



BMP INSPECTION MANUAL

Instructional Manual for BMP Inspection Program and Process



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V2

TABLE OF CONTENTS

1.	INTRODUCTION, BACKGROUND AND PURPOSE	1
1.1	INTRODUCTION	1
1.2	BACKGROUND	1
1.3	PURPOSE	1
2	BMP INSPECTION DATABASE FORMAT	3
2.1	BMP INVENTORY FORMS	3
2.2	BMP INSPECTION FORMS	3
2.3	OVERALL FACILITY RATING	5
2.4	BMP MAINTENANCE FORMS	6
3	FILTRATION FACILITY INSPECTIONS	7
3.1	TYPES OF FILTRATION FACILITIES	7
3.1.1	Filtering Practice I & II (CH)	7
3.1.2	Sheet Flow to Vegetated Filter (CH) and Sheet Flow to Conserved Open Space (CH)	7
3.1.3	Constructed Wetland I & II (CH), and Wet Swale I & II (CH)	7
3.2	FACILITY COMPONENT HEADINGS	8
3.2.1	Accessibility	8
3.2.2	Rating for the Accessibility Component Heading	8
3.2.3	Debris	9
3.2.4	Rating for the Debris Component Heading	10
3.2.5	Pretreatment Structures	11
3.2.6	Rating for Pretreatment Structures Component Heading	12
3.2.7	Vegetation	12
3.2.8	Rating for the Vegetation Component Heading	16
3.2.9	Clogging	16
3.2.10	Rating for the Clogging Component Heading	17
3.2.11	Structural Components	17
3.2.12	Rating for the Structural Components Heading	19
3.2.13	Outlets/Overflow Structures	20
3.2.14	Rating for Outlets/Overflow Component Heading	23
3.2.15	Sediment Deposition	24
3.2.16	Rating for Sediment Deposition Component Heading	25
3.2.17	Plants	25
3.2.18	Rating for Plants Component Heading	27
3.2.19	Overall Function of Facility	28
3.2.20	Rating for Overall Function of Facility Component Heading	31
3.3	OVERALL INSPECTION RATING BY THE DATABASE	32
3.3.1	Rating A	32
3.3.2	Rating B	32
3.3.3	Rating C	33
3.3.4	Rating D	33
3.3.5	Rating E	33
3.4	INSPECTOR RATING	33
3.4.1	Rating Input	34
4	INFILTRATION INSPECTIONS	35
4.1	TYPES OF INFILTRATION FACILITIES	35
4.1.1	Bioretention I and II (CH), Urban Bioretention (CH), Bioretention Basins and Bioretention Filters	35
4.1.2	Infiltration I and II CH, Infiltration Trenches and Infiltration Basins	35
4.1.3	Rooftop Disconnect CH	35
4.1.4	Dry Swales I and II CH	36
4.1.5	Permeable Pavement I and II (CH)	36
4.2	FACILITY COMPONENT HEADINGS	36
4.2.1	Accessibility	36
4.2.2	Rating for the Accessibility Component Heading	37
4.2.3	Debris	37
4.2.4	Rating for the Debris Component Heading	39
4.2.5	Sediment Traps, Forebays, and Pretreatment Swales	40
4.2.6	Rating for Sediment Traps, Forebays, and Pretreatment Swales Component Heading	42

4.2.7	Vegetation	42
4.2.8	Overall Rating for the Vegetation Component Heading	45
4.2.9	Clogging	46
4.2.10	Rating for the Clogging Component Heading	46
4.2.11	Inlets, Outlets, and Overflow Spillway	47
4.2.12	Rating for the Inlets, Outlets, and Overflow Spillway Component Heading	48
4.2.13	Aggregates	49
4.2.14	Rating for the Aggregates Component Heading	51
4.2.15	Sediment Deposition	51
4.2.16	Rating for the Sediment Deposition Component Heading	52
4.2.17	Overall Function of Facility	52
4.2.18	Rating for Overall Function of Facility Component Heading	55
4.3	OVERALL INSPECTION RATING BY THE DATABASE	56
4.3.1	Rating A	56
4.3.2	Rating B	57
4.3.3	Rating C	57
4.3.4	Rating D	57
4.3.5	Rating E	57
4.4	INSPECTOR RATING	58
4.4.1	Rating Input	58
5	MANUFACTURED FACILITY INSPECTIONS	59
5.1	TYPES OF MANUFACTURED FACILITIES	59
5.1.1	Pipe Detention, Underground Storage and Underground Sand Filters	59
5.1.2	Manufactured (Hydro-dynamic) BMPs and Manufactured (Filtering) BMPs	59
5.1.3	Tree Box Filter	61
5.2	FACILITY COMPONENT HEADINGS	62
5.2.1	Accessibility	62
5.2.2	Rating for the Accessibility Component Heading	62
5.2.3	Debris	63
5.2.4	Rating for the Debris Component Heading	64
5.2.5	Vegetation and Plantings	65
5.2.6	Overall Rating for the Vegetation Component Heading	65
5.2.7	Clogging	66
5.2.8	Rating for the Clogging Component Heading	67
5.2.9	Structural Components	68
5.2.10	Rating for the Structural Components Heading	70
5.2.11	Outlets/Overflow Structures	70
5.2.12	Rating for Outlets/Overflow Component Heading	72
5.2.13	Sediment Deposition	73
5.2.14	Rating for Sediment Deposition Component Heading	73
5.2.15	Overall Function of Facility	74
5.2.16	Rating for Overall Function of Facility Component Heading	77
5.3	OVERALL INSPECTION RATING BY THE DATABASE	78
5.3.1	Rating A	78
5.3.2	Rating B	78
5.3.3	Rating C	78
5.3.4	Rating D	78
5.3.5	Rating E	79
5.4	INSPECTOR RATING	79
5.4.1	Rating Input	79
6	MISCELLANEOUS FACILITY INSPECTIONS	80
6.1	TYPES OF MISCELLANEOUS FACILITIES	80
6.1.1	Grassed Swales, Water Quality Swales and Grassed Channel (CH)	80
6.1.2	Level Spreaders and Check Dams – Permanent E&S Measures	80
6.2	FACILITY COMPONENT HEADINGS	80
6.2.1	Accessibility	80
6.2.2	Rating for the Accessibility Component Heading	81
6.2.3	Debris	82
6.2.4	Rating for the Debris Component Heading	84

6.2.5	Overall Rating for the Vegetation Component Heading	88
6.2.6	Clogging	89
6.2.7	Overall Rating for the Clogging Component Heading	89
6.2.8	Structural Components	89
6.2.9	Rating for the Structural Components Heading	91
6.2.10	Outlets/Overflow Structures	91
6.2.11	Rating for Outlets/Overflow Component Heading	94
6.2.12	Sediment Deposition	94
6.2.13	Rating for the Sediment Deposition Component Heading	96
6.2.14	Overall Function of Facility	96
6.2.15	Rating for Overall Function of Facility Component Heading	99
6.3	OVERALL INSPECTION RATING BY THE DATABASE	100
6.3.1	Rating A	100
6.3.2	Rating B	101
6.3.3	Rating C	101
6.3.4	Rating D	101
6.3.5	Rating E	101
6.4	INSPECTOR RATING	102
6.4.1	Rating Input	102
7	BASIN FACILITY INSPECTIONS	103
7.1	TYPES OF BASINS	103
7.1.1	Wet Basin, Wet Pond I and II (CH), Extended Detention I & II (CH), Extended Detention Basin-Enhanced, Retention Basin I, II and III and Wet Swale I and II (CH) ..	103
7.1.2	Dry Detention Basin	103
7.1.3	Sand Filter Basin	103
7.2	FACILITY COMPONENT HEADINGS	104
7.2.1	Accessibility	104
7.2.2	Rating for the Accessibility Component Heading	107
7.2.3	Inlet, Inlet Channel and Forebay	107
7.2.4	Overall Rating for the Inlet, Inlet Channel and Forebay Component Heading	111
7.2.5	Dam Embankment	112
7.2.6	Rating for the Dam Embankment Component Heading	117
7.2.7	Emergency Spillway	119
7.2.8	Rating for the Emergency Spillway Component Heading	121
7.2.9	Outlet Structure and PSP	122
7.2.10	Rating for the Outlet Structure Component Heading	127
7.2.11	Principal Spillway Pipe (PSP)	128
7.2.12	Rating for the Principal Spillway Pipe (PSP) Component Heading	130
7.2.13	Outfall Channel	131
7.2.14	Rating for the Outfall Channel Component Heading	133
7.2.15	Impoundment Area	134
7.2.16	Rating for Impoundment Area Component Heading	138
7.3	OVERALL INSPECTION RATING BY THE DATABASE	140
7.3.1	Rating A	140
7.3.2	Rating B	140
7.3.3	Rating C	141
7.3.4	Rating D	141
7.3.5	Rating E	141
7.4	INSPECTOR RATING	141
7.4.1	Rating Input	141
8	LID FACILITY INSPECTIONS	143
8.1	TYPES OF LID FACILITIES	143
8.1.1	Vegetated Roofs Level 1 and 2 (CH)	143
8.1.2	Rainwater Harvesting / Rain Barrels (CH)	143
8.2	OVERALL FUNCTION OF LID FACILITIES	143
8.2.1	“Evidence of illicit discharge”	143
8.2.2	“Inaccessible”	144
8.2.3	“Erosion or deterioration at outlet”	145

8.3	FACILITY COMPONENTS AND HEADINGS FOR RAINWATER HARVESTING / RAIN BARRELS	146
8.3.1	“Blockages to pre-treatment, screening devices, gutters or vents”	146
8.3.2	“Overflow pipes and structures dysfunctional”	146
8.3.3	“Sediment build up in tank / barrel”	147
8.3.4	“Tank, pump, pipe or electrical system needs repairs”	148
8.4	RATING FOR LID-RAINWATER HARVESTING (CH)	148
8.4.1	Rating A	148
8.4.2	Rating B	148
8.4.3	Rating C	148
8.4.4	Rating D	149
8.4.5	Rating E	149
8.5	FACILITY COMPONENT HEADINGS FOR VEGETATIVE ROOFS LEVEL 1 AND 2 (CH)	149
8.5.1	“Dead, dying or invasive vegetation”	149
8.5.2	“Leaking, cracks or deterioration of the waterproof membrane”	150
8.5.3	“Blockages in gutters, downspouts or outflow structures”	151
8.6	RATING FOR LID-VEGETATIVE ROOF LEVEL 1 AND 2 (CH)	151
8.6.1	Rating A	151
8.6.2	Rating B	151
8.6.3	Rating C	151
8.6.4	Rating D	152
8.6.5	Rating E	152
APPENDIX A. STORMWATER BMP DATABASE INVENTORY FORMS		153
APPENDIX B. STORMWATER BMP DATABASE INSPECTION FORMS		157

ACRONYMS

BMP	Best Management Practice
CH	Virginia BMP Clearinghouse
CMP	Corrugated Metal Pipe
DCR	Virginia Department of Conservation and Recreation
DEQ	Virginia Department of Environmental Quality
ESC	Erosion and Sediment Control
EPA	Environmental Protection Agency
GIS	Geographic Information System
IDDE	Illicit Discharge Detection and Elimination
LUP	Land Use Permit
MS4	Municipal Separate Storm Sewer System
NPDES	National Pollutant Discharge Elimination System
POC	Pollutant of Concern
SWM	Stormwater Management
TMDL	Total Maximum Daily Load
VAC	Virginia Administrative Code
VPDES	Virginia Pollutant Discharge Elimination System
VSMP	Virginia Stormwater Management Program
VDOT	Virginia Department of Transportation
WLA	Waste Load Allocation

1. INTRODUCTION, BACKGROUND AND PURPOSE

1.1 INTRODUCTION

The Virginia Stormwater Management Program (VSMP) General Permit for Discharges of Stormwater from Small Municipal Separate Storm Sewer Systems (MS4s) requires VDOT to develop and implement a long-term documented operation and maintenance plan for stormwater management facilities. This includes development of an inspection manual and a maintenance manual to be prepared by EEE Consulting, Inc. describing the procedures to meet this requirement. The stormwater management program (MS4 Program) is designed to reduce the discharge of pollutants from all regulated activities undertaken by the Department within its right-of-way and property boundaries located inside the urbanized areas (as determined by the latest Decennial Census by the Bureau of the Census). The Program ensures the proper operation of stormwater facilities that reduce the discharge of pollutants, protect water quality, and reduce water quantity to satisfy requirements of the Clean Water Act and the State Water Control Law consistent with the VSMP Permit Regulations (9VAC870-112 et seq.) and VDOT's legal authority as authorized by the Commonwealth of Virginia. BMP inspections are required on an annual basis to be completed within a 12-month period unless otherwise specified on the approved plans. *Further information regarding the VSMP Laws and Regulations related to MS4 permitting and programs may be obtained from the Virginia Department of Environmental Quality at:*

<http://www.deq.virginia.gov/Programs/Water/StormwaterManagement/VSMPPermits/LocalVSMPPProgramDevelopment.aspx>

1.2 BACKGROUND

Land development opens up stable vegetated landscapes and increases impervious area, which in turn increases the stormwater runoff that leaves an area. Development increases pollutant concentrations in runoff, as pollution associated with development is deposited onto disturbed surfaces and carried by runoff into nearby water bodies. Such pollutants include sediment, suspended solids, nutrients, pesticides, herbicides, heavy metals, chlorides, hydrocarbons, other organics and bacteria. To remove pollutants from stormwater runoff, structures are installed to filter, slow, and treat drainage using various methods. These stormwater structures are called Best Management Practices, commonly referred to as BMPs. They are designed to reduce flooding, remove pollutants to the land surface and decrease the amount of run-off from stormwater that ultimately flows to our creeks, streams, and rivers. There are many different types of BMPs, both above and underground, that all serve to decrease the detrimental effects of stormwater runoff on our environment.

1.3 PURPOSE

The intent of this manual is to provide a guide to utilize the online BMP inspection forms provided by VDOT that update their BMP inspection database. This manual provides guidance on the inspection of these facilities and characterizes the different

components of each type of BMP. As a part of this characterization, examples of component features and deterioration levels will be discussed and pictures provided as examples. In addition, the rating system will be further explored and correlated with examples of BMP component conditions that represent specific rating levels.

2 BMP INSPECTION DATABASE FORMAT

There are three parts to every stormwater facility inspection as outlined in the database. The first task is to enter the facility information on the Inventory Tab, including the general facility classification and specific facility type from the pull down menus. This step includes scanning in the approved plans and any long term regulatory permits. The second task is to perform the inspection utilizing the inspection tabs on the database form and checking the appropriate inspection items listed under their component headings. The component headings will be rated based the severity of the deficiency following guidance in the manual. The inspection item boxes under the component headings list facility items that may or may not require maintenance resulting from the inspection. This tab also requires an overall rating of the facility that prioritizes maintenance based on the condition of the component headings. The third task is to fill out the maintenance tab of the database checking off the appropriate action items needed to repair the facility and bring it into full compliance. The inspection and requested maintenance will then be reviewed and approved by an inspection supervisor which is entered with a date in the maintenance tab.

2.1 BMP INVENTORY FORMS

The BMP Inventory tab provides details from the BMP plans that clarify what features are present in the field and design. This input modifies the inspection tab by making BMP components that are not applicable to the facility un-selectable and grayed out in the inspection tab. This assists the inspector by only listing the parameters present in the stormwater facility. It also prevents the inspector from checking off an absent BMP feature mistakenly or looking for a BMP feature that is not there.

The information input in this tab, as well as the nomenclature, should match the construction record drawings, or design plans (if record drawings are not available) exactly. This is especially important when selecting the BMP type, to clarify if it is designed under the new regulations and the BMP clearinghouse (Part IIB of the stormwater regulations) or previous stormwater standards (Part IIC of the current regulations). If the facility conforms to the clearinghouse standards a “(CH)” is included in the facility name in the drop down menu. These two design criteria, the old (Part IIC) versus new (Part IIB), have different features, inspection criteria, and reduction in efficiencies established for the listed BMP types.

2.2 BMP INSPECTION FORMS

The following section discusses the inspection criteria (ratings) and parameters of a BMP. The six basic types of BMPs listed in the database are basins, filtration, infiltration, LID measures, manufactured structures and miscellaneous facilities. Each heading has multiple specific BMP types in a pull down menu that is established in the inventory step. Once the type is selected and inventoried, the proper inspection heading components for the facility will show up on the Inspection Tab under various

headings. An explanation of the various BMP types and components is included in the sections below. BMP inspection forms are provided as screenshots in Appendix B.

Additionally, a detailed discussion of the rating system and facility parameters is included in the manual. Examples of various facility and heading component conditions along with pictures are supplied to clarify the appropriate inspection results. Individual inspection heading ratings and the overall facility rating are also detailed for consistency and accurate inspection results.

Each BMP parameter must be thoroughly reviewed by visual assessment, inspection, and potential physical testing, as necessary. All components of the BMP should be looked at closely, including access, the control structure, all inflow and outflow points of the facility, and the downstream outlet and channel. Proper evaluation and classification of these components plays a key role in the facility rating and the maintenance plan of action.

Each of the inspection component headings is rated on a scale of 1 to 5. The scoring defines the relative condition of each parameter. The objective is to provide a consistent framework for performing the scoring of individual parameters. In general, the ratings reflect:

1. *No Problems*
Operating as designed, no issues observed.
2. *Minor*
Functioning as designed, requires routine maintenance repairs.
3. *Moderate*
Functioning as designed, moderate problems exist but are not impacting the outflow structures or water levels in the facility. Routine maintenance can address some but not all of the issues.
4. *Major*
Performance is compromised and major problems exist that affect the water levels in the facility. Maintenance is required and additional supervisor evaluation is recommended. An immediate remediation plan to prevent further deterioration may be required.
5. *Failure*
Functional failure is occurring or imminent, such that pollutant and/or volume reductions are not being met per the design criteria. Extensive maintenance is required and an additional supervisor level inspection is required. A remediation plan for immediate stabilization to prevent further impacts from failure is required.

The following online resources are available for additional information:

- <http://www.deq.virginia.gov/Programs/Water/StormwaterManagement.aspx>

- <http://www.deq.virginia.gov/Programs/Water/StormwaterManagement/ErosionandSedimentControl.aspx>
- <http://vwrrc.vt.edu/swc/StandardsSpecs.html>
- http://www.deq.virginia.gov/Portals/0/DEQ/ConnectwithDEQ/Training/SWM_Act_VSMP_Regulations_CGP_Regulations.pdf

2.3 OVERALL FACILITY RATING

There are two different rating fields for the Overall Facility Rating. One is the database generated rating titled “Database Rating” which follows the logic described in each BMP type overall rating discussion. This field provides the minimum facility rating based on the component heading ratings selected on the inspection form. The second field is the “Inspector Rating”, which is defined by the inspector and allows the overall rating to be upgraded based on the specific field conditions and professional judgment. The “Inspector Rating” cannot be lower than the database rating generated from the inspection form results. However, this rating can be increased or decreased by a supervisor who reviews and approves the inspection results on the maintenance tab in the database.

Please note the inspection rating establishes the time frame to take action on the maintenance plan consisting of the items listed in the inspection database. The time frames described in the Overall Facility Rating prioritize maintenance based on the severity of deterioration, failure potential and potential failure impacts. Each of the resulting five levels of overall facility ratings have a different set of specified maintenance repairs, and thus a specific VDOT procedure to follow. The implementation of the maintenance work plan includes progress and documentation of actions to maintain and remediate the BMP for proper function. The goal of utilizing this concept is to show progress towards repair completion, while accounting for the project specific issues, and following appropriate and established VDOT procedures.

The first action step for all facilities is the review and approval of the BMP inspection which is recorded in the field and uploaded to the database. This step allows higher level employee to supervise the process, clarify any questions, evaluate and prioritize the recommended maintenance items. This action item may result in an additional field inspection from the inspection reviewer to clarify reported findings and evaluate or revise the requested maintenance items. This also allows the inspection reviewer to change the “Inspector Rating” as deemed appropriate with their input. Once the inspection is approved the response time frame begins as described in the “Overall Facility Rating” section of this manual and in the database for each of the six BMP categories. The response time frame for action varies based on the type of facility, severity of repairs required, and potential impacts from further deterioration.

There are many different variables that affect the inspection and maintenance processes along with repair completion. Therefore, once action is initiated with the inspection approval, detailed records of remediation steps, required approvals, anticipated schedules, and completed process steps should be kept. These records

will serve as the maintenance plan of action and shall be enacted within the time frame determined by the overall facility rating. Routine to minor maintenance can be approved by the inspection reviewer and scheduled. Moderate maintenance items may be field verified and if outflow structures are involved, an additional level of review may be warranted. This particularly comes into play when a contractor must be involved for the repairs and purchase orders or bids obtained and approved prior to commencing work. Detailed date records of key events in the process, as well as anticipated dates for meeting project milestones should continue to show progress towards repair completion. Major and failure level ratings should be escalated to the inspection reviewer's supervisor for evaluation. Maintenance involving structural repairs or replacement should be evaluated by qualified personnel.

2.4 BMP MAINTENANCE FORMS

The maintenance form provided in the database has a list of maintenance / repair actions associated with the inspection criteria and results. The items are categorized into two headings, Routine and Extensive. Under this tab there is also a heading for "Weather related inspections" that are less intensive than annual inspections, but check for damage and potential maintenance requirements post storm related events outside of the normal inspection schedule. BMP maintenance forms are provided as screenshots in Appendix C. Further discussion of maintenance practices is covered in the BMP Maintenance Manual.

3 FILTRATION FACILITY INSPECTIONS

3.1 TYPES OF FILTRATION FACILITIES

3.1.1 Filtering Practice I & II (CH)

Filtering practices are very similar in structure and design to a bioretention facility, without the plantings. Stormwater filters capture, temporarily store, and treat stormwater runoff by passing it through a filter media, collecting the filtered water in an underdrain, and then returning it back to the storm drainage system. The filter consists of two chambers: the first is devoted to settling, and the second serves as a filter bed consisting of a sand or organic filter media. Stormwater filters depend mainly on physical treatment mechanisms to remove pollutants from stormwater runoff, including gravitational settling in the sedimentation chamber, straining particles at the top of the filter bed, and filtration and adsorption onto the filter media. Microbial films often form on the surface of the filter bed, which can also enhance biological removal. Filters are usually designed only for water quality treatment and provide no runoff volume reduction.

3.1.2 Sheet Flow to Vegetated Filter (CH) and Sheet Flow to Conserved Open Space (CH)

Filter strips are vegetated areas that treat sheet flow delivered from adjacent impervious and managed turf areas. The two design variants of filter strips are (1) *Conserved Open Space* and (2) designed *Vegetated Filter Strips*. The design, installation, and management of these design variants are quite different, as outlined in the specification. In both instances, stormwater must enter the filter strip or conserved open space as sheet flow. If the inflow is from a pipe or channel, an engineered level spreader must be designed in accordance with the criteria contained in the design specification to convert the concentrated flow to sheet flow. The facility then decreases the runoff velocities and allows sediment and attached pollutants to settle out and/or be filtered by the vegetation.

3.1.3 Constructed Wetland I & II (CH), and Wet Swale I & II (CH)

Constructed wetlands, sometimes referred to as stormwater wetlands, are shallow depressions that treat stormwater to remove pollutants and improve its quality. Wetlands are typically less than 1-foot-deep (although depths vary by location) and use variable water and land levels to promote a dense and diverse wetland cover. Runoff from each new storm displaces runoff from previous storms, and the long residence time allows multiple pollutant removal processes to operate. The wetland habitat provides an ideal environment for gravitational settling, biological uptake, and microbial activity. Constructed wetlands should be considered a final element in the roof-to-stream runoff reduction sequence.

Wet swales are a linear version of a constructed wetland, with a permanent pool and designed plantings. They have the same design concept and functionality as the wetland features described above. Wet swales are long and have a flat slope to store

water and allow for settlement of pollutants. Side slopes and the ability to maintain them require relatively flat slopes as well.

3.2 FACILITY COMPONENT HEADINGS

3.2.1 Accessibility

This is the area available for inspection personnel and maintenance equipment to access the facility from the VDOT right-of-way. The access should be at least 10 feet wide, on a slope of 3:1 (H:V) or less, and stabilized to withstand the periodic passage of heavy equipment. The evaluation of this parameter should take into consideration roadway fill elevations, which are often steeper than 3:1 slopes, the configuration of the roadway with respect to the facility, the natural topography surrounding the facility, and the potential for constructing a stabilized access road to the facility. In addition, this section considers vegetation or debris that may impede access, as well as public safety components such as fencing and gated access.

“Inaccessible”

Check if applicable. If the access has not been maintained or used it can be a sign that the facility itself has not been maintained either. This should result in a higher rating since conditions may make it more difficult for the inspector to perform the required inspection in the allotted time frame.



Photo accessed at ohland.homedns.org on Sept. 4, 2013

This facility has an inadequately maintained access road. There is significant minor growth that would impede equipment from entering the area for inspection or maintenance. This would indicate a minor rating (2) because the access road can be easily cleared due to the small brush. If heavier grade equipment was required to restore the access road, a higher level rating may be warranted.

3.2.2 Rating for the Accessibility Component Heading

If “Inaccessible” is checked, rate it minor to major (2-4). The rating is based on impacts to the surrounding area and the level of work required to establish access. A minor rating (2) would result from having to establish access with a minor amount of work, such as stone laid over an existing cleared path or mowing/bush hogging saplings and brush. A moderate rating (3) would associated with removal of

obstructions from an established access path, or providing a significant amount of a higher grade of stone for access through problematic areas such as saturated soils. If construction equipment, such as a bulldozer, is required to clear and disturb an area for access to the facility and outlet structure, a major rating (4) is appropriate. Consideration of cost can also affect the component heading rating as well as the ability to use an annual contract company to accomplish the work, versus having to use the bid or purchase order process.

3.2.3 Debris

Debris is any loose material that is not a part of the facility design that could potentially create blockages. It can consist of trash, tree limbs, vegetative clippings, construction waste, and other floatables. Debris has a significant impact on filtration facilities because it can block the surface of the filter media, thus decreasing the surface area and capacity of the facility. This causes the normal water level to rise, results in longer residence times for drainage and changes the functionality.

“Area full of debris” or “Facility full of debris”

Check if applicable. Debris in a filtration type facility can inhibit the ability of drainage to migrate to the filter media. It can also be a source of silt or sediment that can clog the filter media. Forebays are designed to catch debris prior to its entering the facility and therefore will require more frequent debris removal in an effort to prevent it from entering of the filtration area. This is a routine maintenance item with a minor rating (2) unless removal of the debris is more extensive, which warrants a higher rating. When inspecting filters, identify any trash or debris that could potentially be an IDDE issue. This topic is further discussed under the component heading titled “Overall Function of the Facility”.



Facility is filled with a significant amount of sediment and woody vegetation, affecting the volume of storage. This would indicate a moderate rating (3) due to the substantial growth in the forebay that is affecting the storage volume.

“Pretreatment/Inlet/outlet debris”

Check if applicable. Debris in a filtration type facility can inhibit the ability of drainage to infiltrate into the filter media. It can also be a source of silt or sediment that clogs the filter media. Take note if there is evidence that the debris is slowing flows in or out of the facility such as backwater effects and debris lines on the banks. This is a routine maintenance item with a minor rating (2) unless removal of the debris will be more extensive, which warrants a higher rating. When inspecting filters identify any trash or debris that could potentially be an IDDE issue. This topic is further discussed under the component heading “Overall Function of the Facility”.



There is a significant amount of debris blocking the inflow from this pipe. This would warrant a minor rating (2) due to the minimal effort required to remove the loose debris. Also, the amount of debris present does not appear to be substantially affecting water levels in the facility and allows partial flow through the pipe. If this blockage was creating a backwater condition for the pipe that was not a part of the design, a higher rating would be warranted.

3.2.4 Rating for the Debris Component Heading

If “Area full of debris”, “Facility full of debris” or “Pretreatment/Inlet/Outlet debris” is checked rate, this component as minor to moderate (2-3).

If “Area full of debris” or “Facility full of debris” is checked, removal of debris is a part of routine maintenance and this indicates a minor rating (2) based on the level of effort needed to remove the debris. Therefore, they require more frequent maintenance than the facility itself.

If “Pretreatment/Inlet/outlet debris” is checked and the presence of debris is affecting the functionality of the facility by slowing flows in or out of the facility, raising the normal water level from blockages, or preventing the forebay from functioning, then a moderate level rating (3) is appropriate. Additionally, if there is enough debris to impact the filtration surface area, a moderate rating (3) is warranted. If more extensive efforts are required for remediation, a higher rating may be warranted.

Multiple Component Headings with Ratings

Note if you have 2 or more minor rating (2) items checked you may consider upgrading the component section rating (3+) depending on the level of repairs required. If you have 2 or more moderate rating (3) items checked, you may

increase the heading rating (4+) based on the inspector's judgment. If any inspection item qualifies as a failure, then the overall failure rating (5) should be used for the component heading rating. Please note a failure in this component heading does not necessarily qualify as failure of the entire facility in the database rating if the principal spillways and outflow structures are properly functioning.

3.2.5 Pretreatment Structures

This section rates the overall condition of the discharge points and conveyances into the main facility and any adverse effects from them. Erosion or sediment build-up in the facility resulting from unstabilized upstream areas or inflow channels should be evaluated in this section. Any evidence of erosion or channel deterioration should also be noted. Note that not all facilities have a pretreatment feature as listed above. Please refer to the inventory section or the scanned plans for specifics about the facility being inspected.

"No sediment trapping"

Check, if applicable. This item describes deterioration of the pretreatment areas to the extent that they are not functional. Inflow initially goes through a pretreatment component to remove sediment and debris prior to water entering the main facility. This component can take the form of a sediment trap, a forebay or a swale that directs runoff into the facility. Removal of debris and trash is covered under routine maintenance in the "Debris" component heading. Be aware that in many cases the pretreatment structure includes some amount of designed storage volume for the facility, and impacts to this must be considered in the rating.



There is not any sediment trapping mechanism for inflow to this basin, which is apparent by the severely eroded channel. The channel is in need of stabilization and a check dam at the end of the channel would serve as a trapping mechanism. This warrants a major rating (4) because of the amount of sediment being transported.

“50% of volume taken”

Check if applicable. Pretreatment areas, particularly forebays, are designed to hold 10% - 15% of the required storage volume, so a loss of 50% of that capacity can impact the water level in the main facility and impair its function. This is more applicable to forebays than pretreatment swales, which do not store part of the treatment volume. Locating the source of erosion or sedimentation upstream, which may be considered an illicit discharge, is critical to minimizing future maintenance of the facility. If you suspect the substance is an illicit discharge, refer to the illicit discharge items listed under component heading “Overall Function of Facility” for further evaluation.



This forebay is filled with a significant amount of sediment and woody vegetation, affecting the volume storage. This warrants a moderate rating (3) due to the substantial growth in the forebay and effort required to remove it.

3.2.6 Rating for Pretreatment Structures Component Heading

If “No Sediment Trapping” or “50% of volume is taken” is checked, rate this category as minor to moderate (2-3).

If there is no sediment trapping but only a minimal amount of matter is entering the facility because the upstream areas are well stabilized, a minor rating (2) is warranted. If sediment impacts the function of the structure, a moderate rating (3) is appropriate.

Some pretreatment structures, such as a forebay, store 10% - 15% of the required design volume for the facility. Other types, such as a pretreatment swale, do not contain any of the required storage volume. A minor rating (2) is appropriate for structures that do not impact the storage volume. Pretreatment structures that do store some of the design volume warrant a moderate rating (3) if they are half full. Consult the scanned plans to verify proper storage levels.

3.2.7 Vegetation

The vegetation in Filter Systems is a key component of the design and the pollutant removal process. The filter media sorts out the silt, sediment, and trash while the vegetation’s roots absorb runoff drainage and store pollutants for their nourishment.

“Erosion at vegetation”

Erosion around vegetation indicates that the inflow has velocities higher than what the vegetation was designed to withstand. This corresponds to a minor rating issue (2) and can usually be repaired by increasing the outlet protection at the end of the inflow channel. This should reduce the energy and thus velocity as runoff enters the facility. Additionally, check the eroded area for indications that the flow is not bypassing the normal path and going around the main treatment features.



Accessed at www.guaduabamboo.com on September 4, 2013

There is a significant amount of erosion in the vegetative cover. Exposed roots can cause plant stress and minimize nutrient uptake. This warrants a minor rating (2), since this can often be corrected by adding additional outlet protection and replacing eroded material lost for proper root coverage. Additional E&S Control measures may be needed to reduce the flow velocity.

“Area not mowed”

As a part of routine maintenance, at least once a year the facility area should be mowed and the clippings should be removed to avoid impacts to the filter bed. Even shallow root systems can impact the facility’s ability to filter runoff and drain within a certain time frame, thus increasing the water depth and potentially backing up water beyond the design footprint. The rating should be based on the density and amount of growth. For example, if commercial equipment is needed to remove brush type growth, it should rate higher than vegetation that can be mowed with regular equipment (i.e. a lawnmower).



Vegetation is overgrown, and negatively affecting the facility. This would indicate a minor rating (2) because of the minor effort required to mow the area. If the vegetation was woodier and more brush like or difficult to access with proper equipment, a higher rating would be warranted.

“Area unstable”

Unstable areas contribute to sedimentation, which impacts the functionality of the system. The source of the instability (sloughing etc.) should be identified and remedied as part of this process. For example, an upstream area that previously generated sheet flow may have additional drainage coming to it that has caused a concentrated flow. This flow may be eroding the inflow location or down a bank, making the area unstable. In this case, the unstable area should be stabilized appropriately to handle the concentrated flow, to prevent future impacts. This action is a part of routine maintenance, so a minor rating (2) is appropriate unless the instability threatens failure of the facility.

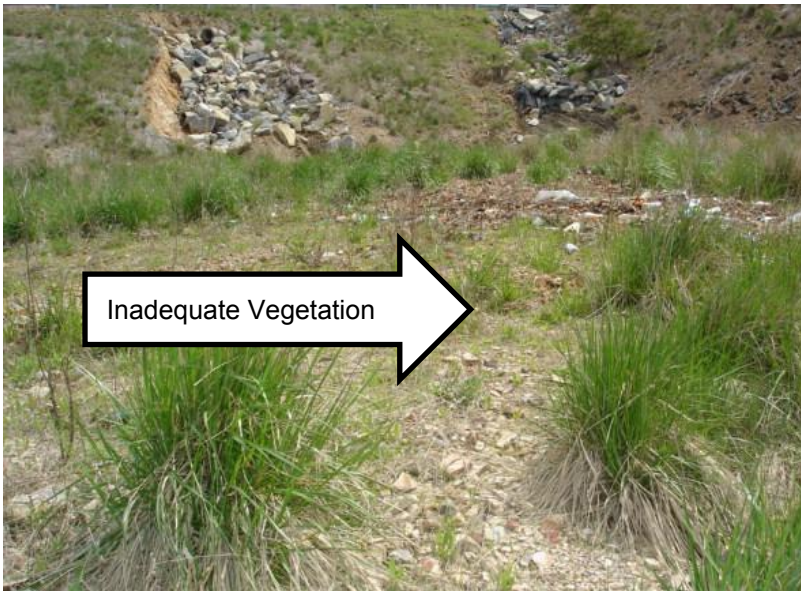


Accessed at www.cenews.com on Sept. 4, 2013

The outlet channel structure and adjacent areas are unstable and contributing to sediment buildup within the facility. This indicates a minor rating (2), due to the size of the area and minor effort required for stabilization. If the sedimentation is affecting the functionality of other facility components, a higher rating is warranted.

“Poor vegetation”

A main design component is the planting plan for many Filter type facilities. The plantings should be checked against the design plans for the number and species of plants present. Having more plants than what is shown on the plans is acceptable as long as none of the plants are invasive species and/or the overgrowth is not impacting the storage volume and the facility’s ability to drain. Checking the general planting location in the facility is also helpful. For example, a section of dying plants adjacent to an area that receives sheet flow from road shoulders indicates the runoff contains some type of plant stressor or contamination (e.g., de-icing salts from the road). Replacing vegetation is a part of routine maintenance and warrants a minor rating (2). Identifying the source of the stressor is imperative to the success of the plantings, but this may involve another component heading and warrant a higher rating.



There is inadequate vegetation in this facility, which significantly impacts the water quality and ground stability. This would indicate a minor rating (2), reflecting the need for routine maintenance. The plans should be referenced to determine any specific planting requirements. If the facility requires a complete replanting of 50% or more of the design plantings, then a higher rating is warranted.

“Unauthorized Plantings”

Weeds are not part of the landscape design for Filter filtration facilities. They evolve naturally and should be removed a minimum of twice a year through routine maintenance procedures [a minor rating (2)]. Weeds may also be indicative of sediment in the filter media bed, since sediment can promote weed growth. If the weeds are taking up storage volume in the filter, choking out required plantings or slowing flows, a higher rating is warranted.



