Report Of Geotechnical
Subsurface Exploration

Berkley Group – Northlake Tower Site
Charlotte, North Carolina
Geoscience Project No. CH10.0088.GE

Prepared For:

AC&S Engineering and Surveying, Inc.
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October 14, 2010

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October 14, 2010

Consulting Engineers

GEOSCIENCE GROUP

AC&S Engineering and Surveying, Inc.
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Attention: Mrs. Terry Aldrich, P.E.

Reference: Report Of Subsurface Exploration
Berkley Group - Northlake Tower Site
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Geoscience Group, Inc. (Geoscience) has completed the subsurface exploration and geotechnical evaluation for the above referenced project. This work was performed in general accordance with Geoscience Proposal No. CH10.194P.GE. The purpose of this exploration was to determine the general subsurface conditions at the tower location and to evaluate those conditions with regard to foundation support. This report presents our findings along with our conclusions and recommendations for design and construction of the project.

SCOPE OF EXPLORATION

Field Exploration: The subsurface exploration included the execution of one (1) soil test boring (B-1) at the approximate location shown on the Boring Location Diagram, Drawing No. CH10.0088.GE-1, included in the Appendix. The boring location was staked at the approximate center of the monopole tower by others. The boring was advanced to a depth of approximately 35 feet below the ground surface using continuous-flight, hollow-stem augers. Drilling fluid was not used in this process.

Standard Penetration Tests were performed in the soil test boring at designated intervals in general accordance with ASTM D 1586-84. The Standard Penetration Test is used to provide an index for estimating soil strength and density. In conjunction with the penetration testing, split-barrel soil samples were recovered for soil classification and potential laboratory tests. A brief description of the field testing procedures and a copy of the Test Boring Record are included in the Appendix. The elevations shown on the Test Boring Record and referenced within this report were interpolated from the July 15, 2010, "Fine Grading Plan" prepared by Sigmon Design for the future Long View Apartments development in which the monopole tower site is located.

Laboratory Services: The laboratory services provided for this project consisted of visual classification of the soil samples by the project engineer. The color, texture and plasticity characteristics were used to identify each soil sample in general accordance with the Unified Soil Classification System (USCS). The results of the visual classifications are presented on the Test Boring Record included in the Appendix.

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SUBSURFACE FINDINGS

The subsurface conditions at the tower site, as indicated by soil test boring B-1, generally consist of a residual soil profile that has formed from the in-place weathering of the underlying parent bedrock. The generalized subsurface conditions are described below and illustrated on the Generalized Subsurface Profile, Drawing No. CH10.0088.GE-2, included in the Appendix.

Underlying a ⅓ foot surficial veneer of topsoil and roots, residual sandy SILT and silty SAND soils are present to a depth of approximately 8 feet. When sampled, these residual SILT and SAND soils exhibited Standard Penetration Resistance values between 16 and 51 Blows Per Foot (BPF).

Partially weathered rock was encountered between the approximate depths of 8 and 22 feet below the ground surface. The top of the partially weathered rock layer corresponds to an elevation of approximately 768 feet (MSL). For engineering purposes, partially weathered rock (PWR) is considered any dense residual material exhibiting a Standard Penetration Resistance value in excess of 100 BPF. When sampled, the partially weathered rock (PWR) generally consists of a silty SAND.

A residual slightly micaceous silty SAND soil is present beneath the partially weathered rock. This slightly micaceous silty SAND soil extends to the boring termination depth of 35 feet. The Standard Penetration Test results within this residual SAND soil range from 13 to 26 BPF.

A groundwater measurement was attempted at the termination of drilling prior to backfilling the open auger hole. Groundwater was observed at a depth of approximately 30 feet below the ground surface. This depth to groundwater corresponds to an elevation of approximately 746 feet (MSL).

