

STORMWATER SYSTEMS MANAGEMENT PLAN

Prepared for:

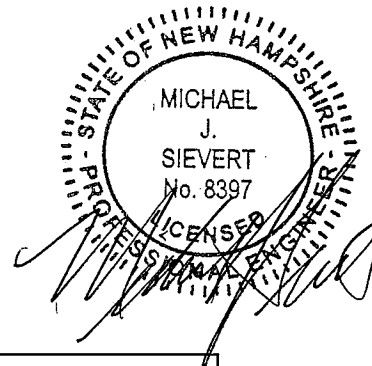
Harmony Homes by the Bay
W. Arthur Grant Circle
Durham, NH 03824
Tax Map 11 Lots (27-1) – (27-7)

RECEIVED
Town of Durham
SEP 17 2015
Planning, Assessing
and Zoning

Prepared on:

September 17, 2015

Prepared By:



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1.0 TABLE OF CONTENTS

1.0	TABLE OF CONTENTS	2
1.0	EXECUTIVE SUMMARY	5
2.0	TEMPORARY BEST MANAGEMENT PRACTICES	5
2.1	ORANGE CONSTRUCTION FENCING (PERIMETER CONTROL CONSTRUCTION).....	5
2.2	SILT SOXX™ (PERIMETER CONTROL)	5
2.3	STABILIZED CONSTRUCTION ENTRANCE	6
2.4	SWEEPING OF PUBLIC WAY.....	6
2.5	SILTATION POND.....	6
2.6	INLET PROTECTION	6
2.7	MULCHING, TACKIFIER, GEOTEXTILE MATTING, CRUSHED GRAVEL	6
2.8	SITE DEWATERING	7
2.9	WASHOUT AREA/BOOM.....	7
2.10	SITE WATERING	7
3.0	PERMANENT BEST MANAGEMENT PRACTICES	7
3.1	ROOF DRAINAGE COLLECTION	7
3.2	CLOSED DRAINAGE SYSTEM.....	7
3.3	SEDIMENT FOREBAYS.....	8
3.4	GRAVEL WETLANDS	8
3.5	CONVEYANCE SWALE	8
3.6	PRE-TREATMENT SWALE.....	8
3.7	TREATMENT SWALE	8
3.8	OUTLET PROTECTION	8
3.9	STONE BERM LEVEL SPREADER.....	8
4.0	LONG TERM MAINTENANCE OF PERMANENT BMPS	9
4.1	ROOF DRAINAGE COLLECTION	9
4.2	CLOSED DRAINAGE SYSTEM.....	9
4.3	SEDIMENT FOREBAYS.....	9
4.4	GRAVEL WETLANDS	9
4.5	CONVEYANCE SWALE	9
4.6	PRE-TREATMENT SWALE.....	10
4.7	TREATMENT SWALE	10

4.8	OUTLET PROTECTION	10
4.9	STONE BERM LEVEL SPREADER.....	10
5.0	REFERENCES.....	10

LIST OF APPENDICES

APPENDIX

STORM WATER SYSTEMS OVERVIEW PLAN.....	A
MAINTENANCE MATRIX	B
MAINTENANCE REPORTS.....	C
MANUFACTURERS DATA SHEETS.....	D

1.0 EXECUTIVE SUMMARY

The Stormwater Systems Management Plan (SSMP) provides a complete reference guide for use by the property owner and their chosen maintenance subcontractor for the inspection and maintenance of the stormwater best management practices (BMPs) at Harmony Homes by the Bay on W. Arthur Grant Circle in Durham, NH. While the primary purpose of the SSMP is to establish inspection and maintenance requirements, the plan also summarizes the purpose and function of each practice. The SSMP, in conjunction with the construction plans and details found in the Site Plan Package, describe the construction requirements of each BMP and standards for their protection and initial stabilization during the construction phase of the development and therefore should be incorporated into the construction bid documents. Compliance with the recommendations in the SSMP will assure expected operation, performance, and life cycle of the BMPs which have a common purpose of collecting and treating storm water runoff in an effort to protect the quality of public waters.

2.0 TEMPORARY BEST MANAGEMENT PRACTICES

This section describes the temporary best management practices to be employed during construction whose purposes are to protect downstream water quality from sediment/contaminants carried in storm water surface run off during the site construction phase of the development. The temporary BMPs are summarized below.

2.1 ORANGE CONSTRUCTION FENCING (PERIMETER CONTROL CONSTRUCTION)

For this project, a formal positive limit of work barrier is needed adjacent to the wetlands which is accomplished by the installation of orange construction fencing as shown on the construction plans. This fence shall be installed prior to the start of any site work. Fencing shall be maintained in place throughout construction and permitted to be removed once the site earthwork and landscaping is completed. Temporary removal of the fencing is permitted to accommodate the full scope of construction. Fencing shall be replaced following the completion of the construction activity.

