DRAINAGE SUMMARY

PROPOSED ADDITION
93 RUANE ROAD
NEWTON, MASSACHUSETTS

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DRAINAGE SUMMARY
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The proposed project consists of the construction of a new addition at an existing residential dwelling at 93 Ruane Rd in Newton, MA, under the requirements of the City of Newton.

The on-site soils in the area are shown as "629C – Canton-Charlton-Urban land complex, 3 to 15 percent slopes" and "253D – Hinckley loamy sand, 15 to 25 percent slopes" soils on the NRCS Soils Survey map of the area, which are areas that fall within the Hydrological Soil Group A. Test pits were performed onsite and the parent material was confirmed as fine to medium sand, with a calculated infiltration rate of 15 min/in or 4 in/hr. For purposes of our design, we have assumed an B soil with an infiltration rate of 8.27 in/hr.

Ground cover on the site is a dense residential grass area, building and bituminous concrete walkways and drives. The existing drainage on the site flows overland from the west side of the lot towards the east side of the lot. Overall, the site will maintain the current flow pattern, however a new collection system for the proposed addition has been provided to collect the runoff and attenuate offsite flows from the additional impervious area.

There are no wetlands or other Resource Areas within 100 feet of the lot. The proposed drainage controls are designed to capture & contain the runoff from the proposed residential addition. This system will store the runoff from the addition and allow the stored water to slowly infiltrate after the storm event and overflow offsite.

Under the proposed conditions, with the new addition, the rate of site runoff from the re-developed lot area will be greater than the existing conditions for the 2, 10, 25 & 100-year storm events. The proposed controls have been designed to store this increase to maintain the pre and post runoff rates.

COMPLIANCE WITH STORMWATER STANDARDS

Untreated Stormwater (Standard 1)
The project is designed so that new stormwater conveyances (outfalls/discharges) do not discharge untreated stormwater into, or cause erosion to, existing wetlands.

Post-Development Peak Rates (Standard 2)
A hydrologic study was performed to determine the rate of runoff for the 2, 10, 25 & 100-year storm events under pre-development (existing) conditions. Unmitigated post-development rates were then computed in a similar manner. The study point where the peak rates were compared were taken at one (1) location at the existing offsite flow area.

From these analyses, it was determined that the proposed project and its stormwater management system would not increase the peak runoff rates above existing levels. It is the intent of the stormwater management system to minimize impacts to drainage patterns, and downstream property prior to its release from the site or discharge to wetlands.

The *United States Department of Agriculture (U.S.D.A)*. Soil Conservation Service (SCS) Technical Release 55 (TR-55), 1986, was used as the procedure for estimating runoff. A SCS TR-20-based computer program was used for estimating peak discharges. TR-55 is a generally accepted model for use on small sites that begin with a rainfall amount uniformly imposed on the watershed over a specified time distribution. Mass rainfall is converted to mass runoff by using a runoff curve number (CN). CN is based on soils, plant cover, impervious areas, interception, and surface storage. Runoff is then transformed into a hydrograph that depends on runoff travel time through segments of the watershed.

Development in a watershed changes the watershed's response to precipitation. The most common effects are reduced infiltration and decreased travel time, which can result in significantly higher peak rates of runoff. The volume of runoff is determined primarily by the amount of precipitation and by infiltration characteristics related to soil type, antecedent rainfall, type of vegetal cover, impervious surfaces, and surface retention. Travel time is determined primarily by slope, flow length, depth of flow, and roughness of flow surfaces. Peak rates of discharge are based on the relationship of the above parameters, as well as the total drainage area of the watershed, the location of the development in relation to the total drainage area, and the effect of any flood control works or other manmade storage. Peak rates of discharge are also influenced by the distribution of rainfall within a given storm event.

Stormwater management computations for the full-build were performed using a SCS-based *HYDROCAD* for existing and proposed conditions, curve numbers, time of concentrations and unit hydrograph computations.

Existing Conditions

Table 1. Shows the curve numbers, areas and times of concentration used to develop the pre-development hydrologic model of the site.

Table 1. – Existing Conditions					
Sub-Areas	**Surface Cover**	**Curve Number (CN)**	**Area (SF)**	**Tc (Mins.)**	**Remarks**
Area #1				6.0	
	Lawn Area	39	12,751		
	Exist. Bldg	98	2,929		Incls. porches
	Exist. Driveway	98	1,122		50%
	Exist. Walks	98	371		Incls. Patios

	Exist. Patio	98	624		
	Exist. Shed	98	63		
		Total Area	17,860		
*CN based on Class B soils.					

Proposed Conditions

The proposed conditions, will result in a new collection system that will collect the site run-off from the proposed addition and direct it to an underground leaching system prior to overflowing off-site.

Table 2. Shows the curve numbers, areas and times of concentration used to develop the post-development hydrologic model of the site.

Table 2. – Proposed Conditions					
Sub-Areas	**Surface Cover**	**Curve Number (CN)**	**Area (SF)**	**Tc (Mins.)**	**Remarks**
Area #1				6.0	
	Lawn Area	61	12,269		
	Exist. House	98	2,929		
	Exist. Patio	98	584		
	Exist. Drive	98	844		
	Exist. Walks	98	371		
	Exist. Shed	98	63		
Area #2				6.0	
	Prop. Addition	98	800		
		Total Area	17,860		
*CN based on Class B soils.					

Peak Rate Summary

Table 3. Shows the peak runoff for the existing, as well as for the developed site at 2, 10, 25 & 100-year design storms.

Areas	**Design Storm**	**Existing Runoff* (CFS)**	**Existing Volume* (Ac-Ft)**	**Proposed Runoff* (CFS)**	**Proposed Volume* (Ac-Ft)**
Offsite Flow					
	2-yr.	0.41	0.029	0.36	0.029
	10-yr.	0.92	0.062	0.84	0.062
	25-yr.	1.22	0.082	1.12	0.082
	100-yr.	2.53	0.172	2.36	0.172

Recharge to Groundwater (Standard 3)

The change in groundcover for the new addition will change by increasing the impervious areas by approximately 482 sf of impervious area. Groundwater infiltration will be achieved through the individual underground storage areas.

Required Recharge Volume for the entire site was calculated in accordance with the Massachusetts Stormwater Management Standards:

Rv = F * impervious area (in acres)
Rv = (0.35/12) * 0.128= 0.0037 Ac-ft. = 163.07 CF

Rv = Required Recharge Volume;
F = Target Depth Factor (0.35 in. for soils of Hydrologic Soil Group A);
Impervious area = building, pavement on site in post development condition (0.128 Ac).

The proposed onsite leaching systems will store and infiltrate 163.07 cf in just the 2-year storm event.

Removal of TSS (Standard 4)

The runoff from the proposed roof will be clean runoff so no additional TSS removal has been provided/added.

Land Uses with Higher Potential Pollutant Loads (Standard 5)

The use proposed does not differ from the current use of the space and has no higher potential for pollution.

Critical Areas (Standard 6 – Water Quality Treatments)

This site does not lie within a critical area. One-half inch (1/2") of runoff is the standard for treatment relative to water quality, but as stated prior, the proposed use will not create pollutants in excess of what exists today.

Redevelopment (Standard 7)

Redevelopment projects are those that involve development, rehabilitation or expansion on previously developed sites provided the redevelopment results in no net increase in impervious area. Furthermore, components of redevelopment project, which include development of previously undeveloped sites, do not fall under Standard 7. In addition, redevelopment of previously developed sites must meet the Stormwater Management Standards to the maximum extent practicable. However, if it is not practicable to meet all the Standards, new (retrofitted or expanded) stormwater management systems must be

designed to improve existing conditions.

The project, as proposed, is a new addition an existing developed site. VTP has considered this project a re-development and we have met all of the applicable standards of the Massachusetts Stormwater Policy to the maximum extent possible.

Erosion and Sedimentation Controls (Standard 8)

A Demolition and Erosion Control Plan is provided as part of the application.

Operation and Maintenance Plan (Standard 9)

An Operation and Maintenance (O&M) Plan is provided as part of the application.

Prohibition of Illicit Discharges

The Owner and User of the facility, assures that there will not be illicit discharges to the nearby wetlands from the proposed facility.

Floodplain (310 CMR 10.57)

The project site does not fall with a floodplain district.

City of Newton Standards

In accordance with the City of Newton's Stormwater Management and Erosion Control Rules and Regulations, this project requires a Minor Stormwater Permit, as it is a residential development less than 4 units with land disturbance less than 0.5 acres.

Storage of Net Increase of Impervious area

Per the City of Newton's Stormwater Management and Erosion Control Rules and Regulations, Section 5, Subsection B.1, requires the applicant to retain 2" of runoff for the total of net increase of impervious area. The net increase for this project is **482.0 SF**.

Volume = (2"/12) * (482 sf) = 80.33 CF

As noted in the post-development HydroCAD report provided, the proposed BMP offers a total storage volume of **446 CF** of available storage, which exceeds the required storage capacity 80.33 CF

Total Phosphorus Removal

Existing Phosphorus Load

BMP Sub Area	Land Use Category	Cover Type	Area (Acres)	PLER (lb/acre/yr)*
1	Developed Land Pervious (HSG- A)	Impervious	0.117	1.96
2	Medium Density Regulations (MDR)	Pervious	0.293	0.03

***From Table 3-1 of appendix F.**

BMP_{Load} = (0.117 x 1.96) + (0.293 x 0.03) = 0.238 lbs P/yr

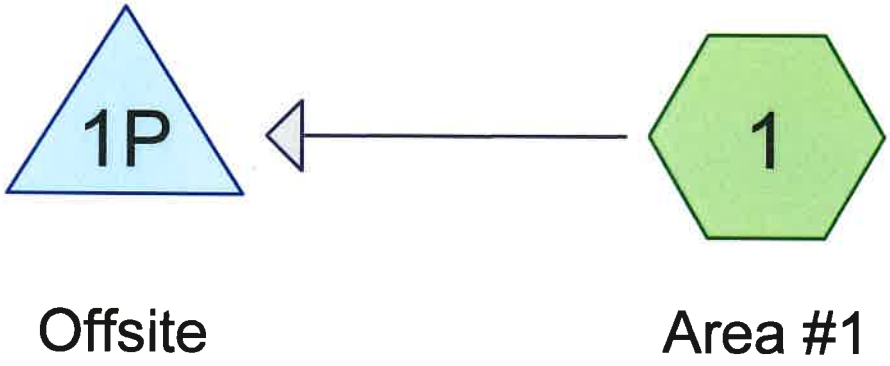
Proposed BMP's

Infiltration System #1

BMP Volume $_{ft3}$ (see HydroCAD) = 446 ft^3

$BMP_{inches\ of\ runoff}$ = BMP_{Volume} (ft^3)/IA x 12 in/ft x 1 acre/43,560 ft^2
= 446 ft^3/0.128 acre x 12 in/ft x 1 acre/43,560 ft^2
= 0.95 in.

In accordance with BMP Curves for Soil Infiltration Rate: Infiltration Basin the BMP will have close to a 100% load reduction Efficiency for soils with an infiltration rate of 2.41 in/hr. and at least 0.95 inches of runoff.



Subcat Reach Pond Link

Routing Diagram for 93 Ruane Rd Existing
Prepared by HP, Printed 7/18/2023

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.293	61	>75% Grass cover, Good, HSG B (1)
0.026	98	Exist. Drive (1)
0.067	98	Exist. House (1)
0.014	98	Exist. Patio (1)
0.001	98	Exist. Shed (1)
0.009	98	Exist. Walks (1)
0.410	**72**	**TOTAL AREA**

Summary for Subcatchment 1: Area #1

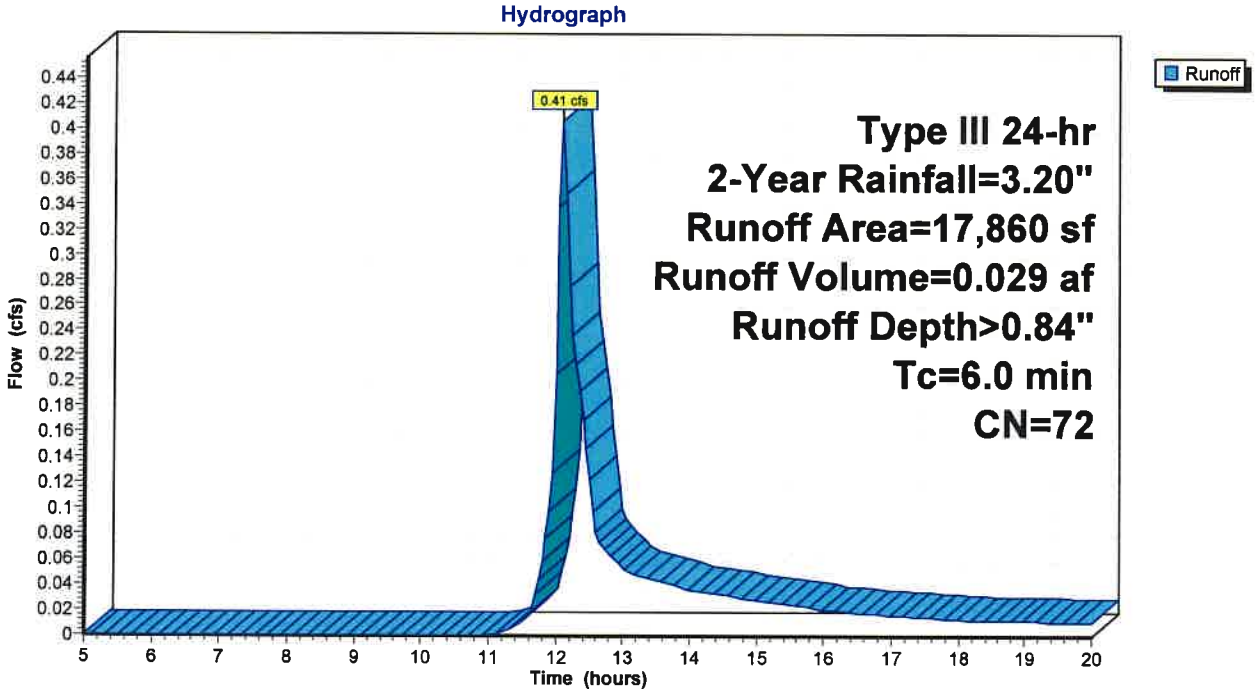
Runoff = 0.41 cfs @ 12.10 hrs, Volume= 0.029 af, Depth> 0.84"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.20"

