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Exhibit C-3

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August 22, 2011
Project No. BE-11-055

Erie Canal Harbor Development Corporation

c/o Mr. Darryl C. Murszewski, Senior Project Engineer
C&S Companies
90 Broadway Street
Buffalo, New York, 14203

Re: Supplemental Geotechnical Evaluation Report for
Inner Harbor Development, Phase 3A - Canal Side
Public Canal Environments Project
Buffalo, New York

Dear Mr. Murszewski:

Empire Geo-Services, Inc. is pleased to submit three (3) copies of the enclosed Supplemental Geotechnical Evaluation Report for the Inner Harbor Development, Phase 3A - Canal Side, Public Canal Environments Project (Public Canal Environments Project). We have also included a pdf electronic file copy of this report for use by the project team.

This supplemental report includes the results of additional field explorations, laboratory testing and geotechnical engineering evaluations, which supplement our November 2, 2009 "Final Geotechnical Evaluation Report for Former Buffalo Memorial Auditorium Site, Proposed Buffalo Canal Side Development". This report also presents applicable subsurface exploration logs, updated subsurface exploration location plans, data maps, and soils/bedrock data, along with geotechnical considerations and recommendations to assist with the design and construction of the Public Canal Environments Project.

As the Public Canal Environments Project design continues to evolve, there will likely be additional issues, which may require further evaluation by Empire. Accordingly, please contact us, should you have any questions regarding this report or if you would like to discuss any design issues.

We look forward to continuing to work with the project team, through completion of this project.

Sincerely,

EMPIRE GEO-SERVICES, INC.

John J. Danzer, P.E.
Senior Geotechnical Engineer

Enc.: Geotechnical Evaluation Report (3 Hard Copies & 1 pdf File Copy)

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ACEC New York

Supplemental Geotechnical Evaluation Report for Inner Harbor Development, Phase 3A - Canal Side Public Canal Environments Project Buffalo, New York

Prepared For:

Erie Canal Harbor Development Corporation

c/o C&S Companies
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Buffalo, New York, 14203

Prepared By:

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8/22/11

Project No. BE-11-055
August 2011

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1.00 INTRODUCTION

1.10 GENERAL

This report presents the results of additional field explorations, laboratory testing and geotechnical engineering evaluations completed by Empire Geo-Services, Inc (Empire) for the proposed Inner Harbor Development, Phase 3A - Canal Side, Public Canal Environments Project (Public Canal Environments Project). This report supplements the "Final Geotechnical Evaluation Report for Former Buffalo Memorial Auditorium Site, Proposed Buffalo Canal Side Development" (Original Report), prepared by Empire Geo-Services, Inc., dated November 2, 2009.

C&S Companies (C&S), on behalf of the Erie Canal Harbor Development Corporation (ECHDC), retained Empire to complete this additional exploration work and supplemental report. This work was completed in general accordance with our March 18, 2011 proposal for design phase services.

The Original Report presented a comprehensive summary of historical explorations, along with the subsurface explorations, laboratory testing and geotechnical engineering evaluations and recommendations, completed by Empire Geo-Services, Inc. (Empire), for the proposed Buffalo Canal Side Development planned in 2009 at the former Buffalo Memorial Auditorium (Auditorium) site, in downtown Buffalo, New York.

The Public Canal Environments Project, currently planned, includes development of canal type water features and pedestrian bridges, along with some infrastructure and site preparation for future Canal Side development projects within the Auditorium site. The approximate location of the Public Canal Environments Project site is shown on Figure 1.

This supplemental report includes the results of additional field explorations, laboratory testing and geotechnical engineering evaluations, which supplement the Original Report. This report also presents applicable subsurface exploration logs, updated subsurface exploration location plans, data maps, and soils/bedrock data, along with geotechnical considerations and recommendations to assist with the design and construction of the Public Canal Environments Project.

The supplemental subsurface exploration program consisted of the following:

- Completion of four (4) additional test borings designated as B-15 through B-18/18A;

- Installation of an additional groundwater observation well within completed test boring B-16;

- Measuring and recording the groundwater levels in the observation well during the course of our additional work; and

- Laboratory testing of representative recovered soil samples and bedrock core samples from the additional borings to supplement previous laboratory test data.

SJB Services, Inc. (SJB), our affiliated drilling and testing company completed the recent test borings and installed the groundwater observation well. In addition, SJB completed the supplemental geotechnical laboratory testing.

1.20 SITE DESCRIPTION

The Canal Side, Public Canal Environments Project site is located within the area of the former Auditorium site. As shown on Figure 2, the Auditorium site is approximately 5.2 acres and is bound by Commercial Street and Pearl Street to the west, Lower Terrace to the north, Main Street to the east, and Marine Drive to the south.

The basement level / lower bowl floor of the former Auditorium was reportedly at elevation (El.) 580.2 feet and has been removed. A sub-basement area of the former Auditorium building is present within the southwest portion of the site. The sub-basement extends approximately 15 feet below the former basement level floor, to approximately El. 565.0 feet. A portion of the sub-basement walls and its floor system currently remain in-place and may be incorporated into the Buffalo Canal Side development plan. In addition, portions of the Auditorium perimeter foundation walls also remain in place.

The former Auditorium structure and floors were supported on driven piles, end bearing on bedrock. Many of the pile caps and grade beams have been removed, however, the piles remain in place.

The former Erie Canal Commercial Slip extended from the Buffalo River (near the current Naval and Military Park) to the southwest portion of the site and connected with a northwest to southeast aligned former canal. The “Hamburg Drain”, which is an approximate 16 feet wide by 13 feet deep trunk sewer, is located within this former canal area, as shown on Figure 2. The top of the Hamburg Drain structure is documented to be at approximate El. 575.0 feet.

The site was graded site following demolition of the Auditorium. The bowl area was generally cut and graded to about El. 577.5 feet ±, following removal of the floor system.

The area between the former Auditorium basement or bowl area, and the roadways surrounding the site, have be graded to slope up to the adjacent sidewalks and roadways. At the north end of the site a soldier pile and lagging wall has been installed to form a vertical face extending from the former basement floor level to the adjacent sidewalk / roadway grade.

The upper ground surface along the roadways and surrounding the former Auditorium structure drops in elevation from north to south, with surface elevations ranging from about El. 598 feet at the north end of the site to about El. 586 feet at the south end of the site.

Fill material was also placed to form a berm area over the Hamburg Drain and in the southeast corner of the site. The top of this fill area is at about El. 585 feet ±. It is understood that a majority of this fill will be removed to establish the final grading associated Public Canal Environments Project.

1.30 PROJECT DESCRIPTION

The proposed Canal Side, Public Canal Environments Project includes development of a canal type water feature structure and pedestrian bridges, along with some infrastructure and site preparation for future Canal Side development projects within the Auditorium site. A conceptual design plan of the canal type water features and pedestrian bridge locations, prepared by Ehrenkrantz, Eckstut, and Kuhn Architects (EEK), has been adapted and presented as Figure 3.

The canal structure will typically range from about 25 feet to 90 feet in width, and will have a bottom of pool at El. 577.75 feet. The water pool depth is planned to be about 18-inches, with adjacent "tow-path" walks set typically at El. 580.0 feet. Three (3) pedestrian bridge structures are planned to cross the canal structure, as shown on Figure 3. The development of the canal structure will also include stairways, ramps and retaining walls. The canal structure, pedestrian bridges, retaining walls and associated structures are planned to be supported on pile type foundations, bearing on or within the Limestone bedrock beneath the site.

A portion of the southwest leg of the proposed canal structure, which aligns with the Erie Canal Commercial Slip, is located between piers No. 31 (southeast) and No. 32 (northwest) supporting the NYS Route 5 Skyway Bridge structure. Pier No. 31 is a pile supported pier with a top of pile cap El. of 581.45 feet and bottom of pile cap El. of 573.45 feet. Pier No. 32 is a caisson supported pier with a top of caisson El. of 581.45 feet and the bottom of caisson extending to bedrock.

2.00 SUBSURFACE EXPLORATIONS

2.10 HISTORICAL SUBSURFACE INFORMATION

During our 2009 study, drawings were obtained by C&S, which presented the results from historical test borings, previously completed within the area of the Auditorium site. These included a November 23, 1938 drawing titled “Plot Plan – Showing Existing Bldgs. – R.R. Siding – Test Borings”. This drawing shows the location of 14 test borings (borings A through P with borings I and O omitted), and a generalized soil and presumed bedrock profile. The test boring data were reportedly obtained from the City of Buffalo Sewer Authority records from 1901, 1912, 1925, and 1936. The drawing also shows the location of 14 proposed test borings (numbers 1 through 14), presumably planned for the Auditorium construction.

The second drawing is dated February, 1939 and is identified as “Sheet No. X-2”. This drawing shows the location of the 14 test borings completed for the Auditorium construction, designated as Hole #1 through Hole #14, and provides a general soil and groundwater elevation profile as well as presumed top of bedrock elevations. The test borings were reportedly completed by Riley Engineering and Drilling Company.

The generalized soil profiles included a soil description at intervals of about 5 feet. The transition depth from fill soils to indigenous soils was estimated as the mid-point between the last fill soil sample and the first indigenous soil sample. Standard Penetration Test “N” values were not reported on the generalized soil profiles.

The elevations included on the drawings are referenced to the City of Buffalo Datum. The conversion from the City of Buffalo Datum to the United States Geologic Survey Datum (NGVD29) was made by adding 575.453 feet to the City of Buffalo Datum elevation. The City of Buffalo Datum Elevation, equal to 0.00 feet, is reported to be near the mean water level of Lake Erie

Pertinent information regarding the subsurface conditions (i.e. fill depths and depth to bedrock), obtained from these drawings, is summarized on updated Table 1. Of these historical borings, the borings designated as E, F, G, H, J, K, L, M, N, #4, #5, #8, #11, #12, #13 and #14 were located in the area of the proposed Public Canal Environments Project.

2.20 SUBSURFACE EXPLORATION COMPLETED IN 2009

The subsurface exploration program completed by Empire / SJB during 2009 consisted of 14 test borings and the installation of four (4) groundwater observation wells. In addition, two test pit explorations were made by Demco, Inc. on July 10, 2009. The test borings are designated B-1 through B-14 and the groundwater observation wells are identified by the test borings in which they were installed (i.e. observation wells B-1, B-4, B-7A, and B-14). The test pits are designated as TP-1 and TP-2. The approximate locations of these explorations are shown on Figure 2.

The groundwater observation wells were removed / cut off during the site grading following the demolition of the Auditorium and therefore were not available for measurement of water levels during this supplemental study.

Test borings B-1, B-7/7A, B-9, B-10, B-11 and B-14 of the 2009 subsurface exploration were located in the area of the proposed Public Canal Environments Project. Subsurface exploration logs for these borings are presented in Appendix A.

2.30 SUPPLEMENTAL 2011 TEST BORINGS

Four (4) additional test borings, designated as borings B-15, B-16, B-17 and B-18/18A and the installation of groundwater observation well B-16 were completed by Empire / SJB in the area of the proposed Public Canal Environments Project. These explorations were completed between June 2nd and 7th, 2011 and their locations are shown on Figure 2.

The test boring locations were established in the field jointly by Empire and C&S, at mutually agreed upon locations. Following completion of the drilling, Foit Albert Associates obtained the “as-drilled” locations of the test borings and monitoring well, and determined the ground surface elevations. This data was provided to Empire for inclusion with this report.

The test borings were made using a Central Mine Equipment (CME) model 75 truck mounted drill rig. The test borings were advanced in the overburden soils using hollow stem auger and split spoon sampling techniques. Split spoon samples and Standard Penetration Tests (SPTs) were taken continuously from the ground surface to a depth of 30 to 32 feet and in intervals of five feet or less below the zone of continuous sampling. The split spoon sampling and SPTs were completed in general accordance with *ASTM D 1586 - "Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils"*.

Each of these test borings were advanced through the overburden until encountering auger refusal conditions (top of bedrock), which was encountered at depths ranging from about 38.0 feet (B-15) to 46.6 feet (B-18A). After auger refusal was met, approximately 10 feet bedrock was cored in general accordance with *ASTM D 2113 – "Standard Practice for Rock core Drilling and Sampling of Rock for Site Investigation"*.

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

The groundwater observation well installed in completed test boring B-16, consisted of a 2-inch diameter PVC well screen and riser pipe with a sand filter, bentonite seal and soil backfill. The well was completed with a locking protective surface casing. Additional details regarding the construction of the observation well is shown on the Monitoring Well Completion Record presented following the log for test boring B-16 in Appendix B.

3.00 LABORATORY TESTING

Several of the collected soil and bedrock samples from the additional test borings were tested in SJB's geotechnical testing laboratory to supplement previous laboratory test data and confirm soil classifications, provide soil index properties, and assist with estimating soil and bedrock engineering properties. In addition, several soil samples were tested by SJB and Paradigm Environmental Services, Inc. (Paradigm) to evaluate their potential corrosiveness to steel and concrete.

The laboratory testing completed on some of the collected soil and bedrock samples included the following tests.

- Natural moisture content in accordance with *ASTM D 2216 – "Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass"*.

- Grain size analyses (sieve analyses only) in accordance with *ASTM C136– "Standard Test Method for Particle-Size Analysis of Soils"*.

- Resistivity, redox, pH, and sulfides according to procedures established by the Ductile Iron Pipe Research Association (DIPRA).

- Chloride ion and sulfate ion in accordance with Analytical Method SW 9056.

- Unconfined compressive strength in accordance with *ASTM D2938- "Standard Test Method for Unconfined Compressive Strength of Intact Rock Core Specimens"*.

The following matrix summarizes the soil and bedrock samples tested and the tests performed. The geotechnical laboratory test data is presented in Appendix C and is discussed in Sections 4.20, 4.30 and 4.40 of this report.

Summary of Geotechnical Laboratory Testing Completed					
Test Boring	Sample No. / Depth (ft. bgs)	Moisture Content	Grain Size Analysis	DIPRA / pH / Chlorides / Sulfates	Rock Core Unconfined Compressive Strength
B-15	S-15 / 28 to 30	X	X		
B-16	S-17 / 35 to 37	X	X		
B-17	S-12 / 22 to 24	X	X		
B-18A	S-16 / 30 to 32	X	X		
B-15	Comp. / 4 to 14	X	X	X	
B-16	Comp. / 4 to 14	X	X	X	
B-17	Comp. / 4 to 14	X	X	X	
B-15	Run #1 / 39.5				X
B-15	Run #2 / 45.0				X
B-17	Run #1 / 44.0				X
B-17	Run #2 / 50.5				X

Notes:
1. ft. bgs = feet below ground surface.
2. Comp. = Composite Sample of Samples taken between 4 feet and 14 feet.

4.00 SUBSURFACE CONDITIONS

4.10 GENERAL

Based on the 2009 test borings and the recently completed 2011 test borings, and our review of the existing subsurface data, the general subsurface stratigraphy in the Public Canal Environments Project area consists of fill soils at the surface which typically extended down to an elevation between 560 and 575 feet, with the deeper fills generally occurring within the apparent limits of the former historic canals. Beneath the fill deposits, the indigenous soils consisted predominately of silty sands. Exceptions include occasional stratums of silty clay and clayey silt soil encountered beneath the fill layer, prior to encountering the sand soils. Limestone bedrock was encountered at an approximate elevation ranging from about El. 540 feet to El. 546.5 feet.

The soil stratigraphy encountered and the groundwater conditions observed are described in more detail in the following sections and on the test boring logs in

Appendices A and B. Table 1 presents a summary of the depths and elevation to the bottom of the fill soils and to the top of bedrock.

4.20 FILL SOILS

As previously stated, the fill soils within the limits of the Public Canal Environments Project area typically extend to an elevations ranging between 560 and 575 feet. The depth to the bottom of the fill, along with the corresponding elevation, at the test boring locations are presented on Table 1.

The nature of the fill generally varies with location and depth. The fill typically consists of reworked silty sands, gravels, silt and clayey silt soils with varying amounts of intermixed brick fragments, ash, cinders, concrete fragments, organics, and wood. Zones of fill consisting predominately of bricks, were also encountered within several of the test borings. The Standard Penetration Test (SPT) “N” values obtained within the fill soils are variable ranging from 2 to greater than 50, with occasional spoon refusal (”REF”). The variable nature of the fill soils, coupled with the variable SPT “N” values, are an indication the fill was likely placed in an uncontrolled manner.

Several composite soil samples collected from the fill layer with both the 2009 and 2011 test borings were tested for resistivity, redox, pH, and sulfides according to procedures established by the Ductile Iron Pipe Research Association (DIPRA). Several fill soil samples were also tested for chloride ion and sulfate ion. The 2011 analytical laboratory test data is included in Appendix C. This data is summarized in the following tables, along with the test data from the applicable 2009 test borings.

Summary of DIPRA Test Results

Test Boring	Sample Depth (feet bgs)	Resistivity (ohm-cm)	Redox (mv)	ph	Sulfides	Moisture (%)	Total DIPRA Points
B-9	2 to 8	1,100	-109	8.0	Negative	8.6	16
B-14	2 to 4	2,300	-45.3	7.8	Negative	9.2	8
B-15	4 to 14	1,100	+65.8	8.5	Negative	13.6	14.5
B-16	4 to 14	890	+79.3	8.7	Negative	14.2	14.5
B-17	4 to 14	1,300	+56.2	8.2	Negative	11.9	14.5

Based on the DIPRA publication “American National Standard for Polyethylene Encasement for Ductile Iron Pipe Systems”, if the total DIPRA points exceed 10, the soil is considered corrosive to ductile iron pipe, and protection against exterior corrosion should be provided. Accordingly, based on these test results it is recommended that metallic pipes and conduits should be provided with cathodic protection or a suitable protective coating to resist potential corrosion.

Summary of Chloride and Sulfate Test Results			
Test Boring	Sample Depth (feet bgs)	Chlorides	Sulfates
B-1	16 to 24	244 ug/g	722 ug/g
B-7	8 to 10	19.3 ug/g	non detect (<50 ug/g)
B-10	6 to 8	398 ug/g	non detect (<50 ug/g)
B-15	4 to 14	262 mg/kg	212 mg/kg
B-16	4 to 14	274 mg/kg	65.1 mg/kg
B-17	4 to 14	109 mg/kg	93.1 mg/kg

Based on the sulfate concentrations, these soils are considered to have a negligible potential for sulfate exposure. However, the water soluble sulfate concentration of the soil sample collected from test boring B-1 is near the upper limit of the range considered to be negligible.

4.30 INDIGENOUS SOILS

Beneath the fill soils, the indigenous soils typically consisted of silty sands with varying amounts of gravel, extending to the top of bedrock. Exceptions include some upper deposits of silty clay and clayey silt soils encountered beneath the fill within test borings B-7A, B-10, B-14 and B-15.

The silty sand soils are classified as a SM and SP group soil using the Unified Soil Classification System (USCS). The SPT “N” values obtained within the granular sand soils ranged from “weight of hammer” (i.e. only the weight of the hammer and rods required to advance the sample spoon) to 44 indicating these soils have a variable relative density of “very loose” to “compact”, but are typically “firm”. When drilling within the sand soils, “running sands” (i.e. flow of sands into the augers after removing the center plug) were often encountered, generally beneath elevation 560 feet. The geotechnical laboratory testing completed on collected samples of the sand soils, as summarized in the table below, indicate these soils typically consists of about 70 to 95 percent sand size particles, with the remaining portions consisting of gravel, silt, or clay size particles. The percentage of silt and clay size particles was typically less than 10 percent. The soil sample from test boring B-14 at 12 to 14 feet consisted of a sandy clayey silt.

The cohesive silty clay and clayey silt soils, encountered within some of the test borings, are classified as a CL and ML group soil using the USCS. The SPT "N" values obtained within these soils ranged from "weight of hammer" to 8, indicating the cohesive soils have a "very soft" to "medium-stiff" consistency. The geotechnical laboratory testing completed on collected samples of the silty clay and clayey silt soils, as summarized in the table below, indicate the soils have a plasticity index of 4 to 10, correlating to a low to medium degree of plasticity.

Summary of Geotechnical Laboratory Test Results

Test Boring	Sample Depth (ft. bgs)	Moisture Content (%)	Particle Size Analysis			LL / PL / PI
			Gravel (%)	Sand (%)	Silt & Clay (%)	
B-7A	14 to 16	24.8				28 / 18 / 10
B-9	10 to 12	27.9				22 / 18 / 4
B-10	28 to 30		0	56.4	43.6	
B-14	12 to 14		0	26.2	73.8	
B-14	25 to 27		0	94.9	5.1	
B-15	28 to 30	24.8	0	96.7	3.3	
B-16	35 to 37	17.1	2.3	75.9	21.8	
B-17	22 to 24	24.5	0	85.4	14.6	
B-18A	30 to 32	18.4	3.0	84.7	12.3	

Notes:

1. ft. bgs = feet below ground surface.
2. LL = liquid limit, PL = Plastic Limit, PI = Plasticity Index.
3. Blank space indicates testing was not completed.

4.40 BEDROCK

Each of the four recently completed test borings (B-15, B-16, B-17 and B-18A) were advanced through the overburden to auger refusal (bedrock refusal) and then cored 10 feet into bedrock. In addition, test borings B-1, B-7/7A, B-9, B-10, B-11 and B-14 of the 2009 subsurface exploration were also advanced to auger refusal (apparent top of bedrock), with borings B-11 and B-14 cored about 5 feet into bedrock. The top of bedrock was also identified on the generalized soil profiles included on the 1938 and 1939 drawings. The depths to the top of bedrock at the test boring locations, along with the corresponding elevations are summarized on Table 1. A top of bedrock contour plan was developed in 2009 and recently updated to include the 2011 test boring data and is presented as Figure 4.

As shown on Figure 4, the top of bedrock typically is in the range of about El. 540 feet to El. 546.5 feet, within the Public Canal Environments Project area.

The bedrock core recovered from test borings B-11, B-14, B-15, B-16, B-17, and B-18A consisted of gray, hard to very hard, weathered to sound, laminated to thickly bedded Limestone bedrock. Occasional fossils, styorites, and chert nodules were noted within the bedrock. The core recoveries ranged from 89% to 100%. Rock quality designation (RQD) values ranged between 76% and 100%, indicating the recovered rock cores have a “good” to “excellent” rock mass quality.

The geotechnical laboratory testing completed on selected samples of the recovered bedrock core from the Public Canal Environments Project area, are summarized in the table below, and indicates the bedrock has an unconfined compressive strength ranging from 13,430 psi to 19,020 psi, with an average of about 16,704 psi.

Unconfined Compressive Strength of Bedrock Core Samples

Test Boring	Sample Depth (ft. bgs)	Unconfined Compressive Strength (psi)
B-11	42	18,430
B-15	39.5	13,430
B-15	45.0	15,030
B-17	44.0	17,610
B-17	50.5	19,020

4.50 GROUNDWATER CONDITIONS

Water level measurements were made in some of the test borings at the completion of overburden drilling and sampling and are noted on the test boring logs included in Appendices A and B. It is noted that these measurements may not have provided sufficient time for the groundwater to accumulate and/or stabilize in the bore holes within the time period that had elapsed from the completion of drilling operations and the time of measurement.

Groundwater observation wells were installed in test borings B-1, B-4, B-7A, and B-10 completed during the 2009 study. Empire visited the site to record the water level in the wells on several occasions between the date of installation and October 16, 2009. The water level depth measurements and corresponding elevations are summarized on Table 2. These groundwater observation wells were removed / cut off during the site grading following the demolition of the Auditorium and therefore were not available for measurement of water levels during this supplemental study

A groundwater observation well installed in completed test boring B-16 as part of the supplement exploration. The water levels in this well were measured on two occasions (June 7, 2011 and July 25, 2011) and are also presented on Table 2.

Based on the water level data, the groundwater elevation at the northern end of the former Auditorium site was observed to be present between about El. 574.5 feet and 575.0 feet. At the south end of the site, the groundwater elevation was observed to fluctuate between about El. 572.0 and 573.0 feet. However, the groundwater elevation at the south end of the site (B-7A and B-10) was noted to fluctuate up to approximately El. 574.5 feet during a high lake level event on October 7, 2009 (i.e. high sustained winds from the south – southwest caused a surge in the Lake Erie water levels).

It is possible some localized zones of perched or trapped groundwater could be encountered in the upper more permeable fill soils, which overlie less permeable soils. Perched groundwater conditions can be particularly more prevalent during and following heavy or extended periods of precipitation and during seasonally wet periods. It should be expected that perched and permanent groundwater conditions will vary with changes in soil conditions, precipitation and seasonal conditions and will be influenced by fluctuations in the level of the nearby Buffalo River and Lake Erie.

5.00 GEOTECHNICAL EVALUATION, CONSIDERATIONS, AND RECOMMENDATIONS

<u>5.10 GENERAL GEOTECHNICAL CONSIDERATIONS</u>

Based on our analysis of the subsurface conditions disclosed by the explorations and groundwater observation wells, the following general considerations and recommendations are provided to assist with planning the design and construction of the foundations for the canal type water feature structures and pedestrian bridges, and associated infrastructure for the proposed Public Canal Environments Project. More detailed considerations and recommendations are presented in the subsequent sections of this report. One is also referred to the 2009 Original Report for additional information regarding the former Auditorium site subsurface conditions, including existing in-place pile foundation conditions and investigations of the subbasement area floor system.

Given the variable composition and extensive thicknesses of the fill soils, along with the generally very loose to firm relative density of the indigenous sand soils, and considering the potential for unpredictable differential foundation settlement to occur within these soils, the use of spread foundations to support the various proposed structures is not considered a viable foundation option. Accordingly, it is recommended that the proposed canal type water feature structures, pedestrian bridges and ancillary structures should be supported using a deep foundation system bearing on or within the Limestone bedrock.

Limestone bedrock was encountered at elevations ranging between about El. 540 feet to El. 546.5 feet, within the Public Canal Environments Project area. As previously stated, an approximate top of bedrock contour plan has been developed based on the apparent bedrock elevations encountered in the test borings, and is presented as Figure 4.

