2012 STAGE 2 REMEDIAL ACTION PLAN UPDATE

for the

LOWER MENOMINEE RIVER AREA OF CONCERN

December 30, 2012

Wisconsin Department of Natural Resources
Office of the Great Lakes

Michigan Department of Environmental Quality
Office of the Great Lakes

2012 Stage 2 Remedial Action Plan Update
for the
Lower Menominee River Area of Concern

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Cover Photo:
A family enjoys the beach at Red Arrow Park, courtesy WDNR.

Disclaimer

The Great Lakes Water Quality Agreement (GLWQA) is a non-regulatory agreement between the United States and Canada which describes the commitment of each country to restore and maintain the chemical, physical, and biological integrity of the Waters of the Great Lakes and their intention to prevent further pollution and degradation of the Great Lakes Basin Ecosystem (GLWQA Protocol, 2012). The actions identified in this document are needed to meet beneficial use impairment (BUI) removal targets leading to the delisting of the Lower Menominee Area of Concern. These actions are not subject to enforcement or regulatory actions. Implementation of the recommendations described within should result in water quality and habitat benefits.

The actions identified in this 2012 Stage 2 Remedial Action Plan Update do not constitute a list of preapproved projects, nor is it a list of projects simply related to BUIs or generally to improve the environment. Actions identified in this document are directly related to removing a BUI and are needed to delist the Area of Concern.

Acknowledgments

We, the Wisconsin Department of Natural Resources and the Michigan Department of Environmental Quality, would like to acknowledge the many contributions of members of the Lower Menominee River Area of Concern (AOC) Citizen's Advisory Committee (CAC) and Technical Advisory Committee (TAC) in the development of this 2012 Stage 2 Remedial Action Plan (RAP) Update, development of the Fish and Wildlife Population and Habitat Management Plan, previous RAPs, and development of public outreach materials and activities. CAC and TAC collaboration with state and federal agencies has resulted in materials and activities which reflect local issues and concerns.

EXECUTIVE SUMMARY

The Wisconsin Department of Natural Resources (WDNR) and the Michigan Department of Environmental Quality (MDEQ) share oversight of the Lower Menominee River Area of Concern (AOC). The *1990 Lower Menominee River Remedial Action Plan* (RAP) and the *1996 Lower Menominee River RAP Update* describe the historical activities that led to AOC designation, identify the beneficial use impairments (BUIs) for the AOC, summarize the status of those impairments, and offer recommendations for meeting environmental cleanup goals. The *2011 Lower Menominee River Stage 2 RAP* outlines a strategic plan for the removal of remaining BUIs, and is the primary tool needed to delist the AOC. The purpose of the *2012 Stage 2 Lower Menominee River RAP Update* is to document progress made for the remaining BUIs since the 2011 Stage 2 RAP and their current status. Please review the 1990 and 1996 RAP documents and 2011 Stage 2 RAP for more information.

Six of the potential fourteen BUIs were identified in the Lower Menominee River when it was designated an AOC. Significant upgrades to the City of Marinette's and City of Menominee's wastewater treatment plants have resulted in removal of the "restrictions on recreational contact" impairment, leaving only five impairments to be addressed (WDNR, MDEQ, 2011). Remaining impairments include: restrictions on dredging, degradation of benthos, restrictions on fish consumption, degradation of fish and wildlife populations, and loss of fish and wildlife habitat. Most of the impairments are influenced by the presence of contaminated sediment (Table 1). Arsenic, paint sludge, and coal tar, have been identified as the three most significant contaminants, although other more minor sediment contaminants exist. Log driving, urbanization, invasive species, habitat fragmentation, and stormwater discharges also contribute to the impairments. The cause(s) of the restrictions on fish consumption BUI is currently under investigation.

Much progress has been made toward restoring the Lower Menominee River AOC relating to contaminated sediment. Paint sludge remediation was completed in 1995 by the Lloyd Flanders Furniture Company through Michigan Act 307 authority (WDNR, MDNR 1996). Remediation of the Ansul arsenic contaminated sediment site is underway. Ansul must finish work by November, 2013, to conform with the Administrative Order on Consent (USEPA, 2007). Remediation of the Wisconsin Public Service Corporation (WPSC) coal tar site is underway, and will likely be completed by early 2013. The City of Marinette and WDNR have entered into a cost share agreement to remove legacy contaminated sediment from Menekaunee Harbor. However, work is yet to begin due to inadequate funding related to unforeseen costs.
The semi-permeable membrane device (SPMD) study was completed in 2012, detecting some net uptake of PCBs just downstream of the Menominee Dam, and narrowing the search for potential sources of the restrictions on fish consumption.

To remove all impairments, activities beyond the remediation of contaminated sediment sites are also required. State agencies working with the Citizen's and Technical Advisory Committees have drafted the *Fish and Wildlife Population and Habitat Management and Restoration Plan*. This plan is the principal document needed to guide the removal of the "degradation of fish and wildlife populations" and "loss of fish and wildlife habitat" impairments. Construction has begun on phases one and two of the fish passage project.

Significant milestones likely to be reached in 2013 include: completion of sediment remediation at the Ansul arsenic and WPSC coal tar sites; obtaining results from sediment characterization

in the Lower Scott Flowage; completion of phases one and two of the fish passage project; and recommendations from the Fish Consumption Advisory Assessment and Fish Data Roundup activities.

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List of Acronyms

AOC	Area of Concern
BUI	Beneficial use impairment
CAC	Citizen's Advisory Committee
CSO	Combined sewer overflow
FERC	Federal Energy Regulatory Commission
GLNPO	Great Lakes National Program Office
GLRI	Great Lakes Restoration Initiative
GLWQA	Great Lakes Water Quality Agreement
LaMP	Lakewide Management Plan
MDCH	Michigan Department of Community Health
MDEQ	Michigan Department of Environmental Quality
MDNR	Michigan Department of Natural Resources
NAH	North American Hydro
NAPL	non-aqueous phase liquid
NOAA	National Oceanic and Atmospheric Administration
NTCRA	Non-time critical removal action
PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyls
ppm	Parts per million
RAP	Remedial Action Plan
SPMD	Semi-permeable membrane device
TAC	Technical Advisory Committee
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey
WDNR	Wisconsin Department of Natural Resources
WPSC	Wisconsin Public Service Corporation

DEFINITIONS

Acceptable Species List- Selected from species found to be dominant in at least one natural area surveyed during the riparian vegetation survey in 2011. Acceptable species include all native and several naturalized species. Several species found on this list are considered only moderately beneficial to the ecosystem; therefore this list is titled "acceptable" instead of "desirable".

Area of Concern (AOC)- Defined by Annex 2 of the 1987 Protocol to the U.S.-Canada Great Lakes Water Quality Agreement (GLWQA) 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 Great Lakes Water Quality Agreement as a reduction in the chemical, physical, or biological integrity of the waters of the Great Lakes sufficient to cause impairment to designated use. The Menominee 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, supplying drinking water and providing habitat for fish and wildlife are both beneficial uses of a water body. If a beneficial use is suppressed or unavailable due to environmental problems, like restrictions on dredging, 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 Great Lakes Water Quality Agreement.

Delisting 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 Citizen's 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.

Goal- Goals are broad ideas that may take a long time to achieve. They usually don't change significantly over the life of a project. An example goal statement is, "*Nesting populations of a diverse array of wetland-dependent and riparian-associated birds are consistently present within the AOC."* The delisting targets for the impairments may also be considered the goal statements (in some cases they may be objectives).

Lakewide Management Plan (LaMP)- A Lakewide Management Plan, or "LaMP", is a plan of action to assess, restore, protect and monitor the ecosystem health of a Great Lake. It is used to coordinate the work of all the government, tribal, and non-government partners working to

improve the Lake's ecosystem. A public consultation process is used to ensure that the LaMP is addressing the public's concerns.

Natural Areas- An area that currently has value as fish and wildlife habitat or has the potential to be restored so that it has value as fish and wildlife habitat. Natural areas can be publically or privately held, and can include wetlands or riparian lands within the AOC. Natural areas are not necessarily formally designated State Natural Areas.

Objective- Objectives are the detailed and quantitative activities that are needed in order to meet goals. Objectives are normally accomplished in less time than goals. They are important because they provide a means of measuring progress toward plan implementation. Objectives should be SMART: Specific, Measurable, Achievable, Realistic, Time-constrained.

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.

Ponar Dredge Sampler- A device used to sample sediments from deep flowing waters which essentially takes a bite out of the surficial sediments. These sediments can be analyzed for chemical composition, sediment consistency, particle size distribution, and benthic organisms.

Project- Also referred to as activity. As defined for this document, a project is a specific activity that has been defined with enough detail to understand who will do the work, how it will be done, and where it will be done. The end result of the activity should be visible and concrete. One or more projects may be identified as needed to meet the goals and objectives for the impairments, or an activity might impact more than one BUI. With this definition, "Coordinating with partners to make sure data is consistently collected and used" would not be a project. However, "XY Agency will host a data symposium and write a set of standards for data collection and analysis for the AOC." would be a project.

Protected- A parcel may be considered "protected" by any agreement, ordinance, easement, or management plan which significantly limits the degradation of that parcel's value as fish or wildlife habitat for an approved length of time.

Semi-Permeable Membrane Device (SPMD)- SPMDs are used as passive bio-accumulators in aquatic, sediment, and air environments to measure trace concentrations of organic lipophilic (mixing more easily with oils than water) environmental contaminants like PCBs, PAHs, and organochlorine pesticides when placed in the water column. An SPMD is composed of "lay flat," low-density polyethylene tubing containing a thin film of a pure, high-molecular weight lipid (triolein). The tubing allows for selective diffusion of hydrophobic (water hating) organic chemicals into the lipid (Huckins et al., 1993). The gel matrix is extracted from the tubing and analyzed for contaminants. Because SPMDs bio-accumulate contaminants, they are a cheaper and simpler way to sample water-borne contaminants than the traditional caged fish study to meet sampling needs. Testing has shown that the SPMD's contaminant accumulation

concentrations track similarly to those concentrations found in caged fish. The advantage of using SPMDs is that they cannot metabolize the sequestered (absorbed) compounds, are site specific to where they were suspended, easy to extract, do not need to eat, and the "test subject" will not overdose and die from the contaminants present.

Undesirable Species List- Used for the riparian vegetation survey. Selected from species found to be dominant in at least one natural area surveyed during the riparian vegetation survey in 2011. Undesirable species include non-native and invasive species. Several species are considered prohibited or restricted species according to Wisconsin State Statute NR 40. Management activities will reduce populations of these species in protected natural areas to meet restoration objectives.

Figure A. Lower Menominee River Area of Concern (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 5 miles east from Seagull Bar.

