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Geotechnical Evaluation Report

Proposed Maintenance Building Addition
NYSTA – Manchester Toll Plaza (MP 390.13)
Town of Manchester
Ontario County, New York

Prepared For

Clark Patterson Lee
205 Saint Paul Street, Suite 500
Rochester, New York, 14604

Prepared By

WMA Engineering, DPC
dba Empire Geotechnical Engineering Services
5167 South Park Avenue
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STATE OF NEW YORK
THOMAS R. SNYDER
079104
LICENSED PROFESSIONAL ENGINEER

9/6/19

Project No. WB-19-100-E
(SJB Project No. BE-19-100-E)
September 2019

A Woman Owned Firm

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September 6, 2019
Project No. WB-19-100-E
(SJB Project No. BE-19-100-E)

Clark Patterson Lee
205 Saint Paul Street, Suite 500
Rochester, New York
14604

Attn. Mr. James Basile, P.E.
Senior Associate

Re: Geotechnical Evaluation Report for
Proposed Maintenance Building Addition
NYSTA – Manchester Toll Plaza (MP 390.13)
Town of Manchester
Ontario County, New York

Dear Mr. Basile:

WMA Engineering DPC, dba Empire Geotechnical Engineering Services (Empire), is pleased to submit this geotechnical evaluation report for the above referenced project. One hard copy and one electronic file copy of this report are provided for your use. SJB Services, Inc. (SJB), our affiliated drilling company, completed two test borings at the site. On this basis, Empire prepared this report, which summarizes the subsurface conditions encountered and presents geotechnical recommendations for design and construction of the proposed addition. Clark Patterson Lee (CPL) retained Empire to complete this work, which was done in general accordance with our June 18th, 2019 proposal, that was authorized on June 20th, 2019.

Site and Project Description

The approximate location of the New York State Thruway Authority (NYSTA) Maintenance Building, at the Manchester Toll Plaza, is shown on Figure 1. The proposed addition is planned off the north side of the buildings east end, within a relatively level lawn and asphalt pavement area. Additional details regarding the existing site conditions are shown of Figure 2. The addition will be used as a break room and will consist of an approximate 25 feet wide by 40 feet long single story structure, with an at-grade floor slab. The building is planned to be constructed using "Fox Blocks", which consist of insulated concrete forms (ICF) with cast-in-place concrete. Exterior load bearing walls and one interior wall are planned. No isolated columns are planned.

Subsurface Exploration

The subsurface exploration program included two test borings, designated as B-1 and B-2, completed by SJB on August 8th and 9th, 2019. The test boring locations were initially established on a site plan provided by CPL. SJB then staked the test boring locations in the field using tape measurements referenced to the existing building. The approximate test boring locations are shown on Figure 2. Laser level survey techniques were utilized to determine the relative ground surface elevation at the test boring locations, using the floor of the existing building as a benchmark. The approximate benchmark location is shown on Figure 1, and was assigned an arbitrary datum elevation of 100.0 feet by SJB.

The test borings were made using a Central Mine Equipment (CME) model 550X, all terrain tire mounted drill rig, using hollow stem auger and split spoon sampling techniques. Split spoon samples and Standard Penetration Tests (SPTs) were taken continuously from the ground surface to a depth of 12 feet, with one additional sample obtained at 15 feet. 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"*.

Both test borings were drilled through the overburden until encountering auger refusal conditions at depths of 15.6 feet at test boring B-1 and 15.5 feet at test boring B-2, suggesting the top of bedrock was encountered. After encountering auger refusal within test boring B-1, 3.4 feet of rock core was obtained using an NQ'2' size core barrel.

A Geologist prepared the test boring logs based on visual observations of the recovered soil and rock core samples and a review of the driller's field notes. The soil samples were described based on a visual/manual estimation of the grain size distribution, along with characteristics such as color, relative density, consistency, moisture, etc. The rock core was also described, including characteristics such as color, rock type, hardness, weathering, bedding thickness, core recovery and rock quality designation (RQD). The test boring logs are presented in Appendix A, along with general information and a key of terms and symbols used to prepare the logs.

Subsurface Conditions

General

Beneath the topsoil, fill type soils were encountered which extended to a depth of about 4 feet. The remaining soils consisted of a mixture of sands and gravels with varying amounts of silt. Dolostone bedrock was encountered at a depth of about 16 feet. The soil and bedrock conditions encountered along with the groundwater conditions observed are described in more detail below and on the test boring logs in Appendix A.

