The following document contains summaries of the 15 non-proprietary BMPs. This document can be added to Module 4, but it is not a replacement for the specifications.

Specification #1: Impervious Surface Disconnection

What Is It?

This is simple, "non-structural" strategy involves managing runoff close to its source by ***intercepting, infiltrating, filtering, treating or reusing*** *it* as it moves from the impervious surface to the drainage system.

Two kinds of disconnection are allowed:

1) **Simple disconnection**
   Residential or small commercial rooftops and/or on-lot residential impervious surfaces are directed to pervious areas

2) **Disconnection leading to alternate runoff reduction practice(s)** adjacent to the roof or small residential impervious area

   Examples of alternative practices: soil-amended filter path, rain garden, dry well or French drain, rainwater harvesting, or stormwater planter (there are separate specifications that address the design of these practices)

Guidance on Inspection of Practice:

- It is understood that the inspector cannot be on-site continuously. Therefore, it is important for inspectors to prioritize and coordinate with the contractor and property owner or manager to arrange inspections at key points, especially during construction.
- For some of the inspection milestones listed below, if the inspector cannot be on-site, then the contractor and/or contractor's qualified professional should take digital photos and careful notes detailing the particular installation step.
- The information below if not intended to replace the more detailed checklists and information in the Specifications, and inspectors are encouraged to avail themselves of these resources. However, the table below may help inspectors understand some of the key inspection milestones.

Important Inspection Milestones: CONSTRUCTION ***NOTE: See Specification #1 for more detailed construction checklist*** **KEY inspection points during installation**	
Ready to Install; drainage area stabilized; confirm locations	• Ensure contributing drainage area is stabilized and will NOT contribute sediment to the disconnection area. • Ensure downspouts have been installed and diverted temporarily away from disconnection area (until it is stabilized). • Confer with builder, landscape contractor, or entity responsible for installation on location of disconnections, especially based on rooflines and downspout locations.
Light grading and soil amendments	• Check that grading creates proper disconnection area dimensions and geometry (length, width, slope, elevations). • If soil amendments are used, check that amendments meet specifications and are incorporated as per plan (depth of amendment material and incorporation depth). • As per plan, check straw mulch or erosion control matting. • If included on plan, check pretreatment at downspout: level spreader or stone energy dissipator.
Stabilization	• Ensure area is stabilized with vegetation before downspout flow is diverted back to disconnection flow path.
Important Inspection Milestones: POST-CONSTRUCTION ***NOTE: See Specification #1 for maintenance guidelines*** **KEY inspection points for long-term maintenance**	
Still Present	• Check that the downspout or impervious area is still disconnected as per the plans. • Check disconnection area for encroachments (e.g., buildings, sheds, dumping of yard waste, etc.).
Disconnection is Working	• Look for evidence that flow through the disconnection area is evenly distributed, and not short-circuiting, channelizing, or eroding. • Check pretreatment (if present) and build-up of debris in flow path.
Vegetative Cover	• Vegetation should cover at least 90% of the disconnection area.

Specification #2: Sheet Flow to Filter or Open Space

What Is It?

Two design variants are included in Specification #2:

1) **Conserved Open Space**

2) **Designed Vegetated Filter Strips.**

These practices treat ***sheet flow*** delivered from adjacent impervious and managed turf areas by ***slowing runoff velocities*** and allowing ***sediment and attached pollutants to settle*** and/or be ***filtered by the vegetation***. The design, installation, and management of these practices are quite different.

In both variations, stormwater must enter the filter strip or conserved open space as sheet flow.

A gravel diaphragm or other "pre-treatment" practice should be used to establish a non-erosive transition between the pavement and the filter strip or open space. If the inflow to the filter strip is from a pipe or channel, an engineered level spreader (ELS) must be designed to convert the concentrated flow to sheet flow.

Guidance on Inspection of Practice:

- It is understood that the inspector cannot be on-site continuously. Therefore, it is important for inspectors to prioritize and coordinate with the contractor and property owner or manager to arrange inspections at key points, especially during construction.
- For some of the inspection milestones listed below, if the inspector cannot be on-site, then the contractor and/or contractor's qualified professional should take digital photos and careful notes detailing the particular installation step.
- The information below if not intended to replace the more detailed checklists and information in the Specifications, and inspectors are encouraged to avail themselves of these resources. However, the table below may help inspectors understand some of the key inspection milestones.

