



LGCI

Lahlaf Geotechnical Consulting, Inc.

January 22, 2021

Mr. Brendan Horigan
Spaulding & Slye Investments
1 Post Office Square
Boston, MA 02109
Phone: (617) 531-4181
E-mail: Brendan.Horigan@ssinvests.com

**Re. Geotechnical Report
Proposed Residential Development at 1165 Massachusetts Avenue
Arlington, Massachusetts
LGCI Project No. 2041**

Dear Mr. Horigan:

Lahlaf Geotechnical Consulting, Inc. (LGCI) has completed a geotechnical study for the proposed Residential Development at 1165 Massachusetts Avenue in Arlington, Massachusetts. This report contains the results of our explorations and our foundation design and construction recommendations.

The soil samples from our explorations are currently stored at LGCI for further analysis, if requested. Unless notified otherwise, we will dispose of the soil samples after three (3) months.

Thank you for choosing LGCI as your geotechnical engineer.

Very truly yours,

Lahlaf Geotechnical Consulting, Inc.

Abdelmadjid M. Lahlaf, Ph.D., P.E.
Principal Engineer



LGCI
Lahlaf Geotechnical Consulting, Inc.

**GEOTECHNICAL REPORT
PROPOSED RESIDENTIAL DEVELOPMENT AT
1165 MASSACHUSETTS AVENUE
ARLINGTON, MASSACHUSETTS**
LGCI Project No. 2041
January 22, 2021

Prepared for:

SPAULDING & SLYE INVESTMENTS
1 Post Office Square
Boston, MA 02109
Phone: (617) 531-4181

2. SITE AND SUBSURFACE CONDITIONS

2.1 Surficial Geology

LGCI reviewed the following Surficial Geologic Map: “Surficial Materials Map of the Lexington Quadrangle, Massachusetts,” prepared by Stone, B.D., and DiGiacomo-Cohen, M.L. Scientific Investigation Map 3402, Quadrangle 114 – Lexington, 2018.

The Surficial Geologic Map shows that the soils in the general vicinity of the site consist of artificial fill, flood-plain alluvium, coarse deposits, and thin till as described below.

- Artificial Fill – The artificial fill consists of earth materials and manmade materials that have been artificially emplaced. The Surficial Geologic Map shows fill placed in the western and southern sides of the site.
- Flood-plain Alluvium – The flood-plain alluvium consists of sand, gravel, silt, and some organic material, stratified and well sorted to poorly sorted, beneath the flood plains of modern streams. The Surficial Geologic Map shows flood-plain alluvium along the Mill Brook.
- Coarse Deposits – The coarse deposits consist of sand, sand and gravel, and gravel deposits. The sand deposits are comprised mostly of fine to coarse sand. Coarser layers may contain up to 25 percent gravel. Finer layers may contain very fine sand, silt, and clay. The sand and gravel deposits occur as a mixture of gravel and sand within individual layers and as alternating layers of sand and gravel. The sand and gravel layers range between 25 and 50 percent gravel and 50 to 75 percent sand. The gravel deposits are comprised of at least 50 percent gravel, cobbles, and boulders. Sand occurs within gravel beds and as separate layers within the gravel. The Surficial Geologic Map shows coarse deposits in the northern side of the site.
- Thin Till – The thin till is described as non-sorted, non-stratified matrix of sand, some silt, and little clay that contains scattered pebbles, cobbles, and boulders. The thin till is generally less than 10 to 15 feet thick. The Surficial Geologic Map shows thin till near the southern edge of the site.

The Surficial Geologic Map is shown in Figure 2.

2.2 Previous Explorations by Others

SSI provided us with a report containing the results of the previous explorations conducted at the site by Haley & Aldrich, Inc. The report is listed below:



**Geotechnical Report
Proposed Residential Development at 1165 Massachusetts Avenue
Arlington, Massachusetts
LGCI Project No. 2041**

- Memorandum subject titled: “Results of Limited Site Investigation, Arlington Mill, 1165 Massachusetts Avenue, Arlington, Massachusetts,” (H&A Geotechnical Report) prepared by Haley & Aldrich, Inc. (H&A) dated September 16, 2020, and provided to LGCI by SSI via e-mail on October 21, 2020.

