APPENDIX C

VISUAL INDICATOR PROTOCOLS

C.1 CONTRIBUTING DRAINAGE AREA CONDITION

Construction Inspection ✓ | Assumption ✓ | Routine Maintenance and Inspection ✓ | Maintenance Verification ✓ | **CONTRIBUTING DRAINAGE AREA**

Contributing drainage area is the total area that drains to the BMP. Compare conditions with design or as-built drawings to look for changes in size or land cover. Also look for evidence of surface ponding, accumulation of sediment and debris and point sources of contaminants (e.g. absent or failing ESCs, leaking waste containers, spills).

Bioretention and Dry Swales

PASS: CDA has not changed in size or land cover. Sediment, trash or debris is not accumulating and point sources of contaminants are not visible.

FAIL: Size of the CDA has changed from design assumptions. A point source for contaminants is visible (i.e. lack of sediment controls on adjacent construction site). (Source: NCCE)

MAINTENANCE TRIGGER: Excessive sediment, trash, debris or other pollutant load is impairing the function of the BMP or point sources are visible. The size of the CDA differs from design or as-built drawings by 10% or more, or land cover has changed.

FOLLOW-UP TASKS: Sweep paved areas to remove accumulated sediment, trash and debris or clean out roof eavestroughs. Revegetate or mulch bare soil areas. Improve or install erosion and sediment control or flow diversion practices to address sediment load from destabilized areas. Address any point sources of contaminants. Consider increasing frequency of routine maintenance.

Enhanced Swales

PASS: CDA has not changed in size or land cover. Sediment, trash or debris is not accumulating and point sources of contaminants are not visible.

FAIL: Ponding and sediment accumulation on the CDA is visible indicating runoff is not freely entering the BMP and that the pavement has not been swept recently.

MAINTENANCE TRIGGER: Excessive sediment, trash, debris or other pollutant load is impairing the function of the BMP or point sources are visible. The size of the CDA differs from design or as-built drawings by 10% or more, or land cover has changed.

FOLLOW-UP TASKS: Sweep paved areas to remove accumulated sediment, trash and debris or clean out roof eavestroughs. Revegetate or mulch bare soil areas. Address any point sources of contaminants. Improve or install erosion and sediment control or flow diversion practices to address sediment load from destabilized areas. Consider increasing frequency of routine maintenance.

Vegetated Filter Strips/Soil Amendment Areas

PASS: CDA has not changed in size or land cover. Sediment, trash or debris is not accumulating and point sources of contaminants are not visible. (Source: CSN)

FAIL: Size of the CDA or land cover within it has changed from design assumptions. Accumulation of sediment on the CDA is visible.

MAINTENANCE TRIGGER: Excessive sediment, trash, debris or other pollutant load is impairing the function of the BMP or point sources are visible. The size of the CDA differs from design or as-built drawings by 10% or more, or land cover has changed.

FOLLOW-UP TASKS: Sweep paved areas to remove accumulated sediment, trash and debris or clean out roof eavestroughs. Revegetate or mulch bare soil areas. Address any point sources of contaminants. Improve or install erosion and sediment control or flow diversion practices to address sediment load from destabilized areas. Consider increasing frequency of routine maintenance.

Permeable Pavements

PASS: CDA has not changed in size or land cover. Sediment, trash or debris is not accumulating and point sources of contaminants are not visible.

FAIL: Size of the CDA has changed from design assumptions (i.e. large asphalt area drains to a small portion of the permeable pavement). Evidence of surface ponding is visible.

MAINTENANCE TRIGGER: Excessive sediment, trash, debris or other pollutant load is impairing the function of the BMP or point sources are visible. The size of the CDA differs from design or as-built drawings by 10% or more, or land cover has changed.

FOLLOW-UP TASKS: Sweep paved areas to remove accumulated sediment, trash and debris or clean out roof eavestroughs. Revegetate or mulch bare soil areas. Address any point sources of contaminants. Improve or install erosion and sediment control or flow diversion practices to address sediment load from destabilized areas. Consider increasing frequency of routine maintenance.

Underground Infiltration Systems

PASS: CDA has not changed in size or land cover. Sediment, trash or debris is not accumulating and point sources of contaminants are not visible.

FAIL: Point sources of contamination are present (i.e. accumulated sediment and debris from melted snow piles).

MAINTENANCE TRIGGER: Excessive sediment, trash, debris or other pollutant load is impairing the function of the BMP or point sources are visible. The size of the CDA differs from design or as-built drawings by 10% or more, or land cover has changed.

FOLLOW-UP TASKS: Sweep paved areas to remove accumulated sediment, trash and debris or clean out roof eavestroughs. Revegetate or mulch bare soil areas. Address any point sources of contaminants. Improve or install erosion and sediment control or flow diversion practices to address sediment load from destabilized areas. Consider increasing frequency of routine maintenance.

Rainwater Cisterns

PASS: CDA has not changed in size from design assumptions. Sediment, trash or debris is not accumulating and point sources of contaminants are not visible.

FAIL: Sediment and debris is accumulating on the CDA due to deteriorating roof shingles. Eavestroughs need cleaning.

MAINTENANCE TRIGGER: Excessive sediment, trash, debris or other pollutant load is impairing the function of the BMP or point sources are visible. The size of the CDA differs from design or as-built drawings by 10% or more.

FOLLOW-UP TASKS: Remove accumulated sediment, trash and debris from roof area and clean out eavestroughs or roof drain covers. Address any point sources of contaminants. Trim back any tree branches hanging over the roof area. Consider increasing frequency of routine maintenance.

C.2 INLET STRUCTURAL INTEGRITY

Construction Inspection | Assumption ✓ | Routine Maintenance and Inspection ✓ | Maintenance Verification ✓ | INLET

Look for signs of damage to, or displacement of the structure(s), missing or broken catchbasin grates or trash racks, or excessive filter bed erosion at the inlets. Confirm pavement and curb elevations are acceptable

Bioretention and Dry Swales

PASS: There is no evidence of damage or displacement of the inlet structure that would prevent runoff from freely entering the BMP.

FAIL: The inlet structure has been damaged or displaced and requires repair. (Source: CSN)

MAINTENANCE TRIGGER: Damage to, or displacement of the structure(s) prevents or impairs the flow of stormwater into the BMP. Catchbasin grate(s) or trash rack(s) are missing or damaged. Erosion gullies ≥ 30 cm in length are visible on the filter bed.

FOLLOW-UP TASKS: Replace catchbasin grate(s) or trash rack(s). Repair damaged or displaced structure(s) and erosion gullies. If excessive erosion persists, consider adding flow spreader (e.g. gravel diaphragm, check dam) or forebay (e.g. geotextile and stone) at inlet(s) to help spread and slow the flow of water before it reaches the filter bed.

Enhanced Swales

PASS: There is no evidence of damage or displacement of the inlet structure and no erosion gullies on the filter bed.

FAIL: Excessive erosion at the inlet is visible and undermining the integrity of the adjacent pavement. (Source: CSN)

MAINTENANCE TRIGGER: Damage to, or displacement of the structure(s) prevents or impairs the flow of stormwater into the BMP. Catchbasin grate(s) or trash rack(s) are missing or damaged. Erosion gullies ≥ 30 cm in length are visible on the filter bed.

FOLLOW-UP TASKS: Replace catchbasin grate(s) or trash rack(s). Repair damaged or displaced structure(s) and erosion gullies. If excessive erosion persists, consider adding flow spreader (e.g. gravel diaphragm, check dam) or forebay (e.g. geotextile and stone) at inlet(s) to help spread and slow the flow of water before it reaches the filter bed.

Vegetated Filter Strips/Soil Amendment Areas

PASS: There is no evidence of damage to the gravel diaphragm inlet that would prevent runoff from entering the BMP nor excessive erosion of the filter bed. (Source: Aquafor Beech)

FAIL: Splash pad has been displaced and could lead to excessive erosion of the filter bed.

MAINTENANCE TRIGGER: Damage to, or displacement of the structure(s) prevents or impairs the flow of stormwater into the BMP. Flow spreading/energy dissipating structures (e.g. splash pads, gravel diaphragms) are missing or displaced.

FOLLOW-UP TASKS: Repair damaged or displaced structures (e.g. sunken pavement, damaged curb or flow spreader) and erosion gullies. If excessive erosion persists, consider adding flow spreader (e.g. gravel diaphragm) if not already present or re-grading the CDA to distribute flow to the BMP more evenly.

Underground Infiltration Systems

PASS: There is no evidence of damage or displacement of the inlet that would prevent runoff from freely entering the BMP.

FAIL: The catchbasin cover is missing, creating dangerous conditions and allowing large debris to enter the BMP. (Flickr Hive Mind).

MAINTENANCE TRIGGER: Damage to, or displacement of the structure(s) prevents or impairs the flow of stormwater into the BMP. Catchbasin grate(s) or trash rack(s) are missing or damaged.

FOLLOW-UP TASKS: Replace catchbasin grate(s) or trash rack(s). Repair damaged or displaced structure(s).

Rainwater Cisterns

PASS: Inlet pipe and couplings are securely connected to the CDA and cistern. (Source: Lake County SMC)

FAIL: The roof downspout is disconnected from the eavestrough, preventing runoff from entering the cistern.

MAINTENANCE TRIGGER: Damage to, or displacement of the structure(s) prevents or impairs the flow of stormwater into the BMP.

FOLLOW-UP TASKS: Repair damaged or displaced structures (e.g. eavestroughs, pipes, overflow diverters).

C.3 INLET OBSTRUCTION

Construction Inspection | Assumption ✓ | Routine Maintenance and Inspection ✓ | Maintenance Verification ✓ | INLET

Check inlets to ensure nothing is obstructing flow of stormwater into the BMP. An obstruction can be due to damaged or displaced structures (e.g. heaved or sunken curb or pavement) or accumulated sediment, trash, debris or vegetation in the inlet, pretreatment device or on the filter bed. Measure sediment depth.

Bioretention and Dry Swales

PASS: There are no obstructions at the inlet and stormwater can freely flow into the BMP.

FAIL: Accumulated sediment and vegetation is preventing stormwater from entering the BMP. Sediment on the pavement surface in front of the inlet indicates ponding is occurring.

MAINTENANCE TRIGGER: Sediment, trash, debris is ≥ 5 cm deep. Sediment, trash, debris or vegetation is blocking inflow over one third (33%) of the inlet width or area.

FOLLOW-UP TASKS: Remove or repair the obstruction. Re-grade at the inlet to provide a 5 cm drop in elevation between pavement edge and pretreatment device or filter bed surface.

Enhanced Swales

PASS: There are no obstructions at the inlet and stormwater can freely flow into the BMP.

FAIL: Accumulated sediment and vegetation is preventing stormwater from entering the BMP. Sediment on the pavement surface in front of the inlet indicates ponding is occurring.

MAINTENANCE TRIGGER: Sediment, trash, debris is ≥ 5 cm deep. Sediment, trash, debris or vegetation is blocking inflow over one third (33%) of the inlet width or area.

FOLLOW-UP TASKS: Remove or repair the obstruction. Regrade at the inlet to provide a 5 cm drop in elevation between pavement edge and pretreatment device or BMP surface.