	Area (sf)	CN	Description
	12,751	61	>75% Grass cover, Good, HSG B
*	2,929	98	Exist. House
*	1,122	98	Exist. Drive
*	371	98	Exist. Walks
*	624	98	Exist. Patio
*	63	98	Exist. Shed
	17,860	72	Weighted Average
	12,751		71.39% Pervious Area
	5,109		28.61% Impervious Area

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

Subcatchment 1: Area #1

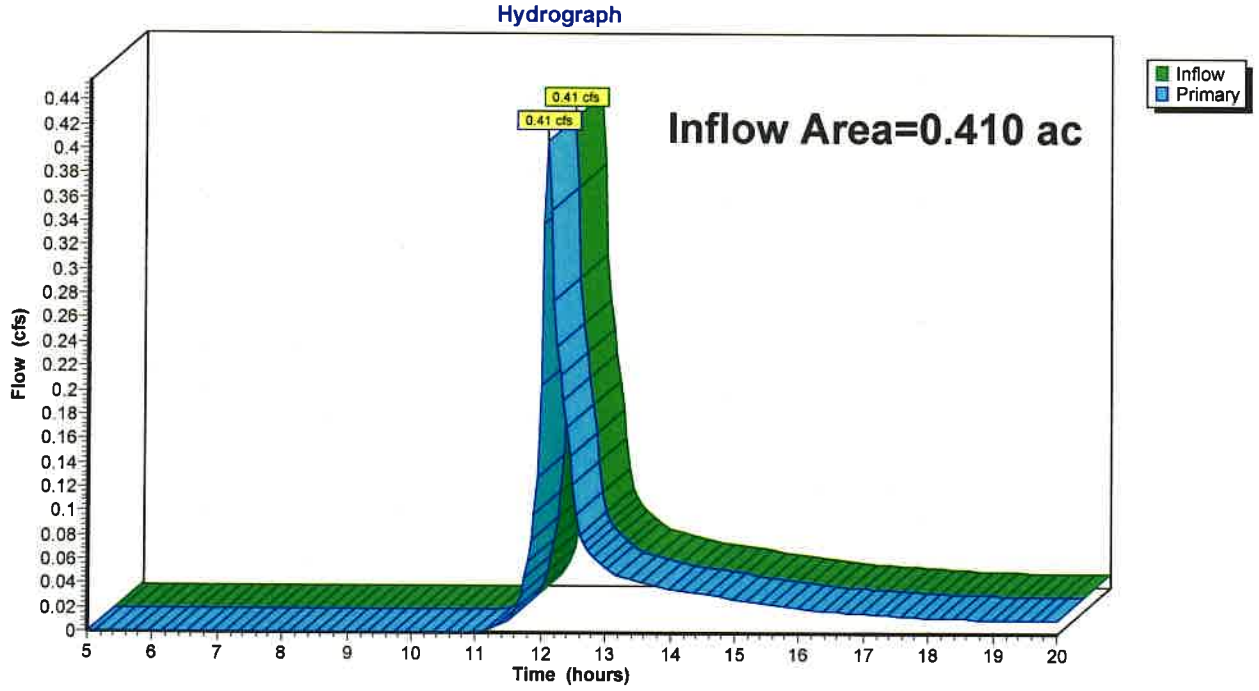


Summary for Pond 1P: Offsite

Inflow Area = 0.410 ac, 28.61% Impervious, Inflow Depth > 0.84" for 2-Year event
Inflow = 0.41 cfs @ 12.10 hrs, Volume= 0.029 af
Primary = 0.41 cfs @ 12.10 hrs, Volume= 0.029 af, Atten= 0%, Lag= 0.0 min

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

Pond 1P: Offsite



Summary for Subcatchment 1: Area #1

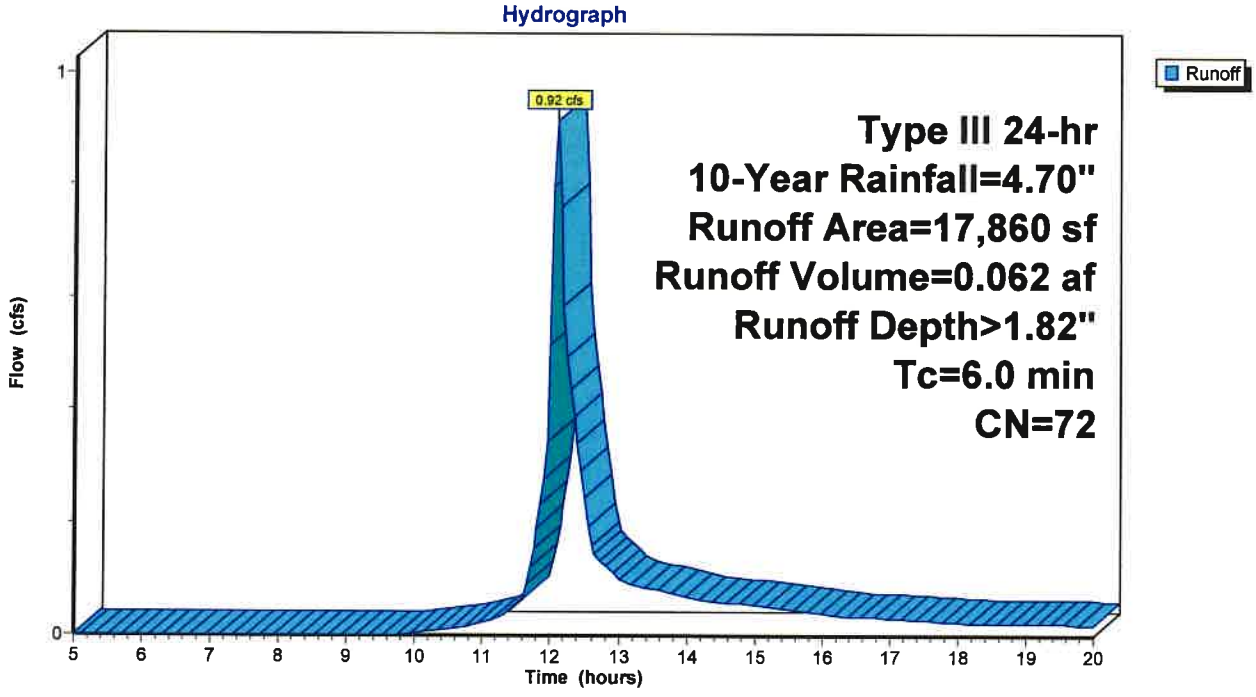
Runoff = 0.92 cfs @ 12.10 hrs, Volume= 0.062 af, Depth> 1.82"

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

	Area (sf)	CN	Description
	12,751	61	>75% Grass cover, Good, HSG B
*	2,929	98	Exist. House
*	1,122	98	Exist. Drive
*	371	98	Exist. Walks
*	624	98	Exist. Patio
*	63	98	Exist. Shed
	17,860	72	Weighted Average
	12,751		71.39% Pervious Area
	5,109		28.61% Impervious Area

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

Subcatchment 1: Area #1

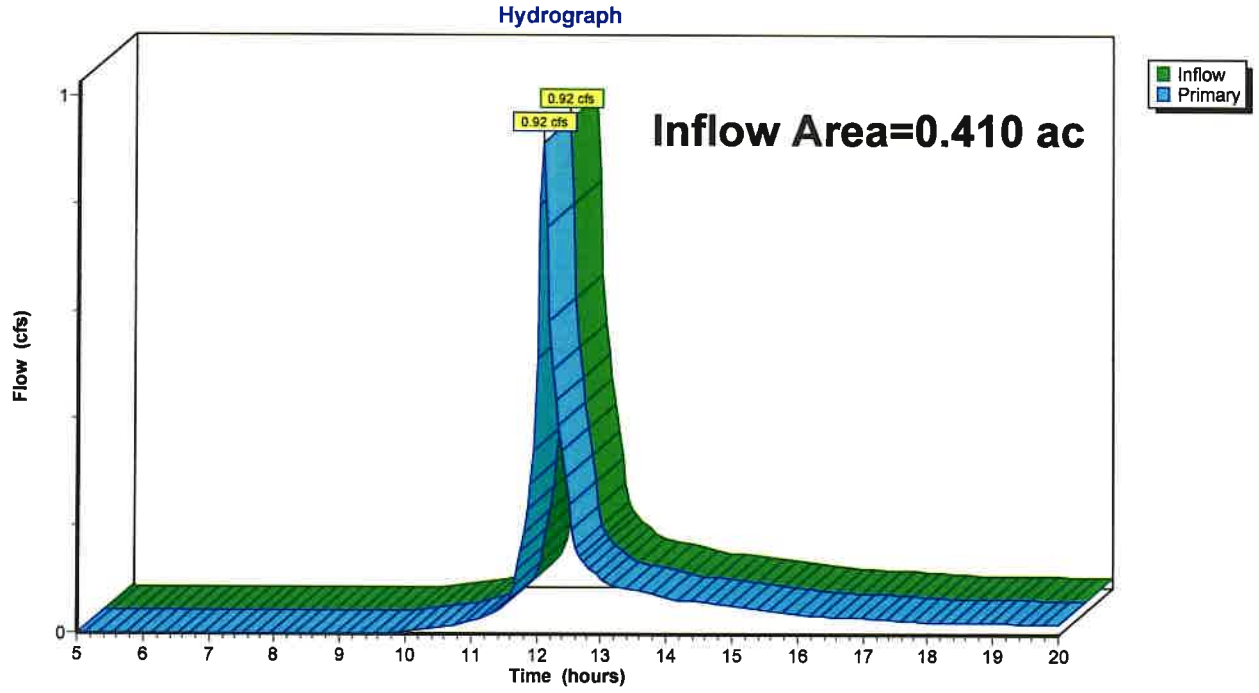


Summary for Pond 1P: Offsite

Inflow Area = 0.410 ac, 28.61% Impervious, Inflow Depth > 1.82" for 10-Year event
Inflow = 0.92 cfs @ 12.10 hrs, Volume= 0.062 af
Primary = 0.92 cfs @ 12.10 hrs, Volume= 0.062 af, Atten= 0%, Lag= 0.0 min

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

Pond 1P: Offsite



Summary for Subcatchment 1: Area #1

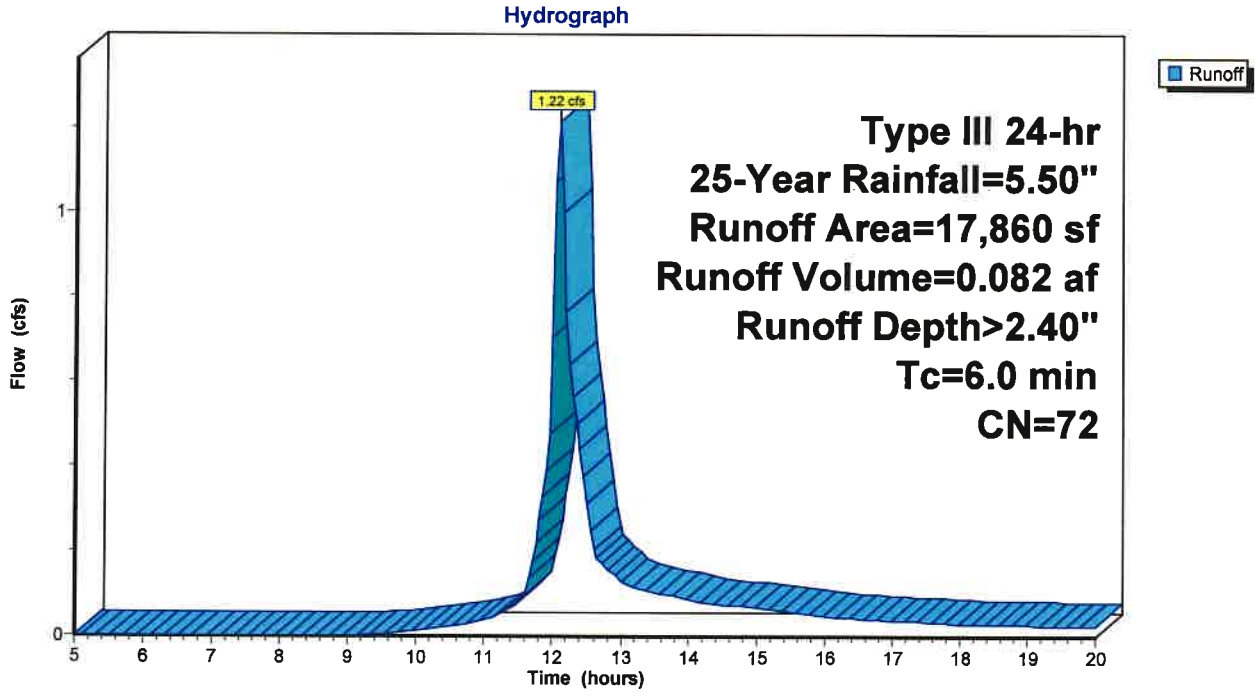
Runoff = 1.22 cfs @ 12.09 hrs, Volume= 0.082 af, Depth> 2.40"

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

	Area (sf)	CN	Description
	12,751	61	>75% Grass cover, Good, HSG B
*	2,929	98	Exist. House
*	1,122	98	Exist. Drive
*	371	98	Exist. Walks
*	624	98	Exist. Patio
*	63	98	Exist. Shed
	17,860	72	Weighted Average
	12,751		71.39% Pervious Area
	5,109		28.61% Impervious Area

