PRELIMINARY FOUNDATION ENGINEERING REPORT

LEICESTER MIDDLE SCHOOL

LEICESTER, MASSACHUSETTS

APRIL 1, 2019

Prepared For:

Finegold Alexander Architects
77 North Washington Street
Boston, MA 02114

PROJECT NO. 6743.2.00

2269 Massachusetts Avenue
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April 1, 2019

Finegold Alexander Architects
77 North Washington Street
Boston, MA 02114

Attention: Ms. Regan Shields Ives

Reference: Leicester Middle School; Leicester, Massachusetts
Preliminary Foundation Engineering Report

Ladies and Gentlemen:

This report documents the results of our subsurface exploration program and preliminary foundation design study to be included as part of a feasibility study of the planned construction of a new middle school building at the site of the existing Leicester Middle and High Schools located in Leicester, Massachusetts. Refer to the Project Location Plan (**Figure 1**) for the general site location.

This report was prepared in accordance with our proposal dated January 30, 2019, and the subsequent authorization of Finegold Alexander Architects (FAA). These services are subject to the limitations contained in **Appendix A**.

Purpose and Scope

The purpose of our preliminary design study was to obtain initial subsurface information across the proposed building site and to identify preliminary foundation design considerations associated with the feasibility study assessing options for the proposed project.

Available Information

Information available to McPhail Associates, LLC (McPhail) for use in the preparation of this report included the following:

- An undated compilation of existing site survey information transmitted to McPhail electronically on February 27, 2019 from FAA; and
- A draft Existing Conditions Plan provided by Nitsch Engineering on April 1, 2019.

Elevations referenced herein are in feet and are referenced to the North American Vertical Datum of 1988 (NAVD 88).

GEOTECHNICAL AND GEOENVIRONMENTAL ENGINEERS
2269 Massachusetts Avenue
Cambridge, Massachusetts 02140
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Existing and Proposed Conditions

It is understood that a feasibility study is being conducted to assess several alternative locations for construction of a new middle school in the area north of the existing Leicester Middle School, which fronts onto Winslow Avenue to the south, and south of the existing Leicester High School, which fronts onto Paxton Street to the west. The existing school buildings are generally surrounded by bituminous concrete paved parking lots and roadways with landscaped margins. Grassed athletic fields occupy the majority of the remaining site area and a pond is located at the southeast corner of the site. The remainder of the site is generally bordered by wooded areas and/or residential properties. The Leicester Senior Center borders the site to the southeast.

It is understood that the proposed construction will likely include a new middle school which would be located in the general vicinity of the existing athletic fields. The size and layout of the proposed building is presently unknown, as well as if it would contain occupied below-grade space.

The athletic fields are generally separated into four relatively level areas which are considered as feasible options for the location of the proposed new school building. East of the existing high school building, the football field is generally level at about Elevation +1000. Located to the north of the existing middle school building, the softball field and general use field to the northwest of the softball field backstop is relatively level at approximately Elevation +995. The general use field consists of a slight slope from north to south down to approximately Elevation +991, where a more pronounced slope leads down to the lacrosse/soccer field at approximately Elevation +987. To the northeast of the existing middle school building, downhill of the surrounding asphalt parking lot, the baseball field is located at approximately Elevation +967.

Subsurface Exploration Program

A subsurface exploration program consisting of eight (8) borings was conducted at the site on March 5 and 6, 2019 by Technical Drilling Services (TDS) of Sterling, Massachusetts under contract to McPhail. Boring logs prepared by McPhail are contained in **Appendix B** and approximate plan locations of the borings are as indicated on the enclosed Subsurface Exploration Plan, **Figure 2**.

Borings were performed utilizing track-mounted drilling equipment. Each boring was advanced using 2.25-inch inner diameter hollow stem augers. Standard 2-inch O.D. split-spoon samples and standard penetration tests (SPT) were generally obtained at 5-foot intervals of depth in accordance with the standard procedures in ASTM D1586. The borings were terminated at depths ranging from 11.5 to 27 feet below the existing ground surface.

The explorations were observed by a representative of McPhail who performed field layout, prepared field logs, obtained and visually classified soil samples, monitored groundwater

conditions in the borings, and made minor adjustments to the exploration locations and determined the required exploration depths based upon the actual subsurface conditions encountered.

Field locations of the borings and the ground surface elevation at each boring location were determined by survey by Nitsch Engineering.

Laboratory Testing

At the completion of the subsurface exploration program, soil samples were returned to our laboratory for more detailed classification, analysis, and testing. The laboratory testing consisted of sieve analyses to determine the grain size distribution and confirm the visual classifications of the fill and glacial till deposits. Laboratory test procedures were in general accordance with applicable ASTM Standards. Results of the gradation testing appear on **Figure 3** and **Figure 4** following the text of this report.

Subsurface Conditions

A detailed description of the subsurface conditions encountered within the borings is documented on the boring logs contained in **Appendix B**. Based on these explorations, the following is a description of the generalized subsurface conditions encountered across the site from ground surface downward.

Underlying a thin surficial layer of topsoil, the borings encountered fill soil which extends to depths of about 2 to 7 feet below ground surface. The fill generally consists of a loose to dense, dark brown to orange-brown silt and sand with trace to some gravel varying to a gravelly sand with trace to some silt. The fill also contains trace amounts of root matter and clay and likely contains cobbles as well. Furthermore, the fill within boring MA-6 was also observed to contain a trace of brick and ash. Grain size distributions of samples of the fill are shown on **Figure 3**. Based on a comparison of the grain size distributions of the fill and underlying glacial till deposit, the fill observed in the borings appears to primarily consist of reworked natural glacial till.

A historic topsoil/subsoil layer was encountered underlying the fill within boring MA-1 at an approximate depth of 4 feet below the existing ground surface, extending to the glacial till deposit at a depth of approximately 6 feet. The historic topsoil/subsoil layer was generally observed to consist of a loose, black-brown sandy silt with trace gravel and some root matter.

Underlying the fill and/or historic topsoil/subsoil, a natural glacial till deposit was encountered within each boring at depths of 2 to 7 feet below grade, specifically ranging from about Elevation +998.6 at boring MA-7 to about Elevation +961.5 at boring MA-1. The glacial till deposit was observed to generally consist of a compact to very dense, brown

to orange-brown to gray silt and sand with trace to some gravel and trace clay varying to a silty sand with some to trace gravel and trace clay. Grain size distributions of samples of the glacial till deposit are shown on **Figure 4**.

Borings MA-1, MA-2, and MA-6 through MA-8 were terminated in the glacial till deposit at depths of 12 to 27 feet below ground surface. Borings MA-3 through MA-5 were terminated upon auger or split spoon refusal, which is generally assumed to be indicative of cobbles or boulders within the glacial till deposit or potentially the underlying bedrock surface, at approximate depths varying from 11.5 to 14.7 feet below ground surface.

Groundwater was observed in borings MA-1 and MA-3 through MA-6 upon completion of drilling at approximate depths ranging from about 6 to 8 feet below ground surface, corresponding to levels ranging from about Elevation +961.5 to about Elevation +992.6. It is anticipated that water levels could be indicative of groundwater that is perched on top of the relatively impervious glacial till deposit or the surface of the bedrock. Groundwater was not encountered in boring MA-2 upon completion of drilling. Additionally, it is anticipated that future groundwater levels across the site may vary from those reported herein due to factors such as normal seasonal changes, periods of heavy precipitation and alterations of existing drainage patterns.

Preliminary Foundation Design Recommendations

Based on the scope of the proposed development and the subsurface conditions encountered at the site, for preliminary design purposes it is recommended that foundation support for the proposed structure consist of conventional spread footing foundations in conjunction with slab-on-grade construction. Additional foundation design recommendations are contained below.

