



Trinkaus Engineering, LLC

114 Hunters Ridge Road
Southbury, Connecticut 06488
203-264-4558 (office)
203-525-5153 (mobile)
E-mail: strinkaus@earthlink.net
<http://www.trinkausengineering.com>

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Project: D3 Realty – 72 Reservoir Road – Bethel, Connecticut

Project Description:

The site is currently vacant and consists of two parcels. The parcels will be merged to create a single parcel. Three duplex homes are proposed on the site under 8-30g. One unit will be at 80% of the statewide median income and one unit will be at 60% of the statewide median income. All three buildings will be served by individual driveways from Knollwood Drive which mirrors the homes on the east side of Knollwood Drive.

The land slopes up from Reservoir Road to the south. Based upon three test holes, the depth of the ledge gets shallower as it moves up the hill. A rock cut will be done to create a relatively flat area for the three units.

Pre-development Conditions:

The watershed area for pre-development conditions goes from the proposed ledge cut to Reservoir Road within the property boundaries.

Post-Development Conditions:

There will be three buildings along with driveways on the site. Only the impervious area on the subject parcel will be used for the design of the stormwater management system. Trench drains will be installed across each of the driveway to collect runoff between the residences and the property line. Roof drains will also be connected to the trench drains. The trench drains will be connected by 6” PVC pipe and directed to the underground water quality/detention system.

The peak rates of runoff were generated using HydroCAD for the Water Quality Storm, 2-year, 10-year, 25-year, 50-year, and 100-year rainfall events using NOAA 14 data.

The Water Quality Flow rate of 0.21 cfs will be directed to a Cultec R-330 XLHD Isolator Row, all other flows will by-pass the Isolator Row and be directed to the underground detention system.

Table 1 – Pre-Development Peak Rate Summary:

Storm Event	Pre-development	Post-development	Net Change
WQ Storm	0.0	0.1	+0.1
2-year	0.4	0.9	+0.5
10-year	1.0	1.7	+0.7
25-year	1.4	2.2	+0.8
50-year	1.7	2.6	+0.9
100-year	2.0	3.0	+1.0

Table 2 – Post-Development Peak Rate Summary:

Storm Event	Pre-development	Cultec system	By-Pass	Design Point
WQ Storm	0.0	0.2/0.1	0.0	0.1
2-year	0.4	0.5/0.1	0.3	0.4
10-year	1.0	0.9/0.3	0.8	0.9
25-year	1.4	1.1/0.5	1.1	1.4
50-year	1.7	1.2/0.6	1.3	1.7
100-year	2.0	1.4/0.6	1.5	2.0

Water Quality Volume and Water Quality Flow Calculations:**North:**

$$WQV = (1.3)(Rv)(A)/12$$

$$A = 0.162 \text{ acres (0.00025 square miles)}$$

$$I = 0.162 \text{ acres (100\%)}$$

$$Rv = 0.05 + 0.009(100) = 0.95$$

$$WQV = (1.3)(0.95)(0.162)/12 = 0.0166 \text{ acre-feet (762.2 cubic feet)}$$

Water Quality Flow (North):

$$\text{Runoff Depth: } Q = WQV * 12 / A = 0.0166 * 12 / 0.162 = 1.22''$$

$$CN = 1000 / [10 + (5 * P) + (10 * Q) - 10(Q^2 + (1.25 * Q * P))^{0.5}]$$

$$CN = 1000 / [10 + (5 * 1.3) + (10 * 1.22) - 10(1.22^2 + (1.25 * 1.22 * 1.3))^{0.5}]$$

$$CN = 1000 / [10 + 6.5 + 12.2 - 18.63]$$

$$CN = 1000 / 10.07 = 99.3, \text{ Use } 99$$

$$S = 1000 / CN - 10, S = 1000 / 99 - 10 = 0.101$$

$$Ia = 0.041 \text{ (table 4-1 from TR-55 Manual)}$$

$$Tc = 6 \text{ minutes}$$

$$Ia/p = 0.041 / 1.3 = 0.031$$

$$\text{Unit Peak discharge} = 685$$

$$WQF = (q_u) * (A) * (Q) = 685 * 0.00025 * 1.22 = 0.21 \text{ cfs}$$

Water Quality Treatment:

Use 4 units of StormTech SC-800 units in Isolator Row Configuration after bypass manhole to address water quality. StormTech requires a loading rate of 2.5 gallons per minute (gpm)/square foot. A flow rate of 0.21 cfs is equal to 94.25 gpm, at the required loading rate of 2.5 gallons/square foot, equals a required area of 37.70 square

feet. Each Cultec R-330 XLHD unit provides 30.33 square feet per unit, so 2 units will provide 60.67 square feet, which exceeds the minimum required area of 37.70 square feet.

