UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

REPLY TO THE ATTENTION OF:

Jon W. Allan, Director
Office of the Great Lakes
Michigan Department of Environmental Quality
525 West Allegan Street
P.O. Box 30473
Lansing, Michigan 48909-7973

Dear Mr. Allan:

Thank you for your November 16, 2016, request to remove the "Degradation of Benthos" Beneficial Use Impairment (BUI) at the Lower Menominee River Area of Concern (AOC) located within the cities of Marinette, WI and Menominee, MI. As you know, we share your desire to restore all of the Great Lakes AOCs and to formally delist them.

Based upon a review of your submittal and the supporting data, the U.S. Environmental Protection Agency (EPA) hereby approves your request to remove this BUI from the Lower Menominee River AOC. EPA will notify the International Joint Commission (IJC) of this significant positive environmental change at this AOC.

We congratulate you and your staff as well as the many federal, state and local partners who have worked so hard and been instrumental in achieving this important environmental improvement. Removal of this BUI will benefit not only the people who live and work in the Lower Menominee River AOC, but all residents of Wisconsin, Michigan and the Great Lakes Basin as well.

We look forward to the continuation of this important and productive relationship with your agency and the local coordinating committee as we work together to delist this AOC in the years to come. If you have any further questions, please contact me at (312) 886-9296, or your staff can contact John Perrecone at (312) 353-1149.

Sincerely,

Tinka G. Hyde

Tinka G. Hyde, Director
Great Lakes National Program Office

cc: Kendra Axness, WDNR
Laurel Last, WDNR
Rick Hobrla, MDEQ
Stephanie Swart, MDEQ
Raj Bejankiwar, IJC
John Perrecone, EPA, GLNPO
Wendy Carney, EPA, GLNPO
Keith West, LMR Citizens Advisory Committee, WI
Mark Erickson, LMR Citizens Advisory Committee, MI

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

REPLY TO THE ATTENTION OF:

Stephen Galarneau, Director
Office of the Great Lakes and Sediment Management Unit
Wisconsin Department of Natural Resources
101 S. Webster Street
P.O. Box 7921
Madison, WI 53707-7921

Dear Mr. Galarneau:

Thank you for your November 18, 2016, request to remove the "Degradation of Benthos" Beneficial Use Impairment (BUI) at the Lower Menominee River Area of Concern (AOC) located within the cities of Marinette, WI and Menominee, MI. As you know, we share your desire to restore all of the Great Lakes AOCs and to formally delist them.

Based upon a review of your submittal and the supporting data, the U.S. Environmental Protection Agency (EPA) hereby approves your request to remove this BUI from the Lower Menominee River AOC. EPA will notify the International Joint Commission (IJC) of this significant positive environmental change at this AOC.

We congratulate you and your staff as well as the many federal, state and local partners who have worked so hard and been instrumental in achieving this important environmental improvement. Removal of this BUI will benefit not only the people who live and work in the Lower Menominee River AOC, but all residents of Wisconsin, Michigan and the Great Lakes Basin as well.

We look forward to the continuation of this important and productive relationship with your agency and the local coordinating committee as we work together to delist this AOC in the years to come. If you have any further questions, please contact me at (312) 886-9296, or your staff can contact John Perrecone at (312) 353-1149.

Sincerely,

Tinka G. Hyde

Tinka G. Hyde, Director
Great Lakes National Program Office

cc: Kendra Axness, WDNR

Laurel Last, WDNR
Rick Hobrla, MDEQ
Stephanie Swart, MDEQ
Raj Bejankiwar, IJC
John Perrecone, EPA, GLNPO
Wendy Carney, EPA, GLNPO
Keith West, LMR Citizens Advisory Committee, WI
Mark Erickson, LMR Citizens Advisory Committee, MI

STATE OF MICHIGAN
OFFICE OF THE GREAT LAKES
LANSING

RICK SNYDER
GOVERNOR

JON W. ALLAN
DIRECTOR

November 16, 2016

Ms. Tinka Hyde, Director
Great Lakes National Program Office
United States Environmental Protection Agency
Region 5
77 West Jackson Boulevard (G-17J)
Chicago, Illinois 60604-3507

Dear Ms. Hyde:

I am writing to request the United States Environmental Protection Agency (USEPA), Great Lakes National Program Office's (GLNPO) concurrence with the removal of the Degradation of Benthos Beneficial Use Impairment (BUI) from the Lower Menominee River Area of Concern (AOC). The Michigan Department of Environmental Quality (MDEQ), Office of the Great Lakes (OGL) and the Wisconsin Department of Natural Resources (WDNR) have assessed the status of this BUI in accordance with the state's *Lower Menominee River Restoration Targets*, and recommend that the BUI be removed from the list of impairments in the Lower Menominee River AOC.

Enclosed please find documentation to support this recommendation, including the BUI Removal Recommendation prepared by the MDEQ, OGL and the WDNR staff. The Lower Menominee River Citizens Advisory Committee passed a motion to support this recommendation on October 20, 2016. Please note that a public comment period was held from September 8 to September 22, 2016.

We value our continuing partnership in the AOC Program and look forward to continuing to work with the GLNPO in the removal of other BUIs and the delisting of AOCs. If you need further information concerning this request, please contact Ms. Sharon Baker at 517-284-5044, or you may contact me.

Sincerely,

Emily Finnell, Acting

Jon Allan, Director
Office of the Great Lakes
517-284-5035

Enclosure
cc/enc: Mr. Marc Tuchman, USEPA
Mr. John Perrecone, USEPA
Mr. Mike Bryant, USEPA
Mr. Stephen Galarneau, WDNR
Ms. Kendra Axness, WDNR
Ms. Laurel Last, WDNR
Mr. Rick Hobrla, MDEQ
Ms. Sharon Baker, MDEQ

Removal Recommendation for the Degradation of Benthos Beneficial Use Impairment In the Lower Menominee River Area of Concern

Submitted to
U.S. EPA-Region 5
Great Lakes National Program Office
77 West Jackson Boulevard
Chicago, Illinois 60604

By
Wisconsin Department of Natural Resources
And
Michigan Department of Environmental Quality

November 17, 2016

Acknowledgements

Prepared by:

Sharon Baker, Michigan's Lower Menominee River AOC Coordinator
Office of the Great Lakes
Michigan Department of Environmental Quality

Laurel Last, Wisconsin's Lower Menominee River AOC Coordinator
Office of the Great Lakes
Wisconsin Department of Natural Resources

Cheryl Bougie, Lake Michigan Sediment and Water Quality Monitoring Coordinator
Office of the Great Lakes
Wisconsin Department of Natural Resources

The Wisconsin Department of Natural Resources and the Michigan Department of Environmental Quality would like to acknowledge the many contributions and support by the members of the Lower Menominee River Area of Concern (AOC) Citizens Advisory Committee (CAC) and Technical Advisory Committee (TAC) in the development of this 2016 Lower Menominee River AOC Degradation of Benthos Beneficial Use Impairment (BUI) Removal Package. CAC and TAC collaboration with state and federal agencies has resulted in materials and activities that reflect local issues and concerns.

EXECUTIVE SUMMARY

In 1987, the lower three miles of the Menominee River, along with Green Island and the Green Bay shoreline three miles north and south of the river mouth, were designated a Great Lakes Area of Concern (AOC), primarily due to toxic chemical contamination. Polycyclic aromatic hydrocarbons (PAHs), heavy metals (specifically arsenic), and paint sludge associated with industrial activities were present in river and bay sediments at high levels within the AOC. Six impairments were assigned to the AOC, including the "Degradation of Benthos" BUI. This impairment indicates that organisms living in or on the river or lake bottom are being negatively affected by the toxic chemicals in the sediments. A great deal of remediation work has been done in recent years, and the Wisconsin Department of Natural Resources (WDNR) Office of the Great Lakes (OGL) and Michigan Department of Environmental Quality (MDEQ) OGL are proposing to remove the benthos impairment.

To address the impairment, polluted sediments were removed from the river and bay by dredging and disposing of them in approved locations. Cleanup efforts took place at the Green Bay paint sludge site from 1993 through 1998, the Ansul/Tyco arsenic site from 2012 through 2015 (river portion), the Wisconsin Public Service Corporation (WPSC) coal tar site from 2012 through 2015, and the Menekaunee Harbor site from 2014 through 2015. The projects are being monitored according to their approved plans and are meeting their remedial action goals to the extent practicable. In addition, sediment assessments in the Lower Scott Flowage and Rio Vista Slough show that no remediation is needed at those sites. Therefore, the sediment contamination that was degrading the benthos in the AOC has been addressed, and restoration targets for this impairment have been met.

While the bulk of the worst contamination has been removed, some low level contamination will persist for some time. Clean sand cover was applied to this lower level contamination to enhance natural deposition that is likely to occur in certain areas of the river. Monitoring will continue at these sites to assure that the projects are meeting their sediment-related remedial action objectives.

Now that the contamination has been removed from their habitat, benthic organisms should recover and move into areas that before were too toxic for them to survive. Over time there will be greater numbers and diversity of benthos in the formerly contaminated areas and the benthos will also accumulate less toxic chemicals. This reduction in toxicity will benefit other animals that eat them, such as fish and birds, and the local ecosystem as a whole.

This BUI removal is proposed by the WDNR OGL and MDEQ OGL and is supported by the Lower Menominee River AOC Technical Advisory Committee (TAC) and the Lower Menominee River AOC Citizens Advisory Committee (CAC). This document describes the contaminated sediment remediation actions and assessments and shows how the BUI targets are being met. The proposal also includes documentation of public involvement in the process.

Table of Contents

ISSUE

Removal of the Degradation of Benthos Beneficial Use Impairment (BUI) is proposed for the Lower Menominee River (LMR) Area of Concern (AOC). This document provides information supporting the recommendation and documents the actions completed to meet the locally established degraded benthos removal criteria found in the *Lower Menominee River AOC Beneficial Use Impairment Restoration Targets 12/22/2008* and hereafter referred to as "criteria." These criteria can be found in Appendix D.

This BUI removal is proposed by the Wisconsin Department of Natural Resources (WDNR) Office of the Great Lakes (OGL) and Michigan Department of Environmental Quality (MDEQ) OGL and supported by the Lower Menominee River AOC Technical Advisory Committee (TAC) and the Lower Menominee River AOC Citizens Advisory Committee (CAC).

BACKGROUND

Rationale for Nominating the Lower Menominee River as an AOC

The LMR became an AOC primarily due to arsenic-contaminated sediments found in the turning basin portion of the river (Appendix B Figure 3, Segment 5) by the U.S. Army Corps of Engineers (USACE) navigational dredging sampling between 1980 and 1989, as shown in Table IV.16 in the 1990 *Lower Menominee River Remedial Action Plan* (RAP), Stage I Report (WDNR and MDNR, 1990). The 1990 RAP identified potential contaminants, sources of contamination, and scope of contamination in the Menominee River and adjacent Green Bay shore. The 1990 RAP recognized two additional sites in the immediate area containing legacy sediment contamination requiring remedial action, including the Lloyd-Flanders paint sludge site along the Green Bay shoreline in Menominee, Michigan and the WPSC coal tar site in the Menominee River near Boom Landing in Marinette, Wisconsin (WDNR and MDNR, 1990).

Remaining BUIs

Five BUIs remain impaired in the Lower Menominee River AOC: Restrictions on Fish and Wildlife Consumption, Restrictions on Dredging Activities, Degradation of Benthos, Degradation of Fish and Wildlife Populations, and Loss of Fish and Wildlife Habitat. The Restrictions on Recreational Contact (Beach Closings) BUI was removed in 2011 (WDNR and MDEQ).

AOC Boundary

The AOC boundary includes the lower three miles of the river from the Park Mill Dam (Upper Scott Dam) to the river's mouth. The AOC boundary extends approximately three miles north of the river mouth to John Henes Park and approximately three miles south of the river mouth past Seagull Bar along the Bay of Green Bay. Seagull Bar is part of the AOC. Green Island in Green Bay is also considered part of the AOC

because of its strong habitat value and biological link to Seagull Bar State Natural Area. There are five permanent islands in the river within the AOC boundary. The AOC includes portions of Marinette County in Wisconsin and Menominee County in Michigan (WDNR and MDNR, 1990). Appendix B Figure 1 shows the AOC boundary and Appendix B Figure 2 shows the entire Menominee River watershed.

Rationale for Listing the Benthos BUI

The 1990 RAP attributes degradation of the benthos in otherwise suitable habitat to toxic conditions caused by contaminated sediment (WDNR and MDNR, 1990). A Wisconsin Board of Health Menominee River survey conducted in August 1957 found few bottom-dwelling organisms at a station just below the Ansul Chemical Company, and populations were composed of known pollution-tolerant varieties (Letter, Committee on Water Pollution, Theodore F. Wisniewski, Director, of the Division of Water Pollution Control). Studies conducted in the area over a period between 1974 and 1989 found degraded benthic communities in and around the turning basin (Appendix B Figure 3, Segment 5) and some studies determined there was an absence of benthic organisms. Elevated levels of arsenic, cadmium, and mercury were detected in subsequent benthic organism tissue analyses. Benthic impairments were due to a variety of causes, but heavy arsenic pollution was identified by the United States Environmental Protection Agency (USEPA) as the likely cause (WDNR and MDNR, 1990).

BUI REMOVAL CRITERIA

Criteria

From the *Lower Menominee River AOC Beneficial Use Impairment Restoration Targets 12/22/2008* (WDNR and MDEQ, 2008; Appendix D)*:*

> *This BUI will be considered restored when: All remediation actions for known contaminated sediment sources are completed and monitored according to the approved plan and have met their remedial action goal*.

Criteria Background

Wisconsin's and Michigan's OGLs agreed that once the court-negotiated allowable contaminant levels were reached, the Benthos BUI criteria would be met. These levels were set through the negotiations with the responsible parties and the state and federal programs with oversight of these projects, and were based on sediment toxicity to benthic-dwelling species. To clarify, the word "monitored" in the Benthos BUI criteria refers to the sediment sampling, or confirmation monitoring, that is required to confirm that final contaminant levels established for each cleanup site are met. This confirmation monitoring was not intended to establish whether benthic organisms had recolonized the area through passive or active processes.

The Benthos BUI removal criteria for this AOC are very similar to the second of two options in Michigan's statewide criteria (MDEQ, 2008). For AOCs where benthic degradation is caused by contaminated sediments, the BUI can be considered restored when remediation of those contaminated sediments is complete. The criteria assumed that benthic communities would re-establish in those areas where contaminated sediments were removed and target sediment contaminant levels for each remediation project were reached. These target levels were based on sediment toxicity to benthic-dwelling species; therefore, it is reasonable to assume that the completion of the projects would allow for benthic recovery in those areas. Numerous studies have shown that benthic organisms will recolonize riverine areas after disturbance from natural and anthropogenic events, and that recovery time is influenced by a variety of factors, including the following: characteristics of the disturbance and its impacts, such as type, duration, and scale; proximity to population sources (refugia); and characteristics of the colonizing organisms, such as life cycle and mobility (Wallace, 1990; Niemi et al., 1990; Yount and Niemi, 1990).

SEDIMENT CONTAMINATION SITES AND REMEDIAL ACTIVITIES

This section will discuss the known areas containing contaminated sediments within the AOC that contributed to one or more impairments to designated beneficial uses. This section will also discuss additional sediment sampling completed to assess the current status of suspected areas. Primary areas identified in the 1990 Stage I RAP include the following: Ansul Arsenic Site, including the turning basin and South Channel; WPSC Coal Tar Site; and Lloyd-Flanders Paint Sludge Site (WDNR and MDNR, 1990). A secondary area, identified by WDNR, was Menekaunee Harbor. Suspected areas investigated by state and federal agencies to determine if those areas were contributing to BUIs include Lower Scott Flowage, between the Menominee and Park Mill Dams, and Rio Vista Slough (RVS), in the city of Menominee.

Contaminated sediment management actions have been implemented at all known contamination sites to the extent practicable, as specified in the USEPA-negotiated Administrative Order on Consent (AOOC) for each site. See Appendix A, Table 1 for a concise picture of the current status of the contamination sites in the AOC. Table 1 provides a summary of the remediation goals for each site, along with the actions taken to achieve those goals, monitoring and maintenance requirements, and whether the remedial action goals have been met. A detailed narrative for each sediment remediation site is provided below.

(Ansul) Tyco Arsenic Site

Contamination Background

The arsenic contamination resulted from arsenic salts produced by the Ansul Fire Protection Company (now known as Tyco Fire Products LP) at their manufacturing site in Marinette adjacent to the turning basin in the river. Arsenic salts were produced as a byproduct of herbicide manufacturing between 1957 and 1977. The waste salts were stored on-site in uncovered piles and in a bunker area, and were discharged directly to

the river via storm water runoff and wind erosion or leached into surface and groundwater, which then flowed to the Menominee River along the turning basin. These discharges impaired water quality and contaminated river sediment (WDNR, 1996).

Tyco purchased Ansul in 2000, making them responsible for the arsenic contamination site. Tyco did not contribute to the contamination, which was already present on the site long before they purchased the facility.

Site Remediation/Source Control

Tyco International, owners of Ansul Incorporated, signed an AOOC with the USEPA to remediate the site (USEPA, 2009). The AOOC requires Tyco to implement the remedy selected in the USEPA's 2008 Statement of Basis and Final Decision Document for Ansul Inc. Tyco completed implementation of the USEPA-approved work plan to remediate arsenic contaminated sediment in 2013.

In addition, Tyco worked with the USEPA to implement a Great Lakes Restoration Initiative (GLRI) - Great Lakes Legacy Act (GLLA) Betterment Action at the contaminated sediment site in 2014 with completion in 2015 (EQM, 2015).

Many remedial activities were conducted before the AOOC was signed. See the USEPA web page *(The link provided was broken and has been removed)* for additional information.

Components of the selected remedy are summarized and listed below, including an informal status update (USEPA, 2008).

Terrestrial

- Construct and maintain an impermeable below-ground barrier wall to control the flow of groundwater to the maximum extent practicable (Appendix C, Map 1).
  - Status: Complete with ongoing maintenance and monitoring as needed.
- Cap surface soils on-site with arsenic concentrations equal to or above 32 ppm (Appendix C, Map 1).
  - Status: Complete with ongoing maintenance and monitoring as needed.
- Remove surface soils near the railroad tracks with arsenic concentrations equal to or above 16 ppm (Appendix C, Map 1).
  - Status: Complete.

Groundwater

- Contain contaminated groundwater on-site through the use of a barrier wall system. Utilize an on-site groundwater extraction system and phyto-pumping as a means to keep the site from flooding. Conduct a technical review of the latest science for treating groundwater containing large quantities of arsenic every five years.
  - Status: Complete with ongoing activities as prescribed. The first five year review was completed in December 2013 (CH2MHill, 2013a). As a result of the five year review, an updated barrier wall groundwater monitoring plan was prepared and approved by USEPA Resource Conservation and Recovery Act (RCRA) in September 2015. The updated plan is being implemented and includes the

installation of additional monitoring wells, dye testing after the completion of the outfall investigation, and a pump down program. Additional monitoring wells were installed in 2015. The pump down program to control hydraulic head within the former Salt Vault and the former 8th Street Slip began in June 2016.
  - The next five-year review will be completed in 2018.

Sediment

Sediment with Arsenic Levels Above 50 ppm

- Remove and properly dispose of all Menominee River soft sediment with arsenic concentrations equal to or greater than 50 ppm (Appendix C, Map 2).
  - Status: Completed in 2013. See additional details below.
- Remove and properly dispose of all Menominee River semi-consolidated silts and clays with arsenic concentrations equal to or greater than 50 ppm (Appendix C, Map 2) or, if removal is technically or economically impractical, provide an alternative to removal that protects human health and the environment, is legally implementable, and achieves arsenic concentrations of 20 ppm or less by November 1, 2023.
  - Status: Complete.
  - Removal began in July, 2012. Soft and semi-consolidated sediment containing total arsenic concentrations greater than or equal to 50 ppm were mechanically dredged using an environmental clamshell bucket and stabilized on-site (CH2MHILL, 2012). Dredging and treatment was completed December 7, 2013. A total of 232,133 cubic yards of contaminated sediment was removed from the river in 2013 (CH2MHill and Sevenson, 2014). Confirmation sampling determined that the remedial action goals for 2013 were reached (CH2MHill and Sevenson, 2014).