Footing Recommendations

Footings are recommended to bear on the natural, undisturbed glacial till deposit, or on imported gravel borrow that is placed and compacted over the natural glacial till deposit. For preliminary design purposes, the footings should be proportioned utilizing a maximum design bearing pressure of two (2) tons per square-foot (tsf). All foundations should be designed in accordance with the Code. Recommended minimum footing widths for continuous and isolated spread footings are 24 and 36 inches, respectively.

All footings in unheated areas should be provided with a minimum 4-foot thickness of soil cover as frost protection. Interior foundations should be located such that the top of the foundation concrete is a minimum of 6 inches below the underside of the lowest level slab. All foundations should be located such that they bear below a theoretical line drawn upward and outward at 2 to 1 (horizontal to vertical) from the bottom exterior edge of all adjacent footings, structures and utilities.

Fill material should be removed at footing locations and within the lateral limits defined herein for the placement of gravel borrow. Where proposed footings are to be supported on gravel borrow, the lateral limits of the excavation should extend beyond the outside edge of the footings for a horizontal distance equal to the depth from the bottom of the proposed footing to the surface of the natural, undisturbed glacial till deposit, plus two (2) feet in all plan directions.

Gravel borrow should consist of an off-site well-graded natural sand and gravel containing less than eight (8) percent passing the no. 200 sieve. Reuse of the on-site soil as ordinary fill outside the building footprint is discussed in more detail in the "Preliminary Geotechnical Construction Considerations" section of this report.

All gravel borrow placed within the footprint of the proposed building for support of the footings and slab-on-grade should be placed in lifts having a compacted thickness of 6 inches and be compacted to a minimum of 95 percent of its maximum modified Proctor dry density. The placement and compaction of gravel borrow should be monitored by a Registered Professional Engineer or his designated representative in accordance with the provisions of the Code.

Slab Recommendations

The proposed lowest level slabs should be designed as conventional soil-supported slabs-on-grade bearing on proof-compacted existing fill material or on imported gravel borrow that is placed and compacted over the proof-compacted existing fill material. Preparation of the building pad for support of the spread footings and slabs should include the removal of all topsoil from the entire proposed building footprint.

The existing fill, where encountered, may remain in place below the lowest level slab provided it is proof-compacted with a minimum of six (6) passes of a large walk-behind double drum vibratory roller. All soft, spongy or "weaving" areas observed during the proof-compaction should be removed and replaced with compacted gravel borrow.

The lowest level slabs should be underlain by a polyethylene vapor barrier spread across the surface of a 9-inch thickness of compacted ¾-inch crushed stone, which is underlain by filter fabric, such as Mirafi 140N or equivalent, spread across the proof-compacted fill or glacial till subgrade.

As indicated above, groundwater was encountered in several borings at depths of 6 to 8 feet below ground surface upon the completion of drilling. If the proposed lowest level slabs will be located below-grade, groundwater and/or surface water runoff that infiltrates into the ground could become periodically or seasonally perched on the surface of the fill or glacial till and infiltrate into the occupied below-grade space. Therefore, to protect the lowest level slabs from groundwater intrusion, underslab and perimeter foundation drains may be required. The proposed grading plan should be provided to McPhail for review to determine

if foundation drainage is required. Recommendations for foundation drainage, if required, would be contained in the Final Foundation Engineering Report (FFER).

All localized depressions in the lowest level slab (such as elevator pits, etc.) should be provided with properly tied continuous waterstops in all construction joints and cementitious waterproofing to protect against groundwater intrusion. Furthermore, the perimeter below-grade foundation walls should receive a trowelled-on bitumastic damproofing.

General Foundation Recommendations

Below-grade foundation walls receiving lateral support at the top and bottom (i.e. restrained walls) should be designed for a lateral earth pressure corresponding to an equivalent fluid density of 60 pounds per cubic-foot. Similarly, drained cantilevered retaining walls, (i.e. receiving no lateral support at the top) should be designed for a lateral earth pressure corresponding to an equivalent fluid density of 40 pounds per cubic-foot for a level backfill condition. To these values must be added the pressures attributable to earthquake forces per Section 1610.2 of the Code.

Cantilevered site retaining walls should be backfilled with free-draining material and provided with weep holes spaced at maximum 10-foot centers. Crushed stone surrounded by filter fabric should be provided at each weep hole.

Lateral forces can be considered to be transmitted from the structure to the soil by passive pressure against the foundation walls utilizing an equivalent fluid density of 120 pounds per cubic-foot providing that the walls are designed to resist these pressures. Lateral force can also be considered to be transmitted from the structures to the soil by friction on the base of footings using a coefficient of 0.35, to which a safety factor of 1.5 should be applied.

Seismic Design Considerations

For the purposes of determining parameters for structural seismic design, for preliminary design purposes this site is considered to be a Site Class D as defined in Chapter 20 of American Society of Civil Engineers (ASCE) Standard 7-10 "Minimum Design Loads for Buildings and Other Structures". The bearing strata on the proposed site are not considered to be subject to liquefaction during an earthquake based on the criterion of Section 1806.4 of the Code.

Preliminary Geotechnical Construction Considerations

The primary geotechnical construction considerations that are anticipated to have an impact on the design of the structure include the elevation of the proposed lowest level floor slab(s) in relation to the elevation of the surface of the natural glacial till deposit, and on-site reuse of excavated soils. Additional geotechnical construction considerations, such as preparation

of foundation and slab bearing surfaces, construction dewatering, and off-site removal of excess excavated material, should be discussed in the FFER.

As indicated above, the proposed footings are recommended to bear on the natural glacial till deposit or on compacted gravel borrow placed over the natural glacial till deposit. The existing fill located below the footings, and within the zone of influence of the footings, will need to be excavated and imported gravel borrow placed and compacted for support of the footings.

Depending on the location of the proposed building and the elevation of the lowest level slab(s), cuts and/or fills may be required to facilitate the building construction. To minimize the amount of imported gravel borrow that is required, it is recommended that the proposed finished slab elevations be located close to the existing site grades. If the site grades will be raised by more than a couple feet, consideration could be given to reusing the on-site fill soil as ordinary fill within the building footprint to raise the proposed grades and employing a ground improvement method such as aggregate piers (APs) to improve the characteristics of the fill in lieu of excavating the fill below footings and importing gravel borrow. As a ground improvement technique, APs are considered to be a technically suitable alternate to the placement of gravel borrow for foundation support. Furthermore, the structural design of the footings and slabs-on-grade supported on soil improved by APs would be the same as if gravel borrow were used.

As described above, grain size distributions of representative samples of the fill material indicate that the fines content (i.e. silt and clay) ranges from about 35 to 46 percent. In addition, grain size distributions of representative samples of the glacial till deposit indicate that the fines content ranges from about 41 to 51 percent. Due to the fines content of the on-site soils, excavated material may become unsuitable for re-use if it is not covered and becomes too wet to be properly compacted. Furthermore, when the on-site material is wet it is susceptible to freezing which would also prevent it from being acceptable for on-site reuse for support of the building foundations. If the earthwork operations are performed during a wet and/or cold period, it is anticipated that significant portions of the on-site soil may become unsuitable for re-use on-site for support of the footings and slabs.

As such, at the present time the on-site fill and glacial till are not recommended to be reused on-site for support of the proposed footings or slabs (unless ground improvement methods are employed) due to the high fines content. It is anticipated that portions of the excavated soils may be re-used on-site as ordinary fill, provided they are maintained in a dry condition and can be properly compacted.

It is emphasized that excavated material will become unsuitable for re-use if it becomes too wet. Therefore, it is recommended that stockpiles of excavated material intended for reuse be protected against increases in moisture content by securely covering the stockpiles at all times with 6-mil polyethylene for protection from precipitation and also as a dust mitigation measure. The placement and compaction of on-site material should be completed during

relatively dry and non-freezing conditions. If, due to any of the above conditions, the excavated material is unsuitable for reuse, an off-site gravel borrow should be used.