Based upon field monitoring by the University of New Hampshire of the StormTech Isolator Road, the following pollutant reductions will be achieved in the field:

- Total Suspended Solids (TSS) – 80%
- Total Petroleum Hydrocarbons (TPH) – 91%
- Zn (Indicator for other metals) – 56%
- Total Phosphorous (TP) – 50%

A Pollutant Renovation Analysis for TSS is found in Appendix “A” of this report.

Pre-Development: Water Quality Storm

Summary for Subcatchment 1S: Pre-development

Runoff = 0.0 cfs @ 13.80 hrs, Volume= 0.001 af, Depth> 0.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr WQ Storm Rainfall=1.30"

Area (sf)	CN	Description
17,416	70	Brush, Fair, HSG C
17,416		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.3	100	0.1100	0.16		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.57"
0.7	92	0.1800	2.12		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
11.0	192	Total			

2-year Storm

Summary for Subcatchment 1S: Pre-development

Runoff = 0.4 cfs @ 12.17 hrs, Volume= 0.035 af, Depth> 1.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.57"

Area (sf)	CN	Description
17,416	70	Brush, Fair, HSG C
17,416		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.3	100	0.1100	0.16		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.57"
0.7	92	0.1800	2.12		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
11.0	192	Total			

10-year Storm

Summary for Subcatchment 1S: Pre-development

Runoff = 1.0 cfs @ 12.16 hrs, Volume= 0.082 af, Depth> 2.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=5.57"

Area (sf)	CN	Description
17,416	70	Brush, Fair, HSG C
17,416		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.3	100	0.1100	0.16		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.57"
0.7	92	0.1800	2.12		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
11.0	192	Total			

25-year Storm

Summary for Subcatchment 1S: Pre-development

Runoff = 1.4 cfs @ 12.16 hrs, Volume= 0.115 af, Depth> 3.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year Rainfall=6.82"

Area (sf)	CN	Description
17,416	70	Brush, Fair, HSG C
17,416		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.3	100	0.1100	0.16		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.57"
0.7	92	0.1800	2.12		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
11.0	192	Total			

50-year Storm

Summary for Subcatchment 1S: Pre-development

Runoff = 1.7 cfs @ 12.16 hrs, Volume= 0.141 af, Depth> 4.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 50-year Rainfall=7.74"

Area (sf)	CN	Description
17,416	70	Brush, Fair, HSG C
17,416		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.3	100	0.1100	0.16		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.57"
0.7	92	0.1800	2.12		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
11.0	192	Total			

100-year Storm

Summary for Subcatchment 1S: Pre-development

Runoff = 2.0 cfs @ 12.16 hrs, Volume= 0.170 af, Depth> 5.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=8.74"

Area (sf)	CN	Description
17,416	70	Brush, Fair, HSG C
17,416		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.3	100	0.1100	0.16		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.57"
0.7	92	0.1800	2.12		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
11.0	192	Total			

Post-Development: Water Quality Storm

Summary for Subcatchment 28S: Post-development

Runoff = 0.1 cfs @ 12.11 hrs, Volume= 0.010 af, Depth> 0.30"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr WQ Storm Rainfall=1.30"

Area (sf)	CN	Description
10,361	74	>75% Grass cover, Good, HSG C
7,055	98	Unconnected pavement, HSG C
17,416	84	Weighted Average
10,361		59.49% Pervious Area
7,055		40.51% Impervious Area
7,055		100.00% Unconnected

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

2-year Storm

Summary for Subcatchment 28S: Post-development

Runoff = 0.9 cfs @ 12.09 hrs, Volume= 0.066 af, Depth> 1.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.57"