Vegetated Filter Strips/Soil Amendment Areas

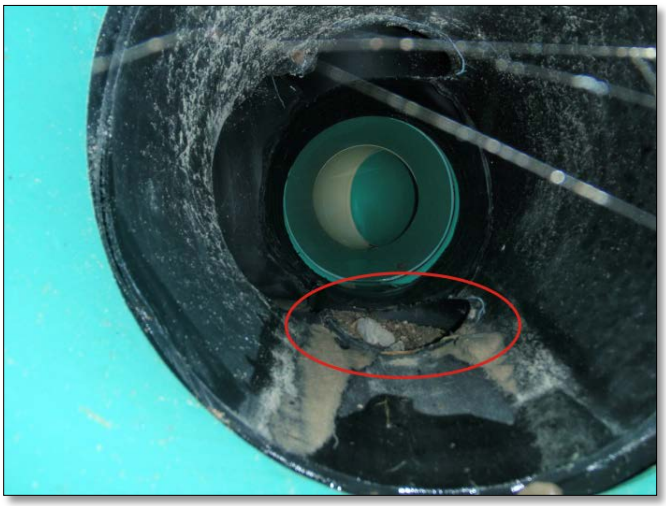
PASS: There are no obstructions at the inlet and stormwater can freely flow into the BMP as sheet flow from the pavement and gravel diaphragm. (Source: CSN).

FAIL: Concrete barriers are preventing stormwater from entering the BMP as sheet flow from the pavement. Sediment has accumulated at the inlet edge of the BMP.

MAINTENANCE TRIGGER: Sediment, trash, debris is ≥ 5 cm deep. Sediment, trash, debris or vegetation is blocking inflow over one third (33%) of the width edge.

FOLLOW-UP TASKS: Remove or repair the obstruction. Re-grade the width edge to provide a 5 cm drop in elevation between pavement edge and top of the flow spreader or BMP surface.

Underground Infiltration Systems



PASS: There are no obstructions at the inlet and stormwater can freely flow into the BMP.

FAIL: Sediment has accumulated in the inlet pipe to the infiltration trench and is fully obstructing flow of stormwater into the BMP.

MAINTENANCE TRIGGER: Sediment, trash, debris is ≥ 5 cm deep. Sediment, trash, debris or vegetation is blocking inflow over one third (33%) of the inlet width or area.

FOLLOW-UP TASKS: Remove or repair the obstruction. A vacuum truck service will be needed to clear obstructed inlet pipes.

Rainwater Cisterns

PASS: There are no obstructions at the inlet and stormwater can freely flow into the BMP

FAIL: Accumulated sediment and debris is blocking inflow over greater than one third of the inlet width and preventing stormwater from freely entering the BMP.

MAINTENANCE TRIGGER: Sediment, trash, debris is ≥ 5 cm deep. Sediment, trash or debris is blocking inflow over one third (33%) of the inlet width or area.

FOLLOW-UP TASKS: Remove or repair the obstruction.

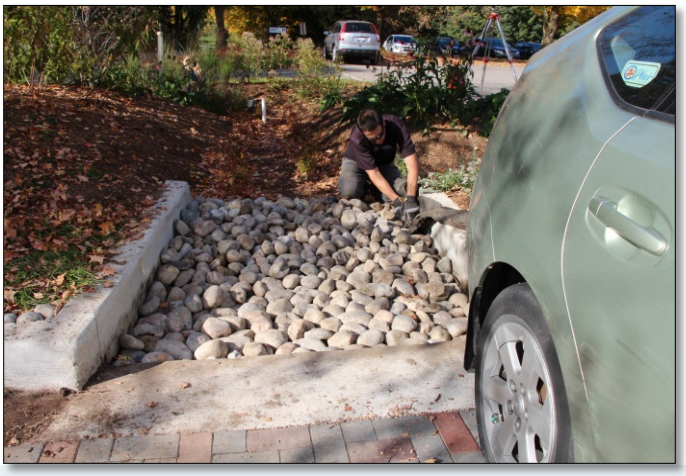
C.4 PRETREATMENT SEDIMENT ACCUMULATION

Construction Inspection ✓ | Assumption ✓ | Routine Maintenance and Inspection ✓ | Maintenance Verification

INLET

Pretreatment devices (e.g. filter strips, forebays, gravel diaphragms, check dams, catchbasin baffles/sumps, filters) slow down and spread out inflowing water and retain coarse sediment, trash and debris. Confirm the device still exists and whether it needs to be cleaned out. Measure sediment depth and compare to last inspection

Bioretention and Dry Swales



PASS: Forebay is free of sediment , trash and debris. Stones to slow down and spread out inflowing water remain in place.

FAIL: Forebay has accumulated sediment and vegetation is growing in it which is impairing its function and preventing stormwater from freely entering the BMP.

MAINTENANCE TRIGGER: Pretreatment device is ≥ 50% full of sediment, trash or debris. Accumulation of sediment is preventing or impairing flow of water into the BMP.

FOLLOW-UP TASKS: Remove sediment, trash and debris. Check for signs of oil or grease contamination (e.g. sheen on surface of water when submerged). If oil or grease contamination is suspected, submit a sediment sample for contaminant testing by an accredited laboratory to determine the proper disposal method. Replace geotextile in forebays every 3 years. If ≥50% full, consider increasing the frequency of CDA sweeping or pretreatment device cleaning.

Enhanced Swales

PASS: The grass filter strip pretreatment is free of sediment, trash and debris. (Source: Abbey and Associates).

FAIL: Sediment and debris has accumulated in the forebay and is preventing stormwater from flowing into the BMP.

MAINTENANCE TRIGGER: Pretreatment device is ≥ 50% full of sediment, trash or debris. Accumulation of sediment is preventing or impairing flow of water into the BMP.

FOLLOW-UP TASKS: Remove sediment, trash and debris. Replace geotextile in forebays every 3 years. If ≥ 50% full, consider increasing the frequency of CDA sweeping or pretreatment device cleaning.

Underground Infiltration Systems

PASS: Geotextile-lined stone inlet is free of sediment , trash and debris. Stones to slow down and spread out inflowing water remain in place.

FAIL: Accumulated sediment, trash and debris in the hydrodynamic (i.e., oil and grit) separator is occupying greater than 50% of its storage capacity. (Source: SWC Canada)

MAINTENANCE TRIGGER: Pretreatment device is ≥ 50% full of sediment, trash or debris. Accumulation of sediment is preventing or impairing flow of water into the BMP.

FOLLOW-UP TASKS: Remove sediment, trash and debris. If ≥ 50% full, consider increasing the frequency of CDA sweeping or pretreatment device cleaning.

Rainwater Cisterns

PASS: The pretreatment filter of the cistern is free of sediment and debris.

FAIL: The pretreatment filter on the roof downspout is partially covered by debris which could prevent stormwater from freely entering the BMP (Source: DMR).

MAINTENANCE TRIGGER: Pretreatment device is ≥ 50% full of sediment, trash or debris. Accumulation of sediment is preventing or impairing flow of water into the BMP.

FOLLOW-UP TASKS: Remove sediment, trash and debris. If ≥ 50% full, consider increasing the frequency of eavestrough or pretreatment device cleaning.

C.5 INLET EROSION

Construction Inspection ✓ | Assumption ✓ | Routine Maintenance and Inspection ✓ | Maintenance Verification

INLET

Look for bare soil areas and signs of excessive soil erosion (e.g. rills or gullies) or mulch/stone displacement at the inlet(s)

Bioretention and Dry Swales

PASS: No signs of soil erosion are visible on the filter bed immediately downstream of the inlet and no stones have been displaced from the forebay.

FAIL: Erosion gully and bare soil is visible on the grass filter strip pretreatment at the inlet indicating it is not sufficiently slowing and spreading out the inflow of stormwater to the BMP.

MAINTENANCE TRIGGER: Erosion gullies or bare soil areas ≥ 30 cm in length are visible. There are clear signs of frequent surface ponding on the filter bed surface at the inlet (e.g. dying vegetation, sediment accumulation). Mulch depth is <7.5 cm.

FOLLOW-UP TASKS: Repair erosion gullies. Restore vegetation and mulch cover or replace with stone cover. Redistribute or replenish mulch cover where missing or displaced. Where problems persist, consider adding a flow spreading device (e.g. check dam, gravel diaphragm), turf reinforcement.

Enhanced Swales

PASS: No erosion gullies or bare soil present at the inlet.

FAIL: Erosion gullies and bare soil areas are visible on the swale surface at the inlet.

MAINTENANCE TRIGGER: Erosion gullies or bare soil areas ≥ 30 cm in length are visible. There are clear signs of frequent surface ponding on the filter bed surface at the inlet (e.g. dying vegetation, sediment accumulation).

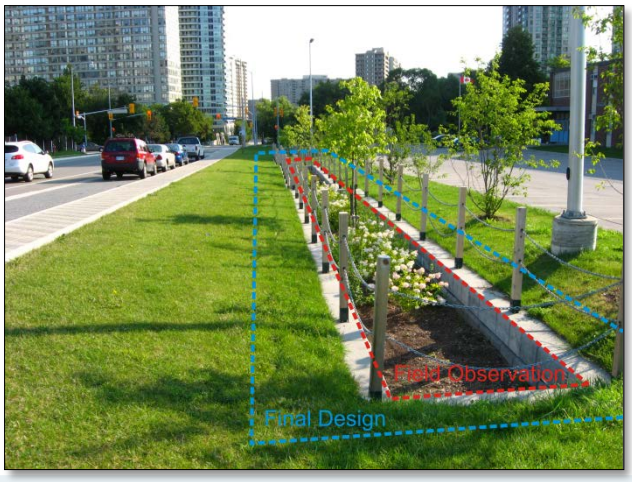
FOLLOW-UP TASKS: Repair erosion gullies. Restore vegetation or mulch cover or replace with stone cover. Where problems persist, consider adding a flow spreading device (e.g. check dam, gravel diaphragm) or turf reinforcement.

C.6 BMP DIMENSIONS

Construction Inspection ✓ | Assumption ✓ | Routine Maintenance and Inspection | Maintenance Verification ✓ | **PERIMETER**

Confirm that the dimensions of the BMP are acceptable. Undersized BMP's may not meet SWM criteria or may require more maintenance. For underground practices, this indicator can only be assessed during construction and prior to backfilling. Measure dimensions (i.e. length, width, depth) with a measuring tape or wheel and compare to final design, as-built drawings or the last inspection. For soil amendments, estimate the depth of uncompacted topsoil present with a soil corer and cone penetrometer to confirm areas where the BMP was implemented.

Bioretention and Dry Swales



PASS: The footprint area of the BMP does not significantly deviate from the final design and should not negatively affect its stormwater management treatment performance.

FAIL: The footprint area of the BMP is significantly smaller than what was specified in the final design.

MAINTENANCE TRIGGER: Dimensions differ from design or as-built drawing by >10%.

FOLLOW-UP TASKS: Check if a maintenance easement exists or a performance bond is still active. If the facility is within limits of a maintenance easement or the performance bond is still active and space is available, restore the dimensions to final design size.

Enhanced Swales

PASS: The footprint area of the BMP does not significantly deviate from the final design and should not negatively affect its stormwater management treatment performance.

FAIL: The footprint area of the swale is significantly smaller than what was specified in the final design due to half the width having been paved over.

MAINTENANCE TRIGGER: Dimensions differ from design or as-built drawing by >10%.

FOLLOW-UP TASKS: Check if a maintenance easement exists or performance bond is still active. If the facility is within limits of a maintenance easement or the performance bond is still active and space is available, restore the BMP footprint area to final design size.

