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STATUS OF AQUATIC HABITAT REHABILITATION AND CONSERVATION EFFORTS IN THE WATERSHEDS OF GREAT LAKES AREAS OF CONCERN

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ACKNOWLEDGEMENTS

This survey and report were made possible by a grant from Environment Canada and U.S. Environmental Protection Agency to the Department of Civil and Environmental Engineering at Wayne State University in Detroit, Michigan. We thank the fishery managers and remedial action plan team members listed as contact persons in Appendix 1 for providing the survey information. Peer review of the report was provided by John Kelso of Canada Department of Fisheries and Oceans, Kent Fuller of U.S. Environmental Protection Agency, Harvey Shear of Environment Canada, Doug Dodge of Ontario Ministry of Natural Resources, Bob Kavetsky of U.S. Fish and Wildlife Service, and Jim Atkinson of Ontario Ministry of Natural Resources. Bruce Jamieson of the International Joint Commission designed the report cover. We also acknowledge the significant contributions of Danny Epstein of Environment Canada and Kent Fuller of U.S. Environmental Protection Agency for their ongoing support and encouragement as project officers.
ABSTRACT

Recent fishery management surveys of the watersheds in the 43 Great Lakes Areas of Concern have documented an increased recognition of the need for habitat rehabilitation and conservation over at least the past five years. Although habitat rehabilitation and conservation initiatives are underway in all Areas of Concern, there frequently appears to be a lack of connection between habitat modification initiatives and aquatic resource management objectives and the scientific method. This could be addressed by:

* placing a higher priority on establishing quantitative, fish community and habitat objectives, targets, or end points for Areas of Concern to help direct rehabilitation and conservation efforts, and help evaluate and select appropriate habitat modification techniques;

* placing greater emphasis on pre- and post-project assessment needed to quantify habitat-related problems, establish cause-and-effect relationships, evaluate and select appropriate habitat modification techniques; and quantify effectiveness relative to ecosystem structure and function; and

* pooling available data on habitat modification effectiveness in 16 Areas of Concern identified as having strong assessment components to learn from different experiences and to provide the basis for application of successful tools in other parts of the Great Lakes Basin Ecosystem.

BACKGROUND ON THE REMEDIAL ACTION PLAN PROGRAM

The concept of RAPs originated from a 1983 recommendation of the International Joint Commission's Great Lakes Water Quality Board (IJC 1985). The Board found that despite implementation of regulatory and response management programs, a number of beneficial uses (e.g., unconfined human consumption of fish, unrestricted disposal of dredged sediments from harbors and rivers, successful reproduction of certain sentinel fish and wildlife...
INTRODUCTION

As progress is being made in pollution control throughout the Great Lakes Basin, it is increasingly evident that loss and degradation of habitat are limiting the recovery of the living resources of aquatic and terrestrial ecosystems. The importance of habitat is specifically recognized in the Great Lakes Water Quality Agreement (GLWQA) as one of the impaired beneficial uses to be restored in Areas of Concern and other parts of the Great Lakes (United States and Canada 1987). Habitat is an essential component which must be addressed to attain the purpose of the GLWQA (i.e. the restoration and protection of the integrity of the Great Lakes Basin Ecosystem).

Areas of Concern are the most degraded locations within the Great Lakes, where beneficial uses such as fish consumption and aquatic community health are impaired. Of the 43 Areas of Concern, most are in or near urban and industrial areas.

For each Area of Concern, a remedial action plan (RAP) is being developed to identify and implement key actions needed to restore beneficial uses, including habitat. Use of an ecosystem approach in development of RAPs provides an opportunity for comprehensive and systematic habitat restoration and protection.

Although numerous laws, policies, and programs exist to enhance habitats in the Great Lakes Basin Ecosystem, there is a need for improved implementation of these laws, policies, and programs, and a need for a strategic approach to habitat protection and restoration, making full use of all levels of partnerships (Dodge and Kavetsky 1994). RAPs provide a unique opportunity to take a comprehensive approach to habitat protection and restoration, to generate public understanding and support, and to accelerate implementation of habitat-related laws, policies, and programs. This report:

* documents aquatic habitat rehabilitation and conservation projects in the watersheds of the 43 Areas of Concern in order to learn from different experiences and help provide the rationale for application of successful techniques in other parts of the Great Lakes Basin Ecosystem;

* reviews and summarizes the assessment of habitat project effectiveness; and

* recommends areas where coordination of effort is required.

BACKGROUND ON THE REMEDIAL ACTION PLAN PROGRAM

The concept of RAPs originated from a 1985 recommendation of the International Joint Commission's Great Lakes Water Quality Board (IJC 1985). The Board found that despite implementation of regulatory and resource management programs, a number of beneficial uses (e.g. unrestricted human consumption of fish, unrestricted disposal of dredged sediments from harbors and rivers, successful reproduction of certain sentinel fish and wildlife
species, fish and wildlife habitat) were not being restored, and recommended that comprehensive and systematic RAPs be developed and implemented to restore all beneficial uses in Great Lakes Areas of Concern (Figure 1). The 1987 Protocol amending the GLWQA formalized the RAP program and explicitly defined Areas of Concern as geographic areas that fail to meet the general or specific objectives of the GLWQA where such failure has caused or is likely to cause impairment of beneficial use or of the area’s ability to support aquatic life (United States and Canada 1987). Impairment of beneficial use means a change in the chemical, physical, or biological integrity of the Great Lakes ecosystem sufficient to cause any of the following 14 use impairments:

* restrictions on fish or wildlife consumption;
* tainting of fish and wildlife flavor;
* degradation of fish and wildlife populations;
* fish tumors or other deformities;
* bird or animal deformities or reproductive problems;
* degradation of benthos;
* restrictions on dredging activities;
* eutrophication or undesirable algae;
* restrictions on drinking water consumption, or taste and odor problems;
* beach closings;
* degradation of aesthetics;
* added costs to agriculture or industry;
* degradation of phytoplankton and zooplankton populations; or
* loss of fish and wildlife habitat.

The 1987 Protocol amending the GLWQA also calls for RAPs to embody a comprehensive and systematic ecosystem approach and ensure public consultation. RAPs are developed in three stages. A Stage 1 RAP must include: a detailed environmental problem definition, including beneficial uses impaired, degree of impairment, and geographic extent;
Figure 1. Forty-three Areas of Concern identified in the Great Lakes Basin.
and a description of causes of use impairments and sources of pollutants. A Stage 2 RAP must: evaluate effectiveness of existing programs; evaluate alternative additional remedial and preventive actions to restore uses; select additional remedial and preventive actions; identify a schedule for implementation and persons or organizations responsible for implementation; identify a process for evaluating implementation and effectiveness of remedial and preventive actions; and describe the surveillance and monitoring program which will be used to track effectiveness of remedial and preventive actions and confirm use restoration. A Stage 3 RAP must provide the data and information necessary to confirm use restoration. It should be noted that the period following completion of the plan includes both implementation and recovery of beneficial uses, which may take a long time. More information on the RAP program can be obtained from Hartig and Law (1994), and Hartig and Zarull (1992).

**HABITAT SURVEYS IN AREAS OF CONCERN**

In 1994, fishery managers and RAP team members with responsibility for habitat in Areas of Concern were surveyed to document the nature and extent of aquatic habitat rehabilitation and conservation projects in each watershed of the 43 Great Lakes Areas of Concern, and to summarize information on project effectiveness. Fishery managers and RAP team members with habitat responsibilities in Areas of Concern were asked the following questions:

* What aquatic habitat rehabilitation and conservation projects have been initiated or completed over the past five years in the watershed of your Area of Concern?

* How effective have these projects been (provide summary data and information if possible)?

* If projects are underway, what kinds of monitoring will be performed to evaluate effectiveness?

Two other recent surveys related to habitat management were undertaken in Areas of Concern. These included:

* a survey of fish community and habitat goals/objectives/targets relative to GLWQA use impairments, and current resource status, was performed by contacting government program managers responsible for fishery management planning in Areas of Concern (Hartig 1993a and b); and

* a survey of the status of all 14 use impairments in Areas of Concern was performed by contacting RAP coordinators (Hartig and Law 1994).

Collectively, the data and information from these three surveys provide a unique opportunity to review and evaluate the status and prospects of management efforts to rehabilitate and conserve aquatic habitats in Great Lakes Areas of Concern.
STATUS OF MANAGEMENT EFFORTS

An ecosystem approach accounts for the interrelationships among land, air, water, and all living things, including humans, and involves all user groups in management (Hartig and Vallentyne 1989). Fishery management (Great Lakes Fishery Commission 1992) and water quality management agencies (United States and Canada 1987) use an ecosystem approach to manage the Great Lakes. Full implementation of an ecosystem approach and achievement of complementary and reinforcing policies and programs will require substantial coordination and integration.

Recognition of the need for habitat rehabilitation and conservation has been increasing over at least the past five years. For example, between 1989 and 1994, there was a 50% increase in the number of Areas of Concern that acknowledged loss of habitat (Table 1).


<table>
<thead>
<tr>
<th>Year</th>
<th>Total Number of Areas of Concern</th>
<th>Number of Areas of Concern Which Recognized Degradation of Fish Populations</th>
<th>Number of Areas of Concern Which Recognized Loss of Fish Habitat</th>
</tr>
</thead>
<tbody>
<tr>
<td>1989*</td>
<td>42</td>
<td>16 (38%)</td>
<td>17 (40%)</td>
</tr>
<tr>
<td>1991#</td>
<td>43</td>
<td>24 (56%)</td>
<td>24 (56%)</td>
</tr>
<tr>
<td>1994^</td>
<td>43</td>
<td>29 (67%)</td>
<td>34 (79%)</td>
</tr>
</tbody>
</table>

* IJC (1989)  
# IJC (1991)  
^ Hartig and Law (1994)

Similar trends in increasing recognition of the need to rehabilitate and conserve habitat are evident in Great Lakes lakewide management plans (LAMPS) and in the lake committees established under the auspices of the Great Lakes Fishery Commission to develop fish community objectives called for in the Joint Strategic Plan for Management of Great Lakes Fisheries (Koonce 1994). Currently, 29 of the 43 Areas of Concern recognize degraded fish populations as an impaired use and 34 of the 43 Areas of Concern recognize loss of fish habitat as an impaired use (Table 2).
Table 2. Status of fish and wildlife population and habitat use impairments, and establishment of quantitative objectives-targets in Great Lakes Areas of Concern.

<table>
<thead>
<tr>
<th>AREA OF CONCERN</th>
<th>Degredation of Fish and Wildlife Populations</th>
<th>Loss of Fish and Wildlife Habitat</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Degredation of Fish and Wildlife Populations</td>
<td>Loss of Fish and Wildlife Habitat</td>
</tr>
<tr>
<td>LEGEND</td>
<td></td>
<td></td>
</tr>
<tr>
<td>X=Present</td>
<td></td>
<td></td>
</tr>
<tr>
<td>U=Under</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R=Restored</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L=Likely</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peninsula Harbour</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Jackfish Bay</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Nipigon Bay</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Thunder Bay</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>St. Louis River</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Torch Lake</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deer Lake-Carp River</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Creek</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manistiquie River</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Menominee River</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Fox River - Green Bay</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Sheboygan River</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Milwaukee Estuary</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Waukegan Harbor</td>
<td>U</td>
<td>X</td>
</tr>
<tr>
<td>Grand Calumet River - Indiana Harbor Canal</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Kalamazoo River</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Muskegon Lake</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>White Lake</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Saginaw River - Bay</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Collingwood Harbour</td>
<td>R</td>
<td>X</td>
</tr>
<tr>
<td>Severn Sound</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Spanish Harbour</td>
<td>X</td>
<td>U</td>
</tr>
<tr>
<td>Clinton River</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Rouge River</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>River Raisin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maumee River</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Black River</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Cuyahoga River</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Ashtabula River</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Presque Isle Bay</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wheatley Harbour</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Buffalo River</td>
<td>L</td>
<td>X</td>
</tr>
<tr>
<td>Eighteenmile Creek</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rochester Embayment</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Oswego River</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Bay of Quinte</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Port Hope Harbour</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metro Toronto</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Hamilton Harbour</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>St. Marys River</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>St Clair River</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Detroit River</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Niagara River (Ontario)</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Niagara River (New York)</td>
<td>L</td>
<td>X</td>
</tr>
<tr>
<td>St. Lawrence River (Cornwall, Ontario)</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>St. Lawrence River (Massena, New York)</td>
<td>L</td>
<td>X</td>
</tr>
</tbody>
</table>
Although degraded fish and wildlife populations and loss of habitat are well recognized, quantitative objectives or targets are often lacking, particularly for habitat (Table 2). Possible reasons why quantitative habitat objectives and targets are often lacking for Areas of Concern include:

* limited agency personnel and expertise to translate habitat needs into quantitative habitat objectives and targets;

* limited knowledge of habitat needs and requirements for some fish species;

* inability to define historic conditions which could be used as objectives;

* limited data on current status of physical, chemical, and biological habitat components;

* the relatively low priority placed on establishing quantitative habitat objectives and targets by many fishery management agencies;

* limited management tools (e.g. habitat classification systems, habitat indices) that are scientifically-defensible, field-tested, pragmatic, and cost-effective; and/or

* poor understanding of the scientific methods and technologies of some types of rehabilitation efforts, particularly for wetlands.

Consequently, there is a need to place higher priority on filling current habitat knowledge and data gaps, and on establishing quantitative, fish community and habitat objectives, targets, or end points for Areas of Concern to help direct rehabilitation and conservation efforts, and to help evaluate and select appropriate habitat modification techniques.

Priority must also be placed on ensuring that the quantitative objectives or targets for Areas of Concern are complementary and reinforcing with lakewide objectives or targets (i.e. those being developed under LAMPs and the Joint Strategic Plan for Management of Great Lakes Fisheries). Indeed, experience has shown that broad-based agreement on quantitative objectives and targets is essential for providing strategic management direction and clarity, and for demonstrating success (Hartig 1993a).

Based on the 1994 habitat project survey, habitat rehabilitation and conservation projects are underway in the watersheds of all 43 Areas of Concern (Table 3). Collectively, this information demonstrates the broad extent and diversity of habitat rehabilitation and conservation efforts throughout Area of Concern watersheds. Detailed information from the habitat project survey is presented by Area of Concern in Appendix 1. This information on habitat rehabilitation and conservation projects in Areas of Concern should make individuals and organizations aware of the range of habitat rehabilitation and conservation techniques in use, provide summary information to aid in the habitat methods selection process of future initiatives, and provide contact persons for follow-up. In addition, this information is
<table>
<thead>
<tr>
<th>Habitat Components Incorporated Into Marina-Breakwall-Dock Design</th>
<th>Channel Modification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Floodplain Rehabilitation and Instream Cover Enhancement</td>
<td>Wetland Rehabilitation or Preservation</td>
</tr>
<tr>
<td>Shoreline or Streambank Stabilization</td>
<td>Island Construction</td>
</tr>
<tr>
<td>Excavation of Shallow Embayments to Enhance Habitat</td>
<td>Construction of Fishway With Habitat Enhancements</td>
</tr>
<tr>
<td>Concurrent Sediment Remediation and Habitat Rehabilitation</td>
<td>Creation of Bird - Waterfowl Habitat</td>
</tr>
<tr>
<td>Purchase of Land for Preservation of Pristine Habitat</td>
<td>Construction of &quot;Lunker&quot; or Other Wooden Structures</td>
</tr>
<tr>
<td>Reestablishment of Native Flora and Fauna</td>
<td>Preservation of Biodiversity</td>
</tr>
<tr>
<td>Use of Rights of Way to Reconnect Biological Corridors</td>
<td>Construction of Barriers to Exclude Unwanted Biota</td>
</tr>
<tr>
<td>Flow Modification or Alteration</td>
<td>Construction of Artificial Reef</td>
</tr>
<tr>
<td>Rehabilitation of Bass Spawning Habitat</td>
<td>Rehabilitation of Walleye Spawning Habitat</td>
</tr>
<tr>
<td>Rehabilitation of Trout Spawning Habitat</td>
<td>Rehabilitation of Northern Pike Spawning Habitat</td>
</tr>
<tr>
<td>Rehabilitation of Perch Spawning Habitat</td>
<td>Rehabilitation of Sunfish Spawning Habitat</td>
</tr>
<tr>
<td>Rehabilitation of Crappie Spawning Habitat</td>
<td>Rehabilitation of Shiner Spawning Habitat</td>
</tr>
<tr>
<td>Rehabilitation of Lake Sturgeon Habitat</td>
<td>Rehabilitation of Salmon Spawning Habitat</td>
</tr>
<tr>
<td>Rehabilitation of Reptile and Amphibian Habitat</td>
<td></td>
</tr>
</tbody>
</table>
intended to promote greater use of proven habitat rehabilitation and conservation methods throughout the Great Lakes Basin Ecosystem.

