R E P O R T

GEOTECHNICAL EVALUATION

VA MEDICAL CENTER
423 EAST 23RD STREET
NEW YORK, NEW YORK

SGURS BUILDINGS 1 - 6 MANHATTAN ELECTRICAL UPGRADES

Prepared for:
Department of Veterans Affairs
Office of Construction and Facilities Management
8380 Colesville Road, Suite 420
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This report provides geotechnical recommendations for the design and construction of the proposed emergency generator structures at the Veterans Affairs Medical Center (VAMC) building at 423 East 23rd Street in Manhattan, New York. The geotechnical evaluations and recommendations presented herein are in general accordance with the 2012 International Building Code (Code) and the United States Department of Veterans Affairs Seismic Design Requirements, dated August 2013.

The proposed generators are located at Buildings 1 and 6 and one geotechnical boring was advanced at each of the proposed generator locations. The subsurface conditions and depths to bedrock are significantly different at each boring location. The subsurface conditions encountered in boring B-1 at Building 6 generally consist of fill (Stratum 1-1), overlying gravel (Stratum1-2), overlying bedrock (Stratum 1-3) at about 17-feet below the existing ground floor slab elevation. The subsurface conditions encountered in boring B-2 at Building 1 generally consist of fill and remnant foundation elements (Stratum 2-1) overlying organic and inorganic silt (Stratum2-2), overlying sand (Stratum 2-3), overlying boulder till (Stratum 2-4), overlying soft rock at about at about 63-feet below the existing ground floor slab elevation.. Groundwater is estimated to be about 13 feet below the sidewalk, which corresponds to approximately el. +2 feet[1].

The recommended seismic site classification is Site Class D. If the proposed building is in Seismic Use Group IV, the Seismic Design Category (SDC) is D. Liquefaction is unlikely.

The new foundation for the proposed generator structures will be constructed around the existing foundation of the VAMC building. Careful consideration of the location of the new foundation with respect to the existing foundation elements must be given in order to minimize the potential for conflict of locating proposed foundations in the same location as existing foundations.

Recommendations are given in the report for 40-ton micro-piles at each of the proposed generator locations for Buildings 1 and 6. Remnant foundation elements of the historic buildings at the site prior to construction of the hospital building are present within the site. We assume the remnant foundation walls and slabs will not be removed prior to new foundation construction, and we recommend that the contract documents include provision for pre-drilling to clear obstructions that may impede the satisfactory installation of the new foundation.

The recommended design groundwater elevation is el. +5 feet. The bottom of the first floor slab will likely be above the design groundwater elevation; therefore, the slab should be fully damp-proofed.

The report includes additional information regarding the subsurface conditions and foundation design recommendations and additional recommendations regarding excavation considerations, temporary groundwater control, underpinning, micro-pile installation and load testing, subgrade preparation, backfill and compaction requirements, pre-construction condition documentation and monitoring, and construction inspection and monitoring.

[1] Elevations are referenced to Borough President of Manhattan Datum, which is 2.75 feet above the National Geodetic Vertical Datum (Mean sea level. at Sandy Hook, NJ 1929). [BPMD = USGS – 2.75]

1.1 GENERAL

This report provides geotechnical recommendations for the design and construction of the proposed emergency generator structures at the Veterans Affairs Medical Center (VAMC) building at 423 East 23rd Street in Manhattan, New York. The geotechnical evaluations and recommendations presented herein are in general accordance with the 2012 International Building Code (Code) and the United States Department of Veterans Affairs Seismic Design Requirements, dated August 2013. Authorization to proceed was obtained in the form of an agreement between Department of Veterans Affairs Office of Construction and Facilities Management and URS Corporation – New York (URS).

All elevations presented herein are referenced to the Borough President of Manhattan Datum (BPMD).