Fill Soils

Fill soils were encountered beneath the topsoil at both test borings, which extended to a depth of about 4 feet. It should be expected that the fill thickness will vary between and away from the test boring locations and will extend to at least the bottom of any existing or former foundations, utility lines, or the excavations made to construct or remove these structures. The fill soils consisted mostly of silty sands and gravels, although a layer of silty clay was encountered from about 2 to 4 feet at test boring B-1. The Standard Penetration Test (SPT) "N" values obtained within the fill soils ranged from 2 to 20, indicating the fill soils have a "very loose" to "firm" relative density.

Indigenous Soils

Beneath the fill soils, and extending to the bottom of the test borings, the remaining soils consisted of silty sands, sandy silts, and gravels / sands. These soils are classified as SM, SW, SP, ML, and GW group soils using the USCS. The SPT "N" values obtained within these soils ranged from 4 to 30, indicating the soils have a "loose" to "firm" relative density.

Bedrock

Auger refusal was encountered at a depth of 15.6 feet within test boring B-1 and at a depth of 15.5 feet within test boring B-2. Following auger refusal within test boring B-1, 3.4 feet of bedrock coring was completed. The material recovered consisted of gray, medium hard, weathered, laminated to thinly bedded, Dolostone bedrock. The core recovery was 25% and the rock quality designation (RQD) value was 12%, indicating the recovered rock core has a "very poor" rock mass quality.

Groundwater Conditions

Following the completion of overburden drilling at test boring B-1, free standing water was measured at a depth of about 8 feet. The collected soil samples at this location were described as “moist to wet” at 4 feet and “wet” at 6 feet.

Test boring B-2 was advanced to 15.5 feet on August 8th, 2019, where auger refusal conditions were encountered. The augers were left in the ground overnight. The next morning, free standing water was measured at a depth of 13 feet. Similar to test boring B-1, the collected soil samples from test boring B-2 were described as “moist to wet” at 4 feet and “wet” at 6 feet to 10 feet.

It is possible the shallower zones of wet soils are the result of some perched or trapped groundwater within the upper soil stratums. A deeper, more general groundwater condition, appears to exist near a depth of 13 feet, based on the overnight water level reading made within test boring B-2.

Perched groundwater conditions can be more prevalent following heavy or extended periods of precipitation 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. Installation of a groundwater observation well would be necessary to better define the groundwater conditions at the site.

Geotechnical Recommendations

General

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

1. The subsurface conditions are generally suitable for construction of the proposed addition using a conventional spread foundation system. The geotechnical issues which should be addressed include the removal of existing fill soils, where present beneath the proposed spread foundation bearing grades.

2. Similar to spread foundations, it is common practice to also recommend that the existing fill soils be removed and replaced with a properly controlled and compacted engineered fill beneath the slab-on-grade floors. However, this is not expected to be economically practical. Accordingly, consideration can be

given to removing a portion of the existing fill and provide some additional Structural Fill/Subbase Stone beneath the slab-on-grade construction. There are some uncertainties with this approach, such as long-term differential settlement, which could potentially occur with leaving the fill soils in-place.

3. The existing building footings and foundation walls should be protected against potential undermining and lateral instability during excavation and construction of the new adjacent foundations.

4. Based on the subsurface conditions encountered in the test borings, the project site can be classified as Seismic Site Class “C” in accordance with ASCE 7, Table 20.3-1, as referenced in the Building Code of New York State (IBC 2015).

Spread Foundations

The spread foundations should bear on suitable, relatively undisturbed, indigenous soil bearing grades or on Engineered Fill (i.e. compacted Structural Fill, suitable flowable backfill, or crushed drainage stone), which is placed over suitable indigenous soil bearing grades, following the removal of the existing fill soils, and any unsuitable indigenous soils, which may be present and extend below the proposed footing grade.

Suitable indigenous soil bearing grades should consist of "firm" silty sand soils, which are free of all fill, organics, soft, loose, wet or otherwise deleterious conditions. Suitable bearing grade soils were encountered at a depth of about 4.0 feet within both test borings.