The two kinds of habitat projects implemented most frequently in Area of Concern watersheds were wetland rehabilitation or preservation projects (29 Areas of Concern) and shoreline and streambank stabilization (27 Areas of Concern)(Table 3 and Appendix 1). In general, there is a high priority for rehabilitating and preserving wetlands because of the historical loss during development (Environment Canada and U.S. Environmental Protection Agency 1994) and the relatively recent public acknowledgement of wetland values and functions (e.g. wetlands serve as breeding, nesting, feeding, and nursery grounds for fish and wildlife; help stabilize and maintain water table; help minimize erosion; help provide natural filtration of pollutants; help provide groundwater recharge; provide recreational opportunities). There is a high priority for shoreline and streambank stabilization, in part, because federal, state, and provincial programs provide resources for reducing nonpoint source inputs of pollutants and simultaneously enhancing habitat. Other reasons include concern for property loss and degradation of aesthetics.

Other common types of habitat rehabilitation and conservation projects included: channel modification (10 Areas of Concern), rehabilitation of trout spawning habitat (10 Areas of Concern), creation of bird-waterfowl habitat (12 Areas of Concern), re-establishment of native flora and fauna (12 Areas of Concern), and construction of barriers to exclude unwanted biota (10 Areas of Concern). These projects were priorities, in general, because of: the priority placed on maximizing high quality, native species and minimizing exotic and unwanted species; the considerable historical loss of wildlife habitat; or the considerable loss of habitat from channelization.

Comparing the number and type of habitat rehabilitation projects underway in the 43 Area of Concern watersheds (Table 3) with the status of quantitative fishery and habitat objectives and targets (Table 2) indicates that habitat rehabilitation and conservation activities are often not directly related to quantitative ecosystem objectives or targets. It may be that habitat rehabilitation is often undertaken on an opportunistic basis. Projects may occur as a result of: the initiative and primary interest of a local fishing club or nongovernmental organization; nonpoint source and erosion control programs that can simultaneously enhance habitat; local interest to conserve, preserve, or restore wetlands; opportunities through mitigation settlements; or other locally-led initiatives. Dodge and Kavetsky (1994) suggest that the reason for the opportunistic approach to habitat is that there is no basinwide habitat inventory or trend data. This has resulted in piecemeal habitat loss and development of piecemeal strategies and information.

In 1993 and 1994, there appeared to be a lack of connection between habitat modification initiatives and aquatic resource management objectives in Areas of Concern. If the intent of management is to achieve a desired future state of lake and watershed ecosystems through use of quantitative objectives, targets, and end points, then higher priority needs to be placed on establishing quantitative objectives. Such objectives can be effectively used to help
evaluate and select appropriate habitat tools, and implement priority actions. Perhaps one reason for the lack of connection between habitat modification initiatives and quantitative ecosystem objectives is that the process of ecosystem objective setting, in practice, is more art than science. It involves both hard and soft sciences, numerous disciplines, numerous stakeholders, and moral visioning.

Many of these habitat projects did not have strong monitoring and assessment components (i.e. nature, frequency, and/or extent of monitoring were insufficient to document effects on ecosystem structure and function). In 10 Areas of Concern, preliminary investigations and/or design studies were still underway in 1994 to provide data and information to be able to identify and evaluate habitat options. Monitoring programs in these 10 Areas of Concern were not finalized. In 16 Areas of Concern, either no assessment or monitoring was underway or planned, or routine monitoring was being performed (e.g. electrofishing surveys every three to five years) to track general status and trends. However, this routine monitoring lacked sufficient spatial and temporal sampling frequency to document fully effects on ecosystem structure and function.

Of the 43 Areas of Concern, only 16 had habitat projects implemented as of 1994 with strong monitoring and assessment components (i.e. nature, frequency, and/or extent of monitoring are intended to document effects on ecosystem structure or function). The 16 Areas of Concern with projects which had strong monitoring and assessment components included: Nipigon Bay (five-year restoration plan), Thunder Bay (five year restoration plan), Fox River/Green Bay (three walleye habitat projects), Collingwood Harbour (Black Ash Creek Restoration Project), Severn Sound (five-year rehabilitation program), Rouge River (Johnson Creek Project), Maumee River (Metzger Marsh), Black River (Lorain Reef Project), Cuyahoga River (Lakewood Reef), Rochester Embayment (Conesus Lake Project), Oswego River (Finger Lake Trout Habitat Project), Metro Toronto (wetland restoration projects, artificial reef construction, shoreline naturalization), Hamilton Harbour (five-year rehabilitation project), St. Clair River (Stage Island and Chenal Ecarte/Syndenham River Habitat Projects), Detroit River (Ruwe Marsh Project; Detroit Metropolitan Airport Wetland Mitigation Project), and Niagara River (Strawberry Island Project). It should also be noted that there were other projects in these 16 Areas of Concern which had monitoring that was not sufficient to document habitat modification effects on ecosystem structure and function.

In general, less than half of the habitat rehabilitation and conservation initiatives in Areas of Concern had assessment and monitoring programs which will lead to understanding their effect on ecosystem structure and function. This situation, in general, reflects a lack of connection between habitat modification initiatives and the scientific method and defined management or ecosystem objectives in many Areas of Concern. Based on these survey data and information, it is recommended that:

* greater emphasis be placed on adequate pre- and post-project assessment in order to quantify habitat-related problems, establish cause-and-effect relationships, evaluate and select appropriate habitat modification techniques, and quantify effectiveness relative to ecosystem
structure and function; and

* all available data and information on project effectiveness in the 16 Areas of Concern listed above be compiled and disseminated to be able to learn from different experiences and help provide the rationale for application of successful techniques elsewhere in the Great Lakes Basin Ecosystem.

Another need is for an easily understood way of thinking about and describing habitat, including the relationship between physical habitat and ecosystem structure and function. This is needed by practitioners and as a means of obtaining public understanding and support. This holistic approach to habitat would involve: describing habitat problems and requirements in an understandable fashion; ensuring that habitat inventories and data are in a form which can be accessed and used by management; recognizing and accounting for time and space/scale dimensions, and natural and human-induced variability; recognizing that habitat rehabilitation and conservation will often be implemented in an adaptive management context (based on experiments and demonstration projects); and ensuring that adequate data and information on the impacts of habitat alterations on ecosystem structure and function are available.

This simple conceptual way of thinking about habitat could then be used in multi-stakeholder processes to rehabilitate and preserve the Great Lakes Basin Ecosystem. Individuals and organizations involved in habitat must establish closer working relationships with organizations responsible for water quality, land use planning, recreation, and other interests. The intent is to develop a community of common interests and to build the capacity to rehabilitate and preserve the Great Lakes Basin Ecosystem.

**SETTING PRIORITIES**

If one agrees that habitat rehabilitation projects will often be implemented in an adaptive management context, then priorities must be set to help expend limited resources on a cost- and ecosystem-effective basis. In general, adaptive management calls for setting priorities, implementing actions, and measuring effectiveness in an iterative fashion for continuous improvement (Holling 1978). Two innovative management strategies are being used to help establish ecosystem priorities. The Nature Conservancy (1994) is using a biodiversity framework to identify: unique elements of biodiversity; human activities which place them at risk; and priority actions that can be taken to preserve those elements that are most important to the Great Lakes Basin’s biodiversity. The Nature Conservancy (1994) recommended four strategic activities to protect biodiversity in the basin:

* developing strategically coordinated, local projects that collectively address the most significant systems and stresses;

* improving the basic and applied science necessary for biodiversity conservation;
* increasing awareness of the basin's biodiversity and of methods to conserve that biodiversity; and

* increasing the support of regional institutions, both governmental and private, for the protection of biodiversity.

The Pacific Rivers Council (1993) also developed a strategy to set ecosystem priorities. Ecologically healthy watersheds require the maintenance and protection of the lateral, longitudinal, and vertical connectedness of the mosaic of habitat patches and ecosystem components within the watershed over time. However, most watersheds are already degraded and fragmented. The remaining relatively healthy undisturbed headwaters, riparian areas, biotic refugia (i.e. areas with relatively undisturbed, healthy habitat and processes that serve as refuges for biodiversity), and biological "hot spots" therefore play a vital role in supporting existing levels of health for the system, and in anchoring potential recovery efforts. As an initial step, The Pacific Rivers Council (1993) recommends identifying and protecting the remaining relatively healthy headwaters, biotic refugia, riparian areas, floodplains and smaller, intact, riverine habitats throughout the watershed. Following protection of these healthy areas, begin to rehabilitate the reaches between protected healthy areas and eventually link the healthy areas. This approach also calls for the active participation of local communities and citizens in implementing the steps and actions. The approach contrasts with traditional rehabilitation strategies which target the majority of resources on rehabilitating the most degraded reaches with little regard for the need of the overall ecosystem or for the opportunities for cost-effective, rapid biotic recovery (The Pacific Rivers Council 1993).

It should be noted that these are but two examples of priority setting frameworks. Individuals are encouraged to evaluate others or use these as a starting point in developing their own priority setting framework.

**CONCLUDING REMARKS**

Environment Canada and U.S. Environmental Protection Agency have identified the need for greater will to conserve and rehabilitate habitats (Dodge and Kavetsky 1994). Although this call for greater will to initiate action to conserve and rehabilitate Great Lakes habitats reflects a sincere sentiment to see the right things get done quickly, Zarull (1994) has recognized the degree of uncertainty in our knowledge of how systems do and should function, and the paucity of information that defines problems. Actions to rehabilitate and restore degraded environments should be taken based on an understanding of causes and predicted results. Adequate assessment, research, and monitoring are essential to define problems, establish cause-and-effect relationships, evaluate remedial options, select remedial actions, and document effectiveness. Such assessment, research, and monitoring are the foundation of effective ecosystem-based management, and in the end have proven to save money for both the public and private sectors (Zarull 1994).

Based on the 1994 habitat project survey, aquatic habitat rehabilitation and
conservation projects are underway in the watersheds of all 43 Areas of Concern (Table 3; Appendix 1). Collectively, this information demonstrates the broad extent and diversity of habitat rehabilitation and conservation efforts throughout Area of Concern watersheds. This information on aquatic habitat rehabilitation and conservation projects in Areas of Concern (Appendix 1) is intended to make individuals and organizations aware of the range of habitat rehabilitation and conservation techniques in use, provide summary information to aid in the habitat methods selection process of future initiatives, and provide contact persons for follow-up.

Based on a review and evaluation of the status of management efforts to rehabilitate and conserve aquatic habitats in Great Lakes Areas of Concern, it is concluded that there frequently is a lack of connection between habitat modification initiatives and aquatic resource management objectives and the scientific method in Areas of Concern. Recommendations to address this lack of connection include:

* higher priority should be placed on filling current habitat knowledge and data gaps, and on establishing quantitative, fish community and habitat objectives, targets, or end points for Areas of Concern in order to help direct rehabilitation and conservation efforts, and help evaluate and select appropriate habitat modification techniques;

* greater emphasis should be placed on adequate pre- and post-project assessment in order to quantify habitat-related problems, establish cause-and-effect relationships, evaluate and select appropriate habitat modification techniques; and quantify effectiveness relative to ecosystem structure and function; and

* all available data and information on habitat project effectiveness in the 16 Areas of Concern listed above should be compiled to learn from different experiences and help provide the rationale for application of successful tools in other parts of the Great Lakes Basin.

These recommendations, if implemented, will help strengthen the scientific basis for habitat management actions and help fulfil the commitment for use of a systematic and comprehensive ecosystem approach in management of the Great Lakes (United States and Canada 1987; Great Lakes Fishery Commission 1992).
LITERATURE CITED


APPENDIX 1

A SURVEY OF AQUATIC HABITAT REHABILITATION AND CONSERVATION PROJECTS IN WATERSHEDS OF GREAT LAKES AREAS OF CONCERN

SURVEY INFORMATION IS PRESENTED IN NUMERICAL ORDER AS IDENTIFIED IN FIGURE 1
1. Peninsula Harbour

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<th>Aquatic Habitat Rehabilitation and Conservation Projects</th>
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* The North Shore of Lake Superior Remedial Action Plan Team and Peninsula Harbour Public Advisory Committee are currently working with the town of Marathon to develop concepts for a new marina/park facility. Habitat components will be incorporated into the marina and breakwall design to enhance the aquatic ecosystem and provide public access and recreational opportunities.

* Sediments in Peninsula Harbour contain elevated levels of mercury and other contaminants which have caused public advisories to be issued for the consumption of larger sizes of suckers and lake trout. As mercury levels in sediments have only slightly decreased over time, investigations to interrupt methylation in the sediments by chemical or physical means have been initiated. Current flow studies, sediment analyses, and a series of bioassays using sediments to test potential methods for slowing or blocking the mercury methylation process have been completed. Further investigations will include in-situ remediation experiments and a mercury modelling study related to remedial options.

2. Jackfish Bay

Aquatic Habitat Rehabilitation and Conservation Projects

* The Blackbird Creek system, including Moberley Lake and Lake A, has been impacted due to its role as effluent receiver for the Kimberly-Clark Canada Inc. Mill. Since 1992, a number of investigations have been initiated to improve water quality, rehabilitate Moberley Lake, and reduce the contaminants entering Lake Superior by stabilizing sediments and creating enhanced terrestrial and aquatic habitat. In 1994, the physical properties of Moberley Lake were investigated to evaluate the option of lowering the lake level to isolate and rehabilitate contaminated sediments. Lakehead University, Kimberly-Clark, and other partners have also studied contaminant uptake in aquatic vegetation, inventoried habitat, and examined methods of colonizing Moberley Lake with aquatic plants.

* Rehabilitation of lake trout spawning habitat is being assessed by the Jackfish Bay Public Advisory Committee and Remedial Action Plan Team. These inshore areas of Jackfish Bay, adjacent the mouth of Blackbird Creek, have been degraded by deposition of wood fiber since mill operations commenced in 1948.

3. Nipigon Bay

### Aquatic Habitat Rehabilitation and Conservation Projects

A five-year plan to restore native fish stocks and rehabilitate degraded habitat began in 1990. The Great Lakes Cleanup Fund projects include:

* 12,000 adult walleye were stocked into the Nipigon River in an effort to restore the population. Monitoring of the stock has documented successful natural reproduction which is attributed to improvements in water quality, fishing regulations, habitat enhancement, and stocking.

* Severe water level fluctuations, caused by power generation, have caused shoreline damage in the Nipigon River and Lake Nipigon, and has created conflicts among resource users. The Nipigon River Water Management Plan is an exercise in public involvement and consensus building which has provided an important model for large river management and conflict resolution elsewhere.

* The Red Rock Marina is an example of how a breakwall structure can be functional both structurally and ecologically. The standard rock and armor stone wall has been overlain with a "living skin" of trees and shrubs. Habitat diversity is maximized by creating more edge and constructing a littoral zone on the inside of the breakwall through the addition of logs and boulders, root wads, and log crib shelters. Spawning by lake trout and lake whitefish on the new breakwall and shoals has been successful.

* Clearwater Creek has been degraded from bank destabilization, channel realignment, silt deposition, and debris accumulation. With strong community support and involvement, a rehabilitation strategy for Clearwater Creek has been prepared which will include removal of silt, channel and floodplain reconstruction, restoration of instream diversity by creating pool/riffle sequences and replacing instream cover, and stormwater management features. A general cleanup of garbage and debris is complete and the first phase of reconstruction was underway in 1994.

* Removal of debris and wetland rehabilitation has been completed simultaneously at an abandoned saw mill and ground wood pulp mill site at the mouth of the Nipigon River. Natural regeneration of aquatic plants has occurred in the nearshore areas of this site. In addition, debris dislodged by a major landslide was removed from the lower Nipigon River.

* Monitoring and assessment of Cleanup Fund projects has been ongoing since 1990 and has included a telemetry study of walleye movement in the Nipigon River. Results are compiled in data reports. To monitor rehabilitation of native fish stocks in the lower Nipigon River, a creel survey jointly funded by Ontario Ministry of Natural Resources,
3. Nipigon Bay (continued)

Aquatic Habitat Rehabilitation and Conservation Projects

Ontario Hydro, and the Nipigon Bay Remedial Action Plan, has been completed for three consecutive open water seasons (1992-1994).

### 4. Thunder Bay

#### Aquatic Habitat Rehabilitation and Conservation Projects

A five year habitat rehabilitation plan to restore estuarine diversity with wetland creation, shoreline and streambank stabilization, and island creation began in 1990. The Great Lakes Cleanup Fund projects include:

* Loss and degradation of habitat and reported declines in the Current River walleye population prompted the restoration and enhancement of spawning grounds at the mouth of the river through the placement of gravel, cobble, and boulders. Monitoring at the site has shown successful spawning and production of larval walleye from the new substrate.

