

1.0 INTRODUCTION

The following Stormwater Management Plan (SMP) and Soil Erosion and Water Pollution Control Plan (SEWPC) is compiled in accordance with all applicable laws and permit requirements within the Town of Kittery and State of Maine. The plan uses the Maine Department of Environmental Protection (DEP) Stormwater Best Management Practices Manual (Draft Revision Summer 2005) and the Maine DEP Best Management Practices for Erosion and Sediment Control (3/2003).

Qualifications of Preparer

Hillier & Associates has reviewed and prepared Erosion and Sediment Control Plans for various projects across the State of Maine. Robert Mohlar, P.E., has worked as a consultant to Maine DOT's Environmental Office for the past four years. Rob has been responsible for DOT construction projects (Bridge, Arterial, and Multi-Modal) throughout Regions 2, 3 & 4 during this time. Responsibilities associated with this role include; design/oversight of temporary and permanent erosion control BMP's, erosion control plan review, SEWPCP review, SPCC Plan review, and coordination of project related surface water issues with DOT staff and contractors. Relevant projects include; shoreline stabilization, culvert sizing, stream channel restoration, slope stabilization, and road design. Rob is proficient in AutoCAD, HydroCAD, and ArcMap GIS. Zach Henderson, M.S., is currently the project manager of the Surface Water Quality Protection Program for the MaineDOT, providing project support and development of permanent erosion/sediment control and stormwater management projects for existing MaineDOT infrastructure. Project responsibilities include project proposal review, landowner contacts, project design, procurement of E&S Control materials, drainage easement acquisition, utilities coordination, construction management and engineering and program marketing.

Project Specific Information

Robert's Maine Grill is being constructed on the site of the former Quarterdeck restaurant along the shore of Spruce Creek in Kittery, Maine (Figure 1). The property (Map 38 Lot 12) is located on the northern shoreline of Spruce Creek just east of the Route 1 causeway. The 0.7 acre property was previously developed with approximately 0.56 acres of parking, 0.11 acres of rooftop and 0.03 acres in maintained grass setback or landscaped area. The property is being redeveloped to accommodate a new restaurant with no changes to overall developed area. Under the Maine Stormwater Management Law administered through the Maine DEP this site does not require a stormwater permit (see Exhibit A). Requirements under a legal agreement between the Town of Kittery, Michael Landgarten of Robert's Maine Grill and the previous landowner has necessitated the development of a stormwater management plan and the associated erosion control plan for the redeveloped site.

Figure 1: Location of Robert's Maine Grill in Kittery, Maine



2.0 GENERAL STORMWATER MANAGEMENT PLAN ELEMENTS

Drainage Study

Stormwater modeling for this project was performed utilizing HydroCAD→ 7.0 software. Modeling consisted of identifying all surface water flowpaths that drain to, across and from the property. Within this “watershed area”, we originally divided the sections into discrete subcatchments based on natural drainage patterns, but modeling the facility as one drainage subcatchment was deemed appropriate based on the small size of the facility and proximate locations of all stormwater outfalls. HydroCAD models each drainage structure and subcatchment as an individual interconnected node. Subcatchment nodes are modeled as individual watersheds with unique physical characteristics consisting of surface area, surface condition, overland flow lengths and associated land slope. Appropriate input parameters were determined through field observation, GIS analysis, or review of construction plan drawings.

Rainfall distribution and depth are standardized inputs, based on geographic location. The Time-of-Concentration (T_c) is based on certain physical characteristics of the subcatchments; land cover, slope, drainage patterns, and dimensions of particular drainage structures.

For the purposes of this study, SCS TR-20 (TR20) was selected as the most appropriate method within HydroCAD to analyze pre- and post stormwater conditions on the site. TR20 is used to determine peak storm water flows (in cubic feet per second – cfs) and corresponding volumes from individual subcatchments. TR20 methodology is based on the following concept.

A rainfall distribution is selected which indicates how the storm depth will be distributed over time. The distribution used in York County is an SCS Type III storm, with a standardized duration of 24 hours. A design storm depth, which is determined from SCS rainfall maps, is based on a 24-hour return period. 2-year (3 inches) 10-year (4.5 inches) and 25-year (5.7 inches) design storms were used for this analysis. Combined with the rainfall distribution, this specifies the cumulative rainfall depth at all times during the storm.