Vegetated Filter Strips/Soil Amendment Areas

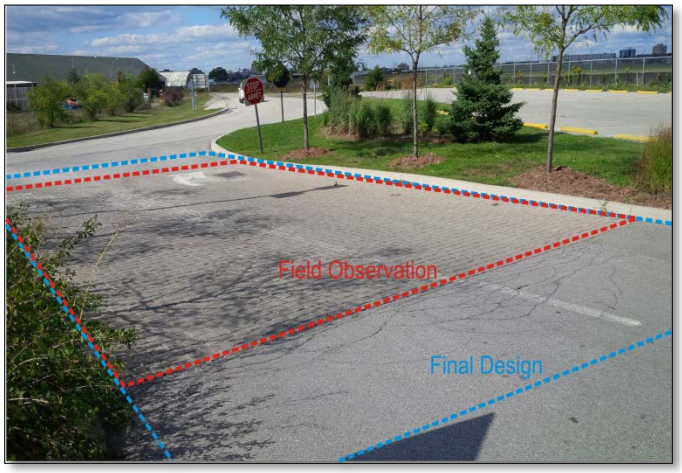
PASS: The footprint area where soil amendments have been implemented does not significantly deviate from the final design and should not negatively affect its stormwater management treatment performance.

FAIL: The footprint area where soil amendments have been implemented is significantly smaller than what was specified in the final design.

MAINTENANCE TRIGGER: Dimensions differ from design or as-built drawing by >10%.

FOLLOW-UP TASKS: Check if a maintenance easement exists or performance bond is still active. If the BMP is within limits of a maintenance easement or the performance bond is still active and space is available, restore the footprint area to final design size.

Permeable Pavements



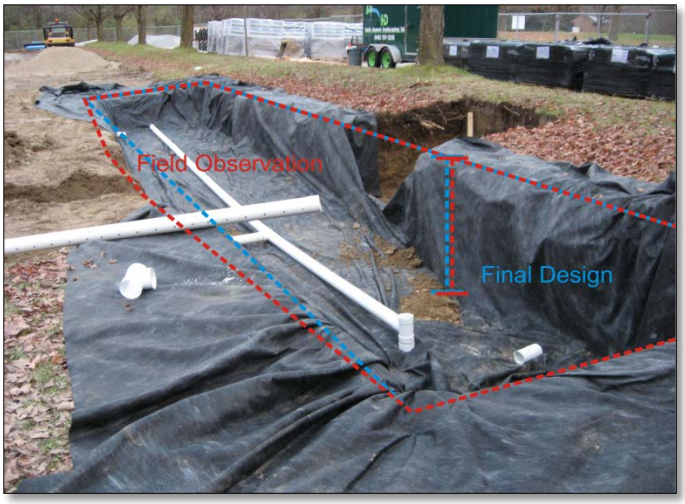
PASS: The footprint area of the BMP does not significantly deviate from the final design and should not negatively affect its stormwater management treatment performance.

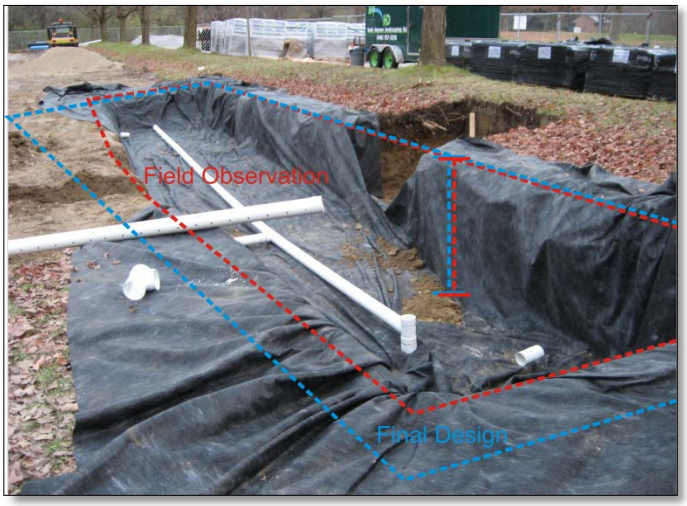
FAIL: The footprint area of the BMP is significantly smaller than what was specified in the final design.

MAINTENANCE TRIGGER: Dimensions differ from design or as-built drawing by >10%.

FOLLOW-UP TASKS: Check if a maintenance easement exists or performance bond is still active. If the facility is within limits of a maintenance easement or the performance bond is still active and space is available, restore the BMP footprint area to final design size.

Underground Infiltration Systems





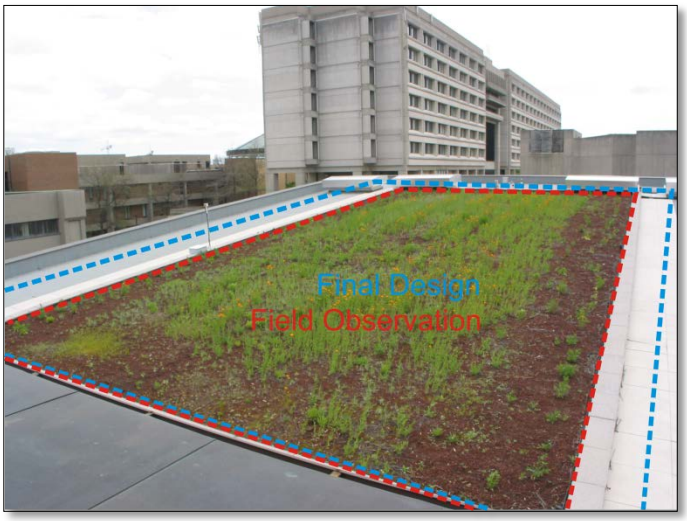
PASS: The footprint area and depth of the bioretention cell does not significantly deviate from the final design and should not negatively affect its stormwater management treatment performance.

FAIL: The footprint area of the bioretention cell deviates significantly from the final design.

MAINTENANCE TRIGGER: Dimensions differ from design or as-built drawing by >10%.

FOLLOW-UP TASKS: (During construction) Issue stop work order to construction contractor. Contact construction site manager and approval authority to decide on corrective actions.

Green Roofs



PASS: The footprint area of the green roof matches what was specified in the final design.

FAIL: The footprint area of the green roof is significantly smaller than what was specified in the final design.

MAINTENANCE TRIGGER: Dimensions differ from design or as-built drawing by >10%.

FOLLOW-UP TASKS: (During construction) Issue stop work order to construction contractor. Contact construction site manager and approval authority to decide on corrective actions.

Rainwater Cisterns

PASS: The size of the cistern matches what was specified in the final design.

FAIL: The size of the cistern being installed is much smaller than what was specified in the final design.

MAINTENANCE TRIGGER: Dimensions differ from design or as-built drawing by >10%.

FOLLOW-UP TASKS: (During construction) Issue stop work order to construction contractor. Contact construction site manager and approval authority to decide on corrective actions.

C.7 SIDE SLOPE EROSION

Construction Inspection | Assumption | Routine Maintenance and Inspection ✓ | Maintenance Verification ✓ | **PERIMETER**

Assess the condition of the slopes along the perimeter of the BMP. Erosion rill or gullies, bare soil areas or ruts indicate slope may be too steep, plantings have not survived, or damage from foot or vehicle traffic. Erosion could also be due to water entering the facility as concentrated flow instead of sheet flow or in an unintended location.

Bioretention and Dry Swales

PASS: No erosion gullies, bare soil areas or ruts are visible on the side slopes. (Source: City of Maplewood)

FAIL: The side slopes of the BMP contain bare soil areas and show clear signs of erosion. (Source: CSN)

MAINTENANCE TRIGGER: Erosion gullies, bare soil areas or ruts ≥ 30 cm in length are visible. Foot or vehicular traffic has damaged the side slope or is preventing vegetation from becoming established.

FOLLOW-UP TASKS: Repair erosion gullies or ruts, replant bare soil areas and restore mulch or stone cover. If water is entering the BMP in an unintended area, install flow diversion device or re-grade the CDA to prevent it. If problems persist, consider adding soil or turf reinforcement, re-grading to reduce the slope or installing barriers to discourage foot or vehicular traffic.

Enhanced Swales

PASS: No erosion gullies, bare soil areas or ruts are visible on the side slopes. (Source: Thomas Engineering).

FAIL: Erosion gullies and bare soil areas exist on a portion of the side slopes due to steep slope.

MAINTENANCE TRIGGER: Erosion gullies or bare soil areas ≥ 30 cm in length are visible. Foot or vehicle traffic has damaged the side slope or is preventing vegetation from becoming established.

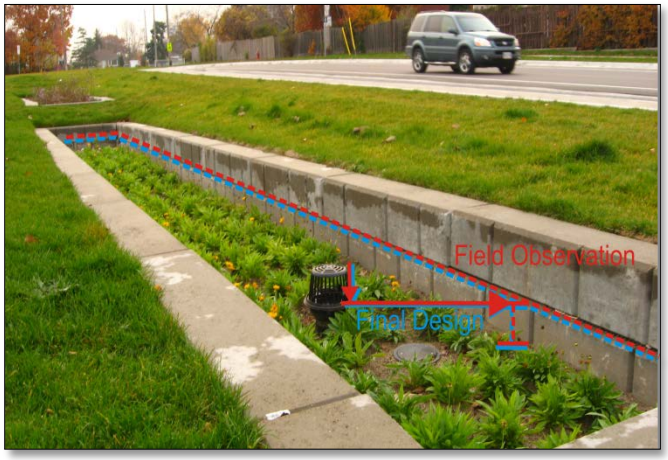
FOLLOW-UP TASKS: Repair erosion gullies or ruts, replant bare soil areas and restore mulch or stone cover. If water is entering the BMP in an unintended area, install flow diversion device or re-grade the CDA to prevent it. If problems persist, consider adding soil or turf reinforcement or re-grading to reduce the slope.

C.8 SURFACE PONDING AREA

Construction Inspection ✓ | Assumption ✓ | Routine Maintenance and Inspection ✓ | Maintenance Verification ✓ | **PERIMETER**

Assess maximum surface ponding area to confirm it is acceptable, determine if it has changed, and estimate the difference. Confirm the overflow outlet elevation is acceptable. Use a level to relate the elevation of the overflow outlet to the perimeter of the BMP to delineate the maximum surface ponding area. Use a measuring tape or wheel to estimate maximum surface ponding area and compare to design, as-built drawing or last inspection.

Bioretention and Dry Swales



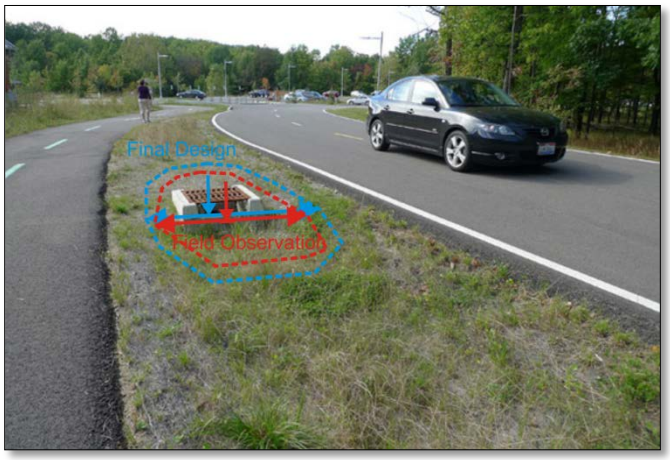
PASS: The overflow outlet elevation and maximum surface ponding area match what was specified in the final design.

