DRAINAGE SUMMARY

PROPOSED MULTI-UNIT DEVELOPMENT
148 PINE STREET
NEWTON, MASSACHUSETTS

October 14, 2019

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

DRAINAGE SUMMARY
PROPOSED MULTI-UNIT DEVELOPMENT
148 PINE STREET
NEWTON, MASSACHUSETTS

The proposed project consists of the demolition of an existing two-family dwelling and the construction of three (3) single-family dwellings, including new driveway and parking areas at 148 Pine St. in Newton, MA, under the requirements of the City of Newton.

The on-site soils in the area are shown as "626B – Merrimac Urban Land Complex, 0 to 8 percent slopes" soils on the NRCS Soils Survey map of the area, which are areas that fall within the Hydrological Soil Groups A & D. VTP performed onsite testpits on August 21, 2019 and found the soils a mixed group of silty, loam sands above a peat layer. For purposes of our design, we have assumed a D soil with an infiltration rate of 0.09 in/hr.

Ground cover on the site is a dense residential grass area, two family dwelling, garage and a driveway that is a mix of bituminous concrete and gravel. The existing drainage on the site flows overland from Pine St towards the rear of the property. Overall, the site will maintain the current flow pattern, however new collection systems for the proposed front dwelling and a detention pond for the rear dwellings and parking area have been provided to collect the runoff and attenuate offsite flows.

There is a small brook to the south of the property but no work will occur within the 25' no disturb buffer zone. The proposed drainage controls are designed to capture & contain the runoff from the renovated residential dwellings and proposed site improvements. This system will store the runoff from the impervious areas and allow the stored water to slowly infiltrate after the storm event and overflow offsite.

Under the proposed conditions, with the new building and new driveway, the rate of site runoff from the re-developed lot area will be greater than the existing conditions for the 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 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				5.0	
	Exist Bldg.	98	2,106		Incl. Garage
	Exist. Imp.	98	5,600		
	Lawn Areas	80	7,044		
		Total Area	14,750		
*CN based on Class D soils.					

Proposed Conditions

The proposed conditions will result in a new collection system that will collect the site run-off from the proposed dwelling and proposed driveway and direct it to underground leaching systems 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				5.0	
	Lawn Area	80	8,711		
Area #2				5.0	
	Prop. Dwelling	98	935		Front Dwelling
Area #3					
	Prop. Dwellings	98	2,138		Rear Units
	Prop. Driveways	98	2,966		
		Total Area	14,750		
*CN based on Class D soils.					

Peak Rate Summary

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

Areas	**Design Storm**	**Existing Runoff* (CFS)**	**Existing Volume* (Ac-Ft)**	**Proposed Runoff* (CFS)**	**Proposed Volume* (Ac-Ft)**
Offsite Flow					
Site	100-yr.	2.79	0.199	1.74	0.135

Recharge to Groundwater (Standard 3)

The change in groundcover for the new development will change by decreasing the impervious areas by approximately 1,700 sf. 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 = (0.10/12) * 0.138 = 0.001Ac-ft. = 50.1 CF

Rv = Required Recharge Volume;
F = Target Depth Factor (0.10 in. for soils of Hydrologic Soil Group D);
Impervious area = building, pavement on site in post development condition (0.138 Ac).

The proposed onsite leaching systems will store and infiltrate over 50.1 cf in just the 2-year storm event.

Removal of TSS (Standard 4)

TSS removal will be achieved from run-off flowing over vegetated areas prior to entering into any drainage collection systems. To handle the TSS removal of the proposed driveway, a 4-ft deep sump has been provided in the proposed cathbasin.

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 new residential dwelling on 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)

Erosion Control measures have been provided on the plans that accompany this 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.

OPERATION & MAINTENANCE PLAN

STORMWATER MANAGEMENT FACILITIES
PROPOSED MULTI-UNIT DEVELOPMENT
148 PINE STREET
NEWTON, MASSACHUSETTS

October 14, 2019

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

OPERATION & MAINTENANCE PLAN
STORMWATER MANAGEMENT FACILITIES
PROPOSED MULTI-UNIT DEVELOPMENT
148 PINE STREET
NEWTON, MA

The proposed project includes stormwater runoff controls associated with the construction of a new multi-unit development. The major components associated with maintenance needs are the proposed leaching drywells and rain garden that will handle runoff from the proposed roofs and paved driveway/parking areas. 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:

Catchbasin/Cleaning:

Have all catch basins cleaned out completely twice annually during April and October, if required.

Leaching Drywell/Cleaning:

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

The drywell is 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.

Rain Garden

Activity	Frequency
Water plants	As necessary during first growing season
Water plants during dry periods	As needed after first growing season
Re-mulch void areas	As needed
Treat diseased trees and shrubs	As needed
Inspect soil and repair eroded areas	Monthly
Remove litter and debris	Monthly
Add additional mulch	Once per year

Access
Sufficient access shall be provided to the facility to allow all necessary inspection and maintenance activities to be completed. Maintenance of access areas shall include removal of tree seedlings and woody vegetation, repair of eroded areas and removal of litter and debris.

Erosion
The soil and mulch in the facility and in areas draining to the facility shall be inspected for eroded areas. Eroded areas shall be filled with soil or mulch and vegetated.

Sediment Accumulation & Clogging
Sediment accumulation within the facility may reduce the infiltration capacity and impair proper performance of the facility. The facility shall be inspected for accumulation of sediment annually. Excessive sediment accumulation shall be removed with the area re-mulched and replanted.

Outlet Structure Maintenance
The Owner will be responsible for outlet structure maintenance. Periodically, the orifice on the outlet pipe may clog with debris. Debris should be removed and appropriately disposed of off-site.

Riprap
The facility may have riprap at points where runoff enters or leaves the facility. The riprap is used to prevent erosion of soils from stormwater flows. The facility shall be checked to make sure that an adequate amount of riprap exists to prevent erosion and additional riprap added if necessary.

Debris & Litter
A bioretention device is expected to accumulate debris and litter. Debris and litter should be removed on a monthly basis to maintain appearance and public acceptance of the bioretention device.

Engineered Soil
Longevity of the engineered soil is decreased by clogging, reduced cation exchange capacity and accumulation of sodium. Clogging problems can be reduced by limiting the input of sediment. Cation exchange capacity can be rejuvenated by the replacement of the engineered soil. Sodium accumulation can be countered by adding gypsum to the soil and/or by allowing about 1" of clean water to percolate through the planting bed 3 to 4 times in the spring.

Plant Maintenance
The vegetation type and amount are important to ensure that the facility operates correctly. Bioretention devices typically have a vegetation plan that specifies plant type, location, planting time of year, fertilizing, watering and other specifications.

Proper vegetation maintenance includes watering plants during dry periods, re-mulching void areas, treating diseased trees and shrubs and mowing turf areas.

Standing Water
The facility owner shall contact the [Municipality] whenever the facility has standing water more than three days after a rain event. The engineered soils may become clogged preventing proper infiltration of stormwater. The facility will need to have the mulch removed, the soil scarified around the plants and new mulch added.

