CIVIL ENGINEERING
ENVIRONMENTAL
SURVEYING
LANDSCAPE ARCHITECTURE
GEOTECHNICAL

STORMWATER MANAGEMENT MAINTENANCE PLAN

Delaware Avenue
Subdivision
Long Hill Township,
Morris County, New Jersey

Prepared For:
Mario Parisi Jr.
8 Lower Overlook Drive
Gillette, New Jersey 07933

November 30, 2017
Last Revised January 31, 2019

Christopher Nusser
Professional Engineer
N.J. P.E. No. 24GE049025

E&LP

140 West Main Street | High Bridge, NJ 08829
T: 908.238.0544 F: 908.238.9572

619 Lake Avenue | 3rd Floor | Asbury Park, NJ 08542
T: 609.454.3433

399 Market Street | Suite 360 | Philadelphia, PA 19106
T: 215.330.4113

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1. STORMWATER MANAGEMENT MAINTENANCE CERTIFICATION

In accordance with N.J.A.C. section 7:8-5.8, a responsible agent for the maintenance of all stormwater management measures implemented into the site design shall be selected. For the site identified as Block 13302, Lot 16.01, is located in Long Hill Township, Morris County, New Jersey, that responsible person shall be:

Name: __Mario Parisi Jr._

Affiliation: _____Owner / Developer_____

Address: _____8 Lower Overlook Drive_____
_____Gillette, New Jersey 07933_____

Phone Number: __(973) 714-2289_____

- Note that responsibility will be transferred to an HOA upon completion of construction.

This person/entity will be required to abide by the requirements set forth in the Stormwater Management Maintenance Plan prepared by Engineering & Land Planning Associates, Inc., in support of the Minor Subdivision Plan application. The above person will also be required to adhere to the requirements described in N.J.A.C. Section 7:8-5.8 listed below.

(e) Preventative and corrective maintenance shall be performed to maintain the function of the stormwater management measure, including repairs or replacement to the structure; removal of sediment, debris, or trash; restoration of eroded areas; snow and ice removal; restoration of vegetation; and repair or replacement of non-vegetated linings.

(f) The person responsible for maintenance identified under (b) above shall maintain a detailed log of all preventative and corrective maintenance procedures for the structural stormwater management measures incorporated into the design of the development, including a record of all inspections and copies of all maintenance logs (or related work orders).

(g) The person responsible for maintenance identified above shall evaluate the effectiveness of the maintenance plan at least once per year and adjust the plan as needed.

(h) The person responsible for maintenance identified above shall retain and make available, upon request by any public entity with administrative, health, environmental or safety authority over the site, the maintenance plan and the documentation required by (f) and (g) above.

_____ _____

Signature of Responsible Person Date

_____

Title / Position

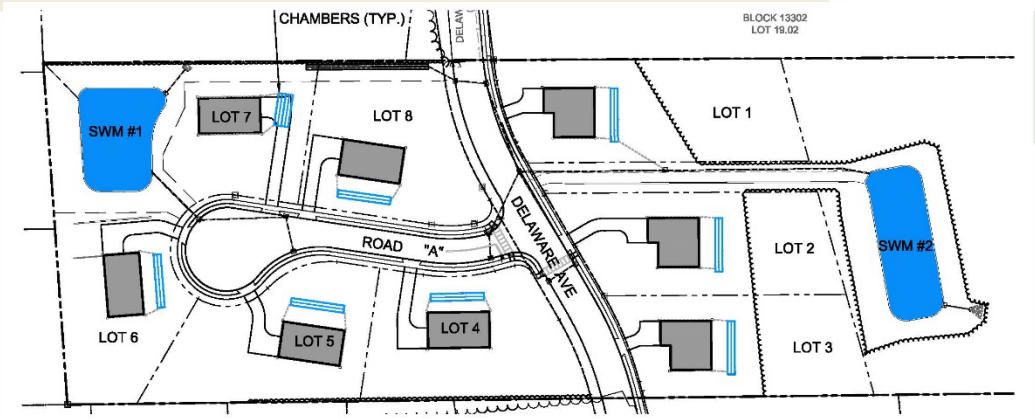
2. MAINTENANCE PLAN

2.1 Introduction

Engineering & Land Planning Associates, Inc. has prepared this Stormwater Management Report on behalf of Mario Parisi Jr., to document the maintenance requirements and procedures associated with stormwater management system designed for the proposed subdivision along Delaware Avenue within Long Hill Township, Morris County.

