IDEAL Group

CASE STUDY

93 STELCOR DDMS INSTALLED FOR A 7-STORY HOSPITAL ADDITION

LOADS:
180 Kips Compression Design Load
116 Kips Tension Design Load
8 Kips Lateral Load

PILE DETAIL:
STELCOR 1400
16" Tip or Drive Plate
14" Corrugated Grout Column
11" Solid Grout Column
8" Reverse Grout Auger
5.50" O.D. X 0.361" W.T. – 80 ksi Central Shaft

SOILS + EMBEDMENT DEPTH:
Fill soils from previous construction on the hospital grounds extends to about 20' below the surface. The fill soils are comprised of gravel, sand, silt, and clayey silt with fragments of brick, concrete, and wood. The indigenous soils below the fill layer consists of silt and gravel with sand throughout the layer. The indigenous soils extend beyond 70', becoming denser at deeper depths.

NUMBER OF PILES: 93

PILE LENGTH: 45'-50'

The piles needed to be installed in the middle of the hospital so there was a zero-tolerance policy for vibrations and noise.

OVERVIEW:
The Highland Hospital Patient Tower Project will take three years to complete and will open in the spring of 2023. The project will add five additional stories to the existing 2-story southeast wing and join the south and southeast wings with a 7-story structure. The $70 million project will add 58 patient rooms allowing nearly every patient to have a private room. The expansion will also allow space for advancing clinical programs and the mechanics required to run the new facilities.

The 2-story annex between the south and southeast wings had to be demolished to allow the two structures to join. A foundation needed to be installed for a 157' tall tower crane with 267' of horizontal reach. A support of excavation (SOE) wall also needed to be put in place.

CHALLENGE:
This project's most significant challenge was the zero-tolerance policy for vibrations and noise. Due to the proximity of the installation area to patient rooms and the critical nature of the hospital's medical procedures, disruptions were not allowed. A residential neighborhood also surrounds the hospital. Wherever possible, noise, mess, and large machinery had to be kept to a minimum.

Limited access on the hospital grounds presented another challenge. Most of the piles had to be installed in the 15 feet wide area between the south and southeast wings of the hospital. With barely enough room to fit an excavator between the two wings, any pile types relying on bulky installation equipment could not be used.

CASE STUDY

93 STELCOR DDMS INSTALLED FOR A 7-STORY HOSPITAL ADDITION

SOLUTION:

CMI Structural Solutions, the installer for this project, submitted STELCOR DDMs as a value-engineered option. STELCOR can be installed relatively quietly compared to other piling methods. STELCOR piles are driven into the ground using an excavator and hydraulic powered rotary drive head, making STELCOR a perfect fit for this project. As part of the test program for the STELCOR pile, vibrations were monitored during installation. The results showed that any vibrations recorded were extremely low and would not be disruptive to the hospital or the nearby residential community.

The largest equipment needed to install the foundation was a 25-ton excavator. The colloidal grout mixer was kept in a remote location, out of the way of the main install area, and pile sections were brought as needed using a track loader. The CMI team commented that installing the piles with compact machinery allowed them to save thousands of dollars and make the best use of the limited site space.

In total, 93 STELCOR DDMs were installed to support the new 7-story structure and the tower crane required for construction. The allowable pile loads were 180k in compression, 116k in tension, and 8k lateral.
STELCOR wasn't the end of time and money savings on this project. With the same equipment used to install STELCOR, CMI also constructed the SOE wall quickly and efficiently using 7" diameter helical pipe piles from IDEAL. By value engineering this project and using the same installation equipment for all the foundations, all parties involved saved time and money. Isn't that Ideal?

TESTING WAS CONDUCTED TO MONITOR VIBRATIONS DURING THE INSTALLATION OF THE STELCOR TEST PROGRAM. TESTING COULD NOT DETECT ANY SIGNIFICANT VIBRATIONS.

EMPIRE GEO
SERVICES, INC.
A SUBSIDIARY OF SJB SERVICES, INC.

September 24, 2014
Project No. RE-14-021

Highland Hospital
1000 South Avenue
Rochester, New York 14620

Attention: Mr. Michael Zanghi
Associate and Senior Project Architect

Re: Geotechnical Engineering Report for
Proposed Highland Hospital Addition
1000 South Avenue
Rochester, New York

Dear Mr. Zanghi:

Empire Geo-Services, Inc. is pleased to submit two (2) copies of the enclosed Geotechnical Engineering Report to Highland Hospital for the above referenced project. We have also e-mailed you an electronic copy (pdf file format) of this report, for your use and distribution as appropriate.

Please contact me should you have any questions or wish to discuss this report. Thank you for considering Empire for this work and we look forward to working with you on this project, through its completion.

Sincerely,

EMPIRE GEO-SERVICES, INC.

Wanda M. Allen, P.E.
Geotechnical Engineer

Enc.: Geotechnical Engineering Report (2 copies & Electronic PDF copy)

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Geotechnical Evaluation Report for Proposed Highland Hospital Addition 1000 South Avenue Rochester, New York

Prepared For:

Highland Hospital
1000 South Avenue
Rochester, New York 14620

Prepared By:

Empire Geo-Services, Inc.
535 Summit Point Drive
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STATE OF NEW YORK
WANDA M. ALLEN
No. 089731
LICENSED PROFESSIONAL ENGINEER

9/24/14

Project No.: RE-14-021
September 2014

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1.00 INTRODUCTION

1.10 GENERAL

This report presents the results of a subsurface exploration program and geotechnical engineering evaluation completed by Empire Geo-Services, Inc. (Empire) for the proposed addition to Highland Hospital located at 1000 South Avenue in Rochester, New York. The approximate project site location is shown on Figure 1.

Highland Hospital retained Empire to complete the subsurface exploration program and provide geotechnical engineering recommendations for the proposed project. SJB Services, Inc. (SJB), Empire's affiliated subsurface exploration company, completed a total of nine (9) test borings, as part of the exploration program. Laboratory testing of several soil samples were tested in SJB's geotechnical laboratory to aid in our analysis. In addition, a seismic refraction shear wave study was completed at the proposed project site, following the subsurface exploration program and based on our findings.

On this basis, Empire prepared this report, which summarizes the subsurface conditions encountered by the test borings and presents geotechnical recommendations for design and construction of the foundations and slab-on-grade, as well as the associated site preparation work for the proposed hospital addition.

1.20 PROJECT AND SITE DESCRIPTION

Based on information provided by Holt Architects, P.C. (Holt) and Ryan-Briggs Associates, P.C. (Ryan-Briggs), the proposed project is currently planned off the south side of the existing hospital at the east entrance. The addition will be constructed adjacent to the north and west sides of the existing hospital within the drop off loop area and is currently planned to consist of a two story structure with a mechanical penthouse roof. However, a three-story vertical addition, to serve as patient towers, is anticipated for future construction over the addition. In addition, the south building on the east side of the current and proposed future vertical addition will be demolished to accommodate a future two-story addition for additional operation room space.

The existing hospital is supported on a shallow spread foundation system. The proposed addition was also planned to be supported on shallow spread foundations. However, due to the conditions encountered at the test boring locations, a deep foundation system will be necessary to support the proposed addition, unless ground improvement methods are considered, as discussed further below.

Preliminarily, the column loads for the two story addition are anticipated to be about 150 kips to 200 kips. However, the foundations are to be designed to accommodate the proposed future vertical three-story addition with column loads anticipated to be about 500 kips or so.

The ground floor is to be constructed as slab on grade and is planned to match a portion of the existing ground floor at elevation (El.) 566.65 feet. A basement will not be included as part of the proposed construction. The existing asphalt and concrete sidewalks within the drop off area and within the proposed footprint of the proposed addition, slopes downward towards the hospital from about El. 572 feet to El. 567 feet based on the "Concept" plan provided to Empire by Ryan-Briggs. The addition will be designed in accordance with the Building Code of New York State, including seismic design criteria.

Based on historical aerial photographs, a portion of the existing hospital was previously demolished within this area. It is unknown, if the previous hospital wing contained a basement or possible tunnel structures. The 1971 historical aerial photograph of the hospital is included in Appendix A.

2.00 SUBSURFACE EXPLORATION

The subsurface exploration program consisted of a total of nine (9) test borings drilled by SJB, on July 25th, 28th and 29th, 2014 and September 7th, 2014. The test borings are designated as B-1 through B-7, SW-1 and SW-2 and their approximate locations are shown on Figure 2.

The test boring locations were established on a site plan provided by Ryan-Briggs. SJB then located the test borings in the field utilizing tape measurements referenced to the existing hospital. Optical survey level techniques were utilized to determine the existing ground elevations at the boring locations. The ground surface elevation at the test boring locations were referenced to rim of the drainage inlet located generally in the center of site (Benchmark), as shown on Figure 2. The Benchmark has a reported elevation of 569.31 feet as determined from the "Concept" plan provided.

Test borings B-1 through B-7 were located within the footprint of the proposed addition and were drilled to depths varying from 22.0 feet to 70.7 feet below existing site grades. Test borings SW-1 and SW-2 were located within the proposed underground storm water infiltration area and were each drilled to a depth of 12 feet below existing site grades then terminated.

The test borings were drilled using a Central Mine Equipment model 75 truck mounted drill rig, using hollow stem auger and split spoon sampling techniques. Split spoon samples and Standard Penetration Tests (SPT) were taken continuously from the ground surface to a depth of 12 feet or 25 feet and then in intervals of five feet or less until boring completion. The split spoon sampling and SPTs were completed in general accordance with *ASTM D1586 – "Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils"*.

A geologist from SJB prepared the boring logs based on visual observation of the recovered soil samples and review of the driller's field notes. The soil samples were described based on visual/manual estimation of the grain size distribution, along with characteristics such as color, relative density, consistency, moisture, etc. The boring logs are presented in Appendix B, along with general information and a key of terms and symbols used to prepare the logs.

3.00 LABORATORY TESTING

Three (3) soil samples obtained at varying depths from test boring B-1 were tested in SJB's geotechnical testing laboratory for grain size analysis to confirm soil classifications and aid in our analysis of the potential for soil liquefaction to occur in the event of an earthquake. The grain size analyses included sieve analyses only and were conducted in general accordance with *ASTM C136 – "Standard Test Method for Particle-Size Analysis of Soils"*.

The grain size sieve analyses of the samples tested generally confirmed our visual soil classifications as summarized on the test boring log (B-1) included in Appendix B. Refer to the laboratory test results included in Appendix C for more information.

4.00 SUBSURFACE CONDITIONS

4.10 GENERAL

The general stratigraphy encountered in the test borings consisted of concrete or asphaltic concrete at the surface underlain by fill followed by indigenous clayey silt, silt and sand soil deposits. It does not appear that bedrock was encountered within the depths explored at the boring locations, as discussed further below. The soil stratigraphy encountered, along with the groundwater conditions observed are described in more detail below and on the boring logs in Appendix B.

4.20 SURFACE MATERIALS

About 5-inches of concrete was encountered at the ground surface of test boring B-1. Asphaltic concrete was encountered at the surface of the remaining test boring locations. The driller noted that the thickness of the asphalt varied from about 3.5-inches to 5-inches at the boring locations. A subbase layer, consisting of crushed stone was encountered beneath the concrete or the asphalt at boring locations B-1 through B-4, SW-1 and SW-2. The driller noted that the thickness of the asphalt at boring locations B-2, SW-1 and SW-2 was about 7.5-inches, 7-inches and 6-inches, respectively. The concrete, asphalt and subbase measurements were made within the test boring holes and should therefore be considered approximate. A geotextile fabric was also apparent beneath the crushed stone layer at test boring locations B-1, B-2, B-4 and SW-1.

4.30 FILL SOILS

Beneath the surface materials, fill was encountered at each location. The fill consisted generally of intermixed sand, gravel, silt and clayey silt soils. At boring locations B-2, B-4, B-5 and B-7, a significant amount of ash, cinders, coal, slag, peat and wood were encountered. In addition, trace to little amounts of ash, asphalt fragments, brick, glass, cinders, concrete fragments, coal and wood were also encountered within the sand, gravel, silt and clayey silt fill soils at the majority of the remaining test borings. The variable nature of the fill, coupled with the typically loose Standard Penetration Test (SPT) "N" values, as provided on the test boring logs, indicate the fill was placed in an uncontrolled manner.

The fill soils were found to extend to the following depths and elevations in the test borings.