There is a significant amount of weeds present in this facility. Weeds can impact the storage volume and water quality benefits. This indicates a moderate rating (2) and can be addressed by routine maintenance. The planting plan should be referenced to determine which plants should remain, be removed or be replanted.

Accessed at www.stormwaterpartners.com on Sept. 4, 2013

3.2.8 Rating for the Vegetation Component Heading

If “Area not mowed,” “poor vegetation,” or “Unauthorized plantings” are checked, rate this component heading as minor to moderate (2-3).

Vegetation is one of the key functioning elements in this type of facility that contribute to the overall pollutant removal efficiency. Performing landscaping maintenance is part of routine maintenance activities and warrants a minor rating (2). If more than 50% of the plantings are not functioning or weeds have taken over 50% of the Filter area, a moderate rating (3) would be appropriate.

If “Erosion at Vegetation” or “Area Unstable” is checked rate it as minor to major (2-4).

If either of the above items are checked, then runoff is likely to be damaging the facility. The rating level should reflect the degree of damage and impacts to functionality. A small amount of erosion at the vegetation that does not impact the life cycle of the vegetation warrants a minor rating (2). If instabilities are causing impacts to the required plantings or minor damage to the facility features, a moderate rating is warranted (3). If the erosion is so severe that the vegetation cannot survive or the instabilities are affecting the functionality of the system, a major rating (4) should result.

Multiple Component Headings with Ratings

Note if you have 2 or more minor rating (2) items checked, you may consider upgrading the component section rating (3+) depending on the level of repairs required. If you have 2 or more moderate rating (3) items checked, you may increase the component section rating (4+) based on the inspector’s judgment. If any inspection item qualifies as a failure, then the overall failure rating (5) should be used for the component heading rating. Please note a failure in the component heading does not necessarily qualify as failure of the entire facility in the database rating, if the principal spillways and outflow structures are properly functioning.

3.2.9 Clogging

Clogging prevents the facility from absorbing runoff and filtering pollutants out of it. There are many different sources of clogging that block or slow the outflow. Some of them are sediment, debris including tree leaves, trash, grass clippings and other yard litter. For a filtration facility, clogging of the filter or filter media is a critical parameter that must be monitored closely.

“Clogging”

If there is water standing in the facility 48 hours after a storm event, the filter media may be clogged. Other indicators of clogging include dry sediment residue on the top surface of the facility or vegetation (which requires soil to thrive) in the media. To further verify that clogging is present, raking the top 3 inches of filtration media and visually inspecting it for discoloration would also be appropriate. Depending on the severity of the clogging, replacement of the media may be required, in which case, contract the MS4 coordinator for further guidance.



Ponding Water in a Dry Facility Indicates Clogging.

The filter media in this facility has become clogged which is causing ponding of the water. This warrants a major rating (4) because clogging can cause the water level to rise and pose a risk to persons and property. This rating can be raised or lowered based on proximity to the public road and/or property which presents a safety threat.

Accessed at http://www.minnehahacreek.org/sites/minnehahacreek.org/files/pdfs/regulatory/WEB_Maintenance%20Guide%202012_bio%20and%20infil.pdf on Sept. 4, 2013

3.2.10 Rating for the Clogging Component Heading

If “Clogging” is checked rate it as minor to major (2-4)

In a Filter filtration type facility, clogging of the filter media is the equivalent of a blocked. The level of clogging and impacts to the function of the filter should be reflected in the rating. A minor rating (2) should result if there are isolated spots of dry, cracked sediment on the surface or isolated spots of small, non-woody vegetation that differ from those specified in the planting plan. If there is a more significant amount of sediment and vegetation coverage, a moderate rating (3) is appropriate. This includes a slight discoloration in part of the top 3 inches of media. If the discoloration extends through and/or beyond the top 3 inches of filter media, then the clogging is extensive. Other indicators of extensive clogging include standing water for 48 hours or more after a storm event and debris lines along the shore that are higher than the design elevations. These indicators warrant a major rating (4).

3.2.11 Structural Components

The structural components of a filtration system are not as apparent as they are in a basin. This section refers to any component that regulates the flow or provides structural support to retain the storm event flows. Structures in a filtration system can be comprised of underdrains, a perforated stand pipe, a concrete containment structure and/or an embankment, and metal surface grates, among others.

“Structural deterioration”

Deterioration refers to the breakdown of any of the structural components such as additional holes/tearing or crushing of the walls or drains or breaches in the embankment. These facilities are usually below grade so there is not an

elevated embankment, but they should still be evaluated for stability to preserve the function of the facility. This is a minor to major rating (2-4) item.



The drain in this structure has become damaged and has heaved out of the ground. This significantly reduces the operation of the drain. This is a minor rating (2) because the facility still drains; however, repairs need to be made to the underdrain. If the elevation difference prevented the facility from draining or significantly raised the water level a high rating is warranted.

“Damaged grates”

Grates should be evaluated to ensure they are functioning properly, preventing debris from entering the outflow system, and not broken or deteriorating. Consider the size of debris that the grate blocks in relation to the orifice size when inspecting.



The grate on this facility has broken off which allows debris to enter the facility. This is a minor rating (2) because the broken section is small and is not causing a performance or safety issue. If this grate were in a public area where safety was a concern, a higher rating would be appropriate. A higher rating would also apply if the broken grate area was large enough to allow debris to entirely block the outlet structure including inside the pipes.

Accessed at www.flickr.com on Sept. 4, 2013

“Cracks or spalling”

Check for cracking or spalling (material flaking off) on the structures, which would impede its ability to function. During the inspection consider if the structure is passing more flow than the designed amount because of cracking or spalling. Spalling is the result of metal corrosion, a natural process due to

contact with water. Minor repairs are performed as needed to prevent future corrosion and ultimately failure of the structure, necessitating its replacement.



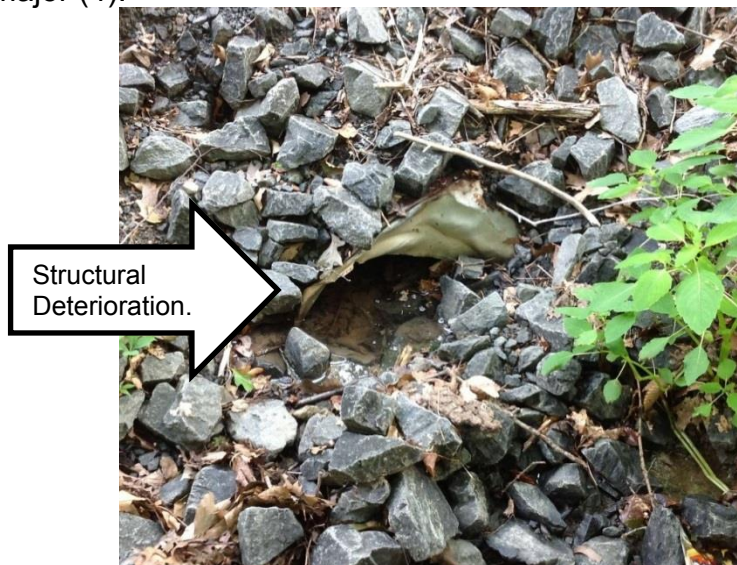
Accessed at www.watersealant.com on Sept. 4, 2013

The outlet structure of this facility has cracked. This can significantly impact structural integrity and operation. This is an instance of isolated cracking that does not go through the entire structure and therefore warrants a minor rating (2). If the cracking was in the bottom of the channel wider and a moderate rating (3) would be appropriate due to saturation frequency.

3.2.12 Rating for the Structural Components Heading

If "Structural Deterioration" is checked, rate it as minor to major (2-4), based on the conditions observed.

Structures regulate the proper function of the facility, so their condition has a direct impact to the proper operation and efficiency of the system. If there are issues occurring above the high water level, but structures are still functional, enter a minor rating (2). If the function is slightly impacted (e.g., the underdrain is flowing but partially clogged), a moderate rating (3) is appropriate. If deterioration is directly affecting the facility's ability to properly perform (e.g., the underdrain is crushed or fully blocked, or it has eroded such that it cannot contain the high flow events), rate it as major (4).



The outlet structure of this facility is crushed. This can significantly impact structural integrity and operation. This appears to be an isolated crushed area that restricts flow warranting a moderate rating (3). If further investigation reveals additional restrictions in the pipe, or backwater impacts from the flow restriction, a major rating (4) may be appropriate based on additional impacts to safety, structures and property.

If items “Damaged Grates” or “Cracks or Spalling” are checked, a minor to moderate (2-3) rating should result based on the field conditions.

Damaged grates can be a very minor item (2) where it is still functioning, but not to the design level by allowing larger size matter through the grate. If there is enough damage to the grate that it allows any size matter through and/or debris large enough to half way or more block the orifice, a moderate rating (3) should result.

Cracking or Spalling is the beginning of further deterioration of the grate and ultimately its functionality, but addressing it in this early form typically prevents a full failure of the grate and ultimately replacement. A minor rating (2) would result from thinning of the structure that does not impact functionality. Cracking or spalling that penetrates through the structure in an isolated location but still allows the structure to function is a moderate rating (3) item depending on its location.

Multiple Component Headings with Ratings

Note if you have 3 or more minor rating (2) items checked you may consider upgrading the heading rating (3+). If you have 2 or more moderate or major rating (3-4) items checked, you may consider increasing the heading rating (4+) based on the inspector’s judgment. If any inspection item qualifies as a failure, then the overall failure rating (5) should be used for the component heading.

3.2.13 Outlets/Overflow Structures

Outlets and outflow structures route the design level flows out of the BMP facility to a runoff system, such as a storm sewer, or natural channel. Examining the condition of the outlet and overflow structures is a good indication of the facility’s function level. Issues at the outfall or overflow structure can result from internal facility issues or stabilization.

“Outlet Erosion”

Check if applicable. Erosion may be caused by high level storm events, structures not properly functioning in the facility, or from dysfunctional outlet protection. If the outlet protection is eroded or scoured along the edges, this indicates that the footprint of the riprap is not large enough. If the riprap in the outlet protection is displaced this indicates that the size and weight of the stone is not large enough for the discharges. One of the purposes of stormwater facilities is to protect downstream waterways from flooding. The rating for this item should be based on the severity of the erosion from minor to moderate.



Inadequate stabilization and high flow, among other things, can cause the erosion in this picture above. This warrants a moderate rating (3) due to the significant erosion and sediment deposition. If there are sediment restrictions downstream, such as a TMDL prescribed by DEQ/EPA, the rating may be increased.

“Blockages”

Check this box if any orifices are blocked. Specify which orifice(s) in the notes section if there are multiple structures in the facility. This is a critical component of facility functionality. A blockage can back up water and raise the water level in the facility area. Abnormal standing water can be evidence of a blockage of the outflow structure; other indicators include lack of flow out of the outlet during storm events or flows much lower than usual.

If the blockage still allows the facility to properly function, such as a partial blockage and can be easily removed a minor rating (2) is appropriate. If more extensive efforts are required to remove the blockage and it is raising the water level a moderate (3) rating is appropriate. If there is a full blockage of a drainage structure significantly raising the water level or impacting other structures a major rating (4) is warranted.

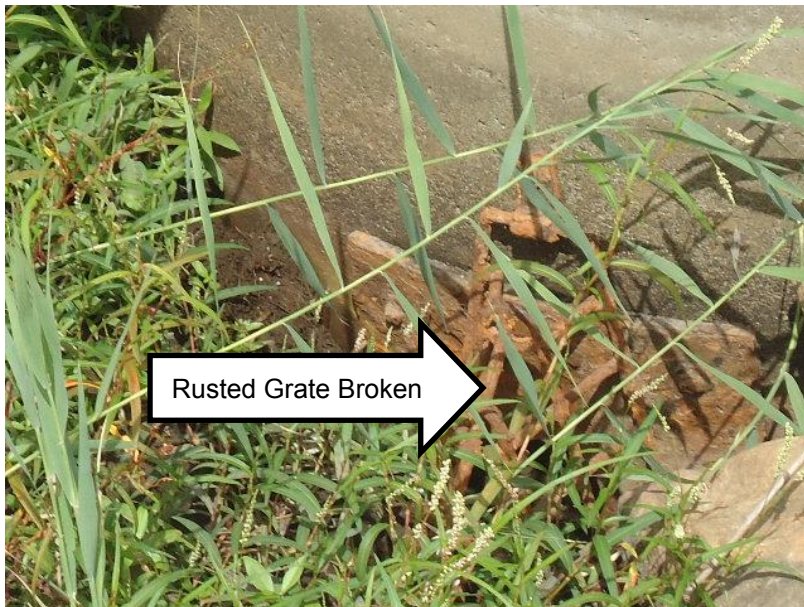


This structure has a large amount of sediment and debris preventing the water from draining properly. This warrants a moderate rating (3) because this could raise the water level. If the top outflow structure were also 100% blocked a major (4) rating would be warranted during large storm events. Debris lines on the facility slopes are good indicators of flow levels, and function of the facility.

“Poor Grate”

Check if applicable. Grates prevent debris and trash from entering the outlet structure and causing blockages. Corrosion is common on grates and should

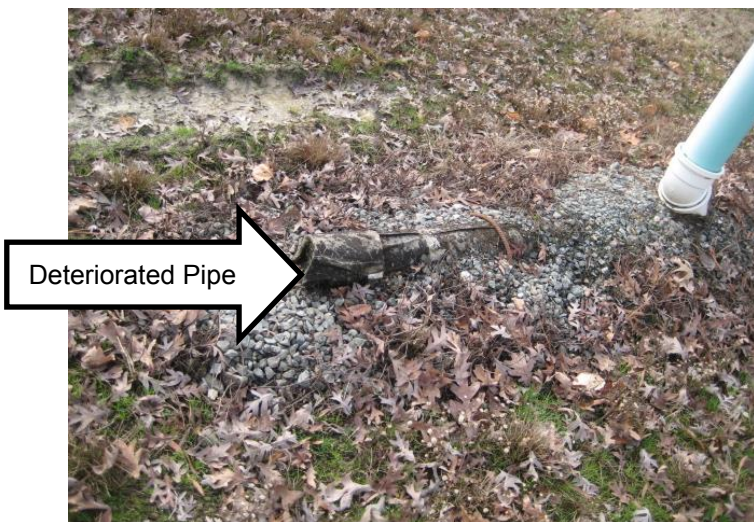
be monitored for full deterioration, i.e. completely eaten away. Cleaning grates should be a part of routine maintenance, and is much easier to accomplish than cleaning the outlet structure.



The grate has rusted and is broken. This could cause the grate to completely break loose and allow debris to clog the low flow orifice. This is a minor rating (2) because it is not allowing debris to enter the facility at this time but should be repaired as preventative maintenance.

“Pipe settling”

Check if applicable. Most filtration systems have a perforated pipe underdrain that routes the post filtered runoff out of the facility to the appropriate drainage system. Other filtration systems, like “sheet flow to vegetated filter strips” from the BMP clearinghouse do not necessarily have pipes, underdrains or structures as a part of the design. Note inventory form should clarify this, consult the scanned plans to clarify. Evidence of pipe issues includes a sunken area above the pipe location due to settlement or material loss through the pipe from deterioration. If there is abnormal standing water in an isolated area, the underdrain may be blocked in that section or settled which can prevent positive drainage out of the system.



The drain in this structure has become damaged and has heaved out of the ground. This significantly reduces the operation of the drain. This is a minor rating (2) because the facility still drains; however, repairs need to be made to the underdrain. If the structure does not have positive drainage into the outlet structure (i.e. sloped upwards instead of downward) and is slowing the flows, then a higher rating is warranted to ensure high water levels are not impacting persons and property. The rating may also be increased based on the level of work required outside of routine maintenance to restore function.

3.2.14 Rating for Outlets/Overflow Component Heading

If items “Outlet Erosion” or “Poor Grates” are checked, a minor to moderate (2-3) rating should result based on the field conditions.

If “Outlet Erosion” is checked, the rating will be minor to moderate (2-3) based on the severity of the erosion. If routine maintenance can repair the erosion a minor rating (2) is appropriate; however, if construction equipment or extensive channel repairs requiring loads of materials, such as riprap, are necessary a moderate rating (3) should result. Please note, when performing or directing appropriate outlet channel repairs, impacts to environmentally sensitive areas should be thoroughly considered as well as potential permit requirements. Additionally, appropriate erosion control measures should be evaluated to prevent further impacts from repairs as required. “Damaged grates” can be a very minor item (2) when it is still functioning, but not to the design level by allowing larger size matter through the grate. If there is enough damage to the grate that it allows any size matter through and/or debris large enough to half way or more block the orifice, a moderate rating (3) should result.

If items “Blockage” or “Pipe Settling” are checked, a moderate to failure level (3-5) rating should result based on the severity of field conditions.

Blocking of outflow orifices can impact the ability of the facility to properly drain; however, occasionally large storm events can dislodge the blockage. If the outlet structure is on a steep enough slope it is unlikely it will raise the water level in the facility; however, high sloped underdrains or outlets are typically not a part of filtration facilities. Flatter outflow structures with less of an elevation difference between the inflow and outlet have more potential for affecting the normal water level by backing up drainage. For filtration facilities, it would typically take longer to draw down (moderate (3) to major (4) based on the backwater footprint and depth) as opposed to a new outflow path being created due to the blockage which is a failure level rating (5) if the drainage is not treated.

Pipe settling or deteriorating can be a moderate to failure level rating item based on the severity of the field conditions. This is a structural mode of failure where the spillway pipe is not functioning properly and drainage is causing further deterioration of the structure and facility. Take note of the damage, location, and accessibility for repair. A small isolated sunken area warrants a moderate rating (3). A major rating (4) is appropriate for larger areas indicating issues, for example settled areas above more than half of the underdrain length, or standing water close to design levels. If there are higher than design level pool indicators in the facility, a failure rating (5) may be warranted.

Multiple Component Headings with Maintenance Ratings

Note if you have 3 or more minor rating (2) items checked you may consider upgrading the heading rating (3+). If you have 2 or more moderate or major rating (3-4) items checked, you may consider increasing the heading rating (4+) based on the inspector’s judgment. If any inspection item qualifies as a failure, then the overall failure rating (5) should be used.

3.2.15 Sediment Deposition

For filtration systems sediment has the most critical impact on functionality and can cause other issues to develop as a result. The type, size, and origin of sediment all create different issues in the BMP and should be thoroughly investigated and addressed.

“Sedimentation”

Evidence of significant sediment would include dried or cracked silt deposits on the media surface, waterlines beyond the normal storm event area, or discoloration in the top 3 inches of media. Vegetation is also a sign that significant sediment is present allowing their growth. Take note of the storm/water level indicators in and around the facility, such as sediment or debris lines on the slopes. This is a good indicator of the impact sedimentation has on the function of the BMP. Please note, locating the source of erosion or sedimentation upstream is critical to the repair of this component, and may be considered an illicit discharge. If so, please see the “Illicit Discharge” item listed under “Overall Function of Facility” heading as described below.



Sediment has built up in the facility and is affecting the storage volume, filtration and potentially the required plantings. This is a moderate rating (3) as the facility is still draining but sediment needs to be cleaned for it to operate as designed and not raise water levels. If additional structures are being engaged in storm events less than design levels, the rating should increase.

“Sediment in chamber”

Chambers are associated with Filtering Practices 1 and 2 CH facilities. Per the BMP clearinghouse if there is 6” or more of sediment in the chamber, the sediment should be removed. This sediment in the chamber prevents proper function of the facility.



Accessed at www.ces-txvi.com on Sept. 4, 2013

There is a significant amount of sediment build up. This is affecting the filtration capabilities of this facility. This is a major rating (4) because the sediment in the chamber is completely blocking the media, causing high water levels during rain events and preventing proper treatment.

3.2.16 Rating for Sediment Deposition Component Heading

If “Sedimentation” is checked a minor to major rating (2-4) should result.

Sediment fills in the voids in the filtration system preventing the key design components from functioning. The amount of sedimentation affects the level of function of the facility which should be reflected in the rating. If you examine the top 3 inches of filtration media and only the surface has sediment, a minor rating (2) is appropriate. If there is vegetative growth and the sediment extends midway through the media, a moderate rating (3) should result. If the sediment extends more than half way through the media and there is evidence of water levels above design storm levels, then rate it as major (4).

If “Sediment in Chamber” is checked a minor to moderate (2-3) rating should result.

Per the specifications if there is 6” of sediment in the filtration chamber it is required to be removed. If the sediment level is not affecting the function of the facility a minor rating (2) should result. If the sediment is blocking inflow or outflow from the chamber, rate it as moderate (3). Consider the level of work and equipment required to remove the sediment in the rating.

Multiple Component Headings with Maintenance Ratings

Note if you have 3 or more minor rating (2+) items checked you may consider upgrading the heading rating (3+). If you have 2 or more moderate or major rating (3-4) items checked, you may consider increasing the heading rating (4+) based on the inspector’s judgment. If any inspection item qualifies as a failure, then the overall failure rating (5) should be used.

3.2.17 Plants

Planting plans are required for some types of Filtration facilities as a part of the facility design. Plan components can include combinations of native trees, shrubs, and perennial ground covers that simulate the structure and function of a native forest

plant community. Such plans also include a delineation of planting areas, the size and list of planting stock, sources of plant species, the planting sequence, post-nursery care and initial maintenance requirements.

“Planting erosion”

Check this box if there is erosion impacting the planting areas or root systems. This issue could result from different causes, such as high velocity flows due to inadequate outlet protection or frequent storms larger than the design level of the facility. Determining the cause of the erosion is critical to achieving a long-term remedy for the problem.



Accessed at www.guaduabamboo.com on Sept. 4, 2013

There is a significant amount of erosion occurring around these plants. Exposed roots can cause plant stress and minimize nutrient uptake. This warrants a minor rating (2), since this can often be corrected by adding additional outlet protection at the facility's discharge point and replacing eroded soil to ensure proper root coverage. Consider additional erosion control measures to prevent or reduce erosion.

“Thin or poor mulch”

Check, if applicable. If the mulch is deteriorating or does not meet the design depth and area requirements, replacement is required. Regarding stabilization, this is a minor (2) issue. If the mulch is a component of the filtration media, this is a moderate (3) issue.



Accessed at www.richmondregional.org on Sept. 4, 2013

The mulch layer on this facility is below minimum specifications. This warrants a moderate rating (3) because the mulch is part of the filtration design. Periodically supplementing the mulch should be a part of routine maintenance.

“Dead/diseased plantings”

Check, if applicable. Plantings should be replaced consistent with the design plans. Dead or diseased plantings could result from improper water levels (e.g., wetland plants in a dry area where the control valve was not closed), substances toxic to the eco-system, or unusual weather patterns. Determining the cause will assist in selecting a healthy plant for those conditions.

“Plant stress”

Check if plantings are deteriorating from unknown stressors. Note that locating the type and source of the stressor is critical to achieving the desired restoration, and note that the source may be considered an illicit discharge. If so, please see the “Illicit Discharge” item listed under “Overall Function of Facility” heading, as described below.



The plants in this facility are diseased, dying and/or stressed. This impacts the pollutant removal capabilities. This warrants a moderate rating (3) because the plants are a main design component regarding water quality and stability of the facility and none have survived.

Accessed at http://en.wikipedia.org/wiki/File:Bioretention_cell_rain_garden_US_winter.jpg on Sept. 4, 2013

3.2.18 Rating for Plants Component Heading

If any boxes are checked, a minor to moderate (2-3) rating should result.

If “Planting erosion” is checked, a minor to moderate rating (2-3) should be used. If the erosion is not affecting the root structure or the ability of the plant to thrive, a minor rating (2) is appropriate.

If “Thin or poor mulch” is checked, a minor to moderate (2-3) rating is appropriate. If the mulch does not meet plating specifications, but is provided for aesthetics and is not a filtration design feature, a minor rating (2) should result. If the mulch is considered part of the filtration media in the design, rate it as moderate (3).

If “Plant stress” or “Dead/Diseased Plantings” is checked, rate it as minor to moderate (2-3). If the stressors are allowing the plant to partially thrive, rate it as minor (2). If the plant is not thriving at all, enter in a moderate rating (3).

Multiple Component Headings with Maintenance Ratings

Note that if you have three or more minor rating (2) items checked, you may consider upgrading the heading rating (3+). If you have two or more moderate or major rating (3-4) items checked, you may consider increasing the heading rating (4+). If any inspection item qualifies as a failure, then the overall failure rating (5) should be entered.

3.2.19 Overall Function of Facility

This component heading evaluates the functionality of the facility as a whole. Design features that are not included in the previous headings are evaluated under this heading.

“Evidence of illicit discharge”

Check, if applicable. Evidence of an illicit discharge can be oil sheens on the water surface or vegetation, atypical odors or colors of substances, or sediment in the facility among others. If there is a possible Illicit Discharge (ID) discovered, report it in accordance with the notification instructions and guidance discussed in VDOT’s *Illicit Discharge Detection and Elimination (IDDE) Program Manual* and the accompanying *Field Guide*.



This oil sheen can be seen entering the facility during a dry weather inspection. This warrants a moderate rating (3) and the VDOT IDDE Manual should be referenced for further guidance on reporting and inspection of the potential ID.

“Flow bypass”

Check, if applicable. If the flow is bypassing the control structure, principal spillway or related design features, then the flows are not being properly treated and the required pollutant removal is not being achieved. Flow bypass can result from many different causes, such as sedimentation causing a lack of positive drainage, a blocked outlet structure, or vegetative overgrowth. This is a minor to moderate (2-3) rating item, depending on the ability to meet pollutant removal requirements.



The flow in this picture is bypassing the control structure and has caused a dam breach. Bypassing flows in a filtration structure are typically evident by erosion and scour indicative of flow around a structure or debris paths that circumvent the outlet/inlet. If drainage bypasses the inlet structure into the facility (i.e. flows outside of the inflow channel) but still connects drainage to the control structure, it warrants a minor rating (2). If it bypasses the control structure during large storm events, rate it as moderate (3). If it is bypassing the outlet structure on a regular basis, rate it as major (4). In the case shown above, it would also be rated as a dam breach in other sections of the inspection form, which increases the overall facility rating to a failure level (5).

“Standing water”

Standing water in a filtration facility for more than 48 hours after a storm event indicates other issues, such as clogged media and potential blockages. Observation wells are recommended to monitor infiltration visually and to note time durations for drainage. This item is typically rated as minor to moderate (2-3).



The filter media in this facility has become clogged which is causing ponding of the water. This is a major rating (4) because clogging can cause the water level to rise and pose a risk to persons and property.

Accessed at http://www.minnehahacreek.org/sites/minnehahacreek.org/files/pdfs/regulatory/WEB_Maintenance%20Guide%202012_bio%20and%20infil.pdf on Sept. 4, 2013

“Odors”

Odors are indicative of stagnant water that is collecting algae, fungus and bacteria. All of these are indicators that the facility is not properly draining or functioning.



Accessed at blogcooperation.be on Sept. 4, 2013

The causes of the bad odor in this facility are algae, fungus, and bacteria. Typically there are other facility deficiencies that are causing them to form. This warrants a minor rating (2) . The rating can be increased if there is a threat to public health or safety, or other components are involved.

“Shoreline erosion”

Notate any erosion caused by or within these facilities. Shoreline erosion is particularly difficult to remedy because sandy soils do not have strong cohesion and compaction. This warrants a minor to moderate (2-3) rating based on the severity of erosion.



The shoreline of this facility has significantly eroded. There are many factors that could play a part in contributing to this condition. This warrants a minor rating (2) because it is fairly well stabilized and the water is clear, indicating little to no sediment pollution at this time.

“Failed pumps”

Some filtration systems have pumps to drain the facility during storm events of certain sizes. Depending on the frequency of needed pumping and the level at which the pumps engage, this item warrants a minor to moderate (2-3) rating.



This photo is a picture of a pump. Pumps come in many shapes and sizes and usually consist of an intake structure, a pump motor, an outlet pipe, and a power source.

Accessed at www.brookslandscapes.biz on Sept. 4, 2013.

3.2.20 Rating for Overall Function of Facility Component Heading

If “Evidence of Illicit Discharge”, “Flow bypass”, “Standing water”, “Odor”, or “Shoreline erosion” are checked, the rating is minor to moderate (2-3).

If the “Evidence of Illicit Discharge” is checked and contained in a small isolated area in relation to the facility footprint, a minor rating (2) is appropriate. If it is a larger area or could potentially impact an environmentally sensitive area, rate it as moderate (3). If this item is checked the highest priority is reporting and following procedures outlined in VDOT’s *Illicit Discharge Detection and Elimination Program Manual and the Field Guide*.

If “Flow bypass” is checked, the severity and impacts to the new drainage pattern determine the appropriate rating. If flows are bypassing certain design features within the facility but the majority of the outflow is still served by the facility, a minor rating (2) is appropriate. If the bypass is severe enough that most of the drainage is bypassing treatment, then a moderate rating (3) should result.

If “Standing water” is present, the rating should be based on the amount of standing water, the length of time present, and the footprint it encompasses. If it is in an isolated small area, perhaps caused by a trash rack blockage or low area, a minor rating (2) is appropriate. If the standing water is impacting the storm-related water level and encompassing a significant portion of the facility, rate it as moderate (3).

If “Odor” is present, it usually indicates long-term stagnant standing water. Depending on the size of the area and type of odor, a minor to moderate rating (2-3) is warranted. Please note this could also be a potential IDDE (e.g., sewage), which necessitates consulting VDOT’s *Illicit Discharge Detection and Elimination Program*

Manual and the associated *Field Guide* for proper procedures and reporting requirements.

If “Shoreline Erosion” is checked, the level and location of erosion determines the rating level. If the erosion is isolated to a specific area and does not threaten the structural integrity of the facility, a minor rating (2) is appropriate. If the erosion is more widespread, it may be caused by rapid fluctuations in pool levels during storm events, soil compaction and cohesion, or inadequate stabilization at the inlet. These conditions should be rated as moderate (3).

If “Failed pumps” is checked, the rating is minor to major (2-4).

If “Failed pumps” is checked, the level of failure and frequency of use should be reflected in the rating. If the pumps are partially working and only engage on a very infrequent-level event (e.g., a 100-year storm), then the rating is minor (2). If the pumps are required in a design storm level event (e.g., a 10-year storm) and they have fully failed, then a major rating (4) is appropriate.

Multiple Component Headings with Maintenance Ratings

Note if you have three or more minor rating (2) items checked, you may consider upgrading the heading rating (3+). If you have two or more moderate or major rating (3-4) items checked, you may consider increasing the heading rating (4+). If any inspection item qualifies as a failure, then the overall failure rating (5) should be used.

3.3 OVERALL INSPECTION RATING BY THE DATABASE

3.3.1 Rating A

The stormwater facility is functioning as designed with no problem conditions identified. There are no signs of impending deterioration. Routine maintenance will be performed twice a year as a preventative or in accordance with the Virginia Stormwater BMP Clearinghouse specifications, whichever is more stringent.

No component headings rate above a 1.

3.3.2 Rating B

Minor problems are observed. However, the stormwater facility is functioning as designed and no critical elements have problem conditions. Routine maintenance can achieve needed repairs. A maintenance work plan will be developed and carried out in 12-26 weeks.

At least one of the component headings “Accessibility”, “Debris”, “Vegetation”, “Plants”, “Pretreatment Structures” or “Overall Function” has a value of 2-3, and / or at least one of the headings “Clogging”, “Structural Components”, or “Outlet/Overflow Structures” and “Sediment Deposition” has a value of 2.

3.3.3 Rating C

Moderate problems are observed, and the stormwater facility has small changes in functionality that do not change the water level or impact its structural integrity. Routine maintenance may address some of the required repairs, but not all of them. A maintenance work plan will be developed and implemented within 6-12 weeks. *At least one of the component headings “Accessibility”, “Debris”, “Vegetation”, “Plants”, “Pretreatment Structures” or “Overall Function” has a value of 4-5, and / or at least one of the headings “Clogging”, “Structural Components”, or “Outlet/Overflow Structures” and “Sediment Deposition” has a value of 3.*

3.3.4 Rating D

Major problems are observed and the stormwater facility is not functioning as designed, with at least one critical parameter requiring repairs. Conditions associated with the facility have compromised its performance and/or raised the water level, potentially impacting the structural integrity. The facility shows signs of impending deterioration, with a potential for failure. Deficiencies require repair and restoration. A maintenance work plan will be developed and implemented within 2-6 weeks. Part of the work plan may include immediate remediation measures to temporarily preserve the facility and prevent further deterioration. *At least one of the component headings “Clogging”, “Structural Components”, “Pretreatment Structures”, or “Outlet/Overflow Structures” and “Sediment Deposition” has a value of 4.*

3.3.5 Rating E

Severe problems are observed, and stormwater facility is not functioning as designed, with several critical parameters requiring immediate repairs. Conditions associated with the facility have compromised its performance, and further deterioration and/or failure is imminent. Deficiencies require repair and restoration. A secondary supervisor-level inspection is necessary to clarify the extent of the maintenance work and what specific parties should be involved. A maintenance work plan will be developed and implemented within 2 weeks. Part of the work plan will include immediate remediation measures to temporarily preserve the facility and prevent further deterioration. *At least one of the component headings “Clogging”, “Structural Components”, “Pretreatment Structures” or “Outlet/Overflow Structures” and “Sediment Deposition” has a value of 5.*

3.4 INSPECTOR RATING

The inspector rating allows input from the inspector based on the specific field conditions for that facility.

3.4.1 Rating Input

The inspector rating cannot be lower than the database rating, but it can be higher, based on the inspector's judgment. For example, if there was a wet area on the back of an embankment that stayed moist and the latest inspection revealed a free flowing colored discharge from the same area, the "Dam Embankment" heading would be ranked appropriately. Having pictures available from previous inspections is a critical means of comparison to ensure the proper rating is assigned. The inspector could increase the inspector rating due to personal knowledge or observations (e.g., proximity of impaired waters, presence of a residential community downstream, the short time frame during which facility conditions changed, etc.).

4 INFILTRATION INSPECTIONS

4.1 TYPES OF INFILTRATION FACILITIES

4.1.1 Bioretention I and II (CH), Urban Bioretention (CH), Bioretention Basins and Bioretention Filters

Bioretention facilities are shallow landscaped depressions that incorporate many of the pollutant removal mechanisms that operate in our natural environment. The primary component of a bioretention practice is the filter bed, which has a mixture of sand, soil, and organic material as the filtering media with a surface mulch layer. During storms, runoff temporarily ponds 6 to 12 inches above the mulch layer and then rapidly filters through the bed. Normally, the filtered runoff is collected in an underdrain and returned to the storm drain system or receiving channel. The underdrain consists of a perforated pipe in a gravel layer installed along the bottom of the filter bed. Bioretention facilities can also be designed to infiltrate runoff into native soils without an underdrain. This can be done at sites with permeable soils, a low groundwater table, and a low risk of groundwater contamination. Small residential applications of bioretention are termed rain gardens.

4.1.2 Infiltration I and II CH, Infiltration Trenches and Infiltration Basins

Infiltration practices are very effective for runoff volume reduction and nutrient removal, due to the natural processes that occur within them. Stormwater passes through pretreatment cells removing sediment and organic matter, then flows into a temporary surface or underground storage area where it infiltrates into the underlying soil. Good soil permeability rates are an essential design feature, and the infiltration rate requirements vary based on the desired pollutant removal level. Infiltration designs typically include pea gravel, layers of filter fabric, aggregate, a sand layer and ultimately undisturbed soils. Infiltration trenches have a more linear shape, and infiltration basins are shallow impoundments. Infiltration facilities are not appropriate for stormwater hotspots, where groundwater contamination is more likely to result.

4.1.3 Rooftop Disconnect CH

This practice disconnects impervious surfaces within a site by routing runoff over the soil or to other BMPs. The systems function by intercepting, reusing, infiltrating, filtering, or using other methods of stormwater treatment which decrease the effect of imperviousness within the watershed. Simple disconnection practices direct rooftop and/or residential impervious surface waters to pervious areas. Disconnection can be used in conjunction with secondary practices, including rain gardens or micro-bioretention facilities, soil compost-amended pathways/trenches, micro-infiltration facilities (i.e., dry wells and French drains), rainwater harvesting via water collection cisterns, and release and storage within the design. This allows the runoff to be infiltrated, treated or re-used locally.

4.1.4 Dry Swales I and II CH

These vegetated channels are designed to decrease flow rates; increase pollutant removal through filtration and infiltration; and enhance runoff storage. They can be used as pre-treatment practices, carrying runoff to other treatment facilities. They are designed to receive relatively clean stormwater runoff and are not suitable for direct sedimentation from disturbed areas.

The swales should be situated adjacent and parallel to the drainage area, and should be at least as long as the drainage area. Channel side slopes should be 2:1 or less. The channel longitudinal slope should be 4% or less, ideally 1-2%.

