Storm Water Modeling Tool for Navy Facilities

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Background

- Navy facilities are typically areas of high imperviousness, condensed industrial operations, and high vehicular traffic.
- Navy industrial storm water commonly exceeds end-of-pipe concentration benchmarks for copper and zinc (63.6 and 117 ppb, respectively).
- End-of-pipe storm water toxicity was found to be primarily a result of elevated copper and zinc.
- Sources of elevated copper and zinc in Navy facility runoff have not yet been identified or quantified.
Navy Facilities Characteristics
Storm Water Characteristics

- Copper (μg/L)
- Zinc (μg/L)
- Total Suspended Solids (mg/L)
- Acute Toxicity (% survival relative to control)
Project Goals

- Identify and quantify potential sources of metals in Navy facility storm water runoff
- Develop a modeling tool that provides facility managers a link between sources, landuses, and storm water concentrations
- Implement the ability to quantify reductions in copper and zinc concentrations as a result of applying Best Management Practices (BMPs)
Planned Efforts

- Work with Bob Pitt (PV & Associates) to enhance and validate his Source Loading and Management Model (WinSLAMM) for use at Navy Facilities
  - Conduct intensive site characterization evaluations
  - Identify and quantify source strengths of various landuses
  - Develop Navy facility-specific calibration files for use in WinSLAMM
  - Use WinSLAMM’s built-in BMP files for assessing efficacy of implementation for different landuses
Site Characterization

- Identify drainage boundaries from facility datasets
- Divide drainages into landuse areas to aid in site visit
- Calculate plan-view areas of buildings, streets, parking lots, etc. using Google Maps Tools (http://www.freemaptools.com/area-calculator.htm)
- Perform site visit – inventory materials and characteristics
Drainage Boundaries
Sub-Area Delineations

Outfall
Area Calculations with Google Maps Tool

Measure an Area

Area Output

2130.738 m²
0.002 km²
0.527 Acres
Site Visit Inventory

- Walk site, measure, and note:
  - Building types (office, industrial, commercial)
  - Building materials, roof slopes, and connectivity
  - Pavement type, slope, wear
  - Differentiate loading docks, parking lots, streets, sidewalks
  - Lay-down areas and type of materials present
  - Activity level (traffic, parking, operations)
Examples – pavement surfaces
Examples – Roof Connectivity
Examples – Laydown Areas
Example – Operational Activities
### Example Characterization Summary

<table>
<thead>
<tr>
<th>Land-use</th>
<th>Area</th>
<th>Percentage of total Area</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sq. Ft.</td>
<td>Acres</td>
</tr>
<tr>
<td>Asphalt</td>
<td>1278028</td>
<td>29.3</td>
</tr>
<tr>
<td>Building</td>
<td>735423</td>
<td>16.9</td>
</tr>
<tr>
<td>Concrete</td>
<td>134870</td>
<td>3.1</td>
</tr>
<tr>
<td>Pervious Surfaces</td>
<td>46822</td>
<td>1.1</td>
</tr>
<tr>
<td>Concrete Walkway</td>
<td>9416</td>
<td>0.2</td>
</tr>
<tr>
<td>Concrete Sidewalk</td>
<td>3449</td>
<td>0.1</td>
</tr>
<tr>
<td>Brick/Pavers</td>
<td>1982</td>
<td>0.0</td>
</tr>
<tr>
<td>Secondary Containment</td>
<td>2763</td>
<td>0.1</td>
</tr>
<tr>
<td>Artificial Turf</td>
<td>364</td>
<td>0.0</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td><strong>2213117</strong></td>
<td><strong>50.8</strong></td>
</tr>
</tbody>
</table>

All ground slopes 0-2%

### Possible Contaminant Source Materials

<table>
<thead>
<tr>
<th>Possible Contaminant Source Materials</th>
<th>Quantity</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Galv. Roof</td>
<td>6736</td>
<td>sq. ft.</td>
</tr>
<tr>
<td>Galv. Fence</td>
<td>4834</td>
<td>LF</td>
</tr>
<tr>
<td>Galv. Guard Rails</td>
<td>314</td>
<td>LF</td>
</tr>
<tr>
<td>Galv. Hand Rails</td>
<td>163</td>
<td>LF</td>
</tr>
<tr>
<td>Galv. Turnstile</td>
<td>2</td>
<td>ea</td>
</tr>
<tr>
<td>Galv. Light Poles</td>
<td>29</td>
<td>ea</td>
</tr>
<tr>
<td>Galv. stop/street pole</td>
<td>19</td>
<td>ea</td>
</tr>
<tr>
<td>Galv. Bike Racks</td>
<td>3</td>
<td>ea</td>
</tr>
<tr>
<td>Galv. Picnic Tables</td>
<td>1</td>
<td>ea</td>
</tr>
<tr>
<td>Galv. Trash Cans</td>
<td>5</td>
<td>ea</td>
</tr>
<tr>
<td>Galv. Scaffolding</td>
<td>1</td>
<td>ea</td>
</tr>
<tr>
<td>Large Galv. Light</td>
<td>1</td>
<td>ea</td>
</tr>
<tr>
<td>Metal Cabinets</td>
<td>4</td>
<td>ea</td>
</tr>
<tr>
<td>Scrap Metal Bin</td>
<td>5</td>
<td>ea</td>
</tr>
<tr>
<td>Conex Boxes</td>
<td>960</td>
<td>sq. ft.</td>
</tr>
<tr>
<td>Dumpsters</td>
<td>17</td>
<td>ea</td>
</tr>
<tr>
<td>Roll-off Bins</td>
<td>5</td>
<td>ea</td>
</tr>
</tbody>
</table>
Source Strength Quantitation

- X-Ray Fluorometry Screening**
- Perform leachate testing of common materials
- Use standardized methods to assess
  - Relative leachability vs. runoff “truth”
  - Variability of materials (wear)
  - Leachability over time

** Effort on hold
WinSLAMM Calibration-Validation

- Develop Navy facility-specific calibration files from site characterizations, and source strength and runoff data
- Conduct WinSLAMM modeling calibration datasets
- Validate WinSLAMM with additional drainage area datasets
Planned Timeline

- Jun 2011 – Complete Site Characterizations
- Jul 2011 – Complete leachability studies
- Sep 2011 – Complete model calibration runs
- Jun 2012 – Complete model validation runs
- Sep 2012 – Begin implementation
- Sep 2013 - Complete implementation
Acknowledgments

This work is supported by the Navy’s Environmental Sustainability Development to Integration Demonstration-Validation Program.
Questions?