Attachment 1.8 to Exhibit A
Geotechnical Subsurface Investigation

City of Chicago Department of Fleet and Facility Management (2FM)

Relocation of 1685 N. Throop Operations 2FM Main Garage at 67th & Wentworth Chicago, Illinois

Prepared for:

2FM
FLEET & FACILITY MANAGEMENT

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May 22, 2017
May 22, 2017

Mr. Rocky Campanelli
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Geotechnical Subsurface Investigation
City of Chicago Department of
Fleet and Facility Management (2FM)
Relocation of 1685 N. Throop Operations
2FM Main Garage at 67th & Wentworth
Chicago, Illinois

Dear Mr. Campanelli:

Attached is a copy of the Geotechnical Subsurface Investigation for the above referenced project. The report provides a description of the site investigation, site conditions and preliminary foundation recommendations. The site investigation included advancing a total of ten (10) borings to depths ranging from 10 to 25 feet for a total linear footage of 175 feet, and two (2) in-situ infiltration tests.

Should you have any questions or require additional information, please call us at 312-733-6262.

Sincerely,

Jeffrey A. Rothamer, P.E.
Project Engineer

Ala E Sassila, Ph.D., P.E.
Principal
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1.0 INTRODUCTION

On behalf of the City of Chicago Department of Fleet and Facility Management (2FM), Arcadis, Inc. retained GSG Consultants, Inc. (GSG) to perform a subsurface exploration and geotechnical analysis, and provide preliminary recommendations for the relocation of the 1685 N. Throop operations. The site is located at 67th Street (Marquette Road) and Wentworth Avenue in Chicago, Illinois (Site Location Plan – Exhibit 1).

1.1 Project Information

Based on site layout provided by Arcadis, the proposed project will include the construction of a new 180,000 SF warehouse on the southeast corner of the site, with two new parking lots north and west of the new building. One parking lot would be for the facility employees while the second lot will be for City of Chicago vehicles.

1.2 Purpose and Scope of Services

The objective of this study was to explore and characterize the subsurface soil conditions in order to provide preliminary recommendations regarding the suitability of the subsurface soil to support the proposed warehouse and parking lots at the site. The scope of this study includes the following:

1. Perform site reconnaissance and advance ten (10) soil borings to depths ranging from 10 to 25 feet and complete two (2) in-situ infiltration tests in accordance with the City of Chicago Stormwater Manual.
2. Perform the geotechnical laboratory testing program on selected representative soil samples obtained during the field investigation to evaluate relevant engineering parameters of the subsurface soils.
3. Perform engineering analysis and evaluation of the data collected during the field study investigation and laboratory testing.
4. Provide preliminary recommendations for foundation and pavement design parameters and associated construction activities.
2.0 SITE SUBSURFACE EXPLORATION PROGRAM

This section describes the subsurface exploration program and laboratory testing program completed as part of this project.

2.1 Subsurface Exploration Program

The subsurface soil investigation was conducted on May 18th, 2017, and included advancing five (5) soil borings to a depth of 25 feet each for the proposed warehouse. An additional five (5) soil borings to a depth of 10 feet each, and two (2) in-situ infiltration tests were also completed for the proposed parking lots. The soil boring and infiltration locations were proposed by Arcadis, and were offset as necessary by GSG due to underground utilities and field conditions. One location, B-03a, was offset approximately 75 feet to the east to B-03b after encountering auger refusal before the planned termination depth. Elevations of the boring locations were gathered by GSG’s field crew using GPS surveying equipment. The Boring Location Plan attached shows the locations of the soil borings (Boring Location Plan – Exhibit 2). Table 1 presents a list of the borings locations completed.

<table>
<thead>
<tr>
<th>Boring ID</th>
<th>Latitude</th>
<th>Longitude</th>
<th>Depth (feet)</th>
<th>Existing Ground Elevation (feet CCD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>B-01</td>
<td>41.770461° N</td>
<td>87.631185° W</td>
<td>25</td>
<td>21.16</td>
</tr>
<tr>
<td>B-02</td>
<td>41.770762° N</td>
<td>87.630301° W</td>
<td>25</td>
<td>16.35</td>
</tr>
<tr>
<td>B-03a*</td>
<td>41.770103° N</td>
<td>87.630545° W</td>
<td>12</td>
<td>19.45</td>
</tr>
<tr>
<td>B-03b</td>
<td>41.770113° N</td>
<td>87.63026° W</td>
<td>25</td>
<td>16.28</td>
</tr>
<tr>
<td>B-04</td>
<td>41.769562° N</td>
<td>87.631212° W</td>
<td>25</td>
<td>19.37</td>
</tr>
<tr>
<td>B-05</td>
<td>41.769328° N</td>
<td>87.630653° W</td>
<td>25</td>
<td>16.37</td>
</tr>
<tr>
<td>B-06</td>
<td>41.772297° N</td>
<td>87.630649° W</td>
<td>10</td>
<td>18.62</td>
</tr>
<tr>
<td>IW-1</td>
<td>41.772287° N</td>
<td>87.630805° W</td>
<td>N/A</td>
<td>16.79</td>
</tr>
<tr>
<td>B-07</td>
<td>41.771693° N</td>
<td>87.63102° W</td>
<td>10</td>
<td>17.37</td>
</tr>
<tr>
<td>B-08</td>
<td>41.771704° N</td>
<td>87.630366° W</td>
<td>10</td>
<td>17.08</td>
</tr>
<tr>
<td>B-09/IW-2</td>
<td>41.770014° N</td>
<td>87.631651° W</td>
<td>10</td>
<td>16.64</td>
</tr>
<tr>
<td>B-10</td>
<td>41.769291° N</td>
<td>87.631699° W</td>
<td>10</td>
<td>16.82</td>
</tr>
</tbody>
</table>

