



**FIVE-YEAR REVIEW REPORT FOR  
FOX RIVER NRDA/PCB RELEASES SUPERFUND SITE**

**BROWN, DOOR, MARINETTE, OCONTO, OUTAGAMIE, KEWAUNEE,  
AND WINNEBAGO COUNTIES, WISCONSIN, AND  
DELTA AND MENOMINEE COUNTIES, MICHIGAN**



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## LIST OF ACRONYMS

|        |   |
|--------|---|
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act |
| CIC    | Community Involvement Coordinator                                     |
| C.F.R. | Code of Federal Regulations   |
| cy     | cubic yards   |
| ESD    | Explanation of Significant Differences                                |
| EPA    | United States Environmental Protection Agency                         |
| FYR    | Five-Year Review  |
| ICIAP  | Institutional Control Implementation and Assurance Plan               |
| ICs    | Institutional Controls  |
| MNR    | Monitored Natural Recovery  |
| NCP    | National Contingency Plan   |
| ng/L   | nanograms per liter   |
| NPL    | National Priorities List  |
| OU     | Operable Unit   |
| PCBs   | Polychlorinated Biphenyls   |
| ppb    | parts per billion   |
| ppm    | parts per million   |
| PRPs   | Potentially Responsible Parties                                       |
| RAL    | Remedial Action Level   |
| RAOs   | Remedial Action Objectives  |
| ROD    | Record of Decision  |
| RPM    | Remedial Project Manager  |
| SQT    | Sediment Quality Threshold  |
| SWAC   | Surface-Weighted Average Concentration                                |
| UAO    | Unilateral Administrative Order                                       |
| U.S.C. | United States Code  |
| UU/UE  | Unlimited Use and Unrestricted Exposure                               |
| WDNR   | Wisconsin Department of Natural Resources                             |

## Executive Summary

The Fox River NRDA/PCB Releases site, also known as the Lower Fox River and Green Bay Superfund site, includes 39 miles of river and 2,700 square miles of Green Bay. The major contaminants are polychlorinated biphenyls (PCBs) located in the sediments of the river channel and Green Bay. The site poses risks to humans and ecological receptors via consumption of PCB-contaminated fish. Fish consumption advisories have been in effect since 1976.

The Wisconsin Department of Natural Resources (WDNR) is the lead technical agency at the site, and the United States Environmental Protection Agency (EPA) is the lead enforcement agency at the site. (Collectively, EPA and WDNR are referred to in this document as "Response Agencies.") The Response Agencies issued Records of Decision (RODs) in 2002 and 2003, ROD Amendments in 2007 and 2008, and an Explanation of Significant Differences (ESD) in 2010. These decision documents divide the site into five operable units (OUs) and select remedies consisting of a combination of dredging, capping and covering of contaminated sediments, monitored natural recovery (MNR), and long-term monitoring/maintenance.

In 2004, under a federal Consent Decree, the WTM I and P.H. Glatfelter companies started the cleanup of PCB-contaminated sediments in OU 1 (a.k.a., "Little Lake Butte des Morts") at the site. Cleanup actions included dredging, capping with sand and armor stone, and sand covering. EPA approved the completion of the construction of the remedial action in 2010.

The remedial action work in OUs 2 – 5 is currently underway and is being performed under a Unilateral Administrative Order (UAO) that EPA issued in November 2007. Dredging work began in 2009 and construction of the remedial action in OUs 2 – 5 is expected to be completed in 2017.

This five-year review (FYR) found that the remedy at OUs 1 – 5 is not protective of human health and the environment. While the remedy is currently being implemented and constructed in accordance with the requirements of the decision documents and design specifications, current levels of PCBs in fish tissue, sediments, and surface water indicate that the remedy is not protective. Although there are fish consumption advisories in place and warning signs posted along the river, fishing has been observed and the Response Agencies believe that fish are being consumed. Ecological receptors are still exposed to unacceptable risks posed by PCB contamination in fish, sediments and surface water. In order for the remedy to be protective, the following actions need to be taken: the remedy needs to be fully implemented; monitoring data needs to show that PCB concentrations in sediments, surface water, and fish are decreasing to meet the remedial action objectives (RAOs) as intended in the decision documents; and effective institutional controls (ICs) need to be fully implemented. Compliance with ICs will be ensured by maintaining, monitoring, and enforcing ICs, as well as maintaining the remedy components (i.e., caps) at the site. It will take some time following completion of the remedial activities to see the fish concentrations decrease to protective levels.

## Five-Year Review Summary Form

| SITE IDENTIFICATION   |   |  |
|---|---|--|
| <b>Site Name:</b> Fox River NRDA/PCB Releases                           |   |  |
| <b>EPA ID:</b> WID0001954841  |   |  |
| <b>Region:</b> 5  | <b>State:</b> WI/MI   | <b>City/County:</b> Brown, Door, Marinette, Oconto, Outagamie, Kewaunee, and Winnebago Counties, Wisconsin, and Delta and Menominee Counties, Michigan |
| SITE STATUS   |   |  |
| <b>NPL Status:</b> Proposed   |   |  |
| <b>Multiple OUs?</b><br>Yes   | <b>Has the site achieved construction completion?</b><br>No |  |
| REVIEW STATUS   |   |  |
| <b>Lead agency:</b> State   |   |  |
| <b>Author name (Federal or State Project Manager):</b> James Hahnenberg |   |  |
| <b>Author affiliation:</b> EPA  |   |  |
| <b>Review period:</b> 09/19/2013 – 07/17/2014                           |   |  |
| <b>Date of site inspection:</b> 11/19/2013                              |   |  |
| <b>Type of review:</b> Statutory  |   |  |
| <b>Review number:</b> 2   |   |  |
| <b>Triggering action date:</b> 07/17/2009                               |   |  |
| <b>Due date (five years after triggering action date):</b> 07/17/2014   |   |  |

**Five-Year Review Summary Form (continued)**

| <b>Issues/Recommendations</b>   |  |
|---|--|
| <b>OU(s) without Issues/Recommendations Identified in the Five-Year Review:</b> |  |
| None  |  |

**Issues and Recommendations Identified in the Five-Year Review:**

|                                      |  |                          |                        |                       |
|--------------------------------------|--|--------------------------|------------------------|-----------------------|
| <b>OU(s): 1 - 5</b>                  | <b>Issue Category:</b> Monitoring  |                          |                        |                       |
|                                      | <b>Issue:</b> Current PCB concentrations in fish tissue, sediments, and surface water indicate that the remedy is not currently protective and RAOs have not been met. |                          |                        |                       |
|                                      | <b>Recommendation:</b> Complete implementation of the remedy to address PCB-contaminated sediments and address ongoing unacceptable exposures.                         |                          |                        |                       |
| <b>Affect Current Protectiveness</b> | <b>Affect Future Protectiveness</b>  | <b>Party Responsible</b> | <b>Oversight Party</b> | <b>Milestone Date</b> |
| Yes                                  | Yes  | PRPs                     | EPA/State              | 12/31/2017            |

|                                      |  |                          |                        |                       |
|--------------------------------------|--|--------------------------|------------------------|-----------------------|
| <b>OU(s): 1 - 5</b>                  | <b>Issue Category:</b> Institutional Controls  |                          |                        |                       |
|                                      | <b>Issue:</b> Approved ICIAP has not been fully implemented.                                   |                          |                        |                       |
|                                      | <b>Recommendation:</b> Implement the portions of the ICIAP that have not yet been implemented. |                          |                        |                       |
| <b>Affect Current Protectiveness</b> | <b>Affect Future Protectiveness</b>  | <b>Party Responsible</b> | <b>Oversight Party</b> | <b>Milestone Date</b> |
| No                                   | Yes  | PRPs                     | EPA/State              | 12/31/2018            |

| <b>Protectiveness Statement(s)</b>   |   |
|--|---|
| <i>Operable Unit:</i> 1 – 5  | <i>Protectiveness Determination:</i> Not protective |
| <p><i>Protectiveness Statement:</i></p> <p>This FYR found that the remedy at OUs 1 – 5 is not protective of human health and the environment. While the remedy is currently being implemented and constructed in accordance with the requirements of the decision documents and design specifications, current levels of PCBs in fish tissue, sediments, and surface water indicate that the remedy is not protective. Although there are fish consumption advisories in place and warning signs posted along the river, fishing has been observed and the Response Agencies believe that fish are being consumed. Ecological receptors are still exposed to unacceptable risks posed by PCB contamination in fish, sediments and surface water. In order for the remedy to be protective, the following actions need to be taken: the remedy needs to be fully implemented; monitoring data needs to show that PCB concentrations in sediments, surface water, and fish are decreasing to meet the RAOs as intended in the decision documents; and effective ICs need to be implemented. Compliance with ICs will be ensured by maintaining, monitoring, and enforcing ICs, as well as maintaining the remedy components (i.e., caps) at the site. It will take some time following completion of the remedial activities to see the fish concentrations decrease to protective levels.</p> |   |

## I. INTRODUCTION

The purpose of a FYR is to evaluate the implementation and performance of the remedy at a site in order to determine whether the remedy is protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in FYR reports. In addition, FYR reports identify issues found during the review, if any, and recommendations to address them.

EPA prepares FYRs pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) § 121 and the National Contingency Plan (NCP). CERCLA § 121 states:

*"If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews."*

EPA interpreted this requirement further in the NCP; 40 C.F.R. § 300.430(f)(4)(ii) states:

*"If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action."*

EPA conducted a FYR of the remedial actions implemented at the Lower Fox River and Green Bay Superfund Site in northeastern Wisconsin. The WDNR is the lead technical agency at the site and EPA is the lead enforcement agency. EPA took the lead on this FYR. The WDNR has reviewed all supporting documentation and provided input to EPA during the FYR process.

This is the second FYR for the site. The triggering action for this statutory review is the signature date of the previous FYR. This FYR is required due to the fact that hazardous substances, pollutants, or contaminants remain at the site above levels that allow for unlimited use and unrestricted exposure (UU/UE). The site consists of 5 OUs, all of which are addressed in this FYR.

## II. PROGRESS SINCE THE LAST REVIEW

**Table 1. Protectiveness Determinations/Statements from the 2009 FYR**

| OU #                  | Protectiveness Determination | Protectiveness Statements   |
|-----------------------|------------------------------|---|
| OUs 1 – 5<br>Sitewide | Will be Protective           | <p>The remedial action being implemented at OU 1 (i.e., dredging, capping and covering) is expected to be protective, although it may take some additional time for fish tissue concentrations to decrease. Although construction work in OU 1 was completed on May 19, 2009, additional required long-term monitoring has not yet been conducted.</p> <p>The remedial actions being implemented at OU 2 and OU 3 (i.e., dredging, capping and covering) are expected to be protective after they are completed, although it may take some time after completion of remediation for fish tissue concentrations to decrease. It is expected that the remedial actions for OUs 2 and 3 will be completed by 2012, after which construction confirmation, follow-up sampling and long-term monitoring will be conducted.</p> <p>The remedial actions being implemented at OU 4 and OU 5 (i.e., dredging, capping and covering) are expected to be protective after they are completed, although it may take some time after completion of remediation for fish tissue concentrations to decrease. It is expected that the remedial actions for OUs 4 and 5 will be completed by 2017, after which construction confirmation, follow-up sampling and long-term monitoring will be conducted.</p> <p>Completion of the remedial actions in OU 4 – 5 should complete cleanup work at the site. Following the completion of the remedial action and after evaluation of additional information, EPA will make a site-wide protectiveness determination.</p> <p>Long-term protectiveness of the remedy will require compliance with effective ICs. Compliance with ICs will be ensured by maintaining, monitoring and enforcing ICs, as well as maintaining the site remedy components.</p> |

**Table 2. Status of Recommendations from the 2009 FYR**

| OU # | Issue  | Recommendations/<br>Follow-up Actions  | Party Responsible | Oversight Party | Original Milestone Date               | Current Status     | Completion Date (if applicable)                |
|------|--|--|-------------------|-----------------|---------------------------------------|--------------------|--|
| 1    | Remedy is not yet complete                                   | Complete remedial actions and confirm that remedial actions have met requirements in the RODs and ROD Amendments | PRPs              | EPA/State       | 2017 for entire site                  | Completed for OU 1 | May 19, 2009 (OU 1 river work)                 |
| 2-5  | Remedy is not yet complete                                   | Complete remedial actions and confirm that remedial actions have met requirements in the RODs and ROD Amendments | PRPs              | EPA/State       | 2017                                  | Ongoing            | N/A  |
| 1    | Long-term monitoring of fish and surface water has not begun | Conduct monitoring of fish and surface water upon completion of remedial actions                                 | PRPs              | EPA/State       | 2012 for OU 1                         | Completed          | 2010 (initiation of OU 1 long-term monitoring) |
| 2-5  | Long-term monitoring of fish and surface water has not begun | Conduct monitoring of fish and surface water upon completion of remedial actions                                 | PRPs              | EPA/State       | 2014 for OU 3; 2019 for OU 4 and OU 5 | Ongoing            | N/A  |
| 1-5  | ICs have not been evaluated                                  | Complete ICIAP and implement as set forth in RODs and ROD Amendments   | PRPs              | EPA/State       | 1/17/2010                             | Ongoing            | N/A  |

**1<sup>st</sup> and 2<sup>nd</sup> Recommendations**

The construction of the remedial action at OU 1 is now complete. EPA approved the *Lower Fox River Operable Unit 1, Remedial Action Certification of Completion Report* on December 15, 2010. The remedial action work at OUs 2 – 5 is ongoing and the cleanup work in those OUs is expected to be completed in 2017.

**3<sup>rd</sup> and 4<sup>th</sup> Recommendations**

Long-term monitoring is underway for some of the OUs but has not yet started for other OUs. Long-term monitoring began in 2010 for OU 1, following completion of the construction of the remedial action in that OU. Long-term monitoring for OU 2 and OU 3 began in 2012, but will not begin for OU 4 and OU 5 until after 2017 (following completion of the construction of the remedial action in those OUs). Since the remedial action work for OUs 2 – 5 is being completed

collectively under the 2007 UAO, the initiation of long-term monitoring for those OUs will not be considered complete until monitoring has begun in each of those OUs.

### 5<sup>th</sup> Recommendation

The potentially responsible parties (PRPs) completed an Institutional Control Implementation and Assurance Plan (ICIAP) in 2012. Institutional controls have not been fully implemented at the site, although fish advisories are in effect. The remaining ICs may not be fully in place until the remedies are fully constructed at the site.

