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DEPARTMENT OF  
PLANNING & ZONING



TRUDELL  
Consulting Engineers

234 – 240 College Street  
Stormwater Management Plan

**General Information**

Project Address: 234 – 240 College Street  
Owner: Sisters and Brothers Investment Group  
Engineer: Trudell Consulting Engineers (TCE)

The Applicant, Sisters and Brothers Investment Group, proposes to build an addition to an existing apartment building. A "blue roof" system is proposed to reduce peak runoff rates from the redeveloped impervious surface. The site drains to the City of Burlington combined sewer system which discharges to the Main Plant and eventually to Lake Champlain.

**Existing Conditions**

Currently, the site consists of a building and alleys. The entire parcel is approximately 5,500 square feet in size, fully impervious. The existing building has a footprint of approximately 3,400 square feet.

The drainage pattern of the site is northeasterly; both alleys on the parcel slope away from College Street down to the rear parking area offsite to the northeast. The local low point is a catch basin that is connected to the historical "ravine sewer", a 3' x 2' stone combined sewer that is located deep below existing grade.

Soils for the site are not mapped, as NRCS information in the downtown Burlington area is not available. Correspondence with Megan Moir (Stormwater Program Manager for the City of Burlington) indicated that the soils could be characterized as Hydrologic Soil Group (HSG) C.

A site map showing the parcel and surrounding existing utilities is attached to this narrative.

**Proposed Conditions**

The proposed project consists of demolishing portions of the existing building and constructing a 1,900 square foot addition. As a result of this project, some area that is currently paved surface will be converted to roof. This will reduce the amount of sediment generated from the site. Stormwater discharge from the proposed building expansion will be conveyed by roof drain to the north of the building, where it will run northeast to the nearby catch basin. As this is the local low point, it is the most feasible discharge point. Running a discharge westward

towards South Winooski Avenue would encroach on neighboring properties as well as run uphill, and discharges to the south into College Street would also inevitably drain into the old ravine sewer.

### **Stormwater Management Plan**

Due to the limited extent of the new building (1,900 square feet) and the small parcel size, the space available is constrained. As a matter of practicality, the only space available for stormwater treatment is the new building area. The available options for treating stormwater in such an area are also limited. Subsurface infiltration is not warranted due to the close proximity of buildings, and the unknown soil conditions. Use of rain barrels or cisterns has a limited benefit; they must be drained in between storm events, and as the entire area is 100% impervious, the collected rainwater would have only minimal use. The small site size precludes the use of surface detention structures.

The remaining options for treatment are on the new rooftop. A "blue roof" was chosen for this site, which provides temporary storage on the roof with a flow-controlled drain to reduce the peak discharge rate from the roof. A Zurn model Z105 roof drain outlet with 1 notch and flow restrictor plate was chosen. Each of these drain outlets provides 4.75 gpm of discharge for every inch of head. Roof scuppers were raised above the roof elevation to allow temporary ponding, and double as overflow structures in the case of larger storm events. As the proposed roof sits above the existing roof, capture of additional runoff is not possible. One roof drain is proposed for this section of roof; coupled with the most restrictive model of roof drain outlet, this maximizes the potential for peak flow reduction.

A hydrologic model was prepared that includes the "greenfield" condition of the expanded building area (meadow, HSG C as per Megan Moir's statement). Results of the pre versus post 1-year, 5-year, and 10-year storms are provided below:

**Table 1: Hydrologic Modeling Results – Building Roof**

<b>Storm Event</b>	<b>Predevelopment Condition</b>	<b>Postdevelopment Condition</b>
<b>1-Year Storm (2.1")</b>	0.03 cfs	0.01 cfs
<b>5-Year Storm (2.82")</b>	0.06 cfs	0.06 cfs
<b>10-Year Storm (3.10")</b>	0.08 cfs	0.09 cfs



Looking at the site as a whole, the overall discharge rate of the site is reduced from existing conditions. Refer to the table below for a summary of hydrologic modeling site-wide:

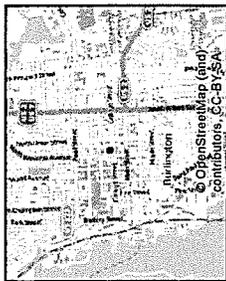
**Table 2: Hydrologic Modeling Results – Overall Site**

<b>Storm Event</b>	<b>Existing Condition</b>	<b>Postdevelopment Condition</b>
<b>1-Year Storm (2.1")</b>	0.44 cfs	0.30 cfs
<b>5-Year Storm (2.82")</b>	0.60 cfs	0.42 cfs
<b>10-Year Storm (3.10")</b>	0.68 cfs	0.51 cfs

### **Conclusions**

Due to the extremely compact nature of this project site, large reductions in peak runoff are not practicable. However, maximizing the detention capabilities of the proposed building expansion result in an 32% reduction in peak flows for the 1-year storm event. Viewing the proposed building expansion as an isolated entity, its effective hydrologic performance is equal to an undeveloped meadow during small storm events (5-year storms and smaller) that account for over 90% of any given average rain event during the course of the year.

**Project Location**



**Legend**

-  Project Parcel
-  Manholes
-  Gravity Mains
-  Inlets
-  Tax Parcel Boundary

**Notes**

Sources: Bing Aerial Photography (2012);  
 Project Area by TCE (2014); Manholes,  
 Gravity Mains and Inlets from the City of  
 Burlington (2014).

