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January 24, 2019

Job No: 18-610

The Gow School
2491 Emery Road
South Wales, New York 14139

ATTN: Mr. Marty O'Connor

RE: Geotechnical Engineering Report
Proposed Gow School Main Building
2491 Emery Road
Town of Aurora, Erie Co., New York

Gentlemen:

This report presents the findings of the subsurface investigation program and geotechnical engineering recommendations for the above referenced project. The geographic orientation of the project site is illustrated on the U.S. Geologic Survey (USGS) site location map in Figure No. 1. The project site is illustrated in Figure No. 2, entitled "Test Boring Location Plan", which includes: the approximate location of four test borings that were drilled by Buffalo Drilling Company, Inc. (BDC); relative ground surface elevations; and additional site details.

EXPLORATION METHODS

Sampling Method: A truck-mounted Diedrich D-50 rotary drill rig was used to drill four borings to depths ranging from approximately 25 to 50 feet below ground surface by using 2-1/4 inch inside diameter (ID), continuous flight hollow stem augers. Samples were recovered by driving a standard split-spoon sampler (2-foot long by 1-3/8 inch inside diameter) 24 inches with a 140-pound hammer falling 30 inches per blow per the American Society of Testing and Materials (ASTM) Standard D1586. The number of blows from six to 18 inches of penetration is defined as the Standard Penetration Test (SPT) N-value. Auger refusal, which may infer the top of bedrock, was not encountered during subsurface exploration.

Any encountered groundwater conditions are documented in the field on the driller's logs for each test boring. If indicators of groundwater are observed on the sampling equipment, the depth to groundwater is also checked and measured through the hollow stem augers at the completion of the sampling efforts.

Classification: The retrieved soil and fill samples were initially logged in the field by the driller, and a portion of each sample was placed and sealed in a glass jar. The boring logs, which are included in Appendix A, were based upon the field logs and a second visual classification of recovered samples in the laboratory by a geologist. Classification/identification of samples, as noted on the boring logs, is based on the Unified Soil Classification System (USCS) in ASTM D2487/D2488. Refer to Appendix B entitled, "Geotechnical Reference Standards", for an explanation of the terminology that is used for soil and rock descriptions.

Laboratory Testing: Laboratory soil testing was undertaken on several retrieved split spoon samples. The overall laboratory testing program consisted of the following test methods:

- Grain-Size Analysis of Soil — ASTM D421/422
- Water (Moisture) Content of Soil — ASTM D2216

Table No. 1 presents the tabulated results of the physical/soil index properties. The associated graphical illustration of the data is included in Appendix C.

SITE AND SUBSURFACE CONDITIONS

General: The proposed site for development is located within The Gow School campus on 2491 Emery Road, in the Town of Aurora, Erie County, New York. The project will include a two-story main building for the school, directly southwest of the existing main building. The site topography slopes gradually to the northwest with ground surface elevation at the test boring locations varying by less than two feet.

Subsurface Soil Conditions: In general, subsurface conditions, underlying a six to nine-inch-thick layer of topsoil or asphalt pavement, consist of naturally deposited layers of silty clay and silty sand and gravel which mantle cohesive glacial till that extends the remaining depth drilled.

Beneath the topsoil or asphalt pavement, naturally deposited silty clay exists and extends approximately two to four feet below ground surface. Additionally, a second layer of clay was encountered approximately 20 feet below ground surface and extends the remaining depth drilled at borings B-1, B-2 and B-4 and to a depth of approximately 43 feet, elevation 881.40 ± feet, at the deep boring B-3. This soil generally consists of moderately plastic, clay with appreciable amounts of silt and lesser amounts of fine-sized to coarse-sized sand and gravel. The consistency of this soil is generally stiff to very stiff in the upper layer and soft to stiff in the lower layer. Moisture contents of retrieved samples increased with depth from moist in the upper portions to wet in the lower portions. The increase is related to proximity to static groundwater table. Isolated pockets of silty clay where encountered within the silty sand and gravel soil at borings B-1 and B-3, 10 to 14 feet below ground surface. These pockets are consistent with the lower clay layer described above. The proposed footing bearing grades for the building will be within or slightly above this soil.

Between the upper and lower cohesive silty clay layers, a 16 to 18-foot-thick layer of naturally deposited silty sand and gravel was encountered. This soil consists of fine to coarse-grained sand and gravel with little to trace quantities of silt and clay. Relative densities are primarily loose with moisture contents ranging from moist to wet increasing with depth and proximity to the static groundwater table. The proposed footing bearing grades for the building will be within or slightly above this soil.

Beneath the lower silty clay layer approximately 42 feet below the ground surface, cohesive glacial till exists and extends the remaining depth drilled. The till generally consists of moderately plastic, clay with appreciable amounts of silt and lesser amounts of sub-rounded fine-sized to coarse-sized sand and gravel. The consistency of this soil is stiff to very stiff with moisture contents of retrieved samples noted to be moist.

Bedrock: Auger refusal, which is generally inferred to be the top of the apparent bedrock surface, was not encountered during subsurface exploration. The depth to the top of the apparent bedrock surface is believed to be approximately 100 feet below the ground surface. Based upon the regional geology the bedrock type beneath the site would be the Angola and Rhinestreet Shale Members of the West Falls Group.

Groundwater: Groundwater was encountered at depths ranging from 14 to 20 feet below ground surface. Note that the groundwater readings were taken at the completion of drilling efforts and, therefore, an adequate amount of time for the groundwater level to recharge to static conditions was probably not allowed. However, based upon observed conditions static groundwater level at or near elevation 910.00 ± feet. Fluctuations in the groundwater level may occur due to other factors than those present during field operations.

EARTHQUAKE/SEISMIC CONSIDERATIONS

Site Class Definition: For the given site conditions, the most applicable site definition is Site Class E, as listed in Table 1613.5.2 of the Building Code of New York State, © 2010.

Liquefaction Potential: For the Site Class E, the design spectral response acceleration parameters S_{DS}, at 0.2 seconds, and S_{D1}, at one second, are 0.36g and 0.12g (g = 32.2 feet/sec^2), respectively, for this part of Erie County, New York (see Appendix D). These values have a two percent probability of being exceeded in 50 years. Based upon the above conditions and an approximate magnitude 6.0 earthquake on the Richter Scale, the potential for liquefaction or settlement of Site Class E soil is considered moderate.

FOUNDATION DESIGN AND CONSTRUCTION RECOMMENDATIONS

General: This section will present and discuss recommendations on foundation design and construction and placement of controlled fills, and subgrade and base layer requirements for concrete floor slabs, paved parking and roadway areas.

As shown in Figure No. 2, the proposed development will include a two-story main building. The existing ground surface slopes gradually across the proposed development area with elevations varying by less than two feet. Finish first floor elevation for the building is assumed to closely match existing main building noted as 925.00 ± feet. The final exterior grade is assumed about one-half foot below finished floor at elevation 924.50 ± feet.

Site Preparation and Earthwork General site preparation will include the demolition and complete removal of any encountered foundations and floor slabs, and removing all unsuitable surficial material (i.e., asphalt pavement, concrete, brick, expansive slag, organic or topsoil layer, and construction and demolition-like fill) to a depth where firm, granular or cohesive fills or naturally occurring soils are encountered. It is recommended, particularly in the location of the proposed structures, that any slag and/or cinder/ash containing material, if encountered, should be tested to determine the expansion and corrosion characteristics (where applicable for direct or potential contact with foundation elements and buried utilities) of these materials prior to their use on-site. Any rubble-like and brick fill, boulders, or wood fill in particular, if encountered, will require undercutting. The proposed building and paved areas are to be proof rolled with a fully loaded ten-wheel dump truck. All encountered soft and disturbed zones should be undercut and stabilized with granular fill that is placed in compacted lifts prior to placement of additional fill materials above. Refer to Appendix E entitled "General Earthwork Specification" for definition of the fill types and gradations, recommended minimum compaction requirements for various site developments, and placement and compaction methods. The NYS Department of Transportation (NYSDOT) specification numbers for typical aggregate subbase/base course components that are included in the select granular fill category as are as follows: Item No. 304.12 (Metric) Subbase Course, Type 2 (< 2-inch maximum size), which is preferred; or Item No. 304.14 (Metric) Subbase Course, Type 4 (< 2-inch maximum size).

It is unknown if any former residential/commercial structures existed at the project site. It is also unknown if any former footings and foundation walls may be buried at the proposed site. Septic tank and system locations and the abandonment conditions or practices are normally unknown. If encountered during site development, it is recommended that any tanks and systems should be properly removed/treated/remediated relative to the proposed development and under the applicable local and state regulations. The remaining cavities, from the aforementioned items, should be backfilled with select/approved granular fill that is placed in thin lifts and compacted to the minimum recommendation, as presented in this report, for the proposed development at that cavity location.

Shallow Foundation: The recommended foundation type is shallow footings. Continuous strip and spread exterior footings and interior spread footings would bear at an elevation of four feet or lower below final grade, at elevation 920.50.00 ± feet or lower. A four-foot minimum footing depth (as required by local or New York State code) is needed to provide adequate protection from frost for exterior footings.

The exterior and interior footings are recommended to bear at the same relative elevation on stable, naturally deposited medium dense or better silty sand with gravel or on thin layers of thoroughly compacted (minimum of 95 percent of the maximum dry density by ASTM D 1557) select/approved granular fill that is placed on an approved subgrade. If needed, a geotextile strength and filter fabric (such as, Mirafi 600X) may be used to line the excavation bottom for the purpose of stabilizing the excavation and placement of the select/approved granular fill. Alternatively, in heated buildings the interior footings are recommended to bear two and one-half feet or lower below finish floor at elevation 922.50 ± feet and on the same soil/fill conditions as the exterior footings. Due to the presence of loose and wet natural soils, specifically at borings B-3 and B-4, compaction of the trench bottom bearing soils to a minimum of 92% of maximum dry density as per ASTM D1557 and field verification via in-place nuclear density testing every 25 linear feet of trench will be necessary to improve bearing conditions. If compaction is not successful a minimum one-foot undercut will be necessary to remove soils unsuitable to direct foundation bearing. Refer to Appendix D "Engineering Computations and Schematics" for more detailed information regarding undercuts.

