OSWEGO CANAL CORRIDOR BOA

APPENDIX R: GEOTECHNICAL ENGINEERING INVESTIGATION

NOVEMBER 2019

RAVI ENGINEERING & LAND SURVEYING, P.C.

September 5, 2017

Bergmann Associates
28 East Main Street
200 First Federal Plaza
Rochester, New York 14614

Attention: Kimberly Baptiste

Subject: Geotechnical Engineering Investigation
West Side Coal Pier
Oswego, New York
Project No.: 40-16-175

Ms. Baptiste,

Ravi Engineering & Land Surveying, P.C. is pleased to submit the Geotechnical Engineering Report for the above referenced project. If you require additional information please contact us at (585) 223-3660. Thank you.

Respectfully submitted,

RAVI ENGINEERING & LAND SURVEYING, P.C.

James D. MacKecknie, P.G.
Project Manager

Attachment: Geotechnical Engineering Investigation Report

REPORT

GEOTECHNICAL ENGINEERING INVESTIGATION

WEST SIDE COAL PIER

OSWEGO, NEW YORK

For

Bergmann Associates

September 2017

September 5, 2017

Bergmann Associates
28 East Main Street
200 First Federal Plaza
Rochester, New York 14614

Attention: Kimberly Baptiste

Subject: Geotechnical Engineering Investigation
West Side Coal Pier
Oswego, New York

Readers:

This report presents the results of a geotechnical engineering investigation for the project identified above. It is understood that development of the pier is being considered. This development could include new buildings, new earth-retaining structures, rehabilitation of existing earth-retaining structures, and/or areas of new pavement. The existing surface conditions and readily observable structural conditions have been described in a report by Ravi Engineering & Land Surveying, P.C. dated 5/26/17.

SUBSURFACE EXPLORATIONS

Subsurface explorations for this investigation consisted of eight test borings, identified as B-1 through B-8.

The approximate locations of the borings are shown on the test boring location plan in Appendix A. This plan is based on a topographic drawing provided by the City of Oswego. This same topographic drawing was also used to estimate the approximate ground surface elevations at the boring locations.

The borings were performed by Nothnagle Drilling, using a truck-mounted rotary drilling rig, between 8/7/17 and 8/10/17. The borings were advanced to depths ranging from 7.2 to 58.5 feet below the ground surface.

The logs of the borings, as prepared by Nothnagle Drilling, are presented in Appendix B.

COMMENTS ON SUBSURFACE CONDITIONS

Selected subsurface information is summarized in attached Table 1.

Materials described as fill and/or lake bottom soil were encountered by all eight borings, to depths as great as approximately 45 feet below the ground surface. Bottom elevations for these materials, at the boring locations, ranged from approximately 210 to 244. In general, the distinction or interface between the fill and the underlying lake bottom soil could not be accurately determined. These materials consisted primarily of varying amounts of sand, gravel, and silt. Varying lesser amounts of cinders, coal, concrete, crushed stone, and wood were also noted. Standard Penetration Test N values were variable, but much of the material is loose.

Below the fill and/or lake bottom soil, most of the borings encountered dense or very dense natural soil. This soil consisted primarily of varying amounts of sand, gravel, and silt. Geologically, it could be described as a glacial till. For the borings that encountered and penetrated through this stratum, it was generally less than 10 feet in thickness.

For all fill and natural soils, it should be noted that objects too large to be retrieved by the sampling equipment (including cobbles, boulders, concrete fragments, and timbers) are likely to be present.

Seven of the eight borings were advanced to bedrock/refusal, and bedrock was core sampled for 10 feet at each of three boring locations (B-3, B-5, and B-6). The rock was described as sandstone. Values of core recovery ranged from approximately 82 percent to 98 percent, and values of rock quality designation (RQD) ranged from approximately 49 percent to 89 percent. The elevations of the top of rock/refusal ranged from approximately 204 to 244, and generally increased from north to south.

Observations of subsurface water are noted on the logs of the borings. It should be noted that short-term observations may not be representative of actual groundwater levels, and that groundwater levels will vary with factors including location, time, precipitation, season, and site activities. For purposes of analysis and design, it should be assumed that the groundwater level could be as high as the maximum anticipated level of Lake Ontario.

More detailed descriptions of the subsurface conditions, as encountered by the borings, are provided on the logs in Appendix B.

DESIGN AND CONSTRUCTION

General

This report has been based on a limited number of widely spaced subsurface explorations. Also, specific information regarding the proposed construction is not yet known. As more information becomes available, and as the project proceeds toward final design and construction, additional subsurface explorations and geotechnical evaluations should be considered. It may be appropriate to address individual buildings, for example, on an individual basis. The need for such additional explorations and evaluations should be determined by a geotechnical engineer. The discussions in this report can be refined, expanded, and presented in one or more design-level reports.

The design and construction of foundations will be strongly influenced by the presence of the existing fill materials and/or lake bottom soils, which are generally unsuitable for support of significant or settlement-sensitive structures. Because of the depth of the existing fill materials and lake bottom soils, the complete removal and replacement of these materials is not a practical option.