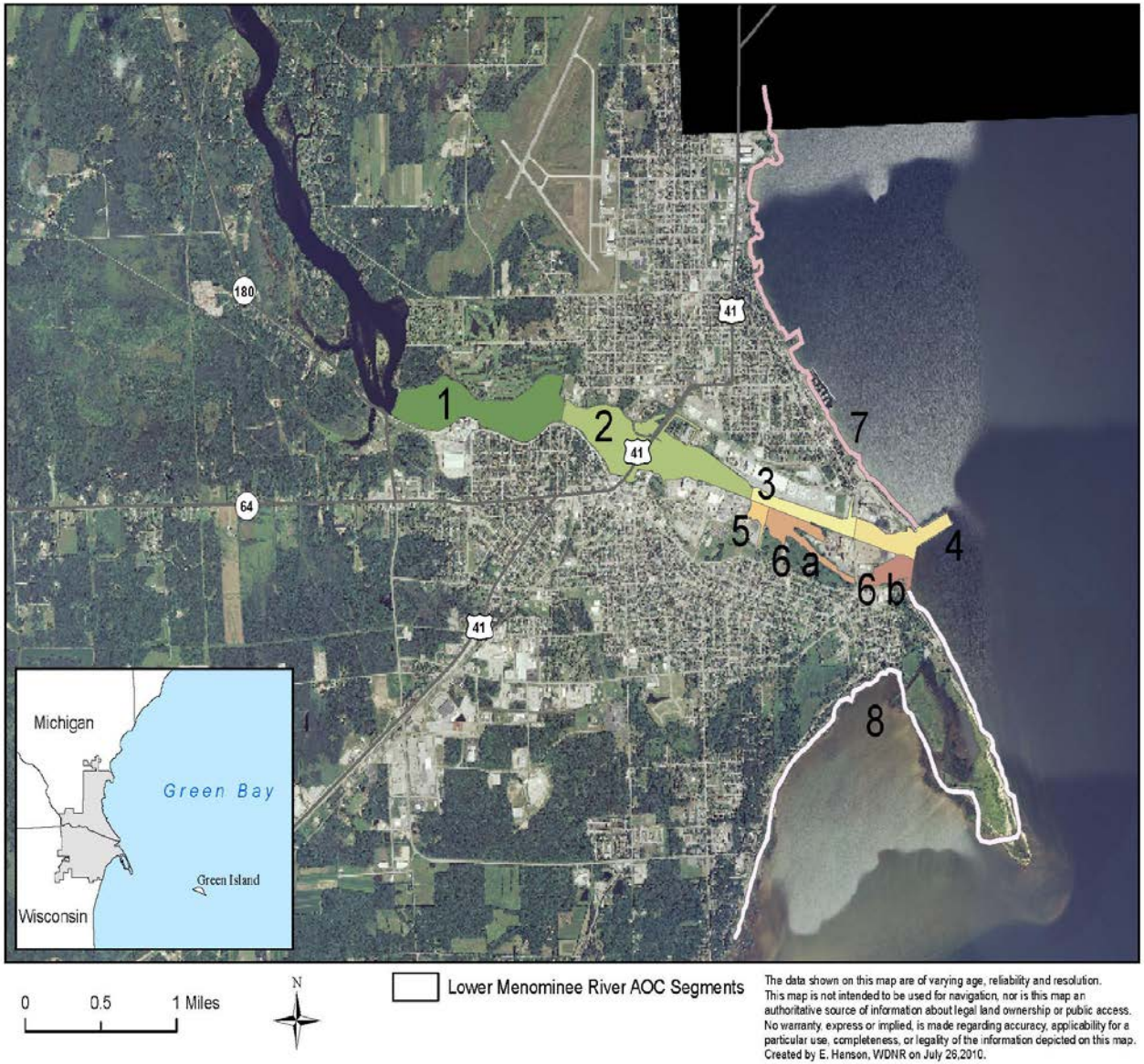

Figure B. Segment Map of the Lower Menominee River Area of Concern. Green Island, seen in the map inlay, has not been assigned a segment number.

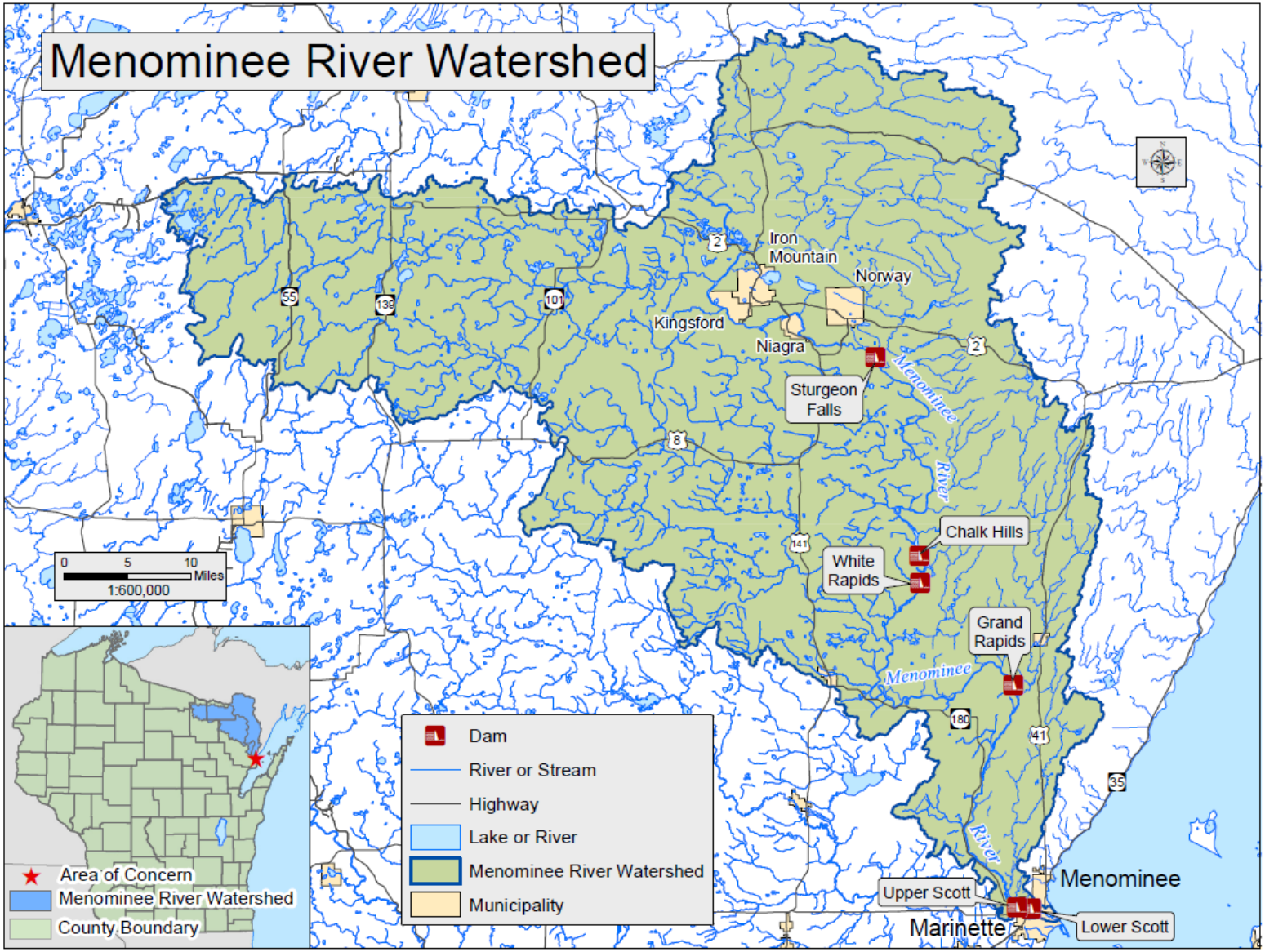

Figure C. Menominee River Watershed including tributaries and dams as they pertain to the Fish Passage Project. The Upper and Lower Scott Dams are commonly referred to as the Park Mill Dam and Menominee or Bridge Street Dams respectively.

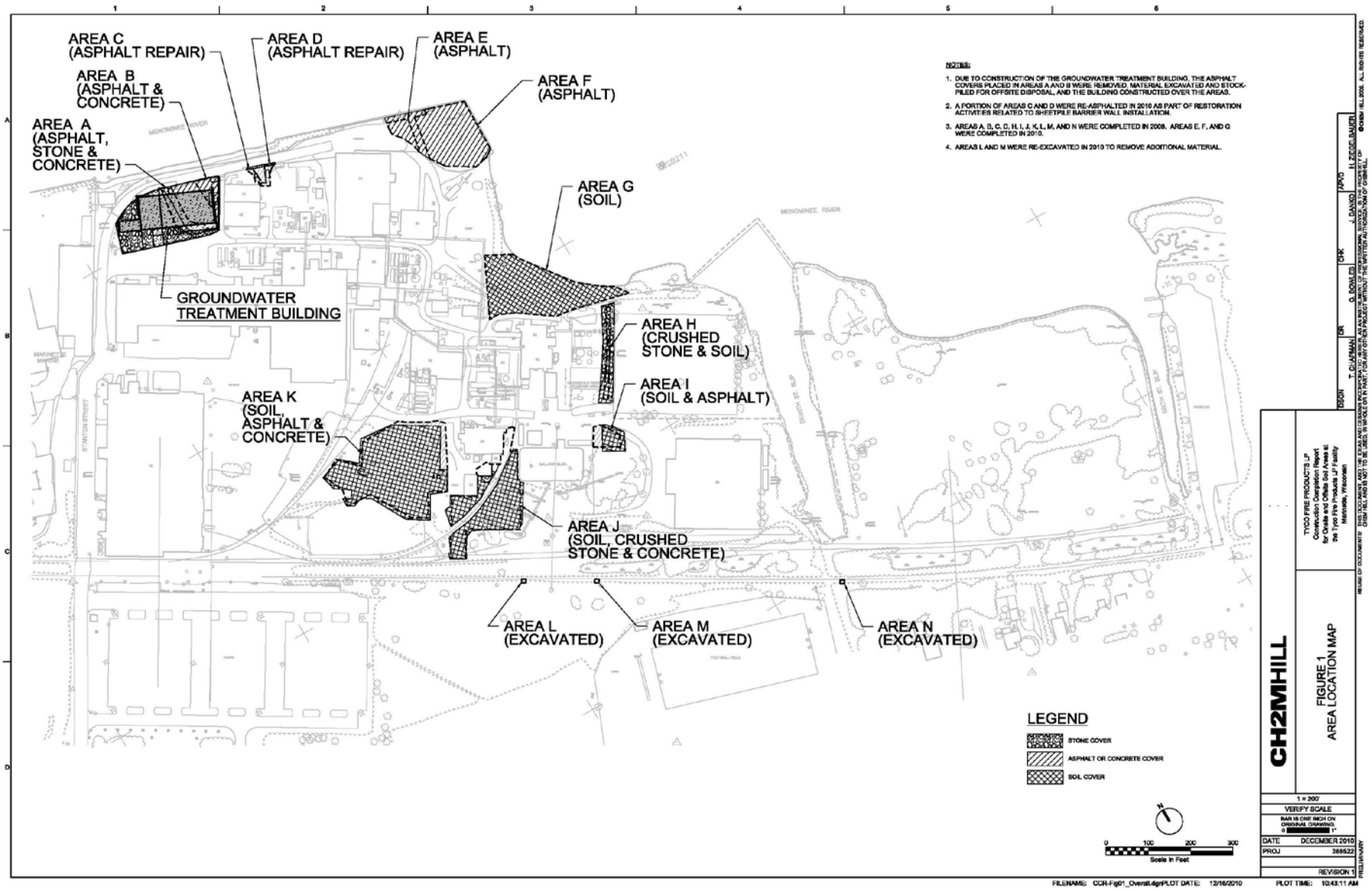

Figure D. Ansul Site, locations of upland soil remedies.

