Stormwater Management O&M and Implications for Siting, Ownership, Permitting, and Construction.

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Stormwater Control Measures (SCMs)

- Non-Structural SCMs
  - Pet Waste Bags
  - Street Sweeping
  - Wildlife Deterrents
  - Prevention Programs – Plastic bag bans, nutrient reduction
- Structural SCMs
  - Stormwater Collection System
  - Construction Site SWPPP
  - Detention/Water Quality Basins
  - LID/Green Infrastructure

LID/GI Challenges

- Performance based standard rather than specific design or technology
- Limited track record, designer knowledge and experience ?
- More detailed design process
- Requires increased construction oversight
- Requires land owner education for private facilities (Compliance?)

Operation and Maintenance

- Maintenance considerations should be a key component of LID design.
- Maintenance agreements are usually required for LID BMPs in private property.
- Once established, LID practices can often be maintained in the same manner as other landscaping elements that require mowing weeding and debris removal.
- LID practices in public right way can be adopted by adjacent property owners

FAQ

Aren't maintenance costs for LID still unknown?

Barrier Busted!

Results show that life cycle costs of LID are usually less than traditional practices.

EPA's LID Barrier Busters fact sheet series... helping to overcome misperceptions that can block adoption of LID in your community

Operation and Maintenance – Common Elements

- Inspection – frequency dependent on BMP but usually after significant rainfall and twice a year
- Debris and Litter Removal – sediment, trash, and leaves that accumulated at inlets, traps, and on the surface
- Mowing – maintain proper height of grasses (usual 3-6”)
- Media replacement – clogging or standing water indicate plugging of media.
- Plant/tree care – trimming, replacing, or removing invasive species.
- Pest management – integrated pest management that minimizes use of insecticides and herbicides.
- Vacuum sweeping – pervious pavement requires vacuuming but frequency is dependent on design and traffic volume.

General Maintenance

- Bioretention/ Bioswale/Planters/Green Roofs
  - Landscaping O&M
- Permeable pavement
  - Vacuum sweeping
- Reinforced turf / Vegetated swales / Filter strips
  - Mowing
- Infiltration practices (trenches, dry wells)
  - Replacement of surficial layer
- Stormwater Storage and/or Reuse
  - Periodic inspection
  - Drainage

Maintenance Checklist

Inspection and Maintenance Checklist

BIORETENTION

Property Address _____

Property Owner _____

Treatment Measure No. _____ Inspection Date _____

Inspector(s) _____

Type of Inspection:

☐ Monthly ☐ Pre-wet season ☐ Post-wet season ____ ☐ After heavy runoff

☐ Other: _____

Defect	Conditions when maintenance is needed	Maintenance needed?	Comments[a]	Results expected when maintenance is performed
1. Standing water	Water stands in the bioretention area between storms and does not drain within 24 hours after rainfall.			There should be no areas of standing water once inflow has ceased. Any of the following could apply: sediment or trash blockages removed, grade from head to foot of bioretention area improved, media surface scarified, underdrains flushed.
2. Trash and debris	Trash and debris accumulated in the bioretention area and around the inlet and outlet.			Trash and debris removed from the bioretention area and disposed of properly.
3. Sediment	Evidence of accumulated sediment in the bioretention area.			Material removed so that there is no clogging or blockage. Material is disposed of properly.
4. Erosion	Channels have formed around inlets, there are areas of bare soil, or there is other evidence of erosion.			Obstructions and sediment removed so that water flows freely and disperses over a wide area. Obstructions and sediment are disposed of properly.
5. Vegetation	Vegetation is dead, diseased or overgrown.			Vegetation is healthy and attractive. Grass is maintained at least 3 inches in height.
6. Mulch	Mulch is missing or patchy. Areas of bare earth are exposed or mulch layer is less than 3 inches deep.			All bare earth is covered, except mulch is kept 6 inches away from trunks of trees and shrubs. Mulch is even at a depth of 3 inches.
7. Inlet/outlet	Sediment accumulations.			Inlet/outlet is clear of sediment and debris and allows water to flow freely.
8. Miscellaneous	Any condition not covered above that needs attention for the bioretention area to function as designed.			The design specifications are met.

Siting

- Traditional SCMs are often located out-of-sight/out-of-mind.
- Natural system SCMs usually double as landscaped areas – At the curb?, in the parking lot, backyards, private property, ROW?
- How will municipalities verify proper function of privately owned SCMs?
- What if private land owners remove a SCM?

