

# Soil and Turf Management for Stormwater

MIDS Group, May 18, 2012



**Minnesota Pollution  
Control Agency**

# Turf and Urban Soils

- “Managed turf”: grassed soil that no longer functions in its natural hydrological state due to disturbance, compaction, or excessive management
  - *Typical turf management activities:*
    - Mowing
    - Active recreational use
    - Fertilizer and pesticide applications
- Two components of concern:
  - Turf surface
  - Soil beneath the turf



# Impacts to Stormwater from Turf Areas

- Impact of grading and construction on soils
  - Increase in bulk density
  - Decline in soil permeability (reduced infiltration rate)
  - Increase in runoff coefficient
- Virginia study (Pitt et al. 2004) found residential runoff contained *significantly higher nutrient* concentrations than non-residential uses (CWP & VA DCR, 2007)
- Disturbed and intensively managed pervious areas may result in elevated nutrient levels in stormwater





# Improving Soil under Turf-How?

- Amended Soil Options for Maximizing Stormwater Benefit
  - OPTION 1 – Leave Native Vegetation and Soil Undisturbed
  - OPTION 2 – Amend Existing Soil In-Place
  - OPTION 3 – Salvage Site Topsoil and Amend
  - OPTION 4 – Import Topsoil



# Amendment Option 1 – Leave Native Vegetation and Soil Undisturbed

- Areas of site where soil has not been disturbed or compacted due to past use
  - Hydrologic Soil Group (HSG) Type A and B Soils
  - Confirm infiltration rate
- Protect from compaction during construction
  - Identify areas that will not be stripped graded or trafficked excessively
  - Protect these areas
  - Maintain protection fencing





# Amendment Option 2 – Amend Existing Soil In-Place

- Scarify or till subgrade to depth of 8”
- Scarify such that surface is evenly disturbed
- Do not scarify within drip line of trees



## Amendment Option 2 – Amend Existing Soil In-Place (continued)



- Method 1: 2-inches of compost into 6-inches of soil (total amended depth of 8-inches).
- Method 2: Achieve 8-inches of soil with an organic content of 5%.

# AMENDMENT OPTION 3

- Stockpile and Salvage Site Topsoil and Amend as necessary to achieve required organic content to 8-inches in depth.
  - Scarify or till subgrade to depth to achieve 12-inches
  - Method 1: 2-inches of compost into 6-inches of soil (total amended depth of 8-inches).
  - Method 2: 8-inches of soil with an organic content of 5%.





# AMENDMENT OPTION 4 – Import Topsoil meeting organic matter content standards.

- Scarify or till subgrade to depth to achieve 12-inches
- Use imported topsoil containing 5% organic matter



# Managing Turfed Areas for Stormwater

- Key recommendations for management of turf areas (*Seattle Public Utilities, 1999*)
  - Set realistic expectations for lawn appearance
  - Tolerate a few weeds
  - Proper site selection and soil preparation via compost amendments (if necessary)
  - Site-adapted and disease-resistant grasses



# Managing Turfed Areas for Stormwater (continued)

- Moderate fertilization
- Mulch-mowing (also called “grasscycling”)
- Timing so that only 1/3 of grass height is removed each time
  - Keep mower blades sharp
- Mowing higher – 2 1/2 to 3 inches (depends on grass species)





# Managing Turfed Areas for Stormwater (continued)

- Improve irrigation practices
  - Avoid overwatering - standard lawn irrigation practice is 1” of water applied per week during the growing season (including rainfall)
  - Water during the cool part of the day
  - Water only grass areas and not impervious surfaces
  - Use sprinklers that spray low large drops instead of high fine ones



