

Site Photographs (taken on 7/28/2016)



Photo1: Nixon Road Looking West

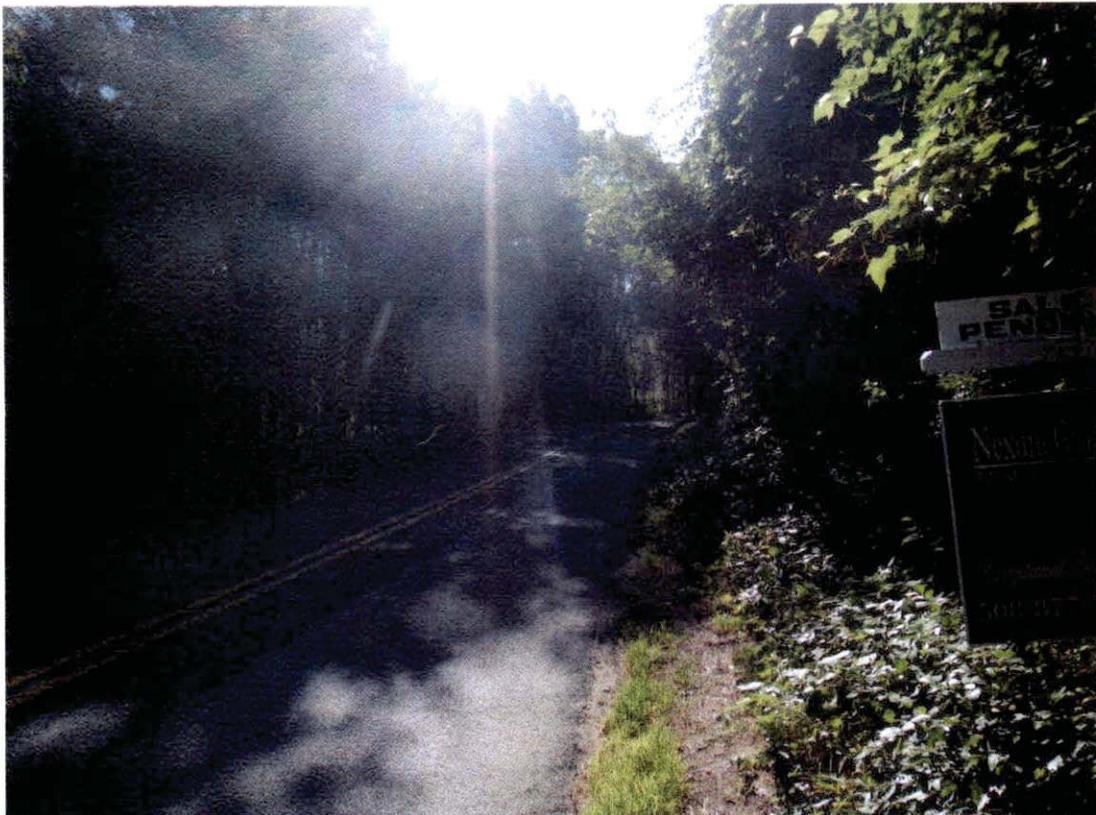


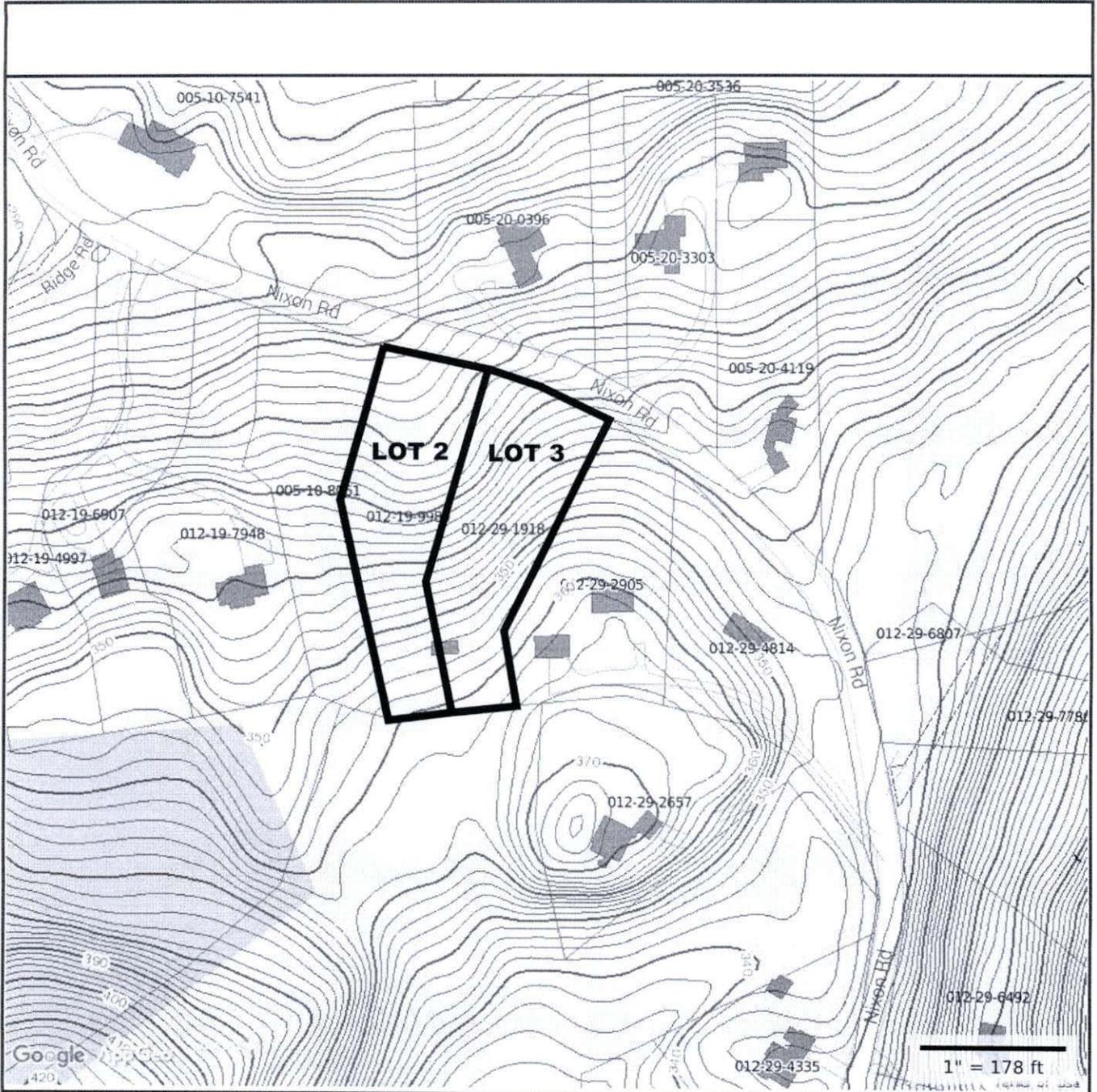
Photo 2: Nixon Road Looking East



Photo 3: Development Area #52C



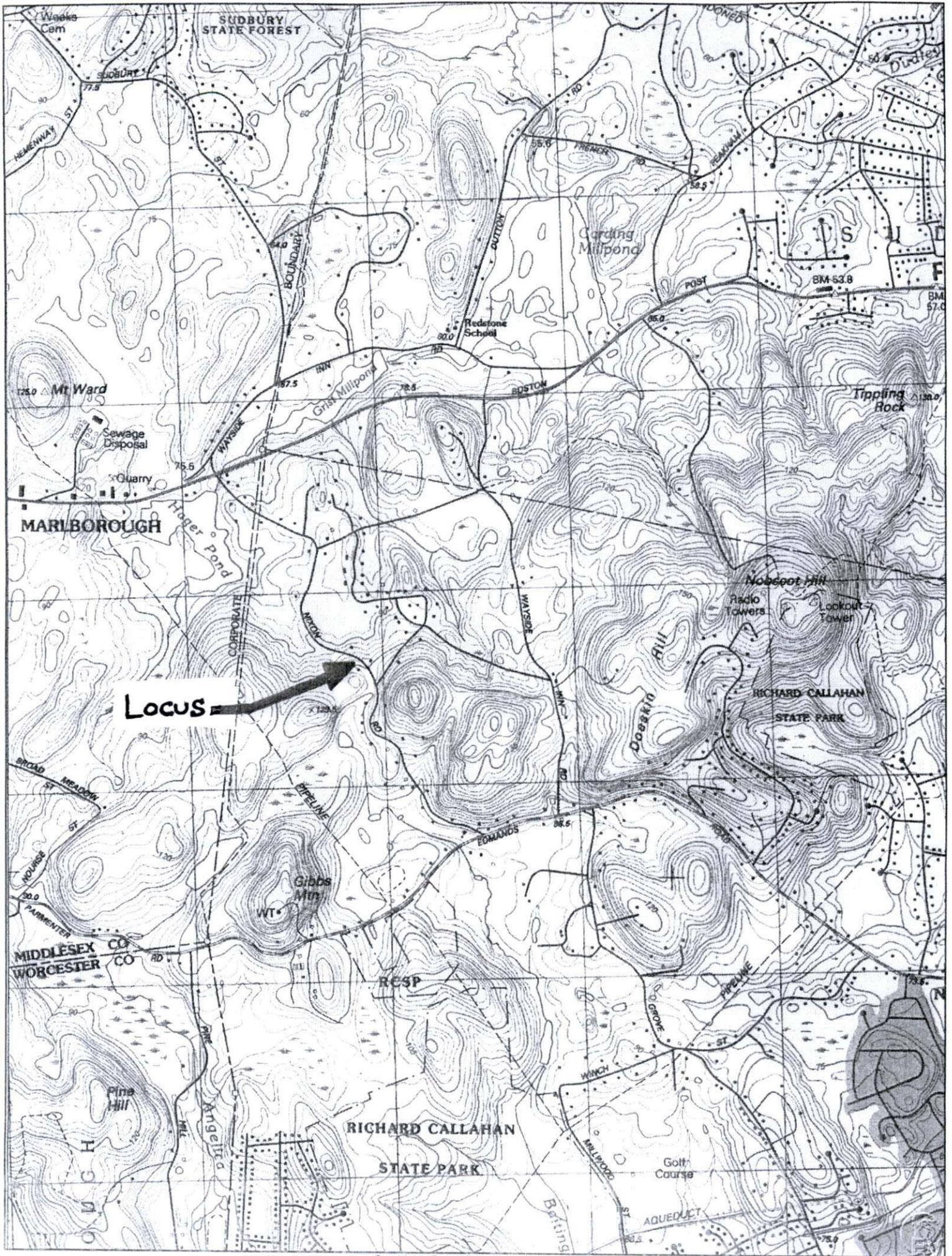
Photo 4: Development Area #52B



FRAMINGHAM
MASSACHUSETTS

MAP FOR REFERENCE ONLY
NOT A LEGAL DOCUMENT

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STORMWATER REPORT

52B & 52c Nixon Road
Framingham, MA

July 28, 2016

PREPARED BY:
Connorstone Engineering, Inc.
10 Southwest Cutoff, Suite 7
Northborough, MA 01532

Site Description

Site Location: 52B & 52C Road, Framingham

Zoning District: R-1 Single Family Residential (no overlays)

Assessors Map / Parcel: 52B Sheet 12, Block 19, Lot 9989
52C Sheet 12 Block 29, Lot 1918

Surface Conditions: Previously disturbed and cleared field along the front portion of the site with typical upland forest to the rear of the site.

Site Topography: The site slopes from north to south at moderate slopes of 15% leading to Nixon Road.

Wetland Resource Areas: No known regulated wetland resources have been located within 125 feet of the site. The proposed project is not located in an Estimated or Priority Habitat of Rare Wildlife as indicated on the 2008 Estimated Habitat Map of State-Listed Rare Wetland Wildlife published by the Natural Heritage and Endangered Species Program (NHESP).

Soil Conditions: The Natural Resource Conservation Service has mapped the soils on site as "Narragansett-Hollis-Rock Complex," and "Narragansett Silt Loam," which are classified as Hydrologic Soil Group A. test pits have also been performed on-site that show well drained soils with a texture ranging from fine sand to gravel. Groundwater varied from 48 inches to greater than 120 inches below grade.