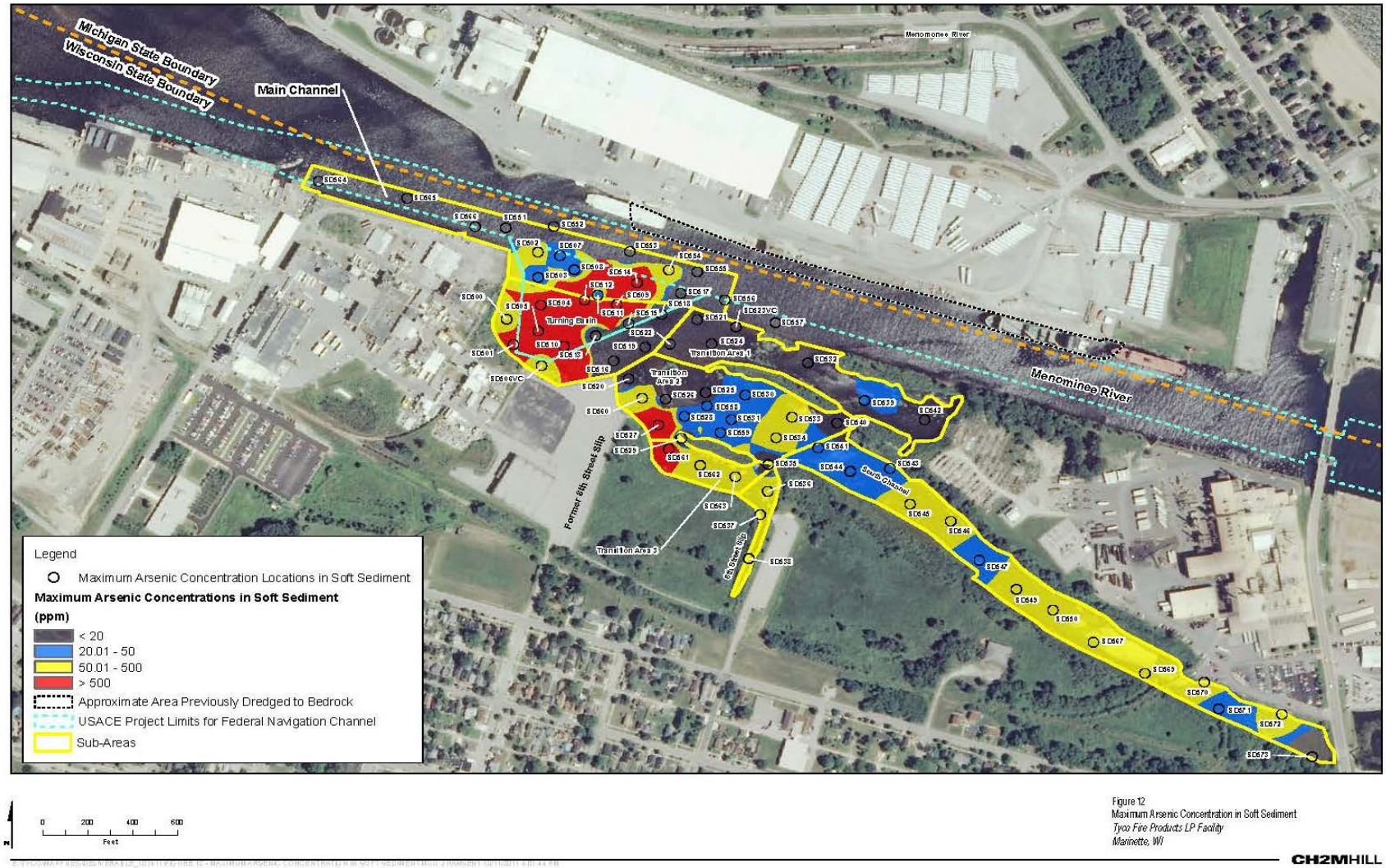

Figure E. Ansul Site, sediment arsenic concentrations in shallow "soft sediment." Numbers correspond to sample identification numbers, arsenic concentrations in parts per million located on the legend. Rationale behind displayed contours: 0-20 ppm considered safe and no action is required, 20.01-50 ppm monitored natural recovery is required to a value <20 ppm by 11/01/2023, 50.01-500 ppm must be removed and properly disposed of, >500 ppm considered hazardous waste and must be removed and properly disposed of.

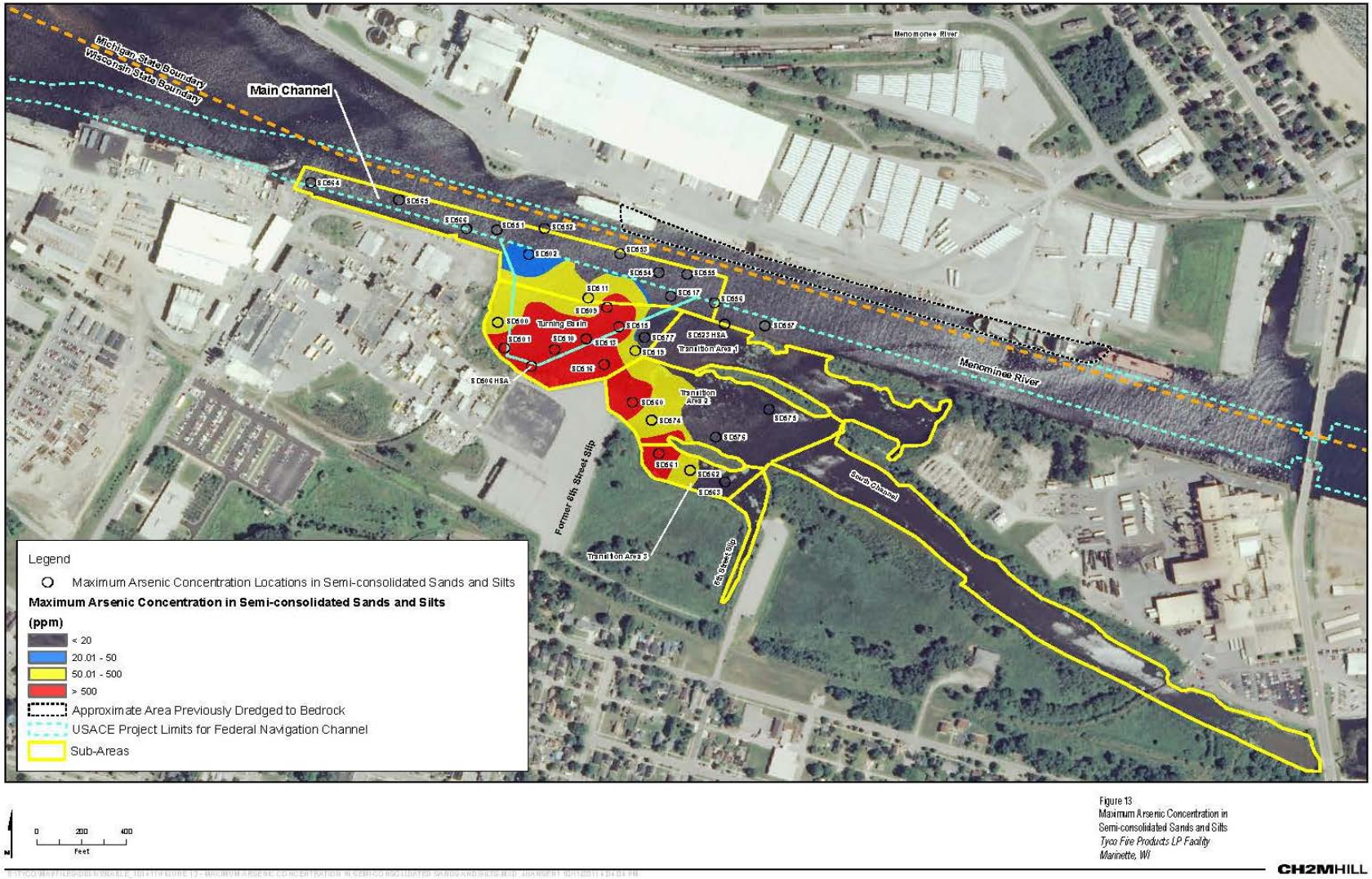

Figure F. Ansul Site, sediment arsenic concentrations in deeper "semi-consolidated sediment." Numbers correspond to sample identification numbers, arsenic concentrations in parts per million located on the legend. Rationale behind displayed contours: 0-20 ppm considered safe and no action is required, 20.01-50 ppm monitored natural recovery is required to a value <20 ppm by 11/01/2023, 50.01-500 ppm must be removed and properly disposed of, >500 ppm considered hazardous waste and must be removed and properly disposed of.

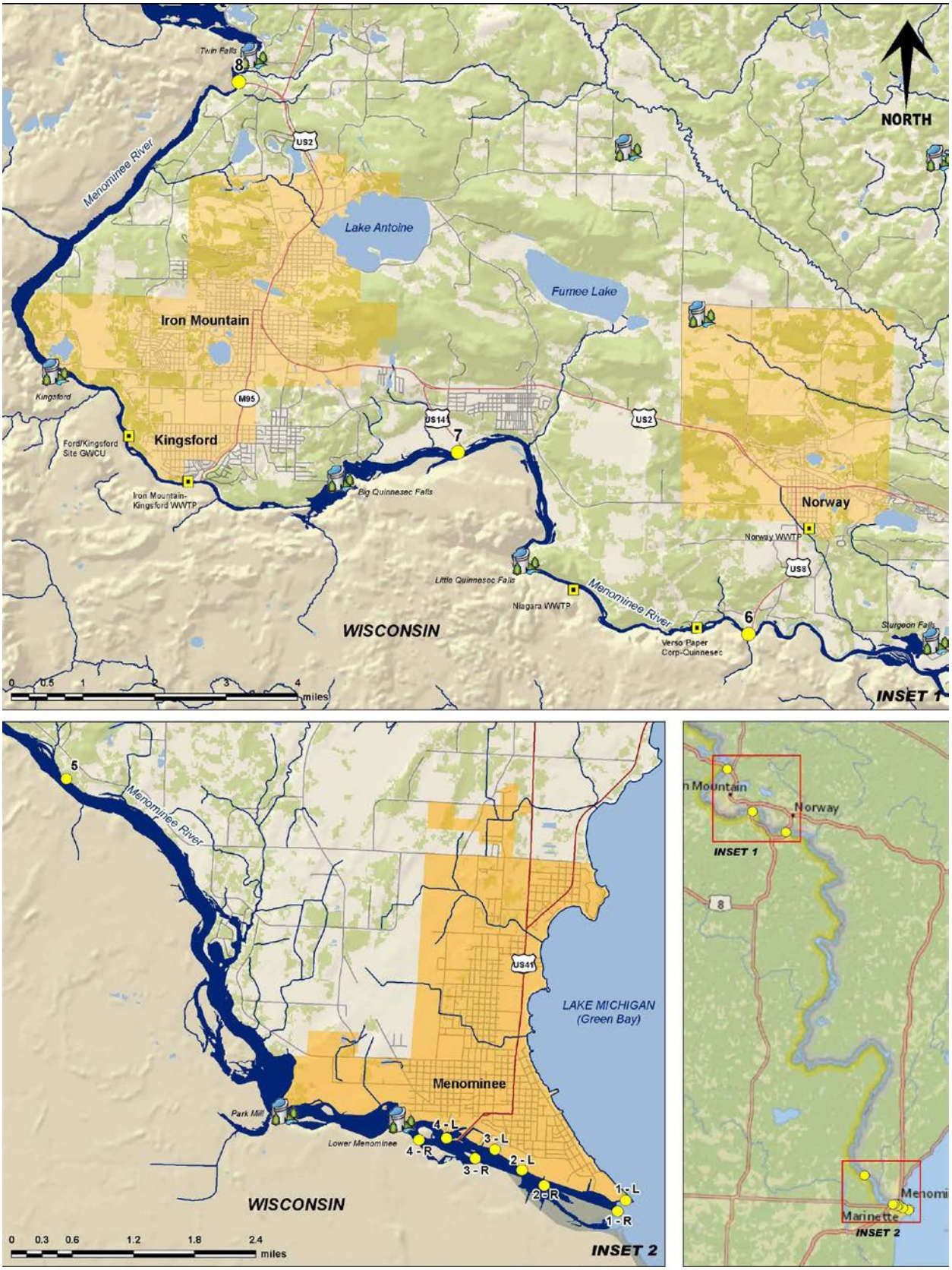

Figure G. Map of the Menominee River showing SPMD sampling sites in the vicinity of Iron Mountain, MI (Inset 1) and Menominee, MI/Marinette, WI (Inset 2) in 2011.

