

STORMWATER MANAGEMENT MEASURES MAINTENANCE PLAN and FIELD MANUALS

PRINCETON EXECUTIVE PARK

**BLOCK 9, LOTS 12.01 & 12.02, BLOCK 9.03, LOTS 12.02
TOWNSHIP OF WEST WINDSOR, MERCER COUNTY, NJ**

Dated: October 18, 2019
Revised: March 20, 2020

Prepared by:
(BCG #080823-C1-001)



Bowman
CONSULTING



303 West Main Street
Freehold, NJ 07728
NJ Certificate of Authorization 24GA280443700



R. Michael McKenna
New Jersey Professional Engineer
License No. 24GE02590400

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Part II Field Manuals and Maintenance Records

Field Manual for Wet Pond BMP # 03

Field Manual for Sand Filter with Infiltration BMP # 04

Field Manual for Swale BMP # 09

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PART I

This manual consists of three parts. The first part includes a narrative introduction and description of facilities and a list of project contacts. The second part provides the operation and maintenance instructions for the facilities and equipment. Part three contains Appendix A, which includes a Maintenance Work Order Checklist, Maintenance Log, Inspection Checklist, and Inspection Log.

A. Introduction and Description of Facilities

This report has been prepared to describe the operations and maintenance procedures of the stormwater management system designed for the proposed mix-use development on block 9, lots 12.01 & 12.02 and block 9.03, lots 12.02 in the Township of West Windsor, New Jersey, consisting of 47+/- acres.

The development site is divided by Meadow Road. The northerly portion of the site is bound by Meadow Road, Route 1 and the onramp to the west, Carnegie Center Drive to the north. The southerly portion is bound by Meadow Road, Old Meadow Road and wooded areas to the east. The project consists of mixed-use residential apartment units, a hotel site, and commercial and retail pad sites. Amenities such as two clubhouses and active/passive recreational facilities are also on site.

Stormwater discharges towards the wooded wetlands areas to the east/southeast of the site, downstream of the existing detention basin that was previously constructed in advance of the current development.

In addition to the previously existing detention wet pond, four (4) additional stormwater management basins are proposed to be constructed to facilitate development phasing and to spread groundwater recharge throughout the site. Basin 1 is an extended detention basin with a sand bottom strip to facilitate groundwater recharge. Basins 2, 3, and 4 also have sand bottoms as well for groundwater recharge. And the existing wet pond (#5) in the southeast corner of the development site provides additional detention to meet post development discharge reduction requirements as well as meeting current NJDEP water quality standards prior to discharge.

The proposed stormwater management system is designed to regulate the rates of runoff generated by the 2, and 10 year, 24-hour design storms events. The basins are designed to treat the water quality design storm event in accordance with the NJDEP Storm Water Management Standards for 80% TSS removal and provides the necessary pretreatment of stormwater runoff before discharging offsite. The sand bottom basins allow water to infiltrate into the ground and are designed to fully drain within 72 hours. Each of the groundwater recharge basins discharge to the wet pond which is equipped with an outlet control structure that regulates stormwater discharge rates for larger storm events.

This manual is intended to provide guidance and instruction to the present landowners for the proper operation and maintenance of the stormwater management system and basins and has been prepared using the NJDEP guidance documents entitled "Stormwater Management Facilities Maintenance Manual". Any and all conveyances, deed restrictions, etc. regarding the owning and maintenance of stormwater management facilities shall be deemed included in the maintenance manual by reference. The Township reserves the right, but not obligation, to maintain the stormwater management facilities as necessary.

B. Project Contacts:

Property Owner

Palladium Realty LLC
c/o Mack-Cali Realty Corporation
Attn: Gary T. Wagner Gen. Counsel
210 Hudson St, Suite 400
Jersey City, NJ 07311

Responsible Representative

Thomas Golden
Vice President of Development
Mack-Cali Realty Corporation
Harborside 3 | 210 Hudson Street | Suite 400
Jersey City, NJ 07311
DL: 732.590.1051 | Fax: 201.434.2726
Cell: 201.300.7114
Email: tgolden@mack-cali.com

Township Contact

Township of West Windsor
271 Clarksville Road
PO Box 38
West Windsor, NJ 08550
Phone: 609-799-2400

Design Engineer

Bowman Consulting Group, Ltd.
303 W. Main Street, Suite 350
Freehold, NJ 07728
Phone: 732-665-5500

This plan is recorded in

Deed Book # _____ Page # _____ with the Mercer County Clerk on Date _____

Stormwater Management Measures

The stormwater management measures incorporated into this development are listed below. The corresponding Field Manuals for the stormwater management measures are located in Part II of the Maintenance Plan.

Type of Stormwater Management Measure	BMP No.	Location Description	State Plane Coordinates / Lat., Long.
Sand Filter Infiltration Basin #1	01	Northwest corner of Meadow Rd and US Rt 1	N = 538,440 E = 447,845
Sand Filter Infiltration Basin #2	01	North side of Meadow Rd. East of Rt 1	N = 538,215 E = 448,280
Sand Filter Infiltration Basin #3	01	North side of Meadow Rd. East of Rt 1	N = 538,000 E = 448,680
Sand Filter Infiltration Basin #4	01	Between Meadow Rd and Old Meadow Rd	N = 538,440 E = 447,845
Wet Pond Basin #5	03	North side of Old Meadow Rd	N = 537,285 E = 448,470
Discharge Point Outfall #1		East of basin #5 north side of Old Meadow Rd	N=537,025 E= 448,365
Swale Carnegie Road	09	South side of Carnegie	N= 538,800 E= 448,580

Preventative and Corrective Maintenance Action Plan

The detention basins have been designed to provide proper control of stormwater and to prevent flooding and degradation of water quality. Without proper routine inspection and maintenance, the basins may lose some or all of their capability.

Routine maintenance of the facility should be separated into two basic types. Functional maintenance is required to ensure safe and effective operation. This can be further broken down into the two categories of preventative and corrective maintenance. Aesthetic maintenance, which is necessary to maintain the visual appeal and aesthetic quality of the basins, should be incorporated into the preventative maintenance efforts. The following are the preventative, corrective and aesthetic maintenance procedures that are to be performed on a routine basis:

1. Preventative Maintenance Procedures

The purpose of preventative maintenance inspections is to ensure that the stormwater management aspects of the basins remain operational and safe at all times, while minimizing the need for corrective or emergency maintenance.

a. Sediment Removal and Disposal

The detention basins should be evaluated for excessive deposition of sediment. Accumulated sediment should be removed before it threatens the storage volume of the basins. Sediment removal should take place when the basin is thoroughly dry. Consideration should be given to evacuating all standing water from the basin before desilting activities are performed. This may be accomplished by means of pumping the water out of the basin. An appropriate stand-by pump should be available for this procedure. Inspection tasks should be performed on a quarterly basis as well as after every storm exceeding one inch of rainfall. If stable soil conditions exist around the basin area sediment deposition should not be a problem. Should a recurrent problem develop, the inspector should identify the upstream sources of sediment and recommend required stabilization measures.

b. Removal and Disposal of Trash and Debris

A regularly scheduled program of debris and trash removal will reduce the chance of components becoming clogged and inoperable during storm events. Additionally, removal of trash and debris will prevent possible damage to vegetated areas and eliminate potential mosquito breeding habitats. Disposal of debris and trash should be done at suitable disposal/recycling sites and in compliance with all applicable local, state and federal waste regulations. These tasks should be performed on a quarterly basis as well as after every storm exceeding one inch of rainfall.

c. Maintenance of Adjacent Vegetated Areas

Grass areas, trees, shrubs adjacent to the basin require periodic fertilizing, de-thatching and soil conditioning in order to maintain healthy growth and to provide bank

stabilization. The application of fertilizers should follow manufacturer's instructions to reduce run-off into the basin. Additionally, provisions should be made to re-seed and re-establish grass cover in areas damaged by sediment accumulation, stormwater flow, or other causes. Mowing and or trimming of vegetation must be performed on a regular schedule based on specific site conditions. Grass should be mowed at least once a month during the growing season. Adjacent Vegetated areas must also be inspected at least annually for erosion and scour. The basin must be inspected for unwanted tree growth at least once a year.

d. Structural Components

All Structural components must be inspected for cracking, subsidence, spalling, erosion, and deterioration at least annually.

e. Elimination of Potential Mosquito Breeding Habitats

The most effective mosquito control program is one that eliminates potential breeding habitats. Almost any stagnant pool of water can be attractive to mosquitoes, and the source of a large mosquito population. A maintenance program dedicated to eliminating potential breeding areas is certainly preferable to chemical means of controlling mosquitoes. The most important maintenance function, which can be performed in this case, is to make sure that all obstructions to natural flow patterns are removed before the stagnant water condition can develop.

f. Inspection

Regularly scheduled maintenance inspections of the facility should be performed by a qualified representative at least once a year. These inspections are separate from the "Routine" inspections discussed above. The primary purpose of these inspections is to ascertain the operational condition and safety of the facility, particularly the condition of embankments and other safety-related aspects. Inspections will also provide information on the effectiveness of regularly scheduled Preventative and Aesthetic Maintenance Procedures and will help to identify where changes in the extent and scheduling of the procedures are warranted. Finally, the facility inspections should also be used to determine the need for and timing of Corrective Maintenance procedures. It should be noted that, in addition to regularly scheduled inspections, the owners or their representatives should perform an informal inspection during every visit to the basin.

g. Reporting

The recording of all maintenance work and inspections provide valuable data on the facility condition. Review of this information will also help to establish more efficient and beneficial maintenance procedures and practices. All recorded information should be directed to the owners for review and subsequent follow-up on recommendations. Data obtained from informal inspections should be retained; however, this data does not have to be submitted to NJDEP.

Preventative Maintenance Actions

Frequency	Preventative Maintenance Actions	Stormwater Measures/ No.
Weekly	Vegetation mowing and removal in growing season. Remove floatables from trash racks.	Basins #1, 2, 3, 4,5 Swales
Monthly	Rake fines and algae off filter sand	Basins #1, 2, 3, 4
Quarterly	Inspection of structures and soil stabilization	Basins #1, 2, 3, 4, 5 Swales
As Required	Sediment removal from major storms or upstream slope failures.	Basins #1, 2, 3, 4, 5 Swale
Annual	Basin Structural Inspection	Basins #1, 2, 3, 4, 5
As Required	Sand layer replacement for sand filter infiltration basin. Conduct permeability tests every 3 years.	Basins #1, 2, 3, 4
Unscheduled	Quick inspection after every 1" rain	Basins #1, 2, 3, 4, 5 Swale

2. Corrective Maintenance Procedures

a. Removal of Debris and Sediment

Sediment, debris and trash which threaten the discharge capacity of the basin should be removed immediately and disposed of properly. Equipment and personnel must be available to perform the removal work on short notice. As noted previously, it is recommended that all water be evacuated from the basin before any significant amount of sediment or settled debris or trash is removed from the basin. The lack of an available disposal site should not delay the removal of trash, debris, and sediment. Temporary disposal sites should be utilized if necessary.

b. Structural Repairs

Structural damage to inlet structures, manholes, flared end sections, outlet control structures and retaining walls from vandalism, flood events, or other causes must be repaired promptly. Equipment, materials and personnel must be available to perform

these repairs on short notice. The immediacy of the repairs will depend upon the nature of the damage and its effects on the safety and operation of the facility. The analysis of structural damage and the design and performance of structural repairs should only be undertaken by the consulting professional engineer.

c. Extermination of Mosquitoes

If neglected, the basin can readily become an ideal mosquito breeding area. Extermination of mosquitoes will usually require the services of the County Mosquito Commission. If mosquito control in the facility becomes necessary, the preventative maintenance program should also be re-evaluated, and more emphasis placed on control of mosquito breeding habitats.

d. Erosion Repair

Vegetative cover or other protective measures are necessary to prevent the loss of soil from the erosive forces of wind and water. Where a re-seeding program has not been effective in maintaining a non-erosive vegetative cover, or other factors have exposed soils to erosion, corrective steps should be initiated to prevent further loss of soil and any subsequent danger to the stability of the facility. Soil loss can be controlled by a variety of materials and methods, including rip-rap, gabion lining, sod, seeding, concrete lining and regrading. When establishing or restoring vegetation, biweekly inspections of vegetation health should be performed during the first growing season or until the vegetation is established. Once established, inspections of vegetation health, density and diversity should be performed at least twice annually during both the growing and non-growing season. If vegetation has greater than 50 percent damage, the area should be reestablished in accordance with the original specifications and the inspection requirements presented above. All use of fertilizers, mechanical treatments, pesticides and other means to assure optimum vegetation health must not compromise the intended purpose of the infiltration basin.

e. Elimination of Trees, Brush, Roots and Animal Burrows

The stability of side slopes, can be impaired by large roots and animal burrows. Additionally, burrows can present a safety hazard for maintenance personnel. Trees and brush with extensive, woody root systems should be completely removed from side slopes to prevent their destabilization and the creation of seepage routes. Roots should also be completely removed to prevent their decomposition within the side slopes. Root voids and burrows should be plugged by filling with material similar to the existing material, and capped just below grade with stone, concrete or other material. If the plugging of the burrows does not discourage the animals from returning, further measures should be taken to either remove the animal population or to make critical areas of the facility unattractive to them. All vegetated areas should be inspected at least annually for unwanted growth, which should be removed with minimum disruption to the remaining vegetation and basin subsoil.

f. Snow and Ice Removal

Accumulations of snow and ice can threaten the functioning of the inlets and outlet control structure. Providing the equipment, material and personnel to monitor and remove snow and ice from these critical areas is necessary to assure the continued functioning of the facility during the winter months.