### **Remedy Implementation Activities**

Background information about the site and the selected remedial actions is contained in Appendix A. Figures and photographs depicting the site location and various aspects of the remedy are contained in Appendix B. Dredging, capping, and covering remedial activities have been underway at the site since 2004. Previously, demonstration projects and a time-critical removal action were undertaken. Table 3 below summarizes remedial action activities through 2013.

**Table 3. Remedial Action Work Completed Through 2013**

| Action                         | OU 1<br>(2004 – 2009) | OUs 2 – 4<br>(2009 – 2012) | OU 4<br>(2013)       | TOTAL     |
|--------------------------------|-----------------------|----------------------------|----------------------|-----------|
| Dredging – cubic yards<br>(cy) | 371,600 <sup>1</sup>  | 2,103,800 <sup>2</sup>     | 584,600 <sup>3</sup> | 3,060,000 |
| Capping – acres                | 114 <sup>1</sup>      | 34 <sup>2</sup>            | 13 <sup>3</sup>      | 161       |
| Capping – cy                   | 275,900 <sup>5</sup>  | 109,700 <sup>6</sup>       | 62,900 <sup>7</sup>  | 448,500   |
| Covering – acres               | 107 <sup>1</sup>      | 62 <sup>2</sup>            | 13 <sup>4</sup>      | 182       |
| Covering – cy                  | 86,300 <sup>8</sup>   | 50,300 <sup>8</sup>        | 10,500 <sup>8</sup>  | 147,100   |

Table 3 Information sources:

<sup>1</sup> Foth and CH2MHILL, November 2010, Remedial Action Certificate of Completion, Table 1-1, page 3.

<sup>2</sup> Tetrattech, et al, October 2012, Lower Fox River Remedial Design 100 percent Design Report for 2010 and Beyond Remedial Actions, Tables 9-1, 9-2, and 9-3.

<sup>3</sup> Tetrattech EC Inc., Week Ending November 15, 2013.

<sup>4</sup> Tetrattech EC Inc., Week Ending October 18, 2013. Sand placed reported was for incomplete caps or sand cover over residual sediments remaining after dredging (i.e., no covering was completed).

<sup>5</sup> Volume of sediment capped for OU 1 is estimated based on the following formula:  
(Acres x 43,560 FT<sup>2</sup>/acre x 1.5 feet) / 27 FT<sup>2</sup>/cy = total cubic yards.

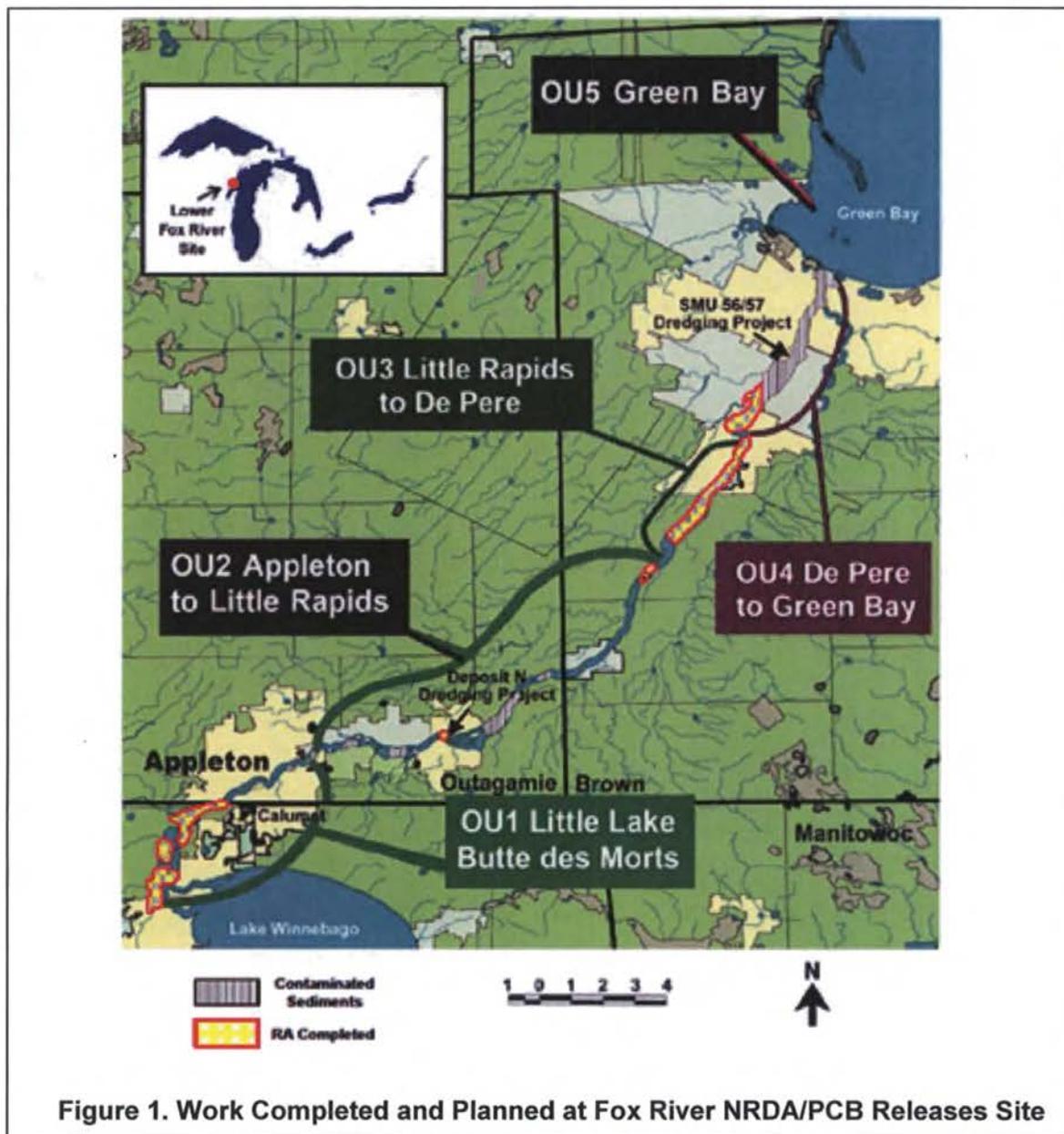
<sup>6</sup> Volume of sediment capped for OU 2 – 4 is estimated based on the following formula:  
(Acres x 43,560 FT<sup>2</sup>/acre x 2 feet) / 27 FT<sup>2</sup>/cy = total cubic yards.

<sup>7</sup> Volume of sediment capped for OU 4 is estimated based on the following formula:  
(Acres x 43,560 FT<sup>2</sup>/acre x 3 feet) / 27 FT<sup>2</sup>/cy = total cubic yards.

<sup>8</sup> Volume of sediment covered is estimated based on the following formula:  
(Acres x 43,560 FT<sup>2</sup>/acre x 0.5 feet) / 27 FT<sup>2</sup>/cy = total cubic yards.

Table note: Volumes are rounded to the nearest hundred cubic yards.

By the end of the 2013 dredging season, approximately 3.8 million cy of PCB-contaminated sediment were removed or contained, while about 3.2 million cy remain to be remediated. The construction of the remedial action is expected to be completed by 2017. Figures 1, 2, and 3 below show the work completed through 2013, as well as the work remaining.



## PCB contaminated sediment cleanup

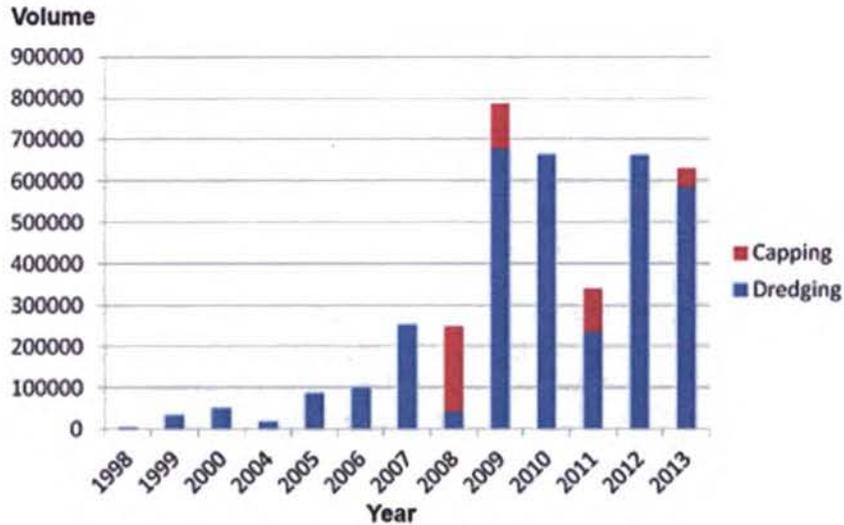


Figure 2. Dredging and Capping Work Completed Through 2013

## Remaining Work

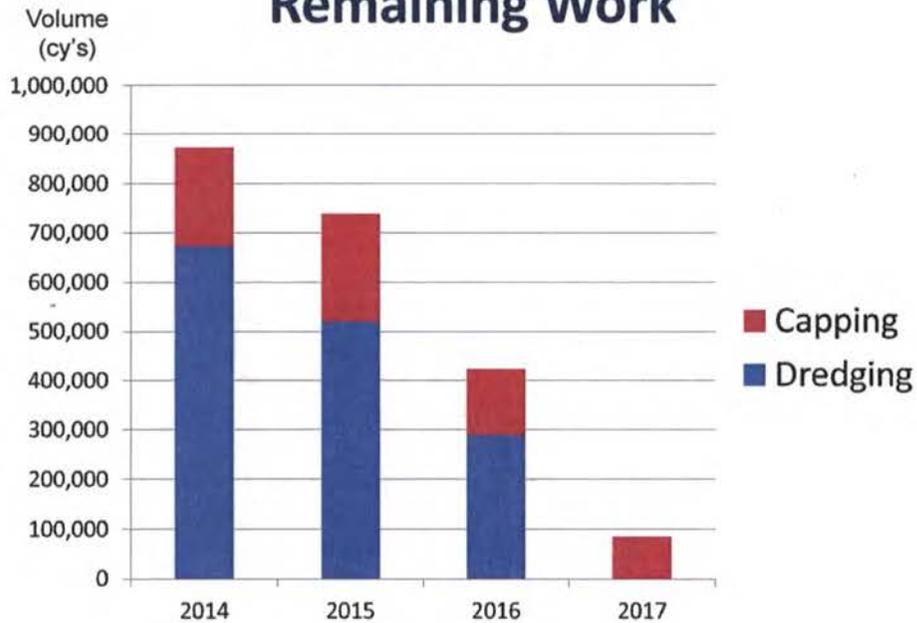


Figure 3. Dredging and Capping Work Remaining After 2013

The Response Agencies issued an ESD in February 2010 which addressed modifications to the monitoring requirements for OU 2, cap design modifications for OUs 2 – 5, and cost increases for OUs 2 – 5. All of the remedial action work has been conducted consistent with the site decision documents, including the 2002 and 2003 RODs, 2007 and 2008 ROD Amendments, and the 2010 ESD.

During the ongoing cleanup, it was determined that the partially submerged hulls of two steam-powered tugboats – the *Bob Teed* and *Satisfaction* – and debris from what is believed to be three old barges needed to be removed from the river within OU 4 and disposed offsite. The tugboats and barges were located within contaminated sediment targeted for remedial action. The vessels were declared historical artifacts and cultural resources under the National Historic Preservation Act. A Memorandum of Agreement among EPA, WDNR, the Wisconsin State Historical Preservation Office, the Neville Museum, and certain PRPs was finalized in September 2013, and removal of the shipwrecks started in November 2014. The MOA requires the creation of an interpretive display at Brown County's Neville Museum. The display will be completed by December 2014 and will explain the history of the vessels and other interesting facts about river commerce in the late 1800s and early 1900s. Shipwreck removal activities were completed on May 9, 2014. See Figures 7, 8, 9, and 10 in Appendix B.

#### Institutional Controls

Institutional controls are required to ensure the protectiveness of the remedy. ICs are non-engineered instruments, such as administrative and legal controls, that help to minimize the potential for human exposure to contamination and that protect the integrity of the remedy. ICs are required to assure the long-term protectiveness for any areas which do not allow for UU/UE and to maintain the integrity of the remedy. ICs are required at the Fox River site because PCB contamination remains at the site above levels that would allow for UU/UE.

Table 4 and the narrative below summarize the ICs that are in place and/or needed for the areas of the site that do not allow for UU/UE. A map showing the area in which the ICs apply is included in Appendix G of the 2012 final Remedial Design.

ICs have not been fully implemented at the site as the remedy is not yet complete. An ICIAP was approved in 2012 as part of the final 100% Remedial Design for OUs 2 – 5.

The ICIAP specifies the types and details of the ICs required at the site and provides a schedule for implementation. Fish advisories, currently in place, would likely be required until contaminant concentrations in fish are reduced such that unrestricted consumption would not present an unacceptable risk (i.e., when PCB fish tissue concentrations are at or below 50 parts per billion (ppb)).

**Table 4. Summary of Planned and/or Implemented ICs**

| Media, Engineered Controls, and Areas that do Not Support UU/UE Based on Current Conditions | ICs Needed? | ICs Called for in the Decision Documents? | Impacted Parcel(s) | IC Objective  | Title of IC Instrument Implemented and Date (or Planned)   |
|---|-------------|---|--------------------|---|--|
| Fish  | Yes         | Yes                                       | Entire Site        | Prevent ingestion of PCB-contaminated fish by humans  | Wisconsin Fish Advisories (in effect since 1976)   |
| Sediments   | Yes         | Yes                                       | Entire Site        | Prevent damage to caps through limitations on anchoring, dredging, spudding or dragging, or conducting salvage operations, and by establishing "no wake" areas and construction limitations | Chapter 30, Wisconsin Statutes (existing); Section 404 of the Clean Water Act, 33 U.S.C. §1344 (existing); Sections 9 and 10 of the Rivers and Harbors Act of 1899, 33 U.S.C. §401 and 403 (existing); and Memoranda of Agreement (planned for 2018) |

The effectiveness of the fish advisories will be evaluated as part of the ICIAP. Compliance with ICs will be required to assure long-term protectiveness for any areas which do not allow for UU/UE and will ensure the remedy continues to function as intended. Once ICs are implemented, long-term stewardship procedures will be developed to ensure that the ICs are maintained, monitored and enforced. A long-term stewardship plan is included in the ICIAP.