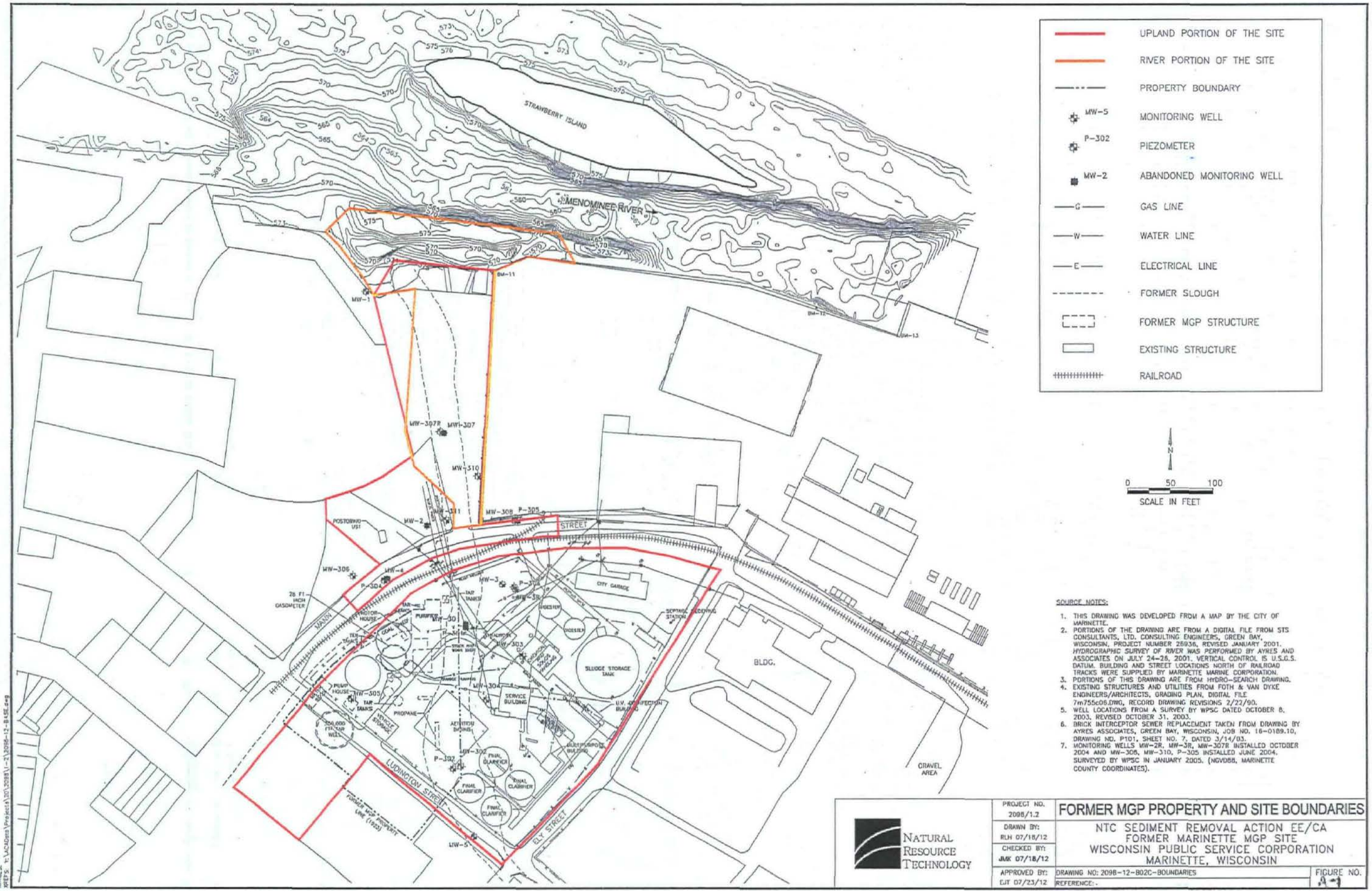

Figure H. WPSC Site, upland and river portions of the Wisconsin Public Service Corporation former manufactured gas plant (MGP) and coal tar remediation site.

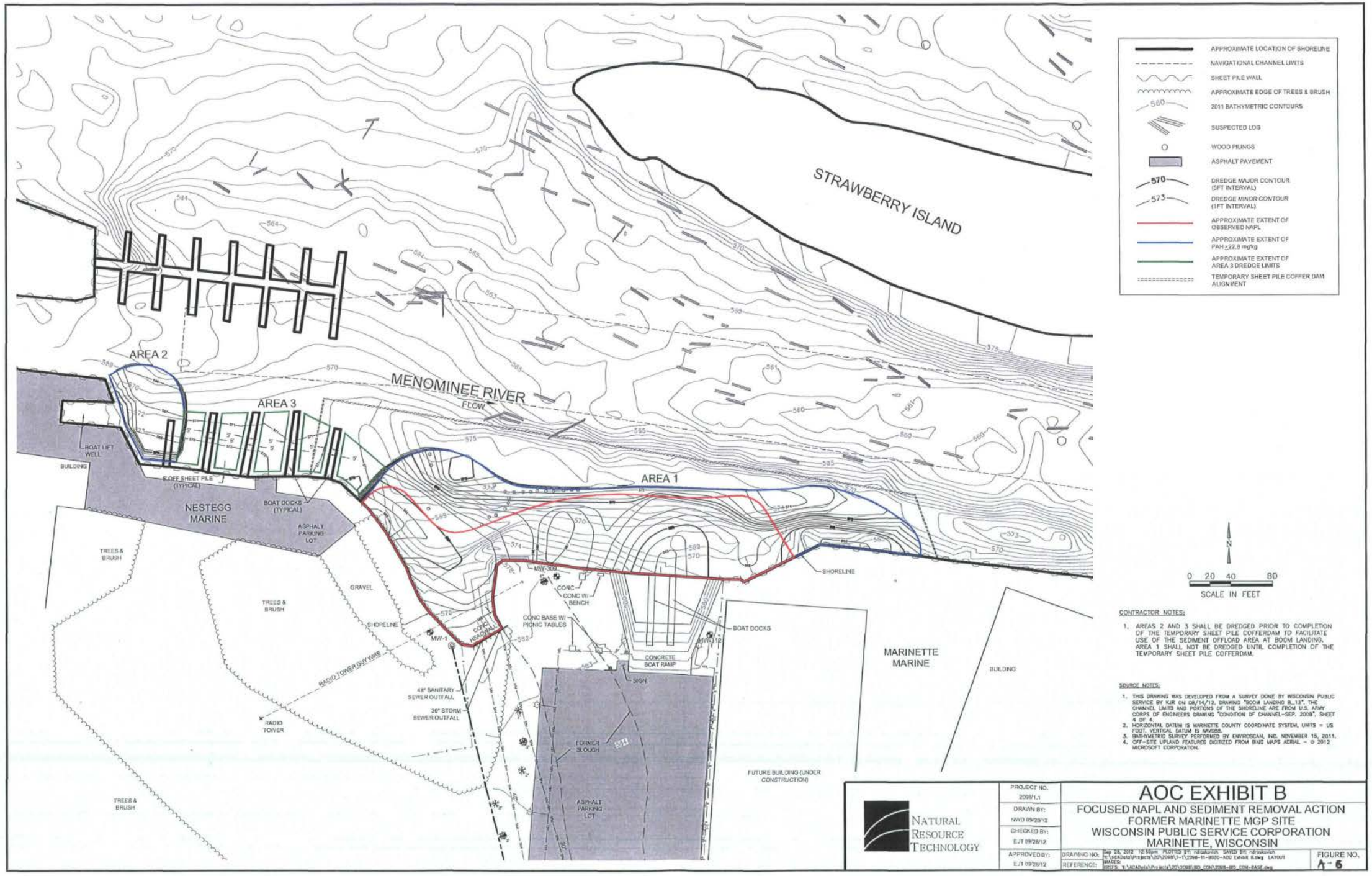

Figure I. WPSC Site, location of the NAPL (area 1) and PAH (areas 2 & 3) coal tar contamination. Also note steel sheet pile cofferdam to be installed prior to excavation of NAPL laden sediment.

PURPOSE STATEMENT

The Stage 2 Remedial Action Plan (RAP) documents the status of each beneficial use impairment (BUI) within the Lower Menominee River Area of Concern (AOC) and provides a strategic plan for their removal. The purpose of the *2012 Stage 2 Lower Menominee River RAP Update* is to document progress made for the remaining BUIs since the 2011 Stage 2 RAP and the current status of the five remaining BUIs. The 2012 Stage 2 RAP Update includes scientific studies, progress reports for cleanup sites, and monitoring documents to track the restoration progress of each impairment through December 1, 2012. Progress will be assessed based on the Lower Menominee River AOC BUI Restoration Targets established by Wisconsin and Michigan with participation of the Citizen's Advisory Committee in December, 2008 (WDNR-MDEQ, 2008). The projects needed to remove BUIs were recommended by members of the Lower Menominee River AOC Citizen's and Technical Advisory Committees.

Stage 2 RAPs are tools for concisely documenting and communicating progress to partners and stakeholders, and identifying specific actions that are necessary for removing BUIs and ultimately delisting the AOC. "Actions" may include on-the-ground restoration projects, monitoring and assessment projects, placing habitat protections such as conservation easements, and stakeholder engagement processes. The Stage 2 RAP will be updated as needed to incorporate new information that may become available.

INTRODUCTION

The Wisconsin Department of Natural Resources (WDNR) and the Michigan Department of Environmental Quality (MDEQ) share oversight of the Lower Menominee River Area of Concern (AOC). The *1990 Lower Menominee River Remedial Action Plan* (RAP) and the *1996 Lower Menominee River RAP Update* describe the historical activities that led to AOC designation, identify the beneficial use impairments (BUIs) for the AOC, summarize the status of those impairments, and offer recommendations for meeting environmental cleanup goals. The *2011 Lower Menominee River Stage 2 RAP* outlines a strategic plan for the removal of remaining BUIs, and is the primary tool needed to delist the AOC. The purpose of the *2012 Stage 2 Lower Menominee River RAP Update* is to document progress made for the remaining BUIs since the 2011 Stage 2 RAP and their current status.

Six of the potential fourteen BUIs were identified in the Lower Menominee River when it was designated an AOC. Significant upgrades to the City of Marinette's and City of Menominee's wastewater treatment plants have resulted in removal of the "restrictions on recreational contact" impairment, leaving only five impairments to be addressed (WDNR, MDEQ, 2011). Remaining impairments include: restrictions on dredging, degradation of benthos, restrictions on fish consumption, degradation of fish and wildlife populations, and loss of fish and wildlife habitat. Most of the impairments are influenced by the presence of contaminated sediment (Table 1). Arsenic, paint sludge, and coal tar, have been identified as the three most significant contaminants, although other more minor sediment contaminants exist. Log driving, urbanization, invasive species, habitat fragmentation, and stormwater discharges also contribute to the impairments. The cause(s) of the restrictions on fish consumption BUI is currently under investigation.

Areas of Concern are severely degraded geographic areas within the Great Lakes. These areas, 43 within the Great Lakes region, were designated as AOCs primarily due to contamination of river and harbor sediments by toxic pollutants (sometimes referred to as "legacy" pollutants due to the historical industrial development that often was the source of the pollution). Cleaning up these severely degraded areas is a first step toward restoring the chemical, physical, and biological integrity of the lakes as required by the Great Lakes Water Quality Agreement (GLWQA). When AOCs have been cleaned up to the point where they are not more degraded than other comparable non-AOC areas, they are "delisted" or considered restored from the perspective of the AOC program. Former AOCs are then considered to be part of the Lakewide Management Plan (LaMP) program, a "whole lake" program that is also set forth in the GLWQA. The Agreement provides the framework for the U.S. and Canada to work together to restore the chemical, physical, and biological integrity of the Great Lakes.