3. Aesthetic Maintenance Procedures

a. Graffiti Removal

The timely removal of this obvious eyesore will restore the aesthetic quality of the basin. Removal can be accomplished by painting or otherwise covering it, or removing it with scrapers, solvents or cleansers. Timely removal is important to discourage further graffiti and other acts of vandalism.

b. Grass Trimming/Landscape Maintenance

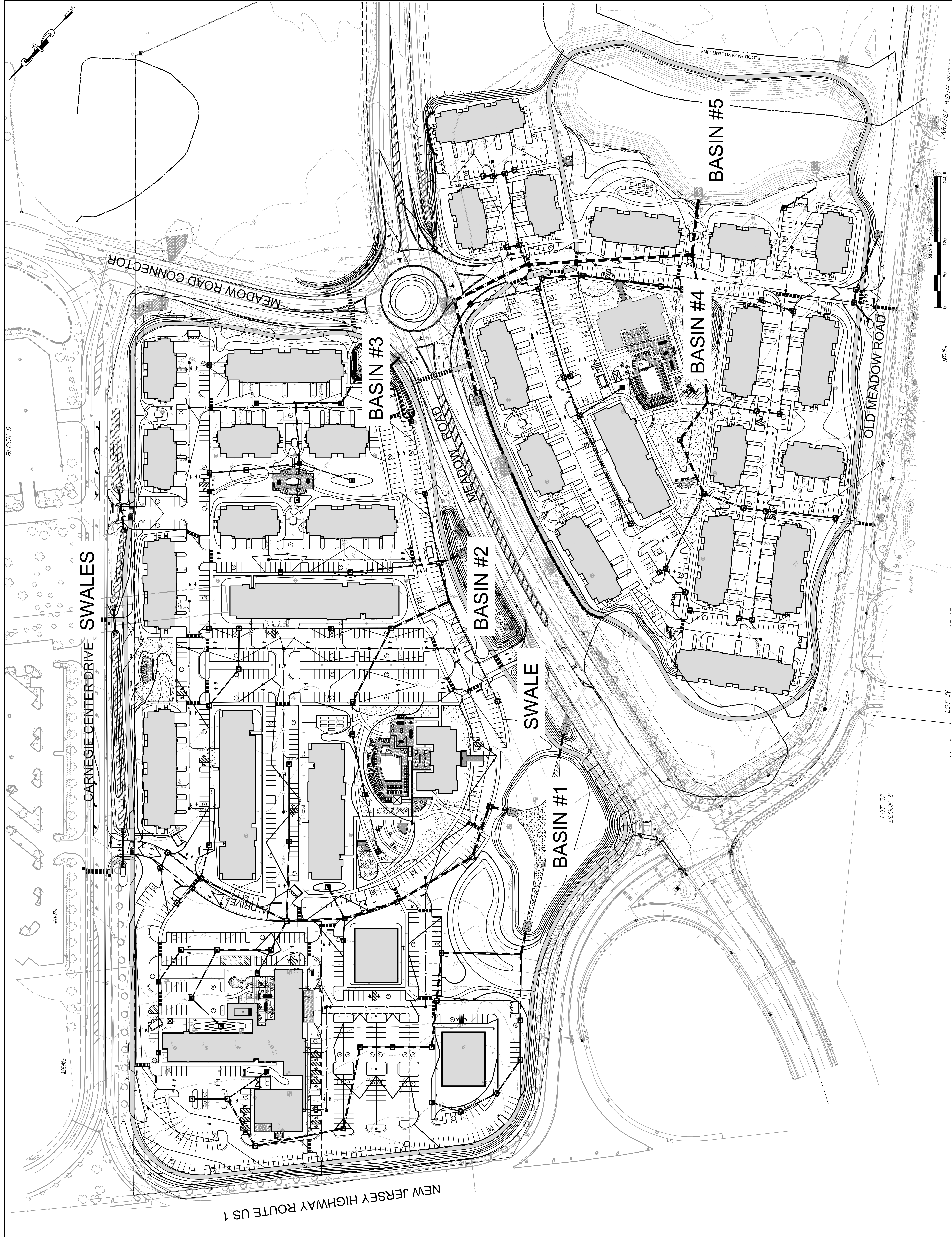
Trimming of grass within and around the basin and proper care of landscape plantings around structures will provide for a neat and attractive appearance of the facility.

c. Control of Weeds

Although a regular grass maintenance program will keep weed intrusion to a minimum, some weeds will invariably appear. Periodic weeding, either chemically or mechanically, will not only help to maintain a healthy turf, but will also keep grassed areas looking attractive. Application of chemicals should be monitored closely so as not to affect the health of the stormwater management facility. Excessive growth of weeds within the basin can also be unattractive and can be controlled mechanically as discussed in the previous section.

REVISION	DATE	CHKD
1		
2		
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12		

REVISION	DATE	CHKD
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MAINTENANCE PERSONNEL, EQUIPMENT AND MATERIALS

Personnel

It is anticipated that routine preventive and corrective maintenance will be performed by a landscape contractor who will supply all labor and material. The landscape contractor will remove all clippings and trash from the site. Personnel will consist of several crews operating the following equipment.

The following is a list of the equipment and materials that may be required to maintain the stormwater facilities:

Grass Maintenance Equipment

1. Riding Mowers
2. Hand Mowers
3. Gas Powered Trimmers
4. Gas Powered Edgers
5. Seed Spreaders
6. Fertilizer Spreaders
7. Pesticide and Herbicide Application Equipment
8. Grass Clipping and Leaf Collection Equipment

Vegetative Cover Maintenance Equipment

1. Saws
2. Pruning Shears
3. Hedge Trimmers
4. Wood Chippers

Transportation Equipment

1. Trucks for Transportation of Materials
2. Trucks for Transportation of Equipment
3. Vehicles for Transportation of Personnel

Debris, Trash and Sediment Removal Equipment

1. Small Loader
2. Small Backhoe
3. Portable Pump for Dewatering

Miscellaneous Equipment

1. Shovels
2. Rakes
3. Picks

4. Wheel Barrows
5. Fence Repair Tools
6. Painting Equipment
7. Gloves
8. Standard Mechanics Tools
9. Tools for Maintenance of Equipment

Materials

1. Topsoil
2. Fill
3. Seed
4. Soil Amenities (Fertilizer, Lime, etc.)
5. Chemicals (Pesticides, Herbicides etc.)
6. Mulch
7. Paint Removers (for Graffiti)
8. Spare Parts for Equipment

DISPOSAL PLAN

Disposal/Recycling Procedures

It is anticipated that routine cleanup and landscaping waste will be hauled off site by the landscape contractor to a NJDEP licensed landfill. In the event that the basins will have to be excavated to either remove the sand filters or accumulative sediment that this task will be contracted out to a excavator/utility contractor for proper disposal of any material.

No onsite disposal is permitted.

Safety Measures and Procedures

Safety Regulations and Requirements

All local ordinance(s) and state and federal regulations regarding occupational safety are referenced to this section

Safety Tools, Equipment and Garments

Safety Tools and Equipment	Location	Responsible Person/Contact #
First Aid Kit	vehicle	Landscape supervisor
Clothing, safety vests, gloves		Each crew member

Safety Training

All safety training by landscape contractor.

Safety Procedures

Nothing atypical.

Emergency Procedures

Contact West Windsor Twp Police 911

Training Plan and Records

I. Training Plan

Types of Training

- Mandatory Stormwater Management Basic Training and Field Manual Usage Training for new maintenance crews
- Occupational Safety Training

Content of Training

- **Stormwater Management Basic Training**
 - Purposes and Functions of BMPs

Training information is available at NJ Stormwater.org
(<http://www.nj.gov/dep/stormwater/training.htm>)

- NJDEP Stormwater BMP Manual, Chapter Nine: Structural Stormwater Management Measures
 - Chapter 9.4 Extended Detention Basins
 - Chapter 9.5 Infiltration Basins
 - Chapter 9.9 Sand Filters
 - Chapter 9.10 Vegetative Filter Strips
 - Chapter 9.11 Wet Ponds
 - Chapter 9.12 Grass Swales
- Vegetation Care
 - NJDEP Stormwater BMP Manual, Chapter Seven: Landscaping (*provides information on vegetation and landscaping for stormwater management measures*)
- Field Manual Usage Training
- Equipment and Tools Operation Training
- Occupational Safety Training
 - OSHA Training
 - Equipment or tool manufacturer's Operation & Maintenance Manual

II. Training Records

Training attendance sheets should be maintained by the responsible party after each training session.

Annual Evaluation of the Effectiveness of the Plan

As per N.J.A.C. 7:8-5.8(g), the person responsible for maintenance shall evaluate the effectiveness of the maintenance plan at least once per year and adjust the plan and the deed as needed.

The responsible party should evaluate the effectiveness of the maintenance plan by comparing the maintenance plan with the actual performance of the maintenance. The items to evaluate may include, but not limited to,

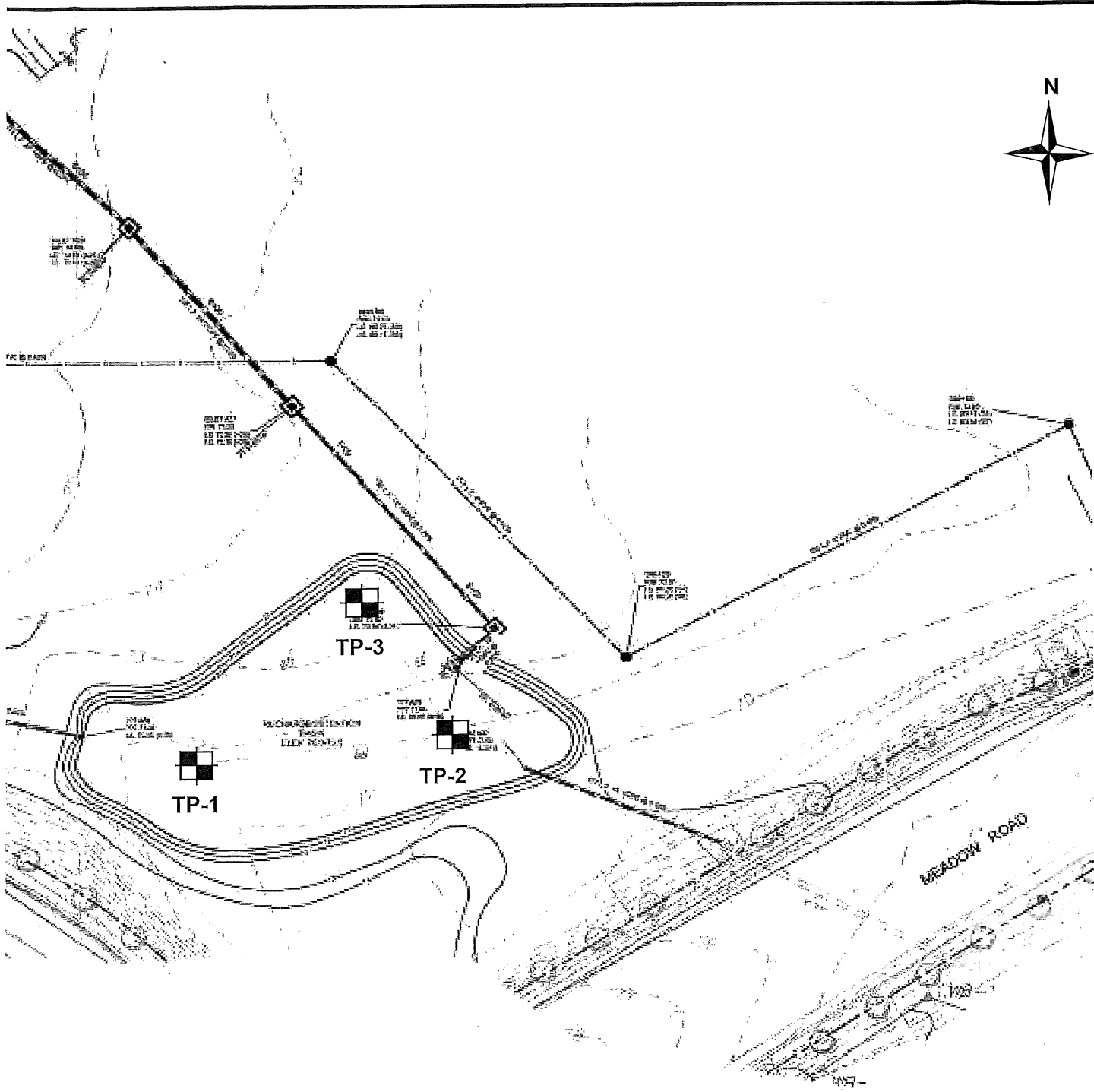
- Whether the inspections have been performed as scheduled;
- Whether the preventive maintenance has been performed as scheduled;
- Whether the frequency of preventative maintenance needs to increase or decrease;
- Whether the planned resources were enough to perform the maintenance;
- Whether the repairs were completed on time;
- Whether the actual cost was consistent with the estimated cost;
- Whether the inspection, maintenance, and repair records have been kept.

If actual performance of those items has been deviated from the maintenance plan, the responsible party should find the causes and implement solutions in a revised maintenance plan.

Annual Evaluation Records

Evaluator(s)	Date of Evaluation	Decision
		<input type="checkbox"/> Maintain current version OR <input type="checkbox"/> Revise current version Revision date _____ (also update the last revision date on the cover page)
		<input type="checkbox"/> Maintain current version OR <input type="checkbox"/> Revise current version Revision date _____ (also update the last revision date on the cover page)

Soil Borings and Permeability Testing



TEST PIT LOCATION PLAN



14 Worlds Fair Drive, Suite B
 Somerset, New Jersey 08873
 (732) 271-9301
 fax (732) 271-9306

GEO-TECHNOLOGY ASSOCIATES, INC.

