

Stage 2 Remedial Action Plan Kalamazoo River Area of Concern



Office of the Great Lakes
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Michigan Department of Environmental Quality

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The efforts to restore the Kalamazoo River Area of Concern are the work of many dedicated and caring individuals over more than 2 decades. The summary information presented here only touches the surface of the good work carried out by those who live in the Kalamazoo River Area of Concern and those who staff the federal and state agencies involved.

Of special note is the work of the members of the Kalamazoo River Watershed Council, who have worked tirelessly to restore the place they call home.

It is a privilege to work with my colleagues in the Departments of Environmental Quality and Natural Resources and with our counterparts in U.S. Environmental Protection Agency and the U.S. Fish and Wildlife Service, among others.

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Kalamazoo River Area of Concern Stage 2 Remedial Action Plan

Purpose of the Stage 2 Remedial Action Plan

A Michigan Department of Environmental Quality (DEQ) Stage 2 Remedial Action Plan (RAP) for each Area of Concern (AOC) is the primary tool for documenting and communicating restoration progress. The AOC-specific Stage 2 RAPs are meant to be brief, user-friendly documents that identify actions needed to restore Beneficial Use Impairments (BUIs) in each AOC. The Stage 2 RAPs are prepared by the DEQ in consultation with the respective AOC Public Advisory Council (PAC) and the U.S. Environmental Protection Agency (USEPA), Great Lakes National Program Office.

Identifying specific actions necessary to remove a BUI is one component of the DEQ'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 DEQ's *Guidance for Delisting Michigan's Great Lakes Areas of Concern (Guidance)* (DEQ, 2008). Comprehensive background information on the AOC is provided in previous RAP documents, which are listed in the Reference section of this publication.

Disclaimer

The Great Lakes Water Quality Agreement (GLWQA) is a non-regulatory agreement between the U.S. and Canada, and criteria developed under its auspices are non-regulatory in nature. The actions identified in this document as needed to achieve BUI restoration criteria are not subject to enforcement or regulatory actions by virtue of being listed in this document.

The actions identified in this Stage 2 RAP do not constitute a list of pre-approved projects, nor is it a list of projects simply related to BUIs or generally to improve the environment. Actions identified in this document are directly related to removing a BUI and are needed to delist the AOC. However, in many AOCs, further information is needed to determine all actions required to remove a BUI. Thus, the AOC-specific BUI Tracking Matrix is not necessarily comprehensive and will be updated to reflect additional actions that are needed.

Introduction

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

The 1987 Remedial Action Plan for the Kalamazoo River Area of Concern was written by the Michigan Department of Natural Resources (DNR, 1987). It described problems known at the time and identified actions and studies needed to further define and remediate those problems. However, the RAP was written before the 1987 amendments to the GLWQA that outlined new guidelines for RAPs were published. The guidelines included identifying which of 14 potential beneficial use impairments existed in the AOC. Eleven years later, the 1998 RAP update, written by the Kalamazoo River Watershed Public Advisory Council (now known as the

Kalamazoo River Watershed Council, or KRWC) reflected those requirements and identified eight BUIs in the Area of Concern. These included: restrictions on fish and wildlife consumption, bird or animal deformities or reproduction problems, degradation of fish & wildlife populations, degradation of benthos, restrictions on dredging activities, beach closings, degradation of aesthetics, and loss of fish & wildlife habitat (Kalamazoo River PAC, 1998).

In February, 2006, the Kalamazoo River PAC, hereafter referred to by its assumed name of the Kalamazoo River Watershed Council (KRWC), adopted the delisting targets included in the *Guidance* to evaluate the status of their BUIs. Additionally, a Fish and Wildlife expert team was created to use the process outlined in the *Guidance* to develop local restoration criteria for the Loss of Fish and Wildlife Habitat and Degradation of Fish and Wildlife Populations BUIs. Table 1 is a summary of the status of BUI assessments and removals for the Kalamazoo River AOC.

Beneficial Use Impairment	Beneficial Use Remains Impaired	Assessment in 2011	BUI Removed
Restrictions on fish and wildlife consumption	x		
Bird or animal deformities or reproductive problems	x	x	
Degradation of benthos	x		
Restrictions on dredging activities	x	x	
Beach Closings			March 3, 2011
Degradation of aesthetics	x	x	
Degradation of fish and wildlife populations	x		
Loss of fish and wildlife habitat	x		

Kalamazoo River AOC Background

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. 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 (DNR, 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 (DEQ, 2006). Dam removal efforts are 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, 1994 PA 451 as amended (NREPA), and is included in the federal Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), commonly known as Superfund.

Superfund Site Description

The Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund site includes five disposal areas, five paper mill properties, an approximately 80-mile stretch of the Kalamazoo River from Morrow Dam to Lake Michigan, and a three-mile stretch of Portage Creek (see Figure 2). This also describes the boundaries of the AOC.

The site is divided into five cleanup projects known as operable units (OUs):

- OU #1, Allied Paper Property/Bryant Mill Pond Area;
- OU #2, Willow Boulevard and A-Site Landfill;
- OU #3, King Highway Landfill;
- OU #4, 12th Street Landfill; and
- OU #5, the Portage Creek and Kalamazoo River sediments.

