

The Michigan Department of Environmental Quality Biennial Remedial Action Plan Update for the Kalamazoo River Area of Concern



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Purpose of the Biennial RAP Update

A Michigan Department of Environmental Quality (MDEQ) Biennial Remedial Action Plan (RAP) Update will be prepared every 2 years for each Area of Concern (AOC), and will be the primary tool for documenting and communicating progress to the public and agencies. These documents are meant to be brief, user-friendly updates on recent remedial actions and assessments in the AOC. They are prepared by the MDEQ in consultation with the Public Advisory Council (PAC) and the U.S. Environmental Protection Agency (USEPA). These biennial RAP updates will also be posted on the MDEQ AOC web site.

The biennial RAP update is one component of the MDEQ's process for tracking AOC restoration, removing BUIs, and ultimately delisting AOCs. These processes and relevant restoration criteria are described in more detail in the MDEQ's *Guidance for Delisting Michigan's Great Lakes Areas of Concern (Guidance)* (MDEQ, 2006a).

The purpose of this Kalamazoo River biennial RAP update is to track progress in the AOC by providing an update on those remedial actions completed in recent years. This update will discuss BUI assessment results that are based on the readiness of a BUI removal and subsequent technical committee review and recommendations. Comprehensive background information is provided in the 1987 and 1998 Kalamazoo River RAP documents (Michigan Department of Natural Resources [MDNR], 1987 and Kalamazoo River Watershed Public Advisory Council [Kalamazoo River PAC], 1998).

How to Use this Document

For each of the eight BUIs identified in the Kalamazoo River AOC, this RAP Update includes:

- A description of the significance of the BUI based on previous RAP documentation
- A summary of the restoration criteria for the BUI outlined in the *Guidance* document
- A brief summary of relevant remedial actions, if any, completed in recent years
- A brief summary of the technical committee's assessment activities and results, if any, completed in recent years
- A list of annotated references and studies that may be used by a technical committee when the MDEQ AOC coordinator, in consultation with the PAC, determines the BUI is ready for formal review of remedial actions and restoration according to the applicable criteria.

Introduction

Background

In 1987, amendments to the Great Lakes Water Quality Agreement (GLWQA) were adopted by the federal governments of the U.S. and Canada. Annex 2 of the amendments listed 14 different beneficial use impairments (BUIs) which are caused by a detrimental change in the chemical, physical, or biological integrity of the Great Lakes system (International Joint Commission, 1988). The Annex directed the two countries to identify AOCs that did not meet the objectives of the GLWQA. RAPs addressing the BUIs were to be prepared for all 43 AOCs identified, including the Kalamazoo River. The BUIs provided a tool for describing effects of the contamination or other kinds of impairments, and a means for focusing remedial actions.

The Kalamazoo River AOC drains an extensive watershed in the southwest portion of the lower peninsula of Michigan. The river flows in a westerly direction and discharges into Lake Michigan near the city of Saugatuck. The upstream boundary of the AOC is Morrow Dam, which forms Morrow Pond, and the AOC includes the river channel and its riparian zone to the high water mark from Morrow Dam downstream to the mouth of the river at Lake Michigan, a distance of approximately 80 miles. A lower reach of Portage Creek is also included in the AOC (Figure 1). The city of Kalamazoo is situated along the AOC reach, and the city of Battle Creek is not far upstream. The Calkins Dam forms a reservoir of 1,600 acres (Lake Allegan) between Kalamazoo and Lake Michigan that reportedly traps most sediments and associated contaminants transported by the river (MDNR, 1987). Between Morrow Dam and Lake Allegan are several smaller, decommissioned hydroelectric dams that are partially removed but require further removal or repair due to their decrepit state according to safety inspection reports (MDEQ, 2006b). Any dam removal effort will be complicated by the contaminated sediments trapped behind the dams.

The Kalamazoo River was listed as an AOC due to historic releases of polychlorinated biphenyls (PCBs), which originated primarily from de-inking operations at local paper mills. The Kalamazoo River has been identified as a site of environmental contamination pursuant to the Michigan Natural Resources and Environmental Protection Act 451 and is included in the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), commonly known as Superfund.

In February, 2006, the Kalamazoo River PAC held a meeting and voted to adopt the delisting targets included in the *Guidance* to evaluate the status of their BUIs. The AOC has eight BUIs determined under Annex 2 of the GLWQA, including: Restrictions on Dredging, Loss of Fish and Wildlife Habitat, Degradation of Fish and Wildlife Populations, Degradation of Aesthetics, Bird and Animal Deformities, Restrictions on Fish Consumption, Beach Closings, and Degradation of Benthos. Table 1 is a matrix for tracking the progress of assessments and removal of these BUIs from the Kalamazoo River AOC.

