

STORMWATER MANAGEMENT FACILITIES OPERATION AND MAINTENANCE MANUAL

for

**Altera Development Company, LLC
Phase II
Proposed Site Improvements**

**Block 166.15, Lot 9
769 Northfield Avenue (CR 508)
Township of West Orange
Essex County, NJ**

Prepared by:



245 Main Street, Suite 110
Chester, NJ 07930

A handwritten signature in dark ink, appearing to read 'RJC', is positioned above a horizontal line.

**Robert J. Colucco, PE
NJ Professional Engineer License #55851**

January 2022
DEC#2530-99-006

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PART I: PROJECT DETAILS

A. Introduction and Description of Facilities:

The project site is comprised of Block 166.15, Lot 9 in the Township of West Orange, Essex County, New Jersey and is located at 769 Northfield Avenue (CR 508). The subject site consists of 4.88 acres and is presently fully developed with a multi-story building and associated parking areas. The proposed Phase II site improvements include the expansion of the rear parking area, should a future tenant require additional parking. Proposed stormwater management improvements under Phase II include a Small Scale Bioretention Basin with associated conveyance network.

This manual consists of three parts: Part I includes the introduction, project description and a list of project contacts; Part II provides the operation and maintenance instructions for the facility and equipment. Part III provides information regarding the inspection and maintenance activities. This manual shall run with the property and be recorded as part of the deed.

B. Project Contacts:

The owner is responsible to maintain a detailed log of all preventative and corrective maintenance for the structural stormwater measures incorporated into the design, including record of all inspections and copies of all maintenance-related work orders. The owner is also responsible to evaluate the effectiveness of the maintenance plan at least once per year, and adjust the plan and deed as needed. The owner shall be responsible for the maintenance plan, and shall retain a copy of this report should a public entity request this report or documentation of said maintenance in the future.

Applicant
Altera 769, LLC 5910 N. Central Expressway, Suite 1360 Dallas, TX 75206
Municipal Engineer
CME Associates 849 W. Bay Avenue, Suite 7 Barnegat, NJ 08005 Attn: John J. Hess (732) 410-2650
Property Owners
Block 166.15, Lot 6 Altera 769, LLC 5910 N. Central Expressway, Suite 1360 Dallas, Texas 75206
Design Engineer
Dynamic Engineering Consultants, P.C. 245 Main Street, Suite 110 Chester, NJ 07930 Attn: Robert J. Colucco, PE (908) 879-9229
Party Responsible for Maintaining Stormwater Management Facility
Altera 769, LLC 5910 N. Central Expressway, Suite 1360 Dallas, Texas 75206 Attn: Eddie Tillman (972) 897-4961

C. Proposed Best Management Practices:

Underground Detention Basin (Phase I)

Stormwater runoff generated from the proposed parking area is collected by an inlet and conveyed to the underground detention basin. The underground detention basin contains an outlet structure that serves to detain and release stormwater runoff, at a controlled rate, to satisfy the stormwater runoff rate requirements set forth by NJAC 7:8. The stormwater is then routed to the existing stormwater management system located within the property.

Bioretention Basin

Stormwater runoff generated from the proposed parking area, which includes one (1) Small-Scale Biorientation Basin, is located on the north west side of the site. The proposed bioretention basin has been designed to address the applicable aspects of NJAC 7:8. The stormwater runoff generated by the subject site will be directed to the basin through storm water management practices. Smaller runoff events will be infiltrated and collected via under drains and larger runoff events will be discharged at a controlled rate via proposed outlet control structures. Stormwater runoff that is detained below the lowest outlet is infiltrated and shall drain from the basin in under 72 hours via the proposed underdrains. If significant increases or decreases in this drain time are observed, a qualified licensed Professional Engineer shall be contacted to evaluate possible corrective measures that may be required.

PART II: INSPECTION AND MAINTENANCE:

A. Routine Inspection and Maintenance of the Stormwater Management Facilities:

The stormwater management basin has been designed to control stormwater and reduce downstream impact. Without proper routine inspection and maintenance, the basin may lose some or all of it's capability to function to its full capacity. Lack of adequate maintenance at this facility could lead to system failures.

A consulting Professional Engineer should perform regularly scheduled maintenance inspections of the stormwater facilities at least (4) times each year. The primary purpose of these inspections is to ascertain the operational condition and safety of the facilities, particularly the condition of outlet structures and other safety-related aspects. Inspections will also provide information on the effectiveness of regularly scheduled Preventative 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.

Routine Functional Maintenance is required to insure the safe and effective operation of the storm water management facility and is further broken down into two (2) categories: Preventative and Corrective. It is important to note that a successful Functional Maintenance program will emphasize regularly scheduled Preventative Maintenance over emergency-based Corrective Maintenance. Listed below are the Preventative and Corrective Maintenance Procedures to be performed on a routine basis:

1. Preventative Maintenance Procedures

The purpose of Preventative Maintenance is to assure that the basin remains operational and safe at all times, while minimizing the need for emergency or corrective maintenance. These procedures are as follows:

Underground Detention:

a) Removal and Disposal of Trash and Debris

All storm water management components expected to receive and/or trap debris and sediment must be inspected for clogging and excessive debris and sediment accumulation at least four times annually as well as after every storm exceeding one inch of rainfall. Such components may include the basin, stormwater conveyance network (piping and inlet), flared end sections, bottoms, riprap or gabion aprons, trash racks and inflow points.