Important Inspection Milestones: CONSTRUCTION ***NOTE: See Specification #2 for more detailed construction checklist*** **KEY inspection points during installation**	
Ready to Install	• Ensure stormwater is diverted away from filter area during installation of BMP components.
During Installation	• Construction of gravel diaphragm and/or engineered level spreader should only commence when drainage area is stabilized. • Ensure that only tracked vehicles are used to grade the filter area. • Check that topsoil and/or compost are incorporated evenly across the filter strip area, stabilized with seed, and protected by erosion control matting. • Check for correct elevations of gravel diaphragm, level spreader, and/or permeable berm and correct slope of filter strip area.
Stabilization	• Ensure that runoff is diverted to filter area only after vegetation is well established and gravel diaphragm and/or level spreader are installed. • Inspect after first big storm to look for any needed adjustments or repairs. • Log the specific location of the practice into local BMP maintenance tracking database.
Important Inspection Milestones: POST-CONSTRUCTION ***NOTE: See Specification #2 for maintenance guidelines*** **KEY inspection points for long-term maintenance**	
Still Present	• Check that the filter area is still present as per the plans. • Check the filter area for encroachments (e.g., buildings, sheds, dumping of yard waste, etc.).
Vegetation	• Vegetation should cover at least 90% of the filter area.
Practice is Working	• Check gravel diaphragm, level spreader, and/or permeable berm to make sure they are flat and flow is not short-circuiting them and that there is no standing water • Look for evidence that flow through the filter strip or conservation area is evenly distributed, and not short-circuiting, channelizing, or eroding.
Sediment	• Check gravel diaphragm, level spreader, and/or permeable berm for build-up of sediment and debris that needs to be removed.

Specification #3: Grass Channels

What Is It?

Grass channels can provide a ***modest amount of runoff filtering and volume attenuation*** within the stormwater conveyance system resulting in the delivery of less runoff and pollutants than a traditional system of curb and gutter, storm drain inlets and pipes.

Grass channels, however, are not capable of providing the same stormwater functions as dry swales as they lack the storage volume and filtering capabilities associated with the engineered soil media. *Their runoff reduction performance can be boosted when compost amendments are* added to the bottom of the swale. Grass channels are a preferable alternative to both curb and gutter and storm drains as a stormwater conveyance system, where development density, topography and soils permit. Grass channels can also be used to treat runoff from the managed turf areas of turf-intensive land uses, such as sport fields and golf courses, and drainage areas with combined impervious and turf cover (e.g., roads and yards).

Guidance on Inspection of Practice:

- It is understood that the inspector cannot be on-site continuously. Therefore, it is important for inspectors to prioritize and coordinate with the contractor and property owner or manager to arrange inspections at key points, especially during construction.
- For some of the inspection milestones listed below, if the inspector cannot be on-site, then the contractor and/or contractor's qualified professional should take digital photos and careful notes detailing the particular installation step.
- The information below if not intended to replace the more detailed checklists and information in the Specifications, and inspectors are encouraged to avail themselves of these resources. However, the table below may help inspectors understand some of the key inspection milestones.

Important Inspection Milestones: CONSTRUCTION ***NOTE: See Specification #3 for more detailed construction checklist*** **KEY inspection points during initial installation**	
Ready to Install	• Ensure that construction sediment has been removed if grass channel was used for erosion & sediment control. • Ensure stormwater is diverted away during installation of grass channel.
During Installation	Check: • Length, width, slope, and elevations of grass channel are consistent with plan • Check dams and pre-treatment structures are properly installed at correct elevations • Any energy dissipators at inlets and outlets are stable and adequate
Stabilization	• Ensure that channel beds and side slopes are stable with turf cover and/or erosion control matting. • Inspect after first big storm to look for any needed adjustments or repairs. • Log the specific location of grass channel into local BMP maintenance tracking database.
Important Inspection Milestones: POST-CONSTRUCTION ***NOTE: See Specification #3 for maintenance guidelines*** **KEY inspection points for long-term maintenance**	
Still Present	• Check that the grass channel is still present and active as per the plans. • Check the grass channel area for encroachments (e.g., buildings, sheds, dumping of yard waste, etc.).
Vegetation	• Turf grass should cover at least 90% of the grass channel area.
Practice is Working	• Look for evidence that flow through the grass channel is evenly distributed, and not short-circuiting, channelizing, or eroding. • Check pretreatment (if present) for build-up of sediment and debris that might be clogging flow into the channel. • Inspect check dams for evidence of under-cutting or erosion and blockages.
Sediment	• Look for excessive sediment in channel bottom (especially behind check dams) that needs to be removed. • Inspect side slopes for erosion that needs to be repaired/stabilized.

Specification #4: Soil Compost Amendments

What Is It?

Soil restoration is an Environmental Site Design (ESD) practice applied after construction, to deeply till compacted soils and restore their porosity by amending them with compost. These soil amendments can reduce the generation of runoff from compacted urban lawns. Importantly, ***soil amendments can be used to enhance the runoff reduction performance of other stormwater BMPs*** *including:*

- Downspout disconnection (Specification #1)
- Filter strips (Specification #2)
- Grass channels (Specification #3)

See the specifications and inspection sheets for those other practices for details on the practice. It's important to know that the soil compost amendments practice has its own specification, ***the practice will likely be used in conjunction with another BMP***.

Guidance on Inspection of Practice:

- It is understood that the inspector cannot be on-site continuously. Therefore, it is important for inspectors to prioritize and coordinate with the contractor and property owner or manager to arrange inspections at key points, especially during construction.
- For some of the inspection milestones listed below, if the inspector cannot be on-site, then the contractor and/or contractor's qualified professional should take digital photos and careful notes detailing the particular installation step.
- The information below if not intended to replace the more detailed checklists and information in the Specifications, and inspectors are encouraged to avail themselves of these resources. However, the table below may help inspectors understand some of the key inspection milestones.