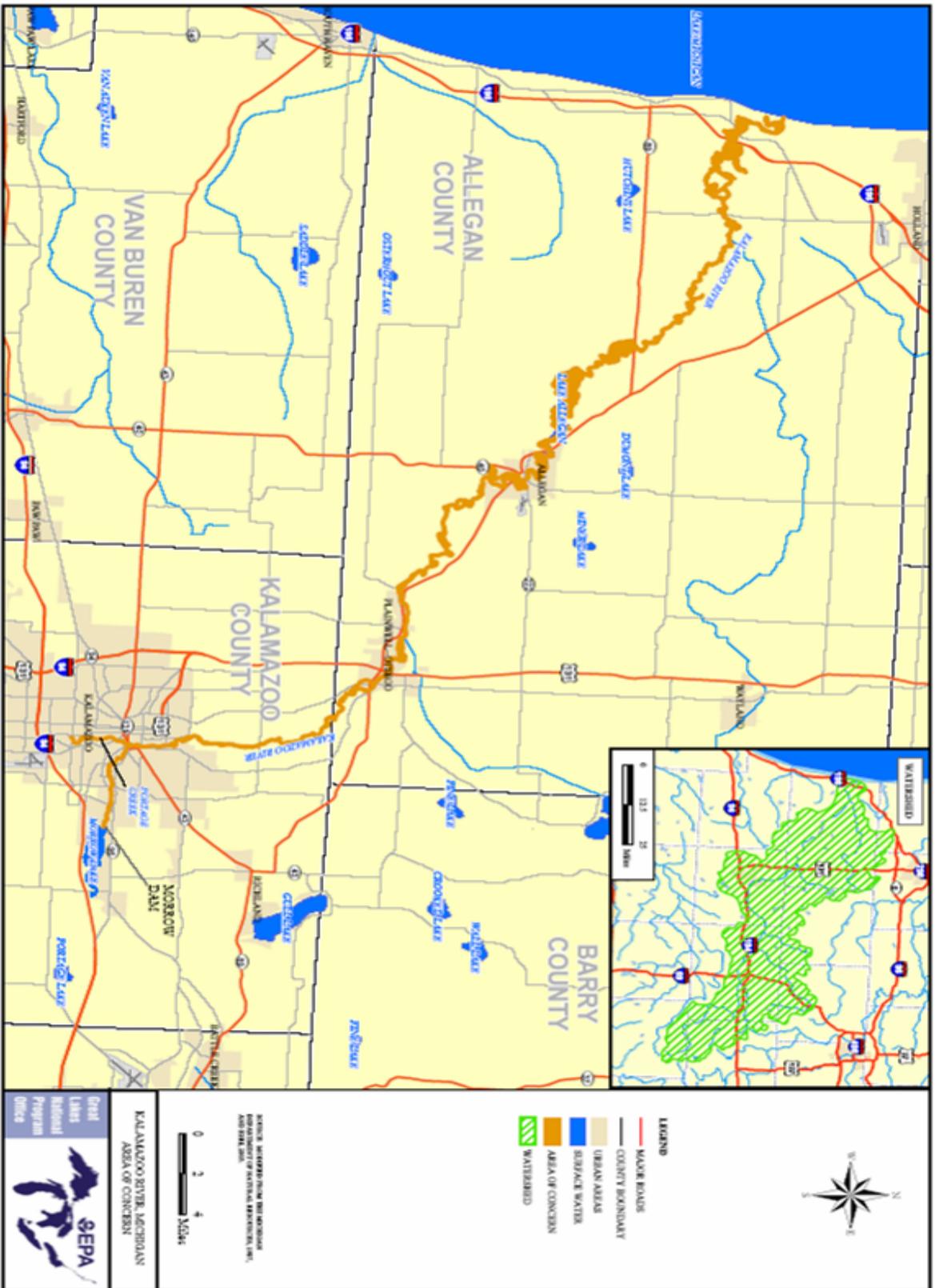


Figure 1. The Kalamazoo River Area of Concern.

Table 1. Kalamazoo River BUI Removal Matrix.			
Beneficial Use Impairment	Beneficial Use Remains Impaired	Assessment in Progress	BUI Removed
Restrictions on fish and wildlife consumption	x		
Bird or animal deformities or reproductive problems	x		
Degradation of benthos	x		
Restrictions on dredging activities	x		
Beach closings	x		
Degradation of aesthetics	x		
Degradation of fish and wildlife populations	x		
Loss of fish and wildlife habitat	x		

Overview of Contaminated Sediments in the Kalamazoo River AOC

Impairments listed in the 1987 RAP are identified as such due to the presence of the primary contaminant, PCBs (MDNR, 1987). Large portions of the downstream half of the Kalamazoo River's main channel, its adjacent floodplain areas, and a portion of Portage Creek, are contaminated by PCBs. Other resource concerns and related BUIs were later identified by the Kalamazoo River PAC and were included in the 1998 RAP Update as they relate to BUIs (Kalamazoo River PAC, 1998). More comprehensive information is available in the 1987 and 1998 RAPs located on USEPA website: <http://www.epa.gov/glnpo/aoc/kalriv.html>.

Remedial activities in the Kalamazoo River AOC have been delayed because the contaminated areas are also designated as a polluted site on the Federal National Priorities List (NPL) of contaminated sites, commonly referred to as Superfund Sites. The Superfund program has the regulatory authority to address the NPL sites.

The Superfund process involves regulatory programming and negotiations with responsible parties that will result in the cleanup of the NPL of contaminated sites. Progress toward removing or isolating PCB contaminants in the Kalamazoo River AOC is limited by the pace of the Superfund process. In particular, Operable Unit (OU) 5, the river channel, has had little to no isolation or removal of PCB contamination. Most remedial actions to date have been focused on containing and isolating other PCB sources located at former paper mills and landfill sites on or near the banks of the Kalamazoo River and tributaries.

The assessment and removal of the BUIs affected by PCB contamination cannot occur until significant remedial actions under the Superfund process have taken place in the OUs of the Kalamazoo River, its tributaries, and their affected floodplains.

The contaminated sediment layers in the Kalamazoo River system reside primarily in backwater and impounded areas, where most sedimentation occurred. Most of these areas were created by impoundments of varying sizes and ages. Over time and under stable hydrologic conditions, these layers will tend to be buried by newer, less contaminated sediments, which may lead to reduced PCB levels in the food web. However, this situation presents a challenge for decisions regarding remediation because future changes in the river and reservoir geomorphology could cause remobilization of the buried sediments. Such changes could be invoked by large floods, dam failure or intentional removal, decreases in water levels, or dredging projects. Thus the long-term, dynamic behavior that is typical of river systems needs to be taken into consideration, in addition to the levels of PCB contamination in fish and other animals at the particular time that a decision is made.

Specific Superfund related details are available at the following websites:

USEPA

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Michigan DEQ:

Go to <http://michigan.gov/deq>, then click on *Land*, then click on *Land Cleanup*, then select *Superfund Program*.

Restrictions on Fish and Wildlife Consumption

Significance in the Kalamazoo River Area of Concern

As a result of historical PCB contamination in the Kalamazoo River, fish contamination and resultant consumption advisories have been identified as an impaired use in the AOC (MDNR, 1987). The Michigan Department of Community Health (MDCH) recommends that no one eat carp or catfish from the Kalamazoo River between Morrow Dam and the river mouth. The MDCH also recommends no consumption of suckers, smallmouth bass and largemouth bass between Morrow and Allegan Dams, and no consumption of northern pike below Allegan Dam (MDCH, 2004). Details and additional consumption recommendations for the Kalamazoo River AOC can be found in the most recent Michigan Family Fish Consumption Guide, available through the MDCH website at: <http://www.michigan.gov/mdch>. All of the restrictions are due to elevated levels of PCBs (MDCH, 2004).