The Lower Menominee River AOC includes the lower three miles of the river from the Upper Scott Dam (Park Mill Dam) to the river's mouth (Figure A). The AOC Boundary extends north of the river mouth to John Henes Park and south of the river mouth past Seagull Bar along Green Bay. Green Island in Green Bay is part of the AOC because of its strong habitat value and biological link to Seagull Bar State Natural Area. There are six islands in the river within the AOC boundary. All of the islands are within the State of Wisconsin's territory. The AOC includes portions of Marinette County in Wisconsin and Menominee County in Michigan (WDNR, MDNR, and MDEQ, 1990 and 1996). Figure A shows the AOC boundaries, Figure B shows the AOC segments, and Figure C shows the entire Menominee River watershed.

Prior to combined sewer separation and wastewater treatment plant upgrades, the Menominee River received high loads of bacteria during combined sewer overflow (CSO) events (WDNR, MDNR, 1990). These CSO related bacteria loads led to the "restrictions on recreational contact" (beach closings) BUI. An extensive wetland complex near the mouth of the river was destroyed by log driving activities in the 1800s. Afterwards, wetlands and nearshore areas surrounding the mouth of the River were filled for industrial expansion, and the shorelines hardened to prevent erosion or providing cargo vessel docking facilities. Remaining quality habitat and wetlands are threatened by encroaching invasive plants and access to spawning and juvenile habitat for potamodromous fish like lake sturgeon has been severely limited due to the lack of a safe passage beyond several dams (Figure C). The loss of historic wetlands has contributed to the "degradation of fish and wildlife populations" and the "loss of fish and wildlife habitat" impairment. There are additional unidentified toxic sources within or upstream of the AOC, as elevated levels of polychlorinated biphenyls (PCBs) and mercury can be detected in fish with no access to Lake Michigan (MDCH, 2011). Unidentified toxic sources within the AOC result in the "restrictions on fish consumption" impairment.

Much progress has been made toward restoring the Lower Menominee River AOC in 2012, including:

- Remediation of the Ansul Arsenic site began in July
- Remediation of the Wisconsin Public Service Corporation (WPSC) Coal Tar site began in October
- Federal Energy Regulatory Commission (FERC) required studies are underway by North American Hydro Holdings Incorporated (NAH)
- Unforeseen project costs have delayed the removal of contaminated sediment from Menekaunee Harbor
- MDEQ completed the semi-permeable membrane device study

Further information on the progress made towards restoring the Lower Menominee River AOC is in the "RECENT PROGRESS" section.

Table 1: Sources of Beneficial Use Impairments for the Lower Menominee River AOC.

Beneficial Use Impairments	**Contaminated Sediments**	**Combined Sewer Overflow**	**Loss of Historic Wetlands**	**Loss of Historic Submerged Aquatic Vegetation**	**Loss of Historic Emergent Aquatic Vegetation**	**Unidentified Toxic Sources**	**Loss of Shoreline Habitat**
Restrictions on Dredging Activities	X						
Restrictions on Fish Consumption						X	
Degradation of Benthos	X						
Degradation of Fish and Wildlife Populations	X		X	X	X		X
Loss of Fish and Wildlife Habitat	X		X	X	X		X
Restrictions on Recreational Contact		X					

There are likely additional unidentified toxic sources within or upstream of the AOC, as elevated levels of PCBs and mercury can be detected in fish upstream of the Lower Scott Dam. These sources are probably contaminated sediment. Lost historic wetlands include emergent, submergent, and riparian varieties. Also note that the “restrictions on recreational contact” BUI was removed in 2011 (WDNR, MDEQ, 2011).

RECENT PROGRESS

The current status of the AOC is strongly influenced by progress made since the 1996 RAP update, and the significant progress made since the 2011 Stage 2 RAP. In particular, the progress made removing contaminated sediment was noteworthy. The status of each impairment is briefly summarized in Table 2, and Table 3 contains a summary of studies relevant to BUI status. For a more thorough status of each impairment see Appendix A and Appendix C. Progress on specific areas of interest is described below.

Ansul Arsenic Site

Ansul is currently in the process of implementing a U.S. Environmental Protection Agency (USEPA) approved work plan to remediate contaminated sediment. In September of 2009 Ansul Incorporated, owned by Tyco International, signed an Administrative Order on Consent with USEPA to complete the following actions (USEPA, 2007). Many remedial activities have been completed by Ansul, see the 2011 Stage 2 RAP for recent history.

- Construct and maintain an impermeable below-ground barrier wall to control the flow of groundwater to the maximum extent practicable (Figure D).
- Cap surface soils on-site with arsenic concentrations equal to or above 32 parts per million (ppm) (Figure D).
- Remove surface soils near the railroads tracks with arsenic concentrations equal to or above 16 ppm (Figure D).
- Collect and treat shallow groundwater on-site. Utilize trees cultivated for high rates of evapotranspiration to further suppress the water table. Conduct a technical review of the latest science for treating groundwater containing large quantities of arsenic every five years.
- Remove and properly dispose of all Menominee River soft sediments with arsenic concentrations equal to or greater than 50 ppm (Figure E).
- Remove and properly dispose of all Menominee River semi-consolidated silts and clays with arsenic concentrations equal to or greater than 50 ppm (Figure F) 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.
- Monitor remaining sediments natural recovery to a concentration of 20 ppm or less arsenic by November 1, 2023.

There is no in situ capping provision in the approved remedy. Soft and semi-consolidated sediment containing total arsenic concentrations greater than or equal to 50 ppm will be mechanically dredged using an environmental clamshell bucket and stabilized onsite (CH2MHILL, 2012). The stabilization process will reduce the concentration of leachable arsenic in the sediment to less than 5 ppm, remove free water, and provide sufficient shear strength so it can be accepted by the landfill (CH2MHILL, 2012). Stabilization is accomplished through the addition of a drying agent and chemical reagent. The stabilized soft sediment is then transported for disposal at an offsite nonhazardous (RCRA subtitle D) landfill. Wastewater produced as part of this process is treated by reserve osmosis to reduce arsenic concentrations and discharged to the river. If arsenic concentrations in wastewater cannot be reduced to acceptable levels, wastewater is properly disposed of at an offsite hazardous waste facility.

Dredging began in July, 2012. Ansul hoped to remove approximately 100,000 cubic yards of contaminated sediment in 2012, but when dredging ceased for the 2012 season, only 26,913 cubic yards of material had been removed from the River (CAC, 2012b). Greater than expected amounts of large woody debris were encountered during dredging, which slowed progress and required additional screening/grinding steps during sediment processing. Dredging was halted for approximately 30 days while sediment stabilization protocols were modified to comply with the leachable arsenic, free water, and shear strength requirements. Approximately 223,000 more cubic yards of sediment needs to be removed by November 1, 2013 to comply with the Administrative Order on Consent.

WPSC Coal Tar

Wisconsin Public Service Corporation (WPSC) is implementing the federally approved non-time critical removal action (NTCRA), and hopes to complete work by early 2013. Issues were first identified when the Marinette Waste Water Treatment Plant was expanded in 1989, and during this expansion surveyors discovered soils contaminated with coal tar and polycyclic aromatic hydrocarbons (PAHs) (WDNR, MDNR, 1990). Site investigations from 1994 to 2002 discovered approximately 4 acres of contaminated soil, and 1.3 acres of contaminated sediment in the nearby Menominee River (Figure H). The source was determined to be a manufactured gas plant (MGP) which operated prior to 1960. WPSC was found to be responsible for the remediation of contaminated soils and sediments. In August of 2012, WPSC signed an Administrative Settlement Agreement and Order on Consent with USEPA (USEPA, 2012) to complete the following contaminated sediment removal actions:

- Dredge non-aqueous phase liquid (NAPL) containing sediments and adjacent sediments containing PAHs as well as upstream near-shore sediments containing PAHs near Nestegg Marine (Figure I).
- Dewater and dispose of dredged sediment in a manner consistent with USEPA and State hazardous waste disposal regulations.
- Meet all applicable or relevant and appropriate requirements during the removal action (although environmental protection permits do not need to be acquired to perform the remediation, the substantive requirements of those permits must be met).

Wisconsin Public Service Corporation is implementing the federally approved NTCRA to accomplish the items above (NRT, 2012). The NTCRA consists of:

- Excavate near-shore PAHs (areas 2 & 3, Figure I)
- Install a sheet pile cofferdam to excavate NAPL laden sediment (area 1, Figure I)
- Backfill excavated areas with sand
- Treat water collected during dredging on upland portion of site prior to returning it to the river
- Mix sediment with dewatering agents to stabilize for transportation
- Transport and off-site disposal of excavated material at a Comprehensive Environmental Response, Compensation, and Liability Act approved disposal facility in accordance with USEPA's Off-Site Rule.

North American Hydro Dam Relicensing & Sturgeon Passage

North American Hydro Holdings Inc. (NAH) is the owner/operator of two hydroelectric dams within the AOC. Both dams, Upper Scott (Park Mill) and Lower Scott (Menominee), are scheduled for relicensing by FERC in 2015. As part of a relicensing agreement, NAH has

funded assessments of the fisheries community, fish tissue contaminant burden, sediment contamination, native mussel community, riparian and aquatic vegetation, wetlands, archeological resources, endangered resources, erosion, and water quality within their areas of responsibility. The FERC-required studies are taking place upstream of the AOC and in segments 1 and 2 (Figure B). These studies are in various states of progress, all final reports are expected to be received in 2013.

Sediment investigations upstream of the AOC and in segment 1 were completed. Surface sediment samples were collected by ponar dredge sampler and analyzed for metals and organics including arsenic, mercury, PCBs, and PAHs. Three samples were collected in the Upper Scott Flowage and combined into a single composite sample. Three samples were also collected in the Lower Scott Flowage and combined into a single composite sample. Results did not indicate the presence of contamination, however, the technique used is not intended to detect low levels of contamination, contamination at depth, or non-uniform contamination.

Through the relicensing process, NAH is working with State and Federal Agencies to facilitate lake sturgeon passage above the Upper and Lower Scott Dams. Downstream passage for all fish species is also being pursued. The Fish Passage Project was originally to be implemented in four phases, but since the 2011 Stage 2 RAP phase 4 has been dropped due to cost and feasibility. Funding has been received through the Great Lakes Restoration Initiative (GLRI) and NAH partner contributions for phases one and two.

Phase one will install an angled bar rack in front of the Upper Scott Dam turbine intake to redirect fish moving downstream from the Upper Scott Flowage into a chute leading to the tailrace below (CAC, 2012a). Phase two will build a fish elevator into one of the existing empty turbine bays of the Lower Scott Dam (also known as the Menominee or Bridge Street Dam) to lift and sort adult lake sturgeon (CAC, 2012a). As the sturgeon are sorted, biologists will check for fish health or disease and remove any invasive species including sea lamprey. Sturgeon to be passed upstream will be loaded into a tanker truck and transported to a release point above the Upper Scott Dam (also known as the Park Mill Dam). Phase three uses technology similar to phase one to redirect fish into a chute carrying them downstream of the Lower Scott Dam (CAC, 2012a). Construction on phases one & two is scheduled to begin during the summer of 2013, phase three feasibility is being investigated. Upstream passage at phase two could begin as early as autumn 2013.

Fish passage efforts will be protective of upstream fish and wildlife populations. It is expected that 21 additional miles of riverine habitat will be open to Lake Michigan sturgeon (Figure C). Riverine habitat is important for young sturgeon, who need time to grow before reaching Green Bay, and adds spawning habitat for adults. Larger young lake sturgeon are less vulnerable to predation when moving out into Green Bay. The upstream passage of lake sturgeon will also improve the sturgeon population genetics.

Green Island

Green Island is an approximately 80 acre privately owned island located 5 miles east of Seagull Bar State Natural Area (Figure B). Green Island was identified as critical wildlife habitat in the 1990 RAP, and included within the boundaries of the AOC to facilitate bird population recoveries. The Citizen's Advisory Committee (CAC) and Technical Advisory Committee (TAC) support acquisition of the island for conservation purposes. Acquisition of Green Island, or other conservation easements, is not required to achieve the removal of any impairment to the AOC. In 2011, a plan to fully develop the Island as vacation housing and a resort was proposed

by the island's owner. No development has begun to date. Environmental and archeological considerations remain an issue (Schiefelbein, C. L. 2012).

