VERMONT

# Non-Structural Practices

**Vermont Stormwater Management Manual Update, Meeting #4**

**Shelburne, Vermont Town Office**

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# Non-Structural Practices…

- We are getting close to a framework that implicitly pushes developers / applicants to minimize impervious cover.
  - How far can VSMM effectively “push” a site planning process that utilizes non-structural practices first – without causing local planning conflicts?
  - What if anything can or should we ask for in site layout and design (before practices are applied)? Is a plain statement of site design steps enough?
- Non-structural practices are tools that maximize the ability of a site to soak away water
- Non-structural practices become preferred because they…
  - Apply “across the board” to all standards
  - Reduce volumes that must be directed to GSI or standard practices

# Non-Structural Practices for Avoiding Impacts – or Minimizing at Planning Stage

- Site layout and design to minimize IC, disturbance, mass grading, etc. and maximize retention of natural cover, undisturbed soils, and especially areas best suited for infiltration.
  - Natural area conservation
  - Riparian, shoreline buffer / floodplain protection
  - Limit site clearing/grading
  - Minimize soil compaction
  - Minimize impervious areas

# Non-Structural Practices for Reducing Impacts

- Implement practices that enhance the land cover's ability reduce runoff volume – whether planned or engineered
  - Disconnection (rooftop and non-rooftop)
  - Filter strips and vegetated buffers
  - Reforestation / revegetation (and/or single trees)
  - Soil restoration
  - Grass channels (but we'll talk about these next time)
- Are there ways to better integrate structural and non-structural practices – especially once we've "avoided" all we can?

# Summary of non-structural LID BMPs included in manuals

| State | Rooftop disconnection | Non-rooftop disconnection | Filter Strips / Vegetated buffers | Reforestation/ revegetation | Soil amendment / restoration |
|---|---|---|---|---|---|
| Vermont | X | X | X | | |
| Maine | | | XX | | |
| Maryland | XX | | XX | | |
| Massachusetts | X | X | | | |
| Minnesota | X | X | XX | X | X |
| Nashville TN | XX | | XX | XX | XX |
| New Hampshire | X | X | XX | | |
| New Jersey | | | XX | | |
| New York | XX | | XX | XX | XX |
| Pennsylvania | X | X | XX | XX | XX |
| Rhode Island | XX | XX | | XX | |
| Washington | XX | XX | XX | XX | XX |

| | |
|---|---|
| X | Design technique/practice eligible for incentive, or described in manual but not necessarily a standard practice or part of a mandated approach |
| XX | Standard design technique/practice |

# Reforestation / Revegetation

- Conserving existing trees or planting new trees at new or redevelopment sites can reduce stormwater runoff, promote evapotranspiration, increase nutrient uptake, provide shading and thermal reductions, and encourage wildlife habitat.
- Examples:
  - *Maryland*
  - *New York*
  - *Washington*
  - *Nashville, TN*

# Reforestation / Revegetation: Approaches to Application

| State (date of manual) | Practice name/ID | Approach | Manual link |
|---|---|---|---|
| **Maryland (2009)** | Sheetflow to Conservation Areas, N-3 | Reforestation indirectly addressed as a means to expand existing conservation areas for meeting minimum required area. | http://www.mde.maryland.gov/programs/Water/StormwaterManagementProgram/MarylandStormwaterDesignManual/Documents/www.mde.state.md.us/assets/document/Design Manual Chapter 5 03 24 2009.pdf |
| **New York (2010)** | Tree Planting/ Tree Pit, Section 5.3.4, practice RR-3 | GSI (RR) practice.<br>RR credit allowed for single trees planted near impervious surfaces. Reduction determined using the same method as for Sheetflow to Riparian Buffer practice. Area considered for runoff reduction is limited to the pervious area in which trees are planted. Reforestation mentioned in RR-1 (conservation) | http://www.dec.ny.gov/docs/water_pdf/swdm2010chptr5.pdf |
| **Washington (2012)** | Tree Retention and Tree Planting, BMP T5.16 | Standard practice on-site SW management practice.<br>Retained and newly planted single trees receive credits toward meeting flow control requirements if located near new and/or replaced ground level impervious or other hard surfaces. Disconnections are credited to natural areas (e.g. BMP T5.11: Concentrated Flow Dispersion and BMP T5.12: Sheet Flow Dispersion) but no specifics on reforestation provided. | http://www.ecy.wa.gov/programs/wq/stormwater/manual.html |
| **Nashville TN (2012)** | Reforestation, GIP-10 | Standard GI practice.<br>Reforested land credited as having twice the forest Rv for corresponding HSG w/o soil restoration, or as equal to the forest Rv factor if amended soils are also used. Impervious disconnection to reforested areas encouraged (GIP-09) | https://www.nashville.gov/Water-Services/Developers/Low-Impact-Development.aspx |