Disclaimer: The accuracy of information presented  
 is determined by its sources. TCE is not responsible  
 for any errors or omissions. The location of  
 on-the-ground location can be resolved by site  
 inspections and/or survey by a registered surveyor.  
 This map is not a replacement for surveyed  
 information or engineering studies.

**SBI - College St. Apartments**  
**234 College St.**  
**Burlington, VT**

**Subsurface Utilities Map**

Project: 14-0141  
 Prepared By: LMJ  
 11/14/2014  
 1 inch = 100 feet





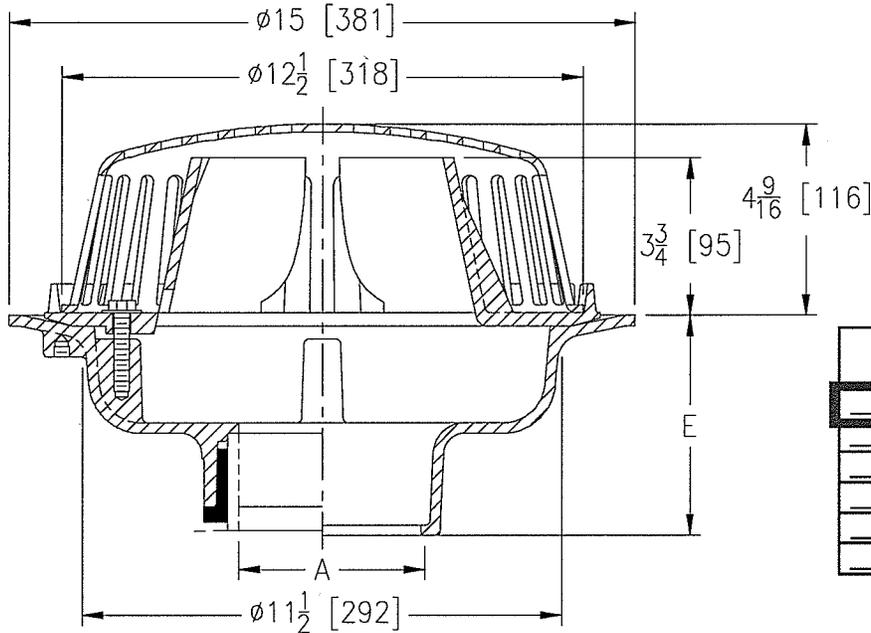
# Z105

## CONTROL-FLO ROOF DRAIN W/ PARABOLIC WEIR

SPECIFICATION SHEET

TAG \_\_\_\_\_

Dimensional Data (inches and [ mm ]) are Subject to Manufacturing Tolerances and Change Without Notice



Specify Number of Notches in Weir	
___-N1	One Notch
___-N2	Two Notches
___-N3	Three Notches
___-N4	Four Notches
___-N5	Five Notches
___-N6	Six Notches

A- Pipe Size In.	Approx. Wt. Lbs. [kg]	Dome Open Area Sq. In. [cm <sup>2</sup> ]
2-3-4 [51-76-102]	34 [15]	103 [665]

**ENGINEERING SPECIFICATION: ZURN Z105**

15 [381] Diameter Control-Flo Roof Drain for Dead-Level roof construction, Dura-Coated cast iron body, Control-Flo weir shall be linear functioning with integral membrane flashing clamp/gravel guard and Poly-Dome. All data shall be verified proportional to flow rates.

**OPTIONS** (Check/specify appropriate options)

**PIPE SIZE**

- \_\_\_ 2, 3, 4 [51, 76, 102]
- \_\_\_ 2, 3, 4 [51, 76, 102]
- \_\_\_ 2, 3, 4 [51, 76, 102]
- \_\_\_ 2, 3, 4 [51, 76, 102]

(Specify size/type) **OUTLET**

- \_\_\_ IC Inside Caulk
- \_\_\_ IP Threaded
- \_\_\_ NH No-Hub
- \_\_\_ NL Neo-Loc

**E BODY HT. DIM.**

- \_\_\_ 5-1/4 [133]
- \_\_\_ 3-3/4 [95]
- \_\_\_ 5-1/4 [133]
- \_\_\_ 4-9/16 [116]

**PREFIXES**

- \_\_\_ Z D.C.C.I. Body with Poly-Dome\*
- \_\_\_ ZA D.C.C.I. Body with Aluminum Dome
- \_\_\_ ZC D.C.C.I. Body with Cast Iron Dome
- \_\_\_ ZRB D.C.C.I. Body with Plain Bronze Dome