Proposed Project Summary

Proposed Use: Two single family houses with associated septic systems, utilities, site work, landscaping, and driveway access off Nixon Road.

Disturbed Area: Approximately 51,000 square feet

Proposed Impervious Area: 9,610 square feet +/- (driveway and house footprint)

Stormwater Management

Existing Conditions: Under the existing conditions, all surface runoff from the project area flows uncollected toward Nixon Road. The upgradient drainage area includes approximately 3.35 acres of vegetated uplands both on-site and upgradient of the site.

Proposed Conditions: A proposed drainage system has been provided in compliance with the Town Bylaws to ensure the rate and volume of runoff does not exceed the existing conditions.

Surface runoff from the roof areas will be collected and directed to two drywells to the front of the proposed house. Overflow from this system will discharge to undisturbed areas. Runoff from the driveway and front lawn area will be collected through a deep sump catch basin and directed to a drywells located at the base of the driveway. Additional information and calculations have been attached to verify the proposed design and stormwater flows.

HYDROLOGIC ANALYSIS

An analysis was performed to determine the peak rate and volume of stormwater runoff leaving the site, and verify the stormwater management system meets the requirements of the Bylaw. Existing conditions were compared to proposed conditions to ensure that the proposed design will not increase the rate or volume of runoff from the site and/or result in downstream impacts.

Calculation Methods:

1. HydroCAD 9.10 Stormwater modeling Software
2. Data/Equation Source: Soil Conservation Service (SCS) Technical Release No. 20 (TR-20), SCS Technical Release 55 (TR-55), Urban Hydrology for Small Watersheds, and NRCS Upland Method.

Storm Event:

1. Rainfall Distribution: Type III, 24-hour storm
2. Rainfall frequency and intensity:

2-year	3.2 in/hr	100- year:	7.0 in/hr
10-year	4.8 in/hr		
3. Data Source: National Weather Service Technical Paper 40

Soil Classification / Information:

1. Soil Classification: Narragansett-Hollis-Rock Complex
 2. Hydrologic Group: HSG B
 3. Depth to Groundwater: Greater than 110 inches (none encountered to bottom of test pit)
 4. Data Source:

a.) NRCS / USDA Soil Survey
b.) On-site test pits
- *See report for soils mapping, test pit results are shown on the plans

Analysis Points

AP-1. Flow to Nixon Road

Summary:

The following table presents the pre- and post- development analysis for the 2-, 10-, and 100-year storm events.

Table 1: PEAK RATE of Runoff Summary

Analysis Point - AP	2-Year Storm Existing (Proposed)	10-Year Storm Existing (Proposed)	100-Year Storm Existing (Proposed)
1 Edmands Road	0.0 cfs (0.0 cfs)	0.0 cfs (0.0 cfs)	0.3 cfs (0.3 cfs)

Table 2: VOLUME of Runoff Summary

Analysis Point - AP	2-Year Storm Existing (Proposed)	10-Year Storm Existing (Proposed)	100-Year Storm Existing (Proposed)
1 Edmands Road	0.0 acre-feet (0.0 acre-feet)	0.0 acre-feet (0.0 acre-feet)	0.11 acre-feet (0.08 acre-feet)

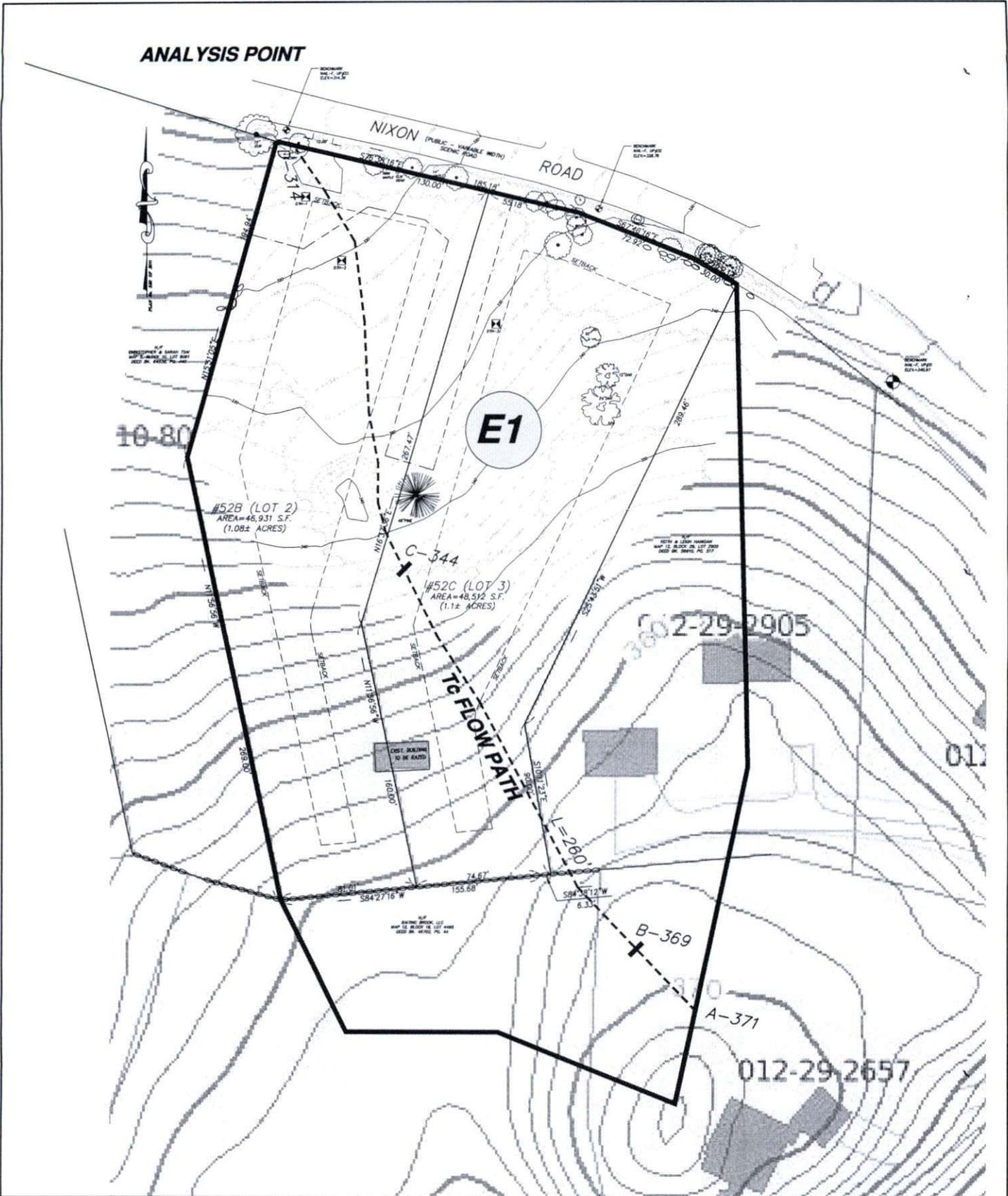
HYDROCAD CALCULATIONS

EXISTING CONDITION
2 Year, 10 Year & 100 Year Storm
Calculation Sheets

AND

PROPOSED CONDITION
2 Year, 10 Year & 100 Year Storm
Calculation Sheets

ANALYSIS POINT



**EXISTING DRAINAGE AREAS
52 NIXON ROAD**

DATE:

7/26/2016

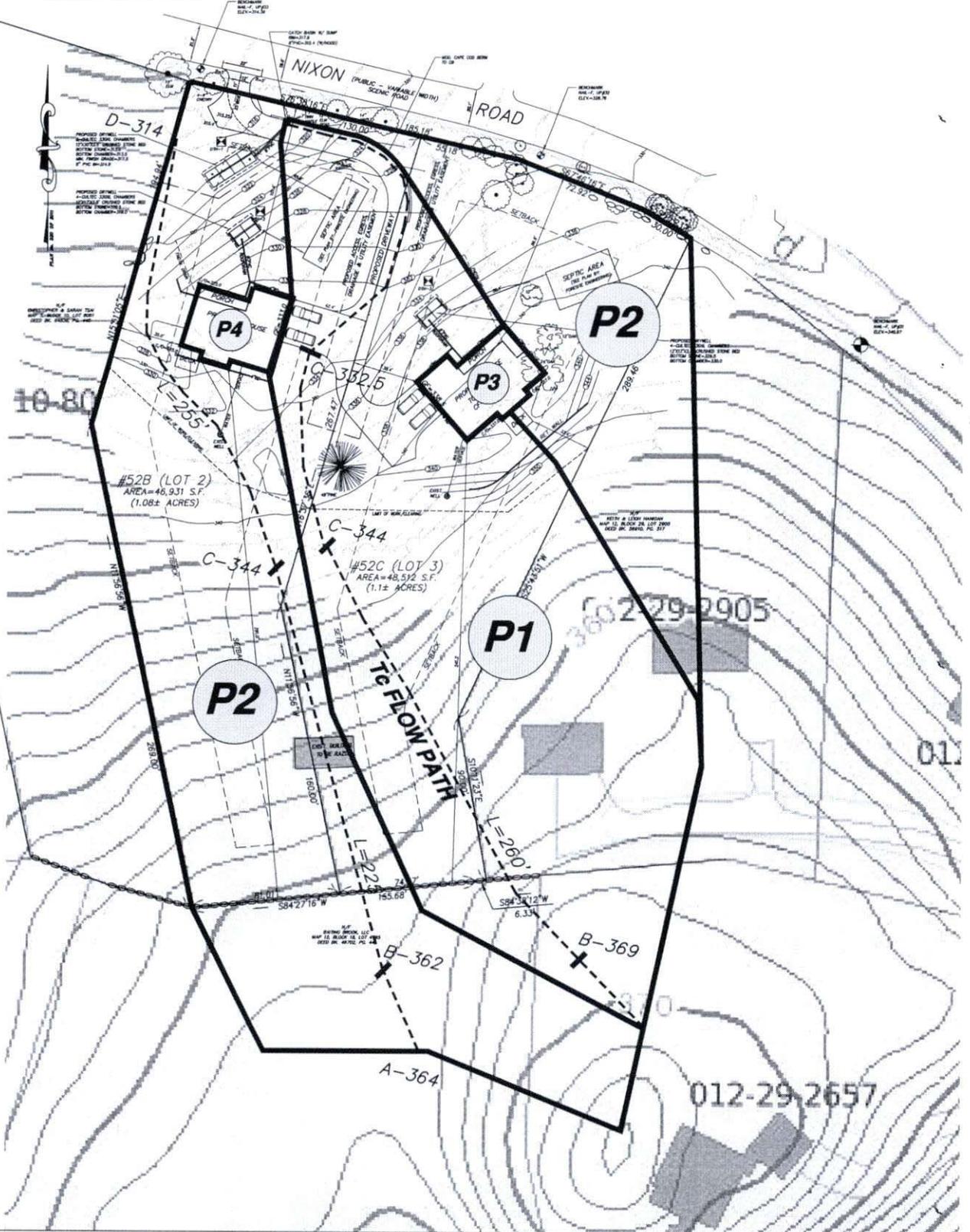
SCALE:

1"=80'