Subsurface conditions can be expected to vary between and away from the exploration locations and therefore could require adjustments in the suitable subgrade elevation based on actual conditions encountered at the time of construction. Accordingly, close full time inspection of the foundation bearing grades by qualified geotechnical personnel is recommended, as the foundation excavations are made at the time of construction.

If necessary, the foundations can be constructed on Engineered Fill (i.e. compacted Structural Fill, suitable flowable backfill, or crushed drainage stone), placed over suitable, undisturbed, indigenous soil subgrades.

If Structural Fill is placed beneath spread foundations, it should be placed beyond the foundation limits a horizontal distance equal to at least 0.5 times the thickness of the Structural Fill layer beneath the foundation. Excavations, therefore, will need to be planned and sized accordingly. Recommendations for Structural Fill material along with its placement and compaction are presented below.

Flowable backfill material, if used, should be a non-swelling type material and should have a minimum 28-day compressive strength (f'c) of 250 pounds per square inch (psi). The flowable backfill should extend at least 12 inches horizontally beyond the foundation limits for its entire depth.

Crushed drainage stone, if used, should be placed beyond the foundation limits a horizontal distance equal to at least 0.5 times the thickness of the drainage stone layer beneath the foundation. Therefore, excavations will need to be planned and sized accordingly. Following excavation, a stabilization/drainage geotextile (Mirafi 160 N or suitable equivalent) should be installed over the exposed soil subgrades, which can then be completely wrapped around the stone to encapsulate it from the surrounding soils. The crushed drainage stone should consist of a 2 inch minus, washed, crushed, coarse aggregate, and should be installed in lifts. Following placement of each lift, the stone should be compacted with a vibratory plate tamper to a visually dense and stable matrix.

Where any new foundation meets an existing foundation, the new foundation should meet the bearing grade of the existing spread foundation, which it will abut. This may require stepping the new foundation up or down away from the existing foundation to meet the design bearing grade for the new foundation. The existing foundation should also be protected from undermining or loss of lateral support during excavation and construction of the new adjacent foundation.

Continuous wall footings should be at least 2.0 feet in width. Exterior foundations should be embedded a minimum of 4.0 feet below finished exterior grades for frost protection. Interior foundations should be embedded a minimum of 2.5 feet below the finished floor elevation in order to develop adequate bearing capacity. All foundations, however, must bear on suitable bearing grades in accordance with the recommendations above.

Foundations constructed on suitable indigenous soil bearing grades or on Engineered Fill, which is properly placed over the suitable bearing grades can be sized based on a maximum net allowable bearing pressure of 2,000 pounds per square foot (psf). It is estimated that spread foundations sized and properly constructed in accordance with these recommendations will undergo a total settlement of less than 1 inch.

Slab-on-Grade Floor

As discussed above, the floor can be constructed as a slab-on-grade over the existing fill soils, provided NYSTA is willing to accept the risks associated with leaving a portion of the existing fill in-place. These risks include the potential for some on-going, long-term settlement, and unpredictable differential settlement, because of the variable composition and density of the fill, and potentially other undetected areas of unsuitable fill soils (i.e. organics, wood, etc.).

The existing fill soil subgrades should be thoroughly compacted and properly prepared and evaluated in accordance with our recommendations provided below, prior to placement of the geotextile and Subbase Stone material.

A minimum of 8 inches of Subbase Stone should be placed beneath the slab-on-grade floor. A suitable stabilization/separation geotextile, such as Mirafi 600X, should be placed over the prepared subgrades prior to placement of the Subbase Stone layer. The slab-on-grade floor can be designed using a modulus of subgrade reaction of 150 pounds per cubic inch at the top of the Structural Fill layer.

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. Any utility trenches located within the proposed addition should be backfilled with Structural Fill.

Seismic Design Considerations

Based on the subsurface conditions encountered in the test borings, the project site should be classified as Seismic Site Class "C" in accordance with ASCE 7, Table 20.3-1 of the Building Code of New York State (IBC 2015). Therefore, seismic design can be based on this seismic site classification.

The spectral response accelerations at the project site were obtained by Empire using the SEAOC / OSHPD web site application https://seismicmaps.org/. The accelerations are based on the 2008 USGS Seismic Hazard Data - Risk Targeted Maximum Considered Earthquake Ground Motion Response Acceleration Maps, as presented in the Building Code of New York State (IBC 2015).