Approximate Fill Depths and Elevations		
Boring No.	Existing Ground Surface El.	Fill Depth (ft) / Bottom El.(ft)
B-1	567.9	4.0 / 563.9
B-2	568.5	16.0 / 552.5
B-3	570.4	4.0 / 566.4
B-4	571.8	20.0 / 551.8
B-5	568.9	25.0 / 543.9
B-6	567.3	9.5 / 557.8
B-7	569.0	25.0 / 544.0
SW-1	573.1	12.0 / 561.1
SW-2	574.2	6.0 / 568.2

At test boring location B-4, a split spoon sample was not obtained between depths of about 17 feet and 20 feet. Therefore, it is possible the fill only extends to a depth of 17 feet at this location. In addition, at test boring locations B-5, B-7 and SW-1, the test borings were terminated within the fill, and therefore, it is indeterminate the actual depth at which the fill extends at these locations.

As noted above, based on historical aerial photographs, a portion of the existing hospital was previously demolished within this area. It is unknown, if the previous hospital wing contained a basement structure, tunnels or other possible deeper underground structures.

It should be expected that subsurface conditions (i.e. fill soil depths) between and away from the test boring locations will vary and will be dependent on the original native site topography, as well as the extent to which the site has been previously disturbed by past uses.

4.40 INDIGENOUS SOILS

Indigenous soils were encountered at each boring location, with the exception of borings B-5, B-7 and SW-1, where fill was found to extend to boring completion. The indigenous soils consisted predominately of sand intermixed with gravel and silt. Sandy silt soil stratums were also encountered at varying locations and depths. A clayey silt soil with varying amounts of sand and gravel was encountered beneath the fill at boring location B-3 prior to encountering the silty sand soil deposits at a depth of about 20 feet. Based on visual descriptions and the laboratory test data, the indigenous soils are classified as SW, SP, SM and ML group soils using the Unified Soil Classification System (USCS). A native peat stratum was encountered beneath the fill at boring location B-2 prior to encountering the gravelly/silty sand soils at a depth of about 16 feet. The peat soil is classified as a PT group soil based on USCS.

Standard Penetration Test (SPT) “N” values obtained in the indigenous, intermixed sand, silt and gravel soils ranged from 4 to “REF” – Sample Spoon Refusal (i.e. 50 blows to advance the split spoon with 6-inches or less of penetration) indicating the generally low to non-plastic indigenous soils vary from a loose to very compact relative density. The very compact soils were only encountered at boring locations B-2 and B-4 below depths of about 60 feet and 55 feet, respectively. The clayey silt soil stratums encountered at test boring location B-3 are of a medium to very stiff consistency with SPT “N” values increasing with depth from 5 to 23.

4.50 REFUSAL CONDITIONS

In some cases, sample spoon refusal can suggest the possibility that bedrock was encountered. Spoon refusal was encountered between depths of 60.0 feet and 70.7 feet at boring location B-2 and between depths of 60.0 feet and 60.9 feet at boring location B-4. Indigenous sand intermixed with silt and gravel was recovered within the spoon samples obtained at these depths. Therefore, the spoon refusal in these cases is likely the result of very compact indigenous soils or cobble or boulder obstructions within the sand soils. Auger refusal, which was not encountered at any of the boring locations, often can provide a better indication of possible bedrock conditions.

Based on past subsurface explorations previously performed in the surrounding areas and our knowledge of the regional geology, it is anticipated that bedrock could be encountered at a depth of about 100 feet to 120 feet below existing site grades. Additional subsurface explorations would need to be completed, however, to determine the actual depth, type and quality of bedrock within this area.

4.60 GROUNDWATER CONDITIONS

Groundwater was encountered in test borings B-1, B-2, B-4 and B-7 at depths of about 37.0 feet (El. 530.9 feet), 54.5 feet (El. 514.5 feet), 46.0 feet (El. 525.8 feet) and 23.0 feet (El. 546.0 feet), respectively immediately following the completion of overburden drilling and soil sampling. Groundwater was not encountered within the remaining test borings immediately following the completion of drilling operations. We note, however, groundwater might not have had sufficient time to accumulate in the test holes following the completion of drilling operations and the time of measurement.

At several test boring locations, the soil samples recovered below depths of about 20 feet to 30 feet are described as “moist-wet” to “wet”. Accordingly, based on the groundwater measurements within the test borings as well as the “moist-wet” to “wet” nature of the soil samples recovered, it appears a permanent groundwater condition (i.e. groundwater table) maybe present at about El. 545 feet to El. 549 feet. The installation of a groundwater observation well(s) would help to better define the groundwater conditions present on the site.

In addition, moist-wet to wet soil samples were encountered at varying depths and boring locations within the upper fill and indigenous soil deposits indicating possible perched groundwater conditions. Perched groundwater conditions can be more prevalent following heavy or extended periods of rain and during seasonally wet periods.

It should be expected that both permanent and perched groundwater conditions could vary with location and with changes in soil conditions, precipitation and seasonal conditions as well as with fluctuations of the nearby Genesee River.

5.00 GEOTECHNICAL CONSIDERATIONS AND RECOMMENDATIONS

5.10 GENERAL

The following general considerations and recommendations are provided to assist with planning the design and construction of the foundations for the proposed addition and the associated site development. More detailed recommendations are presented in the subsequent sections of this report.

From a geotechnical standpoint, development of the addition will be primarily impacted by the amount of fill soils present as well as the underlying loose soils which were generally found to extend to depths up to about 50 to 55 feet below the existing site grades. The fill contained ash, brick, cinders, coal, concrete, glass, peat, slag and wood. The fill was found to extend to depths varying from about 4 feet up to at least 25 feet at the boring locations. The variable nature of the fill, coupled with the typically loose SPT "N" values, indicates the fill was generally placed in an uncontrolled manner. Settlement of conventional spread foundations constructed directly on or over the uncontrolled, non-engineered fill soils can be variable and difficult to predict, particularly when organics, peat and wood or debris/rubble is present within fill, as encountered.

In addition, the loose and medium consistency soils present directly beneath the fill and within close proximity to the to the anticipated design foundation bearing grade elevation, at a couple of the boring locations, are considered marginal for support of spread foundations associated with multiple story buildings or large spans, particularly if heavier structure loads are planned, as currently proposed. Therefore, due to the extensive fill soils present in conjunction with the loose/medium soils, spread foundations do not appear to be a logistical or economical viable option, unless ground improvement methods are considered.

Soil improvement techniques could be implemented that would improve the soil support conditions of the unsuitable fill and indigenous soils described above. One possible soil improvement technique includes compacted stone columns. This method generally utilizes a large excavator equipped with the appropriate equipment (i.e. mandrel, drill, etc.) which should generally be able to access the area around the existing hospital within the area of the proposed addition. Additional information regarding the soil improvement method, along with its limitations is provided further below.

Alternatively, it is our opinion that a deep foundation system consisting of driven piles or micro-piles would be better suited to support the proposed building addition due to some of the limitations of the ground improvement method, as discussed further below.

For the driven pile foundation system, a displacement type pile (i.e. closed end, pipe pile) is recommended mainly due to the larger surface area of the pile tip and the densification of the surrounding soils achieved during the installation of the displacement piles. However, considering the site conditions, as well as the construction logistics of working within the existing hospital drop off area, drilled and grouted micro-piles bearing within the very compact sand soils maybe better suited to support the proposed building addition. A suitable bearing stratum for driven pipe piles and the micro-piles was encountered generally at depth of about 55 feet to 60 feet within the deeper test borings.

The existing fill conditions may also impact the performance of the slab-on-grade floor construction, with regard to the potential for settlement to occur within the fill. It is common practice to recommend the existing fill soils be removed and replaced with a properly controlled and compacted engineered fill layer beneath the slab-on-grade areas. We understand, however, that it will not be economically or logistically practical to remove the fill in its entirety, for the slab-on-grade floor construction. Therefore, Highland Hospital could consider removing a portion of the existing fill and provide some additional Subbase Stone beneath the slab-on-grade construction. There are some uncertainties with this approach, such as the potential for some long-term differential settlement, which could occur with leaving the fill soils in-place.

If Highland Hospital is willing accept these risks, then we would recommend the following be implemented as minimum requirements for constructing the slab-on-grade over the existing fill soils.

- After removal of the asphalt and concrete, the existing fill subgrades must be thoroughly compacted and properly proof rolled, evaluated, and prepared in accordance with our recommendations in Section 5.70.4.
- Suitable Granular Fill should be used to raise the site grades beneath the slab-on-grade subbase stone, where necessary.
- The slab-on-grade floor system should be constructed over a minimum 18-inch thick layer of Subbase Stone, where the existing fill remains in-place

and the floors are lightly loaded. The Subbase Stone layer should be increased to a minimum of 24-inches where heavier loads are expected such as storage areas, mechanical rooms and heavy hospital equipment areas.

- Any deleterious materials, such as organics, large pieces of wood, soft soils, highly voided debris, etc., which are present within the fill soils at the bottom of the subgrade excavation, should be further undercut, removed, and replaced with additional Suitable Granular Fill material.
- A suitable stabilization/separation geotextile, such as Mirafi 600X, should be placed between the existing fill subgrades and the overlying Suitable Granular Fill or Subbase Stone layer

Contingencies should be planned during construction for additional undercutting which potentially could become necessary.

If Highland Hospital is not willing to accept the risk for some possible future floor slab settlement, due to the existing uncontrolled fill soils, then it will be necessary to implement the soil improvement techniques, or structurally support the slabs with a deep foundation system, as recommended for foundation support.

As mentioned above, the potential exists to encounter localized perched groundwater within the fill soils. Perched groundwater seepage generally should be able to be controlled with conventional sump and pump method of dewatering.

5.20 FILL SOIL IMPROVEMENT / SPREAD FOUNDATIONS

As discussed above, soil improvement techniques could be implemented to improve the soil support conditions of the unsuitable fill and indigenous soils. In addition, the ground improvement method would improve the overall fill conditions within the proposed slab on grade areas, which should limit the potential for settlement and soil subsidence to occur within the fill.

It is noted, however, because of the significant amount of peat and wood present within the fill, as encountered at test boring locations B-5 and B-7, which are highly compressible and may degrade in time, the soil improvement method may not actually be a feasible option for this project, as determined by the specialty contractor/consultant.

"Vibro" compacted or ram compacted stone columns (also referred to as aggregate piers or "geopiers") could be a suitable ground improvement method for this project, which would allow the use of a conventional spread foundation system to support the proposed addition.

Preliminarily, based on our discussions with a specialty contractor, it is anticipated that the stone columns would be about 30 feet or less in length and the fill and indigenous soil conditions on the site could be improved to provide a net allowable bearing capacity in the range of about 5,000 to 6,000 pounds per square foot (psf).

Based on past studies, during installation of the geopier system it has been demonstrated that the noise and construction vibrations produced from this type of operation are typically no more than that developed during conventional construction (i.e. large bulldozer, vibratory roller, etc.). However, concerns with potential soil settlement beneath the existing foundations during installation of the geopiers would need to be considered. Limiting the distance between the geopiers and the existing foundations will reduce the potential soil settlement effects beneath the existing foundations. This could be accomplished by use of a cantilever foundation system near the existing building, underpinning the existing foundations or use of an alternative deep foundation system adjacent to the existing building (i.e. micro-piles).

5.30 DRIVEN PIPE PILES

Based on past studies, during installation of pipe piles it was determined the vibrations being produced were generally below or near that developed during conventional construction. There are not concerns with the potential settlement or soil subsidence beneath existing foundations due to installation of the pipe piles. However, the noise levels, although for a limited time, could be an issue especially for hospital patients. In addition, limitations with access within the existing hospital loop drop off area should be discussed with a pile driving contractor as the reach of the equipment is generally extensive. It is noted that pile driving activities have been utilized for hospital additions in the past.

A driven pipe pile will develop capacity through both side friction and end bearing. Pile capacities were estimated by Empire using conventional static analyses for a 10 inch and 12 inch outside diameter closed end pipe pile. A factor of safety of 3.0 was applied to the estimated ultimate pile capacities to obtain the estimated allowable axial pile compressive capacity. The upper 10 feet of the pile friction was ignored due to the fill soils encountered.

Estimated allowable pile capacities for pipe piles driven to a depth of about 60 feet below the proposed finish floor elevation (i.e. driven to approximate elevation 506 feet), are summarized in the following table.

Estimated Allowable Capacity for Driven Closed End Pipe Piles		
Pipe Pile Diameter (inches)	Pile Embedment Depth (feet below finish floor)	Estimated Allowable Capacity per Pile (tons)
10-inches	60	26
12-inches	60	35

The pipe pile material should have minimum yield strength of 50 ksi and should have a wall thickness of at least 0.375 inches. A steel plate designed specifically to close the end of the pile, which is flush with the outer surface, should be used. Driving the pipe piles open ended is not recommended as it will most likely limit the displacement effects.

