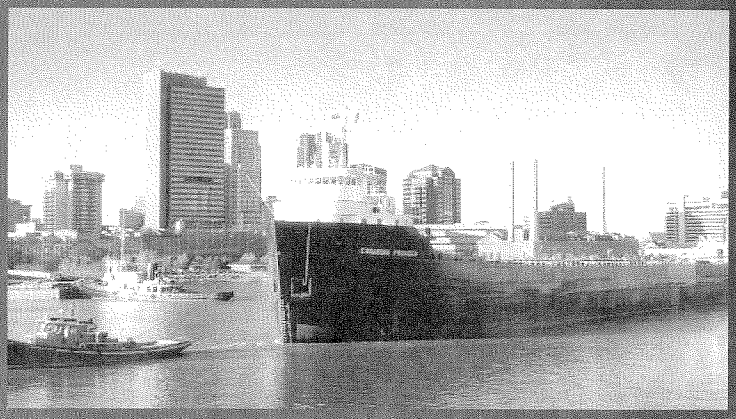
WESTERN LAKE ERIE BASIN
OHIO, MICHIGAN AND INDIANA

RECONNAISSANCE STUDY REPORT



US Army Corps of Engineers
Buffalo District

SEPTEMBER 2001

WESTERN LAKE ERIE BASIN RECONNAISANCE STUDY
SECTION 905(b) (WRDA 86) ANALYSIS

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WESTERN LAKE ERIE BASIN RECONNAISANCE STUDY
SECTION 905(b) (WRDA 86) ANALYSIS

1. STUDY AUTHORITY

1.1. This reconnaissance study was authorized by Section 441 of the Water Resources Development Act (WRDA) of 1999, which directed the Secretary of the Army for Civil Works to conduct a study to develop measures to improve flood control, navigation, water quality, recreation, and fish and wildlife habitat in a comprehensive manner in the Western Lake Erie Basin, Ohio, Indiana, and Michigan, including watersheds of the Maumee, Ottawa, and Portage Rivers (***Figure 1.1***).

In carrying out the study, the Secretary was directed to:

- Cooperate with interested Federal, State, and local agencies and non-governmental organizations;

- Consider all relevant programs of the agencies; and

- Submit a report to Congress on the results of the study, including findings and recommendations no later than 1 year after the date of enactment of this act.

1.2. This Section 905(b) analysis was prepared in response to congressional directives contained in Senate Report 106 – 395 and Conference Report 106 – 988. The Senate Report states: "The Committee has provided $100,000 for the U.S. Army Corps of Engineers to prepare a Section 905 (b) report and, if appropriate, to develop a study management plan for the Western Lake Erie Basin study. The study will address measures to improve flood control, navigation, water quality, and other water resource needs in a comprehensive manner in the Western Lake Erie Basin of Ohio, Indiana, and Michigan," The Conference Report directs that the Senate Report should be complied with, unless specifically addressed to the contrary. A major premise of this study was to recognize relationships between the Basin's watershed ecosystem, Lake Erie's open waters, farmlands, villages, towns, and cities. Funds in the amount of $100,000 were appropriated in fiscal year 2001 to conduct the reconnaissance phase of the study under the title Western Lake Erie Basin Study.

2. STUDY PURPOSE

The purpose of this study is to determine if there is a Federal (Corps) interest in participating in cost shared feasibility studies of water resource problems, needs and opportunities in the western basin of Lake Erie. The purpose of this Section 905 (b) analysis is to document the findings and establish the scope of the feasibility phase.

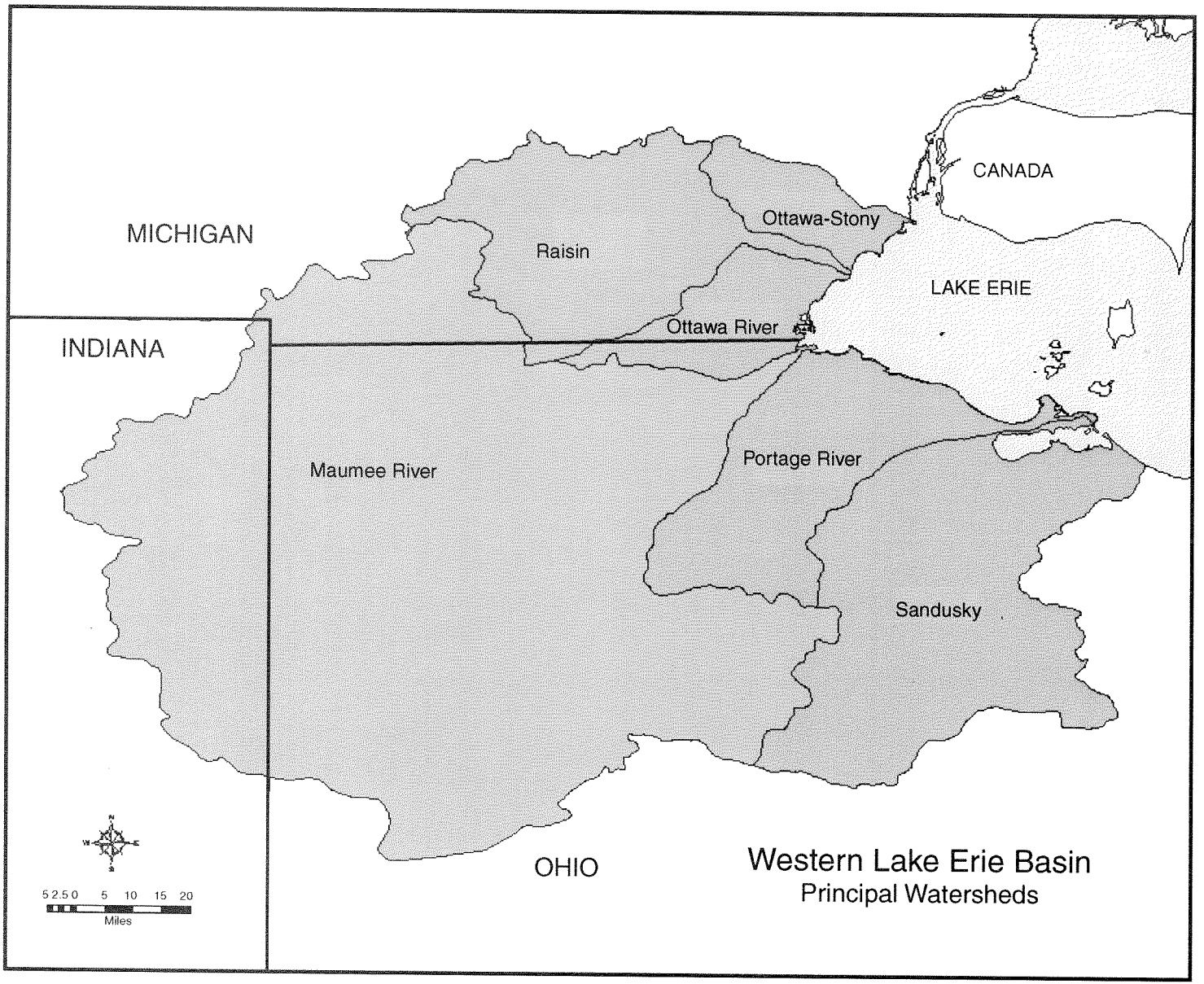


Figure 1.1 - Western Lake Erie Basin

3. DESCRIPTION AND LOCATION OF THE STUDY AREA

The study area is located in the western basin of Lake Erie encompassing watershed areas primarily in the State of Ohio with significant portions in the States of Indiana and Michigan as shown in the enclosed basin map (***Figure 3.1***). This current reconnaissance study effort focuses on the watersheds of the Maumee, Portage, and Ottawa Rivers. The lake portion of the study area is characterized by shallow water generally less than 25 feet deep.

3.1. The Maumee River Basin

The Maumee River has a drainage area of 6,609 square miles, and is the largest stream discharging into Lake Erie in the United States and Canada. It discharges just under 24 percent of the surface water that flows into Lake Erie. The four largest tributaries to the Maumee River, in descending order, are the Auglaize River, the St. Joseph River, the St. Mary's River, and the Tiffin River (***See Figure 3.2***). The Maumee River is formed at the confluence of the St. Joseph and St. Mary's Rivers near Ft. Wayne, Ind. It flows approximately 120 river miles northeast to Toledo, Ohio where it empties into Lake Erie at Maumee Bay.

The Basin comprises a flat lake plain in the center and sloping till planes around the edges. The U.S. Department of Agriculture (1993) reported the average slope of the Maumee River from Fort Wayne to Toledo is 1.3 ft/mi. The average slopes of the major tributaries of the Maumee River are 2.8 ft/mi for the St. Mary's River; 1.6 ft/mi for the St. Joseph River; 1.2 ft/mi for the Tiffin River; 3.2 ft/mi for the Auglaize River and 0.9 ft/mi for the Blanchard River. Some of the headwaters of these tributaries have slopes of 10 ft/mi., especially those in the upper St. Joseph River Basin.

The modern Maumee River was formed during the glacial ice recession from the western end of the Lake Erie Basin, between 8,000 and 12,000 years ago. The Maumee River Basin is overlain by three types of Pleistocene glacial deposits-till, consisting of poorly sorted and generally unstratified particles ranging in size from clay to large boulders; and to a lesser degree, course-grained stratified sediments, consisting of sand and gravel; and fine-grained stratified sediments, consisting of clay, silt, and very fine sand. Sediments overlying bedrock (***See Figure 3.3***) range in thickness from less than 1 ft near lake Erie to more than 200 ft in northwestern Indiana and southwestern Michigan.

The stream-drainage pattern of the Maumee River is dendritic owing to the consistent thick cover of surface material deposited over the sandstone and shale in the northwestern part of the basin and in the thin layers of surfical material deposited on the relatively flat limestone and dolomite bedrock units in the southern part of the basin. The dendritic pattern of stream development in the basin shortens the distances from the land surfaces to waterways and increases the efficiency of sediment delivery to streams.

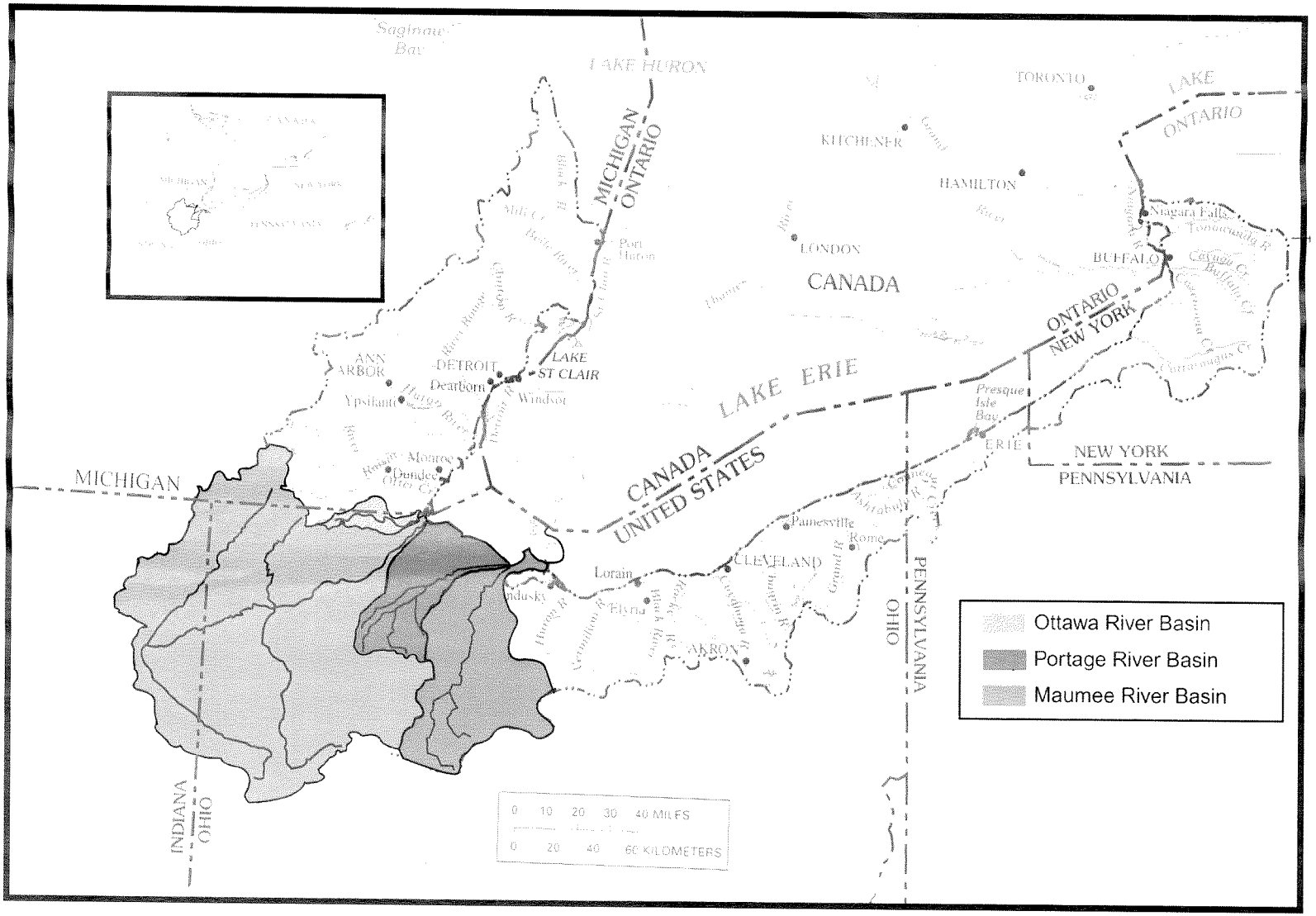


Figure 3.1 - Location of Study Area

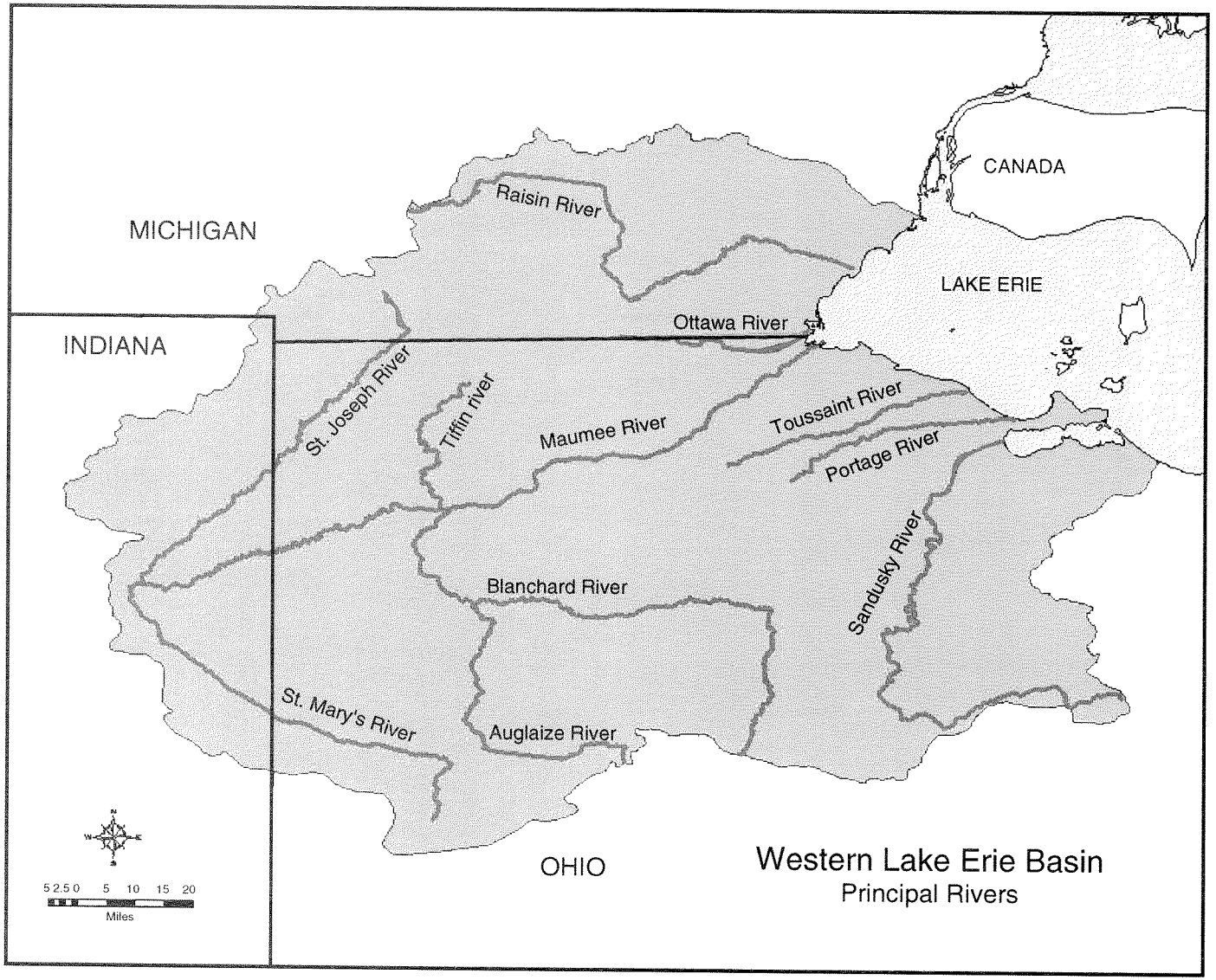


Figure 3.2 - Major Tributaries of the Maumee River

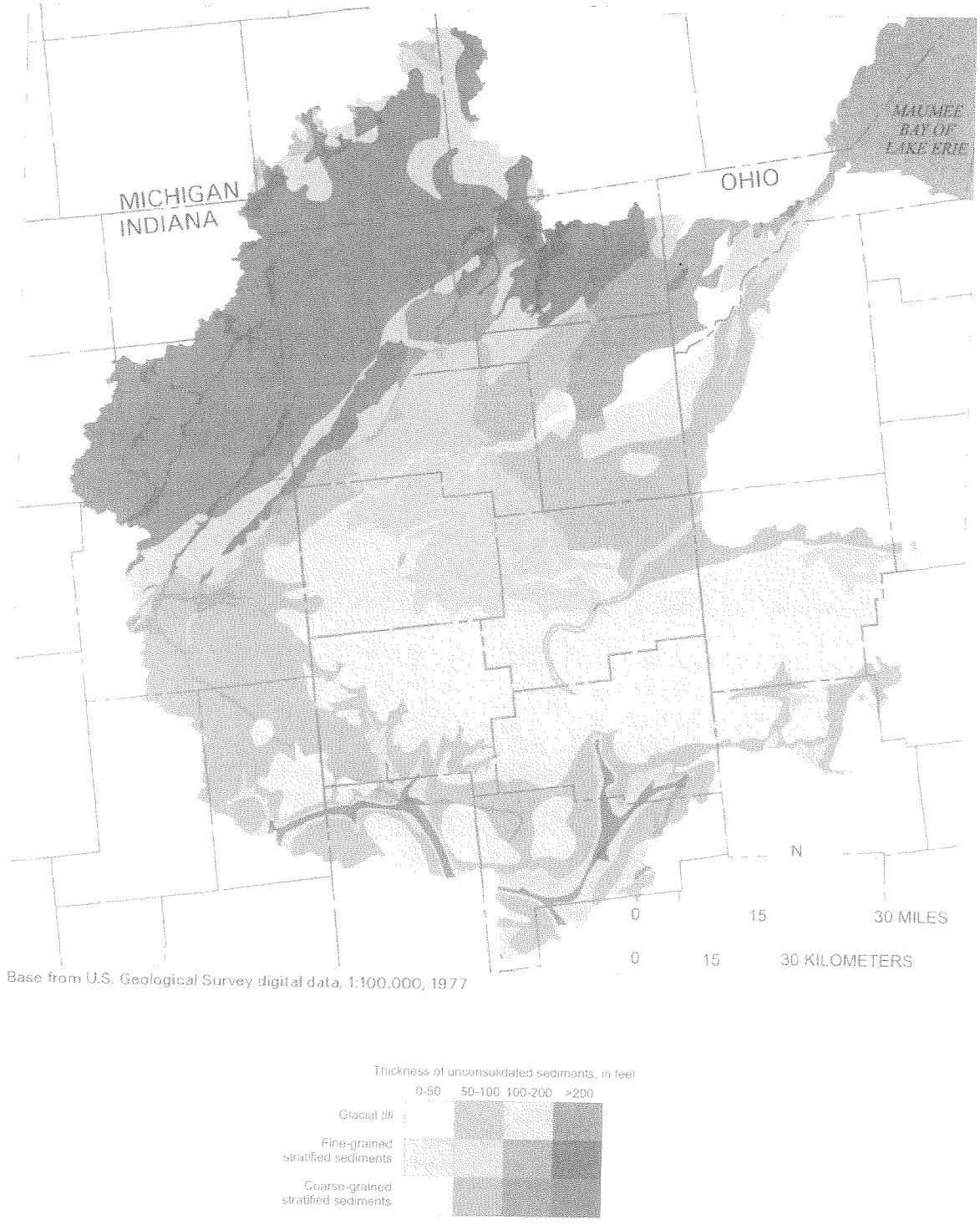


Figure 3.3 - Distribution and Thickness of Unconsolidated Sediments in the Maumee River Basin

3.2. The Portage River Basin

The Portage River Basin is in the general shape of a curved wedge. The river measures approximately 60 miles long, and its width at the headwaters is 25 miles. The watershed lies entirely within Ohio and has little topographic relief. The basin headwaters originate from the Defiance Moraine, immediately north of Findlay, Ohio. The top of this ridge lies 260 feet above the level of Lake Erie, but the river decline is rapid in the headwaters, which results in rather flat stream slopes throughout the central and lower reaches of the river.

