GLYNN GROUP
ENGINEERING & ARCHITECTURE, PLLC

Civil • Geotechnical
Structural • Architecture
Material Testing • Consulting

Crosspoint Business Park Expansion
Amherst, New York

Preliminary Geotechnical Engineering Report

GGEA 19-1065

Prepared for:
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5.17.19

May 16, 2019

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1.0 INTRODUCTION

1.1 SCOPE

This report provides subsurface investigation data and geotechnical recommendations for the proposed addition to 580 Crosspoint Parkway and associated parking lot development at 3750 Millersport Highway in the Town of Amherst, New York. Specifically, Glynn Group Engineering & Architecture, PLLC (GGEA) has provided the following scope of services:

1. Performed a site visit and establish a total of six (6) soil boring locations, with one boring located within the footprint of the proposed building and the remaining borings located in the proposed parking area.

2. Cleared underground utilities with Dig Safely New York.

3. Mobilized drilling subcontractor, Earth Dimensions, Inc. (EDI) with ATV drill rig and crew.

4. Provided SPT soil sampling in accordance with ASTM D-1586 "Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils". One soil boring was advanced to auger refusal on bedrock with a 5 foot rock core. The remaining borings were advanced to a depth of 10 feet each.

5. Provided soil boring logs, prepared by EDI, to include SPT data, N values, soil classification, refusal depth and encountered groundwater conditions.

6. Provided in house laboratory testing of select recovered soil samples to include natural moisture content, grain size analysis, liquid limit and plasticity index.

7. Prepared a preliminary geotechnical report in accordance with the 2015 International Building Code (IBC) to include foundation recommendations, allowable bearing capacity, total and differential settlement, seismic site class and design category, backfill recommendations, groundwater mitigation, expansive soil mitigation, liquefaction mitigation, slab on grade, pavement and construction recommendations.

1.2 CONTRACT

GGEA performed this study in accordance with a written proposal to Kimley-Horn dated January 14, 2019. Subsequently, Kimley-Horn of New York, PC (KHNY) issued a Standard Agreement for Services on April 5, 2019, for which GGEA received a signed copy from Mr. Adam Gibson of KHNY on April 9, 2019. All services provided by GGEA are subject to the Standard Terms and Conditions included in the GGEA January 14, 2019 geotechnical proposal.

1.3 EXCLUSIONS

The project efforts exercised by GGEA include soil borings, preliminary geotechnical analysis, design recommendations and the preparation of this report. The scope of this report specifically excludes any review of former site use, in particular, environmental or pollution related concerns.

2.0 PROJECT BACKGROUND

2.1 SITE DESCRIPTION AND PROPOSED IMPROVEMENTS

The site is located on the west side of Millersport Highway, south of Hopkins Road and north of Crosspoint Parkway. The site encompasses three main parcels, SBL# 28.00-1-58.1 (3750 Millersport Highway), which is located to the east and is primarily undeveloped, SBL# 28.00-1-70, which is located to the west and is covered primarily by asphalt parking, and SBL# 280-155.112, which is located within parcel SBL# 28.00-1-70 and consists of the building at 580 Crosspoint Parkway. All three properties are relatively flat and covered by mowed grass in undeveloped areas. A small wooded area is located at the northeast corner of the 3750 Millersport Highway property. Refer to the Project Location Plan included in Appendix B.

An existing three (3) story building is located at 580 Crosspoint Parkway, which has a footprint of approximately 50,000 square feet and is surrounded by an extensive asphalt parking lot. The proposed construction is to consist of a +/- 15,500 square foot addition to the southeast corner of the existing 580 building. The addition is presumed to not include a basement and have a slab on grade first floor. Once the addition is constructed it will be given an address of 560 Crosspoint Parkway. Supplemental to the building addition, a significant parking expansion is proposed on the SBL# 28.00-1-58.1 parcel to the east of the current parking lot, which is to include 724 new parking spaces and stormwater detention. Refer to the Boring Location Plans S2A and S2B included in Appendix C.

2.2 GEOLOGIC SETTING

The underlying geological conditions at the site are the result of the last glacial advance of the Pleistocene Epoch, referred to as the Wisconsinan Glacial Stage, which ended approximately 12,000 years ago. As the glacier transgressed across Western New York, the massive weight carved and crushed the underlying soil and rock to form glacial till, which typically consists of a dense matrix of silt, sand, rock and clay. Sediments were deposited from the glacial ice and meltwater as glacial drift. As the climate warmed and the glacier melted, vast quantities of meltwater were generated, which became impounded by the receding glacier and local topography to create proglacial lakes throughout much of the area. Sediments were deposited from these lakes in the form of sands, silts and clays. The soils encountered at the Crosspoint property consist of fine grained glacio-lacustrine sediment overlying glacial drift and glacial till. The soils are underlain by calcareous shale bedrock of the upper Silurian Salina Group at a depth of 38 feet below existing grade.

3.0 FIELD INVESTIGATION

3.1 METHODOLOGY

The subsurface investigation consisted of one (1) soil boring advanced to auger refusal within the footprint of the proposed addition and five (5) soil borings advanced to a depth of 10.0 feet each throughout the proposed parking area. A 5.0 foot rock core was extracted from boring B-1 once refusal was encountered.

EDI mobilized a tracked mounted ATV drill rig to the site from April 30, 2019 to May 1, 2019 to perform the subsurface investigation. Soil boring and sampling operations were performed using hollow stem augers to advance through overburden materials in accordance with the Standard Penetration Test Method ASTM D-1586. Resistance values, or blow counts, were recorded for each six-inch advancement of a twenty-four inch long, two inch diameter split spoon sampler. N values were calculated based on the sum of the resistance values for the 6/12 and 12/18 inch sample intervals, which provide for an indication of the in-situ relative density and strength of encountered soils. Rock coring was performed in accordance with ASTM D-2113. All data recorded during drilling operations can be found on the soil boring logs included in Appendix A.

Retrieved soil samples were logged and visually classified by EDI in accordance with the ASEE System of Definition for Visual Identification of Soils (Burmister Classification System) and ASTM D-2488 "Standard Practice for Description and Identification of Soils (Visual – Manual Procedure)". Recovered soil samples were visually examined by GGEA to establish Unified Soil Classification System (USCS) classifications in accordance with ASTM D-2488 "Description and Identification of Soils (Visual-Manual Procedure)". Select samples were subjected to laboratory testing to establish USCS classifications in accordance with ASTM D-2487 "Classification of Soils for Engineering Purposes". Discrepancies observed between classifications noted on the EDI soil boring logs and those identified in this report are due to testing and examination in the GGEA laboratory, which allows for the collection of specific gradation and index property data that was not discerned from visual classification in the field.

3.2 SUBSURFACE CONDITIONS

The native subsurface conditions were found to be typical for the area, but vary slightly from boring B-1 located within the proposed building footprint to borings B-2 through B-6 located throughout the proposed parking area. The soils at boring B-1 were found to consist of a thin layer of topsoil overlying sandy silty clay (CL-ML) and sandy silt (ML) fill to a depth of 5.8 feet, followed by native gray poorly graded sand to a depth of 9.8 feet and native lean clay (CL) to a depth of 12.0 feet. Below this depth, the cohesive soils become wet and lose significant strength to a depth of 34.3 feet, where sandy silty clay (CL) glacial drift is encountered overlying silty gravel with sand (GM) glacial till. Subsurface conditions have been summarized at the proposed building footprint as follows:

0.0 – 0.8 ft	Dark brown, loose, moist, topsoil.
0.8 – 3.6 ft	Brown to light brown, moist to extremely moist, firm to hard, sandy silty clay with gravel (CL-ML) FILL. N values range from 8 to 31.
3.6 – 5.8 ft	Gray, moist, compact, clayey gravel with sand (GC) FILL. N value of 25.
5.8 – 9.8 ft	Brown to gray, faintly mottled, moist, compact, silty sand (SM). N values range from 26 to 16.
9.8 – 12.0 ft	Gray, moist, very stiff, lean clay (CL). N value of 25.
12.0 – 18.0 ft	Gray, extremely moist, stiff to firm, lean clay (CL). N values range from 9 to 5.
18.0 – 34.3 ft	Gray, extremely moist to wet, very soft to soft, lean clay (CL). N values range from 1 to 3.
34.3 – 38.0 ft	Gray, extremely moist, firm, sandy silty clay with gravel (CL-ML). N value of 6.
38.0 – 39.0 ft	Gray, extremely moist, very dense, silty gravel with sand (GM). N value of > 50.
39.0 – 44.0 ft	Dark gray, soft, shale bedrock with gypsum seams. RQD = 36 %.

