November 24, 2020

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Subject: **Preliminary Geotechnical Engineering Report**
Proposed New Center for Active Living
345 Walnut Street, Newtonville, MA 02460
PSI Project No.: 04461013 (Rev. 1)

Dear Mr. Bargmann:

Thank you for choosing Professional Service Industries, Inc. (PSI), an Intertek company, as your consultant for the above referenced project. PSI is pleased to submit this report presenting the results of the preliminary geotechnical engineering studies regarding the proposed Center for Active Living in Newtonville, Massachusetts. Our services were conducted in accordance with PSI's Proposal No. 0446-320483 (Rev. 1) dated September 3, 2020.

The services presented herein were developed to provide geotechnical recommendations for the three options being considered for this facility. When the design option has been finalized and detailed design information is provided, a final geotechnical report will be submitted.

Should there be any questions regarding this report, please do not hesitate to call our office at (781) 821-2355. PSI would be pleased to continue providing geotechnical services throughout design and construction of the project, and we look forward to working with you and your organization on this and future projects.

Respectfully submitted,
Professional Service Industries, Inc.

Brianna Hansen   Stephen M. Simonette

Brianna Hansen
Project Manager

Stephen M. Simonette, P.E.
Principal Consultant

PRELIMINARY GEOTECHNICAL ENGINEERING REPORT

For the Proposed

New Center for Active Living
345 Walnut Street
Newtonville, MA 02460

Brianna Hansen

Brianna Hansen
Project Manager

Prepared for

Bargmann Hendrie + Archetype, Inc.
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CIVIL
No. 55632
REGISTERED
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PSI PROJECT NO. 04461013
(REV. 1)

November 24, 2020

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1.0 PROJECT INFORMATION

1.1 PROJECT AUTHORIZATION

Authorization to proceed with this project was provided by Mr. Joel Bargmann with Bargmann Hendrie + Archetype, Inc. by signing the Acceptance of Proposal on September 3, 2020 included with PSI's Proposal No. 0446-320483 (Rev. 1).

1.2 PROJECT DESCRIPTION

Project information provided to PSI included the Bargmann Hendrie + Archetype, Inc. "NewCAL Project Update" document dated August 26, 2020, which included preliminary information and schematics for three options as follows.

- Retain and renovate a portion of existing building; New construction of 3-story building
- Demolition of existing building; New construction of 3-story building
- Demolition of existing building; New construction of 4-story building

Per the Client, the design team has narrowed down the options to include retaining and renovating a portion of the existing building and constructing a new 3-story addition or demolishing the existing building and constructing a new 4-story building. A below-grade basement level is not planned within the new construction footprints. The new addition or free-standing structure footprints are understood to be on the order of 9,000 to 10,000 square feet. Structural loading information was not provided. Therefore, this report is based on column loads not exceeding 150-kips, uplift load not exceeding 15-kips, wall loads not exceeding 3-klf, and slab loads not exceeding 150-psf. Additionally, grading information was not provided; therefore, PSI will base our recommendations on grading cuts/fills not exceeding 2-feet from existing grade.

Should any of the information identified herein be incorrect or should supplemental information become available, PSI must be notified and have the opportunity to reassess conditions and amend the report where necessary.

PSI understands that the site layouts provided by the Client are preliminary and the final building construction option has not yet been determined. The objective of the exploration program described herein was to obtain profiles of the subsurface materials within the overall area of the potential new construction and development of geotechnical recommendations. Upon final selection by the design team and receipt and review of detailed design information, PSI will provide a final geotechnical report for the project, which may include modifications to the recommendations presented here.

1.3 SITE DESCRIPTION

The referenced site (42° 20’ 57.05” N, 71° 12’ 25.92” W) is located at 345 Walnut Street in Newtonville, Massachusetts, as shown in *Figure 1, USGS Site Location Plan*.

The site consists of an existing Newton Senior Center building with associated bituminous concrete pavements. The overall surface topography is relatively flat. Information contained on Google Earth indicates existing surface grades of approximately EL 55 to 56 feet, NAVD.

The existing building structure consists of 2 above grade stories and a basement, with the main level approximately 5 feet above outside grade. There are stairwells at the two corners of the west side of the building leading down to the basement to a depth of approximately 7½ feet below grade.

1.4 EXPLORATION PROGRAM

PSI conducted a preliminary geotechnical exploration program at the site in conformance with generally accepted geotechnical engineering practices to provide subsurface information about the site. This information was utilized to develop preliminary geotechnical engineering recommendations for members of the design team for use on this project.

The subsurface exploration program consisted of the performance of Standard Penetration Test (SPT) borings to assess the depth and characteristics of the underlying material. PSI marked out the exploration locations using the provided Site Plan and notified Dig Safe System, Inc. for public utility clearance prior to drilling. The exploration locations were also scanned by a private utility location service, Ground Penetrating Radar Systems LLC, prior to performing the explorations at the site.

Soil X Corporation of Leominster, MA drilled four soil test borings on September 23, 2020 at the approximate locations shown in *Figure 2, Boring Location Plan*. The borings were drilled near or within the proposed building footprint. Due to the proposed building footprint being within part of the existing building footprint, the borings were located as close to the proposed building footprint as feasible. A PSI representative observed the exploration activities for this project, retrieved soil samples for classification and testing, and prepared the attached Soil Test Boring Logs.

The borings were advanced by flush joint casing using a Geoprobe 7822DT drill rig equipped with a DH103 automatic hammer to depths of approximately 17 to 22 feet below the existing ground surfaces (bgs), where the borings encountered refusal (Boring B-3: Approximately 17 feet bgs) or were terminated at the scheduled depths. Standard Penetration Test (SPT) and split spoon samples were retrieved at approximate 2-foot intervals to depths of approximately 7 to 12 feet bgs and at approximate 5-foot intervals thereafter. The number of hammer blows required to drive the sampler into the soil in 6-inch increments is recorded on the Soil Test Boring Logs attached in the Appendix for reference. The sum of the hammer blows for the second and third interval provides the Standard Penetration Resistance (N) and is a measure of soil strength. Three soil samples retrieved from the borings were selected for laboratory testing to assist in classifying the material. The remaining samples will be stored in our laboratory and disposed of after 6 months.

PSI classified the soil strata shown in the Soil Test Boring Logs based upon its interpretation of the subsurface conditions encountered at the boring locations. The stratifications shown on the Soil Test Boring Logs represent the conditions only at the actual boring locations and variations will occur and should be expected at other locations. It is also possible that there could be thin layers of material lying between the sampling intervals that are not described on the logs and which might not become known until construction. Likewise, the depth to each soil stratum is approximate and may be more gradual or different in the field.

2.0 SITE AND SUBSURFACE CONDITIONS

2.1 SUBSURFACE CONDITIONS

2.1.1 LOCAL GEOLOGY

Based on the “Plate 5 Surficial Geologic Map of the Newton Quadrangle, Massachusetts” compiled by C.M. Brankman in 2004, the surficial geology of the project site is glacio-fluvial deposits, which consists of primarily sand and gravel with cobbles, as shown in *Figure 3, Surficial Geology*. The subsurface conditions encountered below the fill material at this site generally fits the geologic description.

Based on the “Bedrock Geologic Map of Massachusetts,” compiled by Zen, E-an, Goldsmith, Richard, Ratcliffe, N.M., Robinson, Peter, Stanley, R.S., Hatch, N.L., Shride, A.F., Weed, E.G.A., and Wones, D.R. in 1983, the bedrock geology generally consists of Roxbury Conglomerate, which consists of conglomerate, sandstone, siltstone, argillite, and melaphyre. Refusal was encountered at a depth of approximately 17 feet bgs at Boring B-3, however, the material was not cored for classification.

2.1.2 SOIL TEST BORINGS

The subsurface conditions encountered at the specific boring locations for the proposed building addition and new building options are presented as individual soil profiles and descriptions on the Soil Test Boring Logs in the Appendix. The stratification presented is based on a visual assessment of the recovered soil samples and the interpretation of field logs by a PSI representative. The Standard Penetration Test values (N-values), which are shown on the Soil Test Boring Logs, have been empirically correlated with various soil properties and are indicative of the relative density of cohesionless soils.

A brief description of the soils encountered at the site is presented in this section. Details are shown in the Soil Test Boring Logs.

BITUMINOUS CONCRETE – Approximately 3 to 4 inches of surficial Bituminous Concrete pavement was encountered at Borings B-1 and B-4. Note that the actual thickness of bituminous concrete may vary within the site and may be greater or lesser. The contractor should determine the depth of bituminous concrete pavement to quantify depths for removal purposes.

TOPSOIL – At Borings B-2 and B-3, approximately 4 to 6 inches of surficial Topsoil was encountered. Note that the actual amount of topsoil may vary widely between boring locations. The contractor should determine the depth of topsoil to quantify depths for removal purposes.

FILL – Approximately 3 to 8 feet of material classified as Fill was encountered immediately below the surficial Bituminous Concrete at Borings B-1 and B-4 and the surficial Topsoil at Borings B-2 and B-3. The Fill material is most likely the result of original site development (possibly site grading). The general material description is dark brown, fine to coarse sand, little silt, with trace to some gravel and orange brown to brown, fine to coarse sand, trace to little silt, with little to some gravel. At Boring B-4, pieces of brick and trace fibrous organics (twigs) were present in the recovered samples, indicating the material to be Fill. The Standard Penetration Test (SPT) N-values ranged from 9 blows per foot (bpf) to 50 or more blows for 1 to 5 inches of sampler penetration, indicating loose to very dense relative densities, although the majority of the N-values were in the medium dense relative density range.

It should be stressed however that in miscellaneous fill, the N-values can be erratic, reflecting the variable composition of the fill material. The presence of obstruction and/or cobbles within fill can result in locally high N-values, even in a very loose soil. Other obstructions may be present in a miscellaneous uncontrolled fill and may not be readily detectable with exploratory drill rig methods.

SAND AND GRAVEL – At each boring location, Sand and Gravel soils were encountered below the Fill material and extended to depths of approximately 17 to 22 feet bgs, where Boring B-3 encountered refusal and where Borings B-1, B-2, and B-4 were terminated at the scheduled depths. The general material description is brown, fine to coarse sand, trace silt, with little to some gravel. The SPT N-values ranged from 36 bpf to 50 or more blows for 1 to 5 inches of sampler penetration, indicating dense to very dense relative densities, although the majority of the N-values were in the very dense relative density range.