4.1.5 Permeable Pavement I and II (CH)

Permeable pavement systems have integrated voids for runoff to filter through the surface into an underground stone reservoir. This reservoir stores the runoff and infiltrates it into the underlying soils. Various types of permeable pavement systems are available such as pervious concrete, porous pavement, and permeable interlocking pavers.

4.2 FACILITY COMPONENT HEADINGS

4.2.1 Accessibility

This is the area available for inspection personnel and maintenance equipment to access the facility from the VDOT right-of-way. The access should be at least 10 feet wide, on a slope of 3:1 (H:V) or less, and stabilized to withstand the periodic passage of heavy equipment. The evaluation of this parameter should take into consideration roadway fill elevations (which are often steeper than 3:1 slopes), the configuration of the roadway with respect to the facility, the natural topography surrounding the facility, and the potential need to stabilize the access to the BMP. In addition, this section considers vegetation or debris that may impede access, as well as public safety components such as fencing and gated access.

“Inaccessible”

Check, if applicable. If the access has not been maintained or used, this can be a sign that the BMP itself has not been maintained. This should result in a higher rating, since the conditions may make it more difficult for the inspector to perform the required inspection in the allotted time frame.



Accessed at ohland.homedns.org on Sept. 4, 2013

This facility has an inadequately maintained access road. There is significant minor growth that would impede equipment from entering the area for inspection or maintenance. This would warrant a minor rating (2) because the access road can be easily restored by cutting down the low brush.

4.2.2 Rating for the Accessibility Component Heading

If “Inaccessible” is checked, rate it as minor to major (2-4). The rating is based on impacts to the surrounding area and the level of work required to establish access. A minor rating (2) would result from having to establish access with a minor amount of work, such as laying stone over an existing cleared path or mowing/bush-hogging saplings and trees. A moderate rating (3) is appropriate if it is necessary to remove obstructions from an established access path or provide a significant amount of higher grade of stone for access through problematic areas, such as saturated soils. If heavy construction equipment such as a bulldozer is necessary to clear an area for access to the facility and outlet structure, a major rating (4) is warranted. The rating for this heading can also depend on the amount of repair cost, as well as whether it is necessary to use an annual contract company or, beyond that, to recruit a contractor through the bid or purchase order process.

4.2.3 Debris

Debris is any loose material that is not a part of the facility design that could potentially create blockages. It can consist of trash, tree limbs, vegetative clippings, construction waste, and other floatables. Debris has a significant impact on infiltration facilities because it can block the filter media, thus decreasing the effective surface area and treatment capacity of the facility. This causes the normal water level to rise and changes the functionality.

“Area full of debris” or “Facility full of debris”

Check, if applicable. Debris in an infiltration type facility can inhibit the ability of water to migrate to the filtration media. It can also be a source of silt or sediment that blocks the filtration media. Pretreatment areas are designed to catch debris and prevent it from entering the facility. Therefore, they require more frequent debris removal than the infiltration area itself. This item also

addresses upstream areas that drain to the facility and their effects on functionality. Isolating the source of the debris is critical in order to minimize future maintenance of the facility. Upstream areas can impact the inflow channel as well as the facility's ability to adequately perform. Additionally, a full inlet blockage can create a backwater that may extend across property lines. When inspecting, identify any trash or debris that could potentially be considered an illicit discharge. This topic is further discussed under the component heading "Overall Function of the Facility".



This facility is filled with a significant amount of natural debris and trash, affecting the volume of storage. This warrants a moderate rating (3) due to the substantial growth in the forebay that is affecting the storage volume.

"Pretreatment/Inlet/outlet debris"

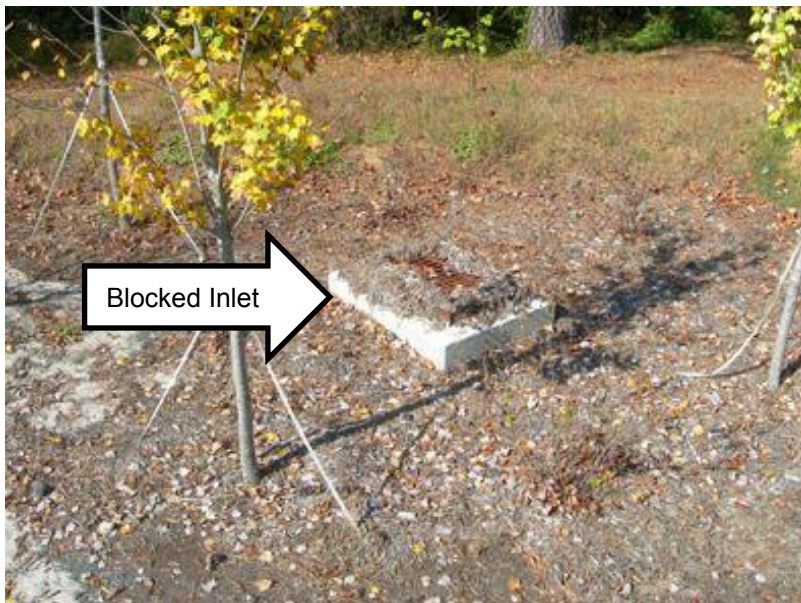
Check, if applicable. Debris in an infiltration type facility can inhibit the ability of water to migrate down to the filtration media. It can also be a source of silt or sediment that blocks the filtration media. This is a routine maintenance item with a minor rating (2) unless removal of the debris is more extensive, which warrants a higher rating. When inspecting, identify any trash or debris that could potentially be considered an illicit discharge. This topic is further discussed under the component heading "Overall Function of the Facility".



There is a significant amount of debris blocking the inflow from this pipe. This would warrant a minor rating (2) due to the minimal effort required to remove the loose debris. Also, the amount of debris present does not appear to be substantially affecting water levels in the facility and allows partial flow through the pipe. If this blockage was creating a backwater condition for the pipe that was not a part of the design, a higher rating would be warranted.

“Spillway full of debris”

Check, if applicable. Debris in the spillway typically results from storm events; however, it can become so dense that it affects the capacity and function of the spillway by slowing or reducing the outflow. Isolating the source of the debris is critical in order to minimize future maintenance of the facility. When inspecting, identify any trash or debris that could potentially be considered an illicit discharge. This topic is further discussed under the component heading “Overall Function of the Facility”.



This spillway has become clogged with leaves. This impacts the capacity and raises the water level which may cause flows to find an alternate exit path. This warrants a minor rating (2), because of the minimal effort required to remove the blockage. Removal of this type of debris in the channel is typically done as part of routine maintenance.

4.2.4 Rating for the Debris Component Heading

If “Area full of Debris”, “Facility full of debris” or “Pretreatment/Inlet/outlet debris” is checked rate it as minor to moderate (2-3).

Debris removal is part of routine maintenance and warrants a minor rating (2) unless removal of the debris is more extensive, for which a higher rating is appropriate

based on the level of work required. Pretreatment areas are designed to trap and filter debris and sediment from the runoff before it enters the facility. Therefore, they require more frequent maintenance than the infiltration area itself. If debris is affecting the functionality of the facility by slowing flows into or out of the facility, causing higher than normal water levels, then a moderate rating (3) is appropriate.

If “Spillway Full of Debris” is checked rate it as minor to moderate (2-4).

Debris removal is part of routine maintenance and removal of small amounts not affecting flow rates is a minor rating (2) item. If the debris is affecting the functionality of the outflow structure by slowing flows out of the facility, a moderate rating (3) should result. If the outlet structure is full blocked by debris, or blocked enough to affect the water level in the facility, rate it as major (4).

4.2.5 Sediment Traps, Forebays, and Pretreatment Swales

This section rates the overall condition of the discharge points and conveyances into the main facility and any adverse effects from them. Erosion or sediment build-up in the facility resulting from unstabilized upstream areas or inflow channels should be evaluated in this section. Any evidence of erosion or channel deterioration should also be noted. Note that not all facilities have the components listed. Please refer to the inventory section or the scanned plans for specific features about the facility.

“No sediment trapping”

Check, if applicable. This item describes deterioration of the pretreatment areas to the extent that they are not functional. Inflow initially goes through a pretreatment component to remove sediment and debris prior to drainage entering the main facility. This component can take the form of a sediment trap, a forebay or a swale that directs runoff into the facility. Removal of debris and trash is covered under routine maintenance in the “Debris” component heading. Be aware that in many cases the pretreatment structure includes some amount of designed storage volume for the facility, and impacts to this must be considered in the rating.



There isn't any sediment trapping mechanism for inflow to this basin, which is apparent by the severely eroded channel. The channel is in need of stabilization and a check dam at the end of the channel would serve as a trapping mechanism. This warrants a major rating (4) because of the amount of sediment being transported.

"50% of volume taken"

Check if applicable. Pretreatment areas, particularly forebays, are designed to hold 10% - 15% of the required storage volume, so a loss of 50% of that capacity can impact the water level in the main facility and impair its function. This is more applicable to forebays than pretreatment swales, which do not store part of the treatment volume. Locating the source of erosion or sedimentation upstream, which may be considered an illicit discharge, is critical to minimizing future maintenance of the facility. If the sediment is considered an illicit discharge, refer to the illicit discharge items listed under component heading "Overall Function of Facility".



This facility is filled with a significant amount of sediment and woody vegetation, affecting the volume of storage. This warrants a moderate rating (3) due to the substantial growth in the forebay that is affecting the storage volume and the level of effort needed for repairs.

4.2.6 Rating for Sediment Traps, Forebays, and Pretreatment Swales Component Heading

If “No Sediment Trapping” or “50% of volume is taken” is checked, rate this category as minor to moderate (2-3).

If there is no sediment trapping but only a minimal amount of matter is entering the facility because the upstream areas are well stabilized, a minor rating (2) is warranted. If sediment impacts the function of the structure, a moderate rating (3) is appropriate.

Some pretreatment structures, such as a forebay, store 10% - 15% of the required design volume for the facility. Other types, such as a pretreatment swale, do not contain any of the required storage volume. A minor rating (2) is appropriate for structures that do not impact the storage volume. Pretreatment structures that do store some of the design volume warrant a moderate rating (3) if they are half full. Consult the scanned plans to verify proper storage levels.

4.2.7 Vegetation

The vegetation designed for infiltration systems is a key component of the pollutant removal. The infiltration media provides pollutant reduction through various treatment mechanisms, while the vegetation’s roots absorb storm water runoff and pollutants.

“Erosion at vegetation”

Erosion at vegetation indicates that the inflow has velocities higher than what the surface cover was designed for. This corresponds to a minor rating (2) and can usually be repaired by increasing the riprap size or footprint of the outlet protection upstream from the vegetation. This should reduce the energy and thus velocity as runoff enters the facility. Additionally, check the eroded area for indications that the flow is bypassing the normal path and going around the main conveyance features.



Accessed at www.guaduibamboo.com on Sept. 4, 2013

There is a significant amount of erosion at the base of the plant material. Exposed roots can cause plant stress and minimize nutrient uptake. This warrants a minor rating (2), since this can often be corrected by adding additional outlet protection and replacing material lost for proper root coverage.

“Area unstable”

Proper stabilization is critical to keeping the BMP operational. The source of the sedimentation or instability (sloughing, etc.) should be identified and remedied as part of this process, as well as the unstable area. For example, an upstream area that previously drained as sheet flow may receive additional drainage, turning into concentrated flow. This flow may be eroding the area, making it unstable. In this case, the unstable area and concentrated flow should be stabilized to prevent future impacts. This repair is a part of routine maintenance, and a minor rating (2) is appropriate unless the area requires more extensive repairs or impacts the structural integrity of the facility.



The contributing drainage area to this grass swale is unstable and is contributing to sediment buildup within the channel. This warrants a minor rating (2).

Accessed at www.cenews.com on Sept. 4, 2013

“Area not mowed”

The infiltration area should be mowed and clippings should be removed a minimum of twice a year to avoid impacts to the filter bed. Even shallow root systems can impact the facility’s ability to filter runoff and drain within a certain time frame. This repair is a part of routine maintenance, so a minor rating (2) is appropriate. The rating can be upgraded, as needed, based on the degree of the work to be performed by the locality.



Vegetation is greatly overgrown, and negatively affecting the facility. This warrants a minor rating (2).

“Unauthorized Plantings”

Weeds are not a part of the landscape design for infiltration facilities. They evolve naturally and should be removed a minimum of twice a year as part of routine maintenance. The proper rating would be a 1 for no problem or 2 for minor issues, based on the amount that must be removed and its relative location. Weeds may also be indicative of sediment in the media bedding, since it promotes their growth. If the weeds are taking up storage volume in the infiltration media, choking out required plantings, or slowing flow, then a higher rating may be justified.



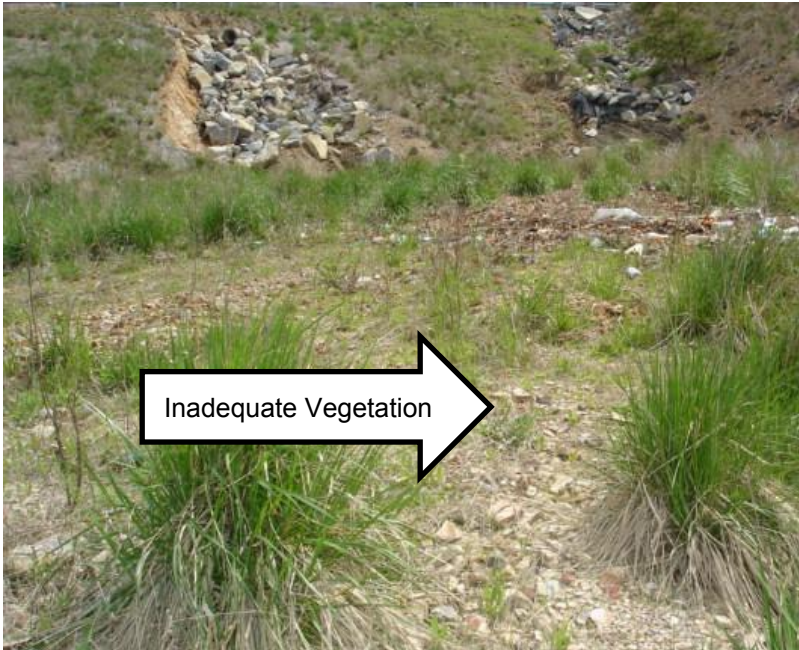
There is a significant amount of weeds present in this facility. Weeds can impact the storage volume and water quality benefits. This warrants a moderate rating (2) and can be addressed through routine maintenance. The planting plan should be referenced to determine which plants should remain or need to be replanted.

Accessed at www.stormwaterpartners.com on Sept. 4, 2013

“Poor vegetation”

A main design component of infiltration facilities is the planting plan. The plantings should be verified against the design plans for the number and species of plants present. Having more plants than what is shown on the plans is acceptable, as long as the plants are not invasive species and/or the overgrowth is not impacting the storage volume and the facility’s ability to drain. Checking the general planting location in the facility is also helpful. For example, if there is a section of plants adjacent to an area that receives sheet

flow into the facility from the road shoulders and they are dying, this is indicative of the runoff having some type of plant stressor or contamination in it, such as de-icing salts. Replacing vegetation is a part of routine maintenance and warrants a minor rating (2). Identifying the source of the stressor is imperative to the success of the plantings. However, that may involve a different inspection heading component and warrant a higher rating. Based on the level of required repairs and the variance from the design plans, the rating may be upgraded.



There is inadequate vegetation in this facility, which significantly impacts the water quality and soil stability. This warrants a minor rating (2), since it is addressed through routine maintenance. The plans should be referenced to verify specific planting requirements.

4.2.8 Overall Rating for the Vegetation Component Heading

If “Area not mowed”, “Poor vegetation” or “Unauthorized plantings” are checked, rate it as minor to moderate (2-3).

Maintenance of the vegetation in infiltration facilities is a part of routine maintenance. Vegetation is one of the key functioning elements in this type of BMP that contributes to the overall pollutant removal efficiency. Landscaping maintenance, including mowing, is part of routine maintenance and warrants a minor rating (2).

If more than 50% of the plantings are dying or weeds have taken over 50% of the infiltration area, a moderate rating (3) is appropriate.

If “Erosion at vegetation” or “Area Unstable” are checked, rate it as minor to major (2-4).

If “Erosion” or “Area Unstable” is checked, damage to the facility is occurring from runoff. The rating level should reflect the degree of damage and impacts to functionality. A small amount of erosion around the vegetation that does not impact the life cycle of the vegetation warrants a minor rating (2). If instabilities are causing impacts to the designed plantings or minor damage to facility features, a moderate rating is warranted (3). If the erosion is so severe that the vegetation cannot survive

or the instabilities are affecting the functionality of the system, a major rating (4) is appropriate.

Multiple Component Headings with Maintenance Ratings

Note if you have two or more minor rating (2) items checked, you may consider upgrading the component section rating (3+), depending on the level of repairs required. If you have two or more moderate rating (3) items checked, you may increase the heading rating (4+), based on the inspector's judgment. If any inspection item qualifies as a failure, then the overall failure rating (5) should be given for the heading rating. Note that a failure in this heading does not necessarily qualify as failure of the facility in the database rating, as long as the principal spillways and outflow structures are still properly functioning.

4.2.9 Clogging

Clogging prevents the infiltration facility from absorbing runoff and filtering pollutants from it. It can be caused by items of various sizes such as tree debris, leaf litter, or silt filling the voids of the media, which is harder to observe visually.

"Clogging"

If water is still standing in the facility 48 hours after a storm event, the infiltration media may be clogged. Other indicators of clogging include dry sediment residue on the top surface of the facility. To further verify that clogging is occurring, rake the top 3" of the media and visually inspect for discoloration. A higher rating is warranted if replacement of the media is required.



The filter media in this facility has become clogged, which is causing standing water. This is a major rating (4) because clogging can cause the water level to rise higher than expected, posing a risk to persons and property.

Accessed at
http://www.minniehahacreek.org/sites/minniehahacreek.org/files/pdfs/regulatory/WEB_Maintenance%20Guide%202012_bio%20and%20infil.pdf on Sept. 4, 2013

4.2.10 Rating for the Clogging Component Heading

If "Clogging" is checked rate it as minor to major (2-4)

For an infiltration facility, clogging of the filter media is the equivalent of a blocked outlet on a basin. The level of clogging and impacts to the function of the facility should be reflected in the rating. A minor rating (2) should result if there are isolated

spots of dry cracked sediment on the surface or isolated spots of small non-woody vegetation that differ from the design, but the facility still drains according to design specifications. If there is a more significant amount of sediment and vegetation coverage present, a moderate rating (3) is appropriate. This includes slight discoloration in part of the top 3 inches of media. If the discoloration extends through and/or beyond the top 3 inches of infiltration media, then the clogging is considered extensive. Other indicators of extensive clogging include standing water 48 hours or more after a storm event and debris lines along the shore at elevations higher than the design levels. These indicators warrant a major rating (4).

4.2.11 Inlets, Outlets, and Overflow Spillway

The structural components of an infiltration system are not as apparent as they are in a basin, because most of the facility is underground. This section refers to any component that regulates the flow or provides structural support to retain the storm event flows. Structures in an infiltration system can be comprised of underdrains, a perforated stand pipe, and/or an embankment, to name a few.

“Poor inlet / outlet”

Check if there is structural deterioration of the inlet or outlet structures. This warrants a minor rating (2) unless the deterioration is directly affecting the facility’s ability to fully function. For example, if the underdrain is crushed or fully blocked, such that the facility cannot contain or properly treat the high flow events, a major rating (4) is appropriate.



The drain in this structure has become damaged and has heaved out of the ground. This significantly reduces its operation. This warrants a minor rating (2) because the facility still drains; however, repairs need to be made to the underdrain.

“Erosion at inlet/outlet”

Check, if applicable. Look for erosion of the facility areas where (1) the inflow channel discharges runoff into the BMP and (2) the outflow structure discharges flow from the BMP. Evidence of erosion includes soil loss at the channel outlet, soil loss around the edges of the outlet protection (if present), and displaced or missing outlet protection. If the riprap is transported downstream or displaced, it signifies that the stone size is too small, whereas

erosion or scour at the edges of the riprap indicate that the riprap footprint dimensions are not large enough.



Inadequate stabilization and high flow, among other things, can cause the erosion evident in this picture. This warrants a moderate rating (3) due to the significant erosion and sediment deposition. Outlet protection and backfill may be warranted in this case.

4.2.12 Rating for the Inlets, Outlets, and Overflow Spillway Component Heading

If items “Poor inlet/outlet” or “Erosion at inlet/outlet” is checked, a minor to moderate (2-3) rating should result based on observed conditions.

If “Poor inlet/outlet” is checked, the rating should be based on the amount of damage and how it affects the water levels and functionality of the system. If there is minor damage at the end of the structure that is compensated for by outlet protection, a minor rating (2) is appropriate. If the damage extends further back in the inflow or outflow system and is starting to compromise stability and functionality, such as undermining of an outflow structure, a moderate rating (3) is appropriate. If there are indications that the structure is separating and causing additional impacts to the facility, a major rating (4) is warranted.

If “Erosion at inlet/outlet” is checked, the rating will be minor to moderate (2-3) based on the severity of the erosion. If routine maintenance can repair the erosion, a minor rating (2) is appropriate. However, if construction equipment or extensive channel repairs requiring loads of materials, such as riprap, are necessary, a moderate rating (3) should be given. If the erosion is severe enough to threaten the integrity of the inlet or outlet structures, a major rating (4) is appropriate. Be aware that when performing or directing appropriate outlet channel repairs, impacts to environmentally sensitive areas should be thoroughly considered as well as potential permit requirements. Additionally, appropriate ESC measures should be evaluated to prevent further impacts from repairs as required during maintenance.

Multiple Component Headings with Maintenance Ratings

Note if you have three or more minor rating (2) items checked, you may consider upgrading the heading rating (3+). If you have two or more moderate or major rating (3-4) items checked, you may consider increasing the heading rating (4+), based on

the inspector's judgment. If any inspection item qualifies as a failure, then the overall failure rating (5) should be given.

4.2.13 Aggregates

The volume of storage in an infiltration facility is determined by the voids in the aggregate, which is where the water is stored until it infiltrates into the surrounding soil. Inspection and maintenance of the aggregates is essential for the facility to properly function.

"Aggregates dirty"

Check, if applicable. For the facility to properly function, the designed storage volume in the aggregate voids must be available for all storm events, and not reduced by sediment or other obstructions. This warrants a minor rating (2) if there are no significant changes to functionality. However, if there are significant impacts to the storage volume, which would require aggregate replacement, then a major rating (4) is appropriate.



Accessed at westsideaction.blogspot.com on Sept. 4, 2013

The aggregate in this infiltration facility has become clogged with sediment from the contributing drainage area. This warrants a minor rating (2), because it is not very deep nor does it have a large footprint

"Replace top layer"

Check, if applicable. The top layer of an infiltration facility is typically pea gravel, mulch or landscaped grass. This is the first filtering mechanism runoff reaches, and it serves to maximize sediment and pollutant removal. It functions as a "choker layer" that slows or prevents larger particles from entering the system.



The aggregate in this infiltration facility has become clogged with sediment from the contributing drainage area. This warrants moderate rating (3), since the facility is still draining but sediment needs to be cleaned for it to fully operate as intended.

“Poor trench”

Check, if applicable. The trench serves to hold the filter media in place at the proper volumetric dimensions. It is also wrapped in filter fabric to prevent surrounding soil from piping into the aggregate. This warrants a minor to major (2-4) rating, depending on the level of degradation of the trench. If the trench has shifted or settled in an isolated area but functionality doesn't appear to be affected, this warrants a minor (2) rating. If a large section of the trench has settled in a manner that impacts the storage volume, flow rates, or causes flow to bypass the facility a major (3) rating is appropriate.



This infiltration trench has shifted due to high flow velocities that have dislodged the rock. This warrants a major rating (4) because the trench has completely disintegrated due to high velocities and flow volumes.

Accessed at www.businessinsider.com on Sept. 4, 2013

4.2.14 Rating for the Aggregates Component Heading

If “aggregates dirty”, “Replace top layer not functional” or “Poor trench” are checked, rate it as minor to major (2-4)

If “aggregates dirty” is checked, the rating is based on the severity of the clogging caused by the sediment. Evaluate the depth of the blockage by raking through the media and aggregate. If the normal pool levels in the facility are not affected, a minor rating (2) is appropriate. If the condition is partially blocking infiltration and increasing the water level or holding time, a moderate rating (3) should be given. If the aggregates are fully blocked and the water level has significantly increased, a major rating (4) is appropriate.

The top layer functions to filter out particulate matter to keep it from filling in the voids of the infiltration system. It is typically called a “choker layer” because of this function. If the top layer is not functioning properly, it slows or blocks all drainage from entering the system. If the design water level is not affected, a minor rating (2) is appropriate. If the design water level has slightly increased or water continues at that level over an extended time, but still remains within the facility footprint, a moderate rating (3) should be given. If the top layer is so clogged that it is preventing drainage from getting into the infiltration system for longer than 48 hours, a major rating (4) is warranted.

If poor trench conditions are present, the rating is based on the impacts to the infiltration process from the trench deterioration. Trench deterioration includes blockages to the filter fabric and deterioration of the filter fabric, including gaps in the coverage. If the trench has minor deterioration to its shape and function, a minor rating (2) is appropriate. If the trench has noticeable changes to its shape and dimensions affecting the function of the facility (e.g., media layers compacting and not providing the proper infiltration flow depth, due to compaction or settling around the trench), a moderate rating (3) is appropriate. If the trench has lost most of its shape, then it is not properly containing the filter media in the designed configuration and thus is not properly functioning. This warrants a major rating (4) for structural deficiencies.

4.2.15 Sediment Deposition

For infiltration systems, sediment has the most impact on functionality and can cause other critical issues to develop as a result. The type, size, and origin of sediment all create different issues in the BMP and all these issues should be addressed.

“Sedimentation”

Evidence of significant sediment build-up would include dried or cracked silt deposits on the media surface, waterlines above the design storm elevation, or discoloration of the media. Vegetation is also a sign that significant sediment is present, thus promoting plant growth. Take note of the water level indicators in and around the facility, such as sediment or debris lines on the slopes. These are good indicators of the impact sedimentation has on the function of the BMP. Also, locating the source of erosion or sedimentation upstream is critical to effectively addressing this issue, and be aware that sedimentation may be an indication of an illicit discharge. If so, please see the illicit discharge item listed

under the “Overall Function of Facility” heading, as described below. This warrants a minor to moderate rating (2-3) based on the significance and volume of blockages to be removed.



Sediment has built up in the facility and is affecting the ability and time to infiltrate. This is a moderate rating (3) as the facility is still draining but sediment needs to be cleaned for it to operate as designed and not raise water levels. If additional structures are being engaged in storm events less than design levels the rating should increase. Additionally, the depth of media affected by sediment and needing replacement may warrant a higher rating.

4.2.16 Rating for the Sediment Deposition Component Heading

If “Sediment Deposition” is checked a minor to major (2-4) rating should result.

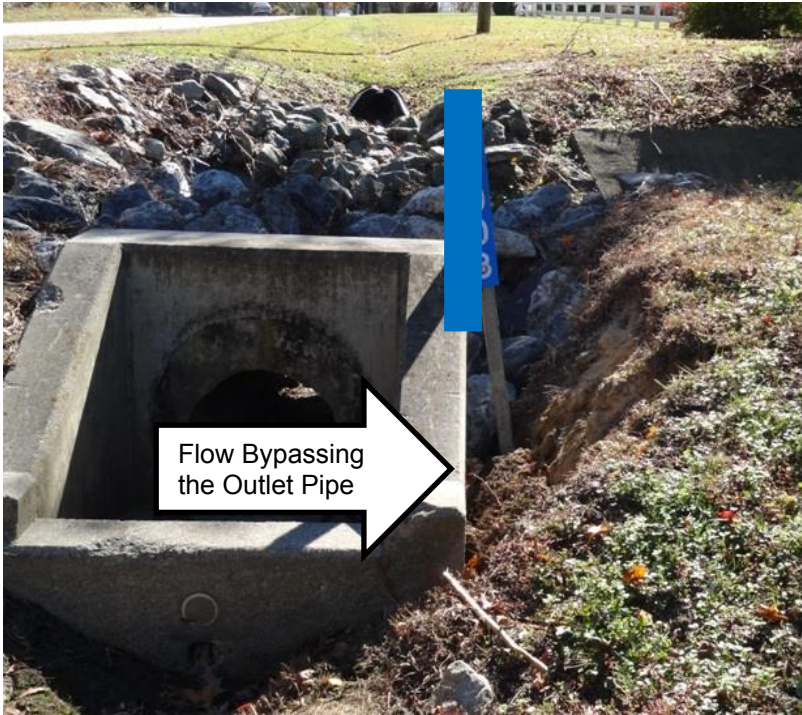
Sediment fills in the voids in the infiltration system’s base aggregate, preventing the system from functioning as designed. The amount of sedimentation affects how much the level of function is diminished, which should be reflected in the rating. If you examine the top layer of infiltration media and only the surface has sediment, a minor rating (2) is appropriate. If there is vegetative growth and the sediment extends midway through the media, a moderate rating (3) should be given. If the sediment extends more than half way through the media and there is evidence of water levels above design storm elevations, then major rating (4) is warranted.

4.2.17 Overall Function of Facility

This component heading evaluates the functionality of the facility as a whole. Design features that are not included in the above headings are evaluated under this heading.

“Flow bypass”

Check, if applicable. If the flow is bypassing the control structure, principal spillway or related design features, then the flows are not being properly treated and the required pollutant removal is not being achieved. Flow bypass can have many different causes, such as a blocked outlet structure, vegetative overgrowth, or sediment accumulation causing a lack of positive drainage. This warrants a minor to moderate rating (2-3), based on the ability to meet pollutant removal requirements.



The flow in this picture is bypassing the control structure and has caused a dam breach. Bypassing flows in an infiltration structure are typically indicated scour on the inflow side of the control structure or flow debris paths that circumvent the outlet/inlet. If drainage bypasses the inlet structure (i.e. flows outside of the inflow channel) but still connects drainage to the control structure, this warrants a minor rating (2). If it bypasses the control structure during large storm events, a moderate rating (3) is appropriate. If it is bypassing the control structure on a regular basis, give it a major rating (4). In the case shown in the photo, it would also be rated as a dam breach under another category heading, which should increase the overall facility rating to failure (5).

“Standing water”

Standing water in an infiltration facility for more than 48 hours after a storm event indicates other issues, such as clogged media and potential blockages. Observations wells are recommended to monitor the infiltration rates visually and to note time tables for drainage. This warrants a moderate to major rating (3-4).



The storage aggregate in this infiltration facility has become clogged, which is causing the water to pond for longer than normal. This warrants a major rating (4), because clogging can cause the water level to rise and pose a risk to persons and property.

Accessed at <http://www.minniehahacreek.org/sites/minniehahacreek.org/>

“Odor”

Odors are indicative of stagnant water containing algae, fungus and bacteria. All of these are indicators that the facility is not properly functioning. Odor may also be an indication of an illicit discharge (see below).



Algae, Fungus, and Bacteria
Causing Bad Odor

The cause of the bad odor in this facility is algae, fungus, and bacteria. Typically there are other inspection deficiencies causing this condition. This warrants a minor rating (2).

Accessed at blogcooperation.be on Sept 4, 2013

“Evidence of illicit discharge”

Check, if applicable. Oil sheens on the water surface, atypical odors, persistent abnormal colors, or high levels of sediment in the facility can all be evidence of an illicit discharge. If there is a possible illicit discharge discovered, report it following the notification instructions and guidance provided in VDOT’s *Illicit Discharge Detection and Elimination Program Manual* and associated *Field Guide*.



Oil Sheen During Dry
Weather Inspection

An oil sheen can be seen entering this facility during a dry weather inspection. This warrants a moderate rating (3), and the VDOT IDDE Manual should be referenced for further guidance on reporting and correcting the potential illicit discharge.

“Structural Deterioration”

Deterioration refers to the breakdown of any of the structural components, such as additional holes in or tearing or crushing of the drains, or breaches in the embankment. Infiltration facilities are usually dug so there is not an elevated embankment, but they should still be evaluated for stability to preserve the function of the facility. These kinds of problems warrant a minor to major rating (2-4). If there are issues above the high water level and the structure is still functional, this warrants a minor rating (2). If the function is slightly impacted (for example, the underdrain is flowing but partially clogged), a moderate rating (3) is appropriate. If deterioration is directly affecting the facility’s ability to perform properly (e.g., the underdrain is being crushed or fully blocked, or it has eroded such that it cannot contain the high flow events), a major rating (4) should be given.



The outlet structure of this facility has cracked. This can significantly impact structural integrity and operation. This photo shows isolated cracking that does not go all the way through the concrete and, therefore, warrants a minor rating (2). If the cracking was in the bottom of the channel and more substantial, a moderate rating (3) would be appropriate, due to saturation level.

Accessed at watersealant.com on Sept. 4, 2013

4.2.18 Rating for Overall Function of Facility Component Heading

If “Flow bypass”, “Standing water”, Odor”, or “Evidence of Illicit Discharge” are checked, the rating is minor to moderate (2-3).

If “Flow bypass” is checked, the severity and impacts to the new drainage pattern determine the appropriate rating. If the flows are bypassing certain design features within the facility but the majority of the outflow is still being treated by the facility, a minor rating (2) is appropriate. If the bypass is severe enough that most of the drainage is bypassing treatment, then a moderate rating (3) is warranted.

If “Standing water” is present, the rating should be based on the amount of standing water, length of time present, and the footprint it encompasses. If it is a small isolated area, perhaps caused by a trash rack blockage or surface depression, a minor rating (2) is appropriate. If the standing water is impacting the storm-related

water level and encompassing a significant portion of the facility, rate it as moderate (3).

The presence of “Odor” usually indicates long-term stagnant standing water. Depending on the size of the area and type of odor, a minor to moderate rating (2-3) should be given. Please note this also could indicate a potential illicit discharge (e.g., for sewage), in which the inspector should consult VDOT’s *Illicit Discharge Detection and Elimination Program Manual* and the associated *Field Guide* for proper procedures.

If “Evidence of Illicit Discharge”, “Flow bypass”, are checked, the rating should be minor to moderate (2-3). If the “Evidence of illicit discharge” is in a small isolated area in relation to the facility footprint, a minor rating (2) is appropriate. If it encompasses a larger area or could potentially impact an environmentally sensitive area, rate it as moderate (3). If this item is checked, it is of highest priority to report the discharge following procedures outlined in VDOT’s *Illicit Discharge Detection and Elimination Program Manual* and the associated *Field Guide*.

If “Structural deterioration” is checked, the rating should be minor to major (2-4).

If “Structural deterioration” is checked, the rating is based on the severity of the decline and impacts to functionality. If the deterioration of the structure has minimal impacts, such as minor surface erosion, but does not affect its functionality, rate it as minor (2). If the deterioration is impacting the system functionally but does not change the normal water levels significantly, a moderate rating (3) is appropriate. If the structure has deteriorated to a point where it is less than 50% functional, a major rating (4) is warranted. An example would be aggregate depth of less than half the design depth due to settling, compaction, or structural instability of the subgrade and ponding water.

Multiple Component Headings with Maintenance Ratings

Note if you have three or more minor rating (2) items checked, you may consider upgrading the heading rating (3+). If you have two or more moderate or major rating (3-4) items checked, you may consider increasing the component heading rating (4+). If any inspection item qualifies as a failure, then the overall failure rating (5) should be given.

4.3 OVERALL INSPECTION RATING BY THE DATABASE

4.3.1 Rating A

The stormwater facility is functioning as designed with no problem conditions identified. There are no signs of impending deterioration. Routine maintenance will be performed twice a year, as a preventative measure, or in accordance with the BMP clearinghouse specifications, whichever is more stringent.

No component headings rate above a 1.

4.3.2 Rating B

Minor problems are observed; however, the stormwater facility is functioning as designed and no critical components have problem conditions. Routine maintenance can achieve necessary repairs. A maintenance work plan will be developed and implemented in 12-26 weeks.

At least one of the component headings "Accessibility", "Debris", "Sediment Traps, Forebays, and Pretreatment Swales", "Vegetation", or "Overall Function" has a rating of 2-3, and/ or at least one of the component headings "Clogging", "Inlets, Outlets, and Overflow Spillways", "Aggregates" and "Sediment Deposition" has a rating of 2.

4.3.3 Rating C

Moderate problems are observed, and the stormwater facility has small changes in functionality that do not change the water level or impact its structural integrity. Routine maintenance may address some of the required repairs, but not all of them. A maintenance work plan will be developed and implemented within 6-12 weeks.

At least one of the component headings "Accessibility", "Debris", "Sediment Traps, Forebays, and Pretreatment Swales", "Vegetation", or "Overall Function" has a rating of 4-5, and /or at least one of the Facility Headings "Clogging", "Inlets, Outlets, and Overflow Spillways", "Aggregates" and "Sediment Deposition" has a rating of 3.