It has been established that regular and thorough maintenance is necessary for storm water management measures to perform effectively and reliably. It has also been demonstrated that failure to perform such maintenance can lead to diminished performance, deterioration, and failure, in addition to a range of health and safety problems including mosquito breeding, vermin, and the potential for drowning. In accordance with NJDEP regulations a Storm Water Management Maintenance Plan has been established for this site in order to maintain the performance and efficiency of the subsurface stone detention system, and associated structures.

2.2 List of Stormwater Management Measures



Type of Stormwater Management Measure	BMP No.	Location Description
Infiltration Basin	SWM #1	Northeast corner of subject property.
Infiltration Basin	SWM #2	South boundary of proposed lots 1,2, and 3.
Stormwater Chambers	Chambers #1- 8	Each Individual proposed residential lot #1 -8

Hydrology Design Targets:

SWM-1

Design storm: 100 year storm.
1. The design drain time is 48 hours.
2. The elevation of the seasonal high water table of this basin was observed on 11/01/2016 at EL. 251.33 feet.
3. This basin will be discharged towards the eastern property boundary.

SWM-2

Design storm: 100 year storm.
1. The design drain time is 48 hours.
2. The elevation of the seasonal high water table of this basin was observed on 11/01/2016 at EL. 224.50 feet.
3. This basin will be discharged towards the southern forest and wetlands.

STORMWATER CHAMBERS 1-8

Design storm: 100 year storm.
1. The design drain time is 4 hours.
2. The elevations of the seasonal high water table were taken from various soil logs on the property (see Grading Plan).
3. The chambers will be discharged into their respective drainage areas through direct connection to stormsewers or discharge onto rip rap aprons.

Hydraulic Design Targets:

SWM-1

Design storm: 100 year storm.
Design Purposes:
- Water quantity
- 1.25 inches in 2 hours
- 2-year storm 3.42 inches
- 10-year storm 5.17 inches
- 100-year storm 8.58 inches
- Depth: 2.75 ft.

SWM-2

Design storm: 100 year storm.
Design Purposes:
- Water quantity
- 1.25 inches in 2 hours
- 2-year storm 3.42 inches
- 10-year storm 5.17 inches
- 100-year storm 8.58 inches
- Depth: 3.60 ft.

STORMWATER CHAMBERS 1-8

Design storm: 100 year storm.
Design Purposes:
- Water quantity
- 1.25 inches in 2 hours
- 2-year storm 3.42 inches
- 10-year storm 5.17 inches
- 100-year storm 8.58 inches
- Depth: 3.04 ft.

2.3 Description of Stormwater Management Measures

The stormwater design for this project consists of the infiltration basins and stormwater chambers designed for stormwater volume and rate control and water quality treatment.

The infiltration basin systems are located in two locations to collect the majority of the proposed runoff of the site, detain and infiltrate the water quality storm. Each system has an outlet control structure associated with it that releases stored runoff at a reduced rate via a small diameter orifice and weir wall.

The stormwater chamber systems are located at each proposed residential lot, and are designed to collect water from the roof of each proposed residence, detain and infiltrate it. Each system has an overflow pipe incase of extreme storm event.