REFUSAL – Macrocore refusal was encountered at Boring B-3 at a depth of approximately 17 feet bgs, which is believed to be caused by a large boulder/cobble. The material was not cored for classification.

2.2 GROUNDWATER CONDITIONS

At the time of the borings (September 2020), groundwater infiltrating the boreholes was not encountered during drilling and sampling operations. For safety purposes, all the borings were backfilled upon completion of drilling and sampling.

The observations represent the groundwater condition (or absence of) at the time of measurement and may not be indicative of other times. The level of groundwater below the ground surface fluctuates based on conditions such as season, temperature, and amount of precipitation that might be different from the time when the observations were made. Therefore, the groundwater levels can be higher or lower during construction and during the life of the structure. This fact must be taken into consideration when developing earthwork procedures.

2.3 SOIL LABORATORY TESTING

2.3.1 LABORATORY RESULTS

PSI tested soil samples for moisture content and gradation to assist in classifying the material and determining the percent fines (percent passing the Number 200 sieve). The material test reports for the samples are in the Appendix of this report and results are summarized in the following table.

Boring No.	Sample No.	Sample Depth (feet)	USCS Classification[1]	Moisture Content (%)	Fines Content (%)
B-4	S1	0.5'-2.5'	Poorly-Graded Sand with Silt and Gravel (SP-SM)	2.9	9.1
B-4	S2	2.5'-4.5'	Well-Graded Sand with Silt and Gravel (SW-SM)	9	12
B-3	S3	5'-7'	Well-Graded Sand with Silt and Gravel (SW-SM)	1.8	8

[1] For USCS Soil Classification definitions, refer to the Soil Classification Chart in the APPENDIX

2.3.2 REUSE OF EXCAVATED SOIL

Based on the results of the laboratory testing, PSI anticipates that the excavated orange brown to brown Fill soils and the Sand and Gravel natural soils may meet the specific gradation requirements for Granular or Structural Fill. This material will be acceptable for reuse provided that the material continues to meet the project specifications and can be compacted to the required degree of compaction.

The dark brown Fill material may meet the gradation requirements for Granular or Structural Fill, however, pieces of brick and fibrous organics (twigs) were observed within some soil samples, which might eliminate reusing the material. Fill soil containing deleterious materials should not be reused. If there are any contamination concerns within the materials excavated, it should be addressed by a qualified environmental consultant. Specific environmental studies were not part of our scope of services. PSI's branch which provides environmental consultation could be engaged for further studies during site development and construction.

3.0 PRELIMINARY RECOMMENDATIONS

3.1 GENERAL

The following preliminary geotechnical design recommendations have been developed for the proposed building addition and new building options based on the previously described project information, the currently planned building and pavement area layouts, and subsurface conditions encountered at this site.

Note that these findings are preliminary and may not be sufficient for final design. Additional explorations, especially within the proposed final building footprint, may be necessary to provide additional information to develop final design recommendations. If the additional explorations reveal differing conditions, PSI reserves the right to amend the recommendations presented below.

The subsurface conditions encountered at this site within the proposed building footprint consist of approximately 3 to 8 feet of loose to very dense Fill material underlain by dense to very dense Sand and Gravel soils to the depths explored. The Fill material is undocumented and may be associated with previously placed general fill or placed as backfill around underground utilities. Undocumented fill is fill material in which no information was provided regarding the procedures that might have been used to backfill and compact the material to satisfactory engineering standards.

Due to the potential variability and potential for deleterious inclusions of human-placed fill, total and differential settlement predictions for foundations and grade-supported concrete floor slabs supported on undocumented fill carry with it less confidence and, therefore, more risk. The degree of acceptable risk of excessive total and differential settlement must be evaluated and accepted by the Owner. This risk can only be significantly reduced through removal and replacement of the existing fill, ground improvement systems such as aggregate piers/stone columns, or deep foundations.

3.2 REMOVING EXISTING FOUNDATIONS

PSI understands the existing Newton Senior Center building may be demolished in part or whole. Based on the schematic drawings provided by the Client, proposed portions of the new Center for Active Living building footprint may be constructed within portions of the footprint of the existing building.

Where the new construction encroaches into the existing building's footprint, the existing building and foundations must be entirely removed to a lateral distance defined by a 1:1 slope extending downward from the outer edge of the new exterior footings to the bottom of the cut or to a lateral distance of 10 feet beyond the perimeter of the new building, whichever is greater. All excavations resulting from demolition operations should be backfilled in accordance with the recommendations in Section 4 of this report.

Once the existing building and foundations are demolished and required backfill is complete, the subgrade soils at design finished subgrades and prior to placement of any additional new fill to attain design finished subgrades must be proof-compacted to densify soil that might be loose. Densifying the soil is important to provide relatively uniform compact conditions and to test for potentially weak areas.

Excavations resulting from demolition and overexcavations to remove yielding soils following proof-compacting should be backfilled with Structural or Granular Fill that meets the specified material requirements. Structural Fill should be used below footing grade, while Granular Fill can be used above footing grade. Lifts must be controlled so that they do not exceed 6-inches in confined areas and 8-inches in open areas where larger compactors can be used, and the material must be compacted to at least 95% of the maximum dry unit weight determined in accordance with ASTM D1557 at plus/minus 2% of the optimum moisture content. At a minimum, a 10,000-pound self-propelled vibratory drum compactor should be used vibrating at least 25 hertz or greater and making at least 6 passes over the backfill in perpendicular directions.

3.3 FOUNDATIONS

3.3.1 EXCAVATE AND REPLACE FILL

The site within the area of the proposed new building consists of approximately 3 to 8 feet of Fill. The area with the deepest depth of Fill material was at Boring B-4, performed near the stairwell leading down to the basement level of the existing structure. Due to the potential variability and potential for deleterious inclusions of human-placed fill, total and differential settlement predictions for foundations supported on undocumented fill carry with it less confidence and, therefore, more risk. Therefore, foundations should not bear directly on the Fill material without further assessment or otherwise removing the material and replacing with Structural Fill compacted to the required degree of compaction. Generally, it is our experience that removal and replacement is a feasible economic alternative when the removal depth is less than 10 feet deep, especially when space is available for open cuts and dewatering is not anticipated at the site.

The recommended alternative includes removing the existing Fill entirely down to undisturbed natural material. In accordance with OSHA, the sidewalls of excavation should be sloped to prevent cave in and to protect on-site workers. The lateral extent of excavation at the bottom of the cut should be defined by a line extending down on a 1:1 slope from the exterior edge of the perimeter footings to the bottom of the Fill or 5 feet, whichever is greater.

Once the existing Fill is excavated and the subgrade densified, the excavation should be backfilled with Structural or Granular Fill that meets the specified material requirements. Fill material below footings should be Structural Fill material, while Granular Fill can be used below pavement subgrade and above footing bearing levels. Lifts must be controlled so that they do not exceed 6-inches in confined areas and 12-inches in open areas where larger compactors can be utilized and the material must be compacted to at least 95% of the maximum dry density determined in accordance with ASTM D1557 at plus/minus 2% of the optimum moisture content.

3.3.2 FOOTINGS

Exterior footings should be placed at least 4 feet below the lowest adjacent exterior finished grade for frost protection and interior footings should be placed at the nominal depth below the floor slab as required by the Building Code.

PSI anticipates that footings will bear upon the natural, undisturbed Sand and Gravel soils or properly compacted Structural Fill depending upon the actual design grades. Conventional footing foundations bearing in approved natural soils and new, properly compacted, Structural Fill may be proportioned using a maximum allowable net bearing pressure of 2 tsf (4,000 psf). These pressures are acceptable if the minimum foundation width is 3 feet. For widths less than 3 feet, the design pressure recommended above should be reduced by a factor of B/3, where B is the actual footing width. For this pressure, settlements should be within tolerable limits of 1-inch total and ½-inch differential over 20 feet.

PSI recommends that wall footings have a minimum width of 18 inches and that column footings have a minimum width of 24 inches, regardless of the actual bearing pressure. Wall footings should be provided with continuous longitudinal steel reinforcement, as determined by the structural engineer, for greater bending strength so they can span across small areas of loose or soft soils that may go undetected during construction.

All foundation bearing materials should be proof-compacted to densify these materials as a result of the excavation process or if loose in their natural state. Densifying the soil below the footing grade is important to provide relatively uniform compact conditions and to test for potentially weak areas.

After excavating and compacting the foundation soils, the contractor may elect (means and methods) to place a 4 to 6-inch layer of ¾-inch angular crushed stone over the footing subgrade to provide a firm working surface, reduce the possibility of disturbing the footing subgrade, and to provide a drainage layer to remove water that might accumulate due to groundwater or precipitation. Footings bearing on new, properly placed and compacted Structural Fill do not require a stone layer below the footing.

Footing reinforcement and concrete should be placed as soon as practical following completion of excavation to final grade and proof-compacting the footing subgrade. Once the footing concrete is placed, the foundations should be backfilled with Structural or Granular Fill as soon as the concrete has cured to an acceptable degree to allow backfilling. The backfill serves to protect the footing as a component of overturning resistance and prevents accumulation of water around the foundations which can soften and weaken the bearing soils. The ground surface near the completed foundations should be sloped to drain away from the foundations throughout construction to avoid accumulation of moisture in the subgrade soils.

The foundation subgrade should be observed by the geotechnical engineer of record or a representative prior to formwork to document that the foundation materials are consistent with this report.

3.3.3 GROUND IMPROVEMENT ALTERNATIVES

A ground improvement system may also be considered as a risk-adverse alternative for implementation of conventional footing foundations and grade-supported slabs for the new building structure. Ground improvement systems such as Rammed Aggregate Piers (RAPs) and Controlled Modulus Columns (CMCs) are commonly implemented in this geographic area.

RAPs improve soft/loose soils by vibration, compaction, and ramming of thin lifts of crushed rock into a drilled hole. Holes are drilled into the foundation soils and then very dense, high quality crushed stone is compacted into the drilled hole expanding the hole into the adjacent soil. The vertical ramming action increases the lateral stress and improves the soils surrounding the cavity, which results in foundation settlement control and greater bearing pressures for design.

For CMCs, reverse flight displacement augers are used to drill holes into the foundation soils and then grout or concrete is used to fill the holes, essentially creating concrete columns. The difference between the RAP and CMC systems is that CMCs are a vibration-free process, making it ideal for sensitive locations.