* Auger and spoon refusal at 12 feet, offset 75 feet to B-03b
The soil borings were drilled using a truck mounted, Mobile B-57 drill rig equipped with 3 ¼-inch I.D. hollow stem augers. GSG performed the field exploration activities using standard penetration test procedures in accordance with ASTM D1586-99, “Penetration Test and Split-barrel Sampling of Soil.” In this procedure, a 2 inch O.D. split-spoon sampler is driven 18 inches into undisturbed soil using a 30 inch drop of a 140-pound hammer. The number of hammer drops (Blow Counts) is recorded at six inch intervals for each sample collected. The number of blows to advance the sampler 12 inches is called the standard penetration test (SPT). The SPT values are shown on the Soil Boring Logs (Appendix A).

Representative soil samples were obtained at 2.5-foot intervals to a depth of 15 feet, and 5-foot intervals thereafter through to the termination depths. GSG’s field representative visually classified the soils according to the Unified Soil Classification System (ASTM 2487), performed pocket penetrometer on all native cohesive soil samples to estimate their unconfined compressive strength, and obtained relatively undisturbed samples of the subsurface soil for laboratory testing. The results of the pocket penetrometer tests are shown on the boring logs. Representative soil samples were collected from each sample interval, and were placed in jars and returned to the laboratory for further testing and evaluation. Soil boring holes were back-filled with soil cuttings after the borings were completed and patched with fast-set concrete where applicable.

2.2 Laboratory Testing Program
All samples were inspected in the laboratory to verify the field classifications. A laboratory testing program was undertaken to characterize and determine engineering properties of the subsurface soils encountered in the area of the proposed improvements. Moisture content tests (ASTM D2216) were completed on representative samples

The laboratory tests were performed in accordance with test procedures per ASTM requirements. Based on the laboratory test results, the soils encountered were classified according to the United Soil Classification System (USCS). The results of the laboratory testing program are shown on the Soil Boring Logs (Appendix A).

2.3 Subsurface Soil Conditions
The soil boring logs provide specific conditions encountered at each boring location, including detailed soil descriptions, stratifications, penetration resistance, location of the samples, and
laboratory test data. The stratification shown on the boring logs represents the conditions only at the actual borings locations, and represents the approximate boundary between subsurface materials; however, the actual transition may be gradual. The general soil descriptions for the attached soil borings are presented below.

**Warehouse - Soil Borings B-1 through B-5**
At the ground surface, the borings encountered 6 inches of topsoil underlain by brown and gray sand and clay fill with gravel and urban debris to depths ranging from 5 to 12.5 feet. Below the fill, the borings encountered loose to dense, brown and gray sand to depths of 13.5 to 18.5 feet, underlain by stiff to very stiff, gray silty clay to the boring termination depths of 25 feet. The brown and gray sand had SPT N values ranging from 9 to 38 blows per foot while the gray silty clay had unconfined compressive strengths ranging from 1.5 to 3.25 tsf. Boring B-03a encountered rubblized concrete at a depth of 8 feet that extended until hitting practical auger refusal at 12 feet due to a possible buried basement slab or foundation from a previous building on site. GSG encountered multiple spoon refusals and concrete debris during the drilling activities, which appeared to be related to the former building foundation and basement that were left in place.

**North Parking Lot - Soil Borings B-06 through B-08**
At the ground surface, borings B-06 and B-08 encountered 6 inches of topsoil while boring B-07 encountered 2 inches of asphalt and 6 inches of aggregate base course. Under the surficial layers, the borings encountered interbedded layers of brown and gray sand and clay fill with urban debris to depths of 3.5 to 7 feet, underlain by very loose to medium dense, brown and gray sand to the boring termination depths of 10 feet. The native brown and gray sand had SPT N values ranging from 2 to 21 blows per foot. Boring B-06 encountered very stiff, brown and gray clay from 9 to 10 feet with an unconfined compressive strength of 2.0 tsf.

**South Parking Lot - Soil Borings B-09 and B-10**
At the ground surface, the borings encountered 2 inches of asphalt and 6 inches of aggregate base course. Below the pavement, the borings encountered layers of brown and gray sand and clay fill with urban debris to the boring termination depths of 10 feet. A petroleum odor was noted in each of the borings below 5 feet.
2.4 Groundwater Conditions

Water level measurements were made at each location when evidence of free groundwater was detected on the drill rods or in the samples. The boreholes were also checked for free water immediately after auger removal and before filling the open boreholes with soil cuttings. Water was encountered while drilling in most of the borings at depths ranging between 3.5 and 9 feet. No water was encountered immediately after the completion of drilling in any of the borings.