2.4 Maintenance Procedures

As per N.J.A.C. 7:8-5.8(b) & (e), preventative and corrective maintenance shall be performed to maintain the function of the stormwater management measure, including, but not limited to, repairs or replacement to the structure; removal of sediment, debris, or trash; restoration of eroded areas; snow and ice removal; fence repair or replacement; restoration of vegetation; and repair or replacement of non-vegetated linings.

The following maintenance procedures shall be utilized to maintain the functionality and reliability of the storm water management system according to the schedules indicated:

Stormwater Chambers:

- Quarterly (and after major storms in excess of 1 inch of rainfall): Inspect inflow points, cleanouts, stone storage interior, and structural integrity. Trash and debris should be removed immediately as required.
- Annually: Inspect overflow for evidence of scour and erosion, repair as necessary. Inspect for unwanted vegetative growth. Inspect all structural components for cracking, subsidence, spalling, erosion, and deterioration. Make necessary repairs or corrective action. Inspect discharge location (overflow) and ensure stability of grate and remove trash/debris.

- Underground Detention System Draining The maximum 'allotted time' for a detention system to drain is 72 hours. If at any time the stone storage systems fail to drain within the 'allotted time', immediate corrective measures shall be employed.

Roof Leader Drain Collection System:

- Semi-Annually: Inspect each roof leader drain to confirm proper operation during storm conditions; check for clogging

Infiltration Basins:

- During the two-year guarantee period after construction:
  - Inspect the basin after each runoff event and on a weekly basis. All preventative and remedial maintenance work (clean out, repair, replacement, re-grading, re-seeding, re-mulching, and re-netting) must be performed immediately. If the basin fails to perform as expected, replacement BMPs, or modifications of the installed basin is required. A written report documenting inspections and repairs must be delivered to the responsible party for the maintenance of the feature.
  - The basin and all onsite plantings shall be irrigated.

- Monthly: Trim grass or vegetation to maintain neat and orderly appearance. Inspect for unwanted tree growth annually at a minimum. Inspect basin bottom and remove sediment and debris as required.

- Quarterly (or after major storm in excess of 1 inch of rainfall) Inspect all basin components for clogging and excessive debris and sediment accumulation. Such components may include bottoms, trash racks, low flow channels, outlet structures, riprap or gabion aprons, and inlets. Sediment removal should take place when the basin is thoroughly dry. Trash and debris should be removed immediately and disposed of at the proper sites.

- Bi-Annually: Inspect vegetation for health, density and desired diversity. If 50% of the vegetation is substandard the entire basin shall be re-vegetated. Inspect vegetated areas for evidence of scour and erosion, repair and necessary. Inspect all components for cracking subsidence erosion, deterioration. Make necessary repairs or corrective action.

- During winter months: Salt and nontoxic, organic deicers may be used on pavement adjacent to the basin.

- Construction staging, soil/mulch storage, and other construction activities shall not occur on the basin.

- Sediment removed from the basin shall be disposed of in landscape areas outside of steep slopes, wetlands, floodplains, or drainage swales.

- Vehicles shall not be parked or driven over the proposed basin.

2.5 Maintenance Requirements

Sediment removal shall take place when the inlet and outlet structures are thoroughly dry. All sediment and debris shall be properly disposed of. Trash must be disposed of in proper containers. Sediment shall be cleaned out of all structures and disposed of by a qualified contractor in compliance with all applicable local, state and federal regulations. Maintenance workers shall be trained in proper facility maintenance procedures by the responsible party (or his/her agent). All areas that permit access to storm water management facilities requiring maintenance shall be kept clear from any obstructions that would prevent the inspection or upkeep of the facilities. All maintenance practices contained in the New Jersey Stormwater Best Management Practices Manual shall be followed for the individual stormwater management components contained on the site.

2.6 Required Personnel, Tools, and Equipment

A general maintenance crew will be required to perform all regular maintenance practices and monitoring for the underground detention systems. Standard landscaping equipment (shovels, pry-bar, gloves, etc.) will be required for maintenance of the detention systems and any surrounding vegetated areas. Cleanouts and inspection ports may be opened by hand for visual inspection. Manholes and outlet structures may need a pry-bar or crowbar to lift the access lid for visual inspection. Removal of accumulated sediment, debris, trash, etc. may be done by hand with a shovel or potentially a vacuum truck if required.

