Fox River cleanup & related issues

June 22, 2005

James Hahnenberg
Today's discussion

1. Tittabawassee & Fox rivers

2. Fox river cleanup activities (today: upriver focus)

3. Dredging issues and cleanup options

4. Cleanup economics
From Midland to the Saginaw River

Note: Saginaw to Saginaw Bay is 22 miles:
Saginaw River width is up to 500 feet)
Fox and Tittabawassee

Depth (feet)

<table>
<thead>
<tr>
<th></th>
<th>Fox</th>
<th>Tittabawasee¹</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>15</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>(6 - 24)</td>
<td>(3 - 11)</td>
</tr>
</tbody>
</table>

Water velocity (ft³/sec)

<table>
<thead>
<tr>
<th></th>
<th>Fox</th>
<th>Tittabawasee²</th>
</tr>
</thead>
<tbody>
<tr>
<td>²</td>
<td>2330</td>
<td>2353</td>
</tr>
</tbody>
</table>

¹Midland to the Saginaw River
(Saginaw River is up to 28 feet deep)

²Upstream
(Dioxin)

(Tittabawassee
(PCBs)

Fox

Fox (PCBs)

Tittabawassee
(Dioxin)
Fox River PCBs: from papermills

Modified from Green Bay Press Gazette
PCBs can get into your body
Fox fish advisories

NOTICE

Fish from these waters contain chemicals. Eating too much may be harmful, especially for women and children. Follow the safe fish eating guidelines below.

Los peces de estas aguas están contaminados. Su consumo puede ser mal para la salud, especialmente las mujeres y niños. Para protegerse y proteger a su familia, siga las recomendaciones siguientes.

Mwee los niwem cev dej no musu yam tchiam khoum xhob yog noj ni ciu tsum kuj jouv tis zoo lo zuag, chov leem ni xia lo yog tis zoo rau cev niem thiam mengyam yava noj. Le xia lai ni noj mwee us zo saab bwe ci cev xem tejex lo qhia raw li ram yek no.

For more information, please contact your local health department or the Wisconsin Department of Health & Family Services

http://health.wisconsin.gov

De Pere Dam to Mouth of Fox River
Fox River progress

1. State & federal studies – 1990’s

2. Superfund studies: 1998


Fox River progress

5. Cleanup decisions: 2002 & 2003 by EPA and WDNR

6. Upriver dredging begins: 2004

7. Upriver completion: 2010

8. Downriver completion: 2018
Lower Fox River Dredging projects

Deposit N (1998-1999)

SMU 56/57 (1999-2000)
# Fox River dredging demonstrations

<table>
<thead>
<tr>
<th></th>
<th>Deposit N (upriver)</th>
<th>SMU 56/57 (downriver)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volume removed (cubic yards)</td>
<td>8000*</td>
<td>80,000**</td>
</tr>
<tr>
<td>Material under contamination</td>
<td>Bedrock</td>
<td>Clay &amp; silty sediment</td>
</tr>
<tr>
<td>Costs</td>
<td>$4,000,000 by WDNR</td>
<td>$17,000,000 by companies</td>
</tr>
</tbody>
</table>

*Football field – 5’ high  **Football field – 5 stories high
Dredging projects
Achievements

1. Removed 2200 pounds of PCBs

2. PCB concentrations reduced (where no bedrock)

3. Negligible PCB loss to air and water
Dredging projects

Achievements

4. Minimal community disturbance (e.g., noise, odors, traffic, etc.)

5. Developed working relationship with companies and communities

6. Showed dredging works
Fox River cleanup decisions

Total cost: $400 million (dredging $350 million)

Dredging/disposal – 7.2 million cubic yards

Upriver work started 2004

Monitored Natural Recovery
Fox Cleanup Decision

• Reduce risks

• Mixture of cleanup options
  1. Dredging/disposal
  2. Capping
  3. Natural recovery

• Practical and flexible
Upriver cleanup

OU 2: Monitored Natural Recovery
Monitored Natural Recovery (OU 2)