Removal of trash and debris will prevent possible damage to trash racks and outlets, vegetated areas and eliminate potential mosquito breeding habitats. Disposal of debris and trash must comply with all local, county, state, and federal waste flow control regulations. Only suitable disposal and recycling sites should be utilized.

b) Sediment Removal and Disposal

The basin should also be evaluated for excessive deposition of sediment. Accumulated sediment should be removed before it threatens the storage volume of the basin. Before de-sedimentation activities are performed, consideration should be given to evacuating all standing water from the basin. This may be accomplished by clearing any blocked openings of the outlet structure or by mechanical means such as pumping. If stable soil conditions exist on-site, sediment deposition should not be an excessive maintenance issue. Should a recurrent stabilization situation develop, the inspector should identify the upstream sources of sediment and recommend required stabilization measures.

c) Mechanical Components

Mechanical components such as valves, sluice gates, pumps, fence gates, locks, and access hatches, should remain functional at all times. Regularly scheduled maintenance should be performed in accordance with the manufactures' recommendations. Additionally, all mechanical components should be operated at least once every three months to assure their continued performance.

d) Parking Lot Maintenance

This management measure involves employing pavement cleaning practices, such as parking lot sweeping on a regular basis, to minimize pollutant export to the stormwater conveyance system/detention basins and eventually the receiving waters. These cleaning practices are designed to remove sediment, debris, and other pollutants from access drive and parking lot surfaces that are a potential source of pollution impacting urban waterways. Mechanical machines that use vacuum assisted dry sweeping to remove particulate matter shall be utilized as these have the ability to remove finer sediment particles. Parking lots and access drives shall be swept/vacuumed at least once a month. The disposal of the swept material must be properly hauled off the site and transferred to an approved disposal site. Other parking lot maintenance features include the use of on-site trash receptacle. These receptacles should be located in strategic areas where the majority of the pedestrian traffic occurs. These receptacles should be emptied daily. The disposal of the solid waste must be properly hauled off the site and transferred to an approved disposal site.

e) Observation After Rainfall

This management measure involves monitoring the amount of time the detention basin takes to drain to ensure the basin is working properly. The detention basin should drain to the bottom in less than 72 hours. If significant increases or decreases are observed in the drawdown time, a qualified licensed Professional Engineer shall be contacted to evaluate the basin's bottom surface, subsoil and both groundwater and tailwater elevations to determine what corrective measures may need to be implemented.

f) Inspection and Reporting

Regularly scheduled inspections of the facility should be performed by a consulting Professional Engineer. The primary purpose of the inspections is to ascertain the operational condition and safety of the facility. Inspections will also provide information on the effectiveness of regularly scheduled Preventative Maintenance procedures. It should be noted that, in addition to regularly scheduled inspections, an informal inspection should be performed during every visit to stormwater management facilities by maintenance or supervisory personnel.

The recording of all maintenance work and inspections provides valuable data on the condition of the stormwater management facilities. 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 owner of the facility for review and subsequent follow-up on recommendations. Inspection and maintenance checklists and logs are included in the Appendix of this manual.

Bioretention:

g) Grass Cutting

A regularly scheduled program of mowing and trimming of grass at and surrounding the basin during the growing season will help to maintain a tightly knit turf, and will also help to prevent diseases, pests and the intrusion of weeds. The actual mowing requirements of an area should be tailored to the specific site conditions, grass type, and seasonal variations in the climate. In general, lawn areas should be mowed at least once a month during the growing season and grass should not be allowed to grow more than 1 to 2 inches between cuttings. Allowing the grass to grow more than this amount prior to cutting it may result in damage to the grass' growing points and limit its continued healthy growth.

h) Grass Maintenance

Grassed areas require periodic fertilizing, de-thatching and soil conditioning in order to maintain healthy growth and to provide bank stabilization. Additionally, provisions should be made to re-seed and re-establish grass cover in areas damaged by sediment accumulation, stormwater flow, or other causes. These tasks should be performed, or at least evaluated, on a quarterly basis.

i) Vegetative Cover

Trees, shrubs, and ground cover require periodic maintenance, including fertilizing, pruning, and pest control in order to maintain healthy growth. Vegetated areas must be inspected at least annually for erosion and scour as well as unwanted growth, which should be removed with minimum disruption to the remaining vegetation. The basin should be evaluated regularly to determine whether excessive plant growth is evident. A correction in the application of fertilizers can often solve these problems. Weeds, which have become a problem, can be cleared through harvesting by professional maintenance technicians.

Note: All use of fertilizers, mechanical treatments, pesticides and other means to ensure optimum vegetation health must not compromise the intended purpose of the storm water management facility. All vegetation deficiencies should be addressed without the use of fertilizers and pesticides whenever possible.

j) Removal and Disposal of Trash and Debris

All storm water management components expected to receive and/or trap debris and sediment must be inspected for clogging and excessive debris and sediment accumulation at least four times annually as well as after every storm exceeding one inch of rainfall. Such components may include the basin, stormwater conveyance network (piping and inlet), flared end sections, bottoms, riprap or gabion aprons, trash racks and inflow points.

