DRAINAGE REPORT

70 Walker St, Newton

Newton, Massachusetts

March 3, 2020

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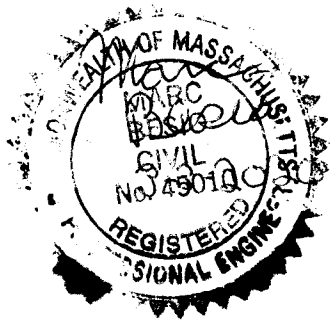


IMPERVIOUS AREAS

Date: March 3, 2020

Address: 70 Walker St, Newton

Project: 218237

Impervious Areas	Existing	Proposed
Buildings	2,493.8 s.f.	5,255.9 s.f.
Porch	232.2 s.f.	232.2 s.f.
Driveway	3,122.5 s.f.	3,400.5 s.f.
Walkways, patios	160.6 s.f.	160.6 s.f.
Window Well	0.0 s.f.	76.9 s.f.
Bulkhead	32.4 s.f.	124.8 s.f.
Retaining Walls	246.2 s.f.	65.6 s.f.
Total	**6,287.7 s.f.**	**9,316.5 s.f.**

Increase in Impervious Area: 9,316.5 - 6,287.7 = 3,028.8 s.f.

Lot area: 20,151.0 s.f.

4% of lot area: 806.0 s.f.

400 s.f. Max.

3,028.8 s.f. > 400.0 s.f. Drainage Required

DRAINAGE SUMMARY

Project Location: 70 Walker St, Newton **Lot Area:** 20,151 sq. ft. = 0.463 acres
Project Number: 218237 **Date:** 3/3/2020

IMPERVIOUS AREAS:

Existing Conditions:

Impervious Area:	6,288 sq. ft. / 43560 sq. ft. / acre	= 0.144 acres
Pervious Area:	13,863 sq. ft. / 43560 sq. ft. / acre	= 0.318 acres

Runoff Coefficient (weighted):

0.1444 acres	x 0.95 =	0.1372 acres	
0.3183 acres	x 0.35 =	0.1114 acres	
0.463 acres		**0.249 acres / 0.463 acres**	**= 0.538**

Proposed Conditions:

Impervious Area:	9,317 sq. ft. / 43560 sq. ft. / acre	= 0.214 acres
Pervious Area:	10,834 sq. ft. / 43560 sq. ft. / acre	= 0.249 acres

Runoff Coefficient (weighted):

0.2139 acres	x 0.95 =	0.2032 acres	
0.2487 acres	x 0.35 =	0.0870 acres	
0.463 acres		**0.290 acres / 0.463 acres**	**= 0.626**

VOLUME AND FLOW:

Q_{25} pre =	0.538 x	5.91 x	0.463 =	1.472 cfs	
Q_{25} post =	0.626 x	5.91 x	0.463 =	1.713 cfs	
V_{25} pre =	0.493 x	1.472 x	0.463 =	0.336 ac-ft	
V_{25} post =	0.493 x	1.713 x	0.463 =	0.391 ac-ft	
Q_{100} pre =	0.538 x	8.78 x	0.463 =	2.187 cfs	
Q_{100} post =	0.626 x	8.78 x	0.463 =	2.545 cfs	
V_{100} pre =	0.732 x	2.187 x	0.463 =	0.741 ac-ft	
V_{100} post =	0.732 x	2.545 x	0.463 =	0.863 ac-ft	

V_{100} post -	V_{100} pre =	0.863 ac-ft	- 0.741 ac-ft		**= 0.122 ac-ft**
0.122 ac-ft x	43560 sq. ft. / acre		= 5314.32 cu-ft	x 7.48 gal/cf	**= 39,751 gal**
Q_{100} post -	Q_{100} pre =	2.545 cfs	- 2.187 cfs =	0.358 cfs	
0.358 cfs x	60 sec/min	x 45 min	= 966.60 cfm	x 7.48 gal/cf	**= 7,230 gpm**

