

RADFORD UNIVERSITY

BMP INSPECTION REPORT

Located in:

Radford, Virginia

Project Number: 2429.3

Date: July 26, 2017

25 **GAY AND NEEL, INC.**
Y  A R S
ENGINEERING  LAND PLANNING  SURVEYING
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Radford University BMP Inspection Report

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Radford University

BMP INSPECTION REPORT

EXECUTIVE SUMMARY

Gay and Neel, Inc. investigated the 9 BMP facilities on campus to determine if they met compliance in regards to the original design as well as determining if the facilities were being maintained properly. The 2016 report completed by MBP referenced three main areas of concern for the existing facilities on campus:

- 1) Sediment accumulation,
- 2) Invasive species,
- 3) Excessive vegetation growth.

Radford University has been working on the areas of concern and has addressed many of the original concerns in the 2016 report. The University has removed much of the excessive growth and sediment in many of the existing BMPs. However, there is still some invasive species within one of the BMPs.

The 2017 report emphasizes the need to continue the sediment removal, reseeding of the BMP and to keep any invasive species out of the existing Constructed Wetland BMP. In addition, there are a few minor items such as avoiding compaction of engineered soils, checking cleanouts, as well as other minor maintenance concerns.

DETAILED INSPECTION

RU-BMP-IF-1 – UNDERGROUND STORAGE

- Small bits of sediment in sections. Sediment has not reached the 5% range. Recommend cleaning once the 5% level has been reached.



RU-BMP-HF-1 – UNDERGROUND STORAGE

- Small bits of sediment in sections. Sediment has not reached the 5% range. Recommend cleaning once the 5% level has been reached.



RU-BMP-HF-1 – GRASSED SWALE

- Riprap has been added to the outfall of the underground detention prior to entrance into the grass swale.



- Check cleanout tops & missing covers. Check required screening to keep animals out of the drain system. Some areas of the grass swale have been compacted due to heavy equipment being driven over the BMP. Larger mowing equipment should be avoided in this area.



RU-BMP-WT-1 – CONSTRUCTED WETLANDS

- The pretreatment (forebay) requires removal of vegetation as well as location of the 50% marker to measure the amount of sediment buildout in the facility. Parts of the gravel access road can be seen but the remaining sections are covered in vegetation.



- Excess vegetation should be removed to allow access to the various cells within the wetlands as well as the outfall and emergency spillway areas. Based upon the 2016 report, invasive species were identified in the wetland cells. The original plan has a schedule for the high and low mashes. Currently there are cattails and phragmites within the wetland area. Control of those invasive species should be implemented if they reach 15% of the wetland cell.



WETLAND PLANT SCHEDULE			
KEY	QUANTITY	SCIENTIFIC NAME	COMMON NAME
LM	LOW MARSH		
LM-1	5,328	POTAMOGETON PECTINATUS	PONDWEED
LM-2	7,018	CERATOPHYLLUM DEMERSUM	COONTAIL
LM-3	3,575	VALISNERIA AMERICANA	WILD CELERY
LM-4	2 BAGS	LEMNA SPP.	DUCKWEED
HM	HIGH MARSH		
HM-1	617	SCIPUS PUNGENS	COMMON THREE SQUARE
HM-2	1,361	SCIPUS VALIDUS	SOFT STEM BULRUSH
HM-3	547	PONTEDERIA CORDATA	PICKERELWEED
HM-4	566	PELTANDRA VIRGINICA	ARROW ARUM
HM-5	3,941	CAREX SPP.	SEDGES

RU-BMP-AL-1 – DETENTION POND

- Trash, debris, and excessive vegetation removed. Riprap placed alongside slopes to protect areas identified in the 2016 report. At the time of this investigation, the seeding had not been completed. The University will reseed the pond to stabilize the facility.



- Sediment removed from riser structure and clean riprap placed around lower orifice. Pond functions restored. Excess concrete in spillway removed.





- Once vegetation had been removed, it was noted that the berm area near a gas line installation shows a potential compromise to the berm structure due to cutting into the lower part of the berm during the installation of the gas line. Berm structure is intact but does not have full width. Recommend placement of fill in section to widen berm.



RU-BMP-AR-1 – DETENTION POND

- Trash, debris, and excessive vegetation removed. At the time of this investigation, no seeding had been done. University to seed the pond area for final stabilization of the BMP.



- Restoration of side slopes, pipe replacement and fill material to protect areas identified in the 2016 report.



- During the inspection it was noted that the maintenance road into the site was depressed. The University should maintain the access road but make sure that the depression does not lower in elevation to compromise the pond volume or function. In addition, traps have been set for nuisance animals to protect the berm from being compromised.



RU-BMP-CH-1 – DETENTION POND

- Trash and debris was removed from the inlet structure and minors repairs completed. Overall, the facility has been kept in good condition.



RU-BMP-SC-1 – BIORETENTION

- The BMP is a relatively new facility with no apparent trash or debris from drainage area. Plants and mulch have been maintained. No issues with the underdrain or media.



RU-BMP-HU-1 – UNDERGROUND DETENTION

- Small bits of sediment in structure, however, less than 1%. Removal of sediment is required once 5% has been reached to ensure proper function of detention system. It was noted that the Humanities Building HVAC units send condensation water to the facility. Overall the system is new and in good condition but the amount of condensation water should be monitored.



Radford University BMP Inspection Report

APPENDIX A

OPERATION & MAINTENANCE INSPECTION FOR DETENTION, RETENTION & EXTENDED DETENTION BASINS

- RU-BMP-AL-1
- RU-BMP-AR-1
- RU-BMP-CH-1
- RU-BMP-CU-1

BMP Operation & Maintenance Inspection for Detention, Retention and Extended Detention Basins

Owner Name: Radford University	Facility ID # (See Mapping): RU-BMP-AL-1
Date of Inspection: June 29, 2017	As-Built Plan Available: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Date of Last Inspection: May 31, 2016	Inspector: Timothy D. Guthrie, P.E.
Were issues identified during the previous inspection that required maintenance? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	

BMP Element	Issue	Yes	No	N/A	Corrective Action
Contributing Drainage Area	Excessive trash/debris		X		Remove trash/debris and properly dispose.
	Bare exposed soil		X		Stabilize with seed and mulch. E&S measures may be warranted until stabilized.
	Evidence of erosion		X		Backfill area, seed, mulch and consider matting. E&S measures may be warranted until stabilized.
	Excessive landscape waste/yard clippings		X		Remove landscape waste and yard clippings to prevent clogging and properly dispose of them.
Pretreatment /Forebay /Inflow	Excessive trash/debris/sediment or other blockage			X	Remove trash/debris/sediment or blockages and properly dispose of.
	Dead vegetation, exposed soil			X	Replace vegetation and stabilize according to plans. E&S measures may be warranted until stabilized.
	Evidence of erosion, undercutting, or bare soils			X	Backfill area, seed, mulch, and consider matting. E&S measures may be warranted until stabilized.
	Structural deterioration of inlets, outfalls or pretreatment overflow weirs into the facility			X	Repair and restabilize area. Consult plans for approved configuration or an engineer. E&S measures may be warranted until stabilized.
	Animal burrows			X	Fill in immediately and stabilize.
Aquatic Bench / Vegetation	Plantings inconsistent with approved plans			X	Consult approved plans and/or management to ensure no approved plant substitutions were used. Remove unapproved plants and replace any required plantings in kind.
	Dead vegetation/exposed soil			X	Replace vegetation and stabilize according to plans. E&S measures may be warranted until stabilized.
	Invasive plants, such as cattails and phragmites, exceeds 15% of the planted area			X	Invasive plants should be removed immediately. Vegetation may require periodic harvesting for proper long term management.
Berm / Embankment	Overgrown, including woody growth 5' beyond the outfall pipe and/or embankment		X		Removal of woody species near or on the embankment is critical for proper function and long term stability. Remove all woody growth including stumps. Consult an engineer for backfill specifications. Mow thick growth.
	There is sparse vegetative cover and erosion channels are present	X			Backfill area with structural fill and consult engineer for proper specifications. Stabilize with seed and mulch, consider matting. E&S measures may be warranted until stabilized.
	Cracking, bulging, sloughing and seepage		X		Consult an engineer immediately to prevent failure.
	Evidence of animal burrows		X		Fill in immediately and stabilize.

