GEI Consultants

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Scientists

Geotechnical Report for

1299 Beacon Street

Brookline, Massachusetts

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Executive Summary

This report presents the results of our subsurface explorations and our geotechnical recommendations for design and construction of the proposed development to be located at 1299 Beacon Street in Brookline, Massachusetts. The project will consist of demolishing the existing building at 1299 Beacon Street and constructing an approximately 130-foot-tall, 11-story residential building with ground floor retail space and four levels of below-grade parking.

Northern Drill Service of Northborough, Massachusetts drilled five borings and installed one groundwater observation well (B1 through B5(OW)) at the site. B1 through B4 were advanced to a depth of 51 feet and B5(OW) to a depth of 31 feet. B5(OW) was completed as a groundwater observation well.

Proceeding from the ground surface downward, the major soil layers encountered in the borings consisted of granular fill, fine sand, stratified sand and clay (B2 only), lean clay, and a lower layer of sand. Groundwater was measured at a depth of 26.2 feet (approximately El. 30) in B5(OW) on December 27, 2018.

We recommend that the proposed building be supported on a waterproofed structural mat foundation that bears on the clay or sand strata. The mat may be designed using an allowable net bearing pressure of 3 kips per square foot (ksf).

The bottom of the mat and outside face of the foundation walls should be membrane waterproofed up to El. 40. The outside face of the foundation walls should be damp-proofed from El. 40 to the ground surface. Waterstops should be included at all penetrations through the mat foundation and at the foundation walls. Pits or vaults that extend below the mat should be membrane waterproofed and structurally designed to resist hydrostatic pressures.

An excavation over 41 feet deep located immediately adjacent to property lines, existing buildings, and roadways will be required to construct the proposed building. We anticipate that either drilled secant pile walls or slurry walls will be appropriate excavation support systems for this project. The excavation support system should be designed so that it can be incorporated into the permanent building foundation walls.

Dewatering wells or a series of filtered sumps extending below the excavation bottom will be required to maintain the groundwater level below the bottom of the excavation at all phases of excavation and throughout the construction of the foundation until sufficient building strength and weight is in place to resist hydrostatic uplift pressures. Permits will be required to discharge dewatering effluent into the storm drain system.

Dewatering activities may lower surrounding groundwater levels beyond the limits of the excavation, which may cause settlement of the surrounding ground surface and impact nearby buildings and infrastructure. The excavation support system should extend at least 5 feet into an impervious soil layer or bedrock to act as a groundwater cutoff.

An adequate impervious layer for groundwater cutoff was not identified in the borings completed to date. Thus, additional deeper borings should be performed as the design is advanced to locate a suitable soil or rock layer for groundwater cutoff.

Observation wells should be installed and monitored outside of the excavation to monitor the impacts to groundwater levels outside the limits of the excavation. In addition, monitoring wells should be installed inside the excavation to confirm the groundwater levels are maintained at least 2 feet below the excavation subgrade.

The contractor should perform pre- and post-construction conditions surveys to document the existing condition of buildings within 100 feet of the proposed construction. Crack gages should be installed at representative cracks observed in the adjacent structures during the pre-construction condition surveys. Buildings within 100 feet of the proposed construction should be monitored for construction induced vibrations and movements.

The proposed building will be constructed immediately adjacent to buildings and retaining walls on abutting properties. If as-built foundation drawings of the of these structures cannot be located, we recommend performing test pits or probes to expose and/or locate the foundations of these structures to evaluate if they will interfere with the proposed construction, to evaluate the condition of the foundations, and to evaluate construction impacts on the structures.

This report has been prepared for the exclusive use of Mason and Murphy, Inc.

1. Introduction

1.1 Purpose and Scope

GEI Consultants, Inc. prepared this geotechnical report to present the results of our subsurface explorations and our recommendations for design and construction of the proposed development to be located at 1299 Beacon Street in Brookline, Massachusetts.

We performed the following scope of work:

- Engaged a drilling subcontractor to drill five borings and install one groundwater observation well.
- Observed and documented the borings and installation of the well.
- Performed laboratory tests on selected samples collected from the borings.
- Visited and documented the basements of the adjacent buildings at 1295A-1297 and 1309-1317 Beacon Street.
- Developed recommendations for foundation design and construction.
- Prepared this report.

We prepared this report for the exclusive use of Mason & Murphy, Inc.

1.2 Authorization

Ms. Rachna D. Balakrishna, Esq. authorized our work for this project by signing our October 26, 2018 proposal.

1.3 Project Personnel

The following personnel performed the work for this project:

Douglas J. Aghjayan, P.E.	Senior Project Manager
Michael A. Yako, P.E.	Technical Reviewer
Jay Scully	Project Engineer

1.4 Elevation Datum

Elevations in this report are in feet and referenced to a draft plan of the site titled “Existing Conditions Plan, 1299 Beacon Street, Brookline, MA,” prepared by RJ O’Connell & Associates, Inc., dated June 20, 2018.

The plan indicates that elevations are referenced to the Town of Brookline datum. The Town of Brookline datum is 5.78 feet below the National Geodetic Vertical Datum of 1929 (NGVD 29). Thus, El. 0 (Brookline) equals El. 5.78 (NGVD 29).

2. Site and Project Description

2.1 Site Description

The site is located at 1299 Beacon Street in Brookline, Massachusetts (Figs. 1 and 2). The site is bordered on the east by 1295 Beacon Street and 1295A-1297 Beacon Street, on the west by 1309-1317 Beacon Street, on the north by Beacon Street, and on the south by Sewall Avenue.

The site covers an area of about 0.43 acre. Site topography is relatively flat, with the ground surface ranging from El. 57 along the north side of the site to about El. 54 along the south side of the site.

A one- to two-story brick building with basement occupies the approximate northern half of the 1299 Beacon Street site. The remainder of the site is a paved parking lot. The north and east walls of the building abut the property lines of the site. The east wall of the building abuts the west wall of the building at 1295A-1297 Beacon Street. There is an approximately 5-foot-wide alley located along the west side of the site between the existing building and the building at 1309-1317 Beacon Street. We do not know what type of foundation support the existing building, but we expect that the building is supported on footings.

1309-1317 Beacon Street is occupied by a three-story brick and concrete building with a one-level below-grade parking garage beneath the building and surface parking in the rear. We measured the bottom floor of the below-grade parking garage to be about 9 feet below exterior grade (~El. 48) along its east side where it abuts the west property line of the site. There is a relatively short (~2 to 3 feet tall) concrete retaining wall that extends from the southeast corner of the existing 1309-1317 building along the west property line of the site that supports the surface parking lot. We do not know what type of foundations support the building or retaining wall, but we expect that they are supported on footings.

1295A-1297 Beacon Street is occupied by a two-story brick and concrete structure with one basement level. The building is occupied by a yoga studio, commercial bank, and dentist office. We measured the basement floor to be about 10 feet below exterior grade (~El. 46) along its west and south sides where it abuts the site. We do not know what type of foundation support this building, but we expect that it is also supported on footings.

1295 Beacon Street is occupied by a single-story brick building with basement that serves as the U.S. Post Office for the Town of Brookline. The building does not abut the site, but the southern approximately third of the building is located within about 10 feet of the proposed building and is located within the zone of influence of the proposed excavation. There is a concrete retaining wall along the west side of the property with steps that appear to lead

down to the building's basement. We measured the bottom of the retaining wall to be about 11 feet below grade at its deepest point. We did not visit the basement of this building. We do not know what type of foundation support this building or retaining wall, but we expect that they are also supported on footings.

2.2 Project Description

The project will consist of demolishing the existing building at 1299 Beacon Street and constructing an approximately 130-foot-tall, 11-story residential building with ground floor retail space. The proposed building will have four levels of below-grade parking that will extend to a depth of about 41 feet below existing grade. The proposed building and below-grade parking will occupy the entire footprint of the site.

3. Subsurface Explorations

3.1 Soil Borings

GEI engaged Northern Drill Service of Northborough, Massachusetts to drill five borings and install one groundwater observation well (B1 through B5(OW)) during the period from December 11 through December 17, 2018 at the approximate locations shown in Fig. 2. The boring and groundwater well installation logs are contained in Appendix A. A GEI engineer was on site full time to coordinate the work and log the borings.

Northern advanced B1 through B4 to a depth of 51 feet and B5(OW) to a depth of 31 feet using rotary-wash drilling methods. Standard Penetration Tests (SPTs) were performed in each boring beginning near the ground surface and at about five-foot intervals thereafter using an automatic hammer. B5(OW) was completed as a groundwater observation well. All other boreholes were backfilled with the soil cuttings and topped off with asphalt cold patch.

3.2 Laboratory Testing

We performed nine gradation tests and one Atterberg (liquid and plastic) limits determination on soil samples collected from the borings to verify field classifications. The test results are contained in Appendix B.

4. Subsurface Conditions

4.1 Soil

The generalized description of soil layers encountered in the borings are described below in order of increasing depth. The subsurface conditions are known only at the boring locations. The subsurface conditions at other locations may vary significantly from the descriptions given below. These variations may not become evident until construction.

Asphalt: A 2- to 3-inch-thick layer of asphalt was encountered at the ground surface at all the boring locations

Fill: An approximately 12- to 22-foot-thick layer of granular fill was encountered beneath the asphalt at all the boring locations. The fill consisted of brown to dark brown sand and gravel with varying amounts of nonplastic fines. SPT N-values in the fill ranged from 11 to 83, indicating a medium dense to very dense soil.

Sand: A layer of tan to brown fine sand with varying amounts of nonplastic fines was encountered beneath the fill in all the borings. Where penetrated, the layer ranged from about 9 to 25 feet thick and extended to depths ranging from about 27 to 42 feet. B5(OW) was terminated in the sand at a depth of about 31 feet. SPT N-values in the sand ranged from 14 to 45, indicating a medium dense to dense soil.

Stratified Sand and Clay: An approximately 10-foot-thick layer of stratified sand and clay was encountered beneath the sand in B2 at a depth of about 27 feet. This layer consisted of alternating discrete (stratified) layers of fine sand with nonplastic fines and lean clay, with each discrete layer ranging from less than 1 inch to a few inches thick.

Clay: Lean clay was encountered beneath the sand and stratified sand and clay layers in B1 through B4 at depths ranging from about 27 to 42 feet. A single shallow sample of clay was also obtained at a depth of about 15 feet in B3. Excluding the single shallow sample from B3, the SPT N-values in the clay ranged from 2 to 10, indicating a soft to stiff soil. The clay layer was penetrated in B2 and B3 at depths of about 47 and 32 feet, respectively. B1 and B4 were both terminated in the clay at a depth of about 51 feet.

Lower Sand: A lower layer of sand was encountered beneath the clay in B2 and B3 at depths of about 47 and 32 feet, respectively. The layer consisted of mostly fine sand with varying amounts of silt. SPT N-values in the lower sand ranged from 18 to 34, indicating a medium dense to dense material. B2 and B3 were both terminated in the lower sand at a depth of about 51 feet.

4.2 Groundwater

Groundwater levels measured in the boreholes upon completion of drilling are noted on the boring logs. Groundwater levels measured upon completion of drilling may not represent a stabilized condition because water was introduced into the borehole during drilling.

A summary of the groundwater levels measured in B5(OW) is provided in the table below. Groundwater levels may be significantly different at other times and locations.

Well	Installation Date	Approximate Ground Surface Elevation (Brookline datum)	Date of Reading	Depth to Groundwater (ft)	Approximate Groundwater Elevation
B5(OW)	Dec. 12, 2018	56.5	Dec. 12, 2018	19.6	36.9
			Dec. 13, 2018	23.9	32.6
			Dec. 14, 2018	25.2	31.3
			Dec. 17, 2018	25.8	30.7
			Dec. 27, 2018	26.2	30.3

As shown in the table above, groundwater levels initially dropped quickly. The groundwater levels measured 5 and 15 days after installation of the well likely represent relatively stabilized groundwater levels. However, we recommend that additional groundwater level readings be collected during the spring, summer, and fall of 2019 to confirm and capture seasonal variations.

5. Geotechnical Recommendations

5.1 Foundation Design Considerations

The lowest level of the proposed building will extend to a depth of about 41 feet below existing grade and about 15 feet below groundwater. At this depth, the soils encountered in the borings consisted of sand and clay. Because the weight of the proposed building will be less than the weight of the soil displaced by the building, the natural sand and clay soils at the bottom of the excavation can support the proposed building on a structural mat foundation or on conventional spread footings.

The lowest level of the proposed building will be located about 15 feet below the lowest measured groundwater level. Therefore, the foundation walls and lowest level floor slab must be waterproofed, and the lowest level floor slab or mat foundation must also be designed to resist hydrostatic uplift pressures.