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

Subcatchment 1: Area #1

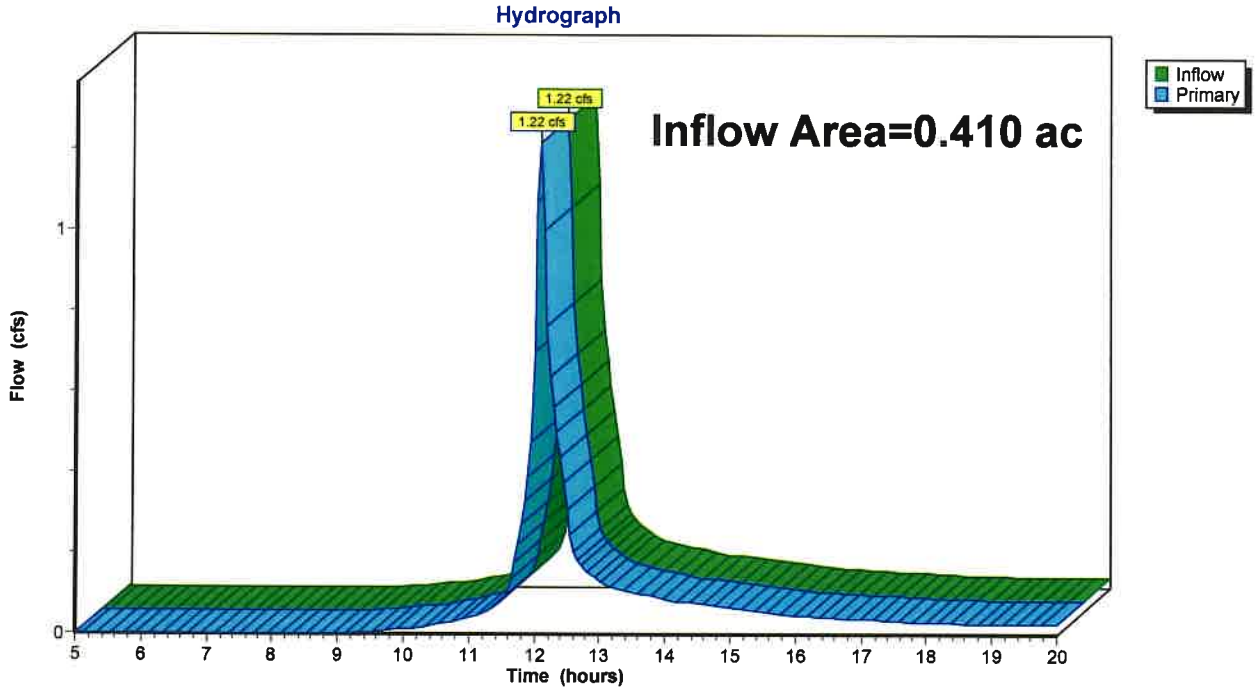


Summary for Pond 1P: Offsite

Inflow Area = 0.410 ac, 28.61% Impervious, Inflow Depth > 2.40" for 25-Year event
Inflow = 1.22 cfs @ 12.09 hrs, Volume= 0.082 af
Primary = 1.22 cfs @ 12.09 hrs, Volume= 0.082 af, Atten= 0%, Lag= 0.0 min

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

Pond 1P: Offsite



Summary for Subcatchment 1: Area #1

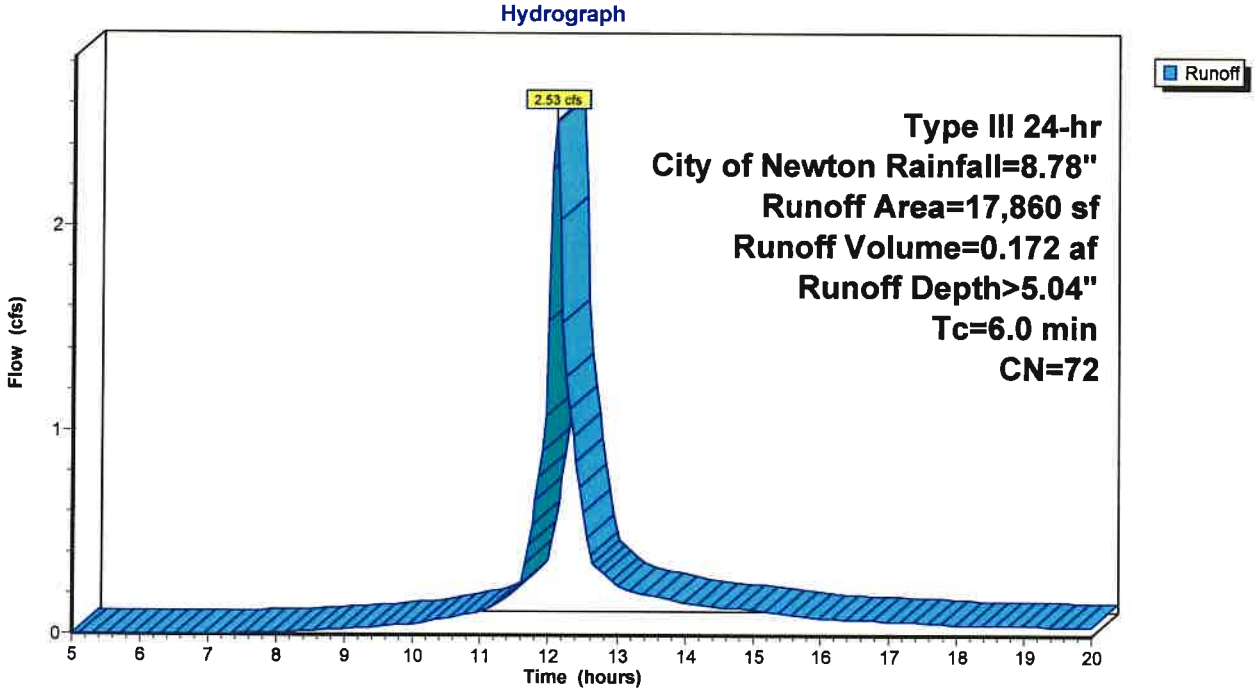
Runoff = 2.53 cfs @ 12.09 hrs, Volume= 0.172 af, Depth> 5.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr City of Newton Rainfall=8.78"

	Area (sf)	CN	Description
	12,751	61	>75% Grass cover, Good, HSG B
*	2,929	98	Exist. House
*	1,122	98	Exist. Drive
*	371	98	Exist. Walks
*	624	98	Exist. Patio
*	63	98	Exist. Shed
	17,860	72	Weighted Average
	12,751		71.39% Pervious Area
	5,109		28.61% Impervious Area

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

Subcatchment 1: Area #1

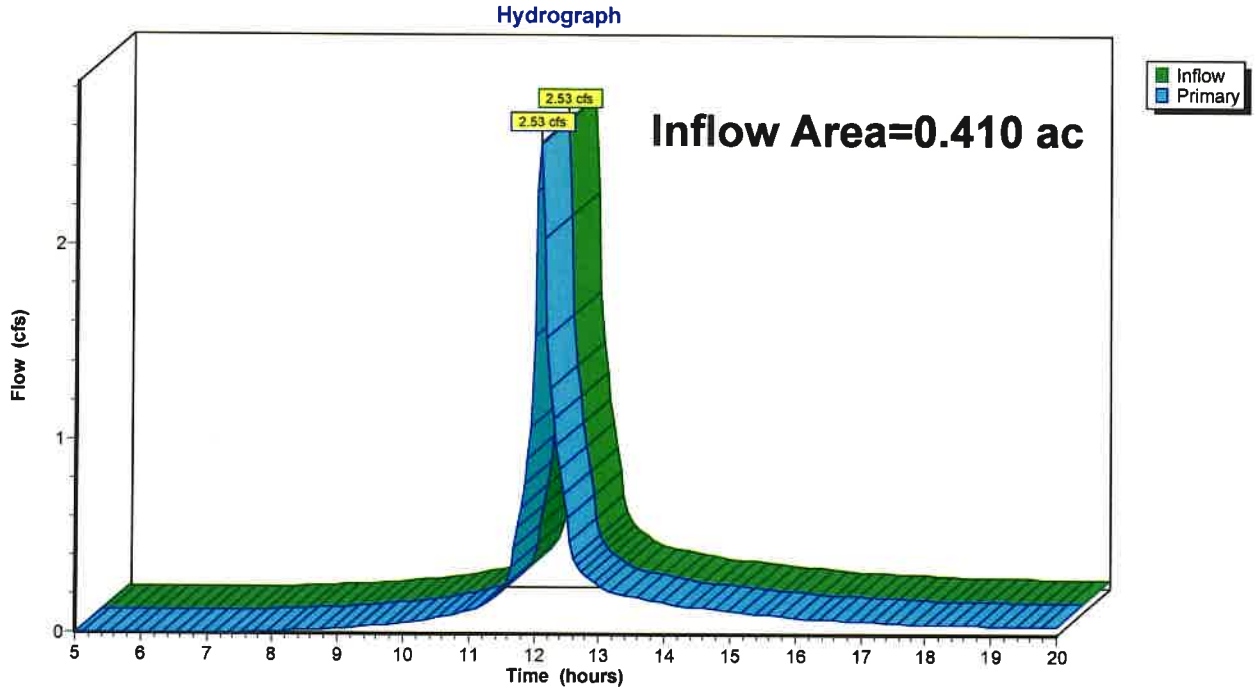


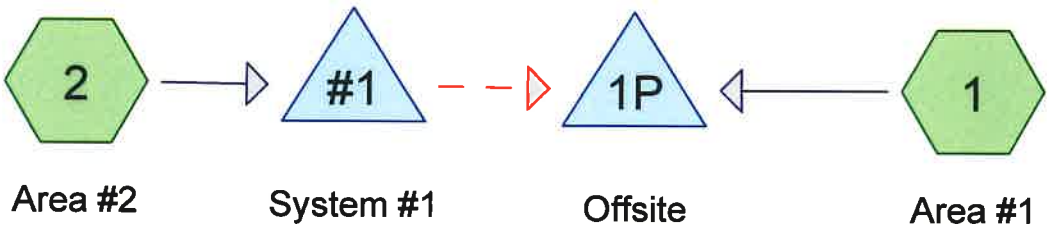
Summary for Pond 1P: Offsite

Inflow Area = 0.410 ac, 28.61% Impervious, Inflow Depth > 5.04" for City of Newton event
Inflow = 2.53 cfs @ 12.09 hrs, Volume= 0.172 af
Primary = 2.53 cfs @ 12.09 hrs, Volume= 0.172 af, Atten= 0%, Lag= 0.0 min

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

Pond 1P: Offsite





Subcat Reach Pond Link

Routing Diagram for 93 Ruane Rd Proposed
Prepared by HP, Printed 7/18/2023

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.282	61	>75% Grass cover, Good, HSG B (1)
0.067	98	Exist, House (1)
0.019	98	Exist. Drive (1)
0.013	98	Exist. Patio (1)
0.001	98	Exist. Shed (1)
0.009	98	Exist. Walks (1)
0.018	98	Prop. Addition (2)
0.410	**73**	**TOTAL AREA**

Summary for Subcatchment 1: Area #1

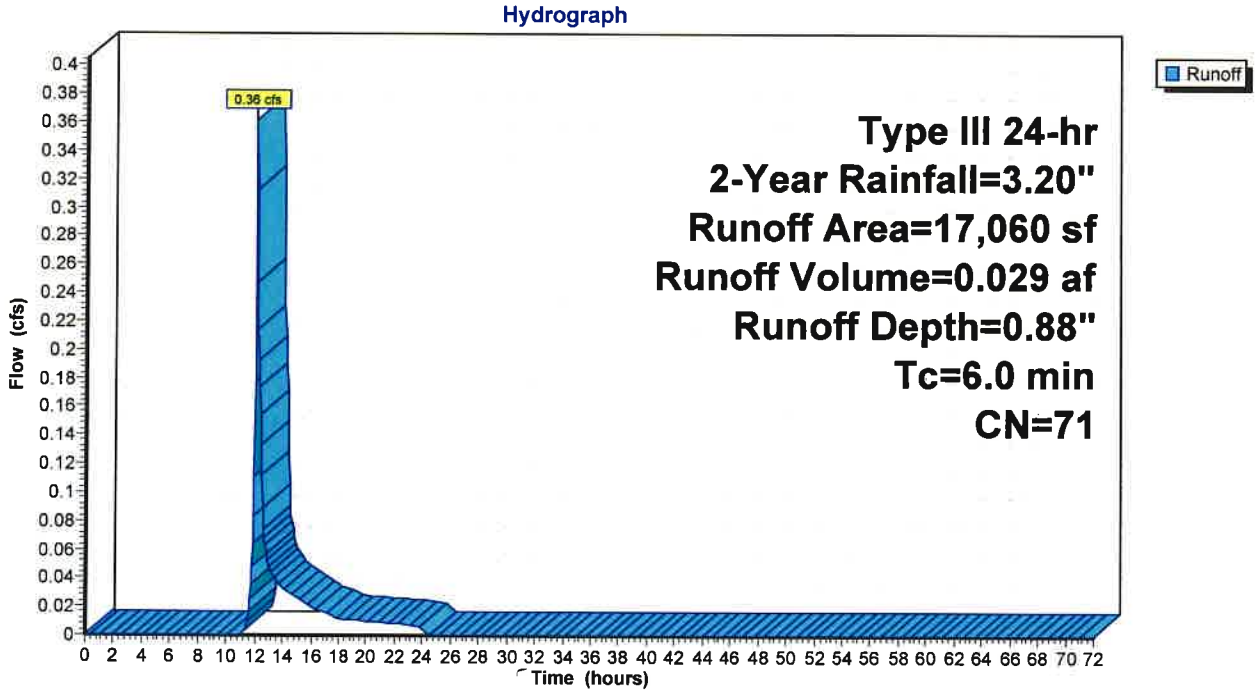
Runoff = 0.36 cfs @ 12.10 hrs, Volume= 0.029 af, Depth= 0.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.20"

	Area (sf)	CN	Description
	12,269	61	>75% Grass cover, Good, HSG B
*	2,929	98	Exist, House
*	371	98	Exist. Walks
*	584	98	Exist. Patio
*	63	98	Exist. Shed
*	844	98	Exist. Drive
	17,060	71	Weighted Average
	12,269		71.92% Pervious Area
	4,791		28.08% Impervious Area

