Dear Mr. Whitsett:

O’Reilly, Talbot & Okun Associates, Inc. (OTO) is pleased to provide this letter report summarizing our preliminary geotechnical engineering recommendations for the proposed elementary school Site, located off Pearl Street in Gardner, Massachusetts. The information in this report is intended to help in assessing the feasibility of locating a school building on the subject property and to provide data for preliminary design. A Site Locus is provided as Figure 1. A Site Sketch is provided as Figure 2.

Our geotechnical recommendations are based upon subsurface conditions observed in ten backhoe test pits. Our services consisted of the full-time observation of the test pits, laboratory testing, review of the logs and soil samples, engineering analyses, and preparation of this report. This report is subject to the attached limitations.

We note that additional explorations will be necessary for final design.

PROJECT DESCRIPTION

The project Site consists of an undeveloped, wooded parcel. It is located off Pearl Street in Gardner, Massachusetts. The location of the Site is shown on Figure 1. The Site is accessed from Pearl Street via a logging road, which crosses a wetland buffer zone. The Site is bounded by residential properties (which are located on Ridgewood Land) to the southeast, Pearl Street to the south, and undeveloped parcels to the north, west, and east. Approximate property lines are shown on Figure 2.

A topographic high (at approximately elevation 1200) is located in the northern part of the Site. From this high topography, the ground surface slopes downward toward the southeast, south and southwest. The ground surface along Pearl Street (at the lowest area of the Site) is at approximate elevation 1110 feet. At the steepest location, the ground surface slopes downhill at 4 horizontal to 1 vertical or steeper. Approximate topographic contours are shown on Figure 2.

We anticipate that any proposed building will be slab on grade.
SUBSURFACE EXPLORATIONS AND TESTING

Subsurface investigations consisted of ten backhoe test pits (TP-1 through TP-6 and TP-8 through TP-11). Previously planned test pit TP-7 was not completed. The test pits were performed on November 28, 2018 by David Richard Excavating of Gardner, Massachusetts. A John Deere 160C excavator, equipped with a 3/4 cubic yard bucket, was used to advance the test pits. The locations of the test pits were adjusted in the field due to access restraints, such as steep slopes and dense vegetation. Each test pit was extended to a depth of between 3.5 and 9.5 feet below ground surface. Test pit locations are shown on Figure 2.

An O’Reilly, Talbot & Okun Associates, Inc. (OTO) engineer observed and logged each of the test pits. The soils encountered were classified according to a modified version of the Burmister Soil Classification System. Upon completion, test pits were backfilled with the excavated soils. Test pit logs and photographs are attached.

Soil samples were collected from test pits TP-1 and TP-4 at an approximate depth of five and eight feet below ground surface, respectively. The samples were analyzed for grain size distribution analysis by Allied Testing Laboratories of Springfield, Massachusetts. These tests were performed to evaluate the suitability of on-Site soils for use as engineered fill. Results are discussed below.

SUBSURFACE CONDITIONS

Subsurface conditions were interpreted based upon the test pits. In general, subsurface conditions were similar across the Site and consisted of sandy topsoil underlain by granular soils. Numerous cobbles and boulders were present in the test pits. The soil conditions are favorable for the construction of a slab on grade school building.

Soil Conditions and Test Results

A three inch thick layer of organic material (forest duff, consisting of decaying plant matter) was present at the ground surface of each test pit. The duff was immediately underlain by approximately nine inches of sandy topsoil. The topsoil consisted of orange-brown, fine sand with some organics (roots) and trace amounts of silt. The topsoil was underlain by native soils consisting of a brown, sand and gravel containing numerous cobbles and boulders. The boulders ranged in size from six inches to greater than three feet in diameter. In addition, boulders were observed at the ground surface. Test pits TP-1, TP-5, TP-6, TP-9, and TP-10 encountered refusal upon either bedrock or large boulders at a depth of between 7.5 and 9 feet below ground surface. Test pit TP-11 encountered refusal at a shallower depth, 3.5 feet below ground surface, upon a large boulder or bedrock. The remaining test pits were terminated in dense soils at a depth of between 8 and 9.5 feet.

Grain size distribution analysis was performed on two representative soil samples to evaluate its potential use as engineered fill. Oversized material (greater than two inches) were removed from the samples prior to testing. The soils generally consisted of a gravelly, fine to medium sand containing little to trace amounts of silt. Grain size distribution tests indicate that the native soils appear to meet requirements for engineered fill, provided
oversized materials (greater than three inches in diameter) are removed. Laboratory grain size distribution data and grain size distribution requirements for use as engineered fill are presented in Table 1. Laboratory data sheets are attached.

