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SOMERVILLE, MA 02145
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2012 APR -2 PM 3:18

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68 PLEASANT STREET
NEWBURYPORT, MA 01950
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Drainage Report

For

The Beacon Street Hotel

369 Beacon Street

Somerville, MA

March 12, 2012



Prepared for:
Makrigiannis Fuel, LLC
DCI Project #2009-009

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ATTACHMENTS

Figure 1 – Existing Catchment Areas

Figure 2 – Proposed Catchment Areas

Drainage Calculations

4:1 Inflow/Infiltration Calcs

INTRODUCTION

Makrigiannis Fuel, LLC proposes the development of the property at 369 Beacon Street in Somerville, MA. The site is zoned Business District A and is located at the intersection of Somerville Avenue and Beacon Street. The MBTA tracks abut the property on the northeast side. The existing parcel covers 9,670 square feet (0.22 acres). There is a one-story, abandoned, concrete block service station on the site with two gas pump stations, also not in use. The remainder of the site is primarily paved with asphalt or concrete.

EXISTING CONDITION

Like many small urban sites, the existing stormwater runoff characteristics for this site are fairly simple. The site is 100% impervious and is entirely pitched towards Beacon Street where surface flow crosses the sidewalk into the gutter and eventually into the 48" brick combined sewer in the middle of Beacon Street. Roof drainage is connected to a small drywell. The drywell has a capacity of approximately 500 gallons and is in fair condition. When the drywell has reached capacity, the roof overflows to the surrounding pavement and sheetflows into Beacon Street. See Figure 1, attached.

SOILS

The NRCS Web Soil Survey characterizes the soil at the site as predominantly Urban Land and does not specify a Hydrologic Soil Group.

For calculation purposes, a Hydrologic Soils Group of C was used for all subsurface soils. Per the Massachusetts Stormwater Handbook, Table 2.3.3 1982 Rawls Rates, an infiltration rate of 0.27 in/hr has been used in the hydrologic model. Groundwater is not anticipated to be an issue because the site sits more than 15 feet above the MBTA tracks, to the immediate north.

PROPOSED CONDITION

The proposed development includes the demolition of the existing service station and the construction of a new four-story hotel. A driveway on the south side of the building will access a parking facility under the building. A landscaped courtyard is proposed for the northern corner of the site. The courtyard introduces some landscaping, including planters, to the currently 100% impervious site. For the purpose of this report, in an effort to design conservatively, this area is modeled as semi-impervious.

While the proposed condition collects the stormwater onsite, its destination remains the same 48" combined sewer in Beacon Street. The plan utilizes an existing connection identified on a sewer plan for Beacon and Elm Street, dated April 2, 1877. See Figure 2, attached.

Drainage:

Drainage calculations were conducted to evaluate peak discharges from the project site under the pre-development and post-development conditions. As required under the City

of Somerville's Stormwater Management Policy, peak discharges under post-development condition will be less than the pre-development conditions. Also, the 4:1 Inflow/Infiltration requirement is far exceeded. Calculations are attached. 2012 APR -2 PM 3:18

The proposed stormwater management system consists of collecting and detaining stormwater onsite prior to discharging it through an existing connection to the 48" combined sewer in Beacon Street. The roof makes up the vast majority of the overall site area and will be utilized to detain and release stormwater at a controlled rate. The roof will be capable of holding a maximum of 6-inches of water before overflowing through scuppers at its perimeter. However, the model shows that no overflow will occur in the 100 year storm event. The remaining areas are the courtyard and the driveway. The courtyard is proposed to be constructed with pervious materials. Drywell will collect runoff from this small area and recharge stormwater back into the ground. The driveway, as it is ramping down to the garage under, must be pumped to structure where it can gravity feed to the existing connection to the 48" combined sewer. Water quality for the driveway runoff is considered to be unnecessary due to its limited area and because vehicles will not be parking in the driveway.

HYDROLOGIC MODEL

The hydrologic model used for this analysis is based upon the SCS Method. Both existing and proposed conditions are modeled for the 2-year, 10-year, 25-year and 100-year storm events. The SCS Method allows for variable rainfall intensity throughout the storm duration, peaking near the middle of the Type III, 24-hour storm. The drainage area's time of concentration (t_c), assumed to be six minutes for this site.

The designed on-site stormwater management system collects and infiltrates site runoff reducing off-site flows for all storm events.

Table 1

Description	Existing Conditions		Proposed Conditions	
Drainage Area	0.22 Acres		0.22 Acres	
Weighted Runoff Coefficient, C	98		95	
Time of Concentration	6 minutes		6 minutes	
Storm Event (Years)	Offsite Peak Runoff (CFS)	Offsite Runoff Volume (CF)	Offsite Peak Runoff (CFS)	Offsite Runoff Volume (CF)
2	0.65	2,060	0.26	1,911
10	0.95	3,034	0.35	2,873
25	1.13	3,695	0.43	3,415
100	1.38	4,529	0.53	4,240

CONCLUSION

Based on DCI's analysis of the existing and proposed conditions, the proposed site condition meets the criteria set forth by the City of Somerville. Off-site runoff volume and peak flow rate for the 2, 10, 25 and 100-year storm events is dramatically decreased. The existing connection to the Municipal system will be eliminated and no new connection is proposed. The 4:1 I/I requirement will easily be met. DCI concludes that the proposed development at 369 Beacon Street, Somerville, MA adheres to all applicable stormwater management policy.

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MASSACHUSETTS BAY
TRANSPORTATION
AUTHORITY

180.42' (CALC-HELD)
181.70' (DEED)
S 52°36'40" E

LOT AREA
= 9,538 s.f. (CALC)
= 9,670 s.f. (DEED)

PRE-1
1 STORY
CONCRETE BLOCK
SERVICE STATION
No. 371

PRE-2
FLUSH CONCRETE PAD
WITH UNDER GROUND
STORAGE TANK FILL
COVERS

DRY WELL

ROOF DRAIN TO 500 GALLON
DRYWELL. OVERFLOWS TO
SURFACE.

BK. 31289 PG. 562
PLAN BK. 28 PLAN 41
MAP 37, BLOCK C, LOT 5

84.35' (CALC-HELD)
84.80' (DEED)
S 47°18'55" W

2 STORY
WOOD FRAME
No. 363

L.C.C. 3463A

76.72' (DEED-HELD)
SITE SHEET FLOWS
TO BEACON STREET
AND 48" COMBINED
SEWER.