WEST WINDSOR HOTEL SITE

West Windsor Township,
 Mercer County, New Jersey

Prepared For: Bowman Consulting

DESIGN BY: *	DRAWN BY: AMT	REVIEWED BY: DCL
SCALE: NTS	DATE: NOV. 2018	PROJECT #: 31180591

Figure

APPENDIX B

Exploration Logs

NOTES FOR EXPLORATION LOGS

KEY TO USCS TERMINOLOGY AND GRAPHIC SYMBOLS

MAJOR DIVISIONS (BASED UPON ASTM D 2488)			SYMBOLS			
			GRAPHIC	LETTER		
COARSE-GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS <small>(LESS THAN 15% PASSING THE NO. 200 SIEVE)</small>		GW		
		GRAVELS WITH FINES <small>(MORE THAN 15% PASSING THE NO. 200 SIEVE)</small>		GP		
				GM		
		SAND AND SANDY SOILS <small>(LESS THAN 15% PASSING THE NO. 200 SIEVE)</small>	CLEAN SANDS		SW	
			SP			
	MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	SANDS WITH FINES <small>(MORE THAN 15% PASSING THE NO. 200 SIEVE)</small>		SM		
				SC		
		FINE-GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILT OR CLAY <small>(<15% RETAINED ON THE NO. 200 SIEVE)</small> SILT OR CLAY WITH SAND OR GRAVEL <small>(15% TO 30% RETAINED ON THE NO. 200 SIEVE)</small>	SILTS AND LEAN CLAYS LIQUID LIMIT LESS THAN 50		ML
					CL	
	SANDY OR GRAVELLY SILT OR CLAY <small>(>30% RETAINED ON THE NO. 200 SIEVE)</small>		ELASTIC SILTS AND FAT CLAYS LIQUID LIMIT GREATER THAN 50		OL	
				MH		
			CH			
			OH			
HIGHLY ORGANIC SOILS				PT		

COARSE-GRAINED SOILS (GRAVEL AND SAND)

DESIGNATION	BLOWS PER FOOT (BPF) "N"
VERY LOOSE	0 - 4
LOOSE	5 - 10
MEDIUM DENSE	11 - 30
DENSE	31 - 50
VERY DENSE	>50

NOTE: "N" VALUE DETERMINED AS PER ASTM D 1586

FINE-GRAINED SOILS (SILT AND CLAY)

CONSISTENCY	BPF "N"
VERY SOFT	<2
SOFT	2 - 4
MEDIUM STIFF	5 - 8
STIFF	9 - 15
VERY STIFF	16 - 30
HARD	>30

NOTE: ADDITIONAL DESIGNATIONS TO ADVANCE SAMPLER INDICATED IN BLOW COUNT COLUMN:
 WOH = WEIGHT OF HAMMER
 WOR = WEIGHT OF ROD(S)

SAMPLE TYPE

DESIGNATION	SYMBOL
SOIL SAMPLE	S-
SHELBY TUBE	U-
ROCK CORE	R-

NOTE: DUAL SYMBOLS ARE USED TO INDICATE COARSE-GRAINED SOILS WHICH CONTAIN AN ESTIMATED 5 TO 15% FINES BASED ON VISUAL CLASSIFICATION OR BETWEEN 5 AND 12% FINES BASED ON LABORATORY TESTING; AND FINE-GRAINED SOILS WHEN THE PLOT OF LIQUID LIMIT & PLASTICITY INDEX VALUES FALLS IN THE PLASTICITY CHART'S CROSS-HATCHED AREA. FINE-GRAINED SOILS ARE CLASSIFIED AS ORGANIC (OL OR OH) WHEN ENOUGH ORGANIC PARTICLES ARE PRESENT TO INFLUENCE ITS PROPERTIES. LABORATORY TEST RESULTS ARE USED TO SUPPLEMENT SOIL CLASSIFICATION BY THE VISUAL-MANUAL PROCEDURES OF ASTM D 2488.

ADDITIONAL TERMINOLOGY AND GRAPHIC SYMBOLS

ADDITIONAL DESIGNATIONS	DESCRIPTION		GRAPHIC SYMBOLS	
		TOPSOIL		
		MAN MADE FILL		
		GLACIAL TILL		
		COBBLES AND BOULDERS		
RESIDUAL SOIL DESIGNATIONS	DESCRIPTION	"N" VALUE		
	HIGHLY WEATHERED ROCK	50 TO 50/1"		
	PARTIALLY WEATHERED ROCK	MORE THAN 50 BLOWS FOR 1" OF PENETRATION OR LESS, AUGER PENETRABLE		

WATER DESIGNATION

DESCRIPTION	SYMBOL
ENCOUNTERED DURING DRILLING	
UPON COMPLETION OF DRILLING	
24 HOURS AFTER COMPLETION	

NOTE: WATER OBSERVATIONS WERE MADE AT THE TIME INDICATED. POROSITY OF SOIL STRATA, WEATHER CONDITIONS, SITE TOPOGRAPHY, ETC. MAY CAUSE WATER LEVEL CHANGES.



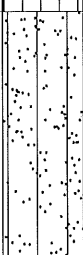
LOG OF TEST PIT NO. TP-1 (Stake 1003)

PROJECT: **West Windsor Hotel Site**
 PROJECT LOCATION: **West Windsor Township, New Jersey**
 CLIENT: **Bowman Consulting**

PROJECT NO.: **31180596x1**

DATE STARTED: **11/12/18**
 DATE COMPLETED: **11/12/18**
 CONTRACTOR: **Heritage Contracting Company, Inc.**
 EQUIPMENT: **John Deere 410G Backhoe**

GROUNDWATER ENCOUNTERED: **7 Ft.**
 GROUND SURFACE ELEVATION: **72 Ft.**
 DATUM: **TOPO**
 LOGGED BY: **AMT**
 CHECKED BY: **DCL**

ELEVATION (ft.)	DEPTH (ft.)	USCS	GRAPHIC SYMBOL	DESCRIPTION	REMARKS
71.2	0			10 In. of Topsoil	
		ML		Dark yellow-brown (10YR 4/6), moist, SILT with sand and gravel	- Infiltration rate = 0 in/hr at 2 Ft.
68.5	5	SP-SM		Light yellow-brown (2.5Y 6/4), moist, Poorly-graded SAND with silt	- NMC = 17.2% - Infiltration rate = 18 in/hr at 4-1/2 Ft.
				- wet at 7 Ft. - Brown (10YR 5/3) at 8 Ft.	▼ - Rapid water seepage at 7 Ft. - Sidewall collapses at 7, 8 and 10 Ft.
62.0	10			Test pit complete at 10 Ft.	
	15				
	20				
	25				
	30				

NOTES: **Locations were staked by others.**
Backfilled on completion.



GEO-TECHNOLOGY ASSOCIATES, INC.
 14 Worlds Fair Drive, Suite B
 Somerset, NJ 08873

LOG OF TEST PIT NO. TP-1 (Stake 1003)


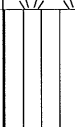

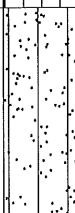
LOG OF TEST PIT NO. TP-2 (Stake 1004)

PROJECT: **West Windsor Hotel Site**
 PROJECT LOCATION: **West Windsor Township, New Jersey**
 CLIENT: **Bowman Consulting**

PROJECT NO.: **31180596x1**

DATE STARTED: **11/12/18**
 DATE COMPLETED: **11/12/18**
 CONTRACTOR: **Heritage Contracting Company, Inc.**
 EQUIPMENT: **John Deere 410G Backhoe**

GROUNDWATER ENCOUNTERED: **6 Ft.**
 GROUND SURFACE ELEVATION: **71 Ft.**
 DATUM: **TOPO**
 LOGGED BY: **AMT**
 CHECKED BY: **DCL**

ELEVATION (ft.)	DEPTH (ft.)	USCS	GRAPHIC SYMBOL	DESCRIPTION	REMARKS
70.1	0			11 In. of Topsoil	
		ML		Dark yellow-brown (10YR 4/6), moist, SILT with sand and gravel	- NMC = 20.4% - Infiltration rate = 1 in/hr at 1-1/2 Ft.  - Rapid water seepage at 6 Ft. - Sidewall collapses at 7, 8 and 9 Ft.
66.5	5	SP-SM		Light yellow-brown (2.5Y 6/4), moist, Poorly-graded SAND with silt - wet at 6 Ft.	
61.0	10			Test pit complete at 10 Ft.	
	15				
	20				
	25				
	30				

NOTES: **Locations were staked by others.**
Backfilled on completion.



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LOG OF TEST PIT NO. TP-2 (Stake 1004)

LOG OF TEST PIT NO. TP-3 (Stake 1005)

PROJECT: **West Windsor Hotel Site**
 PROJECT LOCATION: **West Windsor Township, New Jersey**
 CLIENT: **Bowman Consulting**

PROJECT NO.: **31180596x1**

DATE STARTED: **11/12/18**
 DATE COMPLETED: **11/12/18**
 CONTRACTOR: **Heritage Contracting Company, Inc.**
 EQUIPMENT: **John Deere 410G Backhoe**

GROUNDWATER ENCOUNTERED: **7.5 Ft.**
 GROUND SURFACE ELEVATION: **73 Ft.**
 DATUM: **TOPO**
 LOGGED BY: **AMT**
 CHECKED BY: **DCL**

ELEVATION (ft.)	DEPTH (ft.)	USCS	GRAPHIC SYMBOL	DESCRIPTION	REMARKS
72.1	0		▽▽▽	11 In. of Topsoil	
		ML		Dark yellow-brown (10YR 4/6), moist, SILT with sand and gravel	
69.0	5	SP-SM		Light yellow-brown (2.5Y 6/4), moist, Poorly-graded SAND with silt	- Infiltration rate = 9 in/hr at 4 Ft. - NMC = 11.6%
				- wet at 7-1/2 Ft. - Yellow-brown (10YR 5/4) at 8 Ft.	▽ - Rapid water seepage at 7-1/2 Ft. - Sidewall collapses at 7, 8, 10 and 12 Ft.
61.0	12			Test pit complete at 12 Ft.	
	15				
	20				
	25				
	30				

NOTES: **Locations were staked by others.**
Backfilled on completion.



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LOG OF TEST PIT NO. TP-3 (Stake 1005)

natural soils. The results of the infiltration tests performed for this study are summarized in the following table:

SUMMARY OF INFILTRATION TEST RESULTS

Test Pit Location	Approximate Test Depth* (ft)	Final Water Level Drop (in)	Time Interval (min)	USCS Classification	Measured Infiltration Rate (in/hr)
TP-1	2	0	20	SILT with sand (ML)	0
TP-1	4½	1½	5	Poorly-graded SAND with silt (SP-SM)	18
TP-2	1½	¼	15	SILT with sand (ML)	1
TP-3	4	¾	5	Poorly-graded SAND with silt (SP-SM)	9

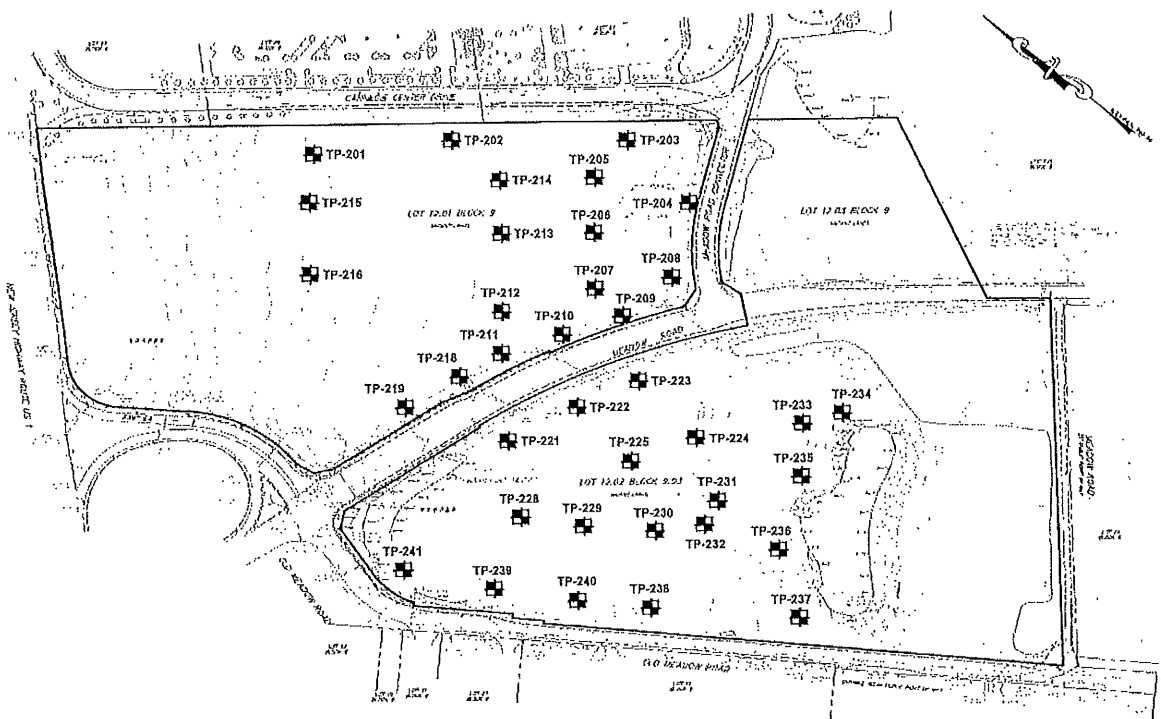
*Beneath the existing ground surface.

A factor of safety of at least 2 should be applied to the measured infiltration rates.

CONCLUSIONS AND RECOMMENDATIONS

The primary conditions that affect the capacity to infiltrate water are the soil gradation and density properties and the presence of hydraulically restrictive layers such as silt or clay (fines), rock, or groundwater, each of which would restrict the flow of water into the underlying aquifer. The soil profile generally consisted of fine-grained silts overlying poorly-graded sands. Groundwater was encountered in the test pits at depths ranging from about 6 to 7½ feet below the ground surface. In general, the fine-grained silts (ML) were not receptive to infiltration, and the coarse-grained sands (SP-SM) appeared receptive to infiltration.

We believe the infiltration test results and groundwater observations indicate that infiltration of collected stormwater is generally feasible at the basin location within the deeper poorly-graded sand layer. However, it appears that fine-grained soils will be present at the planned basin subgrade level. Therefore, it will be necessary to excavate and replace the upper silty soils to expose the more permeable granular soils. We recommend additional testing be performed at the time of construction to verify the design assumptions. This testing should be performed after the basin subgrades are properly prepared.



