STORMWATER MANAGEMENT REPORT (BASIC, GENERAL, FLOODING, AND URBAN IMPAIRED STREAM STANDARDS)

421 WARREN AVENUE COMMERCIAL COMPLEX

PREPARED FOR:

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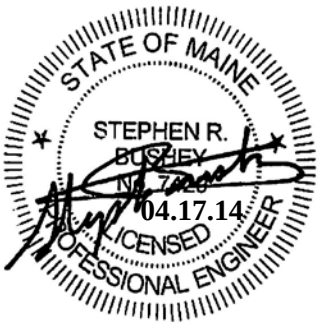

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STORMWATER MANAGEMENT REPORT

1.0 INTRODUCTION

Fay, Spofford & Thorndike (FST) has been retained by PH Warren Ave, LLC to assist on the preparation of site design and site permitting for a proposed 25,040 SF footprint, multi-unit building in Portland, Maine. The development will include a new 6-unit building, 36 space parking lot, and related infrastructure improvements.

The project's primary stormwater management measure will be the construction of two gravel wetlands. Gravel wetlands are a relatively new BMP measure that offer higher storage volumes on sites with low hydraulic head. The gravel wetland section is intended to provide sufficient capacity to meet the Chapter 500 Flooding and water quality treatment standards. In addition to the gravel wetlands, the project's stormwater management will include a gravel drip strip for water quality treatment of runoff from the building roof.

This proposed project will create a total of 2.25 acres of developed area of which 1.29 acres will be new structure area (building and other impervious surfaces) within the approximately 4.63 acre project watershed area analyzed. The Applicant also owns nearly 55 acres of surrounding property. The 4.63 acre watershed area that was analyzed was determined to be relevant to the two project hydrologic points of interest impacted by the new development. This project meets the thresholds requiring a MaineDEP Stormwater Permit. The stormwater management design presented herein complies with criterion of the City of Portland Stormwater Requirements and the MaineDEP Chapter 500 Regulations. The Applicant is requesting the City of Portland complete the MaineDEP Stormwater review under their delegated review authority.

The development site is located on the north side of Warren Avenue between Interstate 95 and Forest Avenue in Portland. The site is owned by PH Warren Avenue, LLC. A large portion of this site currently drains to a drainage way in the northeast quadrant of the site. Part of the southerly tip of the site drains into Warren Avenue and is collected by the City's municipal drainage system. A second part of the southerly end drains across to Harbour Auto-Body and is collected in a small detention pond before being conveyed into the City drainage system.

The use of two gravel wetlands will allow the capture and treatment of the required water quality volume derived from a 1" rainfall as well as up to the 25-year storm event. The Stormwater Management devices on site will also meet the Chapter 500 flooding requirements up to a 100-year storm.

Various figures including USGS, aerial photographs, and related maps are appended to this report in Appendix A.

On behalf of the Applicant, FST has prepared this report to show the proposed Stormwater Management Plan meets the MeDEP's General Stormwater and Urban Impaired Stream Standards and City of Portland's Technical Standards.

2.0 EXISTING SITE CONDITIONS

The proposed site lies within a 4.63 acre analyzed watershed area which is part of a broader 48.71 acre property area. FST decided to only analyze watershed area in which the proposed development would impact two points of interest. The site is currently undeveloped with the following land cover:

TABLE 1 – EXISTING LAND COVER	
Current Land Cover	**Area (acre)**
Woods/Meadow	2.58
Roof	0.27
Lawn	0.42
Pavement	0.67
Gravel	0.69
Total	**4.63**

The existing site is comprised of mostly undeveloped woods, meadows, lawn and gravel areas.

Topography is relatively flat within the site. A large portion of the site drains over a flat wetland area towards a tributary in the northeast quadrant of the site. This tributary contributes to the so called "Northern Branch" of the Capisic Brook Stream System[1]. About half of the area in the southern portion of the site drains towards Warren Avenue and where runoff is picked up by the City of Portland Municipal Stormwater System through a catch basin in the street. The remaining front area contributes runoff towards an existing detention pond adjacent to the Harbour Auto Body shop, which is located on property owned by the Applicant. Runoff is released from this detention pond and is discharged to the City of Portland Stormwater System.

The preliminary geotechnical explorations by S.W. Cole Engineering in December 2013 show that the site contains fill soils over a layer of relic topsoil underlain by glaciomarine sands, silts and clays.

The site is in the B-4 Zone and is considered by the City of Portland as a permitted use.

The site is not located in a mapped 100-year floodplain and is denoted as Zone X based upon the Portland FEMA mapping as depicted on Figure 7 containing an excerpt of the MGIS Firm Panel #2300510006B.

Figures 8, 9, and 10 appended to the report provide the USDA medium intensity soils, sand and gravel aquifers maps, and surficial geology map for the site. A copy of the geotechnical findings for the site is contained in Appendix F. Wetlands resources were delineated by James Logan of Albert Frick Associates.

3.0 PROPOSED PROJECT

The proposed project is generally described below and is shown on the Post Development Watershed Map. The project will develop 2.25 acres including 1.29 acres of impervious area.

The proposed project includes parking areas surrounding an approximately 25,040 SF building footprint. The site access will be off the existing Warren Avenue drive serving 429 Warren Avenue and this will consist of a 45' wide two-lane driveway positioned directly in front of the building. The parking areas include 36 spaces on the west side of the building.

[1] See Capisic Brook Watershed Plan, Woodard & Curran, November 2012

The proposed land use for the site after development will be as follows:

TABLE 2 – POSTDEVELOPMENT LAND USE		
Proposed Land Cover	**Area (acre)**	**Change from Current (acre)**
Woods/Meadow	1.40	-1.18
Roof	0.85	+0.58
Lawn/Landscaped Planting Areas	0.70	+0.28
Pavement/Impervious	1.57	+0.90
Gravel	0.11	-0.58
Total	**4.63**	

The Erosion & Sediment Control Report contained in Appendix G of this section outlines the erosion control measures which will be required for the project (Basic Stormwater Standards).

4.0 WATERSHED DELINEATION METHOD

The following resources were used for watershed delineation:

- USGS Topographic Mapping
- Field Reconnaissance

  Justin Pellerin, Design Engineer, Fay, Spofford & Thorndike
  Reviewed by Stephen Bushey, P.E., Fay, Spofford & Thorndike

- Site Topographic Survey

  Nadeau Land Survey Dated December 2013

- Hydrologic Soil Group Information

  Medium Intensity Soils Survey by Albert Frick & Associates, Inc.

5.0 REFERENCES

- Urban Hydrology for Small Watersheds from the USDA SCC *Technical Release SS, dated 1986*
- Erosion and Sediment *Maine Erosion and Sediment Control BMPs", published by the MeDEP in 2003 http://www.maine.gov/dep/blwg/docstand/escbmps/index.htm*
- City of Portland – Code of Ordinances
- Stormwater Management for Maine Volume III – BMP Technical Design Manual
- Chapter 500 MaineDEP Rules, Revision December 2011
- City of South Portland Stormwater Manual – Gravel Wetland
- Modeling Software HydroCAD Stormwater Modeling System, Version 8.5, Applied Microcomputer Systems – used for modeling underground storage facilities
- Microsoft Excel 2010, Microsoft Corporation – used for spreadsheet computations.

6.0 DESIGN STORMS

TABLE 3 – RAINFALL	
Rainfall Amount (inches)	
2-Year Storm	3.0
10-Year Storm	4.7
25-Year Storm	5.5
100-Year Storm	6.7

Hydrologic Parameters: Cumberland County SE Type III Distribution: Antecedent Moisture Condition 2, SCS 24 Hour Distribution as per MeDEP Stormwater Best Management Practices (page 25).

7.0 PRESENTATION OF ANALYSIS

The stormwater analysis has been performed for the project to determine compliance with the stormwater management requirements of the City of Portland and the MeDEP Chapter 500 Stormwater Rules and to show a plan which will generally meet the requirements with any exceptions noted herein. The analysis is documented with supporting HydroCAD models appended to this narrative.

8.0 MODELING ASSUMPTIONS

- The gravel wetlands were modeled as ponds to capture and store up to the 100-year storm event rainfall volume. The gravel wetland section includes an 8" thick wetland soil layer underlain by a 3" pea stone layer and a permanently saturated 24" deep layer of crushed stone. The crushed stone layer will be tied into outlet control structures that will contain weirs/orifices that will control the rate of flow passing horizontally through the crushed stone system as well as control the overall peak discharge to the two points of analysis studied for the post development conditions.
- Analysis was run with pipe lengths modeled as culvert outlets. Pipe sizes were generated using the HydroCAD modeling flow computations.
- The Tc flow paths were assumed to be a min. of 6 minutes as recommended in the TR-55 technical manual. In instances where flow paths were computed to be less then 6 minutes a direct entry command was used.

9.0 PREDEVELOPMENT ANALYSIS

Runoff from the site currently flows to two points of analysis (POA). These consist of the following:

- Point of Analysis #1 is a point on the site where the directional flow of two wetland fingers meet and it is close to the proposed gravel wetland #2 discharge point. The area north of the proposed development is a relatively large and flat area. The point of analysis was chosen to minimize unnecessary watershed area in the analysis and to arrive at an accurate flow rate comparison of pre and post development flows. Due to the development the area tributary to this POA varies slightly from pre-development to post-development. Approximately 2.47 acres are tributary in the pre development condition versus approximately 2.52 acres of area tributary in the post development condition.

- Point of Analysis #2 is an existing City of Portland catch basin where flows from the southerly tip of the site drain and discharge into the city drainage system. Currently runoff drains from the proposed development site and a portion of Harbour Auto Body property into an existing detention pond that discharges via a pipe into the municipal system. Since flows from pre development sub catchment two travels to a detention pond on an adjacent property, FST felt like it was important to model the hydrological impacts from the adjacent site to accurately model pre versus post development conditions. As stated before, due to the development, the area tributary to this point varies slightly from pre development to post development. Approximately 2.16 acres are tributary in the pre development condition versus 2.11 acres of area tributary in the post development condition.

The Predevelopment Peak flows at the two POA's are as follows:

TABLE 4
PREDEVELOPMENT FLOWS (PEAK DISCHARGE RATES) AT POA

POI #	2 Yr Storm Event (CFS)	10 Yr Storm Event (CFS)	25 Yr Storm Event (CFS)
1	1.46	3.21	4.08
2	3.66	6.87	8.13

10.0 POSTDEVELOPMENT ANALYSIS

The postdevelopment analysis considers the two gravel wetlands and the proposed roof drain gravel drip strip treatment systems for their storage capacity. These measures offer control to detain runoff volumes up to the 100-year storm event. Runoff passing through the gravel wetland section will be captured and stored within the pond reservoir. The outflow from each gravel wetland will be controlled through a control structure that will contain an orifice control mechanism to regulate the flow rate discharging from the system. The outlet pipes from each water storage system will discharge to stabilized ground conditions or via pipe to each Point of Interest. The following post development peak flows have been computed for each POA:

TABLE 5
POST DEVELOPMENT FLOWS (PEAK DISCHARGE RATES) AT POA

POI #	2 Yr Storm Event (CFS)	10 Yr Storm Event (CFS)	25 Yr Storm Event (CFS)
1	1.19	3.03	3.92
2	2.79	5.92	6.90

11.0 STORMWATER MANAGEMENT OBJECTIVES

The goal of the Stormwater Management Plan is to design, operate, and maintain the development to avoid downstream erosion or significant water quality impairment, as well as to avoid downstream flooding.

These goals will be achieved by:

- Designing the project to meet the Portland Stormwater Management Standards and the MeDEP Chapter 500 Basic Standards, General Standards, and Flooding Standards (revised October 2010).
- Designing water quality measures to provide long-term removal of non-point contaminants.
- Implementing a plan to control erosion, sedimentation, or fugitive dust emissions during construction.
- Maintenance of the Stormwater Management System in accordance with the Stormwater O&M Manual (provided as a separate document).

The plan has been designed in accordance with the MeDEP Chapter 500 Stormwater and City of Portland Stormwater Rules.

12.0 STORMWATER MANAGEMENT QUANTITY SUMMARY

To meet the Flooding Standards of the MaineDEP Chapter 500 Stormwater Rules the project has been designed to store runoff in the two gravel wetlands and a roof drip strip system. Based on the storage volume provided by these reservoirs, there will be sufficient capacity to store greater than the 100 year storm event rainfall amount. For runoff from the building roof, the plans include the installation of a gravel drip strip system.

Flows and storage characteristics of the each gravel wetland and gravel drip strip are contained in Appendix D. A summary of the systems is as follows:

TABLE 6
SUMMARY OF GRAVEL WETLAND 1

Storm Event Interval	Peak Flows In (CFS)	Peak Flows Out (CFS)	Storage (CF)	Peak Elevation (FT)
2-Year	1.06	0.44	1,213	69.11
10-Year	1.90	1.51	1,566	69.26
25-Year	2.29	1.88	1,668	69.30
100-Year	2.88	2.40	1,805	69.36

TABLE 7
SUMMARY OF GRAVEL WETLAND 2

Storm Event Interval	Peak Flows In (CFS)	Peak Flows Out (CFS)	Storage (CF)	Peak Elevation (FT)
2-Year	2.31	0.27	3,988	69.32
10-Year	4.08	1.00	6,476	69.74
25-Year	4.91	1.34	7,511	69.91
100-Year	6.14	2.56	8,586	70.09

The following table summarizes the pre and post development comparison at each point of analysis:

TABLE 8 PRE AND POST COMPARISON (POI)						
Description	**2 Year**		**10 Year**		**25 Year**	
	Pre	**Post**	**Pre**	**Post**	**Pre**	**Post**
POI #1	1.46	1.19	3.21	3.03	4.08	3.92
POI #2	3.66	2.79	6.87	5.92	8.13	6.90

TABLE 9 SUMMARY OF GRAVEL DRIP STRIP				
Storm Event Interval	**Peak Flows In (CFS)**	**Peak Flows Out (CFS)**	**Storage (CF)**	**Peak Elevation (FT)**
2-Year	1.89	1.14	312	70.22
10-Year	3.01	1.25	1,103	70.78
25-Year	3.53	1.31	1,585	71.12
100-Year	4.32	1.41	2,383	71.69

The post development flows are lower then those in predevelopment conditions at each point of analysis and therefore the Flooding Standard Goal has been met. Postdevelopment computations are contained in Appendix C.

13.0 STORMWATER MANAGEMENT QUALITY SUMMARY

Approach

To meet the General Standards, our office has reviewed the implementation of the four approved treatment strategies listed below. Our findings are as follows:

- **Wetpond** – Wetponds were considered for part of the project's stormwater management strategy; however, due to physical and natural resource site constraints and the required limits of proposed development, there is insufficient vertical and horizontal space to utilize this method of water quality treatment. Generally speaking, the development area would require a wet pond of approximately 0.5 to 0.75 acres in size; thus this option is not feasible.
- **Filter** – Filters cover a broad range of techniques including pre-approved proprietary stormwater treatment devices and a porous surface treatment. The development site has very flat relief and is not conducive to the use of filters which generally require at least 5' of vertical space to an outlet.
- **Infiltration** – Our office has reviewed the Geotechnical Report about the site and the USDA medium intensity soil survey. The medium intensity soil survey maps the site as predominantly Scantic Silt loam. These soils are commonly found to be poorly drained. The limiting factor to effective infiltration is the restrictive layer (i.e. bedrock, depth to groundwater, and infiltration rates of receiving soils. The presence of a restrictive layer (high groundwater table and Glacial marine soils) will make infiltration very difficult to incorporate into this site. Geotechnical explorations show that glacial marine soils are present within 3 to 5 feet below existing grade and seasonally high groundwater table

approximately 5 feet below existing grade. Due to the proximity to the groundwater table and marine soils our office is not recommending the use of infiltration for the purposes of water quality treatment.

- **Buffers** – Buffers were not considered as part of the site's stormwater management due to insufficient space. As an example, a minimum forested or meadow buffer width needs to be 75 feet, 100 feet or 150 feet with a slope of 0% - 8%, none of which is attainable on the site. Additionally, buffers are required to be encumbered by a conservation easement and deed restrictions.

Implementation

Our office has laid out a plan which utilizes two gravel wetlands that will treat the entire developed parking area. We have also implemented a gravel drip strip system to treat runoff from the proposed building. Gravel wetlands are horizontal flow retention and filter systems. These systems maintain a saturated gravel bed and provide treatment by stormwater movement through the gravel bed and plant/soil processes. These systems are suited to the project site due to poorly draining subsoils and limited availability of hydraulic head (vertical space). In addition, the salvage and reuse of existing onsite hydric (wetland) soil is particularly well suited to the use of gravel wetlands.

A water quality summary chart of the project is appended with this application in Appendix D. The basis of design of gravel wetlands and gravel drip strip are as follows:

- **Gravel Drip Strip –** The intent of a gravel drip strip is to collect and provide treatment for runoff from a building roof area. The gravel drip strip for this project was designed based on the following considerations from the MeDEP Chapter 7 Stormwater manual:

  Stone layer is assumed to have 40% void space and be able to retain 1" of runoff over the entire building area.

  For example, a 70' deep building roof must be able to hold: (70')*(1/12)*(1') = 5.83 CF, Per Foot of Building Length

  For this project, there was 25,040 SF of building area, which requires a capacity of 2,087 CF of storage. Approximately 2,115 CF of storage will be available within the drip strip proposed along the rear of the building.

  Complete gravel drip strip computations can be found in Appendix D.

- **Gravel Wetlands –** The gravel wetland treatment reservoirs have been designed to treat at least 95% of the new structure area and 80 % of the developed area along with the gravel drip strip to capture building roof runoff.

To meet Chapter 500, the Channel Protection Volume[2] provided must be equal to or greater than the following:

WQV= (P1)*(Rv)*(A)
Where P1=90% rainfall event assumed to be 1"
Where A = total tributary area within the sub-catchment
Where Rv= .05+*0.9*(I)
Where I = the percentage of impervious Area within the sub-catchment.

Typically, gravel wetlands are broken into three zones:

1. First, the forebay must hold 10% of the desired WQV. The purpose of the sediment forebay is to settle solids from storm water before it reaches the two gravel wetland cells.

2. Two wetland cells shall hold approximately 45% of desired WQV each. These cells provide a majority of the water treatment.

3. The water quality volume provided is equal to 3,346 cubic feet in the two gravel wetland systems. Gravel wetlands water quality computations can be found in Appendix D.

Based on University of New Hampshire Design Specifications, the gravel wetlands shall be sized to treat the entire water quality volume in 24 hours with a discharge rate that is controlled by an orifice on the under drain system. The orifice drawdown computations are appended in Appendix E.

For Gravel Wetland 1 located nearer to Warren Avenue, the discharge from larger storm events overflows over a broad crested weir contained in a precast concrete outlet control structure set at Elevation 69.00 (i.e. the basin stage when water quality volume has been reached). The overflow piping network is sized to handle runoff from a 25-year storm event. This system will discharge into an existing storm drain stub previously installed into the site.

For Gravel Wetland 2, located at the rear of site, the discharge from larger storm events will overflow over a weir spill-way set at Elevation 69.00. The overflow will flow into the undeveloped sub-catchment and eventually drain into a drainage way in the northeast quadrant of the site.

Therefore, water quality goals for the gravel wetland system meet the General Stormwater Standards of the November 2005 Chapter 500 Rules of MeDEP (rev. December 2011), as well as City of Portland Technical Standards.

14.0 CHAPTER 500 TREATMENT PERCENT COMPLIANCE

The proposed development project creates 1.29 acres of newly constructed impervious area and 0.96 acres of pervious area for a total disturbed area of about 2.25 acres.

[2] See UNHSC Subsurface Gravel Wetland Design Specifications, June 2009

Of the 1.29 acres of impervious area the proposed Stormwater Management Plan provides treatment for 1.29 acres or 99.44% percent. The disturbed area as part of this redevelopment is approximately 2.25 acres. Of the 2.25 acres the proposed Stormwater Management Plan provides treatment for 2.13 acres or 94.41% percent. Hence, the strategies proposed herein meets the minimum requirements stated in the General Standards.

TABLE 10 WATER QUALITY SUMMARY				
	Impervious Area (ac)	**Treated Impervious (ac)**	**Developed Area (ac)**	**Treated Developed (ac)**
	1.29	1.29	2.25	2.13
PERCENTAGE		**100%**		**94.41%**

A summary of the water quality treatment values is as follows:

- **Gravel Wetlands:** There are two gravel wetland areas proposed to treat runoff from the site's developed area. The design and treatment parameters are as follows:

TABLE 11 GRAVEL WETLAND		
Gravel Wetland Subcatchment	2*	4*
Impervious Area Treated (sf)	13,262	28,370
Pervious Area Treated (sf)	3,440	8,369
Required Sediment Forebay Water Quality Volume (cf)	108	228
Sediment Forebay Volume Provided (cf)	217	255
Required Wetland Cell Water Quality Volume (cf) Each Cell Approximately 45%	479	1,026
Bottom Elevation (ft)	68.50	68.50
Elevation Where Water Quality Volume is Achieved	69.00	69.00
Depth at Water Quality Volume (in.)	0.5	0.5
Controlling Orifice Size (in.)	0.95	1.4
Controlling Orifice Elevation (ft)	68.17	68.17
100 Year Storm Stage Elevation (ft)	69.36	70.09
Major Storm Event Control Devices	WEIR	WEIR
Freeboard (ft)	1.14	.91'
Surface Area Provided (sf)	1,727	4,191

See HydroCAD Computations – Appendix C

- **Gravel Drip Strip**: The rooftop will sheet runoff into a gravel drip strip system. The design results are summarized below.

TABLE 12 GRAVEL DRIP STRIP	
Water Quality Volume required= (1")*(roof area) (cf)	2,087
Proposed Stone Layer Volume (CF)	2,115
Bottom Elevation of Storage Layers (ft)	70.50
Top of Elevation of Stone Layer (ft)	72.00
Elevation Where Water Quality Volume is Achieved (ft)	72.00
Depth of Water Quality (ft)	1.5
Freeboard – 100-Year Storm (ft)	0.31
Maximum Volume Stone Reservoir (cf)	2,820
Proposed Surface Elevation (ft)	72.00

15.0 EROSION CONTROL

An Erosion Control Narrative, Plan, and Details have been prepared for the project and accompany this submission in Appendix G.

16.0 OPERATIONS AND MAINTENANCE

An Operations & Maintenance Manual has been prepared and accompanies this application in Appendix H.

17.0 PERMIT REQUIREMENTS

City of Portland review and permitting of the Stormwater Management Plan is required and will be completed with the review of the Site Plan Application submitted to the City of Portland Planning Department.

18.0 DRAINAGE NETWORK PIPE SIZING

The drainage network has been sized using the flows computed using HydroCAD modeling software. The pipe sizes are noted on the drawings.

19.0 URBAN REPAIRED STREAM COMPENSATION FEE SCHEDULE

This project falls within the Capisic Brook Watershed which the MaineDEP has identified as an Urban Repaired Stream. As noted in the Chapter 500 MaineDEP stormwater rules and Applicant whose project falls within in an urban repaired stream zone must either eliminate existing on or offsite impervious area or pay a fee. The Applicant has chosen to pay a fee which is based off the following schedule referencing MaineDEP Chapter 500:

TABLE 13 MAINE DEP URBAN REPAIRED STREAM COMPENSATION FEE SCHEDULE			
Area Type	**Area (acres)**	**Cost Per Acre ($)**	**Total Cost ($)**
Non-Roof Impervious	1.03	$5,000	$5,150
Roof Area	.58	$2,000	$1,160
Landscaped Area	.64	$1,000	$640
Totals	2.25	-	**$6,950**

20.0 APPENDICES

A – Figures (Refer to Section 1 of the Site Plan Application)

B – Predevelopment Computations (2, 10 and 25-year Storm Event HydroCAD Computations)

C – Postdevelopment Computations (2, 10 and 25-year Storm Event HydroCAD Computations)

D – Water Quality Summary Chart and Computations

E – Orifice Drawdown Computations

F – Geotechnical Exploration Test Pit Logs

G – Erosion & Sediment Control Report

H – Inspection & Maintenance Manual for Stormwater Management and Related Stormwater Facilities

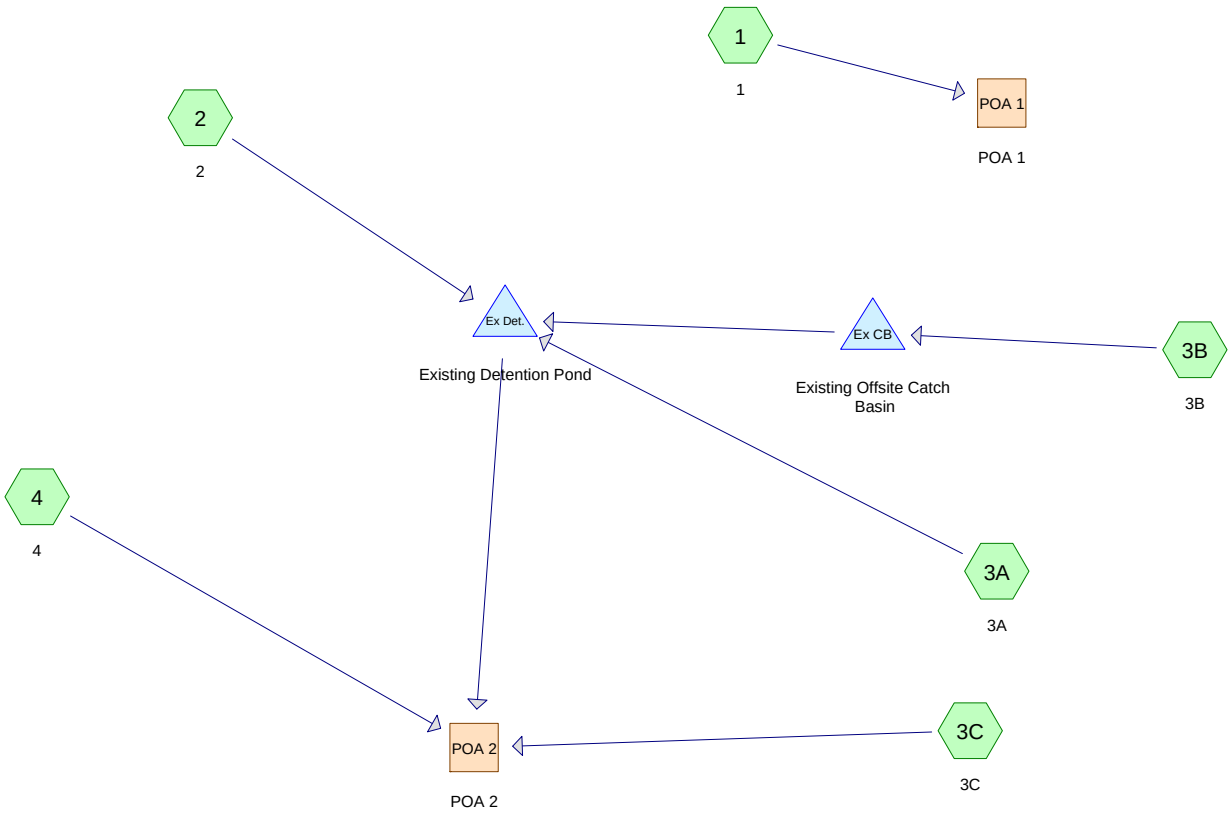
APPENDIX A

FIGURES

(Refer to Section 1 of the Site Plan Application)

APPENDIX B

PREDEVELOPMENT COMPUTATIONS
(2, 10 AND 25-YEAR STORM EVENT HYDROCAD COMPUTATIONS)



Subcat Reach Pond Link

Drainage Diagram for SP-M104 2-3-14 PRE DEVELOPMENT 4-10-14 Update

Prepared by {enter your company name here}, Printed 4/11/2014

HydroCAD® 8.50 s/n 000734 © 2007 HydroCAD Software Solutions LLC

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.667	73	Woods, Fair, HSG C (1,2)
0.017	74	Existing Land Scaped Area (3A)
0.078	74	Pervious Pond Area (3A)
0.324	79	50-75% Grass cover, Fair, HSG C (2,4)
0.753	79	Pasture/grassland/range, Fair, HSG C (1)
0.528	79	Woods, Fair, HSG D (1)
0.633	84	Pasture/grassland/range, Fair, HSG D (1)
0.658	89	Gravel Pavement (2,4)
0.033	89	Gravel roads, HSG C (1)
0.469	98	Impervious (3B,3C)
0.428	98	Impervious Pavement (2,3A)
0.028	98	Pavement (4)
0.017	98	Smaller Building (3A)
4.631		**TOTAL AREA**

Soil Listing (selected nodes)

Area (acres)	Soil Goup	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
1.777	HSG C	1, 2, 4
1.161	HSG D	1
1.693	Other	2, 3A, 3B, 3C, 4
4.631		**TOTAL AREA**

Time span=0.00-72.00 hrs, dt=0.02 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1: 1 Runoff Area=107,766 sf 0.00% Impervious Runoff Depth=1.19"
Flow Length=317' Slope=0.0030 '/' Tc=50.8 min CN=79 Runoff=1.46 cfs 0.245 af

Subcatchment 2: 2 Runoff Area=17,114 sf 9.75% Impervious Runoff Depth=1.31"
Flow Length=305' Tc=6.0 min CN=81 Runoff=0.60 cfs 0.043 af

Subcatchment 3A: 3A Runoff Area=21,816 sf 81.20% Impervious Runoff Depth=2.25"
Tc=6.0 min CN=93 Runoff=1.28 cfs 0.094 af

Subcatchment 3B: 3B Runoff Area=4,298 sf 100.00% Impervious Runoff Depth=2.77"
Tc=6.0 min CN=98 Runoff=0.29 cfs 0.023 af

Subcatchment 3C: 3C Runoff Area=16,117 sf 100.00% Impervious Runoff Depth=2.77"
Tc=6.0 min CN=98 Runoff=1.07 cfs 0.085 af

