Acknowledgements:

• Erin Shankie, BSc (Bio), PMP
  - Environmental Specialist
  - *Environmental Services*
  - *Public Works and Government Services Canada*

• Gary Watson, GIT
  - Environmental Officer
  - *Transport Canada*
Purpose of Evaluation

- Support of risk assessment activities for Lot 17 sediments
- Develop understanding of vertical and horizontal extents of vessel disturbance to sediment bioactive zone
- Evaluate propeller wash impacts on natural recovery processes
Work Conducted as Part of Evaluation

• Collected vessel and operations data
  - Divide site into operational areas
• Reviewed surface sediment data
  - Divide site into two categories: cohesive or non-cohesive
• Developed list of scenarios based on operational areas and surface sediment information
• Calculated potential scour depth due to propeller wash for each scenario
Site Description
Vessel Information

- Obtained through interviews with Harbour Master and various operators
- Also discussed general operations and berthing maneuvers

<table>
<thead>
<tr>
<th>Vessel</th>
<th>Length (m)</th>
<th>Beam (m)</th>
<th>Draft (m)</th>
<th>HP</th>
<th>Propeller Diameter (m)</th>
<th>Ducted?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coho</td>
<td>104.1</td>
<td>22</td>
<td>3.8</td>
<td>2,551</td>
<td>2.44</td>
<td>no</td>
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<tr>
<td>Victoria Clipper</td>
<td>38.7</td>
<td>9.1</td>
<td>2.5</td>
<td>5,438</td>
<td>none</td>
<td>JET</td>
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<tr>
<td>Seaspan Foam</td>
<td>17.6</td>
<td>6.1</td>
<td>2.4</td>
<td>800</td>
<td>1.52</td>
<td>yes</td>
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<tr>
<td>Storm Rider</td>
<td>11.0</td>
<td>4.7</td>
<td>1.6</td>
<td>440</td>
<td>1.37</td>
<td>yes</td>
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<tr>
<td>HMCS Nanaimo</td>
<td>55.3</td>
<td>11.3</td>
<td>3.4</td>
<td>1,000</td>
<td>1.83</td>
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<tr>
<td>Nimpkish</td>
<td>33.5</td>
<td>12.5</td>
<td>2.5</td>
<td>680</td>
<td>1.83</td>
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</tbody>
</table>
Example: *Coho* Ferry Departure
Surface Sediment Information

- **Cohesive**
  - Clay/silt content > 15%
  - D50 < 250 microns
- **Non-cohesive**
  - Primarily sand or gravel
Operational Areas and Sediment Bed Type
Tide Levels Relative to Chart Datum (CD)
## Scenarios Developed for Calculations

<table>
<thead>
<tr>
<th>Area</th>
<th>Operation Type</th>
<th>Water Levels</th>
<th>Number of Vessels</th>
<th>Engine Power Levels</th>
<th>Total Number of Scenarios</th>
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<tbody>
<tr>
<td>Incoming/Outgoing</td>
<td>Transit</td>
<td>Low and High</td>
<td>6</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>Transit</td>
<td>Low and High</td>
<td>6</td>
<td></td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>Turning</td>
<td>Low, Mid-range (Coho only), and High</td>
<td>2</td>
<td></td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Docking</td>
<td>Low and High</td>
<td>3</td>
<td></td>
<td>10</td>
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<tr>
<td>Inner Harbour</td>
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</tr>
<tr>
<td></td>
<td>Transit</td>
<td>Low and High</td>
<td>3</td>
<td></td>
<td>12</td>
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<tr>
<td></td>
<td>Turning</td>
<td>Low and High</td>
<td>3</td>
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<tr>
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<td>Docking</td>
<td>Low and High</td>
<td>3</td>
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<td>Upper Harbour 1</td>
<td>Transit</td>
<td>Low and High</td>
<td>1</td>
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<td></td>
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<td>Docking</td>
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<td>4</td>
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<td>Upper Harbour 2</td>
<td>Transit</td>
<td>Low and High</td>
<td>1</td>
<td></td>
<td>4</td>
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</table>
Expected Scour Depths – *Coho*

Low Water Level, Low/High Power (cm)
- 0.2/0.4
- 0.5/1.5
- 2/5
- 9/21
- 42/93

High Water Level, Low/High Power (cm)
- 0.02/0.06
- 0.07/0.2
- 0.3/0.8
- 0.6/1.4
- 2/3
Expected Scour Depths – *Coho* (cont.)

Mid-range water level

0.95 m CD, Low/High Power (cm)
Expected Scour Depths – Seaspan Foam

Low Water Level, Low/High Power (cm)

High Water Level, Low/High Power (cm)
Study Conclusions

- Bioactive zone is approximately 5 to 10 cm below the bed
- All estimates of scour depth are less than 10 cm for water levels $\geq 0.95$ m CD
- Most estimates of scour depth are less than 10 cm for our extreme low water condition (0 m CD, lower low water large tides)
- Highest scour occurs at docking areas for the *Coho* and *Victoria Clipper* (assumed to be the same as the *Coho*)
  - Maximum of 1 m at high power/low water
Study Conclusions (cont.)

• Relatively high scour is expected in the Inner Harbour and South Bay turning areas (*Coho* and tugs)
  - Approximately 0.25 m in both areas at high power/low water

• Maximum scour at low water condition occurs less than 1% of the time (0.2%)