Based on the color change of the material from brown to gray, it is assumed the long-term water table is approximately 13.5 to 18.5 feet below grade. Long term observations in cased borings or piezometers would be necessary to more accurately evaluate groundwater conditions at the site. However, it should be noted that fluctuations in groundwater level may occur due to variations in rainfall, other climatic conditions, or other factors not evident at the time measurements were made and reported herein.

2.5 Infiltration Parameters

GSG conducted single-ring infiltrometer testing to measure the in-situ infiltration rate of the soils below the proposed parking lots. The infiltration testing locations were performed adjacent to borings B-6 and B-9 as shown on the Boring Location Plan – Exhibit 2. Table 2 provides a summary of the soil types observed at each test location, the depth of the infiltration tests, and measured field permeability results for each location.

<table>
<thead>
<tr>
<th>Infiltration Test #</th>
<th>Boring</th>
<th>Depth Below Existing Grade (feet)</th>
<th>Soil Type Tested</th>
<th>Permeability (in/hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>IW-1</td>
<td>B-6</td>
<td>1.5</td>
<td>Sand Fill</td>
<td>4.04</td>
</tr>
<tr>
<td>IW-2</td>
<td>B-9</td>
<td>1.5</td>
<td>Sand Fill</td>
<td>4.46</td>
</tr>
</tbody>
</table>

It should be noted that near surface soils consisting of the variable fill materials encountered in the borings can generally vary greatly across a site. This variability can significantly affect the infiltration rate from one location to the next. GSG assessed the infiltration rates based on the soils encountered at each location and established an infiltration rate of greater than 4 inches per hour. However, for sand soils, a maximum design infiltration rate of 3.6 inch per hour may be used per the City of Chicago Stormwater Design Manual. Based on the existing upper soil conditions consisting predominantly of sand (fill and native materials), some infiltration of stormwater
water is anticipated. Surface and subsurface drainage of the pavement section should be provided to prevent standing water from developing on the pavement or within the base course. Standing water will cause softening of the subgrade and deterioration of the pavement. The subgrade should be prepared in accordance with the Construction Considerations section of this report.
3.0 GEOTECHNICAL ANALYSES AND PRELIMINARY RECOMMENDATIONS
This section provides GSG’s geotechnical analysis and preliminary recommendations for the
design of the proposed project based on the results of the field exploration and laboratory
testing.

3.1 Building Foundations
Based on the results of the subsurface investigation, the proposed building could be supported
upon conventional shallow spread and continuous footing foundation system, bearing on the
native stiff to very stiff silty clay and medium dense sand with gravel encountered below the fill
materials. The shallow foundations should be designed for a preliminary net allowable bearing
capacity of 3,000 psf. Existing fill materials should be removed from below the proposed
foundations, down to the native soils. Based on the depth of the existing fill materials
encountered in the borings, undercuts of up to 9 feet may be anticipated to reach native bearing
soils. The foundations could then either be designed at the lower elevation or the over
excavation should be backfilled to the bearing grade with granular structural fill. The granular
structural fill should be placed in accordance with the Construction Considerations section of this
report. The minimum depth of the foundation bearing grade should be 3.5 feet below the final
exterior grade to alleviate the effects of frost.

The above preliminary bearing capacity is based on an assumed allowable total settlement of one
inch and an allowable differential settlement of one half inch. If any of the assumptions or design
loading information above is not correct or has been changed, GSG should be contacted to re-
evaluate the foundation design recommendations.

Spread footings should have a minimum plan dimension of 4 feet and should be at least 12 inches
thick. Continuous footings should have a minimum width of 2 feet and should be at least 10
inches thick. The actual footing thickness and reinforcement should be determined by a
structural analysis of the individual footings with chosen plan dimensions.

If the native soils at the base of the excavation become disturbed, the exposed subgrade should
be compacted prior to placing structural fill. The lateral limit of engineered structural fill placed
beneath the footing should extend a minimum 1 foot beyond the outside edges of the footing
and from that point outward laterally 1 foot for every 2 feet of fill thickness below the footing.
The granular structural fill should be placed and compacted in accordance with the Construction
Considerations section of this report. Figure 1 illustrates the structural fill placement below the footings.