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Riser	Structural condition of the riser is deteriorating.		X		Consult an engineer to recommend a repair and review the approved plans.
	Adjustable control valve inaccessible and inoperable (if present).			X	Repair valve to be operational.
	Pieces of the riser are broken or missing.		X		Repair immediately in accordance with the approved plans. Consult and engineer as needed.
	Riser or low flow orifice is blocked.		X		Remove blockage and properly dispose of.
	Rise provides inadequate conveyance out of facility.		X		Repair to properly convey drainage to the outfall per the approved plan. Consult an engineer as needed.
	Evidence of erosion or undermining at/around riser.		X		Repair erosion. Consult engineer for structural repairs as needed.
	Structural deterioration.		X		Consult engineer for proper repair procedures.
Outlet / Outfall	Exposed rebar, joint failure, loss of joint material, misalignment, leaking or corrosion		X		Repair concrete to cover rebar. Consult engineer for all other structural repairs.
	Excessive trash/debris/sediment or blockages.		X		Remove trash/debris/sediment/blockages and properly dispose.
	Evidence of erosion and bare soil		X		Backfill area, seed, mulch and consider matting. E&S measures may be warranted until stabilized.
	Valves, manholes or locks cannot be opened or operated (if present)		X		Repair/replace any broken fixtures.
	Erosion of outfall channel or riprap deterioration		X		Repair and/or supplement riprap outlet protection in accordance with the approved plans.
	Outlets provide inadequate conveyance out of facility		X		Repair to properly convey drainage to the outfall per the approved plan. Consult an engineer as needed.
Overall	Access to the facility is in need of repair		X		Restore access for maintenance equipment per the approved plans.
	Encroachment on facility or easement by buildings or other structures		X		Contact Facilities Planning.
	Evidence of oil/chemical accumulation, odor, algae, color or pollution		X		Report to management and consult IDDE manual.
	Fences and/or safety signage is inadequate		X		Repair fences and signage for public safety.
	Trash in the pool		X		Remove immediately and observe safety procedures.
	Additional notes: <ul style="list-style-type: none"> • Side slopes – reseed. • Vegetation removed. • Sediment removed. RU Staff to reseed pond area. • Noted that area where gas line access is located has the potential to compromise the embankment. RU Staff to investigate alternatives to monitor berm. 				

BMP Operation & Maintenance Inspection for Detention, Retention and Extended Detention Basins

Owner Name: Radford University	Facility ID # (See Mapping): RU-BMP-AR-1
Date of Inspection: June 29, 2017	As-Built Plan Available: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Date of Last Inspection: May 31, 2016	Inspector: Timothy D. Guthrie, P.E.
Were issues identified during the previous inspection that required maintenance? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	

BMP Element	Issue	Yes	No	N/A	Corrective Action
Contributing Drainage Area	Excessive trash/debris		X		Remove trash/debris and properly dispose.
	Bare exposed soil		X		Stabilize with seed and mulch. E&S measures may be warranted until stabilized.
	Evidence of erosion		X		Backfill area, seed, mulch and consider matting. E&S measures may be warranted until stabilized.
	Excessive landscape waste/yard clippings		X		Remove landscape waste and yard clippings to prevent clogging and properly dispose of them.
Pretreatment /Forebay /Inflow	Excessive trash/debris/sediment or other blockage			X	Remove trash/debris/sediment or blockages and properly dispose of.
	Dead vegetation, exposed soil			X	Replace vegetation and stabilize according to plans. E&S measures may be warranted until stabilized.
	Evidence of erosion, undercutting, or bare soils			X	Backfill area, seed, mulch, and consider matting. E&S measures may be warranted until stabilized.
	Structural deterioration of inlets, outfalls or pretreatment overflow weirs into the facility			X	Repair and restabilize area. Consult plans for approved configuration or an engineer. E&S measures may be warranted until stabilized.
	Animal burrows			X	Fill in immediately and stabilize.
Aquatic Bench / Vegetation	Plantings inconsistent with approved plans			X	Consult approved plans and/or management to ensure no approved plant substitutions were used. Remove unapproved plants and replace any required plantings in kind.
	Dead vegetation/exposed soil			X	Replace vegetation and stabilize according to plans. E&S measures may be warranted until stabilized.
	Invasive plants, such as cattails and phragmites, exceeds 15% of the planted area			X	Invasive plants should be removed immediately. Vegetation may require periodic harvesting for proper long term management.
Berm / Embankment	Overgrown, including woody growth 5' beyond the outfall pipe and/or embankment		X		Removal of woody species near or on the embankment is critical for proper function and long term stability. Remove all woody growth including stumps. Consult an engineer for backfill specifications. Mow thick growth.
	There is sparse vegetative cover and erosion channels are present	X			Backfill area with structural fill and consult engineer for proper specifications. Stabilize with seed and mulch, consider matting. E&S measures may be warranted until stabilized.
	Cracking, bulging, sloughing and seepage		X		Consult an engineer immediately to prevent failure.
	Evidence of animal burrows	X			Fill in immediately and stabilize.

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Riser	Structural condition of the riser is deteriorating.		X		Consult an engineer to recommend a repair and review the approved plans.
	Adjustable control valve inaccessible and inoperable (if present).			X	Repair valve to be operational.
	Pieces of the riser are broken or missing.		X		Repair immediately in accordance with the approved plans. Consult and engineer as needed.
	Riser or low flow orifice is blocked.		X		Remove blockage and properly dispose of.
	Rise provides inadequate conveyance out of facility.	X			Repair to properly convey drainage to the outfall per the approved plan. Consult an engineer as needed.
	Evidence of erosion or undermining at/around riser.		X		Repair erosion. Consult engineer for structural repairs as needed.
	Structural deterioration.		X		Consult engineer for proper repair procedures.
Outlet / Outfall	Exposed rebar, joint failure, loss of joint material, misalignment, leaking or corrosion		X		Repair concrete to cover rebar. Consult engineer for all other structural repairs.
	Excessive trash/debris/sediment or blockages.		X		Remove trash/debris/sediment/blockages and properly dispose.
	Evidence of erosion and bare soil		X		Backfill area, seed, mulch and consider matting. E&S measures may be warranted until stabilized.
	Valves, manholes or locks cannot be opened or operated (if present)		X		Repair/replace any broken fixtures.
	Erosion of outfall channel or riprap deterioration		X		Repair and/or supplement riprap outlet protection in accordance with the approved plans.
	Outlets provide inadequate conveyance out of facility		X		Repair to properly convey drainage to the outfall per the approved plan. Consult an engineer as needed.
Overall	Access to the facility is in need of repair		X		Restore access for maintenance equipment per the approved plans.
	Encroachment on facility or easement by buildings or other structures		X		Contact Facilities Planning.
	Evidence of oil/chemical accumulation, odor, algae, color or pollution		X		Report to management and consult IDDE manual.
	Fences and/or safety signage is inadequate		X		Repair fences and signage for public safety.
	Trash in the pool		X		Remove immediately and observe safety procedures.
	Additional notes: <ul style="list-style-type: none"> • Traps set to capture groundhogs and other vermin. • Area cleaned of vegetation and sediment. • Currently not seeded at time of inspection. RU Staff to seed and stabilize. • Inlet pipes repaired. • Maintenance road is depressed. RU Staff notified to make sure berm is not compromised. 				