Undercut areas beneath proposed foundations must extend laterally beyond each vertically projected edge of the foundation by a minimum distance equal to one-half the total depth of the undercut or equating to a slope of two vertical to one horizontal from the bottom foundation corner. The undercuts and placement of compacted select/approved granular fill are required to ensure a suitable and more uniform bearing media for the footings, and to prevent unacceptable differential settlements.

Wall footings should have a minimum two-foot width and column footings should have a minimum three-foot width. Based on the above described conditions, the recommended maximum net allowable foundation bearing pressure is 1,500 pounds per square foot (psf) of bearing area. All footings for the proposed buildings are recommended to be designed near the same contact pressure. The recommended maximum net allowable foundation bearing pressure is based on generally accepted design methods for cohesive soil conditions. Based on the provisions of the above recommendations and estimated design requirements and utilization of proper construction procedures and experienced field supervision and testing personnel, total and differential settlements are estimated to be less than one inch and 3/4's inch, respectively. Refer to Appendix D for additional foundation design and construction details.

Additional Foundation Considerations: In addition to the above, the following recommendations will provide additional assurances with regard to proper foundation construction.

a) All fill placed beneath, adjacent, or above foundations must comply with the "General Earthwork Specification", included as Appendix E.

b) Backfill of foundations with approved select granular fill must be completed prior to placement of substantial superstructure loads, except for basement walls or substructure areas that may additionally require superstructure loads and possibly internal bracing.

c) The upper silty materials may rut and "pump" if exposed to excessive surface water and repeated construction traffic. Proper site management and fill placement operations are needed to minimize costly undercuts and subgrade repairs prior to placement of concrete slabs and asphalt pavement. It is noted that construction during wet/rainy and/or Fall and Spring conditions may require added precautions and possibly a thicker base layer to maintain a stable subgrade condition.

d) Step footings, if utilized, should have a rise to run ratio of 1:2, with a two-foot maximum rise and a four-foot minimum run between steps or as recommended by the design structural engineer.

e) The recommended at rest (rigid wall), active, and passive static earth pressure coefficients for unsaturated, select granular sandy gravel fill against an earth retaining structure/wall are 0.76, 0.24, and 2.8 (with an ultimate value of 4.2), respectively. The respective equivalent static lateral fluid pressures are recommended to be 90, 30 and 330 (with an ultimate value of 500) pounds per square foot (psf) per foot depth which are based upon a moist, compacted unit backfill weight of 120 pounds per cubic foot (pcf). The at rest value would account for the average expected compaction induced stresses and/or the potential influences of hydrostatic pressure. The static lateral fluid pressures can be directly proportioned for other unit weights.

<u>Stabilization of Excavations</u>: The trench/excavation sidewall stability concerns can be addressed with the Occupational Safety and Health Act (OSHA) requirements as set forth in Subpart P of 29 CFR Part 1926, Sections 1926.650 to 1926.652. In lieu of a properly designed shoring system, side slopes of the trench excavation should be one on one (vertical to horizontal distance) or flatter in cohesive soils or one on one and one-half or flatter in the granular materials, as required by OSHA.

Water must not be allowed to accumulate or pond on exposed foundation bearing grades. Surface water and groundwater from within the excavation must be either pumped, diverted or channelized by gravity flow to effectuate the construction of the proposed foundation. Pockets of localized perched groundwater may seasonally be expected to be encountered at footing and/or footing undercut bearing grades. At these locations, dewatering with surface sumps may be required to maintain stable side slopes and excavation bottom.

<u>Concrete Interior Floor Slab(s)/Pad</u>: For the most part and based on test results for similar soils/fills, slightly to moderately plastic cohesive natural soils/fills may be somewhat difficult to compact in a controlled manner considering the varying soil plasticity and natural moisture contents that are estimated to be at to wet of optimum, at the time of this investigation. Excavated and approvable cohesive soil/fill types are not

expected to be available in any reasonable quantities. These soils/fills may be expected to be suitable for re-use as general fill with the implementation of uniformly applied soil conditioning (i.e., drying and blending) and compaction methods, if additional volume of soil for backfill is needed.

Excavated and approvable granular (i.e., sand or gravel and non-plastic silt and sand) soil/fill are not expected to be available in any reasonable quantity. For the most part, granular (i.e., sand or gravel) soil/fill is expected to be acceptable for on-site re-use, as general/ordinary fill without substantial reworking and/or modification, while silty fine-sized sand may first require drying and blending.

Dissimilar excavated materials should not be commingled prior to their use elsewhere on-site, unless designated for a green/vegetation area. General fill material is also recommended to be placed on prepared and approved subgrade and in accordance with previous recommendations.

A geotextile fabric (such as, Mirafi 600X or equal) that separates the subgrade and the approved/select granular base layer may be needed and is particularly recommended for sensitive cohesive/fine-grained/silty clay subgrade soil/fills. This approach will stabilize and provide a workable building pad condition with minimal required repairs.

The approved subgrades will most likely consist of medium stiff or better/thoroughly compacted (i.e., minimum 92 percent of the maximum dry density by ASTM D 1557) natural silty clay and/or a thoroughly compacted imported select/approved granular fill. Above the approved subgrades, a minimum eight-inch thick select granular fill (i.e., number two crusher run stone or equal) layer is recommended as the base course for the proposed building concrete floor slab. The NYSDOT specification numbers for typical aggregate subbase/base course components are Item No. 304.12 (Metric) Subbase Course, Type 2 (< 2-inch maximum), which is preferred, or Item No. 304.14 (Metric) Subbase Course, Type 4 (< 2-inch maximum). This select granular base layer would be compacted to a minimum 95 percent of the maximum dry density by ASTM D 1557. The floor slab for the proposed building is recommended to be a four-inch minimum thickness or is as determined by the design structural engineer. The floor slab reinforcement should be provided through placement of wire mesh or plastic fibers and is also as determined by the design structural engineer.

At the discretion of the design architect, a vapor barrier may be considered for use in the proposed structure. The use of a thin gravel cushion, as a capillary break, or a thin sand cushion over a vapor barrier that is placed beneath the concrete slab(s) are at the discretion of the design architect/engineer or as required by local code. Gradations of gravels that are satisfactory capillary breaks include 1 ¼-inch or ¾-inch crushed stone or aggregate per the ASTM D2321 Types IA, IB and II with less than 5 % fines. A number two crusher run stone may also be applicable, but the gradation and material property specifications must qualify.

At the assumed final site grade and based upon the thickness and character of the underlying fill and natural soils, the subgrade modulus is recommended not to exceed 150 pounds per cubic inch (pci). A Poisson Ratio of 0.4 is recommended for design purposes. Isolation of the floor slabs from the footings-piers-columns and walls do appear to be warranted. Based upon the subgrade modulus and slab mechanical properties and thickness, the design structural engineer may accordingly adjust the granular aggregate base thickness.

Exterior Concrete Slabs-on-Grade/Pad/Parking and Roadway Facilities: The characteristics of the fill and natural soils and the known frost penetration in Western New York require that specific attention is provided to the design and construction of paved roadway and parking areas. For new pavement sections, isolated pockets of surficial silty/cohesive/fine-grained soil/fill may be encountered and may be too soft and wet in the proposed parking and roadway areas. These types of soil/fill may be adequately conditioned (i.e., dried and blended) and compacted (i.e., minimum 90 percent compaction) to support necessary construction equipment and normal pavement section. Otherwise, the removal/undercutting of the silty/cohesive/fine-grained soil/fill to a firm, approved subgrade and subsequent placement and compaction of select or approved granular fill will be required in order to accommodate the recommended pavement sections.

For new pavement sections, it is recommended that the subgrade surface is adequately graded and/or underdrains are installed to prevent water accumulation. Above the approved subgrade surface (i.e., minimum 90 percent compaction), a minimum eight-inch thick select granular layer is recommended as the base course for lightly traveled roadway and parking areas (standard duty section). A geotextile filter and strength fabric (such as, Mirafi 600X or equal) and minimum 12-inch thick base course are recommended for all truck routes and heavily traveled roadways (heavy duty section). If "pumping" of the silty/cohesive/fine-grained soil subgrade occurs or is difficult to stabilize during construction, an increase in the base thickness to that of the heavy-duty section and/or a geotextile filter and strength fabric is recommended to be placed on the prepared and approved subgrade for the standard duty section. The NYS Department of Transportation (NYSDOT) specification numbers for typical aggregate subbase/base course components are Item No. 304.12 (Metric) Subbase Course, Type 2 (< 2-inch maximum size), which is preferred, or Item No. 304.14 (Metric) Subbase Course, Type 4 (< 2-inch maximum size). The granular aggregate base layer is recommended to be compacted to at least 95 percent of maximum dry density by ASTM D1557.

The thickness of top and binder course layers should be determined in accordance with AASHTO methods. In summary, the minimum recommended asphalt thicknesses for the heavy-duty section and standard duty section are three and one-half inches and three inches, respectively. The top and binder course layers are recommended to be designed and constructed in accordance with New York State Department of Transportation Standard Specification.

Limitations, Field Inspections and Monitoring: This report is based on the preliminary information that is provided by project representatives and the subsurface conditions that were encountered at the test boring locations. Due to the nature of the investigation method, test pit excavation will provide a greater level of delineation of the subsurface soil/fill/rock conditions than can be defined by the test boring data alone. As detailed in Appendix F "Limitations", modification regarding proposed building/structure locations and other site developments can result in changes to provided recommendations. It is recommended that the geotechnical engineer be provided the opportunity to generally review the final detailed design and contract specifications. Required earthwork and foundation construction should be done under the supervision of experienced construction personnel and in a manner consistent with proven methods. All site work should be carefully monitored and tested by experienced geotechnical personnel to assure compliance with earthwork and foundation construction specifications.

Thank you for the opportunity to assist on this project. If questions should arise, please call the undersigned at your earliest convenience.