The primary site contaminant is polychlorinated biphenyls (PCBs), a hazardous substance and probable human carcinogen. PCBs were introduced to Portage Creek and the Kalamazoo River through past discharges and disposal of PCB-contaminated paper residuals by the paper industry. The five disposal areas are situated on the river banks and contain millions of cubic yards of PCB-contaminated waste. It is estimated that the river sediments contain more than 120,000 pounds of PCBs. The contaminated sediments have largely been deposited in four impoundment areas.

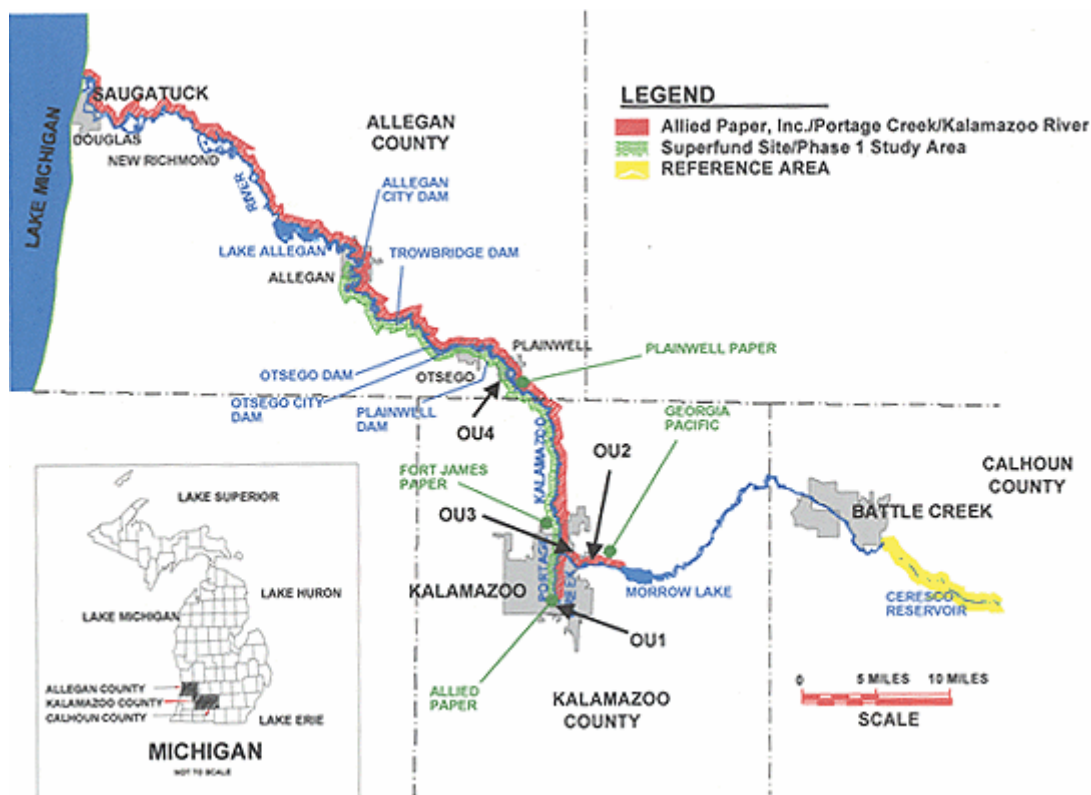


Figure 2. Kalamazoo River Superfund Site Operable Units

Overview of Contaminated Sediments in the Kalamazoo River AOC

Impairments listed in the 1987 RAP are identified as such due to the presence of PCBs (DNR, 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 KRWC 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 contaminated areas are also designated as polluted sites 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.

Progress toward removing or isolating PCB contaminants in the Kalamazoo River AOC is limited by the pace of the Superfund process. Prior to 2007, most remedial actions were focused on containing and isolating PCB sources located at former paper mills and landfill sites on or near the banks of the Kalamazoo River and its tributaries. Until 2007, Operable Unit (OU) 5, the river channel, underwent minimal isolation or removal of PCB contamination. However, in a time critical removal action, significant contamination was removed from Portage Creek at a site commonly referred to as the "Bryant Mill Pond". Between 2007 and 2009, Superfund efforts removed a significant amount of instream, streambank, and floodplain contaminated sediment and soil from the Plainwell Impoundment, part of a time critical removal action covering about 1.5 miles of river, and concurrently removed the Plainwell Dam. Recent work was also completed removing floodplain and some instream contaminated sediment from the Kalamazoo River and side channels upstream of the City of Plainwell near the "Plainwell #2 Dam", also referred to as the Plainwell diversion dam.

The assessment and removal of the BUIs affected by PCB contamination cannot occur until significant, additional remedial actions under the Superfund process take place in the Operable Units 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 occurs. Over time and under stable hydrologic conditions, these layers 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 making 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 dam removal, decreases in water levels, or dredging projects. Climate change is likely to further disrupt the hydrologic cycle in Michigan resulting in larger storms, further destabilizing the watershed runoff and river flow regime. Thus the long-term, dynamic behavior that is typical of river systems must be considered at the time decisions are made.