Alternatively, the hydrostatic uplift pressures could be fully or partially relieved. However, given the potential for off-site impacts on adjacent buildings and infrastructure from lowering of the groundwater, we recommend that the building be supported on either a waterproof mat foundation or spread footings with a waterproof structural slab designed to resist full hydrostatic uplift pressures. Neither of these proposed systems would be affected by a power outage. A full or partial hydrostatic relief system would need backup power in the event of a power outage, or the lowest basement level would need to be designed to flood to avoid damaging the floor slab.

5.2 Mat Foundation Design

Based on the foundation design considerations discussed above, we recommend that the proposed building be supported on a waterproofed structural mat that bears on the sand and clay. The advantages of the structural mat are that the waterproofing installation is significantly less complex and would be less prone to leaks, the mat can be thickened as needed to resist hydrostatic uplift pressures, and differential settlements between adjacent columns would be less compared to the spread footing option. The structural mat may be more expensive to construct than spread footings with a structural pressure slab. However, if the combined area of the footings exceeds about 50 percent of the area of the mat, the mat foundation may also be an economical option.

The mat may be designed using an allowable net bearing pressure of 3 kips per square foot (ksf). However, since the weight of the building will be less than the soil that is removed to construct the garage, bearing capacity should not be an issue.

The mat should be designed for the maximum bending moments associated with potential settlements. To compute the moments in the slab, the distribution of soil reaction pressures against the bottom of the slab must first be estimated, which is often done based on estimated values of modulus of subgrade reaction.

For the structural design of the mat, we recommend assuming that the soil reaction pressure acting against the bottom of the slab is uniform, which is a conservative assumption for computing maximum moments. However, this assumption is reasonable because the upward pressure against the bottom of the slab from hydrostatic pressure is in fact uniform and the remaining soil pressure is treated conservatively. Using this uniform distribution, values of modulus of subgrade reaction are not needed.

5.3 Spread Footings with Bottom Floor Structural Slab

As an alternate to the mat foundation, the building may be supported on footings with a bottom floor structural slab. The footings should be designed for a net allowable bearing pressure of 3 ksf. All footings should be at least 3 feet wide. Perimeter footings and footing in unheated portions of the building should bear at least 4 feet below exterior grade for frost protection. The tops of all footings should be at least 6 inches below the bottom of the overlying floor slabs. A friction coefficient of 1.0 may be used to evaluate resistance to sliding, which assumes that the footings will be formed directly on a concrete mud mat with a roughened surface.

The bottom floor slab should be designed as a waterproof structural slab that is designed to resist hydrostatic uplift pressures. Recommendations for waterproofing and computing hydrostatic uplift pressures are provided in Sections 5.4 and 5.5, respectively.

As discussed above, if the combined area of the footings exceeds about 50 percent of the area of the mat, then the mat foundation may be an economical foundation option.

5.4 Waterproofing and Damp-proofing

Foundation waterproofing should be performed in accordance with Section 1805 of the International Building Code, 2015 edition (IBC 2015) and include the following elements:

1. Membrane waterproofing beneath the mat foundation and on the outside face of the foundation walls up to El. 40.
2. Damp-proofing foundation walls from El. 40 to the ground surface.
3. Waterstops at all penetrations through the mat foundation, foundation walls, and all construction joints.
4. Waterproofing and structural design for hydrostatic uplift of any pits or vaults that extend below the mat, including membrane seals around elevator piston shafts.

5.5 Lateral Earth and Hydrostatic Pressures

Recommended lateral earth and hydrostatic pressures for design of the foundation walls are provided in Fig. 3. For computing hydrostatic pressures, we recommend a design groundwater level of El. 35, which is about 5 feet higher than the lowest measured groundwater level in B5(OW).

5.6 Seismic Design and Liquefaction

The site is classified as a Site Class D in accordance with ASCE/SEI 7-10 Chapter 20.

For seismic design, we recommend using the earthquake design factors for the City of Brookline (per the Massachusetts amendments to Chapter 16 of the IBC) and the amplification factors (F_a and F_v) for Site Class D provided in Tables 1613.3.3(1) and 1613.3.3(2) of the 2015 IBC as summarized in the table below.

S_S	0.211 g
S_1	0.068 g
F_a	1.6
F_v	2.4

The underlying soils at the site are not considered to be susceptible to liquefaction.

5.7 Settlement

We estimate that total building settlements will be less than one inch, and that differential settlements between adjacent columns will be less than ½ inch. Much of this settlement will occur as the building is being constructed.

The weight of soil that will be removed to construct the proposed below-grade parking will be greater than the weight of the proposed building itself; thus, there will be no net increase in the effective stress in the underlying soil layers. Since no net increase in effective stress will occur in the underlying soil layers, long-term consolidation (or compression) of the soils beneath the building should not occur.

6. Construction Considerations

6.1 Demolition and Removal of Existing Structures and Obstructions

Demolition and removal of the building and foundation at 1299 Beacon Street will be needed to install the excavation support system and construct the garage beneath the building. In addition, other remnant buried obstructions may be encountered during the installation of the excavation support system and excavations for the garage. Special precautions should be taken when attempting to remove obstructions to avoid undermining or damaging nearby existing structures or infrastructure to remain.

The method to demolish and remove obstructions will depend on the nature and location of the obstructions but will likely include drilling, hoe rams, and jackhammers. We recommend that hoe ramming not be used to remove obstructions that abut existing buildings.

Vibrations from demolition and removal of structures and obstructions will be transmitted to nearby structures and utilities to remain. The peak particle velocity induced in any structure or utility should not exceed the limits given in the regulations. We recommend that the peak particle velocity not exceed 0.5 inches per second for continuous vibrations (such as jack hammering or hoe ramming). At a minimum, vibrations should be monitored at 1295, 1295A-1297, and 1307-1317 Beacon Street.

6.2 Excavations and Excavation Support

All excavations should be made in accordance with OSHA requirements.

An excavation over 41 feet deep located immediately adjacent to property lines, existing structures, and roadways will be required to construct the proposed building. We anticipate that either drilled secant pile or slurry walls will be appropriate excavation support systems for this project. The excavation support system that is selected should be designed such that it can be incorporated into the permanent building foundation walls.

It is unlikely that abutting property owners or the Town of Brookline will allow tie-backs to extend beneath their properties or Beacon Street. Therefore, internal bracing will likely be required to provide lateral support for the excavation support system.

The excavation will extend below the foundations of adjacent structures. Underpinning or designing the excavation support system to support adjacent structures will be required. Given the depth of the proposed excavation, depth to groundwater, and proximity of the adjacent structures to the excavation, we expect that it will be more practical to design the

excavation support system and permanent foundation walls to support the adjacent structures rather than attempting to underpin them.

The excavation for the garage will extend to over 15 feet below the groundwater table. We recommend that the groundwater table be lowered ahead of the excavation.

The excavation support system should be designed in conjunction with the dewatering system by a Professional Engineer registered in the State of Massachusetts that is engaged by the contractor. We recommend that GEI be engaged to review contractor submittals related to the design of the excavation support and dewatering systems.

6.3 Dewatering and Groundwater Cutoff

We recommend that the groundwater level be lowered and maintained to at least 2 feet below the bottom of excavation during foundation construction.

Dewatering wells, well points, or a series of filtered sumps extending below the excavation bottom will be required to maintain the groundwater level below the bottom of the excavation at all phases of excavation and throughout the construction of the foundation. Dewatering activities can stop only when the building has sufficient weight and strength to withstand the hydrostatic pressure.

Dewatering activities may lower surrounding groundwater levels beyond the limits of the excavation, which may cause settlement of the surrounding ground surface and impact nearby buildings and infrastructure. To reduce the potential for lowering the surrounding groundwater levels, the excavation support system discussed in Section 6.2 should extend at least 5 feet into an impervious soil layer or bedrock to act as a groundwater cutoff.

Only two of the borings (B1 and B4) were terminated in the impervious clay layer. B2 and B3 were terminated in the lower sand layer. The thickness and location of the clay layer across the site is not well defined, and lower sand layer beneath the clay is unsuitable for groundwater cutoff. Thus, additional deeper borings should be performed as the design is advanced to locate a suitable layer for groundwater cutoff.

Dewatering effluent will need to be discharged into the storm drain system. Permits will be required for discharging dewatering effluent into the storm drain. Pre-treatment and periodic chemical testing of the dewatering effluent may be required as part of the process for obtaining the permits. We recommend that you consult with your Licensed Site Professional (LSP) to evaluate how the effluent can be discharged. If you have not yet engaged an LSP, GEI can assist you with these services

The dewatering system should be designed in conjunction with the excavation support system by a Professional Engineer registered in the state of Massachusetts that is engaged by

the contractor. We recommend that GEI be engaged to review contractor submittals related to the design of the dewatering system.

6.4 Preparation of Foundation Subgrades

After the groundwater has been lowered at least 2 feet below the bottom of excavation, the final excavation to subgrade should be made using a smooth-bladed excavator bucket to avoid disturbing or loosening the soil. The soil subgrade should be covered with a 4- to 6-inch-thick concrete mud mat. The final 6 to 12 inches of excavation should be made just before placing the mud mat to prevent the subgrade from softening.

Bearing surfaces should be free of standing water, frost, and frozen or loose soil before placement of mud mat. Areas of the subgrade disturbed by traffic or surface water should be repaired. We recommend that a GEI engineer observe the final preparation of subgrades prior to placement of the mud mat.

6.5 Frost Protection

If construction is performed during freezing weather, special precautions will be required to prevent the subgrade soils from freezing. If slabs are built and left exposed during the winter, precautions should be taken to prevent freezing of the underlying soil.

6.6 Protection and Monitoring of Adjacent Structures

The contractor should be required to perform pre- and post-construction conditions surveys of structures within 100 feet of the site. The surveys should document existing visible damage or signs of distress outside the buildings, and readily accessible areas of the building interiors. The surveys should be provided to the respective property owners. We recommend that you meet with the adjacent building owners to inform them of your plans and that you establish a contingency for repairs to the adjacent buildings if necessary.

We recommend that the adjacent buildings be monitored for vibrations and movements during construction. Vibrations can be monitored using seismographs placed inside the buildings. We recommend that the peak particle velocity not exceed 0.5 inches per second for continuous vibrations (such as jack hammering or hoe ramming). At a minimum, vibrations should be monitored at 1295, 1295A-1297, and 1307-1317 Beacon Street.

Survey points should be installed at selected locations on the adjacent buildings and the excavation support system, and their horizontal and vertical positions should be established before the start of construction. The survey points should be monitored for vertical and horizontal movements on a weekly basis through construction. More frequent monitoring should be performed for adjacent structures during installation of the excavation support system and while excavating below the foundation elevation of the adjacent structures.

Crack gages should be installed at representative cracks observed in the adjacent structures during the pre-construction condition surveys. The crack gages should be monitored on a weekly basis during construction.

Temporary groundwater observation wells should be installed inside and outside the excavation to monitor groundwater levels during dewatering activities. The groundwater levels should be monitored on a daily basis beginning at least two weeks before the start of dewatering and throughout dewatering.

Construction activities should be modified or stopped if vibrations exceed 0.5 inch per second, or if the vibrations disrupt activities within the building. Construction operations should be evaluated and modified if necessary if movements exceed 1/4 inch. If movements exceed ½ inch, construction operations should be stopped and modified if necessary.

Even with good contractor practices, some cosmetic damage to adjacent structures may occur due to ground movements and vibrations. The contract documents should include provisions that require the contractor to repair any damage to adjacent structures caused by the construction activities.

6.7 Foundation Installation, Monitoring, and Testing

In accordance with the Building Code, full-time observations and documentation are required during installation of the foundations. These observations should be made by a registered design professional or their representative to meet the requirements of the foundation completion letter referred to in Section 1701.1.1 subsection 5 of the Building Code (Massachusetts amendments). We recommend that GEI be engaged during construction to observe and document the installation of the foundations.

7. Future Work and Limitations

7.1 Recommendations for Additional and Future Work

The proposed building will be constructed such that it abuts the retaining wall at the rear of 1295 Beacon Street; the building at 1295A-1297 Beacon Street; and the building at 1309-1317 Beacon Street, including a retaining wall at the rear of the building. If as-built drawing of the foundations of these structures cannot be located, we recommend performing test pits or probes to expose and/or locate the foundations of these structures to evaluate if they will interfere with the proposed construction, to evaluate the condition of the foundations, and to evaluate construction impacts on the structures.

We recommend that additional deeper borings be performed as the design is advanced to locate a suitable impervious soil or rock layer for groundwater cutoff.

During construction, we recommend that GEI be engaged to:

- Review the final design drawings and specifications to confirm that our recommendations have been properly incorporated into the documents.
- Respond to requests for information and review contractor submittals related to the geotechnical aspects of the project such as support of excavation, dewatering, instrumentation, etc.
- Provide full-time observation during foundation construction as required by the Code (Massachusetts amendments).
- Provide consultation and participate in meetings as-needed during construction.

