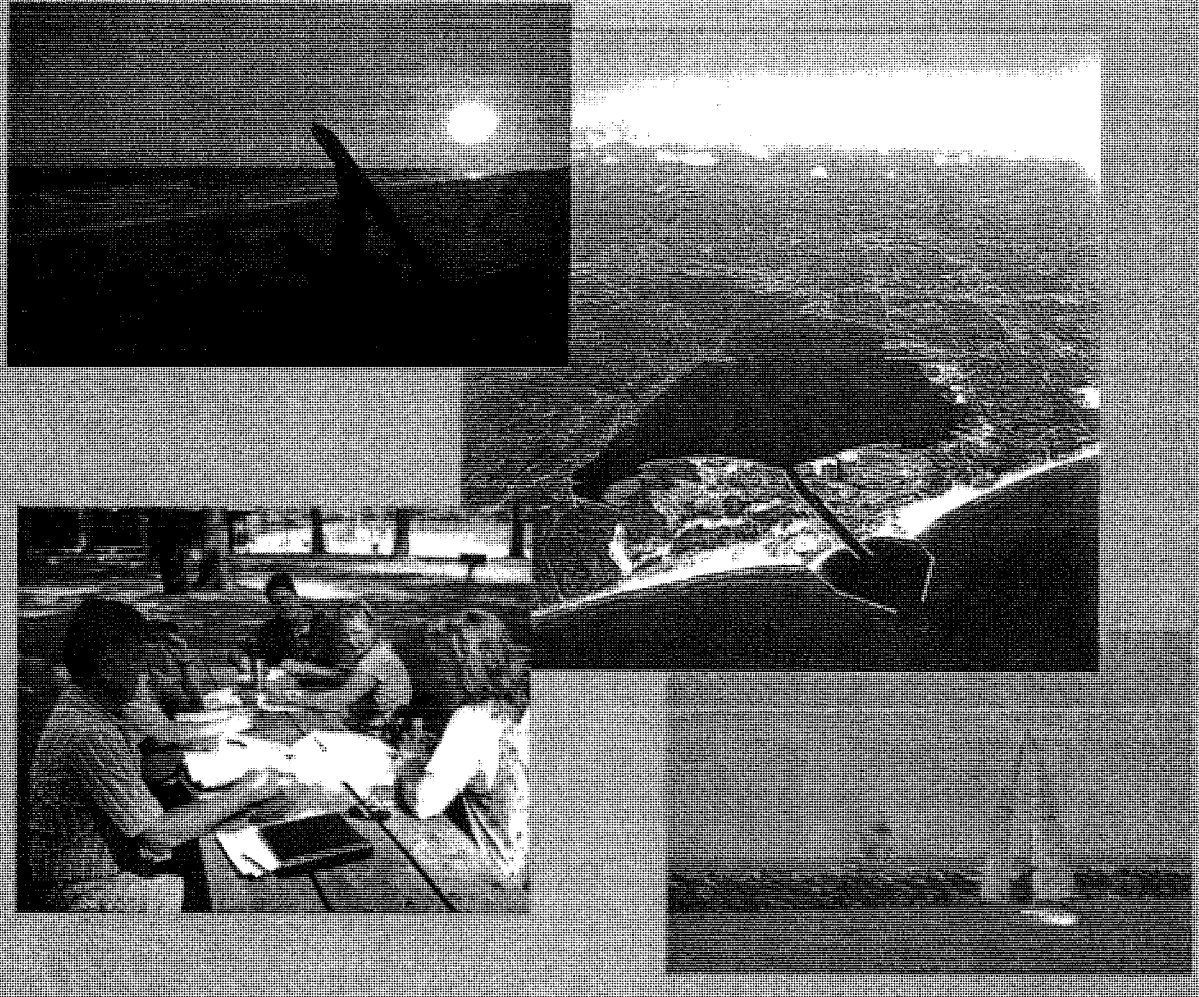
Muskegon Lake Community Action Plan

2002 Remedial Action Plan Update



Prepared for the Muskegon Lake Public Advisory Council and the Muskegon Lake Watershed Community by the Muskegon Conservation District

with a grant from the
Great Lakes Commission and the
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Areas of Concern Program
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Coastal Environmental Management Funds

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Executive Summary

The Muskegon Lake Remedial Action Plan (RAP) Update, 2002 was prepared by Kathy Evans, Water Quality Program Manager for the Muskegon Conservation District. The plan was prepared in partnership with the Muskegon Lake Public Advisory Council (PAC). It is a companion to the 1994 RAP Update and the 1987 RAP for the Muskegon Lake Area of Concern (AOC). This document is intended for use as a guide to facilitate continued interest and involvement by the public. It identifies targets for restoration; indicators of success and actions to address the restoration of impaired beneficial uses throughout the Muskegon Lake AOC ecosystem. Many recommended actions call on governmental or private sector involvement. We encourage individuals to work with local officials, business representatives and agencies to take effective steps to implement this plan.

The Muskegon Lake PAC advised that this update use common and recognizable terms to address many of the complicated issues underlying specific Beneficial Use Impairments (BUIs). Therefore, this update approaches impairments from a wider scope to increase public understanding and participation. It also draws attention to the specific human actions that contribute to each impairment. The 2002 RAP provides a strategic update to the 1994 Muskegon Lake RAP. The 1994 RAP is still useful as it contains relevant technical information, recommendations and references.

In addition to the BUIs listed on this page, the Muskegon Lake PAC has identified three important needs necessary for successful restoration and de-listing of the Muskegon Lake AOC:

- The need for a watershed-wide, ecosystem approach to remediation, development, and resource management
- The need to clean up and prevent groundwater contamination sites in the AOC
- The need for broader public awareness about the AOC's current condition, along with the continuation of local public involvement opportunities in the development of solutions

The Muskegon Conservation District worked closely with the Muskegon Lake PAC and utilized additional public input processes and technical advice to develop mutually acceptable targets for ecosystem improvements. This approach was used to ensure continued interest and community involvement in the restoration and protection of the Muskegon Lake AOC watershed. Annual updates will be made to the plan, and the public is invited to provide input through the interactive web site feature at *muskegonlake.org*.

RESOURCES:

Restoration targets and indicators, along with research and monitoring suggestions begin on page 38 of this document. Due to the technically oriented, complex science of interactions between biological, chemical and physical aspects of the ecosystem, contaminated sediment cleanup recommendations are addressed in this document but also in more detail in a companion document, the *Muskegon Lake RAP Contaminated Sediment Update, 2002.* It is available through the Muskegon Conservation District or at *muskegonlake.org*

The 2002 Muskegon Lake RAP Update summarizes the status of each BUI. It identifies actions to take and measurable targets to reach toward restoring and de-listing the AOC. All Muskegon Lake watershed community members, organizations and agencies are encouraged to use the 2002 RAP Update to plan and carry out ecosystem improvement projects in the Muskegon Lake AOC watershed.

Background

The Muskegon Lake Remedial Action Plan (RAP) update is designed to guide the community in actions that will restore the Beneficial Use Impairments (BUIs) and eventually de-list Muskegon Lake as one of the Great Lakes 42 Areas of Concern (AOCs). It is not a comprehensive assessment of all the problems in the Muskegon Lake watershed. Other projects and research important to the AOC, even though not mentioned in this report, may also be important to address social, economic, and environmental issues in the AOC watershed. You will find reference to some of these projects and research under the *Resources* section of each chapter.

Muskegon Lake's Nine (9) Beneficial Use Impairments (BUIs):

In 1987, the Michigan Department of Natural Resources RAP Team identified 10 of 14 impairments to uses of the waters of the Muskegon Lake AOC. The 1994 RAP Update identified the following 5 BUIs of *most concern* to the local Public Advisory Council (PAC):

1. Restrictions on human consumption of fish an wildlife
2. Loss of fish and wildlife habitat
3. Degradation of fish and wildlife populations
4. Degradation of benthos (bottom dwelling organisms)
5. Restrictions on dredging

Although progress was made to restore impaired uses between 1994 and 2002, the Muskegon Lake PAC identified four additional BUIs of concern to the AOC during that period:

6. Degradation of Aesthetics
7. Beach Closings (health advisories)
8. Eutrophication or Undesirable Algae
9. Restrictions on Drinking Water Consumption (Groundwater)

The Great Lakes Water Quality Agreement listed 14 potential impairments as measurements of ecological health for the 42 Areas of Concern in the Great Lakes. Those 14 BUI's include those 9 listed above (for Muskegon Lake) and the following:

10. Bird or Animal Deformities or Reproduction Problems
11. Degradation of Phytoplankton & Zooplankton Populations
12. Tainting of Fish and Wildlife Flavor
13. Fish Tumors or other Deformities
14. Added Costs to Agriculture or Industry

INTRODUCTION

Throughout the history of Michigan the Great Lakes have played an important economic, environmental and political role between the United States and Canada. In 1909, an international effort to protect and manage the Great Lakes, resulted in the Boundary Waters Treaty and created the International Joint Commission (IJC). The IJC consists of representatives appointed by leaders of the two countries. As increased use and environmental pressures continued throughout the 1900's, the IJC strengthened the Treaty with the Great Lakes Water Quality Agreements (GLWQA) of 1972, 1978 and a 1983 revision. In 1985, the IJC-Water Quality Board identified 42 Areas of Concern (AOCs) that may be negatively impacting the five Great Lakes. The 42 AOCs include rivers, lakes, and bays. The State of Michigan and the U.S. Environmental Protection Agency classified 14 Areas of Concern in Michigan – one being Muskegon Lake. In 1987, the GLWQA included guidelines for preparing Remedial Action Plans (RAPs) to restore AOCs and to eliminate negative impacts in the Great Lakes ecosystem.

Muskegon Lake "Area of Concern" Designation

Muskegon Lake is a 4,150 acre "drowned river mouth," directly connected to lake Michigan by a navigation channel. Approximately 11,000 years ago, Muskegon River (and the lake) formed by fluctuating Lake Michigan water levels and wind erosion of coastal sand dunes. The watershed was a continuous system of wetlands, marshes, riparian forests and sand dunes, prior to the lumbering era of the 1800's. During the 1900's, the lake was dominated by industrial growth related to foundries, metal finishing facilities, petrochemical production and shipping. Muskegon Lake's sub-watershed is one of fourteen (14) Areas of Concern in Michigan. In 1985, the lake and tributaries were designated an AOC because of degraded ecological conditions that correspond to criteria known as Beneficial Use Impairments (BUIs). Even though significant water quality improvements resulted from the diversion of municipal and industrial wastewater from the lake to the Muskegon County Wastewater Management System in 1973, problems remain. During the 1980's and into the 2000's, Muskegon Lake's shoreline began to reflect more commercial and recreational uses, and heavy industry began to re-locate. To this day, Muskegon Lake remains an AOC because of water quality, sediment and habitat problems associated with urban runoff, dredging and filling at the shoreline, the historical discharges of polluted wastewater into the AOC, localized groundwater contamination moving toward the lake and its tributaries, and the potential effects on Lake Michigan.

The Muskegon Lake Remedial Action Plan (RAP) Process and Public Advisory Council (PAC)

Since the original 1987 RAP was updated in 1994, the Muskegon Lake RAP process has provided an avenue for community involvement and partnerships to restore and protect Muskegon Lake and Lake Michigan. The Muskegon Lake Public Advisory Council (PAC) identifies environmental problems, recommends actions, establishes targets for restoration, and addresses current concerns. The Muskegon Conservation District provides staff support for the PAC and provides technical assistance to plan restoration projects. The PAC helps state and federal agencies identify sources of contaminants, causes of impairments and actions needed to restore beneficial uses. In 2003, the PAC will work with agencies to develop monitoring programs that will track the restoration of beneficial use impairments. The final goal of the PAC is to provide documentation about Muskegon Lake to the Michigan Department of Environmental Quality (MDEQ), the U.S Environmental Protection Agency (U.S. EPA) and the IJC-Water Quality Board for de-listing of the AOC designation.

The Muskegon Lake PAC adopted the U.S. RAP Workgroup's De-listing Principles and Guidelines in 2001. The workgroup was convened by the U.S. Environmental Protection Agency's Great Lakes National Program Office at the direction of the United States Policy Committee. The Muskegon Lake PAC is an active participant in the Statewide Public Advisory Council for Michigan's Areas of Concern and works closely with the Great Lakes Commission, U.S. EPA and MDEQ to ensure continuing progress in all 14 of Michigan's Areas of Concern.

Muskegon Lake AOC Delisting

Since the last Muskegon Lake Remedial Action Plan update in 1994, local public involvement with state and federal partnerships have initiated a number of environmental improvement projects, yet there continue to be historical site specific problems and current land use practices that affect how the lake is used. These problems need to be resolved before de-listing can occur. Most notable for de-listing the Muskegon Lake PAC recommends the following actions of greatest priority:

1. Enhance cleanup of sites leading to groundwater contamination
2. Enhance contaminated sediment cleanup and monitoring
3. Determine nutrient input loads and management specifications
4. Restore fish & wildlife habitat in aquatic, shoreline, and wetland areas
5. Monitor sediment contamination relative to fish and wildlife population changes and fish consumption advisories

Muskegon Lake Public Advisory Council (PAC)

The Muskegon Lake Public Advisory Council (PAC) is a coalition of community interests dedicated to working cooperatively for the improvement of the Muskegon Lake ecosystem through the Remedial Action Plan (RAP) process. The PAC addresses the quality of Muskegon Lake and its affiliated watersheds with activities that advise agencies, form partnerships and express local community views for the restoration and protection of the Muskegon Lake Area of Concern (AOC).

Perhaps the most significant progress made in the Muskegon Lake RAP Process since the 1994 RAP Update, is in the increase of public involvement, educational activities and partnership projects. These activities have resulted in local stewardship activities that range from hands-on shoreline cleanups to public input for remedial investigations of contaminated sediments. Truly, the commitment and persistence of the Muskegon Lake Public Advisory Council remains the brightest spot in this continuing effort to restore and protect Muskegon Lake. The 2002 RAP Update recommends community actions and it provides targets for restoration along with indicators of success. Therefore, measuring future restoration progress will be possible. Listed below is a summary of projects that met recommendations from the 1994 RAP Update:

Muskegon Lake RAP Progress Summary
Research, Monitoring and Restoration Activities
Related to Beneficial Use Impairments from 1994—2002

Activities and Studies Completed

- Wildlife Habitat Assessment—1995
  MDEQ / MCD—Day & Associates
- Aquatic Plant Assessment—1995
  MDEQ / MCD-Dr. Mark Luttenton
- Muskegon & White Lake "Watershed" Study—1995
  MDEQ / MCD-GVSU
- Muskegon "LakeWatch" Monitoring Program— 1995-1997
  MCD/DEQ/ NOAA GLERL Lake Michigan Field Station
- Muskegon River Watershed Assessment –1997
  Richard P. O'Neal, MDNR Fisheries Division
- Ryerson Creek Watershed Needs Assessment—1997
  MCD/USDA-NRCS/ML PAC—MDEQ
- Ruddiman Creek Phase I Assessment—1999
  MDEQ / USACE-Snell Environmental Group
- Lower Muskegon River Streambank Erosion Survey—1998
  Timberland RC&D/MCD/MDNR/Consumers Energy/Trout Unlimited/United States Coast Guard
- Muskegon County–Land Use Trends Report—1998
  LMF / MEC / MSU-E—CFMC
- Ruddiman Creek "Phase II" Assessment—2000
  DEQ / USACOE-Snell Environmental Group
- Preliminary Investigation of the Extent of Sediment Contamination in Muskegon Lake—1999-2002
  U.S. EPA-GLNPO / GVSU-AWRI / NOAA-GLERL
  Hope College/University of Florida
- Muskegon Lake-Ruddiman & Ryerson Creeks Education & Outreach—1999 MCD/CFMC—Great Lakes Collaborative
- Muskegon Lake 905B (Contaminated Sediment) Draft Data Summary Report—2000 USACE
- Ryerson Creek Stormwater Management Plan and Land Use Education Project—2000 Great Lakes Commission MCD/ USDA-NRCS/ Westshore Consultants/MDEQ/GVSU
- Ryerson Creek Stormwater Report—2002
  Dave Fongers, MDEQ-LWMD/Hydrologic Unit
- Lower Muskegon River Preliminary Habitat Assessment—2000 Dr. Rick Rediske, GVSU / CFMC
- Muskegon River Watershed Plan, 2002—MDEQ-GVSU-AWRI / MCD / WMSRDC / Westshore Consulting
- Remedial Investigation of Ruddiman Creek— 2002
  MDEQ-SWQD-Earth Tech
- Ruddiman Creek Integrated Assessments Report—2002
  USACE-Dr. Rick Rediske, GVSU-AWRI
- Muskegon Lake RAP Contaminated Sediment Update—2002 MCD/MDEQ-Dr. Rick Rediske, GVSU-AWRI

Activities and Studies Underway

- Muskegon River & AOC Nonpoint Source Implementation—2002 DEQ-CMI / MCD
- Muskegon River Research Assessments— 2001- 2003
  Great Lakes Fisheries Trust / Wege Foundation--GVSU
  MSU-University of Michigan-Wayne State
- Bear Creek 319 Watershed Plan— 2002-2003 MCD/MDEQ
- Muskegon Lake RAP Non Point Source Implementation—2002-2003 MCD/ MDEQ Clean Michigan Initiative / City of Muskegon / MERES/ Bultema & Bailey
- Muskegon Lake "Plan"—MDNR Fisheries Division
- Muskegon County Wastewater Management System "Study"

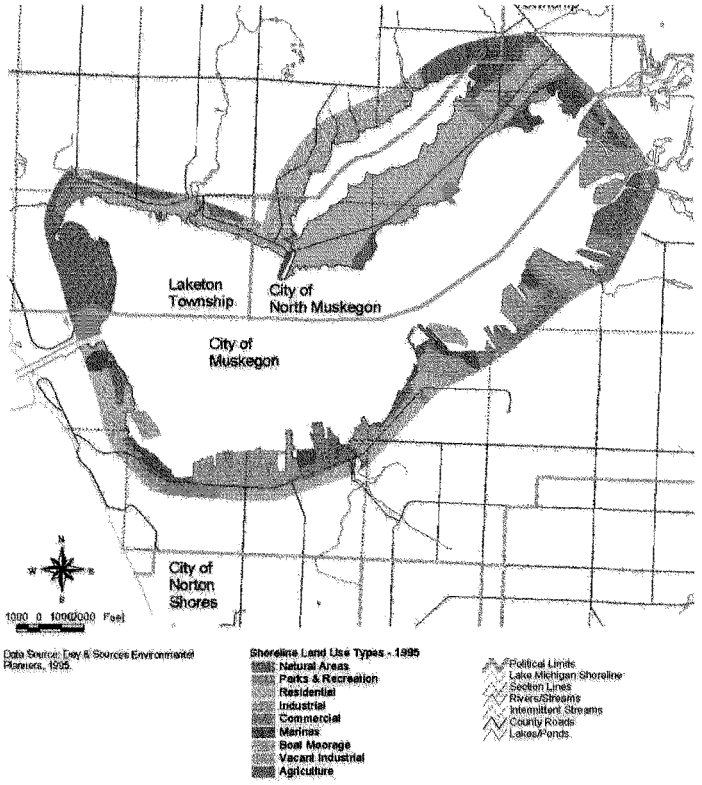
Acronym Definitions for Partners Listed Above

- MDEQ-Michigan Department of Environmental Quality
- MCD-Muskegon Conservation District
- USDA-NRCS—Natural Resources Conservation Service
- GVSU-AWRI-Grand Valley State University, Annis Water Resources Institute
- NOAA /GLERL—National Oceanic and Atmospheric Admisistration—Great Lakes Environmental Research Labs
- MDNR-Michigan Department of Natural Resources
- U.S. EPA-GLNPO– U.S. Environmental Protection Agency, Great Lakes National Program Office
- USACE-U.S. Army Corps of Engineers
- LMF-Lake Michigan Federation
- CFMC-Community Foundation for Muskegon County
- MEC-Michigan Environmental Council
- MSU-E-Michigan State University-Extenstion
- MERES-Muskegon Environment , Research & Educ. Society
- WMSRDC-West Michigan Shoreline Regional Development Commission

Information Source: Muskegon Conservation District Information Repository

Muskegon Lake Shoreline and Aquatic Plant Habitat Assessments—1995 Baseline Data

Muskegon Lake Shoreline Habitat Assessment



Data Source: Dey & Sources Environmental Planners, 1995.

Shoreline Land Use Types - 1995
- Natural Areas
- Parks & Recreation
- Residential
- Industrial
- Commercial
- Marinas
- Boat Moorage
- Vacant Industrial
- Agriculture

- Political Limits
- Lake Michigan Shoreline
- Section Lines
- Rivers/Streams
- Intermittent Streams
- County Roads
- Lakes/Ponds

The 1995 Muskegon Lake Habitat and Aquatic Plant Assessments were funded with a Muskegon Conservation District grant from the Michigan Department of Environmental Quality's Areas of Concern Program with U.S. Environmental Protection Agency (EPA) Region V, Coastal Environmental Management funds.

Muskegon Lake Public Advisory Council (PAC) members offered input for the studies and hosted community meetings to present and discuss the results. The studies are used to develop strategies and monitoring plans for habitat restoration in the Area of Concern's immediate lake area.

The 1995 Muskegon Lake Habitat Assessment provided the Muskegon Lake Remedial Action Plan participants with baseline information about plant and animal species and land uses present along Muskegon Lake's shoreline.

The City of Muskegon's 1997 Master Land Use Plan Update and Natural Features Inventory used the data to help develop recommendations for policies and actions to enhance and preserve several shoreline and tributary corridors.

Also in 1995, an aquatic plant assessment was performed to identify the types of vegetation in the lake, and how far the aquatic plant beds extended from the shoreline into the lake.

These studies are used to guide fish and wildlife habitat restoration projects in the Area of Concern (AOC).

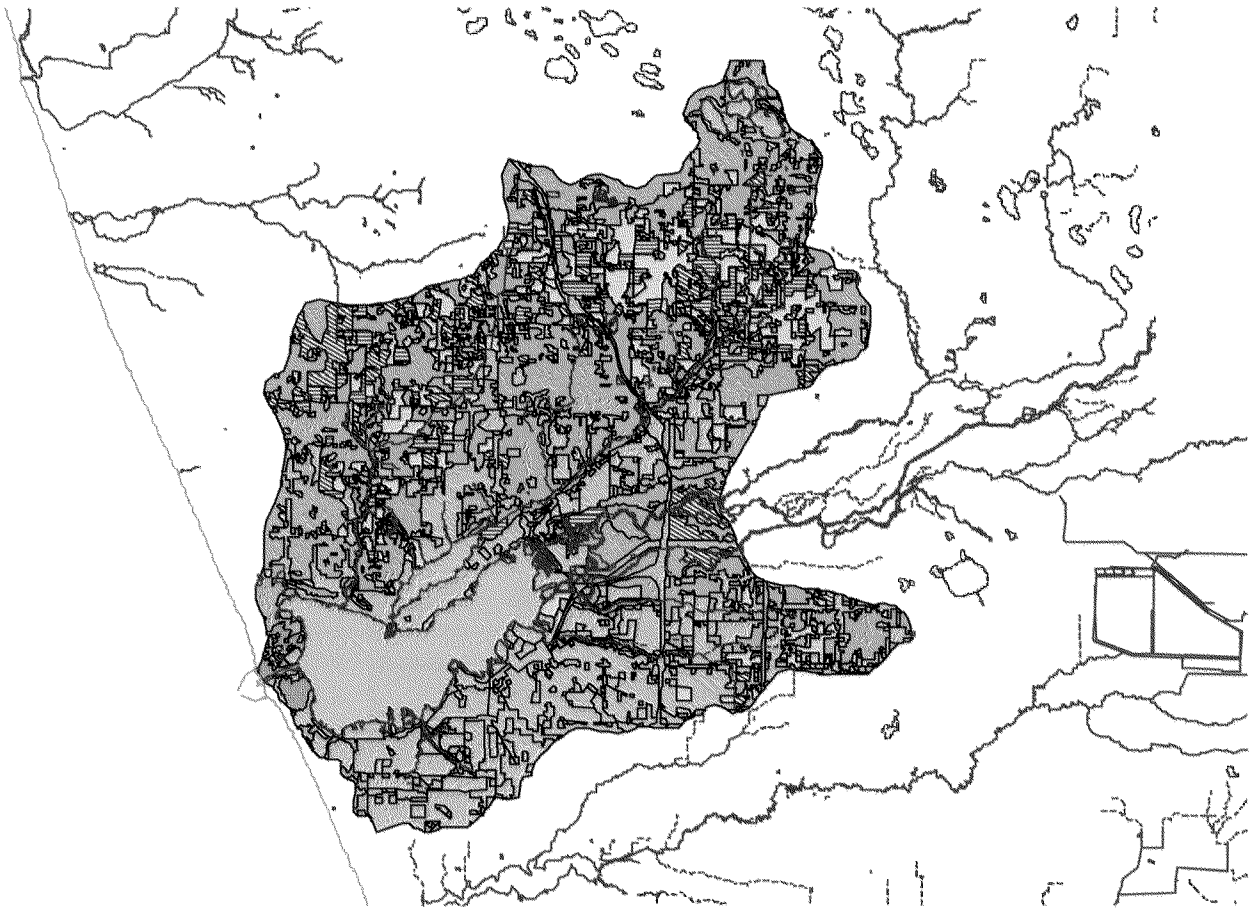
Aquatic Plant Habitat Assessment

The types and amounts of aquatic vegetation in Muskegon Lake was determined in 1995.