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 Inlet Protection

All existing and newly installed catch basin 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 MULTI-UNIT DEVELOPMENT
148 PINE STREET
NEWTON, MASSACHUSETTS

INSPECTION REPORT:

Inspection Firm: _____

Inspectors Name: _____ Date: _____

Components Inspected: _____

Signed: _____

SYSTEM MAINTENANCE:

Maintenance Firm: _____ Date: _____

Catchbasin Inspected: Yes ____ No ____ Comments: _____

Catchbasin Cleaned: Yes ____ No ____ Comments: _____

Leaching Drywell Inspected: Yes____No__Comments:_____

Leaching Drywell Inspected: Yes____No__Comments:_____

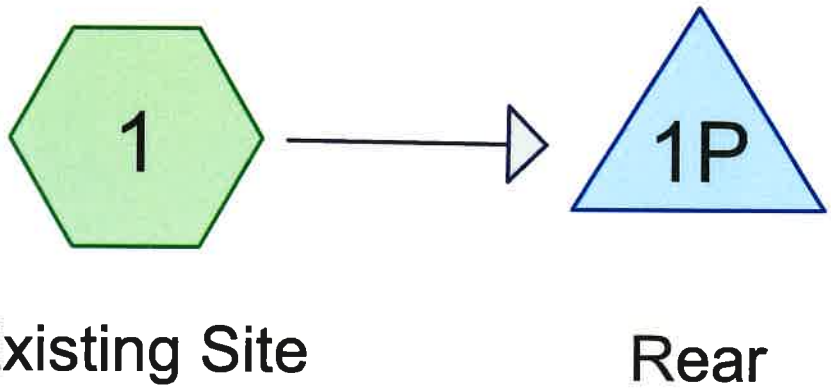
Rain Garden Inspected: Yes____No__Comments:_____

Rain Garden Inspected: Yes____No__Comments:_____

Estimate of Material Removed: _____

Other Comments: _____

Signed: _____



Subcat Reach Pond Link

Routing Diagram for 148 Pine St - Existing
Prepared by HP, Printed 10/14/2019

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.162	80	>75% Grass cover, Good, HSG D (1)
0.129	98	Exist. Bit Conc & Gravel Drives (1)
0.048	98	Existing Structures (1)
0.339	**89**	**TOTAL AREA**

Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
0.162	HSG D	1
0.177	Other	1
0.339		**TOTAL AREA**

Ground Covers (selected nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.000	0.162	0.000	0.162	>75% Grass cover, Good	1
0.000	0.000	0.000	0.000	0.129	0.129	Exist. Bit Conc & Gravel Drives	1
0.000	0.000	0.000	0.000	0.048	0.048	Existing Structures	1
0.000	**0.000**	**0.000**	**0.162**	**0.177**	**0.339**	**TOTAL AREA**	

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1: Existing Site Runoff Area=14,750 sf 52.24% Impervious Runoff Depth>7.04"
Tc=5.0 min CN=89 Runoff=2.79 cfs 0.199 af

Pond 1P: Rear Inflow=2.79 cfs 0.199 af
Primary=2.79 cfs 0.199 af

Total Runoff Area = 0.339 ac Runoff Volume = 0.199 af Average Runoff Depth = 7.04"
47.76% Pervious = 0.162 ac 52.24% Impervious = 0.177 ac

Summary for Subcatchment 1: Existing Site

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

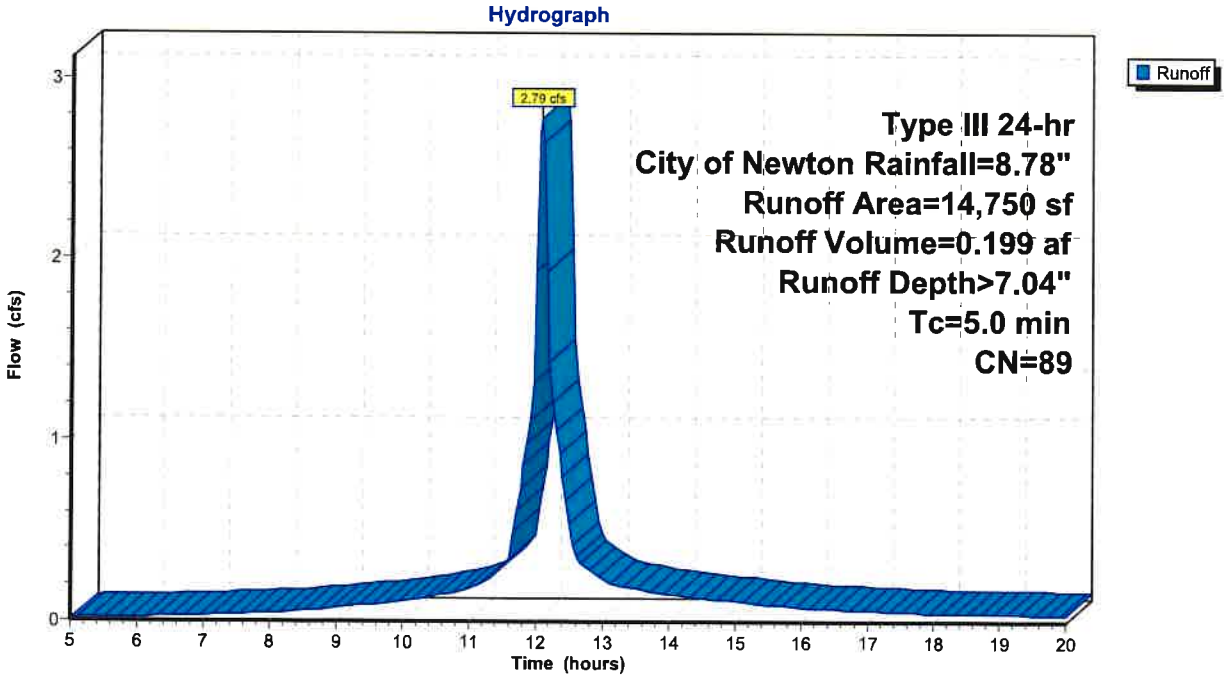
Runoff = 2.79 cfs @ 12.07 hrs, Volume= 0.199 af, Depth> 7.04"

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
	7,044	80	>75% Grass cover, Good, HSG D
*	5,600	98	Exist. Bit Conc & Gravel Drives
*	2,106	98	Existing Structures
	14,750	89	Weighted Average
	7,044		47.76% Pervious Area
	7,706		52.24% Impervious Area