Sediment With Arsenic Levels Between 20 ppm and 50 ppm

- A GLLA Betterment Action Agreement between Tyco, the USEPA, and the WDNR was signed in May 2014. The agreement called for additional dredging of all soft and semi-consolidated sediment having arsenic concentrations greater than 20 ppm remaining after the 2013 completion of the RCRA component of the project. This agreement speeds recovery of the aquatic ecosystem and delisting of the Menominee River AOC by an estimated 10 years, because the required time for natural recovery/Monitored Natural Recovery (MNR) of the sediment surface from 50 ppm to 20 ppm arsenic will no longer be required due to the active removal of contaminated material.
  - Dredging for the Betterment Action began in late August 2014, with sediment processing, treatment, and disposal methods remaining the same as those used for the RCRA activities. Dredging was completed in mid-November 2014, with 42,000 additional cubic yards of arsenic contaminated sediment removed from the river (Appendix C, Map 3). When processed, the material resulted in 73,000 tons of non-hazardous waste, which was hauled to Michigan for conventional landfilling. Of this waste, 556 tons was scrap debris, including lumber wood waste and old construction concrete (EQM, 2015).
  - Post-dredge confirmation sampling and bathymetry were performed to ensure the project goal of 20 ppm or less of arsenic in remaining surface sediment was

met. Due to the vast amount of data collected, please refer to the *Sampling Summary Report Great Lakes Legacy Act Lower Menominee River Tyco Site Adjacent to the Tyco Fire Products LP Facility, Marinette, Wisconsin* (CH2MHill, 2015b). Refer to Appendix E of the *Remedial Action Completion Report, Great Lakes Legacy Act Lower Menominee River Tyco Site* (EQM, 2015) for bathymetric survey data.

- In those deep-water areas where dredging activities exposed glacial till, a covering of carbon-enhanced sand was layered on top of any till areas having >20 ppm arsenic. This cover is approximately 12 inches thick and is intended to physically and chemically attenuate any remaining arsenic that might migrate vertically through the till to the water column. The design cover required a minimum placement of 10 inches of sand and activated carbon. Because the majority of exposed till is found within the bounds of the federal navigation channel, the action must be approved through U.S. Code Title 33, sec. 408 permitting by the USACE. That permit was approved on March 2, 2015, with cover placement occurring during the summer construction season. Sand cover placement was completed on June 24, 2015 (Appendix C, Map 4; CH2MHill, 2015b). Pan tests, pre and post bathymetry, and diver-assisted core sampling were performed to verify sediment placement and thickness (EQM, 2015).

Site Monitoring/Maintenance

The Ansul/Tyco Site is following the Operations and Maintenance Plan *(Revised Barrier Wall Groundwater Monitoring Plan Update (BWGMP)* (CH2MHill, 2015a) agreed to with the WDNR and USEPA RCRA Program. The objective of the BWGMP is to provide the approach to long-term monitoring of the effectiveness of the barrier at containing on-site groundwater. The plan is required by the AOOC between Tyco and USEPA RCRA.

Tyco agreed to implement the following activities:

- Barrier wall inspections, installation of additional groundwater monitoring wells, groundwater elevation monitoring, and water quality monitoring to demonstrate barrier wall effectiveness.
- A pump-down program to lower water levels in the former Salt Vault and the former 8th Street Slip and ultimately maintain a constant groundwater elevation within these areas.
- Enhanced monitoring of the Main Plant Area by calculating the potential amount of groundwater migration from the upland area that would impact the ability of the Menominee River sediment to remain less than the remedial action objective (RAO) of 20 ppm total arsenic and conducting groundwater dye testing, upon completion of an outfall investigation, to determine if any portion of the barrier wall is leaking.
- Sample collection of post-dredging accumulated soft sediment in the main river channel outside the Main Plant Area, in the turning basin, and the Transition Area (CH2MHill, 2015a). The post-dredging sediment sampling will coincide with the five year review and will be completed in 2018.

Sediment-Related Remedial Action Goals

The sediment-related remedial action goals of this remediation project were to prevent arsenic-contaminated groundwater from migrating into the Menominee River and to achieve sediment contaminant levels in the river of less than or equal to 20 ppm of arsenic. The sediment-related remedial actions have been implemented to the extent practicable. Future planned monitoring activities will determine the long-term effectiveness of the remedial actions (see Site Remediation/Source Control Section above).

Green Bay Paint Sludge Site (Lloyd-Flanders, Menominee, Michigan)

Contamination Background

Since the early 1900s, a manufacturing plant in Menominee, Michigan has produced high end woven wicker furniture and metal seating. The furniture plant operations included the crafting, assembling, and finishing of seating components. Operations involved plating of metal parts or spray painting of metal and wicker components. Until the late 1980s, furniture production processes used water shields (curtains) to capture paint mists and overspray which generated large volumes of paint sludge. The painting and plating processes contained heavy metals, including high levels of lead, and other metals used as colorants. The overspray containing bulk paint wastes (paint sludge) collected at the bottom of the painting booths, and these paint wastes along with other manufacturing wastes were dumped behind the plant on shore, along the shore, or flushed out to Green Bay offshore of the property (WDNR and MDNR, 1990; WDNR, 1996). The majority of these wastes remained behind the plant or along the adjacent shoreline (Appendix C, Maps 5 and 6).

In 1982, Lloyd-Flanders Industries, Incorporated purchased the furniture manufacturing plant from the Heywood-Wakefield Company, making them responsible for the furniture production contamination source control at the Green Bay Paint Sludge Site. Lloyd-Flanders did not contribute to the contamination, which was already present on the site long before they purchased the facility.

The MDEQ and MDNR site inspections from the early 1980s through the early 1990s documented the presence of the paint sludge contamination in upland areas behind the manufacturing plant, in waters, and in sediment along approximately one half mile of the Menominee, Michigan portion of Green Bay, including shoreline properties adjacent to and including the area behind the Lloyd-Flanders Plant.

Site delineation by consultants for the company or MDNR found that immediately behind the plant these bulk paint wastes formed continuous multicolored layers. In some places, the waste was three feet thick on the sediment of the bay, covering approximately 0.5 acres (GZA-Donahue, 1989; Appendix C, Map 5). Bits of these layers eroded into fragments due to wave and ice actions, and these fragments—through natural water movements, including waves, ice flows, and off-shore currents—spread throughout an approximate half mile radius of the plant. These colorful, putty-like fragments of paint sludge are hydrophobic (fail to dissolve/mix in water), and will sometimes form balls (a.k.a. paint balls). Fragments can be found imbedded in the

beaches or sediment and occasionally can be found floating just below the surface of the water.

Site Remediation/Source Control

In a 1992 Administrative Order, Lloyd-Flanders was required by the State of Michigan to investigate and remediate the paint sludge contamination and other manufacturing wastes connected to plant operations and processes. The Administrative Order made necessary the development of a RAP for the Green Bay Paint Sludge (GBPS) site, Menominee Michigan. The RAP and the Administrative Order describe the remediation requirements for the site and also provide paint sludge contamination background, history, and required source control actions.

Shoreline Collections

The Lloyd-Flanders shore patrol began collection, removal, storage, and disposal of paint balls (nodules) and fragments in 1992. This collection continues as part of their ongoing responsibilities related to the bulk paint contamination. The purpose of collection is to minimize exposure to wastes washing up to shore. The company is required to collect and remove paint sludge pieces/paint balls after ice-out in the spring and after storm events because water or ice actions can loosen the wastes imbedded in the bottom of Green Bay or along the Bay's shoreline and bring them back to the surface and deposit them along the shore. Under the Administrative Order, these paint wastes were to be stored and disposed of appropriately.

At the end of 1995 the company had reported removal of 7,500 gallons of hardened paint sludge waste nodules/fragments. In personal communications to TAC and CAC by Mark Erickson, Lloyd-Flanders Plant Engineer/Manager and CAC Co-Chair, paintballs/nodules and fragment collections have decreased in volume since collections began. The shoreline collection data provided in 2010 to the former Michigan Department of Natural Resources and Environment (now MDEQ)-Upper Peninsula District Office showed a reduction of 40% of material collected from 2006 to 2010. An additional 41% reduction was documented between 2010 and 2015. Collection activities in 2015 resulted in a total measured volume of 33 gallons (Mark Erickson, personal communication).

Shoreline/Terrestrial Source Control

A berm/rock dike was constructed in 1993 to enclose the submerged paint wastes to prevent further migration of the manufacturing wastes into Green Bay from the main disposal area. The core of this berm structure contains a series of membrane liners designed to hydraulically isolate the wastes from the bay. The original GBPS RAP required dewatering within the berm to facilitate waste removal and disposal, but testing indicated that dewatering was not feasible due to the conductivity of the sediment underlying the berm. Waste removal plans were modified to allow removal by mechanical and hydraulic suction dredging.

Contaminant removal work was conducted during the summer and fall of 1995, and October 1998. Approximately 5,300 tons of bulk paint wastes were sent to a hazardous

waste treatment and disposal facility and 10,500 tons of excavated contaminated sediment and soils were sent to the local landfill. Berm dismantling and shoreline restoration was completed in October and November 1998. Shoreline restoration included the installation of a 12-ounce non-woven polypropylene fabric liner, anchored and covered by rock rip-rap, on a portion of the shoreline bordering the plant site. This shoreline barrier was intended to prevent further erosion of waste remnants and contaminated soil.

Additional actions were taken as described in the *Outstanding Issues Regarding the RAP, GBPS Site Menominee, Michigan* report to address issues described in the RAP Supplement response letter. Exposure barriers comprised of gravel and crushed limestone were placed on upland soil areas from October 30 to November 3, 2000 to prevent surface soil lead exposures on portions of the Lloyd Flanders plant site. To address elevated lead levels detected along the southern end of the shoreline bordering the plant site after shoreline restoration was completed, an additional 180 feet of liner and rock rip-rap barrier was installed November 6-9, 2000.

Site Monitoring/Maintenance

There were no reporting requirements negotiated under the Administrative Order RAP for any parameters—such as the amount of paint wastes collected per year, water quality, groundwater quality, sediment contaminants, viability of the liner placed over the waste area after bulk paint wastes were removed, or stability of the rock berm—to insure site remediation was working as designed.

The GBPS site exposure barriers are regularly inspected and maintained, as needed, and shoreline paint wastes are being collected for proper disposal, as required in the Operations and Maintenance Plan agreed to with the State of Michigan. A letter of credit is being maintained to ensure availability of funding for these activities for a period of 30 years. In the last 15 years the upland barrier and shoreline rip-rap have required no repairs.

Remedial Action Goals

The goals of this remediation project were to remove paint waste and impacted sediment and soil from the site and collect and remove paint nodules that wash up along the shoreline. These goals were achieved through the removal of bulk paint waste, sediment, and soil and ongoing shoreline paint nodule collection (see Site Remediation/Source Control Section above).

Wisconsin Public Service Corporation Marinette Coal Tar and PAHs Site

Contamination Background

The Wisconsin Public Service Corporation (WPSC) site is located in Marinette, Wisconsin. The four-acre former manufactured gas plant (MGP) is about 750 feet south of the Menominee River and about 1.5 miles upstream from the river mouth at Green Bay. The WPSC MGP was formerly located on the property currently known as the Marinette Wastewater Treatment Plant (WWTP). Boom Landing Park is between the river and the site. It is currently used as a boat launch facility operated by the city.

Former WPSC MGP operations have caused impacts to soil, groundwater, and sediment. Residual coal tars generated by the former MGP operations washed into the Menominee River via a former slough, contaminating sediment along the Wisconsin shoreline of the Menominee River near Boom Landing.

The WPSC Marinette MGP operated from 1910 to 1960 using two coal gasification methods: retort and carbureted. The retort gasification process operated from 1910 to 1928. Retort gasification involved heating and volatilizing coal in an airtight chamber (retort) at temperatures reaching 2,200°F so the coal decomposed into gas and tar and generated impurities including sulfur, carbon dioxide, cyanide, and ammonia. During the carbureted coal gasification method, used from 1910 until operations ceased in 1960, air and steam were passed over incandescent coal in a brick-filled vessel to form a combustible gas, which was then enriched by injecting a fine oil mist over the bricks, purified, and stored in holders prior to distribution. Coal tars are a byproduct from coal gasification (manufactured gas) and form NAPL (non-aqueous phase liquid) and DNAPL (dense non-aqueous phase liquid). Coal tars contain polycyclic aromatic hydrocarbons (PAHs) and other site-specific processing contaminants including sulfur, heavy metals, and metalloids such as mercury and arsenic. PAHs can cause risks to human and environmental health.

Coal tar-affected soil and groundwater were identified on the property and reported to the WDNR during the 1989 WWTP expansion on the former MGP site. The city of Marinette excavated, removed a large amount of the impacted MGP residuals in the soil, and backfilled the excavations with clean material. The groundwater contaminant plume appears to be limited (based on ongoing ground water monitoring) to the WWTP property, Boom Landing, and portions of Mann Street. The groundwater plume does not appear to extend to the Menominee River and is not impacting surface water.

PAHs pose a risk to human health when there is a pathway to exposure to the chemicals contained in the soil, sediment, and groundwater. Exposure to these chemicals can possibly cause adverse health effects, depending on the degree of exposure. Chronic exposure to coal tars, by dermal contact or inhalation, produces lesions to skin and mucous membranes. Some PAH structures are carcinogenic with chronic exposure (U.S. Department of Health and Human Services, 2005). A State of Wisconsin Committee on Water Pollution in 1960, in *An Investigational Report on Floating Tars on the Menominee River in Marinette, Wisconsin* showed that there were tar droplets in the water of a former slough and two discharge pipes draining from the coal gasification plant area into the river. The tar and tar droplets were found in the former slough area and Menominee River sediment adhered to anchored boats and equipment located downstream of the gasification plant area and were found floating as far as 500 feet downstream.

Sediment-Related Site Remediation/Source Control

The USEPA's Docket Number V-W-13 • C-001 *Administrative Settlement Agreement and Order On Consent For Removal Action* negotiations between USEPA-Superfund

Alternative Approach and WPSC resulted in a decision to remove the coal tar contaminated sediment (USEPA, 2012).

A total of 15,221 cubic yards (CY) of PAH-impacted sediment was removed from the Menominee River from November 2012 through March 2013 as part of the Non-Time Critical Removal Action (NTCRA). As discussed in the Final Report - Focused NAPL and Sediment Removal Action Final Report - Revision 1, dated October 3, 2013, Natural Resource Technology (NRT, 2013a), due to an uneven bedrock surface the mechanical dredge equipment was unable to completely remove dredge residuals on the bedrock surface. Soft sediment was removed to the extent practicable (less than 6 inches) and NAPL was not observed.

As a result, per the approved Construction Quality Assurance Project Plan a minimum of six inches of a residual sand cover was required. As discussed in Section 2.9.4 of the Final Report, a minimum thickness of ten inches of sand was placed over approximately 12,250 square feet in areas of the river where post-dredge confirmation samples indicated residual total (13) PAH concentrations exceeded the RAO, for the NTCRA, of 22.8 milligrams per kilogram (mg/kg) (Appendix C, Map 7; NRT, 2015).

A reactive core mat (RCM) was installed around the outfall structure and former slough to the river (Appendix C, Map 7) over an area of 19,500 square-feet (including mainly side slopes or bank areas) as a conservative contingency measure to prevent any potential small “stringers” of NAPL that may be sorbed to the upland soil and debris from migrating into the river.

The “(13)” above stands for the 13 priority PAHs that were sampled versus the entire list of PAHs. Following is the list of PAHs sampled:

Acenapthene	Benzo(b)fluoranthene	Naphthalene
Acenaphthylene	Benzo(k)fluoranthene	Phenanthrene
Anthracene	Chrysene	Pyrene
Benzo(a)anthracene	Fluoranthene	
Benzo(a)pyrene	Fluorene	

Sediment-Related Site Monitoring/Maintenance

The WPSC MGP site is following the Residual Sand Cover Monitoring Plan agreed to with WDNR and USEPA Superfund Alternative Program (NRT, 2013b). The residual sand cover was monitored using a combination of bathymetric surveys and residual sand cover core sample results. Two sediment sampling events were completed on May 21, 2014, and October 27, 2014. All of the surface sand cover sample results were below 22.8 mg/kg total PAH (13) and are all below 1 mg/kg total PAH (13). Sand thickness was also measured during the sampling events. During each sampling event, a push core was advanced to refusal. Sand cover thickness was greater than ten inches in all events with the exception of site A1B35 which was 9.6 inches. Overall, sand cover thickness measurements ranged from 9.6 to18 inches (NRT, 2015).

In addition, bathymetric surveys were performed in 2013 post dredge prior to sand cover placement and again in 2015 post sand cover. Ninety-seven percent of the area

contains a sand cover thickness of ten inches or greater, indicating natural deposition on the sand cover (Appendix C, Map 8; NRT, 2015).

As a result of the sediment quality data and bathymetry results, sampling is completed until the five-year review in 2018, consistent with the decision tree presented in the USEPA-approved 2013 Residual Sand Cover Monitoring Plan (NRT, 2013b).

Discussions are ongoing between WPSC, USEPA Superfund Alternative Program, and WDNR with regard to future long-term monitoring of the sand cover and the RCM. In addition, the upland and river areas of the WPSC MGP site are being evaluated for the purpose of developing a Record of Decision (ROD). The ROD is not scheduled for completion until June 2017 and could likely impose continuing obligations associated with the soil, ground water, RCM, and other engineered controls, if necessary. This, however, does not change the BUI removal status as the remedial goals for sediment removal action have been met to the extent practicable.

Sediment-Related Remedial Action Goals

The goal of this sediment-related remediation project was to achieve surface sediment contaminant levels of less than or equal to 22.8 mg/kg (ppm) of 13 priority PAHs. These goals were achieved to the extent practicable through sediment removal, sand cover placement, and an RCM (see Sediment-Related Site Remediation/Source Control Section above).

Menekaunee Harbor Heavy Metals and PAHs Site

Contamination Background

Menekaunee Harbor is a 13-acre natural embayment of the Menominee River. The city of Marinette owns the property around Menekaunee Harbor with the exception of a small parcel off the south break wall. Sediment quality in the harbor was degraded and sediment deposition in the harbor had a negative impact on the health and functionality of the aquatic ecosystem. Contamination was not as high as other segments of the AOC, but elevated concentrations of metals, PAHs, and nutrients had been reported (Weston Solutions, 2008). Since the harbor is located at the most downstream area of the watershed, it received contaminants from many historical industrial operations and, therefore, responsible parties could not be identified. Much of the harbor's shoreline protection consisted of dilapidated vertical wooden seawalls, which were constructed in the early 1930s.

Site Remediation/Source Control

For many years, the city of Marinette planned to restore the harbor for recreation; however, due to the expense of handling contaminated sediment, the city was unable move forward with the project. In 2010, the WDNR began partnering with the city and USEPA to move the harbor restoration project forward in an effort to meet the goals and objectives to remove beneficial use impairments with the ultimate goal of delisting the AOC. After several years of planning and engineering, and with financial support through WDNR and the GLRI, the project moved into the implementation phase in 2014.

Dredging commenced August 21, 2014, with the goal of removing contaminants at or above Threshold Effect Concentrations (TECs) identified in the Consensus Based Sediment Quality Guidelines (CBSQG) (WDNR, 2003) for heavy metals: total arsenic, copper, lead, mercury, and zinc (Ayres, 2014a and 2014b). A total of 57,809 CY of material was removed from the harbor. Environmental material (27,129 CY) was placed at the Waste Management Landfill in Menominee, Michigan, and navigational dredge material (30,680 CY) was placed at the city-owned Lot 24. Lot 24 is located in the Sand Hill Industrial Park, west end of Murray Street, city of Marinette. Additional clean dredge material (termed beneficial-use fill) removed from the west side of the harbor was used to bring the southeast quadrant of the harbor to the desired restoration depths. Seventy-seven thousand CY of this clean material from within the harbor was hydraulically pumped to the restoration area. The beneficial use material was far less than the 22,500 CY planned, as the contractor encountered large amounts of woody debris co-mingled in the sediment within the harbor, requiring disposal at the landfill or Lot 24.

Confirmation sampling indicated exceedances of heavy metals in the area near Harbor Town Marine Dock. To account for the material shortfall, clean, sand fill was placed to address low level metal contaminants and bring the habitat area to design elevation. Pan Testing and bathymetric surveys were conducted to ensure the six-inch sand cover thickness was achieved over the 12,500 square foot area (REL, 2016). Refer to Appendix C, Map 9 for the sand cover area. Dredging was complete in November 2014, and sand cover was finished in June 2015.

Site Monitoring/Maintenance

Additional monitoring and maintenance of this site are not required.