7.2 Sample Disposition

GEI will retain the samples collected from the borings for a period of 1 year, after which they will be discarded. If you wish to retain the samples for a longer period, we can either store the samples for an additional fee or arrange to have the samples returned to you.

7.3 Limitations

This report has been prepared for the exclusive use of Mason and Murphy, Inc. Our recommendations are based on the project information provided to us at the time of this report and may require modification if there are any changes in the nature, design, or location of the proposed structure. We cannot accept responsibility for designs based on our recommendations unless we are engaged to review the final plans and specifications to

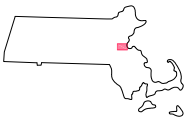
determine whether any changes in the project affect the validity of our recommendations and whether our recommendations have been properly implemented in the design.

The recommendations in this report are based in part on the data obtained from the subsurface explorations. The nature and extent of variations between explorations may not become evident until construction. If variations from the anticipated conditions are encountered, it may be necessary to revise the recommendations in this report. We therefore recommend that GEI be engaged to make site visits during construction to: (a) check that the subsurface conditions encountered during construction are in general conformance with our design assumptions and (b) ascertain that the work is being performed in general compliance with the contract documents.

Our scope of work did not include exploring for or researching the locations of buried utilities or other buried structures at the site. Our recommendations assume that no buried structures exist, other than those discussed in this report. A diligent effort should be made to determine the presence and location of any buried structures including utilities before the start of construction. This effort should include a thorough review of available drawings and other records of the site use and facilities. If the presence of such structures is determined to be likely, GEI should be notified so that we may review and revise our recommendations, if appropriate.

Our professional services for this project have been performed in accordance with generally accepted engineering practices; no warranty, express or implied, is made.

This Image provided by MassGIS is from U.S.G.S. Topographic
7.5 X 15 Minute Series
Boston South, MA Quadrangle, 1987.
Datum is National Geodetic Vertical Datum of 1929 (NGVD29).
Contour Interval is 3 Meters.



MASSACHUSETTS
QUADRANGLE LOCATION

1299 Beacon Street Brookline, Massachusetts	GEI Consultants	SITE LOCATION MAP
Mason and Murphy, Inc. Brookline, Massachusetts	Project 1804540	January 2019 Fig. 1

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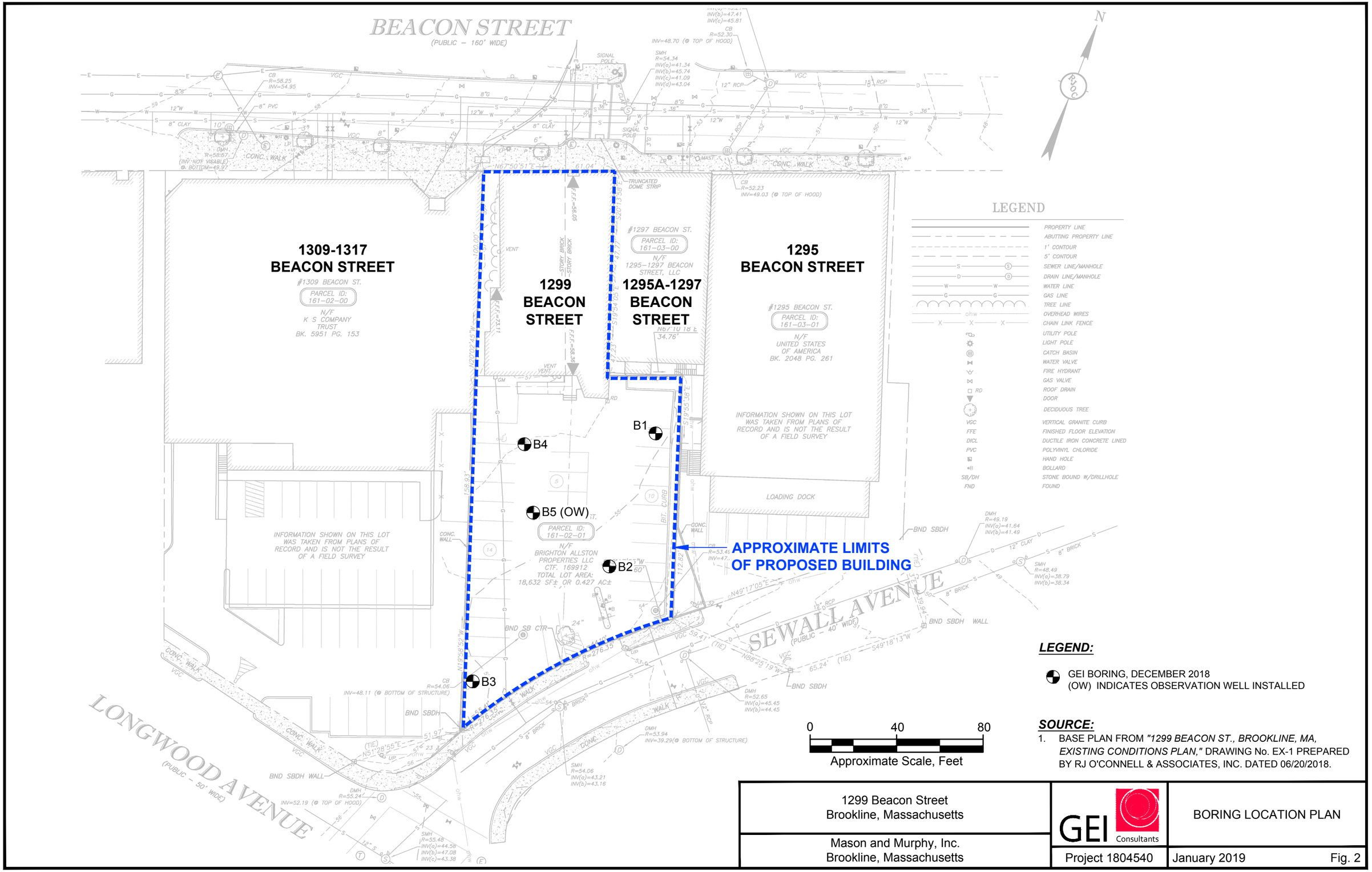

1299 Beacon Street Brookline, Massachusetts	GEI Consultants	BORING LOCATION PLAN
Mason and Murphy, Inc. Brookline, Massachusetts	Project 1804540	January 2019 Fig. 2

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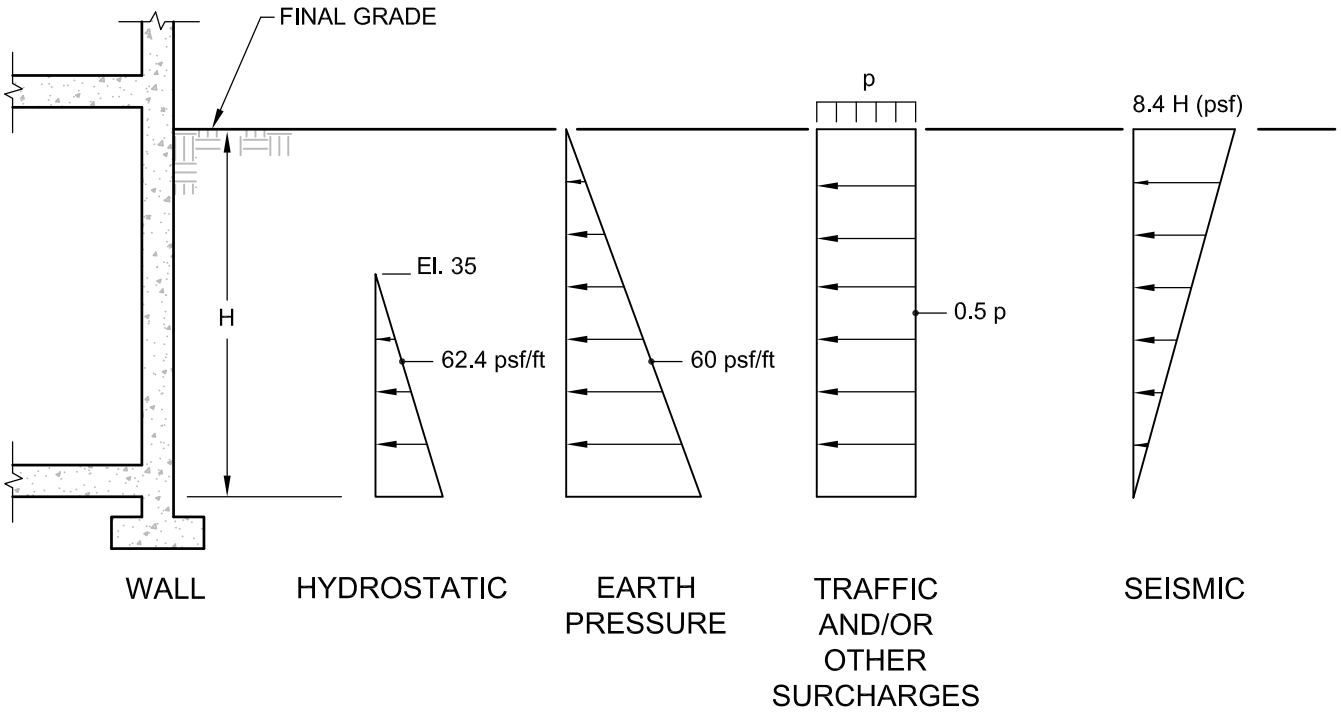

NOTES:

1. p = THE COMBINED VERTICAL SURCHARGE PRESSURES LOCATED WITHIN 0.5 H OF THE FACE OF THE WALL.

2. ELEVATION REFERENCED TO TOWN OF BROOKLINE DATUM.

1299 Beacon Street Brookline, Massachusetts	GEI Consultants	RECOMMENDED LATERAL EARTH PRESSURES
Mason and Murphy, Inc. Brookline, Massachusetts	Project 1804540	January 2019 Fig. 3

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Appendix A

Boring Logs

BORING INFORMATION

LOCATION: See Plan
GROUND SURFACE EL. (ft): 55
VERTICAL DATUM: Town of Brookline
TOTAL DEPTH (ft): 51.0
LOGGED BY: J. Scully
DATE START/END: 12/14/2018 - 12/14/2018
DRILLING COMPANY: Northern Drill Service, Inc.
DRILLER NAME: T. Tucker
RIG TYPE: Mobile B-59 Truck Rig

BORING

B1

DRILLING INFORMATION

HAMMER TYPE: Automatic
AUGER I.D./O.D.: NA / NA
DRILLING METHOD: Driven casing and washed with rotary tooling.
WATER LEVEL DEPTHS (ft): ▼ 13.5
CASING I.D./O.D.: 4 inch / 4.5 inch
DRILL ROD O.D.: NM
CORE BARREL TYPE: NA
CORE BARREL I.D./O.D. NA / NA

ABBREVIATIONS:
Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation
= Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer
S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger
Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D. = Inside Diameter/Outside Diameter
NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140-lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
							FILL	ASPHALT ~3".
		S1	0.5 to 2.5	24/6	6-10-14-24			S1: SILTY SAND WITH GRAVEL (SM); ~60% fine to coarse sand, ~20% gravel up to ~1/2", ~20% nonplastic fines, dark brown.
50	5	S2	4 to 6	24/8	13-28-27-21			S2: WIDELY GRADED SAND WITH SILT AND GRAVEL (SW-SM); ~60% fine to coarse sand, ~30% gravel up to ~3/4", ~10% nonplastic fines, brown.
45	10	S3	9 to 11	24/12	31-26-28-30			S3: WIDELY GRADED GRAVEL WITH SILT AND SAND (GW-GM); 53.3% fine to coarse gravel to 3/4", 39.3% fine to coarse sand, 7.4% nonplastic fines, brown, gray.
40	15	S4	14 to 16	24/10	22-21-21-22			S4: WIDELY GRADED SAND WITH SILT AND GRAVEL (SW-SM); ~60% fine to coarse sand, ~30% gravel up to ~3/4", ~10% nonplastic fines, gray and brown.
						Hard drilling at ~17 ft		
35	20	S5	19 to 21	24/7	7-12-11-12			S5: WIDELY GRADED SAND WITH SILT AND GRAVEL (SW-SM); 74.6% fine to medium sand, 9.4% nonplastic fines, 16% fine gravel up to ~1/2", brown.
							SAND	

NOTES: Ground surface elevation estimated from existing conditions plan. Water level measured upon completion of drilling and may not represent stabilized water level.

PROJECT NAME: 1299 Beacon Street
CITY/STATE: Brookline, Massachusetts
GEI PROJECT NUMBER: 1804540

GEI Consultants

LOCATION: See Plan
GROUND SURFACE EL. (ft): 55 **DATE START/END:** 12/14/2018 - 12/14/2018
VERTICAL DATUM: Town of Brookline **DRILLING COMPANY:** Northern Drill Service, Inc.