48" BRICK
COMBINED SEWER

48" CS

BEACON STREET

(PUBLIC - 66' WIDE)

BEACON STREET

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Consulting Engineers and Surveyors

120 MIDDLESEX AVENUE
SOMERVILLE, MA 02145
617-776-3350

68 PLEASANT STREET
NEWBURYPORT, MA 01950
978-358-7173

SCALE:

HORIZ: 1"=20'

VERT: _____

DESIGNED: RLB

DRAFTED: RLB

CHECKED: SBS

APPROVED: SBS

PLAN OF LAND
369 BEACON STREET
SOMERVILLE, MASSACHUSETTS

PREPARED FOR
MAKRIGIANNIS FUEL, LLC

PROJECT NO.
2009-009

DATE: MAR. 2, 2012

FIGURE 1

P:\2009 PROJECTS\2009-009 369 BEACON SOMERVILLE\DWG\ENGINEERING\2009-009 SP-PRELIM.DWG

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MASSACHUSETTS BAY
TRANSPORTATION
AUTHORITY

180.42' (CALC-HELD)
181 70' (DEED)
S 52°36'40" E

IRON PIPE FOUND



PROPOSED 500 GAL
DRYWELL, RIM=35.20

DRIVEWAY COLLECTED BY
TRENCH DRAIN AND
DISCHARGES TO 48"
COMBINED SEWER.

1 STORY
CONCRETE
SERVICE STATION
No. 371

CHU YING LIN
BK 31289 PG. 562
PLAN BK. 28 PLAN 41
MAP 37, BLOCK C, LOT 5

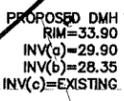
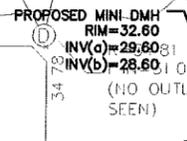
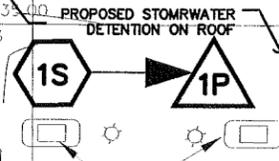
PROPOSED HOTEL BUILDING
GROSS AREA=6490 S.F.
RESTAURANT AREA=1760 S.F.

84 35' (CALC-HELD)
84 80' (DEED)
S 47°18'55" W

2 STORY
WOOD FRAME
No. 363

L.C.C. 3463A

COURTYARD COLLECTED
BY DRYWELL. OVERFLOWS
INTO STREET



ROOF RUNOFF
DISCHARGES TO 48"
COMBINED SEWER

CONTRACTOR TO LOCATE AND
VIDEO INSPECT EXISTING
SERVICE CONNECTION.



BEACON STREET

(PUBLIC - 66' WIDE)

BEACON STREET

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P:\2009 PROJECTS\2009-009 369 BEACON SOMERVILLE\DWG\ENGINEERING\2009-009 SP-PRELIM.DWG

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SCALE:

HORIZ: 1"=20'

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DESIGNED: RLB

DRAFTED: RLB

CHECKED: SBS

APPROVED: SBS

PLAN OF LAND
369 BEACON STREET
SOMERVILLE, MASSACHUSETTS
PREPARED FOR
MAKRIGIANNIS FUEL, LLC

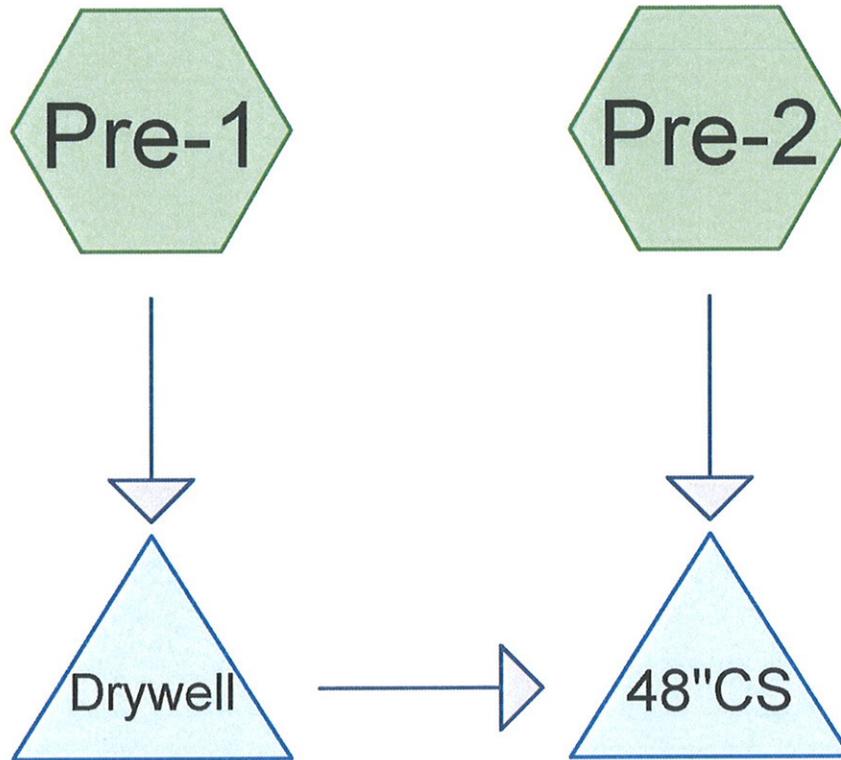
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DATE: MAR. 2, 2012

FIGURE 2

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Subcat



Reach



Pond



Link

Drainage Diagram for 09-009 Pre

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09-009 Pre

Type III 24-hr 2-Year Rainfall=3.10"

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Page 2

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment Pre-1: Runoff Area=1,232 sf 100.00% Impervious Runoff Depth>2.68"
Tc=6.0 min CN=98 Runoff=0.08 cfs 275 cf

Subcatchment Pre-2: Runoff Area=8,438 sf 100.00% Impervious Runoff Depth>2.68"
Tc=6.0 min CN=98 Runoff=0.57 cfs 1,886 cf

Pond 48"CS: Inflow=0.65 cfs 2,060 cf
Primary=0.65 cfs 2,060 cf

Pond Drywell: Peak Elev=34.91' Storage=93 cf Inflow=0.08 cfs 275 cf
Discarded=0.00 cfs 10 cf Primary=0.08 cfs 174 cf Outflow=0.08 cfs 185 cf

Total Runoff Area = 9,670 sf Runoff Volume = 2,161 cf Average Runoff Depth = 2.68"
0.00% Pervious = 0 sf 100.00% Impervious = 9,670 sf

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Type III 24-hr 2-Year Rainfall=3.10"

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Summary for Subcatchment Pre-1:

Runoff = 0.08 cfs @ 12.09 hrs, Volume= 275 cf, Depth> 2.68"

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 Rainfall=3.10"

Area (sf)	CN	Description
* 1,232	98	Roof
1,232		100.00% Impervious Area

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

Summary for Subcatchment Pre-2:

Runoff = 0.57 cfs @ 12.09 hrs, Volume= 1,886 cf, Depth> 2.68"

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 Rainfall=3.10"

Area (sf)	CN	Description
8,438	98	Paved parking, HSG D
8,438		100.00% Impervious Area

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

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Summary for Pond 48"CS:

Inflow Area = 9,670 sf, 100.00% Impervious, Inflow Depth > 2.56" for 2-Year event
 Inflow = 0.65 cfs @ 12.09 hrs, Volume= 2,060 cf
 Primary = 0.65 cfs @ 12.09 hrs, Volume= 2,060 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Pond Drywell:

Inflow Area = 1,232 sf, 100.00% Impervious, Inflow Depth > 2.68" for 2-Year event
 Inflow = 0.08 cfs @ 12.09 hrs, Volume= 275 cf
 Outflow = 0.08 cfs @ 12.09 hrs, Volume= 185 cf, Atten= 0%, Lag= 0.0 min
 Discarded = 0.00 cfs @ 12.09 hrs, Volume= 10 cf
 Primary = 0.08 cfs @ 12.09 hrs, Volume= 174 cf

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs / 2

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Type III 24-hr 2-Year Rainfall=3.10"

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Peak Elev= 34.91' @ 12.09 hrs Surf.Area= 29 sf Storage= 93 cf

Plug-Flow detention time= 132.6 min calculated for 185 cf (67% of inflow)

Center-of-Mass det. time= 61.1 min (800.0 - 738.9)

Volume	Invert	Avail.Storage	Storage Description
#1	30.81'	79 cf	5.00'D x 4.00'H Drywell Inside #2
#2	30.31'	15 cf	6.00'D x 4.50'H Drywell Stone 127 cf Overall - 79 cf Embedded = 49 cf x 30.0% Voids
#3	34.81'	1 cf	0.67'D x 4.00'H Vertical Cone/Cylinder
		95 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	34.81'	4.0" Round Overflow X 4.00 L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 34.81' / 33.00' S= 0.1810 '/' Cc= 0.900 n= 0.010 PVC, smooth interior
#2	Discarded	30.31'	0.270 in/hr Exfiltration over Surface area Conductivity to Groundwater Elevation = 0.00'

Discarded OutFlow Max=0.00 cfs @ 12.09 hrs HW=34.91' (Free Discharge)

↳ **2=Exfiltration** (Controls 0.00 cfs)

Primary OutFlow Max=0.08 cfs @ 12.09 hrs HW=34.91' (Free Discharge)

↳ **1=Overflow** (Inlet Controls 0.08 cfs @ 0.86 fps)

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Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentPre-1: Runoff Area=1,232 sf 100.00% Impervious Runoff Depth>3.96"
Tc=6.0 min CN=98 Runoff=0.12 cfs 407 cf

SubcatchmentPre-2: Runoff Area=8,438 sf 100.00% Impervious Runoff Depth>3.96"
Tc=6.0 min CN=98 Runoff=0.83 cfs 2,786 cf

Pond 48"CS: Inflow=0.95 cfs 3,034 cf
Primary=0.95 cfs 3,034 cf

Pond Drywell: Peak Elev=34.93' Storage=93 cf Inflow=0.12 cfs 407 cf
Discarded=0.00 cfs 11 cf Primary=0.11 cfs 248 cf Outflow=0.11 cfs 259 cf

Total Runoff Area = 9,670 sf Runoff Volume = 3,193 cf Average Runoff Depth = 3.96"
0.00% Pervious = 0 sf 100.00% Impervious = 9,670 sf

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Type III 24-hr 10-Year Rainfall=4.50"

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Summary for Subcatchment Pre-1:

Runoff = 0.12 cfs @ 12.09 hrs, Volume= 407 cf, Depth> 3.96"

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 Rainfall=4.50"

Area (sf)	CN	Description
* 1,232	98	Roof
1,232		100.00% Impervious Area

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

Summary for Subcatchment Pre-2:

Runoff = 0.83 cfs @ 12.09 hrs, Volume= 2,786 cf, Depth> 3.96"

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 Rainfall=4.50"

Area (sf)	CN	Description
8,438	98	Paved parking, HSG D
8,438		100.00% Impervious Area

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

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Summary for Pond 48"CS:

Inflow Area = 9,670 sf, 100.00% Impervious, Inflow Depth > 3.77" for 10-Year event
 Inflow = 0.95 cfs @ 12.09 hrs, Volume= 3,034 cf
 Primary = 0.95 cfs @ 12.09 hrs, Volume= 3,034 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Pond Drywell:

Inflow Area = 1,232 sf, 100.00% Impervious, Inflow Depth > 3.96" for 10-Year event
 Inflow = 0.12 cfs @ 12.09 hrs, Volume= 407 cf
 Outflow = 0.11 cfs @ 12.09 hrs, Volume= 259 cf, Atten= 6%, Lag= 0.0 min
 Discarded = 0.00 cfs @ 12.09 hrs, Volume= 11 cf
 Primary = 0.11 cfs @ 12.09 hrs, Volume= 248 cf

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs / 2

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Type III 24-hr 10-Year Rainfall=4.50"

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Peak Elev= 34.93' @ 12.09 hrs Surf.Area= 29 sf Storage= 93 cf

Plug-Flow detention time= 133.9 min calculated for 259 cf (64% of inflow)

Center-of-Mass det. time= 57.7 min (793.4 - 735.8)

Volume	Invert	Avail.Storage	Storage Description
#1	30.81'	79 cf	5.00'D x 4.00'H Drywell Inside #2
#2	30.31'	15 cf	6.00'D x 4.50'H Drywell Stone 127 cf Overall - 79 cf Embedded = 49 cf x 30.0% Voids
#3	34.81'	1 cf	0.67'D x 4.00'H Vertical Cone/Cylinder
		95 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	34.81'	4.0" Round Overflow X 4.00 L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 34.81' / 33.00' S= 0.1810 '/' Cc= 0.900 n= 0.010 PVC, smooth interior
#2	Discarded	30.31'	0.270 in/hr Exfiltration over Surface area Conductivity to Groundwater Elevation = 0.00'

Discarded OutFlow Max=0.00 cfs @ 12.09 hrs HW=34.93' (Free Discharge)

↳ **2=Exfiltration** (Controls 0.00 cfs)

Primary OutFlow Max=0.10 cfs @ 12.09 hrs HW=34.93' (Free Discharge)

↳ **1=Overflow** (Inlet Controls 0.10 cfs @ 0.92 fps)