Driven piles (i.e. H-piles or pipe piles) end bearing on bedrock or micro-piles drilled and grouted into bedrock, appear to be the most appropriate deep foundation systems to consider for supporting the proposed structures. It is anticipated that most of the structures will be supported using driven piles, based on preliminary discussions with the project team.

NYSDOT, however, has expressed concern (NYSDOT E-mail June 1, 2011) with regard to driving piles in close proximity to the NYS Route 5 Skyway Bridge Piers. NYSDOT indicated that drilled type pile foundations are preferred in this area.

Our experience monitoring vibrations during driven pile installations, as well as published studies and guidance, indicate that vibrations and associated potential impacts on existing structures should generally be negligible beyond a separation distance of about 30 to 50 feet. Therefore, we would recommend that drilled and grouted micro-piles be used for foundation support within 50 feet of the existing Skyway Bridge Piers.

If necessary, drilled and grouted micro-piles could also be considered for locations, which require resistance of uplift loads.

The existing fill is expected to contain occasional inclusions or zones of rubble, possible boulder size obstructions, in addition existing piles, pile caps, grade beams and elements associated with the Hamburg Drain are also present. These conditions may cause some difficulties with deep foundation installation. If such conditions are encountered during construction, contingency plans will need to be developed to handle these situations.

The existing uncontrolled fill conditions will also need to be considered with regard to the design and construction of slab-on-grade type pedestrian walkways and pad areas. It is common practice to recommend that the existing uncontrolled fill type soils be removed and replaced with a properly controlled and compacted engineered fill beneath the slab-on-grade construction. However, due to the substantial amounts of existing fill encountered, it will not be economically or technically practical to remove the fill in its entirety.

It should be understood that there can be some uncertainties and risks, such as the potential for some long-term differential settlement, which may occur with leaving potentially unsuitable fill soils in-place. The existing fill that has been recently placed, forming the berm over the majority of the Public Canal Environments Project area will act as a surcharge load and will help to reduce some of these risks where it is removed to establish the final grading.

Provided that ECHDC understands and accepts these uncertainties and risks, the following can be implemented as minimum requirements for constructing lightly loaded slabs-on-grade over the existing fill soils.

- The existing fill subgrades should be thoroughly compacted, proof rolled, evaluated and prepared in accordance with our recommendations in Section 6.120.5
- All existing structures (i.e. pile caps, foundation walls, footings, etc.) within the limits of the slab-on-grade construction, should be removed to a depth of at least 15-inches from the bottom of the proposed slab-on-grade.
- Lightly loaded slabs-on-grade or paver type walkways should be constructed over a minimum 12-inch thick layer of compacted Structural Fill/Subbase Stone. A minimum of 18-inches of Subbase Stone should be placed over the existing fill, or directly on loose indigenous sand subgrade soils in areas where slabs would be subject to light vehicle loads.
- Any deleterious materials, such as voided rubble, wood, organics, soft soils, etc., which are present within the fill soils at the bottom of the subgrade excavation, should be further undercut, removed and replaced with additional Structural Fill/Subbase Stone material.

- A suitable stabilization/separation geotextile, such as Mirafi 500X or suitable equivalent, should be placed between the existing fill subgrade and the overlying Structural Fill/Subbase Stone layer for the slab-on-grade construction.

As an alternative to slab-on-grade construction, consideration could be given to using a structural slabs supported by grade beams and the deep foundation system. Although potentially more costly, the structural slabs will generally eliminate the potential settlement risks associated with constructing a slab-on-grade over the fill soils.

In addition to the foundation and site preparation considerations, it will also be necessary to consider the groundwater conditions present on the site. Based on the water levels observed in the groundwater observation wells, groundwater was typically present between El. 572 feet and 575 feet, depending on the location within the site, and depending on the seiche effects that occur in Lake Erie.

The groundwater conditions will need to be considered with regard to potential uplift pressures acting on any depressed pit or vault type structures, which may be situated below the groundwater level. The non-plastic silty sand soils present beneath the groundwater table can be expected pose difficulties with maintaining stable excavations below the groundwater level. The more granular and non-plastic soils will be susceptible to rapid subgrade and excavation side wall instability, if not properly dewatered. Substantial amounts of groundwater could also be encountered where existing highly voided or rubble type fill is present below the groundwater surface. Proper dewatering procedures, therefore, will need to implemented for excavations which must extend below the groundwater.

The design and construction of the proposed canal water feature structures, pedestrian bridge foundations, and associated infrastructure, along with the site preparation for future Canal Side development, in relation to the adjacent existing roadways, utilities and existing substructures should be carefully planned. Proper sloping/benching and/or temporary shoring of the excavation sidewalls, along with underpinning/bracing of the existing structures and utilities will be required where the excavation extends below these structures. In addition, the existing adjacent roadways and surface structures (i.e. sidewalks, utilities, etc.) must also be protected from potential excavation slope instability, soil relaxation and undermining.

Based on the subsurface conditions encountered, the proposed Public Canal Environments Project site should be classified as Seismic Site Class “D” in accordance with Table 1613.5.2 of the Building Code of New York State - December 2010 (NYS Building Code). Therefore, seismic design may be based on this site classification.

5.20 DESIGN RECOMMENDATIONS FOR DRIVEN PILE FOUNDATIONS

The Limestone bedrock should provide a suitable bearing stratum for a driven pile foundation system. H-piles or pipe piles driven to refusal on the bedrock will derive their capacity predominately through end bearing.

An H-pile, driven to absolute refusal on the bedrock, may be designed for an allowable axial capacity equal to 33% of the pile yield strength or 16.5 kips per square inch (ksi), whichever is less, times the cross sectional area of the pile. We recommend that a 10% reduction in the cross sectional area be considered to account for potential corrosion and section loss over the pile life. Alternatively, the piles could be coated with a suitable bitumastic coating to help limit potential corrosion within the embedment zone from the top of the pile to at least 10 feet below the permanent groundwater table (i.e. to El. 565 feet). In this case the 10% area reduction to account for potential pile section loss, would not be necessary.

Based on the above criteria, an HP12 x 53 section (Grade 50 steel), with a cross sectional area of 15.5 in^2, would provide an allowable axial capacity of about 115 tons per pile, when accounting for the 10% section loss. The piles, however, should be driven and tested for an ultimate capacity of 256 tons to account for the above reduction, assuming an HP 12 x 53 is used.

A lighter or heavier pile section could also be used to obtain a different allowable axial capacity, using the same criteria outlined above. The following table summarizes the allowable axial compressive capacity and required ultimate test capacity for various pile sections based on the above design criteria. These capacities assume the use of Grade 50 Steel, as well as account for the 10% section loss.

Pile Section	Allowable Axial Compressive Capacity per H-Pile	Required Ultimate Test Capacity
HP 12 x 53	115 tons	256 tons
HP 10 x 42	92 tons	205 tons
HP 8 x 36	78 tons	175 tons

The ultimate load test capacities presented above assume a Factor of Safety of 2.0 as required by the Building Code of New York State.

Pipe piles should have a wall thickness of at least 0.25 inches and may be driven open ended or with a closed end, as determined appropriate by the pile driving contractor. If a closed end pipe pile is used, a flat steel plate, at least 0.50 inches thick, should be welded to the pile to form the closed end. Following driving and acceptance, the annulus of the pipe pile should be filled with concrete having a 28-day compressive strength (f'c) of 3,000 psi or greater.

A pipe pile, driven to refusal on the bedrock, may be designed for an allowable axial capacity equal to 33% of the pile yield strength or 16.5 kips per square inch (ksi), whichever is less, times the cross sectional area of the pipe pile. As with the H-piles, a 10% reduction in the cross sectional area or a bitumastic coating should also be considered to account for potential corrosion / section loss over the pile life.

The following table summarizes the allowable axial compressive capacity and required ultimate test capacity for various pipe pile sections based on the above design criteria. These capacities assume the use of Grade 50 Steel. Other pipe pile sections could also be used, based on current product availability, to obtain different allowable axial capacities, provided the same design criteria outlined above is used.

Pipe Pile Section	Allowable Axial Compressive Capacity per Pipe Pile	Required Ultimate Test Capacity
12.000" O.D. Pipe Pile (0.375" Wall Thickness)	101 tons	226 tons
10.750" O.D. Pipe Pile (0.375" Wall Thickness)	90 tons	202 tons
9.625" O.D. Pipe Pile (0.352" Wall Thickness)	76 tons	169 tons
8.625" O.D. Pipe Pile (0.313" Wall Thickness)	60 tons	135 tons
6.625" O.D. Pipe Pile (0.281" Wall Thickness)	41 tons	95 tons

The ultimate load test capacities presented above assume a Factor of Safety of 2.0 as required by the Building Code of New York State, as well as consider the section reduction for potential corrosion loss.

Driven pile foundations end bearing on the bedrock are expected to undergo insignificant total settlement, when designed and constructed in accordance with our recommendations. Driven piles should be spaced a minimum of 3 pile widths apart, or three feet, whichever is greater. At this spacing, no group reduction factor is considered necessary. Pile caps and grade beams for driven pile foundations should be embedded a minimum of 4 feet below final exterior grades for frost protection.

A preliminary evaluation was made of the estimated uplift capacity resistance of a driven piles bearing on the Limestone bedrock. Based on these preliminary analyses, we suggest that an allowable uplift capacity (i.e. side shear resistance) of 150 pounds per square foot of pile surface area embedded below the pile cap or grade beam be utilized. The box perimeter of H-pile sections should be used in calculating the uplift resistance of H-piles.

If requested, Empire can perform a pile lateral load analysis (i.e. pile lateral load vs. lateral deflection) based on pile type selected and the anticipated lateral loading conditions.

At least 2 to 3 random piles of each driven pile type used, or no less than a total of 5 piles, should be dynamically tested in accordance with *ASTM D 4945 – "Standard Test Method for High Strain Dynamic Testing of Piles"* to confirm that the pile capacity has been obtained with an adequate factor of safety (i.e. Factor of Safety of 2.0 or greater as required by the Building Code of New York State). For driven piles subject to uplift loads, at least 1 pile should be tested in accordance with *ASTM D 3689 – "Standard Test Method for Individual Piles Under Static Axial Tensile Load"* to confirm the that the uplift capacity has been obtained with an adequate factor of safety (i.e. Factor of Safety of 2.0 or greater).

5.30 DESIGN RECOMMENDATIONS FOR MICRO-PILE FOUNDATIONS

As stated above in Section 5.10, drilled and grouted micro-piles are recommended for foundation support within 50 feet of the existing Skyway Bridge Piers. Micro-piles can also be considered for locations, which require resistance of uplift loads.

Micro-pile foundations are generally designed and installed by a Specialty Contractor qualified and experienced in such construction methods. Therefore, it is general practice for the Structural Engineer to develop a performance specification for the micro-pile and then have the Contractor provide a suitable pile design, which considers the logistics of the installation and the subsurface conditions. The diameter of the effective grout column, depth of effective embedment, steel reinforcing, and cement grout strength can be varied by the Specialty Contractor based on the structural design requirements as well as considering the sizes and economics of permanent casing pipe available on the market.

The Post Tensioning Institute (PTI) - "Recommendations for Prestressed Rock and Soil Anchors" and the Federal Highway Administration (FHWA) – “Micro-pile Design and Construction Reference Manual (FHWA-NHI-05-039)” can be referenced with regard to providing design criteria and installation recommendations for micro-piles.

The micro-pile foundations for this project would be expected to be typically 6 to 8 inches in diameter and would be drilled and grouted into competent Limestone bedrock to develop their compressive or uplift axial capacities.

The micropile foundation installation should consist of a permanent steel casing from the top of the micropile to the top of Limestone bedrock. We recommend the steel casing pipe consist of Grade 50 steel and be at least 6-inches in diameter, with a minimum wall thickness of 0.250 inches. Micropile spacing should be at least 30-inches or 3 pile diameters, center to center, whichever is greater.

Micro-piles should have a minimum effective bond length of at least five (5) feet in competent Limestone bedrock. The effective compression bond length can be the entire length of the rock socket into the competent bedrock.

An allowable bond strength of 100 pounds per square inch (psi), developed between the micro-pile grout and the competent Limestone bedrock socket, can be used for preliminary design and planning purposes. A concrete/grout with a minimum compressive strength of 4,000 psi should be used, with grout placement under pressure (i.e. a Type B micropile).

Based on the above criteria, a 6-inch diameter grout column micro-pile, with about 7 feet of effective bond length in competent Limestone bedrock would be expected to develop an allowable compressive capacity of around 79 tons per pile or greater.

Micro-pile foundations should undergo insignificant total settlement when designed and constructed in accordance with our recommendations.

We recommend that at least 1 micro-pile be load tested to twice the allowable design capacity to verify the design assumptions will be met. The test pile may be constructed and tested outside the proposed foundation area, provided that the test pile is constructed similar to, and with similar bearing conditions, to that of the production piles.

5.40 SLAB-ON-GRADE CONSTRUCTION

As discussed in Section 5.10, where lightly loaded slabs-on-grade, or paver block type walkways are constructed over the existing fill, or directly on loose indigenous sand soils, it is recommended that a minimum of 12-inches of Subbase Stone, as described in Appendix D, be placed beneath the slab-on-grade construction. A minimum of 18-inches of Subbase Stone should be placed over the existing fill, or directly on loose indigenous sand subgrade soils in areas where slabs would be subject to light vehicle loads.

In areas where more than 12-inches of compacted Suitable Granular Fill, or other approved compacted subgrade backfill materials, are placed over the existing fill or indigenous soil subgrades, then it is recommended that a minimum of 6-inches of Subbase Stone, be placed beneath the slab-on-grade construction for lightly loaded slabs. A minimum of 10-inches of Subbase Stone should be placed over the Suitable Granular Fill subgrade in areas where slabs would be subject to light vehicle loads.

A suitable stabilization/separation geotextile, such as Mirafi 500X, should be placed over the existing fill or indigenous soil subgrades prior to placement of the Suitable Granular Fill. A second geotextile would not be necessary where Subbase Stone is placed over Suitable Granular Fill.

For exterior slabs, subgrade underdrains should be provided to allow drainage of the Subbase Stone course to help minimize the potential for frost action. The underdrains should drain to a suitable storm sewer or other drainage relief point.

Slabs constructed as a slab-on-grade may be designed using a modulus of subgrade reaction of 150 pounds per cubic inch at the top of the Subbase Stone layer. It is recommended that the slab-on-grade be constructed such that it floats on the subbase and subgrades and is not structurally connected to, or resting directly on, perimeter walls in order to limit differential settlement effects.

As an alternative to slab-on-grade construction, consideration could be given to using a structural slab supported by grade beams/retaining walls and the deep foundation system. If the slabs are structurally supported by the deep foundation system, it is recommended a minimum of 6-inches of Subbase Stone material be placed beneath the structural slab to provide a suitable working surface to construct the slabs.

5.50 PIT STRUCTURE AND EARTH RETAINING WALL DESIGN

As previously stated, permanent groundwater conditions are typically present between El. 572 and El. 575 feet, depending location within the site. For design purposes, however, it is recommended the groundwater conditions be assumed to rise as high as El. 578 feet or the 100-year flood elevation, whichever is higher.

Accordingly, depressed pit or vault structures, which would be situated below the design permanent groundwater elevation, should be designed to resist full hydrostatic pressures acting the walls and bottom slab, as well as be properly waterproofed. Potential hydrostatic uplift pressures should also be considered for the canal water features, when they are in a drained condition.

Where the depressed structure or earth retaining wall is situated above the design groundwater elevation, a foundation drainage system, as discussed below, should be incorporated, to relieve hydrostatic pressures from developing against the structure walls and bottom, due to the potential presence of upper perched groundwater zones.

The design of earth retaining foundation walls or depressed pit structure walls (restrained walls), should be designed to resist “at rest” lateral earth pressures generated by the earth backfill and any temporary or permanent surcharge loads, based on the following soil parameters. Walls, which are allowed to yield (i.e. cantilevered earth retaining walls), can be designed on the basis of “active” lateral earth pressures.

The lateral earth pressures can be computed using the following soil parameters where the wall backfill is a Structural Fill or Suitable Granular Fill, as described in Appendix D.

Recommended Soil Parameters for Earth Retaining Wall Design

- Coefficient of “At-Rest” Lateral Earth Pressure – 0.50
- Coefficient of “Active” Lateral Earth Pressure – 0.33
- Coefficient of Passive Lateral Earth Pressure – 3.00

- Angle of Internal Friction – 30 Degrees
- Total Unit Weight of Soil – 125 pcf
- Submerged Unit Weight of Soil – 65 pcf
- Surcharge Load Lateral Coefficient – 0.50

Water should not be allowed to collect against the backfilled wall section unless the wall is designed for the additional hydrostatic pressure. If the earth retaining structure is designed for full hydrostatic pressures, the walls should be designed to resist the hydrostatic pressures as well as the lateral earth pressures acting the walls. In this case, the lateral earth pressure should be computed based on a submerged soil unit weight below the design groundwater level. In addition, the floor or bottom slab must be designed to resist the hydrostatic uplift pressure acting on floor or pit bottom slab. In this case, the pit structure should also be fully water proofed.

Perimeter foundation wall and underslab foundation drains, to intercept perched groundwater and relieve potential hydrostatic pressures, should be provided where the structure or retaining wall is situated above the groundwater elevation. The foundation drainage system must be properly designed, installed and maintained for long-term performance and should include such features as clean-outs to properly maintain the system. The foundation drainage system should drain to a sump and pump system. The foundation drain pipes should be set at a minimum depth of 1.0 foot below the structure floor grade.

The foundation drainage system should include a geotextile, selected considering drainage and filtration, installed around drainage stone surrounding a slotted under-drain pipe. The drainage stone should be sized in accordance with the pipe slotting or perforations. A crushed aggregate conforming to NYSDOT Standard Specifications Section 703-02, Size Designation No. 1 (½-inch washed gravel or stone) is generally acceptable for slotted under-drain pipe. The foundation drainage stone and surrounding geotextile, along the walls, should extend above the drainpipe a minimum of 2 feet.

A pervious granular backfill (soil type drainage media) or a suitable geosynthetic drainage composite (i.e. "Grace Hydroduct", "Miradrain", "Delta MS" or other suitable equivalent) should be placed against the foundation wall, above the drainage system, to allow infiltration to the drainage system. Concrete Sand, which meets the minimum requirements of NYSDOT Standard Specifications Section 703-07 (100 percent passing 3/8 inch sieve to maximum of 3 percent passing a No. 200 sieve), is generally acceptable as a pervious granular drainage media backfill.

The soil type drainage media against the wall should be a nominal 2 feet in width. The drainage media against the wall should extend to about 1 to 2 feet below the finished grade surface, where it may be capped off with the foundation backfill material.

5.60 EXCAVATION SHORING

The design and construction of the proposed water feature canal structures, pedestrian bridge abutments and ancillary structures in relation to the adjacent existing roadways, utilities and existing substructures should be carefully planned. Proper sloping/benching and/or temporary shoring of the excavation sidewalls, along with underpinning/bracing of the existing structures and utilities will be required where the excavation extends below these structures. In addition, the existing adjacent roadways and surface structures (i.e. sidewalks, utilities, etc.) must also be protected from potential excavation slope instability, soil relaxation and undermining. Braced or tied backed tight sheet piling, soldier pile and lagging type wall systems, a soilcrete curtain wall (i.e. jet grouting) or compaction grouting could be considered to protect these structures.

Excavations must be adequately sloped back and/or properly supported (i.e. sheeted, shored, braced, shielded etc.) in accordance with OSHA requirements as a minimum. Based on the test boring information, it would appear that the overall soil conditions encountered would be generally classified as Type C soil in accordance with OSHA criteria.

Based on the OSHA Type C soil criteria, unsupported excavations less than 20 feet deep would need to be sloped backed to at least a 1.5 H (min) to 1 V slope. It is noted, however, that any slopes which encounter or extend below perched or permanent groundwater conditions, or unsuitable fill soils (i.e. topsoil, wood, organics, etc), can be expected to be unstable using this criteria, and therefore may require flatter slopes in conjunction with proper dewatering in order to maintain stable and safe conditions. The contractor should confirm the OSHA soil classification and excavation requirements at the time of construction based on actual location and soil and groundwater conditions present. The Contractor should be solely responsible for all excavation safety, including the design of all excavation support systems.

Generally it is expected that properly braced or tied back tight steel sheeting or soldier piles and lagging and/or soilcrete curtain wall will be necessary to protect existing structures, utilities and roadways from potential detrimental soil movement/undermining where the excavations extends below these existing structures or foundations. The use of a cantilevered sheet piling excavation support system (un-braced tight sheeting) will not be sufficient to prevent soil relaxation/stress relief (i.e. soil deformation) beneath adjacent structures, utilities and roadways, and therefore, should not be permitted in this case. Rock anchors, as discussed in Section 6.60 of the Original Report, can be incorporated into the shoring system design to provide additional lateral restraint.

It is recommended that excavation support systems (i.e., tight sheeting, shoring and bracing, soilcrete, etc.), be properly designed by a Professional Engineer licensed in the State of New York and experienced in the design of earth support systems. The design requirements should consider the subsurface and groundwater conditions, the potential for undercutting subgrades, the structures that must be protected, construction sequence, lateral earth pressures, hydrostatic conditions, bottom stability and any surcharge effects, as well as the construction staging logistics.

Excavation support systems should be designed for a factor of safety equal to or greater than 1.5 for lateral stability. “At-rest”, “active” and “passive” earth pressures can be computed based on the following parameters, which have been generalized from the test borings.

<u>Existing Fill Soils and Indigenous Silty Clay Soils:</u>

- Coefficient of Active Earth Pressure – 0.39
- Coefficient of At-Rest Earth Pressure – 0.56
- Coefficient of Passive Earth Pressure – 2.56
- Angle of Internal Friction – 26 Degrees
- Estimated Interface Friction Coefficient with Steel – 0.20
- Moist Unit Weight of Soil – 110 pcf (Above El. 578 feet)
- Submerged Unit Weight of Soil – 50 pcf (Below El. 578 feet)

<u>Indigenous Silty Sand Soils:</u>

- Coefficient of Active Earth Pressure – 0.33
- Coefficient of At-Rest Earth Pressure – 0.50
- Coefficient of Passive Earth Pressure – 3.00
- Angle of Internal Friction – 30 Degrees
- Estimated Interface Friction Coefficient with Steel – 0.25
- Submerged Unit Weight of Soil – 60 pcf (Below El. 578 feet)

It is recommended that pre-construction, during construction and post construction surveys be taken on the adjacent existing structures, utilities and roadways to confirm that construction of the excavation support systems does not adversely affect the integrity of these structures. In addition, it is recommended that an appropriate vibration monitoring program be implemented during driving and removal of sheeting/soldier piles, immediately adjacent to existing structures, utilities and roadways. The removal of sheet piling which is installed immediately adjacent to existing structures, utilities and roadways may cause settlement. Therefore, in this case, the removal of the sheet piling following construction is not recommended.

5.70 SEISMIC DESIGN CONSIDERATIONS

Based on the subsurface conditions encountered at the project site, the upper 100 feet of the site can be classified as Seismic Site Class "D" in accordance with Table 1613.5.2 of the Building Code of New York State - December 2010 (NYS Building Code). Therefore, seismic design may be based on this site classification.

The spectral response accelerations in the project area were obtained by Empire using the United States Geological Survey (USGS) web site application (https://geohazards.usgs.gov/secure/designmaps/us/). The accelerations are based on the 2009 NEHRP Recommended Seismic Provisions, which makes use of the 2008 USGS seismic hazard data. The acceleration values obtained from this application were then adjusted, as recommended by the USGS, to obtain the 2% probability in 50 years mapping accelerations, as presented in the NYS Building Code.

Using the Zip Code 14202 for the Downtown area of Buffalo, New York, the calculated spectral response accelerations for Site Class "B" soils are 0.215g for the short period (0.2 second) response (S_S) and 0.050g for the one second response (S_1). For design purposes, these spectral response accelerations were then adjusted for the Seismic Site Class "D" soil profile determined for the project site.

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

- Short Period Response (S_{MS}) - 0.344g
- 1 Second Period Response (S_{M1}) - 0.120g

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

- S_{DS} - 0.229g
- S_{D1} - 0.080g

5.80 SITE PREPARATION AND CONSTRUCTION CONSIDERATIONS

5.80.1 Construction Dewatering

Based on the water levels observed in the monitoring observation wells, the permanent groundwater table appears to be generally present at elevations in the range of about El. 572 feet to 575 feet. The permanent groundwater conditions however can be influenced by the nearby Buffalo River and Erie Lake levels, and can be expected to fluctuate with changes in the levels of these water bodies, as well as with precipitation and seasonal events. It is also possible some perched groundwater may be encountered in the upper fill soils.

Depending on the design elevation of the various structure components, it is anticipated that groundwater conditions will be encountered during construction in the deeper structure excavations (i.e. for pile cap, grade beam, utility construction, etc).

The impacts of groundwater on the structure construction will be dependent on the design depths of the various components, along with the soil conditions present. Silty clay and clayey silt soils, which are present at some locations and depths are not expected to yield vast quantities of water, however, more substantial seepage can be expected from the more granular and non-plastic silty sand soils. These soils will also be susceptible to rapid subgrade and excavation side wall instability, if not properly dewatered. In addition, substantial amounts of groundwater could be encountered where existing porous or highly voided fill extends below the groundwater surface.

Where the excavations do not extend more than a foot or two below the groundwater table, it is anticipated that sump and pump methods of dewatering in conjunction a working mat/drainage stone layer, as necessary, can be used to control the groundwater such that construction can proceed in the dry. For deeper excavations, which must extend further below the water table, more substantial methods of dewatering such as deep sumps, deep wells and/or vacuum well points are expected to be necessary to properly perform the work in the dry and to maintain stable excavation sidewall and subgrade conditions.