### Table 1
Grain Size Analysis Results & Engineered Fill Requirements

<table>
<thead>
<tr>
<th>Test Pit</th>
<th>TP-1</th>
<th>TP-4</th>
<th>Requirements for Engineered Fill</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample Depth</td>
<td>5 feet</td>
<td>8 feet</td>
<td>Sand &amp; Gravel</td>
</tr>
<tr>
<td>Sieve Size</td>
<td></td>
<td></td>
<td>Percent Finer by Weight</td>
</tr>
<tr>
<td>3 inch</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>1 ½ inch</td>
<td>79.2</td>
<td>76.5</td>
<td>--</td>
</tr>
<tr>
<td>¾ inch</td>
<td>69.2</td>
<td>62.5</td>
<td>--</td>
</tr>
<tr>
<td>½ inch</td>
<td>65.8</td>
<td>58.8</td>
<td>50 – 85</td>
</tr>
<tr>
<td>No. 4</td>
<td>56.4</td>
<td>51.3</td>
<td>40 – 75</td>
</tr>
<tr>
<td>No. 8</td>
<td>49.8</td>
<td>46.1</td>
<td>--</td>
</tr>
<tr>
<td>No. 10</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>No. 16</td>
<td>43.0</td>
<td>40.8</td>
<td>--</td>
</tr>
<tr>
<td>No. 40</td>
<td>31.2</td>
<td>30.7</td>
<td>10 – 35</td>
</tr>
<tr>
<td>No. 200</td>
<td>10.8</td>
<td>10.4</td>
<td>0 – 10</td>
</tr>
</tbody>
</table>

### Groundwater Conditions

No groundwater was encountered in the test pits. However, oxidation features (typically 10 to 20% rust staining) were generally observed below a depth of two to three feet. We do not expect that groundwater will be encountered during construction or during the service life of the building. We note that wetlands are located to the east and west of the Site, and a thin strip of mapped wetland passes through the southern part of the Site. However, we recommend stormwater control and drainage features be incorporated into the final design. Based upon the preliminary test pits, infiltration may be limited at this Site.

### PRELIMINARY DESIGN RECOMMENDATIONS

The following recommendations are provided for the construction assumed in this report. The recommendations in this report refer to the 9th Edition of the Massachusetts State Building Code (MSBC). We note that the 9th Edition of the MSBC includes amendments to the 2015 International Building Code (IBC).

Site conditions appear to be favorable for the proposed project. The native Site soils were observed to be relatively dense and groundwater is not likely to be encountered during construction or significantly impact the building. Additional geotechnical recommendations and considerations are provided below.
Bedrock/Large Boulders

We expect that the bedrock surface will vary significantly across the Site, and will likely mimic the ground surface topography. Refusal was generally encountered upon bedrock or large boulders below a depth of 7.5 feet below ground surface. At location TP-11, refusal was encountered at a depth of 3.5 feet below ground surface. Depending on final slab elevation bedrock may be encountered during construction. Once the building location has been finalized and slab and utility elevations have been established, explorations (including bedrock coring) will be required to establish actual bedrock conditions.

Furthermore, large boulders (greater than three feet in diameter) were observed at the ground surface and within the test pits. Large excavations (and/or blasting) may be required for the removal of large boulders.

Foundations

The proposed building can be founded on normal spread footing foundations bearing on densified native soils, compacted engineered fill, or bedrock. Provided these recommendations are followed, a maximum allowable bearing pressure of 4,000 pounds per square foot may be used for preliminary design of exterior and isolated column footings. If competent bedrock is encountered at footing subgrade level, the allowable bearing capacity will not govern design, and footings should be designed based upon minimum widths contained in buildings codes.

Seismic Considerations


Section 1613 of the IBC covers lateral forces imposed on structures from earthquake shaking and requires that every structure be designed and constructed to resist the effects of earthquake motions in accordance with ASCE-7. Lateral forces are dependent on the type and properties of soils present beneath the Site, along with the geographic location. Per Table 1604.11, the maximum considered earthquake spectral response acceleration at short periods (S<sub>s</sub>) and at 1-sec (S<sub>1</sub>) was determined to be 0.191 and 0.070, respectively, for Gardner, Massachusetts.

Soil properties are represented through Site Classification. Procedures for the Site-specific determination of Site Classification are provided in Chapter 20 of ASCE-7. Where soil properties, such as SPT collected through soil borings, are not known in sufficient detail, Class D may be used. At this Site, it appears that final design borings may support the seismic classification of Site Class C. Therefore, Site Class should be reviewed/revised during final design. The Site coefficients F<sub>a</sub> and F<sub>v</sub> were determined according to Tables 1613.3.3(1) and 1613.3.3(2) of the IBC (2015), using both the S<sub>s</sub> and
S₁ values and the Site Class. For Site Class C, F_a and F_v were determined to be 1.2 and 1.7, respectively. For Site Class D, F_a and F_v were determined to be 1.6 and 2.4, respectively.