**SULLIVAN, CONNORS
AND ASSOCIATES**

LAND SURVEYING AND CIVIL ENGINEERING
121 BOSTON POST RD. SUDBURY, MA. 01776

ANALYSIS POINT

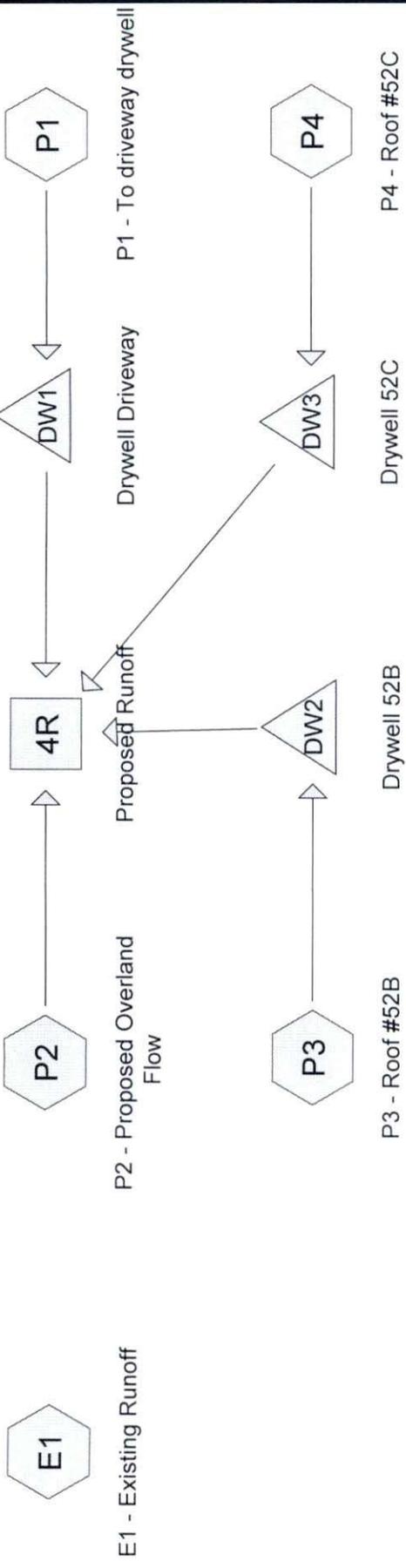


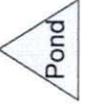
**PROPOSED DRAINAGE AREAS
52 NIXON ROAD**

**SULLIVAN, CONNORS
AND ASSOCIATES**
LAND SURVEYING AND CIVIL ENGINEERING
121 BOSTON POST RD. SUDBURY, MA. 01776

DATE:
7/26/2016

SCALE:
1"=80'



 Subcat
 Reach
 Pond
 Link

Drainage Diagram for 52 Nixon Drainage
 Prepared by Microsoft, Printed 7/28/2016
 HydroCAD® 9.10 s/n 01413 © 2011 HydroCAD Software Solutions LLC

Summary for Subcatchment E1: E1 - Existing Runoff

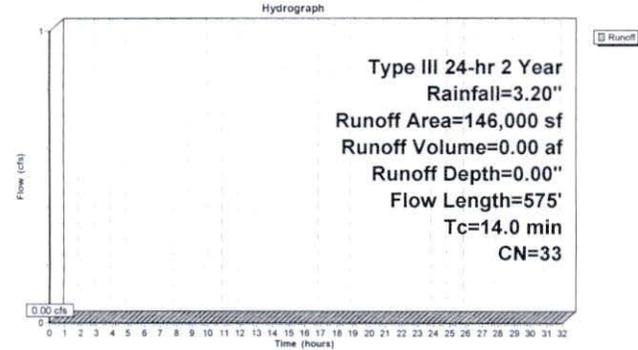
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.00 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-32.00 hrs, dt= 0.01 hrs
 Type III 24-hr 2 Year Rainfall=3.20"

Area (sf)	CN	Description
94,000	30	Woods, Good, HSG A
52,000	39	Pasture/grassland/range, Good, HSG A
146,000	33	Weighted Average
146,000		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	50	0.0400	0.09		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.20"
2.8	260	0.0960	1.55		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
1.9	265	0.1100	2.32		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
14.0	575	Total			

Subcatchment E1: E1 - Existing Runoff



Summary for Subcatchment P1: P1 - To driveway drywell

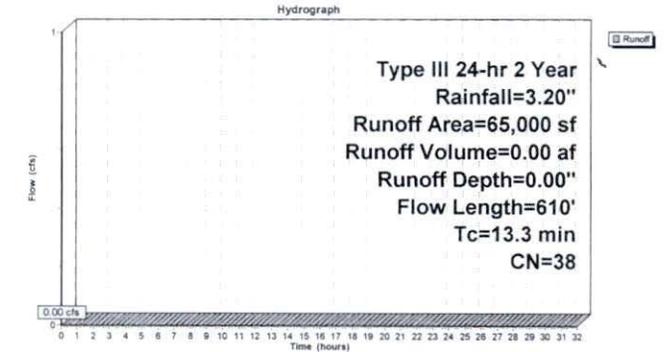
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.00 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-32.00 hrs, dt= 0.01 hrs
 Type III 24-hr 2 Year Rainfall=3.20"

Area (sf)	CN	Description
40,000	30	Woods, Good, HSG A
20,300	39	>75% Grass cover, Good, HSG A
4,700	98	Paved parking, HSG A
65,000	38	Weighted Average
60,300		92.77% Pervious Area
4,700		7.23% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	50	0.0400	0.09		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.20"
2.8	260	0.0960	1.55		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
0.6	110	0.1900	3.05		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
0.6	190	0.0800	5.74		Shallow Concentrated Flow, Paved Kv= 20.3 fps
13.3	610	Total			

Subcatchment P1: P1 - To driveway drywell



Summary for Subcatchment P2: P2 - Proposed Overland Flow

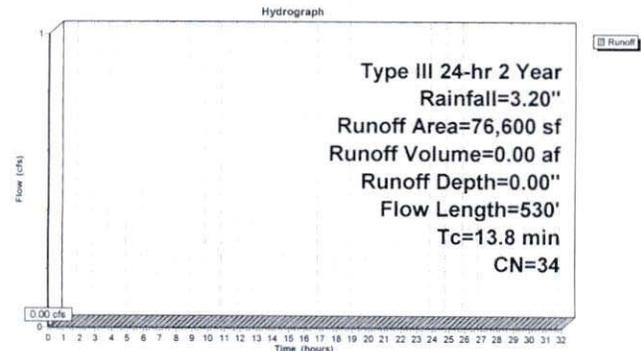
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.00 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-32.00 hrs, dt= 0.01 hrs
 Type III 24-hr 2 Year Rainfall=3.20"

Area (sf)	CN	Description
47,000	30	Woods, Good, HSG A
29,000	39	>75% Grass cover, Good, HSG A
600	98	Paved parking, HSG A
76,600	34	Weighted Average
76,000		99.22% Pervious Area
600		0.78% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	50	0.0400	0.09		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.20"
2.7	225	0.0800	1.41		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
1.8	255	0.1200	2.42		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
13.8	530	Total			

Subcatchment P2: P2 - Proposed Overland Flow



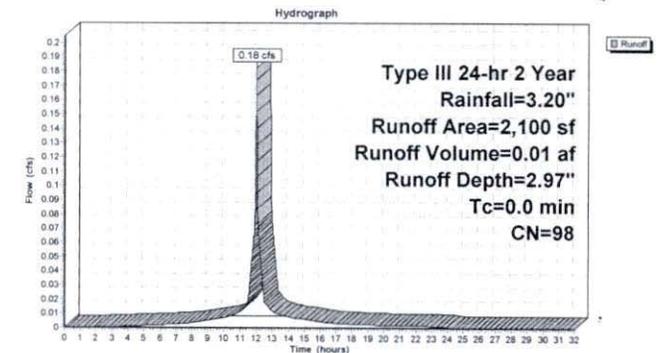
Summary for Subcatchment P3: P3 - Roof #52B

Runoff = 0.18 cfs @ 12.00 hrs, Volume= 0.01 af, Depth= 2.97"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-32.00 hrs, dt= 0.01 hrs
 Type III 24-hr 2 Year Rainfall=3.20"

Area (sf)	CN	Description
2,100	98	Roofs, HSG A
2,100		100.00% Impervious Area

Subcatchment P3: P3 - Roof #52B



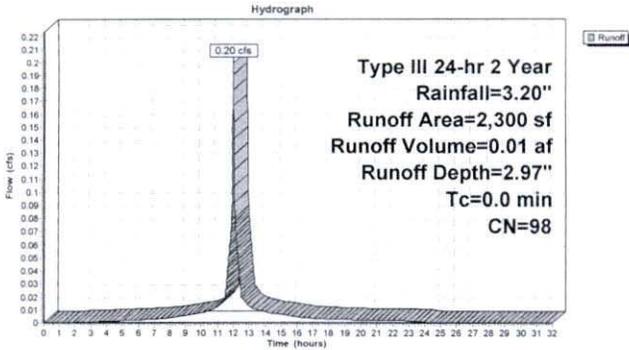
Summary for Subcatchment P4: P4 - Roof #52C

Runoff = 0.20 cfs @ 12.00 hrs, Volume= 0.01 af, Depth= 2.97"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-32.00 hrs, dt= 0.01 hrs
 Type III 24-hr 2 Year Rainfall=3.20"

Area (sf)	CN	Description
2,300	98	Roofs, HSG A
2,300		100.00% Impervious Area

Subcatchment P4: P4 - Roof #52C

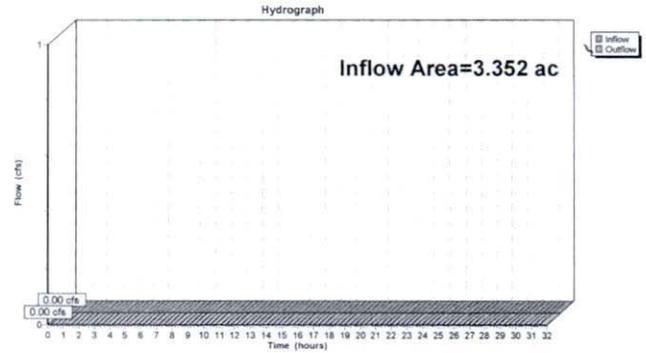


Summary for Reach 4R: Proposed Runoff

Inflow Area = 3.352 ac, 6.64% Impervious, Inflow Depth = 0.00" for 2 Year event
 Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.00 af
 Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.00 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-32.00 hrs, dt= 0.01 hrs

Reach 4R: Proposed Runoff



Summary for Pond DW1: Drywell Driveway

Inflow Area = 1.492 ac, 7.23% Impervious, Inflow Depth = 0.00" for 2 Year event
 Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.00 af
 Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.00 af, Atten= 0%, Lag= 0.0 min
 Discarded = 0.00 cfs @ 0.00 hrs, Volume= 0.00 af
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.00 af

Routing by Stor-Ind method, Time Span= 0.00-32.00 hrs, dt= 0.01 hrs / 3
 Peak Elev= 313.00' @ 0.00 hrs Surf.Area= 345 sf Storage= 0 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
 Center-of-Mass det. time= (not calculated: no inflow)

Volume	Invert	Avail. Storage	Storage Description
#1A	313.00'	322 cf	11.50'W x 30.00'L x 3.54'H Field A 1,222 cf Overall - 417 cf Embedded = 805 cf x 40.0% Voids
#2A	313.50'	417 cf	Cultec R-330XL x 8 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
#3	315.40'	50 cf	4.00'D x 4.00'H Catch Basin Barrel -impervious
		789 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	313.00'	8.270 in/hr Exfiltration over Surface area
#2	Primary	317.90'	2.0' long Sharp-Crested Rectangular Weir 2 End Contractions(s)

Discarded OutFlow Max=0.00 cfs @ 0.00 hrs HW=313.00' (Free Discharge)
 1=Exfiltration (Passes 0.00 cfs of 0.07 cfs potential flow)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=313.00' (Free Discharge)
 2=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)

Pond DW1: Drywell Driveway - Chamber Wizard Field A

Chamber Model = Cultec R-330XL
 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

52.0" Wide + 6.0" Spacing = 58.0" C-C

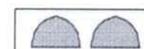
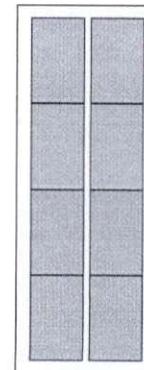
4 Chambers/Row x 7.00' Long = 28.00' + 12.00' End Stone x 2 = 30.00' Base Length
 2 Rows x 52.0" Wide + 6.0" Spacing x 1 + 14.0" Side Stone x 2 = 11.50' Base Width
 6.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.54' Field Height