Based on the H&A Geotechnical Report, four (4) borings (HA19-B1 to HA19-B4) were advanced at the site in December 2019 and six (6) borings (HA20-01 to HA20-06) were advanced at the site in August 2020. Based on the H&A Geotechnical Report, five (5) groundwater observation wells were installed at the site. The previous borings extended to depths ranging between 15 and 16.5 feet beneath the existing ground surface at the time of the borings, i.e., at elevations ranging between El. 78 feet and El. 89 feet. The elevations were referenced with respect to NAVD88.

The previous borings generally indicated 4 to 6 inches of bituminous concrete (asphalt); overlying a layer of fill; overlying a layer of glaciofluvial deposits (natural sand). The fill extended to depths ranging between 4 and 7.3 feet beneath the ground surface. The fill generally consisted of organic soil, silty sand, or poorly graded sand with traces of bricks and cinders. The (SPT) N-values in the fill ranged between 5 and 76 bpf, with most values less than 28 bpf, indicating very loose to medium dense fill. The high SPT N-values may have been caused by obstructions in the soil. The glaciofluvial deposits underlying the fill were generally described as dense to very dense well graded sand and gravel with varying amount of silt. All borings were terminated in this layer.

Groundwater was encountered in all the previous borings at depths ranging between 6 and 14 feet beneath the ground surface. Groundwater levels measured in the groundwater observation wells ranged between 6 and 9.5 feet beneath the existing ground surface, i.e., at elevations ranging between El. 85.5 feet and El. 92.5 feet. The locations and logs of the previous borings and groundwater observation wells are included in Appendix B.

2.3 Previous Explorations by LGCI

LGCI previously performed explorations at the site for the then proposed bridge crossing Mill Brook. The results of our previous explorations were included in the following report:

- Report titled: “Geotechnical Report, Proposed Mirak Mill Bridge, Arlington, Massachusetts,” (LGCI’s Previous Geotechnical Report) prepared by LGCI dated August 10, 2020 and revised on August 28, 2020. This report was provided to LGCI by SSI via e-mail on October 21, 2020.

As part of LGCI’s previous explorations for the proposed Mill Brook bridge, LGCI’s two (2) borings (BB-1 and BB-2) and eight (8) probes (P1-1, P1-2, P2-1 to P2-6) were advanced at the site in June 2020. LGCI’s previous borings BB-1 and BB-2 extended to depths of 34 and 35 feet beneath the existing ground surface, i.e., at elevations of El. 66 feet and El. 67.5 feet, respectively. The elevations were referenced with respect to NAVD88.



**Geotechnical Report
Proposed Residential Development at 1165 Massachusetts Avenue
Arlington, Massachusetts
LGCI Project No. 2041**

LGCI's previous borings generally indicated 6 to 12 inches of asphalt; overlying a layer of fill; overlying a layer of sand on top of bedrock. The fill extended to depths of 15 and 17.5 feet beneath the ground surface. The fill generally consisted of silty sand with gravel, well graded sand, or well graded gravel. The fill contained traces of organic soil, coal ash, bricks, and slag. A 2-foot-thick layer of buried organic soil was encountered within the fill in previous boring BB-1. The (SPT) N-values in the fill ranged between 4 and 76 blows per foot (bpf), with most values between 7 and 48 bpf, indicating loose to dense fill. The high SPT N-values may have been caused by obstructions in the soil. The sand underlying the fill was described as very dense silty sand. Cobbles and boulders were encountered beneath the fill in boring BB-2. Bedrock was encountered in the borings BB-1 and BB-2 at depths of 23 and 24 feet beneath the ground surface, i.e., at elevations of El. 77 feet and El. 78.5 feet, respectively. The borings were terminated in bedrock.

Groundwater was encountered in the borings BB-1 and BB-2 at depths of 8 and 10 feet beneath the ground surface, respectively. The locations and logs of our previous borings and probes are included in Appendix C.

