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**STORMWATER MANAGEMENT REPORT**  
**118 on MUNJOY HILL**  
**PORTLAND, MAINE**

**January 2, 2014**

This site is located at the top of Munjoy Hill. There are no upstream flows to consider. The current site has 9,131 sq. ft. of impervious surface. The new development will have 9,514 sq. ft. of impervious surface. This increase is considered minor in the City's standards. No treatment or flow control is required.

The direct connection of the roof drains to the city's sewer has the potential to cause peak flow issues. In response to City Staff comments we have developed a management system to address the concerns.

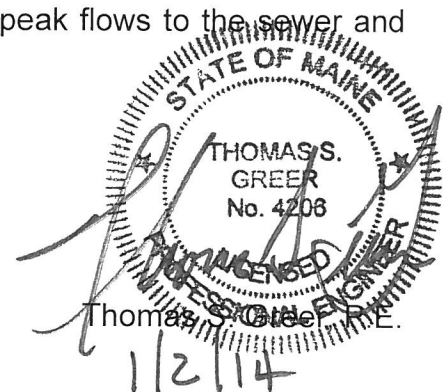
The roof drains will be connected to the garden area on the east end of the building. The area will consist of two feet of crushed stone and one foot of open storage. The roof leader will discharge to a 6" diameter perforated pipe loop, located below the ground surface. This discharge to the crushed stone bed will allow for some infiltration to the ground for small storms. Large storms will overflow to a field inlet that will discharge to the sewer in St. Lawrence Street.

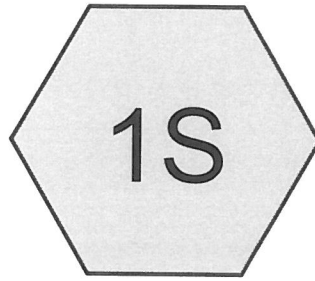
Borings were done for the foundation design. B-2 was located in close proximity to the garden system. It shows granular material that will be suitable for infiltration. An infiltration rate of 6" to 12" per hour was selected to analyze the system; a rate of 0.1 cfs approximates that rate.

Attached are HydroCad calculations for the 2, 10, and 25 year storm events to be infiltrated. Larger storms will have a slight discharge to the sewer, generally after the peak of the storm. Below is a discharge rate table for flows off the roof and to the sewer:

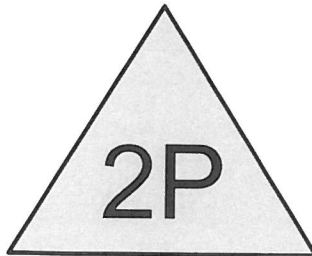
Rate Table		
	Roof Flow	Sewer Flow
2 Year Storm	0.63 cfs	0.0 cfs
10 Year Storm	0.99 cfs	0.24 cfs
25 Year Storm	1.17 cfs	0.46 cfs

This system, as designed meets the goals of reduced peak flows to the sewer and reduced total volumes.

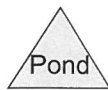




ROOF



GARDEN SYSTEM



**Summary for Subcatchment 1S: ROOF**

Runoff = 0.63 cfs @ 12.06 hrs, Volume= 0.045 af, Depth> 2.59"