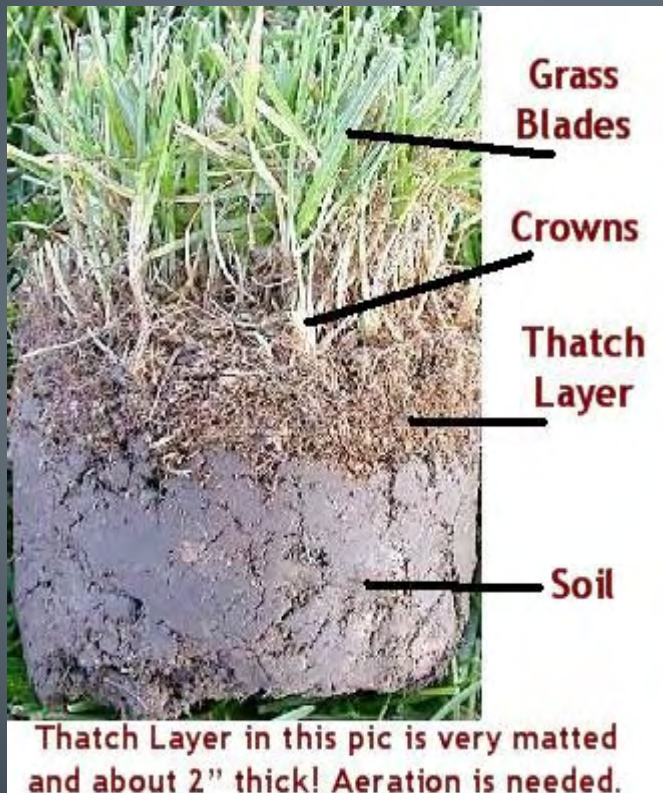
# Managing Turfed Areas for Stormwater (continued)

- Lawn aeration annually and as much as 2-3 times per year or more on heavily used lawn areas
- Compost topdressing
- Overseeding
- Results:
  - Reduced compaction
  - Increases infiltration rates
  - Better soil structure
  - Natural disease control
  - Crowd out weeds



[www.carolinaorganiclawns.com/aeration.html](http://www.carolinaorganiclawns.com/aeration.html)

# Managing Turfed Areas for Stormwater (continued)



Source: <http://www.lawn-care-minnesota.com/thatch.html>

- Remove excess thatch
  - Excess thatch is a sign of over-fertilization, over-watering, compacted soil, or over-use of chemicals.
  - Can be solved through core aeration and topdressing



# Quantifying Stormwater Benefits of Managing Turf for Stormwater

- Rate of runoff reduction can be calculated by upgrading the Hydrologic Soil Group (HSG) condition of the soil group.
  - Example: HSG type C soil in poor condition (CN 86 for open space) with soil amendments upgrade to HSG type C soil in good condition (CN 74 for open space)
  - Volume reduction varies based on soil type
- Lose credit for both rate and runoff reduction if beneficial long-term maintenance practice are not used
  - Turf soil condition could degrade based on turf use and management



# Use of Turf Areas as a Stormwater BMP

- Disconnection of impervious surface to a turf area (Philadelphia Stormwater Manual v2.0)
  - Runoff discharged to a pervious area such as turf
  - Allows for infiltration, filtration, and increased time of concentration
- Rooftop disconnection
  - Contributing area of rooftop to each disconnected discharge should be 500 square feet or less
  - Soil should not be designated as a HSG “D”
  - Overland flow path <math><5\%</math> slope



# Use of Turf Areas as a Stormwater BMP (continued)

**Table 4.1: Partial Rooftop Disconnection**

Length of Pervious Flow Path*	Roof Area Treated as Disconnected
(ft)	(% of contributing roof area)
0 - 14	0
15 - 29	20
30 - 44	40
45 - 59	60
60 - 74	80
75 or more	100

\* Flow path cannot include impervious surfaces and must be at least 15 feet from any ground level impervious surfaces.



# Use of Turf Areas as a Stormwater BMP (continued)

- Pavement disconnection
  - Applies to driveways and pathways.
  - The length of overland flow over the turf area  $\geq$  the contributing length
  - The soil should not be an HSG type “D”
  - The slope of the contributing area and the turf area should be  $<5\%$
  - No more than 1,000 ft<sup>2</sup> may discharge to any one concentration point
    - A gravel strip or other spreading device is required for concentrated discharges



# Other uses of turf in stormwater management

- Storage area for stormwater reuse
- Pretreatment area or “buffer strip”
  - Filtration of stormwater before entering a second stormwater BMP
- Vegetated swales
- Dry ponds
- Others?



# Questions for discussion

- How should stormwater volume and pollutant reduction credits be calculated for:
  - Soil amendments? – revise CN for change in turf condition?
  - Turf management practices? – condition for getting amendment credit?
  - Disconnection of impervious areas to turf areas? – reduction in imp area?
- Should stormwater credit be given for a change in turf maintenance practices?
- How will long term maintenance practices be enforced (example: city-managed turf vs. residential lawns)?
- Should turf used for other stormwater BMPs be required to meet the same soil/turf maintenance practices?