The RAP and CMC systems are designed to reinforce the soil within a zone beneath shallow footings where the stresses are the highest. To accomplish this, the ground improvement elements are typically installed to depths ranging between one and two times the foundation width for settlement control and do not need to extend into a dense soil layer or bedrock like a pile foundation. An advantage of the RAP and CMC systems is that they are cost effective as they allow the foundation to be designed as if it were founded on dense gravel using conventional shallow spread footings and slab-on-grade.

Following implementation of a ground improvement program, designed by a qualified specialty contractor, a shallow foundation system is considered feasible. The allowable soil bearing pressure that can be used after ground improvement will be dependent upon the improvement program design and is typically specified by the specialty contractor. Typically, these systems can provide for design bearing pressures ranging from 3,000 to 6,000 psf. The final design bearing pressure will be selected by the ground improvement contractor.

If implemented, we recommend that the performance-based specification be designed to limit total and differential settlements to 1-inch and ½-inch over a 40-foot span, respectively. If this option is selected, we recommend that the ground modification plan be reviewed by PSI prior to implementation. Post evaluation is also recommended to confirm that the recommended performance specification settlement of 1-inch total and ½-inch differential has been achieved.

Although alternatives such as Ductile Iron Piles (DIPs) and Helical Piers can be used to support the perimeter foundation, they will not support the slab unless grade beams and a structural slab or a thickened slab are used. Piles could be used to support just the building but there would be a risk of settlement below the slab. Therefore, piles are not considered as a feasible alternative unless they also include supporting the slab. Ductile Iron Piles and Helical Piers are proprietary items. If these alternatives are considered further, then PSI recommends discussing these alternatives with specialty contractors to assess both feasibility and cost.

3.4 CONCRETE SLAB

Due to the potential variability and potential for deleterious inclusions of human-placed fill, total and differential settlement predictions for grade-supported concrete floor slabs supported on undocumented fill carry with it less confidence and, therefore, more risk. The degree of acceptable risk of excessive total and differential settlement must be evaluated and accepted by the Owner. Provided the risk of settlement of unremoved fill is acceptable by the Owner and all subgrade soils exhibiting yielding or rutting under proofroll equipment loads are corrected, the floor slabs may be designed as grade-supported slabs.

However, in order to completely eliminate the risk of settlement, the existing Fill would have to be removed and replaced. Subsurface soil conditions are suitable for supporting a slab-on-grade for the building after excavating and filling to the base course subgrade layer and proof-rolling the footprint to densify the subgrade soil. Fill required to raise the site to the slab base course grade should be compacted Structural or Granular Fill.

The slab subgrade should be proof-rolled to verify that the soil is firm prior to constructing the slab base course layer. A vibratory drum compactor (10-ton minimum weight at the drum) should be used, making at least 5 passes over the subgrade at the bottom of the excavation. Soft soils exhibiting yielding and/or rutting conditions under proof-roll equipment loads should be overexcavated to a dense underlying stratum and replaced with compacted Structural or Granular Fill.

To reduce the possibility of capillary rise of groundwater and moisture into the floor slab, PSI recommends that the concrete floor slabs be constructed over a 4-inch thick layer of compacted, freely draining base course material such as the ¾-inch angular Crushed Stone or a 6-inch thick layer of Dense Graded Crushed Stone, both as specified herein. Base course soil material must be compacted to at least 95% of the maximum dry density determined in accordance with ASTM D1557. Crushed Stone must be tamped into firm interlock so that it is firm and stable.

PSI recommends that a continuous vapor retarder of at least 10-mil thick, or as specified by the structural engineer, be installed between the slab and the base course to reduce migration of moisture.

For subgrade prepared as recommended and properly compacted Granular or Structural Fill, a modulus of subgrade reaction, *k* value, of 150 pounds per cubic inch (pci) may be used in the grade slab design based on values typically obtained from 1 ft. x 1ft. plate load tests. However, depending on how the slab load is applied, the value will have to be geometrically modified. The value should be adjusted for larger areas using the following expression for cohesive and cohesionless soil:

Modulus of Subgrade Reaction, $k_s = \left(\frac{k}{B}\right)$ for cohesive soil and

$k_s = k\left(\frac{B+1}{2B}\right)^2$ for cohesionless soil

where: k_s = coefficient of vertical subgrade reaction for loaded area
k = coefficient of vertical subgrade reaction for 1x1 square foot area
B = width of area loaded, in feet

Cosmetic cracking of slabs-on-grade is normal and should be expected. Cracking can occur not only as a result of heaving or compression of the underlying soil, but also as a result of concrete curing stresses. To reduce the potential for cracking, the following listed precautions should be closely followed for construction of all slabs-on-grade:

- PSI recommends installing construction joints between the floor slab and the walls and columns to account for differential settlement between the footings and slab. Concrete slabs should be jointed according to the American Concrete Institute (ACI) requirements, or other suitable code.
- All backfill in areas supporting slabs should be moisture conditioned and compacted. Backfill in all interior and exterior water and utility line trenches should be carefully compacted to match adjacent soils.
- Exterior slabs should be isolated from the building. These slabs should be constructed to function as independent units. Movement of these slabs should not be transmitted to the building foundation or superstructure.

3.5 SEISMIC CONSIDERATIONS

Subsurface conditions beginning at the surface of the site within the building footprint consist of loose to very dense Fill material underlain by dense to very dense Sand and Gravel soils to the depths explored. At Boring B-3, macrocore refusal was encountered at a depth of approximately 17 feet bgs, which is interpreted as a large boulder/cobble.

Based on the preliminary explorations, it is PSI's opinion that the site should be classified as Site Class C as defined in the Building Code and using the available information, if necessary, for design. Seismic values based on Site Class C are presented in the following table.

2015 International Building Code and Massachusetts Amendments	Reference	Equation	Value
City – Newton, MA			
Site Class Definition	1613.3.2	C	
Earthquake Design Factors (short)	Table 1604.11	S_S	0.208
Earthquake Design Factors (1 -sec)	Table 1604.11	S_1	0.068
Site Coefficient - F_a	Table 1613.3.3(1)	F_a	1.2
Site Coefficient - F_v	Table 1613.3.3(2)	F_v	1.7
Max EQ spectral response - S_{MS}	Eq 16-37	F_a*S_S	0.250
Max EQ spectral response - S_{M1}	Eq 16-38	F_v*S_1	0.116
Design spectral response acceleration - S_{DS}	Eq 16-39	$2/3*S_{MS}$	0.167
Design spectral response acceleration - S_{D1}	Eq 16-40	$2/3*S_{M1}$	0.077

The subsurface conditions to the depths explored at the site were also assessed for its liquefaction potential using the guidance provided in the 2015 International Building Code. It is PSI's opinion that the site is not susceptible to liquefaction to the depths explored.

4.0 CONSTRUCTION CONSIDERATIONS

4.1 EARTHWORK

In the preceding sections, PSI has outlined several recommendations for earthwork. There are additional recommendations provided herein which should be incorporated into the structural design and Contract Documents.

1. Following initial demolition (removal of existing pavements, concrete, utilities to be abandoned/relocated) and removal of all surficial vegetation, topsoil, root mat, shrubbery, and trees (including root systems and root balls) at the design finished subgrades in planned cut areas and prior to placement of new fill (if needed), the exposed subgrades should be proof-rolled using a minimum 10-ton, smooth-drum roller. Proof-rolling should be performed in the presence of a representative of PSI. Subgrade materials exhibiting yielding and/or rutting conditions should be scarified, aerated, and re-compacted, removed and replaced, or stabilized in place through addition of geo-grid and/or coarse aggregate.

2. Soil compaction criteria requires compaction of at least 95 percent of the maximum dry density determined in accordance with ASTM D1557 at plus/minus 2% of the optimum moisture content. Lifts must be controlled so that they do not exceed 6 inches in confined areas and 12 inches in open areas where larger compactors can be utilized. Use hand-operated equipment within 10 feet behind retaining walls and do not over-compact the backfill material. All fill placed within and below the structure must be compacted in accordance with ASTM D1557.

3. All excavations shall be stabilized by cutting back the side slopes or using shoring and bracing as required by 29 CFR 1926 Subpart P, Excavations. Plans and specifications should refer to this requirement so that contractors are aware of their responsibility.

4. Drainage must not be directed onto adjacent property either during construction or as part of the design grading, especially if this would affect groundwater and / or moisture conditions on the adjacent parcel.

5. Proof-compact the foundation soil at each footing excavation to verify that the material is firm and compact.

4.2 CONSTRUCTION DEWATERING

Groundwater was not observed within the borings during the field exploration program at the site. Therefore, excavations are not expected to encounter groundwater.

Should groundwater or wet conditions be encountered, it is PSI's opinion that dewatering can be handled by pumping from the bottom of the excavation. If dewatering is necessary, the contractor is solely responsible for designing all dewatering systems and maintaining a groundwater level that is at least 24 inches below the bottom of the excavation so that the bottom of the excavation remains firm and dry to allow placing and compacting of fill.

The contractor is responsible for maintaining a dewatered and firm subgrade condition and is solely responsible for selecting the method of groundwater control, designing, and maintaining the system. PSI recommends that this requirement be stated in the project specifications.

4.3 MATERIALS

PSI recommends that the following material gradations and names be used for consistency on the drawings and in the earthwork specifications. All material must be well graded between the limits shown herein and be capable of being compacted to the required degree of density. The material shall have sufficient fines so that it does not shove and remains stable.

PSI also recommends that the specifications not allow the use of recycled material such as reprocessed building demolition material. Material having more than 30 percent retained on the ¾-inch sieve may be difficult to test for compaction. Therefore, PSI recommends that the material selected also be satisfactory for compaction testing purposes.

Common Borrow

Friable, natural soil containing no gravel greater than 2/3 loose lift thickness and free of trash, snow, ice, organics, roots, and tree stumps and no more than 35 percent passing the No. 200 sieve. Common borrow can be used as general site backfill provided it can be compacted and stabilized for the intended purpose.

Structural Fill (recommended for over-excavation backfill below footing grade):

Natural or processed materials meeting the following grading ranges.

Sieve Size	Percent Finer
3-inches	100
½-inches	50 - 100
No. 4	30 - 85
No. 10	20 - 75
No. 40	5 - 35
No. 200	0-10

Granular Fill (recommended for general site fill and backfill above footing grade):

Natural or processed materials meeting the following grading ranges.