Area (sf)	CN	Description
10,361	74	>75% Grass cover, Good, HSG C
7,055	98	Unconnected pavement, HSG C
17,416	84	Weighted Average
10,361		59.49% Pervious Area
7,055		40.51% Impervious Area
7,055		100.00% Unconnected

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

10-year Storm

Summary for Subcatchment 28S: Post-development

Runoff = 1.7 cfs @ 12.09 hrs, Volume= 0.126 af, Depth> 3.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=5.57"

Area (sf)	CN	Description
10,361	74	>75% Grass cover, Good, HSG C
7,055	98	Unconnected pavement, HSG C
17,416	84	Weighted Average
10,361		59.49% Pervious Area
7,055		40.51% Impervious Area
7,055		100.00% Unconnected

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

25-year Storm

Summary for Subcatchment 28S: Post-development

Runoff = 2.2 cfs @ 12.09 hrs, Volume= 0.165 af, Depth> 4.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year Rainfall=6.82"

Area (sf)	CN	Description
10,361	74	>75% Grass cover, Good, HSG C
7,055	98	Unconnected pavement, HSG C
17,416	84	Weighted Average
10,361		59.49% Pervious Area
7,055		40.51% Impervious Area
7,055		100.00% Unconnected

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

50-year Storm

Summary for Subcatchment 28S: Post-development

Runoff = 2.6 cfs @ 12.09 hrs, Volume= 0.195 af, Depth> 5.84"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 50-year Rainfall=7.74"

Area (sf)	CN	Description
10,361	74	>75% Grass cover, Good, HSG C
7,055	98	Unconnected pavement, HSG C
17,416	84	Weighted Average
10,361		59.49% Pervious Area
7,055		40.51% Impervious Area
7,055		100.00% Unconnected

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

100-year Storm

Summary for Subcatchment 28S: Post-development

Runoff = 3.0 cfs @ 12.09 hrs, Volume= 0.227 af, Depth> 6.80"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=8.74"

Area (sf)	CN	Description
10,361	74	>75% Grass cover, Good, HSG C
7,055	98	Unconnected pavement, HSG C
17,416	84	Weighted Average
10,361		59.49% Pervious Area
7,055		40.51% Impervious Area
7,055		100.00% Unconnected

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

Post-Development Detention Routing Analysis: Water Quality Storm

Summary for Pond 18P: Detention

Inflow Area = 0.162 ac, 100.00% Impervious, Inflow Depth > 1.08" for WQ Storm event
 Inflow = 0.2 cfs @ 12.09 hrs, Volume= 0.015 af
 Outflow = 0.1 cfs @ 12.32 hrs, Volume= 0.015 af, Atten= 61%, Lag= 13.8 min
 Primary = 0.1 cfs @ 12.32 hrs, Volume= 0.015 af
 Routed to Link 26L : Design Point

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
 Peak Elev= 384.01' @ 12.32 hrs Surf.Area= 616 sf Storage= 126 cf

Plug-Flow detention time= 17.1 min calculated for 0.015 af (100% of inflow)
 Center-of-Mass det. time= 15.7 min (794.8 - 779.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	383.50'	546 cf	16.00'W x 38.50'L x 3.54'H Field A 2,182 cf Overall - 816 cf Embedded = 1,366 cf x 40.0% Voids
#2A	384.00'	816 cf	Cultec R-330XLHD x 15 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 3 rows
		1,362 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	383.50'	2.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#2	Primary	385.00'	4.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.1 cfs @ 12.32 hrs HW=384.01' (Free Discharge)
 1=Orifice/Grate (Orifice Controls 0.1 cfs @ 3.42 fps)
 2=Orifice/Grate (Controls 0.0 cfs)

2-year Storm

Summary for Pond 18P: Detention

Inflow Area = 0.162 ac, 100.00% Impervious, Inflow Depth > 3.33" for 2-year event
 Inflow = 0.5 cfs @ 12.09 hrs, Volume= 0.045 af
 Outflow = 0.1 cfs @ 12.49 hrs, Volume= 0.045 af, Atten= 78%, Lag= 24.1 min
 Primary = 0.1 cfs @ 12.49 hrs, Volume= 0.045 af
 Routed to Link 26L : Design Point