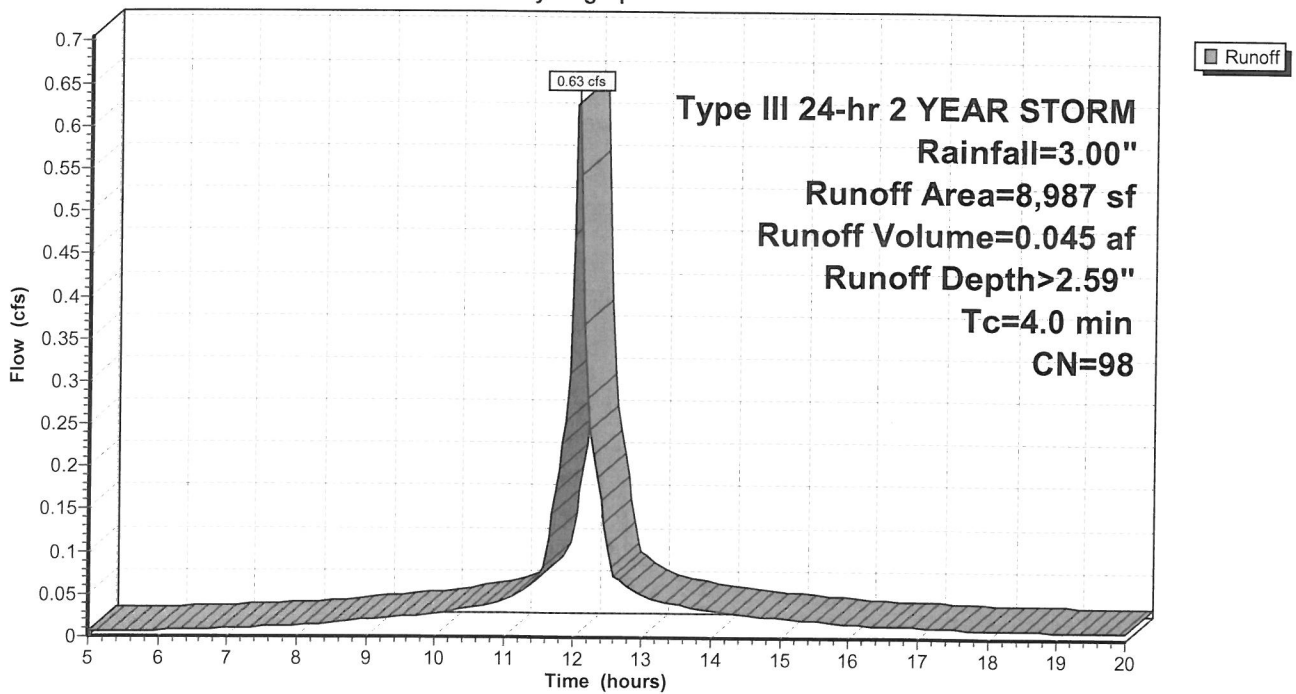
Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
 Type III 24-hr 2 YEAR STORM Rainfall=3.00"

Area (sf)	CN	Description
* 8,987	98	ROOF
8,987		100.00% Impervious Area

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

**Subcatchment 1S: ROOF**

Hydrograph



**Summary for Pond 2P: GARDEN SYSTEM**

Inflow Area = 0.206 ac, 100.00% Impervious, Inflow Depth > 2.59" for 2 YEAR STORM event  
 Inflow = 0.63 cfs @ 12.06 hrs, Volume= 0.045 af  
 Outflow = 0.10 cfs @ 11.65 hrs, Volume= 0.045 af, Atten= 84%, Lag= 0.0 min  
 Discarded = 0.10 cfs @ 11.65 hrs, Volume= 0.045 af  
 Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
 Peak Elev= 146.01' @ 12.52 hrs Surf.Area= 560 sf Storage= 540 cf

Plug-Flow detention time= 31.3 min calculated for 0.044 af (100% of inflow)  
 Center-of-Mass det. time= 31.0 min ( 768.7 - 737.7 )

Volume	Invert	Avail.Storage	Storage Description
#1	144.00'	1,092 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
144.00	168	0	0
145.00	168	168	168
146.00	560	364	532
147.00	560	560	1,092