Muskegon Lake Watershed Assessment —1995 Baseline Data

The Muskegon Lake Watershed Assessment measured nutrients and metals along several tributary streams and stormwater outfalls in the Muskegon Lake watershed. The Muskegon Conservation District used the 1995 study to educate and inform the community about the condition of the Area of Concern watershed. It also helped to identify volunteer water quality monitoring sites on Ruddiman, Ryerson and Bear Creeks (State of Michigan "Total Maximum Daily Load" tributaries).

The 1995 study provided the community with the incentive to initiate an ongoing partnership effort to clean up contaminated sediment, surface and groundwater resources in the Ruddiman Creek watershed. Partners include Michigan Department of Environmental Quality; U.S. Environmental Protection Agency; U.S. Army Corps of Engineers; Grand Valley State University Annis Water Resources Institute; Muskegon Conservation District; City of Muskegon; Muskegon County Health Department; Muskegon Lake Public Advisory Council and the Ruddiman Creek Task Force.



The 1995 Watershed Study measured nutrients, heavy metals, oil and grease at stormwater outfalls and tributaries in the Muskegon Lake Area of Concern.

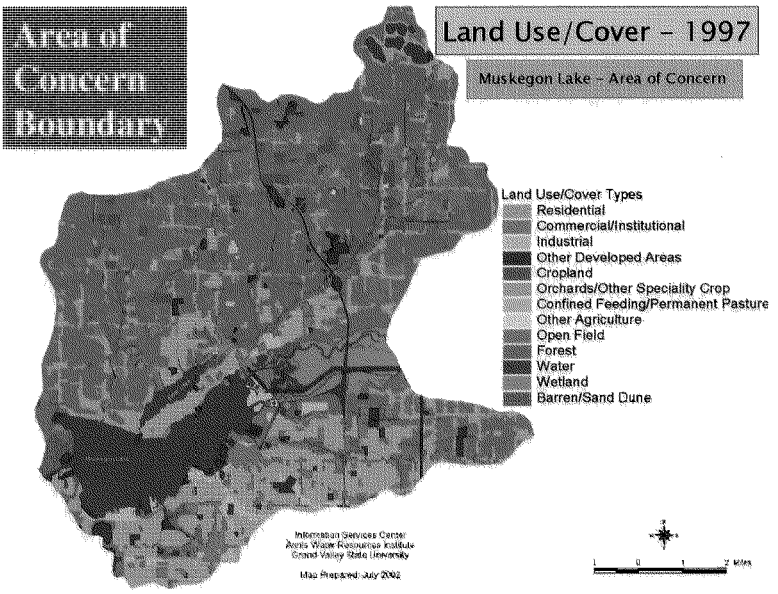
POLLUTION PREVENTION

Overview: Pollution prevention (P2) is perhaps, the single, most effective tool, to improve and protect natural resources in the Muskegon Lake Watershed. Implementing P2 at all levels of the Muskegon Lake community now and in the future will provide a strong, sustainable approach to the management of waste sources into the lake. Pollution prevention requires the foresight to look for possible problems before they occur. It requires the willingness of individuals to exchange behaviors and other routine practices for those with less impact to the environment. Practicing pollution prevention has far reaching consequences that address many of the social, economic, and environmental issues that are important to sustaining the Muskegon Lake ecosystem and our economy for future generations. Pollution prevention activities reduce or eliminate problems before they occur. Like all other social, economic, and environmental systems it is more efficient and less expensive to prevent problems before they occur rather than try to correct them after the fact.

What it is: Pollution prevention is the elimination or minimization of the generation of waste at its ***source***. Waste treatment, control, management, and disposal are ***not*** considered pollution prevention. Effective P2 also includes environmentally sound on-site or off-site recycling or reuse of those wastes that cannot be eliminated.

The patterns of P2 traditionally demonstrate a proactive, voluntary stewardship toward the protection of natural resources through such programs as household hazardous waste collections and curbside recycling. In recent years, however, the P2 paradigm has shifted to a broader vision of sustainable practices. Water use, energy consumption and process waste streams are now a major focus of P2 activities.

Muskegon Lake PAC Members point out historically significant sites of contamination for a 2002 U.S. EPA/MDEQ sediment investigation of Ryerson Creek, Four Mile Creek and the Lower Muskegon River Estuary.



The Muskegon Lake Area of Concern (AOC) boundary includes a 52 square mile immediate watershed with several tributaries, including Ruddiman, Ryerson, Green, Four Mile and Bear Creeks. Local governments in the AOC watershed include the Cities of Muskegon, North Muskegon, Norton Shores, Muskegon Heights, Roosevelt Park and the townships of Laketon, Muskegon, Dalton, Egelston and Cedar Creek.

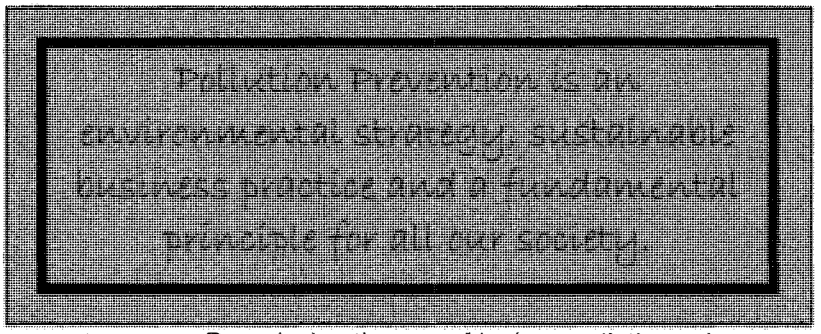
Effective restoration and protection of Muskegon Lake, its aquatic habitats, shoreline, streams and wetlands will depend on the involvement of all the residents, businesses, organizations and local governments in the watershed. Coordination of pollution prevention activities with efforts in the rest of the Muskegon River and Lake Michigan watersheds is also important.

Waste reduction at its source is a key component of pollution prevention and is often achieved through such simple actions as the use of alternative products, process and technology changes, and good operating practices.

Where we are:

In 1996, the Michigan Department of Environmental Quality became responsible for developing and implementing a comprehensive strategy to promote P2. A major objective of this strategy is to encourage and increase voluntary pollution prevention activities through partnerships with stakeholders such as businesses, institutions, local communities and health departments. Today, several programs throughout Michigan are successfully providing P2 technical assistance, low interest financing and partnerships that focus on the waste minimization at its source.

Reducing the amount of waste generated, reusing products and materials, and recycling materials that would have become waste by converting them into new materials and products makes both environmental and



economic sense. By reducing the use of toxic or polluting substances at the source, the hazards related to handling, storage, disposal, worker health and safety, as well as, personal and environmental liability are also minimized. This translates into benefits such as, cost savings for the producer and the protection of valuable local natural resources in a community like Muskegon Lake.

A tool such as the Environmental Management System (EMS) is a new standard of quality in industrial and community settings. EMS creates an overall site specific management system to address environmental concerns through the allocation of resources, assignment of responsibilities, and ongoing evaluation of practices, procedures, and processes to achieve sound environmental performance.
Environmental standards in the EMS include:

- Environmental Policy
- Environmental Planning
- Implementation & Operation
- Monitoring & Measurement
- Management Review

Unified support for such an effort is always a key component to the success of such programs. Partnerships and teamwork are important functions that give each EMS a specific ownership, which, in turn, reflects an efficient, collective approach to productivity.

RESOURCES:

Michigan Department of Environmental Quality - Environmental Assistance Division
1-800-662-9278 *(The link provided was broken and has been removed.)*

West Michigan Sustainable Business Forum (a project of West Michigan Environmental Action Council) Contact—Bill Stough-(616) 365-3246

West Michigan United Labor—Brent Gillette—(231) 722-3134 x227

Michigan Department of Agriculture – Environmental Stewardship Division (517) 241-0236 *(The link provided was broken and has been removed.)*

U.S. Environmental Protection Agency (The link provided was broken and has been removed.)

Simple Solutions to Water Pollution—muskegoncd.org or 773-0008

ACTION AGENDA

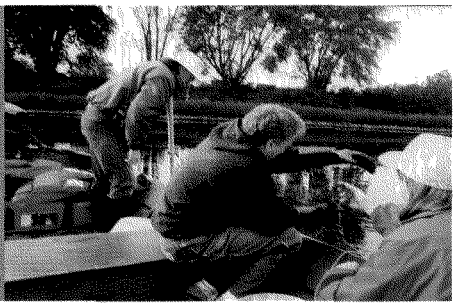
GENERAL PUBLIC:

1. Get Involved! – Participate and become a member of the Muskegon Lake Public Advisory Council, the Muskegon County Environmental Coordinating Council and other organizations that support the sustainability of Muskegon Lake.
2. Become Educated – Learn about the products you use and common everyday practices which may contribute to pollution directly and indirectly. The more you know the more you can help be a part of the solution. Contact Muskegon Conservation District and the Muskegon County Health Department to find out how.
3. Express Your Opinion – Let your local, state, and federal governmental representatives hear your voice concerning Muskegon Lake's environmental needs and know who you're electing!
4. Support Your Community - Support individuals, local companies, businesses, and farms that use pollution prevention for a more sustainable economic, social, and environmental community.
5. Evaluate Your Impact - Call 773-0008 for a free and confidential Lake-A-Syst, Home-A-Syst or Farm-A-Syst evaluation to learn how you can correct impacts you may be having on Muskegon Lake and groundwater resources.

GOVERNMENTS, ORGANIZATIONS, BUSINESS AND AGENCIES:

1. **Waste Reduction** – Municipalities can adopt pollution prevention and waste reduction resolutions and philosophies.
2. **Provide Financial Support**—Encourage opportunities for businesses to perform environmental audits through independent agencies.
3. Work with Suppliers and Contractors - Reduce waste through the production, packaging and distribution cycles.
4. Environmental Publicity - Encourage local publications and newspapers to write about pollution prevention and to recognize businesses and industries that meet or exceed state and federal regulations through voluntary compliance.
5. **Local Environmental Planning Committee**—Work with Muskegon County to encourage pollution prevention with major industries in our communities.
6. RAP Support - Strengthen public involvement in programs mentioned throughout this document that protect Muskegon Lake and the community.

NEARSHORE AQUATIC HABITAT



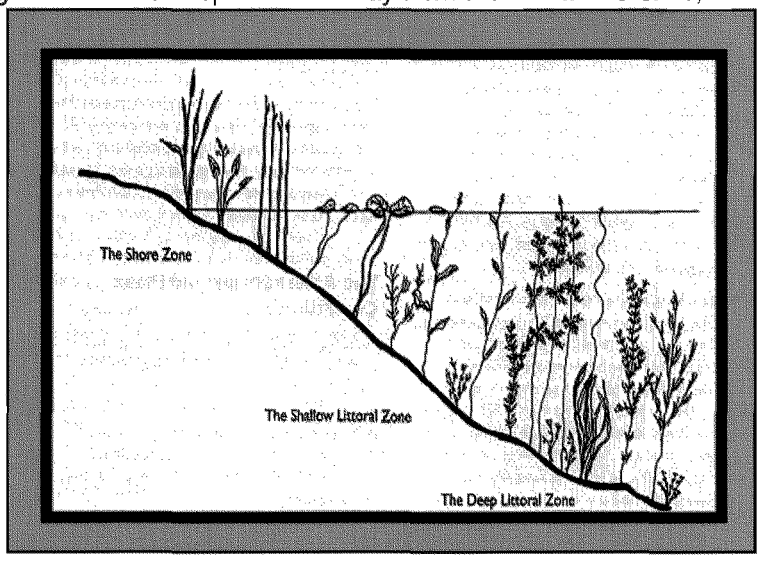
Overview Water resources are important in Michigan with 3,288 miles of Great Lakes shoreline, more than 35,000 inland lakes and 51,438 miles of rivers and streams. In the Muskegon Lake watershed, communities rely on the resource for recreation, sporting, tourism and industrial uses. Muskegon Lake and the adjacent wetland habitats comprise one of the four major freshwater estuary wetland complexes along the east shore of Lake Michigan. Defining Muskegon Lake and Muskegon River as part of Lake Michigan's ecosystem provides an opportunity to assess what biological communities utilize these areas. Monitoring this habitat can help us determine improving or declining recreational, cultural, ecologic and economic benefits.

What's the problem? The aquatic habitat within Muskegon Lake includes shallow water areas, open water, bottom (benthos), artificial structures (docks, seawalls, pilings) and natural structures (logs, rocks, and rooted plants). This habitat is disrupted by dredging, plant removal and indirectly through chemical herbicides and competition by non-native, invasive species. According to the Michigan Department of Natural Resources fish and wildlife biologists, dredging, filling, and related shoreline development continue to impair habitat critical to the survival, reproduction, and growth of most important fish and wildlife species. This is because the disruption of plants directly impacts aquatic insects, fish, birds, and mammal populations by decreasing food sources and changing or eliminating species in the food chain that may not directly utilize aquatic plants as a food source. Aquatic plants also provide structure for critical life stages of insects and fish. They also provide areas of refuge from larger predators. Although there is public concern about the destruction of Muskegon Lake's nearshore (littoral zone), a critical fish and wildlife habitat, the shoreline continues to be altered by dredging, installation of seawalls, bulkheads, riprap, marinas and other structural developments.

Where we are Opportunities for preservation and restoration of aquatic habitat in Muskegon Lake remain abundant. For example, the Muskegon Lake PAC, Muskegon River Watershed Assembly and Muskegon Conservation District (MCD) are partnering with the U.S. Fish and Wildlife Service to re-establish wild rice and other emergent vegetation to the lake's littoral zone and estuary. In addition, MCD will begin work in 2002 on a MDEQ Clean Michigan Initiative grant project to restore vegetation along three other public and privately owned shoreline areas. Ideally, public/private partnership projects, like these, are developed hand-in-hand with the early conceptual and planning stages of all water's edge developments. When they are not, aquatic habitats become altered without consideration for the community-wide economic or ecologic benefits. For example, shallow areas are recognized as important zones for many fish and waterfowl species, but they are often poorly managed because they interfere with boating or swimming. Lawn runoff is considered a problem in the AOC, but land use changes that produce excessive nutrient loadings are also developed miles away from the actual shoreline, so the connection between land use and the aquatic system is not always obvious.

Excessive nutrient loadings from lake tributaries, stormwater discharges and the Muskegon River have brought a reduction in dissolved oxygen in the deeper parts of the lake during summer and winter stratification. According to a 1999 U.S. Environmental Protection Agency/University of Michigan Benthic Study, a reduction in nutrient and organic loadings to Muskegon Lake could potentially improve dissolved oxygen levels and help restore the habitat available to fish species that require high levels of dissolved oxygen.

The 1995 Muskegon Lake Aquatic Plant Assessment baseline data, correlated with the bathymetry (lake depth contours) indicates a "volume" of vegetation in Muskegon Lake at **4%.** According to MDNR Fisheries Division, there is no target for a volume-based, vegetative cover for Muskegon Lake. However, MDNR recommends maintaining vegetative cover at a minimum of 25—45% of the surface acreage area for healthy fisheries in most inland lakes.



Based on surface area, Muskegon Lake's 1995 vegetative cover was at the minimum target of 25%. The lake's total volume of vegetation was at 4%.

A 2001 survey of Muskegon Lake's south shoreline by Wayne State University researchers and Muskegon Conservation District, revealed a diverse area of elodea, water celery and other beneficial aquatic plants near West Michigan Steel, the mouth of Ruddiman Creek, and the Grand Trunk areas. These are a few important areas to protect and enhance in conjunction with any future shoreline development projects.

Regarding reptile and amphibian populations, the general consensus is that they are decreasing because, of all species, they are most susceptible to contaminants and the loss of littoral zone and wetland habitats. However, baseline data on reptile and amphibian populations for Muskegon Lake and the Muskegon State Game area is needed.

All Remaining Aquatic Habitat is Critical!
Preserve ecological and economic values, by restoring and maintaining aquatic plants at 45% of the lake's surface acreage.

Regarding waterfowl, annual aerial survey counts are done in the Muskegon State Game Area, but beyond that, site-specific population data is not available for most species.

The City of Muskegon's 2002 Master Plan update includes a focus on the shoreline. It provides a foundation to integrate habitat and water quality improvements with development and re-development projects. On Muskegon Lake's north and east sides, the City of North Muskegon, Muskegon and Laketon Townships also have master plans that allow for protective ordinance and zoning practices. Appropriate ordinance language and amendments are needed to provide local officials with the "tools" for implementation. By March, 2003, all governmental units in the Muskegon Lake AOC watershed will be required to regulate stormwater runoff by the U.S. Environmental Protection Agency (EPA).

Because Muskegon Lake is attractive for recreation, residential, and business uses, the potential for continuing development is high. Often, the Public Notice process is the only avenue for community input on proposals that may significantly effect aquatic habitat.

Regardless of how the aquatic habitat is becoming degraded, increased losses will limit how the lake can be used and will lead to economic, educational and quality of life losses. Many community members and organizations in Muskegon County have an interest in aquatic habitat and value wildlife viewing, education, research and fishing as being of great importance.

REFERENCES

- *Environmental Assessment of the Benthic Community of Muskegon Lake, 1999*, Glenn Carter, University of Michigan.
- *Muskegon River Watershed Assessment-1997.* Richard P. O'Neal, Michigan Department of Natural Resources
- *Muskegon Lake Aquatic Plant Assessment*—1995. Dr. Mark Luttenton
- *Muskegon Lake Habitat Assessment* – 1995. Day & Associates
- ***Lower Muskegon River Preliminary Habitat Assessment***-2000. Dr. Richard Rediske, Grand Valley State University-AWRI
- *U.S. EPA*—www.epa.gov/grtlakes/solec/94/habitats

ACTION AGENDA

GENERAL PUBLIC:

1. Reduce Plant Removal - Conserve 60% (or more) of your near shore, "under water" environment and protect aquatic plants from unnecessary dredging and spraying.

2. Protect Native Aquatic Plants - Help re-establish aquatic plant communities by planting natives and correctly removing exotic species. *To learn how, call Adopt-A-Watershed at 773-0008.*

3. Attend Programs - Participate in education workshops to learn about the importance of aquatic plants to wildlife.

4. Evaluate Your Impact - Learn how you can change lawn, garden, septic and other maintenance practices to help the lake's ecology. *Call 773-0008 and ask for a Lake-A-Syst or Home-A-Syst evaluation.*

GOVERNMENTS, ORGANIZATIONS, BUSINESS AND AGENCIES:

1. Maintain Quality Habitat - Start a list of nearshore aquatic habitat areas. Compare this list with your inventory of preserved land.

2. Map What's Important - Provide aquatic zoning ordinances and map extent of critical areas—They are all critical areas in Muskegon Lake!

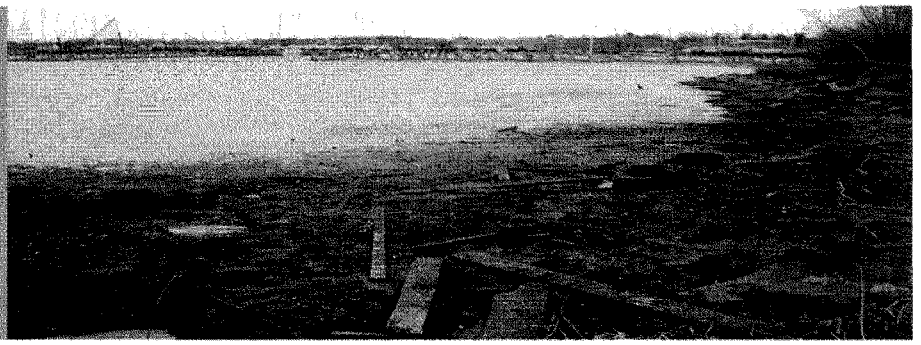
3. Provide Guidance - Provide landowners and developers with management plans for specific areas to prevent elimination of fish and wildlife habitat and the introduction of exotic species.

4. Eliminate Invasives - Promote research on whole lake, multi-jurisdictional integrated pest management. Research should include the "pros and cons" of biological controls, localized herbicide treatments, hand raking and harvesting.

5. Evaluate Nutrient Inputs - Determine source of nutrients in Muskegon Lake leading to eutrophication. Local sources may include: stormsewer discharges, in-lake sediment, groundwater, septic and sewer effluent, residential and commercial runoff.

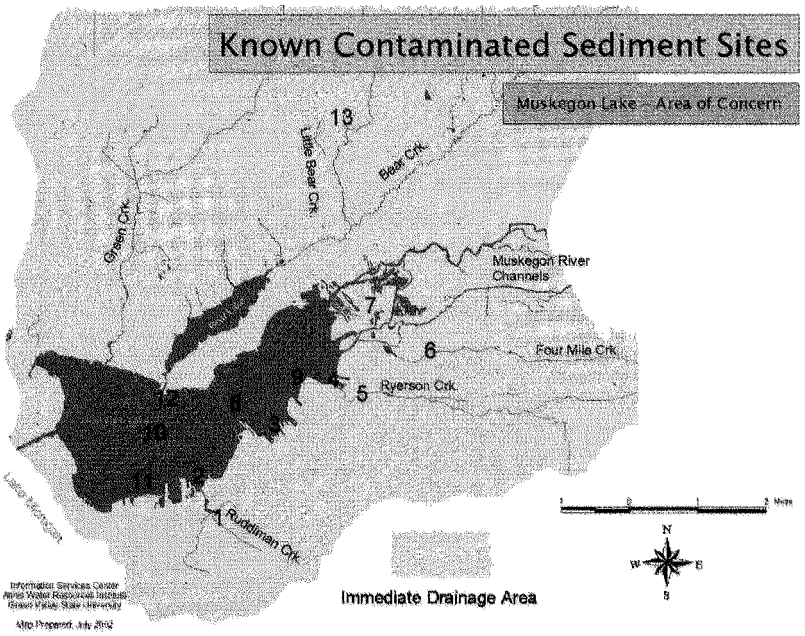
6. Develop a Nutrient Budget to guide reduction plans for stormwater runoff, construction sites, wastewater management and other land use and waste management practices.

CONTAMINATED SEDIMENTS



Overview Contaminated sediments continue to be a problem for many areas in the Great Lakes including Muskegon Lake and its tributaries. Muskegon Lake's sediment contamination is highest near contaminated industrial sites, at storm sewer outfalls, tributary mouths and in deeper, depositional areas of the lake. Industrial growth and chemical production in the 1950's and 1960's, brought associated environmental contamination because of limited knowledge, lenient regulations for the disposal of waste products, non-compliance and a lack of enforcement. Although the sources no longer discharge waste directly to surface water, the sediments themselves continue to act as sources of contaminants. Contaminants continue to cycle in the system because of storm events and currents that transport sediment from location to location. Organisms living in the sediment also bring contaminants to the surface and into the food web.

What's the problem? Once these contaminants enter the environment they impact living organisms through direct contact or indirectly by passing throughout the food web. Sediments in Muskegon Lake nearshore areas and tributaries are transported by lake currents and by high flow events. Environmental impacts from contaminants alter ecological health as organisms in the sediment ingest toxins and pass contaminants throughout the food web either altering the functioning or survival rate of wildlife that depend directly on these organisms. Some chemicals may have instant impacts on the environment while others become harmful to living organisms as they accumulate in body tissues and fat. Most notably the presence of contaminants can affect human health through consumption (fish/wildlife and water) and contact (directly with sediments or indirectly with the water).



