**Construction Inspection Checklist for Bioretention Basins**

# Introduction

Proper construction of permanent stormwater best management practices (BMPs) is essential to ensure that BMPs achieve their treatment objectives; namely reducing the amount of stormwater runoff and pollution discharged to local lakes, rivers and streams.

This construction inspection checklist is intended to reduce construction errors for **bioretention basins** (one type of BMP). These errors can result in inadequate BMP performance and/or expensive maintenance and rehabilitation costs for the BMP owner. This checklist should be filled out by an inspector, construction supervisor and/or design engineer throughout the duration of BMP construction to assure that the BMP is installed correctly.

The items herein assume that designs follow those recommended in Volume 3 of the Urban Drainage and Flood Control District Design Criteria Manual. In some locations, design criteria may be different and certain items may not apply.

# Pre-Construction

## 1.1 - Pre-Construction Meeting

A pre-construction meeting should be held between design engineers, project managers, contractor foreman and other relevant personnel to discuss important aspects of BMP installation, including (but not limited to) verifying the items outlined in this document.

## 1.2 – Stake BMP Perimeter

Prior to excavation, stake the perimeter of excavation and verify dimensions match the design specifications.

# Excavation

## 2.1 – Heavy Equipment

To ensure even distribution and infiltration of stormwater throughout the storage layer, avoid compaction of subgrade during construction. If possible, use a backhoe/excavator to avoid driving in the area of the BMP. Alternatively, use low ground pressure equipment in the excavated area. Use construction fencing where applicable to deter unnecessary construction traffic in the area of the BMP. *If using an impermeable liner, ignore this requirement.*

## 2.2 – Bottom “Ripping”

If equipment must travel over the excavated area, the bottom of the cell should be “ripped” to a depth of 8 to 12 inches after excavating to the appropriate depth. *If using an impermeable liner, ignore this requirement.*

## 2.3 – Bottom is Flat and Level

The bottom of the cell should be flat and level to allow for even distribution of water throughout the storage layer.  *If design calls for a sloped bottom to drain storage layer towards an underdrain, this requirement is not applicable.*

## 2.4 – Protection after Excavation

Immediately following excavation, place construction sediment control BMPs around the basin to prevent runoff from entering the cell. Only remove sediment control BMPs after the upstream catchment is stable.

## 2.5 – Infiltration Testing

If the facility is uses a “full-infiltration” design, verify the infiltration rate at the surface of the subgrade is 1.0 inches/hour or greater. Conduct infiltration tests using ASTM D3385 or other method approved by the inspector/reviewer. If infiltration rates are less than 1.0 in/hr, notify the engineer of record immediately for design review.

# Inlet

## 3.1 – Inlet Installation and Location

Verify that runoff from upstream catchment drains to the inlet(s) unimpeded.

## 3.2 – Inlet Invert Elevation

Verify runoff will continue to flow into the BMP even when sediment deposits at the entrance. This requires a vertical drop at the inlet. A drop of 1 to 3 inches is typical depending on the configuration.

# Forebay/Energy Dissipation

## 4.1 – Forebay Overflow Elevation

Verify that the forebay drains completely into the filter area of the BMP. Forebays for bioretention should not hold water. Often the Forebay is at least 2 inches above the filter media elevation to ensure positive drainage into the BMP. *If design does not specify a forebay, this item is not applicable.*

## 4.2 – Forebay Bottom

Verify that the forebay has a concrete bottom to allow for easy maintenance. If the design calls for a rock or similar soft bottom in the construction plans, contact the design engineer/reviewer to discuss alternatives. *If design does not specify a forebay, this item is not applicable.*

## 4.3 – Energy Dissipation

Verify energy dissipation materials (riprap or other) meet design specifications and are installed according to design. If rip rap is placed directly on top of filter media, verify fabric between riprap and filter media to reduce settling. Mixing riprap with the filter media also recommended.

# Outlet Structure/Overflow

## 5.1 – Outlet Structure/Overflow Elevation

Verify outlet overflow elevation is according to design drawings and the distance between the overflow invert and top of the filter media is equal to or greater than the design WQCV depth.