Subcatchment 4: 4 Runoff Area=34,630 sf 3.52% Impervious Runoff Depth=1.74"
Tc=6.0 min CN=87 Runoff=1.62 cfs 0.115 af

Reach POA 1: POA 1 Inflow=1.46 cfs 0.245 af
Outflow=1.46 cfs 0.245 af

Reach POA 2: POA 2 Inflow=3.66 cfs 0.325 af
Outflow=3.66 cfs 0.325 af

Pond Ex CB: Existing Offsite Catch Basin Inflow=0.29 cfs 0.023 af
Primary=0.29 cfs 0.023 af

Pond Ex Det.: Existing Detention Pond Peak Elev=67.70' Storage=2,494 cf Inflow=2.17 cfs 0.160 af
12.0" x 190.0' Culvert Outflow=1.33 cfs 0.124 af

Total Runoff Area = 4.631 ac Runoff Volume = 0.605 af Average Runoff Depth = 1.57"
79.67% Pervious = 3.690 ac 20.33% Impervious = 0.942 ac

Summary for Subcatchment 1: 1

Runoff = 1.46 cfs @ 12.71 hrs, Volume= 0.245 af, Depth= 1.19"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type III 24-hr 2-YR Rainfall=3.00"

Area (sf)	CN	Description
22,963	73	Woods, Fair, HSG C
22,985	79	Woods, Fair, HSG D
32,785	79	Pasture/grassland/range, Fair, HSG C
27,590	84	Pasture/grassland/range, Fair, HSG D
1,443	89	Gravel roads, HSG C
107,766	79	Weighted Average
107,766		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
43.5	150	0.0030	0.06		**Sheet Flow, AB** Grass: Dense n= 0.240 P2= 3.00"
7.3	167	0.0030	0.38		**Shallow Concentrated Flow, BC** Short Grass Pasture Kv= 7.0 fps
50.8	317	Total			

Summary for Subcatchment 2: 2

Runoff = 0.60 cfs @ 12.09 hrs, Volume= 0.043 af, Depth= 1.31"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type III 24-hr 2-YR Rainfall=3.00"

	Area (sf)	CN	Description
*	4,035	89	Gravel Pavement
	5,303	79	50-75% Grass cover, Fair, HSG C
*	1,668	98	Impervious Pavement
	6,108	73	Woods, Fair, HSG C
	17,114	81	Weighted Average
	15,446		Pervious Area
	1,668		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	90	0.0167	1.21		**Sheet Flow, AB** Smooth surfaces n= 0.011 P2= 3.00"
2.3	215	0.0090	1.53		**Shallow Concentrated Flow, BC** Unpaved Kv= 16.1 fps
3.5	305	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 3A: 3A

Runoff = 1.28 cfs @ 12.09 hrs, Volume= 0.094 af, Depth= 2.25"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type III 24-hr 2-YR Rainfall=3.00"

	Area (sf)	CN	Description
*	3,377	74	Pervious Pond Area
*	725	74	Existing Land Scaped Area
*	16,973	98	Impervious Pavement
*	741	98	Smaller Building
	21,816	93	Weighted Average
	4,102		Pervious Area
	17,714		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 3B: 3B

Runoff = 0.29 cfs @ 12.08 hrs, Volume= 0.023 af, Depth= 2.77"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type III 24-hr 2-YR Rainfall=3.00"

	Area (sf)	CN	Description
*	4,298	98	Impervious
	4,298		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 3C: 3C

Runoff = 1.07 cfs @ 12.08 hrs, Volume= 0.085 af, Depth= 2.77"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type III 24-hr 2-YR Rainfall=3.00"

	Area (sf)	CN	Description
*	16,117	98	Impervious
	16,117		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 4: 4

Runoff = 1.62 cfs @ 12.09 hrs, Volume= 0.115 af, Depth= 1.74"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type III 24-hr 2-YR Rainfall=3.00"

	Area (sf)	CN	Description
*	24,611	89	Gravel Pavement
	8,799	79	50-75% Grass cover, Fair, HSG C
*	1,220	98	Pavement
	34,630	87	Weighted Average
	33,410		Pervious Area
	1,220		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Reach POA 1: POA 1

Inflow Area = 2.474 ac, 0.00% Impervious, Inflow Depth = 1.19" for 2-YR event
Inflow = 1.46 cfs @ 12.71 hrs, Volume= 0.245 af
Outflow = 1.46 cfs @ 12.71 hrs, Volume= 0.245 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs

Summary for Reach POA 2: POA 2

Inflow Area = 2.157 ac, 43.65% Impervious, Inflow Depth = 1.81" for 2-YR event
Inflow = 3.66 cfs @ 12.11 hrs, Volume= 0.325 af
Outflow = 3.66 cfs @ 12.11 hrs, Volume= 0.325 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs

Summary for Pond Ex CB: Existing Offsite Catch Basin

Inflow Area = 0.099 ac,100.00% Impervious, Inflow Depth = 2.77" for 2-YR event
Inflow = 0.29 cfs @ 12.08 hrs, Volume= 0.023 af
Primary = 0.29 cfs @ 12.08 hrs, Volume= 0.023 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs

Summary for Pond Ex Det.: Existing Detention Pond

Inflow Area = 0.992 ac, 54.78% Impervious, Inflow Depth = 1.93" for 2-YR event
Inflow = 2.17 cfs @ 12.09 hrs, Volume= 0.160 af
Outflow = 1.33 cfs @ 12.19 hrs, Volume= 0.124 af, Atten= 39%, Lag= 6.2 min
Primary = 1.33 cfs @ 12.19 hrs, Volume= 0.124 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Peak Elev= 67.70' @ 12.19 hrs Surf.Area= 1,538 sf Storage= 2,494 cf

Plug-Flow detention time= 160.6 min calculated for 0.124 af (78% of inflow)
Center-of-Mass det. time= 79.3 min (881.8 - 802.5)

Volume	Invert	Avail.Storage	Storage Description
#1	65.00'	4,848 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
65.00	432	0	0
66.00	740	586	586
67.00	1,171	956	1,542
68.00	1,693	1,432	2,974
69.00	2,056	1,875	4,848

Device	Routing	Invert	Outlet Devices
#1	Primary	67.00'	**12.0" x 190.0' long Culvert** CPP, projecting, no headwall, Ke= 0.900 Outlet Invert= 66.05' S= 0.0050 '/' Cc= 0.900 n= 0.012

Primary OutFlow Max=1.33 cfs @ 12.19 hrs HW=67.70' TW=0.00' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 1.33 cfs @ 2.25 fps)

Time span=0.00-72.00 hrs, dt=0.02 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1: 1 Runoff Area=107,766 sf 0.00% Impervious Runoff Depth=2.55"
Flow Length=317' Slope=0.0030 '/' Tc=50.8 min CN=79 Runoff=3.21 cfs 0.525 af

Subcatchment 2: 2 Runoff Area=17,114 sf 9.75% Impervious Runoff Depth=2.72"
Flow Length=305' Tc=6.0 min CN=81 Runoff=1.25 cfs 0.089 af

Subcatchment 3A: 3A Runoff Area=21,816 sf 81.20% Impervious Runoff Depth=3.90"
Tc=6.0 min CN=93 Runoff=2.16 cfs 0.163 af

Subcatchment 3B: 3B Runoff Area=4,298 sf 100.00% Impervious Runoff Depth=4.46"
Tc=6.0 min CN=98 Runoff=0.45 cfs 0.037 af

Subcatchment 3C: 3C Runoff Area=16,117 sf 100.00% Impervious Runoff Depth=4.46"
Tc=6.0 min CN=98 Runoff=1.70 cfs 0.138 af

Subcatchment 4: 4 Runoff Area=34,630 sf 3.52% Impervious Runoff Depth=3.29"
Tc=6.0 min CN=87 Runoff=3.01 cfs 0.218 af

Reach POA 1: POA 1 Inflow=3.21 cfs 0.525 af
Outflow=3.21 cfs 0.525 af

Reach POA 2: POA 2 Inflow=6.87 cfs 0.609 af
Outflow=6.87 cfs 0.609 af

Pond Ex CB: Existing Offsite Catch Basin Inflow=0.45 cfs 0.037 af
Primary=0.45 cfs 0.037 af

Pond Ex Det.: Existing Detention Pond Peak Elev=68.19' Storage=3,295 cf Inflow=3.86 cfs 0.289 af
12.0" x 190.0' Culvert Outflow=2.47 cfs 0.253 af

Total Runoff Area = 4.631 ac Runoff Volume = 1.169 af Average Runoff Depth = 3.03"
79.67% Pervious = 3.690 ac 20.33% Impervious = 0.942 ac

Summary for Subcatchment 1: 1

Runoff = 3.21 cfs @ 12.70 hrs, Volume= 0.525 af, Depth= 2.55"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type III 24-hr 10-YR Rainfall=4.70"

Area (sf)	CN	Description
22,963	73	Woods, Fair, HSG C
22,985	79	Woods, Fair, HSG D
32,785	79	Pasture/grassland/range, Fair, HSG C
27,590	84	Pasture/grassland/range, Fair, HSG D
1,443	89	Gravel roads, HSG C
107,766	79	Weighted Average
107,766		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
43.5	150	0.0030	0.06		**Sheet Flow, AB** Grass: Dense n= 0.240 P2= 3.00"
7.3	167	0.0030	0.38		**Shallow Concentrated Flow, BC** Short Grass Pasture Kv= 7.0 fps
50.8	317	Total			

Summary for Subcatchment 2: 2

Runoff = 1.25 cfs @ 12.09 hrs, Volume= 0.089 af, Depth= 2.72"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type III 24-hr 10-YR Rainfall=4.70"

	Area (sf)	CN	Description
*	4,035	89	Gravel Pavement
	5,303	79	50-75% Grass cover, Fair, HSG C
*	1,668	98	Impervious Pavement
	6,108	73	Woods, Fair, HSG C
	17,114	81	Weighted Average
	15,446		Pervious Area
	1,668		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	90	0.0167	1.21		**Sheet Flow, AB** Smooth surfaces n= 0.011 P2= 3.00"
2.3	215	0.0090	1.53		**Shallow Concentrated Flow, BC** Unpaved Kv= 16.1 fps
3.5	305	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 3A: 3A

Runoff = 2.16 cfs @ 12.08 hrs, Volume= 0.163 af, Depth= 3.90"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type III 24-hr 10-YR Rainfall=4.70"

	Area (sf)	CN	Description
*	3,377	74	Pervious Pond Area
*	725	74	Existing Land Scaped Area
*	16,973	98	Impervious Pavement
*	741	98	Smaller Building
	21,816	93	Weighted Average
	4,102		Pervious Area
	17,714		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 3B: 3B

Runoff = 0.45 cfs @ 12.08 hrs, Volume= 0.037 af, Depth= 4.46"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type III 24-hr 10-YR Rainfall=4.70"

	Area (sf)	CN	Description
*	4,298	98	Impervious
	4,298		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 3C: 3C

Runoff = 1.70 cfs @ 12.08 hrs, Volume= 0.138 af, Depth= 4.46"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type III 24-hr 10-YR Rainfall=4.70"

	Area (sf)	CN	Description
*	16,117	98	Impervious
	16,117		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 4: 4

Runoff = 3.01 cfs @ 12.09 hrs, Volume= 0.218 af, Depth= 3.29"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type III 24-hr 10-YR Rainfall=4.70"

	Area (sf)	CN	Description
*	24,611	89	Gravel Pavement
	8,799	79	50-75% Grass cover, Fair, HSG C
*	1,220	98	Pavement
	34,630	87	Weighted Average
	33,410		Pervious Area
	1,220		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Reach POA 1: POA 1

Inflow Area = 2.474 ac, 0.00% Impervious, Inflow Depth = 2.55" for 10-YR event
Inflow = 3.21 cfs @ 12.70 hrs, Volume= 0.525 af
Outflow = 3.21 cfs @ 12.70 hrs, Volume= 0.525 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs

Summary for Reach POA 2: POA 2

Inflow Area = 2.157 ac, 43.65% Impervious, Inflow Depth = 3.39" for 10-YR event
Inflow = 6.87 cfs @ 12.10 hrs, Volume= 0.609 af
Outflow = 6.87 cfs @ 12.10 hrs, Volume= 0.609 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs

Summary for Pond Ex CB: Existing Offsite Catch Basin

Inflow Area = 0.099 ac,100.00% Impervious, Inflow Depth = 4.46" for 10-YR event
Inflow = 0.45 cfs @ 12.08 hrs, Volume= 0.037 af
Primary = 0.45 cfs @ 12.08 hrs, Volume= 0.037 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs

Summary for Pond Ex Det.: Existing Detention Pond

Inflow Area = 0.992 ac, 54.78% Impervious, Inflow Depth = 3.49" for 10-YR event
Inflow = 3.86 cfs @ 12.09 hrs, Volume= 0.289 af
Outflow = 2.47 cfs @ 12.18 hrs, Volume= 0.253 af, Atten= 36%, Lag= 5.7 min
Primary = 2.47 cfs @ 12.18 hrs, Volume= 0.253 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Peak Elev= 68.19' @ 12.18 hrs Surf.Area= 1,761 sf Storage= 3,295 cf

Plug-Flow detention time= 113.4 min calculated for 0.253 af (88% of inflow)
Center-of-Mass det. time= 57.3 min (846.4 - 789.0)

Volume	Invert	Avail.Storage	Storage Description
#1	65.00'	4,848 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
65.00	432	0	0
66.00	740	586	586
67.00	1,171	956	1,542
68.00	1,693	1,432	2,974
69.00	2,056	1,875	4,848

Device	Routing	Invert	Outlet Devices
#1	Primary	67.00'	**12.0" x 190.0' long Culvert** CPP, projecting, no headwall, Ke= 0.900 Outlet Invert= 66.05' S= 0.0050 '/' Cc= 0.900 n= 0.012

Primary OutFlow Max=2.47 cfs @ 12.18 hrs HW=68.19' TW=0.00' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 2.47 cfs @ 3.15 fps)

Time span=0.00-72.00 hrs, dt=0.02 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1: 1 Runoff Area=107,766 sf 0.00% Impervious Runoff Depth=3.24"
Flow Length=317' Slope=0.0030 '/' Tc=50.8 min CN=79 Runoff=4.08 cfs 0.667 af

Subcatchment 2: 2 Runoff Area=17,114 sf 9.75% Impervious Runoff Depth=3.43"
Flow Length=305' Tc=6.0 min CN=81 Runoff=1.57 cfs 0.112 af

Subcatchment 3A: 3A Runoff Area=21,816 sf 81.20% Impervious Runoff Depth=4.69"
Tc=6.0 min CN=93 Runoff=2.57 cfs 0.196 af

Subcatchment 3B: 3B Runoff Area=4,298 sf 100.00% Impervious Runoff Depth=5.26"
Tc=6.0 min CN=98 Runoff=0.53 cfs 0.043 af

Subcatchment 3C: 3C Runoff Area=16,117 sf 100.00% Impervious Runoff Depth=5.26"
Tc=6.0 min CN=98 Runoff=1.99 cfs 0.162 af

Subcatchment 4: 4 Runoff Area=34,630 sf 3.52% Impervious Runoff Depth=4.04"
Tc=6.0 min CN=87 Runoff=3.67 cfs 0.268 af

Reach POA 1: POA 1 Inflow=4.08 cfs 0.667 af
Outflow=4.08 cfs 0.667 af

Reach POA 2: POA 2 Inflow=8.13 cfs 0.746 af
Outflow=8.13 cfs 0.746 af

Pond Ex CB: Existing Offsite Catch Basin Inflow=0.53 cfs 0.043 af
Primary=0.53 cfs 0.043 af

Pond Ex Det.: Existing Detention Pond Peak Elev=68.41' Storage=3,701 cf Inflow=4.67 cfs 0.351 af
12.0" x 190.0' Culvert Outflow=2.78 cfs 0.316 af

Total Runoff Area = 4.631 ac Runoff Volume = 1.449 af Average Runoff Depth = 3.75"
79.67% Pervious = 3.690 ac 20.33% Impervious = 0.942 ac

Summary for Subcatchment 1: 1

Runoff = 4.08 cfs @ 12.70 hrs, Volume= 0.667 af, Depth= 3.24"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type III 24-hr 25-YR Rainfall=5.50"

Area (sf)	CN	Description
22,963	73	Woods, Fair, HSG C
22,985	79	Woods, Fair, HSG D
32,785	79	Pasture/grassland/range, Fair, HSG C
27,590	84	Pasture/grassland/range, Fair, HSG D
1,443	89	Gravel roads, HSG C
107,766	79	Weighted Average
107,766		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
43.5	150	0.0030	0.06		**Sheet Flow, AB** Grass: Dense n= 0.240 P2= 3.00"
7.3	167	0.0030	0.38		**Shallow Concentrated Flow, BC** Short Grass Pasture Kv= 7.0 fps
50.8	317	Total			

Summary for Subcatchment 2: 2

Runoff = 1.57 cfs @ 12.09 hrs, Volume= 0.112 af, Depth= 3.43"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type III 24-hr 25-YR Rainfall=5.50"

	Area (sf)	CN	Description
*	4,035	89	Gravel Pavement
	5,303	79	50-75% Grass cover, Fair, HSG C
*	1,668	98	Impervious Pavement
	6,108	73	Woods, Fair, HSG C
	17,114	81	Weighted Average
	15,446		Pervious Area
	1,668		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	90	0.0167	1.21		**Sheet Flow, AB** Smooth surfaces n= 0.011 P2= 3.00"
2.3	215	0.0090	1.53		**Shallow Concentrated Flow, BC** Unpaved Kv= 16.1 fps
3.5	305	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 3A: 3A

Runoff = 2.57 cfs @ 12.08 hrs, Volume= 0.196 af, Depth= 4.69"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type III 24-hr 25-YR Rainfall=5.50"

	Area (sf)	CN	Description
*	3,377	74	Pervious Pond Area
*	725	74	Existing Land Scaped Area
*	16,973	98	Impervious Pavement
*	741	98	Smaller Building
	21,816	93	Weighted Average
	4,102		Pervious Area
	17,714		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 3B: 3B

Runoff = 0.53 cfs @ 12.08 hrs, Volume= 0.043 af, Depth= 5.26"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type III 24-hr 25-YR Rainfall=5.50"

	Area (sf)	CN	Description
*	4,298	98	Impervious
	4,298		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 3C: 3C

Runoff = 1.99 cfs @ 12.08 hrs, Volume= 0.162 af, Depth= 5.26"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type III 24-hr 25-YR Rainfall=5.50"

	Area (sf)	CN	Description
*	16,117	98	Impervious
	16,117		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 4: 4

Runoff = 3.67 cfs @ 12.09 hrs, Volume= 0.268 af, Depth= 4.04"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type III 24-hr 25-YR Rainfall=5.50"

	Area (sf)	CN	Description
*	24,611	89	Gravel Pavement
	8,799	79	50-75% Grass cover, Fair, HSG C
*	1,220	98	Pavement
	34,630	87	Weighted Average
	33,410		Pervious Area
	1,220		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Reach POA 1: POA 1

Inflow Area = 2.474 ac, 0.00% Impervious, Inflow Depth = 3.24" for 25-YR event
Inflow = 4.08 cfs @ 12.70 hrs, Volume= 0.667 af
Outflow = 4.08 cfs @ 12.70 hrs, Volume= 0.667 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs

Summary for Reach POA 2: POA 2

Inflow Area = 2.157 ac, 43.65% Impervious, Inflow Depth = 4.15" for 25-YR event
Inflow = 8.13 cfs @ 12.09 hrs, Volume= 0.746 af
Outflow = 8.13 cfs @ 12.09 hrs, Volume= 0.746 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs

Summary for Pond Ex CB: Existing Offsite Catch Basin

Inflow Area = 0.099 ac,100.00% Impervious, Inflow Depth = 5.26" for 25-YR event
Inflow = 0.53 cfs @ 12.08 hrs, Volume= 0.043 af
Primary = 0.53 cfs @ 12.08 hrs, Volume= 0.043 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs

Summary for Pond Ex Det.: Existing Detention Pond

Inflow Area = 0.992 ac, 54.78% Impervious, Inflow Depth = 4.25" for 25-YR event
Inflow = 4.67 cfs @ 12.09 hrs, Volume= 0.351 af
Outflow = 2.78 cfs @ 12.19 hrs, Volume= 0.316 af, Atten= 40%, Lag= 6.4 min
Primary = 2.78 cfs @ 12.19 hrs, Volume= 0.316 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Peak Elev= 68.41' @ 12.19 hrs Surf.Area= 1,842 sf Storage= 3,701 cf

Plug-Flow detention time= 101.5 min calculated for 0.316 af (90% of inflow)
Center-of-Mass det. time= 52.7 min (837.2 - 784.6)

Volume	Invert	Avail.Storage	Storage Description
#1	65.00'	4,848 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

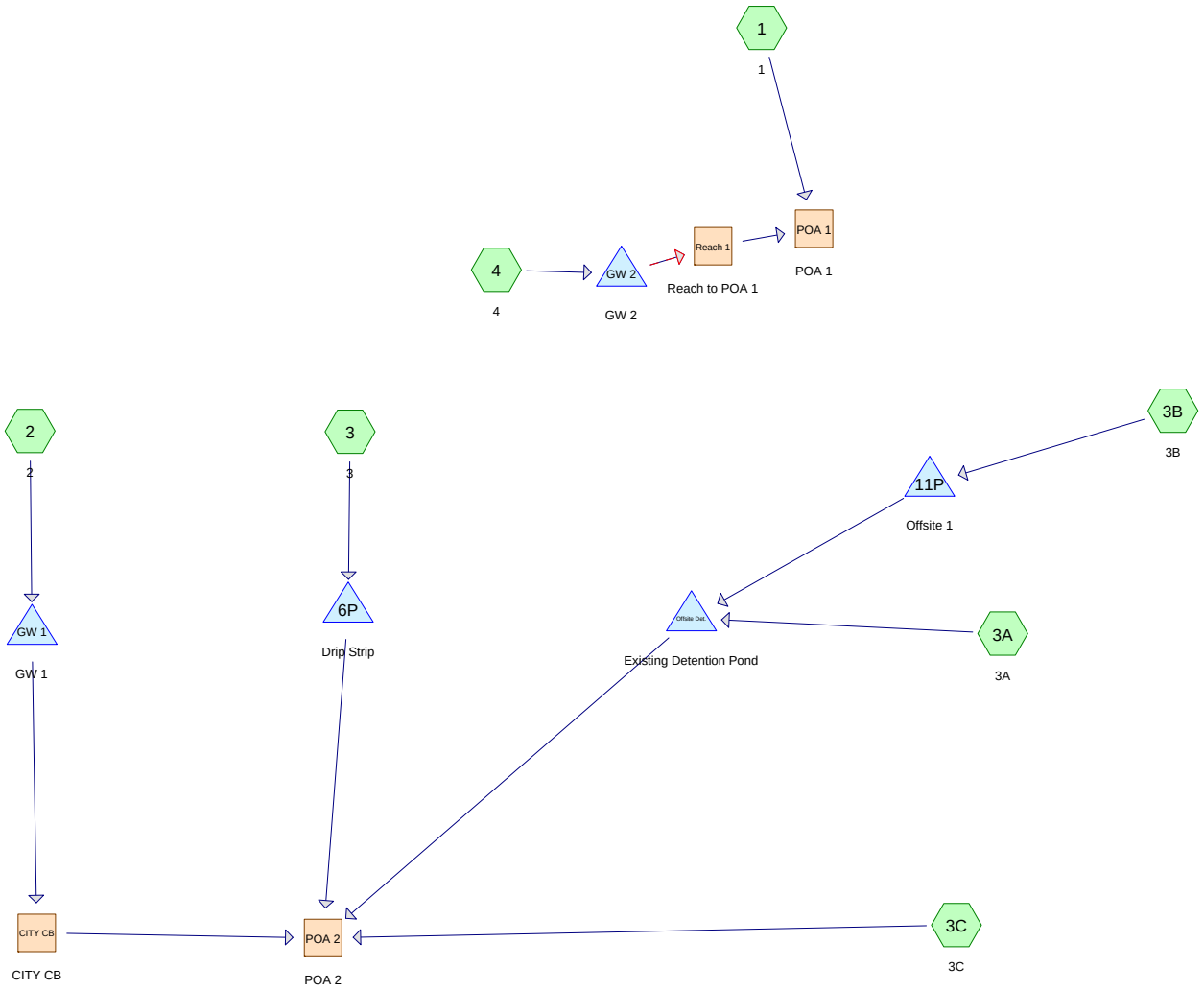
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
65.00	432	0	0
66.00	740	586	586
67.00	1,171	956	1,542
68.00	1,693	1,432	2,974
69.00	2,056	1,875	4,848

Device	Routing	Invert	Outlet Devices
#1	Primary	67.00'	**12.0" x 190.0' long Culvert** CPP, projecting, no headwall, Ke= 0.900 Outlet Invert= 66.05' S= 0.0050 '/' Cc= 0.900 n= 0.012

Primary OutFlow Max=2.78 cfs @ 12.19 hrs HW=68.41' TW=0.00' (Dynamic Tailwater)
↑—**1=Culvert** (Barrel Controls 2.78 cfs @ 3.54 fps)

APPENDIX C

POSTDEVELOPMENT COMPUTATIONS
(2, 10 AND 25-YEAR STORM EVENT HYDROCAD COMPUTATIONS)



Subcat Reach Pond Link

Drainage Diagram for SP-M104 4-16-14 POST DEVELOPMENT MODEL Update

Prepared by {enter your company name here}, Printed 4/16/2014

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Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.096	73	Woods, Fair, HSG C (1)
0.017	74	Existing Land Scaped Area (3A)
0.078	74	Pervious Pond Area (3A)
0.641	74	Proposed Landscape (1,2,3A,4)
0.441	79	Pasture/grassland/range, Fair, HSG C (1)
0.229	79	Woods, Fair, HSG D (1)
0.636	84	Pasture/grassland/range, Fair, HSG D (1)
0.086	89	Gravel Drip Strip Area (3)
0.033	89	Gravel roads, HSG C (1)
0.016	98	Existing Pavement (4)
0.460	98	Impervious (3B,3C)
0.368	98	Impervious Pavement (3A)
0.009	98	New Impervious (3C)
0.636	98	New Pavement (4)
0.304	98	Pavement (2)
0.575	98	Proposed Building (3)
4.623		**TOTAL AREA**

Soil Listing (selected nodes)

Area (acres)	Soil Goup	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.570	HSG C	1
0.865	HSG D	1
3.189	Other	1, 2, 3, 3A, 3B, 3C, 4
4.623		**TOTAL AREA**

Time span=0.00-72.00 hrs, dt=0.02 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1: 1 Runoff Area=65,893 sf 0.00% Impervious Runoff Depth=1.31"
Flow Length=317' Slope=0.0030 '/' Tc=50.8 min CN=81 Runoff=1.00 cfs 0.166 af

Subcatchment 2: 2 Runoff Area=20,782 sf 63.82% Impervious Runoff Depth=1.90"
Flow Length=190' Tc=6.0 min CN=89 Runoff=1.06 cfs 0.076 af

Subcatchment 3: 3 Runoff Area=28,800 sf 86.94% Impervious Runoff Depth=2.66"
Tc=6.0 min CN=97 Runoff=1.89 cfs 0.146 af

Subcatchment 3A: 3A Runoff Area=21,816 sf 73.52% Impervious Runoff Depth=2.16"
Tc=6.0 min CN=92 Runoff=1.24 cfs 0.090 af

Subcatchment 3B: 3B Runoff Area=4,298 sf 100.00% Impervious Runoff Depth=2.77"
Tc=6.0 min CN=98 Runoff=0.29 cfs 0.023 af

Subcatchment 3C: 3C Runoff Area=16,113 sf 100.00% Impervious Runoff Depth=2.77"
Tc=6.0 min CN=98 Runoff=1.07 cfs 0.085 af

Subcatchment 4: 4 Runoff Area=43,696 sf 64.93% Impervious Runoff Depth=1.98"
Flow Length=455' Tc=6.0 min CN=90 Runoff=2.31 cfs 0.166 af

Reach CITY CB: CITY CB Inflow=0.44 cfs 0.076 af
Outflow=0.44 cfs 0.076 af

Reach POA 1: POA 1 Inflow=1.19 cfs 0.279 af
Outflow=1.19 cfs 0.279 af

Reach POA 2: POA 2 Inflow=2.79 cfs 0.385 af
Outflow=2.79 cfs 0.385 af

Reach Reach 1: Reach to POA 1 Avg. Depth=0.04' Max Vel=0.10 fps Inflow=0.27 cfs 0.113 af
n=0.150 L=138.0' S=0.0072 '/' Capacity=58.12 cfs Outflow=0.25 cfs 0.113 af

Pond 6P: Drip Strip Peak Elev=70.22' Storage=312 cf Inflow=1.89 cfs 0.146 af
6.0" x 51.0' Culvert Outflow=1.14 cfs 0.147 af

Pond 11P: Offsite 1 Inflow=0.29 cfs 0.023 af
Primary=0.29 cfs 0.023 af

Pond GW 1: GW 1 Peak Elev=69.11' Storage=1,213 cf Inflow=1.06 cfs 0.076 af
Outflow=0.44 cfs 0.076 af

Pond GW 2: GW 2 Peak Elev=69.32' Storage=3,988 cf Inflow=2.31 cfs 0.166 af
Primary=0.25 cfs 0.091 af Secondary=0.03 cfs 0.022 af Outflow=0.27 cfs 0.113 af

Pond Offsite Det.: Existing Detention Pond Peak Elev=67.49' Storage=2,178 cf Inflow=1.53 cfs 0.113 af
12.0" x 190.0' Culvert Outflow=0.72 cfs 0.077 af