All components expected to receive and/or trap debris and sediment must be inspected for clogging and excessive debris and sediment accumulation at least four times annually as well as after every storm exceeding 1 inch of rainfall. Such components may include inlets and diversion structures, fore bays, sand beds, and overflows.

Removal of trash and debris will prevent possible damage to trash racks and outlets, vegetated areas and eliminate potential mosquito breeding habitats. Disposal of debris and trash must comply with all local, county, state, and federal waste flow control regulations. Only suitable disposal and recycling sites should be utilized.

k) Sediment Removal and Disposal

The basin should also be evaluated for excessive deposition of sediment. Accumulated sediment should be removed before it threatens the storage volume of the basin. Before de-sedimentation activities are performed, consideration should be given to evacuating all standing water from the basin. This may be accomplished by clearing any blocked openings of the outlet structure or by mechanical means such as pumping. If stable soil conditions exist on-site, sediment deposition should not be an excessive maintenance issue. Should a recurrent stabilization situation develop, the inspector should identify the upstream sources of sediment and recommend required stabilization measures.

Sediment removal should take place when all runoff has drained from the sand bed and the sand is reasonably dry. In addition, runoff should be drained or pumped from fore bays with permanent pools before removing sediment. Disposal of debris, trash, sediment, and other waste material should be done at suitable disposal/recycling sites and in compliance with all applicable local, state, and federal waste regulations.

l) Mechanical Components

Mechanical components such as valves, sluice gates, pumps, fence gates, locks, and access hatches, should remain functional at all times. Regularly scheduled maintenance should be performed in accordance with the manufactures' recommendations. Additionally, all mechanical components should be operated at least once every three months to assure their continued performance.

m) 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 may become the source of a large mosquito population. A maintenance program dedicated to eliminating potential breeding areas is preferable to chemical means of controlling mosquitoes. The most important maintenance function is removal of all obstructions to natural flow patterns before stagnant water conditions can develop.

n) Parking Lot Maintenance

This management measure involves employing pavement cleaning practices, such as parking lot sweeping on a regular basis, to minimize pollutant export to the stormwater conveyance system/detention basins and eventually the receiving waters. These cleaning practices are designed to remove sediment, debris, and other pollutants from access drive and parking lot surfaces that are a potential source of pollution impacting urban waterways. Mechanical machines that use vacuum assisted dry sweeping to remove particulate matter shall be utilized as these have the ability to remove finer sediment particles. Parking lots and access drives shall be swept/vacuumed at least once a month. The disposal of the swept material must be properly hauled off the site and transferred to an approved disposal site. Other parking lot maintenance features include the use of on-site trash receptacle. These receptacles should be located in strategic areas where the majority of the pedestrian traffic occurs. These receptacles should be emptied daily. The disposal of the solid waste must be properly hauled off the site and transferred to an approved disposal site.

o) Observation After Rainfall

This management measure involves monitoring the amount of time the detention basin takes to drain to ensure the basin is working properly. The detention basin should drain to the bottom in less than 72 hours. If significant increases or decreases are observed in the drawdown time, a qualified licensed Professional Engineer shall

be contacted to evaluate the basin's bottom surface, subsoil and both groundwater and tailwater elevations to determine what corrective measures may need to be implemented.

The management measure involves monitoring the amount of time it would normally take to drain the maximum design storm runoff volume below the top of the filter's sand bed. This normal drain or drawdown time should then be used to evaluate the filter's actual performance. If significant increases or decreases in the normal drain time are observed, a qualified licensed Professional Engineer shall be contacted to evaluate the filter's sand bed, underdrain system, and tailwater levels to determine what corrective measures may need to be implemented to maintain the proper functioning of the filter.

p) Inspection of the Soil Bed

The soil bed should be inspected at least twice annually. The infiltration rate of the soil bed material may also be retested. If the water fails to infiltrate 72 hours after the end of the stormwater quality design storm, corrective measures must be taken.

q) Vegetation Maintenance

All landscaped areas within the aboveground basin shall be periodically inspected a minimum of once per month and every two weeks during growing season or after each mowing session. In general, mowing should occur at least once a month during the growing season. Clippings from the mowing operations shall be removed and disposed of in accordance with all local, state and federal regulations. Reseeding, if required, shall occur within spring or early fall. Summer and fall seeding can be successful with a light mulching of weed-free straw to conserve moisture.

All landscaped areas shall be inspected for invasive plant species. Invasive species should be removed immediately and properly disposed of at an approved disposal site.

r) Inspection and Reporting:

Regularly scheduled inspections of the facility should be performed by a consulting Professional Engineer. The primary purpose of the inspections is to ascertain the operational condition and safety of the facility. Inspections will also provide information on the effectiveness of regularly scheduled Preventative and Aesthetic Maintenance procedures. It should be noted that, in addition to regularly scheduled

inspections, an informal inspection should be performed during every visit to stormwater management facilities by maintenance or supervisory personnel.