Sieve Size	Percent Finer
2-inches	100
No. 10	30 - 95
No. 40	10 - 70
No. 200	0 - 15

Dense Graded Crushed Stone (recommended as the granular base for floor slabs):

Dense graded crushed rock meeting the following grading ranges.

Sieve Size	Percent Finer
2-inch	100
1½-inch	70 - 100
¾-inches	50 - 85
No. 4	30 - 55
No. 50	8 - 24
No. 200	3 - 10

Crushed Stone:

The crushed stone should meet the requirements for material M2.01.4 (3/4-inch gradation) stated in the Massachusetts Highway Department Standard Specifications for Highways and Bridges.

5.0 GEOTECHNICAL RISK

The concept of risk is an important aspect of the geotechnical evaluation. The primary reason for this is that the analytical methods used to develop geotechnical recommendations do not comprise an exact science. Site exploration identifies actual subsurface conditions only at those points where samples are taken.

A geotechnical report is based on conditions that existed at the time of the subsurface exploration. The analytical tools which geotechnical engineers use are generally empirical and must be used in conjunction with engineering judgment and experience. Therefore, the solutions and recommendations presented in the geotechnical evaluation should not be considered risk-free and, more importantly, are not a guarantee that the interaction between the soils and the proposed structure will perform as planned.

The engineering recommendations presented in the preceding sections constitute PSI’s professional estimate of those measures that are necessary for the proposed structure to perform according to the proposed design based on the information generated and referenced during this evaluation, and PSI’s experience in working with these conditions.

6.0 REPORT LIMITATIONS

PSI’s professional services have been performed and our preliminary findings presented in accordance with generally accepted geotechnical engineering principles and practices. PSI is not responsible for the conclusions, opinions, or recommendations made by others based on this data. No other warranties are implied or expressed. As stated previously, our recommendations are made based on the limited information available.

The scope of explorations was intended to assess soil conditions within the influence of the proposed foundations. The analyses and preliminary recommendations submitted in this report are based upon the data obtained from the soil borings performed at the locations indicated. If subsoil variations become evident during this project, a re-assessment of the recommendations contained in this report will be necessary after we have had an opportunity to observe the characteristics of the conditions encountered. The applicability of the report should also be reviewed in the event significant changes occur in the design, nature, or location of the proposed structure.

The scope of our services does not include any environmental assessment or investigation for the presence or absence of hazardous or toxic materials in the soil, groundwater, or surface water within or beyond the site studied. Any statements in this report regarding odors, staining of soils, or other unusual conditions observed are strictly for the information of our Client.

PSI did not provide any service to investigate or detect the presence of moisture, mold or other biological contaminate in or around any structure, or any service that was designed or intended to prevent or lower the risk of the occurrence of the amplification of the same. Mold is ubiquitous to the environment with mold amplification occurring when building materials are impacted by moisture. Site conditions are outside of PSI’s control, and mold amplification will likely occur, or continue to occur, in the presence of moisture. As such, PSI cannot and shall not be held responsible of the occurrence or recurrence of mold amplification.

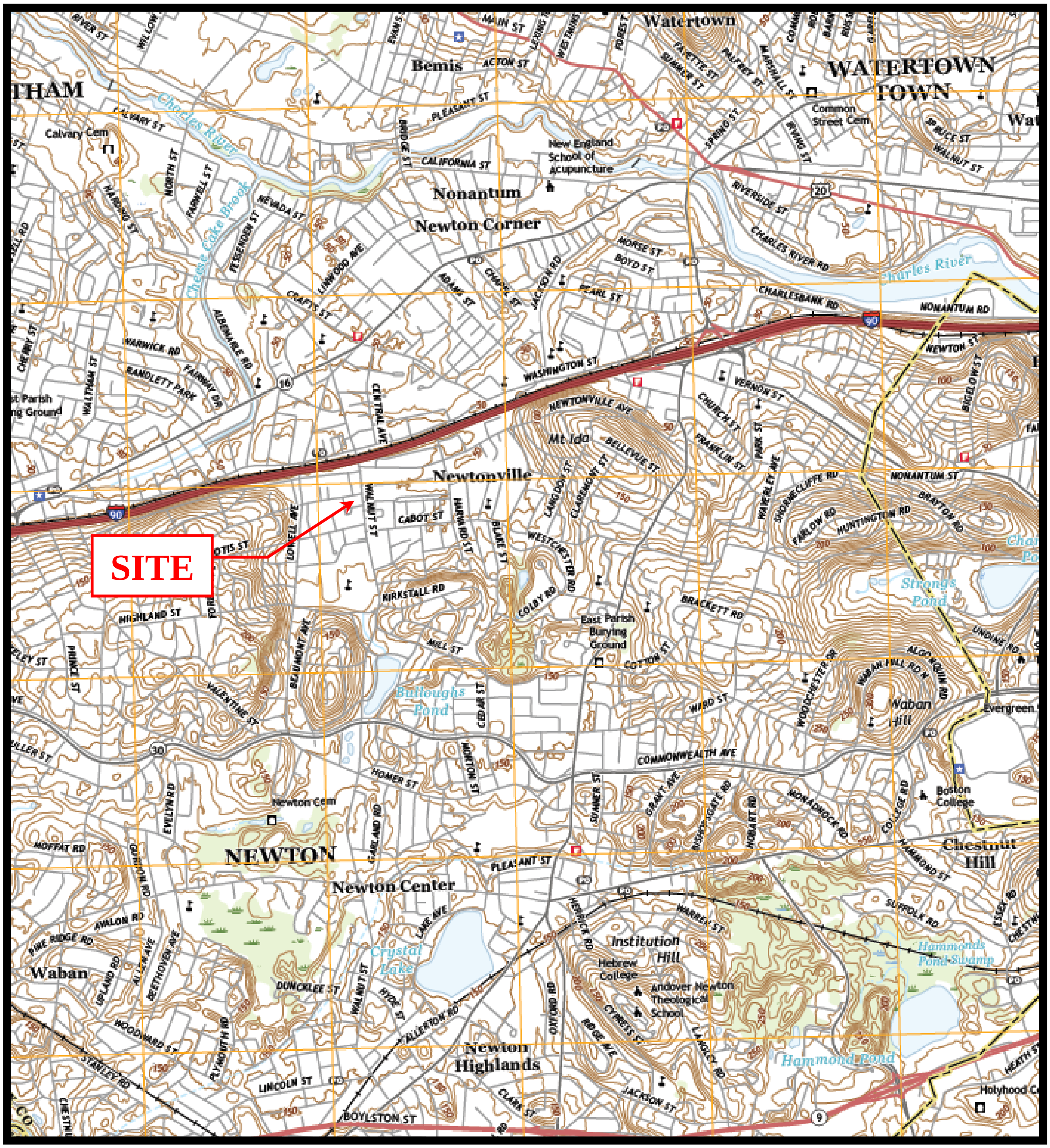
After the new construction option is selected and upon receipt of detailed design drawings, PSI should be retained and provided the opportunity to review the design plans, perform additional borings and laboratory testing if deemed necessary, and provide a final geotechnical evaluation and report.

FIGURES

Figure 1: USGS Site Location Plan

Figure 2: Boring Location Plan

Figure 3: Surficial Geology



REFERENCE: U.S.G.S. “NEWTON, MA” 7.5’ QUADRANGLE MAP
ISSUED: 2018

FIGURE 1: USGS SITE LOCATION PLAN

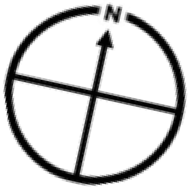
PROJECT NAME:
Proposed New Center for Active Living
345 Walnut Street
Newtonville, MA 02460

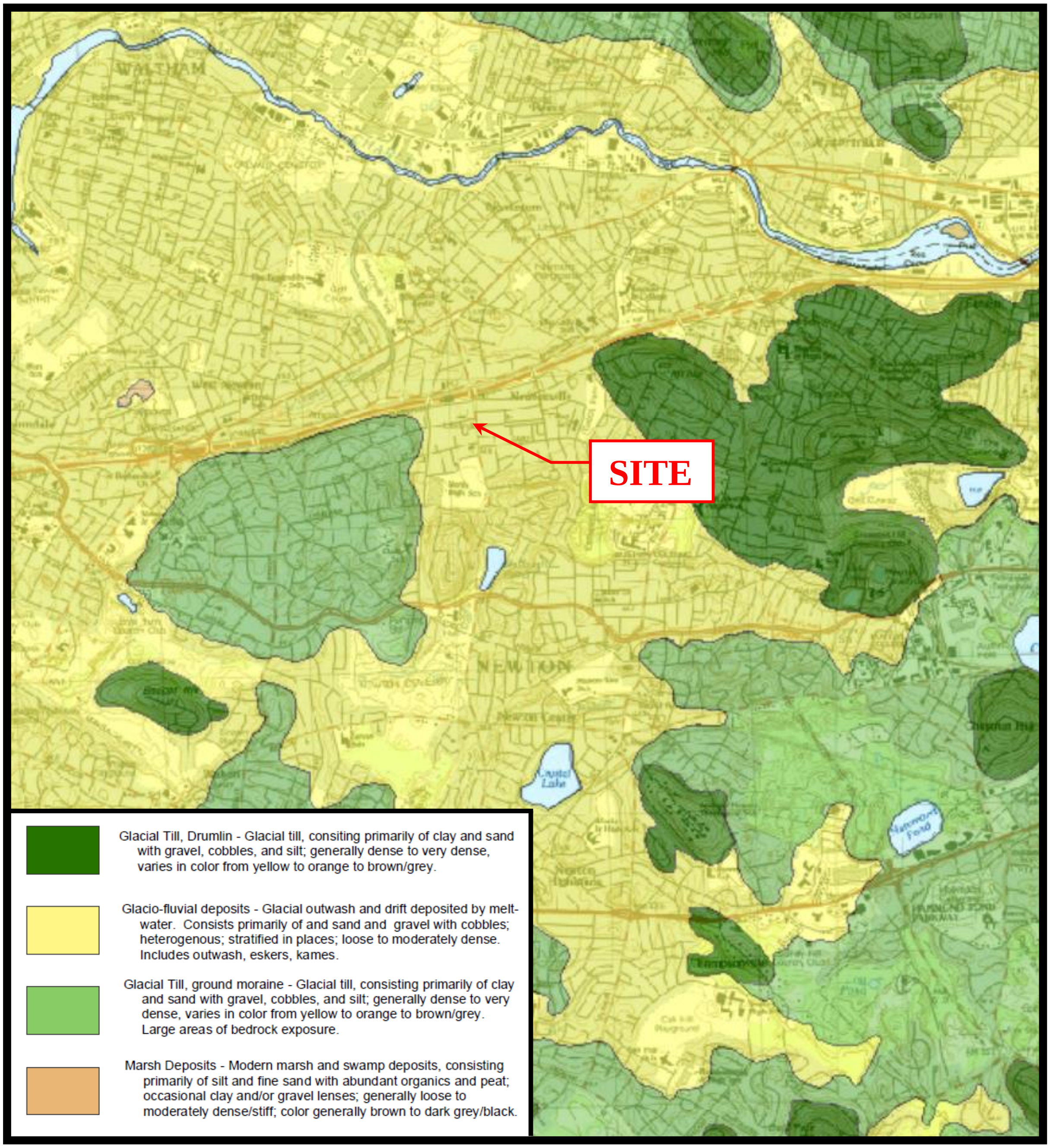
PSI Project No.	Date	Scale
04461013	September 2020	N.T.S.