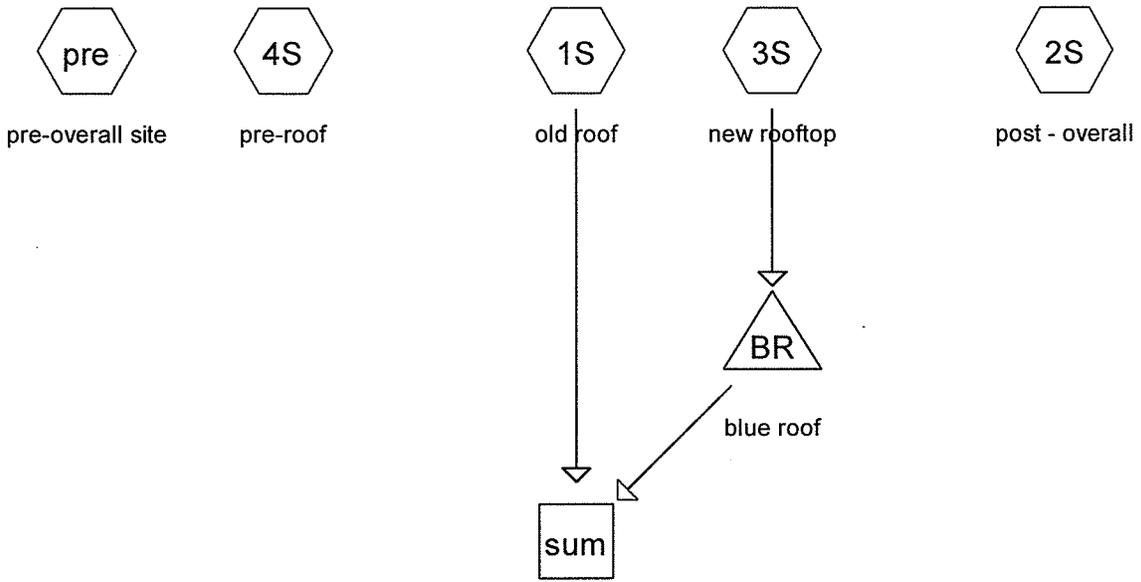
Note: Restrictor Plate Required to limit flow rate to 4.75 gpm/inch of head

**SUFFIXES**

- |   |   |
|---|---|
| <ul style="list-style-type: none"> <li>___ -C Underdeck Clamp</li> <li>___ -DE Deck Extension</li> <li>___ -DP Top-Set® Deck Plate (Replaces both -C &amp; -R)</li> <li>___ -DR Top-Set® Drain Riser</li> <li>___ -DX Dex-o-Tex Flange</li> <li>___ -E Static Extension 1 [25] thru 4 [102] (Specify Ht.)</li> <li>___ -EA Adjustable Extension Assembly 2-1/8 [54] thru 3-1/2 [89]</li> <li>___ -G Galvanized Cast Iron</li> <li>___ -R Roof Sump Receiver</li> <li>___ -SC Secondary Clamping Collar</li> </ul> | <ul style="list-style-type: none"> <li>___ -TC Neo-Loc Test Cap Gasket (2-4 [51-102] NL Bottom Outlet Only)</li> <li>___ -VP Vandal Proof Secured Top</li> <li>___ -XJ Vertical Expansion Joint (See Z190)</li> <li>___ -10 6 [152] High Parabolic Weir for Sloped Roof (Z or ZA)</li> <li>___ -90 90° Threaded Side Outlet Body</li> </ul> |
|---|---|

REV. H	DATE: 08/17/12	C.N. NO. 124666
DWG. NO. 58816	PRODUCT NO. Z105	

\*REGULARLY FURNISHED UNLESS OTHERWISE SPECIFIED



Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

**Subcatchment 1S: old roof** Runoff Area=3,660 sf 100.00% Impervious Runoff Depth=1.87"  
Flow Length=89' Slope=0.0620 '/' Tc=0.8 min CN=98.0 Runoff=0.29 cfs 0.013 af

**Subcatchment 2S: post - overall** Runoff Area=5,570 sf 100.00% Impervious Runoff Depth=1.87"  
Flow Length=89' Slope=0.0620 '/' Tc=0.8 min CN=98.0 Runoff=0.44 cfs 0.020 af

**Subcatchment 3S: new rooftop** Runoff Area=1,910 sf 100.00% Impervious Runoff Depth=1.87"  
Tc=0.0 min CN=98.0 Runoff=0.15 cfs 0.007 af

**Subcatchment 4S: pre-roof** Runoff Area=1,910 sf 0.00% Impervious Runoff Depth=0.31"  
Tc=0.0 min CN=71.0 Runoff=0.03 cfs 0.001 af

**Subcatchment pre: pre-overall site** Runoff Area=5,570 sf 0.00% Impervious Runoff Depth=0.31"  
Flow Length=89' Slope=0.0620 '/' Tc=6.7 min CN=71.0 Runoff=0.06 cfs 0.003 af

**Reach sum:** Inflow=0.30 cfs 0.020 af  
Outflow=0.30 cfs 0.020 af

**Pond BR: blue roof** Peak Elev=137.33' Storage=156 cf Inflow=0.15 cfs 0.007 af  
Primary=0.01 cfs 0.007 af Secondary=0.00 cfs 0.000 af Outflow=0.01 cfs 0.007 af

**Total Runoff Area = 0.427 ac Runoff Volume = 0.044 af Average Runoff Depth = 1.24"**  
**40.17% Pervious = 0.172 ac 59.83% Impervious = 0.256 ac**

**Summary for Subcatchment 1S: old roof**

remainder of project site

[49] Hint:  $T_c < 2dt$  may require smaller  $dt$

Runoff = 0.29 cfs @ 11.91 hrs, Volume= 0.013 af, Depth= 1.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs,  $dt= 0.01$  hrs  
 Type II 24-hr 1-year Rainfall=2.10"