The recording of all maintenance work and inspections provides valuable data on the condition of the stormwater management facilities. 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 owner of the facility for review and subsequent follow-up on recommendations. Inspection and maintenance checklists and logs are included in the Appendix of this manual.

2. Corrective Maintenance Procedures

Corrective Maintenance is required on an emergency or non-routine basis to correct problems or malfunctions and to restore the intended operation and safe condition of the basin.

Underground Detention:

a) Removal of Debris and Sediment

Sediment, debris and trash which threaten the discharge capacity of the basin should be removed immediately and properly disposed. As noted previously, it is recommended that all water be evacuated from the basin with a pump before any significant amount of sediment, 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 outlet and inlet structures, trash racks, access hatches, roadways and headwalls as a result of vandalism, flood events, settlement or other causes must be repaired promptly. The urgency 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) Dewatering

It may be necessary to remove ponded water from within a malfunctioning basin. This ponding may be the result of a blocked principal outlet or poor bottom drainage. Portable pumps may be necessary to remove the ponded water temporarily until a permanent solution can be implemented.

d) Snow and Ice Removal

Accumulations of snow and ice can threaten the functioning of the inlets, outlets and emergency spillways. Provision of the equipment, material and personnel to monitor and remove snow and ice from critical areas will assure the function of the facility during the winter months.

e) Basin Drain Time

The basin is an underground detention basin. In accordance with the Stormwater Management Summary, the amount of time for the basin to drain and reach the base elevation is less than 72 hours.

If significant increases or decreases are observed in the drawdown time, a qualified licensed Professional Engineer shall be contacted to evaluate the basin's bottom surface, subsoil and both groundwater and tailwater elevations to determine what corrective measures may need to be implemented.

Bioretention:

a) Removal of Debris and Sediment

Sediment, debris and trash which threaten the discharge capacity of the basin should be removed immediately and properly disposed. As noted previously, it is recommended that all water be evacuated from the basin with a pump before any significant amount of sediment, 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 outlet and inlet structures, trash racks, access hatches, roadways and headwalls as a result of vandalism, flood events, settlement or other causes must be repaired promptly. The urgency 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) Embankment and Slope Repairs

Damage to embankments, and side slopes must be repaired promptly. This damage can be the result of rain or flood events, vandalism, animals, vehicles or neglect. Typical problems include settlement, scouring, cracking, sloughing, seepage and

rutting. The urgency of the repairs will depend upon the nature of the damage and its effect on the safety and operation of the facility. The analysis of the damage and the design and performance of geotechnical repairs should only be undertaken by qualified personnel and under the direction of a consulting Professional Engineer. All basin embankments shall be inspected quarterly and after each significant storm greater than one (1) inch of rainfall. Any damage or indication of erosion shall be immediately inspected by a professional engineer.

d) Dewatering

It may be necessary to remove ponded water from within a malfunctioning basin. This ponding may be the result of a blocked principal outlet or poor bottom drainage. Portable pumps may be necessary to remove the ponded water temporarily until a permanent solution can be implemented.

e) Weed Harvesting

It may be necessary to remove congested weeds from the basin. Companies with specialized harvesters should be contacted to perform these operations. Note that such work may require the approval of various regulatory agencies.

f) Extermination of Mosquitoes

If neglected, the basin can become an ideal mosquito breeding area. The 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 be re-evaluated, and more emphasis should be placed on control of mosquito breeding habitats.

g) Erosion Repair

Vegetative cover or other protective measures are necessary to prevent the loss of soil due to the 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 that may result in danger to the stability of the facility. Soil loss can be controlled by a variety of materials and methods, including rip-rap, gabion lining, geotextile fabrics, sod, seeding, concrete lining and re-grading.

h) Elimination of Trees, Brush, Roots and Animal Burrows

The stability of embankments 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 to prevent destabilization and the creation of seepage routes. Roots should also be completely removed to prevent decomposition within the embankment. Root voids and burrows should be filled with material similar to the existing material, and capped just below grade with stone, concrete or other material. If the filling of the burrows does not discourage the animals from returning, further measures should be taken to either move the animal population or to make critical areas of the facility unattractive to them.

i) Snow and Ice Removal

Accumulations of snow and ice can threaten the functioning of the inlets, outlets and emergency spillways. Provision of the equipment, material and personnel to monitor and remove snow and ice from critical areas will assure the function of the facility during the winter months.

j) Basin Drain Time

As mentioned above, two basins are infiltration basins. In accordance with the Drainage Report, the amount of time for the water quality storm volume to drain and reach the bottom elevation is approximately 24 hours.

If the basin fails to drain in the above-mentioned time, the basin should be dewatered down to the soil bed elevation and the soil bed shall be replaced partially or completely depending on field inspection result. This task is to be followed by re-grading and leveling of the soil bed. The thickness of the sand layer should be checked to ensure that a minimum of 18" is maintained throughout the basin bottom area to ensure that the infiltration basin water quality treatment feature operates correctly. The soil bed material to be utilized shall consist of the following, by volume: 85-95% sand, with no more than 25% of the sand as fine or very fine sands; no more than 15% silt and clay with a 2-5% clay content. Pre-mixed soil must be certified to consistent with the requirement above for use in a bioretention basin by either the vendor or a professional engineer. The contact of any soil mixed on-site must be certified by professional engineer who must be present while its being mixed. A maximum permeability rate of 10 inches per hour. Any disturbed vegetated area should be re-vegetated immediately to prevent erosion.

