an AOC? | Support GRLI Focus Areas? | Stakeholder Support? | Applicable Authority/Program |
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| PA-1 | Port Austin Harbor hydrologic study<br>• Break wall is connected to mainland by rock wall<br>• Residents maintain rock wall, which prevents flow into bay and results in stagnant water, milfoil and accumulated pollutants<br>• Need hydraulic study to determine best solution | Village of Port Austin<br><br>Port Authority | Technical assistance – water quality and circulation, habitat protection | Saginaw River/Bay AOC | Nearshore health and nonpoint source pollution | Yes<br><br>Huron County<br><br>Local home owner groups | USACE – Section 22 (planning assistance)<br><br>Planning assistance could lead to a potential USACE – Section 1135 project (Project Modifications for Improvement of the Environment).<br><br>Presently, local stakeholder interest is high, but no willing NFS could be identified. |
| PA-2 | Small port dredging<br>• Sebewaing, Caseville, Bay Port, Port Hope all need dredging<br>• Sources of sediment, mostly from agricultural , need to be addressed<br>• Sebewaing - Section 516 study already done<br>• Need congressional authorization to dredge harbor | Local communities or county governments | Supports navigation/ecosystem restoration | Saginaw River/Bay watershed | Nearshore health and nonpoint source pollution<br><br>Habitat restoration | Yes | USACE – O&M harbor maintenance (recreational harbor)<br><br>USACE – Section 516 (might be applicable to look at sediment source(s) at Federal harbors other than Sebewaing Harbor) |
| TS-2 | Mining – Presque Isle<br>• Stone Pour Inc. mines a quarry that results in the drop of the water level in Lake Essau (through groundwater depletion), which in turn lowers the level of Grand Lake.<br>• There is an agreement that all the water they harvest from their operation will be returned to Lake Esau, but it is not legally binding once the mine closes.<br>• Need to find long-term solution. The State and an East Coast University own mineral rights. | State Lake level program | Technical assistance | No | Not directly | Yes | USACE – Section 22 program (planning assistance) |

| Project #* | Project/Study Opportunities | Likely Partner(s) | Applicability to Corps' Mission Areas | Within an AOC? | Support GRLI Focus Areas? | Stakeholder Support? | Applicable Authority/Program |
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| TS-6 | O&M maintenance manual for drains<br>• Designed to improve water quality of local waterways<br>• Stakeholders documented problems with Huron County Drain Commission approach to drain maintenance in the Pinnebog watershed (photos provided by stakeholders)<br>• Ditch maintenance (referred to as "dredging" by stakeholders) leads to substantial erosion and sedimentation<br>• Stakeholders want to see an improved method for drain maintenance that does not cause excessive sedimentation<br>• Need for changes to ordinances<br>• Need for Drainage Commission education | Michigan Association of County Drain Commissioners County Drain Commissioners | Technical assistance - supports ecosystem protection and restoration | Applicable to St. Marys and Saginaw River/Bay watersheds | Nearshore health and nonpoint source pollution<br><br>Habitat restoration | Yes | USACE – Section 22 program (planning assistance) |
| TS – 7 | Modeling support<br>• Expand Section 516 program to model sediment transport in more tributaries in the basin<br>• Update the 516 models for the Saginaw and Sebewaing Rivers<br>• Assess impact of sediment loading on Saginaw Bay | Counties | Supports ecosystem protection and restoration | Saginaw River/Bay watersheds | Nearshore health and nonpoint source pollution<br><br>Habitat restoration | Yes | USACE - Section 516 Study |

*Project numbers assigned based on the meeting in which they were proposed: SSM – Sault Ste. Marie; Che – Cheboygan; Alp – Alpena; Taw – East Tawas; BC – Bay City; Mid – Midland; PA – Port Austin; PS – Port Sanilac; TS – Technical Stakeholder Meeting

**Table 7. WLHB Proposed Study/Project Opportunities**

**Tier 3 (Implementable by other organizations/eliminated from further consideration for Corps implementation)**

| Project #* | Project/Study Opportunities | Likely Partner(s) | Applicability to Corps' Mission Areas | Within an AOC? | Support GRLI Focus Areas? | Stakeholder Support? | Applicable Authority/Program |
|---|---|---|---|---|---|---|---|
| SSM-3 | Repair road stream crossings<br>• Sediment was identified as a major concern<br>• Conservation District has inventoried | Conservation District<br><br>Road Commission | None | St. Marys River watersheds | Nearshore health and nonpoint source pollution<br><br>Habitat restoration | Yes | NRCS programs |
| SSM-4 | Stormwater master plan<br>• St. Marys River *E. coli* study<br>• SSM needs stormwater master plan | City of Sault Ste. Marie | None | St. Marys River watersheds | Nearshore health and nonpoint source pollution<br><br>Habitat protection and restoration | Yes | GLRI<br>Potential MDEQ project |
| Che-1 | Develop port into commercial center<br>• Need dredging from 21 feet to 23 feet to accommodate larger freighters<br>• US Oil has indicated interest in using the port<br>• Currently considered a low-use waterway (less than 100,000 tons annually) for O&M dredging purposes | Cheboygan Port Authority<br><br>City of Cheboygan | Navigation | No | No | Yes | Corps is authorized to perform maintenance dredging of the existing channel. Maintenance dredging is not presently performed due to low waterway use. No basis for further study of channel improvements at this time. |
| Che-2 | Repair road stream crossings<br>• Huron Pines RC&D has inventory and priority<br>• Road Commissioner is willing | Huron Pines RC&D<br><br>Road Commissions | None | No | Nearshore health and nonpoint source pollution<br><br>Habitat protection and restoration | Yes | Specific implementation of these improvements more appropriately conducted by Road Commissions and Huron Pines RC&D |