Total Runoff Area = 4.623 ac Runoff Volume = 0.752 af Average Runoff Depth = 1.95"
48.80% Pervious = 2.256 ac 51.20% Impervious = 2.367 ac

Summary for Subcatchment 1: 1

Runoff = 1.00 cfs @ 12.71 hrs, Volume= 0.166 af, Depth= 1.31"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type III 24-hr 2-YR Rainfall=3.00"

	Area (sf)	CN	Description
	4,163	73	Woods, Fair, HSG C
	9,957	79	Woods, Fair, HSG D
	19,210	79	Pasture/grassland/range, Fair, HSG C
	27,709	84	Pasture/grassland/range, Fair, HSG D
	1,443	89	Gravel roads, HSG C
*	3,411	74	Proposed Landscape
	65,893	81	Weighted Average
	65,893		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
43.5	150	0.0030	0.06		**Sheet Flow, AB** Grass: Dense n= 0.240 P2= 3.00"
7.3	167	0.0030	0.38		**Shallow Concentrated Flow, BC** Short Grass Pasture Kv= 7.0 fps
50.8	317	Total			

Summary for Subcatchment 2: 2

Runoff = 1.06 cfs @ 12.09 hrs, Volume= 0.076 af, Depth= 1.90"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type III 24-hr 2-YR Rainfall=3.00"

	Area (sf)	CN	Description
*	13,263	98	Pavement
*	7,519	74	Proposed Landscape
	20,782	89	Weighted Average
	7,519		Pervious Area
	13,263		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	85	0.0222	1.34		**Sheet Flow, AB** Smooth surfaces n= 0.011 P2= 3.00"
1.1	105	0.0058	1.55		**Shallow Concentrated Flow, BC** Paved Kv= 20.3 fps
2.2	190	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 3: 3

Runoff = 1.89 cfs @ 12.08 hrs, Volume= 0.146 af, Depth= 2.66"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type III 24-hr 2-YR Rainfall=3.00"

	Area (sf)	CN	Description
*	25,040	98	Proposed Building
*	3,760	89	Gravel Drip Strip Area
	28,800	97	Weighted Average
	3,760		Pervious Area
	25,040		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 3A: 3A

Runoff = 1.24 cfs @ 12.09 hrs, Volume= 0.090 af, Depth= 2.16"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type III 24-hr 2-YR Rainfall=3.00"

	Area (sf)	CN	Description
*	3,377	74	Pervious Pond Area
*	725	74	Existing Land Scaped Area
*	16,040	98	Impervious Pavement
*	1,674	74	Proposed Landscape
	21,816	92	Weighted Average
	5,776		Pervious Area
	16,040		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 3B: 3B

Runoff = 0.29 cfs @ 12.08 hrs, Volume= 0.023 af, Depth= 2.77"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type III 24-hr 2-YR Rainfall=3.00"

	Area (sf)	CN	Description
*	4,298	98	Impervious
	4,298		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 3C: 3C

Runoff = 1.07 cfs @ 12.08 hrs, Volume= 0.085 af, Depth= 2.77"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type III 24-hr 2-YR Rainfall=3.00"

	Area (sf)	CN	Description
*	15,719	98	Impervious
*	394	98	New Impervious
	16,113	98	Weighted Average
	16,113		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 4: 4

Runoff = 2.31 cfs @ 12.09 hrs, Volume= 0.166 af, Depth= 1.98"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type III 24-hr 2-YR Rainfall=3.00"

	Area (sf)	CN	Description
*	27,691	98	New Pavement
*	15,326	74	Proposed Landscape
*	679	98	Existing Pavement
	43,696	90	Weighted Average
	15,326		Pervious Area
	28,370		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.0	135	0.0111	1.12		**Sheet Flow, AB** Smooth surfaces n= 0.011 P2= 3.00"
1.2	130	0.0077	1.78		**Shallow Concentrated Flow, BC** Paved Kv= 20.3 fps
2.6	190	0.0068	1.24		**Shallow Concentrated Flow, CD** Grassed Waterway Kv= 15.0 fps
5.8	455	Total, Increased to minimum Tc = 6.0 min			

Summary for Reach CITY CB: CITY CB

Inflow Area = 0.477 ac, 63.82% Impervious, Inflow Depth = 1.90" for 2-YR event
Inflow = 0.44 cfs @ 12.31 hrs, Volume= 0.076 af
Outflow = 0.44 cfs @ 12.31 hrs, Volume= 0.076 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs

Summary for Reach POA 1: POA 1

Inflow Area = 2.516 ac, 25.89% Impervious, Inflow Depth = 1.33" for 2-YR event
Inflow = 1.19 cfs @ 12.76 hrs, Volume= 0.279 af
Outflow = 1.19 cfs @ 12.76 hrs, Volume= 0.279 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs

Summary for Reach POA 2: POA 2

Inflow Area = 2.108 ac, 81.42% Impervious, Inflow Depth = 2.19" for 2-YR event
Inflow = 2.79 cfs @ 12.21 hrs, Volume= 0.385 af
Outflow = 2.79 cfs @ 12.21 hrs, Volume= 0.385 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs

Summary for Reach Reach 1: Reach to POA 1

Inflow Area = 1.003 ac, 64.93% Impervious, Inflow Depth = 1.36" for 2-YR event
Inflow = 0.27 cfs @ 12.72 hrs, Volume= 0.113 af
Outflow = 0.25 cfs @ 13.23 hrs, Volume= 0.113 af, Atten= 7%, Lag= 30.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Max. Velocity= 0.10 fps, Min. Travel Time= 22.8 min
Avg. Velocity = 0.05 fps, Avg. Travel Time= 45.9 min

Peak Storage= 349 cf @ 13.23 hrs, Average Depth at Peak Storage= 0.04'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 58.12 cfs

60.00' x 1.00' deep channel, n= 0.150 Very weedy reaches w/pools
Side Slope Z-value= 20.0 '/' Top Width= 100.00'
Length= 138.0' Slope= 0.0072 '/'
Inlet Invert= 69.00', Outlet Invert= 68.00'

‡

Summary for Pond 6P: Drip Strip

Inflow Area = 0.661 ac, 86.94% Impervious, Inflow Depth = 2.66" for 2-YR event
Inflow = 1.89 cfs @ 12.08 hrs, Volume= 0.146 af
Outflow = 1.14 cfs @ 12.19 hrs, Volume= 0.147 af, Atten= 40%, Lag= 6.2 min
Primary = 1.14 cfs @ 12.19 hrs, Volume= 0.147 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Peak Elev= 70.22' @ 12.19 hrs Surf.Area= 3,525 sf Storage= 312 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 0.9 min (768.6 - 767.7)

Volume	Invert	Avail.Storage	Storage Description
#1	70.50'	2,115 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 5,288 cf Overall x 40.0% Voids
#2	70.00'	705 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 1,763 cf Overall x 40.0% Voids
		2,820 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
70.50	3,525	0	0
72.00	3,525	5,288	5,288

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
70.00	3,525	0	0
70.50	3,525	1,763	1,763

Device	Routing	Invert	Outlet Devices
#1	Primary	67.17'	**6.0" x 51.0' long Culvert** CPP, projecting, no headwall, Ke= 0.900 Outlet Invert= 66.92' S= 0.0049 '/' Cc= 0.900 n= 0.012

Primary OutFlow Max=1.14 cfs @ 12.19 hrs HW=70.22' TW=0.00' (Dynamic Tailwater)
↑—**1=Culvert** (Barrel Controls 1.14 cfs @ 5.81 fps)

Summary for Pond 11P: Offsite 1

Inflow Area = 0.099 ac,100.00% Impervious, Inflow Depth = 2.77" for 2-YR event
Inflow = 0.29 cfs @ 12.08 hrs, Volume= 0.023 af
Primary = 0.29 cfs @ 12.08 hrs, Volume= 0.023 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs

Summary for Pond GW 1: GW 1

Inflow Area = 0.477 ac, 63.82% Impervious, Inflow Depth = 1.90" for 2-YR event
Inflow = 1.06 cfs @ 12.09 hrs, Volume= 0.076 af
Outflow = 0.44 cfs @ 12.31 hrs, Volume= 0.076 af, Atten= 58%, Lag= 13.1 min
Primary = 0.44 cfs @ 12.31 hrs, Volume= 0.076 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Peak Elev= 69.11' @ 12.31 hrs Surf.Area= 2,284 sf Storage= 1,213 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 339.1 min (1,152.8 - 813.7)

Volume	Invert	Avail.Storage	Storage Description
#1	68.50'	3,446 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
68.50	1,727	0	0
69.00	2,123	963	963
69.90	3,396	2,484	3,446

Device	Routing	Invert	Outlet Devices
#1	Device 3	65.83'	**6.0" x 18.0' long 6" UD** CPP, projecting, no headwall, Ke= 0.900 Outlet Invert= 65.83' S= 0.0000 '/' Cc= 0.900 n= 0.012
#2	Device 1	65.83'	**0.9" Vert. Water Quality Orifice Control** C= 0.600
#3	Primary	68.17'	**12.0" x 140.0' long Culvert** CPP, projecting, no headwall, Ke= 0.900 Outlet Invert= 65.00' S= 0.0226 '/' Cc= 0.900 n= 0.012
#4	Device 3	69.00'	**4.0' long x 0.7' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 Coef. (English) 2.76 2.82 2.93 3.09 3.18 3.22 3.27 3.30 3.32 3.31 3.32

Primary OutFlow Max=0.44 cfs @ 12.31 hrs HW=69.11' TW=0.00' (Dynamic Tailwater)
- **3=Culvert** (Passes 0.44 cfs of 2.00 cfs potential flow)
  - **1=6" UD** (Passes 0.02 cfs of 0.73 cfs potential flow)
    - **2=Water Quality Orifice Control** (Orifice Controls 0.02 cfs @ 4.68 fps)
  - **4=Broad-Crested Rectangular Weir** (Weir Controls 0.42 cfs @ 0.93 fps)

Summary for Pond GW 2: GW 2

Inflow Area = 1.003 ac, 64.93% Impervious, Inflow Depth = 1.98" for 2-YR event
Inflow = 2.31 cfs @ 12.09 hrs, Volume= 0.166 af
Outflow = 0.27 cfs @ 12.72 hrs, Volume= 0.113 af, Atten= 88%, Lag= 38.3 min
Primary = 0.25 cfs @ 12.73 hrs, Volume= 0.091 af
Secondary = 0.03 cfs @ 12.58 hrs, Volume= 0.022 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs

Peak Elev= 69.32' @ 12.76 hrs Surf.Area= 5,569 sf Storage= 3,988 cf

Plug-Flow detention time= 286.4 min calculated for 0.113 af (68% of inflow)
Center-of-Mass det. time= 190.1 min (999.6 - 809.4)

Volume	Invert	Avail.Storage	Storage Description
#1	68.50'	13,861 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
#2	69.00'	255 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
		14,115 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
68.50	4,191	0	0
69.00	4,954	2,286	2,286
70.00	6,065	5,510	7,796
71.00	6,065	6,065	13,861

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
69.00	214	0	0
69.90	352	255	255

Device	Routing	Invert	Outlet Devices
#1	Secondary	68.17'	**6.0" x 20.0' long Culvert** CPP, projecting, no headwall, Ke= 0.900 Outlet Invert= 68.09' S= 0.0040 '/' Cc= 0.900 n= 0.012
#2	Device 1	65.83'	**1.4" Vert. Orifice/Grate** C= 0.600
#3	Primary	69.00'	**0.5' long x 0.7' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 Coef. (English) 2.76 2.82 2.93 3.09 3.18 3.22 3.27 3.30 3.32 3.31 3.32
#4	Primary	70.00'	**10.0' long x 0.7' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 Coef. (English) 2.76 2.82 2.93 3.09 3.18 3.22 3.27 3.30 3.32 3.31 3.32

Primary OutFlow Max=0.25 cfs @ 12.73 hrs HW=69.32' TW=69.04' (Dynamic Tailwater)
└─**3=Broad-Crested Rectangular Weir** (Weir Controls 0.25 cfs @ 1.55 fps)
└─**4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Secondary OutFlow Max=0.03 cfs @ 12.58 hrs HW=69.31' TW=69.03' (Dynamic Tailwater)
└─**1=Culvert** (Passes 0.03 cfs of 0.40 cfs potential flow)
└─**2=Orifice/Grate** (Orifice Controls 0.03 cfs @ 2.57 fps)

Summary for Pond Offsite Det.: Existing Detention Pond

Inflow Area = 0.599 ac, 77.88% Impervious, Inflow Depth = 2.26" for 2-YR event
Inflow = 1.53 cfs @ 12.09 hrs, Volume= 0.113 af
Outflow = 0.72 cfs @ 12.25 hrs, Volume= 0.077 af, Atten= 53%, Lag= 10.0 min
Primary = 0.72 cfs @ 12.25 hrs, Volume= 0.077 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Peak Elev= 67.49' @ 12.25 hrs Surf.Area= 1,427 sf Storage= 2,178 cf

Plug-Flow detention time= 200.6 min calculated for 0.077 af (69% of inflow)
Center-of-Mass det. time= 106.4 min (898.0 - 791.6)

Volume	Invert	Avail.Storage	Storage Description
#1	65.00'	4,848 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
65.00	432	0	0
66.00	740	586	586
67.00	1,171	956	1,542
68.00	1,693	1,432	2,974
69.00	2,056	1,875	4,848

Device	Routing	Invert	Outlet Devices
#1	Primary	67.00'	**12.0" x 190.0' long Culvert** CPP, projecting, no headwall, Ke= 0.900 Outlet Invert= 66.05' S= 0.0050 '/' Cc= 0.900 n= 0.012

Primary OutFlow Max=0.72 cfs @ 12.25 hrs HW=67.49' TW=0.00' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 0.72 cfs @ 1.88 fps)

Time span=0.00-72.00 hrs, dt=0.02 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1: 1 Runoff Area=65,893 sf 0.00% Impervious Runoff Depth=2.72"
Flow Length=317' Slope=0.0030 '/' Tc=50.8 min CN=81 Runoff=2.10 cfs 0.343 af

Subcatchment 2: 2 Runoff Area=20,782 sf 63.82% Impervious Runoff Depth=3.49"
Flow Length=190' Tc=6.0 min CN=89 Runoff=1.90 cfs 0.139 af

Subcatchment 3: 3 Runoff Area=28,800 sf 86.94% Impervious Runoff Depth=4.35"
Tc=6.0 min CN=97 Runoff=3.01 cfs 0.240 af

Subcatchment 3A: 3A Runoff Area=21,816 sf 73.52% Impervious Runoff Depth=3.80"
Tc=6.0 min CN=92 Runoff=2.12 cfs 0.158 af

Subcatchment 3B: 3B Runoff Area=4,298 sf 100.00% Impervious Runoff Depth=4.46"
Tc=6.0 min CN=98 Runoff=0.45 cfs 0.037 af

Subcatchment 3C: 3C Runoff Area=16,113 sf 100.00% Impervious Runoff Depth=4.46"
Tc=6.0 min CN=98 Runoff=1.70 cfs 0.138 af

Subcatchment 4: 4 Runoff Area=43,696 sf 64.93% Impervious Runoff Depth=3.59"
Flow Length=455' Tc=6.0 min CN=90 Runoff=4.08 cfs 0.300 af

Reach CITY CB: CITY CB Inflow=1.51 cfs 0.139 af
Outflow=1.51 cfs 0.139 af

Reach POA 1: POA 1 Inflow=3.03 cfs 0.591 af
Outflow=3.03 cfs 0.591 af

Reach POA 2: POA 2 Inflow=5.92 cfs 0.675 af
Outflow=5.92 cfs 0.675 af

Reach Reach 1: Reach to POA 1 Avg. Depth=0.09' Max Vel=0.17 fps Inflow=1.00 cfs 0.247 af
n=0.150 L=138.0' S=0.0072 '/' Capacity=58.12 cfs Outflow=0.93 cfs 0.247 af

Pond 6P: Drip Strip Peak Elev=70.78' Storage=1,103 cf Inflow=3.01 cfs 0.240 af
6.0" x 51.0' Culvert Outflow=1.25 cfs 0.240 af

Pond 11P: Offsite 1 Inflow=0.45 cfs 0.037 af
Primary=0.45 cfs 0.037 af

Pond GW 1: GW 1 Peak Elev=69.26' Storage=1,566 cf Inflow=1.90 cfs 0.139 af
Outflow=1.51 cfs 0.139 af

Pond GW 2: GW 2 Peak Elev=69.74' Storage=6,476 cf Inflow=4.08 cfs 0.300 af
Primary=0.96 cfs 0.219 af Secondary=0.04 cfs 0.029 af Outflow=1.00 cfs 0.247 af

Pond Offsite Det.: Existing Detention Pond Peak Elev=67.86' Storage=2,743 cf Inflow=2.57 cfs 0.195 af
12.0" x 190.0' Culvert Outflow=1.79 cfs 0.160 af

Total Runoff Area = 4.623 ac Runoff Volume = 1.354 af Average Runoff Depth = 3.51"
48.80% Pervious = 2.256 ac 51.20% Impervious = 2.367 ac

Summary for Subcatchment 1: 1

Runoff = 2.10 cfs @ 12.70 hrs, Volume= 0.343 af, Depth= 2.72"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type III 24-hr 10-YR Rainfall=4.70"

	Area (sf)	CN	Description
	4,163	73	Woods, Fair, HSG C
	9,957	79	Woods, Fair, HSG D
	19,210	79	Pasture/grassland/range, Fair, HSG C
	27,709	84	Pasture/grassland/range, Fair, HSG D
	1,443	89	Gravel roads, HSG C
*	3,411	74	Proposed Landscape
	65,893	81	Weighted Average
	65,893		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
43.5	150	0.0030	0.06		**Sheet Flow, AB** Grass: Dense n= 0.240 P2= 3.00"
7.3	167	0.0030	0.38		**Shallow Concentrated Flow, BC** Short Grass Pasture Kv= 7.0 fps
50.8	317	Total			

Summary for Subcatchment 2: 2

Runoff = 1.90 cfs @ 12.09 hrs, Volume= 0.139 af, Depth= 3.49"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type III 24-hr 10-YR Rainfall=4.70"

	Area (sf)	CN	Description
*	13,263	98	Pavement
*	7,519	74	Proposed Landscape
	20,782	89	Weighted Average
	7,519		Pervious Area
	13,263		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	85	0.0222	1.34		**Sheet Flow, AB** Smooth surfaces n= 0.011 P2= 3.00"
1.1	105	0.0058	1.55		**Shallow Concentrated Flow, BC** Paved Kv= 20.3 fps
2.2	190	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 3: 3

Runoff = 3.01 cfs @ 12.08 hrs, Volume= 0.240 af, Depth= 4.35"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type III 24-hr 10-YR Rainfall=4.70"

	Area (sf)	CN	Description
*	25,040	98	Proposed Building
*	3,760	89	Gravel Drip Strip Area
	28,800	97	Weighted Average
	3,760		Pervious Area
	25,040		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 3A: 3A

Runoff = 2.12 cfs @ 12.08 hrs, Volume= 0.158 af, Depth= 3.80"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type III 24-hr 10-YR Rainfall=4.70"

	Area (sf)	CN	Description
*	3,377	74	Pervious Pond Area
*	725	74	Existing Land Scaped Area
*	16,040	98	Impervious Pavement
*	1,674	74	Proposed Landscape
	21,816	92	Weighted Average
	5,776		Pervious Area
	16,040		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 3B: 3B

Runoff = 0.45 cfs @ 12.08 hrs, Volume= 0.037 af, Depth= 4.46"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type III 24-hr 10-YR Rainfall=4.70"

	Area (sf)	CN	Description
*	4,298	98	Impervious
	4,298		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 3C: 3C

Runoff = 1.70 cfs @ 12.08 hrs, Volume= 0.138 af, Depth= 4.46"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type III 24-hr 10-YR Rainfall=4.70"

	Area (sf)	CN	Description
*	15,719	98	Impervious
*	394	98	New Impervious
	16,113	98	Weighted Average
	16,113		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 4: 4

Runoff = 4.08 cfs @ 12.09 hrs, Volume= 0.300 af, Depth= 3.59"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type III 24-hr 10-YR Rainfall=4.70"

	Area (sf)	CN	Description
*	27,691	98	New Pavement
*	15,326	74	Proposed Landscape
*	679	98	Existing Pavement
	43,696	90	Weighted Average
	15,326		Pervious Area
	28,370		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.0	135	0.0111	1.12		**Sheet Flow, AB**
					Smooth surfaces n= 0.011 P2= 3.00"
1.2	130	0.0077	1.78		**Shallow Concentrated Flow, BC**
					Paved Kv= 20.3 fps
2.6	190	0.0068	1.24		**Shallow Concentrated Flow, CD**
					Grassed Waterway Kv= 15.0 fps
5.8	455	Total, Increased to minimum Tc = 6.0 min			

Summary for Reach CITY CB: CITY CB

Inflow Area = 0.477 ac, 63.82% Impervious, Inflow Depth = 3.49" for 10-YR event
Inflow = 1.51 cfs @ 12.15 hrs, Volume= 0.139 af
Outflow = 1.51 cfs @ 12.15 hrs, Volume= 0.139 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs

Summary for Reach POA 1: POA 1

Inflow Area = 2.516 ac, 25.89% Impervious, Inflow Depth = 2.82" for 10-YR event
Inflow = 3.03 cfs @ 12.69 hrs, Volume= 0.591 af
Outflow = 3.03 cfs @ 12.69 hrs, Volume= 0.591 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs

Summary for Reach POA 2: POA 2

Inflow Area = 2.108 ac, 81.42% Impervious, Inflow Depth = 3.85" for 10-YR event
Inflow = 5.92 cfs @ 12.12 hrs, Volume= 0.675 af
Outflow = 5.92 cfs @ 12.12 hrs, Volume= 0.675 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs

Summary for Reach Reach 1: Reach to POA 1

Inflow Area = 1.003 ac, 64.93% Impervious, Inflow Depth = 2.96" for 10-YR event
Inflow = 1.00 cfs @ 12.46 hrs, Volume= 0.247 af
Outflow = 0.93 cfs @ 12.66 hrs, Volume= 0.247 af, Atten= 7%, Lag= 11.7 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Max. Velocity= 0.17 fps, Min. Travel Time= 13.8 min
Avg. Velocity = 0.06 fps, Avg. Travel Time= 39.9 min

Peak Storage= 771 cf @ 12.66 hrs, Average Depth at Peak Storage= 0.09'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 58.12 cfs

60.00' x 1.00' deep channel, n= 0.150 Very weedy reaches w/pools
Side Slope Z-value= 20.0 '/' Top Width= 100.00'
Length= 138.0' Slope= 0.0072 '/'
Inlet Invert= 69.00', Outlet Invert= 68.00'

‡

Summary for Pond 6P: Drip Strip

Inflow Area = 0.661 ac, 86.94% Impervious, Inflow Depth = 4.35" for 10-YR event
Inflow = 3.01 cfs @ 12.08 hrs, Volume= 0.240 af
Outflow = 1.25 cfs @ 12.28 hrs, Volume= 0.240 af, Atten= 58%, Lag= 11.9 min
Primary = 1.25 cfs @ 12.28 hrs, Volume= 0.240 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Peak Elev= 70.78' @ 12.28 hrs Surf.Area= 7,050 sf Storage= 1,103 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 3.5 min (760.5 - 757.1)

Volume	Invert	Avail.Storage	Storage Description
#1	70.50'	2,115 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 5,288 cf Overall x 40.0% Voids
#2	70.00'	705 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 1,763 cf Overall x 40.0% Voids
		2,820 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
70.50	3,525	0	0
72.00	3,525	5,288	5,288

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
70.00	3,525	0	0
70.50	3,525	1,763	1,763

Device	Routing	Invert	Outlet Devices
#1	Primary	67.17'	**6.0" x 51.0' long Culvert** CPP, projecting, no headwall, Ke= 0.900 Outlet Invert= 66.92' S= 0.0049 '/' Cc= 0.900 n= 0.012

Primary OutFlow Max=1.25 cfs @ 12.28 hrs HW=70.78' TW=0.00' (Dynamic Tailwater)
↑—**1=Culvert** (Barrel Controls 1.25 cfs @ 6.37 fps)

Summary for Pond 11P: Offsite 1

Inflow Area = 0.099 ac,100.00% Impervious, Inflow Depth = 4.46" for 10-YR event
Inflow = 0.45 cfs @ 12.08 hrs, Volume= 0.037 af
Primary = 0.45 cfs @ 12.08 hrs, Volume= 0.037 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs

Summary for Pond GW 1: GW 1

Inflow Area = 0.477 ac, 63.82% Impervious, Inflow Depth = 3.49" for 10-YR event
Inflow = 1.90 cfs @ 12.09 hrs, Volume= 0.139 af
Outflow = 1.51 cfs @ 12.15 hrs, Volume= 0.139 af, Atten= 21%, Lag= 3.7 min
Primary = 1.51 cfs @ 12.15 hrs, Volume= 0.139 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Peak Elev= 69.26' @ 12.15 hrs Surf.Area= 2,493 sf Storage= 1,566 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 209.6 min (1,006.2 - 796.6)

Volume	Invert	Avail.Storage	Storage Description
#1	68.50'	3,446 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
68.50	1,727	0	0
69.00	2,123	963	963
69.90	3,396	2,484	3,446

Device	Routing	Invert	Outlet Devices
#1	Device 3	65.83'	**6.0" x 18.0' long 6" UD** CPP, projecting, no headwall, Ke= 0.900 Outlet Invert= 65.83' S= 0.0000 '/' Cc= 0.900 n= 0.012
#2	Device 1	65.83'	**0.9" Vert. Water Quality Orifice Control** C= 0.600
#3	Primary	68.17'	**12.0" x 140.0' long Culvert** CPP, projecting, no headwall, Ke= 0.900 Outlet Invert= 65.00' S= 0.0226 '/' Cc= 0.900 n= 0.012
#4	Device 3	69.00'	**4.0' long x 0.7' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 Coef. (English) 2.76 2.82 2.93 3.09 3.18 3.22 3.27 3.30 3.32 3.31 3.32

Primary OutFlow Max=1.50 cfs @ 12.15 hrs HW=69.26' TW=0.00' (Dynamic Tailwater)
- **3=Culvert** (Passes 1.50 cfs of 2.29 cfs potential flow)
  - **1=6" UD** (Passes 0.02 cfs of 0.78 cfs potential flow)
    - **2=Water Quality Orifice Control** (Orifice Controls 0.02 cfs @ 5.03 fps)
  - **4=Broad-Crested Rectangular Weir** (Weir Controls 1.48 cfs @ 1.42 fps)

Summary for Pond GW 2: GW 2

Inflow Area = 1.003 ac, 64.93% Impervious, Inflow Depth = 3.59" for 10-YR event
Inflow = 4.08 cfs @ 12.09 hrs, Volume= 0.300 af
Outflow = 1.00 cfs @ 12.46 hrs, Volume= 0.247 af, Atten= 75%, Lag= 22.7 min
Primary = 0.96 cfs @ 12.46 hrs, Volume= 0.219 af
Secondary = 0.04 cfs @ 12.42 hrs, Volume= 0.029 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs

Peak Elev= 69.74' @ 12.47 hrs Surf.Area= 6,108 sf Storage= 6,476 cf

Plug-Flow detention time= 211.7 min calculated for 0.247 af (82% of inflow)
Center-of-Mass det. time= 141.5 min (934.3 - 792.8)

Volume	Invert	Avail.Storage	Storage Description
#1	68.50'	13,861 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
#2	69.00'	255 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
		14,115 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
68.50	4,191	0	0
69.00	4,954	2,286	2,286
70.00	6,065	5,510	7,796
71.00	6,065	6,065	13,861

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
69.00	214	0	0
69.90	352	255	255

Device	Routing	Invert	Outlet Devices
#1	Secondary	68.17'	**6.0" x 20.0' long Culvert** CPP, projecting, no headwall, Ke= 0.900 Outlet Invert= 68.09' S= 0.0040 '/' Cc= 0.900 n= 0.012
#2	Device 1	65.83'	**1.4" Vert. Orifice/Grate** C= 0.600
#3	Primary	69.00'	**0.5' long x 0.7' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 Coef. (English) 2.76 2.82 2.93 3.09 3.18 3.22 3.27 3.30 3.32 3.31 3.32
#4	Primary	70.00'	**10.0' long x 0.7' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 Coef. (English) 2.76 2.82 2.93 3.09 3.18 3.22 3.27 3.30 3.32 3.31 3.32

Primary OutFlow Max=0.96 cfs @ 12.46 hrs HW=69.74' TW=69.08' (Dynamic Tailwater)
└─**3=Broad-Crested Rectangular Weir** (Weir Controls 0.96 cfs @ 2.59 fps)
└─**4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Secondary OutFlow Max=0.04 cfs @ 12.42 hrs HW=69.74' TW=69.08' (Dynamic Tailwater)
└─**1=Culvert** (Passes 0.04 cfs of 0.61 cfs potential flow)
└─**2=Orifice/Grate** (Orifice Controls 0.04 cfs @ 3.91 fps)

Summary for Pond Offsite Det.: Existing Detention Pond

Inflow Area = 0.599 ac, 77.88% Impervious, Inflow Depth = 3.91" for 10-YR event
Inflow = 2.57 cfs @ 12.08 hrs, Volume= 0.195 af
Outflow = 1.79 cfs @ 12.17 hrs, Volume= 0.160 af, Atten= 30%, Lag= 4.9 min
Primary = 1.79 cfs @ 12.17 hrs, Volume= 0.160 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Peak Elev= 67.86' @ 12.17 hrs Surf.Area= 1,620 sf Storage= 2,743 cf

Plug-Flow detention time= 146.9 min calculated for 0.160 af (82% of inflow)
Center-of-Mass det. time= 75.1 min (853.1 - 778.0)

Volume	Invert	Avail.Storage	Storage Description
#1	65.00'	4,848 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
65.00	432	0	0
66.00	740	586	586
67.00	1,171	956	1,542
68.00	1,693	1,432	2,974
69.00	2,056	1,875	4,848