Remedial Action Goals

The goals of this remediation project were to improve navigation in the harbor and achieve sediment contaminant levels of heavy metals and PAHs below TEC values of the CBSQGs. These goals were achieved through sediment removal and placement of sand cover over a limited area in the southeast section near the Harbortown Marine Dock (see Site Remediation/Source Control Section above).

SEDIMENT ASSESSMENTS

Lower Scott Flowage Sediment Investigation

The Lower Scott Flowage (LSF) is located between the Park Mill and Menominee Dams. Little historical information was available for the flowage. The 1996 Lower Menominee River AOC RAP update (WDNR, 1996) indicated that the Scott Paper Company (located on the flowage between the dams) historically discharged its plant effluent, coal ash, and other debris into the Flowage. Currently, there is a fish consumption advisory for PCBs and mercury, specifically for the LSF, indicating a potential issue with sediment quality within the impoundment. In March 2012, the WDNR contacted USEPA and requested a sediment characterization to determine if there are any impairments due to sediment quality in the LSF. As a result, a sediment

investigation was conducted in November 2013 for GLNPO under Task Order No. 0014, Contract No. EP-RS-11-09. (CH2MHill, 2013b).

The investigation included the following:

- Visual survey of shoreline to document outfalls and other shoreline features of interest.
- Collection of water depth and sediment thickness measurements.
- Collection of sediment samples for analysis of polychlorinated biphenyl (PCB) Aroclors and congeners, PAHs, pesticides, dioxins, oil and grease, total metals, and acid volatile sulfide/simultaneously, extracted metals to provide information regarding the nature and extent of contaminant concentrations within site sediments.
- Collection of sediment samples for analysis of total organic carbon, particle size, specific gravity, and percent moisture to characterize the physical properties of the sediment.

Sediment thickness and water depth vary throughout the LSF. Water depth is shallow in the western portion of the flowage and the riverbed consists primarily of rock with thin sediment deposits less than one foot in isolated areas. Very little sediment was identified within the main river channel. The only sediment deposits identified along the south side of the river were located near the culverts located east of the hydroelectric plant property and near the downstream Menominee Dam. Sediment thicknesses up to four feet were identified in the northeastern portion of the flowage.

Analytical results were screened against Wisconsin TECs and Probable Effect Concentrations (PECs) (WDNR, 2003) and USEPA Region 5 (2003) RCRA Ecological Screening Levels, which include screening values from MacDonald, et al. (2000a and 2000b).

PAHs, metals, PCBs, and dioxin compounds were detected at concentrations exceeding TEC concentrations at 11 of the 36 sample locations within the LSF. TEC exceedances of PAHs, PCBs, and dioxins were also detected at two of the three sample locations upstream of the Park Mill Dam. TEC exceedances are located in isolated pockets throughout the flowage and are not indicative of a large contaminated sediment mass. No distinguishable trends in TEC exceedances were observed with depth.

PEC exceedances were present at only two of the 36 sample locations within the flowage. There were no PEC exceedances upstream of the Park Mill Dam. PAHs and copper were the only compounds detected at concentrations exceeding PECs within the flowage. The two samples with PEC exceedances are located in close proximity to one another within an isolated sediment pocket immediately downstream of the culverts discharging from the vicinity of the former Scott Paper Mill (now called Kimberly Clark). The estimated volume of sediment exceeding PECs is approximately 200 CY and covers a limited area (CH2MHill, 2014). The WDNR Storm Water Permit Program staff have followed up with the owners and operators of the storm sewer system and requested that they (Kimberly Clark and the city of Marinette) evaluate their outfalls at

the next required monitoring period to determine if they are an ongoing source of contaminants to the LSF. No further recommendations were made for remediation of this minor deposit or the flowage overall. Therefore, the results of the sediment characterization show that the sediment in the LSF is not a source of PCBs, heavy metals, or PAHs in the AOC (Appendix C Map 10, Map 11, and Map 12; CH2MHill, 2014).

Rio Vista Slough Sediment Investigation

The MDEQ-Surface Water Assessment Section (SWAS) staff used a petite Ponar dredge to capture sediment samples at eight locations in RVS in 2014 (Appendix C, Map 13; Appendix A, Table 2; MDEQ, 2015). The primary purpose of the study was to help answer the question: Is RVS acting as a partial source for PCBs found in fish tissues driving the fish consumption advisory in the AOC? PCBs were not found in any of these samples (Appendix A, Table 3). As part of this analysis the samples were also analyzed for heavy metals and PAHs. PAHs were detected at above PECs at three locations adjacent to storm drains that flowed into the slough (Appendix A, Table 4). Sheen was observed at all locations during sample collections. Heavy metals were detectable at all locations, but varied greatly by location and were not above probable effects concentrations (Appendix A, Table 5). The locations nearest the storm drain had the highest concentrations of metals.

The MDEQ SWAS staff indicated that the PAHs and metals levels found in RVS were similar to other areas across the state associated with asphalt or tar topped parking lot areas, were not high enough to drive a removal action, and would be reviewed by appropriate state programs. The small size of RVS and its isolation from the main channel mean that the potential for sedimentation downstream is minimal and not likely to impact benthos. Therefore, the results of the sediment characterization show that the sediment in RVS is not a significant source of PCBs, heavy metals, or PAHs in the AOC.

BENTHOS-RELATED STUDIES

The Benthos BUI removal criteria for this AOC were chosen assuming that benthic communities would re-establish in those areas where contaminated sediments were removed and target sediment contaminant levels for each remediation project were reached. These target levels were based on sediment toxicity to benthic-dwelling species; therefore, it is reasonable to assume that the completion of the projects would allow for benthic recovery in those areas.

Although the delisting target/criteria for the Lower Menominee River AOC does not require confirmation of benthos community recovery, we are including information on benthos-related studies in order to be thorough and better understand the story of benthos in this AOC.

The Degradation of Benthos BUI was listed for this AOC because several studies had documented low benthic diversity and abundance, particularly near the Ansul Fire

Protection Company in the Eighth Street slip area and the turning basin (Appendix B, Figure 3, Segment 5). Elevated levels of arsenic, cadmium, and mercury were detected in subsequent analyses of benthic organism tissues from those areas. Although unsuitable habitat was also an issue at some sites in the AOC—especially those with excessive saw mill wastes from the lumber industry boom of the late 1800s and early 1900s—sediment toxicity was determined to be the primary cause of impairment in the area of the Ansul plant. It was also suspected that the paint sludge wastes offshore of the Lloyd Flanders site were impacting benthic populations, but no monitoring had been done to confirm that suspicion. More details on these historic studies can be found in the 1990 RAP (WDNR and MDNR, 1990).

WDNR Benthos Monitoring

In the spring of 1993, the WDNR collected four or five three inch core samples at each of four sites and five artificial substrate samples at each of three sites in the AOC. There were five sites sampled—both core and artificial substrate samples were collected at two of the sites. They also collected similar core and substrate samples at two more sites in the river upstream of the AOC. One of the five AOC sites was downstream of Highway 41 near the WPSC coal tar contamination area, three were near the Ansul plant in areas known to be contaminated with arsenic, and one was in the main channel 1000' above Ogden Street Bridge. The artificial substrate samplers consisted of a number of concrete balls about the size of a baseball placed in a wire basket that was chained to a cement block and placed directly on the bottom of the river.

For the 1993 WDNR study, the modified Hilsenhoff Biotic Index (HBI-10; Hilsenhoff, 1998) ratings for the samples collected in the AOC ranged from "Very good" for one of the Eighth Street slip core samples to "Very poor" for two core samples from near the Ansul outfall. The HBI-10 ratings for samples collected at the station near the WPSC site ranged from "Fair" to "Poor."

Although the 1996 RAP Update (WDNR, 1996) described a plan to continue benthic macroinvertebrate monitoring in the AOC in order to assess long-term trends, this was not done, likely due to lack of funding and/or personnel. Hester-Dendy (H-D) artificial substrate samples were collected in 2005 and 2012 at another site downstream of Highway 41 but a bit further out from the WPSC site, and the HBI-10 values for those samples were in the "fairly poor" range.

USGS Wisconsin Lake Michigan AOC Benthos and Plankton Study

More recently, the AOC was included in a GLRI-funded study, initiated by the WDNR and carried out by the United States Geological Survey (USGS), to characterize benthic invertebrate and planktonic communities in Wisconsin's four Lake Michigan AOCs and six reference sites. The Lower Menominee River AOC site was included to increase the statistical power of the study. Ponar dredge and H-D artificial substrate samples were collected three times each year in 2012 and 2014 in the main river channel downstream

of the turning basin (Appendix B, Figure 4; Scudder Eikenberry et al., 2014; Scudder Eikenberry, Burns, et al., 2016).

Dredging of the arsenic-contaminated sediment in the turning basin and South Channel occurred from July to December in 2012 and May to December in 2013 for the RCRA project, and from September to November in 2014 for the GLLA Betterment project, followed by placement of an enhanced sand cover in the turning basin in June of 2015 (see "Ansul Arsenic Site" section for more details). The 2012 sampling report notes that between the spring and summer H-D sampler retrievals, the dredging contaminant curtain was placed such that it encompassed the samplers within the remediation dredging area, and that this may have adversely affected the benthos community in the samplers (Scudder Eikenberry et al., 2014). In 2014, the H-D site was moved 0.4 km downstream in order to avoid such issues (Appendix B, Figure 4; Scudder Eikenberry, Burns, et al., 2016).

A comparison of benthos results from 2012 can be found in Scudder Eikenberry, Bell, et al., 2016. An interpretive report on the 2014 results is in progress. Preliminary analysis shows that the benthos Index of Biotic Integrity (IBI) metrics (calculated from the H-D samples) in both sampling years were significantly lower than their paired AOC comparison sites—Escanaba River and Oconto River—across all seasons (Barb Scudder Eikenberry, personal communication). IBI ratings for the AOC were "Very poor" for 2012 spring, summer, and fall samples and 2014 fall samples, and "Poor" for 2014 spring and summer samples. Since the sampling occurred during and downstream of the Ansul Arsenic Site sediment remediation and occurred two years ago, it is our assessment that these results do not adequately represent the current status of the benthic community in the AOC, or the ability of the benthos community in the river to recover over time, now that the contaminated sediments have been remediated.

The BUI removal target for this AOC does not require confirmation of benthos community recovery, and it is reasonable to assume that the benthos will recover and re-colonize the area over time now that the sediment remediation projects are complete (Wallace, 1990; Niemi et al., 1990; Yount and Niemi, 1990). Therefore, we will not hinge Benthos BUI removal on benthos monitoring results. Since no benthos sampling has occurred in the AOC since completion of the sediment remediation projects in 2015, we cannot confirm whether the communities have recovered. Other programs will continue to monitor the AOC.

USGS Birds as Indicators of Contaminant Exposure Study

Another GLRI-funded USGS study that is useful to understanding benthic conditions in the AOC is GLRI Project 80, "Birds as Indicators of Contaminant Exposure in the Great Lakes." This study uses the tree swallow (*Tachycienta bicolor*), an insectivorous bird residing alongside waterbodies, to study historic and newly emerging contaminants in food chains around the Great Lakes. Since the swallows feed on the aerial stage of benthic aquatic insects, they can be used as an indicator of the bioavailability of

contaminants in local waterways. The researchers worked in the Menominee River AOC site in 2011 and 2012. Nest boxes were located along the north side of the river, across from and upstream of the turning basin (Appendix B Figure 5; Christine Custer, personal communication). Arsenic was detected in relatively few samples and then only at low concentrations. Since no contaminants were detected at concerning levels, they decided to discontinue sampling after 2012 (Christine Custer, personal communication). The results of this study indicate that—even before the sediment remediation projects were completed—arsenic levels in the benthos were not high enough to cause harm to the birds using them for food. More information is available online at *(The link provided was broken and has been removed)*.

STAKEHOLDER/PUBLIC INVOLVEMENT

This removal recommendation was discussed with the Lower Menominee River TAC and CAC at their regular meetings on August 24, 2016. The Lower Menominee River TAC and CAC concur with the recommendation, and the CAC has submitted a formal letter of support for removal of the BUI, dated October 20, 2016 (Appendix E). The proposed action was public noticed via listing in the EagleHerald (https://www.ehextra.com) on September 10, 2016, (Appendix F), and also publicized via AOC e-mail distribution lists and the AOC GovDelivery listserv (2,828 recipients) on September 8, 2016. Supporting documents were posted on the WDNR AOC website (https://dnr.wisconsin.gov/topic/GreatLakes/Menominee.html) for public review and comment from September 8, 2016, through September 22, 2016. The WDNR received written and verbal comments from federal and state agencies during this period and has addressed the comments by incorporating them into this document. The WDNR received no public comments during the review and comment period. A Lower Menominee River AOC open house was held on September 15, 2016, at University of Wisconsin-Marinette Campus as an additional opportunity for the public to review and comment on the BUI removal package.

The TAC was formed in 1988 to bring together technical experts familiar with the AOC for the development and implementation of the RAP (WDNR and MDNR, 1990). In addition, TAC members review and provide input on project plans, monitoring data, RAP updates, and BUI removal documents. The TAC members also provide support for monitoring programs to assess impaired uses, removal of the BUI, and ultimately removing/delisting the AOC status.

The CAC was formed in 1988 as a means of incorporating stakeholder feedback into the RAP documents and to serve as ambassadors on AOC issues to the Marinette and Menominee communities (WDNR and MDNR, 1990). CAC members help the agencies by identifying local issues, developing local targets and goals, serving as a resource for historical information, and assisting in project implementation when possible. The CAC developed governing bylaws in June of 2011 to ensure the committee's long-term viability and balanced representation of the community. As of September 2016, there are 13 membership positions filled of a possible 26. Dozens more individuals have attended monthly meetings and currently receive meeting minutes and AOC updates through e-mail. The WDNR and the MDEQ strongly prefer that requests to remove the

impaired designation of a BUI be agreed to by the TAC and CAC. The TAC meeting minutes and CAC letter of support document support for the removal of the degradation of Benthos BUI and are located in Appendix E.

The CAC holds nine or ten regular meetings per year on the University of Wisconsin-Marinette campus, open to all interested parties. Meetings are advertised through the WDNR Public Meetings Calendar (https://dnr.wisconsin.gov/calendar) and the CAC e-mail distribution list. Participation in meetings is the primary way members of the CAC stay informed and provide input on AOC activities. In addition to attending CAC meetings, the CAC members have been active in the AOC in the following ways: participated in tours of remediation and restoration projects, reviewed documents and provided letters of support for AOC projects, provided local representation or feedback at various state and federal AOC meetings, and hosted and participated in AOC open house events.

CONCLUSIONS/REMOVAL STATEMENT

In conclusion, the WDNR OGL and MDEQ OGL have determined that the Lower Menominee River AOC Degradation of Benthos BUI is able to be removed. All management actions established to meet the BUI delisting targets have been completed. The following required actions have been completed:

- Remediation of Green Bay paint sludge/sediment completed and meeting targets
- Remediation of WPSC coal tar sediment completed and meeting targets
- Remediation of Ansul/Tyco arsenic sediment completed and meeting targets
- Remediation of Menekaunee Harbor sediment completed and meeting targets
- Lower Scott Flowage sediment characterization showed no remediation needed
- Rio Vista Slough sediment characterization showed no remediation needed

Based on the review of all pertinent data, and input from the USEPA project staff, the TAC, the CAC, and the public, all sediment remediation projects have been completed to the extent practicable, and no further sediment characterization or sediment remediation in the Lower Menominee River AOC is required. The MDEQ and WDNR AOC Program staff request concurrence with our recommendation to remove the Degradation of Benthos BUI from the Lower Menominee River AOC.

REFERENCES/CITATIONS

Ayres Associates, 2014a. Project Manual for Menekaunee Harbor Improvements, City of Marinette, Marinette, Wisconsin.
https://drive.google.com/file/d/0B2gzvflVdaq1V2ZIRFdRLXpsWHc/view?pref=2&pli=1
https://drive.google.com/file/d/0B2gzvflVdaq1d294LWxnZzg5a1E/view?pref=2&pli=1

Ayres Associates, 2014b. Quality Assurance Project Plan and Dredge Handling Plan, Lower Menominee River Area of Concern, Menekaunee Harbor Restoration Project, Grant/Project No. GL-00E01312-0 Sub 1-Appendix C.
https://drive.google.com/file/d/0B2gzvflVdaq1V2ZIRFdRLXpsWHc/view?pref=2&pli=1

CH2MHill, 2012. *Draft Final Design Report: Menominee River Sediment Removal Project adjacent to Tyco Fire Products LP Facility, Marinette, WI.* CH2MHill for Tyco Fire Products LP.
(The link provided was broken and has been removed.)
(The link provided was broken and has been removed.)

CH2MHill, 2013a. *Final Five Year Technical Review, Revision 0, Document Control No. 473274.176. Prepared for Tyco Fire Products LP.* CH2MHill, 135 S 84th Street, Milwaukee,WI 53212.

CH2MHill, 2013b. *Assessment of Contaminated Sediments in the Lower Scott Flowage in Menominee River Area of Concern.* CH2MHILL for USEPA. U.S. Environmental Protection Agency, 77 West Jackson Boulevard, Chicago, IL 60604.

CH2MHill, 2014. *Final Site Characterization Report: Assessment of Contaminated Sediments in the Lower Scott Flowage in the Menominee River Area of Concern Site.* CH2MHILL for USEPA. U.S. Environmental Protection Agency, 77 West Jackson Boulevard, Chicago, IL 60604.

CH2MHill, 2015a. *Final Revised Barrier Wall Groundwater Monitoring Plan Update. Prepared for Tyco Fire Products LP.* CH2MHill, 135 S 84th Street, Milwaukee, WI 53212.
- *(The link provided was broken and has been removed.)* (86pp, 9.5MB) September 2015
- *(The link provided was broken and has been removed.)* (35pp, 6.1MB) September 2015
- *(The link provided was broken and has been removed.)* (194pp, 7.5MB) September 2015
- *(The link provided was broken and has been removed.)* (13pp, 249KB) September 2015

CH2MHill, 2015b. *Sampling Summary Report Great Lakes Legacy Act lower Menominee River Tyco Site Adjacent to the Tyco Fire Products LP Facility, Marinette, Wisconsin.*
- *(The link provided was broken and has been removed.)* (114pp, 7MB) November 2015
- *(The link provided was broken and has been removed.)* (116pp, 4MB) November 2015
- *(The link provided was broken and has been removed.)* (12pp, 6.3MB) November 2015

CH2MHill and Sevenson, 2014. *Construction Completion Report. Menominee River Sediment Removal Project Adjacent to the Tyco Fire Products LP Facility, Marinette, Wisconsin.*
(The link provided was broken and has been removed.)

EQM, 2015. *Remedial Action Completion Report, Great Lakes Legacy Act Lower Menominee River Tyco Site*. Environmental Quality Management, Inc.
- *(The link provided was broken and has been removed.)* (83pp, 9.6B) December 2015
- *(The link provided was broken and has been removed.)* (95pp, 7.3MB) December 2015

GLWQA, 1987. Agreement on Great Lakes water quality, 1978, with annexes and terms of reference. *Signed at Ottawa November 22, 1978. Entered into force November 22, 1978.* 30 UST 1383; TIAS 9257; 1153 UNTS 187. Amendments: October 16, 1983 (35 UST 2370; TIAS 10798), November 18, 1987 (TIAS 11551; 2185 UNTS 504).

GLWQA, 2013. Agreement on Great Lakes water quality, 1978, with annexes and terms of reference. *Signed at Ottawa November 22, 1978. Entered into force November 22, 1978.* 30 UST 1383; TIAS 9257; 1153 UNTS 187. Amendments: October 16, 1983 (35 UST 2370; TIAS 10798), November 18, 1987 (TIAS 11551; 2185 UNTS 504), September 7, 2012 (TIAS 13-212), last amendment entered into force February 12, 2013. Retrieved 8/12/2013 from the U.S. Environmental Protection Agency Web site: *(The link provided was broken and has been removed)*

GZA-Donahue, 1989. *Site Reconnaissance, Field Sampling and Analytical Test Results Green Bay Paint Sludge Menominee, Michigan Project No. X-63042.37, October 24, 1989.*

Hilsenhoff, W.L., 1998. *A modification of the biotic index of organic stream pollution to remedy problems and permit its use throughout the year.* Great Lakes Entomologist, v. 31, no. 1, p. 1–12.

MacDonald, D.D., C.G. Ingersoll, and T. Berger. 2000a. *Development and Evaluation of Consensus-Based Sediment Quality Guidelines for Freshwater Ecosystems.* Arch Environ Contam. Toxicol.39:20-31.