*Base plan provided by Bowman Consulting titled "Plan Showing Test Pit Locations" dated February 5, 2019.

LEGEND:

TP-X
 Indicates the numbers and approximate locations of test pits performed for this study.

TEST PIT LOCATION PLAN



14 Worlds Fair Drive, Suite B
 Somerset, New Jersey 08873
 (732) 271-9301
 fax (732) 271-9306

GEO-TECHNOLOGY ASSOCIATES, INC.

WEST WINDSOR RESIDENTIAL DEVELOPMENT

West Windsor Township,
 Mercer County, New Jersey

Prepared For: Bowman Consulting

DESIGN BY: *	DRAWN BY: AMT	REVIEWED BY: DCL
SCALE: NTS	DATE: FEB. 2019	PROJECT #: 31190147

Figure 2

APPENDIX B

Exploration Logs

LOG OF TEST PIT NO. TP-208

PROJECT: West Windsor Residential Development
 PROJECT LOCATION: West Windsor, New Jersey
 CLIENT: Bowman Consulting

PROJECT NO.: 31190147

DATE STARTED: 2/15/2019
 DATE COMPLETED: 2/15/2019
 CONTRACTOR: Heritage Contracting Company, Inc.
 EQUIPMENT: Caterpillar 308CR Excavator

GROUNDWATER ENCOUNTERED: 7 Ft.
 GROUND SURFACE ELEVATION: 69 Ft.
 DATUM: TOPO
 LOGGED BY: JMM
 CHECKED BY: AMT

ELEVATION (ft.)	DEPTH (ft.)	USCS	GRAPHIC SYMBOL	DESCRIPTION	REMARKS
68.2	0			10 in. of Topsoil	
	2	ML		Dark yellow-brown, moist, Sandy SILT with gravel	
65.0	4	SP-SM		Light yellow-brown, moist, Poorly-graded SAND with silt and gravel	
	6				
	8			- Wet at 7 Ft.	
	10			- Gravel grades out at 10 Ft.	
57.0	12			Test pit complete at 12 Ft.	- Infiltration rate = 4 in/hr at 5 Ft.
	14				
	16				
	18				
	20				
	22				
	24				

NOTES: Locations were staked by others.
 Backfilled On Completion.



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LOG OF TEST PIT NO. TP-208

LOG OF TEST PIT NO. TP-209

Sheet 1 of 1

PROJECT: **West Windsor Residential Development**
 PROJECT LOCATION: **West Windsor, New Jersey**
 CLIENT: **Bowman Consulting**

PROJECT NO.: **31190147**

DATE STARTED: **2/14/2019**
 DATE COMPLETED: **2/14/2019**
 CONTRACTOR: **Heritage Contracting Company, Inc.**
 EQUIPMENT: **Caterpillar 308CR Excavator**

GROUNDWATER ENCOUNTERED: **7 Ft.**
 GROUND SURFACE ELEVATION: **68 Ft.**
 DATUM: **TOPO**
 LOGGED BY: **JMM**
 CHECKED BY: **AMT**

ELEVATION (ft.)	DEPTH (ft.)	USCS	GRAPHIC SYMBOL	DESCRIPTION	REMARKS
67.2	0		▽▽▽	10 in. of Topsoil	
	2	ML		Dark yellow-brown, moist, SILT with sand and gravel	
63.0	6	SM		Light olive-brown, moist, Silty SAND	- Infiltration rate = 3 in/hr at 5 Ft.
	8			- Wet at 7 Ft.	▼
56.0	12	SP-SM		Dark yellow-brown, wet, Poorly-graded SAND with silt and gravel	
53.0	15			Test pit complete at 15 Ft.	
	16				
	18				
	20				
	22				
	24				

NOTES: **Locations were staked by others.**
Backfilled On Completion.



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LOG OF TEST PIT NO. TP-209

Sheet 1 of 1

LOG OF TEST PIT NO. TP-210





Sheet 1 of 1

PROJECT: West Windsor Residential Development
 PROJECT LOCATION: West Windsor, New Jersey
 CLIENT: Bowman Consulting

PROJECT NO.: 31190147

DATE STARTED: 2/14/2019
 DATE COMPLETED: 2/14/2019
 CONTRACTOR: Heritage Contracting Company, Inc.
 EQUIPMENT: Caterpillar 308CR Excavator

GROUNDWATER ENCOUNTERED: 7 Ft.
 GROUND SURFACE ELEVATION: 68 Ft.
 DATUM: TOPO
 LOGGED BY: JMM
 CHECKED BY: AMT

ELEVATION (ft.)	DEPTH (ft.)	USCS	GRAPHIC SYMBOL	DESCRIPTION	REMARKS
67.2	0			10 in. of Topsoil	
	2	ML		Dark yellow-brown, moist, SILT with sand and gravel	
65.5	4	SP-SM		Yellow-brown, moist, Poorly-graded SAND with silt	
	6			- Wet at 6 Ft.	
	8			- Dark yellow-brown at 8 Ft.	
55.0	13			Test pit complete at 13 Ft.	- Infiltration rate = 6.25 in/hr at 4-1/2 Ft. 
	14				
	16				
	18				
	20				
	22				
	24				

NOTES: Locations were staked by others.
 Backfilled On Completion.



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LOG OF TEST PIT NO. TP-210

Sheet 1 of 1

LOG OF TEST PIT NO. TP-211

Sheet 1 of 1

PROJECT: West Windsor Residential Development
 PROJECT LOCATION: West Windsor, New Jersey
 CLIENT: Bowman Consulting

PROJECT NO.: 31190147

DATE STARTED: 2/14/2019
 DATE COMPLETED: 2/14/2019
 CONTRACTOR: Heritage Contracting Company, Inc.
 EQUIPMENT: Caterpillar 308CR Excavator

GROUNDWATER ENCOUNTERED: 5 Ft.
 GROUND SURFACE ELEVATION: 69 Ft.
 DATUM: TOPO
 LOGGED BY: JMM
 CHECKED BY: AMT

ELEVATION (ft.)	DEPTH (ft.)	USCS	GRAPHIC SYMBOL	DESCRIPTION	REMARKS
68.2	0			10 In. of Topsoil	
	2	ML		Dark yellow-brown, moist, Sandy SILT with gravel	
	4			- Wet at 5 Ft.	
63.0	6	SP-SM		Light yellow-brown, wet, Poorly-graded SAND with silt	- Infiltration rate = 0 in/hr at 2-1/2 Ft.
	8			- Dark yellow-brown at 8 Ft.	
57.0	12			Test pit complete at 12 Ft.	
	14				
	16				
	18				
	20				
	22				
	24				

NOTES: Locations were staked by others.
 Backfilled On Completion.



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LOG OF TEST PIT NO. TP-211

Sheet 1 of 1




LOG OF TEST PIT NO. TP-218

PROJECT: **West Windsor Residential Development**
 PROJECT LOCATION: **West Windsor, New Jersey**
 CLIENT: **Bowman Consulting**

DATE STARTED: **2/14/2019**
 DATE COMPLETED: **2/14/2019**
 CONTRACTOR: **Heritage Contracting Company, Inc.**
 EQUIPMENT: **Caterpillar 308CR Excavator**

PROJECT NO.: **31190147**

GROUNDWATER ENCOUNTERED: **5 Ft.**
 GROUND SURFACE ELEVATION: **69.5 Ft.**
 DATUM: **TOPO**
 LOGGED BY: **JMM**
 CHECKED BY: **AMT**

ELEVATION (ft.)	DEPTH (ft.)	USCS	GRAPHIC SYMBOL	DESCRIPTION	REMARKS
	0			10 In. of Topsoil	
68.7	2	CL-ML		Dark yellow-brown, moist, Sandy, Silty CLAY	- NMC = 18.2% - Infiltration rate = 0 in/hr at 2-1/2 Ft.
65.5	4	SP-SM		Yellow-brown, moist, Poorly-graded SAND with silt	
	6			- Wet at 5 Ft.	
	8			- Dark yellow-brown at 7 Ft.	
	10			- Dark brown, with cemented soils at 9 Ft.	
56.5	13			Test pit complete at 13 Ft.	
	14				
	16				
	18				
	20				
	22				
	24				

NOTES: **Locations were staked by others.**
Backfilled On Completion.



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LOG OF TEST PIT NO. TP-218






LOG OF TEST PIT NO. TP-219

PROJECT: West Windsor Residential Development
PROJECT LOCATION: West Windsor, New Jersey
CLIENT: Bowman Consulting

DATE STARTED: 2/18/2019
DATE COMPLETED: 2/18/2019
CONTRACTOR: Heritage Contracting Company, Inc.
EQUIPMENT: Caterpillar 308CR Excavator

PROJECT NO.: 31190147

GROUNDWATER ENCOUNTERED: 4 Ft.
GROUND SURFACE ELEVATION: 69 Ft.
DATE: TOPO
LOGGED BY: JMM
CHECKED BY: AMT

ELEVATION (ft.)	DEPTH (ft.)	USCS	GRAPHIC SYMBOL	DESCRIPTION	REMARKS
68.2	0			10 In. of Topsoil	
	2	CL-ML		Dark yellow-brown, moist, Sandy, Silty CLAY	- Infiltration rate = 0 In/hr at 2 Ft. 
66.0	4	SP-SM		Dark yellow-brown, moist, Poorly-graded SAND with silt and clay clods - Wet at 4 Ft.	
	8			- Light yellow-brown at 8 Ft. - Dark yellow-brown and gray, with cemented soils at 9 Ft.	
59.0	10	SP		Red-brown, wet, Poorly-graded SAND	
57.0	12			Test pit complete at 12 Ft.	
	14				
	16				
	18				
	20				
	22				
	24				

NOTES: Locations were staked by others.
Backfilled On Completion.



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LOG OF TEST PIT NO. TP-219

SUMMARY OF LABORATORY TESTING

Test Pit Location	Depth (Ft)	LL (%)	PI (%)	USCS Classification	NMC (%)
TP-201	4-5	NP	NP	Silty SAND (SM)	20.6
TP-205	6½-7½	NP	NP	Poorly-graded SAND with silt (SP-SM)	10.2
TP-207	12-13	NP	NP	Poorly-graded SAND with silt and gravel (SP-SM)	27.7
TP-214	3½-4½	35.5	20.7	Sandy Lean CLAY (CL)	23.3
TP-218	2-3	19.6	4.9	Sandy, Silty CLAY (CL-ML)	18.2
TP-222	2-3	24.1	5.7	Silty, Clayey SAND (SC-SM)	18.1
TP-224	4½-5½	NP	NP	Poorly-graded SAND (SP)	22.5
TP-229	3-4	NP	NP	Well-graded SAND with silt (SW-SM)	17.6
TP-237	6-7	NP	NP	Poorly-graded SAND with gravel (SP)	10.6

Note: NMC=Natural Moisture Content, LL=Liquid Limit, PI=Plasticity Index, NP=Non-plastic

SUBSURFACE CONDITIONS

An approximately 10- to 12-inch thick layer of topsoil was encountered at the ground surface in the test pits performed for this study. The natural soils encountered below the topsoil appear to be consistent with the geologic mapping, and in the northern half of the site generally consisted of fine-grained silt or clay soils overlying silty sands and poorly-graded sands with varying amounts of silt. Clayey sands and silty, clayey sands were encountered at the surface in the eastern portion of the southern half of the site, and silty sands were encountered at the surface in the western portion of the southern half, overlying mainly poorly-graded sands with some well-graded sands encountered in Test Pits TP-228 and TP-229.

Fill materials were encountered at the ground surface in Test Pits TP-231, TP-233, TP-234, TP-235 and TP-236 performed for this study in the southern portion of the southern half of the site, adjacent to the existing basin. The extent of the fill in this area can be seen on the topographic plan. The fill extended to depths ranging from about 6 to 8½ feet below the ground surface and generally consisted of sandy silt, silty sand and poorly-graded sand soils. Relatively minor amounts of asphalt and concrete fragments were encountered within the fill.

Groundwater was encountered in 36 of the 37 test pits at depths ranging from about 4 to 13½ feet below the ground surface. Long-term groundwater readings were not obtained because the test pits were backfilled upon completion for safety considerations. Fluctuations in the groundwater level typically occur due to several factors, including variations in precipitation, seasonal changes, and site development activities. Soil mottling indicative of the seasonal high groundwater level was not observed in the test pits. We believe the seasonal high groundwater level generally corresponds to the groundwater level encountered in the explorations.

INFILTRATION TEST RESULTS

In-situ infiltration tests were performed adjacent to each of the test pits performed for this study using a double-ring infiltrometer in accordance with the ASTM D 3385 test procedure. The tests were performed at depths ranging from approximately 2 to 10 feet below the ground surface within the natural soils, and at 4 of the test locations (TP-231, TP-234, TP-235, and TP-236) the infiltration tests were performed within the existing fill materials. The results of the infiltration tests performed for this study are summarized in the following table. A factor of safety of at least 2 should be applied to the measured infiltration rates.