The soils throughout the proposed parking area were typically found to consist of a thin layer of topsoil overlying surficial sandy silt fill and potential buried topsoil followed by compact native silty sand and stiff cohesive soil. Subsurface conditions throughout the proposed parking area have been generalized as follows:

0.0 – 0.5 ft	Dark brown, loose, moist, topsoil.
0.5 – 1.0 ft	Gray, moist to extremely moist, loose, sandy silt (ML) and silty sand (SM) FILL. N value of 8.
1.0 – 1.3 ft	Dark gray, moist, loose, silty sand (SM) FILL, trace of organics, possible buried topsoil.
1.3 – 4.0 ft	Brown and light gray, moist, compact, silty sand (SM). N value of 20.
4.0 – 10.0 ft	Gray, moist, stiff to very stiff, lean clay (CL). N values range from 13 to 23.

It is GGEA's opinion the extent of this investigation was sufficient to accurately characterize the subsurface conditions and provide information necessary for the preparation of this preliminary report. The subsurface conditions identified on the soil boring logs are typical for the East Amherst area, which is known to have soft clay soils of poor structural quality. The soil borings portray the subsurface conditions encountered at the soil boring locations at the time of investigation. The stratification lines shown on the soil boring logs are approximate, whereas in-situ the changes between strata may be more gradual. Specific subsurface conditions can be found on the soil boring logs included in Appendix A.

3.3 GROUNDWATER

Groundwater was not measured in the augers upon the completion of drilling efforts. The augers did not remain in the ground for an extended period of time to allow groundwater to migrate through the soils and stabilize within the augers, nor was the installation of groundwater monitoring wells or piezometers included in the scope of this investigation. However, based on the moisture content and strength of recovered soil samples, the stabilized groundwater elevation is estimated at a depth of approximately 12 feet, where soil strength begins to decrease and soil moisture content increases. Perched groundwater should be anticipated within surficial granular soil strata during seasonal wet periods and after storm events.

3.4 LABORATORY TESTING

A total of three (3) soil samples were selected for geotechnical laboratory testing to establish USCS classifications and index properties for native soils. Testing consisted of Grain Size Analysis (ASTM D-422), Atterberg Limits (ASTM D-4318) and Natural Moisture Content (ASTM D-2216). Specific laboratory test reports have been included in Appendix D. Laboratory test results have been summarized in the following table:

Lab No.	Boring No.	Depth (ft)	USCS	NMC (%)	LL	PL	PI
19-01	B-1-19	0.8 - 5.8	GC	12.2	26	16	10
19-02	B-1-19	5.8 - 8.0	SM	22.1	NV	NP	NP
19-03	B-1-19	12.0 - 16.0	CL	35.6	47	23	24

USCS = Unified Soil Classification System
NMC = Natural Moisture Content
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
NP = Non-Plastic
NV = Non-Viscous

4.0 GEOTECHNICAL EVALUATION AND RECOMMENDATIONS

4.1 FOUNDATIONS

The soft to very soft cohesive soils encountered at this site below a depth of approximately 15 feet provide significant limitations to the construction of a shallow foundation system due to the potential for long term consolidation settlement. GGEA provides preliminary recommendations and limitations for shallow foundation design as follows:

1. Foundation design should be predicated on a net allowable bearing capacity not to exceed 2,000 psf.

2. Dimensions for continuous strip footings and square spread footings should be designed to limit significant load distribution into soft clay soils. The foundation design should include an evaluation of Boussinesq pressure isobars to ensure the majority of the load transmitted is contained within the upper soils of good structural quality (i.e., within 15 feet of the ground surface).

3. Once foundation loads are established, a detailed settlement analysis should be performed based on the soil boring and laboratory data provided herein. Furthermore, additional sampling and testing should be considered, including the extraction of undisturbed Shelby Tube samples of soft cohesive soils and triaxial shear and/or consolidation analysis.

4. Foundation excavations should be advanced through existing topsoil, buried topsoil and fill materials to engage competent undisturbed, native soil. Based on conditions encountered at soil boring B-1, foundation excavations should be advanced to a minimum depth of 5.8 feet below existing grade to engage native soils. The foundation subgrade may be reconstructed to a higher design bearing elevation using properly placed engineered fill.

5. Control of perched groundwater may be necessary during construction and should be provided through the use of temporary sumps and suction pumps.

6. Once excavation has been completed to the design bearing elevation, the foundation subgrade should be compacted to ensure the densification of any loose material that may have been disturbed during the excavation process. Compaction can be performed by "knuckling" with the underside of the excavator bucket. Densification of the subgrade will assure the development of the anticipated bearing strength and reduce settlement potential.

7. Foundations should be constructed to bear at a minimum depth of > 3.5 feet below final grade to provide frost protection in accordance with regional frost depth regulations.

Confining building loads to the shallow foundation design criteria established above may prove difficult, especially if the addition is to match the three story height of the existing building. In the event shallow foundations cannot be designed to the constraints established above, or supplemental testing and settlement analysis yields unacceptable settlement results, a deep foundation system consisting of drilled concrete shafts installed to rock, steel H-piles driven to rock or helical screw anchors installed into glacial till should be considered. Furthermore, investigation into the performance of the foundation system supporting the existing building should be performed. Selection of the foundation system for the proposed addition should consider (1) the foundation system beneath the existing building, (2) if that system has experienced unacceptable settlement and (3) how new foundations may influence or be influenced by the existing foundation system.

4.2 SLAB ON GRADE

Although the building may be supported by deep foundations, the subsurface conditions will provide for standard slab on grade construction pending the slab is not subjected to excessive loading. The building interior slab on grade should be designed and constructed in accordance with the following recommendations:

1. All slabs should be designed using a recognized standard procedure, such as identified in the text "Designing Floor Slabs on Grade" by Ringo and Anderson (ISBN 0-924659-34-3). The floor slab should be designed to properly support the intended fork truck traffic, rack post loading or intended usage.
2. Remove topsoil and poor quality subsoil. Existing fill soils may remain if free of organic or deleterious materials. The removal of +/- 2.0 feet of subsoil may be required to engage competent subgrade.
3. Compact the exposed subgrade thoroughly with a smooth drum vibratory roller to produce a uniform density throughout the subgrade.
4. Proof roll the exposed subgrade with a fully loaded 10-wheel dump truck weighing at least 30 tons or a smooth drum roller having an effective force of at least 600 pounds per linear inch of roller width. Any area exhibiting weaving, yielding, rutting or boiling should be reworked and compacted to produce an acceptable response *or* over excavated and replaced with structural fill. The depth of the undercut and type of soil fill will depend on the soil material encountered, weather conditions and the bearing conditions at the base of the undercut. The top surface of the subgrade should be pitched to drain to prevent ponding of stormwater.
5. Install Structural Fill to achieve the design subgrade elevation.
6. Separation geotextile is not required for design, but is suggested to prevent contamination of the granular stone base from underlying soil subgrade as a result of repeated traffic during construction. Any granular stone base that becomes contaminated with soil during construction should be removed and replaced prior to pouring concrete. GGEA recommends US Fabrics US 250 or equivalent.
7. Place Select Structural Fill granular base. The thickness of the Select Structural Fill should be dependent upon the intended slab usage. At a minimum, GGEA recommends the granular base thickness be equivalent to that of the thickness of the slab. Heavily loaded slabs may require additional thickness.
8. Install subsurface utilities.
9. Install the concrete slab, which should be designed based on a subgrade reaction modulus of 125 pci. The subgrade reaction modulus may be increased depending on the installed thickness of Select Structural Fill. The use of a vapor barrier and specification of the concrete finish technique is at the discretion of the architect.

10. Proper joint spacing and reinforcing steel spacing/placement will be critical to the long term performance of slab. The Portland Cement Association recommends joint spacing in feet should be two to three times the slab thickness in inches.