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

Subcatchment 1: Area #1



Summary for Subcatchment 2: Area #2

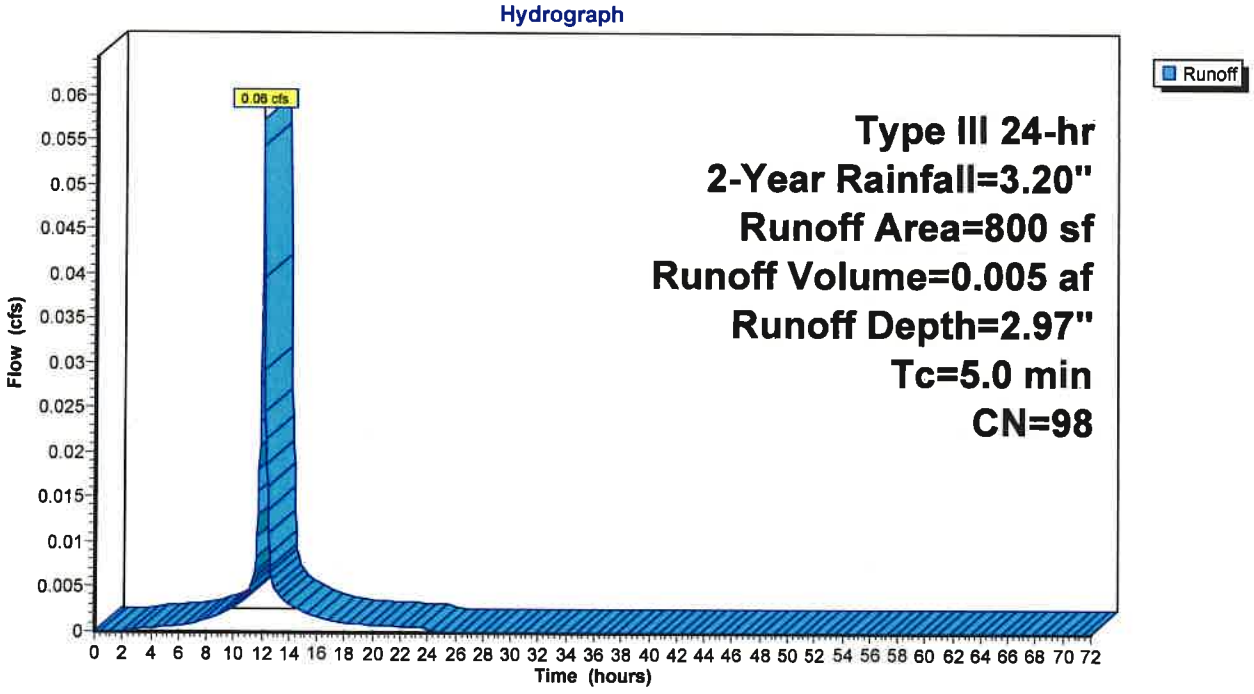
Runoff = 0.06 cfs @ 12.07 hrs, Volume= 0.005 af, Depth= 2.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.20"

	Area (sf)	CN	Description
*	800	98	Prop. Addition
	800		100.00% Impervious Area

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

Subcatchment 2: Area #2



Summary for Pond #1: System #1

Inflow Area = 0.018 ac,100.00% Impervious, Inflow Depth = 2.97" for 2-Year event
Inflow = 0.06 cfs @ 12.07 hrs, Volume= 0.005 af
Outflow = 0.01 cfs @ 11.70 hrs, Volume= 0.005 af, Atten= 85%, Lag= 0.0 min
Discarded = 0.01 cfs @ 11.70 hrs, Volume= 0.005 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 140.82' @ 12.55 hrs Surf.Area= 95 sf Storage= 56 cf

Plug-Flow detention time= 38.2 min calculated for 0.005 af (100% of inflow)
Center-of-Mass det. time= 38.2 min (793.6 - 755.5)

Volume	Invert	Avail.Storage	Storage Description
#1	139.53'	189 cf	**11.00'D x 7.67'H Gravel** 729 cf Overall - 257 cf Embedded = 472 cf x 40.0% Voids
#2	140.53'	257 cf	**7.00'D x 6.67'H Drywell** Inside #1
		446 cf	Total Available Storage

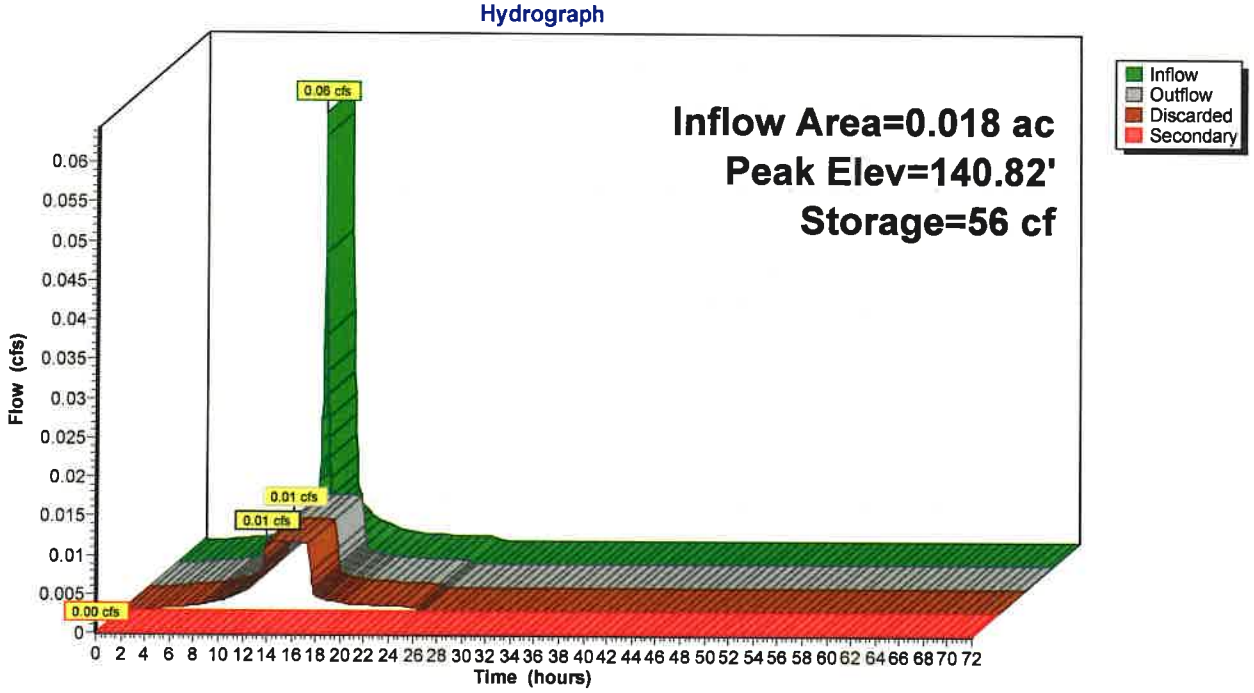
Device	Routing	Invert	Outlet Devices
#1	Discarded	139.53'	**4.000 in/hr Exfiltration over Surface area**
#2	Secondary	146.20'	**6.0" Vert. Gutter Overflow** C= 0.600

Discarded OutFlow Max=0.01 cfs @ 11.70 hrs HW=139.62' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.01 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=139.53' (Free Discharge)
↑—**2=Gutter Overflow** (Controls 0.00 cfs)

Pond #1: System #1

Hydrograph

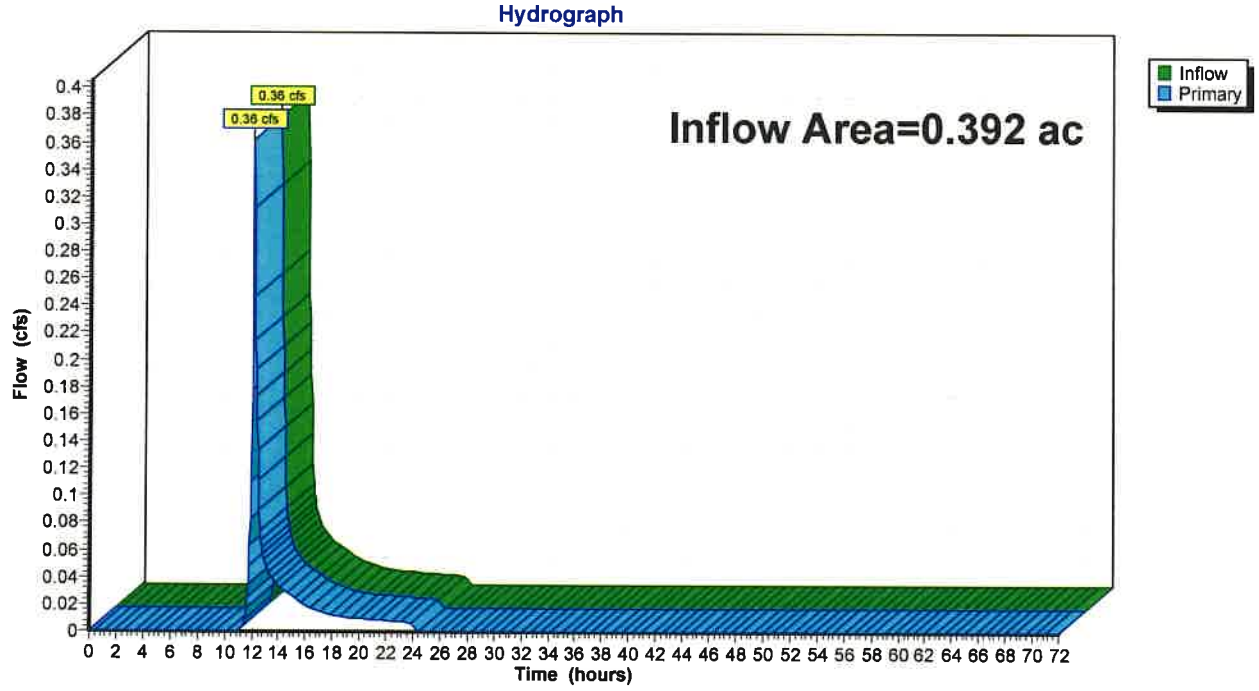


Summary for Pond 1P: Offsite

Inflow Area = 0.392 ac, 28.08% Impervious, Inflow Depth = 0.88" for 2-Year event
Inflow = 0.36 cfs @ 12.10 hrs, Volume= 0.029 af
Primary = 0.36 cfs @ 12.10 hrs, Volume= 0.029 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Pond 1P: Offsite



Summary for Subcatchment 1: Area #1

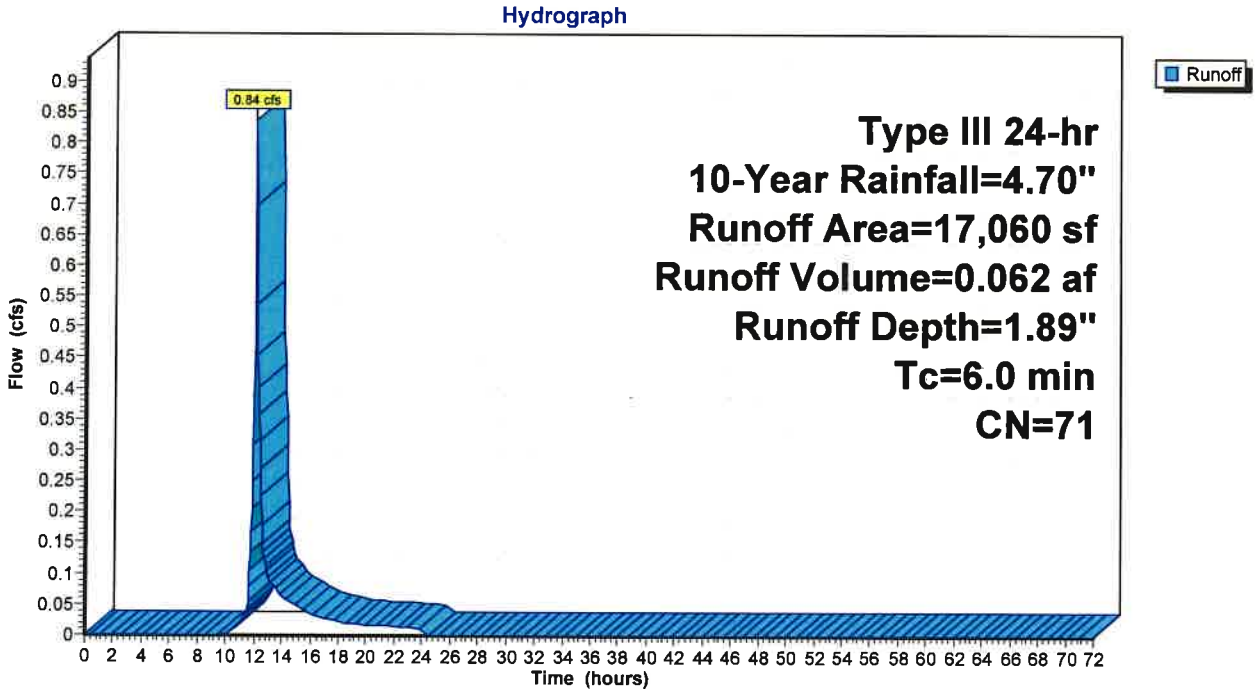
Runoff = 0.84 cfs @ 12.10 hrs, Volume= 0.062 af, Depth= 1.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.70"

	Area (sf)	CN	Description
	12,269	61	>75% Grass cover, Good, HSG B
*	2,929	98	Exist, House
*	371	98	Exist. Walks
*	584	98	Exist. Patio
*	63	98	Exist. Shed
*	844	98	Exist. Drive
	17,060	71	Weighted Average
	12,269		71.92% Pervious Area
	4,791		28.08% Impervious Area