5.80.2 Driven Pile Construction and Testing

H-piles or pipe piles should be driven to absolute refusal, into the Limestone bedrock, using a pile hammer having a suitable energy rating. The pile driving criteria should be confirmed by the contractor through the use of the wave equation, based on the actual pile, pile hammer and cushions that will be used, to determine the final driving criteria and that adequate stresses can be developed in the pile to confirm its capacity through dynamic testing and to determine that the pile will not be overstressed during driving. Pile stresses should not exceed 85% of the pile yield stress. Plumbness of the piles should be maintained within 1% of the total length. Any misaligned or damage piles should be replaced.

It is possible that some rubble or boulders may be encountered in the existing fill soils. Therefore, the contractor should expect to possibly encounter some obstructions and should be prepared to handle such conditions.

Absolute refusal should be defined as when about 5 blows have been recorded for less than ¼ inch of pile penetration and the pile reaches the anticipated bedrock elevation. At least 6 random piles should be dynamically tested in accordance with *ASTM D 4945 – "Standard Test Method for High Strain Dynamic Testing of Piles"* to confirm the driving criteria and to evaluate that the pile capacity has been obtained with an adequate factor of safety (i.e. Factor of Safety of 2.0 or greater). The dynamic testing should also include piles, which are suspect of not having been seated on bedrock.

A qualified individual should observe all pile driving and should prepare an individual pile driving report for each pile installed. The Contractor should be required to properly mark all production and test piles with suitable depth markings in order to determine the actual driven depths. The reports should include, pile number and location, hammer and cushion types, pile size and material, installed length, blows per foot, unusual conditions encountered during driving, top of pile elevation following driving and notes on any necessary re-striking. Installed piles should be monitored for potential heaving during installation of adjacent piles. Any piles that heave should be re-driven and reseated as appropriate.

5.80.3 Micro-Pile Foundation Construction

The micro-pile foundations should designed and installed by a Specialty Contractor qualified and experienced in such construction methods. The micro-piles should be installed in accordance with NYSDOT Special Specifications 551.99400017 or

551.99410017. Plumbness of the micro-pile should be maintained within 1% of the total length. A qualified individual should observe all micro-pile installations and prepare a report summarizing the installation process. In addition, at least one of the micro-piles should be load tested by the Contractor to twice the allowable or working load, to confirm that adequate capacity has been developed.

5.80.4 Excavation and Backfilling

Excavations for construction of canal water feature structures, pedestrian bridge foundations, and associated infrastructure, as well as any other structure excavations, should be performed using a method, which reduces disturbance to the subgrade soils, such as a backhoe equipped with a smooth blade bucket. If any soils containing organics, voided demolition debris/rubble, or otherwise deleterious soil material are encountered, they should be removed and replaced with compacted Structural Fill or Suitable Granular Fill, as recommended in Appendix D. Any ridges or loose soil left by machine excavation should also be manually trimmed and removed.

Subgrades should be protected from precipitation and surface water. Water should not be allowed to accumulate on the soil subgrades and the subgrades should not be allowed to freeze, either prior to or after construction of foundations. If subgrades are not protected and degrade, they must be undercut/removed accordingly.

Structure excavations should be backfilled as soon as possible and prior to construction of any superstructures. It is recommended that the structure excavations be backfilled with a properly compacted Structural Fill or Suitable Granular Fill material, as recommended in Appendix D.

5.80.5 Subgrade Preparation for Slab-on-Grade Construction

All existing surface structures, slabs, organic soils, etc., and any other deleterious materials within the proposed slab-on-grade and paver type walkway areas should be removed. In addition, existing pile caps and concrete structures directly beneath slabs-on-grade and paver areas should be cut out and removed to a nominal depth of at least 15-inches below the bottom of the proposed slabs or paver courses.

Following removal of the existing pile caps, grade beams, surface structures, etc. and excavation to proposed subgrades, the exposed fill soil subgrades should be thoroughly compacted/densified and then proof rolled using a vibratory smooth drum roller weighing at least 7 tons or other acceptable compaction/proof-rolling type equipment, depending on the site logistics. The roller should be operated in the vibratory mode for compacting the subgrades and in the static mode for proof rolling.

The roller should complete at least four (4) passes over the exposed subgrades for the compaction/densification operation and at least two (2) passes for the proof rolling evaluation.

The subgrade compaction and proof-rolling procedure should be observed and evaluated by qualified geotechnical personnel. Any areas, which appear wet, loose, soft, unstable or otherwise contain unsuitable materials or exhibit unsuitable conditions, should be undercut. Over excavation, which may be required as the result of the subgrade inspection and/or proof-rolling, should be performed based on evaluation of the conditions and guidance provided by qualified geotechnical personnel. Resulting over-excavations should be backfilled with a controlled Structural Fill or Suitable Granular Fill as described in Appendix D, or other suitable engineered type fill material.

A separation/stabilization geotextile (i.e. Mirafi 500X or suitable equivalent), should be placed over the final subgrade prior to placing the Subbase Stone course.

The recommended Subbase Stone course thicknesses beneath the slab-on-grade construction, in some cases, may not be sufficient for carrying heavy construction vehicle loads. In addition, undercutting of the subbase stone surface and replacement with new subbase stone material may be necessary if the subbase becomes contaminated with soil from the foundation construction activities.

Therefore, it may be desirable for the Contractor to temporarily increase the Subbase Stone thickness in certain areas to provide a suitable working surface to stage the construction, carry construction vehicle loads and protect the underlying subgrades. This will be particularly important if construction proceeds during wet periods. The additional temporary subbase stone material could then be removed and the subbase layer re-graded in preparation for the actual slab or paver construction. This additional temporary subbase material could then be re-used where determined to be appropriate.

During construction the contractor should take precautions to limit construction traffic over the subgrades for foundation, slab on grade and paver construction. Any subgrades, including existing soil subgrades or fill subgrades, which become damaged, rutted or unstable should be undercut and repaired as necessary prior to placement of the Subbase Stone courses. Utility trenches located within slab and paver areas should be backfilled with controlled Structural Fill.

6.00 CONCLUDING REMARKS

This report was prepared to assist in design and construction of the proposed Inner Harbor Development, Phase 3A - Canal Side, Public Canal Environments Project (Public Canal Environments Project) and supplements the "Final Geotechnical Evaluation Report for Former Buffalo Memorial Auditorium Site, Proposed Buffalo Canal Side Development", prepared by Empire Geo-Services, Inc., dated November 2, 2009.

This report has been prepared for the exclusive use of C&S Companies, the Erie Canal Harbor Development Corporation, and other members of the design team, for specific application to this site and this project only.

The recommendations were prepared based on Empire Geo-Services, Inc.'s understanding of the proposed project, as described herein, and through the application of generally accepted soil and foundation engineering practices. No warranties, expressed or implied are made by the conclusions, opinions, recommendations or services provided.

Empire Geo-Services, Inc. should be informed of any changes to the planned construction so that it may be determined if any changes to the recommendations presented in this report are necessary. Empire Geo-Services, Inc. should also be retained to review final plans and specifications, and to monitor the earthwork and foundation construction, to verify that the recommendations were properly interpreted and implemented. Additional information regarding the use and interpretation of this report is presented in Appendix E.

If you have any questions or wish to discuss this information, please do not hesitate to contact our office at any time. Thank you for considering Empire Geo-Services, Inc. for this work.

Sincerely,

EMPIRE GEO-SERVICES, INC.

John J. Danzer, P.E.
Senior Geotechnical Engineer

TABLES

TABLE 1 (UPDATED AUGUST 2011)

SUMMARY OF SUBSURFACE CONDITIONS

FORMER BUFFALO MEMORIAL AUDITORIUM SITE,
PROPOSED BUFFALO CANAL SIDE DEVELOPMENT
BUFFALO, NEW YORK

Test Boring	Ground Surface Elevation		Bottom of Fill Soils		Top of Bedrock		Groundwater Conditions	
	City of Buffalo Datum	USGS Datum	Depth (feet bgs)	Bottom Elevation (feet)	Depth (feet bgs)	Elevation (feet)	Approximate Depth (feet bgs)	Approximate Elevation (feet)
SJB Test Borings (2009)								
B-1	12.8	588.3	24.0	564.3	44.0	544.3	Refer to Table 2 Summary of Groundwater Elevations	
B-2	22.3	597.8	21.0	576.8	57.0	540.8		
B-3	23.5	599.0	>19.7	<579.3	N.E.	N.E.		
B-3A	24.1	599.6	26.0	573.6	N.E.	N.E.		
B-3B	24.0	599.5	24.5	575.0	60.6	538.9		
B-4	19.2	594.7	23.0	571.7	58.0	536.7		
B-5	14.8	590.3	15.0	575.3	53.5	536.8		
B-6	10.4	585.9	13.5	572.4	47.7	538.2		
B-7	9.5	585.0	>12.9	<572.1	N.E.	N.E.		
B-7A	9.5	585.0	14.0	571.0	44.5	540.5		
B-8	9.8	585.3	9.0	576.3	42.5	542.8		
B-9	3.0	578.5	9.5	569.0	35.7	542.8		
B-10	9.6	585.1	24.0	561.1	40.5	544.6		
B-11	10.6	586.1	28.0	558.1	41.5	544.6		
B-12	3.3	578.8	6.5	572.3	39.4	539.4		
B-13	4.2	579.7	5.0	574.7	41.4	538.3		
B-14	3.6	579.1	8.0	571.1	37.6	541.5		
SJB Test Borings (2011)								
B-15	8.9	584.4	20.0	564.4	38.0	546.4	Refer to Table 2 Summary of Groundwater Elevations	
B-16	10.8	586.3	24.0	562.3	43.6	542.7		
B-17	9.8	585.3	21.0	564.3	43.6	541.7		
B-18A	11.5	587.0	27.0	560.0	46.6	540.4		
Riley Engineering and Drilling Company Test Borings (1939)								
# 1	16.12	591.57	17.9	573.7	54.7	536.9	21.4	570.2
# 2	15.48	590.93	17.3	573.6	53.8	537.1	19.5	571.4
# 3	13.37	588.82	16.7	572.1	49.2	539.6	15.1	573.7
# 4	12.79	588.24	25.9	562.3	47.2	541.0	15	573.2
# 5	9.55	585.00	25.3	559.7	43.3	541.7	12	573.0
# 6	11.56	587.01	12.7	574.3	45.6	541.4	14.6	572.4
# 7	9.34	584.79	11.5	573.3	42.4	542.4	12.1	572.7
# 8	2.75	578.20	7.5	570.7	34.4	543.8	5.1	573.1
# 9	8.82	584.27	8.6	575.7	40.2	544.1	12.4	571.9
# 10	13.55	589.00	16.1	572.9	44.2	544.8	15	574.0
# 11	14.06	589.51	16.1	573.4	46.4	543.1	16.5	573.0
# 12	11.84	587.29	27.6	559.7	42.3	545.0	14.1	573.2
# 13	10.48	585.93	11.5	574.4	40.7	545.2	13.9	572.0
# 14	8.98	584.43	12.1	572.3	38.6	545.8	9.5	574.9
Test Boring Data from November 23, 1938 Drawing "Plot Plan - Showing Existing Buildings - RR Siding - Test Borings"								
A-B	22.54	597.99	2.2	595.8	54.7	543.3	N.R.	N.R.
C	20.45	595.90	N.R.	N.R.	52.4	543.5	N.R.	N.R.
D	14.19	589.64	6.4	583.2	48.1	541.5	N.R.	N.R.
E	10.45	585.90	N.R.	N.R.	45.0	540.9	N.R.	N.R.
F	1.80	577.25	22.6	554.7	31.3	546.0	N.R.	N.R.
G	13.08	588.53	15.2	573.3	46.9	541.6	N.R.	N.R.
H	2.16	577.61	8.9	568.7	36.2	541.4	N.R.	N.R.
J	10.00	585.45	23.8	561.7	44.4	541.1	N.R.	N.R.
K	2.80	578.25	6.8	571.5	36.8	541.5	N.R.	N.R.
L	1.33	576.78	3.1	573.7	35.3	541.5	N.R.	N.R.
M	2.04	577.49	7.3	570.2	34.5	543.0	N.R.	N.R.
N	0.88	576.33	6.6	569.7	34.4	541.9	N.R.	N.R.
P	1.06	576.51	6.1	570.4	27.6	548.9	N.R.	N.R.

Notes:
1) All depths and elevations are approximate based on test boring logs.
2) N.R. = Not Recorded.
3) N.E. = Not Encountered.
4) Conversion of City of Buffalo Datum to USGS NGVD 1929: City of Buffalo + 575.453
5) Soil at test boring B-3A, from 26 feet to the bottom of the test boring at 28.5 feet noted as "possible fill"
6) Test borings not completed by SJB were sampled at intervals of 5 feet or greater. Accordingly, the depth to the bottom of the fill soils should be considered approximate.

Test Borings located in the vicinity of the Public Canals Environments Project area.

Empire Geo-Services, Inc.
5167 South Park Avenue
Hamburg, New York 14075

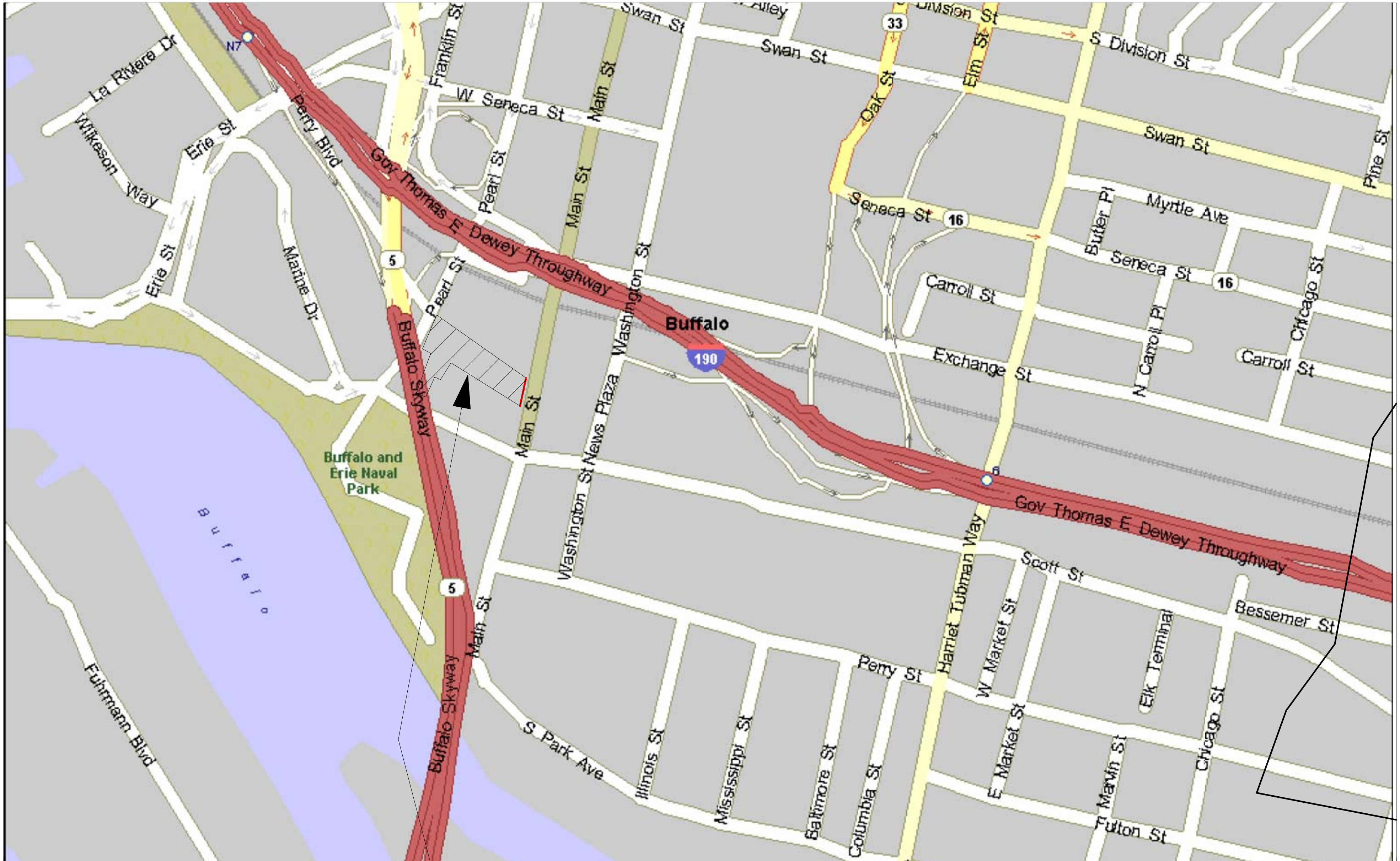
TABLE 2 (UPDATED AUGUST 2011)

SUMMARY OF GROUNDWATER ELEVATIONS

FORMER BUFFALO MEMORIAL AUDITORIUM SITE, PROPOSED BUFFALO CANAL SIDE DEVELOPMENT BUFFALO, NEW YORK

Observation Well	Ground Surface Elevation (feet)	Top of PVC Riser Elevation (feet)	Date	Groundwater Depth / Elevation			Remarks
				Depth from Riser (feet)	Elevation (feet)	Depth Below Ground Surface (feet)	
B-1	588.3	588.01	6/26/2009	13.37	574.6	13.7	Approx. 30 minutes after well installation.
			7/7/2009	13.35	574.7	13.6	
			7/10/2009	13.42	574.6	13.7	
			9/28/2009	13.22	574.8	13.5	
			9/30/2009	13.36	574.7	13.7	
			10/6/2009	13.30	574.7	13.6	
			10/7/2009	13.11	574.9	13.4	High sustained winds from the southwest.
			10/12/2009	13.50	574.5	13.8	
			10/16/2009	13.60	574.4	13.9	
B-4	594.7	597.01	6/25/2009	20.88	576.1	18.6	Approx. 30 minutes after well installation.
			6/26/2009	19.85	577.2	17.5	
			7/7/2009	22.30	574.7	20.0	Removed approx. 2 gallons of water following measurement.
			7/10/2009	22.36	574.7	20.1	
			9/28/2009	22.42	574.6	20.1	
			9/30/2009	22.30	574.7	20.0	
			10/6/2009	22.30	574.7	20.0	
			10/7/2009	22.07	574.9	19.8	High sustained winds from the southwest.
			10/12/2009	22.45	574.6	20.1	
			10/16/2009	22.58	574.4	20.3	
B-7A	585.0	587.28	10/6/2009	14.40	572.9	12.1	
			10/7/2009	12.64	574.6	10.4	High sustained winds from the southwest.
			10/12/2009	14.68	572.6	12.4	Removed approx. 10 gallons of water following measurement.
			10/16/2009	14.97	572.3	12.7	
B-10	585.1	586.96	10/6/2009	14.20	572.8	12.3	
			10/7/2009	12.54	574.4	10.7	High sustained winds from the southwest.
			10/12/2009	14.37	572.6	12.5	Removed approx. 10 gallons of water following measurement.
			10/16/2009	14.64	572.3	12.8	
B-16	586.3	588.85	6/7/2011	14.07	574.8	11.5	
			7/25/2011	14.21	574.6	11.7	

FIGURES



APPROXIMATE PROJECT SITE LOCATION

N

NOTE:
SITE LOCATION PLAN DEVELOPED
FROM MICROSOFT STREETS & TRIPS 2006

EMPIRE GEO SERVICES INC
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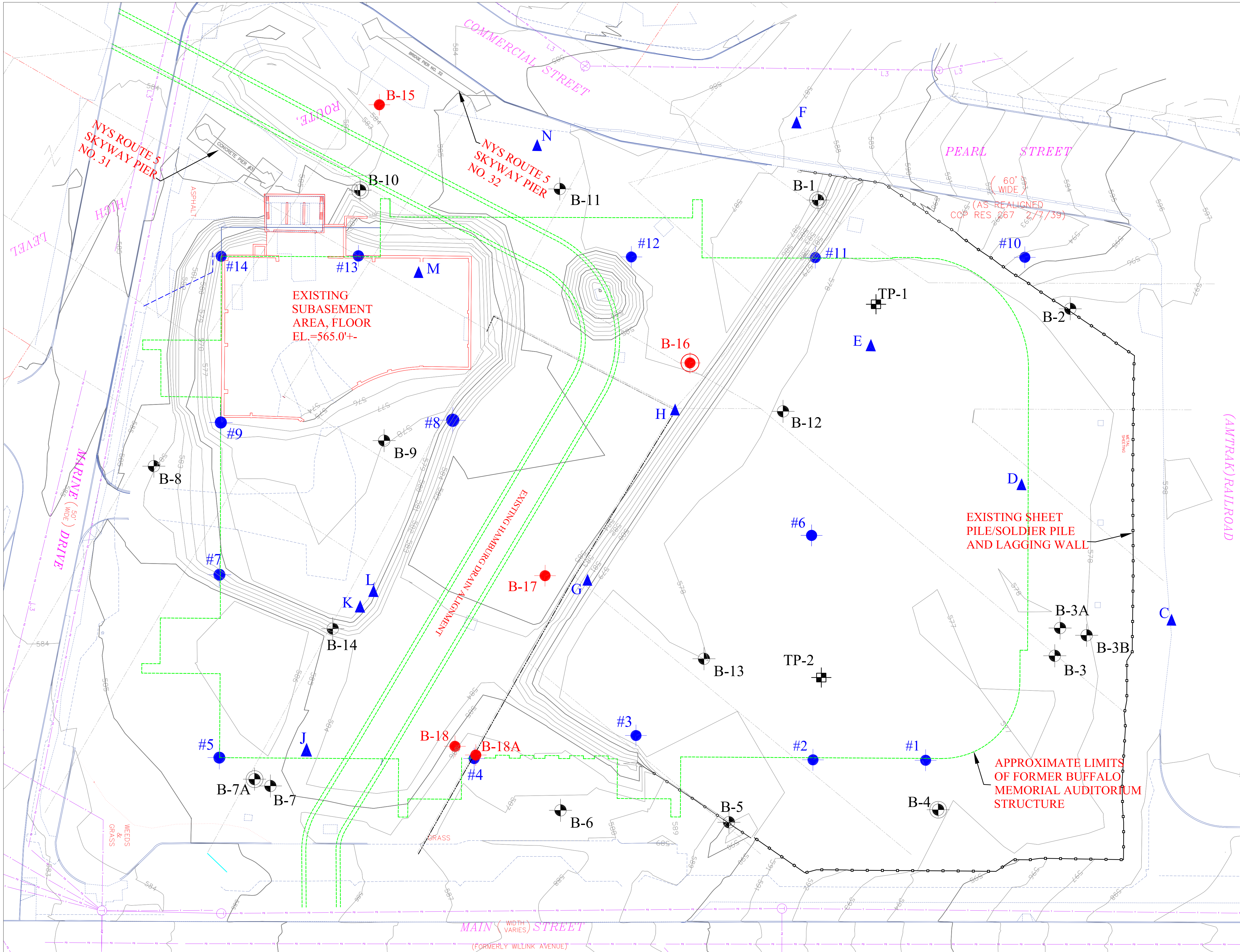
INNER HARBOR DEVELOPMENT, PHASE 3A-CANAL SIDE
PUBLIC CANAL ENVIRONMENTS PROJECT
BUFFALO, NY

PROJECT LOCATION PLAN

DR BY: BPF	SCALE: NTS	PROJ NO.: BE-11-055
CHKD BY: JJD	DATE: 07/13/11	FIGURE NO: 1



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SUBSURFACE EXPLORATION LOCATIONS AND EXISTING SITE CONDITIONS PLAN (UPDATED JULY 2011)

INNER HARBOR DEVELOPMENT PHASE 3A-CANAL SIDE PUBLIC CANAL ENVIRONMENTS PROJECT BUFFALO, NEW YORK

SCALE: AS SHOWN	PROJ NO.: BE-11-055
DR. BY: BFS	FIGURE NO.: 2
CK BY: JJD	DATE: 07/19/11

N

50 0 50

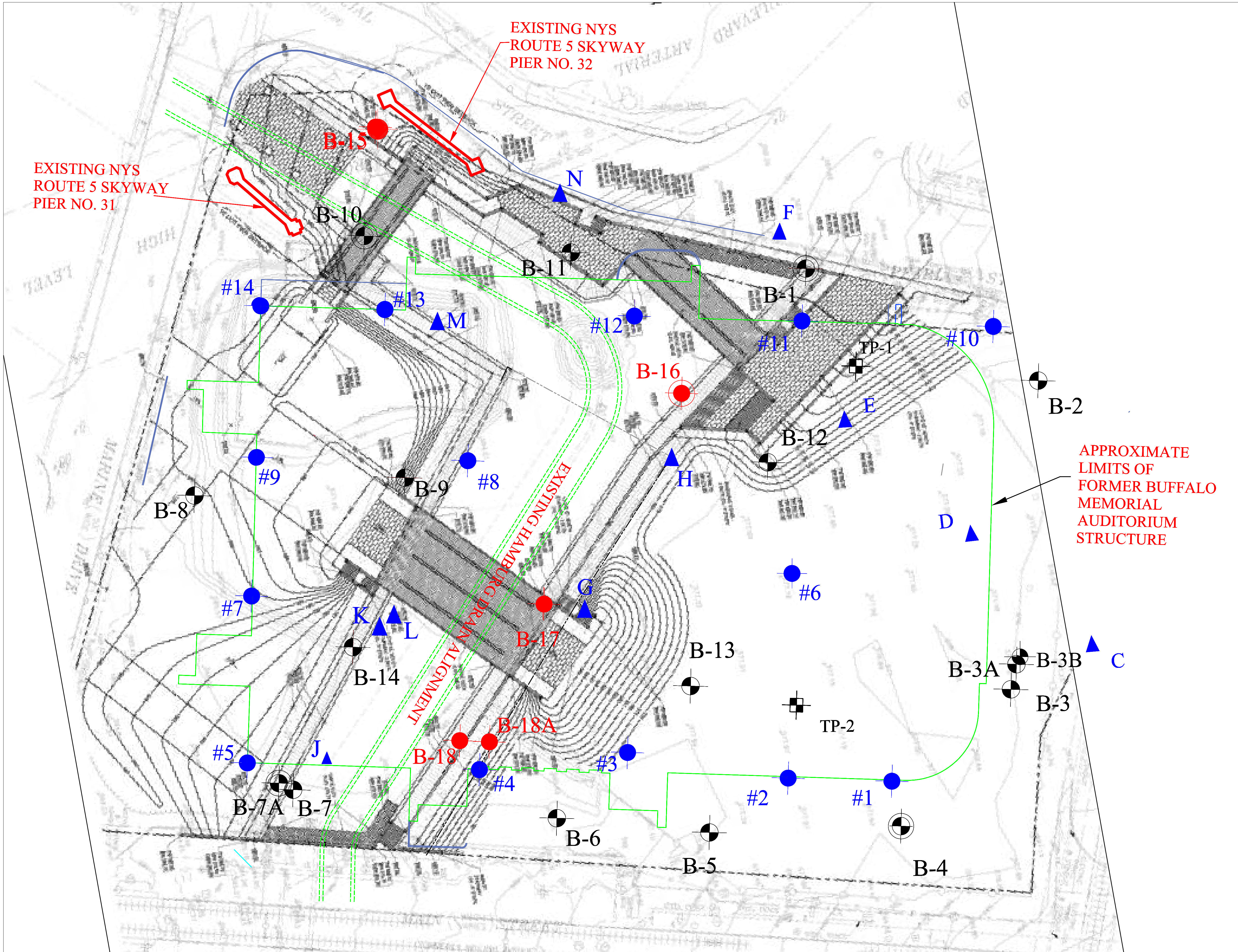
SCALE FEET

LEGEND:

- B-17 INDICATES APPROXIMATE SUPPLEMENTAL TEST BORING LOCATION AND DESIGNATION COMPLETED BY SJB SERVICES, INC., JUNE 2011
- B-16 INDICATES APPROXIMATE SUPPLEMENTAL TEST BORING LOCATION AND DESIGNATION COMPLETED BY SJB SERVICES, INC. WITH A GROUNDWATER OBSERVATION WELL, JUNE 2011
- TP-1 INDICATES APPROXIMATE TEST PIT LOCATION AND DESIGNATION COMPLETED BY DEMCO, INC. ON JULY 10, 2009
- B-2 INDICATES APPROXIMATE TEST BORING LOCATION AND DESIGNATION COMPLETED BY SJB SERVICES, INC. DURING JUNE 2009
- B-1 INDICATES APPROXIMATE TEST BORING LOCATION AND DESIGNATION COMPLETED WITH A GROUNDWATER OBSERVATION WELL COMPLETED BY SJB SERVICES, INC. DURING JUNE 2009.
- #1 INDICATES APPROXIMATE LOCATION AND DESIGNATION OF TEST BORING COMPLETED BY RILEY ENGINEERING AND DRILLING COMPANY, CIRCA 1939.
- A INDICATES APPROXIMATE LOCATION AND DESIGNATION OF TEST BORING COMPLETED CRICA 1901 TO 1936.