Final Comments

It is recommended that McPhail be retained to prepare a Final Foundation Engineering Report once the details of the proposed building project are finalized. The final report would provide final foundation recommendations based on the specific project design requirements. Additional subsurface explorations will be necessary to further delineate the subsurface conditions across the final building site.

We trust that the above preliminary information is sufficient for your present requirements. Should you have any questions concerning the recommendations presented herein, please do not hesitate to call us.

Very truly yours,

McPHAIL ASSOCIATES, LLC

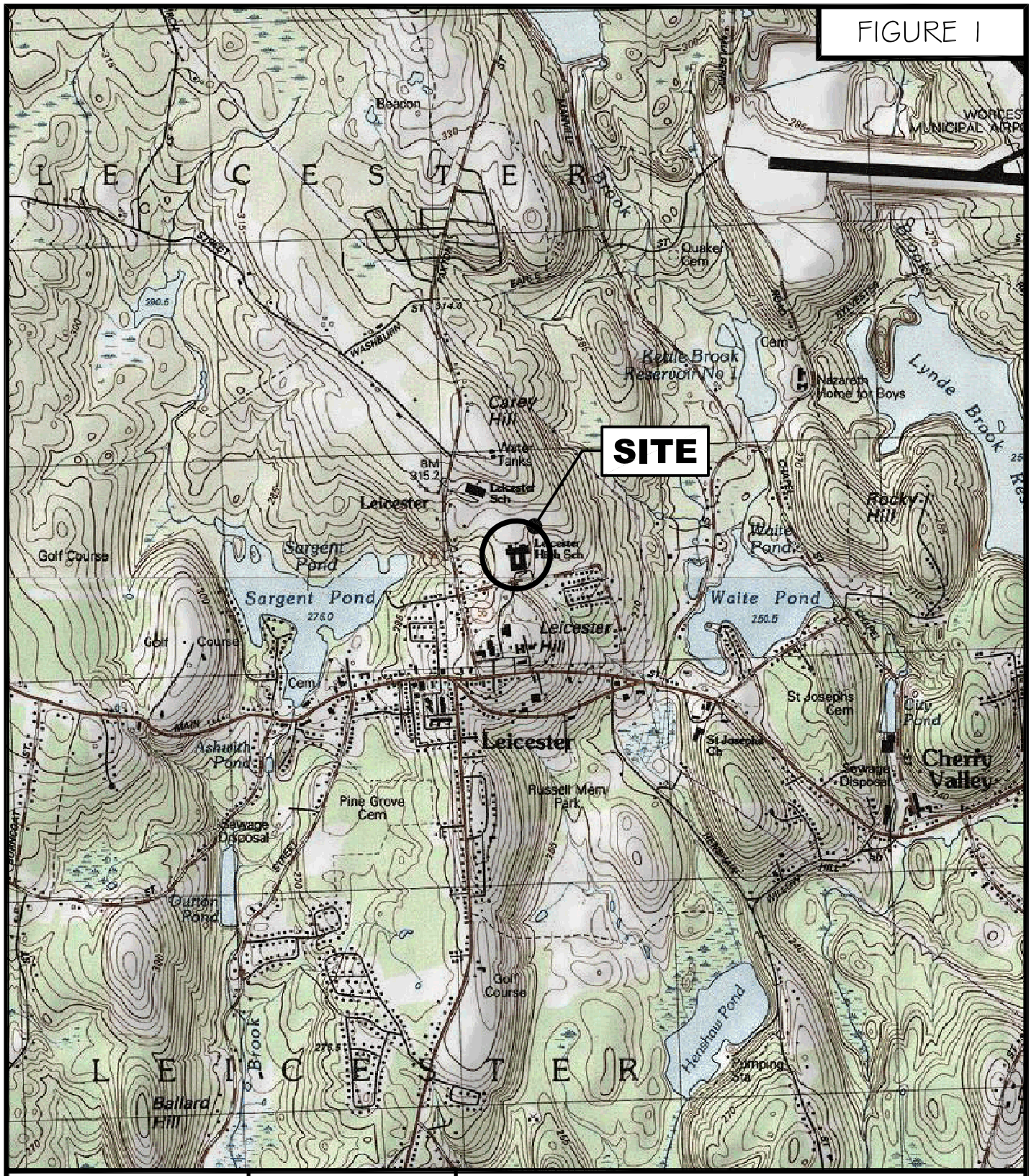
Christopher P. Miller

Jonathan W. Patch, P.E.

N:\Working Documents\Reports\6743_PFER_040119.docx

CPM/jwp

FIGURE 1



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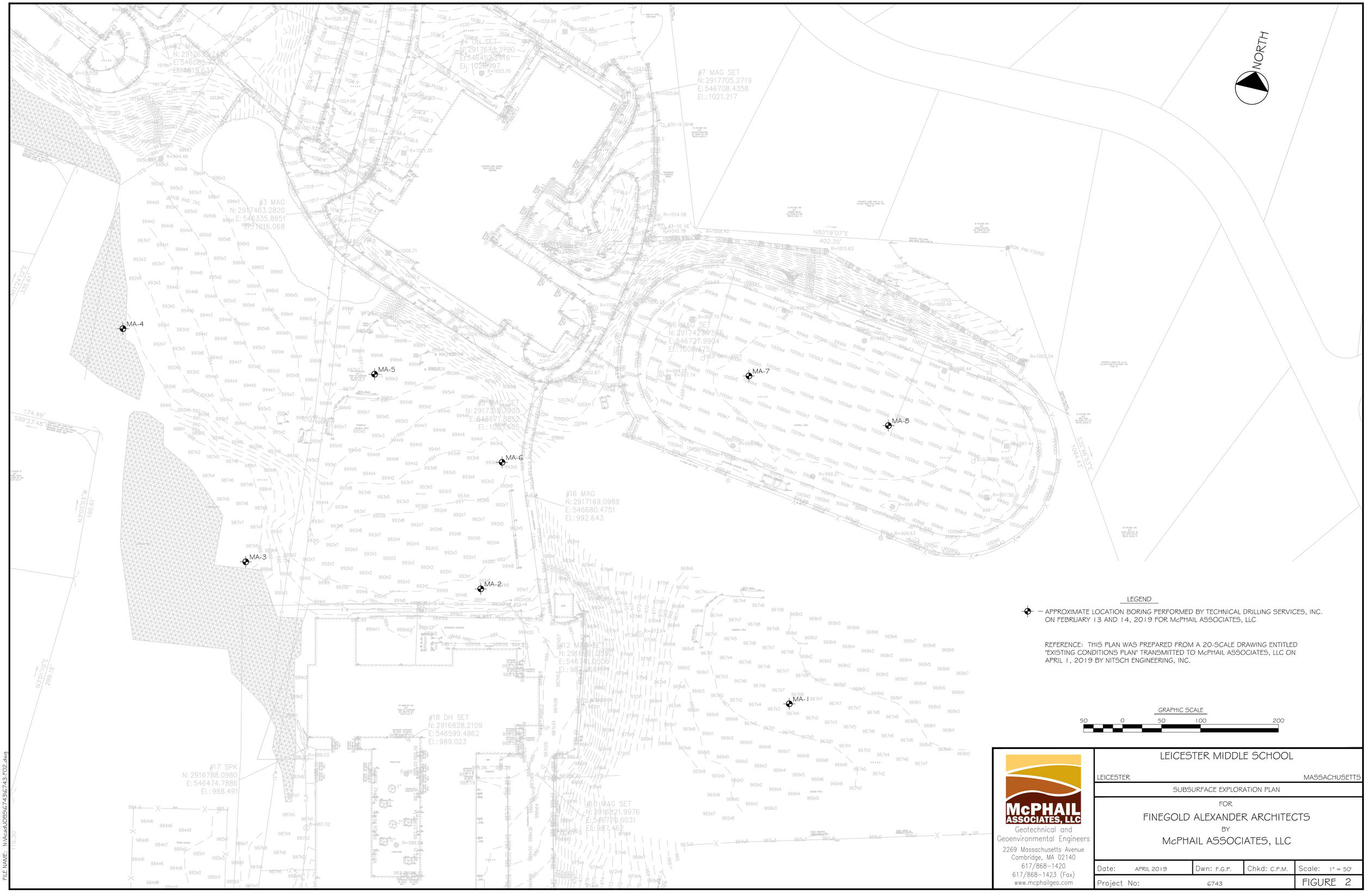
SCALE 1:25,000

PROJECT LOCATION PLAN

LEICESTER MIDDLE SCHOOL

LEICESTER MASSACHUSETTS



LEGEND

— APPROXIMATE LOCATION BORING PERFORMED BY TECHNICAL DRILLING SERVICES, INC. ON FEBRUARY 13 AND 14, 2019 FOR McPHAIL ASSOCIATES, LLC

REFERENCE: THIS PLAN WAS PREPARED FROM A 20-SCALE DRAWING ENTITLED "EXISTING CONDITIONS PLAN" TRANSMITTED TO McPHAIL ASSOCIATES, LLC ON APRIL 1, 2019 BY NITSCH ENGINEERING, INC.