Using the site location, the calculated spectral response accelerations for Site Class "B" soils are 0.149g for the short period (0.2 second) response (S_S) and 0.059g for the one second response (S_1). For design purposes, these spectral response accelerations must be adjusted for the Seismic Site Class "C" soil profile determined for the project site.

Accordingly, the adjusted spectral response accelerations for Site Class "C" are as follows:

- Short Period Response (S_{MS}) - 0.179g
- 1 Second Period Response (S_{M1}) - 0.100g

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

- S_{DS} - 0.119g
- S_{D1} - 0.067g

Construction and Material Recommendations

Dewatering

Construction dewatering will be required for surface water control and for excavations which encounter groundwater conditions. Surface water should be diverted away from open excavations and prevented from accumulating on exposed subgrades.

Dewatering should be implemented in conjunction with excavation work such that the work proceeds in the dry. Groundwater conditions should be maintained below the proposed excavation bottom. It is anticipated that diversion berms, proper site grading, cut-off trenches, and sump and pump methods of dewatering will be required, as a minimum, to control surface water and groundwater conditions, should they be encountered.

It is recommended that the Contractor excavate some test pits in advance of the excavation work, particularly where deeper excavations are required, to ascertain potential groundwater conditions and plan the dewatering that will be necessary. Groundwater dewatering plans should include implementation of measures to control erosion, sedimentation and the migration of soil fines.

Spread Foundation Excavation and Construction

Excavation to the proposed bearing grades should be performed using a method, which reduces disturbance to the bearing grade soils, such as a backhoe equipped with a smooth blade bucket. Any existing structures, topsoil, fill soils, organics, softer soils, and disturbed or otherwise deleterious materials, beneath the proposed foundation bearing grades, should be removed.

The soil bearing grades should be observed and evaluated by qualified geotechnical personnel, prior to placement of Engineered Fill or the foundation. Placement and compaction of Engineered Fill beneath foundations should also be observed and tested.

Where foundations are constructed directly on the indigenous soils, and where construction of the foundations proceed during seasonal wet periods and/or the foundations will not be constructed on the same day of the excavation, it may be desirable to place a 2 to 3 inch thick lean concrete mud mat in the excavation bottom to help protect the exposed subgrades and provide a suitable working surface for the foundation construction.

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 areas and adjacent pavement areas, be backfilled with a Structural Fill, as recommended in Appendix B.

Protection of Existing Structures

The excavation and construction of the foundations in relation to the adjacent building and utilities, should be carefully planned. The existing structures should be protected from potential excavation slope instability, soil relaxation and undermining. Proper sloping/benching of the excavation and/or temporary shoring and bracing of the existing adjacent structures and utilities will be required where the excavation extends below these structures.

Subgrade Preparation for Slab-on-Grade Construction

The following subgrade preparation should be implemented for the slab-on-grade floor construction over the existing fill soils.

- All pavement, topsoil, organics, vegetation, trees, stumps, and any other deleterious materials within the proposed addition should be removed.

- Any deleterious materials, such as wood, organics, etc., which are present within the fill soils at the bottom of the subgrade excavation, should be further undercut, removed, and replaced with additional Structural Fill material.
- The existing fill subgrades should be allowed to dry as necessary, and then be thoroughly compacted, using a vibratory smooth drum roller weighing at least 7 tons. The roller should be operated in the vibratory mode for compacting the subgrades and complete at least four passes over the exposed subgrades.
- The subgrades should then be proof rolled using a smooth drum roller weighing at least 7 tons, in the static mode. The proof-rolling should be done under the guidance of, and observed by qualified geotechnical personnel. Any areas which appear wet, loose, soft, unstable or otherwise unsuitable, should be undercut. Resulting over-excavations should be backfilled with controlled Structural Fill (Subbase Stone) as recommended below.
- A suitable stabilization/separation geotextile, such as Mirafi 600X, should be placed between the existing fill soil subgrades and the overlying Structural Fill/Subbase Stone layer for the slab-on-grade construction.
- The contractor should take precautions to limit construction traffic over the soil subgrades for the slab-on-grade floor construction. Any subgrades, including existing soil subgrades or fill subgrades, which become damaged, rutted or unstable should be undercut and repaired as necessary prior to placement of the Subbase Stone.