NOTE:

FIGURE WAS DEVELOPED FROM: TOPOGRAPHIC SURVEY PREPARED BY FOIT-ALBERT ASSOCIATES; DATE UPDATED 07/19/2011; A NOVEMBER 23, 1938 DRAWING TITLED "PLOT PLAN - SHOWING EXISTING BLDGS. - R.R. SIDING - TEST BORINGS"; A FEBRUARY 1939 "SHEET NO. X-2", AND CONCEPTUAL PLANS PREPARED BY EHRENKRANTZ, ECKSTUT, & KUHN ARCHITECTS, PROVIDED BY C&S COMPANIES;



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SUBSURFACE EXPLORATION LOCATIONS AND PROPOSED PUBLIC CANAL ENVIRONMENTS PLAN

INNER HARBOR DEVELOPMENT
PHASE 3A-CANAL SIDE
PUBLIC CANAL ENVIRONMENTS PROJECT
BUFFALO, NEW YORK

SCALE: AS SHOWN	PROJ NO.: BE-11-055
DR. BY: BFS	FIGURE NO.: 3
CK BY: JJD	DATE: 07/19/11

N

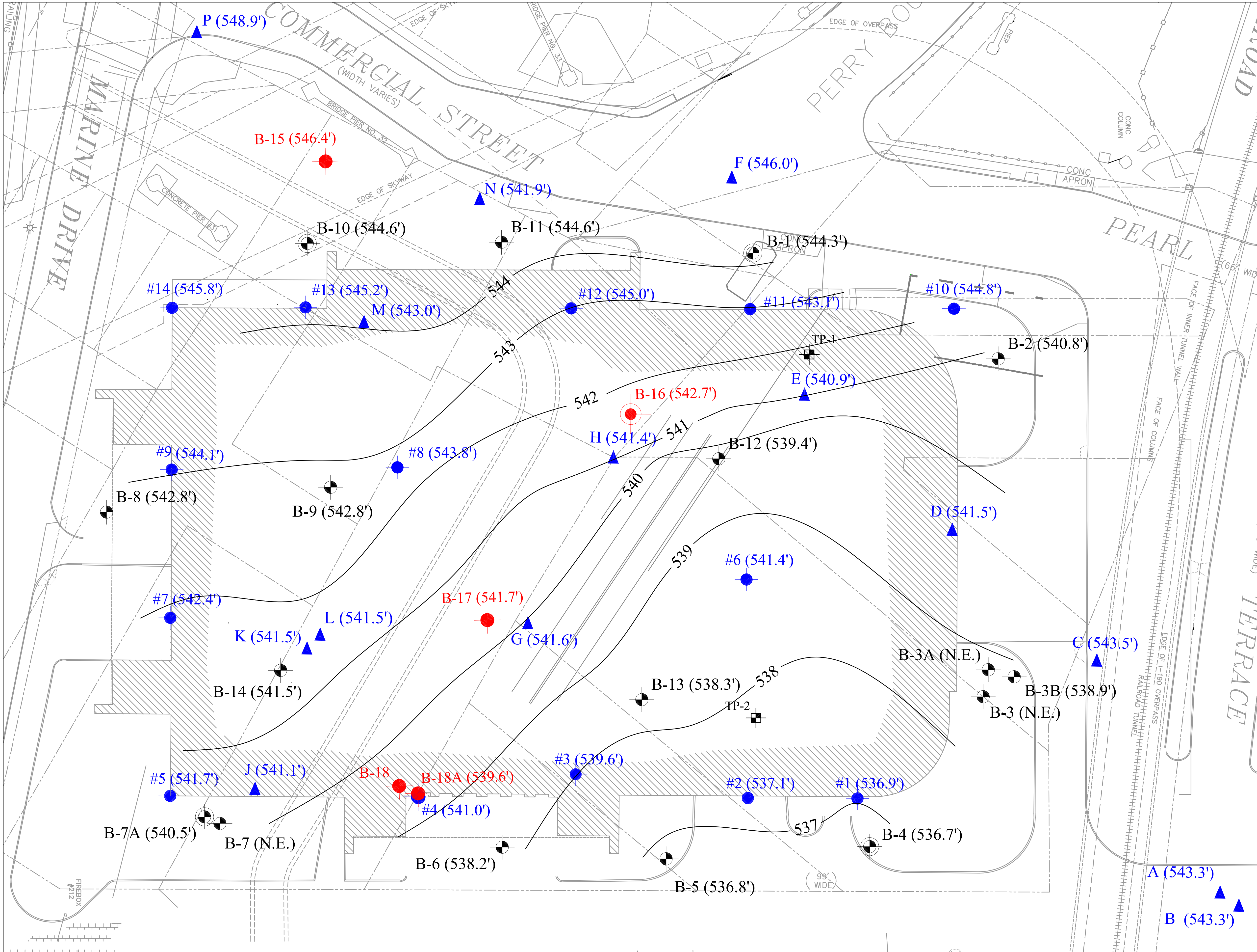
50 0 50
SCALE FEET

LEGEND:

- B-17 INDICATES APPROXIMATE SUPPLEMENTARY TEST BORING LOCATION AND DESIGNATION COMPLETED BY SJB SERVICES, INC., JUNE 2011
- B-16 INDICATES APPROXIMATE SUPPLEMENTARY TEST BORING LOCATION AND DESIGNATION COMPLETED BY SJB SERVICES, INC. WITH A GROUNDWATER OBSERVATION WELL, JUNE 2011
- TP-1 INDICATES APPROXIMATE TEST PIT LOCATION AND DESIGNATION COMPLETED BY DEMCO, INC. ON JULY 10, 2009
- B-2 INDICATES APPROXIMATE TEST BORING LOCATION AND DESIGNATION COMPLETED BY SJB SERVICES, INC. DURING JUNE 2009
- B-1 INDICATES APPROXIMATE TEST BORING LOCATION AND DESIGNATION COMPLETED WITH A GROUNDWATER OBSERVATION WELL COMPLETED BY SJB SERVICES, INC. DURING JUNE 2009.
- #1 INDICATES APPROXIMATE LOCATION AND DESIGNATION OF TEST BORING COMPLETED BY RILEY ENGINEERING AND DRILLING COMPANY, CIRCA 1939.
- A INDICATES APPROXIMATE LOCATION AND DESIGNATION OF TEST BORING COMPLETED CRICA 1901 TO 1936.

NOTE:

FIGURE WAS DEVELOPED FROM: TOPOGRAPHIC SURVEY PREPARED BY FOIT-ALBERT ASSOCIATES; UPDATED 07/19/2011; A NOVEMBER 23, 1938 DRAWING TITLED "PLOT PLAN - SHOWING EXISTING BLDGS. - R.R. SIDING - TEST BORINGS"; A FEBRUARY 1939 "SHEET NO. X-2", AND CONCEPT PLANS PREPARED BY EHRENKRANTZ, ECKSTUT, & KUHN ARCHITECTS, PROVIDED BY C&S COMPANIES;



EMPIRE GEO SERVICES INC

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APPROXIMATE TOP OF BEDROCK CONTOUR PLAN (UPDATED JULY 2011)

INNER HARBOR DEVELOPMENT
PHASE 3A-CANAL SIDE
PUBLIC CANAL ENVIRONMENTS PROJECT
BUFFALO, NEW YORK

SCALE: AS SHOWN	PROJ NO.:BE-11-055
DR. BY: BFS	FIGURE NO.: 4
CK BY: JJD	DATE: 07/27/11

N

50 0 50

SCALE FEET

LEGEND:

TP-1 INDICATES APPROXIMATE TEST PIT LOCATION AND DESIGNATION COMPLETED BY DEMCO, INC. ON JULY 10, 2009.

B-2 INDICATES APPROXIMATE TEST BORING LOCATION AND DESIGNATION COMPLETED BY SJB SERVICES, INC. DURING JUNE 2009.

B-1 INDICATES APPROXIMATE TEST BORING LOCATION AND DESIGNATION COMPLETED WITH A GROUNDWATER OBSERVATION WELL COMPLETED BY SJB SERVICES, INC. DURING JUNE 2009.

B-17 INDICATES APPROXIMATE SUPPLEMENTARY TEST BORING LOCATION AND DESIGNATION COMPLETED BY SJB SERVICES, INC., JUNE 2011

B-16 INDICATES APPROXIMATE SUPPLEMENTARY TEST BORING LOCATION AND DESIGNATION COMPLETED BY SJB SERVICES, INC. WITH A GROUNDWATER OBSERVATION WELL, JUNE 2011

#1 INDICATES APPROXIMATE LOCATION AND DESIGNATION OF TEST BORING COMPLETED BY RILEY ENGINEERING AND DRILLING COMPANY, CIRCA 1939.

A INDICATES APPROXIMATE LOCATION AND DESIGNATION OF TEST BORING COMPLETED CRICA 1901 TO 1936.

(544.0') INDICATES APPROXIMATE TOP OF BEDROCK ELEVATION.

544 INDICATES APPROXIMATE TOP OF BEDROCK ELEVATION CONTOUR (FEET).

NOTE:

FIGURE WAS DEVELOPED FROM: TOPOGRAPHIC SURVEY PREPARED BY FOIT-ALBERT ASSOCIATES; UPDATED 07/19/2011; A NOVEMBER 23, 1938 DRAWING TITLED "PLOT PLAN - SHOWING EXISTING BLDGS. - R.R. SIDING - TEST BORINGS"; A FEBRUARY 1939 "SHEET NO. X-2", AND CONCEPT PLANS PREPARED BY EHRENKRANTZ, ECKSTUT, & KUHN ARCHITECTS, PROVIDED BY C&S COMPANIES;

APPENDIX A

TEST BORING LOGS FOR APPLICABLE 2009 TEST BORINGS (BORINGS B-1, B-7/7A, B-9, B-10, B-11 AND B-14)

DATE

STARTED

FINISHED

SHEET OF

SJB SERVICES, INC.
SUBSURFACE LOG

PROJ. No.

HOLE No.

SURF. ELEV.

G.W. DEPTH

PROJECT LOCATION

DEPTH (ft)	SAMPLES	SAMPLE No.	BLOWS ON SAMPLER 0/6	6/12	12/18	18/24	N	BLOWS ON CASING C	SOIL OR ROCK CLASSIFICATION	NOTES
0		1	3	3	4	8	7	10	3" TOPSOIL	Groundwater at 10' upon completion, and 5' 24 hrs after completion
								15	Brown SILT, some Sand, trace clay, ML (Moist-Loose)	
								50/.5		
5									Gray SHALE, medium hard, weathered, thin bedded, some fractures	Run#1, 2.5'-5.0' 95% Recovery 50% RQD

1 2 3 4 5 6 7 8 9 10

(numbered features explained on reverse)

TABLE I

- Split Spoon Sample
- Shelby Tube Sample
- Geoprobe Macro-Core
- Auger or Test Pit Sample
- Rock Core

TABLE II

Identification of soil type is made on basis of an estimate of particle sizes, and in the case of fine grained soils also on basis of plasticity.

Soil Type	Soil Particle Size	
Boulder	>12"	
Cobble	3" - 12"	
Gravel - Coarse	3" - 3/4"	Coarse Grained (Granular)
- Fine	3/4" - #4	
Sand - Coarse	#4 - #10	
- Medium	#10 - #40	
- Fine	#40 - #200	
Silt - Non Plastic (Granular)	<#200	Fine Grained
Clay - Plastic (Cohesive)		

TABLE III

The following terms are used in classifying soils consisting of mixtures of two or more soil types. The estimate is based on weight of total sample.

Term	Percent of Total Sample
"and"	35 - 50
"some"	20 - 35
"little"	10 - 20
"trace"	less than 10

(When sampling gravelly soils with a standard split spoon, the true percentage of gravel is often not recovered due to the relatively small sampler diameter.)

TABLE IV

The relative compactness or consistency is described in accordance with the following terms:

Granular Soils Term	Blows per Foot, N	Cohesive Soils Term	Blows per Foot, N
Very Loose	0 - 4	Very Soft	0 - 2
Loose	4 - 10	Soft	2 - 4
Firm	10 - 30	Medium	4 - 8
Compact	30 - 50	Stiff	8 - 15
Very Compact	>50	Very Stiff	15 - 30
		Hard	>30

(Large particles in the soils will often significantly influence the blows per foot recorded during the penetration test)

TABLE V

Varved	Horizontal uniform layers or seams of soil(s).
Layer	Soil deposit more than 6" thick.
Seam	Soil deposit less than 6" thick.
Parting	Soil deposit less than 1/8" thick.
Laminated	Irregular, horizontal and angled seams and partings of soil(s).

TABLE VI

Rock Classification Term		Meaning
Hardness	- Soft	Scratched by fingernail
	- Medium Hard	Scratched easily by penknife
	- Hard	Scratched with difficulty by penknife
	- Very Hard	Cannot be scratched by penknife
Weathering	- Very Weathered	Judged from the relative amounts of disintegration, iron staining, core recovery, clay seams, etc.
	- Weathered	
	- Sound	

Rock Classification Term		Meaning	
Bedding	- Laminated	(<1")	Natural breaks in Rock Layers
	- Thin Bedded	(1" - 4")	
	- Bedded	(4" - 12")	
	- Thick Bedded	(12" - 36")	
	- Massive	(>36")	

(Fracturing refers to natural breaks in the rock oriented at some angle to the rock layers)

GENERAL INFORMATION & KEY TO SUBSURFACE LOGS

The Subsurface Logs attached to this report present the observations and mechanical data collected by the driller at the site, supplemented by classification of the material removed from the borings as determined through visual identification by technicians in the laboratory. It is cautioned that the materials removed from the borings represent only a fraction of the total volume of the deposits at the site and may not necessarily be representative of the subsurface conditions between adjacent borings or between the sampled intervals. The data presented on the Subsurface Logs together with the recovered samples provide a basis for evaluating the character of the subsurface conditions relative to the project. The evaluation must consider all the recorded details and their significance relative to each other. Often analyses of standard boring data indicate the need for additional testing or sampling procedures to more accurately evaluate the subsurface conditions. Any evaluation of the contents of this report and recovered samples must be performed by qualified professionals. The following information defines some of the procedures and terms used on the Subsurface Logs to describe the conditions encountered, consistent with the numbered identifiers shown on the Key opposite this page.

1. The figures in the Depth column define the scale of the Subsurface Log.

2. The Samples column shows, graphically, the depth range from which a sample was recovered. See Table I for descriptions of the symbols used to represent the various types of samples.

3. The Sample No. is used for identification on sample containers and/or Laboratory Test Reports.

4. Blows on Sampler - shows the results of the "Penetration Test", recording the number of blows required to drive a split spoon sampler into the soil. The number of blows required for each six inches is recorded. The first 6 inches of penetration is considered a seating drive. The number of blows required for the second and third 6 inches of penetration is termed the penetration resistance, N.

5. Blows on Casing - Shows the number of blows required to advance the casing a distance of 12 inches. The casing size, hammer weight, and length of drop are noted at the bottom of the Subsurface Log. If the casing is advanced by means other than driving, the method of advancement will be indicated in the Notes column or under the Method of Investigation at the bottom of the Subsurface Log. Alternatively, sample recovery may be shown in this column, or other data consistent with the column heading.

6. All recovered soil samples are reviewed in the laboratory by an engineering technician, geologist or geotechnical engineer, unless noted otherwise. Visual descriptions are made on the basis of a combination of the driller's field descriptions and noted observations together with the sample as received in the laboratory. The method of visual classification is based primarily on the Unified Soil Classification System (ASTM D 2487) with regard to the particle size and plasticity (See Table No. II), and the Unified Soil Classification System group symbols for the soil types are sometimes included with the soil classification. Additionally, the relative portion, by weight, of two or more soil types is described for granular soils in accordance with "Suggested Methods of Test for Identification of Soils" by D.M. Burmister, ASTM Special Technical Publication 479, June 1970. (See Table No. III). Description of the relative soil density or consistency is based upon the penetration records as defined in Table No. IV. The description of the soil moisture is based upon the relative wetness of the soil as recovered and is described as dry, moist, wet and saturated. Water introduced into the boring either naturally or during drilling may have affected the moisture condition of the recovered sample. Special terms are used as required to describe soil deposition in greater detail; several such terms are listed in Table V. When sampling gravelly soils with a standard two inch diameter split spoon, the true percentage of gravel is often not recovered due to the relatively small sampler diameter. The presence of boulders and large gravel is sometimes, but not necessarily, detected by an evaluation of the casing and sampler blows or through the "action" of the drill rig as reported by the driller.

7. Rock description is based on review of the recovered rock core and the driller's notes. Frequently used rock classification terms are included in Table VI.

8. The stratification lines represent the approximate boundary between soil types and the transition may be gradual. Solid stratification lines delineate apparent changes in soil type, based upon review of recovered soil samples and the driller's notes. Dashed lines convey a lesser degree of certainty with respect to either a change in soil type or where such change may occur.

9. Miscellaneous observations and procedures noted by the driller are shown in this column, including water level observations. It is important to realize the reliability of the water level observations depends upon the soil type (water does not readily stabilize in a hole through fine grained soils), and that any drill water used to advance the boring may have influenced the observations. The ground water level will fluctuate seasonally, typically. One or more perched or trapped water levels may exist in the ground seasonally. All the available readings should be evaluated. If definite conclusions cannot be made, it is often prudent to examine the conditions more thoroughly through test pit excavations or groundwater observation wells.

10. The length of core run is defined as the length of penetration of the core barrel. Core recovery is the length of core recovered divided by the core run. The RQD (Rock Quality Designation) is the total length of pieces of NX core exceeding 4 inches divided by the core run. The size core barrel used is also noted in the Method of Investigation at the bottom of the Subsurface Log.

DATE		**SJB SERVICES, INC.**	HOLE NO. B-1
START	6/26/2009	**SUBSURFACE LOG**	SURF. ELEV 588.3'
FINISH	6/26/2009		G.W. DEPTH See Notes
SHEET	1 OF 2		

PROJECT: BUFFALO CANAL SIDE DEVELOPMENT LOCATION: FORMER MEMORIAL AUDITORIUM SITE

PROJ. NO.: BE-09-094 BUFFALO, NEW YORK

DEPTH FT.	SMPL NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	PID	SOIL OR ROCK CLASSIFICATION	NOTES
	1	-	12				CONCRETE SIDEWALK	PID= Photoionization
		7	9		16	1.0	Black to Brown f-c SAND, some fine Gravel, little	Detector
	2	11	12				Silt, tr. cinders, tr. brick (moist, FILL)	BG= Background,
		7	14		19	1.0	Becomes Brown, contains little f-c Gravel, tr. silt	measured in parts per
5	3	-	-					million
		-	-		-	-		Driller noted obstruction
	4	3	2				Red- Brown Mottled Grey Silty CLAY, tr. brick,	at 4'- 6'. No sample taken.
		3	2		5	BG	occasional f-c Sand laminations (moist, FILL)	Pea- gravel noted at 4'.
	5	5	4				Becomes Brown to Dark Grey, contains little f-c	
10		7	2		11	BG	Sand, little Cinders, some Concrete fragments	
	6	1	1					
		2	2		3	BG	Contains tr. wood, tr. cinders, tr. concrete	
	7	3	3				Becomes Black, contains some Wood	Poor Recovery Sample #7
		2	2		5	1.3		Cresol odor noted on
15	8	3	1					Sample #7
		4	4		5	-		No Recovery Sample #8
	9	2	4				Contains little f-c Sand, little Wood, tr. glass,	
		3	4		7	BG	tr. brick	
	10	1	1					No Recovery Sample #10
20		1	1		2	-		
	11	1	1				Black f-m SAND, little fine Gravel, little Silt, tr. wood	
		2	1		3	BG	(moist- wet, FILL)	
	12	2	1				Contains tr. gravel, tr. metal, occasional Organic	Slight sheen on Sample
		3	3		4	BG	matter (wet)	#12
25	13	1	8				Yellow- Brown f-m SAND, some Silt (wet, firm, SM)	
		5	5		13	BG		
	14	1	4				Becomes Brown f-c SAND, tr. gravel, tr. silt	
		5	5		9	BG	(loose, SP- SM)	
	15	3	6					
30		11	12		17	BG	(firm)	
	16	1	6				Becomes Yellow- Brown f-m SAND, tr. gravel, tr. silt	Driller noted significant
		4	15		10	BG		running sands. Begin
								sampling at 5' intervals to
								limit running sands.
35								
	17	6	9				Becomes Light Brown, contains little Silt	
		10	15		19	BG		
40								

N = NO. BLOWS TO DRIVE 2-INCH SPOON 12-INCHES WITH A 140 LB. PIN WT. FALLING 30-INCHES PER BLOW CLASSIFIED BY: Geologist

DRILLER: D. MATTHIES DRILL RIG TYPE : CME-550X

METHOD OF INVESTIGATION ASTM D-1586 USING HOLLOW STEM AUGERS

DATE			
START	6/26/2009		
FINISH	6/26/2009		
SHEET	2 OF 2		

SJB SERVICES, INC.
SUBSURFACE LOG

HOLE NO. B-1
SURF. ELEV 588.3'
G.W. DEPTH See Notes

PROJECT: BUFFALO CANAL SIDE DEVELOPMENT
LOCATION: FORMER MEMORIAL AUDITORIUM SITE
BUFFALO, NEW YORK
PROJ. NO.: BE-09-094

DEPTH FT.		SMPL NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	PID	SOIL OR ROCK CLASSIFICATION	NOTES
		18	2	3				Becomes Brown f-c SAND, tr. silt	
			3	5		6	BG		
45								Boring Complete with Auger Refusal at 44.0'	Free Standing Water Measured at 21.1' at Boring Completion 2" PVC groundwater observation well installed in completed test boring. Refer to installation log for details.
50									
55									
60									
65									
70									
75									
80									

N = NO. BLOWS TO DRIVE 2-INCH SPOON 12-INCHES WITH A 140 LB. PIN WT. FALLING 30-INCHES PER BLOW

CLASSIFIED BY: Geologist

DRILLER: D. MATTHIES

DRILL RIG TYPE : CME-550X

METHOD OF INVESTIGATION ASTM D-1586 USING HOLLOW STEM AUGERS

DATE START 10/1/2009 FINISH 10/1/2009 SHEET 1 OF 1	**SJB SERVICES, INC.** **SUBSURFACE LOG**	HOLE NO. B-7 SURF. ELEV 585.0 G.W. DEPTH See Notes