GRAPHIC SCALE

50 0 50 100 200

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LEICESTER MIDDLE SCHOOL

LEICESTER MASSACHUSETTS

SUBSURFACE EXPLORATION PLAN

FOR

FINEGOLD ALEXANDER ARCHITECTS

BY

McPHAIL ASSOCIATES, LLC

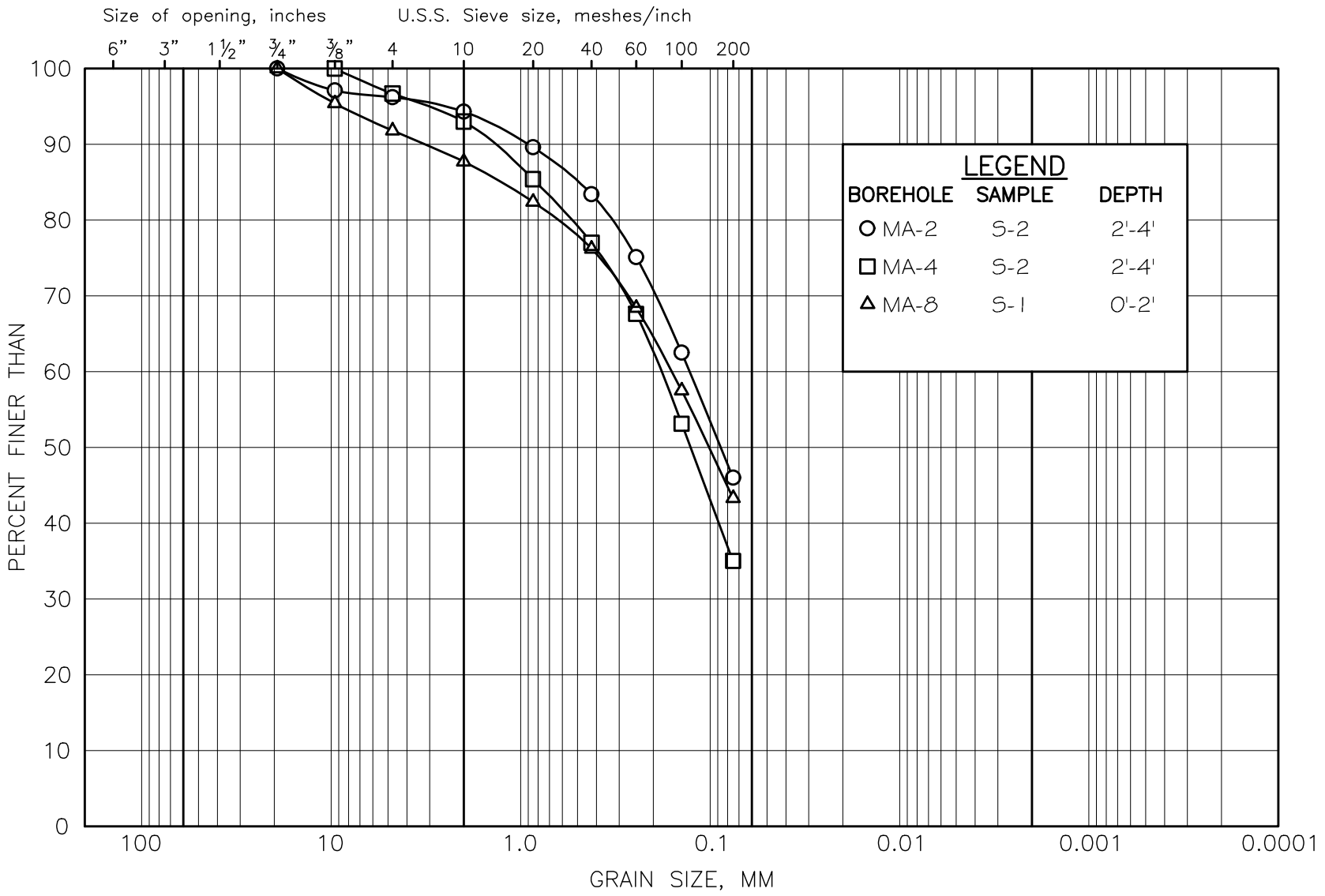
Date: APRIL 2019	Dwn: F.G.P.	Chkd: C.P.M.	Scale: 1" = 50'
Project No: 6743			FIGURE 2