1. PCB burial, dilution, or breakdown from biological activity

2. Monitoring to track “recovery”
PCBs by river segment (pounds)
## Fox River PCB concentrations

<table>
<thead>
<tr>
<th>Media</th>
<th>Operable Unit</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sediments (ppm)</td>
<td>Average¹</td>
<td>15</td>
<td>5</td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>Surface average</td>
<td>3.7</td>
<td>0.2</td>
<td>2.1</td>
<td>3.0</td>
</tr>
<tr>
<td>Water (ppt)</td>
<td>Average</td>
<td>28</td>
<td>17</td>
<td>41</td>
<td>61</td>
</tr>
</tbody>
</table>

¹ All depths

**Sediment goal:** 0.25 ppm
Lower Fox River
side view profile

OU1 Little Lake Butte des Mort
OU2 Appleton to Little Rapids
OU3 Little Rapids to De Pere
OU4 De Pere to Green Bay
OU5 Green Bay

OU 2 - steep slope
(thin sediment - faster flow)
Monitored Natural Recovery
OU 2

1. Relatively small PCB mass
2. Lower PCB concentrations
3. Bedrock
4. Lots of dams (difficult access)
Upriver dredging

Started September 2004
1. Dredge sediments (800,000 cubic yards*)
2. Separate water from dredge slurry
3. Treat dredge water
4. Dispose at landfill

*Football field – 50 stories high
Sediment processing facility

Water treatment plant

Geotubes (separates dredge water from mud)

Truck disposal route

From: Little Lake Cleanup Team
Stacked geotubes

Geotubes need a lot of space
Water treatment

- Air flotation
- Sand/gravel filters
- Carbon filters

From: WDNR webpage
Landfill disposal

* Engineered for contaminant containment
Good effort

1. Commitment to goals
2. Flexibility
3. Cooperation
4. Coordination & communication

PCB dredging a smooth operation

Little Lake Butte des Morts cleanup surpasses expectations

By Duke Behnke
Post-Crescent staff writer

TOWN OF MENASHA — Engineers and contractors are all smiles three weeks into the six-year, $62 million cleanup of PCBs from Little Lake Butte des Morts.

A high-tech hydraulic dredge has been removing PCB-contaminated...
Why are we doing all this anyway? (time to fish recovery)

![Bar chart showing time to fish recovery for different cleanup levels.](image)

- **No Action**: 51 years
- **5 ppm**: 29 years
- **1 ppm**: <1 year
- **0.5 ppm**: <1 year
- **0.25 ppm**: <1 year
- **0.125 ppm**: <1 year
Project Objectives

• Clean water

• Edible fish

• Ecological improvements
Possible capping

Capping: possible dredging supplement

1. Post-capping water depth 3-feet+

2. Not in navigation channel

3. Avoid pipelines, utilities, etc.

4. PCBs less than 50 ppm

From: DEA, 2003
Dredging

Issues

1. Stirring up (resuspension)
2. Leftover contamination (“residuals”)
3. Habitat effects
4. Disposal
Contaminant losses during dredging

Hudson River White Paper
Resuspension of PCBs During Dredging

• 5 Projects

• 388 observations

Average loss:
hydraulic dredge 0.1%

Average loss:
mechanical dredge 0.3%
Dredging
Surface water monitoring

From: OU 1 Environmental Data Memorandum, November 2, 2004
Contamination left behind (dredging “failures”)

Critics view: “…no contaminant concentration reduction.”

Reasons:

1. Shallow bedrock

2. Debris (e.g., rock and wood)
Shallow bedrock: “leftovers” are hard to remove
Wood debris
Manistique River, MI
Rock debris
Grasse River, NY
## Concentrations after dredging

<table>
<thead>
<tr>
<th>Project</th>
<th>Contaminant</th>
<th>Average % Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grasse River, NY</td>
<td>PCBs</td>
<td>79</td>
</tr>
<tr>
<td>GM Massena, NY</td>
<td>PCBs</td>
<td>99</td>
</tr>
<tr>
<td>Cumberland Bay, NY</td>
<td>PCBs</td>
<td>97</td>
</tr>
<tr>
<td>New Bedford, MA</td>
<td>PCBs</td>
<td>97</td>
</tr>
<tr>
<td>Marathon Battery, NY</td>
<td>Cadmium</td>
<td>92</td>
</tr>
<tr>
<td>Lake Jarnsjon, Sweden</td>
<td>PCBs</td>
<td>99</td>
</tr>
<tr>
<td><strong>AVERAGE</strong></td>
<td></td>
<td><strong>94</strong></td>
</tr>
</tbody>
</table>