| Project #* | Project/Study Opportunities | Likely Partner(s) | Applicability to Corps' Mission Areas | Within an AOC? | Support GRLI Focus Areas? | Stakeholder Support? | Applicable Authority/Program |
|---|---|---|---|---|---|---|---|
| Che-3 | Fish passage near paper mill dam, Cheboygan River, Cheboygan, Michigan<br>• Prior restoration activities provided by the GLFC under the Section 506 program (not conducted by USACE).<br>• Additional restoration opportunities may exist to fully complete the project. | Tip of the Mitt,<br>Great Lakes Fishery Commission | Ecosystem restoration | No | Habitat restoration | Yes | Study may qualify for Corps participation under the Section 206 program (Ecosystem Restoration) or the Section 506 program (GLFER). However, strong stakeholder support and a willing NFS were not identified. |
| Che-4 | Ocqueoc River breakwall construction<br>• Reduce sedimentation impacting recreation resources | MDNR | None | No | Nearshore health and nonpoint source pollution | Yes | MDNR resources |
| Alp-3 | Phragmites control<br>• Thunder Bay Mouth, Black River, Phelan Creek<br>• Need way to address problem on an ongoing basis<br>• HP RC&D – Americorp Program – treated 80 sites<br>• Likely need to expand existing program | Huron Pines RC&D | None | No | Invasive species | Yes | EPA - GLRI |
| Alp-4 | Van Etten Creek (Nonattainment for nutrients)<br>• Look in the Watershed Management Plan for actions to address problem | Huron Pines RC&D | None | No | Nearshore health and nonpoint source pollution | Yes<br>Van Etten Watershed Coalition | EPA - GLRI |
| BC – 3 | Saginaw Bay/Channel toxin removal<br>• Need Corps' assistance on pier/navigational issues<br>• Other sources of funding and a local sponsor are available<br>• Install sediment traps Tittabawassee/Saginaw Rivers<br>• Goal is to catch migrating dioxins and other toxics before entering Saginaw Bay/Lake Huron | TBD | Ecosystem restoration | Saginaw River/Bay AOC | Contaminated sediments | Yes | Dioxin issues are the subject of long standing litigation. The issues will be addressed by way of the eventual settlement process.<br>This issue may be partially addressed through the GLRI program (EPA)<br>Corps has conducted modeling for potential sediment traps in Saginaw River for contaminated sediments in recent years. Section 312, WRDA 1990, as amended (environmental |

| Project #* | Project/Study Opportunities | Likely Partner(s) | Applicability to Corps' Mission Areas | Within an AOC? | Support GRLI Focus Areas? | Stakeholder Support? | Applicable Authority/Program |
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| | | | | | | | dredging) provides authority for the Corps to conduct environmental dredging outside the authorized navigation channel. However, the program is not generally funded, and no willing NFS is likely to step forward. |
| BC – 5 | Bay City State Recreation Area Ecosystem Restoration Project, Bay City, Michigan<br><br>The State Recreation Area is an important natural system and highly utilized public recreation area near an urban center (Bay City). The values and functions of the natural system (Tobico Marsh and Lagoon, and the surrounding watershed and coastal area) have been impacted by the activities of others in the watershed and conditions in Saginaw Bay.<br><br>Habitat restoration/protection opportunities may include: managing water levels in the marsh; improving aquatic habitat conditions; collecting additional biological data and increasing the diversity of vegetation; maintaining an open channel from the marsh to Tobico Lagoon and Saginaw Bay for fish migration, and addressing invasive plant species (phragmites) issues. | MDNR (Parks and Recreation Division) | Ecosystem restoration | Saginaw River/Bay watershed | Habitat restoration<br><br>Nearshore health, and nonpoint source pollution<br><br>Invasive species | Yes<br><br>Bay County Drain Commission<br><br>Bay Co. Envr Affairs and Community Development Dept.<br><br>Bangor Township<br><br>USFWS<br><br>Friends of Bay City State Recreation Area<br><br>Save Our Shoreline | EPA – GLRI<br><br>Potential opportunity was reviewed for applicability to the USACE Section 206 program (Ecosystem Restoration) or USACE – Section 506 (GLFER) program.<br><br>MDNR could not determine the scope of issues they might be willing to address or whether they would be willing to serve as NFS for any studies.<br><br>Therefore, potential project was eliminated from consideration by the Corps at this time. Work could be pursued at a future date under GLRI or Corps Continuing Authorities Program. |
| BC – 8 | Wet weather issues<br><br>• Stormwater master plans for non-MS4 communities | Local communities | None | Saginaw River/Baywatersheds | Nearshore health and nonpoint source pollution | Yes | EPA – GLRI |