* At McVicar Creek, infilled from erosion, a natural stream profile was recreated by dredging the creek bottom and replacing gravel and boulders. Steam banks were protected from further erosion by installing gabion mats. With the help of Tree Plan Canada and volunteers from the community, planting of the steep bank is helping to stabilize the soil, provide wildlife habitat, and improve aesthetics.

* Sanctuary Island was constructed in 1993 off the mouth of McVicar Creek. Its crescent shape is designed to foster the natural development of a wetland and restore some diversity to an area affected by harbor development. Underwater features, such as rock shoals and sediment traps, and pockets of topsoil, add habitat value to the standard armor stone berm construction. In only one season, three species of aquatic plants have already colonized the inner bay. Planting of the topsoil pods with indigenous species has been accomplished with Tree Plan Canada partnership.

* The provision for flood protection by directing the flows of two rivers through one uniform channel destroyed habitat diversity within critical stretches of two productive Thunder Bay waterways. Four embayments were excavated into the bank of the floodway to create shallow, sheltered areas for fish and invertebrate production.

* In partnership with the City of Thunder Bay, a more habitat friendly dock structure was constructed at a heritage park. This section is constructed on steel piles away from the shore and provides habitat values at a cost savings of about $400,000 (as compared to conventional dock construction).

* Two shallow embayments have been excavated off the McKeller River into Mission Island to provide critical habitat for spawning, nursery, shelter, and food production for species such as northern pike, walleye, yellow perch, and smallmouth bass. Assessment of the ponds includes monitoring benthic invertebrates, aquatic plants, fish, and water and sediment quality.
4. Thunder Bay (continued)

Aquatic Habitat Rehabilitation and Conservation Projects

* An annual shoreline cleanup dubbed "Wake Up to Your Waterfront" brought out 2,500 volunteers to remove thousands of tons of garbage and debris from 125 km of waterfront in 1993 and 1994. An industrial challenge was added to the event in the second year.

* Bacterial contamination at Chippewa Beach in Thunder Bay Harbour has been a serious use impairment identified by the Thunder Bay Remedial Action Plan Public Advisory Committee. Site investigations, which revealed several potential causes for contamination, have resulted in improvements to the park septic system. In addition, the City of Thunder Bay has agreed to divert stormwater runoff from the park and Thunder Bay Zoo.

* Construction of the Current River Fishway was completed in fall 1992. Habitat enhancements were completed below the fishway to provide unrestricted access for anadromous species to the base of the fishway and increase habitat diversity.

* A fixed velocity barrier in the McIntyre River, to prevent lamprey from migrating to upstream spawning areas, was completed in September 1993. Post-construction assessment has been completed over the last two years and future assessment of lamprey migrations will verify the effectiveness of this experimental non-chemical barrier.

* Monitoring and assessment of Cleanup Fund projects has been ongoing since 1990 and includes sampling the fish, macrophyte, and benthic communities. Results are compiled in data reports.

* Arising from a commitment to transfer information from habitat projects, an international workshop on Habitat Conservation and Restoration Strategies (HabCARES) was held in November 1994. Proceedings will be published in the Canadian Journal of Fisheries and Aquatic Sciences in 1996. The contact person is Dr. John Kelso, Dept. of Fisheries and Oceans, Sault Ste. Marie, Ontario.

* The operation of a sawmill and wood preserving plant on the harborfront has resulted in the most significant soil and sediment contamination in Thunder Bay. In addition, an important wetland has been reduced to a fraction of its former size through incremental industrial growth. A concept design has been produced which will address the issues of sediment containment and remediation, prevention of further contamination, habitat rehabilitation, and public access to the waterfront in a situation where everyone is involved and all can benefit.

Contact person: J. VanderWal, Lake Superior Programs Office, Thunder Bay, Ontario.
5. St. Louis River

### Aquatic Habitat Rehabilitation and Conservation Projects

- **Wisconsin** will acquire about 2,830 ha (7,000 acres) of land to create the St. Louis and Red River Streambank Protection Area for the protection of in-stream fisheries and water quality.

- **Wisconsin Department of Natural Resources (WDNR)** constructed a wooden crib on a spit of land next to Allouez Bay within the Wisconsin Point bird management area. The crib will be filled with sand to provide stable, safe nesting area for common terns.

- Living and dead vegetation from Interstate Island was removed and the shoreline riprapped to prevent erosion as part of an effort to create habitat for the common tern and piping plover. In addition, tern decoys were placed in the area and recordings of terns were played to attract birds to the site. An estimated 212 nests were sited during the nesting season in 1993 and 142 common terns have fledged from this site.

- An electric fence measuring approximately 100 m by 50 m in 2 m rows was set up on Wisconsin Point to keep predators (e.g. gulls) away from nests. In addition, a 1 m fence was constructed to exclude molting geese from the tern nesting area.

- $2.2 million has been appropriated by the State of Minnesota to purchase lands along the St. Louis River. Much of this land is undeveloped and has been owned by Minnesota Power. The St. Louis River Board has selected a total of 8,903 ha (22,000 acres) of land for purchase. The present appropriation provides one-third of the funds needed. The purchase of these lands will preserve some of the pristine habitat along the river to help maintain an undeveloped river corridor.

- The Fond du Lac Tribe is attempting to reintroduce wild rice into the St. Louis River below the Fond du Lac Dam. In the fall of 1993, three areas were seeded near Boy Scouts Landing. Some of the rice came up this summer, however, there were problems with waterfowl eating the rice before it could reseed the area. Reservation technicians will be seeding larger areas in the coming years and will be gathering information on factors that may be affecting the success of the reintroduction.

- Funding has been recently secured by the Minnesota Department of Natural Resources (DNR) to conduct two habitat enhancement projects in the St. Louis River estuary. The purpose of both projects is to improve aquatic and wetland habitat. One site, Grassy Point, requires removal of woody and other debris, planting of native vegetation, and restoration of the wetland. The other site is on Hearding Island, which was created from dredged material and is managed as a wildlife refuge. The DNR will clear 10.1 ha (25 acres) of upland and wetland areas of exotic species and will plant native beach and
5. St. Louis River (continued)

Aquatic Habitat Rehabilitation and Conservation Projects

wetland plant species.

* A Frog Watch project was begun in spring of 1994 as part of the St. Louis River Watch program. Families volunteered to go out to the river on three evenings between spring and mid-summer and listen for frogs. The frog species and numbers were determined by the frog call, if possible, and recorded on a data sheet. These data will be used as baseline information to help determine the health of the frog population (and its habitat) in the St. Louis River. It will also be compared to other data being collected throughout the state.

Contact person: Mary Ann Koth, Minnesota Pollution Control Agency, Duluth, Minnesota.
6. Torch Lake

Aquatic Habitat Rehabilitation and Conservation Projects

Torch Lake is part of a larger U.S. Environmental Protection Agency (EPA) Superfund site that includes all of Torch Lake, part of Portage Lake and the Keweenaw waterway, and several individual sites on the Keweenaw Peninsula. Historically, most of the western shore and over 20% of the lake (present mean depth is 17 m) was covered or filled with copper ore tailings from local mining and smelting activities, beginning in the 1860s for about 100 years. Eventually, most of the tailing piles on the lakeshore were re-mined or hydraulically dredged, treated to remove copper, and discharged back to the lake along with copper concentrating chemicals. U.S. EPA’s Record of Decision, issued September 30, 1991 for Units I and III of the Superfund site, calls for capping (applying a cover of soil and vegetation) of 179 ha of tailings and 3.6 ha of slag in the Torch Lake Area of Concern. In lieu of this decision, the U.S. Department of Agriculture - Soil Conservation Service (U.S.D.A.- S.C.S) has continued experimenting with various capping procedures in an effort to stabilize stampsand piles. These onsite studies are needed to provide factual data dealing with revegetation of the stampsands. Progress has been made toward a successful method of capping. Economic aspects are also being considered. The U.S.D.A.- S.C.S. will be performing follow-up studies to determine effectiveness of the different test plots.

Contact person: Ray Juetten, Michigan Department of Natural Resources, Baraga, Michigan.

7. Deer Lake-Carp River Watershed

Aquatic Habitat Rehabilitation and Conservation Projects

* Site specific efforts are being taken to preserve/conserve existing wetlands in the Carp River watershed through the Michigan Department of Natural Resource’s Wetland Permit Program under the Inland Lakes and Steams Act.

Contact person: Del Siler, Michigan Department of Natural Resources, Gladstone, Michigan.
### 8. Manistique River

**Aquatic Habitat Rehabilitation and Conservation Projects**

* In 1992, a streambank restoration project was completed on the main branch of the Fox River (a tributary of the Manistique River) in Schoolcraft County. At 12-15 sites, streambanks were stabilized with field stone to help prevent erosion and enhance habitat. Follow-up monitoring (i.e. sediments, benthos, fisheries) is being performed to evaluate effectiveness of rehabilitation efforts.

* During 1993 and 1994, the Manistique River Partnership Council was instrumental in obtaining a $35,000 federal planning grant to inventory eroding banks in the Manistique River Watershed. To date, $23,000 in private funds have been committed for implementation of actions to rehabilitate eroding banks and construct sediment traps. Additional funds are also being sought.

Contact person: Steve Scott, Michigan Department of Natural Resources, Newberry, Michigan.

### 9. Menominee River

**Aquatic Habitat Rehabilitation and Conservation Projects**

* The City of Marinette, Wisconsin has had the authority to establish a bulkhead line removed in the lower river in order to preserve and protect a marsh.

* In Menominee, Michigan, a permit to fill a recently dug slip off the lower river was granted, with mitigation of habitat loss being considered.

* As a part of the Federal Energy Regulatory Commission relicensing process, a proposal has been developed to investigate the feasibility of removing the Grand Rapids Dam to facilitate fish passage. The dam is 32 km upstream from the river mouth.

* Future plans call for the mechanical transfer/movement of sturgeon around the first two dams on the Menominee River (Federal Energy Regulatory Commission relicensing in 2015).

Contact person: Brian Belanger, Wisconsin Department of Natural Resources, Marinette, Wisconsin.
10. Fox River/Southern Green Bay

Aquatic Habitat Rehabilitation and Conservation Projects

* Three projects have been undertaken in the past few years which were designed to help increase recruitment of walleye. These projects include:
  - creating 335 m of walleye spawning habitat at one location along the Fox River in Voyageur Park in 1990;
  - enhancing walleye spawning habitat during the construction of a boat launching facility in DePere in 1992; and
  - stabilizing the shoreline and enhancing walleye spawning habitat during the repair of a sewer line at the Brown County Fairgrounds in the late 1980s.

Follow-up monitoring has been performed to document the effectiveness of these projects (e.g. spawning success, year class strength, return of mature males).

* 68 ha of wetlands have been acquired within the West Shore Wildlife Area and 46 ha north of Duck Creek for preservation and conservation purposes.

* 20 private pothole wetlands have been restored in the Fox River Basin (4.2 ha).

* A permanent barrier to sea lamprey migration was constructed in 1988 by U.S. Army Corps of Engineers and the Wisconsin Department of Natural Resources at Rapide Croche Dam.

* The Remedial Action Plan Biota and Habitat Committee, the U.S. Environmental Protection Agency, and the U.S. Fish and Wildlife Service have used wetland inventories to identify critical wetlands and habitats for protection and enhancement (completed in 1993). Follow-up is underway.

Contact person: Terry Lychwick, Wisconsin Department of Natural Resources, Green Bay, Wisconsin.
## Aquatic Habitat Rehabilitation and Conservation Projects

* Each year, Wisconsin Department of Natural Resources, along with the Soil Conservation Service, restores wetlands that have been farmed previously. More than 15 wetlands have been restored throughout the Sheboygan River Basin.

* Lunker structures have been installed along the Pigeon River in the Sheboygan River Basin. This effort increased the quantity and quality of habitat in the Pigeon River for trout and salmon. The structures provide bank cover, create overhangs, and give the streambank greater stability and protection from erosion.

* Thomas Industries Stormwater Detention Facility: This project was initiated to collect stormwater runoff from an existing and expanding industrial area. The pond will be about 1.6 ha in size. Since the pond is located adjacent to a high quality beech forest, the design incorporates extensive natural landscaping to enhance the overall value of the area.

* The Sheboygan River Watershed Nonpoint Source Abatement Program encourages farmers and other landowners to restrict livestock access to rivers through cost-sharing activities such as fencing and streambank stabilization. In cooperation with these efforts, the Sheboygan County Conservation Club has given more than $16,000 to augment cost-sharing of streambank practices improving wildlife habitat for both the Sheboygan and Milwaukee River Watersheds.

Contact person: Marsha Jones, Wisconsin Department of Natural Resources, Milwaukee, Wisconsin.
12. Milwaukee Estuary Watershed

Aquatic Habitat Rehabilitation and Conservation Projects

* Contaminated Sediment Removal at Ruck Pond (Cedarburg): This pond is the furthest upstream pond on Cedar Creek that was highly contaminated with PCBs. Wisconsin Department of Natural Resources' Solid and Hazardous Waste Program worked out a cooperative agreement with the responsible party to remove the contaminated sediments from the pond. This project was completed in the fall of 1994. This pond is one of four ponds on Cedar Creek that are suspected of contributing PCB contamination to the Milwaukee River.

* North Avenue Dam Impoundment Restoration: Work will begin in the summer of 1995 to restore the Milwaukee River in the vicinity of the North Avenue Impoundment and Milwaukee Estuary. Phase I of the restoration includes implementing contaminated sediment management practices, restoring fish and wildlife habitat, and removing the 24.4 m wide section of the dam that is currently obstructing flow in the Milwaukee River. The over 100 year old North Avenue Dam created a 32.8 ha impoundment. The surface water in the impoundment is considered degraded. Water-based recreational uses and aquatic and wildlife habitat are limited by low dissolved oxygen, elevated levels of turbidity, algae, temperature, bacteria, poor cover, and sediments contaminated with PCBs, PAHs, heavy metals, and oxygen demanding materials. A feasibility study for addressing these problems was completed in the summer of 1994. Implementing the feasibility study's recommendations will involve managing about 573,599 m$^3$ of contaminated sediment, thereby reducing exposure to humans, fish, and wildlife using the area. In addition, in-stream wetland and upland habitats will be restored for use by fish and wildlife, including recreational sport fish, non-game fish species, shore birds, waterfowl, and other terrestrial wildlife. A comprehensive park and recreational use plan was also developed for the area surrounding the site emphasizing passive recreational uses and environmental education. This is a major effort among the Wisconsin Department of Natural Resources, City of Milwaukee, Milwaukee County, and many private landowners. Funding is being contributed by Federal and State Nonpoint Source Pollution Abatement Programs, the Milwaukee Estuary Remedial Action Plan, the City of Milwaukee, and Milwaukee County.

* Each year, Wisconsin Department of Natural Resources, along with the Soil Conservation Service, restores wetlands that have been farmed previously. More than 20 wetlands are restored each year in the Milwaukee River Basin.

* Hoyt Park Streambank Stabilization Project: Approximately 122 m of eroding streambank (2 m high) along the Menomonee River were stabilized using bioengineering techniques, including live fascines (bundles of plant material), brush mattresses, and live
stabilized. The combination of these techniques stabilized the streambank, while enhancing riverine habitat.

* Woolen Mills Dam Impoundment Restoration: The City of West Bend completed a major impoundment restoration in 1992. Riverside Park was developed out of the former Woolen Mills Dam. The city removed the dam, which created more than 24 ha of parkland, and with the assistance of Wisconsin Department of Natural Resources, restored the impoundment and created the park. The new Riverside Park, alive with native grasses and wildflowers, provides residents with the opportunity to enjoy the outdoors with its canoe launch, athletic fields, and riverfront trail.

* Village of Campbellsport Prairie Restoration: An area that was formerly farmed was restored along the Milwaukee River, and is now used for a nature trail as part of Campbellsport Park. The trail was planted with natural prairie landscaping of native flowers and grasses.

* Menomonee River Steambank Stabilization/Restoration: A 46 m long area (6 m high) along the Menomonee River in the City of Wauwatosa has been stabilized using a combination of live plantings and a gabion toe. The toe is being used to prevent bank undercutting, while the plantings will enhance riverine wildlife habitat.