For significant or settlement-sensitive structures, some type of deep foundation system will be required. A deep foundation system would bypass the existing fill materials and lake bottom soils, and transfer the structural loads to the underlying dense natural soil or bedrock. Deep foundation options include driven steel H piles and drilled piers (concrete caissons). These two deep foundation options are discussed in subsequent sections of this report. Other types of deep foundations may be feasible, and may be considered as the project proceeds toward final design and construction.

More conventional spread footings may be considered for lightweight and settlement-tolerant structures.

Depending on floor loads and the sensitivity to settlement, options for ground-level floors include slabs on grade and structural floors.

All design and construction should satisfy the requirements of all applicable codes.

Seismic Site Class

With regard to the International Building Code, a Site Class of “D” should be applied to this project. This corresponds to a “Stiff soil profile.”

Driven Steel H Piles

Driven steel H piles are likely to represent an attractive foundation option, particularly north of Boring B-6.

Steel H piles should be driven, using a suitable hammer, to practical refusal in very dense glacial till or bedrock. A steel H pile should not be terminated with its tip in existing fill or lake bottom soil.

The piles may be designed for a maximum allowable axial stress of 35 percent of the yield strength, or 17,500 pounds per square inch, whichever is less.

Pile load capacities should be verified by the use of a pile-driving analyzer (PDA).

The minimum center-to-center spacing of piles should be 30 inches or 2.5 pile widths, whichever is greater. Exterior pile caps and grade beams should be seated at least 4 feet below final adjacent exterior grade.

Piles should be installed by a contractor experienced in this specialized work. Obstructions and other installation difficulties should be anticipated. All piles should be installed in such a way that they are not overstressed or otherwise damaged during installation.

Drilled Piers (Concrete Caissons)

Drilled piers are likely to represent an attractive foundation option, particularly south of Boring B-5.

Each drilled pier should be designed for a bearing pressure of 100,000 pounds per square foot or less, and should in no case be less than 2.5 feet in diameter.

Each drilled pier should bear directly on sound bedrock, below any severely weathered or fractured zones. The bearing surface below each pier should be relatively level, with a slope no steeper than 1 vertical on 10 horizontal. No loose, soft, wet, frozen, or otherwise unsuitable material should be left in place below a drilled pier.

It is anticipated that each drilled pier will be installed using conventional rotary drilling methods and temporary casings. Drilling difficulties should be expected. Dewatering may be necessary. All concrete should be placed in the dry, or by a suitable tremie method.

Exterior grade beams between drilled piers should be seated at least 4 feet below final adjacent exterior grade.

Footings

The use of conventional footings would be limited to lightweight and settlement-tolerant structures. Each structure should be addressed on an individual basis, and additional subsurface explorations and geotechnical evaluations are likely to be necessary.

The use of footings would be linked to: an increased emphasis on subgrade preparation and construction monitoring; the use of relatively low bearing pressures; the partial removal of existing fill materials below footings, and the replacement of that existing fill with new compacted fill; the stiffening of footing-wall systems; and an acknowledgment, on the part of the owner, that a shallow footing foundation system is likely to undergo more settlement than a deep foundation system.

Allowable bearing pressures are unlikely to exceed 1,500 pounds per square foot. The minimum respective widths of column and wall footings are unlikely to be less than 3 feet and 2 feet.

Footings should be seated at least 2 feet below the lowest adjacent final surface, and at least 4 feet below the lowest adjacent final surface exposed to freezing temperatures.

The imaginary slope between the bottom edges of any two footings should be no steeper than 1 vertical on 2 horizontal.

Any stepped wall footings should be stepped in vertical increments of 12 inches or less, and horizontal increments of 24 inches or more.

The potential effects of a footing on a nearby earth-retaining structure, and the related performance of that footing, should be considered.

Floor Slabs on Grade

For typically moderate floor loads and normal usage requirements, slab-on-grade floor construction is likely to be feasible. If unusually heavy floor loads are anticipated, however, or if the use of the floors would be unusually sensitive to settlement, structural floors should be considered. The structural floors would transfer their loads to a deep foundation system such as driven piles or drilled piers.

The use of floor slabs on grade would be linked to: an increased emphasis on subgrade preparation and construction monitoring; an acknowledgement that the partial removal of existing fill materials may be necessary; and an acknowledgment, on the part of the owner, that some settlement of the floor slab should be anticipated.

At least 6 inches of compacted granular fill should be placed beneath all floor slabs. Drained, unsaturated conditions should be maintained within the granular fill. Compacted common fill may be placed as required below the granular fill. Subgrades should be prepared, and fill should be placed and compacted, as described elsewhere in this report.

Floor slabs should be designed and constructed in accordance with ACI recommendations. It is also recommended that the design be based on a subgrade modulus (K) not exceeding 75 pounds per cubic inch.

Lateral Earth Pressures and Related Properties

For purposes of analysis and design, the existing fill and lake bottom soil may be assigned a moist or total unit weight of 120 pounds per cubic foot, a buoyant or submerged unit weight of 60 pounds per cubic foot, and an internal friction angle of 28 degrees. The active, at-rest, and passive coefficients of lateral earth pressure may be assigned respective values of 0.36, 0.53, and 2.77.