![Figure 1: Structural Fill Placement Below Footing](image)

### 3.2 Lateral Load Resistance for Shallow Foundations

Resistance to lateral loads can be provided by a combination of friction at the foundation base and slab-on-grade, and by passive resistance acting against the vertical faces of foundation elements. A coefficient of friction of 0.35 may be used for footings. For the floor slab, a coefficient of friction of 0.35 may be used between the floor slab and subgrade. For passive resistance, an equivalent fluid pressure of 275 pounds per cubic foot (pcf) acting against the footing may be used. Passive resistance in the upper one foot of soil should be neglected unless the area is covered by concrete or pavement. The friction and passive resistance may be used concurrently provided the passive resistance is reduced by 50%.
3.3 Parking Lot Recommendations

For any paved areas where vehicular traffic will be light to moderate, GSG recommends supporting the pavement on a minimum 8 inches of granular fill consistent with IDOT CA-6 gradation. The pavement for the parking lot could be designed using the Illinois Department of Transportation’s pavement design procedures using an assumed CBR/IBR value of 12 based on the sand fill soils encountered at the site. It is recommended that the minimum pavement section should consist of 1.5 inches of bituminous surface course and 2.0 inches of binder course.

For pavement areas that may experience heavier loads, such as those from buses, delivery trucks, or garbage trucks, it is recommended that the minimum pavement section should consist of 2.5-inches of surface course and 3.5-inches of binder course over the 12-inches granular base course. As an alternative, the pavement section may consist of a 6-inch layer of concrete, reinforced with welded wire fabric, over a 6-inch lift of granular base course.

The existing fill materials extend to depths of between 3.5 to 10 feet below the existing grade. Based on the proposed grading for the parking areas, existing fill materials are anticipated to be left in place below the proposed new pavements. Additional observation and testing of the fill materials will be necessary. Any significant organic materials should be removed and replaced with new engineered fill. The remaining fill materials should be evaluated during construction according to the recommendations provided in Section 4.1 Site and Subgrade Preparation.

Prior to placing any base course stone, the subgrade soil should first be prepared in accordance with the Construction Considerations section of this report. Granular backfill should be placed in 8-inch maximum thickness lifts, and should be compacted with the use of a vibratory smooth drum compactor to 95% of the material’s standard dry density (ASTM D-698) and finally proof rolled.
4.0 CONSTRUCTION CONSIDERATIONS

4.1 Site and Subgrade Preparation

GSG recommends removing all existing pavements, concrete, construction debris, vegetation, trees, topsoil, root mats, and any soft or unsuitable/deleterious materials from the proposed building and parking lot areas. After any unsuitable material is removed from the site, the exposed subgrade soils should be evaluated, and any unsuitable/deleterious material should be removed.

It is recommended that any underground utility lines, buried slabs and foundation remnants that will impact the proposed building footprint should also be completely removed from beneath the proposed structures. Existing utility lines that are to be abandoned should be removed to the property line, and should be plugged with a minimum of 2 feet of cement grout. All excavations resulting from foundation and underground utilities removal activities should be cleaned of loose and disturbed materials, including all previously-placed backfill, and backfilled with suitable fill materials.

The existing soil materials in all of the proposed improvement areas should be excavated down to the recommended design depth of 8 inches below the base of the pavement section. The exposed subgrade should then be scarified to a minimum depth of 8 inches, moisture conditioned to within two (2) percent of the materials optimum moisture content, and compacted to 95 percent of the materials maximum standard proctor value as determined per ASTM D-698. After completing the scarification and compaction activities, the subgrade should then be proof-rolled using a loaded tandem axle dump truck or similar rubber tire vehicle weighing at least 25 tons. The purpose of the proof-rolling is to detect the presence of unsuitable or unstable soil that may exist within a few inches of the subgrade level. Areas which are observed to rut or deflect excessively under the moving load should be investigated to determine the extent of the unstable material. The unsuitable soils should then be removed from below the proposed pavement and slab areas and replaced with structural fill. It is recommended that the structural fill consist of crushed aggregate meeting IDOT CA-6 gradation requirements. The structural fill should be placed in 8-inch maximum lift thicknesses and should be compacted to 95 percent of the materials maximum standard proctor value as determined per ASTM D-698. After the subgrade soils have been prepared as stated above, the base course materials should be placed.
Suitable structural fill materials shall be of a nature that will compact and develop stability satisfactory to the geotechnical engineer. It is recommended that structural fill generally consist of crushed limestone or recycled concrete consistent with IDOT CA-6 gradation. Materials to be used as structural fill shall be inorganic, free of waste and debris, and shall not contain frozen material or any material which, by decay or otherwise, might cause settlement. Structural fill shall be placed in lifts not to exceed 8 inches in loose thickness, and should be compacted to a minimum of 95% of the material’s modified proctor maximum dry density obtained according to the ASTM D1557 method.

No foundation concrete or structural fill should be placed upon wet or frozen subgrade soils. Rainfall and runoff can soften soils and affect the load bearing capacity of the soils. All water entering the foundation excavation should be removed prior to placement backfill materials above the footings.

4.2 Site Excavations

GSG does not anticipate groundwater related issues during construction activity; however, water may become perched in the fill material encountered at the surface. If rainwater run-off or perched water is accumulated during construction, the contractor should remove any accumulated water using conventional sump pit and pump procedures, in order to maintain a dry and stable excavation. If water seepage occurs during footing excavation or where wet conditions are encountered such that the water cannot be removed with conventional sumping, GSG recommends placing open grade stone similar to IDOT CA-7 to stabilize the bottom of the excavation. The CA-7 stone should be placed in 12-inch lifts to 12 inches above the water table, and should be compacted with the use of a heavy smooth drum roller or heavy vibratory plate compactor until stable. The remaining portion of the excavation beneath the footings should be backfilled using approved structural fill consisting of granular materials such as IDOT CA-6.

