



# **BARRON & ASSOCIATES, P.C.**

**Geotechnical Consulting and Special Inspections**

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May 5, 2026

Job No: 26-529

Specialized Early Childhood Center of WNY  
25 Chateau Terrace  
Amherst, New York 14226

ATTN.: Ms. Shannon Karcher

RE: Geotechnical Engineering Report  
Proposed Addition to Bornhava School  
25 Chateau Terrace  
Amherst, Erie Co., New York 14226

Ms. Karcher:

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 drilled by Buffalo Drilling Company, Inc. (BDC); relative ground surface elevations; and additional site details. Boring location B-5 was not drilled due to limitations with access and appropriate drilling equipment.

## **EXPLORATION METHODS**

Sampling Method: A truck-mounted Diedrich D-50 rotary drill rig was used to drill each test boring to auger refusal 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 encountered at each of the test borings approximately three to 11 feet below ground surface.

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:

- Water (Moisture) Content of Soil ASTM D2216
- Liquid Limit, Plastic Limit, and Plasticity Index of Soils ASTM D4318

Table No. 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 the existing Bornhava School and is addressed as 25 Chateau Terrace, in the Town of Amherst, Erie County, New York. The project will include a two-story, lateral addition to the north end of the existing structure. The site topography slopes to the north/northwest with ground surface elevations at the boring locations varying by almost four feet.

Subsurface Soil Conditions: In general, subsurface conditions beneath the asphalt pavement consists of granular fill material atop naturally deposited cohesive glacial till which extends to auger refusal.

Beneath the asphalt, approximately two to three feet of granular fill material exists. The fill is comprised of fine to coarse-grained, sand and gravel-sized crushed limestone with little amounts of silt. Relative density of the fill is medium dense to dense with moisture contents of retrieved samples noted to be moist. This material is typical for subbase aggregate beneath asphalt pavements. A thin layer of cohesive fill material exists beneath the granular fill at boring B-3. This fill is comprised of silty clay with varying amounts of fine to coarse-grained sand and gravel, and trace quantities of asphalt. The fill appears to be native soil which was reworked / disturbed during previous earthwork activities on site. Consistency of the fill is very stiff with moisture contents of retrieved samples are noted to be moist. In general, fill materials are typically placed in uncontrolled and uncompacted manners. As such, the variable strengths and erratic material characteristics, of random fill, make them unsuitable in providing reliable direct supporting media for footings/shallow foundations.

Beneath the fill materials, naturally deposited cohesive glacial till exists and extends to auger refusal. The till generally consists of a silty clay matrix with lesser amounts of sub-rounded fine-sized to coarse-sized sand and gravel. Plasticity is noted as slightly plastic with consistency of this soil being very stiff to hard. Moisture contents of retrieved samples are noted to be moist.

Bedrock: Auger refusal, which is generally inferred to be the top of the apparent bedrock surface, was encountered at each boring approximately three to 11 feet below ground surface, elevations 672.70 to 663.60  $\pm$  feet. Based upon the regional geology, the bedrock type beneath the site would be the Onondaga Limestone.

Groundwater: Groundwater was not encountered during subsurface exploration. 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. 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 BC, in accordance with Section 1613.2 of Building Code of New York State © 2025 and listed in Table 20.2-1 of Chapter 20 of American Society of Civil Engineers (ASCE) Standard 7-22. Shear wave velocities have been estimated (correlated) via SPT N-values. Estimated velocities have received a site class sensitivity analysis with a bounding envelope of  $1.3 \cdot V_s$  (upper bound) and  $V_s/1.3$  (lower bound) as per Section 20.3 of ASCE 7-22.

Liquefaction Potential: For the Site Class BC, the design spectral response acceleration parameters  $S_{DS}$ , at 0.2 seconds, and  $S_{D1}$ , at one second, are 0.11g and 0.027g ( $g = 32.2 \text{ feet/sec}^2$ ), 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 BC soil/rock is considered extremely low.

### **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.

As shown in Figure No. 2, site development will include a two-story, lateral addition to the north end of the existing structure. The site topography slopes to the north/northwest with ground surface elevations at the boring locations varying by almost four feet. Finish floor elevation, provided by Tredo Engineers via email, is proposed at elevation 675.20  $\pm$  feet. The final exterior grade is assumed about one-half foot below

finished floor, at elevation  $674.70 \pm$  feet. The maximum design exterior and interior bearing wall loads are not expected to exceed 10 kips per lineal foot. The maximum live-floor load is taken as 100 pounds per square foot (psf).

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 structure, 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 pad and any 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 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 to  $670.70 \pm$  feet. 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 very stiff ( $N_{\text{values}} \geq 15$  blows) or better glacial till, and/or 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) should 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 and on the same soil/fill conditions as the exterior footings. Interior footings bearing at that depth would require undercuts of approximately two feet to reach approvable natural soils.

Undercut areas, when necessary, 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 described conditions, the recommended maximum net allowable foundation bearing pressure is 3,500 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.

Stabilization of Excavations: 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.

Concrete Interior Floor Slab(s)/Pad: 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 or wet of optimum, at the time of this investigation. Excavated and approvable cohesive soil types are not expected to be available in any reasonable quantities without an intensive soil conditioning program. These soils 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 available in limited quantity and would be associated with the asphalt pavement subbase aggregate. 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 is recommended for sensitive cohesive/fine-grained/silty clay subgrade soil/fills which are present across the site. This approach will stabilize and provide a workable building pad condition with minimal required repairs.

The approved subgrades will most likely consist of dense or better/thoroughly compacted (i.e., minimum 92 percent of the maximum dry density by ASTM D 1557) granular fill material, 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 as determined by the design structural engineer or architect. 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 or architect.

At the discretion of the design structural engineer or 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.

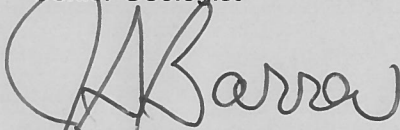
At the assumed final site grade and based upon the thickness and character of the underlying fill and natural soils, the subgrade modulus is recommended not to exceed 125 pounds per cubic inch (pci). A Poisson Ratio of 0.4 is recommended for design purposes. Isolation of the floor slabs from the footings-piers-columns and walls do appear to be warranted. Based upon the subgrade modulus and slab mechanical properties and thickness, the design structural engineer or architect may accordingly adjust the granular aggregate base thickness.

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.

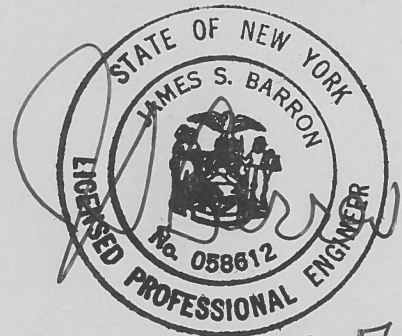
Thank you for the opportunity to assist on this project. If questions should arise, please call the undersigned at your earliest convenience.