The stream pattern of the basin consists of a single channel threading the lower 30 miles of the basin. Three major tributaries, the North Branch, Middle Branch, and East Branch, meet at the same general confluence (***Figure 3.4***). Basin soils are clays and mucks in the downstream reaches and sand, gravels, and admixtures of clays in the headwaters regions. The total drainage area of the Portage River basin is approximately 591 square miles.

3.3. The Ottawa River Basin

The Ottawa River, a tributary to Lake Erie, empties into the Lake's westerly end about 3.5 miles northerly from the mouth of the Maumee River and Toledo Harbor, Ohio. The river has a total length of 41.6 miles including 41 miles in Lucas County, and the remainder in Monroe County, Michigan. The river is shallow with depths averaging 2 feet below low water datum, which limits navigation to small boats usually moored at marinas and yacht clubs. The river serves both local based and transient watercraft. The existing traffic on the river consists entirely of recreational craft. The presence of the Lake Erie, in the region containing Ottawa Harbor, tends to moderate the temperature, which ranges from mid-20s (°F) in January to mid-70s (°F) in July. Precipitation is well distributed throughout the year with an annual average precipitation of 35 inches. Prevailing winds in the Ottawa River area are from the west through southwest directions. Wind seiche and a barometric pressure change on the lake surface create drastic short-term fluctuations in lake levels, particularly at the eastern and western extremities of the Lake. These fluctuations at the western extremities of the lake tend to influence water levels at the nearby Ottawa River Harbor and adjacent Toledo Harbor. In this area lake levels have ranged from 8.3 feet above low water datum to 7.5 feet below low water datum in direct proportion to the effects of wind, seiche and seasonal variations.

Water quality of the Ottawa River is classified as highly polluted and unsafe for swimming, fishing and other water activities. Upstream landfills, sewer outfalls, and agriculture runoff have been the sources of pollution (***Figure 3.5***), which degrades water quality and adversely impacts river bottom sediments.

3.4. Non-Federal Sponsor

The non-Federal sponsor for the feasibility phase of the study is the Toledo Metropolitan Area Council of Government (TMACOG).

3.5. Congressional Districts

The study area lies within the jurisdiction of the following Congressional Districts:

- Congresswoman Marcy Kaptur of Ohio, District (OH-09)
- Congressman Paul E. Gillmor of Ohio, District (OH-05); and
- Congressman John Dingell of Michigan, District (MI-16)
- Congressman Mark Souder of Indiana, (IN-04)

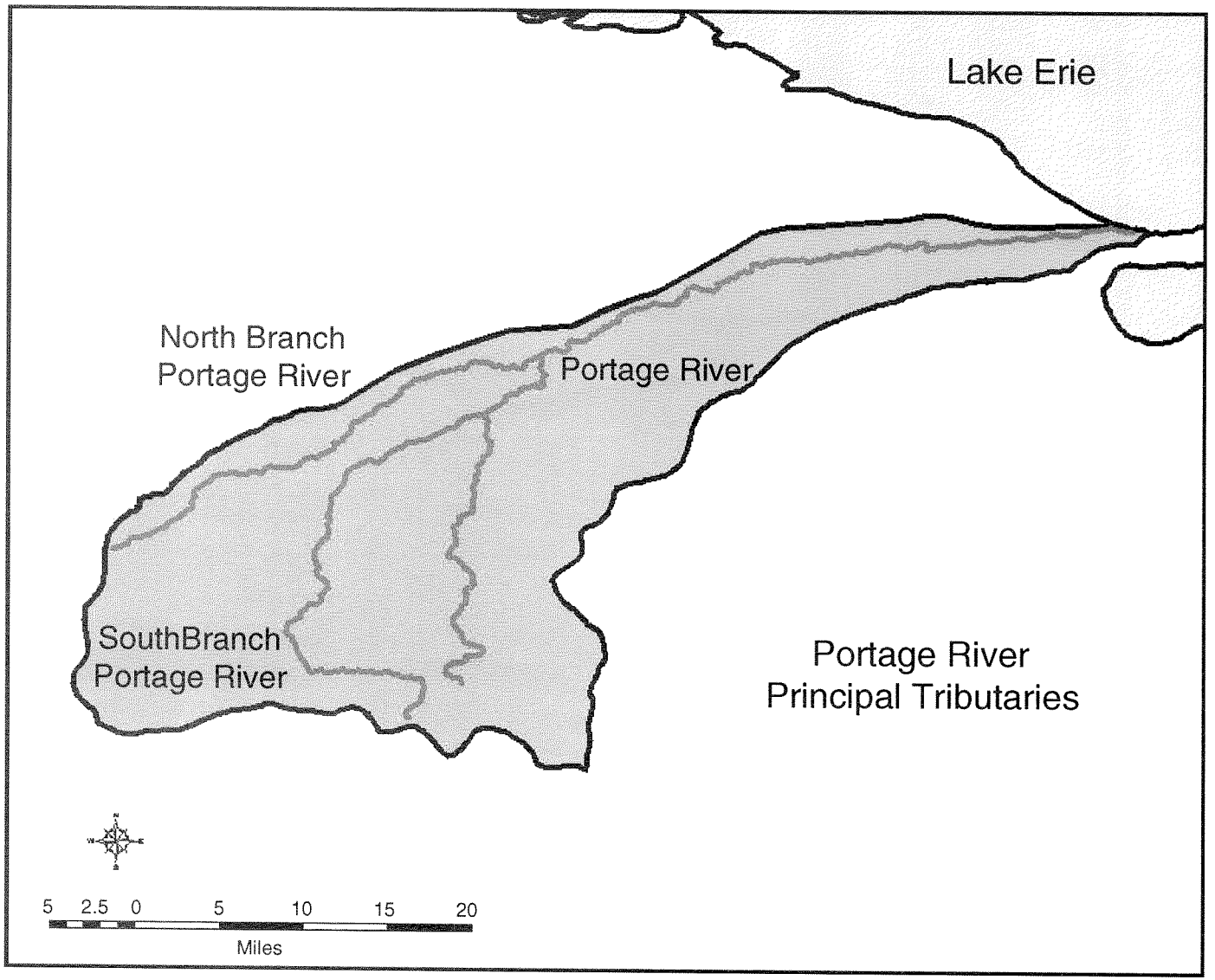


Figure 3.4 - Portage River Basin

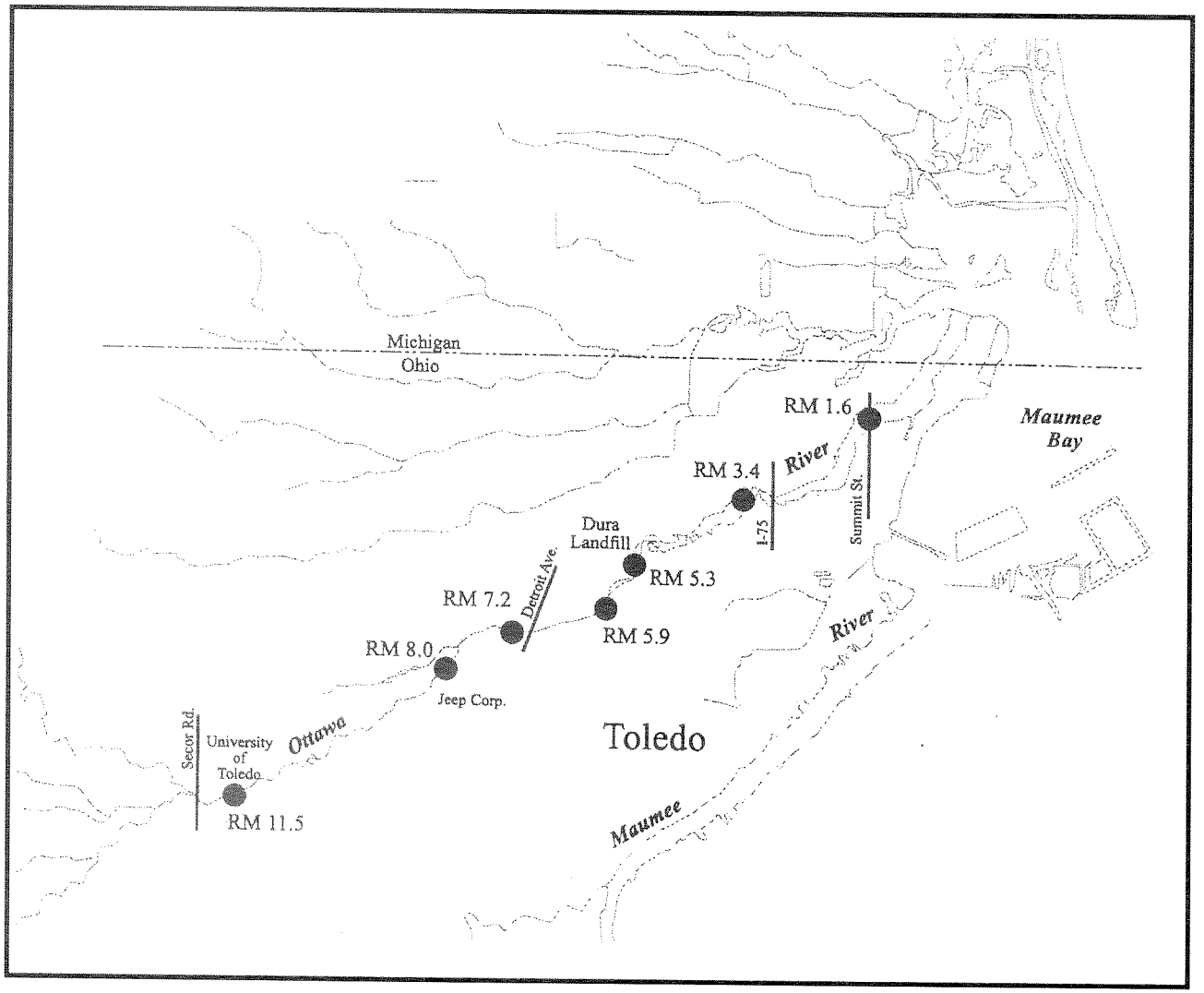


Figure 3.5 - Map of the Ottawa River

4. PRIOR STUDIES/REPORTS AND EXISTING PROJECTS

There are multiple studies that provide a basis for establishing water resource needs and opportunities in the western basin of Lake Erie. Some of these studies are discussed below:

4.1. Long Term Management Strategy

In 1991, the U.S. Environmental Protection Agency (USEPA) and Ohio EPA (OEPA) determined that the practice of open lake disposal of dredge sediment from the Maumee River at Toledo Harbor and from Lake Erie at Maumee Bay, OH was environmentally unacceptable. In order to resolve this impasse, and to provide continued operation and maintenance of Toledo Harbor, Congress through the Assistant Secretary of the Army for Civil Works directed the Corps of Engineers to develop a long-term management strategy (LTMS) for dredge sediment management and disposal.

The LTMS study, authorized by Section 356 of the Water Resources Development Act of 1992 (WRDA 92), has been performed in a five-phase approach of which three phases have been completed. The phase one report provided an overview of the dredge disposal problem at Toledo, which involves disposal of up to 1 million cubic yards annually. The phase two report, as required by the National Environmental Policy Act (NEPA) examined alternatives for sediment management including basin soil erosion control, recycling and beneficial use of dredge material, and expansion of confined disposal facility (CDF) capacity. The Phase 3 report examined viable options in more details. The Phase 4 draft report documents progress in implementing some of the management strategies and provides recommendations for future actions and study, including the enlargement of existing CDFs and construction of new ones. Phase 5 will include implementation of innovative management of CDFs to prolong the useful life of existing CDFs, and the expansion and/or construction of a new CDF to accommodate dredge material over a 20 to 25 year period.

4.1.1. CDF Capacity Expansion

Several efforts were undertaken by the U.S. Army Corps of Engineers to investigate the prospect of capacity expansion. The first effort was to look at innovative techniques for managing dredge materials. The Army Corps of Engineers implemented a process of trenching the existing confined disposal facility to enhance the runoff of moisture from the dredge material. This enhanced drainage system allowed for accelerated consolidation and settlement of the material, and restored some capacity at confined disposal facilities. Implementation of this technique has improved the economic efficiency and usefulness of confined disposal facilities. However, application of this technique is not a long-term solution to the storage capacity issues facing the Toledo Harbor project. It is rather one of the contributing factors to a long-term solution.

In addition to taking steps to de-water the existing facility, steps were taken to maximize the use of the design capacity of the disposal area. This was accomplished by utilizing the total capacity of the facility instead of filling it to a level 2 feet below the existing dike height.

The U.S. Army Corps of Engineers initiated another effort to investigate the prospect of raising the dikes at the existing confined disposal facility. This investigation was intended to determine the technical feasibility of raising the dikes with on-site material, as well as the cost of such an effort. Experiments were completed in both 1998 and 1999 and demonstrated the practical feasibility of raising the dikes. It was determined that this is a very cost effective way of adding additional capacity at the existing confined disposal facilities including the abandoned Island 18 facility. On the other hand, raising the dikes does pose a problem for the potential future use of the facility. The higher the dikes are raised the less accessible the property is for marine, park, or other uses. At the time of preparation of this report, the acceptability of such expansions was in question with the U.S. Fish and Wildlife Service and the Ohio Department of Natural Resources (ODNR) as well as local interest. The city of Oregon, Ohio had expressed grave concern regarding any attempt to expand facility #3. Consequently, efforts to move forward with any horizontal expansion of facility #3 have been eliminated.

4.1.2. Woodtick Peninsula

While being sensitive to the concerns of the U.S. Fish and Wildlife Service and Ohio DNR, the Port Authority had investigated numerous means of restoring the environmental benefit of the Woodtick Peninsula by proposing the beneficial confinement of dredged material at the site. The Woodtick Peninsula is located in the Southeasternmost corner of the state of Michigan. Over the last 100 years, the Peninsula had been subject to a tremendous amount of erosion and is now in danger of being lost forever. The wave and high water levels which threaten this peninsula also threaten 1,400 acres of wildlife area located inland of the Peninsula.

Consequently, the Port Authority undertook several investigations into means of rebuilding the Woodtick Peninsula. The first effort investigated the construction of a reinforced spine down the middle of the peninsula which would then have dredge material pumped onto the spine, thus rebuilding the peninsula. It was understood that this would act as a sacrificial measure with the wave action, in time, eroding away the material after it was placed on the peninsula.

Since Woodtick Peninsula is a popular habitat for bird populations feeding off sandy beaches, the Michigan DNR requested that the Port Authority investigate an offshore facility, which could act as a protective barrier for the Woodtick Peninsula as well as a confined disposal facility. An option was assessed that resulted in the proposed construction of a 3.5 mile long, 0.5 mile wide CDF, located approximately less than 0.75 mile east of the Woodtick Peninsula (***See Figure 4.1***). The CDF would be constructed in 6 to 10 feet of water and have a capacity of approximately 24 million cubic yards. At a disposal rate of 800,000 cubic yards per year, this facility would provide more than 30 years of storage capacity. The assessment looked at the potential impacts on the natural resources of the area for both the construction and operation of the CDF.

The assessment results indicated that a variety of upland, wetland, and shallow-water habitats currently exist in the Woodtick Peninsula area and that they would potentially benefit from the construction of the CDF facility. The protection resulting from the CDF would occur from the significant reduction of direct wave impacts on and along the Woodtick's eastern shore. Wave propagation into the North Maumee Bay area would also be minimized. This would provide additional protection to non-diked wetlands in the bay and along the mainland, as well as upland

dike structures that surround significant bay area wetland resources. Protection of these habitats would greatly benefit the resident and migratory wildlife and aquatic communities that populate these areas.

In addition to protecting and preserving existing upland and deep-water habitats, construction of a CDF near Woodtick may also promote the development of new and valuable wetland, shallow water, and/or upland habitats in the area. New fish habitat unique to the area, and new wetland, shallow water, and/or upland habitats could also develop in the area between the CDF and Woodtick and within the boundaries of the Peninsula itself. The extent of development of these new resources will depend on hydrologic and sedimentation conditions that occur due to the construction of the new CDF.

The construction of the CDF would also have positive socioeconomic impacts. A number of recognized historical/cultural sites occur on Peninsula uplands, as well as islands in the southern portion of the Bay area. These sites would also be protected from erosion by construction of the CDF. Finally, the construction of the CDF at this location would offer a facility convenient for the disposal of sediments dredged from Toledo Harbor benefiting the Toledo Port Authority and meeting the needs of regional shipping interests.

The cost of the existing option being investigated at the Woodtick Peninsula would range from $40-$60 million, depending upon the capacity to be established. Considering the economic benefits provided by Toledo Harbor, any environmental restoration project at Woodtick Peninsula that would involve the construction of innovative CDFs whose cost would fall within the above stated range would be economically feasible.