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

Subcatchment 1: Existing Site



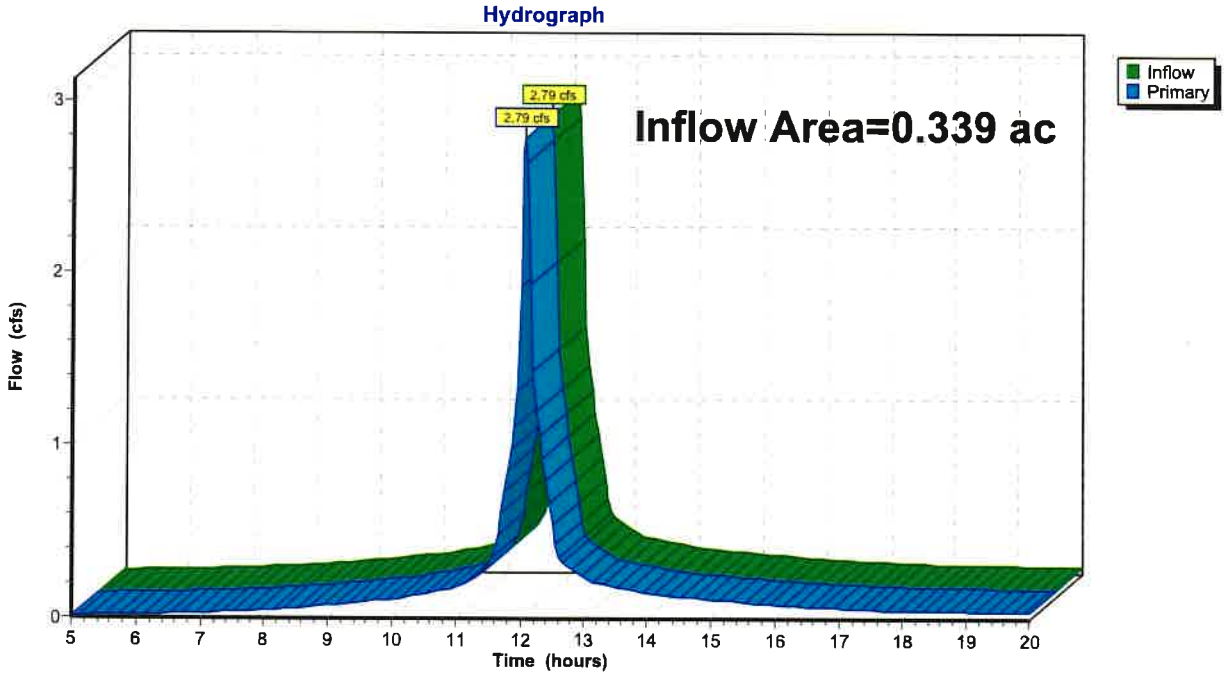
Summary for Pond 1P: Rear

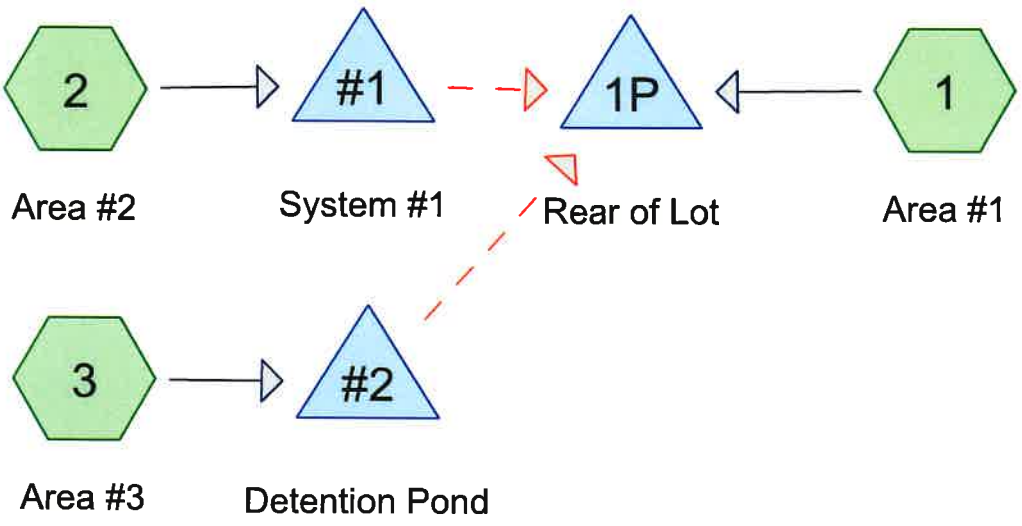
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.339 ac, 52.24% Impervious, Inflow Depth > 7.04" for City of Newton event
Inflow = 2.79 cfs @ 12.07 hrs, Volume= 0.199 af
Primary = 2.79 cfs @ 12.07 hrs, Volume= 0.199 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: Rear





Subcat Reach Pond Link

Routing Diagram for 148 Pine St - Prop
Prepared by HP, Printed 10/14/2019

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.200	80	>75% Grass cover, Good, HSG D (1)
0.068	98	Bit. Conc. Drive and Parking (3)
0.021	98	Prop. Dwelling (2)
0.049	98	Prop. Dwellings (3)
0.339	**87**	**TOTAL AREA**

Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
0.200	HSG D	1
0.139	Other	2, 3
0.339		**TOTAL AREA**

Ground Covers (selected nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.000	0.200	0.000	0.200	>75% Grass cover, Good	1
0.000	0.000	0.000	0.000	0.068	0.068	Bit. Conc. Drive and Parking	3
0.000	0.000	0.000	0.000	0.021	0.021	Prop. Dwelling	2
0.000	0.000	0.000	0.000	0.049	0.049	Prop. Dwellings	3
0.000	**0.000**	**0.000**	**0.200**	**0.139**	**0.339**	**TOTAL AREA**	

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1: Area #1 Runoff Area=8,711 sf 0.00% Impervious Runoff Depth>6.00"
Tc=5.0 min CN=80 Runoff=1.47 cfs 0.100 af

Subcatchment2: Area #2 Runoff Area=935 sf 100.00% Impervious Runoff Depth>7.85"
Tc=5.0 min CN=98 Runoff=0.19 cfs 0.014 af

Subcatchment3: Area #3 Runoff Area=5,104 sf 100.00% Impervious Runoff Depth>7.85"
Tc=5.0 min CN=98 Runoff=1.02 cfs 0.077 af

Pond #1: System #1 Peak Elev=55.28' Storage=0.010 af Inflow=0.19 cfs 0.014 af
Discarded=0.00 cfs 0.001 af Secondary=0.02 cfs 0.004 af Outflow=0.02 cfs 0.005 af

Pond #2: Detention Pond Peak Elev=47.86' Storage=1,835 cf Inflow=1.02 cfs 0.077 af
Discarded=0.00 cfs 0.003 af Secondary=0.96 cfs 0.031 af Outflow=0.97 cfs 0.035 af

Pond 1P: Rear of Lot Inflow=1.74 cfs 0.135 af
Primary=1.74 cfs 0.135 af

Total Runoff Area = 0.339 ac Runoff Volume = 0.191 af Average Runoff Depth = 6.76"
59.06% Pervious = 0.200 ac 40.94% Impervious = 0.139 ac