For purposes of analysis and design, compacted granular fill of sufficient lateral extent may be assigned a moist or total unit weight of 130 pounds per cubic foot, a buoyant or submerged unit weight of 70 pounds per cubic foot, and an internal friction angle of 35 degrees. The active, at-rest, and passive coefficients of lateral earth pressure may be assigned respective values of 0.27, 0.43, and 3.69. Compacted granular fill is discussed in a subsequent section of this report.

Surcharge loads should be considered.

It should be assumed that the groundwater level could be as high as the maximum anticipated level of Lake Ontario. Drained, unsaturated conditions should be maintained above the lake level. Any drainage system should be designed, constructed, and operated in such a way that disturbance or removal of subsurface soil does not occur.

Pavement

A practical pavement design is based on factors including subgrade quality, frost action, traffic loads, traffic frequency, design life, and the relative importance of initial costs versus future maintenance.

At this site, the subgrade quality for flexible pavement should be represented using a California Bearing Ratio (CBR) not exceeding 5.

For auto parking areas, the recommended minimum flexible pavement section consists of a 1-inch asphaltic top course, a 2-inch asphaltic binder course, and a 12-inch course of compacted granular fill.

For areas subjected to more frequent and/or heavier vehicles, the minimum combined thickness of asphaltic top and binder courses should be increased to 5 inches. The minimum thickness of the granular subbase should be increased to 16 inches.

The subgrade quality for rigid pavement should be represented using a subgrade modulus (K) not exceeding 75 pounds per cubic inch. The rigid section should consist of reinforced concrete, and should be at least 6 inches thick. At least 12 inches of compacted granular fill should be placed below the slab.

For all pavement sections, compacted common fill may be placed as required below the granular fill.

No existing pavement, topsoil, organic matter, or other unsuitable materials should be left in place. Subgrades should be prepared, and fill should be placed and compacted, as described elsewhere in this report.

Drained, unsaturated conditions should be maintained within all pavement sections. Surface water should be conducted away from paved areas and structures.

The project designers may wish to consider pavement thicknesses more or less conservative than those presented, depending on the traffic and cost factors described above.

Excavation and Construction Dewatering

Excavation should be performed in accordance with all applicable local, state, and federal requirements. The sides of all excavations should be sloped or supported as required by safety regulations. Existing structures, utilities, and other property should be protected.

With regard to the current OSHA regulations, Type C soil should be assumed. This would apply to materials above the water level, or to materials that have been adequately dewatered.

To minimize subgrade disturbance, excavation should be performed with increasing care as subgrade levels are approached.

All excavation, fill placement, and foundation construction should be performed in the dry. In addition, any dewatering should be sufficient to permit suitable preparation of the subgrade and compaction of any subsequent fill materials.

The contractor should be prepared to dewater as necessary, and should choose and employ an appropriate type of dewatering system. Any dewatering system should be operated in such a way that disturbance or removal of the subgrade soil does not occur.

Because of the anticipated difficulty associated with dewatering below lake levels, deep excavations should generally be avoided or minimized.

Preparation of Soil Subgrades

It is cautioned that the soils at this site contain fine-grained material, and that they will be sensitive to disturbance. Subgrades should be kept free of water, subjected to a minimum amount of construction traffic, exposed no longer than necessary, and not permitted to freeze.

Subgrades should be carefully prepared and thoroughly examined by qualified personnel. Subgrades should also be tamped using vibratory equipment, to the greatest extent possible without loosening or softening the subgrade soils. Where space permits, subgrades should also be proofrolled using a fully-loaded ten-wheel dump truck or full-size (ten-ton or larger) roller.

No new fill or foundation concrete should be placed over material that is loose, soft, wet, frozen, organic, or otherwise unsuitable with respect to the design recommendations.

Fill and Backfill

Granular fill should consist of a durable sand and gravel or crusher-run stone, free of any organic matter. The plasticity index should be less than 5. Granular fill should have 100 percent finer than 3 inches, 20 to 60 percent finer than the Number 4 sieve, and no more than 10 percent finer than the Number 200 sieve.

Granular fill could also be specified as meeting the NYSDOT requirements for Subbase Course; 304-2.02; Type 1, 2, or 4.

Common fill should consist of durable soil material, free of any organic matter. The plasticity index should be less than 15. Common fill should have 100 percent finer than 6 inches, at least 90 percent finer than 3 inches, and at least 20 percent finer than the Number 4 sieve.

Some of the inorganic on-site is likely to satisfy the material requirements for common fill. Little or none of the on-site soil, however, is likely to satisfy the material requirements for granular fill. It should also be noted that granular fill meets all of the requirements of common fill, and that granular fill can generally be placed and compacted with less difficulty.

All load-bearing fill should be compacted, in lifts of 9 inches or less, to at least 95 percent of the maximum dry density determined by ASTM D 1557.

CLOSING COMMENTS AND RECOMMENDATIONS

Professional services for this investigation were performed in accordance with generally accepted geotechnical engineering practices, exclusively for the subject project. No warranty, expressed or implied, is made.