MacDonald, D.D., L.M. Di Pinto, J. Field, C.G. Ingersoll, E.R. Long, and R.C Swartz. 2000b. *Development and Evaluation of Consensus-Based Sediment Effect Concentrations for Polychlorinated Biphenyls (PCBs).*

MDEQ, 2008. Guidance for Delisting Michigan's Great Lakes Areas of Concern. Report OGL-002. https://www.michigan.gov/-/media/Project/Websites/egle/Documents/Programs/WRD/AOC/delisting-guidance.pdf

MDEQ, 2015. *Sediment Chemistry of Rio Vista Slough, Menominee River Area of Concern, Menominee County, Michigan, June 24, 2014.* MI/DEQ/WRD-15/023. Keiper, W. MDEQ-Water Resources Division, 525 W. Allegan, P.O. Box 30242, Lansing, MI 48909-7742

Niemi, G. J., P. DeVore, N. Detenbeck, D. Taylor, A. Lima, J. Pastor, J. D. Yount, and R. J. Naiman, 1990. *Overview of Case Studies on Recovery of Aquatic Systems from Disturbance.* Environmental Management Vol. 14, No. 5, pp. 571-587.

NRT, 2013a. *DRAFT Final Report: Focused NAPL and Sediment Removal Action, Wisconsin Public Service Corporation Former Marinette Manufactured Gas Plant Site, Marinette, Wisconsin*. Add web link once available.

NRT, 2013b. Technical Memorandum: *Residual Sand Cover Monitoring Plan, Wisconsin Public Service Corporation, Former MGP Site, Marinette, Wisconsin*. Add web link once available.

NRT, 2015. Technical Memorandum: *Residual Sand Cover Monitoring Results, Wisconsin Public Service Corporation, Former MGP Site, Marinette, Wisconsin*. Add web link once available.

REL, 2015. Figure – Menekaunee Harbor Sand Cover Area. Robert E Lee and Associates, Inc. 1250 Centennial Centre Blvd., Hobart, WI 54155.

REL, 2016. *Construction Completion Report Lower Menominee River Area of Concern Menekaunee Harbor Restoration Project Marinette, Wisconsin.* Robert E Lee and Associates, Inc. 1250 Centennial Centre Blvd., Hobart, WI 54155. https://drive.google.com/file/d/0B2gzvflVdaq1RGQ3aXRlRlJ2cDg/view?pref=2&pli=1

Scudder Eikenberry, B.C., Bell, A.H., Burns, D.J., and Templar, H.A., 2014. *Benthos and Plankton Community Data for Selected Rivers and Harbors along Wisconsin's Lake Michigan Shoreline, 2012.* U.S. Geological Survey Data Series 824, 30 p. plus 8 appendixes, http://dx.doi.org/10.3133/ds824.

Scudder Eikenberry, B.C., Bell, A.H., Templar, H.A., and Burns, D.J., 2016, *Comparison of benthos and plankton for selected Areas of Concern and non-Areas of Concern in Western Lake Michigan Rivers and Harbors in 2012.* U.S. Geological Survey Scientific Investigations Report 2016–5090, 28 p., http://dx.doi.org/10.3133/sir20165090.

Scudder Eikenberry, B.C., Burns, D.J., Templar, H.A., Bell, A.H., and Mapel, K.T., 2016, *Benthos and plankton community data for selected rivers and harbors along the western Lake Michigan shoreline, 2014.* U.S. Geological Survey Data Series 1000, 29 p. plus 8 appendixes, http://dx.doi.org/10.3133/ds1000.

US Department of Health and Human Services, 2005. *Health Consultation-Marinette Sewage Treatment Plant, Marinette. Marinette County, Wisconsin, EPA Facility ID: WID980703359.* USHHS, Atlanta, Georgia. http://www.atsdr.cdc.gov/HAC/PHA/MarinetteSewage022305-WI/MarinetteSewage022305-WI.pdf

USEPA, 2003. United States Environmental Protection Agency, Region 5, Resource Conservation and Recovery Act Ecological Screening Levels. August.

USEPA, 2008. *Statement of Basis and Final Decision Document for Ansul Inc.* EPA ID# 006 125 215. *(The link provided was broken and has been removed.)*

USEPA, 2009. *Administrative Order on Consent for Ansul Incorporated Stanton Street Facility*. EPA ID# WID 006 125 215. *(The link provided was broken and has been removed.)*

USEPA, 2012. *Administrative Settlement Agreement and Order on Consent for Removal Action*. EPA ID No. WID 006 125 215. *(The link provided was broken and has been removed.)*

Wallace, J. B., 1990. *Recovery of Lotic Macroinvertebrate Communities from Disturbance.* Environmental Management Vol. 14, No. 5, pp. 605-620.

Weston Solutions, 2008. *Menekaunee Harbor Sediment Investigation Report*. Weston Solutions Inc. for USEPA. U.S. Environmental Protection Agency, 77 West Jackson Boulevard, Chicago, IL 60604.

WDNR, 1996. *The Lower Menominee River Remedial Action Plan Update.* PUBL WR-410 96. *(The link provided was broken and has been removed)*

WDNR, 2003. *Consensus-Based Sediment Quality Guidelines. Recommendations for Use and Application-Interim Guidance.* PUBL WT-732 2003. *(The link provided was broken and has been removed.)*

WDNR and MDEQ, 2008. *Lower Menominee River AOC Beneficial Use Impairment Restoration Targets*. *(The link provided was broken and has been removed)*

WDNR and MDEQ, 2011. *Stage 2 Remedial Action Plan for the Lower Menominee River Area of Concern. (The link provided was broken and has been removed)*

WDNR and MDNR, 1990. *The Lower Menominee River Remedial Action Plan: Stage One Report.* PUBL WR-246 90. *(The link provided was broken and has been removed)*

Yount, J. D. and G. J. Niemi, 1990. *Recovery of Lotic Communities and Ecosystems from Disturbance—A Narrative Review of Case Studies.* Environmental Management Vol. 14, No. 5, pp. 547-569.

List of Acronyms and Initialisms

AOC	Area of Concern
AOOC	Administrative Order on Consent
BUI	Beneficial Use Impairment
CAC	Citizens Advisory Committee
CBSQG	Consensus Based Sediment Quality Guidelines
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended, 42 U.S.C. §§ 9601-9675
CQAPP	Construction Quality Assurance Project Plan
CSO	Combined Sewer Overflow
CY	Cubic Yards
DMU	Dredge Management Unit
DNAPL	Dense non-aqueous phase liquid
EQM	Environmental Quality Management, Inc.
GBPS	Green Bay Paint Sludge Site
GLLA	Great Lakes Legacy Act
GLNPO	Great Lakes National Program Office
GLRI	Great Lakes Restoration Initiative
GLWQA	Great Lakes Water Quality Agreement
HBI	Hilsenhoff Biotic Index
H-D	Hester-Dendy
IBI	Index of Biotic Integrity
LMR	Lower Menominee River
LSF	Lower Scott Flowage
MDEQ	Michigan Department of Environmental Quality
MDNR	Michigan Department of Natural Resources
MGP	Manufactured Gas Plant
NAPL	Non-aqueous phase liquid
NRT	Natural Resource Technology
NTCRA	Non-Time Critical Removal Action
OGL	Office of the Great Lakes
PAH	Polycyclic Aromatic Hydrocarbon
PEC	Probable Effect Concentrations
PCB	Polychlorinated Biphenyls
ppm	parts per million
QAPP	Quality Assurance Project Plan
RAO	Remedial Action Objective
RAP	Remedial Action Plan
RCM	Reactive Core Mat
RCRA	Resource Conservation and Recovery Act (Solid Waste Disposal Act, as amended, 42 U.S.C. § 6901. et seq.)
ROD	Record of Decision
RVS	Rio Vista Slough
SWAS	Surface Water Assessment Section
TAC	Technical Advisory Committee
TEC	Threshold Effect Concentrations
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey
WDNR	Wisconsin Department of Natural Resources
WPSC	Wisconsin Public Service Corporation
WWTP	Wastewater Treatment Plant

DEFINITIONS

Area of Concern (AOC) - Defined by Annex 2 of the 1987 Protocol to the U.S.-Canada Great Lakes Water Quality Agreement (GLWQA, 1987) as "geographic areas that fail to meet the general or specific objectives of the Agreement where such failure has caused or is likely to cause impairment of beneficial use or of the area's ability to support aquatic life." These areas are, or were, the "most contaminated" areas of the Great Lakes, and the purpose of the AOC program is to bring these areas to a point at which they are not environmentally degraded more than other comparable areas of the Great Lakes. When that point has been reached, the AOC can be removed from the list of AOCs in the Annex, or "delisted." The GLWQA can be found at http://www.ijc.org/rel/agree/quality.html

Beneficial Use Impairment (BUI) - Defined by the QLWQA as a reduction in the chemical, physical, or biological integrity of the waters of the Great Lakes sufficient to cause impairment to a designated use (GLWQA, 2013). The Lower Menominee River AOC has five BUIs remaining including: restrictions on fish and wildlife consumption; restrictions on dredging activities; degradation of benthos; degradation of fish and wildlife populations; and loss of fish and wildlife habitat.

Beneficial use(s) are ways that a water body can improve the quality of life for people or for fish and wildlife. For example, providing habitat for fish and wildlife is a beneficial use of a water body. If a beneficial use is suppressed or unavailable due to environmental problems, like loss of habitat, then that beneficial use is considered impaired. The International Joint Commission provided a list of 14 possible beneficial use impairments in the 1987 amendments to the GLWQA.

Benthos – A term that refers collectively to all aquatic organisms that live on, in, or near the bottom of water bodies. Some examples are clams, snails, worms, amphipods, crayfish, and the larvae of many aquatic insects.

Great Lakes Restoration Initiative (GLRI) - A federal program that provides unprecedented funding for protection and restoration efforts on the five Great Lakes. State and local governments and non–profit organizations are eligible to receive grants from the U.S. Environmental Protection Agency (USEPA) for projects addressing toxic substances, invasive species, non–point source pollution, habitat protection and restoration or accountability, monitoring, evaluation, communication, and partnership building.

Polychlorinated Biphenyls (PCBs) - A group of more than 200 compounds, PCBs have been manufactured since 1929 for uses including electrical insulation, hydraulics, fluorescent lights, and carbonless paper to name a few. In 1979, PCBs were banned because of their persistence in the environment and tendency to magnify up the food chain. They have been linked to reproductive problems in wildlife and are suspected of causing developmental problems in human infants.

Polycyclic Aromatic Hydrocarbons (PAHs) - Chemicals commonly associated with oils, greases, and other components derived from petroleum. Some PAH compounds have been identified as cancer or mutation causing.

Remedial Action Plan (RAP) - A RAP is developed for each AOC to identify the status of BUIs and their sources, document restoration targets, and list actions needed to reach those targets. RAPs are updated periodically to report progress toward achieving the restoration targets. This Plan, along with the most current RAP Update for the Lower Menominee River AOC, constitutes a complete strategy for removing all BUIs in the Lower Menominee River AOC.

Restoration Target - Specific goals and objectives established to track restoration progress of beneficial use impairments. Once targets have been met, the beneficial use is no longer considered impaired. Targets should be locally derived. Working with the Lower Menominee AOC Citizens Advisory Committee, delisting targets were developed in partnership with the WDNR and the MDEQ. Wisconsin and Michigan use different criteria when assessing BUIs. The agencies and CAC agreed to implement the most restrictive criteria from either state when developing the Menominee AOC specific delisting targets.

APPENDICES

Appendix A Tables
Appendix B Figures
Appendix C Sediment Project Maps
Appendix D Lower Menominee River AOC BUI Removal Criteria
Appendix E Technical Advisory Committee Meeting Minutes and Citizens Advisory Committee Letter of Support
Appendix F Open House News Release, Eagle-Herald 9/10/16

APPENDIX A: TABLES

Table 1. Lower Menominee River AOC Sediment Remediation Sites Summary of Goals, Actions, and Monitoring.

Site Name/ Contaminant of Concern	Media Type	Remediation Goals	Remedial Action	Remedial Action Implementation Status	Remediation Goal Met?	Monitoring and Maintenance
Ansul/Tyco (former Ansul Fire Protection) Arsenic	Terrestrial	Onsite Surface Soils ≤32 ppm Total Arsenic Adjacent Offsite Surface Soils 16 ≤ppm Total Arsenic	• 90,000 Tons of Salt Waste Removal • Limited Soil Removal • Capping	Complete	Verified 2015 • Construction Completion Report	Ongoing Maintenance & Monitoring • 2018 5-Year Review
	Ground Water	Containment & Flood Control	• Barrier Wall • Ground Water Extraction & Treatment System • Phyto Pumping Tree Plots	Complete	• 2010 • Yes, with management plan implementation	Ongoing Maintenance & Monitoring • Barrier Wall Ground Water Monitoring Plan 2015 Update • 2018 5-Year Review & Research new arsenic removal technologies
	Sediment	≤20 ppm Total Arsenic	• Dredge 300,056 CY • 12” Sand Cover Areas ≥ 20 ppm	Complete	Verified 2015 • Core Sampling • Pan Testing • Bathymetry	Ongoing Monitoring • Post Dredge Sand Cover Sediment Sampling 2018 • 2018 5-Year Review
Green Bay Paint Sludge (Lloyd Flanders, former Heyward-Wakefield) Heavy Metals	Sediment/Soil	Remove Paint Waste, Impacted Sediment & Soil and Install Shoreline Barrier	• Remove 5,000 Tons Bulk Paint Waste (hazardous waste facility) • Excavate 10,500 Tons Sediment & Soil (local landfill)	Complete	Reported volumes to MDNR 1995 & 1998 under Public Act 307.	Ongoing Implementation of Operations and Maintenance Plan
	Paint Nodules	Remove Paint Nodules that wash up along shoreline	• Collect & Remove Paint Nodules • Report under Admin Order	Ongoing	Verified Annually	Ongoing monthly and post storm events collection along shoreline
Menekaunee Harbor Heavy Metals & PAHs	Sediment	Threshold Effect Concentration (TEC) Values for Heavy Metals & Polynuclear Aromatic Hydrocarbons (PAHs)	• Dredge 27,129 CY • 6” Sand Cover Areas that exceed TEC for Metals.	Complete	Verified 2015 • Core Sampling • Pan Testing • Bathymetry	Not Required
Wisconsin Public Service Corporation (former manufactured gas plant) Coal Tar – PAHs	Terrestrial	Limited Soil Removal During Construction of Wastewater Treatment Plant & Road Construction.	• None at this Time • Developing Record of Decision (ROD)	Ongoing Evaluation	Removal documented & developing ROD to determine next steps.	Ongoing Maintenance & Monitoring
	Ground Water	Contamination plume defined	• None at this Time • Developing ROD	Ongoing Evaluation	Verified Feasibility Study Report 2016 ROD to determine next steps.	Ongoing monitoring
	Sediment	≤22.8 ppm 13 Priority PAHs	• Dredge 15,221 CY • 10” Sand Cover Areas ≥22.8 ppm • Reactive Core Mat (RCM)	Complete (Non-Time Critical Removal Action)	Verified 2013 & 2015 • Core Sampling • Bathymetry ROD to determine continuing obligations for Sand Cover & RCM.	Ongoing Maintenance & Monitoring • Reactive Core Mat • Sand Cover • 2018 5-Year Review

Table 2. Site locations and sample descriptions for Rio Vista Slough sampling 6/24/2014 (MDEQ, 2015).

SITE ID	LAT	LONG	DESCRIPTION	ODOR	COMMENTS
Men 1	45.10561	-87.6242	organic	no	no sheen
Men 2	45.10550	-87.62524	organic w/ sheen	no	large outfall, sheen
Men 3	45.10537	-87.62581	organic	no	small outfall, light sheen
Men 4	45.10524	-87.62563	organic w/ sheen	no	sheen
Men 5	45.10514	-87.62632	organic	no	no sheen
Men 6	45.10493	-87.62708	organic	no	no sheen
Men 7 (Dup)	45.10493	-87.62708	organic	no	no sheen
Men 8	45.10441	-87.6271	organic	no	no sheen
Men 9	45.10455	-87.62629	organic	no	no sheen

Table 3. Aroclor results for Rio Vista Slough sediment samples taken on 6/24/14 (MDEQ, 2015). ND = not detectable

SITE ID	Aroclor 1016	Aroclor 1221	Aroclor 1232	Aroclor 1242	Aroclor 1248	Aroclor 1254	Aroclor 1260	Aroclor 1262	Aroclor 1268
	ug/kg dry	ug/kg dry	ug/kg dry	ug/kg dry	ug/kg dry	ug/kg dry	ug/kg dry	ug/kg dry	ug/kg dry
Men 1	ND	ND	ND	ND	ND	ND	ND	ND	ND
Men 2	ND	ND	ND	ND	ND	ND	ND	ND	ND
Men 3	ND	ND	ND	ND	ND	ND	ND	ND	ND
Men 4	ND	ND	ND	ND	ND	ND	ND	ND	ND
Men 5	ND	ND	ND	ND	ND	ND	ND	ND	ND
Men 6	ND	ND	ND	ND	ND	ND	ND	ND	ND
Men 7 (Dup)	ND	ND	ND	ND	ND	ND	ND	ND	ND
Men 8	ND	ND	ND	ND	ND	ND	ND	ND	ND
Men 9	ND	ND	ND	ND	ND	ND	ND	ND	ND

Table 4. Heavy metal results for surficial sediment samples taken in Rio Vista Slough, 6/24/14 (MDEQ, 2015). * PEC and TEC consensus-based values, Macdonald et. al., 2000. Bold values above PEC values. ND = not detectable

	TEC*	PEC*	Men 1	Men 2	Men 3	Men 4	Men 5	Men 6	Men 7 (Dup)	Men 8	Men 9
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Arsenic	9.79	33	6.3	1.2	2.6	2	3.7	3	3.5	2.3	5
Cadmium	0.99	4.98	2.1	0.4	0.5	0.6	0.3	0.9	0.3	ND	0.8
Chromium	43.4	111	46	32	15	26	14	11	7.8	8.8	20
Copper	31.6	149	66	23	23	36	24	26	16	7.7	28
Lead	35.8	128	110	23	42	49	37	42	14	5.7	34
Mercury	0.18	1.06	**1.1**	ND	0.1	0.5	0.1	0.3	0.2	0.1	0.5
Zinc	121	459	410	180	220	300	89	120	85	38	150

Table 5. PAH results for surficial sediment samples taken in Rio Vista Slough, 6/24/14 (MDEQ, 2015). * PEC and TEC consensus- based values, Macdonald et. al., 2000. Bold values above PEC values. ND = not detectable

	TEC*	PEC*	Men 1	Men 2	Men 3	Men 4	Men 5	Men 6	Men 7 (Dup)	Men 8	Men 9
	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
Benz[a] anthracene	108	1050	ND	**3700**	ND	**4200**	ND	ND	ND	ND	ND
Benz[b] fluoranthene	na	na	ND	7200	ND	**10000**	ND	ND	ND	ND	ND
Chrysene	166	1290	ND	**6300**	ND	**8100**	ND	ND	ND	ND	ND
Fluoranthene	423	2230	ND	**14000**	**5600**	**17000**	ND	ND	ND	ND	ND
Phenanthrene	204	1170	ND	**6200**	ND	**6300**	ND	ND	ND	ND	ND
Pyrene	195	1520	ND	**10000**	**4100**	**12000**	ND	ND	ND	ND	ND
Total PAHs	1610	22800		**47400**	9700	**57600**					

APPENDIX B: FIGURES

Figure 1. The Lower Menominee River AOC as delineated by USEPA. Green Island, which was included in the AOC in the 1996 RAP, is not visible on this map, and is located approximately five miles east from Seagull Bar.

Figure 2. Menominee River Watershed.

