Rhode Island Stormwater Design and Installation Standards Manual

RIDOT Workshop
Acceptable Water Quality BMPs and Selection Criteria
July 13, 2011
Water Quality BMPs

Community Planning

LID Site Design

LID BMPs

Larger Conventional BMPs

Receiving Waters
3.2.3 Minimum Standard 3: Water Quality

- The WQv must be treated by at least one of the structural BMPs listed in Chapter Five at each location where a discharge of stormwater will occur.

- Minimum average pollutant removal efficiencies: 85% removal of total suspended solids (TSS), 60% removal of pathogens, 30% removal of total phosphorus (TP) for discharges to freshwater systems, and 30% removal of total nitrogen (TN) for discharges to saltwater or tidal systems.

- Excludes LID credits allowed under Section 4.6
Acceptable BMPs

- 5.2 Wet Vegetated Treatment Systems (WVTS)
- 5.3 Stormwater Infiltration Practices
- 5.4 Permeable Paving
- 5.5 Filtering Systems
- 5.6 Green Roofs
- 5.7 Open Channel Systems
Minimum Design Criteria

• Required Elements and Design Guidance
  - If required elements can’t be met, select a different BMP

• Six Categories
  - Feasibility
  - Conveyance
  - Pretreatment
  - Treatment
  - Landscaping
  - Maintenance
Wet Vegetated Treatment Systems

- Designed to stay wet!
- Vegetation - key component
- Some restrictions near coldwater streams
Gravel WVTS

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Highway Cloverleaves
Surface WVTS in Cloverleaf
Typical Location for highway BMPs: A WVTS within the R/W
Infiltration

- Soil testing required
- Separation to SHGT and bedrock
- Restrictions in fill
Permeable Paving

- Two main categories
Porous Pavements
Permeable Pavers
Considerations for Permeable Pavements for Linear Projects

• Pros:
  - Reduced salt/sand usage;
  - Water quality/recharge benefits;
  - Safety? (less ice? less water spray?);
  - Maintenance? (less potential for frost heave)

• Cons:
  - Uncertain long-term performance;
  - Maintenance frequency (sweeping-resurfacing);
  - Contractor/plant capabilities;
  - Initial capital cost.
Recent Example-Maine Mall Road

- 1st application of PP on high volume road in Northeast;
- Approx 1.5 acres of Imp. cover converted (1,000’ +/-)

Porous Asphalt Pavement and Infiltration Bed

http://restorelongcreek.org/docs/projects/MaineMallRdProject-web.pdf
Filtering Practices

- Sand/organic filters
- Bioretention areas/Tree filters
Sand Filters
Bioretention
Bioretention Planting Soil and Mulch

- Loamy Sand to a Sandy Loam
  - 85-88 % sand
  - 8-12 % silt
  - 0-2 % clay
- Well-aged graded compost (25% of soil mix)
- Layer of well-aged, shredded hardwood mulch (aged 6 months, if possible)
Bioretention - Many Applications
Tree pits
Highway Dry Swale with Check Dams in Median

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Dry Swale
Wet Swale
Swales/Bios Combinations & Applications

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Practices Approved for Other Criteria

• Pretreatment Practices
  - Chapter 6
    - Grass Channel
    - Filter Strips
    - Sediment Forebay
    - Deep Sump Catch Basins
    - Proprietary Devices

• Storage Practices
  - Chapter 7
    - Stormwater Basins
    - Underground Storage Devices

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II. Selecting the Most Effective and Appropriate Stormwater Practices

<table>
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<th>BMP Group</th>
<th>BMP Design</th>
<th>Rural</th>
<th>Residential</th>
<th>Roads and Highways</th>
<th>Commercial/High Density</th>
<th>LUHPPL</th>
<th>Ultra-urban</th>
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O: Yes. Good option in most cases.

\( \triangledown \): Depends. Suitable under certain conditions, or may be used to treat a portion of the site.

\( \bigcirc \): No. Seldom or never suitable.

\( \bigcirc \): Acceptable option, but may require a liner to reduce risk of groundwater contamination.