SUMMARY OF INFILTRATION TEST RESULTS

Test Pit Location	Approximate Test Depth* (ft)	Final Water Level Drop (in)	Time Interval (min)	USCS Classification	Measured Infiltration Rate (in/hr)
TP-201	4	¼	10	Silty SAND with gravel (SM)	0.75
TP-202	3	0	10	Silty SAND (SM)	0
TP-203	5	2	5	Poorly-graded SAND (SP)	24
TP-204	4	1¼	6	Poorly-graded SAND with silt (SP-SM)	12.5
TP-205	6.5	2¼	10	Poorly-graded SAND with silt and gravel (SP-SM)	13.5
TP-206	5	⅛	30	Silty SAND (SM)	0.25
TP-207	5½	½	10	Silty SAND (SM)	3
TP-208	5	1	15	Poorly-graded SAND with silt and gravel (SP-SM)	4
TP-209	5	½	30	Silty SAND (SM)	3
TP-210	4½	⅝	6	Poorly-graded SAND with silt (SP-SM)	6.25
TP-211	2½	0	30	Sandy SILT (ML)	0

Test Pit Location	Approximate Test Depth* (ft)	Final Water Level Drop (in)	Time Interval (min)	USCS Classification	Measured Infiltration Rate (in/hr)
TP-212	3	0	30	Sandy SILT (ML)	0
TP-213	3	¼	10	Silty SAND (SM)	1.5
TP-214	3½	⅛	10	Sandy SILT (ML)	0.75
TP-215	2	0	10	Silty SAND (SM)	0
TP-216	2½	⅛	10	Silty SAND (SM)	0.75
TP-218	2½	0	30	Sandy SILT (ML)	0
TP-219	2	0	30	Sandy SILT (ML)	0
TP-221	4½	½	5	Silty SAND (SM)	6
TP-222	3½	⅛	30	Sandy SILT (ML)	0.25
TP-223	5	1¼	5	Poorly-graded SAND with silt (SP-SM)	15
TP-224	5	2	5	Poorly-graded SAND (SP)	24
TP-225	5	1	5	Poorly-graded SAND with silt (SP-SM)	12
TP-228	4½	¼	30	Poorly-graded SAND with silt (SP-SM)	0.5
TP-229	3	2½	10	Poorly-graded SAND with silt (SP-SM)	15
TP-230	4½	½	5	Silty SAND (SM)	6
TP-231	7	1½	10	FILL: Silty SAND with gravel (SM)	9
TP-232	4	1	10	Silty SAND (SM)	6
TP-233	10	0	30	Sandy SILT (ML)	0
TP-234	5	3	10	FILL: Poorly-graded SAND with silt (SP-SM)	18
TP-235	6	0	30	FILL: Sandy SILT (ML)	0
TP-236	5	0	30	FILL: Sandy SILT (ML)	0
TP-237	4	3	5	Poorly-graded SAND with gravel (SP)	36
TP-238	5½	2¼	10	Poorly-graded SAND with silt (SP-SM)	13.5
TP-239	3	1	10	Poorly-graded SAND with silt (SP-SM)	6
TP-240	5	2½	10	Poorly-graded SAND with silt (SP-SM)	15
TP-241	3½	¼	10	Poorly-graded SAND with silt (SP-SM)	1.5

*Beneath the existing ground surface.

Part II Field Manuals and Maintenance Records

**BMP # 03
Wet Pond**

**Basin #5
on the Location Map**

**Princeton Executive Park
West Windsor Twp, Mercer County, NJ**

Basin #5 Location (NJ Plane Grid) X (East): 448,470
Y(North): 537,285

Location of Basin #5: North side of Old Meadow Road

Wet Pond Overview

Functionality

Wet ponds, also known as retention basins, are used to address the stormwater quantity and quality impacts of land development. This type of stormwater facility has an elevated outlet structure that creates a permanent pool where stormwater runoff is detained and attenuated. Wet ponds can be designed as multi-stage, multi-function systems; extended detention in the permanent pool provides pollutant treatment for runoff from the Water Quality Design Storm through sedimentation and biological processing; detention and attenuation is also provided for larger storm event through the higher elevation outlets. The total suspended solids (TSS) removal rate is 50 – 90%, depending upon the storage volume in the permanent pool and the duration of detention time, if extended detention is provided.

Proper care and attention in the long-term maintenance of the stormwater management measure is critically important to the safety and health of the public.

Type of BMP – Wet Basin / Extended Detention of Runoff and Settlement of TSS

A wet pond is a type of **wet** basin, in which water is retained in a permanent pool. This wet pond is designed for **extended detention of runoff** and **settlement of TSS**. It is **not** designed to infiltrate runoff.

Wet ponds shall have a water surface elevation approximately at the design water surface elevation year round. If a wet pond has an exposed bottom or a shallow water level, there may be an issue caused by changes to the contributing drainage area, damage to the outlet structure(s), or damage to the bottom liner. An investigation is then required to determine the issue and restore proper function.

Basic Design Information

Hydrology Design Targets

1. The **design detention time** of this pond is approximately 48 hours.
2. This wet pond is design to receive runoff from a drainage area of 47 acres.
3. The TSS removal rate of this wet pond is 80 %.
4. This basin will be discharged to existing roadside swales, then conveyed easterly to Upper Bear Brook Swamp.

Hydraulic Design Targets

1. Design parameters

	Water Quality Design Storm	2-year storm	10-year storm	100-year storm
Rainfall Depth (inches)	1.25 inch in 2 hours	3.31 inches in 24 hours	5.01 inches In 24 hours	8.33 inches In 24 hours
Runoff Volume (ac-ft)	0.31	4.48	8.46	17.07
Peak Flow Rate (cfs)	0.05	0.54	0.93	15.80
Water Surface Elevation (feet)	65.47	67.18	68.86	69.95

2. The emergency spillway is at EL. 70.5 feet.

Basin Configuration Targets

1. Outlet Information:

Outlet Description	Outlet Type	Orifice Size / Weir Length	Invert Elevation
Water Quality Orifice	Orifice	4 inches	65.00
Outlet #1	Weir	L= 4 ft	68.81
Outlet #2	Weir	A= 12 sf L= 12 ft	70.50

2. This wet pond is designed to have vegetation along its perimeter.
3. The basin is not lined.
4. The wet pond does not intercept groundwater.
5. The wet pond is not aerated by an aerator or fountain
6. The pond is designed without a bottom drain pipe to empty the pond.

7. A Safety ledge is installed at El 63 or 2 feet above the bottom of the pond and 2 feet below the normal water level.

Critical Maintenance Features

1. Floatables need to be cleaned and removed from the pond.
2. Remove dead vegetation to prevent mosquito problem.
3. The pond needs to maintain aeration or circulation to prevent mosquito problem.
4. Native species when revegetating is required.

Wetland Disturbance Notice:

Maintenance of this BMP may disturb a wetland area. Contact NJDEP Division of Land Use Regulation for guidance and any required permit(s) before performing maintenance.

Visual Aid for Wet Type Stormwater Basin Inspection

Note: Basins shown here include various types of wet basins, not limited to the category of basin in this field manual.



Issues: The forebay has not drained. Note the sediment accumulation in the forebay.

Corrective Action: Clear and remove sediment. Check if the drain hole is clogged.

Preventative Action: Routine inspection and maintenance to remove sediment. If sediment accumulates too fast, find the source of sediment and method to reduce the sediment.



Issues: Algae blooming.

Corrective Action: Remove algae.

Preventative Action: Routine inspection and aeration of the pond. Remove algae before blooming. A finding of the nutrient source and method to reduce the nutrient loading may be needed.



Issues: The outlet grating is covered by trash. Excessive trash in the pond.

Corrective Action: Clear and remove trash.

Preventative Action: Routine inspection and removal of trash. A finding of the trash source and method to reduce the trash may be needed.



Issues: The water level in the wet pond is significantly below the design water surface elevation.

Corrective Action: Check if the outlet structure or the liner is damaged. Repair any damage.

Preventative Action: Routine inspection of the basin and the liner.



Issues: Erosion on the embankment.

Corrective Action: Repair the embankment. Report to local authority and DEP Dam Safety as required by the local and DEP rules.

Preventative Action: Construct a riprap apron on the slope. Routine inspection before erosion becomes severe.



Issues: This basin was designed as a detention basin (dry basin), but now looks like a constructed wetland (wet basin). If the maintenance crews do not refer back to the original design information, they may perform the wrong maintenance work.

Note: The maintenance crew must refer to the as-built drawings and design information to avoid confusion and inappropriate maintenance work.



If the original design information is not available, the pond configuration may signal whether it was designed as a wet basin or dry basin. As shown here, the water level is at the invert elevation of the outlet (orifice behind the trash rack). If the water level is at the first outlet from the basin bottom (this can be determined by checking the inside the outlet box), then it is a wet basin and is at correct water surface level. However, if there is another outlet below the water, then it may signal that it is a failed dry basin now filled with water.

Also the pond has a circle of riprap (also known as an energy dissipater) around the edge at the water level. A dry basin will generally not have this configuration; therefore, it suggests a wet pond.

Reference Documents

As-built Drawings with Drainage Plans

Inspection Checklist / Maintenance Actions Wet Pond

Checklist (circle one): Quarterly / Annual / Monthly / Special Event Inspection

Checklist No. _____ **Inspection Date:** _____

Date of most recent rain event: _____

Rain Condition (circle one):
Drizzle / Shower / Downpour / Other _____

Ground Condition (circle one):
Dry / Moist / Ponding / Submerged / Snow accumulation

The inspection items and preventative/corrective maintenance actions listed below represent general requirements. The design engineer and/or responsible party shall adjust the items and actions to better meet the conditions of the site, the specific design targets, and the requirements of regulatory authorities.

Component No. Component Name	For Inspector		For Maintenance Crew
	Inspection Item and Inspection Item No.	Result	Preventative / Corrective Maintenance Actions
Pond Area	1	The water level in the pond is below the design water surface elevation	Y___ N___ Check for: *Changes in inflow *patterns (less runoff, *lower groundwater table) *Damages to the outlet structure Repair any structural damages Work Order # _____
	2	Islands or shallow marsh emerging out of the pond	Y___ N___ Check whether there is excessive sediment in the pond Check whether the incoming flow has excessive sediment Find the source of excessive sediment and method to reduce the source Remove excessive sediment Work Order # _____
	3	The observed detention time is longer than the design detention time. The observed detention time is approximately _____ hours.	Y___ N___ Check whether the outlets are clogged, see section E-Outlet of this checklist
	4	Debris or trash floating on the water	Y___ N___ Remove debris and trash If trash and debris are excessive, find the source and the method to reduce the source.

Component No. Component Name	For Inspector		For Maintenance Crew
	Inspection Item and Inspection Item No.	Result	Preventative / Corrective Maintenance Actions
	5	Excessive dead vegetation in the pond	Y__ N__ Clear and remove vegetation
	6	Mosquito breeding	Y__ N__ Aerate or circulate the pond Remove dead vegetation Consult local mosquito commission for guidance Work Order # _____
	7	Presence of domestic waterfowl and wildlife	Y__ N__ Maintain native second growth to water to prevent waterfowl from accessing the pond Contact NJDEP - Division of Fish and Wildlife for guidance and permits to capture and release
Pond Area	8	Erosion on pond side	Y__ N__ Check whether the surrounding area has uncontrolled drainage into the pond Install an energy dissipater to slow down the incoming flow (e.g. deep-rooted riparian vegetation or bioengineering method) Work Order # _____

	For Inspector		For Maintenance Crew
Component No. Component Name	Inspection Item and Inspection Item No.	Result	Preventative / Corrective Maintenance Actions
<p>Note: If emptying the pond is required before sediment removal, it shall be noted that a permit may be required before discharging the pond water. Contact NJDEP Division of Land Use Regulation before discharge</p> <p>Note:</p>			
Vegetation	1	Invasive plants are present	Y___ N___ Remove the invasive plants and restore the vegetation in accordance with the landscaping plan Work Order # _____
	2	Algae blooming	Y___ N___ Remove algae Aerate the pond Find the nutrient source and the solution to reduce the nutrient loading Work Order # _____
Pond Embankment and Side Slopes	1	Signs of erosion, soil slide or bulges, seeps and wet spots, loss of vegetation, or erosion on the basin slope	Y___ N___ Check for excessive overland runoff flow through the embankment. Check for any sink hole development Restabilize the bank Work Order # _____
Outlet	1	Trash or debris accumulation more than 20%	Y___ N___ Clean and remove Determine source of trash and address to reduce future maintenance costs or basin failure

Component No. Component Name	For Inspector		Result	For Maintenance Crew
	Inspection Item and Inspection Item No.			Preventative / Corrective Maintenance Actions
	2	Trash rack is damaged or rusted greater than 50%	Y__	Repair or replace trash rack
		Trash rack is bent, loose, or missing parts	N__	Work Order # _____
	3	Outlet components (e.g., orifice plates or weir plate) skewed, misaligned, or missing	Y__	Repair or replace component
			N__	Work Order # _____
4	Discharge pipe apron is eroded or scoured	Y__	Restabilize the discharge riprap apron	
		N__	Work Order # _____	
5	Standing water is present in the outlet structure longer than 72 hours	Y__	Pump out the standing water	
		N__	Work Order # _____	
Emergency Spillway	1	Trees or excessive vegetation present	Y__	Remove trees and roots, and restore berms if necessary
			N__	Work Order # _____
	2	Damaged structure	Y__	Repair
			N__	Work Order # _____
Miscellaneous	1	Fence: broken or eroded parts	Y__	Repair or replace
			N__	Work Order # _____
	2	Gate: missing gate or lock	Y__	Repair or replace
			N__	Work Order # _____

Component No. Component Name	For Inspector		For Maintenance Crew
	Inspection Item and Inspection Item No.		Preventative / Corrective Maintenance Actions
	3	Sign/plate: tiled, missing, or faded	Y__ N__ Repair or replace Work Order #_____
	4	Excessive or overgrown vegetation blocking access to the basin	Y__ N__ Clear, trim, or prune the vegetation to allow access for inspection and maintenance Work Order #_____

Note:

Follow Up Items (Component No. / Inspection Item No.):

Associated Work Orders: # _____, # _____, # _____, # _____, # _____

Inspector Name

Signature

Date

Report issues to the local authority and mosquito commission as required by local ordinances and regulatory authorities.

File this checklist in the Maintenance Log after performing maintenance.

Preventative Maintenance Record

Corresponding Checklist No. _____
 Component No. _____, Inspection Item No. _____

Work Logs

Activities	Components	Date Completed
Sediment/debris removal Sediment removal should take place when the basin is thoroughly dry.	Pond Area	
	Pond Embankment and Side Slopes	
	Outlet	
Vegetation removal	Pond Area	
	Pond Embankment and Side Slopes	
	Outlet	
	Emergency Spillway	

Vegetation is removed by _____ (type of equipment) with minimum disruption to the remaining vegetation.

