



# CHAPTER 3

## APPENDIX

# CHAPTER 3

## APPENDIX

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# **APPENDIX 3A**

Introduction - Checklists

### **Design and Plan Review Checklists**

Design and plan review checklists provide general guidance for both the designer and plan reviewer. Many items listed on the checklists may not apply to any given design and it is therefore up to the designer to indicate items as “*not applicable*” or “*NA*” as appropriate. Similarly, the reviewer must be able to distinguish which items are required based on the local conditions or requirements and verify the status of those items. These checklists serve as a tool for providing the designer with the necessary information needed to develop an approvable plan, as well as for providing the plan review authority with a consistent review procedure.

### **Construction Inspections and As-Built Survey Checklists**

The purpose of construction inspections and an as-built survey is to verify that constructed SWM facilities and associated conveyance systems have been built in accordance with the approved plan and design specifications. An as-built survey, including construction inspection logs should be provided prior to final site approval and release of the performance guarantee. This is in the best interest of the owner as well as the local program, since long term maintenance costs can increase significantly, if the facility is not built correctly. Also, there could be a problem that the system may not provide the quantitative and/or qualitative control, as prescribed by the approved plan. Liability issues arise if a downstream property owner is adversely affected and can prove that the facility is not per the approved plan.

#### **A. Construction Inspections**

Adequate construction inspection of stormwater BMPs will usually require an on-site inspector to verify that the materials, methods, and placement, are in accordance with the approved plans and specifications. Critical components of the design; such as the anti-seep collar or filter and drainage diaphragm on the outlet conduit, the embankment foundation, riser footing, and other sub-surface components, must be examined for compliance to the design prior to being backfilled with the earthen embankment. The use of an on-site inspector will help to avoid delays by allowing the contractor to proceed with the earthwork rather than waiting for a scheduled (or non scheduled) inspection of a critical component.

Localities will usually provide regular inspections of SWM facilities under construction. The frequency of these inspections will vary based on the workload represented by active projects and the number of inspectors on staff. These inspections should verify that the contractor and on-site inspector are documenting the construction inspections in order to adequately substantiate the as-built certification. In the case of a local program requirement of inspections during critical portions of the construction, a signed inspection log by a qualified individual (other than the contractor) should be acceptable. Otherwise, the locality should establish a construction inspection schedule with the contractor prior to construction.

All inspection logs and other related information should be incorporated into a file for each individual project.

## **B. As-Built Survey**

Some as-built documentation must be obtained *during* the construction process, since some vital components are hidden in the final product. Therefore, construction inspections and inspection records are included in the as-built survey. For purposes of discussion, an as-built survey may be broken down into three components. These components are earthwork specifications, material specifications (other than earthwork) and a dimensions and elevations survey. The items noted within these components should be checked, and documentation be retained as needed to substantiate that the SWM BMP has been constructed in accordance with the approved plan and specifications. The following provides a discussion of the components of an as-built survey.

### **1. Earthwork Specifications**

The acceptable completion of earthwork in the construction of a SWM facility is crucial in assuring that a facility is structurally sound. This category covers all aspects pertaining to the completion of earthwork for a facility. It is essential that specific elements of the construction inspection, as well as the pre-construction feasibility analysis of the soils, be documented. This may include compaction tests, inspections of the removal of unsuitable materials under and adjacent to the embankment foundation, construction of the cut off trench and other seepage control measures, compaction around the barrel, riser structure footing, and any other element that is hidden in the final condition. All work should be completed under supervision of a licensed geotechnical engineer. The inspection logs and test results should be included in the final as-built survey.

#### **a. Geotechnical/Geophysical Testing**

The examination of existing underlying strata indicates the composition of that strata and if that strata will support a SWM facility. For example, the presence of bedrock at the natural ground surface or in “cut” provides a plane of weakness that water may follow or exfiltrate to. This is especially critical in areas of karst. Also, the presence of organics or other unsuitable materials under the embankment and embankment footing may require additional excavation. This must be documented as having been completed.

Normally, in non-karst terrain (east of the Blue Ridge), simple geotechnical logs taken at the SWM site will provide adequate interpretative results. In karst west of the Blue Ridge, however, it is extremely useful that the testing be expanded to geophysical (seismic) evaluation. These tests

provide images of underlying strata and indicate the presence of anomalies. This is critical since limestone geology exhibits extensive caves and cavities where ponding of runoff may exacerbate collapse of underlying cavities, which ultimately results in extremely expensive repairs.

**b. Fill Classification**

The geotechnical portion of the approved plan should provide a listing of soil classification types that are suitable for use at the project infill. Specialized criteria may also specify the classification of impermeable soil to be used for clay liners in areas of sandy soils or karst. Fill soils containing such materials as excessive or large rock, organic material or “fatty clay” (CH) classification are not acceptable due to the inability to achieve proper compaction or because of their shrink-swell properties. Verification must also be provided that the specifications for materials to be used in the construction of drainage and filter diaphragms have been complied with.

**c. Compaction**

The application of “lifts” in proper thickness and density is essential in attaining a stable SWM structure. The compaction of dam embankment to a percentage at or above the percent compaction specified in the approved plan and within the optimal range of moisture content assures that there will not be adverse settlement of the embankment. Careful compaction in areas adjacent to the barrel and seepage control measures is critical to eliminate excessive “void space” along the outlet barrel where the potential for embankment failure is high. Sufficient test results should be retained to document uniform compaction of the dam embankment and density/permeability of **existing soil formation and/or soils to be** used for liners (where applicable), in accordance with the approved plan.

**2. Material Specifications**

Construction materials may be classified as those items other than earthwork. A large number of component items needed for the construction of SWM facilities are grouped into this category. Some of these components must be inspected during installation. Materials would include, but not be limited to, concrete, reinforcing steel, concrete pipe, metal pipe, woodwork, masonry, and any other items that are applicable to the facility and satisfy all the requirements of the local program. The following provides a general discussion of some of the components of a SWM facility:

**a. Riprap and Aggregate**

The size distribution (diameter of aggregate), the amount of “fines” and integrity of rock may be

factors, since aggregate sizing should be in accordance to the plan.

- (1) Aggregate sizing plays a role in two distinct areas. In underground reservoir use, the size of aggregate dictates the amount of void space available for infiltration or retention/detention of runoff. In riprap use, the minimum size is critical in maintaining stability during high velocity flow, while a size in great excess of the stone specified may be as equally detrimental in regards to aesthetics and/or proper placement.
- (2) The amount of fines contained within aggregate is generally a visual observation, although quarry delivery tags should bear out the specifications per VDOT specs. The percentage of fines generally is important where washed stone is to be utilized for an underground aggregate reservoir, or where the outlet protection of a facility is discharging into a stream or other sensitive area that is susceptible to turbidity.
- (3) Rock integrity and shape is generally the visual observation that the aggregate used will meet specifications without long term decay. For example, sandstone does not make good riprap since it may be expected to disintegrate over time. Slate usually exhibits cleavage planes and therefore lays flat. When used for outlet protection, insufficient surface roughness of the slate may not dissipate concentrated flow energy.