All excavations should be conducted in accordance with applicable federal, state, and local safety regulations, including, but not limited to the Occupational Safety and Health Administration (OSHA) excavation safety standards. Excavations near existing structures and underground utilities should be performed with extreme care to avoid undermining existing structures. Excavations should not extend below the level of adjacent existing foundations unless underpinning or other support is installed. The contractor will be responsible to provide a safe excavation during the construction activities of the project.
4.3 Approved Fill Material and Placement

Reuse of onsite native materials can be considered provided the materials meet the following soil properties. These on-site soils are not considered expansive. A shrinkage factor of 15% should be used for earthwork calculations.

Suitable structural fill should have the following soil properties:

1. A maximum dry density greater than 100 pounds per cubic foot (pcf) when determined in accordance with ASTM D1557, Modified Proctor.
2. Shall not contain organic material in excess of 3% when tested in accordance with ASTM D2974.
3. Suitable fine-gained soils include materials that comply with ASTM D 2487 soil classification group CL.
4. Suitable coarse-grained soils include materials that comply with ASTM-D2487 soil classification groups GW, GP, GM, SW, SP and SC.
5. Should not contain deleterious material, should be within ±4% of optimum moisture content, and have a maximum particle size of three inches.
6. Shall consist of a locally available material.

Suitable structural fill materials shall be of a nature that will compact and develop stability satisfactory to the geotechnical engineer. Structural fill is recommended beneath buildings and other similar structures or equipment sensitive to settlement. It is recommended that structural fill generally consist of crushed limestone or recycled concrete consistent with IDOT CA-6 gradation or silty clays of medium plasticity. Materials to be used as structural fill shall be inorganic, free of waste and debris, and shall not contain frozen material or any material which, by decay or otherwise, might cause settlement. Structural fill shall be placed in lifts not to exceed 8 inches in loose thickness, and should be compacted to a minimum of 95% of the material’s modified proctor maximum dry density obtained according to the ASTM D1557 method.

Materials unsatisfactory for use as a structural include soils classified as silt or organic silt (ML, MH, PT, OL, and OH) in the Unified Classification System (ASTM D2847). Soils with these classifications may be used for general purpose landscaping or in areas where fill will not support structures and uncontrolled settlement is acceptable. Topsoil material shall be relatively free from large roots, sticks,
weeds, brush, stones larger than 1 inch in diameter, and other litter or waste products. It shall be a loamy mixture having at least 90% passing the no. 10 sieve.

Frozen materials should not be used and fill materials should not be placed on frozen subgrade. If fill is to be placed during cool, wet seasons, the use of granular fill may be necessary since weather conditions will make compaction of cohesive soils more difficult.
5.0 LIMITATIONS

GSG has prepared this report in accordance with generally accepted geotechnical engineering practices to aid in the evaluation of the site subsurface soils. No other warranty, expressed or implied, is made. The scope of this report is limited to the specific project and location described herein, and our description of this project represents our understanding of the project. The geotechnical engineering analysis presented herein was developed based on the information obtained during the subsurface investigation. It should be noted that the borehole data reflects the subsurface conditions only at the specific locations at the particular time designated on the logs, and that soil and groundwater conditions could vary widely throughout the site. The nature and extent of any variation in the borings may not become evident until subsurface exposure, during construction activities. If variations do appear, it may become necessary to re-evaluate the recommendations of this report. It is recommended that all field construction activities be inspected by GSG’s geotechnical engineer to verify the type and strength of soil materials present at the site and their conformance with the geotechnical recommendations in this report.
SITE LOCATION

EXHIBIT 1 - SITE LOCATION MAP
RELOCATION OF 1685 N. THROOP OPERATIONS
2FM MAIN GARAGE AT 67TH & WENTWORTH
CHICAGO, ILLINOIS
EXHIBIT 2 - BORING LOCATION PLAN
RELOCATION OF 1685 N. THROOP OPERATIONS
2FM MAIN GARAGE AT 67TH & WENTWORTH
CHICAGO, ILLINOIS
APPENDIX A

SOIL BORING LOGS
# Boring Number B-01

**Client:** Arcadis, Inc.  
**Project Name:** Relocation of 1685 N. Throop Operations  
**Project Location:** 2FM Main Garage at 67th & Wentworth  
**Drilling Contractor:** GSG Drilling  
**Drilling Method:** HSA  
**Ground Elevation:** 21.16 ft CCD  
**Hole Size:** 3 1/4”

