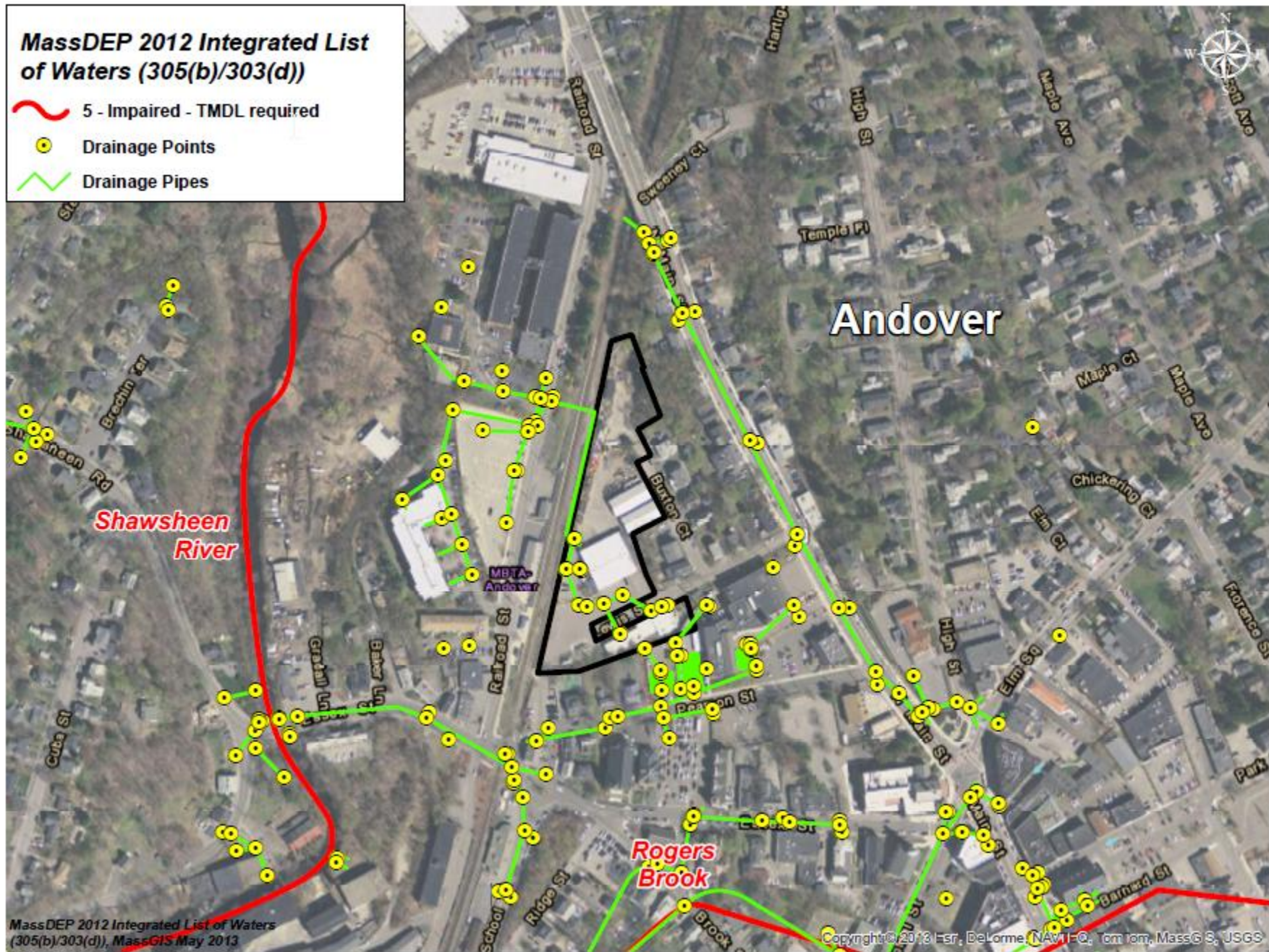


Stormwater Maintenance Best Practices

- Catch basins and street sweeping
- Winter snow and ice management
- Drainage ditches and swales
- Other stormwater BMPs
 - Detention ponds and constructed wetlands
 - Infiltration practices
 - Oil/water separators
 - Bioretention and other green infrastructure

MassDEP 2012 Integrated List of Waters (305(b)/303(d))

-  5 - Impaired - TMDL required
-  Drainage Points
-  Drainage Pipes



Who Has the Primary Responsibility for Stormwater Maintenance?