The EPA began removing PCB contamination in Portage Creek in late 2011 (a time critical removal action). Workers are dredging sediment from Portage Creek, digging up soil immediately adjacent to the creek, stabilizing the creek banks to prevent future contamination and erosion and disposing of contaminated materials at a chemical waste landfill. EPA expects to remove about 17,000 cubic yards of contaminated soil and sediment. The Portage Creek site begins at East Cork Street and follows the creek north about three miles to the Kalamazoo River. The site is bordered by residential, commercial and industrial properties, as well as undeveloped properties.

Specific details related to Superfund remedial activities are available at the following websites:

US EPA

<http://www.epa.gov/region5/sites/kalproject/index.htm>

Michigan DEQ

http://michigan.gov/deq/0,4561,7-135-3311_4109_4217-84646--,00.html

The following section is an edited excerpt from the EPA Superfund website,

<http://www.epa.gov/R5Super/npl/michigan/MID006007306.htm>

Cleanup Progress

EPA's cleanup approach for the Kalamazoo River is to first eliminate ongoing sources of PCBs, which includes the exposed paper wastes along the river banks and flood plain soils (or impoundments), and then to address in-stream sediments. The exposed paper wastes are located behind State-owned and privately-owned dams along the river. Before evaluating cleanup options for in-stream sediments, EPA will investigate upstream sources of PCBs and evaluate the existing landfill OUs and paper mill properties to ensure they are not a source of PCBs to the river. Generally, EPA's cleanup will begin upstream and work downstream on a reach-by-reach and dam-to-dam basis.

Interim Actions

To date, a number of actions have been implemented to reduce the release of PCBs from the disposal areas. In 1992, a fence was erected around the entire OU #1 Allied Paper property, including the Bryant Mill Pond area (approximately 70 acres on Portage Creek), to restrict access and thereby reduce the potential for exposure from direct contact with exposed sediments. Because of concern about the ongoing release of PCBs from the Bryant Mill Pond area to Portage Creek and the slow progress at the time of actions under the state-lead RI/FS, EPA entered into negotiations in 1997 with H.M. Holdings, Inc., to expedite an action to address the Bryant Mill Pond sediments. In November 1997, EPA and H.M. Holdings reached an agreement in principal for H.M. Holdings to fund, up to a certain monetary limit, an EPA-conducted removal and on-site containment action for the Bryant Mill Pond sediments. The Removal Action began in June 1998. Portage Creek was temporarily diverted from its normal streambed in order to conduct "dry" excavation of 150,000 cubic yards of the creek bed and floodplain soils. Excavation work was completed in May 1999. Excavated material was placed in the Historical Residual Dewatering Lagoon and the Bryant Former Residual Dewatering Lagoons. PCB concentrations remaining after the removal action were less than 1 part per million (ppm). The cost of the removal action was \$7.5 million.

The Alcott Street dam is the structure that impounds the Bryant Mill Pond. Funds are being sought through the Great Lakes Restoration Initiative and other sources to conduct a feasibility study to remove the dam, which no longer serves a useful function on Portage Creek.

Other interim Superfund actions that have been completed include:

- Sheet pile and temporary cap installation at the Willow Blvd/A-Site Landfill (OU #2) to prevent direct erosion into the river.
- Sheet pile installation at the Allied Paper Landfill (OU #1) along with a cap.

In June 2009, the Kalamazoo River Study Group (KRSG) completed a time-critical removal action to remove PCB-contaminated sediment from the Kalamazoo River's Plainwell Impoundment near Plainwell, MI. The KRSG conducted the time-critical removal action under a February 2007 AOC, with EPA oversight. Work began in March 2007. A total of 130,000 cubic yards of contaminated in-stream and bank sediment were removed by this action. Consistent with the federal Toxic Substances Control Act, sediments containing PCB concentrations greater than 50 ppm were disposed at Environmental Quality Co.'s Wayne Disposal Landfill in Belleville, Michigan. Sediments with concentrations less than 50 ppm, which are considered non-hazardous waste and represent 80 percent of the waste material, were disposed at Allied Waste's C and C Landfill near Marshall, MI, and its Ottawa Farms Landfill near Coopersville, MI. The estimated cost of this project was \$30 million. This project also rerouted the Kalamazoo River to its original channel and removed the dam near Plainwell. The Kalamazoo River is now free-flowing from Kalamazoo to the City of Otsego.

In June 2009, Georgia-Pacific LLC (GP) and EPA entered into a legal agreement committing GP to conduct a time-critical removal action in the Plainwell #2 Dam area. This second removal action project began in August 2009 approximately three miles upstream of the earlier Plainwell Dam cleanup, and included a two-mile stretch of the Kalamazoo River. The project was completed in December 2010. Approximately 11,000 linear feet of riverbank was cleared, excavated and restored, with approximately 18,000 cubic yards of soil and debris disposed off-site at the Allied Waste C&C Landfill in Marshall, MI, and at Ottawa County Farms Landfill in Coopersville, MI. This action removed 90 percent of the PCB-contaminated soil from the area at a cost of about \$10 million.

In July 2011, EPA signed an action memo to conduct a time-critical removal action along a 1.8-mile stretch of Portage Creek from Alcott Street to the confluence of the Kalamazoo River. EPA began implementing this PCB hot spot excavation project in September 2011 and the project is expected to take two to four field seasons to complete. This action will remove approximately 17,000 cubic yards of contaminated soil and sediment at a cost of about \$16 million.