END GALLEY STORAGE:

Design Infiltration Rate: 7 min/inch = 0.71 ft/hr Rawls Ratio: 8.27 (Sand)

Infiltration Capacity

Bottom Area =	8.0'	x 6.0'	= 48.0 sq. ft.	
48.0 sq. ft.	x 0.71 ft/hr	= 34.1 cfh	= 818.4 cf/day	= 0.0188 ac-ft

Galley Storage

Total =	48.0 sq. ft.	x 3.25'	= 156.0 cf	
Embedded Galley Volume =	4.00'	x 4.00'	x 3.25'	= 52.0 cf
Stone Volume =	156.0 cf	- 52.0 cf	= 104.0 cf	
Storage =	stone volume x voids ratio		= 104.0 x 0.35	= 36.4 cf
Galley Volume =	3.50'	x 3.50'	x 3.25'	= 39.8 cf

Total Capacity = Galley Volume + stone void volume

39.8 + 36.4 = 76.2 cf = 0.0017 ac-ft

Total stored/infiltrated = infiltration capacity + total capacity

0.0188 ac-ft + 0.0017 ac-ft = **0.0205 ac-ft**

MIDDLE GALLEYS STORAGE:

Design Infiltration Rate: 7 min/inch = 0.71 ft/hr Rawls Ratio: 8.27 (Sandy)

Infiltration Capacity

Bottom Area =	8.0'	x 4.0'	= 32.0 sq. ft.	
32.0 sq. ft.	x 0.71 ft/hr	= 22.7 cf/hr	= 544.8 cf/day	= 0.0125 ac-ft

Galley Storage

Total =	32.0 sq. ft.	x 3.25'	= 104.0 cf	
Embedded Galley Volume =	4.00'	x 4.00'	x 3.25'	= 52.0 cf
Stone Volume =	104.0 cf	- 52.0 cf	= 52.0 cf	
Storage =	stone volume x voids ratio		= 52.0 x 0.35	= 18.2 cf
Galley Volume =	3.50'	x 3.50'	x 3.25'	= 39.8 cf

Total Capacity = Galley Volume + stone void volume

52.0 + 18.2 = 70.2 cf = 0.0016 ac-ft

Total stored/infiltrated = infiltration capacity + total capacity

0.0125 ac-ft + 0.0016 ac-ft = **0.0141 ac-ft**

REQUIRED SYSTEM STORAGE:

Storage required: **0.1220 ac-ft**

Storage provided:

Unit Type	Qty.	Unit Capacity	Total
End:	4	0.0205 ac-ft	0.0820 ac-ft
Middle:	4	0.0141 ac-ft	0.0564 ac-ft
Low Profile End:	0	0.0056 ac-ft	0.0000 ac-ft
Low Profile Middle:	0	0.0038 ac-ft	0.0000 ac-ft
Total =	**8 units**		**0.1384 ac-ft**

> 0.1220 ac-ft

Therefore OK

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: Kames, eskers, moraines, outwash terraces, outwash plains
Landform position (two-dimensional): Backslope, footslope, shoulder, summit
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

Sudbury
Percent of map unit: 5 percent
Landform: Outwash plains, terraces, deltas
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, eskers, kames
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