#### **b. Control Structure**

There are an infinite number of design configurations for a control structure. Whatever the design, there should be project specifications for dimensions, strength and specific materials in accordance with the specifications found in Chapter 3, and any other local requirements. Appropriate documentation from the manufacturer should be retained (as applicable) to document each component. For example, pre-cast concrete risers normally arrive with as-built shop drawings that indicate specifications of the item furnished. Where components are constructed at the site, such as a cast in-place riser footing, test information and/or delivery tags from the concrete plant should be retained, while rebar reinforcement and dimensional information is documented in the construction log. Other items normally applicable to the control structure include:

- (1) An outlet barrel, normally affixed to the control structure, is used to convey flow to an accepted discharge point. Items related to proper conduit installation include the procedure used in sealing joints of conduit together, the method of attachment to the control structure and the use of inlet and floor shaping (as applicable) within

the control structure.

There is also a need to inspect and document the existence, location and spacing of anti-seep collars, concrete cradle or other seepage control measures (at the outlet barrel) as specified in the approved plan. Documentation should include verification of critical dimensions, existence of reinforcement and indication of concrete mix strength. In the case of filter diaphragms, both earthwork and materials need to be **considered in installation**.

- (2) Trash racks of varying design and construction are normally affixed to a control structure and in some cases inlets which “feed” the SWM facility. Visual observation (with inspection log entry) should indicate bar size, spacing grate configuration, and proper attachment to the control structure, or inlet and the application of rust resistant coating to the same where applicable.

#### **c. Geotextiles**

Synthetic fabrics are frequently specified for application beneath various components, under riprap or individually in spillways or for low flow channels. Proper selection of a manufacturer’s product along with installation per the plan and/or manufactures directives is necessary to assure the performance intended. Method of installation should be observed and tag be provided from the product that verify compliance to the product specification given in the approved plan.

#### **d. Conveyance System Components**

One frequently overlooked portion of a SWM design is the components comprising the drainage system for the site. It is obvious that if the system is not built as intended by the approved plan, then the facility may not function accordingly. Critical items such as conveyance conduit diameter, slope, inlet and grate length/configuration are essential to insure that the required design storm (generated by contributory area) is adequately conveyed to the SWM facility for control and/or that non-contributory area is diverted away from SWM facilities.

### **3. Dimensions and Elevations Survey**

The approved plan provides detailed information for specific elevations such as the inverts of the outlet conduits, control orifice and weir invert elevations, invert of emergency spillway, top of the dam, as well as pond bottom and slope of the same. Additional dimensional information exclusive of the control structure should also be provided. This could include the dimensions of the impoundment area at specific



elevations and the top width and side slope of a dam embankment. The purpose of the as-built survey is to substantiate elevations and dimensions per the plan.

### **G. As-Built Submittal Requirements**

As-built information should be documented and submitted in three forms: 1) a copy of the applicant's inspection log book. 2) a red-line revision of the approved SWM plan sheets and 3) a certification statement from a qualified individual regarding the conformance of the as-built to the approved plan.

1. A copy of the inspection log book should be kept at the project site. The log should document all aspects of the construction of the facility (with copies of applicable test results) to insure compliance with the approved plan. Any significant inconsistencies should immediately be reported to the engineer for evaluation and possible modification.
2. Red-line revision plans should be submitted upon completion of the facility. The plans should indicate any changes to the approved plan. Items that differ from the original approved plans and computations should be shown in red on both the plans and computations as follows:
  - a. A red check mark must be made beside design values where they agree with actual constructed values.
  - b. For changed values "line out" the design value and enter the actual value in red.
  - c. Elevations to the nearest 0.1' are sufficient.
  - d. A stage-storage summary table comparing the design values and the as-built values should be provided for facilities with storage volume.
3. The project owner should have those persons responsible for the inspection and implementation of the plan submit written certification that the SWM facility(s) and conveyance system have been built in accordance to the approved plan since this will cover underground facilities as well. Survey work during stake out and construction should be documented to verify underground volumes, elevations, pipe sizes, etc.

### **Operation and Maintenance Inspection Checklists**

Once construction is completed, the SWM BMP takes on the role for which it was intended. Periodic site inspections are essential in order to monitor the effectiveness and to anticipate the maintenance needs of

the BMP. It should be pointed out that not only the facility or BMP measure installed for stormwater control is important, but also the conveyance system to the BMP and the receiving channel immediately downstream of the BMP. The conveyance channel, curbing and/or storm sewer that convey flow to the facility or intentionally divert flows around it (as a part of the design) are all considered components and must function as intended.

The necessary frequency of inspections will vary with each facility based on the type of facility, size of the contributory drainage area, and development or land use conditions within the contributory drainage area. At a minimum, a full inspection should be performed at least once a year. Periodic inspections for trash and debris accumulation and general aesthetics should be performed after significant storm events.

The following checklists provide a guide for regular inspections of the various types of urban BMPs covered in this manual. The checklists are detailed enough for an inexperienced inspector or homeowner not familiar with the specific components of the facility. Checking the column provided under the *Investigate* heading for any given item indicates a potential problem that requires attention by a qualified individual to interpret the visual indicators for possible maintenance. The checklists should be signed, dated, and maintained at an accessible location such as with an official representative of the homeowners association, the individual or company contracted for maintenance, owner, etc.



# **APPENDIX 3B**

Checklists - Detention, Retention, and  
Impoundment BMPs

**Design and Plan Review Checklist**

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**Applicant:** \_\_\_\_\_ **Phone No.:** \_\_\_\_\_  
**Designer:** \_\_\_\_\_ **Phone No.:** \_\_\_\_\_  
**Project Name:** \_\_\_\_\_  
**Location:** \_\_\_\_\_  
**Type of Facility and Identification No.:** \_\_\_\_\_

**Plan status:** \_\_\_\_\_ approved  
 \_\_\_\_\_ not approved

**Legend:**           - Complete  
                   Inc. - Incomplete/Incorrect  
                   N/A - Not Applicable

**I.     SUPPORTING DATA**

\_\_\_\_\_ Narrative describing stormwater management strategy including all assumptions made in the design.

**A.     Drainage Area Map**

- \_\_\_\_\_ Site and drainage area boundaries
- \_\_\_\_\_ Off-site drainage areas
- \_\_\_\_\_ Pre- and post-developed land uses with corresponding acreage
- \_\_\_\_\_ Pre- and post-developed time of concentration flow paths
- \_\_\_\_\_ Existing and proposed topographic features
- \_\_\_\_\_ Drainage area appropriate for BMP

**B.     Soils Investigation**

- \_\_\_\_\_ Soils map with site and drainage area outlined
- \_\_\_\_\_ Geotechnical report with recommendations and earthwork specifications
- \_\_\_\_\_ Boring locations
  - \_\_\_\_\_ Borrow area
  - \_\_\_\_\_ Basin pool area
  - \_\_\_\_\_ Embankment area: centerline principal spillway, emergency spillway , abutments
- \_\_\_\_\_ Boring logs with Unified Soils Classifications, soil descriptions, depth to seasonal high groundwater table, depth to bedrock, etc.
- \_\_\_\_\_ Compaction requirements specified
- \_\_\_\_\_ Additional geophysical investigation and recommendations in Karst environment

**Design and Plan Review Checklist**

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**II. COMPUTATIONS****A. Hydrology**

- \_\_\_\_\_ Runoff curve number determinations: pre- and post-developed conditions, with worksheets.
- \_\_\_\_\_ Time of concentration: pre- and post-developed conditions, with worksheets.
- \_\_\_\_\_ Hydrograph generation: pre- and post-developed condition for appropriate design and safety storms (SCS methods or modified rational-critical storm duration method)