Structural Fill (Subbase Stone) Material

Structural Fill (Subbase Stone) material placed beneath the foundations and beneath floor slabs as subbase, should be a crusher run stone or a crushed gravel and sand product, which is free of clay, organics and friable or deleterious particles. The material should comply with NYSDOT Standard Specifications, Item No. 304.12 - Type 2 Subbase or Item No. 304.14 - Type 4 Subbase, with the condition that if a gravel and sand product is used (vs. a crusher run stone), the gravel should be a crushed gravel material, with at least 50% of the particles greater than ¼ inch, having a minimum of one crushed face. The Structural Fill should have the following gradation requirements.

Item 304.12 – Type 2 Subbase (crushed stone)		Item 304.14 – Type 4 Subbase (crushed gravel)	
Sieve Size Distribution	Percent Finer by Weight	Sieve Size Distribution	Percent Finer by Weight
2 inch	100	2 inch	100
¼ inch	25 to 60	¼ inch	30 to 65
no. 40	5 to 40	no. 40	5 to 40
no. 200	0 to 10	no. 200	0 to 10

The Structural Fill or Subbase Stone should be compacted to a minimum of 95 percent of the maximum dry density as measured by the modified Proctor test (ASTM D1557). Placement of the fill should not exceed a maximum loose lift thickness of 6 to 9 inches. It may be necessary to reduce the loose lift thickness depending on the type of compaction equipment used so that the required density is attained. The material should have a moisture content within two percent of the optimum moisture content at the time of compaction.

Suitable Granular Fill Material

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 4 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 beneath slab-on-grade 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. The Suitable Granular Fill should be placed and compacted in accordance with the requirements stated above for the Structural Fill.

Closing

This report was prepared to assist in the design and construction of the proposed addition to the Maintenance Building at the NYSTA – Manchester Toll Plaza, within the Town of Manchester, Ontario County, New York. The report has been prepared for the exclusive use of Clark Patterson Lee, and other members of the project design team, for specific application to this site and this project only.

The site information and recommendations were prepared based on Empire's understanding of the proposed project, as described herein, and through the application of generally accepted soils and foundation engineering practices. Empire should be consulted with any questions regarding the interpretation of the findings of our work, and/or the geotechnical considerations and recommendations presented. In addition, the recommendations presented are provided as guidance to the designer and should not be considered a project specification. No warranties, expressed or implied are made by the conclusions, opinions, recommendations or services provided.

Empire should be informed of any changes to the planned project so that it may be determined if any modifications to the information presented in this report are necessary. Empire and / or its designated representative should also be retained to review final plans and specifications and to monitor the foundation and site work construction to verify that the recommendations were properly interpreted and implemented.

Additional information regarding the use and interpretation of this report is presented in Appendix B.