2.2 SILT SOXX™ (PERIMETER CONTROL)

Silt Soxx is a 12 to 18 inch diameter tube of geotextile fabric filled on site with bark mulch/compost. This is used along the down gradient side of disturbed site areas where surface runoff is non-concentrated sheet flow or minimal shallow concentrated flow. The material in the tubes filters the runoff and allows sediment to settle out by temporarily ponding runoff on the up gradient side.

These tubes are placed as shown in the construction plans prior to any soil disturbance on the site and maintained in accordance with the manufacturers requirements throughout construction. The tubes are removed once the development site has achieved greater than 75% stabilization. Bare soil areas resulting from the removal of the tubes are revegetated. Alternatively, the tubes can be slit along the top and the mulch/compost distributed to either side. The tube material then gets removed and disposed of in a normal trash container used by the contractor.

2.3 STABILIZED CONSTRUCTION ENTRANCE

The stabilized construction entrance created from placement of 2-1/2 inch or smaller crushed stone as detailed in the construction plans provides a firm supportive means of entering and exiting the property from/to the public way. The friction of the tires on construction vehicles against the stone acts as a tire scrubber which releases soil bound to the tires. This minimizes the amount of soil and fines deposited on public roadways. Stabilized Construction Entrances shall be used wherever there is major traffic between the construction site and public way. Construction traffic shall be encouraged to the extent practicable to access the site via the stabilized construction entrance.

2.4 SWEEPING OF PUBLIC WAY

Sweeping is accomplished by power broom or hand broom as needed whenever soil or debris from site construction activities are deposited on the public way. At a minimum, sweeping shall take place at the end of each work day during the site work and landscaping phase of construction.

2.5 SILTATION POND

Storm water runoff from disturbed areas associated with site construction tends to concentrate more easily than on naturally vegetated soils. The velocity of the runoff becomes erosive as it concentrates in the resulting conveyance of sediment. Properly placed siltation ponds allow temporary ponding of this runoff which allows much of the sediment to settle out. The siltation pond is provided with a stable overflow channel such as a rip rap spillway underlain with a geotextile fabric or sand filter to allow runoff to exit the pond during more intense rain events.

In many instances, the pond areas used as a permanent BMP can temporarily be used as a siltation pond. In this case, it is recommended that the stormwater pond be used as a siltation pond prior to the construction of the permanent stormwater pond.

2.6 INLET PROTECTION

The purpose of inlet protection is to collect and contain the majority of soil particles conveyed in storm water runoff prior to the runoff entering a drainage structure inlet (catchbasin, manhole opening, culvert, etc.). This project employs the Siltsack™ which is to be installed at all catch basin frame/grate openings receiving runoff from the site. The Siltsack™ is placed in the opening of the catch basin and functions as a filter. Maintenance of this shall be in compliance with the manufacturer's requirements. The Siltsack™ shall be emptied once filled to 2/3 capacity, rinsed to release all fines, and reinstalled back in the catch basin. Care shall be taken to prevent puncture of the filter. A Siltsack™ showing signs of any tears, rips, or punctures shall be immediately repaired or replaced with a new Siltsack™.

2.7 MULCHING, TACKIFIER, GEOTEXTILE MATTING, CRUSHED GRAVEL

These temporary practices are employed to improve the resistance of bare soil to erosion. Mulching with weed free straw/hay, sprayed on liquid tackifier, and placement of decomposable fabrics reduce and disperse the impact of falling rain drops, minimize the velocity of runoff, and help hold soil particles in place. Use of a temporary 4" thick layer of crushed gravel provides a necessary means of equipment travel through otherwise unstable material and helps minimize the release and conveyance of soil particles. Any single or combined form of these practices is highly encouraged during construction. Examples include disturbed areas excavated to subgrade and then left un-worked for more than 3 consecutive days and on temporary soil stockpiles. This shall continue until the final permanent site stabilization is in place and at least 75% of the vegetation is established.

2.8 SITE DEWATERING

Efforts shall be made to eliminate excavating in extremely damp conditions. The use of equipment in soils where free water is present tends to cause erosion and increased sedimentation. Dewatering requires removal of free groundwater to below the depth of excavation and can be accomplished by digging a temporary sump adjacent to the excavation site and filling this sump with clean crushed stone embedded with a perforated stand pipe. A pump is then placed in the standpipe to extract the water. With time, the free groundwater in the vicinity of the excavation is lowered and then site excavation can occur with minimal release of fines into storm water.