2.7 Safety Measures and Procedures

As per NJDEP BMP Manual Ch. 8 procedures and equipment are required to protect the safety of inspection and maintenance personnel.

Stormwater BMPs	Safety Tools and Equipment
All BMPs	Access cover lifting tool
	Gloves and safety shoes
	Flashlight
	Safety Cones and/or caution tape
	Hard Hats and Safety glasses
	Proper Safety Equipment for confined space entry

Qualification for Performing Maintenance in Special Circumstances

Maintenance task that require the entry of inlet/outlet structures or manholes are required to be performed by qualified personnel that have the necessary Occupational Safety and Health Administration (OSHA) Confined-Space Entry training and certification. A list of certified maintenance providers in included in Appendix C.

Safety Procedures

Observational monitoring maintenance of the underground stone storage detention basins shall be carried out with the following safety precautions:

- Check for hazardous odors or gasses
- Check for sharp or dangerous debris or trash
- Wear all recommended safety equipment
- Establish traffic cones/signs/caution tape around work area

Maintenance personnel shall follow all other procedures required by local, state, and federal laws and regulations, and the safety instructions provided by the equipment or device manufacturers.

2.8 Evaluation and Reporting

Per N.J.A.C. 7:8-5.8(g), the Responsible Party designated at the beginning of this report shall evaluate the effectiveness of the maintenance plan at least once per year and adjust the plan as needed.

The Responsible Party shall evaluate the effectiveness of the maintenance plan by comparing the maintenance plan with the actual performance of the maintenance. The following items shall be evaluated at a minimum:

- Whether inspections have been performed as scheduled;
- Whether 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 repairs were completed on time;
- Whether the actual cost was consistent with the estimated cost;
- Whether inspection, maintenance, and repair records have been kept.

If actual performance of these items has deviated from the maintenance plan, the Responsible Party should find the causes and implement solutions in a revised maintenance plan.

Reporting on the system is required for this maintenance plan. Per N.J.A.C. 7:8-5.8(e), preventative and corrective maintenance shall be performed to maintain the function of the stormwater management measure(s), including repairs or replacement to the structure; removal of sediment, debris, or trash; restoration of eroded areas; snow and ice removal; fence repair or replacement; restoration of vegetation; and repair or replacement of non-vegetated linings.

Also per N.J.A.C. 7:8-5.8(f), the person responsible for maintenance shall maintain a detailed log of all preventative and corrective maintenance for the structural stormwater management measures incorporated into the design of the development, including a record of all inspections and copies of all maintenance-related work orders.

The responsible party shall maintain a record of all maintenance actions performed, including:

- Inspection checklists from each performed inspection
- Preventative maintenance logs
- Corrective maintenance logs, including work orders
- Other maintenance records

Example logs have been included in Appendix A of this plan.

2.9 Opinion of Probable Cost

Maintenance costs given below are estimates for standard stormwater management facility maintenance. Costs of major or emergency repairs are not considered within the scope of this plan.

Yearly Maintenance Cost Estimate Table – General Cost for Routine Maintenance

BMP Item	**Annual Maintenance Cost per BMP**	**Number of BMPs**	**Total Yearly Cost Estimate**
Infiltration Basin	$750	2	$1,500
Stormwater Chambers	$150	8	$1,200
Roof Leaders	$50	8	$400
Total Cost of Standard Maintenance Tasks			$3,100

General Cost for Unscheduled Maintenance

The frequency of large storm events that require routine maintenance varies from year to year. Therefore, it is possible that the estimated quantities of tasks shown above will vary. In these cases, the 'Cost per Task' column may be used to estimate single unscheduled tasks.