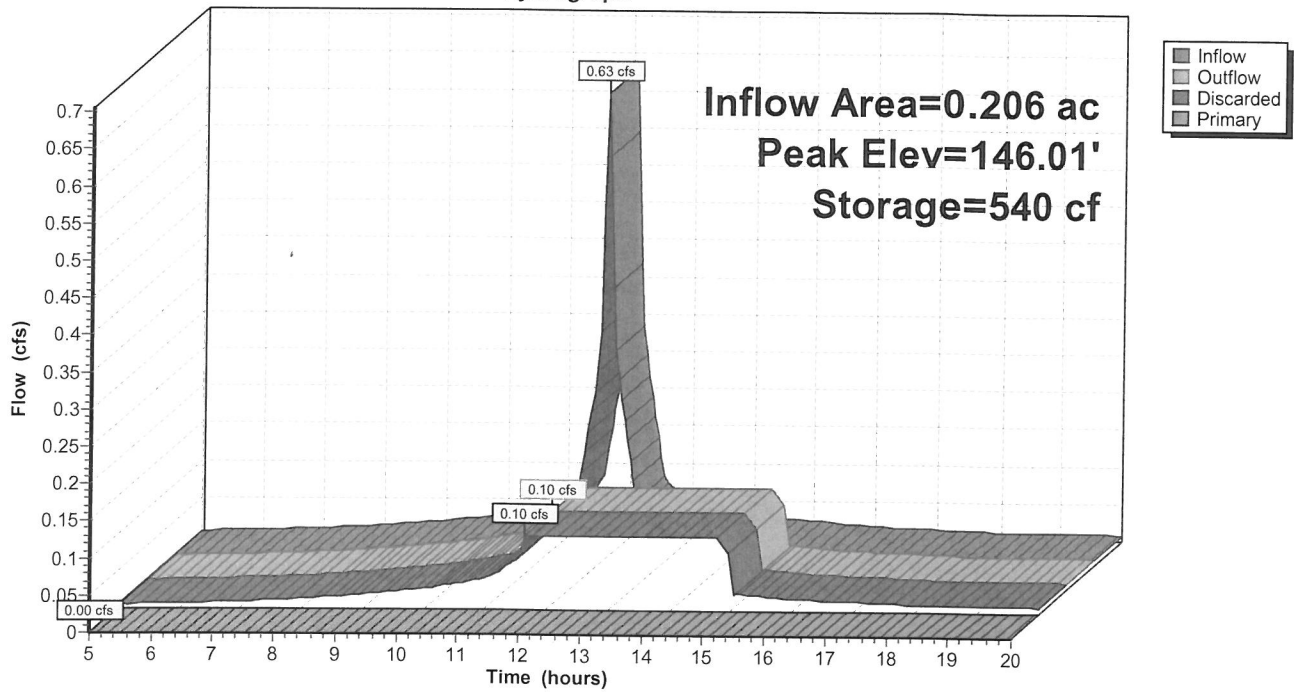
Device	Routing	Invert	Outlet Devices
#1	Discarded	144.00'	<b>0.10 cfs Exfiltration at all elevations</b>
#2	Primary	146.80'	<b>1.5" x 1.5" Horiz. Orifice/Grate X 81.00</b> C= 0.600 Limited to weir flow at low heads

**Discarded OutFlow** Max=0.10 cfs @ 11.65 hrs HW=144.04' (Free Discharge)  
 ↑1=Exfiltration (Exfiltration Controls 0.10 cfs)

**Primary OutFlow** Max=0.00 cfs @ 5.00 hrs HW=144.00' (Free Discharge)  
 ↑2=Orifice/Grate ( Controls 0.00 cfs)

### Pond 2P: GARDEN SYSTEM

Hydrograph



**Summary for Subcatchment 1S: ROOF**

Runoff = 0.99 cfs @ 12.06 hrs, Volume= 0.071 af, Depth> 4.15"