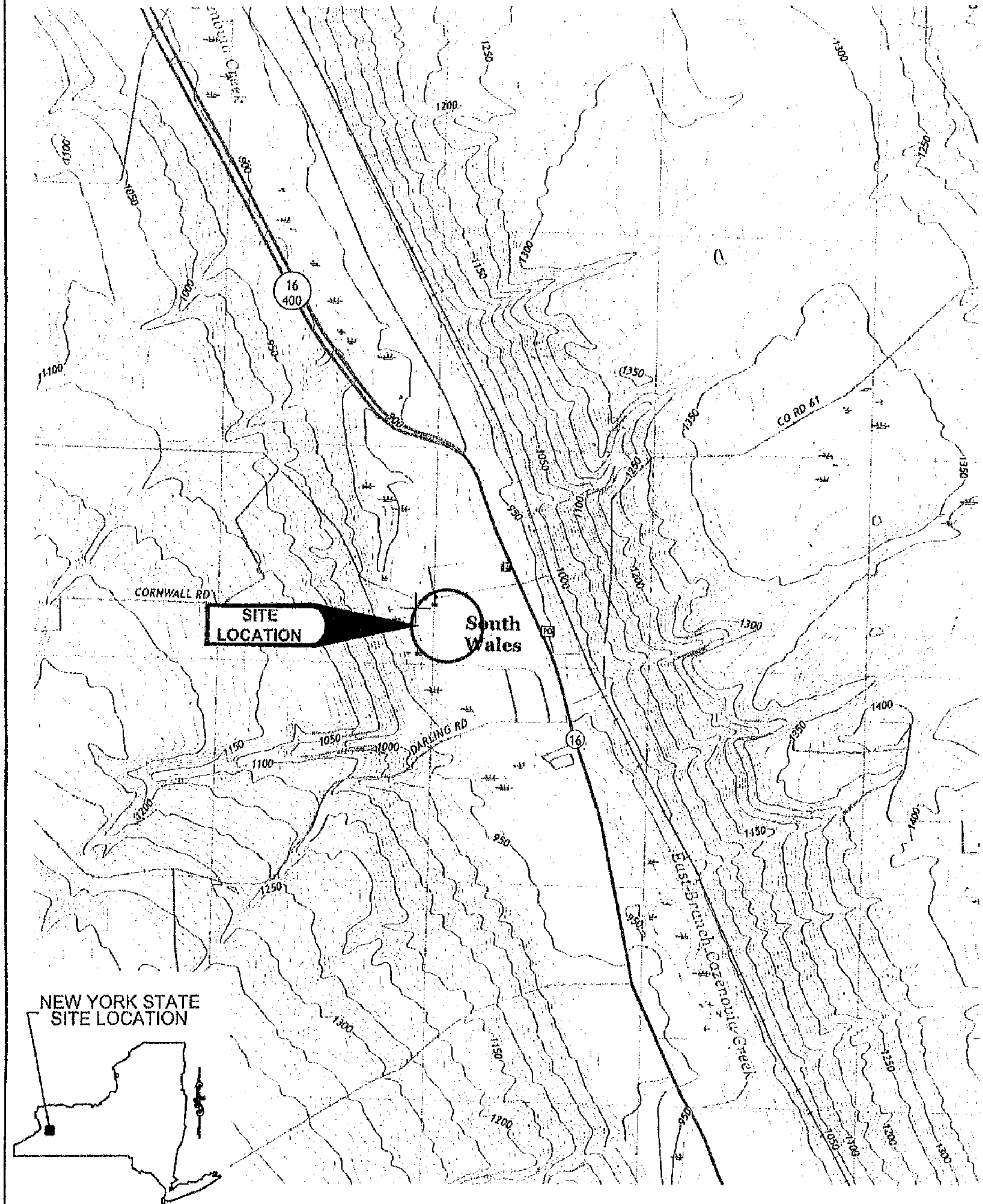
Very truly yours,
BARRON & ASSOCIATES, INC.
and
BUFFALO DRILLING COMPANY, INC.

Andrew J. Camping, PG
Senior Geologist

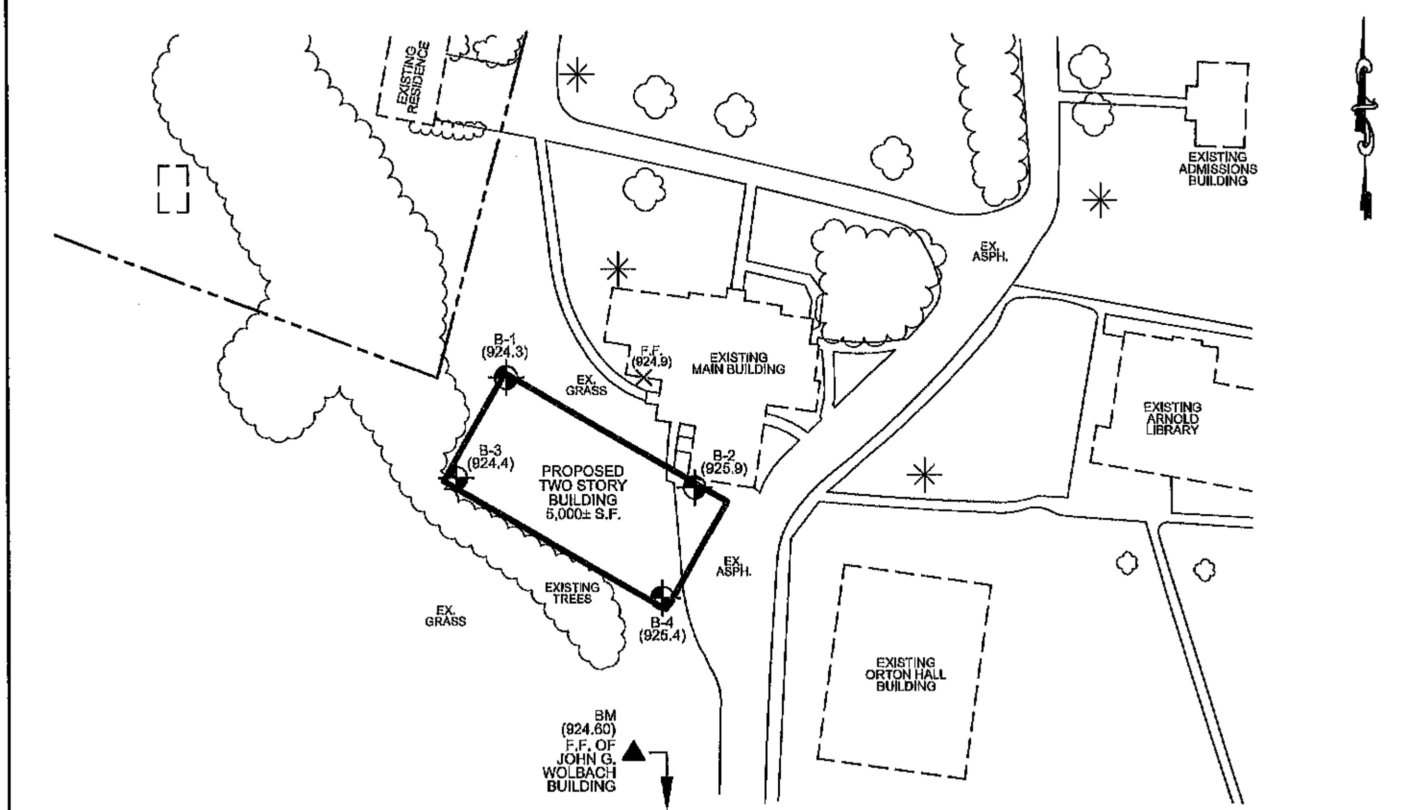
James S. Barron, PE
President/Geotechnical Engineer

STATE OF NEW YORK ★ JAMES S. BARRON ★ 58612 ★ LICENSED PROFESSIONAL ENGINEER

1.23.19



BARRON & ASSOCIATES, P.C. & BUFFALO DRILLING COMPANY 10440 MAIN ST. CLARENCE, NY 14031 (716)759-7821 FAX (716)759-7823 INFO@BUFFALODRILLING.COM INFO@BARRONANDASSOCIATESPC.COM	CLIENT: THE GOW SCHOOL 2491 EMERY ROAD SOUTH WALES, NEW YORK 14139 PROJECT: PROPOSED GOW SCHOOL MAIN BUILDING 2491 EMERY ROAD TOWN OF AURORA, ERIE CO., NEW YORK 14139	USGS SITE LOCATION PLAN HOLLAND, QUAD 2016	
		JOB NO.: 18-610	SCALE: 1" = 2000' ±
DRAWN: DAN KASPROWICZ		DATE: 1/7/2019	FIGURE NO. 1



LEGEND

⯐	B-2	= TEST BORING & NO.
	(925.9)	= GROUND SURFACE ELEVATION (FT.)
×		= SPOT ELEVATION
▲	BM	= BENCH MARK (FINISH FLOOR OF EXISTING BUILDING)

NOTES:

1. BORINGS, BUILDINGS, SITE FEATURES, PROPERTY LINE LOCATIONS, AND SCALE OF DRAWING ARE APPROXIMATE.
2. BASE MAP REFERENCE PROVIDED BY YOUNG WRIGHT ARCHITECTURAL, TITLED "ATTACHMENT A - PROPOSED NEW 2-STORY BUILDING APPROX. 50' X 100'", UNDATED.
3. BENCH MARK ELEVATION PROVIDED BY RJR ENGINEERING, P.C., TITLED "EXISTING UTILITIES - THE GOW SCHOOL", PROJECT NO. 11039, SHEET NO. 1 OF 1, LAST REVISION DATED 9/2/2011.