4.3 FLEXIBLE PAVEMENT

GGEA provides design and construction recommendations for flexible pavement as follows:

1. Remove existing topsoil to expose competent, undisturbed native subgrade soil. Considering the existing fill soils and dark slightly organic subsoil (possibly buried topsoil) encountered at borings B-2, B-4 and B-6, the removal of +/- 2.0 feet of subsoil may be required to engage competent subgrade. GGEA recommends performing a series of test pits prior to performing stripping operations.
2. Compact the exposed subgrade thoroughly with a smooth drum vibratory roller to produce a uniform density throughout the subgrade.
3. After the exposed subgrade is thoroughly densified, proof roll the subgrade with a fully loaded 10-wheel dump truck weighing at least 30 tons or a smooth drum roller having an effective force of at least 600 pounds per linear inch of roller width. Any area exhibiting weaving, yielding, rutting or boiling should be reworked and compacted to produce an acceptable response or over excavated and replaced with structural fill. The depth of the undercut and type of soil fill will depend on the soil material encountered, weather conditions and the bearing conditions at the base of the undercut. The top surface of the subgrade should be pitched to drain to prevent ponding of stormwater.
4. Install structural fill (if necessary) to achieve the design subgrade elevation.
5. If the design dictates, install ditches, lateral drains, weeps and storm drainage piping.
6. Install a granular base layer composed of properly placed and compacted Select Structural Fill. GGEA recommends a minimum granular base thickness of 10 inches for automobile traffic and 12 inches for bus or truck traffic.
7. If catch basins are installed, special attention should be directed at the compaction of stone around the catch basins and the pipes. Failure to properly compact the stone will result in pavement settlement around the catch basins and ponding of water.
8. Construct a flexible pavement system consisting of asphalt binder followed by asphalt top. GGEA provides recommended pavement sections as follows:

    Light Duty (primarily car traffic)
        10 inches select structural fill
        2.5 inches of asphalt concrete binder (2008 NYSDOT item number 403.138902)
        1.0 inch of asphalt concrete top (2008 NYSDOT item number 403.178902 or 403.198902)

Heavy Duty (mixed truck/bus and car traffic)
- 12 inches select structural fill
- 3.0 inches of asphalt concrete binder (2008 NYSDOT item number 403.138902)
- 1.5 inch of asphalt concrete top (2008 NYSDOT item number 403.178902 or 403.198902)

The native subgrade soils may become soft if exposed to moisture, which will contaminate the overlying select structural fill over time through repeated loading. The installation of a separation geotextile will provide additional support and should be considered, especially if the granular base will be used as a working surface during construction. GGEA recommends US 200 beneath light duty pavement and US 250 beneath heavy duty pavement, both of which are manufactured by US Fabrics.

All site contractors should be notified that roadways and parking areas will not support repeated travel by construction loads. Pavement and subgrade failure can be anticipated in areas that receive a high volume of heavy construction traffic. To preclude the overstressing of the pavement system it is recommended that haul roads be located in non-critical areas. As an option, the base course of stone can be overbuilt to a total thickness of 20 inches to serve as a haul route. The additional thickness of stone should be removed prior to paving along with any areas of stone that have been contaminated with soil. Failure to remove fine-grained soils from the stone base may cause pavement distress in the form of heaving resulting from freeze thaw effects.

In the event the binder layer is used as a working surface during construction or there is a prolonged time period between binder and top placement such that daily activities occur over the binder surface, the surface must be power washed, not just swept, and a tack coat should be applied prior to installation of the top course. In addition, any yielding area of pavement binder should be removed and replaced prior to application of the top course.

Design and construction of the pavement system should take care to provide adequate drainage to prevent saturation of the subgrade soil, which may have a high silt content in some areas and provide a high potential for frost heave if exposed to water and freezing temperatures.

4.4 EXCAVATION, STORMWATER DETENTION AND BACKFILL

Excavation within the construction depths of this project is anticipated to require minimal effort from standard excavation equipment. Installation effort for deep foundations will increase significantly below a depth of +/- 34 feet once glacial drift and till soils are penetrated.

Boring B-6 was located within the footprint of the proposed storm detention pond. Construction of the basin will require lining of the upper portion with a compacted low permeability cohesive soil or geosynthetic material due to the silty sand (SM) soil encountered within 4.0 feet of the ground surface. This soil exhibits a high permeability and will result in seepage of detained stormwater beneath the proposed parking area if the upper portion of the basin is not properly lined. The underlying low permeability lean clay (CL) will provide an adequate low permeability basin for stormwater detention and can be used as a liner throughout the upper 4.0 feet.

The soil encountered at this site should be classified by an OSHA competent person in accordance with 29 CFR, Part 1926, OSHA Subpart P, "Excavations and Trenches" prior to and during excavation. GGEA has preliminarily classified the soils as Type C over Type A. However, this classification may change depending on other site criteria and moisture conditions at the time of construction. An OSHA competent person should judge the potential need for excavation bracing and excavation geometry in the field.

Engineered fill materials are defined as follows:

- Select Structural Fill (SSF) is defined as run of crusher stone or gravel in compliance with NYSDOT Item Number 304.12 (Subbase Course Type 2) or NYSDOT Item Number 304.14 (Subbase Course Type 4). Fill should be placed in lifts with a loose thickness of 9 inches and compacted to 95 % of modified proctor density (ASTM D 1557) within 2% of optimum moisture content.
- Controlled Low Strength Material (CLSM), commonly referred to as flowable fill, is typically a fly ash based pozzolanic fill manufactured by local concrete plants. A specific mix design should be provided by the manufacturer and reviewed/approved by the project design professional prior to placement. CLSM should have a minimum 28-day compressive strength of 100 psi and may include fine aggregate materials. The material should be placed in separate lifts not to exceed 30 inches in depth and each lift should be allowed to fully cure (monitor for shrinkage and/or desiccation) prior to placing subsequent lifts or constructing the foundation. CLSM should not be used within 42 inches of final grade due to potential freeze/thaw susceptibility and should not be used if the excavation contains standing water or is subject to water infiltration.
- Structural Fill (SF) is defined as soil materials with the exception of those classified as CH, MH, OH, OL, ML and CL-ML. Pending proper moisture conditioning, stockpiling and blending, native soils may be used for structural fill. Fill should be placed in lifts with a loose thickness of 9 inches and compacted to 95 % of modified proctor density (ASTM D 1557) within 2% of optimum moisture content.
- Engineered Fill – SSF or CLSM.
- Common Fill is defined as soil materials with the exception of those classified as CH, MH, OH and OL. Existing site soils may be used as common fill. The fill should be placed in maximum 12 inch lifts and compacted to 90 % modified proctor density (ASTM D-1557) at a moisture content within 2 % of optimum. The soil material should free of organics or other deleterious materials.

Shallow foundations should be backfilled once the frost wall concrete has achieved a nominal compressive strength. The initial lift of backfill placement should be on the outside of the wall, with subsequent lifts balanced along the interior and exterior of the wall perimeter. Foundations should be backfilled with properly placed and compacted Structural Fill and Select Structural Fill in structurally loaded areas (pavement, sidewalk, interior backfill) and Common Fill in non-structural landscaped areas. Select Structural Fill should be used for the upper 12 inches in structurally loaded areas. In place density testing should be performed at a rate of one test per 50 feet of trench or 2500 square feet of area per lift with a minimum of one test per day of placement.

Engineering properties for compacted native soils and Select Structural Fill have been estimated as follows:

Native silty sand (SM), compacted

moist unit weight = 120 pcf

friction angle = 34^0

Rankine theory
    at rest pressure coefficient (Ko) = 0.44
    active pressure coefficient (Ka) = 0.28
    passive pressure coefficient (Kp) = 3.54

2015 IBC Table 1610.1 Lateral Soil Load
    at rest pressure = 60 psf/ft of depth
    active pressure = 45 psf/ft of depth

Select Structural Fill (GW)

moist unit weight = 145 pcf

friction angle = 40 degrees

Rankine theory
    at rest pressure coefficient (Ko) = 0.36
    active pressure coefficient (Ka) = 0.22
    passive pressure coefficient (Kp) = 4.60

2015 IBC Table 1610.1 Lateral Soil Load
    at rest pressure = 60 psf/ft of depth
    active pressure = 30 psf/ft of depth

4.5 EXPANSIVE SOIL MITIGATION

Some cohesive soils undergo volumetric change (shrinkage and swelling) with changes in moisture content and degree of saturation, which are commonly referred to as expansive soils. This condition primarily occurs with fat clay (CH) soil, which is a cohesive soil that exhibits a liquid limit of 50 or greater. The liquid limit is the water content, in percent, of a soil that defines the boundary between the plastic and viscous fluid states.

The cohesive soils tested at this site were found to have liquid limits ranging from 26 to 47 and plasticity indices ranging from 10 to 24, providing for a low to moderate potential for volumetric change.

4.6 LIQUEFACTION MITIGATION

Liquefaction is the process where saturated cohesionless (granular) soils, specifically, loose sands and silts, transform from a solid into a liquid as a result of an increase in the pore water pressure caused by repeated disturbance such as experienced during seismic events. Liquefaction results in an immediate loss of shear strength and bearing capacity, causing total and differential settling of the overlying structure.

The granular soils encountered at this site exhibit a high relative density and are not susceptible to liquefaction.

4.7 SETTLEMENT

A detailed settlement analysis is recommended to verify potential settlement once the building loads are established. Considering the poor structural quality of the soft cohesive soils encountered below a depth of +/- 15 feet, total settlement of greater than 1.0 inch is highly probable for shallow foundations designed beyond the limitations established in section 4.1 of this report.

4.8 SEISMIC SITE CLASS AND DESIGN CATEGORY

In accordance with Section 1613 (Earthquake Loads) of the 2015 IBC, GGEA has classified the site as Seismic **Site Class E.** The site classification is based on the summation of N values for the upper 100 feet of soil boring B-1 in accordance with ASCE 7.

The design spectral response accelerations have been calculated as 0.353 g for short period design spectral response acceleration (S_{DS}) and 0.142 g for one second design spectral response acceleration (S_{D1}). In accordance with tables 1613.5.6(1) and 1613.5.6(2), using Risk Category II (estimated), the site is classified as Seismic **Design Category** C. See Appendix E for reference.