**B. Hydraulics**

- \_\_\_\_\_ Specify assumptions and coefficients used.
- \_\_\_\_\_ Stage-storage table and curve
- \_\_\_\_\_ Riser structure and barrel
  - \_\_\_\_\_ Weir/orifice control analysis for riser structure discharge openings
  - \_\_\_\_\_ Weir/orifice control analysis for riser crest
  - \_\_\_\_\_ Barrel: inlet/outlet control analysis
  - \_\_\_\_\_ Riser/Outlet Structure flotation analysis (factor of safety = 1.25 min.).
  - \_\_\_\_\_ Anti-seep collar or filter diaphragm design.
  - \_\_\_\_\_ Outlet protection per VE&SCH Std. & Spec. 3.18.
  - \_\_\_\_\_ Provisions for use as a temporary sediment basin riser with clean out schedule & instructions for conversion to a permanent facility.
- \_\_\_\_\_ Emergency spillway adequacy/capacity analysis with required embankment freeboard.
- \_\_\_\_\_ Stage - discharge table and curve (provide equations & cite references).
- \_\_\_\_\_ Storm drainage & hydraulic grade line calculations.
- \_\_\_\_\_ Reservoir routing of post-development hydrographs for appropriate design storms (2-yr., 10-yr., or as required by watershed conditions) & safety storms (100-yr. or as required).

**C. Downstream impacts**

- \_\_\_\_\_ Danger reach study.
- \_\_\_\_\_ 100 year floodplain impacts.
- \_\_\_\_\_ "Adequate channel" calculations for receiving channel
- \_\_\_\_\_ Provide downstream hydrographs at critical study points.
- \_\_\_\_\_ Storm drainage plans for site areas not draining to BMP
  - \_\_\_\_\_ Safe conveyance - MS-19
  - \_\_\_\_\_ Areas compensated for in water quality performance-based criteria calculations

**Design and Plan Review Checklist**

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**D. Water Quality**

- Impervious cover tabulation
- Technology-based criteria: proper selection of BMP based on impervious cover
- Performance-based criteria: pre- and post-developed pollutant load and pollutant removal requirement calculations (provide worksheets)
- Water quality volume for retention basin I, II, or III permanent pool
- Water quality volume for ext. detention and ext. detention enhanced with drawdown calculations
- Proper surface area/depth allocations for permanent pool/shallow marsh/constructed wetland
- Constructed stormwater wetland / shallow marsh
  - Adequate drainage area and/or base flow
  - Adequate pool volume
  - Adequate surface area
  - Allocation of surface area to depth zones
  - Maximum ponding depth over pool surface specified

**III. PLAN REQUIREMENTS****A. General Items**

- Plan view drawn at 1"=50' or less (40', 30', etc.)
- North arrow
- Legend
- Location plan and vicinity map
- Property lines
- Existing & proposed contours ( 2' contour interval min.)
- Existing features & proposed improvements (including utilities and protective measures)
- Locations of test borings
- Earthwork specifications
- Construction sequence for SWM basin and E&S controls
- Temporary erosion & sediment control measures
- Conveyance of base flow during construction
- Temporary and permanent stabilization requirements
  - Emergency spillway
  - Basin side slopes

**Design and Plan Review Checklist**

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- Basin bottom
- Delineation of FEMA 100 year floodplain
- Plans sealed by a qualified licensed professional

**B. BMP Plan Views**

- Dimensions of basin features: perm. Pool, sediment forebay, embankment, etc.
- Location of all conveyance system outfalls into basin
  - Proper orientation to avoid short circuiting
  - Outlet protection per VE&SCH
- Top of bank & basin bottom elevations
- Elevations of permanent pool, water quality volume and max. design water surface elevations for all appropriate design storms and safety storms
- Side slope (H:V) of basin storage area and embankment (upstream and downstream slopes)
- Proper length-to-width ratio as specified in BMP design criteria
- Pervious** low flow channel
- Sediment forebay
- Basin bottom slope
- Maintenance access to sediment forebay, riser structure, and one side of the basin ponding area
- Peripheral ledge for safety
- Aquatic Bench
- Shoreline protection
- Safety fence
- Riser and barrel materials and dimensions labeled
- Constructed stormwater wetland / shallow marsh
  - Basin liner specifications
  - Pool depth zones identified on plan
  - Pool geometry - wet/dry weather flow path



**Design and Plan Review Checklist**

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**C. BMP - Section Views & Related Details****1. Embankment (or dam) and Ponding Areas**

- \_\_\_\_\_ Elevations of permanent pool, water quality volume and max. design water surface elevations for all appropriate design storms and safety storms
- \_\_\_\_\_ Top of dam elevations- constructed height and settled height (10% settlement).
- \_\_\_\_\_ Adequate freeboard
- \_\_\_\_\_ Top width labeled
- \_\_\_\_\_ Elevation of crest of emergency spillway
- \_\_\_\_\_ Emergency spillway w/ side slopes labeled.
- \_\_\_\_\_ Emergency spillway inlet, level, and outlet sections labeled
- \_\_\_\_\_ Existing ground and proposed improvements profile along center line of embankment
- \_\_\_\_\_ Existing ground and proposed improvements profile along center line of principal spillway
- \_\_\_\_\_ Typical grading section through pond including typical side slopes with aquatic bench, safety ledge, shoreline protection, etc.
- \_\_\_\_\_ Existing ground and proposed improvements along center line of emergency spillway
- \_\_\_\_\_ Dimensions of zones for zoned embankment

**2. Seepage Control**

- \_\_\_\_\_ Impervious lining
- \_\_\_\_\_ Phreatic line (4:1 slope measured from the principal spillway design high water).

**a. Anti-seep Collar**

- \_\_\_\_\_ Anti-seep collar (detail reqd..).
- \_\_\_\_\_ Size (based upon 15% increase in seepage length).
- \_\_\_\_\_ Spacing & location on barrel (at least 2' from pipe joint).

**b. Filter Diaphragm**

- \_\_\_\_\_ Design certified by a professional geotechnical engineer.

**3. Foundation Cut Off Trench or Key Trench**

- \_\_\_\_\_ Materials labeled
- \_\_\_\_\_ Bottom width (4' min. or greater per geotech. report).
- \_\_\_\_\_ Side slopes labeled (1:1 max. steepness).
- \_\_\_\_\_ Depth (4' min. or as specified in geotechnical report)

**Design and Plan Review Checklist**

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**4. Multi Stage Riser and Barrel System**

- Materials labeled
- Bedding or cradle details provided
- Gauge & corrugation size for metal pipes specified
- Barrel diameter, inverts, and slope (%) labeled
- Outlet protection per VESCH, Std. & Spec. 3.18, 3.19 w/ filter cloth underlayment
- Crest elevation of riser structure shown
- Inverts and dimensions of control release orifices/weirs shown
- Structure dimensions shown
- Control orifice/weir dimensions shown
- Extended detention orifice protection (detail required for construction)
- Riser trash rack or screen (detail reqd.. for construction).
- Riser anti-vortex device (detail reqd.. for construction).
- Proper riser structure footing.
- Access to riser structure interior for maintenance.
- Basin drain pipe

**D. Landscape Plan**

- Planting schedule and specifications (transport / storage / installation / maintenance)
- Plant selection for planting zones 1 thru 6
- Preservation measures for existing vegetation
- Top soil / planting soil included in final grading

**E. Maintenance Items**

- Person or organization responsible for maintenance.
- Maintenance narrative which describes the long-term maintenance requirements of the facility and all components.
- Facility access from public R/W or roadway.
- Maintenance easement.