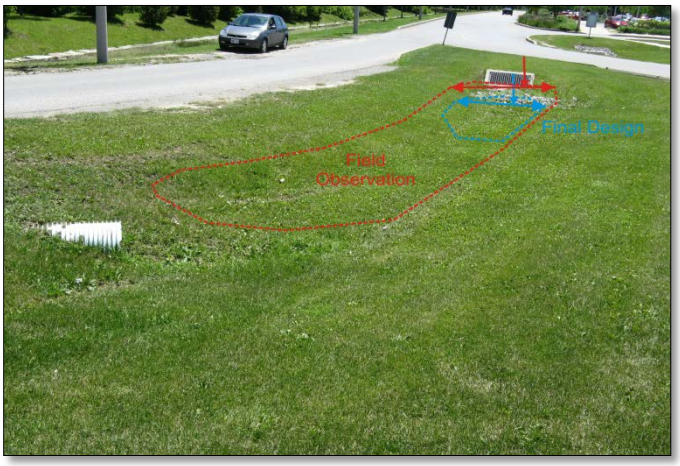
FAIL: The elevation of the overflow outlet is lower than what was specified in the design, producing a much smaller surface ponding area than intended and reducing the stormwater treatment capacity of the bioretention cell.

MAINTENANCE TRIGGER: Maximum surface ponding area differs from design or as-built drawing by ≥ 25%. Elevation of overflow outlet does not match final design. There are visible signs that the facility overflows at an unintended location (e.g. mulch displacement, soil erosion).

FOLLOW-UP TASKS: Re-grade or alter the overflow outlet elevation to match the final design. Re-grade the BMP surface or perimeter to achieve the maximum surface ponding area intended in the final design.

Enhanced Swales





PASS: The overflow outlet elevation and maximum surface ponding area closely match what was specified in the final design.

FAIL: The elevation of the overflow outlet is higher than what was specified in the design, producing a much larger surface ponding area than intended which could produce standing water for prolonged periods and cause vegetation to die off.

MAINTENANCE TRIGGER: Maximum surface ponding area differs from final design by ≥ 25%. Elevation of overflow outlet(s) does not match final design. There are visible signs that the facility overflows at an unintended location (e.g. mulch displacement, soil erosion).

FOLLOW-UP TASKS: Re-grade or alter the overflow outlet elevation to match the final design. Re-grade the BMP surface or perimeter to achieve the maximum surface ponding area intended in the final design.

C.9 STANDING WATER

Construction Inspection | Assumption ✓ | Routine Maintenance and Inspection ✓ | Maintenance Verification ✓ | FILTER BED

This indicator should be assessed during, or within 24 hours after a storm event. Look for standing (i.e. ponded) water on the BMP surface. Check if ponded water drains within an acceptable time period (i.e., 24 hours). Standing water can indicate problems with the surface infiltration rate, the sub-drain system, overflow outlet, or that the maximum surface ponding depth is excessive.

Bioretention and Dry Swales

PASS: There is no standing water on the surface of this bioretention cell.

FAIL: There is standing water and highly saturated soils on the surface of this dry swale. Presence of algae indicates the swale does not drain between storms. (Source: James Urban).

MAINTENANCE TRIGGER: There is standing water on the BMP surface > 24 hours after the end of a storm event. Presence of highly saturated soil and bare soil areas.

FOLLOW-UP TASKS: Flush the sub-drain if present. Confirm maximum surface ponding depth matches final design. Schedule Forensic Inspection and Testing (FIT) to assess the cause of slow surface drainage. The FIT involves inspecting the sub-drain for obstructions, draining the BMP, checking for sediment accumulation on BMP surface, measuring surface infiltration rate, and testing of the surface soil/filter media for compaction, texture and organic matter content.

Enhanced Swales

PASS: There is no standing water on the surface of the swale and no bare soil areas around the outlet that would indicate surface ponding occurs regularly.

FAIL: There is standing water and highly saturated soils on the surface of swale. Dead vegetation and bare soil areas indicate that surface ponding occurs regularly. (Source: CSN).

MAINTENANCE TRIGGER: There is standing water on the BMP surface > 24 hours after the end of a storm event. Presence of highly saturated soil and bare soil areas.

FOLLOW-UP TASKS: Confirm maximum surface ponding depth matches final design. Schedule Forensic Inspection and Testing (FIT) to assess the cause of slow surface drainage. A FIT involves draining the BMP, checking for sediment accumulation on BMP surface, measuring surface infiltration rate and testing of the surface soil/filter media for compaction, texture and organic matter content.

Vegetated Filter Strips/Soil Amendment Areas

PASS: There is no standing water on the vegetated filter strip and no bare soil areas that would indicate surface ponding occurs regularly. (Source: Washington State DOT)

FAIL: Presence of large patches of dying vegetation and bare soil indicate that surface ponding occurs regularly and that the vegetated filter strip does not drain well.

MAINTENANCE TRIGGER: There is standing water on the BMP surface > 24 hours after the end of a storm event. Presence of highly saturated soil and bare soil areas.

FOLLOW-UP TASKS: Schedule Forensic Inspection and Testing (FIT) to assess the cause of slow surface drainage. A FIT involves draining the BMP, checking for sediment accumulation on BMP surface, measuring surface infiltration rate and testing of the surface soil/filter media for compaction, texture and organic matter content.

Permeable Pavement

PASS: There is no standing water on the surface of the permeable pavement shortly after a storm event and no signs of sediment accumulation to suggest that surface ponding occurs regularly.

FAIL: There is standing water on the permeable pavement surface during a storm event. Sediment accumulation on the pavement surface indicates that surface ponding occurs regularly.

MAINTENANCE TRIGGER: There is standing water on the BMP surface.

FOLLOW-UP TASKS: Flush the sub-drain if present. Schedule Forensic Inspection and Testing (FIT) to assess the cause of slow surface drainage. A FIT involves inspecting the sub-drain for obstructions, draining the BMP, checking for sediment accumulation on BMP surface and measuring surface infiltration rate.

Green Roofs

PASS: There is no standing water on the green roof surface shortly after a storm event.

FAIL: Standing water is present on the green roof surface and in the sub-drain system and bare soil areas are visible. (Source: J.V. Heidler)

MAINTENANCE TRIGGER: There is standing water on the green roof surface or in the overflow outlet > 3 hours after the end of a storm event.

FOLLOW-UP TASKS: If the overflow outlet is draining slowly, flush the pipe with a hose or schedule drain snaking service to unclog it. If the green roof surface is draining slowly, schedule Forensic Inspection and Testing (FIT) with an agent of the green roof system provider to assess the cause of slow drainage and determine corrective actions. A FIT could involve draining the BMP, checking for sediment accumulation on BMP surface, measuring surface infiltration rate and testing the growing media for compaction, texture and organic matter content. It may also involve excavation of portions of the green roof to inspect the drainage layer.

C.10 TRASH

Construction Inspection | Assumption ✓ | Routine Maintenance and Inspection ✓ | Maintenance Verification

FILTER BED

Check if the BMP contains trash or recyclables, which impair aesthetic value and could block inlets or outlets.

Bioretention and Dry Swales

PASS: There is no trash in or around the bioretention area that could possibly block inlets and outlets.

FAIL: The bioretention cell contains trash which could block the overflow outlet and is impairing aesthetic value. (Source: CVC).

MAINTENANCE TRIGGER: Presence of trash is impairing aesthetic value or function of the BMP.

FOLLOW-UP TASKS: Pick up the trash, sort out recycleables and properly dispose of any remaining items. Assess the CDA for point sources such as overflowing trash cans. If problems persist, consider providing recycling bin/trash can nearby.

Enhanced Swales

PASS: There is no trash in or around the swale that could possibly block inlets and outlets.

FAIL: The swale contains trash which could block the overflow outlet and is impairing aesthetic value.

MAINTENANCE TRIGGER: Presence of trash is impairing aesthetic value or function of the BMP.

FOLLOW-UP TASKS: Pick up the trash, sort out recycleables and properly dispose of any remaining items. Assess the CDA for point sources such as overflowing trash cans. If problems persist, consider providing recycling bin/trash can nearby.

C.11 FILTER BED EROSION

Construction Inspection | Assumption | Routine Maintenance and Inspection ✓ | Maintenance Verification ✓ | FILTER BED

Look for signs of excessive soil erosion on the surface of the filter media/growing media bed, caused by concentrated flow of water or wind scour. Check for damage from foot or vehicle traffic.

Bioretention and Dry Swales

PASS: There are no erosion gullies or bare soil areas on the filter bed surface and mulch cover remains in place.

FAIL: Erosion gullies and bare soil areas are present on the filter bed surface, indicating that concentrated flow occurs regularly. (Source: CVC)

MAINTENANCE TRIGGER: Erosion gullies or bare soil areas ≥ 30 cm in length are visible. Foot or vehicle traffic has damaged the filter bed surface or is preventing vegetation from becoming established.

FOLLOW-UP TASKS: Repair erosion gullies, replant bare soil areas and irrigate as needed until vegetation cover is established or restore mulch or stone cover. If water is entering the BMP in an unintended area, install a flow diversion device or re-grade the CDA to prevent it. If problems persist, consider adding inlets, check dams, stone cover, soil/turf reinforcements or re-grading to reduce slope and spread out the flow of water.

Enhanced Swales

PASS: There are no erosion gullies or bare soil areas on the swale surface.

FAIL: Large erosion gully is present on the swale surface indicating that concentrated flow occurs regularly.

MAINTENANCE TRIGGER: Erosion gullies or bare soil areas ≥ 30 cm in length are visible. Foot or vehicle traffic has damaged the filter bed surface or is preventing vegetation from becoming established.

FOLLOW-UP TASKS: Repair erosion gullies, replant bare soil areas and irrigate as needed until vegetation cover is established or restore mulch or stone cover. If water is entering the BMP in an unintended area, install a flow diversion device or re-grade the CDA to prevent it. If problems persist, consider adding inlets, check dams, stone cover, soil/turf reinforcements or re-grading to reduce slope and spread out the flow of water.

Vegetated Filter Strips/Soil Amendment Areas

PASS: There are no erosion rills, gullies or bare soil areas on the filter strip surface. (Source: CIRIA)

FAIL: Scour erosion along the inlet edge is visible. Bare soil areas and bright green biofilm on the filter strip surface indicate that concentrated flow and surface ponding occurs regularly.

MAINTENANCE TRIGGER: Erosion gullies or bare soil areas ≥ 30 cm in length are visible. Foot or vehicle traffic has damaged the filter bed surface or is preventing vegetation from becoming established.

FOLLOW-UP TASKS: Repair erosion gullies, replant bare soil areas and irrigate as needed until vegetation cover is established or restore mulch or stone cover. If water is entering the BMP in an unintended area, install a flow diversion device or re-grade the CDA to prevent it. If problems persist, consider adding gravel diaphragms, check dams, soil/turf reinforcements, splash pads at roof downspouts or re-grading to reduce slope and spread out the flow of water.

Green Roofs

PASS: There are no bare areas or signs of erosion of growing media from concentrated flowing water or wind scour on the green roof (i.e. filter bed) surface.

FAIL: Wind scour of protective matting and growing media on the green roof (i.e. filter bed) surface is visible in several locations. (Source: Recover Green Roofs)

MAINTENANCE TRIGGER: Erosion gullies or bare areas ≥ 30 cm in length are visible. Foot traffic has damaged the filter bed surface or is preventing vegetation from becoming established.

FOLLOW-UP TASKS: Repair erosion gullies or wind scoured areas, replant and irrigate as needed until vegetation cover is established. If water is entering the BMP in an unintended area, install a flow diversion device or re-grade the CDA to prevent it. If problems persist, consider adding matting to protect growing media from scour until vegetation is established and/or wind barriers along the perimeter (e.g. stone, brick or paved parapets).

C.12 MULCH DEPTH

Construction Inspection ✓ | Assumption ✓ | Routine Maintenance and Inspection ✓ | Maintenance Verification ✓

FILTER BED

Check that the depth of mulch is adequate to protect the soil, surpress weeds and is not impeding the flow of water into the BMP.