INSPECTION CHECKLIST / MAINTENANCE ACTIONS

Infiltration Basin System

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

	For Inspector			For Maintenance Crew
Component	Inspection Item		Result	Preventative / Corrective Maintenance Actions
SWM #1	1	All preventative and remedial maintenance work (clean out, repair, replacement, regrading, reseeding, remulching, and renetting) must be performed immediately. If the basin fails to perform as expected, replacement BMPs, or modifications of the installed basin is required.	Y__ N__	Fix, repair, or replace the BMP. Work Order #_____
	2	Trim grass or vegetation to maintain neat and orderly appearance. Inspect for unwanted tree growth annually at a minimum. Inspect basin bottom and remove sediment and debris as required.	Y__ N__	Fix, repair, or replace the BMP. Work Order #_____
	3	Inspect all basin components for clogging and excessive debris and sediment accumulation. Such components may include bottoms, trash racks, low flow channels, outlet structures, riprap or gabion aprons, and inlets. Sediment removal should take place when the basin is thoroughly dry. Trash and debris should be removed immediately and disposed of at the proper sites.	Y__ N__	Clear and remove sediment or debris Fix, repair, or replace the BMP. Work Order #_____
	4	Standing water is present after the design drain time The observed drain time is approximately _____ hours.	Y__ N__	Recheck to determine if there is standing water after 72 hours. If standing water is present longer than 5 days, report to mosquito commission. Remove any sediment buildup and replace the stone fill if necessary Check the perforated pipe for clogging and clean it if necessary Check the perforated pipe for damage and repair it if necessary Check outlet control structure for damage and repair if necessary Work Order #_____
	5	Inlet or Outlet Pipe, Outlet Structure clogged	Y__ N__	Clear the clog Clear and remove sediment or debris Fix, repair, or replace the BMP. Work Order #_____
Notes:				

	For Inspector			For Maintenance Crew
Component	Inspection Item		Result	Preventative / Corrective Maintenance Actions
SWM #2	1	All preventative and remedial maintenance work (clean out, repair, replacement, regrading, reseeding, remulching, and renetting) must be performed immediately. If the basin fails to perform as expected, replacement BMPs, or modifications of the installed basin is required.	Y__ N__	Fix, repair, or replace the BMP. Work Order #_____
	2	Trim grass or vegetation to maintain neat and orderly appearance. Inspect for unwanted tree growth annually at a minimum. Inspect basin bottom and remove sediment and debris as required.	Y__ N__	Fix, repair, or replace the BMP. Work Order #_____
	3	Inspect all basin components for clogging and excessive debris and sediment accumulation. Such components may include bottoms, trash racks, low flow channels, outlet structures, riprap or gabion aprons, and inlets. Sediment removal should take place when the basin is thoroughly dry. Trash and debris should be removed immediately and disposed of at the proper sites.	Y__ N__	Clear and remove sediment or debris Fix, repair, or replace the BMP. Work Order #_____
	4	Standing water is present after the design drain time The observed drain time is approximately _____ hours.	Y__ N__	Recheck to determine if there is standing water after 72 hours. If standing water is present longer than 5 days, report to mosquito commission. Remove any sediment buildup and replace the stone fill if necessary Check the perforated pipe for clogging and clean it if necessary Check the perforated pipe for damage and repair it if necessary Check outlet control structure for damage and repair if necessary Work Order #_____
	5	Inlet or Outlet Pipe, Outlet Structure clogged	Y__ N__	Clear the clog Clear and remove sediment or debris Fix, repair, or replace the BMP. Work Order #_____
Notes:				