OPERABLE UNIT 1: ALLIED LANDFILL

The Remedial Investigation Report developed for the Site by the DEQ was finalized and approved by EPA in March 2008. A groundwater investigation to determine the impacts, if any, from OU #1 was completed in the summer of 2009. The groundwater investigation confirmed the conclusions in the Remedial Investigation Report that groundwater from OU #1 is flowing toward Portage Creek. In October 2009, Millennium Holdings submitted the draft Feasibility Study Report for OU #1 which examined a range of cleanup alternatives. As a result of the April 23, 2010, Lyondell bankruptcy settlement, Millennium Holdings ceased work at OU #1 and approximately \$50 million was placed in a trust to pay for the remaining work at OU #1. EPA is completing the Feasibility Study and anticipates presenting to the public in early 2012 the proposed cleanup plan for the Allied Landfill.

OPERABLE UNIT 2: WILLOW BOULEVARD AND A-SITE LANDFILL

The Willow Blvd/A-Site Landfill OU #2 was under DEQ control through completion of the Remedial Investigation/Feasibility Study Report in 2006. EPA completed a Record of Decision for the closure of the landfill in 2006. In September 2009, the legal settlement between EPA and Georgia Pacific for design and implementation of the cleanup was approved by a federal District Court. Under the legal agreement, Georgia-Pacific will consolidate waste materials, construct a permanent landfill cap, and install a ground water monitoring system. The design work was completed in 2010 and construction activities began in April 2011. Consolidation and capping activities are expected to be completed in the spring of 2013.

OPERABLE UNIT 3: KING HIGHWAY LANDFILL

Cap construction at the King Highway Landfill (OU #3) was completed in the fall of 2001. During summer 2002 the cap was seeded for vegetative growth. In the fall of 2007, a gas collection trench was constructed at the landfill. The King Highway Landfill remains under DEQ control and the remedy is nearing completion.

OPERABLE UNIT 4: 12th STREET LANDFILL

In September 2001, EPA signed the Record of Decision for the 12th St. Landfill. The remedy includes excavation of PCB residuals that have migrated from the landfill and consolidation of those residuals back into the landfill, stabilization of the side slopes of the landfill, installation of a cap, and long-term monitoring of groundwater. Weyerhaeuser is designing and implementing the cleanup, with oversight by EPA and DEQ. Landfill consolidation and capping was completed in December 2010. Landfill cap maintenance activities were conducted in the summer of 2011 and long-term monitoring of groundwater will continue into the future.

To accommodate the channel diversion as part of the time-critical removal action near the Plainwell Dam (discussed above under "Interim Actions"), the slope of the 12th Street Landfill adjacent to the Kalamazoo River was reshaped, upgraded, stabilized and restored in 2007. As a result of this work, contamination adjacent to the river along the 12th Street Landfill has been removed.

OPERABLE UNIT 5: PORTAGE CREEK AND KALAMAZOO RIVER SEDIMENTS

On February 21, 2007, EPA reached two settlement agreements with Georgia-Pacific Corporation and Millennium Holdings LLC, two of the Potentially Responsible Parties (PRPs) collectively known as the Kalamazoo River Study Group (KRSG). The agreements were a result of 2 years of mediated negotiations between the PRPs and EPA, DEQ and the Natural Resource Trustees (including the Michigan Department of Natural Resources, DEQ, Michigan Department of Attorney General, National Oceanic and Atmospheric Administration, and the U.S. Fish and Wildlife Service).

Under one agreement, KRSG agreed to perform the time-critical removal action sediment excavation in the Kalamazoo River near Plainwell, MI (as described above under "Interim Actions"). Under the other agreement, KRSG agreed to conduct a supplemental Remedial Investigation/Feasibility Study on the 80-mile stretch of the Kalamazoo River from Morrow Dam to Lake Michigan and Portage Creek from Cork

Street to the confluence with the Kalamazoo River. Although large amounts of data have been obtained throughout the river, numerous areas were identified where further investigation is required. The Kalamazoo River was divided into seven areas. Currently, supplemental Remedial Investigation/Feasibility Study work is underway in Area 1 which includes a 21-mile stretch of the Kalamazoo River from Morrow Dam to the Plainwell Dam and 3 miles of Portage Creek. Sampling has been completed, and the supplemental Remedial Investigation Report for Area 1 was submitted to EPA in April 2011. The Feasibility Study Report, which details potential cleanup options for Area 1, is scheduled to be submitted to EPA in the spring of 2012. Planning for the supplemental Remedial Investigation/Feasibility Study in Area 2, which includes a 1.8-mile stretch of the Kalamazoo River from the former Plainwell dam to the Otsego City dam, was completed in August 2011. Area 2 soil and sediment samples are being collected in the fall of 2011 and the supplemental Remedial Investigation/Feasibility Study is scheduled to be submitted to EPA in November 2012. Planning for the supplemental Remedial Investigation/Feasibility Study in Area 3, which includes a 3.4-mile stretch of the Kalamazoo River from the Otsego City dam to the Otsego dam, will begin in November 2011, with sampling for the supplemental Remedial Investigation/Feasibility Study in Area 3 to begin in the summer of 2012.