General Modeling Assumptions

The existing stormwater conditions modeling for this plan have been based on the previously developed condition of the site. The existing conditions were derived from aerial photographs, the pre-construction survey and field determination of surface land-use conditions. Soils are not assumed to be a major factor in the rainfall-runoff evaluation for the site due to the primarily impervious surfaces encountered under the existing conditions. The site has been developed since the mid-1940's and is assumed to be fill over a poorly-drained Scantic Silt Loam (Hydrologic Soil Group D).

Roberts Maine Grill sits on a commercial lot less than 1 acre in size. The existing surface conditions on this lot are comprised almost entirely of impervious surfaces (approximately 96%) with no storage/detention occurring. Approximately 4% of the lot is comprised of small isolated landscaped areas that are typically curbed and raised such that they provide little to no stormwater detention benefit. Additionally, the lot presently receives a portion of drainage off the Route 1 corridor (0.17 acres). Initially, the existing conditions were modeled as four separate sub-catchments. There are no defined outfalls or ponds, as drainage just generally drains off the southerly and easterly edges of the site. The rough dimensions of the site are approximately 200 feet by 180 feet, which produces Time-of-concentration (T_c) values in the one-minute range. The limited footprint of the site provides little opportunity to achieve meaningful quantity reductions associated with measures designed to increase T_c . The small footprint of the site and proximity to coastal wetlands also limits our ability to consider typical storage/detention options.

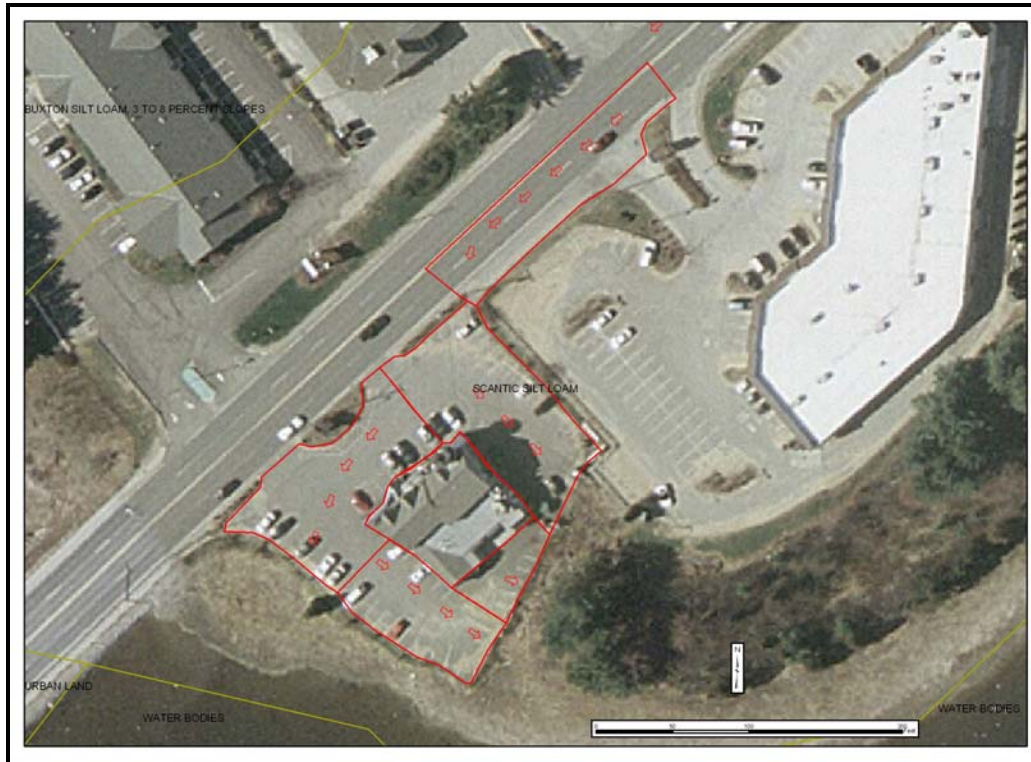
Based on the T_c limitations and the fact that there are no defined drainage structures we decided to model the entire site as a single subcatchment and focus on innovative structural improvements to provide surface infiltration/filtration and detention/storage. Modeling the site as a whole also allows for better comparison of pre and post redevelopment conditions. Detailed assumptions for the existing and proposed conditions are included in their respective sections.