# Impermeable Liner

The impermeable liner will prevent runoff from infiltrating into adjacent soils. This component is not present for all installations. “No infiltration” sections use impermeable liners.

## 6.1 - Liner Material

Verify liner material meets the design specifications, is at least 30 mil thick, is thermally welded, and all seams are tested. Verify liner has no tears prior to and after placement.

## 6.2 – Liner Attachment

Prior to backfilling, ensure slack in liner to prevent the liner from tearing during placement of material. After backfilling, verify liner is attached to a concrete perimeter wall according to design specifications. Perimeter attachment can take place prior to or after placement of backfill. Attaching the liner to the perimeter wall following backfill reduces potential tears but requires the means to secure the liner during backfill.

# Underdrain System

## 7.1 – Underdrain Pipe

Verify the underdrain pipe meets design specifications, particularly with regard to the size and number of slots.

## 7.2 – Underdrain Wrapping

Verify the underdrain is NOT wrapped (directly) in geotextile fabric (or a sock) to avoid clogging of this fabric immediately adjacent to the underdrain openings.

## 7.3 – Underdrain Filter

Verify filter material placed around the underdrain meets the gradation specifications in the design specifications. Provide a copy of the gradation lab results to the reviewing engineer.

## 7.4 – Cleanout Locations

Verify placement of at least one cleanout for each underdrain lateral.

## 7.5 – Cleanout Pipe

Verify cleanout pipes are solid pipe to avoid short-circuiting of runoff through the cleanout pipes.

## 7.6 – Cleanout Covers

Verify cleanout covers are installed and watertight.

## 7.7 – Orifice Plate

Verify installation of the orifice plate at the outlet point of the underdrain system and placement of gasket material between the structure and orifice plate, per design specifications.

# Filter Media

## 8.1 – Filter Media Composition and Mixing

Verify the filter media meets material specifications in the design specifications. Also, verify the filter media was “machine mixed” by the supplier to ensure a homogeneous media. Provide documentation of materials and mixing by the supplier to the reviewing engineer.

## 8.2 – Filter Media Installation

Verify installation of the appropriate depth of filter media and that the top of the filter media is relatively flat to ensure an even distribution of runoff over the entire filter media.

# Containment Wall

## 9.1 – Containment Wall

Verify the containment wall (if applicable) is continuous and level so runoff can pond evenly throughout the bioretention basin.

## 9.2 – Protection from Vehicles

Ensure the containment wall (or other perimeter controls) protect the entirety of the bioretention basin from potential vehicle traffic/parking.

# Final Landscaping

## 10.1 – Sand-Grown Sod

If design specifications call for sod as final landscaping, verify sod is “sand-grown” sod, not “clay-grown” (or conventional) sod. Clay-grown sod is most common, but will reduce the infiltration rate of runoff and create standing water problems.

## 10.2 – Wood/Rock Mulch

If design specifications call for mulch (either rock or wood), verify even distribution of mulch on top of the filter media and unimpeded drainage from the inlet or forebay into the BMP per section 3.2. Verify use of shredded wood mulch to avoid displacement of the mulch from ponding runoff.

## 10.3 – Plantings and Vegetation

Verify plantings and vegetation meet landscaping design specifications.

## 10.4 – Weed Barrier

Verify NO placement of weed barrier on top of the filter media. Weed barrier will reduce the infiltration rate of runoff and create standing water problems.

## 10.5 – Irrigation

Verify temporary and/or permanent irrigation according to landscape design specifications, to ensure establishment of plantings and vegetation.

# Close Out

## 11.1 – Upstream Catchment Stabilization

Verify that construction in the upstream catchment is complete and landscaped areas are stable, prior to removing temporary sediment control BMPs. If the upstream catchment is not stable, the bioretention filter media may clog rapidly and require complete replacement of filter media.

## 11.2 – Snow Storage Signage

If bioretention cell is located adjacent to roadway or parking lot, verify signage exists to notify snow removal personnel not to store snow on top of the bioretention basin. If design specifications do not call for signage, consult with the engineer of record to determine if signage is required.