Restoration Criteria

The Kalamazoo River PAC accepted the state's criteria for restoring this beneficial use. The fish consumption advisory in the Kalamazoo River is more stringent than Lake Michigan and will need to be assessed using either a comparison study or trend analysis.

Remedial Actions

Significant Superfund related remedial actions have not occurred within the Kalamazoo River channels and adjacent floodplains. However, some remedial actions have occurred in OUs (e.g., landfills and mill properties) to reduce the sources of PCBs to the AOC.

OU 1 (Allied Paper, Inc. Landfill)

1998

150,000 tons of PCB contaminated waste removed by USEPA in the former Bryant Mill Pond.

2000

2,600 linear feet of sheetpile installed around perimeter of the waste lagoons, installation of impermeable PVC cap over most of the landfill, and ground water recovery system installed.

OU 2 (Willow Blvd./ A-Site Landfill)

1998

Sheetpile installed around the perimeter of the A-Site landfill to prevent erosion and to stabilize the berm.

1999

7,300 tons of PCB contaminated waste removed from the shoreline of Kalamazoo River and Olmstead Creek.

A six-inch temporary sand cap was installed on top of Willow Blvd., and large rocks and stone were placed along the Kalamazoo River edge to prevent erosion.

OU 3 (King Highway Landfill)

1996

Sheetpile was installed to prevent erosion and stabilize the berms.

PCB contaminated waste (349,300 tons) was removed from the King Highway landfill, lagoons, street storm sewer system, and from the landfill to the edge of the Kalamazoo River edge.

OU 4 (12th Street Landfill)

No remedial actions have occurred at this site.

OU 5 (80 miles of the Kalamazoo River and a 3-mile stretch of Portage Creek)

No remedial actions have occurred at this site. However, dam repairs have occurred at several dams along the river to add stability and to prevent further erosion.

OU 6 (Georgia-Pacific Kalamazoo Mill and former Hawthorne Mill Properties)

2006

Time critical removal action of contaminated material has been initiated. Removed material is being placed in the A-Site landfill along the river.

OU 7 (Plainwell Mill Property)

No remedial actions have occurred at this site.

Assessment Results

This beneficial use is currently impaired. Assessment will occur after substantial completion of Superfund remedial actions. Long-term monitoring required by the Superfund process may provide the data necessary to complete a formal assessment. A technical committee will be convened when the MDEQ and the Kalamazoo River PAC determine that this BUI is ready for a formal review and assessment. The technical committee will review the results of all remedial actions completed and other supporting documentation to provide a decision on whether or not to support a recommendation to formally remove this BUI.

Annotated References and Studies

Bohr, J. and J. Zbytowski. 2006. Michigan Fish Contaminant Monitoring Program: 2005 Annual Report. MDEQ-WB Report #MI/DEQ/WB-06/091.
www.michigan.gov/deq/0,4561,7-135-3313_3681_3686_3728-32393--,00.html

The MDEQ's fixed station whole fish contaminant trend monitoring project was initiated to measure spatial and temporal trends of certain bioaccumulative contaminants.

Michigan Department of Community Health. 2004. 2002 Michigan Family Fish Consumption Guide: Important Facts to Know if You Eat Michigan Fish.
www.michigan.gov/mdhhs/0,5885,7-339-71548_54783_54784_54785---,00.html

Certain kinds and sizes of fish from the Great Lakes, and some Michigan lakes and streams, contain levels of toxic chemicals that may be harmful if those fish are eaten too often. The Michigan Department of Community Health advises caution about eating Michigan fish for the general population, women of childbearing age, and children under 15 years old.

Michigan Department of Environmental Quality. 2003. Human Health Risk Assessment. Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site.

The purpose of this risk assessment is to identify potential risks and hazards associated with exposures to PCBs released into the Kalamazoo River system.

Michigan Department of Environmental Quality, Michigan Attorney General, U.S. Fish and Wildlife Service, and National Oceanic and Atmospheric Administration. 2000. Stage I Assessment Plan: Kalamazoo River Environment Site. Prepared by Stratus Consulting, Boulder, CO.

Michigan Department of Environmental Quality, Michigan Attorney General, U.S. Fish and Wildlife Service, and National Oceanic and Atmospheric Administration. 2005a. Stage I Assessment Report, Volume 1 – Injury Assessment: Kalamazoo River Environment. Prepared by Stratus Consulting, Boulder, CO.

MDEQ, Michigan Attorney General, U.S. Fish and Wildlife Service, and National Oceanic and Atmospheric Administration. 2005b. Stage I Assessment Report, Volume 2 – Economic Assessment: Kalamazoo River Environment. Prepared by Stratus Consulting, Boulder, CO.

The purpose of the Kalamazoo River Natural Resource Damage Assessment (NRDA) is to identify the natural resources that have been impacted by the PCBs. Any funds recovered in the NRDA are used to restore or enhance natural resources, and to compensate the public for the effects of the PCB contamination. NRDA is authorized by both federal and state laws, and supplements the Superfund cleanup process.

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Bird or Animal Deformities or Reproductive Problems

Significance in the Kalamazoo River Area of Concern

As a result of historical pollution, PCB concentrations in the Kalamazoo River AOC exceed levels known to cause mortality, deformities, and biological effects in many organisms found in the Kalamazoo River AOC (Kalamazoo River PAC, 1998). Species known to have been adversely affected include birds, mink, waterfowl, white-footed mice, earthworms, and muskrats. For example, PCB contamination has been linked to bald eagle reproductive failures in the Allegan State Game Area (Kalamazoo River PAC, 1998).