The presence of contaminated sediments also affects economic development with increased testing and disposal costs. Contaminated sediment cleanup costs often exceed the financial resources of local governments and can complicate issues for the Army Corps of Engineers in maintaining navigation. Economic impacts can also reach tourism and sport markets as individuals decrease their use of Muskegon and Bear Lakes for recreational boating, fishing, and swimming activities.

Where we are The Muskegon Lake Public Advisory Council and the Ruddiman Creek Task Force are very active in the process to clean up historically significant sites of sediment contamination in the Muskegon Lake AOC watershed. The Muskegon Conservation District assists the PAC by facilitating local input and comments for the agencies. In addition, a technical team reviews draft sampling plans and reports for refinement by state and federal agencies and their consultants. This local, state and federal partnership has accelerated the cleanup *process,* however no actual clean up has occurred as of 2002. Due to the complexity and expense involved in contaminated sediment cleanup, it is anticipated that it will be 2015 before all sites are finally assessed and remediated.

REFERENCES:

- ***Muskegon Lake RAP 2002 Update's "Contaminated Sediment Assessment."*** 2002. Dr. Richard Rediske, Grand Valley State University-Annis Water Resources Institute (for Muskegon Conservation District)
- ***Preliminary Assessment of Sediment Contamination in Muskegon Lake. 2002.*** Dr. Richard Rediske, GVSU—AWRI
- ***Muskegon Lake 905(b) Analysis, Draft Data Summary Report—Muskegon Lake, Muskegon County, Michigan. March 2000.*** U.S. Army Corps of Engineers, Detroit District.
- ***Ruddiman Creek Remedial Investigation Report.*** 2002 -Earth Tech, for MDEQ and USACE
- ***Muskegon Lake Tributaries Investigation.*** 2002—Gannett/Fleming, for MDEQ and U.S. EPA
- ***U.S. Environmental Protection Agency.*** *https://www.epa.gov/environmental-topics/water-topics* and *(The link provided was broken and has been removed.)*
- ***Hazardous Substance Research Centers/South & Southwest.*** *(The link provided was broken and has been removed.)*

Contaminated sediments in Muskegon Lake and its tributaries need to be addressed in order to improve aquatic habitat and public use of the resource.

Known Contaminated Sediment Sites, 2002

SITE	STATUS OF CONTAMINATION	FUTURE
1. Ruddiman Creek, Tributaries & Lagoon	Remedial investigation completed in 2002 by Earth Tech w/USACE & MDEQ	Feasibility Study scheduled; possible clean-up through MDEQ Clean Michigan Initiative w/USACE/U.S. EPA
2. S. Muskegon Lake at Mouth of Ruddiman Creek	Continued problem area sampled in 1996, 1997. VOCs in shallow sediments	Remediation not evaluated. Future assessment needed
3. S. Bay at Division St. Storm Sewer Outfall between YPCA and Heritage Landing Facility	Sampling completed in 1998 by U.S. EPA. 1999 assessment by GVSU	Remediation not evaluated. Future assessment needed
4. NE Muskegon Lake at Mouth of Ryerson Creek	Sampling completed in 1998 and by Gannett Fleming w/U.S. EPA/MDEQ in 2002	Remedial investigation pending sampling results due September, 2002
5. Ryerson Creek	" " "	" " "
6. Four Mile Creek	" " "	" " "
7. Muskegon R. Estuary	" " "	" " "
8. Mid-lake offshore from Former Westrat site	Sampling completed in 1998. Chromium exceeded PEL	Remediation not evaluated. Further assessment needed
9. Mid-lake offshore from Former Lakey Foundry	Sampling completed in 2001 by GVSU w/ U.S. EPA. Waste tar on lake bottom. PAHs exceed PEL	Remediation not evaluated. Further assessment needed
10. Mid-lake Muskegon Lake Offshore of Grand Trunk	Depositional area for transported sediment. Sampled in 1998 & 2001. Lead and chromium exceed PEL	Remediation not evaluated. Further assessment Needed
11. SW Muskegon Lake near Bayer Mill	Possible problem area sampled in 1995, 1996	Remediation not evaluated. Future Assessment needed
12. NW Muskegon Lake near Mouth of Bear Lake	Possible problem area sampled in 1995, 1997	Remediation not evaluated. Future assessment needed
13. Little Bear Creek and Tributary	Possible problem area. NPL Site.	Remediation not evaluated. Groundwater cleanup ongoing

Problem Area Sediment Summary: The Muskegon Lake sites were confirmed in a 2001 305 B Study by the U.S. Army Corps of Engineers to be negatively affecting the ecological health of Muskegon Lake. The study suggests removal and/or capping for all of these sites. A Feasibility Study is pending agreement with a non-federal cost-share sponsor.

ACTION AGENDA

GENERAL PUBLIC:

1. Report Contamination - Contact the Muskegon Lake Public Advisory Council or the Muskegon Conservation District at 773-0008 to provide input about possible contamination sites due to historical uses (*comments will be used to identify sources and sites for cleanup).*

2. Express Your Opinion - Let your local, state, and federal governmental representatives hear your concerns about sediment contamination sites. Attend public meetings and hearings on sediment contamination cleanup projects.

3. Support Your Representatives - Contact representatives to voice encouragement, congratulations and appreciation for helping us restore specific Muskegon Lake watershed sites.

GOVERNMENTS, ORGANIZATIONS, BUSINESS AND AGENCIES:

1. Set a Vision for Future Use - Set priorities for all sites that are known to have contaminated sediments in regard to the communities' desired social, environmental, and economic uses.

2. Design an Innovative Contaminated Site Clean-up Monitoring Program - Coordinate existing local, state and federal monitoring programs to assist in evaluating the effectiveness of contaminated site cleanups.

3. Map and Research Contaminated Sites - Map sites and identify the extent of historical contamination to inform future planning and development.

4. Conduct Biological Assessments and evaluate sediment contaminant levels at sites affected by stormwater discharges.

5. Assess for the Future - Evaluate soil and groundwater sites that are potential sources of contaminants to sediments.

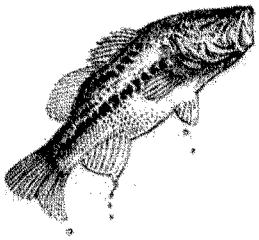
6. Develop a Standard Inspection Protocol to evaluate the integrity of "remedial effectiveness monitoring" and to document improvements or needs.

7. Standardize Surveys – Develop a fish and benthic organism survey protocol for use by community organizations, volunteers and agencies to evaluate pre and post cleanup conditions.

8. Design a Study to determine if contaminants are taken up in native aquatic plants and bio-available to wildlife through the food web.

FISHERIES

Overview Muskegon Lake is 4150 acres in size and supports extensive fisheries. Associated systems include Bear Lake, a shallow lake connected by a channel to Muskegon Lake; a marsh system 10—15 square miles in size encompassing the river immediately above the lake; and Lake Michigan, connected to Muskegon Lake by a shipping channel. The association of the river, marsh, and Lake Michigan produces a large variety of sport fishing in Muskegon Lake. Important fisheries include resident black crappie, bluegill, yellow perch, walleye, smallmouth bass, largemouth bass, northern pike, and flathead catfish. Walleye are the only species currently stocked. Largemouth bass are most abundant at the east end of the lake where smallmouth bass are more abundant near the west end. The west end receives cool water influxes from Lake Michigan which are favorable to smallmouth bass. The extensive marsh system supports a large northern pike population. The fisheries for bass and northern pike are excellent. Sometimes during fall and winter months, large numbers of yellow perch migrate from Lake Michigan to Muskegon Lake, and these fish support a large winter fishery.



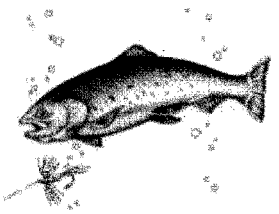
Yellow perch use Muskegon Lake for both feeding and reproduction. Spawning runs of Chinook salmon, steelhead and brown trout provide fall and spring fisheries. Both lake trout and lake whitefish move into the lake for feeding and spawning during fall. Lake sturgeon also use the lake for feeding and as a staging area prior to spawning movements into the Muskegon River. Brown trout from Lake Michigan use Muskegon Lake during spring and fall for feeding.

What's the problem? Although there are several reasons for populations declines throughout Lake Michigan the greatest impact on fisheries in Muskegon Lake has been due to the loss of shallow, littoral zone fish and wildlife habitat from dredging and development . Almost the entire littoral zone of the south shore of Muskegon Lake has been dredged or filled (see Aquatic Habitat chapter for more on this). In addition to shoreline filling and dredging, significant filling of wetlands has also occurred in the primary northern pike spawning areas located above the lake.

Fishery concerns include degraded populations of native white bass and the Great Lakes Muskellunge. Both are important sport fish in the Muskegon Lake Area of Concern. White bass are found in small numbers at the present time, along with the non-indigenous white perch. White perch are competitors with white bass and can cause declines in white bass populations. Another concern is the introduction of zebra mussel and the round goby. Non-native species continue to alter the food web structure for native species. This impact needs to be addressed with local and regional strategies. Otherwise, these ecological changes could lead to a collapse in the Muskegon Lake and Lake Michigan fishery as we know it. This would result in a substantial economic and quality of life loss for the Muskegon Lake community.

> Establish a native fishery that is naturally productive, safe from the impacts of non-native species and free of consumption advisories.

Other fishery concerns are related to the existing polluted sediments and the continued consumption advisories for certain species due to elevated levels of contaminants like mercury and PCBs (more on this in the Human Health chapter).

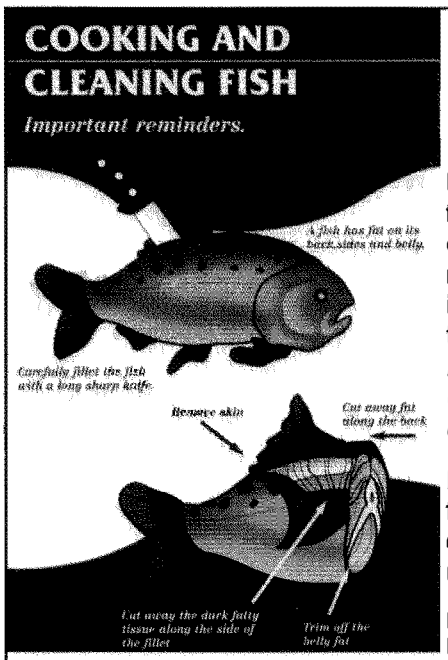


Where we are: According to the Michigan Department of Natural Resources Fisheries Division, two species of native fish should be considered for reintroduction into Muskegon Lake. These are white bass and Great Lakes muskellunge. Both are important sport fish and reintroduction may be favorable due to improvements in water quality. However, the presence of a large northern pike population may deter introduction of muskellunge.

Recently, both white bass and white perch were collected from Muskegon Lake (Rich O'Neal, MDNR) . However, white perch compete with white bass and may interfere with rehabilitation efforts.

Yellow perch use the shallow areas of Muskegon Lake and marsh for spawning. Many juveniles of these fish passively or actively move between Muskegon Lake and Lake Michigan. The contributions of young from Muskegon Lake is considered important to Lake Michigan fish communities.

A remnant population of lake sturgeon is present in the Muskegon River system. According to the Michigan Department of Natural Resources, this population is presently under study to determine possible restoration scenarios for this once abundant species.



Fish Muskegon Lake!

Trim & Cook Fish Properly to Reduce Risk

Proper preparation reduces the concentration of organic chemicals like PCB. By trimming fatty areas before cooking and by cooking in ways that allow fat to drip away, ***more than 50 percent of the contaminants in fish can be eliminated!***

Methyl mercury is stored in fish flesh. Trimming fat and cooking methods do not remove it.

Information provided by Michigan Department of Community Health.

2002 Michigan Fish Advisory.

See Human Health Chapter for Michigan Consumption Advisory details on specific Muskegon Lake, Bear Lake and lower Muskegon River fish species, their sizes and the number of meals per week for general population, women and children.

RESOURCES:

Muskegon River Watershed Assessment and Appendix. July 1997. Richard P. O'Neal, Michigan Department of Natural Resources

Muskegon River Watershed Fisheries Assessment. 1994. Richard P. O'Neal, Michigan Department of Natural Resources

Michigan Fish Consumption Advisory. *2002.* Michigan Department of Community Health—Environmental and Occupational Epidemiology Division, 1-800-648-6942

Muskegon Lake Aquatic Plant Assessment. 1995. Dr. Mark Luttenton.

Michigan Department of Environmental Quality. "GLEAS" Caged Fish Monitoring Reports for Muskegon Lake and tributary waters

Great Lakes Sport Fishing Council - Michigan
(The link provided was broken and has been removed.)

ACTION AGENDA

GENERAL PUBLIC:

1. Support a Sustainable Fishery - Follow fishing regulations concerning possession (species taken) and become educated about specific advisories for Muskegon Lake and surrounding waters.

2. Report Useful Data - Report fish with tainting of taste or smell. The majority of other abnormalities are usually natural.

3. Slow the Spread of Invasive Species - Learn to identify invasive species and never release them into the lake (including species used as bait).

GOVERNMENTS, ORGANIZATIONS, BUSINESS AND AGENCIES:

1. Determine Public Concern - Survey local fishermen and sport fishing organizations to determine the extent/ presence of tainting; population estimates; and educational needs on fish consumption.

2. Health Concerns - Research or utilize existing fish contaminant monitoring to assess the species and extent of contamination. Determine where contaminants are entering the aquatic food web.

3. Provide a Solution - Develop a aquatic habitat plan to protect, preserve, and rehabilitate fish habitat for various fishes and certain life cycle stages (including breeding and spawning habitat for walleye in the lower river).

4. Set Harvest Limits - Set localized harvest limits for species of concern.

5. Map What's Important - Provide aquatic zoning ordinances and map extent of critical areas.

6. Increase Your Stock - Support local sport fishing organizations to work with MDNR to stock native fish of importance to Muskegon Lake (including top predators like – White bass, Great Lake Spotted Muskellunge, Sturgeon, Walleye.

7. Support the Clean Up of Contaminated Sediments in Muskegon Lake and its tributaries.

8. Support the Prevention of new loadings of toxic substances from sources such as stormwater runoff and regulated air pollution or process wastewater discharges.

9. Reduce Air Pollution—Support clean air initiatives in the Muskegon Lake and Lake Michigan region.

10. Recycle—Participate in mercury reduction efforts and promote thermometer recycling programs

INVASIVE SPECIES

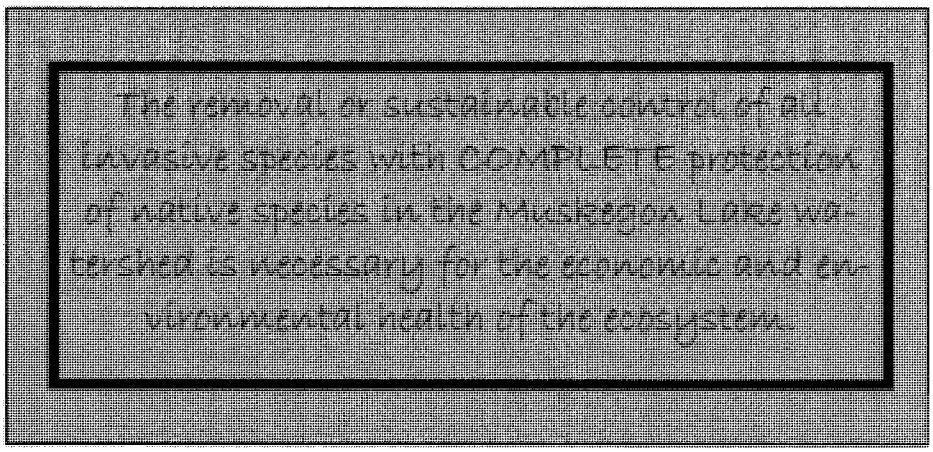
Overview Non-native invasive species continue to pose a serious threat within the Great Lakes terrestrial and aquatic systems They are considered to be one of the greatest dangers to ecosystems - a serious biological pollution problem. More and more people have knowledge of at least one exotic species but seldom understand all the associated problems, including: disruption of the food web through direct competition with native species; a decrease in the diversity of natural habitats; and the diminishing effectiveness of natural functions and services. It is difficult to determine the long-term impact of biological damage to native systems, and often thought as being overemphasized. Yet invasive species are becoming of great economic concern because they are expensive to control and they directly impact fisheries, recreation, aesthetics and tourism. State and Federal programs continue to explore how to best address introductions from Great Lakes ballast water and other means of transport. The problem has become a moving target that is hard to track, yet it is agreed the spread must be slowed.

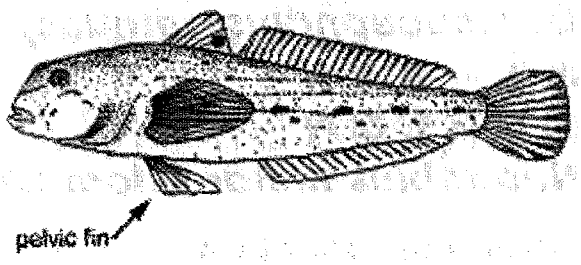
What's the problem? Non-native, invasive species can drastically alter the structure of food webs while often dominating environments. The decrease in diversity destabilizes the food web and can be devastating to aquatic systems. Once a system becomes altered it often creates a new habitat, suitable for the establishment of other invasive species. Even species like zebra mussels that appear to "clean" or filter the water are actually drastically changing the food web by filtering out microscopic plants and animals that are food for fish. Further studies are also showing that nutrient increases in phosphorus levels are causing major algal blooms of microcystis and other problem algae. Invasive species may also act as a pathway for the introduction of foreign pathogens.

Where we are: Muskegon Lake has become home to several invasive species that were introduced in the last 10-15 years. Those of great concern include: zebra mussels, round goby, ruffe, rusty crayfish, sea lamprey, mute swans, purple loosestrife and Eurasian water milfoil. As aquatic plant communities are disturbed or removed, individual species are often replaced by invasive species that have few predators and can over compete native species for light, nutrients, and space. Throughout Muskegon Lake and Bear Lake, the introduction of Eurasian watermilfoil and the continued elimination of native aquatic plants has led to a serious alteration in the aquatic habitat. In localized areas, algae and thick mats of vegetation interfere with recreation, fishing, boating, and swimming. Many of these shallow environments also continue to be altered by boating (docking, launching, storage) while public swimming access areas are limited to only a few isolated areas.

There is concern that invasive species are degrading populations of native white bass in Muskegon Lake. White bass are found in small numbers at the present time, along with the non-indigenous white perch. White perch are competitors with white bass and can cause declines in white bass populations. Another concern is the introduction of zebra mussel and the round goby. Non-native species continue to alter the food web structure for native species in the Muskegon Lake AOC.

This impact needs to be addressed with local and regional strategies. Otherwise, these ecological changes could lead to a collapse in the Muskegon Lake and Lake Michigan fishery as we know it. This would result in a substantial economic and quality of life loss for the Muskegon Lake community.





Round Goby

The introduction of round goby and their interaction with yellow perch may impact Muskegon Lake's walleye and white bass populations. If round goby creates a bottleneck in the growth of perch it may increase perch vulnerability to predation by walleye (Hartman and Margraf 1993) and white bass (Hartman 1998).

According to Ohio Sea Grant, the invasion of the round goby is likely to have complex effects on yellow perch populations and on the amphipod-yellow perch interaction in the Great Lakes *(The link provided was broken and has been removed.)*

Yellow perch has been an important component of the commercial and sport fisheries in Muskegon Lake and Lake Michigan. Severe flucuations in yellow perch abundance have been linked with the introduction of not-native species such as alewife and white perch (Well 1977, Parrish and Margraf 1990).

TECHNICAL

Great Lakes Commission/Great Lakes Panel on Aquatic Nuisance Species (734) 665-9135 and glc@great-lakes.net

U.S. Fish and Wildlife Service (703) 358-1718

Michigan Department of Environmental Quality, Office of the Great Lakes (517) 335-4056

Sea Grant National, Aquatic Nuisance Species Clearinghouse (716) 395-2516

Round goby has found suitable habitat in the historical sawmill slab wood fill that layers the nearshore in Muskegon Lake

ACTION AGENDA

GENERAL PUBLIC:

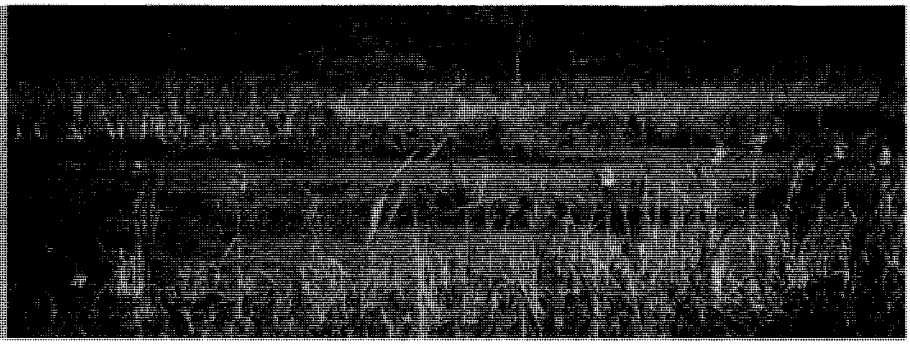
1. **Slow the Spread** - Do not help introduce new species – be conscious of transporting invasive species on your boat, the trailer, or in your vehicle.
2. **Start in Your Yard** - Remove non-native invasive species on your property in the correct manner (so as not to disburse seeds or encourage root growth).
3. **Help the Community** - Volunteer your time to help control and slow the spread of invasive species in public areas throughout your community.
4. **Improve Regulations** - Contact your State and Federal representatives to encourage the strengthening of regulations and the enforcement of non-native invasive species regulations.

GOVERNMENTS, ORGANIZATIONS, BUSINESS AND AGENCIES:

1. **Support Research on round goby management and the identification of ways to minimize its habitat in Muskegon Lake**
2. **Stock Predators** - Stock species important to Muskegon Lake (walleye, muskellunge, sturgeon) to mediate populations competing for habitat and food.
2. **Integrate Community Control Measures** - Explore Integrated Pest Management, including physical and biological measures to control Eurasian watermilfoil, and Purple Loosestrife.
3. **Map the Impact** - Assess and map the extent of areas where non-native invasive species are of greatest concern within aquatic and terrestrial habitats.
4. **Increase Regulation and Education** - Implement plans to eliminate or reduce the introductions of invasive species and their pathways.
5. **Train Parks Maintenance Staff** – Contact the Muskegon Conservation District for technical information about ways to control invasive species on public lands.
6. **Support Public Education** – Work with local and regional organizations that address the monitoring and control of non-native invasive species in your community.

LAND BY THE LAKE

SHORELINE AND WETLAND HABITAT



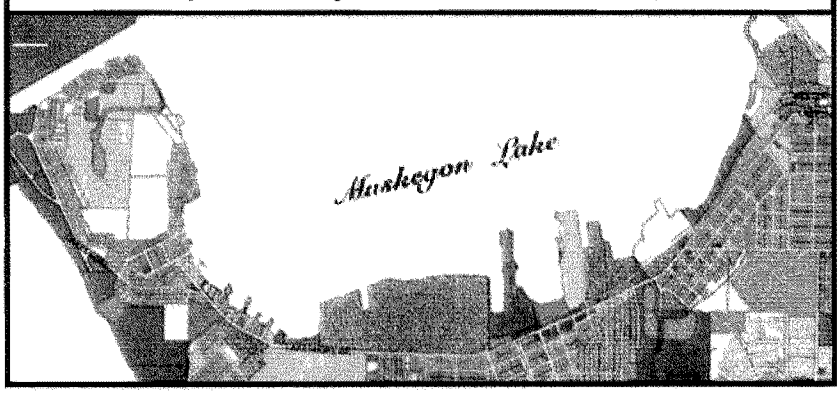
Overview Shoreline and wetland areas are not only unique in what they support from an aquatic habitat standpoint, but are also from a biological standpoint. These areas connect aquatic and upland areas and are home to many rare species of plants and animals. This habitat is not only critical for those rare species, but is also important to the common species that utilize the area for reproduction, growth or survival including reptiles, birds, amphibians, and some mammals. Loss or alteration can lead to reproductive decline for the general wildlife population. These areas are particularly important to migratory birds and insects: including the monarch butterfly and many of the warblers. Shoreline and wetland habitat play significant roles for an abundance of many species thought as important to hunters, naturalists, scientists and include an integral habitat for ducks, geese, shorebirds, songbirds, birds of prey, fish, frogs, salamanders, snakes, turtles, snails, mussels, insects, and crayfish.