1.2 SITE DESCRIPTION AND PROPOSED DEVELOPMENT

The project site is located at 423 East 23rd Street in Manhattan, New York and is referenced as Block 955, Lot No.5. The total lot size is about 288,000 ft^2 and is currently occupied by the Veterans Affairs Medical Center. The site is bounded to the west by First Avenue, to the north by East 25th Street, to the west by Asser Levy Place, and bounded to the south by East 23rd Street. A site location plan is presented as Figure No. 1.

The proposed development involves upgrades to the electrical infrastructure at Buildings 1 and 6 within the VAMC campus for the purposes of mitigation of future storm flood damage. This study focuses on two proposed emergency generator installations at Buildings 1 & 6. The new generators will be supported on new foundations that will be independent of the existing building foundation. The new foundation will be constructed at about the same elevation of the foundation of the existing building known as the ground floor level. All proposed elevations are estimated and are to be finalized by the architect. Structural foundation loads were not developed at the time of writing this report.

1.3 HISTORIC BUILDING INFORMATION AND GEOTECHNICAL DATA

URS reviewed the following documents with information relating to the historic site conditions prior to construction of the existing medical center, and information relating to past and current projects performed at the existing medical center:

- Alfred Hopkins & Associates – Veterans Administration Hospital – Topographic Survey Boring & Drill Hole Plan, dated 20 October 1950
- Alfred Hopkins & Associates – Veterans Administration Hospital – Foundation Plan North East, dated 1 December 1950
- Russo & Sonder, PC – Hellmuth, Obata & Kassabaum, PC – Dwg 5B-1 – Boring Data – Part I, dated 25 July 1985
- Russo & Sonder, PC – Hellmuth, Obata & Kassabaum, PC – Dwg 5B-2 – Boring Data – Part II, dated 25 July 1985

- Soil Solutions, Inc. – submittal dated 12 May 2010 – includes partial geotechnical report by Medina Consultants for new emergency generator
- HDR Engineering – Report of Geotechnical Evaluation for Proposed Floodwall Project – Revision 2, dated December 2013

The historic topographic plan dated 20 October 1950 shows the site was occupied by former buildings including a gas station and garage building in the vicinity of the current Building 6 location, and former warehouses and factory buildings in the vicinity of the current Building 1 location. The historic documents and geotechnical reports suggest that the remnant foundations of the former buildings exist below the existing buildings.

The historic building plans for the hospital indicate the existing VAMC building is supported by a deep foundation system of piles interconnected by reinforced concrete pile caps and grade beams. The type and capacity of the existing piles is not known.

1.4 OBJECTIVES AND SCOPE OF SERVICES

The objectives of this investigation were to evaluate the subsurface conditions in the vicinity of the proposed generator locations for Buildings 1 and 6, and provide geotechnical recommendations for the design and construction of the proposed emergency generator foundation. The following scope of services was performed to achieve these objectives:

- Retained a subcontractor to perform test borings;
- Provided full-time special inspection of the test boring operations;
- Performed engineering evaluations and prepared this report that includes the following:
  a) A description of the subsurface investigation performed for this project;
  b) A plan drawing showing the locations of the as-drilled test borings;
  c) An overview of general site and geologic conditions;
  d) The results of engineering evaluations and recommendations regarding the foundation design, including:
     - Foundation type, estimated capacity, bearing elevation, and settlement estimate;
     - Evaluation of drilled mini-pile foundations, including estimated pile lengths, and capacities;
     - Requirements for pile load testing;
     - Seismic site class and liquefaction potential;
     - Ground floor slab support;
     - Permanent groundwater control measures;
  e) A discussion regarding construction related issues, including:
     - Excavation and temporary support of excavation considerations;

- Underpinning;
- Temporary groundwater control;
- Subgrade preparation;
- Pile load test and installation inspection requirements, if applicable
- Backfill and compaction requirements;
- Pre-construction survey;
- Construction monitoring recommendations;

f) Appendices that include test boring logs.

1.5 REPORT ORGANIZATION

This report is divided into five sections. Following this section is a description of the subsurface investigation methods and results in Section 2. Section 3 summarizes the engineering evaluations and our recommendations. Construction considerations are addressed in Section 4. The limitations of this study are discussed in Section 5. Figures are provided at the end of the text. The boring logs are included in the appendices.