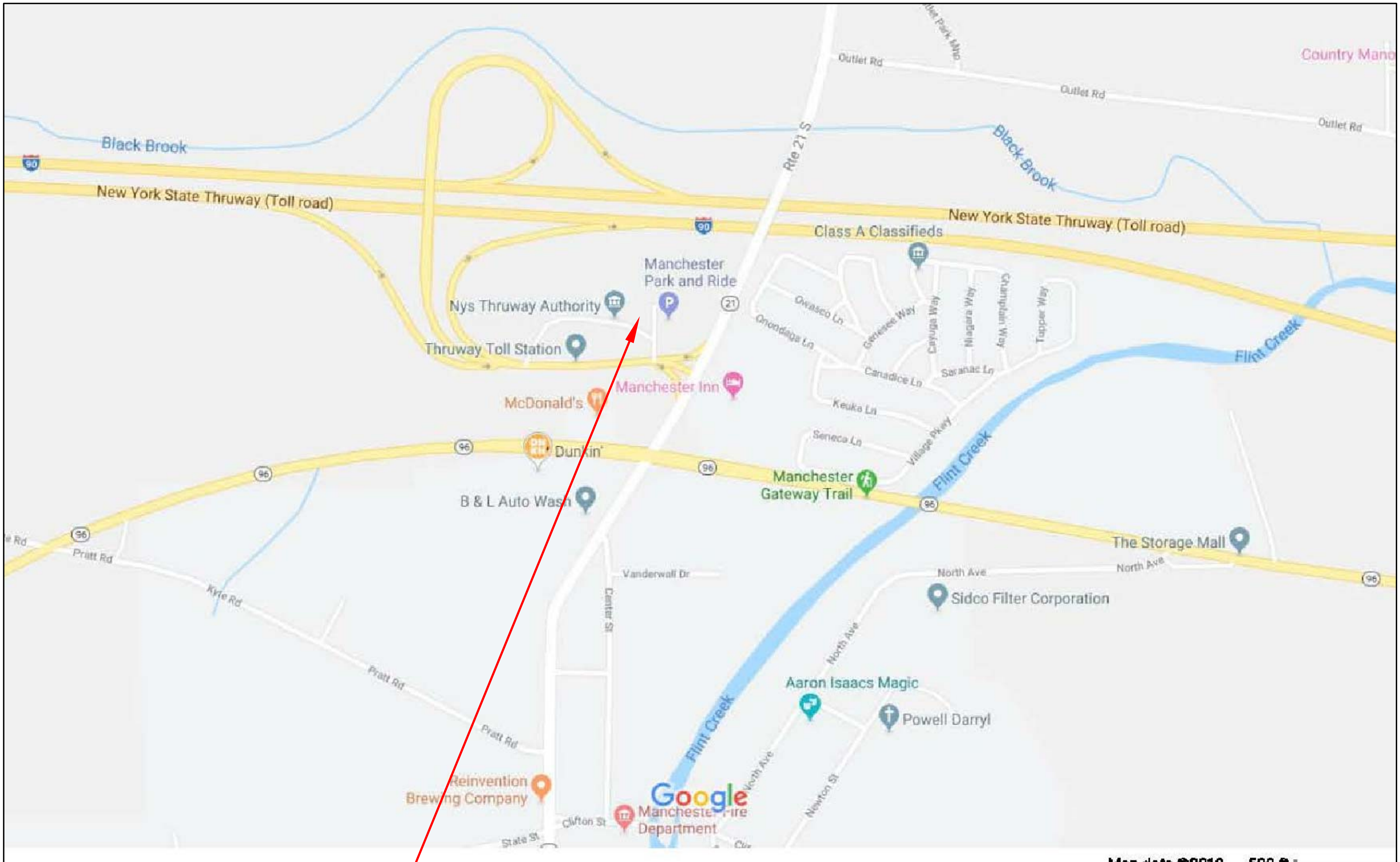
Respectfully Submitted:

WMA Engineering DPC
dba Empire Geotechnical Engineering Services

Thomas R. Seider

Thomas R. Seider, P.E.
Senior Geotechnical Engineer

FIGURES



APPROXIMATE PROJECT SITE LOCATION

N

NOTE:

SITE LOCATION PLAN DEVELOPED FROM GOOGLE EARTH

WMA ENGINEERING DPC|DBA
EMPIRE GEOTECHNICAL ENGINEERING SERVICES

PROPOSED MAINTENANCE BUILDING ADDITION
NYSTA - MANCHESTER TOLL PLAZA (MP 390.13)
TOWN OF MANCHESTER
ONTARIO COUNTY, NEW YORK

SITE LOCATION PLAN	DR BY: BVB	SCALE: NTS	PROJECT NO.: WB-19-100E
	CHKD BY: TRS	DATE: 09/4/2019	FIGURE NO: 1

LEGEND:

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

B.M. BENCHMARK: FLOOR AT OVERHEAD DOOR. ASSIGNED AN ARBITRARY DATUM ELEVATION OF 100.0 FEET BY SJB SERVICES, INC.

NOTE: FIGURE DEVELOPED USING GOOGLE EARTH.

N

WMA ENGINEERING DPC|DBA
EMPIRE GEO TECHNICAL
ENGINEERING SERVICES

PROPOSED MAINTENANCE BUILDING ADDITION
NYSTA - MANCHESTER TOLL PLAZA (MP 390.13)
TOWN OF MANCHESTER
ONTARIO COUNTY, NEW YORK

EXISTING SITE CONDITIONS

DR BY: BVB	SCALE: NTS	PROJECT NO.: WB-19-100E
CHKD BY: TRS	DATE: 09/4/2019	FIGURE NO: 2

APPENDIX A

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.**

DATE		
STARTED ______	**SJB SERVICES, INC.**	PROJ. No. ______
FINISHED ______	**SUBSURFACE LOG**	HOLE No. ______
SHEET ____ OF ____	SJB SERVICES, INC.	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 ⑧ ⑨ ⑩ *(numbered features explained on reverse)*