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

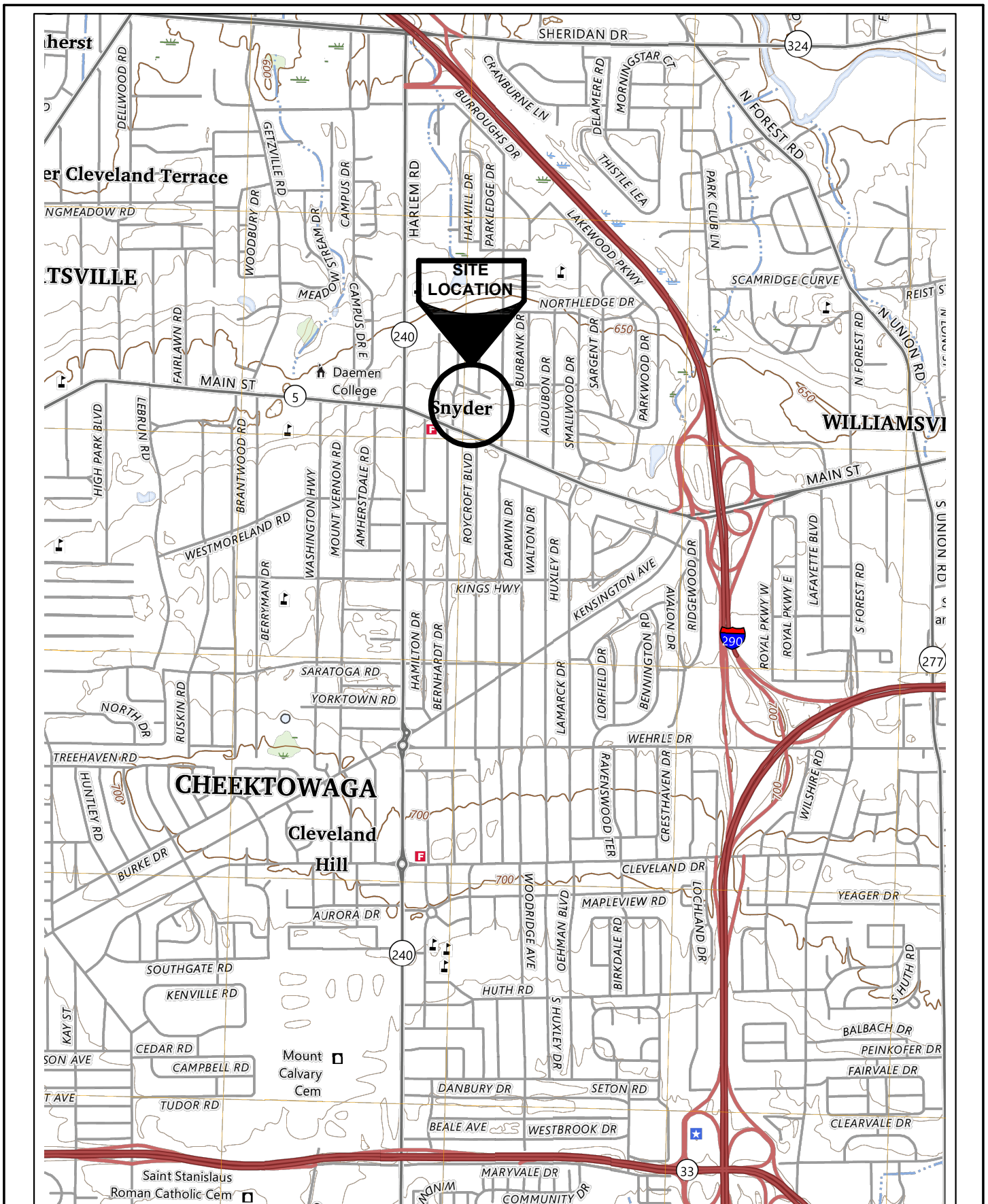
Andrew J. Camping  
Senior Geologist



James S. Barron, PE  
President/Geotechnical Engineer



5-7-26



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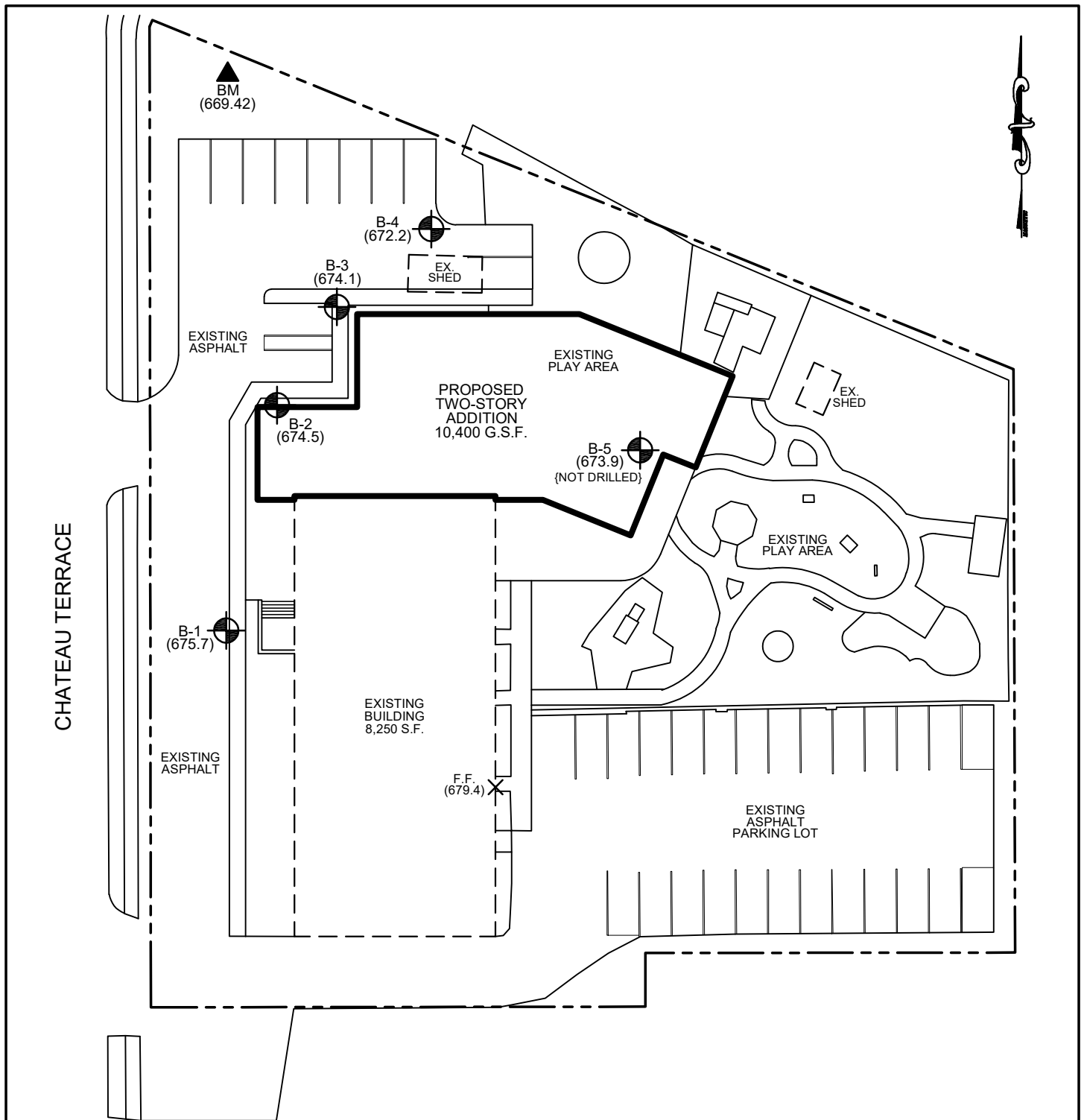
DRAWN: DAN KASPROWICZ

CLIENT: SPECIALIZED EARLY CHILDHOOD CENTER OF WNY  
 25 CHATEAU TERRACE  
 AMHERST, NEW YORK 14226  
 PROJECT: PROPOSED ADDITION TO BORNHAVA SCHOOL  
 25 CHATEAU TERRACE  
 TOWN OF AMHERST, ERIE CO., NEW YORK 14226



USGS SITE LOCATION PLAN  
 BUFFALO NE  
 2023

|                 |               |
|-----------------|---------------|
| JOB NO.: 26-529 | SCALE: N.T.S. |
| DATE: 3/31/2026 | FIGURE NO. 1  |



| LEGEND  |                                            |
|---------|--------------------------------------------|
|         | B-2 = TEST BORING & NO.                    |
| (674.5) | = GROUND SURFACE ELEVATION (FT.)           |
|         | = SPOT ELEVATION                           |
|         | BM = BENCH MARK (NORTH RIM OF CATCH BASIN) |

#### NOTES:

- BORINGS, BUILDINGS, SITE FEATURES, PROPERTY LINE LOCATIONS, & SCALE OF DRAWING ARE APPROXIMATE.
- BASE MAP REFERENCE PROVIDED BY ELEV8 ARCHITECTURE, TITLED "ARCHITECTURE DESIGN - SCHEMATIC DESIGN", SHEET NO. A004, PROJECT NO. 266.01, DATED 3/4/2026.
- BORING LOCATIONS AND BENCH MARK ELEVATION PROVIDED BY TREDO ENGINEERS, TITLED "BORING LOCATION PLAN - BORNHAVA", DATED 3/10/2025.