Device	Routing	Invert	Outlet Devices
#1	Primary	67.00'	**12.0" x 190.0' long Culvert** CPP, projecting, no headwall, Ke= 0.900 Outlet Invert= 66.05' S= 0.0050 '/' Cc= 0.900 n= 0.012

Primary OutFlow Max=1.79 cfs @ 12.17 hrs HW=67.86' TW=0.00' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 1.79 cfs @ 2.49 fps)

Time span=0.00-72.00 hrs, dt=0.02 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1: 1 Runoff Area=65,893 sf 0.00% Impervious Runoff Depth=3.43"
Flow Length=317' Slope=0.0030 '/' Tc=50.8 min CN=81 Runoff=2.64 cfs 0.433 af

Subcatchment 2: 2 Runoff Area=20,782 sf 63.82% Impervious Runoff Depth=4.25"
Flow Length=190' Tc=6.0 min CN=89 Runoff=2.29 cfs 0.169 af

Subcatchment 3: 3 Runoff Area=28,800 sf 86.94% Impervious Runoff Depth=5.15"
Tc=6.0 min CN=97 Runoff=3.53 cfs 0.283 af

Subcatchment 3A: 3A Runoff Area=21,816 sf 73.52% Impervious Runoff Depth=4.58"
Tc=6.0 min CN=92 Runoff=2.53 cfs 0.191 af

Subcatchment 3B: 3B Runoff Area=4,298 sf 100.00% Impervious Runoff Depth=5.26"
Tc=6.0 min CN=98 Runoff=0.53 cfs 0.043 af

Subcatchment 3C: 3C Runoff Area=16,113 sf 100.00% Impervious Runoff Depth=5.26"
Tc=6.0 min CN=98 Runoff=1.99 cfs 0.162 af

Subcatchment 4: 4 Runoff Area=43,696 sf 64.93% Impervious Runoff Depth=4.36"
Flow Length=455' Tc=6.0 min CN=90 Runoff=4.91 cfs 0.364 af

Reach CITY CB: CITY CB Inflow=1.88 cfs 0.169 af
Outflow=1.88 cfs 0.169 af

Reach POA 1: POA 1 Inflow=3.92 cfs 0.744 af
Outflow=3.92 cfs 0.744 af

Reach POA 2: POA 2 Inflow=6.90 cfs 0.814 af
Outflow=6.90 cfs 0.814 af

Reach Reach 1: Reach to POA 1 Avg. Depth=0.11' Max Vel=0.19 fps Inflow=1.39 cfs 0.312 af
n=0.150 L=138.0' S=0.0072 '/' Capacity=58.12 cfs Outflow=1.31 cfs 0.312 af

Pond 6P: Drip Strip Peak Elev=71.12' Storage=1,585 cf Inflow=3.53 cfs 0.283 af
6.0" x 51.0' Culvert Outflow=1.31 cfs 0.284 af

Pond 11P: Offsite 1 Inflow=0.53 cfs 0.043 af
Primary=0.53 cfs 0.043 af

Pond GW 1: GW 1 Peak Elev=69.30' Storage=1,668 cf Inflow=2.29 cfs 0.169 af
Outflow=1.88 cfs 0.169 af

Pond GW 2: GW 2 Peak Elev=69.91' Storage=7,511 cf Inflow=4.91 cfs 0.364 af
Primary=1.34 cfs 0.281 af Secondary=0.05 cfs 0.031 af Outflow=1.39 cfs 0.312 af

Pond Offsite Det.: Existing Detention Pond Peak Elev=67.98' Storage=2,945 cf Inflow=3.06 cfs 0.234 af
12.0" x 190.0' Culvert Outflow=2.09 cfs 0.199 af

Total Runoff Area = 4.623 ac Runoff Volume = 1.646 af Average Runoff Depth = 4.27"
48.80% Pervious = 2.256 ac 51.20% Impervious = 2.367 ac

Summary for Subcatchment 1: 1

Runoff = 2.64 cfs @ 12.70 hrs, Volume= 0.433 af, Depth= 3.43"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type III 24-hr 25-YR Rainfall=5.50"

	Area (sf)	CN	Description
	4,163	73	Woods, Fair, HSG C
	9,957	79	Woods, Fair, HSG D
	19,210	79	Pasture/grassland/range, Fair, HSG C
	27,709	84	Pasture/grassland/range, Fair, HSG D
	1,443	89	Gravel roads, HSG C
*	3,411	74	Proposed Landscape
	65,893	81	Weighted Average
	65,893		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
43.5	150	0.0030	0.06		**Sheet Flow, AB** Grass: Dense n= 0.240 P2= 3.00"
7.3	167	0.0030	0.38		**Shallow Concentrated Flow, BC** Short Grass Pasture Kv= 7.0 fps
50.8	317	Total			

Summary for Subcatchment 2: 2

Runoff = 2.29 cfs @ 12.09 hrs, Volume= 0.169 af, Depth= 4.25"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type III 24-hr 25-YR Rainfall=5.50"

	Area (sf)	CN	Description
*	13,263	98	Pavement
*	7,519	74	Proposed Landscape
	20,782	89	Weighted Average
	7,519		Pervious Area
	13,263		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	85	0.0222	1.34		**Sheet Flow, AB** Smooth surfaces n= 0.011 P2= 3.00"
1.1	105	0.0058	1.55		**Shallow Concentrated Flow, BC** Paved Kv= 20.3 fps
2.2	190	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 3: 3

Runoff = 3.53 cfs @ 12.08 hrs, Volume= 0.283 af, Depth= 5.15"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type III 24-hr 25-YR Rainfall=5.50"

	Area (sf)	CN	Description
*	25,040	98	Proposed Building
*	3,760	89	Gravel Drip Strip Area
	28,800	97	Weighted Average
	3,760		Pervious Area
	25,040		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 3A: 3A

Runoff = 2.53 cfs @ 12.08 hrs, Volume= 0.191 af, Depth= 4.58"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type III 24-hr 25-YR Rainfall=5.50"

	Area (sf)	CN	Description
*	3,377	74	Pervious Pond Area
*	725	74	Existing Land Scaped Area
*	16,040	98	Impervious Pavement
*	1,674	74	Proposed Landscape
	21,816	92	Weighted Average
	5,776		Pervious Area
	16,040		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 3B: 3B

Runoff = 0.53 cfs @ 12.08 hrs, Volume= 0.043 af, Depth= 5.26"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type III 24-hr 25-YR Rainfall=5.50"

	Area (sf)	CN	Description
*	4,298	98	Impervious
	4,298		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 3C: 3C

Runoff = 1.99 cfs @ 12.08 hrs, Volume= 0.162 af, Depth= 5.26"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type III 24-hr 25-YR Rainfall=5.50"

	Area (sf)	CN	Description
*	15,719	98	Impervious
*	394	98	New Impervious
	16,113	98	Weighted Average
	16,113		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 4: 4

Runoff = 4.91 cfs @ 12.08 hrs, Volume= 0.364 af, Depth= 4.36"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type III 24-hr 25-YR Rainfall=5.50"

	Area (sf)	CN	Description
*	27,691	98	New Pavement
*	15,326	74	Proposed Landscape
*	679	98	Existing Pavement
	43,696	90	Weighted Average
	15,326		Pervious Area
	28,370		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.0	135	0.0111	1.12		**Sheet Flow, AB**
					Smooth surfaces n= 0.011 P2= 3.00"
1.2	130	0.0077	1.78		**Shallow Concentrated Flow, BC**
					Paved Kv= 20.3 fps
2.6	190	0.0068	1.24		**Shallow Concentrated Flow, CD**
					Grassed Waterway Kv= 15.0 fps
5.8	455	Total, Increased to minimum Tc = 6.0 min			

Summary for Reach CITY CB: CITY CB

Inflow Area = 0.477 ac, 63.82% Impervious, Inflow Depth = 4.25" for 25-YR event
Inflow = 1.88 cfs @ 12.14 hrs, Volume= 0.169 af
Outflow = 1.88 cfs @ 12.14 hrs, Volume= 0.169 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs

Summary for Reach POA 1: POA 1

Inflow Area = 2.516 ac, 25.89% Impervious, Inflow Depth = 3.55" for 25-YR event
Inflow = 3.92 cfs @ 12.67 hrs, Volume= 0.744 af
Outflow = 3.92 cfs @ 12.67 hrs, Volume= 0.744 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs

Summary for Reach POA 2: POA 2

Inflow Area = 2.108 ac, 81.42% Impervious, Inflow Depth = 4.63" for 25-YR event
Inflow = 6.90 cfs @ 12.12 hrs, Volume= 0.814 af
Outflow = 6.90 cfs @ 12.12 hrs, Volume= 0.814 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs

Summary for Reach Reach 1: Reach to POA 1

Inflow Area = 1.003 ac, 64.93% Impervious, Inflow Depth = 3.73" for 25-YR event
Inflow = 1.39 cfs @ 12.42 hrs, Volume= 0.312 af
Outflow = 1.31 cfs @ 12.58 hrs, Volume= 0.312 af, Atten= 5%, Lag= 9.7 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Max. Velocity= 0.19 fps, Min. Travel Time= 12.1 min
Avg. Velocity = 0.06 fps, Avg. Travel Time= 38.3 min

Peak Storage= 953 cf @ 12.58 hrs, Average Depth at Peak Storage= 0.11'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 58.12 cfs

60.00' x 1.00' deep channel, n= 0.150 Very weedy reaches w/pools
Side Slope Z-value= 20.0 '/' Top Width= 100.00'
Length= 138.0' Slope= 0.0072 '/'
Inlet Invert= 69.00', Outlet Invert= 68.00'

‡

Summary for Pond 6P: Drip Strip

Inflow Area = 0.661 ac, 86.94% Impervious, Inflow Depth = 5.15" for 25-YR event
Inflow = 3.53 cfs @ 12.08 hrs, Volume= 0.283 af
Outflow = 1.31 cfs @ 12.32 hrs, Volume= 0.284 af, Atten= 63%, Lag= 14.3 min
Primary = 1.31 cfs @ 12.32 hrs, Volume= 0.284 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Peak Elev= 71.12' @ 12.32 hrs Surf.Area= 7,050 sf Storage= 1,585 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 5.1 min (759.0 - 753.8)

Volume	Invert	Avail.Storage	Storage Description
#1	70.50'	2,115 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 5,288 cf Overall x 40.0% Voids
#2	70.00'	705 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 1,763 cf Overall x 40.0% Voids
		2,820 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
70.50	3,525	0	0
72.00	3,525	5,288	5,288

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
70.00	3,525	0	0
70.50	3,525	1,763	1,763

Device	Routing	Invert	Outlet Devices
#1	Primary	67.17'	**6.0" x 51.0' long Culvert** CPP, projecting, no headwall, Ke= 0.900 Outlet Invert= 66.92' S= 0.0049 '/' Cc= 0.900 n= 0.012

Primary OutFlow Max=1.31 cfs @ 12.32 hrs HW=71.12' TW=0.00' (Dynamic Tailwater)
↑—**1=Culvert** (Barrel Controls 1.31 cfs @ 6.69 fps)

Summary for Pond 11P: Offsite 1

Inflow Area = 0.099 ac,100.00% Impervious, Inflow Depth = 5.26" for 25-YR event
Inflow = 0.53 cfs @ 12.08 hrs, Volume= 0.043 af
Primary = 0.53 cfs @ 12.08 hrs, Volume= 0.043 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs

Summary for Pond GW 1: GW 1

Inflow Area = 0.477 ac, 63.82% Impervious, Inflow Depth = 4.25" for 25-YR event
Inflow = 2.29 cfs @ 12.09 hrs, Volume= 0.169 af
Outflow = 1.88 cfs @ 12.14 hrs, Volume= 0.169 af, Atten= 18%, Lag= 3.4 min
Primary = 1.88 cfs @ 12.14 hrs, Volume= 0.169 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Peak Elev= 69.30' @ 12.14 hrs Surf.Area= 2,550 sf Storage= 1,668 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 178.0 min (969.1 - 791.1)

Volume	Invert	Avail.Storage	Storage Description
#1	68.50'	3,446 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
68.50	1,727	0	0
69.00	2,123	963	963
69.90	3,396	2,484	3,446

Device	Routing	Invert	Outlet Devices
#1	Device 3	65.83'	**6.0" x 18.0' long 6" UD** CPP, projecting, no headwall, Ke= 0.900 Outlet Invert= 65.83' S= 0.0000 '/' Cc= 0.900 n= 0.012
#2	Device 1	65.83'	**0.9" Vert. Water Quality Orifice Control** C= 0.600
#3	Primary	68.17'	**12.0" x 140.0' long Culvert** CPP, projecting, no headwall, Ke= 0.900 Outlet Invert= 65.00' S= 0.0226 '/' Cc= 0.900 n= 0.012
#4	Device 3	69.00'	**4.0' long x 0.7' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 Coef. (English) 2.76 2.82 2.93 3.09 3.18 3.22 3.27 3.30 3.32 3.31 3.32

Primary OutFlow Max=1.87 cfs @ 12.14 hrs HW=69.30' TW=0.00' (Dynamic Tailwater)
- **3=Culvert** (Passes 1.87 cfs of 2.37 cfs potential flow)
  - **1=6" UD** (Passes 0.02 cfs of 0.79 cfs potential flow)
    - **2=Water Quality Orifice Control** (Orifice Controls 0.02 cfs @ 5.12 fps)
  - **4=Broad-Crested Rectangular Weir** (Weir Controls 1.85 cfs @ 1.53 fps)

Summary for Pond GW 2: GW 2

Inflow Area = 1.003 ac, 64.93% Impervious, Inflow Depth = 4.36" for 25-YR event
Inflow = 4.91 cfs @ 12.08 hrs, Volume= 0.364 af
Outflow = 1.39 cfs @ 12.42 hrs, Volume= 0.312 af, Atten= 72%, Lag= 20.2 min
Primary = 1.34 cfs @ 12.42 hrs, Volume= 0.281 af
Secondary = 0.05 cfs @ 12.39 hrs, Volume= 0.031 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs

Peak Elev= 69.91' @ 12.43 hrs Surf.Area= 6,317 sf Storage= 7,511 cf

Plug-Flow detention time= 193.4 min calculated for 0.312 af (86% of inflow)
Center-of-Mass det. time= 131.0 min (918.6 - 787.5)

Volume	Invert	Avail.Storage	Storage Description
#1	68.50'	13,861 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
#2	69.00'	255 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
		14,115 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
68.50	4,191	0	0
69.00	4,954	2,286	2,286
70.00	6,065	5,510	7,796
71.00	6,065	6,065	13,861

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
69.00	214	0	0
69.90	352	255	255

Device	Routing	Invert	Outlet Devices
#1	Secondary	68.17'	**6.0" x 20.0' long Culvert** CPP, projecting, no headwall, Ke= 0.900 Outlet Invert= 68.09' S= 0.0040 '/' Cc= 0.900 n= 0.012
#2	Device 1	65.83'	**1.4" Vert. Orifice/Grate** C= 0.600
#3	Primary	69.00'	**0.5' long x 0.7' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 Coef. (English) 2.76 2.82 2.93 3.09 3.18 3.22 3.27 3.30 3.32 3.31 3.32
#4	Primary	70.00'	**10.0' long x 0.7' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 Coef. (English) 2.76 2.82 2.93 3.09 3.18 3.22 3.27 3.30 3.32 3.31 3.32

Primary OutFlow Max=1.34 cfs @ 12.42 hrs HW=69.91' TW=69.11' (Dynamic Tailwater)
└─**3=Broad-Crested Rectangular Weir** (Weir Controls 1.34 cfs @ 2.95 fps)
└─**4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Secondary OutFlow Max=0.05 cfs @ 12.39 hrs HW=69.91' TW=69.10' (Dynamic Tailwater)
└─**1=Culvert** (Passes 0.05 cfs of 0.67 cfs potential flow)
└─**2=Orifice/Grate** (Orifice Controls 0.05 cfs @ 4.32 fps)

Summary for Pond Offsite Det.: Existing Detention Pond

Inflow Area = 0.599 ac, 77.88% Impervious, Inflow Depth = 4.69" for 25-YR event
Inflow = 3.06 cfs @ 12.08 hrs, Volume= 0.234 af
Outflow = 2.09 cfs @ 12.17 hrs, Volume= 0.199 af, Atten= 32%, Lag= 5.1 min
Primary = 2.09 cfs @ 12.17 hrs, Volume= 0.199 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Peak Elev= 67.98' @ 12.17 hrs Surf.Area= 1,684 sf Storage= 2,945 cf

Plug-Flow detention time= 133.5 min calculated for 0.199 af (85% of inflow)
Center-of-Mass det. time= 69.0 min (842.6 - 773.6)

Volume	Invert	Avail.Storage	Storage Description
#1	65.00'	4,848 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
65.00	432	0	0
66.00	740	586	586
67.00	1,171	956	1,542
68.00	1,693	1,432	2,974
69.00	2,056	1,875	4,848

Device	Routing	Invert	Outlet Devices
#1	Primary	67.00'	**12.0" x 190.0' long Culvert** CPP, projecting, no headwall, Ke= 0.900 Outlet Invert= 66.05' S= 0.0050 '/' Cc= 0.900 n= 0.012

Primary OutFlow Max=2.08 cfs @ 12.17 hrs HW=67.98' TW=0.00' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 2.08 cfs @ 2.66 fps)

Time span=0.00-72.00 hrs, dt=0.02 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1: 1 Runoff Area=65,893 sf 0.00% Impervious Runoff Depth=4.53"
Flow Length=317' Slope=0.0030 '/' Tc=50.8 min CN=81 Runoff=3.47 cfs 0.571 af

Subcatchment 2: 2 Runoff Area=20,782 sf 63.82% Impervious Runoff Depth=5.42"
Flow Length=190' Tc=6.0 min CN=89 Runoff=2.88 cfs 0.215 af

Subcatchment 3: 3 Runoff Area=28,800 sf 86.94% Impervious Runoff Depth=6.34"
Tc=6.0 min CN=97 Runoff=4.32 cfs 0.349 af

Subcatchment 3A: 3A Runoff Area=21,816 sf 73.52% Impervious Runoff Depth=5.76"
Tc=6.0 min CN=92 Runoff=3.14 cfs 0.240 af

Subcatchment 3B: 3B Runoff Area=4,298 sf 100.00% Impervious Runoff Depth=6.46"
Tc=6.0 min CN=98 Runoff=0.65 cfs 0.053 af

Subcatchment 3C: 3C Runoff Area=16,113 sf 100.00% Impervious Runoff Depth=6.46"
Tc=6.0 min CN=98 Runoff=2.43 cfs 0.199 af

Subcatchment 4: 4 Runoff Area=43,696 sf 64.93% Impervious Runoff Depth=5.53"
Flow Length=455' Tc=6.0 min CN=90 Runoff=6.14 cfs 0.462 af

Reach CITY CB: CITY CB Inflow=2.40 cfs 0.215 af
Outflow=2.40 cfs 0.215 af

Reach POA 1: POA 1 Inflow=5.29 cfs 0.980 af
Outflow=5.29 cfs 0.980 af

Reach POA 2: POA 2 Inflow=8.23 cfs 1.022 af
Outflow=8.23 cfs 1.022 af

Reach Reach 1: Reach to POA 1 Avg. Depth=0.15' Max Vel=0.23 fps Inflow=2.56 cfs 0.410 af
n=0.150 L=138.0' S=0.0072 '/' Capacity=58.12 cfs Outflow=2.26 cfs 0.410 af

Pond 6P: Drip Strip Peak Elev=71.69' Storage=2,383 cf Inflow=4.32 cfs 0.349 af
6.0" x 51.0' Culvert Outflow=1.41 cfs 0.350 af

Pond 11P: Offsite 1 Inflow=0.65 cfs 0.053 af
Primary=0.65 cfs 0.053 af

Pond GW 1: GW 1 Peak Elev=69.36' Storage=1,805 cf Inflow=2.88 cfs 0.215 af
Outflow=2.40 cfs 0.215 af

Pond GW 2: GW 2 Peak Elev=70.09' Storage=8,586 cf Inflow=6.14 cfs 0.462 af
Primary=2.51 cfs 0.375 af Secondary=0.05 cfs 0.035 af Outflow=2.56 cfs 0.410 af

Pond Offsite Det.: Existing Detention Pond Peak Elev=68.17' Storage=3,273 cf Inflow=3.79 cfs 0.293 af
12.0" x 190.0' Culvert Outflow=2.45 cfs 0.258 af

Total Runoff Area = 4.623 ac Runoff Volume = 2.090 af Average Runoff Depth = 5.43"
48.80% Pervious = 2.256 ac 51.20% Impervious = 2.367 ac

Summary for Subcatchment 1: 1

Runoff = 3.47 cfs @ 12.69 hrs, Volume= 0.571 af, Depth= 4.53"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type III 24-hr 100-YR Rainfall=6.70"

	Area (sf)	CN	Description
	4,163	73	Woods, Fair, HSG C
	9,957	79	Woods, Fair, HSG D
	19,210	79	Pasture/grassland/range, Fair, HSG C
	27,709	84	Pasture/grassland/range, Fair, HSG D
	1,443	89	Gravel roads, HSG C
*	3,411	74	Proposed Landscape
	65,893	81	Weighted Average
	65,893		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
43.5	150	0.0030	0.06		**Sheet Flow, AB** Grass: Dense n= 0.240 P2= 3.00"
7.3	167	0.0030	0.38		**Shallow Concentrated Flow, BC** Short Grass Pasture Kv= 7.0 fps
50.8	317	Total			

Summary for Subcatchment 2: 2

Runoff = 2.88 cfs @ 12.08 hrs, Volume= 0.215 af, Depth= 5.42"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type III 24-hr 100-YR Rainfall=6.70"

	Area (sf)	CN	Description
*	13,263	98	Pavement
*	7,519	74	Proposed Landscape
	20,782	89	Weighted Average
	7,519		Pervious Area
	13,263		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	85	0.0222	1.34		**Sheet Flow, AB** Smooth surfaces n= 0.011 P2= 3.00"
1.1	105	0.0058	1.55		**Shallow Concentrated Flow, BC** Paved Kv= 20.3 fps
2.2	190	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 3: 3

Runoff = 4.32 cfs @ 12.08 hrs, Volume= 0.349 af, Depth= 6.34"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type III 24-hr 100-YR Rainfall=6.70"

	Area (sf)	CN	Description
*	25,040	98	Proposed Building
*	3,760	89	Gravel Drip Strip Area
	28,800	97	Weighted Average
	3,760		Pervious Area
	25,040		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 3A: 3A

Runoff = 3.14 cfs @ 12.08 hrs, Volume= 0.240 af, Depth= 5.76"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type III 24-hr 100-YR Rainfall=6.70"

	Area (sf)	CN	Description
*	3,377	74	Pervious Pond Area
*	725	74	Existing Land Scaped Area
*	16,040	98	Impervious Pavement
*	1,674	74	Proposed Landscape
	21,816	92	Weighted Average
	5,776		Pervious Area
	16,040		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 3B: 3B

Runoff = 0.65 cfs @ 12.08 hrs, Volume= 0.053 af, Depth= 6.46"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type III 24-hr 100-YR Rainfall=6.70"

	Area (sf)	CN	Description
*	4,298	98	Impervious
	4,298		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 3C: 3C

Runoff = 2.43 cfs @ 12.08 hrs, Volume= 0.199 af, Depth= 6.46"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type III 24-hr 100-YR Rainfall=6.70"

	Area (sf)	CN	Description
*	15,719	98	Impervious
*	394	98	New Impervious
	16,113	98	Weighted Average
	16,113		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 4: 4

Runoff = 6.14 cfs @ 12.08 hrs, Volume= 0.462 af, Depth= 5.53"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type III 24-hr 100-YR Rainfall=6.70"

	Area (sf)	CN	Description
*	27,691	98	New Pavement
*	15,326	74	Proposed Landscape
*	679	98	Existing Pavement
	43,696	90	Weighted Average
	15,326		Pervious Area
	28,370		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.0	135	0.0111	1.12		**Sheet Flow, AB** Smooth surfaces n= 0.011 P2= 3.00"
1.2	130	0.0077	1.78		**Shallow Concentrated Flow, BC** Paved Kv= 20.3 fps
2.6	190	0.0068	1.24		**Shallow Concentrated Flow, CD** Grassed Waterway Kv= 15.0 fps
5.8	455	Total, Increased to minimum Tc = 6.0 min			

Summary for Reach CITY CB: CITY CB

Inflow Area = 0.477 ac, 63.82% Impervious, Inflow Depth = 5.42" for 100-YR event
Inflow = 2.40 cfs @ 12.14 hrs, Volume= 0.215 af
Outflow = 2.40 cfs @ 12.14 hrs, Volume= 0.215 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs

Summary for Reach POA 1: POA 1

Inflow Area = 2.516 ac, 25.89% Impervious, Inflow Depth = 4.68" for 100-YR event
Inflow = 5.29 cfs @ 12.57 hrs, Volume= 0.980 af
Outflow = 5.29 cfs @ 12.57 hrs, Volume= 0.980 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs

Summary for Reach POA 2: POA 2

Inflow Area = 2.108 ac, 81.42% Impervious, Inflow Depth = 5.82" for 100-YR event
Inflow = 8.23 cfs @ 12.12 hrs, Volume= 1.022 af
Outflow = 8.23 cfs @ 12.12 hrs, Volume= 1.022 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs

Summary for Reach Reach 1: Reach to POA 1

Inflow Area = 1.003 ac, 64.93% Impervious, Inflow Depth = 4.90" for 100-YR event
Inflow = 2.56 cfs @ 12.29 hrs, Volume= 0.410 af
Outflow = 2.26 cfs @ 12.41 hrs, Volume= 0.410 af, Atten= 12%, Lag= 7.6 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Max. Velocity= 0.23 fps, Min. Travel Time= 9.8 min
Avg. Velocity = 0.06 fps, Avg. Travel Time= 36.4 min

Peak Storage= 1,332 cf @ 12.41 hrs, Average Depth at Peak Storage= 0.15'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 58.12 cfs

60.00' x 1.00' deep channel, n= 0.150 Very weedy reaches w/pools
Side Slope Z-value= 20.0 '/' Top Width= 100.00'
Length= 138.0' Slope= 0.0072 '/'
Inlet Invert= 69.00', Outlet Invert= 68.00'

‡

Summary for Pond 6P: Drip Strip

Inflow Area = 0.661 ac, 86.94% Impervious, Inflow Depth = 6.34" for 100-YR event
Inflow = 4.32 cfs @ 12.08 hrs, Volume= 0.349 af
Outflow = 1.41 cfs @ 12.37 hrs, Volume= 0.350 af, Atten= 67%, Lag= 17.1 min
Primary = 1.41 cfs @ 12.37 hrs, Volume= 0.350 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Peak Elev= 71.69' @ 12.37 hrs Surf.Area= 7,050 sf Storage= 2,383 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 7.7 min (757.8 - 750.1)

Volume	Invert	Avail.Storage	Storage Description
#1	70.50'	2,115 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc) 5,288 cf Overall x 40.0% Voids
#2	70.00'	705 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc) 1,763 cf Overall x 40.0% Voids
		2,820 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
70.50	3,525	0	0
72.00	3,525	5,288	5,288

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
70.00	3,525	0	0
70.50	3,525	1,763	1,763

Device	Routing	Invert	Outlet Devices
#1	Primary	67.17'	**6.0" x 51.0' long Culvert** CPP, projecting, no headwall, Ke= 0.900 Outlet Invert= 66.92' S= 0.0049 '/' Cc= 0.900 n= 0.012

Primary OutFlow Max=1.41 cfs @ 12.37 hrs HW=71.69' TW=0.00' (Dynamic Tailwater)
↳**1=Culvert** (Barrel Controls 1.41 cfs @ 7.18 fps)

Summary for Pond 11P: Offsite 1

Inflow Area = 0.099 ac,100.00% Impervious, Inflow Depth = 6.46" for 100-YR event
Inflow = 0.65 cfs @ 12.08 hrs, Volume= 0.053 af
Primary = 0.65 cfs @ 12.08 hrs, Volume= 0.053 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs

Summary for Pond GW 1: GW 1

Inflow Area = 0.477 ac, 63.82% Impervious, Inflow Depth = 5.42" for 100-YR event
Inflow = 2.88 cfs @ 12.08 hrs, Volume= 0.215 af
Outflow = 2.40 cfs @ 12.14 hrs, Volume= 0.215 af, Atten= 17%, Lag= 3.2 min
Primary = 2.40 cfs @ 12.14 hrs, Volume= 0.215 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Peak Elev= 69.36' @ 12.14 hrs Surf.Area= 2,625 sf Storage= 1,805 cf

Plug-Flow detention time= 146.2 min calculated for 0.215 af (100% of inflow)
Center-of-Mass det. time= 146.4 min (931.0 - 784.6)

Volume	Invert	Avail.Storage	Storage Description
#1	68.50'	3,446 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
68.50	1,727	0	0
69.00	2,123	963	963
69.90	3,396	2,484	3,446

Device	Routing	Invert	Outlet Devices
#1	Device 3	65.83'	**6.0" x 18.0' long 6" UD** CPP, projecting, no headwall, Ke= 0.900 Outlet Invert= 65.83' S= 0.0000 '/' Cc= 0.900 n= 0.012
#2	Device 1	65.83'	**0.9" Vert. Water Quality Orifice Control** C= 0.600
#3	Primary	68.17'	**12.0" x 140.0' long Culvert** CPP, projecting, no headwall, Ke= 0.900 Outlet Invert= 65.00' S= 0.0226 '/' Cc= 0.900 n= 0.012
#4	Device 3	69.00'	**4.0' long x 0.7' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 Coef. (English) 2.76 2.82 2.93 3.09 3.18 3.22 3.27 3.30 3.32 3.31 3.32