2.9 WASHOUT AREA/BOOM

A washout area/boom can take the form of either a naturally vegetated area or manufactured system where water from dewatering can be directed for treatment prior to release into public waters. A simple practice is to encircle an area with haybales overlaid with geotextile and direct the discharge onto a splash plate in the middle of this circle. The size of the area will depend on the amount of water to be discharged and therefore experimentation at the site is warranted. This area is often used to treat the discharge waters from the washout of concrete trucks. Maintenance is required as the area or system becomes 2/3 or more clogged with fines and fails to contain the majority of fines. Removal of the accumulated fines may be adequate, however, in many instances, full replacement of the practice may be necessary due to the difficulty of restoring the filtration of the practice.

2.10 SITE WATERING

Site watering is intended to dampen the surface of bare soils in order to reduce airborne dust associated with earth moving operations. It is important to establish an application rate suitable for each site that provides adequate dampening of the soils but does not generate runoff. The weather conditions will dictate the frequency of site watering needs.

3.0 PERMANENT BEST MANAGEMENT PRACTICES

The section identifies the BMPs employed on this development and provides a brief summary to establish their purpose in the collection and treatment train within the storm water system. See the included Storm Water Systems Overview Plan for the location(s) of each of the BMPs.

3.1 ROOF DRAINAGE COLLECTION

Portions of the buildings shall have a roof gutter system with down spouts and collector pipes that discharge to a drip strip system which includes a perforated PVC pipe. Underground roof leaders shall be protected from receiving storm water during earth moving operations. Simple use of a cap or duct tape over the open ends of the roof leaders should be sufficient. When the building gutters are installed, care shall be taken to ensure that gutters and down spouts are protected from becoming clogged with construction material and accidentally misplaced/abandoned tools. A test flushing to ensure proper operation at completion of construction and prior to final sign-off is recommended.

3.2 CLOSED DRAINAGE SYSTEM

The closed drainage system is composed of collection and conduit systems. The closed drainage system includes drip strips along the perimeter of each building. This runoff will travel through the drip strip select materials and reach a perforated PVC pipe which will convey the runoff to multiple locations based on where the runoff is from. Building #1 will have closed drainage which outlets directly to the Oyster River and Building #2 will have closed drainage

that outlets to Gravel Wetland #2. The roof drainage collection will be incorporated into the closed drainage system in order to outlet the runoff collected from the roof of each building.

3.3 SEDIMENT FOREBAYS

A sediment forebay is a pre-treatment practice that consists of a small basin designed to dissipate the energy of incoming runoff and allow for settling of suspended solids. A staff gage (wood stake) marked at 6 inch increments shall be permanently installed to measure the depth of sediment accumulation. Runoff outlets through a spillway.

3.4 GRAVEL WETLANDS

Gravel wetlands are constructed wetlands consisting of a sediment forebay and two cells designed to provide stormwater treatment and detention. Each gravel filled cell is topped with a wetland soil media. The soil media is planted with a New England Wetland Seed mix containing a variety of wetland species suitable for this area. During smaller storm events runoff flows horizontally through the gravel and root zone of the vegetation providing treatment. During larger storm events, the controlled release of runoff occurs through an outlet control structure. The outlet control structure is designed to maintain a saturated condition to just below the level of the soil media. A series of PVC risers and underdrains allow the system to function and provide a means for inspection.

3.5 CONVEYANCE SWALE

Conveyance swales are vegetated channels that collect and transport runoff. Conveyance swales do not provide stormwater treatment. Swale shall have 85% vegetative growth prior to receiving runoff.

3.6 PRE-TREATMENT SWALE

Pre-treatment swales are shallow, vegetated channels designed to convey flows while capturing a limited amount of sediment and associated pollutants. Unlike treatment swales, pre-treatment swales are not designed for a specific residence time therefore only allowing for the removal of larger sediment particle as well as the associated pollutants. Flows must be directed in such a way that the runoff will flow through the entire length of the swale to achieve adequate pre-treatment. Swale must have greater than 85% vegetated growth prior to receiving runoff.

3.7 TREATMENT SWALE

Treatment swales are long, wide, vegetated channels that allow for longer hydraulic residence time to promote filtration and vegetative uptake of pollutants. Care shall be taken to prevent the flow of sediment laden runoff to the treatment swale. Swale must have greater than 85% vegetated growth prior to receiving runoff.

3.8 OUTLET PROTECTION

Rip rap aprons are used as outlet protection for all the pipe outlets. Rip rap aprons reduce the velocity of stormwater and prevent erosion at the pipe outlet and receiving channel.