2.1 GENERAL

The subsurface investigation included a test boring program to identify soil, rock, and groundwater conditions in the vicinity of the proposed generator locations. Details of the subsurface investigation are presented in the following sections.

2.2 SUBSURFACE INVESTIGATION

Two test borings, designated B-1 and B-2, were drilled between February 10 and February 28, 2014, from the ground floor level inside of Buildings 1 and 6 within the VAMC campus. Boring B-1 was drilled in the vicinity of the proposed generator structure at Building 6, and boring B-2 was drilled in the vicinity of the proposed generator structure at Building 1. The borings were inspected on a full-time basis by a URS Geotechnical Engineer, under the direction of Mr. Jamie Rodger, P.E. The test boring locations are presented in Figure 1.

The URS test borings were performed by Aquifer Drilling and Testing, Inc. of Mineola, New York using a portable electric restricted access drill rig. The borings were advanced using the mud rotary technique with a 3-7/8-inch diameter tricone roller bit. Soil samples were obtained in all borings using a 2-inch O.D. split-spoon sampler in accordance with American Society for Testing and Materials (ASTM) Standard Specification D1586-Standard Penetration Test (SPT). The SPT consists of driving a 2-in O.D. split-spoon for a depth of 24 inches with repeated blows of a 140-lb hammer free-falling 30 inches. The standard penetration or N-value is defined as the number of blows required to drive the sampler for a 12-in interval after an initial 6 inches of penetration. The split-spoon sampler was advanced using a donut hammer in all borings. The soil samples obtained from the borings were visually classified by the URS field inspector using the Unified Soil Classification System. The recovered split-spoon samples were placed in properly labeled jars.

Rock coring was performed using a five-foot long NX (2-1/8 in. O.D.) core barrel. The top of rock was estimated based on the drilling operations (e.g., excessive rig chatter, difficult penetration) and practical spoon refusal as indicated by blow counts greater than 100 for a 6-inch interval on the split spoon sampler. Rock coring was performed to verify the presence of rock (instead of encountering a boulder) and assess its relative quality, as indicated by Core Recovery[2] and the Rock Quality Designation (RQD)[3].

A groundwater observation well was not installed in any of the completed borings and groundwater measurements were not taken.

The test boring logs are included in Appendix A.

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[2] The Core Recovery is defined as the ratio (expressed as a percent) of the total length of recovered core to the length cored.

[3] The Rock Quality Designation (RQD) is defined as the ratio (expressed as a percentage) of the total length of recovered core samples having a length of at least twice the core diameter (e.g., about 4 in for NX-core) to the total length of core.

2.3 GENERALIZED SUBSURFACE CONDITIONS

The generalized strata descriptions provided below are based on our interpretation of the results of the subsurface investigation. Note that the subsurface conditions and depths to bedrock are significantly different at each boring location as discussed herein.

2.3.1 Boring B-1 at Building 6 Proposed Generator Location

Stratum 1-1 – Fill: This stratum generally consists of dark grey silt with medium-fine sand. Two N-Values were measured in this stratum and are 40 and 19 blows per foot (bpf). The thickness of this stratum is about 13 feet.

Stratum 1-2 – Gravel: This stratum was encountered below Stratum 1-1 at about 13 feet below the ground floor. This stratum generally consists of gravel with mica flakes and some silt. One N-Value of 50 blows over three-inches was measured in this stratum. The thickness of this stratum is about 4 feet thick.

Stratum 1-3 –Rock: This stratum was encountered below Stratum 1-2 at about 17.5 feet below the ground floor slab in boring B-1. The rock consists of gray mica schist with moderately spaced fracturing. One rock core about 4.5-feet long was recovered in this boring. The rock core recovery was about 92% and the Rock Quality Designation (RQD) was about 50%.