3. Summary of Maintenance Procedures

Preventative Maintenance -Underground detention basin

- a. Removal and Disposal of Trash and Debris
- b. Sediment Removal and Disposal
- c. Mechanical Components
- d. Parking Lot Maintenance
- e. Observation After Rainfall
- f. Inspection and Reporting

Corrective Maintenance – Underground detention basin

- a. Removal of Debris and Sediment
- b. Structural Repairs
- c. Dewatering
- d. Snow and Ice Removal
- e. Basin Drain Time

Preventative Maintenance -Bioretention basin

- a) Grass Cutting
- b) Grass Maintenance
- c) Vegetative Cover
- d) Removal and Disposal of Trash and Debris
- e) Sediment Removal and Disposal
- f) Mechanical Components
- g) Elimination of Mosquito Breeding Habitats
- h) Parking Lot Maintenance
- i) Observation After Rainfall
- j) Inspection of the Soil Bed
- k) Vegetation Maintenance
- l) Inspection and Reporting

Corrective Maintenance – Bioretention basin

- a) Removal of Debris and Sediment
- b) Structural Repairs
- c) Embankment and Slope Repairs
- d) Dewatering
- e) Weed Harvesting
- f) Extermination of Mosquitoes

- g) Erosion Repair
- h) Elimination of Trees, Brush, Roots, and Animal Burrows
- i) Snow and Ice Removal
- j) Basin Drain Time

Aesthetic Maintenance

- a. Grass Trimming/Landscape Maintenance
- b. Control of Weeds

B. Checklists and Logs

The Appendix of this report contains sample checklists and logs regarding various aspects of the basin maintenance and inspection. A brief description of the use of each form is listed below:

1. “Drainage, & Utility Plan” – a plan identifying stormwater management facilities on- site.
2. “Estimated Maintenance Costs” – an estimate of the approximate cost to maintain the proposed stormwater management system on an annual basis.
3. “Maintenance Equipment and Materials” – a comprehensive list of equipment and materials typically required for stormwater management facility maintenance.
4. “Maintenance Work Order and Checklist” – a comprehensive form outlining both required and completed maintenance work.
5. “Maintenance Log” – a summary table for recording of all maintenance work at the site.
6. “Inspection Checklist” – a comprehensive checklist of the items to be inspected.
7. “Inspection Log” – a summary table for recording the results of all inspections.

APPENDIX

GRADING, DRAINAGE, & UTILITY PLAN

ESTIMATED MAINTENANCE COSTS

Estimated Maintenance Costs

An estimated total cost of approximately **\$6,200** will be incurred to maintain the proposed stormwater management system on an annual basis. The following is a summary of the required maintenance tasks and associated costs in written and tabular form:

- Inspections to be performed by a consulting engineer on an annual basis.
- Inspections to be performed by the property owner and/or a maintenance designee on a monthly basis and/or after a storm event exceeding 1 inch of rainfall
- Stormwater conveyance system and outlet control structure access for debris removal to be performed on an annual basis and/or as inspection routine dictates.
- Surface debris removal including garbage and organic matter to be performed in conjunction with lawn and grounds maintenance, includes removal of leaves in the Fall and removal of excessive amounts of snow (as necessary) in the Winter. These tasks are encouraged as necessary to maintain safe operating conditions (twice a month from Spring through Winter recommended or on as-needed basis)

Maintenance Schedule Summary

Task Identification	Task Frequency	Estimated Cost	Annual Cost
Inspection by licensed professional consulting engineer	Once (1) per year	\$1,500.00	\$1,500.00
Inspection by property owner and/or maintenance designee	Once (1) per month (or after a storm event exceeding 1 inch of rainfall)	Minimal Cost	Minimal Cost
Debris removal from conveyance system (inlets, pipes, manholes, and outlet control systems)	Twice (2) per year	\$1,750.00	\$3,500.00
Surface debris removal (garbage & organic matter) including leaves in the Fall and snow in the Winter	Twice (2) per month (or on as-needed basis)	\$50.00	\$1,200.00

MAINTENANCE EQUIPMENT AND MATERIALS

Maintenance Equipment and Materials

A. Grass Maintenance Equipment

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

B. Vegetative Maintenance Equipment

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

C. Transportation Equipment

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

D. Debris, Trash and Sediment Removal Equipment

1. Loader
2. Backhoe
3. Grader
4. Dredging Equipment
5. Portable Pump for Dewatering

E. 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
10. Office Space
11. Office Equipment
12. Telephones
13. Safety Equipment
14. Tools for Concrete Work (Mixers, Form Materials, etc.)
15. Welding Equipment (for Repair of Trash Racks, etc.)