**Design and Plan Review Checklist**

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**COMMENTS**

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BY: \_\_\_\_\_

DATE: \_\_\_\_\_

**Construction Inspection and As-Built Survey Checklist**

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**Applicant:** \_\_\_\_\_ **Phone No.:** \_\_\_\_\_**Designer:** \_\_\_\_\_ **Phone No.:** \_\_\_\_\_**Project Name :** \_\_\_\_\_**Location:** \_\_\_\_\_**Contractor:** \_\_\_\_\_ **Phone No.:** \_\_\_\_\_**Permit No.:** \_\_\_\_\_**Type of Facility and Identification No.** \_\_\_\_\_

A separate checklist is to be completed for separate BMPs, should more than one be used at a given project.

\* Key - ( T ) If acceptable

( Inc. ) If not adequate, explanation at the end of a section is required

(NA) If not applicable

**I. INSPECTION LOGS and TEST DOCUMENTATION****A. Earthwork**

\_\_\_\_\_ The results and interpretation of geo-physical testing in areas of karst formation (west of the Blue Ridge) or geo-technical analysis (boring log data) of underlying strata elsewhere in the state

\_\_\_\_\_ Verification of removal of all unsuitable material beneath dam embankment and footing

\_\_\_\_\_ Verification of fill classification/suitability for use in the embankment

\_\_\_\_\_ Verification of proper installation of cut-off trench

\_\_\_\_\_ Verification of soil impermeability for material used in the liner, and proper liner thickness

\_\_\_\_\_ Multiple compaction test results indicating adequacy throughout the embankment section including areas adjacent to the outlet conduit and any seepage control measures.

\_\_\_\_\_ Verification that underlying bedrock and/or the water table does not interfere with the impoundment

\_\_\_\_\_ Verification of dimensions of sub surface features such as the riser structure footing, anti seep collars, filter and drainage diaphragm, etc.

**B. Materials**

\_\_\_\_\_ Riprap size distribution and composition

\_\_\_\_\_ Inlet shaping (within the control structure and system manholes)

\_\_\_\_\_ Trash rack construction/coatings

\_\_\_\_\_ Trash rack; method of installation

\_\_\_\_\_ Shop drawings for control structure detailing dimensions, elevations, and reinforcing information

\_\_\_\_\_ Verification of structure reinforcement and water tight connections

**Construction Inspection and As-Built Survey Checklist**

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- \_\_\_\_\_ Low-flow channel lining
- \_\_\_\_\_ Outlet barrel size/construction type/length
- \_\_\_\_\_ Outlet protection
- \_\_\_\_\_ Anti-vortex device

(Comments)

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**II. DIMENSIONS and ELEVATIONS SURVEY (Red Lined Plan Sheets)**

- \_\_\_\_\_ Top width, and side slopes (profile) of dam embankment
- \_\_\_\_\_ Inverts and slope (%) of outlet conduit
- \_\_\_\_\_ Elevation and cross section of the emergency spillway
- \_\_\_\_\_ Principal spillway profile including elevations and geometry of riser control orifices and/or weirs
- \_\_\_\_\_ Cast-in-place control structure dimensions/elevations
- \_\_\_\_\_ Riser crest and invert of control structure
- \_\_\_\_\_ Outlet protection
- \_\_\_\_\_ Contours of the ponding area
- \_\_\_\_\_ Slope(s) of storm sewer system conduit with inverts in and out for each pipe
- \_\_\_\_\_ Slope and cross-section of all on-site channels

(Comments)

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**II. CERTIFICATIONS**

- \_\_\_\_\_ Certification's from manufacturers for materials used
- \_\_\_\_\_ Seeding tickets and specifications
- \_\_\_\_\_ Certification statement and seal by licensed professional indicating the as-built drawing is accurate, complete and constructed per the approved plan

**Operation and Maintenance Checklist**

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	YES / NO	REPAIR	INVESTIGATE	Inspector Name: _____ _____ Inspection Date: _____ _____ Type of BMP: _____ _____
Item				Comments
<b>I. EMBANKMENT</b>				
<b>A. Crest</b>				
1. Visual settlement				
2. Misalignment				
3. Cracking				
<b>B. Upstream slope</b>				
1. Erosion				
2. Adequate groundcover				
3. Trees, shrubs or other				
4. Cracks, settlements or bulges				
5. Rodent holes				
<b>C. Downstream slope</b>				
1. Erosion				
2. Adequate groundcover				
3. Trees, shrubs or other				
4. Cracks, settlements or bulges				
5. Rodent holes				
<b>D. Abutments</b>				
1. Erosion				
2. Seepage				
3. Cracks				

**Operation and Maintenance Checklist**

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	YES / NO	REPAIR	INVESTIGATE	Inspector Name: _____ -- Inspection Date: _____ Type of
<b>E. Drainage, seepage control</b>				
1. Internal drains flowing				
2. Seepage at toe				
<b>II. EMERGENCY SPILLWAY</b>				
1. Eroding or backcutting				
2. Obstructed				
3. Leaking				
4. Operational				
<b>IV. PRINCIPAL SPILLWAY BARREL</b>				
1. Seepage into conduit				
2. Debris present				
3. Displaced or offset joints				
<b>V. OUTLET PROTECTION/ STILLING BASIN</b>				
1. Obstructed				
2. Adequate riprap				
3. Undercutting at outlet				
4. Outlet channel scour				
<b>VI. BASIN &amp; UPLAND BUFFER AREA</b>				
<b>A. Low flow channel</b>				
1. Erosion				
2. Adequate vegetation				
3. Obstructed				

## Operation and Maintenance Checklist

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	YES / NO	REPAIR	INVESTIGATE	Inspector Name: _____ Inspection Date: _____ Type of BMP: _____
<b>B. Basin bottom &amp; side slopes</b>				
1. Erosion				
2. Adequate stabilization				
3. Sediment accumulation				
4. Floating debris				
5. High water marks				
6. Shoreline protection				
<b>C. Inflow channels/pipes</b>				
1. Erosion				
2. Adequate stabilization				
3. Undercutting				
<b>D. Sediment forebay</b>				
1. Sediment accumulation				
2. Stable overflow into basin				
<b>E. Upland landscaping</b>				
<b>F. Aquatic landscaping</b>				



# **APPENDIX 3C**

Checklists - Infiltration BMPs

**Design and Plan Review Checklist**

Page 1 of 5

Applicant: \_\_\_\_\_ Phone No.: \_\_\_\_\_

Designer: \_\_\_\_\_ Phone No.: \_\_\_\_\_

Project Name: \_\_\_\_\_

Location: \_\_\_\_\_

Type of Facility and Identification No.: \_\_\_\_\_

***Plan status:***

\_\_\_\_\_ approved

\_\_\_\_\_ not approved

***Legend:***      - Complete      - Incomplete/Incorrect      - Not Applicable**I. SUPPORTING DATA**

\_\_\_\_\_ Narrative describing stormwater management strategy including all assumptions made in the design.