8 Chambers x 52.2 cf = 417.3 cf Chamber Storage

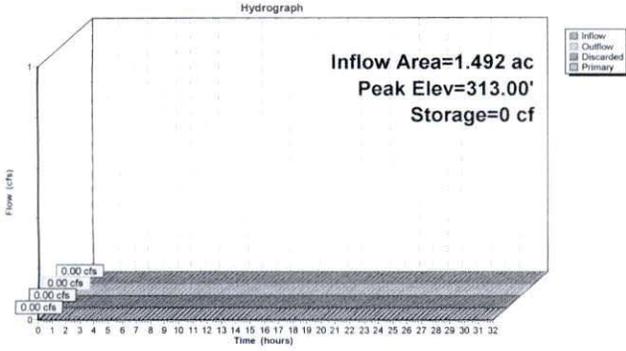
1,221.9 cf Field - 417.3 cf Chambers = 804.6 cf Stone x 40.0% Voids = 321.8 cf Stone Storage

Stone + Chamber Storage = 739.1 cf = 0.02 af

8 Chambers
 45.3 cy Field
 29.8 cy Stone



Pond DW1: Drywell Driveway



Summary for Pond DW2: Drywell 52B

Inflow Area = 0.048 ac, 100.00% Impervious, Inflow Depth = 2.97" for 2 Year event
 Inflow = 0.18 cfs @ 12.00 hrs, Volume= 0.01 af
 Outflow = 0.04 cfs @ 11.68 hrs, Volume= 0.01 af, Atten= 79%, Lag= 0.0 min
 Discarded = 0.04 cfs @ 11.68 hrs, Volume= 0.01 af

Routing by Stor-Ind method, Time Span= 0.00-32.00 hrs, dt= 0.01 hrs / 2
 Peak Elev= 319.38' @ 12.35 hrs Surf Area= 204 sf Storage= 97 cf

Plug-Flow detention time= 11.6 min calculated for 0.01 af (100% of inflow)
 Center-of-Mass det. time= 11.6 min (762.4 - 750.8)

Volume	Invert	Avail Storage	Storage Description
#1A	318.50'	206 cf	12.00'W x 17.00'L x 3.54'H Field A 723 cf Overall - 209 cf Embedded = 514 cf x 40.0% Voids
#2A	319.00'	209 cf	Cultec R-330XL x 4 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
			414 cf Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	318.50'	8.270 in/hr Exfiltration over Horizontal area

Discarded Outflow Max=0.04 cfs @ 11.68 hrs HW=318.54' (Free Discharge)
 1=Exfiltration (Exfiltration Controls 0.04 cfs)

Pond DW2: Drywell 52B - Chamber Wizard Field A

Chamber Model = Cultec R-330XL
 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

52.0" Wide + 6.0" Spacing = 58.0" C-C

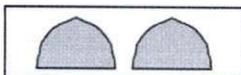
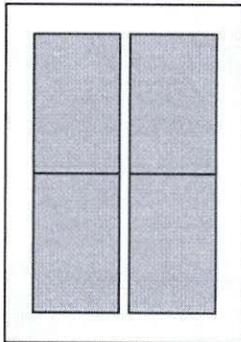
2 Chambers/Row x 7.00' Long = 14.00' + 18.0" End Stone x 2 = 17.00' Base Length
 2 Rows x 52.0" Wide + 6.0" Spacing x 1 + 17.0" Side Stone x 2 = 12.00' Base Width
 6.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.54' Field Height

4 Chambers x 52.2 cf = 208.6 cf Chamber Storage

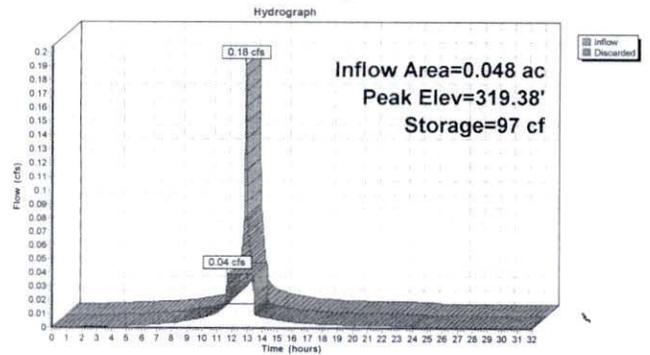
722.5 cf Field - 208.6 cf Chambers = 513.9 cf Stone x 40.0% Voids = 205.5 cf Stone Storage

Stone + Chamber Storage = 414.2 cf = 0.01 af

4 Chambers
 26.8 cy Field
 19.0 cy Stone



Pond DW2: Drywell 52B



Summary for Pond DW3: Drywell 52C

Inflow Area = 0.053 ac, 100.00% impervious, Inflow Depth = 2.97" for 2 Year event
 Inflow = 0.20 cfs @ 12.00 hrs, Volume = 0.01 af
 Outflow = 0.04 cfs @ 11.66 hrs, Volume = 0.01 af, Atten = 80%, Lag = 0.0 min
 Discarded = 0.04 cfs @ 11.66 hrs, Volume = 0.01 af

Routing by Stor-Ind method, Time Span = 0.00-32.00 hrs, dt = 0.01 hrs / 2
 Peak Elev = 330.50' @ 12.37 hrs Surf.Area = 204 sf Storage = 115 cf

Plug-Flow detention time = 14.2 min calculated for 0.01 af (100% of inflow)
 Center-of-Mass det. time = 14.2 min (765.0 - 750.8)

Volume	Invert	Avail. Storage	Storage Description
#1A	329.50'	206 cf	12.00'W x 17.00'L x 3.54'H Field A 723 cf Overall - 209 cf Embedded = 514 cf x 40.0% Voids
#2A	330.00'	209 cf	Cultec R-330XL x 4 - 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
		414 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	329.50'	8.270 in/hr Exfiltration over Horizontal area

Discarded OutFlow Max=0.04 cfs @ 11.66 hrs HW=329.54' (Free Discharge)
 1=Exfiltration (Exfiltration Controls 0.04 cfs)

Pond DW3: Drywell 52C - Chamber Wizard Field A

Chamber Model = Cultec R-330XL
 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

52.0" Wide + 6.0" Spacing = 58.0" C-C

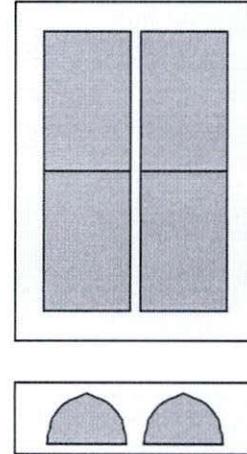
2 Chambers/Row x 7.00' Long = 14.00' + 18.0" End Stone x 2 = 17.00' Base Length
 2 Rows x 52.0" Wide + 6.0" Spacing x 1 + 17.0" Side Stone x 2 = 12.00' Base Width
 6.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.54' Field Height

4 Chambers x 52.2 cf = 208.6 cf Chamber Storage

722.5 cf Field - 208.6 cf Chambers = 513.9 cf Stone x 40.0% Voids = 205.5 cf Stone Storage

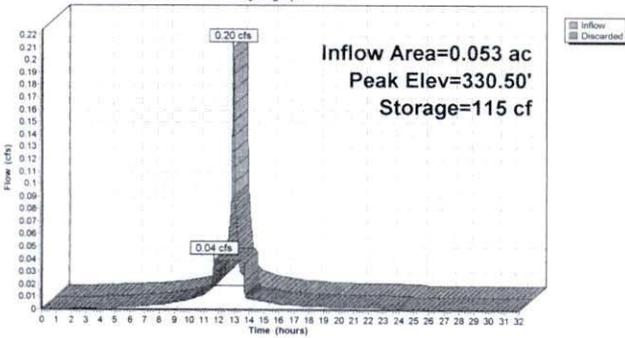
Stone + Chamber Storage = 414.2 cf = 0.01 af

4 Chambers
 26.8 cy Field
 19.0 cy Stone



Pond DW3: Drywell 52C

Hydrograph



Summary for Subcatchment E1: E1 - Existing Runoff

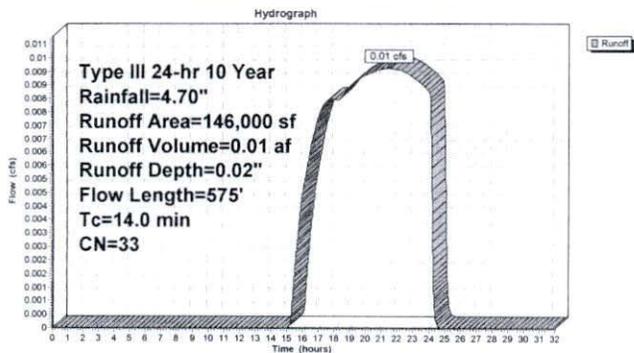
Runoff = 0.01 cfs @ 21.42 hrs, Volume= 0.01 af, Depth= 0.02"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-32.00 hrs, dt= 0.01 hrs
 Type III 24-hr 10 Year Rainfall=4.70"

Area (sf)	CN	Description
94,000	30	Woods, Good, HSG A
52,000	39	Pasture/grassland/range, Good, HSG A
146,000	33	Weighted Average
146,000		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	50	0.0400	0.09		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.20"
2.8	260	0.0960	1.55		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
1.9	265	0.1100	2.32		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
14.0	575	Total			

Subcatchment E1: E1 - Existing Runoff



Summary for Subcatchment P1: P1 - To driveway drywell

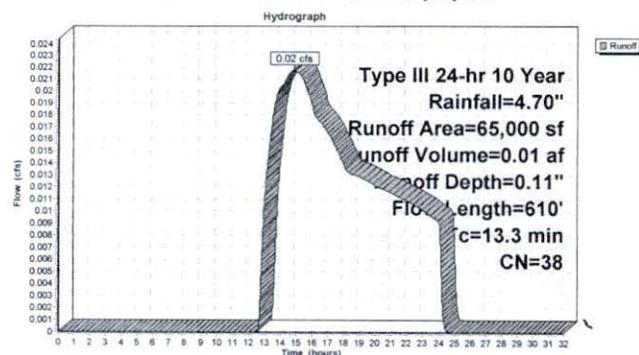
Runoff = 0.02 cfs @ 14.88 hrs, Volume= 0.01 af, Depth= 0.11"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-32.00 hrs, dt= 0.01 hrs
 Type III 24-hr 10 Year Rainfall=4.70"

Area (sf)	CN	Description
40,000	30	Woods, Good, HSG A
20,300	39	>75% Grass cover, Good, HSG A
4,700	98	Paved parking, HSG A
65,000	38	Weighted Average
60,300		92.77% Pervious Area
4,700		7.23% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	50	0.0400	0.09		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.20"
2.8	260	0.0960	1.55		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
0.6	110	0.1900	3.05		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
0.6	190	0.0800	5.74		Shallow Concentrated Flow, Paved Kv= 20.3 fps
13.3	610	Total			

Subcatchment P1: P1 - To driveway drywell



Summary for Subcatchment P2: P2 - Proposed Overland Flow

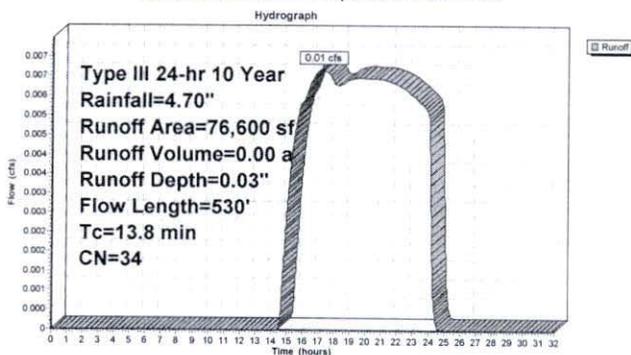
Runoff = 0.01 cfs @ 17.28 hrs, Volume= 0.00 af, Depth= 0.03"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-32.00 hrs, dt= 0.01 hrs
 Type III 24-hr 10 Year Rainfall=4.70"

Area (sf)	CN	Description
47,000	30	Woods, Good, HSG A
29,000	39	>75% Grass cover, Good, HSG A
600	98	Paved parking, HSG A
76,600	34	Weighted Average
76,000		99.22% Pervious Area
600		0.78% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	50	0.0400	0.09		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.20"
2.7	225	0.0800	1.41		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
1.8	255	0.1200	2.42		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
13.8	530	Total			