Primary OutFlow Max=2.40 cfs @ 12.14 hrs HW=69.35' TW=0.00' (Dynamic Tailwater)
- **3=Culvert** (Passes 2.40 cfs of 2.47 cfs potential flow)
  - **1=6" UD** (Passes 0.02 cfs of 0.81 cfs potential flow)
    - **2=Water Quality Orifice Control** (Orifice Controls 0.02 cfs @ 5.24 fps)
  - **4=Broad-Crested Rectangular Weir** (Weir Controls 2.37 cfs @ 1.67 fps)

Summary for Pond GW 2: GW 2

Inflow Area = 1.003 ac, 64.93% Impervious, Inflow Depth = 5.53" for 100-YR event
Inflow = 6.14 cfs @ 12.08 hrs, Volume= 0.462 af
Outflow = 2.56 cfs @ 12.29 hrs, Volume= 0.410 af, Atten= 58%, Lag= 12.1 min
Primary = 2.51 cfs @ 12.29 hrs, Volume= 0.375 af
Secondary = 0.05 cfs @ 12.23 hrs, Volume= 0.035 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs

Peak Elev= 70.09' @ 12.29 hrs Surf.Area= 6,417 sf Storage= 8,586 cf

Plug-Flow detention time= 172.0 min calculated for 0.410 af (89% of inflow)
Center-of-Mass det. time= 118.5 min (899.8 - 781.2)

Volume	Invert	Avail.Storage	Storage Description
#1	68.50'	13,861 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
#2	69.00'	255 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
		14,115 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
68.50	4,191	0	0
69.00	4,954	2,286	2,286
70.00	6,065	5,510	7,796
71.00	6,065	6,065	13,861

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
69.00	214	0	0
69.90	352	255	255

Device	Routing	Invert	Outlet Devices
#1	Secondary	68.17'	**6.0" x 20.0' long Culvert** CPP, projecting, no headwall, Ke= 0.900 Outlet Invert= 68.09' S= 0.0040 '/' Cc= 0.900 n= 0.012
#2	Device 1	65.83'	**1.4" Vert. Orifice/Grate** C= 0.600
#3	Primary	69.00'	**0.5' long x 0.7' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 Coef. (English) 2.76 2.82 2.93 3.09 3.18 3.22 3.27 3.30 3.32 3.31 3.32
#4	Primary	70.00'	**10.0' long x 0.7' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 Coef. (English) 2.76 2.82 2.93 3.09 3.18 3.22 3.27 3.30 3.32 3.31 3.32

Primary OutFlow Max=2.50 cfs @ 12.29 hrs HW=70.09' TW=69.14' (Dynamic Tailwater)
- **3=Broad-Crested Rectangular Weir** (Weir Controls 1.78 cfs @ 3.28 fps)
- **4=Broad-Crested Rectangular Weir** (Weir Controls 0.72 cfs @ 0.82 fps)

Secondary OutFlow Max=0.05 cfs @ 12.23 hrs HW=70.08' TW=69.12' (Dynamic Tailwater)
- **1=Culvert** (Passes 0.05 cfs of 0.73 cfs potential flow)
  - **2=Orifice/Grate** (Orifice Controls 0.05 cfs @ 4.72 fps)

Summary for Pond Offsite Det.: Existing Detention Pond

Inflow Area = 0.599 ac, 77.88% Impervious, Inflow Depth = 5.87" for 100-YR event
Inflow = 3.79 cfs @ 12.08 hrs, Volume= 0.293 af
Outflow = 2.45 cfs @ 12.18 hrs, Volume= 0.258 af, Atten= 35%, Lag= 5.6 min
Primary = 2.45 cfs @ 12.18 hrs, Volume= 0.258 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Peak Elev= 68.17' @ 12.18 hrs Surf.Area= 1,756 sf Storage= 3,273 cf

Plug-Flow detention time= 118.5 min calculated for 0.258 af (88% of inflow)
Center-of-Mass det. time= 62.5 min (831.0 - 768.5)

Volume	Invert	Avail.Storage	Storage Description
#1	65.00'	4,848 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
65.00	432	0	0
66.00	740	586	586
67.00	1,171	956	1,542
68.00	1,693	1,432	2,974
69.00	2,056	1,875	4,848

Device	Routing	Invert	Outlet Devices
#1	Primary	67.00'	**12.0" x 190.0' long Culvert** CPP, projecting, no headwall, Ke= 0.900 Outlet Invert= 66.05' S= 0.0050 '/' Cc= 0.900 n= 0.012

Primary OutFlow Max=2.45 cfs @ 12.18 hrs HW=68.17' TW=0.00' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 2.45 cfs @ 3.12 fps)

APPENDIX D

WATER QUALITY SUMMARY CHART AND COMPUTATIONS

Water Quality Calculations

Area	Treatment Approach	Total Developed Area	Total Treated Developed Area	Total New Impervious Area	Total Treated New Impervious Area
SUB CATCHMENT 1	NONE	3,411	0	0	0
SUB CATCHMENT 2	Gravel Wetland 1	20,782	20,782	13,263	13,263
SUB CATCHMENT 3	Gravel Drip Strip	28,800	28,800	28,800	28,800
SUB CATCHMENT 4	Gravel Wetland 2	43,017	43,017	27,691	27,691
Utreated flow to adjacent Site	NONE	2,068	0	394	0
Totals		**98,078**	**92,599**	**70,148**	**69,754**

Developed Area Treated %	94.41%
Impervious Area Treated %	99.44%

APPENDIX E

ORIFICE DRAWDOWN COMPUTATIONS

ORIFICE DIAMETER FOR GRAVEL WET LAND 1

Elevation	Surface Area (sq.ft)	Area End (sq.ft)	Area End Depth (ft)	Volume (c.f)	Head (ft)	Orifice Flow (cfs)	Drawdown Time (secs)	Drawdown Time (hours)
69.00	2,123.00	1925.00	0.50	962.50	0.83	0.0216	44593.17	12.387
68.50	1,727.00	1727.00	0.33	569.91	0.33	0.0136	41875.11	11.632
68.17	1,727.00	0.00	0.00	0.00	0.00	0.0000	0.00	0.000
							TOTAL	***24.019***

$CA\ (2gh)^{1/2}$

Orifice Diameter	0.95	inch
Area	0.0049	sq.ft
g	32.174	ft/s^2
C	0.6	Orifice/Grate

ORIFICE DIAMETER FOR GRAVEL WETLAND 2

Depth (ft)	Surface Area (sq.ft)	Area End (sq.ft)	Area End Depth (ft)	Volume (c.f)	Head (ft)	Orifice Flow (cfs)	Drawdown Time (secs)	Drawdown Time (hours)
69.00	4,954.00	4572.50	0.50	2286.25	0.83	0.0469	48773.33	13.548
68.50	4,191.00	4191.00	0.33	1383.03	0.33	0.0296	46792.08	12.998
68.17	4,191.00	0.00	0.00	0.00	0.00	0.0000	0.00	0.000
							TOTAL	***26.546***

$CA\ (2gh)^{1/2}$

Orifice Diameter	1.4	inch
Area	0.0107	sq.ft
g	32.174	ft/s^2
C	0.6	Orifice/Grate

APPENDIX F

GEOTECHNICAL EXPLORATION TEST PIT LOGS

REPORT

December 27, 2013
13-1392 S

Geotechnical Engineering Services

Proposed Pre-Engineered Building
424 Warren Avenue
Portland, Maine

PREPARED FOR:
Peter F. Holmes
c/o Harbour Auto Body
401 Warren Avenue
Portland, Maine 04103

PREPARED BY:
S. W. Cole Engineering, Inc.
286 Portland Road
Gray, Maine 04039
207-657-2866

S.W.COLE ENGINEERING, INC.

- *Geotechnical Engineering*
- *Construction Materials Testing*
- *GeoEnvironmental Services*
- *Ecological Services*

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December 27, 2013

Peter F. Holmes
c/o Harbour Auto Body
401 Warren Avenue
Portland, Maine 04103

Subject: Geotechnical Engineering Services
Proposed Pre-Engineered Building
424 Warren Avenue
Portland, Maine

Dear Peter:

In accordance with our Proposal dated December 12, 2013, we have performed subsurface explorations for the subject project in Portland, Maine. This report presents our findings and geotechnical recommendations and its contents are subject to the limitations set forth in Attachment A.

1.0 INTRODUCTION

1.1 Scope and Purpose

The purpose of our work was to obtain subsurface information at the site in order to develop geotechnical recommendations relative to foundations and earthwork associated with the proposed construction. Our scope of work included the making of thirteen test pit explorations, a geotechnical analysis of the subsurface findings and preparation of this report.

1.2 Proposed Construction

Based on the information provided by FST, Inc. (project civil engineer), we understand development plans call for construction of a new L-Shaped, pre-engineered steel building with associated paved and stormwater management areas. We understand the building will occupy a plan area of about 38,500 SF and is proposed at a finished floor

elevation of 72.0 feet, requiring about 1 to 3 feet of tapered fill over the building pad. Proposed and existing site features are shown on the "Exploration Location Plan" attached as Sheet 1.

2.0 EXPLORATION AND TESTING

2.1 Explorations

Thirteen test pits (TP-101 through TP-109 and TP-ST-1 through TP-ST-4) were made at the site on December 20, 2013, by Eastern Excavation, Inc. of Westbrook, Maine working under subcontract to S. W. Cole Engineering, Inc. (S.W.COLE). The exploration locations were selected and established by S.W.COLE using taped measurements from existing site features.

The approximate exploration locations are shown on the "Exploration Location Plan" attached as Sheet 1. Logs of the explorations are attached as Sheets 2 through 8. A key to the notes and symbols used on the log is attached as Sheet 9. The ground surface elevations shown on the logs were estimated based on topographic information shown on Sheet 1.

2.2 Testing

The soils were visually classified as they were encountered at the explorations. Pocket Penetrometer Tests (PPT) were performed on some cohesive soils encountered at the test pits. PPT results are shown on the test pit logs.

3.0 SITE AND SUBSURFACE CONDITIONS

3.1 Surficial Conditions

The site is located at 424 Warren Avenue in Portland, Maine. The site consists of an open gravel lot adjacent to Warren Avenue transitioning to a lightly wooded area and open grassed field area to the north and to the rear of the existing Harbour Auto Body Facility. The site is relatively flat and level with existing grades varying from about elevation 68 to 70 feet within the proposed building footprint.

Existing site features are shown on the "Exploration Location Plan" attached as Sheet 1.

3.2 Subsurface Conditions

Underlying a surficial layer of topsoil, the test pits encountered a soils profile generally consisting of fill and/or reworked soils overlying a layer of relic topsoil overlying glaciomarine sands, silts, and clays. The principal strata encountered are summarized below. Refer to the attached logs for more detailed descriptions of the subsurface findings.

Fill and Reworked Soils: Each test pit encountered a layer of fill and/or reworked soils extending to depths varying from 0.8 to 3.2 feet below ground surface. The fill generally consisted of sand or clay with varying portions of silt, gravel, cobbles, organics and miscellaneous debris such as bricks and plastic. The reworked soils generally consisted of disturbed silt and clay with varying portions of sand and organics.

Relic Topsoil: Underlying the fill and/or reworked soils, test pits TP-105 through TP-109 encountered a layer of relic topsoil up to about 1 foot in thickness. The relic topsoil generally consisted of dark brown silty sand with organics. A layer of reworked, disturbed silty sandy clay was encountered below the relic topsoil at test pit TP-105 to a depth of about 3.5 feet.

Glaciomarine Soils: Underlying the fill, reworked soils, and/or relic topsoil, the test pits encountered glaciomarine soils generally consisted of brown to gray-brown sands, silts, and relatively stiff silty clays. The test pits were terminated in the glaciomarine soils at depths varying from 4.0 to 6.2 feet below the ground surface.

3.3 Groundwater Conditions

The soils encountered at the explorations were generally moist to wet. Groundwater seepage was encountered at some of the explorations at depths varying from 3.1 to 5.5 feet. Groundwater likely becomes perched on the relatively impervious glaciomarine silts and clays encountered beneath the site. It should be anticipated that seasonal groundwater levels will fluctuate, especially during periods of snowmelt and precipitation.

3.4 Seismic and Frost Conditions

The 25-year Air Freezing Index for the Portland, Maine area is about 1,250-Fahrenheit degree-days, which corresponds to a frost penetration depth on the order of 4.5 feet.

Based on the findings at the explorations and our experience on adjacent sites, we interpret the site soils to correspond to Seismic Soil Site Class E according to 2009 IBC.

4.0 EVALUATION AND RECOMMENDATIONS

4.1 General Findings

Based on the subsurface findings, the proposed construction appears feasible from a geotechnical standpoint. The principle geotechnical considerations are:

- The existing fill, relic topsoil, and reworked/disturbed soils must be completely removed beneath the proposed building footprint and replaced with compacted Granular Borrow.

- Spread footing foundations and on-grade floor slabs bearing on properly prepared subgrades appear appropriate for the proposed construction.

- A 6-inch thick layer of crushed stone wrapped in geotextile fabric is recommended beneath the perimeter building foundations. Interior footings may bear on compacted Granular Borrow or stable, native non-organic soils.

- Perimeter foundation underdrains should be provided for the proposed building.

- Imported Granular Borrow, Structural Fill and Crushed Stone will be needed for construction. The existing fills and native soils are unsuitable for reuse below the proposed building or as backfill for foundations.

4.2 Site and Subgrade Preparation

We recommend that site preparation begin with the construction of an erosion control system to protect adjacent drainage ways and areas outside the construction limits. As much vegetation as possible should remain outside the construction areas to lessen the potential for erosion and site disturbance.

All organics, existing fills, relic topsoil, and reworked/disturbed soils must be completely removed from beneath the proposed building and entrance slabs until undisturbed native non-organic soils are encountered. Overexcavation of existing unsuitable materials should

extend 1-foot horizontally outward from outer edge of perimeter footings for each foot of excavation depth (1H:1V bearing splay). Overexcavations should be backfilled to grade with properly compacted Structural Fill (over wet subgrades and during wet/cold weather conditions) or with properly compacted Granular Borrow (over dry subgrades and during non-freezing, dry conditions).

At least 6-inches of Crushed Stone wrapped in non-woven geotextile, such as Mirafi 160N or equivalent, should be provided below perimeter foundations. The crushed stone and geotextile should overlay undisturbed native glaciomarine soils and/or properly compacted Structural Fill or Granular Borrow overlying undisturbed native glaciomarine soils.

We recommend that excavations be completed with a smooth-edged bucket to help lessen disturbance of native soils and foundation bearing surfaces. S.W.COLE should observe exposed subgrades prior to placement of compacted fills and geotextile wrapped crushed stone mats below the footings.

4.3 Excavation and Dewatering

Excavation work will generally encounter existing fills, relic topsoil, reworked native soils and native glaciomarine sands, silts, and clays. Care must be exercised during construction to minimize disturbance of the bearing soils. Final cuts to subgrade elevation should be performed with a smooth-edged bucket to help minimize soil disturbance.

Sumping and pumping dewatering techniques should be adequate to control groundwater in excavations. The layer of geotextile wrapped Crushed Stone recommended below foundations will provide a media from which to sump and pump, as needed. Controlling the water levels to below planned excavation depths will help stabilize subgrades during construction.

Excavations must be properly shored and/or sloped in accordance with OSHA Regulations to prevent sloughing and caving of the sidewalls during construction. The contractor is ultimately responsible for dewatering and stability of excavations.

4.4 Foundations

We recommend the proposed building be supported on spread footings bearing on properly prepared subgrades. We recommend the following geotechnical parameters for design consideration:

- Design Frost Depth = 4.5 feet
- Allowable Soil Bearing Pressure = 1.5 ksf or less
- Seismic Site Soil Class = E (IBC 2009)
- Base Friction Factor = 0.40
- Lateral Earth Pressure = 65 pcf (equivalent fluid pressure)
- Unit Weight of Backfill = 130 pcf (compacted Structural Fill)
- At-Rest Lateral Earth Pressure Coefficient = 0.5 (compacted Structural Fill)
- Internal Friction Angle of Backfill = 30° (compacted Structural Fill)

Footings should be at least 18-inches in width regardless of bearing pressure.

4.5 Foundation Drainage

We recommend an underdrain system be installed along the exterior side of the perimeter foundations. The underdrain system should consist of a 4-inch diameter, perforated SDR-35 foundation drain pipe surrounded by at least 6-inches of Crushed Stone, fully enveloped in non-woven geotextile, such as Mirafi 160N or equivalent. The underdrain pipe must be connected to a positive gravity outlet protected from freezing, clogging and backflow. Surface grades should be sloped away from the building for positive drainage. General underdrain details are illustrated on Sheet 10.

If a drip strip is used, S.W.COLE should be consulted to provide recommendations for frost protection.

4.6 Slab-On-Grade

On-grade floor slabs in heated areas may be designed using a subgrade reaction modulus of 120 pci (pounds per cubic inch) provided the slab is underlain by at least 12-inches of compacted Structural Fill overlying properly prepared subgrades. The structural engineer or concrete consultant must design steel reinforcing and joint spacing appropriate to slab thickness and function.

We recommend a sub-slab vapor retarder particularly in areas of the building where the concrete slab will be covered with an impermeable surface treatment or floor covering that may be sensitive to moisture vapors. The vapor retarder must have a permeance that is less than the floor cover or surface treatment that is applied to the slab. The vapor retarder must have sufficient durability to withstand direct contact with the sub-slab base material and construction activity. The vapor retarder material shall be placed according to the manufacturer's recommended method, including the taping and lapping of all joints and wall connections. The architect and/or flooring consultant should select the vapor retarder products compatible with flooring and adhesive materials.

The floor slab should be appropriately cured using moisture retention methods after casting. Typical floor slab curing methods should be used for at least 7 days. The architect or flooring consultant should assign curing methods consistent with current applicable American Concrete Institute (ACI) procedures with consideration of curing method compatibility to proposed surface treatments, flooring and adhesive materials.

4.7 Entrance Slabs

Entrance slabs adjacent to buildings must be designed to reduce the effects of differential frost action between adjacent pavement, doorways, and sidewalks. We recommend that clean, non-frost susceptible sand and gravel meeting the requirements of Structural Fill be provided to a depth of at least 4.5 feet below the top of entrance slabs. This thickness of Structural Fill should extend the full width of the entrance slabs and outward at least 4.5 feet, thereafter transitioning up to the bottom of the adjacent sidewalk or pavement subbase gravel at a 3H:1V or flatter slope. General details of this frost transition zone are illustrated on Sheet 10.

4.8 Backfill and Compaction

We recommend the following fill and backfill materials for use during construction:

Granular Borrow: Sand or silty sand meeting the requirements of MDOT Standard Specification 703.19 Granular Borrow. Granular Borrow is recommended for use as:

- Fill to raise site grades and backfill overexcavations (dry and non-freezing conditions and over dry subgrades)

Structural Fill: Clean, non-frost susceptible sand and gravel meeting the gradation requirements for Structural Fill as given below.

Structural Fill	
Sieve Size	**Percent Finer by Weight**
4 inch	100
3 inch	90 to 100
¼ inch	25 to 90
#40	0 to 30
#200	0 to 5

Structural Fill is recommended for use as:

- Fill to raise site grades and backfill overexcavations (wet and cold weather conditions and over wet subgrades)
- Backfill for building foundations and below entrance slabs
- Slab-on-grade base material

Crushed Stone: Crushed Stone used below footings and around underdrains should consist of crushed rock meeting the gradation requirements of MDOT Standard Specifications 703.22 “Underdrain Backfill Type C”.

Placement and Compaction: Fill should be placed in horizontal lifts and compacted such that the desired density is achieved throughout the lift thickness with 3 to 5 passes of the compaction equipment. Loose lift thicknesses for grading, fill and backfill activities should not exceed 12 inches. We recommend that fill and backfill in building areas be compacted to at least 95 percent of its maximum dry density as determined by ASTM D-1557. Crushed Stone should be compacted in loose lifts not exceeding 12-inches with 2 to 3 passes of a vibratory plate compactor with a static weight of at least 600 lbs.

4.9 Weather Considerations

Construction activity should be limited during wet weather and the site soils may require drying before construction activities may continue. The contractor should anticipate the need for water to temper fills in order to facilitate compaction during dry weather. If construction takes place during cold weather, subgrades, foundations and floor slabs must be protected during freezing conditions. Concrete and fill must not be placed on frozen

soil; and once placed, the concrete and soil beneath the structure must be protected from freezing.

4.10 Design Review and Construction Testing

S.W.COLE should be retained to review the foundation and earthwork construction documents to determine that our geotechnical recommendations have been properly interpreted and implemented.

A soils and concrete testing program should also be implemented during construction to observe compliance with the design concepts, plans, and specifications. S.W.COLE is available to provide earthwork observations as well as testing services for soils, concrete, asphalt, steel and spray-applied fireproofing construction materials.

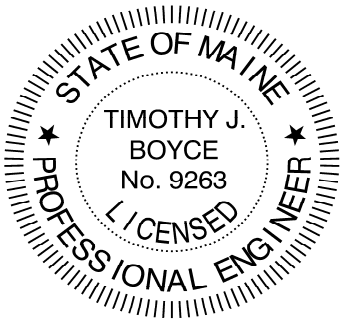
5.0 CLOSURE

It has been a pleasure to be of assistance to you with this phase of your project. We look forward to working with you during the construction phase of the project.

Sincerely,

S. W. Cole Engineering, Inc.

Evan M. Walker, P.E.
Geotechnical Engineer



Timothy J. Boyce, P.E.
Senior Geotechnical Engineer

EMW:tjb

Attachment A
Limitations

This report has been prepared for the exclusive use of Peter F. Holmes for specific application to the proposed Pre-Engineered Building at 424 Warren Avenue in Portland, Maine. S. W. Cole Engineering, Inc. (S.W.COLE) has endeavored to conduct the work in accordance with generally accepted soil and foundation engineering practices. No warranty, expressed or implied, is made.

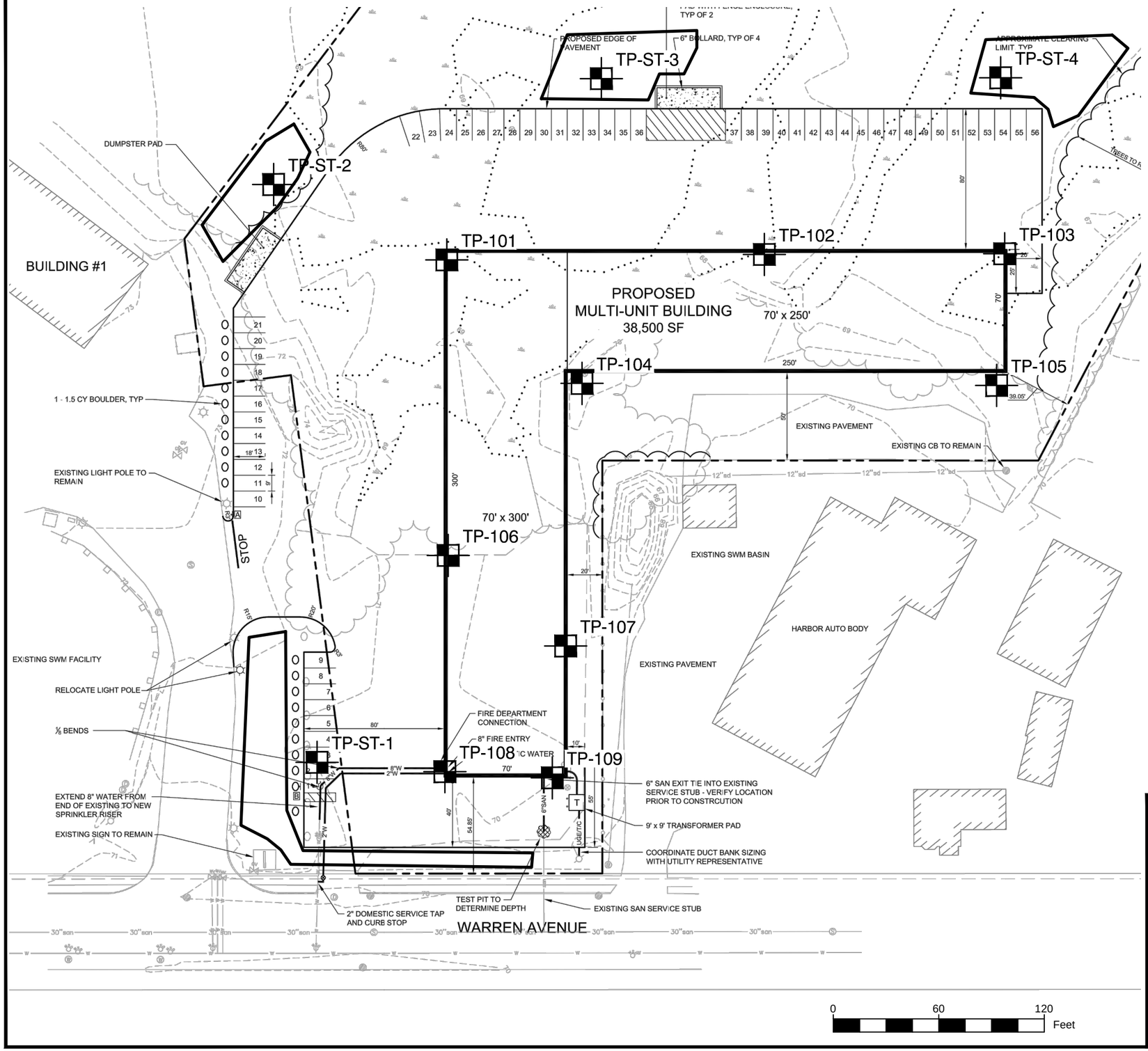
The soil profiles described in the report are intended to convey general trends in subsurface conditions. The boundaries between strata are approximate and are based upon interpretation of exploration data and samples.

The analyses performed during this investigation and recommendations presented in this report are based in part upon the data obtained from subsurface explorations made at the site. Variations in subsurface conditions may occur between explorations and may not become evident until construction. If variations in subsurface conditions become evident after submission of this report, it will be necessary to evaluate their nature and to review the recommendations of this report.

Observations have been made during exploration work to assess site groundwater levels. Fluctuations in water levels will occur due to variations in rainfall, temperature, and other factors.

S.W.COLE's scope of work has not included the investigation, detection, or prevention of any Biological Pollutants at the project site or in any existing or proposed structure at the site. The term "Biological Pollutants" includes, but is not limited to, molds, fungi, spores, bacteria, and viruses, and the byproducts of any such biological organisms.

Recommendations contained in this report are based substantially upon information provided by others regarding the proposed project. In the event that any changes are made in the design, nature, or location of the proposed project, S.W.COLE should review such changes as they relate to analyses associated with this report. Recommendations contained in this report shall not be considered valid unless the changes are reviewed by S.W.COLE.



LEGEND:

APPROXIMATE TEST PIT LOCATION

NOTES:

1. EXPLORATION LOCATION PLAN WAS PREPARED FROM A 1"=30' SCALE PLAN OF THE SITE ENTITLED "SITE LAYOUT AND UTILITY PLAN," PREPARED BY FAY, SPOFFORD & THORNDIKE, INC., DATED NOVEMBER 2013.
2. THE TEST PITS WERE LOCATED IN THE FIELD BY TAPED MEASUREMENTS FROM EXISTING SITE FEATURES.
3. THIS PLAN SHOULD BE USED IN CONJUNCTION WITH THE ASSOCIATED S.W. COLE ENGINEERING, INC. GEOTECHNICAL REPORT.
4. THE PURPOSE OF THIS PLAN IS ONLY TO DEPICT THE LOCATION OF THE EXPLORATIONS IN RELATION TO THE EXISTING CONDITIONS AND PROPOSED CONSTRUCTION AND IS NOT TO BE USED FOR CONSTRUCTION.

S.W.COLE ENGINEERING, INC.

PETER F. HOLMES

EXPLORATION LOCATION PLAN

PROPOSED PRE-ENGINEERED BUILDING
424 WARREN AVENUE
PORTLAND, MAINE

Job No.:	13-1392	Scale:	1" =60'
Date :	12/24/2013	Sheet:	1

R:\2013\13-1392\CAD\Drawings\13-1392 Sheet 1 ELP.dwg, 12/27/2013 2:09:37 PM, 1:1, TJH, S.W. Cole Engineering, Inc.

S.W.COLE ENGINEERING, INC.

TEST PIT LOGS

PROJECT / CLIENT: PROPOSED PRE-ENGINEERED BUILDING / PETER F. HOLMES
LOCATION: 424 WARREN AVENUE, PORTLAND, MAINE
EXCAVATOR: EASTERN EXCAVATION, INC. / KOMATSU PC 50 MR

SWC REP.: EMW
PROJECT NO. 13-0912

TEST PIT TP-101

DATE: 12/20/13 SURFACE ELEVATION: 69' +/- LOCATION: SEE SHEET 1

SAMPLE NO.	SAMPLE DEPTH	DEPTH (FT)	STRATUM DESCRIPTION	TEST RESULTS
		0.5	VEGETATION / BROWN CLAYEY SILTY SAND WITH ORGANICS (TOPSOIL)	
		1.5	REWORKED DARK GRAY AND BROWN SILTY SAND CLAYEY WITH ORGANICS (FILL / DISTURBED SOILS)	
		5.5	BROWN SILTY FINE SAND WITH SILT SEAMS	

COMPLETION DEPTH: 5.5' DEPTH TO WATER: SEEPAGE/CAVING @ 4.6'

TEST PIT TP-102

DATE: 12/20/13 SURFACE ELEVATION: 68' +/- LOCATION: SEE SHEET 1

SAMPLE NO.	SAMPLE DEPTH	DEPTH (FT)	STRATUM DESCRIPTION	TEST RESULTS
		0.2	VEGETATION / DARK BROWN CLAYEY SILTY SAND WITH ORGANICS (TOPSOIL)	
		0.8	DARK GRAY-BROWN AND BLACK SANDY SILTY CLAY WITH BRICK, ORGANICS (FILL)	
		3.6	GRAY-BROWN WITH RUST-BROWN STAINING SILTY FINE SAND WITH SILT LAYERS	
		5.3	BROWN SILTY CLAY WITH SAND SEAMS ~ VERY STIFF ~	@ 4' : q_p = 7 KSF

COMPLETION DEPTH: 5.3' DEPTH TO WATER: SEEPAGE @ 3.9', SOILS MOIST ABOVE 3.9'

S.W.COLE ENGINEERING, INC.