(Infiltration basin, infiltration trench, roof downspout system, porous pavement)

**A. Drainage Area Map**

\_\_\_\_\_ Site and drainage area boundaries

\_\_\_\_\_ Off-site drainage areas

\_\_\_\_\_ Pre- and post-developed land uses with corresponding acreage

\_\_\_\_\_ Pre- and post-developed time of concentration flow paths

\_\_\_\_\_ Existing and proposed topographic features

\_\_\_\_\_ Drainage area appropriate for BMP

**B. Soils Investigation**

\_\_\_\_\_ Soils map with site and drainage area outlined

\_\_\_\_\_ Geotechnical report verifying suitability for infiltration ( $0.52"/hr \leq f < 8.27"/hr$ )

\_\_\_\_\_ Boring locations

\_\_\_\_\_ Boring logs with Unified Soils Classifications

\_\_\_\_\_ Soil descriptions

\_\_\_\_\_ Depth to seasonal high groundwater (2' to 4' below design bottom of facility, min.)

\_\_\_\_\_ Depth to bedrock (2' to 4' below design bottom of facility, min.)

\_\_\_\_\_ Verification of absence of karst topography

**Design and Plan Review Checklist**

Page 2 of 5

**C. Topographic Conditions**

- Meets minimum slope requirements
  - Porous pavement:  $s < 3\%$  (20H:1V)
  - All other infiltration facilities:  $s < 20\%$  (5H:1V)

**II. COMPUTATIONS****A. Hydrology**

- Runoff curve number determinations: pre- and post-developed conditions, with worksheets.
- Time of concentration: pre- and post-developed conditions, with worksheets.
- Hydrograph generation: pre- and post-developed condition for appropriate design and safety storms (SCS methods or modified rational-critical storm duration method)

**B. Hydraulics**

- 48 hour drain time provided
- Specify assumptions and coefficients used.
- Stage-storage table and curve (void ratio of 0.4 for stone storage)
- Riser structure and barrel for large storm overflow or bypass
- Emergency spillway adequacy/capacity analysis with required embankment freeboard for infiltration basins
- Storm drainage & hydraulic grade line calculations.

**D. Water Quality**

- Impervious cover tabulation
- Technology-based criteria: proper selection of BMP based on impervious cover
- Performance-based criteria: pre- and post-developed pollutant load and pollutant removal requirement calculations (provide worksheets)
- Water quality volume for desired target phosphorus removal efficiency.

**Design and Plan Review Checklist**

Page 3 of 5

**III. PLAN REQUIREMENTS****A. General Items**

- \_\_\_\_\_ Plan view drawn at 1"=50' or less (40', 30', etc.)
  - \_\_\_\_\_ North arrow
  - \_\_\_\_\_ Legend
  - \_\_\_\_\_ Location plan and vicinity map
  - \_\_\_\_\_ Property lines
  - \_\_\_\_\_ Existing & proposed contours ( 2' contour interval min.)
  - \_\_\_\_\_ Existing features & proposed improvements (including utilities and protective measures)
  - \_\_\_\_\_ Locations of test borings
  - \_\_\_\_\_ Construction sequence
    - \_\_\_\_\_ Infiltration BMP to be constructed after site work is completed and stabilization measures have been implemented
    - \_\_\_\_\_ traffic control
  - \_\_\_\_\_ Temporary erosion & sediment control measures
  - \_\_\_\_\_ Temporary and permanent stabilization requirements
    - \_\_\_\_\_ Infiltration basin emergency spillway
    - \_\_\_\_\_ Infiltration basin side slopes
  - \_\_\_\_\_ Construction specifications
    - \_\_\_\_\_ Infiltration basin bottom surface preparation
    - \_\_\_\_\_ Infiltration trench bottom surface preparation
    - \_\_\_\_\_ Infiltration trench filter fabric laydown
    - \_\_\_\_\_ Infiltration trench aggregate placement
  - \_\_\_\_\_ Plans sealed by a qualified licensed professional
- 
- B. BMP Plan Views**
- \_\_\_\_\_ Dimensions of infiltration facility
  - \_\_\_\_\_ Location of all conveyance system outfalls into basin with pretreatment and outlet protection per VE&SCH

**Design and Plan Review Checklist**

Page 4 of 5

- \_\_\_\_\_ Infiltration basin
  - \_\_\_\_\_ Top of bank & basin bottom elevations
  - \_\_\_\_\_ Elevations of water quality volume and max. design water surface elevations for all appropriate design storms and safety storms
  - \_\_\_\_\_ Side slope (H:V) of basin storage area and embankment (upstream and downstream slopes)
  - \_\_\_\_\_ Sediment forebay
  - \_\_\_\_\_ Maintenance access to sediment forebay and riser structure
- \_\_\_\_\_ Safety fence
- \_\_\_\_\_ Observation well

**C. BMP - Section Views & Related Details****1. Infiltration Basin**

- \_\_\_\_\_ Elevations of water quality volume and max. design water surface elevations for all appropriate design storms and safety storms
- \_\_\_\_\_ Top of dam elevations- constructed height and settled height (10% settlement).
- \_\_\_\_\_ Adequate freeboard
- \_\_\_\_\_ Top width labeled
- \_\_\_\_\_ Elevation of crest of emergency spillway
- \_\_\_\_\_ Principal/emergency spillway w/ side slopes labeled.
- \_\_\_\_\_ Principal/emergency spillway inlet, level, and outlet sections labeled
- \_\_\_\_\_ Existing ground and proposed improvements profile along center line of embankment
- \_\_\_\_\_ Existing ground and proposed improvements profile along center line of principal spillway
- \_\_\_\_\_ Typical grading section through basin
- \_\_\_\_\_ Existing ground and proposed improvements along center line of emergency spillway
- \_\_\_\_\_ Dimensions of zones for zoned embankment
- \_\_\_\_\_ Foundation Cut Off Trench or Key Trench
  - \_\_\_\_\_ Materials labeled
  - \_\_\_\_\_ Bottom width (4' min. or greater per geotech. report).
  - \_\_\_\_\_ Side slopes labeled (1:1 max. steepness).
  - \_\_\_\_\_ Depth (4' min. or as specified in geotechnical report)

**Design and Plan Review Checklist**

Page 5 of 5

**2. Infiltration Trench**

- Dimensions provided
- Backfill material specified
  - Stone storage: clean VDOT No. 1 Open Graded Course Aggregate or equal
  - Bottom sand layer: VDOT Fine Aggregate, Grading A or B
- Filter Fabric
- Observation well

**3. Porous Pavement**

- Subgrade preparation
- Aggregate
  - Filter course: clean VDOT No. 57 Open Graded Course Aggregate or equal
  - Reservoir course: clean VDOT No. 3 Open Graded Course Aggregate or equal
  - Sand layer: VDOT Fine Aggregate, Grading A or B
- Porous asphalt surface course

**E. Maintenance Items**

- Person or organization responsible for maintenance.
- Maintenance narrative which describes the long-term maintenance requirements of the facility and all components.
- Facility access from public R/W or roadway.
- Maintenance easement.

**COMMENTS**

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BY: \_\_\_\_\_

DATE: \_\_\_\_\_

**Construction Inspection and As-Built Survey Checklist**

Page 1 of 2

Applicant: \_\_\_\_\_ Phone No.: \_\_\_\_\_

Designer: \_\_\_\_\_ Phone No.: \_\_\_\_\_

Project Name: \_\_\_\_\_

Location: \_\_\_\_\_

Contractor: \_\_\_\_\_ Phone No.: \_\_\_\_\_

Permit No.: \_\_\_\_\_

Type of Facility and Identification No. \_\_\_\_\_

A separate checklist is to be completed for each BMP, should more than one be used at a given project.