Subcatchment P2: P2 - Proposed Overland Flow



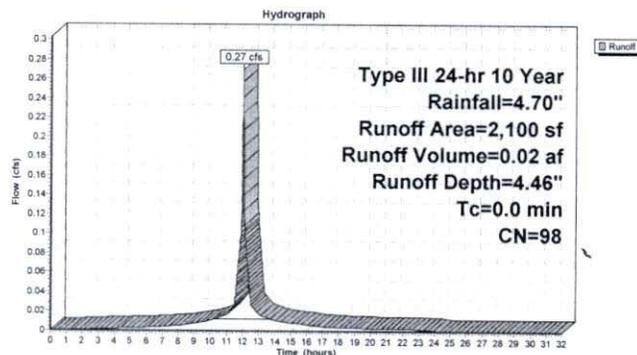
Summary for Subcatchment P3: P3 - Roof #52B

Runoff = 0.27 cfs @ 12.00 hrs, Volume= 0.02 af, Depth= 4.46"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-32.00 hrs, dt= 0.01 hrs
 Type III 24-hr 10 Year Rainfall=4.70"

Area (sf)	CN	Description
2,100	98	Roofs, HSG A
2,100		100.00% Impervious Area

Subcatchment P3: P3 - Roof #52B



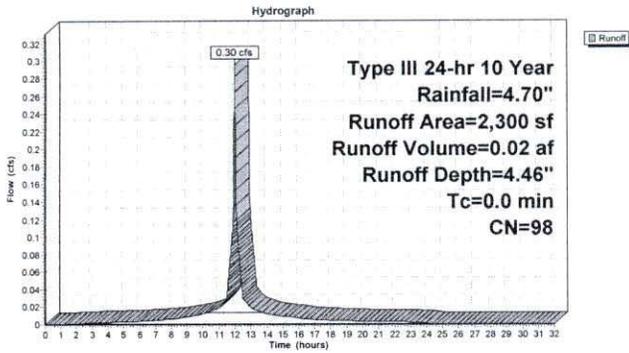
Summary for Subcatchment P4: P4 - Roof #52C

Runoff = 0.30 cfs @ 12.00 hrs, Volume= 0.02 af, Depth= 4.46"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-32.00 hrs, dt= 0.01 hrs
 Type III 24-hr 10 Year Rainfall=4.70"

Area (sf)	CN	Description
2,300	98	Roofs, HSG A
2,300		100.00% Impervious Area

Subcatchment P4: P4 - Roof #52C

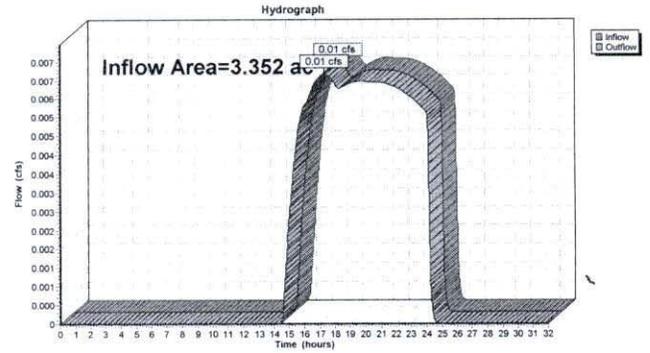


Summary for Reach 4R: Proposed Runoff

Inflow Area = 3,352 ac, 6.64% Impervious, Inflow Depth = 0.02" for 10 Year event
 Inflow = 0.01 cfs @ 17.28 hrs, Volume= 0.00 af
 Outflow = 0.01 cfs @ 17.28 hrs, Volume= 0.00 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-32.00 hrs, dt= 0.01 hrs

Reach 4R: Proposed Runoff



Summary for Pond DW1: Drywell Driveway

Inflow Area = 1,492 ac, 7.23% Impervious, Inflow Depth = 0.11" for 10 Year event
 Inflow = 0.02 cfs @ 14.88 hrs, Volume= 0.01 af
 Outflow = 0.02 cfs @ 14.92 hrs, Volume= 0.01 af, Atten= 0%, Lag= 2.3 min
 Discarded = 0.02 cfs @ 14.92 hrs, Volume= 0.01 af
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.00 af

Routing by Stor-Ind method, Time Span= 0.00-32.00 hrs, dt= 0.01 hrs / 3
 Peak Elev= 313.02' @ 14.92 hrs Surf.Area= 345 sf Storage= 3 cf

Plug-Flow detention time= 2.2 min calculated for 0.01 af (100% of inflow)
 Center-of-Mass det. time= 2.2 min (1,067.9 - 1,065.6)

Volume	Invert	Avail. Storage	Storage Description
#1A	313.00'	322 cf	11.50'W x 30.00'L x 3.54'H Field A 1,222 cf Overall - 417 cf Embedded = 805 cf x 40.0% Voids
#2A	313.50'	417 cf	Cultec R-330XL x 8 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
#3	315.40'	50 cf	4.00'D x 4.00'H Catch Basin Barrel -Impervious
		789 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	313.00'	8.270 in/hr Exfiltration over Surface area
#2	Primary	317.90'	2.0' long Sharp-Crested Rectangular Weir 2 End Contractions(s)

Discarded OutFlow Max=0.07 cfs @ 14.92 hrs HW=313.02' (Free Discharge)
 1=Exfiltration (Exfiltration Controls 0.07 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=313.00' (Free Discharge)
 2=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)

Pond DW1: Drywell Driveway - Chamber Wizard Field A

Chamber Model = Cultec R-330XL
 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

52.0" Wide + 6.0" Spacing = 58.0" C-C

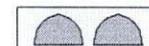
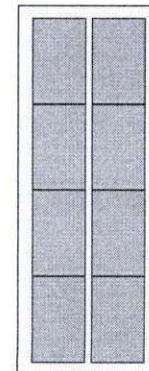
4 Chambers/Row x 7.00' Long = 28.00' + 12.00' End Stone x 2 = 30.00' Base Length
 2 Rows x 52.0" Wide + 6.0" Spacing x 1 + 14.0" Side Stone x 2 = 11.50' Base Width
 6.0' Base + 30.5' Chamber Height + 6.0' Cover = 3.54' Field Height

8 Chambers x 52.2 cf = 417.3 cf Chamber Storage

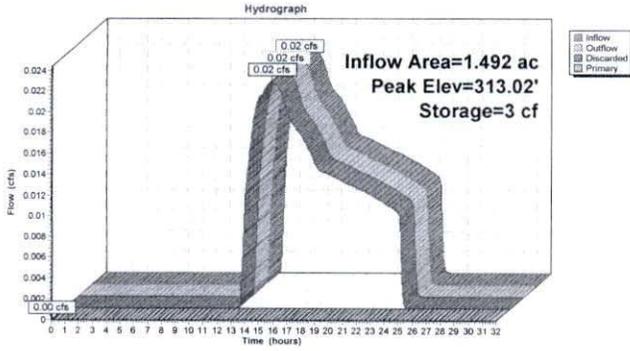
1,221.9 cf Field - 417.3 cf Chambers = 804.6 cf Stone x 40.0% Voids = 321.8 cf Stone Storage

Stone + Chamber Storage = 739.1 cf = 0.02 af

8 Chambers
 45.3 cy Field
 29.8 cy Stone



Pond DW1: Drywell Driveway



Summary for Pond DW2: Drywell 52B

Inflow Area = 0.048 ac, 100.00% Impervious, Inflow Depth = 4.46" for 10 Year event
 Inflow = 0.27 cfs @ 12.00 hrs, Volume = 0.02 af
 Outflow = 0.04 cfs @ 11.59 hrs, Volume = 0.02 af, Atten = 86%, Lag = 0.0 min
 Discarded = 0.04 cfs @ 11.59 hrs, Volume = 0.02 af

Routing by Stor-Ind method, Time Span = 0.00-32.00 hrs, dt = 0.01 hrs / 2
 Peak Elev = 320.06' @ 12.44 hrs Surf Area = 204 sf Storage = 195 cf

Plug-Flow detention time = 26.0 min calculated for 0.02 af (100% of inflow)
 Center-of-Mass det. time = 26.0 min (769.5 - 743.5)

Volume	Invert	Avail. Storage	Storage Description
#1A	318.50'	206 cf	12.00'W x 17.00'L x 3.54'H Field A 723 cf Overall - 209 cf Embedded = 514 cf x 40.0% Voids
#2A	319.00'	209 cf	Cultec R-330XL x 4 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
		414 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	318.50'	8.270 in/hr Exfiltration over Horizontal area

Discarded OutFlow Max=0.04 cfs @ 11.59 hrs HW=318.54' (Free Discharge)
 1=Exfiltration (Exfiltration Controls 0.04 cfs)

Pond DW2: Drywell 52B - Chamber Wizard Field A

Chamber Model = Cultec R-330XL
 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

52.0" Wide + 6.0" Spacing = 58.0" C-C

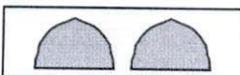
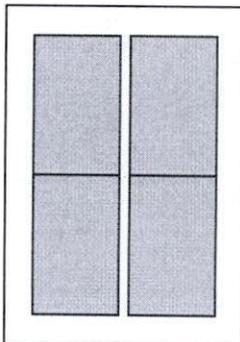
2 Chambers/Row x 7.00' Long = 14.00' + 18.0" End Stone x 2 = 17.00' Base Length
 2 Rows x 52.0" Wide + 6.0" Spacing x 1 + 17.0" Side Stone x 2 = 12.00' Base Width
 6.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.54' Field Height

4 Chambers x 52.2 cf = 208.6 cf Chamber Storage

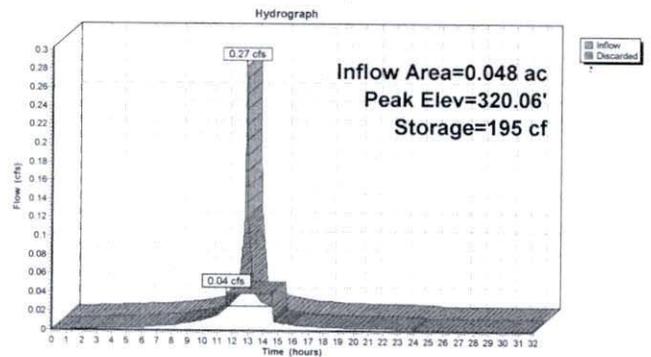
722.5 cf Field - 208.6 cf Chambers = 513.9 cf Stone x 40.0% Voids = 205.5 cf Stone Storage

Stone + Chamber Storage = 414.2 cf = 0.01 af

4 Chambers
 26.8 cy Field
 19.0 cy Stone



Pond DW2: Drywell 52B



52 Nixon Drainage

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Type III 24-hr 10 Year Rainfall=4.70"

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Summary for Pond DW3: Drywell 52C

Inflow Area = 0.053 ac, 100.00% Impervious, Inflow Depth = 4.46" for 10 Year event
 Inflow = 0.30 cfs @ 12.00 hrs, Volume= 0.02 af
 Outflow = 0.04 cfs @ 11.57 hrs, Volume= 0.02 af, Atten= 87%, Lag= 0.0 min
 Discarded = 0.04 cfs @ 11.57 hrs, Volume= 0.02 af

Routing by Stor-Ind method, Time Span= 0.00-32.00 hrs, dt= 0.01 hrs / 2
 Peak Elev= 331.27' @ 12.46 hrs Surf.Area= 204 sf Storage= 225 cf

Plug-Flow detention time= 31.1 min calculated for 0.02 af (100% of inflow)
 Center-of-Mass det. time= 31.2 min (774.7 - 743.5)

Volume	Invert	Avail. Storage	Storage Description
#1A	329.50'	206 cf	12.00'W x 17.00'L x 3.54'H Field A 723 cf Overall - 209 cf Embedded = 514 cf x 40.0% Voids
#2A	330.00'	209 cf	Cultec R-330XL x 4 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
			414 cf Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	329.50'	8.270 in/hr Exfiltration over Horizontal area

Discarded OutFlow Max=0.04 cfs @ 11.57 hrs HW=329.54' (Free Discharge)
 ←1=Exfiltration (Exfiltration Controls 0.04 cfs)

52 Nixon Drainage

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Type III 24-hr 10 Year Rainfall=4.70"

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Pond DW3: Drywell 52C - Chamber Wizard Field A