Restoration Criteria

The Kalamazoo River PAC accepted the state's criteria for restoring this beneficial use. According to the *Guidance*, restoration of this beneficial use will be demonstrated using one of two approaches. The approach taken will depend on the availability of data. The first approach evaluates restoration based on field assessment of birds and/or other wildlife where MDEQ or other state-approved bird and wildlife data are available. The

second approach will be applied when bird or other wildlife data are not available. This approach will use levels of contaminated fish tissue as an indicator of the likelihood that deformities or reproductive problems may exist in the AOC.

Remedial Actions

See the Restrictions on Fish and Wildlife Consumption BUI above for recent remedial actions completed on contaminated sediments in the Kalamazoo River AOC.

Assessment Results

This beneficial use is currently impaired. Assessment will occur after substantial completion of Superfund remedial actions. Long-term monitoring required by the Superfund process may provide the data necessary to complete a formal assessment. A technical committee will be convened when the MDEQ and the Kalamazoo River PAC determine that this BUI is ready for a formal review and assessment. The technical committee will review the results of all remedial actions completed and other supporting documentation to provide a decision on whether or not to support a recommendation to formally remove this BUI.

Annotated References and Studies

Beckett, K.; Millsap, S.; Blankenship, A.; Zwiernik, M.; Giesy, J., and Bursian, S. 2005. Squamous Epithelial Lesion of the Mandibles and Maxillae of Wild Mink (*Mustela Vison*) Naturally Exposed to Polychlorinated Biphenyls. *Environ Toxicol Chem.* 24(3):674-7.

Mink are a naturally occurring predator in the Kalamazoo River AOC and also a species of concern because of their known sensitivity to 2,3,7,8-tetrachlorodibenzo-p-dioxin and structurally similar compounds, such as PCBs. Significant correlations were found between the severity of the lesion and the hepatic concentrations of total PCBs and toxic equivalents.

Blankenship, A.; Zwiernik, M.; Coady, K.; Kay, D.; Newsted, J.; Strause, K.; Park, C.; Bradley, P.; Neigh, A.; Millsap, S.; Jones, P., and Giesy, J. 2005. Differential Accumulation of Polychlorinated Biphenyl Congeners in the Terrestrial Food Web of the Kalamazoo River Superfund Site, Michigan. *Environ Sci Technol.* 39(16):5954-63.

A series of field studies were conducted to determine the bioaccumulation of PCB congeners in the terrestrial food web of the Kalamazoo River flood plain. The data collected suggest that the differential accumulation of PCB congeners in the terrestrial food web can be explained by congener-specific differences in bioavailability from soil, exposure pathways, and metabolic potential of each of the food web components.

Kay, D.; Blankenship, A.; Coady, K.; Neigh, A.; Zwiernik, M.; Millsap, S.; Strause, K.; Park, C.; Bradley, P.; Newsted, J.; Jones, P., and Giesy, J. 2005. Differential Accumulation of Polychlorinated Biphenyl Congeners in the Aquatic Food Web at

the Kalamazoo River Superfund Site, Michigan. Environ Sci Technol. 39(16):5964-74.

A series of field studies were conducted to gain a better understanding of the bioaccumulation and dynamics of PCB congeners in the aquatic food web of the Kalamazoo River flood plain. No significant correlation was found between concentrations of total PCBs and toxic equivalents at sites sampled near the Trowbridge impoundment and an upstream reference location.

Michigan Department of Environmental Quality. 2003. Final (Revised) Baseline Ecological Risk Assessment. Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site.

The purpose of the risk assessment is to identify and describe actual or potential onsite conditions that may result in unacceptable risks to exposed organisms. This risk assessment compares PCB concentrations in different types of exposure media with predicted biological effects to estimate risks and to preliminarily identify appropriate and protective cleanup levels.

Michigan Department of Environmental Quality, Michigan Attorney General, U.S. Fish and Wildlife Service, and National Oceanic and Atmospheric Administration. 2000. Stage I Assessment Plan: Kalamazoo River Environment Site. Prepared by Stratus Consulting, Boulder, CO.

Michigan Department of Environmental Quality, Michigan Attorney General, U.S. Fish and Wildlife Service, and National Oceanic and Atmospheric Administration. 2005a. Stage I Assessment Report, Volume 1 – Injury Assessment: Kalamazoo River Environment. Prepared by Stratus Consulting, Boulder, CO.

Michigan Department of Environmental Quality, Michigan Attorney General, U.S. Fish and Wildlife Service, and National Oceanic and Atmospheric Administration. 2005b. Stage I Assessment Report, Volume 2 – Economic Assessment: Kalamazoo River Environment. Prepared by Stratus Consulting, Boulder, CO.

The purpose of the Kalamazoo River Natural NRDA is to identify the natural resources that have been impacted by the PCBs. Any funds recovered in the NRDA are used to restore or enhance natural resources, and to compensate the public for the effects of the PCB contamination. NRDA is authorized by both federal and state laws, and supplements the Superfund cleanup process.

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

Michigan Department of Environmental Quality. 2004. Michigan Wildlife Contamination Trend Monitoring. Year 2002 Annual Report. Nestling Bald Eagles. MI/DEQ/WD-04/024.

Since 1999, the MDEQ has funded researchers at Michigan State University and Clemson University to measure contaminant levels in bald eagle blood and feathers each year. Bald eagle productivity is also monitored. Eaglets from

selected nests have been monitored annually, while others have been sampled according to the MDEQ's five-year rotating watershed cycle. Samples are analyzed for PCBs, mercury, dichlorodiphenyltrichloroethane (DDT), and a few other selected pesticides (Edly and Wuycheck, 2006). http://www.michigan.gov/deq/0,1607,7-135-3313_3686_3728-32394--,00.html

Neigh, A.; Zwiernik, M.; Blankenship, A.; Bradley, P.; Kay, D.; MacCarroll, M.; Park, C.; Jones, P.; Millsap, S., and Newsted, J.. 2006. Exposure and Multiple Lines of Evidence Assessment of Risk for PCBs Found in the Diets of Passerine Birds at the Kalamazoo River Superfund Site, Michigan. *Human and Ecological Risk Assessment*. 12(5):924-946.

This article discusses risk associated with dietary exposures of passerine birds at the Kalamazoo River to PCBs in the terrestrial and aquatic food webs.