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
 Peak Elev= 384.87' @ 12.49 hrs Surf.Area= 616 sf Storage= 554 cf

Plug-Flow detention time= 36.1 min calculated for 0.045 af (100% of inflow)
 Center-of-Mass det. time= 34.7 min (788.4 - 753.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	383.50'	546 cf	16.00'W x 38.50'L x 3.54'H Field A 2,182 cf Overall - 816 cf Embedded = 1,366 cf x 40.0% Voids
#2A	384.00'	816 cf	Cultec R-330XLHD x 15 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 3 rows
		1,362 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	383.50'	2.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#2	Primary	385.00'	4.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.1 cfs @ 12.49 hrs HW=384.87' (Free Discharge)
 1=Orifice/Grate (Orifice Controls 0.1 cfs @ 5.63 fps)
 2=Orifice/Grate (Controls 0.0 cfs)

10-year Storm

Summary for Pond 18P: Detention

Inflow Area = 0.162 ac, 100.00% Impervious, Inflow Depth > 5.33" for 10-year event
 Inflow = 0.9 cfs @ 12.09 hrs, Volume= 0.072 af
 Outflow = 0.3 cfs @ 12.30 hrs, Volume= 0.072 af, Atten= 60%, Lag= 13.1 min
 Primary = 0.3 cfs @ 12.30 hrs, Volume= 0.072 af
 Routed to Link 26L : Design Point

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
 Peak Elev= 385.40' @ 12.30 hrs Surf.Area= 616 sf Storage= 810 cf

Plug-Flow detention time= 38.2 min calculated for 0.072 af (100% of inflow)
 Center-of-Mass det. time= 36.8 min (782.7 - 745.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	383.50'	546 cf	16.00'W x 38.50'L x 3.54'H Field A 2,182 cf Overall - 816 cf Embedded = 1,366 cf x 40.0% Voids
#2A	384.00'	816 cf	Cultec R-330XLHD x 15 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 3 rows
		1,362 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	383.50'	2.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#2	Primary	385.00'	4.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.3 cfs @ 12.30 hrs HW=385.40' (Free Discharge)
 ↑ **1=Orifice/Grate** (Orifice Controls 0.1 cfs @ 6.64 fps)
 ↓ **2=Orifice/Grate** (Orifice Controls 0.2 cfs @ 2.33 fps)

25-year Storm

Summary for Pond 18P: Detention

Inflow Area = 0.162 ac, 100.00% Impervious, Inflow Depth > 6.58" for 25-year event
 Inflow = 1.1 cfs @ 12.09 hrs, Volume= 0.089 af
 Outflow = 0.5 cfs @ 12.27 hrs, Volume= 0.089 af, Atten= 55%, Lag= 11.0 min
 Primary = 0.5 cfs @ 12.27 hrs, Volume= 0.089 af
 Routed to Link 26L : Design Point

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
 Peak Elev= 385.73' @ 12.27 hrs Surf.Area= 616 sf Storage= 955 cf

Plug-Flow detention time= 37.3 min calculated for 0.089 af (100% of inflow)
 Center-of-Mass det. time= 35.9 min (778.8 - 742.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	383.50'	546 cf	16.00'W x 38.50'L x 3.54'H Field A 2,182 cf Overall - 816 cf Embedded = 1,366 cf x 40.0% Voids
#2A	384.00'	816 cf	Cultec R-330XLHD x 15 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 3 rows
		1,362 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	383.50'	2.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#2	Primary	385.00'	4.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.5 cfs @ 12.27 hrs HW=385.72' (Free Discharge)
 ↑ **1=Orifice/Grate** (Orifice Controls 0.2 cfs @ 7.18 fps)
 ↓ **2=Orifice/Grate** (Orifice Controls 0.3 cfs @ 3.60 fps)