FILE NAME: N:\Acad\JOBS\6743\6743-F02.dwg

FILE NAME: N:\Acad\JOBS\6743\6743-F03_Sieve.dwg

PROJECT No. 6743

M.I.T. GRAIN SIZE SCALE



COBBLE SIZE	GRAVEL SIZE			SAND SIZE			FINE GRAINED	
	COARSE	MEDIUM	FINE	COARSE	MEDIUM	FINE	SILT SIZE	CLAY SIZE

McPHAIL ASSOCIATES, LLC

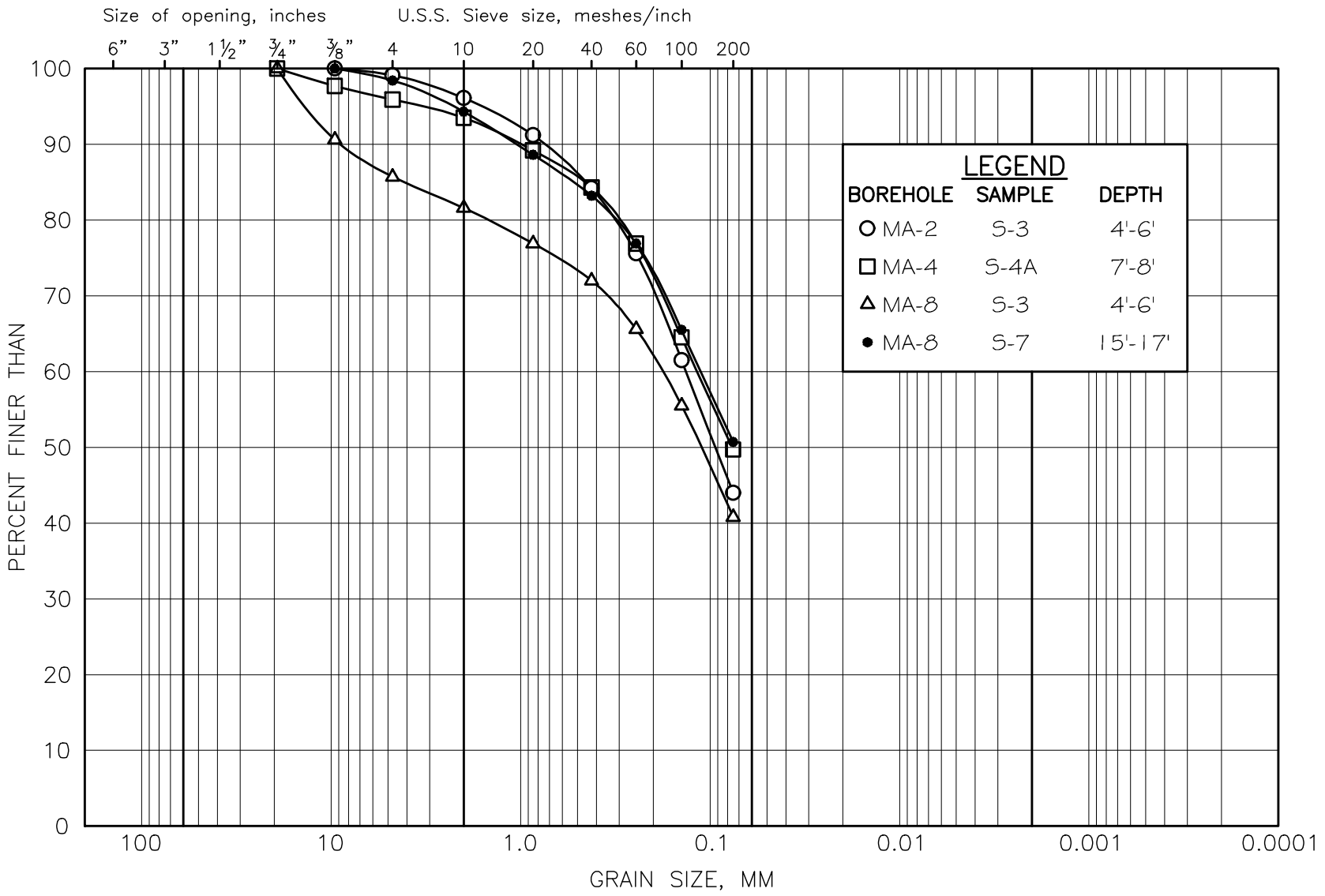
GRAIN SIZE DISTRIBUTION
FILL

FIGURE 3

FILE NAME: N:\Acad\JOBS\6743\6743-F04_Sieve.dwg

PROJECT No. 6743

M.I.T. GRAIN SIZE SCALE



COBBLE SIZE	GRAVEL SIZE			SAND SIZE			FINE GRAINED	
	COARSE	MEDIUM	FINE	COARSE	MEDIUM	FINE	SILT SIZE	CLAY SIZE

McPHAIL ASSOCIATES, LLC

GRAIN SIZE DISTRIBUTION
GLACIAL TILL

FIGURE 4

APPENDIX A:

LIMITATIONS

LIMITATIONS

This preliminary report has been prepared on behalf of and for the exclusive use of Finegold Alexander Architects for specific application to the proposed new Leicester Middle School in Leicester, Massachusetts in accordance with generally accepted soil and geotechnical engineering practices. No other warranty, expressed or implied, is made.

The recommendations contained in this report are for preliminary pricing and design purposes only. Final subsurface exploration program and foundation engineering analyses will be required for the design and construction of the proposed project. In the event that any changes in nature, design, or location of the proposed construction are planned, the conclusions and recommendations contained in this report should not be considered valid unless the changes are reviewed and conclusions of this report modified or verified in writing by McPhail Associates.

The preliminary analyses and recommendations presented in this report are based upon the data obtained from the preliminary subsurface explorations performed at the approximate locations indicated to McPhail. If variations in the nature and extent of subsurface conditions between the widely spaced explorations become evident during the course of construction, it will be necessary for a re-evaluation of the recommendations of this report to be made after performing on-site observations during the construction period and noting the characteristics of any variations.

APPENDIX B:

BORING LOGS MA-1 THROUGH MA-8
PREPARED BY MCPHAIL ASSOCIATES, LLC

Project: Leicester Middle School
Location: 70 Winslow Avenue
City/State: Leicester, MA

Job #: 6743.2.00
Date Started: 3-6-19
Date Finished: 3-6-19

Boring No.

MA-1

Contractor: Technical Drilling Services
Driller/Helper: Brett/Donnie
Logged By/Reviewed By: K. Seaman
Surface Elevation (ft): 967.5

Casing Type: 4 1/2" HSA
Casing Hammer (lbs)/Drop (in): N/A
Sampler Size/Type: 24" Split Spoon
Sampler Hammer (lbs)/Drop (in): 140LB/30"

Groundwater Observations

Date	Depth	Elev.	Notes
3-6-19	6.0	961.5	

Depth (ft)	Elev. (ft)	Symbol	Depth/EL to Strata Change (ft)	Stratum	Sample N-Value / RQD	Sample No.	Sample Pen./Rec. (in)	Sample Depth (ft)	Sample Blows/6" / Min/ft	Sample Description and Boring Notes
1	967			FILL	46	S1	12/11	0.0-1.0	21 25	Dense, light brown to orange, SAND, trace silt. (Fill)
2	966				76	S1A	12/11	1.0-2.0	41 35	Very dense, orange to gray, GRAVELLY SAND, some silt. (Fill)
3	965				40	S2	24/8	2.0-4.0	17 22 18 19	Dense, brown to gray, SILTY SAND and GRAVEL. (Fill)
4	964		4.0 / 963.5							
5	963			HISTORIC TOPSOIL/SUBSOIL	9	S3	24/10	4.0-6.0	3 3 6 15	Loose, black-brown, SAND SILT, trace gravel, with some root matter. (Historic Topsoil/Subsoil)
6	962		6.0 / 961.5							
7	961			GLACIAL TILL	33	S4	24/4	6.0-8.0	22 18 15 17	Dense, gray, SILTY SAND, some gravel. (Glacial Till)
8	960				10	S5	24/10	8.0-10.0	10 5 5 9	Compact, brown to gray-brown, SILT and SAND, some gravel. (Glacial Till)
9	959				16	S6	24/12	10.0-12.0	10 10 6 5	Compact, brown to gray-brown, SILT and SAND, some gravel. (Glacial Till)
10	958				18	S7	24/12	12.0-14.0	7 7 11 14	Compact, brown to gray-brown, SILT and SAND, some gravel. (Glacial Till)
11	957									
12	956									
13	955									
14	954									
15	953									
16	952									
17	951									
18	950									
19	949									
20	948		20.0 / 947.5							
21	947			GLACIAL TILL	28	S8	24/6	20.0-22.0	9 12 16 18	Compact, gray, SILT and SAND, some gravel. (Glacial Till)
22	946									
	945									

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	COMPACT
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	CONSISTENCY
<2	V.SOFT
2-4	SOFT
4-8	FIRM
8-15	STIFF
15-30	V.STIFF
>30	HARD

SOIL COMPONENT

DESCRIPTIVE TERM	PROPORTION OF TOTAL
"TRACE"	0-10%
"SOME"	10-20%
"ADJECTIVE" (eg SANDY, SILTY)	20-35%
"AND"	35-50%

SOIL CONTAINING THREE COMPONENTS EACH OF WHICH COMPRISE AT LEAST 25% OF THE TOTAL ARE CLASSIFIED AS "A WELL-GRADED MIXTURE OF"

Notes:

Weather: Partly Cloudy

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2269 MASSACHUSETTS AVENUE
CAMBRIDGE, MA 02140
TEL: 617-868-1420
FAX: 617-868-1423

Project: Leicester Middle School
Location: 70 Winslow Avenue
City/State: Leicester, MA

Job #: 6743.2.00
Date Started: 3-6-19
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Boring No.