What's the problem? Development around the lake, once primarily industrial, has changed to a mix of industrial, marina, vacant, public park and recreation, single and multi family residential. As a result, approximately 5% of the original shoreline and wetlands remain in a relatively "natural" state. Shoreline habitat also includes areas along streams and rivers within the watershed that need protection to act as a viable part of the watershed. The greatest concern in these habitats is the filling of wetlands and the removal of vegetation along streams and the shoreline itself.

Where we are: In the Muskegon Lake watershed, there is a growing awareness about the ecological services provided by healthy shoreline and wetland habitats. Planners and developers are beginning to take into account the importance of the functions these areas provide. Although some developments have "set aside" these critical areas, there is a need for continuing management to ensure they remain in a condition that benefits both the environment and people. This loss or fragmentation of habitat decreases the general aesthetics of the community, lake, and surrounding area and may lead to a general decrease in recreation and tourism. Fragmentation occurs, incrementally, through the elimination of small sections of wetlands, mowing to the water's edge, or from the construction of small developments, seawalls and docks that eliminate important spawning and nursery areas for many species of fish.

Muskegon's historically industrial shoreline led to over 100 acres of brownfield sites in the downtown/south shoreline area. The City of Muskegon was awarded a $1,000,000 site Assessment Fund grant to perform an in depth analysis of and to develop recommendations on several lakefront brownfield sites. The grant also provided funds for an area-wide plan to address shoreline foundry fill issues. The City has both a federal and state enterprise zone designation which provides businesses within these zones the opportunity to receive many special incentives. The re-development along with the ecological restoration of these areas will be necessary in order to restore the loss of fish and wildlife habitat in the Muskegon Lake AOC. It will also help to prevent the loss of open space in the more rural areas of the watershed.

Properties along Muskegon Lake's South Shoreline are Eligible for Inclusion, Rehabilitation and Redevelopment in the City of Muskegon's Brownfield Authority Plan



Wild rice is being restored in historically significant areas of Muskegon Lake and the lower River estuary

RESOURCES:

Michigan Department of Natural Resources

U.S. Environmental Protection Agency
Protecting Coastal Wetlands Resources: A Guide for Local Governments. 1992. USEPA, Office of Water. Washington D.C.

Muskegon Conservation District and the USDA-Natural Resources Conservation Service: Wildlife Habitat Incentive Program and other services. (231) 773-0008

(The link provided was broken and has been removed.)
www.epa.gov/OWOW/wetlands

Clinton River Watershed Council
(The link provided was broken and has been removed.)

Living with Michigan's Wetlands: A Landowners Guide. **1996. Wilfred Cwikiel. Tip of the Mitt Watershed Council.**

Develop a Community Vision and Goals

- No net loss of shoreline habitat
- Preserve ALL wetlands
- Restore habitat corridors to a minimum of 132 ft between aquatic and upland areas

Join the PAC in the annual, spring **Muskegon County *Earth Weeks Cleanup*** or the fall ***Coastal Cleanup.*** Help to restore habitat and natural beauty along the shoreline!

GOVERNMENTS, ORGANIZATIONS, BUSINESS AND AGENCIES:

1. Assess Local Wetlands - Map important wetland locations integrate community wetland protection ethic in your master plan and recreational plan.

2. Fill the Gaps - Prevent habitat fragmentation along the water's edge by connecting neighboring properties with habitat friendly landscapes.

3. Ensure No Net Loss of lake and stream buffers and wetlands by obtaining a conservation easement for your property.

4. Survey the Area - **Utilize a natural areas parks program to s**urvey and count reptile and amphibian populations along the lake and tributaries.

5. Decrease Flooding - Establish setbacks and ordinances to protect the 100 year floodplain so development doesn't affect flood storage capacity.

6. Evaluate Costs for maintaining wetlands compared to the damages caused by flooding and erosion.

ACTION AGENDA

GENERAL PUBLIC:

1. Become Educated - Attend a native plants / water's edge landscaping demonstration or workshop.

2. Set aside a Buffer Strip (area adjacent to the water) that is protected and human activity is limited.

3. Give Habitat Back - Restore altered shoreline (riparian habitats, shallow littoral zone, deep littoral zone) with native vegetation to provide habitat and nesting area.

4. Evaluate Your Impact - Participate in a Lake-A-Syst / Home-A-Syst to learn about what impacts you may be having on Muskegon Lake and its tributaries.

5. Don't Block Access - Limit seawall construction on your property or provide alternatives that are "access friendly" to wildlife. Restore failing walls and revetments in a similar manner.

6. Encourage Native "Re-Vegetation" by managing purple loosestrife and reed canary grass during low water level periods in shoreline/beach zones.

7. Remove Dams—Encourage removal of all dams and in stream obstructions that block migratory pathways of fish and the public's access to the waterway.

8. NEVER FILL IN A WETLAND!! Know the difference between a bog, marsh, swamp or a seasonal wetland. Many species depend on wetlands that are only wet during part of the year.

GOVERNMENTS, ORGANIZATIONS, BUSINESS AND AGENCIES:

7. Maintain Corridors - Maintain continuous riparian corridors.

8. Road Crossings Over Streams should be maintained to ensure that the velocity of water does not scour sensitive stream habitats during rain events.

9. Develop a Community Vision to guide development and restoration. Use historic maps & photographs to determine the original shoreline and wetlands extent.

10. Evaluate Necessity of Seawalls - Limit seawall construction and permits along shoreline. Do not disturb 25% of your shoreline.

11. Educate the Public - Provide educational opportunities about the importance of wetlands during public events.

12. Improve Storm Water Quality - Provide for wetlands in stormwater manage-ment plans. Ensure that they are not overly stressed by runoff. Create manmade, constructed wetlands for stormwater treatment & management.

LAND USE GREEN SPACE AND BROWNFIELDS

Overview The Muskegon Lake sub-watershed of the Muskegon River watershed is comprised of a 52 square mile area of land. Unique natural features include freshwater marshes, sand dunes, streams, the Muskegon River estuary and Muskegon Lake, a drowned river mouth lake that outlets into Lake Michigan. The sub-watershed includes the cities of: Muskegon, North Muskegon, Norton Shores, Roosevelt Park, Muskegon Heights; and the Townships of: Laketon, Muskegon, Egelston and Dalton.

What's the problem? The quality of water in the Muskegon Lake watershed is determined by how the land is used. Land use within the watershed encompasses everything from natural areas to residential subdivisions; and agricultural to commercial and industrial uses. In the 1960's, a slow but steady migration of people who lived in the older communities moved into the outlying open space areas. This trend is continuing and many of these outlying areas are becoming rapidly urbanized.

When land changes from a natural state to a more intensive uses, it can affect water quality and the amount of livable habitat for wildlife. As areas of land are developed for human use, or as natural areas become fragmented and isolated from each other, the livable area for wildlife decreases. Isolation and fragmentation also affects migratory pathways and breeding habitat for mammals, birds, reptiles and amphibians. The increased fragmentation due to urban sprawl is considered to be the greatest threat to species in North America. Habitat fragmentation also leads to increased social interaction between humans and animals such as skunks and raccoons, while increasing the likelihood of problems for wild animals in general.

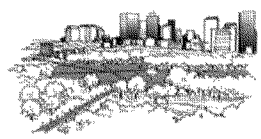
All land use practices can affect water. The greatest impact is from areas immediately adjacent to water like streams, rivers and lakes. Along Muskegon Lake's south shoreline, former industrial land and waste management practices resulted in a number of contaminated properties, known as brownfields. These areas are prime shoreline re-development sites and can be cleaned up and re-developed through private and public partnerships and funds. When re-development occurs in such a way that is sensitive to the ecosystem, improvements in water quality and wildlife habitat can occur.

Shoreline brownfields offer vast opportunities to restore habitat and water quality in Muskegon Lake and provide a number of benefits:

- **Protection of public health and a cleaner environment**
- **Tax base enhancement by finding productive uses for neglected sites**
- **Job creation and retention**
- **Spin-off redevelopment and stronger neighborhoods**
- **Creating an alternative to urban sprawl and the loss of open space**

Sustainable Development for a Clean, Healthy Environment

Of course, one of the most effective ways to maintain good water quality and habitat is in the permanent preservation of natural areas adjacent to the water, wetlands, buffer areas, and riparian zones. A conservation easement is a voluntary restriction placed by a landowner on the use of his or her property to protect resources such as wildlife habitat, agricultural lands, natural areas, scenic views, historic structures, or open spaces. The landowner retains title to the property, and the easement is donated to a qualified conservation organization, such as a land trust, or a government agency. The effect is permanent protection of the land by allowing a land trust or government agency to enforce the terms of the agreement.



Where we are: The future of Muskegon Lake and the water quality of the system depends on human actions and land use practices occurring in the immediate shoreline and Muskegon Lake watershed - along with a Muskegon River watershed-wide approach. This holistic approach view is the natural landscape as an ecological service that benefits the community with services like flood control, water quality, wildlife habitat, recreational opportunities and aesthetics.

The Muskegon Lake community is addressing land use concerns in various ways, including the following:

- The City of Muskegon's "shoreline brownfield designation" allows faster re-development of the former industrial shoreline
- The City of Muskegon, State of Michigan, private developers, Lakeside Neighborhood Association, Bunker Schools and SAPPI Local 6-1015 union volunteers are working with the Muskegon Conservation District at the former Grand Trunk Carferry Dock brownfield site to restore vegetation along the shoreline, provide stormwater management and improve fish and wildlife habitat.
- Conservation zoning at Muskegon's public parks and properties provides setbacks from streams and protects natural features
- Community involvement in the Muskegon Area Plan can provide a long-term strategy for natural resources protection
- Master Plan updates are beginning to include the foundation for future environmental ordinances and zoning in most of the watershed's municipalities
- The Muskegon Environment, Research and Education Society is providing a conservation easement for use as a match in a Muskegon Conservation District grant with MDEQ Clean Michigan Initiative funds. The project will set aside 15 acres and leverage grant funds to install several more acres of vegetative stormwater runoff control and habitat enhancement.

RESOURCES:

Muskegon Area Plan, West Michigan Shoreline Regional Development Commission—(231) 722-7878

Muskegon County Land Use Task Force-Education Committee—Roland Crummel, Laketon Township Supervisor - (231) 744-2454

West Michigan Strategic Alliance—Local Contact - Mayor Nancy Crandall, City of Norton Shores—(231) 798-4391

Smart Growth—www.smartgrowth.org

U.S. Environmental Protection Agency
(The link provided was broken and has been removed)

Michigan Land Use Institute
www.mlui.org (231) 882-4723

Land Conservancy of West Michigan—1432 Wealthy SE., Grand Rapids, MI 49506 (616) 451-9476

American Farmland Trust
www.farmland.org (202) 331-7300

Farmland Information Center Fact Sheet:
(The link provided was broken and has been removed.)

The Nature Conservancy—tnc.org

Other Resources:
www.sprawlwatch.org

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www.preservenet.com

ACTION AGENDA

GENERAL PUBLIC:

1. **Become Involved** – Participate in the Muskegon Area Plan (MAP) and the Muskegon Lake Public Advisory Council.
2. **Protect Your Property** - Consider acquiring a conservation easement on your property.
3. **Learn about the Natural History** - Find out about the significance of establishing native landscapes in areas where there is already development.

GOVERNMENTS, ORGANIZATIONS, BUSINESS AND AGENCIES:

1. **Reusing the Land** – Provide cleanup and development incentives at abandoned sites and limit development expansion into natural areas that provide the community with ecological services.
2. **Inventory Your Community** - Inventory community's preserved land and use it to develop ordinances, zoning, and update master plans. (Ensure habitat protection with changing land use patterns.)
3. **Utilize Overlay Zones**—Provide additional development guidance to conserve and enhance special features such as shoreline areas, riparian corridors and wetlands.
4. **Work Together** - Land use techniques and zoning: if development is going to occur, propose "conservation sudivisions." Link these with other conservation items in adjacent communities.
5. **Educate Landowners** - Provide Best Management Practice workshops and educational materials for the public.
6. **Work on Sub-Watersheds** - Ensure that every Muskegon Lake sub watershed develops a 319 watershed plan or a storm water management plan with implementation funds.
7. **Implement Best Management Practices (BMP's)** and wetland ordinances to setback development from floodplains and riparian areas.
8. **Preserving the Land** - Work with landowners and developers to implement conservation easements on streamside and shoreline property (including large shoreline brownfields with high potential for re-development such as the Teledyne property).
9. **Look at the Big Picture** - Develop projects on a greater scale to include entire sub-watersheds for an approach that includes ecosystem restoration, comprehensive greenways and wildlife corridors.

SUB-WATERSHEDS in the AOC

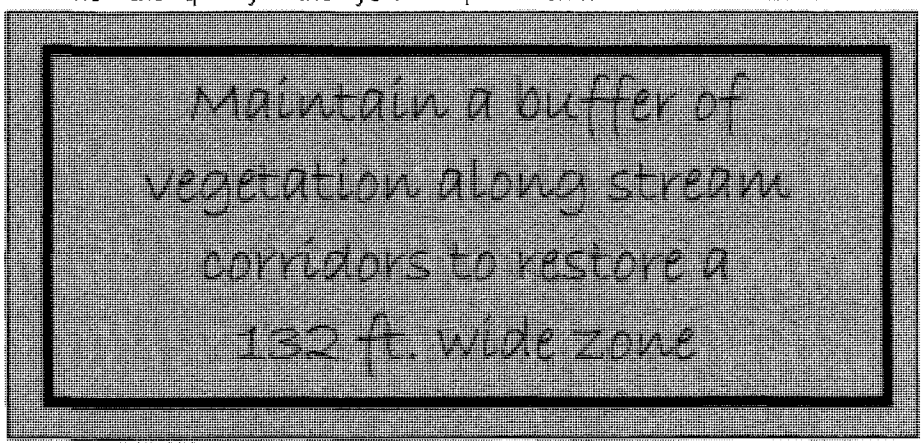
Overview: Muskegon Lake is a scenic, 4,149-acre drowned-river mouth lake in Muskegon County, with access to Lake Michigan through a channel. The Muskegon River is the primary tributary to the lake and supplies 97% of the water to the system. However, other contributing tributaries to Muskegon Lake have had significant impacts on Muskegon Lake because of historical uses and continuing land use changes and practices in stream corridors and storm water basins.

The Muskegon Lake Area of Concern (AOC) boundary is a 52-square mile watershed. It includes the sub-watersheds of: Ruddiman Creek; Ryerson Creek; Four Mile Creek; Bear Creek; Green Creek; the Division Street Stormwater Basin and Mosquito Creek. The Cedar Creek watershed is not considered part of the AOC boundary. The watershed can be thought of as all the land area in which any precipitation flows and drains to a common point, Muskegon Lake. Most of the sub-watersheds are either developed or rapidly urbanizing with land uses ranging from residential, recreational, forested and open space to commercial and heavy industrial uses. Muskegon Lake's local soil types are primarily highly permeable, sandy soils.

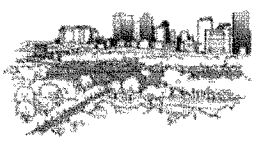
What's the problem? The Muskegon Lake watershed is comprised of a land area within the jurisdiction of several local governmental communities. With a 52-square mile area, it's no surprise that many residents assume that their actions have no significant impact on Muskegon Lake or Lake Michigan. Yet, it is these individuals who determine the quality of the environment on their property and the practices used on the land. Some people believe that the quality of our water is the State's responsibility. There are laws and ordinances that regulate the dredging and filling of wetlands; erosion from construction sites; and other land use practices. Unfortunately, regulatory processes do not always take an holistic, ecosystem approach. Therefore, piece by piece, and project by project, natural functions are diminished throughout the watershed.

Variances to local zoning requirements can also impact the natural functions of our lakes and streams. All land use practices can affect our water, with the greatest impacts from areas immediately adjacent to wetlands, streams, rivers and lakes. Natural areas along the lake and creeks are still being lost and altered by human uses in the Muskegon Lake watershed. Along with the loss of the natural areas, comes the loss of the ecological functions and amenities that they provide our communities.

Where we are: The future of Muskegon Lake and the water quality of the system depends on human actions and land use practices in the watershed. The Muskegon Lake Public Advisory Council and the Muskegon River Watershed Assembly are taking a watershed-wide approach to protect the natural functions of the landscape. A watershed approach to land use decision-making can benefit the community in many ways. Benefits include natural flood control, improved water quality, expanded recreational opportunities, wildlife travel corridors and greenways. This approach also instills a community-wide "sense of place" that celebrates the unique natural features of our west Michigan landscape.



The Muskegon Lake Public Advisory Council has taken a "sub-watershed" approach to carry out Remedial Action Plan (RAP) implementation and public involvement projects in the Muskegon Lake AOC. Progress has been made in the Ruddiman Creek watershed to address contaminated sediments; in the Ryerson Creek watershed with stormwater management; and in the Bear Creek watershed with a watershed planning project.
Volunteer monitoring is underway in these sub-watersheds as well.



Community involvement on a sub-watershed scale ensures local natural resources stewardship and sustainability for the improvements made.

ACTION AGENDA

GENERAL PUBLIC

1. Get Involved! – Participate and become an member of the Muskegon Lake Public Advisory Council, the Ruddiman Creek Task Force, the Muskegon River Watershed Assembly, or the Muskegon County Environmental Coordinating Council and other organizations that support the sustainability of Muskegon Lake.

2. Learn about the Watershed – Find out about the importance of using natural and native landscapes in areas where there have already development. Learn about products and common everyday practices which may contribute to pollution directly and indirectly. The more you know the more you can help be a part of the solution. Contact Muskegon Conservation District and the Muskegon County Health Department to find out more.

3. Attend Local Government Meetings or Volunteer for a seat on your local planning commission or parks and recreation committee. Your input on local decision making can make a big difference in how local natural resources are protected and used.

4. Support Your Community – Support local companies, businesses, and the agricultural community that are taking pollution prevention steps for a more sustainable future in our economic, social, and environmental community. Encourage groups that do not practice pollution prevention techniques to do so.

5. Express Your Opinion – Let your local, state, and federal governmental representatives hear your voice concerning environmental issues in your community that impact Muskegon Lake. If you don't know where to voice your opinion contact the Muskegon Lake Public Advisory Council for information.

6. Evaluate Your Impact - Participate in the Muskegon Conservation District sponsored confidential Lake-A-Syst, Home-A-Syst or Farm-A-Syst programs to learn how you can correct impacts you may be having on Muskegon Lake surface water and groundwater resources.

7. Protect Your Property - Consider acquiring a conservation easement on your property.

See next page for more on watersheds

ACTION AGENDA

GOVERNMENTS, ORGANIZATIONS, BUSINESS AND AGENCIES

1. Work on Sub-Watersheds – Ensure every sub watershed in lake wil have a 319 watershed plan or a storm water management plan with implementation funds.

2. Implement Best Management Practices (BMP's) and floodplain ordinance to regulate floodplains and riparian areas.

3. Preserving the Land – Work with landowners and developers to implement conservation easements on streambank and shoreline property still remaining in the watershed (including large brownfields with high potential for re-development along the lake and streams such as the Old Story, Teledyne and West Michigan Steel properties).

4. Reusing the Land – Provide development opportunities at abandoned sites to limit expansion into areas that are still providing ecological services.

5. Educate Landowners - Provide Best Management Practice workshops and educational materials for the public.

6. Look at the Big Picture - Develop projects on a greater scale to include entire sub-watersheds for an approach that includes ecosystem restoration, utilize county comprehensive greenways and provide corridor management).

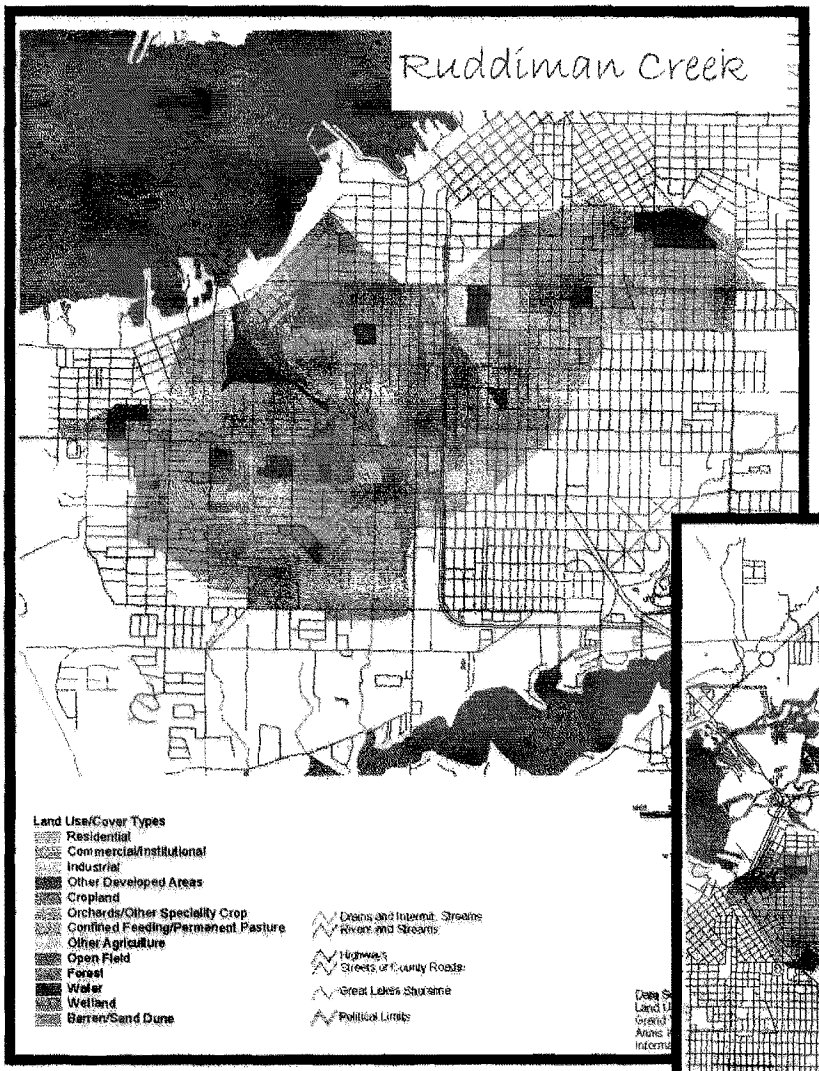
7. Waste Reduction – Municipalities can adopt pollution prevention and waste reduction philosophies and resolutions.

8. Work Together - Land use techniques and zoning. If development is going to occur look for conservation subdivisions and link these with other conservation areas in other communities/municipalities.

9. Inventory Your Community - Inventory community's preserved land and use it to develop ordinances, zoning, and create master plans. (must be a balance between habitat protection and changing land use patterns).

Muskegon Lake TMDL Sub-Watersheds

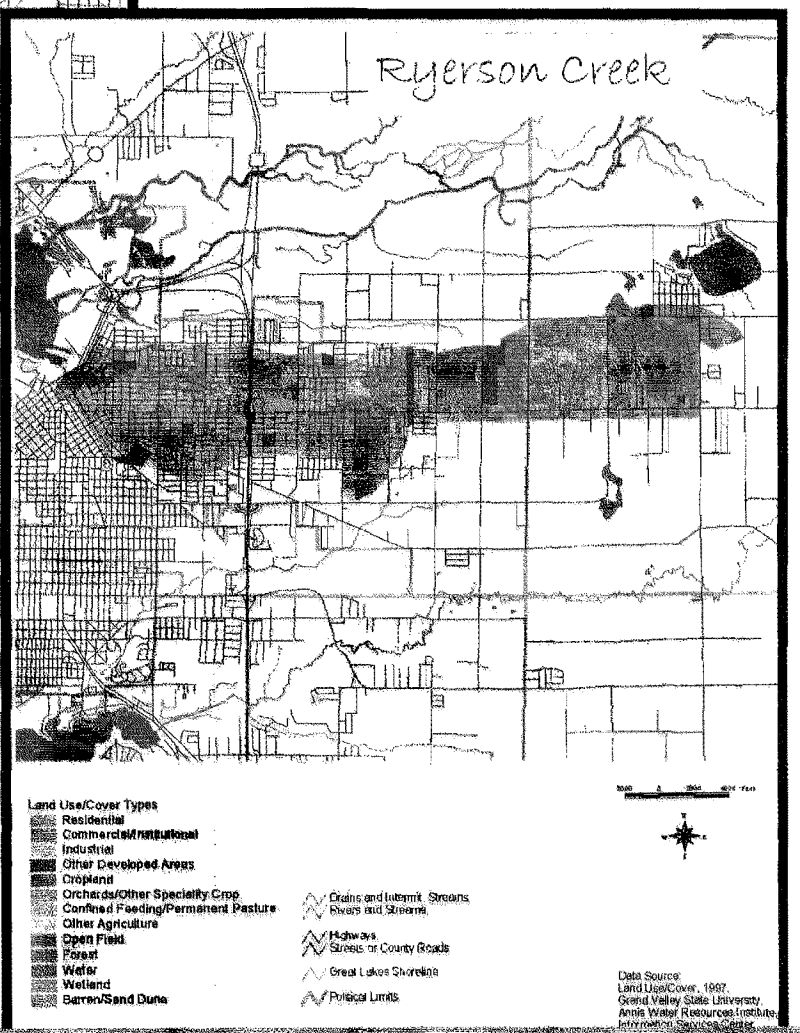
Ruddiman Creek



The Ruddiman Creek Strategic Plan was developed as a strategy to implement the Muskegon Lake Remedial Action Plan on a sub-watershed basis. The strategy outlines needs in the areas of Land Use, Stormwater, Contaminated Sediment Remediation, and Education.