| Project #* | Project/Study Opportunities | Likely Partner(s) | Applicability to Corps' Mission Areas | Within an AOC? | Support GRLI Focus Areas? | Stakeholder Support? | Applicable Authority/Program |
|---|---|---|---|---|---|---|---|
| BC – 9 | Fish passage/dam removal – Saginaw River watershed<br><br>• Saginaw Bay WIN has a prioritized list of dams/fish passage projects on its website<br>• Dow Dam removal - potentially problematic – dioxin issues and private ownership | Saginaw Bay WIN<br><br>MDEQ<br><br>Drain Commissioner<br><br>Council of Michigan Foundations | Ecosystem restoration | Saginaw River/Bay watershed | Habitat restoration<br><br>Contaminated sediments | Yes | EPA – GLRI<br><br>No potential Corps role at this time; Corps assistance with dam removal/fish passage could be requested in the future under Section 206 program; future Corps role, if any, at Dow Dam depends on resolution of dioxin issues. |
| BC – 10 | Wetland restoration – Saginaw River and tributaries<br><br>• Crow Island (along with phragmites control)<br>• Saginaw Bay Land Conservancy study of shoreline wetlands<br>• Saginaw Bay Land Conservancy – Potential acquisition of abandoned golf course on lower Tittabawassee River and restoration of wetlands | Saginaw Bay Land Conservancy | Ecosystem restoration | Saginaw River/Bay watershed | Habitat restoration | Yes | EPA – GLRI<br><br>Potential wetland restoration projects may be eligible for the USACE – Section 206 program (Ecosystem Restoration). However, potential projects are not sufficiently defined at this time and no willing NFS has been identified. Therefore, no further consideration was given at this time.<br><br>Work could be pursued at a future date under GLRI or Corps Continuing Authorities Program. |
| BC – 11 | Bacteria source assessment and control<br><br>• Need strategic source investigations and source control<br>• Saginaw Bay Coastal Initiative Combined Sewage Overflow Workgroup reviewed the data from CSO discharges and have ruled out CSOs as major sources of bacteria | Bay County Environmental Affairs and Community Development Dept. | None | Saginaw River/Bay watershed | Nearshore health and nonpoint source pollution | Yes | EPA – GLRI |

| Project #* | Project/Study Opportunities | Likely Partner(s) | Applicability to Corps' Mission Areas | Within an AOC? | Support GRLI Focus Areas? | Stakeholder Support? | Applicable Authority/Program |
|---|---|---|---|---|---|---|---|
| BC – 12 | Restore Saginaw Bay public access<br>• Need funding to reestablish the Wenona Park bayfront park and public promenade with a bayfront restaurant close to the Bay City urban area<br>• Need funding to help develop the limited public access sites and to create additional sites | Bay County Environmental Affairs and Community Development Dept. | None | Saginaw River/Bay watershed | Not directly | Yes | Bay County<br>HUD programs |
| BC - 13 | General Bay County Opportunities<br>• Phosphorus loads from Huron and Tuscola Counties that enter Saginaw Bay<br>• Mercury from coal ash discharged from coal-fired plants where Saginaw River enters the bay<br>• Land application of fertilizers/sludge<br>• Reestablish road end access to Saginaw Bay at the end of State Road | Various | None | Tributaries to Saginaw River/Bay AOC | Nearshore health and nonpoint source pollution<br>Habitat restoration | Yes | EPA – GLRI |
| PA-3 | *E. coli* source management<br>• More livestock than people in the "thumb"<br>• Septic problems too<br>• Flows from Bird Creek to bay<br>• Closes Lighthouse Beach<br>• Need management options<br>• Unified septic<br>• Drain tile weirs | Health departments<br>Drain Commissioner | None | Tributary to Saginaw River/Bay AOC | Nearshore health and nonpoint source pollution<br>Habitat restoration | Yes | EPA – GLRI |
| PS-2 | Agricultural weirs<br>• Installation of weirs in agricultural areas to retain moisture and reduce pollutants (nitrogen and *E. coli*) | Farm Bureau<br>Conservation District<br>NRCS | None | No | Nearshore health and nonpoint source pollution<br>Habitat restoration | Yes | EPA – GLRI<br>NRCS programs |
| TS-1 | Lexington Heights dune preservation | Conservation District<br>NRCS | None | No | Habitat restoration | Yes | EPA - GLRI |

| Project #* | Project/Study Opportunities | Likely Partner(s) | Applicability to Corps' Mission Areas | Within an AOC? | Support GRLI Focus Areas? | Stakeholder Support? | Applicable Authority/Program |
|---|---|---|---|---|---|---|---|
| TS-3 | Potable water (Tuscola County) study<br>• The identified area does not have potable water available to its residents. The problem is elevated levels of lead and arsenic.<br>• The source(s) of the problem are unknown. A study to identify the sources needs to be conducted. | Tuscola County Health Department | None | Saginaw River/Bay watershed | Not directly | Yes | NRCS rural water supply programs<br><br>EPA drinking water program |
| TS-4 | BUI delisting criteria – more specific targets need to be developed | PACs | None | Applicable to St. Marys and Saginaw River/Bay AOCs | All GLRI focus areas | Yes | EPA – GLRI |
| TS-5 | Invasive species monitoring for fish passage structure on Cass River, Frankenmuth<br>• Concerns that fish ramp might also allow invasive species to migrate upstream in addition to desirable fish species<br>• Lamprey are of particular concern<br>• Need for a monitoring program | Great Lakes Fisheries Commission | None | Tributary to Saginaw River/Bay AOC | Invasive species | | EPA – GLRI |
| TS –9 | Muck and phragmites management and removal demonstration project<br>• Conduct demonstration projects using Truxor vehicle | MDEQ | None | Applicable to St. Marys and Saginaw River/Bay AOCs | Invasive species<br><br>Nearshore health and nonpoint source pollution | | EPA – GLRI |