Neigh, A.; Zwiernik, M.; Bradley, P.; Kay, D.; Jones, P.; Holem, R.; Blankenship, A.; Strause, K.; Newsted, J., and Giesy, J. 2006. Accumulation of Polychlorinated Biphenyls From Floodplain Soils by Passerine Birds. *Environ Toxicol Chem*. 25(6):1503-11.

In this study, data from eggs, nestlings, and adults of the eastern bluebird and house wren was collected at a PCB contaminated site in the Kalamazoo River AOC and an upstream reference site. Despite the greater accumulation of PCBs at the more contaminated location, the risk of exposure to PCBs did not exceed the threshold for adverse effects at either location.

Neigh, A. M.; Zwiernik, M. J.; Joldersma, C. A.; Blankenship, A. L.; Strause, K. D.; Millsap, S. D.; Newsted, J. L., and Giesy, J. P. 2007. Reproductive Success of Passerines Exposed to Polychlorinated Biphenyls Through the Terrestrial Food Web of the Kalamazoo River. *Ecotoxicol Environ Saf*. 66(1):107-18.

The eastern bluebird and the house wren were identified as ecological receptors of concern due to exposure and potential effects from exposure to PCB contamination in the Kalamazoo River floodplain soils. This study compares measure of population health at a contaminated and a less contaminated reference location. The results of the study suggest that other factors in addition to PCB exposure were the likely causes of the differences that were observed at the two locations.

Neigh, A. M.; Zwiernik, M. J.; MacCarroll, M. A.; Newsted, J. L.; Blankenship, A. L.; Jones, P. D.; Kay, D. P., and Giesy, J. P. 2006. Productivity of Tree Swallows (*Tachycineta Bicolor*) Exposed to PCBs at the Kalamazoo River Superfund Site. *J Toxicol Environ Health A*. 69(5):395-415.

Risk to bird species in the Kalamazoo River were evaluated using the tree swallow as a monitor for possible effects due to PCB exposure. This study

suggests that there were no significant population-level effects of PCBs on tree swallows at the Kalamazoo River Superfund site sampled compared to an upstream reference location.

Degradation of Benthos

Significance in the Kalamazoo River Area of Concern

Bottom dwelling communities and habitats have been degraded in many areas because of sedimentation, low oxygen, and contamination in the Kalamazoo River AOC (Kalamazoo River PAC, 1998). Bottom dwelling communities are exposed to PCB contaminated sediments, and are the primary link in the aquatic food chain that moves PCBs from sediments to organisms at the higher trophic levels. Biosurveys conducted by MDEQ's Surface Water Assessment Section (SWAS) report aquatic habitat quality ranging from excellent to poor and impaired (Cooper, 2005).

Restoration Criteria

The Kalamazoo River PAC has accepted the state's criteria for restoring this beneficial use. According to the *Guidance*, an assessment of the benthic community will be conducted by either MDEQ's SWAS procedures for wadeable or non-wadeable streams; or, in cases where MDEQ procedures are not applicable and benthic degradation is caused by contaminated sediments, this beneficial use will be considered restored when all remedial actions for known contaminated sediment sites with degraded benthos are completed (except for minor repairs required during operation and maintenance) and monitored according to the approved plan for the site.

Because the historic benthic impairments were due mainly to contaminated sediments, the assessment of this BUI will likely depend on whether or not all remedial actions for known contaminated sediment sites with degraded benthos are completed and monitored.

Remedial Actions

See the Restrictions on Fish and Wildlife Consumption BUI above for recent remedial actions completed on contaminated sediments in the Kalamazoo River AOC.

Assessment Results

This beneficial use is currently impaired. Assessment will occur after substantial completion of Superfund remedial actions. Long-term monitoring required by the Superfund process may provide the data necessary to complete a formal assessment. A technical committee will be convened when the MDEQ and the Kalamazoo River PAC determine that this BUI is ready for a formal review and assessment. The technical committee will review the results of all remedial actions completed and other supporting documentation to provide a decision on whether or not to support a recommendation to formally remove this BUI.

Annotated References and Studies

Cooper, J. 2005. A Biological Survey of the Kalamazoo River and Selected Tributaries from the City of Battle Creek to Lake Michigan, July-September, 2004. Michigan Department of Environmental Quality. Report #MI/DEQ/WB-05/064.

As part of the five year watershed review cycle, staff biologists from the MDEQ SWAS conducted qualitative biological assessments in the lower Kalamazoo River Watershed. These surveys were conducted using the Procedure #51 (MDEQ, 2002) and were centered on sub-watersheds between the cities of Battle Creek and Douglas, Michigan. The survey objectives included: qualitative characterization of the macro-invertebrate community with respect to existing habitat conditions at sites, determine attainment status of the watershed, provide data to support permitting, and provide assistance to existing non-point source activities.

Michigan Department of Environmental Quality. 2003. Human Health Risk Assessment. Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site.

The purpose of this risk assessment is to identify potential risks and hazards associated with exposures to PCBs released into the Kalamazoo River system.

Michigan Department of Environmental Quality. 2003. Final (Revised) Baseline Ecological Risk Assessment. Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site.

The purpose of the risk assessment is to identify and describe actual or potential onsite conditions that may result in unacceptable risks to exposed organisms. This risk assessment compares PCB concentrations in different types of exposure media with predicted biological effects to estimate risks and to preliminarily identify appropriate and protective cleanup levels.

Michigan Department of Environmental Quality, Michigan Attorney General, U.S. Fish and Wildlife Service, and National Oceanic and Atmospheric Administration. 2000. Stage I Assessment Plan: Kalamazoo River Environment Site. Prepared by Stratus Consulting, Boulder, CO.

Michigan Department of Environmental Quality, Michigan Attorney General, U.S. Fish and Wildlife Service, and National Oceanic and Atmospheric Administration. 2005a. Stage I Assessment Report, Volume 1 – Injury Assessment: Kalamazoo River Environment. Prepared by Stratus Consulting, Boulder, CO.