Potential Effects on Abutters

There will be no effect from the proposed plan on abutters of the property. All drainage from the property drains directly or indirectly to Spruce Creek.

Existing Conditions

Figure 2: Existing conditions drainage overlay based on 2003 aerial photographs. The site is underlain by Scantic Silt Loam based on York County Soil Survey. Drainage subcatchment is indicated in red and has been broken into parcels to indicate minor flow paths. Major Tc flowpath drains from Route 1 to and across the site.



Existing stormwater drains across the parking areas to three locations on the south and southwest sides of the property. There is no detention or storage of any of the stormwater runoff. Additionally, Route 1 contributes runoff through a curbbreak in the northern corner of the lot. This flows as shallow concentrated flow across the northern portion of the lot and has been used as the primary Tc flowpath for the existing conditions model. A weighted curve number was generated based on the proportion of subcatchment contributing area in impervious and pervious surfaces. Please see Appendix A and the Existing Condition Plan for detailed information regarding the HydroCAD input values and assumptions.

Figure 3: Summary table of HydroCAD input and output for existing conditions.

HydroCAD Existing Condition Inputs and Outputs							
Time Span - 5-20 hours dT- 0.01 hours							
	Rainfall (in)	Runoff Area (sf)	Runoff Depth (in)	Flow Length (ft)	Tc (min)	Weighted CN	Runoff Peak (cfs)
Type III 2 year	3	40254	2.5	366	2.5	97	2.99
Type III 10 year	4.5	40254	3.88	366	2.5	97	4.56
Type III 25 year	5.7	40254	4.98	366	2.5	97	5.81

Proposed Conditions

Basic stormwater management objectives for the redevelopment of the site are listed as follows.

1. Management of stormwater quantity through the reduction of impervious area on site.
2. Maintain or improve runoff quality through the minimization of contact between rainfall and polluted surfaces (i.e. parking lot pavement, disposal areas, etc.) and through infiltration/filtration/settling after contact.
3. Minimize the potential for human activity to contribute to pollution potential through stormwater pollution prevention practices. Keeping impervious surfaces free of pollutants is the best way to reduce stormwater pollution loads.

The following figure illustrates the proposed structural changes to the site.

Figure 4: General overview of stormwater management improvements to the RMG site.



It is our judgment that the proposed management scenario provides a reasonable option for stormwater quantity and quality treatment on a previously developed site and provides a demonstration of a variety of techniques advocated by the Maine DEP under the precepts of “Low Impact Development”.

The stormwater management on the site as proposed would consist of three major components; (1) a reduction in overall impervious surface by approximately 30% on the facility through the

use of pervious parking technology and an expansion of landscaped areas, (2) store, reuse and filter rooftop runoff and (3) develop and utilize stormwater pollution prevention practices for facility management. The following diagrams illustrate typical details for the first two technologies.

Figure 5: Pervious pavement system utilizing GeoWEB and a crushed stone sub-base.