Subsurface conditions are inferred from the logs of subsurface explorations. Conditions between, beyond, and below these explorations are likely to vary. It should also be noted that subsurface conditions are often described on the basis of visual examinations of recovered samples, that these visual descriptions may not always agree well with descriptions made on the basis of laboratory tests, and that the distinction between fill and naturally-deposited soil can not always be readily determined on the basis of recovered samples. If subsurface conditions are subsequently revealed that appear to be significantly different or less favorable than those described, we should be given the opportunity to revise the statements in this report.

As previously noted, this report has been based on a limited number of widely spaced subsurface explorations. Also, specific information regarding the proposed construction is not yet known. As more information becomes available, and as the project proceeds toward final design and construction, additional subsurface explorations and geotechnical evaluations should be considered. It may be appropriate to address individual buildings, for example, on an individual basis. The need for such additional explorations and evaluations should be determined by a geotechnical engineer. The discussions in this report can be refined, expanded, and presented in one or more design-level reports.

Designers and contractors are advised that this report may not contain sufficient information for bidding. Contractors should visit the site, review this report and the related boring logs, and evaluate potential construction difficulties on the basis of their own knowledge and experience.

It is recommended that qualified personnel be retained to review the geotechnical portions of contract drawings and specifications, and to provide monitoring services during construction.

If you have questions or comments regarding this report, please contact the undersigned.

Yours truly,

RAVI ENGINEERING & LAND SURVEYING, P.C.

Nagappa Ravindra, P.E.
President

FOR

Ray M. Teeter, P.E.
Geotechnical Engineer

Attachments: Table 1 – Selected Subsurface Information
Appendix B – Test Boring Location Plan
Appendix B – Test Boring Logs

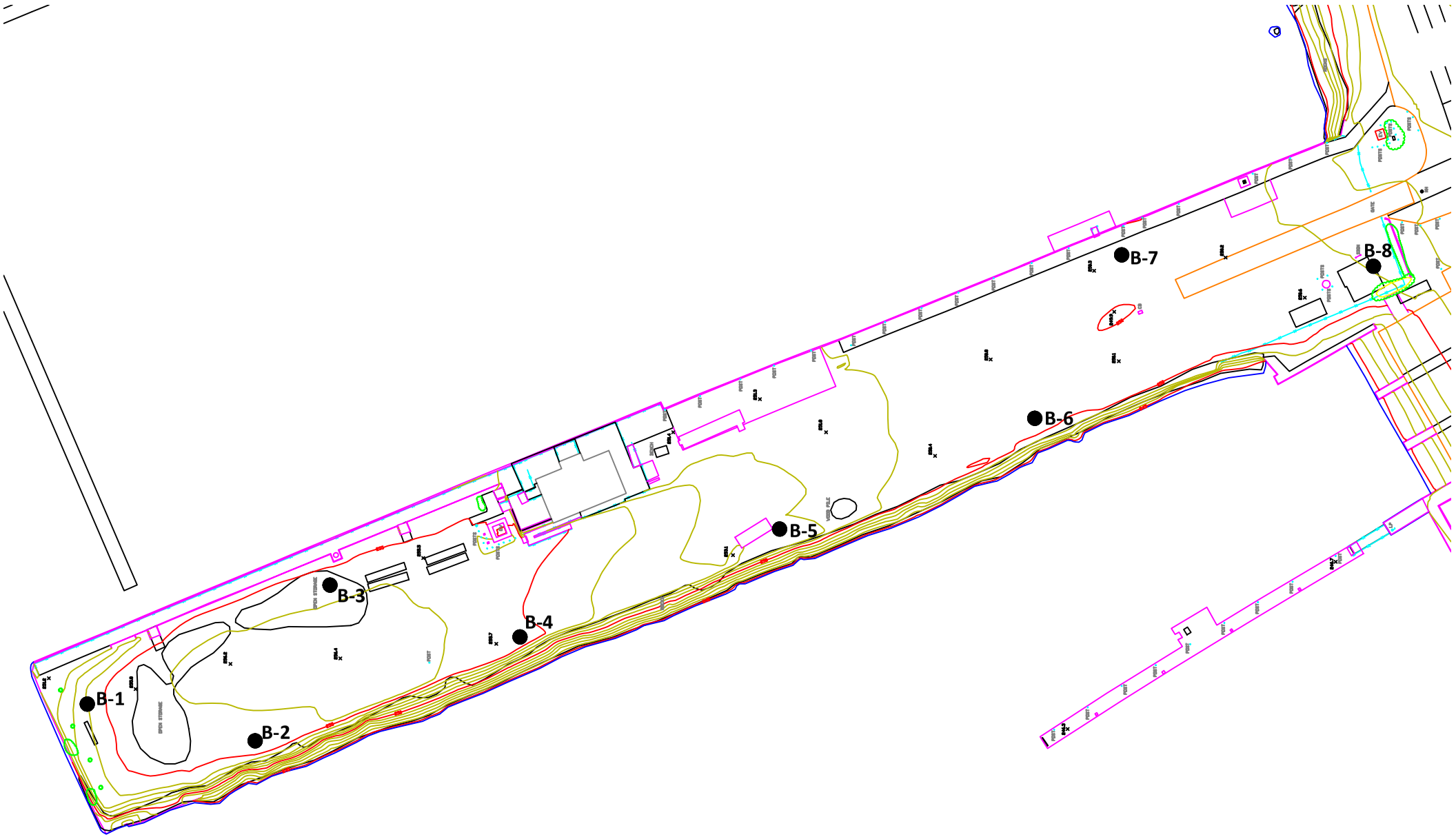
Table 1
Selected Subsurface Information
West Side Coal Pier
Oswego, New York