Summary for Subcatchment 1: Area #1

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

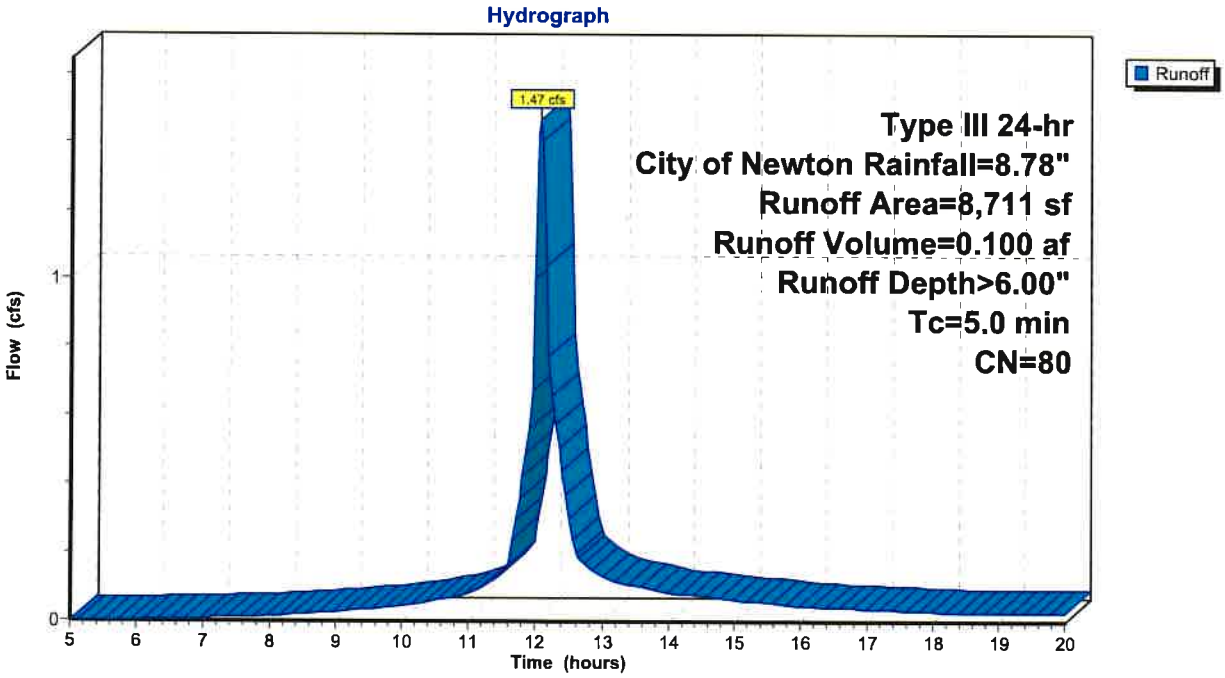
Runoff = 1.47 cfs @ 12.07 hrs, Volume= 0.100 af, Depth> 6.00"

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
8,711	80	>75% Grass cover, Good, HSG D
8,711		100.00% Pervious Area

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

Subcatchment 1: Area #1



Summary for Subcatchment 2: Area #2

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

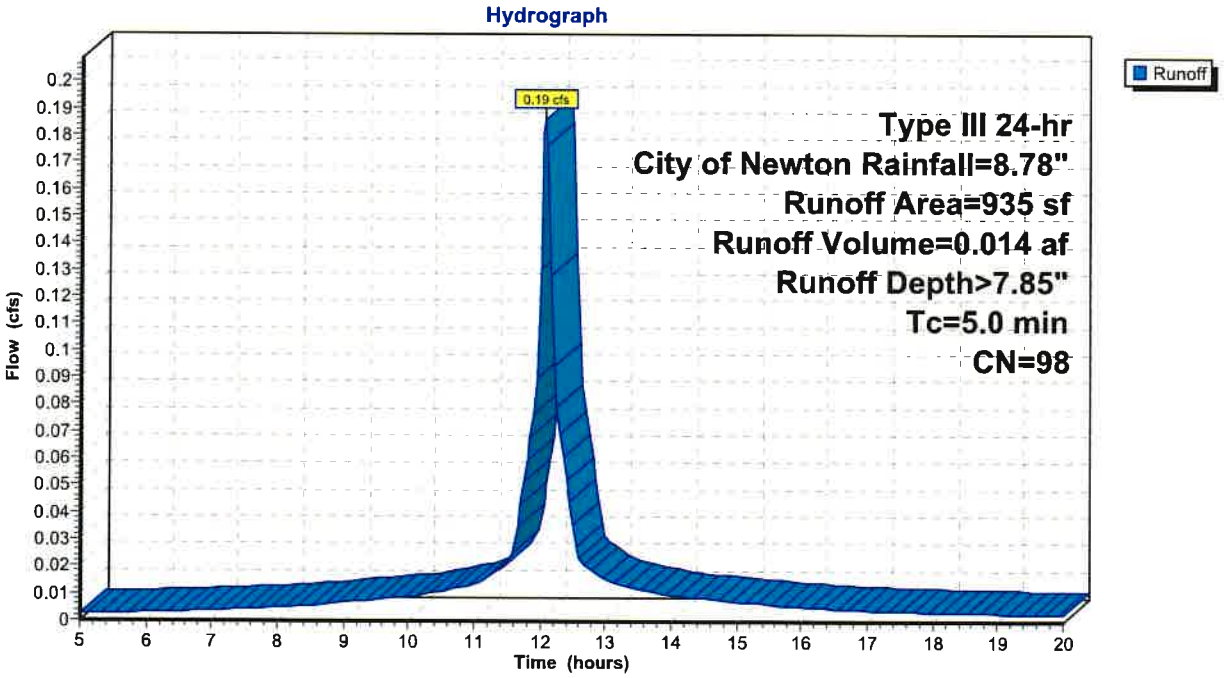
Runoff = 0.19 cfs @ 12.07 hrs, Volume= 0.014 af, Depth> 7.85"

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
*	935	98	Prop. Dwelling
	935		100.00% Impervious Area

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

Subcatchment 2: Area #2



Summary for Subcatchment 3: Area #3

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

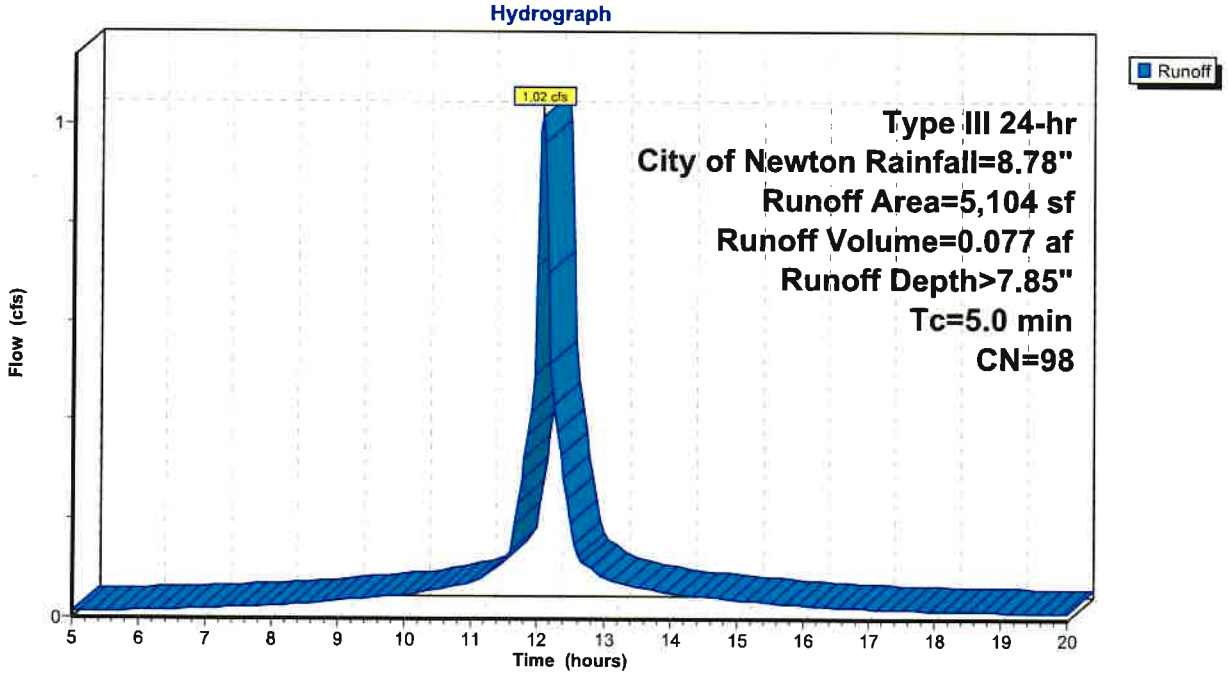
Runoff = 1.02 cfs @ 12.07 hrs, Volume= 0.077 af, Depth> 7.85"