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DRAWN: DAN KASPROWICZ

CLIENT: THE GOW SCHOOL
2491 EMERY ROAD
SOUTH WALES, NEW YORK 14139

PROJECT: PROPOSED GOW SCHOOL MAIN BUILDING
2491 EMERY ROAD
TOWN OF AURORA, ERIE CO., NEW YORK 14139

TEST BORING LOCATION PLAN

0 30 60 120

JOB NO.: 18-610	SCALE: 1" = 60' ±
DATE: 1/7/2019	FIGURE NO. 2

BARRON & ASSOCIATES, P.C. &
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B&A JOB NO: 18-610
CLIENT: The Gow School
PROJECT: Proposed Gow School Main Building
2491 Emery Road
Town of Aurora, Erie Co., New York 14139

TABLE NO. 1
LABORATORY PHYSICAL SOIL TEST RESULTS

Boring No.	Sample No.	Depth	Moisture Content ASTM D2216	Organic Matter Content ASTM D2974	Unconfined Compressive Strength ASTM D2166	Wet Density ASTM D2166	Grain Size Analysis ASTM D422				Atterberg Limits ASTM D4318			USCS Soil Classification ASTM D2487 / ASTM D2488 *
							Gravel	Sand	Silt	Clay	LL	PL	PI	
		(ft.)	(%)	(%)	(psf)	(pcf)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(-)
B-3	S-1	0-2	41.2	-	-	-	-	-	-	-	-	-	-	CL
	S-2	2-4	21.3	-	-	-	-	-	-	-		-	-	CL
	S-3	4-6	11.2	-	-	-					-	-	-	SM
	S-4	6-8	9.9	-	-	-	34.9	48.1	17.0		-	-	-	SM
	S-5	8-10	31.4	-	-	-					-	-	-	SM
	S-6	10-12	22.8	-	-	-	-	-	-	-	-	-	-	CL
	S-7	14-16	21.4	-	-	-	-	-	-	-	-	-	-	SM
	S-8	19-21	23.0	-	-	-	-	-	-	-	-	-	-	SM
	S-9	24-26	30.4	-	-	-	-	-	-	-	-	-	-	CL
	S-10	29-31	40.0	-	-	-	-	-	-	-	-	-	-	CL
	S-11	34-36	25.6	-	-	-	-	-	-	-	-	-	-	CL
	S-12	39-41	35.8	-	-	-	-	-	-	-	-	-	-	CL
	S-13	44-46	10.7	-	-	-	-	-	-	-	-	-	-	CL-Till
	S-14	48-50	8.3	-	-	-	-	-	-	-	-	-	-	CL-Till

* Soil classification based on visual identification and soil classification of adjacent samples (as applicable).

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APPENDIX A

TEST BORING LOGS

BARRON & ASSOCIATES, P.C. &
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CLARENCE, NEW YORK 14031
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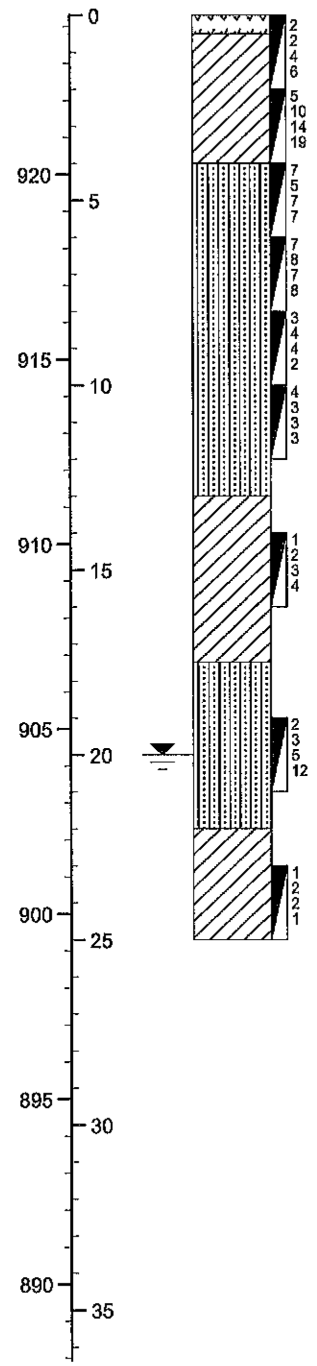
TEST BORING LOG

JOB No.: 18-610 **BORING No.:** B-1

PROJECT: Proposed Gow School Main Building
2491 Emery Road, Town of Aurora, Erie Co., New York 14139

DRILLER:	J. Garnder	**TYPE OF DRILL RIG:**	Diedrich D-50 (Truck)
SAMPLING METHODS:	ASTM D1586	**SIZE AND TYPE OF BIT:**	2 1/4" I.D. H.S.A.
DATE STARTED:	1/10/19	**SURFACE ELEVATION (ft.):**	924.3
DATE COMPLETED:	1/10/19	**GROUNDWATER DEPTH (ft.):** (measured at completion unless indicated below)	20.0'

Elevation/ Depth (feet) | Soil Symbols Sampler Symbols Field Test Data



Sample No. : Range	N-Value	% REC (RQD)	Soil and Rock Description / Remarks
			Topsoil (6")
S-1 : 0.0'- 2.0'	6	0	Brown, m. stiff CLAY, some Silt, little f. Sand, tr. Gravel, mod. plastic, moist (CL) *(Driller took auger cuttings.)*
S-2 : 2.0'- 4.0'	24	0	...grade: v. stiff *(Driller took auger cuttings.)*
S-3 : 4.0'- 6.0'	12	60	Brown, m. dense f/c SAND and Gravel, little Silt, tr. Clay, non-plastic, moist (SM)
S-4 : 6.0'- 8.0'	15	0	Same as S-3 *(Large gravel blocking cutting shoe.)*
S-5 : 8.0'- 10.0'	8	10	...grade: loose, wet
S-6 : 10.0'- 12.0'	6	30	Same as S-5
S-7 : 14.0'- 16.0'	5	100	Gray, m. stiff CLAY, some Silt, little f. Sand, tr. Gravel, mod. plastic, moist (CL)
S-8 : 19.0'- 21.0'	8	100	Gray, loose f/c SAND, some Silt, tr. Gravel, tr. Clay, non-plastic, wet (SM)
S-9 : 23.0'- 25.0'	4	80	Gray, m. stiff CLAY, some Silt, little f. Sand, tr. Gravel, mod. plastic, wet (CL)

Depth to Bottom of Hole: 25.0 feet

Logged by: B. Smith

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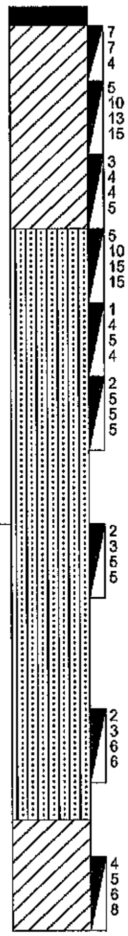
TEST BORING LOG

JOB No.: 18-610 **BORING No.:** B-2

PROJECT: Proposed Gow School Main Building
2491 Emery Road, Town of Aurora, Erie Co., New York 14139

DRILLER: J. Garnder
SAMPLING METHODS: ASTM D1586
DATE STARTED: 1/11/19
DATE COMPLETED: 1/11/19
TYPE OF DRILL RIG: Diedrich D-50 (Truck)
SIZE AND TYPE OF BIT: 2 1/4" I.D. H.S.A.
SURFACE ELEVATION (ft.): 925.9
GROUNDWATER DEPTH (ft.): 14.0
(measured at completion unless indicated below)



Soil Symbols / Sampler Symbols / Field Test Data	Sample No. : Range	N-Value	% REC (RQD)	Soil and Rock Description / Remarks
				Asphalt (6")
7, 7, 4	S-1 : 0.5'- 2.0'	11	70	Brown, stiff CLAY, some Silt, little Gravel, little f/c Sand, mod. plastic, moist (CL)
5, 10, 13, 15	S-2 : 2.0'- 4.0'	23	30	...grade: v. stiff, tr. Gravel
3, 4, 4, 5	S-3 : 4.0'- 6.0'	8	70	...grade: m. stiff
5, 10, 15, 15	S-4 : 6.0'- 8.0'	25	10	Brown, m. dense f/c SAND and Gravel, little Silt, tr. Clay, non-plastic, moist (SM)
1, 4, 5, 4	S-5 : 8.0'- 10.0'	9	15	...grade: Gray, loose, wet
2, 5, 5, 5	S-6 : 10.0'- 12.0'	10	10	Same as S-5
2, 3, 5, 6	S-7 : 14.0'- 16.0'	8	100	Same as S-5
2, 3, 6, 6	S-8 : 19.0'- 21.0'	9	100	...grade: some Silt
4, 5, 6, 8	S-9 : 23.0'- 25.0'	11	75	Gray, stiff CLAY, some Silt, little f. Sand, tr. Gravel, mod. plastic, wet (CL)

Depth to Bottom of Hole: 25.0 feet

Logged by: B. Smith

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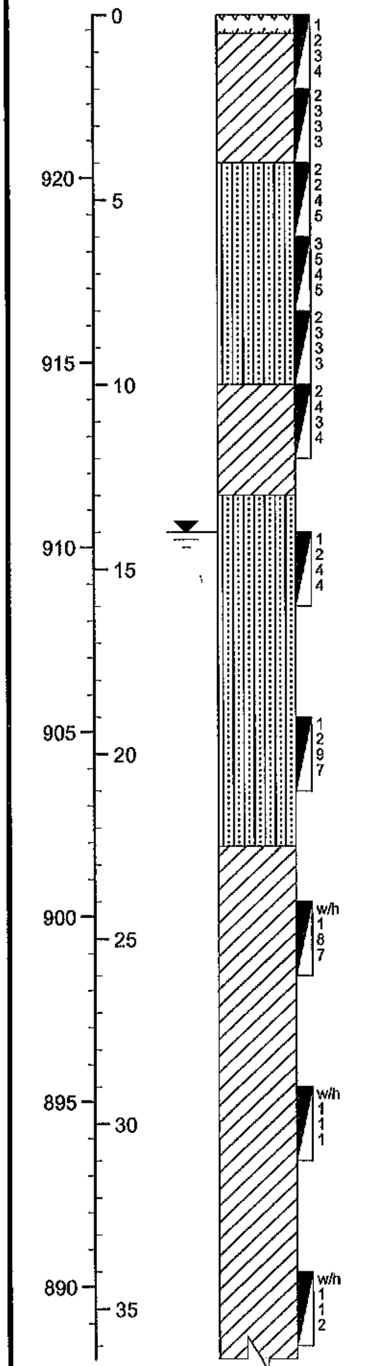
TEST BORING LOG

JOB No.: 18-610 **BORING No.:** B-3

PROJECT: Proposed Gow School Main Building
2491 Emery Road, Town of Aurora, Erie Co., New York 14139

DRILLER:	J. Garnder	**TYPE OF DRILL RIG:**	Diedrich D-50 (Truck)
SAMPLING METHODS:	ASTM D1586	**SIZE AND TYPE OF BIT:**	2 1/4" I.D. H.S.A.
DATE STARTED:	1/11/19	**SURFACE ELEVATION (ft.):**	924.4
DATE COMPLETED:	1/11/19	**GROUNDWATER DEPTH (ft.):** (measured at completion unless indicated below)	14.0