TEST PIT LOGS

PROJECT / CLIENT: PROPOSED PRE-ENGINEERED BUILDING / PETER F. HOLMES
LOCATION: 424 WARREN AVENUE, PORTLAND, MAINE
EXCAVATOR: EASTERN EXCAVATION, INC. / KOMATSU PC 50 MR

SWC REP.: EMW
PROJECT NO. 13-0912

TEST PIT TP-103

DATE: 12/20/13 SURFACE ELEVATION: 68' +/- LOCATION: SEE SHEET 1

SAMPLE NO.	SAMPLE DEPTH	DEPTH (FT)	STRATUM DESCRIPTION	TEST RESULTS
		0.3	VEGETATION / BROWN CLAYEY SILTY SAND WITH ORGANICS (TOPSOIL)	
		2.0	REWORKED BROWN SILTY CLAY WITH SAND SEAMS WITH ORGANICS (FILL / DISTURBED SOILS)	
		4.8'	LAYERED BROWN SILTY FINE SAND, CLAYEY SILT AND SILTY CLAY	

COMPLETION DEPTH: 4.8' DEPTH TO WATER: SEEPAGE @ 3.1'

TEST PIT TP-104

DATE: 12/20/13 SURFACE ELEVATION: 70' +/- LOCATION: SEE SHEET 1

SAMPLE NO.	SAMPLE DEPTH	DEPTH (FT)	STRATUM DESCRIPTION	TEST RESULTS
		2.0	DARK BROWN SILTY SAND WITH COBBLES, ORGANICS, BRICKS, PLASTIC DEBRIS (FILL)	
		2.5	ORANGE-BROWN SILTY FINE SAND	
		6.0	LAYERED GRAY-BROWN SILTY CLAY WITH SILTY FINE SAND LAYERS	

COMPLETION DEPTH: 6.0' DEPTH TO WATER: SEEPAGE @ 5.5'. SOILS MOIST ABOVE 5.5'

S.W.COLE ENGINEERING, INC.

TEST PIT LOGS

PROJECT / CLIENT: PROPOSED PRE-ENGINEERED BUILDING / PETER F. HOLMES
LOCATION: 424 WARREN AVENUE, PORTLAND, MAINE
EXCAVATOR: EASTERN EXCAVATION, INC. / KOMATSU PC 50 MR

SWC REP.: EMW
PROJECT NO. 13-0912

TEST PIT TP-105

DATE: 12/20/13 SURFACE ELEVATION: 69' +/- LOCATION: SEE SHEET 1

SAMPLE NO.	SAMPLE DEPTH	DEPTH (FT)	STRATUM DESCRIPTION	TEST RESULTS
		0.3	VEGETATION / BROWN SILTY SAND WITH ORGANICS (TOPSOIL)	@ 4' : q_p = 6 KSF
		1.1	YELLOW-BROWN SILTY SAND TRACE ORGANICS (FILL)	
		2.1	DARK BROWN SILTY SAND WITH ORGANICS (RELIC TOPSOIL)	
		3.5	REWORKED GRAY-BROWN WITH RUST-BROWN STAINING SILTY SANDY CLAY (DISTURBED SOILS)	
		6.2'	LAYERED BROWN SILTY FINE SAND, SILTY CLAY, AND CLAYEY SILT	

COMPLETION DEPTH: 6.2' DEPTH TO WATER: SEEPAGE @ 5.5', SOILS MOIST ABOVE 5.5'

TEST PIT TP-106

DATE: 12/20/13 SURFACE ELEVATION: 70' +/- LOCATION: SEE SHEET 1

SAMPLE NO.	SAMPLE DEPTH	DEPTH (FT)	STRATUM DESCRIPTION	TEST RESULTS
		2.0	DARK GRAY-BROWN SILTY SAND SOME GRAVEL WITH COBBLES, ORGANICS, BRICK (FILL)	
		3.2	BROWN SAND SOME SILT, SOME GRAVEL (FILL)	
		3.6	DARK BROWN AND BLACK SILTY SAND WITH ORGANICS (RELIC TOPSOIL)	
		5.6	GRAY WITH BROWN MOTTLING CLAYEY SILT AND FINE SAND WITH SAND LAYERS	

COMPLETION DEPTH: 5.6' DEPTH TO WATER: ALL SOILS MOIST

S.W.COLE ENGINEERING, INC.

TEST PIT LOGS

PROJECT / CLIENT: PROPOSED PRE-ENGINEERED BUILDING / PETER F. HOLMES
LOCATION: 424 WARREN AVENUE, PORTLAND, MAINE
EXCAVATOR: EASTERN EXCAVATION, INC. / KOMATSU PC 50 MR

SWC REP.: EMW
PROJECT NO. 13-0912

TEST PIT TP-107

DATE: 12/20/13 SURFACE ELEVATION: 69' +/- LOCATION: SEE SHEET 1

SAMPLE NO.	SAMPLE DEPTH	DEPTH (FT)	STRATUM DESCRIPTION	TEST RESULTS
			BROWN GRAVELLY SAND SOME SILT WITH COBBLES ORGANICS IN UPPER 6" +/-	
		1.5	(FILL)	
		2.0	DARK BROWN SILTY SAND WITH ORGANICS (RELIC TOPSOIL)	
		5.0	LAYERED GRAY-BROWN SILTY SAND AND SILTY CLAY	

COMPLETION DEPTH: 5 DEPTH TO WATER: ALL SOILS MOIST TO WET

TEST PIT TP-108

DATE: 12/20/13 SURFACE ELEVATION: 70' +/- LOCATION: SEE SHEET 1

SAMPLE NO.	SAMPLE DEPTH	DEPTH (FT)	STRATUM DESCRIPTION	TEST RESULTS
			BROWN GRAVELLY SAND SOME SILT WITH COBBLES (FILL)	
		0.6		
		1.4	DARK BROWN AND BLACK SILTY SAND WITH ORGANICS (RELIC TOPSOIL)	
		1.7	ORANGE-BROWN SILTY SAND	
		3.5	LIGHT GRAY-BROWN SILTY SAND	
		6.0	GRAY-BROWN CLAYEY SANDY SILT WITH SAND LAYERS	@ 4.5' : q_p = 7 KSF

COMPLETION DEPTH: 6.0' DEPTH TO WATER: ALL SOILS MOIST

S.W.COLE ENGINEERING, INC.

TEST PIT LOGS

PROJECT / CLIENT: PROPOSED PRE-ENGINEERED BUILDING / PETER F. HOLMES
LOCATION: 424 WARREN AVENUE, PORTLAND, MAINE
EXCAVATOR: EASTERN EXCAVATION, INC. / KOMATSU PC 50 MR

SWC REP.: EMW
PROJECT NO. 13-0912

TEST PIT TP-109

DATE: 12/20/13 SURFACE ELEVATION: 70' +/- LOCATION: SEE SHEET 1

SAMPLE NO.	SAMPLE DEPTH	DEPTH (FT)	STRATUM DESCRIPTION	TEST RESULTS
			BROWN SILTY GRAVELLY SAND WITH COBBLES (FILL)	
		1.9		
		2.1	DARK BROWN SILTY SAND WITH ORGANICS (TOPSOIL)	
			GRAY SILTY FINE SAND WITH SILT AND SILTY CLAY SEAMS TRACE ROOTLETS	
		4.0		
			GRAY-BROWN WITH RUST-BROWN MOTTLING SILTY SANDY CLAY	
		6.2		

COMPLETION DEPTH: 6.2' DEPTH TO WATER: ALL SOILS MOIST

Town, City, Plantation	Street, Road Subdivision	Owner's Name
PORTLAND	WARREN AVENUE	PETER HOLMES

SOIL DESCRIPTION AND CLASSIFICATION (Location of Observation Holes Shown Above)

Observation Hole TP ST-1 ■ Test Pit ☐ Boring

_____" Depth of Organic Horizon Above Mineral Soil

DEPTH BELOW MINERAL SOIL SURFACE (inches)

	Texture	Consistency	Color	Mottling
0–10	GRAVELLY LOAMY SAND (FILL)	FROZEN	VARIABLE BROWN	
10–20	SANDY LOAM		DARK BROWN 10YR3/3	
20–30	LOAMY SAND	FRIABLE	YELLOWISH BROWN 10YR5/6	
30–40	FINE SAND W/ SILT LENSES	SOMEWHAT FIRM TO FIRM	MIXED OLIVE BROWN / LIGHT OLIVE BROWN	FEW FAINT
40–50	SILTY CLAY LOAM	FIRM (NO SATURATION)	OLIVE GRAY	COMMON DISTINCT

(LIMIT OF EXCAVATION @ 52")

Soil Classification	Slope	Limiting Factor	Ground Water / Restrictive Layer / Bedrock / Pit Depth
Profile: _____ Condition: _____	____ %	23 "	■ Ground Water ☐ Restrictive Layer ☐ Bedrock ☐ Pit Depth

FOR WASTEWATER DISPOSAL

Soil Series Name:	Drainage Class:	Hydrologic Group:
FILL OVER ELDRIDGE (ELMWOOD)		

FOR SOILS MAPPING

SOIL DESCRIPTION AND CLASSIFICATION (Location of Observation Holes Shown Above)

Observation Hole TP ST-2 ■ Test Pit ☐ Boring

_____" Depth of Organic Horizon Above Mineral Soil

DEPTH BELOW MINERAL SOIL SURFACE (inches)

	Texture	Consistency	Color	Mottling
0–10	SILT LOAM	FRIABLE	DARK BROWN	
10–20	SILTY CLAY LOAM	SOMEWHAT FIRM	OLIVE GRAY	COMMON DISTINCT
20–30				
30–40	LOAMY FINE SAND	FRIABLE	LIGHT OLIVE BROWN	
40–50	SILTY CLAY LOAM	FIRM	OLIVE	△△△ FREE WATER

(LIMIT OF EXCAVATION @ 56")

Soil Classification	Slope	Limiting Factor	Ground Water / Restrictive Layer / Bedrock / Pit Depth
Profile: _____ Condition: _____	____ %	7 "	■ Ground Water ☐ Restrictive Layer ☐ Bedrock ☐ Pit Depth

Soil Series Name:	Drainage Class:	Hydrologic Group:
STRIPPED LAMOINE		

SOIL DESCRIPTION AND CLASSIFICATION (Location of Observation Holes Shown Above)

Observation Hole TP ST-3 ■ Test Pit ☐ Boring

_____" Depth of Organic Horizon Above Mineral Soil

DEPTH BELOW MINERAL SOIL SURFACE (inches)

	Texture	Consistency	Color	Mottling
0–10	SILT LOAM	FRIABLE	DARK BROWN 10YR3/3	
10–20	SILTY CLAY (FILL/ OVERBURDEN)	FIRM	OLIVE	RELIC
20–30	SILTY CLAY LOAM W/ SILT & LOAMY FINE SAND IN LENSES		OLIVE BROWN	
40–50				△△△ FREE WATER

STATE OF MAINE — JAMES LOGAN #213 — SOIL SCIENTIST

Soil Classification	Slope	Limiting Factor	Ground Water / Restrictive Layer / Bedrock / Pit Depth
Profile: _____ Condition: _____	____ %	46 "	■ Ground Water ☐ Restrictive Layer ☐ Bedrock ☐ Pit Depth

FOR WASTEWATER DISPOSAL

Soil Series Name:	Drainage Class:	Hydrologic Group:
STRIPPED/REGRADED LAMOINE		

FOR SOILS MAPPING

SOIL DESCRIPTION AND CLASSIFICATION (Location of Observation Holes Shown Above)

Observation Hole TP ST-4 ■ Test Pit ☐ Boring

_____" Depth of Organic Horizon Above Mineral Soil

DEPTH BELOW MINERAL SOIL SURFACE (inches)

	Texture	Consistency	Color	Mottling
0–10	SILTY CLAY (REGRADED & OVERBURDEN)	FROZEN	VARIABLE OLIVE BROWN & OLIVE GRAY	
10–20		SOMEWHAT FIRM		MANY PROMINENT (RELIC)
20–30	SILTY CLAY LOAM W/LOAMY FINE SAND AND SILT LENSES	FIRM	VARIABLE OLIVE BROWN AND DARK YELLOWISH BROWN	COMMON DISTINCT NOTE: NO FREE WATER IN TEST PIT

(LIMIT OF EXCAVATION @ 55")

Soil Classification	Slope	Limiting Factor	Ground Water / Restrictive Layer / Bedrock / Pit Depth
Profile: _____ Condition: _____	____ %	9 "	■ Ground Water ☐ Restrictive Layer ☐ Bedrock ☐ Pit Depth

Soil Series Name:	Drainage Class:	Hydrologic Group:
STRIPPED/REGRADED LAMOINE		

James Logan (for ASF-S) — Site Evaluator / Soil Scientist Signature

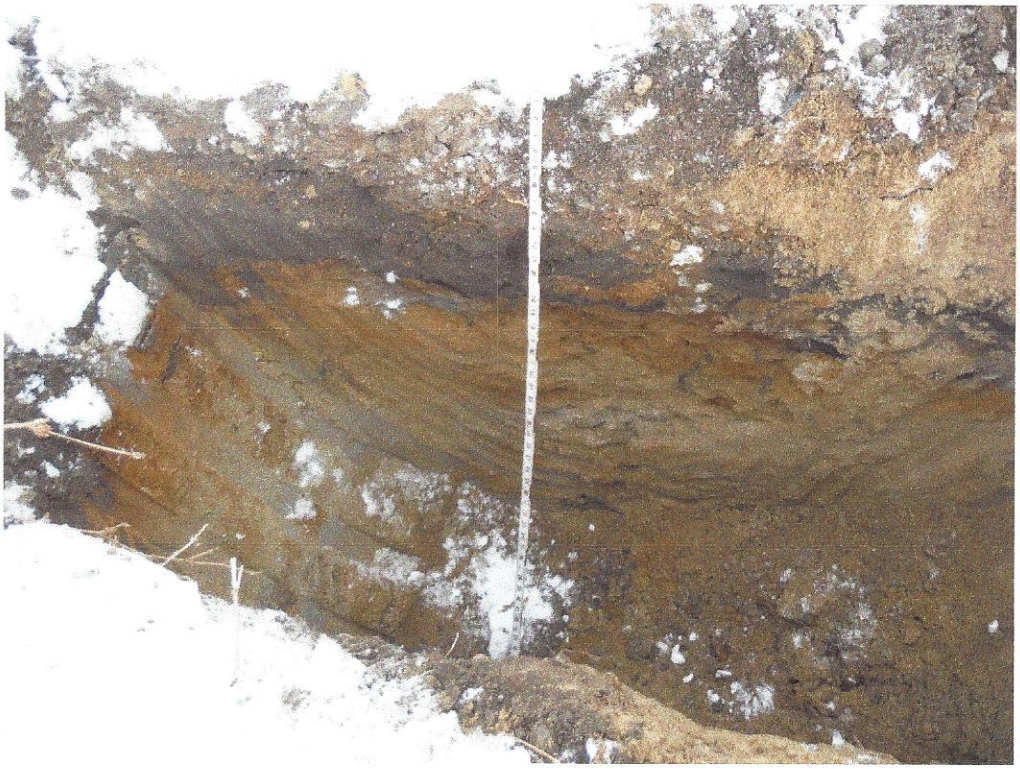
237/213 — SE/CSS #

12-20-13 — Date

ALBERT FRICK ASSOCIATES – 95A COUNTY ROAD GORHAM, MAINE 04038 – (207) 839-5563

Peter Holmes Site
off Warren Avenue
Portland, Maine

View of excavator near edge of upland



View of typical non-hydric, regraded soils on site (TP ST-4)

APPENDIX G

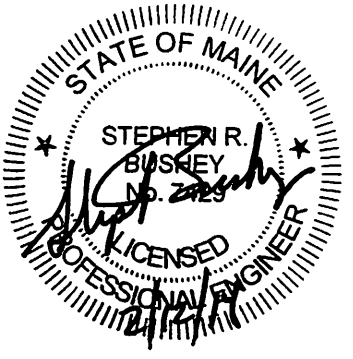
EROSION CONTROL PLAN

BASIC STANDARDS
EROSION AND SEDIMENTATION CONTROL REPORT

421 WARREN AVENUE
COMMERCIAL COMPLEX

PREPARED FOR:

PH WARREN AVENUE, LLC
421 WARREN AVENUE
PORTLAND, MAINE 04101



PREPARED BY:

FAY, SPOFFORD & THORNDIKE, INC.
778 MAIN STREET, SUITE 8
SOUTH PORTLAND, MAINE 04106
(207) 775-1121

FEBRUARY 2014

TABLE OF CONTENTS

Figures and Photographs

Please refer to Section 1 of the Site Plan Application for Figures and Photographs

Appendices

1.0 INTRODUCTION

Fay, Spofford & Thorndike (FST) has been retained by Peter Holmes to assist on the preparation of site design and site permitting for a proposed 28,000 SF footprint multi-unit building in Portland, Maine. The development will include a new multi-unit building, 41 space parking lot and related infrastructure improvements. This proposed project will create a total of 2.53 ac of developed area of which 1.90 ac will be new structure area (building and other impervious surfaces) within the approximately 7.95 acre project watershed area analyzed. The landowner of this site also owns an approximate additional 40 acres surrounding this site.

The development site is located on the north side of Warren Avenue between Interstate 95 and Forest Avenue in Portland. The site is owned by PH Warren Avenue, LLC. A large portion of this site currently drains to a drainage way in the northeast quadrant of the site. Part of the southerly tip of the site drains into Warren Avenue and is collected by the City's municipal drainage system. A second part of the southerly end drains across to Harbour Auto-Body and is collected in a small detention pond before being routed into the city drainage system.

A USGS Map, Zoning, Aerial Photographs, Flood, Soils, figures are included in Section 1 of the Site Plan Application. The accompanying plan set includes erosion control details and overall erosion control plan.

This section of the permit application presents the Erosion Sediment Control Plan designed for the project. The erosion control plans will be contained in the contract documents for implementation by the Contractor who is awarded the bid for the project. This project is coordinated with the MeDEP erosion control requirements. The Contract documents will require that turbid discharges from the site do not occur. Fugitive dust emissions will be controlled and the requirements of this erosion control plan, and all permit requirements will be fulfilled. Winter construction may be required. Specific erosion controls stipulated by the plan and this report are minimum requirements.

2.0 EXISTING SITE CONDITIONS

The current site cover conditions are summarized in the table below:

SUMMARY OF LAND USE COVER	
Current Land Cover	**Area (acre)**
Woods/Meadow	5.75
Roof	0.28
Lawn	0.46
Pavement	0.67
Gravel	0.79
Total	**7.95**

3.0 EXISTING DRAINAGE FEATURES

The existing site is comprised of undeveloped woods, meadow and lawn area associated and gravel areas.

Topography is relatively flat within the site. A large portion of the site drains over a flat wetland area towards a tributary in the northeast quadrant of the site. About half of the area in the southern portion of the site drains towards Warren Avenue and is picked up by the City of Portland Municipal Stormwater System through a catch basin in the street. The other half flows towards an existing detention pond adjacent to Harbour Auto Body shop, which is located on property owned

by the applicant. Flow is released from this detention pond and is discharged to the City of Portland Stormwater System.

The preliminary geotechnical explorations by S.W. Cole Engineering in December 2013 show that the site contains fill soils over a layer of relic topsoil underlain by glaciomarine sands, silts and clays.

4.0 OVERVIEW OF SOIL EROSION AND SEDIMENTATION CONCERNS

The susceptibility of soils to erosion is indicated on a relative "K" scale of values over a range of 0.02 to 0.69. The "K" value is frequently used with the universal soil loss equation. The higher values are indicative of the more erodible soils. The relative K values of the underlying material at the site would be as follows:

Soil Symbol	Soil Description	"K" Value
Scantic	Silt Loam	0.49-0.64

The primary emphasis of the Erosion and Sedimentation Control Plan to be implemented for this project is as follows:

- **Temporary Measures:** Planning the project to have erosion resistant measures in place by implementing measures intended to prevent erosion from occurring.

- **Phasing Sequencing:** The plan includes measures to intercept and convey runoff to temporary sediment sumps and control devices as the construction of the project occurs. The use of small collection sumps with a clean sand filter above an underdrained discharge is recommended to supplement the principal sumps to help reduce turbidity.

- **Use of Type 1 Settling:** Installing sediment sumps and swales early in the construction sequence to provide secondary relief for erosion control measures within the site until late in the project when the sedimentation areas need to be removed for final restoration.

- **Restabilization:** Stabilization of areas denuded to underlying parent material must occur within stipulated time frame to minimize the period of soil exposure and stabilization of drainage paths to avoid rill and gully erosion.

- **Interim Entrapment:** The use of on-site measures to capture sediment (hay bales/silt fence, etc.) before it is conveyed to sediment sumps.

- **Long Term Site Protection:** The implementation of long-term measures for erosion/sediment and pollutant treatment through the construction of permanent water quality measures including gravel wetlands.

- **Special Winter Construction Measures:** These will be required for work between September 15 and April 15.

5.0 DESCRIPTION AND LOCATION OF LIMITS OF ALL PROPOSED EARTH MOVEMENTS

The construction of the project will disturb about 4 acres of land. The limit of disturbance is generally coincident with the limit of grading.

The earth moving will include trenching for underground utilities, excavation for the water quality measures, earthwork to reshape the perimeter of the site, earthwork to prepare and shape the parking lot, excavation attendant with the building, and excavation and borrow for the project improvements.

6.0 PROPOSED DRAINAGE FEATURES

The postdevelopment plan includes consideration and design for water quality treatment of stormwater runoff. These measures will also constitute the stormwater management provisions for the development.

Certain manholes on the project provide flow management by directing stormwater to different areas and by regulating the discharge rates for various points of analysis.

The proposed cover conditions for the site upon completion of the project will be as follows:

TABLE 2 – POSTDEVELOPMENT LAND USE

Proposed Land Cover	Area (acre)	Change from Current (acre)
Woods/Meadow	4.38	-1.37
Roof	0.92	+0.64
Lawn/Landscaped Planting Areas	0.66	+0.20
Pavement	1.77	+1.17
Gravel	0.22	-0.57
Total	**7.95**	

7.0 CRITICAL AREAS

Critical resource areas include nearby wetlands to the north of the site. No special species habitats have been identified on the interior areas of the site. It is noted that the stormwater systems shall not be activated until the tributary areas have been stabilized and at least three weeks has passed subsequent to placement of bituminous concrete paving materials.

8.0 EROSION/SEDIMENTATION CONTROL DEVICES

As part of the site development, the Contractor will be obligated to implement the following erosion and sediment control devices. These devices shall be installed as indicated on the plans or as described within this report. For further reference on these devices, see the *Maine Department of Environmental Protection Erosion and Sediment Control BMPS Manual (March, 2003).*

1. Siltation fence or an erosion control mix berm shall be installed down slope of any disturbed areas to trap runoff borne sediments until the site is revegetated. The silt fence shall be installed per the detail provided in the plan set and inspected immediately after each rainfall and at least daily during prolonged rainfall. The Contractor shall make repairs immediately if there are any signs of erosion or sedimentation below the fence line. If such erosion is observed, the Contractor shall take proactive action to identify the cause of the erosion and take action to avoid its reoccurrence. Typically, this requires that stabilization measures be undertaken. Proper placement of stakes and keying the bottom of the fabric into the ground is critical to the fence's effectiveness. If there are signs of undercutting at the center or the edges, or impounding of large volumes of water behind the fence, the barrier shall be replaced with a stone check dam and measures taken to avoid the concentration of flows not directed to the silt fence.

2. Straw or hay mulch including hydroseeding is intended to provide cover for denuded or seeded areas until revegetation is established. Mulching should be occurring several times per week when the site construction activity is high and at sufficient intervals to reduce the period of exposure of bare soils to the time limits set forth in this plan. Mulch placed on slopes of less than 10 percent shall be anchored by applying water; mulch placed on slopes steeper than 10 percent shall be covered with fabric netting as immediately after mulching as practicable and anchored with staples in accordance with the manufacturer's recommendations. Proposed drainage channels, which are to be revegetated, shall receive Curlex® blankets by American Excelsior Company selected for the slope, velocity, and whether the measure is temporary or intended to be in place for a sustained period. Mulch application rates are provided in Appendix A of this section. Hay mulch shall be available on site at all times in order to provide immediate temporary stabilization when necessary. Where necessary, a windrow of crushed stone and/or gravel shall be placed at the top of the slope and directed to a temporary stone channel or pipe sluice to convey runoff down slopes. A dissipation device such as stone or a plunge pool should be installed at the base of the slope and sluice outlet to dissipate the energy of the water from the sluice or channel.

3. Temporary sediment sumps will provide sedimentation control for stormwater runoff from disturbed areas during construction until stabilization has been achieved. The sediment sumps need to include a sand filter above an underdrain or a chemical coagulant to remove fine-grained sediment. Appropriate measures to reduce sediment suspended in discharges to less than 280 NTU's will be required.

4. Riprap slopes, ditch linings, stone check dams, hay bale barriers, and culvert outlet aprons are intended to stabilize and protect denuded soil surfaces or dissipate the energy and erosive forces from concentrated flows. Installation details and stone sizes are provided in the construction plan set on the erosion control detail sheets.

5. A construction entrance will be constructed at all access points onto the site to prevent tracking of soil onto adjacent local roads and streets and the existing driveway for 429 Warren Avenue.

6. Stone sediment traps or a premanufactured SiltSack™ and a sediment bag will be installed at catch basin inlets to prevent silt from entering the municipal storm drain system. Installation details are provided in the plan set on the erosion control detail sheets.

7. Dirtbags™ will be required to be on site and available for construction dewatering. The Contractor will be required to provide two Dirtbags™ with one prepared for operation prior to commencing any trenching operations. Dirtbags™ will need to be installed above filter sand and crushed stone in accordance with the details shown on the plan set will need to be installed.

8. Loam and seed is intended to serve as the primary permanent revegetative measure for all denuded areas not provided with other erosion control measures, such as riprap. Specific areas as shown on the landscape plan may receive sod. Application rates are provided in Appendix A of this section for temporary and permanent seeding.

9. Stone check dams will be installed in areas noted on the plan or as warranted, based upon observations during construction of the site.

10. Silt logs are an option for stone check dams and may be substituted provided the devices are well anchored.

11. DirtGlue™ is an acceptable means of temporary stabilization and is intended to form a "crust" on the surface that is resistant to erosion. However, applications where DirtGlue™ is used must be protected from traffic that would crack the "crust" and the DirtGlue™ has temperature

limitations that restrict the periods of use. Use of this material shall conform to the requirements of Appendix D.

12. Wattles (constructed of rice straw) are to be used for small areas where the surface is irregular and where an immediate measure is needed to protect downstream measures.

9.0 TEMPORARY EROSION/SEDIMENTATION CONTROL MEASURES

The following are planned as temporary erosion/sedimentation control measures during construction:

1. Crushed stone-stabilized construction entrances shall be placed at any construction access points from adjacent streets or the existing 429 Warren Avenue driveway. The location of the construction entrance shown on the drawings should be considered illustrative and will need to be adjusted as appropriate and located at any area where there is the potential for tracking of mud and debris onto existing roads or streets. Stone stabilized construction entrances will require the stone to be removed and replaced, as it becomes covered or filled with mud and material tracked by vehicles exiting the site.

2. Dirtbags™ shall be installed in accordance with the details in the plan set. The purpose of the Dirtbags™ is to receive any water pumped from excavations during construction. A Dirtbag™ shall be installed and prepared for operation prior to any trenching or foundation construction on site. When Dirtbags™ are observed to be at 50% capacity, they shall be cleaned or replaced. Stone and filter sand under the Dirtbag™ shall be removed and replaced concurrently with the replacement of the Dirtbag™.

3. Temporary stockpiles of common excavation will be protected as follows:

   a) Temporary stockpiles shall not be located at least 50 feet upgradient of the perimeter silt barrier.

   b) Inactive stockpiles shall be stabilized within 5 days by either temporarily seeding the stockpile with a hydroseed method containing an emulsified mulch tackifier or by covering the stockpile with mulch. If necessary, mesh shall be installed to prevent wind from removing the mulch.

4. All denuded areas except gravel areas shall receive mulch, erosion control mesh fabric, or other approved temporary erosion sediment measure within 7 days of initial disturbance of soil or before a predicted rain event of >1/2" unless permanent measures are installed.

5. All soils disturbed between September 15 and April 15 will be covered with mulch within 5 days of disturbance, prior to any predicted storm event of the equivalent of ½" of rainfall in a 24-hour period, or prior to any work shutdown lasting more than 35 hours (including weekends and holidays). The mulch rate shall be double the normal rate.

   For work that is conducted between September 15 and April 15 of any calendar year, all denuded areas will be covered with hay mulch, applied at twice the normal application rate, and (in areas over 10% grade) anchored with a fabric netting. The time period for applying mulch shall be limited to 5 days for all areas, or immediately in advance of a predicted rainfall event.

6. Stone check dams, silt logs, or hay bale barriers will be installed at any evident concentrated flow discharge points during construction and earthwork operations.

7. Silt fencing with a maximum stake spacing of 6 feet should be used, unless the fence is supported by wire fence reinforcement of minimum 14 gauge and with a maximum mesh spacing of 6 inches, in which case stakes may be spaced a maximum of 10 feet apart. The

bottom of the fence should be properly anchored a minimum of 6" per the plan detail and backfilled. Any silt fence identified by the owner or reviewing agencies as not being properly installed during construction shall be immediately repaired in accordance with the installation details.