BORING B1

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
30	25	S6	24 to 26	24/10	17-15-16-18		SAND	S6: SILTY SAND (SM); ~60% fine sand, ~40% nonplastic fines, tan.
25	30	S7	29 to 31	24/9	7-8-9-8		SAND	S7: SILTY SAND (SM) AND SILT (ML); Interbedded layers ~1/2" thick, tan.
20	35	S8	34 to 36	24/12	15-14-13-12		SAND	S8: SILTY SAND (SM); ~85% fine to medium sand, ~15% nonplastic fines, tan.
15	40	S9	39 to 41	24/18	5-3-7-12		CLAY	S9(0-12"): LEAN CLAY WITH SAND (CL); ~85% low plasticity fines, ~15% fine sand, gray. S9(12-18"): SILTY SAND (SM); ~65% fine sand, ~35% nonplastic fines, olive-gray.
10	45	S10	44 to 46	24/8	1-3-2-3		CLAY	S10: LEAN CLAY (CL); ~95% medium plasticity fines, ~5% fine sand, gray.
5	50	S11	49 to 51	24/12	WOH-1-2-3		CLAY	S11: LEAN CLAY (CL); Similar to S10.
0	55							Bottom of boring at 51 ft. Backfilled with soil cuttings. Topped with asphalt patch.

NOTES: Ground surface elevation estimated from existing conditions plan. Water level measured upon completion of drilling and may not represent stabilized water level.

PROJECT NAME: 1299 Beacon Street
CITY/STATE: Brookline, Massachusetts
GEI PROJECT NUMBER: 1804540

GEI Consultants

BORING INFORMATION

LOCATION: See Plan
GROUND SURFACE EL. (ft): 54.5 **DATE START/END:** 12/13/2018 - 12/13/2018
VERTICAL DATUM: Town of Brookline **DRILLING COMPANY:** Northern Drill Service, Inc.
TOTAL DEPTH (ft): 51.0 **DRILLER NAME:** T. Tucker
LOGGED BY: J. Scully **RIG TYPE:** Mobile B-59 Truck Rig

BORING B2

DRILLING INFORMATION

HAMMER TYPE: Automatic **CASING I.D./O.D.:** 4 inch / 4.5 inch **CORE BARREL TYPE:** NA
AUGER I.D./O.D.: NA / NA **DRILL ROD O.D.:** NM **CORE BARREL I.D./O.D.** NA / NA
DRILLING METHOD: Driven casing and washed with rotary tooling.
WATER LEVEL DEPTHS (ft): ▼ 12.5

ABBREVIATIONS:
Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation
= Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer
S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger
Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D. = Inside Diameter/Outside Diameter
NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140-lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
							FILL	ASPHALT ~3".
		S1	0.5 to 2.5	24/8	14-10-11-5			S1: SILTY SAND WITH GRAVEL (SM); ~70% fine to coarse sand, ~15% gravel up to ~1/2", ~15% nonplastic fines, brown, gray.
50	5	S2	4 to 6	24/10	15-24-42-40			S2: WIDELY GRADED SAND WITH SILT AND GRAVEL (SW-SM); ~55% fine to coarse sand, ~35% gravel up to ~1/2", ~10% nonplastic fines, brown.
45	10	S3	9 to 11	24/11	18-26-35-37			S3: WIDELY GRADED SAND WITH SILT AND GRAVEL (SW-SM); Similar to S2, except gravel up to ~1".
40	15	S4	14 to 16	24/8	8-16-13-12			S4: WIDELY GRADED SAND WITH SILT AND GRAVEL (SW-SM); Similar to S2.
						Change at ~18 ft.	SAND	
35	20	S5	19 to 21	24/9	7-8-15-17			S5: WIDELY GRADED SAND WITH SILT (SW); ~85% fine to coarse sand, ~10% nonplastic fines, ~5% gravel up to ~1/4", brown, tan.

NOTES: Ground surface elevation estimated from existing conditions plan. Water level measured upon completion of drilling and may not represent stabilized water level.

PROJECT NAME: 1299 Beacon Street
CITY/STATE: Brookline, Massachusetts
GEI PROJECT NUMBER: 1804540

GEI Consultants

LOCATION: See Plan
GROUND SURFACE EL. (ft): 54.5 **DATE START/END:** 12/13/2018 - 12/13/2018
VERTICAL DATUM: Town of Brookline **DRILLING COMPANY:** Northern Drill Service, Inc.

BORING B2

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
30	25	S6	24 to 26	24/16	10-11-11-9		SAND	S6: SILTY SAND (SM); 50.2% fine sand, 49.8% nonplastic fines, ~1/8-in-thick lean clay layers, tan.
25	30	S7	29 to 31	24/18	5-9-9-13		STRATIFIED SAND & CLAY	S7: SANDY LEAN CLAY (CL); ~60% low plasticity fines, ~40% fine sand, interbedded layers, ~1/4" to 2" thick, tan.
20	35	S8	34 to 36	24/15	4-4-4-9			S8: SANDY LEAN CLAY (CL); 68.4% low plasticity fines, 31.6% fine sand
15	40	S9	39 to 41	24/14	3-2-2-6		CLAY	S9: LEAN CLAY (CL); ~95% medium plasticity fines, ~5% fine sand, gray.
10	45	S10	44 to 46	24/16	1-2-2-5			S10: LEAN CLAY (CL); Similar to S9.
5	50	S11	49 to 51	24/14	3-7-11-11		SAND	S11: SILTY SAND (SM); ~65% fine sand, ~35% nonplastic fines, tan.
0	55							Bottom of boring at 51 ft. Backfilled with soil cuttings. Topped with asphalt patch.

NOTES: Ground surface elevation estimated from existing conditions plan. Water level measured upon completion of drilling and may not represent stabilized water level.

PROJECT NAME: 1299 Beacon Street
CITY/STATE: Brookline, Massachusetts
GEI PROJECT NUMBER: 1804540

GEI Consultants

BORING INFORMATION

LOCATION: See Plan
GROUND SURFACE EL. (ft): 55
VERTICAL DATUM: Town of Brookline
TOTAL DEPTH (ft): 51.0
LOGGED BY: J. Scully
DATE START/END: 12/11/2018 - 12/11/2018
DRILLING COMPANY: Northern Drill Service, Inc.
DRILLER NAME: A. Miller
RIG TYPE: Mobile B-59 Truck Rig

BORING B3

DRILLING INFORMATION

HAMMER TYPE: Automatic
AUGER I.D./O.D.: NA / NA
CASING I.D./O.D.: 4 inch / 4.5 inch
DRILL ROD O.D.: NM
CORE BARREL TYPE: NX
CORE BARREL I.D./O.D. NA / NA
DRILLING METHOD: Driven casing and washed with rotary tooling.
WATER LEVEL DEPTHS (ft): ▼ 25.3

ABBREVIATIONS:
Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation
= Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer
S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger
Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D. = Inside Diameter/Outside Diameter
NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140-lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
							FILL	ASPHALT 2-3".
		S1	0.5 to 2.5	24/4	8-6-5-2			S1: SILTY SAND WITH GRAVEL (SM); ~50% fine to coarse sand, ~35% gravel up to ~1/2", ~15% nonplastic fines, dark brown.
50	5	S2	4 to 5.3	15/5	4-22-50/3"			S2: NARROWLY GRADED GRAVEL WITH SAND (GP); ~60% gravel up to ~1/2", ~35% fine to coarse sand, ~5% nonplastic fines, brown.
						Split spoon stopped. Hard drilling Switch to NX core barrel.		
		C1	7 to 8	12/3	0			Boulder from ~6.5 to ~7.5 ft.
45	10	S3	9 to 11	24/14	17-32-36-35			S3: NARROWLY GRADED GRAVEL WITH SILT AND SAND (GP-GM); 48.5% fine to coarse gravel to ~3/4", 40.6% fine to coarse sand, 10.9% nonplastic fines, brown.
							SAND	
40	15	S4	14 to 16	24/12	9-6-8-7			S4: LEAN CLAY WITH SAND (CL); ~85% low plasticity fines, ~15% mostly fine sand, yellow-brown.
35	20	S5	19 to 21	24/10	9-10-12-16			S5: NARROWLY GRADED SAND WITH SILT (SP-SM); ~85% mostly fine sand, ~10% nonplastic fines, ~5% gravel up to ~1/4", brown.

NOTES: Ground surface elevation estimated from existing conditions plan. Water level measured upon completion of drilling and may not represent stabilized water level.

PROJECT NAME: 1299 Beacon Street
CITY/STATE: Brookline, Massachusetts
GEI PROJECT NUMBER: 1804540

GEI Consultants

LOCATION: See Plan
GROUND SURFACE EL. (ft): 55 **DATE START/END:** 12/11/2018 - 12/11/2018
VERTICAL DATUM: Town of Brookline **DRILLING COMPANY:** Northern Drill Service, Inc.

BORING B3

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
30	25	S6	24 to 26	24/11	10-14-14-14		SAND	S6: SILTY SAND (SM); ~60% fine sand, ~40% nonplastic fines, tan.
25	30	S7	29 to 31	24/20	2-2-4-4		CLAY	S7: LEAN CLAY WITH SAND (CL); ~85% low plasticity fines, ~15% fine sand layers ~1/8" thick, yellow-brown.
20	35	S8	34 to 36	24/12	8-10-11-12		SAND	S8: SILTY SAND (SM); ~85% fine sand, ~15% nonplastic fines, tan.
15	40	S9	39 to 41	24/10	11-14-14-21			S9: NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% mostly fine to medium sand, ~10% nonplastic fines, olive-gray.
10	45	S10	44 to 46	24/14	13-14-16-21			S10: NARROWLY GRADED SAND (SM); 95.8% fine sand, 4.2% nonplastic fines, tan.
5	50	S11	49 to 51	24/0	7-9-11-14	Redrove S11 with 3-inch spoon.		S11: NO RECOVERY. S11(Redrive): NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% fine sand, ~10% nonplastic fines, olive-gray.
0	55							Bottom of boring at 51 ft. Backfilled with soil cuttings. Topped with asphalt patch.

NOTES: Ground surface elevation estimated from existing conditions plan. Water level measured upon completion of drilling and may not represent stabilized water level.

PROJECT NAME: 1299 Beacon Street
CITY/STATE: Brookline, Massachusetts
GEI PROJECT NUMBER: 1804540

GEI Consultants

BORING INFORMATION

LOCATION: See Plan
GROUND SURFACE EL. (ft): 56
VERTICAL DATUM: Town of Brookline
TOTAL DEPTH (ft): 51.0
LOGGED BY: J. Scully
DATE START/END: 12/17/2018 - 12/14/2018
DRILLING COMPANY: Northern Drill Service, Inc.
DRILLER NAME: J. Stevens
RIG TYPE: Mobile B-59 Truck Rig

BORING

B4

DRILLING INFORMATION

HAMMER TYPE: Automatic
AUGER I.D./O.D.: NA / NA
DRILLING METHOD: Driven casing and washed with rotary tooling.
WATER LEVEL DEPTHS (ft): ▼ 13.0
CASING I.D./O.D.: 4 inch / 4.5 inch
DRILL ROD O.D.: NM
CORE BARREL TYPE: NA
CORE BARREL I.D./O.D. NA / NA

ABBREVIATIONS:
Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation
= Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer
S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger
Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D. = Inside Diameter/Outside Diameter
NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140-lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
							FILL	ASPHALT ~3".
55		S1	0.5 to 2.5	24/5	8-10-8-6			S1: SILTY SAND WITH GRAVEL (SM); ~55% fine to coarse sand, ~30% gravel up to ~3/4", ~15% nonplastic fines, dark brown.
	5	S2	4 to 6	24/12	26-40-43-45			S2: WIDELY GRADED SAND WITH SILT AND GRAVEL (SW-SM); ~55% fine to coarse sand, ~35% gravel up to ~1", ~10% nonplastic fines, brown.
50								
	10	S3	9 to 11	24/8	12-23-16-16			S3: WIDELY GRADED SAND WITH SILT AND GRAVEL (SW-SM); Similar to S2, except gray.
45								
	15	S4	14 to 16	24/9	10-28-26-23			S4: WIDELY GRADED SAND WITH SILT AND GRAVEL (SW-SM); ~60% fine to coarse sand, ~30% gravel up to ~1/2", ~10% nonplastic fines, brown, gray.
40						Strata change at ~17 ft.		
	20	S5	19 to 21	24/8	9-13-14-16		SAND	S5: WIDELY GRADED SAND WITH SILT AND GRAVEL (SW-SM); ~70% fine to coarse sand, ~20% gravel up to ~1/4", ~10% nonplastic fines, tan, brown.
35								

NOTES: Ground surface elevation estimated from existing conditions plan. Water level measured upon completion of drilling and may not represent stabilized water level.