Contact person: Marsha Jones, Wisconsin Department of Natural Resources, Milwaukee, Wisconsin.
### Aquatic Habitat Rehabilitation and Conservation Projects

* The City of Waukegan, State of Illinois and the Waukegan Park District are demonstrating the effectiveness of vegetative stabilization along the Waukegan River in urban parks where high velocity floodwaters have damaged park bridges and city sewer lines. Under provisions of Section 319 of the Clean Water Act, the Illinois Environmental Protection Agency (EPA) and U.S. Environmental Protection Agency have funded innovative steam stabilization efforts which increase instream habitat while controlling bank erosion. The urban restoration techniques included construction of "lunker structures" (i.e. large wooden boxes with both ends and the streamside open; wooden stringers and rebar are used to anchor the boxes into the bank and streambed) and use of "A-jacks" (i.e. interlocking concrete jacks which help stabilize stream banks during high intensity storms; dense root systems of willows, dogwood, and grasses will then intertwine throughout the "A-jacks" and provide additional stability). These structures have been placed at three of the most erosive sites and have withstood the severe flooding of 1993 (10.2 cm rain in one hour) without need of repairs. The Illinois EPA and Illinois Department of Conservation are determining the degree of habitat enhancement and gamefish response in a long-term monitoring program. At the Franklin Creek State Park site (north central Illinois), the lunker enhancement resulted in a 300% increase in smallmouth bass fry survival and a 50% increase in largemouth bass residence.

* Waukegan River Rock Riffle Restoration Project: The Illinois State Water Survey and the Waukegan State Park District have proposed a two-year project to create a series of pools and riffles in the Waukegan River to increase aeration and improve habitat for aquatic life. The proposed techniques for recreating riffles should prevent further streambank erosion and will act as protection for the sewer stream crossings. When combined with vegetative bank stabilization, this process will reverse the instability created by runoff and early channel modifications. In addition, the creation of riffles will improve water aeration during normal stream flows when urban streams typically have very low oxygen levels. The stream habitat improvements resulting from the creation of deep pools, rock riffles, and increased water aeration will provide strong positive benefits for aquatic life. A proposal for this project was submitted to the Illinois EPA in 1994. Restoration activities are projected to take two years to complete following project approval.

* Waukegan River Wetland Demonstration Project: The Illinois EPA and the Lake County (Illinois) Stormwater Management Commission have both identified the Waukegan River watershed for intensive study and development of controls for urban stormwater runoff. The Waukegan River is a direct tributary to Lake Michigan near Waukegan Harbor. A large area of degraded wetlands exists in the upper part of the
13. Waukegan River Watershed (continued)

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Wetlands Research Inc. will study the feasibility of restoring the wetlands in the watershed to manage stormwater, reduce stream bank erosion, improve water quality, and work with the local Citizens Advisory Committee for the Waukegan Harbor Remedial Action Plan to evaluate the plan. The study will determine the potential water quality improvements from three different types of wetland restoration projects (one each in Illinois, Wisconsin, and Michigan). Results of these pilot projects will be promoted at a series of regional workshops for government agencies and citizens groups so that similar efforts can be created around the basin.

* Shoreline Stabilization at Illinois Beach State Park: In 1994, a beach restoration project for the Illinois Beach State Park in Zion, Illinois was implemented by the Illinois Department of Conservation and the Illinois State Geological Survey. Approximately 20,000-23,000 cubic meters of washed pea gravel will be used to slow downstream shoreline erosion. Monitoring of transport rates will provide sound baseline data on how and where future beach nourishment activities will achieve the best results.

Aquatic Habitat Rehabilitation and Conservation Projects

* The RAP process has begun ecosystem restoration through several habitat restoration projects in the Area of Concern pursuant to the Stage 2 Habitat Component.

* A new State Nature Preserve on the Grand Calumet River in Gary Indiana, has been acquired through natural resource damage litigation of the Midco I and II Superfund sites. Called the "Bongi property", this 102 ha (253 acre) parcel contains one of the highest biodiversity areas of vascular plants in the State and is part of the historical Chicago Lake Plain of dune and swale topography. Of the "Bongi property", 19 ha are pristine and not modified in any way, 41 ha are modified but still represent high quality habitat, and the remaining 42 ha have residual contamination and are highly degraded, but are showing signs of recovery. The State has placed the value of this resource at $1.8-2.4 million. Another benefit is that this parcel is across the street from the Clark and Pine Nature Preserve, which is approximately 41 ha in size. Taken together, these parcels account for 143 ha of contiguous dune and swale habitat. Under this settlement, the "Potentially Responsible Parties" acquired the "Bongi property" in an expedited and cost-effective manner. A restoration plan will be developed. There is a unique opportunity to develop and test restoration techniques. The 19 ha of pristine habitat can be used as a benchmark, where the success of any restoration option, including natural recovery, can be compared to the benchmark.

* A RAP Rights of Way (ROW) Project has been initiated to cooperate with ROW owners to manage their land in an ecologically sensitive manner. This project includes railroads, utilities and pipeline companies in a joint effort to reconnect portions of the biological corridors which were once parallel to the lake shore.

Contact person: Wayne Faatz, Indiana Department of Natural Resources, Indianapolis, Indiana.
15. Kalamazoo River Watershed

Aquatic Habitat Rehabilitation and Conservation Projects

* During 1994, a $10,000 grant was awarded to the City of Portage (Kalamazoo County) to narrow and deepen a section of Portage Creek, a top quality trout stream, through an urban setting in Central Park. The Portage Creek trout fishery is maintained by supplemental stocking of trout and is the only major urban trout fishery in southwest Michigan. Portage Creek exhibits extremely stable flow regimes, but habitat for trout and other fish species is limited. Many portions of the creek have excessive amounts of sand and are wide and shallow. The City of Portage, through the Parks and Recreation Division, is in the process of completing a parkway along the creek’s banks through the city limits. This project is intended to be a demonstration project in a highly visible public area in order to show people what can be done to enhance aquatic habitat. An upstream sediment basin is an integral part of the project. It is necessary in order to maintain the proposed enhancements. Work is to be completed on the 91.4 m (300 foot) long demonstration project by November 1995. No formal evaluation will be conducted; however, a general fisheries survey of the project area will be completed 3 years after the project is done.

* In 1986, a large portion (oxbow) of Sand Creek (a wild trout stream in Allegan County) was dewatered when a heavy rainfall breached a bank. The segment dewatered was perhaps the best fish habitat section in the creek. Restoration of the bank, along with other minor fishery habitat enhancements, occurred in 1987. A 1991 population estimate in this area showed wild brook trout, rainbow trout, and coho salmon. In 1993, a portion of the stabilization had slumped and was in danger of washing out. In 1994, rock and log material was procured to maintain the site. Work was completed in October 1994. All work has been funded by the Michigan Wildlife Habitat Foundation and supervised by the Michigan Department of Natural Resources (DNR). The Kalamazoo Valley Chapter of Trout Unlimited is providing the manpower for the project.

* The same fall flood of 1986 also caused bank damage in two areas of Swan Creek, Allegan County, a trout stream maintained by stocking. Repair work was conducted on these sites, which is still stabilized. No evaluation occurred.

* Silver Creek is a top quality wild brown trout stream that starts in southern Allegan County and ends up in the Kalamazoo River in Kalamazoo County. Only one property along the entire stream was in serious need of rehabilitation. The landowner has allowed creek access to his cattle for decades, which were causing soil erosion estimated at the rate of 127.3 tonnes (140 tons) per year (estimates by U.S. Soil Conservation Service). After 6 years of unsuccessful negotiations with the Michigan DNR and the landowner, the Michigan Department of Agriculture, in conjunction with the U.S. Soil Conservation Service, convinced the landowner to fence the creek off and conduct habitat
16. Muskegon Lake Watershed

<table>
<thead>
<tr>
<th>Aquatic Habitat Rehabilitation and Conservation Projects</th>
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<tbody>
<tr>
<td>During 1994, a $3,300 aquatic habitat rehabilitation project on Cedar Creek (Muskegon County) was sponsored by Muskegon-White River Chapter of Trout Unlimited to stabilize banks and construct fish habitat structures. This is part of an ongoing effort to stabilize stream banks and enhance habitat for brook trout in a 6-7 km stretch of Cedar Creek. Specific actions include constructing fish habitat improvement structures, planting grasses and trees, matting, etc. This larger effort has been sponsored by the Muskegon-White River Chapter of Trout Unlimited, the Michigan Department of Natural Resources (DNR) Inland Fisheries Program, and the U.S. Forest Service. Approximately $20,000-30,000 has been spent since 1989.</td>
</tr>
<tr>
<td>Site specific efforts have also been taken to preserve/conserve existing wetlands in the Muskegon Lake Watershed through Michigan DNR’s Wetland Permit Program under the Inland Lakes and Streams Act.</td>
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</tbody>
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Contact person: Rich O’Neal, Michigan Department of Natural Resources, Grand Rapids, Michigan.

17. White Lake Watershed

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<tr>
<th>Aquatic Habitat Rehabilitation and Conservation Projects</th>
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<tbody>
<tr>
<td>From 1989 to present, efforts have been made to stabilize stream banks and enhance habitats on approximately 6-7 km of the Main Branch of the White River and Carlton Creek. Specific actions (e.g. constructing fish habitat improvement structures, planting grasses and trees, matting, etc.) were taken to stabilize banks and rehabilitate habitat for brook and brown trout, and anadromous fishes. These actions were taken primarily by the U.S. Forest Service and totalled about $15,000.</td>
</tr>
<tr>
<td>Site specific efforts have also been taken to preserve/conserve existing wetlands in the White Lake Watershed through Michigan DNR’s Wetland Permit Program under the Inland Lakes and Streams Act.</td>
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</tbody>
</table>

Contact person: Rich O’Neal, Michigan Department of Natural Resources, Grand Rapids, Michigan.
18. Saginaw River Watershed

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<tr>
<th>Aquatic Habitat Rehabilitation and Conservation Projects</th>
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<tr>
<td>The soil erosion control component of the Saginaw Bay National Watershed Initiative has been implementing best management practices which prevent soil erosion, decrease nonpoint source loadings, and enhance habitat. During the first three years of the Saginaw Bay National Watershed Initiative, the following accomplishments were noted relative to habitat:</td>
</tr>
<tr>
<td>* restored wetlands at 47 sites;</td>
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<td>* established stream filter strips (buffer strips) on 140 ha; and</td>
</tr>
<tr>
<td>* excluded livestock from 1,762 m of stream.</td>
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Contact persons: Brian Mastenbrook, Saginaw Bay National Watershed Initiative, University Center, Michigan; Gary Towns, Michigan Department of Natural Resources, Morrice, Michigan.
20. Severn Sound

Aquatic Habitat Rehabilitation and Conservation Projects

* A five-year Tributary Rehabilitation Program was initiated in 1991 to address elevated levels of phosphorus entering Severn Sound from six river systems that flow through agricultural areas, and to restore fish and wildlife habitat. To date, 29 km of river banks have restricted livestock access and over 34,150 trees have been planted on 13 ha of valley lands; eroded sections of river banks have been stabilized; and 6 alternate water sources for livestock have been provided. As a result, erosion has been controlled, sources of phosphorus have been minimized, and fish and wildlife habitat has been improved.

* Landowners along Hog River have fenced off the creek and planted trees under the Remedial Action Plan (RAP) Tributary Rehabilitation Program to restrict livestock access and restore valley lands along the creek.

* Canadian Pacific is creating fish habitat in a development proposed for the Port McNichol area. The developer was directed to the RAP Team by the Municipality as a result of the RAP Fish Habitat Management Plan.

* A partnership among the Town of Penetanguishene, the Federal Cleanup Fund, and Ontario Ministries of Natural Resources (MNR) and Environment and Energy has been established to undertake a Penetang Bay Habitat Restoration Project.

* Interim Fish Habitat Management Plan: An agreement by the Department of Fisheries and Oceans and three Ontario Ministry of Natural Resources offices prescribes the interim plan for managing fish habitat in Severn Sound. The plan was developed with the assistance of municipal representatives, Severn Sound Public Advisory Committee members, and agency representatives. It puts forth guidelines for activities in or near water according to broad habitat classifications (to be refined later), and will be widely available for reference at municipal offices to proactively guide land use decisions by landowners.

* Wetland Evaluations: Evaluation of several wetlands in Severn Sound has resulted in their classification for protection under the Planning Act.

### Aquatic Habitat Rehabilitation and Conservation Projects

* Shoreline Management Plan: The Ontario Ministry of Natural Resource's (MNR) Espanola Area office has developed a shoreline management plan for regulating activities that may affect nearshore habitat.

* Wetland Evaluation: The 300 ha wetland at the mouth of the Spanish River was evaluated in 1993 according to the Ontario MNR procedure for northern wetland classification. The wetland has been rated as provincially significant and is subject to protection under the Planning Act.

* Effluent Treatment: Installation of secondary treatment in 1983 at the E.B. Eddy pulp and paper mill at Espanola resulted in substantial improvements downstream, including the cessation of habitat degradation by bark and fiber. Construction has begun on a secondary treatment facility at the Espanola sewage treatment plant, which will further improve water quality in the river.

* Muskellunge Rehabilitation: A feasibility study for the rehabilitation of muskellunge in the Spanish River is under way. Results will help in the selection of remedial options for degraded fish populations.

Clinton River Watershed

Aquatic Habitat Rehabilitation and Conservation Projects

* Clinton River Spillway Weir: The spillway, a 3.2 km long cutoff to divert flood flows from 14.4 km of the lower river, was constructed in 1952. The weir was intended to confine low flows to the river, accept most flood flows, and provide flows to the spillway to avoid stagnation. Changing water levels in Lake St. Clair coupled with increasing sedimentation at its junction with the natural river, has severely reduced flows in the lower river. Federal funds have been secured by the U.S. Army Corps of Engineers to modify the existing weir and spillway system to restore flows in the lower Clinton River. Work during fiscal year 1994 included several environmental and engineering studies needed before actual construction activities begin. Water quality and fishery values will be greatly improved once this is accomplished. Fishery values, as measured by potential angling success, could exceed $0.75 million per year.

* Gallagher Creek Demonstration Project: This small brook trout "feeder" tributary to Paint Creek, which connects to the Clinton River, can no longer avoid development in its watershed. Clinton Township, Clinton River Watershed Council, Oakland University, Trout Unlimited, Michigan Department of Natural Resources, and local developers worked together to develop the best management practices to protect this high quality stream. The publication "Paint Creek (Gallagher Creek) Non Point Source Control Plan" is available through the Clinton River Watershed Council.

* North Branch Clinton River Smallmouth Bass Project: A section of the North Branch has undergone four years of summertime angler creel census, population studies, and bass tagging. The next step is to plan and implement stream habitat improvement to enhance the fishery. Follow up will include a repeat of the first phase.

* Paint Creek Habitat Improvement: For a number of years, local trout Unlimited Chapters have worked together in a 0.8 km stretch of southeast Michigan’s best trout stream. Shoreline stabilization with rock, lunker structures and other log structures have enhanced that section of the stream. This activity will be expanded as funds, manpower and permits become available.

* Lake Orion/Paint Creek water Quality Improvement Project: In 1991, a 46 cm diameter tube, 226 m long, was placed on the bottom of Lake Orion, tapping cold water from 19 m deep. A control structure discharges the bottom-draw flows through another 69 m of pipe under a five lane highway and into Paint Creek at the base of the Lake Orion dam. Summertime bottom draw temperatures (approximately 10-12 degrees C) are blended with lake surface dam discharge temperatures to maintain a downstream temperature below 21 degrees C. Brown trout were planted in 1992 immediately below the dam and thrived throughout the summer. Some 5-7 km of the stream were therefore improved for

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Aquatic habitat Rehabilitation and Conservation Projects

Year round trout survival. Cold water aquatic invertebrates "invaded" the area as well. Benefits to Lake Orion may include expanded habitat for fishes and invertebrates through the improved dissolved oxygen concentrations at greater depths and a reduction of nutrient storage in the basins affected by the bottom draw. Follow up studies continue.

Contact person: Jennifer Beam, Michigan Department of Natural Resources, Livonia, Michigan.
Aquatic Habitat Rehabilitation and Conservation Projects

* Fisheries Division of the Michigan Department of Natural Resources is working in partnership with Western Wayne County Conservation Association to preserve and enhance the cool water fishery habitat in Johnson Creek. Johnson Creek currently supports a brown trout population and a population of the "threatened species" red side dace. During 1994, tree revetments will be placed at four locations along Johnson Creek to curtail bank erosion and enhance habitat. In addition, rocks less than 30 cm (12 inches) will be placed along the leading edge of two existing natural islands to help minimize erosion and create habitat.

* Commerce Township is developing a Seeley Drain Fishery Management Plan to maintain and restore Seeley Drain and the Upper Rouge River from its origin at the confluence of Seeley Drain and Minnow Pond Drain downstream to Eight Mile Road. The intent is to protect it as a high quality headwater stream that supports a fish and aquatic invertebrate community characteristic of pre-settlement conditions in southeastern Michigan. In particular, maintenance of a healthy population of red side dace will be considered indicative of meeting this goal. Components of this plan include: protection against flow instability; protection from nonpoint source pollution; protection of floodplain wetlands; and maintenance of good water quality.