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

Subcatchment 1: Area #1



Summary for Subcatchment 2: Area #2

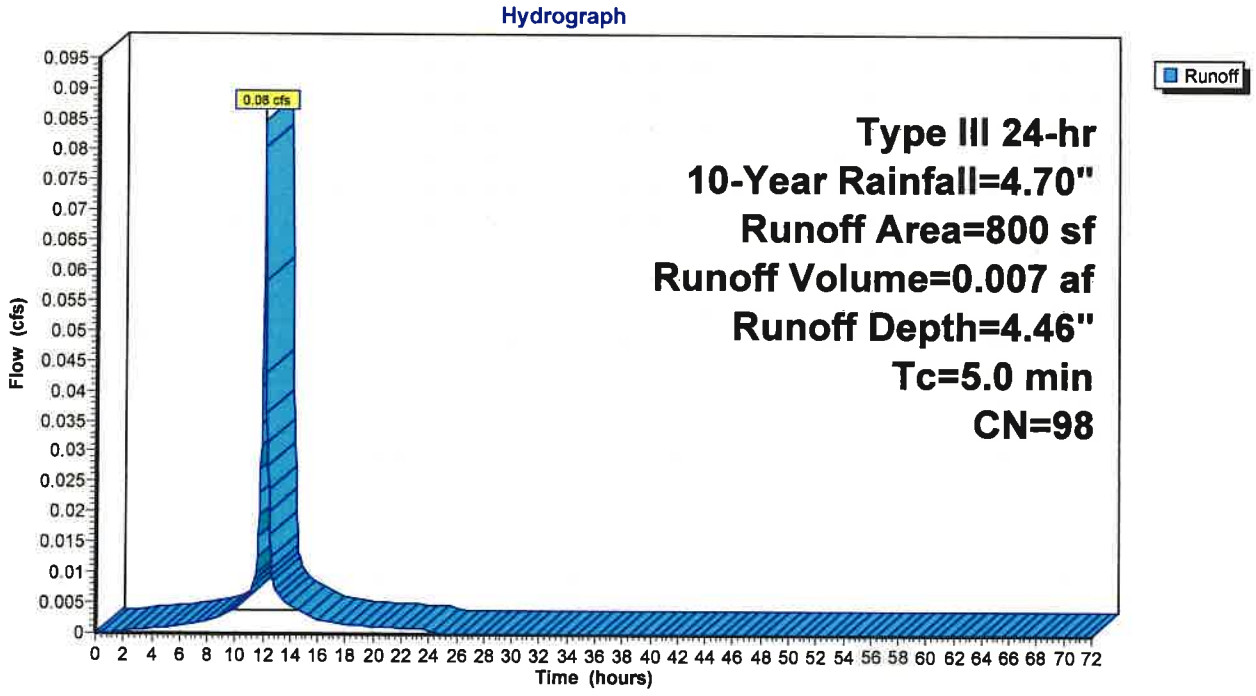
Runoff = 0.08 cfs @ 12.07 hrs, Volume= 0.007 af, Depth= 4.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.70"

	Area (sf)	CN	Description
*	800	98	Prop. Addition
	800		100.00% Impervious Area

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

Subcatchment 2: Area #2



Summary for Pond #1: System #1

Inflow Area = 0.018 ac,100.00% Impervious, Inflow Depth = 4.46" for 10-Year event
Inflow = 0.08 cfs @ 12.07 hrs, Volume= 0.007 af
Outflow = 0.01 cfs @ 11.50 hrs, Volume= 0.007 af, Atten= 90%, Lag= 0.0 min
Discarded = 0.01 cfs @ 11.50 hrs, Volume= 0.007 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 141.51' @ 12.77 hrs Surf.Area= 95 sf Storage= 98 cf

Plug-Flow detention time= 74.2 min calculated for 0.007 af (100% of inflow)
Center-of-Mass det. time= 74.1 min (822.2 - 748.1)

Volume	Invert	Avail.Storage	Storage Description
#1	139.53'	189 cf	**11.00'D x 7.67'H Gravel** 729 cf Overall - 257 cf Embedded = 472 cf x 40.0% Voids
#2	140.53'	257 cf	**7.00'D x 6.67'H Drywell** Inside #1
		446 cf	Total Available Storage

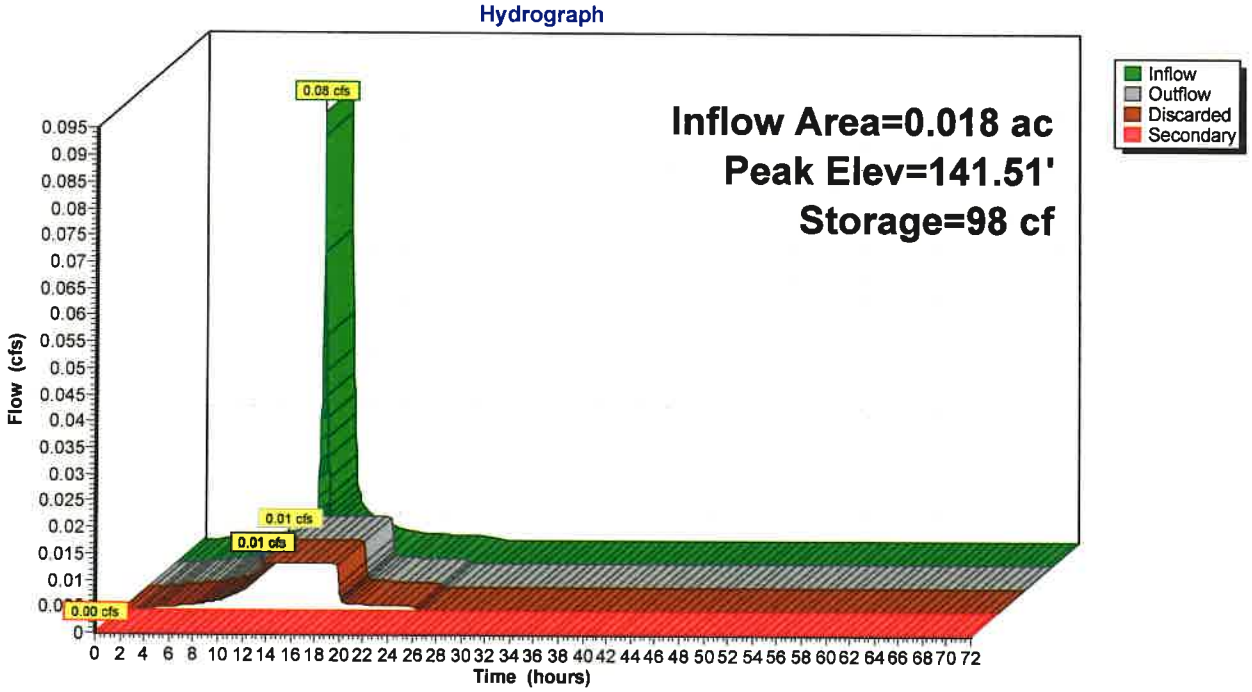
Device	Routing	Invert	Outlet Devices
#1	Discarded	139.53'	**4.000 in/hr Exfiltration over Surface area**
#2	Secondary	146.20'	**6.0" Vert. Gutter Overflow** C= 0.600

Discarded OutFlow Max=0.01 cfs @ 11.50 hrs HW=139.61' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.01 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=139.53' (Free Discharge)
↑—**2=Gutter Overflow** (Controls 0.00 cfs)

Pond #1: System #1

Hydrograph

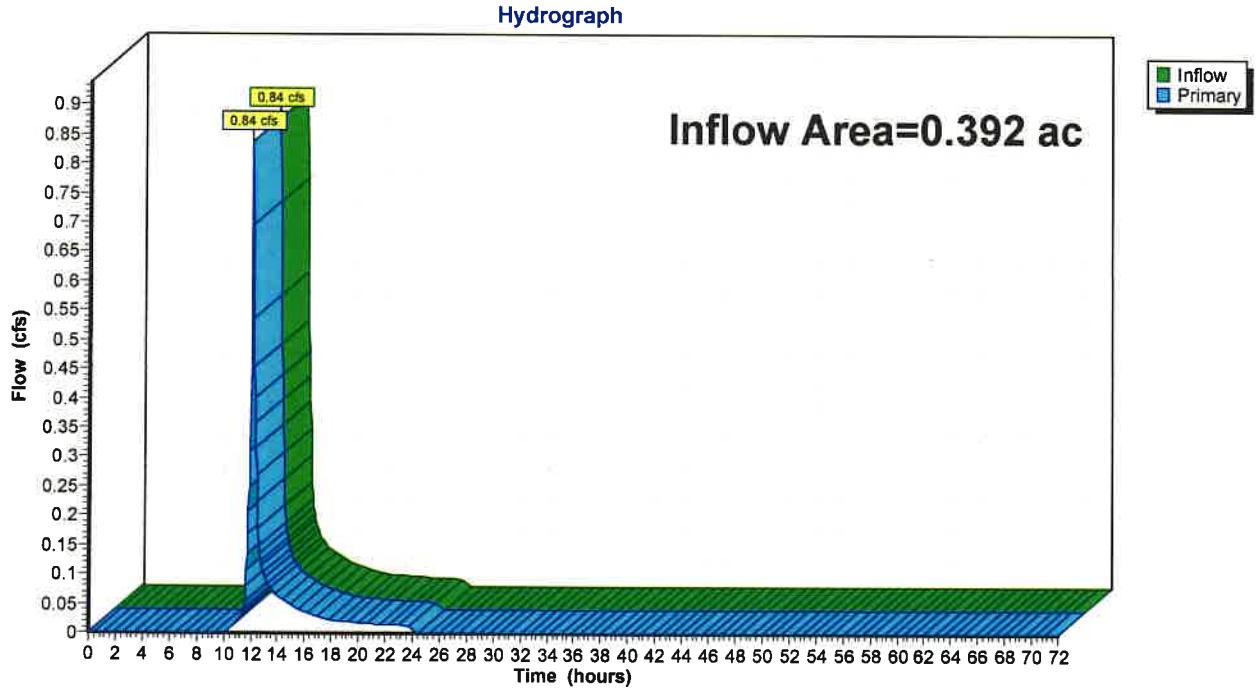


Summary for Pond 1P: Offsite

Inflow Area = 0.392 ac, 28.08% Impervious, Inflow Depth = 1.89" for 10-Year event
Inflow = 0.84 cfs @ 12.10 hrs, Volume= 0.062 af
Primary = 0.84 cfs @ 12.10 hrs, Volume= 0.062 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Pond 1P: Offsite



Summary for Subcatchment 1: Area #1

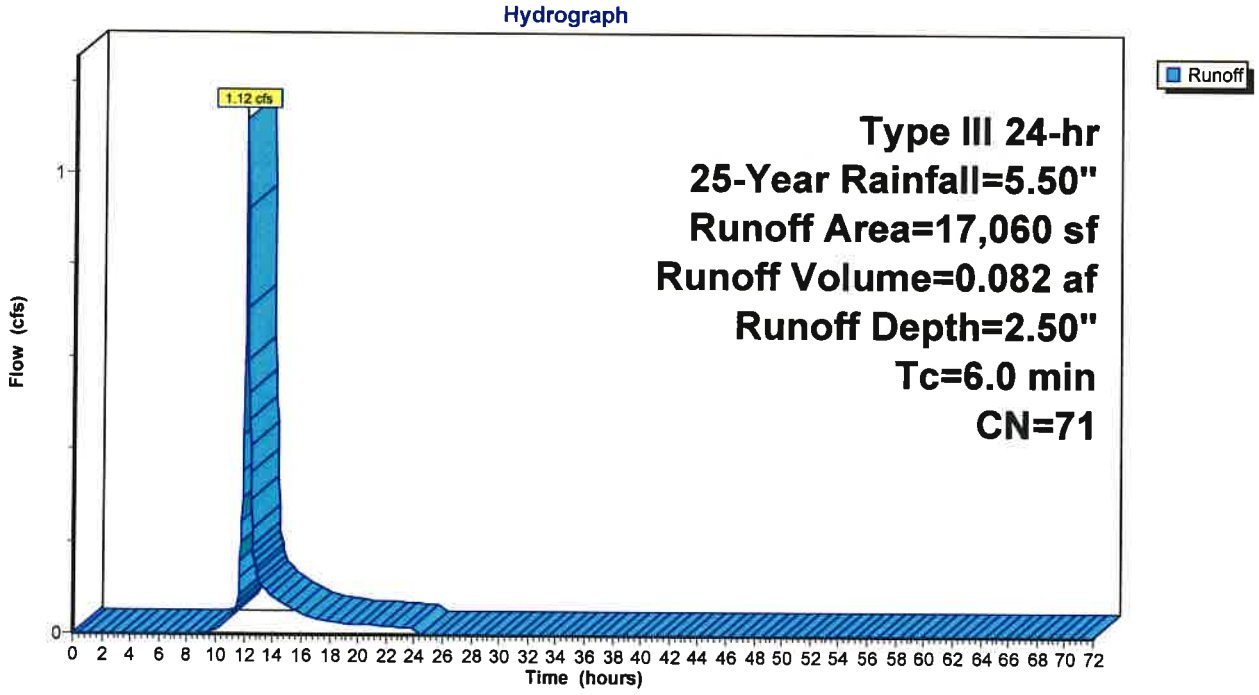
Runoff = 1.12 cfs @ 12.10 hrs, Volume= 0.082 af, Depth= 2.50"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.50"

	Area (sf)	CN	Description
	12,269	61	>75% Grass cover, Good, HSG B
*	2,929	98	Exist, House
*	371	98	Exist. Walks
*	584	98	Exist. Patio
*	63	98	Exist. Shed
*	844	98	Exist. Drive
	17,060	71	Weighted Average
	12,269		71.92% Pervious Area
	4,791		28.08% Impervious Area

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

Subcatchment 1: Area #1



Summary for Subcatchment 2: Area #2

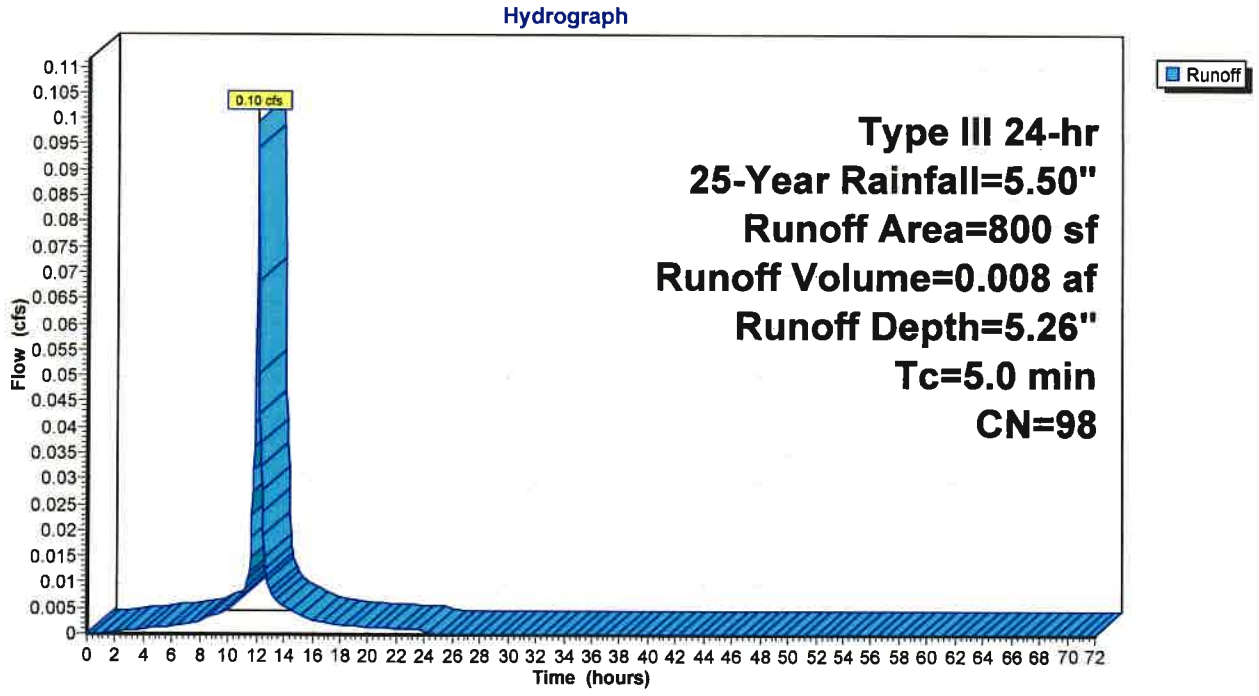
Runoff = 0.10 cfs @ 12.07 hrs, Volume= 0.008 af, Depth= 5.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.50"