PROJECT DESCRIPTION

Proposed for construction is a monopole tower. The tower will have a base to tip height of approximately 190 feet. The base of the tower will be located near elevation 772 feet (MSL). An excavation depth of approximately 4 feet will be required to reach the base elevation. The maximum structural reactions at the base of the monopole tower were provided to us by Nello Corporation and are as follows:

Downward Load:	43 to 60½ kips
Horizontal Shear:	18 to 23½ kips
Overturning Moment:	225 to 1,766 kips-foot

CONCLUSIONS AND RECOMMENDATIONS

The boring performed at the tower site represents the subsurface conditions at the test location only. Due to the prevailing geology, there can be changes in the subsurface conditions over relatively short distances that have not been disclosed by the results of the boring performed. Consequently, there may be undisclosed subsurface conditions that require special treatment or additional preparation once these conditions are revealed during construction.

Changes in the project or subsurface conditions encountered during construction may require modifications to our recommendations. Therefore, we request the opportunity to review our recommendations in light of any revisions to this project and make the required changes. Also, we recommend that an engineer from Geoscience verify during construction that the anticipated subsurface conditions are present.

Foundation Support: Based upon the subsurface data, laboratory testing, loading conditions and tower base elevation, we recommend that the monopole tower be supported on a shallow foundation system bearing on top of partially weathered rock. The parameters in the following table can be used for design of the foundation. **These parameters pertain to only the undisturbed (in-situ) condition of the partially weathered rock.** The actual foundation size and depth should be determined by the tower designer. We do not anticipate that the foundation settlements will exceed ½-inch since the foundations will bear on top of partially weathered rock. In addition, some difficult excavation may be required to obtain a complete partially weathered rock bearing surface across the entire foundation subgrade.

Boring Depth (feet)	Material Classification	Net Allowable Bearing Pressure (KSF)	Passive Earth Pressure Coefficient	Internal Angle of Friction (deg)	Moist Unit Weight (PCF)	Cohesion (KSF)
>8.0	PWR	20	3.7	35	135	0

Cut And Fill Slopes: Permanent cut slopes within residual soils and properly compacted fill slopes should be no steeper than 2½(H):1(V) and should be properly seeded to minimize erosion. For maintenance purposes, the permanent slopes may need to be flattened to allow access to mowing equipment. Temporary slopes should perform satisfactorily at inclinations of approximately 1(H):1(V). The face of the temporary slopes should be adequately protected from inclement weather. All excavations should conform to applicable OSHA regulations.

Difficult Excavation: As mentioned previously, partially weathered rock (PWR) was encountered at a depth of approximately 8 feet below the ground surface. A Caterpillar 335 or similar size backhoe equipped with rock teeth will be required to excavate the weathered rock materials. In addition, depending on the required embedment depth and the irregularity of the partially weathered rock, some very difficult excavation may be required.

Fill Material And Placement: All fill used for the project should be free of organic matter and debris with a low to moderate plasticity (plasticity index less than 30). The fill should exhibit a maximum dry density of at least 90 pounds per cubic foot, as determined by the Standard Proctor compaction test (ASTM D 698). We recommend that moisture control limits be established for the proposed fill soils, with the added requirement that fill placed wet of the optimum moisture content remain stable under construction traffic.

The onsite soils generally appear suitable for use as structural fill. However, weathered rock fragments larger than 6 inches in diameter should be broken into smaller pieces or adequately integrated with a fine-grained soil. For uplift resistance, a moist unit weight of 125 pounds per cubic foot should be used for the onsite soils placed as structural fill.

All fill should be placed in lifts not exceeding eight (8) inches loose thickness and should be compacted to at least 95 percent of its Standard Proctor maximum dry density. However, for isolated excavations, a hand tamper or walk-behind roller will likely be required. While using a hand tamper or walk behind roller, the maximum lift thickness (loose) should not exceed five (5) inches. We recommend that field density tests be performed on the fill as it is being placed, at a frequency determined by an experienced geotechnical engineer, to verify that proper compaction is achieved.

Foundation Observations: We recommend that the foundation excavation(s) be observed by an experienced geotechnical engineer or his authorized representative from Geoscience to verify the suitability of the subgrade for the design bearing pressure. Bearing surfaces for foundations should not be disturbed or left exposed during inclement weather. If construction occurs during inclement weather, and concreting of the foundation is not possible at the time it is excavated, a layer of lean concrete should be placed on the bearing surface for protection. Also, concrete should not be placed on frozen subgrades.