Test Boring Number	Approx Ground Surface Elevation	Bottom of Fill and/or Lake Bottom Soil		Top of Bedrock/Refusal	
		Approx Depth	Approx Elevation	Approx Depth	Approx Elevation
B-1	254	39	215	50	204
B-2	255	35	220	---	---
B-3	255	45	210	49	206
B-4	255	41	214	42	213
B-5	252	30	222	38	214
B-6	250	19	231	19	231
B-7	250	16	234	16	234
B-8	251	7	244	7	244

Note: All elevations and depths are in feet, and are approximate. Elevations and depths at other locations will vary. See accompanying report and boring logs for additional information.

Appendix A

Test Boring Location Plan



OSWEGO CANAL CORRIDOR
BROWNFIELD OPPORTUNITY AREA
CITY OF OSWEGO, NEW YORK
WEST SIDE COAL PIER

TEST BORING LOCATION PLAN PREPARED BY:
RAVI ENGINEERING & LAND SURVEYING, P.C.

TOPOGRAPHIC MAP PROVIDED BY:
ROBERT JOHNSON, CITY OF OSWEGO

40 0 40 80 120
SCALE (FEET)

TEST BORING LOCATION PLAN
WEST SIDE COAL PIER
OSWEGO, NEW YORK

N

NOTE: ALL LOCATIONS ARE APPROXIMATE.
TEST BORINGS WERE TAKEN BETWEEN AUGUST 7 AND AUGUST 10, 2017.

Appendix B

Test Boring Logs

NOTHNAGLE *DRILLING*, INC.
1821 Scottsville-Mumford Road
Scottsville, New York 14546
Phone (585) 538-2328
Fax (585) 538-2357

Test Boring No. B-1
Page 1 of 2
ND Job # 175056

Project Subsurface Investigation, West Side Coal Pier, Oswego, New York
Client Ravi Engineering & Land Surveying, P.C., 2110 South Clinton Avenue, Suite 1, Rochester, New York 14618
Elevation _____ Start 8/7/17 Completed 8/7/17 Driller N. Short
Water Level - During Drilling 9'0" Inspector _____
Water Level - At Completion 10'6", cave in 12'0"
Seasonal and climatic changes may alter observed water levels.

	C	Blows on Sampler 0"/6"	6"/12"	12"/18"	18"/24"	Sample N	Rec.	No.	Depth	Visual Soil and Rock Information Remarks	
0		1	3							Topsoil	0'3"
				5	6	8	18"	1	0'0"-2'0"	Loose brown-black damp coarse to fine sand and coarse to fine gravel, some coal fragments (fill)	
5		3	5							Loose brown-black damp	
				5	5	10	13"	2	4'0"-6'0"		
10		1	2							Loose brown-black wet	10'6"
				1	2	3	12"	3	9'0"-11'0"	Loose brown wet coarse to fine sand and silt, some coarse to fine gravel	
										(based on blow counts)	14'0"
15		1	5							No recovery sample No. 4	
				6	2	11	0"	4	14'0"-16'0"		
20		1	4							Loose gray saturated coarse to fine sand and coarse to fine gravel, little silt	
				6	6	10	12"	5	19'0"-21'0"		24'0"
25		WR	WH							Loose gray saturated fine sand and silt	
				WH	1	WH	15"	6	24'0"-26'0"		
30		2	6								29'0"
				7	7	13	24"	7	29'0"31'0"	Firm gray saturated medium to fine sand, trace silt	
35		3	8							Firm gray saturated	
				11	11	19	24"	8	34'0"-36'0"		
											39'0"
40		20	26							Very dense gray wet medium to fine	

N=No. of Blows to Drive 2" Spoon 12" with 140 lb. Wt. 30" Ea. Blow
C=No. of Blows to Drive__ Casing___with___ lb. Wt.___ Ea. Blow
Transitional Depths are Estimated Based on Field Observations

NOTHNAGLE *DRILLING*, INC.
1821 Scottsville-Mumford Road
Scottsville, New York 14546
Phone (585) 538-2328
Fax (585) 538-2357

Test Boring No. B-1
Page 2 of 2
ND Job # 175056

Project Subsurface Investigation, West Side Coal Pier, Oswego, New York
Client Ravi Engineering & Land Surveying, P.C., 2110 South Clinton Avenue, Suite 1, Rochester, New York 14618
Elevation _____ Start 8/7/17 Completed 8/7/17 Driller N. Short
Water Level - During Drilling 9'0" Inspector _____
Water Level - At Completion 10'6", cave in 12'0"
Seasonal and climatic changes may alter observed water levels.