*Project numbers assigned based on the meeting in which they were proposed: SSM – Sault Ste. Marie; Che – Cheboygan; Alp – Alpena; Taw – East Tawas; BC – Bay City; Mid – Midland; PA – Port Austin; PS – Port Sanilac; TS – Technical Stakeholder Meeting

## 5.10 Preliminary Plans

Preliminary plans will be composed of one or more management measures for each of the twelve (12) Tier 1 project opportunities (presented in Table 5) that would address specific water resource problems in the WLHB study area and survived the initial screening process for detailed feasibility level investigations. The study team conducted a preliminary evaluation of each project opportunity with respect to the following considerations: (1) the nature and extent of the water resource problem being addressed; (2) the significant resources likely to benefit from a potential project; (3) probable management measures to be considered during feasibility level studies; (4) potential benefits to significant resources; and (5) the likelihood that a cost-effective plan can be developed. This preliminary evaluation for each potential project is reflected in the water resource problem/opportunity summaries in Appendix C.

## 5.11 Conclusions from the Preliminary Screening

The preliminary screening indicates that potential studies and projects identified in Tier 1 have high potential for implementation. Of the 12 Tier1 study/project opportunities identified in the large and diverse WLHB study area, nine are for ecosystem restoration, one is for flood risk management, and two address opportunities for ecosystem restoration combined either with flood risk management or storm risk management/coastal erosion. All of these are directly relevant and applicable to Corps authorities and capabilities. The potential magnitude and types of benefits from the proposed actions would support and be directly consistent with the priority focus areas of the GLRI. In addition, six of the study/project opportunities lie in or are on tributaries to the St. Marys River AOC or Saginaw River/Bay AOC. These opportunities offer potential to support delisting of pertinent BUIs in those AOCs. For the ecosystem restoration opportunities, the environmental effects are expected to beneficial, with only minor temporary adverse effects during construction and no separable mitigation requirements. For the flood (or coastal storm) risk management opportunities, adverse effects would be expected to be minor overall, with minimal or no separable mitigation requirements. Based on this information, alternatives to address planning goals and objectives appear viable.

All the Tier 1 projects, with one exception discussed below, are expected to fall within the scope of one of the Corps' Continuing Authorities, as identified in Table 5. As presented in detail in Section 10, feasibility study cost estimates for these Continuing Authority projects are expected to range between $200,000 and $600,000. Based on limited information at this point, the total Federal project implementation costs for each project may be expected to range from about $600,000 up to a maximum of about $7.0 million.

A proposed General Investigations study was identified for the coastline and coastal watersheds in eastern Sanilac County, Michigan, and it has been discussed in detail with the staffs of the Michigan DEQ, Michigan DOT, Sanilac County Drain Commission, Sanilac County Road Commission, and Sanilac County Conservation District. There are significant erosion problems along the coast of Lake Huron in the project area. Additionally, these tributary streams are experiencing significant erosion and sedimentation issues as they near the coast. These issues pose a major threat to Michigan Highway 25 and the associated infrastructure along the highway. Erosion is causing loss of fish and wildlife habitat and is resulting in heavy sediment deposition into Lake Huron. These parties have discussed the need for a holistic evaluation of the water resource problems in this coastal area are considering the various state/local needs with respect to this potential Corps study. They are considering whether a "traditional" feasibility study leading to congressional authorization of a project for construction or watershed assessment in accordance with Section 729 of WRDA 1986 would better meet their needs. A watershed assessment for this area would likely cost in the range of $400,000 to $800,000. A "traditional" feasibility study would likely cost in the range of $1.5 to $2.5 million, depending on the scope of the

study that would be negotiated with the NFS. The potential NFS has not been determined among the participating parties but is most likely to be Michigan DEQ or Michigan DOT.

A proposed General Investigations study was identified for Kawkawlin River watershed in Bay, Midland, and Gladwin Counties, Michigan. The watershed has experience excessive erosion and sedimentation associated with agriculture and urban development that have led to highly degraded wetland and aquatic habitat conditions, decline of important fisheries, and some backwater flooding problems under high flow conditions. Discussions concerning the water resource problems in the watershed have been initiated local agencies and stakeholders in the project area regarding pursuit of this study and non-Federal sponsorship. These parties recognize the need to build on a recently completed Kawkawlin River watershed management plan to investigate and determine specific cost-effective measures necessary to achieve restoration objectives in the watershed. Pending further discussions, it is not clear whether a "traditional" feasibility study leading to congressional authorization of a project for construction or watershed assessment in accordance with Section 729 of WRDA 1986 would better meet their needs. A watershed assessment for this area would likely cost in the range of $400,000 to $800,000. A "traditional" feasibility study would likely cost in the range of $1.5 to $2.5 million, depending on the scope of the study that would be negotiated with the NFS. The potential NFS has not been determined at this point.