All use of fertilizers, pesticides, mechanical treatments, and other means to ensure optimum vegetation health must not compromise the intended purpose of the stormwater management measure. No fertilizer is to be applied.

Debris, sediment, and trash are handled by _____ (contractor name) to disposal site NJDEP Licensed landfill.

Crew member: _____ / _____ **Date:** _____
(name/ signature)

Supervisor: _____ / _____ **Date:** _____

**A permit may be required to discharge when emptying the pond. Contact NJDEP Division of Land Use Regulation before discharging.
 File this Preventative Maintenance Record in the Maintenance Log after performing maintenance**

Corrective Maintenance Record

1. **Work Order #** _____ **Date Issued** _____

2. **Issue to be resolved:**

3. The issue was from **Corresponding Checklist No.** _____, **Component No.** _____ **Inspection Item No.** _____

4. **Required Actions**

Actions	Planned Date	Date Completed

5. **Responsible person(s):**

6. **Special requirements**

- Time of the season or weather condition: _____
- Tools/equipment: _____
- Subcontractor (name or specific type): _____

Approved by _____ / _____ **Date** _____
(name/signature)

Verification of completion by _____ / _____ **Date** _____
(name/signature)

File this Corrective Maintenance Record in the Maintenance Log after performing maintenance

Sand Filter with Infiltration Overview

Functionality

Sand filters with infiltration are stormwater management systems designed to maximize the removal of pollutants from stormwater. They consist of a pre-treatment zone and a treatment zone. The treatment zone includes a sand bed and underlying components. Pollutants are treated through settling, filtration, and adsorption by the sand bed.

Proper care and attention in the long-term maintenance of the stormwater management measure is critically important to the safety and health of the public.

Type of BMP – Dry Basin / Filtration and Infiltration

A sand filter with infiltration is a type of **dry** basin. Dry basins must fully drain within 72 hours of the most recent rainfall. Standing water in excess of 72 hours is a sign of basin failure. It may also contribute to mosquito breeding and other health and safety issues. The design drain time shall be closely monitored to ensure that potential failure is recognized early. A sand filter designed for infiltration does not have an underdrain piping system. The runoff exits the system by infiltrating into the subsoil beneath the sand bed.

A sand filter with infiltration can also be designed for extended detention, in which case it will attenuate peak flows from storms larger than the Water Quality Design Storm.

Basic Design Information Basin #1

Hydrology Design Targets

1. This sand filter is designed with a sand bed permeability rate of 0.5 (min) inches/hour (min) (pre-construction) and 0.5 inches/hour (min) post-construction (tested on (MM) / (DD) / (YYYY)).
2. This sand filter is designed with a subsoil permeability rate of 0.5 inches/hour (min)(pre-construction) and 0.5 inches/hour post-construction (tested on (MM) / (DD) / (YYYY)).
3. The design drain time is 48 hours.
4. The elevation of the seasonal high water table of this basin was observed on 11/12/2018 and it was 5 feet below the basin bottom surface, at EL. 70 feet.
5. This basin will be discharged to the existing drainage system along Meadow Road easterly toward Upper Bear Brook Swamp.

Hydraulic Design Targets

1. Design parameters

	Water Quality Design Storm	2-year storm	10-year storm	100-year storm
Rainfall Depth (inches)	1.25 inch in 2 hours	3.31 inches in 24 hours	5.01 inches In 24 hours	8.33inches In 24 hours
Runoff Volume (acre feet)	0.81	1.25	2.63	5.58
Peak Flow Rate (cfs)	0	2.42	8.23	34.26
Water Surface Elevation (feet)	71.38	72.24	72.87	73.59

2. The emergency spillway is at EL 73.75 feet.

Basin Configuration Targets

1. Pretreatment is provided by Sand Filter Surface Infiltration BMP #04. A perforated riser is not used.
2. Outlet Information:

Outlet Description	Outlet Type	Orifice Size / Weir Length	Invert Elevation
Water Quality Orifice			70.0
Outlet #1	Weir	Weir L=2.25 ft	71.75
Outlet #2	Orifice 12 sq ft	Weir L=12 ft	73.00

3. Sand Layer
 - o The depth of the K4 sand layer shall be 6 inches, which requires a volume of 3,355 cubic feet of sand.
 - o The invert elevation of the sand layer is EL. 70.0 feet.
 - o The sand layer is designed to be checked for permeability every 36 months and replaced if percolation rates are < 0.5 in/hr.
 - o The sand bed is designed to not be covered by topsoil and vegetation.

Critical Maintenance Features

1. No heavy equipment on the basin surface or sand layer.
2. Keep the sand layer surface clean and no accumulation of dead leaves.
3. Grass clippings shall be collected from the basin and properly disposed.
4. Top surface of the sand is to be raked monthly to remove moss, algae and organic debris.
5. The sand must be replaced if percolation rates drop below 0.5 in/hr.

Basic Design Information Basin #2

Hydrology Design Targets

1. This sand filter is designed with a sand bed permeability rate of 0.5 (min) inches/hour (min) (pre-construction) and 0.5 inches/hour (min) post-construction (tested on (MM) / (DD) / (YYYY)).
2. This sand filter is designed with a subsoil permeability rate of 0.5inches/hour (min)(pre-construction) and 0.5 inches/hour post-construction (tested on (MM) / (DD) / (YYYY)).
3. The design drain time is 48 hours.
4. The elevation of the seasonal high water table of this basin was observed on 02/14/2019 and it was 2.5 feet below the basin bottom surface, at EL. 64.5 feet.
5. This basin will be discharged to the existing drainage system under Meadow Road easterly toward a pipe system to basin 5.

Hydraulic Design Targets

1. Design parameters

	Water Quality Design Storm	2-year storm	10-year storm	100-year storm
Rainfall Depth (inches)	1.25 inch in 2 hours	3.31 inches in 24 hours	5.01 inches In 24 hours	8.33inches In 24 hours
Runoff Volume (acre feet)	0.13	0.89	1.57	3.06
Peak Flow Rate (cfs)	2.20	10.25	14.82	26.29
Water Surface Elevation (feet)	69.22	69.59	69.76	70.22

2. The emergency spillway is at EL 72.5 feet.

Basin Configuration Targets

1. Pretreatment is provided by Sand Filter Surface Infiltration BMP #04. A perforated riser is not used.
2. Outlet Information:

Outlet Description	Outlet Type	Orifice Size / Weir Length	Invert Elevation
Water Quality Orifice	1.75 ft Sump		67.00
Outlet #1	Weir	Weir L= 4 ft	69.00
Outlet #2	Orifice 12 sq ft	Weir L=12 ft	71.50

3. Sand Layer
 - o The depth of the K4 sand layer shall be 6 inches, which requires a volume of 2,185 cubic feet of sand.
 - o The invert elevation of the sand layer is EL. 67.0 feet.
 - o The sand layer is designed to be checked for permeability every 36 months and replace if percolation rates are <0.5 in/hr.
 - o The sand bed is designed to not be covered by topsoil and vegetation.

Critical Maintenance Features

1. No heavy equipment on the basin surface or sand layer.
2. Keep the sand layer surface clean and no accumulation of dead leaves.
3. Grass clippings shall be collected from the basin and properly disposed.
4. Top surface of the sand is to be raked monthly to remove moss, algae and organic debris.
5. The sand must be replaced if percolation rates drop below 0.5 in/hr.

Basic Design Information Basin #3

Hydrology Design Targets

1. This sand filter is designed with a sand bed permeability rate of 0.5 (min) inches/hour (min) (pre-construction) and 0.5 inches/hour (min) post-construction (tested on (MM) / (DD) / (YYYY)).
2. This sand filter is designed with a subsoil permeability rate of 0.5inches/hour (min)(pre-construction) and 0.5 inches/hour post-construction (tested on (MM) / (DD) / (YYYY)).
3. The design drain time is 48 hours.
4. The elevation of the seasonal high water table of this basin was observed on 02/14/2019 and it was 5 feet below the basin bottom surface, at EL. 62.0 feet.
5. This basin will be discharged to the existing pipe under Meadow Road and then piped to basin 5.

Hydraulic Design Targets

1. Design parameters

	Water Quality Design Storm	2-year storm	10-year storm	100-year storm
Rainfall Depth (inches)	1.25 inch in 2 hours	3.31 inches in 24 hours	5.01 inches In 24 hours	8.33inches In 24 hours
Runoff Volume (acre feet)	0.04	0.40	0.72	1.44
Peak Flow Rate (cfs)	0.71	4.40	6.87	12.88
Water Surface Elevation (feet)	69.14	69.50	69.67	70.03

2. The emergency spillway is at EL 71.0 feet.

Basin Configuration Targets

1. Pretreatment is provided by Sand Filter Surface Infiltration BMP #04. A perforated riser is not used.
2. Outlet Information:

Outlet Description	Outlet Type	Orifice Size / Weir Length	Invert Elevation
Water Quality Orifice	2.0 ft Sump		67.0
Outlet #1	Weir	Weir L= 4 ft	69.0
Outlet #2	Orifice 12 sq ft	Weir L=12 ft	70.5

3. Sand Layer
 - o The depth of the K4 sand layer shall be 6 inches, which requires a volume of 1,150 cubic feet of sand.
 - o The invert elevation of the sand layer is EL.67.0 feet.
 - o The sand layer is designed to be checked for permeability every 36 months and replace if percolation rates are <0.5 in/hr.
 - o The sand bed is designed to not be covered by topsoil and vegetation.

Critical Maintenance Features

1. No heavy equipment on the basin surface or sand layer.
2. Keep the sand layer surface clean and no accumulation of dead leaves.
3. Grass clippings shall be collected from the basin and properly disposed.
4. Top surface of the sand is to be raked monthly to remove moss, algae and organic debris.
5. The sand must be replaced if percolation rates drop below 0.5 in/hr.

Basic Design Information Basin #4

Hydrology Design Targets

1. This sand filter is designed with a sand bed permeability rate of 0.5 (min) inches/hour (min) (pre-construction) and 0.5 inches/hour (min) post-construction (tested on (MM) / (DD) / (YYYY)).
2. This sand filter is designed with a subsoil permeability rate of 0.5inches/hour (min)(pre-construction) and 0.5 inches/hour post-construction (tested on (MM) / (DD) / (YYYY)).
3. The design drain time is 48 hours.
4. The elevation of the seasonal high water table of this basin was observed on 02/14/2019 and it was 5 feet below the basin bottom surface, at EL. 70 feet.
5. This basin will be discharged to the existing drainage system along Meadow Road easterly toward Upper Bear Brook Swamp.

Hydraulic Design Targets

1. Design parameters

	Water Quality Design Storm	2-year storm	10-year storm	100-year storm
Rainfall Depth (inches)	1.25 inch in 2 hours	3.31 inches in 24 hours	5.01 inches In 24 hours	8.33inches In 24 hours
Runoff Volume (acre feet)	0.36	1.36	2.23	4.06
Peak Flow Rate (cfs)	2.20	12.90	20.20	36.96
Water Surface Elevation (feet)	68.08	68.28	68.59	68.93

2. The emergency spillway is at EL 71.5 feet.

Basin Configuration Targets

1. Pretreatment is provided by Sand Filter Surface Infiltration BMP #04. A perforated riser is not used.
2. Outlet Information:

Outlet Description	Outlet Type	Orifice Size / Weir Length	Invert Elevation
Water Quality Orifice	Circular	4 inch	65.25
Outlet #1	Weir	Weir L= 4 ft	67.25
Outlet #2	Orifice 12 sq ft	Weir L=12 ft	68.50

3. Sand Layer
 - o The depth of the K4 sand layer shall be 6 inches, which requires a volume of 1,325 cubic feet of sand.
 - o The invert elevation of the sand layer is EL. 69.5 feet.
 - o The sand layer is designed to be checked for permeability every 36 months and replace if percolation rates are <0.5 in/hr.
 - o The sand bed is not to be covered by topsoil and vegetation.

Critical Maintenance Features

1. No heavy equipment on the basin surface or sand layer.
2. Keep the sand layer surface clean and no accumulation of dead leaves.
3. Grass clippings shall be collected from the basin and properly disposed.
4. Top surface of the sand is to be raked monthly to remove moss, algae and organic debris.
5. The sand must be replaced if percolation rates drop below 0.5 in/hr.

Visual Aid for Dry Type Stormwater Basin Inspection

(Note: Basins shown here include various types of dry basins, not limited to the category of basin in this field manual.)



Issue: The inlet is not properly drained, assuming it has not rained within 72 hours.

Corrective Action: Clear and remove sediment. Check whether the water table is at or above the bottom of the forebay. Also check the permeability of the underlying soil, if necessary.

Preventative Action: Routine inspections and removal of sediment from the forebay.



Issue: The Inflow pipe is clogged by sediment and vegetation.

Corrective Action: Clear and remove sediment and unwanted vegetation.

Preventative Action: Routine inspection and removal of sediment and unwanted vegetation.



Issue: The Inflow pipe is entirely clogged by sediment and trees.

Corrective Action: Clear and remove sediment and trees.

Preventative Action: Routine inspection & removal of sediment and unwanted vegetation.



Issue: The excessive sediment in inflow pipe (shown above) might be caused by a blockage of flow to the basin due to excessive vegetation and overgrown trees.

Corrective Action: Clear and remove trees and vegetation. If necessary, re-grade the bottom slope to ensure the flow properly spreads over the basin bottom.

Preventative Action: Routine inspection and removal of sediment and unwanted vegetation.



Issue: Eroded inflow apron.

Corrective Action: Repair apron.

Preventative Action: Routine inspection and rehabilitation, if necessary.



Issue: The vegetation loss and the blackish soil may indicate frequent inundation.

Corrective Action: Check the permeability rate of the soil and the water table elevation. Replace the soil if necessary.

Preventative Action: Routine inspection and tilling/aeration, if necessary.



Issue: The low flow channel has excessive accumulation of sediment and debris. The outflow orifice is clogged by a trash bag and debris. Note that there is no trash rack installed.