Menekaunee Harbor

The City of Marinette and WDNR have entered into an agreement to remove contaminated sediment from historic Menekaunee Harbor (WDNR, 2011a). WDNR is supporting these efforts through an agreement to reimburse the city for 65 percent of the total project cost up to $1.1 million for the safe excavation, transport, and disposal of the sediments. The money comes from environmental repair funds set aside to remove contaminated sediments in Great Lakes harbors and estuaries. Sediment contaminant levels in Menekaunee Harbor are not as high as in other areas of the lower Menominee River, but concentrations of arsenic, copper, cyanide, lead, zinc, mercury, PCBs, oil and grease, phosphorus, and ammonia-nitrogen have been found at levels affecting the growth and development of aquatic organisms. Contaminant sources are primarily considered to be urban and industrial nonpoint source pollution. Work was to begin in 2012, but complications with dredge spoil disposal and total project cost have delayed work until 2013 or 2014.

Semi-Permeable Membrane Device Study

MDEQ conducted a semi-permeable membrane device study on the Menominee River to determine if significant sources of PCBs, PAHs, and organochlorine pesticides exist in the Menominee River watershed and to narrow the search for any such sources (Bohr, 2012). The study used semi-permeable membrane devices (SPMDs) in a screening level effort to measure water column PCB, PAH, and chlorinated pesticide concentrations at sites within and upstream of the AOC (Figure G).

There was no net uptake of PCBs at any of the four sampling sites upstream of the Menominee Dam. This indicates that there is no significant source of PCBs upstream of the Upper Scott Flowage (Bohr, 2012). Some net uptake of PCBs was observed just downstream of the Menominee Dam nearest the south bank, indicating that sediments in either the Lower or Upper Scott Flowage, or both, are a source of PCBs. However, the relatively small uptake suggests that levels of PCBs in the lower Menominee River are probably not different than levels in rivers flowing through typical small cities. Further sediment investigation of the flowages is recommended to ensure that no significant source of PCBs exists in the AOC.

Table 2: Lower Menominee River Beneficial Use Impairment Status Summary (refer to Appendix A and Appendix C for more detail).

Beneficial Use Impairment	Impaired?	Summary of Status and Next Steps
Restrictions on Dredging	Yes	One of four known contaminated sediment sites has been remediated and cleanup is underway at another two. The remaining site is expected to begin remediation in 2013 or 2014. Lower and Upper Scott Flowage sediments will be investigated in 2013 by GLNPO, consistent with results of the SPMD Study. An area dredge management plan may also be required prior to delisting.
Restrictions on Fish Consumption	Yes	Sediment characterization work was completed in 2012 and included contaminant sampling by NAH as part of FERC dam relicensing requirements and source identification through MDEQ's semi-permeable membrane device study. MDCH and MDEQ are conducting a statewide fish consumption advisory assessment that will compare fish tissue contaminant levels in Michigan AOCs, including the Menominee River, to non-AOC reference sites. This assessment will include WI data. The TAC and CAC will review fish tissue assessment results to determine impairment status when the study is complete.
Degradation of Benthos	Yes	One of four known contaminated sediment sites has been remediated and cleanup is underway at another two. The remaining site is expected to begin remediation in 2013 or 2014. Lower and Upper Scott Flowage sediments will be investigated in 2013 by GLNPO, consistent with results of the SPMD Study.
Degradation of Fish and Wildlife Populations & Loss of Fish and Wildlife Habitat	Yes	Restoration goals, objectives, and activities have been captured in the "Fish and Wildlife Population and Habitat Management and Restoration Plan." Construction of the first two phases of the Fish Passage Project is expected to be complete in 2013. The CAC and TAC must come to an agreement and final list of sites considered a priority for long term protection. Sites already agreed upon as a priority should pursue design then implementation of habitat improvement and protection projects.
Restrictions on Recreational Contact	No	Source control has been achieved. Recommendation to remove impaired status approved by GLNPO in March, 2011, see the 2011 Stage 2 RAP for details (WDNR, MDEQ, 2011).

Table 3: Summary of Relevant Environmental Studies.

Study	Data Gathering	Data Review	Data Uses	BUI Removal Effort Benefited	Date Results Available
aquatic vegetation survey	WDNR, MDEQ	MDCH, MDEQ, WDNR	evaluate potential aquatic natural areas	degradation of fish and wildlife habitat	2010
USGS swallow study	USGS	USGS, WDNR, MDEQ, MDNR	evaluate reproductive success rates and tissue contaminant concentrations	loss of F&W populations	2011
riparian vegetation survey	WDNR	MDCH, MDEQ, WDNR	evaluate potential riparian natural areas, document undesirable species infestations	degradation of fish and wildlife habitat	2011
mussel survey	NAH, WDNR	WDNR, MDEQ, MDNR, NAH	evaluate evidence of native mussel recruitment	loss of fish and wildlife populations	2011
Semi-Permeable Membrane Device (SPMD) Study	MDEQ, WDNR	MDEQ, MDNR, WDNR, TAC	detect PCBs, pesticides, and PAHs	restrictions on dredging activities, restrictions on fish consumption, degradation of benthos	2012
FERC-required sediment sampling	NAH	WDNR, MDEQ, MDNR, NAH	detect metals, mercury, PCBs, PAHs	restrictions on dredging activities, restrictions on fish consumption, degradation of benthos	2012
FERC-required fish tissue sampling	NAH, WDNR	WDNR, MDEQ, MDNR, NAH	detect metals and PCBs in fish tissue	restrictions on fish consumption	2012
NOAA Mussel Watch Program	NOAA	NOAA, WDNR, MDEQ, MDNR	detect PCBs and mercury in mussel tissue	restrictions on fish consumption	2012
WPSC coal tar site investigation	WPSC	WPSC, USEPA, WDNR	Define the degree and extent of landward and waterward contamination	restrictions on dredging activities, degradation of benthos, degradation of F&W habitat, loss of F&W populations	2012
MDCH fish consumption advisory assessment	MDCH, MDNR	MDCH, MDEQ, WDNR	detect mercury, metals, pesticides, and PCBs in fish tissue, compare contaminants in the AOC to those at a reference site	restrictions on fish consumption	2013
USGS Benthos and Plankton Assessment	USGS	USGS, WDNR, MDEQ, MDNR	assess benthic conditions	degradation of benthos	2013
Fisheries Data Roundup	WDNR	WDNR, MDNR, TAC	evaluate evidence of recruitment for appropriate fish species	loss of fish and wildlife populations	2013

STAKEHOLDER ENGAGEMENT

The Citizen's Advisory Committee (CAC) was formed 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. Citizen's Advisory Committee 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. Requests to remove the impaired status of a BUI must also be agreed to by the CAC, and the CAC has included a letter of support for this document as Appendix B. The CAC holds regular meetings on the UW-Marinette campus open to all interested parties. Meetings are advertised through the WDNR Open Meeting Calendar, CAC/TAC list serve, and other means. Nine meetings of the CAC were held in 2012.

The CAC developed governing bylaws in June of 2011 to ensure the committee's long term viability and balanced representation of the community. There are presently twelve memberships filled of a possible twenty-six, up three from 2011. Dozens more individuals have attended monthly meetings and currently receive meeting minutes and AOC updates through e-mail.

Citizen's Advisory Committee members also play a critical role in conducting community outreach presenting the AOC educational display and discussing local concerns. The CAC also coordinated a Shoreline Cleanup activity in 2011, and hopes to plan future similar events. CAC members have participated in on-site tours for the sturgeon passage project; participated in on-site tours of the arsenic and coal tar remediation sites; reviewed documents and provided letters of support for AOC BUI related projects; provided local representation or feedback at various state and federal AOC workshops, trainings, and meetings; and participated in state and federal AOC-related conference calls.

Short videos on AOC-related topics are seen as a way to efficiently reach a large, broad audience. Videos can easily be distributed online through agency websites, and then shared through social media outlets. New videos should be produced as agreed upon by agencies and the CAC. The few existing videos pertaining to the Lower Menominee River AOC are available below as examples:

- Menominee River Sturgeon Passage
- USGS Swallow Contaminant Study
- Controlling Phragmites along the Lake Michigan Shoreline

Table 4: Summary of community outreach activities undertaken to help keep the local community, businesses, and tourists updated and supportive of projects, and aware of needed actions on their part.

MEDIA	TARGET AUDIENCE	MESSAGES	IMPLEMENTER(S)	COLLABORATORS	FUNDED BY
Interpretive Kiosks	General public, tourists, birders	Dredging improves conditions for aquatic life and recreational opportunities for people. Seagull Bar is important habitat for the AOC.	City of Marinette & Marinette County Land Water Conservation Division	WDNR, UW-Extension, MDEQ, Citizen's Advisory Committee	WDNR CAC support funding
Boat Launch Signs	General public, canoeists, kayakers, boaters, anglers	The Lower Menominee River is an AOC. Efforts are underway to clean up contaminated sediment and restore fish & wildlife habitat.	Marinette County Land Water Conservation Division	WDNR, UW-Extension, MDEQ, City of Marinette, Citizen's Advisory Committee, City of Menominee, North American Hydro	WDNR CAC support funding
Traveling Educational Display & Materials	General public, tourists, people attending Marinette/Menominee community events	The Lower Menominee River is an AOC. Details on major restoration and cleanup projects. The CAC and how they can be involved.	Marinette County Land Water Conservation Division, Citizen's Advisory Committee	WDNR, UW-Extension, MDEQ, Citizen's Advisory Committee	WDNR CAC support funding, display and accessories purchased through a Michigan CAC support grant in 2011

Next action(s) needed

CAC support funding should be sought from either MDEQ or WDNR to continue presenting and updating the interpretive kiosks, boat launch signs, and traveling educational display on an as needed basis. Expected funding need ranges between $2,000 and $10,000 annually. Funding should also be sought to produce one or more short films on the AOC for web based distribution, costing approximately $1,000 per finished minute of video.

BENEFICIAL USE IMPAIRMENT UPDATES

The following pages summarize the current status of each Beneficial Use Impairment using the format below. An explanation of each section is provided after the heading.

Restoration Target and Status

Beneficial Use Impairment Name	Status
The 2008 Lower Menominee River AOC Beneficial Use Impairment Restoration Targets (WDNR and MDEQ, 2008) are listed here as separate target components on each row to clearly show the status of each part of the target.	May be: • "Complete" • "Assessment in progress" • "Incomplete" • "Incomplete, in progress"

Target Concerns

This section may discuss one or more of the following:

- potential concerns about the target, particularly if the target is not specific enough to define a measurable endpoint for the BUI
- if revisions are anticipated and how such changes might be approached including responsible party and timeline
- if the 2008 target was modified and details of any changes

PLEASE NOTE: MDEQ and WDNR have established that when a disagreement regarding restoration targets arose, the more restrictive target would be used.

Rationale for Listing

The section briefly summarizes the reason the BUI was known or suspected at the time of listing. If sources contributing to the impairment have been identified since listing, those are included in this section as well.

Summary of key remedial actions since the 2011 Stage 2 RAP and current status

"Key remedial actions" are those that directly contributed to the current status of the BUI. A table may be included as an appendix, or reference made to the "RECENT PROGRESS" section to capture a detailed list of past projects. The narrative here explains and leads to the "Next action needed."

Next action(s) needed

This section is a narrative listing of assessments, on-the-ground projects, and stakeholder engagement processes that are clearly delineated and directly address the specific BUI. Plans for verifying achievement of delisting targets are listed here if known.

Issues (challenges, risks) affecting progress on this BUI

This section lists project contingencies (i.e., one thing has to happen before another can occur), funding obstacles and any other considerations that could affect the timeline for delisting.