MILL PROPERTIES

Several old paper mills exist along the Kalamazoo River. EPA is investigating these areas to determine whether the mill properties, although inactive, are a source of PCB contamination to the river.

Work at the Georgia-Pacific Kalamazoo Mill and former Hawthorne Mills (consisting of removal of buildings, removal of contaminated soil and site stabilization) was completed in July 2007. In December 2008, Georgia-Pacific submitted a report to EPA asserting its position that the two properties no longer contribute PCBs to the Kalamazoo River. In July 2009, EPA concurred with this report and no further work on these mill properties is anticipated at this time.

Preliminary work to remove PCB-contaminated sediment from the banks of the Plainwell Mill began in the fall of 2007 and was completed in March 2008. Approximately 5,000 cubic yards of material was removed. The first phase of the Remedial Investigation, a cursory groundwater investigation, was completed in December 2008. Currently, Weyerhaeuser is conducting Phase 2 of the site remedial investigation at the Plainwell Mill, and the draft remedial investigation report was submitted to EPA in August 2011.

MILLENNIUM BANKRUPTCY

On January 6, 2009, Lyondell Chemical Company and 79 affiliated debtors filed for bankruptcy under Chapter 11 reorganization. One of the debtors is Millennium Holdings, LLC, one of the PRPs at the Kalamazoo River site. On April 23, 2010, the US Bankruptcy Court approved Lyondell's reorganization plan. Millennium Holdings ceased all work at the site. Part of the settlement included a \$50 million trust being established for cleanup of OU #1 and a \$50 million cash settlement to be used for cleanup of the entire Site. Georgia-Pacific is addressing its obligations to complete the supplemental Remedial Investigation/Feasibility Study according to the 2007 AOC. All work on the project under the two AOCs signed with EPA in 2007 is proceeding according to schedule. EPA is currently working with Georgia-Pacific, DEQ, and other stakeholders to ensure that the cleanup of the Kalamazoo River site continues.

Status of Beneficial Use Impairments in the Area of Concern

1) *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 (DNR, 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. All of the restrictions are due to elevated levels of PCBs (MDCH, 2011). Details and additional consumption recommendations for the Kalamazoo River AOC can be found in the 2011-2012 Michigan Fish Advisory, A Family Guide to Eating Michigan Fish, available from the MDCH website at: http://www.michigan.gov/documents/FishAdvisory03_67354_7.pdf.

PCBs have been documented in river bottom sediments, in river banks and in the floodplain. As remedial activities are progressively undertaken, the cost and effectiveness of those activities varies widely, depending on the amount of sediment removed from the river bottom, and the amount of contamination that may be removed from the floodplain, versus contamination that may be left in place and capped with clean material.

Restoration Criteria

The state criteria as set forth in the Guidance are in effect for this BUI. The fish consumption advisory in the Kalamazoo River is more restrictive than that for Lake Michigan and will need to be assessed using either a comparison study or trend analysis after additional contaminated sediments have been removed and PCB levels in fish have dropped.

Current Status

This beneficial use is currently impaired. Assessment will occur after substantial completion of Superfund remedial actions. As noted above, removal of PCB-contaminated sediments is proceeding under the direction of the federal Superfund program, generally in a phased approach from upstream to downstream. As each section of the river is remediated, PCB concentrations in sediment will drop. Over time, it is expected that contaminant levels in fish will fall as well.

Realistically, it is likely to take 20 or more years to complete contaminated sediment removal throughout the entire Kalamazoo River AOC, depending on funding availability and a host of other variables. Reductions in fish tissue contaminants will lag behind the sediment removals, because PCBs will remain in the food web for some time after they are removed from the river banks, river bottom and floodplain. Therefore, it is expected that monitoring may need to continue for several years after the last contaminated sediments are removed.

Long-term monitoring required by the Superfund process may provide the data necessary to complete a formal assessment. Because the fish consumption advisories in the Kalamazoo River AOC result from PCB contamination, it is expected that Superfund remedial activities will address this BUI in its entirety.

A technical committee will be convened when the DEQ and the KRWC 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, including fish contaminant data, to decide whether to support a recommendation to formally remove this BUI.

2) 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 DEQ's Surface Water Assessment Section (SWAS) report aquatic habitat quality ranging from excellent to poor and impaired (Cooper, 2005).

Restoration Criteria

The KRWC 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 DEQ's SWAS procedures for wadeable or non-wadeable streams (DEQ, 2002). In addition, where the DEQ 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 and monitored according to the approved plan for the site.

Current Status

This beneficial use is currently impaired. As mentioned previously, complete removal of all contaminated sediments may not occur for many years while remediation efforts continue from Portage Creek downstream toward Lake Michigan. Upstream areas may be expected to recover before downstream areas, while remedial progress is achieved. The choices in remedial options are likely to impact the time it takes for this beneficial use to recover. For example, when dams are removed and extensive stream bank armoring is employed to keep the river within its banks, rather than undertaking a more comprehensive contaminant removal throughout the entire floodplain, some of the residual contamination may be reintroduced into the river system following extreme flooding events. Of course, greater volumes of contaminated sediment removal is preferable from an ecological standpoint, but the realities of far greater costs associated with more extensive removal and subsequent contaminant disposal will be a significant determining factor with regard to the chosen remedial measures. Primarily, these are decisions to be made by the Superfund program, with input from Potentially Responsible Parties and other stakeholders.