- Public roads and publically owned properties – municipalities
- Subdivision ponds – most municipalities have assumed this
- Industrial/commercial properties – mostly privately maintained

Survey Says... (n = 10)

In what areas do you maintain stormwater management systems?

Residential/subdivisions	8
Industrial park	5
Rural/ agricultrue	4
Commercial district (strip malls and bog box stores)	3
Commercial district (Town/Village center)	4
Other	1

What types of stormwater systems are you responsible for maintaining?

Enclosed pipe drainage system and catch basins	10
Swales and ditches	10
Culverts	9
Bioretention systems, constructed wetlands, wet ponds, infiltration basins, detention basins	6
Oil-grit separators	5
Other	1

The Maintenance Myth



Typical Current Municipal Maintenance Responsibilities

- Crack sealing
- Catch basin cleaning
- Filling pot holes
- Resetting curbs
- Cleaning ditches/swales
- Landscape maintenance/beautification of streetscape
- Culvert repairs/replacement
- Pipe lining/repair



Factors that influence maintenance costs

- Inspection frequency
- Required routine maintenance (function of complexity and loading)
- Specialized equipment
- Non-routine and rehabilitative maintenance
- Regulatory requirement
- Extreme storms/damage
- Speculative unknowns

Survey Says...

For what services do you use contracted service providers for stormwater management? (n=10)

- Catch basin cleaning and disposal
- Street sweeping and disposal
- Vector trucks

One Reality and Two Questions

- Frequently, some maintenance only occurs when there is a complaint of failure
- Green infrastructure versus gray infrastructure – which requires more maintenance?
- What are the “costs” of deferred maintenance and what is sustainable?



≠



Green Infrastructure: Tools, Equipment, Skills



Survey Says...

What are your biggest stormwater maintenance challenges? (n=8)

- Limited funds/staff/equipment/resources
- Cleaning swales and drainage ditches
- Upgrading infrastructure to meet new regs
- Maintaining outfalls
- Beavers?



Catch Basin Cleaning



2008 DEP Stormwater Standards:

- Inspect or clean at least **4 times/yr** AND at the end of the foliage and snow removal seasons
- Sediment must be removed **4 times/yr** OR whenever $\frac{1}{2}$ the depth of the basin is reached



Who does this to all their municipal catch basins?

2014 Draft Permit: **Infrastructure** O&M 2.3.7(a)(iii)

Permittees are required to:

(b) Clean catch basins

- 50% capacity threshold
- Optimization/increased frequency where needed
- Maintenance logs- quantity of material removed

(c) Sweep streets/parking areas 1/yr
(more in target pollutant areas)