RESTRICTIONS ON DREDGING ACTIVITIES

Restoration Target and Status

Restrictions on Dredging Activities	Status
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	Incomplete, in progress
An AOC dredge management plan is developed by the communities and agencies that includes an evaluation of: o Restrictions that must remain in place to protect human health and the environment o Restrictions that must remain in place due to RCRA requirements that are based upon state and federal law o Priority areas for navigational use o Priority areas for utility dredging, e.g. utility crossings o Identify costs and funding options for removing dredging restrictions in priority areas	Incomplete

Target Concerns

MDEQ and WDNR have established that when a disagreement regarding restoration targets arose, the more restrictive target would be used. In this case, MDEQ normally considers only federally designated navigational channels when assessing this impairment (WDNR, MDEQ 2008), while WDNR considers dredging impairments throughout the AOC. The entire AOC will be considered per interstate agreement above.

Rationale for Listing

The Lower Menominee River is classified as a federal navigable harbor and is used as a diversified cargo port and shipyard. Dredging activities are restricted due to the presence of toxic contaminants in the river's sediments. Their presence increases dredging costs and limits dredge spoil disposal options. The shipping channel in the Lower Menominee River and Harbor has been regularly dredged since 1982. Dredged spoils have been deposited into the open waters of Lake Michigan in Michigan's waters. However, the turning basin was not dredged at that time because of increased costs and limited dredge spoil disposal options from the arsenic contamination. The contamination was so severe that sediments from this portion of the river could have been classified as a hazardous waste if an attempt were made to remove them via dredging (WDNR, MDNR, and MDEQ, 1996).

It is important to note that contaminated sediment sites outside the boundaries of the federal navigation channel also contribute to the impairment. Any location within the AOC where the presence of contaminated sediment increases dredging costs and limits dredge spoil disposal options contributes to the listing of this impairment. This includes the Ansul arsenic, WPSC coal tar, Lloyd Flanders paint sludge, Menekaunee Harbor, and any remaining sites yet to be identified.

Summary of key remedial actions since the last RAP and current status

See the *1996 Lower Menominee River Remedial Action Plan* for information on the Lloyd Flanders Paint Sludge site, as its remediation was recorded in that document. Remediation of the Ansul arsenic and WPSC coal tar sites is in progress. Efforts are underway to identify any unknown sources of contamination to the AOC. See the **"**RECENT PROGRESS" for a

summary of key remedial actions since the 2011 Stage 2 RAP. An area dredge management plan is required prior to delisting.

Next action(s) needed

Complete remediation of the Ansul arsenic, WPSC coal tar, and Menekaunee Harbor sites, according to their approved remedies, are the most important steps towards BUI removal. Sediment remediation began at the Ansul arsenic and WPSC coal tar sites in 2012, and needs to be completed. Additional funding is required to begin dredging at Menekaunee Harbor, and is being sought through the GLRI and other means.

The identification of any unknown sources of contamination to the AOC is also important. Results of the SPMD study indicated that sediments in either the Lower or Upper Scott Flowage, or both, are a relatively small source of PCBs. WDNR has formally requested USEPA Great Lakes National Program Office (GLNPO) to pursue sediment characterization of the Lower Scott Flowage through the Great Lakes Legacy Act Program. The request has been accepted and will likely be carried out during 2013. Sediment characterization by GLNPO will be the final determination of sediment quality in the Lower Scott. Reference sampling in the Upper Scott Flowage conducted as part of this effort will address sediment quality concerns there.

A dredge management plan must be completed to remove this impairment. As details relating to site remediation become available, they should be incorporated into an AOC dredge management plan which includes priority areas for navigational and recreational dredging.

Issues (challenges, risks) affecting progress on this BUI

The Ansul arsenic site remediation is significantly behind the contaminated sediment removal goal for 2012. To compensate, approximately 223,000 more cubic yards of material will have to be removed by November 1, 2013 to comply with the Administrative Order on Consent. Wisconsin Public Service Corporation began dredging the coal tar site in late October, and hopes to complete the project by early 2013. Complications with dredge spoil disposal and total project cost have delayed dredging in Menekaunee Harbor until 2013 or 2014. If GLNPO sediment investigations indicate additional sources of contaminants exist, they would need to be remediated prior to removal of this impairment.

RESTRICTIONS ON FISH CONSUMPTION

Restoration Target and Status

Restrictions on Fish Consumption	Status
Sources of PCBs, mercury, and dioxins within the AOC have been controlled or eliminated; and	Incomplete, in progress
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	Incomplete,
Fish tissue contaminants causing advisories in the AOC are the same or lower than those in the associated Great Lake or appropriate control site.	Assessment in progress

Target Concerns

Fish from the waters of Green Bay and the Lower Fox River have access to all segments of the AOC except segment 1 (Figure B). These fish are known to have elevated levels of PCBs in their tissue. To be protective of human health, the fish consumption advisories from both states for these segments are the same as advisories for Green Bay. It's unlikely that all fish consumption advisories in AOC waters will be lifted due to the presence of Green Bay and Lake Michigan fish. BUI removal could occur if studies indicate that fish are not impacted by contamination within the AOC, even though fish consumption advisories will likely remain.

Rationale for Listing

This beneficial use is considered impaired, because of elevated levels of mercury and PCBs in fish tissue that do not meet Wisconsin Department of Health Services, U.S. Food and Drug Association, and/or Michigan Department of Community Health's (MDCH's) health advisory limits (WDNR, MDNR, 1990). Fish from Green Bay have access to all segments of the AOC except segment 1 (Figure B) and may carry contamination in their tissues originating outside of the AOC. These fish are known to have elevated levels of PCBs and mercury in their tissue. There is potential for unidentified toxic sources within or upstream of the AOC, as elevated levels of PCBs and mercury can be detected in fish upstream of the Lower Scott Dam (MDCH, 2011).

Michigan issues fish consumption advisories for Green Bay south of the Cedar River including the Menominee River below the Lower Scott Dam for PCBs, dioxins, and mercury (MDCH, 2011). Michigan also issues advisories for the Menominee River below Quinnesec to the Lower Scott Dam for mercury and PCBs (MDCH, 2011). Wisconsin issues fish consumption advisories for Green Bay and its tributaries, including the Menominee River, up to the first dam for PCBs and mercury (WDNR, 2011b). Wisconsin also issues advisories on the Menominee River from Pier's Gorge, near Quinnesec, downstream to the Lower Scott Dam also for PCBs and mercury (WDNR, 2011b).

Summary of key remedial actions since the last RAP and current status

Both states update fish consumption guidance based on the most current fish tissue monitoring data and state and federal guidance. Current Michigan and Wisconsin fish consumption advice may be found online at www.michigan.gov/eatsafefish, and http://dnr.wi.gov/topic/fishing/consumption/index.html respectively.

Next action(s) needed

Results of the SPMD study indicated that sediments in either the Lower or Upper Scott Flowage, or both, are a relatively small source of PCBs. WDNR has formally requested USEPA

GLNPO to pursue sediment characterization of the Lower Scott Flowage through the Great Lakes Legacy Act Program. The request has been accepted and will likely be carried out during 2013. Sediment characterization by GLNPO will be the final determination of sediment quality in the Lower Scott. Reference sampling in the Upper Scott Flowage conducted as part of this effort will address sediment quality concerns there.

Completion of the Fish Consumption Advisory Assessment by MDCH is required. This project will assess whether fish tissue contaminants causing advisories in the AOC are the same or lower than those in Lake Michigan and appropriate control sites. Tissue analysis has begun, but additional fish tissue samples need to be collected for the full analysis. The assessment is expected to be completed in 2013 or 2014. Fish tissue samples were collected as part of the FERC Dam relicensing agreement during 2011 and 2012.

The National Oceanic and Atmospheric Administration (NOAA) Mussel Watch program collected zebra mussel tissue and sediment in three locations near the mouth of the Menominee River in 2011 and 2012 (NOAA Mussel Watch, Table 3). They are being analyzed for chemicals including PCBs and dioxins. Results are not available yet, but may provide additional evidence relating to sediment quality and contaminant body burdens of Menominee River Fish.

Issues (challenges, risks) affecting progress on this BUI

It is important to note that current contaminated sediment remediation efforts do not significantly affect the removal of this beneficial use impairment. There is no advisory at this time for consuming fish contaminated with arsenic or PAHs in the AOC.

Several scenarios exist that could slow progress regarding this BUI. If the MDCH assessment observes contaminant levels higher than background in Lake Michigan or other the reference site(s) used, BUI removal would be delayed until a source is identified and remediated. Likewise, if GLNPO sediment investigations detect sources of mercury, PCBs, or dioxins in the AOC, they would need to be remediated prior to removal of this impairment.

DEGRADATION OF BENTHOS

Restoration Target and Status

Degradation of Benthos	Status
All remediation actions for known contaminated sediment sources are completed and monitored according to the approved plan and have met their remedial action goal.	Incomplete, in progress

Target Concerns

Some concerns have arisen because restoration targets for this BUI do not include monitoring efforts to document the recovery of the benthic community. Sites not impacted by contaminated sediments in the AOC show a relatively healthy benthic community. It's assumed that these communities will re-colonize former degraded areas once contaminated sediment sites have met their remedial goals.

The Lower Menominee River AOC was included in a GLRI-funded study, initiated by WDNR and carried out by the U.S. Geological Survey (USGS), to characterize benthic invertebrate and planktonic communities in Wisconsin's Lake Michigan AOCs and six reference sites (USGS Benthos and Plankton Assessment, Table 3). The Lower Menominee AOC site was included to increase the statistical power of the study. Although the BUI removal target does not require such data, it may be useful for gaining a better understanding of benthic conditions in the AOC.

Rationale for Listing

The 1990 Remedial Action Plan attributes degradation of the benthos in otherwise suitable habitat to toxic conditions caused by contaminated sediment (WDNR, MDNR, 1990). A WDNR Menominee River Survey conducted in August 1957 sampled just below the Ansul Chemical Company, found few bottom-dwelling organisms at this point and populations were composed of known of pollution tolerant varieties [Letter, Committee on Water Pollution, Theodore F. Wisniewski, Director, 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 (Figure B, 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. According to the 1990 RAP, benthic impairments were due to a variety of causes but heavy arsenic pollution was interpreted by USEPA as the likely cause since there were substrate and nutrients available to support a diverse benthic population (WDNR, MDNR, 1990).

Summary of key remedial actions since the last RAP and current status

See the *1996 Lower Menominee River Remedial Action Plan* for information on the Lloyd Flanders Paint Sludge site, as its remediation was recorded in that document. Remediation of the Ansul arsenic and WPSC coal tar sites is in progress. Efforts are underway to identify any unknown sources of contamination to the AOC. See the **"**RECENT PROGRESS" section for a summary of key remedial actions since the 2011 Stage 2 RAP.

Next action(s) needed

Complete remediation of the Ansul arsenic, WPSC coal tar, and Menekaunee Harbor sites, according to their approved remedies, are the most important steps towards BUI removal. Sediment remediation began at the Ansul arsenic and WPSC coal tar sites in 2012, and needs

to be completed. Additional funding is required to begin dredging at Menekaunee Harbor, and is being sought through the GLRI and other means.

The identification of any unknown sources of contamination to the AOC is also important. Results of the SPMD study indicated that sediments in either the Lower or Upper Scott Flowage, or both, are a relatively small source of PCBs. WDNR has formally requested USEPA GLNPO to pursue sediment characterization of the Lower Scott Flowage through the Great Lakes Legacy Act Program. The request has been accepted and will likely be carried out during 2013. Sediment characterization by GLNPO will be the final determination of sediment quality in the Lower Scott. Reference sampling in the Upper Scott Flowage conducted as part of this effort will address sediment quality concerns there.