2.4 LGCI's Borings

2.4.1 General

LGCI coordinated our exploration locations with SSI and marked the exploration locations in the field by taping distances from the physical landmarks. LGCI notified Dig Safe and the Town of Arlington for utility clearance prior to starting our explorations at the site.

Unless notified otherwise, we will dispose of the soil samples obtained during our explorations after three (3) months.

2.4.2 LGCI Soil Borings

LGCI engaged Northern Drill Service, Inc. (NDS) of Northborough, Massachusetts to advance two (2) borings (B-1 and B-2) on December 31, 2020. The borings were advanced with a track-mounted Diedrich D-25 drill rig using drive and wash technique with a 4-inch casing. The borings extended to depths of 18 feet beneath the ground surface. Upon completion, the boreholes were backfilled with the soil cuttings and the ground surface was restored using cold patch asphalt in paved areas.

NDS performed Standard Penetration Tests (SPT) during drilling and obtained split spoon samples in the borings with an automatic hammer at typical 2-foot or 5-foot depth intervals as noted on the boring logs in general accordance with ASTM D-1586.

An LGCI engineer observed and logged the borings in the field.



2.4.3 Boring Logs and Locations

The boring locations are shown in Figure 3. Appendix D contains LGCI's boring logs and Table 1 includes a summary of LGCI's borings.

2.5 Subsurface Conditions

The subsurface description in this report is based on a limited number of borings and is intended to highlight the major soil strata encountered during our borings. The subsurface conditions are known only at the actual boring locations. Variations may occur and should be expected between boring locations. The boring logs represent conditions that we observed at the time of our borings and were edited, as appropriate, based on the results of the laboratory test data and inspection of the soil samples in the laboratory. The strata boundaries shown in our boring logs are based on our interpretations and the actual transitions may be gradual. Graphic soil symbols are for illustration only.

The soil strata encountered in the borings were as follows, starting at the ground surface.

Asphalt – Asphalt was encountered at the ground surface in borings B-1 and B-2. The thickness of the asphalt was about 2 and 3 inches, respectively.

Organic Fill – A layer of organic fill was encountered beneath the asphalt in borings B-1 and B-2 and extended to depths of 4.2 and 2.8 feet beneath the ground surface, respectively. The fill is anticipated to be thicker near Mill Brook.

The samples in the layer were described as organic soil, silty sand with gravel, or silty gravel with sand. The samples in the organic fill contained between 15 and 20 percent fines, and up to 35 percent gravel. When the samples were described as gravel, the sand content ranged between 10 and 15 percent. The organic fill contained traces of asphalt.

The standard penetration test (SPT) N-values in this layer were mostly 4 blows per foot (bpf), indicating very loose fill. One (1) SPT N-value of 28 bpf was encountered in boring B-1 that may have been caused by obstructions in the fill and may not be representative of the true density of the fill.

Sand and Gravel – A layer of sand and gravel was encountered beneath the organic fill in borings B-1 and B-2 and extended to the termination depths of the borings at 18 feet beneath the ground surface. The samples in this layer were mostly described as well graded gravel and occasionally as poorly graded gravel or poorly graded sand. Two (2) samples were described as silty gravel and one (1) sample was described as well graded sand with silt and gravel. The fines content in this layer ranged between 0 and 20 percent and the sand content ranged between 15 and 45 percent. When the samples were described as sand, the gravel content ranged between 5 and 30 percent. The layer contained traces of organic soil.



**Geotechnical Report
Proposed Residential Development at 1165 Massachusetts Avenue
Arlington, Massachusetts
LGCI Project No. 2041**

The SPT N-values in this layer ranged between 33 and 125 bpf, with most values above 40 bpf, indicating mostly dense to very dense sand.

The subsurface conditions encountered in borings B-1 and B-2 are generally consistent with those encountered in the previous H&A and LGCI borings.

2.6 Groundwater

Groundwater was encountered in borings B-1 and B-2 at depths of 4 and 3 feet beneath the ground surface, respectively as shown in Table 1 and in the boring logs.

LGCI monitored the groundwater observation wells HA19-B1/OW1, HA19-B2/OW2, and HA20-01(OW) previously installed at the site by H&A. Groundwater levels were measured at depths of 5.5, 4.4, and 4.5 feet beneath the ground surface, respectively which is in accordance with the groundwater levels encountered in our borings.