# Reforestation / Revegetation: Key Design Criteria (single trees)

| State (date of manual) | Practice name/ID | Impervious Reduction Credited (ft2) | Max. ft. from impervious | Min. caliper (in) | Min. soil volume (ft2) | Limits on credit? | Other |
|---|---|---|---|---|---|---|---|
| **Maryland (2009)** | Sheetflow to Conservation Areas, N-3 | No information for single trees as non-structural practice. | | | | | |
| **New York (2010)** | Tree Planting/ Tree Pit, Section 5.3.4, practice RR-3 | Retained trees | | | | 25% of directly connected ground level impervious area | Inadequate soil rooting volumes and compacted soils noted as largest factors in tree decline<br>Tree species must be chosen from approved list<br>Slope limits similar to buffers (5% for new trees, higher for retained)<br>Alternative sizing for runoff reduction in urban setting rec. to follow bioretention or stormwater planters (with infiltration) design and sizing – practice sized and credited based on soil storage capacity and ponding area alone.<br>Few specifics on planting materials, soil quality, planting specs |
| | | Mature trees up 16-foot diameter canopy: ½ canopy area. Max. 100/tree | 20 | 4” | None specified | | |
| | | New trees | | | | | |
| | | 100 | 10 | Evergreen: 6 ft. tall; Deciduous: 2” caliper | 1000 | | |

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|---|---|---|---|---|---|---|---|
| **Washington (2012)** | Tree Retention and Tree Planting, BMP T5.16 | Retained trees | | | None specified | 25% of total impervious surface requiring mitigation | Existing and new trees must be on development site.<br>An arborist report may be required if impervious surface proposed within CRZ of existing tree<br>Not applicable to trees in native vegetation areas used for flow dispersion or other flow control credit.<br>Not applicable to trees in planter boxes.<br>Recommended species lists, planting specs from City of Seattle referenced. |
| | | Evergreen: 20% canopy area (min. 100/tree)<br>Deciduous: 10% of canopy area (min. 50/tree) | 20 | 6" diameter at breast height (DBH) | | | |
| | | New trees | | | | | |
| | | 50 for evergreens<br>20 for deciduous | 20 | Evergreen: 4 ft. tall<br>Deciduous: 1.5", measured 6" from ground | | | |
| **Nashville TN (2012)** | Reforestation, GIP-10 | Explicit credit for single trees limited to Level 2 bioretention facility design (GIP-01), which must include trees planted at 1 tree/400 s.f.<br>Level 2 design also includes increased bioretention facility surface area, filter media depth, facility flow path length, etc. | | | | | |

# Reforestation / Revegetation: Key Design Criteria (larger plantings)

| State (date of manual) | Practice name/ID | Reduction credited | Minimum area | Planting density | Other |
|---|---|---|---|---|---|
| **Maryland (2009)** | Sheetflow to Conservation Areas, N-3 | Up to 1" towards meeting rainfall target for contributing areas | 20,000 ft2 | None specified | Conservation easement required |
| **New York (2010)** | Tree Planting/ Tree Pit, Section 5.3.4, practice RR-3 | Same as for Riparian Buffer – only for area in which trees planted | None specified (except as in disconnections to riparian buffer, sheet flow to filter strip, etc.) | None specified | Disconnections are credited to natural areas but no specifics on reforestation provided. |
| **Washington (2012)** | Concentrated Flow Dispersion (BMP T5.11), Sheet Flow Dispersion (T5.12) | Disconnected impervious areas may be modeled as landscaped area | Vegetated flow path must be at least 50 feet long | None specified | Disconnections are credited to natural areas but no specifics on reforestation provided. |
| **Nashville TN (2012)** | Reforestation, GIP-10 | Land area credited as 2X forest Rv for HSG w/o soil restoration. Equivalent to forested Rv if soils restored. | 5,000 ft2 | 300 large canopy trees (overall height at maturity of 30+ ft.) per acre<br>2 sm. canopy trees or 10 shrubs sub. for 1 large canopy tree | No more than 20% of any one species<br>Consider composition of local forests<br>2/3 of trees must be large canopy<br>Achieve 75% forest canopy in 10 yrs<br>Min. tree size 6-8 ft tall; shrubs 18-24" or 3 gallon size<br>Impervious disconnection to reforested areas encouraged (GIP-09) |