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
*	2,966	98	Bit. Conc. Drive and Parking
*	2,138	98	Prop. Dwellings
	5,104	98	Weighted Average
	5,104		100.00% Impervious Area

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

Subcatchment 3: Area #3



Summary for Pond #1: System #1

[82] Warning: Early inflow requires earlier time span

Inflow Area = 0.021 ac,100.00% Impervious, Inflow Depth > 7.85" for City of Newton event
Inflow = 0.19 cfs @ 12.07 hrs, Volume= 0.014 af
Outflow = 0.02 cfs @ 12.70 hrs, Volume= 0.005 af, Atten= 89%, Lag= 37.7 min
Discarded = 0.00 cfs @ 5.45 hrs, Volume= 0.001 af
Secondary = 0.02 cfs @ 12.70 hrs, Volume= 0.004 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 55.28' @ 12.70 hrs Surf.Area= 0.006 ac Storage= 0.010 af

Plug-Flow detention time= 277.4 min calculated for 0.005 af (33% of inflow)
Center-of-Mass det. time= 137.5 min (869.6 - 732.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	53.00'	0.006 af	**28.00'W x 10.00'L x 3.21'H Field A** 0.021 af Overall - 0.007 af Embedded = 0.014 af x 40.0% Voids
#2A	53.50'	0.007 af	**Cultec R-280HD** x 6 Inside #1 Effective Size= 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf Overall Size= 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap Row Length Adjustment= +1.00' x 6.07 sf x 6 rows
		0.012 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	53.00'	**0.090 in/hr Exfiltration over Surface area**
#2	Secondary	55.20'	**6.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.00 cfs @ 5.45 hrs HW=53.03' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Secondary OutFlow Max=0.02 cfs @ 12.70 hrs HW=55.28' (Free Discharge)
↑—**2=Orifice/Grate** (Orifice Controls 0.02 cfs @ 0.97 fps)

Pond #1: System #1 - Chamber Wizard Field A

Chamber Model = Cultec R-280HD (Cultec Recharger®280HD)
Effective Size= 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf
Overall Size= 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap
Row Length Adjustment= +1.00' x 6.07 sf x 6 rows

47.0" Wide + 6.0" Spacing = 53.0" C-C Row Spacing

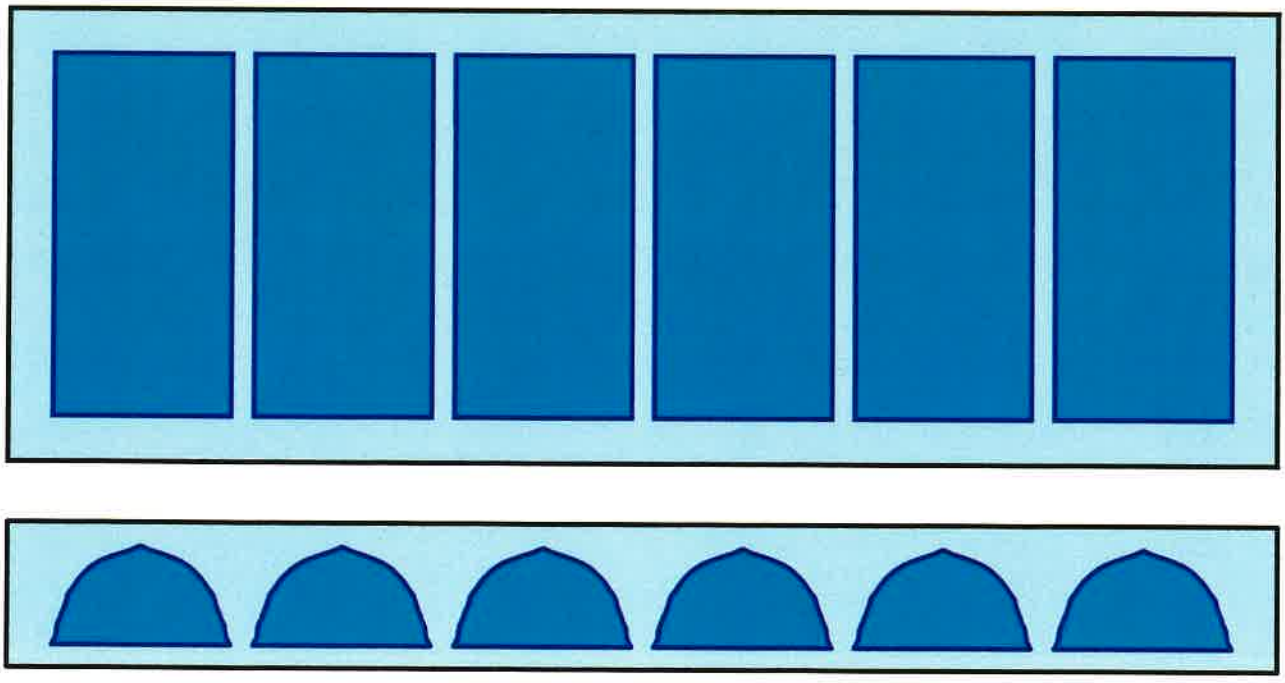
1 Chambers/Row x 7.00' Long +1.00' Row Adjustment = 8.00' Row Length +12.0" End Stone x 2 = 10.00' Base Length
6 Rows x 47.0" Wide + 6.0" Spacing x 5 + 12.0" Side Stone x 2 = 28.00' Base Width
6.0" Base + 26.5" Chamber Height + 6.0" Cover = 3.21' Field Height

6 Chambers x 42.5 cf +1.00' Row Adjustment x 6.07 sf x 6 Rows = 291.4 cf Chamber Storage

898.3 cf Field - 291.4 cf Chambers = 606.9 cf Stone x 40.0% Voids = 242.8 cf Stone Storage