BMP Operation & Maintenance Inspection for Detention, Retention and Extended Detention Basins

Owner Name: Radford University	Facility ID # (See Mapping): RU-BMP-CH-1
Date of Inspection: June 29, 2017	As-Built Plan Available: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Date of Last Inspection: May 31, 2016	Inspector: Timothy D. Guthrie, P.E.
Were issues identified during the previous inspection that required maintenance? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	

BMP Element	Issue	Yes	No	N/A	Corrective Action
Contributing Drainage Area	Excessive trash/debris		X		Remove trash/debris and properly dispose.
	Bare exposed soil		X		Stabilize with seed and mulch. E&S measures may be warranted until stabilized.
	Evidence of erosion		X		Backfill area, seed, mulch and consider matting. E&S measures may be warranted until stabilized.
	Excessive landscape waste/yard clippings		X		Remove landscape waste and yard clippings to prevent clogging and properly dispose of them.
Pretreatment /Forebay /Inflow	Excessive trash/debris/sediment or other blockage		X		Remove trash/debris/sediment or blockages and properly dispose of.
	Dead vegetation, exposed soil		X		Replace vegetation and stabilize according to plans. E&S measures may be warranted until stabilized.
	Evidence of erosion, undercutting, or bare soils		X		Backfill area, seed, mulch, and consider matting. E&S measures may be warranted until stabilized.
	Structural deterioration of inlets, outfalls or pretreatment overflow weirs into the facility		X		Repair and restabilize area. Consult plans for approved configuration or an engineer. E&S measures may be warranted until stabilized.
	Animal burrows		X		Fill in immediately and stabilize.
Aquatic Bench / Vegetation	Plantings inconsistent with approved plans			X	Consult approved plans and/or management to ensure no approved plant substitutions were used. Remove unapproved plants and replace any required plantings in kind.
	Dead vegetation/exposed soil			X	Replace vegetation and stabilize according to plans. E&S measures may be warranted until stabilized.
	Invasive plants, such as cattails and phragmites, exceeds 15% of the planted area			X	Invasive plants should be removed immediately. Vegetation may require periodic harvesting for proper long term management.
Berm / Embankment	Overgrown, including woody growth 5' beyond the outfall pipe and/or embankment		X		Removal of woody species near or on the embankment is critical for proper function and long term stability. Remove all woody growth including stumps. Consult an engineer for backfill specifications. Mow thick growth.
	There is sparse vegetative cover and erosion channels are present		X		Backfill area with structural fill and consult engineer for proper specifications. Stabilize with seed and mulch, consider matting. E&S measures may be warranted until stabilized.
	Cracking, bulging, sloughing and seepage		X		Consult an engineer immediately to prevent failure.
	Evidence of animal burrows		X		Fill in immediately and stabilize.

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Riser	Structural condition of the riser is deteriorating.		X		Consult an engineer to recommend a repair and review the approved plans.
	Adjustable control valve inaccessible and inoperable (if present).		X		Repair valve to be operational.
	Pieces of the riser are broken or missing.		X		Repair immediately in accordance with the approved plans. Consult and engineer as needed.
	Riser or low flow orifice is blocked.		X		Remove blockage and properly dispose of.
	Rise provides inadequate conveyance out of facility.		X		Repair to properly convey drainage to the outfall per the approved plan. Consult an engineer as needed.
	Evidence of erosion or undermining at/around riser.		X		Repair erosion. Consult engineer for structural repairs as needed.
	Structural deterioration.		X		Consult engineer for proper repair procedures.
Outlet / Outfall	Exposed rebar, joint failure, loss of joint material, misalignment, leaking or corrosion		X		Repair concrete to cover rebar. Consult engineer for all other structural repairs.
	Excessive trash/debris/sediment or blockages.		X		Remove trash/debris/sediment/blockages and properly dispose.
	Evidence of erosion and bare soil		X		Backfill area, seed, mulch and consider matting. E&S measures may be warranted until stabilized.
	Valves, manholes or locks cannot be opened or operated (if present)			X	Repair/replace any broken fixtures.
	Erosion of outfall channel or riprap deterioration		X		Repair and/or supplement riprap outlet protection in accordance with the approved plans.
	Outlets provide inadequate conveyance out of facility		X		Repair to properly convey drainage to the outfall per the approved plan. Consult an engineer as needed.
Overall	Access to the facility is in need of repair		X		Restore access for maintenance equipment per the approved plans.
	Encroachment on facility or easement by buildings or other structures		X		Contact Facilities Planning.
	Evidence of oil/chemical accumulation, odor, algae, color or pollution		X		Report to management and consult IDDE manual.
	Fences and/or safety signage is inadequate		X		Repair fences and signage for public safety.
	Trash in the pool		X		Remove immediately and observe safety procedures.
	Additional notes: <ul style="list-style-type: none"> • No animals detected. • Good condition. • Keep sediment trash removed. Orifice clear. • Trash and debris cleaned. • Stabilizing around inlet. 				

BMP Operation & Maintenance Inspection for Detention, Retention and Extended Detention Basins

Owner Name: Radford University	Facility ID # (See Mapping): RU-BMP-CU-1
Date of Inspection: June 29, 2017	As-Built Plan Available: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No (Only plan set)
Date of Last Inspection: May 31, 2016	Inspector: Timothy D. Guthrie, P.E.
Were issues identified during the previous inspection that required maintenance? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	