**Construction Inspection Checklist for Bioretention Basins**

**Project: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Site: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Inspector: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Company: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

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| --- | --- | --- | --- | --- | --- | --- |
| **No.** | **Item/Activity** | **Pass** | **Fail** | **N/A** | **Date** | **Notes** |
| **Pre-Construction** | | | | | | |
| 1.1 | Pre-construction meeting held to discuss BMP installation, inspection and checklist |  |  |  |  |  |
| 1.2 | BMP perimeter verified and staked |  |  |  |  |  |
| **Excavation** | | | | | | |
| 2.1 | Heavy equipment did not travel over bioretention basin during excavation. |  |  |  |  |  |
| 2.2 | Bottom of cell was “ripped” after excavation. |  |  |  |  |  |
| 2.3 | Bottom of cell is flat and level |  |  |  |  |  |
| 2.4 | Construction BMPs are in place to protect the filter surface from contamination due to construction sediment. |  |  |  |  |  |
| 2.5 | Infiltration rate verified (“full-infiltration” design only) |  |  |  |  |  |
| **Inlet** | | | | | | |
| 3.1 | Upstream catchment drains to inlet |  |  |  |  |  |
| 3.2 | Inlet invert elevation drops 1 or more inches at entry. |  |  |  |  |  |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Forebay/Energy Dissipation** | | | | | | |
| 4.1 | Forebay overflow will not hold standing water. |  |  |  |  |  |
| 4.2 | Forebay has concrete bottom |  |  |  |  |  |
| 4.3 | Riprap meets specifications and fabric is beneath riprap |  |  |  |  |  |
| **Outlet/Overflow Structure** | | | | | | |
| 5.1 | Overflow elevation is per plan and distance between filter media and outlet overflow is correct. |  |  |  |  |  |
| **Impermeable Liner** | | | | | | |
| 6.1 | Liner meets design specifications, is at least 30 mil thick, is thermally welded, and tested with no tears. |  |  |  |  |  |
| 6.2 | Liner is attached to concrete perimeter wall according to design specification. |  |  |  |  |  |
| **Underdrain System** | | | | | | |
| 7.1 | Verify underdrain pipe is per design specifications. |  |  |  |  |  |
| 7.2 | Verify underdrain is NOT wrapped in geotextile fabric. |  |  |  |  |  |
| 7.3 | Verify underdrain filter material gradation meets design specifications. |  |  |  |  |  |
| 7.4 | Verify at least one cleanout is provided per underdrain lateral. |  |  |  |  |  |
| 7.5 | Verify cleanout pipe is solid (no slots or perforations). |  |  |  |  |  |
| 7.6 | Verify cleanout covers are installed and watertight. |  |  |  |  |  |
| 7.7 | Verify orifice plate is installed at underdrain discharge point, per design specifications. |  |  |  |  |  |
| **Filter Media** | | | | | | |
| 8.1 | Verify filter media composition is per design specifications and was “machine mixed” by supplier prior to delivery. |  |  |  |  |  |
| 8.2 | Verify depth of filter media installed and flat surface. |  |  |  |  |  |
| **Containment Wall** | | | | | | |
| 9.1 | Verify containment wall/berm is continuous and level. |  |  |  |  |  |
| 9.2 | Verify of the filter surface from protection from vehicles. |  |  |  |  |  |
| **Final Landscaping** | | | | | | |
| 10.1 | Verify sod (if used) is sand-grown. |  |  |  |  |  |
| 10.2 | Verify final mulch elevation is at least 1 inch below inlet elevation. Verify wood mulch (if used) is shredded. |  |  |  |  |  |
| 10.3 | Vegetation is planted according to landscape design specifications. |  |  |  |  |  |
| 10.4 | Verify weed barrier is not installed. |  |  |  |  |  |
| 10.5 | Verify irrigation is installed (temporary or permanent) according to design specifications. |  |  |  |  |  |
| **Close Out** | | | | | | |
| 11.1 | Verify that upstream catchment stabilized prior to diverting runoff into bioretention media. |  |  |  |  |  |
| 11.2 | Verify that signage is installed according to design specifications |  |  |  |  |  |