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### Material Description

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Material Description</th>
<th>Sample Type</th>
<th>Recovery (%)</th>
<th>Blow Counts (N Value)</th>
<th>Unconfined Compression (tsf)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>6 inches of Topsoil</td>
<td>SS 1</td>
<td>56</td>
<td>2-4-25 (29)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>FILL: SAND, with gravel and concrete fragments - Brown and Gray - Moist</td>
<td>SS 2</td>
<td>89</td>
<td>3-4-9 (13)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>FILL: SAND, trace gravel, slag, brick fragments, wood, and cinders - Black - Moist to Wet</td>
<td>SS 3</td>
<td>78</td>
<td>3-4-5 (9)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>SS 4</td>
<td>22</td>
<td>1-1-1 (2)</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>SAND, fine grain (SP) - Brown and Gray - Loose - Wet</td>
<td>SS 5</td>
<td>67</td>
<td>1-1-2 (3)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>SS 6</td>
<td>56</td>
<td>2-4-8 (12)</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>SILTY CLAY, trace gravel (CL/ML) - Gray - Stiff to Very Stiff - Moist</td>
<td>SS 7</td>
<td>100</td>
<td>2-3-4 (7)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>SS 8</td>
<td>78</td>
<td>2-2-4 (6)</td>
<td></td>
</tr>
</tbody>
</table>

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**Ground Water Levels:**

- **At Time of Drilling:** 9.00 ft / Elev 12.16 ft
- **At End of Drilling:** None
- **After Drilling:** NA

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**Ground Elevations:** 21.16 ft CCD

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**Notes:** All elevations are referenced to Chicago City Datum.
6 inches of Topsoil

FILL: SAND, with concrete and brick fragments - Black and Brown - Moist to Wet

SAND, fine grain, trace gravel (SP) - Brown and Gray - Medium Dense to Dense - Moist to Wet

SILTY CLAY, trace gravel (CL/ML) - Gray - Stiff - Moist

Bottom of borehole at 25.0 feet.

All elevations are referenced to Chicago City Datum.
6 inches of Topsoil

FILL: SAND, with gravel, concrete fragments - Brown and Gray - Moist

FILL: SAND, trace gravel, brick fragments - Black and Brown - Moist

FILL: CLAY, trace concrete fragments - Black and Brown - Moist

FILL: Rubblized Concrete and Steel Rebar

Auger Refusal at 12 feet

Bottom of borehole at 12.0 feet.
6 inches of Topsoil

FILL: SAND, with gravel and concrete fragments - Brown and Gray - Wet

FILL: SAND, trace gravel, brick fragments - Black and Brown - Moist to Wet

SAND, medium grain, with gravel (SPG) - Brown and Gray - Medium Dense - Wet

SILTY CLAY, trace gravel (CL/ML) - Gray - Very Stiff - Wet

Bottom of borehole at 25.0 feet.

All elevations are referenced to Chicago City Datum.
Bottom of borehole at 25.0 feet.
CLIENT  Arcadis, Inc.
PROJECT NUMBER  17-2031
DATE STARTED  5/18/17  COMPLETED  5/18/17
DRILLING CONTRACTOR  GSG Drilling
DRILLING METHOD  HSA
LOGGED BY  JJR  CHECKED BY  JR
NOTES  All elevations are referenced to Chicago City Datum.

6 inches of Topsoil  FILL: SAND, with gravel, concrete fragments - Brown and Gray - Moist

FILL: SAND, trace gravel and slag - Black - Moist to Wet

SAND, medium grain, with gravel (SPG) - Brown and Gray - Medium Dense to Dense - Wet

SILTY CLAY, trace gravel (CL/ML) - Gray - Very Stiff - Moist

Bottom of borehole at 25.0 feet.
**BORING NUMBER B-06**

**CLIENT:** Arcadis, Inc.

**PROJECT NUMBER:** 17-2031

**DATE STARTED:** 5/18/17  
**COMPLETED:** 5/18/17

**DRILLING CONTRACTOR:** GSG Drilling

**DRILLING METHOD:** HSA

**LOGGED BY:** JJR  
**CHECKED BY:** JR

**NOTES:** All elevations are referenced to Chicago City Datum.

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**GROUND ELEVATION:** 18.62 ft CCD

**HOLE SIZE:** 3 1/4"

**GROUND WATER LEVELS:**

- **AT TIME OF DRILLING:** 8.50 ft / Elev 10.12 ft
- **AT END OF DRILLING:** --- None
- **AFTER DRILLING:** --- NA

---

**GRAPHIC LOG & MATERIAL DESCRIPTION**

<table>
<thead>
<tr>
<th>DEPTH (ft)</th>
<th>GRAPHIC LOG</th>
<th>MATERIAL DESCRIPTION</th>
<th>SAMPLE TYPE NUMBER</th>
<th>RECOVERY (%)</th>
<th>BLOW COUNTS (N VALUE)</th>
<th>UNCONFINED COMPRESSION (tsf)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td>6 inches of Topsoil</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>FILL: SAND, with gravel - Gray - Moist</td>
<td>SS 1</td>
<td>44</td>
<td>8-11-5 (16)</td>
<td>2.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>FILL: SAND, trace gravel, concrete, and brick fragments - Gray - Moist</td>
<td>SS 2</td>
<td>56</td>
<td>2-3-16 (19)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>FILL: CLAY, trace gravel, brick fragments and wood - Black and Brown - Moist</td>
<td>SS 3</td>
<td>67</td>
<td>3-12-9 (21)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>FILL: SAND, trace concr and brick fragments - Black and Brown - Wet</td>
<td>SS 4</td>
<td>67</td>
<td>2-2-3 (5)</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>SAND (SP) - Brown and Gray - Medium Dense - Wet</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
<td>CLAY (CL) - Brown and Gray - Moist - Very Stiff - Moist</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Bottom of borehole at 10.0 feet.
**BORING NUMBER B-07**