The groundwater information reported herein is based on observations made during or shortly after the completion of drilling, and may not represent the actual groundwater conditions. Furthermore, the drilling procedure introduced water into the boreholes; therefore, additional time may be required for the groundwater levels to stabilize. The groundwater information presented in this report only represents the conditions encountered at the time and location of the explorations. Seasonal fluctuation should be anticipated.

2.7 Laboratory Test Data

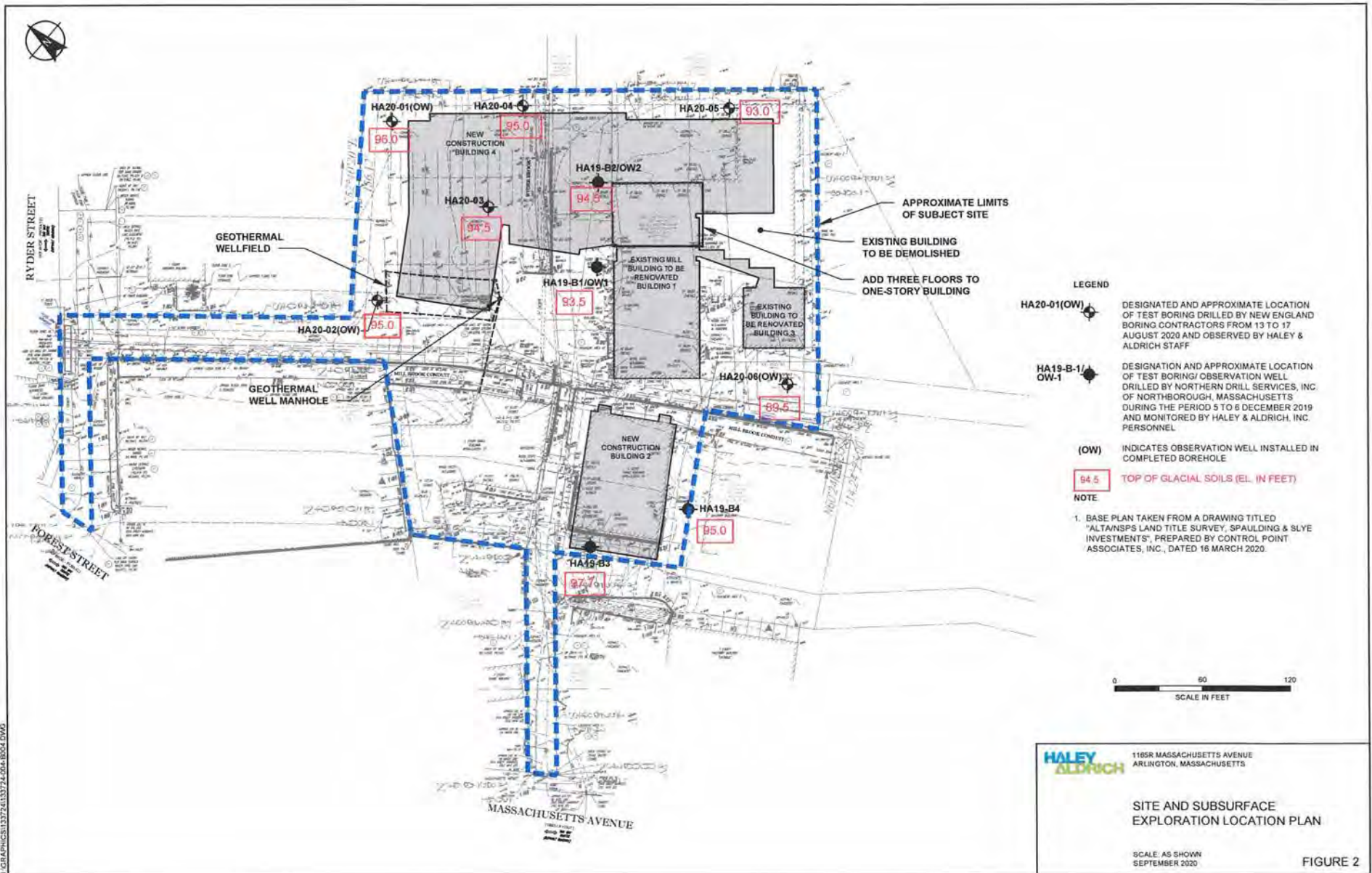
LGCI submitted three (3) soil samples collected from the borings for grain-size analysis. The results of the grain-size analysis are provided in the test data sheets included in Appendix E and are summarized in the table below.