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CLIENT: SPECIALIZED EARLY CHILDHOOD CENTER OF WNY  
 25 CHATEAU TERRACE  
 AMHERST, NEW YORK 14226  
 PROJECT: PROPOSED ADDITION TO BORNHAVA SCHOOL  
 25 CHATEAU TERRACE  
 TOWN OF AMHERST, ERIE CO., NEW YORK 14226

DRAWN: DAN KASPROWICZ

#### TEST BORING LOCATION PLAN

0 20 40 80

|                 |                  |
|-----------------|------------------|
| JOB NO.: 26-529 | SCALE: 1" = 40'± |
| DATE: 4/14/2026 | FIGURE NO. 2     |



# BARRON & ASSOCIATES, P.C.

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B&A JOB NO: 26-529

CLIENT: Specialized Early Childhood Ctr. of WNY

PROJECT: Proposed Addition to Bornhava School  
25 Chateau Terrace  
Amherst, Erie Co., New York 14226

TABLE NO. 1  
LABORATORY PHYSICAL SOIL TEST RESULTS

| Boring No. | Sample No. | Depth | Moisture Content<br>ASTM D2216 | Organic Matter Content<br>ASTM D2974 | Unconfined Compressive Strength<br>ASTM D2166 | Wet Density<br>ASTM D2166 | Grain Size Analysis<br>ASTM D422 |      |      |      | Atterberg Limits<br>ASTM D4318 |     |     | USCS Soil Classification<br>ASTM D2487 / ASTM D2488 * |
|------------|------------|-------|--------------------------------|--------------------------------------|-----------------------------------------------|---------------------------|----------------------------------|------|------|------|--------------------------------|-----|-----|-------------------------------------------------------|
|            |            |       |                                |                                      |                                               |                           | Gravel                           | Sand | Silt | Clay | LL                             | PL  | PI  |                                                       |
|            |            | (ft.) | (%)                            | (%)                                  | (psf)                                         | (pcf)                     | (%)                              | (%)  | (%)  | (%)  | (%)                            | (%) | (%) | ( - )                                                 |
| B-2        | S-1        | 0.3-2 | 3.0                            | -                                    | -                                             | -                         | -                                | -    | -    | -    | -                              | -   | -   | GM-Fill                                               |
|            | S-2        | 2-3   | 5.9                            | -                                    | -                                             | -                         | -                                | -    | -    | -    | -                              | -   | -   | GM-Fill                                               |
|            |            | 3-4   | 11.2                           | -                                    | -                                             | -                         | -                                | -    | -    | -    | -                              | -   | -   | CL-Till                                               |
|            | S-3        | 4-6   | 9.5                            | -                                    | -                                             | -                         | -                                | -    | -    | -    | 21                             | 13  | 8   | CL-Till                                               |
|            | S-4        | 6-8   | 10.3                           | -                                    | -                                             | -                         | -                                | -    | -    | -    | -                              | -   | -   | CL-Till                                               |
|            | S-5        | 8-9   | 10.4                           | -                                    | -                                             | -                         | -                                | -    | -    | -    | -                              | -   | -   | CL-Till                                               |
| B-3        | S-1        | 0.1-2 | 5.4                            | -                                    | -                                             | -                         | -                                | -    | -    | -    | -                              | -   | -   | GM-Fill                                               |
|            | S-2        | 2-3   | 3.8                            | -                                    | -                                             | -                         | -                                | -    | -    | -    | -                              | -   | -   | GM-Fill                                               |
|            |            | 3-4   | 19.0                           | -                                    | -                                             | -                         | -                                | -    | -    | -    | -                              | -   | -   | CL-Fill                                               |
|            | S-3        | 4-6   | 10.5                           | -                                    | -                                             | -                         | -                                | -    | -    | -    | -                              | -   | -   | CL-Till                                               |
|            | S-4        | 6-8   | 10.9                           | -                                    | -                                             | -                         | -                                | -    | -    | -    | -                              | -   | -   | CL-Till                                               |
|            | S-5        | 8-10  | 10.7                           | -                                    | -                                             | -                         | -                                | -    | -    | -    | -                              | -   | -   | CL-Till                                               |
| B-4        | S-1        | 0-2   | 5.8                            | -                                    | -                                             | -                         | -                                | -    | -    | -    | -                              | -   | -   | GM-Fill                                               |
|            | S-2        | 2-4   | 11.0                           | -                                    | -                                             | -                         | -                                | -    | -    | -    | -                              | -   | -   | CL-Till                                               |
|            | S-3        | 4-6   | 9.6                            | -                                    | -                                             | -                         | -                                | -    | -    | -    | -                              | -   | -   | CL-Till                                               |
|            | S-4        | 6-8   | 11.4                           | -                                    | -                                             | -                         | -                                | -    | -    | -    | -                              | -   | -   | 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. &  
BUFFALO DRILLING COMPANY, INC.**



12340 MAIN STREET  
AKRON, NEW YORK 14001  
(716) 759-7821 FAX: (716) 759-7823

**TEST BORING LOG**

**JOB No.:** 26-529

**BORING No.:** B-1

**PROJECT:** Proposed Addition to Bornhava School  
25 Chateau Terrace, Town of Amherst, Erie Co., New York 14226

**DRILLER:** D. Rimbeck  
**SAMPLING METHODS:** ASTM D1586  
**DATE STARTED:** 4/6/26  
**DATE COMPLETED:** 4/6/26

**TYPE OF DRILL RIG:** Diedrich D-50 (Truck)  
**SIZE AND TYPE OF BIT:** 2 1/4" I.D. H.S.A.  
**SURFACE ELEVATION (ft.):** 675.7  
**GROUNDWATER DEPTH (ft.):** None  
(measured at completion unless indicated below)

| Elevation/<br>Depth<br>(feet) | Soil Symbols<br>Sampler Symbols<br>Field Test Data                                           | Sample<br>No. : Range | N-<br>Value | % REC<br>(RQD) | Soil and Rock Description / Remarks                                                  |
|-------------------------------|----------------------------------------------------------------------------------------------|-----------------------|-------------|----------------|--------------------------------------------------------------------------------------|
| 675                           | <br>REFUSAL |                       |             |                | Asphalt (2")                                                                         |
|                               |                                                                                              | S-1 : 0.2'- 2.0'      | 43          | 50             | Gray, dense f/c sand to gravel-sized Crushed Limestone, little Silt, moist (GM-Fill) |
|                               |                                                                                              | S-2 : 2.0'- 2.9'      | 50+         | 10             | (Subbase aggregate)<br>...grade: v. dense                                            |
| 670                           |                                                                                              |                       |             |                | Depth to Bottom of Hole: 3.0 feet                                                    |
| 665                           |                                                                                              |                       |             |                |                                                                                      |
| 660                           |                                                                                              |                       |             |                |                                                                                      |
| 655                           |                                                                                              |                       |             |                |                                                                                      |
| 650                           |                                                                                              |                       |             |                |                                                                                      |
| 645                           |                                                                                              |                       |             |                |                                                                                      |
| 640                           |                                                                                              |                       |             |                |                                                                                      |