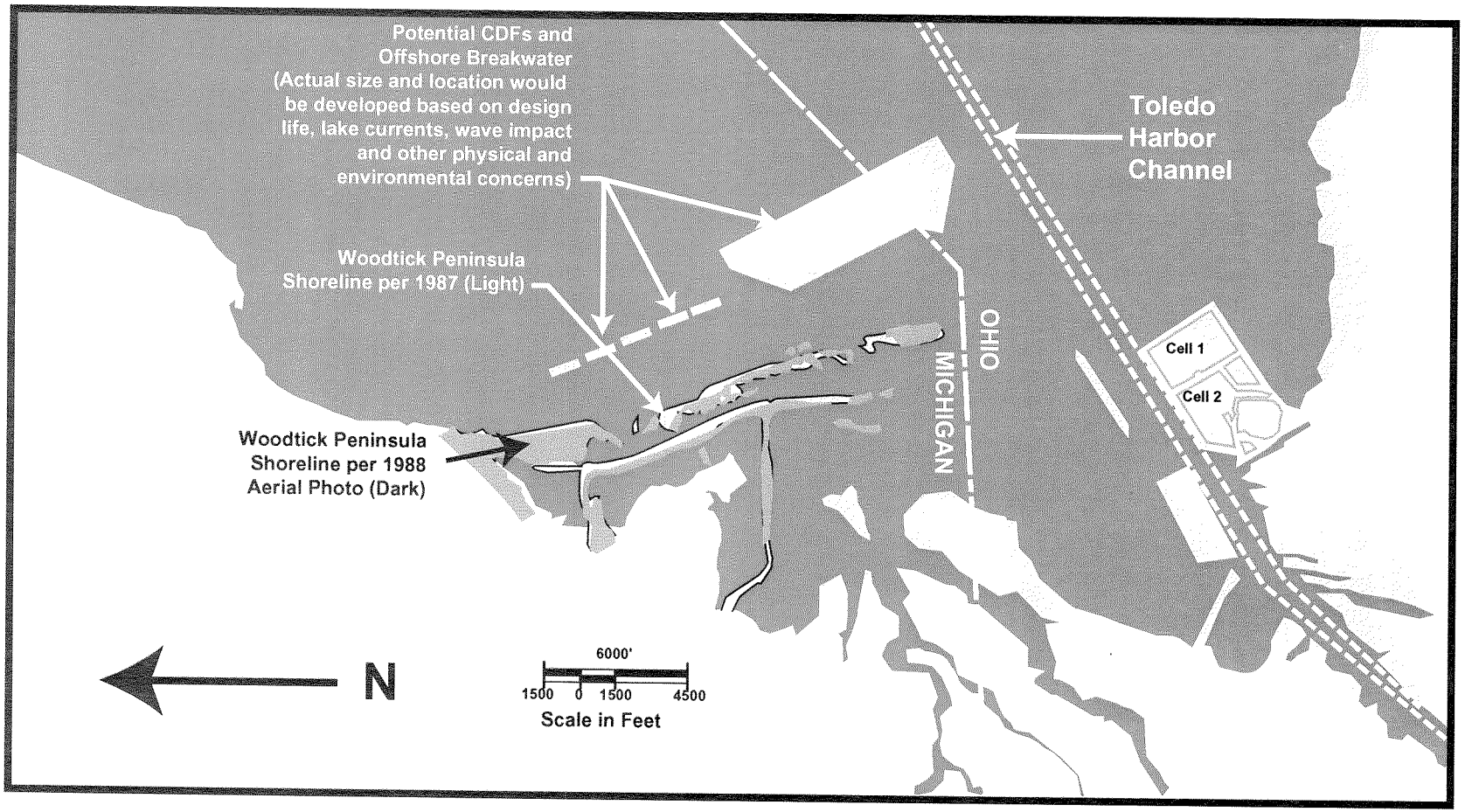


Figure 4.1 - Eroded Woodtick Peninsula

4.1.3. Recycling of Dredged Material

One of the studies conducted under the LTMS was an "Evaluation of Toledo Harbor Dredged Material for Manufactured Soil," conducted by the Corps of Engineers Waterways Experiment Station (WES) and published in 1998. Controlled tests were conducted on the use of dredge material in manufactured soil.

Finding places at Toledo harbor to dispose of the dredged material had becoming harder and harder. The Corps had sought solutions to this situation. Likewise, sewage sludge at the Toledo treatment plant is difficult to dispose. To resolve the accumulation of sewage sludge, the USEPA has issued 40 CFR Part 503 regulations that promote the reuse of biosolids derived from conditioned sludge.

To address both the excess of dredged material and sewage sludge at Toledo, the Corps of Engineers WES Environmental Laboratory has evaluated the potential for manufacturing an artificial soil from dredged material and organic wastes. Cooperative Research and Development Agreements (CRDAs) were established with commercial companies to develop the technology for manufacturing soil from dredged material. Technology would allow the development of a fertile soils/manufactured soil product that can be used in beneficial manner, allow the Corps to empty confined dredged material disposal sites that are full, and recycle the nation's waste materials in an environmentally sound manner.

The results from the tests at the Corps WES indicated that a mixture of Toledo Harbor CDF dredged material, cellulose and bio-solids, will enhance plant growth. WES concluded that this mixture is very promising as a manufactured soil product that may be used for landscaping and topsoil. The results from Scott and Sons screening test also showed that Toledo Harbor CDF dredged material may be suitable as an ingredient for Scott and Sons Company bagged soil product. Therefore, a high quality manufactured soil product could be blended using Toledo Harbor CDF dredged material making more space available for disposal.

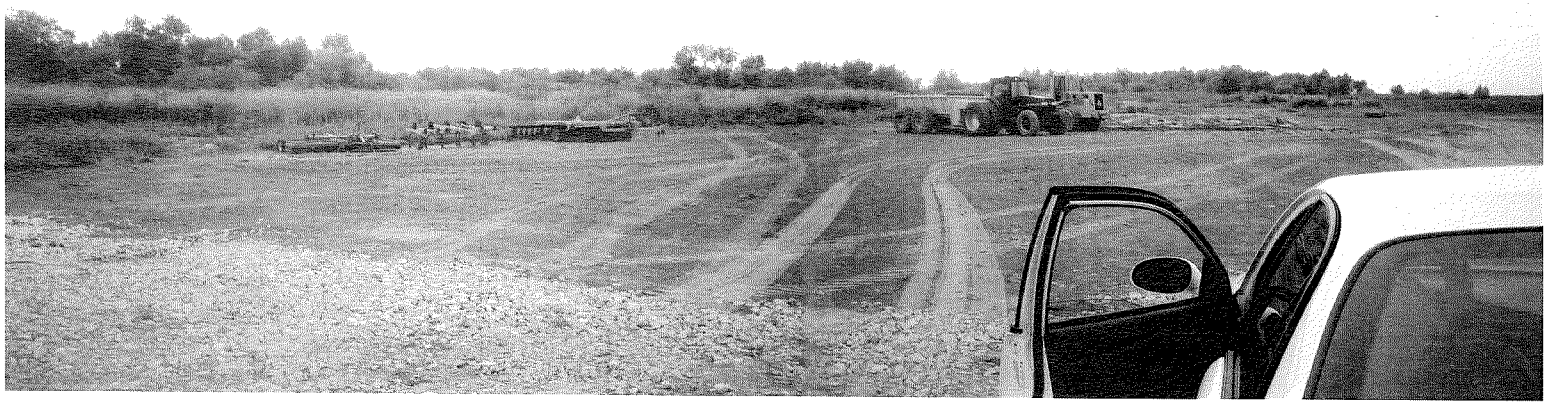
As a result of the successful greenhouse (laboratory) studies, large batches of manufactured soils were prepared. The manufactured soil was loaded into trucks, sealed, and covered prior to transport to the two field demonstration sites. Field demonstration sites were located at the University of Toledo and the Toledo Botanical Gardens. The University of Toledo site used the manufactured soil to landscape two entrance sites at the University. The sites consisted of a grassed lawn, evergreen trees toward the back of the area, and a small shrub landscaped area around the entrance signs to the University. The Toledo Botanical Gardens used the manufactured soil to increase the elevation of soil beds behind a hedge at the entrance to the Botanical Garden. The remaining material was used to either rework other soil beds or satisfy landscaping needs throughout the Botanical Garden.

The demonstration sites were monitored by observation and photographed periodically to document their progress. Grass lawn areas and areas with shrubs and trees were maintained with standard procedures used for the remainder of the Garden. Test results showed that soil manufactured using dredged material from Cell 1 of the Toledo CDF was a very good medium for plant growth. Tests for minerals/heavy metals were conducted on Cell 1 dredged material.

These tests determined minerals/heavy metals contained in the dredged material were not a concern at the current level of detection. Results from the plant bioassay tests indicated that a blend of Toledo Harbor dredged material from Cell 1, cellulose, and biosolids would enhance plant growth.

The engineering feasibility of the recycling and beneficial reuse of the soils manufactured from the dredged material has been established and successfully demonstrated. There remains yet the task of establishing its economic feasibility and which product will expand the current market and what share of the expanded market it will capture. In order to achieve this goal and move forward, the Toledo-Lucas County Port Authority initiated a demonstration program for the different technologies and uses of the material. Three companies responded to a request for a proposal from the Port Authority and each has been provided several acres of land at the Port's confined disposal facility Cell 1 to demonstrate the commercial feasibility of their product. The producer of "Nu soil" (*Product name given by the manufacturer*) will expand on its existing program of using sewage sludge and lime sludge mixed with dredge material ***(Figure 4.2).*** The second company's effort will involve mixing fly ash with dredge material to produce a construction grade material. Finally, the third company will be using yard waste mixed with dredge material to produce high quality topsoil.

Entrance to recycling site on Cell 1 Aug 2001



Recycling site. Recycled material ready to be harvested. Aug 2001

Figure 4.2 - On-Site Production of "Nu-Soil"

4.1.4. Conservation Tillage and Buffer

In July 1998, the Natural Resources Conservation Service performed an important ancillary study to the LTMS and published a report entitled *"Analysis of Conservation Buffer Effectiveness for Toledo Harbor Project."* This analysis evaluated the effect that widespread installation of conservation buffers in the Maumee Watershed would have on the in-situ volume of dredge material in the Toledo Harbor channels. This analysis was prepared as part of the Natural Resource Conservation Service Toledo Harbor Demonstration Project final report submitted to the U.S. Army Corps of Engineers (USACE, Buffalo District). The objectives of this analysis were to:

- Quantify the effect of conservation buffers on sediment reduction in the harbor.
- Determine the average savings in yards of dredging saved per acre of buffer installed.
- Evaluate the cumulative effect that widespread installation of buffers would have on project goals.

The LTMS goal was to reduce sedimentation in the Toledo Harbor navigation channel by 130,000 cubic yards annually through the use of the Conservation Tillage technique to grow 75 percent of the corn and soybeans in the watershed. The 130,000 cubic yards represents agriculture's contribution to the overall goal of sediment reduction. In addition to the agricultural component, there are several other components in the Phase 3 plan, which also contribute to dredging reduction.

At the time the initial NRCS plan was prepared in 1992 there was no effective program to promote filter strips (conservation buffers), especially with widths that would be effective in sediment removal. Since that time the National Conservation Buffer Initiative has been developed as part of the Continuous Signup provisions of the CRP program. Both of these programs now work in tandem to now make the use of filter and buffer strips more attractive to farmers.

Conservation buffers can provide a significant portion of the sediment reduction needed to meet the agricultural goals of the Toledo Harbor Long Term Management Plan. Each acre of conservation buffer installed would provide from .383 cubic yards to .497 cubic yards of sediment reduction, depending on the level of conservation tillage in the watershed. Based on 1992 crop patterns, the combination of additional conservation buffers on 25 percent of the cropland acres, 55 percent conservation tillage corn, and 66 percent conservation tillage soybeans would provide an estimated sediment reduction of 131,163 cubic yards. This would meet the Toledo Harbor Executive Committee's goal of 130,000 cubic yards.

4.2. Lake Erie Wastewater Management Study

Over the period 1975 to 1982, the Buffalo District conducted a *Lake Erie Wastewater Management Study* directed at reducing sediment and nutrient loading to the Western Basin of the lake. The authority for this study was contained in Sections 108 (d) and 108 (e) of The

Federal Water Pollution Act Amendments of 1972. A final report was issued in 1982. This study quantified the delivery of sediments and phosphorous to the Maumee River and Lake Erie from various combinations of soils, crops, slopes, and crop management practices. It also predicted and demonstrated reductions in loadings that could be effected by employing conservation practices such as minimum tillage and no tillage. This study was important because it shows that dredging quantities may be significantly reduced by good agricultural management practices in the very large and principally agricultural watershed of the Maumee River.

In addition to the studies discussed above, there have been a number of potential flood control, navigation, and shoreline erosion projects identified in the Western Basin. Reports on these projects are briefly summarized as follows:

4.3. General Reevaluation Report for the Blanchard River Ottawa, Ohio Flood Protection Project.

In April 1987, the Buffalo District completed the general reevaluation report on the Blanchard River, Ottawa, Ohio flood control project, and recommended the National Economic Development (NED) plan be implemented. However, no Federal action was taken due to the inability of the non-Federal sponsor to share in the cost of construction.

The NED plan consists of improving the channel capacity and floodway of the Blanchard River supplemented by an "early warning system" for community response. The plan also called for the relocation of the Ohio Power Company's 69-KV electric power transition line; the removal of an abandoned railroad embankment and disposing of the material on the adjacent floodplain; the removal of the remains of the Perry street embankment on the right overbank of the river; the clearing and snagging of the River from the downstream corporate limit of the village of Ottawa. The plan had a non-structural feature consisting of the installation of automated gages, operation and maintenance of the flood warning system.

The project was authorized by Section 203 of the 1966 Flood Control Act to protect residential, commercial, and industrial areas of the village from overbank flooding of the Blanchard River. The Blanchard River Basin upstream of Ottawa drains about 638 square miles and is roughly rectangular in shape. The basin varies from flat plains along its main course to rolling hills in the headwaters. The village is situated along the banks of the Blanchard River and is the commercial center of a farming district. Major floods in the project area occurred in 1913, 1950, 1959, and more recently in 1981; however, some flooding does occur annually. Several measures and plans were considered and investigated during the reevaluation study. The plan with the largest NED benefits was recommended for implementation.

The NED plan had net benefits of $15,400 and a B/C ratio of 1.14 to 1. This plan could have been implemented at a total first cost of $1,425,700 (January 1987 prices).

4.4. Final Limited Reevaluation Report Ottawa River Harbor Michigan and Ohio

In July 1992 the Buffalo District completed a final limited reevaluation report on the Ottawa River Harbor, Michigan and Ohio project. The report found that none of the alternative

plans were justified based on high priority outputs and that Corps policy classified the recreational benefits as low priority outputs. The report concluded that: "No local or state government agency, including the city of Toledo, Ohio, has provided a Letter of Intent to cost share in this project. Therefore, the selected Federal alternative is the No-Action Plan.

The Buffalo District Commander recommended that the Limited Reevaluation investigation be terminated by this report due to lack of support by local interests and because no alternative plan could be identified with sufficient high priority outputs to justify Federal Interest."

This study of Ottawa River Harbor was initiated based on a Resolution by the Committee of Public Works of the United States House of Representatives on August 15, 1961. A favorable interim survey report was prepared and submitted to Congress. A project was recommended and adopted by the Senate Public Works Committee on December 15, 1970. The project was deauthorized on December 31, 1989. Increased public support provided for the reauthorization of the project under Section 107 of the Water Resources Development Act of 1990 (Public Law 101-640).

Area residents have long desired a project to dredge a channel in the Ottawa River into Lake Erie to relieve the siltation problem and provide an added measure of safety for entering the harbor when strong southwest winds depress the water surface. During periods of low lake level and resulting shallow river depths, passage by all but the shallowest draft small boats is prohibited. Even during periods of higher lake levels, depths required for recreational boats often restrict the classes of pleasure craft able to safely navigate the river, due to the shoals and shallow depths in the river and bay channels.

The major features of the plans include dredging (deepening) the Ottawa River channel from Summit Street at Mudjaw Creek downstream to the mouth to 4 feet below LWD and the bay channel from the mouth to the Toledo Harbor shipping channel to 5 feet below LWD. Island 18 (Grassy Island) was the recommended location for disposal of the dredged material.

The Maumee River Ottawa River Action Group (RAP) supports the dredging initiative and will work to obtain a local government sponsor to provide financial support. In 1998, Ohio State University surveyed Ottawa River businesses and found that collectively area boaters and businesses are willing to pay $400,000 over a 10-year period for dredging the Ottawa River and a connecting channel to Lake Erie for navigational and environmental purposes.

Based on high priority outputs, the highest benefit-to-cost ratios varied from 0.40 to 0.51; and from 1.04 to 3.25 on low priority outputs.

4.5. Maumee River at Toledo Harbor - Navigation Channel Study and Report

In 1998, the Buffalo District conducted a study of the last seven miles of the lower Maumee River beginning immediately downstream of the I-75 bridge at the upper limit of the existing Federal commercial navigation channel in the Maumee River at Toledo Harbor, Ohio. The report recommended improvement of the channel that consisted of widening/deepening the channel and relocating/widening a turning basin to primarily alleviate the problem of

maneuvering in and outbound commercial vessels. The project was not implemented due to lack of non-Federal share of the cost of pre-construction engineering feasibility and design, plans and specifications, and construction.

The Reconnaissance Phase study of the Maumee River navigation channel at Toledo Harbor, Ohio was authorized by Resolution 2496 of the U.S. House of Representatives adapted May 9, 1996. Funds were provided in the 1998 Energy and Water Development Appropriations Act (Public Law 105-62, 111 Stat. 1320, dated October 13, 1977). This resolution reads as follows:

"RESOLVED BY THE COMMITTEE ON TRANSPORTATION AND INFRASTRUCTURE OF THE UNITED STATES HOUSE OF REPRESENTATIVES, That the Secretary of the Army review the report of the Chief of Engineers on the Federal navigation project at Toledo, Ohio, published as House document 153, Eighty-six Congress, and other reports, with a view to determining whether modification of the channel and turning basin at the upstream end of the project is required to reduce the probability of future ship collisions with the Conrail bridge, and to facilitate ship transits to and from commercial docks upstream of the bridge."

The investigated commercial navigation problems in the study reach have been maneuvering and turning difficulties, high wind and river currents, and narrow bridge openings which resulted in several vessel collisions with the Conrail bridge. The location of the bridge with respect to the usable channel requires proper alignment of the outbound vessel to transit the eastern opening of the bridge. This proper alignment is difficult to achieve while maneuvering or veering the vessel in a turn, and at the same time adjusting for strong winds and river currents. Given the minimal clearance of 19.5 feet on each side of the bridge opening, the 76-foot wide vessel transiting this opening had no margin for errors. Strong river currents are adverse to the maneuvering of the vessels in the outbound lane. The angle of approach of these vessels with the bridge is so acute that after several adjustments the vessel is not able to navigate under the bridge in the outbound lane without risking colliding the vessel against the bridge. This problem of acute angle of approach combined with high wind and river currents resulted in several accidents where vessels collided with the bridge. One collision caused physical damages to both the bridge and the vessel, and delayed train traffic for 24 hours. The U.S. Coast Guards Marine Safety Office in Toledo, OH recorded about seven of these accidents between 1986 and 1997.

Along the last half mile of the upper part of the Federal channels in the study area, the unbuilt 200-foot wide, 18-foot deep channel and 18.3-acre turning basin was authorized for construction by the River and Harbor Act of 1960 to serve the companies located along the west bank, particularly a company named "Sand Products, Inc." This company went out of business prior to the construction of the authorized project. This resulted in not building this portion of the mid-1960 channel improvement project. Meanwhile, several businesses such as Cargill Inc. and the Andersons Co. had expanded and modernized. Considering these changed conditions, the authorized but unbuilt channel was reevaluated and redesigned to serve the Federal interest in providing safer and effective commercial navigation channels to conduct the commercial business activities of the nation, and enhance the operations of these terminals between the Conrail and I-75 bridges.

The non-Federal sponsor for the project, the Toledo-Lucas County Port Authority, supported the necessary planning, engineering, and design required to ready the project for construction. In 1998, the Port Authority expressed and demonstrated understanding of the preconstruction engineering feasibility cost responsibility of local interests. The Authority was willing but unable to complete negotiations and enter into a Feasibility Cost Sharing Agreement (FCSA) with the Federal Government.

4.6. Additional Non-Corps Studies/Reports

As discussed earlier in this section of the report, multiple studies have been conducted to address the many water resource problems at hand in the basin. During the takeoff meeting in Toledo on July 12, 2001, and at subsequent problem identification and plan formulation meetings, several of these studies and reports were referred to by various stakeholders present at those meetings. For instance, reference was made of the *State of Ohio 1998 State of the Lake Report.* This report measured many indicators of quality of the Lake. Among those of particular interest were the aquatic Habitat Quality Metric and the Biotic Integrity Metric.

The Aquatic Habitat metric used six general habitat characteristics; bottom texture, cover, extent of modification by human activity, land use surrounding the body of water, riffle/pool development and gradient. The shorelines of Lucas and Ottawa Counties, both in the Western basin, received a "poor" rating. The areas are naturally low in substrate texture; and aquatic plants that were once present have been reduced. It is believed that the sediments from agricultural activity have increased turbidity, thereby reducing light penetration and the plants exposure to light. There is the issue of providing beneficial access to wetlands for fish habitats while protecting them from the invasive species.

By contrast, the spawning habitat in the Maumee River itself is rated "good" due to longer free-flowing sections (17.4 miles), but "poor" in the Portage River (5.8 miles). Opportunities exist here to restore aquatic/wetland habitat and to assess the removal of non-beneficial dams, which obstruct upstream fish spawning migrations.