Various Memoranda of Agreement are envisioned in the ICIAP and would have three key objectives: 1) provision of notices, in accordance with a schedule, to riparian owners advising them of the presence of caps offshore from their property; 2) provision of geographical coordinates for all caps so that they may be placed in Wisconsin's GIS Registry; and 3) inspections to check for disturbances to the caps with subsequent reporting to the WDNR.

**System Operation/Operation and Maintenance**

After construction completion and verification that the 2007 and 2008 ROD Amendments' remedial action level (RAL) and/or surface-weighted average concentration (SWAC) standards have been met, the site will be monitored on a regular basis. For OU 1, the construction of the remedial action was approved in 2010 with the approval of the *Lower Fox River Operable Unit 1, Remedial Action Certification of Completion Report*. There will also be a final construction report for OUs 2 – 5 following completion of the construction work in those OUs.

A long-term monitoring plan identifies the long-term monitoring activities to be conducted at the site. Completion of the remedial action construction work in 2017 in OUs 4 - 5 should

complete cleanup work at the site. Following the completion of remedial action construction work, additional information to be obtained will consist of the following:

- Post-remediation sampling of residual sediments in dredged areas that do not have a cap or sand cover will be performed immediately after dredging. The long-term monitoring plan requires long-term sediment monitoring of the MNR areas only (OU 2 and OU 5). EPA's FIELDS Team performed post-remediation sediment sampling in OU 1 and OU 3 in only the soft sediment areas (not in capped areas).
- Post-construction monitoring to determine if caps and covers are installed as designed.
- Long-term monitoring of caps to confirm their containment effectiveness. If necessary, additional maintenance of caps will be conducted.
- Long-term monitoring of surface water and fish for confirmation of environmental improvements.

These same monitoring activities will also be done at OU 1 and OU 2, with post-construction monitoring having begun in 2010 (OU 1) and 2012 (OU 2) and other monitoring activities to follow.

System operation and maintenance is not required, as the remedy is dredging (i.e., removal) and capping (containment). As discussed above, a long-term monitoring plan has been developed for sampling and analysis of surface water and fish, and will be implemented as long as PCBs are present at the site.

### **III. FIVE-YEAR REVIEW PROCESS**

#### **Administrative Components**

The PRPs were notified of the development of the FYR on June 23, 2014. The FYR was led by James Hahnenberg, EPA Remedial Project Manager (RPM) for the site, with assistance from Susan Pastor, EPA Community Involvement Coordinator (CIC). Beth Olson of the WDNR assisted in the review as the representative for the State of Wisconsin.

The review, which began on September 19, 2013, consisted of the following components:

- Community Notification and Involvement;
- Document Review;
- Data Review;
- Site Inspection;
- Interviews; and
- FYR Report Development and Review.

## **Community Notification and Involvement**

Activities to involve the community in the FYR process were initiated with a meeting in November 2013 between the RPM and CIC for the site. A notice was published on the EPA webpage on June 26, 2014, inviting the public to submit any comments to EPA. An ad will run in a local newspaper announcing the completion of the FYR, and the final FYR report will be made available at the site information repositories listed below:

### **Appleton Public Library**

225 N. Oneida St.  
Appleton, WI  
920-832-6173

### **Brown County Library**

515 Pine St.  
Green Bay, WI

### **Door County Library**

107 S. Fourth Ave.  
Sturgeon Bay, WI

### **Oneida Community Library**

201 Elm St.  
Oneida, WI

### **Oshkosh Public Library**

106 Washington Ave.  
Oshkosh, WI

Further information regarding recent site construction and remediation-related activities can be found at the following EPA Region 5 website:  
<http://www.epa.gov/region5/sites/foxriver/index.html>

Additionally, the PRPs currently doing work at OUs 2 – 5 have posted photos and site construction updates at the following website, maintained by the PRPs:  
<http://www.foxrivercleanup.com/>

## **Document Review**

EPA's document review was completed for analytical results, design evaluations, post-remediation sampling, and progress reports of volumes removed and acres capped. EPA reviewed analytical results (i.e., from confirmation sampling), bathymetric surveys, and design evaluations.

## Data Review

Current levels of PCBs at OUs 1 – 5 still exceed remediation goals for fish tissue, sediments, and surface water, thus affecting protectiveness of human health and the environment.

### Fish Tissue

Long-term monitoring of fish was conducted in 2006, 2010, and 2012. PCB concentrations in fish during the 2012 monitoring event are shown in Table 5 below. The Sediment Quality Thresholds (SQTs) developed during the feasibility study for humans and ecological receptors are provided in Figures 5 and 6 in Appendix A. In general, fish consumption advisories are needed if fish tissue concentrations exceed 50 ppb.

**Table 5. Lower Fox River Mean PCB Concentrations (ppb), 2012 Fish Sampling**

| OU   | Carp   | Gizzard Shad | Walleye | Smallmouth Bass |
|------|--------|--------------|---------|-----------------|
| 1*   | 1261.1 | 26.2         | 84.2    | 208.7           |
| 2A** | 825.3  | 67.5         | -       | 141.5           |
| 2B** | 598.9  | 26.7         | 184.5   | -               |
| 2C** | 707.3  | 66.9         | 650.3   | -               |
| 3**  | 549.4  | 184.3        | 928.3   | -               |

Table 5 Data Sources

\* OU 1 2013 Long-Term Monitoring Summary Report, Table 4-3.

\*\* OU 2 – 3 2012 Long-Term Monitoring Summary Report, Table 4-6.

Note: Smallmouth Bass substituted for Walleye in OU 2A.

### Surface Water

PCB surface water monitoring results from sampling conducted in OUs 1 – 3 in 2012 are shown in Table 6 below. The two columns at the far right show the human health and ecological water quality criteria contained in RAO 1 for the site, as described in the site decision documents. RAO 1 specifies that the objective is to “achieve, *to the extent practicable*, surface water quality criteria throughout the Lower Fox River and Green Bay” [emphasis added]. Other sections of the site decision documents clearly state that these water quality criteria are “To Be Considered” criteria and not “Applicable or Relevant and Appropriate Requirements,” and that the principal measure of management and/or cleanup success is achieving protective levels of PCBs in fish tissue. For this reason, RAO 1 included the phrase, “to the extent practicable” regarding achievement of the water quality criteria.

**Table 6. 2012 Monitoring Results for Surface Water**

| OU             | 2012 Concentrations<br>(nanograms per liter)<br>(ng/L) | Human Health Water<br>Quality Criterion<br>(ng/L) | Ecological Water<br>Quality Criterion<br>(ng/L) |
|----------------|--|---|---|
| Lake Winnebago | 0.2*   | 0.18  | 0.003   |
| 1              | 1.2*   |   |   |
| 2A             | 2.1**  |   |   |
| 2B             | 2.6**  |   |   |
| 2C             | 2.1**  |   |   |
| 3              | 3.3**  |   |   |

Table 6 Data Sources:

\* 2012 Long-Term Monitoring Summary Report, Lower Fox River Operable Unit 1, November 2013, Table 3-12.

\*\* 2012 Long-Term Monitoring Summary Report, Lower Fox River Operable Units 2 – 3, October 2013, Table 3-18.

### Sediments

Post-remediation sediment confirmation sampling was completed for OU 1 in 2009 and 2010, and for OU 3 in 2012. This sampling showed that the PCB sediment cleanup standards specified in the 2008 and 2009 ROD Amendments were met. Specifically, these PCB cleanup standards are SWACs of 0.25 parts per million (ppm) for OU 1 and 0.28 ppm for OU 3.

### **Site Inspection**

PRP and WDNR representatives were present at the FYR site inspection conducted by the EPA RPM on November 19, 2013. The inspection examined the river to determine if site conditions had changed and to confirm the status of ongoing remedial activities. The Site Inspection Checklist is included as Appendix C.

### **Interviews**

During the FYR process, interviews were conducted with WDNR and oversight personnel involved in site cleanup activities. The purpose of the interviews was to document any perceived problems or successes with remedy implementation to date, as well as progress made to date and remaining work. These interviews were conducted by the EPA RPM on November 19, 2013, and May 21, 2014.

## **IV. TECHNICAL ASSESSMENT**

### ***Question A: Is the remedy functioning as intended by the decision documents?***

No. The remedy is currently under construction and is being constructed in accordance with the requirements of the RODs, ROD Amendments, ESD, and design specifications. However, current levels of PCBs still exceed remediation goals for fish tissue, sediments, and surface water, thus affecting the protectiveness of the remedy. Once the Response Agencies determine that the RAL performance standard (i.e., SWAC goal) is achieved in an OU, construction of the remedy is deemed complete, although monitoring and maintenance requirements continue to apply. Only OU 1 is currently considered "construction complete," while all other OUs are still under construction. Monitoring has begun for OUs 1 – 3. Upon

completion of construction of all remedial actions, site-wide long-term monitoring will be conducted. Fish consumption advisories are in place and will be reevaluated as deemed appropriate by WDNR. ICs have been implemented to the extent feasible given that the remedy is still underway. In addition, full implementation of the ICIAP will begin upon completion of the construction of the remedy at the site.

**Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of remedy selection still valid?**

Yes. Site conditions are essentially unchanged and there are no new cleanup standards applicable to the site.

**Question C: Has any other information come to light that could call into question the protectiveness of the remedy?**

No. At this time, no other information has come to light that would call into question the protectiveness of the remedy.

**Technical Assessment Summary**

The remedy is currently being implemented and constructed in accordance with the requirements of the RODs, ROD Amendments, ESD, and design specifications. However, current levels of PCBs in fish tissue, sediments, and surface water indicate that the remedy is not yet protective of human health and the environment. EPA will determine whether the remedy is functioning as intended once the construction of the remedy is completed. This evaluation will measure PCB concentrations in dredged/uncovered areas, and will evaluate whether the caps and covers have been installed as required by the site decision documents.

**V. ISSUES/RECOMMENDATIONS AND FOLLOW-UP ACTIONS**

**Table 7. Issues/Recommendations and Follow-up Actions**

| Issue   | Recommendations and Follow-up Actions  | Party Responsible | Oversight Agency | Milestone Date | Affects Protectiveness |        |
|---|--|-------------------|------------------|----------------|------------------------|--------|
|   |  |                   |                  |                | Current                | Future |
| Current PCB concentrations in fish tissue, sediments, and surface water indicate that the remedy is not currently protective and RAOs have not been met | Complete implementation of the remedy to address PCB-contaminated sediments and address ongoing unacceptable exposures | PRPs              | EPA/State        | 12/31/2017*    | Yes                    | Yes    |
| Approved ICIAP has not been fully implemented   | Implement the portions of the ICIAP that have not yet been implemented   | PRPs              | EPA/State        | 12/31/2018     | No                     | Yes    |

\* All areas are anticipated to have remedial action construction activities completed by 2017. Remedial action construction activities for OU 1 were completed in May 2009 and long-term monitoring started in 2010. Remedial action construction activities for OUs 2 – 5 are expected to be completed by the end of 2017, with long-term monitoring for OUs 4 – 5 starting in 2018. Long-term monitoring for OU 2 and OU 3 began in 2012.

## **VI. PROTECTIVENESS STATEMENT(S)**

This FYR found that the remedy at OUs 1 – 5 is not protective of human health and the environment. While the remedy is currently being implemented and constructed in accordance with the requirements of the decision documents and design specifications, current levels of PCBs in fish tissue, sediments, and surface water indicate that the remedy is not protective. Although there are fish consumption advisories in place and warning signs posted along the river, fishing has been observed and the Response Agencies believe that fish are being consumed. Ecological receptors are still exposed to unacceptable risks posed by PCB contamination in fish, sediments and surface water. In order for the remedy to be protective, the following actions need to be taken: the remedy needs to be fully implemented; monitoring data needs to show that PCB concentrations in sediments, surface water, and fish are decreasing to meet the RAOs as intended in the decision documents; and effective ICs need to be fully implemented. Compliance with ICs will be ensured by maintaining, monitoring, and enforcing ICs, as well as maintaining the remedy components (i.e., caps) at the site. It will take some time following completion of the remedial activities to see the fish concentrations decrease to protective levels.

## **VII. NEXT REVIEW**

The next FYR report for the Lower Fox River and Green Bay site is required five years from the completion date of this review.