3.9 STONE BERM LEVEL SPREADER

A stone berm level spreader is an outlet structure used to convert concentrated flow to "sheet

flow" and discharge to a receiving area that is usually undisturbed vegetated ground. This allows runoff to be discharged at non-erosive velocities onto natural ground.

4.0 LONG TERM MAINTENANCE OF PERMANENT BMPS

This section will be useful to the property owner and their maintenance subcontractor to establish a systematic approach for the inspection and maintenance of the on-site storm water system components. Included in Appendix B is an Inspection Matrix which summarizes the inspection needs described below. An Inspection Report is provided in Appendix C. It is recommended that completed Inspection Reports be filed with this manual for future reference.

4.1 ROOF DRAINAGE COLLECTION

Underground roof leaders, if utilized on the project, shall be protected from receiving storm water during earth moving operations. Simple use of a cap or duct tape over the open ends of the roof leaders should be sufficient. When the building gutters are installed, care shall be taken to ensure that gutters and down spouts are protected from becoming clogged with construction material and accidentally misplaced/abandoned tools. A test flushing to ensure proper operation at completion of construction and prior to final sign-off is recommended.

4.2 CLOSED DRAINAGE SYSTEM

Implementation of the Temporary BMPs, particularly the Siltsack™ will protect the closed drainage system from siltation. A riprap apron is provided at culvert outlets. Outlet protection reduces the velocity of runoff exiting a pipe thereby preventing scour and downstream erosion. Inspect rip rap for damage and deterioration and repair as necessary. Ensure outlet is free of debris.

4.3 SEDIMENT FOREBAYS

Inspect annually for sediment accumulation, erosion, and condition of vegetation. Sediment should be removed and properly disposed of from the forebay at least once per year and more if accumulation exceeds 1 foot in depth as noted on the staff gage. Embankments should be mowed at least twice per year. Inspect spillway outlet annually and repair as necessary.

4.4 GRAVEL WETLANDS

Inspect the wetland vegetation and bed in the spring. Remove accumulated sediment and replant damaged or dead areas with a suitable New England wetland restoration mix from a local native plant nursery. The seed mix should be suitable for wetland restoration sites that are not permanently inundated. The riser cleanouts and outlet control structure should be inspected annually after a storm event exceeding 2.5 inches in a 24 hour period to determine if the gravel wetland is functioning as designed. Consult a professional if the basin is inundated for more than 48 hours following such an event as replacement of the soil media, gravel, and vegetation may be necessary. Inspect annually the outlet control structure and pipe outlet for clogging and/or debris. The berm should be inspected annually for eroded areas or rodent damage and repaired as necessary. Invasive species shall be removed using hand tools and disposed at the local landfill. Do not dispose of cut invasive species in the woods as this could cause further spreading of the plants.

4.5 CONVEYANCE SWALE

Swales shall be inspected at least annually for sediment accumulation, erosion, and condition of vegetation. Annual mowing to no less than 4 inches of the swale is required to prevent the

growth of woody vegetation. Swale shall have 85% vegetative growth prior to receiving runoff.

4.6 PRE-TREATMENT SWALE

Inspect pre-treatment swales annually for erosion, sediment accumulation, vegetation loss, and presence of invasive species. Perform periodic mowing, using caution to not cut shorter than the Water Quality Flow depth. Remove sediment and debris, repair eroded areas, remove invasive species and dead vegetation, and reseed bare areas as necessary.

4.7 TREATMENT SWALE

Inspect annually for sediment accumulation, erosion, and condition of vegetation. Remove sediment and debris, repair eroded areas, and reseed bare areas as necessary. Channel should be mowed at least once per year to a minimum height of 4 inches.

4.8 OUTLET PROTECTION

Inspect rip rap apron annually for damage and repair as needed. Ensure outlet is free of debris.

4.9 STONE BERM LEVEL SPREADER

Inspect level spreader annually for accumulation of sediment and debris and signs of erosion. Remove debris and sediment when accumulation exceeds 25% of channel depth. Repair damage as needed. Mow as required but at a minimum annually..

5.0 REFERENCES

The Storm Water Systems Management Plan incorporates many standard and accepted practices. Specifically the following references were utilized:

Stormwater Management and Erosion and Sediment Control Handbook for Urban and Developing Areas in New Hampshire. Rockingham County Conservation District, August 1992, or latest edition.

The New Hampshire Stormwater Manual, December 2008, Revision 1.0.