BMP Element	Issue	Yes	No	N/A	Corrective Action
Contributing Drainage Area	Excessive trash/debris		X		Remove trash/debris and properly dispose.
	Bare exposed soil		X		Stabilize with seed and mulch. E&S measures may be warranted until stabilized.
	Evidence of erosion		X		Backfill area, seed, mulch and consider matting. E&S measures may be warranted until stabilized.
	Excessive landscape waste/yard clippings		X		Remove landscape waste and yard clippings to prevent clogging and properly dispose of them.
Pretreatment /Forebay /Inflow	Excessive trash/debris/sediment or other blockage			X	Remove trash/debris/sediment or blockages and properly dispose of.
	Dead vegetation, exposed soil			X	Replace vegetation and stabilize according to plans. E&S measures may be warranted until stabilized.
	Evidence of erosion, undercutting, or bare soils			X	Backfill area, seed, mulch, and consider matting. E&S measures may be warranted until stabilized.
	Structural deterioration of inlets, outfalls or pretreatment overflow weirs into the facility			X	Repair and restabilize area. Consult plans for approved configuration or an engineer. E&S measures may be warranted until stabilized.
	Animal burrows			X	Fill in immediately and stabilize.
Aquatic Bench / Vegetation	Plantings inconsistent with approved plans			X	Consult approved plans and/or management to ensure no approved plant substitutions were used. Remove unapproved plants and replace any required plantings in kind.
	Dead vegetation/exposed soil			X	Replace vegetation and stabilize according to plans. E&S measures may be warranted until stabilized.
	Invasive plants, such as cattails and phragmites, exceeds 15% of the planted area			X	Invasive plants should be removed immediately. Vegetation may require periodic harvesting for proper long term management.
Berm / Embankment	Overgrown, including woody growth 5' beyond the outfall pipe and/or embankment		X		Removal of woody species near or on the embankment is critical for proper function and long term stability. Remove all woody growth including stumps. Consult an engineer for backfill specifications. Mow thick growth.
	There is sparse vegetative cover and erosion channels are present		X		Backfill area with structural fill and consult engineer for proper specifications. Stabilize with seed and mulch, consider matting. E&S measures may be warranted until stabilized.
	Cracking, bulging, sloughing and seepage		X		Consult an engineer immediately to prevent failure.
	Evidence of animal burrows		X		Fill in immediately and stabilize.

Riser	Structural condition of the riser is deteriorating.		X		Consult an engineer to recommend a repair and review the approved plans.
	Adjustable control valve inaccessible and inoperable (if present).		X		Repair valve to be operational.
	Pieces of the riser are broken or missing.		X		Repair immediately in accordance with the approved plans. Consult and engineer as needed.
	Riser or low flow orifice is blocked.		X		Remove blockage and properly dispose of.
	Rise provides inadequate conveyance out of facility.		X		Repair to properly convey drainage to the outfall per the approved plan. Consult an engineer as needed.
	Evidence of erosion or undermining at/around riser.		X		Repair erosion. Consult engineer for structural repairs as needed.
	Structural deterioration.		X		Consult engineer for proper repair procedures.
Outlet / Outfall	Exposed rebar, joint failure, loss of joint material, misalignment, leaking or corrosion			X	Repair concrete to cover rebar. Consult engineer for all other structural repairs.
	Excessive trash/debris/sediment or blockages.			X	Remove trash/debris/sediment/blockages and properly dispose.
	Evidence of erosion and bare soil			X	Backfill area, seed, mulch and consider matting. E&S measures may be warranted until stabilized.
	Valves, manholes or locks cannot be opened or operated (if present)			X	Repair/replace any broken fixtures.
	Erosion of outfall channel or riprap deterioration			X	Repair and/or supplement riprap outlet protection in accordance with the approved plans.
	Outlets provide inadequate conveyance out of facility			X	Repair to properly convey drainage to the outfall per the approved plan. Consult an engineer as needed.
Overall	Access to the facility is in need of repair		X		Restore access for maintenance equipment per the approved plans.
	Encroachment on facility or easement by buildings or other structures		X		Contact Facilities Planning.
	Evidence of oil/chemical accumulation, odor, algae, color or pollution		X		Report to management and consult IDDE manual.
	Fences and/or safety signage is inadequate			X	Repair fences and signage for public safety.
	Trash in the pool		X		Remove immediately and observe safety procedures.
	Additional notes: <ul style="list-style-type: none"> • Trash has been removed from last inspection. • Sediment removed from facility as described in last inspection. • Riprap in channel removed per inspection notes from DEQ. • Berm near sidewalk seems low, advised RU staff to check riser height vs. berm height per plans. Survey requested. 				

Radford University BMP Inspection Report

APPENDIX B

UNDERGROUND DETENTION SYSTEM INSPECTION & MAINTENANCE CHECKLIST

- RU-BMP-HF-1
- RU-BMP-IF-1
- RU-BMP-HU-1

Underground Detention System Inspection and Maintenance Checklist

Facility: RU-BMP-HF-1			
Location/Address: Radford University			
Date: June 29, 2017	Time:	Weather Conditions:	Date of Last Inspection: May 31, 2016
Inspector: Timothy D. Guthrie, P.E.		Title:	
Rain in Last 48 Hours <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No If yes, list amount and timing:			
Pretreatment: <input type="checkbox"/> vegetated filter strip <input type="checkbox"/> swale <input type="checkbox"/> turf grass <input type="checkbox"/> forebay <input type="checkbox"/> other, specify:			<input checked="" type="checkbox"/> none
Site Plan or As-Built Plan Available: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No (Drawing files, Sheets Locate/No As-Builts)			

*Do not enter underground detention chambers to inspect system unless Occupational Safety & Health Administration (OSHA) regulations for confined space entry are followed.

*Follow inspection and maintenance instructions and schedules provided by system manufacturer and installer.

*Properly dispose of all wastes.

Inspection Item	Comment	Action Needed
1. PRETREATMENT		
Sediment has accumulated.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Trash & debris have accumulated.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
2. INLETS		
Inlets are in poor structural condition.	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Sediment, trash, or debris have accumulated and/or is blocking the inlets.	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
3. CHAMBERS		
Sediment accumulation threshold has been reached.	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Trash & debris have accumulated in chambers.	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
4. OTHER SYSTEM COMPONENTS		
Structural deterioration is evident.	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
5. OUTLETS		
Outlets in poor structural condition	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Sediment, trash or debris are blocking outlets.	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Erosion is occurring around outlets.	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
6. OTHER		
Evidence of ponding water on area draining to system.	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Evidence that water is not being conveyed through the system.	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Additional Notes		
1. Additional riprap added from last inspection (no evidence of erosion). 2. Some sediment in chambers <5%.		
Wet weather inspection needed <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		

Underground Detention System Inspection and Maintenance Checklist

Facility: RU-BMP-IF-1			
Location/Address: Radford University			
Date: June 29, 2017	Time:	Weather Conditions: Sunny	Date of Last Inspection: May 31, 2016
Inspector: Timothy D. Guthrie, P.E.		Title:	
Rain in Last 48 Hours <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No If yes, list amount and timing:			
Pretreatment: <input type="checkbox"/> vegetated filter strip <input type="checkbox"/> swale <input type="checkbox"/> turf grass <input type="checkbox"/> forebay <input type="checkbox"/> other, specify:			<input checked="" type="checkbox"/> none
Site Plan or As-Built Plan Available: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No (Plan sheets)			

*Do not enter underground detention chambers to inspect system unless Occupational Safety & Health Administration (OSHA) regulations for confined space entry are followed.

*Follow inspection and maintenance instructions and schedules provided by system manufacturer and installer.

*Properly dispose of all wastes.