Important Inspection Milestones: CONSTRUCTION ***NOTE: See Specification #4 for more detailed construction sequence*** **KEY inspection points during installation**	
Installation Sequence	• Ensure contributing drainage area is stabilized and will NOT contribute sediment to the soil amendment area. • Check that the right equipment is being used (e.g., tiller, tractor, subsoiler) to rip the soil to the depth indicated on the plans. • For amended areas exceeding 2,500 square feet, check that simple erosion control measures (e.g., silt fence) are employed.
Compost Material	• Check that compost material meets the material requirements in the specification (e.g., general criteria set forth by the U.S. Composting Seal of Testing Assurance (STA) program). This is best done PRIOR to incorporation of the compost.
Incorporation & Stabilization	• Check that the compost is incorporated to the depth indicated on the plan. This can be done by digging a test pit and, for larger areas, using a rod penetrometer (1 test per 10,000 square feet of amended area). • Check that the amended area is seeded and mulched, and that provisions are made for lime and watering, if necessary.
Important Inspection Milestones: POST-CONSTRUCTION ***NOTE: See Specification #4 for maintenance guidelines*** **KEY inspection points for long-term maintenance**	
Vegetation & Encroachments	• The first year is critical for vegetation. The area may require spot reseeding, some fertilization (in the fall based on a soil test) and/or watering to establish good vegetative cover. • After the first year, check that area has good vegetative cover and is not eroding or ponding water. • Check for encroachments of buildings, sheds, dumping of yard debris, etc.
Inspect Associated Practice	• If soil amendments are included in the design of another practice - downspout disconnection (Specification #1), filter strips (Specification #2), and grass channels (Specification #3) – inspect based on the guidelines of that practice.

Specification #5: Vegetated Roof

What Is It?

Vegetated roofs (also known as *green roofs, living roofs* or *ecoroofs*) are alternative roof surfaces that typically consist of waterproofing and drainage materials and an engineered growing media that is designed to support plant growth. Vegetated roofs capture and temporarily store stormwater runoff in the growing media before it is conveyed into the storm drain system. A portion of the captured stormwater evaporates or is taken up by plants, which helps reduce runoff volumes, peak runoff rates, and pollutant loads otherwise generated by rooftops.

Intensive vegetated roofs have a relatively thick layer of growing media, and support a variety of vegetation types. *Extensive vegetated roofs* have shallower media (often supplied in modular trays) and vegetation tends to be carefully-selected, drought-tolerant species, such as sedums and herbaceous plants.

Guidance on Inspection of Practice:

- It is understood that the inspector cannot be on-site continuously. Therefore, it is important for inspectors to prioritize and coordinate with the contractor and property owner or manager to arrange inspections at key points, especially during construction.
- For some of the inspection milestones listed below, if the inspector cannot be on-site, then the contractor and/or contractor's qualified professional should take digital photos and careful notes detailing the particular installation step.
- The information below if not intended to replace the more detailed checklists and information in the Specifications, and inspectors are encouraged to avail themselves of these resources. However, the table below may help inspectors understand some of the key inspection milestones.

Important Inspection Milestones: CONSTRUCTION ***NOTE: See Specification #5 for construction guidelines*** **KEY inspection points during installation**	
Coordination with Architect, Contractor, Vendors	• In general, stormwater inspectors are not expected to understand all of the architectural components of a vegetated roof system. As such, the inspector's chief role is to coordinate installation with the project architect, vegetated roof manufacturer or vendor, civil, mechanical, and plumbing engineers, contractor, and other materials vendors. The main objective is that the roof is installed as per the design plans. • Help ensure that there is maintenance access to the vegetated roof, and confer with the architect and vendors about plans for maintenance.
Important Inspection Milestones: POST-CONSTRUCTION ***NOTE: See Specification #5 for maintenance guidelines (generally for the property owner)*** **KEY inspection points for long-term maintenance**	
Maintenance Access	• Since vegetated roofs are part of the building, inspections will require communication and coordination with the property owner or manager to access the roof.
Vegetation	• It can take 12-18 months for vegetation to become fully established. During this time, inspectors should confer with the property owner or manager on any needed watering and replacement of dead plants. • After plant establishment, the main issues are filling in bare spots and removal of invasive or volunteer species.

Specification #6: Rainwater Harvesting

What Is It?

Rainwater harvesting systems intercept, divert, store and release rainfall for future use. Rainwater that falls on a rooftop is collected and conveyed into an above- or below-ground storage tank where it can be used for non-potable water uses and on-site stormwater disposal/infiltration. Non-potable uses may include flushing of toilets and urinals inside buildings, landscape irrigation, exterior washing (e.g. car washes, building facades, sidewalks, street sweepers, fire trucks, etc.), fire suppression (sprinkler) systems, supply for chilled water cooling towers, replenishing and operation of water features and fountains, and laundry, if approved by the local authority.

In many instances, rainwater harvesting can be combined with a secondary (down-gradient) runoff reduction practice to enhance runoff volume reduction rates and/or provide treatment of overflow from the rainwater harvesting system.