● Boring Location

- Base Plan is Newtonville New Construction: 4 Stories Site Plan (dated 8/26/20) provided by Client.
- Borings were located in the field by PSI. Locations are approximate.
- Borings drilled on September 23, 2020 by Soil X Corp. of Leominster, MA.

FIGURE 2: BORING LOCATION PLAN	PSI Project No.	Date
PROJECT: Proposed New Center for Active Living 345 Walnut Street Newtonville, MA 02460	04461013	September 2020





<u>REFERENCE:</u> “Plate 5 Surficial Geologic Map of the Newton Quadrangle, Massachusetts”
Compiled by C.M. Brankman - 2004

FIGURE 3: SURFICIAL GEOLOGY		**PSI Project No.**	**Date**	**Scale**
PROJECT NAME: Proposed New Center for Active Living 345 Walnut Street Newtonville, MA 02460		04461013	September 2020	N.T.S.

APPENDIX

Boring Logs

Legend for Graphic Log

■	**Bituminous Concrete**
▒	**Topsoil**
▩	**Fill**
●	**Sand and Gravel**

BORING B-1

DATE STARTED: 9/23/20
DATE COMPLETED: 9/23/20
COMPLETION DEPTH 22.0 ft
BENCHMARK: N/A
ELEVATION: 55 ft
LATITUDE:
LONGITUDE:
STATION: N/A **OFFSET:** N/A
REMARKS: Ground elevation based on information contained on Google Earth

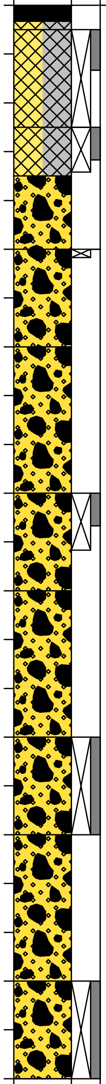
DRILL COMPANY: Soil X Corp.
DRILLER: Don Leger **LOGGED BY:** Intertek-PSI
DRILL RIG: Geoprobe 7822
DRILLING METHOD: Flush Joint Casing
SAMPLING METHOD: SS
HAMMER TYPE: Automatic
EFFICIENCY N/A
REVIEWED BY: Brianna Hansen

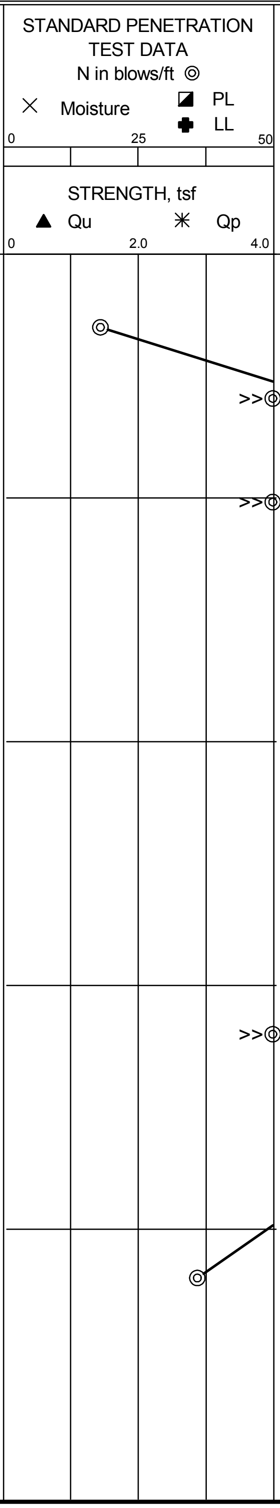
Water ∇ ▼ ▼ Dry

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0				Approximately 4" of bituminous concrete				
			1	10	Medium dense Brown, fine to coarse sand, trace silt, little gravel **(Fill)** Bottom 5"- Orange brown to dark brown, fine to medium sand, trace coarse sand, little silt, trace roots **(Fill)**		13-10-8-9 N=18		
			2	8			16-50/5"		
					Very dense, brown, fine to coarse sand, trace to little silt, little to some gravel **(Fill)**				
50	5		3	0	Very dense, no recovery		65/2"		
45	10		4	8	Very dense, brown, fine to coarse sand, trace silt, some gravel **(Glaciofluvial Deposits)**		66-35-50/2"		
40	15		5	24	Very dense, brown, fine to coarse sand, trace silt, some gravel **(Glaciofluvial Deposits)**		53-52-49-50 N=101		
35	20		6	24	Dense, brown, fine to coarse sand, trace silt, little to some gravel **(Glaciofluvial Deposits)**		23-18-18-18 N=36		
					Boring terminated at approx. 22 feet bgs				

Graphic Log





Professional Service Industries, Inc.
480 Neponset Street, Suite 9C
Canton, MA 02021
Telephone: (781) 821-2355

PROJECT NO.: 04461013
PROJECT: Newtonville Center for Active Living
LOCATION: 345 Walnut Street
Newtonville, MA 02460

The stratification lines represent approximate boundaries. The transition may be gradual.

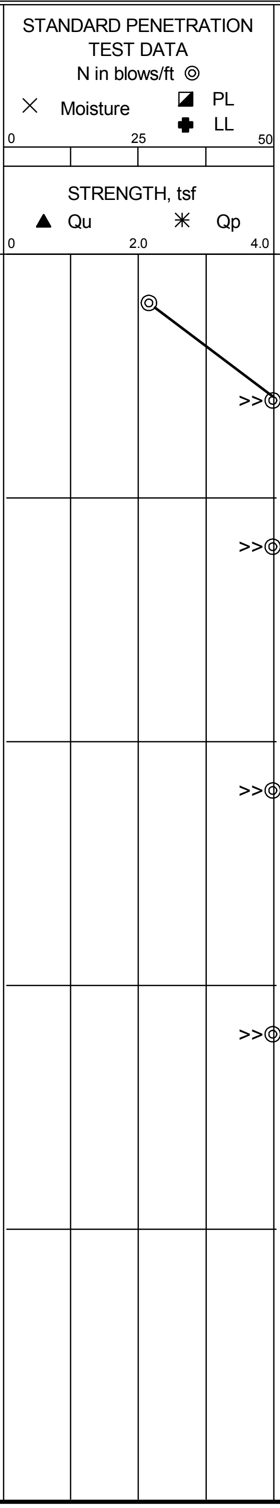
DATE STARTED: 9/23/20
DATE COMPLETED: 9/23/20
COMPLETION DEPTH 22.0 ft
BENCHMARK: N/A
ELEVATION: 55 ft
LATITUDE:
LONGITUDE:
STATION: N/A **OFFSET:** N/A
REMARKS: Ground elevation based on information contained on Google Earth

DRILL COMPANY: Soil X Corp.
DRILLER: Don Leger **LOGGED BY:** Intertek-PSI
DRILL RIG: Geoprobe 7822
DRILLING METHOD: Flush Joint Casing
SAMPLING METHOD: SS
HAMMER TYPE: Automatic
EFFICIENCY N/A
REVIEWED BY: Brianna Hansen

BORING B-2

Water ▽ Dry
▼
▼

BORING LOCATION:



Elevation (feet)	Depth, (feet)	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0				Approximately 4" of topsoil				
		☒	1	12	Medium dense, dark brown, fine to coarse sand, little silt, trace to little gravel **(Fill)**		4-10-17-15 N=27		
		☒	2	16	Very dense, dark brown, fine to coarse sand, little silt, trace gravel **(Fill)** Very dense, brown, fine to coarse sand, trace silt, little gravel **(Glaciofluvial Deposits)**		16-21-30-32 N=51		
50	5	☒	3	15	Very dense, brown, fine to coarse sand, trace silt, some gravel **(Glaciofluvial Deposits)**		59-47-38-38 N=85		
45	10	☒	4	17	Very dense, brown, fine to coarse sand, trace silt, some gravel **(Glaciofluvial Deposits)**		29-30-28-27 N=58		
40	15	☒	5	24	Very dense, brown, fine to coarse sand, trace silt, some gravel **(Glaciofluvial Deposits)**		39-30-29-30 N=59		
35	20	☒	6	15	Very dense, brown, fine to coarse sand, trace silt, some gravel **(Glaciofluvial Deposits)**		40-55-60/5"		
					Boring terminated at approx. 22 feet bgs				

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480 Neponset Street, Suite 9C
Canton, MA 02021
Telephone: (781) 821-2355

PROJECT NO.: 04461013
PROJECT: Newtonville Center for Active Living
LOCATION: 345 Walnut Street
Newtonville, MA 02460

The stratification lines represent approximate boundaries. The transition may be gradual.