## APPENDIX A – EXISTING SITE INFORMATION

## APPENDIX A – EXISTING SITE INFORMATION

### A. SITE CHRONOLOGY

**Table 1: Chronology of Site Events**

| Event  | Date              |
|--|-------------------|
| Fish advisories issued by Wisconsin Department of Natural Resources (WDNR)                           | 1976              |
| NPL listing proposal   | July 28, 1998     |
| Deposit N dredging demonstration   | 1998-1999         |
| Remedial Investigation/Feasibility Study made available to the public                                | March 1999        |
| Dredging demonstration project and removal actions (SMU 56/57)                                       | 1999-2000         |
| Proposed Plan identifying EPA's preferred remedy issued to the public for review and comment         | October 5, 2001   |
| Remedial Investigation/Feasibility Study complete  | December 20, 2002 |
| Record of Decision (ROD) signature – OUs 1 – 2   | December 20, 2002 |
| Site restoration plan completed by U.S Fish and Wildlife Service                                     | June 2003         |
| ROD signature – OUs 3 – 5  | June 30, 2003     |
| Administrative Order on Consent for OU 1 design  | July 1, 2003      |
| Administrative Order on Consent for design for OU 2 (Deposit DD), OU 3, OU 4, and OU 5 (river mouth) | March 5, 2004     |
| Judicial Consent Decree for OU 1 design and remediation  | April 12, 2004    |
| Remedial action start (OU 1)   | September 9, 2004 |
| OU 1 remediation   | 2004-2009         |
| Judicial Consent Decree for "Phase 1" remediation  | November 3, 2006  |
| ROD Amendment for OU 2 (Deposit DD), OU 3, OU 4, and OU 5 (river mouth)                              | June 26, 2007     |
| Unilateral Administrative Order (UAO) for OU 2 – 5 remediation                                       | November 13, 2007 |
| ROD Amendment for OU 1   | June 12, 2008     |
| Remedial action start (OU 2, OU 3, and OU 4)   | April 28, 2009    |
| First Five-Year Review signed  | July 17, 2009     |
| Explanation of Significant Differences for OUs 1 – 5   | February 26, 2010 |
| Remedial Action Certification of Completion Report   | November 15, 2010 |
| Memorandum of Agreement regarding shipwreck removal  | September 4, 2013 |
| Completion of shipwreck removal  | May 9, 2014       |

## B. BACKGROUND

### Physical Characteristics

The site comprises a 39-mile stretch of the Lower Fox River as well as the bay of Green Bay. The river portion of the site extends from the outlet of Lake Winnebago and continues downstream to the mouth of the river at Green Bay, Wisconsin. The bay portion of the site includes all of Green Bay from the city of Green Bay to the point where Green Bay enters Lake Michigan. The site has been divided into five discrete operable units (OUs) by the Response Agencies. An OU is a geographical area designated for the purpose of analyzing and implementing remedial actions, and is defined on the basis of similar features and characteristics (e.g., physical and geographic properties). The river and the bay OUs are depicted in Figure 1 and are as follows:

- OU 1 – Little Lake Butte des Morts
- OU 2 – Appleton to Little Rapids
- OU 3 – Little Rapids to De Pere
- OU 4 – De Pere to Green Bay
- OU 5 – Green Bay

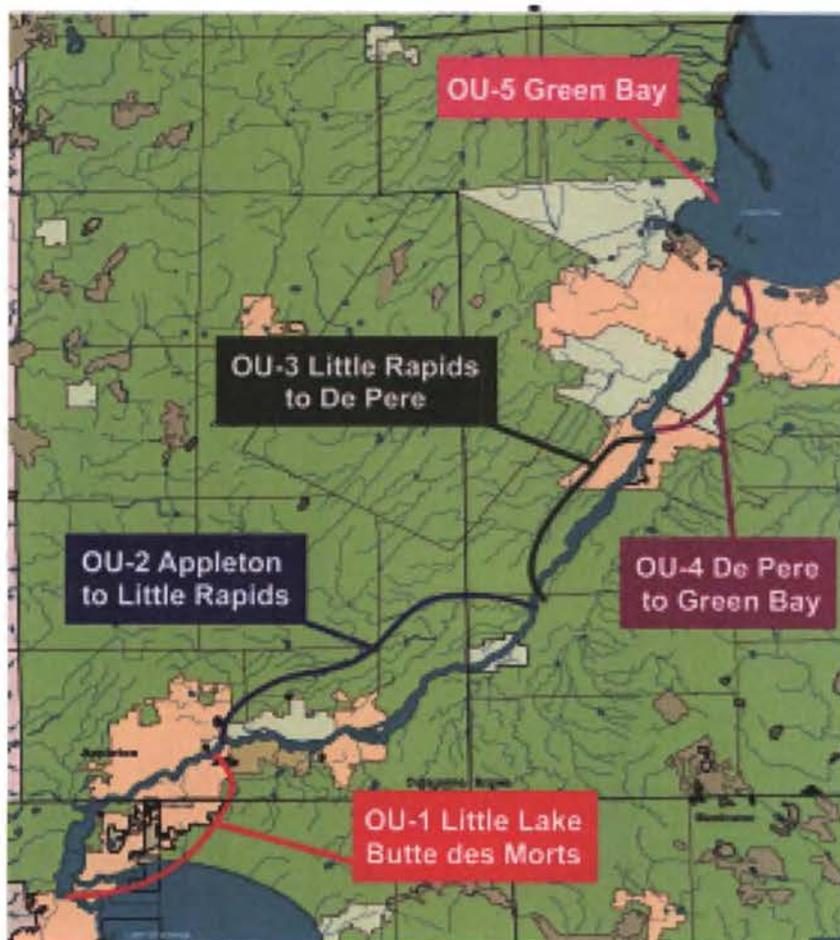


Figure 1. Fox River Operable Units

## **Hydrology**

This is a contaminated sediment site. Groundwater is not a media of concern and was not investigated during the remedial investigation/feasibility study (RI/FS).

## **Land Resource and Use**

The river and areas bordering the river include the following uses: recreational (with likely subsistence fishing), residential, commercial, agricultural, and industrial. Residential areas are concentrated in the upriver (Neenah/Menasha and Appleton areas) but are also present from De Pere to Green Bay. Industrial use is present in the Neenah/Menasha and Appleton area, and is scattered along the river up to and including Green Bay. Agricultural use is located mainly between Appleton and De Pere.

## **History of Contamination**

For many years, a large number of paper production facilities have been and continue to be concentrated along the river. Some of the facilities manufactured and/or recycled PCB-containing carbonless copy paper from 1954 to 1971. PCBs were released from the paper production facilities to the Fox River directly, or after passing through municipal wastewater treatment plants. PCBs were then transported within the river system, as PCBs have a tendency to sink and adhere to sediments in the river bottom. PCBs have contaminated areas in the 39-mile length of the Lower Fox River, and Green Bay.

## **Initial Response**

The site was proposed for the National Priorities List (NPL) on July 28, 1998. The site's placement on the NPL was deferred, pending cooperation of the potentially responsible parties (PRPs).

The Response Agencies conducted extensive evaluations, particularly beginning in 1989 with the Green Bay Mass Balance Study, as well as demonstration projects in two discrete areas of the river (known as Deposit N/O and Sediment Management Unit 56/57 [SMU 56/57]) from 1998 – 2000. Details of these projects are discussed in the 2003 ROD. In 2000, the SMU 56/57 project was completed as a time-critical removal action. A total of 90,000 cubic yards (cy) of PCB-contaminated sediments were removed and disposed off-site during these dredging projects.

In March 1998, WDNR began an RI/FS and Risk Assessment with funding and technical assistance from the U.S. Environmental Protection Agency (EPA). After extensive public comment on the draft documents, a proposed plan was released for public comment in October 2001.

The construction of an interim action identified as "Phase 1" was completed in 2007. This dredging project was located in OU 4 just downstream of the De Pere Dam, and removed 130,000 cy of PCB contaminated sediments, consistent with the 2003 ROD and 2007 ROD Amendment, which are discussed in the "Remedy Selection" section below.

## **Basis for Taking Action**

The site is contaminated with PCBs, a hazardous substance and probable human carcinogen. Other contaminants of concern (COCs) include dioxins/furans, the pesticide DDT

and its metabolites (DDD and DDE), the pesticide dieldrin, and metals including arsenic, lead, and mercury. These non-PCB contaminants were found to present substantially less risk compared to PCBs. Additionally, some of the other contaminants identified in sediment have similar fate and transport properties, and are generally found with PCBs. For this reason, a remedy that effectively addresses PCB exposure will also address the other COCs (with lesser toxicities) in the sediment. It has been estimated that the 14 million cy of contaminated river sediments contain over 65,000 pounds of PCBs, and at least several hundred million cy of sediments in Green Bay are contaminated with as much as 150,000 pounds of PCBs. Because fish and wildlife are contaminated with PCBs, people who eat contaminated fish or waterfowl may suffer adverse health effects. Fish consumption advisories for the site were first issued in 1976 and 1977 by WDNR and the State of Michigan, respectively. The advisories are still in effect. Wildlife also has documented adverse impacts.

In conjunction with the RI/FS, an ecological risk and exposure assessment for the site was completed in December 2002. The results of the risk assessment are summarized in the 2002 and 2003 RODs. The conclusions of the evaluations (which are still valid, since site conditions are relatively unchanged since the 2002 ROD) are:

- Human health and ecological receptors are at risk in each operable unit.
- Fish consumption is the exposure pathway representing the greatest level of risk for human and ecological receptors, other than the direct risks posed to benthic invertebrates via direct exposure to contaminated sediments.
- The primary COC is PCBs.

## **C. REMEDIAL ACTIONS**

### **Remedy Selection**

In December 2002, the Response Agencies signed the ROD for OU 1 and OU 2 which called for active remediation in OU 1 and Monitored Natural Recovery (MNR) in most of OU 2. In June 2003, the Response Agencies issued a ROD for OU 3, OU 4, and OU 5 which called for active remediation in OU 2 (deposit DD), OU 3, and OU 4, and MNR for OU 5.

The Response Agencies subsequently modified the remedies described in the 2002 and 2003 RODs. A ROD Amendment signed on June 26, 2007, modified certain aspects of the 2003 ROD for all or part of the following OUs: OU 2 (Deposit DD), OU 3, OU 4, and OU 5 (near the mouth of the river). A second ROD Amendment, signed on June 12, 2008, made changes to parts of the remedy described in the 2002 ROD for OU 1. In general, the ROD Amendments changed the selected remedies from all-dredging to a combination of dredging, capping, and covering.

The Response Agencies issued an ESD on February 26, 2010, which addressed modifications to the monitoring requirements for OU 2, cap design modifications for OUs 2 – 5, and cost increases for OUs 2 – 5.

More details about the selected remedy for each OU is provided in the “Remedies Summary” section below.

## Remedial Action Objectives

The RODs and ROD Amendments adopted the same site-wide remedial action objectives (RAOs). The following five RAOs were established for the site:

- RAO 1: Achieve, to the extent practicable, surface water quality criteria throughout the Lower Fox River and Green Bay. This RAO is intended to reduce PCB concentrations in surface water as quickly as possible. The current water quality criteria for PCBs are 0.003 nanograms per liter (ng/L) for the protection of human health, and 0.012 ng/L for the protection of wild and domestic animals. Water quality criteria incorporate all routes of exposure assuming the maximum amount is ingested daily over a person's (or animal's) lifetime.
- RAO 2: Protect humans who consume fish from exposure to COCs that exceed protective levels. This RAO is intended to protect human health by targeting removal of fish consumption advisories as quickly as possible. The Response Agencies defined the expectation for the protection of human health as recreational and high-intake fish consumers being able to safely eat unlimited amounts of fish within 10 years to 30 years, respectively, following remedy completion.
- RAO 3: Protect ecological receptors from exposure to COCs above protective levels. This RAO is intended to protect ecological receptors such as invertebrates, birds, fish, and mammals. The Response Agencies defined the ecological expectation of achieving safe ecological thresholds for fish-eating birds and mammals within 30 years following remedy completion. Although the Feasibility Study did not identify a specific time frame for evaluating ecological protection, the 30-year figure was used as a measurement tool.
- RAO 4: Reduce transport of PCBs from the Lower Fox River into Green Bay and Lake Michigan. The objective of this RAO is to reduce the transport of PCBs from the river into the bay and Lake Michigan as quickly as possible. The Response Agencies defined the transport expectation as a reduction in PCB loading to Green Bay and Lake Michigan to levels comparable to the PCB loading from other Lake Michigan tributaries. This RAO applies to each OU encompassing part of the river.
- RAO 5: Minimize the downstream movement of PCBs during implementation of the remedy. This objective would minimize, as much as feasible, the release of contaminants during remedial activities such as dredging, capping, or placing sand covers.

## Remedies Summary

### OU 1 (a.k.a. Little Lake Butte des Morts)

Operable Unit 1 consists of the first six upstream miles of the Lower Fox River, commonly known as Little Lake Butte des Morts. The 2008 ROD Amendment for OU 1 was based on new information compiled and analyzed in the OU 1 Design Supplement, Lower Fox River Operable Unit 1, dated November 16, 2007 (Design Supplement). The remedy consists of the following actions for all sediments with PCB concentrations greater than 1 part per million (ppm):

- Dredging and off-site disposal.
- 7-inch thick engineered cap of sand and armor stone.
- 3- to 6-inch-thick sand cover for areas with PCB concentrations less than 2 ppm and where the contaminant interval is less than 8-inches in thickness.
- Long-term monitoring and maintenance. Monitoring will consist of monitoring fish and surface water, and cap integrity and containment effectiveness. If cap integrity is compromised, either cap repair or removal (along with removal of underlying contamination) would be conducted.

The Remedial Action Level (RAL) for the major COC, PCBs, is 1 ppm, with a goal for a PCB surface-weighted average concentration (SWAC) of 0.25 ppm. This compares to a pre-remediation SWAC of 1.9 ppm.

## OU 2

The remedy for OU 2 consists of MNR, including measuring PCB levels in water, sediment, and fish. Baseline monitoring has been completed and long-term monitoring has begun.

### OU 2 (Deposit DD), OU 3, OU 4 and OU 5 (river mouth)

- Remedial actions for OUs 2 – 5 are currently underway.

The 2007 ROD Amendment for OUs 2 – 5 was based on new information compiled and analyzed in the Basis of Design Report for OUs 2 – 5, dated June 16, 2006. Additionally, the 2010 ESD modified monitoring requirements for OU 2, and remedy cost and cap thickness requirements for OUs 2 – 5. The remedy consists of the following actions for all sediments with PCB concentrations greater than 1 ppm:

- Dredging and off-site disposal.
- An engineered cap of sand and armor stone with a minimum thickness of 7 inches (“A Caps”), 10 inches (“B Caps”), or 21 inches (“C Caps”), depending on the level of PCB contamination and location relative to the navigation channel, with “targeted” thicknesses of 13 inches, 16 inches, or 33 inches, respectively.
- A 6-inch-thick sand cover for areas with PCB concentrations less than 2 ppm, and where the contaminant interval is less than 6 inches in thickness.
- Long-term monitoring and maintenance. This will consist of monitoring fish, surface water, and cap integrity. If cap integrity is compromised, either cap repair or removal (with removal of underlying contamination) will be conducted.

The RAL for the major contaminant, PCBs, is 1 ppm. There is a post-remediation goal for a PCB SWAC of 0.25 ppm for OU 3 and OU 4, compared to a pre-remediation SWAC of 1.8 ppm for OU 3 and 3.6 ppm for OU 4.

OU 5 (except near river mouth)

The selected remedy for OU 5 is MNR with institutional controls (ICs). Activities will include monitoring to confirm long-term recovery of Green Bay through reliance on natural processes, primarily dispersion.

**Table 2. Site Decision Documents Summary**

| Operable Units | RODs   |                                    | ROD Amendments                             |  |
|----------------|--|------------------------------------|--|--|
|                | Remedy                                       | Signature Date                     | Remedy Amendment                           | Signature Date                           |
| 1              | Dredging/disposal;<br>Capping<br>contingency | December 20,<br>2002<br>(2002 ROD) | Dredging/disposal<br>Capping<br>Covering.  | June 12, 2008<br>(2008 ROD<br>Amendment) |
| 2              | Monitored Natural<br>Recovery <sup>1</sup>   |                                    | Monitored Natural<br>Recovery <sup>1</sup> |  |
| 3              | Dredging/disposal;<br>Capping<br>contingency | June 30, 2003<br>(2003 ROD)        | Dredging/disposal<br>Capping<br>Covering   | June 26, 2007<br>(2007 ROD<br>Amendment) |
| 4              |  |                                    | Monitored Natural<br>Recovery <sup>2</sup> |  |

<sup>1</sup> Except for Deposit DD

<sup>2</sup> Except near the mouth of the Fox River

Table Note: The 2010 ESD is not included in this table because it did not fundamentally alter the selected remedy for any of the OUs.