Logged by: E. Zinni

**BARRON & ASSOCIATES, P.C. &  
BUFFALO DRILLING COMPANY, INC.**



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# TEST BORING LOG

**JOB No.:** 26-529

**BORING No.:** B-2

**PROJECT:** Proposed Addition to Bornhava School  
25 Chateau Terrace, Town of Amherst, Erie Co., New York 14226

**DRILLER:** D. Rimbeck  
**SAMPLING METHODS:** ASTM D1586  
**DATE STARTED:** 4/6/26  
**DATE COMPLETED:** 4/6/26

**TYPE OF DRILL RIG:** Diedrich D-50 (Truck)  
**SIZE AND TYPE OF BIT:** 2 1/4" I.D. H.S.A.  
**SURFACE ELEVATION (ft.):** 674.5  
**GROUNDWATER DEPTH (ft.):** None  
(measured at completion unless indicated below)

| Elevation/<br>Depth<br>(feet) | Soil Symbols<br>Sampler Symbols<br>Field Test Data | Sample<br>No. : Range | N-<br>Value | % REC<br>(RQD) | Soil and Rock Description / Remarks                                                     |
|-------------------------------|----------------------------------------------------|-----------------------|-------------|----------------|-----------------------------------------------------------------------------------------|
| 0                             |                                                    |                       |             |                | Asphalt (3")                                                                            |
|                               |                                                    | S-1 : 0.3'- 2.0'      | 33          | 70             | Gray, dense f/c sand to gravel-sized Crushed Limestone, little Silt, moist (GM- Fill)   |
|                               |                                                    | S-2 : 2.0'- 4.0'      | 38          | 75             | (Subbase aggregate)<br>Same as S-1                                                      |
| 670                           |                                                    | S-3 : 4.0'- 6.0'      | 44          | 75             | Brown, hard CLAY and Silt, little Gravel, little f/c Sand, sl. plastic, moist (CL-Till) |
| 5                             |                                                    | S-4 : 6.0'- 8.0'      | 44          | 75             | Same as S-2                                                                             |
|                               |                                                    | S-5 : 8.0'- 8.8'      | 50+         | 25             | Same as S-2                                                                             |
| 665                           |                                                    |                       |             |                | Depth to Bottom of Hole: 9.0 feet                                                       |
| 10                            |                                                    |                       |             |                |                                                                                         |
| 15                            |                                                    |                       |             |                |                                                                                         |
| 20                            |                                                    |                       |             |                |                                                                                         |
| 25                            |                                                    |                       |             |                |                                                                                         |
| 30                            |                                                    |                       |             |                |                                                                                         |
| 35                            |                                                    |                       |             |                |                                                                                         |

Logged by: E. Zinni

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AKRON, NEW YORK 14001  
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# TEST BORING LOG

**JOB No.:** 26-529

**BORING No.:** B-3

**PROJECT:** Proposed Addition to Bornhava School  
25 Chateau Terrace, Town of Amherst, Erie Co., New York 14226

**DRILLER:** D. Rimbeck  
**SAMPLING METHODS:** ASTM D1586  
**DATE STARTED:** 4/6/26  
**DATE COMPLETED:** 4/6/26

**TYPE OF DRILL RIG:** Diedrich D-50 (Truck)  
**SIZE AND TYPE OF BIT:** 2 1/4" I.D. H.S.A.  
**SURFACE ELEVATION (ft.):** 674.1  
**GROUNDWATER DEPTH (ft.):** None  
(measured at completion unless indicated below)

| Elevation/<br>Depth<br>(feet) | Soil Symbols<br>Sampler Symbols<br>Field Test Data | Sample<br>No. : Range | N-<br>Value | % REC<br>(RQD) | Soil and Rock Description / Remarks                                                                                            |
|-------------------------------|----------------------------------------------------|-----------------------|-------------|----------------|--------------------------------------------------------------------------------------------------------------------------------|
| 0                             |                                                    | S-1 : 0.1'- 1.6'      | 24          | 65             | Asphalt (1")<br>Gray, m. dense f/c sand to gravel-sized Crushed Limestone, little Silt, moist (GM-Fill)<br>(Subbase aggregate) |
|                               |                                                    | S-2 : 2.0'- 4.0'      | 23          | 50             | Same as S-1<br>Dk. brown, v. stiff Clay, some Silt, little Gravel, little f/c Sand, tr. Asphalt, mod. plastic, moist (CL-Fill) |
| 670                           |                                                    | S-3 : 4.0'- 6.0'      | 24          | 75             | Brown, v. stiff CLAY and Silt, little Gravel, little f/c Sand, sl. plastic, moist (CL-Till)<br>...grade: hard                  |
| 5                             |                                                    | S-4 : 6.0'- 8.0'      | 40          | 75             | Same as S-4                                                                                                                    |
| 665                           |                                                    | S-5 : 8.0'- 10.0'     | 47          | 75             |                                                                                                                                |
| 10                            |                                                    |                       |             |                |                                                                                                                                |
| 660                           |                                                    |                       |             |                |                                                                                                                                |
| 15                            |                                                    |                       |             |                |                                                                                                                                |
| 655                           |                                                    |                       |             |                |                                                                                                                                |
| 20                            |                                                    |                       |             |                |                                                                                                                                |
| 650                           |                                                    |                       |             |                |                                                                                                                                |
| 25                            |                                                    |                       |             |                |                                                                                                                                |
| 645                           |                                                    |                       |             |                |                                                                                                                                |
| 30                            |                                                    |                       |             |                |                                                                                                                                |
| 640                           |                                                    |                       |             |                |                                                                                                                                |
| 35                            |                                                    |                       |             |                |                                                                                                                                |
|                               |                                                    |                       |             |                | Depth to Bottom of Hole: 10.5 feet                                                                                             |

Logged by: E. Zinni

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# TEST BORING LOG

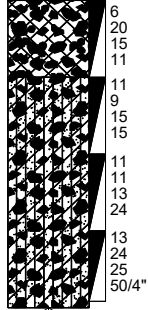
**JOB No.:** 26-529

**BORING No.:** B-4

**PROJECT:** Proposed Addition to Bornhava School  
25 Chateau Terrace, Town of Amherst, Erie Co., New York 14226

**DRILLER:** D. Rimbeck  
**SAMPLING METHODS:** ASTM D1586  
**DATE STARTED:** 4/6/26  
**DATE COMPLETED:** 4/6/26

**TYPE OF DRILL RIG:** Diedrich D-50 (Truck)  
**SIZE AND TYPE OF BIT:** 2 1/4" I.D. H.S.A.  
**SURFACE ELEVATION (ft.):** 672.2  
**GROUNDWATER DEPTH (ft.):** None  
(measured at completion unless indicated below)

| Elevation/<br>Depth<br>(feet) | Soil Symbols<br>Sampler Symbols<br>Field Test Data                                | Sample<br>No. : Range | N-<br>Value | % REC<br>(RQD) | Soil and Rock Description / Remarks                                                                                |
|-------------------------------|-----------------------------------------------------------------------------------|-----------------------|-------------|----------------|--------------------------------------------------------------------------------------------------------------------|
| 0                             |  |                       |             |                |                                                                                                                    |
| 670                           |                                                                                   | S-1 : 0.0'- 2.0'      | 35          | 50             | Gray, dense f/c sand to gravel-sized Crushed Limestone, little Silt, moist (GM-Fill)<br><i>(Subbase aggregate)</i> |
|                               |                                                                                   | S-2 : 2.0'- 4.0'      | 24          | 75             | Brown, v. stiff CLAY and Silt, little Gravel, little f/c Sand, sl. plastic, moist (CL-Till)                        |
| 5                             |                                                                                   | S-3 : 4.0'- 6.0'      | 24          | 75             | Same as S-2                                                                                                        |
| 665                           |                                                                                   | S-4 : 6.0'- 7.8'      | 49          | 75             | ...grade: hard                                                                                                     |
| 10                            |                                                                                   |                       |             |                | Depth to Bottom of Hole: 8.0 feet                                                                                  |
| 660                           |                                                                                   |                       |             |                |                                                                                                                    |
| 15                            |                                                                                   |                       |             |                |                                                                                                                    |
| 655                           |                                                                                   |                       |             |                |                                                                                                                    |
| 20                            |                                                                                   |                       |             |                |                                                                                                                    |
| 650                           |                                                                                   |                       |             |                |                                                                                                                    |
| 25                            |                                                                                   |                       |             |                |                                                                                                                    |
| 645                           |                                                                                   |                       |             |                |                                                                                                                    |
| 30                            |                                                                                   |                       |             |                |                                                                                                                    |
| 640                           |                                                                                   |                       |             |                |                                                                                                                    |
| 35                            |                                                                                   |                       |             |                |                                                                                                                    |