Corrective Action: Check the permeability rate of the soil and the water table elevation. Replace the soil if necessary.

Preventative Action: Routine inspection and cleaning.



Issue: Trash rack is damaged.

Corrective Action: Repair the trash rack.

Preventative Action: Routine inspection, especially after large storm events. Tighten any loose bolts and repair structural flaws.



A well maintained detention basin

Reference Documents

Documents attached to this field manual should include the following:

- As-built Drawings with Drainage Plans (when they become available)
- Soil Boring Logs
- Permeability Test – Sand Layer
- Permeability Test – Subsoil (Pre-construction)

Inspection Checklist / Maintenance Actions Sand Filter with Infiltration

Checklist (circle one): Quarterly / Annual / Monthly / Special Event Inspection

Checklist No. _____ **Inspection Date:** _____

Date of most recent rain event: _____

Rain Condition (circle one):
Drizzle / Shower / Downpour / Other _____

Ground Condition (circle one):
Dry / Moist / Ponding / Submerged / Snow accumulation

The inspection items and preventative/corrective maintenance actions listed below represent general requirements. The design engineer and/or responsible party shall adjust the items and actions to better meet the conditions of the site, the specific design targets, and the requirements of regulatory authorities.

Component No. Component Name	For Inspector		For Maintenance Crew
	Inspection Item and Inspection Item No.	Result	Preventative / Corrective Maintenance Actions
A Pretreatment Forebay Sump	1	Scouring or erosion is present at inlet structure and/or riprap apron	Y___ N___ Check the flow diversion device before the inlet pipe and whether the bypass flow channel is clogged
	2	Clogged pipes or excessive sediment in the forebay	Y___ N___ Remove sediment or debris
	3	Damaged outlet structure (e.g., cracking, subsidence, spalling, erosion, or deterioration)	Y___ N___ Repair or replace the outlet structure Work Order # _____
B Sand Bed	1	The observed drain time is approximately _____ hours.	Y___ N___ Recheck to determine if there is standing water after 72 hours Remove any sediment buildup If standing water is present longer than 5 days, report to mosquito commission. Determine percolation rate and replace the sand layer if it is below 0.5"/hr (volume of replacement sand is specified in the Basin Configuration Targets in the Basic Design Information Section of this Manual) Work Order # _____
	2	Excessive sediment, silt, or trash accumulation on basin bed	Y___ N___ Check for source upstream. Remove silt, sediment, and trash

Component No. Component Name	For Inspector		For Maintenance Crew
	Inspection Item and Inspection Item No.	Result	Preventative / Corrective Maintenance Actions
	3	Erosion or channelization is present	Y__ N__ Check whether the flow bypass or diversion device is clogged Re-grade the infiltration bed Work Order # _____
	4	Animal burrows/rodents are present	Y__ N__ Pest control Work Order # _____
	5	Uneven bed	Y__ N__ Use light equipment to resurface the bed Work Order # _____
	6	Evidence of sinkholes or subsidence	Y__ N__ Monitor for sinkhole development
C Vegetation	1	Large spot(s) showing bare soil	Y__ N__ Vegetative cover must be maintained at 85%. Revegetate the entire basin if 50% or more vegetation has been lost Check with landscape Architect for guidance Work Order # _____
	2	Overgrown vegetation	Y__ N__ Mow/trim the vegetation Work Order # _____
	3	Tree growth in the basin	Y__ N__ Clear, trim, or prune the trees according to the original Vegetation or Landscaping Plan Inspect to determine if the tree roots caused any structural damage Work Order # _____

Component No. Component Name	For Inspector		For Maintenance Crew
	Inspection Item and Inspection Item No.	Result	Preventative / Corrective Maintenance Actions
D Basin Embankment and Side Slopes	1	Signs of erosion, soil slide or bulges, seeps and wet spots, loss of vegetation, or erosion on the basin slope	Y___ N___ Check for excessive overland runoff flow through the embankment. Check for any sink hole development Direct the overland runoff to the forebay or pretreatment area Restabilize the bank Work Order # _____
E Outlet	1	Trash or debris accumulation more than 20%	Y___ N___ Clean and remove Determine source of trash and address to reduce future maintenance costs or basin failure
	2	Trash rack is damaged or rusted greater than 50%	Y___ N___ Repair or replace trash rack Work Order # _____
	3	Trash rack is bent, loose, or missing parts	Y___ N___ Repair or replace component Work Order # _____
	4	Outlet components (e.g., orifice plates or weir plate) skewed, misaligned, or missing	Y___ N___ Restabilize the discharge riprap apron Work Order # _____
	5	Discharge pipe apron is eroded or scoured	Y___ N___ Check downstream for blockage
5	Standing water is present in the outlet structure longer than 72 hours	Y___ N___	

Component No. Component Name	For Inspector		For Maintenance Crew
	Inspection Item and Inspection Item No.	Result	Preventative / Corrective Maintenance Actions
F Emergency Spillway	1	Trees or excessive vegetation present	Y__ N__ Remove trees and roots, and restore berms if necessary Work Order #_____
	2	Damaged structure	Y__ N__ Repair Work Order #_____
G Miscellaneous	1	Fence: broken or eroded parts	Y__ N__ Repair or replace Work Order #_____
	2	Gate: missing gate or lock	Y__ N__ Repair or replace Work Order #_____
	3	Sign/plate: missing, faded or defaced.	Y__ N__ Repair or replace Work Order #_____
	4	Excessive or overgrown vegetation blocking access to the basin	Y__ N__ Clear, trim, or prune the vegetation to allow access for inspection and maintenance Work Order #_____

Notes:

Follow Up Items (Component No. / Inspection Item No.):

Associated Work Orders: # _____, # _____, # _____, # _____, # _____

Inspector Name	Signature	Date
-----------------------	------------------	-------------

Report issues to the local authority and mosquito commission as required by local ordinances and regulatory authorities.

File this checklist in the Maintenance Log after performing maintenance.

Preventative Maintenance Record

Corresponding Checklist No. _____
 Component No. _____, Inspection Item No. _____

Work Logs

Activities	Components	Date Completed
Sediment/debris removal Sediment removal should take place when the basin is thoroughly dry.	A – Pretreatment Forebay Sump	
	B – Sand Bed	
	D – Basin Embankment and Side Slopes	
	E – Outlet	
Vegetation removal	A – Pretreatment Forebay Sump	
	B – Sand Bed	
	D – Basin Embankment and Side Slopes	
	E – Outlet	
	F – Emergency Spillway	

Vegetation is removed by _____ (type of equipment) with minimum disruption to the remaining vegetation.

All use of fertilizers, pesticides, mechanical treatments, and other means to ensure optimum vegetation health must not compromise the intended purpose of the stormwater management measure. The fertilizer applied is _____ (type), and _____ (quantity per usage) is applied _____ (frequency of use).

Debris, sediment, and trash are handled by landscape contractor: _____ to disposal site NJDEP Licensed landfill.

Replacement of the sand layer will occur as required (see Basin Configuration Targets above). The next scheduled percolation test date is _____ (date).

Crew member: _____ / _____ **Date:** _____
(name/ signature)

Supervisor: _____ / _____ **Date:** _____
(name/ signature)

File this Preventative Maintenance Record in the Maintenance Log after performing maintenance

Corrective Maintenance Record

1. **Work Order #** _____ **Date Issued** _____

2. **Issue to be resolved:**

3. The issue was from **Corresponding Checklist** _____

Component No. _____, **Inspection Item No.** _____

4. **Required Actions**

Actions	Planned Date	Date Completed

5. **Responsible person(s):**

6. **Special requirements**

- Time of the season or weather condition: _____
- Tools/equipment: _____
- Subcontractor (name or specific type): _____

Approved by _____ / _____ **Date** _____
(name/signature)

Verification of completion by _____ / _____ **Date** _____
(name/signature)

File this Corrective Maintenance Record in the Maintenance Log after performing maintenance.

Grass Swale Overview

Functionality

A grass swale is a stable, parabolic or trapezoidal channel that is lined with turf; it is used to improve water quality and convey stormwater runoff. Grass swales do not rely on the permeability of the underlying soil for pollutant removal; instead, pollutants are removed by settling and filtration through the grass. The maximum total suspended solids (TSS) removal rate is 50%.

Low velocities and shallow depths of runoff generated from the Water Quality Design Storm allow for particulate settling; while at the same time, the blades of grass in the swale filter the suspended solids. Because these pollutant removal mechanisms do not rely on infiltration into the subsoil, soil permeability is not a design consideration. For larger storm events, the swale can be designed to convey stormwater downstream.

Proper care and attention in the long-term maintenance of the stormwater management measure is critically important to the safety and health of the public.

Type of BMP – Dry Stormwater Management Measure

A grass swale is a type of **dry** stormwater management measure. Dry stormwater management measures must fully drain within 72 hours of the most recent rainfall. Standing water in excess of 72 hours is a sign of failure. It may also contribute to mosquito breeding and other health and safety issues. The design drain time shall be closely monitored to ensure that potential failure is recognized early. For the design drain time, please see **Hydrology Design Targets** in the **Basic Design Information** section.

Basic Design Information

Hydrology Design Targets

1. The maximum design storm is 10 year storm, which corresponds to 5.01 inches of rain in 24 hours.
2. The design drain time is < 6 hours.
3. The design total suspended solids removal rate is %.
4. The swale discharge to a wetland at the Meadow Road culvert which is at the elevation of the seasonal high water table approximately elevation 66.

Hydraulic Design Targets

1. The maximum design velocity in the grass swale is < two feet per second.
2. The outlet structure is the culvert under Meadow Road. The invert elevation of the outlet is 66.34 feet at existing 24"x 38" HERCP.

Configuration Targets

1. The longitude slope of the grass swale is 0.5 %.
2. The side slope is 3:1 max_.
3. The length of the grass swale is 700 feet.
4. The swale shape is parabolic, with a bottom width of 4 feet.
5. The grass height must be established and maintained between four and six inches.

Critical Maintenance Features

1. Grass clippings shall be collected and properly disposed.
2. Check any eroded or channelized area, repair it immediately. Find the cause of erosion or channelization and find solution to prevent it.
3. Remove dead vegetation to keep grass swale aesthetic.

Wetland Disturbance Notice: Maintenance of this BMP may disturb a wetland area. Contact NJDEP Division of Land Use Regulation for guidance and any required permit(s) before performing maintenance.

Visual Aid for Vegetative Filter Strip/Grass Swale Maintenance



Issue: The inlet to the swale is clogged by sediment and leaves.

Corrective Action: Clear and remove sediment and leaves.

Preventative Action: Preventative Action: Routine inspection and removal of sediment and debris.



Issue: The sediment and loss of vegetation indicates that the swale is not well drained.

Corrective Action: Re-grade the swale to ensure proper drainage. A steeper slope may be required but must ensure that all criteria are met for the required TSS removal rate (see the Basic Design Information section). Revegetate the grass swale.

Preventative Action: Routine inspection and monitoring of the drain time.



- Issue:** The loss of vegetation on the side slope and bottom likely indicate an erosion problem.
- Corrective Action:** Re-grade the side slope of the swale to prevent erosion and revegetate the swale.
- Preventative Action:** Routine inspection and reseeding the soil before the erosion becomes severe.



- Issue:** Overgrown and dead vegetation in swale.
- Corrective Action:** Remove dead and unwanted vegetation.
- Preventative Action:** Routine inspection and mowing of the swale.



Courtesy of NJDOT

Issue: Ponding in swale. Vegetation loss due to long term inundation.

Corrective Action: Clear the outlet structure, clear the sediment in the outlet, and re-grade the swale to allow for better drainage.

Preventative Action: Routine inspection and cleaning.



Courtesy of NJDOT

Issue: The left slope of the swale is eroded by runoff from the roadside.

Corrective Action: Re-grade the slope or provide energy dissipation to reduce the flow velocity and alleviate the erosion. Revegetate the slope.

Preventative Action: Routine inspection and reseeding of bare soil.

Inspection Checklist / Maintenance Actions Grass Swale

Checklist (circle one): Quarterly / Annual / Monthly / Special Event Inspection

Checklist No. _____ **Inspection Date:** _____

Date of most recent rain event: _____

Rain Condition (circle one):
Drizzle / Shower / Downpour / Other _____

Ground Condition (circle one):
Dry / Moist / Ponding / Submerged / Snow accumulation

The inspection items and preventative/corrective maintenance actions listed below represent general requirements. The design engineer and/or responsible party shall adjust the items and actions to better meet the conditions of the site, the specific design targets, and the requirements of regulatory authorities.

Component No. Component Name	For Inspector		For Maintenance Crew
	Inspection Item and Inspection Item No.	Result	Preventative / Corrective Maintenance Actions
Grass Swale Area	1	Standing water is present after the design drain time The observed drain time is approximately _____ hours.	Y__ N__ Remove excessive sediment and debris Check whether the outlet is clogged (if applicable) Re-grade the slope to allow the swale to drain within the design drain time. Revegetate if necessary If standing water is present longer than 5 days, report to mosquito commission. Work Order # _____
	2	Excessive sediment, silt, or trash accumulation in swale	Y__ N__ Remove sediment, silt, and trash
	3	Erosion or channelization is present	Y__ N__ Check whether the flow is concentrated. If so, re-grade the swale to ensure smoother flow. Work Order # _____
	4	Animal burrows/rodents are present	Y__ N__ Pest control Work Order # _____
	5	Sediment and/or debris on the edge between the contributing drainage area and the grass swale	Y__ N__ Remove sediment and debris

Component No. Component Name	For Inspector		For Maintenance Crew
	Inspection Item and Inspection Item No.	Result	Preventative / Corrective Maintenance Actions
Vegetation	1	Large spot(s) showing bare soil	Y__ N__ Vegetative cover must be maintained at 85%. Revegetate the entire swale if 50% or more vegetation has been lost. Check Landscaping plan for guidance (if available) Work Order # _____
	2	Excessive tree canopy shading the vegetated area inhibiting the growth of vegetation	Y__ N__ Prune and trim the trees
	3	Grass is overgrown and taller than the design height (_____ inches)	Y__ N__ Mow the grass to the design height
	4	Grass clippings are not collected and removed	Y__ N__ Remove the grass clippings
Outlet	1	Trash or debris accumulation more than 20%	Y__ N__ Clean and remove Determine source of trash and address to reduce future maintenance costs or BMP failure
	2	Discharge pipe apron is eroded or scoured	Y__ N__ Restabilize the discharge riprap apron Work Order # _____

Note:

Follow Up Items: (Component No. / Checklist No.):

Associated Work Orders: # _____, # _____, # _____, # _____, # _____

Inspector Name

Signature

Date

Report issues to the local authority and mosquito commission as required by local ordinances and regulatory authorities.