# Soil Restoration

- Used to restore soil porosity and permeability and improve infiltration rates that were adversely affected (e.g., compacted) during site construction/earth disturbance
- Examples:
  - *Pennsylvania (substituted for MD; no soil restoration in that manual)*
  - *New York*
  - *Washington*
  - *Nashville, TN*

# Soil Restoration: Approaches to Application

| State (date of manual) | Practice name / ID | Approach | Manual link |
|---|---|---|---|
| **Pennsylvania (2006)** | Soil Amendment / Restoration, BMP 6.7.3 | Standard practice available to applicants.<br>No requirement to utilize, no penalty for not using | http://www.elibrary.dep.state.pa.us/dsweb/Get/Version-69220/ |
| **New York (2010)** | Soil Restoration, 5.1.6 | Required element of the NOI and SWPPP.<br>Restore in accordance with BMP requirements OR consider impervious when calculating WQv and assign post-construction HSG one level less permeable | http://www.dec.ny.gov/docs/water_pdf/swdm2010chptr5.pdf |
| **Washington (2012)** | Post Construction Soil Quality and Depth, BMP T5-13 | Required as part of compliance with Minimum Requirement #5: On-site Stormwater Management | http://www.ecy.wa.gov/programs/wq/stormwater/manual.html |
| **Nashville TN (2012)** | GIP-07 Downspout Disconnection, GIP-08 Grass Channels, GIP-09 Sheet Flow and GIP-10 Reforestation | Soil restoration and/or compost amendment integrated into Green Infrastructure Practices that involve disturbed soils or disconnection-based practices | https://www.nashville.gov/Water-Services/Developers/Low-Impact-Development.aspx |

# Soil Restoration: Key Design Criteria

| State (date of manual) | Practice name / ID | Basic Requirements | Deep ripping, decompaction procedures | Compost Specs | Other |
|---|---|---|---|---|---|
| **Pennsylvania (2006)** | Soil Amendment / Restoration, BMP 6.7.3 | None | Rototill or rip subgrade, remove rocks, distribute compost, spread the nutrients, rototill again | Design considerations indicate compost application rates/depths but not quality; example spec suggests use of products certified by U.S. Composting Council's Seal of Testing (STA) Program | Field measured bulk density testing suggested if volume reduction applied for restored soils |
| **New York (2010)** | Soil Restoration, 5.1.6 | Level of restoration required depends on type of disturbance (no disturbance up to cut/fill and heavy traffic) | Apply 3 inches of compost over subsoil; till compost into subsoil to a depth of at least 12 inches; rock-pick materials 4" and larger; apply 6" topsoil; vegetate | Aged, from plant derived materials, free of viable weed seeds, no visible free water or dust produced when handling, pass through a half inch screen, and have pH suitable to grow desired plants | An inspector should be able to push a 3/8" metal bar 12 inches into the soil with body weight |
| **Washington (2012)** | Post Construction Soil Quality and Depth, BMP T5-13 | Retain undisturbed soils OR re-establish topsoil to meet OM, pH, depth standards on cleared/graded land that remains open | Scarify subsoils at least 4" with some incorporation of upper material (no deep ripping etc.); establish min. 8" topsoil layer; plant vegetation/ mulch. | Two amendment rate choices for meeting OM content: "pre-approved" (must meet legal "composted materials" definition) or "custom calculated"; compost OM content=40-65% and C:N below 25:1 | Multiple choices for implementation<br>Clear inspection guidance provided for field verification |
| **Nashville TN (2012)** | Appendix 7-A Design Criteria for Amending Soils with Compost | Restoration/ amendment used in tandem with GIPs. Amendment depth and incorporation method vary with design level and HSG. | Subsoil to 2-3 feet prior to building; deep till 12-18" after final grading; incorporate compost; level site; establish cover. Amendment depth 2-10"; incorporation depth 6-24". | Basic requirements similar to NYS (aged, plant-derived, etc.). Compost from member of STA Program; pH=6-8, compost OM content=35-65%, C:N below 25:1 | Amendment rate based on ratio of amended soil surface area to contributing area of impervious cover (up to 1:1).<br>Simple soil testing and field inspection guidelines |