To find out more about how to get involved, call Ruddiman Creek Task Force (RCTF) Chairperson, Theresa Bernhardt at 755-6321. The RCTF meets on the third Tuesday, each month at the McGraft Park Community Building.

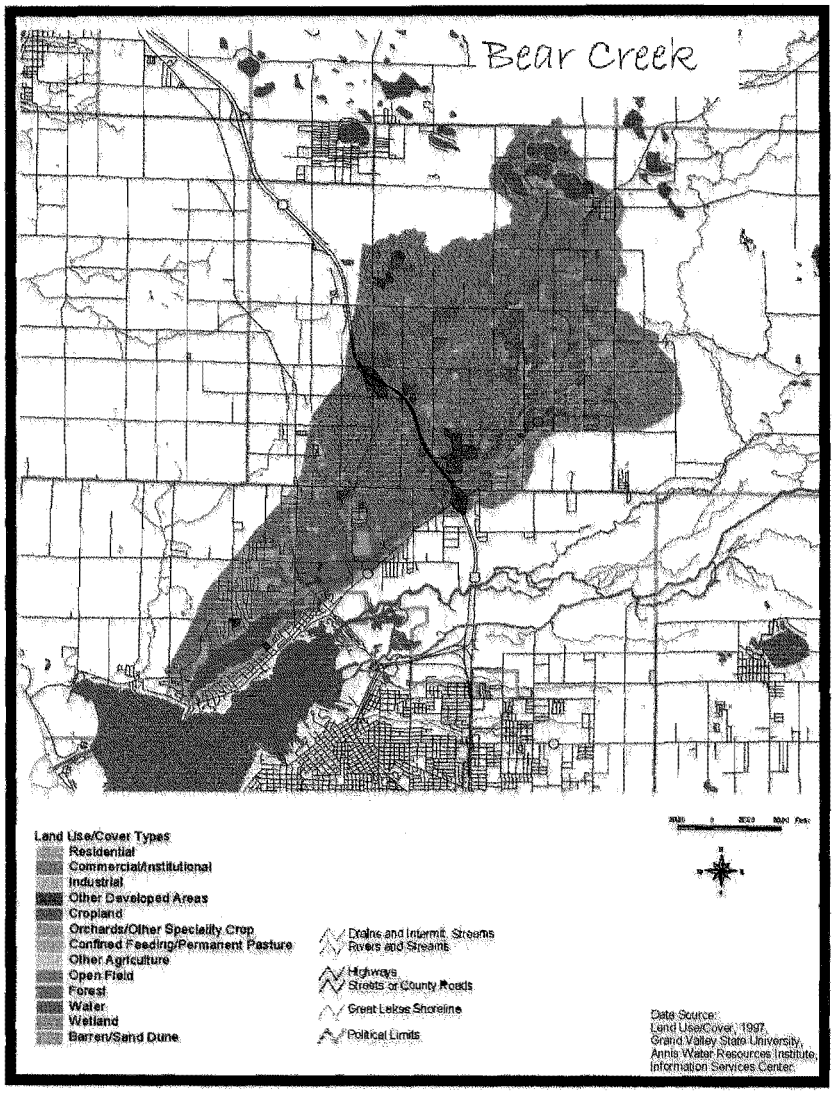
Ryerson Creek



The Ryerson Creek watershed is comprised of three local units of government. A stormwater management plan was developed in 2000. For information on local planning, ordinance and zoning techniques that are in place to improve Ryerson Creek, contact Egelston Township Planning Director Brian Hill at 788-2306, Muskegon Township's Zoning Administrator Dave Fisher at 777-2655 or City of Muskegon Department of Public Works Supervisor Robert Fountain at 724-4100. Each local government is active in stormwater planning and management activities.

Public Involvement in the Sub-Watersheds

The Michigan Department of Environmental Quality will develop Total Maximum Daily Loads (TMDLs) of certain pollutants for water bodies that do not meet water quality standards in the federal Clean Water Act. TMDLs are scheduled for Muskegon Lake in 2008, Ruddiman and Ryerson Creeks in 2008 and Bear Lake in 2009. The Muskegon Conservation District's Adopt-A-Watershed Program provides assistance for public involvement activities that address these goals and the natural resources vision for each local community.



The Bear Creek Watershed is comprised of the City of North Muskegon and the townships of Dalton, Muskegon and Laketon. A Michigan Department of Environmental Quality/U.S. Environmental Protection Agency 319 watershed planning grant was awarded to the Muskegon Conservation District in 2002. The project includes inventories of streambanks; road stream crossings; water flow and rainfall measurements; public involvement opportunities and a stormwater management plan with ordinance development. The plan will be completed in September, 2003.

RESOURCES:

Muskegon Conservation District—Adopt-A-Watershed Program (231) 773-0008 or Muskegoncd.org

U.S. Environmental Protection Agency
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Michigan Department of Natural Resources
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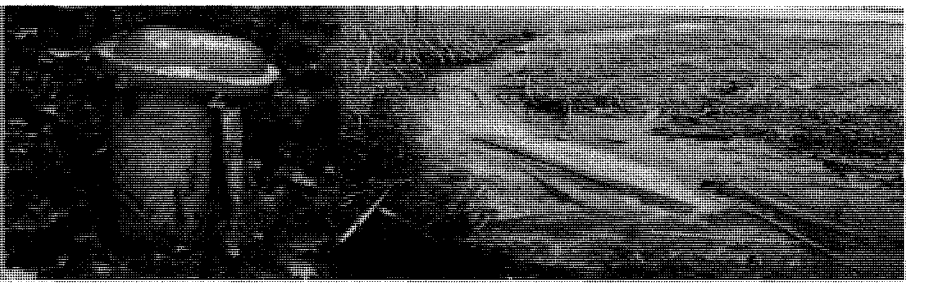
Michigan Department of Environmental Quality ***(The link provided was broken and has been removed.)***

Adopt-A-Watershed is available to community volunteers, students, teachers, landowners and others who wish to perform environmental stewardship actions in their own backyards.

Program support includes native plant and habitat restoration; streambank and shoreline clean-ups; training workshops; volunteer water quality monitoring; storm drain education and stenciling.

In addition to hands on and educational programming, assistance is available for project grant writing; watershed, forest and wildlife habitat planning; and cost-share programs for wetland restorations; stream bank and shoreline vegetative buffers. Please call the Muskegon Conservation District at (231) 773-0008 to find out more.

GROUNDWATER



Overview: Drinking water is a resource everyone uses although often not realized, so is seldom thought of as a responsibility. Groundwater is a vital resource used for irrigation and human consumption. It constitutes the primary water source for roughly 90% of all people in the United States and is the major source for the Muskegon Lake community. While usually a very safe source of clean potable water, groundwater is at risk of contamination by many human activities. Groundwater is an important source of water to maintain flow and water levels in rivers, wetlands, and lakes. Large open tracts of undeveloped land are the most important areas that ensure water seeps into ground and fills groundwater and eventually the surface water. Groundwater is responsible for 30% of all stream flow in the United States and even a greater percentage in Michigan. Groundwater can move anywhere between 2-500 ft. a year, so contamination is not easily contained.

What's the problem? Groundwater pollution and contamination can occur from a variety of sources. One of the greatest sources of pollution is from nutrient contamination because it is associated with multiple human uses including: homeowner fertilizer use, agricultural fertilizers and improper manure management, septic failure or poor management, placement of septics in improper areas because of soil or drainage, sewer system malfunctions/breaks. Nutrient contamination is hard to track because the wide use of nutrients confuses the source or point of pollution, leading to the name "non-point source pollution." However, non-point source pollution is also one of the easiest to fix because we know what it comes from so individuals can easily alter impacts. Increased nutrients in the aquatic system readily alter the environment by leading to excessive aquatic plant growth (eutrophication) and increase colonization by aggressive "weed" species. Eutrophication is a natural process, yet human impacts have accelerated the rate of aging and reduced the health of Muskegon Lake. Although it is widely accepted that water quality has improved in Muskegon Lake over recent years, we must continue to protect our groundwater resources.

Other problems that impact groundwater quality include old underground leaking gasoline storage tanks and sites of soil contamination. Muskegon Lake has had several areas contaminated because of underground storage tanks. They are slowly being identified and removed, but some probably remain unlocated. Abandoned wells are also a major problem as they are a direct link to the groundwater. Contaminants entering an old well do not have the opportunity to break down as they travel through the overlying soil. Old wells should always be capped and never have any thing poured down the old pipe.

Where we are

Cleaning up contaminated groundwater sites will be important to the overall cleanup of contaminated sediments in Muskegon Lake. Ongoing sources of contaminants need to be stopped before sediment is cleaned up. Otherwise re-contamination may occur.

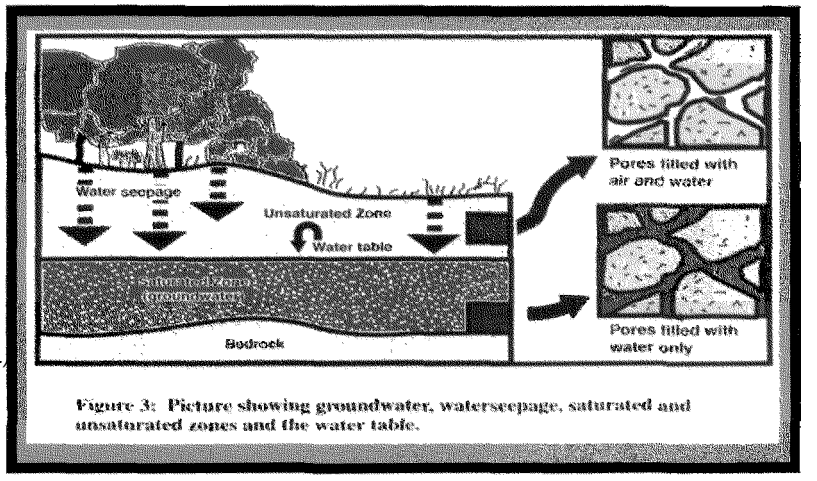


Figure 3: Picture showing groundwater, waterseepage, saturated and unsaturated zones and the water table.

RESOURCES

- **Center for Applied Environmental Research at University of Michigan, Flint** (810) 766-6600
  (The link provided was broken and has been removed.)
- **Michigan Department of Agriculture**
  (The link provided was broken and has been removed.)
- *(The link provided was broken and has been removed.)*
- https://www.epa.gov/ground-water-and-drinking-water
- **The Groundwater Foundation**
  www.groundwater.org
- **Michigan State University Extension**
- *(The link provided was broken and has been removed.)*
- RegionalGroundwater/rgchome.html
- **U.S. Environmental Protection Agency**
- *(The link provided was broken and has been removed.)*

SITE NAME - POLLUTANTS OF CONCERN - CLEANUP STATUS

Brunswick Corp. Received permit termination August 1999. There is no longer any discharge from the groundwater clean-up to the surface waters. Currently monitoring groundwater—some additional soil and groundwater work needed.

Amoco Oil-Muskegon Terminal. Noncompliance with *BTEX limits in 1999, 2000 and into early 2001, due to problems with air stripper system build-up of iron oxides and undersized blowers. A tray stripper system was installed and compliance has been consistent since April 2001. Soil & groundwater investigation completed in 2002.

Old City of Muskegon Dump. Some sampling by Gen-tech/Fleming and MDEQ in 2002 for the Muskegon Lake Contaminated Sediment Tributary Investigation.

MichCon and Lakey Foundry (vacant area at Morris St. and Shoreline Dr.). Xylene, toluene, zinc, lead, benzene—evaluation, interim response (parking lot cap at Morris Street). Proceeding with design of groundwater remediation system. Area at the lake currently being proposed for marina development.

Marathon Pipe Line Wood Street. Groundwater cleanup and monitoring ongoing.

Marathon Terminal North Muskegon. Largely in compliance with a notable exception of November 2001, when a slug of free product passed through the treatment system causing violations of BTEX limits. This problem was remedied through treatment.

Zeeryn, Incorporated. Facility taken over by the State of Michigan Environmental Response Division, and the NPDES permit was terminated. A different means of treatment has been employed that does not involve a surface water discharge. U.S. EPA currently remediating historic treatment lagoons.

Teledyne Continental Motors/General Dynamics (78 Getty St.). PCBs, Cyanide and metals in soils and groundwater. Site transferred from Environmental Response Division to Hazardous Waste Permits Section in 2001. Last report showed groundwater plume not being contained. RCRA engineers actively working on site. A soil investigation work plan was reviewed by MDEQ Waste Management Division in 2002.

Harbortown Marina. Site considered active—No recent reports submitted to DEQ.

Bays Mini Mart. BTEX—A pump and treat and air sparge system with monitoring is underway. Some maintenance-related noncompliance over last few years.

Peerless Putter Schroder. BTEX—A pump treat system has been discontinued and plume monitoring is underway, with closure in mind. Some periodic maintenance-related noncompliance in last few years. System shut down since May 20, 2001.

Westgate Oil (1919 Apple). BTEX—Recently installed an Air Sparge/SVE system that was turned on June, 2002. Monitoring is underway. Some maintenance-related noncompliance over last few years.

Chevron Terminal. Continuing groundwater investigation along Ruddiman Creek and conducting annual groundwater monitoring (BTEX).

Mobil Oil Co. (Socony Oil Co) Lots at Sisson and McCracken Streets. Currently monitoring groundwater.

Former City of Muskegon Wastewater Treatment Plant/Richards Park (Ottawa St between south and middle branch of Muskegon River mouth). MDEQ requested that City perform groundwater monitoring at the site.

Former Grand Trunk Railroad Dock (McCracken Street at Muskegon Lake). Recently completed additional soil & groundwater investigation. Expect supplying results soon.

Mona Rose Amoco (Petro Pantry). No information available at time of printing.

SPX Headquarters, Terrace Street. No information available at time of printing.

Superfund Sites:

Old Story Facility NPL Site. Groundwater treatment underway. Soils and creek bed sediments are separate operable units. The 1993 Record of Decision (ROD) was amended to remove 4,000 cubic yards of soil, if future land use remains industrial instead of residential. The original ROD called for removal of 10,000 cubic yards.

Duell/Gardner Landfill NPL Site. The 1993 ROD addressed volatile organics and inorganics. ROD recommends treatment of groundwater, soils, landfill cap. Initial monitoring began in 1985. Some soil, sludge, drums, and debris removed in 1986.

* BTEX are gasoline contaminants - benzene, toluene, ethylbenzene and xylene.

ACTION AGENDA

SOLUTIONS FOR THE PUBLIC:

1. Evaluate Your Impact - Participate in a Farm, Home or Lake-A-Syst to learn about impacts you may have on Muskegon Lake with pesticides & fertilizer.

2. Plug Abandoned Wells – Call your local conservation district to receive information and possible cost share programs to close abandoned residential or farm wells

3. Soften Your Property – Reduce areas of impervious/hard surfaces in your yard (including driveways and lawns) to decrease storm water runoff and increase recharge to groundwater.

4. Check the Septic – Maintain your septic system through yearly inspections and replace failed systems or hook into sewer.

GOVERNMENTS, ORGANIZATIONS, BUSINESS AND AGENCIES:

1. **Map contaminated groundwater plumes in the Muskegon Lake watershed**

2. Determine Supply Vulnerability - Identify and map present and future areas dependent on groundwater and municipal water supply and determine vulnerability assessments.

3. Close Abandoned Wells – Evaluate all properties with potential abandoned well sites and properly close all wells surveyed. Call your local conservation district to receive information and cost share programs to close abandoned wells.

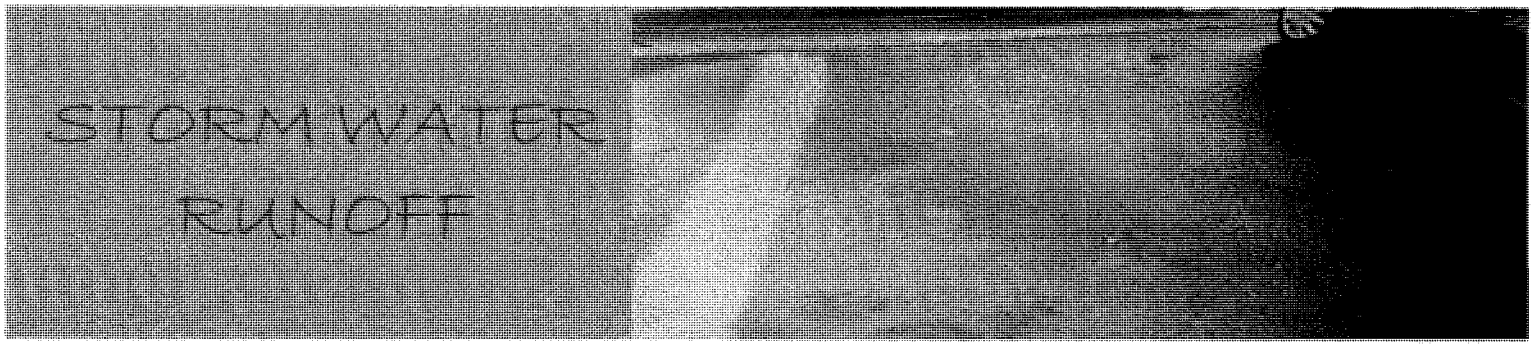
4. Limit Hard Surfaces - Reduce impervious surfaces in industrial, commercial and residential areas to reduce runoff and increase groundwater recharge.

5. Implement Education Programs – Provide educational materials and programs for public, business, industry, and other municipalities concerning nutrients, pesticides and herbicide issues. Implement Best Management Practices (BMPs) in rural and urban areas.

6. Implement Septic Inspection System– Initiate scheduled inspections of local septic systems and provide incentives for proper maintenance to reduce both nutrients and pathogens.

7. Implement a Reporting Procedure for failed systems and survey areas with unknown wastewater systems.

8. Monitor surface and groundwater inputs for nutrient contamination.

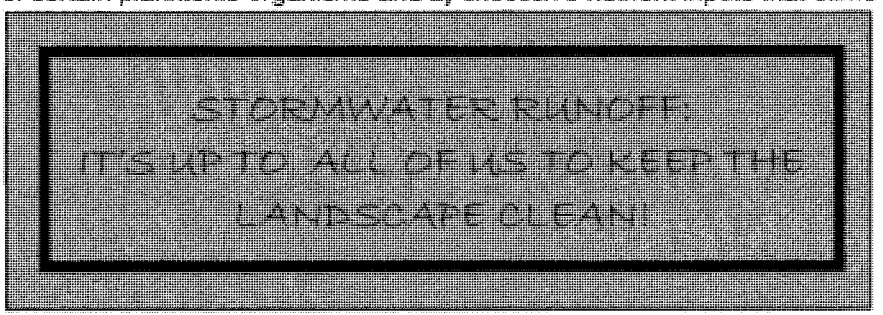


Overview Storm water runoff occurs when rainfall travels over the surface of the land, rather than filtering through vegetation, soil and into the groundwater. Both stormwater and groundwater eventually flow into Muskegon Lake. In developed areas, some of our stormwater can be absorbed by lawns, but once saturated, the extra rain travels over the land and enters storm drains or roadside ditches. From there, it enters Muskegon Lake and its streams. Because of the expansion of roads and development in recent years there has been increased pressure to expand the network of drains, ditches, and pipes. Storm water runoff is largely a result of the development of hard (impervious) surfaces. By March 2003, the U.S. Environmental Protection Agency will require permits for all communities in the Muskegon Lake AOC watershed to manage the quality and quantity of storm water generated within their jurisdiction.

What's the problem? Storm water management, originally a practice designed to control local flooding, has actually increased the water quality problem by increasing water flow and quantity to our lake and streams at levels that exceed the natural capacity of the system. Storm water runoff has becomes a concern in Ruddiman, Ryerson and Bear Creeks because hydrologic flows are becoming unstable. Unstable hydrology can occur when impervious surfaces are developed or when natural stream beds are channelized. These changes increase the rate at which water enters the system, and scours out stream bed habitats and causes stream bank erosion. Both the amount of water entering a system and what is in the water can impact water quality, wildlife and even human health. Most of our historically significant sources of pollution from "point" sources (usually industrial discharge pipes) have been identified. However, pollution from "non-point" sources like residential and urban areas that include oil, gas, and grease from streets and parking lots can decrease water quality and contribute to contamination of sediments in Muskegon Lake. Increased flow also diminishes the natural filtering ability of the landscape since the water does not have time to seep into the ground. This movement into the soil (rather than over it) would normally allow for groundwater recharge; natural filtering of water; and a decrease in flooding, erosion, and sedimentation.

Another factor largely impacting the quality of water in storm water systems is the misuse of storm water sewers. Many people are unaware that street drains are not connected to treatment facilities. Anything that goes down the drain is directed to the nearest natural water body. What goes down the drain empties into your local stream, and eventually into Muskegon Lake and Lake Michigan. Muskegon Lake also faces a seasonal loading of salt during the winter because of road maintenance.

Although no direct measurements were made as of the 1994 Muskegon Lake RAP, phytoplankton and zooplankton populations (free-swimming or free-floating algae and animals) in Muskegon Lake were likely impaired in the past from **1)** discharges of toxic chemicals that reduced survival and growth of certain planktonic organisms and **2)** excessive nutrient inputs that stimulated and supported growth of certain nuisance blue-green algae.



Since 1994, residents around Muskegon Lake and Bear Lake have noticed an increasing presence of localized algal blooms. An over abundance of aquatic plant growth (eutrophication) can become unsightly for people and restrict recreational uses. It also means an over abundance of plants that decompose. Decomposition uses oxygen available for fish and other living organisms. Deep areas in Muskegon Lake have low oxygen levels and limited life. In addition, human contact with degraded surface water can become a public health concern during certain conditions.

Wetlands are increasingly considered for their use as stormwater filters, but like open water, they too can become degraded and lose their capacity to function when unnaturally high levels of polluted stormwater enters them. Wetlands are characterized by plant and soil types. They are often (but not always) adjacent to lakes and streams and usually have wet conditions during at least part of the year. Wetlands are recognized as important natural systems that filter, absorb, and clean water. They are extremely important in preventing flooding and in maintaining hydrologic stability as they soak up, hold, and slow down the release water before it enters Muskegon Lake. Areas along the lake also buffer the energy transported through wave action and shoreline vegetation prevents nearshore sedimentation. Manufactured stormwater filtration systems containing activated charcoal. They can be installed right into storm drain collection pipes to capture oil, grease, gasoline constituents, organically bound metals, and other pollutants.

In 1995, the Muskegon Conservation District contracted a watershed study to Grand Valley State University in order to measure inputs of nutrients, heavy metals, oil and grease to Muskegon Lake. Among other findings, the 1995 study revealed that zooplankton and bottom dwelling insect populations near storm water outfalls were locally impaired.

Where we Are

The Cities of Muskegon, Norton Shores, Roosevelt Park along with Laketon, Muskegon, Dalton Townships will apply for the MDEQ's Voluntary Stormwater Permit in 2002. The City of North Muskegon has made application for a stormwater discharge permit with the U.S. EPA permit program. Both programs comply with the new 2003 federal stormwater requirements.

The City of Muskegon received a MDEQ Clean Michigan Initiative grant in 2002 to examine sanitary and storm sewers for potential cross connections.