(d) Properly store catch basin
cleanings/sweepings prior to
disposal

(e) Procedures for salt storage/usage

(f) Stormwater drain/BMP inspection
and maintenance



Proper Storage and Disposal of Catch Basin Cleanings

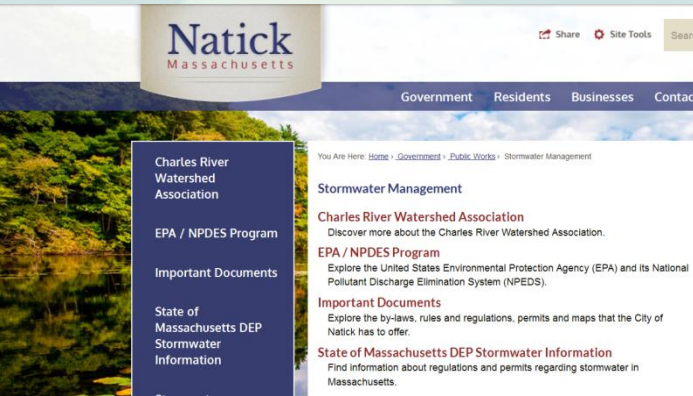
- DEP classifies as solid waste
- Dispose of at any landfill that is permitted by MassDEP to accept solid waste
- Testing not required, unless there is evidence that they have been contaminated by a spill or some other means
- Can use as grading and shaping material at landfills undergoing closure
- May be used as daily cover or grading material at active landfills – but requires DEP specific approval



<http://www.mass.gov/eea/agencies/massdep/recycle/regulations/management-of-catch-basin-cleanings.html>



Beneficial Use Determination (BUDs)



2004 Natick Case Study: Mixing sweeping and compost – saves Town \$\$\$

- BUD process tends to be time-consuming and case-by-case
- A regional or state-wide BUD for other uses for catch basin/street sweeping materials would be beneficial to Towns.

<http://www.mass.gov/eea/docs/dep/recycle/approvals/sw3942ap.pdf>



Components of Winter Snow and Ice Management

1. Storage of Materials
2. Plowing and Road Safety
3. Options for Treatment
4. Equipment
5. Spring Clean-up
6. Disposal of Street Sweeping Debris



Ready for winter?

Winter Road Maintenance Options to Reduce Potential Chloride Impacts

Control Strategy	Description	Advantages	Disadvantage
Non-chloride road treatments	Salt alternatives, such as: urea, potassium acetate, ag/brewing by-products, sand.	Less chloride impacts, less corrosion, less veg. impacts	Higher upfront costs, other env. concerns (e.g. TP loading)
Equipment upgrades	Ground speed sensors, GPS controllers, pre-wetting apparatuses, plow upgrades	More effective road maint. and salt application	Higher capital costs
Operator Training & Certification Programs	Certification programs, such as UNH T ² GreenSnowPro	Public and Private operators	Need liability limitation, cost/available of program
Road Weather Information System	Real-time weather & road condition monitoring program	Limits required deicing based on actual conditions	Costly to establish & maintain
Winter/Storm Traffic Laws	Reduced speeds or require snow tires during winter	Reduced need for bare pavement, less accidents during bad weather	Increased work load, enforcement difficult
Voluntary Change in Behavior	Expectations on travel after storms, liability limits on private property owners		Will require a major earth shift in public attitudes