4.3.4 Rating D

Major problems are observed and the stormwater facility is not functioning as designed with at least one critical component requiring repairs. Conditions associated with the facility have compromised its performance and/or raised the water level, potentially impacting the structural integrity. The facility shows signs of impending deterioration with potential for failure. Deficiencies require repair and restoration. A maintenance work plan will be developed and implemented within 2-6 weeks. Part of the work plan may include immediate remediation measures to temporarily preserve the facility and prevent further deterioration.

At least one of the component headings "Clogging", "Inlets, Outlets, and Overflow Spillways", "Aggregates" and "Sediment Deposition" has a rating of 4.

4.3.5 Rating E

Severe problems are observed, and the stormwater facility is not functioning as designed, with several critical parameters requiring immediate repairs. Conditions associated with the facility have compromised its performance, and further deterioration and/or failure is imminent. Deficiencies require repair and restoration. A secondary supervisor level inspection is necessary to clarify the extent of the maintenance work and what specific parties should be involved. A maintenance work plan will be developed and implemented within 2 weeks. Part of the work plan will include immediate remediation measures to temporarily preserve the facility and prevent further deterioration.

At least one of the component headings “Clogging”, “Inlets, Outlets, and Overflow Spillways”, “Aggregates” and “Sediment Deposition” has a rating of 5.

4.4 INSPECTOR RATING

The inspector rating allows input from the inspector based on the specific field conditions observed for that facility.

4.4.1 Rating Input

The rating cannot be entered lower than the database rating, but it can be increased based on the inspector’s judgment. For example, if there was a wet area on the back of an embankment that stayed moist and the latest inspection revealed a free flowing colored discharge from the same area, the “Dam Embankment” heading would be ranked appropriately. Having pictures available from previous inspections is a critical means of comparison, useful to ensure the proper rating is given. The inspector could increase the inspector rating due to personal knowledge, such as proximity to impaired waters, the presence of a residence just downstream, or the short time frame within which the condition of the facility changed.

5 MANUFACTURED FACILITY INSPECTIONS

5.1 TYPES OF MANUFACTURED FACILITIES

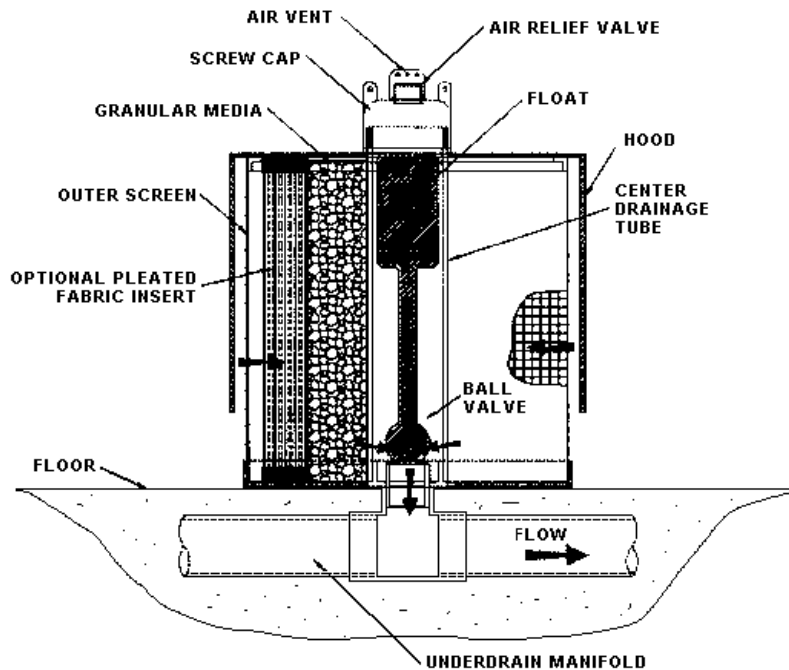
5.1.1 Pipe Detention, Underground Storage and Underground Sand Filters

These types of facilities are typically used in urbanized areas to minimize the impact to the development area. Various companies have developed manufactured BMP's and have developed inspection and maintenance procedures associated with them. Additionally, the manufacturer typically provides the design of the facility. The operation and maintenance procedures for these facilities should be included on the plans and should be available for scanning from the internet. General inspection criteria are described below; however, additional items may be required by the manufacturer. Examples of different functional types of manufactured BMPs are described below for reference:

5.1.2 Manufactured (Hydro-dynamic) BMPs and Manufactured (Filtering) BMPs

These types of manufactured facilities are installed within the drainage system such as inside a manhole, inlet or pipe. These facilities are designed to intercept stormwater runoff and prevent transfer of pollutants downstream. They are flow-through structures where design rate of flow into the structure is regulated by the inflow pipe or structure hydraulics as opposed to traditional BMPs designed to store the entire water quality volume. They generally provide effective spill containment for material handling and transfer areas such as automobile fuel and service areas, and other urban pollution "hot-spots."

Hydrodynamic separators function by slowing incoming flows and creating a non-turbulent flow such that debris and oil products float to the top and sediment falls to the bottom of the facility. This sediment is typically laden with pollutants and thus the facility removes the pollution by trapping the sediment and separating it from the drainage flows exiting the system. Note the hydrodynamic separators must be maintained in accordance with the manufacturer's specifications for proper function which may require the use of certified service technicians for maintenance in some cases. Please consult the maintenance manual and facility plans for further information. A schematic of a typical hydro-dynamic separator is shown below for your reference, please note manufacturer's products and designs vary.

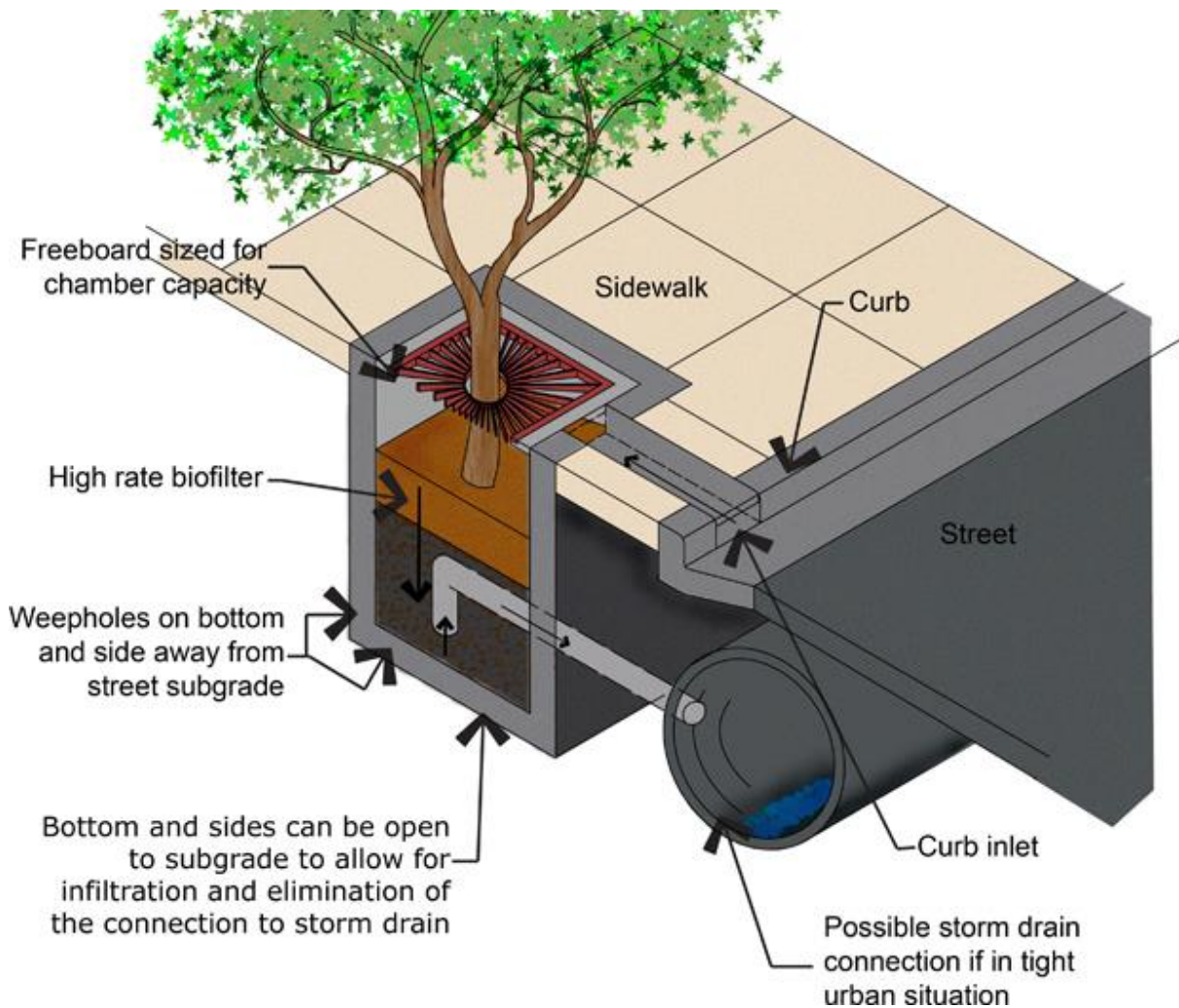


Filtering systems pass the flow through a filter structure, such as an internal cartridge, that removes pollutants and debris. Filtering systems typically use various configurations, techniques and media (screens, geotextile filters, cartridges containing filter media, free compost-type media, simulated wetland conditions, etc.) to filter various pollutants from stormwater runoff flowing through them. Many systems include both a sedimentation chamber and a filtering chamber. The sedimentation chamber removes sediment to prevent clogging of the filter media, which extends the service life of the media material, cartridges, etc. In cartridge systems, the filter media selected is typically based on the target pollutants to be removed or the desired removal efficiency. The number of cartridges typically varies with project size, desired removal efficiency, and peak flow rates to the system. Note the filters must be maintained in accordance with the manufacturer's specifications for proper function which may require the use of certified service technicians for maintenance in some cases. Please consult the maintenance manual and facility plans for further information. A schematic of a typical underground filtering system using cartridges is shown below for your reference, please note manufacturer's products and designs vary.



5.1.3 Tree Box Filter

This type of manufactured facility functions as a mini bioretention cell. There is typically an inlet that routes flow into the facility. The subgrade inside the structure is filled with organic media as specified by the designer to provide filtration. The visible part of the facility is the top layer of mulch, some type of planting, such as a tree, to help absorb and filter pollutants and a grate on top. [Note the tree box must be maintained in accordance with the manufacturer's specifications for proper function which may require the use of certified service technicians for maintenance in some cases. Please consult the maintenance manual and facility plans for further information.] A schematic of a typical tree box filter is shown below for your reference, please note manufacturer's products and designs vary.



5.2 FACILITY COMPONENT HEADINGS

5.2.1 Accessibility

This is the area available for inspection personnel and maintenance equipment to access the facility from the VDOT right-of-way. The access should be at least 10 feet wide, on a slope of 3:1 (H:V) or less, and stabilized to withstand the periodic passage of heavy equipment. The evaluation of this parameter should take into consideration roadway fill elevations, which are often steeper than 3:1 slopes, the configuration of the roadway with respect to the facility, the natural topography surrounding the facility, and the potential for constructing a stabilized access road to the facility. In addition, this section considers vegetation or debris that may impede access, as well as public safety components such as fencing and gated access.

“Inaccessible”

Check if applicable. If the access has not been maintained or used it can be a sign that the facility itself has not been maintained either. This should result in a higher rating since conditions may make it more difficult for the inspector to perform the required inspection in the allotted time frame.



This facility has an inadequately maintained access road. There is minor growth that would impede equipment from entering the area for inspection or maintenance. This would warrant a minor rating (2), because the access road can be easily cleared of the small brush. If larger equipment was required for repairs, a higher rating would be appropriate.

5.2.2 Rating for the Accessibility Component Heading

If *“Inaccessible”* is checked rate it at minor to major (2-4).

The rating is based on impacts to the surrounding area and the level of work needed to establish access. A minor rating (2) would result from having to establish access with a minor amount of work, such as laying stone over an existing cleared path or mowing/bush-hogging saplings and brush. A moderate rating (3) would apply to the removal of obstructions from an established access path, or providing a significant amount of a higher grade of stone for access through problematic areas such as saturated soils. If construction equipment such as a bulldozer is required to clear an

area for access to the facility and outlet structure, a major rating (4) is appropriate. Consideration of cost can also affect the rating for this component heading, as well as whether an annual contract company can be used to do the work or, alternatively, it will be necessary to use the RFP process.

5.2.3 Debris

Debris is any loose material that is not a part of the facility design that could potentially create blockages. Debris can consist of trash, tree limbs, vegetative clippings, construction waste, and other floatables. Debris has a significant impact on infiltration facilities because it can block access into the facility or clog the filter media, thus decreasing its effective surface area and the treatment/storage capacity of the facility. This causes the normal water level to rise and changes the facility's performance.

“Area full of debris” or “Facility full of debris”

Check if applicable. Debris present at a manufactured treatment facility can inhibit the ability of water to enter the facility. It can also be a source of sediment or other particulate matter that clogs the infiltration media. This is a routine maintenance item for which a minor rating (2) is appropriate, unless removal of the debris is requires a more extensive process, which warrants a higher rating. When inspecting the facility, identify any trash or debris that could potentially be present as the result of an illicit discharge. This issue is further discussed under the “Overall Function of the Facility” component heading.



A significant amount of debris is blocking this inlet and, likely, the infiltration media. The debris would have the same effect on an underground manufactured structure as it would at a “tree box filter” structure, shown here. This would warrant a moderate rating (3), due to the backwater created on the adjacent roadway when other paved areas remain dry. Potential impacts to public safety increase the rating from minor (2), which would apply to debris removal with minimal effort as a part of routine maintenance. The rating would be higher if there was limited access due to the facility being located underground, a higher level of effort is necessary to remove the debris, or there are backwater effects or other impacts to public safety.

“Pretreatment/Inlet/outlet debris”

Check, if applicable. This component heading examines the upstream areas that drain to the facility and their effects on functionality. Identifying the source of the debris is critical for effective maintenance of the facility. Upstream areas

can impact the inflow channel as well as the facility's ability to function properly. Debris for manufactured facilities that have filters can inhibit the ability of water to migrate down to the filtration media. It can also be a source of silt or sediment that blocks the filtration media. Additionally, complete blockage of the inlet can create a backwater that may extend across property lines or impact public safety. This typically warrants a minor rating (2), unless the debris is creating a complete blockage, which warrants a higher rating. When inspecting the facility, identify any trash or debris that could potentially be the result of an illicit discharge. This issue is further discussed under the "Overall Function of the Facility" component heading.



This BMP inlet is blocked by leaf debris and trash. This warrants a minor rating (2), due to the minor effort required for maintenance. If the blockage was creating a backwater, creating a public safety issue, or required a greater maintenance effort, an increased rating would be appropriate.

Accessed at esem.wmich.edu on Sept. 4, 2013

5.2.4 Rating for the Debris Component Heading

If "Area full of debris" or "Facility full of debris" is checked, rate it as minor to moderate (2-3).

Debris removal is part of routine maintenance and typically warrants a minor rating (2), unless removal of the debris is more extensive, which warrants a higher rating based on the level of work required. Inlet areas are typically designed to trap and filter debris and sediment from the runoff before it enters the facility. Therefore, they require more frequent maintenance than the treatment system itself. If debris in the facility area is affecting the functionality by slowing flows in or out of the facility, then a moderate rating (3) is appropriate.

If "Pretreatment/Inlet/outlet debris" is checked, rate it as minor to moderate (2-4).

Debris removal is part of routine maintenance. Removal of small amounts not affecting flow rates warrants a minor rating (2). If the debris is affecting the functionality of the outlet structure by slowing of the discharge from the facility, a moderate rating (3) is appropriate. If the outlet structure is completely blocked by

debris, or blocked enough to significantly affect the water level in the facility, rate it as major (4).

5.2.5 Vegetation and Plantings

Vegetation planted in a manufactured treatment facility is usually a key design component. Not all manufactured systems will have a vegetative component in the design, so be sure to check the scanned plans from the inventory tab. Where vegetation is part of the design, its health is essential. Any vegetation present that is not a design feature should be removed.

“Erosion at vegetation”

Tree box filters would be the only type of facility in this section with vegetation. The vegetation usually consists of a tree or large bush in an inlet type structure. You may see erosion when you remove the grate for annual inspection. Erosion around vegetation indicates that the inflow has velocities higher than for the design parameters. Such erosion warrants a minor rating (2) and can usually be repaired by increasing the stabilization at the end of the inflow channel. Alternately you can re-stabilize and improve method by adding more material. This should reduce the energy and velocity of water entering the facility. Additionally, check the eroded area for indications that the flow is not bypassing the normal flow path and going around the main components of the facility.



This is an example of a well maintained tree box filter, free from debris and erosion. If erosion was present you would see it around the tree base when removing the lid. This warrants a no problems rating (1), since no visible maintenance is needed.

5.2.6 Overall Rating for the Vegetation Component Heading

If “Erosion at vegetation” is checked, rate it as minor to moderate (2-3).

If “Erosion at Vegetation” is checked, damage to the facility is occurring from runoff. The rating level should reflect the degree of damage and impacts to functionality. A small amount of erosion around the vegetation that does not impact the health of the vegetation warrants a minor rating item (2). If erosion is causing impacts to the

specified plant materials or damage to the facility components, a moderate rating (3) is warranted.

Multiple Component Headings with Maintenance Ratings

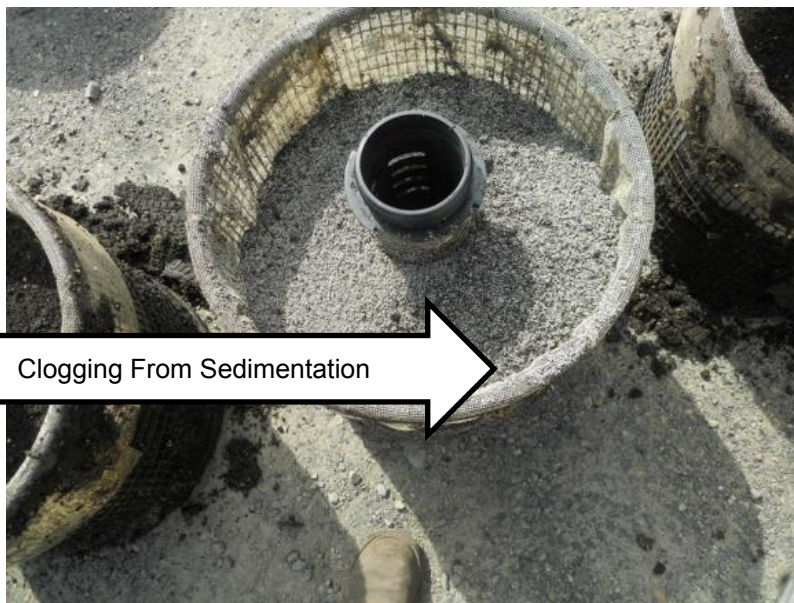
Note if you have two or more minor rating (2) items checked, you may consider upgrading the component section rating (3), depending on the level of repairs required. If you have two or more moderate rating (3) items checked, you may increase the heading rating (4). If any inspection item qualifies as a failure, then the overall failure rating (5) should be used for the component heading rating. Please note a failure in this heading does not necessarily qualify as failure of the facility in the database rating, especially if the principal spillways and outlet structures are functioning properly.

5.2.7 Clogging

Manufactured facilities usually operate with some type of internal filtration component that removes pollutants. Clogging of the filter media prevents the facility from filtering runoff and properly removing pollutants from it. Therefore, this is a critical component to inspect.

“Clogging”

Evidence of clogging includes water standing in the facility 48 hours after a storm event. Other indicators of clogging include dry sediment residue on the top surface of the facility. Depending on the severity of the clogging, replacing the filter media may be required. Some manufactured treatment facilities have filter cartridges that need to be replaced periodically. Removing and checking these cartridges during the inspection is a useful evaluation procedure. Additionally, the manufacturer’s maintenance recommendations should be included on the approved plans or can be scanned from the company’s website to clarify the configuration, function and proper maintenance of the facility.



This cartridge system is not in full working order. The filter media has escaped from the cartridge, likely due to overwhelming which is leaving stormwater untreated leaving the site. . This warrants a moderate rating (3), because clogging can cause the water level to rise and poses a potential risk to persons and property.

“Woody vegetation present?”

For manufactured treatment facilities that incorporate vegetation, woody growth not included in the design plans can impact the functionality of the facility. The root systems are typically water-seeking and will invade the storage area, thus changing the flow rates and storage capacity. Woody growth spreads naturally and should be removed a minimum of twice a year through routine maintenance. The area of concern includes the facility itself and adjacent areas that would allow the root systems to grow into the facility. If more extensive work is required for woody growth removal, a higher rating should be given.



Most manufactured treatment facilities are below ground. However, root systems can penetrate into the underground facility, damaging the structural components. If there is heavy growth over the storage structure, the rating should be higher than growth over other parts of the system. This warrants a moderate rating (3), due to the woody growth and the moderate level of effort required for maintenance. If there was evidence of increased water levels or impacts to persons and properties, a higher rating would be appropriate.

5.2.8 Rating for the Clogging Component Heading

If “Clogging” or “Woody vegetation present?” is checked, rate it as minor to major (2-4).

Manufactured treatment facilities typically contain a form of filtration through cartridges or filter media with mulch or organics. The level of clogging and impacts to the function of the structure should be reflected in the rating. A minor rating (2) should result if there are isolated areas of clogging but no backwater conditions caused by them. If water remains present in the facility for a longer time than the designed draw-down period but does not significantly impact the design water elevation, a moderate rating (3) is appropriate. If the pooling never subsides or the water level is higher than design water elevation, rate it as major (4).

Woody growth should be removed as a part of routine maintenance, because of the impacts the root structures can have on the function of the facility. If saplings are present, a minor rating (2) is appropriate. If larger and denser growth is present, rate it as moderate (3). If a high number of trees or large trees are growing in the structure or adjacent to it, a major rating (4) is warranted.

Multiple Component Headings with Maintenance Ratings

Note if you have two or more minor rating (2) items checked, you may consider upgrading the component section rating (3), depending on the level of repairs required. If you have two or more moderate rating (3) items checked, you may increase the heading rating (4). If any inspection item qualifies as a failure, then the overall failure rating (5) should be used for this component heading rating. Please note a failure in this heading does not necessarily qualify as failure of the facility in the database rating, especially if the principal spillway and outlet structure are properly functioning.

5.2.9 Structural Components

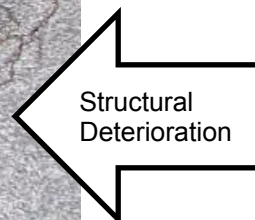
The structural components of a manufactured treatment facility may not be as apparent as they are in a facility or other BMP constructed above the ground surface. This section refers to any component that regulates the flow or provides structural support to retain the runoff from storm events.

“Structural deterioration”

Deterioration refers to the breakdown of any of the structural components, such as cracking or crushing of the drains or breaches in the structure. This is a minor to major rating item. If there are issues above the design high water levels and structures are still functional, a minor rating (2) is appropriate. If the function is slightly impacted (for example, the underdrain is flowing but partially clogged), a moderate rating (3) is warranted. If deterioration is directly affecting the facility’s ability to function properly (e.g., the underdrain is crushed or fully blocked or some problem is impeding its ability to contain the high flow events), a major rating (4) should be given.



The foundation of this concrete inlet has failed, causing it to buckle. This warrants a major rating (5) because it has the potential to affect public safety.



Accessed at mypavementguy.com on Sept. 4, 2013

“Damaged grates”

Grates should be evaluated to ensure they are functioning properly, preventing debris from entering the system, and not deteriorating. This is a minor rating (2) item. If the grate has a hole in it, a moderate to major rating (3-4) is warranted, depending on the size the hole is, the size the debris is that can be passed into the system, and how much of a flow blockage may result. However, if the grate is missing or there is a large hole in it, that threatens public safety or road stability a failure rating (5) should be given.



This is a drain inlet grate with structural damage. This warrants a moderate rating (3) because it appears to be structurally stable, but could be a public safety concern. This break also allows larger debris to enter the system and potentially clog it.

Damaged Grates

Accessed at seeclifix.com on Sept. 4, 2013

“Cracks or spalling”

Check for cracking or spalling (material flaking off) on the structure, which could impede its ability to function. This warrants a low to moderate rating based on the nature of the damage. If the structure is passing more flow than the designed amount because of cracking or spalling, it warrants a moderate rating (3). If the cracking does not impact the functionality, a minor rating (2) is appropriate. If the flows are leaving the pipe and saturating subgrade or adjacent fill a major (4) rating is appropriate.



This is a rusted CMP with flakes of rust falling off, or spalling. This warrants a moderate rating (3), because the pipe appears to be close to failure (rusting through) just above the flow line. Monitoring this structure is recommended.

Spalling

Accessed at http://www.dot.state.mn.us/bridge/pdf/hydraulics/Understanding_HydInfra_Inspection_Data.pdf on September 4, 2013

5.2.10 Rating for the Structural Components Heading

If it items “Damaged Grates” or “Cracks or Spalling” are checked, a minor to major (2-4?) rating should be given based on the field conditions.

Damaged grates typically warrant a minor rating (2) where the facility is still functioning properly, but not if the damage is allowing larger size trash and debris through the grate. If there is enough damage to the grate that it allows any size matter through and/or the debris is large enough to block the orifice 50% or more, a moderate rating (3) is warranted. However, if the grate is missing altogether, a rating (4) major is warranted, since the hole in the pavement or ground surface presents a potential public safety issue.

Cracking or Spalling is the beginning of further deterioration of the facility components and ultimately their functionality. Addressing it at an early stage can typically prevent a full failure of the one or more facility components and, ultimately, the need to replace them. A minor rating (2) is warranted where thinning of the structure is taking place, but it does not impact functionality. Cracking or spalling that penetrate through the structure in an isolated location but still allows the structure to function warrants a moderate rating (3) item.

Multiple Component Headings with Maintenance Ratings

Note if three or more component headings are given minor ratings (2), you may consider upgrading the heading rating (3+). If you give two or more moderate or major ratings (3-4), you may consider increasing the heading rating (4+). If any inspection item qualifies as a failure, then the overall failure rating (5) should be given.

5.2.11 Outlets/Overflow Structures

Outlets and outflow structures route the design level flows out of the BMP facility to a runoff system, such as storm sewer, or natural channel. Examining the condition of the outlet and outflow structures is a good indication of the level of the facility function. Issues at the outfall or overflow structure can result from internal facility issues or lack of stabilization.

“Outlet Erosion”

Check, if applicable. Erosion may be caused by high level storm events, structures not properly functioning in the facility, or from dysfunctional outlet protection. One of the purposes of Stormwater facilities is to protect downstream waterways from flooding. The rating for this item should be based on the severity of the erosion from minor to moderate.



Accessed at <http://www.dot.state.mn.us/> on September 4, 2013

This outlet structure failure has caused severe erosion around the outlet pipe. This warrants a major rating (4) and should be corrected quickly to prevent permanent damage to the end section of the pipe or potential injury to persons and property because of its proximity to the parking area and commercial structures.

“Grate Full of Debris”

Check, if applicable. Grates prevent debris and trash from entering the outlet structure and causing blockages. Cleaning grates should be a part of routine maintenance and is much easier to accomplish than cleaning debris from the outlet structure. This issue warrants a minor to moderate rating (2-3), based on the amount of debris and the ability and size of material that can pass through the grate and into the outlet structure.



This curb inlet is partially blocked by debris which slows flows, causes a backwater condition and can also cause untreated drainage to bypass the system. This warrants a minor rating (2), and the grate should be cleaned as a part of routine maintenance.

“Pipe settling”

Check, if applicable. Evidence of pipe issues includes material loss through the pipe from deterioration. If the pipe is not structurally sound the flow can undermine the subgrade of the pipe from underneath and cause failure of the underground manufactured treatment facility. If the settlement is minor from self-weight and not causing a loss of structural material (subgrade) a moderate rating (3) with monitoring is appropriate. A major rating (4) is for compromised structural integrity of the system by losing supportive material around the underground system. If there is outflow from structures other than the outlet, or untreated flows, a failure rating (5) is warranted.



Settlement Over Underground Structures.

Many manufactured treatment facilities are underground systems. Settlement of the ground above it can be indicative of structural deterioration within the system. This can occur from joints separating or cracks or defects within the structure itself. This is a moderate rating (3) as the above ground has settled some. If outflow was sediment laden, the rating would be higher.

5.2.12 Rating for Outlets/Overflow Component Heading

If “Grates Full of Debris” is checked, a minor to moderate (2-3) rating should result based on the field conditions.

A damaged grate can be a very minor item (2) if it is still functioning properly, but not if it is allowing larger size matter through the grate. If there is enough damage to the grate that it allows debris to pass through large enough to block 50% of flow through the orifice, a moderate rating (3) should be given.

Multiple Component Headings with Maintenance Ratings

Note if you have three or more minor rating (2) items checked, you may consider upgrading the heading rating (3+). If you have two or more moderate or major rating (3-4) items checked, you may consider increasing the heading rating (4+). If any

inspection item qualifies as a failure, then the overall failure rating (5) should be given.

5.2.13 Sediment Deposition

For manufactured treatment facilities, sediment typically has the most impact on functionality and can cause other issues to develop as a result. The type, size, and origin of sediment all create different issues in the BMP and should be addressed.

“Basin Full of Sediment”

Evidence of significant sediment would include dried or cracked silt deposits on the filter media surface, waterlines beyond the design storm elevation, or discoloration in the top 3 inches of the filter media. Unintended vegetation is also a sign that significant sediment is present, providing a soil medium for vegetation growth. Take note of the stormwater level indicators in and around the facility. Also, locating the source of the sediment source upstream is important not only for the repair of this issue, but also to prevent such build-up in the future. Keep in mind that the sediment may be associated with an illicit discharge. If so, see the illicit discharge item listed under the “Overall Function of Facility” heading below. The presence of sediment deposits warrants a minor to moderate rating (2-3) based on the volume of sediment present and the significance of any blockages caused by the sediment.



Sediment is entering the system through a curb cut in this picture. Sediment clogs the filter media below the tree box and also clogs the filter media in high volume situations. This is a minor rating (2) due to the amount of sediment and effort to remove it. If the sediment was causing a backwater condition a higher rating is warranted.

5.2.14 Rating for Sediment Deposition Component Heading

If “Significant Sediment Present” is checked, a minor to major (2-4) rating should be given.

Sediment fills in the voids in the filter media, preventing one of the key design components from functioning. The amount of sedimentation affects the level of function of the facility, which should be reflected in the rating. If you examine the top 3 inches of filter media and sediment is present only on the surface, a minor rating

(2) is appropriate. If there is vegetative growth and the sediment extends midway through the media, a moderate rating (3) is warranted. If the sediment extends more than half-way through the media and there is evidence of water levels above design storm levels, then give it a major rating (4).

Multiple Component Headings with Maintenance Ratings

Note if you have three or more minor rating (2) items checked, you may consider upgrading the heading rating (3+). If you have two or more moderate or major rating (3-4) items checked, you may consider increasing the heading rating (4+). If any inspection item qualifies as a failure, then an overall failure rating (5) should be given.

5.2.15 Overall Function of Facility

This component heading evaluates the functionality of the facility as a whole. Design features that are not included in the above component headings are evaluated under this heading.

“Flow bypass”

Check, if applicable. Most BMPs, manufactured or otherwise, will have a designed capability to bypass large storm flows. However, if the flow is bypassing the treatment process during storm events that are within the design parameters, then the flows are not being properly treated and the required pollutant removal is not being met. Flow bypass can have many different causes, but in manufactured facilities it is usually due to a blockage/backup within the system. This warrants a minor to moderate rating (2-3), based on the facility’s ability to meet pollutant removal requirements.



Flows Bypassing Inlet to Treatment Structure

The flow in this picture is bypassing the inlet to the treatment structure and is flowing into the system downstream untreated. Bypassing flows in a manufactured treatment facility are typically indicated by sediment and flowlines near the structure inlet. If drainage bypasses the inflow structure into the facility (i.e. flows outside of the inflow channel) but still connects drainage to the treatment structure, it warrants a minor rating (2). If the flow bypasses the control structure during large storm events, rate it as moderate (3). If it is bypassing the outlet structure on a regular basis it rates as major (4).

Accessed at the http://saveourstream.blogspot.com/2010_06_01_archive.html on February 16, 2015

“Standing water”

Standing water in a manufactured treatment facility for more than 48 hours after a storm event indicates other issues, such as clogged media and/or flow blockages. This warrants a minor to moderate rating (2-3).



The standing water at this roadside inlet, within a specified time from the manufacturer, is evidence of a potential problem. This warrants a major rating (4), because the high water level during certain storm events can be a risk to persons and property. There are causes of standing water, such as debris blockages and others, which are addressed under other component headings in the inspection form.

Accessed at <http://www.twp.lancaster.pa.us/public-works/adopt-an-inlet/> on February 16, 2015

“Odor”

Odors are indicative of debris buildup and/or stagnant water with algae, fungus and bacteria, all of which are indicators that the facility is not properly functioning. Odors could also be the result of an illicit discharge (see above).



Debris and sediment that builds up in manufactured systems inlets may produce bad odors when decomposition begins. This warrants a minor rating (2), but it is indicative of other issues to address.

“Failed pumps”

Some manufacture treatment systems have pumps for various purposes. Depending on the frequency of pumping and the water level at which the pumps engage, this item warrants a minor to moderate rating (2-3).



Accessed at brookslandscapes.biz on Sept. 4, 2013

A typical pump consists of an inlet structure, the mechanical pump motor, an outlet pipe, and an electrical connection. Abnormal water levels may indicate the pump is not properly functioning. The rating is based on the level of pump function and how frequently it is used based on the design.

“Evidence of illicit discharge”

Check, if applicable. Evidence of an illicit discharge can be oil sheens on the water surface or vegetation, atypical odors or colors of substances, or the presence of sediment in the facility. See VDOT’s *Polluted Stormwater / Illicit Discharge* pamphlet for a discussion of additional illicit discharge sources and types. If there is a possible illicit discharge discovered, report it based on the notification instructions and guidance provided in *VDOT’s Illicit Discharge Detection and Elimination Program Manual* and the associated *Field Guide*.



An oil sheen can be seen entering this facility during a dry weather inspection. This warrants a moderate rating (3), and the VDOT IDDE Manual should be referenced for further guidance on reporting and correcting the potential illicit discharge.

5.2.16 Rating for Overall Function of Facility Component Heading

If “Flow bypass”, “Standing water”, “Odor” or “Evidence of Illicit Discharge” are checked, the rating should be minor to major (2-4).

If “Flow bypass” is checked, the degree to which flow routinely bypasses the facility’s treatment process determines the appropriate rating. If the majority of the flow is still being treated within the facility, a moderate rating (3) is appropriate. If the bypass is severe enough that most of the drainage is regularly bypassing treatment, then a major rating (4) should result.

If “Standing water” is present the rating should be based on the amount of standing water, length of time present, and how the operation of the treatment facility is affected. If it is an isolated small area, perhaps caused by a trash rack blockage, a minor rating (2) is appropriate. If the standing water is the result of a blockage that is interfering with the treatment process, a major rating (4) is warranted.

If “Odor” is present, it usually indicates the presence of long-term stagnant standing water. Depending on the nature and source of the odor, a minor to moderate rating (2-3) should be given. However, this odor could be caused by an illicit discharge (e.g., a chemical or sewage leaking into the facility), which requires referring to VDOT’s *Illicit Discharge Detection and Elimination Program Manual* and the associated *Field Guide* for proper reporting procedures.

If “Evidence of Illicit Discharge” is checked and the concern is isolated within a small isolated area in relation to the facility footprint, a minor rating (2) is appropriate. If the potential illicit discharge involves a larger area or could potentially impact an environmentally sensitive area, rate this as moderate (3). If this item is checked, it is extremely important to report the matter following procedures outlined in VDOT’s *Illicit Discharge Detection and Elimination Program Manual* and the associated *Field Guide*.

If “Failed pumps” is checked, the rating is minor to major (2-4).

If “Failed pumps” is checked, the level of failure and frequency of use should be reflected in the rating. If the pumps are partially working and only engage very infrequently (e.g., for a 100-year storm), then the rating would be minor (2). If the pumps are required to function during each design storm event (e.g., the 1-inch, 2-year or 10-year storm) but have fully failed, a major rating (4) is appropriate.

Multiple Component Headings with Maintenance Ratings

Note if you have three or more minor rating (2) items checked, you may consider upgrading the heading rating (3+). If you have two or more moderate or major rating (3-4) items checked, you may consider increasing the heading rating (4+). If any inspection item qualifies as a failure, then an overall failure rating (5) should be given.