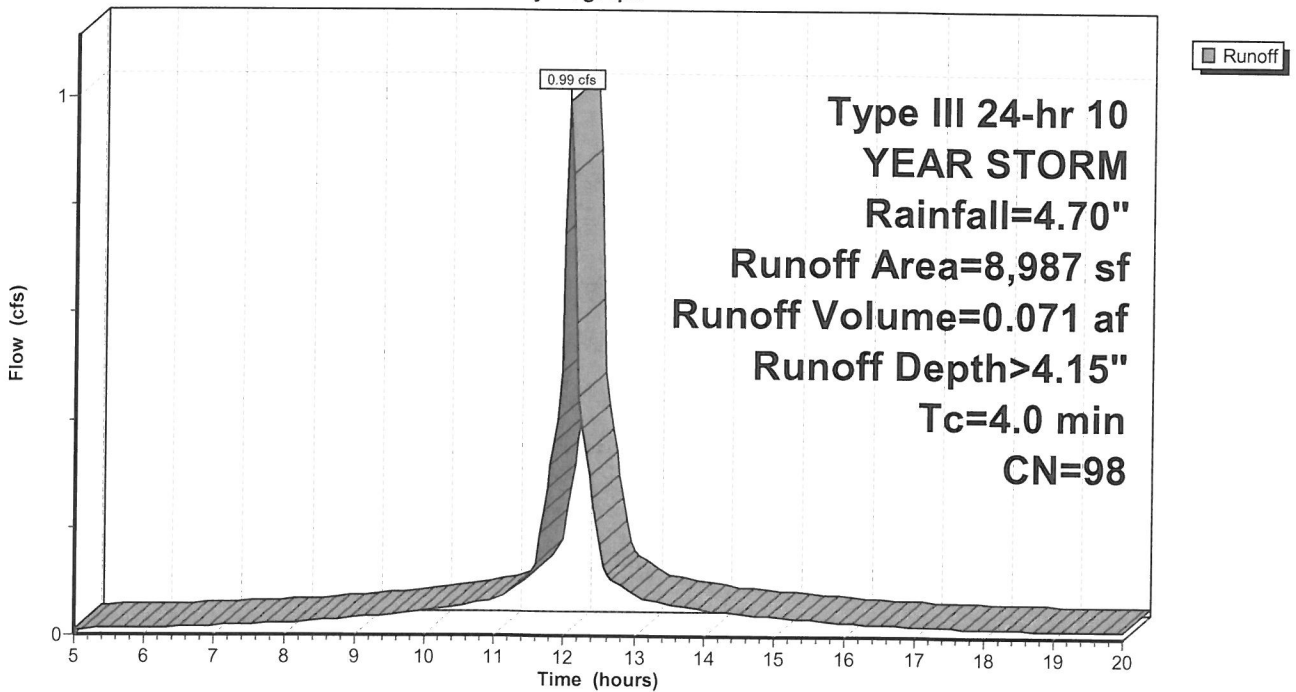
Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
 Type III 24-hr 10 YEAR STORM Rainfall=4.70"

Area (sf)	CN	Description
* 8,987	98	ROOF
8,987		100.00% Impervious Area

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

**Subcatchment 1S: ROOF**

Hydrograph



**Summary for Pond 2P: GARDEN SYSTEM**

Inflow Area = 0.206 ac, 100.00% Impervious, Inflow Depth > 4.15" for 10 YEAR STORM event  
 Inflow = 0.99 cfs @ 12.06 hrs, Volume= 0.071 af  
 Outflow = 0.34 cfs @ 12.41 hrs, Volume= 0.071 af, Atten= 66%, Lag= 20.9 min  
 Discarded = 0.10 cfs @ 11.45 hrs, Volume= 0.069 af  
 Primary = 0.24 cfs @ 12.41 hrs, Volume= 0.002 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
 Peak Elev= 146.81' @ 12.41 hrs Surf.Area= 560 sf Storage= 987 cf

0.01 over rim

Plug-Flow detention time= 65.3 min calculated for 0.071 af (100% of inflow)  
 Center-of-Mass det. time= 64.9 min ( 798.9 - 734.0 )

Volume	Invert	Avail.Storage	Storage Description
#1	144.00'	1,092 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
144.00	168	0	0
145.00	168	168	168
146.00	560	364	532
147.00	560	560	1,092

Device	Routing	Invert	Outlet Devices
#1	Discarded	144.00'	<b>0.10 cfs Exfiltration at all elevations</b>
#2	Primary	146.80'	<b>1.5" x 1.5" Horiz. Orifice/Grate X 81.00</b> C= 0.600 Limited to weir flow at low heads