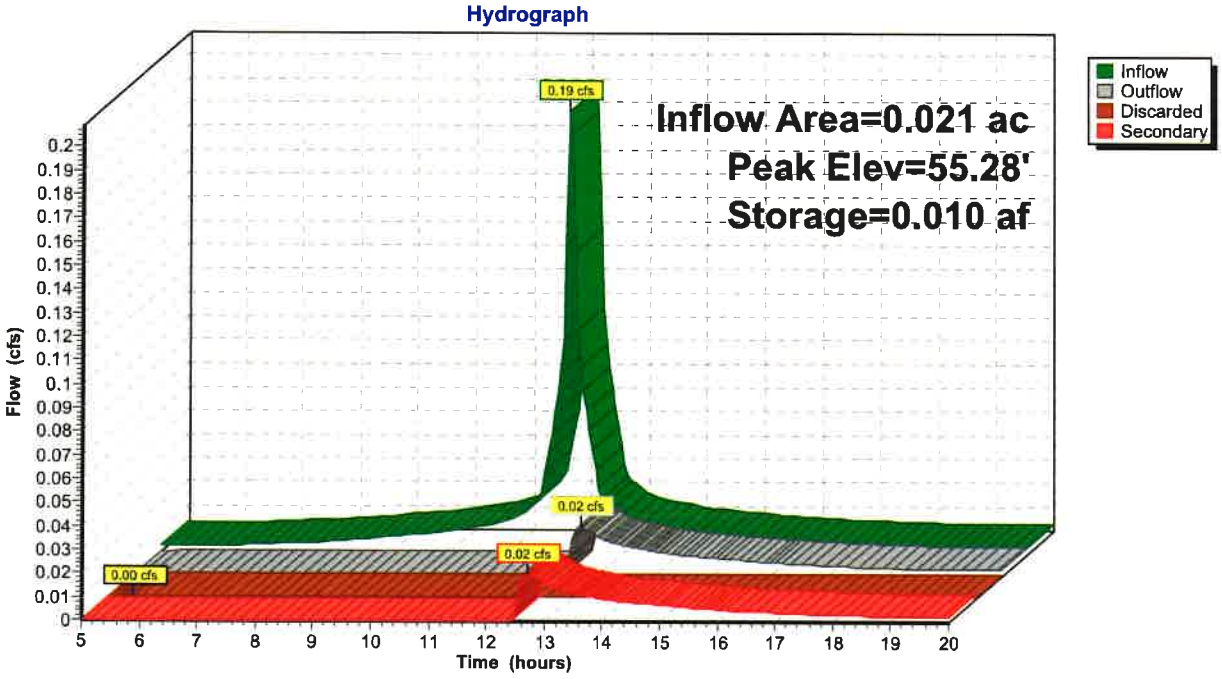
Chamber Storage + Stone Storage = 534.2 cf = 0.012 af
Overall Storage Efficiency = 59.5%
Overall System Size = 10.00' x 28.00' x 3.21'

6 Chambers
33.3 cy Field
22.5 cy Stone



Pond #1: System #1

Hydrograph



Summary for Pond #2: Detention Pond

[82] Warning: Early inflow requires earlier time span
[92] Warning: Device #2 is above defined storage
[93] Warning: Storage range exceeded by 0.36'
[85] Warning: Oscillations may require smaller dt or Finer Routing (severity=75)

Inflow Area =	0.117 ac,100.00% Impervious,	Inflow Depth >	7.85"	for City of Newton event
Inflow =	1.02 cfs @	12.07 hrs, Volume=	0.077 af	
Outflow =	0.97 cfs @	12.20 hrs, Volume=	0.035 af, Atten= 5%, Lag= 7.8 min	
Discarded =	0.00 cfs @	12.20 hrs, Volume=	0.003 af	
Secondary =	0.96 cfs @	12.20 hrs, Volume=	0.031 af	

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 47.86' @ 12.20 hrs Surf.Area= 1,427 sf Storage= 1,835 cf

Plug-Flow detention time= 207.3 min calculated for 0.034 af (45% of inflow)
Center-of-Mass det. time= 100.9 min (832.9 - 732.1)

Volume	Invert	Avail.Storage	Storage Description
#1	46.00'	1,835 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

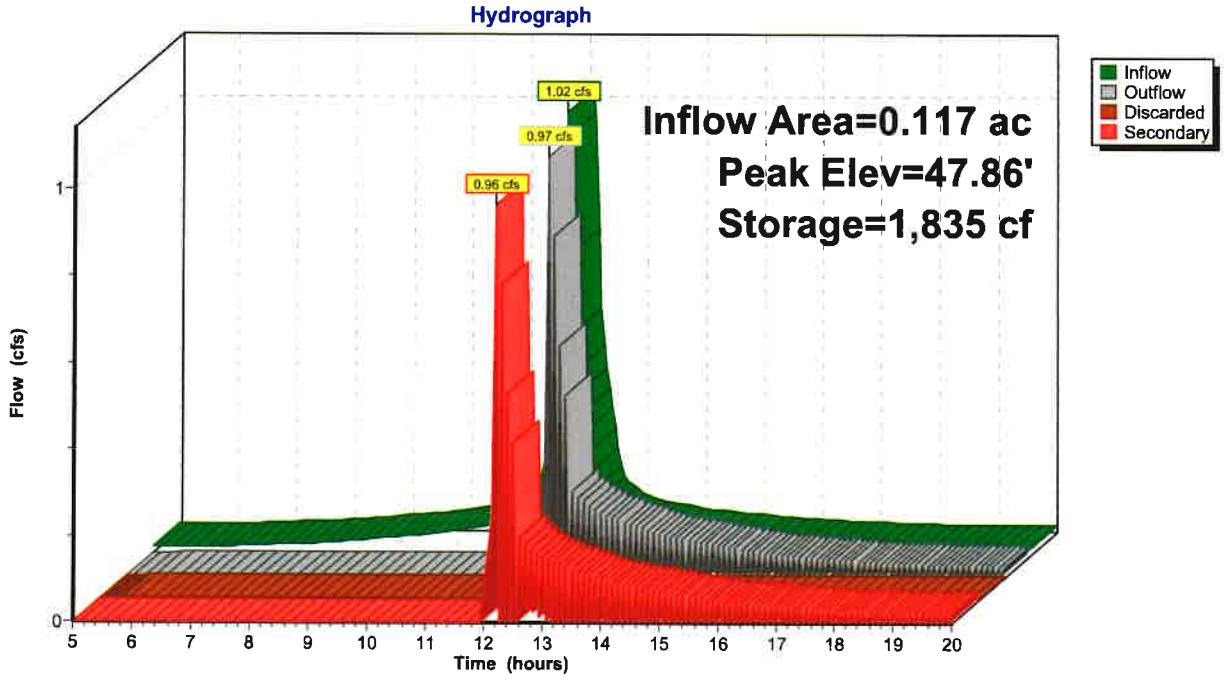
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
46.00	1,025	0	0
47.00	1,287	1,156	1,156
47.50	1,427	679	1,835

Device	Routing	Invert	Outlet Devices
#1	Discarded	46.00'	**0.090 in/hr Exfiltration over Surface area**
#2	Secondary	47.75'	**10.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Discarded OutFlow Max=0.00 cfs @ 12.20 hrs HW=47.86' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Secondary OutFlow Max=0.96 cfs @ 12.20 hrs HW=47.86' (Free Discharge)
↑**2=Broad-Crested Rectangular Weir** (Weir Controls 0.96 cfs @ 0.85 fps)