4.9 GENERAL CONSTRUCTION RECOMMENDATIONS

GGEA provides general construction recommendations as follows:

1. The exposed subgrade grade should not be allowed to become saturated or inundated with standing water. No fill material or concrete shall be placed in water, over saturated subgrade or over frozen subgrade. Soils may lose considerable strength and bearing capacity if subject to saturation. The foundation subgrade should be pitched to drain and provided with a temporary sump(s), located outside of the structure footprint, to prevent the accumulation of stormwater in the excavation and subsequent deterioration of the foundation subgrade during construction. Likewise, stormwater should not be permitted to remain in the excavation adjacent to foundations after construction and prior to backfill.
2. Prior to placement of overlying stone, pavement and slab on grade soil subgrade soil should be sealed with a smooth drum roller regularly to minimize rutting and weather related deterioration.
3. Backfill foundations prior to applying load.
4. Upon completion of the excavation for shallow foundations, the exposed foundation subgrade should be compacted to densify soil loosened by the excavation process. Proper subgrade preparation will assure the development of the anticipated bearing strength and reduce settlement potential.
5. If additional undercut is necessary, the excavation bottom should be graded to a uniform elevation and gradually sloped back to design elevation. Undercut "pockets" should be avoided.
6. Conformance to OSHA standards is mandatory during excavation and trench work.
7. Topsoil and organic soils should be removed from all load bearing areas.
8. Footing sizes should be proportioned to create nearly equal contact pressures under all foundations, which will serve to minimize differential settlement.
9. Foundation bearing grades should not be allowed to freeze prior to or after placement of concrete. Insulating blankets should be used to cover bearing grades plus a one foot perimeter outside of the forms or completed footings until backfill is placed.
10. The fill placed at grade elevation should be sloped to drain away from the foundation walls to eliminate the potential for standing water to accumulate along the foundation
11. During the excavation process, if encountered soils or moisture contents are found to be different than those identified on the soil boring logs and represented within this report, the allowable bearing capacity and associated design recommendations may need to be reevaluated by a qualified geotechnical engineer to account for varying bearing capacity.

4.10 CONCLUSION

This completes the preliminary geotechnical evaluation for the proposed construction of a +/- 15,500 square foot addition with associated parking and stormwater detention at the Crosspoint Business Park in the Town of Amherst, New York. The site soils are of poor structural quality below a depth of 15 feet and provide for limited use of shallow foundations. This report has been prepared based on the encountered subsurface conditions at the soil boring locations and pertinent data supplied by Kimley-Horn and EDI. Alteration of the plans, including relocation of the proposed building may serve to invalidate this report. Note this report has been designated as preliminary. Supplemental geotechnical investigation and evaluation may be necessary at later stages of the design process. Please contact GGEA if major project changes are made or if encountered soils differ from conditions noted herein.

Sincerely,

JESSE E. GROSSMAN
076886
5.17.19

G. Edward Lover
Senior Geologist

Jesse E. Grossman, P.E.
Engineering Manager

/gel

Appendix A

Subsurface Investigation Logs

Crosspoint Business Park Expansion
Amherst, New York

Preliminary Geotechnical Engineering Report

GGEA 19-1065

May 16, 2019

EARTH DIMENSIONS, INC.

Soil and Hydrogeologic Investigations • Wetland Delineations
1091 Jamison Road • Elma, NY 14059
(716) 655-1717 • FAX (716) 655-2915

2A95t HOLE NO. B-1-19 SURF. ELEVATION _

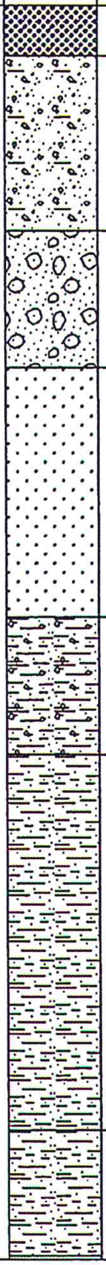
PROJECT Crosspoint Business Park LOCATION _

Town of Amherst, Erie County, NY

CLIENT Glynn Group Engineering & Architecture, PLLC DATE STARTED 04/30/19 COMPLETED 04/30/19

DEPTH IN FT	SN REC	BLOWS ON SAMPLER 0/6	6/12	12/18	18/24	N
	1 15	2	3	5	6	8
	2 16	10	14	17	15	31
5	3 18	18	15	10	13	25
	4 15	14	12	14	10	26
	5 18	6	6	10	12	16
10	6 0	11	11	14	10	25
	7 24	5	4	5	6	9
15	8 22	4	2	3	2	5
	9 19	2	2	1	2	3
20						

LITH



DESCRIPTION AND CLASSIFICATION

Moist dark gray (SANDY-SILT) topsoil fill with 3 to 7% gravel, little sand and organic matter, loose, massive soil structure, (ML). 0.8

Moist to extremely moist brown to light brown (SAND-SILT-CLAY) fill with 5 to 15% gravel, little sand and clay, trace brick fragments, stiff, massive soil structure, (ML-CL). 3.6

Moist gray (SANDY-SILT) fill with 10 to 20% gravel, little sand, dense, massive soil structure, (ML). 5.8

Moist faintly mottled brown to gray (SAND) with mostly very fine to fine size sand, trace silt and clay, compact, weakly thinly bedded, (SP).

grades downward to 9.8

Moist gray (SILTY-CLAY) with 3 to 7% gravel, trace sand, very stiff, thinly laminated with very thin coarse silt lenses, (CL).

grades downward to 12.0

Extremely moist gray (SILTY-CLAY) with trace sand, firm to stiff, thinly laminated with very thin coarse silt lenses, (CL).

grades downward to 18.0

Extremely moist gray (SILTY-CLAY) with trace sand, very soft to soft, thinly laminated with very thin coarse silt lenses, (CL).

WATER TABLE AND REMARKS

Coarse silty topsoil fill with little sand and organic matter, trace gravel to 0.8 feet over silty soil fill with little sand and clay, trace to little gravel, trace brick fragments to 3.6 feet over coarse silty soil fill with little sand and gravel to 5.8 feet over water sorted and deposited sand with trace silt and clay to 9.8 feet over clayey lake sediment with trace sand and gravel to 12.0 feet over clayey lake sediment with trace sand to 34.3 feet over silty glacial drift with little to some clay, little gravel and sand to 38.0 feet over sand and gravel till with trace to little silt to 39.0 feet over shale bedrock to end of coring.

Note: Advanced bore hole with 3 1/4" ID x 7" OD hollow stem auger casing with continuous split spoon sampling to 16.0 feet and 5.0-foot interval sampling to 39.0 feet. Continued below with a NQ-2 size double tubed wireline core barrel with diamond bit to end of coring at 44.0 feet. Bore hole was backfilled with cuttings to ground surface upon completion.

Note: No water in bore hole prior to coring.

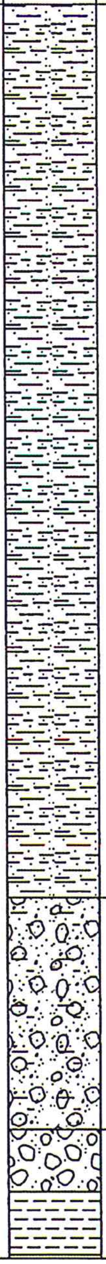
N=NUMBER OF BLOWS TO DRIVE 2 " SPOON 12 " WITH 140 lb. WT. FALLING 30 " PER BLOW

LOGGED BY Jason Kryszak, Geologist, (cns) SHEET 1 OF 3

2A95t HOLE NO. B-1-19 SURF. ELEVATION _

PROJECT Crosspoint Business Park
Town of Amherst, Erie County, NY
LOCATION _

CLIENT Glynn Group Engineering & Architecture, PLLC DATE STARTED 04/30/19 COMPLETED 04/30/19



DEPTH IN FT	SN REC	0/ 6	6/ 12	12/ 18	18/ 24	N	LITH	DESCRIPTION AND CLASSIFICATION	WATER TABLE AND REMARKS
								Extremely moist gray (SILTY-CLAY) with trace sand, very soft to soft, thinly laminated with very thin coarse silt lenses, (CL).	
	10 23	1	1	1/12		<2			
25									
	11 23	1	1	2	1	3			
30									
	12 12	3	3	3	8	6		grades downward to 34.3	
35								Extremely moist gray (SAND-SILT-CLAY) with 10 to 20% gravel, little to some clay, little sand, firm to stiff, massive soil structure, (ML-CL).	
								grades downward to 38.0	
	13 6 ↑	38 Run	100/3 #1					Extremely moist gray very gravelly (SILTY-SAND) with 40 to 60% gravel, trace to little silt, very dense, massive soil structure, (SM), (GM).	
40									