Logged by: E. Zinni



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## **APPENDIX B**

### **GEOTECHNCIAL REFERENCE STANDARDS**



# BARRON & ASSOCIATES, P.C.

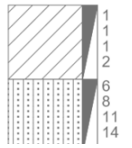
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PAGE: 1 of 3

## Column Header Descriptions

| BARRON & ASSOCIATES, P.C. &<br>BUFFALO DRILLING COMPANY, INC.                                                                                                         |                                                                                    | TEST BORING LOG                                                             |             |                |                                                                                                                     |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|-------------|----------------|---------------------------------------------------------------------------------------------------------------------|
|  10440 MAIN STREET<br>CLARENCE, NEW YORK 14031<br>(716) 759-7821 FAX: (716) 759-7823 |                                                                                    | JOB No.:                                                                    |             | BORING No.:    |                                                                                                                     |
| PROJECT:                                                                                                                                                              |                                                                                    | EXAMPLE                                                                     |             |                |                                                                                                                     |
| DRILLER:                                                                                                                                                              |                                                                                    | TYPE OF DRILL RIG:                                                          |             |                |                                                                                                                     |
| SAMPLING METHODS:                                                                                                                                                     |                                                                                    | SIZE AND TYPE OF BIT:                                                       |             |                |                                                                                                                     |
| DATE STARTED:                                                                                                                                                         |                                                                                    | SURFACE ELEVATION (ft.):                                                    |             |                |                                                                                                                     |
| DATE COMPLETED:                                                                                                                                                       |                                                                                    | GROUNDWATER DEPTH (ft.):<br>(measured at completion unless indicated below) |             |                |                                                                                                                     |
| Elevation/<br>Depth<br>(feet)                                                                                                                                         | Soil Symbols<br>Sampler Symbols<br>Field Test Data                                 | Sample<br>No. : Range                                                       | N-<br>Value | % REC<br>(RQD) | Soil and Rock Description / Remarks                                                                                 |
| 100<br>0                                                                                                                                                              |  | S-1 : 0.0'- 2.0'                                                            | 2           | 50             | Dk. brown, soft, CLAY, some Silt, little f. Sand, tr. Gravel, tr. Roots, tr. Organic matter, mod. plastic, wet (CL) |
|                                                                                                                                                                       |                                                                                    | S-2 : 2.0'- 4.0'                                                            | 19          | 50             | Brown, m. dense f. SAND, some Silt, tr. Gravel, tr. Clay, tr. Roots, non-plastic, moist (SM)                        |

Elevation/Depth: The depth column provides the vertical scale of the boring log in feet below ground surface.

Sample No. : Range: Disturbed samples are identified with "S" preceding the sample number. Undisturbed (Shelby-tube) samples are identified with "U" preceding the sample number. Rock core samples identified with "C" preceding the core run. The range of elevation/depth where the sample was taken is identified in one-tenth foot increments.

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-in outside diameter split-spoon sampler 12 inches.

% REC (RQD): "Percent Recovery" is the length of samples recovered divided by the total length sampled. The result is numerically expressed as a percent. The Rock Quality Designation (RQD) is the total length of places >4 inches divided by the total length of core run.

Soil and Rock Description / Remarks: This column denotes the exact depth of recovery and general documentation of drilling efforts. 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 time under conditions stated on the boring logs. Fluctuations in the water level may occur due to other factors than those present the time measurement was taken. See attached sheet.

**Soil and Rock Description / Remarks: Terminology Used for Soil Description****Density Description of Granular Soil**

| <i>Number of Blows per ft., N</i> | <i>Relative Density</i> |
|-----------------------------------|-------------------------|
| 0 - 4                             | Very Loose              |
| 4 - 10                            | Loose                   |
| 10 - 30                           | Medium                  |
| 30 - 50                           | Dense                   |
| Over 50                           | Very Dense              |

**Abbreviations Used in Soil Sample Classification**

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

**Consistency Description of Cohesive Soil**

| <i>Number of Blows per ft., N</i> | <i>Consistency</i> |
|-----------------------------------|--------------------|
| Below 2                           | Very Soft          |
| 2 - 4                             | Soft               |
| 4 - 8                             | Medium             |
| 8 - 15                            | Stiff              |
| 15 - 30                           | Very Stiff         |
| Over 30                           | Hard               |

**Bedding**

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

**Grain Size**

|         | <i>Passing / Retained on</i>   |
|---------|--------------------------------|
| Boulder | LARGE / 12-in sieve            |
| Cobble  | 12-in / 3-in sieve             |
| Gravel  | 3-in sieve / No. 4 sieve       |
|         | No. 4 sieve / No. 10 sieve     |
| Sand    | No. 10 sieve / No. 40 sieve    |
|         | No. 40 sieve / No. 200 sieve   |
| Silt    | No. 200 sieve / 0.005 mm sieve |
| Clay    | Smaller than 0.005 mm          |

**Hardness**

|                      |                                  |
|----------------------|----------------------------------|
| Very Soft or Plastic | Can be indented with thumb       |
| Soft                 | Can be scratched with fingernail |
| Moderately Hard      | Can be scratched with knife      |
| Hard                 | Difficulty to scratch with knife |
| Very hard            | Cannot be scratched with knife   |

**Percentage Terminology Used in Soil Classification**

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

**Moisture**

|           |                                                                        |
|-----------|------------------------------------------------------------------------|
| Dry       | Absence of moisture, dusty, dry to the touch.                          |
| Moisture  | 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.           |

**Plasticity**

|                     |                                                                                                         |
|---------------------|---------------------------------------------------------------------------------------------------------|
| Non-plastic         | An 1/8-in thread cannot be rolled at any water content.                                                 |
| Slight plasticity   | Thread can be barley rolled.                                                                            |
| Moderate plasticity | Thread is easy to roll and little time is required to reach the plastic limit (PL).                     |
| Plasticity          | Considerable time is required to reach PL. Thread can be re-rolled several times after reaching the PL. |

**Crystallinity or Texture**

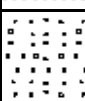
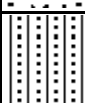
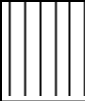
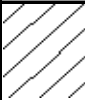
|                           |                                                                        |
|---------------------------|------------------------------------------------------------------------|
| Dense                     | Crystals are to small they cannot be distinguished with the naked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

**Voids**

|        |                                                                                                              |
|--------|--------------------------------------------------------------------------------------------------------------|
| Porous | Smaller than pinhead. Their presence is indicated by the degree of absorbcency.                              |
| Pitted | Pinhead size to 1/4 in. If thin walls separate the individuals pits, the core may be described as honeycomb. |
| 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.                                                                        |