Guidance on Inspection of Practice:

- It is understood that the inspector cannot be on-site continuously. Therefore, it is important for inspectors to prioritize and coordinate with the contractor and property owner or manager to arrange inspections at key points, especially during construction.
- For some of the inspection milestones listed below, if the inspector cannot be on-site, then the contractor and/or contractor's qualified professional should take digital photos and careful notes detailing the particular installation step.
- The information below if not intended to replace the more detailed checklists and information in the Specifications, and inspectors are encouraged to avail themselves of these resources. However, the table below may help inspectors understand some of the key inspection milestones.

Important Inspection Milestones: CONSTRUCTION ***NOTE: See Specification #6 for more detailed construction checklist*** **KEY inspection points during installation**	
Prior to Installation	***Note:*** *It may be more appropriate for a third-party contractor or engineer familiar with rainwater harvesting to inspect the system.* • Ensure that construction runoff is diverted away from tank installation site so that sediment cannot enter tank or pipes. • Rooftop area size and materials match plan.
During Installation	**Check that:** • Tank foundation properly constructed. • Diversion system (e.g., downspouts and pipes) is properly sized and installed to deliver roof runoff to tank. • Inflow and outflow pipes constructed properly. • Pre-treatment properly installed. • Mosquito screen installed on all openings (as needed). • Overflow device installed at proper elevation and with stable erosion control at outfall. • Secondary runoff reduction practice(s) properly installed. • Log the specific location of the practice into local BMP maintenance tracking database.
Important Inspection Milestones: POST-CONSTRUCTION ***NOTE: See Specification #6 for maintenance guidelines*** **KEY inspection points for long-term maintenance**	
Still Present	• Check that the rainwater harvesting system is still present and actively used as described on plan.
Practice is Working	• Ensure that roof runoff is still entering the treatment system and tank. • Check for any blockages in downspouts, diverters, and filters to ensure that runoff is not bypassing system. • Check integrity of backflow preventer (if present). • Inspect integrity of tank, pipes, covers, pumps, etc. for structural and safety problems. • Ensure that outlets are not closed or clogged. • Inspect condition of overflow path for erosion and secondary runoff reduction practices (if present).
Sediment	• Inspect tank for sediment build-up that needs to be removed.

Specification #7: Permeable Pavement

What Is It?

Permeable pavements are alternative paving surfaces that allow stormwater runoff to filter through voids in the pavement surface into an underlying stone reservoir, where it is temporarily stored and/or infiltrated. A variety of permeable pavement surfaces are available, including **pervious concrete**, **porous asphalt** and permeable **grid pavers** and **interlocking concrete pavers**. While the specific design may vary, all permeable pavements have a similar structure, consisting of a permeable surface pavement layer, an underlying stone aggregate reservoir layer and a filter layer or fabric installed on the bottom.

Guidance on Inspection of Practice:

- It is understood that the inspector cannot be on-site continuously. Therefore, it is important for inspectors to prioritize and coordinate with the contractor and property owner or manager to arrange inspections at key points, especially during construction.
- For some of the inspection milestones listed below, if the inspector cannot be on-site, then the contractor and/or contractor's qualified professional should take digital photos and careful notes detailing the particular installation step.
- The information below if not intended to replace the more detailed checklists and information in the Specifications, and inspectors are encouraged to avail themselves of these resources. However, the table below may help inspectors understand some of the key inspection milestones.

Important Inspection Milestones: CONSTRUCTION ***NOTE: See Specification #7 for more detailed construction checklist*** **KEY inspection points during installation**	
Protection of Area During Construction	• If permeable pavement area is using an infiltration design, check that area is not excessively compacted during construction by construction equipment, materials storage, etc. This would also apply to a Level 2 "infiltration sump" design (additional stone reservoir <u>below</u> the underdrain pipe).
Installation Sequence	• Ensure contributing drainage area is stabilized and will NOT contribute sediment to the permeable pavement area. • In some cases, plan may call for diverting drainage area runoff around permeable pavement area and/or secondary E&S measures during installation.
Excavation	• Check that excavation is to the proper design depth. In most cases, the bottom should be completely flat (check as per plan). Check that excavator are working from the side and not overly compacting the bottom. • The bottom of the excavation should be scarified or tilled to promote infiltration. • In some larger applications, the plan may call for compaction of the sub-base, depending on the soil analysis.
Reservoir & Bedding Layers	• Confer with contractor that all aggregates – including filter layer (bottom), stone reservoir layer, and bedding layer – meet the specifications as certified by the quarry. • Ensure that layers are installed at proper depths and elevations. • Ensure proper placement of underdrain pipes, if included in the design.
Pavement Surface	• Manufacturers' specifications will dictate the correct procedures for placement, compaction, leveling, etc (also see more detailed descriptions in Specification #7). Verify that contractor is following the specifications.
Important Inspection Milestones: POST-CONSTRUCTION ***NOTE: See Specification #7 for maintenance guidelines*** **KEY inspection points for long-term maintenance.**	
Drainage Area	• If the permeable pavement has any "run-on" areas (upgradient pervious or impervious areas that flow onto the permeable pavement), check these areas for erosion, sediment loading, dumping of yard waste, materials storage, etc.