	Area (sf)	CN	Description
*	800	98	Prop. Addition
	800		100.00% Impervious Area

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

Subcatchment 2: Area #2



Summary for Pond #1: System #1

Inflow Area = 0.018 ac,100.00% Impervious, Inflow Depth = 5.26" for 25-Year event
Inflow = 0.10 cfs @ 12.07 hrs, Volume= 0.008 af
Outflow = 0.01 cfs @ 11.35 hrs, Volume= 0.008 af, Atten= 91%, Lag= 0.0 min
Discarded = 0.01 cfs @ 11.35 hrs, Volume= 0.008 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 141.91' @ 12.93 hrs Surf.Area= 95 sf Storage= 122 cf

Plug-Flow detention time= 97.0 min calculated for 0.008 af (100% of inflow)
Center-of-Mass det. time= 96.9 min (842.5 - 745.5)

Volume	Invert	Avail.Storage	Storage Description
#1	139.53'	189 cf	**11.00'D x 7.67'H Gravel** 729 cf Overall - 257 cf Embedded = 472 cf x 40.0% Voids
#2	140.53'	257 cf	**7.00'D x 6.67'H Drywell** Inside #1
		446 cf	Total Available Storage

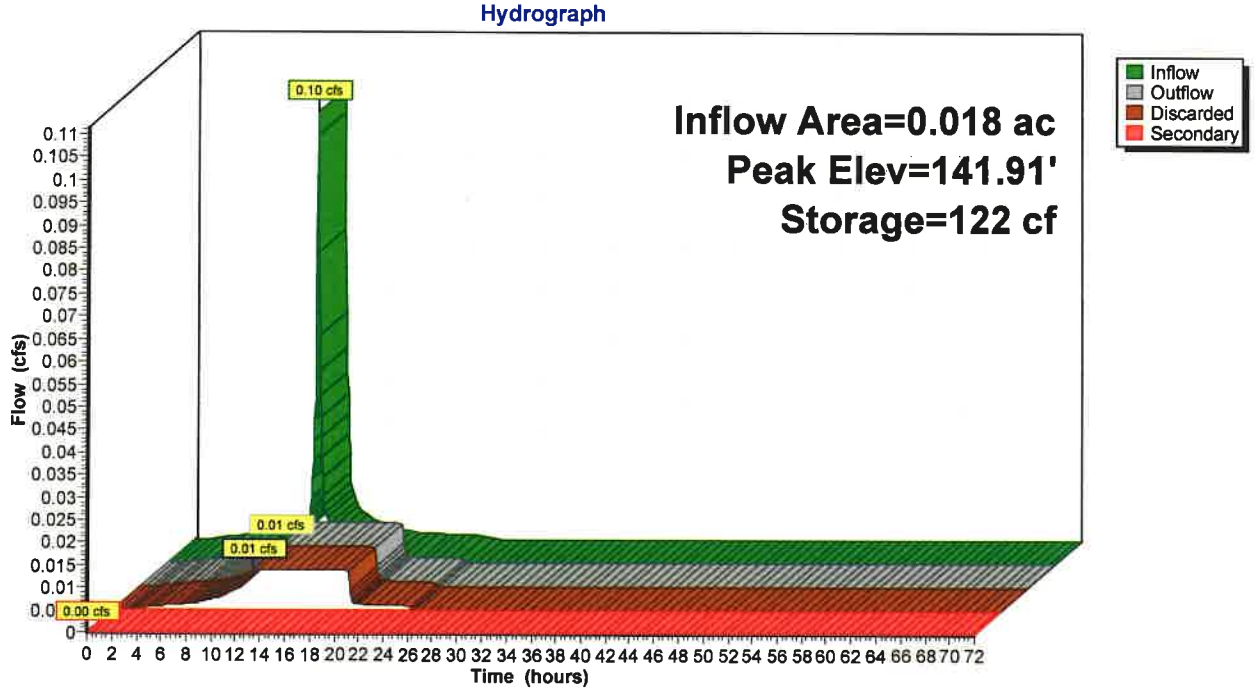
Device	Routing	Invert	Outlet Devices
#1	Discarded	139.53'	**4.000 in/hr Exfiltration over Surface area**
#2	Secondary	146.20'	**6.0" Vert. Gutter Overflow** C= 0.600

Discarded OutFlow Max=0.01 cfs @ 11.35 hrs HW=139.61' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.01 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=139.53' (Free Discharge)
↑—**2=Gutter Overflow** (Controls 0.00 cfs)

Pond #1: System #1

Hydrograph

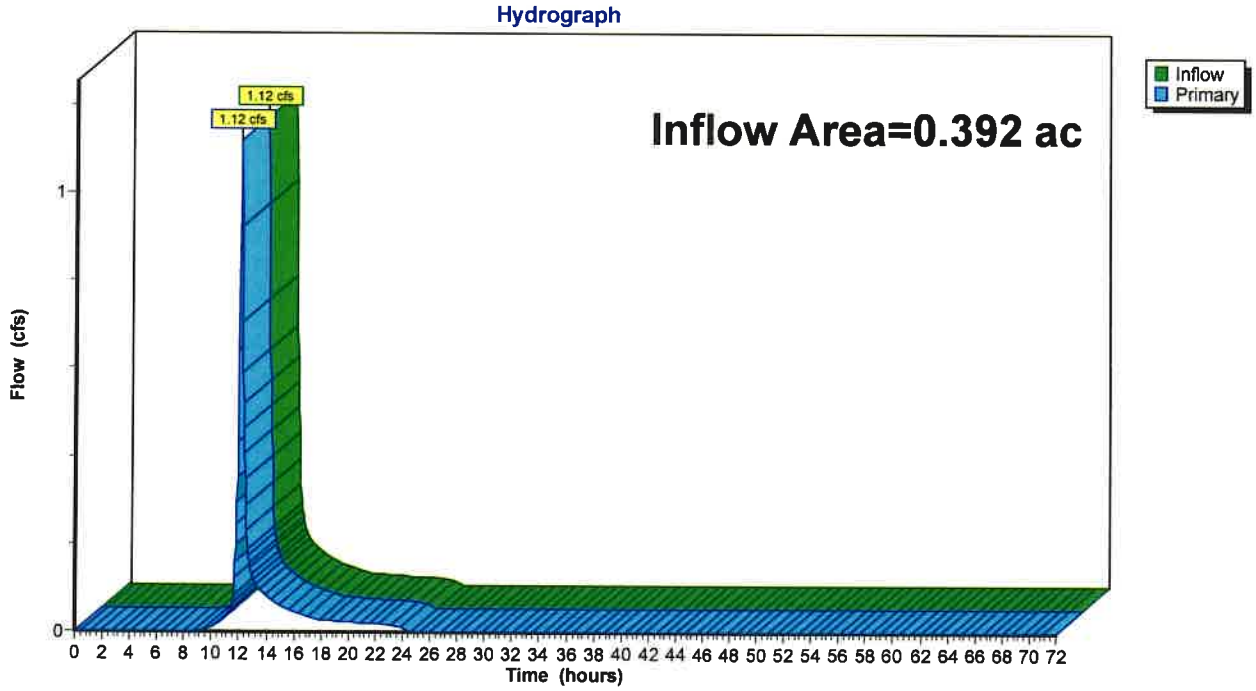


Summary for Pond 1P: Offsite

Inflow Area = 0.392 ac, 28.08% Impervious, Inflow Depth = 2.50" for 25-Year event
Inflow = 1.12 cfs @ 12.10 hrs, Volume= 0.082 af
Primary = 1.12 cfs @ 12.10 hrs, Volume= 0.082 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Pond 1P: Offsite



Summary for Subcatchment 1: Area #1

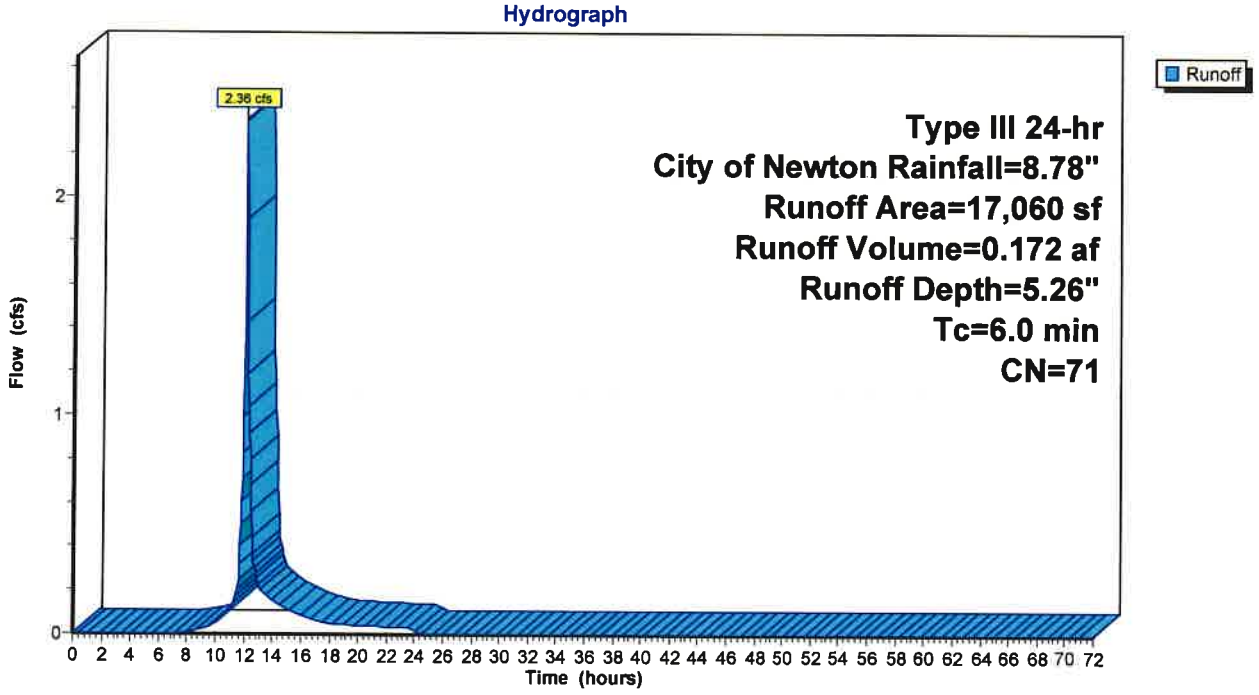
Runoff = 2.36 cfs @ 12.09 hrs, Volume= 0.172 af, Depth= 5.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr City of Newton Rainfall=8.78"

	Area (sf)	CN	Description
	12,269	61	>75% Grass cover, Good, HSG B
*	2,929	98	Exist, House
*	371	98	Exist. Walks
*	584	98	Exist. Patio
*	63	98	Exist. Shed
*	844	98	Exist. Drive
	17,060	71	Weighted Average
	12,269		71.92% Pervious Area
	4,791		28.08% Impervious Area

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

Subcatchment 1: Area #1



Summary for Subcatchment 2: Area #2

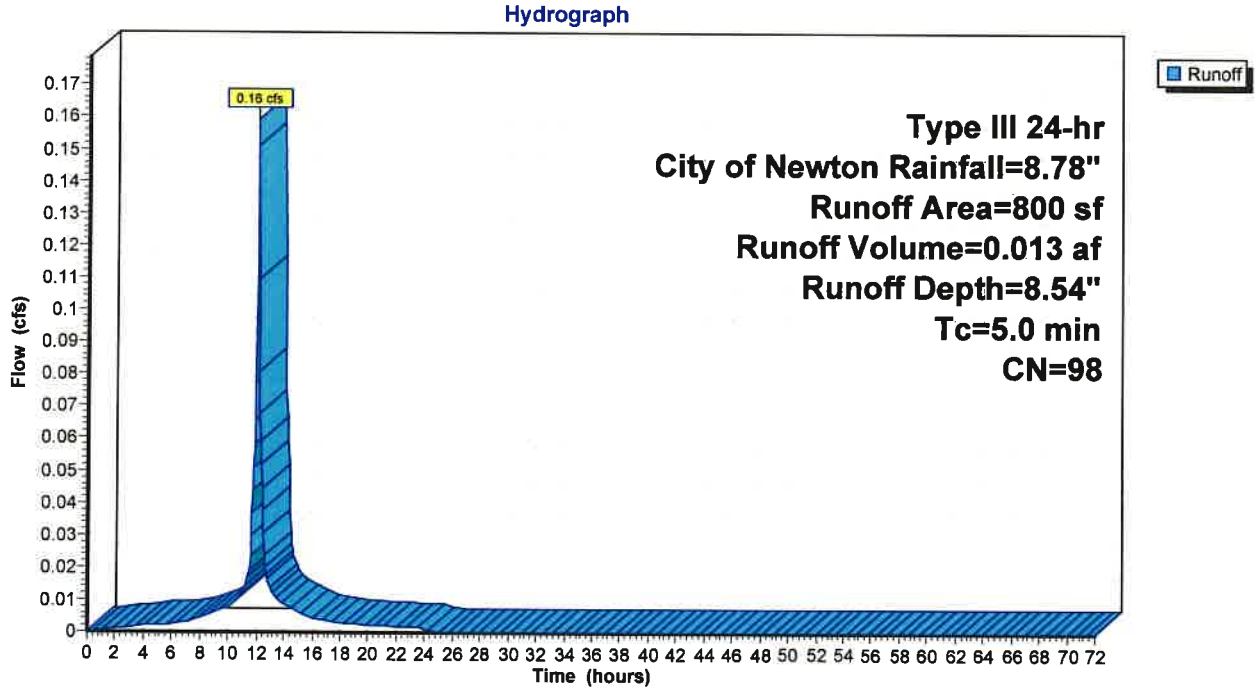
Runoff = 0.16 cfs @ 12.07 hrs, Volume= 0.013 af, Depth= 8.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr City of Newton Rainfall=8.78"