2.3.2 Boring B-2 at Building 1 Proposed Generator Location

Stratum 2-1 – Fill: This stratum generally consists of reinforced concrete, brick and rock fragments. This material is likely remnant foundation elements of the former buildings that occupied the site before the VAMC building was constructed. Difficult drilling and split spoon refusal was encountered over about 17-feet below the existing slab elevation.

Stratum 2-2 – Organic and Inorganic Silt: This stratum was encountered below Stratum 2-1 at about 17 feet below the ground floor. This stratum generally consists of dark grey organic silt with shells, organic fibers, and trace clay and mica flakes. Peat was encountered in the spoon tip at about 22-feet below existing slab elevation. Two N-Values of 4 and 7 bpf were measured in the organic silt stratum. The thickness of this stratum is about 8 feet thick.

The soil transitions to inorganic silt at about 25-feet below the existing slab and consists of dark grey micaceous silt with some sand and trace clay. One N-Value of 19 bpf was measured in this stratum. The thickness of this stratum is about 4 feet thick.

Stratum 2-3 – Sand: This stratum was encountered below Stratum 2-2 at about 28 feet below the ground floor. This stratum generally consists of grey medium-fine sand with trace silt and mica flakes. Four N-Values of 46, 19, 25 and 61 bpf were measured in the sand stratum. The thickness of this stratum is about 19-feet thick.

A lens of stiff brown inorganic clay was encountered within the sand stratum at about 41-feet below the slab.

Stratum 2-4 – Boulder Till: This stratum was encountered below Stratum 2-3 at about 47 feet below the ground floor slab. Difficult drilling was encountered in this stratum and the material generally consisted of cobble and boulder sized fragments in a matrix of sand and silty sand (boulder till). Split spoon refusal was encountered and rock coring was performed to advance through cobbles and boulders. The thickness of this stratum is about 16-feet thick.

Stratum 2-5 – Soft Rock: This stratum was encountered below Stratum 2-4 at about 63 feet below the ground floor slab in boring B-2. Split spoon sampling could not be performed in this material and rock coring was used to advance the boring and retrieve samples. Rock core recoveries were poor and no intact specimens were recovered suggesting the rock is very soft and was disintegrating under the action of the coring. The borehole was terminated at about 82-feet below grade.

Our review of historic borings in the vicinity of boring B-2 indicate that “soft rock” was encountered at similar depths of about 60-feet.

2.4 GROUNDWATER LEVEL

A groundwater observation well was not installed in the completed borings as part of this investigation. Groundwater readings were measured during the HDR Engineering, Inc. investigation of December 2013, and groundwater is reported to be about 8-feet to 9-feet below existing exterior grades at about elevation +0 to about elevation +2.

Since groundwater measurements were not taken over an extended period of time, the measured groundwater level does not adequately reflect seasonal or other time dependent variations that may occur.

3.1 GENERAL

This section presents engineering evaluations and recommendations for the design of the foundations and below grade structures. The evaluations and recommendations are based on the results of the subsurface investigation, our experience on other projects, and the information we have been provided to date on the design requirements for the proposed structure.

3.2 SEISMIC CONSIDERATIONS

Based on the soil profile, the recommended seismic site classification is Site Class D. Therefore, if the Seismic Use Group is IV, the Seismic Design Category is "D". The appropriate Seismic Use Group should be determined by the Architect or Structural Engineer.

Earthquake induced soil liquefaction is unlikely.

3.3 FOUNDATION RECOMMENDATIONS

The new foundation for the proposed generator structures will be constructed around the existing foundation of the VAMC building. Careful consideration of the location of the new foundation with respect to the existing foundation elements must be given in order to minimize the potential for conflict of locating proposed foundations in the same location as existing foundations.

As discussed in a previous section of the report, remnant foundation elements of the historic buildings at the site prior to construction of the hospital building are present within the site. We assume the remnant foundation walls and slabs will not be removed prior to new foundation construction, and we recommend that the contract documents include provision for pre-drilling to clear obstructions that may impede the satisfactory installation of the new foundation.