Inspection Item	Comment	Action Needed
1. PRETREATMENT		
Sediment has accumulated.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Trash & debris have accumulated.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
2. INLETS		
Inlets are in poor structural condition.	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Sediment, trash, or debris have accumulated and/or is blocking the inlets.	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
3. CHAMBERS		
Sediment accumulation threshold has been reached.	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Trash & debris have accumulated in chambers.	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
4. OTHER SYSTEM COMPONENTS		
Structural deterioration is evident.	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
5. OUTLETS		
Outlets in poor structural condition	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Sediment, trash or debris are blocking outlets.	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Erosion is occurring around outlets.	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
6. OTHER		
Evidence of ponding water on area draining to system.	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Evidence that water is not being conveyed through the system.	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Additional Notes		
1. Good condition. 2. Less than 5% sediment in section of chambers & overflow pipe.		
Wet weather inspection needed <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		

Underground Detention System Inspection and Maintenance Checklist

Facility: RU-BMP-HU-1			
Location/Address: Radford University			
Date: June 29, 2017	Time:	Weather Conditions:	Date of Last Inspection: N/A
Inspector: Timothy D. Guthrie, P.E.		Title:	
Rain in Last 48 Hours <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No If yes, list amount and timing:			
Pretreatment: <input type="checkbox"/> vegetated filter strip <input type="checkbox"/> swale <input type="checkbox"/> turf grass <input type="checkbox"/> forebay <input type="checkbox"/> other, specify:			<input checked="" type="checkbox"/> none
Site Plan or As-Built Plan Available: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No			

*Do not enter underground detention chambers to inspect system unless Occupational Safety & Health Administration (OSHA) regulations for confined space entry are followed.

*Follow inspection and maintenance instructions and schedules provided by system manufacturer and installer.

*Properly dispose of all wastes.

Inspection Item	Comment	Action Needed
1. PRETREATMENT		
Sediment has accumulated.	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Trash & debris have accumulated.	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
2. INLETS		
Inlets are in poor structural condition.	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Sediment, trash, or debris have accumulated and/or is blocking the inlets.	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
3. CHAMBERS		
Sediment accumulation threshold has been reached.	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Trash & debris have accumulated in chambers.	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A	*Some water at base from roof drains condensation <input type="checkbox"/> Yes <input type="checkbox"/> No
4. OTHER SYSTEM COMPONENTS		
Structural deterioration is evident.	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
5. OUTLETS		
Outlets in poor structural condition	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Sediment, trash or debris are blocking outlets.	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Erosion is occurring around outlets.	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
6. OTHER		
Evidence of ponding water on area draining to system.	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Evidence that water is not being conveyed through the system.	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Additional Notes		
1. Drains from the roof sending condensation water to the system. 2. Overall good condition.		
Wet weather inspection needed <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		

Radford University BMP Inspection Report

APPENDIX C

DRY SWALES: O&M CHECKLIST

- RU-BMP-HF-1

9-C.11.0. DRY SWALES: O&M CHECKLIST

Inspection Date 6/29/2017
 Project RU-BMP-HF-1 Site Plan/Permit Number _____
 Location Radford University Date BMP Placed in Service _____
 Date of Last Inspection 5/31/2016 Inspector Timothy D. Guthrie, P.E.
 Owner/Owner's Representative _____
 As-Built Plans available: **No (Plan sheets)**

Facility Type: Level 1 _____ Level 2 Dry swale

Facility Location:

- Surface
- Underground

Hydraulic Configuration:

- On-line facility
- Off-line facility

Filtration Media:

- No filtration (e.g., dry well, permeable pavement, infiltration facility, etc.)
- Sand
- Bioretention Soil
- Peat
- Other: _____

Type of Pre-Treatment Facility:

- Sediment forebay (above ground)
- Sedimentation chamber
- Plunge pool
- Stone diaphragm
- Grass filter strip
- Grass channel
- Other: _____

Ideally, Dry Swales should be inspected annually in the Spring, triggering such maintenance activities as sediment removal, spot revegetation, inlet stabilization, and repairs to check dams, underdrains and outlets.

Element of BMP	Potential Problem	Problem? Y/N			How to Fix Problem	Who Will Address Problem	Comments
Contributing Drainage Area	There is excessive trash and debris	N			Remove immediately	Owner or professional	
	There is evidence of erosion and / or bare or exposed soil	N			Stabilize immediately	Owner or professional	
	There are excessive landscape waste or yard clippings	N			Remove immediately and recycle or compost	Owner or professional	
Pre-Treatment and Flow Spreaders	There is adequate access to the pre-treatment facility.				Establish adequate access	Professional and, perhaps, the locality	
	There is excessive trash, debris, or sediment.				Remove immediately	Owner or professional	
	There is evidence of erosion and / or exposed soil				Stabilize immediately	Owner or professional	
	There is evidence of clogging (standing water, noticeable odors, water stains, algae or floating aquatic vegetation)				Identify and eliminate the source of the problem. If necessary, remove and clean or replace the clogged material.	Professional	

Element of BMP	Potential Problem	Problem? Y / N			How to Fix Problem	Who Will Address Problem	Comments
Pre-Treatment and Flow Spreaders (continued)	There is dead vegetation or exposed soil in the grass filter				Restabilize and revegetate as necessary	Owner or professional	
	The pea gravel diaphragm is at the correct level				Correct the installation, as needed	Professional	
Inlet and Swale Sides and Base	The inlet provides a stable conveyance into the swale	Y			Stabilize immediately, as needed, and clear blockages.	Owner or professional	
	There is excessive trash, debris, or sediment.	N			Remove immediately	Owner or professional	
	There is evidence of erosion at or around the inlet	N			Repair erosion damage and reseed	Owner or professional	
Check Dams	A check dam is not functioning properly.	N			Check upstream and downstream sides of check dams for evidence of undercutting, side cutting or erosion and repair immediately.	Professional	
	There is a large accumulation of sediment or trash/debris behind the check dam.	N			Remove sediment when the accumulation exceeds 25% of the original Tv. Remove trash/debris and clear blockages of weep holes.	Professional	
Vegetation	Invasive species or weeds make up at least 10% of the facility's vegetation				Remove invasive species and excessive weeds immediately and replace vegetation as needed.	Owner or professional	
	Trees form an overhead canopy that may drop leaf litter, fruit and other vegetative materials that may cause clogging.	N			Prune or remove vegetation and organic litter as necessary.	Owner or professional	
	Grass height is not consistent with standards.	Y			Dry Swales must be mowed to keep grass at a height of 4" to 9". Remove grass clippings after mowing.	Owner or professional	
	The grass cover is not dense enough or is dead or dying	N			Increase watering and reseed, if necessary, to maintain 95% turf cover, but avoid using chemical fertilizers unless absolutely necessary. Replace salt-killed vegetation with salt-tolerant species.	Professional	
Filter Media/ Soil	There is evidence that chemicals, fertilizers, and/or oil are present	N			Remove undesirable chemicals from media and facility immediately, and replace mulch or media as needed	Professional	

Element of BMP	Potential Problem	Problem? Y / N			How to Fix Problem	Who Will Address Problem	Comments
Filter Media/ Soil (continued)	There is excessive trash, debris, or sediment.	N			Remove trash and debris immediately. Check plant health and, without damaging plants, manually remove the sediment, especially if the depth exceeds 20% of the facility's design depth.	Owner or professional	
	There is evidence of erosion and / or exposed soil	N			Stabilize immediately	Owner or professional	
	There is evidence that chemicals, fertilizers, and/or oil are present	N			Remove undesirable chemicals from media immediately, and replace mulch or media as needed	Professional	
Underdrain	The perforated pipe is not conveying water as designed	N			Determine if the pipe is clogged with debris or if woody roots have pierced the pipe. Immediately clean out or replace the pipe, as necessary.	Professional	
	The underlying soil interface is clogged (there is evidence on the surface of soil crusting, standing water, the facility does not dewater between storms, or water ponds on the surface of basin for more than 48 hours after an event).	N			Measure the draw-down rate of the observation well for three days following a storm event in excess of 1/2 inches in depth. After three days, if there is standing water on top but not in the underdrain, this indicates a clogged soil layer. If standing water is both on the surface and in the underdrain, then the underdrain is probably clogged. This should be promptly investigated and remediated to restore proper filtration. Grading changes may be needed or underdrain repairs made.	Professional	
Outlet	Outlets are obstructed or erosion and soil exposure is evident below the outlet.	N			Remove obstructions and stabilize eroded or exposed areas.	Owner or Professional	
	There is excessive trash, debris, or sediment at the outlet	N			Remove immediately, and keep the contributing area free of trash and debris.	Owner or professional	
Overall	Access to the Infiltration facility or its components is adequate	Y			Establish adequate access. Remove woody vegetation and debris that may block access. Ensure that hardware can be opened and operated.	Professional and, perhaps, the locality	