**Discarded OutFlow** Max=0.10 cfs @ 11.45 hrs HW=144.03' (Free Discharge)

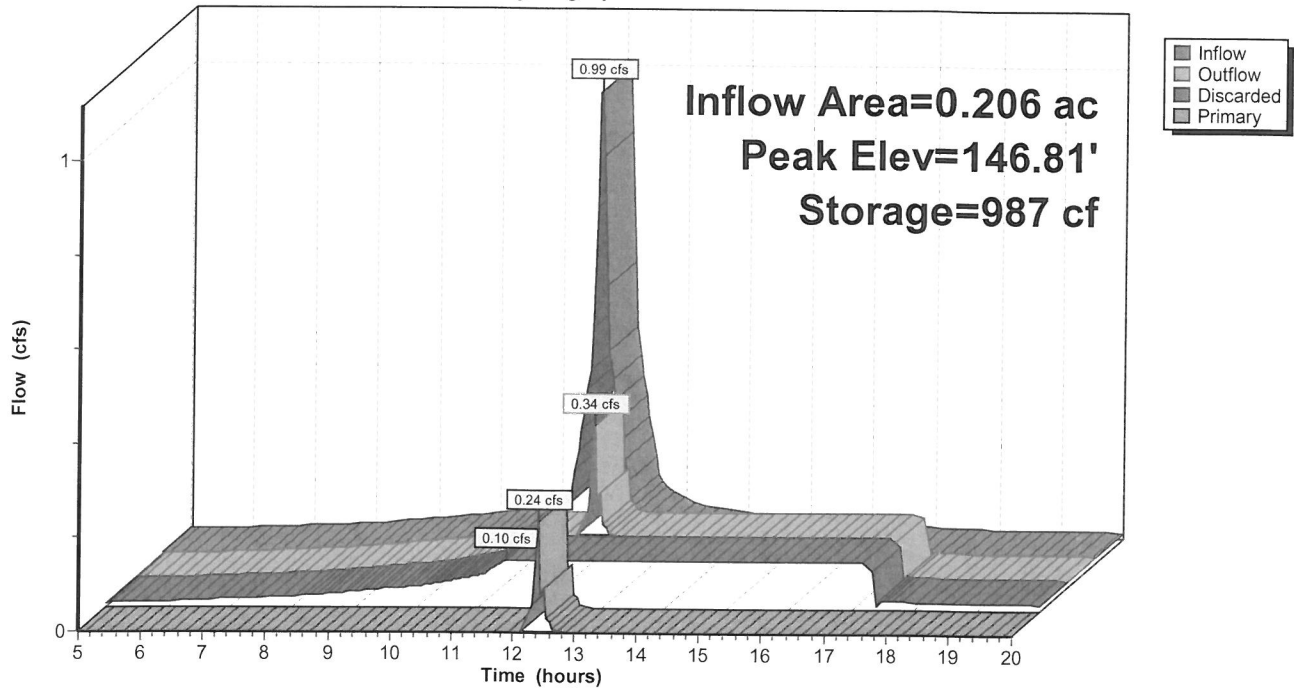
↳ **1=Exfiltration** (Exfiltration Controls 0.10 cfs)

**Primary OutFlow** Max=0.17 cfs @ 12.41 hrs HW=146.81' (Free Discharge)

↳ **2=Orifice/Grate** (Weir Controls 0.17 cfs @ 0.35 fps)

### Pond 2P: GARDEN SYSTEM

Hydrograph





**Summary for Subcatchment 1S: ROOF**

Runoff = 1.17 cfs @ 12.06 hrs, Volume= 0.084 af, Depth> 4.87"

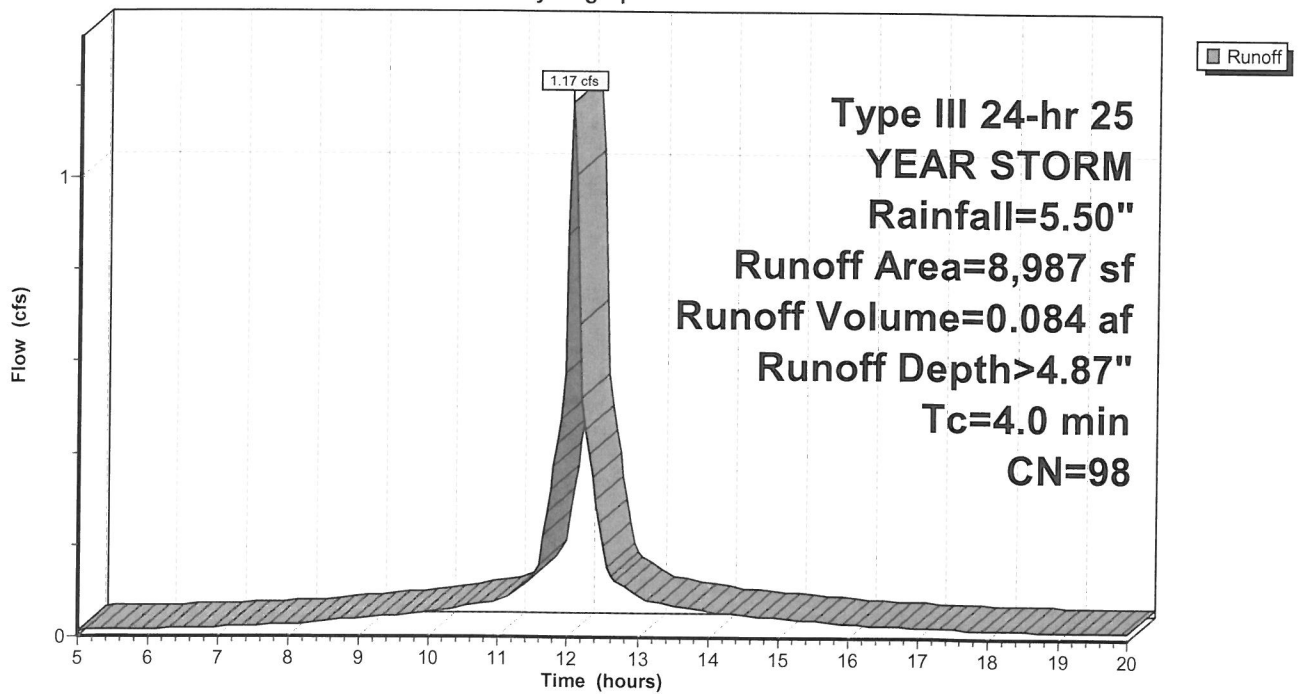
Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
 Type III 24-hr 25 YEAR STORM Rainfall=5.50"