Section 1806.4 relates to the liquefaction potential of the underlying soils. Evaluation of liquefaction potential is beyond the scope of this study. However, based upon the conditions observed in the test pits, we do not anticipate liquefaction to be a significant concern.

Earthwork Considerations

We anticipate that earthwork for this project will include the following: cuts and fills to form the new building pad and surrounding proposed features; excavations for footings; placement of compacted engineered fill beneath the building, floorslabs, and pavements (as needed); and the treatment of the existing soils to address any localized loose areas that may be present. Depending on the building location and the elevation of the bedrock surface, blasting may be required. We note that large excavations may result from the removal of boulders.

DESIGN PHASE INVESTIGATIONS AND TESTING

This preliminary study indicates that conditions are favorable for the project. However, design phase explorations will be requested. The number and scope of additional explorations will depend upon the final location and footprint of any new building. Typically, design phase borings should be competed at a spacing of 100 feet, or less. The design phase geotechnical study should also include testing to evaluate the hydraulic conductivity of Site soils (for stormwater control and disposal). Bedrock coring may be required. If significant quantities of soil are to be removed from the Site, environmental testing of the soils would be appropriate.

We appreciated the opportunity to be of service on this project. If you have any questions, please do not hesitate to contact the undersigned.

Sincerely yours,
O'Reilly, Talbot & Okun Associates, Inc.

Attachments: Limitations, Site Locus, Site Sketch, Test Pit Logs, Test Pit Photographs, Laboratory Data Sheets
LIMITATIONS
LIMITATIONS

1. The observations presented in this report were made under the conditions described herein. The conclusions presented in this report were based solely upon the services described in the report and not on scientific tasks or procedures beyond the scope of the project or the time and budgetary constraints imposed by the client. The work described in this report was carried out in accordance with the Statement of Terms and Conditions attached to our proposal.

2. The analysis and recommendations submitted in this report are based in part upon the data obtained from widely spaced subsurface explorations. The nature and extent of variations between these explorations may not become evident until construction. If variations then appear evident, it may be necessary to reevaluate the recommendations of this report.

3. The generalized soil profile described in the text is intended to convey trends in subsurface conditions. The boundaries between strata are approximate and idealized and have been developed by interpretations of widely spaced explorations and samples; actual soil transitions are probably more erratic. For specific information, refer to the boring logs.

4. In the event that any changes in the nature, design or location of the proposed structures are planned, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and conclusions of this report modified or verified in writing by O'Reilly, Talbot & Okun Associates Inc. It is recommended that we be retained to provide a general review of final plans and specifications.

5. Our report was prepared for the exclusive benefit of our client. Reliance upon the report and its conclusions is not made to third parties or future property owners.
FIGURES
SITE

SITE LOCUS

O'Reilly, Talbot & Okun
ENGINEERING ASSOCIATES

293 Bridge Street, Suite 500
Springfield, Massachusetts 01103

Phone: 413-788-6222
www.oto-env.com

PROJECT NUMBER
J1843-17-01

Pearl Street
Gardner, MA

DECEMBER, 2018
Figure 1
NOTES:
1. BASE MAP PROVIDED TO OTO IN ELECTRONIC FORMAT. ORIGINAL DRAWING TITLED "TEST PIT LOCATION, FIG. 1" BY FUS & O'NEILL, DATED 11/16/2018.
2. SAMPLE LOCATIONS ARE SHOWN ACCORDING TO GPS COORDINATES OBTAINED IN THE FIELD.
3. ALL DATA IS TO BE CONSIDERED ACCURATE ONLY TO THE DEGREE IMPLIED BY THE METHODS USED IN THE DEVELOPMENT OF THIS PLAN.

LEGEND:
APPX TEST PIT LOCATION PERFORMED BY DAVID RICHARD EXCAVATING ON 11/28/2018, OBSERVED BY OTO.
TEST PIT LOGS
## LOG OF TEST PIT  TP-1

<table>
<thead>
<tr>
<th>DEPTH (ft)</th>
<th>SOIL DESCRIPTION</th>
<th>EXCAV. EFFORT</th>
<th>BOULDERS/COBBLES</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>COUNT</td>
<td>SIZE</td>
</tr>
<tr>
<td>3&quot;</td>
<td>Black, organics (decaying brush), damp-moist</td>
<td>E</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>1&quot;</td>
<td>Orange-brown, fine SAND, some organics (roots), trace silt, damp (TOPSOIL)</td>
<td>E</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2&quot;</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>3&quot;</td>
<td>~20% orange-gray oxidation features from 3' to end of exploration</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>4&quot;</td>
<td>Brown, fine to medium SAND and GRAVEL, damp some cobbles and boulders</td>
<td>M-D NURIOUS</td>
<td></td>
<td>3&quot; - &gt;36&quot;</td>
</tr>
<tr>
<td>5&quot;</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>6&quot;</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>7&quot;</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>8&quot;</td>
<td>End of exploration at 8' upon refusal on possible bedrock or large boulders</td>
<td>VD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9&quot;</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>10&quot;</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>11&quot;</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