PROJECT NAME: 1299 Beacon Street
CITY/STATE: Brookline, Massachusetts
GEI PROJECT NUMBER: 1804540

GEI Consultants

GEI WOBURN STD 1-LOCATION-LAYER NAME BORING LOGS.GPJ 1/9/19

LOCATION: See Plan
GROUND SURFACE EL. (ft): 56 **DATE START/END:** 12/17/2018 - 12/14/2018
VERTICAL DATUM: Town of Brookline **DRILLING COMPANY:** Northern Drill Service, Inc.

BORING B4

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
	25	S6	24 to 26	24/0	13-19-26-21	Redrove S6 with 3-inch spoon.	SAND	S6: NO RECOVERY. S6 (Redrive): SILTY SAND (SM); 76.7% mostly fine to medium sand, 9.8% fine gravel up to ~1/4", 13.5% nonplastic fines, brown.
30								
	30	S7	29 to 31	24/14	8-6-8-11			S7: SILTY SAND (SM); ~70% fine sand, ~30% nonplastic fines.
25						Alternating gray and tan drill water return.		
	35	S8	34 to 36	24/8	14-18-12-11			S8: SANDY SILT (ML); ~60% low plasticity fines, ~40% fine sand, olive.
20								
	40	S9	39 to 41	24/12	7-13-13-14			S9: SILTY SAND (SM); 72.4% mostly fine sand, 27.6% nonplastic fines, gray.
15								
	45	S10	44 to 46	24/14	1-1-1-3		CLAY	S10: LEAN CLAY (CL); ~95% medium plasticity fines, ~5% fine sand, olive-gray.
10								
	50	S11	49 to 51	24/18	WOH-1-2-5			S11: LEAN CLAY (CL); Similar to S10, except with lenses of fine sand.
5								Bottom of boring at 51 ft. Backfilled with soil cuttings. Topped with asphalt patch.
	55							

NOTES: Ground surface elevation estimated from existing conditions plan. Water level measured upon completion of drilling and may not represent stabilized water level.

PROJECT NAME: 1299 Beacon Street
CITY/STATE: Brookline, Massachusetts
GEI PROJECT NUMBER: 1804540

GEI Consultants

BORING INFORMATION

LOCATION: See Plan
GROUND SURFACE EL. (ft): 55.5
VERTICAL DATUM: Town of Brookline
TOTAL DEPTH (ft): 31.0
LOGGED BY: J. Scully
DATE START/END: 12/12/2018 - 12/12/2018
DRILLING COMPANY: Northern Drill Service, Inc.
DRILLER NAME: T. Tucker
RIG TYPE: Mobile B-59 Truck Rig

BORING B5(OW)

DRILLING INFORMATION

HAMMER TYPE: Automatic
AUGER I.D./O.D.: NA / NA
DRILLING METHOD: Driven casing and washed with rotary tooling.
WATER LEVEL DEPTHS (ft): ▼ 15.0
CASING I.D./O.D.: 4 inch / 4.5 inch
DRILL ROD O.D.: NM
CORE BARREL TYPE: NA
CORE BARREL I.D./O.D. NA / NA

ABBREVIATIONS:
Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation
= Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer
S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger
Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D. = Inside Diameter/Outside Diameter
NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140-lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
55							FILL	ASPHALT ~3".
		S1	0.5 to 2.5	24/11	7-14-10-6			S1: SILTY SAND (SM); ~45% fine to coarse sand, ~35% gravel up to ~1/2", ~20% low plasticity fines, dark brown.
	5	S2	4 to 5.6	19/7	15-26-38-40/1"			S2: SILTY SAND WITH GRAVEL (SM); ~45% fine to coarse sand, ~40% gravel up to ~1/2", `15% nonplastic fines, brown.
50						Hard drilling at ~5.6 ft.		
	10	S3	9 to 11	24/10	21-18-16-20			S3: SILTY GRAVEL WITH SAND (GM); ~50% fine to medium gravel up to ~3/4", ~35% fine to coarse sand, ~15% nonplastic fines, brown.
45								
	15	S4	14 to 16	24/12	16-26-13-15			S4: WIDELY GRADED SAND WITH SILT AND GRAVEL(SW-SM); ~70% fine to coarse sand, ~20% fine to medium gravel, up to ~3/4", ~10% nonplastic fines, brown.
40						Possible strata change at ~17 ft.		
	20	S5	19 to 21	24/8	10-14-31-36			S5: WIDELY GRADED SAND WITH SILT AND GRAVEL (SW-SM); ~75% fine to coarse sand, ~15% gravel up to ~1/4", ~10% nonplastic fines, brown.
35							SAND	

NOTES: Ground surface elevation estimated from existing conditions plan. Water level measured upon completion of drilling and may not represent stabilized water level.

PROJECT NAME: 1299 Beacon Street
CITY/STATE: Brookline, Massachusetts
GEI PROJECT NUMBER: 1804540

GEI Consultants

LOCATION: See Plan
GROUND SURFACE EL. (ft): 55.5 **DATE START/END:** 12/12/2018 - 12/12/2018
VERTICAL DATUM: Town of Brookline **DRILLING COMPANY:** Northern Drill Service, Inc.

BORING B5(OW)

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
30	25	S6	24 to 26	24/15	13-15-12-13		SAND	S6: SILTY SAND (SM); 55.6% fine sand, ~44.4% nonplastic fines, olive-gray, tan.
25	30	S7	29 to 31	24/18	4-7-13-12			S7: SILTY SAND (SM); ~70% fine sand, ~30% nonplastic fines, tan, trace~1/4" thick layers of lean clay.
20	35							Bottom of boring at 31 ft. Groundwater observation well installed upon completion.
15	40							
10	45							
5	50							
	55							

NOTES: Ground surface elevation estimated from existing conditions plan. Water level measured upon completion of drilling and may not represent stabilized water level.

PROJECT NAME: 1299 Beacon Street
CITY/STATE: Brookline, Massachusetts
GEI PROJECT NUMBER: 1804540

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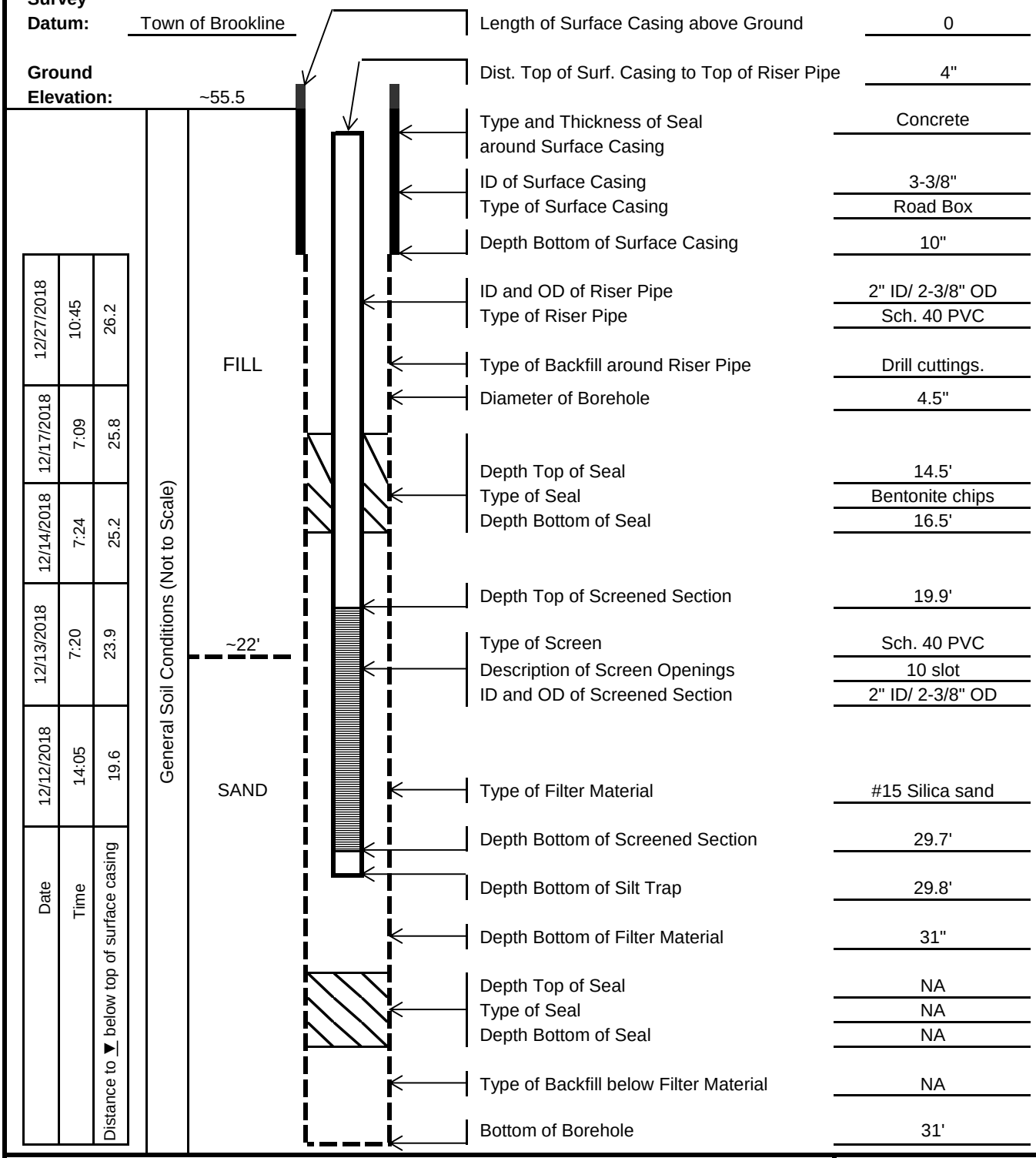
Groundwater Well Installation Log

B5(OW)

Project	1299 Beacon Street	**GEI Proj. No.**	1804540
City / Town	Brookline, MA	**Location**	1299 Beacon St.
Client	Mason & Murphy, inc.		Brookline, MA.
Contractor	Northern Drill Service		Rear parking lot.
Driller	T. Tucker **GEI Rep.** J. Scully	**Install Date**	12/12/18

Survey Datum: Town of Brookline

Ground Elevation: ~55.5



Date	12/12/2018	12/13/2018	12/14/2018	12/17/2018	12/27/2018
Time	14:05	7:20	7:24	7:09	10:45
Distance to ▼ below top of surface casing	19.6	23.9	25.2	25.8	26.2

Length of Surface Casing above Ground	0
Dist. Top of Surf. Casing to Top of Riser Pipe	4"
Type and Thickness of Seal around Surface Casing	Concrete
ID of Surface Casing	3-3/8"
Type of Surface Casing	Road Box
Depth Bottom of Surface Casing	10"
ID and OD of Riser Pipe	2" ID/ 2-3/8" OD
Type of Riser Pipe	Sch. 40 PVC
Type of Backfill around Riser Pipe	Drill cuttings.
Diameter of Borehole	4.5"
Depth Top of Seal	14.5'
Type of Seal	Bentonite chips
Depth Bottom of Seal	16.5'
Depth Top of Screened Section	19.9'
Type of Screen	Sch. 40 PVC
Description of Screen Openings	10 slot
ID and OD of Screened Section	2" ID/ 2-3/8" OD
Type of Filter Material	#15 Silica sand
Depth Bottom of Screened Section	29.7'
Depth Bottom of Silt Trap	29.8'
Depth Bottom of Filter Material	31"
Depth Top of Seal	NA
Type of Seal	NA
Depth Bottom of Seal	NA
Type of Backfill below Filter Material	NA
Bottom of Borehole	31'

Notes:

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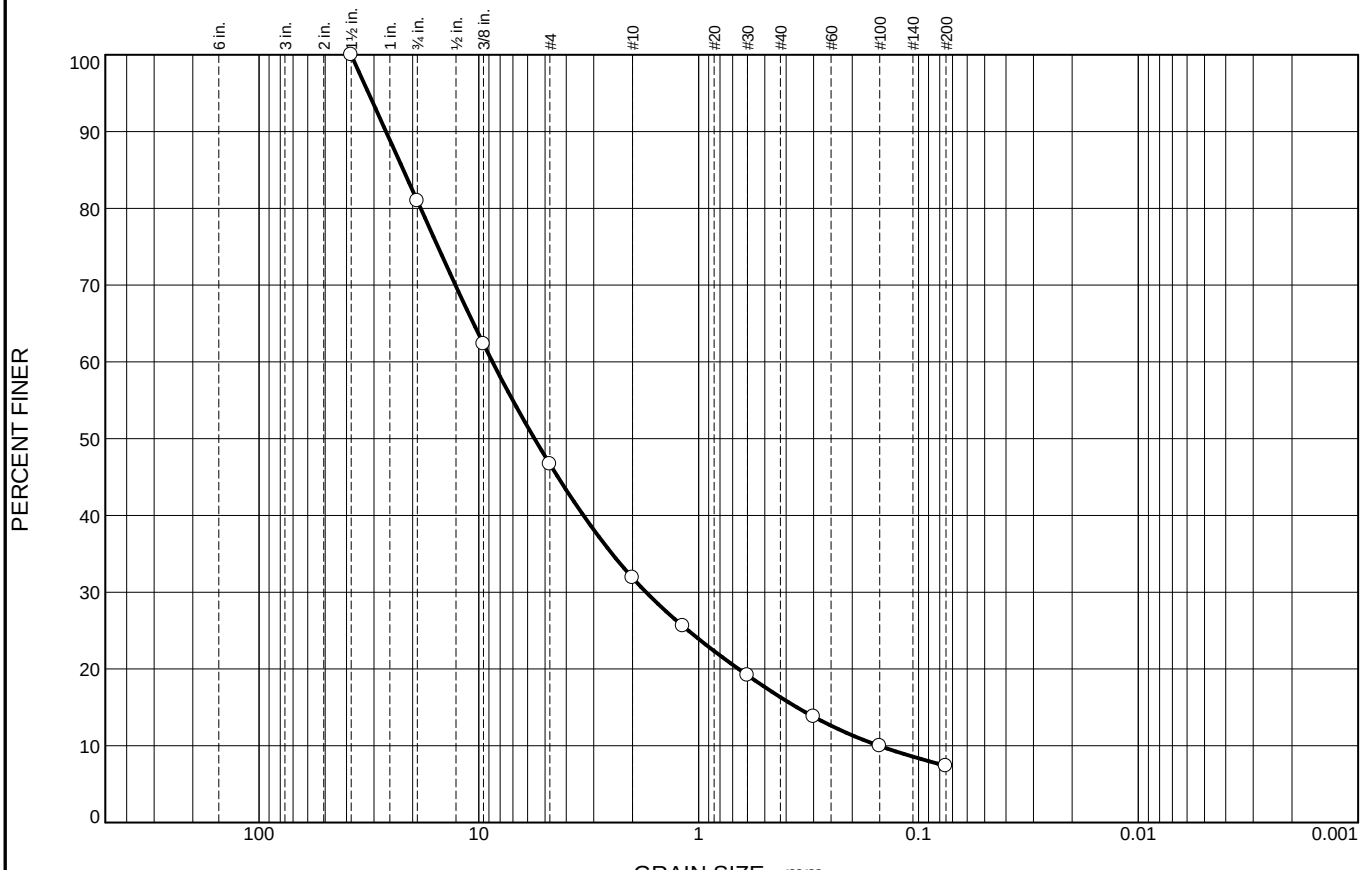
Appendix B

Laboratory Test Results

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	19.0	34.3	14.8	15.6	8.9	7.4	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	-	-	22.0501	8.6680	5.5803	1.7342	0.3567	0.1512	2.30	57.33

Material Description	USCS	AASHTO
○ Widely Graded GRAVEL with Silt and Sand	GW-GM	-

Project No. 1804540 **Client:** Mason & Murphy, Inc.

Project: 1299 Beacon Street

○ **Source of Sample:** B1 **Depth:** 9-11 ft **Sample Number:** S3

Remarks:

○As Rec'd WC = 9.4%

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Woburn, MA 01801

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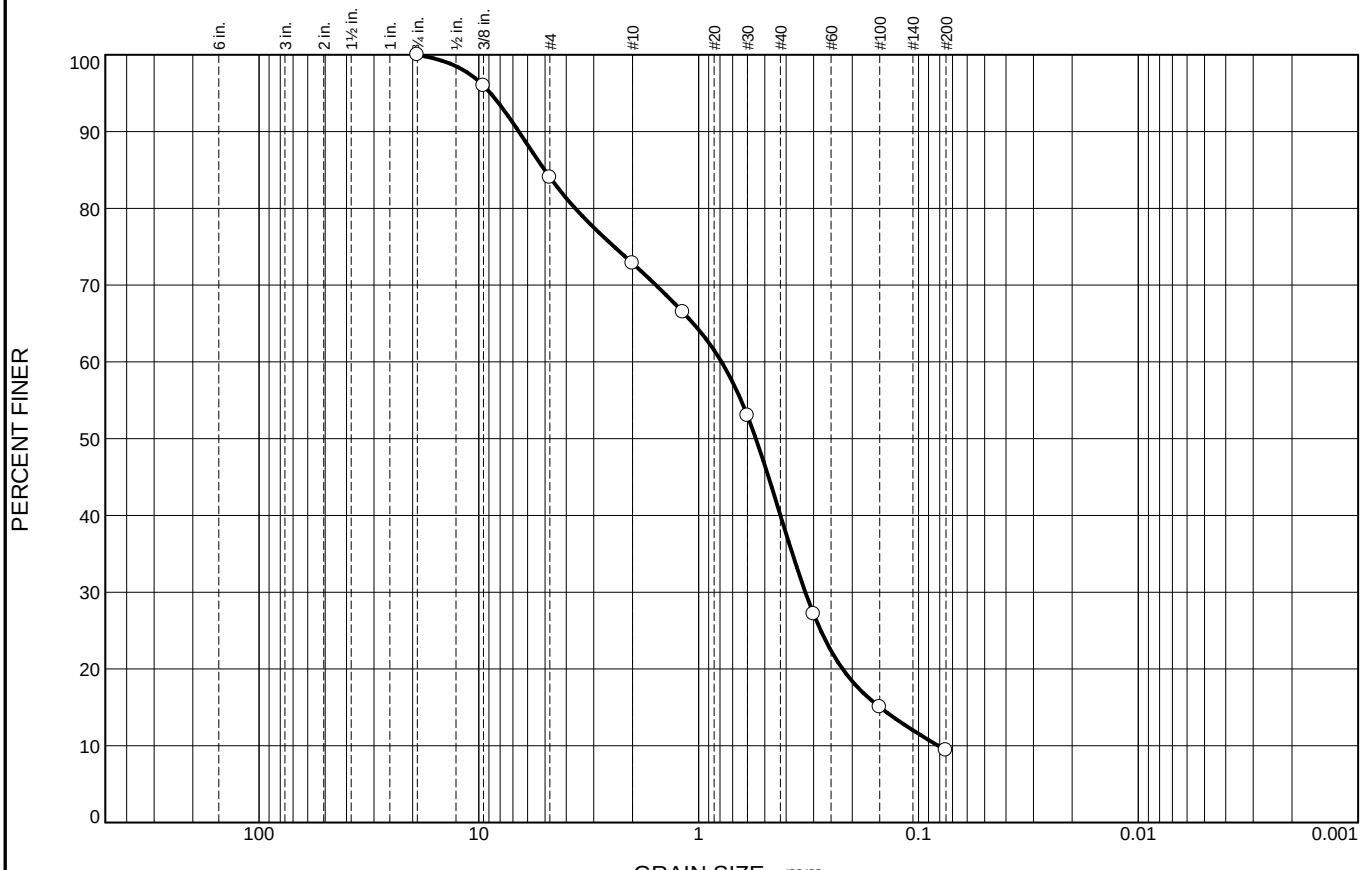
Figure

Tested By: EF **Checked By:** MHC

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	16.0	11.2	32.7	30.7	9.4	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	-	-	5.0222	0.7865	0.5491	0.3271	0.1494	0.0812	1.68	9.69

Material Description	USCS	AASHTO
○ Widely Graded SAND with Silt and Gravel	SW-SM	-

Project No. 1804540 **Client:** Mason & Murphy, Inc.

Project: 1299 Beacon Street

○ **Source of Sample:** B1 **Depth:** 19-21 ft **Sample Number:** S5

Remarks:

○As Rec'd WC = 9.6%

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Figure

Tested By: EF **Checked By:** DJA

Particle Size Distribution Report

	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.1	0.6	49.5	49.8	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	-	-	0.1315	0.0868	0.0752					

Material Description	USCS	AASHTO
○ Silty SAND	SM	-

Project No. 1804540 **Client:** Mason & Murphy, Inc.

Project: 1299 Beacon Street

○ **Source of Sample:** B2 **Depth:** 24-26 ft **Sample Number:** S6

Remarks:

○As Rec'd WC = 24.4%

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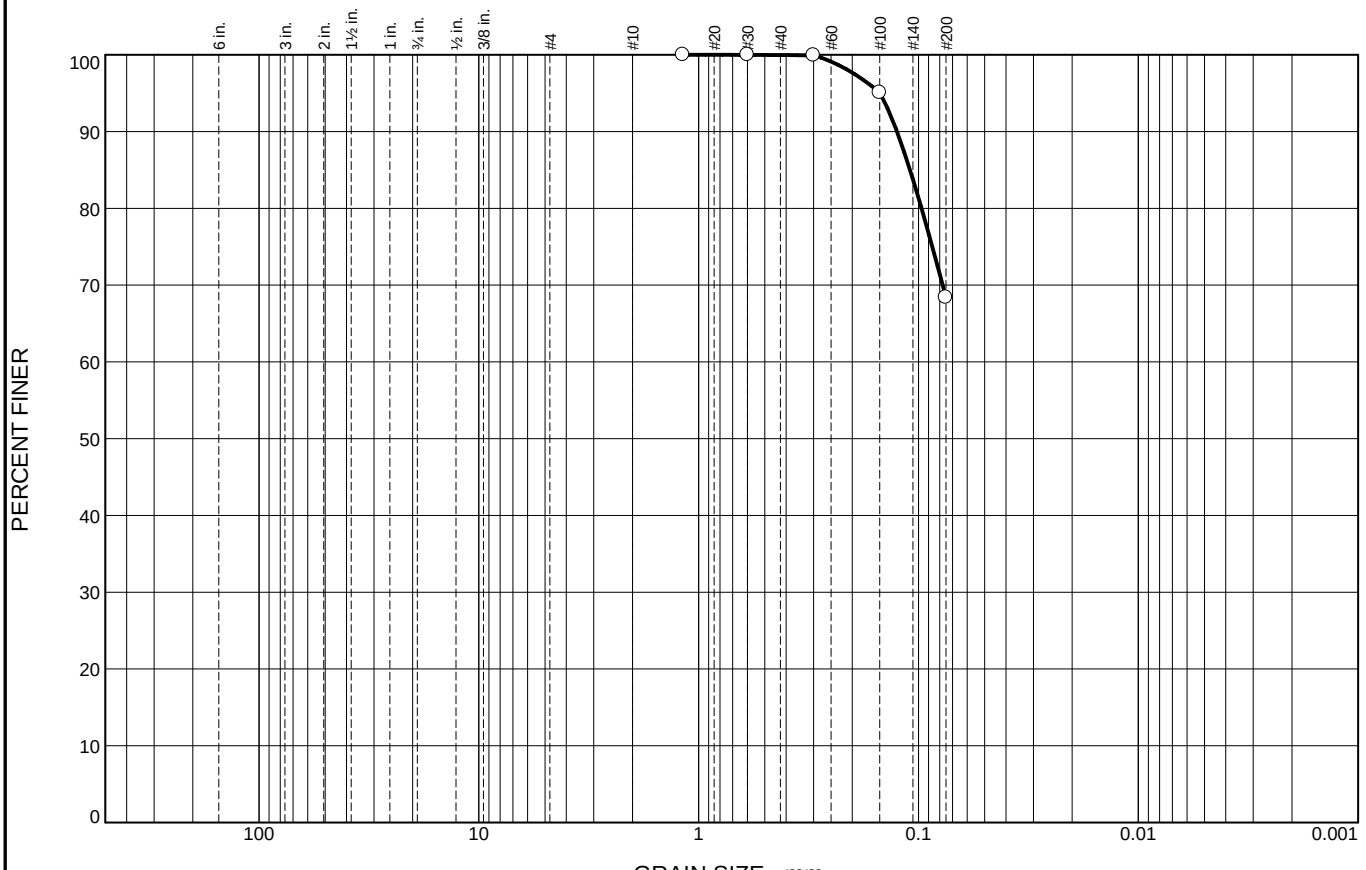
Figure

Tested By: EF **Checked By:** MHC

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	31.6	68.4	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	-	-	0.1093							

Material Description	USCS	AASHTO
○ Sandy SILT	ML	-

Project No. 1804540 **Client:** Mason & Murphy, Inc.