* The City of Southfield, Michigan received a 1989 Clean Waters Award from the Michigan Outdoor Writers Association for a simple aquatic habitat rehabilitation project in the Rouge River. During 1987 and 1988, six triangular wing wall deflectors were constructed of broken concrete and stone along a 0.5 km stretch of river to direct the current against the banks, which had already been riprapped with similar material. Those actions resulted in decreased bank erosion, increased current speed, and provided deeper pools in other areas. This resulted in creation of a sequence of deep pools and shallow riffles. The project was expanded by 0.8 km of river in 1993. Preliminary field observations have included: some stocked trout have survived the summer and winter and been caught by fisherman; some panfish and gamefish have been observed in this stretch of the river; and limited fish shocking surveys have found good numbers of cool water forage species, but no large predators.

* The Rouge RiverWatch adopt-a-stream project is bringing year-round stewardship to the Rouge River for the first time through community and school groups who are taking responsibility for sections of the river. The project was officially launched in June 1994, with 17 groups who have either adopted a section of the Rouge or one of its tributaries, or have expressed interest in doing so in the future. A training workshop was conducted June 18 and a manual of procedures and suggested activities was supplied to each group. Through the RiverWatch project, groups will conduct quarterly clean-ups and surveys of
23. Rouge River (continued)

Aquatic Habitat Rehabilitation and Conservation Projects

their section of the river, beginning in September. They have the option of monitoring the stream’s water quality and conducting pollution prevention and habitat enhancement projects.

* Friends of the Rouge have initiated a project of building nesting boxes for wood ducks, bluebirds, tree swallows, and brown bats. The project began during Rouge Rescue ’92 at University of Michigan-Dearborn where volunteers built and placed nesting boxes in the University’s outdoor education center (this activity was continued in 1994). Since then, the project has spread throughout the watershed. For the past two years, a teacher and the Monroe Elementary Nature Club in Wayne have placed nearly a dozen wood duck nesting boxes in that City’s natural area. There is evidence that some of the boxes are being used. An Eagle Scout Candidate in Garden City has led his troop in building dozens of bluebird boxes, and recently completed construction of 40 bat nesting boxes. Boy Scouts, Cub Scouts, and school groups in Birmingham, Bloomfield, Plymouth-Salem, Livonia, Dearborn, and Detroit have contributed to the project. As an added benefit in the Riverside Park section of Detroit (near Telegraph and McNichols), the community is reducing its annual insecticide spraying and relying more on bat nesting boxes to control mosquitoes.

* Two major tree planting projects were included in Rouge Rescue ’94 to enhance habitat and stabilize stream banks. In Detroit’s Rouge Park, Friends of the Rouge cooperated with The Greening of Detroit, Global Releaf, and the Detroit Parks and Recreation Department’s Forestry Division, to purchase and plant 15 sycamore trees. The trees were placed in a picnic grove near the river, with assistance of student athletes from Hartland, Michigan. In Novi, a City forester led Rouge Rescue ’94 volunteers in planting a variety of trees and shrubs in order to stabilize banks near the headwaters of the Upper Rouge close to Walled Lake.

* The City of Novi, along with the Michigan Department of Transportation, is developing several artificial wetlands to compensate for those destroyed during construction of Highway M-5.

* West Bloomfield Township is focusing on wetlands conservation through enforcement of a strong floodplain and wetlands ordinance with a detailed permit system. The Township utilizes a geographical information system (GIS) to map wetlands and floodplains and better manage their permitting process.

* As part of the Middle Rouge Parkway Improvement Plan, Wayne County Parks and Recreation Department is enhancing and preserving historical and natural resources in the
<table>
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<th>23. Rouge River (continued)</th>
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<td>Aquatic Habitat Rehabilitation and Conservation Projects</td>
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<td>floodplain.</td>
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* A wetland area adjacent to Willow Creek was developed to improve water quality and flood control.

Contact person: C. Bean, Michigan Department of Natural Resources, Livonia, Michigan.
24. River Raisin

Aquatic Habitat Rehabilitation and Conservation Projects

* Initially, the 8 ha Sharon Hollow Preserve was established on the north side of Sharon Mill Pond in Washtenaw County. This Preserve was expanded in 1992 by The Nature Conservancy to over 80 ha for the preservation of wetlands and other unique habitats. Currently, the Raisin Valley Land Trust is working in partnership with The Nature Conservancy to establish conservation easements along the Preserve property. In addition, the Raisin Valley Land Trust is working on establishing "green ways" along the river and its tributaries from Manchester to Clinton.

* The River Raisin Watershed Council began its fourth year in 1994 of creating vegetative buffer strips and wind breaks along tributaries of the River Raisin in Lenawee County. These buffer strips and wind breaks help reduce nonpoint source loadings and help create wildlife habitat. The River Raisin Watershed Council has provided $5,000 annually to this project. Those funds are matched with federal funding to the Lenawee County Soil Conservation Service District. Thus far, the project has established over 3.8 ha of buffer strips 9-20 m wide.

* Over the past six years the River Raisin Watershed Council, the Drain Commissioner, and concerned citizens have worked in partnership to remove logjams from the river. This not only increases flow and dissolved oxygen concentrations, but provides citizens with first-hand experience with the River Raisin. This is extremely important to help get people to "buy-in" to protection and enhancement of the river, and to foster an attitude of stewardship for the river.

* Related efforts to help enhance habitat include the efforts of the Soil Conservation Service to control nonpoint source pollution in the watershed. The watershed is dominated by intensive agricultural land use. Projects conducted by the Soil Conservation Service can lead to changes in agricultural practices which will greatly benefit the river and its tributaries.

Contact person: Ken Dodge, Michigan Department of Natural Resources, Jackson, Michigan.
### Aquatic Habitat Rehabilitation and Conservation Projects

* Grants from U.S. Environmental Protection Agency’s Great Lakes National Program Office and the Ohio Department of Natural Resources have allowed the Blue Creek Management Team to construct a wetland on 125 ha of City of Toledo property. The Blue Creek Project was designed primarily to study the effectiveness of wetlands in removing pollutants from runoff; however, one of the additional goals of the project is to enhance habitat. As of April 1994, the created wetland was attracting waterfowl even before vegetation had been established. Exposed mudflats and shallow-water margins have attracted birds such as the Greater Yellowleg, Common Snipe, Pectoral Sandpiper, Mallards, Canada Geese, and Killdeer.

* The state’s first restoration of a Lake Erie coastal marsh began in June 1994, with ground breaking for the creation and preservation of the Metzger Marsh Wildlife Area. The project is expected to last two years and will cost $4 million. A 2,347 m dike will keep carp and other lake impacts out of the marsh to protect the vegetation. Fish/water passages in the dike will enable water and most fish to flow in and out of the marsh. Water levels will be controlled for the first two years to allow the vegetation to flourish. The project is in support of the goals of the North American Waterfowl Management Plan, which seeks to increase waterfowl populations to levels of the 1970s. Ohio Division of Wildlife has set a target to reach this goal by the year 2000, primarily through habitat enhancement, protection, and management. The Metzger Marsh project will set the standards for further marsh restoration.

* The Open Space and Wetlands Action Group of the Maumee RAP is planning a stream bank reforestation project for 1995. An inventory of riparian land in the Area of Concern is being conducted and stream banks in need of riparian vegetation for habitat and erosion control will be targeted for tree planting events in the spring of 1995.

* Funding from the North American Waterfowl management Plan has enabled the Ohio Department of Natural Resources to provide cost-share funding for wetlands restoration on private lands in the Lake Erie Marsh focus area, adding over 51 ha of new and restored wetlands. A National Wildlife Foundation grant also provided cost-share funds for wetlands restoration on private lands. The Ottawa Soil And Water Conservation District completed three such projects in the last year, with five more being planned.

Contact person: Sue Thomas, Ohio Environmental Protection Agency, Columbus, Ohio.
Aquatic Habitat Rehabilitation and Conservation Projects

* Since 1991, Friends of the Black River have conducted numerous cleanups in sections of the Black River. Volunteers have constructed and maintained the Two Falls Trail area in Cascade Park, as well as removing literally tons of trash and debris. In 1993 and 1994, they co-sponsored underwater cleanups of the harbor and beach areas to help restore and enhance habitat. They are currently working with the Lorain Metro Parks on bank habitat restoration projects in the Black River Reservation. They have also established a volunteer monitoring program for water chemistry and stream conditions at several sites throughout the watershed. Several volunteers have been trained in the Ohio Environmental Protection Agency’s Qualitative Habitat Evaluation Index (QHEI) methodology. QHEI information from stream segments in the basin will be utilized to determine areas where habitat problems are of concern.

* $200,000 in Federal funding was awarded to farmers in the Black River basin in 1992 and applied towards equipment buy downs, installation of buffer strips, and conservation tillage/cover crop measures. An additional $20,000 was awarded in 1994 to expand the buffer strip program. Over $10 million in low interest loan funds is being requested by basin farmers to continue expansion of conservation measures over a 20 year period. As a part of the loan application process, a watershed management plan for the agricultural community has been developed.

* In 1993, the Lorain Soil and Water Conservation District received over $150,000 in a grant from the Great Lakes National Program Office for an agricultural wetlands/habitat restoration project along Charlemont Creek in the upper watershed of the basin. This was a joint project with the support of the Black River RAP, Lorain Metroparks, Oberlin College, Ohio Department of Natural Resources - Division of Wildlife, and Pheasants Forever.

* The Black River RAP Coordinating Committee established a Habitat Restoration subcommittee in 1994. This group is charged with addressing issues such as regional planning, conservation easements, logjam removal, and riparian zone protection ordinances. They will also be involved coordinating, planning, and showcasing riparian zone surveys and habitat restoration projects.

* In 1981, Ohio Sea Grant constructed two artificial reefs off the mouth of the Black River in Lorain. Underwater videos taken in 1989 indicated large concentrations of smallmouth bass and extensive zebra mussel growth at the two reefs. Subsequent fishing reports showed consistently good catches of yellow perch, walleye and smallmouth bass. 1990 videos revealed vast numbers of smallmouth bass, with only a few yellow perch. 1990 fishing reports were consistent with 1989. Zebra mussels cover all the reefs, but
Aquatic habitat Rehabilitation and Conservation Projects

this does not seem to affect fish numbers or catch. A 1993 video assessment showed significantly more fish at the reef sites than the control sites (24:1). 93% of the fish captured on video were smallmouth bass; however, walleye have been documented as the most prevalent catch at the reefs. Walleye are known to be camera shy, so video assessments may not be reliable in documenting fish presence. Research will also focus on the interaction between zebra mussels and sponges at artificial reefs.

Contact person: Kelvin Rogers, Ohio Environmental Protection Agency, Twinsburg, Ohio.
27. Cuyahoga River

Aquatic Habitat Rehabilitation and Conservation Projects

* The Cuyahoga RAP Habitat Work Group undertook a survey of highly eroding sites along the main stem of the Cuyahoga River in the Area of Concern. Approximately 25 sites were identified. The Work Group is now seeking opportunities to revegetate these areas. Ohio Department of Natural Resources and Cleveland Metroparks are teaming up on a willow post project at one site. The Cuyahoga County Soil and Water Conservation District has received funds to do a restoration project at a second site. Several other projects are in progress.

* In 1981, Ohio Sea Grant constructed an artificial reef Cuyahoga County (Cuyahoga River Area of Concern). During 1984-1989, a total of 12,700 tonnes of broken sandstone and concrete rubble were placed in about 8.5 m of water at three sites creating the Lakewood reef (167 m long). Underwater videos taken in 1989 indicated large numbers of smallmouth bass and extensive zebra mussel growth at the reef. Many yellow perch were present with only one smallmouth bass. Subsequent fishing reports showed consistently good catches of yellow perch and walleye. 1990 fishing reports were consistent with 1989. Zebra mussels cover all the reefs, but this does not seem to affect fish numbers or catch. A 1993 video assessment showed significantly more fish at the reef sites than the control sites (24:1). 93% of the fish captured on video were smallmouth bass; however, walleye have been documented as the most prevalent catch at the reefs. Walleye are known to be camera shy, so video assessments may not be reliable in documenting fish presence. Research will also focus on the interaction between zebra mussels and sponges at artificial reefs.

* The Northeast Ohio Areawide Coordinating Agency (NOACA) is sponsoring a new initiative called "Willow Planting Day" in the Greater Cleveland area. NOACA is working in concert with the Cleveland Metroparks to distribute willow shoots to local actively eroding locations. Three local groups were involved in the first planting day on October 15, 1994. The Friends of Crooked River are actively supporting the Remedial Action Plan. The Friends of the River Valley (West Branch of the Rocky River) have organized to protect areas increasingly threatened by encroaching development. Lessons learned from the first willow cuttings will be made available to restoration groups on a regular basis. The parent plants are growing on islands formed in a lake used for water supply and are considered to be a nuisance there. Their replanting to areas suffering from erosion problems will not only help stabilize these banks, but will help to provide aquatic habitat. This low cost, low technology solution will also provide volunteer groups with projects that are both fun and meaningful.

Contact person: Mary Beth Binns, Cuyahoga River Community Planning Organization, Cleveland, Ohio.
* To improve river navigation prior to environmental cleanup, an interim dredging project was completed in 1993. Shallow areas between the upper turning basin and the 5th Street bridge were dredged. A small amount of non-toxic sediment (approximately 23,000 m³) was removed with a closed clamshell dredge and deposited in a rehabilitated confined disposal facility (CDF) adjacent to the river. After three years, the dewatered sediments will be disposed upland and the old CDF will be allowed to develop into wetland habitat.

Contact person: Natalie Farber, Ohio Environmental Protection Agency, Columbus, Ohio.
29. Presque Isle Bay

Aquatic Habitat Rehabilitation and Conservation Projects

* A habitat enhancement project is being planned for 1994 using an Adopt-A-Stream cooperative effort to construct coarse brush structures within the Bay to provide cover for gamefish and panfish. Adopt-A-Stream is a cooperative program which provides technical assistance and planning, construction supervision, and a limited amount of materials to the cooperator of an approved project on qualified waters. Coarse brush structures (i.e. PA Porcupine Brush Cribs) will be constructed along and near the northwest shore of Presque Isle Bay State Park. Porcupine Brush Cribs are designed to provide cover to young-of-the-year, juvenile, and adult gamefish and panfish. The Cribs have a long, submerged life-span and are easily constructed and placed.

* The Pennsylvania Department of Environmental Resources has recently set aside the tip of Gull Point as a bird sanctuary, off-limits to all people during the nesting season, in an effort to reestablish colonial and other shorebirds. While not in the Area of Concern itself, this project will benefit bird populations throughout the area (including the Area of Concern).

Contact person: K. Burch, Pennsylvania Department of Environmental Resources, Meadville, Pennsylvania.
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<thead>
<tr>
<th>30. Wheatley Harbour</th>
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<td>Aquatic Habitat Rehabilitation and Conservation Projects</td>
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<tr>
<td>* In 1988, students organized a cleanup of Muddy Creek wetlands and Wheatley Harbour.</td>
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<tr>
<td>* The Wheatley Harbour Remedial Action Plan (RAP) Team is investigating the possibility of protecting Muddy Creek wetlands under local zoning.</td>
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Aquatic Habitat Rehabilitation and Conservation Projects

* Ohio Street Public Access Site: The New York State Department of Environmental Conservation (DEC) acquired a 1.8 ha parcel located along the Buffalo River in the City of Buffalo. The land was to be developed to provide boat launching facilities, general public access and green space. The site is located in the Buffalo River Area of Concern (AOC). The cost to acquire the property was $111,000. The first phase of development consisted of removing debris, regrading selected areas and removing some understory vegetation to provide recreational facilities for launching canoes and cartop boats. A small permeable parking area has also been built. The first phase was built jointly by the New York State DEC and the City of Buffalo. The New York State DEC contributed $11,000 in materials and supplies, and both agencies contributed significant amounts of construction services staff time and equipment. A second phase of access enhancement, consisting of a boat launch ramp and associated parking, is being considered. Estimated cost of the additional amenities is approximately $90,000. The Ohio Street site is the downstream terminus for the Buffalo River Canoe Trail described below. Proposals for enhancing fish and wildlife habitat at the site have been developed. It is anticipated that plantings, site clean-up and some maintenance activities will be performed by volunteer stakeholder groups as an Adopt-A-Stream project.