Grain-Size Analysis Test Results

Boring No.	Sample No.	Stratum	Sample depth (ft.)	Percent Gravel	Percent Sand	Percent Fines
B-1	S3	Sand and Gravel	4.2 – 6.2	43.6	41.0	15.4
B-2	S3	Sand and Gravel	4.3 – 6.3	45.3	41.9	12.8
B-2	S4 Top 7”	Sand and Gravel	6.3 – 6.9	59.5	35.6	4.9

LGCI also submitted two (2) soil samples from the fill layer to a laboratory for organic soil content. The results were 1.2 and 5.6 percent by weight of organic content. The results are included in Appendix E.





LEGEND

HA20-01(OW) DESIGNATED AND APPROXIMATE LOCATION OF TEST BORING/ OBSERVATION WELL DRILLED BY NEW ENGLAND BORING CONTRACTORS FROM 13 TO 17 AUGUST 2020 AND OBSERVED BY HALEY & ALDRICH STAFF

HA19-B-1/OW-1 DESIGNATION AND APPROXIMATE LOCATION OF TEST BORING/ OBSERVATION WELL DRILLED BY NORTHERN DRILL SERVICES, INC. OF NORTHBOROUGH, MASSACHUSETTS DURING THE PERIOD 5 TO 6 DECEMBER 2019 AND MONITORED BY HALEY & ALDRICH, INC. PERSONNEL

(OW) INDICATES OBSERVATION WELL INSTALLED IN COMPLETED BOREHOLE

94.5 TOP OF GLACIAL SOILS (EL. IN FEET)

NOTE

1. BASE PLAN TAKEN FROM A DRAWING TITLED "ALTANSPS LAND TITLE SURVEY, SPAULDING & SLYE INVESTMENTS", PREPARED BY CONTROL POINT ASSOCIATES, INC., DATED 16 MARCH 2020.