Element of BMP	Potential Problem	Problem? Y / N			How to Fix Problem	Who Will Address Problem	Comments
Overall (continued)	Mosquito proliferation	N			Eliminate stagnant pools and establish vegetation; treat for mosquitoes as needed. If sprays are considered, then a mosquito larvicide, such as Bacillus thurendensis or Altoside formulations can be applied <i>only if absolutely necessary</i> .	Owner or professional	
	Complaints from local residents	N			Correct real problems.	Owner or professional	
	Encroachment on the swale or easement by buildings or other structures	N			Inform involved property owners of BMPs status ; clearly mark the boundaries of the receiving pervious area, as needed	Owner or professional (and perhaps the locality)	

1. Check cleanout tops & cover (some exposed) requires screening from animals & repair from extendable drain pipe.
2. Some areas are compacted due to heavy equipment on swale. RU Staff advised to avoid heavy mowing equipment in swale area to avoid compaction of soil mixture.

Radford University BMP Inspection Report

APPENDIX D

CONSTRUCTED WETLANDS: O&M CHECKLIST

- RU-BMP-WT-1

9-C.14.0. CONSTRUCTED WETLANDS: O&M CHECKLIST

Inspection Date 6/29/2017
Project RU-BMP-WT-1 **Site Plan/Permit Number** _____
Location Radford University **Date BMP Placed in Service** _____
Date of Last Inspection 5/31/2016 **Inspector** Timothy D. Guthrie, P.E.
Owner/Owner's Representative _____
As-Built Plans available: **No**

Facility Type: Level 1 _____ Level 2 _____

Hydraulic Configuration:

- On-line facility
- Off-line facility

Type of Pre-Treatment Facility:

- Sediment forebay (above ground)
- Vegetated buffer area
- Grass filter strip
- Grass channel
- Other: _____

Type of wetland

- Emergent
- Forested

During the first 6 months following construction, the wetland should be inspected twice after storm events that exceed 1/2 inch of rainfall. Bare or eroding areas in the CDA or around the wetland buffer should be stabilized immediately with grass cover. Trees planted in the buffer and on wetland islands and peninsulas need to be watered every 3 days for the first month, and then weekly during the remainder of the first growing season (April-October), depending on rainfall. Due to typical vegetation survival problems, it is typical to plan and budget for a round of reinforcement planting after one or two growing seasons. Constructed wetlands should be inspected and cleaned up annually. A wetland professional should inspect the facility every 5 years, especially to determine if there is any significant negative change in the wetland species composition from the design or an otherwise healthy wetland.

Element of BMP	Potential Problem	Problem? Y/N	Investigate? Y/N	Repaired? Y/N	How to Fix Problem	Who Will Address Problem	Comments
Contributing Drainage Area	Adequate vegetation	Y			Supplement as needed	Owner	
	There is excessive trash and debris	N			Remove immediately.	Owner or professional	
	There is evidence of erosion and/or bare or exposed soil	N			Stabilize immediately.	Owner or professional	
	There are excessive landscape waste and yard clippings	N			Remove immediately and recycle or compost	Owner or professional	
Pre-Treatment	There is adequate access to the pre-treatment facility	N			Establish adequate access	Professional and, perhaps, the locality	Needs to be cleaned & sediment removed.
	There is excessive trash and debris	N			Remove immediately.	Owner or professional	
	There is evidence of erosion and/or exposed soil.	N			Immediately identify and correct the cause of the erosion and stabilize the eroded or bare area.	Owner or professional	
	Sediment deposits are 50% or more of forebay capacity.	N			Dredge the sediment to restore the design capacity; sediment should be dredged from forebays at least every 5 years.	Professional	Sediment needs to be removed to determine 50% marker.
Pre-Treatment (continued)	The sediment marker is not vertical.	Y			Adjust the sediment depth marker to a vertical alignment	Professional	Find marker.
	There is dead vegetation	N			Revegetate, as needed	Owner or professional	
Inlets	The inlet provides a stable conveyance.	Y			Stabilize immediately, as needed; clear blockages.	Owner or professional	
	There is excessive trash, debris, or sediment.	Y			Remove immediately	Owner or professional	Remove sediment.
	There is evidence of erosion/undercutting at or around the inlet	N			Repair erosion damage and reseed	Owner or professional	
	There is cracking, bulging, erosion or sloughing of the forebay dam.	N			Repair and restabilize immediately.	Professional	
	There is woody growth on the forebay dam.	Y			Remove within 2 weeks of discovery.	Professional	Cut back vegetation.
	There is evidence of nuisance animals.	N			Animal burrows must be backfilled and compacted. Burrowing animals should be humanely removed from area	Professional	
Vegetation (trees, shrubs,	Plant composition is consistent with the	N			Determine if existing plant materials are at least	Professional	Some invasive plants.

Element of BMP	Potential Problem	Problem? Y / N	Investigate? Y / N	Repaired? Y / N	How to Fix Problem	Who Will Address Problem	Comments
aquatic plants)	approved plans	Y			consistent with the general Constructed Wetland design criteria, and replace inconsistent species.		
	Invasive species are present.	Y			Remove invasive species immediately and replace vegetation as needed. As a general rule, control of undesirable invasive species (e.g., cattail and Phragmites) should commence when their coverage exceeds more than 15% of a wetland cell area. Although the application of herbicides is not recommended, some types, such as Glyphosate, have been used to control cattails with some success. Extended periods of dewatering may also work, since early manual removal provides only short-term relief from invasive species.	Professional	Remove some of the invasive plants.
	Vegetation is dead or reinforcement planting is needed.	N			Remove and replace dead or dying vegetation.	Professional	
	Trees planted in the buffer and on wetland islands and peninsulas need watering during the first growing season	N			Consider watering every 3 days for first month, and then weekly during first year (April – October), depending on rainfall.	Owner or professional	
Vegetation (trees, shrubs, aquatic plants) (continued)	Practice has become overgrown and is not developing into a mature wetland.	Y			Harvest vegetation periodically if the wetland becomes overgrown or to guide maturing of forested wetlands (typically 5 and 10 years after constr.).	Owner or professional	Needs vegetation removal.
Wetland Cells and Pools	Sediment accumulation is 50% or more of capacity.	N			Dredge the sediment to restore the design capacity	Professional	
	There is evidence of floating debris, sparse vegetative cover, erosion or slumping of side slopes.	N			Remove debris. Repair and stabilize.	Owner or professional	
	Open water is becoming overgrown.	N			Harvest the unwanted vegetation.	Professional	
	There is evidence of nuisance animals.	N			Animal burrows must be backfilled and compacted. Burrowing animals should be humanely removed from the area.		
Riser/Principle Spillway and Low-Flow Orifice(s)	There is adequate access to riser for maintenance.	N			Establish adequate access	Professional and, perhaps, the locality	Remove vegetation.
	Pieces of the riser are deteriorating,	N			Repair immediately.	Professional	