DATE STARTED: 9/23/20
DATE COMPLETED: 9/23/20
COMPLETION DEPTH 17.0 ft
BENCHMARK: N/A
ELEVATION: 55 ft
LATITUDE:
LONGITUDE:
STATION: N/A **OFFSET:** N/A
REMARKS: Ground elevation based on information contained on Google Earth

DRILL COMPANY: Soil X Corp.
DRILLER: Don Leger **LOGGED BY:** Intertek-PSI
DRILL RIG: Geoprobe 7822
DRILLING METHOD: Flush Joint Casing
SAMPLING METHOD: SS
HAMMER TYPE: Automatic
EFFICIENCY N/A
REVIEWED BY: Brianna Hansen

BORING B-3

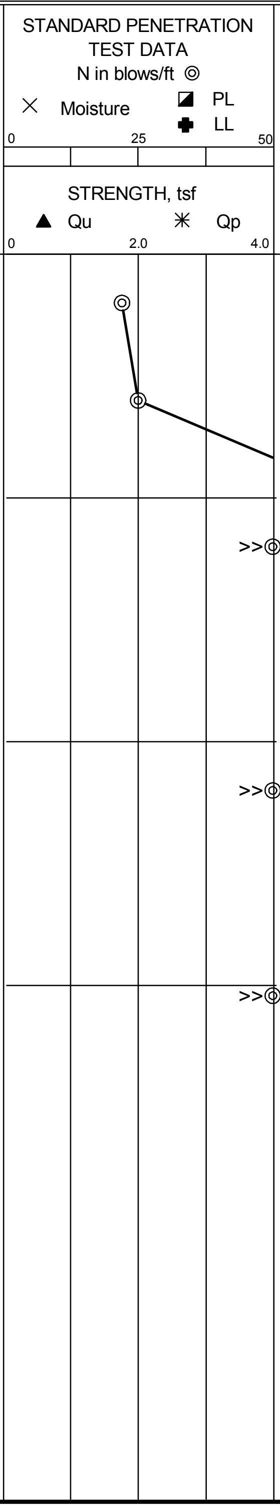
Water ▽ ▼ ▽ Dry

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0			Approximately 6" of topsoil				
		1	15	Medium dense, dark brown, fine to coarse sand, little silt, some gravel **(Fill)**		7-8-14-13 N=22		
		2	9	Medium dense Dark brown, fine to coarse sand, little silt, little gravel **(Fill)** Orange brown, fine to coarse sand, trace to little silt, little gravel **(Fill)**		10-11-14-22 N=25		
50	5							
		3	15	Very dense, brown, fine to coarse sand, trace silt, some gravel **(Glaciofluvial Deposits)**		41-39-50-29 N=89		
45	10							
		4	19	Very dense, brown, fine to coarse sand, trace silt, little to some gravel **(Glaciofluvial Deposits)**		38-33-33-55 N=66		
40	15							
		5	5	Very dense, brown, fine to coarse sand, trace silt, some gravel **(Glaciofluvial Deposits)**		60/5"		
				Macrocore refusal encountered at ~17 ft bgs				

Graphic Log


Sample Type

STANDARD PENETRATION TEST DATA
N in blows/ft ◎


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PROJECT NO.: 04461013
PROJECT: Newtonville Center for Active Living
LOCATION: 345 Walnut Street
Newtonville, MA 02460

The stratification lines represent approximate boundaries. The transition may be gradual.

BORING B-4

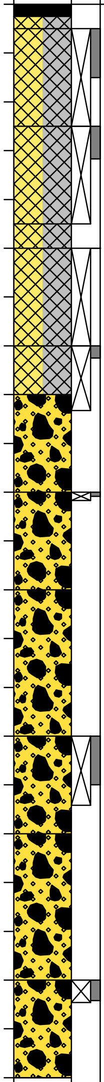
DATE STARTED: 9/23/20
DATE COMPLETED: 9/23/20
COMPLETION DEPTH 22.0 ft
BENCHMARK: N/A
ELEVATION: 56 ft
LATITUDE:
LONGITUDE:
STATION: N/A **OFFSET:** N/A
REMARKS: Ground elevation based on information contained on Google Earth

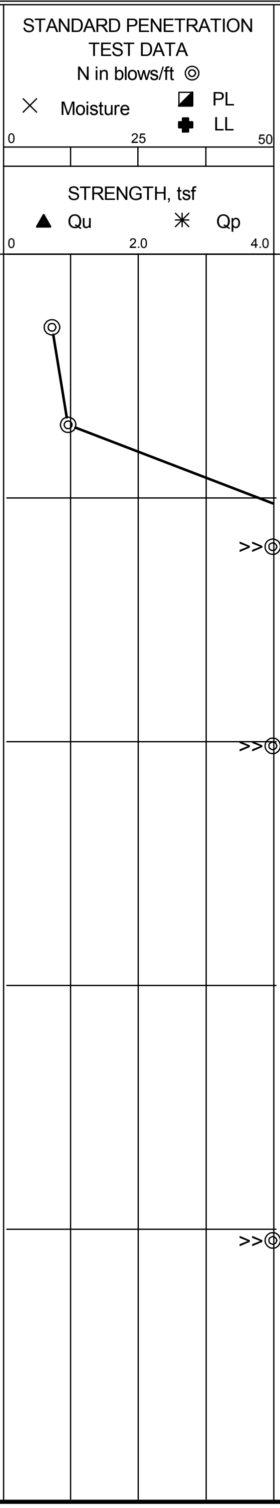
DRILL COMPANY: Soil X Corp.
DRILLER: Don Leger **LOGGED BY:** Intertek-PSI
DRILL RIG: Geoprobe 7822
DRILLING METHOD: Flush Joint Casing
SAMPLING METHOD: SS
HAMMER TYPE: Automatic
EFFICIENCY N/A
REVIEWED BY: Brianna Hansen

Water ▽ ▼ ▼ Dry

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0			Approximately 3" of bituminous concrete				
55		1	12	Loose Top 4"- Dark brown, fine to coarse sand, little silt, trace brick **(Fill)** Orange brown, fine to coarse sand, trace silt, little to some gravel **(Fill)**		7-5-4-5 N=9		
		2	8	Medium dense, dark brown, fine to coarse sand, little silt, little to some gravel, trace brick, trace fibrous organics/twigs **(Fill)**		6-7-5-3 N=12		
	5			Very dense, no recovery				
50		3	0			2-12-59-18 N=71		
		4	3	Very dense, dark brown, fine to coarse sand, little silt, little gravel, trace brick **(Fill)**		12-38-60/4"		
	10	5	1	Very dense, brown, fine to coarse sand, trace silt, little to some gravel **(Glaciofluvial Deposits)**		60/2"		
45								
	15	6	12	Very dense, brown, fine to coarse sand, trace silt, little to some gravel **(Glaciofluvial Deposits)**		11-23-63/5"		
40								
	20	7	5	Very dense, brown, fine to coarse sand, trace silt, some gravel **(Glaciofluvial Deposits)**		60/5.5"		
35								
				Boring terminated at approx. 22 feet bgs				





Professional Service Industries, Inc.
480 Neponset Street, Suite 9C
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Telephone: (781) 821-2355

PROJECT NO.: 04461013
PROJECT: Newtonville Center for Active Living
LOCATION: 345 Walnut Street
Newtonville, MA 02460

The stratification lines represent approximate boundaries. The transition may be gradual.

FIELD CLASSIFICATION SYSTEM FOR SOIL EXPLORATION

COHESIONLESS SOILS

(Silt, Sand, Gravel and Combinations)

Density

Very Loose	4 blows per foot or less
Loose	5 - 10 blows per foot
Medium Dense	11 - 30 blows per foot
Dense	31 - 50 blows per foot
Very Dense	51 blows per foot or more

Relative Properties

Descriptive Term	Percent
Trace	1 - 10
Little	11 - 20
Some	21 - 35
And	36 - 50

Particle Size Indentification

Boulders	8 inch diameter or more	
Cobbles	3 - 8 inch diameter	
Gravel	Coarse	1 - 3 inches
	Medium	1/2 - 1 inch
	Fine	1/4 - 1/2 inch
Sand	Coarse	0.6 mm - 1/4 inch (diameter of pencil lead)
	Medium	0.2 mm - 0.6 mm (diameter of broom straw)
	Fine	0.05 mm - 0.2 mm (diameter of human hair)
Silt		0.002 mm - 0.05 mm (cannot see particles)

COHESIVE SOILS

(Clay, Silt and Combinations)

Consistency

Very soft	2 blows per foot or less
Soft	3 - 4 blows per foot
Medim Stiff	5 - 8 blows per foot
Stiff	9 - 15 blows per foot
Very Stiff	16 - 30 blows per foot
Hard	31 blows per foot or more

Plasticity

Degree of Plasticity	Plasticity Index
None to slight	0 - 4
Slight	5 - 7
Medium	8 - 22
High to very high	over 22

CLASSIFICATION ON LOGS ARE MADE BY VISUAL EXAMINATION OF SAMPLES.

Standard Penetration Test	Driving a 2.0" O.D., 1 3/8" I.D., sampler a distance of 2.0 feet into undisturbed soil with a 140 pound hammer free falling a distance of 30 inches. The number of hammer blows required to drive the sampler into the soil in 6-inch increments is recorded. The sum of the hammer blows for the second and third interval provides the Standard Penetration Resistance (N) and is a measure of soil strength. The reader is referenced to ASTM D1586.
Strata Changes	Boundaries between soil layers are considered approximate based upon observed changes during the drilling operations or noted changes within representative samples.
Groundwater	Observations were made to determine either the depth or elevation of water at the times indicated on the Soil Exploration Logs. The water so encountered may be groundwater or perched water. The depth or elevations indicated for water may fluctuate due to seasonal changes or other unknown factors.