Bioretention and Dry Swales

PASS: Mulch depth is within the range specified in the final design (i.e. 5 to 10 cm) and covers all non-vegetated portions of the filter bed.

FAIL: Mulch depth is greater than what was specified in the final design and is blocking the inlet to the bioretention cell. (Source: CSN).

MAINTENANCE TRIGGER: Average depth is less than 5 cm or greater than 15 cm. Bare soil areas are present. Mulch depth is impeding the flow of water into the BMP.

FOLLOW-UP TASKS: Add or redistribute mulch to maintain depth between 5 and 10 cm and not impede flow of water into the BMP.

Enhanced Swales

PASS: Mulch depth is within the range specified in the final design (i.e. 5 to 10 cm) and covers all portions of the BMP not covered by stone or vegetation. (Source: Blade Runners)

FAIL: Mulch depth is greater than what was specified in the final design and is blocking the inlet to the swale.

MAINTENANCE TRIGGER: Average depth is less than 5 cm or greater than 15 cm. Bare soil areas are present. Mulch depth is impairing flow of water into the BMP.

FOLLOW-UP TASKS: Add or redistribute mulch to maintain depth between 5 and 10 cm and not impede flow of water into the BMP.

C.13 FILTER BED SEDIMENT ACCUMULATION

Construction Inspection | Assumption ✓ | Routine Maintenance and Inspection ✓ | Maintenance Verification ✓ | FILTER BED

Assess the depth of sediment that has accumulated on the filter bed surface, which could be affecting the surface infiltration rate, vegetation cover or aesthetic value. Measure the depth in at least five (5) locations by digging test holes or examining soil core samples and compare to last inspection

Bioretention and Dry Swales

PASS: Depth of accumulated sediment below the stone cover on the filter bed surface is less than 5 cm.

FAIL: Sediment accumulation is visible on the filter bed surface and stone covering it and is greater than 5 cm deep.

MAINTENANCE TRIGGER: Mean or local sediment depth is 5 cm or greater.

FOLLOW-UP TASKS: Remove accumulated sediment and the top 15 cm of filter media by rake/shovel or small excavator, keeping heavy equipment off the filter bed surface. Check for signs of oil or grease contamination (e.g. sheen on surface of water when sediment is submerged). If oil or grease contamination is suspected, submit a sediment sample for contaminant testing by an accredited laboratory to determine the proper disposal method. Restore filter bed surface grading to match final design. Replant and replace mulch/stone cover. Assess the CDA for changes in land cover or point sources of sediment. Inspect and remove sediment from pretreatment devices. If problems persist, consider increasing frequency of routine maintenance.

Enhanced Swales

PASS: There are no signs of excessive sediment accumulation on the surface of the swale. (Source: DAA)

FAIL: Sediment is visible on top of the stone cover on the swale surface near the inlet and is greater than 2.5 cm deep .

MAINTENANCE TRIGGER: Mean or local sediment depth is 5 cm or greater.

FOLLOW-UP TASKS: Remove accumulated sediment by rake/shovel or small excavator, keeping heavy equipment off the filter bed surface. Check for signs of oil or grease contamination (e.g. sheen on surface of water when sediment is submerged). If oil or grease contamination is suspected, submit a sediment sample for contaminant testing by an accredited laboratory to determine the proper disposal method. Restore filter bed surface grading to match final design. Replant and replace mulch cover. Assess the CDA for changes in land cover or point sources of sediment. Inspect and remove sediment from pretreatment devices. If problems persist, consider adding pretreatment devices or increasing frequency of routine maintenance.

Underground Infiltration Systems

PASS: The coarse gravel filter bed of this infiltration chamber system has very little sediment accumulated on the surface indicating pretreatment devices are working well and that sediment removal from the gravel filter bed is not needed.

FAIL: A substantial amount of sediment has accumulated on the coarse gravel filter bed of the infiltration chamber system which could be impairing the drainage function of the BMP. (Source: Stormwater Maintenance)

MAINTENANCE TRIGGER: Mean or local sediment depth is 8 cm or greater on the gravel bed surface.

FOLLOW-UP TASKS: Removal of accumulated sediment from infiltration chamber systems requires entry into the chambers themselves by staff trained in confined space entry and equipped with recently certified safety equipment (i.e. tripod, winch, harness) and recently calibrated and tested multi-gas detector. Sediment removal involves the use of a pressure sprayer and shovels to consolidate sediment at the nearest access hatches and a vacuum truck to remove it. Flush inlet and outlet pipes with a hose. Check the removed material for signs of oil or grease contamination (e.g. sheen on surface of water when submerged). If oil or grease contamination is suspected, submit a sediment sample for contaminant testing by an accredited laboratory to determine the proper disposal method. Assess the CDA for changes in land cover or point sources of sediment. Inspect and remove sediment from pretreatment devices. If problems persist, consider adding pretreatment devices or increasing frequency of routine maintenance.

C.14 SURFACE PONDING DEPTH

Construction Inspection ✓ | Assumption ✓ | Routine Maintenance and Inspection ✓ | Maintenance Verification ✓ | FILTER BED

Measure maximum surface ponding depth to confirm it is acceptable, determine if it has changed, and estimate the difference. Use a level to measure the elevation difference between the overflow outlet and the lowest point on the filter bed surface.

Bioretention and Dry Swales

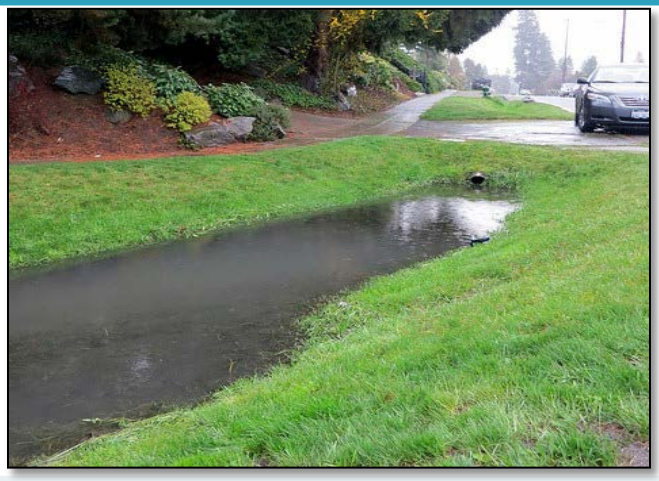
PASS: The maximum surface ponding depth of the bioretention cell matches what was specified in the final design.

FAIL: The maximum ponding depth of the bioretention cell is significantly shallower than intended as the overflow outlet is at the same elevation as the lowest point on the filter bed. (Source: CSN)

MAINTENANCE TRIGGER: Maximum surface ponding depth differs from design or as built drawing by >10%.

FOLLOW-UP TASKS: Measure filter media depth using a cone penetrometer or soil corer and check if it matches final design specification. Add, remove or redistribute filter media, or adjust the elevation of the overflow outlet to make the maximum surface ponding depth match the final design specification.

Enhanced Swales



PASS: The maximum surface ponding depth behind check dams matches what was specified in the final design. (Source: NEOSWTC)

FAIL: The maximum ponding depth of the swale is significantly deeper than intended as the elevation of the check dam or overflow outlet is too high. (Source: CSN)

MAINTENANCE TRIGGER: Maximum surface ponding depth differs from design or as built drawing by >10%.

FOLLOW-UP TASKS: Measure filter media depth using a cone penetrometer or soil corer and check if it matches final design specification. Add, remove or redistribute filter media, or adjust the elevation of the overflow outlet to make the maximum surface ponding depth match the final design specification.

C.15 FILTER BED SURFACE SINKING

Construction Inspection | Assumption ✓ | Routine Maintenance and Inspection ✓ | Maintenance Verification ✓ | FILTER BED

Look for local depressions or holes on the filter bed surface. Surface depressions can indicate problems with uneven settling of filter media/soil, a damaged sub-drain, heavy traffic (e.g. tire ruts) or the presence of animal burrows, all of which can affect the function of the BMP.

Bioretention and Dry Swales

PASS: The filter bed is nearly flat and there are no signs of localized bed sinking. (Source: CSN).

FAIL: Clear evidence of bed sinking is visible, creating a preferential ponding area where vegetation has died off.

MAINTENANCE TRIGGER: Local surface depressions 10 cm in depth or greater or animal burrows are visible on the filter bed surface.

FOLLOW-UP TASKS: Repair the depressions or fill animal burrows with filter media/soil. Inspect the sub-drain to ensure it has not been damaged. If problems with damage from heavy traffic persist, consider adding barriers.

Enhanced Swales

PASS: The filter bed has retained its original grading without any sharp depressions that would indicate surface bed sinking. (Source: SVR Design).

FAIL: Clear evidence of bed sinking is visible, creating a preferential ponding area where vegetation has died off.

MAINTENANCE TRIGGER: Local surface depressions 10 cm in depth or greater or animal burrows are visible on the filter bed surface.

FOLLOW-UP TASKS: Repair the depressions or fill animal burrows with filter media/soil. If problems with damage from heavy traffic persist, consider adding barriers.

Vegetated Filter Strips/Soil Amendment Areas

PASS: The lawn where soil amendments have been implemented is well graded with no signs of localized bed sinking , animal burrows or ruts.

FAIL: Clear evidence of bed sinking on the lawn, creating preferential ponding areas which could cause vegetation to die off (Source: The Anxious Gardener).

MAINTENANCE TRIGGER: Local surface depressions 10 cm in depth or greater or animal burrows are visible on the filter bed surface.

FOLLOW-UP TASKS: Repair the depressions or fill animal burrows with filter media/soil. If problems with damage from heavy traffic persist, consider adding barriers.

C.16 CHECK DAMS

Construction Inspection ✓ | Assumption ✓ | Routine Maintenance and Inspection ✓ | Maintenance Verification ✓

FILTER BED

Ensure that the check dam structures are still visible (i.e. not buried in sediment) and continue to help retain sediment and spread the flow of water across the BMP surface.

Bioretention and Dry Swales

PASS: The check dam is visible and continues to help retain sediment and spread the flow of water across the BMP surface. (Source: Green Girl PDX)

FAIL: Sediment has accumulated on the upstream side of the check dam and is affecting its function. (Source: James Urban).

MAINTENANCE TRIGGER: Check dam structures are missing or buried in sediment.

FOLLOW-UP TASKS: Remove accumulated sediment by rake/shovel. Check for signs of oil or grease contamination (e.g. sheen on surface of water when submerged). If oil or grease contamination is suspected, submit a sediment sample for contaminant testing by an accredited laboratory to determine the proper disposal method. Install check dams where specified in the final design. Assess the CDA for changes in land cover or point sources of sediment. Inspect and remove sediment from pretreatment devices. If problems persist, consider adding pretreatment devices or increasing frequency of routine maintenance.

Enhanced Swales

PASS: The check dams are visible and continue to help retain sediment and spread the flow of water across the BMP surface. (Source: CSN).

FAIL: Sediment has accumulated on the upstream side of the check dam and is affecting its function. (Source: Tennessee EPSC).

MAINTENANCE TRIGGER: Check dam structures are missing or buried in sediment.

FOLLOW-UP TASKS: Remove accumulated sediment by rake/shovel. Check for signs of oil or grease contamination (e.g. sheen on surface of water when sediment is submerged). If oil or grease contamination is suspected, submit a sediment sample for contaminant testing by an accredited laboratory to determine the proper disposal method. Install check dams where specified in the final design. Assess the CDA for changes in land cover or point sources of sediment. Inspect and remove sediment from pretreatment devices. If problems persist, consider adding pretreatment devices or increasing frequency of routine maintenance.