Run #	Depth (ft)	Length (ft)	Rec (ft)	Rec %	RQD %
1	39.0 to 44.0	5.0	3.1	62	36

N=NUMBER OF BLOWS TO DRIVE 2 " SPOON 12 " WITH 140 lb. WT. FALLING 30 " PER BLOW

LOGGED BY Jason Kryszak, Geologist, (cns)

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Soil and Hydrogeologic Investigations • Wetland Delineations
1091 Jamison Road • Elma, NY 14059
(716) 655-1717 • FAX (716) 655-2915

2A95t

HOLE NO. B-1-19

SURF. ELEVATION _

PROJECT Crosspoint Business Park
Town of Amherst, Erie County, NY

LOCATION _

CLIENT Glynn Group Engineering & Architecture, PLLC

DATE STARTED 04/30/19

COMPLETED 04/30/19

DEPTH IN FT	SN	0/ 6	6/ 12	12/ 18	18/ 24	N	LITH	DESCRIPTION AND CLASSIFICATION	WATER TABLE AND REMARKS
	REC	Run	#1					Extremely moist gray very gravelly (SILTY-SAND) with 40 to 60% gravel, trace to little silt, very dense, massive soil structure, (SM), (GM). 39.0	
								Dark gray shale bedrock, soft, thinly laminated, intensely to moderately fractured horizontally along bedding planes with an occasional vertical fracture, occasional thin lense of gypsum, core lengths range from (0.01-1.4'). 44.0	
45									
								Coring completed at 44.0 feet.	
50									
55									
60									

Run #	Depth (ft)	Length (ft)	Rec (ft)	Rec %	RQD %
1	39.0 to 44.0	5.0	3.1	62	36

EDI Bedrock Hardness Classification

Soft: Hand-held specimen crumbles under firm blows with point of geologic pick.

N=NUMBER OF BLOWS TO DRIVE 2 " SPOON 12 " WITH 140 lb. WT. FALLING 30 " PER BLOW

LOGGED BY Jason Kryszak, Geologist. (cns)

SHEET 3 OF 3

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2A95t HOLE NO. B-2-19 SURF. ELEVATION _

PROJECT Crosspoint Business Park
Town of Amherst, Erie County, NY
LOCATION _

CLIENT Glynn Group Engineering & Architecture, PLLC
DATE STARTED 04/30/19 COMPLETED 04/30/19

DEPTH IN FT

BLOWS ON SAMPLER

SN	REC	0/6	6/12	12/18	18/24	N
1	13	6	5	6	10	11
2	12	7	8	12	14	20
3	13	7	7	9	12	16
4	11	7	7	6	12	13
5	16	7	8	11	13	19

5
10
15
20

LITH

DESCRIPTION AND CLASSIFICATION

Moist brown (SANDY-SILT) fill with 10 to 20% gravel, little sand, trace organic matter, compact, massive soil structure, (ML). 0.3

Moist to extremely moist gray (SANDY-SILT) fill with trace to little sand, trace clay and organic matter, compact, massive soil structure, (ML). 1.3

Moist dark gray (SILTY-SAND) fill with mostly very fine to fine size sand, trace to little silt, trace organic matter, compact, massive soil structure, (SM). 1.6

Moist faintly mottled brown (SILTY-SAND) with mostly very fine to fine size sand, trace to little silt, compact, thinly bedded, (SM).
grades downward to 4.0

Moist gray (SILTY-CLAY) with trace sand, stiff to very stiff, thinly laminated with very thin coarse silt lenses, (CL). 10.0

Boring completed at 10.0 feet.

WATER TABLE AND REMARKS

Coarse silty soil fill with little sand and gravel, trace organic matter to 0.3 feet over coarse silty soil fill with trace to little sand, trace clay and organic matter to 1.3 feet over sandy soil fill with trace to little silt, trace organic matter to 1.6 feet over water sorted and deposited sand with trace to litlte silt to 4.0 feet over clayey lake sediment with trace sand to end of boring.

Note: Advanced bore hole with 3 1/4" ID x 7" OD hollow stem auger casing with continuous split spoon sampling to 10.0 feet. Bore hole was backfilled with cuttings to ground surface upon completion.

No water at completion.

N=NUMBER OF BLOWS TO DRIVE 2 " SPOON 12 " WITH 140 lb. WT. FALLING 30 " PER BLOW

LOGGED BY Jason Kryszak, Geologist. (cns)

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2A95t HOLE NO. B-3-19 SURF. ELEVATION _

PROJECT Crosspoint Business Park LOCATION _

Town of Amherst, Erie County, NY

CLIENT Glynn Group Engineering & Architecture, PLLC DATE STARTED 05/01/19 COMPLETED 05/01/19

DEPTH IN FT	SN REC	BLOWS ON SAMPLER 0/6	6/12	12/18	18/24	N	DESCRIPTION AND CLASSIFICATION
0	1 20	WH	3	3	5	6	Extremely moist to wet gray (SANDY-SILT) topsoil with little sand and organic matter, very loose, granular soil structure, (ML). 0.4 Moist gray (SILTY-CLAY) with trace sand, firm, blocky soil structure, (CL). clear transition to 2.0
2	2 19	6	5	6	10	11	
4	3 15	6	6	10	18	16	Moist faintly mottled to distinctly mottled light gray to orangish brown, (SILTY-SAND) with little silt, trace clay and organic matter, weakly thinly bedded, (SM). grades downward to 4.0
6	4 17	6	8	9	10	17	Moist brownish gray to gray (SILTY-CLAY) with trace sand, very stiff, thinly laminated with very thin coarse silt lenses, (CL).
8	5 20	6	9	12	16	21	10.0
10							Boring completed at 10.0 feet.
15							
20							

WATER TABLE AND REMARKS

Coarse silty topsoil fill with little sand and organic matter to 0.4 feet over clayey slack water sediment with trace sand to 2.0 feet over water sorted and deposited sand with little silt, trace clay and organic matter to 4.0 feet over clayey lake sediment with trace sand to end of boring.

Note: Advanced bore hole with 3 1/4" ID x 7" OD hollow stem auger casing with continuous split spoon sampling to 10.0 feet. Bore hole was backfilled with cuttings to ground surface upon completion.

No water at completion.

WH: Sampler penetration with weight of rods and hammer.

N=NUMBER OF BLOWS TO DRIVE 2 " SPOON 12 " WITH 140 lb. WT. FALLING 30 " PER BLOW

LOGGED BY Jason Kryszak, Geologist, (cns) SHEET 1 OF 1

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2A95t HOLE NO. B-4-19 SURF. ELEVATION _

PROJECT Crosspoint Business Park LOCATION _

Town of Amherst, Erie County, NY

CLIENT Glynn Group Engineering & Architecture, PLLC DATE STARTED 05/01/19 COMPLETED 05/01/19

DEPTH IN FT / BLOWS ON SAMPLER

SN	REC	0/6	6/12	12/18	18/24	N
1	15	2	3	6	6	9
2	8	6	8	12	14	20
3	18	5	8	9	13	17
4	23	6	7	11	15	18
5	19	7	8	10	10	18

DESCRIPTION AND CLASSIFICATION

Moist gray (SANDY-SILT) topsoil fill with little sand and organic matter, very loose, massive soil structure, (ML). 0.5

Moist dark gray (SILTY-SAND) fill with moslty fine size sand, little silt, trace organic matter, loose, massive soil structure, (SM). 1.5

Moist to extremely moist faintly mottled light gray (SILTY-SAND) with mostly very fine to fine size sand, little silt, compact, weakly thinly bedded, (SM).

grades downward to 2.0

Extremely moist to wet light brown (SILTY-SAND) with mostly very fine to fine size sand, little silt, compact, thinly bedded, (SM).

grades downward to 4.0

Moist gray (SILTY-CLAY) with trace sand, very stiff, thinly laminated with very thin coarse silt lenses, (CL). 10.0

Boring completed at 10.0 feet.

WATER TABLE AND REMARKS

Coarse silty topsoil fill with little sand and organic matter to 0.5 feet over sandy soil fill with little silt, trace organic matter to 1.5 feet over water sorted and deposited sand with little silt to 4.0 feet over clayey lake sediment with trace sand to end of boring.

Note: Advanced bore hole with 3 1/4" ID x 7" OD hollow stem auger casing with continuous split spoon sampling to 10.0 feet. Bore hole was backfilled with cuttings to ground surface upon completion.

No water at completion.