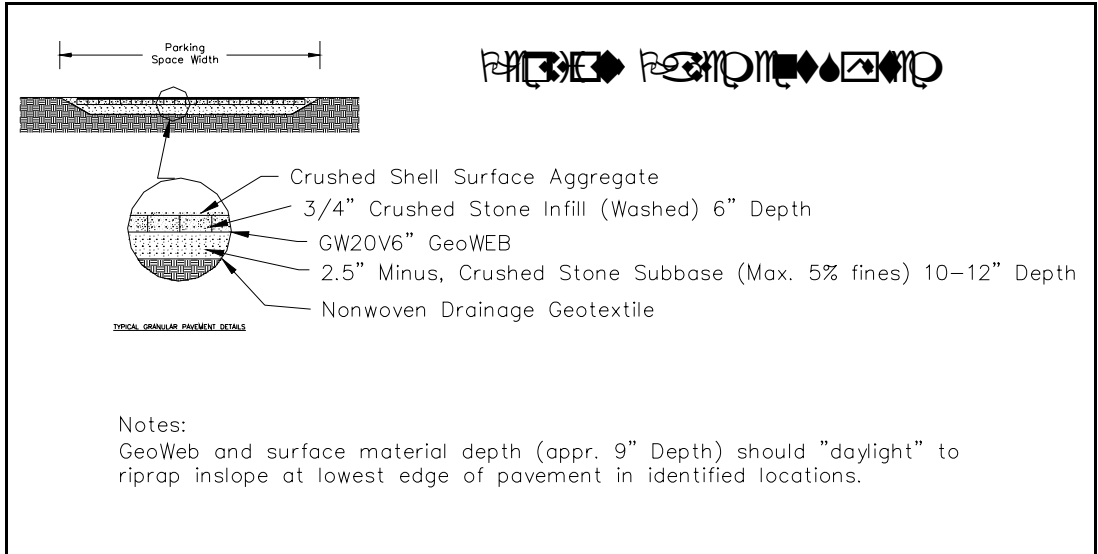
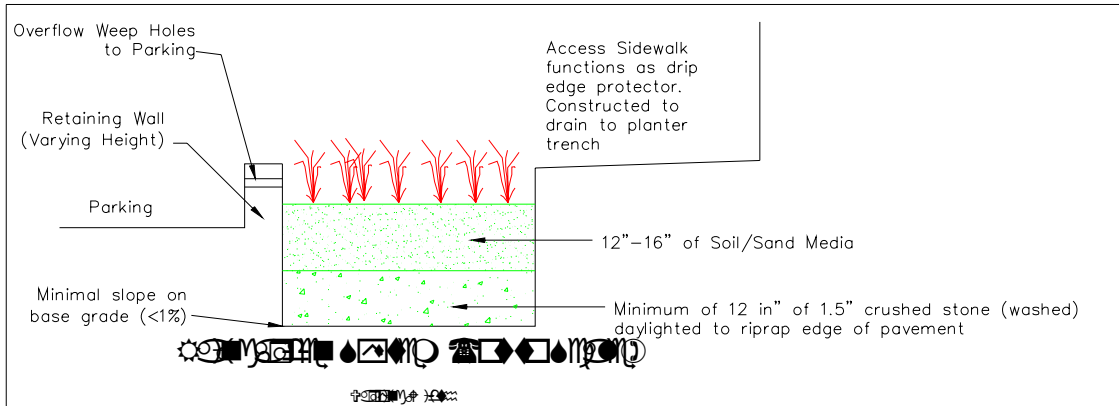


Figure 6: Raingarden cross-section. Dimensions may vary in relation to existing grades and specific location.



The perimeter rain gardens serve a dual purpose of temporary ponding and filtration but more importantly keep rooftop runoff off the parking areas during smaller, more frequent storm events through subsurface drainage.

In addition to the perimeter raingardens, temporary storage of rooftop runoff will be handled in a 550 gallon cistern. The cistern will drain over 30 hours through drip irrigation tape and will only be utilized in the season above freezing. The reduction of stormwater quantity as a function of the rooftop runoff storage was not included in the hydrologic model as a function of its seasonal use.

Instead of modeling the stormwater treatment systems independently we determined to attach a specific curve number to each system feature and its associated area. We feel this is a conservative approach for the resulting model. It is assumed that there is no exfiltration from the system and little or no storage other than that obtained through the initial abstraction as a result of the adjusted curve number, although research indicates that pervious pavement systems (with a sealed sub-base) can result in runoff reduction of 25-45% over a 30-day period due to evaporation of stored water within the structure (Pratt et al, 1990). Despite this information, we are considering that each of the stormwater systems will simply have a different curve number as a result of changing surface material and infiltration rate.

It is expected that runoff from Route 1 will be permanently diverted back along Route 1 through the construction of a sidewalk project planned for construction no later than the Spring of 2006 (personal communication, Shawn Smith, Maine DOT, Exhibit C). This will result in a net reduction of stormwater routing and discharge from the facility but this change to the hydrology of the proposed conditions was not included in the plan at this time.