Pavement Surface	• Check for signs of clogging or staining that may indicate standing water. • Some accumulation of fine particles in the pavement joints of interlocking pavers is expected. If the pavement joints appear to be preventing flow through the pavement surface, contact the owner concerning needed maintenance (usually use of a vacuum sweeper). • Check for water standing in any observation wells. Water should not stand in observation wells 3 days after a storm event of 0.5" or less. • Check for structural damage, such as surface deterioration, slumping, cracking, spalling or broken pavers.

Specification #8: Infiltration

What Is It?

Infiltration practices use temporary surface or underground storage to allow incoming stormwater runoff to exfiltrate into underlying soils. Runoff first passes through multiple pretreatment mechanisms to trap sediment and organic matter before it reaches the practice. As the stormwater penetrates the underlying soil, chemical and physical adsorption processes remove pollutants. Infiltration practices are suitable for use in residential and other urban areas where *measured* soil permeability rates exceed 1/2 inch per hour. To prevent possible groundwater contamination, infiltration should not be utilized at sites designated as stormwater hotspots.

Guidance on Inspection of Practice:

- It is understood that the inspector cannot be on-site continuously. Therefore, it is important for inspectors to prioritize and coordinate with the contractor and property owner or manager to arrange inspections at key points, especially during construction.
- For some of the inspection milestones listed below, if the inspector cannot be on-site, then the contractor and/or contractor's qualified professional should take digital photos and careful notes detailing the particular installation step.
- The information below if not intended to replace the more detailed checklists and information in the Specifications, and inspectors are encouraged to avail themselves of these resources. However, the table below may help inspectors understand some of the key inspection milestones.

Important Inspection Milestones: CONSTRUCTION ***NOTE: See Specification #8 for construction sequence*** **KEY inspection points during installation**	
Protect Area During Construction	• Ensure areas designated for infiltration are not compacted or disturbed during construction. Construction traffic, material storage, etc. should be kept from the area and, wherever possible, the area should be outside of the limits of disturbance. Future infiltration sites should <u>NOT</u> be used for temporary sediment traps or structures.
Soil Testing	• Verify that the contractor or consultant has conducted the required soil testing procedure, as outlined in the Appendix of Specification #8.
Ready to Install; Drainage Area Stabilized	• Ensure contributing drainage area (impervious AND pervious) is stabilized and will NOT contribute sediment to the infiltration area. • Divert runoff away from infiltration areas (e.g., diversions, block inlets) and install secondary erosion control practices around perimeter of infiltration practices to ensure sediment does not enter.
Excavation, Filter & Reservoir Layers	• Ensure excavation is within footprint of practice as shown on the plan and the right dimensions. • If present during excavation, check that equipment is operating from the perimeter and not compacting the bottom. • Check proper elevation of the bottom of the excavation, and that soil at bottom is scarified with teeth of excavator. Ensure that bottom filter layer of sand (6-8") is used. If filter fabric or geotextile is used, it should be on the SIDES ONLY. • Check for proper installation of observation wells. • Check for placement of clean, washed aggregate as per the plans. • Check surface cover (stone, turf, etc.) as per plans.
Pre-Treatment	• Verify correct installation and sizing of all pre-treatment areas, as per plans.
Open Drainage Area Connection	• Check that area immediately surrounding the infiltration practice and the drainage area are completely stabilized before removal of secondary E&S measures and diversions.

Important Inspection Milestones: POST-CONSTRUCTION ***NOTE: See Specification #8 for maintenance guidelines*** **KEY inspection points for long-term maintenance**	
Inlets & Pre-Treatment	• Ensure inlets are not clogged or diverting water away from the infiltration practice. • Check for sediment accumulation, blockages, or structural damage in pre-treatment devices. If grass buffer is used, check for bare spots or erosion.
Infiltration Bed & Observation Well	• Look for evidence of standing water or filter bed not draining adequately. • Look for sediment buildup, weedy growth, or other evidence of clogging or poor drainage; overhead vegetation may need to be pruned if it is dropping leaves or fruit onto the infiltration surface. • Check observation well; there should be no water 3 days after a storm event in excess of ½ inch.
Drainage Area & Maintenance Access	• Check for any controllable sources of sediment or debris in the drainage area. • Ensure that maintenance access is still open and accessible.
Outlet	• Check weirs, spillways, or outlet pipes for erosion, blockages, or clogging.

Specification #9: Bioretention & #10: Dry Swale

What is it?

Bioretention is a shallow landscaped depressional area that incorporates many of the pollutant removal mechanisms that operate in forested ecosystems. The primary component of a bioretention practice is the filter bed, which has a mixture of sand, soil, and organic material as the filtering media with a surface mulch layer. During storms, runoff temporarily ponds 6 to 12 inches above the mulch layer and then rapidly filters through the bed. Normally, the filtered runoff is collected in an underdrain and returned to the storm drain system and the surface of an individual bioretention cell is flat.

Dry swales are essentially bioretention cells that are configured as **linear channels**, and have some longitudinal slope, sometimes with check dams along the length. Water is stored temporarily on the surface behind these check dams. Dry swales may appear as simple grass channels, while others may have more elaborate landscaping. Swales can be planted with turf grass, tall meadow grasses, decorative herbaceous cover, or trees.