TABLE I

(symbol)	Split Spoon Sample
(symbol)	Shelby Tube Sample
(symbol)	Geoprobe Macro-Core
(symbol)	Auger or Test Pit Sample
(symbol)	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 8/9/2019 FINISH 8/9/2019 SHEET 1 OF 1	**SJB SERVICES, INC.** **SUBSURFACE LOG**	HOLE NO. B-1 SURF. ELEV 99.1' G.W. DEPTH See Notes

PROJECT: NYSTA BUILDING ADDITION LOCATION: EXIT 43
PROJ. NO.: BE-19-100-E MANCHESTER, NY

DEPTH FT.	SMPL NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N		SOIL OR ROCK CLASSIFICATION	NOTES
							TOPSOIL	Driller noted top soil at the
	1	2	6				Brown f-c SAND, little f-c Gravel, little Silt (moist, FILL)	surface
		5	5		11			
								REF = Sample Spoon
	2	2	1				Dark Brown Silty CLAY, little f-c Gravel, little f-c Sand (moist, FILL)	Refusal
		1	2		2			
5	3	6	10				Brown f-c SAND, little Silt, tr.gravel (moist-wet, firm, SM)	
		9	7		19			
	4	7	5				Becomes Gray, contains tr.silt, occasional Silt Seams (wet, loose)	
		4	4		9			
	5	2	2				Brown fine SAND, some Silt (wet, loose, SM)	
10		2	5		4		Gray f-c SAND, little Silt (moist, loose, SM)	
	6	16	17				(firm)	Free Standing Water recorded at 8' following auger refusal, and 7.4' after coring.
		12	20		29			
								Possible Highly Weathered Bedrock - Sample #7
15							Contains little fine Gravel	NQ '2' Size Rock Core
	7	12	50/0.1		REF			
							Gray DOLOSTONE, medium hard, weathered, laminated to thinly bedded, highly broken core.	RUN #1: 15.6' - 19.0' REC = 25% RQD = 12%
20							Boring Complete at 19.0'	

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: S. WOLKIEWICZ DRILL RIG TYPE : CME 550X

METHOD OF INVESTIGATION ASTM D-1586 USING HOLLOW STEM AUGERS

DATE			
START	8/8/2019	**SJB SERVICES, INC.**	HOLE NO. B-2
FINISH	8/9/2019	**SUBSURFACE LOG**	SURF. ELEV 98.6'
SHEET	1 OF 1		G.W. DEPTH See Notes

PROJECT: NYSTA BUILDING ADDITION LOCATION: EXIT 43
PROJ. NO.: BE-19-100-E MANCHESTER, NY

DEPTH FT.	SMPL NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	SOIL OR ROCK CLASSIFICATION	NOTES
	1	5	7			TOPSOIL Brown f-c SAND, some f-c Gravel, tr.silt (moist, FILL)	Driller noted top soil at the surface
		6	3		13		
	2	5	6			Contains little f-c Gravel, little Silt.	
		6	9		12		
5	3	7	12			Brown f-m SAND, tr.silt, occasional fine Sand seams (moist-wet, firm, SP)	
		15	10		27		
	4	8	6			Brown f-c SAND, tr.silt (wet, firm, SW)	
		5	5		11		
	5	8	6			Brown SILT, some f-c Sand, tr.gravel (wet, firm, ML)	
10		5	4		11		
	6	6	7			Gray f-c GRAVEL and f-c Sand, tr.silt (moist, firm, GW)	Possible Highly Weathered Bedrock - Sample #6
		25	50/0.4		32		
							REF = Sample Spoon Refusal
15							Poor Recovery - Sample #7
	7	50/0.1			REF	Boring Complete with Auger Refusal at 15.5'	Free Standing Water measured at 13' below ground surface on 8/9/19
20							

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: S. WOLKIEWICZ DRILL RIG TYPE : CME 550X

METHOD OF INVESTIGATION ASTM D-1586 USING HOLLOW STEM AUGERS

APPENDIX B

GEOTECHNICAL REPORT LIMITATIONS

GEOTECHNICAL REPORT LIMITATIONS

WMA Engineering DPC / DBA Empire Geotechnical Engineering Services (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.