C.17 VEGETATION COVER

Construction Inspection | Assumption ✓ | Routine Maintenance and Inspection ✓ | Maintenance Verification ✓

PLANTING AREA

This indicator can only be assessed during the growing season. Estimate what portion of the planting area is covered by living vegetation. Inadequate vegetation cover can impair the water and pollutant retention functions and aesthetic value of the BMP and can contribute to filter bed erosion.

Bioretention and Dry Swales

PASS: The planted portion of the bioretention cell is completely covered with dense, attractive vegetation which helps to maintain its stormwater treatment function and aesthetic value.

FAIL: A larger portion of the bioretention cell has no vegetation cover which reduces its aesthetic value and could be negatively affecting its stormwater treatment function.

MAINTENANCE TRIGGER: Less than 80% of the planting area is covered by living vegetation.

FOLLOW-UP TASKS: Aerate bare spots and replant or reseed with plants specified in the final design (i.e. planting plan) and water as needed until cover is established. If bare spots persist, consider watering during extended dry periods, planting more tolerant species, amending the filter media/topsoil with compost or initiating a FIT to investigate the cause of plant mortality.

Enhanced Swales

PASS: The planted portion of the swale is well covered with dense, attractive vegetation which helps to maintain its stormwater treatment function and aesthetic value.

FAIL: Major portions of the swale surface contains dead or dying vegetation which reduces its aesthetic value and could be negatively affecting its stormwater treatment function.

MAINTENANCE TRIGGER: Less than 80% of the planting area is covered by living vegetation.

FOLLOW-UP TASKS: Aerate bare spots and replant or reseed with plants specified in the final design (i.e. planting plan) and water as needed until cover is established. If bare spots persist, consider watering during extended dry periods, planting more tolerant species, amending the filter media/topsoil with compost or initiating a FIT to investigate the cause of plant mortality.

Vegetated Filter Strips/Soil Amendment Areas

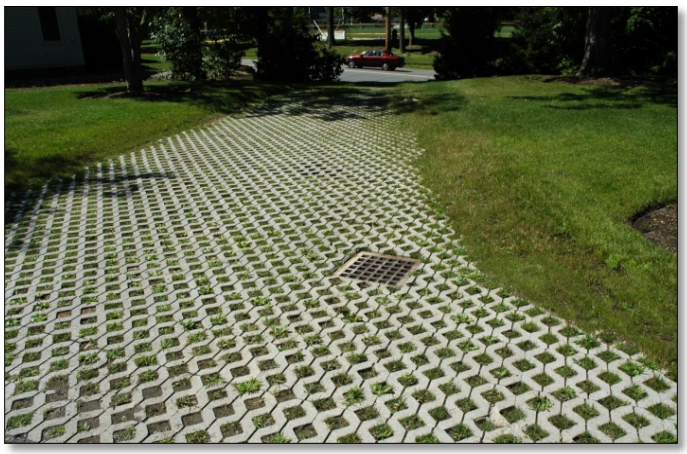
PASS: The vegetated filter strip is evenly covered with dense turf grass which helps to maintain its stormwater treatment function and aesthetic value. (Source: Trinkaus Engineering)

FAIL: Major portions of the filter strip contain bare soil or dead vegetation which reduces its aesthetic value and could be negatively affecting its stormwater treatment function.

MAINTENANCE TRIGGER: Less than 80% of the planting area is covered by living vegetation.

FOLLOW-UP TASKS: Aerate bare spots and replant or reseed with plants specified in the final design (i.e. planting plan) and water as needed until cover is established. If bare spots persist, consider watering during extended dry periods, planting more tolerant species, amending the filter media/topsoil with compost or initiating a FIT to investigate the cause of plant mortality.

Permeable Pavement



PASS: The permeable driveway is completely covered by dense turf grass which helps to maintain its stormwater treatment function and aesthetic value. (Source: Matthew Hague)

FAIL: Much of the permeable driveway contains bare soil which reduces its aesthetic value and could be affecting its stormwater treatment function. (Source: Dallas Metropolis)

MAINTENANCE TRIGGER: Less than 80% of the planting area is covered by living vegetation.

FOLLOW-UP TASKS: Reseed bare spots with the grass seed mixture specified in the final design and water as needed until grass cover is established. If bare spots persist, consider watering during extended dry periods, reseeding with more tolerant species, amending the filter media/topsoil with compost, or initiating a FIT to investigate the cause of grass mortality.

Green Roofs

PASS: The green roof is well covered by dense, attractive vegetation which helps maintain its stormwater treatment function and aesthetic value. (Source: Earth Rangers)

FAIL: A major portion of the green roof contains no living vegetation cover (Source: Kevin Songer).

MAINTENANCE TRIGGER: Less than 80% of the planting area is covered by living vegetation.

FOLLOW-UP TASKS: Replant or reseed with plants specified in the final design (i.e. planting plan) and water as needed until established. Check the irrigation system (if present) to ensure it is functioning. If the planting area is receiving regular foot traffic install pedestrian barriers to discourage it. If bare spots persist, consider watering during extended dry periods, planting more tolerant species, amending the soil/filter media or initiating a FIT to investigate the cause of plant mortality.

C.18 VEGETATION CONDITION

Construction Inspection | Assumption | Routine Maintenance and Inspection ✓ | Maintenance Verification ✓

PLANTING AREA

This indicator can only be assessed during the growing season. Assess the condition of vegetation growing in the planting area with regard to its health and aesthetic value. Look for plants that are not thriving or over-grown, or planting areas that are over-crowded.

Bioretention and Dry Swales

PASS: The vegetation looks healthy and well maintained.

FAIL: The vegetation looks healthy but is overcrowded and overgrown.

MAINTENANCE TRIGGER: Plants are not thriving and impairing the aesthetic value of the BMP. Plants are over-grown or over-crowded and obstructing sight lines need for safe driving or walking.

FOLLOW-UP TASKS: Trim over-grown shrubs to maintain clear sight lines for safety. Thin out vegetation cover in over-crowded plant areas to improve aesthetic value. If plants are not well established after the second growing season consider watering during extended dry periods, planting more tolerant species, amending the filter media/topsoil with compost or initiating a FIT to investigate the cause.

Enhanced Swales

PASS: The turf grass cover looks very healthy and well-maintained. (Source: CSN).

FAIL: Portions of the turf grass looks like it is dying or not flourishing, likely due to frequent surface ponding.

MAINTENANCE TRIGGER: Plants are not thriving and impairing the aesthetic value of the BMP. Plants are over-grown or over-crowded and obstructing sight lines need for safe driving or walking.

FOLLOW-UP TASKS: Trim over-grown shrubs to maintain clear sight lines for safety. Thin out vegetation cover in over-crowded plant areas to improve aesthetic value. If plants are not well established after the second growing season consider watering during extended dry periods, planting more tolerant species, amending the filter media/topsoil with compost or initiating a FIT to investigate the cause.

Vegetated Filter Strips/Soil Amendment Areas

PASS: The turf grass cover on the vegetated filter strip looks healthy and well maintained. (Source: VWRRC)

FAIL: The turf grass cover is patchy and not yet thriving. (Source: Washington State DOT).

MAINTENANCE TRIGGER: Plants are not thriving and impairing the aesthetic value of the BMP. Plants are over-grown or over-crowded and obstructing sight lines need for safe driving or walking.

FOLLOW-UP TASKS: Trim over-grown shrubs to maintain clear sight lines for safety. Thin out vegetation cover in over-crowded plant areas to improve aesthetic value. If plants are not well established after the second growing season consider watering during extended dry periods, planting more tolerant species, amending the filter media/topsoil with compost or initiating a FIT to investigate the cause.

Permeable Pavement

PASS: The turf grass cover on the permeable pavement looks healthy and well maintained. (Source: Herrerra Consulting).

FAIL: The turf grass cover on the permeable walkway is not thriving in some areas and needs cutting in others.

MAINTENANCE TRIGGER: Grass is not thriving or over-grown and impairing the aesthetic value of the BMP.

FOLLOW-UP TASKS: Mow grass more frequently to improve aesthetic value. If grass is not well established after the second growing season consider watering during extended dry periods, planting more tolerant species, amending the filter media/topsoil with compost or initiating a FIT to investigate the cause.

Green Roofs

PASS: The green roof vegetation looks healthy and well maintained.

FAIL: A portion of the vegetation on the green roof is dying or not thriving.

MAINTENANCE TRIGGER: Plants are not thriving, over-grown or over-crowded and impairing the aesthetic value of the BMP.

FOLLOW-UP TASKS: Check the irrigation system (if present) to ensure it is functioning. Thin out vegetation cover where it is over-crowded to improve aesthetic value. If the planting area is receiving regular foot traffic install pedestrian barriers to discourage it. If plants are not well established after the second growing season consider watering during extended dry periods, planting more tolerant species, amending the growing media or initiating a FIT to investigate the cause.

C.19 VEGETATION COMPOSITION

Construction Inspection | Assumption | Routine Maintenance and Inspection ✓ | Maintenance Verification ✓

PLANTING AREA

This indicator can only be assessed during the growing season. Compare the types of plants present to those specified in the final design (i.e. planting plan). Look for species that did not survive or are not thriving. Estimate the portion of vegetation cover that is invasive or unwanted (i.e. weeds). Look for volunteer tree seedlings in unsuitable locations (e.g. where soil depth is less than 60 cm).

Bioretention and Dry Swales

PASS: The species of plants in the bioretention cell matches what was specified in the final design with few weeds and no volunteer tree seedlings present.

FAIL: Vegetation in the bioretention cell is dominated by invasive species (i.e. weeds) and includes volunteer tree saplings, indicating it is in need of routine maintenance.

MAINTENANCE TRIGGER: More than 50% of the vegetation cover is invasive or unwanted species (i.e. weeds) or not the species specified in the final design and is impairing the aesthetic value of the BMP. Volunteer tree seedlings or saplings are present in inappropriate locations.

FOLLOW-UP TASKS: Remove invasive, unwanted or inappropriate species and replant with species specified in the final design (i.e. planting plan). If problems persist, consider increasing the frequency of routine maintenance (i.e. mulching and weeding) or replanting with more tolerant species.

Enhanced Swales

PASS: The species of plants growing in the swale closely matches what was specified in the final design with few weeds.

FAIL: Vegetation in the swale is dominated by grasses and invasive species (i.e. weeds) rather than the shrubs and flowers specified in the final design .

MAINTENANCE TRIGGER: More than 50% of the vegetation cover is invasive or unwanted species (i.e. weeds) or not the species specified in the final design and is impairing the aesthetic value of the BMP. Volunteer tree seedlings or saplings are present in inappropriate locations.

FOLLOW-UP TASKS: Remove invasive, unwanted or inappropriate species and replant with species specified in the final design (i.e. planting plan). If problems persist, consider increasing the frequency of routine maintenance (i.e. mulching and weeding) or replanting with more tolerant species.

Permeable Pavement

PASS: The vegetation cover on the permeable pavement is turf grass as specified in the final design and contains very few weeds. (Source: WEF)

FAIL: The vegetation cover on the permeable pavement is a mixture of turf grass and invasive species (i.e. weeds). (Source: Immanuel Giel)

MAINTENANCE TRIGGER: More than 50% of the vegetation cover is invasive or unwanted species (i.e. weeds) or not the species specified in the final design and is impairing the aesthetic value of the BMP. Volunteer tree seedlings or saplings are present in inappropriate locations.

FOLLOW-UP TASKS: Remove invasive, unwanted or inappropriate species and replant with species specified in the final design (i.e. planting plan). If problems persist, consider increasing the frequency of routine maintenance (i.e. mulching and weeding) or replanting with more tolerant species.