\* Key - ( T ) If acceptable

( Inc. ) If not adequate, explanation at the end of a section is required

(NA) If not applicable

**I. INSPECTION LOGS and TEST DOCUMENTATION****A. Flow splitter / Overflow**

\_\_\_\_\_ Overflow invert at correct elevation

\_\_\_\_\_ Inflow pipe plugged prior to full site stabilization

**B. Earthwork**

\_\_\_\_\_ The results and interpretation of geo-physical testing in areas of karst formation (west of the Blue Ridge) or geo-technical analysis (boring log data) of underlying strata elsewhere in the state

\_\_\_\_\_ Infiltration rate of soils

\_\_\_\_\_ Depth to seasonal watertable

\_\_\_\_\_ Depth to bedrock

\_\_\_\_\_ Verification of removal of all unsuitable material beneath dam embankment and footing

\_\_\_\_\_ Verification of fill classification/suitability for use in the embankment

\_\_\_\_\_ Verification of proper installation of cut-off trench

\_\_\_\_\_ Multiple compaction test results indicating adequacy throughout the embankment section including areas adjacent to the outlet conduit and any seepage control measures.

\_\_\_\_\_ Verification that underlying bedrock and/or the water table does not interfere with the impoundment

\_\_\_\_\_ Verification of dimensions of sub surface features such as the riser structure footing, anti seep collars, filter and drainage diaphragm, etc.

**B. Materials**

\_\_\_\_\_ Stone aggregate size, composition, and placement

\_\_\_\_\_ Filter fabric placement

**Construction Inspection and As-Built Survey Checklist**

Page 2 of 2

**C. Sequence of Construction**

- Site stabilization prior to facility construction
- Traffic control

(Comments)

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**II. DIMENSIONS and ELEVATIONS SURVEY (Red Lined Plan Sheets)**

- Invert and diameter/geometry of flow splitter, overflow pipes, and channels
- Top width, and side slopes (profile) of dam embankment
- Dimensions of storage area
- Elevation and cross section of the emergency / principal spillway
- Outlet protection
- Contours of the ponding area
- Slope and cross-section of all on-site channels

(Comments)

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**II. CERTIFICATIONS**

- Certification's from manufacturers for materials used
- Seeding tickets and specifications
- Certification statement and seal by licensed professional indicating the as-built drawing is accurate, complete and constructed per the approved plan



**Operation and Maintenance Checklist**

Page 1 of 2

Date \_\_\_\_\_

Project \_\_\_\_\_ Site Plan / SUP Number \_\_\_\_\_

Location \_\_\_\_\_ Date Placed in Service \_\_\_\_\_

Date of Last Inspection \_\_\_\_\_ Inspector \_\_\_\_\_

Owner/Owner's Representative \_\_\_\_\_

"As Built" Plans available: Y/N

	<u>Satisfactory</u>	<u>Unsatisfactory</u>
<b>1. Debris cleanout</b>		
Contributing areas clean of debris	_____	_____
Filtration facility clean of debris	_____	_____
Inlets and outlets clear of debris	_____	_____
<b>2. Vegetation</b>		
Contributing drainage area stabilized	_____	_____
No evidence of erosion	_____	_____
Area mowed and clippings removed	_____	_____
<b>3. Clogging</b>		
No evidence of surface clogging	_____	_____
Observation well clear of water within 48 hrs of storm event	_____	_____
<b>4. Structural components</b>		
No evidence of structural deterioration	_____	_____
Any grates are in good condition	_____	_____
No evidence of spalling or cracking of structural parts	_____	_____

**Operation and Maintenance Checklist**

Page 2 of 2

Site Plan/SUP Number \_\_\_\_\_ Date: \_\_\_\_\_

	<u>Satisfactory</u>	<u>Unsatisfactory</u>
<b>6. Outlets/overflow spillway</b>		
Good condition, no need for repair	_____	_____
No evidence of erosion (if draining into a natural channel)	_____	_____
<b>8. Overall function of facility</b>		
No evidence of flow bypassing facility	_____	_____
No standing water	_____	_____

**Action to be taken:**

If any of the answers to the above items are checked unsatisfactory, a time frame shall be established for their correction or repair.

No action necessary. Continue routine inspections \_\_\_\_\_

Correct noted facility deficiencies by \_\_\_\_\_

Facility repairs were indicated and completed. Site reinspection is necessary to verify corrections or repairs.

Site reinspection accomplished on \_\_\_\_\_

Site reinspection was satisfactory. Next routine inspection is scheduled for approximately: \_\_\_\_\_

\_\_\_\_\_  
Signature of inspector

# **APPENDIX 3D**

Checklists - Intermittent Sand Filters

**Construction Inspection and As-Built Survey Checklist**

Page 1 of 3

Date \_\_\_\_\_

Project \_\_\_\_\_

Site Plan / SUP Number \_\_\_\_\_

Location \_\_\_\_\_

Date BMP Placed in Service \_\_\_\_\_

Individual(s) Conducting the Inspection \_\_\_\_\_

"As Built" Plans available Y/N

**Warning:** If filtration facility has a watertight cover; be careful regarding the possibility of flammable gases within the facility. Care should be taken lighting a match or smoking while inspecting facilities that are not vented. If filtration facility is in a completely enclosed vault, OSHA Confined Space Entry procedures must be followed.

	<u>Satisfactory</u>	Observed and Confirmed by (Initial) _____
<b>1. Flow Splitter</b>		
Overflow invert at correct elevation	_____	_____
Inflow pipe to filter plugged with watertight seal prior to site stabilization	_____	_____
<b>2. Filter Shell</b> ( Note: Separate structural inspections of the filter shell must be conducted and documented during construction)		
Specified number and type of manhole covers and hatches installed	_____	_____
No evidence of structural defects ("honeycombing", etc)	_____	_____
Access ladders installed as specified	_____	_____
Shell completely cleaned of construction debris, dirt, etc.	_____	_____
Dewatering drain meets specs and holds water	_____	_____
Dewatering drain penetration sealed with specified water stop	_____	_____
<b>3. Watertight Integrity Test of Filter Shell</b>		
Watertight plug installed in outflow pipe	_____	_____
Elevation of shell bottom observed at _____ ft.	_____	_____
Filled with water to bottom of top slab at _____ (Time/date)	_____	_____
Top of water elevation observed at _____ ft.	_____	_____
Observed 24-hour drawdown at _____ (Time/date)	_____	_____
Top of water elevation after drawdown observed at _____ ft.	_____	_____
Footprint of wetted shell (from drawings) is _____ ft. <sup>2</sup>	_____	_____
Volume of water lost (footprint x elevation drop) = _____ ft. <sup>3</sup>	_____	_____
Volume of initial water (footprint x depth of water) = _____ ft. <sup>3</sup>	_____	_____
Percent of initial volume lost = _____ %	_____	_____

**Note:** If shell had ≤ five % water loss, the shell is satisfactory. If the shell had > five % water loss, find and seal leaks and retest until five % limit is achieved.