Pond #2: Detention Pond



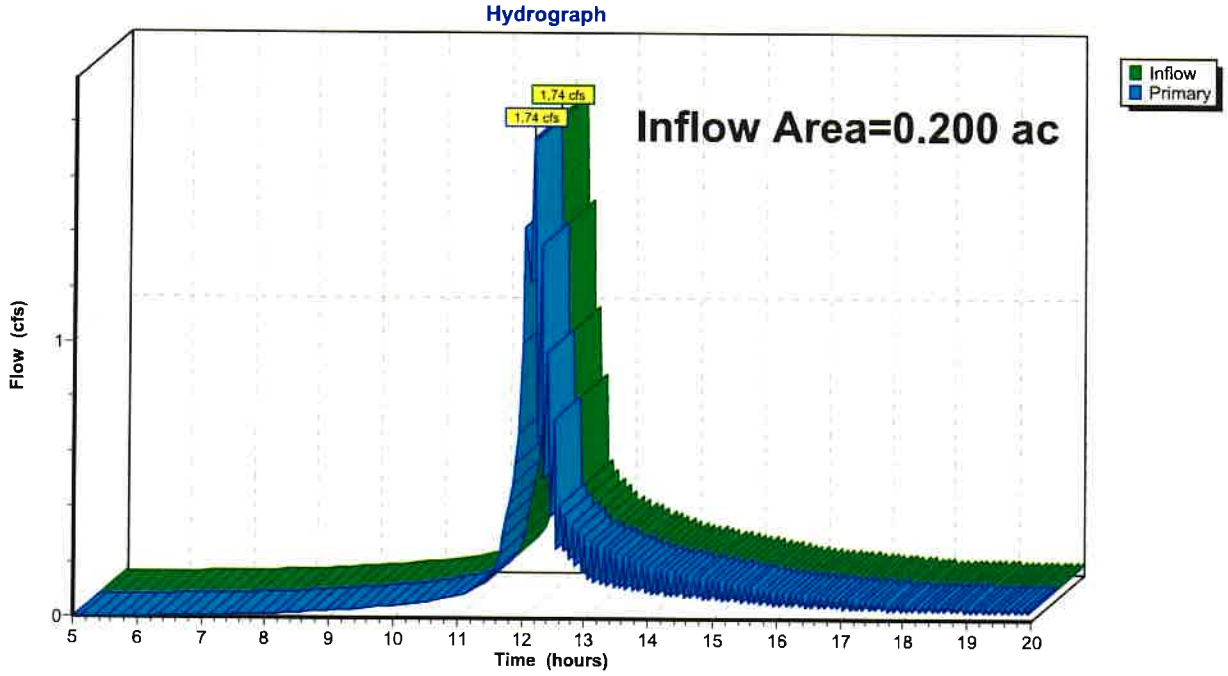
Summary for Pond 1P: Rear of Lot

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

Inflow Area = 0.200 ac, 0.00% Impervious, Inflow Depth > 8.11" for City of Newton event
Inflow = 1.74 cfs @ 12.19 hrs, Volume= 0.135 af
Primary = 1.74 cfs @ 12.19 hrs, Volume= 0.135 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: Rear of Lot



~Pre-Development Catchment Area Plan~

148 Pine Street

Newton, Massachusetts

Scale: n.t.s. October 1, 2019

VERNE T. PORTER Jr, PLS

Land Surveyors – Civil Engineers

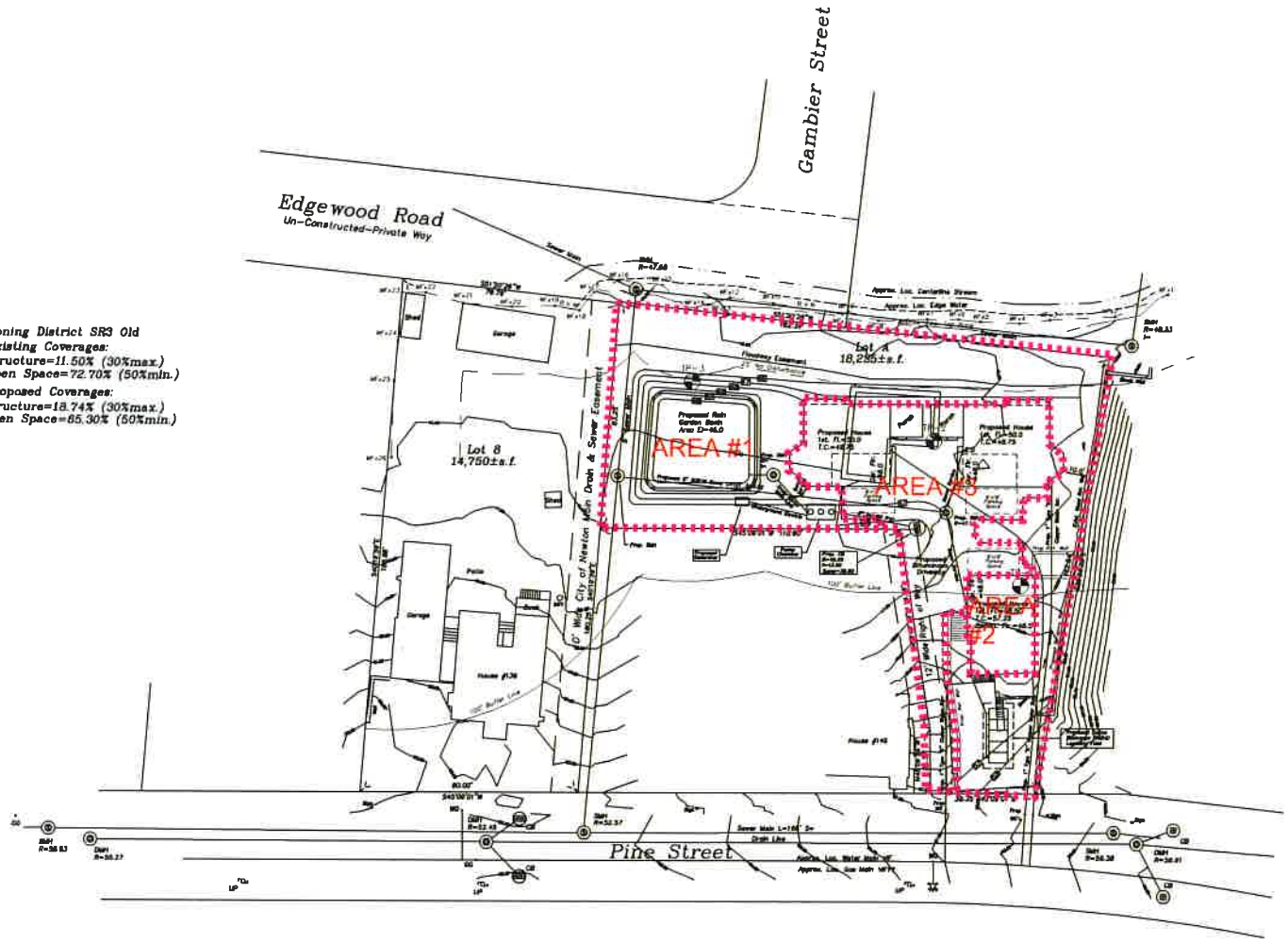
354 Elliot Street, Newton, Ma. 02464

Design By:

Checked By:

Drawn By:

Sheet 1 of 2



Zoning District SR3 Old
Existing Coverages:
Structure=11.50% (30%max.)
Open Space=72.70% (50%min.)
Proposed Coverages:
Structure=18.74% (30%max.)
Open Space=65.30% (50%min.)