N=NUMBER OF BLOWS TO DRIVE 2 " SPOON 12 " WITH 140 lb. WT. FALLING 30 " PER BLOW

LOGGED BY Jason Kryszak, Geologist, (cns)

SHEET 1 OF 1

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2A95t

HOLE NO. B-5-19

SURF. ELEVATION _

PROJECT Crosspoint Business Park
Town of Amherst, Erie County, NY

LOCATION _

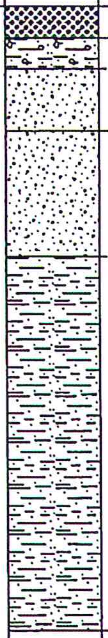
CLIENT Glynn Group Engineering & Architecture, PLLC

DATE STARTED 05/01/19

COMPLETED 05/01/19

DEPTH IN FT	SN REC	0/6	6/12	12/18	18/24	N
	1 19	1	3	5	7	8
	2 23	7	10	9	12	19
5	3 22	6	7	9	12	16
	4 23	7	8	14	17	22
10	5 24	7	8	10	9	18
15						
20						

LITH



DESCRIPTION AND CLASSIFICATION

Extremely moist to wet light gray (SILTY-SAND) topsoil fill with little to some silt, trace to little organic matter, very loose, massive soil structure, (ML).
0.5

Moist light gray (SILTY-CLAY) with 3 to 7% gravel, trace organic matter, firm, blocky soil structure, (CL).
clear transition to 1.0

Moist faintly mottled dark gray (SILTY-SAND) with mostly very fine to fine size sand, trace to little silt, trace organic matter, loose, (SM).
2.0

Moist faintly mottled light gray (SILTY-SAND) with mostly very fine to fine size sand, trace to little silt, compact, weakly thinly bedded, (SM).
grades downward to 4.0

Moist light gray (SILTY-CLAY) with trace clay, very stiff, thinly laminated with very thin coarse silt lenses, (CL).
10.0

Boring completed at 10.0 feet.

WATER TABLE AND REMARKS

Sandy soil fill with little to some silt, trace to little organic matter to 0.5 feet over clayey slack water sediment with trace gravel and organic matter to 1.0 feet over water sorted and deposited sand with trace to little silt to 4.0 feet over clayey lake sediment to end of boring.

Note: Advanced bore hole with 3 1/4" ID x 7" OD hollow stem auger casing with continuous split spoon sampling to 10.0 feet. Bore hole was backfilled with cuttings to ground surface upon completion.

No water at completion.

N=NUMBER OF BLOWS TO DRIVE 2 " SPOON 12 " WITH 140 lb. WT. FALLING 30 " PER BLOW

LOGGED BY Jason Kryszak, Geologist. (cns)

SHEET 1 OF 1

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2A95t HOLE NO. B-6-19 SURF. ELEVATION _

PROJECT Crosspoint Business Park
Town of Amherst, Erie County, NY
LOCATION _

CLIENT Glynn Group Engineering & Architecture, PLLC

DATE STARTED 05/01/19 COMPLETED 05/01/19

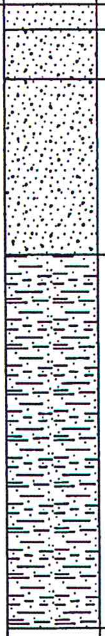
DEPTH IN FT

BLOWS ON SAMPLER

SN	REC	0/ 6	6/ 12	12/ 18	18/ 24	N
1	15	2	3	5	7	8
2	14	4	7	10	10	17
3	16	6	9	14	18	23
4	18	6	8	13	14	21
5	23	7	7	6	8	13

Depth scale: 5, 10, 15, 20

LITH



DESCRIPTION AND CLASSIFICATION

Extremely moist gray (SANDY-SILT) fill with little sand, trace organic matter, very loose, massive soil structure, (ML).

0.4

Moist dark gray (SILTY-SAND) fill with mostly very fine to fine size sand, little silt, trace organic matter, loose, massive soil structure, (SM).

1.2

Moist faintly mottled light brown (SILTY-SAND) with mostly very fine to fine size sand, little silt, loose, weakly thinly bedded, (SM).

grades downward to 4.0

Moist brown to light gray (SILTY-CLAY) with trace sand, very stiff, thinly laminated with very thin coarse silt lenses, (CL).

10.0

Boring completed at 10.0 feet.

WATER TABLE AND REMARKS

Coarse silty soil fill with little sand, trace organic matter to 0.4 feet over sandy soil fill with little silt, trace organic matter to 1.2 feet over water sorted and deposited sand with little silt to 4.0 feet over clayey lake sediment with trace sand to end of boring.

Note: Advanced bore hole with 3 1/4" ID x 7" OD hollow stem auger casing with continuous split spoon sampling to 10.0 feet. Bore hole was backfilled with cuttings to ground surface upon completion.

No water at completion.

N=NUMBER OF BLOWS TO DRIVE 2 " SPOON 12 " WITH 140 lb. WT. FALLING 30 " PER BLOW

LOGGED BY Jason Kryszak, Geologist, (cns) SHEET 1 OF 1

Appendix B

Project Location Plan

Crosspoint Business Park Expansion
Amherst, New York

Preliminary Geotechnical Engineering Report

GGEA 19-1065

May 16, 2019

GGE
ENGINEERING · DESIGN
GLYNN GEOTECHNICAL ENGINEERING
415 S. TRANSIT STREET
LOCKPORT, NEW YORK 14094
VOICE (716) 625 - 6933 / FAX (716) 625-6983
www.glynngroup.com

PROJECT: CROSSPOINT EXPANSION

SUBJECT: PROJECT LOCATION PLAN

CLIENT: KIMLEY-HORN

PROJ. NO.:	SCALE:	DATE:	BY:
19-1065	1"= 600'-0"	04.08.19	GEL

SHEET NO.: S1

Appendix C

Soil Boring Location Plan

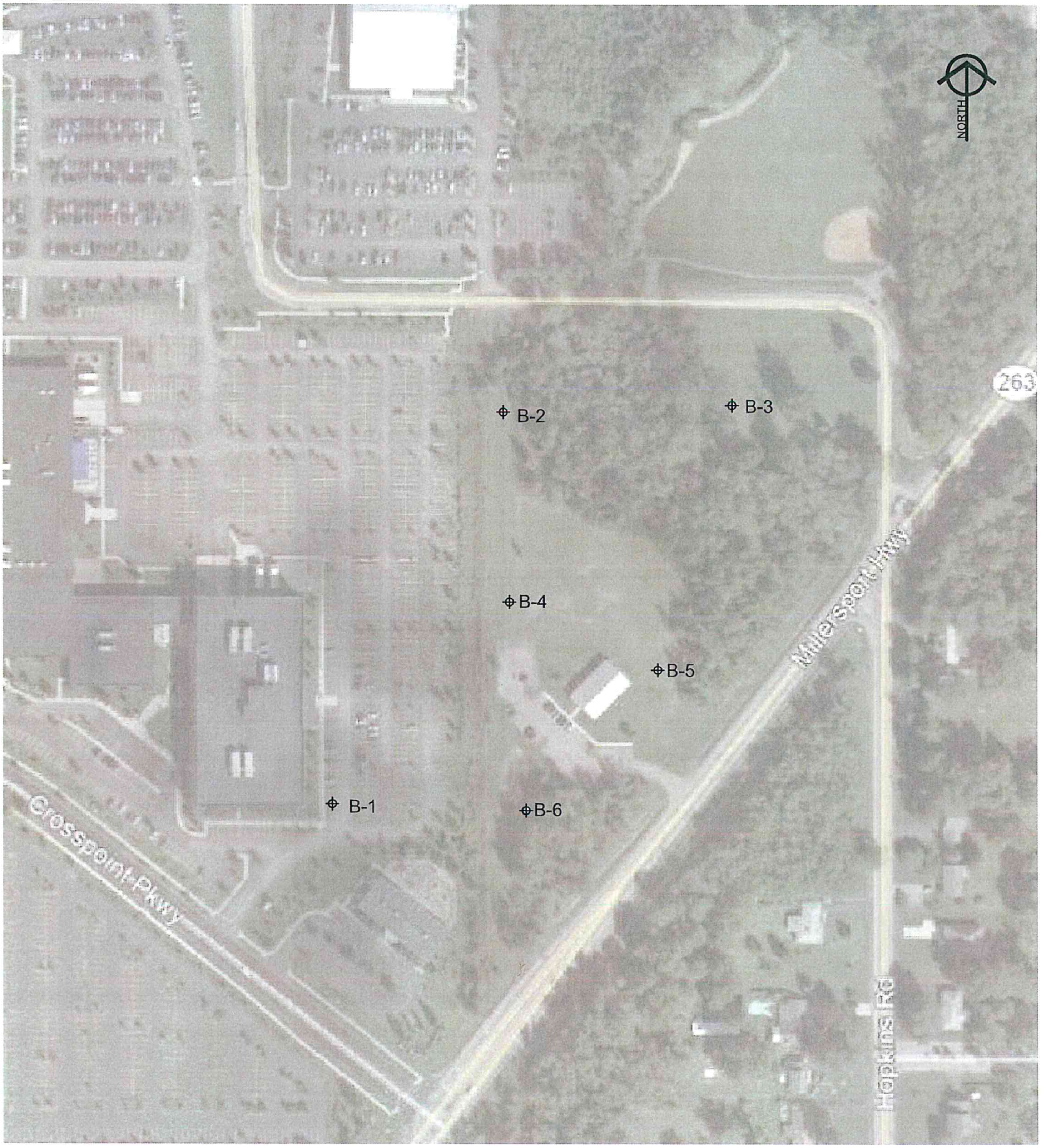
Crosspoint Business Park Expansion
Amherst, New York