Sample No. : Range	Field Test Data (blows)	N-Value	% REC (RQD)	Soil and Rock Description / Remarks
				Topsoil (6")
S-1 : 0.0'- 2.0'	1, 2, 3, 4	5	15	Brown, m. stiff CLAY, some Silt, little f. Sand, tr. Gravel, tr. Roots, mod. plastic, moist (CL)
S-2 : 2.0'- 4.0'	2, 3, 3, 3	6	20	Same as S-1
S-3 : 4.0'- 6.0'	2, 2, 4, 5	6	30	Brown, loose f/c SAND and Gravel, little Silt, tr. Clay, non-plastic, moist (SM)
S-4 : 6.0'- 8.0'	3, 5, 4, 5	9	20	Same as S-3
S-5 : 8.0'- 10.0'	2, 3, 3, 3	6	50	...grade: wet
S-6 : 10.0'- 12.0'	2, 4, 3, 4	7	60	Brown, m. stiff CLAY, some Silt, little f. Sand, tr. Gravel, mod. plastic, moist (CL)
S-7 : 14.0'- 16.0'	1, 2, 4, 4	6	100	Gray, loose f/c SAND, some to and Silt, tr. Gravel, tr. Clay, non-plastic, wet (SM)
S-8 : 19.0'- 21.0'	1, 2, 9, 7	11	100	...grade: m. dense
S-9 : 24.0'- 26.0'	w/h, 1, 8, 7	9	100	Gray, stiff CLAY, some Silt, little to tr. f. Sand, tr. Gravel, mod. plastic, wet (CL)
S-10 : 29.0'- 31.0'	w/h, 1, 1, 1	2	100	...grade: soft
S-11 : 34.0'- 36.0'	w/h, 1, 1, 2	2	100	Same as S-10

Logged by: B. Smith

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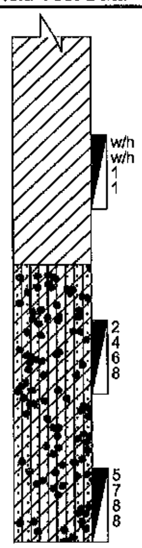
TEST BORING LOG (CONTINUATION)

JOB No.: 18-610 **BORING No.:** B-3

PROJECT: Proposed Gow School Main Building
2491 Emery Road, Town of Aurora, Erie Co., New York 14139



Elevation/ Depth (feet)	Sample No. : Range	N-Value	% REC (RQD)	Soil and Rock Description / Remarks
885 / 40	S-12 : 39.0'- 41.0'	1	100	...grade: v. soft
880 / 45	S-13 : 44.0'- 46.0'	10	100	Gray, stiff CLAY, some Silt, little Gravel, little f/c Sand, mod. plastic, moist (CL-Till)
875 / 50	S-14 : 48.0'- 50.0'	15	20	...grade: v. stiff

Depth to Bottom of Hole: 50.0 feet

Elevation/Depth scale: 885/40, 880/45, 875/50, 870/55, 865/60, 860/65, 855/70, 850/75, 845/80

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TEST BORING LOG

JOB No.: 18-610 **BORING No.:** B-4

PROJECT: Proposed Gow School Main Building
2491 Emery Road, Town of Aurora, Erie Co., New York 14139

DRILLER:	J. Garnder	**TYPE OF DRILL RIG:**	Diedrich D-50 (Truck)
SAMPLING METHODS:	ASTM D1586	**SIZE AND TYPE OF BIT:**	2 1/4" I.D. H.S.A.
DATE STARTED:	1/10/19	**SURFACE ELEVATION (ft.):**	925.4
DATE COMPLETED:	1/10/19	**GROUNDWATER DEPTH (ft.):** (measured at completion unless indicated below)	19.0'

Elevation/ Depth (feet)	Soil Symbols Sampler Symbols Field Test Data	Sample No. : Range	N-Value	% REC (RQD)	Soil and Rock Description / Remarks
925 / 0					Topsoil (9")
	2, 3, 5, 7	S-1 : 0.0'- 2.0'	8	70	Brown, stiff CLAY, some Silt, little f. Sand, tr. Gravel, mod. plastic, moist (CL)
	7, 7, 6, 5	S-2 : 2.0'- 4.0'	13	20	Same as S-1
920 / 5	3, 3, 3, 4	S-3 : 4.0'- 6.0'	6	55	Brown, loose f/c SAND and Gravel, little Silt, tr. Clay, non-plastic, moist (SM)
	5, 5, 6, 7	S-4 : 6.0'- 8.0'	11	20	...grade: m. dense
	2, 5, 4, 5	S-5 : 8.0'- 10.0'	9	40	...grade: loose, wet
915 / 10	3, 4, 5, 6	S-6 : 10.0'- 12.0'	9	50	...grade: some Gravel
910 / 15	1, 2, 5, 5	S-7 : 14.0'- 16.0'	7	50	...grade: Gray, and Silt, tr. Gravel
905 / 20	2, 2, 3, 3	S-8 : 19.0'- 21.0'	5	70	Same as S-7
	2, 2, 2, 3	S-9 : 23.0'- 25.0'	4	80	Gray, m. stiff CLAY, some Silt, little f. Sand, tr. Gravel, mod. plastic, wet (CL)
900 / 25					Depth to Bottom of Hole: 25.0 feet
895 / 30					
890 / 35					

Logged by: B. Smith

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APPENDIX B

GEOTECHNICAL REFERENCE STANDARDS

GEOTECHNICAL REFERENCE STANDARDS
SUMMARY OF LOGGING TECHNIQUES

Depth (ft.)	Blows per .5 ft.	Sample No.	N	% REC (RQD)	SOIL AND ROCK DESCRIPTION	REMARKS

Depth- The depth column provides the verticle scale of the boring log in feet below ground surface.

The number of blows obtained from each of the 0.5 ft. intervals of sampler penetration.

NOTE: WR represents the static weight of drill rods. WH represents the static weight of rods and hammer.

Sample Identification Number- Disturbed samples are identified with "S" preceding the sample number. Undisturbed samples (shelby tube) samples are identified with "U" preceding the sample number. Rock core samples are identified with "C" preceding the core run.

% Recovery- The length of sample recovered divided by the total length sampled. The result is numerically expressed as percent.

(RQD)- The "Rock Quality Designation". The total length of pieces>4 inches divided by the total length of core run.

N-Value- The Standard Penetration Test N-Value, as specified by ASTM D1586 is defined as the number of blows required by a 140-pound hammer falling 30 inches each blow to drive a 2 inch outside diameter split spoon sampler 12 inches.

TERMINOLOGY USED FOR SOIL DESCRIPTION

Density Description of Granular Soil

Number of Blows per ft., N.	Relative Density
0-4	Very loose
4-10	Loose
10-30	Medium
30-50	Dense
Over 50	Very dense

Consistency Description of Cohesive Soil

Number of Blows per ft., N.	Consistency
Below 2	Very soft
2-4	Soft
4-8	Medium
8-15	Stiff
15-30	Very stiff
Over 30	Hard

Grain Size

- Boulder - greater than 12 inch diameter
- Cobble - passing 12 inch, retained on 3 inch
- Gravel - passing 3 inch, retained on No. 4 sieve
- Sand - Coarse - passing No. 4 sieve, retained on No. 10 sieve
  - Medium - passing No. 10 sieve, retained on No. 40 sieve
  - Fine - passing No. 40 sieve, retained on No. 200 sieve
- Silt - 0.074 mm to 0.005 mm
- Clay - smaller than 0.005 mm

Description of Percentage or Proportions Used in Soil Sample Classification

Trace	0-10%
Little	10-20%
Some	20-35%
And	35-50%

Abbreviations Used In Soil Sample Classification

f - fine	v - very
m - medium	gr - gray
c - coarse	br - brown
f/m - fine to medium	yel - yellow
f/c - fine to coarse	sl - slight
tr - trace	

Plasticity

- Non-plastic - A 1/8 inch thread cannot be rolled at any water content.
- Slight plasticity - The thread can barely be rolled.
- Moderate Plasticity - Thread is easy to roll and little time is required to reach plastic limit.
- Plastic - Considerable time is required to reach plastic limit. Thread can be re-rolled several times after reaching the plastic limit.

Moisture

- Dry - Absence of moisture, dusty, dry to the touch.
- Moist - Small quantity of moisture. Soil usually above groundwater level.
- Wet - Moisture noticeable to the touch. Soil may be below groundwater level.
- Saturated - Visible free water, usually soil is below groundwater level.

TERMINOLOGY USED FOR ROCK DESCRIPTION

Bedding

Parting	Less than 0.02 ft.
Band	0.02 to 0.2 ft.
Thin bed	0.2 to 0.5 ft.
Medium bed	0.5 to 1.0 ft.
Thick bed	1.0 to 2.0 ft.
Massive	Over 2.0 ft.

Hardness

- Very Soft or Plastic - Can be indented w/ thumb
- Soft - Can be scratched with fingernail
- Moderately Hard - Can be scratched easily with knife; cannot be scratched with fingernail
- Hard - Difficulty to scratch with knife
- Very hard - Cannot be scratched with knife

Voids

- Porous - Smaller than a pinhead. Their presence is indicated by the degree of absorbency.
- Pitted - Pinhead size to 1/4 inch. If only thin walls separate the individual pits, the core may be described as honeycombed.
- Vug - 1/4 inch to the diameter of the core. The upper limit will vary with core size.
- Cavity - Larger than the diameter of the core.

Crystallinity or Texture

- Dense - Crystals are so small they cannot be distinguished with the naked eye.
- Very Fine Crystalline - Crystals barely discernible with the naked eye.
- Crystalline - Crystals are medium size -up to 1/8 inch diameter.
- Very Coarsely Crystalline - Crystals larger than 1/8 inch diameter.

Remarks - Denotes exact depth of recovery and general documentation of drilling efforts.

Notes - Description and classification are based on visual inspection of samples and boring operations.

The stratum lines shown on the boring logs are based upon interpretation and may not represent precise subsurface conditions.