Area (sf)	CN	Description
* 8,987	98	ROOF
8,987		100.00% Impervious Area

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

**Subcatchment 1S: ROOF**

Hydrograph



**Summary for Pond 2P: GARDEN SYSTEM**

Inflow Area = 0.206 ac, 100.00% Impervious, Inflow Depth > 4.87" for 25 YEAR STORM event  
 Inflow = 1.17 cfs @ 12.06 hrs, Volume= 0.084 af  
 Outflow = 0.56 cfs @ 12.22 hrs, Volume= 0.084 af, Atten= 52%, Lag= 9.6 min  
 Discarded = 0.10 cfs @ 11.25 hrs, Volume= 0.075 af  
 Primary = 0.46 cfs @ 12.22 hrs, Volume= 0.008 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
 Peak Elev= 146.82' @ 12.20 hrs Surf.Area= 560 sf Storage= 992 cf

Plug-Flow detention time= 62.2 min calculated for 0.083 af (100% of inflow)  
 Center-of-Mass det. time= 61.8 min ( 795.0 - 733.1 )

Volume	Invert	Avail.Storage	Storage Description
#1	144.00'	1,092 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
144.00	168	0	0
145.00	168	168	168
146.00	560	364	532
147.00	560	560	1,092

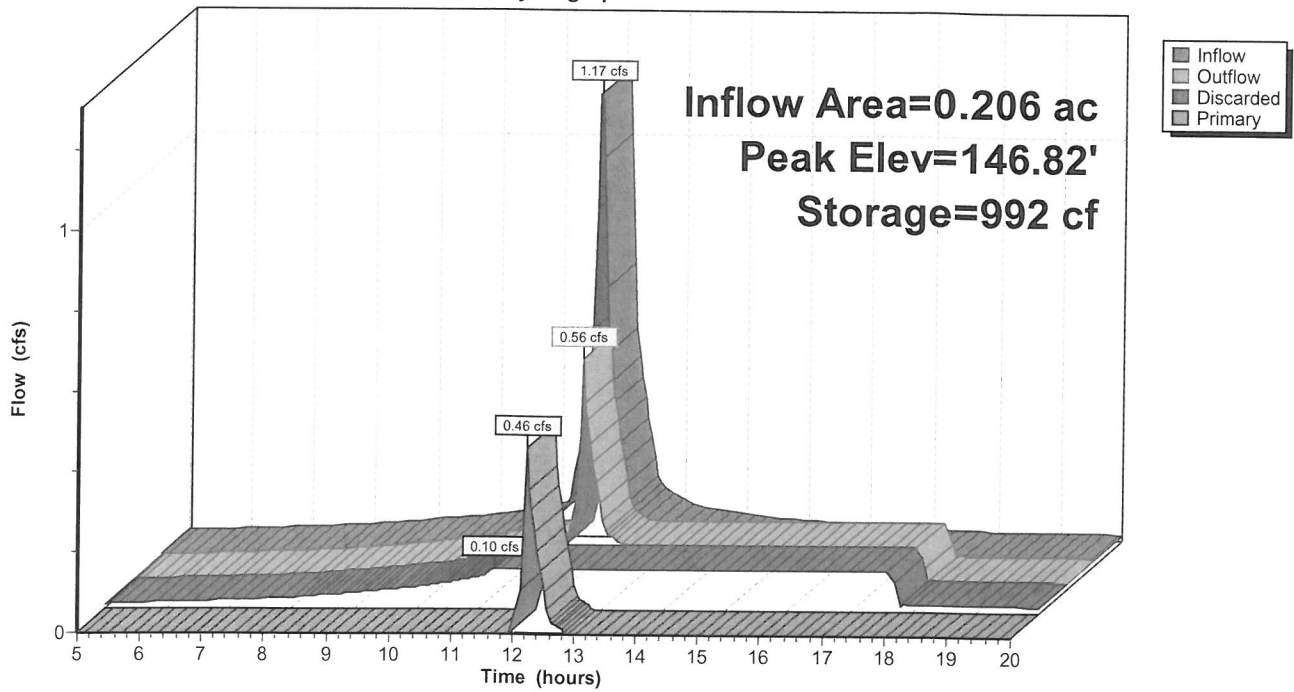
Device	Routing	Invert	Outlet Devices
#1	Discarded	144.00'	<b>0.10 cfs Exfiltration at all elevations</b>
#2	Primary	146.80'	<b>1.5" x 1.5" Horiz. Orifice/Grate X 81.00</b> C= 0.600 Limited to weir flow at low heads

**Discarded OutFlow** Max=0.10 cfs @ 11.25 hrs HW=144.03' (Free Discharge)  
 ↑1=Exfiltration (Exfiltration Controls 0.10 cfs)

**Primary OutFlow** Max=0.40 cfs @ 12.22 hrs HW=146.82' (Free Discharge)  
 ↑2=Orifice/Grate (Weir Controls 0.40 cfs @ 0.47 fps)

### Pond 2P: GARDEN SYSTEM

Hydrograph



**Tom Greer**


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**From:** Bill Peterlein [bpeterlein@summitgeoeng.com]  