## 5.12 Establishment of a Plan Formulation Rationale

The conclusions from the preliminary screening form the basis for the next iteration of the planning steps that will be conducted in the feasibility phase. The likely array of alternatives that will be considered in the next iteration include measures typically considered for stream and coastal aquatic ecosystem restoration projects performed by the Corps (and others) in similar conditions across the region, including no Federal action and nonstructural alternative(s). Future screening and reformulation will be based on the following factors and considerations:

- Application of principles and guidelines and Corps planning and policy guidance
- Resource agency and public input
- Engineering feasibility
- Environmental acceptability
- Cost effectiveness/incremental cost analysis of habitat benefits (for ecosystem restoration features)
- Benefit/cost analysis (for flood risk management features)

# 6. Federal Interest

Ecosystem restoration and flood (storm) risk management represent high priority mission areas (or project purposes) in the Corps' water resources program and, consequently, have high budget priority. Additionally, the proposed studies/projects will address several of the focus areas in the GLRI action plan, and eight sites are located such that restoration would be expected to contribute to efforts to delist pertinent BUIs in the St. Marys River AOC or Saginaw River/Bay AOC.

Federal Interest is established once it has been determined that the project will contribute to NED or, in the case of ecosystem restoration, NER (or the net increase of habitat value). For each of the twelve (12) Tier 1 project opportunities presented in Table 5, the study team considered the preliminary evaluation of plans discussed in Section 5.8 as well as the general level of stakeholder support for the project and the availability of an interested non-Federal sponsor. This preliminary evaluation for each potential project is reflected in the water resource problem/opportunity summaries in Appendix C.

It appears that ten of these twelve project opportunities could be initiated and pursued separately under the Corps Continuing Authority Program and two watershed planning opportunities could be pursued under the General Investigations program. Based on the information developed during this 905(b) study, there is a strong Federal interest in conducting the feasibility investigations for all twelve of these project opportunities in the WLHB study area. Based on the preliminary review of the project opportunities and potential alternatives, there appear to be potential solutions that would be consistent with Army policies, costs, benefits, and environmental impacts.

# 7. Preliminary Financial Analysis

Each prospective NFS for Tier 1 projects identified in Table 5 will be required to provide 50 percent of the cost of the feasibility phase. This can be provided as a combination of cash and in-kind services. For each proposed project in Table 5 that falls within the scope of the Continuing Authorities Program, the NFS will provide 50 percent of the feasibility phase study cost after the first $100,000 expended (Federal cost). The NFSs are also aware of the cost-sharing requirements for potential project implementation. A letter of interest (LOI) has been requested from each prospective NFS to indicate willingness to pursue the feasibility study and to share in its cost, as well as an understanding of the cost sharing that would be required for project construction. Letters received to date for the Tier 1 projects are included in Appendix C.

# 8. Assumptions and Exceptions

## 8.1 Feasibility Phase Assumptions

A number of assumptions have been used that will guide development of the PMP and schedule for feasibility investigations. The following critical assumptions will guide the feasibility investigations:

- Feasibility studies for ecosystem restoration and flood risk management will be pursued in the WLHB watershed.
- The feasibility investigations will recognize and consider the effects of other ongoing and likely future activities under the GLRI and other related programs and activities. To the extent practicable, these feasibility investigations will be conducted in a manner that complements and leverages the environmental benefits of the ongoing and any likely future efforts.
- Without Federal action in areas identified for feasibility investigations in the 905(b) study, ecosystem health and flooding conditions in the affected areas of WLHB are likely to continue to deteriorate over time. State and local interests are unlikely to pursue these potential projects identified in this study apart from Federal participation. These deteriorating conditions are likely to be offset to some degree by implementation of other environmental protection and restoration projects in the watershed under the GLRI. The “without project condition” for these feasibility investigations will consider the implementation of the other GLRI projects.
- Feasibility studies will be conducted in accordance with the Principles and Guidelines, Corps of Engineers regulations, and all applicable Federal laws and executive orders.
- For each of the identified studies, the decision document will be the recommendation of the Feasibility Report (also called the Detailed Project Report) supported by the appropriate National Environmental Policy Act documentation (Environmental Assessment/Finding of No Significant Impact or Environmental Impact Statement/Record of Decision), as applicable.
- Appropriate cost effectiveness/incremental costs analysis (for ecosystem restoration) and a benefit-cost analysis (for flood damage reduction) will be developed in accordance with the requirements of ER 1105-2-100.

- All models used in the development of feasibility studies will be subject to model certification by the pertinent Corps Planning Center of Expertise.
- For feasibility phase investigations, an MCACES (MII) cost estimate will be performed on the project features that comprise the selected plan. The cost of preliminary alternatives for ecosystem restoration and flood risk management measures will be developed at a lesser level of detail with comparative cost estimating techniques.
- Sustained Federal appropriations to conduct the feasibility investigations, in accordance with agreed on scopes and schedules with the NFS, are anticipated. Schedules for feasibility investigations will assume uninterrupted funding (both Federal and non-Federal) for the period of the study.

## 8.2 Risk and Uncertainty Considerations

Consideration of risk and uncertainty is a vitally important element of effective water resources planning. Situations of *risk* are conventionally defined as those in which the potential outcomes can be described in reasonably well-known probability distributions. Risk can generally be managed or minimized by improving the quantity and quality of data and refining the analytical tools and models. In situations of *uncertainty*, potential outcomes cannot be described in objectively known probability distributions. Some future demographic, economic, hydrologic, meteorological, and ecological events are often unpredictable because they are subject to random influences. Absent a historical database to describe the probability distribution objectively, these random influences can be described subjectively, using best available insight and judgment.