The new foundation will be constructed inside the existing building likely using restricted access equipment (see Section 4). The construction of shallow foundations bearing on rock is not likely feasible given the depth to rock, excavation of remnant foundation elements, and dewatering of the excavation. Therefore, construing isolated spread footings is likely not feasible and is not recommend.

The construction of a driven pile foundation is not feasible since the foundations will be constructed inside the existing building and large pile driving equipment cannot access the interior of the building to drive piles.

3.3.1 Columns and Walls

Deep Foundations

The new foundation will be constructed at about the same elevation of the existing foundation at the ground floor level of Buildings 1 and 6. The proposed top of slab elevation will be coincident with the existing slab elevation.

It is recommended that the generator foundation be supported on drilled micro-pile foundations socketed into soil and soft rock (at about 35 feet below existing slab at Building 1 location) or competent rock (at about 17 feet below existing slab at Building 6 location). The micro-piles should be drilled and cased through the remnant historic building foundations, and the natural boulder till (cobbles and boulders) to reduce the potential for collapse of the drill hole or necking of the grout-ground socket. The amount of time needed to drill through the remnant foundations and boulders adds uncertainty to the drilling cost and schedule.

The final design of the micro-pile is often performed by the contractor, because some contractors have their preferred design methods and materials to suit their construction capabilities. For the purpose of preparing design drawings and evaluating costs, the following preliminary micro-pile sizes and capacities can be used:

Location	Maximum Allowable Compression Capacity (tons)	Steel Casing Outside Diameter (see Note 1) (in.)	Steel Casing Thickness (in.)	Number and Size of Reinforcing Bars (see Note 1)	Minimum Socket Length (see Note 2) (ft)	Bearing Stratum
Building 1	40	9.625	0.545	1 - #9	30	Soil and Soft Rock
Building 6	40	9.625	0.545	1 - #9	4	Competent Rock

Notes:

1. The estimated micro-pile capacities are based on steel casing and reinforcing bar minimum yield strengths of 50 ksi and 75 ksi, respectively. The casing shall be installed at least 1 foot into the rock. The reinforcing steel shall be installed through the cased and uncased (i.e., rock socket) portions of the micro-pile. The connection of the reinforcement to the pile cap shall be designed by others.
2. The socket length is based on the socket having a minimum diameter of 7-inches. The expected bearing stratum is competent bedrock at Building 6 location, and a combination of soil and soft rock at Building 1 location.
3. A minimum of one axial load test will be required at each location (minimum of two tests total) to substantiate the micro-pile capacity. The design of the load test assembly will be the responsibility of the pile contractor.
4. The concrete/grout compression strength should be 6,000 psi.
5. The minimum center-to-center micro-pile spacing shall be 30-inches.

Index Piles and Pile Load Tests for Drilled Micro-Piles

We recommend installing index piles that are the same in every aspect to production piles at the start of the pile drilling operations. The recommended number of index piles is about 5% to 10% of the total number of piles required. Index piles allow for estimating pile lengths, identifying unusual drilling conditions, and the need for pre-drilling. The index piles should be installed under the full-time Special Inspection of a URS engineer. The index piles may be used as production piles if properly installed and accepted by the geotechnical engineer.

Pile load tests are necessary to substantiate the proposed micro-pile capacities, verify the pile construction methods, and satisfy the requirements of the 2012 International Building Code. A minimum of one axial load test will be required at each location (minimum of two tests total) to substantiate the micro-pile capacity. The design of the load test assembly will be the responsibility of the pile contractor's engineer. The compression load tests should be performed in accordance with ASTM D1143 Standard Loading Procedure and 2012 IBC specifications.

The basic allowable lateral load per pile is 1-ton without performing additional lateral pile analyses or lateral load tests. If more than 1 ton lateral capacity is needed, it is recommended that lateral pile analyses or load tests be performed to determine if the selected pile(s) can resist the lateral loads.

3.3.2 Ground Floor Slab

The ground floor slab will be constructed at the same elevation as the existing ground floor slab The existing floor slab is of slab-on-grade construction. Assuming there is no proposed increase in floor load, it is recommended that the new ground floor slab be designed as a slab-on-grade.