Project: 1299 Beacon Street

○ **Source of Sample:** B2 **Depth:** 34-36 ft **Sample Number:** S8

Remarks:

○As Rec'd WC = 23.8%

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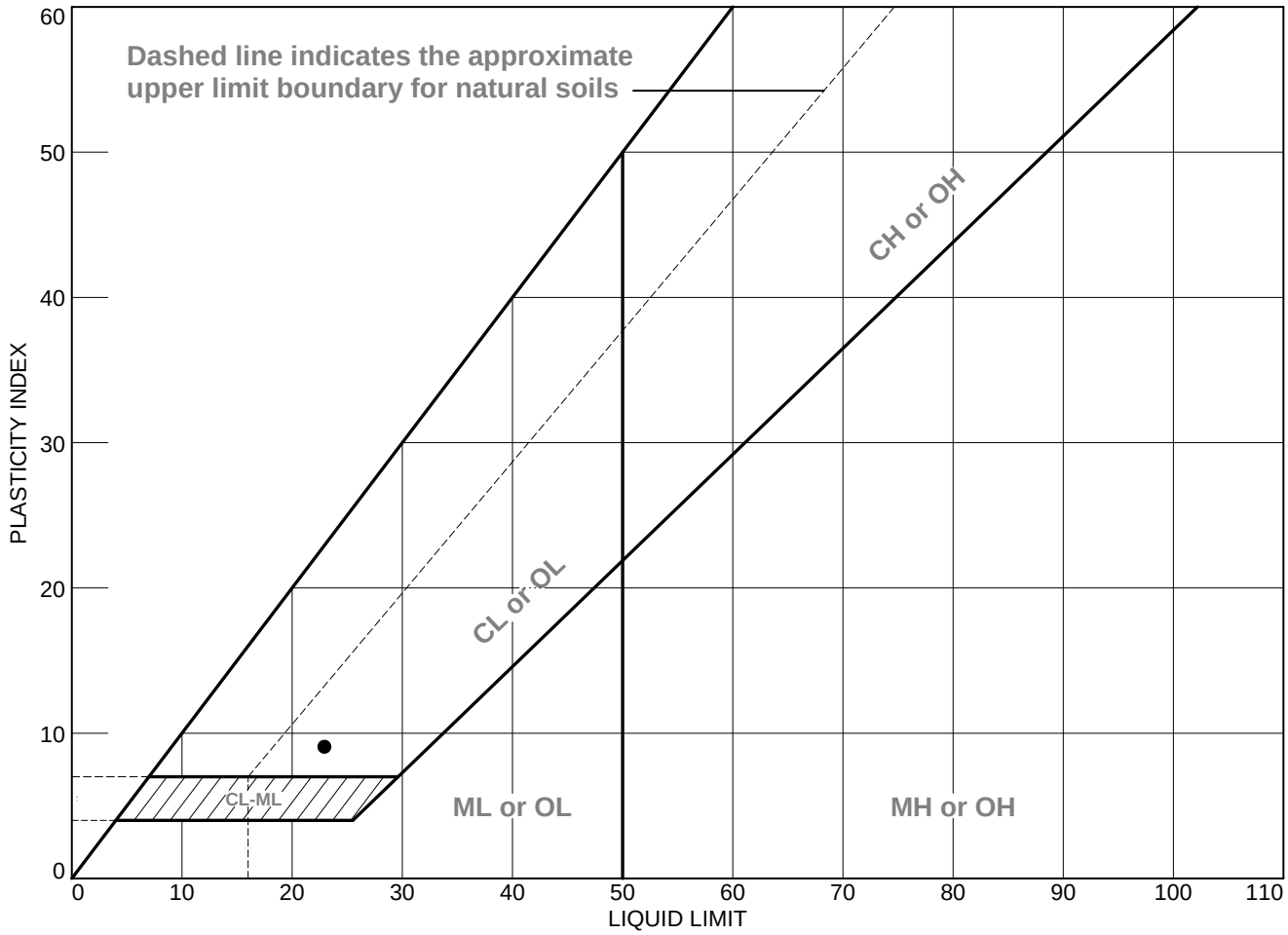
Figure

Tested By: EF **Checked By:** DJA

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	B2	S10	44-46 ft	25.0	14	23	9	CL

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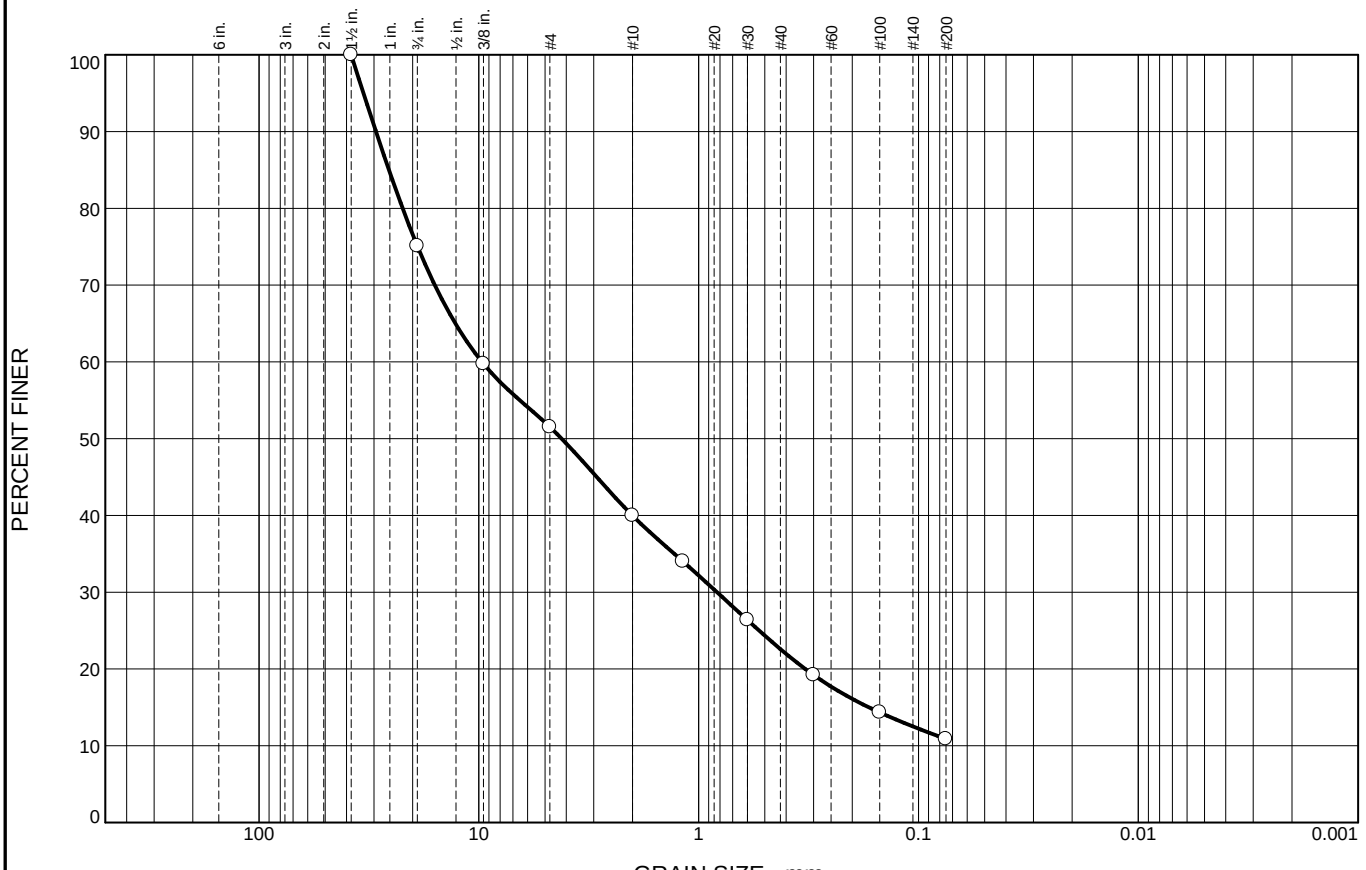
Client: Mason & Murphy, Inc.
Project: 1299 Beacon Street
Project No.: 1804540 **Figure**

Tested By: MHC **Checked By:** EF

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	24.9	23.6	11.5	17.4	11.7	10.9	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	-	-	25.6461	9.6868	4.1985	0.8249	0.1680			

Material Description	USCS	AASHTO
○ Narrowly Graded GRAVEL with Silt and Sand	GP-GM	-

Project No. 1804540 **Client:** Mason & Murphy, Inc.

Project: 1299 Beacon Street

○ **Source of Sample:** B3 **Depth:** 9-11 ft **Sample Number:** S3

Remarks:

○As Rec'd WC = 6.7%

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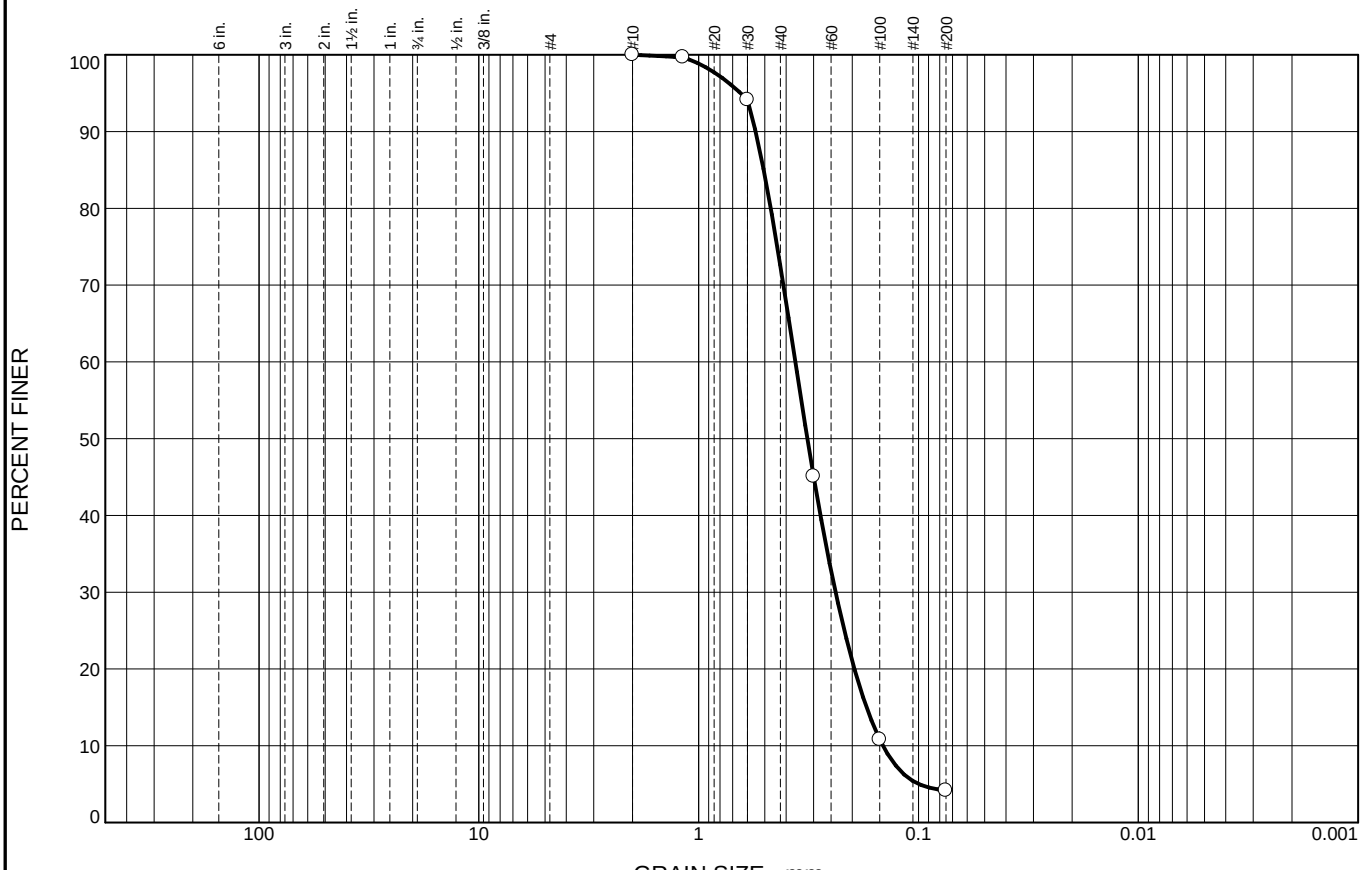
Figure

Tested By: EF **Checked By:** DJA

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	27.5	68.3	4.2	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	-	-	0.5060	0.3632	0.3201	0.2382	0.1723	0.1452	1.08	2.50

Material Description	USCS	AASHTO
○ Narrowly Graded SAND	SP	-

Project No. 1804540 **Client:** Mason & Murphy, Inc.