Area (sf)	CN	Description
3,660	98.0	Paved parking, HSG C
3,660		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.8	89	0.0620	1.79		<b>Sheet Flow,</b> Smooth surfaces n= 0.011 P2= 2.30"

**Summary for Subcatchment 2S: post - overall**

[49] Hint:  $T_c < 2dt$  may require smaller  $dt$

Runoff = 0.44 cfs @ 11.91 hrs, Volume= 0.020 af, Depth= 1.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs,  $dt= 0.01$  hrs  
 Type II 24-hr 1-year Rainfall=2.10"

Area (sf)	CN	Description
5,570	98.0	Paved parking, HSG C
5,570		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.8	89	0.0620	1.79		<b>Sheet Flow,</b> Smooth surfaces n= 0.011 P2= 2.30"

**Summary for Subcatchment 3S: new rooftop**

[46] Hint:  $T_c=0$  (Instant runoff peak depends on  $dt$ )

Runoff = 0.15 cfs @ 11.90 hrs, Volume= 0.007 af, Depth= 1.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs,  $dt= 0.01$  hrs  
 Type II 24-hr 1-year Rainfall=2.10"

Area (sf)	CN	Description
1,910	98.0	Paved parking, HSG C
1,910		100.00% Impervious Area

**Summary for Subcatchment 4S: pre-roof**

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 0.03 cfs @ 11.90 hrs, Volume= 0.001 af, Depth= 0.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type II 24-hr 1-year Rainfall=2.10"

Area (sf)	CN	Description
1,910	71.0	Meadow, non-grazed, HSG C
1,910		100.00% Pervious Area

**Summary for Subcatchment pre: pre-overall site**

Runoff = 0.06 cfs @ 12.00 hrs, Volume= 0.003 af, Depth= 0.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type II 24-hr 1-year Rainfall=2.10"

Area (sf)	CN	Description
5,570	71.0	Meadow, non-grazed, HSG C
5,570		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.7	89	0.0620	0.22		<b>Sheet Flow,</b> Grass: Short n= 0.150 P2= 2.30"

**Summary for Reach sum:**

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.128 ac, 100.00% Impervious, Inflow Depth = 1.87" for 1-year event  
 Inflow = 0.30 cfs @ 11.91 hrs, Volume= 0.020 af  
 Outflow = 0.30 cfs @ 11.91 hrs, Volume= 0.020 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

**Summary for Pond BR: blue roof**

zurn drain uses 1 notch internal weir & restrictor plate. From mfr, 1" head = 475 gpm discharge

Inflow Area =	0.044 ac, 100.00% Impervious, Inflow Depth = 1.87" for 1-year event
Inflow =	0.15 cfs @ 11.90 hrs, Volume= 0.007 af
Outflow =	0.01 cfs @ 12.31 hrs, Volume= 0.007 af, Atten= 92%, Lag= 24.6 min
Primary =	0.01 cfs @ 12.31 hrs, Volume= 0.007 af
Secondary =	0.00 cfs @ 12.31 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Peak Elev= 137.33' @ 12.31 hrs Surf.Area= 1,910 sf Storage= 156 cf  
 Flood Elev= 138.25' Surf.Area= 1,910 sf Storage= 1,910 cf

Plug-Flow detention time= 231.0 min calculated for 0.007 af (100% of inflow)  
 Center-of-Mass det. time= 230.9 min ( 987.9 - 756.9 )

**14-141**

Type II 24-hr 1-year Rainfall=2.10"

Prepared by Trudell Consulting Engineers

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Volume	Invert	Avail.Storage	Storage Description
#1	137.25'	1,910 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
137.25	1,910	0	0
138.25	1,910	1,910	1,910

Device	Routing	Invert	Outlet Devices
#1	Primary	137.25'	<b>8.0" Horiz. discharge pipe</b> C= 0.600 Limited to weir flow at low heads
#2	Device 1	137.25'	<b>Zurn Z105 drain</b> Head (feet) 0.00 0.08 0.17 0.25 0.33 0.42 0.50 Disch. (cfs) 0.000 0.011 0.021 0.032 0.042 0.053 0.064
#3	Secondary	137.33'	<b>1.0' long x 0.50' rise overflow scuppers X 4.00</b> Cv= 2.62 (C= 3.28)

**Primary OutFlow** Max=0.01 cfs @ 12.31 hrs HW=137.33' TW=0.00' (Dynamic Tailwater)

↳ **1=discharge pipe** (Passes 0.01 cfs of 0.16 cfs potential flow)

↳ **2=Zurn Z105 drain** (Custom Controls 0.01 cfs)

**Secondary OutFlow** Max=0.00 cfs @ 12.31 hrs HW=137.33' TW=0.00' (Dynamic Tailwater)

↳ **3=overflow scuppers** (Weir Controls 0.00 cfs @ 0.13 fps)

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points  
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
 Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

**Subcatchment 1S: old roof** Runoff Area=3,660 sf 100.00% Impervious Runoff Depth=2.59"  
 Flow Length=89' Slope=0.0620 '/' Tc=0.8 min CN=98.0 Runoff=0.39 cfs 0.018 af

**Subcatchment 2S: post - overall** Runoff Area=5,570 sf 100.00% Impervious Runoff Depth=2.59"  
 Flow Length=89' Slope=0.0620 '/' Tc=0.8 min CN=98.0 Runoff=0.60 cfs 0.028 af