* Harlem Road Public Access Site: New York State Department of Environmental Conservation purchased a 1.4 ha property located along the Buffalo River in the Town of West Seneca. The goals for the project are to provide canoe and cartop boat launching facilities, public access for recreation and green space preservation. The site is visible from the New York State Thruway (I-90), which is immediately adjacent. Although the property is located several kilometers upstream of the Area of Concern, the site is the upstream access point for the Buffalo River Canoe Trail. The cost of acquiring the property was $61,000. The site is currently undeveloped; however, the New York State DEC has designed plans for an access road, parking area and canoe launch. Specific funding for the project was not readily available, so an innovative approach to implementing access was adopted. The New York State DEC and New York State Thruway Authority entered into a cooperative agreement whereby the Authority will construct the physical facilities (per New York State DEC specifications) in exchange for construction access during a pending Thruway widening project. The proposed canoe access facilities are scheduled to be built during 1996. At least one stakeholder group has expressed a strong interest in volunteering for clean-up and other maintenance activities at the proposed access site.

* Buffalo River Urban Canoe Trail: This unique project, dedicated in September 1994, provides canoe and cartop boat access to the Lower Buffalo River, including much of the AOC. The upstream and downstream access points are at the Harlem Road and Ohio...
Aquatic Habitat Rehabilitation and Conservation Projects

Street sites, respectively. The New York State DEC initiated and developed the trail in partnership with numerous stakeholder groups including the City of Buffalo, Erie County Department of Environment and Planning, Friends of the Buffalo River, the Industrial Heritage Committee and private individuals. The route provides both recreational and educational opportunities designed primarily for canoe users. Canoe Trail users are certain to gain an appreciation for the River’s industrial and commercial heritage, environmental changes and recovering fish and wildlife resources. The trail covers a total of 15.6 kilometers and contains markers at many notable features, including historical landmarks, industrial facilities, hazardous waste sites and fish and wildlife resources. An interpretative brochure identifies and describes the marked features and guides the boater through the route.

* Buffalo River Fish and Wildlife Habitat Restoration Demonstration Project: The Erie County Department of Environment and Planning was awarded a grant from the U.S. Environmental Protection Agency (EPA) Great Lakes National Program Office for projects in the Buffalo River corridor. Approximately $500,000 of the grant funding has been devoted to a fish and wildlife habitat demonstration project in the Buffalo River AOC. A steering Committee composed of the Erie County Department of Environmental Protection, the U.S. Army Corps of Engineers, the U.S. EPA, U.S. Fish and Wildlife Service, City of Buffalo and The New York State DEC, was formed to provide technical guidance for the restoration project. The committee established goals, objectives and strategies for the restoration project. Through a ranking process, the committee then selected five potential project sites located on publicly owned property. One of the sites selected is the Ohio Street site. Specific recommendations were developed for each site to enhance or preserve the fish and wildlife habitat and accommodate public uses such as hiking, fishing, and nature observation. Detailed performance guidelines were also developed to assist in integrating habitat restoration and human use, and to meet project goals and objectives.

* Buffalo Color Site Remediation Plan: The Buffalo Color hazardous waste site is located on a peninsula in the Buffalo River AOC and occupies approximately 915 m of river shoreline. The property owner is designing plans for site remediation to include a groundwater recovery system, dredging of nearshore sediments, installation of a slurry barrier wall, and stabilization of the river bank with a protective revetment and capping of the site. Extensive physical alteration of terrestrial and aquatic habitat components will occur as part of the remediation process. The owner, through the New York State DEC, contacted the Buffalo River Fish and Wildlife Habitat Restoration Project Committee (HRPC) and friends of the Buffalo River to explain the project and to identify issues of concern. Both groups expressed concerns about re-establishing fish and wildlife
Aquatic Habitat Rehabilitation and Conservation Projects

habitats on the Buffalo River. The New York State DEC, on behalf of the HRPC, submitted a list of the proposed habitat enhancement measures for the incorporation into the remedial design. Measures to enhance aquatic and riparian habitats include: use of rip rap shoreline erosion control (as opposed to using fabriform mats), planting small trees and shrubs along the shoreline, planting grasses and modifying mowing schedules on the cap to enhance bird nesting and constructing a wetland in shallow water along the shoreline. The company has indicated it will make every effort to incorporate the proposed habitat enhancement measures into the remediation design. There are no plans for monitoring the habitat enhancement measures.

Contact person: Michael Wilkinson, New York State Department of Environmental Conservation, Buffalo, New York.
32. Eighteenmile Creek

Aquatic Habitat Rehabilitation and Conservation Projects

* The Eighteenmile Creek Remedial Action Plan (RAP) was the last of three RAP's in the New York State Department of Environmental Conservation (DEC) Region 9 to be initiated. Planning activities began during 1994. The Citizens Committee was assembled in March and has been meeting on a monthly basis. The Area of Concern (AOC) has been defined, and work recently began on identifying impairments. The proposed timetable for completion of the draft RAP document is 18 to 24 months. Habitat restoration work associated directly with the RAP process has been limited; however, a sediment sampling program took place in September 1994. Sediment cores were taken from the navigation dredging project area and from the area upstream of Olcott Harbor. Sediment analysis will include contaminants of concern to fish and wildlife populations.

* Eighteenmile Creek Marina Development Policy: Several marina and or boat launch facilities were proposed in Eighteenmile Creek near Olcott Harbor during the 1970's and 1980's. In response to these proposals and the implementation of the New York State Wetlands Law, the New York State DEC Division of Fish and Wildlife established a regional policy restricting marina-related facilities in Eighteenmile Creek. This policy has restricted marina-related development south of the Route 18 bridge, thus helping to preserve ecological benefits of the Creek's estuarine wetland.

Contact person: Michael Wilkinson, New York State Department of Environmental Conservation, Buffalo, New York.
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* Three artificial northern pike spawning marshes were constructed under contract from the U.S. Army Corps of Engineers (ACE) during 1987 as mitigation relating to the Conesus Lake Flood Control Project. The mitigation was requested of ACE by the New York State Department of Environmental Conservation because lower spring water levels expected from flood control improvements would result in reduced recruitment of wild northern pike fry produced on the Conesus Lake Fish and Wildlife Management Area. Virtually all Conesus Lake northern pike are produced in these flooded wetlands.

* About 4 ha of wet, old field adjacent to Conesus Inlet were scalped and graded to slope toward the Inlet. This strategy would allow pike fry easy access to the stream and subsequently Conesus Lake. Importantly, it would reduce stranding of pike fry in the natural pits and mounds of the irregular surfaced field. The area was split into three spawning marshes of 2.1, 1.0 and 0.5 ha, respectively. The marshes were constructed with low head dikes and water control structures to provide a maximum marsh depth of 45 cm.

* A detailed evaluation of these marshes during the spring periods from 1992-94 was conducted by the ACE Waterway Experiment Station at Vicksburg, Mississippi. The report will be available late 1994.

Contact person: Bill Abraham, New York State Department of Environmental Conservation, Avon, New York
### 34. Oswego River

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* The Oswego River Remedial Action Plan identified three areas in the "habitat improvement" section. The areas consisted of: river habitat, fish passage, and harbor habitat. These issues are being addressed by ongoing negotiations with the Niagara Mohawk Power Corporation (NMPC), concerning the Varick bypass in the following areas: 1) minimum flow, 2) modifications to minimize the potential for fish stranding during low flow periods, 3) design and sighting of a fish collection device and 4) development of a downstream passage facility. To date, no progress has been made in instituting these measures. The Federal Energy Regulatory Commission can order these actions when NMPC reapplies for renewal of their hydroelectric generation permit.

* The New York State Department of Environmental Conservation has committed to developing a draft management plan for the Lake Shore Marshes Focus Area (which includes the Area of Concern) of the Great Lakes/St. Lawrence Joint Venture within the framework of the North American Waterfowl Management Plan.

* Finger Lake Rainbow Trout Nursery Tributary Habitat Enhancement: During the 1960’s and the 1970’s the Bureau of Fisheries in the New York State Department of Environmental Conservation (DEC) enhanced the habitat for anadromous rainbow trout in nursery tributaries to Canandaigua and Seneca Lakes. The enhancement was performed on Public Fishing Rights (PFR) segments of Naples and Catherine Creeks. Stream improvement structures such as: log cribs, pool diggers, rip wrap, and deflectors were constructed to stabilize the stream banks and to provide instream shelter. Streamco willows were planted for further stabilization and for cover to the stream. Instream debris has been removed each year in these PFR stretches by prison inmates. There is an inventory of about 180 stream improvement structures on the PFR segments of these two streams. About 60 log cribs and 40 each of log cribs, pool diggers, deflectors and rip wrap sections were placed along these two streams to stabilize the stream bed and stream banks. Thousands of streamco willows were also planted. Debris removal and minor repair to structures are carried out each year by Camp Monterey inmates under the guidance of the Operations Unit of the DEC. Evaluations and benefits of stream improvement structures are difficult to measure. Adult and young rainbow trout are routinely collected during surveys at these structures. Cornell University has performed evaluations of these structures and the results can be found in their literature.

Contact person: Les Wedge, New York State Department of Environmental Conservation, Cortland, New York.
### Aquatic Habitat Rehabilitation and Conservation Projects

* Quinte RAP introduced a Habitat Protection and Rehabilitation Program in 1992. A management strategy will be developed to protect remaining wetland areas and rehabilitate degraded habitats. The program is a partnership supported by Environment Canada’s Great Lakes Cleanup Fund and Ontario Ministry of Natural Resources (MNR), Quinte Conservation Alliance, Canadian Wildlife Service (CWS), and local naturalist groups.

* Wetland/nearshore fish habitat inventories have been completed for 1991, 1992 and 1993. Data are being processed to provide information to protect critical habitats through public education and the municipal planning process.

* Creation of submergent marsh habitat in monoculture cattail stands is being investigated. Surveys in created channels showed that new fish habitat was created; however, water birds did not show preference for this habitat. Creation of ponds is now being investigated. Funding for this project comes from the Great Lakes Cleanup Fund, Ontario MNR, and CWS.

* The Federal Partners Fund has approved funds for livestock fencing and creek/marsh rehabilitation to the Mohawks of the Bay of Quinte. The Ontario Ministry of Environment and Energy will provide in-kind and communication costs.

* Shoreline naturalization has been demonstrated at 2 sites in the Bay. Two other sites will be completed this fall. Demonstrations are being conducted with the financial support of the Great Lakes Cleanup Fund and the assistance of local school and naturalist groups.

* The Federal Green Plan - Wetland/Woodlands/Wildlife programs are providing funding over three years to two projects in the Quinte watershed. Farming practices on Cold, Wilton, Little, and Sucker Creeks are targeted. The projects will promote sustainable agricultural activities, seek compatibility of agriculture and wildlife, and improve water quality. Actions will include lure cropping, cattle fencing, stream/shoreline rehabilitation, erosion control, and fragile land retirement.

Contact person: Alistair Mathers, Ontario Ministry of Natural Resources, Glenora, Ontario.
Remediation of radionuclide contaminated sediments remains the top priority in Port Hope.

* Demonstration projects have been completed which confirm contaminated sediments can be safely removed.

* The Government of Canada has established a federal Low-Level Radioactive Waste Office to resolve historic waste problems that are a federal responsibility. The Low-Level Radioactive Waste Management (LLRWM) Office is currently responsible for the management of historical low-level radioactive waste in the Town of Port Hope. Responsibilities of the LLRWM Office are discharged through its role as a technical advisor to the Siting Task Force and, when requested, to the Port Hope Community Liaison Group (CLG).

* The Federal Siting Task Force is working with the CLG on finding an appropriate location for a low-level radioactive waste management facility for the Province of Ontario. The Task Force is implementing a five-phase siting process that encourages the voluntary/collaborative participation of communities in the search for a low-level radioactive waste facility site. Phase 4 of the siting process is underway for the three source communities (Port Hope, Hope Township, and Newcastle) and one host community (Deep River).

* The Port Hope CLG is developing options to remediate the harbor.

Contact person: Jim Atkinson, Ontario Ministry of Natural Resources, Peterborough, Ontario; Sandra Weston, Environment Canada, Toronto, Ontario.
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  Mimico Creek: Sediments deposited within the estuary have not colonized naturally with aquatic vegetation since completion of a lakefill park (Humber Bay Park) during 1975. Wetlands vegetation was introduced to the area during the fall of 1992 by means of a variety of planting techniques. Since then, the area occupied by cattail plantings has increased several times. Background monitoring data included water and sediment quality, local fish and wildlife communities, and adjacent shoreline plant communities. Fish and plant communities continue to be monitored on a trend-through-time basis. Additional growth of the cattail beds should result in at least 0.5 ha of western estuary wetlands in a vegetated state.
  Buffers' Park: Wetlands vegetation was introduced to a shallow western embayment of the park during 1992, similar to the above project. A sewer overflow empties into the embayment, creating poor water quality conditions, and an opportunity for improvement through vegetation establishment. Due to excessive wave action and energy at this site, vegetation plantings were not successful.
  Funding for the above wetlands projects was $56,000.

  Ashbridges' Bay: A reef was constructed within a boat basin dominated by fine silt deposits, macrophytes, and deeper water at the construction site. The reef site adds vertical relief to a steeply sloping and relatively uniform boat basin, with various sized aggregate being used for substrate. Siltation of the aggregate since construction may have reduced reef function; however, plant colonization within the embedded silt may result in the reef site eventually functioning as a shallow-water macrophyte bed. Fish communities are being monitored on a trend-through-time basis. SCUBA was used to evaluate characteristics of the reef one year after construction.
  Buffers' Park: Site characteristics, construction, monitoring and results were similar to those at Ashbridges' Bay.
  Funding for the artificial reef projects was $51,000.

* Fish access improvements, wetlands restoration, northern pike spawning habitat creation (1992-1993).
  Toronto Islands: A former "put and take" trout pond was reconnected to the Toronto waterfront by breaching a barrier berm. Three channels were cut through the berm, creating two small islands to serve as wildlife refuge areas. Upland shrubs were planted along drier sites of the berm, while emergent wetlands vegetation was re-introduced to the ponds' edge. Approximately 3 ha of lagoon and remnant wetlands habitat were made accessible to local fish populations. A number of emergent hummocks and linear "fingers" were created and seeded to provide northern pike spawning habitat during
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spring high water conditions. Fish communities are being monitored on a trend-through-time basis. Large northern pike have been observed within the ponds during spawning migrations. The hummocks and "fingers" have been colonized with emergent vegetation. Establishment of planted vegetation is being monitored. Funding for the project was $66,000.

  Ashbridges' Bay: Lakefill park shorelines adjacent to the above artificial reef were modified by varying surface topography, thereby altering surface soil moisture regimes. Additions of municipal compost were added to soils with subsequent plantings of native vegetation. Vegetated areas were then left to undergo natural regeneration. The naturalized areas will be monitored for botanic succession and use by wildlife. Initial observations indicate successful establishment and growth of planted vegetation.
  Bluffes' Bay: Lakefill park shorelines adjacent to the reef project were naturalized by means of techniques described above, with similar monitoring procedures. Initial observations indicate successful establishment and growth of planted vegetation.
  Mimico Creek: Lakefill park shorelines adjacent to the wetlands project were naturalized by means of techniques described above, with similar monitoring techniques. Initial observations indicate successful establishment and growth of planted vegetation.
  Rouge River Marsh: Filled estuarine shorelines along an access road were graded and stabilized by addition of aggregate and vegetation, thereby diversifying shoreline composition. Municipal compost was incorporated into the surface soils, with plantings of terrestrial and emergent vegetation. Initial observations indicate successful establishment and growth of planted vegetation.

Funding for the above naturalization projects was $80,000.

* Wetlands Creation (1993-1994)
  Colonel Samuel Smith Park: An existing small pond was enlarged and graded to create approximately 3.5 ha of wetland habitat. Habitat design included - graded shoreline elevations to allow seasonally flooded areas; addition of gravel, rock and armorstone aggregate for substrate diversity; an adjacent underground snake hibernaculum constructed from armorstone, logs, and stumps; placement of logs and stumps within the wetland basin; incorporation of municipal compost into adjacent terrestrial soils; and plantings of native trees, shrubs, grasses, and wildflowers along shorelines. Fish, plant, and wildlife communities are being monitored on a trend-through-time basis. Assessment of project effectiveness is in progress and will likely be available within the next several years. Funding for the project was $200,000.
  Colonel Samuel Smith Boat Basin Wetland (initiated 1994): This project was initiated in 1994 and will be extended into 1995. A small wetlands area will be
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established within a boat basin, created by lakefilling. Initial works included excavation and grading of the wetlands area, with shoreline plantings of native shrubs. Wetlands vegetation planting will begin during 1995. Background and post-project monitoring will include trend-through-time fish community, plant, and wildlife data. Funding for the project is estimated to be $144,000.

* Brush Shelter Creation (initiated 1994).

Various sheltered locations along the Toronto waterfront - sites will be selected where larger habitat rehabilitation projects are not possible or where diversification of altered shoreline structure should be beneficial. Woody brush will be weighted and placed to create a linear shelter running parallel to the shore, and at an appropriate depth. At shallow locations, fallen trees may provide additional habitat for birds and amphibious wildlife. Increased biological production and cover for fish and wildlife will result at sheltered sites where simplified shorelines predominate. Fish community monitoring and wildlife observation will be carried out at project sites on a trend-through-time basis. Funding for the initial project year is estimated to be $25,000.

