LID Systems and the Future of Effluent Standards
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James Houle, CPSWQ, Robert Roseen, PE, PhD,
Thomas Ballestero, PE, PhD, PH, CGWP, PG, Tim Puls
The University of New Hampshire Stormwater Center
Environmental Research Group, Department of Civil Engineering
University of New Hampshire
The UNH Stormwater Center
Durham, New Hampshire

1. Research and development of stormwater treatment systems
2. To provide resources to stormwater communities currently involved in design and implementation of Phase II requirements
3. To meet current and future water quality objectives through baseline monitoring of common stormwater BMPs

http://www.unh.edu/erg/cstev
Related Questions

- What is the deal with a TSS Removal Requirement?
- Will 80% TSS removal accomplish water quality objectives?
- How do we better target stormwater treatment?
Where did 80% TSS Removal Originate?

- The 80% standard was a product of the Coastal Zone Act Reauthorization Amendments of 1990 (CZARA) requiring EPA to develop NPS guidance based on being:
  - economically achievable
  - reflect the greatest degree of pollutant reduction achievable through the application of the best available nonpoint pollution control practices.
1993 EPA Guidance


Recommends by design or performance:

Water Quality:
1. Either
   a. Post construction: reduce average annual TSS loadings by 80%
      …or
   b. Reduce post-development loadings of TSS so that average annual TSS load = pre-development conditions

Water Quantity:
2. To the MEP maintain post-development peak runoff rate AND average rainfall volume at levels similar to pre-development conditions
EPA and States are shifting their emphasis from pollutant treatment to reductions in flow rates and volumes.

States and Cities throughout the U.S. are rapidly adopting new regulatory requirements to require volume control and new and re-development.

1993 Guidance is Today’s Policy
Moving Towards Other Measures

- Regulatory entities are considering changes to:
  - Removal efficiency criteria (rate, PSD, contaminants)
  - Effluent limitation guidelines
  - Reduction in runoff volumes
  - Other measures entirely-TMDL (hydrology, % impervious, thermal)

- TAPE (Technology Assessment Protocol– Ecology)
  - TSS removal or effluent limitation of 20 mg/l TSS
  - Examines by PSD at 500, 250, and sub 250 micron particles

- WERF 04-SW-4 (Improved Protocol for Classification and Analysis of Stormwater-Borne Solids)
  - Recommends examination of 75 micron b/c of challenge of TSS methodology
Innovative TMDL Development

- 2007 TMDL for Eagle Brook, CT ---Impervious Cover
  - Imposes 11% IC criteria
  - IC as a surrogate for complex array of pollutants causing aquatic life impairment

- 2006 TMDL for Potash Brook, VT---Hydrology
  - Imposes an increase of low flow conditions (95% exceeding) by 12% and a decrease in high flow (0.3% exceeding) conditions of -16%
  - Runoff velocity as a surrogate for pollutants causing aquatic life impairment and addressing primarily geomorphic and baseflow considerations

- 2007 TMDL for Walla Walla, WA---Thermal
  - Imposes limitation on thermal impacts for protection of anadramous fish
  - Will control by increase in effective shade/riparian buffers, BMPs, baseflow
Will 80% TSS removal accomplish water quality objectives?

100 % Mass Removal!
Stormwater BMP Treatment Mechanisms

- Just as in the wastewater and drinking water field, stormwater BMPs employ unit operations and unit processes (UOP) for treatment.
- UOPs for removal of pollutants from waste streams are the building blocks of environmental engineering.
UOP’s

- Hydrologic Operations – flow alteration
- Physical Operations – sedimentation and filtration
- Biological Processes – plants, microbe respiration
- Chemical Processes – coagulation and flocculation
Filter Systems

Enhanced Sedimentation Systems

Filter with Bio

Filter Systems

Porous Asphalt

Isolator Row

Subsurface Infiltration

Filter Unit

Sand Filter

Hydrodynamic Separator (3)

Retention Pond

Swale (3)

Gravel Wetland

Bioretention Unit (2)

Tree Filter
Introduction to Exceedence Probability

The graph illustrates the exceedence probability of Total Suspended Solids (TSS) EMC (mg/L) for different conditions:

- **Influent**
- **Filter w/Bio**

The graph shows the percentage of exceedence for various TSS EMC levels, with arrows indicating specific points of exceedence.
TZn Effluent Probability

TZn EMC (mg/L)

Percent Under %

- Influent
- Filter Systems
- Filter w/Bio
- Sedimentation
- Enhanced Sed
Will 80% TSS removal accomplish water quality objectives?

100 % Mass Removal!
### Leading impairments of national rivers, lakes, and estuaries and their leading sources (EPA, 2000)

<table>
<thead>
<tr>
<th>Causes</th>
<th>Rivers and Streams</th>
<th>Lakes, Ponds, and Reservoirs</th>
<th>Estuaries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pathogens (Bacteria)</td>
<td></td>
<td>Nutrients</td>
<td>Metals (Primarily mercury)</td>
</tr>
<tr>
<td>Siltation (Sedimentation)</td>
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<td>Pesticides</td>
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<td>Habitat Alterations</td>
<td></td>
<td>Siltation (Sedimentation)</td>
<td>Oxygen-Depleting Substances</td>
</tr>
<tr>
<td>Sources</td>
<td>Agriculture</td>
<td>Agriculture</td>
<td>Municipal Point Sources</td>
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<tr>
<td>Hydrologic Modifications</td>
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<td>Urban Runoff/Storm Sewers</td>
<td></td>
<td>Industrial Discharges</td>
</tr>
</tbody>
</table>
TP Effluent Probability

Percent Under %

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

TP EMC (mg/L)

0.01 0.08 0.10 1.00

Influent
Filter Systems
Filter w/Bio
Sedimentation
Enhanced Sed

UNIVERSITY OF NEW HAMPSHIRE
STORMWATER CENTER
<table>
<thead>
<tr>
<th>Process (mg/L)</th>
<th>Annual Effluent</th>
<th>Average EMC (mg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TSS Standard</td>
<td>&gt; 90 %</td>
<td>20</td>
</tr>
<tr>
<td>TPH Performance</td>
<td>&gt; 90 %</td>
<td>6</td>
</tr>
<tr>
<td>TZn Performance</td>
<td>&gt; 90 %</td>
<td>0.04</td>
</tr>
<tr>
<td>DIN Performance</td>
<td>&gt; 40 %</td>
<td>0.1</td>
</tr>
<tr>
<td>TP Performance</td>
<td>&gt; 60 %</td>
<td>0.08</td>
</tr>
</tbody>
</table>

“Best Management Practices”
Conclusions

- 80% TSS removal performance standard will not meet future WQ criteria
- TMDL and Impaired Waters require “no net increase”
- Narrow focus on TSS misses impact from complex array of other contaminants
- Focus on filtration/infiltration unit process for BMP solutions can be significant improvement
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