**Subcatchment 3S: new rooftop** Runoff Area=1,910 sf 100.00% Impervious Runoff Depth=2.59"  
 Tc=0.0 min CN=98.0 Runoff=0.21 cfs 0.009 af

**Subcatchment 4S: pre-roof** Runoff Area=1,910 sf 0.00% Impervious Runoff Depth=0.66"  
 Tc=0.0 min CN=71.0 Runoff=0.06 cfs 0.002 af

**Subcatchment pre: pre-overall site** Runoff Area=5,570 sf 0.00% Impervious Runoff Depth=0.66"  
 Flow Length=89' Slope=0.0620 '/' Tc=6.7 min CN=71.0 Runoff=0.14 cfs 0.007 af

**Reach sum:** Inflow=0.42 cfs 0.028 af  
 Outflow=0.42 cfs 0.028 af

**Pond BR: blue roof** Peak Elev=137.35' Storage=197 cf Inflow=0.21 cfs 0.009 af  
 Primary=0.01 cfs 0.008 af Secondary=0.05 cfs 0.001 af Outflow=0.06 cfs 0.009 af

**Total Runoff Area = 0.427 ac Runoff Volume = 0.065 af Average Runoff Depth = 1.81"**  
**40.17% Pervious = 0.172 ac 59.83% Impervious = 0.256 ac**

**Summary for Subcatchment 1S: old roof**

remainder of project site

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.39 cfs @ 11.91 hrs, Volume= 0.018 af, Depth= 2.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type II 24-hr 5-year Rainfall=2.82"

Area (sf)	CN	Description
3,660	98.0	Paved parking, HSG C
3,660		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.8	89	0.0620	1.79		<b>Sheet Flow,</b> Smooth surfaces n= 0.011 P2= 2.30"

**Summary for Subcatchment 2S: post - overall**

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.60 cfs @ 11.91 hrs, Volume= 0.028 af, Depth= 2.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type II 24-hr 5-year Rainfall=2.82"

Area (sf)	CN	Description
5,570	98.0	Paved parking, HSG C
5,570		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.8	89	0.0620	1.79		<b>Sheet Flow,</b> Smooth surfaces n= 0.011 P2= 2.30"

**Summary for Subcatchment 3S: new rooftop**

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 0.21 cfs @ 11.90 hrs, Volume= 0.009 af, Depth= 2.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type II 24-hr 5-year Rainfall=2.82"

Area (sf)	CN	Description
1,910	98.0	Paved parking, HSG C
1,910		100.00% Impervious Area

**Summary for Subcatchment 4S: pre-roof**

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 0.06 cfs @ 11.90 hrs, Volume= 0.002 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
Type II 24-hr 5-year Rainfall=2.82"

Area (sf)	CN	Description
1,910	71.0	Meadow, non-grazed, HSG C
1,910		100.00% Pervious Area

**Summary for Subcatchment pre: pre-overall site**

Runoff = 0.14 cfs @ 11.99 hrs, Volume= 0.007 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
Type II 24-hr 5-year Rainfall=2.82"

Area (sf)	CN	Description
5,570	71.0	Meadow, non-grazed, HSG C
5,570		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.7	89	0.0620	0.22		<b>Sheet Flow,</b> Grass: Short n= 0.150 P2= 2.30"

**Summary for Reach sum:**

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.128 ac, 100.00% Impervious, Inflow Depth = 2.59" for 5-year event  
Inflow = 0.42 cfs @ 11.91 hrs, Volume= 0.028 af  
Outflow = 0.42 cfs @ 11.91 hrs, Volume= 0.028 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

**Summary for Pond BR: blue roof**

zurn drain uses 1 notch internal weir & restrictor plate. From mfr, 1" head = 475 gpm discharge

Inflow Area = 0.044 ac, 100.00% Impervious, Inflow Depth = 2.59" for 5-year event  
Inflow = 0.21 cfs @ 11.90 hrs, Volume= 0.009 af  
Outflow = 0.06 cfs @ 11.98 hrs, Volume= 0.009 af, Atten= 71%, Lag= 5.0 min  
Primary = 0.01 cfs @ 11.98 hrs, Volume= 0.008 af  
Secondary = 0.05 cfs @ 11.98 hrs, Volume= 0.001 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
Peak Elev= 137.35' @ 11.98 hrs Surf.Area= 1,910 sf Storage= 197 cf  
Flood Elev= 138.25' Surf.Area= 1,910 sf Storage= 1,910 cf

Plug-Flow detention time= 199.2 min calculated for 0.009 af (100% of inflow)  
Center-of-Mass det. time= 199.2 min ( 948.9 - 749.7 )

**14-141**

Type II 24-hr 5-year Rainfall=2.82"

Prepared by Trudell Consulting Engineers

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Volume	Invert	Avail.Storage	Storage Description
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Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
137.25	1,910	0	0
138.25	1,910	1,910	1,910

Device	Routing	Invert	Outlet Devices
#1	Primary	137.25'	<b>8.0" Horiz. discharge pipe</b> C= 0.600 Limited to weir flow at low heads
#2	Device 1	137.25'	<b>Zurn Z105 drain</b> Head (feet) 0.00 0.08 0.17 0.25 0.33 0.42 0.50 Disch. (cfs) 0.000 0.011 0.021 0.032 0.042 0.053 0.064
#3	Secondary	137.33'	<b>1.0' long x 0.50' rise overflow scuppers X 4.00</b> Cv= 2.62 (C= 3.28)