Chamber Model = Cultec R-330XL
 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

52.0" Wide + 6.0" Spacing = 58.0" C-C

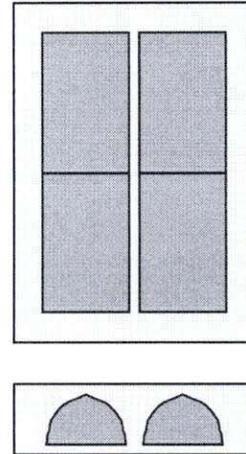
2 Chambers/Row x 7.00' Long = 14.00' + 18.0" End Stone x 2 = 17.00' Base Length
 2 Rows x 52.0" Wide + 6.0" Spacing x 1 + 17.0" Side Stone x 2 = 12.00' Base Width
 6.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.54' Field Height

4 Chambers x 52.2 cf = 208.6 cf Chamber Storage

722.5 cf Field - 208.6 cf Chambers = 513.9 cf Stone x 40.0% Voids = 205.5 cf Stone Storage

Stone + Chamber Storage = 414.2 cf = 0.01 af

4 Chambers
 26.8 cy Field
 19.0 cy Stone



52 Nixon Drainage

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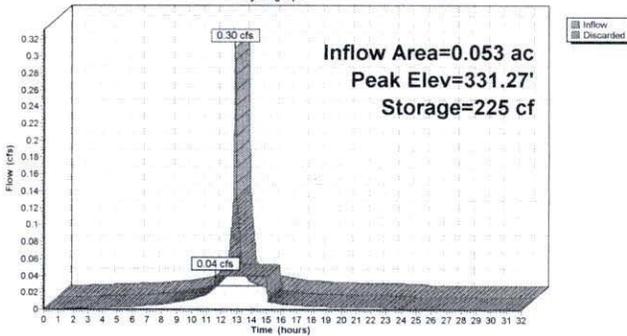
Type III 24-hr 10 Year Rainfall=4.70"

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Pond DW3: Drywell 52C

Hydrograph



Summary for Subcatchment E1: E1 - Existing Runoff

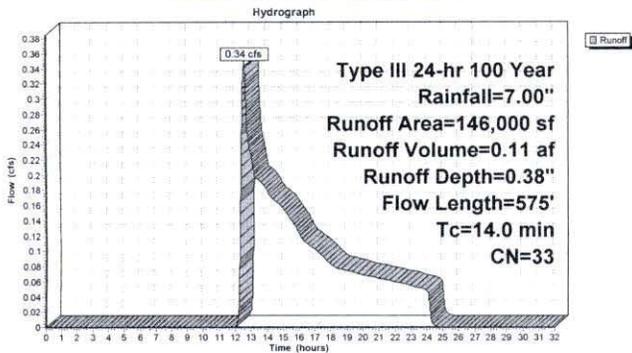
Runoff = 0.34 cfs @ 12.53 hrs, Volume= 0.11 af, Depth= 0.38"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-32.00 hrs, dt= 0.01 hrs
 Type III 24-hr 100 Year Rainfall=7.00"

Area (sf)	CN	Description
94,000	30	Woods, Good, HSG A
52,000	39	Pasture/grassland/range, Good, HSG A
146,000	33	Weighted Average
146,000		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	50	0.0400	0.09		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.20"
2.8	260	0.0960	1.55		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
1.9	265	0.1100	2.32		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
14.0	575	Total			

Subcatchment E1: E1 - Existing Runoff



Summary for Subcatchment P1: P1 - To driveway drywell

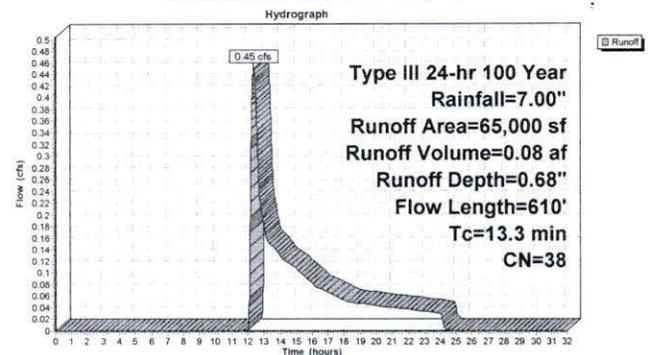
Runoff = 0.45 cfs @ 12.40 hrs, Volume= 0.08 af, Depth= 0.68"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-32.00 hrs, dt= 0.01 hrs
 Type III 24-hr 100 Year Rainfall=7.00"

Area (sf)	CN	Description
40,000	30	Woods, Good, HSG A
20,300	39	>75% Grass cover, Good, HSG A
4,700	98	Paved parking, HSG A
65,000	38	Weighted Average
60,300		92.77% Pervious Area
4,700		7.23% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	50	0.0400	0.09		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.20"
2.8	260	0.0960	1.55		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
0.6	110	0.1900	3.05		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
0.6	190	0.0800	5.74		Shallow Concentrated Flow, Paved Kv= 20.3 fps
13.3	610	Total			

Subcatchment P1: P1 - To driveway drywell



Summary for Subcatchment P2: P2 - Proposed Overland Flow

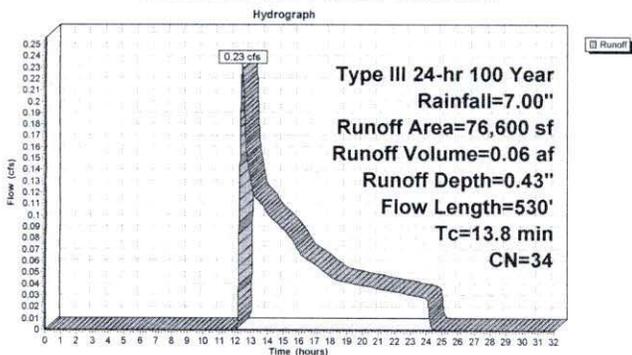
Runoff = 0.23 cfs @ 12.50 hrs, Volume= 0.06 af, Depth= 0.43"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-32.00 hrs, dt= 0.01 hrs
 Type III 24-hr 100 Year Rainfall=7.00"

Area (sf)	CN	Description
47,000	30	Woods, Good, HSG A
29,000	39	>75% Grass cover, Good, HSG A
600	98	Paved parking, HSG A
76,600	34	Weighted Average
76,000		99.22% Pervious Area
600		0.78% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	50	0.0400	0.09		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.20"
2.7	225	0.0800	1.41		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
1.8	255	0.1200	2.42		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
13.8	530	Total			

Subcatchment P2: P2 - Proposed Overland Flow



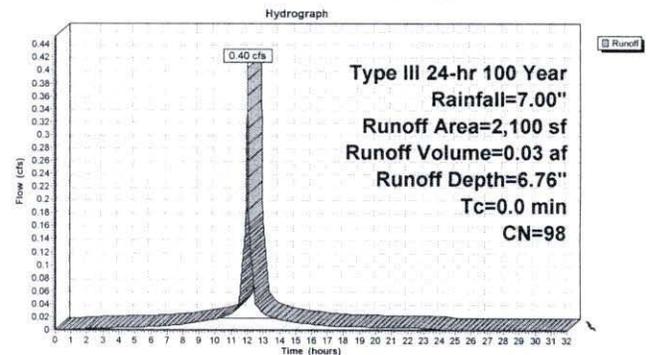
Summary for Subcatchment P3: P3 - Roof #52B

Runoff = 0.40 cfs @ 12.00 hrs, Volume= 0.03 af, Depth= 6.76"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-32.00 hrs, dt= 0.01 hrs
 Type III 24-hr 100 Year Rainfall=7.00"

Area (sf)	CN	Description
2,100	98	Roofs, HSG A
2,100		100.00% Impervious Area

Subcatchment P3: P3 - Roof #52B



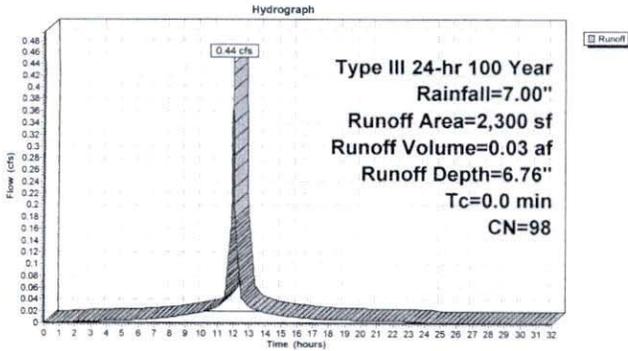
Summary for Subcatchment P4: P4 - Roof #52C

Runoff = 0.44 cfs @ 12.00 hrs, Volume= 0.03 af, Depth= 6.76"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-32.00 hrs, dt= 0.01 hrs
 Type III 24-hr 100 Year Rainfall=7.00"

Area (sf)	CN	Description
2,300	98	Roofs, HSG A
2,300		100.00% Impervious Area

Subcatchment P4: P4 - Roof #52C

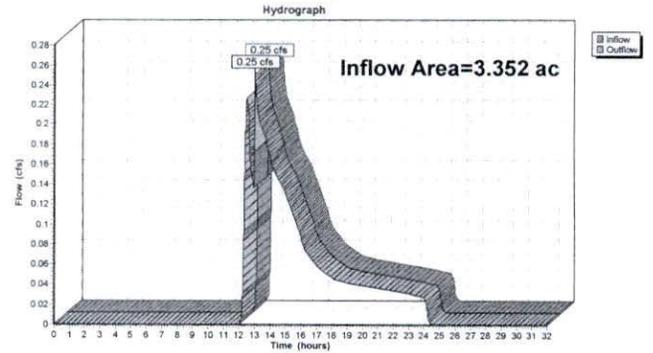


Summary for Reach 4R: Proposed Runoff

Inflow Area = 3.352 ac, 6.64% Impervious, Inflow Depth = 0.28" for 100 Year event
 Inflow = 0.25 cfs @ 13.00 hrs, Volume= 0.08 af
 Outflow = 0.25 cfs @ 13.00 hrs, Volume= 0.08 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-32.00 hrs, dt= 0.01 hrs

Reach 4R: Proposed Runoff



Summary for Pond DW1: Drywell Driveway

Inflow Area = 1.492 ac, 7.23% Impervious, Inflow Depth = 0.68" for 100 Year event
 Inflow = 0.45 cfs @ 12.40 hrs, Volume= 0.08 af
 Outflow = 0.18 cfs @ 13.00 hrs, Volume= 0.08 af, Atten= 59%, Lag= 36.1 min
 Discarded = 0.07 cfs @ 12.14 hrs, Volume= 0.07 af
 Primary = 0.12 cfs @ 13.00 hrs, Volume= 0.01 af

Routing by Stor-Ind method, Time Span= 0.00-32.00 hrs, dt= 0.01 hrs / 3
 Peak Elev= 317.97' @ 13.00 hrs Surf.Area= 345 sf Storage= 771 cf

Plug-Flow detention time= 121.1 min calculated for 0.08 af (100% of inflow)
 Center-of-Mass det. time= 121.0 min (1,067.6 - 946.5)

Volume	Invert	Avail Storage	Storage Description
#1A	313.00'	322 cf	11.50'W x 30.00'L x 3.54'H Field A 1,222 cf Overall - 417 cf Embedded = 805 cf x 40.0% Voids
#2A	313.50'	417 cf	Cultec R-330XL x 8 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
#3	315.40'	50 cf	4.00'D x 4.00'H Catch Basin Barrel -Impervious
		789 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	313.00'	8.270 in/hr Exfiltration over Surface area
#2	Primary	317.90'	2.0' long Sharp-Crested Rectangular Weir 2 End Contractions(s)

Discarded OutFlow Max=0.07 cfs @ 12.14 hrs HW=313.08' (Free Discharge)
 1=Exfiltration (Exfiltration Controls 0.07 cfs)

Primary OutFlow Max=0.11 cfs @ 13.00 hrs HW=317.97' (Free Discharge)
 2=Sharp-Crested Rectangular Weir (Weir Controls 0.11 cfs @ 0.84 fps)

Pond DW1: Drywell Driveway - Chamber Wizard Field A

Chamber Model = Cultec R-330XL
 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