**CLIENT** Arcadis, Inc.  
**PROJECT NUMBER** 17-2031  
**DATE STARTED** 5/18/17  
**COMPLETED** 5/18/17  
**DRILLING CONTRACTOR** GSG Drilling  
**DRILLING METHOD** HSA  
**LOGGED BY** JJR  
**CHECKED BY** JR  
**NOTES** All elevations are referenced to Chicago City Datum.

<table>
<thead>
<tr>
<th>DEPTH (ft)</th>
<th>MATERIAL DESCRIPTION</th>
<th>Sample Type Number</th>
<th>Recovery (%)</th>
<th>Blows Count (N Value)</th>
<th>Unconfined Compression (tsf)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>2 inches of Asphalt</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>6 inches of Aggregate Base Course</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>FILL: SILTY CLAY, trace gravel - Brown and Gray - Moist</td>
<td>SS 1</td>
<td>67</td>
<td>2-3-4 (7)</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>FILL: SAND - Brown - Moist</td>
<td>SS 2</td>
<td>56</td>
<td>4-4-4 (8)</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>SAND, fine grain (SP) - Brown and Gray - Loose - Wet</td>
<td>SS 3</td>
<td>67</td>
<td>2-3-4 (7)</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>SAND, trace gravel (SP) - Brown and Gray - Very Loose - Wet</td>
<td>SS 4</td>
<td>44</td>
<td>1-1-1 (2)</td>
<td></td>
</tr>
</tbody>
</table>

Bottom of borehole at 10.0 feet.
**CLIENT**  Arcadis, Inc.  
**PROJECT NUMBER**  17-2031  
**DATE STARTED**  5/18/17  
**COMPLETED**  5/18/17  
**DRILLING CONTRACTOR**  GSG Drilling  
**LOGGED BY**  JJR  
**CHECKED BY**  JR  

---

**NOTES**  All elevations are referenced to Chicago City Datum.

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**PROJECT NAME**  Relocation of 1685 N. Throop Operations  
**PROJECT LOCATION**  2FM Main Garage at 67th & Wentworth  
**GROUND ELEVATION**  17.08 ft CCD  
**HOLE SIZE**  3 1/4"  

---

**GROUND WATER LEVELS:**  
\( \vee \) **AT TIME OF DRILLING**  3.50 ft / Elev 13.58 ft  
**AT END OF DRILLING**  --- None  
**AFTER DRILLING**  --- NA  

---

**DEPT (ft)**  
**GRAPHIC LOG**  
**MATERIAL DESCRIPTION**  
**SAMPLE NUMBER**  
**RECOVERY (%)**  
**BLOW CNTS (N VALUE)**  
**UNCONFined COMPR (tsf)**  
**SPT N VALUE**  

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>GRAPHIC LOG</th>
<th>Material Description</th>
<th>Sample Type Number</th>
<th>Recovery (%)</th>
<th>Blow Cnts (N Value)</th>
<th>Unconfined Compression (tsf)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td>6 inches of Topsoil</td>
<td>SS1</td>
<td>56</td>
<td>8-8-7 (15)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>FILL: SAND, with concrete fragments - Brown - Moist</td>
<td>SS2</td>
<td>56</td>
<td>2-2-3 (5)</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>SAND, fine grain, trace gravel (SP) - Brown and Gray - Very Loose to Loose - Moist to Wet</td>
<td>SS3</td>
<td>67</td>
<td>1-1-1 (2)</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
<td>SS4</td>
<td>78</td>
<td>1-1-1 (2)</td>
<td></td>
</tr>
</tbody>
</table>

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Bottom of borehole at 10.0 feet.
**BORING NUMBER B-09**

**CLIENT**  Arcadis, Inc.

**PROJECT NUMBER**  17-2031

**DATE STARTED**  5/18/17  
**COMPLETED**  5/18/17

**DRILLING CONTRACTOR**  GSG Drilling

**GROUND WATER LEVELS:**
- **AT TIME OF DRILLING**  --- None
- **AT END OF DRILLING**  --- None
- **AFTER DRILLING**  --- NA

**NOTES**  All elevations are referenced to Chicago City Datum.

---

**DEPTH (ft)** | **GRAPHIC LOG** | **MATERIAL DESCRIPTION** |
--- | --- | --- |
**0** |  | 2 inches of Asphalt  
6 inches of Aggregate Base Course  
FILL: SAND, trace gravel - Black and Brown - Moist |