**Primary OutFlow** Max=0.01 cfs @ 11.98 hrs HW=137.35' TW=0.00' (Dynamic Tailwater)

↳ **1=discharge pipe** (Passes 0.01 cfs of 0.23 cfs potential flow)

↳ **2=Zurn Z105 drain** (Custom Controls 0.01 cfs)

**Secondary OutFlow** Max=0.05 cfs @ 11.98 hrs HW=137.35' TW=0.00' (Dynamic Tailwater)

↳ **3=overflow scuppers** (Weir Controls 0.05 cfs @ 0.50 fps)

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points  
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
 Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

**Subcatchment 1S: old roof**

Runoff Area=3,660 sf 100.00% Impervious Runoff Depth=2.97"  
 Flow Length=89' Slope=0.0620 '/' Tc=0.8 min CN=98.0 Runoff=0.45 cfs 0.021 af

**Subcatchment 2S: post - overall**

Runoff Area=5,570 sf 100.00% Impervious Runoff Depth=2.97"  
 Flow Length=89' Slope=0.0620 '/' Tc=0.8 min CN=98.0 Runoff=0.68 cfs 0.032 af

**Subcatchment 3S: new rooftop**

Runoff Area=1,910 sf 100.00% Impervious Runoff Depth=2.97"  
 Tc=0.0 min CN=98.0 Runoff=0.24 cfs 0.011 af

**Subcatchment 4S: pre-roof**

Runoff Area=1,910 sf 0.00% Impervious Runoff Depth=0.88"  
 Tc=0.0 min CN=71.0 Runoff=0.08 cfs 0.003 af

**Subcatchment pre: pre-overall site**

Runoff Area=5,570 sf 0.00% Impervious Runoff Depth=0.88"  
 Flow Length=89' Slope=0.0620 '/' Tc=6.7 min CN=71.0 Runoff=0.19 cfs 0.009 af

**Reach sum:**

Inflow=0.51 cfs 0.032 af  
 Outflow=0.51 cfs 0.032 af

**Pond BR: blue roof**

Peak Elev=137.36' Storage=215 cf Inflow=0.24 cfs 0.011 af  
 Primary=0.01 cfs 0.009 af Secondary=0.08 cfs 0.002 af Outflow=0.09 cfs 0.011 af

**Total Runoff Area = 0.427 ac Runoff Volume = 0.076 af Average Runoff Depth = 2.13"**  
**40.17% Pervious = 0.172 ac 59.83% Impervious = 0.256 ac**

**Summary for Subcatchment 1S: old roof**

remainder of project site

[49] Hint:  $T_c < 2dt$  may require smaller  $dt$

Runoff = 0.45 cfs @ 11.91 hrs, Volume= 0.021 af, Depth= 2.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs,  $dt= 0.01$  hrs  
 Type II 24-hr 10-year Rainfall=3.20"

Area (sf)	CN	Description
3,660	98.0	Paved parking, HSG C
3,660		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.8	89	0.0620	1.79		<b>Sheet Flow,</b> Smooth surfaces n= 0.011 P2= 2.30"

**Summary for Subcatchment 2S: post - overall**

[49] Hint:  $T_c < 2dt$  may require smaller  $dt$

Runoff = 0.68 cfs @ 11.91 hrs, Volume= 0.032 af, Depth= 2.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs,  $dt= 0.01$  hrs  
 Type II 24-hr 10-year Rainfall=3.20"

Area (sf)	CN	Description
5,570	98.0	Paved parking, HSG C
5,570		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.8	89	0.0620	1.79		<b>Sheet Flow,</b> Smooth surfaces n= 0.011 P2= 2.30"

**Summary for Subcatchment 3S: new rooftop**

[46] Hint:  $T_c=0$  (Instant runoff peak depends on  $dt$ )

Runoff = 0.24 cfs @ 11.90 hrs, Volume= 0.011 af, Depth= 2.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs,  $dt= 0.01$  hrs  
 Type II 24-hr 10-year Rainfall=3.20"

Area (sf)	CN	Description
1,910	98.0	Paved parking, HSG C
1,910		100.00% Impervious Area

**Summary for Subcatchment 4S: pre-roof**

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 0.08 cfs @ 11.90 hrs, Volume= 0.003 af, Depth= 0.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
Type II 24-hr 10-year Rainfall=3.20"

Area (sf)	CN	Description
1,910	71.0	Meadow, non-grazed, HSG C
1,910		100.00% Pervious Area

**Summary for Subcatchment pre: pre-overall site**

Runoff = 0.19 cfs @ 11.99 hrs, Volume= 0.009 af, Depth= 0.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
Type II 24-hr 10-year Rainfall=3.20"

Area (sf)	CN	Description
5,570	71.0	Meadow, non-grazed, HSG C
5,570		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.7	89	0.0620	0.22		<b>Sheet Flow,</b> Grass: Short n= 0.150 P2= 2.30"

**Summary for Reach sum:**

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.128 ac, 100.00% Impervious, Inflow Depth = 2.97" for 10-year event  
Inflow = 0.51 cfs @ 11.91 hrs, Volume= 0.032 af  
Outflow = 0.51 cfs @ 11.91 hrs, Volume= 0.032 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