### TEST PIT PLAN

<table>
<thead>
<tr>
<th>EXCAVATION EFFORT</th>
<th>BOULDER/COBBLE CLASS</th>
<th>PROPORTIONS USED</th>
<th>GROUNDWATER CONDITIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Easy ...E</td>
<td>Type</td>
<td>Term Relative Quantity</td>
<td>GW Depth (ft): N/E</td>
</tr>
<tr>
<td>Moderate ...M</td>
<td>Cobble</td>
<td>and</td>
<td>GW Elevation (ft): -</td>
</tr>
<tr>
<td>Difficult ...D</td>
<td>Small</td>
<td>some</td>
<td>Elapsed Time (min): -</td>
</tr>
<tr>
<td>Very Difficult ...V</td>
<td>Medium</td>
<td>little</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Large</td>
<td>trace</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3&quot; - 6&quot;</td>
<td>10% or less</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6&quot; - 18&quot;</td>
<td>10% - 20%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>18&quot; - 36&quot;</td>
<td>10% - 20%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>36&quot; and Larger</td>
<td>10% or less</td>
<td></td>
</tr>
</tbody>
</table>

### PROJECT NO.

1843-17-01

### LOG OF TEST PIT

TP-1

Remarks:

1. Numerous cobbles and boulders at ground surface (all sizes).
**LOG OF TEST PIT TP-2**

**PROJECT** Pearl Street Elementary

**JOB NO.** 1843-17-01  **LOCATION** Gardner, MA

**DATE** 11/28/2018  **WEATHER** Sunny, 30's

**OPERATOR** David Richard  **BACKHOE** Deere 160C

**PROJECT NO.** 1843-17-01  **DATE** 11/28/2018

<table>
<thead>
<tr>
<th>DEPTH (ft)</th>
<th>SOIL DESCRIPTION</th>
<th>EXCAV. EFFORT</th>
<th>BOULDERS/COBBLES</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>0'</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1'</td>
<td>Orange-brown, fine SAND, some organics (roots), damp (TOPSOIL)</td>
<td>E</td>
<td>E</td>
<td></td>
</tr>
<tr>
<td>2'</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3'</td>
<td>~10% orange-gray oxidation features from 3' to end of exploration</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4'</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5'</td>
<td>Brown, fine to medium SAND and GRAVEL, damp some boulders and cobbles</td>
<td>M-D</td>
<td>NURIOUS</td>
<td>3&quot; - &gt;36&quot;</td>
</tr>
<tr>
<td>6'</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7'</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8'</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9'</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10'</td>
<td>End of exploration at 9.5'</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11'</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**TEST PIT PLAN**

- **EXCAVATION EFFORT**
  - Easy …..E
  - Moderate …..M
  - Difficult …..D
  - Very Difficult …..V

- **BOULDER/COBBLE CLASS**
  - Type: Cobble
  - Size: 3" - 6"

- **PROPORTIONS USED**
  - Term: and
  - Relative Quantity: 35% - 50%

- **GROUNDWATER CONDITIONS**
  - GW Depth (ft): N/E
  - GW Elevation (ft): -

**Remarks:**
1. Numerous cobbles and boulders at ground surface (all sizes).
## LOG OF TEST PIT  TP-3

<table>
<thead>
<tr>
<th>DEPTH (ft)</th>
<th>SOIL DESCRIPTION</th>
<th>EXCAV. EFFORT</th>
<th>BOULDERS/COBBLES</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>0'</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1'</td>
<td></td>
<td>E</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>2'</td>
<td></td>
<td>E</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3'</td>
<td></td>
<td>E</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4'</td>
<td></td>
<td>E</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5'</td>
<td>Brown-light brown, fine to medium SAND and GRAVEL, damp</td>
<td>M-D</td>
<td>Numerous 3&quot; - &gt;36&quot;</td>
<td></td>
</tr>
<tr>
<td>6'</td>
<td>Some boulder and cobbles</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7'</td>
<td></td>
<td>E</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8'</td>
<td></td>
<td>VD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9'</td>
<td>End of exploration at 9'</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10'</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11'</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**TEST PIT PLAN**

- **3'**
- **10'**

**EXCAVATION EFFORT**

- Easy ....E
- Moderate ....M
- Difficult ....D
- Very Difficult ....V

**BOULDER/COBBLE CLASS**

- Type: Cobble
- Size: 3" - 6"