The Biotic Integrity Index evaluates overall ecosystem health, which encompasses sub factors as water chemistry, habitat availability, food web structure, etc. Again, Ottawa County rated "poor" while Lucas County rated "fair". This is because of the low texture of sandy beaches and muddy bottoms, associated with the lack of aquatic plants. The river mouths of both the Maumee and Portage were rated "fair".

Other studies/reports are:

- Lake Erie Lakewide Management Plan (LaMP 2000);
- Lake Erie Protection & Restoration Plan
- Maumee River Remedial Action Plan 1997;
- "208" Areawide Water Quality Management Plan;
- Ohio Lake Erie Buffer Strategic Plan (2000 –2004);
- USGS Water Quality in the Lake Erie-Lake Saint Clair Drainage (1996 –1998);

- USGS Areal Distribution and Concentrations of Contaminants of Concern.(1900-1997);
- Portage River, A Resource Worth Protecting (June 1997);
- Portage River Basin Water Quality Study, (TMACOG, Nov 1995); etc

5. PLAN FORMULATION

The planning process and procedures set forth in the Water Resources Council's Principles and Guidelines guided this reconnaissance level of formulating plans for detailed studies in the feasibility phase. At this level of study, emphasis was placed on identifying issues, problems, needs and opportunities, inventory and forecast conditions, and on formulating and assessing concepts and conceptual plans. In digesting ideas discussed with stakeholders including public agencies, experts, and environmental organizations representatives during meetings, the recurring theme that resonated through these meetings were problems related to Lake Erie's tributary streams, rivers, and the cumulative effects of actions taken throughout the basin. The objectives were to consider the entire Lake Erie ecosystem in devising comprehensive plans that could realize a healthy environment, protect public health, stimulate a competitive economy, and ensure a sustainable quality of life for the basin residents, specifically for the Maumee, Ottawa and Portage watersheds.

The subparagraphs that follow present the results of the initial iterative process of formulating and screening conceptual plans that would meet defined national and planning objectives.

5.1. Identified Issues/ Problems/Needs/Opportunities

5.1.1. National Objectives

The national objectives to be achieved during the 50-year period of analysis are described below:

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

- The Corps has added a second national objective for Ecosystem Restoration in response to legislation and administration policy. This objective is to contribute to the nation's ecosystems through ecosystem restoration, with contributions measured by changes in the amounts and values of habitat.

5.1.2. Existing Conditions

The following paragraphs briefly discuss the existing conditions in the Western Basin of Lake Erie focusing on the basin environment setting including its physical environment, its natural resources, and its human environment.

5.1.2.a. *The Maumee River*

The Maumee River drains more than 4.2 million acres in Ohio, Indiana, and Michigan. More than 70 percent of the acreage is cultivated cropland, the bulk of which is dedicated to corn and soybeans. Due to the large size of the watershed and its high percentage of cropland that is intensively cultivated, the Maumee River discharges more tons of suspended sediment per year than any other tributary to the Great Lakes. Sediment dredging, ditching, and removing streambank vegetation to maximize acres of cultivated land, effect stream channel and riparian habitats. Some of the most greatly modified stream channels and impacted fish and aquatic invertebrate communities in Ohio are found in selected areas of the Maumee River Basin. These negative effects are attributed to habitat modification by agriculture.

The International Joint Commission identified the lower main stem of the Maumee River as an Area of Concern (AOC)- a waterway where beneficial uses of the water resources have been impaired by human activities. Industrialization of this Area of Concern (***Figure 5.1***), has resulted in impairments to water and sediment quality from contaminants. Trace metals and PCBs contaminate sediments coming from the watershed upstream from Toledo as they pass by. Principal sources of these contaminants are industrial point and non-point sources, and farmlands. Impairments from contaminated sediments include restrictions on human consumption of contaminated fish and documented impairments to benthic aquatic life. Restrictions on the disposal of dredged sediment are considered impairment to the beneficial use of the material.

The effects of suspended-sediment deposition from the Maumee on the economy of the port of Toledo and on the aquatic resources of the basin rank near the top of regional environmental concerns. Recent changes in regulations governing the disposal of dredged sediments and the desire to improve aquatic resources of the Maumee River Basin have resulted in the adoption of basinwide programs to improve the management of land, soil, water, sediments, and sand resources.

The Maumee Remedial Action Plan (RAP) began over twelve years ago as a community effort to restore beneficial uses. The Maumee AOC includes the lower Maumee River from the Bowling Green water intake near Waterville to Maumee Bay, as well as other tributaries to Maumee Bay and Lake Erie.

Figure 5.1 - Industrialized Area of the Lower Maumee River

5.1.2.b. The *Ottawa River*

The use of the *Ottawa River* for activities such as swimming, fishing and related water activity was banned in the 1990's by the Toledo Department of Health and the Ohio Department of Health. The Ottawa River is 41 miles long and has drainage basin of 178 square miles. The lower section of the river is primarily located in the City of Toledo, Lucas County, Ohio.

The Maumee RAP was started in an effort to restore areas in the Western Lake Erie Basin, like the Ottawa River, to "fishable and swimmable". The Maumee River Implementation Committee (MRIC) makes the official decisions of the RAP and provides general oversight with regards to policy. Under MRIC Issue Action Groups are identified to deal with specific issues that effect the AOC. One of these groups is the Ottawa River Action Group.

According to the Maumee RAP Strategic Plan (1997), the purpose of the Ottawa River Action Group is to return the Ottawa River to "fishable and swimmable" condition with ecological and recreational value. One step taken by the Ottawa River Action Group toward reaching their goals was the formation of the Ottawa River Remediation Team. The Ottawa River Remediation Team is a partnership of environmental professionals working to expedite the restoration of beneficial uses through strategic watershed planning and coordination throughout the Maumee AOC community.

As a result of this coordination the Ottawa River-Ten Mile Creek watersheds cooperators had 12.9 acres registered in filter strips, wetlands and windbreaks. A number of landfills, dumps and uncontrolled waste sites within the basin have been identified and are going through remediation. Combined sewer and sanitary sewer overflows have been studied under findings and orders from Ohio EPA. Contaminated stream sediment risk assessment is being completed in order prioritize areas for remediation. Finally, the 1999 study; *Valuing the Ottawa River: The Economic Values and Impacts of Recreational Boating*, was completed to provide the basis to build the necessary local financial support to make dredging of the Ottawa River possible.

5.1.2.c. *The Portage River*

The Portage River, with its mouth at Port Clinton, is 69 miles long and its basin is about 591 square miles (378,443 acres). It drains most of the Great Black Swamp, which hindered development of northwest Ohio until the 1830s. Most ditches and small streams flowing into the Portage, and parts of its major tributaries, are man-made streams designed to help drain the Great Black Swamp.

The River is one of northwest Ohio's major tributaries to Lake Erie. Its basin includes some of Ohio's most productive farmland. The Portage provides drinking water, water for industrial use, and is a resource for draining storm water, and treated wastewater. It provides drainage, which is essential for successful agriculture in the heavy clay soils. The Portage supports recreation and tourism including excellent bass streams and boating areas.

The largest cities in the Portage River basin, Bowling Green, Fostoria, and Port Clinton, are all on the edges of the watershed. This is no surprise considering original developments were in

areas avoiding the swamp. In all, roughly 100,000 people make their home within the basin. Between the lack of large cities and industries, the Portage River has mostly been spared the severe pollution problems of other rivers in the Western Lake Erie Basin. Around 75 percent of the Portage River meets Ohio EPA Standards, making it one of northwest Ohio's highest quality streams. Farming and agriculture is a major industry in the basin. Although Portage is largely agriculture, the main industries that provide livelihoods for many residents are automotive parts, quarrying operations and food processing. Recreation is another major industry. Thousands of people fish and boat on the River every year; others hunt and trap in the wild areas along the river and its tributaries. Portage is an important part of Lake Erie food chain. It provides drinking water for 100,000 inhabitants. With the exception of Bowling Green and Port Clinton, most of the area uses wells, which the Portage helps recharge. There are still many wetlands in the basin.

5.1.3. Statement of Public Concerns/Issues/Problems and Opportunities

The evaluation of public concerns often reflects a range of needs, which are perceived by the public. This section describes these needs in the context of problems and opportunities that can be addressed through water and related land resource management. These needs and opportunities are water-related problems and involve flooding, environmental degradation, water quality, and sediment movement, etc. These concerns are discussed first from a general perspective then in light of existing and expected future without-project condition in the watersheds of Maumee, Ottawa, and Portage.

5.1.3.a. *Public Concerns and Issues*

A number of public concerns have been identified during discussions with the potential sponsor, Federal, state, county, local agencies, private groups, and interested citizens.

- Uninterrupted maintenance dredging of the Federal commercial navigation channels at Maumee River and Maumee Bay, Ohio;

- Support for construction of the Maumee River turning basin at upper end of the Federal commercial navigation channel;

- Efficient cost-effective management and expansion of existing CDFs;

- Sound scientific rationale for cessation of open lake disposal of dredge material;

- Impacts on fish and wildlife resulting from the construction of a new CDF in Maumee Bay or at Woodtick Peninsula.

- Sediment and contaminant reduction from Maumee River and other basin watersheds, particularly agricultural land;

- Beneficial use of dredge material for array of uses including CDF expansion, manufactured soil, landform construction, landfill cover, and road sub-base;

- Loss of littoral fish spawning and habitat as a result of shore-connected or in-lake CDF construction or expansion.

- Impacts of CDFs on valuable sports fisheries (Walleye, Bass, Perch) spawning and habitat;

- Impact of existing and planned CDFs on water circulation and sediment transport in Maumee Bay and Woodtick Peninsula;

- Impact of Toledo Edison water intakes and heated effluent discharge on fisheries, water circulation, and bacterial contamination of beaches;

- Impact of existing and planned CDFs on aesthetics and future land uses, especially raising dike heights;

- Possible impacts of Toledo Wastewater Treatment Plant, upstream sources (small treatment plants, septic systems, feed lots) on bacterial contamination of beaches; this includes Combined Sewer Overflows (CSO) and Sanitary Sewer Overflows (SSO).

- Possible increase in pesticide/herbicide leaching or runoff from increased implementation of conservation tillage practices;

- Environmental and navigational dredging of Ottawa River Harbor;

- Wetland restoration throughout the Western Basin (e.g., Duck Creek, Otter Creek, Ottawa River) to assist in flood control, water quality improvement, and sediment runoff reduction;

- Environmentally friendly flood control measures in Portage River, Blanchard River, and Ottawa River;

- Impacts and dynamics of Lake Erie coastal processes on navigation, flood control, shore erosion, and dredging;

- Preservation of Woodtick Peninsula;

- Impact of large water withdrawals from Raisin River associated with proposed power plant and irrigation;

- Contaminated sediments, fish, and endangered species protection;

- Control of Lotus beds, which impede recreational boating;

- Dredging of channels/canals at Estra Beach, MI, to improve recreational boating;

- Maintenance of natural water re-circulation/connectivity to maintain natural populations of Walleye and Perch that are not stocked; and

- Effects of lake levels on fisheries and nearshore wetlands.

5.1.3.b. *Maumee River Watershed Problems, Needs, and Opportunities*

Site Location for New CDF and Restoration of Woodtick Peninsula: Toledo Harbor is a major and vital Great Lakes Port to international transshipment of grains and other commodities. On one hand, the harbor had been experiencing an acute scarcity of land for the construction of new diked facilities to confine material dredged from its Federal navigation channels. Two thirds of the approximately one million cubic yards (CY) of the material dredged annually are being confined, filling existing facilities about 3 times faster than planned. On the other hand, adjacent Michigan shoreline erosion at Woodtick Peninsula, and constant farmland erosion, are filling these Federal channels at accelerated rates. The Woodtick Peninsula is devastatingly eroded away. These two problems complement each other and can be integrated into opportunities, which benefit a number of interests including sustained commercial navigation in the Maumee River, restoration of the Woodtick Peninsula, and protection/enhancement of fish and wildlife resources at the Peninsula. The opportunity exists for creative design and construction of a CDF at Woodtick to accommodate more than 30 years of dredge material. At the same time, fish and wildlife habitat at Woodtick would be protected and enhanced, and water re-circulation and sediment movement would be restored.

Sedimentation in Maumee River and Resultant Dredge Volumes and Costs: Currently, annual dredging volumes in the Maumee River and Maumee Bay at Toledo Harbor range from 800,000-1,000,000 cubic yards of material. The opportunity exists to reduce dredging volumes by approximately 130,000 cubic yards through soil conservation practices in the 3.3 million acres of farmland in the Maumee River watershed. Both the USDA Natural Resources Conservation Service (NRCS) and the U.S. Army Corps of Engineers working together have demonstrated that conservation tillage in the primarily agricultural watershed of the Maumee River can be a major contributor to the effort of reducing soil erosion at the source.

More recently, the NRCS has instituted the Conservation Reserve Enhancement Program (CREP), which establishes waterway buffer strips which further reduces sediment runoff. The buffer strip alternatives include woodland strips and wetlands that are sorely needed in the primarily agricultural Western Basin. The CREP offers opportunities for the Corps, USDA, Fish and Wildlife Service, U.S. Geological Survey, and State agencies, including Ohio Department of Natural Resources and the Michigan Department of Natural Resources to continue to work together for common goals, including soil erosion control, fish and wildlife habitat enhancement, and the Lake Erie Western Basin water quality improvement.

Opportunities exist to regain disposal space by a number of actions. They include using in-place CDF material to construct temporary inner CDF dikes to accommodate more dredge material. In addition it has been demonstrated that Toledo dredge material can be recycled and beneficially re-used as topsoil, landfill cover, or landform construction (e.g., recreational hills, wetlands construction landscaping). This beneficial re-use effort would restore storage capacity in, and extend the life of, CDFs for keeping Toledo Harbor open for commercial navigation. Further, the opportunity exists to integrate recycled dried dredge material from existing CDFs into the design and construction of a new CDF at Woodtick or elsewhere, thereby reducing their construction costs and channel maintenance dredging and disposal costs. Opportunities also exist to reduce agricultural non-point source pollution of surface waters, increase wetland area and wildlife habitat, and increase farm profitability within the Maumee River Basin. These opportunities reside in a number of programs such as the Maumee Valley Resource Conservation and Development (RCED), and Wetland Reservoir Sub-Irrigation System (WRSIS) program. The WRSIS program is a new agricultural water management system that integrates *1)* a constructed wetland for water treatment, *2)* a reservoir for water storage, and *3)* a network of sub-surface pipes that can be used to both drain and irrigate crops through root zone (***Fig 5.2***). Widespread adoption of WRSIS could substantially reduce the amount of nitrates, phosphates, and sediment entering surface water discharging into the Maumee River system. Several agencies including USEPA, GLNPO, Lake Erie Protection Fund, Ohio Sea Grants Programs, and others have sponsored this WRSIS program. The program needs to be expanded to fully appreciate its impact and contributions to soil erosion in the basin. Three demonstration sites have been constructed to document their long-term beneficial environmental impacts and develop management and operation manual for users.

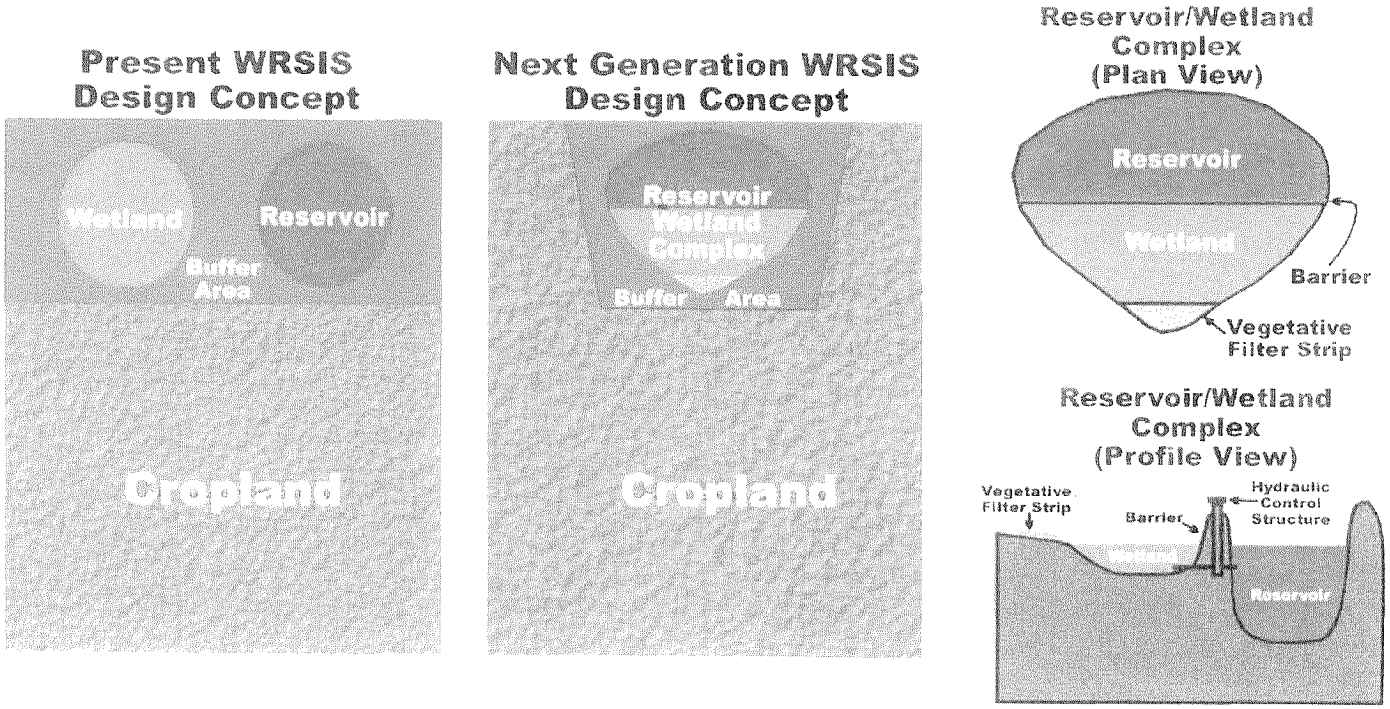


Figure 5.2 - Wetland Reservoir

5.1.3.c. *Environmental Dredging of Ottawa River Harbor*

The Ottawa River/Harbor has been experiencing recreational navigation problems for many years. In addition, there are serious environmental problems associated with highly contaminated sediments in the river and harbor. Contamination of sediments resulted from historical industrial activities and leaking toxic industrial landfills along the river. Although much of the industry and landfills have come under environmental control, the legacy of contaminated sediments remains.

Area residents have long desired a navigation project, which would provide adequate channel depth in the Ottawa River and into Lake Erie; and relieve the siltation problem. A deepened channel would provide an added measure of safety for boats entering the harbor when strong southwest winds depress the water surface. During periods of low lake level and resulting shallow river depths, passage by all but the shallowest-draft small boats is prohibited. Even during periods of higher lake levels, depths required for recreational boats often restrict the classes of pleasure craft able to safely navigate the river, due to the shoals and shallow depths in the river and bay channels.

The sedimentation and lake hydrologic effects have resulted in industrial and agricultural runoff and have contributed to the poor water quality in the Ottawa River. The river is highly polluted in the lower reach, which washes into the mouth of the river and into Lake Erie. Specifically, pollution derives from leaching industrial and municipal landfills, abandoned industrial sites and combined storm and sanitary sewer overflows ***(Figure 5.3)***. The city of Toledo is under orders from OEPA to eliminate three SSOs (pump stations at 129th and Edgewater; 145th and Edgewater; and 290th and Ottawa Road). The pollution level was so high in the 1990s that the Toledo Department of Health and the Ohio Department of Health banned swimming, fishing, and other related water activities in the lower Ottawa River. The findings of human health and ecological risks assessments, as shown in ***(Figures 5.4 - 5.6)***, indicated:

- Lifetime excess cancer risks to individuals who catch and consume fish in the Ottawa River from all reaches may be significant ***(Figure 5.4)***.