The pile embedment depths and capacities presented above were determined based on a theoretical static analysis and should be satisfactory for design purposes. These pile capacities will need to be confirmed with an appropriate pile load test program (i.e. wave equation analyses and dynamic testing) prior to installation of the production piles. The actual production pile lengths may vary and therefore such contingencies should be planned in pile installation contract.

The piles should be spaced center to center, no closer than 3 diameters or 3 feet, whichever is greater. Using this spacing, no reductions in single pile capacity will be necessary for group effects. All exterior pile caps and grade beams should be embedded a minimum of 4 feet for frost protection.

The development of skin friction was utilized in our analysis for driven piles. For this reason, we recommend that any pre-drilling or jetting be limited to that necessary (i.e. about 3 to 5 feet maximum) to properly set and align the pile prior to driving.

5.40 DRILLED MICRO-PILES

Due to concerns with the noise, vibrations and access limitations, as well as impacts upon the existing adjacent foundation structures, it appears micro-piles would be the best option for support of the proposed addition. Micro-piles (steel cased /concrete micro-piles) are typically 6 to 8 inches in diameter and drilled and grouted into competent soils or socketted into bedrock to develop their axial capacity. Alternatively, a hollow stem threaded bar grouted during advancement through the upper softer/looser soils prior to advancement and grouting within the underlying competent soils without the use of an outer casing can result in higher grout to ground bond stresses. This type of micropile, however, may not be appropriate where lateral loads must be resisted by the pile.

Drilled micro pile systems are designed and installed by a Specialty Contractor qualified and experienced in such construction methods. Therefore, it is general practice to develop a performance specification for the micro-pile and then have the installation contractor provide a suitable pile design, considering the logistics of the installation and the subsurface conditions. The diameter of the micro-pile (i.e. steel casing size), depth of effective embedment zone, steel reinforcing, and cement grout strength can be varied by the Specialty Contractor based on the structural design requirements, as well as considering the sizes/costs of casing pipe available on the market.

Preliminarily an allowable side shear resistance (bond strength) of 20 pounds per square inch (psi), developed between the concrete micro-pile and the very compact indigenous soils can be used for conceptual design. A concrete/grout with a minimum compressive strength of 4,000 psi should be used.

Based on the above criteria, a 7-inch diameter micro pile, with about 10 feet of effective bond length in the very compact soils would be expected to develop an allowable compressive capacity of around 26 tons. Accordingly, additional capacity can be developed with increasing the embedment length within the effective bond zone.

Alternatively, a hollow stem threaded bar grouted during advancement through the upper softer/looser soils prior to advancement and grouting within the competent soils without the use of an outer casing may result in higher grout to ground bond stresses. In either case, a Specialty Contractor should be consulted regarding the appropriate micropile type and design conditions.

5.50 SLAB-ON-GRADE FLOOR DESIGN

As discussed in Section 5.10 above, where the floor system is constructed as slab-on-grade over the existing fill, it is recommended that a minimum of 18 inches of Subbase Stone be placed beneath the slab-on-grade construction for lightly loaded floors. The Subbase Stone layer should be increased to a minimum of 24-inches where heavier loads are expected.

A suitable stabilization/separation geotextile, such as Mirafi 600X, should be placed over the existing fill soil subgrades prior to placement of Suitable Granular Fill to raise the site grades beneath the Subbase Stone layer. The existing fill soil subgrades should be thoroughly compacted and properly prepared and evaluated in accordance with our recommendations in Section 5.70.4 prior to placement of the geotextile, Suitable Granular Fill and/or Subbase Stone material. The slab-on-grade floor slabs can be designed using a modulus of subgrade reaction of 150 pounds per cubic inch at the top of the Structural Fill layer.

Alternatively, the floors can also be constructed as a structural slab supported by grade beams and the deep foundation system. If the floors are structurally supported by the deep foundation system, it is recommended a minimum of 4 to 6-inches Subbase Stone material be placed beneath the structural slab to provide a suitable working surface to set the reinforcing steel and construct the slabs.

It is understood the finished floor grade will be established above the surrounding exterior grades. Therefore, the use of a moisture barrier does not appear warranted, unless otherwise recommended by the finished flooring manufacturer. It is recommended that the slab-on-grade be constructed such that it floats on the subbase and subgrades and is not structurally connected to, or resting directly on, perimeter walls or column footings in order to limit differential settlement effects.

5.60 SEISMIC DESIGN CONSIDERATIONS

Based on the subsurface conditions encountered, the upper 100 feet of the project site can be classified as Seismic Site Class “E” in accordance with Table 1613.5.2 of the Building Code of New York State - December 2010 (NYS Building Code). Therefore, seismic design may be based on this site classification.

The spectral response accelerations in the project area were obtained by Empire using the United States Geological Survey (USGS) web site application (http://earthquake.usgs.gov/designmaps/us/application.php). The accelerations are based on the 2009 NEHRP Recommended Seismic Provisions, which makes use of the 2008 USGS seismic hazard data. The uniform hazard acceleration values obtained from this application using the site location were then adjusted, as recommended by the USGS, to obtain the 2% probability in 50 years geometric mean mapped accelerations, as presented in the NYS Building Code.

The calculated geometric mean spectral response accelerations for Site Class “B” soils are 0.164g for the short period (0.2 second) response (S_S) and 0.051g for the one second response (S_1). For design purposes, these spectral response accelerations were then adjusted for the Seismic Site Class “E” soil profile determined for the project site.

Accordingly, the adjusted spectral response accelerations for Site Class “E” are as follows:

- Short Period Response (S_{MS}) - 0.410g
- 1 Second Period Response (S_{M1}) - 0.178g

The corresponding five percent damped design spectral response accelerations (S_{DS} and S_{D1}) are as follows:

- S_{DS} - 0.273g
- S_{D1} - 0.118g

Empire subcontracted with ConeTec of New Jersey, New York to perform a seismic refraction shear wave study at the proposed project site. The seismic shear wave study was recommended to confirm the seismic site class, and to determine if it would be possible to upgrade the seismic site class, from Site Class "E", as this is expected to reduce costs associated with seismic reinforcement of the building addition. The results of the seismic shear wave study were not yet complete prior to preparation of this report. Therefore, the results of the shear wave study will be submitted under a separate cover letter.

In addition, considering the presence of a saturated, generally loose silty/gravelly sand soil deposits at and below the anticipated depth of about 20 feet below existing site grades, an analysis of the potential for soil liquefaction to occur was made by Empire, using the computer software program *Liquefy Pro* by Civil Tech Corporation of Bellevue, Washington. An earthquake magnitude of 5.0 was assumed, and the mapped peak ground acceleration (PGA) of 0.207g for the project area was used, representing a two percent probability of exceedance in 50 years (as obtained from the USGS earthquake hazards mapping program).

Based on these parameters and site specific conditions determined through the subsurface investigation and the laboratory test data, the calculated factor of safety against liquefaction is 1.45 (with factor of safety < 1 indicating the potential for liquefaction). As such, liquefaction potential at the project site is considered low.

5.70 SITE PREPARATION AND CONSTRUCTION

5.70.1 Pile Supported or Ground Improvement Foundation Construction

Excavations to prepare the proposed subgrades for spread foundations with ground improvement methods or pile supported foundation construction (i.e. pile caps / grade beams) should be performed using a method, which reduces disturbance to the subgrade soils. Subgrades which are disturbed during excavation should be compacted to a dense stable matrix using a large plate tamper prior to placement of the foundations or engineered fill.

All organics, wood, debris, and any other unsuitable fill material, beneath the proposed bearing grades, should be undercut and removed. All existing foundation/wall elements within the proposed new foundation area should be removed in their entirety. Resulting excavations should be backfilled with controlled Structural Fill or flowable backfill.

The proposed foundation bearing grades should be observed and evaluated by a representative of Empire, prior to placement of Engineered Fill and/or the foundation. Any placement and compaction of Structural Fill beneath foundations should also be observed and tested by a representative of Empire.

All subgrades for Engineered Fill placement and foundation construction should be protected from precipitation and surface water. No water should be allowed to accumulate on the subgrades. The subgrades should not be allowed to freeze, either prior to or after construction of foundations. If the bearing grades are not protected and degrade, they must be undercut/removed accordingly.

Foundation excavations should be backfilled as soon as possible and prior to construction of the superstructure. It is recommended that foundation excavations, within slab on grade floor, exterior slab and pavement areas be backfilled with a Structural Fill, as recommended in Appendix D.

5.70.2 Driven Pipe Pile Installation

The piles should be driven using a hammer producing a suitable energy to obtain the desired ultimate capacity, yet not overstress the pile. The appropriate hammer and driving criteria should be determined by the contractor through the use of the wave equation based on the actual pile hammer and cushions that will be used for the project. If the wave equation analysis indicates that the pile may be overstressed during driving then the contractor should select an alternate hammer/cushion arrangement, which will not overstress the pile.

At least four random piles should be dynamically tested in accordance with *ASTM D 4945 – Standard Test Method for High Strain Dynamic Testing of Piles* to confirm the driving criteria and to evaluate that the allowable pile capacity has been obtained with an adequate factor of safety (i.e. Factor of Safety of 2.0 or greater). The dynamic testing should be performed prior to installation of the production piles. The test piles may be used as production piles provided the test data is acceptable. The results of the dynamic testing should include an evaluation to simulate static load testing. We recommend the dynamic testing be completed during the initial installation and during a re-strike after a minimum 48 hour “set-up” period from the initial test pile installation.

The wave equation results, pile installation records and the results of the dynamic testing should be evaluated to confirm the design capacity and to possibly refine the driving criteria and pile lengths if determined necessary. It should be understood that the pile capacities presented above were estimated using conventional static analyses based on engineering interpretation of the conditions disclosed by the test borings. Variations in soil conditions may occur, which can impact the actual pile installation requirements. Therefore, it is recommended that the contract documents contain provisions to make adjustments in the actual pile lengths required, should the installation conditions and field testing dictate such changes.

5.70.3 Drilled and Grouted Micro-Pile Foundation Construction

A qualified individual should observe the micro-pile installation and prepare a report summarizing the installation process, load testing results, length of piles and effective embedment lengths, grout type and grout pressures used, etc. Plumbness of the micro-pile should be maintained within 1% of the total length. We recommend at least 1 micro-pile be load tested to twice the allowable design capacity to verify the design assumptions will be met. The test pile may be constructed and tested outside the proposed foundation area, provided that the test pile is constructed similar to, and with similar bearing conditions, to that of the production piles.

5.70.4 Subgrade Preparation for Slab-on-Grade Construction

Existing vegetation, topsoil, asphalt, concrete, surface structures, etc., and any other deleterious materials within the proposed slab on grade areas should be removed. Resulting excavations in slab-on-grade areas should be backfilled with Structural Fill or Suitable Granular Fill as described in Appendix D.

Following removal of the surface materials and any required excavation to the proposed subgrades, the exposed fill soil subgrades should be thoroughly compacted/densified and then proof-rolled. Compaction of the soils may be waived as determined by Empire at the time of construction. The subgrade compaction should be performed, prior to the Structural Fill / Subbase Stone placement, using a vibratory smooth drum roller weighing at least 10 tons. The roller should be operated in the vibratory mode for compacting the subgrades and in the static mode for proof rolling. The roller should complete at least four (4) passes over the exposed subgrades for the compaction/densification operation and at least two (2) passes for the proof rolling evaluation.

The subgrade proof-rolling should be done under the guidance of, and observed by, a representative of Empire. Any areas, which appear wet, loose, soft, unstable or otherwise unsuitable, should be undercut. Over excavation, which may be required as the result of the proof-rolling, should be performed based on evaluation of the conditions by Empire. Resulting over-excavations should be backfilled with a controlled Structural Fill as described in Appendix D.

Suitable Granular Fill, as described in Appendix D, can be used as subgrade fill to raise the site grades, beneath the Subbase Stone course for slab-on-grade construction. It is recommended that utility trenches located within slab on grade areas be backfilled with controlled Structural Fill.

During construction the contractor should take precautions to limit construction traffic over the subgrades for floor slab construction. Any subgrades, which become damaged, rutted or unstable should be undercut and repaired as necessary prior to placement of the overlying fill courses.

5.70.5 Protection of Existing Foundations, Foundation Walls and Utilities

Existing building foundations, foundation walls, and underground utilities should be protected during excavation and construction of the new adjacent foundations or installation of the underpinning system. Proper bracing of existing foundation walls, which are exposed during excavation, must also be considered. Existing utilities or other structures, which are to remain during adjacent excavation work, should also be protected as appropriate.