Risk and uncertainty considerations for follow-on feasibility level investigations conducted as a result of this reconnaissance study will include: (1) those that influence the timing, funding, and scoping of any actual investigations that may be conducted; and (2) those directly associated with the technical analyses conducted during the feasibility phase that capture and quantify the degree of reliability of the estimated benefits and costs as well as the effectiveness of alternative plans. Those considerations include:

- While a letter of interest or intent may be provided by a potential NFS during the 905(b) study, there is a residual degree of uncertainty associated with the process of negotiating and reaching agreement with the NFS(s) on scope and cost estimates for feasibility level investigations and successfully completing a FCSA.
- Availability of Federal and non-Federal funds to initiate the feasibility study (or studies) and to sustain the ongoing investigations in subsequent years is uncertain. Upon initiation, the likelihood of continued funding during out years, while not certain, would be much higher.
- Some prospective NFSs in the WLHB area are seeking financial resources through the GLRI and other sources to address their water resource problems independently, while concurrently exploring the potential for cost-shared feasibility level investigations with the Corps. The successful outcome of ongoing local efforts to secure grants or funding from other sources to address problems/opportunities identified during the Corps' reconnaissance study may supersede or significantly influence or change future Corps feasibility study/project plans.
- All feasibility level investigations conducted as a result of the reconnaissance study will incorporate risk-based analytical methods, as prescribed in ER 1105-2-100 and other supplemental guidance documents, to characterize the different degrees of risk and uncertainty to the extent possible and to describe them clearly so that decision makers have the best available information on which to base their decision.

## 8.3 Policy Exceptions and Streamlining Initiatives

The feasibility investigations will be conducted in accordance with the principles and guidelines and the Corps of Engineers regulations. No potential exceptions to established guidance have been identified that would appreciably streamline the feasibility study process and maintain the same standard of quality for the feasibility investigations. Portions of the WLHB study area have been the subject of extensive studies and evaluations by Federal, state, and local agencies, as well as nongovernment organizations and academic interests. This is particularly true over the last 20 years, as greater focus on the environmental challenges in the Great Lakes area has emerged. During feasibility investigations, the study team will make maximum use of existing and relevant data and analyses and will leverage the knowledge and experience of technical experts in other organizations to reduce overall study costs, eliminate duplication of effort, and condense the study schedule to the extent practicable. Wherever possible, the study team will also use ecological and other models that have already been reviewed and certified for use by the appropriate Corps Planning Center of Expertise to further streamline the technical work.

# 9. Feasibility Phase Milestones

The schedule milestones to complete the feasibility studies for Tier 1 projects detailed in this report that are pursued under the Continuing Authorities Program will be fully developed with the completion of a PMP. In that process, the study schedule will be negotiated with the NFS. A typical schedule for a Continuing Authority level study (from initiation to Division approval) would be expected to last about 17 months. A typical schedule, presented by major study milestones, is depicted in Table 8. The actual schedule for each study would vary based on the overall scope, complexity, and range of alternatives associated with the problem or opportunity being addressed.

**Table 8. Typical Feasibility Study Milestones (Continuing Authority Study)**

| Milestone | Description | Duration (mo) | Cumulative (mo) |
|---|---|---|---|
| Milestone F1 | Initiate Study | 0 | 0 |
| Milestone F2 | Public Workshop/Scoping | 2 | 2 |
| Milestone F3 | Feasibility Scoping Meeting | 2 | 4 |
| Milestone F4 | Alternative Review Conference | 3 | 7 |
| Milestone F4A | Alternative Formulation Briefing | 3 | 10 |
| Milestone F5 | Draft Feasibility Report | 2 | 12 |
| Milestone F6 | Final Public Meeting | 1 | 13 |
| Milestone F7 | Feasibility Review Conference | 1 | 14 |
| Milestone F8 | Final Report to Division | 2 | 16 |
| Milestone F9 | Division Approval of Report | 1 | 17 |
| - | Chief of Engineer's Report | NA* | NA* |
| - | Project Authorization | NA* | NA* |

* Not Applicable – The Chief of Engineer's Report and Project Authorization (by Congress) milestones are not applicable to Continuing Authority projects. These milestones apply to GI studies only.

As discussed in Section 5.9, one potential General Investigations study for the coastline and coastal watersheds in eastern Sanilac County, Michigan, has been considered. A study of severe erosion and sedimentation issues along the coast line and in the coastal tributaries appears to be in the Federal interest.

A consortium of non-Federal stakeholders (including Michigan DEQ, Michigan DOT, Sanilac County Drain Commission, Sanilac County Road Commission, and Sanilac County Conservation District) support a holistic evaluation of the water resource related problems in the area. However, they are not yet

clear on the approach that would best address their needs, nor has a willing NFS been identified to date. Development of a watershed plan for this area in accordance with Section 729 of WRDA 1986 would likely take 18 to 30 months to complete. A "traditional" feasibility study leading to congressional authorization of a project for construction would likely take 36 to 48 months to complete, including Washington level review, Chief of Engineer's Report, Office of Management and Budget review, and Congressional authorization in a WRDA. The actual study schedule would be negotiated with the NFS.

# 10. Feasibility Phase Cost Estimate

The costs to complete the feasibility studies for Tier 1 projects detailed in this report that are pursued under the Continuing Authorities Program will be fully developed with the completion of a PMP. In that process, study costs will be negotiated with the NFS. The costs to complete each of these feasibility studies are expected to fall between $200,000 and $600,000, depending on the scope of work developed for each study. An expected range of costs for each major study element is presented in Table 9.