PROJECT: BUFFALO CANAL SIDE DEVELOPMENT LOCATION: FORMER MEMORIAL AUDITORIUM SITE

PROJ. NO.: BE-09-094A BUFFALO, NEW YORK

DEPTH FT.	SMPL NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	PID	SOIL OR ROCK CLASSIFICATION	NOTES
	1	9	5				Dark Brown f-c SAND, little- some Clayey Silt,	PID= Photoionization
		7	8		12	BG	tr. cinders, tr. brick, tr. concrete (moist, FILL)	Detector, measured in
	2	6	6					parts per million.
		5	6		11	BG	Contains Red Brick and Fire Brick fragments	BG= Background
5	3	3	2					
		2	1		4	BG		Poor Recovery Sample
	4	6	6					#'s 2, 3, 4, 6, 7
		5	4		11	BG		
	5	3	2				Contains little Silt	
10		2	3		4	BG		
	6	4	4				Contains some Clayey Silt	
		50/0.1			REF	BG		REF= Sample Spoon
	7	50/0.4			REF	BG	Contains Crushed Stone fragments	Refusal
15							Boring Complete with Auger Refusal at 12.9'	No Free Standing Water Encountered at Boring Completion
20								Moved 10' south for test boring B-7A
25								
30								
35								
40								

N = NO. BLOWS TO DRIVE 2-INCH SPOON 12-INCHES WITH A 140 LB. PIN WT. FALLING 30-INCHES PER BLOW CLASSIFIED BY: Geologist

DRILLER: N. HINTZ DRILL RIG TYPE : CME-85

METHOD OF INVESTIGATION ASTM D-1586 USING HOLLOW STEM AUGERS

SJB SERVICES, INC.
SUBSURFACE LOG

DATE
START 10/1/2009
FINISH 10/1/2009
SHEET 1 OF 2

HOLE NO. B-7A
SURF. ELEV 585.0
G.W. DEPTH See Notes

PROJECT: BUFFALO CANAL SIDE DEVELOPMENT
PROJ. NO.: BE-09-094A
LOCATION: FORMER MEMORIAL AUDITORIUM SITE
BUFFALO, NEW YORK

DEPTH FT.	SMPL NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	PID	SOIL OR ROCK CLASSIFICATION	NOTES
							Auger to 12' before sampling-	PID= Photoionization
		A	U	G	E	R	See log B-7 for details	Detector, measured in
								parts per million.
								BG= Background
5								
								Test boring B-7 was
								located approximately
								10' north of B-7A.
10								
	1	4	3				Dark Grey Clayey SILT, tr. sand, tr. wood	
		3	4		6	BG	(moist, FILL)	
15	2	3	3				Grey and Olive Silty CLAY, tr. sand	
		3	4		6	BG	(moist, medium, CL)	
	3	5	4					
		4	3		8	BG	Contains wet Sandy Silt seam at 17.5'- 19.0'	
	4	WOH/1.0						WOH= Weight of Hammer
20		2	3		2	BG	Grey Clayey SILT, some fine Sand	and Rods
	5	WOH	1				(moist- wet, v. soft, ML)	
		3	5		4	BG	Contains wet Sandy Silt seam 20'- 21'	
							Becomes Dark Grey- Brown, contains tr. wood	
							(soft)	
25								
	6	4	6					Encountered "running
		7	11		13	BG	Brown- Grey f-c SAND, little- some Clayey Silt,	sands" while augering
							tr. gravel (wet, firm, SW- SM)	to 30'.
								Added water to augers
30								to offset running sands.
	7	2	3				Becomes Brown, contains f-m Sand, tr. silt	
		4	8		7	BG	(loose, SP)	
35								
	8	1	1					
		2	7		3	BG	(v. loose)	
40								

N = NO. BLOWS TO DRIVE 2-INCH SPOON 12-INCHES WITH A 140 LB. PIN WT. FALLING 30-INCHES PER BLOW   CLASSIFIED BY: Geologist

DRILLER: N. HINTZ   DRILL RIG TYPE : CME-85

METHOD OF INVESTIGATION ASTM D-1586 USING HOLLOW STEM AUGERS

DATE	**SJB SERVICES, INC.**	HOLE NO. B-9
START 10/5/2009	**SUBSURFACE LOG**	SURF. ELEV 578.5
FINISH 10/5/2009		G.W. DEPTH See Notes
SHEET 1 OF 1		

PROJECT: BUFFALO CANAL SIDE DEVELOPMENT LOCATION: FORMER MEMORIAL AUDITORIUM SITE
PROJ. NO.: BE-09-094A BUFFALO, NEW YORK

DEPTH FT.	SMPL NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	PID	SOIL OR ROCK CLASSIFICATION	NOTES
	1	1	2				Brown Silty CLAY, some f-c Sand, little f-m Gravel,	PID= Photoionization
		17	6		19	BG	tr. brick, tr. cinders (moist, FILL)	Detector, measured in
	2	10	9					parts per million.
		12	13		21	BG		BG= Background
5	3	11	12				Contains little f-m Sand, tr. gravel	
		7	5		19	BG		Poor Recovery Sample
	4	7	8					#'s 1, 2 ,3 ,4
		10	10		18	BG		
	5	5	4				Contains seam of Black Cinders 8.8'- 9.4'	
10		7	5		11	BG		
	6	3	4				Grey Silty CLAY, tr. sand (moist, stiff, CL)	
		6	5		10	BG		
	7	4	3				Brown- Grey Clayey SILT, some fine Sand	
		3	3		6	BG	(moist- wet, medium, ML)	
15	8	2	2				Contains wet Silty Sand seam 12'-13'	
		4	15		6	BG	Becomes Dark Brown, contains little fine Sand	
	9	2	3				Grey- Brown f-m SAND, tr. silt, tr. gravel	
		2	4		5	BG	(wet, loose, SP)	
	10	1	5					
20		6	5		11	BG	(firm)	
	11	5	6					
		11	10		17	BG		
25								
	12	WOH	3					"Running Sands"
		5	5		8	BG	(loose)	encountered between
								25' and 30' to bottom of
								boring.
30								WOH= Weight of Hammer
	13	6	3				Becomes Tan- Brown	and Rods
		2	10		5	BG		
								REF= Sample Spoon
								Refusal
35								
	14	5	50/0.2		REF	BG	Red- Brown Silty CLAY, tr. sand, tr. gravel	Silty Clay Till at 35.5'- 35.7'
							(moist, CL)	
								Free Standing Water
							Boring Complete with Auger Refusal at 35.7'	Recorded at 21.4' at
40								Boring Completion

N = NO. BLOWS TO DRIVE 2-INCH SPOON 12-INCHES WITH A 140 LB. PIN WT. FALLING 30-INCHES PER BLOW CLASSIFIED BY: Geologist

DRILLER: N. HINTZ DRILL RIG TYPE : CME-85

METHOD OF INVESTIGATION ASTM D-1586 USING HOLLOW STEM AUGERS

DATE			
START	9/29/2009	HOLE NO.	B-10
FINISH	9/30/2009	SURF. ELEV	585.1'
SHEET	1 OF 2	G.W. DEPTH	See Notes

SJB SERVICES, INC.
SUBSURFACE LOG

PROJECT: BUFFALO CANAL SIDE DEVELOPMENT
LOCATION: FORMER MEMORIAL AUDITORIUM SITE
BUFFALO, NEW YORK
PROJ. NO.: BE-09-094A

DEPTH FT.	SMPL NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	PID	SOIL OR ROCK CLASSIFICATION	NOTES
	1	7	9				Brown SILT, some f-c Gravel, some f-c Sand,	PID= Photoionization
		10	12		19	1.7	tr. cinders (moist, FILL)	Detector, measured in
	2	6	6				Brown Silty CLAY, little fine gravel sized Cinders,	parts per million.
		5	6		11	3.0	tr. sand, contains occasional seams of brick fragments	BG= Background
5	3	3	4				(moist, FILL)	
		6	6		10	3.1	Contains occasional f-c Sand laminations, tr. wood,	Collect Sample 0-8' for
	4	6	6				tr. gravel, tr. brick fragments	analytical testing.
		7	8		13	BG	Becomes Grey, contains some f-c Sand	
	5	4	3				Brown SILT, some f-c Sand, tr. brick (moist, FILL)	Poor Recovery Sample #5
10		4	6		7	BG		
	6	2	4				Brown f-m SAND, some Silt, tr. clay, tr. wood	
		2	1		6	BG	(moist, FILL)	
	7	4	2					No Recovery Sample #7
		5	3		7	-		
15	8	2	5				Red BRICK fragments, some Silty Clay	Poor Recovery Sample #8
		2	2		7	BG	(wet, FILL)	
	9	3	3				Black SLAG (moist, FILL)	
		7	4		10	BG		
	10	2	2					No Recovery Sample #10
20		2	2		4	-		
	11	1	1				Black SILT, tr. sand, tr. clay, tr. organics	
		1	2		2	BG	(moist, v. loose, possible FILL)	
	12	1	2					
		2	2		4	BG		
25	13	WOH	WOH				Grey Clayey SILT, tr. sand (moist- wet, v. soft, ML)	WOH= Weight of Hammer
		WOH	WOH		WOH	3.0		and Rods
	14	2	5				Brown to Grey Fine SAND, some Silt (wet, firm, SM)	
		6	9		11	BG		
	15	4	6				Becomes Brown	
30		7	7		13	BG		
35								
	16	3	6				Becomes f-m Sand, contains little Silt	
		9	14		15	BG		
40								

N = NO. BLOWS TO DRIVE 2-INCH SPOON 12-INCHES WITH A 140 LB. PIN WT. FALLING 30-INCHES PER BLOW   CLASSIFIED BY: Geologist

DRILLER: R. STEINER/ N. HINTZ   DRILL RIG TYPE : CME-85

METHOD OF INVESTIGATION ASTM D-1586 USING HOLLOW STEM AUGERS

DATE		SJB SERVICES, INC. SUBSURFACE LOG		
START	9/29/2009		HOLE NO.	B-11
FINISH	9/29/2009		SURF. ELEV	586.1'
SHEET	1 OF 2		G.W. DEPTH	See Notes

PROJECT: BUFFALO CANAL SIDE DEVELOPMENT LOCATION: FORMER MEMORIAL AUDITORIUM SITE
PROJ. NO.: BE-09-094A BUFFALO, NEW YORK

DEPTH FT.	SMPL NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	PID	SOIL OR ROCK CLASSIFICATION	NOTES
	1	6	9	11	20		CONCRETE (0.5')	PID= Photoionization
						BG	Light Brown to Brown f-m SAND, tr. silt (moist, FILL)	Detector, measured in
	2	5	6				Becomes Light Brown, contains tr. gravel, tr. concrete	parts per million.
		5	4		11	BG		BG= Background
5	3	3	3					
		3	3		6	BG		Collect Sample 0-8' for
	4	2	2				Brown Silty CLAY, little f-c Sand, little brick fragments,	analytical testing.
		12	8		14	BG	tr. organics (moist, FILL)	
	5	WOH	3					Poor Recovery Sample #1
10		5	8		8	BG	Contains tr. sand, tr. cinders, occasional f-c Sand	
	6	2	5				seams	Poor Recovery Sample #6
		6	8		11	BG	Brown Fine SAND, some Silt, little coarse Gravel,	
	7	2	3				tr. brick, occasional Silt seams (moist, FILL)	WOH= Weight of Hammer
		2	3		5	BG	Contains tr. cinders	and Rods
15	8	WOH	3				Becomes f-c Sand, little fine Gravel, little Silt,	
		3	2		6	2.1	little Brick, tr. wood, occasional Silty Clay seams	
	9	24	50				Black SILT, little f-c Sand, tr. glass, tr. organics,	
		4	3		54	17.4	occasional Silty Clay seams (moist- wet, FILL)	
	10	3	8					
20		2	2		10	4.5		
	11	1	50/0.2		REF	4.1	Contains some fine Sand, tr. gravel	REF= Sample Spoon
								Refusal
	12	3	5				Black f-c GRAVEL, some f-c Sand, little Silty Clay,	
		3	1		8	14.5	tr. organics (wet, FILL)	
25	13	1	3					No Recovery Sample #13
		7	14		10	-		
	14	19	10					No Recovery Sample #14-
		11	10		21	-		wood in shoe
	15	14	16				Brown to Grey f-m SAND, tr. silt (wet, firm, SP)	
30		12	10		28	BG		
	16	1	4				Becomes Brown (loose)	
		3	6		7	BG		
	17	2	4					
		9	10		13	BG	(firm)	
35	18	5	7					
		9	9		16	BG		
	19	19	22					
		22	27		44	BG	(compact)	
40								

N = NO. BLOWS TO DRIVE 2-INCH SPOON 12-INCHES WITH A 140 LB. PIN WT. FALLING 30-INCHES PER BLOW CLASSIFIED BY: Geologist

DRILLER: R. STEINER DRILL RIG TYPE : CME-85

METHOD OF INVESTIGATION ASTM D-1586 USING HOLLOW STEM AUGERS

DATE		**SJB SERVICES, INC.**	HOLE NO.	B-14
START	10/5/2009	**SUBSURFACE LOG**	SURF. ELEV	579.1
FINISH	10/6/2009		G.W. DEPTH	See Notes
SHEET	1 OF 2			

PROJECT: BUFFALO CANAL SIDE DEVELOPMENT — LOCATION: FORMER MEMORIAL AUDITORIUM SITE
PROJ. NO.: BE-09-094A — BUFFALO, NEW YORK

DEPTH FT.	SMPL NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	PID	SOIL OR ROCK CLASSIFICATION	NOTES
	1	6	7				Black f-c SAND, some Cinders, little Silty Clay,	PID= Photoionization
		6	7		13	BG	tr. gravel, tr. brick fragments, tr. wood (moist, FILL)	Detector, measured in
	2	5	8					parts per million.
		8	6		16	BG	Becomes Grey, contains some Silty Clay,	BG= Background
5	3	2	1				tr. cinders	
		3	1		4	BG		Poor Recovery Sample #3
	4	3	3				Dark Grey Clayey SILT, tr. sand (moist- wet, FILL)	
		3	2		6	BG		
	5	WOH/2.0					Grey Silty CLAY, tr. sand, tr. wood	WOH= Weight of Hammer
10					WOH	BG	(moist- wet, v. soft, CL)	and Rods
	6	WOH/2.0						
					WOH	BG		
	7	WOH/2.0					Grey f-m SAND and Silt (wet, v. loose, SP- SM)	
					WOH	BG	Grey- Brown Clayey SILT, some f-m Sand	
15	8	WOH	1				(moist- wet, v. soft, ML)	
		2	5		3	BG		
	9	5	11				Brown- Grey f-m SAND, tr. silt (wet, firm, SP)	
		10	10		21	BG		
20								
	10	WOH	3					"Running sands"
		5	7		8	BG	(loose)	encountered from
								approximately 20' to
								boring completion.
25								
	11	WOH	3					
		3	2		6	BG		
30								
	12	1	6					
		9	8		15	BG	(firm)	
35								
	13	9	10					
		11	13		21	BG		NQ '2' Size Rock Core
								Run 1: 37.6'- 42.4'
40								

N = NO. BLOWS TO DRIVE 2-INCH SPOON 12-INCHES WITH A 140 LB. PIN WT. FALLING 30-INCHES PER BLOW — CLASSIFIED BY: Geologist

DRILLER: N. HINTZ — DRILL RIG TYPE : CME-85

METHOD OF INVESTIGATION ASTM D-1586 USING HOLLOW STEM AUGERS

APPENDIX B

TEST BORING LOGS AND MONITORING WELL COMPLETION RECORDS 2011 SUPPLEMENTAL TEST BORINGS (BORINGS B-15, B-16, B-17 AND B-18/18A)

DATE

STARTED

FINISHED

SHEET OF

SJB SERVICES, INC.
SUBSURFACE LOG

SJB SERVICES, INC.

PROJ. No.

HOLE No.

SURF. ELEV.

G.W. DEPTH

PROJECT

LOCATION

DEPTH (ft)	SAMPLES	SAMPLE No.	BLOWS ON SAMPLER 0/6	6/12	12/18	18/24	N	BLOWS ON CASING C	SOIL OR ROCK CLASSIFICATION	NOTES
0		1	3	3	4	8	7	10	3" TOPSOIL	Groundwater at 10' upon completion, and 5' 24 hrs after completion
								15	Brown SILT, some Sand, trace clay, ML (Moist-Loose)	
								50/.5		
5									Gray SHALE, medium hard, weathered, thin bedded, some fractures	Run#1, 2.5'-5.0' 95% Recovery 50% RQD
1	2	3	4					5	6 7 8	9 10

7 *(numbered features explained on reverse)*

TABLE I

(symbol)	Split Spoon Sample
(symbol)	Shelby Tube Sample
(symbol)	Geoprobe Macro-Core
(symbol)	Auger or Test Pit Sample
(symbol)	Rock Core

TABLE II

Identification of soil type is made on basis of an estimate of particle sizes, and in the case of fine grained soils also on basis of plasticity.

Soil Type	Soil Particle Size	
Boulder	>12"	
Cobble	3" - 12"	
Gravel - Coarse	3" - 3/4"	Coarse Grained (Granular)
- Fine	3/4" - #4	
Sand - Coarse	#4 - #10	
- Medium	#10 - #40	
- Fine	#40 - #200	
Silt - Non Plastic (Granular)	<#200	Fine Grained
Clay - Plastic (Cohesive)		

TABLE III

The following terms are used in classifying soils consisting of mixtures of two or more soil types. The estimate is based on weight of total sample.

Term	Percent of Total Sample
"and"	35 - 50
"some"	20 - 35
"little"	10 - 20
"trace"	less than 10

(When sampling gravelly soils with a standard split spoon, the true percentage of gravel is often not recovered due to the relatively small sampler diameter.)

TABLE IV

The relative compactness or consistency is described in accordance with the following terms:

Granular Soils Term	Blows per Foot, N	Cohesive Soils Term	Blows per Foot, N
Very Loose	0 - 4	Very Soft	0 - 2
Loose	4 - 10	Soft	2 - 4
Firm	10 - 30	Medium	4 - 8
Compact	30 - 50	Stiff	8 - 15
Very Compact	>50	Very Stiff	15 - 30
		Hard	>30

(Large particles in the soils will often significantly influence the blows per foot recorded during the penetration test)

TABLE V

Varved	Horizontal uniform layers or seams of soil(s).
Layer	Soil deposit more than 6" thick.
Seam	Soil deposit less than 6" thick.
Parting	Soil deposit less than 1/8" thick.
Laminated	Irregular, horizontal and angled seams and partings of soil(s).

TABLE VI

Rock Classification Term		Meaning
Hardness	- Soft	Scratched by fingernail
	- Medium Hard	Scratched easily by penknife
	- Hard	Scratched with difficulty by penknife
	- Very Hard	Cannot be scratched by penknife
Weathering	- Very Weathered	Judged from the relative amounts of disintegration, iron staining, core recovery, clay seams, etc.
	- Weathered	
	- Sound	

Rock Classification Term		Meaning	
Bedding	- Laminated	(<1")	Natural breaks in Rock Layers
	- Thin Bedded	(1" - 4")	
	- Bedded	(4" - 12")	
	- Thick Bedded	(12" - 36")	
	- Massive	(>36")	

(Fracturing refers to natural breaks in the rock oriented at some angle to the rock layers)

GENERAL INFORMATION & KEY TO SUBSURFACE LOGS

The Subsurface Logs attached to this report present the observations and mechanical data collected by the driller at the site, supplemented by classification of the material removed from the borings as determined through visual identification by technicians in the laboratory. It is cautioned that the materials removed from the borings represent only a fraction of the total volume of the deposits at the site and may not necessarily be representative of the subsurface conditions between adjacent borings or between the sampled intervals. The data presented on the Subsurface Logs together with the recovered samples provide a basis for evaluating the character of the subsurface conditions relative to the project. The evaluation must consider all the recorded details and their significance relative to each other. Often analyses of standard boring data indicate the need for additional testing or sampling procedures to more accurately evaluate the subsurface conditions. Any evaluation of the contents of this report and recovered samples must be performed by qualified professionals. The following information defines some of the procedures and terms used on the Subsurface Logs to describe the conditions encountered, consistent with the numbered identifiers shown on the Key opposite this page.

1. The figures in the Depth column define the scale of the Subsurface Log.

2. The Samples column shows, graphically, the depth range from which a sample was recovered. See Table I for descriptions of the symbols used to represent the various types of samples.

3. The Sample No. is used for identification on sample containers and/or Laboratory Test Reports.

4. Blows on Sampler - shows the results of the "Penetration Test", recording the number of blows required to drive a split spoon sampler into the soil. The number of blows required for each six inches is recorded. The first 6 inches of penetration is considered a seating drive. The number of blows required for the second and third 6 inches of penetration is termed the penetration resistance, N.

5. Blows on Casing - Shows the number of blows required to advance the casing a distance of 12 inches. The casing size, hammer weight, and length of drop are noted at the bottom of the Subsurface Log. If the casing is advanced by means other than driving, the method of advancement will be indicated in the Notes column or under the Method of Investigation at the bottom of the Subsurface Log. Alternatively, sample recovery may be shown in this column, or other data consistent with the column heading.

6. All recovered soil samples are reviewed in the laboratory by an engineering technician, geologist or geotechnical engineer, unless noted otherwise. Visual descriptions are made on the basis of a combination of the driller's field descriptions and noted observations together with the sample as received in the laboratory. The method of visual classification is based primarily on the Unified Soil Classification System (ASTM D 2487) with regard to the particle size and plasticity (See Table No. II), and the Unified Soil Classification System group symbols for the soil types are sometimes included with the soil classification. Additionally, the relative portion, by weight, of two or more soil types is described for granular soils in accordance with "Suggested Methods of Test for Identification of Soils" by D.M. Burmister, ASTM Special Technical Publication 479, June 1970. (See Table No. III). Description of the relative soil density or consistency is based upon the penetration records as defined in Table No. IV. The description of the soil moisture is based upon the relative wetness of the soil as recovered and is described as dry, moist, wet and saturated. Water introduced into the boring either naturally or during drilling may have affected the moisture condition of the recovered sample. Special terms are used as required to describe soil deposition in greater detail; several such terms are listed in Table V. When sampling gravelly soils with a standard two inch diameter split spoon, the true percentage of gravel is often not recovered due to the relatively small sampler diameter. The presence of boulders and large gravel is sometimes, but not necessarily, detected by an evaluation of the casing and sampler blows or through the "action" of the drill rig as reported by the driller.

7. Rock description is based on review of the recovered rock core and the driller's notes. Frequently used rock classification terms are included in Table VI.

8. The stratification lines represent the approximate boundary between soil types and the transition may be gradual. Solid stratification lines delineate apparent changes in soil type, based upon review of recovered soil samples and the driller's notes. Dashed lines convey a lesser degree of certainty with respect to either a change in soil type or where such change may occur.

9. Miscellaneous observations and procedures noted by the driller are shown in this column, including water level observations. It is important to realize the reliability of the water level observations depends upon the soil type (water does not readily stabilize in a hole through fine grained soils), and that any drill water used to advance the boring may have influenced the observations. The ground water level will fluctuate seasonally, typically. One or more perched or trapped water levels may exist in the ground seasonally. All the available readings should be evaluated. If definite conclusions cannot be made, it is often prudent to examine the conditions more thoroughly through test pit excavations or groundwater observation wells.

10. The length of core run is defined as the length of penetration of the core barrel. Core recovery is the length of core recovered divided by the core run. The RQD (Rock Quality Designation) is the total length of pieces of NX core exceeding 4 inches divided by the core run. The size core barrel used is also noted in the Method of Investigation at the bottom of the Subsurface Log.