\( \bigcirc \): Acceptable option, if not designed as an exfilter. (An exfilter is a conventional stormwater filter without an underdrain system. The filtered volume ultimately infiltrates into the underlying soils.)
Five Selection Factors to Consider

1. Land Use
2. Physical Feasibility
3. Watershed
4. Stormwater Management Capability
5. Community and Environmental
#1. Land Use

The land use of the contributing drainage area influences the stormwater strategy:

- Rural areas
- Residential sites
- Roads/highways
- Commercial sites
- LUHPPLs
- Urban sites (e.g., redevelopment)
Linear Bioretention
Retrofit Application
# 2. Physical Feasibility

Some Practices Cannot Be Used Because of Site Constraints:

- Soils
- Groundwater
- Drainage Area
- Minimum Surface Area
- Slope Restriction
- Head
Wet Swale

- Used when water table is close to surface
#3. Watershed Factors

Different Receiving Water Management Objectives Shape Stormwater Strategies:

- Groundwater (Aquifer protection)
- Freshwater streams and Rivers
- Other Freshwaters (Ponds/Lakes/Wetlands)
- Coastal Waters (shellfish/beach areas)
No single practice achieves all stormwater management objectives. A combination of practices is often needed to provide desired level of:

- Groundwater recharge
- Water quality treatment
- Channel protection
- Flood control
- Ability to treat LUHPPLs
#5. Community and Environmental Impacts

Other community and environmental impacts should be considered when selecting BMPs:

• Ease of maintenance
• Affordability
• Community acceptance/aesthetics
• Safety
• Habitat
Pollutant Removal Capability

Important when higher removals are required (see list in Section 3.2.3). Table H-3/H-4 compares removal efficiencies for:

- Total Suspended Solids
- Total Phosphorus
- Total Nitrogen
- Bacteria
1. Sediment Barriers  
2. Diversions & Conveyances  
3. Settling Devices  
4. Stabilization  
5. Inlet Protection  
6. Outlet Protection
Typical ESC Practices for Roads

1. Inlet protection
2. Sediment barriers/perimeter control
3. Outlet protection
4. Traffic management
5. Check dams in roadside ditches
6. Slope stabilization
7. Stockpile management/designated storage
How could you apply ESC practices on this project?
1. Sediment Barriers

Objective: Keep sediment from leaving site

- Natural area protection
- Silt fence
- Stable construction entrance
- Alternative “fencing”
- Turbidity curtains
Perimeter Controls
Perimeter Controls
2. Diversions & Conveyances

Objective: Convey “clean” and “dirty” runoff safely around or through site

Must convey 10-yr storm

- Earth berms
- Diversion swales
- Vegetated/lined waterways
- Check dams
3. Settling Devices

Objective: Temporarily pond runoff to let sediment settle out before discharging off site

- Sediment trap:
  - small depression
  - simpler outlet structure

- Sediment basin:
  - larger excavation
  - can be permanent
  - more infrastructure
4. Stabilization Practices

Objective: Protect bare soils and slopes from eroding

- Surface roughening
- Erosion control blankets
- Vegetation/mulch/soil
- Pipe slope drains
5. Inlet Protection

Objective: Keep sediment out of inlets, but still let water in

- Fabric
- Block & rock
- Wattles
- Inserts
Objective: Prevent erosion at point of discharge by slowing and spreading flow
Minimum Standard 11: Stormwater Management System Operation and Maintenance

The stormwater management system must have an operation and maintenance plan that shall at a minimum include:

- Stormwater management system(s) owners;
- The party(ies) responsible for operation and maintenance;
- The routine and non-routine maintenance tasks and a schedule;
- A plan that shows the location of all stormwater BMPs and discharge points;
- A description and delineation of public safety features; and
- An estimated budget; and
- The funding source.
Minimum Standard 11: Stormwater Management System Operation and Maintenance

Provide a stormwater management system operation and maintenance plan that at a minimum includes:

- Name, address, and phone number of responsible parties for maintenance
- Description of annual maintenance tasks
- Description of applicable easements
- Description of funding source
- Minimum vegetative cover requirements
- Access and safety issues

APPENDIX E: GUIDANCE FOR DEVELOPING OPERATION AND MAINTENANCE PLANS

An essential component of a successful stormwater system is the ongoing operation and maintenance of the various components of the stormwater drainage, control, and conveyance systems. Failure to provide effective maintenance can reduce the hydraulic capacity and the pollutant removal efficiency of stormwater practices.
O&M Plan Components

There are two key components to adequately maintaining stormwater management infrastructure:

- Periodic and scheduled inspections, and
- Maintenance scheduling and performance
  - Routine
  - Non-routine
Typical Maintenance Elements

- Sediment removal or containment
- Sediment disposal
- Erosion and gully repair
- Trash and debris cleanout
- Structural and mechanical systems
- Vegetation pruning and replacement
- System repair and replacement
Stormwater Practice Maintenance Burden

Maintenance Burden is a function of the type of facility as well as the design and implementation.

- WVTS: Medium to Easy
- Infiltration*: Medium to Difficult
- Filters: Medium to Difficult
- Green Roofs: Medium
- Open Channels: Medium to Easy

*Except drywells - Easy

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Questions?