### Soil Classification Chart: Unified Soil Classification System (USCS)

| Major Divisions                                                                  |                                                                          |                                                                                     | Pattern                                                                             | USCS ID                                                                                                            | Typical Descriptions                                                    |
|----------------------------------------------------------------------------------|--------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|
| <b>Coarse-Grained Soils:</b> More than 50% of material larger than No. 200 sieve | <b>Gravels:</b> 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-silt mixtures                               |
|                                                                                  | <b>Sands:</b> 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 amount of fines                                               |   | SM                                                                                                                 | Silty sands, silt-sand mixtures                                         |
|                                                                                  |                                                                          |                                                                                     |  | SC                                                                                                                 | Clayey sands, sand-clay mixtures                                        |
| <b>Fine-Grained Soils:</b> Less than 50% of material larger than No. 200 sieve   | <b>Silts and Clays, Low plasticity:</b><br>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, gravelly clays, sandy clays, silty clays, lean clays                  |                                                                         |
|                                                                                  |                                                                          |  | OL                                                                                  | Organic silts and organic silty clays of low plasticity                                                            |                                                                         |
|                                                                                  | <b>Silts and Clays, High plasticity:</b><br>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**

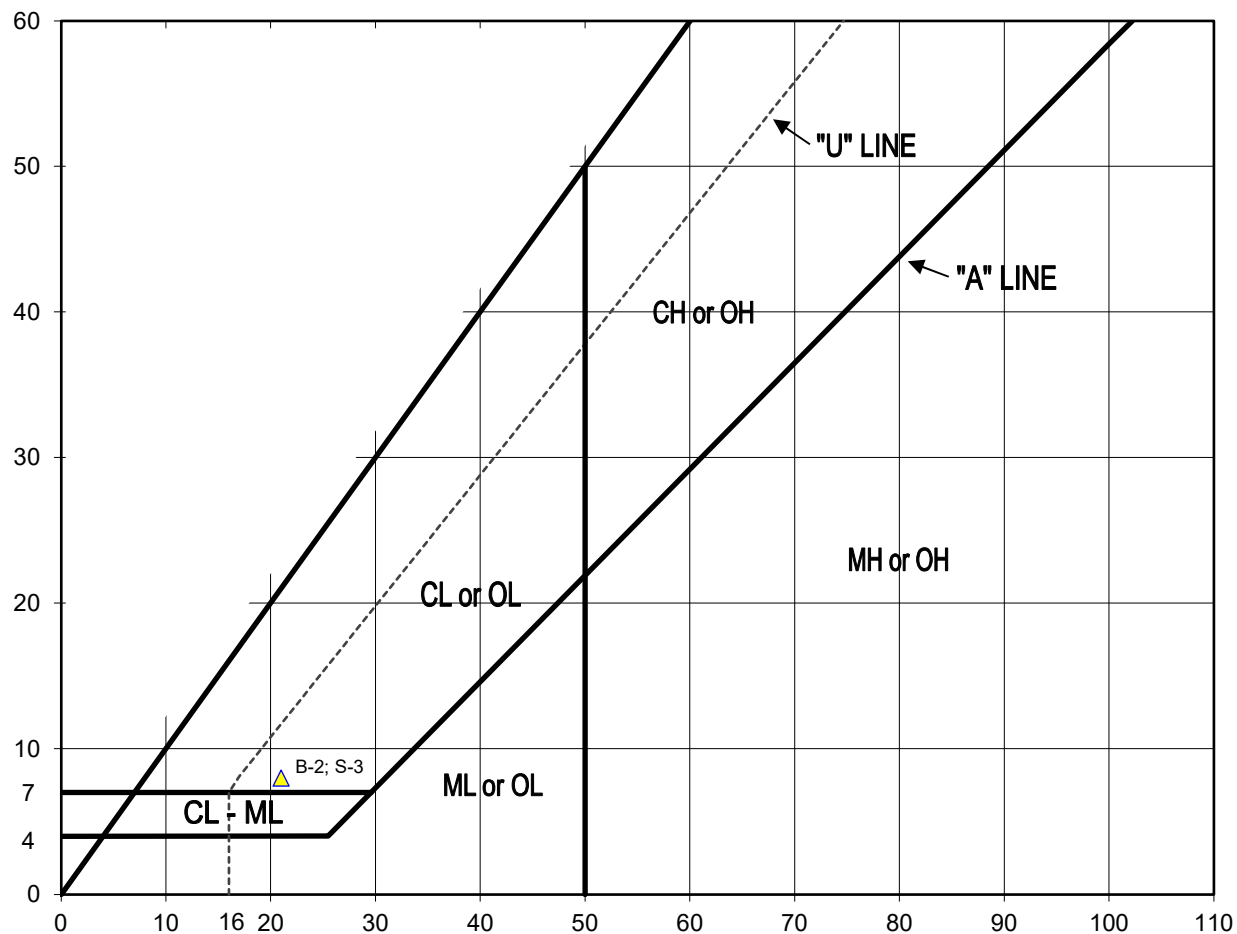
### **LABORATORY SOIL TEST RESULTS**

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Job No: 26-529

Project: Proposed Addition to Bornhava School  
25 Chateau Terrace  
Amherst, Erie Co., New York 14226**Plasticity Chart**  
ASTM D4318 & D2487

| Boring No. | Sample No. | Depth (ft.) | LL (%) | PL (%) | PI (%) |
|------------|------------|-------------|--------|--------|--------|
| B-2        | S-3        | 4-6         | 21     | 13     | 8      |



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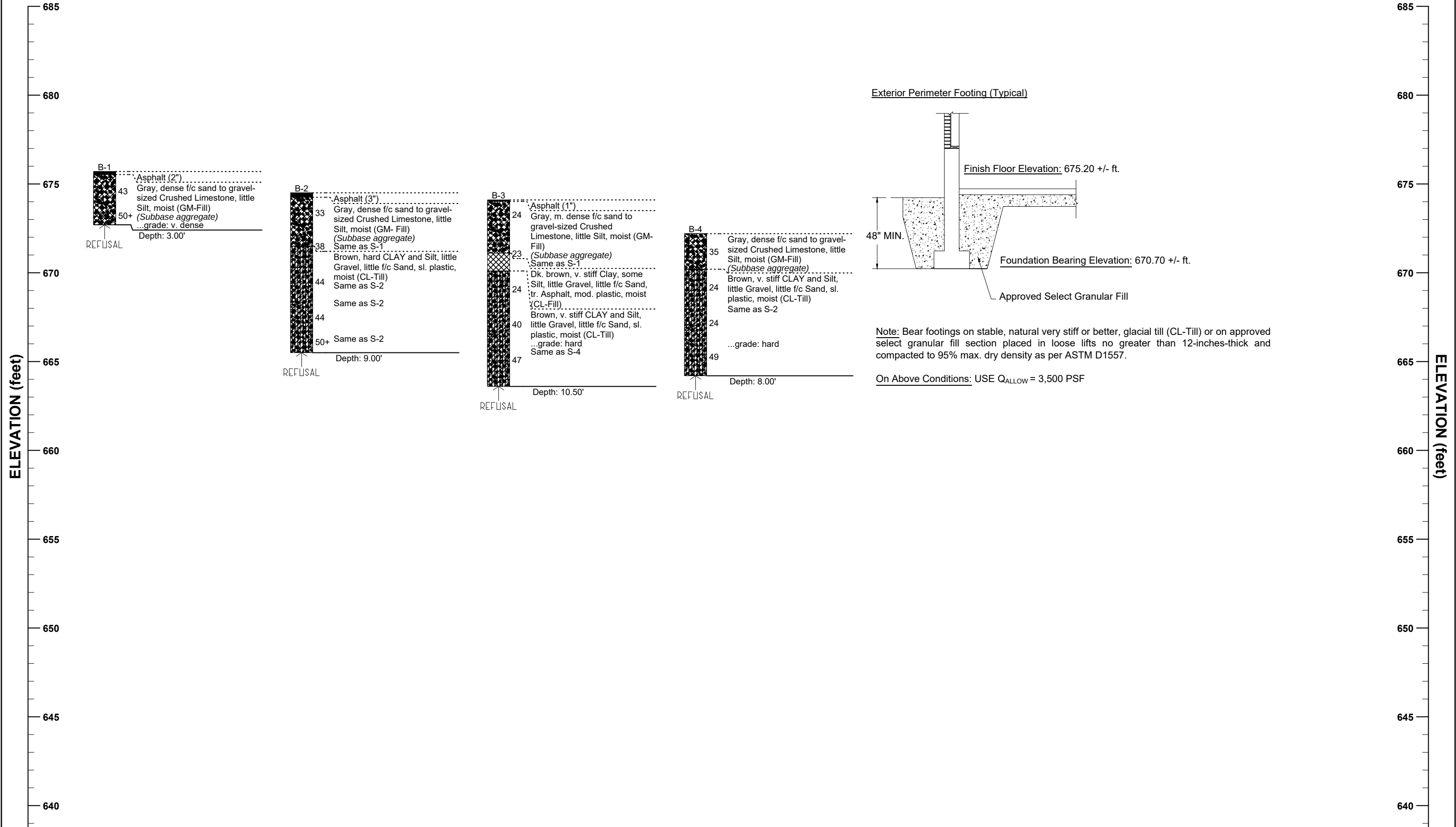
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## **APPENDIX D**