Project: 1299 Beacon Street

○ **Source of Sample:** B3 **Depth:** 44-46 ft **Sample Number:** S10

Remarks:

○As Rec'd WC = 21.3%

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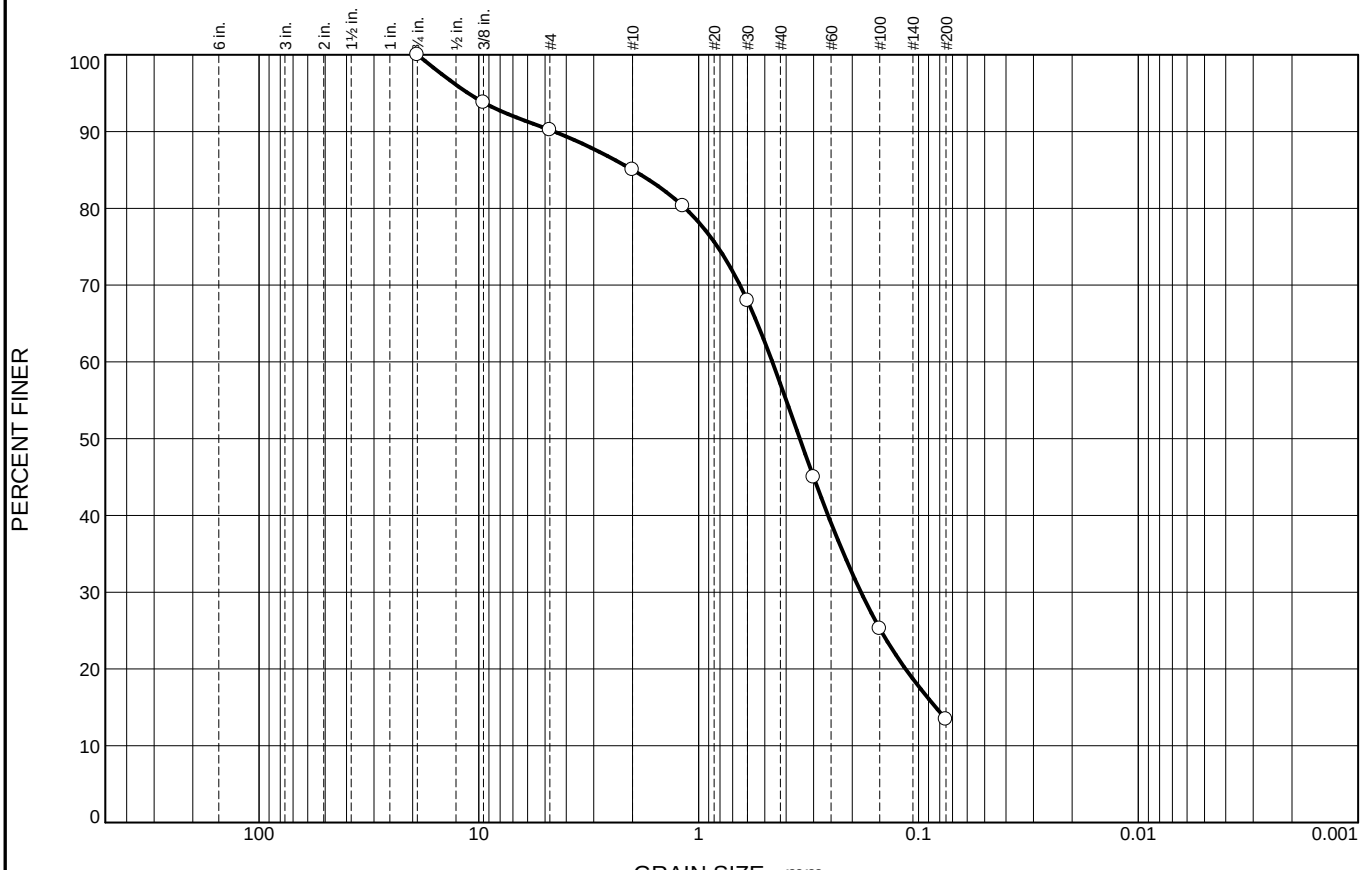
Figure

Tested By: EF/MHC **Checked By:** DJA

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	9.8	5.2	27.9	43.6	13.5	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	-	-	1.9958	0.4622	0.3466	0.1827	0.0834			

Material Description	USCS	AASHTO
○ Silty SAND	SM	-

Project No. 1804540 **Client:** Mason & Murphy, Inc.

Project: 1299 Beacon Street

○ **Source of Sample:** B4 **Depth:** 24-26 ft **Sample Number:** S6

Remarks:

○As Rec'd WC = 16.2%

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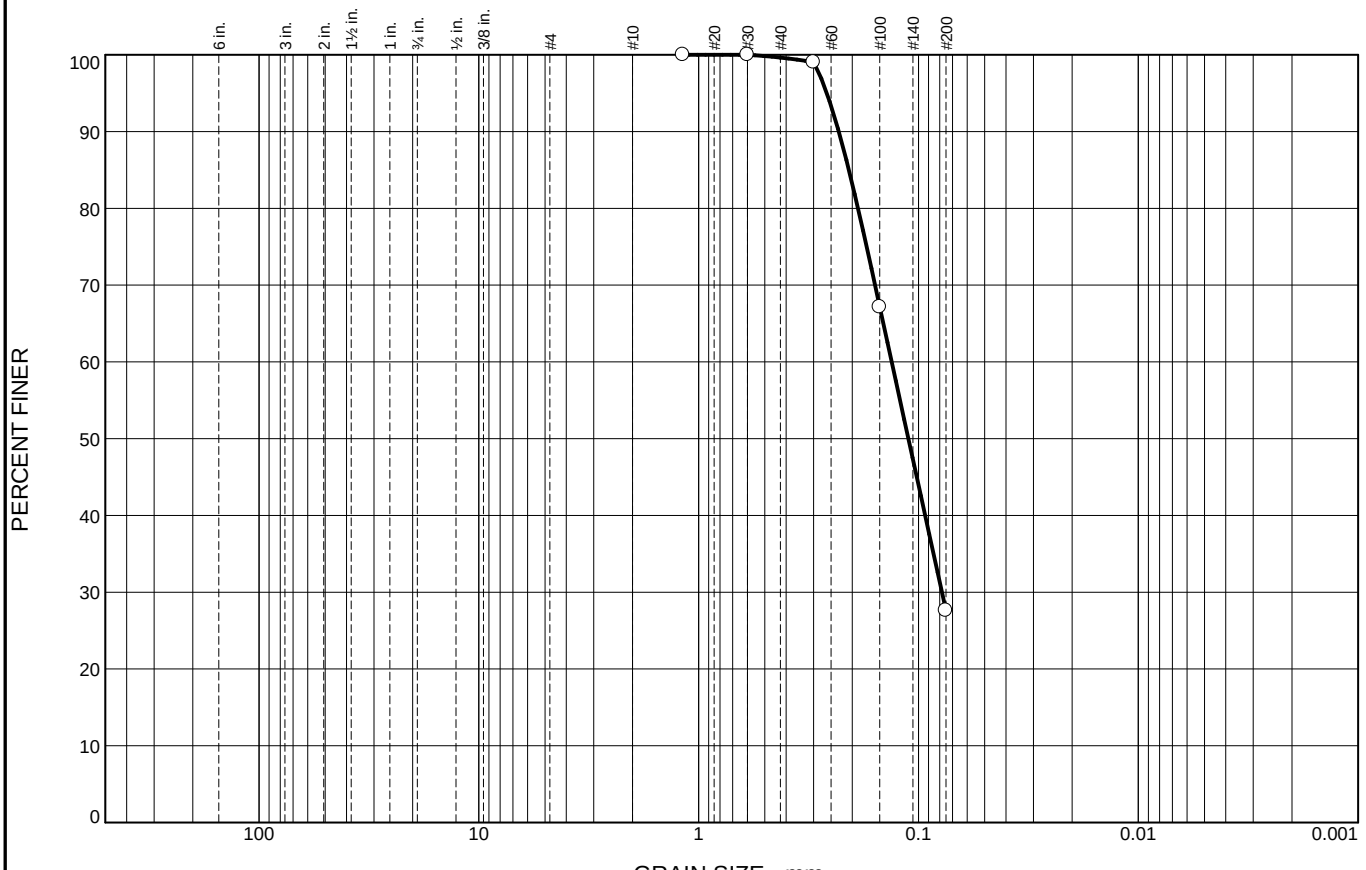
Figure

Tested By: EF **Checked By:** MHC

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.4	72.0	27.6	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	-	-	0.2074	0.1324	0.1111	0.0782				

Material Description	USCS	AASHTO
○ Silty SAND	SM	-

Project No. 1804540 **Client:** Mason & Murphy, Inc.

Project: 1299 Beacon Street

○ **Source of Sample:** B4 **Depth:** 39-41 ft **Sample Number:** S9

Remarks:

○As Rec'd WC = 23.9%

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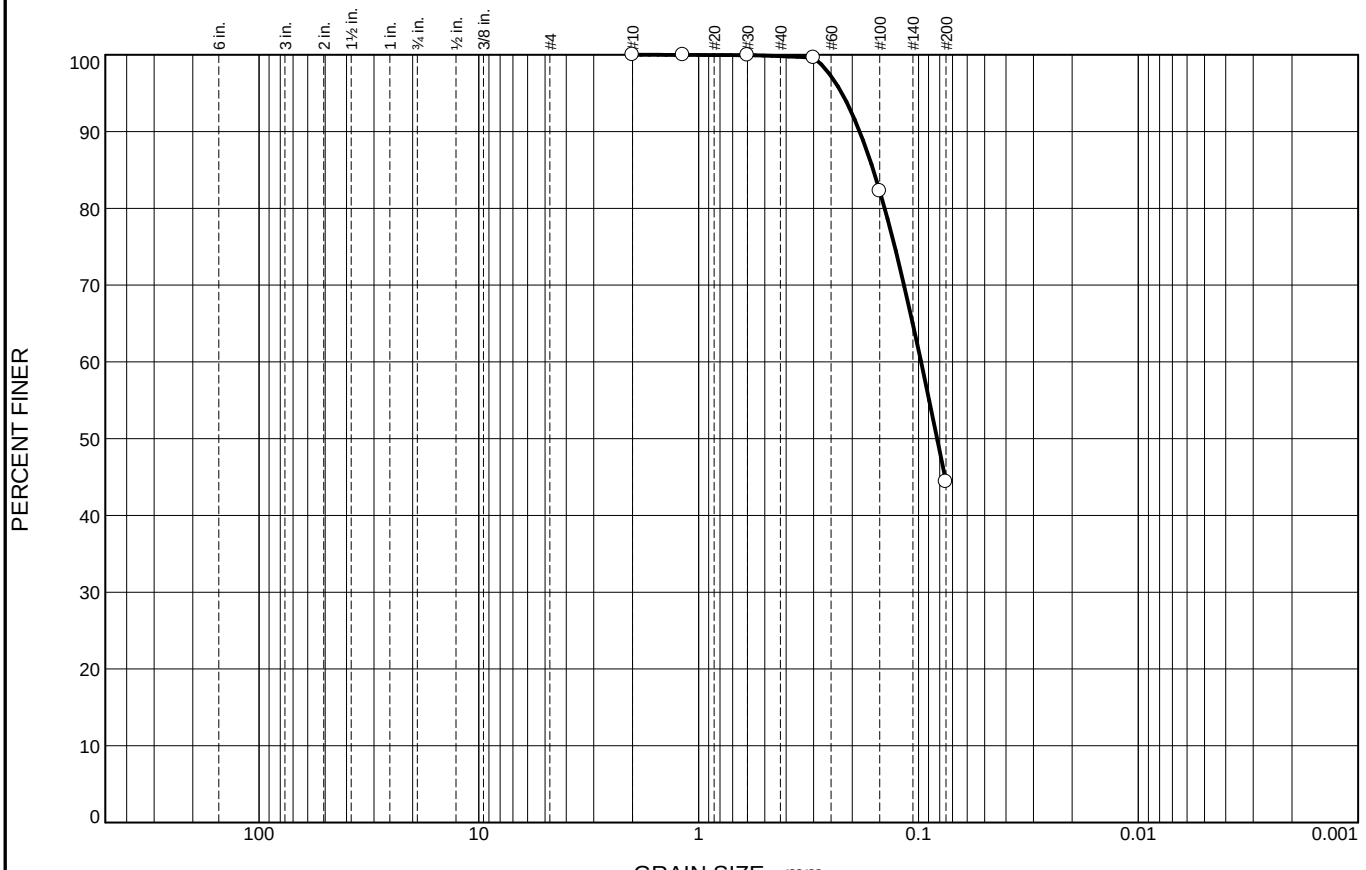
Figure

Tested By: EF **Checked By:** MHC

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.2	55.4	44.4	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	-	-	0.1606	0.0973	0.0823					

Material Description	USCS	AASHTO
○ Silty SAND	SM	-

Project No. 1804540 **Client:** Mason & Murphy, Inc.

Project: 1299 Beacon Street

○ **Source of Sample:** B5 **Depth:** 24-26 ft **Sample Number:** S6

Remarks:

○As Rec'd WC = 23.6%

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Figure

Tested By: EF **Checked By:** DJA