**Remedy Implementation**

OU 1

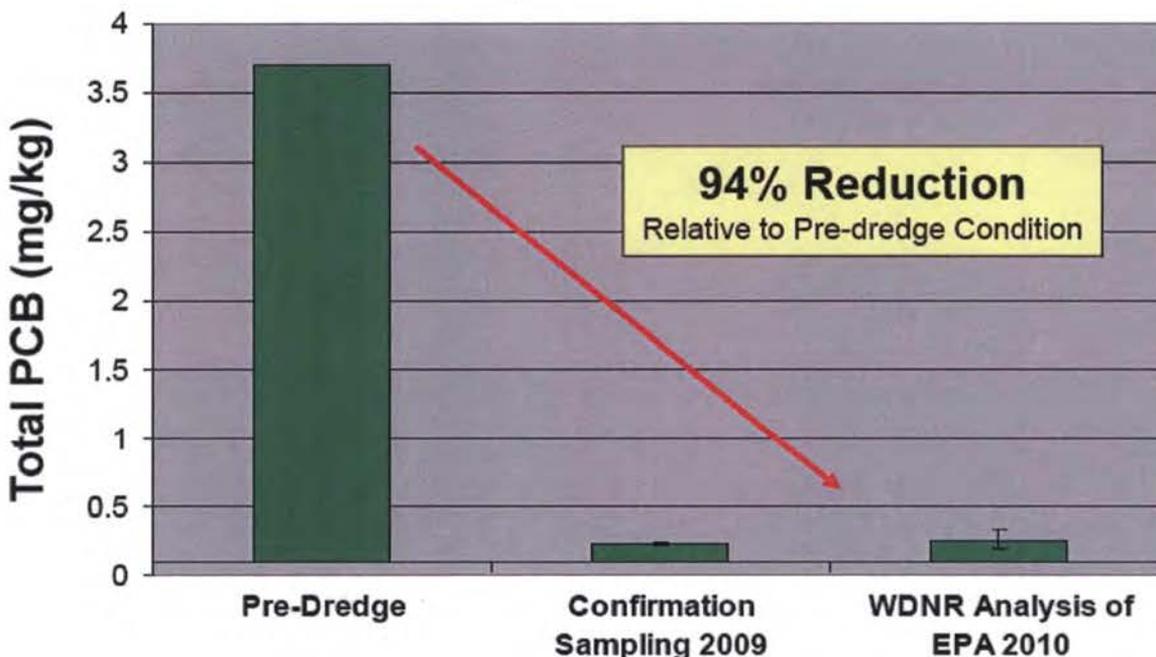
From 2004 to 2009, 371,600 cy of PCB-contaminated sediment in OU 1 were dredged, and 260 acres were capped with sand and armor stone or covered with sand. Dredged sediments were disposed offsite. Table 3 and Figures 2, 3, 4, and 5 summarize these actions. Final remedial action construction activities for OU 1 were completed on May 19, 2009. These actions provided a final PCB SWAC concentration of 0.22 ppm, less the 2008 ROD Amendment goal of 0.25 ppm.

**Table 3. Summary of OU 1 Remedial Action Work**

| Remedial Activity                                     | Years Completed | Volume Removed (cy) | Areas Addressed (acres) |
|---|-----------------|---------------------|-------------------------|
| Dredging  | 2004 – 2008     | 371,600             | 220                     |
| Capping   | 2007 – 2009     | --                  | 110                     |
| Covering*   | 2007 - 2008     | --                  | 150                     |
| All activities<br>(dredging, capping<br>and covering) | 2004 - 2009     | 371,600             | 480                     |

\* Includes areas with sand covers that still had PCB concentrations greater than 1 ppm after dredging (i.e., "residual" contaminated sediments).

### Total PCB Concentration in Surface Sediments Little Lake Buttes Des Morts, WI



**Figure 2. Pre-remedial (i.e., pre-dredge) PCB surface sediment concentration, and surface sediment PCB concentration in 2010 after remediation (i.e., 2009 Confirmation Sampling and "WDNR Analysis of EPA Data, 2010") for Little Lake Butte des Mort (OU 1).**

Figures 3, 4, and 5 below show areas where dredging, capping, and sand covering, respectively, were completed in OU 1 through May 19, 2009.

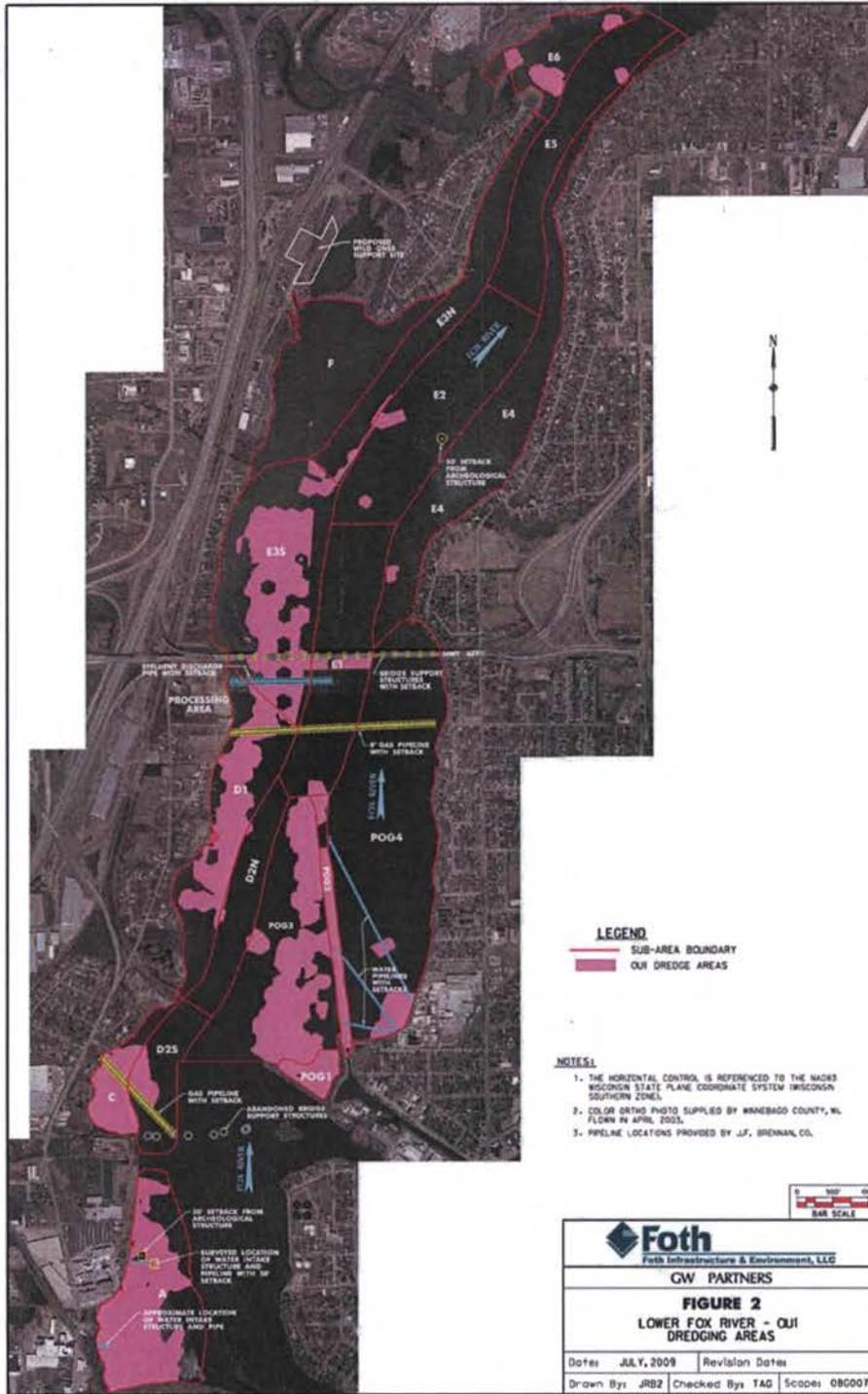


Figure 3. OU 1 Dredged Areas

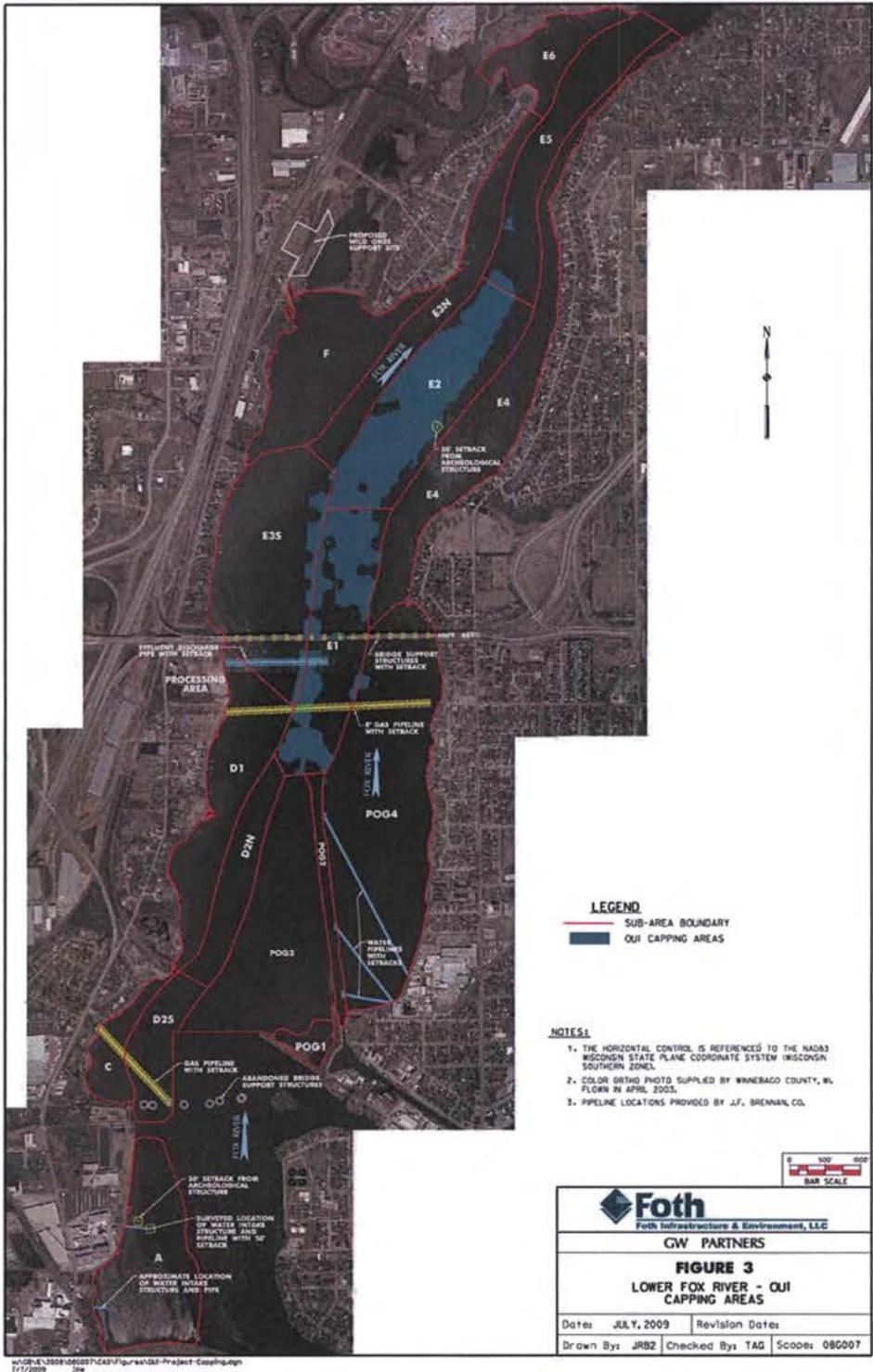


Figure 4. OU 1 Capped Areas

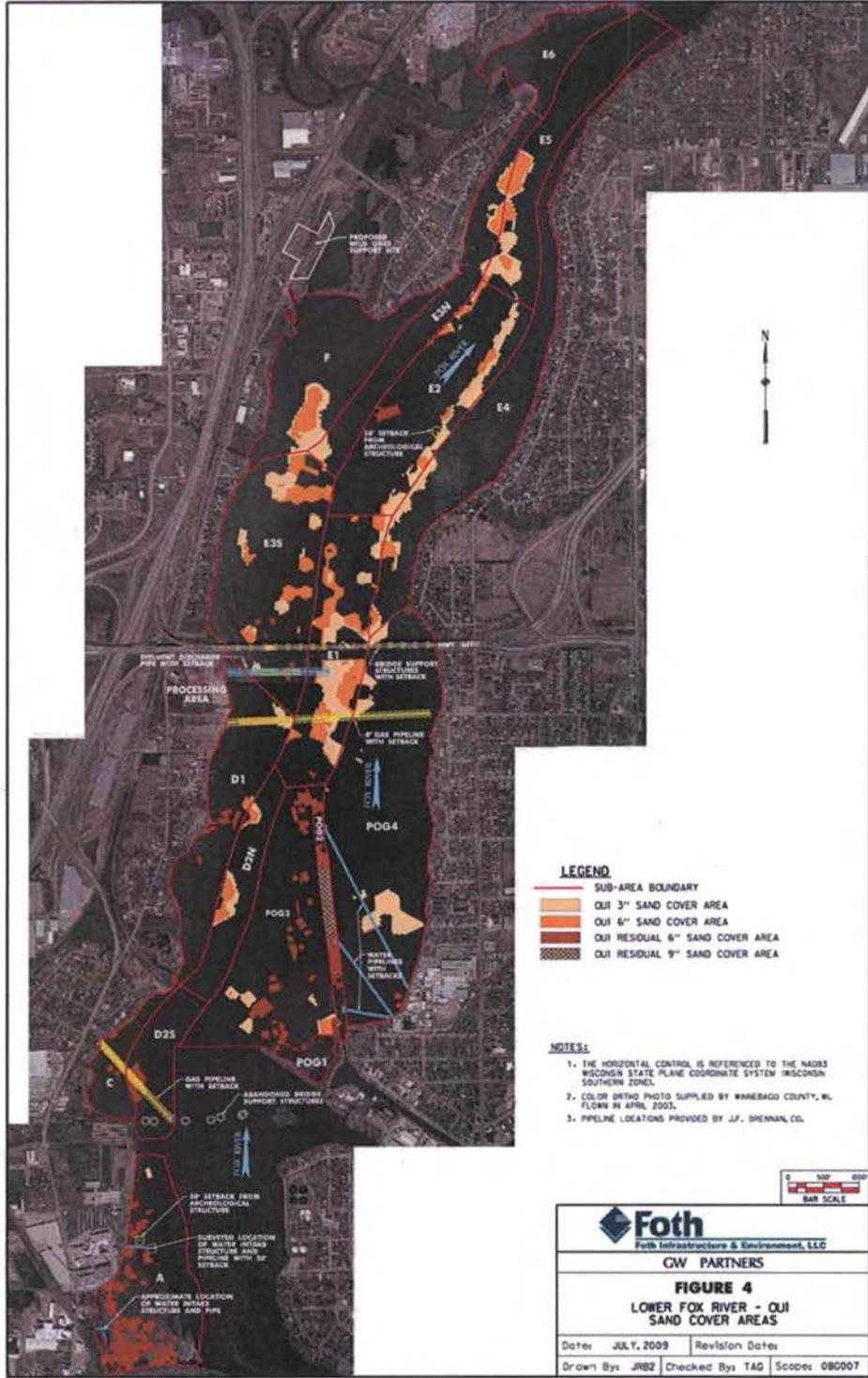


Figure 5. OU 1 Sand-Covered Areas

OU 2 (excluding Deposit DD)

The OU 2 remedy includes a monitoring program for measuring PCBs in surface water, sediment and fish tissue.