MA-1

Contractor: Technical Drilling Services
Driller/Helper: Brett/Donnie
Logged By/Reviewed By: K. Seaman
Surface Elevation (ft): 967.5

Casing Type: 4 1/2" HSA
Casing Hammer (lbs)/Drop (in): N/A
Sampler Size/Type: 24" Split Spoon
Sampler Hammer (lbs)/Drop (in): 140LB/30"

Groundwater Observations

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3-6-19	6.0	961.5	

Depth (ft)	Elev. (ft)	Symbol	Depth/EL to Strata Change (ft)	Stratum	Sample N-Value / RQD	Sample No.	Sample Pen./Rec. (in)	Sample Depth (ft)	Sample Blows/6" / Min/ft	Sample Description and Boring Notes
24	944									
25	943			GLACIAL TILL						
26	942				18	S9	24/2	25.0-27.0	5 9 9 9	Compact, gray, SILT and SAND, trace gravel. (Glacial Till)
27	941		27.0 / 940.5							
28	940			Bottom of boring at 27 feet below ground surface.						
29	939									
30	938									
31	937									
32	936									
33	935									
34	934									
35	933									
36	932									
37	931									
38	930									
39	929									
40	928									
41	927									
42	926									
43	925									
44	924									
45	923									
	922									

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	COMPACT
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	CONSISTENCY
<2	V.SOFT
2-4	SOFT
4-8	FIRM
8-15	STIFF
15-30	V.STIFF
>30	HARD

SOIL COMPONENT

DESCRIPTIVE TERM	PROPORTION OF TOTAL
"TRACE"	0-10%
"SOME"	10-20%
"ADJECTIVE" (eg SANDY, SILTY)	20-35%
"AND"	35-50%

SOIL CONTAINING THREE COMPONENTS EACH OF WHICH COMPRISE AT LEAST 25% OF THE TOTAL ARE CLASSIFIED AS "A WELL-GRADED MIXTURE OF"

Notes:

Weather: Partly Cloudy

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CAMBRIDGE, MA 02140
TEL: 617-868-1420
FAX: 617-868-1423

Project: Leicester Middle School
Location: 70 Winslow Avenue
City/State: Leicester, MA

Job #: 6743.2.00
Date Started: 3-6-19
Date Finished: 3-6-19

Boring No.

MA-2

Contractor: Technical Drilling Services
Driller/Helper: Brett/Donnie
Logged By/Reviewed By: K. Seaman
Surface Elevation (ft): 991.8

Casing Type: 4 1/2" HSA
Casing Hammer (lbs)/Drop (in): N/A
Sampler Size/Type: 24" Split Spoon
Sampler Hammer (lbs)/Drop (in): 140LB/30"

Groundwater Observations

Date	Depth	Elev.	Notes

Depth (ft)	Elev. (ft)	Symbol	Depth/EL to Strata Change (ft)	Stratum	Sample N-Value / RQD	Sample No.	Sample Pen./Rec. (in)	Sample Depth (ft)	Sample Blows/6" / Min/ft	Sample Description and Boring Notes
1	991			FILL	17	S1	24/20	0.0-2.0	15 11 6 9	Compact, brown, SAND, some silt, trace root matter and gravel. (Fill)
2	990									
3	989				28	S2	24/22	2.0-4.0	14 13 15 15	Compact, brown, SILT and SAND, trace gravel. (Fill)
4	988		4.0 / 987.8							
5	987			GLACIAL TILL	14	S3	24/18	4.0-6.0	4 6 8 12	Compact, brown to tan, SILT and SAND, some gravel. (Glacial Till)
6	986									
7	985				20	S4	24/16	6.0-8.0	7 9 11 10	Compact, brown to tan, SAND, some silt, trace gravel (Glacial Till)
8	984									
9	983				20	S5	24/20	8.0-10.0	6 7 13 20	Compact, brown to tan, SAND, some silt and gravel. (Glacial Till)
10	982									
11	981									
12	980									
13	979				51	S6	24/10	12.0-14.0	16 25 26 32	Very dense, gray, SILTY SAND, some gravel. (Glacial Till)
14	978		14.0 / 977.8							
15	977			Bottom fo borehole 14' below ground surface.						
16	976									
17	975									
18	974									
19	973									
20	972									
21	971									
22	970									
	969									

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	COMPACT
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	CONSISTENCY
<2	V.SOFT
2-4	SOFT
4-8	FIRM
8-15	STIFF
15-30	V.STIFF
>30	HARD

SOIL COMPONENT

DESCRIPTIVE TERM	PROPORTION OF TOTAL
"TRACE"	0-10%
"SOME"	10-20%
"ADJECTIVE" (eg SANDY, SILTY)	20-35%
"AND"	35-50%

SOIL CONTAINING THREE COMPONENTS EACH OF WHICH COMPRISE AT LEAST 25% OF THE TOTAL ARE CLASSIFIED AS "A WELL-GRADED MIXTURE OF"

Notes:
No groundwater observed.

Weather: Clear

McPHAIL ASSOCIATES, LLC
2269 MASSACHUSETTS AVENUE
CAMBRIDGE, MA 02140
TEL: 617-868-1420
FAX: 617-868-1423

Project: Leicester Middle School
Location: 70 Winslow Avenue
City/State: Leicester, MA

Job #: 6743.2.00
Date Started: 3-5-19
Date Finished: 3-5-19

Boring No. MA-3

Contractor: Technical Drilling Services
Driller/Helper: Brett/Donnie
Logged By/Reviewed By: C. Miller
Surface Elevation (ft): 987.5

Casing Type: 4 1/2" HSA
Casing Hammer (lbs)/Drop (in): N/A
Sampler Size/Type: 24" Split Spoon
Sampler Hammer (lbs)/Drop (in): 140LB/30"

Groundwater Observations			
Date	Depth	Elev.	Notes
3-5-19	6.0	981.5	

Depth (ft)	Elev. (ft)	Symbol	Depth/EL to Strata Change (ft)	Stratum	Sample N-Value / RQD	Sample No.	Sample Pen./Rec. (in)	Sample Depth (ft)	Sample Blows/6" / Min/ft	Sample Description and Boring Notes
1	987			FILL	24	S1	18/16	0.0-1.5	13 13 11	Compact, dark brown, SILT and SAND, trace gravel. (Fill)
2	986				20	S1A	6/6	1.5-2.0	10	Compact, light brown, SAND and GRAVEL, some silt. (Fill)
3	985				19	S2	24/23	2.0-4.0	5 9 10 14	Compact, light brown/orange-brown, SILTY SAND, trace gravel. (Fill)
4	984		4.0 / 983.5							
5	983			GLACIAL TILL	18	S3	24/24	4.0-6.0	6 8 10 12	Compact, light brown, SILTY SAND, some gravel. (Glacial Till)
6	982									
7	981				28	S4	24/16	6.0-8.0	10 13 15 17	Compact, light brown/orange-brown, SILTY SAND, some gravel. (Glacial Till)
8	980									
9	979				30	S5	24/20	8.0-10.0	5 12 18 22	Dense, orange-brown, SILTY SAND, some gravel, occasional cobbles. (Glacial Till)
10	978									
11	977									
12	976									
13	975									
14	974				24	S6	20/11	13.0-14.7	8 16 8 100/2"	Dense, orange-brown, SILTY SAND, some gravel, occasional cobbles. (Glacial Till) Split spoon refusal at 14.7' below ground surface.
15	973		14.7 / 972.8							
16	972			Bottom of borehole 14.7' below ground surface.						
17	971									
18	970									
19	969									
20	968									
21	967									
22	966									
	965									

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	COMPACT
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	CONSISTENCY
<2	V.SOFT
2-4	SOFT
4-8	FIRM
8-15	STIFF
15-30	V.STIFF
>30	HARD

SOIL COMPONENT

DESCRIPTIVE TERM	PROPORTION OF TOTAL
"TRACE"	0-10%
"SOME"	10-20%
"ADJECTIVE" (eg SANDY, SILTY)	20-35%
"AND"	35-50%

SOIL CONTAINING THREE COMPONENTS EACH OF WHICH COMPRISE AT LEAST 25% OF THE TOTAL ARE CLASSIFIED AS "A WELL-GRADED MIXTURE OF"

Notes:
Frost from 0'-1.25' below ground surface.

