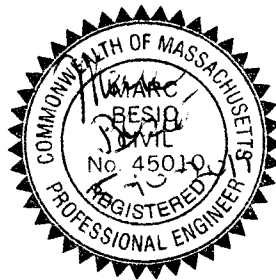


**DRAINAGE REPORT
180,184&186 ADAMS STREET
NEWTON, MASSACHUSETTS**



Date: February 28, 2019

Prepared by:
Natalie Doyle

Reviewed by:
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Job # 218157

Addendum A

180,184&186 Adams Street Date: February 27, 2019

Project: 218157

Existing Impervious Areas-

Buildings – 2738.2.f.

Driveway – 2726.1.f.

Walks – 397.5 s.f.

Patio – 0.0 s.f.

Landings/Stairs – 134.1 s.f.

Bulkhead – 34.3 s.f.

Total = 6,030.2.f.

Proposed Impervious Areas-

Building – 6073.0 s.f.

Driveway – 3434.3 s.f.

Walks – 52.3 s.f.

Patio & AC Pad – 563 s.f.

Landings/Stairs – 144.6.f.

Bulkhead/W.Well – 30.0s.f.

Total 10,297.2 s.f.

Increase of Impervious Area: 10,297.2 – 6,030.2= 4,267.0 s.f.

Lot area: 15,355 s.f.

15,355 x 4% = 614.2 s.f.

4,267.0.f >614.2 s.f. **Drainage Required**

DRAINAGE SUMMARY

Project Location: 180-186 Adams Street, Newt Lot Area: 15,355 sq. ft. = 0.353 acres
 Project Number: 218186 Date: 2/28/2019

EXISTING CONDITIONS:

Impervious Area: 6,030 sq. ft. / 43560 sq. ft. / acre = 0.138 acres
 Pervious Area: 9,325 sq. ft. / 43560 sq. ft. / acre = 0.214 acres
 15,355 sq. ft.

Runoff Coefficient (weighted):

$$\begin{array}{rcl} 0.138 \text{ acres} & \times 0.95 = & 0.131 \\ \underline{0.214 \text{ acres}} & \times 0.35 = & \underline{0.075} \\ 0.352 & & 0.206 / 0.352 = 0.585 \end{array}$$

PROPOSED CONDITIONS:

Impervious Area: 10,297 sq. ft. / 43560 sq. ft. / acre = 0.236 acres
 Pervious Area: 5,058 sq. ft. / 43560 sq. ft. / acre = 0.116 acres
 15,355 sq. ft.

Runoff Coefficient (weighted):

$$\begin{array}{rcl} 0.236 \text{ acres} & \times 0.95 = & 0.224 \\ \underline{0.116 \text{ acres}} & \times 0.35 = & \underline{0.041} \\ 0.352 & & 0.265 / 0.352 = 0.753 \end{array}$$

$$Q_{25} \text{ pre} = 0.585 \times 5.91 \times 0.353 = 1.220 \text{ cfs}$$

$$Q_{25} \text{ post} = 0.753 \times 5.91 \times 0.353 = 1.571 \text{ cfs}$$

$$V_{25} \text{ pre} = 0.493 \times 1.220 \times 0.353 = 0.212 \text{ ac-ft}$$

$$V_{25} \text{ post} = 0.493 \times 1.571 \times 0.353 = 0.273 \text{ ac-ft}$$

$$Q_{100} \text{ pre} = 0.585 \times 8.78 \times 0.353 = 1.813 \text{ cfs}$$

$$Q_{100} \text{ post} = 0.753 \times 8.78 \times 0.353 = 2.334 \text{ cfs}$$

$$V_{100} \text{ pre} = 0.732 \times 1.813 \times 0.353 = 0.468 \text{ ac-ft}$$

$$V_{100} \text{ post} = 0.732 \times 2.334 \times 0.353 = 0.603 \text{ ac-ft}$$

$$V_{100} \text{ post} - V_{100} \text{ pre} = 0.603 \text{ ac-ft} - 0.468 \text{ ac-ft} = 0.135 \text{ ac-ft}$$