50-year Storm

Summary for Pond 18P: Detention

Inflow Area = 0.162 ac, 100.00% Impervious, Inflow Depth > 7.50" for 50-year event
 Inflow = 1.2 cfs @ 12.09 hrs, Volume = 0.101 af
 Outflow = 0.6 cfs @ 12.26 hrs, Volume = 0.101 af, Atten = 54%, Lag = 10.5 min
 Primary = 0.6 cfs @ 12.26 hrs, Volume = 0.101 af
 Routed to Link 26L : Design Point

Routing by Stor-Ind method, Time Span = 0.00-24.00 hrs, dt = 0.05 hrs
 Peak Elev = 386.01' @ 12.26 hrs Surf.Area = 616 sf Storage = 1,069 cf

Plug-Flow detention time = 37.0 min calculated for 0.101 af (100% of inflow)
 Center-of-Mass det. time = 35.7 min (776.9 - 741.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	383.50'	546 cf	16.00'W x 38.50'L x 3.54'H Field A 2,182 cf Overall - 816 cf Embedded = 1,366 cf x 40.0% Voids
#2A	384.00'	816 cf	Cultec R-330XLHD x 15 Inside #1 Effective Size = 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size = 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment = +1.50' x 7.45 sf x 3 rows
		1,362 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	383.50'	2.0" Horiz. Orifice/Grate C = 0.600 Limited to weir flow at low heads
#2	Primary	385.00'	4.0" Vert. Orifice/Grate C = 0.600 Limited to weir flow at low heads

Primary OutFlow Max = 0.6 cfs @ 12.26 hrs HW = 386.00' (Free Discharge)
 1 = **Orifice/Grate** (Orifice Controls 0.2 cfs @ 7.62 fps)
 2 = **Orifice/Grate** (Orifice Controls 0.4 cfs @ 4.41 fps)

100-year Storm

Summary for Pond 18P: Detention

Inflow Area = 0.162 ac, 100.00% Impervious, Inflow Depth > 8.49" for 100-year event
 Inflow = 1.4 cfs @ 12.09 hrs, Volume = 0.115 af
 Outflow = 0.6 cfs @ 12.25 hrs, Volume = 0.114 af, Atten = 53%, Lag = 10.1 min
 Primary = 0.6 cfs @ 12.25 hrs, Volume = 0.114 af
 Routed to Link 26L : Design Point

Routing by Stor-Ind method, Time Span = 0.00-24.00 hrs, dt = 0.05 hrs
 Peak Elev = 386.37' @ 12.25 hrs Surf.Area = 616 sf Storage = 1,195 cf

Plug-Flow detention time = 37.0 min calculated for 0.114 af (100% of inflow)
 Center-of-Mass det. time = 35.6 min (775.4 - 739.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	383.50'	546 cf	16.00'W x 38.50'L x 3.54'H Field A 2,182 cf Overall - 816 cf Embedded = 1,366 cf x 40.0% Voids
#2A	384.00'	816 cf	Cultec R-330XLHD x 15 Inside #1 Effective Size = 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size = 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment = +1.50' x 7.45 sf x 3 rows
		1,362 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	383.50'	2.0" Horiz. Orifice/Grate C = 0.600 Limited to weir flow at low heads
#2	Primary	385.00'	4.0" Vert. Orifice/Grate C = 0.600 Limited to weir flow at low heads

Primary OutFlow Max = 0.6 cfs @ 12.25 hrs HW = 386.37' (Free Discharge)
 1 = **Orifice/Grate** (Orifice Controls 0.2 cfs @ 8.16 fps)
 2 = **Orifice/Grate** (Orifice Controls 0.5 cfs @ 5.28 fps)

Post-development By-pass: WQ- storm

Summary for Subcatchment 27S: Post-Development-Bypass

Runoff = 0.0 cfs @ 12.37 hrs, Volume= 0.002 af, Depth> 0.09"
Routed to Link 26L : Design Point

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr WQ Storm Rainfall=1.30"

Area (sf)	CN	Description
10,361	74	>75% Grass cover, Good, HSG C
10,361		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	85	0.0400	0.23		Sheet Flow, Grass: Short n= 0.150 P2= 3.57"

2-year storm

Summary for Subcatchment 27S: Post-Development-Bypass

Runoff = 0.3 cfs @ 12.10 hrs, Volume= 0.026 af, Depth> 1.29"
Routed to Link 26L : Design Point