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Type III 24-hr 25-Year Rainfall=5.30"

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Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentPre-1: Runoff Area=1,232 sf 100.00% Impervious Runoff Depth>4.69"
Tc=6.0 min CN=98 Runoff=0.14 cfs 482 cf

SubcatchmentPre-2: Runoff Area=8,438 sf 100.00% Impervious Runoff Depth>4.69"
Tc=6.0 min CN=98 Runoff=0.98 cfs 3,299 cf

Pond 48"CS: Inflow=1.13 cfs 3,695 cf
Primary=1.13 cfs 3,695 cf

Pond Drywell: Peak Elev=34.95' Storage=93 cf Inflow=0.14 cfs 482 cf
Discarded=0.00 cfs 11 cf Primary=0.14 cfs 396 cf Outflow=0.14 cfs 406 cf

Total Runoff Area = 9,670 sf Runoff Volume = 3,781 cf Average Runoff Depth = 4.69"
0.00% Pervious = 0 sf 100.00% Impervious = 9,670 sf

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Type III 24-hr 25-Year Rainfall=5.30"

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Summary for Subcatchment Pre-1:

Runoff = 0.14 cfs @ 12.09 hrs, Volume= 482 cf, Depth> 4.69"

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 Rainfall=5.30"

Area (sf)	CN	Description
* 1,232	98	Roof
1,232		100.00% Impervious Area

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

Summary for Subcatchment Pre-2:

Runoff = 0.98 cfs @ 12.09 hrs, Volume= 3,299 cf, Depth> 4.69"

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 Rainfall=5.30"

Area (sf)	CN	Description
8,438	98	Paved parking, HSG D
8,438		100.00% Impervious Area

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

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Summary for Pond 48"CS:

Inflow Area = 9,670 sf, 100.00% Impervious, Inflow Depth > 4.59" for 25-Year event
 Inflow = 1.13 cfs @ 12.09 hrs, Volume= 3,695 cf
 Primary = 1.13 cfs @ 12.09 hrs, Volume= 3,695 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Pond Drywell:

Inflow Area = 1,232 sf, 100.00% Impervious, Inflow Depth > 4.69" for 25-Year event
 Inflow = 0.14 cfs @ 12.09 hrs, Volume= 482 cf
 Outflow = 0.14 cfs @ 12.09 hrs, Volume= 406 cf, Atten= 0%, Lag= 0.0 min
 Discarded = 0.00 cfs @ 12.09 hrs, Volume= 11 cf
 Primary = 0.14 cfs @ 12.09 hrs, Volume= 396 cf

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs / 2

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Type III 24-hr 25-Year Rainfall=5.30"

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Peak Elev= 34.95' @ 12.09 hrs Surf.Area= 29 sf Storage= 93 cf

Plug-Flow detention time= 92.4 min calculated for 406 cf (84% of inflow)

Center-of-Mass det. time= 45.3 min (780.1 - 734.8)

Volume	Invert	Avail.Storage	Storage Description
#1	30.81'	79 cf	5.00'D x 4.00'H Drywell Inside #2
#2	30.31'	15 cf	6.00'D x 4.50'H Drywell Stone 127 cf Overall - 79 cf Embedded = 49 cf x 30.0% Voids
#3	34.81'	1 cf	0.67'D x 4.00'H Vertical Cone/Cylinder
		95 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	34.81'	4.0" Round Overflow X 4.00 L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 34.81' / 33.00' S= 0.1810 1' Cc= 0.900 n= 0.010 PVC, smooth interior
#2	Discarded	30.31'	0.270 in/hr Exfiltration over Surface area Conductivity to Groundwater Elevation = 0.00'

Discarded OutFlow Max=0.00 cfs @ 12.09 hrs HW=34.95' (Free Discharge)

↳ **2=Exfiltration** (Controls 0.00 cfs)

Primary OutFlow Max=0.13 cfs @ 12.09 hrs HW=34.95' (Free Discharge)

↳ **1=Overflow** (Inlet Controls 0.13 cfs @ 0.99 fps)

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Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment Pre-1: Runoff Area=1,232 sf 100.00% Impervious Runoff Depth>5.78"
Tc=6.0 min CN=98 Runoff=0.18 cfs 594 cf

Subcatchment Pre-2: Runoff Area=8,438 sf 100.00% Impervious Runoff Depth>5.78"
Tc=6.0 min CN=98 Runoff=1.21 cfs 4,067 cf

Pond 48"CS: Inflow=1.38 cfs 4,529 cf
Primary=1.38 cfs 4,529 cf

Pond Drywell: Peak Elev=34.97' Storage=93 cf Inflow=0.18 cfs 594 cf
Discarded=0.00 cfs 11 cf Primary=0.17 cfs 462 cf Outflow=0.17 cfs 473 cf

Total Runoff Area = 9,670 sf Runoff Volume = 4,661 cf Average Runoff Depth = 5.78"
0.00% Pervious = 0 sf 100.00% Impervious = 9,670 sf

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Type III 24-hr 100-Year Rainfall=6.50"

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Summary for Subcatchment Pre-1:

Runoff = 0.18 cfs @ 12.09 hrs, Volume= 594 cf, Depth> 5.78"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
* 1,232	98	Roof
1,232		100.00% Impervious Area

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

Summary for Subcatchment Pre-2:

Runoff = 1.21 cfs @ 12.09 hrs, Volume= 4,067 cf, Depth> 5.78"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
8,438	98	Paved parking, HSG D
8,438		100.00% Impervious Area

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

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Summary for Pond 48"CS:

Inflow Area = 9,670 sf, 100.00% Impervious, Inflow Depth > 5.62" for 100-Year event
 Inflow = 1.38 cfs @ 12.09 hrs, Volume= 4,529 cf
 Primary = 1.38 cfs @ 12.09 hrs, Volume= 4,529 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Pond Drywell:

Inflow Area = 1,232 sf, 100.00% Impervious, Inflow Depth > 5.78" for 100-Year event
 Inflow = 0.18 cfs @ 12.09 hrs, Volume= 594 cf
 Outflow = 0.17 cfs @ 12.09 hrs, Volume= 473 cf, Atten= 1%, Lag= 0.0 min
 Discarded = 0.00 cfs @ 12.09 hrs, Volume= 11 cf
 Primary = 0.17 cfs @ 12.09 hrs, Volume= 462 cf

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs / 2

09-009 Pre

Type III 24-hr 100-Year Rainfall=6.50"

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Peak Elev= 34.97' @ 12.09 hrs Surf.Area= 29 sf Storage= 93 cf

