MAINTENANCE DREDGING
NANTICOKE RIVER
SEAFORD, DELAWARE
NANTICOKE RIVER

• Channel is authorized to a depth of 12 feet and a width of 100 feet
• Approximately 55,000 cubic yards of material will be hydraulically dredged
• A 20 acre placement site will be constructed
• Return water will be pumped back to the Nanticoke River
• No dredging 15 February through 15 June
Testing and Evaluation of Dredged Materials

Protection of Human Health and the Environment
Introduction

• Navigation channel dredging

• US ACE must test and evaluate dredge materials (sediment) within the federal channel before dredging and for placement

• US ACE must be protective of human health and the environment
Introduction – Nanticoke River

• Sediment in the Nanticoke River near Seaford have been tested three times in the last 15 years

• DNREC (1997), “Chemical Contaminants in Sediments of the Nanticoke River”
Introduction – Local Conditions

• Local Conditions: types and amounts of chemicals present in the river today

• US ACE compares these conditions to those that could be created by dredging
Screening - Basics

- Many different types of screening and many different sets of numbers that regulators have created for this purpose
- Bulk Chemical (what is in the water or what is attached to the sediment)
- Elutriate (what comes off the sediment when dredging occurs)
- TCLP (what comes off the sediment when in the placement site) that could leach into the groundwater
Screening - Basics

• Lab results for these tests will report:
  (1) a real number from the analysis
  (2) identify that the chemical was undetected (“U”), or
  (3) estimated (“J”)
• Screen using real numbers (i.e. no “U” or “J”)
• Compare to DNREC or DNREC approved standards
• Terminology: “no impacts” or “exceedance”
• Slight exceedances of conservative screening standards are acceptable
Screening - Results

Bulk Chemistry – Surface water
• Environmental: No adverse impacts (Table 1)
• Human Health: No adverse impacts (Table 2)

Elutriate:
• Environmental: No adverse impacts (Table 3)
• Human Health: No adverse impacts (Table 4)

TCLP:
• No adverse impacts to groundwater (Table 5)
Screening - Results

Bulk Chemistry – Sediment

• Environmental (sediment dwelling organisms in the river): No adverse impacts (Table 6)

• Environmental (terrestrial receptors at the placement site): No adverse impacts (Table 7)

• Human Health (restricted and unrestricted uses for humans): No adverse impacts (Table 8)
Sediment Characteristics - Results

• Sediment properties that make chemicals bind to particles and not be available to receptors include fine particulates and Total Organic Carbon (TOC)

• Nanticoke sediments at Seaford are fine textured (% silt and % clay are high; >65% fines) and have 3-6% TOC (1% TOC = 10,0000 mg/kg)

• See Table 9

- Table 10 summarizes analytical data for sediment from 1997 and 2006
- PAH levels have increased but only slightly exceed the screening standard; organics bind to sediment fines and TOC
- PCB: cannot really compare the data; the two methods have vastly different sensitivities BUT both sets of data are less than screening standard; PCBs bind to sediment fines and TOC
- Metals: concentrations decreasing over time; all below screening standards; metals bind to sediment fines and TOC
Bottom Line

Will this dredging adversely impact aquatic/terrestrial environments or impact ecological/human receptors?

Answer: No
Additional Questions?

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Testing
&
Additional Data Evaluation
Local Conditions - Surface Water (Testing)

• Evaluation at the dredging site
• Polychlorinated biphenyls (PCBs)
• Metals/inorganics (arsenic, cadmium, chromium, copper, lead, mercury, zinc)
• Misc: ammonia, nitrogen, phosphorus, total suspended solids (TSS)
Local Conditions - Surface Water (Evaluation)

Environment (Table 1)
• No exceedances
• No adverse impacts

Human Health (Table 2)
• Total PCBs – Slight exceedance of one standard
• No adverse impacts
Effluent Elutriate (water) - Testing

• Evaluation for the placement site

• Designed to mimic partitioning of chemicals off of sediment during the settling phase

• Put sediment in a beaker with water, stir and let it settle

• Test water phase the same way you test surface water (total PCBs, metals and general chemistry)
Effluent Elutriate - Evaluation

Environment (Table 3)
• Slight exceedances of metals (copper and zinc)
• Instantaneous mixing/dilution with river water when CDF water is returned to the river
• No adverse impacts

Human Health (Table 4)
• Total PCBs – Slight exceedance of one standard
• No adverse impacts
## Comparison - River Water & Elutriate

<table>
<thead>
<tr>
<th>Chemical</th>
<th>Ecological (ug/L) (Table 3)</th>
<th>Human Health (ug/L) (Table 4)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lowest Standard</td>
<td>River Water</td>
</tr>
<tr>
<td>PCBs</td>
<td>0.014</td>
<td>0.00026</td>
</tr>
<tr>
<td>Arsenic</td>
<td>150</td>
<td>1</td>
</tr>
<tr>
<td>Cadmium</td>
<td>0.2</td>
<td>0.5</td>
</tr>
<tr>
<td>Chromium</td>
<td>49</td>
<td>1</td>
</tr>
<tr>
<td>Copper</td>
<td>5.8</td>
<td>1.8</td>
</tr>
<tr>
<td>Lead</td>
<td>1.2</td>
<td>0.5</td>
</tr>
<tr>
<td>Mercury</td>
<td>0.077</td>
<td>0.02</td>
</tr>
<tr>
<td>Zinc</td>
<td>76</td>
<td>15</td>
</tr>
</tbody>
</table>
Leaching Potential (TCLP) - Testing