52.0" Wide + 6.0" Spacing = 58.0" C-C

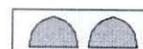
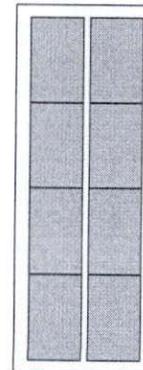
4 Chambers/Row x 7.00' Long = 28.00' + 12.0" End Stone x 2 = 30.00' Base Length
 2 Rows x 52.0" Wide + 6.0" Spacing x 1 + 14.0" Side Stone x 2 = 11.50' Base Width
 6.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.54' Field Height

8 Chambers x 52.2 cf = 417.3 cf Chamber Storage

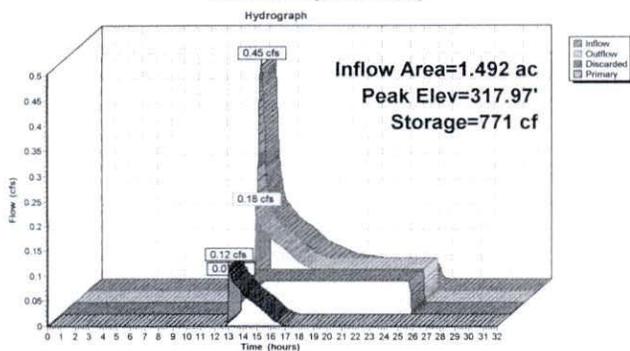
1,221.9 cf Field - 417.3 cf Chambers = 804.6 cf Stone x 40.0% Voids = 321.8 cf Stone Storage

Stone + Chamber Storage = 739.1 cf = 0.02 af

8 Chambers
 45.3 cy Field
 29.8 cy Stone



Pond DW1: Drywell Driveway



Summary for Pond DW2: Drywell 52B

Inflow Area = 0.048 ac, 100.00% Impervious, Inflow Depth = 6.76" for 100 Year event
 Inflow = 0.40 cfs @ 12.00 hrs, Volume= 0.03 af
 Outflow = 0.04 cfs @ 11.49 hrs, Volume= 0.03 af, Atten= 90%, Lag= 0.0 min
 Discarded = 0.04 cfs @ 11.49 hrs, Volume= 0.03 af

Routing by Stor-Ind method, Time Span= 0.00-32.00 hrs, dt= 0.01 hrs / 2
 Peak Elev= 321.34' @ 12.54 hrs Surf.Area= 204 sf Storage= 356 cf

Plug-Flow detention time= 55.2 min calculated for 0.03 af (100% of inflow)
 Center-of-Mass det. time= 55.2 min (792.6 - 737.4)

Volume	Invert	Avail. Storage	Storage Description
#1A	318.50'	206 cf	12.00'W x 17.00'L x 3.54'H Field A 723 cf Overall - 209 cf Embedded = 514 cf x 40.0% Voids
#2A	319.00'	209 cf	Cultec R-330XL x 4 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
			414 cf Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	318.50'	8.270 in/hr Exfiltration over Horizontal area

Discarded OutFlow Max=0.04 cfs @ 11.49 hrs HW=318.54' (Free Discharge)
 1=Exfiltration (Exfiltration Controls 0.04 cfs)

Pond DW2: Drywell 52B - Chamber Wizard Field A

Chamber Model = Cultec R-330XL
 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

52.0" Wide + 6.0" Spacing = 58.0" C-C

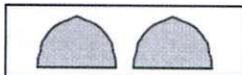
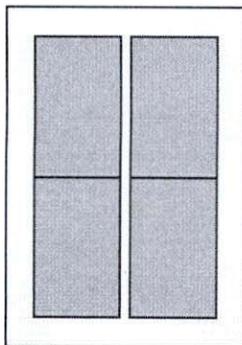
2 Chambers/Row x 7.00' Long = 14.00' + 18.0" End Stone x 2 = 17.00' Base Length
 2 Rows x 52.0" Wide + 6.0" Spacing x 1 + 17.0" Side Stone x 2 = 12.00' Base Width
 6.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.54' Field Height

4 Chambers x 52.2 cf = 208.6 cf Chamber Storage

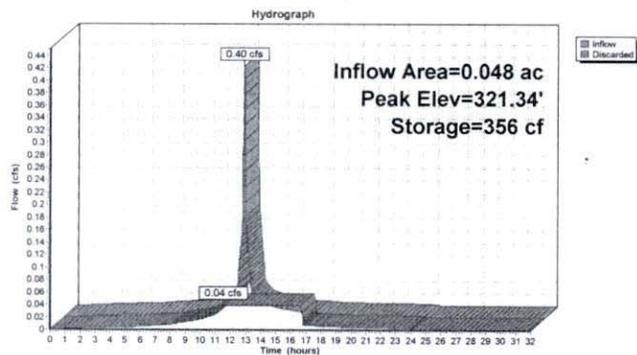
722.5 cf Field - 208.6 cf Chambers = 513.9 cf Stone x 40.0% Voids = 205.5 cf Stone Storage

Stone + Chamber Storage = 414.2 cf = 0.01 af

4 Chambers
 26.8 cy Field
 19.0 cy Stone



Pond DW2: Drywell 52B



Summary for Pond DW3: Drywell 52C

Inflow Area = 0.053 ac, 100.00% Impervious, Inflow Depth = 6.76" for 100 Year event
 Inflow = 0.44 cfs @ 12.00 hrs, Volume = 0.03 af
 Outflow = 0.04 cfs @ 11.38 hrs, Volume = 0.03 af, Atten = 91%, Lag = 0.0 min
 Discarded = 0.04 cfs @ 11.38 hrs, Volume = 0.03 af

Routing by Stor-Ind method, Time Span = 0.00-32.00 hrs, dt = 0.01 hrs / 2
 Peak Elev = 332.93' @ 12.65 hrs Surf Area = 204 sf Storage = 405 cf

Plug-Flow detention time = 65.2 min calculated for 0.03 af (100% of inflow)
 Center-of-Mass det. time = 65.2 min (802.6 - 737.4)

Volume	Invert	Avail. Storage	Storage Description
#1A	329.50'	206 cf	12.00'W x 17.00'L x 3.54'H Field A 723 cf Overall - 209 cf Embedded = 514 cf x 40.0% Voids Cultec R-330XL x 4 Inside #1
#2A	330.00'	209 cf	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
			414 cf Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	329.50'	8.270 in/hr Exfiltration over Horizontal area

Discarded OutFlow Max=0.04 cfs @ 11.38 hrs HW=329.54' (Free Discharge)
 1=Exfiltration (Exfiltration Controls 0.04 cfs)

Pond DW3: Drywell 52C - Chamber Wizard Field A

Chamber Model = Cultec R-330XL
 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

52.0" Wide + 6.0" Spacing = 58.0" C-C

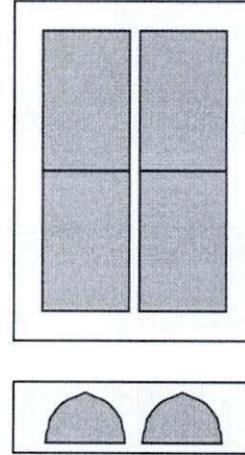
2 Chambers/Row x 7.00' Long = 14.00' + 18.0" End Stone x 2 = 17.00' Base Length
 2 Rows x 52.0" Wide + 6.0" Spacing x 1 + 17.0" Side Stone x 2 = 12.00' Base Width
 6.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.54' Field Height

4 Chambers x 52.2 cf = 208.6 cf Chamber Storage

722.5 cf Field - 208.6 cf Chambers = 513.9 cf Stone x 40.0% Voids = 205.5 cf Stone Storage

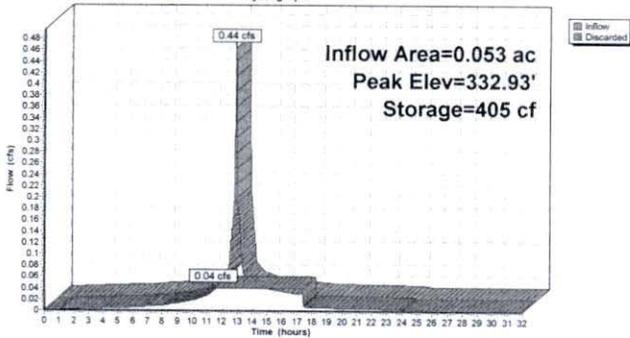
Stone + Chamber Storage = 414.2 cf = 0.01 af

4 Chambers
 26.8 cy Field
 19.0 cy Stone



Pond DW3: Drywell 52C

Hydrograph



DRYWELL STORAGE TABLES & RECHARGE/TREATMENT SUMMARY

The project has been designed with three drywells to provide groundwater recharge and treatment with a greater volume than typically required under MassDEP Stormwater Standards.

Recharge:

Standard requirement: 0.6" (A soil) x impervious area
0.6" x 9,610 sq. ft. = 481 cubic feet

Proposed Recharge Volume: DW1: 747 c.f.
DW2: 411 c.f.
DW3: 411 c.f.
Total: 1,569 cubic feet

Treatment:

Standard requirement: 0.5" x driveway area
0.5" x 5,220 sq. ft. = 217 cubic feet

Proposed Treatment Volume: DW1: 747 cubic feet

Treatment = 80% TSS through infiltration
Pretreatment = 25% TSS through deep sump catch basin

52 Nixon Drainage

Prepared by Microsoft

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Type III 24-hr 100 Year Rainfall=7.00"

Printed 7/28/2016

Stage-Area-Storage for Pond DW1: Drywell Driveway

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
313.00	345	0	318.20	345	774
313.10	345	14	318.30	345	776
313.20	345	28	318.40	345	777
313.30	345	41	318.50	345	778
313.40	345	55	318.60	345	779
313.50	345	69	318.70	345	781
313.60	345	96	318.80	345	782
313.70	345	123	318.90	345	783
313.80	345	150	319.00	345	784
313.90	345	177	319.10	345	786
314.00	345	204	319.20	345	787
314.10	345	230	319.30	345	788
314.20	345	257	319.40	345	789
314.30	345	283			
314.40	345	309			
314.50	345	335			
314.60	345	361			
314.70	345	386			
314.80	345	412			
314.90	345	437			
315.00	345	461			
315.10	345	485			
315.20	345	508			
315.30	345	531			
315.40	345	554			
315.50	345	577			
315.60	345	598			
315.70	345	619			
315.80	345	638			
315.90	345	656			
316.00	345	672			
316.10	345	687			
316.20	345	702			
316.30	345	717			
316.40	345	732			
316.50	345	747			
316.60	345	754			
316.70	345	755			
316.80	345	757			
316.90	345	758			
317.00	345	759			
317.10	345	760			
317.20	345	762			
317.30	345	763			
317.40	345	764			
317.50	345	765			
317.60	345	767			
317.70	345	768			
317.80	345	769			
317.90	345	771			
318.00	345	772			
318.10	345	773			

WQV = 747 C.F.