Plug-Flow detention time= 101.1 min calculated for 471 cf (79% of inflow)

Center-of-Mass det. time= 46.6 min (780.4 - 733.8)

Volume	Invert	Avail.Storage	Storage Description
#1	30.81'	79 cf	5.00'D x 4.00'H Drywell Inside #2
#2	30.31'	15 cf	6.00'D x 4.50'H Drywell Stone 127 cf Overall - 79 cf Embedded = 49 cf x 30.0% Voids
#3	34.81'	1 cf	0.67'D x 4.00'H Vertical Cone/Cylinder
		95 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	34.81'	4.0" Round Overflow X 4.00 L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 34.81' / 33.00' S= 0.1810 '/' Cc= 0.900 n= 0.010 PVC, smooth interior
#2	Discarded	30.31'	0.270 in/hr Exfiltration over Surface area Conductivity to Groundwater Elevation = 0.00'

Discarded OutFlow Max=0.00 cfs @ 12.09 hrs HW=34.96' (Free Discharge)

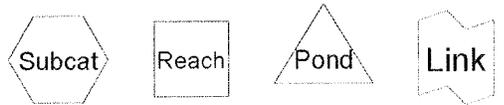
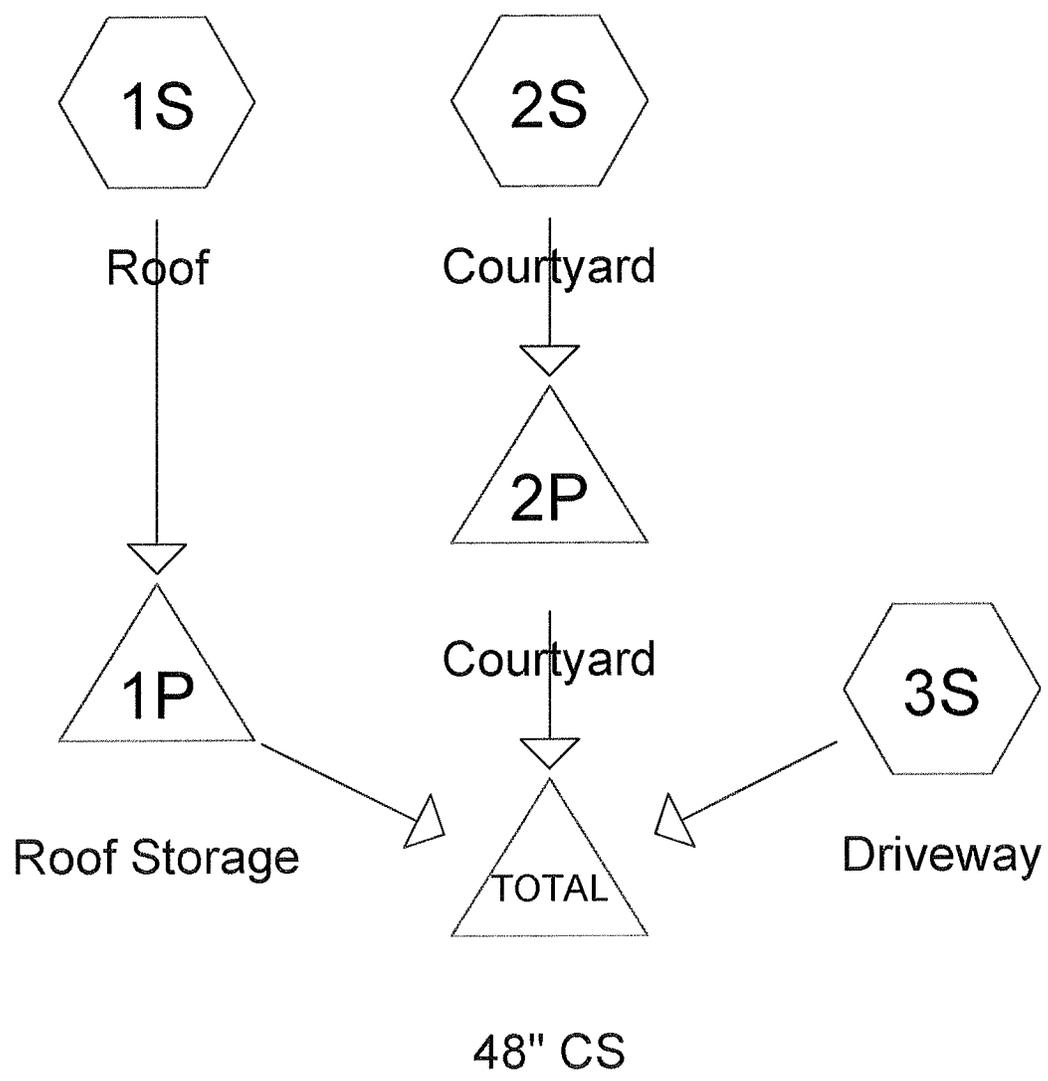
↳ **2=Exfiltration** (Controls 0.00 cfs)

Primary OutFlow Max=0.16 cfs @ 12.09 hrs HW=34.96' (Free Discharge)

↳ **1=Overflow** (Inlet Controls 0.16 cfs @ 1.05 fps)

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Summary for Subcatchment 1S: Roof

Runoff = 0.44 cfs @ 12.09 hrs, Volume= 1,553 cf, Depth= 2.87"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-25.00 hrs, dt= 0.05 hrs
 Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
6,500	98	Roofs, HSG C
6,500		100.00% Impervious Area

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

Summary for Subcatchment 2S: Courtyard

Runoff = 0.03 cfs @ 12.09 hrs, Volume= 108 cf, Depth= 2.87"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-25.00 hrs, dt= 0.05 hrs
 Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
450	98	Roofs, HSG C
450		100.00% Impervious Area

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

Summary for Subcatchment 3S: Driveway

Runoff = 0.09 cfs @ 12.09 hrs, Volume= 335 cf, Depth= 2.87"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-25.00 hrs, dt= 0.05 hrs
 Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
1,400	98	Roofs, HSG C
1,400		100.00% Impervious Area

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

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Type III 24-hr 2-Year Rainfall=3.10"

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Summary for Pond 1P: Roof Storage

Inflow Area = 6,500 sf, 100.00% Impervious, Inflow Depth = 2.87" for 2-Year event
 Inflow = 0.44 cfs @ 12.09 hrs, Volume= 1,553 cf
 Outflow = 0.19 cfs @ 12.28 hrs, Volume= 1,553 cf, Atten= 57%, Lag= 11.5 min
 Primary = 0.19 cfs @ 12.28 hrs, Volume= 1,553 cf