3.4 PERMANENT GROUNDWATER CONTROL

The static groundwater level is expected to be about el. +2 within the granular overburden material, and either perched on top of shallow soft rock and/or flowing through fractures within the rock. Considering that the groundwater level may fluctuate due to seasonal conditions, the recommended design groundwater elevation is el. +5 feet.

Although the bottom of the ground floor slab will likely be above the design groundwater elevation; we recommend the new slab be fully damp-proofed in order to mimimize the potential for water vapor permeating the slab. Waterproofing materials should be installed directly beneath the new floor slab (Grace Construction Products Florprife 120, or equivalent). Waterstops should be installed at appropriate locations.

Quality control is critical to a successful damp-proofing project. Careful installation, diligent protection, and close full-time oversight are critical to produce a final product that limits the potential for seepage. It is recommended that a warrantee be obtained from the installer to cover materials and workmanship. Only certified installers approved by the product manufacturer should perform the work. The installation of all damp-proofing elements should be inspected on a full time basis to confirm that the damp-proofing is being applied as per the manufacturer's specifications and details. A representative of the manufacturer should perform final damp-proofing inspection, in coordination with the damp-proofing inspector, and approve all damp-proofing work prior to concrete placement.

4.1 GENERAL

This section presents a discussion and recommendations regarding special geotechnical aspects of the proposed construction, which should be addressed in the project specifications and contract documents.

The foundation construction work will take place inside the existing building. We understand other construction work for other contracts within the campus will be taking place at different times in the vicinity of the proposed generator structures. We recommend VAMC consider the sequence of the proposed construction work in order to minimize potential conflicts of schedule and tasks.

We recommend VAMC consult with local specialist foundation contractors experienced with the construction of deep foundations within existing buildings to discuss schedule and task logistics. The contractor should be aware that remnant foundation elements of the former historic buildings were encountered during the investigation. The contractor should have equipment and expertise in drilling through natural and manmade obstructions.

4.2 EXCAVATION CONSIDERATIONS

Local temporary soil excavations above and below the groundwater level can have cut slopes as steep as 1.5H:1V and 2H:1V, respectively, unless steeper slopes are approved by the support of excavation (SOE) engineer. The slopes of any excavations adjacent to the existing structures should be no steeper than 2H:1V, unless approved by the SOE engineer.

The excavations are expected to be relatively shallow and about 4-feet or less. If deeper excavations are required, all vertical soil faces will require temporary support until the new foundations are constructed and the area is properly backfilled. The design and construction of any slopes and/or temporary excavation support systems should be the responsibility of a licensed New York Professional Engineer. All excavations and temporary support systems should conform to pertinent OSHA and local safety regulations.

4.3 TEMPORARY GROUNDWATER CONTROL

Based on the current design information, it is estimated that construction of the new grade beams and slab will be performed above the static groundwater elevation. Assuming that the groundwater remains at about el. +2, it is estimated that temporary dewatering will not be required. Since the groundwater may be perched, it may be possible for the contractor to use sump pits and pumps to control the water. Discharge of groundwater to the sewer will require a discharge permit from the NYCDEP.

4.4 MICRO-PILE INSTALLATION AND TESTING

Micro-piles should be performed by a contractor with experience on similar projects. The contract specifications should require that the proposed contractor submit a construction procedure to the Engineer for review and approval prior to beginning the work. It is the responsibility of the contractor to use an installation method that will not cause damage to the existing building foundation or adjacent structures. The use of air or undereamers to advance the casing through the overburden and/or remnant foundation elements may cause damage to the existing or adjacent structures if the air cannot be contained in the casing. Control of the air will depend on the drillers equipment, procedures, and experience. If the driller cannot control the air, they will have to switch to another method, which typically consists of using water with no air. The use of water to advance the casing may be much slower than using air; therefore, this should be taken into consideration when obtaining pricing from the contractor.