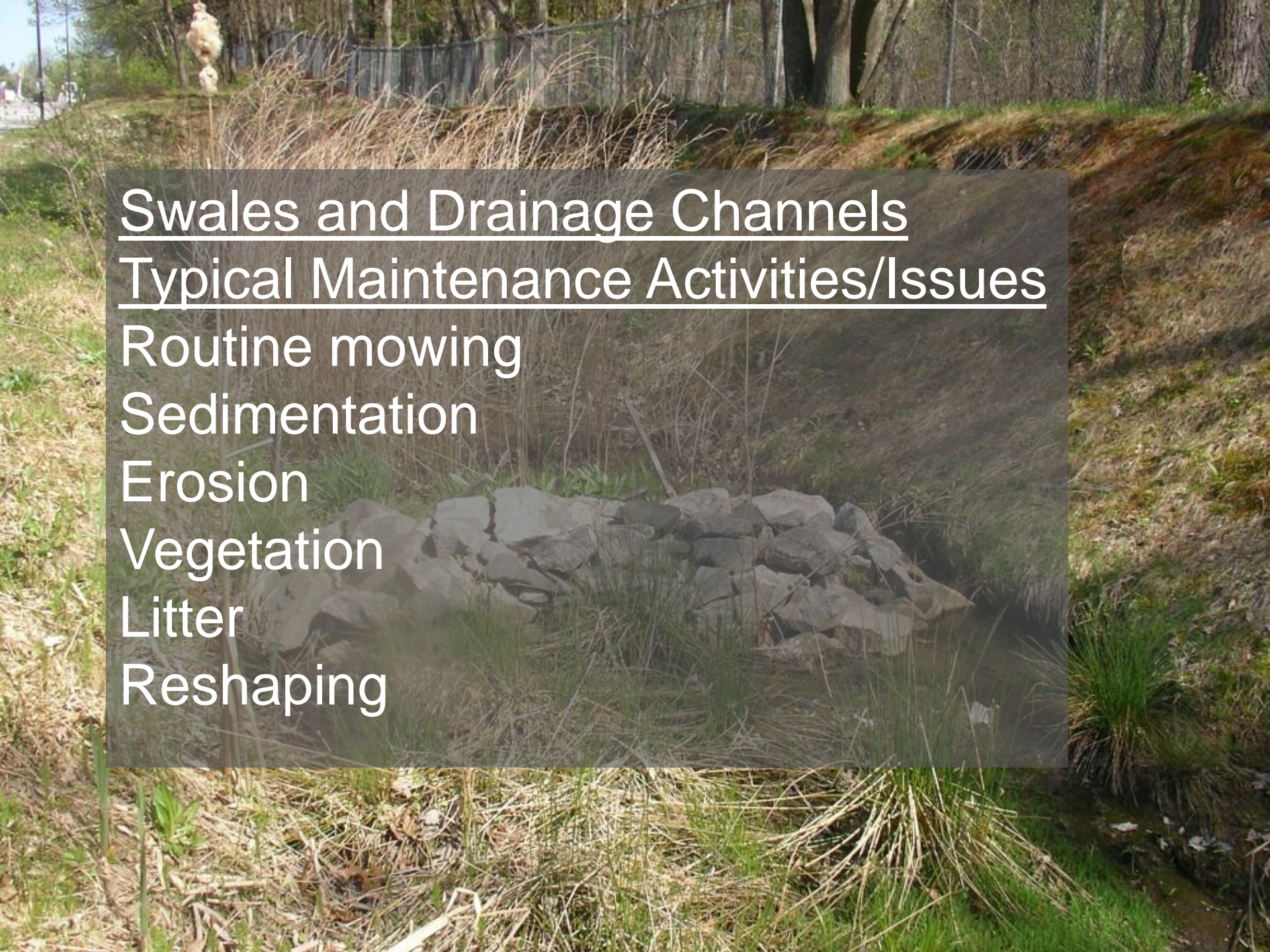
Minimize exposure at loading/unloading
(sweeping, temporary covers, etc)



LOADER
MONITORS
CHARGE

DRIVERS
IN WET OR SLIPY COND.
IN WET CONDITIONS
DUMP MATERIAL AWAY
FROM FOOTPRINTS UNDER
RED ARROW



A photograph of a drainage channel with a stone structure, overlaid with a semi-transparent text box. The channel is filled with water and surrounded by grass and trees. The text box contains the following text:

Swales and Drainage Channels
Typical Maintenance Activities/Issues

Routine mowing

Sedimentation

Erosion

Vegetation

Litter

Reshaping

Do you have one of these?



Swales and Drainage Ditches

Drainage Ditches:

- Remove accumulated sediment
- Mowing, vegetation management
- Litter/debris removal
- Stabilization of eroded slopes



Water Quality Swales:

- Pretreatment cleanout (when ½ full)
- Discing/aeration of swale bottom
- Structural repairs (trash racks, weirs, etc).

Mowing



Drainage Channels - Inspection

- Annually and after major storms;
- Vegetation condition;
- Structural components (check dams/weirs, stabilization);
- Areas of erosion and/or sediment accumulation.