Water level readings have been made in the drill holes at times and under conditions stated on the boring logs. Fluctuations in the water level may occur due to other factors than those present at the time measurements taken.

SOIL CLASSIFICATION CHART
(Unified Soil Classification System)

MAJOR DIVISIONS			GRAPH SYMBOL	LETTER SYMBOL	TYPICAL DESCRIPTIONS
COARSE-GRAINED SOILS More than 50% of material larger than No. 200 sieve	GRAVELS- More than 50% of coarse fraction larger than No. 4 sieve	Clean Gravels (little or no fines)		GW	Well-graded gravels, gravel-sand mixtures, little or no fines
				GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines
		Gravels with appreciable amounts of fines		GM	Silty gravels, gravel-sand-silt mixtures
				GC	Clayey gravels, gravel-sand-clay mixtures
	SANDS- Less than 50% of coarse fraction larger than No. 4 sieve	Clean sands (little or no fines)		SW	Well-graded sands, gravelly sands, little or no fines
				SP	Poorly-graded sands, gravelly sands, little or no fines
		Sand with appreciable amounts of fines		SM	Silty sands, silt-sand mixtures
				SC	Clayey sands, sand-clay mixtures
FINE-GRAINED SOILS Less than 50% of material larger than No. 200 sieve	SILTS AND CLAYS Low plasticity Liquid Limit < 50%			ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity
				CL	Inorganic clays of low to medium plasticity, gravely clays, sandy clays, silty clays, lean clays
				OL	Organic silts and organic silty clays of low plasticity
	SILTS AND CLAYS High plasticity Liquid limit > 50%			MH	Inorganic silts, micaceous or diatomaceous fine sand or silty soils
				CH	Inorganic clays of high plasticity, fat clays
				OH	Organic clays of medium to high plasticity, organic silts
	Highly Organic Soils			Pt	Peat, humus, swamp soils with organic contents
	Miscellaneous Fill			FILL	Miscellaneous fill may belong in any division but is identified as FILL

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APPENDIX C

LABORATORY SOIL TEST RESULTS

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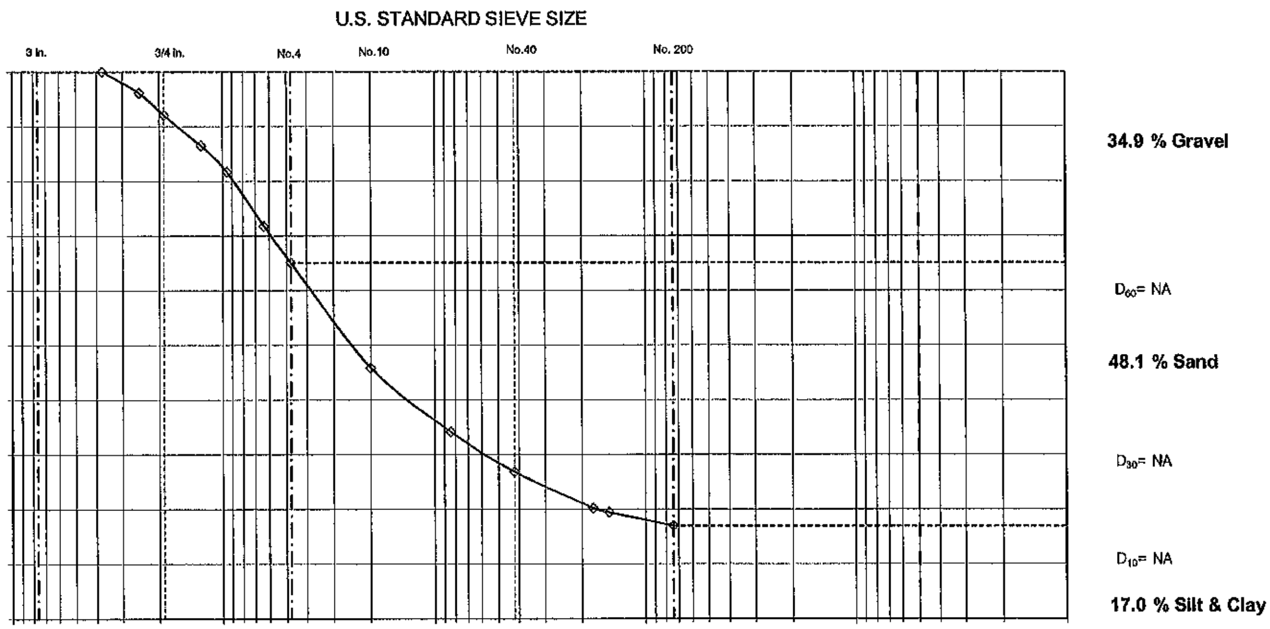
GRAIN SIZE ANALYSIS ASTM D-421/D-422

Job No: 18-610
Project: Proposed Gow School Main Building
2491 Emery Road
Town of Aurora, Erie Co., New York 14139

C_C= NA C_U= NA LL= NA PL= NA PI= NA USCS= SM



COBBLES	GRAVEL		SAND			SILT	CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE		

Date Tested: January 22, 2019 **Boring No.: B-3** **Sample No.: S-3 to S-5** **Depth: 4 to 10 ft.**

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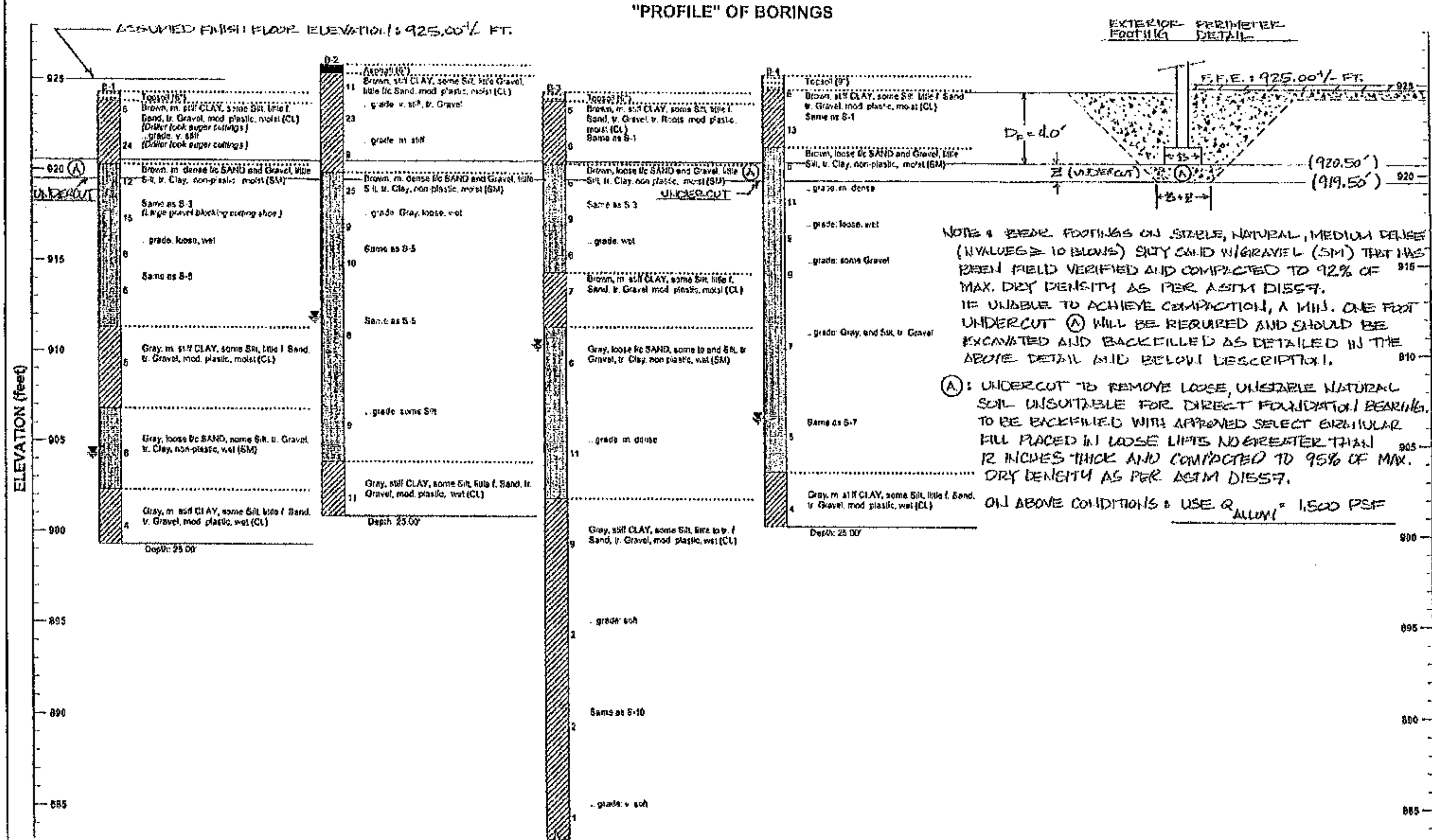
APPENDIX D

ENGINEERING COMPUTATIONS AND SCHEMATICS

"PROFILE" OF BORINGS



Topsoil · Low plasticity clay · Silty sand · Paving · Water table at boring completion · Boring continues

BARRON & ASSOCIATES, P.C. & BUFFALO DRILLING COMPANY, INC. 10440 MAIN STREET, CLARENCE, NEW YORK 14031	Plotted: 1/24/2019	Job No.: 18-610
PROJECT: Proposed Gow School Main Building 2491 Emery Road, Town of Aurora, Erie Co., New York 14139	Page No.: 1 of 3	Figure No.: P-1

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DATA INPUT BY: Andrew J. Camping
B&A JOB NO.: 18-610
CLIENT: The Gow School
PROJECT: Proposed Gow School Main Building
2491 Emery Road
Town of Aurora, Erie Co., New York 14139

BUILDING CODE OF NEW YORK STATE © - 2010: USGS 2008 ACCELERATIONS at 2% IN 50 YEARS CALCULATED BY LATITUDE AND LONGITUDE

Site Latitude (o) = +42.7072

Site Longitude (o) = -78.5823

Seismic Site Class = E

Building/Structure with Shallow Foundation

S_s = 0.2 sec acceleration value for Class B (in g's)