Vegetation Selection – O&M

- Maintain lines-of-sight
- Allow sunlight into bed to kill pathogens
- Facilitate trash pick-up
- Safety issues

Trash Removal Option 1

Curb Inlet Screens

- Collect trash in the right-of-way
- Collection and disposal by routine street sweeping
- Fits with ongoing programs?

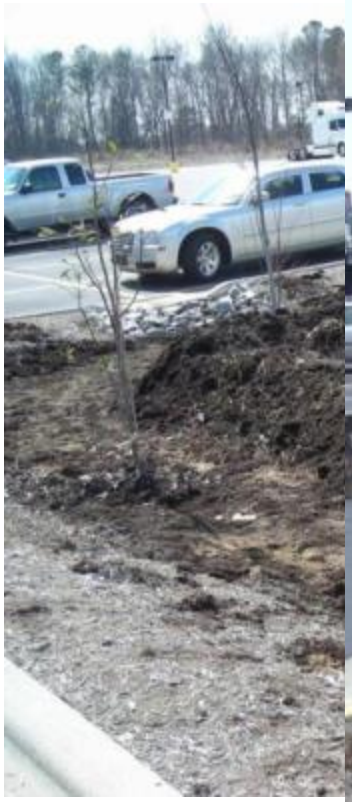
Trash Removal Option 2

Catch Basin Screens

- Collect trash in the catch basin
- Collected and disposed of during routine catch basin cleaning

Equipment Access for Rebuild/Replacement

- Remove clogging layer & top 3 inches of media to increase surface ponding volume



Source: NCSU BAE

Maintenance Trigger: Dirty watershed

- Dirty/poorly maintained watersheds = clogged filtration/infiltration systems

Single Control versus Distributed Controls

Single Control

- One location for maintenance
- Failure can be catastrophic
- If a large, deep SCM access and safety require equipment and training
- Single practice, single maintenance approach

Distributed Controls

- Maintenance is required at multiple locations but less intensive
- Failure of one BMP likely only a nuisance during a single event
- Multiple BMP types, multiple maintenance approaches and schedules

Permitting and Ownership

- Private facilities will be maintained ONLY by knowledgeable owners or because of compliance measures
- Ownership changes on private property MAY cause headaches and legal issues.
- Homeowners vs HOA's
- Do you want to sue a single family property owner to enforce compliance?
- Does you code compliance department have time to inspect SCMs during construction?
- Are contractors building the sites to drain properly?

Public Right of Way

Inlets must be clear to accept water.

Private Property

Source: Michael Barrett, Ph.D., P.E., University of Texas at Austin

Private Property

General Maintenance

- Good Housekeeping: Keep the watershed clean

Mowing regimen for grassed systems?

- As needed
- Consider safety
- Aesthetic appearance

Mulching

If Vegetated….

- You may need to irrigate
- but what happens during a drought?
  - Can you stabilize the site?
  - Do drought restrictions apply?
  - Does your landscape ordinance require irrigation systems?

Permeable Pavement :
Clogging

Street Sweeping

Know Your Watershed!

General Consideration for Most Practices

- Adjacent parcel erosion control (EC)
- Construction EC
- Internal and external flow velocities
- Pretreatment
- Inlets
- Media
- Outlets/underdrains

Construction Considerations

- Protect and preserve natural areas
- Protect infiltration areas and filtering/infiltrating SCMs from construction debris/sediment
- Protect porous pavement from sediment sources
- Stabilize the site and maintain sediment control measures until erosion control is complete.
- Construction observation and adherence to plans is critical for long term performance.

Protect Natural Areas

(Construction Considerations)

- Use site fingerprinting to limit disturbed areas.
- Preserve understory around large trees.
- Prevent any vehicle storage, equipment movement, or utility construction through preserved areas.

Infiltration Areas

(Construction Considerations)

- Minimize and Mitigate Compaction
- Inspect Soil Media before Placement
- Verify Surface Storage

Pervious Pavement

(Construction Considerations)

- Check gravel storage layer material before placement – Must be washed stone
- Protect pervious pavement from other onsite construction activities.
- Don’t allow landscape contractor to store topsoil/mulch etc on pervious pavement

A Final Thought

Design and Construction – 1 year
O&M – 25-49 years
Where should our focus be?