- Most fish in the river of the size and species likely to be caught for human consumption have concentrations exceeding "Great Lakes Fish Advisory Task Force" advisories for limited consumptions (One meal every 2 months).

- Cancer risks and hazards of non-carcinogenic effects associated with limited recreational contact with lower Ottawa River surface waters and sediments is not likely to be significant. However, for some chemicals, estimated risks due to exposure to sediments and surface water are highly uncertain because their limits of detection exceed risk-based concentrations.

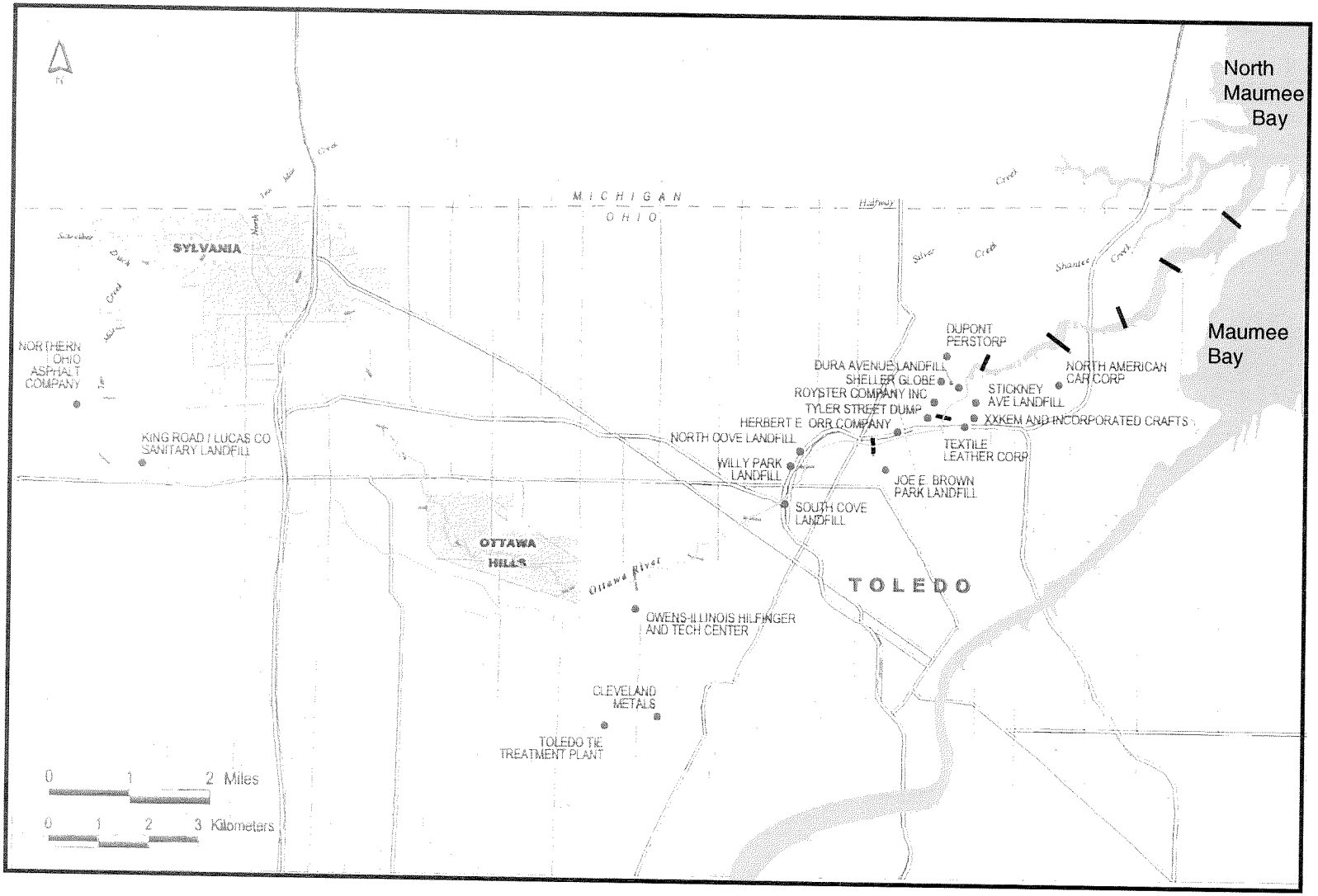


Figure 5.3 - Ottawa River Site With Sources of Pollution

Figure 5.4 - Estimated Cancer Risks for the RME Angler Scenario, Lower Ottawa River Human Health Risk Assessment

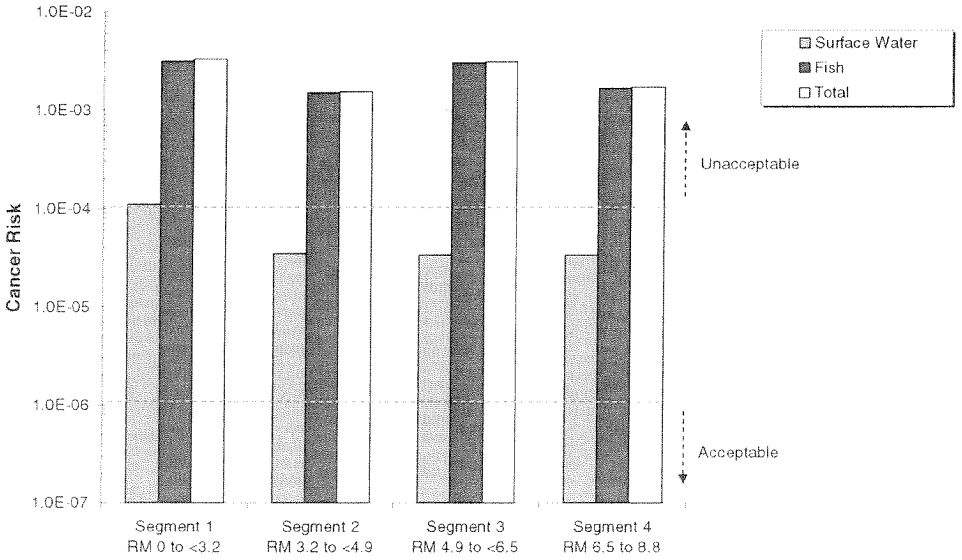


Figure 5.5 - Estimated Non-Cancer Hazards for the RME Angler Scenario, Lower Ottawa River Human Health Risk Assessment

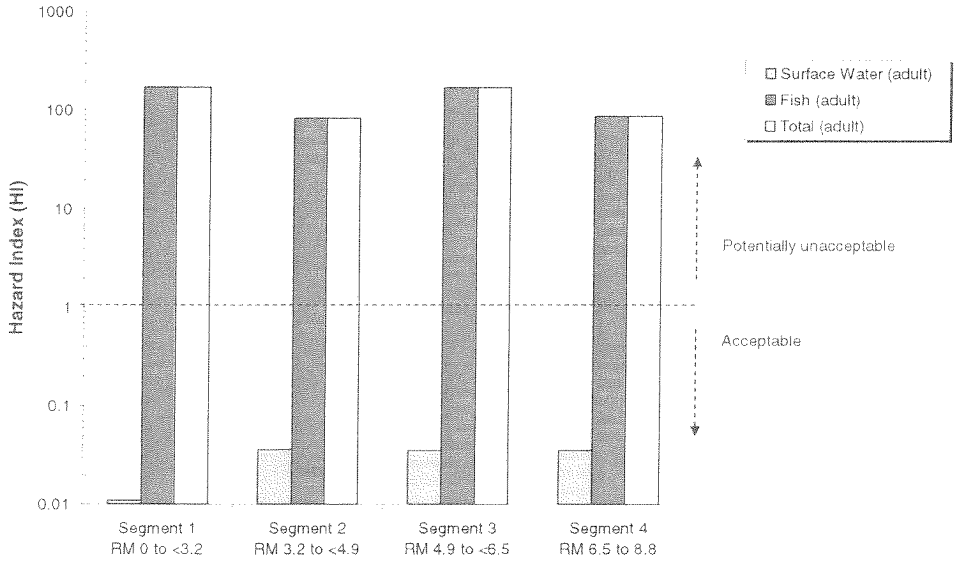
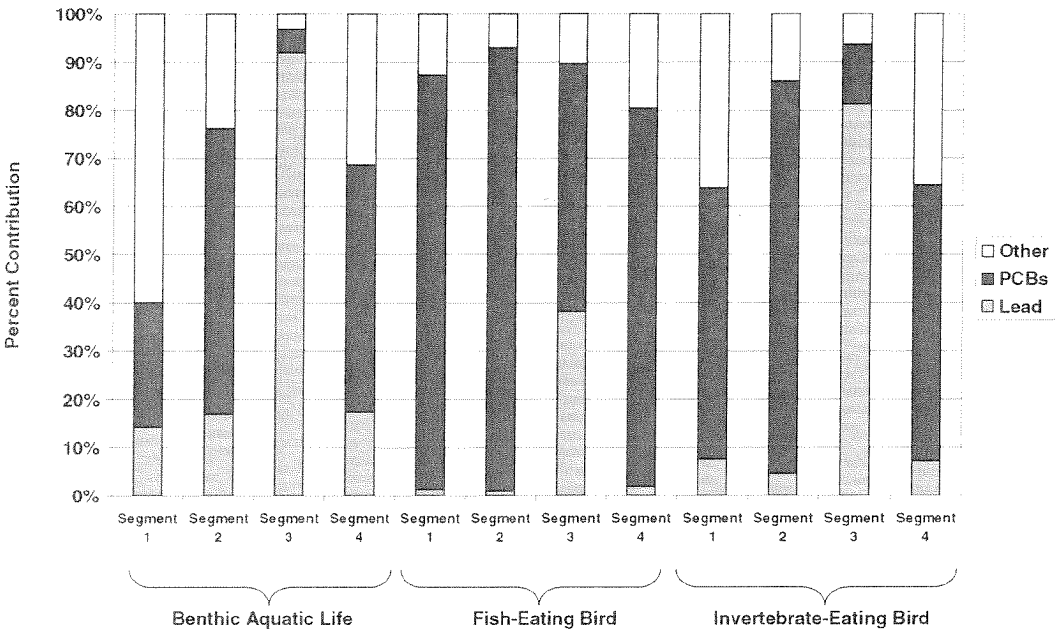


Figure 5.6 - Percent Contributions of Lead and PCB Hazard Quotients (HQs) to the Total Sum of HQs



- In general, risks were found to be highest in River Segment 1 (River Mile 0.0 to River Mile 3.2) (*See previously shown* ***Figures 5.3-5.5***). Estimated cancer risks and non-cancer hazards for the other three segments were slightly lower.

- Lead and PCBs were consistently identified as Chemicals of Potential Concern (COPC) for both wildlife receptors and aquatic life (*See previously shown* ***Figure 5.6***). Lead and PCB hot spots were not co-located, suggesting different sources, and possible transport, within the river.

- River Miles 4.9-6.5 represent a potential hot spot for metal contamination. Data collected at River Mile 5.5 showed metals concentrations (including lead) that were significantly elevated.

- The potential risks posed by polycyclic aromatic hydrocarbons (PAHs) to bottom-dwelling aquatic organisms are uncertain. Observed fish deformities could be due to the presence of PAHs in the sediment, and further investigation may be warranted.

In the Ottawa River Basin, opportunities exist for greatly improving recreational navigation and significant environmental cleanup. The Maumee Remedial Action Plan (RAP) effort with its official decision Committees and Issue Action Groups have formulated several Action Plans that are pending implementation. These Action Plans offer significant opportunities to reduce sediment oxygen demand, pollutants of concern for CSOs, ammonia, fecal coliforms, mercury, cyanide, lead, copper, zinc, and silver. This cleanup would result in reduction of contaminated sediment transport to the Maumee Bay and Western Basin of Lake Erie. In addition, commercially important Walleye and Perch spawning areas and fisheries would benefit. Innovative integration of dredging with design and inclusion of wetlands in low lying areas adjacent to the Ottawa River can greatly improve ecology of this area which once was part of the Great Black Swamp.

5.1.3.d. *Portage River Watershed Problem/Needs/Opportunities*

The Portage River has been experiencing major environmental issues and problems. Many streams have sewage problems of varying degrees, few of them severe. The Portage River and TMACOG in their June 1997 report entitled: "*Portage River: A Resource Worth Protecting*", discussed the water pollution problem of combined sewer systems carrying both sewage and rain water to the river during storms in areas where home septic systems are not properly maintained. The report also discussed the pollution problem at the headwaters, where fish species diversity is low and composed of only fishes that are tolerant of pollution and degraded habitats. Besides degraded habitats, industrial pollution and municipal sewage impact fish communities as well. According to the report, municipal sewage contributes large amounts of phosphorus and nitrogen, the primary nutrients for algal growth and productivity leading to wide variations in dissolved oxygen between day and night, which causes increases in fish mortality.

Other problem areas include sedimentation from agricultural runoff with high content of nitrate and pesticides. The main sources of these crucial eutrophication nutrients were industrial, municipal wastewater and agriculture. The sediment is the most non-point source pollutant by

volume. Deposited sediment problems include accumulated sediment fill in stream channels and marina areas; impaired biological system due to covering of the bottom feeding and spawning areas of fish; filled drainage ditches, which require expensive ditch maintenance and environmentally destructive channelization to restore usage.

Further, landfills and dumpsites usually considered worst in major cities are not confined only to urban areas. Portage has its share of dumpsites, which are obvious sources of chemical pollution, as well as a source of trash in the river.

Flooding and drainage in the Portage River has had more hydro-modification than any other watershed in Ohio because of agricultural ditching. Some water that would have drained into the Maumee River goes into Portage because of the extensiveness of the ditching. The ditches have been there over 100 years because of agricultural needs. The Portage River flooded three times in the last five years and covered major roads two of these times. The flooding is "back flow" flooding. There is an opportunity to develop environmentally friendly solutions for reducing flooding in the Portage River Basin.

Opportunities exist to maintain high quality wastewater treatment; promote good onsite sewage disposal practices through education, identification of problem areas, and proper system maintenance.

5.1.3.e. *Streambank/Shore Erosion in Western Lake Erie Basin*

A complete "Beach Erosion" control study of the entire Western Lake Erie basin, in conjunction with ODNR, could be conducted to update studies performed in the 1930's and 1950's. This erosion control study would be comprehensive and would include littoral processes, sand management, shoreline management (CZM), shore/offshore change, bottom cores, existing structures inventory, etc.

The purpose of this streambank and shoreline erosion study would be to document existing conditions, assess future needs and to lay the foundation for Regional Sediment Management (RSM). RSM refers to the effective use of littoral and riverine sediment resources in an environmentally sound and economically effective manner. Because of the natural and other forces causing longshore sediment movement, and scarcity of available beach quality sediment to nourish eroding beaches; and because sediment is a valuable resource that is being depleted in this region, RSM is more than needed to successfully address all and every issue relative to coastal zone management including sediment and particularly sand management. Cases in point are the Woodtick on the Maumee River and the north bank of the Ottawa River.

Woodtick Peninsula is a natural barrier, which protects an area of ecological and cultural significance and that has undergone severe erosion in the period 1915-1988 (***Figure 5.7***). Higher water levels over the past 20 to 30 years have caused considerable change and deterioration to this narrow landmass that separates Lake Erie from the Erie State Game Area. The statigraphy of the Peninsula indicates that this feature has undergone several cycles of erosion and accretion. Presumably, these cycles are linked to the cyclical fluctuations in Lake Erie water level. Heavy mineral analysis of beach sands and a consideration of coastal geomorphology reveal that the

proximate sand source for the Woodtick Peninsula is, most likely, the sand spit south of the Toledo Beach, MI.

The extensive use of revetments, groins and other structures that protect shoreline properties in Western Lake Erie has limited the supply of coastal sediments. These sediments are important in maintaining barrier beaches that in turn protect wetlands behind them. The few remaining wetlands with barrier beaches and sand splits are now losing this protection, as losses to erosion cannot be replenished by the available sediment in the littoral drift system. The erosion thought to be occurring at Woodtick Peninsula today may be an example of this process (***Figure 5.8***). An understanding of the overall sediment transport regime, therefore, must be a fundamental requirement to develop coastal management strategies to help address these environmental problems. Should there be a need to place quality dredged material on the peninsula, then a physical and chemical analysis of the material should be performed in the feasibility phase.

Lake Erie Shoreline at the "Oak Opening" Region has a most diverse habitat with a prime aquifer, and is a plentiful sand and gravel source. It stretches from the Michigan border south to the Maumee River. Located in Lucas, Henry, and Fulton counties of Ohio, the region covers 80,000 acres and harbors more rare species than any other area of a similar size in the state. It sustains globally rare oak savanna and wet prairie communities. Federally endangered karner blue butterfly were reintroduced into Oak Openings Region at Maumee Bay State Park. In 1999, it was designated one of the most important ecosystem in the U.S. according to the Nature Conservancy. This designation stresses the biological significance of the Oak Openings Region and illustrates the importance of responsible stewardship of this protected land. Currently residential and commercial growth in the Toledo area threatens to eliminate what remains of the Oak Openings ecosystem. Most natural vegetation in the Northeastern one-fifth of the region has been eliminated by urbanization.

The north bank of the Ottawa River had been severely eroded away (***Figure 5.9***). By letter dated 6 June 2001, the Ottawa Department of Public Services requested Corps of Engineers' assistance to restore more than 2000 feet of streambank erosion hot spots, specifically the north bank of the Ottawa River.