Michigan Department of Environmental Quality, Michigan Attorney General, U.S. Fish and Wildlife Service, and National Oceanic and Atmospheric Administration. 2005b. Stage I Assessment Report, Volume 2 – Economic Assessment: Kalamazoo River Environment. Prepared by Stratus Consulting, Boulder, CO.

The purpose of the Kalamazoo River NRDA is to identify the natural resources that have been impacted by the PCBs. Any funds recovered in the NRDA are used to restore or enhance natural resources, and to compensate the public for

the effects of the PCB contamination. NRDA is authorized by both federal and state laws, and supplements the Superfund cleanup process.
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Restrictions on Dredging Activities

Significance in the Kalamazoo River Area of Concern

Since PCBs were identified as a problem in 1971, several actions have taken place to improve conditions. The direct discharge of PCBs has been eliminated due to the PCB ban, originally under Michigan law, and subsequently under the Federal Toxic Substances Control Act (MDNR, 1987). However, to address the problem of PCB contamination affecting about 80 miles of the Kalamazoo River AOC, significant remedial actions are still needed. Numerous studies have documented PCB concentrations in the Kalamazoo River that exceed the USEPA dredge spoil guidelines and standards (Kalamazoo River PAC, 1998).

Restoration Criteria

The Kalamazoo River PAC has accepted the state's criteria for restoring this beneficial use. According to the *Guidance*, this BUI will be considered restored when either there have been no restrictions on routine commercial or recreational navigational channel dredging by the U.S. Army Corps of Engineers, based on the most recent dredging cycle; or, in cases where dredging restrictions exist, a comparison of sediment contaminant data from the commercial or recreational navigation channel (at the time of proposed dredging) in the AOC indicates that contaminant levels are not statistically different from other comparable, non-AOC commercial or recreational navigation channels.

Remedial Actions

See the Restrictions on Fish and Wildlife Consumption BUI above for recent remedial actions completed on contaminated sediments in the Kalamazoo River AOC. The downstream Superfund areas of OU 5 overlap with maintained navigation channels and are scheduled to be part of Phase II of the Superfund process in the AOC.

Assessment Results

This beneficial use is currently impaired. Assessment will occur after substantial completion of Superfund remedial actions. Long-term monitoring required by the Superfund process may provide the data necessary to complete a formal assessment. A technical committee will be convened when the MDEQ and the Kalamazoo River PAC determine that this BUI is ready for a formal review and assessment. The technical committee will review the results of all remedial actions completed and other supporting documentation to provide a decision on whether or not to support a recommendation to formally remove this BUI.

Annotated References and Studies

Great Lakes Dredging Team. 1999. Decision Making Process for Dredged Material Management. Draft Final, October 13, 1998, Amendment #1, January 18, 1999.

This document describes dredged material management options, treatment technologies available and the technical evaluation process, and regulatory requirements.

Beach Closings

Significance in the Kalamazoo River Area of Concern

This impairment was previously listed due to concerns related to body contact with PCB contaminated river water and sediments (Kalamazoo River PAC, 1998). In response to community concerns, the MDCH, in consultation with Agency for Toxic Substances and Disease Registry (ATSDR) investigated risks associated with ingestion of water and sediment associated with recreational activities. Their investigations found that there is no apparent health hazard regarding dermal contact with or incidental ingestion of water and sediments during recreational use of the river (MDCH, 2002).

In the 1998 RAP Update, additional concerns regarding bacteria pollution from storm runoff from livestock waste and septic systems were included as part of the impaired beneficial use.

Restoration Criteria

The Kalamazoo River PAC has accepted the state's criteria for restoring this beneficial use. The *Guidance* criteria requires that no waterbodies within the AOC are included on the list of impaired waters due to contamination with pathogens in the most recent Integrated Report.

Remedial Actions

Remedial efforts have been ongoing in the Kalamazoo River watershed intended to reduce the risk of *E. coli* contamination from runoff from various land uses. Kalamazoo River Watershed plans are available on the internet at: kalamazooriver.net. In addition, there are no combined sewers in the Kalamazoo River which are the primary source of *E. coli* contamination in other AOCs.

Assessment Results

This beneficial use is currently impaired. Although the Kalamazoo River is not currently included on the list of impaired waters due to contamination with pathogens in the most recent Integrated Report, Superfund remedial activities are expected to disturb substantial sediment. Institutional controls will likely be required that minimize the risk of significant downstream transport of re-suspended contaminated sediments.

A technical committee will be convened when the MDEQ and the Kalamazoo River PAC determine that this BUI is ready for a formal review and assessment. The technical committee will review the results of all remedial actions completed and other supporting documentation to provide a decision on whether or not to support a recommendation to formally remove this BUI.

Annotated References and Studies

Aiello, C. 2006. Michigan Water Chemistry Trend Monitoring Great Lakes Tributaries 2004 Report. Michigan Department of Environmental Quality Water Division. Report #MI/DEQ/WD-06/045.

The Water Chemistry Monitoring Project allows for the calculation of contaminant loadings from key Michigan tributaries. The key goals of this project are to: 1) assess the current status and condition of individual waterbodies and determine whether standards are being met, 2) measure temporal and spatial trends, 3) detect new and emerging water quality problems, and 4) provide data to support MDEQ water quality programs and evaluate their effectiveness. Water chemistry reports are available at:

http://www.michigan.gov/deq/0,1607,7-135-3313_3686_3728-32361--,00.html

Michigan Department of Community Health. 2002. Health Consultation, Response to Comments, Allied Paper, Inc./Portage Creek/Kalamazoo River, Kalamazoo County, Michigan.

The Kalamazoo River PAC asked the MDCH to evaluate the health hazards from the PCBs present in the water and sediment of the Kalamazoo River. Following the PAC's review of the public health assessment for Allied Corp. Kalamazoo Plant, Kalamazoo, Kalamazoo County, Michigan, CERCLIS No. MID006007306, the PAC requested responses to specific questions regarding dermal contact with and incidental ingestion of water and sediments during recreational use of the river. This document states that there are no apparent health hazards associated with the PAC's specific concerns. This document is available at:
(The link provided was broken and has been removed.)