Element of BMP	Potential Problem	Problem? Y / N	Investigate? Y / N	Repaired? Y / N	How to Fix Problem	Who Will Address Problem	Comments
	misaligned, broken or missing.	N					
	Adjustable control valves are accessible and operational.	N/A			Repair, as needed.	Professional	
	Reverse-slope pipes and flashboard risers are in good condition.	N/A			Repair, as needed.	Professional	
	There is excessive trash, debris, or other obstructions in the trash rack.	N/A			Remove immediately.	Owner or professional	
	Seepage into conduit	N/A			Seal the conduit	Professional	
Berm/Dam/ Embankment and Abutments	There is sparse veg. cover, settlement, cracking, bulging, misalignment, erosion rills deeper than 2 inches, or sloughing of the dam.	N			Repair and restabilize immediately.	Professional	
	There are soft spots, boggy areas, seepage or sinkholes present.	N			Reinforce, fill and stabilize immediately.	Professional	
	There is evidence of nuisance animals.	N			Animal burrows must be backfilled and compacted. Burrowing animals should be humanely removed frm area.	Professional	
	There is woody vegetation on the embankment.	Y			Removal of woody species near or on the embankment and maintenance access areas should be done when discovered, but at least every 2 years.		Remove vegetation.
Emergency Spillway	There is woody growth on the spillway.	Y			Removal of woody species near or on the emergency spillway should be done when discovered, but at least every 2 years.	Owner or professional	Remove vegetation.
	There is excessive trash, debris, or other obstructions.	N			Remove immediately.	Owner or professional	
	There is evidence of erosion/back-cutting	N			Repair erosion damage and reseed	Owner or professional	
	There are soft spots, seepage or sinkholes.	N			Reinforce, fill and stabilize immediately.	Owner or professional	
Outlet	The outlet provides stable conveyance from the wetland.	Y			Stabilize as needed.	Professional	
	There are excessive sediment deposits.	N			Remove sediment.	Professional	
	Released water is causing undercutting, erosion or displaced rip-rap at or around the outlet	N			Repair, reinforce or replace rip rap as needed, and restabilize.	Professional	
	Woody growth within 5 feet of the outlet pipe barrel.	N			Prune vegetation back to leave a clear discharge area.	Owner or Professional	
	There is excessive	N			Remove immediately.	Owner or	

Element of BMP	Potential Problem	Problem? Y / N	Investigate? Y / N	Repaired? Y / N	How to Fix Problem	Who Will Address Problem	Comments
	trash, debris, or other obstructions.	N				professional	
Overall	Access to the facility or its components is adequate.	N			Establish adequate access. Remove woody vegetation and debris that may block access. Ensure that hardware can be opened and operated.	Professional and, perhaps, the locality	Remove vegetation & establish access routes.
	Water levels in one or more cells are abnormally high or low.	N			Clear blockages of the riser or orifice(s) and make other adjustments needed to meet the approved design specifications.	Professional	
	Complaints from local residents	N			Correct real problems.	Owner or professional	
	Mosquito proliferation	N			Eliminate stagnant pools if feasible, and treat for mosquitoes as needed. If sprays are considered, then a mosquito larvicide, such as Bacillus thurendensis or Altoside formulations can be applied <i>only if absolutely necessary</i> . Can also stock the basin with mosquito fish to provide natural mosquito & midge control.	Owner or professional	
	Encroachment on the wetland or easement by buildings or other structures	N			Inform involved property owners of BMPs status ; clearly mark the boundaries of the receiving pervious area, as needed	Owner or professional (and perhaps the locality)	
Overall (continued)	Safety signage is not adequate.	N			Provide sufficient, legible safety signage.	Owner or professional	

Additional Notes:

1. Some invasive species on site.
2. Sediment removal in forebay.
3. Need to remove excessive vegetation.

Radford University BMP Inspection Report

APPENDIX E

BIORETENTION PRACTICES: O&M CHECKLIST

- RU-BMP-SC-1

9-C.10.0. BIORETENTION PRACTICES: O&M CHECKLIST

Inspection Date 6/29/2017
 Project RU-BMP-SC-1 Site Plan/Permit Number _____
 Location Radford University Date BMP Placed in Service _____
 Date of Last Inspection _____ Inspector Timothy D. Guthrie, P.E.
 Owner/Owner's Representative _____
 As-Built Plans available: **Yes**

Facility Type: Level 1 _____ Level 2 Bioretention

Facility Location:

- Surface
- Underground

Hydraulic Configuration:

- On-line facility
- Off-line facility

Filtration Media:

- No filtration (e.g., dry well, permeable pavement, infiltration facility, etc.)
- Sand
- Bioretention Soil
- Peat
- Other: _____

Type of Pre-Treatment Facility:

- Sediment forebay (above ground)
- Sedimentation chamber
- Plunge pool
- Stone diaphragm
- Grass filter strip
- Grass channel
- Other: _____

Ideally, Bioretention facilities should be inspected and cleaned up annually, preferably during the Spring. During the first 6 months following construction of a bioretention facility, the site should be inspected at least twice after storm events that exceed 1/2-inch of rainfall. Watering is needed once a week during the first 2 months following installation, and then as needed during the first growing season (April-October), depending upon rainfall. If vegetation needs to be replaced, one-time spot fertilization may be needed, preferably using an organic rather than a chemical fertilizer. Each facility should have a customized routine maintenance schedule addressing issues such as the following: grass mowing, weeding, trash removal, mulch raking and maintenance, erosion repair, reinforcement plantings, tree and shrub pruning, and sediment removal.

Element of BMP	Potential Problem	Problem?	Investigate?	Repaired?	How to fix problem	Who Will Address Problem	Comments
		Y/N	Y/N	Y/N			
Contributing Drainage Area	Adequate vegetation	Y			Supplement as necessary	Owner or professional	
	There is excessive trash and debris	N			Remove immediately	Owner or professional	
	There is evidence of erosion and / or bare or exposed soil	N			Stabilize immediately	Owner or professional	
	There are excessive landscape waste or yard clippings	N			Remove immediately and recycle or compost	Owner or professional	
	Oil, grease or other unauthorized substances are entering the facility	N			Identify and control the source of this pollution. It may be necessary to erect fences, signs, etc	Owner or professional	
Pre-Treatment	There is adequate access to the pre-treatment facility	Y			Establish adequate access	Professional and, perhaps, the locality	