8. Storm drain catch basin inlet protection shall be provided through the use of stone sediment barriers or a premanufactured SiltSack™. Stone sediment barrier installation details are provided in the plan set. The barriers or SiltSacks™ shall be inspected after each rainfall and repairs made as necessary, including the removal of sediment. Sediment shall be removed and the barrier or SiltSack™ restored to its original dimensions when the sediment has accumulated to one-half the design depth of the barrier. Sediment shall be removed from SiltSacks™ as necessary. Inlet protection shall be removed when the tributary drainage area has been stabilized.
9. All slopes steeper than 4:1 shall receive erosion control mesh.
10. Slopes steeper than 3:1 shall receive erosion control blanket.
11. Areas of visible erosion and the temporary sediment sumps shall be stabilized with crushed stone. The size of the stone shall be determined by the contractor's designated representative in consultation with the Owner.
12. Any flow from the site that is concentrated must be directed to a sump with sand filter and underdrained discharge.
13. Underground utilities must be installed in compliance with the following standards and other requirements of this erosion control plan:

    - No more than 500 linear feet of trench may be opened at one time;
    - Excavated materials shall be placed on the uphill side of trenches;
    - Dewatering of the trench shall be pumped through a Dirtbag™ and appropriate sediment control facilities to avoid a turbid discharge; and
    - Stabilization shall occur as soon as practicable.

14. Rice straw wattles shall be used to control localized erosion.
15. Maintenance of the erosion control, sedimentation facilities, and control of fugitive dust must occur until the site is stabilized with permanent erosion control measures. For turf areas, stabilization shall be defined to be the establishment of a 90 percent "catch of grass" with no areas larger than 2 square feet, and no spots that cumulatively add up to more than 5 square feet per 100 square feet.

10.0 STANDARDS FOR STABILIZING SITES FOR THE WINTER

The construction of the project will require winter construction. The project is anticipated to require about 11-12 months to construct. For permitted winter construction, the erosion control measures are substantially more stringent due to the cold temperatures and lack of weather conditions which aid in drying the subgrade soils through evaporation.

If construction activities involving earth disturbance continue past September 15 or begin before April 15, the following must be incorporated with the erosion control plan and implementation:

1. Enlarged access points must be stabilized to provide for snow stockpiling.

2. Limits of disturbance shall be reduced to the extent practicable.

3. A snow management plan including adequate storage and control of snowmelt, requiring cleared snow to be stored downgradient of all areas of disturbance shall be prepared by the contractor and submitted to the Owner for review and approval.

4. Snow shall not be stored in sediment basins or to preclude drainage structures from operating as intended.

5. A minimum 25-foot buffer maintained from perimeter controls such as silt fence shall be maintained on the "work area side" to allow for snow clearing and maintenance.

6. Drainage systems intended to operate during the winter shall be catalogued, shown on a plan, and inspected after each snow removal period to make sure the drainage structures are open and free of snow and ice dams.

7. To ensure cover of disturbed soil in advance of a melt event, areas of disturbed soil must be stabilized at the end of each work day, with the following exceptions:

   - If no precipitation within 24 hours is forecast and work will resume in the same disturbed area within 24 hours, daily stabilization is not necessary.
   - Disturbed areas that collect and retain runoff, such as house foundations or open utility trenches.

8. Standard for the timely stabilization of ditches and channels: The Contractor shall construct and stabilize all stone-lined ditches and channels on the site by September 15. The contractor shall construct and stabilize all grass-lined ditches and channels on the site by September 1. If the Contractor fails to stabilize a ditch or channel to be grass-lined by September 1, then the Contractor shall take one of the following actions to stabilize the ditch for late fall and winter.

   i. Install a sod lining in the ditch. The contractor shall line the ditch with properly installed sod by September 15. Proper installation includes the applicant pinning the sod onto the soil with wire pins, rolling the sod to guarantee contact between the sod and underlying soil, watering the sod to promote root growth into the disturbed soil, and anchoring the sod with jute or plastic mesh to prevent the sod strips from sloughing during flow conditions.

   ii. Install a stone lining in the ditch. The contractor shall line the ditch with stone riprap by September 15. The contractor shall hire a registered professional engineer to determine the stone size and lining thickness needed to withstand the anticipated flow velocities and flow depths within the ditch. If necessary, the Contractor shall regrade the ditch prior to placing the stone lining so as to prevent the stone lining from reducing the ditch's cross-sectional area.

9. Standard for the timely stabilization of disturbed slopes: The Contractor shall construct and stabilize stone-covered slopes by September 15. The Contractor shall seed and mulch all slopes to be vegetated by September 1. The Department will consider any area having a grade greater than 15% (10H:1V) to be a slope. If the Contractor fails to stabilize any slope to be vegetated by September 1, then the Contractor shall take one of the following actions to stabilize the slope for late fall and winter.

   i. Stabilize the soil with temporary vegetation and erosion control mesh. By September 15, the Contractor shall seed the disturbed slope with winter rye at a seeding rate of 3 pounds per 1,000 square feet and apply erosion control mats over the mulched slope. The contractor shall monitor growth of the rye over the next 30 days. If the rye fails to grow at least three inches or fails to cover at least 75% of the disturbed slope by September 15,

then the Contractor shall cover the slope with a layer of wood waste compost as described in item iii of this standard or with stone rip rap as described in item iv of this standard.

ii. Stabilize the slope with sod. The Contractor shall stabilize the disturbed slope with properly installed sod by September 15. Proper installation includes the Contractor pinning the sod onto the slope with wire pins, rolling the sod to guarantee contact between the sod and underlying soil, and watering the sod to promote root growth into the disturbed soil. The Contractor shall not use late-season sod installation to stabilize slopes having a grade greater than 33% (3H:1V) or having groundwater seeps on the slope face.

iii. Stabilize the slope with wood waste compost. The Contractor shall place a six-inch layer of wood waste compost on the slope by September 15. Prior to placing the wood waste compost, the Contractor shall remove any snow accumulation on the disturbed slope. The contractor shall not use wood waste compost to stabilize slopes having grades greater than 50% (2H:1V) or having groundwater seeps on the slope face.

iv. Stabilize the slope with stone rip rap. The Contractor shall place a layer of stone riprap on the slope by September 15. The Contractor shall hire a registered professional engineer to determine the stone size needed for stability and to design a filter layer for underneath the riprap.

10. Standard for the timely stabilization of disturbed soil: By September 1, the Contractor shall seed and mulch all disturbed soils on areas having a slope less than 15%. If the Contractor fails to stabilize these soils by this date, then the Contractor shall take one of the following actions to stabilize the soil for late fall and winter.

    i. Stabilize the soil with temporary vegetation. By September 15, the Contractor shall seed the disturbed soil with winter rye at a seeding rate of 3 pounds per 1,000 square feet, lightly mulch the seeded soil with hay or straw at 75 pounds per 1,000 square feet, and anchor the mulch with plastic netting. The Contractor shall monitor the growth of the rye over the next 30 days. If the rye fails to grow at least three inches or fails to cover at least 75% of the disturbed soil before September 15, then the Contractor shall mulch the area for over-winter protection as described in item iii of this standard.

    ii. Stabilize the soil with sod. The Contractor shall stabilize the disturbed soil with properly installed sod by September 15. Proper installation includes the Contractor pinning the sod onto the soil with wire pins, rolling the sod to guarantee contact between the sod and underlying soil, and watering the sod to promote root growth into the disturbed soil.

    iii. Stabilize the soil with mulch. By September 15, the Contractor shall mulch the disturbed soil by spreading hay or straw at a rate of at least 150 pounds per 1,000 square feet on the area so that no soil is visible through the mulch. Prior to applying the mulch, the Contractor shall remove any snow accumulation on the disturbed area. Immediately after applying the mulch, the Contractor shall anchor the mulch with plastic netting to prevent wind from moving the mulch off the disturbed soil.

    iv. Stabilize all stockpiles with mulch within 24 hours.

11.0 SPECIAL MEASURES FOR SUMMER CONSTRUCTION

The summer period is generally optimum for construction in Maine, but it is also the period when intense short duration storms are most common, making denuded areas very susceptible to erosion,

when dust control needs to be the most stringent, and when the potential to establish vegetation is often restricted by moisture deficit. During these periods, the Contractor must:

1. Implement a program to apply dust control measures on a daily basis except those days where the precipitation exceeds 0.25 inch. This program shall extend to and include adjacent streets used by construction vehicles.

2. Spray any mulches with water after anchoring to dampen the soil and encourage early growth. Spraying may be required several times. Temporary seed may be required until the late summer seeding season.

3. Mulch, cover, and moisten stockpiles of fine-grained materials, which are susceptible to erosion. In the summer months, the potential for wind erosion is of concern, as well as erosion from the intense, short-duration storms, which are more prevalent in the summer months.

4. Take additional steps needed to control fugitive dust emissions to minimize reductions in visibility and the airborne disbursement of fine-grained soils. This is particularly important along the adjacent streets.

These measures may also be required in the spring and fall during the drier periods of these seasons.

12.0 SEDIMENTATION SUMPS

The sediment sumps shall be sized in accordance with the plan and specifications. The bottom of the sumps is intended to be used for temporary infiltration.

Discharge must be through a sand filter over an underdrained outlet to aid in the control of turbidity levels in the discharge. An emergency bypass shall be included and shall be constructed of 6" of stone overlaying filter fabric and discharge to undisturbed turf.

13.0 PERMANENT EROSION CONTROL MEASURES

The following permanent erosion control measures have been designed as part of the Erosion/Sedimentation Control Plan:

1. The drainage conveyance systems have been designed to intercept and convey the 25-year storm. In the case of open channels or swales, this includes the design of measures to resist scour of the channel.

2. All storm drainpipes shall have stabilization at their outlet to protect the outlet and receiving channel of the culverts from scour and deterioration. Installation details are provided in the plan set. The aprons shall be installed and stabilized prior to directing runoff to the tributary pipe or culvert. Orifices in hydraulic control structures will be protected with a wire mesh screen with an opening of no more than 25 percent of the orifice size and a surface are of at least 25 times the area of the orifice.

3. All areas disturbed during construction, but not subject to other restoration (paving, riprap, etc.), will be loamed, limed, fertilized, mulched, and seeded. Fabric netting, anchored with staples, shall be placed over the mulch in areas where the finish grade slope is greater than 10 percent. Native topsoil and wetland soils shall be stockpiled and temporarily stabilized with seed and mulch and reused for final restoration when it is of sufficient quality.

4. Permanent seeding shall be conducted only in April through May and in late summer until September 15.

5. A riprap plunge pool will be installed at the stormwater management discharges at the wetland edge to disperse the flows.

14.0 TIMING AND SEQUENCE OF EROSION/SEDIMENTATION CONTROL MEASURES

The Contractor must control fugitive dust emissions respect and not impede the neighboring land uses while controlling sediment laden runoff to 280 NTU or less. For all grading activities, the Contractor shall exercise extreme caution not to overexpose the site by limiting the disturbed area and shall stabilize any steep slopes within 24 hours if final slope grading and stabilization will not be completed within 7 days. Any final slopes shall have the specified erosion control measures installed within 7 days of final stabilization.

The following construction sequence shall be required, (unless otherwise authorized in writing by the Owner's project manager or authorized permit agent).

The description of the work is:

- Mark the Phase 1 work limits.
- Install safety fence and security signs around the perimeter of the site.
- Establish and install construction entrances with gates.
- Install silt fence or equivalent sediment barrier along the perimeter and other designated areas requiring silt fence or equivalent sediment barrier.
- Establish Dirtbag® area and pump system for dewatering activities.
- Construct sedimentation facilities with riprap discharge locations.
- Construct a diversion swale(s) to direct as much of the site to the sedimentation basins as possible.
- Install temporary seed and mulch around the perimeter of the temporary sedimentation facilities.

There is more flexibility for the contractor to schedule the work provided once the erosion control measures are in place. The measures shown on the erosion control drawing of the plan set are the measures that need to be installed as soon as practicable during construction in subsequent phases.

The underground facilities and treatment units shall not be activated until authorized by the design engineer or a certified erosion control professional who has signed an affidavit indicating they have reviewed the plans, Stormwater Management, Erosion Sediment Control Plan, Stormwater O&M Manual, and any State and Local site permits issued for the project.

15.0 CONTRACTING PROCEDURE

The onsite components of the project will be constructed by a General Contractor under contract to the Developer. Offsite improvements may be constructed by a General Contractor under contract to the owner. The Contractor shall submit a schedule for the completion of the work, which will satisfy the following criteria:

1. The construction sequence of Section M should generally be completed in the specified order; however, several separate items may be constructed simultaneously. Work must also be scheduled or phased to prevent the duration of areas exposed or susceptible to erosion as specified below. The intent of this sequence is to provide for erosion control and to have structural measures such as sediment barriers and construction entrances in place before large areas of land are denuded.
2. The work shall be conducted in sections which will:
   a) Limit the amount of exposed area to those areas in which work is expected to be undertaken during the preceding 30 days.
   b) Revegetate disturbed areas as rapidly as possible. All areas shall be permanently stabilized within 7 days of final grading and temporarily stabilized within 7 days of initial disturbance or before a predicted storm event of over ½" of rain.
   c) Incorporate planned inlets and drainage system as early as possible into the construction phase. The ditches shall be immediately lined or revegetated as soon as their installation is complete.
   d) Achieve the parking space numbers indicated in the construction phasing.
3. Once final grade has been established, the Contractor may choose to dormant seed the disturbed areas prior to placement of mulch and placement of fabric netting anchored with staples.
   a) If dormant seeding is used for the site, all disturbed areas shall receive 6" of loam and seed at an application rate of 5#/1,000 s.f.

      All areas seeded during the winter months will be inspected in the spring for adequate catch. All areas insufficiently vegetated (less than 75 percent catch) shall be revegetated by replacing loam, seed, and mulch.
   b) If dormant seeding is not used for the site, all disturbed areas shall be revegetated in the spring.
4. The area of denuded, non-stabilized construction shall be limited to the minimum area practicable. An area shall be considered to be denuded until the subbase gravel is installed in parking areas, or the areas of future loam and seed have been loamed, seeded, and mulched. The mulch rate shall be twice the rate specified in the seeding plan. [For example, 115#/1,000 s.f. x 2 = 230#/s.f.]
5. Within the exposed work area, temporary sedimentation sumps shall be provided any concentrated flow area with sand filter or chemical coagulation. Additional information is provided in prior sections of this narrative and on the Erosion Control Details of the plan set. Along the sedimentation sumps, barriers shall be provided at sufficient intervals to permit runoff to be accumulated to a maximum depth of 12" before overflowing.
6. The schedule shall be subject to the approval of the Owner.

7. The Contractor must maintain an accurate set of record drawings indicating the date when an area is first denuded, the date of temporary stabilization, and the date of final stabilization. On September 15 of any calendar year, the Contractor shall submit a detailed plan for stabilizing the site for the winter and a description of what activities are planned during the winter.

8. The Contractor must install any added measures which may be necessary to control erosion/sedimentation and fugitive dust emissions from the site, with adjustments made dependent upon forecasted and actual site and weather conditions.

9. The Contractor shall note that no area within 50 feet of a slope with a vertical drop of more than 3' in 50 feet shall remain denuded for a period of over 5 days before it is temporarily stabilized. Temporary stabilization shall be the installation of mulching. All other areas shall be stabilized within 7 days or before a predicted rain event. For construction between September 15 and April 15 of any calendar year, all areas shall be temporarily stabilized at the earlier time frames specified above.

10. Certain erosion control products (such as DirtGlue™) come in a form that a release could occur on the site or into the environs. The Contractor shall include MSDS information for all products that have the potential for release to the environment and shall be responsible for implementing a safety control program for proper handling of these materials on the site.

11. A notice and point of contact with cell phone number shall be posted at the trailer to permit access to the erosion records during normal work hours and in case of emergency at other times. All additions and construction records shall be copied via e-mail to the Owner.

    The Owner reserves the right to add additional personnel to this list at the pre-construction conference or at reasonable intervals during the project.

12. The Owner will provide a copy of the Maine Construction General Permit Notice of Intent acceptance letter to the Contractor. This letter shall be maintained at the site with the Erosion Control Plan.

13. Any revisions to the Erosion Control Plan must be authorized in writing by the Preparer of the Plan (Fay, Spofford & Thorndike) The Preparer of the Plan shall be permitted reasonable time to review and notify the city and other agencies of said changes. Revisions to the Erosion Control Plan will be required:

    a. Whenever the current provisions prove to be ineffective in minimizing pollutants in stormwater *discharges* from the site;

    b. Whenever there is a change in design, construction, or operation at the construction site that has or could have an effect on the discharge of pollutants; and

    c. To address issues or deficiencies identified during an inspection by the *qualified inspector*, the MaineDEP, City of Portland, or other regulatory authority.

14. Should the Owner notify the contractor that the activity on the site is in violation of the Erosion Control Plan, the Contractor shall at its sole cost correct the deficiencies and file a photographic log with a list of corrective actions with the Owner within 7 days of notification by the Owner.

15. The Contractor shall engage a qualified inspector to monitor the work. This inspector shall be approved by the Owner prior to the individual being engaged on the project. This inspection

shall be a part of the Contractor's Quality Control Plan for the project by the Contractor. The inspector's qualifications and duties that he shall perform are as follows:

a. Licensed Professional Engineer or Certified Professional in Erosion Control

b. Covered by Workman's Compensation Insurance

c. Experienced in this type of work, the specific erosion controls applicable to this project with a resume approved by the engineer

d. Compensated on a unit rate basis with no incentives for reduced costs or subject to any type of compensation for passing inspections

e. Approved by the Owner and the preparer of this plan

The *qualified inspector*s shall conduct site inspections in accordance with the following timetable:

a. Where soil disturbance activities are on-going, the *qualified inspector* shall conduct a site inspection at least once every seven (7) calendar days.

b. Where soil disturbance activities have been temporarily suspended (e.g. winter shutdown) and temporary stabilization measures have been applied to all disturbed areas, the *qualified inspector* shall conduct a site inspection at least once every thirty (30) calendar days. The *owner or operator* shall notify the City's stormwater contact person or, in areas under the jurisdiction of a *regulated traditional land use control MS4*, the MS4 (provided the MS4 is not the *owner or operator* of the construction activity) in writing prior to reducing the frequency of inspections.

c. Where soil disturbance activities have been shut down with partial project completion, the *qualified inspector* can stop conducting inspections if all areas disturbed as of the project shutdown date have achieved *final stabilization* and all post-construction stormwater management practices required for the completed portion of the project have been constructed in conformance with the Erosion Control requirements and are operational. The *owner or operator* shall notify the City's stormwater contact person in writing prior to the shutdown. If soil disturbance activities are not resumed within 2 years from the date of shutdown, the Contractor shall have the *qualified inspector* perform a final inspection and certify that all disturbed areas have achieved *final stabilization*, and all temporary, structural erosion and sediment control measures have been removed, and that all post-construction stormwater management practices have been constructed in conformance with the Erosion Control Plan by signing the "Final Stabilization" and "Post-Construction Stormwater Management Practice" certification statements on the Notice of Termination. The *owner or operator* shall then submit the completed Notice of Termination form to the City of Portland and MaineDEP.

At a minimum, the *qualified inspector* shall inspect all erosion and sediment control practices to ensure integrity and effectiveness, all post-construction stormwater management practices under construction to ensure that they are constructed in conformance with the Contract documents and Permit conditions, all areas of disturbance that have not achieved *final stabilization*, all points of discharge to natural surface water bodies located within, or immediately adjacent to, the property boundaries of the construction site, and all points of discharge from the construction site.

The *qualified inspector* shall prepare an inspection report subsequent to each and every inspection. At a minimum, the inspection report shall include and/or address the following:

a. Date and time of inspection;

b. Name and title of person(s) performing inspection;

c. A description of the weather which shall be consistent with the National Weather Service Forecast Office, Portland-Gray, ME and soil conditions (e.g. dry, wet, saturated) at the time of the inspection;

d. A description of the condition of the runoff at all points of discharge from the construction site and sampling to determine the turbidity in NTU's. This shall include identification of any *discharges* of sediment from the construction site. Include *discharges* from conveyance systems (i.e. pipes, culverts, ditches, etc.) and overland flow;

e. A description of the condition of all natural surface water bodies located within, or immediately adjacent to, the property boundaries of the construction site which received runoff from disturbed areas. This shall include identification of any *discharge* of sediment to the surface water body;

f. Identification of all erosion and sediment control practices that need repair or maintenance;

g. Identification of all erosion and sediment control practices that were not installed properly or are not functioning as designed and need to be reinstalled or replaced;

h. Description and sketch of areas that are disturbed at the time of the inspection and areas that have been stabilized (temporary and/or final) since the last inspection;

i. Current phase of construction of all post-construction stormwater management practices and identification of all construction that is not in conformance with the SWPPP and technical standards;

j. Corrective action(s) that must be taken to install, repair, replace or maintain erosion and sediment control practices; and to correct deficiencies identified with the construction of the post-construction stormwater management practice(s); and

k. Digital photographs, with date stamp, that clearly show the condition of all practices that have been identified as needing corrective actions. The *qualified inspector* shall attach paper color copies of the digital photographs to the inspection report being maintained onsite within seven (7) calendar days of the date of the inspection. The *qualified inspector* shall also take digital photographs, with date stamp, that clearly show the condition of the practice(s) after the corrective action has been completed. The *qualified inspector* shall attach paper color copies of the digital photographs to the inspection report that documents the completion of the corrective action work within seven (7) calendar days of that inspection.

Within one business day of the completion of an inspection, the *qualified inspector* shall notify the owner the appropriate contractor or subcontractor of any corrective actions that need to be taken. The contractor or subcontractor shall begin implementing the corrective actions within one business day of this notification and shall complete the corrective actions in a reasonable time frame, at its sole cost.

All inspection reports shall be signed by the *qualified inspector*. The inspection reports shall be maintained on site.

16. The Owner reserves the right to have quality assurance monitoring of the work. The Contractor shall, at its sole cost, cooperate with the Owner and their quality assurance monitoring of the work including maintaining an accurate schedule for performing the work. The Owner will notify the contractor if any particular elements of the work should be uncovered or available for observation by the Quality Assurance Monitor selected by the Owner. The Owner reserves the right to conduct the quality assurance monitoring during working hours at any time during the project.

16.0 PROVISIONS FOR MAINTENANCE OF THE EROSION/SEDIMENTATION CONTROL FEATURES

The project will be contracted to a General Contractor. The project is subject to the requirements of the local permits, and a state regulated Construction General Permit and City of Portland Site Plan Approval.

This project requires the Contractor to prepare a list and designate by name, address and telephone number all individuals who will be responsible for implementation, inspection, and maintenance of all erosion control measures identified within this section and as contained in the Erosion and Sedimentation Control Plan of the contract drawings. Specific responsibilities of the inspector(s) will include:

1. Execution of the Contractor/Subcontractor Certification contained in Appendix B by any and all parties responsible for erosion control measures on the site as required by the permit authorities.

2. Assuring and certifying the Owner's construction sequence is in conformance with the specified schedule of this section. A weekly certification stating compliance, any deviations, and corrective measures necessary to comply with the erosion control requirements of this section shall be prepared and signed by the inspector(s).

3. In addition to the weekly certifications, the inspector(s) shall maintain written reports recording construction activities on site which include:

    - Dates when major grading activities occur in a particular areas.
    - Dates when major construction activities cease in a particular area, either temporarily or permanently.
    - Dates when an area is stabilized.

4. Inspection of this project work site on a weekly basis and after each significant rainfall event (0.5 inch or more within any consecutive 24-hour period) during construction until permanent erosion control measures have been properly installed and the site has been stabilized. Inspection of the project work site shall include:

    - Identification of proper erosion control measure installation in accordance with the erosion control detail sheet or as specified in this section.
    - Determine whether each erosion control measure is properly operating. If not, identify damage to the control device and determine remedial measures.
    - Identify areas which appear vulnerable to erosion and determine additional erosion control measures which should be used to improve conditions.

- Inspect areas of recent seeding to determine percent catch of grass. A minimum catch of 90 percent is required prior to removal of erosion control measures.
- All erosion controls shall be removed within 30 days of permanent stabilization except for mulch and netting not detrimental to the project. Removals shall include but not be limited to all silt fence, hay bales, inlet protection, and stone check dams.
- Accumulated silt/sediment should be removed when the depth of sediment reaches 50 percent of the barrier height. Accumulated silt/sediment should be removed from behind silt fencing when the depth of the sediment reaches 6 inches.
- Silt sacks should be removed and replaced at least every three months and at any time where the weekly inspection reveals that siltation has significantly retarded the rate of flow through the silt sack.
- Discharges should be measured during storm events to document the turbidity of stormwater discharge is <280 NTU.

5. If inspection of the site indicates a change should be made to the erosion control plan, to either improve effectiveness or correct a site-specific deficiency, the inspector shall immediately implement the corrective measure and notify the Owner of the change.
6. Arranging for an on-site meeting prior to commencing winter construction to assure that all special winter construction measures will be implemented and to review the specific requirements of this plan for winter construction.

All certifications, inspection forms, and written reports prepared by the inspector(s) shall be filed with the Owner, and the Permit File contained on the project site. All written certifications, inspection forms, and written reports must be filed within one (1) week of the inspection date.

The Contractor has sole responsibility for complying with the erosion/sediment control report, including control of fugitive dust, and shall be responsible for any monetary penalties resulting from failure to comply with these standards.

Once construction has been completed, long-term maintenance of the stormwater management system will be the responsibility of the applicant. Inspection and Maintenance items with a list of maintenance requirements and frequency are described in a separate document. In the event of defective workmanship or any failure by the contractor and its subcontractors to adhere to the Standards set forth in these documents, the Contractor shall be responsible to correct, at its sole cost, any latent defects together with reimbursement of Owner for any expenses borne by the Owner up to the time of said correction. This provision shall remain in effect beyond any stated or implied warranty period.

17.0 PRECONSTRUCTION CONFERENCE

Prior to any construction at the site, representatives of the Contractor, the Owner, and the site design engineer and any personnel identified in the permit conditions shall meet to discuss the scheduling of the site construction and the designation of the responsible parties for implementing the plan. The Contractor shall be responsible for scheduling the meeting. Prior to the meeting, the Contractor will prepare a detailed schedule and a marked-up site plan indicating areas and components of the work and key dates showing date of disturbance and completion of the work. The Contractor shall conduct a meeting with employees and sub-contractors to review the erosion control plan, the construction techniques which will be employed to implement the plan, and provide a list of attendees and items

discussed at the meeting to the Owner. Three copies of the schedule, the Contractor's meeting minutes, and marked-up site plan shall be provided to the Owner.

18.0 APPENDICES

Appendix A – Seeding Plan

Appendix B –Sample Erosion Control Compliance Certification and Inspection Forms

Appendix C –DirtGlue™ Application and Use Requirements

19.0 PLAN REFERENCES

Drawings C-5.0 & C-6.0 to C-6.2 Erosion/Sediment Control Plan and Details

APPENDIX A

Seeding Plan

PERMANENT SEEDING PLAN (TURF AROUND PERIMETER)

Project: 421 Warren Avenue Commercial Complex

Site Location: Portland, Maine

X Permanent Seeding _____ Temporary Seeding

1. **Area to be Seeded:** Approximately 1.0 acre(s) or 40 /M. Sq. Ft.

2. **Instructions on Preparation of Soil:** Prepare a good seed bed for planting method use (do not overcompact).

3. **Apply Lime as Follows:** _____ #/acres or 138# /M Sq. Ft. or per soil test

4. **Fertilize:** __ pounds of _____ - _____N-P-K/ac.

   20 pounds of 3-27-5 N-P-K/M Sq. Ft. or per soil test

5. **Method of Applying Lime and Fertilizer:** Spread and work into the soil before seeding.

6. **Seed with the following mixture:**

   30% Perennial Rye
   35% Kentucky Bluegrass
   35% Penn Lawn Tall Fescue

7. **Mulching Instructions**: Apply at the rate of ___ tons per acre or 115 pounds per M. Sq. Ft.

8. **Application:**

Type	Unit#	Tons, Etc.
Total Lime	138	#/1,000 s.f.
Total Fertilizer	20	#/1,000 s.f.
Total Seed	8.0	#/1,000 s.f.
Total Mulch	115	#/1,000 s.f.
Total Other	0	0

9. **Remarks:**

Seeding dates April 15 to May 31 and August 1 until September 1. Permanent seeding should be made prior to September 1 or as a dormant seeding after the first killing frost and before the first snowfall. If seeding cannot be done within these seeding dates, temporary seeding and mulching shall be used to protect the site. Permanent seeding shall be delayed until the next recommended seeding period.

Fertilizer requirements shall be subject to actual test results of the topsoil used for the project. The Contractor shall be responsible for providing topsoil test results for pH and recommended fertilizer application rates to the Owner.

Seed mixture shall be fresh, clean, new crop seed. Seed may be mixed by an appropriate method on the site or may be mixed by the dealer. If the seed is mixed on the site, each variety shall be delivered in the original containers bearing the dealer's guaranteed analysis.

Deep tine aerate if soil is compacted.

If seed is mixed by the dealer, the Seeding Contractor shall furnish to the Owner the dealer's guaranteed statement of the composition of the mixture and the percentage of purity and germination of each variety.

Seed shall be purchased from a recognized distributor and shall test to a minimum percentage of 95% for purity and 85% for germination.

All loam shall have compost or peat admixtures to raise the organic content to 6%.

TEMPORARY SEEDING PLAN (EROSION CONTROL MIX)

Project: 421 Warren Avenue Commercial Complex

Site Location: Portland, Maine

__X__ Permanent Seeding __X__ Temporary Seeding

1. **Area to be Seeded:** Approximately 0.5 acre(s) or _____/M. Sq. Ft.