52 Nixon Drainage

Prepared by Microsoft

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Type III 24-hr 100 Year Rainfall=7.00"

Printed 7/28/2016

Stage-Area-Storage for Pond DW2: Drywell 52B

Elevation (feet)	Horizontal (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Horizontal (sq-ft)	Storage (cubic-feet)
318.50	204	0	321.10	204	331
318.55	204	4	321.15	204	336
318.60	204	8	321.20	204	342
318.65	204	12	321.25	204	347
318.70	204	16	321.30	204	352
318.75	204	20	321.35	204	357
318.80	204	24	321.40	204	361
318.85	204	29	321.45	204	366
318.90	204	33	321.50	204	370
318.95	204	37	321.55	204	374
319.00	204	41	321.60	204	378
319.05	204	48	321.65	204	382
319.10	204	56	321.70	204	386
319.15	204	63	321.75	204	390
319.20	204	70	321.80	204	394
319.25	204	78	321.85	204	399
319.30	204	85	321.90	204	403
319.35	204	92	321.95	204	407
319.40	204	100	322.00	204	411
319.45	204	107			
319.50	204	114			
319.55	204	122			
319.60	204	129			
319.65	204	136			
319.70	204	143			
319.75	204	151			
319.80	204	158			
319.85	204	165			
319.90	204	172			
319.95	204	179			
320.00	204	186			
320.05	204	193			
320.10	204	200			
320.15	204	207			
320.20	204	215			
320.25	204	222			
320.30	204	228			
320.35	204	235			
320.40	204	242			
320.45	204	249			
320.50	204	256			
320.55	204	262			
320.60	204	269			
320.65	204	275			
320.70	204	282			
320.75	204	288			
320.80	204	295			
320.85	204	301			
320.90	204	307			
320.95	204	313			
321.00	204	319			
321.05	204	325			

VOL = 411 C.F

52 Nixon Drainage

Prepared by Microsoft

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Type III 24-hr 100 Year Rainfall=7.00"

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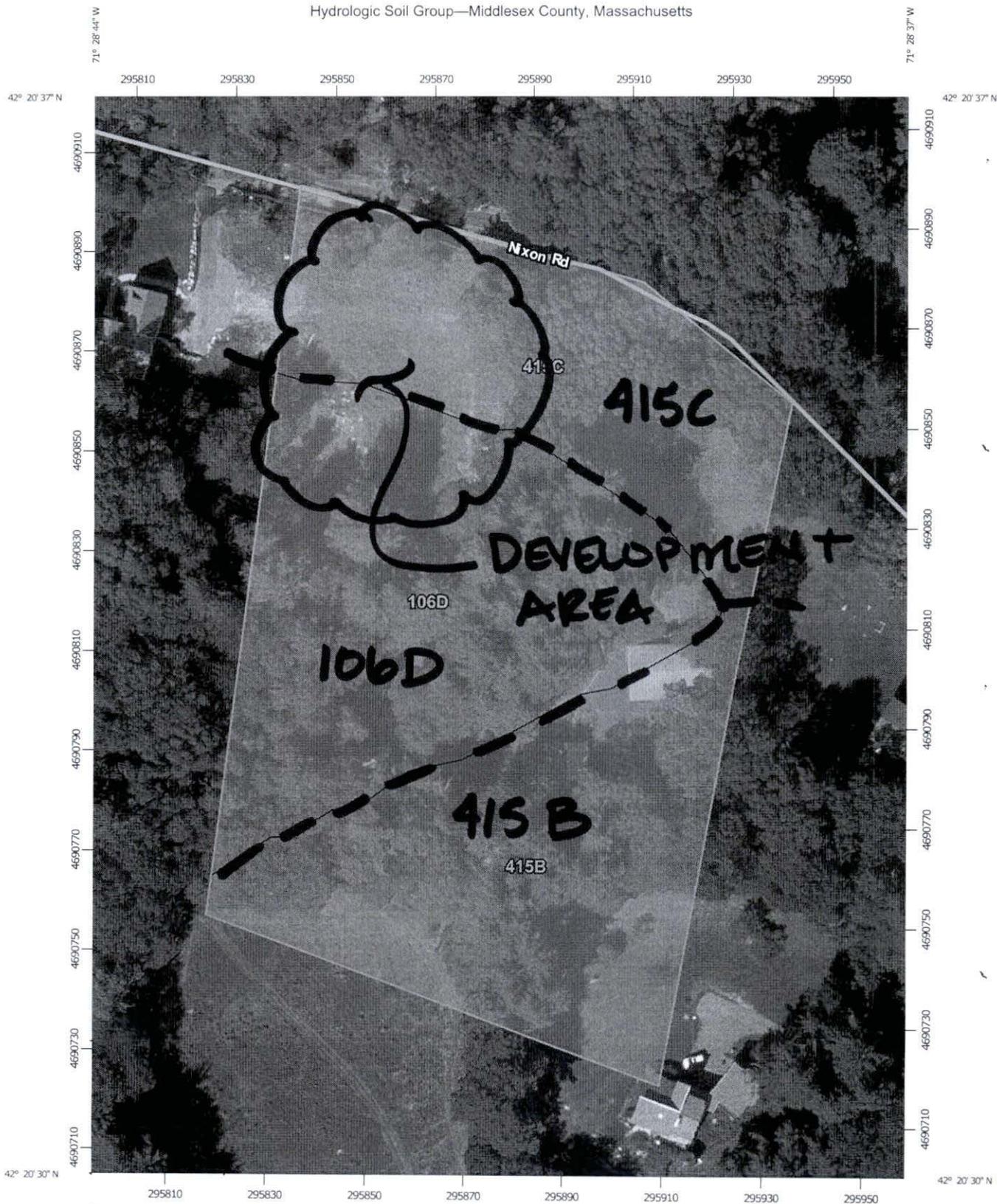
Stage-Area-Storage for Pond DW3: Drywell 52C

Elevation (feet)	Horizontal (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Horizontal (sq-ft)	Storage (cubic-feet)
329.50	204	0	332.10	204	331
329.55	204	4	332.15	204	336
329.60	204	8	332.20	204	342
329.65	204	12	332.25	204	347
329.70	204	16	332.30	204	352
329.75	204	20	332.35	204	357
329.80	204	24	332.40	204	361
329.85	204	29	332.45	204	366
329.90	204	33	332.50	204	370
329.95	204	37	332.55	204	374
330.00	204	41	332.60	204	378
330.05	204	48	332.65	204	382
330.10	204	56	332.70	204	386
330.15	204	63	332.75	204	390
330.20	204	70	332.80	204	394
330.25	204	78	332.85	204	399
330.30	204	85	332.90	204	403
330.35	204	92	332.95	204	407
330.40	204	100	333.00	204	411
330.45	204	107			
330.50	204	114			
330.55	204	122			
330.60	204	129			
330.65	204	136			
330.70	204	143			
330.75	204	151			
330.80	204	158			
330.85	204	165			
330.90	204	172			
330.95	204	179			
331.00	204	186			
331.05	204	193			
331.10	204	200			
331.15	204	207			
331.20	204	215			
331.25	204	222			
331.30	204	228			
331.35	204	235			
331.40	204	242			
331.45	204	249			
331.50	204	256			
331.55	204	262			
331.60	204	269			
331.65	204	275			
331.70	204	282			
331.75	204	288			
331.80	204	295			
331.85	204	301			
331.90	204	307			
331.95	204	313			
332.00	204	319			
332.05	204	325			

411
 Vol = 411 C.F.

NRCS SOIL MAPPING

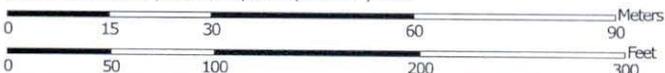
Hydrologic Soil Group—Middlesex County, Massachusetts



71° 28' 44" W



Map Scale: 1:1,050 if printed on A portrait (8.5" x 11") sheet.



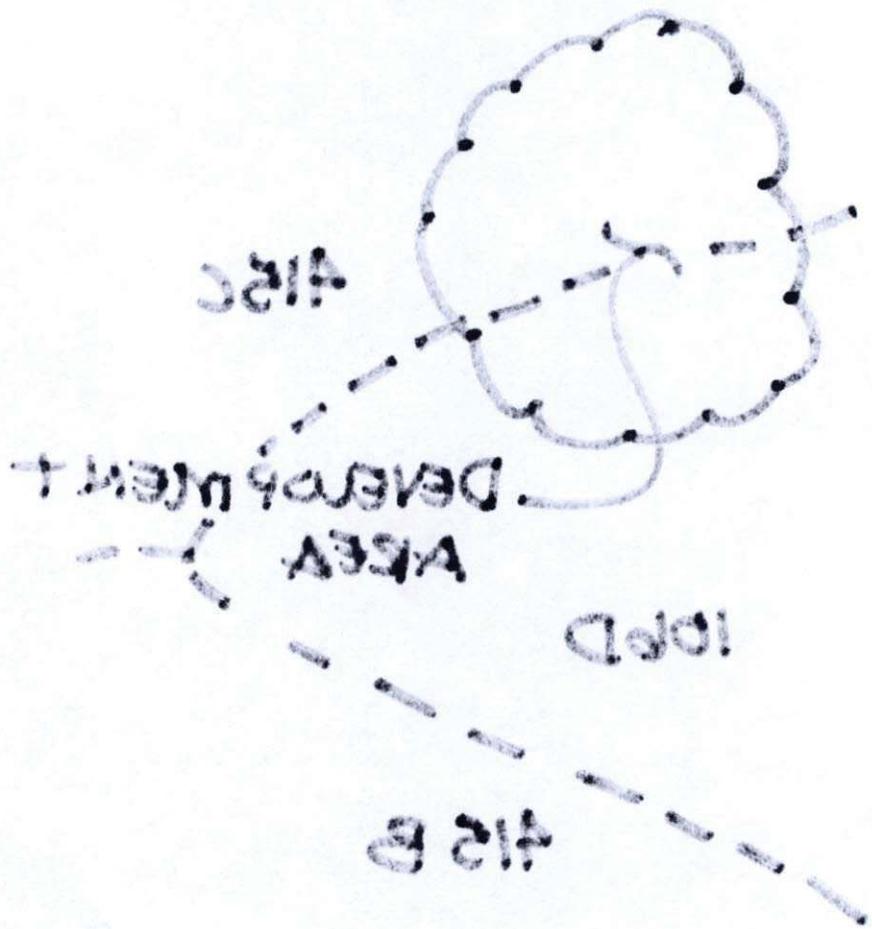
Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84



Natural Resources
Conservation Service

Web Soil Survey
National Cooperative Soil Survey

7/21/2016
Page 1 of 4



Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Middlesex County, Massachusetts (MA017)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
106D	Narragansett-Hollis-Rock outcrop complex, 15 to 25 percent slopes	A	1.4	39.1%
415B	Narragansett silt loam, 3 to 8 percent slopes	A	1.2	33.9%
415C	Narragansett silt loam, 8 to 15 percent slopes	A	1.0	26.9%
Totals for Area of Interest			3.7	100.0%

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Middlesex County, Massachusetts

106D—Narragansett-Hollis-Rock outcrop complex, 15 to 25 percent slopes

Map Unit Setting

National map unit symbol: 98yl
Elevation: 0 to 1,000 feet
Mean annual precipitation: 45 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 110 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Narragansett and similar soils: 45 percent
Hollis and similar soils: 20 percent
Rock outcrop: 10 percent
Minor components: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

→ Description of Narragansett

Setting

Landform: Ridges, hills
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Friable silty eolian deposits and/or friable loamy eolian deposits over loose sandy glaciofluvial deposits derived from metamorphic rock and/or friable sandy basal till derived from metamorphic rock

Typical profile

H1 - 0 to 2 inches: slightly decomposed plant material
H2 - 2 to 7 inches: silt loam
H3 - 7 to 35 inches: silt loam
H4 - 35 to 60 inches: very gravelly loamy sand
H5 - 60 to 65 inches: very gravelly loamy sand

Properties and qualities

Slope: 15 to 25 percent
Percent of area covered with surface fragments: 1.6 percent
Depth to restrictive feature: 18 to 35 inches to strongly contrasting textural stratification
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat):
Moderately high to high (0.60 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Available water storage in profile: Moderate (about 6.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 6s

Hydrologic Soil Group: A

Description of Hollis

Setting

Landform: Ridges, hills

Landform position (two-dimensional): Summit, shoulder

Landform position (three-dimensional): Head slope, crest

Down-slope shape: Linear

Across-slope shape: Convex

Parent material: Friable, shallow loamy basal till over granite and gneiss

Typical profile

H1 - 0 to 2 inches: fine sandy loam

H2 - 2 to 14 inches: fine sandy loam

H3 - 14 to 18 inches: unweathered bedrock

Properties and qualities

Slope: 15 to 25 percent

Percent of area covered with surface fragments: 1.6 percent

Depth to restrictive feature: 8 to 20 inches to lithic bedrock

Natural drainage class: Well drained

Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Available water storage in profile: Very low (about 2.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 6s

Hydrologic Soil Group: D

Description of Rock Outcrop

Setting

Landform: Ledges

Landform position (two-dimensional): Summit

Landform position (three-dimensional): Head slope

Down-slope shape: Concave

Across-slope shape: Concave

Parent material: Granite and gneiss

Properties and qualities

Slope: 15 to 25 percent

Depth to restrictive feature: 0 inches to lithic bedrock