CLOSURE

Geoscience appreciates having had the opportunity to assist you during this phase of the project. If you have any questions concerning this report, or require additional information, please contact us.

Respectfully,
GEOSCIENCE GROUP, INC.

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Project Engineer
North Carolina License No. 32050

NORTH CAROLINA PROFESSIONAL SEAL 24977 ENGINEER DANIEL A. MICKEY

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Vice President
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DAM/TCH
Enclosures
File: P:/Work Files/Geotech/2010/0088

APPENDIX

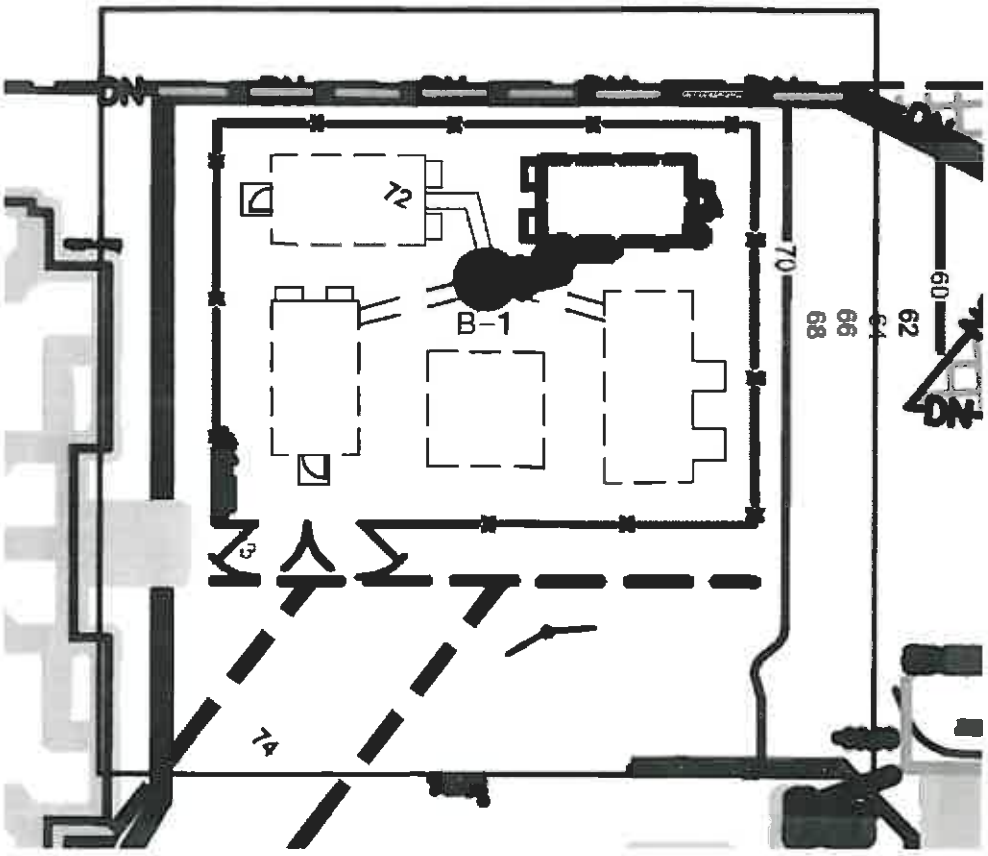
Boring Location Diagram

Generalized Subsurface Profile

Investigative Procedures

Test Boring Record

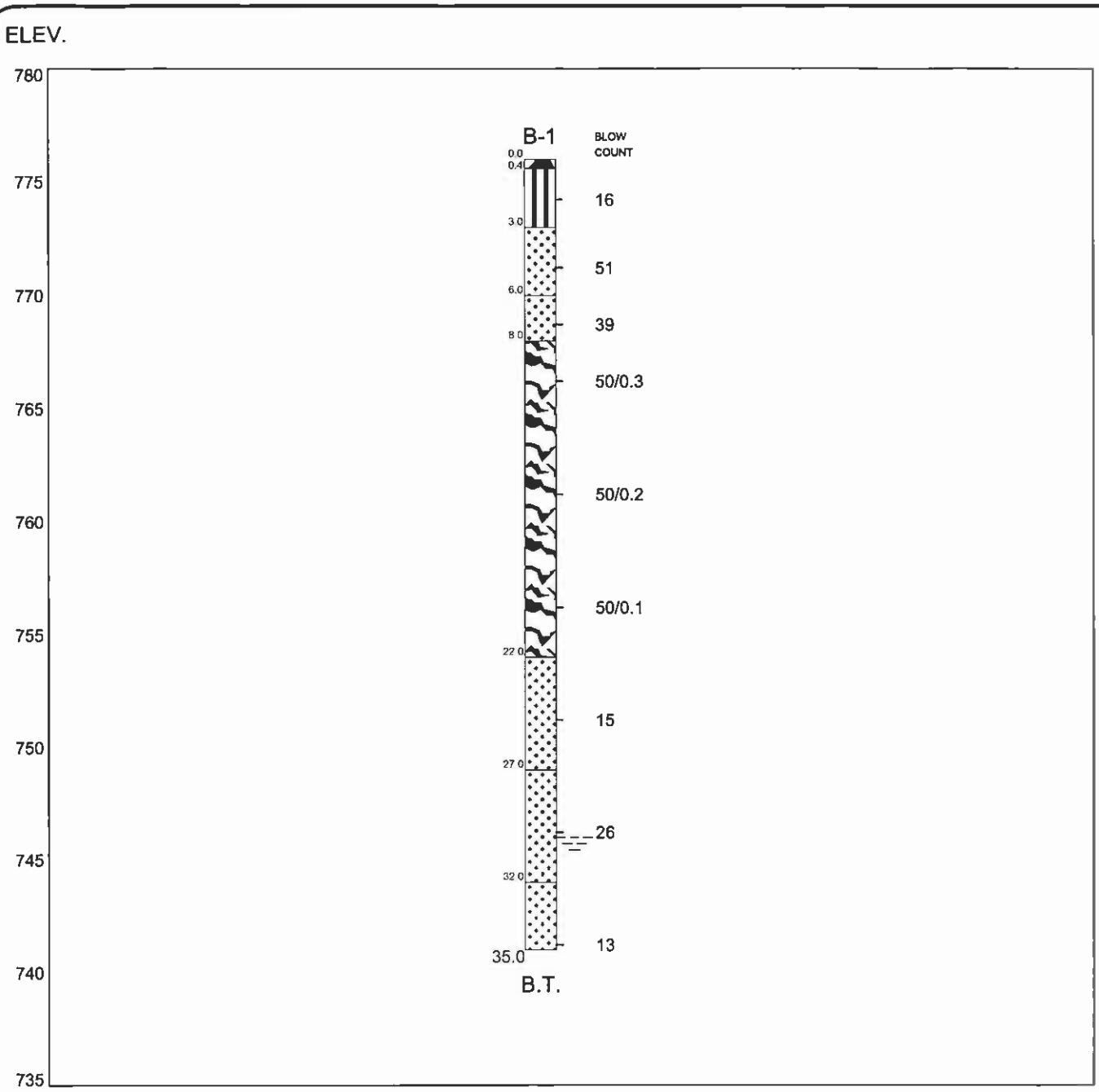
PLANTATION PIPELINE



LEGEND

● - Approximate Location Of Soil Test Boring

GEOSCIENCE GROUP, INC. CHARLOTTE, NORTH CAROLINA		
SCALE: AS SHOWN	APPROVED BY:	DRAWN BY:
DATE: October 14, 2010		REVISED:
NORTHLAKE TOWER SITE CHARLOTTE, NORTH CAROLINA		
BORING LOCATION DIAGRAM		DRAWING NUMBER: CH10.0088.GE-1



LEGEND

- Water Table - 24 HR.
- Water Table 1 HR.
- Loss of Drilling Water
- Cavein Depth
- A.R. - Auger Refusal
- B.T. - Boring Terminated
- C.T. - Coring Terminated
- WOH - Weight of Hammer
- NGWE - No Groundwater
- Topsoil/Asphalt/Stone
- Clayey SILT/Sandy SILT
- Silty SAND/Clayey SAND
- Partially Weathered Rock

GEOSCIENCE GROUP INC.
CHARLOTTE, NORTH CAROLINA

DRAWN BY: dm	APPROVED BY	VERTICAL: AS SHOWN
DATE: 10/14/10		HORIZONTAL: N.T.S.