OU 2 (Deposit DD), OU 3, OU 4 and OU 5 (near river mouth)

80,000 cy of PCB-contaminated sediment were removed in the SMU 56/57 project and 130,000 cy of PCB-contaminated sediment were removed in the Phase 1 project. These two dredging projects addressed the highest PCB concentrations in the river, with PCB concentrations as high as 3,000 ppm in Phase 1.

Remedial activities for OUs 2 – 5, pursuant to the 2007 UAO, began in late April 2009 in OU 2, OU 3 and OU 4. These activities will continue through 2017 when remedial construction activities for the Fox River will be complete. Long-term monitoring will continue until the PCB concentrations in sediment, surface water, and biota no longer present an unacceptable risk to human health and the environment.

Table 4 summarizes all actions (i.e., demonstration projects, time-critical removal action, OU 1 remedial actions, Phase 1 remedial action, and OUs 2 – 5 remedial actions through 2013) taken at the site.

**Table 4. Dredging Completed Through 2013**

| <b>Project Name and Operable Unit</b> | <b>Years</b>     | <b>Volume Removed (cy)</b> | <b>Project Type</b>                                 |
|---------------------------------------|------------------|----------------------------|---|
| Deposit N (OU 2)                      | 1998-1999        | 10,000                     | Demonstration                                       |
| SMU 56/57 (OU 4)                      | 1999             | 30,000                     | Demonstration                                       |
|                                       | 2000             | 50,000                     | Time-critical removal                               |
| Phase 1 (OU 4)                        | 2007             | 130,000                    | Remedial action                                     |
| OU 1                                  | 2004-2008*       | 371,600                    | Remedial action                                     |
| OUs 2 – 5                             | 2009-2013        | 2,688,400                  | Remedial Action                                     |
| <b>TOTAL through 2013</b>             | <b>1998-2013</b> | <b>3,280,000</b>           | <b>Demonstrations, removal and remedial actions</b> |

\*Dredging work in OU1 was completed in 2008, although capping work continued through 2009 as noted in Table 3.

Table 5 below summarizes all the remedial action work conducted in OUs 1 – 5 through 2013.

**Table 5. Remedial Action Work Completed Through 2013**

| Action           | OU 1<br>(2004 – 2009) | OUs 2 – 4<br>(2009 – 2012) | OU 4<br>(2013)       | TOTAL     |
|------------------|-----------------------|----------------------------|----------------------|-----------|
| Dredging – cy    | 371,600 <sup>1</sup>  | 2,103,800 <sup>2</sup>     | 584,600 <sup>3</sup> | 3,060,000 |
| Capping - acres  | 114 <sup>1</sup>      | 34 <sup>2</sup>            | 13 <sup>3</sup>      | 161       |
| Capping – cy     | 275,900 <sup>5</sup>  | 109,700 <sup>6</sup>       | 62,900 <sup>7</sup>  | 448,500   |
| Covering – acres | 107 <sup>1</sup>      | 62 <sup>2</sup>            | 13 <sup>4</sup>      | 182       |
| Covering – cy    | 86,300 <sup>8</sup>   | 50,300 <sup>8</sup>        | 10,500 <sup>8</sup>  | 147,100   |

Table 5 Information sources:

<sup>1</sup> Foth and CH2MHILL, November 2010, Remedial Action Certificate of Completion, Table 1-1, page 3.

<sup>2</sup> Tetrattech, et al, October 2012, Lower Fox River Remedial Design 100 percent Design Report for 2010 and Beyond Remedial Actions, Tables 9-1, 9-2, and 9-3.

<sup>3</sup> Tetrattech EC Inc., Week Ending November 15, 2013.

<sup>4</sup> Tetrattech EC Inc., Week Ending October 18, 2013. Sand placed reported was for incomplete caps or sand cover over residual sediments remaining after dredging (i.e., no covering was completed).

<sup>5</sup> Volume of sediment capped for OU 1 is estimated based on the following formula:  
(Acres x 43,560 FT<sup>2</sup>/acre x 1.5 feet) / 27 FT<sup>2</sup>/cy = total cubic yards.

<sup>6</sup> Volume of sediment capped for OU 2 – 4 is estimated based on the following formula:  
(Acres x 43,560 FT<sup>2</sup>/acre x 2 feet) / 27 FT<sup>2</sup>/cy = total cubic yards.

<sup>7</sup> Volume of sediment capped for OU 4 is estimated based on the following formula:  
(Acres x 43,560 FT<sup>2</sup>/acre x 3 feet) / 27 FT<sup>2</sup>/cy = total cubic yards.

<sup>8</sup> Volume of sediment covered is estimated based on the following formula:  
(Acres x 43,560 FT<sup>2</sup>/acre x 0.5 feet) / 27 FT<sup>2</sup>/cy = total cubic yards.

Table note: Volumes are rounded to the nearest hundred cubic yards.

OU 5

The selected remedy for OU 5 is MNR with ICs for most of Green Bay, with dredging, capping, or covering of PCB-contaminated sediments near the mouth of the Lower Fox River (discussed above). Long-term monitoring and cap maintenance in OU 5 will be initiated upon completion of dredging, capping, and covering actions near the mouth of the river.

Remaining Work

Table 6 shows the active remediation work remaining to be completed at the site.

**Table 6. Volumes, Acreages and Areas Remaining to be Remediated for OUs 2 – 5**

| Year            | Dredging       |         | Capping |         | Sand Covering* |         |
|-----------------|----------------|---------|---------|---------|----------------|---------|
|                 | Volume<br>(cy) | OU(s)   | Acres   | OU(s)   | Acres          | OU(s)   |
| 2014            | 673,000        | 4       | 66      | 4       | 47             | 4       |
| 2015            | 520,000        | 4 and 5 | 63      | 4       | 31             | 4       |
| 2016            | 275,000        | ---     | 28      | 4       | 3              | 4       |
| 2017            | 0              | ---     | 94      | 4 and 5 | 55             | 4 and 5 |
| Total Remaining | 1,468,000      | 4 and 5 | 415     | 4 and 5 | 459            | 4 and 5 |

\* Includes both sand cover as the primary remedial action and, where necessary, for residuals over dredge areas.

Targets

Sediment Quality Thresholds (SQTs) for human health and ecological effects are shown in Table 7 and Table 8, respectively, below.

**Table 7. Human Health SQTs from Table 3-2 of the Lower Fox River and Green Bay Feasibility Study**

**Table 3-2 Sediment Quality Thresholds Estimated for Human Health Effects at a 10<sup>-5</sup> Cancer Risk and a Noncancer Hazard Index of 1.0**

|  | Fish Parameters<br><br>Filet-to-Whole Fish Ratio | Sediment Quality Thresholds  |              |   |              |
|--|--|--|--------------|---|--------------|
|  |  | Recreational Anglers:<br>Average of Michigan<br>Studies<br>(West et al., 1989;<br>West et al., 1993) |              | High-Intake Fish Consumers:<br>Average of Low-Income<br>Minority Anglers and Hmong<br>Anglers<br>(West et al., 1993 and<br>Hutchison and Kraft, 1994) |              |
|  |  | RME<br>µg/kg   | CTE<br>µg/kg | RME<br>µg/kg  | CTE<br>µg/kg |
| <b>Sediment Quality Thresholds for Risk of 10<sup>-5</sup></b> |  |  |              |   |              |
| Carp   | 0.53   | 16   | 180          | 11  | 57           |
| Walleye  | 0.17   | 21   | 143          | 14  | 75           |
| Yellow Perch   | 0.13   | 105  | 677          | 68  | 356          |
| <b>Sediment Quality Thresholds for HI of 1.0</b>               |  |  |              |   |              |
| Carp   | 0.53   | 44   | 180          | 28  | 90           |
| Walleye  | 0.17   | 58   | 238          | 37  | 119          |
| Yellow Perch   | 0.13   | 276  | 1,128        | 175   | 564          |

**Notes:**  
 \* SQTs for cancer risks of 10<sup>-6</sup> and 10<sup>-4</sup> are an order of magnitude higher and lower, respectively.  
 RME indicates reasonable maximum exposure and CTE indicates central tendency exposure.  
 Sediment quality thresholds are bolded and in italics.

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**Table 8. Ecological SQTs from Table 3-3 of the Lower Fox River and Green Bay Feasibility Study**

**Table 3-3 Sediment Quality Thresholds Estimated for Ecological Effects**

| Species                  | Effect                                | Whole Fish Concentration (µg/kg ww) | Estimated SQT (µg/kg) |
|--------------------------|---------------------------------------|-------------------------------------|-----------------------|
| Benthic Invertebrates    | Threshold Effect Concentration (TEL)  | —                                   | 31.6                  |
| Walleye                  | NOAEC - fry growth and mortality      | 760                                 | 176                   |
|                          | LOAEC - fry growth and mortality      | 7,600                               | 1,759                 |
| Carp                     | NOAEC - fry growth and mortality      | 760                                 | 363                   |
|                          | LOAEC - fry growth and mortality      | 7,600                               | 3,633                 |
| Common Tern              | NOAEC - hatching success              | 2,508                               | 3,073                 |
|                          | LOAEC - hatching success              | 4,055                               | 4,969                 |
|                          | NOAEC - deformity                     | 427                                 | 523                   |
|                          | LOAEC - deformity                     | 4,269                               | 5,231                 |
| Forster's Tern           | NOAEC - hatching success              | 2,399                               | 2,940                 |
|                          | LOAEC - hatching success              | 3,879                               | 4,753                 |
|                          | NOAEC - deformity                     | 408                                 | 500                   |
|                          | LOAEC - deformity                     | 4,083                               | 5,003                 |
| Double-crested Cormorant | NOAEC - hatching success              | 814                                 | 997                   |
|                          | LOAEC - hatching success              | 1,317                               | 1,614                 |
|                          | NOAEC - deformity                     | 139                                 | 170                   |
|                          | LOAEC - deformity                     | 1,386                               | 1,698                 |
| Bald Eagle               | NOAEC - hatching success              | 709                                 | 339                   |
|                          | LOAEC - hatching success              | 1,147                               | 548                   |
|                          | NOAEC - deformity                     | 121                                 | 58                    |
|                          | LOAEC - deformity                     | 1,207                               | 577                   |
| Mink                     | NOAEC - reproduction and kit survival | 50                                  | 24                    |
|                          | LOAEC - reproduction and kit survival | 500                                 | 239                   |

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## APPENDIX B – ADDITIONAL FIGURES / PHOTOGRAPHS

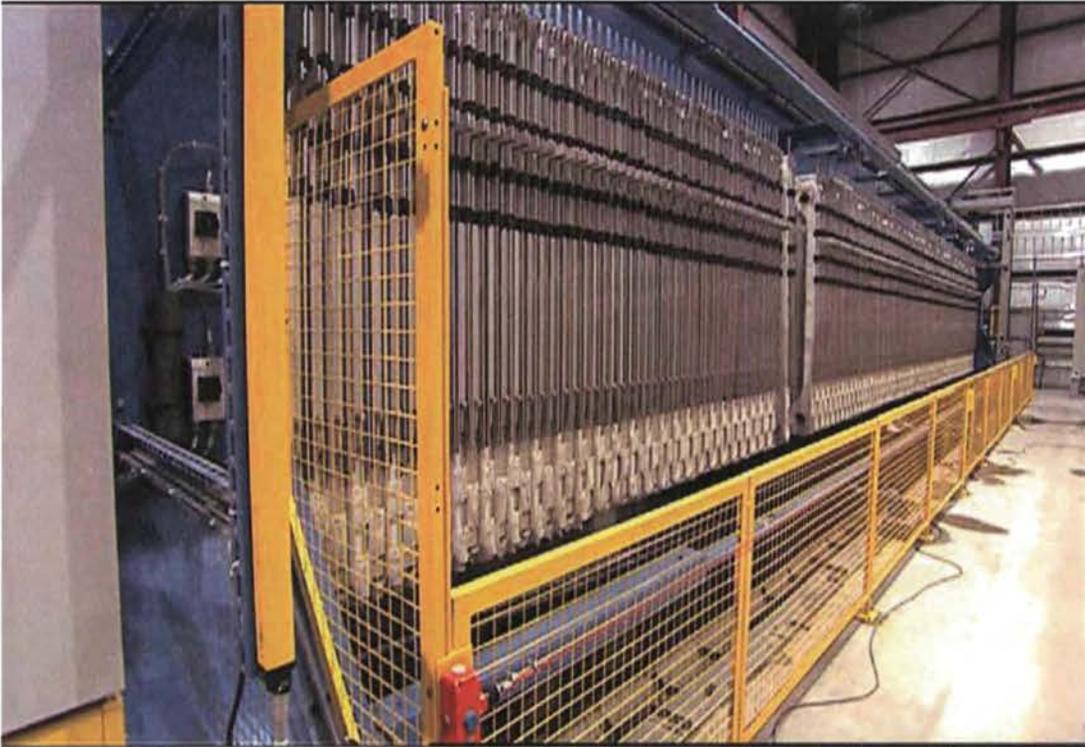


Photo from Wikipedia

Figure 1. Site location.