**PROPORTIONS USED**

- Term: Moderate
- Relative Quantity: 35% - 50%

**GROUNDWATER CONDITIONS**

- GW Depth (ft): N/E
- GW Elevation (ft): -
- Elapsed Time (min): -

**PROJECT NO.**

1843-17-01

**LOG OF TEST PIT**

TP-3

**Remarks:**

1. Numerous cobbles and boulders at ground surface (all sizes).
**LOG OF TEST PIT TP-4**

- **PROJECT**: Pearl Street Elementary
- **DATE**: 11/28/2018
- **WEATHER**: Sunny, 30°s
- **START TIME**: 10:30
- **FINISH TIME**: 11:15
- **GS ELEV. (ft)**: --
- **CITY**: Gardner, MA
- **LOCATION**: Northern extent of Site
- **OPERATOR**: David Richard
- **CONTRACTOR**: David Richard Excavating
- **BACKHOE**: Deere 160C
- **WEIGHT**: Sunny, 30°s
- **CAPACITY (cy)**: 3/4
- **JOB NO.**: 1843-17-01
- **PROJECT NO.**: 1843-17-01
- **FINISH TIME**: 11:15
- **RED**: --
- **MUN**: MUN
- **FINAL DEPTH (ft)**: 8.0

### Soil Description

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Soil Description</th>
<th>Excav. Effort</th>
<th>Boulders/Cobble Class</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>3'</td>
<td>Black, organics (decaying brush), damp</td>
<td>E</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1'</td>
<td>Orange-brown, fine SAND, trace silt, some organics (roots), damp (TOPSOIL)</td>
<td>E</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2'</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3'</td>
<td>~15% orange-gray oxidation features from 3' to end of exploration</td>
<td>M-D</td>
<td>NUMEROUS 3&quot; - &gt;36&quot;</td>
<td></td>
</tr>
<tr>
<td>4'</td>
<td>Brown-light brown, fine to medium SAND and GRAVEL, damp, some cobbles and boulders</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5'</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6'</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7'</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8'</td>
<td>End of exploration at 8'</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9'</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10'</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11'</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Excavation Effort

- **Easy**: E
- **Moderate**: M
- **Difficult**: D
- **Very Difficult**: V

### Boulder/Cobble Class

- **Type**: Cobble
- **Size**: 3" - 6"
- **Term**: Relative Quantity
- **Relative Quantity**: 35% - 50%

### Groundwater Conditions

- **GW Depth (ft)**: N/E
- **GW Elevation (ft)**: --
- **Elapsed Time (min)**: --

Remarks:

1. Numerous cobbles and boulders at ground surface (all sizes).
**LOG OF TEST PIT  TP-5**

**PROJECT**  
Pearl Street Elementary

**JOB NO.**  
1843-17-01

**LOCATION**  
Gardner, MA

**DATE**  
11/28/2018

**WEATHER**  
Sunny, 30's

**START TIME**  
12:45

**CAPACITY (cy)**  
3/4

**FINISH TIME**  
1:00

**GS ELEV. (ft)**  
--

**PROJECT NO.**  
1843-17-01

**CONTRACTOR**  
David Richard Excavating

**OPERATOR**  
David Richard

**BACKHOE**  
Deere 160C

**JOB NO.**  
1843-17-01

**DATE**  
11/28/2018

**LOCATION**  
Central portion of Site

**WEATHER**  
Sunny, 30°s

**BACKHOE**  
Deere 160C

**OPERATOR**  
David Richard

**START TIME**  
12:45

**FINISH TIME**  
1:00

**GS ELEV. (ft)**  
--

**SOIL DESCRIPTION**

- **3'**: Black, organics (decaying brush), damp
- **1'**: Orange-brown, fine SAND, trace silt, some organics (roots), damp (TOPSOIL)
- **2'**: ~10-15% oxidation features from 2.5' to end of exploration
- **3'**: Brown-light brown, fine to medium SAND and GRAVEL, damp some cobbles and boulders

**EXCAVATION EFFORT**

- **COUNT**: 1

**BOULDER/COBBLE CLASS**

- **Type**: Cobble
- **Size**: 3" - 6" and Larger

**REMARKS**

1. Numerous cobbles and boulders at ground surface (all sizes).
2. End of exploration at 8.5' upon large boulders/bedrock.