2. **Instructions on Preparation of Soil:** Prepare a good seed bed for planting method used.

3. **Apply Lime as Follows:** ____ #/acres or 138# /M Sq. Ft. or per soil test

4. **Fertilize:** __ pounds of _____ - _____N-P-K/ac.

   20 pounds of 10-10-10 N-P-K/M Sq. Ft. or per soil test

5. **Method of Applying Lime and Fertilizer:** Spread and work into the soil before seeding.

6. **Seed with the following mixture:**

Annual Rye-grass	50%
Timothy	25%
Winter Rye	25%

7. **Mulching Instructions:** Apply at the rate of tons per acre or 230 pounds per M. Sq. Ft.

8. **Application:**

Type	Unit#	Tons, Etc.
Total Lime	138	#/1,000 s.f.
Total Fertilizer	20	#/1,000 s.f.
Total Seed	1	#/1,000 s.f.
Total Mulch	230	#/1,000 s.f.
Total Other		

9. **Remarks:**

   For areas with slopes >10% and fall and winter erosion control areas, mulch netting shall be used per manufacturer's specifications.

   Permanent seeding should be made prior to September 1 or as a dormant seeding after the first killing frost and before the first snowfall. If seeding cannot be done within these seeding dates, temporary seeding and mulching shall be used to protect the site. Permanent seeding shall be delayed until the next recommended seeding period.

   Fertilizer requirements shall be subject to actual test results of the topsoil used for the project. The Contractor shall be responsible for providing topsoil test results for pH and recommended fertilizer application rates to the Owner.

   Seed mixture shall be fresh, clean, new crop seed. Seed may be mixed by an appropriate method on the site or may be mixed by the dealer. If the seed is mixed on the site, each variety shall be delivered in the original containers bearing the dealer's guaranteed analysis. If seed is mixed by the dealer, the Seeding Contractor shall furnish to the Owner the dealer's guaranteed statement of the composition of the mixture and the percentage of purity and germination of each variety.

   Seed shall be purchased from a recognized distributor and shall test to a minimum percentage of 95% for purity and 85% for germination.

   All loam shall have compost or peat admixtures to raise the organic content to 6%.

APPENDIX B

Sample Erosion Control Compliance Certification and Inspection Forms

MAINE CONSTRUCTION GENERAL PERMIT
CONTRACTOR/SUBCONTRACTOR CERTIFICATION

PROJECT INFORMATION

Project Name: 421 Warren Avenue Commercial Complex

Address: Portland, Maine

CONTRACTOR/SUBCONTRACTOR INFORMATION

Firm Name:

Address:

Telephone:

Type of Firm:

CERTIFICATION STATEMENT

"I certify under penalty of law that I understand the terms and conditions of the Maine Construction General Permit (MCGP) permit that authorizes the stormwater discharges associated with construction activity from the project site identified as part of this certification."

_____
Signature

_____
Typed Name

_____
Title

_____
Date

MAINE CONSTRUCTION GENERAL PERMIT

INSPECTION REPORT

PROJECT INFORMATION

Project Name: 421 Warren Avenue Commercial Complex

Address: Portland, Maine

INSPECTOR INFORMATION

Inspector Name: _____

Firm: _____

Title: _____

Qualifications: _____

Weather and Soil Conditions: _____

INSPECTION SUMMARY

Date of Inspection: _____

Major Observations: _____

_____

_____

_____

1. Attach the following to the Report:

   a. A description of the condition of the runoff at all points of discharge from the construction site and sampling to determine the NTU. This shall include identification of any *discharges* of sediment from the construction site. Include *discharges* from conveyance systems (i.e. pipes, culverts, ditches, etc.) and overland flow;

   b. A description of the condition of all natural surface water bodies located within, or immediately adjacent to, the property boundaries of the construction site which received runoff from disturbed areas. This shall include identification of any discharge of sediment to the surface water body;

   c. Identification of all erosion and sediment control practices that need repair or maintenance.

   d. Identification of all erosion and sediment control practices that were not installed properly or are not functioning as designed and need to be reinstalled or replaced;

   e. Description and sketch of areas that are disturbed at the time of the inspection and areas that have been stabilized (temporary and/or final) since the last inspection;

f. Current phase of construction of all post-construction stormwater management practices and identification of all construction that is not in conformance with the SWPP and technical standards;

g. Corrective action(s) that must be taken to install, repair, replace or maintain erosion and sediment control practices; and to correct deficiencies identified with the construction of the post-construction stormwater management practice(s); and

h. Digital photographs, with date stamp, that clearly show the condition of all practices that have been identified as needing corrective actions. The *qualified inspector* shall attach paper color copies of the digital photographs to the inspection report being maintained onsite within seven (7) calendar days of the date of the inspection. The *qualified inspector* shall also take digital photographs, with date stamp, that clearly show the condition of the practice(s) after the corrective action has been completed. The *qualified inspector* shall attach paper color copies of the digital photographs to the inspection report that documents the completion of the corrective action work within seven (7) calendar days of that inspection.

2. Within one business day of the completion of an inspection, the *qualified inspector* shall notify the owner the appropriate contractor or subcontractor of any corrective actions that need to be taken. The contractor or subcontractor shall begin implementing the corrective actions within one business day of this notification and shall complete the corrective actions in a reasonable time frame.

3. All inspection reports shall be signed by the *qualified inspector*. The inspection reports shall be maintained on site and distributed via email at the time of filing.

THE FACILITY IS IN COMPLIANCE WITH THE STORMWATER POLLUTION PREVENTION PLAN WITH THE FOLLOWING EXCEPTIONS:

_____

_____

_____

_____

ACTIONS NECESSARY TO BRING FACILITY INTO COMPLIANCE:

_____

_____

REQUIRED MODIFICATIONS TO STORMWATER POLLUTION PREVENTION PLAN (MUST BE SUBMITTED WITHIN 2 DAYS OF INSPECTION TO OWNER FOR APPROVAL):

_____

_____

_____

_____

CERTIFICATION STATEMENT:

"I certify under penalty of law that this document and all Appendices were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the systems, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of find and imprisonment for knowing violations."

_____
Signature

_____
Typed Name

_____
Title

_____
Date

APPENDIX C

DirtGlue™ Application and Use Requirements

DIRTGLUE™
APPLICATION INSTRUCTIONS FOR DUST CONTROL

METHODOLOGY

A. Heavy Duty Driving Surface

Application Rates (per surface acre)

DirtGlue™ Polymer Emulsion:	2,400 gallons/acre
Water:	3,600 -14,400 gallons/acre

Application Process

1. Loosen the existing soil using a scarifying attachment mounted on a grader (or similar piece of equipment) or a tractor with an agriculture disk attachment. If additional soil is required, it should be applied and mixed into the existing soil at this time. It is important to loosen the soil to ensure penetration of the DirtGlue™/water mixture into the soil.
2. Apply DirtGlue™/water mixture to soil using a water truck equipped with a gravity feed drip bar, spray bar, or automated distributor truck. Multiple passes will be necessary to get the desired amount of DirtGlue™ polymer emulsion for the specific application. Multiple passes will also ensure gradual, thorough saturation of the soil.
3. Thoroughly blend the DirtGlue™/water mixture into the soil with a rototiller, "S" harrow, or similar attachment. The soil must be evenly mixed and saturated with the DirtGlue™/water mixture to a depth of four (4") inches.
4. Grade the soil to finish grade with a grader, a small dozer or other suitable equipment.
5. Compact the soil with a vibratory roller. The final compaction should be greater than asphalt (Strive for 100% compaction, but always in excess of 95%).
6. Immediately after compacting, apply a topcoat of DirtGlue™ polymer emulsion to seal the road surface. In order to ensure a longer life and superior performance of the application, an additional coat should be applied between twenty four to forty eight hours after completion and then annually as an ongoing maintenance procedure. This topcoat should be applied at a rate of 250 gallons per surface acre.

B. Temporary Light Duty Driving Surface

This type of application will provide acceptable performance when used by cars and light trucks. It is not intended for constant use by heavy-duty trucks and/or tracked construction equipment. Areas that will be used by this type of equipment should be treated as a heavy-duty application as noted above.

Application Rates (per surface acre)

DirtGlue™ Polymer Emulsion:	1,200 gallons/acre
Water:	3,600-6000 gallons/acre

Application Process:

1. Loosen the existing soil for a depth of two (2") inches using a scarifying attachment mounted on a grader (or similar piece of equipment) or a tractor with a rototiller or agriculture disk attachment. If additional soil is required, it should be applied and mixed into the existing soil

at this time. It is important to loosen the soil to ensure penetration of the **DirtGlue™/**water mixture into the soil.

2. Apply **DirtGlue™/**water mixture to soil using a water truck equipped with gravity feed drip bar, spray bar, or automated distributor truck. Multiple passes will be necessary to get the desired amount of DirtGlue™ polymer emulsion for the specific application. Multiple passes will also ensure gradual, thorough saturation of the soil. Do not apply the **DirtGlue™/**water mixture so heavy as to create run-off.
3. Grade the soil to finish grade with a grader, a small dozer or other suitable equipment.
4. Compact with a vibratory roller. The final compaction should be greater than asphalt (Strive for 100% compaction, but always in excess of 95%).
5. Immediately after compacting, apply a topcoat of **DirtGlue™** polymer emulsion to seal the road surface. In order to ensure a longer life and superior performance of the application, an additional coat should be applied between twenty four to forty eight hours after completion and then again annually as an ongoing maintenance procedure.

C. Dust & Erosion Control (Non-driving Areas)

This type of application is intended for pedestrian use only. Vehicular use will break through the skin and adversely affect the performance of the application. Areas that will require any vehicular use should be treated as a light-duty application as noted above or retreated as traffic damage occurs.

Application Rates (per surface acre)

DirtGlue™ Polymer Emulsion:	300 gallons (windblown dust control) 600 gallons (bank stabilization, erosion/silt, run-off control)
Water:	2,000-6,000 gallons

Application Process

1. Apply *DirtGlue*™/water mixture to existing soil using a water truck equipped with a gravity feed spray bar or tank and pump (i.e. hydro seeder).
2. Add *DirtGlue*™ to water rather than water to *DirtGlue*™ or place a fill hose at bottom of tank, underneath surface of liquid to prevent foaming.
3. When applying *DirtGlue*™/water mixture, dispense large droplets. Avoid any fine mist. <u>The intent is to apply a sheet of liquid onto the soil</u>.
4. It is important to determine the moisture content of the soil prior to starting an application. The moisture content will have an effect on the dilution ratio of the *DirtGlue*™/water mixture. Your *DirtGlue*™ representative will assist you in determining the correct dilution ratio for the conditions on your site.
5. Temperature and, to a lesser extent, humidity have a significant effect on curing/drying time. Testing has shown that applications should be done only when the air temperature will be above 50° F for at least 72 hours following the application. Soil temperature must be above 40° F for several days.
6. The *DirtGlue*™ application must be protected from the rain until the curing process has formed a skin on the surface. Uncured *DirtGlue*™ is water soluble. If the application is exposed to rain before it has the opportunity to cure, the rainwater will dilute the polymer and wash it out of the soil. If this happens, the application will not be as strong.

CONDITIONS FOR USE OF DIRTGLUE™ (REGISTERED TRADEMARK OF DIRTGLUE™ ENTERPRISES)
APPROVED MATERIALS LIST

Applicant: DirtGlue™ Enterprises

General Conditions

1. DirtGlue™ Enterprises shall ensure that every applicator of DirtGlue™ is provided a copy of these conditions.

2. These Conditions do not override the need for any applicator to obtain permits (including DEP permits) or approvals that may be required (e.g., use associated with activities in or near regulated wetlands, surface waters, or other regulated natural resources).

3. DirtGlue™ shall only be used as stated in these conditions and shall not be mixed with any other chemicals, including petroleum products.

4. No application shall be conducted when the National Weather Service forecasts greater than 25% probability of precipitation in the application area to occur within 24 hours, or the temperature will drop below 35° F anytime within 24 hours after the application.

5. Applications shall not be conducted when the ground is saturated (due to precipitation or wetting) as defined by visible pools of water at or in the vicinity of the application, in order to prevent movement of DirtGlue™ beyond the shoulder of the road.

6. DirtGlue™ must not be applied or handled in a manner that could result in spillage or application within 100 feet of a wetland regulated by New York State, or 50 feet of all other water bodies and bridges.

7. Any spill which could enter the waters of the state shall be reported to the DEC Spills Hotline within two hours (1-800-457-7362). Any required response (including any needed cleanup) in addition to that being conducted shall then be determined by the DEC regional office.

8. The time of application shall be chosen to take meteorological conditions into account, to avoid significant potential airborne or odor impacts.

9. Prior to application, DirtGlue™ Material Safety Data Sheet shall be provided to applicators and others who would come in proximity or contact with the material.

APPENDIX H

INSPECTION & MAINTENANCE MANUAL FOR STORMWATER MANAGEMENT AND RELATED STORMWATER FACILITIES

INSPECTION AND MAINTENANCE MANUAL FOR STORMWATER MANAGEMENT AND RELATED STORMWATER FACILITIES

421 WARREN AVENUE COMMERCIAL COMPLEX PORTLAND, ME

PREPARED FOR:

PH WARREN AVENUE, LLC
401 WARREN AVENUE
PORTLAND, MAINE 04101

PREPARED BY:

FAY, SPOFFORD & THORNDIKE, INC.
778 MAIN STREET, SUITE 8
SOUTH PORTLAND, MAINE 04106
(207) 775-1121

APRIL 2014

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APPENDICES

I. SUMMARY

The proposed Warren Avenue Commercial Complex is subject to the City of Portland's Performance Standards for Stormwater Management, specifically, contained in Section 27-1536 of the City's Code of Ordinances. The responsibilities and requirements for monitoring and reporting a development's stormwater management system are more fully outlined on the following narrative. This Inspection and Maintenance Manual is intended to be a tool for reference by the development's owner/operator and their third party inspector as they perform required inspections and system maintenance.

II. INTRODUCTION

Relatively complex stormwater management facilities are commonly installed in development projects including commercial facilities, and many other developments. The complexity and goals of these systems vary with the nature of the receiving water, as well as the type of development. Runoff from developed areas of the project, including rooftops, paved or lawn areas typically contain materials that can impact the receiving waters. Source control and the installation of wet ponds, infiltration galleries, and green infrastructure practices often combined with pretreatment measures or followed by vegetated buffer strips, filtration, and other best management practices, can significantly reduce the non-point pollution discharge from the developed area. These measures are particularly important to projects in the watersheds of sensitive water bodies, or projects with potential impacts to groundwater. With the increased cost of land and development and operational costs, there is an increased tendency to construct portions of the stormwater management systems underground, to employ green infrastructure practices where practicable, and to enhance pretreatment devices to capture non-point contaminants as close to the source as possible.

The effectiveness of water quality management provisions and other components of the stormwater management system are dependent on the site setting, the design, upkeep, and maintenance to assure they meet their intended function over an extended period of years. It is critical that the stormwater management facilities are designed considering both the opportunities and constraints of the site be regularly inspected, and that maintenance is performed on an as-needed basis. It must also be recognized that the effectiveness of these formal treatment BMP's and their maintenance requirements, are related to the routine maintenance of effective source control, inspection, and maintenance of the stormwater drainage facilities that collect and transport the flow to the ponds, infiltration galleries, green infrastructure elements, and other treatment measures. Thus, maintenance should be directed to the total system, not just the primary stormwater management facility.

Figure 1 – Wetpond

The purpose of this document is to define, in detail, the inspection and maintenance requirements deemed necessary to assure that the stormwater management facilities function as intended when they were designed. This manual is specific to this site and the defined BMP's selected for application on this specific project. Subsequent sections identify individual maintenance items; give a brief commentary of the function and need for the item; a description of the work required;

and a suggested frequency of accomplishment. While the suggested programs and schedules must be adapted to specific projects, the material presented should provide guidance for a successful long-term program for operation and maintenance. A supplemental section provides guidance for construction monitoring of the facilities during their installation and more detailed checklists (Attachment D). Certain facilities are not intended to be placed in service until the tributary catchment area has the permanent cover in place and any contributing turf areas have achieved a 90% catch of vegetation (i.e. established). This manual discusses the specific measures designed and intended to be featured in this project.

A. GUIDELINES OVERVIEW

A summary of the individual components of stormwater management facilities has been prepared. The format used in the summary is as follows:

Preface: A general description of what function/benefit the element is intended to provide. This is a short summary and not intended to provide the design basis, which can be found in other sources.

Inspection: This section provides the inspection requirements for the individual component.

Maintenance: The section provides general information on the routine maintenance requirements of this element.

Frequency: This section outlines the frequency of maintenance on the system as recommended by the designer.

Comments: This section provides any particular comment on the site-specific features of this element. This is a summary only. The owner/operator should review the design drawings and documents carefully to understand the particular elements of the project. The end of this section should allow the owner/operator to make notes on the specific program. This may include the selected maintenance procedure, cross-references to applicable design drawings, etc.

A list of the individual inspection/maintenance elements is provided in the table of contents. The guidelines are proposed for initial use with adjustments made as appropriate based upon specific project experience.

III. PROJECT OVERVIEW

Key permits issued (or applied for) on the project include:

- City of Portland Site Plan
- Maine Department of Environmental Protection Maine Construction General Permit.

The permit applications pending for the project include the design information for the stormwater system.

A copy of the permits and Stormwater Management Report should be appended to this manual as Attachment B. The Owner/Operator of the stormwater management system should review these permits for a general description and background of the project, as well as any specific permit conditions or requirements of the project.

The applicant has retained Fay, Spofford & Thorndike for civil engineering for the new commercial building located at 421 Warren Avenue in Portland, Maine. Fay, Spofford & Thorndike has prepared the design for the stormwater management facilities and may be contacted at:

Fay, Spofford & Thorndike
778 Main Street, Suite 8
South Portland, Maine 04106
Tel. (207) 775-1121

It is recommended the preparer of the plan be contacted with any particular questions on the design intent or similar issues. This plan includes measures for Green Infrastructure elements including gravel wetlands.

The Owner/Operator of the plan will be:

PH Warren Avenue, LLC
401 Warren Avenue
Portland, Maine 04101
Tel. 207-878-4496

The applicable plans/design documents, which apply to the project, are:

1. Site Plans/Permit Applications
2. The Erosion Control/Sedimentation Control Plan for the project.
3. The Stormwater Management Plan for the project.

A copy of these documents should be retained with the manual.

The proposed design will include gravel wetlands, sediment forebays, collection and conveyance discharge systems and drainage swales.

IV. STANDARD INSPECTION/MAINTENANCE DESCRIPTIONS

The following narratives describe the inspection/maintenance provisions for the Stormwater Management area. These O&M procedures will complement scheduled source control sweeping of the pavement areas and routine maintenance of the cover in the drainage catchment controlled by the applicant. Source control includes not over-salting the parking field and access roadway which can be encouraged in the design process by maintaining adequate grades to avoid ponding and icing, and generally maintaining the surfaces free of litter and deleterious debris. This also includes elements such as repair of winter damage that can expose cover material to erosion, to maintaining good cover in vegetated areas, to maintaining landscape materials which can reduce storm water flows through inception and evapotranspiration. Proper O&M is necessary to make sure the system will provide its intended purpose of conveying runoff, removing a substantial amount of the suspended solids, and other contaminants in the stormwater runoff.

A. GRAVEL WETLANDS

Preface: Gravel wetlands are designed horizontal flow-through treatment cells that are preceded by a sediment basin used to treat/detain flow on a site. Gravel wetlands are utilized on sites that are flat because they do not require as much hydraulic head as a typical bio-retention cell or under-drain soil filter.

Inspection: 1st year Post Construction: Inspect and confirm that system drains within 24-48 hours to make sure water quality controls are working properly after significant rain events. Inspecting vegetation (especially during the first growing season) to ensure vegetation is growing adequately. Quarterly inspection of soil and repairing eroded areas especially on slopes in necessary. Checking inlets, outlets and overflow spillways are also necessary on a regular basis.

General Post Construction: Inspect filter surface for dense, complete root mat establishment across wetland surface. Inspect gravel wetland surface for water or other evidence of gravel wetland risers clogging.

Maintenance: Plants need to be watered as necessary especially during first growing season. Areas of poor growth may need to be re-vegetated. Any vegetation that appears diseased needs to be treated. Removal of any trash and debris should be removed from sediment forebay as needed. Sediment should be removed from sediment forebay when it accumulates to a depth of 12 inches or 10% of pretreatment volume. Sediment should be removed from gravel wetland cells when sediment depth is greater than 3 inches.

Frequency: Gravel wetlands shall be inspected regularly during the first year after construction to ensure that device is working properly. After the first year of construction the gravel wetland system shall be inspected every 6 months.

Design Guidelines: The Gravel wetlands for the Warren Avenue commercial building have been designed based on the assumption that they will be inspected and maintained according the criteria laid out. Failure to do so will cause the system to function incorrectly.

B. VEGETATED SWALES

Preface*:* Vegetated swales are often used to convey stormwater. Swales can be intended to be part of a green infrastructure system and may be:

1. Mowed and maintained
2. Reverted to wetlands
3. Naturalized

Inspection*:* Swales should be inspected for erosion and sedimentation and examined for deleterious material that could clog downstream inlets.

Maintenance*:* Eroded or silted channels need to be repaired when discovered. If erosion is a problem, the swale design should be examined. Likewise, if situation is a continuing problem, the upgradient conditions should be assumed.

Frequency*:* It is recommended vegetated swales be inspected quarterly until vegetation is established and a year after installation. Thereafter, if no problems have been noticed, the frequency can be reduced to once per year.

Design Guidelines*:* The vegetated swale should consider channel cover at the time of concentration as well as several years after construction.

Design computations should state the assumed channel of vegetation and provide the basis for the Manning's or other roughness coefficient and for design.

Applicability*:* The Warren Avenue facility will have minor open channel systems as shown on the drainage and stormwater management plans.

VEGETATED SWALE WITH HAY BALE CHECK DAM TO REDUCE VELOCITIES UNDER CONSTRUCTION

C. TRIBUTARY DRAINAGE SYSTEM

Preface: Stormwater from some of the project will be directed through a conveyance system which transports the flow ultimately to its discharge location. This conveyance system will be principally overland flow and a limited amount of piped drain systems. Most of the sediment carried by the drainage system is intended to be trapped in sediment sumps in structures. Maintenance of this system can play a major role in the long-term maintenance costs and the effectiveness of the stormwater management system.

Inspection: The tributary drainage system should be periodically inspected to assure that it is operating as intended, and that its carrying capacity has not been diminished by accumulations of debris and sediment or other hydraulic impediments. On piped systems the inlets must be inspected to ensure the rims are set at the proper elevation to optimize flow entry and are not clogged with leaves or other debris. The inlet basins are normally equipped with sumps fitted with hooded outlets, which will remove large sediment particles from the flow stream.

The level of sediment in the sumps should be checked to assure their effectiveness. Pipelines connecting the inlets should be checked to determine if siltation is occurring. This will be most critical on drain lines laid at minimal slopes. This can usually be accomplished by a light and mirror procedure.

In some projects most of the stormwater is carried in open swales, channels, or ditches. These conveyance channels may be rip rapped or vegetated, depending on the gradient and expected flow velocities. These facilities must be inspected to insure debris or sedimentation does not reduce their carrying capacity. Excess vegetative growth must

also be noted. The surface protection for the channels, either stone or vegetation, must be inspected to insure its integrity. Any areas subject to erosion should be noted.

Maintenance: Maintenance of the storm drainage system must assure that it continues to serve its design function on a long-term basis, and that its operation does not transport excessive sedimentation to any downstream receiving waters. Elevations on the rim of catch basins should be adjusted as needed to assure optimal water entry. Depending on the frost susceptibility of the soil, the rims may become elevated over time causing flow to circumvent the inlet. When the filter bag in an inlet restricts capacity and is coated with silt or other deleterious materials, the bag should be removed and catch basin cleaning would normally be accomplished with vacuum trucks contracted as a maintenance service for the site. The removed material must be disposed of at an approved site for such materials.

If sediment in the pipeline exceeds 20% of the diameter of the pipe, it should be removed. This may be accomplished by hydraulic flushing, or by mechanical means. If hydraulic flushing is used the downstream conditions should be analyzed. In general a sump or sediment trap should be used to capture flushed sediment for removal.

Frequency: The piped drainage system should be inspected on an annual basis. Adjustment of inlet rim elevations should be on an as needed basis. Cleaning catch basin sumps and pipelines will depend on the rate of accumulation.

Maintenance/Inspection Responsibility:

Maintenance Personnel: PH Warren Avenue, LLC

Special Services: The owner may elect to contract with an independent agent for cleaning or replacement of components of the drainage system. Remedial source control measures may be performed by the owner or an outside service depending upon the nature of the particular situation.

D. LITTER

Litter should be removed as a matter of course by workers and be a part of the grounds maintenance contract.

E. SUMMARY CHECKLIST

The above described inspection and maintenance items have been summarized on a checklist attached hereto as Attachment C.

V. PROGRAM ADMINISTRATION

A. GENERAL

A reliable administrative structure must be established to assure implementation of the maintenance programs described in the foregoing section. Key factors that must be considered in establishing a responsive administrative structure include:

1. Administrative body must be responsible for long-term operation and maintenance of the facilities.

2. Administrative body must have the financial resources to accomplish the inspection and maintenance program over the life of the facility.

3. The administrative body must have a responsible administrator to manage the inspection and maintenance programs.

4. The administrative body must have the staff to accomplish the inspection and maintenance programs, or must have authority to contract for the required services.

5. The administrative body must have a management information system sufficient to file, retain, and retrieve all inspection and maintenance records associated with the inspection and maintenance programs.

If any of the above criteria cannot be met by the entity assigned inspection and maintenance responsibilities, it is likely that the system will fail to meet its water quality objectives at some point during its life. While each of the above criteria may be met by a variety of formats, it is critical to clearly establish the assigned administrative body in a responsible and sustainable manner.

B. RECORD KEEPING

Records of all inspections and maintenance work accomplished must be kept and maintained to document facility operations. These records should be filed and retained for a minimum 5-year time span. The filing system should be capable of ready retrieval of data for periodic reviews by appropriate regulatory bodies. Where possible, copies of such records should also be filed with the designated primary regulatory agency for their review for compliance with permit conditions. Typical inspection and maintenance record forms are attached hereto as Attachment B.

C. CONTRACT SERVICES

In some instances or at specific times, the Maintenance Personnel may not have the staff to conduct the required inspection and/or maintenance programs as outlined in this document. In such cases the work should be accomplished on a contractual basis with a firm or organization that has the staff and equipment to accomplish the required work.

The service contract for inspection and maintenance should be formal, well written legal document which clearly defines the services to be provided, the contractual conditions that will apply, and detailed payment schedules. Liability insurance should be required in all contracts.

ATTACHMENT A

Sample Inspection Logs

WARREN AVENUE COMMERICAL COMPLEX
PORTLAND, ME

STORMWATER MANAGEMENT
FACILITIES POND
ANNUAL INSPECTION & MAINTENANCE LOG

FACILITY:		**YEAR:**	
LOCATION:		**CONTRACTOR:**	
FUNCTION:		**INSPECTOR:**	
DATE OF INSPECTION:			
ITEM IDENTIFICATION	**DESCRIPTION OF CONDITIONS**	**MAINTENANCE ACCOMPLISHED**	**DATE OF MAINTENANCE**
GENERAL COMMENTS:			

WARREN AVENUE COMMERCIAL COMPLEX
PORTLAND, ME

STORMWATER MANAGEMENT
MONTHLY INSPECTION & MAINTENANCE LOG

FACILITY:			YEAR:			
LOCATION:			CONTRACTOR:			
FUNCTION:						
				OVERFLOW WEIR		
MONTH	DAY	INSPECTOR	WATER DEPTH	CLEAR	DEBRIS	WEIR CONDITION
JANUARY						
FEBRUARY						
MARCH						
APRIL						
MAY						
JUNE						
JULY						
AUGUST						
SEPTEMBER						
OCTOBER						
NOVEMBER						
DECEMBER						
LIST SPECIAL MAINTENANCE UNDERTAKEN:						

WARREN AVENUE COMMERCIAL COMPLEX
PORTLAND, ME

STORMWATER MANAGEMENT
SEMI-ANNUAL INSPECTION & MAINTENANCE LOG

SEMI-ANNUAL INSPECT 1.2	FACILITY:
DATE:	LOCATION:
INSPECTOR:	FUNCTION:
WEIR CONDITION:	
OUTLET CONDITION	

FORE BAY SUMP	EST. DEPTH SED.	REMOVED? Y/N	EST. VOL. CY	WHERE DISPOSED OF	STRUCTURAL CONDITION

CONTROL STRUCTURE:
DESCRIBE CONDITIONS FOUND & MAINTENANCE ACCOMPLISHED:

ATTACHMENT B

Permits for Project

(To be Added at a Subsequent Time)

ATTACHMENT C

Summary Checklist
Inspection and Maintenance

Stormwater Management System Maintenance Program – Summary Checklist						
		Frequency				
Item	**Commentary**	**Monthly**	**Quarterly**	**Semi-Annual**	**Annual**	**Long Term**
Tributary Drainage	Inspect to assure that the carrying capacity has not been diminished by debris, sediment or other hydraulic impediments.				X	
Vegetated Swales	Swales should be inspected for erosion and sedimentation		X (until vegetation established)		X	
Parking Lot Cleaning	Parking lot is to be swept at mid winter and spring. Power washing with an appropriate vacuum/power wash vehicle to be done twice a year.			X		
Litter	Litter should be removed daily.					
Berms	Inspect berms for sags, sloughing, or erosion and undesirable tree growth. Mow berm slope to control vegetation repair structure flaws upon identification.	Mow X Summer			X	
Submerged Pipelines and Sediment Storage Manholes	The pipeline should be inspected quarterly		X			