* Fishway Construction (initiated 1994).

Rouge River, Milne dam: The Rouge River Fisheries Management plan was completed during 1992 as a result of partnerships among municipalities, the Ontario Ministry of Natural Resources, and the Metro Toronto and region Conservation Authority. Aquatic habitat rehabilitation recommendations were made on a sub-watershed basis, with a healthy, self-sustaining fishery forming the overall watershed goal. Currently, the Milne dam is identified as the most significant limitation to achievement of this goal, blocking migrant fish access to viable spawning habitat within several tributaries. Preliminary fishway design requirements and alternatives are being considered at this location. Trend-through-time monitoring will be based on spring and fall fish collections. Additional monitoring for evidence of successful natural reproduction will be carried out within identified coldwater production zones. Funding for this project is estimated to be approximately $500,000.

Contact person: Richard Strus, Ontario Ministry of Natural Resources, Maple, Ontario.
Over $19 million has been identified to test and implement habitat rehabilitation techniques. Approximately $12 million has been contributed to date from private and public contributors. $19 million will be invested over the life of the project to: rehabilitate the 250 ha marsh in Cootes Paradise, enhance the pike spawning marsh in Grindstone Creek, improve the littoral habitat in Hamilton Harbour, rehabilitate the littoral fish community, and provide nesting and loafing sites for colonial waterbirds. Restructuring the fish community will be accomplished by the combined effects of carp control, habitat improvement and introductions of top predators. The five year project will alter the fish community from one dominated by pollution tolerant exotic species such as carp, white perch, and alewife to a community dominated by native fish species and controlled by top predators. Moreover, habitats will be created for shorebirds, waterfowl, reptiles and mammals. The project has a large public participation component. Construction of fishing piers, boardwalks, wildlife viewing platforms, and an information center will enhance opportunities for access and education. There are over 29 partners contributing to this multi-agency cooperative project. Highlights include:

* Final Design and Engineering Supervision for Carp Barrier/Fishway: Public Works Canada has been contracted to complete the final design and supervise construction of the carp barrier/fishway at Cootes Paradise. This contract includes the design of an access road and bridge crossing of the Chedoke Creek in order to gain access to the project site for construction and operation of the carp barrier/fishway. The City of Hamilton has provided the land for the access road and has participated in the project by providing site surveying, engineering computer design, preparation of landscape plans, and drafting of various legal agreements between partners and land owners. Final design is nearing completion and tendering is expected in 1994.

* Final Designs and Tender Documents for LaSalle Park and Northeastern Shoreline: Through a Memorandum of Agreement, Cleanup funds were transferred to the Hamilton Harbour Commissioners (HHC). The HHC are the principal land owners at LaSalle Park and the Northeastern Shoreline project sites, and have expertise in constructing marine works within the harbor. The HHC are contributing the land base and have assigned a professional engineer as project manager to oversee final design tendering and construction. The detailed design drawings and tender documents for the final design of these projects will be completed in 1994.

* Experimental Planting in Cootes Paradise and Restoration of the Pike Spawning Marsh: Through a Memorandum of Agreement, Cleanup funds were transferred to the Royal Botanical Gardens as part of the federal contribution to the Cootes Paradise marsh...
rehabilitation project. The funds were used to: monitor the effectiveness of the carp exclosures constructed in 1992/93, establish an aquatic nursery, construct a temporary silt control barrier across Westdale Cut, carry out an extensive program of experimental planting, establish a volunteer planting program, and carry out water quality and turbidity monitoring. Interpretive signs were constructed at the various activity sites. The Royal Botanical Gardens worked closely with McMaster University on the monitoring components of the project and contracted student labor from the University. The water level control structure was installed in the spring of 1993 and the beaded channels were constructed in the fall of 1993. Enhancement of the pike spawning program is complete.

* Wave Break Experimental Design and Aqua Dam Construction:
Studies were undertaken to design, construct and monitor proto-type wave breaks to protect aquatic planting beds in the Cootes Paradise Marsh. A new portable dam structure made of geotextile fabric was installed to determine if it could control water levels on a temporary basis for areas being planted. The structure known as "Aquadam" offers the potential to isolate portions of the marsh in order to control water levels, turbidity, and carp predation on new plants. Once plantings are completed, the Aquadam can be removed and the area completely integrated with the remainder of the marsh. If successful, this trial will offer significant benefits to the Cootes Paradise project and other similar projects within the Great Lakes Basin.

* Assessment of Fish, Underwater Plants and Carp Movement in Hamilton Harbour and Cootes Paradise: Cleanup funds and Department of Fisheries and Oceans' funds were combined to monitor the status of the littoral fish community (3 times during the season by electrofishing 40 transects) and submerged plant community (once using SCUBA) in Hamilton Harbour. Electrofishing was used to determine if carp overwintered in Cootes Paradise. In addition, radio tags were attached to 48 carp to monitor their movements in and out of the Cootes Paradise Marsh. Forty carp of various sizes and ages were taken from the harbor and sampled for contaminants in order to determine use and/or disposal requirements for the operation of the carp barrier/fishway.

* Construction of Littoral Habitat and Habitat Modules in Harbourfront Park: As part of the City of Hamilton Harbourfront Park and the Fish and Wildlife Restoration Project development, the entire 1.75 km shoreline was restructured from an eroding, unvegetated shore to one containing a variety of habitat types in order to provide spawning, nursery and adult habitats for bass, sunfish, crappies, perch and shiners. Forty-five underwater habitat modules were placed in 3-6 m of water to the west of the Harbourfront Park. Department of Fisheries and Oceans has been monitoring fish production on the habitat modules. Low dissolved oxygen in the vicinity of the modules seemed to be a limiting
factor during the summer. However, fall 1993 sampling showed that the modules are attracting crappies, sunfish, bullheads, rockbass and young-of-the-year largemouth and smallmouth bass. Fish abundance around the habitat modules in the fall is 3-4 times greater than at the control sites. The modules were provided by the Fish and Wildlife Restoration Project for the Great Lakes Cleanup Fund.

* A substantial research and monitoring effort is underway to evaluate the effectiveness of these rehabilitation projects. Scientists from McMaster University, Canada Centre for Inland Waters, Brock University, Trent University, and the University of Toronto are involved. A brief list of evaluation projects includes: effectiveness of spawning habitat creation for centrarchids; effects of carp exclosures on water quality; changes in littoral fish community composition in Hamilton Harbour; effectiveness of spawning habitat for pike; evaluation of submerged habitat structures as attractants for the fish community; evaluation of nesting habitat creation for common and caspian terns; evaluation of nursery and planting techniques used to rehabilitate wetlands; and monitoring changes in water quality and aquatic plant distribution in Hamilton Harbour and Cootes Paradise.

Contact person: V. Cairns, Canada Department of Fisheries and Oceans, Burlington, Ontario.
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* Shoreline Management Plan: The Sault Ste. Marie District Office of the Ontario Ministry of Natural Resources (MNR) and the Sault Ste. Marie Conservation Authority have developed a Shoreline Management Plan to regulate activities that may affect nearshore habitat.

* Berm Construction in Rapids: To reduce the impact of dewatering along the south shore of Whitefish Island in the St. Marys Rapids (caused by the diversion of flows for power generation) and maintain water levels, a berm was installed on the Ontario side of the rapids. Substrate types and elevation were engineered to provide high quality habitat for anadromous salmonid fishes. Water supply was guaranteed by prescribing a minimum flow rate into the dyked channel through Gate 1 of the compensating works. Construction costs were borne by local power companies. Maintenance work on the berm in August 1994 required temporary dewatering of the channel within the berm, facilitating assessment of fauna using the area. Invertebrates and small fish were very abundant, indicating that the berm project had provided excellent habitat conditions.

* Wetlands Evaluations: Several wetlands in the St. Marys River (and some inland watersheds) have been evaluated using the Ontario MNR wetland classification scheme for northern Ontario. These are being reviewed to determine final classification for protection under the Ontario Planning Act.

* Remedial Action Plan Flora and Fauna Task Team: A group within the Task Team has been working on a project to broadly classify the habitat zones in each reach of the river. When compiled in Michigan Department of Natural Resource’s MIRIS Geographical Information System, this project will generate quantitative information on habitat zones and will incorporate a ranking system for priority protection, based on biological significance, sensitivity to perturbation, and contribution to the ecology of the river system.

* Members of the Task Team have developed a series of proposed habitat improvement projects, which are still at a conceptual stage. Emphasis is placed on compensating for the loss of rapids and wetlands habitats in association with each other. A key theme in the approach is integration of projects with each other, with the overall spectrum of habitat in the river system, and with other river uses. Broad stakeholder and partner involvement is recognized as key to this integration. International cooperation is likely, with the support committed from Environment Canada’s Cleanup Fund, and strong interest expressed by U.S. Army Corps of Engineers.

* A.B. McLean Site: Sand and gravel removal operations have been carried out for years
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at a site in the upper St. Marys River. Plans call for experimental rehabilitation of the site, using clean slag from Algoma Steel. Partnership contribution by the McLean Company has recently been nullified by the company’s bankruptcy.

* Purple Loosestrife Campaign: A community volunteer program has been initiated to try to slow the spread of purple loosestrife in the area of the St. Marys River.

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* The Stag Island Habitat Rehabilitation Project: This project is located opposite the Town of Corunna, Moore Township, Lambton County. The purpose of this project is to enhance/create a significant wetland/upland area in the upper end of the St. Clair River. Stag Island may be the only location in the upper reaches of the river where a project of this nature can be undertaken due to the intensive industrial and urban development along both the Ontario and Michigan shores. Due to its location in the middle of the river, there has been a strong interest by the Michigan Department of Natural Resources and the U.S. Army Corps of Engineers to investigate the possibility of making this a cooperative international project. Stag Island presents an excellent opportunity to create a large wetland and submersed macrophyte bed in the shallow waters surrounding the island. This island shoal historically supported a large amount of wetland vegetation, particularly on the southern tip of the island. Dredge disposal has virtually eliminated the wetland. The objectives of the rehabilitation plan for Stag Island are: 1) to enhance the existing wetland/upland areas for fish and wildlife production; and 2) to create as much new wetland as possible by creating calm water areas within the shallow waters of the island. The re-creation of wetland in this location will help to improve the impaired status of fish and wildlife habitat in the Area of Concern, as well as improve water quality, improve the aesthetic values and offer new educational and recreational opportunities for the upper end of the river. The approximate cost of this project is $800,000.

* The Chenal Ecarte/Sydenham River Habitat Re-Creation Project: The Chenal Ecarte contains a high diversity of fish and wildlife species. Designated a priority 1 waterfowl staging area, the system is home to several species of waterfowl, shorebirds, raptors, mammals, reptiles, fish, amphibians, and aquatic and terrestrial plants. Wetland evaluations have identified areas within the Chenal Ecarte and bordering Walpole Island to be of value to at least 26 provincially significant bird species and at least 95 provincially significant vascular plants. It should be noted that the Ontario bird list has not been researched as significantly as the higher plants, so the bird number is probably higher. The Chenal Ecarte is one of the last remaining areas along the St. Clair River that is not industrialized or overly populated. This adds to the additional value of habitat protection, enhancement, rehabilitation, or creation projects in the Chenal Ecarte proposed study area. The Chenal Ecarte provides a unique opportunity for the implementation of a large scale fisheries, wildlife, and waterfowl rehabilitation and enhancement project. Over 845 ha of agricultural land has been identified as possible rehabilitation sites under the St. Clair River Remedial Action Plan. Flowing basically north to south, the Chenal Ecarte delta is bordered to the north by the St. Clair River, to the east by Kent and Lambton counties, to the south by Lake St. Clair and to the west by Bkjewanonss (Walpole Island First Nation). The Sydenham River enters the Chenal
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Ecarte just southwest of the Town of Wallaceburg. Linkage with other possible locations along eastern Lake St. Clair may offer greater potential as candidate sites from a cost-benefit ratio and overall value to the resource. The Sydenham Valley (Lambton County) lies well within the Deciduous Forest Region of Canada, otherwise known as the "Carolinian Zone". Since many species of plants and animals occurring within this zone are restricted in their Canadian range, and because the area is one of the most heavily impacted by human development in Canada, a high percentage of these plants and animals are classified as rare, threatened or endangered. For example, of the 542 taxa of plants considered rare in Ontario, approximately 20% are known to be in Lambton County. Also 5 of the 43 species of warmwater fish found in the Sydenham River and tributaries have been designated as vulnerable by the Committee on the Status of Endangered Wildlife in Canada. The Sydenham River is also a significant spawning area for the threatened Lake St. Clair walleye fisheries. A recent survey of the mussels found in the Sydenham River determined that although some species may have disappeared, it is still the richest site in Canada. In fact, one species of mussel found in this river occurs nowhere else in the country.

* Bear Creek Wetland Complex (Davidson/Griffore Properties): This area was at one time a wetland. Natural back flooding will be encouraged in order to create a wetland with hydrological connection to the Chenal Ecarte. Some closed wetland cells may be incorporated for those areas located above water level. Upland areas will be protected from flooding. With the possible purchase of the Griffore farm, the project could expand to include more than the anticipated 24 ha owned by Mr. Davidson.

* The Darcy McKeough Floodway: The main objective is to produce a secondary use for this large area of vacant land. A method of turning the bottom of the floodway into wetland would produce a considerable amount of staging area for waterfowl. The vacant berms provide a good opportunity to produce nesting, shelter, and feeding areas for a variety of songbirds and small mammals. The educational component of this site could be quite significant as the project would illustrate a dual use for an otherwise limited use structure. Approximate cost is $70,000.

* MacDonald Park: The main objective is to change the park from a single use area with a manicured landscape to an area that incorporates wildlife and fish rehabilitation demonstrations in a setting accessible by the public. Wetland vegetation should be encouraged where possible to enhance fisheries production potential. Approximate cost will be $50,000.
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Monitoring: A number of techniques will be used to monitor the progress of the rehabilitation efforts, including: 1) electrofishing (by boat and backpack) and seine netting to monitor populations and diversity; 2) monitoring nesting boxes to determine hatch success; 3) monitoring or counting of amphibian calls in the spring of the year to determine diversity and population size estimates; 4) plant inventories may be performed to determine the effects on the plant communities; and 5) a re-evaluation of the wetland may be necessary to upgrade the wetlands classification.

Contact persons: Bret Colman, Ontario Ministry of Natural Resources, Chatham, Ontario; Jeff Braunscheidel, Michigan Department of Natural Resources, Livonia, Michigan.
41. Detroit River

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* The City of Detroit’s Belle Isle Habitat Restoration Project is underway to restore and reconnect Belle Isle aquatic habitat to the Detroit River. Canal and lake dredging, coupled with pump station improvements, will improve flows, water quality, and habitat. Over-winter survival of fish populations will be assured. Connecting Blue Herron Lagoon to the Detroit River for water and fish movement will enhance the Lagoon’s fishery value while contributing spawning, nursery, and feeding habitat for a variety of Detroit River fish. This $1.2 million project will expand the fishery, improve aquatic habitat, improve recreational opportunities, and make the waterway more aesthetically pleasing.

* Efforts are underway to acquire several islands in the lower Detroit River and over 16 ha of Gibraltar Bar at the southern end of Grosse Ile, and return them into public ownership. Protection and conservation of these critical habitats are essential to the survival of fish and wildlife populations of national and international significance.

* In 1994, the City of Windsor and the Essex Region Conservation Authority began construction of 1,600 m of nearshore fish habitat off Coventry Park, Reaume Park, and Alexander Park. Rock and substrate were placed in the river to improve shelter, food, and spawning for local fish populations.

* Monitoring and Inventories: Several electrofishing surveys have been conducted on the Detroit River since 1989 to examine fish of shallow water areas and to collect fish species for stomach content analysis. Surveys were conducted in 1989 and 1990 by Beak Consultants of Brampton, Ontario. The three reaches of the river, (upper, middle and lower), were intensively surveyed during these two projects. Electrofishing surveys were also conducted in 1990 and 1991 by staff from the Ontario Ministry of Natural Resources (MNR) to document fish use of shallow water areas along the middle and southern reaches of the river. The information from these two surveys has been used as background data for fisheries habitat protection initiatives by the Ontario MNR. Wetland inventories were also conducted for the Detroit River wetland complex in 1986 as part of the evaluation process for southern Ontario wetlands. These data and information are used in all planning matters and development proposals along the Ontario shore.