**Summary for Pond BR: blue roof**

urn drain uses 1 notch internal weir & restrictor plate. From mfr, 1" head = 475 gpm discharge

Inflow Area =	0.044 ac, 100.00% Impervious, Inflow Depth = 2.97" for 10-year event				
Inflow =	0.24 cfs @	11.90 hrs,	Volume=	0.011 af	
Outflow =	0.09 cfs @	11.97 hrs,	Volume=	0.011 af,	Atten= 61%, Lag= 4.3 min
Primary =	0.01 cfs @	11.97 hrs,	Volume=	0.009 af	
Secondary =	0.08 cfs @	11.97 hrs,	Volume=	0.002 af	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
Peak Elev= 137.36' @ 11.97 hrs Surf.Area= 1,910 sf Storage= 215 cf  
Flood Elev= 138.25' Surf.Area= 1,910 sf Storage= 1,910 cf

Plug-Flow detention time= 186.2 min calculated for 0.011 af (100% of inflow)  
Center-of-Mass det. time= 186.4 min ( 933.4 - 746.9 )

14-141

Type II 24-hr 10-year Rainfall=3.20'

Prepared by Trudell Consulting Engineers

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Volume	Invert	Avail.Storage	Storage Description
#1	137.25'	1,910 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
137.25	1,910	0	0
138.25	1,910	1,910	1,910

Device	Routing	Invert	Outlet Devices
#1	Primary	137.25'	<b>8.0" Horiz. discharge pipe</b> C= 0.600 Limited to weir flow at low heads
#2	Device 1	137.25'	<b>Zurn Z105 drain</b> Head (feet) 0.00 0.08 0.17 0.25 0.33 0.42 0.50 Disch. (cfs) 0.000 0.011 0.021 0.032 0.042 0.053 0.064
#3	Secondary	137.33'	<b>1.0' long x 0.50' rise overflow scuppers X 4.00</b> Cv= 2.62 (C= 3.28)

**Primary OutFlow** Max=0.01 cfs @ 11.97 hrs HW=137.36' TW=0.00' (Dynamic Tailwater)

↳1=**discharge pipe** (Passes 0.01 cfs of 0.26 cfs potential flow)

↳2=**Zurn Z105 drain** (Custom Controls 0.01 cfs)

**Secondary OutFlow** Max=0.08 cfs @ 11.97 hrs HW=137.36' TW=0.00' (Dynamic Tailwater)

↳3=**overflow scuppers** (Weir Controls 0.08 cfs @ 0.59 fps)