Preliminary Geotechnical Engineering Report

GGEA 19-1065

May 16, 2019

GLYNN GROUP
ENGINEERING & ARCHITECTURE, PLLC



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LOCKPORT, NEW YORK 14094
VOICE (716) 625 - 6933 / FAX (716) 625-6983
www.glynngroup.com

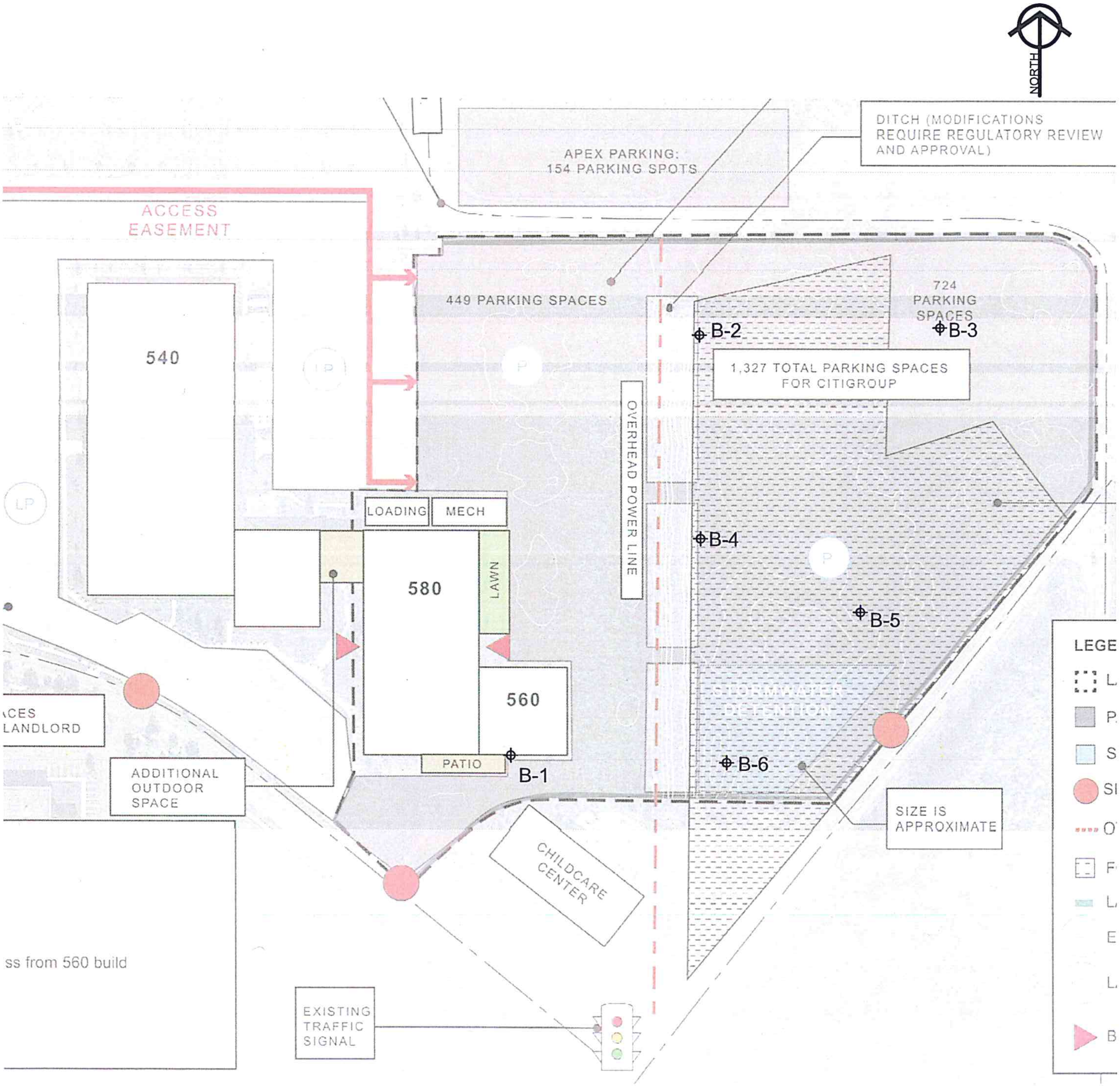
PROJECT: CROSSPOINT EXPANSION

SUBJECT: SOIL BORING LOCATION PLAN

CLIENT: KIMLEY-HORN

PROJ. NO.:	SCALE:	DATE:	BY:
19-1065	1"= 200'-0"	04.08.19	GEL

SHEET NO.: S2A



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LOCKPORT, NEW YORK 14094
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www.glynngroup.com

PROJECT: CROSSPOINT EXPANSION

SUBJECT: SOIL BORING LOCATION PLAN

CLIENT: KIMLEY-HORN

PROJ. NO.:	SCALE:	DATE:	BY:
19-1065	1"= 200'-0"	04.08.19	GEL

SHEET NO.: S2B

Appendix D

Laboratory Analysis

Crosspoint Business Park Expansion
Amherst, New York

Preliminary Geotechnical Engineering Report

GGEA 19-1065

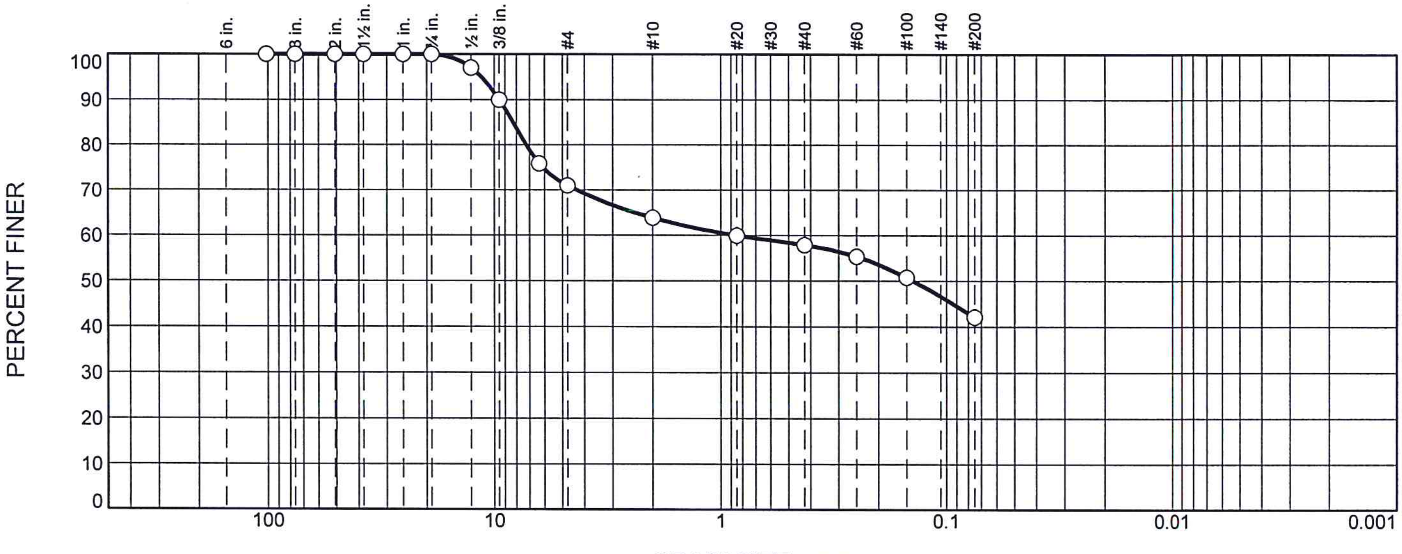
May 16, 2019

GRAIN SIZE ANALYSIS
ASTM D-422

Project: Crosspoint Business Park Expansion **Project No.:** 19-1065

Client: Kimley-Horn

Location: B-1-19 (S2, S3)
Sample Number: 19-01 **Depth:** 0.8 - 5.8 ft **Date:** 5.8.19



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	29.0	7.1	6.0	15.8	42.1	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
4"	100.0		
3"	100.0		
2"	100.0		
1-1/2"	100.0		
1-0"	100.0		
3/4"	100.0		
1/2"	97.0		
3/8"	90.0		
1/4"	75.9		
#4	71.0		
#10	63.9		
#20	60.0		
#40	57.9		
#60	55.4		
#100	50.8		
#200	42.1		

* (no specification provided)

Material Description

clayey gravel with sand

Atterberg Limits

PL= 16 LL= 26 PI= 10

Coefficients

D_{85}= 8.2911 D_{60}= 0.8533 D_{50}= 0.1399
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= GC AASHTO= A-4(1)