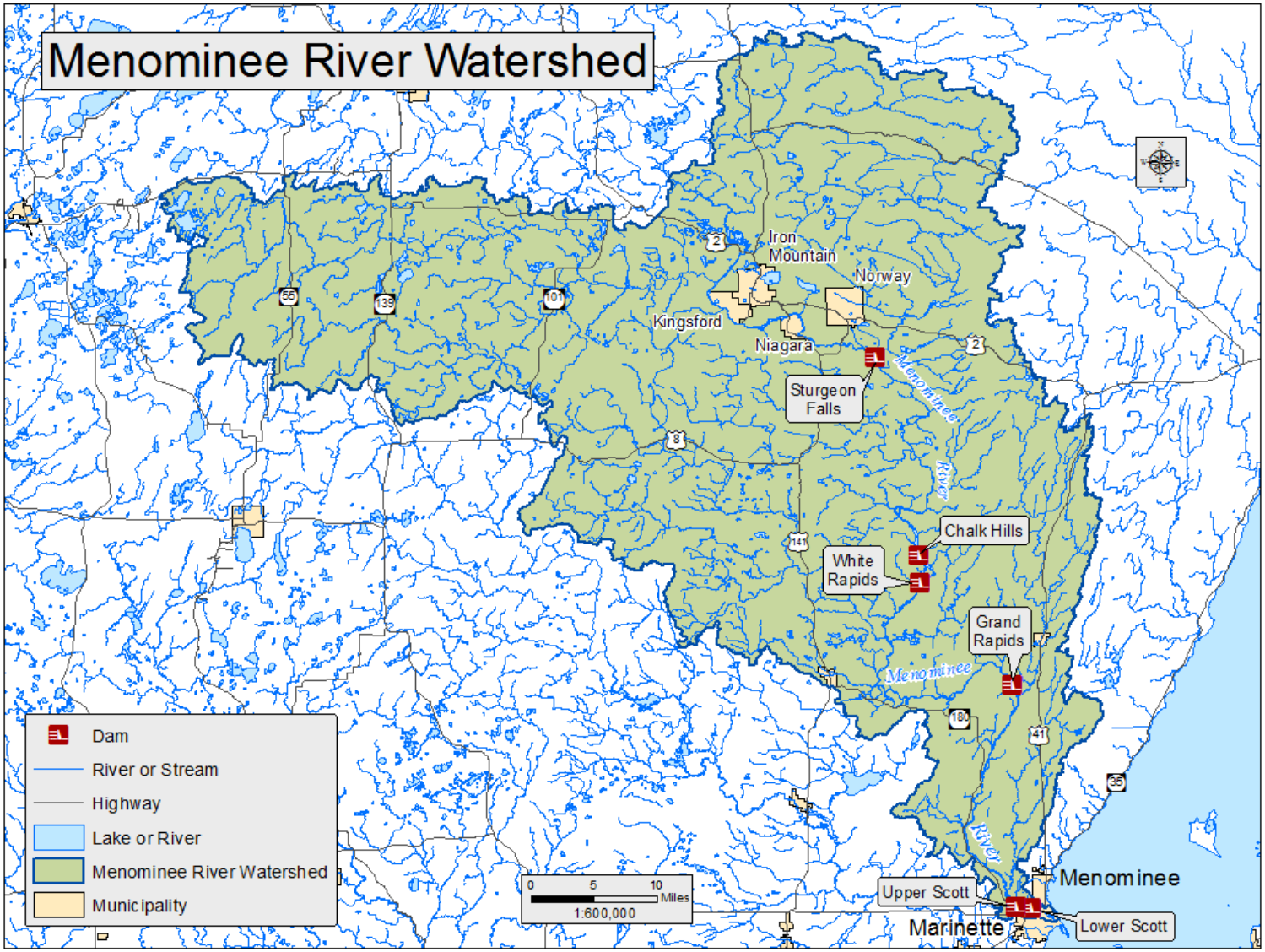


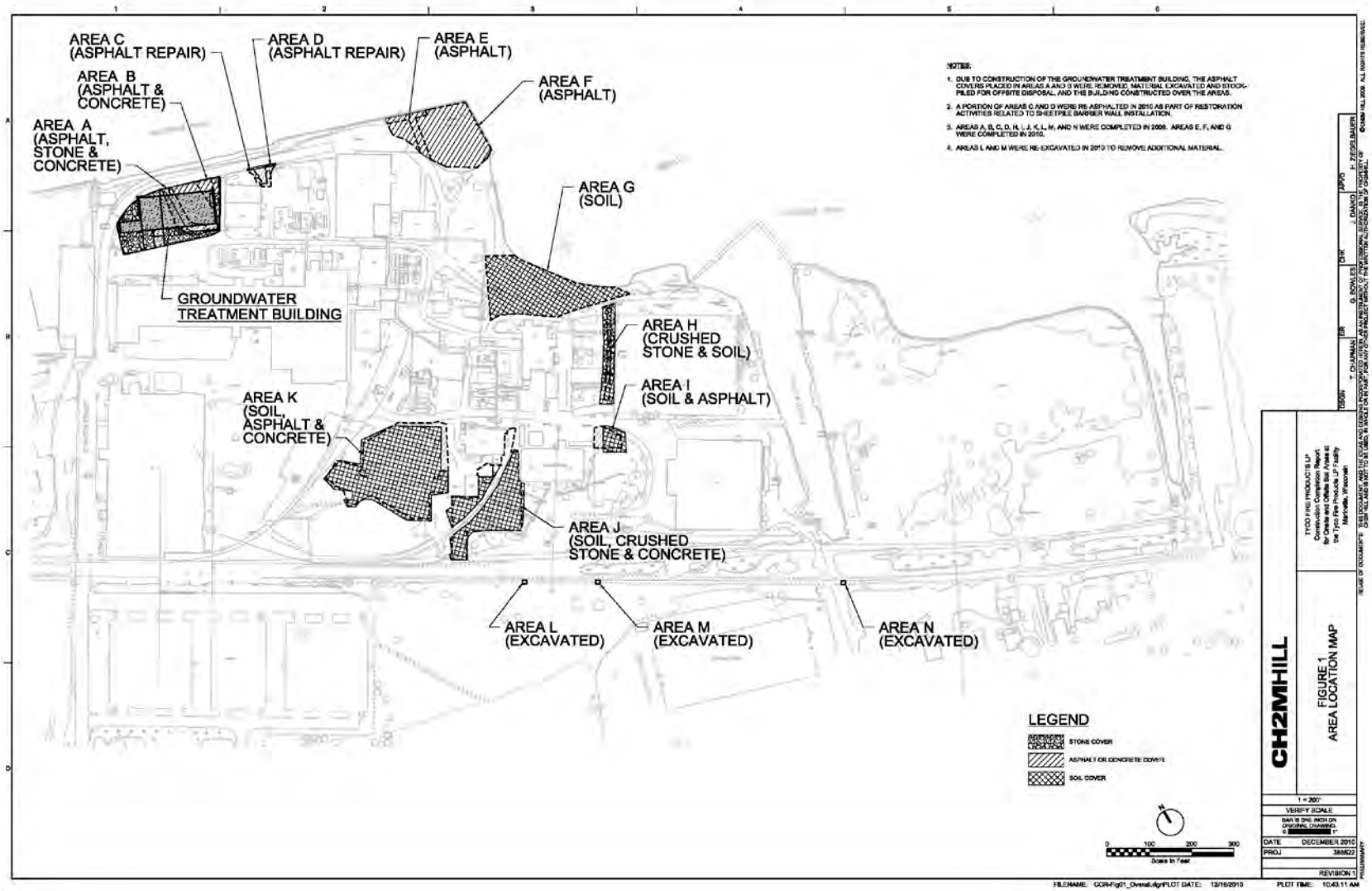
Figure 3. Segments of the Lower Menominee River AOC.

Figure 4. USGS 2012 and 2014 benthos sampling sites in the Lower Menominee River AOC (Barb Scudder Eikenberry, personal communication). "H-D" = Hester-Dendy artificial substrate samplers.

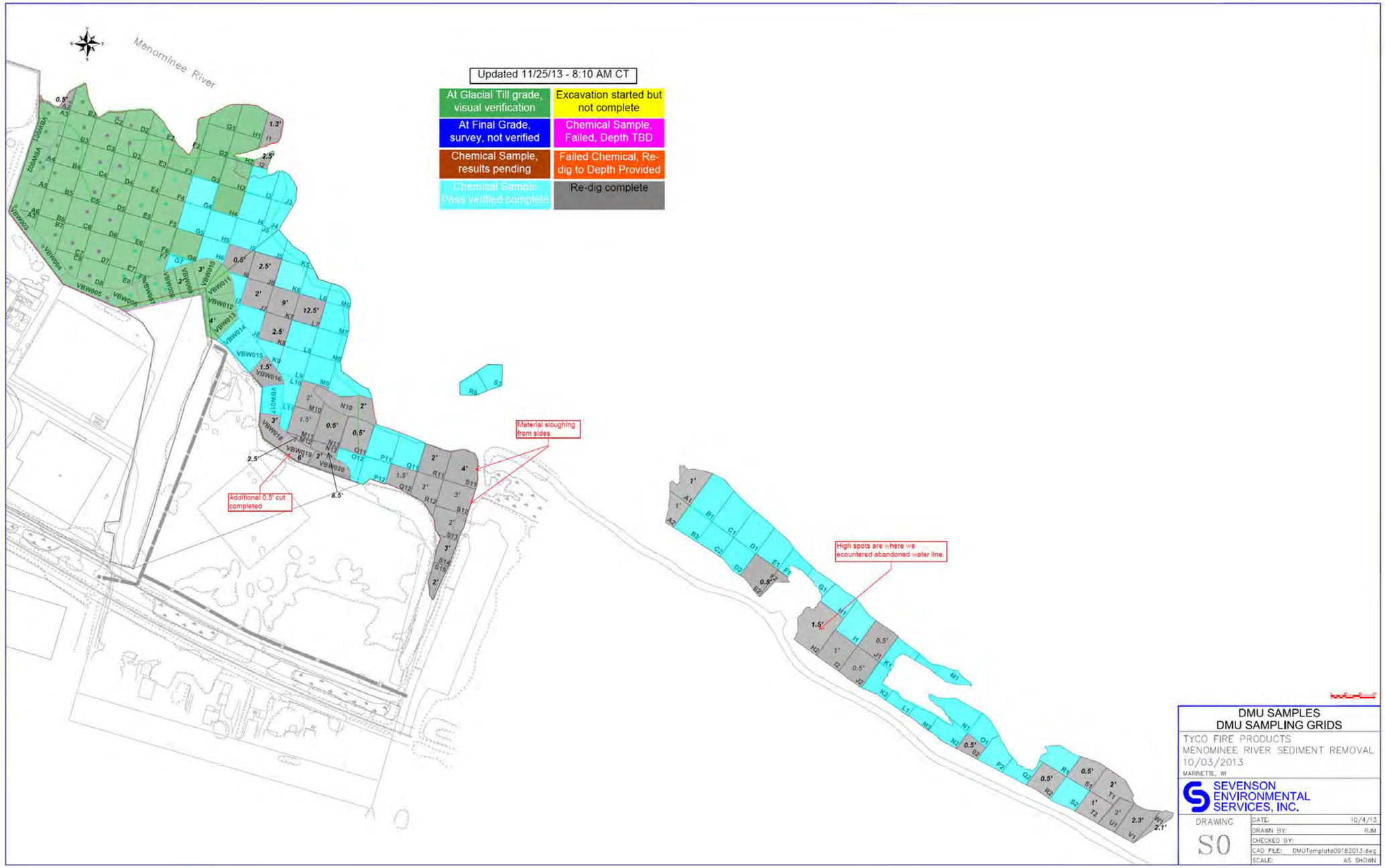
Figure 5. USGS 2011 and 2012 tree swallow nest box location (Christine Custer, personal communication).

APPENDIX C: SEDIMENT PROJECT MAPS

Map 1. Ansul Arsenic Site, locations of upland soil remedies.

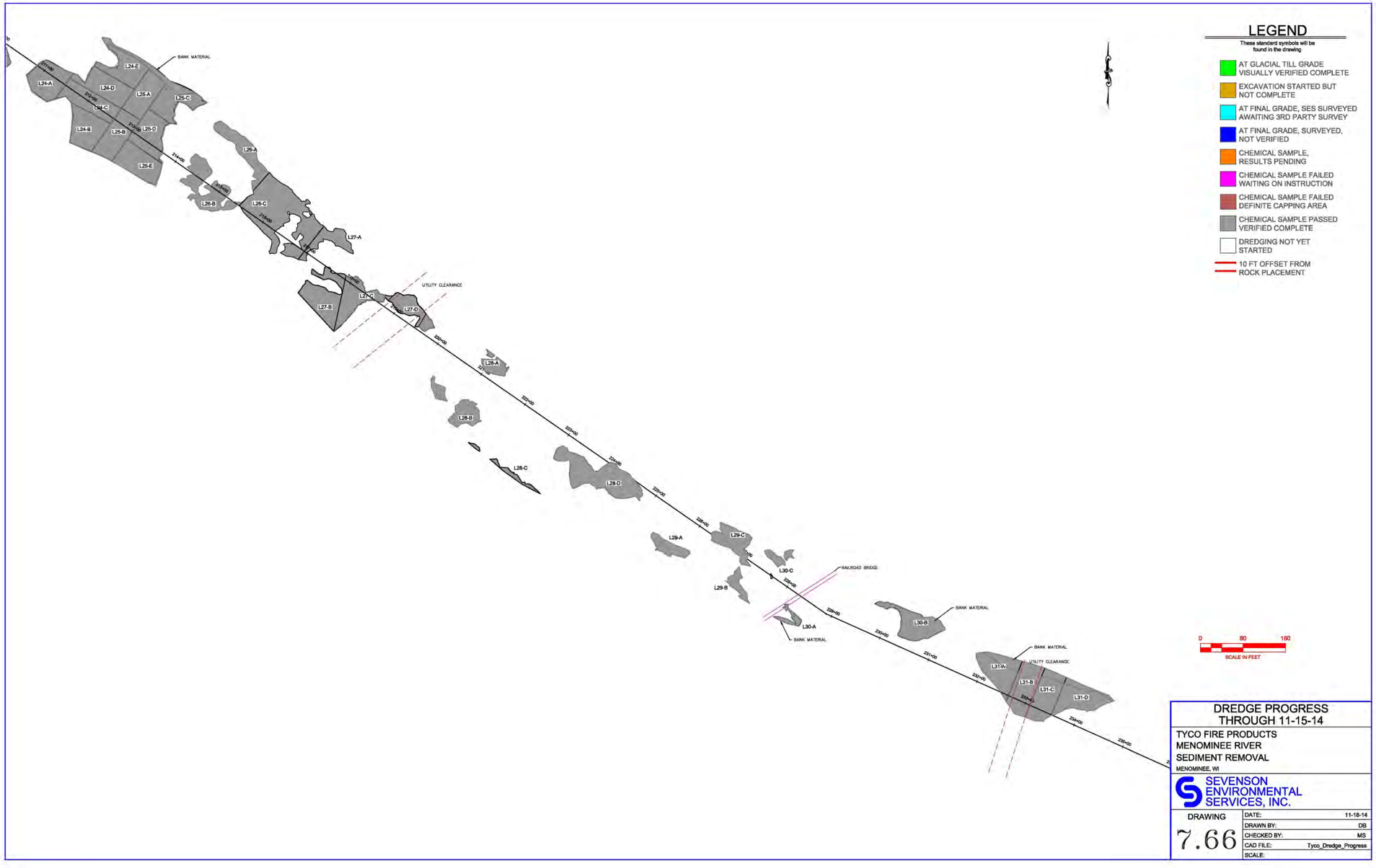


Map 2. Ansul Arsenic Site, November 25, 2013 status of the removal of Menominee River arsenic contaminated sediment delineated by dredge management unit.

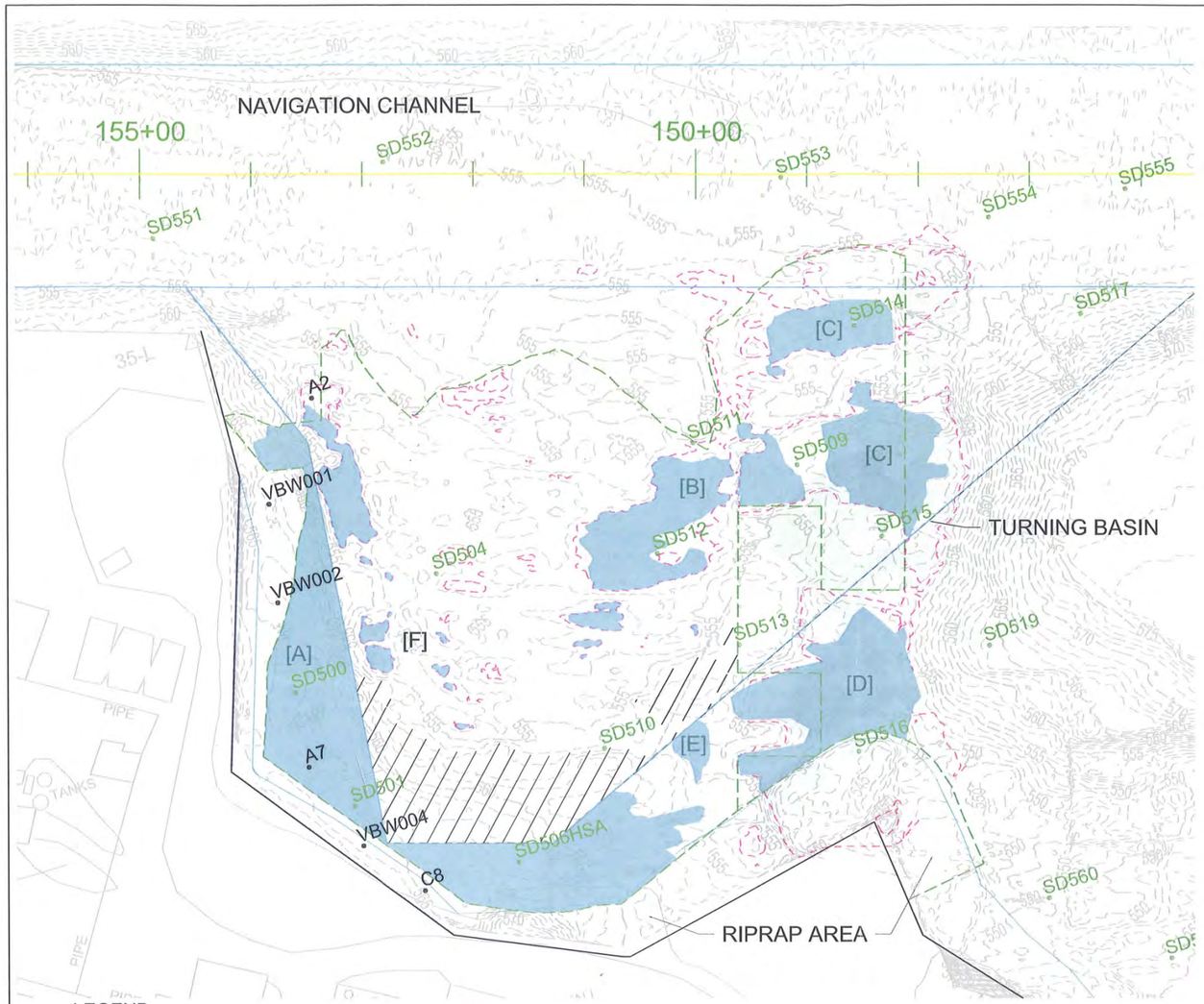


Map 3. Page 1. Ansul Arsenic Site, November 15, 2014 status of the removal of Menominee River arsenic contaminated sediment delineated by dredge management unit.

Map 3. Page 2. Ansul Arsenic Site, November 15, 2014 status of the removal of Menominee River arsenic contaminated sediment delineated by dredge management unit.



Map 4. Ansul Arsenic Site GLLA sand cover placement area (CH2MHill, 2015b).



N

0 100 200 300
Scale In Feet

Till Arsenic Concentration Data - 2010 RI Sampling & 2013 EPA Samples

Sample Location ID	Arsenic Concentration (mg/kg)	Easting	Northing	Top of Till Elevation
A2	14	2585053.81	470338.03	551.17
A7	53	2584956.52	470021.17	568.76
C8	52	2585024.84	469885.19	564.73
SD500	28.2	2584964.07	470088.66	565.3
SD501	139	2584985.55	469975.68	565.6
SD504	2.6	2585115.89	470155.21	552.9
SD506HSA	160	2585113.19	469885.64	562.3
SD509	4.1	2585455.01	470157.00	549.1
SD510	111	2585216.18	469961.77	554.9
SD511	2.7	2585370.72	470202.26	549.7
SD512	182	2585311.45	470115.99	551.7
SD513	95.7	2585358.49	470016.81	550.1
SD514	144	2585539.85	470262.17	548.8
SD515	94.6	2585509.51	470073.67	550.9
SD516	28.6	2585434.50	469894.27	548.4
SD517	2.6	2585738.01	470214.26	545.5
SD519	1.8	2585574.42	469952.31	547.6
SD523HSA	2.6	2585978.09	470080.24	546.4
SD551	2.1	2584957.61	470516.38	550.2
SD552	1.6	2585175.91	470523.56	547.9
SD553	1.9	2585514.79	470408.82	549.6
SD554	2.1	2585683.59	470321.32	548.0
SD555	2.1	2585808.19	470310.80	542.1
SD556	2.4	2585925.78	470176.67	545.9
SD560	2.9	2585561.14	469719.36	543.9
SD561	2.7	2585681.73	469481.92	540.7
SD562	1.6	2585826.11	469408.57	544.1
SD564	14.7	2584124.74	470735.78	547.3
SD565	2.2	2584515.79	470659.98	545.6
SD574	3.1	2585650.58	469636.48	546.7
SD576	3.3	2585938.39	469558.52	544.3
VBW001	12	2584989.49	470257.76	564.59
VBW002	0.82	2584971.8	470170.68	563.64
VBW004	41	2584983.22	469939.47	566.43

TABLE LIST ONLY ARSENIC CONCENTRATIONS FOR THE TOP (SURFACE) 12"OF TILL SAMPLE.