### **ENGINEERING COMPUTATIONS AND SCHEMATICS**

"PROFILE" OF BORINGS

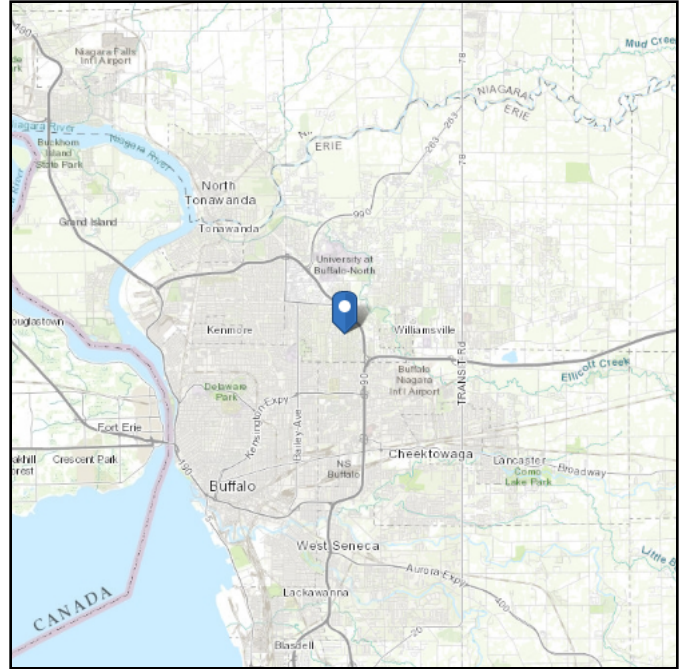
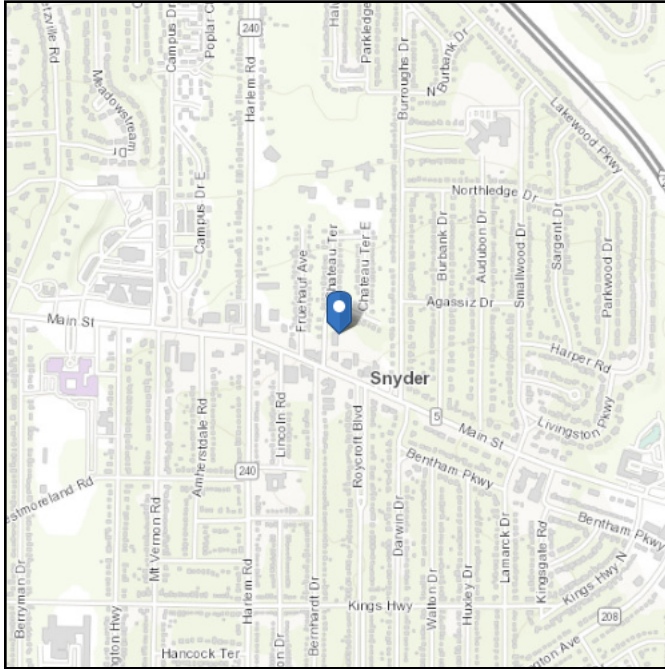


# ASCE Hazards Report

**Address:**  
No Address at This Location

**Standard:** ASCE/SEI 7-22  
**Risk Category:** II  
**Soil Class:** BC

**Latitude:** 42.9635  
**Longitude:** -78.7808  
**Elevation:** 677.6971107742334 ft  
(NAVD 88)

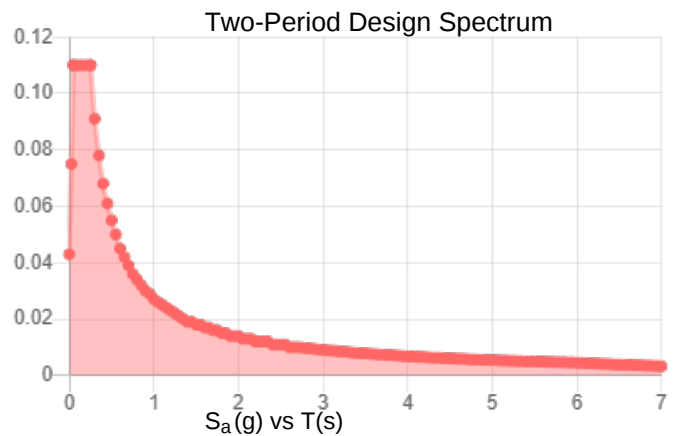
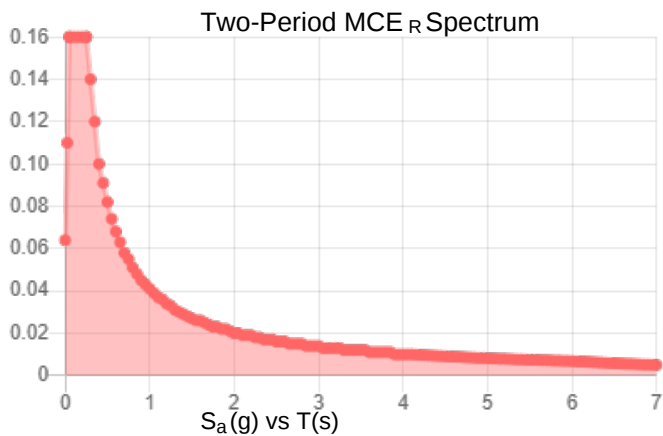
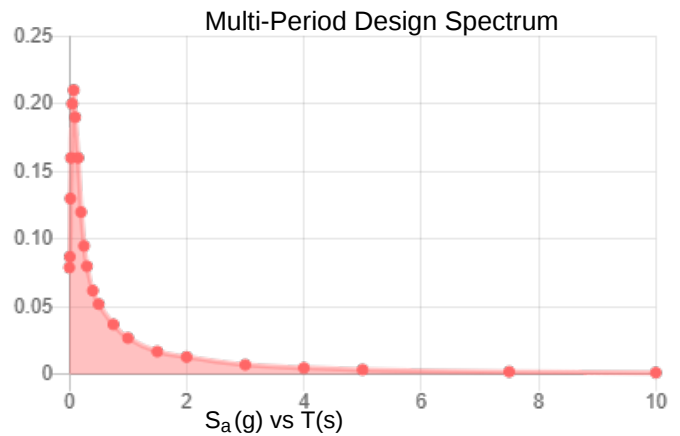
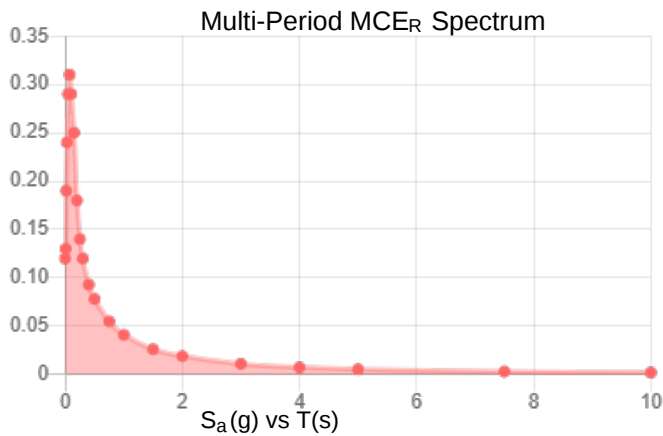