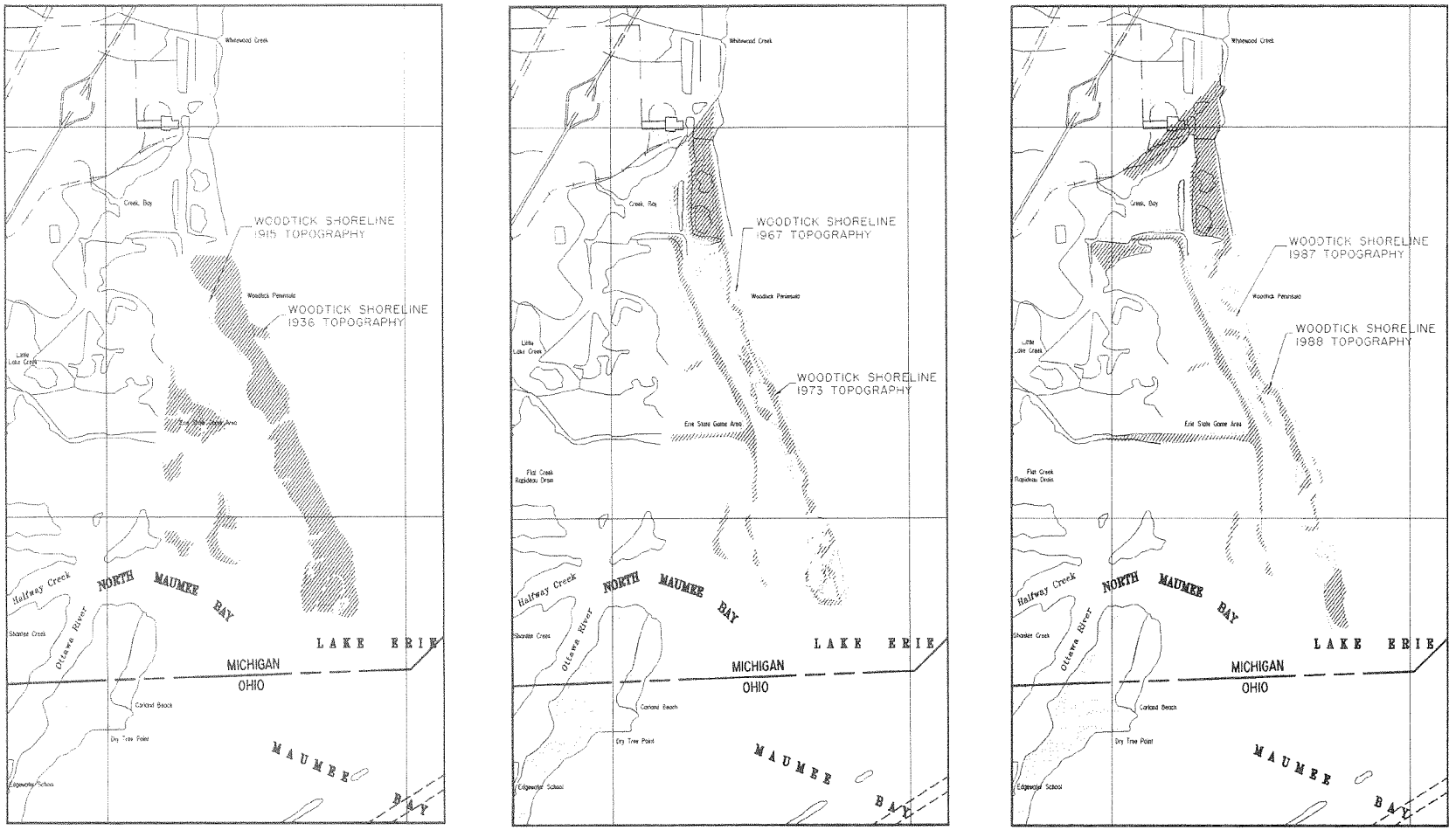


Figure 5.7 - Erosion Trend at Woodtick Peninsula

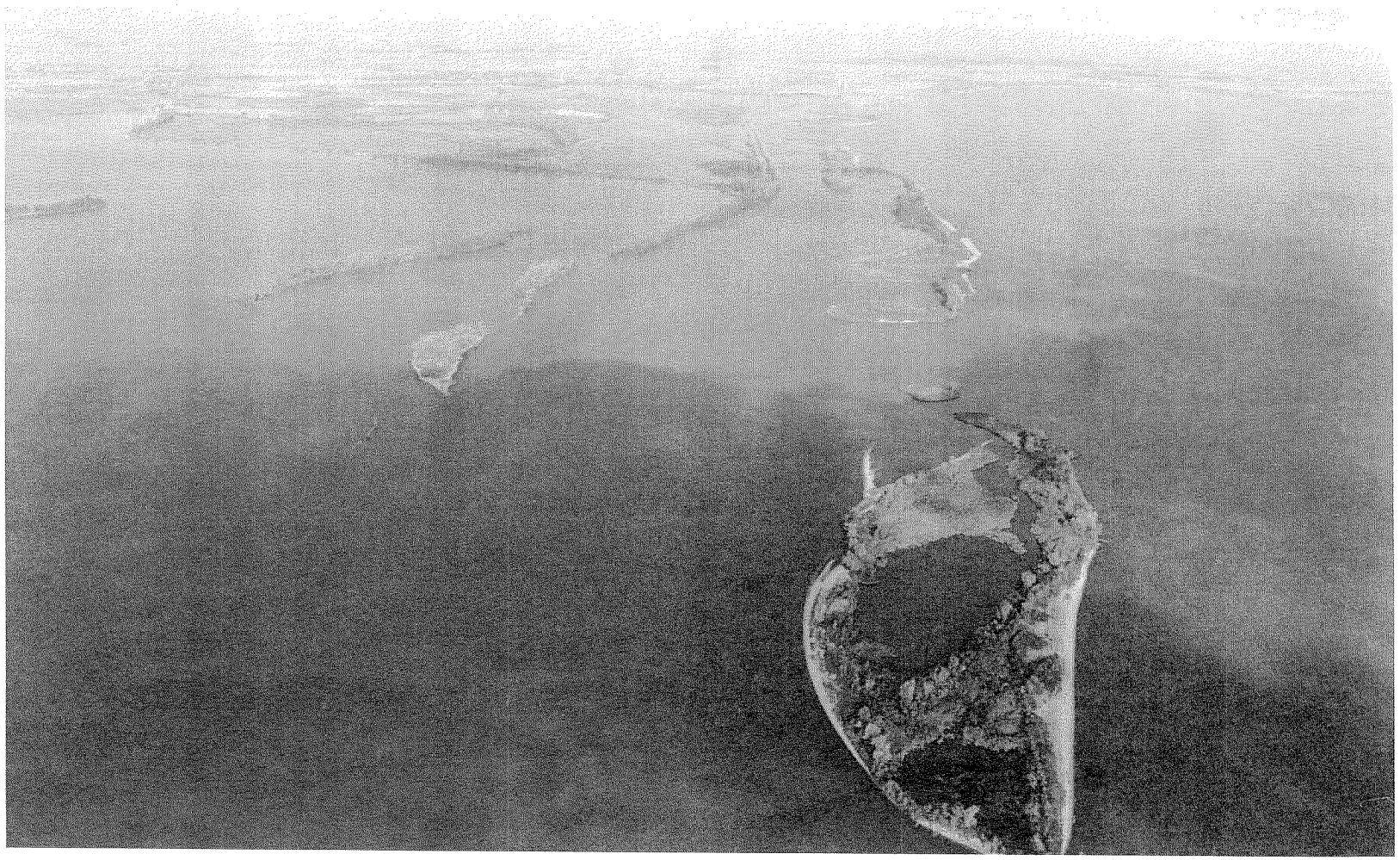


Figure 5.8 - Eroded Woodtick Peninsula, Oct. 1992

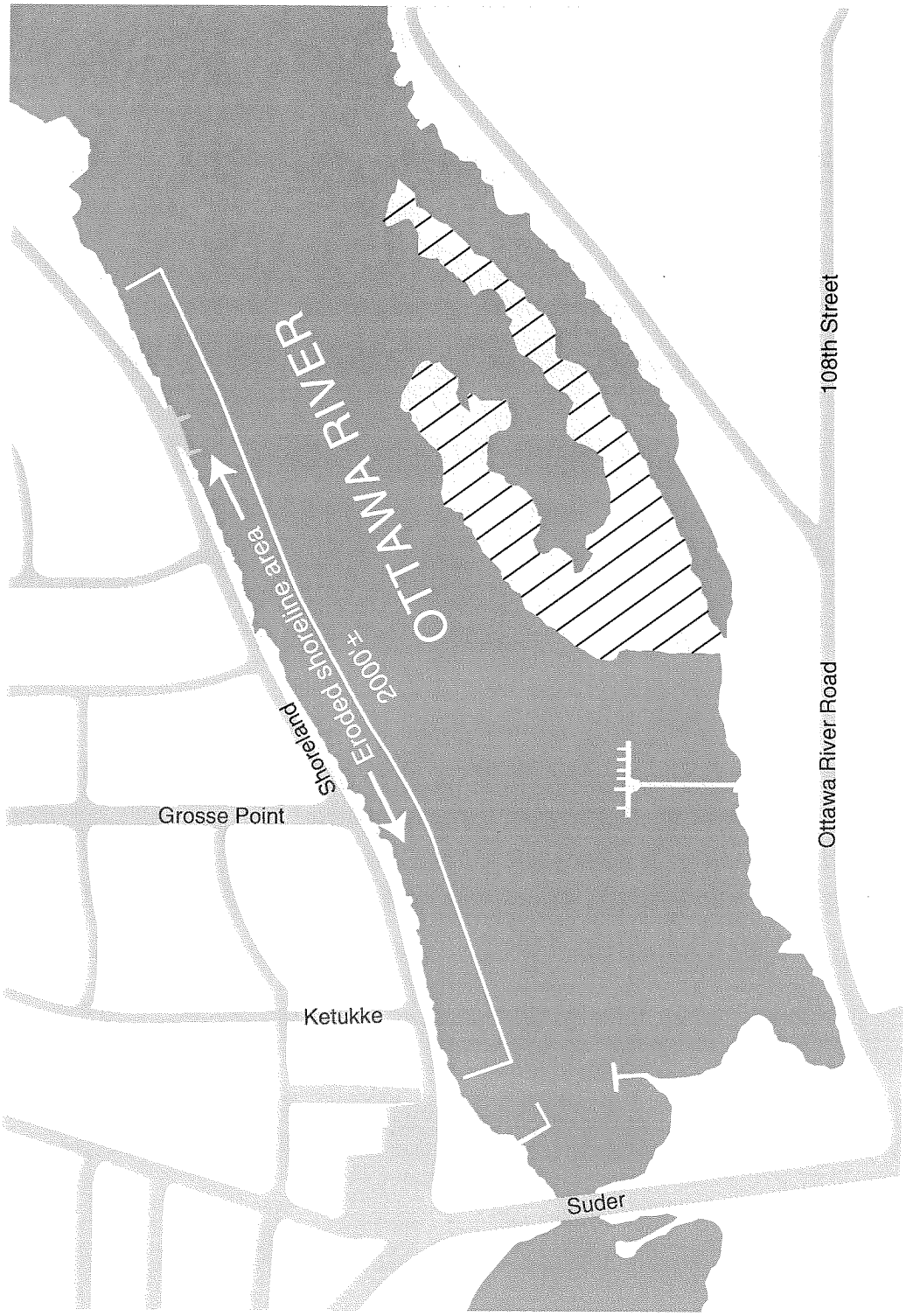


Figure 5.9 - Ottawa River 2000' of Eroded Shoreline

5.1.3.f. *Flood Problem in the Entire Western Lake Erie Basin*

In the Maumee and Ottawa Basins, flood events and problems have been documented at a number of locations, particularly along the Maumee River, Blanchard River, and the Ottawa River. Specific locations include the Maumee River at Defiance, Ohio; the Blanchard River at Ottawa, Ohio; and various locations along the Ottawa River in Michigan and Ohio. The city of Defiance is located on the banks of the Maumee and Auglaize Rivers and their confluence in Defiance County, approximately 60 miles southwest of Toledo. The village of Ottawa is situated along the banks of the Blanchard River in the southeastern portion of the basin and is the commercial center of a farming district. Other tributaries of the Maumee that have documented flood problems include Swan Creek, Mud Creek, Flat Rock Creek and the Auglaize River.

Flooding occurs in these streams and their tributaries with the more generalized storms usually occurring in the winter and spring months and the more localized storms occurring in the summer. This area is also subject to increased flooding when winter storms that fall on ice clogged streams resulting in ice jams at bridges and other obstructions. Damages from floods in the past have primarily involved crop damage due to the large amount of agriculture in the area.

No major Federal flood control projects exist on the Ottawa or the Maumee River. However, there are small flood control projects on Swan Creek, Blanchard Creek, etc. A Federal commercial navigation project, built since the late 1800's, is currently maintained on the lower seven miles of the Maumee River and extends through Maumee Bay into Lake Erie for 19 miles. A particular concern raised by State agencies, local governments, and the public, is that the flood control projects be aesthetically pleasing and have minimum negative impact on riverine ecology or wetlands and blend as well as possible with the natural riverine environment.

Little economic data is available at this time, with the exception of some Flood Insurance Administration (FIA) damage estimates from 1978-2000 that exclude substantial ineligible economic damages. Localized flooding has occurred to some extent in virtually every year since 1978, with the largest storm event occurring in 1982. FIA damages totaled approximately $1.5 million for the period from 1978-2000 for the communities on the Maumee and Ottawa Rivers. FIA damages are summarized in the chart below.

Summary of FIA Damages in the Maumee and Ottawa River Basins

COMMUNITY	COUNTY	POPULATION 2000	FIA DAMAGES (78-2000)
Toledo (city)	Lucas	313,619	299 claims: $608,870
Maumee (city)	Lucas	15,237	3 claims: $18,683
Perrysburg (city)	Wood	16,945	*None reported*
Waterville (village)	Lucas	4,828	24 claims: $34,259
Napoleon (city)	Henry	9,318	27 claims: $93,677
Defiance (city)	Defiance	1,740	*None reported*
Paulding (village)	Paulding	3,595	4 claims: $7,215

Source: Flood Insurance Administration

The Portage River basin receives less precipitation than those northernmost basins of Ohio. However the runoff factor for the basin appears rather large. The comparatively low rate of infiltration appears to be caused by the proximity of the bedrock to the ground surface and the character of the overburden. At the present time the Corps of Engineers has no flood control project in the Portage River or its tributaries.

Some residents along the Portage River state that flood events occur every 2 to 3 years. The principle damage resulting from floods in the Portage River basin is the loss of crops during the growing season and the flooding of some roads. A particular concern raised by State agencies, local governments, and the public, is that the flood control projects be aesthetically pleasing and have minimum negative impact on riverine ecology or wetlands and blend as well as possible with the natural riverine environment.

Little economic data is available at this time, with the exception of some Flood Insurance Administration (FIA) damage estimates from 1978-2000 that exclude substantial economic damages. FIA damages totaled approximately $720,000 for the period from 1978-2000 for the communities on the Portage River. FIA damages are summarized in the chart below.

Summary of Flood Damages in the Portage River Basin

COMMUNITY	COUNTY	2000 POPULATION	FIA DAMAGES (1978-2000)
Port Clinton (city)	Ottawa	6,391	143 claims: $474,790
Oak Harbor (village)	Ottawa	2,841	47 claims: $143,496
Elmore (village)	Ottawa	1,426	*None reported*
Woodville (village)	Sandusky	1,977	7 claims: $10,671
Pemberville (village)	Wood	1,365	9 claims: $41,480
Fostoria (city)	Hancock/ Seneca/ Wood	13,391	5 claims: $47,401

Source: Flood Insurance Administration

5.1.4. Expected Future Conditions

Under a "No-Action" scenario, neither the Federal Government nor non-Federal interests would implement project(s) to achieve the national and specific planning objectives defined in this report. The expected future conditions would be a continuation of the issues/problems described above. That is, locally developed action plans would not be implemented; and the shallow nature of the Western Lake Erie Basin will continue to make it vulnerable to land use changes and deprive it of the beneficial protection and restoration it deserves. For instance, the U.S., Canada bi-national structure, provided by the Lakewide Management Plan (LaMP) to address environmental and natural resource issues and to improve environmental quality, would become ineffective. The LaMP recommended action plans would not be implemented. Particularly, projects in pending status would continue to remain in that status in the Maumee, Ottawa, and Portage River Basins.

In the Maumee and Ottawa River Basins, the following projects are on pending status:

- North Cove Landfill remediation;
- Sediment sampling on Duck and Otter Creeks;
- Development of strategic plan for restoration of Duck and Otter Creeks;
- Sediment transport modeling in Maumee main stem;
- Implementation of Conservation Reserve Enhancement Program in NW Ohio; and
- Implementation of Ohio Buffer Initiative to increase buffer strips along streams in the Ohio Lake Erie Basin.

Further, Federal, State, and local stakeholders and partners involved in planning efforts to restore the Western Basin ecosystem would not be able to meet the goals outlined in their watershed strategic plans. For instance, the Ottawa River Remediation Team would be hampered in achieving these goals outlined below:

- Elimination of all major sources of contamination to the Ottawa River including point and non-point as well as chemical and bacterial;

- Remediation/cleanup of all contaminated sediments in the Ottawa River as appropriate, based on risk;

- Dredge the lower Ottawa River for recreational navigation;

- Restoration of the upland and aquatic ecosystem in the Ottawa River;

- Identification of all funding sources and authorizations available to assist with implementing the goals of the Ottawa River Remediation Team and the Maumee RAP Ottawa River Action Group;

- Identification of all stakeholders and partners available to assist with implementing the goals of Ottawa River Remediation Team;

- Removal of the contact and consumption advisories on the Ottawa River; and

- Achieve full attainment of the Ohio EPA's Water Quality Standards.

If Federal action is taken, the future expected conditions would be that cost-effective, environmentally acceptable, and engineeringly feasible comprehensive plans of improvement resulting from this 905(b) (WRDA 86) analysis could be implemented. The rivers, the lake, the water, the sediment, the contaminants, the disposal, and other facilities that form the basin ecosystem would be restored to their natural states, as possible. For instance, the highly polluted conditions of the river system, particularly the Ottawa would be reversed and populations of commercial and sport fish species would be improved. Some of the identified beneficial use impairments (Human use impairments, impairments due to chemical contaminants, and ecological impairments) and their causes (PCBs, mercury, PAHs, lead, chlordane, dioxins, DDE, DDT, nitrates, E. coli, fecal coliforms, non-indigenous invasive species, habitat loss, and sediment loadings) would be remedied or controlled to acceptable levels. Other beneficial use impairment such as drinking water impairment, fish consumption advisories, and recreational water quality use that directly address human health would be assessed and removed.

In addition to the specific problems identified above, the shallow water depths throughout the Western Basin present a unique set of problems for basin residents. These problems can be summarized as follows:

- Annual dredging and disposal of up to 1 million cubic yards of sediment from

Federal navigation channels in an environmentally acceptable manner;

- Provision of adequate future capacity for containment of contaminated dredge material in confined disposal facilities (CDFs);

- Displacement of shallow water fish habitat and spawning areas caused by offshore and/or nearshore CDF construction;

- Impairment of important sports and commercial fishery in the western basin;

- Impaired water circulation and water quality in Maumee Bay engendered by nearshore confined disposal facilities;

- Sediment runoff from a primarily agricultural watershed. Over 90 percent of dredge sediment originates from agricultural land;

- Water quality impairment from sediment, agricultural pesticides and fertilizer runoff;

- Water quality impairment of Maumee Bay from combined sewer overflow and other sources;

- Accelerated runoff of water and sediment from farmland resulting in seasonal flooding and high sediment loading to Federal navigation channels in the Maumee River;

- Increased urbanization resulting in the flooding of Swan Creek in Toledo;

- Regional shoreline and streambank erosion; and

- Decrease in acreage of prime wetlands in Western Lake Erie Basin.

These many problems, however, present opportunities to take actions and increase the quality of life and the environment in the Western Basin of Lake Erie in a holistic approach. These opportunities include:

- Continued benefits to the national and local economy through continued maintenance and improvement of the Federal navigation channels;

- Reduction of sedimentation in Federal navigation channels and consequent cost-effective dredging and disposal;

- Improved water quality in the Western Basin through source reduction of sediment erosion and associated pollutants such as pesticides and nutrients;

- Construction of structural and non-structural flood control projects to reduce flood damages;

- Restoration of fish and wildlife habitat;
- Wetland and aquatic ecosystem restoration;

- Beneficial use of dredge material for an array of uses including shoreline erosion control; and

- Innovative sediment management, and CDF design and management.

Opportunities exist for the Corps of Engineers to work with other Federal and State agencies and local interests to achieve aesthetically pleasing, and environmentally friendly projects. This could include inclusion of wetland and wooded wetland strips in flood control projects. Also, dredge material may be used to build new or enhanced wetlands in the proximity of the Maumee and Ottawa Rivers, to cover landfills, dumpsites, and reclaim old mines. The filtering effect of wetland establishment along rivers and creeks in the basin will serve to retard storm water and sediment runoff, provide habitat and feeding areas for nesting and migratory waterfowl, enhance groundwater recharge, and improve water quality.

Concluding Statements: The Lake Erie watershed has undergone extensive changes such that vast tracts of forest, coastal wetlands and open prairie have been replaced by thousands of farms, large urban centers and sprawling residential and commercial developments. These changes, although economically beneficial to Northern Ohio, have greatly accelerated soil erosion and sedimentation throughout most of the Western Lake Erie Basin. Soil erosion and its subsequent transport and deposition have been identified as the primary impediment to improving water quality in the Western Basin. The ecological impacts of excessive soil erosion and tributary sediment loadings have greatly contributed to the deterioration of stream habitat and a severe reduction in light penetration. These factors acting together have reduced biological productivity and species diversity in most Lake Erie tributaries, estuaries and near shore zones. Streambank erosion as a result of river flooding, and shoreline erosion have both contributed to millions of cubic yards of sediments deposited in Lake Erie's river mouths, which negatively impact the operations of ports and harbors. Frequent dredging of these waterways in Lake Erie has produced large amounts of dredged material that are confined in containment facilities at high cost to the public because of concerns over the levels of contaminants and pollutants in the sediment. A great deal of effort spent over the years in soil conservation efforts throughout the Western Lake Erie watershed helped reduce the load of sediment discharging into the river system. A comprehensive study of sediment resources, historical change and littoral processes would identify the best Federal and state investment options for operating and maintaining coastal projects. While it is not feasible to return all littoral sand to the active transport system, the best opportunities for innovative management of sand need to be identified and implemented. This knowledge can then be extended to the public to ensure that possible private coastal do not restrict shoreline or littoral movement of sediment. Opportunities also exist to restore, create and/or enhance a variety of new upland, wetland, and shallow water fish habitat, unique to the area. These habitats would greatly benefit the resident and migratory wildlife and aquatic communities that populate these areas.