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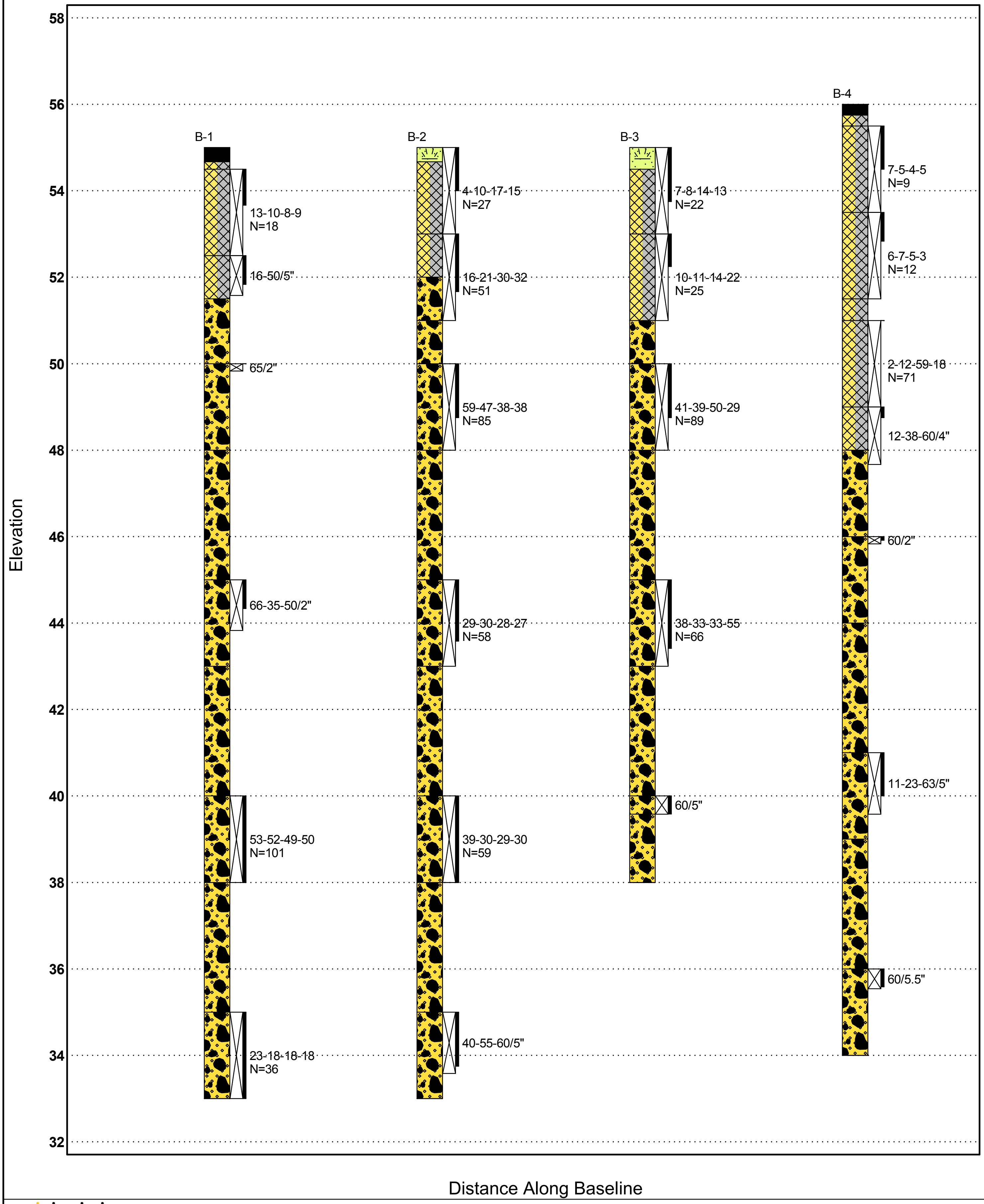
psi

Soil Profiles

Profile



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Canton, MA 02021
Telephone: (781) 821-2355

Newtonville Center for Active Living
PSI Project Number: 04461013

Material Test Reports

Professional Service Industries, Inc.
480 Neponset Street, Suite 9C
Canton, MA 02021

Phone: (781) 821-2355
Fax: (781) 821-6276

Report No: MAT:04461013-1-S1
Issue No: 1

Material Test Report

Client: BARGMANN HENDRIE
ARCHETYPE
9 CHANNEL CENTER STREET,
SUITE 300
BOSTON, MA 02210
Project: NEWTONVILLE NEWCAL
NEWTONVILLE, MA

CC:

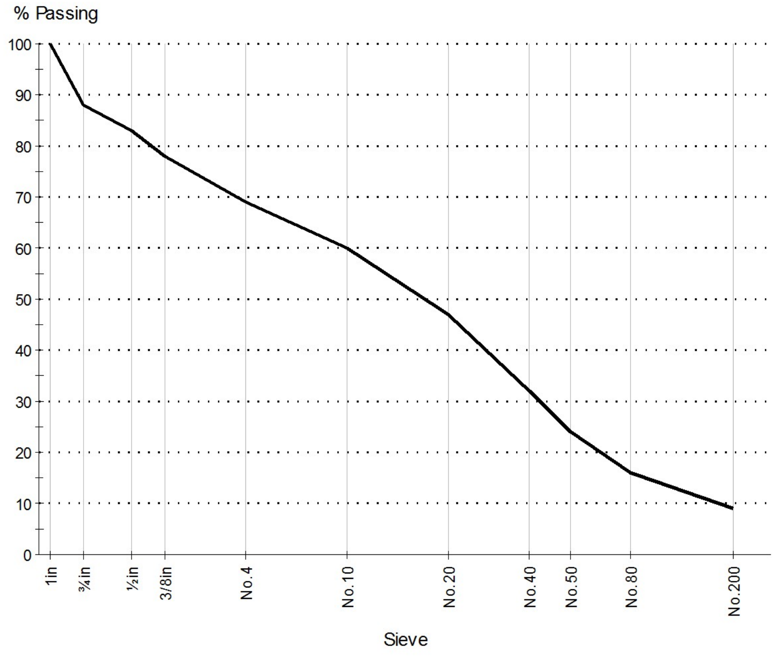
Approved Signatory: Yannick Lastennet (Department Manager)
Date of Issue: 9/25/2020

Sample Details

Sample ID:	04461013-1-S1
Client Sample ID:	
Date Sampled:	09/23/20
Sampled By:	PSI
Specification:	No Spec. Sieve
Supplier:	
Source:	On-Site
Material:	
Sampling Method:	Soil Boring Split Spoon Sample
General Location:	B-4 (0.5'-2.5')

Sample Description:

Particle Size Distribution



COBBLES	GRAVEL		SAND			FINES (9.1%)	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
(0.0%)	(11.7%)	(19.2%)	(9.4%)	(28.1%)	(22.5%)		

Grading: ASTM C 136, ASTM C 117

Drying by: Oven
Date Tested: 9/24/2020
Tested By: Gary Brooks

Sieve Size	% Passing	Limits
1in (25.0mm)	100	
¾in (19.0mm)	88	
½in (12.5mm)	83	
3/8in (9.5mm)	78	
No.4 (4.75mm)	69	
No.10 (2.0mm)	60	
No.20 (850µm)	47	
No.40 (425µm)	32	
No.50 (300µm)	24	
No.80 (180µm)	16	
No.200 (75µm)	9.1	

D85: 14.7791 **D60:** 2.0000 **D50:** 1.0356
D30: 0.3896 **D15:** 0.1586 **D10:** 0.0841
Cu: 23.79 **Cc:** 0.90

Professional Service Industries, Inc.
480 Neponset Street, Suite 9C
Canton, MA 02021

Phone: (781) 821-2355
Fax: (781) 821-6276

Report No: MAT:04461013-1-S1
Issue No: 1

Material Test Report

These test results apply only to the specific locations and materials noted and may not represent any other locations or elevations. This report may not be reproduced, except in full, without written permission by Professional Service Industries, Inc. If a non-compliance appears on this report, to the extent that the reported non-compliance impacts the project, the resolution is outside the PSI scope of engagement.

Client: BARGMANN HENDRIE
ARCHETYPE
9 CHANNEL CENTER STREET,
SUITE 300
BOSTON, MA 02210

CC:

Project: NEWTONVILLE NEWCAL
NEWTONVILLE, MA

Approved Signatory: Yannick Lastennet (Department Manager)
Date of Issue: 9/25/2020

Sample Details

Sample ID:	04461013-1-S1
Client Sample ID:	
Date Sampled:	09/23/20
Sampled By:	PSI
Specification:	No Spec. Sieve
Supplier:	
Source:	On-Site
Material:	
Sampling Method:	Soil Boring Split Spoon Sample
General Location:	B-4 (0.5'-2.5')

Other Test Results

Description	Method	Result	Limits
Water content (%)	ASTM D 2216	2.9	
Method		B	
Tested By		Gary Brooks	
Date Tested		9/24/2020	

Comments

N/A

Professional Service Industries, Inc.
480 Neponset Street, Suite 9C
Canton, MA 02021

Phone: (781) 821-2355
Fax: (781) 821-6276

Report No: MAT:04461013-1-S2
Issue No: 1

Material Test Report

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Approved Signatory: Yannick Lastennet (Department Manager)
Date of Issue: 9/25/2020

Client: BARGMANN HENDRIE
ARCHETYPE
9 CHANNEL CENTER STREET,
SUITE 300
BOSTON, MA 02210

CC:

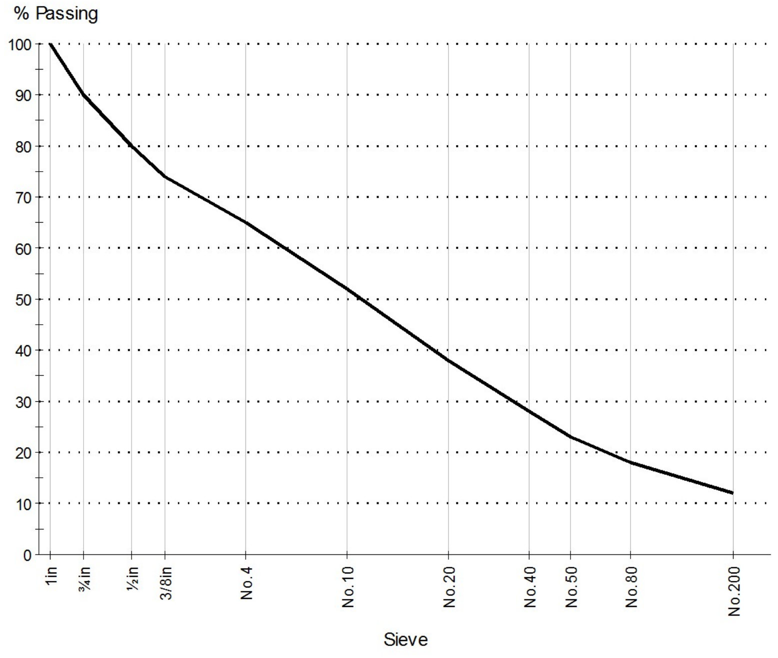
Project: NEWTONVILLE NEWCAL
NEWTONVILLE, MA

Sample Details

Sample ID:	04461013-1-S2
Client Sample ID:	
Date Sampled:	09/23/20
Sampled By:	PSI
Specification:	No Spec. Sieve
Supplier:	
Source:	On-Site
Material:	
Sampling Method:	Soil Boring Split Spoon Sample
General Location:	B-4 (2.5'-4.5')

Sample Description:

Particle Size Distribution



COBBLES	GRAVEL		SAND			FINES (11.8%)	
(0.0%)	Coarse (9.7%)	Fine (25.7%)	Coarse (12.7%)	Medium (24.1%)	Fine (15.9%)	Silt	Clay

Grading: ASTM C 136, ASTM C 117

Drying by: Oven
Date Tested: 9/24/2020
Tested By: Gary Brooks

Sieve Size	% Passing	Limits
1in (25.0mm)	100	
¾in (19.0mm)	90	
½in (12.5mm)	80	
3/8in (9.5mm)	74	
No.4 (4.75mm)	65	
No.10 (2.0mm)	52	
No.20 (850µm)	38	
No.40 (425µm)	28	
No.50 (300µm)	23	
No.80 (180µm)	18	
No.200 (75µm)	12	

D85: 15.4110 **D60:** 3.4057 **D50:** 1.7699
D30: 0.4882 **D15:** 0.1162 **D10:** 0.0560
Cu: 60.80 **Cc:** 1.25

Professional Service Industries, Inc.
480 Neponset Street, Suite 9C
Canton, MA 02021

Phone: (781) 821-2355
Fax: (781) 821-6276

Report No: MAT:04461013-1-S2
Issue No: 1

Material Test Report

These test results apply only to the specific locations and materials noted and may not represent any other locations or elevations. This report may not be reproduced, except in full, without written permission by Professional Service Industries, Inc. If a non-compliance appears on this report, to the extent that the reported non-compliance impacts the project, the resolution is outside the PSI scope of engagement.