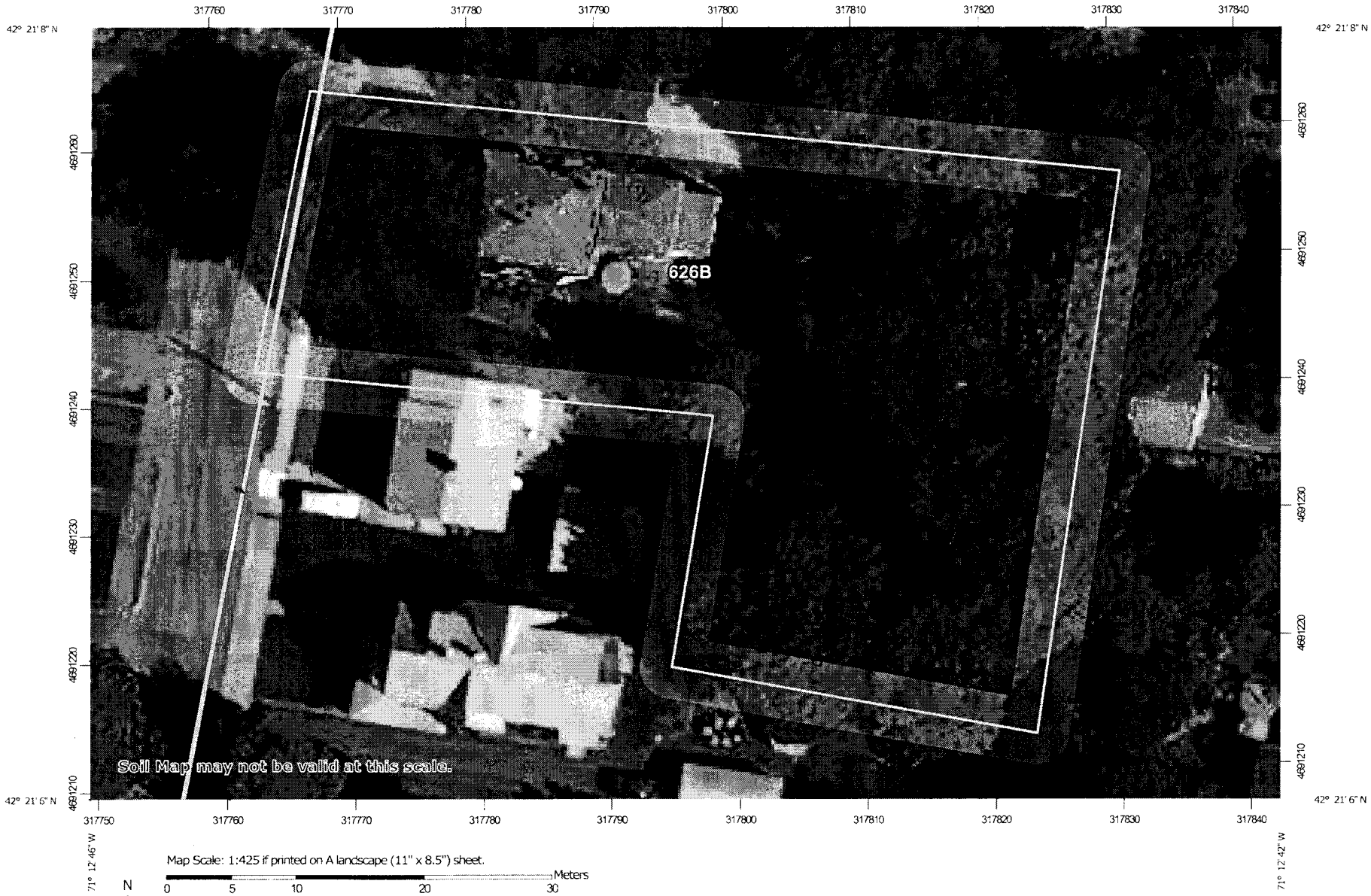
Windsor
Percent of map unit: 5 percent
Landform: Deltas, outwash plains, dunes, outwash terraces
Landform position (three-dimensional): Riser, tread
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex

Hydric soil rating: No

Data Source Information

Soil Survey Area: Middlesex County, Massachusetts
Survey Area Data: Version 18, Sep 7, 2018

Soil Map—Middlesex County, Massachusetts
(70 Walker Street)



Map Scale: 1:425 if printed on A landscape (11" x 8.5") 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 18, Sep 7, 2018

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	0.5	100.0%
Totals for Area of Interest		**0.5**	**100.0%**