The following figure illustrates the potential peak flows under the proposed conditions. There is no change to the hydrology of the site related to the Time of Concentration flowpath as there will be no change to existing grades and topography on the site. The Curve Number changes as a result of expansion of the pervious parking and landscaped areas, with a resulting decrease in peak flows from the site under the redeveloped conditions. Please see Appendix A and the Proposed Condition Plan for detailed information regarding the HydroCAD input values and assumptions.

Figure 7: Summary table of input and output for proposed conditions

HydroCAD Proposed Condition Inputs and Outputs							
Time Span - 5-20 hours dT- 0.01 hours							
	<i>Rainfall (in)</i>	<i>Runoff Area (sf)</i>	<i>Runoff Depth (in)</i>	<i>Flow Length (ft)</i>	<i>Tc (min)</i>	<i>Weighted CN</i>	<i>Runoff Peak (cfs)</i>
Type III 2 year	3	32927	2.22	366	2.5	94	2.78
Type III 10 year	4.5	32927	3.6	366	2.5	94	4.39
Type III 25 year	5.7	32927	4.71	366	2.5	94	5.66

Modeling Conclusions

The reconstruction of the site to incorporate stormwater structural and non-structural best management practices should create a reduction in the migration of stormwater pollutants off the Robert's Maine Grill site. The combination of a reduction in impervious surfaces, reduced contact time between stormwater and parking areas and facility pollution prevention best management practices should greatly improve the new facility over the previously site. Site constraints limit overall stormwater quantity (and subsequently quality) control, but the proposed management scenario should dampen peak flows as expressed in the HydroCAD evaluation. There are numerous references in the literature that examine stormwater pollutant load reductions as a result of filtration and pervious pavement systems and we would expect that the proposed changes will provide some improvement for overall stormwater runoff quality as well.

General Inspection and Maintenance Plan

- 1. Stormwater filtration and treatment systems shall be inspected at least annually** for the continued functionality and infiltration of the pervious surface materials. Stormwater systems should be inspected during rain events if possible and systems may be checked at the outlet of the underdrain system for flow during and after rain events. Consistent overflow of the systems during rain events will indicate the need for excavation and replacement.
- 2. Any deterioration threatening the structural integrity of the facilities shall be immediately repaired.** These include such things as replacement or cleanout of raingarden overflow components, excessive slumping or sagging of pervious parking areas or deformation of structure holding the rainwater storage tanks.
- 3. Accumulation of surface organic debris within the raingardens should be kept to a minimum and cleaned out annually to prevent clogging of overflow pipes.**
- 4. Plants and shrubs within the raingardens and planted buffer area should be inspected twice per year** to evaluate their health and remove any dead vegetation. Diseased vegetation should be treated as necessary using preventative and low-toxic measures to the extent possible. Pruning and weeding may also be necessary to maintain the treatment area's appearance. Mulch and or stone replacement is recommended when erosion is evident or when the site begins to look unattractive. Spot mulching may be adequate when there are random void areas; however, once every two to three years the entire area may require mulch replacement. This should be done during the spring. The old mulch should be removed before the new mulch is distributed. Old mulch should be disposed of properly.
- 5. Pervious parking surfaces should be raked as necessary** to maintain a 1.5-2" cover over the GeoWEB product. The parking areas should be kept free of organic material and trash on an ongoing basis.
- 6. Paved parking lots shall be swept when necessary to remove debris.**
- 7. Use minimal amounts of pesticides, fertilizers, etc.** on landscaped elements, if at all, and only in dry weather periods. Never exceed manufacturer's recommended application rates.
- 8. Maintain the existing paved separation berms along the Route 1 entryway and exit** in order to eliminate the overrunning of the RMG lot with concentrated shallow runoff from the curblines of Route 1.