In addition, the effects of compacting existing or new fill soils immediately adjacent to the existing building must also be considered and properly addressed, so as not to impact the existing structure. Accordingly, it is recommended that proper planning design and construction be implemented to protect these structures as appropriate.

6.00 CONCLUDING REMARKS

This report was prepared to assist in planning the design and construction of the proposed addition to Highland Hospital located at 1000 South Avenue in Rochester, New York. The report has been prepared for the exclusive use of Highland Hospital and members of the design team, for specific application to this site and this project only.

The recommendations were prepared based on Empire Geo-Services, Inc.'s understanding of the proposed project, as described herein, and through the application of generally accepted soils and foundation engineering practices. No warranties, expressed or implied are made by the conclusions, opinions, recommendations or services provided.

Empire Geo-Services, Inc. should be informed of any changes to the planned construction so that it may be determined if any changes to the recommendations presented in this report are necessary. Empire Geo-Services, Inc. should also review final plans and specifications to verify that the recommendations were properly interpreted and implemented.

Important information regarding the use and interpretation of this report is presented in Appendix E.

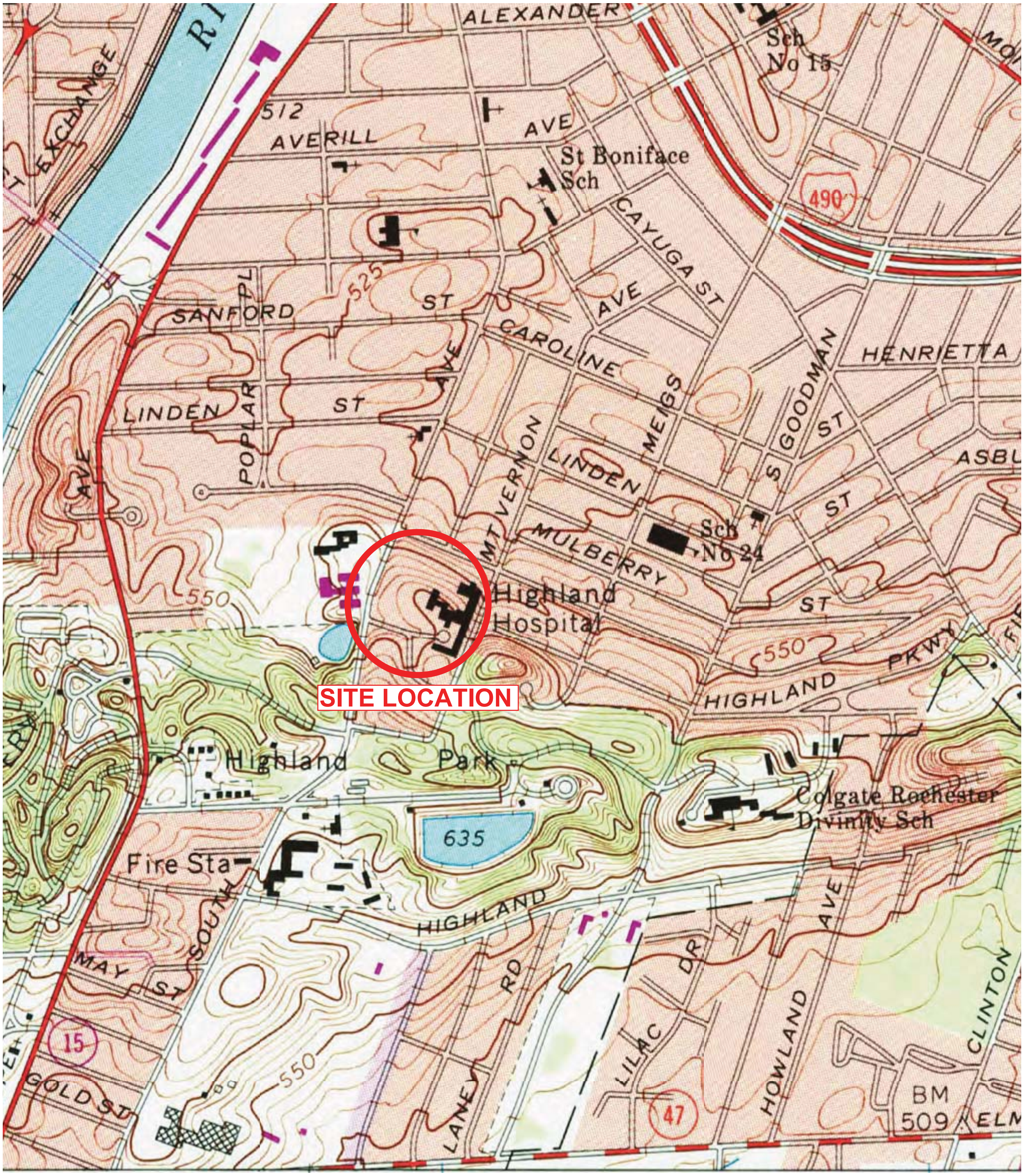
Respectfully Submitted:

EMPIRE GEO-SERVICES, INC.

Wanda Allen, P.E.
Geotechnical Engineer

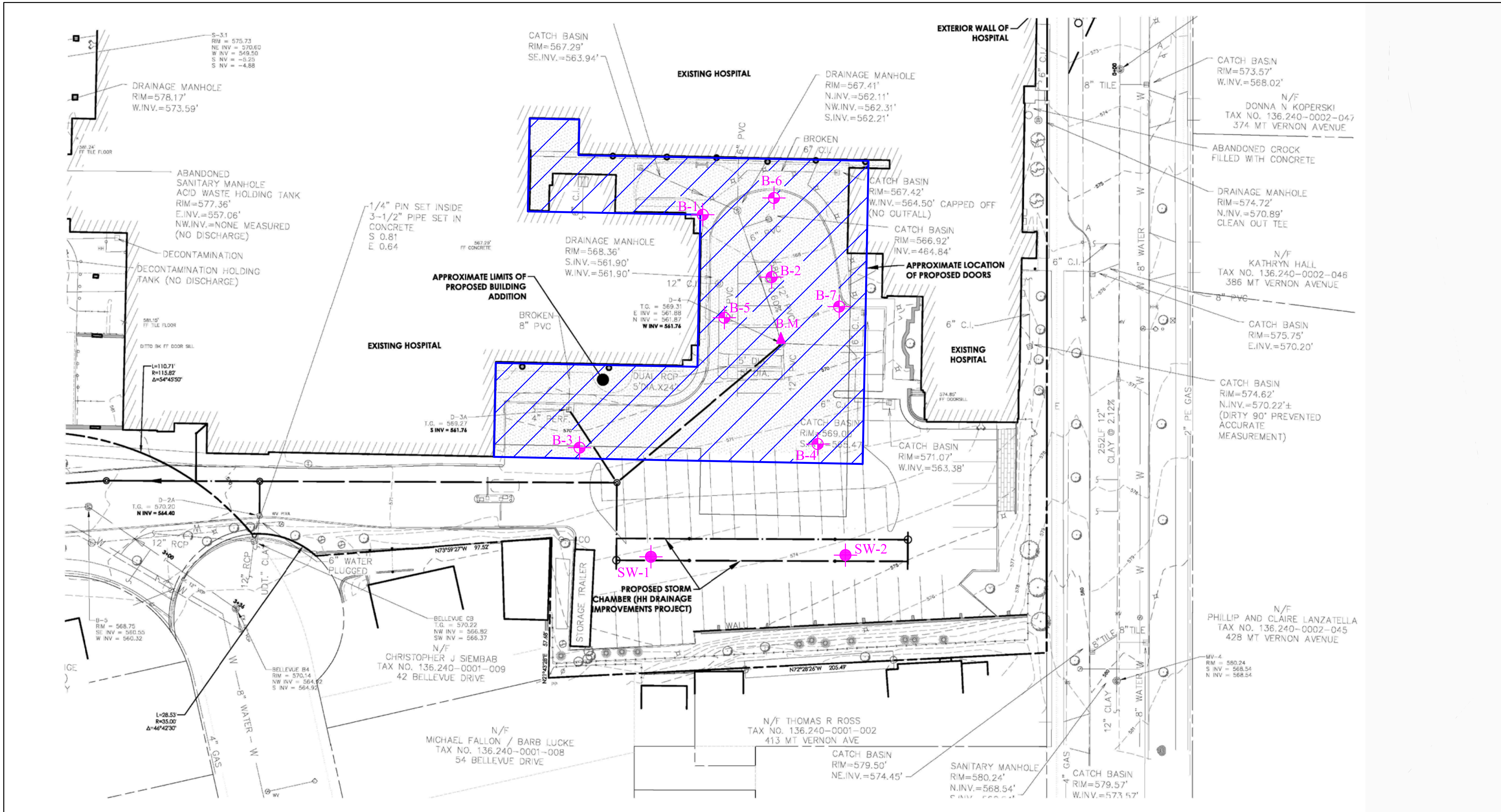
John J. Danzer, P.E.
Senior Geotechnical Engineer and
Project Reviewer

FIGURES



Note: This drawing was reproduced from a USGS Topographic Map of the Rochester East Quadrangle, dated 1971 and photorevised 1978.

EMPIREGEO SERVICES INC a subsidiary of SJB Services, Inc.	SCALE: N.A.
	DATE: 8/7/14
	DRAWN BY: MJB
SITE LOCATION PLAN	REV'D BY: WA
Highland Hospital Addition **1000 South Ave** **Rochester, New York**	DWG. FILE:
	PROJ. No.: RE-14-021
	FIGURE No.: 1



LEGEND:

B-1 INDICATES APPROXIMATE LOCATION AND DESIGNATION OF BUILDING TEST BORING.

SW-1 INDICATES APPROXIMATE LOCATION AND DESIGNATION OF UNDERGROUND STORM WATER INFILTRATION CHAMBERS TEST BORING.

B.M. BENCHMARK: RIM OF DRAINAGE INLET. REPORTED ELEVATION OF 569.31 FEET PER "CONCEPT" PLAN DATED AUGUST 2014 PREPARED BY PASSERO ASSOCIATES.

40 0 40

SCALE FEET

NOTE:

FIGURE DEVELOPED FROM "CONCEPT" PLAN DATED AUGUST 2014 PREPARED BY PASSERO ASSOCIATES

N

EMPIREGEO SERVICES INC
a subsidiary of SJB Services, Inc.

PROPOSED HIGHLAND HOSPITAL ADDITION
1000 SOUTH AVENUE
ROCHESTER, NEW YORK

SUBSURFACE EXPLORATION PLAN	DR BY: WMA	SCALE: 1" ~ 40'	PROJ NO.: RE-14-021
	CHKD BY: JJD	DATE: 09/17/14	FIGURE NO: 2

APPENDIX A

1971 AERIAL PHOTOGRAPH


HISTORICAERIALS.COM
MATERIAL, NON-COMMERCIAL USE ONLY
APPROXIMATE LIMITS OF
PORTION OF HOSPITAL
PREVIOUSLY DEMOLISHED
©2011
COPYRIGHTED MATERIAL,
FIGURE DEVELOPED FROM
HISTORICALAERIALS.COM

APPENDIC B

SUBSURFACE EXPLORATION LOGS

GENERAL INFORMATION & KEY TO SUBSURFACE LOGS

The Subsurface Logs attached to this report present the observations and mechanical data collected by the driller at the site, supplemented by classification of the material removed from the borings as determined through visual identification by technicians in the laboratory. It is cautioned that the materials removed from the borings represent only a fraction of the total volume of the deposits at the site and may not necessarily be representative of the subsurface condition between adjacent borings or between the sampled intervals. The data presented of the Subsurface Logs together with the recovered samples provide a basis for evaluating the character of the subsurface conditions relative to the project. The evaluation must consider all the recorded details and their procedures to more accurately evaluate the subsurface conditions. Any evaluation of the contents of this report and recovered samples must be performed by qualified professionals. The following information defines some of the procedures and terms used of the Subsurface Logs to describe the conditions encountered, consistent with the numbered identifiers shown on the Key opposite this page.