5.3 OVERALL INSPECTION RATING BY THE DATABASE

5.3.1 Rating A

The stormwater facility is functioning as designed with no problem conditions identified. There are no signs of impending deterioration. Routine maintenance will be performed twice a year as a preventative or in accordance with the BMP Clearinghouse specifications, whichever is more stringent.

No headings rate above a 1.

5.3.2 Rating B

Minor problems are observed; however, the stormwater facility is functioning as designed and no critical parameters have problem conditions. Routine maintenance is capable of accomplishing repairs. A maintenance work plan will be developed and enacted in 12-26 weeks.

At least one of the component headings "Accessibility", "Debris", "Vegetation" or "Overall Function" has a value of 2-3, and/ or at least one of the headings "Clogging", "Structural Components", "Outlet/Overflow Structures" or "Sediment Deposition" has a value of 2.

5.3.3 Rating C

Moderate problems are observed, and the stormwater facility has small changes in functionality that do not change the water level or impact its structural integrity. Routine maintenance may address some of the required repairs, but not all of them. A maintenance work plan will be developed and enacted within 6-12 weeks.

At least one of the component headings "Accessibility", "Debris", "Vegetation" or "Overall Function" has a value of 4-5, and / or at least one of the component headings "Clogging", "Structural Components", "Outlet/Overflow Structures" or "Sediment Deposition" has a value of 3.

5.3.4 Rating D

Major problems are observed and the stormwater facility is not functioning as designed, with at least one critical parameter requiring repairs. Conditions associated with the facility have compromised its performance and/or raised the water level, potentially impacting the structural integrity. The facility shows signs of impending deterioration with potential for failure. Deficiencies require repair and restoration. A maintenance work plan will be developed and enacted within 2-6 weeks. Part of the work plan may include immediate remediation measures to temporarily preserve the facility and prevent further deterioration.

At least one of the component headings "Clogging", "Structural Components", "Outlet/Overflow Structures" or "Sediment Deposition" has a value of 4.

5.3.5 Rating E

Severe problems are observed, and stormwater facility is not functioning as designed with several critical parameters requiring immediate repairs. Conditions associated with the facility have compromised its performance, and further deterioration and/or failure is imminent. Deficiencies require repair and restoration. A secondary supervisor-level inspection is necessary to clarify the extent of the maintenance work and determine what specific parties should be involved. A maintenance work plan will be developed and enacted within 2 weeks. Part of the work plan will include immediate remediation measures to temporarily preserve the facility and prevent further deterioration.

At least one of the component headings “Clogging”, “Structural Components”, or “Outlet/Overflow Structures” and “Sediment Deposition” has a value of 5.

5.4 INSPECTOR RATING

The inspector rating allows input from the inspector based on the specific field conditions for that facility.

5.4.1 Rating Input

The Inspector rating cannot be entered lower than the database rating, but it can be increased based on the inspector’s judgment. For example, if there was a wet area on the back of an embankment that stayed moist and the latest inspection revealed a free flowing colored discharge from the same area, the “Dam Embankment” heading would be ranked appropriately. Having pictures available from previous inspections is critical to ensuring the proper rating is given, so they can be used as a means of comparison. The inspector could increase the inspector rating due to personal knowledge, such as proximity of impaired waters, presence of a residential community downstream, or the short time frame during which facility conditions changed.

6 MISCELLANEOUS FACILITY INSPECTIONS

6.1 TYPES OF MISCELLANEOUS FACILITIES

6.1.1 Grassed Swales, Water Quality Swales and Grassed Channel (CH)

These vegetated channels are designed to decrease flow rates; increase pollutant removal through filtration and infiltration; and enhance runoff storage. They can be used as pre-treatment practices, carrying runoff to other treatment facilities. They are designed to receive relatively clean stormwater runoff and are not suitable for direct sedimentation from disturbed areas.

The swales should be situated adjacent and parallel to the drainage area, and should be at least as long as the drainage area. Channel side slopes should be 2:1 or flatter. The channel longitudinal slope should be 4% or less, ideally 1%-2%.

Grassed swales are typically used to treat runoff from small drainage areas (less than 5 acres). These channels can be used in roadways in the place of a typical conveyance channel, but are likely to have a larger footprint. They may, however, reduce the size of other required onsite stormwater management applications.

6.1.2 Level Spreaders and Check Dams – Permanent E&S Measures

Level spreaders and check dams slow runoff flow, and thereby decrease erosion and increase the opportunities for pollutant absorption. Additionally, they are erosion control measures and can filter debris and sediment out of the runoff through their stone construction.

A **level spreader** is an outlet with a level excavated depression that disperses concentrated runoff as sheet flow across a stabilized, vegetated surface. It reduces erosion potential and impacts to downstream channels and other erosion control measures. Depression depth may be increased to improve debris removal and sediment settling, and to increase the level spreader's temporary storage capacity.

A **check dam** is a small, temporary dam constructed of rock used in channels that function to slow runoff and trap sediment. There can be a single check dam or more in series. Outlet stabilization measures, such as riprap or geotextile lining, should be in place after the final check dam in a channel to protect against erosion.

6.2 FACILITY COMPONENT HEADINGS

6.2.1 Accessibility

This is the area available for inspection personnel and maintenance equipment to access the facility from the VDOT right-of-way. The access should be at least 10 feet wide, on a slope of 3:1 (H:V) or less, and stabilized to withstand the periodic passage of heavy equipment. The evaluation of this parameter should take into consideration roadway fill elevations, which are often steeper than 3:1 slopes, the configuration of

the roadway with respect to the facility, the natural topography surrounding the facility, and the potential for constructing a stabilized access road to the facility. In addition, this section considers vegetation or debris that may impede access, as well as public safety components such as fencing and gated access.

“Inaccessible”

Check if applicable. If the access has not been maintained or used it can be a sign that the facility itself has not been maintained either. This should result in a higher rating since conditions may make it more difficult for the inspector to perform the required inspection in the allotted time frame.



Accessed at ohland.homedns.org on September 4, 2013

This facility has an inadequately maintained access road. There is significant vegetative growth that would impede equipment from entering the area for inspection or maintenance. This warrants a minor rating (2) because the access road can be cleared without the need for large construction equipment. This could be achieved through routine maintenance.

6.2.2 Rating for the Accessibility Component Heading

If “Inaccessible” is checked, rate it as minor to major (2-4).

If “Inaccessible” is checked, a minor to major (2-4) is appropriate. The rating is based on impacts to the surrounding area and the level of work needed to establish adequate access. A minor rating (2) would result from being able to establish access with a minimal amount of work, such as placing stone over an existing cleared path. A moderate rating (3) would be associated with removal of obstructions from an established access path, or providing a significant amount of a higher grade of stone for access through problematic areas, such as saturated soils. If construction equipment such as a bull dozer is necessary to clear and prepare an area for access to the BMP, a major rating (4) is appropriate. Consideration of cost can also affect the rating, as well as whether an annual contract company can be used for the work instead of having to use the RFP process.

6.2.3 Debris

Debris is any loose material that is not a part of the facility design that could potentially create blockages. It can consist of trash, tree limbs, vegetative clippings, construction waste, and other floatables. In this Miscellaneous category of BMPs, debris becomes an issue because it can block flow to or through the BMP. This causes water to back up and prevents the BMP from functioning properly.

“Area full of debris” or “Facility full of debris”

Check, if applicable. This is a routine maintenance item with a minor rating (2) unless removal of the debris is more extensive, which warrants a higher rating. When inspecting, identify any trash or debris that could potentially be associated with an illicit discharge. Illicit discharges are further discussed below, under the component heading “Overall Function of the Facility”.



This facility is filled with debris, potentially affecting the storage volume and blocking flow to or within the BMP. This warrants a minor rating (2) and can be addressed through routine maintenance. The rating should be higher if the debris is blocking flow and causing elevated water levels, or if there is a more significant amount of effort required to remove the debris.

“Pretreatment/Inlet/outlet debris”

Check, if applicable. Debris can accumulate enough to block flow into the BMP and, if it progresses into the facility, can also block flow out of the BMP. This is a routine maintenance item with a minor rating (2) unless removal of the debris is more extensive, which warrants a higher rating. When inspecting, identify any trash or debris that could potentially be associated with an illicit discharge. Illicit discharges are further discussed below, under the component heading “Overall Function of the Facility”.



This channel has debris that is affecting drainage. This warrants a minor rating (2) and can be addressed through routine maintenance. A higher rating would be warranted if the debris slowed the inflow such that it caused a backwater effect or created a significant blockage, affecting flow rates.

“Yard Waste or Litter”

Check, if applicable. This topic examines the upstream areas that drain to the facility and their effects on the BMP’s functionality. Identifying the source of the trash is critical for effective maintenance of the facility. Litter from upstream areas can impact the inflow channel as well as the BMP’s ability to function properly, which are both discussed below. When inspecting, identify any trash or debris that could be associated with an illicit discharge. Illicit discharges are further discussed under the component heading “Overall Function of the Facility”.



The contributing drainage area of the BMP is filled with litter, potentially affecting the storage volume and causing flow blockages. This warrants a minor rating (2) and can be addressed through routine maintenance. In some cases, yard waste such as leaf litter or other debris can become compacted and cause a complete blockage of flow, which would warrant a higher rating.

6.2.4 Rating for the Debris Component Heading

If “Area full of debris”, “Facility full of debris”, “Pretreatment/Inlet/outlet debris” or “Yard Waste or Litter” is checked, rate it as minor to major (2-4).

Debris can be a critical factor impacting the function of these Miscellaneous BMPs, due to their small footprint and simple operation. Debris removal is part of routine maintenance and typically warrants a minor rating (2), unless removal of the debris is more extensive, which warrants a higher rating based on the level of work required. Inflow areas are typically designed to trap and filter debris and sediment from runoff before it enters the facility; therefore, they require more frequent maintenance than the BMP itself. If debris is affecting the BMP’s functionality by slowing flows in or out of the facility, then a moderate rating (3) is appropriate. If the debris is causing a total blockage, backing up water or causing other issues, a major rating (4) is warranted.

Vegetation

Where vegetation is a component of a Miscellaneous type BMP, it can be a key to effective pollutant removal. The vegetation assists with runoff absorption, filters particulate from the runoff, and absorbs some pollutants (e.g., nutrients) into the root system.

“Erosion at vegetation”

Erosion around vegetation indicates that runoff velocities may be higher than the vegetation can tolerate and could result in the flow channelizing through a pretreatment filter strip rather than passing as sheet flow. This warrants a minor rating (2) and requires taking measures that will ensure flow velocities are not excessive or that sheet flow occurs through filter strips. This should reduce the energy and thus velocity as it enters the vegetated area.

Additionally, check the eroded area for indications that the flow is bypassing the normal path and going around the main control features (e.g., a level spreader).



Erosion in the grassed swale is present and impacting the function and infiltration of the facility. This warrants a moderate rating (3), to repair the minor erosion and restabilize the area. If additional fill was needed to bring the area back to grade a higher rating is warranted.

“Area not mowed”

The grass area should be mowed and clippings removed a minimum of twice a year to avoid impacts to proper function.



Accessed at midwestpermaculture.com on Sept. 4, 2013

This grass swale area has not been mowed. In addition, there is evidence that previously trimmed grass has not been removed, which can create blockages and transport nutrients downstream. This warrants a minor rating (2), due to the minimal level of effort required for maintenance. Mowing is a part of routine maintenance that allows increased visibility for a proper inspection. A higher rating is warranted if saplings or brush type vegetation grows where grass alone is intended, because removal of the brush requires more effort.

“Area unstable”

Proper stabilization is critical to keeping the BMP system operational. The source of the sedimentation and cause of any instability (sloughing, etc.) should be identified and remedied, as well as repairing the unstable area. For example, an upstream area that previously drained as sheet flow may have additional drainage coming to it that has caused the flow to concentrate. This flow may cause erosion or channelization. In such a case, the eroding area should be stabilized and concentrated flow should be restored to sheet flow to prevent future impacts. This can be achieved through routine maintenance, so minor rating (2) is appropriate. More severe instabilities should be rated higher, and they usually cause other issues in the BMP that are addressed in other component headings below.



Accessed at www.cenews.com on Sept. 4, 2013

The side slopes and contributing drainage area of this grass swale are unstable. This is causing a sediment buildup within the channel. This warrants a minor rating (2), due to the minimal effort required to repair the area. If the area was larger, including upstream and/or off-site areas, especially if steep slopes were involved, then it would rate higher.

“Poor vegetation”

A main design component is the planting plan for many miscellaneous type facilities. The plantings should be checked against the design plans for the number and species of plants present. Having more plants than what is shown on the plans is acceptable, as long as it is not an invasive species and/or the overgrowth is impacting the storage volume and the facility’s ability to drain. Checking the general planting location in the facility is an evaluation tool for this heading. The critical component to remedying this situation is determining why the plantings are not present. For example, it could be that they were never planted, or they died off due to improper water levels, or road chemicals. Replacing planting is a part of routine maintenance and warrants a minor rating (2).



The vegetation has diminished and the area has not been restabilized. This affects the pollutant removal capabilities of the facility. This is a minor rating (2) because the lack of vegetation is affecting water quality but not raising the water level of the facility. If the poor vegetation was causing sedimentation or backwater a higher rating is warranted.

“Unauthorized Plantings”

A main design component is the planting plan for many miscellaneous type facilities. The plantings should be checked against the design plans for the number and species of plants present. The plants are selected based on the design criteria and published recommendations. Unauthorized plantings can be a stressor to the plantings designed for their pollutant removal characteristics, and potentially choke them out as they compete to thrive. Having more plants than what is shown on the plans is acceptable as long as the overgrowth is not impacting the storage volume, the facility’s ability to drain, and the plants ability to thrive.



Accessed at www.prairiefirenewspaper.com on Sept. 4, 2013

The plantings in this photo are different from those in the designed plans. Plantings that are not part of design can have a negative effect on the BMP's function. This warrants a minor rating (2), due to the level of effort required to remove the unwanted vegetation and reestablish turf cover.

“Dead / Diseased Plantings”

If there is a section of dying vegetation adjacent to an area that flows from road shoulders or parking areas, this is indicative of the runoff having some type of plant stressor or contamination in it. One example is de-icing salts washing off the pavement. Identifying the source of the stressor is imperative to the recovery and survival of the vegetation. This may involve another topic under this category heading and warrant a higher rating, including a potential association with an illicit discharge.



Accessed at http://en.wikipedia.org/wiki/File:Bioretention_cell_rain_garden_US_winter.jpg on Sept. 4, 2013

The plants in this facility are diseased and dying, which impacts their pollution removal capabilities. This warrants a moderate rating (3) because the plants are a main component of the water BMP design.

“Deficient Stakes”

Stakes are usually set in the bottom of stormwater facilities to mark the designed bottom elevation and 50% height as a measure against issues within the facility, such as sediment accumulation or abnormal ponding. Stakes are a key reference element for the proper inspection of the BMP.



Accessed at www.richmondregional.org on Sept. 4, 2013

This facility does not have a sedimentation marker set at the finished elevation so that an inspector can determine the cleanout level. This warrants a minor rating (2), due to the minimal level of effort required for correct the problem. Consult the approved plans for proper elevations.

6.2.5 Overall Rating for the Vegetation Component Heading

If “Area not mowed”, “Poor Vegetation”, “Unauthorized plantings” or “Deficient stakes” are checked, rate this as minor to moderate (2-3).

Maintenance of the vegetation in these BMP facilities is a part of routine maintenance. Vegetation is one of the key functioning elements of certain Miscellaneous category BMPs, contributing to the overall pollution removal efficiency. Landscaping maintenance, including mowing and stake monitoring, is part of routine maintenance and warrants a minor rating (2). If more than 50% of the turf cover is impacted, unauthorized vegetation has taken over 50% of the BMP area, or the stakes are not visible or due to overgrowth, a moderate rating (3) should be given. Be aware that some of the component heading topics will affect other inspection criteria under different component headings below.

If “Erosion at vegetation”, “Area Unstable” or “Dead/diseased plantings” is checked, rate it as minor to major (2-4).

If “Erosion at vegetation”, “Area Unstable” or “Dead/diseased plantings” is checked, damage to the BMP is occurring from runoff. The rating level should reflect the degree of damage and impacts to functionality. A small amount of erosion that does not impact the life cycle of the vegetation warrants a minor rating (2), as does a small amount of dead plants. If instabilities are causing impacts to the vegetation (less than 90% vegetation cover), minor damage to other BMP features, or between 25% and 50% of the plantings are dead, then a moderate rating is warranted (3). If the erosion is so severe that the vegetation cannot survive (with more than 50% mortality) or other instabilities are affecting the BMP’s performance, then a major rating (4) should be given.

Multiple Component Headings with Maintenance Ratings

Note if you have two or more minor rating (2) items checked, you may consider upgrading the component section rating (3), depending on the level of repairs required. If you have two or more moderate rating (3) items checked, you may increase the heading rating (4). If any inspection item qualifies as a failure, then the overall failure rating (5) should be given for this component heading. Be aware that

a failure rating for this heading does not necessarily qualify as failure of the entire BMP in the database rating, if the outflow structures are properly functioning.

6.2.6 Clogging

For this category, clogging (e.g., of check dams, etc.) prevents the facility from slowly passing flow through to the next section.

“Clogging”

If there is water standing at a BMP for 48 hours or more after a storm event, the BMP may be clogged. Other indicators of clogging include dry sediment residue on the top surface of the BMP or leaf litter, grass clippings, trash/debris or other items that block or slow passage through the BMP. Depending on the severity of the clogging, washing or replacing the BMP material (e.g., riprap at a check dam) may be required, which would deserve a higher rating than simply removing isolated debris causing a blockage.



The wet plant species are indicators of clogging and water retention. This is a moderate rating (3) that is affecting the facility drainage. Care should be taken to ensure that the water levels are not affecting adjacent persons or property and proper infiltration rates and functionality of the facility are preserved.

6.2.7 Overall Rating for the Clogging Component Heading

If “Clogging” is checked, rate it as minor to major (2-4)

The level of clogging and impacts to the function of the facility should be reflected in the rating. A minor rating (2) should result if there are isolated spots of dry cracked sediment on the surface or isolated spots of debris or litter blockages. If there is a more significant amount of sediment and debris covering the BMP surface, a moderate rating (3) is appropriate. Other indicators of extensive clogging include standing water for 48 hours or more after a storm event and debris lines along the shore higher than the design water levels, which warrant a major rating (4).

6.2.8 Structural Components

The structural components of a swale or channel system are not as apparent as they are in a facility. This section refers to any component that regulates the flow or provides structural support to retain the storm event flows. Structures in a swale or channel system can be comprised of check dams or weir walls (typically notches) that regulate the outflow and increase the residence time in the facility. Level spreaders

may be used in conjunction with grass filter strips, and underdrains are often placed beneath infiltration and bioretention type BMPs.

“Sumps full of Sediment”

Sumps in these types of BMPs represent a water storage area and increase the residence times critical to meeting pollutant removal specifications. Sediment accumulation reduces the storage volume and residence time, thus decreasing the pollutant removal efficiency of the BMP. This warrants a moderate rating (3).



Sediment has built up and is effecting the storage volume and plant growth in this BMP. This warrants a minor rating (2) because the sediment is smothering the vegetation. A moderate rating (3) is warranted if the sediment impacts the storage volume and raises the water level or expands the footprint beyond property lines.

“Toe Erosion”

Toe erosion is indicative of higher than predicted velocities or flows at the bottom slope of the BMP. On a check dam, this would be the bottom back of the riprap structure. For swale and channel facilities, it is the earthen or other material structures at the outlet. This inspection topic is intended to examine the stability and level of erosion at the BMP outlet, including the downstream face of the structure. The rating should be based on the severity of erosion and potential impacts to the BMP’s function.



Erosion and sedimentation has been caused by high velocities. This warrants a minor rating (2), and the plans should be referenced for any missing components related to velocity management, such as a channel lining that may have deteriorated. A higher rating is warranted if there is scour and significant erosive soil loss that affects the structural stability of the

6.2.9 Rating for the Structural Components Heading

If items “Sedimentation”, “Sumps full of sediment” or “Toe erosion” are checked, a minor to major (2-4) rating should be given, based on the observed conditions.

If there are isolated small amounts of sediment, a minor rating (2) is warranted and removal is a part of routine maintenance.

If sedimentation is causing issues such as ponding due to blockages, a moderate rating (3) is appropriate. If the sediment has filled in more than half the storage volume or is half-way up the height of the sump, a major rating (4) should be given.

Toe erosion can be confined to a small isolated area of shallow erosion, which warrants a minor rating (2), or can involve a more significant soil loss, which would warrant a moderate rating (3). If the erosion threatens the structural stability of the BMP, a major rating (4) is warranted. An example of this would be concentrated drainage that is not properly spreading out into sheet flow and is eroding beneath the end of a level spreader. To properly repair the structure, it is imperative that the cause of the erosion be identified, which may involve inspection items under other component headings.

Multiple Component Headings with Maintenance Ratings

If you have three or more minor rating (2) items checked, you may consider upgrading the heading rating (3+). If you have two or more moderate or major rating (3-4) items checked, you may consider increasing the heading rating (4+). If any inspection item qualifies as a failure, then the overall failure rating (5) should be given.

6.2.10 Outlets/Overflow Structures

Outlets and overflow structures route the design level flows out of the BMP facility to a receiving drainage system, such as storm sewer or natural channel. The condition of the outlet and overflow structure is a good indication of the effectiveness of the BMP’s function. Issues at the outfall or overflow structure can result from internal issues or the condition of stabilization at the outlet.

“Outlet Erosion”

Check, if applicable. Erosion may be caused by large storm events, components of the BMP not properly functioning, or from inadequate outlet protection. One of the purposes of stormwater management facilities is to protect downstream waterways from erosion and flooding. The rating for this item should be based on the severity of the erosion and impact to surrounding areas.



Inadequate stabilization and high flow, among other things, can cause the erosion in this picture. This warrants a moderate rating (3) due to the efforts required to repair it. If this channel was in a residential area, it may warrant a higher rating.

“Grate Full of Debris”

Check, if applicable. Debris can accumulate enough to block flow into the BMP and, if it progresses into the facility, can also block flow out of the BMP. This is a routine maintenance item with a minor rating (2) unless removal of the debris is more extensive, which warrants a higher rating. When inspecting, identify any trash or debris that could potentially be associated with an illicit discharge. Illicit discharges are further discussed below, under the component heading “Overall Function of the Facility”.



The grate has become clogged. This significantly impacts the operation of the facility. This is a moderate rating (3) because it is almost entirely clogged which can affect the water levels in the facility and potentially expand the footprint of the facility with backwater effects.

Accessed at eyeteeth.blogspot.com on Sept. 4, 2013

“Poor Grate”

Grates should be evaluated to ensure they are functioning properly, preventing debris from entering the system, and not broken or deteriorating. Consider the

size of debris that the grate blocks in relation to the orifice size when inspecting.



The grate on this facility has broken off. This is allowing debris to enter the facility. This is a minor rating (2) because the broken section is small and is not causing a significant performance or safety issue. If this grate were in a public area where safety was a concern, or if it allowed debris into the system large enough to create a significant blockage, a higher rating would be appropriate.

“Blockages”

Check this box if flows into, within or from the BMP are blocked. Specify which condition applies in the Notes section. A blockage that backs up water and raises the water level above the BMP’s design storage elevation is a critical issue for BMP functionality. Standing water or lack of flow or flows much lower than usual from the outlet during storm events can indicate a blockage is occurring.



This grassed channel outlet has tires in it that prevent the water from draining properly. This is a minor rating (2) because this is a routine maintenance item. If the blockage is causing a backwater effect onto the roadway or personal property, a higher rating is warranted.

6.2.11 Rating for Outlets/Overflow Component Heading

If “Outlet Erosion” or “Poor Grate” are checked, a minor to major (2-4) rating should be given, based on observed conditions.

If “Outlet Erosion” is checked, the rating will be minor to moderate (2-3) based on the severity of the erosion. If routine maintenance can repair the erosion, a minor rating (2) is appropriate. However, if construction equipment or extensive channel repairs requiring loads of materials such as riprap are necessary, a moderate rating (3) should be given. Please note that when performing or directing necessary outlet channel repairs, potential impacts to environmentally sensitive areas and associated permit requirements should be thoroughly considered. Additionally, appropriate erosion control measures should be used, as needed, to prevent further impacts due to the repairs.

“Damaged grates” can be a very minor item (2) when it is still functioning, but not to the design level by allowing larger size matter through the grate. If there is enough damage to the grate that it allows any size matter through and/or debris large enough to half way or more block the orifice, a moderate rating (3) should result.

If “Blockages” or are checked, a moderate to failure level (3-5) rating should result based on the severity of the observed conditions.

Swale and channel type facilities can be affected by blockages at check dams, potentially slowing the flows through them. If the blockages are causing the facility to hold water in small isolated areas, a moderate rating (3) is appropriate. Blockages that raise the water levels but do not damage the facility or downstream areas should be rated as major (4). If the blockages are backing up water across property lines, causing drainage to develop a new untreated flow path, or significantly raising the water levels such that the pollutant removal requirements are not being met and/or damage is occurring downstream, a failure rating (5) is warranted.

Multiple Component Headings with Maintenance Ratings

Note if you have three or more minor rating (2) items checked, you may consider upgrading the component heading rating (3+). If you have two or more moderate or major rating (3-4) items checked, you may consider increasing the component heading rating (4+). If any inspection item qualifies as a failure, then the overall failure rating (5) should be given.

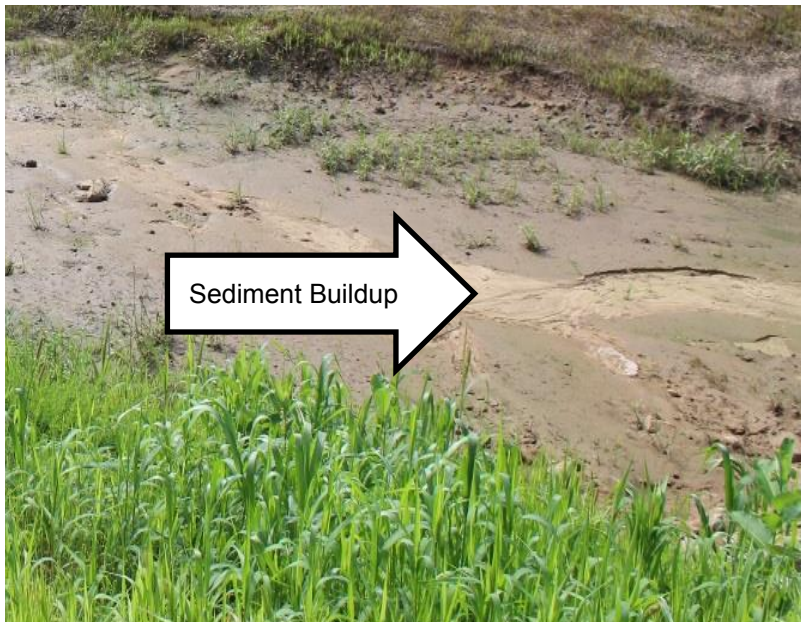
6.2.12 Sediment Deposition

For swale and channel systems, sediment has the most impact on functionality and can cause other issues to develop as a result. The type, size, and origin of sediment all create different issues in the BMP and should be addressed.

“Swale full of sediment”

Evidence of significant sediment accumulation would include dried or cracked silt deposits on the absorption surface or water/debris lines above the normal storm event elevations. Locating the upstream source of the sediment is important for achieving effective correction of the problem. Be aware that the sediment source may be associated with an illicit discharge. If so, refer to the

illicit discharge topic listed under the “Overall Function of Facility” heading below. Sediment accumulation warrants a minor to moderate rating (2-3) based on the significance and volume of sediment to be removed.



This warrants a moderate rating (3), since the BMP is still draining; however, the sediment needs to be removed and the area stabilized for the BMP to operate as designed. If the sediment is impacting the storage volume significantly or increasing the footprint of the facility, a higher rating is appropriate.

“Sedimentation”

Evidence of significant sediment would include dried or cracked silt deposits on the BMP surface or water lines beyond the normal design storm event elevations. Take note of the stormwater level indicators in and around the facility, such as sediment or debris lines on the slopes. This is a good indicator that sediment or some other blockage is affecting the function of the BMP. Be aware that locating the source of erosion upstream is critical to long-term resolution of the sediment problem, and it is always possible that the sediment is associated with an illicit discharge. If so, refer to the illicit discharge topic listed under the “Overall Function of Facility” heading below. This warrants a minor to moderate rating (2-3), based on the significance and volume of blockages to be removed.



Sediment has accumulated and is affecting this BMP. This warrants a minor rating (2), because it is affecting the flow path to the BMP outlet but not affecting the storage volume or outflow from the facility. Care should be taken to ensure that the elevated water levels are not affecting adjacent persons or property, which would warrant a higher rating.

6.2.13 Rating for the Sediment Deposition Component Heading

If “Swale full of sediment” is checked, a minor to major (2-4) rating should be given.

The amount of sediment accumulation affects the level of function of the facility, which should be reflected in the rating. If a small amount of sediment accumulation is present, with nothing indicating that the water levels are affected, a minor rating (2) is appropriate. If the sediment is not only in the bottom of the swale or channel, but also up the sides and has filled in 25% or less of the depth, a moderate rating (3) should result. If the sediment extends more than half-way up the depth of the swale or height of the check dam, such that it is taking half or more of the storage volume, then rate it as major (4). See the above picture for additional information.

6.2.14 Overall Function of Facility

This component heading evaluates the functionality of the facility as a whole. Design features that are not included in the above component headings are evaluated under this heading.

“Flow bypass”

Check, if applicable. If the flow is bypassing the control structures or other BMP components, then the flows are not being properly managed and the required pollutant removal is probably not being met. Bypasses can have many different causes, such as sediment accumulation redirecting flow, a blocked outlet structure, or vegetative overgrowth. This warrants a minor to moderate rating (2-3) based on the ability to meet pollutant removal requirements and manage the flow correctly.

The flow in this picture is bypassing the check dam structure. Bypassing flows are typically evident by



Accessed at http://www.theraincatcherinc.com/gallery_erosion_control.html on February 16, 2015

erosion and scour around the structure or debris paths that circumvent the outlet/inlet. If drainage bypasses the structure unfiltered (i.e. flows outside of the inflow channel) but still delivers flow into the facility, it warrants a minor rating (2). If flow bypasses the control structure for large storm events, a moderate rating (3) is appropriate. If it is bypassing the structure on a regular basis, the structure has failed; rate it as major (4).

“Standing water”

Standing water in a channel or behind a check dam for more than 48 hours after a storm event indicates other issues, such as clogging or other blockages. This warrants a minor to moderate rating (2-3).



Accessed at <http://redac.eng.usm.my/html/projects/HydraResist/Index.html> on February 16, 2015

The grassed swale has become clogged or blocked which is causing ponding of the water. This is a moderate rating (3) following a rain event because clogging can cause the water level to rise and pose a risk to persons and property. Note the facility’s proximity to a public road and parking lot when considering the rating.

“Odor”

If “Odor” is present, it usually indicates the presence of long-term stagnant standing water, indicating the facility is not properly functioning. Depending on the nature and source of the odor, a minor to moderate rating (2-3) should be

given. However, the odor may be caused by an illicit discharge (e.g., a chemical or sewage leaking into the facility), which requires referring to VDOT's *Illicit Discharge Detection and Elimination Program Manual* and the associated *Field Guide* for proper reporting procedures.



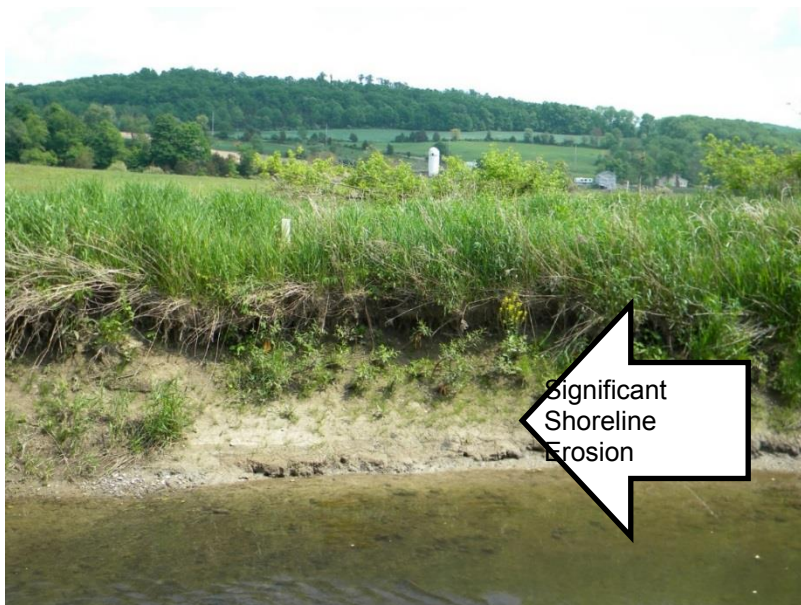
Algae, Fungus, and Bacteria
Causing Bad Odor

The bad odor in this facility can result from stagnant water indicative of a blockage, or from other sources. Typically there are other inspection deficiencies that are causing this problem. This warrants a minor rating (2). If public safety is a concern, the rating should be raised to a higher level.

Accessed at blogcooperation.be on Sept. 4, 2013

“Shoreline erosion”

Notate any erosion caused by or in these facilities. Shoreline erosion is particularly difficult to remedy because sandy soils do not have strong cohesion and compaction. This is a minor to moderate rating item based on the severity of erosion and its impacts to property.



Significant
Shoreline
Erosion

The shoreline on this facility has significantly eroded. There are many factors that could play a part in contributing to this condition. This is a minor rating (2) since it can be repaired with soil stabilization matting and permanent seeding and does not appear to have additional impacts to the facility function. Basic erosion repair is a part of routine maintenance.

“Failed pumps”

Some manufacture treatment systems have pumps for various purposes. Depending on the frequency of pumping and the water level at which the pumps engage, this item warrants a minor to moderate rating (2-3).



Accessed at brookscapes.biz on Sept.4, 2013

This photo is a picture of a pump; however, they come in many shapes and sizes but usually consist of a mechanical pump motor, outlet pipe, and a power source. Abnormal water levels are indication of pump failure.

“Evidence or illicit discharge”

Check, if applicable. Evidence of an illicit discharge includes oil sheens on the water surface or vegetation, atypical odors, unnatural colors of substances, or sediment accumulations in the BMP among others. If there is a possible illicit discharge discovered, report it based on the notification instructions and guidance provided in VDOT’s *Illicit Discharge Detection and Elimination Program Manual* and the associated *Field Guide*.



An oil sheen can be seen entering this facility during a dry weather inspection. This warrants a moderate rating (3), and the VDOT IDDE Manual should be referenced for further guidance on reporting and correcting the potential illicit discharge.

6.2.15 Rating for Overall Function of Facility Component Heading

If “Evidence of Illicit Discharge”, “Flow bypass”, “Standing water”, or Odor are checked, a minor to moderate (2-3) is warranted.

If the “Evidence of illicit discharge” is located in a small isolated area in relation to the BMP’s footprint, a minor rating (2) is appropriate. If it is present in a larger area or could potentially impact an environmentally sensitive area, a moderate rating (3) is warranted. If this item is checked, it is very important to report the concern following procedures outlined in VDOT’s *Illicit Discharge Detection and Elimination Program Manual* and the associated *Field Guide*.

If “Flow bypass” is checked, the severity of the bypass and impacts of the new drainage pattern determine the appropriate rating. If the flows are bypassing certain BMP components but the majority of the flow is still effectively managed or treated by the BMP, a minor rating (2) is appropriate. If the bypass is severe enough that most of the drainage is bypassing the treatment mechanism, then a moderate rating (3) is warranted.

If “Standing water” is present, the rating should be based on the amount of standing water, length of time present (especially the time beyond the normal 48-hour drawdown period), and the footprint it encompasses. If it is located in a small isolated area, perhaps caused by a trash rack blockage or area depression in the flow path, a minor rating (2) is appropriate. If the standing water is exceeding the design storm water level and encompassing a significant portion of the BMP footprint, rate it as moderate (3).

If “Odor” is present, it usually results from long-term stagnant standing water. Depending on the size of the area and type of odor, a minor to moderate rating (2-3) is appropriate. An odor could also be associated with an illicit discharge (e.g., sewage), which requires reference to VDOT’s *Illicit Discharge Detection and Elimination Program Manual* and the associated *Field Guide* to determine proper reporting procedures.

If “Failed pumps” is checked, the rating is minor to major (2-4).

If “Failed pumps” is checked, level of failure and frequency of use should be reflected in the rating. If the pumps are partially working and only engage infrequently (e.g., the 100-year storm), then the rating would be minor (2). If the pumps are required to function during every design storm event (e.g., the 2-, 5- or 10-year storm) and fully failed, a major rating (4) is appropriate.

