Three Innovative Stormwater Treatment Approaches for Three Linked Industrial Sites

Port of Tacoma

General Central Peninsula Infrastructure Improvements Project:
Taming pollutant sources in stormwater discharges

North Intermodal Yard (NIM)
Olympic Container Terminal (OCT)
South Intermodal Yard (SIM)

The Northwest Seaport Alliance

Kennedy/Jenks Consultants
Engineers & Scientists
Agenda

- Three Industrial Sites
- WA Industrial Stormwater General Permit
- Stormwater Characteristics
- Treatment Evaluation and Selection
- Hydrologic and Hydraulic Evaluation
- Performance and Costs
Three Linked Industrial Sites

- General Peninsula Project
  - Olympic Container Terminal (OCT)
  - North Intermodal Yard (NIM)
  - South Intermodal Yard (SIM)
- Heavy Industrial Maritime Property
- Containerized Cargo
- Difficult Meeting ISGP Benchmarks
Olympic Container Terminal (OCT)

- 56 acres
- Ship to Rail or Truck and Back
- 5 Drainage Basins
- Outfalls Under Pier
**North Intermodal Yard (NIM)**

- 12 acres
- Containers Moved Between Terminals
- Efficient means of Ship to Inland or Inland to Ship transport
- 24 hour operations
- Small Strip of Unpaved Land Available
South Intermodal Yard (SIM)

- 22 acres
- Operating Rail Facility
- 2 Drainage Basins
- Long Rectangular Configuration
- Perforated storm drain piping underneath track ballast
Zinc – Main Pollutant of Concern
Occasional Turbidity Exceedances Throughout
Copper at SIM
Larger particulate at SIM (perforated storm drains along tracks)

<table>
<thead>
<tr>
<th></th>
<th>Turbidity</th>
<th>pH</th>
<th>Zinc</th>
<th>Copper</th>
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<tbody>
<tr>
<td>Total</td>
<td>23.0</td>
<td>7.0</td>
<td>150.0</td>
<td>5.0</td>
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<td>OCT Maximum</td>
<td>74.0</td>
<td>7.9</td>
<td>275.0</td>
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<td>NIM Average</td>
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<td>115.0</td>
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<td>NIM Maximum</td>
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<td>7.8</td>
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<td>SIM Average</td>
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<td>7.0</td>
<td>124</td>
<td>9.0</td>
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<tr>
<td>SIM Maximum</td>
<td>44.3</td>
<td>7.8</td>
<td>281.0</td>
<td>17.6</td>
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Note: Bold red text indicates exceedance of the parameter benchmark.
Treatment Alternatives Selected

- Hydro International
  - Up-Flo Filter
- Modular Wetlands
  - MWS-Linear 2.0
- Contech Engineered Solutions, LLC
  - Jellyfish Filter
Up-Flo

- Subsurface Manhole or Vault
- Fluidized Media Filtration Technology
- Bags of Media Inside Filter Modules
- Reported Zinc Removal Efficiency: 60%
MWS-Linear 2.0

- At-Grade System
- Multi-Stage Treatment
  - Front End Settling
  - Pre-Filtration Cartridges
  - Media Filtration
- Water Distribution Around Perimeter of Media
- Perforated Collection Piping
- Reported Zinc Removal Efficiency: 66%
Jellyfish

- Subsurface Manhole
- Up-flow configuration
- Membrane Filters
- Passive Backwash
- Reported TSS Removal Efficiency: 89%
- Reported Metals Removal Efficiency: 50%
Draining by Gravity

► In-depth Hydraulic Modeling
► Tidal Influence
► Check Valves
► Bypassing Flows Greater Than Water Quality Flowrate

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Engineers & Scientists
Final Design
OCT (Up-Flo)

- 5 Subsurface Up-Flo Vaults
- Range in Size from 8’ x 12’ to 16’ x 17’
- Up to 13 feet deep (15 feet deep to construct subgrade)
- Designed to Accommodate 125 Kip Wheel Loads
Final Design
NIM (MWS)

- 2 At-Grade MWS-Linear Systems
- Each Sized @ Approximately 10’ x 20’
- 1 Flow Splitter and Collection Manhole
- Located clear of container traffic, on strip of unpaved area
Final Design SIM (Jellyfish)

- 2 Subsurface Jellyfish Systems
  - Each Sized @ 6’ I.D.
- Upstream Flow Splitter Manhole and Downstream Collection Manhole for each JellyFish
- Designed to Accommodate 125 Kip Wheel Loads
Construction Performance & Cost - OCT

Results:
- Zinc reduced 60%
- Turbidity reduced 75%

Project Costs:
- Final Construction Cost: $1,033,614
- Cost per acre treated: $18,457

Source: Performance and Cost Data Provided by Port of Tacoma
**Construction Performance & Cost - NIM**

**Results:** Zinc reduced 60%

**Project Costs**
- Final Construction Cost: $301,104
- Cost per acre treated: $25,092

Source: Performance and Cost Data Provided by Port of Tacoma
Construction Performance & Cost - SIM

Results:  Turbidity reduced 71%

Project Costs:
Final Construction Cost: $418,603
Cost per acre treated: $11,674

Source: Performance and Cost Data Provided by Port of Tacoma
Congratulations Anita & Jason!

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Port of Tacoma Engineering Project Manager: Rick Unruh
Port of Tacoma Environmental Project Manager: Anita Fichthorn
Port Customers: Yang Ming, "K" Line, Hanjin, COSCO, Westwood, Union Pacific Railroad and Horizon Lines

Kennedy/Jenks Consultants
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Questions?

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