1. **The figures in the Depth column define the scale of the Subsurface Log.**
2. **The Samples column shows, graphically, the depth range from which a sample was recovered. See Table I for descriptions of the symbols used to represent the various types of samples.**
3. **The Sample No. is used for identification on sample containers and/or Laboratory Test Reports.**
4. **Blows on Sampler – shows the results of the "Penetration Test", recording the number of blows required to drive a split spoon sampler into the soil. The number of blows required for each six inches is recorded. The first 6 inches of penetration is considered a seating drive. The number of blows required for the second and third 6 inches of penetration is termed the penetration resistance, N.**
5. **Blows on Casing – Shows the number of blows required to advance the casing a distance of 12 inches. The casing size, hammer weight, and length of drop are noted at the bottom of the Subsurface Log. If the casing is advanced by means other than driving, the method of advancement will be indicated in the Notes column or under the Method of Investigation at the bottom of the Subsurface Log. Alternatively, sample recovery may be shown in this column or other data consistent with the column heading.**
6. **All recovered soil samples are reviewed in the laboratory by an engineering technician, geologist, or geotechnical engineer, unless noted otherwise. Visual descriptions are made on the basis of a combination of the driller's field descriptions and noted observations together with the sample as received in the laboratory. The method of visual classification is based primarily on the Unified Soil Classification System (ASTM D 2487) with regard to the particle size and plasticity (See Table No. II), and the Unified Soil Classification System group symbols for the soil types are sometimes included with the soil classification. Additionally, the relative portion, by weight, of two or more soil types is described for granular soils in accordance with "Suggested Methods of Test for Identification of Soils" by D.M. Burmister, ASTM Special Technical Publication 479, June 1970. (See Table No. III). Description of the relative soil density or consistency is based upon the penetration records as defined in Table No. IV. The description of the soil moisture is based upon the relative wetness of the soil as recovered and is described as dry, moist, wet, and saturated. Water introduced into the boring either naturally or during drilling may have affected the moisture condition of the recovered sample. Special terms are used as required to describe soil deposition in greater detail; several such terms are listed in Table V. When sampling gravelly soils with a standard two inch diameter split spoon, the true percentage of gravel is often not recovered due to the relatively small sampler diameter. The presence of boulders and large gravel is sometimes, but not necessarily, detected by an evaluation of the casing and sampler blows or through the "action" of the drill rig as reported by the driller.**
7. **Rock description is based on review of the recovered rock core and the driller's notes. Frequently used rock classification terms are included in Table VI.**
8. **The stratification lines represent the approximate boundary between soil types and the transition may be gradual. Solid stratification lines delineate apparent changes in soil type, based upon review of recovered soil samples and the driller's notes. Dashed lines convey a lesser degree of certainty with respect to either a change in soil type or where such change may occur.**
9. **Miscellaneous observations and procedures noted by the driller are shown in this column, including water level observations. It is important to realize the reliability of the water level observations depends upon the soil type (water does not readily stabilize in a hole through fine grained soils), and that any drill water used to advance the boring may have influenced the observations. The ground water level will fluctuate seasonally, typically. One or more perched or trapped water levels may exist in the ground seasonally. All the available readings should be evaluated. If definite conclusions cannot be made, it is often prudent to examine the conditions more thoroughly through test pit excavations or groundwater observation wells.**
10. **The length of core run is defined as the length of penetration of the core barrel. Core recovery is the length of core recovered divided by the core run. The RQD (Rock Quality Designation) is the total length of pieces of NX core exceeding 4 inches divided by the core run. The size core barrel used is also noted in the Method of Investigation at the bottom of the Subsurface Log.**

SJB SERVICES, INC.
SUBSURFACE LOG

SJB SERVICES, INC.

DATE STARTED ______ FINISHED ______ SHEET ____ OF ____	SJB SERVICES, INC. SUBSURFACE LOG	PROJ. No. ______ HOLE No. ______ SURF. ELEV. ______ G.W. DEPTH ______

PROJECT ____________________ LOCATION ____________________

DEPTH (ft)	SAMPLES	SAMPLE No.	BLOWS ON SAMPLER 0/6	6/12	12/18	18/24	N	BLOWS ON CASING C	SOIL OR ROCK CLASSIFICATION	NOTES
0		1	3	3	4	8	7	10	3" TOPSOIL	Groundwater at 10' upon completion, and 5' 24 hrs. after completion
								15	Brown SILT, some Sand, trace clay, ML (Moist-Loose)	
								50/.5		
5									Gray SHALE, medium hard, weathered, thin bedded, some fractures	Run#1, 2.5'-5.0' 95% Recovery 50% RQD

① ② ③ ④ ⑤ ⑥ ⑦ *(numbered features explained on reverse)* ⑧ ⑨ ⑩

TABLE I

Split Spoon Sample	
Shelby Tube Sample	
Geoprobe Macro-Core	
Auger or Test Pit Sample	
Rock Core	

TABLE II

Identification of soil type is made on basis of an estimate of particle sizes, and in the case of fine grained soils also on basis of plasticity.

Soil Type	Soil Particle Size	
Boulder	>12"	Coarse Grained (Granular)
Cobble	3" - 12"	
Gravel - Coarse	3" - 3/4"	
- Fine	3/4" - #4	
Sand - Coarse	#4 - #10	
- Medium	#10 - #40	
- Fine	#40 - #200	
Silt - Non Plastic (Granular) Clay - Plastic (Cohesive)	<#200	Fine Grained

TABLE III

The following terms are used in classifying soils consisting of mixtures of two or more soil types. The estimate is based on weight of total sample.

Term	Percent of Total Sample
"and"	35 - 50
"some"	20 - 35
"little"	10 - 20
"trace"	less than 10

(When sampling gravelly soils with a standard split spoon, the true percentage of gravel is often not recovered due to the relatively small sampler diameter.)

TABLE IV

The relative compactness or consistency is described in accordance with the following terms:

Granular Soils Term	Blows per Foot, N	Cohesive Soils Term	Blows per Foot, N
Loose	0 - 4	Very Soft	0 - 2
Loose	4 - 10	Soft	2 - 4
Firm	10 - 30	Medium	4 - 8
Compact	30 - 50	Stiff	8 - 15
Very Compact	>50	Very Stiff	15 - 30
		Hard	>30

(Large particles in the soils will often significantly influence the blows per foot recorded during the penetration test)

TABLE V

Varved	Horizontal uniform layers or seams of soil(s).
Layer	Soil deposit more than 6" thick.
Seam	Soil deposit less than 6" thick.
Parting	Soil deposit less than 1/8" thick.
Laminated	Irregular, horizontal and angled seams and partings of soil(s).

TABLE VI

Rock Classification Term		Meaning
Hardness	- Soft	Scratched by fingernail
	- Medium Hard	Scratched easily by penknife
	- Hard	Scratched with difficulty by penknife
	- Very Hard	Cannot be scratched by penknife
Weathering	- Very Weathered	Judged from the relative amounts of disintegration, iron staining, core recovery, clay seams, etc.
	- Weathered	
	- Sound	

Rock Classification Term		Meaning	
Bedding	- Laminated	(<1")	Natural breaks in Rock Layers
	- Thin Bedded	(1" - 4")	
	- Bedded	(4" - 12")	
	- Thick Bedded	(12" - 36")	
	- Massive	(>36")	

(Fracturing refers to natural breaks in the rock oriented at some angle to the rock layers)

DATE		
START	7/28/2014	
FINISH	7/28/2014	
SHEET	1 OF 2	

SJB SERVICES, INC.
SUBSURFACE LOG

HOLE NO. B-1
SURF. ELEV 567.9'
G.W. DEPTH See Notes

PROJECT: PROPOSED HIGHLAND HOSPITAL ADDITION
LOCATION: 1000 SOUTH AVENUE, ROCHESTER, NEW YORK
PROJ. NO.: RE-14-021

DEPTH FT.	SMPL NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	SOIL OR ROCK CLASSIFICATION	NOTES
	1	9	7			5" CONCRETE	
		6	12		13	Gray Crushed STONE (moist, FILL)	
	2	14	14			Brown fine SAND, some Gravel, little Silt (moist, FILL)	Geofabric was
		17	16		31	Gray Crushed STONE (moist, FILL)	encountered below the
5	3	6	7			Brown fine SAND and Silt (moist, firm, SM)	subbase material.
		7	7		14		
	4	7	8			Contains little Gravel	
		8	7		16		
	5	6	7			Contain tr. gravel	
10		5	6		12		
	6	6	6			Contains some Silt	
		5	6		11		
15							
	7	14	12			Contains little Gravel	
		11	13		23		
20							
	8	5	6			Contains tr. gravel	
		7	11		13		
25							
	9	8	8			Gray fine SAND, some Gravel, some Silt	
		10	11		18	(moist-wet, firm, SP)	
30							
	10	3	2			Contains trace gravel (wet, loose)	
		3	3		5		
35							
	11	3	4			Brown SAND and Gravel, tr. silt (wet, firm, SW)	
		7	13		11		
40							

N = NO. BLOWS TO DRIVE 2-INCH SPOON 12-INCHES WITH A 140 LB. PIN WT. FALLING 30-INCHES PER BLOW CLASSIFIED BY: Geologist

DRILLER: J. FRIDMAN DRILL RIG TYPE : CME 75

METHOD OF INVESTIGATION ASTM D-1586 USING HOLLOW STEM AUGERS

SJB SERVICES, INC.
SUBSURFACE LOG

DATE START	7/28/2014
FINISH	7/28/2014
SHEET	2 OF 2
HOLE NO.	B-1
SURF. ELEV	567.9'
G.W. DEPTH	See Notes

PROJECT: PROPOSED HIGHLAND HOSPITAL ADDITION
PROJ. NO.: RE-14-021
LOCATION: 1000 SOUTH AVENUE, ROCHESTER, NEW YORK

DEPTH FT.	SMPL NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	SOIL OR ROCK CLASSIFICATION	NOTES
	12	3	3			Gray fine SAND, some Silt (wet, loose, SM)	
		3	5		6		
45	13	4	5			Contains little Gravel (SP)	
		3	5		8		
50	14	7	8			Gray SILT and f-c Sand, tr. gravel (wet, firm, ML)	
		7	10		15		
55	15	8	13			Contains some Gravel, little Silt	
		15	10		28		
						Boring Complete at 57.0 feet.	Free standing water was encountered at 37.0 feet at boring completion.
60							
65							
70							
75							
80							

N = NO. BLOWS TO DRIVE 2-INCH SPOON 12-INCHES WITH A 140 LB. PIN WT. FALLING 30-INCHES PER BLOW
CLASSIFIED BY: Geologist
DRILLER: J. FRIDMAN
DRILL RIG TYPE : CME 75
METHOD OF INVESTIGATION ASTM D-1586 USING HOLLOW STEM AUGERS

DATE		**SJB SERVICES, INC.**	HOLE NO. B-2
START	7/25/2014	**SUBSURFACE LOG**	SURF. ELEV 568.5'
FINISH	7/25/2014		G.W. DEPTH See Notes
SHEET	1 OF 2		

PROJECT: PROPOSED HIGHLAND HOSPITAL ADDITION LOCATION: 1000 SOUTH AVENUE
PROJ. NO.: RE-14-021 ROCHESTER, NEW YORK

DEPTH FT.	SMPL NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	SOIL OR ROCK CLASSIFICATION	NOTES
	1	4	7	8	15	ASPHALTIC CONCRETE	Driller notes approx.
						Gray Crushed STONE (moist, FILL)	3.5" of Asphalt and
	2	8	4			Brown GRAVEL and Sand (moist, FILL)	7.5" of Subbase
		2	3		6		
5	3	2	3			Grayish Brown with Brown and Black mottled ASH and	Geofabric was
		2	2		5	Cinders, little Coal (moist, FILL)	encountered below the
	4	2	2			Becomes Grayish Brown	subbase material.
		3	2		5		
	5	2	2				
10		2	3		4		
	6	2	2			Gray SAND and Slag (wet, FILL)	
		2	2		4		
15							
	7	3	3			Brown-Black PEAT (moist, PT)	
		4	5		7	Gray SAND, little Gravel,little Silt (moist, SP)	
20							
	8	4	3			Gray fine SAND and Silt (wet, loose, SM)	
		1	1		4		
25							
	9	7	6			Contains some Gravel, some Silt (moist-wet, firm, SP)	
		7	6		13		
30							
	10	4	3			Gray fine SAND, little Silt (wet, loose, SM)	
		3	2		6		
35							
	11	3	4				
		4	4		8		
40							