	C	Blows on Sampler 0"/6"	6"/12"	12"/18"	18"/24"	Sample N	Rec.	No.	Depth	Visual Soil and Rock Information Remarks
				37	50/4	63	22"	9	39'0"-40'10"	sand and silt, some coarse to fine gravel
										Very dense gray wet
45		47	50/5			50/5	11"	10	44'0"-44'11"	
										Very dense gray wet
50		50/5				50/5	5"	11	49'0"-49'5"	Advanced augers to refusal 49'6"
55										
60										Boring terminated at 49'6" Advanced test boring with hollow stem auger casing. Boring cave in 12'0". 12" diameter x 12' deep hole backfilled with #2 crushed stone.
65										
70										
75										
80										

N=No. of Blows to Drive 2" Spoon 12" with 140 lb. Wt. 30" Ea. Blow
C=No. of Blows to Drive__ Casing___with___ lb. Wt.___ Ea. Blow
Transitional Depths are Estimated Based on Field Observations

NOTHNAGLE *DRILLING*, INC.
1821 Scottsville-Mumford Road
Scottsville, New York 14546
Phone (585) 538-2328
Fax (585) 538-2357

Test Boring No. B-2
Page 1 of 1
ND Job # 175056

Project Subsurface Investigation, West Side Coal Pier, Oswego, New York
Client Ravi Engineering & Land Surveying, P.C., 2110 South Clinton Avenue, Suite 1, Rochester, New York 14618
Elevation _____ Start 8/8/17 Completed 8/8/17 Driller N. Short
Water Level - During Drilling 10'0" Inspector _____
Water Level - At Completion 11'6", cave in 6'0"
Seasonal and climatic changes may alter observed water levels.

	C	Blows on Sampler 0"/6"	6"/12"	12"/18"	18"/24"	Sample N	Rec.	No.	Depth	Visual Soil and Rock Information Remarks
0		8	9							Firm brown damp coarse to fine sand and coarse to fine gravel, little silt (fill)
				7	5	16	3"	1	0'0"-2'0"	
5		5	8							Firm brown damp
				7	7	15	2"	2	5'0"-7'0"	
10		2	3							Firm brown saturated
				11	5	14	12"	3	10'0"-12'0"	
15		2	3							Firm gray saturated
				11	12	14	13"	4	15'0"-17'0"	
20		36	12							Firm gray saturated
				12	8	24	7"	5	20'0"-22'0"	
25		3	2							Loose gray saturated
				2	1	4	12"	6	25'0"-27'0"	
30										30'0"
		23	11							Compact gray saturated coarse to fine sand and wood, some coarse gravel (fill)
				24	50/5	35	8"	7	30'0"-31'11"	
35										35'0"
		50/4				50/4	4"	8	35'0"-35'4"	Very dense gray wet medium to fine sand and silt, some coarse to fine gravel 35'4"
40										Boring terminated at 35'4" Advanced test boring with hollow stem auger casing.

N=No. of Blows to Drive 2" Spoon 12" with 140 lb. Wt. 30" Ea. Blow
C=No. of Blows to Drive__ Casing___with___ lb. Wt.___ Ea. Blow
Transitional Depths are Estimated Based on Field Observations

Boring cave in 6'0". 48" diameter x 6' deep hole backfilled with #2 crushed stone.

NOTHNAGLE *DRILLING*, INC.
1821 Scottsville-Mumford Road
Scottsville, New York 14546
Phone (585) 538-2328
Fax (585) 538-2357

Test Boring No. B-3
Page 1 of 2
ND Job # 175056

Project Subsurface Investigation, West Side Coal Pier, Oswego, New York
Client Ravi Engineering & Land Surveying, P.C., 2110 South Clinton Avenue, Suite 1, Rochester, New York 14618
Elevation _____ Start 8/8/17 Completed 8/8/17 Driller N. Short
Water Level - During Drilling 10'0" Inspector _____
Water Level - At Completion 11'4", cave in 9'0"
Seasonal and climatic changes may alter observed water levels.

	C	Blows on Sampler 0"/6"	6"/12"	12"/18"	18"/24"	Sample N	Rec.	No.	Depth	Visual Soil and Rock Information Remarks	
0		1	3							Topsoil	0'2"
				4	4	7	8"	1	0'0"-2'0"	Loose black damp coarse to fine sand and cinders (fill)	
5		3	3							Very dense black-brown damp (and concrete, some wood)	
				50/5		53/11	10"	2	5'0"-6'5"		
10											10'0"
		3	14							Compact black-brown-gray saturated coarse to fine gravel, some cinders (fill)	
				21	15	35	6"	3	10'0"-12'0"		
15		3	7							Firm black-gray saturated	
				7	3	14	7"	4	15'0"-17'0"		
20		3	5							Firm black-gray saturated (trace cinders)	
				7	15	12	8"	5	20'0"-22'0"		
25		3	3							Firm black-gray saturated (no cinders noted)	
				13	15	16	7"	6	25'0"-27'0"		
30		8	8							Firm gray saturated (some wood)	30'6"
				10	10	18	20"	7	30'0"-32'0"	Firm gray saturated medium to fine sand, trace silt (fill)	
35		9	10							Poor recovery sample No. 8 (wood)	
				10	13	20	4"	8	35'0"-37'0"		
40											40'0"