Green Roofs

PASS: The green roof contains only the species specified in the final design with few weeds and no volunteer tree seedlings or saplings present. (Source: Earth Rangers)

FAIL: Vegetation on the green roof is a mixture of the species specified in the final design and invasive species (i.e. weeds) and needs maintenance.

MAINTENANCE TRIGGER: More than 50% of the vegetation cover is invasive or unwanted species (i.e. weeds) or not the species specified in the final design and is impairing the aesthetic value of the BMP. Volunteer tree or shrub seedlings or saplings are present in inappropriate locations.

FOLLOW-UP TASKS: Remove invasive, unwanted or inappropriate species and replant with species specified in the final design (i.e. planting plan). If problems persist, consider increasing the frequency of routine maintenance (i.e. mulching and weeding) or replanting with more tolerant species.

C.20 MONITORING WELL CONDITION

Construction Inspection ✓ | Assumption ✓ | Routine Maintenance and Inspection ✓ | Maintenance Verification ✓ | OUTLET

Ensure the monitoring well remains accessible. Look for damage to the well structure and missing or insecure cap. A damaged well can allow untreated runoff, sediment and debris to flow into it and potentially clog the screen. Check for obstructions or sediment in the casing. Measure and record water level in the BMP in centimetres by dip method.

Bioretention and Dry Swales

PASS: The well is undamaged and accessible and the cap is in place and secured to prevent unauthorized access.

FAIL: The well standpipe has been damaged by snow plowing which impairs its use for monitoring and is a safety hazard.

MAINTENANCE TRIGGER: Damage to the well structure is visible and impairing the function of the BMP. The cap is missing or not secured to prevent unauthorized access. An obstruction in the well casing is visible.

FOLLOW-UP TASKS: Repair damaged well structure, and firmly tamp around the casing to prevent short circuiting of water flow through the BMP. Replace and secure well cap. Remove well casing obstruction (e.g. flush with water or remove with a vacuum).

Permeable Pavements

PASS: The well is undamaged and accessible and the cap is in place and secured to prevent unauthorized access.

FAIL: The well cap is missing and the casing is clogged by sediment, preventing access for monitoring and allowing sediment to flow into the sub-drain system.

MAINTENANCE TRIGGER: Damage to the well structure is visible and impairing the function of the BMP. The cap is missing or not secured to prevent unauthorized access. An obstruction in the well casing is visible.

FOLLOW-UP TASKS: Repair damaged well structure, and firmly tamp around the casing to prevent short circuiting of water flow through the BMP. Replace and secure well cap. Remove well casing obstruction (e.g. flush with water or remove with a vacuum).

Underground Infiltration Systems

PASS: The well is undamaged and accessible and the cap is in place and secured to prevent unauthorized access.

FAIL: The well was buried during landscaping and found covered only by filter cloth (i.e. cap missing).

PASS: The well is undamaged and accessible and the cap is in place and secured to prevent unauthorized access.

FAIL: The well has been left uncapped and unprotected from erosion and sediment during construction.

MAINTENANCE TRIGGER: Damage to the well structure is visible and impairing the function of the BMP. The cap is missing or not secured to prevent unauthorized access. An obstruction in the well casing is visible.

FOLLOW-UP TASKS: Repair damaged well structure, and firmly tamp around the casing to prevent short circuiting of water flow through the BMP. Replace and secure well cap. Remove well casing obstruction (e.g. flush with water or remove with a vacuum).

C.21 SUBDRAIN/PERFORATED PIPE OBSTRUCTION

Construction Inspection ✓ | Assumption ✓ | Routine Maintenance and Inspection ✓ | Maintenance Verification ✓ | **OUTLET**

This indicator is best assessed using a waterproof snake camera or push camera system specifically designed for inspecting pipes. Assess if the sub-drain pipe is damaged or clogged with sediment, vegetation roots or otherwise obstructed. An obstructed sub-drain pipe impairs the drainage function of the BMP.

Bioretention and Dry Swales

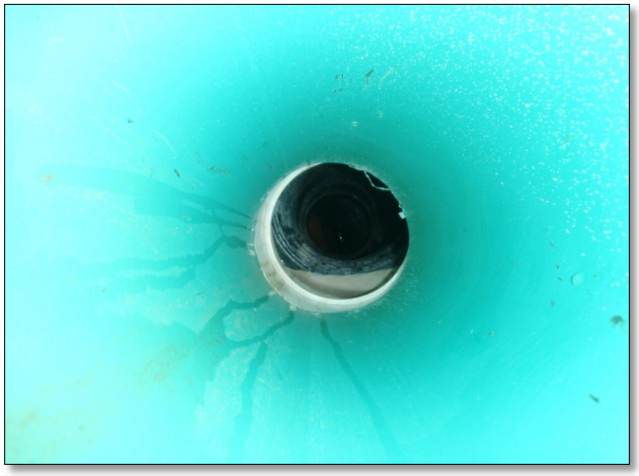
PASS: The perforated sub-drain pipe is not obstructed by sediment, debris or roots and shows no signs of damage.

FAIL: Roots have penetrated the sub-drain pipe and are substantially reducing its conveyance capacity. (Source: Pipelining Denver)

MAINTENANCE TRIGGER: Structural damage, sediment/debris clogs or vegetation roots are visible and are reducing the conveyance capacity of the pipe by one third (33%) or more.

FOLLOW-UP TASKS: Flush the full length of perforated pipe with a hose inserted into the upstream clean-out standpipe or monitoring well to remove accumulated sediment. Schedule drain snaking service to trim vegetation roots in the perforated pipe or vaccuum truck service to address other types of obstructions (e.g. trash/debris). Collapsed or broken perforated pipes or clogged geotextile requires structural repairs involving excavation and replacement.

Permeable Pavements



PASS: The solid section of the sub-drain pipe is not obstructed by sediment, debris or roots and shows no signs of damage.

FAIL: A section of the sub-drain pipe has been crushed which substantially reduces its conveyance capacity.

MAINTENANCE TRIGGER: Structural damage, sediment/debris clogs or vegetation roots are visible and are reducing the conveyance capacity of the pipe by one third (33%) or more.

FOLLOW-UP TASKS: Flush the full length of perforated pipe with a hose inserted into the upstream clean-out standpipe or monitoring well to remove accumulated sediment. Schedule vacuum truck or drain snaking service to address other types of obstructions (e.g. roots/trash/debris). Collapsed or broken pipes or clogged geotextile around pipes requires structural repairs involving excavation and replacement.

Underground Infiltration Systems

PASS: The sub-drain outlet pipe from the infiltration chamber system is not obstructed by sediment, debris or roots and shows no signs of damage.

FAIL: A perforated pipe in an exfiltration storm sewer system is clogged by sediment and debris which inhibits its drainage function.

MAINTENANCE TRIGGER: Structural damage, sediment/debris clogs or vegetation roots are visible and are reducing the conveyance capacity of the pipe by one third (33%) or more.

FOLLOW-UP TASKS: Remove downstream plug (if present) and flush the full length of the perforated pipe with a hose inserted into the upstream clean-out standpipe or monitoring well to remove accumulated sediment. Schedule drain snaking service to trim vegetation roots in the perforated pipe or vacuum truck service to address other types of obstructions (e.g. trash/debris). Collapsed or broken perforated pipes or clogged geotextile around pipes requires structural repairs involving excavation and replacement.

C.22 OVERFLOW OUTLET OBSTRUCTION

Construction Inspection ✓ | Assumption ✓ | Routine Maintenance and Inspection ✓ | Maintenance Verification ✓ | **OUTLET**

Check the overflow outlet structure to ensure it is not damaged and free of obstructions. Look for trash, debris, mulch or sediment on the structure that would impede the flow of water out of the BMP. Ensure that the structure is not full of standing water. A damaged or obstructed overflow outlet structure impairs the drainage function of the BMP and could lead to flooding during extreme storm events.

Bioretention and Dry Swales

PASS: The overflow outlet is free of damage and obstruction and functions as designed. (Source: Dylan Passmore)

FAIL: The overflow outlet is partially obstructed with trash and debris which reduces its capacity to safely convey excess water from the BMP.

MAINTENANCE TRIGGER: Structural damage or sediment/trash/debris is obstructing outflow and impairing the drainage function of the BMP. The structure is full of standing water. Standpipe or catchbasin grates are damaged or not in place and allow trash and debris to enter the outlet pipe or storm sewer.

FOLLOW-UP TASKS: Repair or replace any damaged or missing grates. Remove trash, debris and mulch from the overflow outlet structure. If the overflow outlet structure is not draining, schedule a drain snaking and vacuum truck service to address obstructions in the pipe.

Enhanced Swales

PASS: The overflow outlet of this vegetated swale is free of damage and obstruction and functions as designed to safely convey excess water from the BMP.

FAIL: Vegetation and debris is partially obstructing the overflow outlet structure which impairs its drainage function .

MAINTENANCE TRIGGER: Structural damage or sediment/trash/debris is obstructing outflow and impairing the drainage function of the BMP. The structure is full of standing water. Standpipe or catchbasin grates are damaged or not in place and allow trash and debris to enter the outlet pipe or storm sewer.

FOLLOW-UP TASKS: Repair or replace any damaged or missing grates. Remove trash, debris and mulch from the overflow outlet structure. If the overflow outlet structure is not draining, schedule a drain snaking and vacuum truck service to address obstructions in the pipe.

Permeable Pavements

PASS: The overflow outlet is free of damage and obstruction and functions as designed to safely convey excess water from the BMP.

FAIL: The overflow outlet is obstructed with sediment which impairs its function to convey excess water from the BMP.

MAINTENANCE TRIGGER: Structural damage or sediment/trash/debris is obstructing outflow and impairing the drainage function of the BMP. The structure is full of standing water. Standpipe or catchbasin grates are damaged or not in place and allow trash and debris to enter the outlet pipe or storm sewer.

FOLLOW-UP TASKS: Repair or replace any damaged or missing grates. Remove trash, debris and mulch from the overflow outlet structure. If the overflow outlet structure is not draining, schedule a drain snaking and vacuum truck service to address obstructions in the pipe.

Underground Infiltration Systems

PASS: The overflow outlet weir wall and storm sewer pipe in the control manhole of this infiltration chamber system is free of damage and obstruction and functions as designed to safely convey excess water from the BMP.

FAIL: Sediment and debris has accumulated in the overflow outlet pipe which impairs its function to convey excess water from the BMP.

MAINTENANCE TRIGGER: Structural damage or sediment/trash/debris is obstructing outflow and impairing the drainage function of the BMP. The structure is full of standing water. Standpipe or catchbasin grates are damaged or not in place and allow trash and debris to enter the outlet pipe or storm sewer.

FOLLOW-UP TASKS: Remove trash, debris and sediment from the overflow outlet structure. If the overflow outlet structure is not draining, schedule a drain snaking and vacuum truck service to address obstructions in the pipe.

Green Roofs

PASS: The overflow outlets of this green roof are free of damage and obstruction and function as designed to safely convey excess water from the BMP. (Source: Vegetal I.D.)

FAIL: Sediment is accumulating at the overflow outlet which could impair its drainage function and cause surface ponding and vegetation die-off. (Source: Jorg Breuning)

MAINTENANCE TRIGGER: Structural damage or sediment/trash/debris is obstructing outflow and impairing the drainage function of the BMP. The structure is full of standing water. Standpipe or catchbasin grates are damaged or not in place and allow trash and debris to enter the outlet pipe.

FOLLOW-UP TASKS: Remove any trash or debris from the overflow outlet structure. If the overflow outlet structure is not draining, schedule FIT to investigate the cause.

Rainwater Cisterns

PASS: The overflow outlet pipe diameter matches what was specified in the final design and is free of damage and obstruction.