Figure 2. 8-inch hydraulic dredge.



**Figure 3. Plate and frame presses for dewatering sediments from OU 2 – 5.**



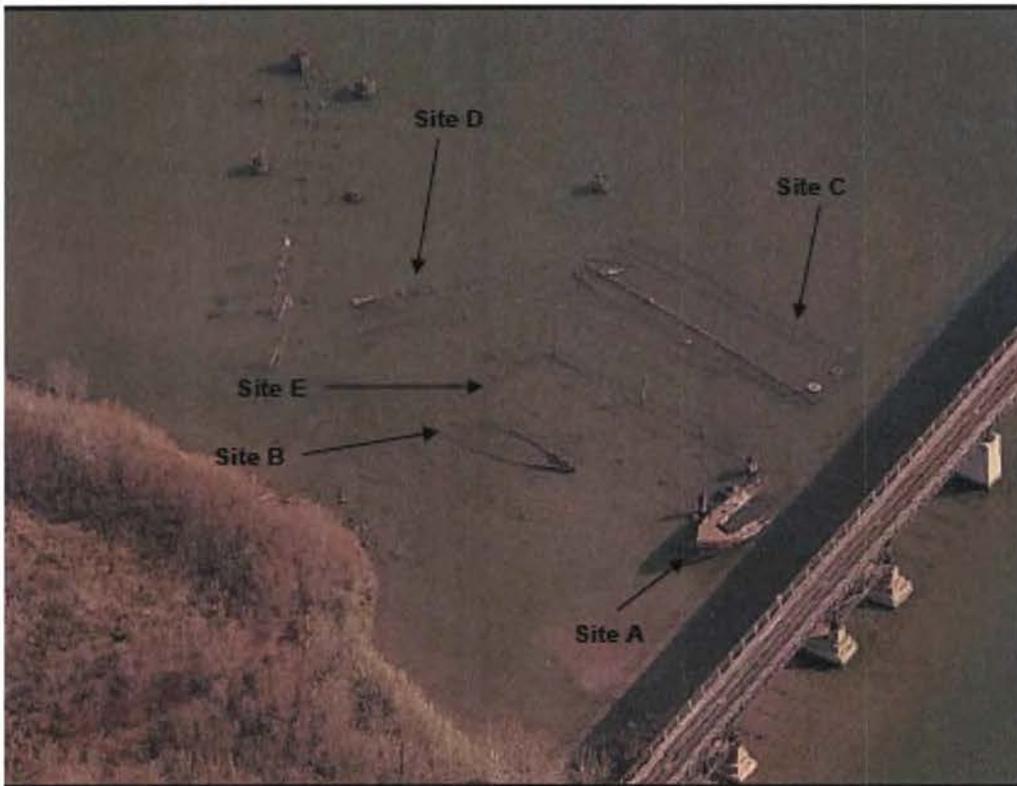
**Figure 4. Geotextile tubes for dewatering sediments at OU 1.**



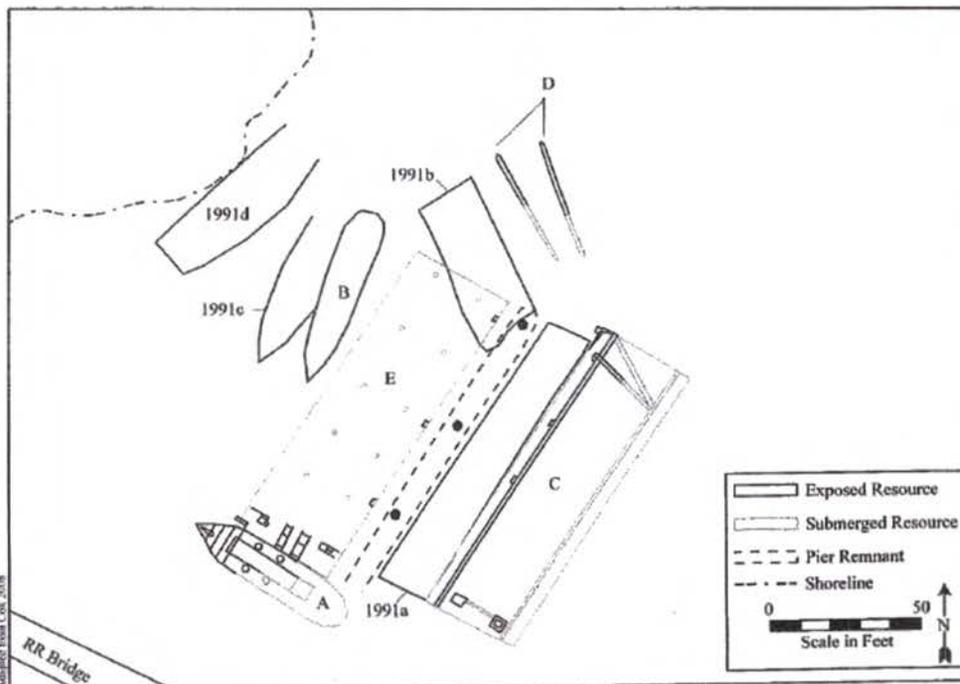
**Figure 5. OU 1 dewatering facility restored (compare to Figure 4 during remediation).**



**Figure 6. Disposal of dredged sediments at landfill.**



**Figure 7. Shipwrecks in OU4 prior to dredging of contaminated sediments. Site A is the Bob Teed and Site B is the Satisfaction, both meriting placement of the shipwreck disposal site on the Historical Site listing.**



**Figure 1. Site Sketch Map**

**Figure 8. Line drawing of shipwrecks in OU 4. Site A is the Bob Teed, and Site B is the Satisfaction. Both of these ships were tugboats, operational from the late 1800s to the 1940s. Sites 1991a, 1991b, 1991c and 1991d were discovered during excavation activities in November 2013.**

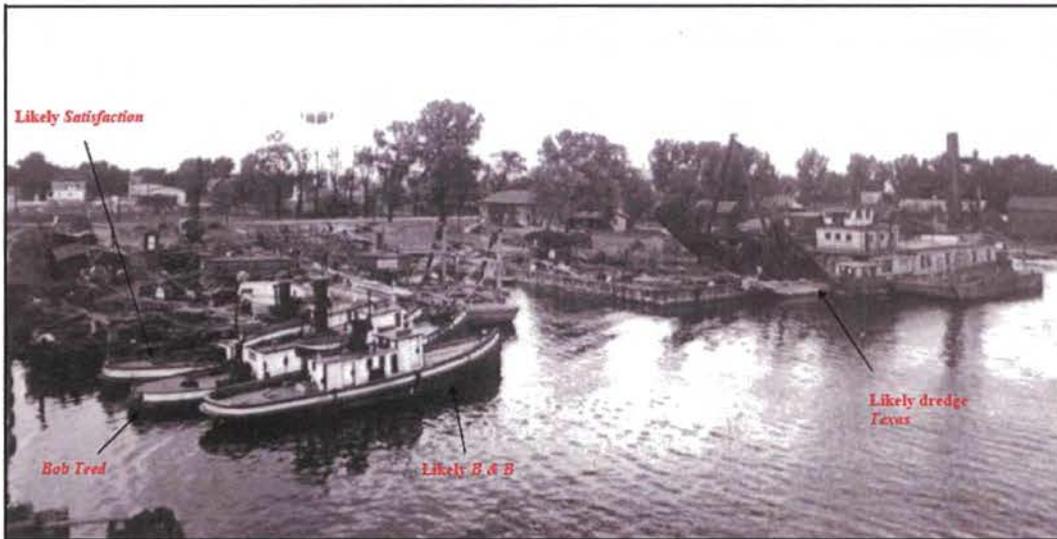


Figure 3 . View of Waterways Engineering Corporation Property. (undated)  
(Courtesy: Wisconsin Maritime Museum Collection)

Note: Likely identities of vessels are annotated.

Figure 9. Ships found in the river in the ship disposal area off the site dewatering facility.



Figure 10. Shipwreck removal, November 2013.

## APPENDIX C – SITE INSPECTION CHECKLIST





| III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply) |   |  |  |
|--|---|--|--|
| 1.   | <b>O&amp;M Documents</b><br>O&M manual<br>As-built drawings<br>Maintenance logs<br>Remarks _____  | Readily available<br>Readily available<br>Readily available                      | Up to date<br>Up to date<br>Up to date<br>N/A<br>N/A<br>N/A                      |
| 2.   | <b>Site-Specific Health and Safety Plan</b><br>Contingency plan/emergency response plan<br>Remarks _____  | Readily available<br>Readily available   | Up to date<br>Up to date<br>N/A<br>N/A   |
| 3.   | <b>O&amp;M and OSHA Training Records</b><br>Remarks _____   | Readily available  | Up to date<br>N/A  |
| 4.   | <b>Permits and Service Agreements</b><br>Air discharge permit<br>Effluent discharge<br>Waste disposal, POTW<br>Other permits _____<br>Remarks _____ | Readily available<br>Readily available<br>Readily available<br>Readily available | Up to date<br>Up to date<br>Up to date<br>Up to date<br>N/A<br>N/A<br>N/A<br>N/A |
| 5.   | <b>Gas Generation Records</b><br>Remarks _____  | Readily available  | Up to date<br>N/A  |
| 6.   | <b>Settlement Monument Records</b><br>Remarks _____   | Readily available  | Up to date<br>N/A  |
| 7.   | <b>Groundwater Monitoring Records</b><br>Remarks _____  | Readily available  | Up to date<br>N/A  |
| 8.   | <b>Leachate Extraction Records</b><br>Remarks _____   | Readily available  | Up to date<br>N/A  |
| 9.   | <b>Discharge Compliance Records</b><br>Air<br>Water (effluent)<br>Remarks _____   | Readily available<br>Readily available   | Up to date<br>Up to date<br>N/A<br>N/A   |
| 10.  | <b>Daily Access/Security Logs</b><br>Remarks _____  | Readily available  | Up to date<br>N/A  |

| <b>IV. O&amp;M COSTS</b>                    |  |   |  |                          |  |
|---|--|---|--|--------------------------|--|
| 1.  | <b>O&amp;M Organization</b>  | State in-house _____ Contractor for State<br>PRP in-house _____ Contractor for PRP<br>Federal Facility in-house _____ Contractor for Federal Facility<br>Other _____ <u>N/A</u> |  |                          |  |
| 2.  | <b>O&amp;M Cost Records</b>  | Readily available _____ Up to date _____<br>Funding mechanism/agreement in place _____<br>Original O&M cost estimate _____ <u>N/A</u> Breakdown attached _____                  | Total annual cost by year for review period if available |                          |  |
|   | From _____ To _____  | Date _____ Date _____   | _____  | Breakdown attached _____ |  |
|   | From _____ To _____  | Date _____ Date _____   | _____  | Breakdown attached _____ |  |
|   | From _____ To _____  | Date _____ Date _____   | _____  | Breakdown attached _____ |  |
|   | From _____ To _____  | Date _____ Date _____   | _____  | Breakdown attached _____ |  |
|   | From _____ To _____  | Date _____ Date _____   | _____  | Breakdown attached _____ |  |
| 3.  | <b>Unanticipated or Unusually High O&amp;M Costs During Review Period</b><br>Describe costs and reasons: _____<br>_____<br>_____<br>_____<br>_____ |   |  |                          |  |
| <b>V. ACCESS AND INSTITUTIONAL CONTROLS</b> |  |   |  |                          |  |
| Applicable <u>(N/A)</u>                     |  |   |  |                          |  |
| <b>A. Fencing</b>                           |  |   |  |                          |  |
| 1.  | <b>Fencing damaged</b>   | Location shown on site map _____  | Gates secured _____                                      | <u>(N/A)</u>             |  |
|   | Remarks _____  |   |  |                          |  |
| <b>B. Other Access Restrictions</b>         |  |   |  |                          |  |
| 1.  | <b>Signs and other security measures</b>   | Location shown on site map _____  |  |                          |  |
|   | Remarks _____  |   |  |                          |  |

| <b>C. Institutional Controls (ICs)</b> |   |   |   |                           |
|--|---|---|---|---------------------------|
| <b>1.</b>                              | <b>Implementation and enforcement</b>                             | <input checked="" type="radio"/> Yes              | <input type="radio"/> No                              | <input type="radio"/> N/A |
|  | Site conditions imply ICs not properly implemented                | <input checked="" type="radio"/> Yes              | <input type="radio"/> No                              | <input type="radio"/> N/A |
|  | Site conditions imply ICs not being fully enforced                | <input checked="" type="radio"/> Yes              | <input type="radio"/> No                              | <input type="radio"/> N/A |
|  | Type of monitoring (e.g., self-reporting, drive by) _____         |   |   |                           |
|  | Frequency _____   |   |   |                           |
|  | Responsible party/agency _____                                    |   |   |                           |
|  | Contact _____   |   |   |                           |
|  | Name  | Title   | Date  | Phone no.                 |
|  | Reporting is up-to-date   |   |   |                           |
|  | Reports are verified by the lead agency                           |   |   |                           |
|  | Specific requirements in deed or decision documents have been met |   |   |                           |
|  | Violations have been reported                                     |   |   |                           |
|  | Other problems or suggestions: Report attached                    |   |   |                           |
|  | _____   |   |   |                           |
|  | _____   |   |   |                           |
|  | _____   |   |   |                           |
| <b>2.</b>                              | <b>Adequacy</b>   | <input checked="" type="radio"/> ICs are adequate | <input type="radio"/> ICs are inadequate              | <input type="radio"/> N/A |
|  | Remarks _____   |   |   |                           |
|  | _____   |   |   |                           |
|  | _____   |   |   |                           |
| <b>D. General</b>                      |   |   |   |                           |
| <b>1.</b>                              | <b>Vandalism/trespassing</b>                                      | Location shown on site map                        | <input checked="" type="radio"/> No vandalism evident |                           |
|  | Remarks _____   |   |   |                           |
|  | _____   |   |   |                           |
| <b>2.</b>                              | <b>Land use changes on site</b>                                   | <input checked="" type="radio"/> N/A              |   |                           |
|  | Remarks _____   |   |   |                           |
|  | _____   |   |   |                           |
| <b>3.</b>                              | <b>Land use changes off site</b>                                  | <input checked="" type="radio"/> N/A              |   |                           |
|  | Remarks _____   |   |   |                           |
|  | _____   |   |   |                           |
| <b>VI. GENERAL SITE CONDITIONS</b>     |   |   |   |                           |
| <b>A. Roads</b>                        | Applicable  | <input checked="" type="radio"/> N/A              |   |                           |
| <b>1.</b>                              | <b>Roads damaged</b>  | Location shown on site map                        | Roads adequate  | <input type="radio"/> N/A |
|  | Remarks _____   |   |   |                           |
|  | _____   |   |   |                           |