**Construction Inspection and As-Built Survey Checklist**

Page 2 of 3

Site Plan/SUP Number \_\_\_\_\_ Date: \_\_\_\_\_

	<u>Satisfactory</u>	Observed and Confirmed by <u>(Initial)</u>
<b>4. Basin(s) and Basin Liner(s) (Where Applicable)</b>		
Basin(s) graded in conformance with plan	_____	_____
Basin liner material(s) conforms to specifications (attach 6" x 6" sample)	_____	_____
Basin liner installation(s) conforms to plans & specifications	_____	_____
<b>5. Collector System</b>		
Collector pipes meet specs and hole patterns are correct	_____	_____
Collector pipes wrapped in geotextile meeting specs (attach labeled 6" x 6" sample)	_____	_____
Specified galvanized hardware cloth installed over weepholes (if used)	_____	_____
Collector gravel meets specs and is installed to design depth	_____	_____
Pea gravel (if used) meets spec and is installed to design depth	_____	_____
Geotextile fabric beneath sand meets spec (attach labeled 6" x 6" sample) and is lapped at least 6" up all 4 sides	_____	_____
<b>6. Filter Components</b>		
Filter sand meets specifications (attach lab report showing gradation, effective size and uniformity coefficient)	_____	_____
Filter sand installed to design depth, hydraulically compacted on _____ (Date) , and refilled to design depth	_____	_____
Filter top geotextile (if used) meets spec (attach labeled 6" x 6" sample) and is lapped up all four sides	_____	_____
Filter top ballast(if used) meets specs and is installed to design depth	_____	_____
<b>7. Clearwell</b>		
Clearwell is free of construction debris and dirt	_____	_____
Outflow pipe invert is at the design elevation	_____	_____
Pump (where applicable) meets specs (attach catalog cuts)	_____	_____
Wiring (where applicable) is in waterproof conduits ( <b>Note:</b> electrical wiring requires separate building code inspection)	_____	_____
Panel box (where applicable) is well marked (attach wiring diagram)	_____	_____
<b>8. Upflow Gravel Prefilter (where used)</b>		
Bottom grate meets spec and installed at design elevation	_____	_____
Bottom geometries (if used) meets spec and properly installed	_____	_____
Large bottom stone meets spec and installed to design depth	_____	_____
Pea gravel meets spec and installed to design depth	_____	_____

**Construction Inspection and As-Built Survey Checklist**

Page 3 of 3

Site Plan/SUP Number \_\_\_\_\_ Date: \_\_\_\_\_

	<u>Satisfactory</u>	Observed and Confirmed by <u>(Initial)</u>
<b>9. Monitoring Manholes (where required)</b>		
Manhole shells and covers conform to specs	_____	_____
Inflow and outflow pipe slopes are as specified	_____	_____
Straight pipe runs through manholes are as specified (no bends)	_____	_____
Manholes and pipes are flushed clean	_____	_____

**Note:** If any of the answers under items 1 - 9 above are checked unsatisfactory, a time frame shall be established for their correction or and a reinspection shall be scheduled. A new form shall be completely filled out at the time of the reinspection. Only the form documenting completely satisfactory performance shall be submitted to the governing jurisdiction for certification. All persons initialing this form shall complete the table below:

Initial	Full Name	Signature	Title/Position and Organization

**CERTIFICATION:** Based on the above, I certify that the Best Management Practice covered by this report is constructed in accordance with the approved Final Site Plan and as designed.

\_\_\_\_\_  
(Signature)

\_\_\_\_\_  
(Typed Name and Title)  
(Place professional seal on certification)

**Operation and Maintenance Checklist**

Page 1 of 2

Date \_\_\_\_\_

Project \_\_\_\_\_ Site Plan / SUP Number \_\_\_\_\_

Location \_\_\_\_\_ Date Placed in Service: \_\_\_\_\_

Date of Last Inspection \_\_\_\_\_ Inspector \_\_\_\_\_

Owner/Owner's Representative \_\_\_\_\_

"As Built" Plans available: Y/N Sand Filter Type: \_\_\_\_\_

**Warning:** If filtration facility has a watertight cover; be careful regarding the possibility of flammable gases within the facility. Care should be taken lighting a match or smoking while inspecting facilities that are not vented. If filtration facility is in a completely enclosed vault, OSHA Confined Space Entry Procedures must be followed.

	<u>Satisfactory</u>	<u>Unsatisfactory</u>
<b>1. Debris cleanout</b>		
Contributing areas clean of debris	_____	_____
Filtration facility clean of debris	_____	_____
Inlets and outlets clear of debris	_____	_____
<b>2. Vegetation</b>		
Contributing drainage area stabilized	_____	_____
No evidence of erosion	_____	_____
Area mowed and clippings removed	_____	_____
<b>3. Oil and grease</b>		
No evidence of filter surface clogging	_____	_____
Activities in drainage area minimize oil & grease entry	_____	_____
<b>4. Water retention where required</b>		
Water holding chambers at normal pool	_____	_____
No evidence of leakage	_____	_____
<b>5. Sediment deposition</b>		
Filtration chamber clean of sediments	_____	_____
Water chambers not more than 1/2 full of sediments	_____	_____

**Operation and Maintenance Checklist**

Page 2 of 2

Site Plan/SUP Number \_\_\_\_\_ Date: \_\_\_\_\_

	<u>Satisfactory</u>	<u>Unsatisfactory</u>
<b>6. Structural components</b>		
No evidence of structural deterioration	_____	_____
Any grates are in good condition	_____	_____
No evidence of spalling or cracking of structural parts	_____	_____
<b>7. Outlets/overflow spillway</b>		
Good condition, no need for repair	_____	_____
No evidence of erosion (if draining into a natural channel)	_____	_____
<b>8. Overall function of facility</b>		
No evidence of flow bypassing facility	_____	_____
No noticeable odors outside of facility	_____	_____
<b>9. Pump (Where Applicable)</b>		
Catalog cuts and wiring diagram for pump available	_____	_____
Waterproof conduits for wiring appear to be intact	_____	_____
Panel box is well marked	_____	_____
No evidence of pump failure (excess water in pump well, etc.)	_____	_____

**Action to be taken:**

If any of the answers to the above items are checked unsatisfactory, a time frame shall be established for their correction or repair.

No action necessary. Continue routine inspections \_\_\_\_\_  
 Correct noted facility deficiencies by \_\_\_\_\_

Facility repairs were indicated and completed. Site reinspection is necessary to verify corrections or repairs.

Site reinspection accomplished on \_\_\_\_\_

Site reinspection was satisfactory. Next routine inspection is scheduled for approximately: \_\_\_\_\_

\_\_\_\_\_  
 Signature of inspector



# **APPENDIX 3E**

Checklists - Bioretention

**Plant Selection and Site Consideration Checklist**

Page 1 of 2

Date \_\_\_\_\_

**I. General Site Information**

Site Plan / SUP Number \_\_\_\_\_

Project Name \_\_\_\_\_

Size of development \_\_\_\_\_

Drainage area size \_\_\_\_\_

**II. Plant Material Layout Considerations**

A. Site Design Considerations

Importance of aesthetics \_\_\_\_\_  
\_\_\_\_\_

Important visual characteristics (foliage, form, etc.) \_\_\_\_\_  
\_\_\_\_\_

Visibility and traffic considerations \_\_\_\_\_  
\_\_\_\_\_

Other safety issues \_\_\_\_\_

Conflict with any structural components of site (proposed powerlines, pipes) \_\_\_\_\_  
\_\_\_\_\_

General comments \_\_\_\_\_  
\_\_\_\_\_

**Plant Selection and Site Consideration Checklist**

Page 2 of 2

Site Plan/SUP Number \_\_\_\_\_ Date: \_\_\_\_\_

**B. Ecological Factors**

Insect and disease infestation on or near site \_\_\_\_\_  
\_\_\_\_\_

Wind exposure \_\_\_\_\_

Sun exposure \_\_\_\_\_

Effects upon bioretention area from adjacent plant communities \_\_\_\_\_  
\_\_\_\_\_

Wildlife benefits be included in plant material layout \_\_\_\_\_  
\_\_\_\_\_

**Construction Inspection and As-Built Checklist**

Page 1 of 2

Date \_\_\_\_\_

Project \_\_\_\_\_ Site Plan / SUP Number \_\_\_\_\_

Location \_\_\_\_\_ Date BMP Placed in Service \_\_\_\_\_

Individual(s) Conducting the Inspection \_\_\_\_\_

"As Built" Plans available: Y/N

**Warning:** If any bioretention facility component has a watertight cover; be careful regarding the possibility of flammable gases within the facility. Care should be taken lighting a match or smoking while inspecting facilities that are not vented.