**GROUNDWATER CONDITIONS**

- **GW Depth (ft)**: N/E
- **GW Elevation (ft)**: --
- **Elapsed Time (min)**: --

**EXCAVATION EFFORT**

- Easy: E
- Moderate: M
- Difficult: D
- Very Difficult: V

**BOULDER/COBBLE CLASS**

- **Type**: Cobble
- **Size**: 3" - 6" and Larger

**PROPORTIONS USED**

- **Term**: and
- **Relative Quantity**: 35% - 50%

**GROUNDWATER CONDITIONS**

- **GW Depth (ft)**: N/E
- **GW Elevation (ft)**: --
- **Elapsed Time (min)**: --

**PROJECT NO.**

**LOG OF TEST PIT**

**TP-5**
**LOG OF TEST PIT  TP-6**

<table>
<thead>
<tr>
<th>DEPTH (ft)</th>
<th>SOIL DESCRIPTION</th>
<th>EXCAV. EFFORT</th>
<th>BOULDERS/COBBLES</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>3&quot;</td>
<td>Black, organics (decaying brush), damp</td>
<td>E</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>1&quot;</td>
<td>Orange-brown, fine SAND, trace silt, some organics (roots), damp (TOPSOIL)</td>
<td>E</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2&quot;</td>
<td>~10-15% orange-gray oxidation features from 2.5' to end of exploration</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3&quot;</td>
<td>Brown-light brown, fine to medium SAND and GRAVEL, damp</td>
<td>M-D NUMEROUS</td>
<td>3&quot; - &gt;36&quot;</td>
<td></td>
</tr>
<tr>
<td>4&quot;</td>
<td>some boulders and cobbles</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5&quot;</td>
<td>End of exploration at 7.5' upon large boulders and/or bedrock</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**TEST PIT PLAN**

- 3'
- 10'

**EXCAVATION EFFORT**

- Easy ......E
- Moderate ......M
- Difficult ......D
- Very Difficult ......V

**BOULDER/COBBLE CLASS**

- Type
- Size: 3"-6" or 6"-18" or 18"-36" or 36" and Larger

**PROPORTIONS USED**

- Term: Easy, Moderate, Difficult, Very Difficult
- Relative Quantity: 35% - 50%
- and: 35% - 50%
- some: 20% - 35%
- little: 10% - 20%
- trace: 10% or less
- some: 35% - 50%
- and: 35% - 50%
- little: 10% - 20%
- trace: 10% or less

**GROUNDWATER CONDITIONS**

- GW Depth (ft): N/E
- GW Elevation (ft): -
- Elapsed Time (min): -

Remarks:

1. Numerous cobbles and boulders at ground surface (all sizes).
### LOG OF TEST PIT  TP-8

#### PROJECT
Pearl Street Elementary

#### JOB NO.
1843-17-01

#### LOCATION
Gardner, MA

#### DATE
11/28/2018

#### WEATHER
Sunny, 30’s

#### BACKHOE
Deere 160C

#### CONTRACTOR
David Richard Excavating

#### OPERATOR
David Richard

#### JOB NO.
1843-17-01

#### DATE
11/28/2018

#### WEATHER
Sunny, 30’s

#### BACKHOE
Deere 160C

#### CONTRACTOR
David Richard Excavating

#### OPERATOR
David Richard

#### LOCATION
Southern portion of Site

#### START TIME
1:25

#### CAPACITY (CY)
3/4

#### FINISH TIME
1:40

#### GS ELEV. (ft)
--

#### OTO STAFF
MJN

#### FINAL DEPTH (ft)
9.0

### DEPTH (ft)

#### SOIL DESCRIPTION

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Soil Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 1'</td>
<td>Black, organics (decaying brush), damp</td>
</tr>
<tr>
<td>1'</td>
<td>Orange-brown, fine SAND, trace silt, some organics (roots), damp (TOPSOIL)</td>
</tr>
<tr>
<td>2'</td>
<td>~10-15% oxidation features from 2.5’ to end of exploration</td>
</tr>
<tr>
<td>3'</td>
<td>Brown-light brown, fine to medium SAND and GRAVEL, damp</td>
</tr>
<tr>
<td>3'</td>
<td>some boulders and cobbles</td>
</tr>
</tbody>
</table>

### EXCAVATION EFFORT

#### BOULDER/COBBLE CLASS

<table>
<thead>
<tr>
<th>Count</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>E</td>
<td>1</td>
</tr>
<tr>
<td>E</td>
<td>1</td>
</tr>
</tbody>
</table>

### PROPORTIONS USED

#### GROUNDWATER CONDITIONS

<table>
<thead>
<tr>
<th>GW Depth (ft)</th>
<th>N/E</th>
</tr>
</thead>
<tbody>
<tr>
<td>GW Elevation (ft)</td>
<td>-</td>
</tr>
<tr>
<td>Elapsed Time (min)</td>
<td>-</td>
</tr>
</tbody>
</table>

### REMARKS

1. Numerous cobbles and boulders at ground surface (all sizes).

### TEST PIT PLAN

![Test Pit Plan Diagram](image)