A number of dam removals are being tentatively planned for the Kalamazoo River. The Plainwell dam was removed in 2009. A feasibility study for the removal of the Otsego City dam was recently completed, while a similar study for the Otsego Township dam is expected to be complete by April 2012. The Trowbridge dam is expected to be removed in the not too distant future, as resources allow. Concurrent with dam removal will be sediment removal from the impoundment areas. Additional riffle areas and increased flow velocity can be expected as a result of dam removals, which will improve benthic habitat by increased oxygenation and providing a greater variety of hardened substrates.

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. However, it is likely that the DEQ will need to perform assessments of the benthic communities in a number of locations to adequately document the recovery of those communities, post remediation. The timeframe for those assessments will depend largely on

the timing of sediment removal, but will certainly occur over a number of years as progress continues in the Kalamazoo River, perhaps for the next 20 years or more.

A technical committee will be convened when the DEQ and the KRWC 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.

3) *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 (DNR, 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

This beneficial use will be considered restored when either there have been no restrictions on routine commercial or recreational navigation channel dredging by the US Army Corps of Engineers (USACE), 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. The federally maintained navigation channel is about two miles long, from Kalamazoo Lake to Lake Michigan.

Current Status

A statewide assessment of the Restrictions on Dredging Activities is currently underway by a technical committee comprised of DEQ, USEPA and USACE technical staff. Initial indications are that PCBs may not be present at detectable levels in the federally maintained navigation channel. However, high concentrations of metals in some sediments in the inner harbor may continue to impair this designated use.

At this point, it is not clear what the sources of those metals might be, and whether there are ongoing sources. Once the sources are identified, if there are any, they need to be abated. Then, the contaminated sediments in the navigation channel must be removed and the area will need to be sampled again, until contaminants reach acceptable concentrations. The DEQ and the USACE will be responsible for conducting these activities. The technical committee will review all sampling and monitoring results to provide a decision on whether to support a recommendation to formally remove this BUI. This process may be completed within the next five years.

4) *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 US 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 bacterial pollution from storm water runoff from livestock waste and septic systems were included as part of the impaired beneficial use. Combined Sewer Overflows (CSOs) are often a cause of bacteria pollution in rivers but these are absent in the Kalamazoo River watershed.

Restoration Criteria

The KRWC accepted the state's criteria for restoring this beneficial use. The *Guidance* criteria for this BUI were revised in 2008 to account for AOCs listed as having CSOs, or being impacted by an upstream CSO. Since the Kalamazoo River AOC does not have CSOs, the first tier of the criteria was used, which requires that no waterbodies within the AOC are included on the state's most recent 303(d) and 305(b) list of impaired waters due to contamination with pathogens.

Current Status

This beneficial use is no longer impaired. The Beach Closings BUI is not linked to PCB contamination, the rationale for AOC listing. Rather, the Beach Closings BUI is linked to significant *E. coli* contamination and inclusion in the state's list of impaired waters, neither of which is the case in the Kalamazoo River AOC. In 2010, the DEQ convened a technical committee to review the appropriate criteria, supporting documentation and the results of completed remedial actions. The committee found that there was no longer an impairment with regard to Beach Closings. A recommendation to remove the BUI was put on Public Notice for 30 days to gather public input and the BUI was officially removed on March 3, 2011, via an approval letter from the EPA Great Lakes National Program Office.

5) 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 KRWC 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 DEQ 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.

Current Status

This beneficial use is currently impaired. The DEQ, through a grant from the US Fish and Wildlife Service (USFWS), is currently performing a statewide assessment for those Areas of

Concern in Michigan with the bird or animal deformities or reproductive problems beneficial use impairment. This assessment will establish the current status of this BUI in each AOC and help the state pin down any gaps in existing data to determine future monitoring and restoration needs. Staff will focus on the assessment of existing data by: conducting a literature review; determining fish contaminant levels protective of wildlife in consultation with USFWS contaminants specialists; and reviewing DEQ's long term database from the Fish Contaminant Monitoring Program. The DEQ anticipates project completion during the spring of 2012.

In all likelihood, due to the extent of PCB contamination that remains throughout the majority of Kalamazoo River AOC, unacceptable levels of concentrations of PCBs continue to negatively impact wildlife in the area. Even after the majority of the PCBs are removed from the river system, it will take some years before the effects of that contamination decrease appreciably in wildlife populations, because PCBs are so well established throughout the complex food web systems. More monitoring and assessment will need to continue into the foreseeable future, after the last PCBs are removed from the system, the responsibility for which will be borne by the DEQ, USFWS and the Michigan DNR.

6) 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 KRWC, except for the occasional presence of excessive algae blooms in some of the impoundment areas, particularly Lake Allegan.