Site Soil Class: BC

**Results:**

|                    |       |                    |       |
|--------------------|-------|--------------------|-------|
| PGA <sub>M</sub> : | 0.1   | T <sub>L</sub> :   | 6     |
| S <sub>MS</sub> :  | 0.16  | S <sub>S</sub> :   | 0.18  |
| S <sub>M1</sub> :  | 0.041 | S <sub>1</sub> :   | 0.041 |
| S <sub>DS</sub> :  | 0.11  | V <sub>S30</sub> : | 760   |
| S <sub>D1</sub> :  | 0.027 |                    |       |

**Seismic Design Category: A**



MCE<sub>R</sub> Vertical Response Spectrum  
Vertical ground motion data has not yet been made available by USGS.

Design Vertical Response Spectrum  
Vertical ground motion data has not yet been made available by USGS.

**Data Accessed:** Tue May 05 2026

**Date Source:**

**USGS Seismic Design Maps based on ASCE/SEI 7-22 and ASCE/SEI 7-22 Table 1.5-2. Additional data for site-specific ground motion procedures in accordance with ASCE/SEI 7-22 Ch. 21 are available from USGS.**

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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:  $\phi' = 38$  degrees {Teng, pg. 12}
  - \* average in-place densities: moist -  $\gamma_m = 120$  pcf
  - saturated -  $\gamma_{sat} = 132$  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):
- $$f_s = \tan(0.58 \times \phi') = 0.40 \quad (\text{AREA silty soil to silty coarse-grained soil})$$
- h) Use equivalent fluid pressure design approach {Hough, pg. 249 and NAVFAC pg. 7-10-9}:
- \* at rest pressure coefficient -  $K_0 = 1 - \sin(\phi') = 0.38$
  - \* effective lateral pressure of soil -  $\gamma'_l = K_0 \times \gamma' = 26.6$  pcf
  - \* hydrostatic pressure -  $\gamma_w = 62.4$  pcf
  - \* equivalent fluid pressure with water level -  $\gamma_{eo} = \gamma'_l + \gamma_w = 89$  pcf (say 90 pcf)
  - at the top of the grade at the wall
  - \* equivalent fluid pressure with compaction  $\gamma_{eo} = 2 \times K_0 \times \gamma_m = 91$  pcf (say 90 pcf)
  - induced lateral stress increase (W&F, pg 409)
  - \* 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)
  - $K_p = [1 + \sin(\phi')] / [1 - \sin(\phi')] = 4.2$
  - $\gamma_{ep} = K_p \times \gamma_m = 504$  pcf (say 330 pcf with a F.S. = 1.5)
  - \* passive pressure case -

|                                                                                                                                                                                           |                                                                                                                              | Thoroughly Compacted $\Rightarrow \Rightarrow$ | Uniformly Graded & Clean<br>Coarse Sand or Sandy Gravel Fill | Non-Plastic Silty Sand<br>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<br>@ 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)                                                                           | =                                              | $(6.8 \text{ psf / foot}) \times H_{bw}^2$                   | (NYS, $S_{ds} = 0.25$ g)                     |
|                                                                                                                                                                                           | ( $\gamma_m = 120$ pcf for $S_{ds}$ value. Add to Static At Rest/                                                            | =                                              | $(13.5 \text{ psf / foot}) \times H_{bw}^2$                  | (NYS, $S_{ds} = 0.50$ g)                     |
|                                                                                                                                                                                           | Active Pressure/Load for unsaturated backfill case)                                                                          | =                                              | $(17.5 \text{ psf / foot}) \times H_{bw}^2$                  | (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**



**GENERAL EARTHWORK SPECIFICATIONS**

**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, PC* 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 31 (Earthwork) and Division 32 (Exterior Improvements).

**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**

**1.2.1. American Standard for Testing and Measurement (ASTM)**

- ASTM C136 Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
- ASTM D6938 Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
- ASTM D7928 Standard Test Method for Particle-Size Distribution (Gradation) of Fine-Grained Soils Using the Sedimentation (Hydrometer) Analysis
- ASTM D1140 Standard Test Methods for Determining the Amount of Material Finer than 75- $\mu$ m (No. 200) Sieve in Soils by Washing
- ASTM D1557 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup> (2,700 kN-m/m<sup>3</sup>))
- ASTM D2216 Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
- ASTM D2487 Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)

- ASTM D4318 Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
- ASTM D1883 Standard Test Method for California Bearing Ratio (CBR) of Laboratory-Compacted Soils

#### 1.2.2. Other

- 2018 International Building Code (IBC)
- 2020 Building Code of New York State
- 2020 Residential Code of New York State
- 2021 MasterSpec

### 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.

| <b>Table A: Select Granular Fill</b>      |                                |
|-------------------------------------------|--------------------------------|
| <u>Sieve Size</u>                         | <u>Percent Finer by Weight</u> |
| $\frac{2}{3}$ 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.

| <b>Table B: Sand and Gravel</b> |                                |
|---------------------------------|--------------------------------|
| <u>Sieve Size</u>               | <u>Percent Finer by Weight</u> |
| *                               | 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.

| <b>Table C: Crushed Stone</b> |                                |                       |
|-------------------------------|--------------------------------|-----------------------|
| <u>Sieve Size</u>             | <u>Percent Finer by Weight</u> |                       |
|                               | <u>¾-inch Stone</u>            | <u>1 ¼-inch Stone</u> |
| 1 ½-inch                      |                                | 100                   |
| 1 ¼-inch                      |                                | 85 - 100              |
| 1-inch                        | 100                            |                       |
| ¾-inch                        | 90 - 100                       | 10 - 40               |
| ⅝-inch                        |                                |                       |
| ½-inch                        | 10 - 50                        | 0 - 8                 |
| ⅜-inch                        | 0 - 20                         |                       |
| No. 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 effects 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, D7928, 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 D6938 and D1557
- (3) Sample: Geotextile fabric

#### 2. PRODUCTS

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

#### 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 event 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                                                         |                           |                                              |                     |                                 |                     |
|------------------------------------------------------------------------------------------|---------------------------|----------------------------------------------|---------------------|---------------------------------|---------------------|
| <u>Compaction Method</u>                                                                 | <u>Maximum Stone Size</u> | <u>Maximum Loose Lift Thickness (inches)</u> |                     | <u>Maximum Number of Passes</u> |                     |
|                                                                                          |                           | 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 affecting 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 areas which have been disturbed due to groundwater seepage pressures and to expedite dewatering operations. Particular attention shall be given to 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                                |                                              |
|-----------------------------------------------------------------|----------------------------------------------|
| <u>Area</u>                                                     | <u>Minimum Degree of Compaction (%)</u>      |
| 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 building addition 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 Specialized Early Childhood Center of WNY and their designated design representatives, for specific application to the construction of a two-story addition to the existing Bornhava School at 25 Chateau Terrace, in the Town of Amherst, Erie County, New York and in accordance with generally accepted geotechnical engineering practice. No other warranty, expressed or implied, is made.