Weather: Clear

McPHAIL ASSOCIATES, LLC
2269 MASSACHUSETTS AVENUE
CAMBRIDGE, MA 02140
TEL: 617-868-1420
FAX: 617-868-1423

Project: Leicester Middle School
Location: 70 Winslow Avenue
City/State: Leicester, MA

Job #: 6743.2.00
Date Started: 3-5-19
Date Finished: 3-5-19

Boring No. MA-4

Contractor: Technical Drilling Services
Driller/Helper: Brett/Donnie
Logged By/Reviewed By: C. Miller
Surface Elevation (ft): 991.6

Casing Type: 4 1/2" HSA
Casing Hammer (lbs)/Drop (in): N/A
Sampler Size/Type: 24" Split Spoon
Sampler Hammer (lbs)/Drop (in): 140LB/30"

Groundwater Observations			
Date	Depth	Elev.	Notes
3-5-19	8.0	983.6	

Depth (ft)	Elev. (ft)	Symbol	Depth/EL to Strata Change (ft)	Stratum	Sample N-Value / RQD	Sample No.	Sample Pen./Rec. (in)	Sample Depth (ft)	Sample Blows/6" / Min/ft	Sample Description and Boring Notes
1	991			FILL	25	S1	24/22	0.0-2.0	13 13 12 12	Compact, gray brown/brown SILTY SAND, some gravel. (Fill)
2	990									
3	989				16	S2	24/17	2.0-4.0	7 9 7 5	Compact, light brown, SILTY SAND, trace gravel. (Fill)
4	988									
5	987				5	S3	24/16	4.0-6.0	4 3 2 2	Loose, brown, SILTY SAND, trace gravel. (Fill)
6	986									
7	985		7.0 / 984.6		7	S4	12/8	6.0-7.0	2 5	Loose, brown, SILTY SAND, trace gravel. (Fill)
8	984			GLACIAL TILL	53	S4A	12/11	7.0-8.0	12 41	Very dense, orange brown, SILT and SAND, trace gravel. (Glacial Till) Mottling at approximately 7' below ground surface.
9	983				70	S5	24/18	8.0-10.0	11 35 35 59	Very dense, orange brown, SILT and SAND, trace gravel. (Glacial Till)
10	982									
11	981									
12	980				122	S6	19/12	11.0-12.6	90 71 51 100/1"	Very dense, orange brown, SILTY SAND, some gravel, with occasional cobbles. (Glacial Till) Auger refusal 11' below ground surface. Split spoon refusal 12.6' below ground surface.
13	979		12.6 / 979.0	Bottom of borehole 12.6' below ground surface.						
14	978									
15	977									
16	976									
17	975									
18	974									
19	973									
20	972									
21	971									
22	970									
	969									

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	COMPACT
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	CONSISTENCY
<2	V.SOFT
2-4	SOFT
4-8	FIRM
8-15	STIFF
15-30	V.STIFF
>30	HARD

SOIL COMPONENT

DESCRIPTIVE TERM	PROPORTION OF TOTAL
"TRACE"	0-10%
"SOME"	10-20%
"ADJECTIVE" (eg SANDY, SILTY)	20-35%
"AND"	35-50%

SOIL CONTAINING THREE COMPONENTS EACH OF WHICH COMPRISE AT LEAST 25% OF THE TOTAL ARE CLASSIFIED AS "A WELL-GRADED MIXTURE OF"

Notes:

Weather: Clear

McPHAIL ASSOCIATES, LLC
2269 MASSACHUSETTS AVENUE
CAMBRIDGE, MA 02140
TEL: 617-868-1420
FAX: 617-868-1423

Project: Leicester Middle School
Location: 70 Winslow Avenue
City/State: Leicester, MA

Job #: 6743.2.00
Date Started: 3-5-19
Date Finished: 3-5-19

Boring No.

MA-5

Contractor: Technical Drilling Services
Driller/Helper: Brett/Donnie
Logged By/Reviewed By: C. Miller
Surface Elevation (ft): 996.3

Casing Type: 4 1/2" HSA
Casing Hammer (lbs)/Drop (in): N/A
Sampler Size/Type: 24" Split Spoon
Sampler Hammer (lbs)/Drop (in): 140LB/30"

Groundwater Observations

Date	Depth	Elev.	Notes
3-5-19	8.0	988.3	

Depth (ft)	Elev. (ft)	Symbol	Depth/EL to Strata Change (ft)	Stratum	Sample N-Value / RQD	Sample No.	Sample Pen./Rec. (in)	Sample Depth (ft)	Sample Blows/6" / Min/ft	Sample Description and Boring Notes
0	996									
1	995									
2	994			FILL	19	S1	24/24	0.0-2.0	13 12 7 8	Compact, brown, SILTY SAND, some gravel, trace root matter. (Fill)
3	993				18	S2	24/22	2.0-4.0	7 7 11 9	Compact, gray brown/orange brown, SILTY SAND, trace gravel. (Fill)
4	992									
5	991		5.0 / 991.3		20	S3	24/24	4.0-6.0	8 9 11 14	Compact, gray brown, SILTY SAND, some gravel. (Fill)
6	990									
7	989				39	S4	24/24	6.0-8.0	19 19 20 22	Dense, gray brown, SILTY SAND, some gravel. (Glacial Till)
8	988			GLACIAL TILL						
9	987				30	S5	24/24	8.0-10.0	11 12 18 26	Dense, gray brown, SILTY SAND, some gravel. (Glacial Till)
10	986									
11	985		11.5 / 984.8		114/11"	S6	17/12	10.0-11.4	11 14 100/5"	Very dense, gray/orange brown, SILTY SAND, some gravel, with occasional cobbles. (Glacial Till) Auger refusal 11.5' below ground surface.
12	984			Bottom of borehole 11.5' below ground surface.						
13	983									
14	982									
15	981									
16	980									
17	979									
18	978									
19	977									
20	976									
21	975									
22	974									

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	COMPACT
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	CONSISTENCY
<2	V.SOFT
2-4	SOFT
4-8	FIRM
8-15	STIFF
15-30	V.STIFF
>30	HARD

SOIL COMPONENT

DESCRIPTIVE TERM	PROPORTION OF TOTAL
"TRACE"	0-10%
"SOME"	10-20%
"ADJECTIVE" (eg SANDY, SILTY)	20-35%
"AND"	35-50%

SOIL CONTAINING THREE COMPONENTS EACH OF WHICH COMPRISE AT LEAST 25% OF THE TOTAL ARE CLASSIFIED AS "A WELL-GRADED MIXTURE OF"

Notes:

Weather: Clear

McPHAIL ASSOCIATES, LLC
2269 MASSACHUSETTS AVENUE
CAMBRIDGE, MA 02140
TEL: 617-868-1420
FAX: 617-868-1423

Project: Leicester Middle School
Location: 70 Winslow Avenue
City/State: Leicester, MA

Job #: 6743.2.00
Date Started: 3-6-19
Date Finished: 3-6-19

Boring No.