N = NO. BLOWS TO DRIVE 2-INCH SPOON 12-INCHES WITH A 140 LB. PIN WT. FALLING 30-INCHES PER BLOW CLASSIFIED BY: Geologist

DRILLER: J. FRIDMAN DRILL RIG TYPE : CME 75

METHOD OF INVESTIGATION ASTM D-1586 USING HOLLOW STEM AUGERS

DATE
START 7/25/2014
FINISH 7/25/2014
SHEET 2 OF 2

SJB SERVICES, INC.
SUBSURFACE LOG

HOLE NO. B-2
SURF. ELEV 568.5'
G.W. DEPTH See Notes

PROJECT: PROPOSED HIGHLAND HOSPITAL ADDITION
PROJ. NO.: RE-14-021
LOCATION: 1000 SOUTH AVENUE
ROCHESTER, NEW YORK

DEPTH FT.	SMPL NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	SOIL OR ROCK CLASSIFICATION	NOTES
	12	4	4			Contains some Silt	
		4	4		8		
45							
	13	3	2			Grayish Brown SILT, little fine Sand (wet, loose, ML)	
		3	2		5		
50							
	14	2	2			Gray fine SAND, some Gravel, little Silt (wet, loose, SP)	
		2	2		4		
55							
	15	10	15				
		19	23		34	Contains some Silt (moist, compact)	
60							
	16	19	44				
		50/0.3			REF	(very compact)	REF - Sample Spoon Refusal
65							
	17	50/0.4			REF		
70							
	18	49	50/0.2		REF		
						Boring Complete with Sample Spoon Refusal at 70.7 feet	Free standing water was encountered at 54.5 feet at boring completion.
75							
80							

N = NO. BLOWS TO DRIVE 2-INCH SPOON 12-INCHES WITH A 140 LB. PIN WT. FALLING 30-INCHES PER BLOW CLASSIFIED BY: Geologist

DRILLER: J. FRIDMAN DRILL RIG TYPE : CME 75

METHOD OF INVESTIGATION ASTM D-1586 USING HOLLOW STEM AUGERS

DATE			HOLE NO. B-3
START 7/29/2014	SJB SERVICES, INC.		SURF. ELEV 570.4'
FINISH 7/29/2014	SUBSURFACE LOG		G.W. DEPTH See Notes
SHEET 1 OF 1			

PROJECT: PROPOSED HIGHLAND HOSPITAL ADDITION LOCATION: 1000 SOUTH AVENUE
PROJ. NO.: RE-14-021 ROCHESTER, NEW YORK

DEPTH FT.	SMPL NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	SOIL OR ROCK CLASSIFICATION	NOTES
	1	7	4	5	9	ASPHALTIC CONCRETE	Driller notes approx.
						Gray Crushed STONE (moist, FILL)	5" Asphalt
	2	5	3			Br. fine SAND, some Gravel, little Clayey Silt (moist, FILL)	
		3	4		6	Brown Clayey SILT, some fine Sand, little Gravel	
5	3	2	2			(moist-wet, FILL)	
		3	5		5	Brown Clayey SILT, some fine Sand, little Gravel	
	4	4	4			(moist, medium, ML)	
		5	6		9	Contains tr. gravel (moist-wet, stiff)	
	5	6	5				
10		5	5		10		
	6	5	4			Contains a seam of fine Sand	
		6	5		10		
15							Boring B-3 was shut down
	7	8	11			Contains little Gravel (very stiff)	by the Hospital, due to
		12	15		23		exhaust fumes from the
							drill rig going into the air
							intake to the hospital.
20							
	8	6	8			Light Brown fine SAND, some Silt (moist, firm, SM)	
		11	10		19		
						Boring Complete at 22.0 feet.	No free standing water
							was encountered at
25							boring completion
30							
35							
40							

N = NO. BLOWS TO DRIVE 2-INCH SPOON 12-INCHES WITH A 140 LB. PIN WT. FALLING 30-INCHES PER BLOW CLASSIFIED BY: Geologist

DRILLER: J. FRIDMAN DRILL RIG TYPE : CME 75

METHOD OF INVESTIGATION ASTM D-1586 USING HOLLOW STEM AUGERS

DATE
START 7/28/2014
FINISH 7/28/2014
SHEET 1 OF 2

SJB SERVICES, INC.
SUBSURFACE LOG

HOLE NO. B-4
SURF. ELEV 571.8'
G.W. DEPTH See Notes

PROJECT: PROPOSED HIGHLAND HOSPITAL ADDITION
LOCATION: 1000 SOUTH AVENUE, ROCHESTER, NEW YORK
PROJ. NO.: RE-14-021

DEPTH FT.	SMPL NO.	0/6	6/12	12/18	N	SOIL OR ROCK CLASSIFICATION	NOTES
	1	8	6	4	10	ASPHALTIC CONCRETE	Driller notes approx.
						Gray Crushed STONE (moist, FILL)	5" Asphalt
	2	4	7			Brown fine SAND, some Gravel, little Silt (moist, FILL)	
		6	7		13	Contains tr. ash	Geofabric was
5	3	2	2				encountered below the
		2	2		4		subbase material.
	4	3	2			(moist-wet)	
		3	4		5		No Recovery Sample #3
	5	3	2				
10		2	3		4		
	6	2	2			Grayish White with Brown mottled ASH and Cinders,	
		2	2		4	Contains a seam of Brown Sandy Silt	
						(moist-wet, FILL)	
15							
	7	3	5			Contains little Coal	
		7	7		12		
20							
	8	4	7			Gray SILT, little fine Sand, trace organics	
		8	7		15	(moist-wet, firm, ML)	
25							
	9	6	6			Contains tr. clay	
		7	5		13		
30							
	10	12	11			Contains tr. gravel (wet)	
		11	14		22		
35							
	11	3	2			Gray fine SAND, little Silt (wet, loose, SM)	
		3	3		5		
40							

N = NO. BLOWS TO DRIVE 2-INCH SPOON 12-INCHES WITH A 140 LB. PIN WT. FALLING 30-INCHES PER BLOW CLASSIFIED BY: Geologist

DRILLER: J. FRIDMAN DRILL RIG TYPE : CME 75

METHOD OF INVESTIGATION ASTM D-1586 USING HOLLOW STEM AUGERS

DATE	
START	7/25/2014
FINISH	7/25/2014
SHEET	2 OF 2

SJB SERVICES, INC.
SUBSURFACE LOG

HOLE NO. B-4
SURF. ELEV 571.8'
G.W. DEPTH See Notes

PROJECT: PROPOSED HIGHLAND HOSPITAL ADDITION
LOCATION: 1000 SOUTH AVENUE, ROCHESTER, NEW YORK
PROJ. NO.: RE-14-021

DEPTH FT.	SMPL NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	SOIL OR ROCK CLASSIFICATION	NOTES
	12	4	6			Becomes Grayish Brown (firm)	
		8	7		14		
45							
	13	3	3			Contains trace fine gravel (loose)	
		3	3		6		
50							
	14	8	4			Gray fine SAND, some Silt, trace fine gravel	
		5	3		9	(moist-wet, loose, SM)	
55							
	15	5	24			Contains some Gravel (very compact)	
		41	50/0.4		65		
60							REF - Sample Spoon
	16	48	50/0.4		REF	Contains little Gravel (moist)	Refusal
						Boring Complete with Sample Spoon Refusal at 60.9 feet	Free standing water was encountered at 46.0 feet at boring completion.
65							
70							
75							
80							

N = NO. BLOWS TO DRIVE 2-INCH SPOON 12-INCHES WITH A 140 LB. PIN WT. FALLING 30-INCHES PER BLOW   CLASSIFIED BY: Geologist

DRILLER: J. FRIDMAN   DRILL RIG TYPE : CME 75

METHOD OF INVESTIGATION ASTM D-1586 USING HOLLOW STEM AUGERS

DATE	
START	9/7/2014
FINISH	9/7/2014
SHEET	1 OF 1

SJB SERVICES, INC.
SUBSURFACE LOG

HOLE NO.	B-5
SURF. ELEV	568.9'
G.W. DEPTH	See Notes

PROJECT: PROPOSED HIGHLAND HOSPITAL ADDITION LOCATION: 1000 SOUTH AVENUE
PROJ. NO.: RE-14-021 ROCHESTER, NEW YORK

DEPTH FT.	SMPL NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	SOIL OR ROCK CLASSIFICATION	NOTES
	1	9	14	12	26	ASPHALTIC CONCRETE	Driller notes approx. 4"
						Brown-Black and Gray f-c GRAVEL and f-c Sand, little Silt	Asphalt
	2	14	11			(moist, FILL)	
		7	6		18	White-Brown and Black CINDERS and f-c Sand, tr.ash	
5	3	2	2			(moist, FILL)	
		2	2		4		
	4	2	2				
		1	2		3		
	5	2	1				
10		1	1		2		
	6	2	3			Brown-Black WOOD and f-m Sand (moist, FILL)	
		7	17		10		
	7	15	12			Black PEAT and Wood fragments (moist, FILL)	
		10	11		22		
15	8	8	10			Brown-Black WOOD and f-c Sand, some Silt	
		10	4		20	(moist, FILL)	
	9	5	4				
		4	12		8		
	10	11	5			Olive-Brown Clayey SILT, tr.-little f-c Sand, tr.wood	
20		5	5		10	(moist, FILL)	
	11	4	2				
		5	5		7		
	12	5	6				
		7	7		13	Contains tr.gravel	
25	13	7	8				
						Boring Complete at 25.0 feet.	No free standing water was encountered at boring completion

N = NO. BLOWS TO DRIVE 2-INCH SPOON 12-INCHES WITH A 140 LB. PIN WT. FALLING 30-INCHES PER BLOW CLASSIFIED BY: Geologist

DRILLER: J. FRIDMAN DRILL RIG TYPE : CME 75

METHOD OF INVESTIGATION ASTM D-1586 USING HOLLOW STEM AUGERS

DATE
START 9/7/2014
FINISH 9/7/2014
SHEET 1 OF 1

SJB SERVICES, INC.
SUBSURFACE LOG

HOLE NO. B-6
SURF. ELEV 567.3'
G.W. DEPTH See Notes

PROJECT: PROPOSED HIGHLAND HOSPITAL ADDITION LOCATION: 1000 SOUTH AVENUE
PROJ. NO.: RE-14-021 ROCHESTER, NEW YORK

DEPTH FT.	SMPL NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	SOIL OR ROCK CLASSIFICATION	NOTES
	1	8	11	12	23	ASPHALTIC CONCRETE	Driller notes approx. 4"
						Brown f-c GRAVEL and f-c Sand, little-some Silt, tr.concrete	Asphalt
	2	10	8			(moist, FILL)	
		6	7		14	Brown-Black f-m SAND, some Silt, tr.ash, tr.cinders	
5	3	4	1			(moist, FILL)	
		2	2		3		
	4	4	4				
		3	5		7		
	5	8	8				
10		9	11		17		Driller notes fill Sands at
	6	8	8			Brown fine SAND, little Silt (moist, SM)	approx. 9.5'
		9	9		17	(firm)	
	7	11	11				
		7	5		18		
15	8	7	7			Becomes Tan-Brown	
		6	6		13		
	9	6	6				
		7	2		13		
	10	7	6				
20		7	3		13		
	11	6	6				
		8	9		14		
	12	8	8				
		9	11		17		
25	13	10	10				
						Boring Complete at 25.0 feet.	No free standing water was encountered at boring completion
30							
35							
40							

N = NO. BLOWS TO DRIVE 2-INCH SPOON 12-INCHES WITH A 140 LB. PIN WT. FALLING 30-INCHES PER BLOW CLASSIFIED BY: Geologist
DRILLER: J. FRIDMAN DRILL RIG TYPE : CME 75
METHOD OF INVESTIGATION ASTM D-1586 USING HOLLOW STEM AUGERS

DATE	
START	9/7/2014
FINISH	9/7/2014
SHEET	1 OF 1

SJB SERVICES, INC.
SUBSURFACE LOG

HOLE NO. B-7
SURF. ELEV 569.0'
G.W. DEPTH See Notes

PROJECT: PROPOSED HIGHLAND HOSPITAL ADDITION
LOCATION: 1000 SOUTH AVENUE, ROCHESTER, NEW YORK
PROJ. NO.: RE-14-021

DEPTH FT.	SMPL NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	SOIL OR ROCK CLASSIFICATION	NOTES
	1	7	6			ASPHALTIC CONCRETE	
		7	8		13	Brown-Black f-c GRAVEL and f-c Sand, little Silt (moist, FILL)	
	2	6	6			Brown-Black f-c SAND, some Silt, tr.ash, tr.cinders, tr.brick	
		4	5		10	(moist, FILL)	
5	3	4	3				
		2	2		5		
	4	2	2				Poor Recovery Sample
		2	2		4		#4, #5, and #6
	5	6	6				
10		3	4		9		
	6	3	2			Contains tr.glass	
		2	2		4		
	7	2	2				No Recovery Sample #7
		2	2		4		
15	8	3	2				Poor Recovery Sample #8
		3	4		5		
	9	7	5			Contains tr.peat, tr.wood	
		8	8		13		
	10	2	2			Black-Brown PEAT and Wood fragments (moist, FILL)	
20		4	4		6		
	11	4	5				
		6	8		11		
	12	5	4			Olive-Brown SILT and fine Sand (wet, FILL)	
		4	3		8		
25	13	3	4				
						Boring Complete at 25.0 feet.	Free standing water recorded at 23.0' boring completion
30							
35							
40							