Acceleration Values Below are S_s

LAT. =	LONG. = -78.6000	-78.5823	-78.5500
42.7000	0.20556		0.20595
+42.7072	0.20628	0.20641	0.20665
42.7500	0.21054		0.21084

S_1 = 1.0 sec acceleration value for Class B (in g's)

Acceleration Values Below are S_1

LAT. =	LONG. = -78.6000	-78.5823	-78.5500
42.7000	0.05001		0.05015
+42.7072	0.05007	0.05012	0.05021
42.7500	0.05045		0.05059

SEISMIC SITE CLASS	Site Coefficient and Design Spectral Response Acceleration Values			
	0.2 Second		1.0 Second	
	F_a	$S_{ds} = 0.6667 * F_a * S_s$	F_v	$S_{d1} = 0.6667 * F_v * S_1$
A	0.8000	0.1101 g	0.8000	0.0267 g
B	1.0000	0.1376 g	1.0000	0.0334 g
C	1.2000	0.1651 g	1.7000	0.0568 g
D	1.6000	0.2202 g	2.4000	0.0802 g
E	2.5000	0.3440 g	3.5000	0.1170 g
F	2.5000	0.3440 g	3.5000	0.1170 g

<<-------- USE THESE VALUES FOR SHALLOW FOUNDATIONS (row E)

NOTE: F_a and F_v values are linearly interpolated, for the above S_s and S_s values, respectively, within the appropriate range of the mapped spectral response accelerations.
(Gridded data at 0.05 degree increments from: http://earthquake.usgs.gov/research/hazmaps/products_data/2012/data/)

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LATERAL EARTH PRESSURE ON GENERIC BLOCK FOUNDATIONS FOR SIGNS, FREE-STANDING RETAINING WALLS, OR BELOW GRADE/BASEMENT/TANK/POOL RETAINING WALLS (Less Than 20 Feet High)

a) Porous filter media, in contact with the basement/below grade foundation wall or retaining walls, protects and is in contact with a minimum 4 inch diameter perforated drainage pipes at the footing/base of the foundation/structural wall (exterior backfill side and interior basement side) and/or weep pipes through the wall, as needed and as applicable.

b) Where recommended, a geotextile filter fabric will protect the gravel filter media from the earth backfill. Overlap unsewn seams as per the manufacturer's recommendations.

c) Waterproof earth side of wall, as is customarily provided in practice.

d) Drainage pipes are connected to an appropriately designed collector pipe, conveyance, and/or sump pump system as is applicable for the intended purpose of the wall and as customarily provided/installed in practice.

e) For potential groundwater table conditions above the top of the basement slab-on-grade condition, install continuous waterstops (with no joints in stop) at wall and floor construction joints, as is customarily provided in practice. Interior intermediate drainage pipes beneath the slab, that are spaced on-center and in both directions, do appear to be needed.

f) Assume a uniformly graded, clean coarse sand or sandy gravel backfills:
- equivalent N-value in a dense state: $(N_1)_{60}$ = 40 blows/foot
- friction angle: ϕ' = 38 degrees {Teng, pg. 12}
- average in-place densities: moist - γ_m = 120 pcf
  saturated - γ_{sat} = 132 pcf submerged - $\gamma' = (\gamma_{sat} - \gamma_w) = 70$ pcf

g) Assume at base of wall/footing, coefficient of friction against sliding (f_s) at base of wall (Refer to Teng, pg. 320-1):
$f_s = \tan(0.58 \times \phi') = 0.40$ (AREA silty soil to silty coarse-grained soil)

h) Use equivalent fluid pressure design approach {Hough, pg. 249 and NAVFAC pg. 7-10-9}:
- at rest pressure coefficient - $K_o = 1 - \sin(\phi') = 0.38$
- effective lateral pressure of soil - $\gamma'_l = K_o \times \gamma' = 26.6$ pcf
- hydrostatic pressure - γ_w = 62.4 pcf
- equivalent fluid pressure with water level - at the top of the grade at the wall $\gamma_{eo} = \gamma'_l + \gamma_w$ = 89 pcf (say 90 pcf)
- equivalent fluid pressure with compaction induced lateral stress increase (W&F, pg 409) $\gamma_{eo} = 2 \times K_o \times \gamma_m$ = 91 pcf (say 90 pcf)
- active pressure case - $K_a = [1 - \sin(\phi')] / [1 + \sin(\phi')] = 0.24$
  $\gamma_{ea} = K_a \times \gamma_m$ = 29 pcf (say 30 pcf)
- passive pressure case - $K_p = [1 + \sin(\phi')] / [1 - \sin(\phi')] = 4.2$
  $\gamma_{ep} = K_p \times \gamma_m$ = 504 pcf (say 330 pcf with a F.S. = 1.5)

		Thoroughly Compacted ⇒		Uniformly Graded & Clean Coarse Sand or Sandy Gravel Fill	Non-Plastic Silty Sand or Sandy Silt Fill	
USE:	Earth Pressure Coefficient	Static Active	=	0.24	0.33	
		Static At-Rest	=	0.76	1.00	
		Static Passive	=	2.80	2.00	(with F.S. = 1.5)
		Static Passive	=	4.20	3.00	(with F.S. = 1.0)
USE:	Equivalent Fluid Pressure	Static Active	=	30 pcf		
		Static At-Rest	=	90 pcf (for rigid walls)		
		Static Passive	=	330 pcf (with F.S. = 1.5)	[500 pcf with (with F.S. = 1.0)]	

[For earthquakes, structural engineer may elect to use the above Static Passive case instead of the below Earthquake Lateral Load for Non-Yielding Wall movement into the soil backfill.]

USE: Simplified Model for Earthquake Lateral Load/Ft. Wall Length @ 0.6 H_{bw} above base. Loads for Non-Yielding Wall. H_{bw} = Earth Height Behind Wall (feet)

Reduce load by 33% for Yielding Wall (active case) = (6.8 psf / foot) x H_{bw}^2 (NYS, S_{ds} = 0.25 g)
(γ_m = 120 pcf for S_{ds} value. Add to Static At Rest/ = (13.5 psf / foot) x H_{bw}^2 (NYS, S_{ds} = 0.50 g)
Active Pressure/Load for unsaturated backfill case) = (17.5 psf / foot) x H_{bw}^2 (NEern NYS, $S_{ds} \leq 0.65$ g)
[Above for Site Class C to E soils. Interpolate for other S_{ds} values.
Use 1.75 x values for walls on Class B/A rock or on rigid foundation base. (FEMA NEHRP Guidelines)]

Saturated/Liquified Soil During Earthquake = 132 pcf
(Equivalent Fluid Pressure. Add to inertial hydrodynamic pressure, not presented here.)

{For looser/denser backfills, adjust above pressures by the ratio = new density / 120 pcf or / 132 pcf (for saturated case)}

USE: Coefficient of Friction Against Sliding (f_s) = 0.45 (on compacted NYSDOT Item #304.12 or #304.14 gravels)
(use lowest f_s with no underlying weaker layers) = 0.35 (on compacted granular soil & non-plastic silt)
= 0.20 (slab-on-grade on polyethylene on granular fill)
[with a F.S. = 1.0] = 0.60/0.50 (on clean, rough, & sound bedrock/smooth bedrock)
Min. Factor of Safety Against Sliding = 1.5 *[Rev.9-30-09]*

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APPENDIX E

GENERAL EARTHWORK SPECIFICATION

Barron & Associates, P.C.
GENERAL EARTHWORK SPECIFICATION

PART 1 GENERAL

1.1 SITE AND SUBSURFACE CONDITIONS

1.1.1 Overview

This specification is included as a courtesy to the clients of Barron & Associates, P.C, and addresses earthwork site preparation. Additions and modifications are necessary to create a job-specific specification. This specification may serve as a basis for the development for a technical specification under Division 2, *Site Work.*

1.1.2 Site Conditions

The site-specific conditions are described under separate cover or may be available from the OWNER.

1.1.3 Subsurface Conditions

The site-specific subsurface conditions are described under separate cover or may be available from the OWNER.

1.2 REFERENCES

American Standard for Testing and Measurement (ASTM):

ASTM C136	Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM C2922	Density for Soil and Soil-Aggregate in Place by Nuclear Methods
ASTM D422	Test Method for Particle-Size Analysis of Soils
ASTM D1140	Amount of Material in Soils Finer Than the No. 200 Sieve
ASTM D1557	Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lb/ft^3)
ASTM D2216	Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock
ASTM D2487	1990 Classification of Soils for Engineering Purposes
ASTM D4318	Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

1.3 DEFINITIONS

1.3.1 Unacceptable Material

Soil material containing debris, wood, scrap material, vegetation, refuse, soft unsound particles, and other organic, frozen, deleterious, or objectionable materials. Contaminated soils shall be properly documented and removed or remediated on site. If necessary, remediation procedure will be defined by the OWNER.

1.3.2 Unsuitable Material

Brown, organic topsoil and underlying soft pockets of organic silt or wet, reworked silty clay.

1.3.3 Ordinary Fill

Friable soil containing no stone greater than two-thirds loose lift thickness and no unacceptable or unsuitable materials. In general, existing random fill is expected to be acceptable for reuse as ordinary fill given proper sorting, blending, drying, and controlled placement methods.

1.3.4 Granular Fill

Ordinary fill meeting the designation of ASTM D2487 classification of GW with a maximum of 10 percent by weight passing ASTM D1140, No. 200 sieve.

1.3.5 Select Granular Fill

Clean, uncoated soil which contains no unacceptable materials and conforms to the gradation requirements defined in Table A: Select Granular Fill.