Water Quality Swales – Long-term Maint. Issues

- Maintaining permeability of filter media (De-thatching/ aeration of swale bottom)
- Damage to structures, settling (change in design elevations)
- Replacement of timber weirs, check dams
- Preserve original design capacity



Once in a while you get something really good!



08/27/2008

Detention Ponds/Constructed Wetlands



Infiltration and Porous Pavements



Bioretention



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

Forebays: Designed to Trap Sediment



Sediment Removal

- Routine sediment accumulation
 - Check surrounding site stabilization
- Remove with a flat shovel or Bobcat



Snow Removal?

- Snow removal is NOT required from the BMPs themselves
- Avoid piling snow in BMP areas if possible
- Piled snow should not block inlets



Photo courtesy of Rutgers New Jersey
Agricultural Experiment Station



Snow Storage (added maintenance burden)



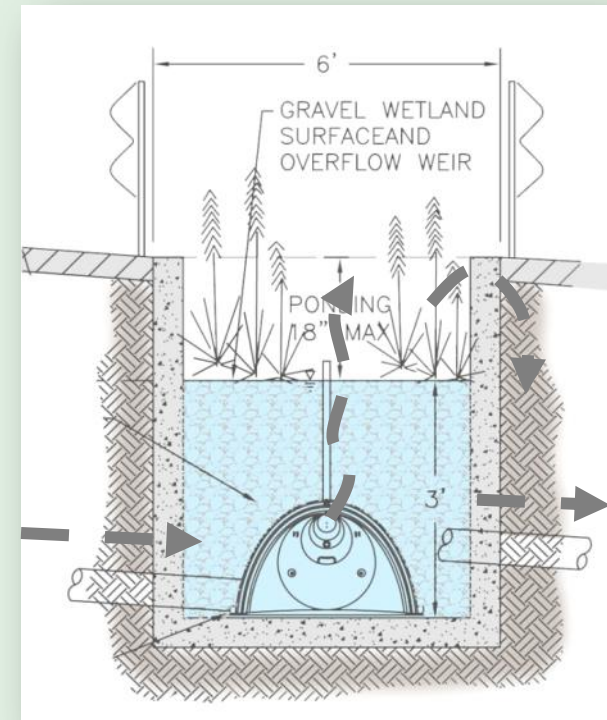
Detention Pond/ Constructed Wetland – Maintenance

- Replace dead/damaged vegetation
- Vegetation management around perimeter of wetland facility
- Repair minor gullying.
- Repair embankment structural integrity (burrowing animals, seepage, slope sloughing);
- Repair structural elements (spillways, orifice, weir, etc.);
- Major erosion (inflow/exit channels)



Constructed Wetland - Maintenance

- Inspect annually and after major storm events;
- Clean-out trash racks and access grates;
- Remove sediment from forebay after 50% loss in capacity;
- If 50% vegetative coverage is not achieved after 2nd growing season, reinforcement planting is required.





Infiltration Trench

Infiltration - Maintenance Guidelines

- Basin: Routine sediment cleanout, mowing, revegetate bare areas, litter & debris removal, & rejuvenation (roto-till surface soils).
- Trench/chambers: Pretreatment and trench sediment cleanout, & mowing. Check 2 days after storm.
- Drywell: Pretreatment cleanout.
Gutter/downspout system cleaning if needed.
- Permeable pavement: Vacuum sweeping and **education.**

Infiltration - Inspection Guidelines

- Annually and after storms;
- Amount of sediment in forebay?
- Look for signs of wetness, dead or dying vegetation on basin bottom;
- Standing water in observation wells > 72 hours after a storm;
- Structural components (overflow spillways, trash racks, access gates, valves, pipes, weirs);
- Areas of erosion and/or sediment accumulation.