Long-term Facility Pollution Prevention Practices

1. **Cover areas where potential pollutants are stored.** Store pollutants such as trash, grease, paints, chemicals, and metals to minimize contact with stormwater or water from other sources. Keep these materials covered, labeled, and stored in appropriate containers.
2. **Seal leaking storage containers and dumpsters.** Prevent substances like grease, liquids, and food products from coming into contact with rainfall and entering the storm drains. Contact local company for replacement of leaking dumpsters.
3. **Prevent spills and leaks. Clean up promptly when they occur.** Maintain a regular inspection and repair schedule for vehicles and equipment. Clean any spill promptly, not allowing them to evaporate. Clean spills without water whenever possible. Rags, damp mops, and dry absorbent materials are recommended for cleanup. Dispose of any spill waste properly.
4. **Sweep parking lots and outdoor storage areas regularly.** Sweep these areas at least once in the spring and late fall to maintain a debris-free facility. Pick up and dispose of debris, when possible. Never hose off paved surfaces.
5. **Train employees to implement stormwater pollution prevention practices.**
6. **Clean equipment in a designated indoor area** where cleaning water will not flow to a storm drain. Collect water and dispose to a sink or indoor floor drain.
7. **Save oil, grease and meat fat for recycling in sealed containers.** Never pour into a sink, floor drain, or storm drain.

3.0 GENERAL SOIL EROSION AND WATER POLLUTION CONTROL PLAN

Schedule and Sequence for Soil Disturbance Activity

The work is anticipated to be done between November 2005 and April 2006. Project Completion Date: April 1, 2006.

November 2005-February 2005

Perimeter Erosion and Sediment Control
Completion of Building Construction

March 2006

Excavation of Parking Area for Stormwater BMP installation
Gravel/Biofilter Media/GeoWEB Placement
Buffer/Raingarden Planting
Remove Temporary Erosion Control

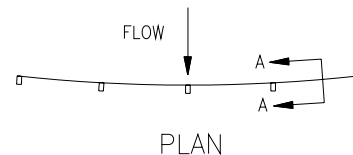
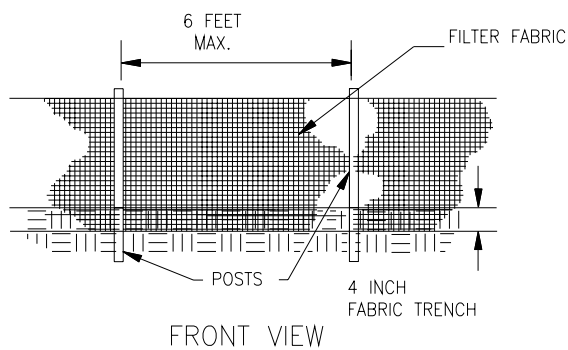
Temporary Erosion and Sediment Control

The following are components of the temporary erosion and sediment control for the site during stormwater improvements.

- Silt Fence Perimeter Control

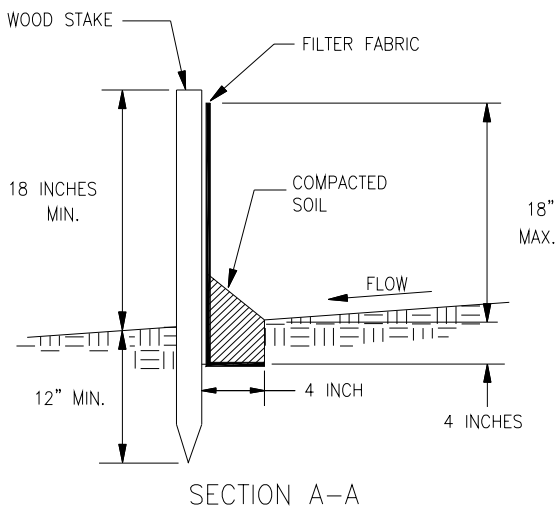
The perimeter of the construction area (as shown on plan) will be protected with silt fence as illustrated below. Upon completion of the project, excessive accumulation of material behind the silt fence should be removed and the disturbed area seeded and mulched. Silt fence is removed upon permanent vegetation establishment and erosion control mulch application along the perimeter buffer of the site.

Figure 8: Typical silt fence sediment control diagram.