NORTHLAKE TOWER SITE
CHARLOTTE, NORTH CAROLINA

GENERALIZED SUBSURFACE PROFILE

DRAWING NUMBER
CH10.0088.GE-2

GEOSCIENCE GROUP, INC.
INVESTIGATIVE PROCEDURES
Northlake Tower Site
Geoscience Project No. CH10.0088.GE

FIELD

Soil Test Boring: One (1) soil test boring (B-1) was drilled at the approximate location shown on the attached Boring Location Diagram, Drawing No. CH10.0088.GE-1. Soil sampling and penetration testing were performed in accordance with ASTM D 1586-84.

The boring was advanced with hollow-stem, continuous-flight augers and, at standard intervals, soil samples were obtained with a standard 1.4-inch (3.6cm) I.D., 2-inch (5.1cm) O.D., split-tube sampler. The sampler was first seated 6 inches (15.2cm) to penetrate any loose cuttings, then driven an additional 12 inches (30.5cm) with blows of a 140 pound (63.5kg) hammer falling 30 inches (76.2cm). The number of hammer blows required to drive the sampler the final 12 inches (30.5cm) was recorded and is designated the "Standard Penetration Resistance" (N-Value). The Standard Penetration Resistance, when properly evaluated, is an index to soil strength, density and ability to support foundations.

Representative portions of each soil sample were placed in glass jars and taken to our laboratory. The samples were then examined by an engineer to verify the driller's field classifications. The Test Boring Record is attached indicating the soil descriptions and Standard Penetration Resistances.

BORING NO.: B-1
DATE DRILLED: 10/11/10
DRILLING CONTRACTOR: Soil Drilling Services
JOB NO.: CH10.0088.GE
PROJECT: NORTHLAKE TOWER SITE

TEST BORING RECORD

GEOSCIENCE GROUP INC.

DEPTH, FT.	DESCRIPTION	Elev.	Blow Count
0.0		776.0±	
0.4	Topsoil And Roots	775.6	
	Very Stiff Reddish-Brown, Brown And Tan Clayey Coarse To Fine Sandy SILT - Residual		16
3.0		773.0	
	Very Dense Brown And Tan Very Silty Coarse To Fine SAND		51
6.0		770.0	
	Dense Brown, Tan And White Silty Coarse To Fine SAND		39
8.0		768.0	
	Partially Weathered Rock When Sampled Becomes Brown, Tan And Grey Silty Coarse To Fine SAND		50/0.3
			50/0.2
			50/0.1
22.0		754.0	
	Firm Brown, Tan And Grey Slightly Micaceous Very Silty Fine SAND Note: Sample Moist		15
27.0		749.0	
	Very Firm Brown, Tan And Grey Slightly Micaceous Very Silty Fine SAND		26
32.0		744.0	
	Firm Brown, Tan And Grey Slightly Micaceous Very Silty Fine SAND		
35.0		741.0	13
	Boring Terminated		

● PENETRATION - BLOW COUNT*

5 10 20 30 40 60 80 100

▽ 30.0'

BORING AND SAMPLING MEETS ASTM D-1586
CORE DRILLING MEETS ASTM D-2113

***PENETRATION IS THE NUMBER OF BLOWS OF A 140 LB. (63.5kg) HAMMER FALLING 30 IN. (76.2cm) REQUIRED TO DRIVE A 1.4 IN. (3.6cm) I.D. SAMPLER 1 FT. (30.5cm)**

PRESSUREMETER TEST
|50|% ROCK CORE RECOVERY
◄ LOSS OF DRILLING WATER
WOH WEIGHT OF HAMMER
WATER TABLE - 24 HR.
WATER TABLE - 1 HR.
CAVE-IN DEPTH