FAIL: The overflow outlet pipe on this rain barrel is undersized and obstructed which impairs its function to safely convey excess water from the BMP. (Source: Melinda Webb)

MAINTENANCE TRIGGER: Structural damage or sediment/trash/debris is obstructing outflow and impairing the drainage function of the BMP. The structure is undersized or full of standing water and not draining.

FOLLOW-UP TASKS: Remove any trash or debris from the overflow outlet structure. If the overflow outlet structure is not draining, schedule FIT to investigate the cause. Undersized outlets should be replaced with structures that meet design specifications.

C.23 PAVEMENT SURFACE CONDITION

Construction Inspection ✓ | Assumption ✓ | Routine Maintenance and Inspection ✓ | Maintenance Verification ✓

PERMEABLE PAVEMENT

Check for damage, displacement or deformation of the surface that impairs its function as a pavement and could be a hazard. Look for displaced or missing pavers, ruts, cracks or gaps on the pavement surface. Check if aggregate fill in paver joints or grid cells needs topping up. Also look for excessive or unsightly weed growth between pavers.

Permeable Pavement

PASS: No damage, displacement or sinking of the permeable surface is visible and there are no weeds growing between paver joints.

FAIL: The pavement surface has sunk in local areas, creating a trip hazard and the potential for further damage from snow plowing. (Source: Basalite)

PASS: No damage, displacement or sinking of the permeable surface is visible. Some grass and weeds are growing in the joints between pavers but the affected area is not extensive.

FAIL: A sink hole has formed in one location on the permeable pavement surface, requiring structural repair.

MAINTENANCE TRIGGER: Potholes or sinkholes are present or pavers are missing or displaced. Edge restraints are no longer functioning. Ruts or local sinking of 13 mm or greater over a 3 metre length. Adjacent pavers or cracks in pervious concrete or porous asphalt are vertically offset by 6 mm or greater. Aggregate between paver joints is missing or below 17 mm from the paver surface. Weed growth between pavers is extensive and impairing aesthetic value.

FOLLOW-UP TASKS: Remove weeds. Spread joint fill material and sweep in until the pavement surface is clean. Repair damaged or displaced portions of the pavement surface. Repairs could involve adding joint fill material into small gaps or cracks, re-installing broken, displaced or sunken pavers or patching to stabilize large cracks or gaps. If problems persist, consider adding or reinforcing edge restraints.

C.24 PAVEMENT SEDIMENT ACCUMULATION

Construction Inspection | Assumption ✓ | Routine Maintenance and Inspection ✓ | Maintenance Verification ✓

PERMEABLE PAVEMENT

Check for sediment accumulation on the pavement surface. Look for areas where fine sediment or sand has collected or completely fills the joints between interlocking pavers or the cells of interlocking grids. Sediment accumulation impairs the drainage function of the pavement and can lead to surface ponding.

Permeable Pavement

PASS: The fine gravel that fills the joints between pavers is clearly visible and there is no sediment accumulated on the surface of the pavers.

FAIL: The joints between pavers are completely filled with fine sediment and sand.

PASS: No portion of the pavement is covered in sediment and fine gravel fill material within the joints between pavers is still visible.

FAIL: The joints between pavers are completely filled with fine sediment in local areas and sediment is accumulating on the surface of the pavers.

MAINTENANCE TRIGGER: The joints between pavers or grid cells are completely filled with fine sediment. Any portion of the pavement surface is completely covered with sediment.

FOLLOW-UP TASKS: Sweep the pavement to remove coarse debris, loosen sediment accumulated in pavement joints or pores and vacuum the pavement surface. For interlocking pavers and grids, replacement of gravel fill in the joints between pavers or grid cells will be necessary. If surface ponding is observed, schedule FIT to determine the cause and corrective actions. A FIT could involve inspection of the sub-drain, measurement of the surface infiltration rate of the pavement, or natural or simulated storm event testing.

C.25 CONTROL STRUCTURE CONDITION

Construction Inspection ✔ | Assumption ✔ | Routine Maintenance and Inspection ✔ | Maintenance Verification ✔

MANHOLE

This indicator assesses the structure (e.g. manhole, catchbasin, access hatch) that controls flow of stormwater in and/or out of the BMP for accessibility, safe entry and visual signs of damage or malfunction. Look for obstructions to entry, missing ladder rungs, cracks or other damage in the concrete structure or evidence of leakage (e.g. pipe connections, valves, weir walls).

Underground Infiltration Systems

PASS: The control manhole of this infiltration chamber system is accessible with ladder rungs in place and no signs of leaking around the weir wall and pipe connections.

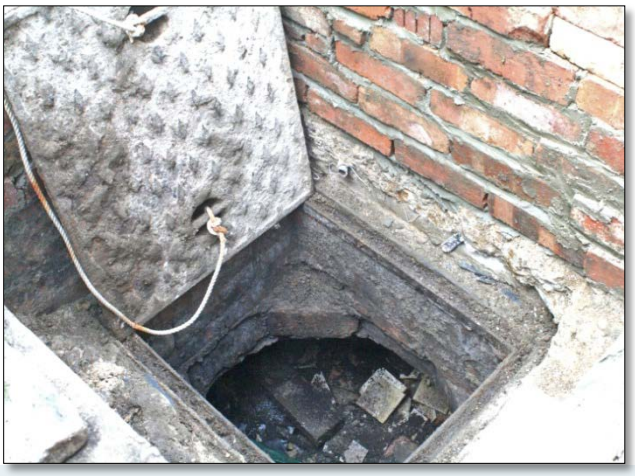
FAIL: The lid of the access hatch is missing which is a safety hazard and the concrete risers are displaced which prevents safe entry for inspection and maintenance tasks.

MAINTENANCE TRIGGER: The manhole is inaccessible or ladder rungs are missing. Damage to the concrete structure or evidence of leaking is visible and may be impairing the function of the BMP.

FOLLOW-UP TASKS: Schedule repairs to fix accessibility issues. Schedule a FIT to determine if the damage or suspected leak is impairing function of the BMP. A FIT could involve draining the BMP, continuous water level monitoring and natural or simulated storm event testing.

Rainwater Cisterns

PASS: The access hatch of this cistern is accessible with ladder rungs in place.



FAIL: The access hatch of this cistern was paved over with concrete and ladder rungs are missing which prevents safe entry for inspection and maintenance tasks. (Source: Miles Golding).

MAINTENANCE TRIGGER: The access hatch is inaccessible or ladder rungs are missing.

FOLLOW-UP TASKS: Schedule repairs to fix accessibility issues.

C.26 CONTROL STRUCTURE SEDIMENT ACCUMULATION

Construction Inspection | Assumption ✓ | Routine Maintenance and Inspection ✓ | Maintenance Verification ✓ | **MANHOLE**

Check if accumulated sediment or debris in the manhole or catchbasin sump is obstructing stormwater flow into or out of the BMP. Measure and record the depth of sediment accumulated since the last inspection.

Underground Infiltration Systems

PASS: There is some sediment accumulated in the manhole but it is not impairing the flow of stormwater into or out of the BMP. (Source: SWC Canada)

FAIL: The manhole sump is full of sediment and debris and it is beginning to impair flow of stormwater into a perforated pipe of the exfiltration storm sewer system.

MAINTENANCE TRIGGER: Depth of sediment is 10 cm or greater, or is obstructing the flow of stormwater into or out of the BMP.

FOLLOW-UP TASKS: Removal of accumulated sediment from underground control structures (i.e. manholes, catchbasins, access hatches) requires entry into the structures themselves by staff trained in confined space entry and equipped with recently certified safety equipment (i.e. tripod, winch, harness) and recently calibrated and tested multi-gas detector. Sediment removal involves the use of a pressure sprayer and shovel to consolidate the sediment and a vacuum truck to remove it. Flush inlet and outlet pipes with a hose. Check the removed material for signs of oil or grease contamination (e.g. sheen on surface of water when submerged). If oil or grease contamination is suspected, submit a sediment sample for contaminant testing by an accredited laboratory to determine the proper disposal method. Assess the CDA for changes in land cover or point sources of sediment. Inspect and remove sediment from pretreatment devices. If problems persist, consider adding pretreatment devices or increasing frequency of routine maintenance.

C.27 GREEN ROOF STRUCTURAL INTEGRITY

Construction Inspection ✔ | Assumption ✔ | Routine Maintenance and Inspection ✔ | Maintenance Verification ✔ | GREEN ROOF

Check for visible signs of damage to components or exposed root barrier or waterproofing membrane. Look at the perimeter for instances of uplifting of green roof layers from wind scour. Wind scour can be a problem in coastal environments, open areas with few obstructions and urban areas where adjacent structures cause turbulence.

Green Roofs

PASS: There are no signs of damage to the concrete parapets along the perimeter and no uplift of green roof layers.

FAIL: One of the green roof growing media structures has been displaced and requires replacement and repair. (Source: Kevin Songer)

MAINTENANCE TRIGGER: Signs of damage to green roof structures are visible or protective membranes are exposed.

FOLLOW-UP TASKS: Repair damaged green roof structures. Secure any uplifted areas. If wind uplift problems persist, consider installing wind barriers along the perimeter (e.g. stone, interlocking pavers or grids, parapets). Restore cover over exposed protective membranes.

C.28 CISTERN STRUCTURAL INTEGRITY

Construction Inspection ✓ | Assumption ✓ | Routine Maintenance and Inspection ✓ | Maintenance Verification ✓ | CISTERN

Assessing this indicator may require entry into the confined space of the cistern structure so inspectors (minimum of two) must be adequately trained and equipped with recently certified safety equipment (e.g. multi-gas detector, harness, tripod and winch). Check the cistern structure for signs of damage or leakage. Look for large cracks or damaged seals that could be impairing the water storage function of the cistern.

Rainwater Cisterns

PASS: There are no cracks or leaks visible in the cistern structure.

FAIL: A section of sealing tape over two pieces of the concrete cistern structure is displaced, raising the potential for leaks in the future.

MAINTENANCE TRIGGER: There are one or more cracks or leaks visible in the cistern. Water level in the cistern is declining when no rainwater use is occurring or never fills completely.

FOLLOW-UP TASKS: Schedule a FIT to determine if the crack or leak is impairing the water storage function of the cistern and to decide on corrective actions/repairs.

C.29 CISTERN SEDIMENT ACCUMULATION

Construction Inspection | Assumption ✓ | Routine Maintenance and Inspection ✓ | Maintenance Verification ✓ | CISTERN

Assess the degree to which sediment and debris has accumulated in the cistern. Accumulation of sediment or debris can lead to elevated levels of turbidity in the water delivered from the cistern which impairs the aesthetics of the BMP (e.g., turbid water in toilets). Measure sediment depth in the cistern. Ensure that the intake for the distribution system is set above the level of accumulated sediment or that the float is in place.

Rainwater Cisterns

PASS: Very little sediment and no coarse debris has accumulated on the bottom of the cistern and the sediment is not at the level of the distribution system intake structure.

FAIL: Enough sediment has accumulated in the cistern to cause water delivered from the distribution system to be turbid and discoloured when cistern water levels are low.

MAINTENANCE TRIGGER: Levels of turbidity or discolouration of water drawn from the cistern are aesthetically unpleasing. The depth of accumulated sediment in the cistern is at the level of the distribution system intake structure when cistern water levels are at their lowest operating level.

FOLLOW-UP TASKS: Drain the cistern and use a wet shop vacuum or hydro-vac truck to remove accumulated sediment and debris. Check pretreatment devices for damage or malfunction and clean out captured sediment and debris. If problems persist, consider adding or improving pretreatment devices.