From: Hudson River Responsiveness Summary White Paper (312663), Post-Dredging PCB Residuals
Fox River dredging project
Concentration reduction

Average PCB concentrations (ppm)

Pre-dredging: 50 ppm
Post-dredging: 2 ppm

96% reduction*

*For all sediments
March 1999 (after excavation)

Habitat disruption - Bryant Mill Pond
August 1999 (4-months after excavation)

Habitat recovery
Bryant Mill Pond

U.S. EPA and WDNR, 2002, Record of Decision, Operable Unit 1 and Operable Unit 2, Lower Fox River and Green Bay, White Paper 8 – Habitat and Ecological Considerations as a Remedy Component for the Lower Fox River
Disposal: engineered landfill

- Capping system
- Native clay soil
- Liner system
- Waste

Groundwater
Treatment - sediment melting (vitrification)
## Melting versus landfill disposal (Fox River upstream)

<table>
<thead>
<tr>
<th></th>
<th>Melting (i.e., vitrification)</th>
<th>Landfill disposal</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Treatment</strong></td>
<td>Yes (beneficial re-use)</td>
<td>No (landfill space used)</td>
</tr>
<tr>
<td><strong>Technology development</strong></td>
<td>Successful small scale test</td>
<td>Proven effective</td>
</tr>
<tr>
<td><strong>Costs (upstream project)</strong></td>
<td>$48 million</td>
<td>$21 million</td>
</tr>
</tbody>
</table>

Preferred
Capping

Sand cap

Contaminated sediment
# Dredging versus Capping

<table>
<thead>
<tr>
<th></th>
<th>Dredging</th>
<th>Capping</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short-term releases</td>
<td>Small release</td>
<td>No releases</td>
</tr>
<tr>
<td>Contaminant disposition</td>
<td>Mostly removed</td>
<td>Contained*</td>
</tr>
<tr>
<td></td>
<td>Landfill</td>
<td>Remains in river</td>
</tr>
<tr>
<td>Habitat</td>
<td>Altered/disrupted (eventual recovery)</td>
<td>Permanent change</td>
</tr>
</tbody>
</table>

**Preferred**

*Assumes long-term stability*
# Dredging versus Capping

<table>
<thead>
<tr>
<th>Construction impacts</th>
<th>Dredging</th>
<th>Capping</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Larger “footprint”</td>
<td>Smaller “footprint”</td>
</tr>
<tr>
<td></td>
<td>Some noise, traffic, odors, etc.</td>
<td>Less noise, traffic, odors, etc.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Monitoring &amp; maintenance</th>
<th>Dredging</th>
<th>Capping</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Limited followup monitoring</td>
<td>More monitoring &amp; institutional controls</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cost</th>
<th>Dredging</th>
<th>Capping</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High</td>
<td>Moderate</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Water depth</th>
<th>Dredging</th>
<th>Capping</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Increased</td>
<td>Decreased</td>
</tr>
</tbody>
</table>

**Preferred**
Capping

- Best in quiet waters
- Typically for low toxicity contamination

Photo courtesy of Bean Environmental, LLC.
Cleanup options summary

• “One size does not fit all”

• Unique site conditions should be considered
Economic benefits of cleanup

• Increase in property values (e.g., Waukegan Harbor: $53,000 increase per house following cleanup*)

• Cleanup-related jobs & business

• Health benefits

Economic benefits of cleanup (continued)

• Recreation improvements & tourism (e.g., removal of fish advisories)

• Lower navigation dredging costs and/or increased commercial use
Big river sites cleanups

<table>
<thead>
<tr>
<th>Site</th>
<th>Cleanup costs</th>
<th>Contaminated sediment (cubic yards)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fox River, WI</td>
<td>$ 400 million</td>
<td>7.2 million</td>
</tr>
<tr>
<td>Kalamazoo, MI</td>
<td>?</td>
<td>1.0 million</td>
</tr>
<tr>
<td>Housatonic, MA</td>
<td>$ 600 million (?)</td>
<td>?</td>
</tr>
<tr>
<td>Hudson, NY</td>
<td>$ 460 million</td>
<td>2.7 million</td>
</tr>
</tbody>
</table>
More information:
http://www.epa.gov/region5/sites/foxriver
http://www.dnr.state.wi.us/org/water/wm/foxriver/index.html
http://www.littlelakecleanup.com/pages/1/index.htm