~Post-Development Catchment Area Plan~	
148 Pine Street	
Newton, Massachusetts	
Scale: n.t.s. October 1, 2019	
VERNE T. PORTER Jr, PLS	
Land Surveyors – Civil Engineers	
354 Elliot Street, Newton, Ma. 02464	
Sheet 2 of 2	Design By:
	Checked By:
	Drawn By:

Middlesex County, Massachusetts

626B—Merrimac-Urban land complex, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2tyr9
Elevation: 0 to 820 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 250 days
Farmland classification: Not prime farmland

Map Unit Composition

Merrimac and similar soils: 45 percent
Urban land: 40 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Merrimac

Setting

Landform: Moraines, outwash plains, kames, eskers, outwash terraces
Landform position (two-dimensional): Backslope, footslope, summit, shoulder
Landform position (three-dimensional): Side slope, crest, riser, tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy glaciofluvial deposits derived from granite, schist, and gneiss over sandy and gravelly glaciofluvial deposits derived from granite, schist, and gneiss

Typical profile

Ap - 0 to 10 inches: fine sandy loam
Bw1 - 10 to 22 inches: fine sandy loam
Bw2 - 22 to 26 inches: stratified gravel to gravelly loamy sand
2C - 26 to 65 inches: stratified gravel to very gravelly sand

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 99.90 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 2 percent
Salinity, maximum in profile: Nonsaline (0.0 to 1.4 mmhos/cm)

Sodium adsorption ratio, maximum in profile: 1.0
Available water storage in profile: Low (about 4.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: A
Hydric soil rating: No

Description of Urban Land

Typical profile

M - 0 to 10 inches: cemented material

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: 0 inches to manufactured layer
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)
Available water storage in profile: Very low (about 0.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydrologic Soil Group: D
Hydric soil rating: Unranked

Minor Components

Windsor

Percent of map unit: 5 percent
Landform: Deltas, outwash plains, dunes, outwash terraces
Landform position (three-dimensional): Riser, tread
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex
Hydric soil rating: No

Sudbury

Percent of map unit: 5 percent
Landform: Terraces, deltas, outwash plains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Hinckley

Percent of map unit: 5 percent
Landform: Deltas, outwash plains, kames, eskers
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Nose slope, crest, head slope, side slope, rise
Down-slope shape: Convex
Across-slope shape: Convex, linear

Hydric soil rating: No

Data Source Information

Soil Survey Area: Middlesex County, Massachusetts
Survey Area Data: Version 19, Sep 12, 2019

Middlesex County, Massachusetts

653—Udorthents, sandy

Map Unit Setting

National map unit symbol: vr1k
Elevation: 0 to 3,000 feet
Mean annual precipitation: 32 to 50 inches
Mean annual air temperature: 45 to 50 degrees F
Frost-free period: 110 to 200 days
Farmland classification: Not prime farmland

Map Unit Composition

Udorthents, sandy, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Udorthents, Sandy

Setting

Parent material: Loamy alluvium and/or sandy glaciofluvial deposits and/or loamy glaciolacustrine deposits and/or loamy marine deposits and/or loamy basal till and/or loamy lodgment till

Properties and qualities

Slope: 0 to 25 percent
Depth to restrictive feature: More than 80 inches
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Minor Components

Udorthents, loamy

Percent of map unit: 5 percent
Hydric soil rating: No

Urban land

Percent of map unit: 5 percent
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear

Unnamed

Percent of map unit: 5 percent

Data Source Information

Soil Survey Area: Middlesex County, Massachusetts
Survey Area Data: Version 19, Sep 12, 2019

Soil Map—Middlesex County, Massachusetts

Map Scale: 1:342 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 5 10 20 30

Feet: 0 15 30 60 90

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 19, Sep 12, 2019

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

Date(s) aerial images were photographed: Aug 10, 2014—Aug 25, 2014

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
626B	Merrimac-Urban land complex, 0 to 8 percent slopes	0.1	33.1%
653	Udorthents, sandy	0.2	66.9%
Totals for Area of Interest		**0.2**	**100.0%**

TEST PIT FIELD LOG

PROJECT

DESCRIPTION: 148 PINE ST

LOCATION: NEWTON

TEST PIT NO.: 1A

DATE: 8-21-19

WEATHER:

GROUND EL:

ENGINEER: VERNE T PORTER JR

PERCOLATION RESULTS

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

REMARKS:

AVERAGE RATE:

SOIL DESCRIPTION

DEPTH

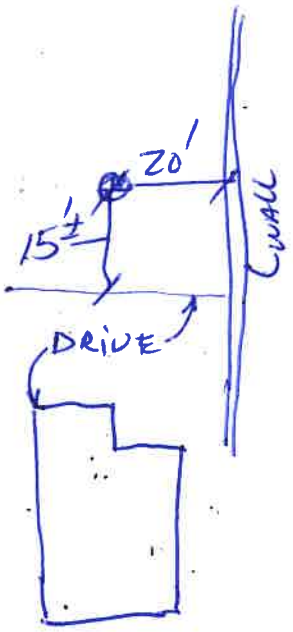
0'
1'
2'
3'
4'
5'
6'
7'
8'
9'
10'
11'
12'
13'
14'

SAND LOAM 7.5YR 3/3

FILL SANDY LOAM 10YR 3/2

WATER @ TOP OF PEAT

BLACK & BROWN PEAT

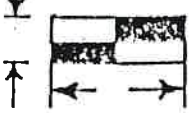


NO REFUSAL

Excav. Effort	Boulder Count	Remar No.

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: 148 PINE ST

LOCATION: NEWTON

TEST PIT NO.: 2

DATE: 8-21-19

WEATHER: SUNNY 80°

GROUND EL:

ENGINEER: VERNE T PORTER JR

PERCOLATION RESULTS

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

REMARKS:

AVERAGE RATE:

SOIL DESCRIPTION

DEPTH	SOIL DESCRIPTION	Excav. Effort	Boulder Count	Remar No.
0'	ASPHAULT			
1'	GRAVEL FILL			
2'	ASPHALT ▽ WATER 2.3'			
3'	FILL			
4'	ASH / PEAT			
5'	TRACE SAND			
6'				
7'				
8'	PEAT			
9'	BLACK & BROWN			
10'				
11'				
12'				
13'	BOTTOM: EXCAVATION			
14'	NO REFUSAL			

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: 148 PINE ST
LOCATION: NEWTON

TEST PIT NO.: 3
DATE: 8-21-19
WEATHER: SUNNY 80°
GROUND EL:
ENGINEER: VERNE T PORTER JR

PERCOLATION RESULTS

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

REMARKS:

AVERAGE RATE:

SOIL DESCRIPTION

DEPTH

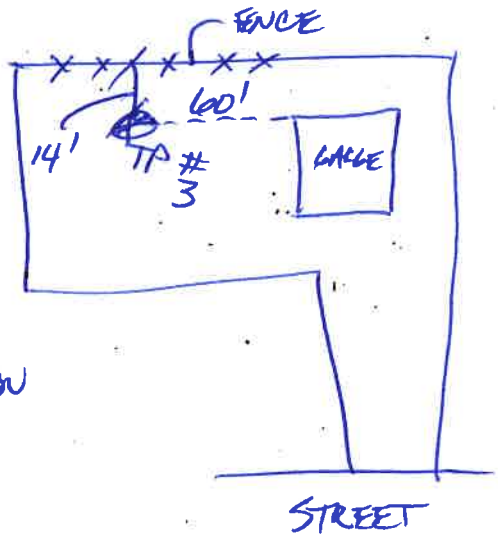
0' 1' 2' 3' 4' 5' 6' 7' 8' 9' 10' 11' 12' 13' 14'

8" CRUSHED STONE & GRAVEL

▽ WATER @ 24"

FILL SANDY GRAVEL/ASH/PEAT DARK IN COLOR

BLACK & BROWN PEAT

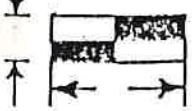


BOTTOM EXCAVATION

Excav. Effort	Boulder Count	Remar No.

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