Routing by Stor-Ind method, Time Span= 0.00-25.00 hrs, dt= 0.05 hrs
 Peak Elev= 30.25' @ 12.28 hrs Surf.Area= 2,107 sf Storage= 264 cf

Plug-Flow detention time= 9.7 min calculated for 1,550 cf (100% of inflow)
 Center-of-Mass det. time= 9.7 min (766.8 - 757.1)

Volume	Invert	Avail.Storage	Storage Description
#1	30.00'	1,050 cf	Roof (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
30.00	0	0	0
30.50	4,200	1,050	1,050

Device	Routing	Invert	Outlet Devices
#1	Primary	30.00'	JR Smith Raintrol X 3.00 Head (feet) 0.00 0.08 0.17 0.25 0.33 0.42 0.50 Disch. (cfs) 0.000 0.021 0.041 0.063 0.086 0.109 0.134

Primary OutFlow Max=0.19 cfs @ 12.28 hrs HW=30.25' (Free Discharge)
 1=JR Smith Raintrol (Custom Controls 0.19 cfs)

Summary for Pond 2P: Courtyard

Inflow Area = 450 sf, 100.00% Impervious, Inflow Depth = 2.87" for 2-Year event
 Inflow = 0.03 cfs @ 12.09 hrs, Volume= 108 cf
 Outflow = 0.00 cfs @ 24.01 hrs, Volume= 15 cf, Atten= 99%, Lag= 715.2 min
 Discarded = 0.00 cfs @ 24.01 hrs, Volume= 15 cf
 Primary = 0.00 cfs @ 24.01 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-25.00 hrs, dt= 0.05 hrs / 4
 Peak Elev= 34.81' @ 24.01 hrs Surf.Area= 29 sf Storage= 93 cf

Plug-Flow detention time= 409.0 min calculated for 15 cf (14% of inflow)
 Center-of-Mass det. time= 113.9 min (871.0 - 757.1)

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Type III 24-hr 2-Year Rainfall=3.10"

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Volume	Invert	Avail.Storage	Storage Description
#1	30.81'	79 cf	5.00'D x 4.00'H Drywell Inside #2
#2	30.31'	15 cf	6.00'D x 4.50'H Drywell Stone 127 cf Overall - 79 cf Embedded = 49 cf x 30.0% Voids
#3	34.81'	1 cf	0.67'D x 4.00'H Vertical Cone/Cylinder
		95 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	34.81'	4.0" Round Overflow X 4.00 L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 34.81' / 33.00' S= 0.1810 '/ Cc= 0.900 n= 0.010 PVC, smooth interior
#2	Discarded	30.31'	0.270 in/hr Exfiltration over Surface area Conductivity to Groundwater Elevation = 0.00'

Discarded OutFlow Max=0.00 cfs @ 24.01 hrs HW=34.81' (Free Discharge)
 ↳ **2=Exfiltration** (Controls 0.00 cfs)

Primary OutFlow Max=0.00 cfs @ 24.01 hrs HW=34.81' (Free Discharge)
 ↳ **1=Overflow** (Inlet Controls 0.00 cfs @ 0.11 fps)

Summary for Pond TOTAL: 48" CS

Inflow Area = 8,350 sf, 100.00% Impervious, Inflow Depth = 2.71" for 2-Year event
 Inflow = 0.26 cfs @ 12.12 hrs, Volume= 1,888 cf
 Primary = 0.26 cfs @ 12.12 hrs, Volume= 1,888 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-25.00 hrs, dt= 0.05 hrs

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Type III 24-hr 10-Year Rainfall=4.50"

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Summary for Subcatchment 1S: Roof

Runoff = 0.64 cfs @ 12.09 hrs, Volume= 2,310 cf, Depth= 4.26"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-25.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
6,500	98	Roofs, HSG C
6,500		100.00% Impervious Area

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

Summary for Subcatchment 2S: Courtyard

Runoff = 0.04 cfs @ 12.09 hrs, Volume= 160 cf, Depth= 4.26"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-25.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
450	98	Roofs, HSG C
450		100.00% Impervious Area

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

Summary for Subcatchment 3S: Driveway

Runoff = 0.14 cfs @ 12.09 hrs, Volume= 497 cf, Depth= 4.26"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-25.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
1,400	98	Roofs, HSG C
1,400		100.00% Impervious Area

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

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Type III 24-hr 10-Year Rainfall=4.50"

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Summary for Pond 1P: Roof Storage

Inflow Area = 6,500 sf, 100.00% Impervious, Inflow Depth = 4.26" for 10-Year event
 Inflow = 0.64 cfs @ 12.09 hrs, Volume= 2,310 cf
 Outflow = 0.25 cfs @ 12.31 hrs, Volume= 2,310 cf, Atten= 61%, Lag= 13.5 min
 Primary = 0.25 cfs @ 12.31 hrs, Volume= 2,310 cf

Routing by Stor-Ind method, Time Span= 0.00-25.00 hrs, dt= 0.05 hrs
 Peak Elev= 30.32' @ 12.31 hrs Surf.Area= 2,713 sf Storage= 438 cf

Plug-Flow detention time= 12.7 min calculated for 2,305 cf (100% of inflow)
 Center-of-Mass det. time= 12.6 min (762.5 - 749.8)

Volume	Invert	Avail.Storage	Storage Description
#1	30.00'	1,050 cf	Roof (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
30.00	0	0	0
30.50	4,200	1,050	1,050

Device	Routing	Invert	Outlet Devices
#1	Primary	30.00'	JR Smith Raintrol X 3.00 Head (feet) 0.00 0.08 0.17 0.25 0.33 0.42 0.50 Disch. (cfs) 0.000 0.021 0.041 0.063 0.086 0.109 0.134

Primary OutFlow Max=0.25 cfs @ 12.31 hrs HW=30.32' (Free Discharge)
 1=JR Smith Raintrol (Custom Controls 0.25 cfs)

Summary for Pond 2P: Courtyard

Inflow Area = 450 sf, 100.00% Impervious, Inflow Depth = 4.26" for 10-Year event
 Inflow = 0.04 cfs @ 12.09 hrs, Volume= 160 cf
 Outflow = 0.03 cfs @ 12.37 hrs, Volume= 81 cf, Atten= 34%, Lag= 16.9 min
 Discarded = 0.00 cfs @ 12.35 hrs, Volume= 16 cf
 Primary = 0.03 cfs @ 12.37 hrs, Volume= 65 cf

Routing by Stor-Ind method, Time Span= 0.00-25.00 hrs, dt= 0.05 hrs / 4
 Peak Elev= 34.85' @ 12.35 hrs Surf.Area= 29 sf Storage= 93 cf