F. Materials

1. Topsoil
2. Fill
3. Seed
4. Soil Amenities (Fertilizer/Lime)
5. Chemicals (Pesticides/Herbicides)
6. Mulch
7. Paint Removers
8. Spare Parts for Equipment
9. Oil and Grease for Equipment and SWMF Components
10. Concrete

G. Parking Lot Maintenance Equipment

1. Sweeping/Vacuuming Equipment
2. Trash Receptacles
3. Snow Plowing Equipment
4. Snow Shovels

MAINTENANCE WORK ORDER AND CHECKLIST

**MAINTENANCE WORK ORDER AND CHECKLIST
FOR STORMWATER MANAGEMENT FACILITIES**

NAME OF FACILITY: _____ DATE: _____
 LOCATION: _____ WORK STARTED: _____
 WEATHER: _____ WORK COMPLETED: _____
 MAINTENANCE PERFORMED BY: _____

A. PREVENTATIVE MAINTENANCE					
WORK ITEMS	ITEMS REQUIRED	ITEMS DONE	COMMENTS AND SPECIAL INSTRUCTIONS		
1. GRASS CUTTING					
A. BOTTOMS					
B. EMBANKMENTS AND SIDE SLOPES					
C. PERIMETER AREAS					
D. ACCESS AREAS AND ROADS					
E. OTHERS					
2. GRASS MAINTENANCE					
A. FERTILIZING					
B. RE-SEEDING					
C. DE-THATCHING					
D. PEST CONTROL					
E. OTHERS					
3. VEGETATIVE COVER					
A. FERTILIZING					
B. PRUNING					
C. PEST CONTROL					
D. POISONOUS PLANTS					
E. OTHERS					
4. TRASH AND DEBRIS REMOVAL					
A. BOTTOMS					
B. EMBANKMENTS AND SIDE SLOPES					
C. PERIMETER AREAS					
D. ACCESS AREAS AND ROADS					
E. INLETS					
F. OUTLETS AND TRASH RACKS					
G. OTHERS					
5. SEDIMENT REMOVAL					
A. INLETS					
B. OUTLETS AND TRASH RACKS					
C. LOW FLOW CHANNELS					
D. BOTTOMS					
E. OTHERS					
6. PEST CONTROL					
A. GEESE					
B. MOSQUITO BREEDING					
C. RODENTS / RODENT HOLES					
D. OTHERS					
7. STRUCTURAL REPAIRS					
A. PIPES					
B. FLARED END SECTIONS					
C. INLETS					
D. MANHOLES					
E. OUTLET CONTROL STRUCTURES					
F. LOW FLOW CHANNELS					
G. RIP-RAP					
H. EMERGENCY SPILLWAY					
I. ACCESS AREA / ROADS					
J. FENCE					
K. TRASH RACKS					
L. OTHERS					

8. BASIN REPAIR					
A. EROSION					
B. SAND LAYER REPLACEMENT					
C. HARMFUL POLLUTANT REMOVAL					
D. BASIN LAYER					
E. SNOW / ICE REMOVAL					
F. OTHERS					
9. OTHER PREVENTIVE MAINTENANCE					
A. PARKING LOT SWEEPING					
B. EMPTYING TRASH RECEPTACLES					
C. PUMPS AND VALVES					
D. ELECTRICAL PANEL AND WIRING					
E. DEWATERING					
F. GRAFFITI REMOVAL					
G. OTHERS					

B. CORRECTIVE MAINTENANCE			
WORK ITEMS	ITEMS REQUIRED	ITEMS DONE	COMMENTS AND SPECIAL INSTRUCTIONS
1. REMOVAL OF DEBRIS AND SEDIMENT			
2. STRUCTURAL REPAIRS			
3. EMBANKMENTS AND SIDE SLOPES			
4. DEWATERING			
5. BASIN MAINTENANCE			
6. CONTROL OF MOSQUITOES			
7. EROSION REPAIR			
8. FENCE REPAIR			
9. SNOW AND ICE REMOVAL			
10. SAND LAYER REPLACEMENT			
11. OTHER			

C. AESTHETIC MAINTENANCE			
WORK ITEMS	ITEMS REQUIRED	ITEMS DONE	COMMENTS AND SPECIAL INSTRUCTIONS
1. GRAFFITI REMOVAL			
2. GRASS TRIMMING			
3. WEEDING			
4. OTHERS			

GENERAL NOTES AND REMARKS:

MAINTENANCE COMPLETED AND BASED ON ALL AREAS VISIBLE AND ACCESSIBLE AT THE TIME OF INSPECTION.