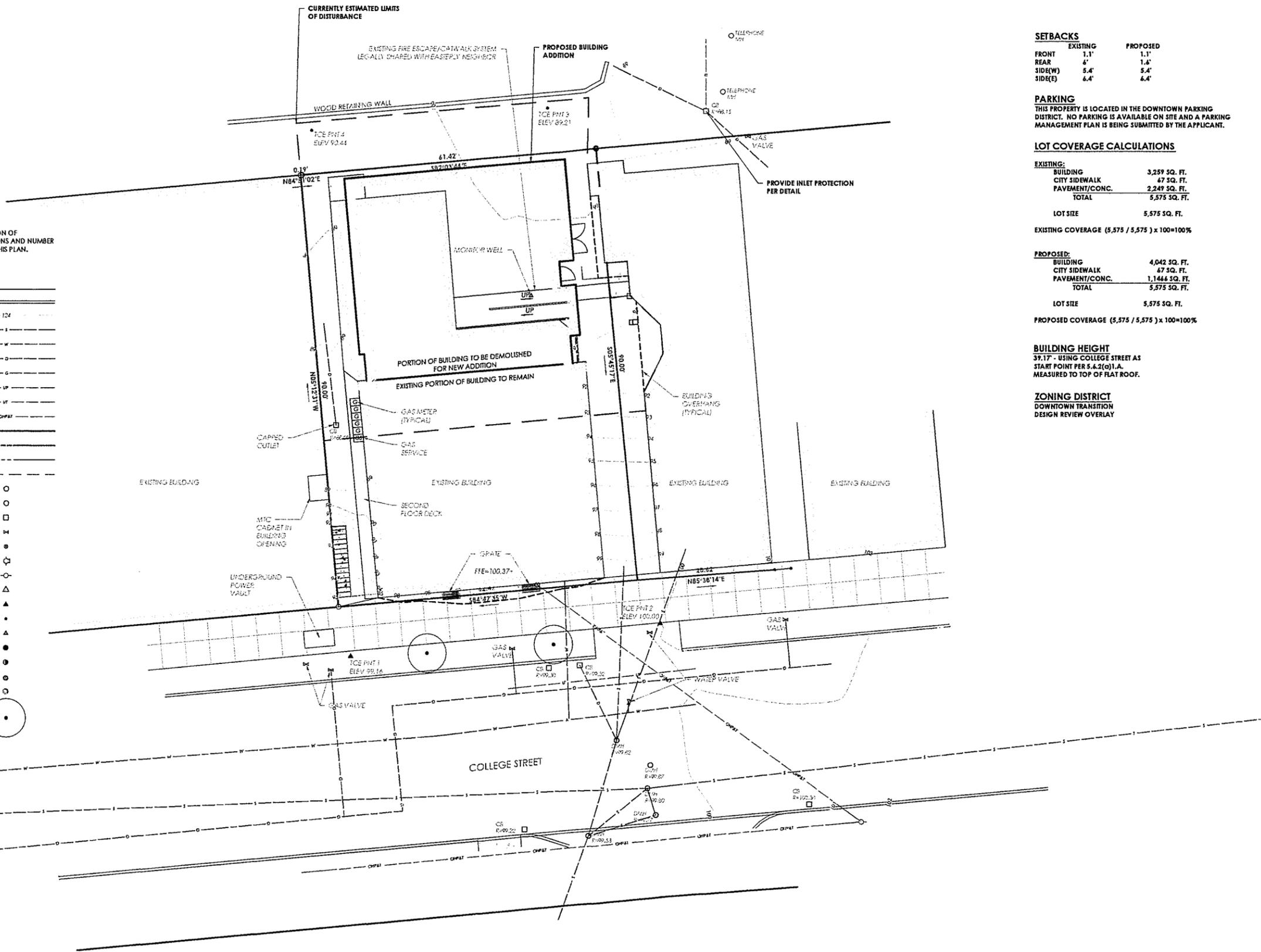


**UTILITIES NOTE**

AS OF 9/30/2014, TCE IS STILL INVESTIGATING THE LOCATION OF UNDERGROUND UTILITIES IN THE PROJECT AREA. LOCATIONS AND NUMBER OF UTILITY LINES MAY DIFFER FROM THOSE DEPICTED ON THIS PLAN.

**LEGEND**

PAVED DRIVE OR ROAD WITH CURB	---
TOPOGRAPHIC CONTOURS	--- 124 ---
SEWER MAINS AND SERVICES	---
WATER MAINS AND SERVICES	---
STORM DRAINAGE	---
LIQUID PROPANE OR NATURAL GAS	---
UNDERGROUND POWER	---
TELEPHONE	---
OVERHEAD POWER & TELEPHONE	---
PROPERTY LINE	---
RIGHT-OF-WAY LINE	---
EASEMENTS	---
BUILDING SETBACKS	---
SEWER MANHOLE (SMH)	○
STORM DRAINAGE MANHOLE (DMH)	○
CATCH BASIN (CB)	□
VALVE	⊕
CURB STOP (CS)	⊕
FIRE HYDRANT (HYD)	⊕
UTILITY POLE	○
CALCULATED POINT	△
TCE CONTROL POINT STEEL REBAR	▲
TCE CONTROL POINT MILD IRON	●
MONITOR WELL	▲
IRON PIPE	●
STEEL REBAR	●
IRON PIN (IP)	●
SURVEY MARKER	○
TREE	○



**SETBACKS**

	EXISTING	PROPOSED
FRONT	1.1'	1.1'
REAR	6'	1.4'
SIDE(W)	5.4'	5.4'
SIDE(E)	6.4'	6.4'

**PARKING**  
THIS PROPERTY IS LOCATED IN THE DOWNTOWN PARKING DISTRICT. NO PARKING IS AVAILABLE ON SITE AND A PARKING MANAGEMENT PLAN IS BEING SUBMITTED BY THE APPLICANT.

**LOT COVERAGE CALCULATIONS**

EXISTING:	
BUILDING	3,259 SQ. FT.
CITY SIDEWALK	47 SQ. FT.
PAVEMENT/CONC.	2,249 SQ. FT.
<b>TOTAL</b>	<b>5,575 SQ. FT.</b>

LOT SIZE 5,575 SQ. FT.

EXISTING COVERAGE (5,575 / 5,575) x 100=100%

PROPOSED:	
BUILDING	4,042 SQ. FT.
CITY SIDEWALK	47 SQ. FT.
PAVEMENT/CONC.	1,146 SQ. FT.
<b>TOTAL</b>	<b>5,575 SQ. FT.</b>

LOT SIZE 5,575 SQ. FT.

PROPOSED COVERAGE (5,575 / 5,575) x 100=100%

**BUILDING HEIGHT**  
37.17' - USING COLLEGE STREET AS START POINT PER 5.4.2(c)1.A. MEASURED TO TOP OF FLAT ROOF.

**ZONING DISTRICT**  
DOWNTOWN TRANSITION DESIGN REVIEW OVERLAY



**TRUDELL CONSULTING ENGINEERS**  
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Revisions  
No. Description Date By

- Use of these Drawings
- Unless otherwise noted, these Drawings are intended for preliminary planning, coordination with other disciplines or utilities, and/or approval from the regulatory authorities. They are not intended as construction drawings unless noted as such.
  - Only drawings specifically marked "For Construction" are intended to be used in conjunction with contract documents, specifications, owner/contractor agreements and to be fully coordinated with other disciplines, including but not limited to, the Architect, if applicable. These Drawings shall not be used for construction layout. Contact TCE for any construction surveying services or to obtain electronic data suitable for construction layout.
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  - It is the User's responsibility to ensure this copy contains the most current revisions.

**For Permitting Only**

Project Title  
**Sisters & Brothers Group, LLP**  
234-240 College Street  
Burlington Vermont

Sheet Title  
**Proposed Site Plan**

Date:	9/20/2014
Scale:	1" = 10'
Project Number:	14-141
Drawn By:	AGM
Project Engineer:	AGM
Approved By:	
Field Book:	290



**C2-01**