Remarks

Natural Moisture Content = 12.2%

Figure

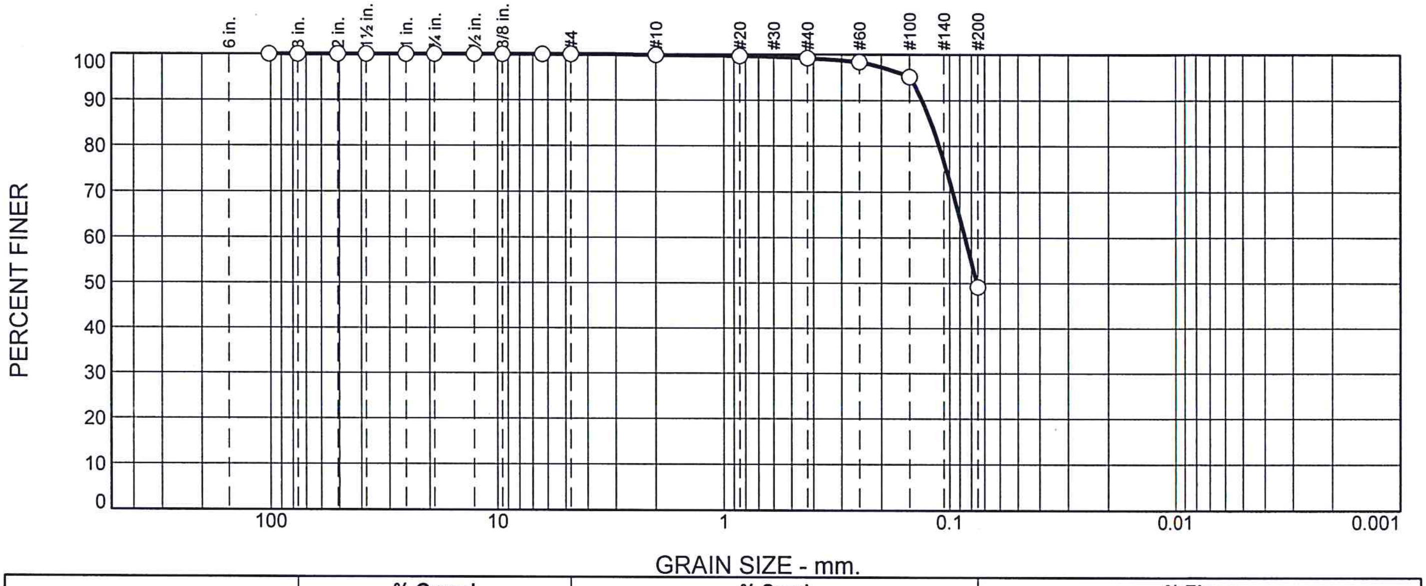
Reported/Reviewed by

GRAIN SIZE ANALYSIS
ASTM D-422

Project: Crosspoint Business Park Expansion **Project No.:** 19-1065

Client: Kimley-Horn

Location: B-1-19 (S4)
Sample Number: 19-02 **Depth:** 5.8 - 8.0 ft **Date:** 5.8.19



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.2	0.6	50.0	49.2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
4"	100.0		
3"	100.0		
2"	100.0		
1-1/2"	100.0		
1-0"	100.0		
3/4"	100.0		
1/2"	100.0		
3/8"	100.0		
1/4"	100.0		
#4	100.0		
#10	99.8		
#20	99.6		
#40	99.2		
#60	98.3		
#100	95.1		
#200	49.2		

* (no specification provided)

Material Description

silty sand

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{85}= 0.1203 D_{60}= 0.0854 D_{50}= 0.0757
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SM AASHTO= A-4(0)

Remarks

Natural Moisture Content = 22.1%

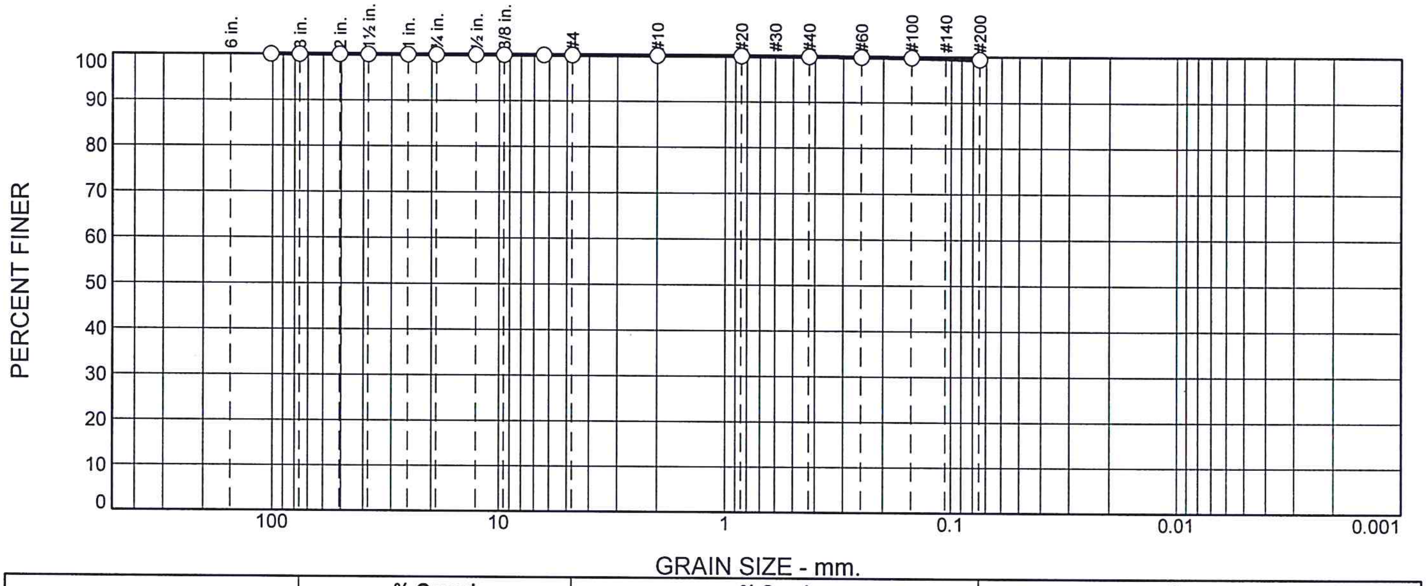
Figure

Reported/Reviewed by

GRAIN SIZE ANALYSIS
ASTM D-422

Project: Crosspoint Business Park Expansion **Project No.:** 19-1065
Client: Kimley-Horn

Location: B-1-19 (S7, S8)
Sample Number: 19-03 **Depth:** 12.0 - 16.0 ft **Date:** 5.8.19



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.1	0.5	99.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
4"	100.0		
3"	100.0		
2"	100.0		
1-1/2"	100.0		
1-0"	100.0		
3/4"	100.0		
1/2"	100.0		
3/8"	100.0		
1/4"	100.0		
#4	100.0		
#10	100.0		
#20	99.9		
#40	99.9		
#60	99.8		
#100	99.7		
#200	99.4		

* (no specification provided)

Material Description

lean clay

Atterberg Limits

PL= 23 LL= 47 PI= 24

Coefficients

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

Classification

USCS= CL AASHTO= A-7-6(27)

Remarks

Natural Moisture Content = 35.6%

Figure

Reported/Reviewed by

Appendix E

Seismic Site Class and Design Category

Crosspoint Business Park Expansion
Amherst, New York

Preliminary Geotechnical Engineering Report

GGEA 19-1065

May 16, 2019

Project : Crosspoint Business Park Expansion
Client: Kimley-Horn
GGEA # : 19-1065
Date: 05.16.19

B-1-19

Depth (di)	N Value (Ni)
12	21
3	7
19.3	2
3.7	10
1	50
61	100

ASCE 7
Equation 20.4-2

$$\frac{100}{\sum \frac{di}{Ni}}$$

$N = \boxed{\mathbf{8.58}}$

ASCE 7
Table 20.3-1 $N < 15$ **SITE CLASS E**

2015 IBC Section 1613

F_a =	2.5	Site coefficient Table 1613.3.3(1)
F_v =	3.5	Site coefficient Table 1613.3.3(2)
S_s =	0.212	Mapped accelerations short periods Figure 1613.3.1(1)
S_1 =	0.061	Mapped accelerations 1 sec period Figure 1613.3.1(2)
S_{MS} =	0.530	Maximum spectral response short periods equation 16-37
S_{M1} =	0.214	Maximum spectral response 1 sec periods equation 16-38
S_{DS} =	0.353	Design spectral response short periods equation 16-39
S_{D1} =	0.142	Design spectral response 1 sec periods equation 16-40

Risk Category = II (estimated)

Seismic Design Category = C