N = NO. BLOWS TO DRIVE 2-INCH SPOON 12-INCHES WITH A 140 LB. PIN WT. FALLING 30-INCHES PER BLOW
CLASSIFIED BY: Geologist
DRILLER: J. FRIDMAN
DRILL RIG TYPE : CME 75
METHOD OF INVESTIGATION ASTM D-1586 USING HOLLOW STEM AUGERS

DATE		**SJB SERVICES, INC.**	HOLE NO. SW-1
START	7/25/2014	**SUBSURFACE LOG**	SURF. ELEV 573.1'
FINISH	7/25/2014		G.W. DEPTH See Notes
SHEET	1 OF		

PROJECT: PROPOSED HIGHLAND HOSPITAL ADDITION LOCATION: 1000 SOUTH AVENUE
PROJ. NO.: RE-14-021 ROCHESTER, NEW YORK

DEPTH FT.	SMPL NO.	0/6	6/12	12/18	N	SOIL OR ROCK CLASSIFICATION	NOTES
	1	10	11	13	24	ASPHALTIC CONCRETE	Driller notes approx.
						Gray Crushed STONE (moist, FILL)	4.5" of Asphalt and
	2	10	12			Brown SAND and Gravel (moist, FILL)	7" Subbase
		13	9		25	Grayish Brown Silty SAND, some Gravel, trace coal	
5	3	5	7			(moist, FILL)	Geofabric was
		37	12		44	Contains little Concrete fragments	encountered below the
	4	8	8				subbase material.
		9	9		17		
	5	7	9			Contains little Gravel	
10		10	8		19		
	6	7	7			Contains some Ash, some Cinders	
		6	7		13		
						Boring Complete at 12.0 feet.	No free standing water
							was encountered at
15							boring completion.
20							
25							
30							
35							
40							

N = NO. BLOWS TO DRIVE 2-INCH SPOON 12-INCHES WITH A 140 LB. PIN WT. FALLING 30-INCHES PER BLOW CLASSIFIED BY: Geologist

DRILLER: J. FRIDMAN DRILL RIG TYPE : CME 75

METHOD OF INVESTIGATION ASTM D-1586 USING HOLLOW STEM AUGERS

DATE
START 7/25/2014
FINISH 7/25/2014
SHEET 1 OF 1

SJB SERVICES, INC.
SUBSURFACE LOG

HOLE NO. SW-2
SURF. ELEV 574.2'
G.W. DEPTH See Notes

PROJECT: PROPOSED HIGHLAND HOSPITAL ADDITION
PROJ. NO.: RE-14-021
LOCATION: 1000 SOUTH AVENUE, ROCHESTER, NEW YORK

DEPTH FT.	SMPL NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	SOIL OR ROCK CLASSIFICATION	NOTES
	1	13	7	9	16	ASPHALTIC CONCRETE	Driller notes approx.
						Brown fine SAND, some Gravel, little Asphalt fragments,	6" of Asphalt and 6"
	2	10	11			little Silt (moist, FILL)	Subbase
		9	10		20	Contains little Wood fragments, tr. brick fragments, tr. ash	
5	3	7	9				
		11	10		20		
	4	8	5			Brown fine SAND, little Gravel, little Silt (moist, firm, SP)	
		7	8		12		
	5	5	4			Light Brown fine SAND, some Silt (moist, loose, SM)	
10		5	8		9		
	6	6	7			Contains little Gravel (firm)	
		5	6		12		
						Boring Complete at 12.0 feet.	No free standing water was encountered at boring completion.
15							
20							
25							
30							
35							
40							

N = NO. BLOWS TO DRIVE 2-INCH SPOON 12-INCHES WITH A 140 LB. PIN WT. FALLING 30-INCHES PER BLOW

CLASSIFIED BY: Geologist

DRILLER: J. FRIDMAN

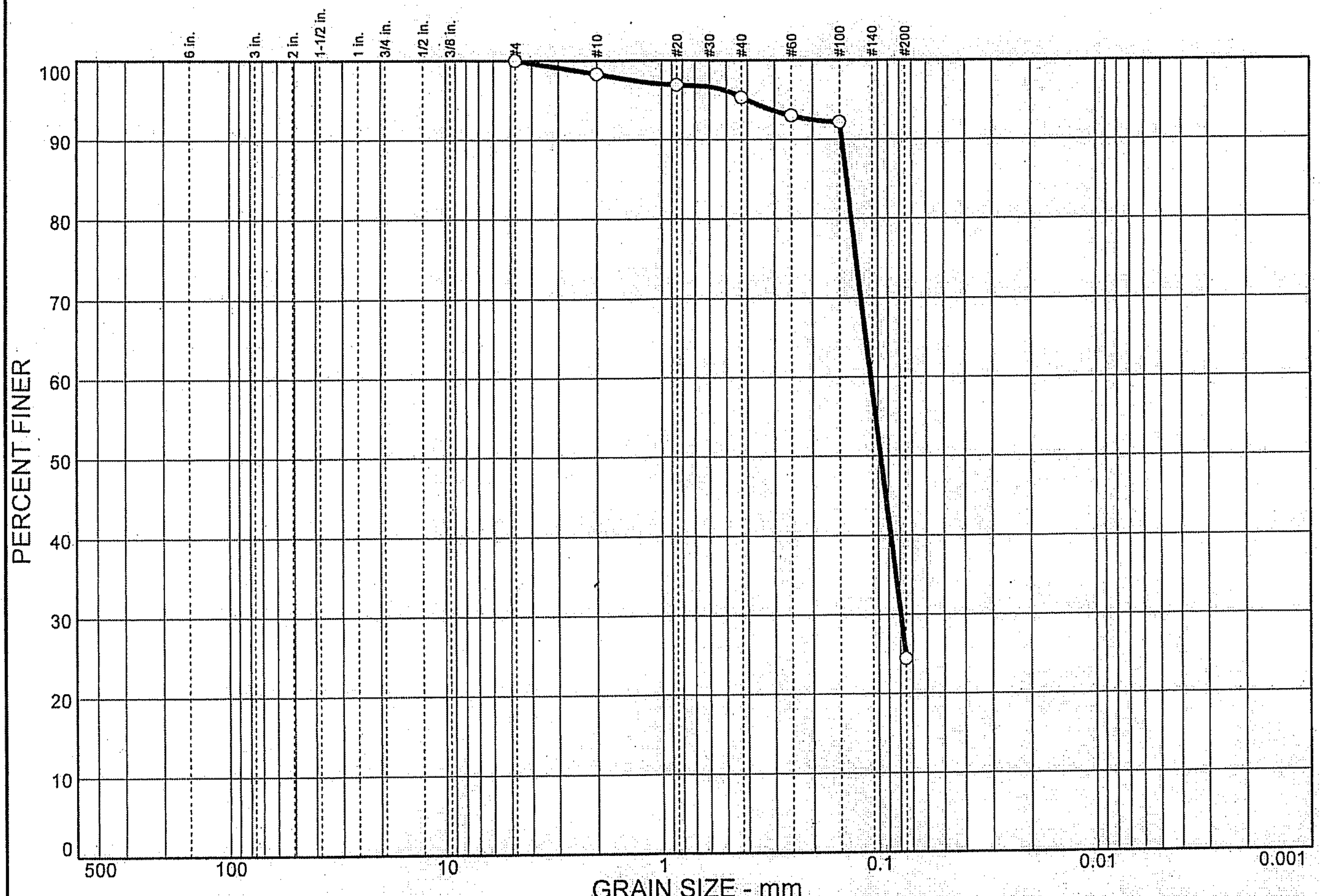
DRILL RIG TYPE : CME 75

METHOD OF INVESTIGATION ASTM D-1586 USING HOLLOW STEM AUGERS

APPENDIX C

LABORATORY TEST DATA

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	75.6	24.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	98.3		
#20	96.9		
#40	95.3		
#60	93.0		
#100	92.2		
#200	24.4		

* (no specification provided)

Soil Description

Sand, Some Fines

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.139 D_{60}= 0.108 D_{50}= 0.0976
D_{30}= 0.0794 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= AASHTO=

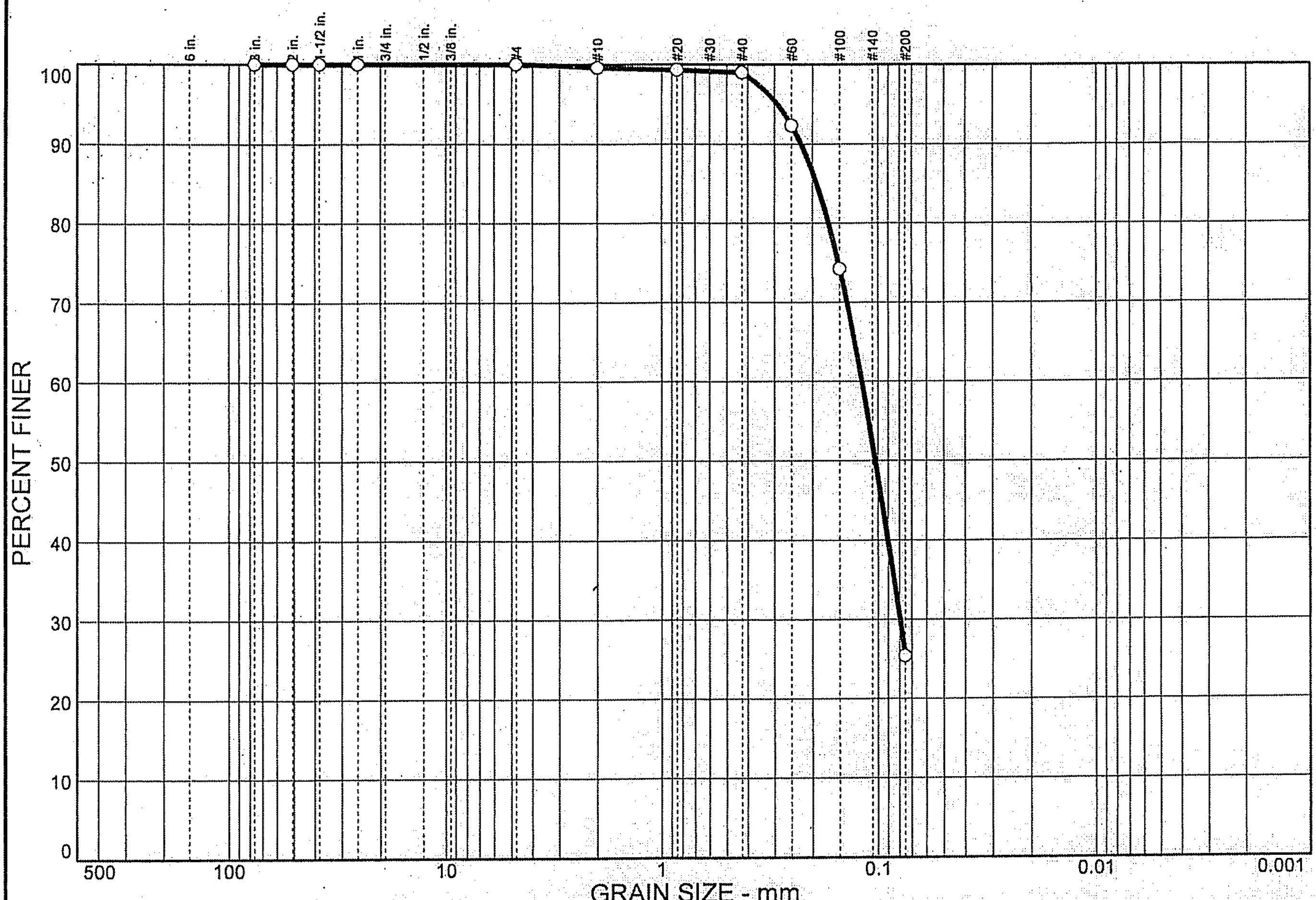
Remarks

Sample No.: 14-669 **Source of Sample:** B-1 **Date:** 09-17-2014
Location: B-1 / S-6 **Elev./Depth:** 10'-12'

SJB SERVICES, INC.