	<u>Satisfactory</u>	Observed and Confirmed by <u>(Initial)</u>
<b>1. Flow Splitter or Overflow Drain</b>		
Overflow Invert at correct elevation	_____	_____
Inflow pipe to filter plugged with watertight seal prior to site stabilization (where applicable)	_____	_____
<b>2. Basin(s) and Basin Liner(s) (Where Applicable - Bioretention Filters)</b>		
Basin(s) graded in conformance with plan	_____	_____
Basin liner material(s) conforms to specifications (attach 6" x 6" sample)	_____	_____
Basin liner installation(s) conforms to plans & specifications	_____	_____
<b>3. Collector System(Where Applicable--Bioretention-Filters and Green Alleys)</b>		
Collector pipes meet specs and hole patterns are correct	_____	_____
Collector pipes wrapped in geotextile meeting specs (attach 6" x 6" sample)	_____	_____
Specified galvanized hardware cloth installed over weepholes	_____	_____
Collector gravel meets specs and is installed to design depth	_____	_____
Pea gravel beneath sand meets spec and is installed to design depth	_____	_____
<b>4. Sand and Planting Soil Components</b>		
Filter sand meets specifications (attach lab report showing gradation, effective size and uniformity coefficient)	_____	_____
Filter sand installed to design depth	_____	_____
Planting soil meets design specifications	_____	_____
Planting soil installed to design depth, hydraulically compacted on _____ (Date) , and refilled to design depth	_____	_____

**Construction Inspection and As-Built Checklist**

Page 2 of 2

	<u>Satisfactory</u>	Observed and Confirmed by <u>(Initial)</u>
<b>5. Bioretention Plant Materials</b>		
Plants meet size and variety specifications	_____	_____
All plants installed per landscape plan	_____	_____
Mulch or cover crop installed according to plans and specifications	_____	_____
<b>6. Clearwell Manhole (Where Applicable--Bioretention Filters and Some Green Alleys)</b>		
Clearwell is free of construction debris and dirt	_____	_____
Outflow pipe invert is at the design elevation	_____	_____
Outflow pipe is capped with orifice drilled to design size	_____	_____
<b>7. Monitoring Manholes (where required)</b>		
Manhole shells and covers conform to specs	_____	_____
Inflow and outflow pipe slopes are as specified	_____	_____
Straight pipe runs through manholes are as specified (no bends)	_____	_____
Manholes and pipes are flushed clean	_____	_____

**Note:** If any of the answers under items 1 - 9 above are checked unsatisfactory, a time frame shall be established for their correction or and a reinspection shall be scheduled. A new form shall be completely filled out at the time of the reinspection. Only the form documenting completely satisfactory performance shall be submitted to the governing jurisdiction for certification. All persons initialing this form shall complete the table below:

Initial	Full Name	Signature	Title/Position and Organization

**CERTIFICATION:** Based on the above, I certify that the Best Management Practice covered by this report is constructed in accordance with the approved Final Site Plan and as designed.

\_\_\_\_\_  
(Signature)

\_\_\_\_\_  
(Typed Name and Title)  
(Place professional seal on certification)

**Operation and Maintenance Inspection Checklist**

Page 1 of 2

**Date** \_\_\_\_\_ **Time** \_\_\_\_\_

**Project** \_\_\_\_\_ **Site Plan / SUP Number** \_\_\_\_\_

**Location** \_\_\_\_\_

**Date Placed in Service:** \_\_\_\_\_ **Date of Last Inspection:** \_\_\_\_\_

**Individual Conducting the Inspection** \_\_\_\_\_

**(Owner)** \_\_\_\_\_

**"As Built" Plans available: Y/N**

**Bioretention Facility Type:** \_\_\_\_\_ **Infiltration;** \_\_\_\_\_ **Filter;** \_\_\_\_\_ **Green Alley**

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**Warning:** If filtration facility has a watertight cover; be careful regarding the possibility of flammable gases within the facility. Care should be taken lighting a match or smoking while inspecting facilities that are not vented. If filtration facility is in a completely enclosed vault, OSHA Confined Space Entry Procedures must be followed.

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	<u>Satisfactory</u>	<u>Unsatisfactory</u>
<b>1. Debris cleanout</b>		
Contributing areas clean of debris	_____	_____
Bioretention facility clean of debris	_____	_____
Inlets and outlets clear of debris	_____	_____
<b>2. Drainage Area Stabilization</b>		
Contributing drainage area stabilized	_____	_____
No evidence of erosion	_____	_____
Area mowed and clippings removed	_____	_____
<b>3. Oil and grease</b>		
No evidence of filter surface clogging	_____	_____
Activities in drainage area minimize oil & grease entry	_____	_____
<b>4. Overflow Structure</b>		
Overflow grate/throat clear of debris	_____	_____
Any grates are in good condition	_____	_____
No evidence of erosion (if draining into a natural channel)	_____	_____

**Operation and Maintenance Inspection Checklist**

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Site Plan/SUP Number \_\_\_\_\_ Date: \_\_\_\_\_

	<u>Satisfactory</u>	<u>Unsatisfactory</u>
<b>5. Bioretention Planting Soil</b>		
No evidence of planting soil erosion	_____	_____
Bioretention basin clean of sediments	_____	_____
<b>6. Organic Layer</b>		
Mulch covers entire area (NO voids) and to specified thickness	_____	_____
Mulch is in good condition	_____	_____
<b>7. Plants</b>		
Specified number and types of plants still in place	_____	_____
No dead or diseased plants	_____	_____
No evidence of plant stress from inadequate watering	_____	_____
No evidence of deficient stakes or wires	_____	_____

**NOTE:** Diseased plants must be treated by a qualified professional. Deficient stakes or wires must be replaced. Dead plants or plants diseased beyond treatment must be replaced by plants meeting original design specifications. New plants must be watered every day for the first 14 days after planting. Reinspections must be scheduled to occur following this period.

**Action to be taken:**

If any of the answers to the above items are checked unsatisfactory, a time frame shall be established for their correction or repair.

No action necessary. Continue routine inspections \_\_\_\_\_  
Correct noted facility deficiencies by \_\_\_\_\_

Facility repairs were indicated and completed. Site reinspection is necessary to verify corrections or repairs.

Site reinspection accomplished on \_\_\_\_\_

Site reinspection was satisfactory. Next routine inspection is scheduled for approximately: \_\_\_\_\_

\_\_\_\_\_  
Signature of inspector