WORK PERFORMED BY: _____

SIGNED: _____ DATE: _____

MAINTENANCE LOG

**MAINTENANCE LOG
FOR STORMWATER MANAGEMENT FACILITIES**

NAME OF FACILITY: _____
 LOCATION: _____ DATE: _____
 WEATHER: _____ WORK STARTED: _____
 MAINTENANCE PERFORMED BY: _____ WORK COMPLETED: _____

A. PREVENTATIVE MAINTENANCE					
WORK ITEMS	ITEMS REQUIRED	DATE REQUIRED	ITEMS DONE	DATE DONE	COMMENTS AND SPECIAL INSTRUCTIONS
1. GRASS CUTTING					
A. BOTTOMS					
B. EMBANKMENTS AND SIDE SLOPES					
C. PERIMETER AREAS					
D. ACCESS AREAS AND ROADS					
E. OTHERS					
2. GRASS MAINTENANCE					
A. FERTILIZING					
B. RE-SEEDING					
C. DE-THATCHING					
D. PEST CONTROL					
E. OTHERS					
3. VEGETATIVE COVER					
A. FERTILIZING					
B. PRUNING					
C. PEST CONTROL					
D. POISONOUS PLANTS					
E. OTHERS					
4. TRASH AND DEBRIS REMOVAL					
A. BOTTOMS					
B. EMBANKMENTS AND SIDE SLOPES					
C. PERIMETER AREAS					
D. ACCESS AREAS AND ROADS					
E. INLETS					
F. OUTLETS AND TRASH RACKS					
G. OTHERS					
5. SEDIMENT REMOVAL					
A. INLETS					
B. OUTLETS AND TRASH RACKS					
C. LOW FLOW CHANNELS					
D. BOTTOMS					
E. OTHERS					
6. PEST CONTROL					
A. GEESE					
B. MOSQUITO BREEDING					
C. RODENTS / RODENT HOLES					
D. OTHERS					
7. STRUCTURAL REPAIRS					
A. PIPES					
B. FLARED END SECTIONS					
C. INLETS					
D. MANHOLES					
E. OUTLET CONTROL STRUCTURES					
F. LOW FLOW CHANNELS					
G. RIP-RAP					
H. EMERGENCY SPILLWAY					
I. ACCESS AREA / ROADS					
J. FENCE					
K. TRASH RACKS					
L. OTHERS					

8. BASIN REPAIR					
A. EROSION					
B. SAND LAYER REPLACEMENT					
C. HARMFUL POLLUTANT REMOVAL					
D. BASIN LAYER					
E. SNOW / ICE REMOVAL					
F. OTHERS					
9. OTHER PREVENTIVE MAINTENANCE					
A. PARKING LOT SWEEPING					
B. EMPTYING TRASH RECEPTACLES					
C. PUMPS AND VALVES					
D. ELECTRICAL PANEL AND WIRING					
E. DEWATERING					
F. GRAFFITI REMOVAL					
G. OTHERS					

B. CORRECTIVE MAINTENANCE					
WORK ITEMS	ITEMS REQUIRED	DATE REQUIRED	ITEMS DONE	DATE DONE	COMMENTS AND SPECIAL INSTRUCTIONS
1. REMOVAL OF DEBRIS AND SEDIMENT					
2. STRUCTURAL REPAIRS					
3. EMBANKMENTS AND SIDE SLOPES					
4. DEWATERING					
5. BASIN MAINTENANCE					
6. CONTROL OF MOSQUITOES					
7. EROSION REPAIR					
8. FENCE REPAIR					
9. SNOW AND ICE REMOVAL					
10. SAND LAYER REPLACEMENT					
11. OTHER					

C. AESTHETIC MAINTENANCE					
WORK ITEMS	ITEMS REQUIRED	DATE REQUIRED	ITEMS DONE	DATE DONE	COMMENTS AND SPECIAL INSTRUCTIONS
1. GRAFFITI REMOVAL					
2. GRASS TRIMMING					
3. WEEDING					
4. OTHERS					

GENERAL NOTES AND REMARKS:

MAINTENANCE COMPLETED AND BASED ON ALL AREAS VISIBLE AND ACCESSIBLE AT THE TIME OF INSPECTION.

WORK PERFORMED BY: _____

SIGNED: _____ DATE: _____

INSPECTION CHECKLIST

**INSPECTION CHECKLIST
FOR
STORMWATER MANAGEMENT FACILITIES**

NAME OF FACILITY: _____

LOCATION: _____

WEATHER: _____ DATE: _____

FACILITY ITEM	O.K. ¹	ROUTINE ²	URGENT ³	COMMENTS
1. EMBANKMENTS AND SIDE SLOPES				
A. VEGETATION				
B. LININGS				
C. EROSION				
D. SETTLEMENT				
E. SLOUGHING				
F. TRASH AND DEBRIS				
G. SEEPAGE				
H. AESTHETICS				
I. OTHER:				
2. BOTTOMS (DETENTION AND INFILTRATION)				
A. VEGETATION				
B. EROSION				
C. STANDING WATER				
D. SETTLEMENT				
E. TRASH AND DEBRIS				
F. SEDIMENT				
G. AESTHETICS				
H. OTHER:				
3. LOW FLOW CHANNELS (DETENTION)				
A. VEGETATION				
B. LININGS				
C. EROSION				
D. SETTLEMENT				
E. STANDING WATER				
F. TRASH AND DEBRIS				
G. SEDIMENT				
H. OTHER:				
4. PONDS (RETENTION)				
A. VEGETATION				
B. SHORELINE EROSION				
C. AERATION EQUIPMENT				
D. TRASH AND DEBRIS				
E. SEDIMENT				
F. WATER QUALITY				
G. OTHER:				
5. INLET STRUCTURE				
A. CONDITION OF STRUCTURE				
B. EROSION				
C. TRASH AND DEBRIS				
D. SEDIMENT				
E. AESTHETICS				
F. OTHER:				
6. OUTLET STRUCTURE				
A. CONDITION OF STRUCTURE				
B. EROSION				
C. TRASH AND DEBRIS				
D. SEDIMENT				
E. MECHANICAL COMPONENTS				
F. AESTHETICS				
G. OTHER:				