N=No. of Blows to Drive 2" Spoon 12" with 140 lb. Wt. 30" Ea. Blow
C=No. of Blows to Drive__ Casing___with___ lb. Wt.___ Ea. Blow
Transitional Depths are Estimated Based on Field Observations

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Scottsville, New York 14546
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Fax (585) 538-2357

Test Boring No. B-3
Page 2 of 2
ND Job # 175056

Project Subsurface Investigation, West Side Coal Pier, Oswego, New York
Client Ravi Engineering & Land Surveying, P.C., 2110 South Clinton Avenue, Suite 1, Rochester, New York 14618
Elevation _____ Start 8/8/17 Completed 8/8/17 Driller N. Short
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	C	Blows on Sampler 0"/6"	6"/12"	12"/18"	18"/24"	Sample N	Rec.	No.	Depth	Visual Soil and Rock Information Remarks
		8	8							Firm gray saturated coarse to fine sand and coarse to fine gravel
				12	12	20	14"	9	40'0"-42'0"	
45										45'0"
		13	50/5			50/5	11"	10	45'0"-45'11"	Very dense gray wet fine sand and silt, some coarse to fine gravel
										Advanced augers to refusal 48'6"
50									RUN #1 48'6"-58'6" REC 117" RQD 89.2%	Medium hard gray-green sandstone mildly fractured horizontally
55										
										58'6"
60										
65										Boring terminated at 58'6" Advanced test boring with hollow stem auger casing. Cored with NQ core barrel and diamond bit. Boring cave in 9'0". 60" diameter x 9' deep hole backfilled with #2 crushed stone.
70										
75										
80										

N=No. of Blows to Drive 2" Spoon 12" with 140 lb. Wt. 30" Ea. Blow
C=No. of Blows to Drive__ Casing___with___ lb. Wt.___ Ea. Blow
Transitional Depths are Estimated Based on Field Observations

NOTHNAGLE *DRILLING*, INC.
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Test Boring No. B-4
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ND Job # 175056

Project Subsurface Investigation, West Side Coal Pier, Oswego, New York
Client Ravi Engineering & Land Surveying, P.C., 2110 South Clinton Avenue, Suite 1, Rochester, New York 14618
Elevation _____ Start 8/9/17 Completed 8/9/17 Driller N. Short
Water Level - During Drilling 10'0" Inspector _____
Water Level - At Completion 10'7", cave in 9'0"
Seasonal and climatic changes may alter observed water levels.

	C	Blows on Sampler 0"/6"	6"/12"	12"/18"	18"/24"	Sample N	Rec.	No.	Depth	Visual Soil and Rock Information Remarks	
0		2	3							Topsoil	0'3"
				3	2	6	18"	1	0'0"-2'0"	Loose black damp coarse to fine sand and cinders (fill)	
5											
		1	WH							No recovery sample No. 2	
				WH	WH	WH	0"	2	5'0"-7'0"		
10											
		4	5							Loose red saturated crushed stone (fill)	
				5	3	10	8"	3	10'0"-12'0"		
15											
		5	35							Compact brown-gray saturated wood and	
				5	5	40	7"	4	15'0"-17'0"	coarse to fine gravel (fill)	
20											
		7	7							Loose gray saturated fine sand and silt, some	
				2	2	9	5"	5	20'0"-22'0"	wood (fill)	
25											
		1	1							Loose gray saturated (no wood noted) (fill)	
				2	7	3	6"	6	25'0"-27'0"		
30											30'0"
		3	3							Firm gray saturated coarse to fine sand	
				9	10	12	6"	7	30'0"-32'0"		
35											35'0"
		10	11							Firm gray wet coarse to fine sand and coarse	
				14	15	25	12"	8	35'0"-37'0"	to fine gravel, some silt	
40											

N=No. of Blows to Drive 2" Spoon 12" with 140 lb. Wt. 30" Ea. Blow
C=No. of Blows to Drive__ Casing___with___ lb. Wt.___ Ea. Blow
Transitional Depths are Estimated Based on Field Observations

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Test Boring No. B-4
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ND Job # 175056

Project Subsurface Investigation, West Side Coal Pier, Oswego, New York
Client Ravi Engineering & Land Surveying, P.C., 2110 South Clinton Avenue, Suite 1, Rochester, New York 14618
Elevation _____ Start 8/9/17 Completed 8/9/17 Driller N. Short
Water Level - During Drilling 10'0" Inspector _____
Water Level - At Completion 10'7", cave in 9'0"
Seasonal and climatic changes may alter observed water levels.

