Treatment Selection, Design, and Performance for Two Heavy Industrial Facilities

Port of Seattle
Terminal 46 Cargo Facility

Port of Tacoma
West Hylebos Pier Log Yard

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NEBC 2016
Outline for Each Facility

- Overview
- Treatment Goals
- Treatment Selection
- Treatment Design
- Performance Results
Port of Seattle T46: Overview

- 90-acre marine cargo import/export facility
- Discharges to Elliot Bay from 4 drainage basins
- Tenant was threatened with a Clean Water Act lawsuit
- Hired K/J to evaluate alternatives for Port & Ecology approval
- Treatment construction complete end of 2014
Port of Seattle T46: Treatment Goals

- Meet Industrial Stormwater General Permit (ISGP) requirements
- Maximize:
  - Terminal operational space
  - Use of the existing infrastructure
- Account for:
  - Tidal influence
  - Heavy wheel loads
Port of Seattle T46: Treatment Selection

- Target pollutants: Cu, Zn, Turbidity
- Meets Ecology All Known, Available and Reasonable methods of prevention, control and Treatment (AKART) standards
- Gravity-based/ low energy
- Flexibility of media selection
- Potential to control pollutants beyond facility control (e.g., atmospheric deposition)
Port of Seattle T46: Treatment Selection

14 alternatives evaluated per area and costs that were various combinations of:

- 4 Conveyance Alternatives
- 7 Treatment Alternatives

Modular Wetland System (MWS) and Up-Flo Filter selected for further evaluation.
Port of Seattle T46: Treatment Selection

In-field pilot studies for each drainage basin:

- Conducted at night and mounted on flatbed truck for less facility disruption
- Design flow rates
  - MWS at 6 gpm
  - Up-Flo at 10 gpm
- MWS had higher pollutant removal but would be abovegrade and pumped
Port of Seattle T46: Treatment Design

Up-Flo selected for design:

- 3 subsurface vaults, each treating a 20-acre drainage basin
- Used proprietary bone char, peat and zeolite (CPZ) media mix
- Port pre-purchased vaults to fast track design and implementation
## Port of Seattle T46: Treatment Design

<table>
<thead>
<tr>
<th>Component</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-Purchase Vaults</td>
<td>$0.5M</td>
</tr>
<tr>
<td>Analysis, Pilot Testing &amp; Design</td>
<td>$0.4M</td>
</tr>
<tr>
<td>Construction</td>
<td>$2.0M</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$2.9M</strong></td>
</tr>
</tbody>
</table>
## Port of Seattle T46: Performance Results

<table>
<thead>
<tr>
<th></th>
<th>Cu (µg/L)</th>
<th>Zn (µg/L)</th>
<th>Turbidity (NTU)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>WA ISGP Benchmark</strong></td>
<td>14</td>
<td>117</td>
<td>25</td>
</tr>
<tr>
<td><strong>Influent- All Basins</strong></td>
<td>4-49</td>
<td>81-783</td>
<td>3-95</td>
</tr>
<tr>
<td>(mean, %exceed)</td>
<td>(16, 32%)</td>
<td>(300, 89%)</td>
<td>(23, 32%)</td>
</tr>
<tr>
<td><strong>Effluent- All Basins</strong></td>
<td>1-38</td>
<td>11-570</td>
<td>3-79</td>
</tr>
<tr>
<td>(mean, %exceed)</td>
<td>(11, 19%)</td>
<td>(188, 46%)</td>
<td>(17, 15%)</td>
</tr>
</tbody>
</table>

- Overall decrease in pollutant concentrations and sample exceedances
- Ongoing troubleshooting of source control operations and O&M to eliminate effluent exceedances
PORT OF TACOMA
WEST HYLEBOS PIER (WHP)
Port of Tacoma WHP: Overview

- 25-acre marine log yard facility
- Discharges to Hylebos Waterway
- Tenant triggered ISGP corrective action
- Hired K/J to evaluate alternatives per AKART
- Treatment construction complete end of 2013
Port of Tacoma WHP: Treatment Goals

- Meet ISGP requirements
- Provide treatment for bark flour for which sweeping is difficult
Port of Tacoma WHP: Treatment Selection

- Target pollutants: Cu, Zn, COD, Turbidity
- Meets Ecology AKART standards
- Treatment costs considered Port revenue loss and 30-year life cycle costs
Port of Tacoma WHP: Treatment Selection

Alternatives analysis included:

- Transfer of runoff to City’s sanitary sewer system
- Constructed wetlands
- Biofiltration
- Advanced treatment via settling, oxidation, coagulation, flocculation, and adsorptive media filtration
Port of Tacoma WHP: Treatment Selection

Pilot testing for media filtration pretreatment followed by biofiltration:

- Defined hydraulic requirements
- Guided material selection:
  - Pretreatment sand filter media
  - Biofiltration mix
  - Aggregate type and gradation
  - Plantings
Port of Tacoma WHP: Treatment Design

Pumped biofiltration chosen for design:

- Could handle log handling facility and other future tenants
- Enhanced flow control via variable speed pumps and actuated valves
Port of Tacoma WHP: Treatment Design

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<th>Component</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Analysis, Pilot Testing &amp; Design</td>
<td>$0.7M</td>
</tr>
<tr>
<td>Construction</td>
<td>$2.9M</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$3.6M</strong></td>
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</table>
### Port of Tacoma WHP: Performance Results

<table>
<thead>
<tr>
<th></th>
<th>Cu (µg/L)</th>
<th>Zn (µg/L)</th>
<th>COD (mg/L)</th>
<th>Turbidity (NTU)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>WA ISGP Benchmark</strong></td>
<td>14</td>
<td>117</td>
<td>120</td>
<td>25</td>
</tr>
<tr>
<td><strong>Influent- All Basins</strong></td>
<td>7-72</td>
<td>68-682</td>
<td>77-3,200</td>
<td>68- &gt;1,000</td>
</tr>
<tr>
<td>(mean, %exceed)</td>
<td>(24, 71%)</td>
<td>(204, 80%)</td>
<td>(1,247, 98%)</td>
<td>(100% exceed)</td>
</tr>
<tr>
<td><strong>Effluent- All Basins</strong></td>
<td>0.5-12.5</td>
<td>0.5-21</td>
<td>23-310</td>
<td>5.6-24.5</td>
</tr>
<tr>
<td>(mean, %exceed)</td>
<td>(5.9, 0%)</td>
<td>(11.5, 0%)</td>
<td>(111, 20%)</td>
<td>(12, 0%)</td>
</tr>
</tbody>
</table>

- COD met in 3rd quarter of 2014; other ISGP benchmark met immediately after install
- Minimal O&M costs for flow distribution and media management
- Ongoing plant monitoring for effectiveness