INSPECTION LOG

**INSPECTION LOG
FOR STORMWATER MANAGEMENT FACILITIES**

NAME OF FACILITY: _____
 LOCATION: _____ DATE: _____
 WEATHER: _____
 INSPECTION PERFORMED BY: _____

A. PREVENTATIVE MAINTENANCE				
FACILITY ITEM	OK (1)	ROUTINE (2)	URGENT (3)	COMMENTS (4)
1. GRASS CUTTING				
A. BOTTOMS				
B. EMBANKMENTS AND SIDE SLOPES				
C. PERIMETER AREAS				
D. ACCESS AREAS AND ROADS				
E. OTHERS				
2. GRASS MAINTENANCE				
A. FERTILIZING				
B. RE-SEEDING				
C. DE-THATCHING				
D. PEST CONTROL				
E. OTHERS				
3. VEGETATIVE COVER				
A. FERTILIZING				
B. PRUNING				
C. PEST CONTROL				
D. POISONOUS PLANTS				
E. OTHERS				
4. TRASH AND DEBRIS REMOVAL				
A. BOTTOMS				
B. EMBANKMENTS AND SIDE SLOPES				
C. PERIMETER AREAS				
D. ACCESS AREAS AND ROADS				
E. INLETS				
F. OUTLETS AND TRASH RACKS				
G. OTHERS				
5. SEDIMENT REMOVAL				
A. INLETS				
B. OUTLETS AND TRASH RACKS				
C. LOW FLOW CHANNELS				
D. BOTTOMS				
E. OTHERS				
6. PEST CONTROL				
A. GEESE				
B. MOSQUITO BREEDING				
C. RODENTS / RODENT HOLES				
D. OTHERS				
7. STRUCTURAL REPAIRS				
A. PIPES				
B. FLARED END SECTIONS				
C. INLETS				
D. MANHOLES				
E. OUTLET CONTROL STRUCTURES				
F. LOW FLOW CHANNELS				
G. RIP-RAP				
H. EMERGENCY SPILLWAY				
I. ACCESS AREA / ROADS				
J. FENCE				
K. TRASH RACKS				
L. OTHERS				
8. BASIN REPAIR				
A. EROSION				
B. SAND LAYER REPLACEMENT				
C. HARMFUL POLLUTANT REMOVAL				
D. BASIN LAYER				
E. SNOW / ICE REMOVAL				
F. OTHERS				
9. OTHER PREVENTIVE MAINTENANCE				
A. PARKING LOT SWEEPING				
B. EMPTYING TRASH RECEPTACLES				
C. PUMPS AND VALVES				

D. ELECTRICAL PANEL AND WIRING				
E. DEWATERING				
F. GRAFFITI REMOVAL				
G. OTHERS				

B. CORRECTIVE MAINTENANCE				
FACILITY ITEM	OK (1)	ROUTINE (2)	URGENT (3)	COMMENTS (4)
1. REMOVAL OF DEBRIS AND SEDIMENT				
2. STRUCTURAL REPAIRS				
3. EMBANKMENTS AND SIDE SLOPES				
4. DEWATERING				
5. BASIN MAINTENANCE				
6. CONTROL OF MOSQUITOES				
7. EROSION REPAIR				
8. FENCE REPAIR				
9. SNOW AND ICE REMOVAL				
10. SAND LAYER REPLACEMENT				
11. OTHER				

C. AESTHETIC MAINTENANCE				
FACILITY ITEM	OK (1)	ROUTINE (2)	URGENT (3)	COMMENTS (4)
1. GRAFFITI REMOVAL				
2. GRASS TRIMMING				
3. WEEDING				
4. OTHERS				

REMARKS

- (1) ITEM CHECKED IS IN GOOD CONDITION, AND THE MAINTENANCE PROGRAM IS ADEQUATE.
- (2) ITEM CHECKED REQUIRES ATTENTION, BUT DOES NOT PRESENT AN IMMEDIATE THREAT TO THE FACILITY FUNCTION OR OTHER FACILITY COMPONENTS.
- (3) THE ITEM CHECKED REQUIRES IMMEDIATE ATTENTION TO KEEP THE FACILITY OPERATIONAL OR TO PREVENT DAMAGE TO OTHER FACILITY COMPONENTS.
- (4) PROVIDE EXPLANATION AND DETAILS IF COLUMNS 2 OR 3 ARE CHECKED.

GENERAL NOTES AND REMARKS:

INSPECTION COMPLETED AND BASED ON ALL AREAS VISIBLE AND ACCESSIBLE AT THE TIME OF INSPECTION.

WORK PERFORMED BY: _____

SIGNED: _____ DATE: _____