TOTAL ARSENIC DATA PRESENTED WITHIN THE ADJACENT TABLE WAS LINEARLY INTERPOLATED USING GEOPAK CAD SOFTWARE TO DETERMINE THE 20PPM CONCENTRATION CONTOUR. ONCE THE 20PPM EXTENT WAS DETERMINED IT WAS CLIPPED TO THE "TOE-BOUNDARY"AND THE 553.5 ELEVATION CONTOUR WITHIN THE FEDERALLY AUTORIZED NAVIGATIONAL CHANNEL. NEW CHANNEL DEPTH BASED ON NLW.

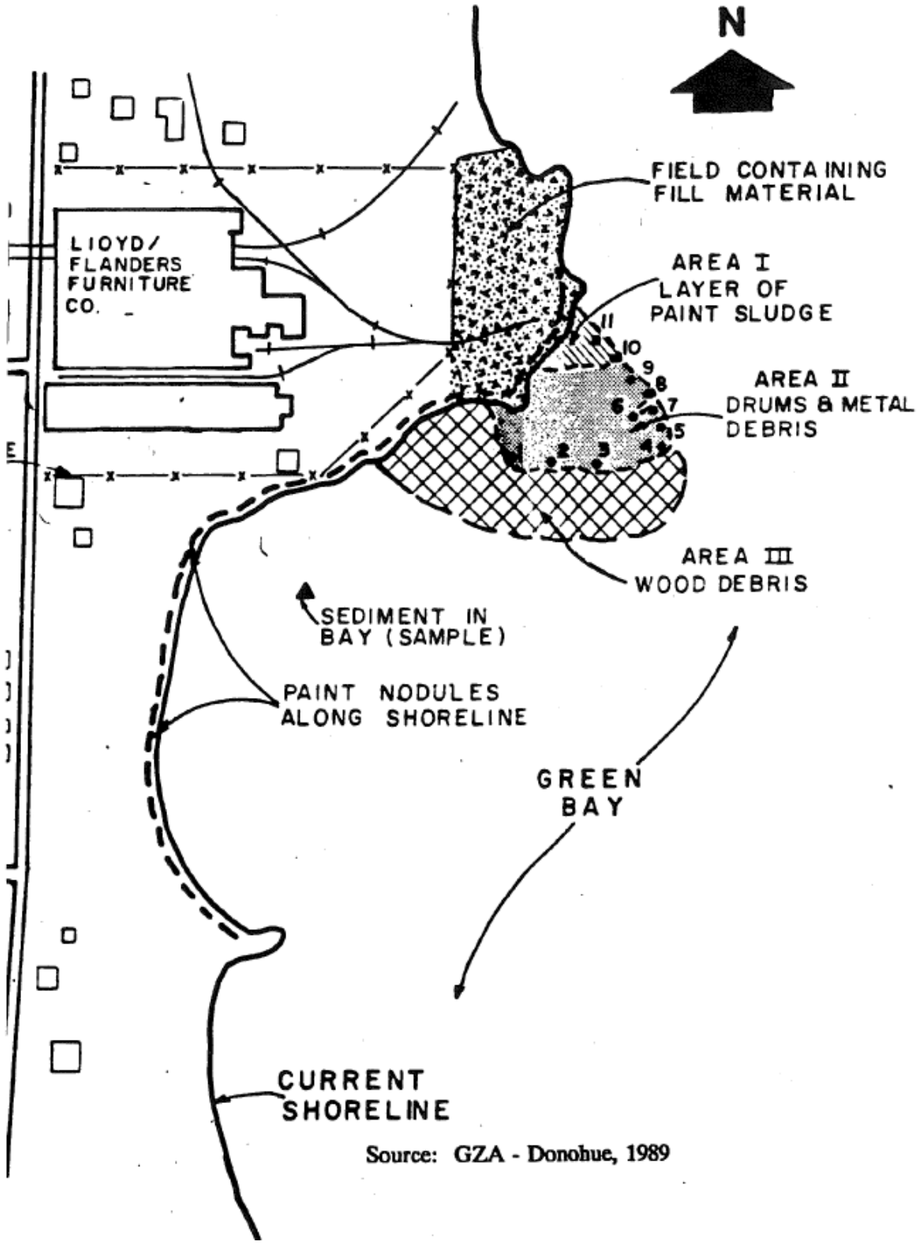
COVER POLYGON	AREA (Ac.)	AREA (SF)
[A]	0.99	43,180
[B]	0.30	13,146
[C]	0.31	13,364
[D]	0.32	13,858
[E]	0.02	1,088
[F]	0.10	4,322
TOTAL	2.04	88,957

FIGURE 6
NAV CHANNEL / TURNING BASIN
COVER ELEVATION 553.50
POTENTIAL GLACIAL TILL
COVER AREA (20ppm)
GREAT LAKES LEGACY ACT
LOWER MENOMINEE RIVER TYCO SITE

CH2MHILL

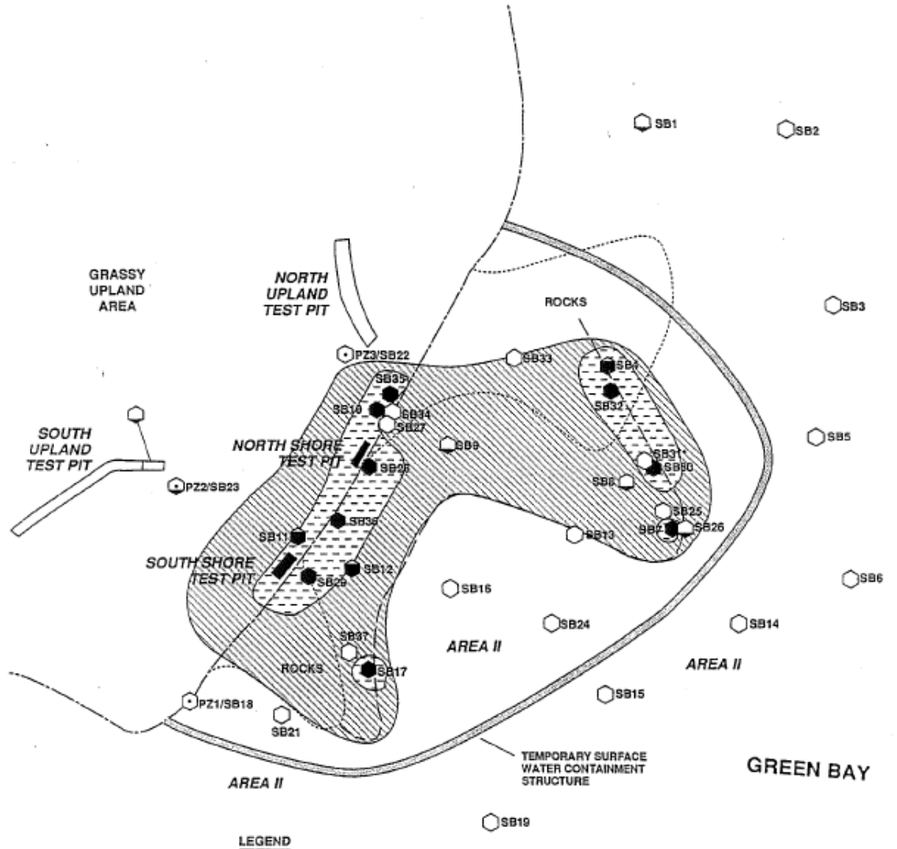
NOT FOR BID - FOR INFORMATION ONLY

Map 5. Green Bay paint sludge contaminated areas.



Source: GZA - Donohue, 1989

Map 6. Areas containing paint sludge before removal.



NOTE: * NO SAMPLE COLLECTED FROM 0-7 FEET BELOW GROUND SURFACE

N
0 25 50 100
APPROXIMATE SCALE IN FEET

GERAGHTY & MILLER, INC. Environmental Services

LEGEND

SB1 SOIL BORING LOCATION
PZ1 PIEZOMETER LOCATION
TEST PIT LOCATION
APPROXIMATE SHORELINE (11-90)
APPROXIMATE EXTENT OF ROCKS (11-90)
APPROXIMATE EXTENT OF PAINT SLUDGE (G&M EST. /11-90)

CONCENTRATION

NO PAINT SLUDGE FRAGMENTS ENCOUNTERED
MINOR TRACES OF PAINT SLUDGE FRAGMENTS ENCOUNTERED IN ONE SPLIT-SPOON SAMPLE
PAINT SLUDGE FRAGMENTS ENCOUNTERED IN AT LEAST TWO SPLIT-SPOON SAMPLES
SIGNIFICANT THICKNESS OF PAINT SLUDGE ENCOUNTERED (FROM 0.5 FT TO POSSIBLY GREATER THAN 3.0 FT THICK)

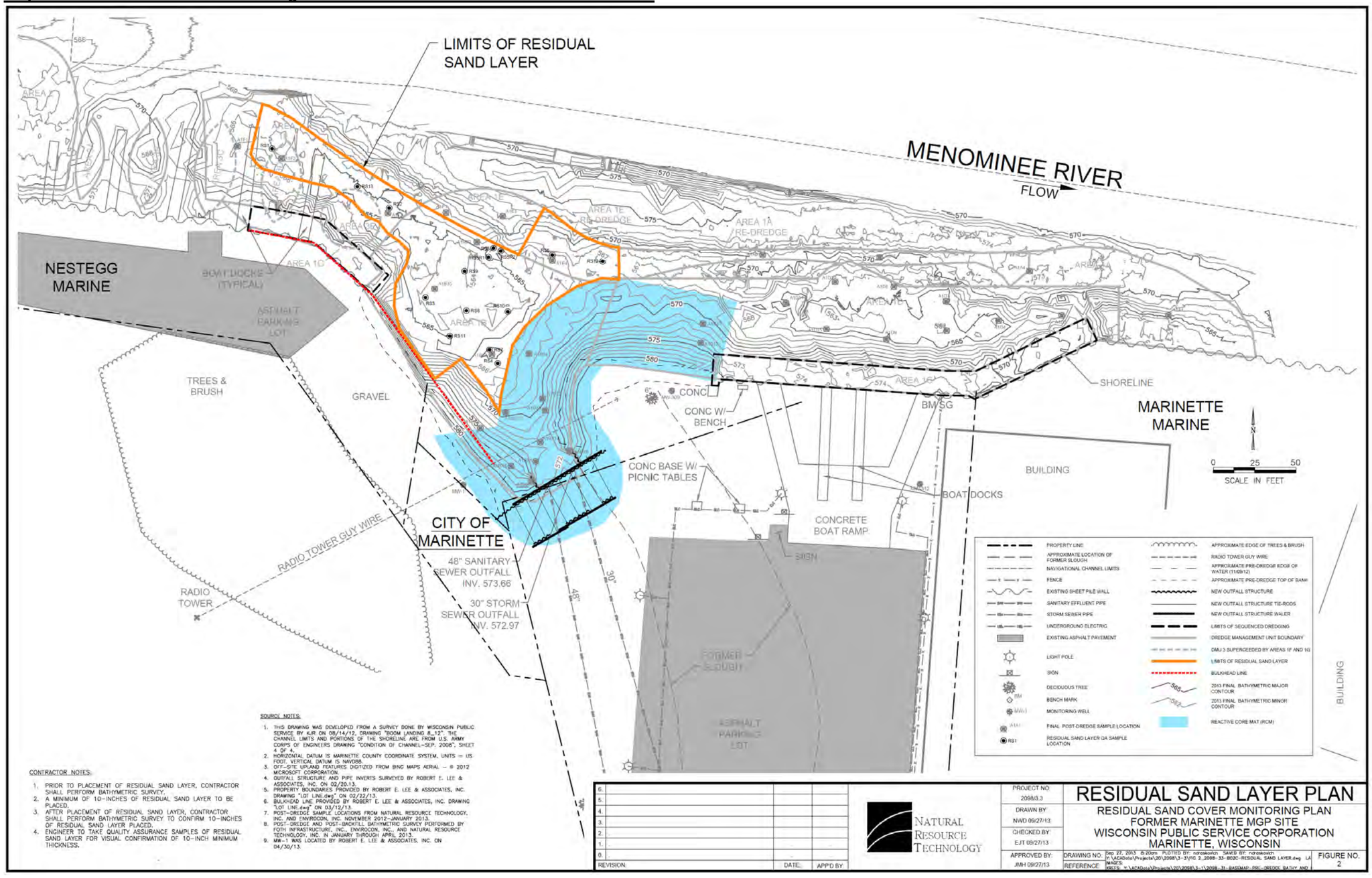
AREA I - Areas containing major accumulations of paint sludge material.

AREA IIA - Area located adjacent to the major accumulation of paint sludge (AREA I). Paint sludge fragments were observed at the surface and in sediment samples collected within this area.

AREA II - Area surrounding Area IIA which likely contains minimal amounts of paint sludge fragments scattered around in offshore areas, the grassy upland area, and along the shoreline adjacent to and south of the site.

FIGURE 2
AREAS CONTAINING PAINT SLUDGE
SUBMERGED WASTE REMOVAL ACTION WORK PLAN
GREEN BAY PAINT SLUDGE SITE
MENOMINEE, MICHIGAN
W017401-0181.CS.1

Map 7. Marinette MGP site including the reactive core mat and sand cover limits.



CONTRACTOR NOTES:

1. PRIOR TO PLACEMENT OF RESIDUAL SAND LAYER, CONTRACTOR SHALL PERFORM BATHYMETRIC SURVEY.
2. A MINIMUM OF 10-INCHES OF RESIDUAL SAND LAYER TO BE PLACED.
3. AFTER PLACEMENT OF RESIDUAL SAND LAYER, CONTRACTOR SHALL PERFORM BATHYMETRIC SURVEY TO CONFIRM 10-INCHES OF RESIDUAL SAND LAYER PLACED.
4. ENGINEER TO TAKE QUALITY ASSURANCE SAMPLES OF RESIDUAL SAND LAYER FOR VISUAL CONFIRMATION OF 10-INCH MINIMUM THICKNESS.

SOURCE NOTES:

1. THIS DRAWING WAS DEVELOPED FROM A SURVEY DONE BY WISCONSIN PUBLIC SERVICE BY KJR ON 08/14/12, DRAWING "BOOM LANDING 8_12". THE CHANNEL LIMITS AND PORTIONS OF THE SHORELINE ARE FROM U.S. ARMY CORPS OF ENGINEERS DRAWING "CONDITION OF CHANNEL-SEP. 2006", SHEET 4 OF 4.
2. HORIZONTAL DATUM IS MARINETTE COUNTY COORDINATE SYSTEM, UNITS = US FOOT. VERTICAL DATUM IS NAVD88.
3. OFF-SITE UPLAND FEATURES DIGITIZED FROM BING MAPS AERIAL - © 2012 MICROSOFT CORPORATION.
4. OUTFALL STRUCTURE AND PIPE INVERTS SURVEYED BY ROBERT E. LEE & ASSOCIATES, INC. ON 02/20.13.
5. PROPERTY BOUNDARIES PROVIDED BY ROBERT E. LEE & ASSOCIATES, INC. DRAWING "LOT LINE.dwg" ON 02/22/13.
6. BULKHEAD LINE PROVIDED BY ROBERT E. LEE & ASSOCIATES, INC. DRAWING "LOT LINE.dwg" ON 03/12/13.
7. POST-DREDGE SAMPLE LOCATIONS FROM NATURAL RESOURCE TECHNOLOGY, INC. AND ENVIROCON, INC. NOVEMBER 2012-JANUARY 2013.
8. POST-DREDGE AND POST-BACKFILL BATHYMETRIC SURVEY PERFORMED BY FOTH INFRASTRUCTURE, INC., ENVIROCON, INC., AND NATURAL RESOURCE TECHNOLOGY, INC. IN JANUARY THROUGH APRIL 2013.
9. MW-1 WAS LOCATED BY ROBERT E. LEE & ASSOCIATES, INC. ON 04/30/13.

REVISION:	DATE:	APPD BY:
6.		
5.		
4.		
3.		
2.		
1.		
0.		

NATURAL RESOURCE TECHNOLOGY

PROJECT NO:	2098/3.3
DRAWN BY:	NWD 09/27/13
CHECKED BY:	EJT 09/27/13
APPROVED BY:	JMH 09/27/13

RESIDUAL SAND LAYER PLAN

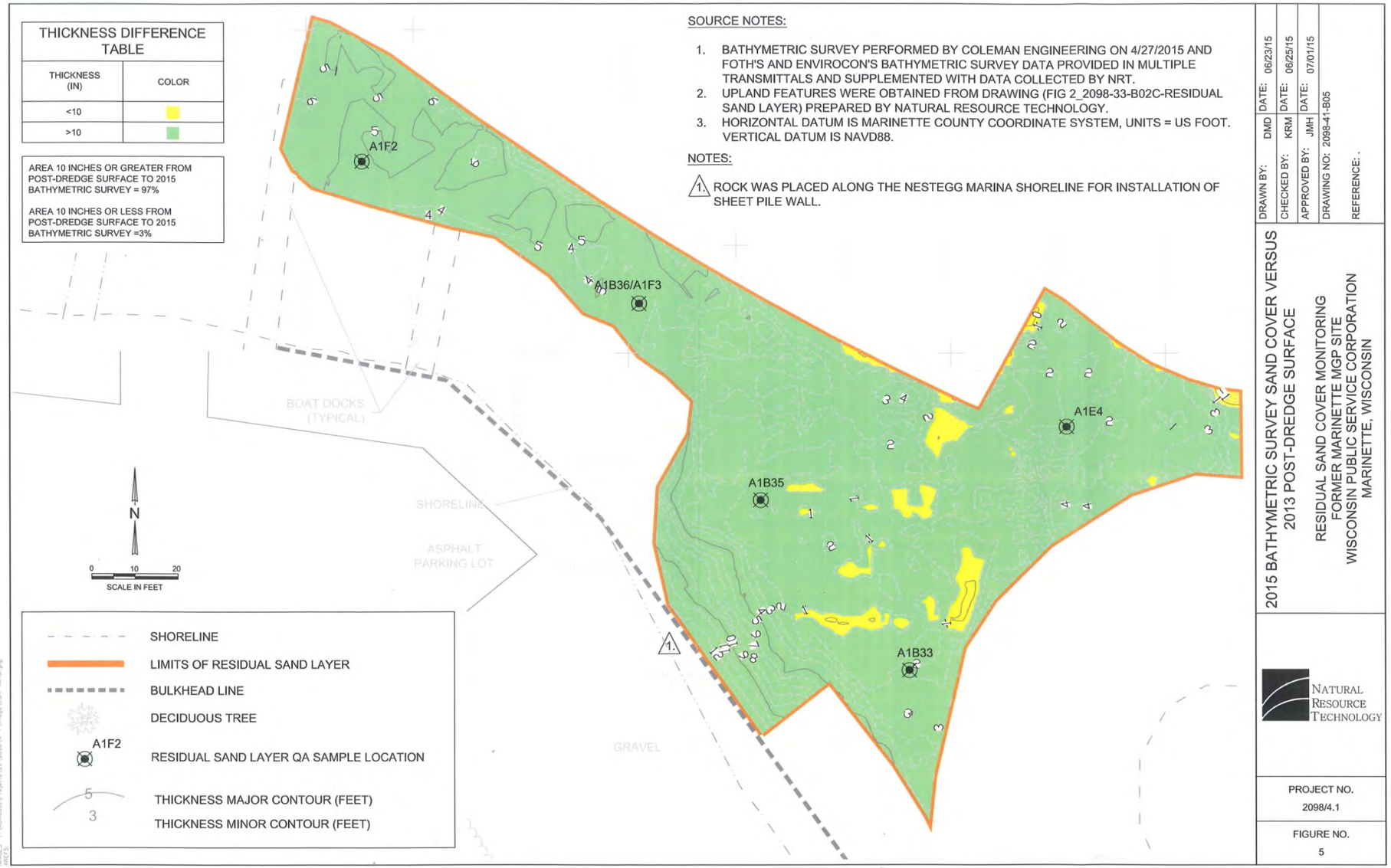
RESIDUAL SAND COVER MONITORING PLAN
FORMER MARINETTE MGP SITE
WISCONSIN PUBLIC SERVICE CORPORATION
MARINETTE, WISCONSIN