<table>
<thead>
<tr>
<th><strong>SAMPLE TYPE</strong></th>
<th><strong>RECOVERY (%)</strong></th>
<th><strong>BLOW COUNTS (N VALUE)</strong></th>
<th><strong>UNCONFINED COMPRESSION (tsf)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>SS 1</td>
<td>17</td>
<td>2-7-8 (15)</td>
<td></td>
</tr>
<tr>
<td>SS 2</td>
<td>67</td>
<td>5-12-13 (25)</td>
<td></td>
</tr>
<tr>
<td>SS 3</td>
<td>56</td>
<td>4-7-9 (16)</td>
<td></td>
</tr>
<tr>
<td>SS 4</td>
<td>67</td>
<td>3-3-5 (8)</td>
<td></td>
</tr>
</tbody>
</table>

---

**GROUND ELEVATION**  16.64 ft CCD

---

**PROJECT NAME**  Relocation of 1685 N. Throop Operations

**PROJECT LOCATION**  2FM Main Garage at 67th & Wentworth

**GROUND LEVELS:**
- **CHECKED BY**  JR

---

**DATE STARTED**  5/18/17  
**COMPLETED**  5/18/17

---

**FACTORY**  GSG Consultants, Inc.  
**ADDRESS**  855 West Adams Street, Suite 200  
**CITY**  Chicago  
**STATE**  Illinois  
**ZIP**  60607  
**PHONE**  312-733-6262  
**FAX**  312-733-5612
2 inches of Asphalt
6 inches of Aggregate Base Course

FILL: SAND - Brown - Moist

FILL: CLAY, trace gravel, concrete fragments - Black and Gray - Moist

FILL: SAND, trace brick and asphalt fragments - Black - Wet
Noted odor in sample

Bottom of borehole at 10.0 feet.
Unified Soil Classification

Soil Classification is based on the Unified Soil Classification System and ASTM Designations D-2487 and D-2488. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; they are described as: clays, if they are plastic, and silts if they are slightly Plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the basis of their relative in-place density and fine grained soils on the basis of their consistency. Example: Lean clay with sand, trace gravel, stiff (CL); silty sand, trace gravel, medium dense (SM).

<table>
<thead>
<tr>
<th>Major Divisions</th>
<th>Group Symbols</th>
<th>Typical Names</th>
<th>Consistency of Cohesive Soil</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gravels (More than half of coarse fraction is larger than No. 4 sieve size)</td>
<td>GW</td>
<td>Well graded gravels, gravel-sand mixtures, little or no fines</td>
<td>Unconfined Compressive Strength, Qu, tsf</td>
</tr>
<tr>
<td>Gravels with fines (Appreciable amount of fines)</td>
<td>GP</td>
<td>Poorly graded gravels, gravel-sand mixtures, little or no fines</td>
<td>&lt; 0.25</td>
</tr>
<tr>
<td></td>
<td>GM</td>
<td>Silty gravels, gravel-sand-clay mixtures</td>
<td>0.25 - 0.50</td>
</tr>
<tr>
<td></td>
<td>GC</td>
<td>Clayey gravels, gravel-sand-clay mixtures</td>
<td>0.50 - 1.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1.0 - 2.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2.0 - 4.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>4.0 - 8.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>&gt; 8.0</td>
</tr>
<tr>
<td>Sands (More than half of coarse fraction is smaller than No. 4 sieve size)</td>
<td>SW</td>
<td>Well graded sands, gravelly sands, little or no fines</td>
<td>Relative Density</td>
</tr>
<tr>
<td>Sands with fines (Appreciable amount of fines)</td>
<td>SP</td>
<td>Poorly graded sands, gravelly sands, little or no fines</td>
<td>0-3</td>
</tr>
<tr>
<td></td>
<td>SM</td>
<td>Silty sands, sand-silt mixtures</td>
<td>4-10</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>11-29</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>30-49</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>50-80</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>&gt;80</td>
</tr>
<tr>
<td>Silts and Clays (liquid limit less than 50)</td>
<td>ML</td>
<td>Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity</td>
<td>Description Term(s) of Components Present in Sample</td>
</tr>
<tr>
<td></td>
<td>CL</td>
<td>Inorganic clay of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays</td>
<td>Trace &lt; 10%</td>
</tr>
<tr>
<td></td>
<td>OL</td>
<td>Organic silts and organic silty clays of low plasticity</td>
<td>Some 20-34%</td>
</tr>
<tr>
<td>Fine Grained Soils (More than half of material is smaller than No. 200 sieve size)</td>
<td>MH</td>
<td>Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, clastic silts</td>
<td></td>
</tr>
<tr>
<td>MH</td>
<td>CH</td>
<td>Inorganic clays of high plasticity, fat clays</td>
<td></td>
</tr>
<tr>
<td>MH</td>
<td>OH</td>
<td>Organic clays of medium to high plasticity, organic silts</td>
<td></td>
</tr>
<tr>
<td>Highly Organic Soils</td>
<td>Pt</td>
<td>Peat and other highly organic soils</td>
<td></td>
</tr>
</tbody>
</table>