A 2003 clean water stormwater management project will involve the following partners to establish native plant, vegetative "filters" on public and private lands along Muskegon Lake's shoreline:

- City of Muskegon
- John Bultema and George Bailey
- Lakeside Neighborhood Association
- Bunker School
- Volunteer Muskegon
- SAPPI Union Local 6-1015.
- Muskegon Conservation District
- Muskegon Environment and Research Education Society
- Michigan Department of Environmental Quality

Muskegon County is working with the Muskegon Conservation District to develop a stormwater management system at Heritage Landing. The system of "best management practices" includes a native plant filter and carbon activated filters installed into the storm drain collection system.

RESOURCES:

Better Site Design: A Handbook for Changing Development Rules in Your Community. 1998. Center for Watershed Protection. Ellicott City, MD

Muskegon Lake and White Lake Watershed Study. 1995. Grand Valley State University. Available through the Muskegon Conservation District Data Repository

Conservation Design for Subdivisions: A Practical Guide to Creating Open Space Networks. 1996. Arendt, Randall G. Island Press, Washington D.C.,

University of Wisconsin - Extension
(The link provided was broken and has been removed.)

Kitsap County Surface and Storm Water Management
(The link provided was broken and has been removed.)

ACTION AGENDA

SOLUTIONS FOR THE PUBLIC:

1. Maintain Your Car - Keep your car tuned to avoid leaks and spills and ensure proper disposal of waste oil and other automotive fluids that can wash down drain from paved/hard surfaces.

2. Down the Drain - Do *NOT* pour anything down the street drain and avoid using any toxic liquids or solids (fertilizers/herbicides/pesticides) that can be washed from your property.

3. Establish a Rain Garden—Use deep rooted native flowers, grasses and sedges to allow stormwater to infiltrate into the soil and groundwater.

GOVERNMENTS, ORGANIZATIONS, BUSINESS AND AGENCIES:

1. Pollution Prevention - Initiate programs to prevent nutrient and other pollution contamination from entering water sources (street sweeping, leaf pick-up and community yard waste composting, eliminate fertilizer on municipal properties)

2. Reduce Stormwater Impact - Develop plans to reduce contaminated stormwater from reaching water resources (treat stormwater in residential, commercial, industrial and urban areas: buffers, wetland protection, wetland construction, wet ponds, infiltration areas)

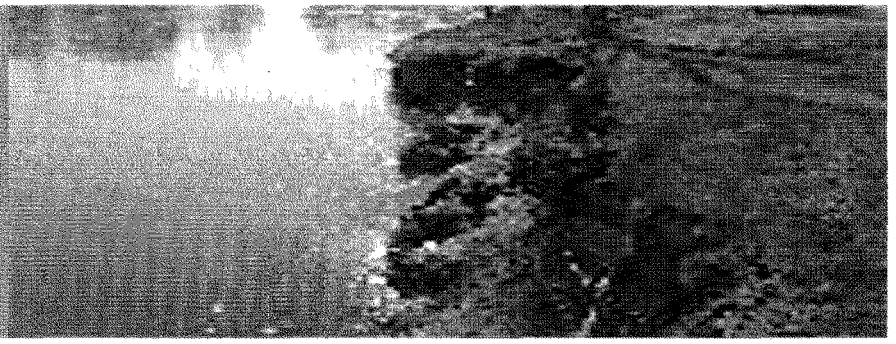
3. Limit Hard Surfaces - Reduce impervious surfaces in industrial and commercial areas to reduce storm water runoff and increase groundwater recharge through percolation. Increased impervious surfaces decrease environmental health and natural system functioning.

4. Assess Illicit Connections – Survey and map cross connections between storm and wastewater sewer to focus wastewater management plans. Eliminate all illicit connections.

5. Participate in State & Federal Programs - Communities should join DEQ voluntary compliance program and state MS4 programs to help facilitate local regulation and tracking of NDPES permits/discharges.

6. Evaluate non-point source pollution - Identify, map, and document critical areas (Non-Point Concerns) in urban, rural, and agricultural areas.

EROSION AND SEDIMENTAION



Overview Erosion is a natural process occurring in many environments through the breaking and wearing down of soil, rock, and surface material through the processes of wind, water, and gravity. As these particles move into the aquatic environment and settle to the bottom in a process called sedimentation they can act as important source of organic material and nutrients in normal minimal amounts. Erosion and sedimentation increase as soil is disturbed through human influence like destabilization along stream banks, construction, and agriculture where vegetation is removed and soil is exposed to the weather. The greatest threat is construction activities that not only remove vegetation and excavate areas of soil but also disturbs the soil structure and stability of the soil.

What's the problem? A visible increase of sediment has built up in Muskegon Lake at the mouth of Muskegon River since the Muskegon Lake RAP was updated in 1994, thought to be a result of the 1986, 500 year storm. This event also created additional streambank erosion sites, adding to the river's sediment load. Erosion also occurs in urban and residential areas along step slopes, in areas with exposed soil, or where there has been increased water flow from storm water. Excessive sediment comes from erosion along streams and rivers, agricultural topsoil and construction sites with each storm event. Although impairments due to erosion are not always obvious, over time they impact communities through the loss of land, property, water quality and fish habitat.

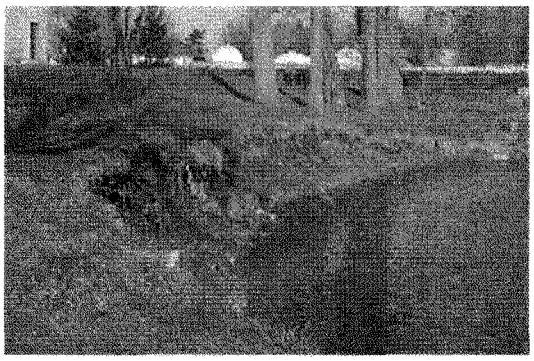
Sediment and soil particles also have high concentrations of fertilizers (nutrients) and pesticides that stick to the particles and are carried with them – eventually being released in other areas causing pollution or contamination. Particles in the water cause many problems for lakes and streams with increased cloudiness, loss of oxygen as organic particles break down, and increased nutrients that can cause excessive aquatic plant growth (eutrophication). Sediment can also change the bottom structure of aquatic systems by reducing depth, burying spawning beds for fish, and burying habitat of some aquatic insects. Sediment deposits in streams from highly eroded sites cause the greatest damage and loss to habitat, increase need for dredging, can causes the greatest physical change in water quality for Muskegon Lake.

Where we are

In order to gather information needed to assess the impact of sediment on the Muskegon Lake AOC ecosystem, the following actions are recommended:

1. Perform a hydrologic model that incorporates Lake Michigan levels, Muskegon Lake, bridges, dams, wetlands, groundwater and overland flow

2. Develop a sediment budget for the lower Muskegon River Watershed that includes suspended material and bed-load sand



Stop unnatural levels of erosion and sedimentation from degrading Muskegon Lake's ecosystem

3. Explore the opportunity to institute a USDA Conservation Reserve Enhancement project in the sub-watersheds of the Muskegon River watershed where agricultural land use is identified as a sediment load contributor.

RESOURCES:

In Muskegon County and in each of the ten counties within the Muskegon River watershed, erosion control services are provided by the USDA Natural Resources Conservation Service. Through your local conservation district, free services are available. Services include technical and financial assistance to landowners for water quality, erosion control, wildlife and forest management; vegetative buffers and conservation easements for wetland restoration.

Muskegon Conservation District and
USDA Natural Resources Conservation Service
1001 E. Wesley Ave, Muskegon, MI 49442(231) 773-0008

Newaygo Conservation District and
USDA Natural Resources Conservation Service
940 Rex St., Fremont, Michigan 49412 (231) 924-2060 x3

Muskegon River Streambank Erosion Survey
And Technical Assistance
Timberland RC&D
6655 Alpine Ave., NW Suite 2
Comstock Park, MI 49321-8325
(616) 784-1090

Muskegon County Soil Erosion Agent/Enforcement
Muskegon County Department of Public Works, 724-6411

Michigan Department of Environmental Quality
(The link provided was broken and has been removed.)

Michigan State University - Extension
(The link provided was broken and has been removed.)

Great Lakes Information Network
(The link provided was broken and has been removed.)

Washtenaw County—Department of
Environment and Infrastructure Services
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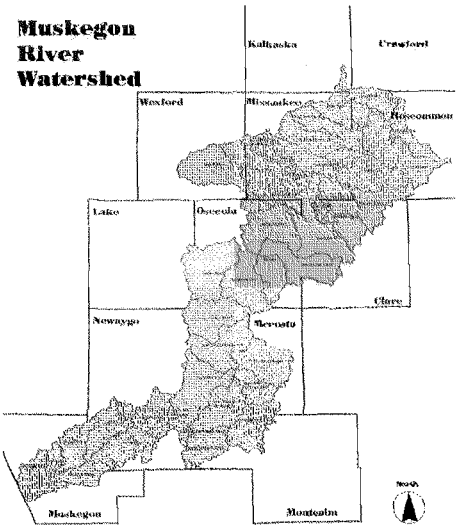


SOLUTIONS FOR THE PUBLIC:

1. Become Educated - Attend local workshops related to native landscaping and buffer strips as a way to prevent erosion on public and private property.

2. Request Technical Assistance— Call the Muskegon or Newaygo Conservation Districts to find out about programs that help restore erosion sites. Advice is free; Some implementation programs are free; others require a cost-share agreement. (231) 773-0008.

2. Protect Public Property - Help maintain public sites along streams and at road crossings by utilizing designated pathways, stairs, and recreation areas. Do not trespass or illegally utilize areas while using snowmobiles or other ORVs in areas that are sensitive to erosion.

3. Report obvious signs of erosion to be addressed with voluntary programs through the Muskegon Conservation District at 773-0008 or with enforcement actions by the Muskegon County Soil Erosion Agent at 724-6411.

GOVERNMENTS, ORGANIZATIONS, BUSINESS AND AGENCIES:

1. Provide Contacts - Educate homeowners about preventing erosion & give contact info for reporting and erosion control questions.

2. Establish Buffers - Develop buffer system plans for stream and road crossings to mitigate erosion sites and enhance wildlife habitat. Implement them as part of your Master Plan.

3. Monitor Erosion Sites - Hold workshops for builders and construction companies on preventing soil erosion. Increase inspections of active construction sites and utilize local inspectors visiting sites for other purposes. Inspectors can be cross-trained to recognize and report noncompliance with erosion control provisions.

4. Determine the Impact - Survey and map areas sensitive to erosion and sedimentation. Evaluate cost damages from flooding (loss of property) and nutrient contamination (loss of usable water).

WASTEWATER MANAGEMENT

Overview Up until 1974, the communities of Muskegon and North Muskegon discharged residential and industrial waste into Muskegon Lake from a treatment facility located at the mouth of Muskegon River's Middle Branch near Richards Park. Since 1974, significant water quality and public health advantages have been realized due to the management of sanitary wastewater through the Muskegon County Wastewater Management System (WMS). Another benefit to Muskegon Lake has been the industrial pollutant surface water discharge permits monitored by MDEQ for compliance. The heavily urbanized areas around Muskegon Lake utilize the WMS, yet some rapidly developing areas continue to utilize septic systems to manage waste. Both systems can be very efficient in reducing contamination of water if maintained and used properly. The Muskegon County WMS Metro system serves all sewered areas of Muskegon County, with the exception of Ravenna, Whitehall and Montague. Current flow is approximately 26.5 million gallons per day (mgd). The plant has a hydraulic capacity of 42 mgd. The facility is currently treating a waste stream that is about 60% industrial in origin and removes about 60,000 pounds of oxygen demanding pollutants and 90,000 pounds of suspended solids. Approximately 90-94% of the discharge from this plant enters the Muskegon River. An interceptor is currently being constructed that will convey the Whitehall and Montague wastewater to the Muskegon Metro plant. Diversion of the waste is expected to occur in early 2003.

What's the problem? Localized cross connections between the storm and sanitary sewer pipes in the older Muskegon Lake area communities are suspected, and communities are working to identify and correct them. Problems associated with septic systems are usually related to improper usage and maintenance. Problems associated with the WMS system include problematic sewer mains that resulted in sewer main releases and lift station failures. These failures resulted in millions of gallons of raw sewage directly discharged to Muskegon Lake, Ruddiman, Ryerson and Four Mile Creeks. These failures are the primary reason for the "no contact" advisories and the listing of Beach Closings as one of the Muskegon Lake impaired uses. In addition to restrictions on contact through recreational activities, volunteers and teachers are also restricted from their Adopt-A-Watershed activities in Ruddiman, Ryerson Creek and Four-Mile Creek surface waters. Community members have concerns about potential human-health problems from water contact.

Where we are: The most recent major upgrades to the Muskegon County WMS metro facility were in 1989 and 1993. Collection system improvements were made in 2001 with the replacement of 3 miles of the problematic 66 inch diameter force main. Organic loading capacity enhancements were made in 2000 and 2002. The first of several studies is currently underway to examine the collection system with a focus on improved reliability. Future work will examine current maintenance practices, telemonitoring, and capacity. It will recommend improvements and necessary construction. The plant has sufficient hydraulic and treatment capacity to handle the anticipated flow and load for the next 20 years.

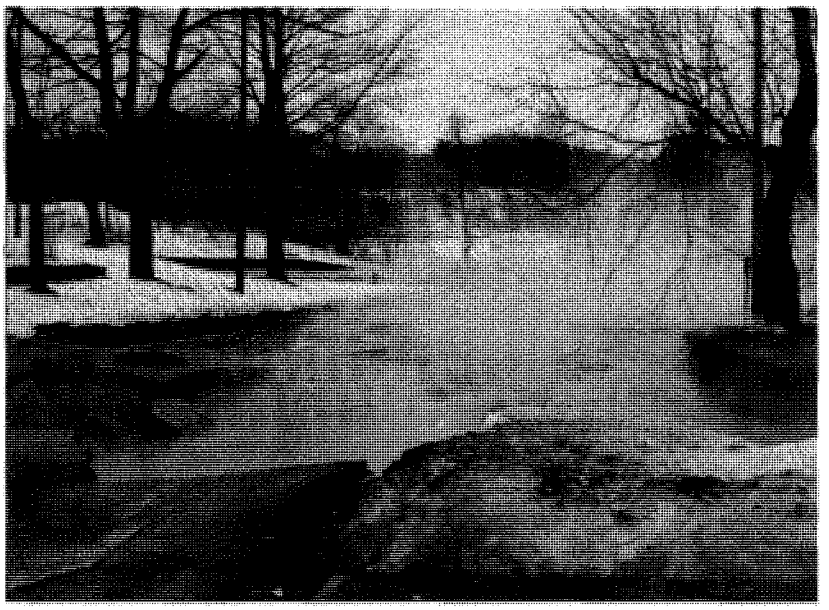
> After wastewater is treated it is always returned back to the environment. Don't pour anything down the drain you wouldn't want in the groundwater or surface water in the future.

As noted earlier, in Muskegon Lake's stormwater and sanitary sewage are conveyed in separate pipes and both industrial and residential wastewater is treated by the Muskegon County WMS. In the more suburban and rural areas septic tanks are used to manage waste. Unlike sanitary sewage, stormwater receives no treatment and it drains into pipes that outlet directly into Muskegon Lake and its tributaries. However, in some Michigan communities, sewers were originally designed to carry both sewage and stormwater so all water would be treated together, but during heavy rains the volume becomes so great that it overflows into rivers and streams. When this happens, untreated or partially treated sewage flows into rivers, streams and lakes. In the Muskegon Lake area, some accidental "cross connections" have been discovered by public works crews during routine sewer maintenance. In 2001, the City of Muskegon received a Clean Michigan Initiative grant to map sewers and to use a T.V. camera to visually inspect pipes for any cross connections.

Compliance Performance - Process Wastewater Discharges to Muskegon Lake surface waters:

Process Wastewater Dischargers report to MDEQ and annual inspections are scheduled. The only two permit holders in the Muskegon Lake AOC are Consumers Energy -BC Cobb and the Muskegon County Wastewater Management System. According to MDEQ, the BC Cobb facility has mostly been in compliance with effluent limits. The facility has some occasional small spills, usually low volume, with no visual impacts noted.

The Muskegon County WMS facility has also mostly been in compliance with effluent limits. Periodic fecal coliform violations have been likely due to animals (ducks, etc) inhabiting the open drains that carry the treated wastewater to the outfall. However, investigation is ongoing.



Periodic sewer main failures are the primary reason that "no contact" postings have been necessary. Corrections have been made to problematic pipes and additional study and monitoring are underway. Once these problems are addressed, "Beach Closings" may be the first BUI to be "de-listed" in the Muskegon Lake AOC.

RESOURCES:

Michigan Department of Environmental Quality
(The link provided was broken and has been removed.)

The Do's and Don'ts of Implementing a Successful Illicit Connection Program. 1998. Wayne County Department of Environment.

Michigan State University - Extension
(The link provided was broken and has been removed.)

U.S. Environmental Protection Agency
www.epa.gov/OWM/

(The link provided was broken and has been removed.)

ACTION AGENDA

GENERAL PUBLIC:

1. Prevent the Problem - Schedule annual certified inspections of your septic tank and drain field to avoid septic failures and contaminated groundwater or surface water.

2. Call the Muskegon County Wastewater Management System if you're unsure about anything you may want to pour down the drain in sewered areas.

3. Contact the Muskegon County Department of Public Works at 724-6411 to schedule a household hazardous waste delivery. Get updated recycling tips too!

4. Contact Muskegon Conservation District at 773-0008 for dates on the annual Clean Sweeps for agricultural pesticides and herbicides will be held in Muskegon and Newaygo Counties.

5. Call Muskegon Conservation District to find out when the FREE Drinking Water Testing will be held each spring. Testing is for nitrates and atrazine.

GOVERNMENTS, ORGANIZATIONS, BUSINESS AND AGENCIES:

1. Multipurpose Inspection Service - Train building inspectors to recognize cross connections (utilize those already specializing in plumbing for commercial, industrial, and residential)

2. Prepare for the Future - Identify future wastewater infrastructure which fits master plan and evaluate possible revisions to master plan to reduce capacity demand.

3. Supply by Need - Adequate industrial pre-treatment standards need to be analyzed, updated, followed and enforced.

4. From Septic to Sewer - Develop ordinance to ensure residents "hook up" to the sewer when it becomes available in their area. Identify areas that septic systems would greatly impact system if failure occurred (utilize county soil survey) and focus infrastructure prior to allowing new development.

5. Protect the New Buyer - Provide ordinances and programs for inspections and repairs of waste systems. Include the requirement of repair at the point of sale, and proof of system corrections.

HUMAN HEALTH

Overview Meeting full-body contact standards for Muskegon Lake and its tributaries is important because of its high value for recreational, quality of life and educational uses. The 4,150 acre lake is part of a 52-square mile watershed that includes Ruddiman, Ryerson, Four Mile, Green Creeks and Bear Lake, a shallow lake connected by a channel to Muskegon Lake. Muskegon Lake is connected to Lake Michigan by a shipping channel.

Muskegon Lake fisheries include resident black crappie, bluegill, yellow perch, walleye, smallmouth bass, largemouth bass, northern pike, and flathead catfish. Largemouth bass are most abundant at the east end of the lake and smallmouth bass are more abundant near the west end. The Muskegon River marsh supports northern pike and yellow perch migrate from Lake Michigan to Muskegon Lake. Yellow perch use Muskegon Lake for both feeding and reproduction. Spawning runs of Chinook salmon, steelhead and brown trout provide fall and spring fisheries. Both lake trout and lake whitefish move into the lake for feeding and spawning during fall. Brown trout from Lake Michigan use Muskegon Lake during spring and fall for feeding.

What's the problem? Fishery concerns in Muskegon Lake are related to both Lake Michigan-wide and localized concerns (see consumption advisories, pg 35). Localized concerns include sources of contamination from existing contaminated sediments (see contaminated sediments, pg 12) and from groundwater migration into the lake (see groundwater, pg 26).

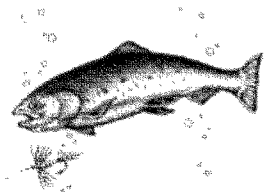
The contaminants in fish are the result of many things including:

1) the concentration of the contaminant in the water
2) the concentration in the fish's primary food supply
3) the size and age of the fish (older, larger fish generally have higher levels)
4) the fish's habitat (sedentary, bottom-dwelling species are more likely than others to concentrate toxic compounds from contaminated sediments)
5) and the species level in the food chain (top-level predators often show higher contaminant levels due to bio-accumulation).

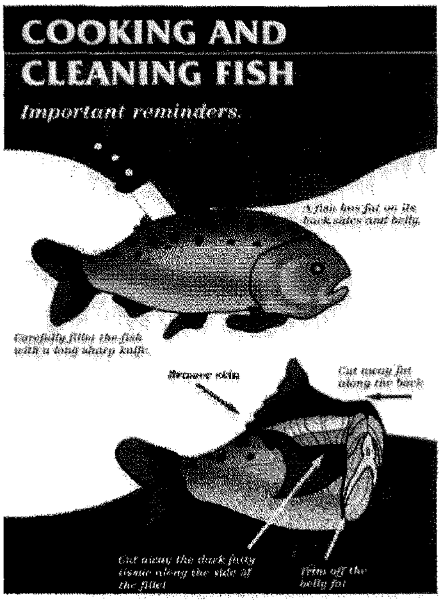
> Maintain water quality, bottom sediment and a fishery safe for human and wildlife contact and consumption

In addition to fish consumption advisories, several "no contact" advisories have been issued for the AOC since the 1994 Muskegon Lake RAP update. The advisories were primarily due to wastewater conveyance system and lift station sensor failures. However, at times, bacterial levels in Ruddiman Creek appeared to be from other sources, possibly wildife or sanitary/storm sewer cross connections. In 1999 there was a sewer line break along Yuba Street at Ryerson Creek; another at Yuba Street/Ryerson Creek on Earth Day, 2000; and another break at Wood Street. During the fall of 2001, sensor malfunctions were responsible for releases at the Ruddiman Creek lift station and at the Bear Lake channel. These system failures resulted in the diversion and discharge of millions of gallons of untreated sanitary and industrial wastewater to Muskegon Lake and its tributaries. Ironically, the investigation of the Wood Street break resulted in the fortunate identification and repair of a sanitary and storm sewer "cross connection" at Muskegon Lake, near the YFCA in downtown Muskegon.

Lake Michigan is the source of drinking water for residents south of Muskegon Lake and for the City of North Muskegon. However, groundwater serves most of Laketon Township and all of Dalton Township. Muskegon Township has city water for some residents, primarily due to expanding commercial development. The public has concerns with recreational contact with the lake and streams; un-captured contaminated groundwater plumes; toxic sediment cycling and transport; and sewer line breaks. The public is also concerned about drinking water consumption in areas with private drinking water wells. These concerns relate to the potential for nitrate contamination from failing septic tanks and from the unknown extent of groundwater contamination from known underground leaking tanks and abandoned oil fields in Muskegon, Laketon and Dalton Townships.



Where we are The use of fish consumption advisories is an interim measure to reduce exposure by promoting the safe consumption of fish and wildlife. All the Great Lakes are under a fish advisory for PCBs and several States have mercury advisories on inland lakes. Unfortunately, surveys have revealed that a large portion of the subsistence and sport fish consuming public is unaware of the advisories. Based on the current understanding of how contaminants circulate, it is expected that advisories will be in place for several decades. However, cleaning up contaminated sediments and reducing new loadings of toxic substances would significantly shorten this time frame. There is also concern that invasive species can potentially redistribute pollutants in the food web. According to U.S. EPA, the long-term goal is to ensure that all Great Lakes fish and wildlife are safe to eat without restriction.



Fish Muskegon Lake!

Trim & Cook Fish Properly to Reduce Risk

Proper preparation reduces the concentration of organic chemicals like PCB. By trimming fatty areas before cooking and by cooking in ways that allow fat to drip away, *more than 50 percent of the contaminants in fish can be eliminated!*

Methyl mercury is stored in fish flesh. Trimming fat and cooking methods do not remove it.

Information provided by Michigan Department of Community Health.