All aspects of the micro-pile installation should be inspected on a full time basis. The use of air during advance of the casing and the drilling of the rock socket should be closely monitored by the special inspector. Upon completion of the micro-pile drilling, the caisson should be thoroughly cleaned prior to installing the reinforcement and grout/concrete.

4.5 SUBGRADE PREPARATION

The subgrade surface for the new floor slab should be level and cleaned of loose soil, mud, and other material (such as concrete, brick, wood, debris, etc.) that can have a negative impact on the performance of the foundation or slab. If directed by the Special Inspector, the soil subgrade should be proof-rolled with a minimum of 6 passes of a smooth drum roller with a minimum 1500 lb. static weight and minimum centrifugal force of 4,000 lbs, or similar approved equipment. Any unstable areas encountered which cannot be stabilized by additional compaction should be excavated to competent material and the area backfilled with compacted structural fill or ¾” stone. The proof-rolling should not be performed when the subgrade is wet, muddy, or frozen. The concrete should not be poured if the subgrade is wet, muddy, or frozen.

A 4-inch thick layer of compacted coarse aggregate, commonly known as ¾” gravel or crushed stone, or a “mud-slab” (i.e., 2 inches of lean concrete), should be placed on the approved subgrade so that the subgrade is properly protected from disturbance.

4.6 BACKFILL AND COMPACTION REQUIREMENTS

Select backfill or structural backfill should be granular soils free of cinder, brick, asphalt, ash, and other unsuitable materials. Such material should not contain any boulders or cobbles larger than about 4 inches across, and should have a fine content (material passing the No. 200 sieve) less than 15 percent. It is recommended that structural backfill or select backfill beneath the proposed building foundations be compacted to a minimum of 95% of the maximum dry density, as determined by ASTM D1557-88, Method C. All backfill should be placed in lifts not exceeding 8-in. in loose thickness. If requested by the special inspector, the subgrade underneath the backfill should be satisfactorily proof-rolled prior to the placement of backfill. Backfill placed beneath slabs-on-grade, behind below-grade walls, and underneath sidewalks should be compacted to a minimum of 90% of the maximum dry density. Backfill placed in landscaped areas should be compacted to a minimum of 85% of the maximum dry density.

4.7 PRE-CONSTRUCTION DOCUMENTATION REPORT AND MONITORING

A pre-construction documentation report of selected sections of the existing VAMC building should be performed for the protection of VAMC in the event of a future damage claim. The report should include detailed documentation and photographs of the existing condition of the structures. Based on the survey results, a monitoring program should be developed for the purpose of checking the performance of the adjacent structures or utilities and for monitoring construction procedures. his monitoring program should include, at a minimum, recommendations for the location of survey points to monitor vertical and horizontal movements, locations for crack gauges, and locations for monitoring vibrations during key construction activities. The monitoring program should also include threshold levels for allowable movements and vibrations, and the procedures to be implemented if the threshold levels are exceeded during construction.

4.8 CONSTRUCTION MONITORING

It is recommended that a geotechnical engineer familiar with the subsurface conditions and foundation design criteria, review the foundation contractors procedures and provide inspection services during excavation and foundation construction. Geotechnical related inspection services should include:

- Review and approval of contractor submittals related to foundation construction;
- Observation and documentation of all phases of excavation and foundation construction.
- Full time special inspection of micro-piles.
- Monitoring of subgrade preparation and structural fill placement and compaction.
- Special inspection of underpinning and support of excavation (if required).
- Monitoring of vibrations and review of monitoring data.

Professional judgments were necessary in relation to determining stratigraphy and soil properties from the subsurface investigations. Such judgments were based partly on the evaluation of the technical information gathered, and partly on our experience with similar projects. If further investigation reveals differences in the subsurface conditions and/or groundwater level, or if the proposed building elevations or design are different from those indicated herein, it is recommended that we be given the opportunity to review this new information and modify our recommendations, if deemed appropriate.

The results presented in this report are applicable only to the present study, and should not be used for any other purpose without our review and consent. This study has been conducted in accordance with the standard of care commonly used as state-of-the-practice in the profession. No other warranties are either expressed or implied.