SJB SERVICES, INC.
SUBSURFACE LOG

DATE
START 6/2/2011
FINISH 6/3/2011
SHEET 1 OF 2

HOLE NO. B-15
SURF. ELEV 584.4' +/-
G.W. DEPTH See Notes

PROJECT: Proposed Buffalo Canal Side Development
LOCATION: Former Buffalo Memorial Auditorium Site, Buffalo, New York
PROJ. NO.: BE-11-055

DEPTH FT.		SMPL NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	PID	SOIL OR ROCK CLASSIFICATION	NOTES
		1	1	2				Brown Fine SAND, little Silt, tr.gravel, tr.brick,	PID = Photoionization
			4	7		6	BG	tr.cinders (moist, FILL)	Detector, measures in
		2	14	7				Brown Clayey SILT, some f-c Sand, tr.gravel, tr.coal	parts per million
			7	4		14	BG	(moist, FILL)	
5		3	2	2				Red-Brown Clayey SILT, tr.gravel, tr.sand	BG = Background
			2	3		4	BG	(moist, FILL)	
		4	4	3				Contains little f-c Sand, tr.brick	
			3	4		6	BG		WOH = Weight of
		5	2	2				Red-Brown Clayey SILT, some f-c Sand	Hammer and Rods
10			1	2		3	BG	(moist, FILL, possible canal deposit)	
		6	WOH	WOH					Collect Composite Soil
			1	6		1	BG	Contains occasional Cinder seams	from 0' - 14' for analytical
		7	4	2					testing
			4	9		6	3.8	Contains little f-m sand size Cinders (compact)	
15		8	4	6				Dark Grey to Grey f-m SAND, some Silt	Poor Recovery Sample #8
			4	3		10	9.8	(wet, FILL, possible canal deposit)	
		9	3	2					Black staining noted on
			3	3		5	17.2	Becomes Black f-c Sand, little Silt, tr.gravel, tr.brick	Sample #9
		10	1	1				Grey SILT, tr.sand, tr.wood	
20			1	2		2	1.4	(wet, FILL, possible canal deposit)	
		11	3	3				Grey Clayey SILT, tr.-sand (wet, medium, ML)	
			3	2		6	1.8		
		12	2	2				Contains occasional f-m Gravel seam	
			2	6		4	2.0		
25		13	3	3				Light Brown to Grey f-m SAND, little Silt, tr.gravel	tr.staining - Sample #13
			2	5		5	1.7	(wet, loose, SM)	
		14	7	10					
			9	10		19	BG	Becomes Light Brown, contains some Silt (firm)	
		15	2	2					
30			2	3		4	BG	Contains little Silt (loose)	
		16	1	1					Driller notes Auger
			3	6		4	BG		Refusal at 38'
									Due to "Running Sands",
35									and
		17	3	3				Becomes Brown	Installed 3" Casing prior to
			5	6		8	BG		Rock coring
								Light Grey to Grey LIMESTONE, sound, laminated to	NQ '2' Size Rock Core
40								thickly bedded, v.hard, occasional horizontal fractures,	

N = NO. BLOWS TO DRIVE 2-INCH SPOON 12-INCHES WITH A 140 LB. PIN WT. FALLING 30-INCHES PER BLOW

CLASSIFIED BY: Geologist

DRILLER: A. KOSKE

DRILL RIG TYPE : CME-75

METHOD OF INVESTIGATION ASTM D-1586 USING HOLLOW STEM AUGERS

DATE		
START	6/2/2011	
FINISH	6/3/2011	
SHEET	2 OF 2	

SJB SERVICES, INC.
SUBSURFACE LOG

HOLE NO.	B-15
SURF. ELEV	584.4' +/-
G.W. DEPTH	See Notes

PROJECT: Proposed Buffalo Canal Side Development LOCATION: Former Buffalo Memorial Auditorium Site
PROJ. NO.: BE-11-055 Buffalo, New York

DEPTH FT.	SMPL NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	PID	SOIL OR ROCK CLASSIFICATION	NOTES
							styolites and fossils	Run #1: 38.0' - 43.0' REC = 100% RQD = 100%
45								Run #2: 43.0' - 48.0' REC = 100% RQD = 93% Driller notes 100% Water Loss at 40'
50							Boring Complete at 48.0'	Free standing water measured at 10' after coring.
55								
60								
65								
70								
75								
80								

N = NO. BLOWS TO DRIVE 2-INCH SPOON 12-INCHES WITH A 140 LB. PIN WT. FALLING 30-INCHES PER BLOW CLASSIFIED BY: Geologist
DRILLER: A. KOSKE DRILL RIG TYPE : CME-75
METHOD OF INVESTIGATION ASTM D-1586 USING HOLLOW STEM AUGERS

DATE
START 6/1/2011
FINISH 6/2/2011
SHEET 1 OF 2

SJB SERVICES, INC.
SUBSURFACE LOG

HOLE NO. B-16
SURF. ELEV 586.3' +/-
G.W. DEPTH See Notes

PROJECT: Proposed Buffalo Canal Side Development LOCATION: Former Buffalo Memorial Auditorium Site
PROJ. NO.: BE-11-055 Buffalo, New York

DEPTH FT.	SMPL NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	PID	SOIL OR ROCK CLASSIFICATION	NOTES
	1	4	8				Brown f-c SAND, little Silt, tr.gravel, tr.cinders, tr.brick	PID = Photoionization
		12	12		20	BG	(moist, FILL)	Detector, measures in
	2	11	6					parts per million
		7	14		13	BG		BG = Background
5	3	6	3				Becomes Dark Brown to Dark Grey, contains little	
		3	5		6	BG	Clayey Silt	Poor Recovery Sample #2
	4	4	4				Contains tr.organics, tr.coal, occassional Silty Clay	
		4	17		8	BG	partings (wet)	
	5	17	9				Red-Brown Silty CLAY, some f-c Sand, little Fine	
10		8	12		17	BG	Gravel size Coal, little f-c Sand size Coal, tr.gravel	
	6	13	8				(moist, FILL)	Poor Recovery Sample #6
		6	3		14	BG	Becomes Red-Brown to Brown Silty Clay, tr.cinders	
	7	3	4				Orange BRICK fragments (moist, FILL)	
		6	19		10	BG		
15	8	4	5				Contains little f-c Sand, tr.silt (wet)	Poor Recovery Sample #8
		2	3		7	BG		
	9	1	2				Black f-m GRAVEL, some f-c Sand, little Silt, little Brick	
		3	2		5	BG	fragments (wet, FILL)	
	10	WOH	2					WOH = Weight of
20		1	1		3	BG	Contains "and" f-c Sand, tr.slag	Hammer and Rods
	11	3	3				Dark Brown to Black f-c SAND, little f-m Gravel,	
		4	11		7	BG	tr.brick (wet, FILL)	
	12	7	6					
		5	6		11	BG	Contains little Wood	
25	13	1	2				Brown f-m SAND, tr.silt (wet, v.loose, SP)	
		1	3		3	BG		
	14	3	4				Contains little f-m Gravel (loose)	
		4	5		8	BG		Driller notes "Running
	15	3	5				Becomes Brown f-c Sand, tr.gravel (firm, SW)	Sands" at 30'
30		6	7		11	BG		
	16	2	4					
		7	4		11	BG		
35								
	17	3	4				Becomes Light Brown Fine Sand, some Silt	
		5	7		9	BG	(wet, loose, SM)	Due to presence of
								"Running Sands", Driller
								installed 3" casing prior to
40								rock coring

N = NO. BLOWS TO DRIVE 2-INCH SPOON 12-INCHES WITH A 140 LB. PIN WT. FALLING 30-INCHES PER BLOW CLASSIFIED BY: Geologist
DRILLER: A. KOSKE DRILL RIG TYPE : CME-75
METHOD OF INVESTIGATION ASTM D-1586 USING HOLLOW STEM AUGERS

DATE START 6/1/2011 FINISH 6/2/2011 SHEET 2 OF 2	**SJB SERVICES, INC.** **SUBSURFACE LOG**	HOLE NO. B-16 SURF. ELEV 586.3' +/- G.W. DEPTH See Notes

PROJECT: Proposed Buffalo Canal Side Development LOCATION: Former Buffalo Memorial Auditorium Site
PROJ. NO.: BE-11-055 Buffalo, New York

DEPTH FT.		SMPL NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	PID	SOIL OR ROCK CLASSIFICATION	NOTES
		18	3	8				Becomes Brown f-m Sand, tr.gravel, tr.silt	Driller notes Auger
			14	7		22	BG	(wet, firm, SP)	Refusal at 43.6'
									Unable to obtain water level
									NQ '2' Size Rock Core
45								Light Grey LIMESTONE, sound, hard to v.hard, laminated to thickly bedded, occasional styolites and fossils	Run #1: 43.6' - 48.6' REC = 89% RQD = 86%
								Becomes Light Grey to Grey, contains frequent styolites (soft)	
50									Run #2: 48.6' - 53.6' REC = 95% RQD = 91%
55								Boring Complete at 53.6'	2" PVC Monitoring Well Installed at Completion See Monitoring Well Completion Record for Well Installation details.
60									
65									
70									
75									
80									

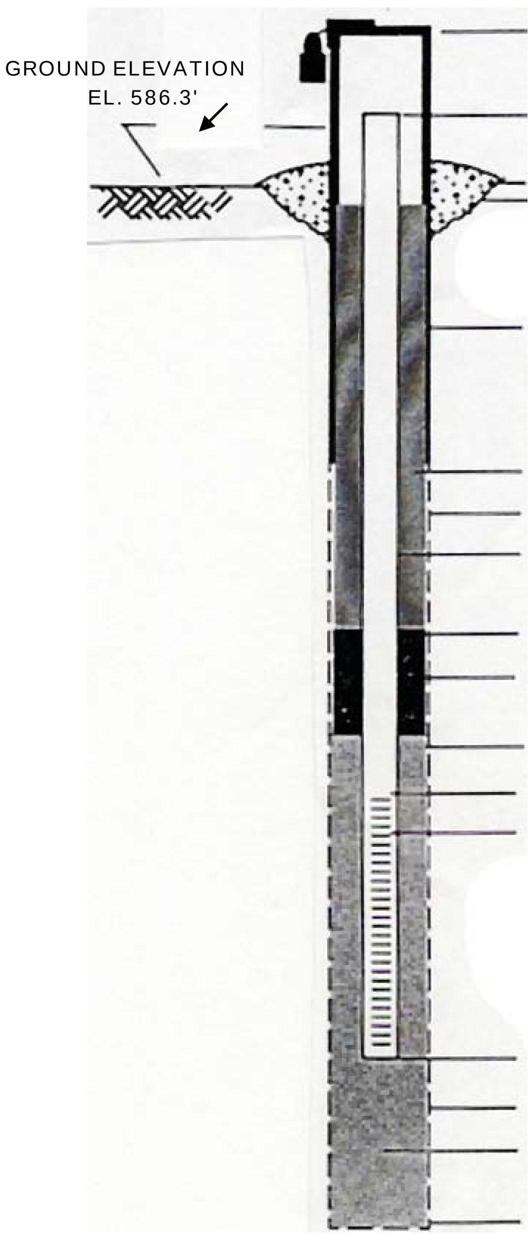
N = NO. BLOWS TO DRIVE 2-INCH SPOON 12-INCHES WITH A 140 LB. PIN WT. FALLING 30-INCHES PER BLOW CLASSIFIED BY: Geologist

DRILLER: A. KOSKE DRILL RIG TYPE : CME-75

METHOD OF INVESTIGATION ASTM D-1586 USING HOLLOW STEM AUGERS

MONITORING WELL COMPLETION RECORD

PROJECT: PROPOSED BUFFALO CANAL SIDE DEV.	
PROJECT NUMBER: BE-11-055	DRILLING METHOD: ASTM D-1586
WELL NUMBER: B-16	GEOLOGIST: S. BOCHENEK
DRILLER: A. KOSKE	INSTALLATION DATE(S): 6/2/2011



ELEVATIONS/ TOP OF SURFACE CASING:	EL. 588.85'	
STICK- UP/ TOP OF SURFACE CASING:	2.6'	
ELEVATION/ TOP OF RISER PIPE:	EL 588.71'	
STICK- UP/ TOP OF RISER PIPE:	2.4'	
TYPE OF SURFACE SEAL:	CONCRETE	
I.D. OF SURFACE CASING:	4.0"	
TYPE OF SURFACE CASING:	LOCKING STEEL CASING	
TYPE OF BACKFILL:	AUGER CUTTINGS	
BOREHOLE DIAMETER:	9" +/-	
I.D. OF RISER PIPE:	2.0"	
TYPE OF RISER PIPE:	PVC	
DEPTH OF SEAL:	11.0'	EL. 575.3'
TYPE OF SEAL:	BENTONITE CHIPS	
DEPTH OF SAND PACK:	14.0'	EL. 572.3'
DEPTH TOP OF SCREEN:	37.2'	EL. 548.4'
TYPE OF SCREEN:	PVC	
SLOT SIZE X LENGTH:	0.10" X 15'	
I.D. OF SCREEN:	2.0"	
TYPE OF SAND PACK:	No. 1 SILICA SAND	
DEPTH BOTTOM OF SCREEN:	52.9'	EL. 533.4'
DEPTH BOTTOM OF SAND PACK:	52.9'	EL. 533.4'
TYPE OF BACKFILL BELOW OBSERVATION WELL:	Bedrock Fragments	
ELEVATION/ DEPTH OF HOLE:	53.6'	EL. 532.7'

DATE
START 6/3/2011
FINISH 6/3/2011
SHEET 1 OF 2

SJB SERVICES, INC.
SUBSURFACE LOG

HOLE NO. B-17
SURF. ELEV 585.3' +/-
G.W. DEPTH See Notes

PROJECT: Proposed Buffalo Canal Side Development
LOCATION: Former Buffalo Memorial Auditorium Site, Buffalo, New York
PROJ. NO.: BE-11-055

DEPTH FT.	SMPL NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	PID	SOIL OR ROCK CLASSIFICATION	NOTES
	1	6	8				Dark Brown f-c SAND, some Silt, little f-m Gravel,	PID = Photoionization
		5	5		13	BG	tr.cinders (moist, FILL)	Detector, measures in
	2	6	6					parts per million
		10	17		16	BG	Contains little Brick, tr.ash, tr.coal	BG = Background
5	3	10	18					
		17	10		35	BG	Contains some f-m Gravel, little Silt, tr.clay, tr.brick	
	4	11	10					
		14	12		24	BG		
	5	5	7				Dark Brown Silty CLAY, little f-m Gravel, tr.sand,	
10		6	8		13	BG	tr.ash, tr.glass (moist, FILL)	
	6	4	4					
		4	5		8	BG	Contains tr.brick	
	7	4	6					WOH = Weight of
		4	5		10	BG	Contains tr.gravel	Hammer and Rods
15	8	WOH/1.0					Grey to Brown Fine SAND, some Silt	
		1			1	BG	(wet, FILL, possible canal deposit)	
	9	1	3				Dark Grey to Black f-m Gravel size SLAG, little f-c	
		3	4		6	BG	Sand, little Silt, tr.wood (wet, FILL)	
	10	4	20				Contains tr.glass, tr.metal	
20		5	4		25	BG		
	11	5	3				Contains little Wood	Poor Recovery Sample #11
		3	7		6	BG	Brown Fine SAND, little Silt (wet, loose, SM)	
	12	4	6					
		8	7		14	BG	Contains some Silt (firm)	
25	13	3	4					
		5	9		9	BG	Contains little Silt (loose)	
	14	7	7					
		8	10		15	BG	Contains some Silt (firm)	Driller notes "Running
	15	3	1					Sands" at 26'
30		1	1		2	BG	Becomes f-c Sand, tr.silt (wet, v.loose, SW)	
	16	4	5				Becomes f-m Sand, iron staining present (loose)	
35		4	6		9	BG		
								Due to presence of
								"Running Sands", Driller
	17	1	4				Becomes Fine Sand, some Silt, occasional Clayey	installed 3" casing prior to
40		8	12		12	BG	Silt seams	rock coring

N = NO. BLOWS TO DRIVE 2-INCH SPOON 12-INCHES WITH A 140 LB. PIN WT. FALLING 30-INCHES PER BLOW
CLASSIFIED BY: Geologist
DRILLER: A. KOSKE
DRILL RIG TYPE : CME-75
METHOD OF INVESTIGATION ASTM D-1586 USING HOLLOW STEM AUGERS

DATE					HOLE NO.	B-17
START	6/3/2011	SJB SERVICES, INC.			SURF. ELEV	585.3' +/-
FINISH	6/3/2011	SUBSURFACE LOG			G.W. DEPTH	See Notes
SHEET	2 OF 2					

PROJECT: Proposed Buffalo Canal Side Development LOCATION: Former Buffalo Memorial Auditorium Site
PROJ. NO.: BE-11-055 Buffalo, New York

DEPTH FT.	SMPL NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	PID	SOIL OR ROCK CLASSIFICATION	NOTES
								Driller notes Casing Refusal at 43.6'
	18	2	50/0.4		REF	BG	Contains little Silt, occasional Silt (wet)	
45							Light Grey to Grey LIMESTONE, sound, hard to v.hard thickly bedded, occasional horizontal fractures, occasional styolites and fossils, occasional calcite partings	NQ '2' Size Rock Core Run #1: 43.6' - 48.5' REC = 100% RQD = 98%
50							Becomes massively bedded	Run #2: 48.5' - 53.5' REC = 100% RQD = 100%
55							Boring Complete at 53.5'	Free standing water measured at 14.2' after spinning casing. Free standing water measured at 10.9' after coring. Water Loss at 46' REF = Sample Spoon Refusal
60								
65								
70								
75								
80								

N = NO. BLOWS TO DRIVE 2-INCH SPOON 12-INCHES WITH A 140 LB. PIN WT. FALLING 30-INCHES PER BLOW CLASSIFIED BY: Geologist

DRILLER: A. KOSKE DRILL RIG TYPE : CME-75

METHOD OF INVESTIGATION ASTM D-1586 USING HOLLOW STEM AUGERS

DATE	
START	6/6/2011
FINISH	6/6/2011
SHEET	1 OF 1

SJB SERVICES, INC.
SUBSURFACE LOG

HOLE NO.	B-18
SURF. ELEV	586.0' +/-
G.W. DEPTH	See Notes

PROJECT: Proposed Buffalo Canal Side Development LOCATION: Former Buffalo Memorial Auditorium Site
PROJ. NO.: BE-11-055 Buffalo, New York

DEPTH FT.	SMPL NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	PID	SOIL OR ROCK CLASSIFICATION	NOTES
	1	5	5				Brown to Dark Brown f-c SAND, some Silt, little f-m	PID = Photoionization
		4	6		9	BG	Gravel, tr.slag, tr.cinders, tr.wood (moist, FILL)	Detector, measures in
	2	5	6					parts per million
		9	4		15	BG	Contains tr.clay, tr.brick	BG = Background
5	3	11	10					
		7	10		17	BG		REF = Sample Spoon
	4	11	9					Refusal
		9	12		18	BG		
	5	7	4				Brown Silty CLAY, tr.sand, tr.gravel, tr.brick	
10		4	4		8	BG	(moist, FILL)	
	6	6	5					
		4	6		9	BG	Contains some f-c Sand	
	7	8	9					No Recovery Sample #7
		7	7		16			
15	8	20	16				Black f-m,Gravel size CINDERS, some f-c Sand size	
		7	9		23	BG	Cinders, tr.silt, tr.wood (wet, FILL)	
	9	2	2					
		3	2		5	BG		
	10	6	4					No Recovery Sample #10
20		7	7		11			Pushed Gravel
	11	13	6				Black Clayey SILT, little f-c Sand, tr.gravel, little wood	Poor Recovery Sample #11
		4	2		6	BG	(moist, FILL, possible canal deposits)	Slow Drilling noted at
	12	4	3					20' - 24'; Weld broke left
		5	8		14	BG	Contains tr.sand	10' of Augers.
25								Moved location 6.5' North,
							Boring Terminated at 24.0'	Auger Refusal @ 10.5'
							After Augers Broke Off	Moved location 4' North,
								Resumed Sampling at 24'
								See Boring B-18A
30								
35								
40								

N = NO. BLOWS TO DRIVE 2-INCH SPOON 12-INCHES WITH A 140 LB. PIN WT. FALLING 30-INCHES PER BLOW CLASSIFIED BY: Geologist

DRILLER: A. KOSKE DRILL RIG TYPE : CME-75

METHOD OF INVESTIGATION ASTM D-1586 USING HOLLOW STEM AUGERS

DATE			HOLE NO. B-18A
START 6/6/2011	**SJB SERVICES, INC.**		SURF. ELEV 587.0' +/-
FINISH 6/7/2011	**SUBSURFACE LOG**		G.W. DEPTH See Notes
SHEET 1 OF 2		SJB SERVICES, INC.	

PROJECT: Proposed Buffalo Canal Side Development LOCATION: Former Buffalo Memorial Auditorium Site
PROJ. NO.: BE-11-055 Buffalo, New York

DEPTH FT.	SMPL NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	PID	SOIL OR ROCK CLASSIFICATION	NOTES
0–24							Augered to 24 Feet (No Soil Samples Taken) To Resume Boring B-18	PID = Photoionization Detector, measures in parts per million BG = Background REF = Sample Spoon Refusal
25	13	50/0.3			REF	BG	Brown f-c SAND, little f-c Gravel, little Silt (wet, FILL)	Resumed Sampling at 24'
	14	11	9					
		8	9		17		Brown f-c SAND, tr.silt (wet, firm, SW)	
	15	8	8					
30		8	12		16	BG		No Recovery Sample #14
	16	2	7					
		7	6		14	BG		
								Driller notes significant "Running Sands" at 35'
35								
	17	1	4				Becomes Brown Fine Sand, little Silt (loose, SM)	Removed Augers after Sample 17; installed 3" Casing
		5	8		9			
	18	8	7					
40		6	9		13		(firm)	

N = NO. BLOWS TO DRIVE 2-INCH SPOON 12-INCHES WITH A 140 LB. PIN WT. FALLING 30-INCHES PER BLOW CLASSIFIED BY: Geologist

DRILLER: A. KOSKE DRILL RIG TYPE : CME-75

METHOD OF INVESTIGATION ASTM D-1586 USING HOLLOW STEM AUGERS

DATE		SJB SERVICES, INC. SUBSURFACE LOG	HOLE NO.	B-18A
START	6/6/2011		SURF. ELEV	587.0' +/-
FINISH	6/7/2011		G.W. DEPTH	See Notes
SHEET	2 OF 2			

PROJECT: Proposed Buffalo Canal Side Development LOCATION: Former Buffalo Memorial Auditorium Site
PROJ. NO.: BE-11-055 Buffalo, New York

DEPTH FT.	SMPL NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	PID	SOIL OR ROCK CLASSIFICATION	NOTES
	19	3	9				Contains little Silt, occasional Silt (wet)	Driller notes Casing Refusal at 47.4'
45		12	14		21	BG		NQ '2' Size Rock Core
50							Light Grey to Grey LIMESTONE, v.hard, slightly weathered to sound, thinly bedded to thickly bedded, occasional horizontal fractures, occasional styolites and fossils 46.8' - 47.0' Zone of broken core Becomes massively bedded, approx. 51'	Run #1: 46.6' - 51.8' REC = 94% RQD = 83% Driller notes small void at 49.2' below ground surface
55								Run #2: 51.8' - 56.8' REC = 102% RQD = 100% Recovered part of core from previous run
60							Boring Complete at 56.8'	Free standing water encountered at 20.4' after spinning casing. Free standing water reading at 13.5' after casing removed.
65								
70								
75								
80								

N = NO. BLOWS TO DRIVE 2-INCH SPOON 12-INCHES WITH A 140 LB. PIN WT. FALLING 30-INCHES PER BLOW CLASSIFIED BY: Geologist

DRILLER: A. KOSKE DRILL RIG TYPE : CME-75

METHOD OF INVESTIGATION ASTM D-1586 USING HOLLOW STEM AUGERS

APPENDIX C

GEOTECHNICAL LABORATORY
TEST RESULTS

Western New York Office
5167 South Park Avenue
Hamburg, NY 14075
Phone: (716) 649-8110
Fax: (716) 649-8051

Laboratory Test Report

PROJECT: **Canal Side – Public Canal Environments**

CLIENT: **C&S Companies**

DATE: **August 10, 2011**

PROJECT NO.: BE-11-055
REPORT NO.: LTR-1

Attached are the results of laboratory testing conducted on various samples from the above referenced project. Mr. John Danzer, representing Empire –Geo Services, Inc, chose samples contained in this report.

The testing conducted was as follows:

ASTM D-2938: Unconfined Compressive Strength of Intact Rock Core Specimens

ASTM D-2216: Laboratory Determination of Water (Moisture) Content of Soil & Rock

ASTM C-136: Sieve Analysis of Fine and Coarse Aggregates

Soil Test Evaluation for Ductile Iron Pipe

Samples were received at the SJB Services, Inc. laboratory on July 18, 2010 where they were processed for testing.

If the reviewer should have any questions concerning this report, please do not hesitate to contact our office at any time.

SJB Services, Inc.

Paul Gregorczyk
Laboratory Manager

SJB SERVICES, INC.

Western New York Office
5167 South Park Avenue
Hamburg, NY 14075
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Fax: (716) 649-8051

Laboratory Test Report

PROJECT: Canal Side – Public Canal Environments

CLIENT: C&S Companies

DATE: August 10, 2011

PROJECT NO.: BE-11-055
REPORT NO.: LTR-1

ASTM D-2938: Unconfined Compressive Strength of Intact Rock Core Specimens

Sample Number	Sample Location	Sample Diameter inches	Sample Length inches	Maximum Load lbs.	Unconfined Compressive Strength psi
11-1271	B-15: 39.5'	1.99	4.15	41760	13,430
11-1272	B-15: 45.0'	1.99	4.03	46755	15,030
11-1273	B-17: 44.0'	1.99	4.11	54760	17,610
11-1274	B-17: 50.5'	1.99	4.08	59155	19,020

SJB SERVICES, INC.

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Laboratory Test Report

PROJECT: **Canal Side – Public Canal Environments**
CLIENT: **C&S Companies**
DATE: **August 10, 2011**

PROJECT NO.: BE-11-055
REPORT NO.: LTR-1

Sample Number: 11-1264
Sample Identification: B-15, Composite Sample: 4' - 14'

ASTM D-2216: Laboratory Determination of Water (Moisture) Content of Soil &Rock
Moisture Content = 13.6 %

ASTM C-136: Sieve Analysis of Fine and Coarse Aggregates

Sieve Size	*Percent Passing*
1"	100.0
¾"	91.7
½"	86.3
⅜"	84.0
¼"	79.8
#4	77.8
#10	73.8
#20	70.7
#40	64.2
#100	56.1
#200	45.7

DIPRA RESULTS

Tests Performed	Results	Point Value
Resistivity	1100 ohm-cm	10
Ph Reading	8.52	0
Redox Potential	+65.8 mv	3.5
Sulfides	Negative	0
Moisture Content	13.6 %	1
	Total DIPRA Points	14.5

CHEMICAL ANALYSIS

Parameter Analyzed	Result
Chloride Content	262 mg/kg
Sulfate Content	212 mg/kg

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Laboratory Test Report

PROJECT: **Canal Side – Public Canal Environments**

CLIENT: **C&S Companies**

DATE: **August 10, 2011**

PROJECT NO.: BE-11-055
REPORT NO.: LTR-1

Sample Number: 11-1265
Sample Identification: B-15, S-15: 28' – 30'

ASTM D-2216: Laboratory Determination of Water (Moisture) Content of Soil &Rock

Moisture Content = 24.8 %

ASTM C-136: Sieve Analysis of Fine and Coarse Aggregates

Sieve Size	*Percent Passing*
#4	100.0
#10	100.0
#20	99.9
#40	98.5
#100	12.2
#200	3.3

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Laboratory Test Report

PROJECT: **Canal Side – Public Canal Environments**
CLIENT: **C&S Companies**
DATE: August 10, 2011

PROJECT NO.: BE-11-055
REPORT NO.: LTR-1

Sample Number: 11-1266
Sample Identification: B-16, Composite Sample: 4' - 14'

ASTM D-2216: Laboratory Determination of Water (Moisture) Content of Soil &Rock
Moisture Content = 14.2 %

ASTM C-136: Sieve Analysis of Fine and Coarse Aggregates

Sieve Size	*Percent Passing*
1"	100.0
¾"	93.6
½"	91.3
⅜"	89.1
¼"	83.6
#4	80.0
#10	71.6
#20	65.4
#40	60.1
#100	47.8
#200	41.5

DIPRA RESULTS

Tests Performed	Results	Point Value
Resistivity	890 ohm-cm	10
Ph Reading	8.74	0
Redox Potential	+79.3 mv	3.5
Sulfides	Negative	0
Moisture Content	14.2 %	1
	Total DIPRA Points	14.5

CHEMICAL ANALYSIS

Parameter Analyzed	Result
Chloride Content	65.1 mg/kg
Sulfate Content	274 mg/kg

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Fax: (716) 649-8051

Laboratory Test Report

PROJECT: Canal Side – Public Canal Environments

CLIENT: C&S Companies

DATE: August 10, 2011

PROJECT NO.: BE-11-055
REPORT NO.: LTR-1

Sample Number: 11-1267
Sample Identification: B-16, S-17: 35' – 37'

ASTM D-2216: Laboratory Determination of Water (Moisture) Content of Soil &Rock

Moisture Content = 17.1 %

ASTM C-136: Sieve Analysis of Fine and Coarse Aggregates

Sieve Size	*Percent Passing*
3/8"	100.0
¼"	98.5
#4	97.7
#10	90.9
#20	83.4
#40	77.5
#100	52.6
#200	21.8

SJB SERVICES, INC.