Multiple Component Headings with Maintenance Ratings

If you have three or more minor rating (2) items checked, you may consider upgrading the heading rating (3+). If you have two or more moderate or major rating (3-4) items checked, you may consider increasing the heading rating (4+). If any inspection item qualifies as a failure, then an overall failure rating (5) should be given.

6.3 OVERALL INSPECTION RATING BY THE DATABASE

6.3.1 Rating A

The stormwater facility is functioning as designed with no problem conditions identified. There are no signs of impending deterioration. Routine maintenance will be performed twice a year as a preventative measure or in accordance with the BMP clearinghouse specifications, whichever is more stringent.

No component headings rate above a 1.

6.3.2 Rating B

Minor problems are observed; however, the stormwater facility is functioning as designed and no critical components have problems. Routine maintenance can achieve necessary repairs. A maintenance work plan will be developed and enacted in 12-26 weeks.

At least one of the component headings “Accessibility”, “Debris”, “Vegetation” or “Overall Function” has a rating of 2-3, and/ or at least one of the component headings “Clogging”, “Structural Components”, or “Outlet/Overflow Structures” and “Sediment Deposition” has a rating of 2.

6.3.3 Rating C

Moderate problems are observed, and the stormwater facility has small changes in functionality that do not change the water level or impact its structural integrity. Routine maintenance may address some of the required repairs, but not all of them. A maintenance work plan will be developed and enacted within 6-12 weeks.

At least one of the component headings “Accessibility”, “Debris”, “Vegetation” or “Overall Function” has a rating of 4-5, and / or at least one of the component headings “Clogging”, “Structural Components”, “Outlet/Overflow Structures” or “Sediment Deposition” has a rating of 3.

6.3.4 Rating D

Major problems are observed and the stormwater facility is not functioning as designed, with at least one critical component requiring repairs. Conditions associated with the facility have compromised its performance and/or raised the water level, potentially impacting the BMP’s structural integrity. The facility shows signs of impending deterioration with a potential for failure. Deficiencies require repair and restoration. A maintenance work plan will be developed and enacted within 2-6 weeks. Part of the work plan may include immediate remediation measures to temporarily preserve the BMP and prevent further deterioration.

At least one of the component headings “Clogging”, “Structural Components”, “Outlet/Overflow Structures” or “Sediment Deposition” has a rating of 4.

6.3.5 Rating E

Severe problems are observed, and the stormwater BMP is not functioning as designed, with several critical components requiring immediate repairs. Conditions associated with the BMP have compromised facility performance, and further deterioration and/or failure is imminent. Deficiencies require repair and restoration. A secondary supervisor level inspection is necessary to clarify the extent of the maintenance work and determine what specific parties should be involved. A maintenance work plan will be developed and enacted within 2 weeks. Part of the

work plan will include immediate remediation measures to temporarily preserve the BMP and prevent further deterioration.

At least one of the component headings “Clogging”, “Structural Components”, “Outlet/Overflow Structures” or “Sediment Deposition” has a rating of 5.

6.4 INSPECTOR RATING

The inspector rating allows input from the inspector based on the specific observed conditions of that BMP.

6.4.1 Rating Input

The rating cannot be entered lower than the database rating, but it can be increased based on the inspector’s judgment. For example, having pictures available from previous inspections is critical as a means of before-after comparison, to ensure the proper rating is given. The inspector could increase the rating due to such issues as proximity of the issue to impaired waters, presence of a residential community downstream, or the short time frame over which facility conditions deteriorated.

7 BASIN FACILITY INSPECTIONS

The Basin Inventory tab has 9 different classifications of basins to choose from. They will be entered in the inventory tab exactly how they are referenced on the approved plans. Once entered in the inventory section, the features that are not part of the particular type of basin will be grayed out and not selectable on the inspection tabs. The types of basins with similar features are grouped together and discussed below.

7.1 TYPES OF BASINS

7.1.1 Wet Basin, Wet Pond I and II (CH), Extended Detention I & II (CH), Extended Detention Basin-Enhanced, Retention Basin I, II and III and Wet Swale I and II (CH)

These basins have at least one inflow channel, an embankment/dam, typically but not always a riser in the basin, a principal spillway structure to route the drainage through the embankment, an emergency spillway for high flow events, and an outlet structure. Wet ponds consist of a permanent pool of standing water that promotes pollution removal and reduces flooding and stream channel erosion. Runoff from each storm enters the pond and raises the normal water level. The outlet structure releases the drainage at a slower rate over a longer period of time. This “draw down” or holding time allows pollutants to settle out of the stormwater and lessens the impact of the flow volume on the receiving channel. Wet Swales are a linear version of a wet pond, although not as deep, and usually have a control structure, such as a weir at the end.

7.1.2 Dry Detention Basin

These basins have at least one inflow channel, an embankment/dam, a bottom level orifice, sometimes a riser in the basin, a principal spillway structure to route drainage through the dam, an emergency spillway for high flow events, and an outlet structure. These basins do not have a permanent pool, and remain dry except during and shortly after storm events. Some extended detention facilities may have a wet marsh with plantings in the bottom for additional pollutant removal. On rare occasions the extended detention basin may be designed to have a permanent pool, in which case the inspector should verify the basin plans and refer to the topics associated with Wet Ponds as well.

7.1.3 Sand Filter Basin

Sand filters referred to in this section are above-ground systems. Underground systems are addressed under the “Manufactured” BMP category. These filters capture, temporarily store, and treat stormwater runoff by passing it through sand or another type of media filter, collecting the filtered water in an underdrain, and then returning it back to the storm drainage system or discharging it to a receiving channel. The sand filter consists of two chambers: the first is devoted to settling, and the second serves as a filter bed consisting of a sand or organic filter media.

7.2 FACILITY COMPONENT HEADINGS

7.2.1 Accessibility

This is the area available for inspection personnel and maintenance equipment to access the facility from the VDOT right-of-way. The access should be at least 10 feet wide, on a slope of 3:1 (H:V) or less, and stabilized to withstand the periodic passage of heavy equipment. The evaluation of this parameter should take into consideration roadway fill elevations, which are often steeper than 3:1 slopes, the configuration of the roadway with respect to the facility, the natural topography surrounding the facility, and the potential for constructing a stabilized access road to the facility. In addition, this section considers vegetation or debris that may impede access, as well as public safety components such as fencing and gated access.

“Inaccessible”

Check if applicable. If the access has not been maintained or used it can be a sign that the facility itself has not been maintained either. This should result in a higher rating since conditions may make it more difficult for the inspector to perform the required inspection in the allotted time frame.



This facility has an inadequately maintained access road. There is significant minor growth that would impede equipment from entering the area for inspection or maintenance. This would indicate a minor rating (2) because the access road can be easily cleared due to the small brush. If heavier grade equipment was required to restore the access road, a higher level rating may be warranted.

Accessed at ohland.homedns.org on Sept. 4, 2013

“Access road eroded or needs repair”

Check, if applicable. The road should have a stabilized surface capable of safely conveying maintenance equipment. The associated slopes, ditches, and culverts should be stabilized and functional without eroding into the basin or surrounding areas. If additional use of the degraded access road could worsen its condition and potentially impact the BMP’s functionality by depositing sediment or debris into the basin area, creating a potential blockage, then a higher rating is warranted.

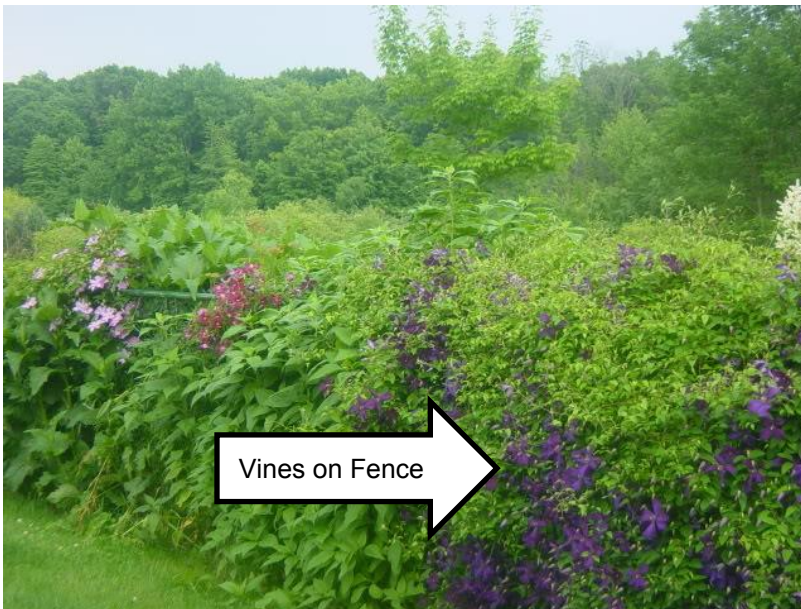


Accessed at www.taxpayersforcannon.com on Sept. 4, 2013

This access road has been inadequately maintained. There is significant erosion in the road area and on the banks. This erosion contributes to sediment deposition closer to the BMP. This warrants a moderate rating (3), because it requires re-stabilization for effective use but not complete reestablishment (e.g., of a new access road, cutting it through a forested area, requiring tree and stump removal).

“Brush or vines on fence”

Check if applicable. Brush or vines on the fence can inhibit visual inspection of the facility and/or impact the functionality of the fence.



Accessed at forums.gardenweb.com on Sept. 4, 2013

Brush and vines on the basin's perimeter fence inhibit visual inspections and can significantly affect fence life by holding moisture. This warrants a minor rating (2) because it can be addressed through routine maintenance activities.

“Fence damaged and repairs needed”

Check, if applicable. A damaged fence that is not restricting access can create a risk to public safety.



Accessed at davidmquintana.blogspot.com on Sept. 4, 2013

This fence is damaged and in need of repair to prevent the general public, and particularly children, access to the basin, perhaps risking their safety and leading to further damage of the BMP. This warrants a minor rating (2).

“Gate not locked”

Check if applicable. An unlocked gate can be considered an attractive nuisance, risking public safety and enabling vandalism of the facility.



Accessed at www.123rf.com on Sept. 4, 2013

This gate has been left unlocked and can invite unauthorized personnel to access the facility. This warrants a minor rating (2).

7.2.2 Rating for the Accessibility Component Heading

If “Brush or vines on fence”, “Fence damaged and repairs needed”, or “Gate not locked” are checked, a no problem to minor rating (1-2) is appropriate.

These issues can typically be remedied by routine maintenance unless public safety is an issue, which increases the rating based on the specific conditions observed.

If “Access road eroded or needs of repair” is checked, rate this component heading as minor to major (2-4).

The rating level should be based on the amount of degradation and the ability to actually use the road to gain access to the BMP without resulting in significant impacts to the BMP. If there are small isolated amounts of erosion, rate it as minor (2); repairing minor erosion is a part of routine maintenance. However, if there is continual erosion or further deterioration in the same area, the nature of the repairs should be re-evaluated.

If road grading equipment or other heavy equipment is necessary for the repair, rate it as moderate (3).

If the road is failing or will further deteriorate with the use of construction equipment such that the basin becomes inaccessible, rate it as major (4).

If “The basin was inaccessible at the time of inspection” is checked rate it at moderate to major (3-4).

The rating is based on the level of work required to establish access. A moderate rating (3) would indicate the need to remove obstructions from an established access path, or provide stone stabilization for access through an open area. If construction equipment such as a bull dozer is necessary to clear an area for access to the basin, a major rating (4) is appropriate. Other distinguishing factors between a moderate and major rating are the ability to perform the work using in-house staff versus having to hire a contractor to complete the repairs. Consideration of cost can also affect this component heading rating.

Multiple Component Headings with Maintenance Ratings

Note, if you have three or more minor rating (2) items checked, you may consider upgrading the heading rating (3+). If you have two or more moderate or major rating (3-4) items checked, it may be appropriate to increase the heading rating (4+). Please note a failure in this component heading does not necessarily qualify as failure of the entire BMP in the overall rating, as long as the principal spillways and outlet structures are functioning properly.

7.2.3 Inlet, Inlet Channel and Forebay

This section rates the overall condition of the conveyances into the basin, the discharge points and any adverse effects from them. Erosion or sediment build-up in the basin resulting from un-stabilized upstream areas or inflow channels should be evaluated in this section. Any evidence of erosion or receiving channel deterioration should also be noted. Note not all basins have forebays, so please refer to the inventory section for specifics on the facility.

“Erosion of Inlet Channel”

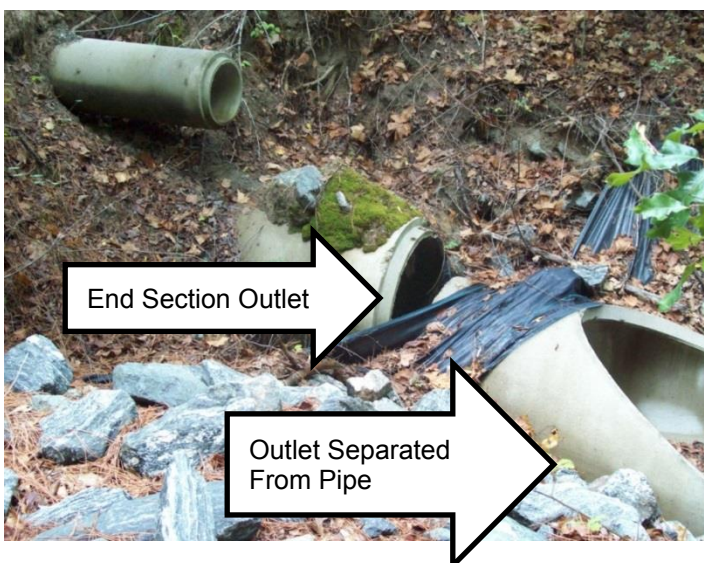
Check, if applicable. Erosion causes the inflow channel to scour out, changing the cross-section due to material washing away. This is a sign of flows or velocities higher than the channel is designed to convey. Unlike the result of sediment washing in from upstream, the channel cross-section will be irregular and the surfaces will be very rough and jagged. This warrants a minor rating unless it is causing significant sedimentation in the basin, which should result in a higher rating.



This inlet channel to the basin is severely eroded, possibly due to inadequate design, construction, or maintenance. This warrants a moderate (3) rating. The plans should be referenced to identify any design flaws and any possible causes of erosion.

“Inlet end section or headwall has separated from inlet pipe”

Check, if applicable. This item describes when the head or end section of the inlet structure has separated from the main part of the structure. This can result from piping under the structure (creating an unstable foundation), poor construction (misalignment, loss of joint material, etc.), significant settlement, or undermining at the outlet due to inadequate energy dissipation. If the end section is completely separated, a higher rating should be given.



This end section has separated from the outlet pipe. This should be corrected to prevent any further deterioration at this junction and to ensure that the pipe system is operating as designed. This warrants a major rating (4) because the outlet structure has broken loose and is not operating as intended. This problem also potentially allows concentrated flows to be discharged into areas that may not be appropriately designed to handle such flows.

“Inlet blocked”

Check, if applicable. This section evaluates any types of blockages to the basin inflow systems. Such blockages can cause stormwater to back up outside of the basin area and potentially impact surrounding areas. This warrants a minor rating unless the backwater affects private property or public infrastructure, which justifies a higher rating.



This inlet channel is partially blocked by vegetation. This impedes the flow of water to the basin and may allow water to backup into the pipe, affecting the pipe capacity and potentially creating a backwater issue. This warrants a minor (2) rating due to the minimal level of effort required to remove the blockage, which can be accomplished through routine maintenance.

“Silt, sediment, or vegetation has filled in significant portions of sediment forebay”

Check, if applicable. If there are significant amounts of sediment or growth in the forebay, it cannot store and filter the volume of flow it was designed for and therefore cannot fully function. Forebays generally provide 10% of the required storage volume for the basin. Forebays require more frequent maintenance than the associated basin because they act as a preliminary sediment trapping measure prior to flows entering the basin itself. Forebay maintenance may occur more frequently than the basin maintenance, but it is typically less intensive to perform. Routine maintenance should include cleaning out the forebay and therefore would result in a minor rating, unless the volume of sediment captured has resulted in flow blockages, deterioration of structures, or significant storage volume impacts, warranting a higher rating. Locating the source of erosion and sediment from upstream is critical to maximizing the time between such cleanouts, and the upstream sources should be checked to determine if they are associated with an illicit discharge. If so, refer to the illicit discharge item discussed below under “Impoundment Area.”



This forebay is filled with a significant amount of sediment and woody vegetation, affecting the storage volume. This warrants a moderate rating (3) due to the substantial growth in the forebay that is affecting its capacity.

“Forebay embankment or riprap eroded or damaged”

Check, if applicable. This item describes deterioration of the area where the drainage leaves the forebay and spills over into the basin. This embankment, usually riprap, acts like a weir to filter the water flowing into basin area and prevent as much sediment as possible from entering the main basin. If the majority of the riprap is present and needs only minor maintenance (e.g., reshaping or adding a small amount of hand placed rock, etc.), such work can be covered under routine maintenance (minor rating of 2). More severe conditions warrant a moderate to major rating (3-4) for this component heading. For example, if the embankment or riprap berm is breached and is thus causing significant impacts to the basin and outlet function, this would warrant a major rating (4).



The forebay embankment has significant erosion along the outer edges, causing flow to bypass the filtering effect of the stone berm. This could be due to inadequate design, construction or maintenance. It is helpful to review the original plans to identify design or construction flaws (e.g., appropriate dimensions of the forebay weir, etc.). This warrants a moderate rating (3) due to the level of effort needed to accomplish proper maintenance.

7.2.4 Overall Rating for the Inlet, Inlet Channel and Forebay Component Heading

If “Erosion of Inlet Channel”, “Inlet Blocked” is checked, it warrants a rating of minor to moderate (2-3).

This component addresses the stability of the inflow channels themselves. Small areas of erosion can be addressed with routine maintenance and warrants only a minor rating (2). If the erosion repairs are beyond the scope of routine maintenance (e.g., they require construction equipment for the repair), a moderate rating (3) is appropriate. Be aware that erosion of the inlet channel can affect other inspection component headings if it results in sediment entering the basin area.

Repairing erosion, which usually includes restoring the stabilization where inlets discharge into the basin, is a part of routine maintenance and warrants a minor rating (2). If the erosion at the inlet is causing sedimentation in the basin or loss of embankment material, a moderate rating (3) is warranted.

If blockages at inlets to the basin are not impacting adjacent properties or creating new flow paths, a minor rating (2) is appropriate. Cleaning blockages to inlets is a part of routine maintenance. If the blockages are backing up water on adjacent property or creating new flow paths, a moderate rating (4) is justified. Note, based on the judgment of the inspector, if the blockage has the potential to damage private property, the rating may be increased based on the potential liability. This should be addressed in the notes section under this component heading.

If “Inlet end section or headwall has separated from inlet pipe” is checked, a rating of moderate to major (3-4) is appropriate.

The rating is based on the severity of the separation, the resulting effects in the basin, and the potential for further deterioration of the inflow channel or a complete structure failure. If the spillway is still 50% or more connected to the adjacent end or headwall section and properly aligned rate, a moderate rating (3) is appropriate. If the section is less than 50% connected and/or at an angle due to an inadequate foundation or misalignment, a major rating (4) is appropriate.

If “Silt, sediment, or vegetation has filled in significant portions of sediment forebay” or “Forebay embankment or riprap eroded or damaged” are checked, a rating of minor to major (2-4) is recommended.

In the forebay, removal of silt and debris and thinning of vegetation (only if it impacts the storage volume or prevents positive drainage) is a part of routine maintenance and warrants a minor rating (2). Forebays typically contain 10%-15% of the required storage volume of the entire basin facility; therefore, if the conditions slightly impact the function of the facility, a moderate rating (3) is appropriate. If there is no trapping capacity or storage volume capacity left in the forebay, give it a major rating (4).

If the forebay embankment has deteriorated, damage to the facility is occurring. The forebay is a first flush trapping measure for sediment and debris entering the basin. It also slows the flow of water into the main facility. Erosion of the embankment/spillway is indicative of higher than expected velocities and / or larger than predicted flows. Additionally, forebay embankment/spillway may be poorly

constructed (e.g., the riprap may not be large enough. A minor rating (2) could be remedied by routine maintenance, such as reshaping a portion of the riprap weir or repairing isolated erosion. If more effort or large construction equipment is required for the repair, a moderate rating (3) should be given. If the embankment has been breached or is otherwise not functioning properly, a major rating (4) is warranted.

Multiple Component Headings with Maintenance Ratings

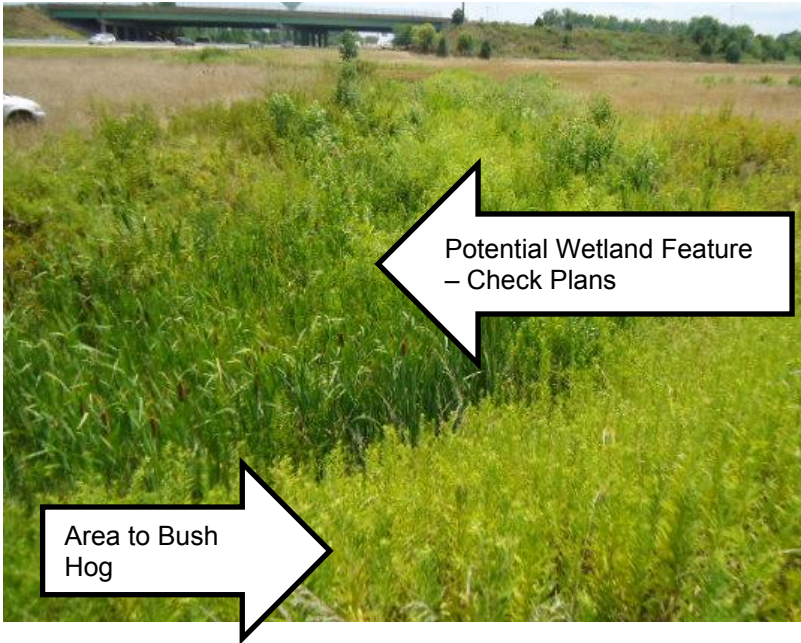
If you have three or more minor rating (2) items checked, you may consider upgrading the component section rating (3+). If you have two or more moderate or major rating (3-4) items checked, you may increase the heading rating (4+). If any inspection item qualifies as a failure, then the overall failure rating (5) should be given for this component heading rating. Be aware that a failure in this component heading does not necessarily qualify as failure of the facility in the overall rating, as long as the principal spillways and outflow structures are properly functioning.

7.2.5 Dam Embankment

This section rates the overall stability and functionality of the impounding structure. The dam is the fill section that blocks drainage and impounds the water. The face of the dam is the front side (facing the basin) that interacts with the water level. The top (or crown) of the dam is the highest flat surface, and the downstream side is the back of the dam from the top down to where the fill section meets the natural grade of the land (called the “toe” of the dam), typically just below the outlet. Basins outlet on the downstream side, which can be a more problematic area due to the effects of water pressure and saturation on the face and through the dam cross-section. Please note a dug basin will not have all of these components since it is excavated into the existing earth and not created by fill placement. Additionally, roadways are not considered embankments because they typically have culvert pipes through them that back up water during storm events, but are not designed as a stormwater management facility and not intended to permanently impound water.

“Dam is largely over grown with non-woody vegetation”

Check, if applicable. This item describes extensive vegetative growth on the dam that can be removed with a lawnmower or bush hog. This vegetation prevents visual observation of the dam surfaces for critical issues. This warrants a minor rating, and it can be addressed through routine maintenance.



This basin, overgrown with natural vegetation, warrants a minor rating (2), since it can be bush-hogged and does not require construction equipment for maintenance. Mowing should be performed twice a year as routine maintenance, which also increases visibility for detailed inspections.

“Trees or woody vegetation growing on embankment”

Check, if applicable. Trees or brush with woody stalks should not be allowed to grow on the dam. The root systems of these trees create a potential seepage path within and through the dam. Roots can also die off and create even larger void spaces within the dam that can go unnoticed until significant problems arise. The rating should be based on the size, density and location of the growth. Heavy growth around and above outlet structures, the conduit through the dam and outlet itself should have a higher rating than would the presence of trees high on the dam (well above the water levels) or on the fringes of the embankment. Also consider in the rating the necessity of removing stumps, their location and size, and the need to subsequently backfill with appropriate compacted material (i.e. clay type material with low permeability and no sand).



This dam has large trees on the face, top and back of the embankment, making it prone to seepage and potential failure. Additionally, some of the larger trees are directly above the principal spillway pipe and can cause damage to the pipe. Removing the trees and stumps will require structural backfill. This warrants a major rating (4) based on the location of the trees and level of effort required for necessary repairs and maintenance.

“Inadequate cover on dam slopes”

Check, if applicable. The surface of all dam slopes and earthen components should be stabilized to prevent erosion and subsequent siltation in the facility or receiving channel. Erosion of the dam is covered in the next topic. This warrants a minor rating, since remedies can be accomplished through routine maintenance.



This dam is not stabilized adequately with vegetation, which leads to erosion and loss of dam fill material. This warrants a minor rating (2). If resulting erosion is contributing to sedimentation in the basin, then it will be addressed in another inspection topic as well. Re-stabilization seeding and mulching can be accomplished through routine maintenance.

“Erosion was noted on the dam”

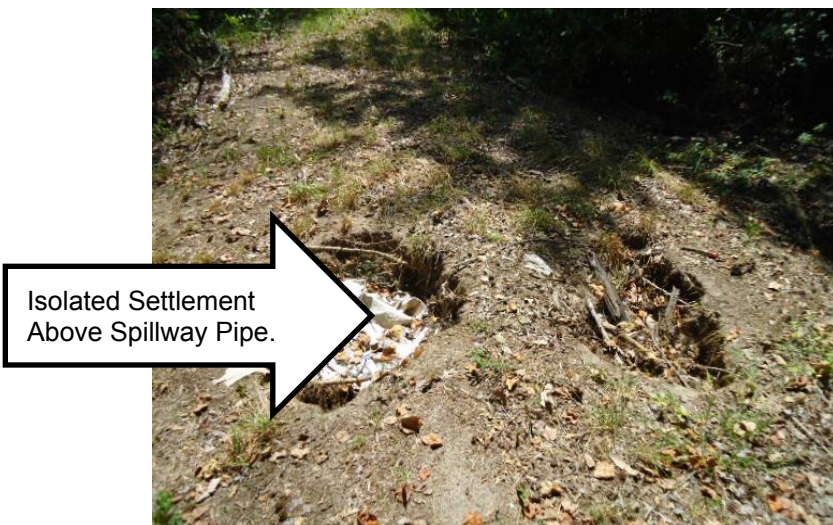
Check, if applicable. Erosion is indicated by bare areas where soil is washing off the face, top or back of dam. Erosion can weaken the dam through loss of material, cause a sediment buildup in the basin, and/or be indicative of other problems, including within the dam structure itself. Erosion can result from inadequate stabilization, which is also a separate inspection topic under this component heading. When evaluating the embankment, it is important to know that the compaction and cohesion of the soils is what creates the water tight embankment to resist the hydraulic forces.



Erosion on this dam is causing structural instability. The dam has erosion in multiple locations, including above the principal spillway pipe, which can be indicative of other issues (e.g., seepage, etc.). These repairs will require structural fill. This warrants a moderate to major rating (3-4), depending on the amount of the pipe that is exposed and its stability.

“Settlement was noted on the dam”

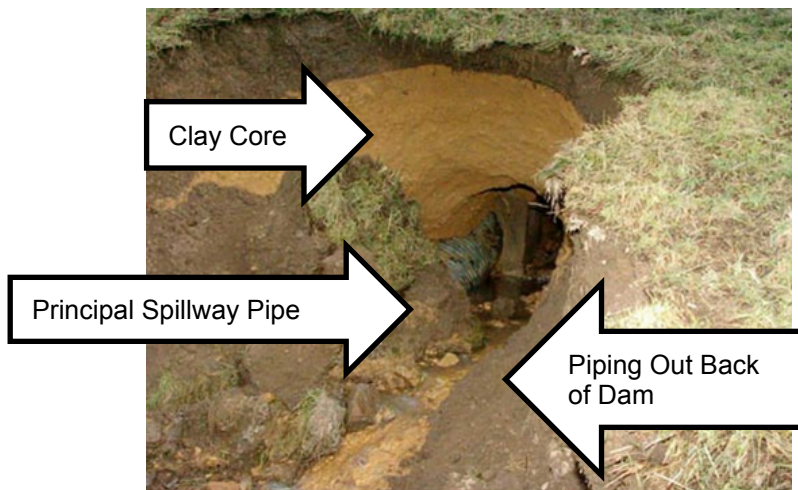
Check this box if there are changes in the vertical surface of the dam (sunken areas) as a whole or in an isolated location. This can be evidence of soils further consolidating from their own weight over time, or losing material somewhere within the dam (e.g., through a loose pipe joint). Determining the cause of the settlement is critical and includes evaluating other topics listed in the inspection form, which could increase the rating as well as affect the ratings of other inspection items.



Isolated areas of settlement above the principal spillway pipe indicate issues internal to the dam itself (i.e., material is being lost). Round sunken areas in parallel are usually indicative of holes on the pipe (e.g., lift holes in RCP pipe not being patched) or joint separation. This warrants a major rating (4).

“Piping was noted on the dam”

Check this box if there is evidence of water flowing through the dam around a structure or drain, excluding water from the structure (i.e., pipe) itself. This usually occurs on the backside of the dam at the drain outlets, but it can begin on the face of the dam and flow all the way through the dam. This indicates that water is running, or “piping,” through the adjacent area, usually through the gravel bedding of the structure, and that the drain may be obstructed, which can cause a loss of dam material. This warrants a moderate to failure level rating (3-5) based on the location of the piping, amount of flow and/or lost soil material, and the size of the holes and discharges.



This embankment has piping through the back surface of the dam where drainage has washed out material along the spillway pipe and created a new pathway for water to discharge. This warrants a failure rating (5).

Accessed at <http://johnrsweet.com/personal/DamProblem.html> on April 25, 2013

“Slope slippage was noted on the dam”

Check this box if there are sections of dam surface that have slid downward leaving exposed soil. This is more common at the abutments where the natural ground meets the compacted fill material at the ends of the dam, which is less problematic. If present on the central portion of the dam, especially above the control structure and barrel of the discharge pipe, slipping and sloughed material is indicative of poor compaction or other problems within the dam below that area.



This picture shows a typical slope slippage condition with clearly defined areas of exposed soil and stabilized areas adjacent to them. If the slippage is on the face of the embankment near the spillway, the rating should be major (4); however, if the slippage is located on the outer sections of dam, a moderate rating (3) is appropriate.

“Animal burrow holes were noted on the dam”

Check this box if burrow holes are noted on any section of the dam. Burrows can be easily identified by piles of exposed soil and rodent paths. They create voids in the dam through which water can flow, and one hole on the face of dam can actually be a part of a much larger cavernous system inside the dam.



These burrows appear to be above the waterline of the basin, including the higher storm level event elevations. Since there are two holes visible, a moderate rating (3) is appropriate. If burrows were present on the face and back of the dam, a failure rating (5) would be appropriate based on the assumption that they are connected all the way through the dam.

“Downstream seepage noted”

Check this box if there is evidence of water seeping through the dam. Seepage is evident on the back of the dam as water flowing out of the dam surface, or as indicated by an area of the dam surface that always remains wet (which may warrant a minor rating but also continued observation). Seepage occurs below

the basin water level on the back of dam, and can be evident up to 10'-25' beyond the toe of the dam. This is a very critical condition that could lead to a failure of the structure, or it could be due to something as simple as a blocked toe drain. Note the color and estimated flow rate for future comparison. Clear or clean water seepage is less problematic than colored water, which could indicate transport of structural soil from within the dam. If the flow is active and clear, it warrants a moderate rating (3) and further monitoring and/or investigation. Occasionally the seep is a result of a spring in the area; if it remains clear with a stable flow rate and without erosion, it is probably not significantly impacting the dam. If the flow is cloudy or colored (particularly if it is orange like clay), and causing erosion of material on the dam surface, this warrants a higher major or (potentially) failure rating (4-5) and further investigation.



Note seepage around the riprap above the endwall. The orange color and sediment deposits below it indicate loss of internal dam material. If observed during a rain event this would warrant a major rating (4), indicating a potential for imminent failure. However, if it were observed to persist during dry weather, it should be considered a failure (5) because it is draining the normal pool, creating an unregulated flow.

Accessed at <http://johnrsweet.com/personal/DamProblem.html> on April 25, 2013

7.2.6 Rating for the Dam Embankment Component Heading

If “Dam is largely overgrown with non-woody vegetation” or “Inadequate cover on dam slopes” is checked, a minor rating (2) is appropriate.

Routine maintenance should accomplish needed repairs. If the denuded slopes cause erosion, that is addressed in another inspection topic and may justify a higher rating.

If “Erosion was noted on the dam,” “Settlement was noted on the dam,” “Slope slippage was noted on the dam,” or “Animal burrow holes were noted on the dam” are checked, a minor to major (2-4) rating should be given.

If the “erosion on the dam” is shallow on the surface and the result of inadequate stabilization, a minor rating (2) is appropriate and routine maintenance is adequate

to accomplish needed repairs. If the erosion is deeper, the cause should be investigated and a moderate level rating (3) should be given. Be aware that repairs for such erosion require compacted fill with the same soil characteristics as the material from which the dam was constructed. If the erosion is around or above the spillway structure, it may be indicative of another issue as well (e.g., seepage through the dam, etc.). A major rating (4) should be given for that, with further investigation to determine the cause.

If observed “settlement” is isolated and small, not located below the elevation of the emergency spillway, and not the result of additional problems, the rating should be minor (2). If the settlement is broader/deeper and in more than one location, a moderate rating (3) is appropriate. Settlement observed above or around spillway structures requires additional investigation to determine the cause and warrants a major rating (4).

The rating for slope slippage is based on the location, area, and amount of soil moved/lost. Shallow areas of sloughing/slippage on the fringes of the embankment warrant a minor rating (2), since it can be repaired through routine maintenance. Slippage on the dam embankment warrants a moderate rating (3). Slippage and sloughing around the spillway can be indicative of other issues and warrants a higher major rating (4). To ensure a long-lasting repair, the cause of the slippage should be determined.

The rating for “animal burrows holes” on the dam is based on the size and location of the burrow(s). If the burrow is isolated above the water level, small in size, and shallow, it warrants a minor rating (2) and repairs can be accomplished through routine maintenance. If it is at the water level, it should be rated as moderate (3), and if burrows are present on both the dam face and back, assume they are connected, which warrants a major to failure level rating (4-5) because of the potential to convey flows through the dam.

The most critical items to the functionality of the embankment are items “Trees or woody vegetation growing on embankment”, “Piping was noted on the dam” or “Downstream seepage noted” and these should be rated from minor to failure level (2-5).

If “Trees or woody vegetation growing on embankment” is checked and there are saplings on the embankment, a minor rating (2) is appropriate, since this can be addressed through routine maintenance. If there are larger trees over/near the spillways, a major (4) rating is warranted. This rating may also be upgraded based on the amount work involved and the necessity of using construction equipment to remove the woody growth. Note that the Virginia Stormwater Management Handbook recommends removal of trees within 25 feet beyond the toe of the dam and abutments, but property lines and wetland impacts may restrict access to this entire area.

If “Piping was noted on the dam” is checked, a moderate to failure rating (3-5) is appropriate, based on the severity of the piping. Assign a moderate rating (3) if

pipings is only noted on one side of the embankment and is not severe enough to cause failure of the spillway system. If piping is noted on both sides (i.e., the face and rear of dam), a moderate rating (4) is warranted; however, if the piping is severe enough to threaten the integrity of the structure due to constant significant flows, a failure rating (5) is necessary per the Virginia Stormwater Management Handbook. Piping around the outlet structures can begin as seepage, and is covered as a separate inspection item

If “Downstream seepage noted” is checked, the rating can vary from minor (2), in the case of a damp area on the downstream impoundment, to major (4), in the case of free flowing cloudy or colored water that can indicate soil is being flushed from within the dam structure. Dam areas with small or intermittent flows of clear water are less problematic and should be given a moderate rating (3), but they should continue to be monitored. If the seepage is causing erosion, slope slippage or any loss of dam material, a major rating (4) should be given.

Multiple Component Headings with Maintenance Ratings

Note, if you have three or more minor rating (2) items checked, you may consider upgrading the component heading rating (3+). If you have two or more moderate or major rating (3-4) items checked, you may consider increasing the section rating (4+). If any inspection item qualifies as a failure, then the overall failure rating (5) should be given.

7.2.7 Emergency Spillway

This is a broad channel that conveys stormwater during large storm events from the basin to an outlet located at the back of the embankment. It prevents the dam from overtopping during an extreme storm event. Not all basins have an emergency spillway. Emergency spillways can be lined with various materials, including grass (with or without erosion control matting), rip-rap, or concrete, based on the expected flow velocity. The emergency spillway is usually visible as a low spot or notch (a minimum of 1 foot lower than the top of dam) off to one side of the embankment.