5.1.5. Planning Objectives

The water and related land resource problems and opportunities identified in this study are stated as specific planning objectives to provide focus for the formulation of alternatives. These planning objectives reflect the problems and opportunities and represent desired positive changes in the with project conditions. The planning objectives, to be accomplished over a 50-year period of analysis, are specified as follows:

- Provide sufficient CDF disposal capacity at Toledo Harbor to insure commercial navigation for the next 50 years;

- Reduce sediment and contaminant runoff into Toledo navigation channels;

- Reduce sediment delivery by 15 percent or 130,000 cubic yards annually;

- Provide reliable recreational navigation and environmental (contaminated sediment) clean up in Ottawa River/Harbor;

- Significantly increase beneficial use of dredge sediments;

- Improve commercial navigation and safety in the upper end of the Toledo Federal commercial navigation channel in the lower Maumee River;

- Provide economically beneficial flood projects, which are aesthetically pleasing and include habitat protection, wetland preservation, or enhancement and preservation of natural stream characteristics as much as possible; (Flood control projects must be acceptable to the local public.);

- Promote projects that will provide wetland and other ecosystem preservation and augmentation on a Basin wide level;

- Promote harmonious partnerships with other Federal, state, local agencies and groups, and the general public to mutually achieve basin wide study objectives;

- Promote and provide financial support for conservation practices (conservation tillage, buffer strips) that reduce delivery of sediments to Maumee River Federal navigation channel and dredging requirements;

- Promote and institutionalize beneficial use of dredge material as a means of restoring CDF capacities and extending useful life of these CDFs;

- Provide new CDF capacity for retaining up to 30 years of dredge material from the Federal navigation channel to keep the Toledo Harbor open for commercial navigation;

• Conduct comprehensive water circulation and sediment yield and transport modeling to evaluate potential impacts of proposed and existing CDFs on fish spawning and feeding, water quality, sediment quality, and sediment accretion and movement;

• Incorporate environmentally/aesthetically pleasing and ecological preservation, measures into flood control project on the Maumee River, Portage River, Blanchard River, Ottawa River, and other rivers in the Western Basin;

• Preserve and increase wetlands in the Western Basin by including wetland preservation and augmentation for Corps of Engineers, other Federal and State and local agencies in water resource projects to the maximum extent possible;

• Provide for the comprehensive restoration and protection of the Western Lake Erie Basin ecosystem including fish and wildlife habitats to meet the *Lake Erie Protection and Restoration Plan's* quality index goals.

5.1.6. Planning Constraints

Unlike planning objectives that represent desired positive changes, planning constraints represent restrictions that should not be violated. The planning constraints identified in this study are as follows:

• Scarcity of land and availability of rights-of-way for potential ecosystem restoration features and potential construction of innovative confined disposal facilities;

• Availability and cost of land for flood control and environmental enhancement (filter strips, wetlands, and woodlands).

5.2. Alternative Measures and Concepts to Address Defined Objectives

The quality of life in the Western Lake Erie basin is a direct reflection of the quality of its component watersheds, and of the lake itself. Alternative conceptual plans of improvement that generated the interest of basin residents were those concepts that can be developed into mutually acceptable plans of improvement to alleviate the numerous water resources problems earlier described in this reconnaissance report. These problems taken separately require specific fixed solutions whose influences and effects on the basin as a whole would undoubtedly be ineffective. Simply put, pertinent and localized plans, devised in isolation, cannot be effective in successfully meeting the national and planning objectives previously defined in this report. Hence, the task of formulating concepts for improvement at this stage requires full integration of the individual concepts that would address these specific problems while simultaneously contributing to other areas of impairments and to the well being of the basin residents as a whole. These individual concepts would address problems in the areas of sediment and water quality, fish and wildlife habitat restoration, flood damage reduction, pollution source reduction, biological well being of the lake, dredging for commercial shipping, source reduction of soil erosion, shore and beach restoration, wetland restoration, contaminated sediment cleanup, etc.

The section 905(b) (WRDA 86) analysis performed help formulate conceptual plans, including the "No-Action" alternative, to satisfactorily address the problems and needs described in previous paragraphs in the interest of both the Federal and non-Federal sponsors.

5.2.1. Description of Management Measures and Alternative Concepts

A management measure is a feature or activity at a site, which addresses one or more of the defined objectives. A variety of management measures and associated concepts were considered and preliminarily assessed for their feasibility and implementability. A determination was made regarding whether a particular measure should be retained in the formulation of alternative plans. The non-isolation by political geographic boundaries of individual watershed compelled Federal and non-Federal stakeholders to look beyond their local problems and to embrace the idea of formulating comprehensive preliminary conceptual plans acknowledging that problems experienced in the lake, rivers, and streams are the cumulative results of actions taken throughout the watershed. Therefore, to select the best course of action at this time, Federal and non-Federal interests relied on their professional judgment and experience to consider the entire ecosystem in devising and assessing conceptual plans to protect and restore the Western Basin. Conceptual plans were assessed in the context of "with" and "without" project conditions. The results of the study team screening are presented below:

5.2.1.a. *Without-Project Condition Action Plan*

The Without-Project Condition Action Plan or No-Action Plan is the expected future condition in the Western Lake Erie Basin (Maumee, Ottawa, Portage River Basins) without the implementation of a plan of improvement for resolving the degradation of the ecosystem by flood waters, sedimentation, contaminated sediment, proliferation of disposal facilities, poor water circulation, etc. That is, there would be no protocol for ensuring a sustainable supply of coastal resources by managing the biological, physical, and ecological processes that support the life cycle and productivity of coastal living resources. Human health and environmental problems as well as legal mandates associated with managing urban runoff in the basin would continue to grow. Adverse effects of swimming, correlation of human pathogenic viruses to numbers of fecal coliforms; benthic impacts; and surface water and sediment toxicity effects would worsen and render the basin more hazardous than ever. The storm water management issues, watershed approach to dredging and disposal, and storm water quality management would continue to be non-compliant to the Clean Water Act requirements. Beach closures due to fecal contamination and other environmental hazardous conditions would continue as there would be 1) no sharing of common goals or coordinating State and Federal activities, and 2) no creation of cooperative partnerships to reduce or eliminate the problems of storm water runoff, bacterial contamination of waters and beaches, the releases of wastes from ships into the basin harbors, and sewage contamination of waters and beaches.

5.2.1.b. *Protecting Natural Lands and Restoring their Beneficial Uses*

This concept calls for the restoration of impaired lands, wetland, and habitats areas of the western Lake Erie basin. This can be accomplished through modification of existing structures; application of hard and soft shore protection measures such as detached breakwaters, jetties, groins; beach nourishment, vegetative plantings, and other innovative

shoreline protection measures. These measures would be used as barriers to attenuate wind/wave energy while providing a certain level of circulation to maintain water quality.

5.2.1.c. *Reclamation of old Mines, Brownfields, Landfills*

Under this concept, old mines, Brownfields and Landfills throughout the basin would be identified and analyzed to receive the appropriate treatments for their reclamation. Existing confined disposal facilities in the basin are excellent sources of material that can be amended and recycled or both to produce manufactured soils to help state, county, and local agencies in their effort to clean up and reclaim these sites. This would also contribute to Ohio EPA, Toledo Metropolitan Area Council of Government (TMACOG), Ohio Lake Erie Commission, and other environmental agencies' effort to eliminate open water disposal of dredged material.

5.2.1.d. *Elimination of Bacterial Loading and Pollutants of Concern*

This concept would address the effective removal of critical pollutants, contaminants of concern and bacterial loading in the basin to provide for cleaner water to achieve full compliance with the 1970 Clean Water Act. Critical pollutants such as mercury and PCBs chemicals, metals, nutrients, bacteria, and suspended solids would be removed through a strategic source-track-down approach for reducing contaminant loads to Lake Erie, and the possibility of thermal pollution from power plants. This concept would also call for education, proper collection and disposal of contaminants discharges, enforcement of regulatory standards and programs as major contributors to the success of this effort and the improvement of human health, and fish and wildlife in the basin watersheds. Further development of this concept would also result in the elimination of the fish consumption advisories; the tainting of fish and wildlife flavor; restrictions on drinking water; added costs to agriculture and industry, and all human impairments caused by PCBs, Mercury, PAHs, lead, dioxins DDE, DDT, E.coli, fecal coliforms, habitat loss and sediment loading.

5.2.1.e. *Improvement of Navigation Channels*

This concept calls for major environmental cleanup of the entire basin's contaminated main stem rivers and principal tributaries. This can be achieved through environmental dredging and, where necessary, dredging to provide adequate depths and widths to insure safe navigation for recreational and or navigational purposes. This effort would help remove scores of contaminants that usually discharge to the receiving lake as their final resting-place. This concept would generate greatest benefit in achieving a clean body of water so needed by basin residents for their drinking water source, food source, water-human body contact sports, and other activities such as research, etc. This would also contribute to the improvement of the local economy by making commercial transportation by water even more attractive than the existing mode of transportation. It would insure affordable prices for the nation's goods and services compared to foreign imported goods and commodities. This concept would be implemented in conjunction with 5.2.2.c and 5.2.2.d to eliminate future point source discharge of contaminants into the system.

5.2.1.f. *Reduction of Farmland/Streambank Erosion and Flood Damage*

This concept would provide for the conservation of soil, a primary and important natural resource in the basin, particular in Ohio; and for the protection of homes and

stream banks from flood water damages. This concept calls for the removal of all existing unwanted reservoirs/dams from the river system to reduce backwater flooding throughout the basin; and for the construction of flood control measures in the Maumee, the largest of the three basins. Another major effort would be to reduce farmland erosion through the implementation of the Conservation Reserve Enhancement Program involving the technique of conservation tillage to protect topsoil from erosion by leaving crop residue on the fields, to reduce water pollution, and to protects the fields' ability to produce crops. Also, the technique referred to as "Buffer" strip, a natural area along a stream including trees, reduces farmland erosion by catching topsoil thus preventing sediment loading to the stream. Education, technical assistance, and financial incentives in the form of grants help farmers invest in equipment for conservation tillage and reduced pesticides application. An equally effective technique is the wetland sub-irrigation reservoir system (retention ponds) to reduce agricultural non-point source pollution of surface waters. It conserves soil, increases wetland area and wildlife habitat, and increases farm profitability within the Maumee River Basin. Further, channelization, and streambank protective structures are other management measures that would be employed to reduce erosion. They would also increase the stream's ability to pass flow to the downstream areas and the receiving lake without experiencing any bank overflow that floods homes and farms resulting in high monetary damages, and erodes away stream bank and bed resulting in reduced navigation channel depths.

5.2.1.g. *Regional Sediment Resource Management*

This concept calls for the implementation of comprehensive management of littoral processes, to include sediment management, sand management, shoreline management, shore/offshore changes, bottom cores, inventory of existing structures, etc. It would also call for the documentation of existing conditions and related issues/problems; the assessment of future needs; and the layout of the foundation for a regional sediment management plan (RSMP). A primary RSM goal would be to keep sediment in the littoral system, or return littoral sand to the active transport system. The RSMP would be accomplished through the effective use of littoral and riverine sediment resource in an environmentally sound and economically justified manner. A key element associated with the riverine sediment resource is farmland erosion. Thus, a potential management measure, which would add to the comprehensiveness of this concept would be the application of increased conservation tillage and increased installation of buffer practices. Therefore, implementation of the RSMP would contribute not only to watershed control programs, but also to the restoration of coastal lands, fish and wildlife habitat, and complement other work effort in the areas of navigation, environmental restoration, storm damage/flood reduction and streambank and shore erosion. Under this concept, monitoring of sediment movement along the shores and within the watersheds and sub-watersheds via an extensive network of stream gauging stations and coastal observation stations, would be implemented in order to collect, summarize, analyze and interpret collected data. In all, this concept provides for the opportunity for partnership to move forward with a project that would include modeling of predicted erosion and sediment movement throughout the Western Lake Erie Basin.

5.2.1.h. *Improvement of Combined Sanitary Sewers/Home Sewage Disposal*

This concept would address the problem of combined sewer overflow, throughout the basin watersheds, discharging into the river system and passing on pollutants and contaminants of concern to the lake. It calls for the elimination of combined sewer overflow, and the repair and/or removal, as appropriate, of household septic systems that discharge untreated sewage to the nearest ditch. This would be achieved by applying both structural and non-structural measures. An effective and applicable structural measure is the installation of new storm sewers to provide for separate, independent sewer systems for storm water and sanitary sewage, and the control of sewage bypassing to reduce the amount of rain water that gets mixed with the sanitary sewage. An important non-structural measure would be improved public services such as periodic water testing, vigorous enforcement assistance, and development of inspection and "maintenance district" program for local health departments. Also, plant operators would be required to attend regular training sessions designed for sewage treatment plants, particularly privately owned sewage treatment plants, as a requirement to obtain permits from regulators.

5.2.1.i. *Western Basin Geographic Information System Data Base*

A comprehensive system database for the Western Lake Erie Basin would be an important and much needed source of information. This database would be available to draw from at any time when it is necessary to address pertinent water resources problems. This concept calls for Federal government, local universities, and state and local public agencies to partner in conducting literature search; and to develop or use existing computer models to achieve successful and effective transfer technology for interested basin residents. This literature search would focus on what is currently available and what is needed to have complete sets of data. Another measure is the use of remote sensing of land cover and land-use changes to provide the data necessary to run watershed models. These datasets would be in the areas of Lake Erie circulation, water level fluctuations, soil characteristics, transport of sediment, sand, water, sediment yield, critical pollutants and contaminants of concern for each and every appropriate sub-watershed of the Portage, Maumee, and Ottawa River watersheds.

5.2.1.j. *Comprehensive Habitat Protection and Restoration*

This comprehensive concept is a combination of 5.2.2.b and 5.2.2.c described above to fully and broadly address the issue of protection of natural lands remaining; the restoration of the beneficial uses of these remaining lands such as the Woodtick Peninsula and other wetlands; the reclamation of old mines, contaminated landfills, dumpsites and Brownfields; the restoration and creation of wetlands as necessary; and the possible clearing and removal of old dams and reservoirs. This concept would, in large part, contribute to meeting the Lake Erie quality index goals and objectives. This would be accomplished through a variety of techniques, including, the applications of conservation tillage, buffer strips, and retention ponds techniques to reduce sediment loadings that cover valuable underwater habitat, choke aquatic plant growth in river mouths and near shore areas, and diminish the aesthetic appeal of the lake. Acting together, this comprehensive protection/restoration effort would provide for more access to Lake Erie; reestablish a more natural flow regime to the lake tributaries; restore critical coastal habitat and properties; provide sufficient quantity and quality of public shoreline fishing and swimming opportunities, and increase the availability of public beaches along the shoreline.

5.2.1.k. *Comprehensive Ecosystem Restoration*

This comprehensive ecosystem restoration concept would involve all of the previously discussed concepts, which would be inter-connected and acting together to restore the total ecosystem as close to its natural state as possible. Under this concept the Lake Erie Protection and Restoration Plan's quality index goals (*Reference Lake Erie Protection & Restoration Plan, 2000*) would serve as criteria for developing plans to meet those quality index goals. That is, the Western Basin's lake and river system indexes for water quality, pollution sources, habitat, biological integrity, physical integrity of shoreline processes, flood control, boating, fishing, and beaches etc. would show considerable improvement. This concept would also assist in meeting the Lake Erie Lakewide Management Plan's (Reference LaMP 2000) goal to control domestic and industrial discharges, and the Long Term Management Strategy's (LTMS') Executive Committee's goal to keep the Port of Toledo open to cost-effective and competitive waterborne transportation. A variety of management actions, social and economic values associated with those management actions would be considered to complement all the techniques, programs, and practices discussed above in order to achieve the desired impacts of this comprehensive concept. Further, all pertinent emerging issues not addressed in any of the previous concepts would be addressed under this comprehensive concept. For instance, issues such as non-indigenous invasive species (aquatic nuisance species) in the lake and their influence on the ecosystem (aquatic and terrestrial); and phosphorus management and monitoring, etc. would be addressed.

5.3. Preliminary Impact Assessment of Concepts

Concern about elevated concentrations of contaminants such as polychlorinated biphenyls and mercury in aquatic bed sediments throughout the western basin have resulted in the need for a better understanding of the scope and the severity of the problem. Also, anthropogenic contaminants, those resulting from human activity, deposited and discharged from point sources such as sanitary, combined, and storm sewers and from industrial facilities, further exacerbate the severity of the problem. Their spatial distribution, concentrations and bio-availability of contaminants in streambed and lakebed sediments have been and are key issues in the Western Basin. Although numerous studies of contaminants in aquatic sediment have been undertaken in Lake Erie, few studies have assessed how these contaminants vary from place to place and under different environmental conditions.

People have also expressed concerns about elevated concentrations of various synthetic compounds and trace metals in streambed and lakebed sediments. These bed-sediment contaminants can accumulate in the tissue of benthic organisms, causing health risks to predatory fish, wildlife and human consumers as the contaminants move through the food chain. Evidence from laboratory tests show that contaminated aquatic sediment can reduce or eliminate benthic (bottom-dwelling) species of commercial or ecological importance. These sediments can also impact the food supply required to sustain fish populations (U.S. EPA, 1997). Elimination of bacterial loadings and pollutants of concern through the source track-down approach can reduce the contaminant load to Lake Erie and its tributaries. Also, environmental dredging, another equally important approach to addressing concern over contaminants, can help remove scores of contaminants that usually discharge in the receiving lakes. Overall, future expansions of the

freshwater biological effects database for sediments are expected to result in sufficient information to calculate assessment values for all substances of concern such as PAHs, PCBs, pesticides, dioxins, etc., which are major causes of human impairments. Possible consequences of these impairments are degraded fish populations, loss of fish habitat, fish tumors or other deformities, animal deformities, reproductive problems, degradation of bottom-dwelling invertebrates, and restrictions of fish-and-wildlife consumption.

6. FEDERAL INTEREST

Federal and non-Federal interests, stakeholders, experts, and local government agencies have demonstrated keen interest in formulating and developing comprehensive alternative plans, which can be studied further in the feasibility phase. This interest had set the tone for a cooperative study approach that investigated broadly defined concepts to address several important concerns and needs related to bacterial contamination, contaminated sediment, poor water quality, loss of fish and wildlife habitat, sediment management, improvement to navigation, wetlands degradation, and erosion of shoreline, streambank, and farmland, etc. They have demonstrated keen interest in eradicating bacterial contamination, restoring wetlands and other ecosystems, and developing basin management plans that could lead to implementation of projects. It is thus in the interest of both the Federal government as well as non-Federal interests to complete this 905(b) (WRDA 86) analysis and continue into a watershed feasibility study to recommend plans that will be in conformance with environmental laws, regulations, policies and guidelines.

7. PRELIMINARY FINANCIAL ANALYSIS

The Toledo Metropolitan Area Council of Government (TMACOG) has expressed interest in sponsoring potential projects that could derive from this Western Lake Erie Basin study. By letter dated September 11, 2001, TMACOG stated a willingness to pursue comprehensive basin management plans and to share in the cost of the feasibility study. TMACOG will form local partnerships and take the lead in coordinating with states, counties, cities, local agencies, and other interested local stakeholders to complete pertinent studies and implement projects that would contribute to the realization of local goals and objectives.

8. SUMMARY OF FEASIBILITY ASSUMPTIONS

The following critical assumptions will provide a basis for the formulation and development of a comprehensive watershed management plan to achieve stated goals and objectives:

8.1. Feasibility Phase Assumptions

- The reclamation of old mines, landfills, and Brownfields will be implemented.

- Remediation and cleanup of all contaminated sediment in Ottawa River including chemical and bacterial loading will be implemented.

- Structural flood damage, shoreline and/or other soil erosion reduction project will be implemented.