MA-6

Contractor: Technical Drilling Services
Driller/Helper: Brett/Donnie
Logged By/Reviewed By: K. Seaman
Surface Elevation (ft): 993.2

Casing Type: 4 1/2" HSA
Casing Hammer (lbs)/Drop (in): N/A
Sampler Size/Type: 24" Split Spoon
Sampler Hammer (lbs)/Drop (in): 140LB/30"

Groundwater Observations

Date	Depth	Elev.	Notes
3-6-19	6.0	987.2	

Depth (ft)	Elev. (ft)	Symbol	Depth/EL to Strata Change (ft)	Stratum	Sample N-Value / RQD	Sample No.	Sample Pen./Rec. (in)	Sample Depth (ft)	Sample Blows/6" / Min/ft	Sample Description and Boring Notes
0	993									
1	992			FILL	14	S1	24/14	0.0-2.0	12 7 7 6	Compact, brown, SAND, some silt, trace gravel, brick and ash. (Fill)
2	991									
3	990				17	S2	24/12	2.0-4.0	5 8 9 21	Compact, gray, SAND, some clay, silt, and gravel. (Fill)
4	989									
5	988		5.0 / 988.2		34	S3	24/14	4.0-6.0	10 10 24 23	Dense, gray, SILTY SAND, some clay and gravel. (Fill)
6	987			GLACIAL TILL						
7	986				41	S4	24/12	6.0-8.0	18 18 23 23	Dense, gray, SILTY SAND, some clay and gravel. (Glacial Till)
8	985									
9	984									
10	983									
11	982				55	S5	24/6	10.0-12.0	29 30 25 29	Very dense, gray, SILTY SAND, some clay and gravel. (Glacial Till)
12	981		12.0 / 981.2	Bottom of borehole 12' below ground surface.						
13	980									
14	979									
15	978									
16	977									
17	976									
18	975									
19	974									
20	973									
21	972									
22	971									

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	COMPACT
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	CONSISTENCY
<2	V.SOFT
2-4	SOFT
4-8	FIRM
8-15	STIFF
15-30	V.STIFF
>30	HARD

SOIL COMPONENT

DESCRIPTIVE TERM	PROPORTION OF TOTAL
"TRACE"	0-10%
"SOME"	10-20%
"ADJECTIVE" (eg SANDY, SILTY)	20-35%
"AND"	35-50%

SOIL CONTAINING THREE COMPONENTS EACH OF WHICH COMPRISE AT LEAST 25% OF THE TOTAL ARE CLASSIFIED AS "A WELL-GRADED MIXTURE OF"

Notes:

Weather: Clear

McPHAIL ASSOCIATES, LLC
2269 MASSACHUSETTS AVENUE
CAMBRIDGE, MA 02140
TEL: 617-868-1420
FAX: 617-868-1423

Project: Leicester Middle School
Location: 70 Winslow Avenue
City/State: Leicester, MA

Job #: 6743.2.00
Date Started: 3-6-19
Date Finished: 3-6-19

Boring No. MA-7

Contractor: Technical Drilling Services
Driller/Helper: Brett/Donnie
Logged By/Reviewed By: K. Seaman
Surface Elevation (ft): 1000.6

Casing Type: 4 1/2" HSA
Casing Hammer (lbs)/Drop (in): N/A
Sampler Size/Type: 24" Split Spoon
Sampler Hammer (lbs)/Drop (in): 140LB/30"

Groundwater Observations			
Date	Depth	Elev.	Notes
3-6-19	8.0	992.6	

Depth (ft)	Elev. (ft)	Symbol	Depth/EL to Strata Change (ft)	Stratum	Sample N-Value / RQD	Sample No.	Sample Pen./Rec. (in)	Sample Depth (ft)	Sample Blows/6" / Min/ft	Sample Description and Boring Notes
1	1000			FILL	33	S1	24/20	0.0-2.0	15 16 17 12	Dense, brown, SILT and SAND, some gravel, trace root matter. (Fill)
2	999		2.0 / 998.6							
3	998			GLACIAL TILL	20	S2	24/20	2.0-4.0	7 9 11 11	Compact, brown to gray, SILTY SAND, some gravel. (Glacial Till)
4	997									
5	996									
6	995									
7	994									
8	993				51	S3	24/4	8.0-10.0	19 24 27 30	Very dense, gray, SILTY SAND, some gravel, trace clay. (Glacial Till)
9	992									
10	991									
11	990		11.0 / 989.6							
12	989			GLACIAL TILL	35	S4	24/14	13.0-15.0	10 16 19 20	Dense, gray, SILT and SAND, trace clay and gravel. (Glacial Till)
13	988									
14	987									
15	986				22	S5	24/8	15.0-17.0	8 10 12 16	Compact, gray, SILT and SAND, trace clay and gravel. (Glacial Till)
16	985									
17	984									
18	983				41	S6	24/20	17.0-19.0	16 19 22 23	Dense, gray, SILT and SAND, trace clay and gravel. (Glacial Till)
19	982		19.0 / 981.6							
20	981			Bottom of borehole 19' below ground surface.						
21	980									
22	979									
	978									

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	COMPACT
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	CONSISTENCY
<2	V.SOFT
2-4	SOFT
4-8	FIRM
8-15	STIFF
15-30	V.STIFF
>30	HARD

SOIL COMPONENT

DESCRIPTIVE TERM	PROPORTION OF TOTAL
"TRACE"	0-10%
"SOME"	10-20%
"ADJECTIVE" (eg SANDY, SILTY)	20-35%
"AND"	35-50%

SOIL CONTAINING THREE COMPONENTS EACH OF WHICH COMPRISE AT LEAST 25% OF THE TOTAL ARE CLASSIFIED AS "A WELL-GRADED MIXTURE OF"

Notes:

Weather: Clear

McPHAIL ASSOCIATES, LLC
2269 MASSACHUSETTS AVENUE
CAMBRIDGE, MA 02140
TEL: 617-868-1420
FAX: 617-868-1423

Project: Leicester Middle School
Location: 70 Winslow Avenue
City/State: Leicester, MA

Job #: 6743.2.00
Date Started: 3-6-19
Date Finished: 3-6-19

Boring No.

MA-8

Contractor: Technical Drilling Services
Driller/Helper: Brett/Donnie
Logged By/Reviewed By: K. Seaman
Surface Elevation (ft): 1001.0

Casing Type: 4 1/2" HSA
Casing Hammer (lbs)/Drop (in): N/A
Sampler Size/Type: 24" Split Spoon
Sampler Hammer (lbs)/Drop (in): 140LB/30"

Groundwater Observations

Date	Depth	Elev.	Notes

Depth (ft)	Elev. (ft)	Symbol	Depth/EL to Strata Change (ft)	Stratum	Sample N-Value / RQD	Sample No.	Sample Pen./Rec. (in)	Sample Depth (ft)	Sample Blows/6" / Min/ft	Sample Description and Boring Notes
1	1000			FILL	25	S1	24/20	0.0-2.0	13 13 12 10	Compact, brown, SILT and SAND, some gravel. (Fill)
2	999									
3	998				31	S2	24/14	2.0-4.0	13 14 17 37	Dense, brown, SAND, some silt and gravel. (Fill) Auger refusal at 4.3' below ground surface.
4	997		4.0 / 997.0							
5	996			GLACIAL TILL	26	S3	24/10	4.0-6.0	10 12 14 12	Compact, brown to gray, SILT and SAND, some gravel, trace clay. (Glacial Till)
6	995									
7	994				30	S4	24/20	6.0-8.0	25 14 16 17	Compact to dense, gray, SILT and SAND, some gravel, trace clay. (Glacial Till)
8	993									
9	992									
10	991									
11	990									
12	989				28	S5	24/14	11.0-13.0	7 11 17 17	Compact, gray-brown, SILT and SAND, trace clay and gravel. (Glacial Till)
13	988		13.0 / 988.0							
14	987			GLACIAL TILL	43	S6	24/12	13.0-15.0	15 16 27 12	Dense, gray, SILT and SAND, trace clay and gravel. (Glacial Till)
15	986									
16	985				34	S7	24/20	15.0-17.0	13 15 19 21	Dense, gray, SILT and SAND, trace clay and gravel. (Glacial Till)
17	984		17.0 / 984.0							
18	983			Bottom of borehole 17' below ground surface.						
19	982									
20	981									
21	980									
22	979									

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	COMPACT
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	CONSISTENCY
<2	V.SOFT
2-4	SOFT
4-8	FIRM
8-15	STIFF
15-30	V.STIFF
>30	HARD

SOIL COMPONENT

DESCRIPTIVE TERM	PROPORTION OF TOTAL
"TRACE"	0-10%
"SOME"	10-20%
"ADJECTIVE" (eg SANDY, SILTY)	20-35%
"AND"	35-50%

SOIL CONTAINING THREE COMPONENTS EACH OF WHICH COMPRISE AT LEAST 25% OF THE TOTAL ARE CLASSIFIED AS "A WELL-GRADED MIXTURE OF"

Notes:
No groundwater observed.

Weather: Clear

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