Hydraulic dredge

Photo from: Little Lake Cleanup Team
Sediment processing facility

Truck disposal route

Water treatment plant

Geotubes (separates dredge water from mud)

From: Little Lake Cleanup Team
Separating dredge water using “geotubes”

- Water drains by gravity
- Less labor/equipment
- “Decouples” dredging & dewatering
- Less potential air release
Dewatering - geotextile tubes

From: Little Lake Cleanup Team
Filling geotubes

From:
Little Lake Cleanup Team
Solids captured & water drains out

Extra slide
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
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)
Project Objectives

• Clean water

• Edible fish

• Ecological improvements
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
Dredging
Issues

1. Stirring up (resuspension)

2. Leftover contamination ("residuals")

3. Habitat effects

4. Disposal
Dredging critics*

Resuspension

*Not U.S. EPA view

Extra slide
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

Water clarity (turbidity)

Background levels

Days

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

C**ritics 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

Post-dredging

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

Waste

Liner system

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>Treatment</td>
<td>Yes (beneficial re-use)</td>
<td>No (landfill space used)</td>
</tr>
<tr>
<td>Technology development</td>
<td>Successful small scale test</td>
<td>Proven effective</td>
</tr>
<tr>
<td>Costs (upstream project)</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></th>
<th>Dredging</th>
<th>Capping</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction impacts</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>
<tr>
<td>Monitoring &amp; maintenance</td>
<td>Limited followup monitoring</td>
<td>More monitoring &amp; institutional controls</td>
</tr>
<tr>
<td>Cost</td>
<td>High</td>
<td>Moderate</td>
</tr>
<tr>
<td>Water depth</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
## Economic benefits to communities from cleanups

<table>
<thead>
<tr>
<th>Superfund project &amp; cleanup costs</th>
<th>Short-term jobs</th>
<th>Permanent jobs</th>
<th>Property value increase</th>
<th>Annual State taxes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>Annual income</td>
<td>No.</td>
<td>Annual income</td>
</tr>
<tr>
<td>Ft. Devens, MA ($80 million)</td>
<td>235</td>
<td>$6 million</td>
<td>2500</td>
<td>$70 million</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$2 million</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$7 million</td>
</tr>
<tr>
<td>Industri-Plex, MA ($60 million)</td>
<td>700</td>
<td>$22 million</td>
<td>4300</td>
<td>$142 million</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$4.6 million</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$14 million</td>
</tr>
<tr>
<td>Raymark Ind., CT ($80 million)</td>
<td>1200</td>
<td>$32.5 million</td>
<td>800</td>
<td>$13.2 million</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$4.2 million</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$1 million</td>
</tr>
</tbody>
</table>

From: EPA, Superfund: The Road to Recovery
### Economic benefits to communities from cleanups

<table>
<thead>
<tr>
<th>Superfund project &amp; cleanup costs</th>
<th>Short-term jobs</th>
<th>Permanent jobs</th>
<th>Property value increase</th>
<th>Annual State taxes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>Annual income</td>
<td>No.</td>
<td>Annual income</td>
</tr>
<tr>
<td>Old Works, MT</td>
<td>42</td>
<td>$1.2 million</td>
<td>20</td>
<td>$0.5 million</td>
</tr>
<tr>
<td>Denver Radium, CO ($130 million)</td>
<td>145</td>
<td>$3.7 million</td>
<td>113</td>
<td>$1.9 million</td>
</tr>
<tr>
<td>Chisman Creek, VA</td>
<td>90</td>
<td>$2.1 million</td>
<td>---</td>
<td>---</td>
</tr>
</tbody>
</table>

From: EPA, Superfund: The Road to Recovery
## 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

Photo from Ann Schell