- The evaluation of ecosystem restoration alternatives will be incrementally analyzed.
- The U.S. Fish and Wildlife Service as part of the process of formulating plans will prepare a Coordination Act Report.

- As appropriate, Environmental Impact Statement (EIS) and/or Environmental Assessment (EA) will be prepared as part of meeting NEPA requirements.

8.2. Policy Exceptions

The study will be conducted in accordance with established Principles and Guidelines and the Corps of Engineers Regulations. No exceptions to established guidance have been identified at this time.

8.3. Quality Objectives

The feasibility phase studies for a comprehensive watershed management plan will be accomplished to meet the following water quality objectives spelled out in the Ohio Lake Erie Commission's *Lake Erie Protection & Restoration Plan:*

- Maximize reinvestment in existing core urban areas, transportation, and infrastructure networks to enhance the economic viability of existing communities.

- Minimize the conversion of green space and the loss of critical habitat areas, farmland, forest and open spaces.

- Limit any net increase in the loading of pollutants or transfer of pollution loading from one medium to another.

- To the extent feasible, protect and restore the natural hydrology of the watershed and flow characteristics of its stream, tributaries and wetlands.

- Restore the physical habitat and chemical water quality of the watershed to protect and restore divers and thriving plant and animal communities and preserve the basin's rare and endangered species.

- Encourage the inclusion of all economic and environmental factors into the cost/benefit accounting in land use and development decisions.

- Avoid development decisions, which shift economic benefits or environmental burdens from one location to another.

- Encourage that all new development and redevelopment initiatives address the need to protect and preserve access to historic, cultural, and scenic resources.

9. FEASIBILITY PHASE MILESTONES APPLICABLE TO OTTAWA, PORTAGE AND MAUMEE RIVER WATERSHEDS

Milestone	Description	Duration (Month)	Date Yr/Month
FI	Initiate Feasibility Phase	0	2-Feb
F2	Develop Draft PMP	1	2-Mar
F3	Public Workshop Scoping	2	2-May
F4	Final Signed PMP, FCSA	3	2-Aug
F5	Feasibilty Scoping Meeting	2	2-Oct
F6	Preliminary Alternative Plans/ Evaluation	15	4-Jan
F7	Alternative Review Conference - Identify preferred alternative, gather additional data	10	4-Nov
F8	Issue Resolution Conference (Corps/Sponsor/Stakeholders)	4	5-Mar
F9	Draft Feasibilty Report (Write report, Perform ITR, Repro)	6	5-Sep
F10	Final Public Meeting	2	5-Nov
F11	Optional Issue Resolution Conference	1	5-Dec
F12	Final Report to LRD	3	6-Mar

NOTE:

PMP : Project Management Plan
FCSA: Feasibility Cost Sharing Agreement
ITR : Independent Technical Review
LRD : Lake River Division (Cincinnati, OH)

10. FEASIBILITY PHASE COST ESTIMATES
FOR
OTTAWA, PORTAGE, AND MAUMEE RIVER WATERSHEDS

Watershed Evaluation	Ottawa River	Portage River	Maumee River
Work items	(x$1000)	(x $1000)	(x$1000)
Pollution Reduction (Bacterial loadings, thermal pollution, PCBs, PAHs, Metals etc.)	500	200	400
WLEB Sediment Management (Conservation buffer, tillage; circulation, transport)	200	300	100
Coastal Engineering Investigations (	200	250	300
Geotechnical Investigations (Subsurface investigations, boring, stability anal.)	100	100	150
Real Estate Analysis (Lands, easements, titles, rights-of-ways)	50	50	100
Environmental Analysis/Investigations (Change in algae, non-ind. species etc.)	300	200	400
Combined Sewer Overflow Improvements (Separation, collection/treatment, diversion)	200	100	500
Cost Estimates (MCACES estimates)	50	50	100
Economic Evaluation (Ecological, commercial, recreational etc.)	100	120	200
Hydraulics & Hydrology Studies(Water circulation, sediment transport) Carrying Capacity, Allocation, Management	400	200	500
Plan Formulation/Evaluation (Id. problems, develop arrray of alternatives)	200	250	300
Fish & Wildlife Coordination Act Report (Coord. OEPA, ODNR, 4-season survey)	30	30	50
Public Involvement/Institutional Studies/NEPA requirements	100	100	150
Surveys And Mapping (Incl. Aerial surveys, water levels, river, shoreline)	200	200	600
Dredge Material Management (mine reclamation, landfills, brownfields, manuf. soils)	100	50	200
Environmental Assessment	100	100	200
GIS Database (Land use, soils, geology, vegetation etc.) (100% Fed.)	100	100	400
Cultural Resources Studies (Cultural areas of concern)	50	50	100
Project Management And Budget Documentation	100	100	150
Sponsor Project Management	100	100	150
Final Report documentation	100	100	200
Supervision & Administration	150	200	350
Contingencies	400	450	900
Prepare PMP, FCSA, QCP, CMP (100% Fed.)	100	100	100
	-------------	-------------	-------------
	3,630	3,500	6,600

11. VIEWS OF OTHER RESOURCE AGENCIES

Because of the funding and time constraints of the reconnaissance phase, limited formal coordination has been conducted with State, Federal and local resource agencies. These agencies, including the Toledo-Lucas County Port Authority, the Toledo Area Metropolitan Council of Government, the U.S Fish and Wildlife Service, the Ohio Department of Natural Resources, the Ohio Environmental Protection Agency, the U.S. environmental protection Agency, the U.S Geological Survey, the U.S. Department of Agriculture's Natural Resources Conservation Service, the Lake Erie Remedial Action (RAP) Committee, and the City of Toledo, are generally supportive of the study. They have expressed views on a number of related issues ***(See correspondence attached to this report)***, and on the overall Western Lake Erie ecosystem restoration. They also expressed concerns about specific problems including bacterial loading, Western Lake Erie water circulation, soil and farmland erosion, sediment transport, etc. During meetings, they have recognized the importance of devising comprehensive watershed management plans that can realize a healthy environment, stimulate a competitive economy, and ensure a sustainable quality of life for the basin residents.

12. POTENTIAL ISSUES AFFECTING INITIATION OF THE FEASIBILITY PHASE

Preliminary discussion with the potential non-Federal sponsors, stakeholders, and other interested parties indicate that there are no known issues at this time that would affect the initiation of the feasibility phase of the study except the completion of the task of evaluating, comparing, and selecting plans for recommendations.

Also, a feasibility cost sharing agreement would be negotiated with the non-Federal sponsor in order to proceed onto the feasibility phase of study. This process will take into consideration the existing and future without-project conditions in the Basin; and address the pertinent issues, problems, and opportunities with a view to contributing to the well-being of the nation's environment and restoration of the basin ecosystems pursuant to national environmental statutes, laws, and planning principles and guidelines.

13. PROJECT AREA MAP

A project area map is attached to the next page.

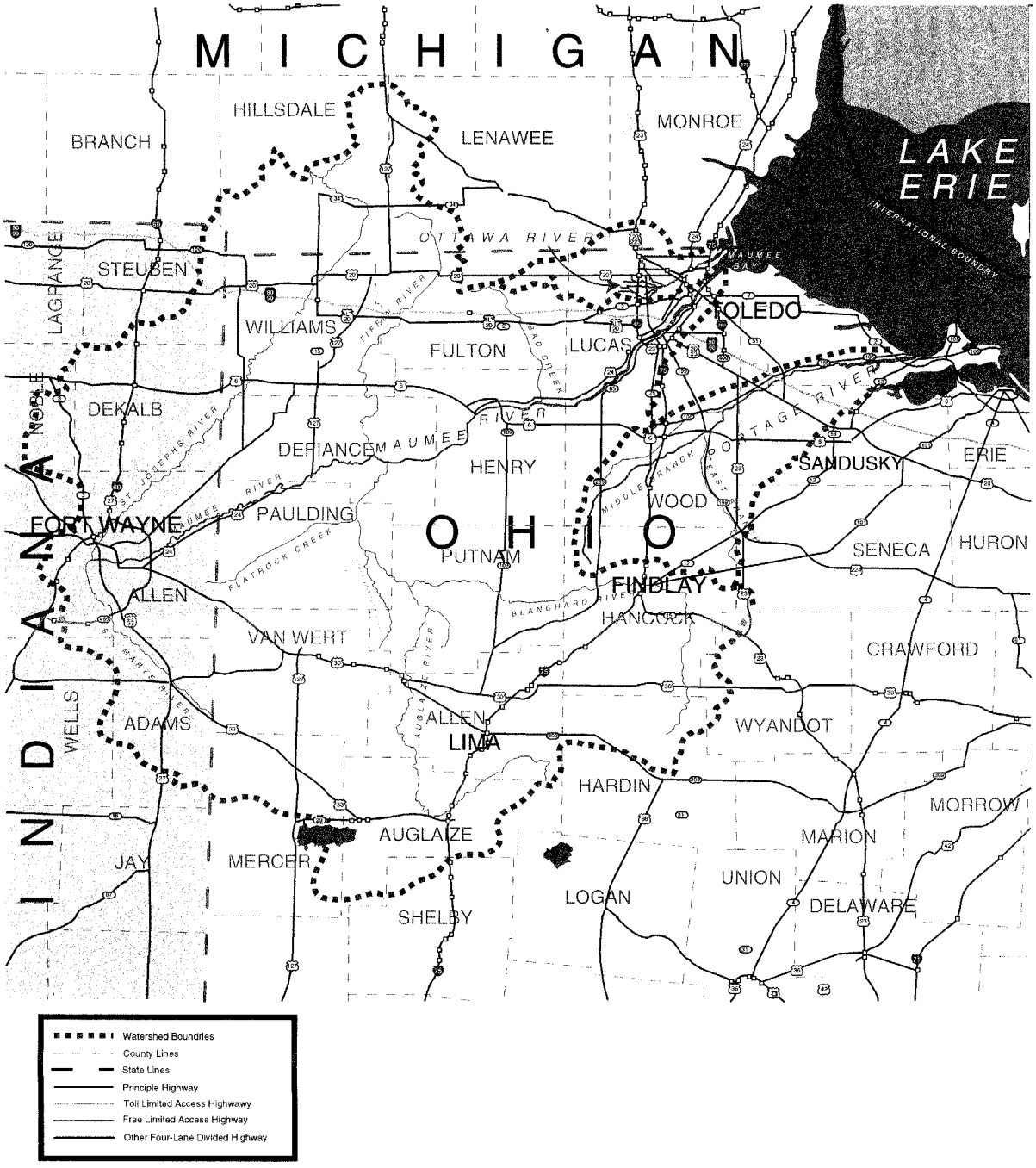


Figure 10 - Project Area Map

14. RECOMMENDATION

I recommend that the Western Lake Erie Basin study proceed into the feasibility phase to develop comprehensive watershed management plans.

Date: October 9, 2001

GLEN R. DEWILLIE
Lieutenant Colonel, U.S. Army
District Engineer

CORRESPONDENCE

TMACOG

Toledo Metropolitan Area Council of Governments
300 Central Union Plaza Toledo, Ohio 43602 • P.O. Box 9508 Toledo, OH 43697-9508
Phone 419-241-9155 • Fax 419-241-9116 • www.tmacog.org

September 11, 2001

Wiener Cadet, M.S.
Civil Engineer
US Army Corps of Engineers
1776 Niagara St
Buffalo, NY 14207-3199

Dear Mr. Cadet:

Please accept this letter as TMACOG's statement of intent and interest in serving as a local sponsor for the Corps of Engineers' Lake Erie Western Basin project.

We appreciate being included in the development of the program, and hope to work with you. If you wish to discuss the project further, please feel free to call Kurt Erichsen, Vice President of Environmental Planning at extension 126.

Sincerely,

Anthony L. Reams
President

ke/clb

cc: Edwin J Hammett, Chief, OEPA NWDO
Steve Katich, Administrative Assistant, U.S. Congresswoman Marcy Kaptur
John Loftus, Seaport Director, Toledo-Lucas County Port Authority

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THE OHIO STATE UNIVERSITY

Department of
Agricultural, Environmental,
and Development Economics

2120 Fyffe Road
Columbus, OH 43210-1067
Phone 614-292-7911
FAX 614-292-4749
http://www-agecon.ag.ohio-state.edu

June 19, 2001

Wiener Cadet
US Army Corps of Engineers
1776 Niagara Street
Buffalo, NY 14207

Dear Wiener,

Thanks for your phone call. I would be interested in helping improve the quality of Lake Erie by working with you on the items you outlined on the phone. Enclosed are some of the research outputs from the work that I have been doing with graduate students and others. Hopefully this information will be of some use to you in your meeting in July.

(1) Book chapter outlining benefits of reducing soil erosion in the Maumee River Basin (in the book titled: "Revealing the Economic Value of Protecting the Great Lakes).

(2) Article on the costs of sediment control through filter strips and targeting (the article by Nakao and Sohngen).

(3) Short Fact Sheets that summarize the two projects listed above.

(4) Old website on the costs and benefits of soil erosion control in the Maumee River Basin:

http://www-agecon.ag.ohio-state.edu/Faculty/bsohngen/maumee/maum_sed.htm

I hope that this information is helpful. Please let me know if you would like to talk further after your meeting July.

Sincerely,

Brent

Brent Sohngen

RETURN TO
SENDER

CELRB-IM
MAILROOM

28 JUN 01 08 27

Planning Branch

June 27, 2001

Your agency is invited to participate in a meeting on Thursday July 12 at 11:00 a.m. at the Toledo Port Authority office located at One Maritime Plaza, Toledo, Ohio. The purpose of this meeting is to identify and discuss potential water resource projects that may be of interest to your agency.

Congress has directed the Corps of Engineers to prepare a reconnaissance level report and if appropriate to develop a study management plan for the Western Lake Erie Basin of Ohio, Indiana and Michigan. The study will address measures to improve flood control, navigation, water quality, recreation, and fish and wildlife habitat in the basin.

A major premise of this study will be to recognize relationships between the watershed ecosystems and the Lake Erie interface as well as farmlands, towns and cities. To that end we must establish cooperative actions among agencies, local governments, and community stakeholders to further the sound development of water resources within the basin.

This reconnaissance level report is scheduled for completion by October of this year. If your agency is interested in attending, please contact Mr. Wiener Cadet, Corps Study/Project Manager at your earliest convenience. Mr. Cadet may be reached at *wiener.cadet@usace.army.mil* or (716) 879-4247.

Sincerely Yours

MFR: NOT PROCESSED IN MAIL ROOM

Wiener Cadet
Study/Project Manager

P.S. Please bring copies of relevant reports, studies, or information that may be of use to the Corps of Engineers in preparing this report.

United States Department of the Interior

U.S. GEOLOGICAL SURVEY
6480 Doubletree Avenue
Columbus, Ohio 43229-1111
(614) 430-7715
dnmyers@usgs.gov

September 25, 2001

Mr. Wiener Cadet
U.S. Army Corps of Engineers
Buffalo District
1776 Niagara Street
Buffalo, NY 14207-4247

Dear Wiener,

Thank you on behalf of the USGS (U.S. Geological Survey) for the opportunity to describe our interests in the environmental, water resources, and natural resources of the Western Basin of Lake Erie and its watershed ecosystems. This letter is to inform you of our past, current, and potential future involvement in the areas of research and assessment in the Western Lake Erie Basin. Feel free to use this information in support of you efforts to develop a reconnaissance-level report about the Western Basin of Lake Erie for Congress. I am enclosing a report published in 1997 that provides information on the environmental and hydrologic setting of the region.

NAWQA (National Water-Quality Assessment) Program: The NAWQA Program is a long-term water-quality monitoring and assessment program of the USGS that has been active in the five-state Lake Erie-Lake Saint Clair Drainages study area since 1994. A six-year initial study (1994-2000) was recently completed and final reports are being published and released. The major focus of these NAWQA studies since 1994 has been on the largest tributaries to Western Lake Erie, the Maumee River in Ohio, Michigan, and Indiana, and the River Raisin in Michigan. Publications to come from these studies have focused on assessments of contaminants in riverbed and lakebed sediments and assessments of nutrients, current-use pesticides, and suspended-sediment concentrations and loadings. Between 2000 and 2003, a lower intensity of activities will characterize the LERI study to complete the first 10-year effort (1994-2003). A reactivation of more intensive studies will be undertaken from 2004-2013, to initiate the next 10-year effort.

A National Trends Network for the nation's streams was developed by the NAWQA Program. Five sites in the national trends network are currently active in the Lake Erie-Lake Saint Clair Drainages study area, three in the Maumee River Basin and one in the River Raisin Basin. These sites have been sampled since 1994 and will continue to be sampled uninterrupted through the next ten-year cycle of the NAWQA Program. The objectives of this sampling are to assess trends in concentrations and loadings of nutrients, pesticides, suspended sediment, and other selected contaminants. All sites in the NAWQA Program are located at continuous streamflow gaging stations. These five trend sites represent an investment of federal dollars of approximately $250,000 per year.

GAP Analysis Program in Lake Erie streams and Lake Erie wetlands: The GAP Analysis Program is a long-term biodiversity assessment program of the USGS. The GAP Analysis Program is currently being undertaken in Ohio in terrestrial, stream, and wetland habitats in the Lake Erie Basin. The GAP Analysis Program will provide a wide-array of spatial data on terrestrial, stream, and wetland landscapes; and data on dominant plant communities and several hundred vertebrate animal species that occupy these landscapes. All species data are being developed in a readily usable Microsoft access database. Remotely sensed land-use and land-cover data (Landsat 7) coupled with ground-truth data will provide an analysis of wetlands larger than one hectare in the Western and West Central Lake Erie Basin where they are most common compared to other coastal areas of Lake Erie. This Program will provide a wealth of assessment information on species diversity and habitats that can be used to set conservation priorities and restoration priorities by land and water managers and planners. The annual investment of USGS and its partners for the GAP Program in Ohio and the Lake Erie Basin was approximately $130,000 in federal fiscal year 2001 and is planned for a similar level in 2002-2003. The program will be completed through the first phase in 2004.

Other Monitoring and Assessment Programs: The USGS currently operates 15 long-term continuous streamflow gaging stations, most with real-time reporting capabilities within the Maumee, Raisin, Portage, and Toussaint River Basins. Data from these gages are used for flood and drought studies, water supply and wastewater treatment and management planning, economic development, water-supply estimation, water-quality networks, climate-change studies, and hazard warning systems. Some of these gaging stations have continuous records of streamflow going back 60 to 70 years or more. The annual operating cost of each gaging station is approximately $10,000 per year, or $150,000 for all 15 active gaging stations.

Many short-term studies are conducted by the USGS through its cooperative water-resources investigations program. The status of these programs in the Western Basin of Lake Erie are varied and diverse but are typically short-term and focused on water and natural resources issues that are local in nature. More information can be provided on specifics of studies on request.

Research Programs: An area of great interest within the USGS is investigating the linkages between terrestrial and aquatic ecosystems in the coastal and near shore environments of the Great Lakes. A systems science approach is being applied to designing these studies wherein all scientific disciplines within USGS (biology, geology, mapping, and water) are applied to issues identified in broad categories of Sustainable Development, Human Health, Ecosystem Health and Integrity, Invasive Species, and Information Management and Dissemination. A Coastal/Nearshore research group within USGS is interested in piloting some of these system-science studies in Western Lake Erie coastal areas in the near future. These studies would focus on the role of changing lake levels on local water circulation patterns, on beaches and wetlands, and on the fisheries resources of near shore and coastal areas. Some capabilities of the researchers involved in these plans include lakebed geologic mapping, hydrology and hydrogeology, aquatic ecology, topographic/bathymetric mapping, land-surface change and remote sensing, fisheries research, aquatic chemistry and geochemistry, and aquatic and human-health related microbiology. A relatively small effort is planned for 2002 whereby we plan to hold a workshop and undertake a small to further refine issues, scientific approaches, study designs, and areas of mutual interests with other partners in the Great Lakes. The workshop will be developed in coordination with nongovernmental and public sector organizations at the regional, state, and federal level in early calendar year 2002. Future funding for studies will be sought from USGS programs and initiatives as well as through cooperative agreements with public sector agencies.