HALEY ALDRICH 1165R MASSACHUSETTS AVENUE ARLINGTON, MASSACHUSETTS

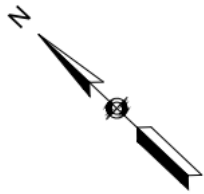
SITE AND SUBSURFACE EXPLORATION LOCATION PLAN

SCALE: AS SHOWN SEPTEMBER 2020

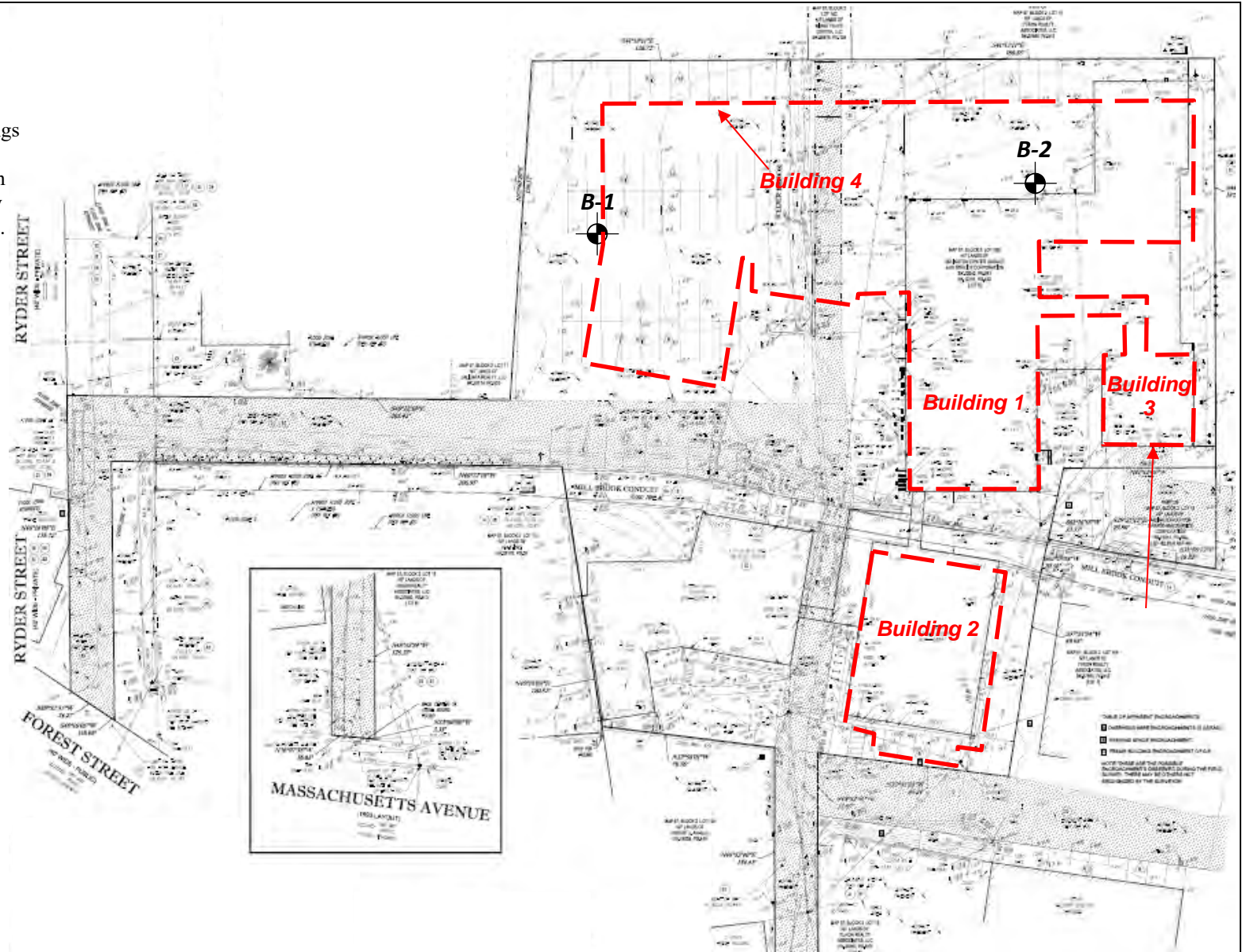
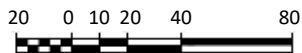
FIGURE 2

Legend

 Approximate location of borings advanced by Northern Drill Service, Inc. (NDS) of Northborough, MA on December 31, 2020 and observed by Lahlaf Geotechnical Consulting, Inc. (LGCI).