In July of 2010, an oil pipeline ruptured near Marshall, spilling more than 840,000 gallons of crude oil into Talmadge Creek, a tributary to the Kalamazoo River. The spill occurred more than 30 miles upstream of the AOC boundary, which begins at Morrow dam on the outskirts of the City of Kalamazoo. As this document is being prepared in January 2012, impacts from the oil spill have not been documented within the AOC.

Restoration Criteria

The state criteria are in effect for restoring this beneficial use. The target is presented below:

This BUI will be considered restored when monitoring data for two successive monitoring cycles indicates that the Kalamazoo River AOC does not exhibit persistent, high levels of the following "unnatural physical properties" (as defined by Rule 323.1050 of the Michigan WQS) 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

Current Status

In 2011, the Kalamazoo River AOC was assessed for aesthetic impairments as part of a statewide effort to assess all AOCs in Michigan with the Aesthetics BUI. No impacts to the AOC were found as a result of the 2010 oil spill, approximately 30 miles upstream of the AOC. After two rounds of monitoring in the summer and fall, no persistent conditions were found which may

impair any of the state's designated uses, therefore the aesthetics beneficial use was found not to be impaired. DEQ staff will share the results of the statewide assessment with a technical committee and other stakeholders, then prepare supporting documentation to formally remove this BUI.

7) Loss of Fish and Wildlife Habitat, and 8) 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

The Kalamazoo River Habitat Expert Team (Team), comprised of representatives from the DEQ, DNR, KRWC, USEPA, USFWS, and Natural Resource Damage Assessment Trustees, completed criteria for restoration of this BUI in June 2009. The DEQ approved the KRWC's *Restoration Plan for the "Loss of Fish and Wildlife Habitat" and "Degradation of Fish and Wildlife Populations" Beneficial Use Impairments* in October that year.

The approved restoration criteria for the Kalamazoo River AOC include:

1. Superfund cleanup processes are completed in the AOC at the Allied Paper Inc./Portage Creek/Kalamazoo River site. The timeframe for completion is not clear, but the Allied Paper and Portage Creek cleanups may be complete within ten years. The remainder of the Kalamazoo River cleanup may not be complete for 20 years or more.
2. Dams are removed at the following sites: Plainwell (completed in 2009), Otsego City, Otsego Township, and Trowbridge. Feasibility studies are nearly complete for the removal of the Otsego dams, but funding has not been identified for their removal. Optimistically, those projects could be complete within five years, with Trowbridge dam removal as soon as 2020.
3. High gradient river-channel habitat and its connection to the floodplain is restored at the following sites: Plainwell, Otsego City, Otsego Township, and Trowbridge. Timeframes for this criterion will coincide with number 2, above.
4. Expected fish community diversity is achieved as habitat becomes restored at the dam removal sites and their upriver areas of influence. The timing for the restoration of the fish community will lag behind habitat restoration listed in number 3, as the newly established natural system has time to recover.
5. "Bird or Animal Deformities or Reproductive Problems" and "Degradation of Benthos" BUIs have been removed. The removal date for these BUIs is not likely to occur for more than 20 years, after all PCB removal actions have been completed and the food web and wildlife populations begin to recover.

It is anticipated that removal of the above mentioned dams will restore high gradient river-channel habitat and restore fish community diversity at the dam removal sites and their upriver areas of influence. However, removal of these dams is linked to the Superfund removal process due to the PCB contamination that exists behind them. GLRI-funded feasibility studies have recently been completed to determine options for the potential removal of the Otsego City dam, and the Otsego Township dam feasibility study is expected to be complete in April 2012.

Additional habitat actions have been identified by the Team that go beyond what is minimally needed to remove this BUI. These actions include naturalized corridor recovery to replace areas that have been lost to permanent disposal facilities and improved public involvement strategies. Implementation of these projects can begin one section at a time, as Superfund activities are completed along the river corridor.

Removal of these BUIs will be based on the full implementation of remedial actions, including monitoring conducted according to site plans that shows consistent improvement in quantity or quality of habitat or populations addressed in the targets. Habitat values and populations need not be fully restored prior to delisting, as some may take many years to recover after actions are complete.

Current Status

These beneficial uses are currently impaired. Assessments 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 DEQ and the KRWC determine that these BUIs are ready for 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 these BUIs.

Actions to Delist: Kalamazoo River AOC BUI Tracking Matrix

The following BUI Tracking Matrix is intended as a simple way to track ongoing progress with the remedial activities identified as being necessary to remove each BUI, and subsequently to delist the AOC entirely. As progress is made, the matrix will be updated to reflect current conditions. Completed activities will remain in the matrix as it is updated, but updates will reflect completed status and completed BUI removals.

The matrix lists each BUI, indicates whether each BUI is scheduled for assessment in the current year, and lists the actions/tasks necessary to advance toward BUI removal. If a funding source has been identified, it is listed along with the targeted start and end dates for each action. Project leads are identified as appropriate, along with the targeted BUI removal date.

The matrix represents the AOC program's current best effort to assess activity in an AOC at the time the document was updated. The matrix does not necessarily commit the listed entities/individuals to any particular activity. Contracts, grant agreements, etc. are the documents governing commitments that have been or will be made.

The dates listed reflect the DEQ's best estimate of project completion given currently available information. Work does not always proceed as planned, and the DEQ recognizes that unforeseen circumstances can arise. The DEQ is dedicated to facilitating the completion of each of the projects listed in the timeliest manner possible.