Guidance on Inspection of Practice:

- It is understood that the inspector cannot be on-site continuously. Therefore, it is important for inspectors to prioritize and coordinate with the contractor and property owner or manager to arrange inspections at key points, especially during construction.

- For some of the inspection milestones listed below, if the inspector cannot be on-site, then the contractor and/or contractor's qualified professional should take digital photos and careful notes detailing the particular installation step.

- The information below if not intended to replace the more detailed checklists and information in the Specifications, and inspectors are encouraged to avail themselves of these resources. However, the table below may help inspectors understand some of the key inspection milestones.

Important Inspection Milestones: CONSTRUCTION ***NOTE: See Specification #9 &10 for detailed construction sequence and construction checklist*** **KEY inspection points during initial installation of the practice**	
Ready to Install; Drainage Area Stabilized	• Ensure contributing drainage area is stabilized and will NOT contribute sediment to the bioretention or dry swale area. • May be necessary to block inlets and/or install secondary erosion control practices around perimeter of the practice to ensure sediment does not enter.
Excavation & Underdrain	• Check that pre-treatment cells/areas are excavated first, and then outlets blocked temporarily so that they can trap sediment. • Ensure excavation is within footprint of practice as shown on the plan and the right dimensions and slope; normally bioretention cells are flat and dry swales have a minor longitudinal slope. • If present during excavation, check that equipment is operating from the perimeter and not compacting the bottom. • If geotextile is used, it should be on the SIDES ONLY. • For underdrains, ensure proper depth and elevation of stone layers. • Underdrain pipes should be correct material, perforated in right sections, clean-outs as per plans, and capped on the UPSTREAM END ONLY. • Ensure choker stone is used between underdrain and soil layer (NOT FILTER FABRIC).
Dry Swale Check Dams	• If the design calls for check dams, ensure that they are installed at the proper spacing, keyed into the bottom and sides of the swale excavation, level across the top with the correct overflow weir section, and that proper armoring is placed on the downslope side of the check dams (the latter would take place AFTER installation of the soil media).
Soil Media	• Try to check soil media PRIOR to placement in bioretention cell or dry swale. If necessary, ask for source of material or results of tests. • Ensure proper depth of soil media, at right elevation, and the correct

	longitudinal slope along a dry swale. In most cases, the soil media surface of a bioretention cell should be flat.
Vegetation, Surface Cover, Stabilization	• Check species (and approved replacements), number of plants, right surface cover (e.g., mulch, matting), provisions for watering, if necessary. • Ensure that inlet protection and energy dissipation measures are in place at concentrated inflow points, such as curb cuts. • Ensure that overflow weirs or spillways are level and built as per plans. • If drainage area is stabilized adequately, ensure that temporary diversions (e.g., blocked inlets) are removed. Make sure inlets are properly installed and operational to actually let water into the practice. • Check after first significant rainfall event to make sure the practice is draining properly and conveys water without erosion or gullies forming down the flow path.
Important Inspection Milestones: POST-CONSTRUCTION **NOTE: See Specifications #9 & 10 for maintenance guidelines and Chapter 9 of Handbook for detailed O&M checklists. The following represent selected KEY inspection points for long-term maintenance.**	
Inlets	• Ensure inlets are not clogged or diverting water away from or around the practice.
Filter Bed	• Look for evidence of standing water or filter bed not draining adequately. Check underdrains if drainage appears to be an issue. • Look for sediment buildup and uneven surface that causes water to pool in only one area. • Check for erosion or gullying along the flow path, indicating that flow velocities may be an issue, additional pre-treatment needed, or vegetation needs to become better established. • Check side slopes for erosion.
Vegetation & Surface Cover	• Check for plant coverage, dead or diseased plants, bare spots, and overgrown areas (especially with invasives). • Check surface cover (e.g. mulch, E&S matting) to see if it needs to be repaired or replaced.
Check Dams & Outlet	• Check weirs, spillways, or outlet pipes for erosion, blockages, or clogging. • In Dry Swales, inspect check dams to see that water is flowing evenly over the weir section and not by-passing around the edges. Check downstream face for erosion, scour holes, or deposition.

Specification #13: Constructed Wetland & #11: Wet Swale

What Is It?

Constructed wetlands, sometimes called stormwater wetlands, are shallow basins that **treat stormwater runoff.** The constructed wetland permanent pool is typically 6 to 18 inches deep (although it may have greater depths in the forebay and outlet micropool). There are many depth zones and changes in topography (known as "microtopography") in a constructed wetland to promote dense and diverse wetland vegetation. Runoff from each new storm displaces runoff from previous storms, and the long residence time and flow path allows multiple pollutant removal processes to operate, including gravitational settling, biological uptake, and microbial activity.

Wet swales are a modification of constructed wetland. They are placed within the conveyance system, and are linear features. Generally, ponding depths are 6 inches or less. Drainage areas are also smaller than for constructed wetlands (generally 5 acres or less).

Guidance on Inspection of Practice:

- It is understood that the inspector cannot be on-site continuously. Therefore, it is important for inspectors to prioritize and coordinate with the contractor and property owner or manager to arrange inspections at key points, especially during construction.
- For some of the inspection milestones listed below, if the inspector cannot be on-site, then the contractor and/or contractor's qualified professional should take digital photos and careful notes detailing the particular installation step.