Table A: Select Granular Fill	
Sieve Size	Percent Finer by Weight
2/3 of the loose lift thickness	100
No. 10	30 - 95
No. 40	10 - 70
No. 200	0 - 15

1.3.6 Sand and Gravel

Clean, hard, durable, uncoated particle of sand and gravel, free from lumps of clay, containing no unacceptable matter, and conforming to gradation requirements of *Table B : Sand and Gravel*

Table B: Sand and Gravel	
Sieve	Percent Finer by Weight
*	100
No. 4	50 - 85
No. 10	--
No. 40	10 - 35
No. 100	--
No. 200	0 - 8

* Job-Specific. To be determined by the ENGINEER

1.3.7 Crushed Stone

Clean, durable, sharp-angled fragments of rock or crushed gravel stone of uniform quality, containing no unacceptable matter, free from coatings, and conforming to gradation requirements of *Table C: Crushed Stone*

Table C: Crushed Stone		
	Percent Passing	
Sieve Size	¾-inch Stone	1 ¼-inch Stone
1 ½-inch	—	100
1 ¼-inch	—	85-100
1- inch	100	—
¾-inch	90-100	10-40
5/8-inch	—	—
½-inch	10-50	0-8
3/8-inch	0-20	—
#4	0-5	—

1.3.8 Flowable Fill

Also known as Controlled Low Strength Material – Controlled Density Fill (CLSM-CDF), this material is available under a variety of producer names (e.g., K-Krete©, M-Crete, Flash Fill©, Flowable Mortar, Unshrinkable Fill, etc.). This non-settling backfill mixture is most commonly used for its flowable characteristics, its support strength under traffic loads, and its removability at a later date. The material may be produced on-site or off-site. In either case, the producer of such materials and the product must meet certain certification criteria. Such information is beyond the scope of this specification and will be considered on a site-specific basis.

Flowable fill may be acceptable for use as a backfill for utility trenches of other low-lying areas which require a compacted granular fill. Its use and warranty of performance is left to the CONTRACTOR in such applications.

The use of flowable fill under load-bearing structural components in place of properly placed and compacted granular fill is NOT common and is questionable. The localized use of such material may have profound affects on the performance of a foundation system. Site-specific conditions and the extent of anticipated use of flowable fill must be examined by geotechnical engineer. Cost of such consultation shall be borne by the CONTRACTOR unless specifically directed by the OWNER to seek such consultation. Without such consultation, warranty of performance for such use is left to the CONTRACTOR.

1.4 SUBMITTALS

The following submittals shall be provided in accordance with approved submittals procedures.

1. Fill Source: Provide name and source locations of fill material.

2. Field Test Reports: Field tests will be performed by OWNER's Representative as needed. CONTRACTOR may be required to perform such tests on proposed off-site fill materials.
   a. Fill material grain size analyses per ASTM C136, D422, D1140, D2487
   b. Moisture/Density test results per ASTM D2216
   c. Liquid limit, plastic limit, and plasticity index per ASTM D4318
   d. Compaction/Density test results per ASTM C2922 and D1557

3. Sample: Geotextile fabric

PART 2 PRODUCTS

Geotextile Fabric: Mirafi 600X or equal. (Also referred to as synthetic fabric).

PART 3 EXECUTION

3.1 PROTECTION

3.1.1 General

Manner of excavation shall minimize disturbance of underlying natural ground. If deemed necessary by the Engineer, alter construction procedures to reduce subgrade disturbance. Excavate areas which have been excessively disturbed to firm ground and backfill with properly compacted granular fill.

3.1.2 Roads and Walks

Keep roads and walks free of dirt and debris at all times.

3.1.3 Trees, Shrubs, and Existing Facilities

Protect from any damage all vegetation and facilities identified to remain.

3.1.4 Utility Lines

Locate all utilities within the area of disturbance prior to the start of work. Show locations on initial plans. Protect utility lines from damage. Notify the ENGINEER immediately of damage to or an encounter with an unknown utility. Damage to utility lines are to be repaired by the CONTRACTOR at no additional cost. The CONTRACTOR shall have underground utility owners stake out utility locations prior to the start of clearing and excavation operations.

3.2 VERIFICATION OF CONDITIONS/PROOF-ROLLING

Prior to placement of the initial layer of fill over the natural ground, proof-roll the exposed natural ground above the groundwater table elevation by making two passes with a fully-loaded ten-wheel truck. Excavate unstable areas detected by this process and replace with compacted granular fill.

3.3 PREPARATION

3.3.1 Surface Preparation

Within the site limits indicated on the drawings, excavate all unsuitable material to firm natural ground in the manner specified herein. Follow a construction procedure which permits visual identification of firm natural ground. In the even that groundwater is encountered, the ENGINEER may require that the size of the open excavation be limited to that which can be handled by open pumping to allow visual inspection of the excavation bottom and the performance of backfill operations to be conducted in a dry state.

Excavation of unsuitable material shall be limited to the greater of the following:

- A distance of 5 feet beyond building lines or
- The area defined by a one-horizontal to one-vertical line sloping down from the outside bottom edge of exterior footings to firm natural ground.

3.4 PLACEMENT AND COMPACTION

3.4.1 General

Place fill in accordance with *Table D: Compaction Alternatives.* These alternatives are provided as minimum compaction
standards only and in no way relieve the CONTRACTOR of his obligation to achieve any specified degree of compaction by whatever means may be necessary.

Grade to provide positive drainage and a smooth surface which will readily shed water. To the extent practicable, compact each layer to the specified density on the same day placed. Place fill in horizontal layers. Where horizontal layers meet a natural slope, key layer into slope by cutting a bench.

Fill that is too wet for proper compaction: Disc, harrow, or otherwise dry to proper moisture content for compaction to the required density.

Fill that is too dry for proper compaction: Uniformly apply water over the surface of the loose layer in sufficient quantity to allow compaction to the required density.

Table D: Compaction Alternatives						
Compaction Method	Max. Stone Size	Maximum Loose Lift Thickness (inches)		Maximum Number of Passes		
		Below Structure and Pavements	Less Critical Areas	Below Structure and Pavements	Less Critical Areas	
Hand operated vibratory plate of light roller in confined areas	3	4	4	4	4	
Hand operated vibratory drum rollers weighing at least 1,000 pounds in confined areas	4	6	8	4	4	
Loaded 10-wheel truck or D-8 crawler	6	10	12	4	2	
Light vibratory drum roller; Min. weight at drum 8,000lbs; Min. dynamic force 10,000lbs.	8	12	12	6	2	
Minimum vibratory drum; Min. weight at drum 10,000lbs; Min. dynamic force 20,000lbs.	8	18	18	6	4	

3.4.2 Dewatering

Provide adequate pumping and drainage facilities to keep excavated areas sufficiently dry of groundwater and surface run-off. Dewatering shall avoid adversely affection construction procedures or causing excessive disturbance of underlying natural ground. Drain all pumped water in such a manner as to avoid damage to adjacent property.

If requested by the ENGINEER, place a 6-inch to 12-inch layer of sand and gravel or crushed stone over the natural underlying soil to stabilize area which have been disturbed due to groundwater seepage pressures and to expedite dewatering operations. Particular attention shall be given areas under proposed foundations.

3.5 FIELD QUALITY CONTROL

3.5.1 Compaction Requirements

Allow the ENGINEER sufficient time to make necessary observations and tests. Base the degree of compaction on maximum dry density as determined by ASTM D1557. The minimum degree of compaction for placed fill shall be as indicated *in Table E: Compaction Requirements.*

Table E: Compaction Requirements	
Area	Minimum Degree of Compaction (%)
Below foundation	95
Pavement and building subbase and base courses	95
Below building slab base course and above bottom of foundation	92
Below pavement subbase and base courses	90
Trench backfill outside of building	90
Trench backfill inside of building	Refer to one of the above-listed categories
Ordinary fill within 5 feet of grade	90
Vegetated areas below 5 feet of grade	85

3.5.2 Testing

Site work should be monitored and tested by geotechnical ENGINEER or his representative and in accordance with requirements of the design team to assure compliance with earthwork and foundation construction specifications.

The owner will retain a geotechnical ENGINEER or his representative to perform on-site observations and testing during this phase of construction operations. The geotechnical ENGINEER or his representative will:

- Observe excavation and dewatering of building and controlled fill areas;
- Observe backfill and compaction within building and controlled fill areas;
- Laboratory test and analyze fill material; and
- Observe construction – and performing water content, gradation, and compaction tests.

On a timely basis, the CONTRACTOR will receive copies of test results submitted to the OWNER. In addition, during construction the geotechnical ENGINEER will advise the OWNER and CONTRACTOR in writing of conditions which fail to conform to the Contract Documents. The CONTRACTOR shall take immediate action to remedy indicated deficiencies.

The geotechnical ENGINEER or his representative will not supervise or direct the actual work of the CONTRACTOR or employees and representatives of the CONTRACTOR. The presence of, observations by, and testing performed by the geotechnical ENGINEER or his representatives shall not excuse the CONTRACTOR from defects discovered in the work.

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APPENDIX F

LIMITATIONS

LIMITATIONS

1. This report is based on the data that was obtained from the subsurface explorations and on the design of the proposed main administration building as submitted to the geotechnical engineer. A geotechnical engineer, who is experienced in foundation construction and earthwork, should be engaged to review the final design and specifications in order to determine whether any change in concept may have any effect on the validity of the conclusions presented herein, and whether these conclusions have, in fact, been implemented in the design and specifications.

2. The subsurface conditions, including thickness, between the exploration locations are approximate and simplified representations of the strata and transitions. There is the possibility that variations in soil and rock conditions and boundaries will be encountered during construction. In order to permit correlation between the exploratory soil data and the actual soil conditions encountered during construction and so as to assess conformance with the plans and specifications as originally contemplated, it is recommended that a geotechnical engineer, who is experienced in foundation construction and earthwork monitoring, should be retained to perform continuous construction review during the site preparation and foundation construction operations.

3. The subsurface exploration logs and subsurface conditions may aid in estimating material quality and quantities, such as topsoil/organic matter, fills, natural soils, and rock, but are not to be relied upon as the exclusive means for bid preparation purposes. It is the responsibility of the contractor to perform any additional site examinations and explorations and to prepare an accurate bid.

4. Disclaimers:

    a. In the event that any changes in the nature, design or location of the structure are planned, the conclusions that are contained in this report shall not be considered valid unless the changes are reviewed and the conclusions of this report are modified or verified in writing.

    b. The geotechnical engineering report has been prepared for this project by Barron & Associates, P.C. This report is for assistance in design only and is not a sufficient basis on which to prepare an accurate bid.

    c. This report has been prepared for the exclusive use of The Gow School of Aurora, New York, and their designated design representatives, for specific application to the construction of a main administration within The Gow School complex at 2491 Emery Road, in the Town of Aurora, Erie County, New York and in accordance with generally accepted geotechnical engineering practice. No other warranty, expressed or implied, is made.