Plug-Flow detention time= 239.4 min calculated for 81 cf (51% of inflow)
 Center-of-Mass det. time= 112.7 min (862.5 - 749.8)

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Type III 24-hr 10-Year Rainfall=4.50"

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Volume	Invert	Avail.Storage	Storage Description
#1	30.81'	79 cf	5.00'D x 4.00'H Drywell Inside #2
#2	30.31'	15 cf	6.00'D x 4.50'H Drywell Stone 127 cf Overall - 79 cf Embedded = 49 cf x 30.0% Voids
#3	34.81'	1 cf	0.67'D x 4.00'H Vertical Cone/Cylinder
		95 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	34.81'	4.0" Round Overflow X 4.00 L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 34.81' / 33.00' S= 0.1810 '/' Cc= 0.900 n= 0.010 PVC, smooth interior
#2	Discarded	30.31'	0.270 in/hr Exfiltration over Surface area Conductivity to Groundwater Elevation = 0.00'

Discarded OutFlow Max=0.00 cfs @ 12.35 hrs HW=34.85' (Free Discharge)
 ↳ **2=Exfiltration** (Controls 0.00 cfs)

Primary OutFlow Max=0.01 cfs @ 12.37 hrs HW=34.85' (Free Discharge)
 ↳ **1=Overflow** (Inlet Controls 0.01 cfs @ 0.54 fps)

Summary for Pond TOTAL: 48" CS

Inflow Area = 8,350 sf, 100.00% Impervious, Inflow Depth = 4.13" for 10-Year event
 Inflow = 0.35 cfs @ 12.12 hrs, Volume= 2,873 cf
 Primary = 0.35 cfs @ 12.12 hrs, Volume= 2,873 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-25.00 hrs, dt= 0.05 hrs

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Type III 24-hr 25-Year Rainfall=5.30"

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Summary for Subcatchment 1S: Roof

Runoff = 0.76 cfs @ 12.09 hrs, Volume= 2,742 cf, Depth= 5.06"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-25.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.30"

Area (sf)	CN	Description
6,500	98	Roofs, HSG C
6,500		100.00% Impervious Area

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

Summary for Subcatchment 2S: Courtyard

Runoff = 0.05 cfs @ 12.09 hrs, Volume= 190 cf, Depth= 5.06"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-25.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.30"

Area (sf)	CN	Description
450	98	Roofs, HSG C
450		100.00% Impervious Area

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

Summary for Subcatchment 3S: Driveway

Runoff = 0.16 cfs @ 12.09 hrs, Volume= 591 cf, Depth= 5.06"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-25.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.30"

Area (sf)	CN	Description
1,400	98	Roofs, HSG C
1,400		100.00% Impervious Area

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

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Type III 24-hr 25-Year Rainfall=5.30"

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Summary for Pond 1P: Roof Storage

Inflow Area = 6,500 sf, 100.00% Impervious, Inflow Depth = 5.06" for 25-Year event
 Inflow = 0.76 cfs @ 12.09 hrs, Volume= 2,742 cf
 Outflow = 0.28 cfs @ 12.33 hrs, Volume= 2,742 cf, Atten= 63%, Lag= 14.6 min
 Primary = 0.28 cfs @ 12.33 hrs, Volume= 2,742 cf

Routing by Stor-Ind method, Time Span= 0.00-25.00 hrs, dt= 0.05 hrs
 Peak Elev= 30.36' @ 12.33 hrs Surf.Area= 3,027 sf Storage= 545 cf

Plug-Flow detention time= 14.2 min calculated for 2,737 cf (100% of inflow)
 Center-of-Mass det. time= 14.2 min (761.3 - 747.1)

Volume	Invert	Avail.Storage	Storage Description
#1	30.00'	1,050 cf	Roof (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
30.00	0	0	0
30.50	4,200	1,050	1,050

Device	Routing	Invert	Outlet Devices
#1	Primary	30.00'	JR Smith Raintrol X 3.00 Head (feet) 0.00 0.08 0.17 0.25 0.33 0.42 0.50 Disch. (cfs) 0.000 0.021 0.041 0.063 0.086 0.109 0.134

Primary OutFlow Max=0.28 cfs @ 12.33 hrs HW=30.36' (Free Discharge)
 ↑1=JR Smith Raintrol (Custom Controls 0.28 cfs)

Summary for Pond 2P: Courtyard

Inflow Area = 450 sf, 100.00% Impervious, Inflow Depth = 5.06" for 25-Year event
 Inflow = 0.05 cfs @ 12.09 hrs, Volume= 190 cf
 Outflow = 0.04 cfs @ 12.16 hrs, Volume= 98 cf, Atten= 21%, Lag= 4.7 min
 Discarded = 0.00 cfs @ 12.15 hrs, Volume= 16 cf
 Primary = 0.04 cfs @ 12.16 hrs, Volume= 82 cf

Routing by Stor-Ind method, Time Span= 0.00-25.00 hrs, dt= 0.05 hrs / 4
 Peak Elev= 34.87' @ 12.15 hrs Surf.Area= 29 sf Storage= 93 cf

Plug-Flow detention time= 235.4 min calculated for 98 cf (52% of inflow)
 Center-of-Mass det. time= 109.2 min (856.2 - 747.1)

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Type III 24-hr 25-Year Rainfall=5.30"

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Volume	Invert	Avail.Storage	Storage Description
#1	30.81'	79 cf	5.00'D x 4.00'H Drywell Inside #2
#2	30.31'	15 cf	6.00'D x 4.50'H Drywell Stone 127 cf Overall - 79 cf Embedded = 49 cf x 30.0% Voids
#3	34.81'	1 cf	0.67'D x 4.00'H Vertical Cone/Cylinder
		95 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	34.81'	4.0" Round Overflow X 4.00 L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 34.81' / 33.00' S= 0.1810 1/ S= 0.1810 1/ Cc= 0.900 n= 0.010 PVC, smooth interior
#2	Discarded	30.31'	0.270 in/hr Exfiltration over Surface area Conductivity to Groundwater Elevation = 0.00'

Discarded OutFlow Max=0.00 cfs @ 12.15 hrs HW=34.87' (Free Discharge)
 ↳2=Exfiltration (Controls 0.00 cfs)

Primary OutFlow Max=0.02 cfs @ 12.16 hrs HW=34.86' (Free Discharge)
 ↳1=Overflow (Inlet Controls 0.02 cfs @ 0.63 fps)

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Summary for Pond TOTAL: 48" CS