### PROJECT NO.
1843-17-01

### LOG OF TEST PIT
TP-8
## LOG OF TEST PIT  TP-9

<table>
<thead>
<tr>
<th>DEPTH (ft)</th>
<th>SOIL DESCRIPTION</th>
<th>EXCAV. EFFORT</th>
<th>BOULDERS/COBBLES</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>3'</td>
<td>3&quot;: Black, organics (decaying brush), damp</td>
<td>E</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>1'</td>
<td>Orange-brown, fine SAND, trace silt, some organics (roots), damp (TOPSOIL)</td>
<td>E</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2'</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3'</td>
<td>~10% oxidation features from 3' to end of exploration</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4'</td>
<td>Brown-light brown, fine to medium SAND and GRAVEL, damp (TOPSOIL)</td>
<td>M-D</td>
<td>NUMEROUS 3&quot; - &gt;36&quot;</td>
<td></td>
</tr>
<tr>
<td>5'</td>
<td>some boulders and cobbles</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6'</td>
<td>End of exploration at 7.5' upon large boulders and/or bedrock</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7'</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8'</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9'</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10'</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11'</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**TEST PIT PLAN**

- **EXCAVATION EFFORT**
  - Easy ..... E
  - Moderate ..... M
  - Difficult ..... D
  - Very Difficult ..... V

- **BOULDER/COBBLE CLASS**
  - Type: Cobble
  - Size: 3" - 6"

- **PROPORTIONS USED**
  - Term: and
  - Relative Quantity: 35% - 50%

- **GROUNDWATER CONDITIONS**
  - GW Depth (ft): N/E
  - GW Elevation (ft): -
  - Elapsed Time (min): -

**PROJECT NO.**

1843-17-01

**LOG OF TEST PIT**

TP-9

Remarks:
1. Numerous cobbles and boulders at ground surface (all sizes).
<table>
<thead>
<tr>
<th>DEPTH (ft)</th>
<th>SOIL DESCRIPTION</th>
<th>EXCAVATION EFFORT</th>
<th>Boulders/Cobbles</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>0' - 3'</td>
<td>Black, organics (decaying brush), damp-moist</td>
<td>E</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>3'</td>
<td>Orange-brown, fine SAND, trace silt, some organics (roots), damp (TOPSOIL)</td>
<td>E</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2'</td>
<td>~10% orange-gray oxidation features from 2' to end of exploration</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3'</td>
<td>Brown, fine to medium SAND and GRAVEL, damp</td>
<td>M-D</td>
<td>NUMEROUS 3&quot; - &gt;36&quot;</td>
<td></td>
</tr>
<tr>
<td>6'</td>
<td>End of exploration at 9' upon dense soils with boulders</td>
<td>VD</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**TEST PIT PLAN**

- **EXCAVATION EFFORT**
  - Easy ..... E
  - Moderate ..... M
  - Difficult ..... D
  - Very Difficult ..... V

- **BOULDER/COBBLE CLASS**
  - Cobble 3" - 6"
  - Small 6" - 18"
  - Medium 18" - 36"
  - Large 36" and Larger

- **PROPORTIONS USED**
  - Count
  - Size

- **GROUNDWATER CONDITIONS**
  - GW Depth (ft): N/E
  - GW Elevation (ft): -
  - Elapsed Time (min): -

Remarks:
1. Numerous cobbles and boulders at ground surface (all sizes).
## LOG OF TEST PIT  TP-11

<table>
<thead>
<tr>
<th>DEPTH (ft)</th>
<th>SOIL DESCRIPTION</th>
<th>EXCAV. EFFORT</th>
<th>BOULDERS/COBBLES</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>3'</td>
<td>Black, organics (decaying brush), damp-moist</td>
<td>E</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>1'</td>
<td>Orange-brown, fine SAND, trace silt, some organics (roots), damp (TOPSOIL)</td>
<td>E</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2'</td>
<td>Brown, fine to medium SAND and GRAVEL, damp</td>
<td>M-D</td>
<td>NUMEROUS 3' - &gt;36'</td>
<td></td>
</tr>
<tr>
<td>3'</td>
<td>Some cobbles and boulders</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4'</td>
<td>End of exploration at 3.5' upon large boulder/ bedrock</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### TEST PIT PLAN

- **6’ x 15’**

### EXCAVATION EFFORT

- **Easy ......E**
- **Moderate ......M**
- **Difficult ......D**
- **Very Difficult ......V**

### BOULDER/COBBLE CLASS

<table>
<thead>
<tr>
<th>Type</th>
<th>Size</th>
<th>Term</th>
<th>Relative Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cobble</td>
<td>3” - 6”</td>
<td>and</td>
<td>35% - 50%</td>
</tr>
<tr>
<td>Small</td>
<td>6” - 18”</td>
<td>some</td>
<td>20% - 35%</td>
</tr>
<tr>
<td>Medium</td>
<td>18” - 36”</td>
<td>little</td>
<td>10% - 20%</td>
</tr>
<tr>
<td>Large</td>
<td>36” and Larger</td>
<td>trace</td>
<td>10% or less</td>
</tr>
</tbody>
</table>