DRAWING NO: Sep 27, 2013 8:20am PLOTTED BY: ndraskovich SAVED BY: ndraskovich
I:\ACADdata\Projects\20\2098\3-3\FIG 2_2098-33-B02C-RESIDUAL SAND LAYER.dwg LAYOUT: IMAGES
XREFS: I:\ACADdata\Projects\20\2098\3-1\2098-31-BASEMAP-PRE-DREDGE BATHY AND

REFERENCE:

FIGURE NO. 2

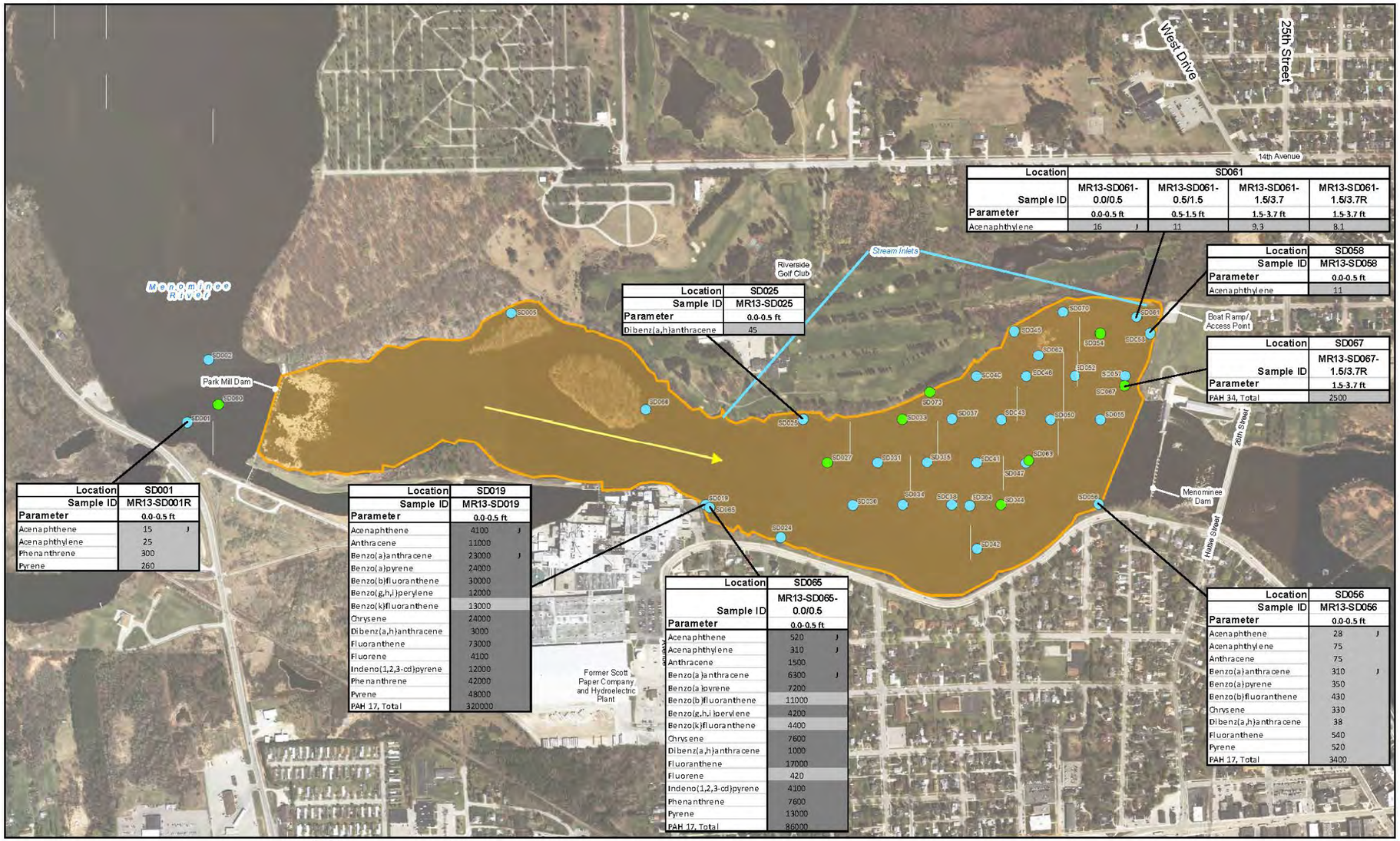
Map 8. Marinette MGP site sand cover bathymetry comparison (NRT, 2015).



Map 9. Menekaunee Harbor sand cover area (REL, 2015).

NO.	DATE	APPROV.	REVISION	NO.	DATE	APPROV.	REVISION	DRAWN TEH / CHECKED JGR / DESIGNED JGR	MENEKAUNEE HARBOR DREDGE CITY OF MARINETTE MARINETTE COUNTY, WISCONSIN	BENEFICIAL REUSE AREA AS-BUILT	DATE 05/27/15 / FILE / JOB NO. 37/75004	Robert E. Lee & Associates, Inc. ENGINEERING, SURVEYING, ENVIRONMENTAL SERVICES 1250 CENTENNIAL CENTRE BOULEVARD HOBART, WI 54155 PHONE:(920) 662-9641 INTERNET: www.releeinc.com FAX:(920) 662-9141	SHEET NO. 1

Map 10. Summary of detected PAH results, Lower Scott Flowage, Lower Menominee River AOC (CH2MHill, 2014).



Location	SD061			
Sample ID	MR13-SD061-0.0/0.5	MR13-SD061-0.5/1.5	MR13-SD061-1.5/3.7	MR13-SD061-1.5/3.7R
Parameter	0.0-0.5 ft	0.5-1.5 ft	1.5-3.7 ft	1.5-3.7 ft
Acenaphthylene	16 J	11	9.3	8.1

Location	SD058
Sample ID	MR13-SD058
Parameter	0.0-0.5 ft
Acenaphthylene	11

Location	SD067
Sample ID	MR13-SD067-1.5/3.7R
Parameter	1.5-3.7 ft
PAH 34, Total	2500

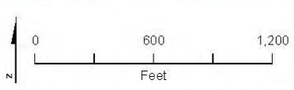
Location	SD025
Sample ID	MR13-SD025
Parameter	0.0-0.5 ft
Dibenz(a,h)anthracene	45

Location	SD001
Sample ID	MR13-SD001R
Parameter	0.0-0.5 ft
Acenaphthene	15 J
Acenaphthylene	25
Phenanthrene	300
Pyrene	260

Location	SD019
Sample ID	MR13-SD019
Parameter	0.0-0.5 ft
Acenaphthene	4100 J
Anthracene	11000
Benzo(a)anthracene	23000 J
Benzo(a)pyrene	24000
Benzo(b)fluoranthene	30000
Benzo(g,h,i)perylene	12000
Benzo(k)fluoranthene	13000
Chrysene	24000
Dibenz(a,h)anthracene	3000
Fluoranthene	73000
Fluorene	4100
Indeno(1,2,3-cd)pyrene	12000
Phenanthrene	42000
Pyrene	48000
PAH 17, Total	320000

Location	SD065
Sample ID	MR13-SD065-0.0/0.5
Parameter	0.0-0.5 ft
Acenaphthene	520 J
Acenaphthylene	310 J
Anthracene	1500
Benzo(a)anthracene	6300 J
Benzo(a)pyrene	7200
Benzo(b)fluoranthene	11000
Benzo(g,h,i)perylene	4200
Benzo(k)fluoranthene	4400
Chrysene	7600
Dibenz(a,h)anthracene	1000
Fluoranthene	17000
Fluorene	420
Indeno(1,2,3-cd)pyrene	4100
Phenanthrene	7600
Pyrene	13000
PAH 17, Total	86000

Location	SD056
Sample ID	MR13-SD056
Parameter	0.0-0.5 ft
Acenaphthene	28 J
Acenaphthylene	75
Anthracene	75
Benzo(a)anthracene	310 J
Benzo(a)pyrene	350
Benzo(b)fluoranthene	430
Chrysene	330
Dibenz(a,h)anthracene	38
Fluoranthene	540
Pyrene	520
PAH 17, Total	3400



Legend
- Analyzed for alkylated PAHs
- Analyzed for PAH-17
- Flow Direction
- Investigation Area

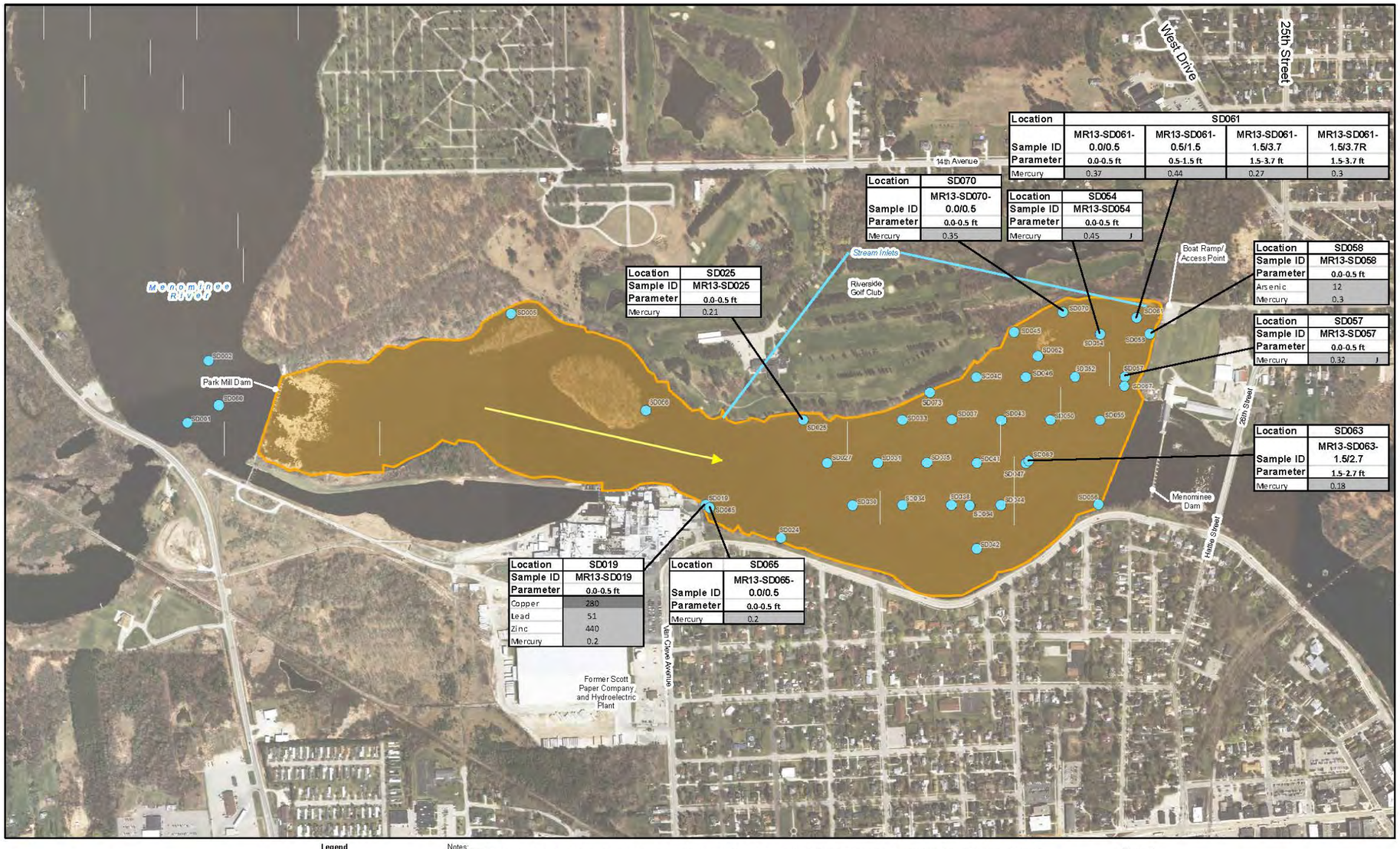
Notes:
1. Shading indicates the analyte was detected above Wisconsin Department of Natural Resources (WDNR) sediment quality guidelines threshold effect concentration (TEC).
2. Shading indicates the analyte was detected above WDNR sediment quality guidelines probable effect concentration (PEC).
3. Only compounds with detected concentrations exceeding the TEC or PEC are included on this figure.
4. All detected concentrations are reported in µg/kg.
5. J = Analyte is present at an estimated concentration between the method detection limit and reporting limit
6. -- = Sample was not analyzed for this constituent.
7. 2010 Aerial Photography
8. WDNR sediment quality guidelines TEC and PEC screening levels are summarized in Table 5

Figure 6
Summary of Detected PAH Results
Lower Scott Flowage
Menominee River AOC

I:\USENVIRONMENTALPROTE\MENOMINEERIVERLOWERSCOTTFLOWAGE\MAPFILES\SIREPORT\FIGURE 06 - SUMMARY OF DETECTED PAH RESULTS- FINAL.MXD JHANSEN1 8/4/2014 1:40:59 PM

CH2MHILL

Map 11. Summary of detected metals results, Lower Scott Flowage, Lower Menominee River AOC (CH2MHill, 2014).



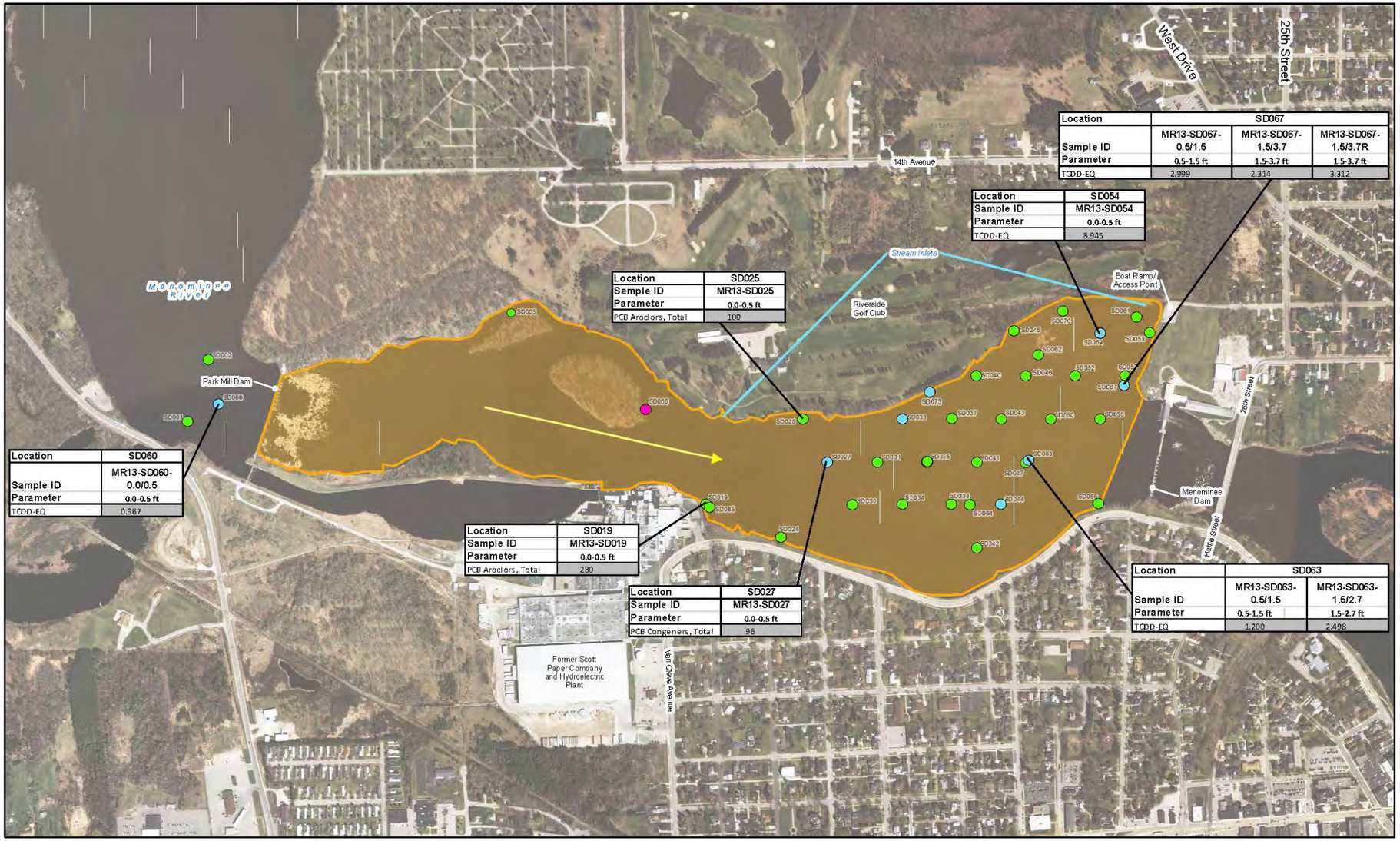
Notes:
1. Shading indicates the analyte was detected above Wisconsin Department of Natural Resources (WDNR) sediment quality guidelines threshold effect concentration (TEC).
2. Shading indicates the analyte was detected above WDNR sediment quality guidelines probable effect concentration (PEC).
3. Only compounds with detected concentrations exceeding the TEC or PEC are included on this figure.
4. All detected concentrations are reported in mg/kg.
5. J = Analyte is present at an estimated concentration between the method detection limit and reporting limit
6. 2010 Aerial Photography
7. WDNR sediment quality guidelines TEC and PEC screening levels are summarized in Table 5

Figure 7
Summary of Detected Metals Results
Lower Scott Flowage
Menominee River AOC

I:\USENV\RONMENTALPROTE\MENOMINEERIVERLOWERSCOTTFLOWAGE\MAPFILES\SIREPORT\FIGURE 07 - SUMMARY OF DETECTED METALS RESULTS - FINAL.MXD JHANSEN1 8/4/2014 2:01:36 PM

CH2MHILL

Map 12. Summary of detected Total PCB and TCDD-EQ results, Lower Scott Flowage, Lower Menominee River AOC (CH2MHill, 2014).



Notes:
1. Shading indicates the analyte was detected above Wisconsin Department of Natural Resources (WDNR) sediment quality guidelines threshold effect concentration (TEC).
2. PCB Arochlors, PCB congeners, and dioxins, were not detected at concentrations above WDNR sediment quality guidelines probable effect concentrations (PECs).
3. Only compounds with detected concentrations exceeding the TEC or PEC are included on this figure.
5. All Dioxin concentrations are reported in ngTEQ/kg.
6. All Total PCB (aroclors and congeners) are reported in µg/kg.
7. 2010 Aerial Photography
8. WDNR sediment quality guidelines TEC and PEC screening levels are summarized in Table 5.

Figure 8
Summary of Detected Total PCB and TCDD-EQ Results
Lower Scott Flowage
Menominee River AOC

CH2MHILL

I:\USENVIRONMENTAL\PROTE\MENOMINEERIVERLOWERSCOTTFLOWAGE\MAPFILES\SIREPORT\FIGURE 08 - SUMMARY OF DETECTED TOTAL PCB AND TCDD-EQ RESULTS - FINAL.MXD JHANSEN1 8/4/2014 2:33:43 PM

Map 13. Surficial sediment sampling locations in RVS, June 24th, 2014 (MDEQ, 2015).

APPENDIX D: Lower Menominee River AOC BUI Removal Criteria

Lower Menominee River AOC
Beneficial Use Impairment Restoration Targets
12/22/2008

Introduction

Areas of Concern (AOCs) were identified in the mid 1980's through work completed by the federal governments of the United States and Canada, in cooperation with state and provincial governments under the Great Lakes Water Quality Agreement (GLWQA). The 1987 amendments to the GLWQA further defined the Beneficial Use Impairments (BUIs). The BUIs in the Lower Menominee River AOC are primarily the result of historic industrial and municipal waste discharges leading to contaminated sediments and degradation to water quality. Some known ongoing contamination exists and these areas are currently in negotiations related to remedial actions. The primary industrial contaminants identified in the 1990 Lower Menominee River Remedial Action Plan (RAP) included paint sludge with associated heavy metals, PCBs, arsenic, and coal tars.