Inflow Area = 8,350 sf, 100.00% Impervious, Inflow Depth = 4.91" for 25-Year event
 Inflow = 0.43 cfs @ 12.15 hrs, Volume= 3,415 cf
 Primary = 0.43 cfs @ 12.15 hrs, Volume= 3,415 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-25.00 hrs, dt= 0.05 hrs

09-009 Proposed - Roof Det

Type III 24-hr 100-Year Rainfall=6.50"

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Summary for Subcatchment 1S: Roof

Runoff = 0.93 cfs @ 12.09 hrs, Volume= 3,392 cf, Depth= 6.26"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-25.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
6,500	98	Roofs, HSG C
6,500		100.00% Impervious Area

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

Summary for Subcatchment 2S: Courtyard

Runoff = 0.06 cfs @ 12.09 hrs, Volume= 235 cf, Depth= 6.26"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-25.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
450	98	Roofs, HSG C
450		100.00% Impervious Area

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

Summary for Subcatchment 3S: Driveway

Runoff = 0.20 cfs @ 12.09 hrs, Volume= 730 cf, Depth= 6.26"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-25.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
1,400	98	Roofs, HSG C
1,400		100.00% Impervious Area

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

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Type III 24-hr 100-Year Rainfall=6.50"

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Summary for Pond 1P: Roof Storage

Inflow Area = 6,500 sf, 100.00% Impervious, Inflow Depth = 6.26" for 100-Year event
 Inflow = 0.93 cfs @ 12.09 hrs, Volume= 3,392 cf
 Outflow = 0.32 cfs @ 12.36 hrs, Volume= 3,392 cf, Atten= 65%, Lag= 16.2 min
 Primary = 0.32 cfs @ 12.36 hrs, Volume= 3,392 cf

Routing by Stor-Ind method, Time Span= 0.00-25.00 hrs, dt= 0.05 hrs
 Peak Elev= 30.41' @ 12.36 hrs Surf.Area= 3,470 sf Storage= 717 cf

Plug-Flow detention time= 16.6 min calculated for 3,385 cf (100% of inflow)
 Center-of-Mass det. time= 16.5 min (760.5 - 744.0)

Volume	Invert	Avail.Storage	Storage Description
#1	30.00'	1,050 cf	Roof (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
30.00	0	0	0
30.50	4,200	1,050	1,050

Device	Routing	Invert	Outlet Devices
#1	Primary	30.00'	JR Smith Raintrol X 3.00 Head (feet) 0.00 0.08 0.17 0.25 0.33 0.42 0.50 Disch. (cfs) 0.000 0.021 0.041 0.063 0.086 0.109 0.134

Primary OutFlow Max=0.32 cfs @ 12.36 hrs HW=30.41' (Free Discharge)
 ↳1=JR Smith Raintrol (Custom Controls 0.32 cfs)

Summary for Pond 2P: Courtyard

Inflow Area = 450 sf, 100.00% Impervious, Inflow Depth = 6.26" for 100-Year event
 Inflow = 0.06 cfs @ 12.09 hrs, Volume= 235 cf
 Outflow = 0.06 cfs @ 12.09 hrs, Volume= 134 cf, Atten= 12%, Lag= 0.2 min
 Discarded = 0.00 cfs @ 12.09 hrs, Volume= 16 cf
 Primary = 0.06 cfs @ 12.09 hrs, Volume= 117 cf

Routing by Stor-Ind method, Time Span= 0.00-25.00 hrs, dt= 0.05 hrs / 4
 Peak Elev= 34.89' @ 12.09 hrs Surf.Area= 29 sf Storage= 93 cf

Plug-Flow detention time= 217.5 min calculated for 134 cf (57% of inflow)
 Center-of-Mass det. time= 99.9 min (843.9 - 744.0)

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Type III 24-hr 100-Year Rainfall=6.50"

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Volume	Invert	Avail.Storage	Storage Description
#1	30.81'	79 cf	5.00'D x 4.00'H Drywell Inside #2
#2	30.31'	15 cf	6.00'D x 4.50'H Drywell Stone 127 cf Overall - 79 cf Embedded = 49 cf x 30.0% Voids
#3	34.81'	1 cf	0.67'D x 4.00'H Vertical Cone/Cylinder
		95 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	34.81'	4.0" Round Overflow X 4.00 L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 34.81' / 33.00' S= 0.1810 '/' Cc= 0.900 n= 0.010 PVC, smooth interior
#2	Discarded	30.31'	0.270 in/hr Exfiltration over Surface area Conductivity to Groundwater Elevation = 0.00'

Discarded OutFlow Max=0.00 cfs @ 12.09 hrs HW=34.89' (Free Discharge)
 ↳2=Exfiltration (Controls 0.00 cfs)

Primary OutFlow Max=0.05 cfs @ 12.09 hrs HW=34.89' (Free Discharge)
 ↳1=Overflow (Inlet Controls 0.05 cfs @ 0.77 fps)

Summary for Pond TOTAL: 48" CS

Inflow Area = 8,350 sf, 100.00% Impervious, Inflow Depth = 6.09" for 100-Year event
 Inflow = 0.53 cfs @ 12.11 hrs, Volume= 4,240 cf
 Primary = 0.53 cfs @ 12.11 hrs, Volume= 4,240 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-25.00 hrs, dt= 0.05 hrs

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INFILTRATION/INFLOW REMOVAL CALCULATIONS

I. INTRODUCTION

The following infiltration/inflow removal calculations are based upon 310 CMR 15.203, the sewer calculations presented above, and the storm drainage calculations summarized in Table I. The City of Somerville requires that infiltration/inflow removal of four times the proposed additional average daily sewer flow must be provided by the project.

II. CALCULATIONS

Existing Average Daily Sewer Flow	400 gal/day
Proposed Average Daily Sewer Flow	7,020 gal/day
Additional Average Daily Flow	6,620 gal/day
Four Times Additional Average Daily Flow	26,480 gal/ day = 0.041 cfs

III. REMOVAL

The required 0.041 cfs of infiltration/ inflow will be removed from the combined sewer system by peak flow reduction in the storm drainage from the site. Subtraction of the proposed flow rates from the existing flow rates given in Table 1 gives flow reductions of 0.22 cfs, 0.30 cfs, 0.34 cfs, and 0.41 cfs for the 2 yr., 10yr., 25 yr., and 100 yr. Storms respectively. All of these flow reductions exceed the required removal of 0.041 cfs.

IV. CONCLUSION

Because the storm drainage flow reductions provided by the project exceed the required infiltration/inflow removal rate we conclude that the proposed design meets and exceeds the requirement for infiltration/inflow removal.

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