Permeable Pavements

- Regular vacuuming



Permeable Pavement

- Never use permeable paving area as temporary ESC facility;
- Minimize use of sand and salt in winter months.
- Do not repave or reseal with impermeable materials
- ESC Plan must specify at a minimum:
 - How sediment will be prevented from entering the pavement area
 - Construction sequence
 - Drainage management
 - Vegetative stabilization



Permeable Pavement - Maintenance

- Keep adjacent landscape areas well-maintained and stabilized
- Ensure surface drains properly after storms
- Inspect surface annually for deterioration or spalling





- Post signs identifying permeable pavement
- Mow upgradient pervious areas, and seed any bare spots
- Avoid stockpiling snow on these areas
- Attach rollers to the bottoms of snowplows to prevent them from catching on the edges of pavers

- Grass pavers need mowing/reseeding of bare spots



Porous Asphalt in the Gutter Line



Is this a
good idea?

Salt/Sand Reduction and Porous Asphalt



DMA 1-HR AFTER PLOWING,
11AM -4°C



PA 1-HR AFTER PLOWING,
11 AM -4°C

Bioretention Maintenance Activities

- Sediment removal (when depth exceeds $\frac{1}{2}$ design depth in forebay)
- Sediment disposal
- Erosion and gully repair
- Trash and debris cleanout
- Vegetation pruning/replacement
- Refurbish mulch every other year





Bioretention: Long-term Maint. Issues

- Maintaining permeability of bio media
 - ~5-7 years, rototill when sediment >1”
 - ~15-20 years, replace media if complete failure (standing water >48 hours after storm)
- Damage to structures, settling (change in design elevations)
- Replacement of timber weirs, check dams
- Root-bound vegetation

Bioretention - Inspection

- Annually and after major storm events
- Amount of sediment in pretreatment facility
- Look for signs of wetness, dead or dying vegetation on bottom
- Vegetation condition (dead/dying, overcrowding?)
- Mulch condition
- Structural components (inlets, overflow spillways, underdrain pipes, weirs)
- Areas of erosion and/or sediment accumulation.



Typical Landscape Maintenance

Pruning and thinning

Weeding and mulching

Watering (initially)

Plant replacement

Dynamic Vegetation Management



Year 1



Year 3



Year 10

Green Infrastructure – a different set of tools



Inspections

- Site inspection worksheet

Bioretention Inspection Checklist*

Project Location: _____
 Date/Time: _____
 Inspector: _____

Maintenance Item	Satisfactory/Unsatisfactory
Inlet/Outlet	
Structural integrity of inlet/outlet	
Inlet/outlet clear of debris	
Overflow spillway or catch basin clear of debris	
Erosion control at inlet in place (e.g., rock, mat)/evidence of erosion	
Erosion control at outlet in place/evidence of erosion	
Inspect/clean catch basin upstream of BMP	
Pretreatment for sediment (Generally consists of catch basin or collection for sediment)	
Device functioning to trap sediment	
Remove accumulated sediment	
Overall functionality	
Ensure bioretention area is functioning properly (professional civil engineer is recommended)	

Bioretention area surface			
Any evidence of sedimentation in BMP		A	
Does sediment accumulation currently require removal		A	
Debris in BMP		M	
Evidence of erosion present		A	
Does good vegetative cover exist		A	
Mulch covers entire area (no voids) and to specified thickness		A	

Bioretention area surface			
Any evidence of sedimentation in BMP		A	
Does sediment accumulation currently require removal		A	
Debris in BMP		M	
Evidence of erosion present		A	
Does good vegetative cover exist		A	
Mulch covers entire area (no voids) and to specified thickness		A	
Optional considerations			
Inspect BMP for invasive species.		A	

Inspection frequency key — A = Annual, M = Monthly, S = After major storm
 *Prior to field inspection, it is recommended to review the as-built plans.

Conclusions

- All advanced stormwater facilities require maintenance
- Green infrastructure practices might offer lower costs, consistent with standard landscaping practices
- Disposal of catch basin materials and street sweepings are expensive; a regional BUD would be a huge benefit.
- The more facility maintenance can be standardized the lower the costs

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