Data collected for the Wisconsin Department of Natural Resources (WDNR) and the Michigan Department of Natural Resources (MDNR) Fish Contaminant Monitoring Programs from 1976 through 1988 detected high levels of PCBs in carp and walleye resulting in fish consumption advisories beginning in 1986. These advisories resulted in the 1987 AOC designation. The BUIs identified for the Lower Menominee River AOC in the 1990 RAP are restrictions on fish consumption, degradation of benthos, restrictions on dredging activities, beach closings, degradation of fish populations, and loss of fish and wildlife habitat. Neither state has identified wildlife consumption advisories as a concern.

Purpose

The Great Lakes Regional Collaboration set a priority for having targets for delisting set for all BUIs by the end of 2008. Agency AOC program staff working with the Lower Menominee River AOC from the WDNR, Michigan Department of Environmental Quality (MDEQ), and United States Environmental Protection Agency (USEPA)-Great Lakes National Program Office (GLNPO) have cooperatively developed the following criteria for these BUIs based on the *Guidance for Delisting Michigan's Great Lakes Areas of Concern* and existing rules and criteria from Wisconsin. These targets are intended to guide local citizens, as well as state and federal agency staff, as they plan and work within the AOC. The states intend to jointly delist individual BUIs and the AOC. The AOC process for both states includes local citizen involvement.

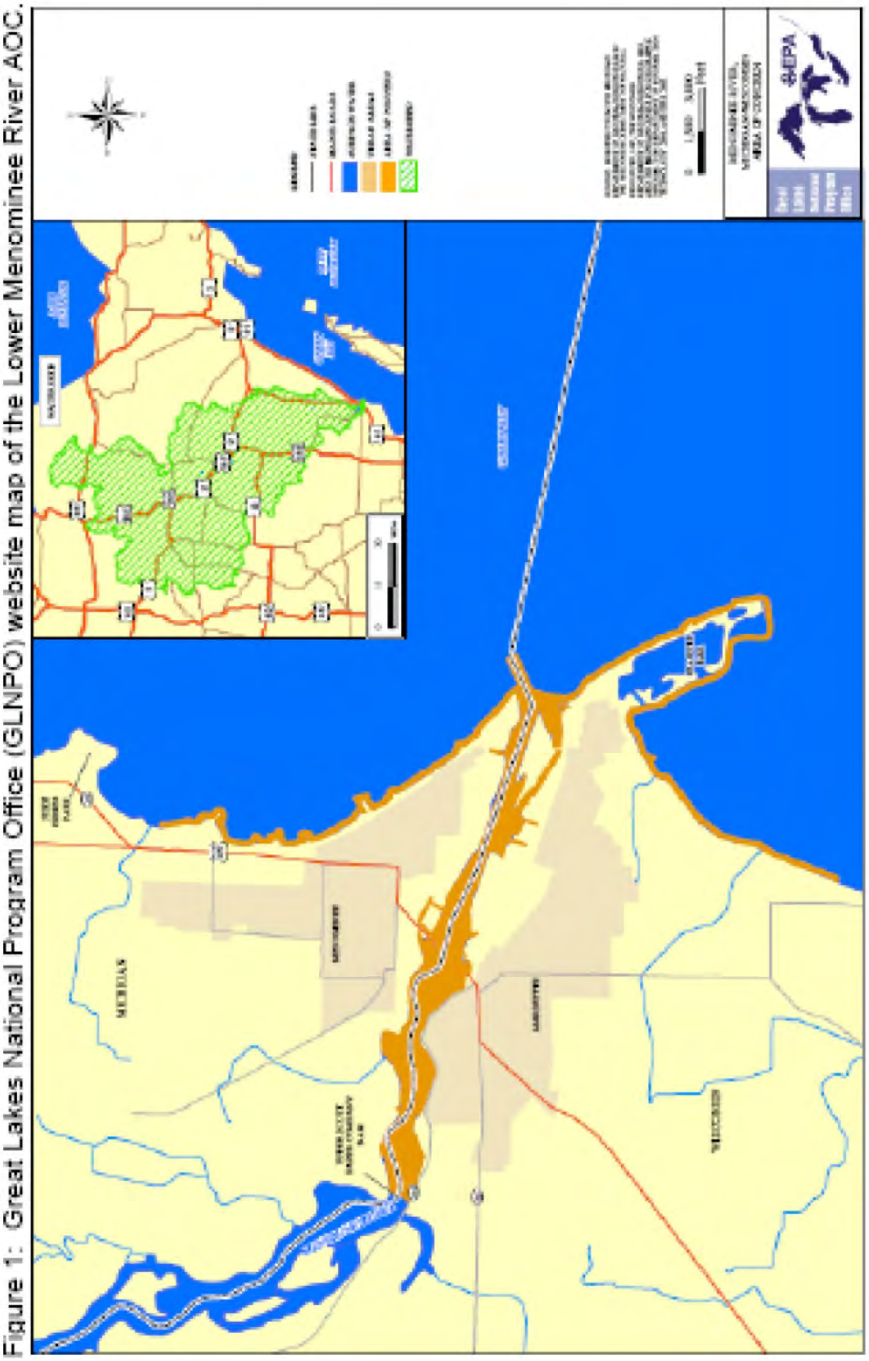


Figure 1: Great Lakes National Program Office (GLNPO) website map of the Lower Menominee River AOC.

Restrictions on Fish and Wildlife Consumption

Restoration Target for Restrictions on Fish Consumption for Michigan and Wisconsin

This BUI will be considered restored when:

- Sources of PCBs, mercury, and dioxins within the AOC have been controlled or eliminated; and
- Waters within the Lower Menominee River AOC are no longer listed as impaired due to PCB or dioxin fish consumption advisories in the most recent Impaired Waters (303(d)) list for either state; or
- Fish tissue contaminants causing advisories in the AOC are the same or lower than those in the associated Great Lake or appropriate control site.

Degradation of Fish Populations and *Loss of Fish and Wildlife Habitat*

Restoration Target for Degradation of Fish Populations & Loss of Fish and Wildlife Habitat Beneficial Use Impairments

> The Degradation of Fish Populations BUI and Loss of Fish and Wildlife Habitat BUI are interrelated; consequently, the delisting of these two BUIs will be addressed together.

These two BUIs will be considered restored when: A local fish and wildlife habitat management and restoration plan has been developed and implemented for the Lower Menominee River AOC that:

- Defines the causes of fish and wildlife population and habitat impairments within the AOC
- Establishes site specific habitat and population objectives for fish and wildlife species within the AOC
- Identifies fish and wildlife population restoration programs and activities within the AOC and establishes a mechanism to assure coordination among states and programs for assessment monitoring, implementation activities and associated monitoring
- The programs and actions necessary to accomplish the recommendations are identified in the fish and wildlife management and restoration plan are implemented
- Monitoring conducted according to the Fish and Wildlife Plan shows consistent improvement in the quality and quantity of habitat or populations identified in the plan

Removal of this BUI will be based on achievement of implementation of actions in the steps above, including monitoring conducted according to site plans and showing consistent improvement in quantity or quality of habitat or populations addressed in the criteria. 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 AOCs may be reported and evaluated as long as the reports contain all the elements above.

The habitat or population restoration plan will determine the type and extent of the restoration necessary to address habitat loss or population degradation issues identified in the RAP or other key documents. Sources of water quality contamination contributing to specific habitat or population degradation must be controlled before habitat or population restoration efforts in that area are conducted. In some circumstances, habitat degradation is actually contributing to water quality problems, rather than vice versa. In those instances, the workplan should discuss this issue and the remedial actions should be targeted accordingly.

Beach Closings / Recreational Restrictions

Restoration Target for Beach Closings and Recreational Use Restrictions:

This BUI will be considered restored when:

1. No waterbodies within the AOC are included on the list of non-attaining waters due to contamination with pathogens in the most recent Clean Water Act Water Quality and Pollution Control in either states: Section 303(d) and 305(b) Integrated Report (Integrated Report), which are submitted to U.S. EPA every two years.

2. OR, in cases where the waterbodies within the AOC are on the list of non-attaining waters due to the presence of Combined Sewer Overflows (CSOs) or are impacted by upstream CSOs, this BUI will be considered restored when CSOs have been eliminated or are being treated.

3. OR, in cases where CSOs still exist and significant progress has been made towards their elimination or treatment, this BUI will be considered restored when:

   - All known sources of bacterial contamination to the AOC originating in the AOC and tributary watersheds have been controlled or treated to reduce exposures; and
   - No unpermitted sanitary sewer overflows have occurred within the AOC during the previous five year period as a result of a less than 25-year precipitation event or snow/ice melt conditions; and
   - Marinette, WI and Menominee, MI have adopted and are implementing storm water reduction programs including an illicit discharge elimination program

Degradation of Benthos

Restoration Target for Degradation of Benthos Beneficial Use Impairment

This BUI will be considered restored when:
All remediation actions for known contaminated sediment sources are completed and monitored according to the approved plan and have met their remedial action goal.

Restrictions on Dredging Activities

Restoration Target for Restrictions on Dredging Use Impairment

This BUI will be considered restored when:

- All remediation actions for known contaminated sediment sources are completed and monitored according to the approved remediation plans and the remedial action goals have been achieved; and
- An AOC dredge management plan is developed by the communities and agencies that includes an evaluation of:
  - Restrictions that must remain in place to protect human health and the environment
  - Restrictions that must remain in place due to RCRA requirements that are based upon state and federal law
  - Priority areas for navigational use
  - Priority areas for utility dredging, e.g. utility crossings
  - Identify costs and funding options for removing dredging restrictions in priority areas

Contacts

Steve Galarneau, WDNR
920-892-8756 ext. 3052
Stephen.Galarneau@Wisconsin.Gov

Sharon Baker, MDEQ
517-335-3310
Bakers9@michigan.gov

John Perrecone, USEPA
312-353-1149
Perrecone.John@epa.gov

APPENDIX E: Technical Advisory Committee Meeting Minutes and Citizens Advisory Committee Letter of Support

Technical Advisory Committee Meeting Minutes

Lower Menominee River Area of Concern
Technical Advisory Committee Meeting
August 24th, 2016, 1:00 – 3:00 pm CST
WDNR Service Center, 101 N Ogden Rd, Peshtigo, WI
Minutes prepared by Laurel Last

Meeting Objectives

- The TAC discusses the revised draft Degradation of Benthos BUI removal document and approves moving forward with stakeholder review process
- The TAC discusses the draft Restrictions on Dredging BUI removal document and approves moving forward with stakeholder review process
- The TAC discusses the draft 2015 RAP Status Report
- The TAC is updated on the status of the Fish Consumption BUI
- The TAC is updated on AOC habitat restoration and monitoring projects

Attendees
Sharon Baker (MDEQ), Cheryl Bougie (WDNR), Mike Bryant (USEPA-GLNPO), Steve Choy (USFWS), Mike Donofrio (WDNR), David Halfmann (WDNR), Laurel Last (WDNR), Conor Neal (USEPA), Tammie Paoli (WDNR), Vic Pappas (WDNR)

Introductions and review of the agenda

Draft Degradation of Benthos BUI removal package – Laurel Last (WDNR) and Sharon Baker (MDEQ)

- Laurel went over changes since last draft responding to TAC and EPA comments
- Added table of contents, but did not add executive summary
- TAC supported executive summary, so Laurel will add that for public review draft
- Two draft sediment remediation site summary tables discussed at last meeting have been combined into one table (in both Benthos and Dredging BUI documents)
- Sharon suggested adding Ansul arsenic salt pile cleanup to table
- Laurel shared draft TAC letter of support for BUI removal package
- **TAC supported moving forward with BUI removal, but decided not to provide letter of support (meeting minutes will suffice)**
- Proposed schedule for review and BUI removal
  - Tonight, CAC reviews and approves (letter of support)
  - Revised draft out for public comment September 8th -22nd
    - Will post on WDNR AOC website
    - WDNR will send announcements via e-mail and GovDelivery; CAC members will contact local papers and radio station
    - Sharon—MDEQ announcement will point to WDNR site
    - Send comments to Laurel
  - Public can also provide input at CAC Open House September 15th

  - BUI documents will be available for review
  - BUI fact sheet and feedback forms
- Plan to respond to comments and submit final package to EPA by September 30th

Restrictions on Dredging BUI removal package – Cheryl Bougie (WDNR)

- Cheryl provided overview of draft Dredge Management Plan / Restrictions on Dredging BUI removal package
- Only area in AOC with dredge restrictions is along shoreline near Boom Landing--reactive core mat barrier at WPSC site (not priority area for navigational dredging)
- TAC members asked questions and provided input on draft
- Mike D—Will USACE dredge turning basin again? Cheryl—Yes, if/when needed in future. Sand cover is 2 ft below authorized depth, will not be a problem.
- Dave H—What is thickness of Tyco sand cover? Cheryl—12 in sand cover
- Need more information on Green Bay paint sludge site—Sharon will send to Cheryl
- Sharon—Have her secretary review document before final version is routed to EPA for concurrence
- Tammie—Tyco bought out by Johnson Controls, might result in name change (later)
- **TAC supported moving forward with BUI removal, but decided not to provide letter of support (meeting minutes will suffice)**
- Proposed review schedule is same as for Benthos BUI (see above), except can take longer to finalize and send to EPA for concurrence

2015 RAP Status Report – Sharon Baker and Laurel Last

- Draft out for stakeholder review—today (24th) is deadline for comments
- Laurel brought current draft and described changes in response to comments
- TAC members discussed draft and provided one editing comment
- TAC supported document

Restrictions on Fish Consumption BUI update – Sharon Baker and Laurel Last

- MDEQ (Joe Bohr) and MDHHS (Michelle Bruneau) completed revised fish consumption report and white paper
- We will refer to these documents in the BUI removal package
- We plan to move forward with this BUI for potential removal later this year or early next year

South Channel Habitat Project Update – Laurel Last and Cheryl Bougie

- Aquatic Ecological Services (AES) began on-site work August 17th
- Conducting herbicide applications and various project startup items
- Plan to be substantially complete by October 31st, with possibly some additional plantings in spring
- Monitoring and maintenance period through 2019

Menekaunee Harbor Project Update – Cheryl Bougie and Laurel Last

- Aquatic Ecological Services (AES) is conducting maintenance of original project area
- Monitoring and maintenance period through 2018
- AES is also working on controlling invasive plants in additional restoration zone east and southeast of original project area (using available funding)

Lower Menominee River Fish Passage Update – Mike Donofrio (WDNR)

- Contractor hired for downstream passage at Menominee Dam
- Construction has started, and should to be complete by November
- Mike and Paul Radzikinas (ECRE) will host table at AOC Open House

Island Rookery Habitat Enhancement Project update – Laurel Last

- Shared 2016 project summary handout from Ecology & Environment (E&E)
- E&E will host a table at the AOC Open House (September 15th)
- Discussed potential island project tour for CAC and TAC members
  - Week of Open House convenient for out-of-town folks
  - Could use Fisheries boats
  - Laurel will coordinate with E&E, Mike D, and Cheryl

Fish populations reference site monitoring update – Laurel Last

- Ben Uvaas (WDNR) volunteered to analyze fish monitoring data from lower Menominee River, Peshtigo River, and Escanaba River to determine whether target species are meeting population/recruitment objectives
- When Ben has completed analysis, Laurel will convene fish team to discuss results and decide next steps

Other News

- AOC Open House 6-8 pm September 15th at UW-Marinette
- Menekaunee Harbor tour 5 pm before the Open House
- Waterfront Cleanup planned for September 17th will likely be postponed until next spring (CAC to discuss tonight)
- Proposed expansion of restricted area around Marinette Marine Corp. Shipyard—Laurel passed around proposal

Future Agenda Items and Next Meeting Date

- Next meeting date—did not discuss, but Sharon and Laurel will plan as needed
- Potential Agenda Topics for next meeting
  - Degradation of Benthos BUI removal progress/status
  - Restrictions on Dredging BUI removal progress/status
  - Restrictions on Fish Consumption BUI
  - 2015/2016 RAP Update
  - Updates on habitat and monitoring projects

Contact information

Laurel Last, Wisconsin DNR
Laurel.last@wisconsin.gov
920-662-5103

Sharon Baker, Michigan DEQ
BakerS9@michigan.gov
517-284-5044

Michael Bryant, EPA Area of Concern Task Force Leader
Bryant.Michael@epa.gov
312-886-5266

ONLINE RESOURCES

EPA – http://www.epa.gov/grtlakes/aoc/menominee/index.html

MDEQ – http://www.michigan.gov/deq/0,1607,7-135-3313_3677_15430_57388---,00.html

WDNR – http://dnr.wi.gov/topic/greatlakes/menominee.html

CAC – https://www.facebook.com/menomineeriveraoc

2014 RAP Update available

http://dnr.wi.gov/topic/greatlakes/documents/Menominee2014RAPUpdate.pdf

2013 F&W Plan available

http://dnr.wi.gov/topic/greatlakes/documents/Menominee2013FishAndWildlifePlan.pdf

Citizens Advisory Committee Letter of Support

\

Lower Menominee River Remedial Action Plan
Citizens Advisory Committee

LOWER MENOMINEE RIVER REMEDIAL ACTION PLAN

The Lower Menominee River: A Great Lakes Area of Concern

October 20, 2016

Laurel Last
Lower Menominee River AOC Coordinator
Wisconsin Department of Natural Resources
2984 Shawano Ave
Green Bay, WI 54313

Sharon Baker
Lower Menominee River AOC Coordinator
Constitution Hall 6FS
525 West Allegan
PO Box 30473
Lansing, MI 48909

Subject: Support for Lower Menominee River AOC Degradation of Benthos BUI removal

Dear Ms. Last and Ms. Baker:

The Lower Menominee River Area of Concern (AOC) Citizens Advisory Committee (CAC) supports the efforts of the Wisconsin Department of Natural Resources (WDNR) and the Michigan Department of Environmental Quality (MDEQ) to remove the Degradation of Benthos Beneficial Use Impairment (BUI) from the Lower Menominee River AOC.

The Lower Menominee River AOC community has partnered with local, state, and federal agencies, businesses, and volunteers over the years to clean up toxic sediments in the AOC. Sediment remediation projects have been completed at the Green Bay paint sludge site, the Wisconsin Public Service Corp. coal tar site, the Ansul/Tyco arsenic site, and Menekaunee Harbor.

The projects are being monitored according to their approved plans and are meeting their respective goals. In addition, sediment assessments in the Lower Scott Flowage and Rio Vista Slough show that no remediation is needed at those sites. Therefore, the sediment contamination that was degrading the benthos in the AOC has been addressed and restoration targets for this impairment have been met. We concur that the Degradation of Benthos impairment has been adequately addressed and we are prepared to celebrate the removal of this BUI.

We appreciate all that the WDNR, MDEQ, EPA, and other partners have done to help achieve this goal.

Respectfully Submitted,

Keith West
CAC Wisconsin Co-Chair
keith.west@uwc.edu

Mark Erickson
CAC Michigan Co-Chair
merickson@lloydflanders.com

APPENDIX F: Open House News Release, Marinette Eagle Herald 9/10/16

DNR seeking public comment

MARINETTE — The Wisconsin Department of Natural Resources is inviting the public to review and comment on the proposed removal of two beneficial use impairments listed for the Lower Menominee River Area of Concern.

Information about the proposal will be presented at a public meeting Thursday. Steve Galarneau, director of DNR's Office of the Great Lakes, will be keynote speaker at an open house hosted by the Lower Menominee River Area of Concern Citizens Advisory Committee from 6-8 p.m., at UW-Marinette in the cafeteria, 750 W. Bayshore St. The event will provide an overview of the work being done to restore the waterway and an opportunity to ask questions about the proposed removal of the two impairments. A walking tour of the Menekaunee Harbor Restoration Project will take place at 5 p.m. before the open house. To join in the tour, meet at the parking lot southwest of the harbor off Ogden Street.

Information about the impairments and an explanation of the progress that has been made as part of ongoing restoration efforts can be found on DNR's website,dnr.wi.gov, by searching "Lower Menominee River." The documents for public comment that describe the proposed removal can be found at http://dnr.wi.gov/topic/greatlakes/menominee.html.

People may submit comments to Laurel Last, 2984 Shawano Ave., Green Bay, WI 54313 or laurel.last@wisconsin.gov by 5 p.m., Sept. 22. Questions about the draft removal packages may be directed to Last via email or to 920-662-5103.