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Fax: (716) 649-8051

Laboratory Test Report

PROJECT: Canal Side – Public Canal Environments
CLIENT: C&S Companies
DATE: August 10, 2011

PROJECT NO.: BE-11-055
REPORT NO.: LTR-1

Sample Number: 11-1268
Sample Identification: B-17, Composite Sample: 4' - 14'

ASTM D-2216: Laboratory Determination of Water (Moisture) Content of Soil &Rock
Moisture Content = 11.9 %

ASTM C-136: Sieve Analysis of Fine and Coarse Aggregates

Sieve Size	*Percent Passing*
1"	100.0
¾"	95.6
½"	92.1
⅜"	89.9
¼"	87.0
#4	85.0
#10	80.6
#20	76.7
#40	72.9
#100	64.8
#200	61.1

DIPRA RESULTS

Tests Performed	Results	Point Value
Resistivity	1300 ohm-cm	10
Ph Reading	8.22	0
Redox Potential	+56.2 mv	3.5
Sulfides	Negative	0
Moisture Content	11.9 %	1
	Total DIPRA Points	14.5

CHEMICAL ANALYSIS

Parameter Analyzed	Result
Chloride Content	109 mg/kg
Sulfate Content	93.1 mg/kg

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Fax: (716) 649-8051

Laboratory Test Report

PROJECT: **Canal Side – Public Canal Environments**

CLIENT: **C&S Companies**

DATE: **August 10, 2011**

PROJECT NO.: BE-11-055
REPORT NO.: LTR-1

Sample Number: 11-1269
Sample Identification: B-17, S-12: 22' – 24'

ASTM D-2216: Laboratory Determination of Water (Moisture) Content of Soil &Rock

Moisture Content = 24.5 %

ASTM C-136: Sieve Analysis of Fine and Coarse Aggregates

Sieve Size	*Percent Passing*
#4	100.0
#10	100.0
#20	99.9
#40	99.3
#100	47.9
#200	14.6

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Laboratory Test Report

PROJECT: **Canal Side – Public Canal Environments**

CLIENT: **C&S Companies**

DATE: **August 10, 2011**

PROJECT NO.: BE-11-055
REPORT NO.: LTR-1

Sample Number: 11-1270
Sample Identification: B-18, S-16: 30' – 32'

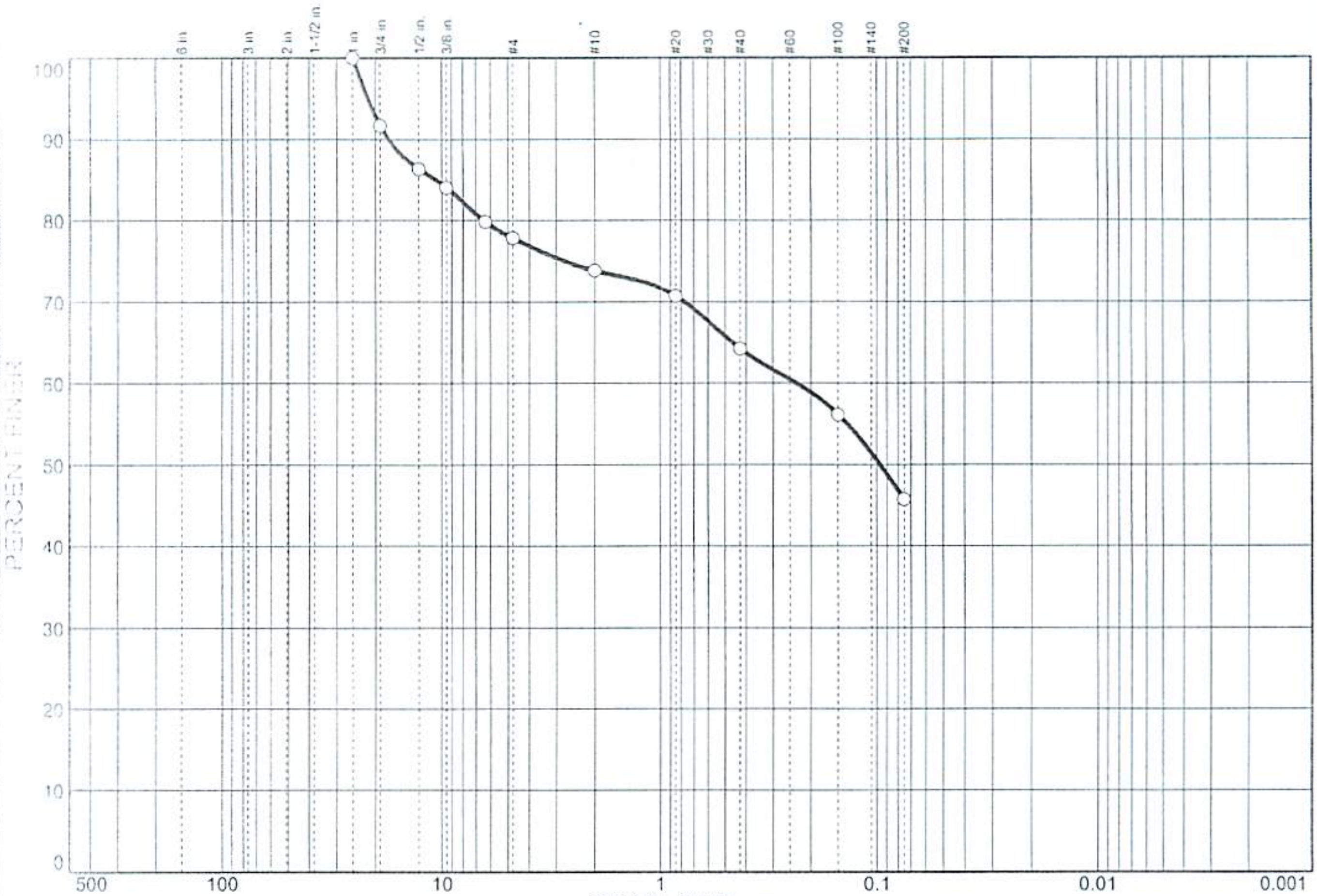
ASTM D-2216: Laboratory Determination of Water (Moisture) Content of Soil &Rock

Moisture Content = 18.4 %

ASTM C-136: Sieve Analysis of Fine and Coarse Aggregates

Sieve Size	*Percent Passing*
¾"	100.0
½"	97.4
⅜"	97.4
¼"	97.1
#4	97.0
#10	96.3
#20	94.7
#40	63.2
#100	17.0
#200	12.3

ASTM C-136: Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	22.2	32.1	45.7	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1 in.	100.0		
.75 in.	91.7		
.5 in.	86.3		
.375 in.	84.0		
.25 in.	79.8		
#4	77.8		
#10	73.8		
#20	70.7		
#40	64.2		
#100	56.1		
#200	45.7		

* (no specification provided)

Soil Description

B-15, COMPOSITE SAMPLE: 4' - 14'

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 10.7 D_{60}= 0.234 D_{50}= 0.0972
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= AASHTO=

Remarks

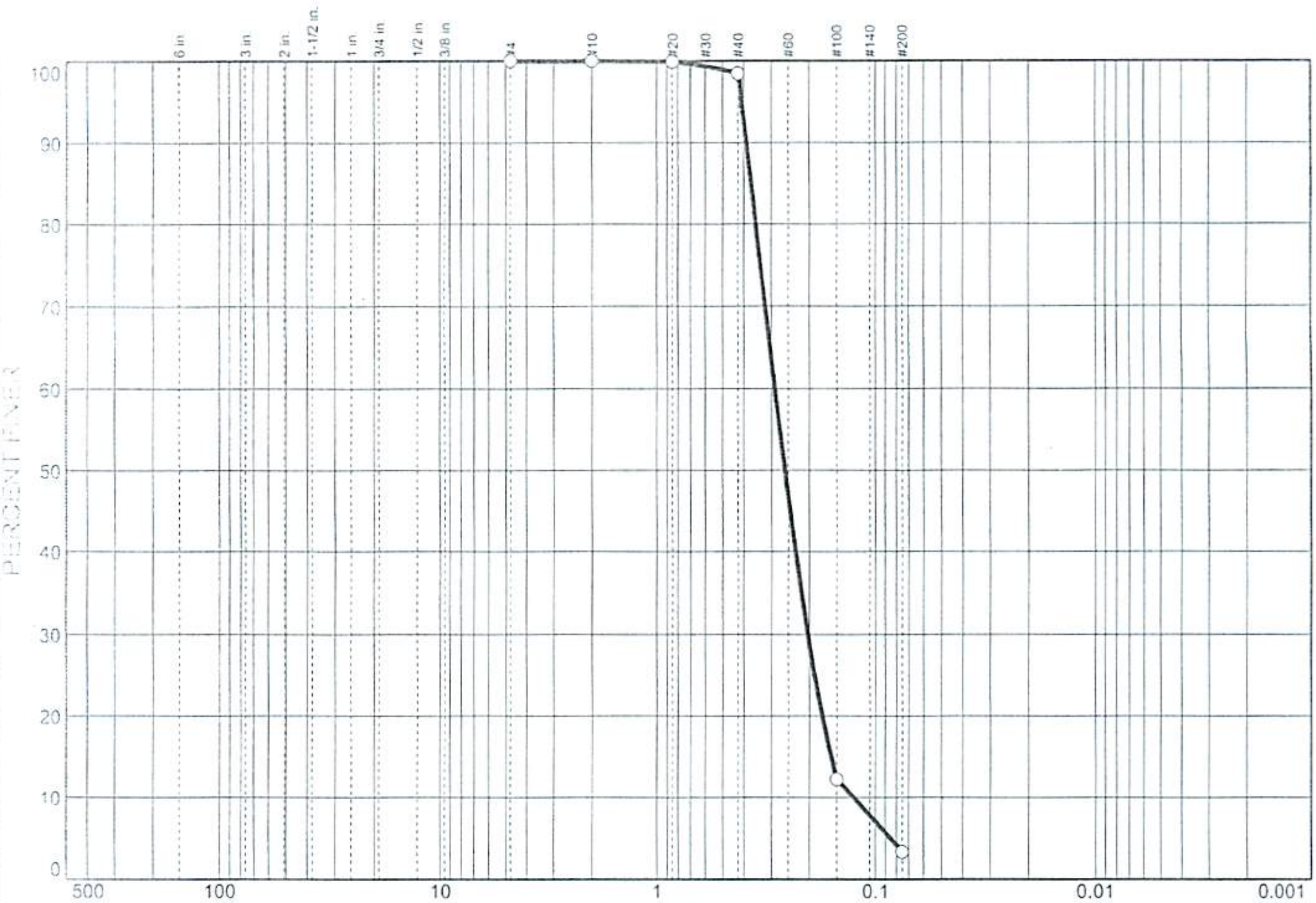
SAMPLE NUMBER: 11-1264

Sample No.: 11-1264 Source of Sample: B-15 Date: 8/10/11
Location: B-15, COMPOSITE: 4' - 14' Elev./Depth: 4' - 14'

SJB SERVICES, INC.

Client: C&S COMPANIES
Project: CANAL SIDE - PUBLIC CANAL ENVIRONMENTS
Project No: BE-11-055

ASTM C-136: Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	96.7	3.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	100.0		
#20	99.9		
#40	98.5		
#100	12.2		
#200	3.3		

* (no specification provided)

Soil Description

B-15, S-15: 28' - 30'

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.373 D_{60}= 0.290 D_{50}= 0.260
D_{30}= 0.204 D_{15}= 0.160 D_{10}= 0.126
C_u= 2.29 C_c= 1.14

Classification

USCS= AASHTO=

Remarks

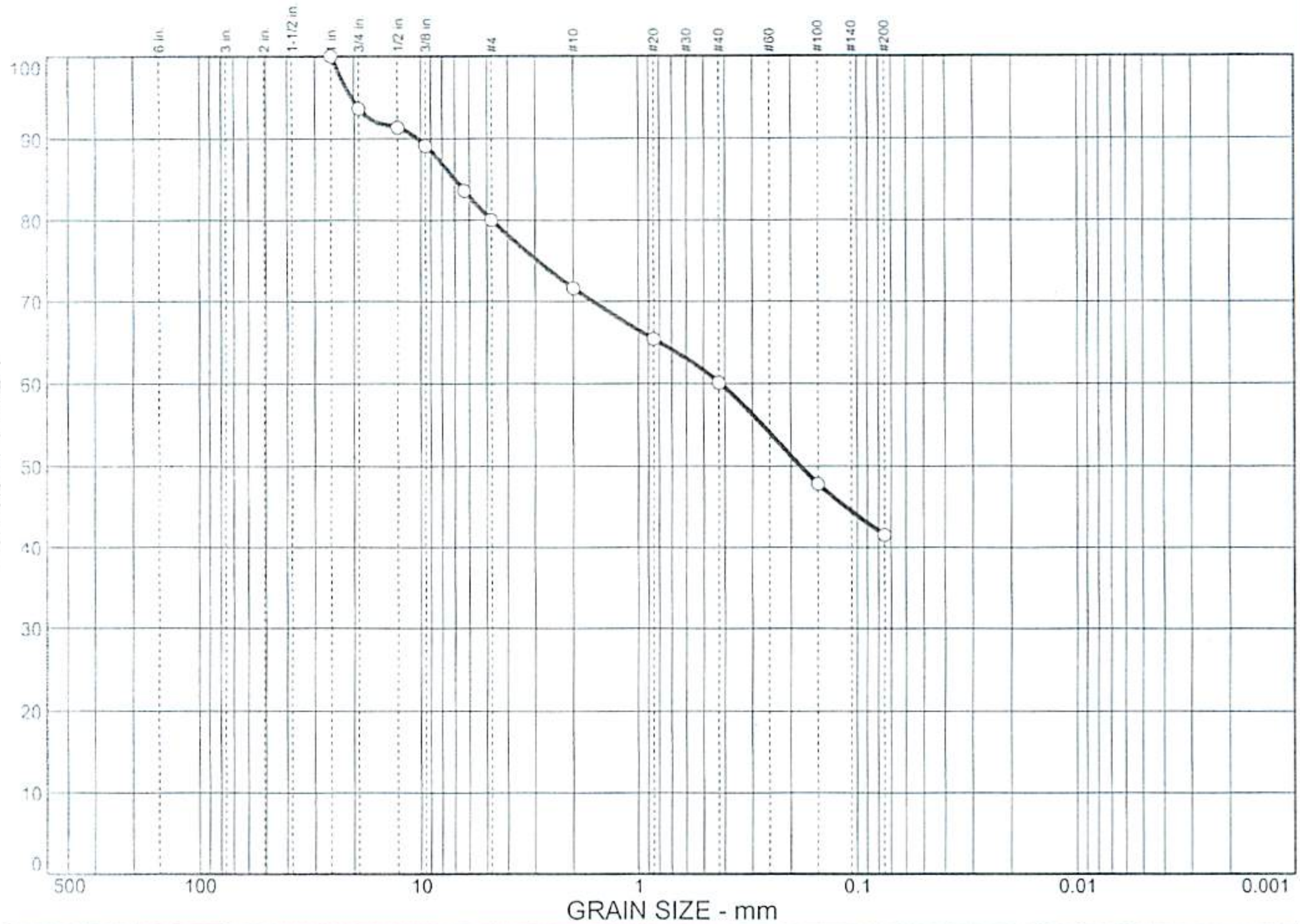
SAMPLE NUMBER: 11-1265

Sample No.: S-15 Source of Sample: B-15 Date: 8/10/11
Location: B-15, S-15: 28' - 30' Elev./Depth: 28' - 30'

SJB SERVICES, INC.

Client: C&S COMPANIES
Project: CANAL SIDE - PUBLIC CANAL ENVIRONMENTS
Project No: BE-11-055

ASTM C-136: Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	20.0	38.5	41.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1 in.	100.0		
.75 in.	93.6		
.5 in.	91.3		
.375 in.	89.1		
.25 in.	83.6		
#4	80.0		
#10	71.6		
#20	65.4		
#40	60.1		
#100	47.8		
#200	41.5		

* (no specification provided)

Soil Description

B-16, COMPOSITE SAMPLE: 4'- 14'

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 7.01 D_{60}= 0.421 D_{50}= 0.182
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= AASHTO=

Remarks

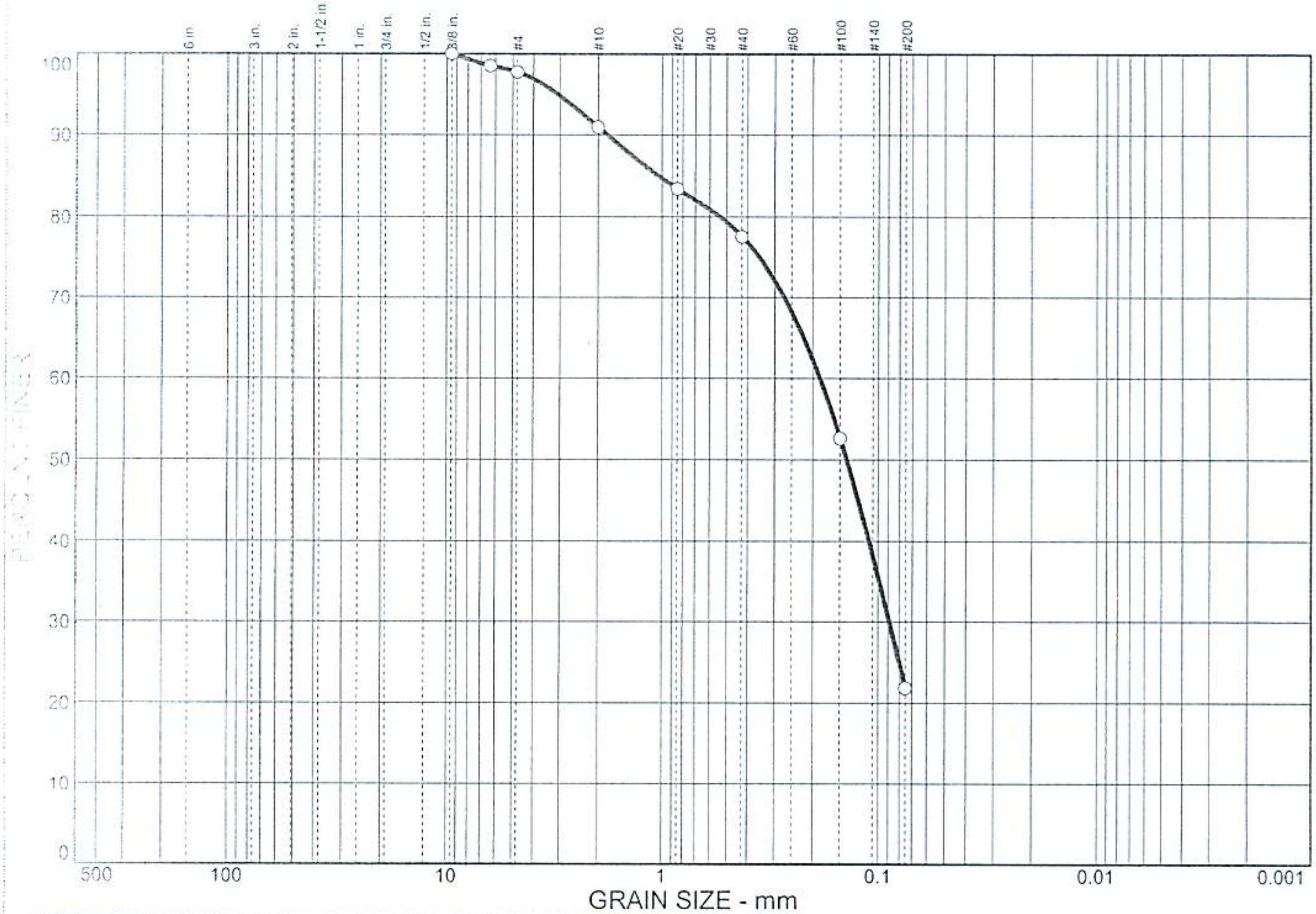
SAMPLE NUMBER: 11-1266

Sample No.: 11-1266 **Source of Sample:** B-16 **Date:** 8/10/11
Location: B-16, COMPOSITE: 4' - 14' **Elev./Depth:** 4' - 14'

SJB SERVICES, INC.

Client: C&S COMPANIES
Project: CANAL SIDE - PUBLIC CANAL ENVIRONMENTS
Project No: BE-11-055

ASTM C-136: Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	2.3	75.9	21.8	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375 in.	100.0		
.25 in.	98.5		
#4	97.7		
#10	90.9		
#20	83.4		
#40	77.5		
#100	52.6		
#200	21.8		

* (no specification provided)

Soil Description

B-16, S-17: 35' - 37'

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 1.04 D_{60}= 0.186 D_{50}= 0.140
D_{30}= 0.0891 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= AASHTO=

Remarks

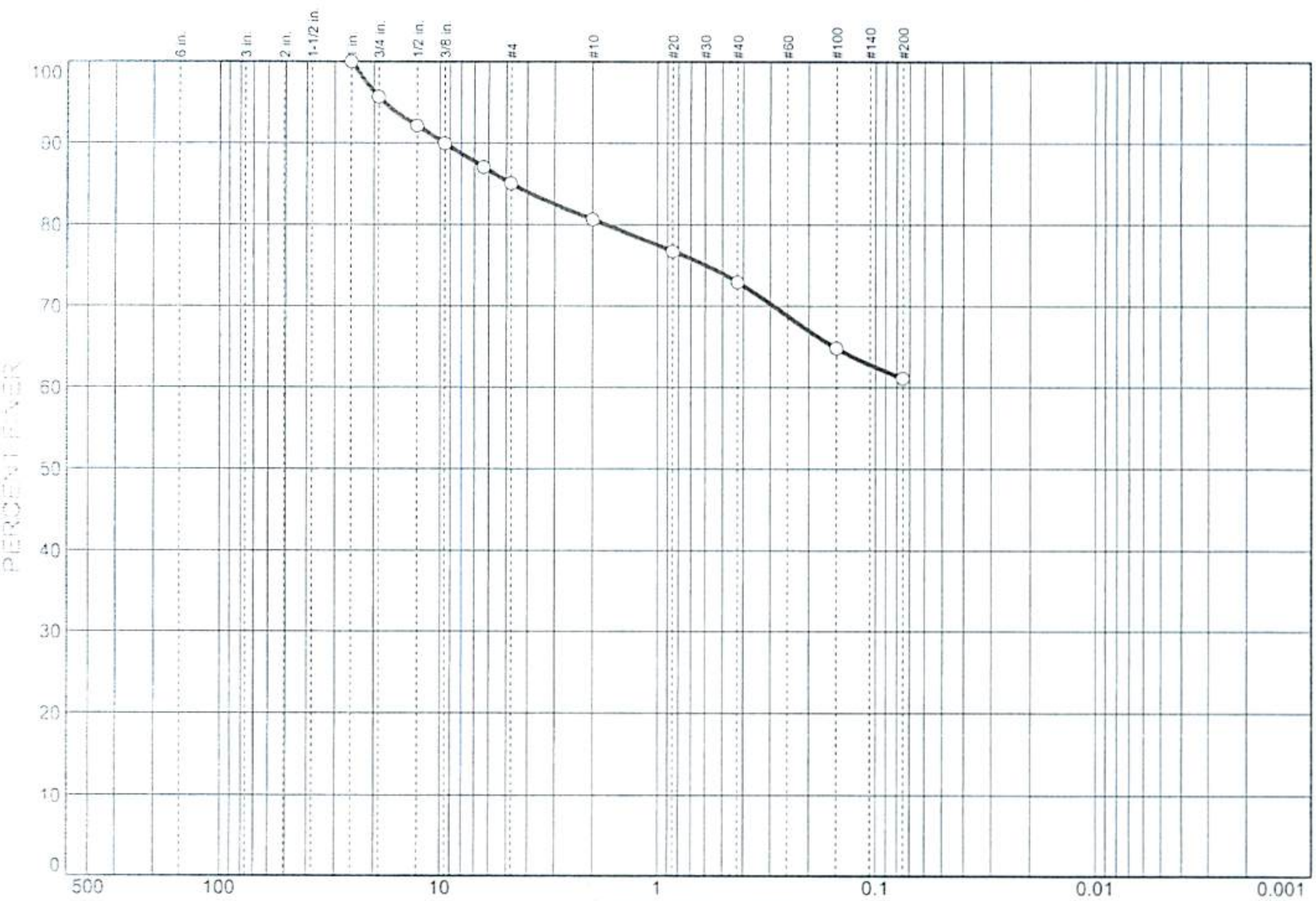
SAMPLE NUMBER: 11-1267

Sample No.: S-17 **Source of Sample:** B-16 **Date:** 8/10/11
Location: B-16, S-17: 35' - 37' **Elev./Depth:** 35' - 37'

SJB SERVICES, INC.