	Area (sf)	CN	Description
*	800	98	Prop. Addition
	800		100.00% Impervious Area

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

Subcatchment 2: Area #2



Summary for Pond #1: System #1

Inflow Area = 0.018 ac,100.00% Impervious, Inflow Depth = 8.54" for City of Newton event
Inflow = 0.16 cfs @ 12.07 hrs, Volume= 0.013 af
Outflow = 0.01 cfs @ 10.45 hrs, Volume= 0.013 af, Atten= 94%, Lag= 0.0 min
Discarded = 0.01 cfs @ 10.45 hrs, Volume= 0.013 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 143.83' @ 13.86 hrs Surf.Area= 95 sf Storage= 240 cf

Plug-Flow detention time= 214.4 min calculated for 0.013 af (100% of inflow)
Center-of-Mass det. time= 214.4 min (953.5 - 739.2)

Volume	Invert	Avail.Storage	Storage Description
#1	139.53'	189 cf	**11.00'D x 7.67'H Gravel** 729 cf Overall - 257 cf Embedded = 472 cf x 40.0% Voids
#2	140.53'	257 cf	**7.00'D x 6.67'H Drywell** Inside #1
		446 cf	Total Available Storage

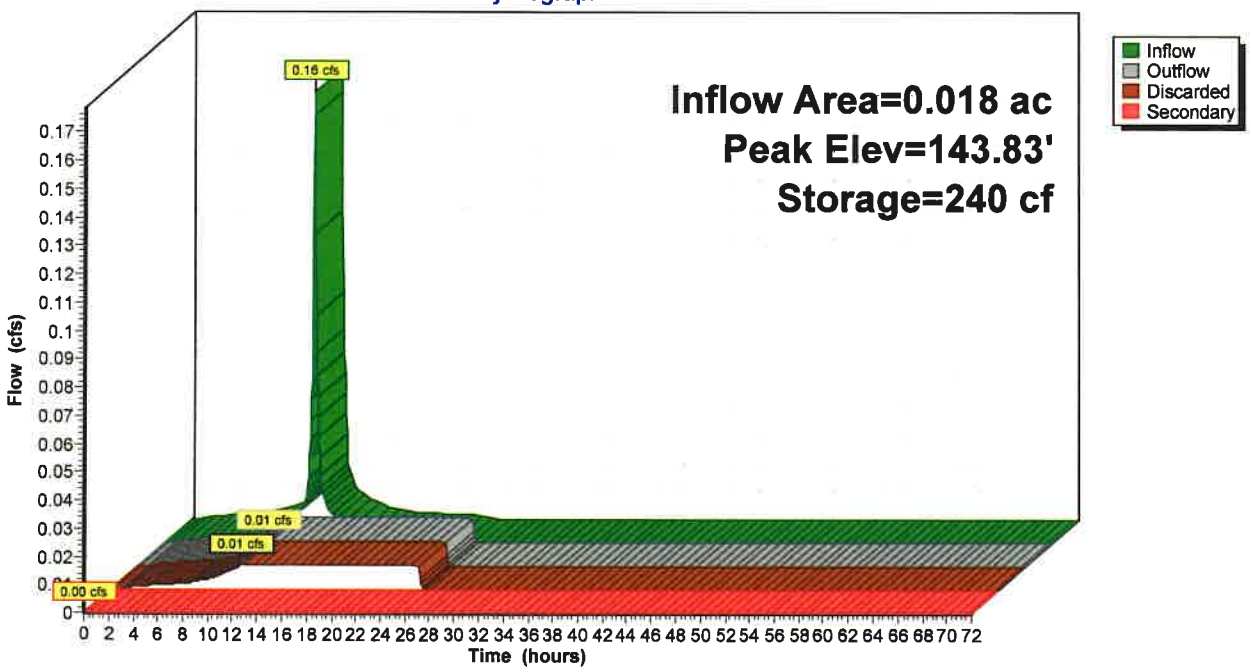
Device	Routing	Invert	Outlet Devices
#1	Discarded	139.53'	**4.000 in/hr Exfiltration over Surface area**
#2	Secondary	146.20'	**6.0" Vert. Gutter Overflow** C= 0.600

Discarded OutFlow Max=0.01 cfs @ 10.45 hrs HW=139.61' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.01 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=139.53' (Free Discharge)
↑—**2=Gutter Overflow** (Controls 0.00 cfs)

Pond #1: System #1

Hydrograph

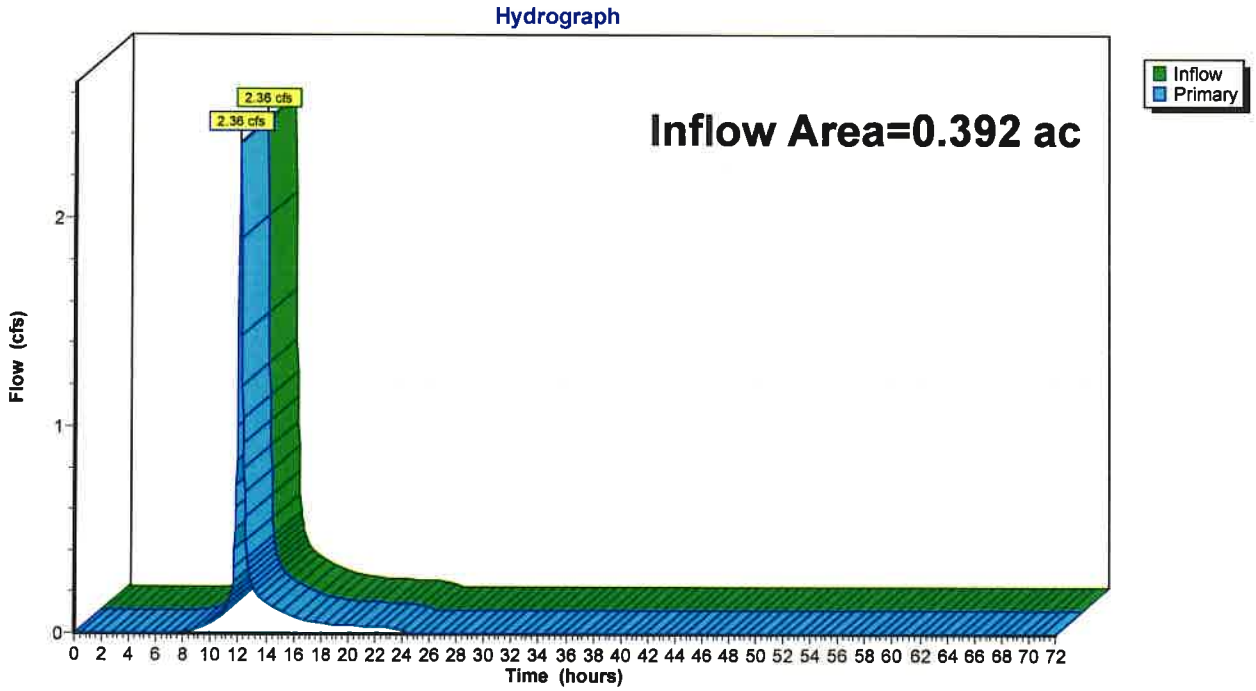


Summary for Pond 1P: Offsite

Inflow Area = 0.392 ac, 28.08% Impervious, Inflow Depth = 5.26" for City of Newton event
Inflow = 2.36 cfs @ 12.09 hrs, Volume= 0.172 af
Primary = 2.36 cfs @ 12.09 hrs, Volume= 0.172 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Pond 1P: Offsite



Hydrograph for Pond #1: System #1

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Outflow (cfs)	Discarded (cfs)	Secondary (cfs)
0.00	0.00	0	139.53	0.00	0.00	**0.00**
2.50	0.00	0	139.54	0.00	0.00	0.00
5.00	0.00	1	139.55	0.00	0.00	0.00
7.50	0.00	1	139.56	0.00	0.00	0.00
10.00	**0.01**	3	139.60	**0.01**	**0.01**	0.00
12.50	**0.03**	**218**	**143.48**	**0.01**	**0.01**	0.00
15.00	0.01	**234**	**143.73**	0.01	0.01	0.00
17.50	0.00	194	143.08	0.01	0.01	0.00
20.00	0.00	137	142.14	0.01	0.01	0.00
22.50	0.00	75	141.13	0.01	0.01	0.00
25.00	0.00	4	139.64	0.01	0.01	0.00
27.50	0.00	0	139.53	0.00	0.00	0.00
30.00	0.00	0	139.53	0.00	0.00	0.00
32.50	0.00	0	139.53	0.00	0.00	0.00
35.00	0.00	0	139.53	0.00	0.00	0.00
37.50	0.00	0	139.53	0.00	0.00	0.00
40.00	0.00	0	139.53	0.00	0.00	0.00
42.50	0.00	0	139.53	0.00	0.00	0.00
45.00	0.00	0	139.53	0.00	0.00	0.00
47.50	0.00	0	139.53	0.00	0.00	0.00
50.00	0.00	0	139.53	0.00	0.00	0.00
52.50	0.00	0	139.53	0.00	0.00	0.00
55.00	0.00	0	139.53	0.00	0.00	0.00
57.50	0.00	0	139.53	0.00	0.00	0.00
60.00	0.00	0	139.53	0.00	0.00	0.00
62.50	0.00	0	139.53	0.00	0.00	0.00
65.00	0.00	0	139.53	0.00	0.00	0.00
67.50	0.00	0	139.53	0.00	0.00	0.00
70.00	0.00	0	139.53	0.00	0.00	0.00

OPERATION & MAINTENANCE PLAN

STORMWATER MANAGEMENT FACILITIES
PROPOSED ADDITION
93 RUANE ROAD
NEWTON, MASSACHUSETTS

July 18, 2023

VERNE T. PORTER JR., PLS
LAND SURVEYORS – CIVIL ENGINEERS
354 ELLIOT STREET
NEWTON, MA 02464

OPERATION & MAINTENANCE PLAN
STORMWATER MANAGEMENT FACILITIES
PROPOSED ADDITION
93 RUANE ROAD
NEWTON, MA

The proposed project includes stormwater runoff controls associated with the construction of a new addition. The major components associated with maintenance needs are the proposed leaching gallies that will handle runoff from the proposed building and driveways. These will need to be cleaned periodically as noted below. Cleaning of this structures shall be done by the property owner or by a specialty contractor with hydraulic cleaning ability. The following outlines the major maintenance issues associated with the project:

Drywell Cleaning:

The proposed drywell should be inspected monthly during the first year, and then every third year following the 1-year inspection.

The drywells are equipped with a frame and cover. After removal of the cover, a stadia rod should be used to measure the depth of sediment. If the depth of sediment is in excess of 3", then the sediment should be removed.

Street Sweeping

Have the driveway swept bi-annually in April and October.

MAINTENANCE RESPONSIBILITIES

The maintenance of the Drainage System is the responsibility of the Property Owners. The actual work can be accomplished by the Owner or can be subcontracted to a company that specializes in the cleaning of storm drainage facilities. Inspections should be performed by independent individual such as the design engineer or other experienced individual in the field.

Construction period pollution control

Erosion and sedimentation control measures will be implemented prior to and during construction activities to minimize impacts from land disturbance activities. Erosion and sedimentation control measures implemented on the site will include, at a minimum, dust control measures, the installation of silt fence barriers on the up-gradient side of resource areas, and catch basin inlet protection. Controls may also include temporary sedimentation basins and diversion swales and temporary seeding. The erosion and sedimentation controls will be inspected at the end of the day if precipitation is forecast,

and after each rainfall event of 0.5 inches or more. Should construction occur during winter months, seasonally appropriate stabilization measure will be utilized.

Below is a summary of the minimum construction period pollution control requirements. These topics are presented as a means of demonstrating understanding of pollution control but are not meant to supplant preparation of the SWPPP. Please refer to the SWPPP for complete construction activity details.

a. Dust Control

Mitigation measures will be implemented to control fugitive dust during construction activities. Dust control measure may include seeding, wet suppression, application of soil stabilization agents, or other measures to control dust generated by construction activities. The Contractor shall confirm with state and local regulations to see if the use of calcium chloride for dust suppression is allowed.

b. Erosion Control Barriers

Prior to any ground disturbance, erosion control barriers will be installed at the limit of work at down-gradient positions on the site. The barriers will consist of silt fence and staked hay bales and will be entrenched in the soil to prevent underflow.

c. Catch Basin/Trench Drain Inlet Protection

All existing and newly installed catch basins or trench drains shall be protected during construction with a filter insert system. These sedimentation control measures will be regularly maintained until the drainage area tributary to the catch basin has been stabilized.

d. Temporary Sedimentation Basins and Diversion Swales

If necessary, temporary sedimentation basins will be constructed to prevent transport of fine-grained sediment into wetland resource areas and other off-site areas. These temporary basins will be located where appropriate, as determined by the contractor. Temporary diversion swales or berms may be used to convey runoff from construction areas to temporary or previously constructed basins.

e. Temporary Seeding

Temporary seeding will be used where vegetative cover is required for less than one year on disturbed soil areas. Such areas will be seeded if the soils will be exposed without construction activity for more than 30 days. Rapidly growing annual grasses, such as annual rye grass, oats, perennial rye grass or winter rye will be uniformly applied. Depending on the slope, the soil may be covered with a layer of straw mulch, an erosion control blanket, or a bonded fiber matrix.

f. Permanent Seeding

Upon completion of the final grading, any areas not covered by pavement, other forms of stabilization, including landscaping, will be seeded with rapidly growing annual rye grass/red fescue seed mix.