* Ruwe Marsh Protection Project: The Ruwe marsh is a privately owned Class 1 marsh located north of the Canard River access in the Detroit River and is part of a 580 ha wetland complex. The proposed project site is the riverine marsh and diked marsh which receives protection from a finger dike extending out in a westerly direction from the northern dike. This finger dike protrudes into the Detroit River approximately 1,200 m and eventually runs in a downstream direction. Two small emergent vegetation islands
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exist at the outer end of the finger dike and are currently being over run with purple loosestrife. The dyked portion of the marsh also has purple loosestrife problems. The key objective of this proposed Remedial Action Plan (RAP) project is the protection of the existing habitat in this most important habitat area on the Detroit River. The existing finger dike at the north end of the area is under stress from wave action and current. The finger dike is essential to maintain the integrity of downstream wetlands and dikes protecting the Canard River marsh system. Phase 1 of the project involves reinforcement and stabilization of the finger dike. Due to the extremely degraded state of the dike this is a high priority. As much of the existing vegetation and trees as possible should be maintained during the operation, including any dead trees, logs or branches that may be used along the shore. Suitable protection against siltation, using a filter fabric fence will be used during reconstruction. Consideration of impact on bald eagles, Canvasback ducks, and fisheries will dictate allowable time for reconstruction. Reconstruction of this finger dike structure will protect approximately 366 ha of significant class 1 wetland including the dyked cell and open water marsh with both provincial and national significance. The monitoring program for Ruwe marsh will provide a demonstration for the RAP Team to build on as it further investigates monitoring methods for each impairment of beneficial use and monitoring strategies for the entire RAP. The monitoring strategy will examine biological, physical, chemical, structural and social assessment needs to accomplish specific mandatory core objectives.

* Windsor Salt Riverfront Rehabilitation Project: The Canadian Salt Company in Windsor operates a salt mine and terminal supplying road salt to a variety of users. The road salt is mined, processed and stockpiled on site. Over the years, salt has encroached upon the shoreline of the site during stockpiling operations as a result of freighter loading operations. The company has shown an interest in developing a partnership agreement to address habitat rehabilitation initiatives for the site. The plan, which also incorporates a method of preventing stock pile run-off from entering the river, is to be completed within the next three years. An embayment area to the south of the Windsor Salt docking terminal (approximately 4.5 ha) is experiencing considerable sedimentation problems due to hardened shorelines groynes downstream of the cove. This area is shallow (less than 1.5 m) and contains a substantial amount of submergent aquatic vegetation. The shoreline area is presently mowed grass and no salt is in this area. Following installation of a cyclone, one outfall is no longer in use and one outfall is releasing levels of brine water (NaCl) that are acceptable to Municipal/Industrial Stormwater Abatement (MISA) program standards. Salt covers most of the shoreline area. The vertical extent of contamination has not been assessed. Some vegetation in the form of *Phragmites* and low lying grasses exists along the shoreline. A small mud-flat
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and narrow creek provide some diversity to present habitat conditions. A canal intersects the property and provides an island hydrologic connection. The property north of the canal is separated by a fence from an undeveloped piece of land and is owned by Windsor Salt’s parent company in Chicago. The key objective is the removal of salt along the shoreline and prevention of run-off from the salt piles entering the river. A secondary objective is to return the degraded area along the shoreline into a wetland/park area. A third objective is to prevent further siltation of the cove south of the docking facility. Phase 1 of the project involves the creation of a series of offshore islands to protect an embayment area from fetch, ice and wave action. Approximately 4 ha of wetlands will be created within the calm water area on the lee side of the island chain. Offshore islands are being designed to increase sedimentation and ensure flow is acceptable for establishment of wetland vegetation. The islands will be capped and covered with substrate acceptable as nesting areas for Common Terns or planted with wildlife shrubs or prairie grass for nesting areas for waterfowl. The lee side of the island will consist of small armorstone, providing cover for fish. Phase 2 involves the creation of a shoreline park with a central marsh area and an excavated channel to improve water flow, following the excavation of contaminated soils. There will also be construction of offshore islands for increased fish and wildlife habitat. Phase 1 and 2 of the project may encompass up to 1 km of shoreline along the Detroit River. Monitoring of fish through an electrofishing survey was conducted in 1994. Marsh bird and an amphibian and reptile monitoring program for the Detroit River will also be established. Following island creation a monitoring strategy to determine the effectiveness of fish habitat will be developed.

* The Wayne County Detroit Metropolitan Airport Crosswinds Marsh Wetland Mitigation Project was initiated in 1993 to reestablish wetland values and functions lost due to airport expansion by restoring and creating wetlands. Project cost was $4.2 million. Approximately 189 ha of new wetland were created. A five-year monitoring program is underway to evaluate effectiveness.

Contact persons: Lisa Tulen, Ontario Ministry of Natural Resources, Chatham, Ontario; Ron Spitler, Michigan Department of Natural Resources, Livonia, Michigan.
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<td><strong>Aquatic Habitat Rehabilitation and Conservation Projects</strong></td>
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<td>* Willoughby Marsh: As a result of a hydrology study, efforts are underway to increase the amount of water in this wetland area. The Niagara River Remedial Action Plan is working in partnership with Ducks Unlimited and the Friends of Fort Erie's Creeks on this project.</td>
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<td>* Glanbrook Conservation Committee/Lake Niapenco: This group has begun a project in the fall of 1994 designed to create a wetland in a draw down reservoir.</td>
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<td>* Frenchman’s Creek: Under the Frenchman’s Creek Watershed Study, a number of reports were completed in 1994 (Hydrology, Aquatic Assessment, History of the Watershed Process). As a result of this study, a habitat rehabilitation project is underway involving a number of partners. Friends of Fort Erie’s Creeks will be spending approximately $80,000 on student wages for this project in 1995.</td>
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Aquatic Habitat Rehabilitation and Conservation Projects

* Buckhorn Island Marsh Restoration Project: This large marsh, located at the northern tip of Grand Island in the Upper Niagara River, has experienced a lowering of water levels since the early 1960's. As a result, much of the 99 ha marsh is a dry cattail meadow offering significantly reduced ecological benefits. Analysis of water level data indicates this lowering of levels is likely due to water diversions for hydropower and navigation purposes. The proposed marsh restoration will re-establish formerly occurring wetland cover types and water levels. The restoration goal is to increase the diversity of native flora and fauna. Restoration activities should improve and re-establish breeding and migration habitat for a diverse array of fish and wildlife including: northern pike, sedge wren, marsh hawk, osprey, bald eagle, American bittern and various other waterbirds and waterfowl. Other fishes anticipated to use the marsh include brook stickleback, banded killifish and emerald shiners. Planned restoration activities include the construction of two low level overtopping weirs east of I-190. The weirs will allow the marsh to fill during daily high water levels and retain water during nightly drawdown. To facilitate flow into the marsh and to restore open water habitat, 6,698 m² of hydraulic dredging is also planned. A public access component of the restoration project consists of two non-intrusive wildlife overlooks with associated parking facilities and the anticipated incorporation of a bike path upon the weir adjacent to I-190. The project, jointly administered by the New York State Department of Environmental Conservation (DEC) and the New York State Office of Parks, Recreation, and Historic Preservation (OPRHP), is being reviewed and guided by an advisory committee with representatives from the Buffalo Audubon Society, Sierra Club, and the Buffalo Ornithological Society, the Grand Island Environmental Commission, and other local governments and environmental groups. It has the enthusiastic support of the Town of Grand Island, Ducks Unlimited and the U.S. Army Corps of Engineers Regulatory Branch. Funding for the project includes a habitat restoration and protection grant of $100,000 from the U.S. Environmental Protection Agency (EPA) Great Lakes National Program Office. The New York State DEC will cost share over $40,000 and the estimated Ducks Unlimited contribution is $60,000. Remaining funding for the $350,000 plus project is anticipated to be generated from wetland mitigation monies. Buckhorn is presently recognized as a viable wetlands mitigation bank by the U.S. Army Corps of Engineers and the New York State DEC. Formal Plans for monitoring success of the enhancement project have not been developed.

* 102nd Street Hazardous Waste Site Remediation: The 102nd Street site is a Federal Superfund site located adjacent to a large shallow embayment on the Upper Niagara River. The upland portion of the site contains an array of toxic and hazardous waste and the nearshore sediments are highly contaminated. The responsible parties, in conjunction with the U.S. EPA and New York State DEC, are currently developing plans to
Aquatic Habitat Rehabilitation and Restoration Projects

remediate the site. One component of the initial sediment remediation plan was to cover and cap the sediments, and install a slurry wall at an offshore location to contain groundwater migration. These remediation measures were designed in accordance with the Record of Decision and based upon existing records of site contamination. This proposal entailed filling over 2.4 ha of the embayment, with the fill material encroaching more than 76 m into the river at one location. The 102nd Street embayment has been documented by the New York State DEC as a significant fish and wildlife habitat. It is a nursery habitat for at least 25 species of fish including muskellunge, northern pike and largemouth and smallmouth bass. The embayment is also used by a number of species of waterbirds and migratory waterfowl, including large numbers of canvasback ducks. The embayment is one of the relatively few remaining large areas of vegetated shallows remaining in the Upper Niagara River. Based on this information, both the New York State DEC Division of Fish And Wildlife and the U.S. Fish and Wildlife Service expressed strong concerns about potential loss of habitat. In response to fish and wildlife habitat concerns, the responsible parties agreed to conduct additional site investigations and re-consider remedial design pending more comprehensive data. Based on the sampling results, the parties are revising remedial plans to substantially reduce encroachment along the approximately 608 m of affected shoreline. The most recent negotiations have reduced loss of embayment habitat to less than 1 ha. Negotiations to reduce habitat loss are continuing, and it is the New York State DEC’s recommendation that lost habitat should be mitigated by replacement of a similar habitat along the Upper Niagara River in a proximate location.

* Pettit Cove Hazardous Waste Site Remediation: Pettit cove is a small wetland embayment located along the Upper Niagara River that was contaminated by groundwater and stormwater discharges from the Occidental Chemical Corporation Durez Plant to the Pettit Creek flume. Pettit Cove sediments contain concentrations of dioxins and many other toxic compounds. Occidental Durez is remediating this site under a consent order with the New York State DEC. The initial remediation plans proposed to cover the sediments and implement associated remedial measures to isolate the sediments from the ecosystem. The New York State DEC Division of Fish and Wildlife Staff expressed concern about the proposed loss of wetland habitat on the Niagara River and recommended that the remedial approach consist of removing contaminated sediments and establishing a wetland in the embayment. The remedial program, currently in the construction phase, consisted of removing contaminated sediments from the embayment, installing a clay liner, providing coarse rock substrate for the interior of the embayment and placing clean soil toward the perimeter of the embayment. The bottom elevations were set to encourage development of emergent vegetation. Construction was scheduled to be completed by December 1994. The estimated cost for remediation of the
Aquatic Habitat Rehabilitation and Restoration Projects

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<td>sediments is in excess of $10 million. At this time, no plans to monitor effectiveness of the wetland restoration activities have been submitted to the New York State DEC.</td>
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<td>* Gill Creek Sediment Remediation: Gill Creek is a tributary to the Upper Niagara River which, prior to remediation, contained some of the highest known concentrations of polychlorinated biphenyls (PCB’s) in its sediments. The worst stretch of Creek sediments has been remediated, thus significantly reducing a major potential source of PCB contamination to the Niagara River. The cost for remediation was approximately $17 million. New York State DEC is not aware of any post-remedial assessment of contaminant exposure to aquatic biota: however, post-remedial sediment sampling of Gill Creek is being conducted for a period of five years. The first sediment traps are scheduled for collection in October 1994.</td>
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<td>* Strawberry Island Erosion Control Project: Strawberry Island is a small island in the Upper Niagara River, formerly about 81 ha in area. Extensive sand and gravel mining and river erosion resulted in a thin horseshoe shaped island with an interior lagoon. The island is currently owned and managed by the New York State OPRHP. The lagoon and approximately 162 ha of adjacent vegetated shoals are important areas for migratory waterbirds, including canvasbacks, scaups, mergansers, goldeneye, mallard, common tern and gulls. The island provides one of the few relatively isolated resting habitats available in the Upper Niagara for birds such as the great blue, blackcrowned and green-backed herons. Sampling by the Regional Fisheries unit in 1992 and 1993 confirmed earlier surveys that the lagoon is a critical nursery habitat for muskellunge in the upper Niagara River. Many other young-of-year fishes, including northern pike, yellow perch and largemouth and smallmouth bass, were found in the lagoon area. This ecologically critical habitat has been delineated a Significant Coastal Fish and Wildlife Habitat. Strawberry Island’s northwest shore has been eroding away steadily. In 1993, a 10 m wide breech developed allowing Niagara River waters to split the island, accelerating the erosion. For many years, different plans have been developed to curb the erosional process, but no one could raise the $500,000 to $1 million for the proposed construction costs. Finally, an agreement was reached between the New York State DEC, U.S. Fish and Wildlife Service, U.S. Army Corps of Engineers, The New York State OPRHP, the Niagara Mohawk Corporation and private citizens to take the initial steps toward repairing the breach and protecting the island’s shoreline. In late December 1993, as winter storms began to batter the island, the breach was filled and a low breakwater constructed. In the spring of 1994, plantings were made to protect the shoreline from further erosion. Niagara Mohawk and a concerned citizen donated the $50,000 worth of</td>
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materials and labor for this initial step in the island's preservation. No specific plans have been made for monitoring the breach repair.

* Iroquois Gas/Westwood Pharmaceutical Site Remediation Plan: Iroquois/Westwood site is located along Scajaquada Creek, a tributary to the upper Niagara River Area of Concern. Contaminants in the creek sediments and upland areas originate primarily from a coal gasification facility which operated many decades ago. Creek sediments contain extremely high concentrations of PAHs. A Record of Decision has been signed for this site. The selected remedy requires the removal of sediments from the highly contaminated zone of the creek. In order to implement the remedy, remedial designs and a remedial action plan are currently being developed by the responsible parties. The New York State DEC Division of Fish and Wildlife Staff are participating in that process to ensure that existing in-stream habitat is mitigated during the clean-up process, and that riparian ecological benefits are not diminished by the remediation. The Cayuga Creek drainage basin has served as the receiving waters for leachate originating from the inactive hazardous waste site known as Love Canal. Among the numerous chemical compounds originating from the site, the most toxic is 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD). To examine the efficacy of remedial work associated with Love Canal, monitoring of young fish for dioxins and dibenzofurans was conducted. Of the chemicals examined, the sole compound diagnostic of Love Canal was 2,3,7,8-TCDD. Declines in 2,3,7,8-TCDD concentrations averaged 70% between 1982 and 1987, and further declines ranging between 46 and 86% occurred between 1987 and 1992, dependant on location in the basin. The reductions were consistent with completion of the encapsulation of the Love Canal site, and later cleaning of stormwater drainage systems and removal of the most highly contaminated sediments from tributaries of Cayuga Creek. Total reduction of 2,3,7,8-TCDD concentrations was 84% or more.

Contact person: Michael Wilkinson, New York State Department of Environmental Conservation, Buffalo, New York.
### 43. St. Lawrence River (Cornwall, Ontario)

**Aquatic Habitat Rehabilitation and Conservation Projects**

* Design studies have been completed for fish habitat rehabilitation in Bainsville Bay - Pointe Mouillee, a significant peninsula-wetland complex. The shoreline would be stabilized to prevent erosion and improve circulation in a way to restore nearshore fish habitat.

* Lake St. Francis tributary restoration is being planned for fiscal year 1994/95. The project will demonstrate a combination of on-land and in-water activities to return the aquatic habitats to full function in Sutherland Creek. The focus will be on reducing nutrient inputs and erosion, restoring water flows, rehabilitating in-stream habitat diversity, and re-establishing buffer strips.

* Remedial designs for littoral zone rehabilitation at the Cornwall waterfront have been initiated and implementation of some measures is proceeding.

Contact person: Mike Eckerseley, Ontario Ministry of Natural Resources, Cornwall, Ontario.

### 43. St. Lawrence River (Massena, New York)

**Aquatic Habitat Rehabilitation and Conservation Projects**

* There are no current aquatic habitat rehabilitation projects in the St. Lawrence River Area of Concern; however, several lake sturgeon spawning habitat enhancement projects have been proposed. The New York Power Authority has expressed an interest in collaborating with the New York State Department of Environmental Conservation (NYSDEC) in enhancing lake sturgeon spawning habitat below the Robert Moses Power Dam. In addition, the St. Regis Mohawks wish to cooperate with the U.S. National Biological Survey and NYSDEC in a similar program in the mouth of the St. Regis River. Both projects would involve placement of washed gravel in areas of suitable water current. Assessment would entail netting adult sturgeon during the spawning run and subsequent sampling for sturgeon eggs and fry.

Contact person: Steve LaPan, New York State Department of Environmental Conservation, Bureau of Fisheries, Watertown, New York.