The cost of the potential General Investigations study of severe erosion and sedimentation issues along the coast line and in the coastal tributaries of eastern Sanilac County would vary depending on the approach to the study that the NFS (TBD) would be willing to pursue. A watershed assessment for this area in accordance with Section 729 of WRDA 1986 would likely cost in the range of $400,000 to $800,000. A "traditional" feasibility study leading to congressional authorization of a project for construction would likely cost in the range of $1.5 to $2.5 million, depending on the scope of the study that would be negotiated with the NFS. Discussions with the Michigan DEQ, Michigan DOT, and other parties regarding this potential study are ongoing.

**Table 9. Range of Feasibility Study Costs for a Typical Continuing Authority Study in WLHB**

| WBS# | Description | Range of Costs ($ 000s) |
|---|---|---|
| JAA00 | Feas - Surveys and Mapping except Real Estate | $10 – 20 |
| JAB00 | Feas - Hydrology and Hydraulics Studies/Report | $10 – 40 |
| JAC00 | Feas - Geotechnical Studies/Report | $10 – 25 |
| JAE00 | Feas - Engineering and Design Analysis Report | $15 – 50 |
| JB000 | Feas - Socioeconomic Studies | $5 – 15 |
| JC000 | Feas - Real Estate Analysis/Report | $10 – 30 |
| JD000 | Feas - Environmental Studies/Report (Except USFWS) | $10 – 50 |
| JE000 | Feas - Fish and Wildlife Coordination Act Report | $5 – 15 |
| JF000 | Feas - HTRW Studies/Report | $5 – 25 |
| JG000 | Feas - Cultural Resources Studies/Report | $5 – 15 |
| JH000 | Feas - Cost Estimates | $10 – 20 |
| JI000 | Feas - Public Involvement Documents | $10 – 20 |
| JJ000 | Feas - Plan Formulation and Evaluation | $25 – 80 |
| JL000 | Feas - Final Report Documentation | $5 – 15 |
| JLD00 | Feas - Agency Technical Review Documents | $10 – 25 |
| JM000 | Feas - Washington Level Report Approval (Review Support) / Independent External Peer Review (IEPR) | NA* |
| JPA00 | Project Management and Budget Documents | $5 – 20 |
| JPB00 | Supervision and Administration | $10 – 30 |
| JPC00 | Contingencies | $10 – 30 |

| WBS# | Description | Range of Costs ($ 000s) |
|---|---|---|
| L0000 | PMP | $20 – 55 |
| Q0000 | PED Cost Sharing Agreement | $10 – 20 |
| Total | | $200 – 600 |

* Not Applicable - Washington Level Review support and IEPR are not normally required for CAP level studies. For traditional GI studies, these costs would be expected to be in the range of about $50,000.

# 11. Views of Other Resource Agencies

During the course of the 905(b) study, numerous informal contacts were made with knowledgeable Federal and state resource agency personnel in the study area concerning their views of water resource problems and opportunities, as well as potential solutions. In addition, the study team conducted nine stakeholder meetings in July and August 2011 (one regional meeting focused on Federal, state, and regional officials, large nonprofit organizations, and tribal representatives, and eight were localized community meetings with local officials, community groups and associations, business and agricultural interests, and interested individuals). While the various interests represented in these meetings and through other coordination efforts might hold differing views in regard to the significance of the identified problems and opportunities and their relative priorities for action, the proposed studies and projects in Tiers 1 and 2 generally received broad support for further consideration. Agency and public involvement efforts for this study are described in detail in Section 5.2, with substantial supporting documentation included in Appendix B.

# 12. Potential Issues Affecting Initiation of Feasibility Phase

Continuation of a study into cost-shared feasibility phase investigations is contingent on an executed FCSA. Failure to achieve an executed FCSA within 18 months of the approval date of the Section 905(b) study will result in termination of the studies. The schedule for signing the FCSA will be determined with each NFS. Based on the schedule of milestones in paragraph 9, completion of a feasibility report under General Investigations would be in the range of 36 to 48 months from study initiation, including potential congressional authorization in a future WRDA.

Feasibility study milestones for all CAP studies that have been identified during this 905(b) study would be determined on a case-by-case basis.

There are no known issues at this time that are likely to impact the initiation of feasibility investigations for WLHB. However, there are a number of factors that could emerge to disrupt or impede the initiation and subsequent progress/completion of feasibility investigations. They could include the following:

- Inconsistent or interrupted Federal funding levels that would likely result in loss of NFS and public support.
- Inconsistent or interrupted NFS funding levels could impact the continuity of Federal appropriations to the project.
- Feasibility investigations in the WLHB are likely to involve representatives of the public, resource agencies, and even the NFS, who have not worked extensively with the Corps and may not understand the Corps' planning process and the specific authorities and mission areas of the Corps. Ongoing communication, education, and outreach in these areas help keep the process on track and minimize confusion and frustration.

- NFSs could encounter limitations to their basic legal or operational authorities in regard to implementing certain project features or acquiring certain real estate interests that could be recommended as a result of feasibility investigations.
- Cross-jurisdictional issues at the local government level could create potential issues for the NFS and study costs and schedules if the pertinent local government entities are not continuously involved in the study.

Some of these issues may be unavoidable during the study, but they can be effectively managed by maintaining a highly collaborative feasibility planning environment.