NOTES:

1. FILTER BARRIER SHALL BE CONSTRUCTED LONG ENOUGH TO EXTEND ACROSS THE EXPECTED FLOW PATH FROM DISTURBED AREA.
2. FILTER FABRIC SHALL BE PROPYLENE, NYLON, POLYESTER OR ETHYLENE YARN WITH A MINIMUM TENSILE STRENGTH OF 50 LBS. PER LINEAR FOOT AT 20 PERCENT MAXIMUM ELONGATION AND CONTAINING ULTRAVIOLET INHIBITORS. FILTER FABRIC SHALL RETAIN A MINIMUM OF 85% OF THE SOIL, BY WEIGHT, BASED ON SIEVE ANALYSIS, BUT IS NOT FINER THAN AN EQUIVALENT OPENING SIZE OF 70.
3. SUPPORT POSTS SHALL BE A MINIMUM 30 INCH LONG WOOD POSTS OR STEEL FORM STAKES DRIVEN A MINIMUM OF 12 INCHES INTO THE GROUND. POSTS SHALL BE SPACED A MAXIMUM OF 6 FEET APART.
4. A 4 INCH FABRIC TRENCH SHALL BE EXCAVATED ALONG THE UPHILL SIDE OF FILTER BARRIER POSTS. THE BOTTOM EDGE OF THE FABRIC SHALL EXTEND TO AND ACROSS THE BOTTOM OF THE TRENCH. THE TRENCH SHALL BE BACKFILLED TO 4 INCHES ABOVE GROUND AND COMPACTED TO BURY AND SECURE THE BOTTOM OF THE FILTER FABRIC.
5. CONTRACTOR SHALL MAKE INSPECTIONS WEEKLY DURING THE WET SEASON, MONTHLY DURING THE DRY SEASON AND IMMEDIATELY AFTER EACH RAINFALL TO DETERMINE IF REPAIRS AND SEDIMENT REMOVAL IS REQUIRED. SEDIMENT SHALL BE REMOVED BEFORE IT HAS REACHED ONE THIRD THE HEIGHT OF THE FILTER FABRIC.



- Temporary Diversion of Route 1 Runoff:

Route 1 runoff should be diverted during construction of pervious parking system in order to keep stormwater runoff from the temporarily excavated areas. Diversion of the curbflow to existing catch basin along Route 1 can be accomplished using sandbags to block curb break inlet. This will only be required if new sidewalk construction and permanent diversion of Route 1 runoff has not been completed at the time of construction.

- Erosion Control Mulch Placement and Buffer Planting

Before the planting of native buffer vegetation along the parking area, a berm of erosion control mulch will be placed below the potential planting area. This berm should exceed 12" deep and 2-4' in base width. The berm should be placed just below the 5' buffer width. After planting of the buffer vegetation the mulch should be raked into place around the plants. Erosion control mulch should be secured through New England Organics, Inc. in Unity, ME.

- Temporary Storage and Placement of Aggregates

All aggregates/media used for stormwater management systems should be stored on the upper (northwestern) portion of the parking lot to reduce the potential for the mobilization of any fines associated with the material. If materials are stored on site overnight the perimeter of the stockpile should be protected with a complete hay bale berm around the stockpile.

- Removal of Excavated Materials

All material excavated for the raingarden and pervious pavement applications should be disposed of as required on the same day as excavated at a location off-site. No excavated material will be stored on the site.

- Riprap Slope Protection

All four of the "daylighted" aggregate drainage areas should be protected with riprap armor at the depth of the aggregate drain on a 3:1 slope.

- Landscaped Area Temporary and Permanent Mulching

All constructed landscape areas (see plan) will be mulched on a daily basis. All permanent stabilization of these areas will be completed within one week of the last soil disturbance. There will be no overnight storage of landscaped area soil fill on the site.

- Sequencing of Excavation

If possible excavation of stormwater management systems should be accomplished so that individual elements can be backfilled and complete before moving on to the next individual element. No open excavated areas should be left overnight.

Spill Protection and Prevention Measures

All refueling should take place in an identified area if on-site. The refueling area should have a spill prevention kit available at all times. No emptying or changing of petroleum products or other materials considered hazardous will occur over bare soil. All handling of materials considered hazardous will occur within the refueling area. The site supervisor should implement routine inspections of all equipment on site for excessive leaks. The site supervisor should have a spill prevention kit available at the site.