Michigan Consumption Advisory for Muskegon Lake

	General Population	Women & Children
Carp (PCB's)	25-30 in. one meal per week 30 in.+ do not eat	8-25 in. one meal per month 25 in.+ do not eat
Largemouth Bass (Mercury, PCB's)	14-30 in. one meal per week	14-30 in. one meal per month
Walleye (Mercury, PCB's)	14-18 in. unlimited consumption 18 in.+ one meal per week	14-22 in. one meal per month 22 in.+ six meals per year
Northern Pike (PCB's)	22 in.+ unlimited consumption	22-26 in. one meal per week 26 in.+ one meal per month

Note: This advisory also applies to Bear Lake. In addition, a portion of the lower Muskegon River is in the Area of Concern. Muskegon River (Below Croton Dam) is also listed for PCBs in Carp and for Mercury and PCBs in [illegible].

[illegible] advisories are listed for northern pike, bullheads, and [illegible] below [illegible] in the [illegible] River of the Muskegon River.

General Mercury Advisory for ALL inland lakes in Michigan:
No one should eat more than one meal a week of rock bass, yellow perch, or crappie over nine inches in length and bass, walleye, northern pike or muskellunge of any size. Women of childbearing age and children under 15 should not eat more than one meal per month of these fish.

RESOURCES:

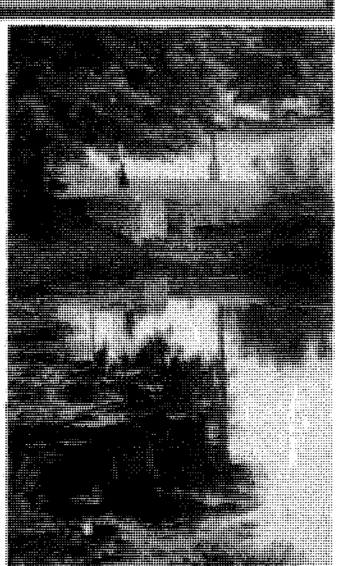
Muskegon County Health Department—
Muskegonhealth.net

U.S. Environmental Protection Agency—
(The link provided was broken and has been removed.)

Lake Michigan Federation—
www.lakemichigan.org

The Muskegon Lake AOC Contaminated Sediment Update. 2002. Dr. Richard Rediske, Grand Valley State University-AWRI (a companion to the Muskegon Lake RAP Update 2002).

The Extent of Contaminated Sediments in Muskegon Lake. 2000. Dr. Richard Rediske, Grand Valley State University



ACTION AGENDA

GENERAL PUBLIC:

1. **Report Useful Data** - Report fish with tainting of taste or smell. The majority of other abnormalities are natural.

2. **Use Public Transportation** to reduce air pollution's effects on air and water quality, and observe Ozone Action Day tips from West Michigan Shoreline Regional Development Commission.

3. **Use Local Resources**— The Muskegon County Health Department will work with you to ensure that septic tanks don't leach pathogens and nitrates into drinking water, groundwater or surface water.

4. **Get Free Information,** Education and Technical Assistance on septic tank and drinking water well maintenance through the Muskegon Conservation District and the Michigan Groundwater Stewardship Program. Other topics include proper storage of agricultural and household chemicals and fertilizers.

GOVERNMENTS, ORGANIZATIONS, BUSINESS AND AGENCIES:

1. **Determine Public Concern** - Survey local fishermen and sport fishing organizations to determine the status of tainting, populations and educational needs relative to fishing and consumption.

2. **Health Concerns** - Research and use existing fish contaminant monitoring to assess the impact on fish and determine where contaminants are entering the aquatic food web.

3. **Support the Clean Up of contaminated sediments** in Muskegon Lake and its tributaries.

4. **Support the Prevention of new loadings** of toxic substances from sources such as stormwater runoff and regulated air pollution or process wastewater discharges.

5. **Agency Responsibilities** for the oversight of groundwater cleanups need to be funded and staffed to ensure that cleanups are adequate and timely.

6. **The Expansion of Sewers** into areas served by private septic systems can help ensure that nutrient contamination is being addressed and eliminated.

PUBLIC EDUCATION STEWARDSHIP

Overview Local public involvement is the single most important ingredient in solving problems and making changes that benefit Muskegon Lake's ecological, economic, cultural and social health. In Muskegon County, we are fortunate to have resources that increase the public's knowledge to make informed decisions, become involved, and learn about the significance of the Muskegon Lake ecosystem and the Lake Michigan watershed.

Where we are Local Programs designed to involve students and community members in the Muskegon Lake watershed:

Youth Conservation Tours-Conservation tours are given each spring and fall. These tours help to enhance the understanding of local habitats and ecological concepts for younger students. Topics include forestry, wildlife, soils, groundwater, and aquatic biology.

Schoolyard Habitats/Outdoor Classrooms–Areas of the schoolyard are developed with Michigan native trees, shrubs, wildflowers, butterfly gardens, animal tracking plots, birdhouses and trails. Sometimes, ponds or natural wetlands are included. Teachers, students, parents, and community groups work together to build and maintain outdoor classrooms.

Watershed Schools & Community Collaborative-
The teaming of teachers and volunteers provides incentive and assistance for school and community groups to complete monitoring and educational objectives. This collaboration between teachers, students, and community members exemplifies the real-world connections that are so critical for engaging and motivating students.

- **WSEA**-The **W**atershed **S**cience **E**ducation **A**cademy prepares teachers to use natural settings as the integrating context for teaching and learning experiences that enhance traditional textbook and computer-based learning systems. Teachers are trained to use DEQ-approved protocols for monitoring water quality.
- **Adopt-A-Watershed**-Volunteer activities include: waterside cleanups, monitoring, storm drain stenciling, nature plantings and habitat enhancement projects. MDEQ protocols for monitoring water quality are used. Data is compiled by Muskegon Conservation District and submitted to the MDEQ each spring and fall.

NATURAL RESOURCES STEWARDSHIP AND EDUCATIONAL PROGRAMMING WILL BE INSTITUTIONALIZED IN COMMUNITY SCHOOLS, BUSINESS, CHURCHES AND GOVERNMENTS

Envirothon-The Envirothon competition strengthens the environmental awareness of Michigan's young men and women, preparing them for the future. High school aged students teams conduct an environmental outreach program in their own community. The teams learn to apply their new and expanding environmental knowledge and skills. Students learn that they can organize and carry out environmental projects that make a difference in their own backyard. Teachers may contact Muskegon Conservation District to sign up a team and receive an informational packet.

4H-"Are You Into It"-This is a program for kids who care and want to help out while having fun at the same time. By combining concerns about the community and the world with 4H resources, kids can really make a difference. They will learn a lot and meet new people. Working together and having a good time is what 4-H and volunteering are all about. Contact MSU-Extension in Muskegon County for more information.

W.G. Jackson-A Grand Valley State University **- Features a r**esearch vessel that is a well equipped floating laboratory-classroom, used to study the aquatic environment of Lake Michigan and adjoining waters. A large number of cruises are offered to schools and groups at minimal cost each year on a first -come, first served basis. The cruises are booked in 2.5 hour trips. The students sample Lake Michigan and Muskegon Lake. Contact GVSU– AWRI for details.

MERES–The **M**uskegon **E**nvironmental **R**esearch & **E**ducation **S**ociety is dedicated to environmental education and to the value of preserving the environment. Its mission is to provide opportunities for individuals to participate in or observe environmental research and to provide professional development for teachers and environmental education for students. The MERES site contains a wetlands boardwalk, water sampling platforms, outdoor pavilion with tables, hiking-biking trails and fishing-wildlife observation areas along the Muskegon River.

MRWA and Muskegon Lake PAC -The **M**uskegon **R**iver **W**atershed **A**ssembly is a non-profit organization with an office in Big Rapids. Their mission is: Preserving, protecting, and enhancing the natural, historic, and cultural resources of the Muskegon River Watershed through educational and scientific initiatives, while supporting positive economic development, agricultural, and quality of life initiatives of organizations working in the watershed. The MRWA works in partnership with the Muskegon Lake Public Advisory Council on projects in the Muskegon Lake Area of Concern watershed. For more on local projects, cal (231) 773-0008.

RESOURCES:

Muskegon Conservation District—(231) 773-0008 or *Muskegoncd.org*

State of the Lakes Ecosystem Conference—*(The link provided was broken and has been removed.)*

Lake Michigan Monitoring Coordination Council—*(The link provided was broken and has been removed.)*

Grand Valley State University—Annis Water Resources Institute—*(The link provided was broken and has been removed.)*

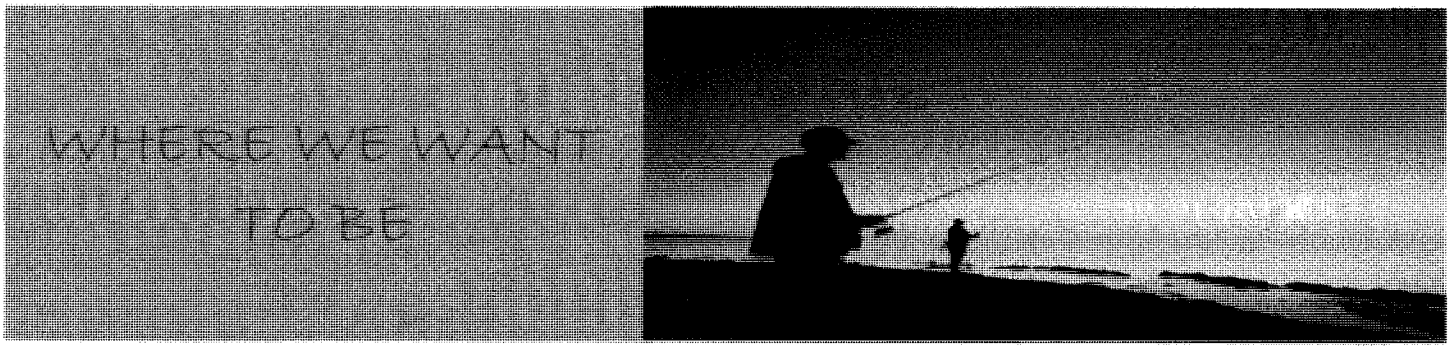
ACTION AGENDA

GENERAL PUBLIC:

1. Do Your Part - Continue to utilize this publication as a resource to determine where you as an individual can become involved with helping to preserve and protect Muskegon Lake and take the necessary steps to do your part.
2. Stay Involved - Help local organizations and groups with volunteer monitoring, community projects, education workshops, student projects.
3. Show Support - Congratulate and support individuals that have already helped improve Muskegon Lake.

GOVERNMENTS, ORGANIZATIONS, BUSINESS AND AGENCIES:

1. Educate Weekly - Write "environmental articles" in the Muskegon Chronicle.
2. Promote Muskegon Lake - Develop programs and products that promote identify and value of water resources in their community. Utilize present events (Muskegon Lake Heritage Landing events) as educational opportunities.
3. Support Local Businesses - Develop financial support programs for business that enhance Muskegon Lake protection as a resource.
4. People Want to Help - Provide stewardship opportunities that keep individuals involved as part of the solution.
5. Show Support - Congratulate and support individuals that have already helped improve Muskegon Lake. Communities, media, and environmental organizations should reward good/ positive behavior that protects the Muskegon Lake and provide public recognition for participating individuals.
6. Attend the State of the Lakes Ecosystem Conference (SOLEC) and the International Joint Commission's biannual meetings to learn about scientific, ecological and societal responsibilities and initiatives in the Great Lakes ecosystem.
7. Attend Workshops and Conferences sponsored by the Statewide Public Advisory Council for Michigan's Areas of Concern (SPAC). Contact the Great Lakes Commission or visit their web site at www.glc.org. for more information about the SPAC.



Targets for Restoration and Delisting the Beneficial Use Impairments (BUIs); Indicators of Success; Recommendations for Further Work, Research and Monitoring

This section identifies Muskegon Lake's Beneficial Use Impairments (BUIs) as determined by the Muskegon Lake Public Advisory Council (PAC) and the Muskegon Lake Remedial Action Plan (RAP) Technical Team. It provides recommendations for actions, targets, research and monitoring needed to restore and de-list each BUI from the Muskegon Lake Area of Concern (AOC). A summary of the BUI de-listing criteria can be found on page 53.

For a quick glance at the status of BUIs, there is a chart on the opposite page, and symbols are used on the following pages to indicate whether we are:

Making Progress ⇧ **Losing Ground** ⇩ **Breaking Even/Remained the Same** ⇳

In some cases, a combination of symbols is used to depict the status of the impaired use. **When so little data has been collected, and the community** is un-aware of efforts to improve the impairment, the status is shown as Unknown. ?

Using Targets and Indicators for Delisting BUIs

The Muskegon Lake PAC is the local organization with the responsibility to initiate the BUI de-listing process. The PAC will work with the Michigan Department of Environmental Quality, U.S. Environmental Protection Agency and the International Joint Commission throughout the process to determine whether or not a BUI is restored and if it should be de-listed from the AOC. The Muskegon Lake PAC intends that the targets and indicators listed in this document be updated annually, and that they will be used to document a "body of evidence" that a BUI is being restored. In some cases, all targets listed for a BUI may be met before de-listing is initiated. In other cases, a majority of the targets may be met, and the PAC could decide that it is either not possible to attain certain targets or that they are no longer necessary to restore the BUI.

Action Agendas

Action Agendas (listed in previous chapters) are referenced below each of the nine (9) BUI summaries on the following pages. 1) General Public; and 2) Governments, Business, Agencies and Organizations. In general, it will be most beneficial and cost effective for the community to coordinate actions and to work on many actions simultaneously.

Future Updates for the Muskegon Lake Community Action Plan

Please contact the Muskegon Conservation District, Local Coordinator for the Muskegon Lake Community Action Plan at (231) 773-0008, or contact Kathy Evans at kevansmcd@aol.com. You are encouraged to visit the interactive Community Action Plan page of the Muskegon Lake PAC web site to provide continuing comments on the actions, targets and indicators listed in this plan. The PAC's web site contains a printable version of the plan, and an interactive version for your comments. The web site address is: *muskegonlake.org.* At the site you will find contact information for PAC members, current events, meeting notices and links to other AOC related web sites.

This Beneficial Use Impairment (BUI) status update chart is based on the 1994 RAP and research findings from the studies listed on page 5, under "Muskegon Lake RAP Progress Summary: Research, Monitoring and Restoration Activities Related to Beneeficial Use Impairments from 1994-2002. This status summary was also reviewed by the Muskegon Lake PAC, Muskegon Conservation District (Local RAP Coordinator/AOC Data Repository), the Michigan Department of Environmental Quality, Michigan Department of Natural Resources, USDA Natural Resources Conservation Service and other organizations working cooperatively in the Muskegon Lake RAP process.

Muskegon Lake Remedial Action Plan (RAP) Update
2002 Beneficial Use Impairment Status Summary

IMPAIRMENT	EXTENT	SUSPECTED CAUSES	POTENTIALSOURCES	CHANGES 1987-94	CHANGES 1994-2002
1) Restrictions on Fish & Wildlife Consumption	Regional; Lakewide	Toxics	Contaminated Sediments, Nonpoint Sources, Atmospheric Deposition	Remained the Same	Remained the Same (no change in consumption advisory)
2) Loss of Fish and Wildlife Habitat		Lake-wide Nutrient Enrichment, Physical Alteration of Shoreline	Nonpoint Sources Development	Degraded	Degraded
3) Degradation of Fish and Wildlife Populations	Regional; Lakewide	Toxics, Nutrient Enrichment, Physical Alteration of Shoreline	Contaminated Sediments, Nonpoint Sources, Atmospheric Deposition Development	Unknown	Unknown (Need more data & analysis of existing data
4) Degradation of Benthos	May be lake-wide, Localized	Toxics, Nutrient Enrichment, Physical Alteration of Shoreline	Contaminated Sediments, Groundwater, Nonpoint Sources in AOC & River Watershed	Unknown	Unknown (Need more data)
5) Restrictions on Dredging	Localized	Toxics	Contaminated Sediments, Nonpoint Sources	Remained the Same	Remained the Same
6) Degradation of Aesthetics	Localized	Algal Bloom Mats, Sludges, Barrels & Nearshore Bottom Debris	Nonpoint Sources, Past Disposal Practices	Known	Improving (Localized improvements with volunteer cleanups of shoreline and bottom debris)
7) Beach closings	Lake-wide, Localized	Toxics	Sanitary & Industrial Wastewater Discharge Sewer Line Failures	No current problems in 1994	Progress Being Made (Sewer Restoration & Monitoring Underway)
8) Eutrophication or Undesirable algae	Localized	Nutrient Enrichment	Nonpoint pollution in sub-watershed & Muskegon River	Improved	Some Improvement (Need more data)
9) Restrictions on Drinking Water Consumption (groundwater)	Localized	Toxics Nutrients	Contaminated Groundwater & Nonpoint sources in watershed infiltration areas	Known Unknown	Remained the Same

Please see pages 12, Contaminated Sediments and 26, Groundwater for specific toxic pollutants of concern.

Where We Want to Be—Targets and Indicators of Success

We Can All Eat the Fish:

BUI #1 — Addressing the Restrictions on Human Consumption of Fish and Wildlife

Targets for Restoration and De-listing

1. All members of the population will be able to eat fish safely.
2. Consumers of fish, subsistence fishers and sport fishers will be knowledgeable about the health benefits and risks from eating fish and abide by the fish consumption advisories for the AOC.
3. Women of childbearing age and children under 15 will not be at more risk nor advised to eat smaller quantities of fish compared to the rest of the general population.
4. Levels of PCBs in Northern Pike and Carp will be below the Michigan Department of Community Health standards for consumption advisories and/or no worse than the advisories for Lake Michigan.
5. Levels of Mercury and PCBs in Largemouth Bass, Walleye and Redhorse Sucker will be below the Michigan Department of Community Health standards for consumption advisories and/or no worse than the advisories for Lake Michigan.

   (In order to address the AOC boundary and this BUI, the above de-listing targets apply to Muskegon Lake, Bear Lake and Muskegon River, below Croton Dam.)

Indicators of Restoration

1. MDCH, U.S. EPA, the Muskegon County Health Department and Muskegon Lake PAC will agree that levels of contaminants in fish are at safe levels for all members of the population.
2. The health benefits and risks of fish consumption are thoroughly understood by the general public.
3. Fish advisories will be lifted for the AOC.

Research and Monitoring Needs

1. Caged fish contaminant monitoring studies need to continue ***(before/after remediation/every 3-5 years)*** in the Muskegon Lake Channel and expand to include localized Muskegon Lake tributaries and "hot spots," to help determine whether fish contamination is worse or better in Muskegon Lake AOC than in Lake Michigan.
2. Fish mobility and life cycle information is needed to determine if the contamination of fish in Muskegon Lake is due to a regional or local problem.
3. A valuation of Muskegon Lake's fishery, relative to economic, cultural and human health concerns is needed.
4. A fish consumption/human health risk behavior survey is needed to identify health concerns and educational needs in the AOC.

Action Agendas

1. Page 14 — Fisheries
2. Page 12 — Contaminated Sediments
3. Page 28 — Stormwater Runoff
4. Page 8 — Pollution Prevention
5. Page 22 — Sub-Watersheds
6. Page 26 — Groundwater Action Agenda
7. Page 36 — Public Education & Stewardship

Where Will They Live?

BUI #2— Restoring the Loss of Fish and Wildlife Habitat

Targets for Restoration and De-listing

1. Communities will work cooperatively to plan, manage and maintain natural levels or a t least a minimum of 45% total vegetative surface cover of native aquatic plant communities in Muskegon Lake.
2. The nearshore/littoral zone will be shallow and obstruction free (including seawalls/concrete/rip-rap/debris) to maintain a productive littoral zone.
3. Communities will require that all shoreline and streamside developments blend in a "water's edge strip" landscaped with either: 1) low maintenance native or 2) no-input traditional plantings. Each strip will: 1) provide adequate space for wildlife movement 2) connect existing isolated and fragmented habitats and 3) provide water quality benefits by slowing down and filtering stormwater runoff. A 130' wide strip is recommended for wildlife nesting and safe movement. Seawalls will not be permitted below the ordinary high water mark, and only if erosion is evident.

4. Invasive species, including Eurasian Water Milfoil and Purple Loosestrife will be eliminated or managed at levels that do not disrupt the sustainability of native, aquatic plant communities.
5. Open surface acreage area will be: 1) maintained at no net loss, at the ordinary high water mark and 2) increased by safely removing historic fill in conjunction with rehabilitation and re-development projects.
6. Existing areas that are critical to reproduction, growth, and survival of fish and wildlife will be preserved through land purchases, conservation easements, state designations or zoning.
7. Aquatic habitats that are connected to large intact areas will be preserved through public purchase, conservation easements, state designations or zoning
8. Altered shoreline areas will be restored to provide habitat and nesting area.

Indicators of Restoration

1. A habitat management plan will be developed and used to track restoration progress for fish and wildlife habitat in the AOC, utilizing the 1995 Muskegon Lake Habitat and Aquatic Plant Assess ments baseline data.
2. An evaluation of opportunities to improve or restore fish and wildlife habitat through public purchase, conservation easements and zoning will be compiled and utilized as a tool by local land managers, planning officials, drain commissioner and landowners.
3. Land purchases through federal land purchases, conservation easements, public ownership, or agreements with individual land owners, and working with local management departments in state and local mu nicipalities.
4. Local governments will adopt zoning and ordinances to support the restoration and maintenance of near shore and tributary aquatic, wetland and shoreline buffer habitats.
5. Habitat will be less fragmented and become more connected to increase the amount of usable habitat for larger-sized wildlife and smaller and/or isolated species
6. Local, state and federal permits issued for construction or removal activities will require creation of aquatic habitat and public access to the lake and streams in development projects in the AOC.
7. Education will be institutionalized for the public's understanding of water's edge management to ensure current and future informed decision-making and practices (audiences will include K-12; developers; landscape service providers; local governments and maintenance staff).
8. All new water's edge developments will implement an invasive species management plan (approved by the local planning commission) as part of their land maintenance practices.
9. Local governments will adopt ordinances that support clean stormwater practices and soft/vegetated shoreline edges to lessen the impact of runoff on water quality and aquatic ecosystems.
10. All sub-watershed communities will have completed watershed management plans and will be implementing them.
11. All sub-watershed communities will be implementing stormwater pollution prevention and public education and involvement activities.
12. All sub-watershed communities will have local and regional processes in place to retain and/or filter stormwater runoff and utilize best management practices in public works projects.

Research and Monitoring Needs

1. Historical evaluation and reconstruction of lake morphometry, plant beds, and wetlands, along with present day comparisons are needed to set sensible and defensible targets for "restoration"
2. An evaluation of nutrients in sediment, including historical to present day values to determine if plant communities are affected by nutrients in the sediment
3. Monitoring for community compliance with stormwater and habitat ordinances and zoning

Action Agendas

1. Page 10 Nearshore Aquatic Habitat
2. Page 18 Land by the Lake—Shoreline and Wetland Habitat
3. Page 16 Invasive Species
4. Page 28 Stormwater Runoff
5. Page 22 Subwatersheds in the Area of Concern
6. Page 8 Pollution Prevention

BUI #3 — Addressing the Degradation of Fish and Wildlife Populations

Many of the contaminants that led to restrictions on fish and wildlife consumption for humans can also degrade fish and wildlife populations. Most notably, this impact has been on predators and especially fish-eating wildlife, as contaminants which bio-accumulate become concentrated higher in the food chain. The most common and well known has been the reduction in large birds like osprey and eagles around Muskegon Lake. However, in recent years osprey again have started to nest in the area and local pairs of eagles and ospreys have been sighted in local communities along the Lake Michigan shoreline.

Due to the size of Muskegon Lake, it is difficult to determine overall fisheries populations, and estimates can only act as an index in time. The presence of suitable habitat may be a more feasible overall indicator. Population estimates for sturgeon, walleye and spotted muskellunge could also provide an indication of overall populations by looking at the presence of these migratory species as indicators of health for the entire watershed. These species act as important top predators, and therefore as a measure of system health.

Targets for Restoration and De-listing

1. Communities will work cooperatively to manage and maintain vegetative cover of native aquatic plant communities in Muskegon Lake to support a healthy fishery.
2. Communities will require that all shoreline and streamside developments blend in a "water's edge strip" landscaped with either low maintenance/no-input traditional, natural or native plantings. Each strip will provide adequate space for wildlife movement and connect isolated and fragmented habitat areas.
3. Exotic Species, including Eurasian Water Milfoil and Purple Loosestrife will be eliminated or managed at levels that do not disrupt the sustainability of native, aquatic plant communities.
4. Fish and wildlife population assessments (for species of concern) will show an increase by 2008 (baseline data needed; assessments recommended every three years).
5. The cause of low levels of deep water DO will be determined by 2006 in order to develop targets and recommendations for restoration. (Assessments may include research on natural productivity, water movement, sediment and water column nutrient and toxicity concentrations.)