APPENDIX A:
STORMWATER SYSTEMS OVERVIEW PLAN

APPENDIX B:
MAINTENANCE MATRIX

LONG TERM BMP INSPECTION / MAINTENANCE MATRIX

BMP	Major Inspection / Maintenance Criterion ⁽¹⁾	Inspection / Maintenance Interval				
		Spring ⁽²⁾	Summer	Fall ⁽³⁾	Winter	Other / Notes
Roof Drainage System	I - observation of system, check for leaks M - flushing clear of debris (leaves) M - splash pads swept clear of leaves and debris	I - RQ M - RQ	I - O	I - R M - R	I - O	
Closed Drainage System	I - check sump for accumulation of sediment M - Pump out basin to remove accumulated sediments and oils/gases. I - Inspect Bioskirt™ and Snout™	I - RQ M - R	I - O	I - RQ M - R	I - O	Pump basin when sediment is 6" or less from outlet pipe
Sediment Forebays	I - read staff gage to determine depth of sediment accumulation M - remove accumulated sediment. M - mow embankments at least twice per year	I - RQ	I - O	I - R M - R	I - O	Remove sediment annually or more if over 1 foot depth as measured with staff gage.

LONG TERM BMP INSPECTION / MAINTENANCE MATRIX

BMP	Major Inspection / Maintenance Criterion ⁽¹⁾	Inspection / Maintenance Interval				
		Spring ⁽²⁾	Summer	Fall ⁽³⁾	Winter	Other / Notes
Gravel Wetlands	I - check for drawdown time I - inspect wetland vegetation and bed I - check earthen dam for settlement, rodent damage, failures I - inspect riser cleanouts, outlet control structure, and pipe outlet M - replant additional wetland vegetation M - remove fallen leaves, branches, etc M - remove invasive species M - remove accumulated sediment	I - RQ M - RQ	I - O	I - R M - R	I - O	Drawdown time to be checked annually following a storm of 2.5 inches or more in a 24 hour period.
Conveyance Swales	I - check for sediment accumulation M - remove debris and sediment M - mow once per year M - reseed bare areas M - repair eroded areas	I - RQ M - RQ	I - O	I - R M - R	I - O	Grass shall be mowed to a height of 4 inches minimum. Reseed with grass mix noted on plans.
Pre-Treatment Swales	I - check for sediment accumulation M - remove debris and sediment M - mow once per year M - reseed bare areas M - repair eroded areas	I - RQ M - RQ	I - O	I - R M - R	I - O	Grass shall be mowed to a height of 4 inches minimum. Reseed with grass mix noted on plans.
Treatment Swales	I - check for sediment accumulation M - remove debris and sediment M - mow once per year M - reseed bare areas M - repair eroded areas	I - RQ M - RQ	I - O	I - R M - R	I - O	Grass shall be mowed to a height of 4 inches minimum. Reseed with grass mix noted on plans.

LONG TERM BMP INSPECTION / MAINTENANCE MATRIX

Inspection / Maintenance Interval						
BMP	Major Inspection / Maintenance Criterion ⁽¹⁾	Spring ⁽²⁾	Summer	Fall ⁽³⁾	Winter	Other / Notes
Outlet Protection	I - check damage to rip rap apron M - remove debris including accumulated leaves and branches M - Repair rip rap apron	I - RQ M - RQ	I - O	I - R M - R	I - O	
<u>Notes</u> (1) The BMP should be inspected as recommended and maintenance shall be performed as needed. Maintenance may be needed at shorter or longer intervals depending on weather conditions, and use of the property and contributing watershed (2) Early Spring as vegetation begins to blossom or earlier (3) Late Fall after majority of leaf fall, but prior to snow fall		<u>Abbreviations</u> I - Inspection M - Maintenance O - Optional R - Recommended RQ - Required				

APPENDIX C:

MAINTENANCE REPORTS



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BMP Maintenance Report

Site Name:	Harmony Homes by the Bay
Site Location:	W. Arthur Grant Circle, Durham NH
Installation Date:	Fall 2015

Owner:	Harmony Homes	Contractor:	
Contact Name:	John Randolph	Contact Name:	
Company Name:		Company Name:	
Telephone:	(603) 834-2317	Telephone:	
Fax:		Fax:	
Address:	1 Stagecoach Road Durham, NH 03824	Address:	

Maintenance Log

Items Inspected	Checked		Maintenance Needed		Comments
	Yes	No	Yes	No	
Roof Drain Collection					
Closed Drainage System					
Sediment Forebays					
Gravel Wetlands					
Conveyance Swales					
Pre-Treatment Swales					
Treatment Swales					
Outlet Protection					
Stone Berm Level Spreader					

APPENDIX D:
MANUFACTURERS DATA SHEETS