“Eroding or back cutting”

Check this box if the emergency spillway has barren areas due to soil material washing away. Back cutting is evident when there is erosion back into the channel (e.g., underneath the concrete spillway) or at the outlet, where the discharge churns and undermines the end of the channel.



Accessed at www.greenvillecounty.org on September 4, 2013

Note erosion around the emergency spillway. Additionally, the fencing across the spillway serves to slow flows and trap debris, clogging the flow. This warrants a minor rating (2) due to the minimal level of effort required to achieve proper maintenance.

“Obstructed”

Check this box if there are any blockages that slow or obstruct flow in the emergency spillway channel, including at the entrance or exit. Cleaning out the channel is a part of routine maintenance and warrants a minor rating (2). If the blockage is significantly impacting the function of the channel it warrants a moderate rating (3).

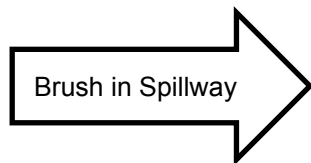


There is vegetative growth impeding flow across the emergency spillway. This could possibly cause overtopping of the dam and adjacent flooding under certain conditions. This warrants a moderate rating (3), due to the level of effort required to accomplish proper maintenance and the potential damage to persons or property in the residential area.

“Non-Operational”

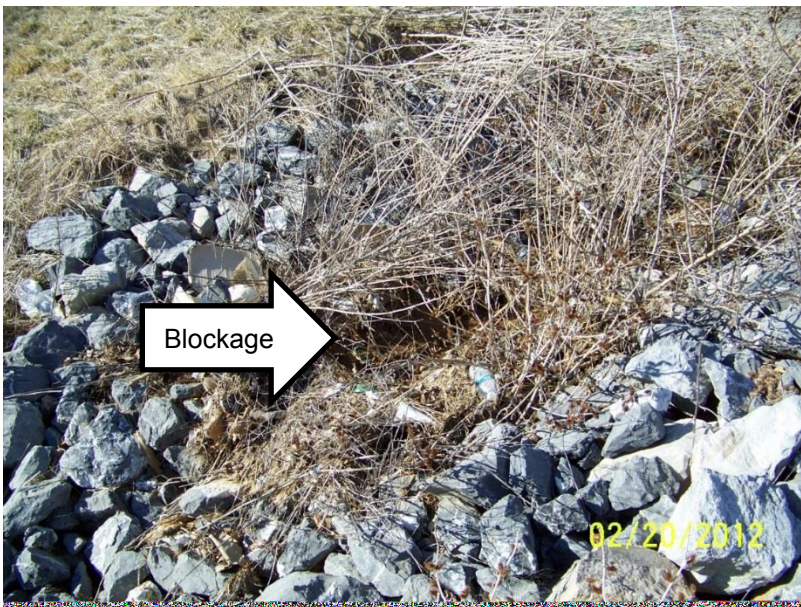
Check this box if the emergency spillway is not functioning properly. Causes of this include severe blockages, overgrowth of vegetation, or any other damage to the channel that prevents it from functioning as designed. This is a critical component parameter, because if the emergency spillway is not functioning properly, then it cannot buffer the overflows from large storm events, which can raise the water level in the basin and create the potential for overtopping of the dam. This problem should be rated moderate to major (3-4).

This beaver dam on the emergency spillway warrants a major rating (4), because a blocked spillway could cause adjacent flooding and damage to persons and property.



“Trees or brush present”

Check this box if there are trees or brush present within the emergency spillway, which could damage the channel, slow flows out of the basin, and raise the water level. Clearing such vegetation is a part of routine maintenance and unless the severity qualifies as “Non-Operational,” as described above, it warrants a minor rating (2).



The brush observed in this emergency spillway will continue to impede flow if the spillway is not maintained. This warrants a minor rating (2), because of the minimal level of effort required for maintenance. Removal of woody brush is a part of routine maintenance.

7.2.8 Rating for the Emergency Spillway Component Heading

If “Eroding or back cutting”, “Obstructed”, or “Trees or brush present are checked, the ratings should range from minor to moderate (2-3).

Eroding or back cutting in the emergency spillway is typically the result of high velocity flows. Erosion at the outlet is prevented by outlet protection, however it can become severe and back cut into the dam and/or emergency spillway. Minor erosion that can be repaired and re-stabilized is a minor rating (2) item. Back cutting such that dam material was lost, or a concrete spillway was undermined would warrant a higher rating based on severity.

Removing debris, trash and vegetative growth along with repairing minor erosion are a part of routine maintenance, which warrants a minor rating (2). If a significant amount of material needs replacing or tree removal requires backfill of stump holes, a moderate rating (3) should be given. This rating is based on the effort required to remediate the issue.

If “Non-Operational” is checked, the rating should be moderate to major (3-4).

The rating should be based on the amount of work and equipment necessary to repair the emergency spillway as well as potential impacts to downstream features should the dam overtop and exceed its design flow rate. If the emergency spillway needs repairs in isolated areas and the problems are unlikely to cause water levels to rise to within 6 inches of the top of dam, a moderate rating (3) is warranted. If the emergency spillway has deteriorated to the point that the entire spillway (or significant sections of it) are non-operational, a major rating (4) is appropriate. Note, consult the scanned-in plans to determine how frequently the emergency spillway is expected to engage. If it is designed for less than a 100-year storm event, the inspector may upgrade the rating, since the risk of overtopping the dam could occur more frequently.

Multiple Facility Component Headings with Maintenance Ratings

Note if you have three or more minor rating (2) items are checked, you may consider upgrading the component heading rating (3+). If you have two or more moderate or major rating (3-4) items checked, you may consider increasing the heading rating (4+). If any inspection item qualifies as a failure, then the overall failure rating (5) should be given.

7.2.9 Outlet Structure and PSP

The outlet or control structure is the structure that normally regulates the flow of stormwater out of the basin and through the dam from within the basin. The outlet can take many different structural forms. Two of the most common types of outlet control structures are a concrete riser with a barrel pipe through the dam or a concrete weir wall structure over which the water flows from the basin. Most outlet structures have a trash rack that prevents debris and trash from entering the control structure and blocking flow. The outlet structure engages for all storm events, unlike the emergency spillway that only functions occasionally.

“The low flow orifice or trash rack is blocked or damaged”

Check this box if any outlet openings on the downstream side of the dam are blocked, and specify which one in the Notes section if more than one opening is present. The outlet structure is a critical component of basin functionality, since a blockage of the outlet can back up water and raise the water level in the

basin, potentially causing overtopping of the dam. It becomes more critical if more than one opening to the system is blocked, which warrants a higher rating than a minor or moderate, based on severity of the blockage.



This outlet structure has a large amount of dirt and debris that is preventing the water from draining properly. This is a major rating (4) because this could possibly produce high water levels that could affect person and property during high storm events. High water levels are evident from the debris lines well above the top of riser in the background.

“The riser overflow top spillway or trash rack is blocked or damaged”

Trash racks prevent debris and trash from entering the outlet structure and causing blockages; however, if they are damaged or missing, allowing the outlet to become extremely blocked and restricting flow, the water level in the basin could rise above the design elevation.



The trash rack on this structure has broken free, posing a potential safety hazard to the public and allowing trash to enter the facility and clog the outflow pipe. This warrants a moderate rating (3) because of the level of effort necessary to make the repairs. The rating should be increased if the facility is in close proximity to residences, parks or schools with public access.

“The riser is filled with excess material”

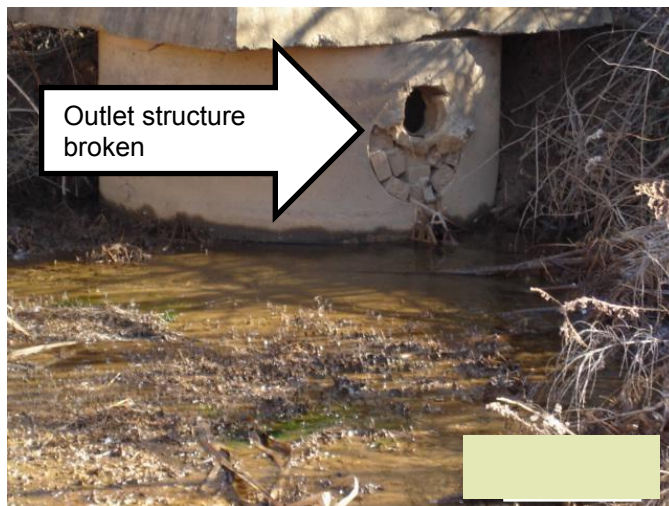
Check, if applicable. Material in the riser can be transported through the outlet structure and potentially block the outflow. It may also slow the inflow, depending on the amount and location of the materials. If severe enough, this issue can raise the water level in the basin and potentially cause overtopping of the dam, which warrants a much higher rating.



The outlet orifice has broken/patched concrete that is not water tight. This allows additional flow through the outlet pipe in excess of the design specifications. The voids must be sealed to ensure proper function. This warrants a moderate rating (3) because it affects the design parameters. If a large portion or the entire structure requires replacement, a higher rating is warranted.

“The riser is damaged or deteriorated”

Check, if applicable. The functionality of the riser can have a large impact on the water level in the basin and the outlet system as a whole. Damage or deterioration can take the form of rust, cracking, exposed rebar, or additional holes in the structure. This warrants a moderate rating, unless the damage is so severe that it increases the water level in the basin, which would warrant a higher rating.



This outlet structure is filled with trash and can significantly affect the operation of the facility. This warrants a major rating (4) because the trash is completely blocking the flow and causing the water level to rise.

“The riser structure has undermined or separated”

Check this if the water is flowing under the riser and into the outlet pipe or if the flows have eaten away the riser foundation in the basin bottom. This problem indicates that the riser is not functioning properly, and additional causes of the undermining and damage should be investigated. If the riser function is severely impacted it can fail, which warrants a higher rating than is typical for this item, as discussed above in “The riser is damaged or deteriorated”.



The riser is sitting slightly off kilter, which may be an indicator of undermining at the base. There appears to be a slight gap between the base of the riser and bottom grade of the basin. This warrants a minor rating (2) since it is still connected more than 50% of the circumference. If it is not corrected in a timely manner, the riser could fully separate and stormwater would leave the facility uncontrolled and untreated which would warrant a failure rating (5) e. Failure of the structure is addressed below.

“Outfall end sections or head wall has separated from PSP”

Check, if applicable. The riser typically has smaller orifice holes near its base to regulate flow in a manner that enhances water quality. The PSP is larger to accept drainage from both normal and high flow events. If the two have separated and more water than normal is draining directly into the PSP from the basin, then the flow is not being properly restricted and drawn down over the designed time period. Therefore, the basin is no longer meeting pollution removal requirements. Depending on the degree of separation and remaining functionality, the outlet structure may be considered to have failed. This warrants a moderate to major rating, depending on the severity of the separation and ability of water to drain directly into the PSP during storm events.



The outlet pipe has separated from the riser structure. This warrants a moderate rating (3) because the separation could cause water to flow out of the separated portion causing surrounding damage. This is especially true during large storm events, which could result in the leaching of dam material. If evidence of piping and material loss are present, a higher rating is warranted.

“Valves, manholes and locks are not operational”

Check, if applicable. These features will not be present on all structures and, if present, they are typically only operated for very large storm events or during extreme maintenance when it is necessary to lower the basin’s water level. These structures provide a mechanism to alleviate flooding in the basin by being able to manually open additional outflow mechanisms and lower the basin water levels to prevent overtopping of the dam. However, if these fixtures are not exercised regularly, they may become immobile. This typically warrants a minor to moderate rating (2-3), depending on frequency of use, but a frozen fixture should have higher rating.



A typical gate valve is shown. Valves should be regularly maintained and periodically exercised to ensure functionality. The rating depends on the level of effort to operate the valve and its purpose and location.

7.2.10 Rating for the Outlet Structure Component Heading

If “The low flow orifice or trash rack is blocked or damaged” or “The riser overflow top spillway or trash rack is blocked or damaged” is checked, the rating is no problem to minor (1-2)

The rating is based on the ability of the outflow structures to pass flows and the likelihood of clogging. Larger pipes and spillways are less likely to be clogged by trash than smaller ones. Cleaning out the trash rack and making minor repairs to it are a part of routine maintenance and should be rated as no problem (1), since this typically does not affect outflow rates. If the blockage slightly increases the normal water level but does not engage additional structures (e.g., the emergency spillway), a minor rating (2) is warranted.

Cleaning trash racks should be a part of routine maintenance and is much easier to accomplish than cleaning out the outlet structure. This warrants a minor rating (2) unless the blockage is severe (90% or greater), or the trash rack not functional which would warrant a moderate rating (3) or higher.

If items “Trash racks are missing or damaged”, “The outlet structure is filled with excess material”, or “Valves, manholes and locks are not operational” are checked a minor to moderate (2-3) rating is appropriate.

The presence of material in the riser structure warrants a minor rating (2) if it is not significantly blocking the main spillway outflow, which would warrant a moderate rating (3+) or higher. Clearing debris out of the riser is a part of routine maintenance and typically does not affect the outflow rates if the blockage is below the outflow pipe invert.

The rating for non-operational valves and flow gates is minor to moderate (2-3), depending on their frequency of use during storm events and proper positioning (i.e. rusted closed when they should be open) and functionality. These kinds of fixtures should be exercised twice a year as a part of routine maintenance. Consult the scanned plans to verify their expected frequency of engagement.

If “The riser is damaged or deteriorated “, “The riser structure is undermined”, “The riser structure has separated from the Principal Spillway Pipe (PSP)”, or “Outfall end sections or head wall has separated from PSP” are checked, a moderate to failure rating (3-5) is appropriate.

If the riser has slight damage, such as minor spalling that exposes an isolated area of rebar at the end section or outlet, a moderate rating (3) should be given. If it has deteriorated to a point where it is slightly affecting flow rates (e.g., leakage in a small area), a major rating is appropriate (4). If the outlet structure cannot function at all (e.g., over half of the structure is rusted away), then a failure rating (5) is appropriate because the structure cannot meet the design standards, resulting in impacts to the downstream receiving channel.

Undermining of the riser can also be considered deterioration, as mentioned above. However, it is critical to identify where the drainage at the undermined area is flowing (e.g. piping under the principal spillway, or scour at the outlet where the turbulent flows eat away at the pipe bedding). The severity of impacts or cause of the undermining determines the appropriate rating, such as moderate (3), where the

structure is unstable but functional to convey flows; major (4), where the undermining is causing erosion and associated impacts downstream); or failure (5), where flows are completely bypassing the outlet and not being regulated.

The severity of an outlet structure's separation from the principal spillway should be reflected in the rating. A moderate rating (3) reflects partial joint separation with insignificant leakage, if any. A major rating (4) would be warranted when more than half of the joint is not connected and is not properly aligned with the structure. A failure rating (5) exemplifies a total separation into two distinct pieces, and further deterioration is imminent.

Multiple Component Headings with Maintenance Ratings

Note if you have three or more minor rating (2) items checked, you may consider upgrading the heading rating (3+). If you have two or more moderate or major rating (3-4) items checked, you may consider increasing the heading rating (4+). If any inspection item qualifies as a failure, then the overall failure rating (5) should be given.

7.2.11 Principal Spillway Pipe (PSP)

The PSP is the pipe (or, rarely, a spillway channel) that routes flows from the control structure inside the basin through the dam to the outlet. Because this is typically the only conduit through the dam, the functionality and structural integrity of the PSP is critical.

"The PSP is blocked"

Check, if applicable. This can raise the water level in the basin, potentially causing overtopping. Note the severity of the blockage, location, and accessibility for removal. This warrants a moderate to major (3-4) rating.



The PSP is blocked. This can cause flooding. This inlet warrants a moderate rating (3), due to the minimal level of effort needed to remove the blockage, which should be included in routine maintenance. The rating should be upgraded if the blockage is more extensive, requiring more effort for removal or if it is causing flooding and potential damage to persons and property.

“One or more of the PSP joints are leaking”

Check, if applicable. Joints that separate or holes in the PSP (e.g. lift holes in the concrete pipe that are not patched) can leak water, soil, or bedding material and can also result in settlement of the structure or sunken areas on the dam. Piping could also result from joint leakage. This situation can appear to be stable for long periods of time before causing a very sudden, large and costly failure including, potentially, a dam breach. This warrants a moderate to major (3-4) rating, depending on the severity of the leak and the visual indicators discussed above.



There is evidence of seepage from the joint between the grated top and the riser pipe. This warrants a moderate rating (3). A higher rating is warranted if there are more serious leaks, causing the area around the riser to become saturated during storm events.

“One or more sections of pipe are cracked, damaged or settled to a point that threatens the integrity of the dam”

Check, if applicable. This is a structural mode of failure, where the PSP is not functioning properly, drainage is causing further deterioration of the structure and the surrounding embankment, and the PSP could collapse or wash out and cause a full breach. Take note of the damage, its location, and accessibility for repair. Evidence of this kind of problem can be seen in the deterioration of the pipe itself and typically accompanies joint leakage or piping. This warrants a moderate rating (3) for cracking, unless failure is imminent, which warrants a major rating (4).



the CMP principal spillway has corroded through the bottom of the pipe. This allows drainage to undermine the pipe and flow beneath the structure eroding away the subbase of the PSP. Also, drainage leaves the facility untreated and uncontrolled. This is a failure rating (5). Immediate remediation efforts should be taken to prevent further damage and a full breach of the dam.

7.2.12 Rating for the Principal Spillway Pipe (PSP) Component Heading

If “The PSP is blocked” is checked, a moderate to major rating (3-4) is warranted.

The rating is based on the specific field conditions. If the principal spillway is partially blocked, a moderate rating (3) is appropriate, whereas a full blockage warrants a major rating (4). If the blockage is backing up water in the basin causing overtopping of the dam, further deterioration of structures (e.g. erosion of the emergency spillway from more frequent use than the design supports), or backwater on private property), the rating should be increased and notes added. Some storm events may actually dislodge the blockage, but action to remove the blockage should be taken first.

If “One or more of the PSP joints are leaking” or “One or more sections of pipe are cracked, damaged or settled to a point that threatens the integrity of the dam” are checked, a rating of moderate to failure (3-5) is warranted.

If “One or more of the PSP joints are leaking” but the section still has a 30% to 50% contact connection to the joint, rate it as moderate (3). A moderate rating (3) is also applicable to isolated voids in the pipe from corrosion or tearing. If there is less joint contact, but the section is mostly level but not severely leaning from undermining (approximately 20 degrees or less), a major rating (4) is warranted. If the section is fully separated or leaning more than 20% so it is not functioning and complete separation and loss of the structure is imminent, rate it as a failure (5).

If “One or more sections of pipe are cracked, damaged or settled to a point that threatens the integrity of the dam” is checked, the rating is based on the severity of the damage. In a dry basin that is only active during storm events, a moderate rating (3) is warranted for cracking that would need to deteriorate further in order to fail. A major rating (4) is appropriate for structures that are still partially functioning but are deteriorating during isolated storm events. If the structure is constantly deteriorating in a manner that threatens the integrity of the dam, a failure (5) rating is warranted.

If “Outfall end section or headwall has separated from PSP” is checked the structure has failed (3-5 rating).

If more than 50% of the joint is still connected and the outfall structure is still in proper alignment, a moderate rating (3) is appropriate. If 30% to 50% of the joint connection is stable, but the structure is not properly aligned (e.g., angled downward), a major rating (4) should be given because failure is imminent. If less than 30% of the joint structure is connected and the alignment is not as designed, a failure rating (5) is warranted. Damage includes material loss at pipe ends or at joints. This item usually accompanies other issues listed above it (piping in particular), because the failure causes flows to find alternate exit paths. Therefore, determining the cause of these issues is critical to accomplishing proper repairs and restoring structural stability of the facility, while avoiding similar problems in the future.

Multiple Component Headings with Maintenance Ratings

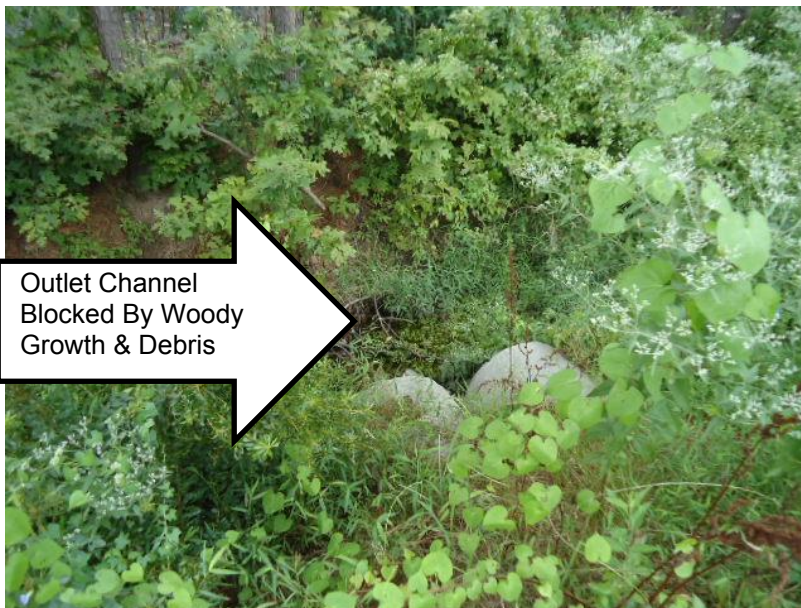
Note if you have three or more minor rating (2) items checked, you may consider upgrading the heading rating (3+). If you have two or more moderate or major rating (3-4) items checked, you may consider increasing the heading rating (4+). If any inspection item qualifies as a failure, then an overall failure rating (5) should be given.

7.2.13 Outfall Channel

The outfall channel is the receiving channel for the discharge from the stormwater basin. At the point of discharge there is usually a section of riprap, called “outlet protection,” to slow the outflow and dissipate the energy of the discharge, to prevent erosion in the channel.

“The outfall channel is blocked”

Check, if applicable. Blockages to the channel include trash, debris, overgrowth, and anything that could slow the outflow. Slowing the outflow could potentially back water up in the basin and raise the water level, causing overtopping of the dam. Removing small to medium blockages should be a part of routine maintenance, and thus warrant only a minor rating (2). If the channel is fully blocked, a higher rating is warranted based on the potential to raise the water level in the basin. For example, an outfall channel 10 feet below the normal pool elevation has a much lower chance of raising the basin’s water level than one that is only a few feet below it.



Outlet Channel
Blocked By Woody
Growth & Debris

The outlet channel is completely blocked to the point where water is pooling. This warrants a moderate rating (3) because water is pooling, which could cause flooding during large storm events. A higher rating is warranted if the channel is 100% blocked or does not have positive drainage, with the potential to raise the basin water levels and back up onto upstream properties or overtop the dam.

“The outfall channel is eroding”

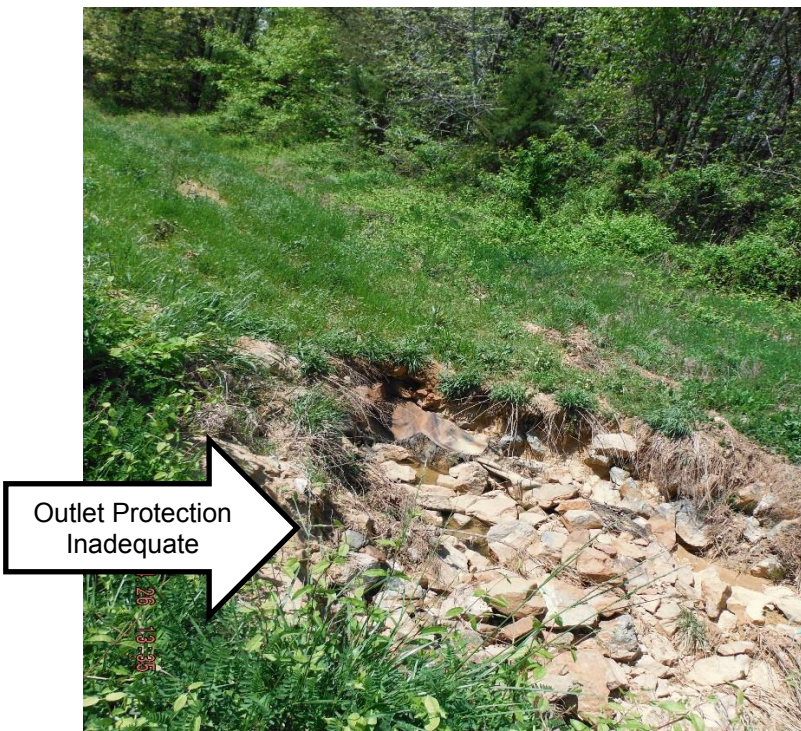
Check, if applicable. Erosion may be caused by large storm events, basin components not properly functioning, or from dysfunctional outlet protection. One of the purposes of stormwater management facilities is to protect downstream waterways from erosion. The rating for this item should be based on the severity of the erosion, from minor to moderate (2-3).



The outlet channel to this basin is severely eroded, possibly due to inadequate design, improper outlet protection, improper construction, or the lack of maintenance. This warrants a moderate rating (3). The plans should be referenced to identify any design flaws and any other possible reasons for the erosion. The rating should be increased if there is potential for damage to persons, downstream property, or environmentally sensitive areas.

“Outlet Protection is deteriorating”

Check, if applicable. Outlet protection serves to reduce erosion potential from drainage leaving the basin and entering the outfall channel. If the riprap is absent or has moved downstream, it indicates that the size of the rock is too small for the flows encountered, and larger heavier rock is needed. If there is erosion around the edges of the riprap, it indicates that the footprint dimensions are not large enough for the flows, and the placement area needs to be increased. Repair of outlet protection should be a part of routine maintenance, and the rating can be increased based on the severity of erosion.



The outlet protection has deteriorated and is clearly inadequate. The riprap has been undermined, and transported downstream, indicating the riprap is not large enough in size and weight. Filter fabric is exposed and the riprap is footprint is scoured around the sides indicating the footprint dimensions are not large enough. This warrants a moderate rating (3), because sediment is being transported into the basin and the outlet protection will continue to deteriorate with storm events. If sediment was being transported into a natural channel at the basin outfall a major rating (4) or higher would be appropriate.

“Outfall end section or headwall has separated from PSP”

Check, if applicable. Note the severity and potential downstream impacts from full separation in the Notes section. Inspect for undermining and further threats to the existing structure through the dam. This warrants a moderate to failure rating (3-5) depending on the severity of the separation (i.e., if it is still in place or washed away and broken off).



This end section has separated from the outlet pipe. This must be corrected to prevent any further deterioration of the outlet structure and, potentially, the dam, and to ensure that the pipe system is operating as designed. This warrants a major rating (4) because the outlet structure has broken loose and is not operating as intended. The configuration of the broken pipes also potentially conveys concentrated flows into areas that are not appropriately designed to handle such flows.

7.2.14 Rating for the Outfall Channel Component Heading

If “The outfall channel is blocked”, “The outfall channel is eroding”, “Outlet Protection is deteriorating” are checked, a minor to moderate (2-3) rating should result, based on the conditions observed at the site.

Blockages to the outfall channel can typically be repaired as a part of routine maintenance and would result in a minor rating (2). Larger storm events have been known to clear blockages from outlet channels and wash the material downstream, but action should be taken first to remedy the situation. If the channel is fully blocked and is causing the basin’s internal water level to rise or causing other structures, such as the emergency spillway, to engage more frequently, a moderate rating (3) is warranted.

If “Outlet channel is eroding” is checked, the rating should be minor to moderate (2-3) based on the severity of the erosion. If routine maintenance can repair the erosion, a minor rating (2) is appropriate. However, if construction equipment or extensive channel repairs requiring loads of materials are necessary, a moderate rating (3) should be given. When performing or directing appropriate outlet channel repairs, potential permit requirements and potential impacts to environmentally sensitive areas should be thoroughly considered. Additionally, appropriate erosion control measures should be implemented to prevent further impacts due to the repairs.

If “Outlet Protection is deteriorating” is checked, a minor to moderate rating (2-3) is appropriate, based on field conditions. Repair of riprap is a part of routine maintenance and warrants a minor rating (2). If the riprap is 50% or more washed away and requires construction equipment to accomplish the repairs, a moderate rating (3) should be given. Determining the cause of the erosion is critical to fully addressing the situation, whether it is from storm events larger than the design storm (which is not a design or maintenance issue) or higher discharge flows due to deteriorated spillway structures.

If “Outfall end section or headwall has separated from PSP” is checked the structure has failed (3-5 rating).

If more than 50% of the joint is still connected and the outfall structure is still in proper alignment, a moderate rating (3) is appropriate. If 30% to 50% of the joint connection is stable, but the structure is not properly aligned (e.g., angled downward), a major rating (4) should be given because failure is imminent. If less than 30% of the joint structure is connected and the alignment is not as designed, a failure rating (5) is warranted. Damage includes material loss at pipe ends or at joints. This item usually accompanies other issues listed above it (piping in particular), because the failure causes flows to find alternate exit paths. Therefore, determining the cause of these issues is critical to accomplishing proper repairs and restoring structural stability of the facility, while avoiding similar problems in the future.

Multiple Component Headings with Maintenance Ratings

Note if you have three or more minor rating (2) items checked, you may consider upgrading the heading rating (3+). If you have two or more moderate or major rating (3-4) items checked, you may consider increasing the heading rating (4+). If any inspection item qualifies as a failure, then an overall failure rating (5) should be given.

7.2.15 Impoundment Area

This section examines the footprint of the basin and all areas associated with the facilities that are not addressed in the above topics. Problems at an inlet or around the basin perimeter ultimately translate to the dam, outlet structures, and the receiving channel. The entire basin area upstream of the embankment is evaluated in this section.

“There is large debris or excessive trash in the basin”

Check, if applicable. Trash and debris can block the flow structures in a basin. Removing trash should be a part of routine maintenance and warrants a minor rating (2).



Excessive Trash in Basin

Excessive trash and debris has accumulated in a channel that is part of the basin due to inadequate maintenance. This warrants a minor rating (2) due to the minimal level of effort required to remove the trash. If the trash were blocking an outflow structure or required more effort to remove it, a higher rating would be warranted.

“Abnormal ponding of water in basin”

Check, if applicable. This applies to dry basins that are holding water permanently, which can be caused by blockages to the outlet structure or lack of positive drainage in the basin bottom. Abnormal ponding also refers to water levels above or below the normal pool in a wet pond, which is indicative of either a blockage or, conversely, a leak in the outlet structure. This warrants a minor to moderate rating (2-3), based on the difference between the observed water level and the design level. In this evaluation, take note of the storm-related design levels if there has been measureable precipitation.



Water Retention Due to Blockages

Cattails are a sign that water is being held in this basin. This warrants a minor rating (2) because the ponding is limited to an isolated area and can easily be corrected. If the ponding occurred over the whole facility and required more effort for maintenance, a higher rating would be appropriate.

“Inadequate vegetation or erosion on side slopes or basin floor”

Check, if applicable. Areas must be stabilized to hold soil in place; otherwise it can erode and contribute to overall sediment build-up in the basin. The side slopes are a more important consideration in facilities with no real dam, such as a dug basin. This warrants a minor to moderate rating (2-3), based on the severity of erosion and the amount and impacts of sediment deposition in the basin.



The bottom of this basin was inadequately stabilized during a recent renovation. This warrants a minor rating (2) due to the minimal level of effort required to correct this. If there is also sedimentation present, a higher rating may be warranted due to the level of effort required to remove the sediment and permanently stabilize the area.

“The low-flow ditch system is blocked with sediment or cracked and/or has been undermined.”

Check, if applicable. A low-flow or pilot channel conveys flows during dry weather and in smaller storm events through the basin and should be unobstructed for proper function. This warrants a minor rating because it does not affect the water level in the basin. Sediment removal and small crack repair in the low flow channel are a part of routine maintenance.



The ditch is blocked, which is causing permanent water accumulation and cattail growth. This warrants a minor rating (2), because the facility appears to still be functional and there is no evidence of water backing up beyond the facility footprint. If backwater increased the facility footprint, especially if the backwater crossed property lines, a higher rating would be warranted.

“Silt, sediment or aquatic overgrowth has impacted the volume”

Check, if applicable. Losing storage volume causes the basin’s water level in storm events to rise above design levels and potentially overtop the dam. Plantings help with pollutant removal but they can become so dense (including their root mat) that they impact the available storage volume in the basin. If the full storage volume is not available for storm events, the water level can rise and potentially cause overtopping of the dam. This warrants a minor to moderate rating (2-3) based on the amount of overgrowth.



The aquatic growth in the above photo impacts the basin storage volume. Having the proper storage volume available is critical for proper operation of the facility. This warrants a moderate rating (3) because the facility still functions and there appears to be no flooding. A higher rating is warranted if additional structures are being affected, there is evidence of dam overtopping, or more extensive effort is required to remove the overgrowth (e.g., trees with stumps).

“The aquatic plantings are inadequate”

Check, if applicable. Aquatic plantings enhance the pollutant removal efficiency from the basin and are often a part of the overall basin design. Plantings can die off, can become too dense and potentially choke out certain species, or invasive species can take over. All of these conditions affect the basin’s ability to properly function consistent with the design, and they must be remedied. This warrants a minor rating (2) because it does not affect the water levels or the integrity of structures within the basin.



The brush type vegetation growing in this facility is not representative of plantings listed in the design specification or the basin plans. The planting plan is an integral part of achieving target pollutant removal; therefore, inappropriate vegetation should be removed. This warrants a minor rating (2) due to the level of effort required to remove the undesirable vegetation and the fact that it is stabilized. If the removal effort was more intensive and required extensive replantings, then a higher rating would be warranted.

“Evidence of Illicit Discharge”

Check, if applicable. Evidence of an illicit discharge can be oil sheens on the water surface, atypical odors or substance colors, or sediment deposits. Refer to VDOT’s *Polluted Stormwater / Illicit Discharge* pamphlet for additional IDDE sources and items. If there is a possible illicit discharge discovered, report it using the notification procedures and guidance provided in VDOT’s *Illicit Discharge Detection and Elimination Program Manual* and the associated *Field Guide*.



An oil sheen can be seen entering the basin during a dry weather inspection. This warrants a moderate rating (3), and VDOT IDDE Manual should be referenced for further guidance on reporting and correcting the potential illicit discharge.

“Not properly converted from a sediment trapping measure to a permanent facility”

Check, if applicable. Site designers typically plan to use the stormwater basin location as a sediment basin or trap during the construction process. Details should be on the plans to convert the E&S control measure to a permanent stormwater facility after the area has been stabilized. This usually involves removing the draw-down tube on the riser and changing the orifice configuration. Be aware that concrete is recommended for permanent basin drainage structures because it is corrosion resistant; metal is typically used for temporary E&S control facilities. This warrants a moderate rating (3), unless there are significant differences in the design volume between the two. Note that the smaller sediment trapping measures are designed for run-off from pervious areas, and not from impervious areas that generate higher levels of runoff.

7.2.16 Rating for Impoundment Area Component Heading

If “There is large debris or excessive trash in the basin”, “The low-flow ditch system is blocked with sediment or cracked and/or has been undermined.”, “Silt, sediment or aquatic overgrowth has impacted the volume” or “The aquatic plantings are inadequate” are checked, a minor rating (2) is appropriate.

Large debris or excessive trash in the basin requires removal in order to prevent future blockages. This warrants a minor rating (2) and is typically accomplished through routine maintenance.

If the low flow ditch system is checked, it needs repairs to properly function in storm events. This does not affect the normal pool elevations in the basin, although it does have the potential for minor impacts to the outflow structures, which is covered in another section. This warrants a minor rating (2) and can be addressed through routine maintenance.

To determine if aquatic overgrowth impacts the storage volume, compare the aquatic bench plantings present to those specified in the design documents. While kinds of vegetation present can affect the pollutant removal credit, overgrowth or undergrowth does not affect the basin water level and thus warrants a minor rating (2).

Compare the aquatic plantings present with the planting design from the scanned plans. Be sure to identify any invasive species and note what plantings are present. Based on the specifications, there may be equivalent plantings that meet the same requirements. Maintenance of the design plantings are a part of routine maintenance and therefore warrant a minor rating (2). More significant deterioration of plants is covered in other inspection items.

If “Abnormal ponding of water in detention basin”, “Inadequate cover or erosion on side slopes or basin floor” or “Evidence of Illicit Discharge” are checked, a minor to moderate rating (2-3) is appropriate.

If “Abnormal ponding of water in basin” is checked, the cause of the ponding should determine the rating. If lack of positive drainage (likely from sedimentation or erosion) is the source of the issue, a minor rating (2) is appropriate. If the issue is caused by issues with the riser, a moderate rating (3) is warranted. Be aware that both of the causes above are also covered in other sections of the inspection form.