Client: BARGMANN HENDRIE
ARCHETYPE
9 CHANNEL CENTER STREET,
SUITE 300
BOSTON, MA 02210

CC:

Project: NEWTONVILLE NEWCAL
NEWTONVILLE, MA

Approved Signatory: Yannick Lastennet (Department Manager)
Date of Issue: 9/25/2020

Sample Details

Sample ID: 04461013-1-S2
Client Sample ID:
Date Sampled: 09/23/20
Sampled By: PSI
Specification: No Spec. Sieve
Supplier:
Source: On-Site
Material:
Sampling Method: Soil Boring Split Spoon Sample
General Location: B-4 (2.5'-4.5')

Other Test Results

Description	Method	Result	Limits
Water content (%)	ASTM D 2216	9.0	
Method		B	
Tested By		Gary Brooks	
Date Tested		9/24/2020	

Comments

N/A

Professional Service Industries, Inc.
480 Neponset Street, Suite 9C
Canton, MA 02021

Phone: (781) 821-2355
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Report No: MAT:04461013-1-S3
Issue No: 1

Material Test Report

Client: BARGMANN HENDRIE
ARCHETYPE
9 CHANNEL CENTER STREET,
SUITE 300
BOSTON, MA 02210

CC:

Project: NEWTONVILLE NEWCAL
NEWTONVILLE, MA

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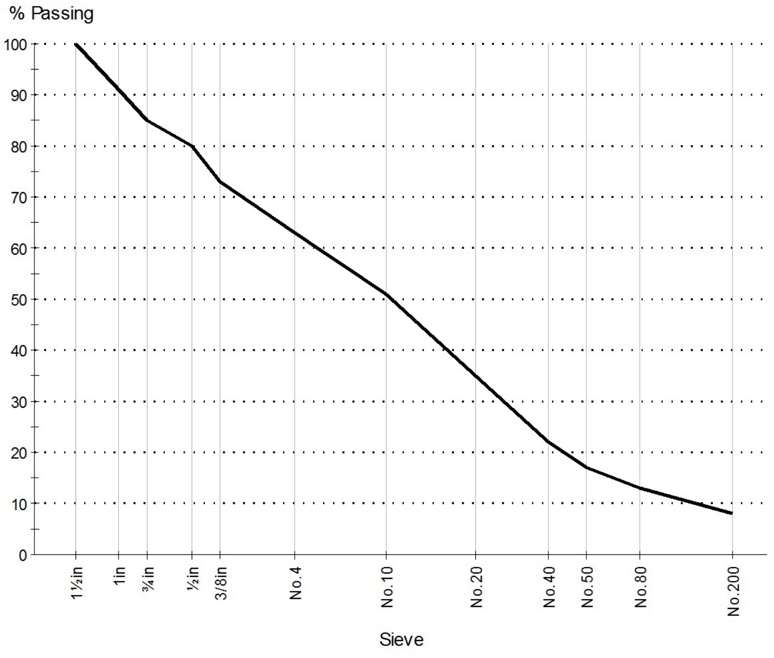
Approved Signatory: Yannick Lastennet (Department Manager)
Date of Issue: 9/25/2020

Sample Details

Sample ID:	04461013-1-S3
Client Sample ID:	
Date Sampled:	09/23/20
Sampled By:	PSI
Specification:	No Spec. Sieve
Supplier:	
Source:	On-Site
Material:	
Sampling Method:	Soil Boring Split Spoon Sample
General Location:	B-3 (5'-7')

Sample Description:

Particle Size Distribution



COBBLES	GRAVEL		SAND			FINES (8.0%)	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
(0.0%)	(14.7%)	(22.4%)	(12.3%)	(28.6%)	(14.1%)		

Grading: ASTM C 136, ASTM C 117

Drying by:	Oven
Date Tested:	9/24/2020
Tested By:	Gary Brooks

Sieve Size	% Passing	Limits
1½in (37.5mm)	100	
1in (25.0mm)	91	
¾in (19.0mm)	85	
½in (12.5mm)	80	
3/8in (9.5mm)	73	
No.4 (4.75mm)	63	
No.10 (2.0mm)	51	
No.20 (850µm)	35	
No.40 (425µm)	22	
No.50 (300µm)	17	
No.80 (180µm)	13	
No.200 (75µm)	8.0	

D85: 19.0000 **D60:** 3.8263 **D50:** 1.8959
D30: 0.6511 **D15:** 0.2324 **D10:** 0.1065
Cu: 35.94 **Cc:** 1.04

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Issue No: 1

Material Test Report

Client: BARGMANN HENDRIE
ARCHETYPE
9 CHANNEL CENTER STREET,
SUITE 300
BOSTON, MA 02210

CC:

Project: NEWTONVILLE NEWCAL
NEWTONVILLE, MA

Approved Signatory: Yannick Lastennet (Department Manager)
Date of Issue: 9/25/2020

Sample Details

Sample ID:	04461013-1-S3
Client Sample ID:	
Date Sampled:	09/23/20
Sampled By:	PSI
Specification:	No Spec. Sieve
Supplier:	
Source:	On-Site
Material:	
Sampling Method:	Soil Boring Split Spoon Sample
General Location:	B-3 (5'-7')

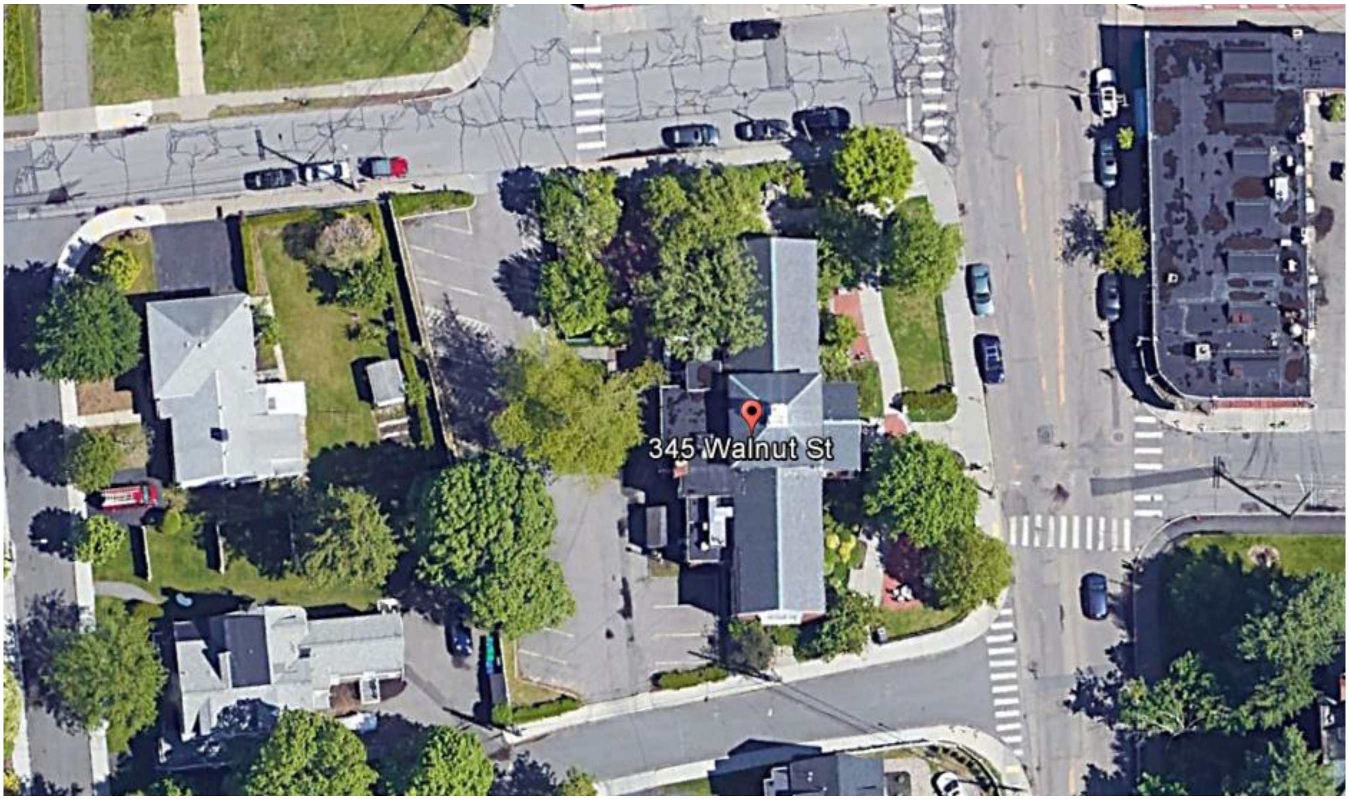
Other Test Results

Description	Method	Result	Limits
Water content (%)	ASTM D 2216	1.8	
Method		B	
Tested By		Gary Brooks	
Date Tested		9/24/2020	

Comments

N/A

Site Images



Aerial View

From south looking north

From east looking west

From west looking east