# 13. Recommendations

The results of this investigation demonstrate that there is Federal Interest in ecosystem and fishery restoration and flood risk management within the study area of the WLHB.

I recommend that the WLHB 905(b) study proceed into feasibility phase investigations (beginning with a formal Determination of Federal Interest) under the Continuing Authorities Program for the recommended studies and locations cited below (and presented in more detail in Table 5 and in Appendix C):

- Ashmun Creek and Bay Ecosystem Restoration, Sault Ste. Marie, Michigan (Project # SSM-5)
- Thunder Bay River Ecosystem Restoration, Alpena, Alcona, Presque Isle, and Montmorency Counties, Michigan (Project # Che-2) *
- Trout River Dam Rebuild/Replacement, Presque Isle County, Michigan (Project # Che-5) *
- Alpena Township Flooding, Alpena, Michigan (Project # Alp-6) *
- Rifle River Watershed Restoration, Arenac and Ogemaw Counties, Michigan (Project # Taw-6) *
- Saganing River/Creek Watershed Ecosystem Restoration, Arenac County, Michigan (Project # BC-1)
- Downtown Caseville Ecosystem Restoration, Caseville, Michigan (Project # PA-4) *
- Lexington Harbor Environmental Restoration, Lexington, Michigan (Project # PS-1)*
- Doe Creek Watershed Ecosystem Restoration, St. Clair County, Michigan (Project # PS-3) *
- Spaulding Drain (Ambrose Road) Ecosystem Restoration, Saginaw County, Michigan (Project # TS-8)

Prospective NFSs for seven of the studies identified above (as indicated by *) have provided LOIs, indicating their desire to pursue the studies and their understanding of the sponsorship requirements. LOIs for the other studies have been requested and are pending. In addition, letters of support from key stakeholders have been provided for some of the potential studies. Those letters received to date are included in Appendix C, at that back of several of the Water Resource Problem/Opportunity Summaries.

In addition, I recommend that ongoing discussions continue with the Michigan DEQ, Michigan DOT, and other potential partners to determine the appropriate scope of studies and confirm a NFS for potential feasibility level investigations to address severe erosion and sedimentation issues along the coast line and in the coastal tributaries in eastern Sanilac County, Michigan, under the General Investigations program. A summary of the proposed study, pertinent issues, potential partners, and the status of coordination efforts is included in Appendix C. I further recommend that discussions continue with the Michigan DEQ, the Bay County Drain Commissioner, and other potential partners to determine the appropriate scope of studies and confirm a NFS for potential feasibility level investigations to address ecosystem restoration

and flood risk management opportunities in the Kawkawlin River watershed in Bay, Midland, and Gladwin Counties, Michigan under the General Investigations program. A summary of the proposed study, pertinent issues, potential partners, and the status of coordination efforts is included in Appendix C.

During the course of this 905(b) study, a variety of water resource related needs were identified from the existing literature and agency and stakeholder input that could effectively be addressed by one or more authorities under which the Corps may provide various types of technical assistance to state and local governments, as described in Section 5.6.2.2. Specific opportunities in the WLHB are summarized in Table 6 of the report. These opportunities can and will be pursued independently of this report in accordance with the specific requirements of the applicable program(s), availability of Federal funds, and availability of a NFS (as applicable).

These recommendations are based upon the best information available during the report formulation process. They reflect program and budgetary considerations but do not necessarily represent the final program and budgetary priorities of the Administration.

_____ _____

Date

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# List of Abbreviations and Acronyms

| | |
|---|---|
| AOC | area of concern |
| BUI | beneficial use impairment |
| CAP | Continuing Authorities Program |
| CDF | confined disposal facility |
| CSO | combined sewer overflow |
| DMMP | dredged material management plan |
| EC | Environment Canada |
| EPA | (United States) Environmental Protection Agency |
| ER | engineer regulation |
| ERA | Estuary Restoration Act (of 2000, as amended) |
| FCSA | feasibility cost share agreement |
| FPMS | Floodplain Management Services |
| FY | fiscal year |
| GI | general investigations |
| GIS | geographic information system |
| GLFC | Great Lakes Fisheries Commission |
| GLFER | Great Lakes Fishery and Ecosystem Restoration (Program) |
| GLRI | Great Lakes Restoration Initiative |
| IEPR | independent external peer review |
| IJC | International Joint Commission |
| LOI | letter of interest |
| LRD | Great Lakes and Ohio River Division |
| MDEQ | Michigan Department of Environmental Quality |
| MDNR | Michigan Department of Natural Resources |
| MDOT | Michigan Department of Transportation |
| NED | National Economic Development |
| NEMCOG | Northeast Michigan Council of Governments |
| NER | National Ecosystem Restoration |
| NFS | non-Federal sponsor |
| NRCS | Natural Resource Conservation Service |
| O&M | operations and maintenance |
| PMP | project management plan |
| RAP | remedial action plan |
| RHA | River and Harbor Act |
| SOLEC | State of the Lakes Ecosystem Conference |
| SWS | Sweetwater Sea |
| SNWR | Shiawassee National Wildlife Refuge |
| TNC | The Nature Conservancy |
| USACE (or Corps) | United States Army Corps of Engineers |
| USCG | United States Coast Guard |
| USFWS | United States Fish and Wildlife Service |
| WLHB | Western Lake Huron Basin |
| WRDA | Water Resources Development Act |

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