Issues (challenges, risks) affecting progress on this BUI

The Ansul arsenic site remediation is significantly behind the contaminated sediment removal goal for 2012. To compensate, approximately 223,000 more cubic yards of material will have to be removed by November 1, 2013 to comply with the Administrative Order on Consent. Wisconsin Public Service Corporation began dredging the coal tar site in late October, and hopes to complete the project by early 2013. Complications with dredge spoil disposal and total project cost have delayed dredging in Menekaunee Harbor until 2013 or 2014. If GLNPO sediment investigations indicate additional sources of contaminants exist, they would need to be remediated prior to removal of this impairment.

DEGRADATION OF FISH AND WILDLIFE POPULATIONS & LOSS OF FISH AND WILDLIFE HABITAT

Restoration Target and Status

Degradation of Fish and Wildlife Populations & Loss of Fish and Wildlife Habitat	Status
A local fish and wildlife habitat management and restoration plan has been developed and implemented for the Lower Menominee River AOC that: o Defines the causes of fish and wildlife population and habitat impairments within the AOC o Establishes site specific habitat and population objectives for fish and wildlife species within the AOC o 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; and	Development complete, implementation in progress
o The programs and actions necessary to accomplish the recommendations are identified in the fish and wildlife management and restoration plan are implemented; and	Incomplete, in progress
o 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	Incomplete
Please note o 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. o Actions already implemented in AOCs may be reported and evaluated as long as the reports contain all the elements above.	

Target Concerns

These BUIs are interdependent and are discussed and addressed together. Removal of these BUIs will take place concurrently through implementation of the 2011 *Fish and Wildlife Population and Habitat Management and Restoration Plan*.

Rationale for Listing

The “degradation of fish and wildlife populations” and “loss of fish and wildlife habitat” BUIs were listed because of the loss of historic wetlands and localized toxicity caused by contaminated sediment. An extensive wetland complex near the mouth of the river was destroyed by log driving activities in the 1800s. Afterwards, land near the mouth of the river was filled for industrial and municipal expansion, and the shorelines hardened to prevent erosion. Remaining quality habitat and wetlands are threatened by encroaching invasive plants and access to spawning and juvenile habitat for potamodromous fish like lake sturgeon has been severely limited due to the lack of a safe passage beyond several dams (Figure C).

Sediment contaminated with arsenic, PAHs, and other heavy metals including cadmium, chromium, copper, lead, mercury, nickel, and zinc have impacted fish populations throughout the AOC (WDNR, MDNR, 1990). Sediment was contaminated through industrial activities and stormwater discharges that took place throughout the 1900s.

Summary of remedial actions since the last RAP and current status

Increased interest in lake sturgeon, spotted muskellunge, native mussels, marsh birds, and native vegetation is reflected in the goals and objectives assembled in the Fish and Wildlife Population and Habitat Management and Restoration Plan. Protection and enhancement of existing wetlands, aquatic habitat, and riverine islands remains a strong priority.

Remedial efforts continue to focus on data collection/ review and modification of the restoration objectives:

- Although the objective has not been formally changed (Appendix C), the CAC and TAC have altered habitat protection objectives from a "total area & linear feet" approach, to a "site-specific based approach". In this approach, specific sites are selected as a protection priority, instead of a specified area or amount.
- A complete draft of the *Fish and Wildlife Population and Habitat Management and Restoration Plan* was submitted to USEPA in early 2012. The plan outlines a path to remove these impairments, including a list of activities to meet the restoration goals and objectives. The plan is currently undergoing revision, and a second draft is expected in 2013.
- Restoration objectives for birds have changed from a quantitative approach to a qualitative one. Changes can been seen in Appendix C.
- The final report for a native mussel survey conducted in 2011 was released in 2012.

Next action(s) needed

In general, implementation of the *Fish and Wildlife Population and Habitat Management and Restoration Plan* is needed to continue making progress in removing these BUIs. More specifically, the next actions necessary can be generalized into three steps. Step one, review existing data and use it to set measureable restoration objectives. Step two, implement activities to meet those objectives. Step three, monitor the outcomes of activities to decide if each objective has been met.

<u>Step One</u>

This step consists primarily of the analysis of existing and forthcoming data, but also includes modification of the restoration goals and objectives. TAC members and state agencies will be largely responsible for this step, although the CAC will participate in any modification of goals or objectives. Significant progress has been made since the last RAP as illustrated above. Remaining required actions needed include:

- A significant amount of sediment quality data is available with more data coming. How sediment remediation affects the overall Fish and Wildlife Plan will have to be determined regularly as new information comes forward.
- Through a project called the "Fish Data Roundup," a subset of the TAC has been working to gather existing fish population data, set populations goals, and evaluate whether or not target species are meeting those goals. A final report including recommendations is expected in early 2013.

- The CAC and TAC must come to an agreement and final list of sites considered a priority for restoration and long-term protection. Several sites and project areas have been selected, but others remain in an undecided category.
- CAC and TAC members must continue to support those involved with implementing sturgeon passage at the Upper and Lower Scott Dams. This will be an ongoing activity until funding is secured for phase 3 (passive downstream passage below the Upper and Lower Scott Dams).

Step Two

Once existing data has been analyzed the second step will commence. The TAC will work with state and federal agencies and the CAC to begin implementing activities to meet objectives. If data gaps were identified as part of step one they will be addressed in step two. The CAC does not have a tax identification number and cannot apply for grant funding directly. It is expected that state agencies and local partners will apply for the funding that will be required to accomplish all necessary activities. The TAC believes that this step could be completed within two years of completing all contaminated sediment remediation projects, if not sooner. The CAC is presently restoring habitat and removing invasive species from a natural area (Strawberry Island) under the direction of the Federal Bureau of Land Management. The CAC and other partners are also pursuing grant funding for habitat restoration design and other means to ensure long term protection of designated sites.

Step Three

As activities are implemented the TAC will continuously measure progress towards meeting objectives. Funding needs depend on the type and quantity of monitoring that is required to demonstrate progress. If all objectives have been met, except those associated with fish recruitment or populations, these BUIs will be considered in a state of recovery. Long term monitoring will be used to meet remaining objectives associated with fish recruitment or populations. Once an objective has been met, any remaining activities for it will no longer be pursued. Conversely, if all identified activities for an objective have been completed and monitoring shows that the objective is still not met, additional activities may be sought to meet that objective.

Issues (challenges, risks) affecting progress on this BUI

Although the existing delisting target doesn't require the remediation of contaminated sediment sites, it is necessary to complete sediment remediation projects before removing this BUI. Habitat frequently cannot be improved until contamination has been dealt with.

Project implementation is largely contingent on funding from the GLRI. The CAC and TAC must come to an agreement and final list of sites considered a priority for restoration and long term protection. A defined list of the projects necessary to remove these impairments allows grant applicants to quantify their proposal's impact towards removing these impairments, allowing the applicant to more successfully compete for funding.

RESTRICTIONS ON RECREATIONAL CONTACT (BEACH CLOSINGS)

Restoration Target and Status

Restrictions on Recreational Contact	Status
No waterbodies within the AOC are included on the list of non-attaining waters due to contamination with pathogens *from combined sewer overflows* 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 USEPA every two years; or	Complete
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; 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: o 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 o 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 o Marinette, WI and Menominee, MI have adopted and are implementing storm water reduction programs including an illicit discharge elimination program	

Target Concerns
The restoration target set in 2008 was modified to identify combined sewer overflows as the primary reason for this impairment, (WDNR, MDEQ, 2011).

Rationale for Listing
Elevated levels of bacteria exceeding water quality standards had been documented in the Menominee River (WDNR, MDNR, 1990). These exceedances were associated with wet weather events causing combined sewer overflows.

Summary of remedial actions since the last RAP and current status
Significant upgrades to the City of Menominee and City of Marinette wastewater treatment plants have resulted in no combined sewer overflows. Both municipalities are operating within their respective state wastewater discharge permits. The impairment was officially removed in 2011, see the 2011 Stage 2 RAP for more information.

SUMMARY AND CONCLUSIONS

Five of the six BUIs identified in the Lower Menominee River AOC still remain. The "restrictions on recreational contact" BUI was removed from the AOC after its cause, combined sewer overflows, was remedied. Causes of the remaining impairments have been identified or are currently under investigation.

Contaminated sediment affects four of the five remaining BUIs (Table 1). Remediation of known and any undiscovered contaminated sediment sites within the AOC will lead to the removal the "restrictions on dredging" and "degradation of benthos" impairments. Contaminated sediment removals will benefit the "degradation of fish and wildlife populations" and "loss of fish and wildlife habitat" BUI removal effort. Paint sludge remediation was completed in 1995 by the Lloyd Flanders Furniture Company through Michigan Act 307 authority (WDNR, MDNR, and MDEQ, 1996). Remediation of the Ansul arsenic contaminated sediment site is underway. Ansul must finish work by November, 2013, to conform with the Administrative Order on Consent (USEPA, 2007). Remediation of the WPSC coal tar site is underway, and will likely be completed by early 2013. The City of Marinette and WDNR have entered into a cost share agreement to remove legacy contaminated sediment from Menekaunee Harbor. However, work is yet to begin due to inadequate funding related to unforeseen costs. With adequate funding, dredging could begin in 2013.

Loss of historic wetlands, including loss of submergent and emergent plant communities, contributes to the "degradation of fish and wildlife populations" and "loss of fish and wildlife habitat" impairments. Implementation of the "Fish and Wildlife Population and Habitat Management and Restoration Plan" along with contaminated sediment remediation will remove these two impairments. Total costs and funding sources to complete the required activities have not been identified. The Great Lakes Restoration Initiative is expected to play a critical role in funding. Partners along with local and state agencies will need to investigate costs and apply for funding to complete these projects. Complete implementation of the *Fish and Wildlife Population and Habitat Management and Restoration Plan* is expected to take three to five years (2015-2017), but may take longer if additional contaminated sediment sites are identified in the AOC.

Unidentified toxic sources are considered the cause of the "restrictions on fish consumption" impairment. The 2012 SPMD study indicated that sediments in either the Lower or Upper Scott Flowage, or both, are a relatively small source of PCBs to the AOC (Bohr, 2012). WDNR has formally requested USEPA GLNPO to pursue sediment characterization of the Lower Scott Flowage through the Great Lakes Legacy Act Program. The request has been accepted and will likely be carried out during 2013. Reference sampling in the Upper Scott Flowage conducted as part of this effort will address sediment quality concerns there. The Fish Consumption Advisory Assessment will be completed in 2013 or 2014, and provide recommendations regarding the BUI status. The results of both efforts will guide the next step to removal of the "restrictions on fish consumption" BUI. BUI removal could be recommended in 2013, or additional sediment remediation may be required first, pending results from these activities.

Wisconsin and Michigan will use the 2011 Stage 2 RAP and subsequent RAP updates as the primary tools needed to remove BUIs and delist the AOC. The 2012 Stage 2 RAP update documents progress made for the remaining BUIs since the 2011 Stage 2 RAP, outlines the

current status of each BUI, and identifies activities needed to remove all BUIs. Additional updates will be produced on an as needed basis to effectively communicate progress to the public as well as local, state, and federal agencies.

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APPENDICES

Appendix A	Lower Menominee River AOC Beneficial Use Impairment Tracking Matrix
Appendix B	Letter of Support for the 2012 Stage 2 RAP Update from the Citizen's Advisory Committee
Appendix C	Updated Goals, Objectives, and Activities Table from the Fish and Wildlife Population and Habitat Management and Restoration Plan

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Appendix A

Lower Menominee River AOC Beneficial Use Impairment Tracking Matrix

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Appendix B

Letter of Support for the 2012 Stage 2 RAP Update from the Lower Menominee River Citizen's Advisory Committee

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Appendix C

Updated Goals, Objectives, and Activities Table from the Lower Menominee River AOC Fish and Wildlife Population and Habitat Management and Restoration Plan

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