Client: C&S COMPANIES
Project: CANAL SIDE - PUBLIC CANAL ENVIRONMENTS
Project No: BE-11-055

ASTM C-136: Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	15.0	23.9	61.1	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1 in.	100.0		
.75 in.	95.6		
.5 in.	92.1		
.375 in.	89.9		
.25 in.	87.0		
#4	85.0		
#10	80.6		
#20	76.7		
#40	72.9		
#100	64.8		
#200	61.1		

* (no specification provided)

Soil Description

B-17, COMPOSITE SAMPLE: 4' - 14'

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 4.75 D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= AASHTO=

Remarks

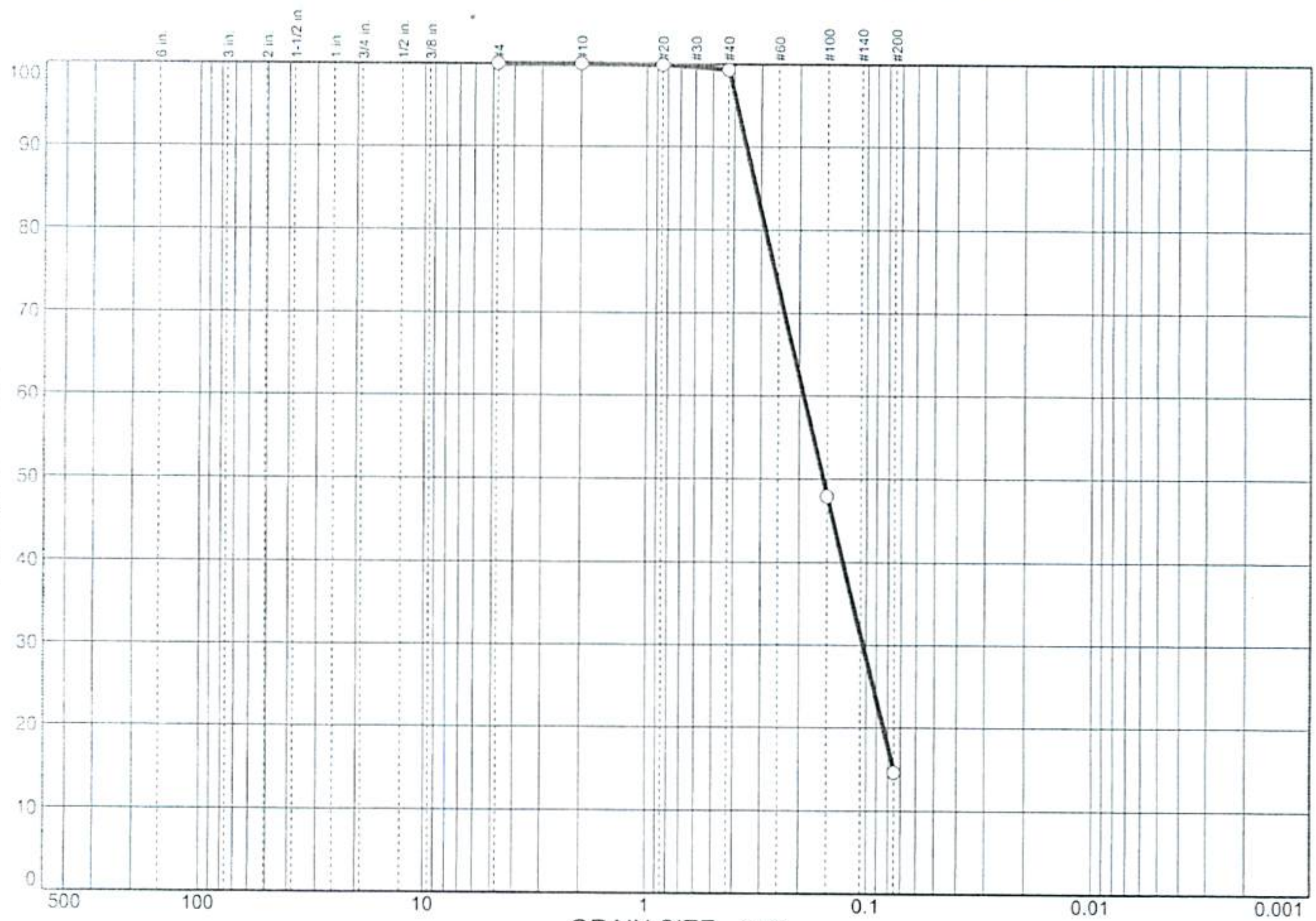
SAMPLE NUMBER: 11-1268

Sample No.: 11-1268 Source of Sample: B-17 Date: 8/10/11
Location: B-17, COMPOSITE: 4' - 14' Elev./Depth: 4' - 14'

SJB SERVICES, INC.

Client: C&S COMPANIES
Project: CANAL SIDE - PUBLIC CANAL ENVIRONMENTS
Project No: BE-11-055

ASTM C-136: Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	85.4	14.6	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	100.0		
#20	99.9		
#40	99.3		
#100	47.9		
#200	14.6		

* (no specification provided)

Soil Description

B-17, S-12: 22' - 24'

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.318 D_{60}= 0.192 D_{50}= 0.157
D_{30}= 0.104 D_{15}= 0.0756 D_{10}=
C_u= C_c=

Classification

USCS= AASHTO=

Remarks

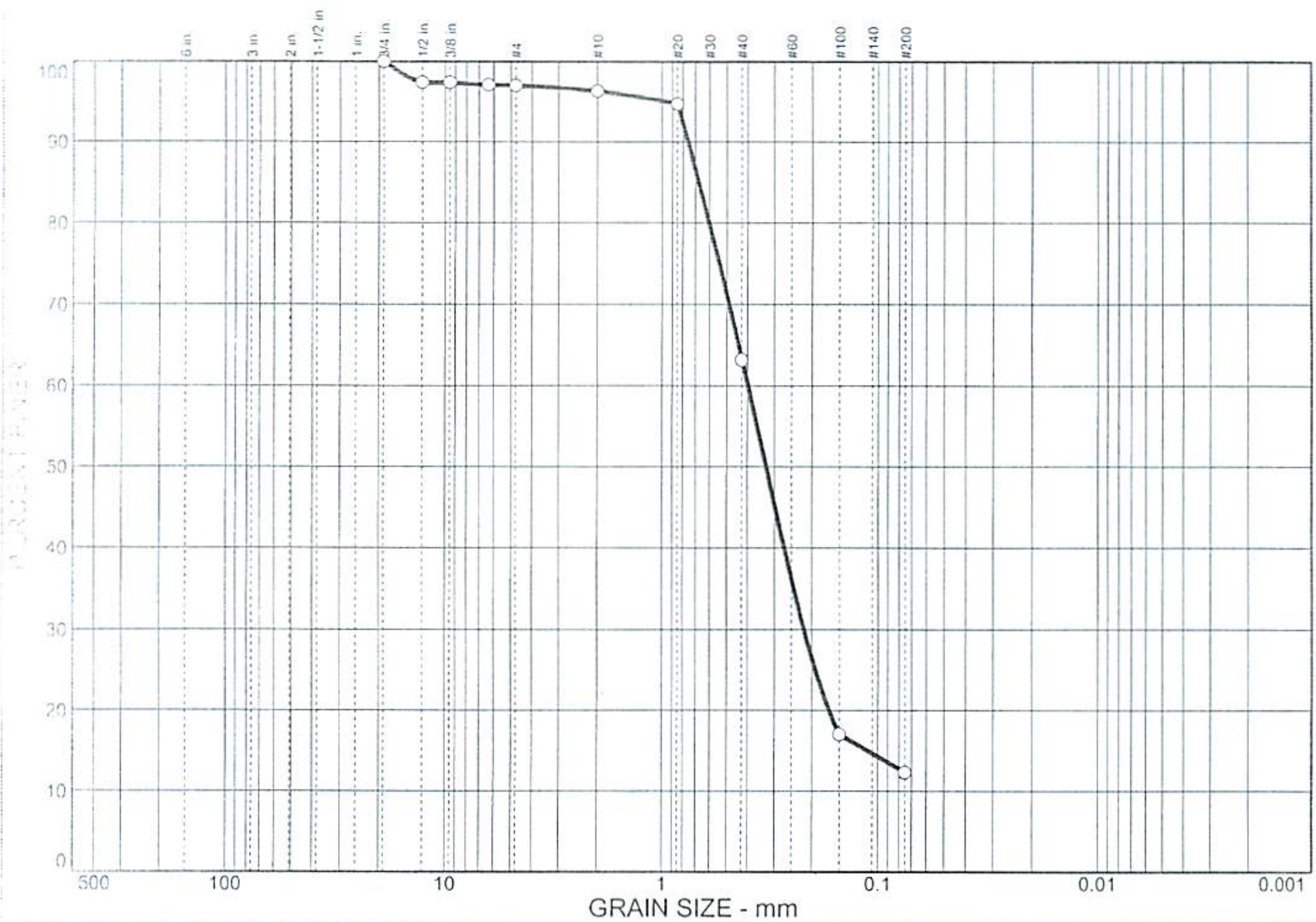
SAMPLE NUMBER: 11-1269

Sample No.: S-12 Source of Sample: B-17 Date: 8/10/11
Location: B-17, S-12: 22' - 24' Elev./Depth: 22' - 24'

SJB SERVICES, INC.

Client: C&S COMPANIES
Project: CANAL SIDE - PUBLIC CANAL ENVIRONMENTS
Project No: BE-11-055

ASTM C-136: Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	3.0	84.7	12.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75 in.	100.0		
.5 in.	97.4		
.375 in.	97.4		
.25 in.	97.1		
#4	97.0		
#10	96.3		
#20	94.7		
#40	63.2		
#100	17.0		
#200	12.3		

* (no specification provided)

Soil Description

B-18, S-16: 30' - 32'

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.679 D_{60}= 0.399 D_{50}= 0.329
D_{30}= 0.219 D_{15}= 0.112 D_{10}=
C_u= C_c=

Classification

USCS= AASHTO=

Remarks

SAMPLE NUMBER: 11-1270

Sample No.: S-16 Source of Sample: B-18 Date: 8/10/11
Location: B-18, S-16: 30' - 32' Elev./Depth: 30' - 32'

SJB SERVICES, INC.

Client: C&S COMPANIES
Project: CANAL SIDE - PUBLIC CANAL ENVIRONMENTS
Project No: BE-11-055

PARADIGM
ENVIRONMENTAL SERVICES, INC.

Analytical Report Cover Page

Empire Geo-Services, Inc.

For Lab Project # 11-3034
Issued August 1, 2011
This report contains a total of 6 pages

The reported results relate only to the samples as they have been received by the laboratory.

Any noncompliant QC parameters having impact on the data are flagged or documented on the final report.

All soil/sludge samples have been reported on a dry weight basis, unless qualified "reported as received". Other solids are reported as received.

The Chain of Custody provides additional information, including compliance with sample condition requirements upon receipt. Sample condition requirements are defined under the 2003 NELAC Standard, sections 5.5.8.3.1 and 5.5.8.3.2.

NYSDOH ELAP does not certify for all parameters. Paradigm Environmental Services or the indicated subcontracted laboratory does hold certification for all analytes where certification is offered by ELAP unless otherwise specified.

Data qualifiers are used, when necessary, to provide additional information about the data. This information may be communicated as a flag or as text at the bottom of the report. Please refer to the following list of frequently used data flags and their meaning:

"<" = analyzed for but not detected at or above the reporting limit.
"E" = Result has been estimated, calibration limit exceeded.
"Z" = See case narrative.
"D" = Duplicate results outside QC limits. May indicate a non-homogenous matrix.
"M" = Matrix spike recoveries outside QC limits. Matrix bias indicated.
"B" = Method blank contained trace levels of analyte. Refer to included method blank report.

179 Lake Avenue · Rochester, NY 14608 · (585) 647-2530 · Fax (585) 647-3311 · ELAP ID# 10958

PARADIGM
ENVIRONMENTAL SERVICES, INC.
179 Lake Avenue Rochester New York 14608 (585) 647-2530 FAX (585) 647-3311

LABORATORY REPORT OF ANALYSIS

Client: Empire Geo-Services, Inc.

Client Job Site: N/A

Client Job No.: BE-11-055

Field Location: B-15 (4 to 14 feet)

Lab Project No.: 11-3034
Lab Sample No.: 9990

Sample Type: Soil

Date Sampled: 6/2/2011
Date Received: 7/21/2011

Parameter	Date Analyzed	Analytical Method	Results (mg/kg)
Chloride	7/29/2011	SW 9056	262
Sulfate	7/29/2011	SW 9056	212

ELAP ID.No.: 10709

Comments:

Approved By: Val McMill for
Bruce Hoogesteger, Technical Director

This report is part of a multipage document and should only be evaluated in its entirety. The Chain of Custody provides additional sample information, including compliance with the sample condition requirements upon receipt.

PARADIGM
ENVIRONMENTAL SERVICES, INC.

179 Lake Avenue Rochester New York 14608 (585) 647-2530 FAX (585) 647-3311

LABORATORY REPORT OF ANALYSIS

Client: Empire Geo-Services, Inc.

Client Job Site: N/A

Client Job No.: BE-11-055

Field Location: B-16 (4 to 14 feet)

Lab Project No.: 11-3034
Lab Sample No.: 9991

Sample Type: Soil

Date Sampled: 6/1/2011
Date Received: 7/21/2011

Parameter	Date Analyzed	Analytical Method	Results (mg/kg)
Chloride	7/29/2011	SW 9056	65.1
Sulfate	7/29/2011	SW 9056	274

ELAP ID.No.: 10709

Comments:

Approved By: ______________________
Bruce Hoogesteger, Technical Director

This report is part of a multipage document and should only be evaluated in its entirety. The Chain of Custody provides additional sample information, including compliance with the sample condition requirements upon receipt.

PARADIGM
ENVIRONMENTAL SERVICES, INC.
179 Lake Avenue Rochester New York 14608 (585) 647-2530 FAX (585) 647-3311

LABORATORY REPORT OF ANALYSIS

Client: Empire Geo-Services, Inc.

Client Job Site: N/A

Client Job No.: BE-11-055

Field Location: B-17 (4 to 14 feet)

Lab Project No.: 11-3034
Lab Sample No.: 9992

Sample Type: Soil

Date Sampled: 6/3/2011
Date Received: 7/21/2011

Parameter	Date Analyzed	Analytical Method	Results (mg/kg)
Chloride	7/29/2011	SW 9056	109
Sulfate	7/29/2011	SW 9056	93.1

ELAP ID.No.: 10709

Comments:

Approved By: Valerie fr.
Bruce Hoogesteger, Technical Director

This report is part of a multipage document and should only be evaluated in its entirety. The Chain of Custody provides additional sample information, including compliance with the sample condition requirements upon receipt.

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PARADIGM ENVIRONMENTAL SERVICES, INC.

179 Lake Avenue
Rochester, NY 14608
(716) 647-2530 * (800) 724-1997

CHAIN OF CUSTODY

REPORT TO:		INVOICE TO:	
COMPANY:	Empire Geo-Services, Inc.	COMPANY:	Same
ADDRESS:	5167 South Park Avenue	ADDRESS:	
CITY:	Hamburg STATE: N.Y. ZIP: 14075	CITY:	STATE: ZIP:
PHONE:	(716) 649-8110 FAX: (716) 649-8051	PHONE:	FAX:
ATTN:	John Danzer	ATTN:	

LAB PROJECT #: 11-3034

CLIENT PROJECT #:

TURNAROUND TIME: (WORKING DAYS)

[ ] 1 [ ] 2 [ ] 3 STD [X] 5 OTHER [ ]

PROJECT NAME/SITE NAME: BE-11-055

COMMENTS:

REQUESTED ANALYSIS

	DATE	TIME	COMPOSITE	GRAB	SAMPLE LOCATION/FIELD ID	MATRIX	NUMBER CONTAINERS	Chloride Ion	Sulfate Ion									REMARKS	PARADIGM LAB SAMPLE NUMBER
1	6/02/11		X		B-15 (4 to 14 feet)	soil	1	x	x										9990
2	6/01/11		X		B-16 (4 to 14 feet)	soil	1	x	x										9991
3	6/03/11		X		B-17 (4 to 14 feet)	soil	1	x	x										9992
4																			
5																			
6																			
7																			
8																			
9																			
10																			

LAB USE ONLY

SAMPLE CONDITION: Check box if acceptable or note deviation:

CONTAINER TYPE: [X] PRESERVATIONS: [ ] NA HOLDING TIME: [ ] 7-21-11 OK parts past HT JD TEMPERATURE: [X] 4°C iced from temp blank 7/21 ng

Sampled By:	Date/Time:	Relinquished By:	Date/Time:
Relinquished By: Thomas R. [illegible]	Date/Time: 7/21/11	Received By:	Date/Time:
Received By: [illegible]	Date/Time: 7/21/11	Received @ Lab By: [illegible]	Date/Time: 7/21/11 1350

Total Cost:

P.I.F.

PARADIGM

CHAIN OF CUSTODY 110722018 ACK 1 of 1

REPORT TO:		INVOICE TO:		LAB PROJECT #:	CLIENT PROJECT #:
COMPANY:	Paradigm Environmental	COMPANY:	Same		
ADDRESS:		ADDRESS:		TURNAROUND TIME: (WORKING DAYS)	
CITY: STATE: ZIP:		CITY: STATE: ZIP:			
PHONE: FAX:		PHONE: FAX:		STD	OTHER
ATTN:	Jane Daloia	ATTN:	Meridith Dillman	1 2 3 5 X	
COMMENTS:	Please email results to khansen@paradigmenv.com and jdaloia@paradigmenv.com			Date Due: 7/29/11	

PROJECT NAME/SITE NAME:

REQUESTED ANALYSIS

	DATE	TIME	COMPOSITE	GRAB	SAMPLE LOCATION/FIELD ID	MATRIX	NUMBER OF CONTAINERS	Chloride	SO4									REMARKS	PARADIGM LAB SAMPLE NUMBER
1	6/2				11-3034-9990	soil	1	X	X									samples	001
2	6/1				9991	↓	1	X	X									rec'd past	002
3	6/3				↓ 9992	↓	1	X	X									HT - ok per ~~client~~	003
4																			
5																			
6																			
7																			
8																			
9																			
10																			

LAB USE ONLY BELOW THIS LINE

Sample Condition: Per NELAC/ELAP 210/241/242/243/244

Receipt Parameter	NELAC Compliance	
Container Type:	Y ☐	N ☐
Comments:		
Preservation:	Y ☑	N ☐
Comments:		
Holding Time:	Y ☐	N ☑
Comments:		
Temperature: 15	Y ☐	N ☐
Comments:		

Client

Sampled By: ngardner Date/Time: 7/21/11 1600

Relinquished By: Date/Time:

Received By: S Valle Date/Time: 7/22/11 10:46

Received @ Lab By: Date/Time:

Total Cost:

P.I.F.

APPENDIX D

FILL MATERIAL AND EARTHWORK RECOMMENDATIONS

APPENDIX D

FILL MATERIAL AND EARTHWORK RECOMMENDATIONS

I. Material Recommendations

A. Structural Fill

Structural Fill should consist of a crusher run stone, which is free of clay, organics and friable or deleterious particles. As a minimum, the Structural Fill material should meet the requirements of New York State Department of Transportation, Standard Specifications, Item 304.12 – Type 2 Subbase, with the following gradation requirements.

Sieve Size Distribution	Percent Finer by Weight
2 inch	100
¼ inch	25-60
No. 40	5-40
No. 200	0-10

B. Subbase Stone

The subbase stone course placed as the aggregate course beneath slab on grade and pavement construction should conform to the same material requirements as Structural Fill as stated above.

C. Suitable Granular Fill

Suitable soil material, well graded from coarse to fine, and classified as GW, GP, GM, SW, SP and SM soils using the Unified Soil Classification System (ASTM D-2487) and having no more than 85 percent by weight material passing the No. 4 sieve, no more than 20 percent by weight material passing the No. 200 sieve, and which is generally free of particles greater than 4 inches, will be acceptable as Suitable Granular Fill. It should also be free of topsoil, asphalt, concrete rubble, wood, debris, clay and other deleterious materials.

Suitable Granular Fill can be used as foundation backfill and as subgrade fill to raise site grades beneath slab-on-grade construction. Material meeting the requirements of New York State Department of Transportation, Standard Specifications, Item 203.07 – Select Granular Fill is acceptable for use as Suitable Granular Fill.

II. <u>Placement and Compaction Requirements</u>

All controlled fill placed beneath foundations, slab-on-grade construction and beneath utilities should be compacted to a minimum of 95 percent of the maximum dry density as measured by the modified Proctor test (ASTM D1557). Fill placed in non-loaded grass areas can be compacted to a minimum of 90 percent of the maximum dry density (ASTM D1557).

Placement of fill should not exceed a maximum loose lift thickness of 6 to 9 inches with the exception of subbase courses beneath slab on grade and pavement construction, which can be placed in a lift not exceeding 12 inches. The loose lift thickness, however, should be reduced in conjunction with the compaction equipment used so that the required density is attained.

Fill should have a moisture content within two percent of the optimum moisture content at the time of compaction compaction. Subgrades should be properly drained and protected from moisture and frost. Placement of fill on frozen subgrades is not acceptable. It is recommended that all fill placement and compaction be monitored and tested on a fulltime basis by a representative of Empire Geo-Services, Inc.

III. <u>Quality Assurance Testing</u>

The following minimum laboratory and field quality assurance testing frequencies are recommended to confirm fill material quality and post placement and compaction conditions. These minimum frequencies are based on generally uniform material properties and placement conditions. Should material properties vary or conditions at the time of placement vary (i.e. moisture content, placement and compaction, procedures or equipment, etc.) Then additional testing is recommended. Additional testing, which may be necessary, should be determined by qualified geotechnical personnel, based on evaluation of the actual fill material and construction conditions.

A. <u>Laboratory Testing of Material Properties</u>

- Moisture content (ASTM D-2216) - 1 test per 4,000 cubic yards or no less than 2 tests per each material type.
- Grain Size Analysis (ASTM D-422) - 1 test per 4,000 cubic yards or no less than 2 tests per each material type.
- Liquid and Plastic Limits (ASTM D-4318) 1 test per 4,000 cubic yards or no less than 2 tests per each material type. Liquid and Plastic Limit testing is necessary only if appropriate, based on material composition (i.e. clayey or silty soils).

- Modified Proctor Moisture Density Relationship (ASTM D-1557) 1 test per 4000 cubic yards or no less than 1 test per each material type. A maximum/minimum density relationship (ASTM D-4253 and ASTM D-4254) may be an appropriate substitute for ASTM D-1557 depending on material gradation.

B. Field In-Place Moisture/Density Testing (ASTM D-3017 and ASTM D-2922)

- Backfilling along trenches and foundation walls - 1 test per 50 lineal feet per lift.
- Backfilling Isolated Excavations (i.e. column foundations, manholes, etc.) 1 test per lift.
- Filling in open areas for slab-on-grade construction - 1 test per 2500 square feet per lift.

APPENDIX E

GEOTECHNICAL REPORT LIMITATIONS

GEOTECHNICAL REPORT LIMITATIONS

Empire Geo-Services, Inc. (Empire) has endeavored to meet the generally accepted standard of care for the services completed, and in doing so is obliged to advise the geotechnical report user of our report limitations. Empire believes that providing information about the report preparation and limitations is essential to help the user reduce geotechnical-related delays, cost over-runs, and other problems that can develop during the design and construction process. Empire would be pleased to answer any questions regarding the following limitations and use of our report to assist the user in assessing risks and planning for site development and construction.

PROJECT SPECIFIC FACTORS: The conclusions and recommendations provided in our geotechnical report were prepared based on project specific factors described in the report, such as size, loading, and intended use of structures; general configuration of structures, roadways, and parking lots; existing and proposed site grading; and any other pertinent project information. Changes to the project details may alter the factors considered in development of the report conclusions and recommendations. *Accordingly, Empire cannot accept responsibility for problems which may develop if we are not consulted regarding any changes to the project specific factors that were assumed during the report preparation.*

SUBSURFACE CONDITIONS: The site exploration investigated subsurface conditions only at discrete test locations. Empire has used judgement to infer subsurface conditions between the discrete test locations, and on this basis the conclusions and recommendations in our geotechnical report were developed. It should be understood that the overall subsurface conditions inferred by Empire may vary from those revealed during construction, and these variations may impact on the assumptions made in developing the report conclusions and recommendations. *For this reason, Empire should be retained during construction to confirm that conditions are as expected, and to refine our conclusions and recommendations in the event that conditions are encountered that were not disclosed during the site exploration program.*

USE OF GEOTECHNICAL REPORT: Unless indicated otherwise, our geotechnical report has been prepared for the use of our client for specific application to the site and project conditions described in the report. *Without consulting with Empire, our geotechnical report should not be applied by any party to other sites or for any uses other than those originally intended.*

CHANGES IN SITE CONDITIONS: Surface and subsurface conditions are subject to change at a project site subsequent to preparation of the geotechnical report. Changes may include, but are not limited to, floods, earthquakes, groundwater fluctuations, and construction activities at the site and/or adjoining properties. *Empire should be informed of any such changes to determine if additional investigative and/or evaluation work is warranted.*

MISINTERPRETATION OF REPORT: The conclusions and recommendations contained in our geotechnical report are subject to misinterpretation. *To limit this possibility, Empire should review project plans and specifications relative to geotechnical issues to confirm that the recommendations contained in our report have been properly interpreted and applied.*

Subsurface exploration logs and other report data are also subject to misinterpretation by others if they are separated from the geotechnical report. This often occurs when copies of logs are given to contractors during the bid preparation process. *To minimize the potential for misinterpretation, the subsurface logs should not be separated from our geotechnical report and the use of excerpted or incomplete portions of the report should be avoided.*

OTHER LIMITATIONS: Geotechnical engineering is less exact than other design disciplines, as it is based partly on judgement and opinion. For this reason, our geotechnical report may include clauses that identify the limits of Empire’s responsibility, or that may describe other limitations specific to a project. These clauses are intended to help all parties recognize their responsibilities and to assist them in assessing risks and decision making. Empire would be pleased to discuss these clauses and to answer any questions that may arise.