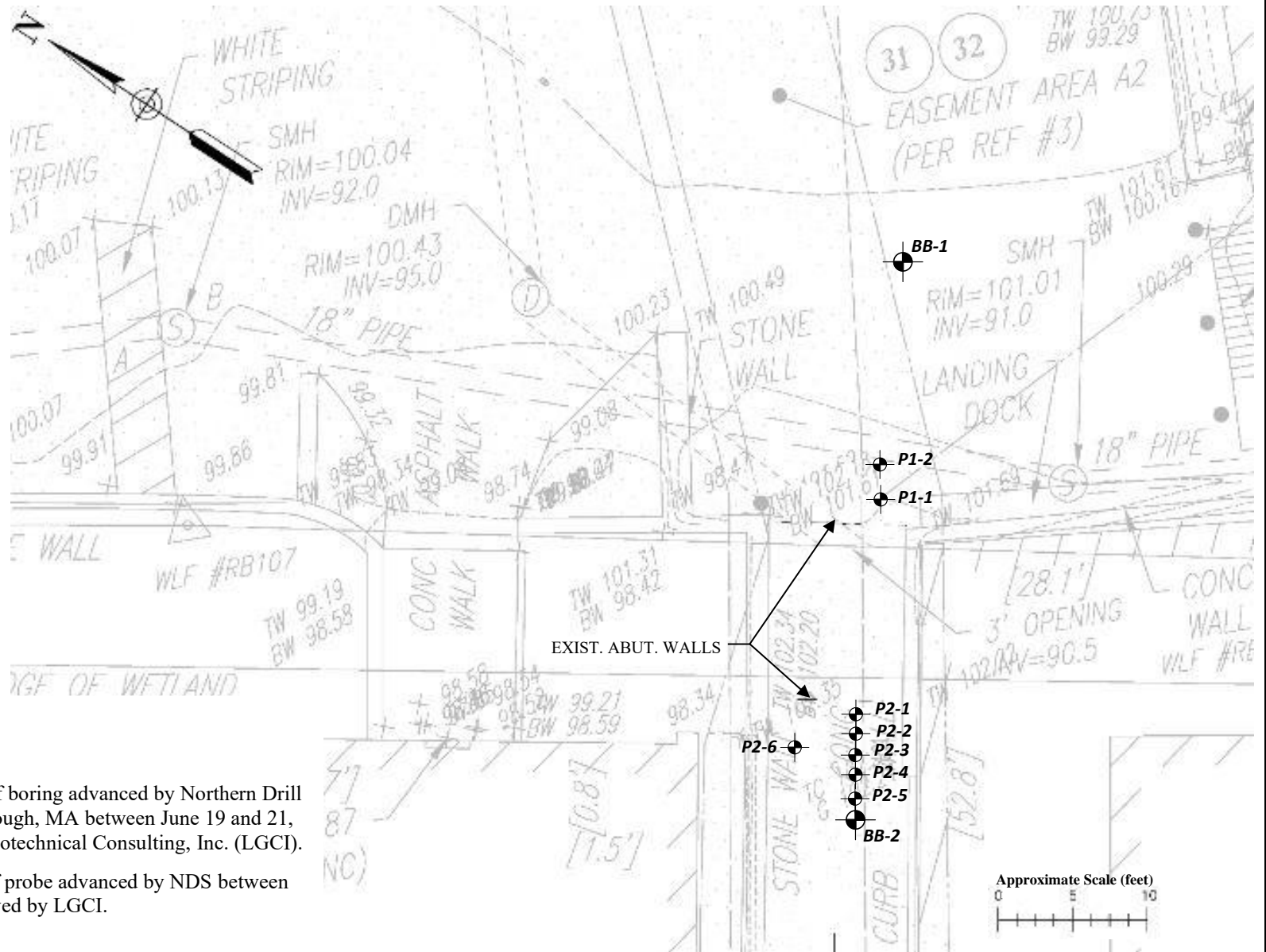
Approximate Scale





Note

Figure based on drawing titled: "ALTA/NSPS Land Title Survey, Dwg. No. 1 of 5," prepared by Control Point Associates, Inc., dated December 9, 2020, and provided to LGCI by Spaulding & Slye Investment. via e-mail on December 16, 2020.


Client: Spaulding & Slye Investments		Project: Proposed Residential Development at 1165 Massachusetts Avenue		Figure 3 – Boring Location Plan	
 LGCI Lahlaf Geotechnical Consulting, Inc.		Project Location: Arlington, MA		LGCI Project No.: 2041	Date: Jan. 2021



Legend

- 
 Approximate location of boring advanced by Northern Drill Service, Inc. (NDS) of Northborough, MA between June 19 and 21, 2020, and observed by Lahlaf Geotechnical Consulting, Inc. (LGCI).
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 Approximate location of probe advanced by NDS between June 19 and 21, 2020, and observed by LGCI.

Note
 Figure based on drawing titled: "Boring Location Plan," prepared by Nitsch Engineering, Inc., dated February 14, 2020, and provided to LGCI via e-mail by Nitsch Engineering, Inc. on March 3, 2020.

Client: Nitsch Engineering, Inc.	Project: Proposed Mirak Mill Bridge	Figure 3 – Boring and Probe Location Plan	
 LGCI Lahlaf Geotechnical Consulting, Inc.	Project Location: Arlington, MA	LGCI Project No.: 2009	Date: August 2020