Element of BMP	Potential Problem	Problem?	Investigate?	Repaired?	How to fix problem	Who Will Address Problem	Comments
		Y / N	Y / N	Y / N			
	Excessive trash, debris, or sediment.	N			Remove immediately	Owner or professional	
Pre-Treatment (continued)	There is evidence of clogging (standing water, noticeable odors, water stains, algae or floating aquatic vegetation, or oil/grease)	N			Identify and eliminate the source of the problem. If necessary, remove and clean or replace the clogged material.	Professional	
	There is evidence of erosion and / or exposed soil	N			Stabilize immediately	Owner or professional	
	There is dead vegetation or exposed soil in the grass filter	N			Restabilize and revegetate as necessary	Owner or professional	
Inlets	Check for sediment build-up at curb cuts, gravel diaphragms or pavement edges that prevent flow from getting into the bed, and check for bypassing.	N			Remove sediment and correct any other problems that block inflow.	Owner or professional	
	There is excessive trash, debris, or sediment.	N			Remove immediately	Owner or professional	
	There is evidence of erosion at or around the inlet	N			Repair erosion damage and reseed or otherwise restabilize with vegetation	Owner or professional	
	Inflow is hindered by trees and/or shrubs.	N			Remove woody vegetation from points of inflow and directly above underdrains. (Trees and shrubs may be located closer to the perimeter.)	Owner or professional	
Side Slopes (Annually, after major storms)	There is evidence of rill or gully erosion or bare soil	N			Identify the source of erosion damage and prevent it from recurring. Repair erosion damage and reseed or otherwise restabilize with vegetation	Owner or professional	
	There is excess sediment accumulation	N			Remove immediately	Owner or professional	
	Side slopes support nuisance animals.	N			Animal burrows must be backfilled and compacted. Burrowing animals should be humanely removed from the area.	Professional	
Vegetation (monthly)	Plant composition is consistent with the approved plans and any stakes or wires are in good condition.	Y			Determine if existing plant materials are at least consistent with general Bioretention design criteria and replace inconsistent species.	Professional	
	There should be 75-90% cover (mulch plus vegetation), and the mulch cover should be 2-3 inches deep.	Y			Supplement vegetation and mulch as needed.		

Element of BMP	Potential Problem	Problem?	Investigate?	Repaired?	How to fix problem	Who Will Address Problem	Comments
		Y / N	Y / N	Y / N			
Vegetation <i>(monthly)</i> (continued)	There is evidence of hydrocarbons or other deleterious materials, resulting in unsatisfactory plant growth or mortality,	N			Replace contaminated mulch. If problem persists, test soils for hydrocarbons and other toxic substances. If excess levels are found, the soils, plants and mulch may all need to be replaced in accordance with the approved construction plans.	Professional	
	Invasive species or weeds make up at least 10% of the facility's vegetation	N			Remove invasive species and excessive weeds immediately and replace vegetation as needed.	Owner or professional	
	The grass is too high	N			Mow within a week. Grass species should be selected that have dense cover, are relatively slow growing, and require the least mowing and chemical inputs. Grass should be from 6-10 inches high.	Owner or professional	
	Vegetation is diseased, dying or dead	N			Remove and replace. Increase watering, but avoid using chemical fertilizers, unless absolutely necessary.	Professional	
	Winter-killed or salt-killed vegetation is present.	N			Replace with hardier species.	Owner or professional	
Filter Media <i>(Annually)</i>	The filter media is too low, too compacted, or the composition is inconsistent with design specifications	N			Raise the level, loosen and amend or replace the media, as needed, to be consistent with the state design criteria for Bioretention (85-88% sand 8-12% soil fines 3-5% organic matter in form of leaf compost). Other remediation options are described in the maintenance section of the state design criteria for Bioretention	Professional	
	The mulch is older than 3 years or is otherwise in poor condition	N			The mulch must be replaced every 2-3 years	Professional	
	There is evidence that chemicals, fertilizers, and/or oil/grease are present	N			Remove undesirable chemicals from media and facility immediately, and replace mulch or media as needed	Professional	
	There is excessive trash, debris, or sediment.	N			Remove trash and debris immediately. Check plant health and, without damaging plants, manually remove the sediment, especially if the depth exceeds 20% of the facility's design depth.	Owner or professional	
	There is evidence of concentrated flows, erosion or exposed soil	N			Identify the source of erosion damage and prevent it from recurring. Repair the erosion damage and reseed or otherwise restabilize with vegetation.	Professional	

Element of BMP	Potential Problem	Problem?	Investigate?	Repaired?	How to fix problem	Who Will Address Problem	Comments
		Y / N	Y / N	Y / N			
Filter Media (Annually) (continued)	The filter bed is clogged and/or filled inappropriately	N			Redistribute the soil substrate and remove sediment within 2 weeks.	Professional	
	The topsoil is in poor condition (e.g., the pH level is not 6-7, the composition is inappropriate, etc.)	N			Ensure a 3-inch surface depth of topsoil consistent with the state design criteria for Bioretention (loamy sand or sandy loam texture, with less than 5% clay content, and organic matter content of at least 2%). If the pH is less than 6.5, spread limestone.	Professional	
Underdrain/ Proper Drainage	The perforated pipe is not conveying water as designed	N			Determine if the pipe is clogged with debris or if woody roots have pierced the pipe. Immediately clean out or replace the pipe, as necessary.	Professional	
	The underlying soil interface is clogged (there is evidence on the surface of soil crusting, standing water, the facility does not dewater between storms, or water ponds on the surface of basin for more than 48 hours after an event).	N			Measure the draw-down rate of the observation well for three days following a storm event in excess of 1/2 inches in depth. After three days, if there is standing water on top but not in the underdrain, this indicates a clogged soil layer. If standing water is both on the surface and in the underdrain, then the underdrain is probably clogged. This should be promptly investigated and remediated to restore proper filtration. Grading changes may be needed or underdrain repairs made. The filter media may need to be raked, excavated and cleaned or replaced to correct the problem. Holes that are not consistent with the design and allow water to flow directly through a planter to the ground must be plugged.	Professional	
Planters	The planter is unable to receive or detain stormwater prior to infiltration. Water does not drain from the reservoir within 3-4 hours of after a storm event.				Identify and correct sources of clogging. Topsoil and sand/peat layer may need to be amended with sand or replaced all together.	Owner or professional	
	The planter has structural deficiencies, including rot, cracks, and failure, or the planter is unable to contain the filter media or vegetation				Make needed repairs immediately.	Owner or professional	
Outlet/ Overflow Spillway	Outlets are obstructed or erosion and soil exposure is evident below the outlet.	N			Remove obstructions and stabilize eroded or exposed areas.	Owner or Professional	

Element of BMP	Potential Problem	Problem?	Investigate?	Repaired?	How to fix problem	Who Will Address Problem	Comments
		Y / N	Y / N	Y / N			
Outlet/ Overflow Spillway (continued)	There is excessive trash, debris, or sediment at the outlet	N			Remove immediately, and keep the contributing area free of trash and debris.	Owner or professional	
	Any grates present are in good condition	Y			Repair or replace as necessary	Owner or professional	
Observation Well	Is the observation well still capped?	Y			Repair, as necessary.	Professional	
Overall	Access to the Infiltration facility or its components is adequate	Y			Establish adequate access. Remove woody vegetation and debris that may block access. Ensure that hardware can be opened and operated.	Professional and, perhaps, the locality	
	There is evidence of standing water	N			Fill in low spots and stabilize; correct flow problems causing ponding.	Owner or professional	
	Mosquito proliferation	N			Eliminate stagnant pools and establish vegetation; treat for mosquitoes as needed. If sprays are considered, then a mosquito larvicide, such as Bacillus thurendensis or Altoside formulations can be applied <i>only if absolutely necessary</i> .	Owner or professional	
	Complaints from local residents	N			Correct real problems	Owner or professional	
	Encroachment on the bioretention area or easement by buildings or other structures	N			Inform involved property owners of BMPs status ; clearly mark the boundaries of the receiving pervious area, as needed	Owner or professional (and perhaps the locality)	