|  |   |   |                        |
|--|---|---|------------------------|
| <b>B. Other Site Conditions</b>  |   |   |                        |
|  | Remarks   | N/A   |                        |
| <b>VII. LANDFILL COVERS</b> Applicable <span style="border: 1px solid black; border-radius: 50%; padding: 2px;">N/A</span> |   |   |                        |
| <b>A. Landfill Surface</b>   |   |   |                        |
| 1.   | <b>Settlement (Low spots)</b><br>Areal extent _____<br>Remarks _____                                | Location shown on site map<br>Depth _____               | Settlement not evident |
| 2.   | <b>Cracks</b><br>Lengths _____<br>Remarks _____   | Location shown on site map<br>Widths _____ Depths _____ | Cracking not evident   |
| 3.   | <b>Erosion</b><br>Areal extent _____<br>Remarks _____   | Location shown on site map<br>Depth _____               | Erosion not evident    |
| 4.   | <b>Holes</b><br>Areal extent _____<br>Remarks _____   | Location shown on site map<br>Depth _____               | Holes not evident      |
| 5.   | <b>Vegetative Cover</b><br>Trees/Shrubs (indicate size and locations on a diagram)<br>Remarks _____ | Grass _____<br>Cover properly established               | No signs of stress     |
| 6.   | <b>Alternative Cover (armored rock, concrete, etc.)</b><br>Remarks _____                            | N/A   |                        |
| 7.   | <b>Bulges</b><br>Areal extent _____<br>Remarks _____  | Location shown on site map<br>Height _____              | Bulges not evident     |

|  |                               |                                    |  |
|--|-------------------------------|------------------------------------|--|
| 8.   | <b>Wet Areas/Water Damage</b> | Wet areas/water damage not evident |  |
|  | Wet areas                     | Location shown on site map         | Areal extent _____   |
|  | Ponding                       | Location shown on site map         | Areal extent _____   |
|  | Seeps                         | Location shown on site map         | Areal extent _____   |
|  | Soft subgrade                 | Location shown on site map         | Areal extent _____   |
|  | Remarks _____                 |                                    |  |
| 9.   | <b>Slope Instability</b>      | Slides                             | Location shown on site map      No evidence of slope instability |
|  | Areal extent _____            |                                    |  |
|  | Remarks _____                 |                                    |  |
| <b>B. Benches</b>  |                               |                                    |  |
|  | Applicable                    | N/A                                |  |
| (Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)                                   |                               |                                    |  |
| 1.   | <b>Flows Bypass Bench</b>     | Location shown on site map         | N/A or okay  |
|  | Remarks _____                 |                                    |  |
| 2.   | <b>Bench Breached</b>         | Location shown on site map         | N/A or okay  |
|  | Remarks _____                 |                                    |  |
| 3.   | <b>Bench Overtopped</b>       | Location shown on site map         | N/A or okay  |
|  | Remarks _____                 |                                    |  |
| <b>C. Letdown Channels</b>   |                               |                                    |  |
|  | Applicable                    | N/A                                |  |
| (Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.) |                               |                                    |  |
| 1.   | <b>Settlement</b>             | Location shown on site map         | No evidence of settlement  |
|  | Areal extent _____            | Depth _____                        |  |
|  | Remarks _____                 |                                    |  |
| 2.   | <b>Material Degradation</b>   | Location shown on site map         | No evidence of degradation                                       |
|  | Material type _____           | Areal extent _____                 |  |
|  | Remarks _____                 |                                    |  |
| 3.   | <b>Erosion</b>                | Location shown on site map         | No evidence of erosion   |
|  | Areal extent _____            | Depth _____                        |  |
|  | Remarks _____                 |                                    |  |

|  |   |   |   |
|--|---|---|---|
| 4.   | <b>Undercutting</b><br>Areal extent _____<br>Remarks _____  | Location shown on site map<br>Depth _____ | No evidence of undercutting   |
| 5.   | <b>Obstructions</b><br>Location shown on site map<br>Size _____<br>Remarks _____  | Type _____<br>Areal extent _____          | No obstructions   |
| 6.   | <b>Excessive Vegetative Growth</b><br>No evidence of excessive growth<br>Vegetation in channels does not obstruct flow<br>Location shown on site map<br>Remarks _____ | Type _____<br>Areal extent _____          |   |
| <b>D. Cover Penetrations</b> Applicable    (N/A) |   |   |   |
| 1.   | <b>Gas Vents</b><br>Properly secured/locked<br>Evidence of leakage at penetration<br>N/A<br>Remarks _____   | Active<br>Functioning                     | Passive<br>Routinely sampled    Good condition<br>Needs Maintenance |
| 2.   | <b>Gas Monitoring Probes</b><br>Properly secured/locked<br>Evidence of leakage at penetration<br>Remarks _____  | Functioning                               | Routinely sampled    Good condition<br>Needs Maintenance    N/A     |
| 3.   | <b>Monitoring Wells (within surface area of landfill)</b><br>Properly secured/locked<br>Evidence of leakage at penetration<br>Remarks _____                           | Functioning                               | Routinely sampled    Good condition<br>Needs Maintenance    N/A     |
| 4.   | <b>Leachate Extraction Wells</b><br>Properly secured/locked<br>Evidence of leakage at penetration<br>Remarks _____  | Functioning                               | Routinely sampled    Good condition<br>Needs Maintenance    N/A     |
| 5.   | <b>Settlement Monuments</b><br>Remarks _____  | Located                                   | Routinely surveyed    N/A   |

|   |   |  |                      |
|---|---|--|----------------------|
| <b>E. Gas Collection and Treatment</b>  |   | Applicable                               | (N/A)                |
| 1.                                      | <b>Gas Treatment Facilities</b><br>Flaring<br>Good condition<br>Remarks _____   | Thermal destruction<br>Needs Maintenance | Collection for reuse |
| 2.                                      | <b>Gas Collection Wells, Manifolds and Piping</b><br>Good condition<br>Remarks _____                                      | Needs Maintenance                        |                      |
| 3.                                      | <b>Gas Monitoring Facilities</b> (e.g., gas monitoring of adjacent homes or buildings)<br>Good condition<br>Remarks _____ | Needs Maintenance                        | N/A                  |
| <b>F. Cover Drainage Layer</b>          |   | Applicable                               | (N/A)                |
| 1.                                      | <b>Outlet Pipes Inspected</b><br>Remarks _____  | Functioning                              | N/A                  |
| 2.                                      | <b>Outlet Rock Inspected</b><br>Remarks _____   | Functioning                              | N/A                  |
| <b>G. Detention/Sedimentation Ponds</b> |   | Applicable                               | (N/A)                |
| 1.                                      | <b>Siltation</b> Areal extent _____<br>Siltation not evident<br>Remarks _____   | Depth _____                              | N/A                  |
| 2.                                      | <b>Erosion</b> Areal extent _____<br>Erosion not evident<br>Remarks _____   | Depth _____                              |                      |
| 3.                                      | <b>Outlet Works</b><br>Remarks _____  | Functioning                              | N/A                  |
| 4.                                      | <b>Dam</b><br>Remarks _____   | Functioning                              | N/A                  |

|  |  |   |  |
|--|--|---|--|
| <b>H. Retaining Walls</b>                      |  | Applicable                                | N/A  |
| 1.   | <b>Deformations</b><br>Horizontal displacement _____<br>Rotational displacement _____<br>Remarks _____ | Location shown on site map                | Deformation not evident<br>Vertical displacement _____ |
| 2.   | <b>Degradation</b><br>Remarks _____  | Location shown on site map                | Degradation not evident                                |
| <b>I. Perimeter Ditches/Off-Site Discharge</b> |  | Applicable                                | N/A  |
| 1.   | <b>Siltation</b><br>Areal extent _____<br>Remarks _____  | Location shown on site map                | Siltation not evident<br>Depth _____                   |
| 2.   | <b>Vegetative Growth</b><br>Vegetation does not impede flow<br>Areal extent _____<br>Remarks _____     | Location shown on site map                | N/A<br>Type _____                                      |
| 3.   | <b>Erosion</b><br>Areal extent _____<br>Remarks _____  | Location shown on site map                | Erosion not evident<br>Depth _____                     |
| 4.   | <b>Discharge Structure</b><br>Remarks _____  | Functioning                               | N/A  |
| <b>VIII. VERTICAL BARRIER WALLS</b>            |  | Applicable                                | N/A  |
| 1.   | <b>Settlement</b><br>Areal extent _____<br>Remarks _____   | Location shown on site map                | Settlement not evident<br>Depth _____                  |
| 2.   | <b>Performance Monitoring</b><br>Perform _____<br>frequency _____<br>_____                             | Type of monitoring _____<br>not monitored | Evidence of breaching _____                            |

|   |   |                   |     |
|---|---|-------------------|-----|
| <b>IX. GROUNDWATER/SURFACE WATER REMEDIES</b>                       |   | Applicable        | N/A |
| <b>A. Groundwater Extraction Wells, Pumps, and Pipelines</b>        |   | Applicable        | N/A |
| 1.  | <b>Pumps, Wellhead Plumbing, and Electrical</b><br>Good condition      All required wells properly operating                            | Needs Maintenance | N/A |
| Remarks _____<br>_____  |   |                   |     |
| 2.  | <b>Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances</b><br>Good condition      Needs Maintenance               |                   |     |
| Remarks _____<br>_____  |   |                   |     |
| 3.  | <b>Spare Parts and Equipment</b><br>Readily available      Good condition      Requires upgrade      Needs to be provided               |                   |     |
| Remarks _____<br>_____  |   |                   |     |
| <b>B. Surface Water Collection Structures, Pumps, and Pipelines</b> |   | Applicable        | N/A |
| 1.  | <b>Collection Structures, Pumps, and Electrical</b><br>Good condition      Needs Maintenance  |                   |     |
| Remarks _____<br>_____  |   |                   |     |
| 2.  | <b>Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances</b><br>Good condition      Needs Maintenance |                   |     |
| Remarks _____<br>_____  |   |                   |     |
| 3.  | <b>Spare Parts and Equipment</b><br>Readily available      Good condition      Requires upgrade      Needs to be provided               |                   |     |
| Remarks _____<br>_____  |   |                   |     |

| C. Treatment System       |  | Applicable                               | N/A   |
|---------------------------|--|--|---|
| 1.                        | <b>Treatment Train</b> (Check components that apply)<br>Metals removal<br>Air stripping<br>Filters<br>Additive (e.g., chelation agent, flocculent)<br>Others<br>Good condition<br>Sampling ports properly marked and functional<br>Sampling/maintenance log displayed and up to date<br>Equipment properly identified<br>Quantity of groundwater treated annually<br>Quantity of surface water treated annually<br>Remarks | Oil/water separation<br>Carbon adsorbers | Bioremediation                                    |
| 2.                        | <b>Electrical Enclosures and Panels</b> (properly rated and functional)<br>N/A<br>Remarks  | Good condition                           | Needs Maintenance                                 |
| 3.                        | <b>Tanks, Vaults, Storage Vessels</b><br>N/A<br>Remarks  | Good condition                           | Proper secondary containment<br>Needs Maintenance |
| 4.                        | <b>Discharge Structure and Appurtenances</b><br>N/A<br>Remarks   | Good condition                           | Needs Maintenance                                 |
| 5.                        | <b>Treatment Building(s)</b><br>N/A<br>Chemicals and equipment properly stored<br>Remarks  | Good condition (esp. roof and doorways)  | Needs repair                                      |
| 6.                        | <b>Monitoring Wells</b> (pump and treatment remedy)<br>Properly secured/locked<br>All required wells located<br>Remarks  | Functioning<br>Needs Maintenance         | Routinely sampled<br>Good condition<br>N/A        |
| <b>D. Monitoring Data</b> |  |  |   |
| 1.                        | <b>Monitoring Data</b><br>Is routinely submitted on time   | Is of acceptable quality                 |   |
| 2.                        | <b>Monitoring data suggests:</b><br>Groundwater plume is effectively contained   | Contaminant concentrations are declining |   |

|  |  |                            |                       |
|--|--|----------------------------|-----------------------|
| <b>D. Monitored Natural Attenuation</b>  |  |                            |                       |
| 1.   | <b>Monitoring Wells</b> (natural attenuation remedy) | Properly secured/locked    | Functioning           |
|  |  | All required wells located | Routinely sampled     |
|  |  |                            | Needs Maintenance     |
|  | Remarks  |                            | Good condition<br>N/A |
| <b>X. OTHER REMEDIES</b>   |  |                            |                       |
| If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.                          |  |                            |                       |
| <b>XI. OVERALL OBSERVATIONS</b>  |  |                            |                       |
| <b>A. Implementation of the Remedy</b>   |  |                            |                       |
| Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.). |  |                            |                       |
| Remedy is to make fish consumable and edible by humans and wildlife and reduce PCB contamination in surface water.   |  |                            |                       |
|  |  |                            |                       |
|  |  |                            |                       |
|  |  |                            |                       |
|  |  |                            |                       |
| <b>B. Adequacy of O&amp;M</b>  |  |                            |                       |
| Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.   |  |                            |                       |
| Long-term monitoring has had initial sampling for OU1, OU2, and OU3. OU4 and OU5 will have initial long-term monitoring once that area has had remedy completed there - estimated by 2018.   |  |                            |                       |
|  |  |                            |                       |
|  |  |                            |                       |

**C. Early Indicators of Potential Remedy Problems**

Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future.

*None*

**D. Opportunities for Optimization**

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.