Client: Highland Hospital
Project: Highland Hospital
Project No: RE-14-021 **Plate** 14-669

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	74.6	25.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3 in.	100.0		
2 in.	100.0		
1.5 in.	100.0		
1 in.	100.0		
#4	100.0		
#10	99.6		
#20	99.3		
#40	99.0		
#60	92.3		
#100	74.2		
#200	25.4		

* (no specification provided)

Soil Description

Sand, Some Fines

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.192 D_{60}= 0.119 D_{50}= 0.103
D_{30}= 0.0795 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= AASHTO=

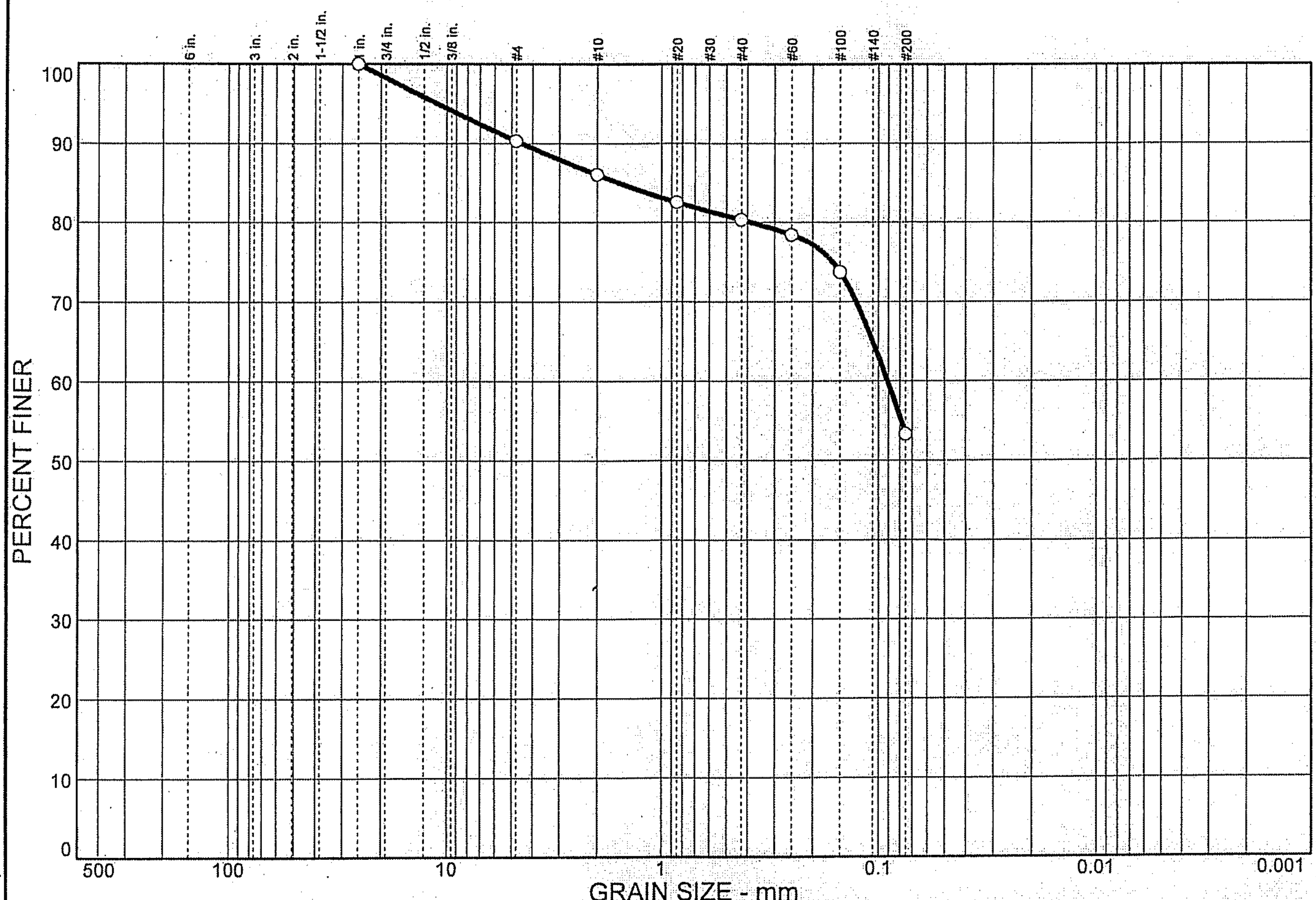
Remarks

Sample No.: 14-670 **Source of Sample:** B-1 **Date:** 09-17-2014
Location: B-1 / S-10 **Elev./Depth:** 30'-32'

SJB SERVICES, INC.

Client: Highland Hospital
Project: Highland Hospital
Project No: RE-14-021 **Plate** 14-670

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	9.7	37.0	53.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1 in.	100.0		
#4	90.3		
#10	86.0		
#20	82.5		
#40	80.3		
#60	78.4		
#100	73.7		
#200	53.3		

* (no specification provided)

Soil Description

Fines and Sand, Trace Gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 1.60 D_{60}= 0.0910 D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Sample No.: 14-671 **Source of Sample:** B-1 **Date:** 09-17-2014
Location: B-1 / S-14 **Elev./Depth:** 50'-52'

SJB SERVICES, INC.

Client: Highland Hospital
Project: Highland Hospital
Project No: RE-14-021 **Plate** 14-671

APPENDIX D

FILL MATERIAL AND EARTHWORK RECOMMENDATIONS

APPENDIX D

FILL MATERIAL AND EARTHWORK RECOMMENDATIONS

I. Material Recommendations

A. Structural Fill

Structural Fill should consist of a crusher run stone, free of clay, organics and friable or deleterious particles. As a minimum, the crusher stone should meet the requirements of New York State Department of Transportation, Standard Specifications, Item 304.12 – Type 2 Subbase, with the following gradation requirements.

Sieve Size Distribution	Percent Finer by Weight
2 inch	100
¼ inch	25-60
No. 40	5-40
No. 200	0-10

B. Subbase Stone

The subbase stone course placed as the aggregate course beneath slab-on-grade and pavement construction should conform to the same material requirements as Structural Fill as stated above.

C. Suitable Granular Fill

Suitable soil material, well graded from coarse to fine and classified as GW, GP, GM, SW, SP and SM soils using the Unified Soil Classification System (ASTM D-2487) and having no more than 85- percent by weight material passing the No. 4 sieve, no more than 20- percent by weight material passing the No. 200 sieve and which is generally free of particles greater than 6 inches, will be acceptable as Suitable Granular Fill. It should also be free of topsoil, asphalt, concrete rubble, wood, debris, clay and other deleterious materials. Suitable Granular Fill can be used as foundation backfill and as subgrade fill to raise site grades or backfill beneath slab-on-grade and pavement construction.

Material meeting the requirements of New York State Department of Transportation, Standard Specifications, Item 203.07 – Select Granular Fill is acceptable for use as Suitable Granular Fill.

D. General Fill

General Fill obtained from site excavations may be used for backfill in non-loaded areas outside of slab-on-grade and paved areas. General Fill should be free of topsoil, organics, debris and deleterious materials and should be of a moisture content suitable for proper compaction.

II. Placement and Compaction Requirements

All controlled fill placed beneath foundations, slab-on-grade construction and beneath utilities should be compacted to a minimum of 95 percent of the maximum dry density as measured by the modified Proctor test (ASTM D1557). Fill placed in non-loaded grass areas can be compacted to a minimum of 90 percent of the maximum dry density (ASTM D1557).

Placement of fill should not exceed a maximum loose lift thickness of 6 to 9 inches with the exception of subbase courses beneath slab on grade and pavement construction, which can be placed in a single lift not exceeding 12 inches. The loose lift thickness should be reduced in conjunction with the compaction equipment used so that the required density is attained.
Fill should have a moisture content within two percent of the optimum moisture content prior to compaction. Subgrades should be properly drained and protected from moisture and frost. Placement of fill on frozen subgrades is not acceptable. It is recommended that all fill placement and compaction be monitored and tested by a representative of Empire Geo-Services, Inc.

III. Quality Assurance Testing

The following minimum laboratory and field quality assurance testing frequencies are recommended to confirm fill material quality and post placement and compaction conditions. These minimum frequencies are based on generally uniform material properties and placement conditions. Should material properties vary or conditions at the time of placement vary (i.e. moisture content, placement and compaction, procedures or equipment, etc.) Then additional testing is recommended. Additional testing, which may be necessary, should be determined by qualified geotechnical personnel, based on evaluation of the actual fill material and construction conditions.

A. Laboratory Testing of Material Properties

- Moisture content (ASTM D-2216) - 1 test per 4,000 cubic yards or no less than 2 tests per each material type.

- Grain Size Analysis (ASTM D-422) - 1 test per 4,000 cubic yards or no less than 2 tests per each material type.

- Liquid and Plastic Limits (ASTM D-4318) 1 test per 4,000 cubic yards or no less than 2 tests per each material type. Liquid and Plastic Limit testing is necessary only if appropriate, based on material composition (i.e. clayey or silty soils).

- Modified Proctor Moisture Density Relationship (ASTM D-1557) 1 test per 4,000 cubic yards or no less than 1 test per each material type. A maximum/minimum density relationship (ASTM D-4253 and ASTM D-4254) may be an appropriate substitute for ASTM D-1557 depending on material gradation.

B. <u>Field In-Place Moisture/Density Testing (ASTM D-3017 and ASTM D-2922)</u>

- Backfilling along trenches and foundation walls - 1 test per 50 lineal feet per lift.

- Backfilling Isolated Excavations (i.e. column foundations, manholes, etc.) 1 test per lift.

- Filling in open areas for slab-on-grade and pavement construction - 1 test per 2,500 square feet per lift.

APPENDIX E

GEOTECHNICAL REPORT LIMITATIONS

GEOTECHNICAL REPORT LIMITATIONS

Empire Geo-Services, Inc. (Empire) has endeavored to meet the generally accepted standard of care for the services completed, and in doing so is obliged to advise the geotechnical report user of our report limitations. Empire believes that providing information about the report preparation and limitations is essential to help the user reduce geotechnical-related delays, cost over-runs, and other problems that can develop during the design and construction process. Empire would be pleased to answer any questions regarding the following limitations and use of our report to assist the user in assessing risks and planning for site development and construction.

PROJECT SPECIFIC FACTORS: The conclusions and recommendations provided in our geotechnical report were prepared based on project specific factors described in the report, such as size, loading, and intended use of structures; general configuration of structures, roadways, and parking lots; existing and proposed site grading; and any other pertinent project information. Changes to the project details may alter the factors considered in development of the report conclusions and recommendations. *Accordingly, Empire cannot accept responsibility for problems which may develop if we are not consulted regarding any changes to the project specific factors that were assumed during the report preparation.*

SUBSURFACE CONDITIONS: The site exploration investigated subsurface conditions only at discrete test locations. Empire has used judgement to infer subsurface conditions between the discrete test locations, and on this basis the conclusions and recommendations in our geotechnical report were developed. It should be understood that the overall subsurface conditions inferred by Empire may vary from those revealed during construction, and these variations may impact on the assumptions made in developing the report conclusions and recommendations. *For this reason, Empire should be retained during construction to confirm that conditions are as expected, and to refine our conclusions and recommendations in the event that conditions are encountered that were not disclosed during the site exploration program.*

USE OF GEOTECHNICAL REPORT: Unless indicated otherwise, our geotechnical report has been prepared for the use of our client for specific application to the site and project conditions described in the report. *Without consulting with Empire, our geotechnical report should not be applied by any party to other sites or for any uses other than those originally intended.*

CHANGES IN SITE CONDITIONS: Surface and subsurface conditions are subject to change at a project site subsequent to preparation of the geotechnical report. Changes may include, but are not limited to, floods, earthquakes, groundwater fluctuations, and construction activities at the site and/or adjoining properties. *Empire should be informed of any such changes to determine if additional investigative and/or evaluation work is warranted.*

MISINTERPRETATION OF REPORT: The conclusions and recommendations contained in our geotechnical report are subject to misinterpretation. *To limit this possibility, Empire should review project plans and specifications relative to geotechnical issues to confirm that the recommendations contained in our report have been properly interpreted and applied.*

Subsurface exploration logs and other report data are also subject to misinterpretation by others if they are separated from the geotechnical report. This often occurs when copies of logs are given to contractors during the bid preparation process. *To minimize the potential for misinterpretation, the subsurface logs should not be separated from our geotechnical report and the use of excerpted or incomplete portions of the report should be avoided.*

OTHER LIMITATIONS: Geotechnical engineering is less exact than other design disciplines, as it is based partly on judgement and opinion. For this reason, our geotechnical report may include clauses that identify the limits of Empire's responsibility, or that may describe other limitations specific to a project. These clauses are intended to help all parties recognize their responsibilities and to assist them in assessing risks and decision making. Empire would be pleased to discuss these clauses and to answer any questions that may arise.