If “Inadequate cover or erosion on side slopes or basin floor” is checked, stabilization and erosion repair on areas other than the embankment itself can be accomplished through routine maintenance. This warrants a minor to moderate rating (2-3) based on the field conditions. If the erosion is significant and more extensive repairs are required, rate it as moderate (3). Be aware that erosion of side slopes is more critical in a dug basin due to the lack of a dam embankment. Also, the issues described above are typically interrelated with other subject matters listed in various sections of the inspection form. For example, the sediment from erosion can potentially block the riser or outflow pipe, which is addressed under the Principal Spillway heading.

If “Evidence of Illicit Discharge” is checked, the inspection has revealed a non-stormwater discharge that is a possible illicit discharge to the facility. Preliminary efforts to identify the source of this discharge should be taken and findings reported in accordance with procedures described in VDOT’s *Illicit Discharge Detection and Elimination Program Manual* and the associated *Field Guide*.

“Aquatic overgrowth or other impacts to storage volume” are checked, a moderate to major rating (3-4) should be given.

If “Aquatic overgrowth or other impacts to storage volume” is checked, the significance of the reduction of the design storage volume determines the rating.

Many basins have a stake present at a determined elevation to assist with the storage volume assessments, among other things. Basins are required to provide a certain amount of freeboard between the highest design storm (typically the 100-year storm), and the top of dam. Therefore, if the cause of the storage volume reduction is not blocking outflow orifices and does not appear to be placing additional stress on the other outflow structures, such as the emergency spillway, the rating should be moderate (3). If only half of the design storage volume remains, it will only be question of time before this does result in significant impacts during storm event. If additional stress is evident, such as a section of matted tall growth at the top and back of dam (indicating overtopping) or higher than usual debris lines in the emergency spillway, a major rating (4) is warranted. If the additional stress has caused deterioration of the structures, this will be addressed under other section headings. Be aware that overtopping of the dam is not considered a “failure” of the facility, but it does indicate non-compliance with design criteria and potential impacts to downstream channels.

Multiple Component Headings with Maintenance Ratings

Note if you have three or more minor rating (2) items checked, you may consider upgrading the heading rating (3+). If you have two or more moderate or major rating (3-4) items checked, you may consider increasing the heading rating (4+). If any inspection item qualifies as a failure, then an overall failure rating (5) should be given.

7.3 OVERALL INSPECTION RATING BY THE DATABASE

7.3.1 Rating A

The stormwater facility is functioning as designed with no problem conditions identified. There are no signs of impending deterioration. Routine maintenance will be performed twice a year as a preventative measure or in accordance with the BMP clearinghouse specifications, whichever is more stringent.

No component headings rate above a 1.

7.3.2 Rating B

Minor problems are observed; however, the stormwater facility is functioning as designed and no critical components have problems. Routine maintenance can achieve necessary repairs. A maintenance work plan will be developed and enacted in 12-26 weeks.

At least one of the component headings “Accessibility”, “Inlet, Inlet Channel and Forebay”, “Outfall Channel” or “Impoundment Area” has a rating of 4-5, and / or at least one of the component headings “Dam Embankment”, “Emergency Spillway”, “Outlet Structure and PSP” or “Principal Spillway Pipe” has a rating of 3.

7.3.3 Rating C

Moderate problems are observed, and stormwater facility has small changes in functionality that do not change the water level or impact its structural integrity. Routine maintenance may address some of the required repairs, but not all of them. A maintenance work plan will be developed and enacted within 6-12 weeks.

At least one of the component headings “Accessibility”, “Inlet, Inlet Channel and Forebay”, “Outfall Channel” or “Impoundment Area” has a value of 4-5, and / or at least one of the Basin Headings “Dam Embankment”, “Emergency Spillway”, “Outlet Structure and PSP” or “Principal Spillway Pipe” has a value of 3.

7.3.4 Rating D

At least one of the component headings “Accessibility”, “Inlet, Inlet Channel and Forebay”, “Outfall Channel” or “Impoundment Area” has a rating of 4-5, and / or at least one of the component headings “Dam Embankment”, “Emergency Spillway”, “Outlet Structure and PSP” or “Principal Spillway Pipe” has a rating of 3.

At least one of the component headings “Dam Embankment”, “Emergency Spillway”, “Outlet Structure” or “Principal Spillway Pipe” has a rating of 4.

7.3.5 Rating E

Severe problems are observed, and the stormwater BMP is not functioning as designed with several critical components requiring immediate repairs. Conditions associated with the BMP have compromised facility performance and further deterioration and/or failure is imminent. Deficiencies require repair and restoration. A secondary supervisor level inspection is necessary to clarify the extent of the maintenance work and determine what specific parties should be involved. A maintenance work plan will be developed and enacted within 2 weeks. Part of the work plan will include immediate remediation measures to temporarily preserve the BMP and prevent further deterioration.

At least one of the component headings “Dam Embankment”, “Emergency Spillway”, “Outlet Structure” or “Principal Spillway Pipe” has a rating of 5.

7.4 INSPECTOR RATING

The inspector rating allows input from the inspector based on the specific observed conditions of that BMP.

7.4.1 Rating Input

The rating cannot be entered lower than the database rating, but it can be increased based on the inspector’s judgment. For example, if there was a wet area on the back of an embankment that stayed moist and the latest inspection revealed a free flowing colored discharge from the same area, the “Dam Embankment” heading would be ranked appropriately. Having pictures available from previous inspections is critical as a means of before-after comparison, to ensure the proper rating is given. The

inspector could increase the rating due to such issues as proximity of the issue to impaired waters, presence of a residential community downstream, or the short time frame over which facility conditions deteriorated.

8 LID FACILITY INSPECTIONS

8.1 TYPES OF LID FACILITIES

8.1.1 Vegetated Roofs Level 1 and 2 (CH)

These are rooftops that support plant growth in an engineered growing media underlain with drainage materials and waterproofing. The growing media captures and stores stormwater. A portion of the stormwater is taken up by the plant roots or evaporates, thereby reducing peak runoff rates, runoff volume, and pollutant loads. The remainder of the stormwater is conveyed into a drain system. There are two types of vegetated roofs: intensive and extensive. Extensive vegetated roofs have growing media 2 to 6 inches deep, and have drought tolerant vegetation such as sedum. Intensive roofs, which have deeper growing media (6 to 48 inches) and typically support a wide variety of plants, including shrubs and trees, are less common than intensive vegetated roofs, because they are heavier and more expensive.

8.1.2 Rainwater Harvesting / Rain Barrels (CH)

Rainfall can be captured to use for a variety of purposes, including irrigation, vehicle washing, toilet flushing, fire suppression, and even to provide potable water, if the water is appropriately purified. Over time, the cost savings from not having to purchase municipally treated water for these purposes can defray the cost of the harvesting system. The system can be comprised of underground or above ground cisterns, or rainwater barrels hooked up to roof gutters. Rainwater harvesting system runoff volume reduction rates are user defined, based on cistern/tank size, configuration, and demand drawdown. They can be combined with a variety of down-gradient runoff reduction practices, including swales, infiltration, and bioretention. Rainwater harvesting systems have six main components: roof surface, collection and conveyance system, pre-screening and first flush diverters, storage tank (cistern, tank or barrel), distribution system, and overflow/ filter path/ secondary runoff reduction/treatment practice.

8.2 OVERALL FUNCTION OF LID FACILITIES

8.2.1 “Evidence of illicit discharge”

Check, if applicable. Evidence of an illicit discharge can be oil sheens on the water surface or vegetation, atypical odors or colors of substances, or sediment in the BMP. Please see VDOT’s pamphlet for additional illicit discharge sources and items. If a potential illicit discharge is discovered, report it following the notification procedures and guidance provided in VDOT’s *Illicit Discharge Detection and Elimination Program Manual* and the associated *Field Guide*.



This oil sheen is evident during a dry weather inspection. This warrants a moderate rating (3) and the VDOT IDDE Manual should be referenced for further guidance on reporting and correcting the potential illicit discharge.

Accessed at <http://hidot.hawaii.gov/harbors/files/2013/01/2010-ACR-Kalaeloa.pdf> on September 4, 2013

8.2.2 “Inaccessible”

This is the area available for inspection personnel and maintenance equipment to access the facility from the VDOT right-of-way. The access should be at least 10 feet wide, on a slope of 3:1 (H:V) or less, and stabilized to withstand the periodic passage of heavy equipment. The evaluation of this parameter should take into consideration roadway fill elevations, which are often steeper than 3:1 slopes, the configuration of the roadway with respect to the facility, the natural topography surrounding the facility, and the potential for constructing a stabilized access road to the facility. In addition, this section considers vegetation or debris that may impede access, as well as public safety components such as fencing and gated access.

“Inaccessible”

Check if applicable. If the access has not been maintained or used it can be a sign that the facility itself has not been maintained either. This should result in a higher rating since conditions may make it more difficult for the inspector to perform the required inspection in the allotted time frame.



Accessed at ohland.homedns.org on Sept. 4, 2013

This facility has an inadequately maintained access road. There is significant minor growth that would impede equipment from entering the area for inspection or maintenance. This would indicate a minor rating (2) because the access road can be easily cleared due to the small brush. If heavier grade equipment was required to restore the access road, a higher level rating may be warranted.

8.2.3 “Erosion or deterioration at outlet”

Erosion at the outlet indicates that the flow has discharge volumes or velocities higher than anticipated in the design. This can usually be repaired by increasing the size of the splash block or protective stone. If the outlet protection has been dislocated downstream by the force of the discharge, it is too small and should be increased at least one size class. If there is erosion around the exterior footprint edges, then the footprint of the outlet protection is too small. Repairing the outlet protection should effectively absorb the discharge energy as it exits the facility. The rating should be based on the severity of erosion.



Accessed at www.biogreenva.com on September 4, 2013

High discharge velocities from this downspout and inadequate outlet protection are causing severe erosion. This warrants a moderate rating (3) because of its proximity to the building foundation.

8.3 FACILITY COMPONENTS AND HEADINGS FOR RAINWATER HARVESTING / RAIN BARRELS

8.3.1 “Blockages to pre-treatment, screening devices, gutters or vents”

Check if applicable. Removing blockages should be a part of routine maintenance. Leaf screens and roof washers are recommended for roof drainage systems to prevent small debris from entering the system and accumulating. Larger debris can block the inflow which would be evident by the downspout system overflowing.



Gutter is blocked to the point where rainwater harvesting is not possible. This is a minor rating (2) due to the minor effort required for repairs. Removal of blockages should be part of routine maintenance.

8.3.2 “Overflow pipes and structures dysfunctional”

Check, if applicable. Outflow structures regulate the flow and keep the storage facility from reaching capacity. This can be particularly critical in a closed system. While the elevation differences between the inflow structures and outflow structures would make it difficult for water to back up to the inflow point, being a closed structure this is an important issue to address in the inspection.



The rain barrel cistern is being overwhelmed by the rain event. However, outlets should be checked for blockages to ensure that is not the source of overflow. This is a minor rating (2) item. If the overflow causes erosion or floods structures a higher rating is warranted.

8.3.3 “Sediment build up in tank / barrel”

Check, if applicable. Sediment decreases the storage capacity of the structure, increases overflow, and reduces holding time. To properly fix the issue, the source of the sediment must be identified, which could be a hole in the inflow pipe system. Sediment removal in closed systems, especially underground ones, can be complex.



Sediment has built up in this rain barrel due to inadequate sediment filtration of rainwater before it enters the barrel. This warrants a minor rating (2) due to the minimal level of effort need to achieve the repair, which can be accomplished through routine maintenance.

Sediment Buildup

Accessed September 4, 2013 at brainright.com

8.3.4 “Tank, pump, pipe or electrical system needs repairs”

Check, if applicable. The storage container itself is the most expensive portion of the system to replace. Above ground storage tanks should be UV resistant to avoid deterioration. Pumps, electrical systems and pipes are all critical systems for the proper function of the BMP, since they control inflow and outflow. Overflow systems for these facilities are required as a part of the BMP’s design criteria.



This rainwater cistern has become severely damaged (rusting) due to inadequate coating and exposure to the elements. It would rate as a failure (5) if water was freely flowing from the cistern or if it was not watertight.

Accessed at tankworksinc.com on September 4, 2013

8.4 RATING FOR LID-RAINWATER HARVESTING (CH)

8.4.1 Rating A

No inspection items are checked.

8.4.2 Rating B

One of the inspection items “Blockages to pre-treatment, screening devices, gutters or vents”, “Overflow pipes and structures dysfunctional”, “Sediment build up in tank/barrel”, “Tank, pipe, pump or electrical system needs repairs” or “Overall Function” or “Evidence of Illicit Discharge” is checked.

8.4.3 Rating C

Two or more of the inspection items “Blockages to pre-treatment, screening devices, gutters or vents”, “Overflow pipes and structures dysfunctional”, “Sediment build up in tank/barrel”, “Tank, pipe, pump or electrical system needs repairs” or “Overall Function” are checked.

8.4.4 Rating D

Three or more of the inspection items “Blockages to pre-treatment, screening devices, gutters or vents”, “Overflow pipes and structures dysfunctional”, “Sediment build up in tank/barrel”, “Tank, pipe, pump or electrical system needs repairs” or “Overall Function” are checked.

8.4.5 Rating E

Four or more of the inspection items “One of the inspection items “Blockages to pre-treatment, screening devices, gutters or vents”, “Overflow pipes and structures dysfunctional”, “Sediment build up in tank/barrel”, “Tank, pipe, pump or electrical system needs repairs” or “Overall Function” or “Evidence of Illicit Discharge” are checked.

8.5 FACILITY COMPONENT HEADINGS FOR VEGETATIVE ROOFS LEVEL 1 AND 2 (CH)

Vegetated roofs are also known as green roofs or living roofs because of the vegetative ecosystem they provide. They consist of a waterproof membrane to protect the structure, a drainage system, and an engineered media on top that promotes the growth of the plantings.

8.5.1 “Dead, dying or invasive vegetation”

A main design component of vegetated roofs is the planting plan. The plantings should be verified against the design plans for the number and species of plants present. Having more plants than what is shown on the plans is acceptable, as long as the plants are not an invasive species, the overgrowth is not impacting the storage volume or the facility’s ability to drain or has structural loading impacts. Checking the general planting location in the facility is also helpful. Replacing vegetation is a part of routine maintenance and warrants a minor rating (2).



Vegetation is the key design component for a vegetated roof. Ensuring the plantings are alive and functioning ensures meeting the design criteria for the facility. Here part of the roof is well vegetated and part of it is dead and not providing any pollutant removal. This warrants a minor rating (2) and if more plants were dead, the rating would be higher.

Accessed at http://www.solaripedia.com/13/350/4467/ellis_residence_vegetated_roof_modules.html on February 15, 2015

8.5.2 “Leaking, cracks or deterioration of the waterproof membrane”

Check, if applicable. There are many types of roof membranes available. The membrane must be 100% waterproof to prevent water damage to the structure itself. The lifespan of the membrane should be as long as any design feature of the system. A malfunction of this system can not only cause damage to the BMP (very costly repair) but also to the structural integrity of the building. If leak locations cannot be readily identified, an electric leak survey can be done to pinpoint the locations.



A leak in the membrane is evident from the water damage to the roof structure directly below the leak location. This warrants a failure rating (5) due to the resulting property damage and the potential for greater structural impacts and the associated risk to human safety.

Accessed September 4, 2013 at www.roofing.com

8.5.3 “Blockages in gutters, downspouts or outflow structures”

Check, if applicable. The drainage layer is sized based on the required storage capacity specified in the BMP design criteria, in order to meet runoff reduction and pollutant removal objectives. There are many different options for construction of the drainage layer (e.g., protected roof drains, prefabricated water cups, plastic modules, etc.). If the flow path is blocked, the backwater can create additional loading on the roof and impact the vegetation’s ability to thrive.



The growth in the gutter system has blocked the outflow for the vegetated roof. This is a moderate rating (3) issue based on the level of the backwater created and degree of the blockage. If the backwater from the blockage has an adequate overflow drainage outlet then rates lower than a blockage that prevents the roof from properly draining and increases the saturation level for the plants and loading..

8.6 RATING FOR LID-VEGETATIVE ROOF LEVEL 1 AND 2 (CH)

8.6.1 Rating A

No inspection items are checked.

8.6.2 Rating B

One of the inspection items “Dead, Dying or Invasive Vegetation”, “Leaking, Cracks or Deterioration of the Waterproof Membrane”, “Blockages in Gutters, Downspouts or Outflow Structures” or “Overall Function” is checked.

8.6.3 Rating C

Two or more of the inspection items “Dead, Dying or Invasive Vegetation”, “Leaking, Cracks or Deterioration of the Waterproof Membrane”, “Blockages in Gutters, Downspouts or Outflow Structures” or “Overall Function” are checked.

8.6.4 Rating D

Three or more of the inspection items “Dead, Dying or Invasive Vegetation”, “Leaking, Cracks or Deterioration of the Waterproof Membrane”, “Blockages in Gutters, Downspouts or Outflow Structures” or “Overall Function” are checked.

8.6.5 Rating E

Four or more of the inspection items “Dead, Dying or Invasive Vegetation”, “Leaking, Cracks or Deterioration of the Waterproof Membrane”, “Blockages in Gutters, Downspouts or Outflow Structures” or “Overall Function” are checked.

APPENDIX A.
STORMWATER BMP DATABASE INVENTORY FORMS

Maintenance Form for All Stormwater BMP Facilities

Inspection Form


Select by SWM ID:

SWM ID:

Alternate ID:

Inspection date:

Inspectors name:



Stormwater BMP Inspection Database

Page 1

Page 2

Basin Inventory

Filtration

Infiltration

Manufactured/Underground

Miscellaneous

LID

Maintenance

Inventory Information

<p style="text-align: center; color: red;">General</p> <p>Inventory date: <input type="text"/></p> <p>General BMP type: <input type="text"/></p> <p>Field surveyor: <input type="text"/></p> <p>Status: <input type="text"/></p> <p>Project no: <input type="text"/></p> <p>PPMS no: <input type="text"/></p> <p>Source: <input type="text"/></p> <hr/> <p style="text-align: center; color: red;">Location</p> <p><input style="width: 100%;" type="text"/></p> <p>Latitude: <input type="text"/> Longitude: <input type="text"/></p> <hr/> <p style="text-align: center; color: red;">General Information</p> <p>Maintained by: <input type="text"/></p> <p>Maintenance partner: <input type="text"/></p> <p>Jurisdiction: <input type="text"/></p> <p>Maintenance agreement? <input type="checkbox"/></p> <p>Comments/Notes: <input type="text"/></p> <p>As-Built plans? <input type="checkbox"/></p>	<p style="text-align: center; color: red;">Routine Maintenance</p> <p><input type="checkbox"/> Mowing</p> <p><input type="checkbox"/> Remove debris and trash</p> <p><input type="checkbox"/> Remove blockages to outflow structures</p> <p><input type="checkbox"/> Remove blockages from inflow structures and/or forebays</p> <hr/> <p>Other: <input type="text"/></p> <p>Maintenance completed by: <input type="text"/> Maintenance date: <input type="text"/></p> <p><input type="checkbox"/> Weather related maintenance inspection Completed by: <input type="text"/> Date: <input type="text"/></p> <p><input type="checkbox"/> Repair or corrective maintenance <input type="checkbox"/> Restore or replace activities</p> <p style="text-align: center;">Comments:</p> <p><input style="width: 100%;" type="text"/></p> <p>Corrective maintenance completed by: <input type="text"/> Corrective maintenance date: <input type="text"/></p>	<p style="text-align: center; color: red;">Extensive Maintenance</p> <p><input type="checkbox"/> Broad leaf application <input type="checkbox"/> Remove woody vegetation</p> <p><input type="checkbox"/> Seeding <input type="checkbox"/> Repair animal burrows</p> <p><input type="checkbox"/> Herbicide <input type="checkbox"/> Repair fence</p> <p><input type="checkbox"/> Restore access <input type="checkbox"/> Repair erosion</p> <p><input type="checkbox"/> Remove sediment <input type="checkbox"/> Repair structural deficiencies</p> <p><input type="checkbox"/> Replace filtration media <input type="checkbox"/> Repair plantings and vegetation</p> <p><input type="checkbox"/> Repair outlet protection/erosion</p>
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This is the maintenance form for the Stormwater BMP Inventory Database used by VDOT for BMP Maintenance. This form will be filled out by the inspector requesting maintenance needs as identified by the BMP inspection.

This form captures two different kinds of facility information, Routine and Corrective. The maintenance manual provides instructions and guidance on each of these maintenance items to assist in the proper maintenance and repair of the facility. Please note, due to the vast number and variation in facility types not all maintenance items listed apply to every BMP type. Maintenance will be tailored to the specific facility inspected.


Inventory Forms for Filtration, Infiltration, Manufactured, Miscellaneous and LID Type BMPs

The screenshot shows a web-based form titled "BMP Inventory" with the ID "888999". The form is organized into several sections:


- Navigation and Actions:** Includes a "Go to SWMID:" dropdown, "Maintained by:" dropdown, and buttons for "Add BMP", "Delete BMP", "View Inspection", "View Inventory Report", and "Switchboard".
- Imagery Links:** Provides links for "Google Maps" and "Bing Maps", along with the VDOT logo.
- Inspection Dates:** Fields for "Date of most recent inspection:", "Next Inspection Date:", and "Override Inspection Date?" with a checkbox.
- BACKGROUND DATA:**
 - Inventory date: [text input]
 - Field surveyor: [text input]
 - General BMP type: LID (dropdown)
 - Type: [dropdown]
 - Other Miscellaneous Type: [text input]
 - L and D classification: [text input]
 - Purpose: [dropdown] As-built plans?
 - Status: [dropdown]
 - Status date: [text input]
 - Project no: [text input]
 - PPMS no: [text input] Source: [dropdown]
 - Control structure orifices checked:
- LOCATIONAL INFORMATION:**
 - Latitude: [text input] Longitude: [text input]
 - District: [dropdown]
 - Jurisdiction: [dropdown]
 - Mile marker: [text input]
 - Route number: [text input]
 - Location: [text area]
- MAINTENANCE:**
 - Maintenance agreement:
 - Ownership: VDOT (dropdown)
 - Maintained by: [dropdown]
 - Maintenance partner: [text input]
- Comments/Notes:** A large text area at the bottom left for user input.

This is the inventory form for the Stormwater BMP Inventory Database used by VDOT for BMP Inspections. This form captures facility information for 5 of the 6 General BMP Types including Filtration, Infiltration, Manufactured, Miscellaneous, and LID. Data input in this section will translate over to the inspection forms based on the features entered.

Inventory Forms for Basin Type BMPs



BMP Inventory
888999

Imagery Links
[Google Maps](#) [Bing Maps](#) 

Go to SWMID:

Maintained by:

Date of most recent inspection:

Next Inspection Date:

Override Inspection Date?

BACKGROUND DATA

Inventory date: Field surveyor:

General BMP type:

Type:

Other Miscellaneous Type:

L and D classification:

Purpose: As-built plans?

Status:

Status date:

Project no:

PPMS no: Source:

Control structure orifices checked:

LOCATIONAL INFORMATION

Latitude: Longitude:

District:

Jurisdiction:

Mile marker:

Route number:

Location:

MAINTENANCE

Maintenance agreement: Ownership:

Maintained by: Maintenance partner:

BASIN GENERAL DESCRIPTION

<p style="text-align: center; color: red; font-weight: bold;">Accessibility</p> <p><input type="checkbox"/> Access road present? <input type="checkbox"/> Mow area?</p> <p><input type="checkbox"/> Basin has security fence? Mow area (ac): <input type="text"/></p>	<p style="text-align: center; color: red; font-weight: bold;">Inlets and Forebay</p> <p><input type="checkbox"/> Inlet(s) present? <input type="checkbox"/> Forebay present?</p> <p>Inlet channel(<input type="text"/> Inlet pipe(s) <input type="text"/></p>	<p style="text-align: center; color: red; font-weight: bold;">Principal Spillway Pipe (PSP)</p> <p><input type="checkbox"/> PSP present?</p> <p>PSP material: <input type="text"/></p>	<p style="text-align: center; color: red; font-weight: bold;">Outfall Channel</p> <p><input type="checkbox"/> Outfall channel?</p> <p><input type="checkbox"/> Direct discharge to storm sewer system?</p>
<p style="text-align: center; color: red; font-weight: bold;">Riser</p> <p><input type="checkbox"/> Outlet structure? Type: <input type="text"/></p> <p><input type="checkbox"/> Riser top trash rack? Type: <input type="text"/></p> <p><input type="checkbox"/> Emergency riser / pipe?</p>		<p style="text-align: center; color: red; font-weight: bold;">Other</p> <p><input type="checkbox"/> Low flow orifice? <input type="checkbox"/> Low flow orifice trash rack?</p> <p><input type="checkbox"/> Upper stage orifice? <input type="checkbox"/> Upper stage orifice trash rack?</p> <p>Dam Embankment: <input type="text"/></p> <p>Emergency spillway? <input type="text"/></p> <p><input type="checkbox"/> Impoundment area? Acres: <input type="text"/></p>	

Comments/Notes

This is the inventory form for the Stormwater BMP Inventory Database used by VDOT for BMP Inspections. This form captures facility information for the Basin General BMP. Data input in this section will translate over to the inspection forms based on the features entered.

APPENDIX B.
STORMWATER BMP DATABASE INSPECTION FORMS

Filtration BMP Inspection Forms

BMP Inspection
888999

Filtration
Inspection Date: 6/20/2016
Inspection type: Annual
Inspector: KAC

Vegetation

- Erosion at vegetation
- Area not mowed
- Area unstable
- Inlet malfunction
- Water on vegetation
- Poor vegetation
- Plant height inadequate
- Unauthorized plantings
- Deficient stakes

Sediment Deposition

- Basin full of sediment
- Sediment in chamber
- Sedimentation
- Remove accumulation
- Swale full of sediment

Structural Components

- Structural deterioration
- Damaged grates
- Cracks or spalling
- Perforated inlet not functioning
- Straps full of sediment
- Toe erosion

Accessibility

- Inaccessible?

Debris

- Area full of debris
- Facility full of debris
- Inlet/outlet debris
- Trench full of debris
- Inflow pipe full of debris
- Spillway full of debris
- Yard waste
- Litter

Overall Function of Facility

- Flow bypass
- Standing water
- Odor
- Shoreline erosion
- Failed pump

Plants

- Planting erosion
- Thin mulch
- Poor mulch
- Dead/diseased plants
- Plant stress
- Deficient stress

Sediment Traps

- No sediment trapping
- 50% of volume taken

Soil

- Waterlogged soils
- Low organic matter
- Pools cover

Aggregates

- Aggregate dirty
- Replace top layer
- Poor trench

Outlet/Overflow Structures

- Outlet erosion
- Grate full of debris
- Poor grate
- Pipe settling
- Poor inlet/outlet
- Erosion at inlet/outlet
- Blockages

Clogging

- Clogging

Roof

- Roof membrane malfunction
- Drainage layer flow paths blocked

Notes

This is the inspection form for the Stormwater BMP Inventory Database used by VDOT for BMP Inspections. This lists all inspection components of a Filtration type BMP. The inspection manual provides instructions and guidance on each of these facility components to assist in the proper inspection of the facility. Data input into the BMP Inventory section should be transferred to the inspection forms by the database automation.

Infiltration BMP Inspection Forms

The screenshot shows a web-based inspection form for an Infiltration BMP. The header includes the VDOT logo, the text 'BMP Inspection 888998', and 'Infiltration' type. The inspection date is set to 6/27/2016, and the inspector is 'kac'. The form is organized into several columns of inspection categories, each with a dropdown menu and a list of checkboxes for specific issues. The categories include:

- Accessibility:** Inaccessible?
- Debris:** Area full of debris, Facility full of debris, Inlet/outlet debris, Trench full of debris, Inflow pipe full of debris, Spillway full of debris, Yard waste, Litter.
- Overall Function of Facility:** Flow bypass, Standing water, Odor, Shoreline erosion, Failed pump.
- Vegetation:** Erosion at vegetation, Area not mowed, Area unstable, Inlet malfunction, Water on vegetation, Poor vegetation, Plant height inadequate, Unauthorized plantings, Deficient stakes.
- Plants:** Planting erosion, Thin mulch, Poor mulch, Dead/diseased plants, Plant stress, Deficient stress.
- Sediment Deposition:** Basin full of sediment, Sediment in chamber, Sedimentation, Remove accumulation, Swale full of sediment.
- Sediment Traps:** No sediment trapping, 50% of volume taken.
- Soil:** Waterlogged soils, Low organic matter, Poor cover.
- Aggregates:** Aggregate dirty, Replace top layer, Poor trench.
- Structural Components:** Structural deterioration, Damaged grates, Cracks or spalling, Perforated inlet not functioning, Straps full of sediment, Toe erosion.
- Outlet/Overflow Structures:** Outlet erosion, Grate full of debris, Poor grate, Pipe settling, Poor inlet/outlet, Erosion at inlet/outlet, Blockages.
- Clogging:** Clogging.
- Roof:** Roof membrane malfunction, Drainage layer flow paths blocked.

A 'Notes' field is located at the bottom left of the form.

This is the inspection form for the Stormwater BMP Inventory Database used by VDOT for BMP Inspections. This lists all inspection components of an Infiltration type BMP. The inspection manual provides instructions and guidance on each of these facility components to assist in the proper inspection of the facility. Data input into the BMP Inventory inlet section should be transferred to the inspection forms by the database automation.

Manufactured BMP Inspection Forms

Inspections

BMP Inspection
888997
Manufactured

Go to SWMID:

Inspection Date:

Inspection type:

Inspector:

Rating:

Non-Basin | Maintenance | Rating Help

Accessibility

Inaccessible?

Debris

Area full of debris

Facility full of debris

Inlet/outlet debris

Trench full of debris

Inflow pipe full of debris

Spillway full of debris

Yard waste

Litter

Overall Function of Facility

Flow bypass

Standing water

Odor

Shoreline erosion

Failed pump

Notes

Vegetation

Erosion at vegetation

Area not mowed

Area unstable

Inlet malfunction

Water on vegetation

Poor vegetation

Plant height inadequate

Unauthorized plantings

Deficient stakes

Plants

Planting erosion

Thin mulch

Poor mulch

Dead/diseased plants

Plant stress

Deficient stress

Sediment Deposition

Basin full of sediment

Sediment in chamber

Sedimentation

Manhole accumulation

Swale full of sediment

Sediment Traps

No sediment trapping

50% of volume taken

Soil

Waterlogged soils

Low organic matter

Poor cover

Aggregates

Aggregate dirty

Replace top layer

Poor trench

Structural Components

Structural deterioration

Damaged grates

Cracks or spalling

Perforated inlet not functioning

Sumps full of sediment

Toe erosion

Outlet/Overflow Structures

Outlet erosion

Grate full of debris

Poor grate

Pipe settling

Poor inlet/outlet

Erosion at inlet/outlet

Blockages

Clogging

Clogging

Roof

Roof membrane malfunction

Drainage layer flow paths blocked

This is the inspection form for the Stormwater BMP Inventory Database used by VDOT for BMP Inspections. This lists all inspection components of a Manufactured type BMP. The inspection manual provides instructions and guidance on each of these facility components to assist in the proper inspection of the facility. Data input into the BMP Inventory section should be transferred to the inspection forms by the database automation.

BMP Inspection Manual
June 2016

Appendix B
Page 160 of 169

Miscellaneous BMP Inspection Forms

The screenshot shows a web-based inspection form for a Miscellaneous BMP. The header includes the following information:

- Inspections** (tab)
- Go to SWMID: [dropdown]
- BMP Inspection 888996**
- Miscellaneous** (type)
- Inspection Date: 6/27/2016
- Inspection type: Annual
- Inspector: kac
- Rating: [dropdown]

Navigation buttons include: Add Inspection, Delete Inspection, View Inspection Report, Switchboard, and View Inventory.

The main inspection area is organized into several columns of categories, each with a dropdown arrow:

- Accessibility:**
 - Inaccessible? [checkbox]
- Debris:**
 - Area full of debris [checkbox]
 - Facility full of debris [checkbox]
 - Inlet/outlet debris [checkbox]
 - Trench full of debris [checkbox]
 - Inflow pipe full of debris [checkbox]
 - Spillway full of debris [checkbox]
 - Yard waste [checkbox]
 - Litter [checkbox]
- Overall Function of Facility:**
 - Flow bypass [checkbox]
 - Standing water [checkbox]
 - Odor [checkbox]
 - Shoreline erosion [checkbox]
 - Failed pump [checkbox]
- Vegetation:**
 - Erosion at vegetation [checkbox]
 - Area not mowed [checkbox]
 - Area unstable [checkbox]
 - Inlet malfunction [checkbox]
 - Water on vegetation [checkbox]
 - Poor vegetation [checkbox]
 - Plant height inadequate [checkbox]
 - Unauthorized plantings [checkbox]
 - Deficient stakes [checkbox]
 - Plants [dropdown]
 - Planting erosion [checkbox]
 - Thin mulch [checkbox]
 - Poor mulch [checkbox]
 - Dead/diseased plants [checkbox]
 - Plant stress [checkbox]
 - Deficient stress [checkbox]
- Sediment Deposition:**
 - Basin full of sediment [checkbox]
 - Sediment in chamber [checkbox]
 - Sedimentation [checkbox]
 - Remove accumulation [checkbox]
 - Swale full of sediment [checkbox]
 - Sediment Traps [dropdown]
 - No sediment trapping [checkbox]
 - 50% of volume taken [checkbox]
 - Soil [dropdown]
 - Waterlogged soils [checkbox]
 - Low organic matter [checkbox]
 - Poor cover [checkbox]
 - Aggregates [dropdown]
 - Aggregate dirty [checkbox]
 - Replace top layer [checkbox]
 - Poor trench [checkbox]
- Structural Components:**
 - Structural deterioration [checkbox]
 - Damaged grates [checkbox]
 - Cracks or spalling [checkbox]
 - Perforated inlet not functioning [checkbox]
 - Sumps full of sediment [checkbox]
 - Toe erosion [checkbox]
 - Outlet/Overflow Structures [dropdown]
 - Outlet erosion [checkbox]
 - Grate full of debris [checkbox]
 - Poor grate [checkbox]
 - Pipe settling [checkbox]
 - Poor inlet/outlet [checkbox]
 - Erosion at inlet/outlet [checkbox]
 - Blockages [checkbox]
 - Clogging [checkbox]
 - Roof [dropdown]
 - Roof membrane malfunction [checkbox]
 - Drainage layer flow paths blocked [checkbox]

A 'Notes' field is located at the bottom left of the form.

This is the inspection form for the Stormwater BMP Inventory Database used by VDOT for BMP Inspections. This lists all inspection components of a Miscellaneous type BMP. The inspection manual provides instructions and guidance on each of these facility components to assist in the proper inspection of the facility. Data input into the BMP Inventory section should be transferred to the inspection forms by the database automation.

Basin BMP Inspection Forms

This is the inspection form for the Stormwater BMP Inventory Database used by VDOT for BMP Inspections. This lists all inspection components of a Basin type BMP. The inspection manual provides instructions and guidance on each of these facility components to assist in the proper inspection of the facility. Data input into the BMP Inventory section should be transferred to the inspection forms by the database automation.

LID BMP Inspection Forms

The screenshot shows a web-based inspection form for BMPs. At the top, there's a navigation bar with 'Inspections' and a 'Go to SWMID:' dropdown. The main header displays 'BMP Inspection 888996' and 'LID'. On the right, there's a 'VDOT' logo and fields for 'Inspection Date: 6/27/2016', 'Inspection type: Annual', and 'Inspector: kac'. Below this is a 'Rating:' section with a 'Rating Help' button. The main content area is titled 'Overall Rating' and contains a 'Rating' section with several categories of inspection items, each with a checkbox:

- Soil Amendments (SA)**
 - Waterlogged soil
 - Poor cover
 - Lack of organic content
- Vegetative Buffer (VB)**
 - Sediment deposition evident
 - Erosion evident
 - Flow channel(s) developed
 - Inadequate vegetation
- Tree Box Filters (TB)**
 - Trash and debris present
 - Sediment deposition evident
 - Lack of mulch or organic material
 - Tree condition deteriorated
- Vegetative Roof (VR)**
 - Roof membrane malfunction
 - Drainage layer flow paths blocked
 - Inadequate vegetation
- Rain Gardens (RG)**
 - Lack of vegetation
 - Lack of organic material
- Permeable pavers and pavement - organic material
- Evidence of illicit discharge
- Further deterioration may adversely impact structures, public safety and/or environment

Notes:

This is the inspection form for the Stormwater BMP Inventory Database used by VDOT for BMP Inspections. This lists all inspection components of a LID type BMP. The inspection manual provides instructions and guidance on each of these facility components to assist in the proper inspection of the facility. Data input into the BMP Inventory section should be transferred to the inspection forms by the database automation.