$$0.135 \text{ ac-ft} \times 43560 \text{ sq. ft. / acre} = 5880.60 \text{ cu-ft} \times 7.48 \text{ gal/cf} = 43,987 \text{ gal}$$

$$Q_{100} \text{ post} - Q_{100} \text{ pre} = 2.334 \text{ cfs} - 1.813 \text{ cfs} = 0.521 \text{ cfs}$$

$$0.521 \text{ cfs} \times 60 \text{ sec/min} \times 45 \text{ min} = 1406.70 \text{ cu-ft} \times 7.48 \text{ gal/cf} = 10,522 \text{ gal}$$

END GALLEY

Design infiltration rate: 8 min/inch = 0.63 ft/hr (Rawls Rate Sand=8.27in/hr.)
INFILTRATION CAPACITY
Bottom Area = 6.0' x 8.0' = 48.0 sq. ft.
48.0 sq. ft. x 0.63 ft/hr = 30.2 cf/hour = 724.8 cf/day = 0.0166 ac-ft

GALLEY STORAGE

Total = 48.0 sq. ft. x 4.25' = 204.0 cf
Galley (Embedded) Volume = x 4.00' x 4.00' x 3.25' = 52.0 cf
Stone Volume = 204.0 cf - 52.0 cf = 152.0 cf
Storage = stone volume x voids ratio = 152.0 x 0.35 = 53.2 cf

GALLEY STORAGE

Galley Volume = x 3.50' x 3.50' x 3.25' = 39.8 cf

Total Capacity = Galley Volume + stone void volume
39.8 + 53.2 = 93.0 cf = 0.0021 ac-ft

Total stored/infiltrated = infiltration capacity + total capacity
0.0166 ac-ft + 0.0021 ac-ft = 0.0187 ac-ft

MIDDLE GALLEYS

Design infiltration rate: 8 min/inch = 0.63 ft/hr (Rawls Rate Sand=8.27in/hr.)
INFILTRATION CAPACITY
Bottom Area = 4.0' x 8.0' = 32.0 sq. ft.
32.0 sq. ft. x 0.63 ft/hr = 20.2 cf/hour = 484.8 cf/day = 0.0111 ac-ft

GALLEY STORAGE

Total = 32.0 sq. ft. x 4.25' = 136.0 cf
Galley (embedded) Volume = x 4.00' x 4.00' x 3.25' = 52.0 cf
Stone Volume = 136.0 cf - 52.0 cf = 84.0 cf
Storage = stone volume x voids ratio = 84.0 x 0.35 = 29.4 cf

Galley Volume = x 3.50' x 3.50' x 3.25' = 39.8 cf

Total Capacity = Galley Volume + stone void volume
39.8 + 29.4 = 69.2 cf = 0.0016 ac-ft

Total stored/infiltrated = infiltration capacity + total capacity
0.0111 ac-ft + 0.0016 ac-ft = 0.0127 ac-ft