File this checklist in the Maintenance Log after performing maintenance.

Preventative Maintenance Record

Corresponding Checklist No. _____
 Component No. _____, Inspection Item No. _____

Work Logs

Activities	Components	Date Completed
Sediment/debris removal Sediment removal should take place when the ground is thoroughly dry.	Grass Swale Area	
	Outlet	
Vegetation removal	Vegetation	

Vegetation is removed by _____ (type of equipment) with minimum disruption to the remaining vegetation.

All use of fertilizers, pesticides, mechanical treatments, and other means to ensure optimum vegetation health must not compromise the intended purpose of the stormwater management measure. No fertilizer is to be applied.

Debris, sediment, and trash are handled by _____ (contractor name) to disposal at NJDEP licensed landfill.

Crew member: _____ / _____ **Date:** _____
(name/ signature)

Supervisor: _____ / _____ **Date:** _____
(name/ signature)

File this Preventative Maintenance Record in the Maintenance Log after performing maintenance.

Corrective Maintenance Record

1. **Work Order #** _____ **Date Issued** _____

2. **Issue to be resolved:**

3. The issue was from **Corresponding Checklist No.** _____, **Component**

4. **No.** _____, **Inspection Item No** _____

5. **Required Actions**

Actions	Planned Date	Date Completed

6. **Responsible person(s):**

—

7. **Special requirements**

- Time of the season or weather condition: _____
- Tools/equipment: _____
- Subcontractor (name or specific type): _____

Approved by _____ / _____ **Date** _____
(name/signature)

Verification of completion by _____ / _____ **Date** _____
(name/signature)

File this Corrective Maintenance Record in the Maintenance Log after performing maintenance.

Stormwater Management Measures Maintenance Plan

Maintenance Logs and Inspection Records

Inspection Checklist Log

1. **The responsible party shall report issues to the local authority and mosquito commission as required by local ordinances and regulatory authorities.**
2. The maintenance crew should fill out the checklist in the field manual when performing each inspection/maintenance task.
3. After the maintenance task is performed, the checklist should be filed in the Maintenance Plan and recorded in the log below.

Cycle of Inspection	Stormwater Management Measure No.	Checklist No.	Date(s) of Inspection
(1st Quarter)	Basin #1		
(2nd Quarter)			
(3rd Quarter)			
(4th Quarter)			
(Unscheduled Inspection; after 1" rain)			
(1st Quarter)			
(2nd Quarter)			
(3rd Quarter)			
(4th Quarter)			
(Unscheduled Inspection; after 1" rain)			

Inspection Checklist Log

1. **The responsible party shall report issues to the local authority and mosquito commission as required by local ordinances and regulatory authorities.**
2. The maintenance crew should fill out the checklist in the field manual when performing each inspection/maintenance task.
3. After the maintenance task is performed, the checklist should be filed in the Maintenance Plan and recorded in the log below.

Cycle of Inspection	Stormwater Management Measure No.	Checklist No.	Date(s) of Inspection
(1st Quarter)	Basin #1		
(2nd Quarter)			
(3rd Quarter)			
(4th Quarter)			
(Unscheduled Inspection; after 1" rain)			
(1st Quarter)			
(2nd Quarter)			
(3rd Quarter)			
(4th Quarter)			
(Unscheduled Inspection; after 1" rain)			

Inspection Checklist Log

1. **The responsible party shall report issues to the local authority and mosquito commission as required by local ordinances and regulatory authorities.**
2. The maintenance crew should fill out the checklist in the field manual when performing each inspection/maintenance task.
3. After the maintenance task is performed, the checklist should be filed in the Maintenance Plan and recorded in the log below.

Cycle of Inspection	Stormwater Management Measure No.	Checklist No.	Date(s) of Inspection
(1st Quarter)	Basin #2		
(2nd Quarter)			
(3rd Quarter)			
(4th Quarter)			
(Unscheduled Inspection; after 1" rain)			
(1st Quarter)			
(2nd Quarter)			
(3rd Quarter)			
(4th Quarter)			
(Unscheduled Inspection; after 1" rain)			

Inspection Checklist Log

1. **The responsible party shall report issues to the local authority and mosquito commission as required by local ordinances and regulatory authorities.**
2. The maintenance crew should fill out the checklist in the field manual when performing each inspection/maintenance task.
3. After the maintenance task is performed, the checklist should be filed in the Maintenance Plan and recorded in the log below.

Cycle of Inspection	Stormwater Management Measure No.	Checklist No.	Date(s) of Inspection
(1st Quarter)	Basin #2		
(2nd Quarter)			
(3rd Quarter)			
(4th Quarter)			
(Unscheduled Inspection; after 1" rain)			
(1st Quarter)			
(2nd Quarter)			
(3rd Quarter)			
(4th Quarter)			
(Unscheduled Inspection; after 1" rain)			

Inspection Checklist Log

1. **The responsible party shall report issues to the local authority and mosquito commission as required by local ordinances and regulatory authorities.**
2. The maintenance crew should fill out the checklist in the field manual when performing each inspection/maintenance task.
3. After the maintenance task is performed, the checklist should be filed in the Maintenance Plan and recorded in the log below.

Cycle of Inspection	Stormwater Management Measure No.	Checklist No.	Date(s) of Inspection
(1st Quarter)	Basin #3		
(2nd Quarter)			
(3rd Quarter)			
(4th Quarter)			
(Unscheduled Inspection; after 1" rain)			
(1st Quarter)			
(2nd Quarter)			
(3rd Quarter)			
(4th Quarter)			
(Unscheduled Inspection; after 1" rain)			

Inspection Checklist Log

1. **The responsible party shall report issues to the local authority and mosquito commission as required by local ordinances and regulatory authorities.**
2. The maintenance crew should fill out the checklist in the field manual when performing each inspection/maintenance task.
3. After the maintenance task is performed, the checklist should be filed in the Maintenance Plan and recorded in the log below.

Cycle of Inspection	Stormwater Management Measure No.	Checklist No.	Date(s) of Inspection
(1st Quarter)	Basin #3		
(2nd Quarter)			
(3rd Quarter)			
(4th Quarter)			
(Unscheduled Inspection; after 1" rain)			
(1st Quarter)			
(2nd Quarter)			
(3rd Quarter)			
(4th Quarter)			
(Unscheduled Inspection; after 1" rain)			

Inspection Checklist Log

1. **The responsible party shall report issues to the local authority and mosquito commission as required by local ordinances and regulatory authorities.**
2. The maintenance crew should fill out the checklist in the field manual when performing each inspection/maintenance task.
3. After the maintenance task is performed, the checklist should be filed in the Maintenance Plan and recorded in the log below.

Cycle of Inspection	Stormwater Management Measure No.	Checklist No.	Date(s) of Inspection
(1st Quarter)	Basin #4		
(2nd Quarter)			
(3rd Quarter)			
(4th Quarter)			
(Unscheduled Inspection; after 1" rain)			
(1st Quarter)			
(2nd Quarter)			
(3rd Quarter)			
(4th Quarter)			
(Unscheduled Inspection; after 1" rain)			

Inspection Checklist Log

1. **The responsible party shall report issues to the local authority and mosquito commission as required by local ordinances and regulatory authorities.**
2. The maintenance crew should fill out the checklist in the field manual when performing each inspection/maintenance task.
3. After the maintenance task is performed, the checklist should be filed in the Maintenance Plan and recorded in the log below.

Cycle of Inspection	Stormwater Management Measure No.	Checklist No.	Date(s) of Inspection
(1st Quarter)	Basin #4		
(2nd Quarter)			
(3rd Quarter)			
(4th Quarter)			
(Unscheduled Inspection; after 1" rain)			
(1st Quarter)			
(2nd Quarter)			
(3rd Quarter)			
(4th Quarter)			
(Unscheduled Inspection; after 1" rain)			

Inspection Checklist Log

1. **The responsible party shall report issues to the local authority and mosquito commission as required by local ordinances and regulatory authorities.**
2. The maintenance crew should fill out the checklist in the field manual when performing each inspection/maintenance task.
3. After the maintenance task is performed, the checklist should be filed in the Maintenance Plan and recorded in the log below.

Cycle of Inspection	Stormwater Management Measure No.	Checklist No.	Date(s) of Inspection
(1st Quarter)	Basin #5		
(2nd Quarter)			
(3rd Quarter)			
(4th Quarter)			
(Unscheduled Inspection; after 1" rain)			
(1st Quarter)			
(2nd Quarter)			
(3rd Quarter)			
(4th Quarter)			
(Unscheduled Inspection; after 1" rain)			

Inspection Checklist Log

1. **The responsible party shall report issues to the local authority and mosquito commission as required by local ordinances and regulatory authorities.**
2. The maintenance crew should fill out the checklist in the field manual when performing each inspection/maintenance task.
3. After the maintenance task is performed, the checklist should be filed in the Maintenance Plan and recorded in the log below.

Cycle of Inspection	Stormwater Management Measure No.	Checklist No.	Date(s) of Inspection
(1st Quarter)	Basin #5		
(2nd Quarter)			
(3rd Quarter)			
(4th Quarter)			
(Unscheduled Inspection; after 1" rain)			
(1st Quarter)			
(2nd Quarter)			
(3rd Quarter)			
(4th Quarter)			
(Unscheduled Inspection; after 1" rain)			

Inspection Checklist Log

1. **The responsible party shall report issues to the local authority and mosquito commission as required by local ordinances and regulatory authorities.**
2. The maintenance crew should fill out the checklist in the field manual when performing each inspection/maintenance task.
3. After the maintenance task is performed, the checklist should be filed in the Maintenance Plan and recorded in the log below.

Cycle of Inspection	Stormwater Management Measure No.	Checklist No.	Date(s) of Inspection
(1st Quarter)	Swale		
(2nd Quarter)			
(3rd Quarter)			
(4th Quarter)			
(Unscheduled Inspection; after 1" rain)			
(1st Quarter)			
(2nd Quarter)			
(3rd Quarter)			
(4th Quarter)			
(Unscheduled Inspection; after 1" rain)			

Inspection Checklist Log

1. **The responsible party shall report issues to the local authority and mosquito commission as required by local ordinances and regulatory authorities.**
2. The maintenance crew should fill out the checklist in the field manual when performing each inspection/maintenance task.
3. After the maintenance task is performed, the checklist should be filed in the Maintenance Plan and recorded in the log below.

Cycle of Inspection	Stormwater Management Measure No.	Checklist No.	Date(s) of Inspection
(1st Quarter)	Swale		
(2nd Quarter)			
(3rd Quarter)			
(4th Quarter)			
(Unscheduled Inspection; after 1" rain)			
(1st Quarter)			
(2nd Quarter)			
(3rd Quarter)			
(4th Quarter)			
(Unscheduled Inspection; after 1" rain)			

Preventative Maintenance Log

Maintenance Schedule	Stormwater Management Measure No.	Preventative Maintenance Record No.	Date(s) of Maintenance
(1st Quarter)			
(2nd Quarter)			
(3rd Quarter)			
(4th Quarter)			
(Unscheduled Maintenance work; after 1" rain)			
(1st Quarter)			
(2nd Quarter)			
(3rd Quarter)			
(4th Quarter)			
(Unscheduled Maintenance work; after 1" rain)			

Preventative Maintenance Log

Maintenance Schedule	Stormwater Management Measure No.	Preventative Maintenance Record No.	Date(s) of Maintenance
(1st Quarter)			
(2nd Quarter)			
(3rd Quarter)			
(4th Quarter)			
(Unscheduled Maintenance work; after 1" rain)			
(1st Quarter)			
(2nd Quarter)			
(3rd Quarter)			
(4th Quarter)			
(Unscheduled Maintenance work; after 1" rain)			

Preventative Maintenance Log

Maintenance Schedule	Stormwater Management Measure No.	Preventative Maintenance Record No.	Date(s) of Maintenance
(1st Quarter)			
(2nd Quarter)			
(3rd Quarter)			
(4th Quarter)			
(Unscheduled Maintenance work; after 1" rain)			
(1st Quarter)			
(2nd Quarter)			
(3rd Quarter)			
(4th Quarter)			
(Unscheduled Maintenance work; after 1" rain)			

Corrective Maintenance Log

Maintenance Schedule	Stormwater Management Measure No.	Corrective Maintenance Record No.	Date(s) of Maintenance
(1st Quarter)			
(2nd Quarter)			
(3rd Quarter)			
(4th Quarter)			
(Unscheduled Maintenance work; after 1" rain)			
(1st Quarter)			
(2nd Quarter)			
(3rd Quarter)			
(4th Quarter)			
(Unscheduled Maintenance work; after 1" rain)			

Corrective Maintenance Log

Maintenance Schedule	Stormwater Management Measure No.	Corrective Maintenance Record No.	Date(s) of Maintenance
(1st Quarter)			
(2nd Quarter)			
(3rd Quarter)			
(4th Quarter)			
(Unscheduled Maintenance work; after 1" rain)			
(1st Quarter)			
(2nd Quarter)			
(3rd Quarter)			
(4th Quarter)			
(Unscheduled Maintenance work; after 1" rain)			

Attach the Inspection Checklist after each Inspection

**Attach the Preventative Maintenance Record after
each maintenance task performed**

**Attach the Corrective Maintenance Record after each
maintenance task performed**