Stone Trench Basin System

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

	For Inspector			For Maintenance Crew
Component	Inspection Item		Result	Preventative / Corrective Maintenance Actions
Trench #1B	1	The cap of the inspection port is loose, damaged, or missing.	Y__ N__	Fix, repair, or replace the cap Work Order #_____
	2	Standing water is present after the design drain time The observed drain time is approximately _____ hours.	Y__ N__	Recheck to determine if there is standing water after 72 hours. If standing water is present longer than 5 days, report to mosquito commission. Remove any sediment buildup and replace the stone fill if necessary Check the perforated pipe for clogging and clean it if necessary Check the perforated pipe for damage and repair it if necessary Work Order #_____
	3	Excessive sediment or debris present in the inspection port	Y__ N__	Clear and remove sediment or debris
	4	Little or no flow into the stone trench	Y__ N__	Check whether the gutter, inlet pipe, or downspout is clogged Clear and remove debris
	5	Downspout or Overflow pipe is clogged	Y__ N__	Clear the clog
Notes:				

	For Inspector			For Maintenance Crew
Component	Inspection Item		Result	Preventative / Corrective Maintenance Actions
Trench #2C	1	The cap of the inspection port is loose, damaged, or missing.	Y__ N__	Fix, repair, or replace the cap Work Order #_____
	2	Standing water is present after the design drain time The observed drain time is approximately _____ hours.	Y__ N__	Recheck to determine if there is standing water after 72 hours. If standing water is present longer than 5 days, report to mosquito commission. Remove any sediment buildup and replace the stone fill if necessary Check the perforated pipe for clogging and clean it if necessary Check the perforated pipe for damage and repair it if necessary Work Order #_____
	3	Excessive sediment or debris present in the inspection port	Y__ N__	Clear and remove sediment or debris
	4	Little or no flow into the stone trench	Y__ N__	Check whether the gutter, inlet pipe, or downspout is clogged Clear and remove debris
	5	Downspout or Overflow pipe is clogged	Y__ N__	Clear the clog
Notes:				

	For Inspector			For Maintenance Crew
Component	Inspection Item		Result	Preventative / Corrective Maintenance Actions
Trench #2D	1	The cap of the inspection port is loose, damaged, or missing.	Y__ N__	Fix, repair, or replace the cap Work Order #_____
	2	Standing water is present after the design drain time The observed drain time is approximately _____ hours.	Y__ N__	Recheck to determine if there is standing water after 72 hours. If standing water is present longer than 5 days, report to mosquito commission. Remove any sediment buildup and replace the stone fill if necessary Check the perforated pipe for clogging and clean it if necessary Check the perforated pipe for damage and repair it if necessary Work Order #_____
	3	Excessive sediment or debris present in the inspection port	Y__ N__	Clear and remove sediment or debris
	4	Little or no flow into the stone trench	Y__ N__	Check whether the gutter, inlet pipe, or downspout is clogged Clear and remove debris
	5	Downspout or Overflow pipe is clogged	Y__ N__	Clear the clog
Notes:				

Drywell System

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

	For Inspector			For Maintenance Crew
Component	Inspection Item		Result	Preventative / Corrective Maintenance Actions
Drywell #1 - 10	1	The cap of the inspection port is loose, damaged, or missing.	Y__ N__	Fix, repair, or replace the cap Work Order #_____
	2	Standing water is present after the design drain time The observed drain time is approximately _____ hours.	Y__ N__	Recheck to determine if there is standing water after 72 hours. If standing water is present longer than 5 days, report to mosquito commission. Remove any sediment buildup and replace the stone fill if necessary Check the seepage pit structure for clogging and clean it if necessary Work Order #_____
	3	Excessive sediment or debris present in the inspection port	Y__ N__	Clear and remove sediment or debris
	4	Little or no flow into the stone trench	Y__ N__	Check whether the gutter, inlet pipe, or downspout is clogged Clear and remove debris
	5	Downspout or Overflow pipe is clogged	Y__ N__	Clear the clog
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.

File associated work orders and evidence of completion in the Maintenance Log upon completion.

Corrective Maintenance Record

Work Order # _____ Date Issued _____

Issue to be resolved:

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

Required Actions

Actions	Planned Date	Date Completed

Responsible person(s):
_____

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.