Storage required: 0.135 ac-ft

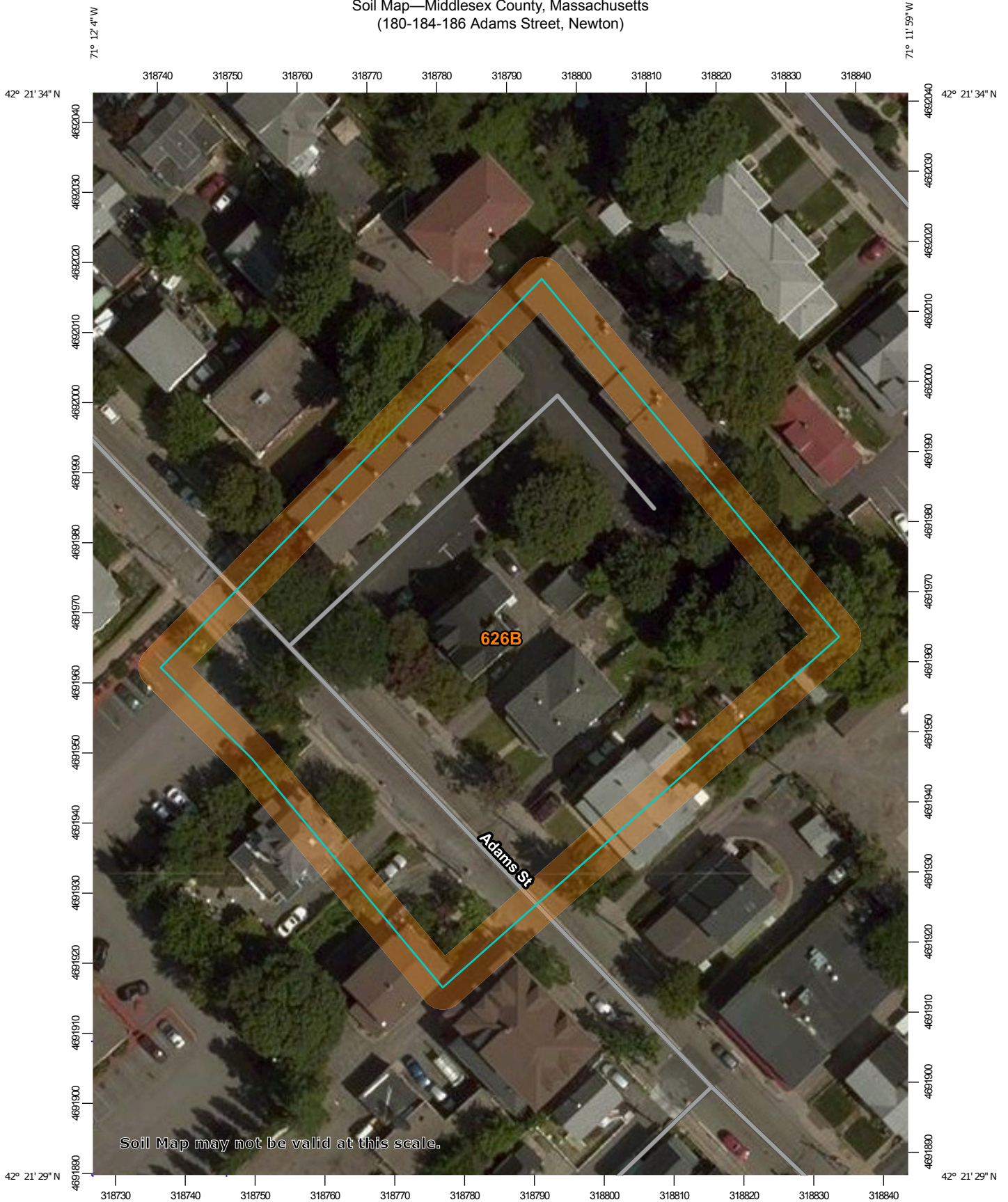
Storage provided: **14 units** = 0.190 ac-ft

UNIT TYPE	#	CAPACITY	CAPACITY
END:	6	@ 0.0187 ac-ft	0.112
MIDDLE:	8	@ 0.0127 ac-ft	0.102

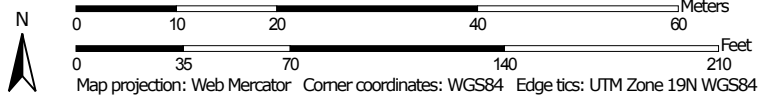
0.214 ac-ft > 0.135 ac-ft

Therefore OK






































Soil Map—Middlesex County, Massachusetts
(180-184-186 Adams Street, Newton)



Map Scale: 1:753 if printed on A portrait (8.5" x 11") sheet.



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	1.2	100.0%
Totals for Area of Interest		1.2	100.0%

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