- The information below if not intended to replace the more detailed checklists and information in the Specifications, and inspectors are encouraged to avail themselves of these resources. However, the table below may help inspectors understand some of the key inspection milestones.

Important Inspection Milestones: CONSTRUCTION ***NOTE: See Specification #13 for Constructed Wetland detailed construction sequence and Specification #11 for Wet Swale*** **KEY inspection points during initial installation of the practice**	
Ready to Install; Conversions From E&S Basins	• Ensure contributing drainage area is stabilized. If the constructed wetland will be converted from a temporary E&S basin, ensure that the site is ready for this conversion. • Check the plan for E&S measured to employ during the conversion, including temporarily diverting the drainage area around the wetland or wet swale and seeding/mulching of slopes around the practice area.
Embankment, Core Trench, Spillway	• For constructed wetlands with impounding structures, check plans for these design elements and proper construction & compaction.
Grading the Wetland Zones, Berms, Weirs, Etc.	• Check that rough grading follows the plan. • Rough grading should ensure elevation 3-6" below final design elevations. • Ensure that internal features, such as berms, weirs, and other features that extend the flow path are constructed at correct locations and elevations. • Check the plans for any soil amendments to be added to the wetland area. • For wet swales, also cross-reference construction guidelines for grass channels (Specification #3).
Wetland Vegetation	• Check plan for when the drainage area connection should be opened up to let water into the wetland or wet swale. • Check vegetation types, depth zones, stock (e.g., container, plugs, seed) for general conformance with plan, including the wetland buffer area. Consult with contractor on any plant substitutions, and check with proper design professional to see if these are appropriate. • If plan calls for it, check installation of Canada goose protection after planting.
Stabilization	• Check final stabilization of slopes or disturbed areas surrounding the wetland or in the drainage area.

Important Inspection Milestones: POST-CONSTRUCTION ***NOTE: See Specifications #13 & #11 for inspection & maintenance guidelines*** **KEY inspection points for long-term maintenance**	
Initial Establishment Period	• During the first 6 months to a year, check if spot reseeding, watering of trees, and/or reinforcement plantings are needed.
Health of Vegetation; Control of Invasives	• By far the most important maintenance task for constructed wetlands is control of invasive species. Once invasives cover 15% or more of any of the wetland features, actions should be taken by the responsible party to remove the invasives (see suggestions in Specification #13). • Check for health and coverage of wetland plants, and for needed thinning or harvesting of woody vegetation.
Structural Elements	• Check for sediment accumulation in forebays and other features. • Check general structural features, such as inlets, side slopes, embankments, outfall channels, spillway and riser, trash racks, and maintenance access (area still accessible for maintenance equipment).

Specification #12: Filtering Practices

What Is It?

Stormwater filters are a useful practice to treat stormwater runoff from small, highly impervious sites. Stormwater filters capture, temporarily store, and treat stormwater runoff by passing it through an engineered filter media – such as sand, peat, compost, or another material -- collecting the filtered water in an underdrain, and then returning it back to the storm drainage system. The filter typically consists of two chambers: the first is devoted to settling, and the second serves as a filter bed. Some filters are above ground, but many are installed below ground. Stormwater filters are a versatile option because they consume very little surface land and have few site restrictions.

Guidance on Inspection of Practice:

- It is understood that the inspector cannot be on-site continuously. Therefore, it is important for inspectors to prioritize and coordinate with the contractor and property owner or manager to arrange inspections at key points, especially during construction.
- For some of the inspection milestones listed below, if the inspector cannot be on-site, then the contractor and/or contractor's qualified professional should take digital photos and careful notes detailing the particular installation step.
- The information below if not intended to replace the more detailed checklists and information in the Specifications, and inspectors are encouraged to avail themselves of these resources. However, the table below may help inspectors understand some of the key inspection milestones.

Important Inspection Milestones: CONSTRUCTION ***NOTE: See Specification #12 for detailed construction sequence*** **KEY inspection points during installation**	
Ready to Install; drainage area stabilized	• Ensure contributing drainage area is stabilized and will NOT contribute sediment to the filter practice. • It will likely be necessary to block inlets and/or install secondary erosion control practices around perimeter of the practice to ensure sediment does not enter. • This is significantly easier for practices installed in parking lots (e.g., perimeter sand filter).
Grading & Installation of the Filter Structure	• Check design elevations for the filter structure, which may on the surface, in a concrete box above or below ground, or in another configuration. • Check with contractor about conducting the "watertightness" test. • Check elevations of all inlets, internal weirs, overflow or internal flow splitters, etc.
Installation of the Underdrain & Filter Material	• Some filter assembly will be dictated by manufacturers' specifications, so this should be coordinated with the contractor. • If underdrain is used, check that it is installed as per plan. • Check the filter material, depth, and top elevation as per the plan.
Open the Drainage Area Connection	• Coordinate with the contractor and manufacturer (if relevant) on when to open up inlets and make the filter operational. If the filter has a grass of vegetated cover, the vegetation should be in good condition. Some structures will also have grate tops, manholes, and other elements that part of the design.

