Active Above-Ground Stormwater Treatment at a Break-Bulk and Container Terminal

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Kennedy/Jenks Consultants
Agenda

- Site and Stormwater Characteristics
- WA State Industrial Stormwater General Permit
- Treatment Alternatives Evaluation
- Interim Treatment and Performance
- Final Design and Construction
- Full-Scale Treatment and Performance
Break-Bulk Terminal

• Domestic import and export of shipping containers and break bulk materials
• Approximately 44 acres of contributing drainage area to be treated
• Various Activities and Operations
• Heavy Wheel Loads
Paved and Unpaved Areas

• Total of 44 Acres to be Treated
  – Approximately 33 Acres Paved
  – Approximately 10 Acres Unpaved
Stormwater Characteristics and the ISGP

• Paved Runoff
  – Runoff high in metals, some solids

• Unpaved Runoff
  – Runoff high in metals and solids
  – Very Fine Particulate
  – Difficult to prevent fines entering storm drains
Stormwater Characteristics and the ISGP

• The ISGP
  – Corrective Actions
    • Level 1 (Operational)
    • Level 2 (Structural)
    • Level 3 (Treatment)
  – Due to high concentrations, Level 3 Corrective Action was triggered

<table>
<thead>
<tr>
<th>Outfall</th>
<th>Turbidity (NTU)</th>
<th>pH (SU)</th>
<th>Zinc (µg/L)</th>
<th>Copper (µg/L)</th>
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<tbody>
<tr>
<td>Outfall #1</td>
<td>Minimum 15</td>
<td>7</td>
<td>160</td>
<td>10</td>
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<td>Maximum 28</td>
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<td>210</td>
<td>11</td>
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<tr>
<td>Outfall #2</td>
<td>Minimum 17</td>
<td>7</td>
<td>150</td>
<td>7</td>
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<tr>
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<td>Maximum 20</td>
<td>8</td>
<td>160</td>
<td>7</td>
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<td>Outfall #3</td>
<td>Minimum 630</td>
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<td>480</td>
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<td>Maximum 850</td>
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<td>1120</td>
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<td>Outfall #4</td>
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<td>290</td>
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<td>Maximum 500</td>
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<td>700</td>
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<td>Outfall #5</td>
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<td>Maximum 144</td>
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<td>Benchmarks</td>
<td>Turbidity 25</td>
<td>5 to 9</td>
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Treatment Alternatives Evaluation

- Biofiltration
- Enhanced Media Filtration
- Chitosan-Enhanced Sand Filtration
- Electrocoagulation
Operation and Maintenance

- Biofiltration and Enhanced Media Filtration
  - No Chemicals
  - Media Gets Spent or Clogged
  - Physical Removal, Disposal, & Replacement
- CESF & Electrocoagulation
  - Chemicals
  - Parts Replacement
  - Mechanical Equipment
  - Sludge Disposal
CESF Selection

- CESF stood out when considering the various criteria
  - Competitive costs and footprint
  - Bench-scale testing indicated the treatment method was appropriate for site-specific runoff
  - High volume of solids in unpaved area assists with flocculation
Interim Treatment

- Unpaved area (10 Acres)
- Small-scale CESF system
  - Designed for 400 GPM
  - Installed upland
  - All components designed to be reused in full-scale system
  - No permanent modifications made to existing infrastructure
Interim Treatment Performance

Influent and Effluent Samples – Monthly Averages – Turbidity (NTU)
Full-Scale Treatment Design

• Treat Entire 44 Acres
• Two Treatment Systems
• Reuse Interim System
• Significant Conveyance Rerouting
• Detailed Hydraulic Modeling

• Electrical Service
• Phasing Plan
• Utility Locating
• Permitting
• Construction Kickoff!
Construction - Dewatering
Construction - Shoring
Construction – Trenching Along the Waterfront
Construction – 125 Kip Rated Structures
Construction – Pumps
Construction – Treatment System Mobilization
Construction – Treatment System Controls
Full-Scale Basin 3 Treatment System

• Designed for 1,200 GPM
Full-Scale Basin 4 Treatment System

• Designed for 725 GPM
• Reused all Interim System Components
Full-Scale Treatment Performance (Basin 4)

- Unpaved Area Still Unpaved; Lower Influent Turbidity Due to Paved Area Contributions
- Less Treatment Efficiency When Compared to the Unpaved Area alone
- Below Benchmarks!

Influent and Effluent Samples
Monthly Averages – Turbidity (NTU)
Questions?