**Sent:** Tuesday, December 17, 2013 12:00 PM  
**To:** Tom Greer  
**Subject:** RE: 118 congress St Geo report  
**Attachments:** Bill Peterlein.vcf

The fill soil at the site is of variable composition.

Based on the grain size test at the B2 location, I estimate an infiltration rate of about 14 in/hr.

Some of the areas where the fill is finer (e.g. B4), my guess is 5 in/hr. So that gives you a range.

The glacial till has a very low infiltration rate and would not work well for infiltration – best to keep the system in the fill.

Groundwater separation obviously is not an issue.

Please contact me if I have left anything out or you have additional questions.

Thanks  
 Bill

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 145 Lisbon St, Suite 601, Lewiston, Maine 04240  
 (207) 576-3313

*0.1 CFS USED TO APPROXIMATE  
 RATE OF INFILTRATION.*

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**From:** Tom Greer [mailto:TGreer@pinkhamandgreer.com]  
**Sent:** Tuesday, December 17, 2013 9:16 AM  
**To:** Bill Peterlein  
**Subject:** RE: 118 congress St Geo report

Hi Bill,

The City has asked us to look at doing something with the roof water besides a direct discharge to the sewer. The soils seem to be fairly permeable. Do you have a guess at what an infiltration rate might be?

**Tom Greer**

Pinkham and Greer, Consulting Engineers  
 207-781-5242 voice, 207-781-4245 fax  
 tgreer@pinkhamandgreer.com

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**From:** Bill Peterlein [mailto:bpeterlein@summitgeoeng.com]  
**Sent:** Thursday, December 12, 2013 9:07 PM  
**To:** Ed Theriault  
**Cc:** David Lloyd; Tom Greer  
**Subject:** 118 congress St Geo report

Goetech report attached.

Please contact me with any questions.