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.57"

Area (sf)	CN	Description
10,361	74	>75% Grass cover, Good, HSG C
10,361		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	85	0.0400	0.23		Sheet Flow, Grass: Short n= 0.150 P2= 3.57"

10-year storm

Summary for Subcatchment 27S: Post-Development-Bypass

Runoff = 0.8 cfs @ 12.10 hrs, Volume= 0.056 af, Depth> 2.82"
Routed to Link 26L : Design Point

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=5.57"

Area (sf)	CN	Description
10,361	74	>75% Grass cover, Good, HSG C
10,361		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	85	0.0400	0.23		Sheet Flow, Grass: Short n= 0.150 P2= 3.57"

25-year storm

Summary for Subcatchment 27S: Post-Development-Bypass

Runoff = 1.1 cfs @ 12.09 hrs, Volume= 0.077 af, Depth> 3.88"
Routed to Link 26L : Design Point

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year Rainfall=6.82"

Area (sf)	CN	Description
10,361	74	>75% Grass cover, Good, HSG C
10,361		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	85	0.0400	0.23		Sheet Flow, Grass: Short n= 0.150 P2= 3.57"

50-year storm

Summary for Subcatchment 27S: Post-Development-Bypass

Runoff = 1.3 cfs @ 12.09 hrs, Volume= 0.093 af, Depth> 4.69"
Routed to Link 26L : Design Point

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 50-year Rainfall=7.74"

Area (sf)	CN	Description
10,361	74	>75% Grass cover, Good, HSG C
10,361		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	85	0.0400	0.23		Sheet Flow, Grass: Short n=0.150 P2= 3.57"

100-year storm

Summary for Subcatchment 27S: Post-Development-Bypass

Runoff = 1.5 cfs @ 12.09 hrs, Volume= 0.111 af, Depth> 5.59"
Routed to Link 26L : Design Point

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=8.74"

Area (sf)	CN	Description
10,361	74	>75% Grass cover, Good, HSG C
10,361		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	85	0.0400	0.23		Sheet Flow, Grass: Short n=0.150 P2= 3.57"

Post-Development - Site Design Point: WQ Storm

Summary for Link 26L: Design Point

Inflow Area = 0.400 ac, 40.51% Impervious, Inflow Depth > 0.49" for WQ Storm event
Inflow = 0.1 cfs @ 12.35 hrs, Volume= 0.016 af
Primary = 0.1 cfs @ 12.35 hrs, Volume= 0.016 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

2-year

Summary for Link 26L: Design Point

Inflow Area = 0.400 ac, 40.51% Impervious, Inflow Depth > 2.11" for 2-year event
Inflow = 0.4 cfs @ 12.10 hrs, Volume= 0.070 af
Primary = 0.4 cfs @ 12.10 hrs, Volume= 0.070 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

10-year

Summary for Link 26L: Design Point

Inflow Area = 0.400 ac, 40.51% Impervious, Inflow Depth > 3.83" for 10-year event
Inflow = 0.9 cfs @ 12.12 hrs, Volume= 0.128 af
Primary = 0.9 cfs @ 12.12 hrs, Volume= 0.128 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

25-year

Summary for Link 26L: Design Point

Inflow Area = 0.400 ac, 40.51% Impervious, Inflow Depth > 4.97" for 25-year event
Inflow = 1.4 cfs @ 12.11 hrs, Volume= 0.166 af
Primary = 1.4 cfs @ 12.11 hrs, Volume= 0.166 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

50-year

Summary for Link 26L: Design Point

Inflow Area = 0.400 ac, 40.51% Impervious, Inflow Depth > 5.82" for 50-year event
Inflow = 1.7 cfs @ 12.11 hrs, Volume= 0.194 af
Primary = 1.7 cfs @ 12.11 hrs, Volume= 0.194 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

100-year

Summary for Link 26L: Design Point

Inflow Area = 0.400 ac, 40.51% Impervious, Inflow Depth > 6.76" for 100-year event
Inflow = 2.0 cfs @ 12.10 hrs, Volume= 0.225 af
Primary = 2.0 cfs @ 12.10 hrs, Volume= 0.225 af, Atten= 0%, Lag= 0.0 min