Michigan Department of Environmental Quality. 2003. Human Health Risk Assessment. Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site.

The purpose of this risk assessment is to identify potential risks and hazards associated with exposures to PCBs released into the Kalamazoo River system.

Degradation of Aesthetics

Significance in the Kalamazoo River Area of Concern

Degradation of Aesthetics was originally identified as an impaired use due to occasional spills or runoff events that caused odor or visual aesthetics problems (Kalamazoo River

PAC, 1998). Currently, the aesthetic qualities of the river are generally considered good by the local Kalamazoo River PAC, except for some of the impoundment areas and the presence of excessive algae blooms in Lake Allegan.

Restoration Criteria

The Kalamazoo River PAC has accepted the state's criteria for restoring this beneficial use. The *Guidance* criteria requires that monitoring data be collected for two successive monitoring cycles to determine whether or not the water bodies in the AOC exhibit persistent, high levels of the following "unnatural physical properties" (as defined by Rule 323.1050 of the Michigan Water Quality Standards) in quantities which interfere with the state's designated uses for surface waters:

- turbidity
- color
- oil films
- floating solids
- foams
- settleable solids
- suspended solids
- deposits

The MDEQ does not routinely monitor this stretch of river for degraded aesthetic conditions. However, once this BUI is ready to be assessed, the MDEQ biologists will monitor for aesthetic conditions during ongoing monitoring projects and/or work with other local water quality efforts to determine the aesthetic status. For example, the MDEQ's Water Chemistry Monitoring Project does collect data in the AOC on a routine basis, which includes analysis for turbidity and suspended solids from two sampling stations located within the AOC.

Remedial Actions

A local watershed effort involving a large number of point and non-point source entities are participating in a joint phosphorus reduction Total Maximum Daily Load (TMDL) effort (Kalamazoo River/Lake Allegan Phosphorus TMDL Implementation Committee, 2005).

Assessment Results

This beneficial use is currently impaired. The Kalamazoo River PAC will develop a Kalamazoo River Non-point Source Watershed Management Plan during 2007 and 2008 which will require extensive review of the status of the resource. Additionally, review of sampling data generated by the local phosphorus TMDL efforts could lead to a clear picture of the spatial and temporal patterns of the phosphorus loading in the Kalamazoo River watershed.

A technical committee will be convened when the MDEQ and the Kalamazoo River PAC determine that this BUI is ready for a formal review and assessment. The technical committee will review the results of all remedial actions completed and other supporting documentation to provide a decision on whether or not to support a recommendation to formally remove this BUI.

Annotated References and Studies

Aiello, C. 2006. Michigan Water Chemistry Trend Monitoring Great Lakes Tributaries 2004 Report. Michigan Department of Environmental Quality Water Division. Report #MI/DEQ/WD-06/045.

The Water Chemistry Monitoring Project allows for the calculation of contaminant loadings from key Michigan tributaries. The key goals of this project are to: 1) assess the current status and condition of individual waterbodies and determine whether standards are being met, 2) measure temporal and spatial trends, 3) detect new and emerging water quality problems, and 4) provide data to support MDEQ water quality programs and evaluate their effectiveness. Water chemistry reports are available at:

http://www.michigan.gov/deq/0,1607,7-135-3313_3686_3728-32361--,00.html

Heaton, S. 2003. Water Quality Monitoring of Lake Allegan and Select Stations on the Kalamazoo River, 2002. Staff Report #MI/DEQ/WD-03/103.

Water quality monitoring of Lake Allegan is conducted on an annual basis to measure progress toward meeting the phosphorus goal established by the Lake Allegan TMDL and to document the effectiveness of phosphorus reduction efforts. This report presents the results of sampling efforts in 2002, and compares the results with previous sampling conducted in 1998, 1999, 2000, and 2001 as part of the phosphorus TMDL. The report also includes sampling results for Morrow Lake for comparison of water quality conditions with Lake Allegan.

Kalamazoo River/Lake Allegan River Phosphorus TMDL Implementation Committee. 2005. Capstone Report to Stakeholders.

The Kalamazoo River/Lake Allegan Phosphorus TMDL, Capstone Report to Stakeholders is a summary of the nutrient enrichment problems that historically have, and continue to, impact the resources of the Kalamazoo River and specifically, Lake Allegan. The report also outlines the impetus behind the development of the TMDL for Lake Allegan, the implementation plan for the reduction of phosphorus in the watershed, and the activities to date that have been completed to reduce this pollutant.

Reid, N.J. and S.K. Hamilton. *In press (2007)*. Controls on algal abundance in a eutrophic river with varying degrees of impoundment (Kalamazoo River, Michigan, USA). *Lake and Reservoir Management*.

This study examines where algal growth occurs along the river channel and impoundments and how hydrology and nutrients interact to control algal growth.

Wesley, J. 2005. Kalamazoo River Assessment. Michigan Department of Natural Resources, Fisheries Division. Special Report 35.

Wesley, J. 2005. Kalamazoo River Assessment Appendix. Michigan Department of Natural Resources, Fisheries Division. Special Report 35.

The Kalamazoo River assessment and appendix were prepared to provide a comprehensive reference for citizens and agency personnel seeking information about fisheries resources, fisheries management tools, water quality data, and biological community structure. The assessment identifies opportunities for restoration and provides problem solving recommendations related to aquatic resources in the Kalamazoo River watershed. The Kalamazoo River Assessment is available online at:

https://www.michigan.gov/dnr/0,4570,7-350-79136_79236_85892_85893---,00.html

Loss of Fish and Wildlife Habitat

Degradation of Fish and Wildlife Populations

Significance in the Kalamazoo River Area of Concern

The most significant factors affecting the Loss of Fish and Wildlife Habitat are the presence of impoundments on the river, channelization, the loss of wetlands, and the removal of riparian vegetation. Degradation of Fish and Wildlife Populations was identified as an impaired use because of habitat loss, poor water quality, reduced reproductive success in some birds and mammal populations due to PCBs in the food web, and exotic species (Kalamazoo River PAC, 1998).