• Use this test to see if there will be impact to groundwater
• TCLP (acidic water percolates through a soil column)
• Severe leaching test (acid dissolves chemicals, especially metals)
• Tested for VOCs, SVOCs, total PCBs, pesticides, metals
Leaching Potential (TCLP) - Evaluation

- Impacts to Groundwater
- No exceedances of drinking water standards
- No impact to local wells and drinking water supply
- Summarized in Table 5
Local Conditions - Bulk Sediment (Testing)

- Evaluation at the dredging site as sediment and at the placement site as soil;
- Tested for multiple categories of analyses (VOCs, SVOCs, PAHs, pesticides, total PCBs, metals)
- Tested for general chemistry (nitrogen, phosphorous, as well as general chemistry and sediment texture (sand, silt, clay and percent solids)
Local Conditions - Bulk Sediment (Evaluation)

Environmental (Table 6):
• Slight exceedances of two metals (arsenic, zinc)
• Sediments are very fine textured and have high TOC (bind chemicals tightly) (Table 9)
• No adverse impacts
Sediment as Soil – Evaluation

• Evaluation at the placement site (Table 7)
• Terrestrial receptors
• 4 exceedances of metals
• 3 of the 4 metals are within Delaware background conc.
• Zinc is about double background
• No adverse impacts
### Local Conditions - Sediment as Soil (Table 7)
Comparison to Typical DE Soil Concentrations

<table>
<thead>
<tr>
<th>Metal</th>
<th>DE Bkgrd (mg/kg)</th>
<th>Lowest Standard (EcoSSL) (mg/kg)</th>
<th>Dredge Material (mg/kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cadmium</td>
<td>1 - 3</td>
<td>0.36</td>
<td>1</td>
</tr>
<tr>
<td>Lead</td>
<td>30 – 100</td>
<td>11</td>
<td>23</td>
</tr>
<tr>
<td>Mercury</td>
<td>0.1 - 0.3</td>
<td>0.10</td>
<td>0.14</td>
</tr>
<tr>
<td>Zinc</td>
<td>60 - 90</td>
<td>46</td>
<td>173</td>
</tr>
</tbody>
</table>
Sediment as Soil - Evaluation

- Evaluation at the placement site (Table 8)
- Human receptors (unrestricted & restricted use)
- Unrestricted use: residential (live, play, grow veggies and eat them etc.)
- Restricted use: commercial (work there)
- Same results for both restricted/unrestricted; slight exceedance for:
  - PCBs (Standard = 2 mg/kg; Result = 3.4 mg/kg)
  - Arsenic (DE background = 1 – 10 mg/kg; Result = 11 mg/kg)
- No adverse impacts
# Nanticoke Sediment – Then and Now (Table 10)

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>Units</th>
<th>Screening TEC</th>
<th>DNREC Conc Range (1997)</th>
<th>US ACE Conc Range (2006)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total PAHs</td>
<td>ug/kg</td>
<td>1,610</td>
<td>1 – 2</td>
<td>512 - 2566</td>
</tr>
<tr>
<td>Total PCBs</td>
<td>ug/kg</td>
<td>59.8</td>
<td>5.66E-05 – 1.04E-04</td>
<td>0 - 7</td>
</tr>
<tr>
<td>METALS</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arsenic</td>
<td>mg/kg</td>
<td>9.79</td>
<td>11 - 18</td>
<td>6 - 15</td>
</tr>
<tr>
<td>Cadmium</td>
<td>mg/kg</td>
<td>0.99</td>
<td>2 - 3</td>
<td>0.67 - 2</td>
</tr>
<tr>
<td>Chromium</td>
<td>mg/kg</td>
<td>43.4</td>
<td>25 - 32</td>
<td>8 - 18</td>
</tr>
<tr>
<td>Copper</td>
<td>mg/kg</td>
<td>31.6</td>
<td>29 - 42</td>
<td>15 - 33</td>
</tr>
<tr>
<td>Lead</td>
<td>mg/kg</td>
<td>35.8</td>
<td>29 - 34</td>
<td>15 - 29</td>
</tr>
<tr>
<td>Mercury</td>
<td>mg/kg</td>
<td>0.18</td>
<td>0.035 - 3</td>
<td>0.079 – 0.16</td>
</tr>
<tr>
<td>Zinc</td>
<td>mg/kg</td>
<td>150</td>
<td>208 - 235</td>
<td>91 - 224</td>
</tr>
</tbody>
</table>
## Compare River Water and Elutriate

<table>
<thead>
<tr>
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<th>Ecological (ug/L)</th>
<th>Human Health (ug/L)</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Lowest Standard</td>
<td>River Water (Table 1)</td>
</tr>
<tr>
<td>(Dissolved)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PCBs</td>
<td>0.014</td>
<td>0.00026</td>
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Leaching to Groundwater

- Acid leaching test showed no exceedances
- No leaching to groundwater (TCLP, Table 5)
- Sediments are fine textured and have high TOC therefore chemicals will bind tightly to them
- County will install sentinel wells to ensure these conditions are maintained
Bottom Line

Will this dredging adversely impact the aquatic or terrestrial environments for ecological and human receptors?

Answer: No
Additional Questions?

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