### GROUNDWATER CONDITIONS

- **GW Depth (ft):** N/E
- **GW Elevation (ft):** -
- **Elapsed Time (min):** -

### PROJECT NO.

- 1843-17-01

### LOG OF TEST PIT

- **TP-11**

**Remarks:**

1. Numerous cobbles and boulders at ground surface (all sizes).
TEST PIT PHOTOGRAPHS
Test Pit Photographs
Proposed Pearl Street Elementary School Site
Gardner, Massachusetts
J1843-17-01

TP-1 – Spoils

TP-1 – Backfilled

TP-2

TP-2 – Spoils
Test Pit Photographs
Proposed Pearl Street Elementary School Site
Gardner, Massachusetts
J1843-17-01
Test Pit Photographs
Proposed Pearl Street Elementary School Site
Gardner, Massachusetts
J1843-17-01

TP-10

TP-10 – Spoils

TP-11

TP-11 – Spoils
LABORATORY DATA SHEETS
Particle Size Distribution Report

Test Results (ASTM C 136 & ASTM C 117)

<table>
<thead>
<tr>
<th>Opening Size</th>
<th>Percent Finer</th>
<th>Spec.* (Percent)</th>
<th>Pass? (X=Fail)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>100.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.5</td>
<td>79.2</td>
<td></td>
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<tr>
<td>1</td>
<td>73.8</td>
<td></td>
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</tr>
<tr>
<td>3/4</td>
<td>69.2</td>
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</tr>
<tr>
<td>1/2</td>
<td>65.8</td>
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</tr>
<tr>
<td>3/8</td>
<td>63.2</td>
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<tr>
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<td>56.4</td>
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<tr>
<td>#8</td>
<td>49.8</td>
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<td></td>
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<tr>
<td>#16</td>
<td>43.0</td>
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<tr>
<td>#200</td>
<td>10.8</td>
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</tr>
</tbody>
</table>

Material Description

TP-1 NS-5'

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)=

AASHTO (M 145)=

Coefficients

<table>
<thead>
<tr>
<th>D05</th>
<th>D60</th>
<th>D15</th>
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<tbody>
<tr>
<td>45.0926</td>
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<td>42.1616</td>
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<td>0.3841</td>
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</tr>
<tr>
<td>0.1170</td>
<td>0.1170</td>
<td></td>
</tr>
</tbody>
</table>

Remarks

This sample was washed.

Date Received: 11-30-2018 Date Tested: 12-4-2018
Tested By: Checked By: JM
Title: Dir. of Testing Services

Sample Number: 6014 Date Sampled: 11-30-2018

ALLIED TESTING LABORATORIES, INC.
Springfield, Massachusetts

Client: OTO
Project: Pearl St. Elementary- Gardner, MA

Project No: Figure
Particle Size Distribution Report

GRAIN SIZE - mm.

<table>
<thead>
<tr>
<th>% +3&quot;</th>
<th>% Gravel</th>
<th>% Sand</th>
<th>% Silt</th>
<th>% Clay</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0</td>
<td>48.7</td>
<td>40.9</td>
<td></td>
<td>10.4</td>
</tr>
</tbody>
</table>

Test Results (ASTM C 136 & ASTM C 117)

<table>
<thead>
<tr>
<th>Opening</th>
<th>Percent Finer</th>
<th>Spec.* (Percent)</th>
<th>Pass? (X=Fall)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>100.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.5</td>
<td>76.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>65.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3/4</td>
<td>62.5</td>
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<td></td>
</tr>
<tr>
<td>1/2</td>
<td>58.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3/8</td>
<td>56.5</td>
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<td></td>
</tr>
<tr>
<td>#4</td>
<td>51.3</td>
<td></td>
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<tr>
<td>#8</td>
<td>46.1</td>
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<tr>
<td>#16</td>
<td>40.8</td>
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<td>#30</td>
<td>34.5</td>
<td></td>
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<td></td>
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<tr>
<td>#100</td>
<td>17.1</td>
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<td></td>
</tr>
<tr>
<td>#200</td>
<td>10.4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Material Description

TP-4 NS-8'

Atterberg Limits (ASTM D 4318)

PL=

LL=

Pl=

Classification

USCS (D 2487)= AASHTO (M 145)=

Coefficients

D_10= 4.55255  D_25= 42.9183  D_60= 14.7125
D_50= 4.0016  D_30= 0.4022  D_15= 0.1235

This sample was washed.

Date Received: 11-30-2018  Date Tested: 12-4-2018

Tested By:  

Checked By: JM

Title: Dir. of Testing Services

Sample Number: 6015

Date Sampled: 11-30-2018

ALLIED TESTING LABORATORIES, INC. Springfield, Massachusetts

Client: OTO

Project: Pearl St. Elementary- Gardner, MA

Project No:  

Figure