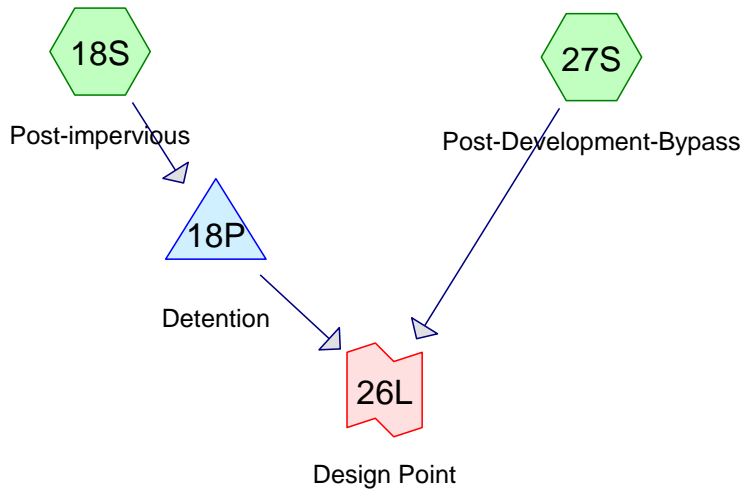
Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Hydrologic Diagrams:

Pre-Development and Post-Development Conditions:



Post-Development Conditions with Detention:



Full flow capacity of drainage pipes:

- P1: 6" PVC at S = 16.7%, Q = 3.31 cfs**
- P2: 6" PVC at S = 35.7%, Q = 4.86 cfs**
- P3: 8" PVC at S = 42.8%, Q = 11.57 cfs**
- P4: 24" HDPE at S = 2.5%, Q = 51.66 cfs**
- P5: 12" HDPE at S = 1.0%, Q = 5.14 cfs**
- P6: 12" HDPE at S = 3.33%, Q = 9.35 cfs**
- P7: 12" HDPE at S = 9.3%, Q = 15.69 cfs**

These capacity rates are all substantially larger than the actual design peak rates for the twenty-five year rainfall event, so there are no capacity issues with the proposed stormwater conveyance system.

Conclusion:

Please contact me if you have any questions concerning this information.

Very Truly Yours,
Trinkaus Engineering, LLC



Steven D. Trinkaus, PE

APPENDIX "A"

TSS RENOVATION ANALYSIS

72 RESERVOIR ROAD						
WATERSHED	TOTAL AREA	IMPERVIOUS AREA	RUNOFF COEFFICIENT	WATER QUALITY STORM (INCHES)		
SYSTEM	A(acres) =	0.162 I (%) =	100 Rv =	0.95 P =	1.3	
POLLUTANT LOADS DETERMINED BY SCHUELER EQUATION: $L = (0.226)*(P)*(Pj)*(Rv)*(C)*(A)$						
HIGH DENSITY RESIDENTIAL						
TSS =	60 mg/l					
TP =	0.3 mg/l					
TN =	2.6 mg/l					
ZN =	0.218 mg/l					
TPH =	3 mg/l					
CALCULATED POLLUTANT LOADS - WATER QUALITY STORM (1.3"/24 HOURS)						
TSS	2.577302 lbs					
TP	0.012887 lbs					
TN	0.111683 lbs					
ZN	0.009364 lbs					
TPH	0.128865 lbs					
POLLUTANT REMOVAL -						
ISOLATOR ROW						
TSS LOAD TO SYSTEM	2.577					
ISOLATOR ROW	0.8					
LOAD REMOVED	2.062					

STORMWATER PRACTICE - REMOVAL RATES						
STORMTECH ISOLATOR ROW						
TSS =	0.8					
SCHUELER'S EQUATION:						
0.226	CONVERSION FACTOR					
P	WATER QUALITY STORM RAINFALL					
Pj	FACTOR THAT CORRECTS FOR STORMS WHICH DO NOT GENERATE RUNOFF					
Rv	RUNOFF COEFFICIENT					
C	POLLUTANT CONCENTRATION (mg/l)					
A	WATERSHED AREA IN ACRES					
L	POUNDS					