Restoration Criteria

Per the *Guidance*, these two BUIs are considered together in recognition of the integral relationship between them. The restoration criteria outlined in the *Guidance* provides a process for local PACs to develop locally-derived restoration targets and plans for fish and wildlife habitat and populations. The Kalamazoo River PAC plans to begin the process of developing restoration criteria in early 2007 and will work with the MDEQ and a local team of experts to develop local criteria for removal of this BUI. The finalized restoration plans will be part of future biennial RAP updates, and will contain at least the following components:

- A short narrative on historical fish and wildlife habitat or population issues in the AOC
- Description of the impairment(s) and location for each aquatic habitat or population site(s) to address all habitat or population issues identified in the RAP documents
- A locally derived restoration target for each impacted habitat or population site
- A list of all other ongoing habitat or population planning processes in the AOC
- A scope of work for restoring each impacted aquatic habitat or population site
- A component for reporting on habitat or population restoration implementation action(s) to the MDEQ.

Removal of this BUI will be based on achievement of full implementation of actions in the steps above. Habitat values and populations need not be fully restored prior to

delisting, as some may take many years to recover after actions are complete. Actions already implemented in the AOC may be reported and evaluated as long as the documentation contains all of the elements above.

Remedial Actions

See the Restrictions on Fish and Wildlife Consumption BUI above for recent remedial actions completed on contaminated sediments in the Kalamazoo River AOC.

Assessment Results

This beneficial use is currently impaired. The Kalamazoo River PAC has identified local habitat experts and made initial contacts. The Kalamazoo River PAC and MDEQ are planning a meeting to discuss the fish and wildlife issues in January 2007. Assessment will likely occur after substantial completion of Superfund remedial actions. Long-term monitoring required by the Superfund process may provide the data necessary to complete a formal assessment. A technical committee will be convened when the MDEQ and the Kalamazoo River PAC determine that this BUI is ready for a formal review and assessment. The technical committee will review the results of all remedial actions completed and other supporting documentation to provide a decision on whether or not to support a recommendation to formally remove this BUI.

Annotated References and Studies

Wesley. J. 2005. Kalamazoo River Assessment. Michigan Department of Natural Resources, Fisheries Division. Special Report 35.

Wesley. J. 2005. Kalamazoo River Assessment Appendix. Michigan Department of Natural Resources, Fisheries Division. Special Report 35.

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https://www.michigan.gov/dnr/0,4570,7-350-79136_79236_85892_85893---,00.html

Cooper. J. 2005. A Biological Survey of the Kalamazoo River and Selected Tributaries from the City of Battle Creek to Lake Michigan, July-September, 2004. Michigan Department of Environmental Quality. Report #MI/DEQ/WB-05/064.

As part of the five year watershed review cycle, staff biologists from the MDEQ SWAS conducted qualitative biological assessments in the lower Kalamazoo River Watershed. These surveys were conducted using the Procedure #51 (MDEQ, 2002) and were centered on sub-watersheds between the cities of Battle Creek and Douglas, Michigan. The survey objectives included qualitative characterization of the macro-invertebrate community with respect to existing habitat conditions at sites, determine attainment status of the watershed, provide

data to support permitting, and provide assistance to existing non-point source activities.

Michigan Department of Environmental Quality, Michigan Attorney General, U.S. Fish and Wildlife Service, and National Oceanic and Atmospheric Administration. 2000. Stage I Assessment Plan: Kalamazoo River Environment Site. Prepared by Stratus Consulting, Boulder, CO.

Michigan Department of Environmental Quality, Michigan Attorney General, U.S. Fish and Wildlife Service, and National Oceanic and Atmospheric Administration. 2005a. Stage I Assessment Report, Volume 1 – Injury Assessment: Kalamazoo River Environment. Prepared by Stratus Consulting, Boulder, CO.

Michigan Department of Environmental Quality, Michigan Attorney General, U.S. Fish and Wildlife Service, and National Oceanic and Atmospheric Administration. 2005b. Stage I Assessment Report, Volume 2 – Economic Assessment: Kalamazoo River Environment. Prepared by Stratus Consulting, Boulder, CO.

The purpose of the Kalamazoo River NRDA is to identify the natural resources that have been impacted by the PCBs. Any funds recovered in the NRDA are used to restore or enhance natural resources, and to compensate the public for the effects of the PCB contamination. NRDA is authorized by both federal and state laws, and supplements the Superfund cleanup process.

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

References

- Bohr, J. and J. Zbytowski. 2006. Michigan Fish Contaminant Monitoring Program: 2005 Annual Report. MDEQ-WB Report #MI/DEQ/WB-06/091.
- Cooper, J. 2005. A Biological Survey of the Kalamazoo River and Selected Tributaries from the City of Battle Creek to Lake Michigan, July-September, 2004. Michigan Department of Environmental Quality. Report #MI/DEQ/WB-05/064.
- Edly, K. and J. Wuycheck. 2006. Water Quality and Pollution Control in Michigan: 2006 Sections 303(d) and 305(b) Integrated Report. Report MI/DEQ/WB- 6/019.
http://www.michigan.gov/deq/0,1607,7-135-3313_3686_3728-12711--,00.html
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- Michigan Department of Community Health. 2004. 2002 Michigan Family Fish Consumption Guide: Important Facts to Know if You Eat Michigan Fish.
www.michigan.gov/mdhhs/0,5885,7-339-71548_54783_54784_54785---,00.html
- Michigan Department of Environmental Quality. 2002. Qualitative Biological and Habitat Survey Protocols for Wadable Streams and Rivers, Great Lakes and Environmental Assessment Section, Procedure #51 (Revised May 2002).
- Michigan Department of Environmental Quality. 2006a. Guidance for Delisting Michigan's Great Lakes Areas of Concern. Report MI/DEQ/WB-06-001.
http://www.michigan.gov/egle/0,9429,7-135-3313_3677_95060---,00.html
- Michigan Department of Environmental Quality. 2006b. Letter from Mary Ellen Cromwell, MDEQ, to William Moritz, MDNR, Wildlife Division, regarding the condition of Kalamazoo River Dams.
- Michigan Department of Natural Resources. 1987. Remedial Action Plan for the Kalamazoo River.