Revised Date: January 24, 2012

Area of Concern Name	Beneficial Use Impairments													Actions / Tasks Needed	Category of Action	Project Location	Funding Source		Estimated Cost	Project Lead	Timeline		Comments
	Restrictions on Fish and Wildlife Consumption	Tainting of fish flavor	Degradation of fish and wildlife population	Fish tumors and other deformities	Bird or animal deformities or reproductive	Degradation of Benthos	Restrictions on dredging activities	Eutrophication or undesirable algae	Restriction on drinking water consumption, or taste and odor	Beach closings	Degradation of aesthetics	Added cost to agriculture and industry	Degradation of phytoplankton and zooplankton				Loss of fish and wildlife habitat	Funding Source 1			Funding Source 2	Start Date	
Kalamazoo River	✓													PCB removal required	Remedial action	All AOC	Superfund		EPA Superfund	-	-	Sediment remediation is underway in Portage Creek, and will proceed downstream in sections separated by dam structures.	
Kalamazoo River					✓									PCB removal required	Remedial action	All AOC	Superfund		EPA Superfund	-	-	Sediment remediation is underway in Portage Creek, and will proceed downstream in sections separated by dam structures.	
Kalamazoo River						✓								Assessment complete	Assessment / Documentation	Administrative	GLRI State Capacity		Swart, DEQ	Jun-11	Jan-12	Remains impaired, due to presence of metals in sediment. Comparison was conducted with non-AOC site South Haven Harbor.	
Kalamazoo River									✓					NONE					-	-	-	BUI formally removed March 3, 2011	
Kalamazoo River					✓									Technical Committee review and assessment of existing data		Administrative	GLRI State Capacity		Baker, DEQ	May-11	Mar-12	Assessment may or may not support removal. There may be a need for additional monitoring.	
Kalamazoo River										✓				Assessment complete	Monitoring	All AOC	GLRI State Capacity		Riley, DEQ	Jul-11	Oct-11	Two rounds of monitoring complete. Data support BUI removal.	
Kalamazoo River			✓											Five criteria must be met, see page 17 of Stage 2 RAP.	Remedial action	All AOC	GLRI		Various	-	-	Dam removal feasibility studies ongoing.	
Kalamazoo River			✓											Feasibility study for Alcott dam removal	Planning / Design	Portage Creek		\$115,000	DuCharme, DEQ RD			Funds applied for through USFWS, waiting for funding decision	
Kalamazoo River			✓											Remove Otsego City dam	Remedial action	Otsego		\$1.4 M					
Kalamazoo River			✓											Remove Otsego Twp dam	Remedial action	Otsego							
Kalamazoo River			✓											Remove Trowbridge dam	Remedial action	Trowbridge Twp							
Kalamazoo River			✓											Remove Alcott dam	Remedial action	Portage Creek							

Area of Concern Name	Beneficial Use Impairments													Actions / Tasks Needed	Category of Action	Project Location	Funding Source		Estimated Cost	Project Lead	Timeline		Comments
	Restrictions on Fish and Wildlife Consumption	Tainting of fish flavor	Degradation of fish and wildlife population	Fish tumors and other deformities	Bird or animal deformities or reproductive	Degradation of Benthos	Restrictions on dredging activities	Eutrophication or undesirable algae	Restriction on drinking water consumption, or taste and odor	Beach closings	Degradation of aesthetics	Added cost to agriculture and industry	Degradation of phytoplankton and zooplankton				Loss of fish and wildlife habitat	Funding Source 1				Start Date	
Kalamazoo River	✓													Remove Restrictions on Fish & Wildlife Consumption BUI	Removal	Administrative							
Kalamazoo River			✓											Remove Degradation of Fish & Wildlife Populations BUI	Removal	Administrative							
Kalamazoo River				✓										Remove Bird or Animal Deformities BUI	Removal	Administrative							
Kalamazoo River					✓									Remove Degradation of Benthos BUI	Removal	Administrative							
Kalamazoo River						✓								Remove Restrictions on Dredging Activities BUI	Removal	Administrative							
Kalamazoo River										✓				Remove Degradation of Aesthetics BUI	Removal	Administrative			Riley	Jan-12	Mar-12		
Kalamazoo River													✓	Remove Loss of Fish & Wildlife Habitat BUI	Removal	Administrative							
Kalamazoo River							✓							Sediment Removal	Remedial action	Inner Harbor Channel at Saugatuck							
Kalamazoo River			✓											✓ Feasibility study for Otsego City dam removal - complete	Planning / Design	Otsego	GLRI		Mills, DNR		Nov-11	Project complete	
Kalamazoo River			✓											✓ Feasibility study for Otsego Twp dam removal - underway	Planning / Design	Otsego	GLRI		Mills, DNR		Apr-12	Project underway	
Kalamazoo River			✓											✓ Feasibility study for Trowbridge dam removal	Planning / Design	Trowbridge Twp							
Kalamazoo River	✓													Assessment of fish contaminants	Monitoring	All AOC						To follow sediment remediation	
Kalamazoo River					✓									Assessment of Benthic community	Monitoring	All AOC						To follow sediment remediation	

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