Important Inspection Milestones: POST-CONSTRUCTION ***NOTE: See Specification #12 for maintenance guidelines*** **KEY inspection points for long-term maintenance**	
Sediment Accumulation	• Check sediment levels in the settling and filter chambers. If sediment accumulation exceeds 6 inches, maintenance may be needed.
Filter Bed	• Look for evidence of standing water or filter bed not draining adequately. Check underdrains and observation wells (if present) if drainage appears to be an issue. Check that the filter bed is still level. • Check the top 3 inches of filter material and look for evidence of clogging, discoloration (e.g., dark, oily), or build-up of algae (which may be coming from air conditioner condensers). This may indicate that this top layer needs to be replaced with new filter material. • Check for trash or debris that needs to be cleaned off the top of the filter bed.
Inlets & Flow Splitters	• Check inlets, weirs, flow splitters, and other structural elements to ensure they are clear of debris and functioning properly.
Drainage Area	• Check for sources of sediment or other pollutants in the drainage area. These may be shortening the life of the filtering practice.

Specifications #14 Wet Pond & #15: Extended Detention Ponds

What is it?

Both Wet and Extended Detention (ED) ponds are stormwater basins that store and treat incoming stormwater. With both ponds, there is also a release of water during the storm event.

The chief different is that Wet Ponds (Specification #14) have a permanent pool of water. Incoming storms displace some of this stored water. The pool allows for settling and other pollutant removal mechanisms.

ED Ponds (Specification #15) store water only temporarily after a storm event – typically 24 to 36 hours, and release this stored water slowly through a control orifice. After a few days, these ponds are designed to return to their "dry" condition. Enhanced ED ponds may have other features such as wetland cells, micropools, and other features that may resemble either wet ponds or constructed wetlands.

Both wet and ED ponds are usually designed for water quality treatment as well as storage for channel and flood protection (peak rate control). Both types of ponds can be considered the terminal practice in a treatment train, with upstream runoff reduction practices providing additional treatment.

Important Inspection Milestones: CONVERSION FROM E&S BASIN ***NOTE: See Specifications #14 & #15 for detailed construction sequence* KEY inspection points during installation**	
Ready to Convert?	• The conversion can only take place once the E&S functions of the basin are complete – the drainage area is stabilized and the site has reached the condition noted in the plan for conversion.
Dewater & Dredge; E&S Measures	• Based on the plan's conversion details, check that the basin is dewatered and dredged with proper E&S measures (e.g., dewatering through sediment filter or dirt bag, proper treatment of dredged materials). • The conversion process may require additional measures, such as temporary dewatering, diversions, and stabilizing denuded areas around the basin.
Regrade to Design Elevations	• In most cases, the wet or ED pond bottom will be lower than the temporary E&S pond, and side slope and overall shape may also require regrading. • Check any internal design features, such as forebays, berms, and other features.
Permanent Configuration for Riser & Spillways	• In most cases, the dewatering snout for E&S control will be removed. The riser structure modification should be as per plan (e.g., orifice sizes and elevations). • Check that the emergency spillway is installed as per plan; if materials were in place during site construction, rock, stone, or other materials may need to be cleaned or replaced. • Check outlet protection to ensure that materials are clean and it is installed as per plan details.
Document Design Depth in Pools	• For wet ponds and enhanced ED ponds that include micro-pools or wetland cells, measure the finished depth as a guide for future maintenance. This may include some sort of measuring rod.
Pondscaping Plan & Stabilization	• Check permanent stabilization of all denuded areas around pond. • Check installation of pondscaping as per the plan.

Important Inspection Milestones: POST-CONSTRUCTION ***NOTE: See Specifications #14 & #15 for maintenance guidelines*** **KEY inspection points for long-term maintenance**	
Maintenance Access	• Ensure that maintenance access is still in place and not obstructed.
Inlets/Inflow Pipes	• Check for condition of pre-treatment cells, clogging, erosion, undercutting of pipes, etc.
Sediment	• Check sediment accumulation in forebays, pond bottom, internal pond features. Document sediment accumulation based on observation of any permanent sediment measuring rods.
Riser & Spillway, Barrel Pipe	• Check condition of riser, orifices, and spillway for clogging, by-passing, accumulation of trash and debris, etc. • Check spillway conditions for excessive vegetation, erosion, lack of armoring, animal borrows, etc. • Check barrel and riser for seepage, corrosion, spalling, cracks or joint problems, slumping, sources of possible failure.
Embankments	• Check for trees on impounding structure, sloughing, seepage, moisture at toe, borrows, voids surrounding barrel pipe, etc.
Side Slopes	• Check for erosion, vegetative condition, ability to mow. • High and frequent water level fluctuations may inhibit health growth of vegetation on side slopes.
Outfall & Channel	• Check for outlet protection, outfall pipe undercutting, erosion, by-passing, displacement of rip-rap, transition to and erosion in the downstream channel.
Wet Pond Pool	• Check stable and correct pool elevation. Higher water levels may indicate clogged orifice or riser. Lower or unstable levels may indicate seepage or inadequate water balance.
Safety & Nuisance Conditions	• Check for mosquitoes, geese, lock or fence problems, unsafe drops, vandalism, trash or yard waste dumping, etc.