STORMWATER MANAGEMENT REPORT
PROPOSED ADDITION
93 RUANE ROAD
NEWTON, MASSACHUSETTS

INSPECTION REPORT:

Inspection Firm: _____

Inspectors Name: _____ Date: _____

Components Inspected: _____

Signed: _____

SYSTEM MAINTENANCE:

Maintenance Firm: _____ Date: _____

Drywells Inspected: Yes____No__Comments:_____

Drywells Cleaned: Yes____No__Comments:_____

Estimate of Material Removed: _____

Other Comments: _____

Signed: _____

Map Scale: 1:507 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 5 10 20 30

Feet: 0 20 40 80 120

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

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:25,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Middlesex County, Massachusetts
Survey Area Data: Version 22, Sep 9, 2022

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: May 22, 2022—Jun 5, 2022

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres In AOI	Percent of AOI
629C	Canton-Charlton-Urban land complex, 3 to 15 percent slopes	0.5	100.0%
Totals for Area of Interest		**0.5**	**100.0%**

Middlesex County, Massachusetts

629C—Canton-Charlton-Urban land complex, 3 to 15 percent slopes

Map Unit Setting

National map unit symbol: 9959
Elevation: 0 to 1,000 feet
Mean annual precipitation: 32 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

Canton and similar soils: 40 percent
Charlton and similar soils: 30 percent
Urban land: 25 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Canton

Setting

Landform: Hills
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Friable loamy eolian deposits over friable sandy basal till derived from granite and gneiss

Typical profile

H1 - 0 to 8 inches: fine sandy loam
H2 - 8 to 21 inches: fine sandy loam
H3 - 21 to 65 inches: gravelly loamy sand

Properties and qualities

Slope: 3 to 15 percent
Depth to restrictive feature: 18 to 30 inches to strongly contrasting textural stratification
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 2.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e

Hydrologic Soil Group: A
Ecological site: F144AY034CT - Well Drained Till Uplands
Hydric soil rating: No

Description of Charlton

Setting

Landform: Ground moraines, drumlins
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Friable loamy eolian deposits over friable loamy basal till derived from granite and gneiss

Typical profile

H1 - 0 to 5 inches: fine sandy loam
H2 - 5 to 22 inches: sandy loam
H3 - 22 to 65 inches: gravelly sandy loam

Properties and qualities

Slope: 3 to 15 percent
Depth to restrictive feature: More than 80 inches
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 supply, 0 to 60 inches: Moderate (about 7.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: A
Ecological site: F144AY034CT - Well Drained Till Uplands
Hydric soil rating: No

Description of Urban Land

Setting

Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Excavated and filled land

Minor Components

Montauk

Percent of map unit: 2 percent
Landform: Hillslopes
Landform position (two-dimensional): Summit, shoulder

Landform position (three-dimensional): Head slope, nose slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Scituate

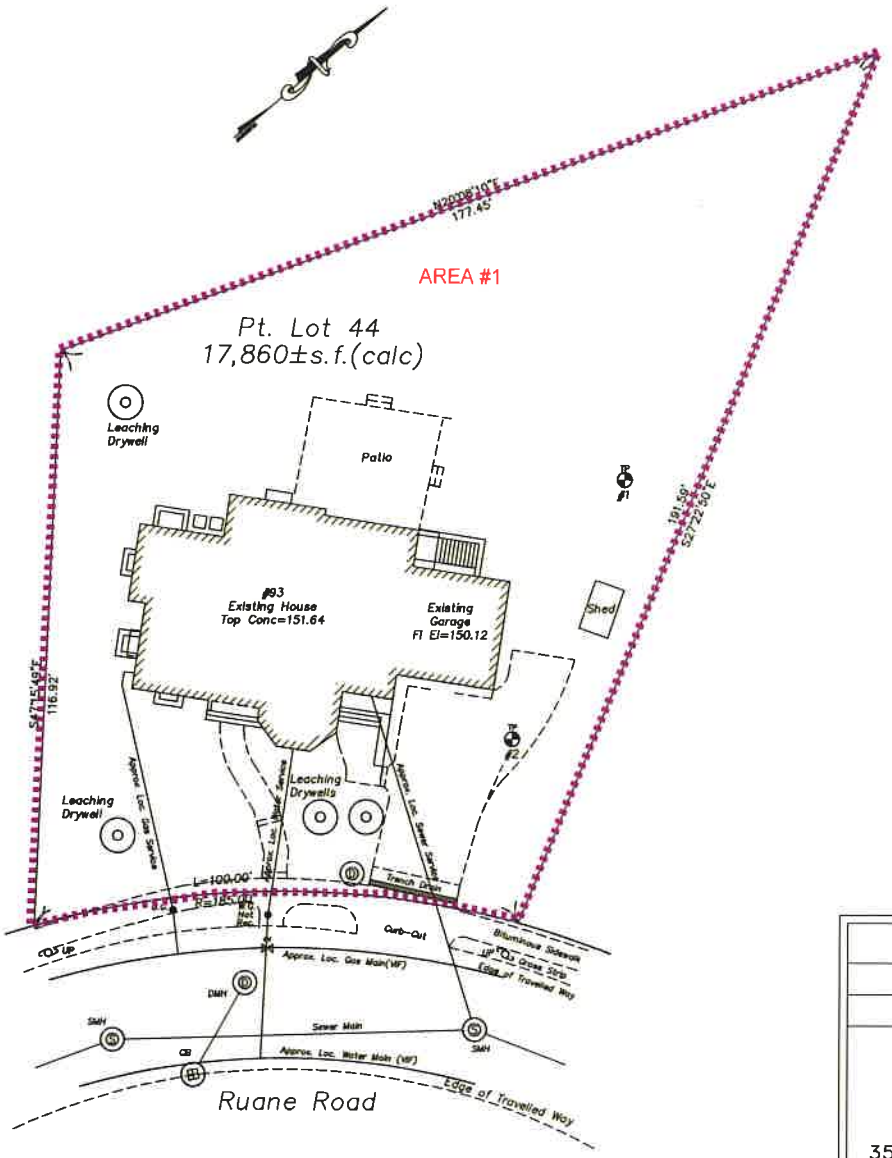
Percent of map unit: 2 percent
Landform: Hillslopes, depressions
Landform position (two-dimensional): Summit, toeslope
Landform position (three-dimensional): Head slope, base slope
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: No

Udorthents, loamy

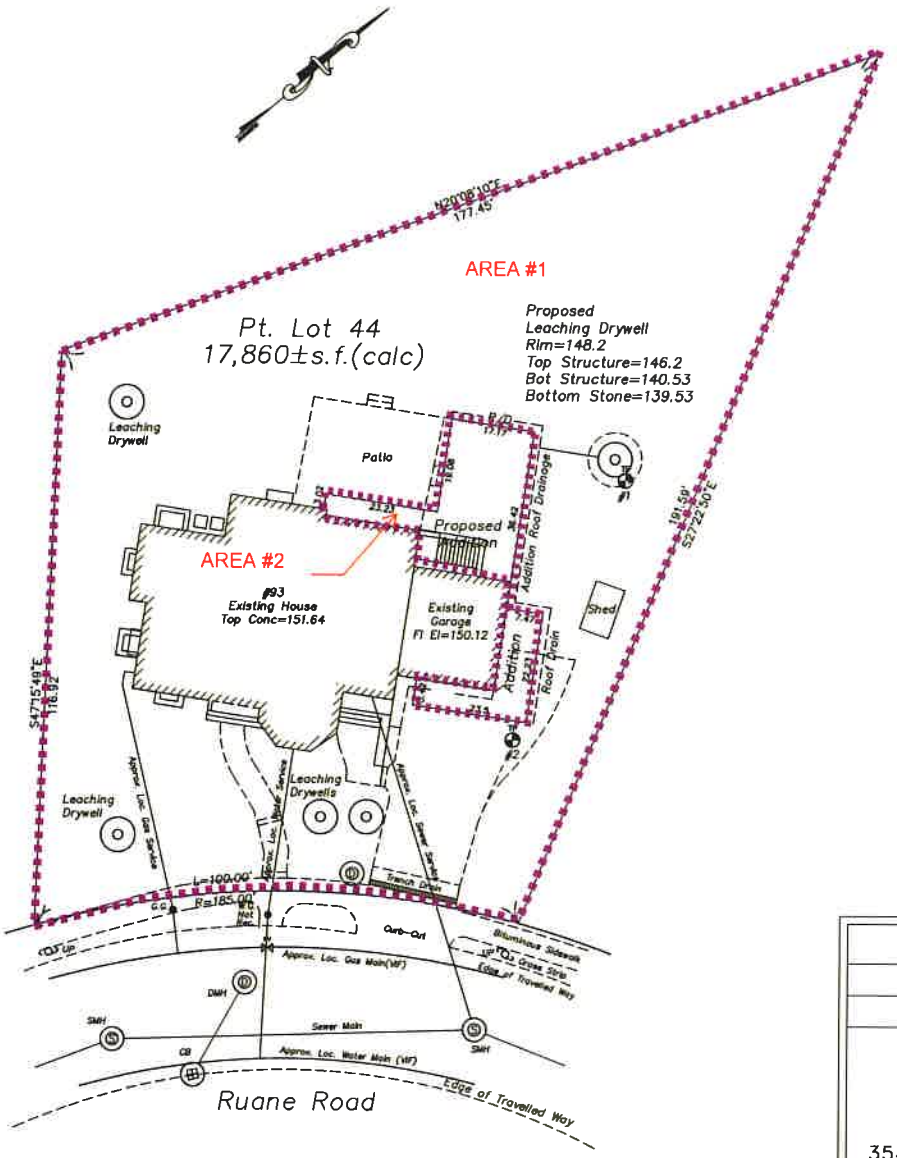
Percent of map unit: 1 percent
Hydric soil rating: No

Data Source Information

Soil Survey Area: Middlesex County, Massachusetts
Survey Area Data: Version 22, Sep 9, 2022



93 Ruane Road	
Newton, Massachustess	
Pre Development Catchment Area Plan	
Scale: n.t.s. July 18, 2023	
VERNE T. PORTER Jr., PLS	
Land Surveyors – Civil Engineers	
354 Elliot Street, Newton, Massachusetts 02464	
Sheet 1 of 2	Project: 14061
	Checked By:
	Drawn By:



93 Ruane Road	
Newton, Massachustess	
Post Development Catchment Area Plan	
Scale: n.t.s. July 18, 2023	
VERNE T. PORTER Jr., PLS	
Land Surveyors – Civil Engineers	
354 Elliot Street, Newton, Massachusetts 02464	
Sheet 2 of 2	Project: 14061
	Checked By:
	Drawn By:

TEST PIT FIELD LOG

PROJECT

DESCRIPTION: 93 RUANE RD

LOCATION: NEWTON

TEST PIT NO.: 1

DATE: 10-7-15

WEATHER: SUNNY 75°

GROUND EL:

ENGINEER: VERNE T PORTER JR

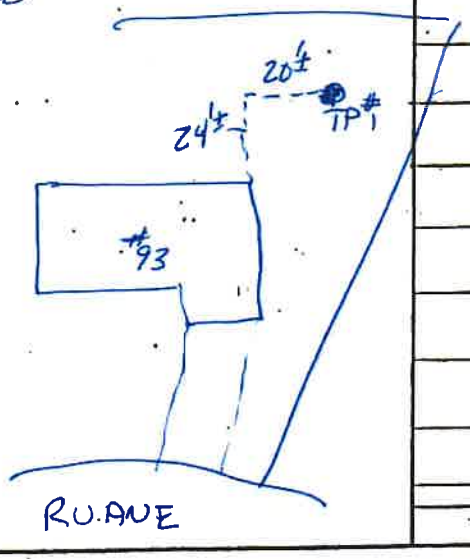
PERCOLATION RESULTS

DEPTH:	TIME:
12"	
11"	
10"	
9"	
8"	
7"	
6"	

REMARKS:

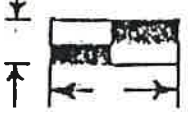
AVERAGE RATE: 15 min/INCH

DEPTH	SOIL DESCRIPTION	Excav. Effort	Boulder Count	Remar No.
0'	12" SANDY LOAM 10YR 3/2			
1'	24" LOAMY SAND 10YR 5/8			
2'				
3'				
4'				
5'	FINE TO MEDIUM SAND/SILTY TILL			
6'				
7'	10YR 6/4			
8'				
9'				
10'				
11'				
12'				
13'	BOTTOM EXCAVATION NO WATER NO REFUSAL			
14'				



REMARKS:

TEST PIT PLAN



LEGEND

Boulder Count
Size Range Classification
6"-18" --------A
18"-30" --------B

PROPORTIONS USED

Trace (TR)- 0 -10%
Little(LI.)-10-20%
Some (SO) -20-35%

ABBREVIATIONS

F-fine
M-medium
C-coarse
F/M-fine to med.
F/C-fine to coar.
V-very
GR-gray

EXCAVATION EFFORT

Easy	E
Moderate	M
Difficult	D
Groundwater	GI

TEST PIT FIELD LOG

PROJECT

DESCRIPTION: 93 RUANE RD.
LOCATION: NEWTON

TEST PIT NO.: 2
DATE: 10-7-15
WEATHER: SUNNY 75°
GROUND EL:
ENGINEER: VERNE T PORTER JR

PERCOLATION RESULTS

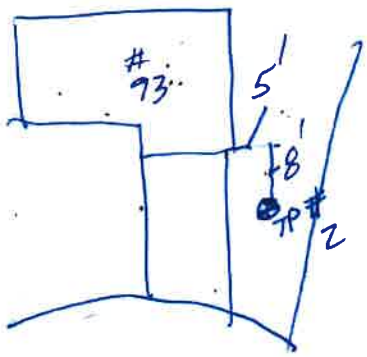
DEPTH:	TIME:
12"	
11"	
10"	
9"	
8"	
7"	
6"	

REMARKS:

AVERAGE RATE: 15 min/inch

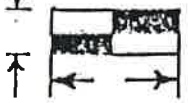
SOIL DESCRIPTION

DEPTH	SOIL DESCRIPTION	Excav. Effort	Boulder Count	Remar No.
0'	12" SANDY LOAM			
1'	12" LOAMY SAND			
2'				
3'				
4'				
5'	FINE TO MEDIUM SANDY TILL SILT			
6'	10YR 6/4			
7'				
8'				
9'				
10'	NO REFUSAL NO WATER			
11'				
12'				
13'				
14'				



REMARKS:

TEST PIT PLAN



LEGEND

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