Indicators of Restoration

1. A habitat management plan will be developed and used to track restoration progress for fish and wildlife habitat in the AOC, utilizing the 1995 Muskegon Lake Habitat and Aquatic Plant Assessments baseline data.
2. Local governments will adopt zoning and ordinances to support the restoration and maintenance of near shore aquatic, wetland and shoreline buffer habitats.
4. Habitat will be less fragmented and become more connected to increase the amount of usable habitat for larger-sized wildlife and smaller and/or isolated species
5. All communities will have adopted nearshore/in-lake management plans and will be implementing restoration and management activities
6. Local, state and federal permits issued for construction or removal activities will require creation of aquatic habitat and public access to the lake and streams in development projects in the AOC
7. A nutrient budget will be developed and used to guide stormwater management in the AOC, utilizing the 1995 Muskegon Lake and White Lake Watershed Study baseline data.
8. Local governments will adopt ordinances that support clean stormwater practices and soft shoreline edges
9. Phase II Stormwater Dischargers are meeting U.S. EPA permit requirements to eliminate discharges of nutrients and toxic pollutants to the AOC's stormwater basin.
10. Road Commission practices will comply with all stormwater, soil erosion and sedimentation regulations
11. Construction site practices will comply with stormwater, soil erosion and sedimentation regulations
12. All sub-watershed communities will be implementing their illicit discharge elimination and public education plans.
13. All sub-watershed communities will have completed watershed management plans and will be implementing stormwater pollution prevention activities
14. Communities will have local and regional processes in place to retain and/or filter stormwater runoff and utilize best management practices in public works projects.

Research and Monitoring Needs

1. Baseline information on historical aquatic habitat abundance and diversity
2. Determine aquatic plant species (and other habitat components) needed to support fish and wildlife species life cycles (in order to develop defensible targets for fish and wildlife populations restoration)
3. Analyze surface acreage and volume related methods (to determine which method is most useful in developing defensible targets for fish and wildlife habitat and populations restoration)
4. Baseline information on nutrient inputs to lake/tributaries/groundwater
5. Assessment of the causes of low levels of deep water dissolved oxygen (DO). This may include research on natural productivity, water movement, water column and sediment nutrient and toxicity concentrations and availability.
6. Fish and wildlife population assessments (indicator species)
7. Survey government officials and general public on attitudes toward regulations that protect aquatic-terrestrial habitats (including educational needs)

Action Agendas

Upgrading the Bottom Dwellers:

BUI #4 — Addressing the degradation of benthos (bottom dwelling organisms)

Targets for Restoration and De-listing

1. Remedial action cleanup will start in Ruddiman Creek by 2003/2004.
2. 50% of the contaminated sediment "hot spots" in Muskegon Lake will be in the feasibility study stage by 2010, with the initiation of remedial actions at the remaining sites at the rate of one site every year.
3. All contaminated sites cleanups will be completed by 2015.
4. Bi-annual assessments of benthos demonstrate a (20% increase?) in diversity and abundance by 2017 and achieving healthy levels by 2025 (right around the time we'll have to give the resource to other countries).
5. Local governments will adopt zoning and ordinances to support the restoration and maintenance of near shore aquatic, tributary, wetland and shoreline buffer habitats.
6. Sub-watershed streams will be hydrologically and morphologically stable and not a source of contaminated sediment transport.

Indicators of Restoration

1. Beginning in 2003, with the Ruddiman Creek site, monitoring of contaminated sediment remediation projects will provide "before, during and after" assessments to document remedy effectiveness.
2. A nutrient budget will be developed in 2003/2004, and used to guide stormwater discharge management and to measure the impact of stormwater on sediment dependent benthos in the AOC.
3. By 2003, local governments will adopt ordinances that support clean stormwater practices including on site and/ or regional retention or detention; street sweeping; and storm drain filtering to lessen the impact of runoff on sediments, water quality and aquatic ecosystems.
4. Phase II Stormwater Dischargers are meeting U.S. EPA permit requirements to eliminate discharges of toxic pollutants, nutrients and unnatural levels of sediment to the AOC's stormwater network.
5. All sub-watershed communities will be implementing their illicit discharge elimination and public education plans.
6. The Muskegon Lake Public Advisory Council will continue to be involved with the agencies in contaminated sediment remediation decisions; pollution prevention and education activities; oversight for NPDES discharge compliance; oversight for state and federally led soil and groundwater cleanups; public notice comments for local, state and federal permit processes; and in providing oversight for the compliance of clean stormwater discharges to the Muskegon Lake AOC.

Research and Monitoring Needs

1. Historic and baseline information on benthos abundance and diversity
2. Contaminated sediments at all sites are evaluated for the remediation process
3. Funding sources for sediment remediation are investigated and obligated
4. The impact of stormwater discharges to the health of the lake and tributaries' benthic communities
5. Nutrient budget analysis for Muskegon Lake and tributaries (surface and groundwater sources)

Action Agendas

1. Page 12 — Contaminated Sediments
2. Page 30 — Erosion and Sedimentation
3. Page 28 — Stormwater Runoff
4. Page 10 — Nearshore Aquatic Habitat
5. Page 26 — Groundwater
6. Page 8 — Pollution Prevention

Cleaning up the Mud:
BUI #5 — Addressing the restrictions on dredging

Targets for Restoration and De-listing
1. Additional costs for sampling sediments for heavy metals, hydrocarbons and/or other contaminants will no longer be necessary in the MDNR Land and Water Permit process because all contaminated sediment sites will be fully characterized
2. The level of contaminants in the Muskegon Lake AOC watershed sediments no longer imposes additional costs due to requirements for the removal, disposal, confinement, or remediation of dredge spoils.
3. Aquatic habitat impacts are mitigated (within immediate area/zone) where development/dredging occurs.

Indicators of Restoration
1. Land and Water Permit applications will indicate levels of contaminants in dredge spoils are below levels that require additional testing, special disposal, removal, confinement or remediation.
2. In the development process, the rehabilitation of contaminated properties and soft edges/habitat protection will be included.
3. Phase II Stormwater Dischargers will meet goals to limit discharges of nutrients to the stormwater system.
4. Municipalities implement aquatic habitat mitigation for all in-lake developments (priority sites for mitigation or new developments will be areas previously filled or degraded by isolation and fragmentation).

Research and Monitoring Needs
1. Baseline information on historic benthic abundance and diversity is needed to guide restoration plans and remediation targets for the open water, nearshore and tributaries impacted by contaminated sediments.
2. All contaminated sediment sites are evaluated for contaminants of concern.

Action Agendas
1. Page 28 — Stormwater Runoff Action Agenda
2. Page 12 — Contaminated Sediment Action Agenda
3. Page 26 — Groundwater
4. Page 8 — Pollution Prevention Action Agenda
5. Page 35 — Human Health

Beauty is in the Eye of the Beholder:

BUI #6 — Addressing the degradation of aesthetics

Targets for Restoration and De-listing:

1. A soft shoreline with abundant fish habitat and overhanging trees
2. A clean, beautiful lake with bottom sediments free of contamination and debris
3. The absence of nuisance algal blooms
4. The absence of oil slicks
5. A sense of place will be secured through the identification, enhancement and maintenance of public access and viewsheds for the lake.
6. A gift to the future is ensured through sustained stewardship, development standards and regulatory action.
8. Motorized and non-motorized quiet areas both

Indicators of Restoration:

1. A broad strategy will be developed and used to resolve development disputes and to implement the vision of the City of Muskegon's lakeshore, and a plan to develop these mixed uses and habitat
2. Developments on Muskegon Lake's south shoreline and stream edges reflect compliance with the City of Muskegon's vision for the shoreline
3. Master Plans will reflect a sense of place and design to enhance and preserve beauty
4. Zoning and ordinances will be used to preserve the aesthetic benefits
5. Wastewater discharges (municipal and on-site septic) are eliminated

Research and Monitoring Needs:

1. Bi-Annual evaluation of public attitudes/knowledge/support for aquatic-terrestrial habitat Action Agendas and targets through 2010
2. Identify areas suitable for safe bathing beaches on east and south sides of the lake

Action Agendas

1. Page 18 Land by the Lake -Shoreline/Wetlands
2. Page 34 Public Education and Stewardship
3. Page 28 Stormwater Runoff Action Agenda
4. Page 12 Contaminated Sediments
5. Page 10 Nearshore Aquatic Habitat
6. Page 20 Land Use, Green Space and Brownfields
7. Page 22 Subwatersheds in the AOC
8. Page 32 Wastewater Management

We Can All Swim in the Water:

BUI #7 — Addressing Beach Closings (contact/health advisories)

Targets for Restoration and De-listing

1. The Muskegon County Health Department will no longer have to post "no contact" advisories in Muskegon Lake or its tributaries due to wastewater sewer line or lift station failures.
2. Lake bottoms will no longer be contaminated with toxic pollutants at levels that are known to impact human health in children or adults in designated public access, boat launch and beach areas.
3. Lake bottoms will be free of dangerous debris (metal scraps, re-rod, wire, rusty barrels) at public access, boat launch and beach areas.

Indicators of Restoration

1. Phase II Stormwater Dischargers will meet goals to limit discharges of oil, grease, heavy metals and nutrients to the stormwater system.
2. Muskegon County Health Department's *E.. coli* sampling will indicate levels of bacteria at non-detect or levels safe for human full body contact with Muskegon Lake and its immediate tributaries in the AOC boundary.
3. Muskegon County Wastewater Management System will not discharge untreated waste due to sewer line failures, and will be in discharge compliance with NPDES permits and ensure industrial pre-treatment standards are met.
4. On site septic maintenance meets/exceeds recommendations on 80% of sites within the Muskegon Lake AOC watershed
5. All known waste disposal that may be leading to bacterial contamination will be eliminated
6. Bacterial (*E. coli*) monitoring program for Muskegon Lake will ensure that state water quality standards are being met, especially in those areas where public in have access to water (marinas, boat launches, swimming beaches, fishing piers).
7. Annual monitoring data will be analyzed and reported in local publications (newspapers, newsletters etc.).

Research and Monitoring Needs

1. Groundwater monitoring for nutrients and E. coli from non-sewered & sewered areas in immediate drainage area
2. Nutrient budget for Muskegon Lake (including #1 above)
3. Identification of safe beaches for passive public access on the south and east sides of Muskegon Lake
4. The Muskegon County Health Department – Environmental Health will perform weekly monitoring of all public beaches, and utilize new technologies for rapid assessment and contact advisories as necessary
5. Petri-film techniques will be used by volunteer monitors as a screening technique for potential upstream sources of *E.coli*. AOC stormwater outfall and tributary outlets will also be screened. The Health Department will receive the results.

Action Agendas

1. Page 32 Wastewater Management
2. Page 28 Stormwater Runoff Action Agenda
3. Page 26 Groundwater
4. Page 12 Contaminated Sediments
5. Page 34 Public Education and Stewardship

Getting Rid of the Slimy Stuff:

BUI #8 — Addressing eutrophication or undesirable algae

Targets for Restoration and De-listing

1. Muskegon Lake has sub-watershed management plans to address nutrients, pesticides, buffers by 2010.
2. A 50% reduction of nutrients/contaminants in surface and groundwater (per bi-annual monitoring) by 2015.

Indicators of Restoration

1. Phase II Stormwater Dischargers will meet goals to limit discharges of nutrients to the stormwater system.
2. Municipalities institute nutrient management plans for watershed areas on 50% of watershed
3. Public/private landscape management (nutrient and pesticides) are implemented on 50% of watershed
4. The occurrences of algal blooms on Muskegon Lake, Bear Lake (Fenner's Ditch and lake tributaries) will no longer be observed at nuisance levels.

Research and Monitoring Needs

1. Nutrient Budget
2. Public Surveys

Action Agendas

1. Page 28 Stormwater Runoff Action Agenda
2. Page 36 Public Education and Stewardship
3. Page 30 Soil Erosion and Sedimentation
4. Page 22 Subwatersheds in the AOC
5. Page 34 Human Health
6. Page 22 Subwatersheds in the AOC
7. Page 34 Human Health
8. Page 8 Pollution Prevention

We Can All Drink the Water:

BUI #9 — Restrictions on drinking water consumption (groundwater)

Targets for Restoration and De-listing

1. MDEQ, U.S. EPA and Potentially Responsible Partners will address groundwater contamination
2. Muskegon County Health Department will address drinking water wells for nitrates and other contaminants of concern

Research and Monitoring Needs

1. Groundwater plumes and concentrations of nutrients and other contaminants need to be mapped in Muskegon Lake AOC in order to prioritize cleanup of sites that contribute to the restriction of drinking water consumption.
2. Existing and potential infrastructure to supply water and sewer to developing areas in Muskegon Lake AOC watershed need to be mapped in order to prioritize the cleanup of sites.

Action Agendas

1. Page 26 Groundwater
2. Page 28 Stormwater Runoff
3. Page 8 Pollution Prevention

FUNDING SOURCES

Coordinate with Local Groups to Develop Strong Funding Proposals

LOCAL CONTACTS

Muskegon Lake Public Advisory Council
muskegonlake.org—Contact, Cynthia Price
(231) 755-3478 or (616) 784-1090

Muskegon Conservation District
muskegoncd.org—Contact, Kathy Evans
(231) 773-0008

Muskegon County Watershed Information Network
(231) 767-1207

Michigan Anglers Association—Contact, Wayne Groesbeck
(231) 777-1555

Muskegon Conservation Club—Contact, Al Bell
(231) 744-7309

Muskegon Environment, Research and Education Society
(616) 455-6236—Contact, Ron Brown

Grand Valley State University Annis Water Resources Institute
(231) 728-3601—Contact, Dr. Rick Rediske

West Michigan Shoreline Regional Development Commission
(231) 722-7878—Contact, Erin Kuhn

Timberland Resource Conservation and Development Council
(616) 784-1090—Contact Phil Dakin or Cynthia Price

Muskegon River Watershed Assembly
mrwa@ferris.edu—Contact, Gary Noble

Muskegon County Health Department
(231) 724-6311—Contact, Vicki Webster

Muskegon County Drain Commission
(231) 724-6219—Drain Commissioner, Martin Hulka

ENTITIES WITH RAP IMPLEMENTATION RESPONSIBILITIES IN MICHIGAN AOCs

Federal
U.S. EPA
U.S. Army Corps of Engineers
U.S. Geological Survey
U.S. Fish and Wildlife Service
U.S.D.A.—Natural Resources Conservation Service

State
Michigan Department of Environmental Quality
Michigan Department of Natural Resources
Michigan Water Resources Commission
Michigan Department of Transportation
Public Universities
State Legislature

Local/Regional
Counties, Cities, Townships and Villages
Drainage and Sewer Districts
Other Special Districts
Sewer Authorities
Port Authorities
Intergovernmental Task Forces

Private
Industrial Permittees
Potentially Responsible Parties
Individual Households
Not-For-Profit Organizations
Farmers/Landowners
Professional Associations/Business Councils
Independent Committees/Councils

MUSKEGON LAKE MUNICIPALITIES

Muskegon County	(231)	724-6520	Dalton Township	(231)	766-3043
City of Muskegon	(231)	724-6705	Egelston Township	(231)	788-2308
City of North Muskegon	(231)	744-1621	City of Muskegon Heights	(231)	733-1175
Laketon Township	(231)	744-2454	City of Norton Shores	(231)	798-4391
Muskegon Township	(231)	777-2555	City of Roosevelt Park	(231)	755-3721
			Cedar Creek Township	(231)	821-0014

Muskegon Lake Community Action Plan Update, 2002

The Muskegon Lake PAC and Support Staff at the Muskegon Conservation District would like to express our gratitude and appreciation for all the community members who took the time to attend one or all of the three public input meetings held over the course of the RAP Update process. (PAC and Technical Team members are listed on pages 52 and 53.)

The community's participation and input was very important in the development of targets for restoration and the actions needed to restore fish and wildlife habitat and good water quality.

We invite you to visit the ***Muskegonlake.org*** (Muskegon Lake PAC) or ***Muskegoncd.org*** (Muskegon Conservation District) web sites to provide additional comments for the next update. An interactive version of the Muskegon Lake Community Action Plan along with a printable pdf format will be available for your use.

Printed copies are also available at the Muskegon Conservation District, 1001 E. Wesley Avenue, Muskegon, Michigan 49442.

In addition, we wish to thank the Michigan Department of Environmental Quality Areas of Concern Program, U.S. Environmental Protection Agency, Region V, and the Great Lakes Commission for making the project funds available.

Thank you again for your input and we hope you find your recommendations reflected throughout this document. Thank you!

Public Meeting Participants

Harold Andersen, Carolyn Aubuchon, James Austin, Karen Bednarek, Al Bell, Bob Bell, Tom Berdinski, Ron Brown, David D'Alcorn, State Representative Julie Dennis, Jerry Garman, Wayne J. Groesbeck, Tom Hamilton, Delphine Hogston, Roger Jones, Virgie Jackson, Lynn Kalfsbeek, Dave Lemieux, James McCabe, Cheryl Mendoza, Roger Morgenstern, Greg Mund, Gary Noble, Dave Peden, Sally Pleimling, Cynthia Price, Rick Rediske, William Schroeder, David Shedd, Al Steinman, State Representative Gerald VanWoerkom, Marian Ward, Don and Juanita Zudor, Carl & Margie Benson, Arn Boezaart, Tanya Cabala, Phil Dakin, Bill Danly, Kathy Dusseau, Kathy Evans, Muskegon County Commissioner, Nancy Frye, Ryan Grant, Sandra Groesbeck, Tim Hall, U.S. House Representative, Peter Hoekstra, Richard & Barbara Jorgensen, Satish Joshi, MSU, Glenn Keebler, Connie King, Ross Kittleman, Brian Lazor, Chris Matteson, Dennis McKee, Jill Montgomery, Greg Roberts, Terry Stilson, Sarah U'Ren, John and Marie VanWyck, Liz Vos

RESOURCES

Financial Planning Guide for Michigan's Areas of Concern. July 1993. Prepared for: U.S. EPA-Great Lakes National Program Office

U.S. EPA—*www.epa.gov/own/finan.htm*

NOAA-Coastal Services Center—*www.csc.noaa.gov/test/grant.html*

U.S. Fish & Wildlife Service-Coastal Wetland Conservation Grants—*www.fws.gov/cep/cwgcover.html*

National Institutes for Water Resources—*www.niwr.org/NIWR*

NOAA Coastal Zone Management Administration Awards—*www.cfda.gov/query.htm*

Great Lakes Commission—Basin Program for Soil Erosion and Sedimentation Control—*www.glc.org*

State of Michigan
DEQ—Clean Michigan Initiative
DNR—Inland Fisheries Program

Great Lakes Protection Fund—*www.glpf.org*

Great Lakes Aquatic Habitat Network & Fund—*www.glhabitat.org*

PAL (People and Land) - *www.peopleandland.org*

NOAA—Sea Grant Great Lakes Network—*www.seagrant.wisc.edu/greatlakes/glnetwork*

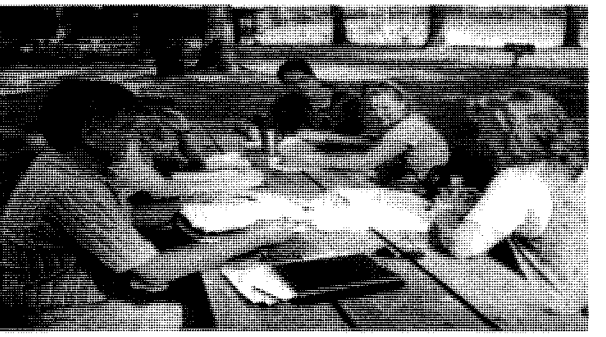
The Joyce Foundation—*www.joycefdn.org/home.htm*

The Peter Wege Foundation

The C.S. Mott Foundation

The Community Foundation for Muskegon County—*cffmc.org*

PUBLIC PARTICIPATION



Overview Local public involvement is the single most important ingredient in solving problems and making changes that benefit Muskegon Lake's ecological, economic, cultural and social health.

In Muskegon County, we are fortunate to have resources that increase the public's knowledge to make informed decisions, provide opportunities to become involved, and instill the political will to move forward in partnership with municipalities, business' and agencies to restore and protect Muskegon Lake. The Muskegon Lake Public Advisory Council (PAC) meets on the fourth Monday every month. Meetings alternate from daytime (noon-2:00 p.m.) to evenings (7:00-9:00 p.m.). This schedule has provided opportunities for a broad array of public representation and participation. Please call the Muskegon Conservation District at (231) 773-0008 to find out more about meeting topics and locations.

Muskegon Lake Public Advisory Council

Cynthia Price, Chair
Allen J. Bell, Vice Chair
Wayne Groesbeck, Secretary
Kathy Evans, Rep.—Statewide Public Advisory Council
Theresa Bernhardt, Chair—Ruddiman Creek Task Force
Gale Nobes, Chair—Muskegon River Watershed Assembly
Greg Mund
Roland Crummel
Chris Overbeek
Jim McCabe
Robert Bell
Dennis McKee
Dave Peden
Robert Fountain
Brenda Moore
Ric Scott
Dave Wendtland
Gary Fahnenstiel
Delphine Hogston
Karen Bednarek
Cheryl Mendoza
Liz Vos

Representation

Timberland RC&D
Muskegon Conservation Club
Michigan Anglers
Muskegon Conservation District
Glenside Neighborhood Association
Muskegon River Watershed Assembly
USDA Natural Resources Conservation Service
Laketon Township
Muskegon County Health Department
Ruddiman Creek Task Force
Consumers Energy
Consumers Energy
Industry/Muskegon Chemical Council
City of Muskegon Department of Public Works
City of Muskegon Planning Department
City of Muskegon Leisure Services
Private Sector
NOAA/GLERL Lake Michigan Field Station
General Public
Save Our Shoreline
Lake Michigan Federation
Muskegon County Environmental Coordinating Council

Strong community involvement and working partnerships are necessary for a healthy, sustainable Muskegon Lake ecosystem.

Front Cover: Muskegon Lake Aerial Photo by Marge Beaver

Muskegon Lake Remedial Action Plan Technical Team

The following people assisted with the development of the Muskegon Lake RAP Update, 2002 by providing written comments within their areas of expertise.

We wish to thank the following individuals for their involvement and their support:

Tom Berdinski
Michigan Department of Environmental Quality

Laura Rauwerda
Michigan Department of Environmental Quality

Sharon Baker
Michigan Deptartment of Environmental Quality

Roger Eberhardt
Michigan Department of Environmental Quality

Jeff Auch
Muskegon Conservation District

Kathy Evans
Muskegon Conservation District

Greg Mund
USDA Natural Resources Conservation Service

Dr. Richard Rediske
Grand Valley State University—Annis Water Resources Institute

Rod Denning
Grand Valley State University—Annis Water Resources Institute

Tim Westman
Muskegon County Wastewater Management System

Victoria Webster
Muskegon County Health Department

Jill Montgomery
Muskegon County Health Department

Rich O'Neal,
Michigan Department of Natural Resources—Fisheries Division

Nik Kalejs
Michigan Department of Natural Resources—Wildlife Division

Removing Beneficial Use Impairments

PROCESS

As Muskegon Lake moves into the restoration of Beneficial Use Impairments (BUIs), the Muskegon Lake Public Advisory Council will initiate final delisting of the Area of Concern.

The final removal of Muskegon Lake as an Area of Concern must meet specific criteria and move through formal approval by state, federal, and international agencies.

Upon completion and approval of final reports, the International Joint Commission will move to officially delist Muskegon Lake. The community will celebrate!

CRITERIA

The Muskegon Lake Public Advisory Council will utilize the following criteria to delist BUIs for Muskegon Lake, or for a particular sub-watershed portion of the AOC, as the BUIs are restored:

- A delisting target has been met through remedial actions which confirms that the beneficial use has been restored.
- It can be demonstrated that the beneficial use impairment is due to natural rather than human causes.
- It can be demonstrated that the impairment is not limited to the local geographic extent, but rather is typical of lakewide, region-wide, or area-wide conditions (under this situation, the beneficial use may not have been originally needed to be recognized as impaired).
- The impairment is caused by sources outside the Area of Concern. The impairment is not restored but the impairment classification and can be removed or changed to "impaired—not due to local sources." Responsibility for addressing "out of AOC" sources is given to another party such as the Lake Michigan Lakewide Management Plan.