	C	Blows on Sampler 0"/6"	6"/12"	12"/18"	18"/24"	Sample N	Rec.	No.	Depth	Visual Soil and Rock Information Remarks
		3	4							Very dense gray wet
				50/3		54/3	7"	9	40'0"-41'3"	Advanced augers to refusal 41'6"
40										
45										
50										Boring terminated at 41'6" Advanced test boring with hollow stem auger casing. Boring cave in 9'0". 36" diameter x 9' deep hole backfilled with #2 crushed stone.
55										
60										
65										
70										
75										
80										

N=No. of Blows to Drive 2" Spoon 12" with 140 lb. Wt. 30" Ea. Blow
C=No. of Blows to Drive__ Casing___with___ lb. Wt.___ Ea. Blow
Transitional Depths are Estimated Based on Field Observations

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Project Subsurface Investigation, West Side Coal Pier, Oswego, New York
Client Ravi Engineering & Land Surveying, P.C., 2110 South Clinton Avenue, Suite 1, Rochester, New York 14618
Elevation ____ Start 8/9/17 Completed 8/9/17 Driller N. Short
Water Level - During Drilling 5'0" Inspector ____
Water Level - At Completion 5'0", cave in 5'0"
Seasonal and climatic changes may alter observed water levels.

	C	Blows on Sampler 0"/6"	6"/12"	12"/18"	18"/24"	Sample N	Rec.	No.	Depth	Visual Soil and Rock Information Remarks	
0		1	4							Topsoil	0'3"
				4	4	8	18"	1	0'0"-2'0"	Loose black damp coarse to fine sand and coarse to fine gravel, some cinders (fill)	
5		4	8							Firm red saturated crushed stone (fill)	
				5	4	13	14"	2	5'0"-7'0"		
10		6	10							Firm red-gray saturated	
				1	6	11	6"	3	10'0"-12'0"		
15		16	39							Dense gray saturated coarse to fine gravel and wood (fill)	
				4	4	43	8"	4	15'0"-17'0"		
20		7	15							Firm gray saturated (little wood)	
				6	6	21	12"	5	20'0"-22'0"		
25		23	30								25'0"
				16	29	46	15"	6	25'0"-27'0"	Dense gray wet coarse to fine sand and coarse to fine gravel, some silt	
30		36	50/5			50/5	10"	7	30'0"-30'11"		30'0"
35		28	37							Very dense brown wet medium to fine sand and silt	35'0"
				36	30	73	13"	8	35'0"-37'0"	Very dense gray wet fine sand and silt, some coarse to fine gravel	
										Advanced augers to refusal	37'8"
									RUN #1		
40									37'8"-47'8"		

N=No. of Blows to Drive 2" Spoon 12" with 140 lb. Wt. 30" Ea. Blow
C=No. of Blows to Drive__ Casing___with___ lb. Wt.___ Ea. Blow
Transitional Depths are Estimated Based on Field Observations

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ND Job # 175056

Project Subsurface Investigation, West Side Coal Pier, Oswego, New York
Client Ravi Engineering & Land Surveying, P.C., 2110 South Clinton Avenue, Suite 1, Rochester, New York 14618
Elevation _____ Start 8/9/17 Completed 8/9/17 Driller N. Short
Water Level - During Drilling 5'0" Inspector _____
Water Level - At Completion 5'0", cave in 5'0"
Seasonal and climatic changes may alter observed water levels.

	C	Blows on Sampler 0"/6"	6"/12"	12"/18"	18"/24"	Sample N	Rec.	No.	Depth	Visual Soil and Rock Information Remarks
40									REC 98" RQD 49.2%	Medium hard gray-green sandstone moderately fractured horizontally (highly fractured horizontally and at low angles 38'6"-39'8" and 41'2"-41'7")
45										
										47'8"
50										
55										Boring terminated at 47'8" Advanced test boring with hollow stem auger casing. Cored with NQ core barrel and diamond bit. Boring cave in 5'0". 96" diameter x 5' deep hole backfilled with #2 crushed stone.
60										
65										
70										
75										
80										

N=No. of Blows to Drive 2" Spoon 12" with 140 lb. Wt. 30" Ea. Blow
C=No. of Blows to Drive__ Casing___with___ lb. Wt.___ Ea. Blow
Transitional Depths are Estimated Based on Field Observations

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Project Subsurface Investigation, West Side Coal Pier, Oswego, New York
Client Ravi Engineering & Land Surveying, P.C., 2110 South Clinton Avenue, Suite 1, Rochester, New York 14618
Elevation _____ Start 8/10/17 Completed 8/10/17 Driller N. Short
Water Level - During Drilling 5'0" Inspector _____
Water Level - At Completion 5'0", cave in 5'0"
Seasonal and climatic changes may alter observed water levels.

	C	Blows on Sampler 0"/6"	6"/12"	12"/18"	18"/24"	Sample N	Rec.	No.	Depth	Visual Soil and Rock Information Remarks
0		4	5							Topsoil 0'3"
				8	6	13	12"	1	0'0"-2'0"	Firm brown-black damp coarse to fine sand and coarse to fine gravel, some cinders (fill)
5		5	5							Firm brown-black saturated (some wood)
				7	40	12	8"	2	5'0"-7'0"	
10		5	6							Loose brown-black saturated (little wood)
				2	2	8	8"	3	10'0"-12'0"	
15		1	7							15'0"
				50/2"		57/8	6"	4	15'0"-16'2"	Very dense gray saturated coarse to fine sand and silt, some coarse to fine gravel, trace wood (fill)
										Advanced augers to refusal 18'10"
20									RUN #1 18'10"-28'10" REC 116" RQD 71.7%	Medium hard gray-green sandstone moderately fractured horizontally (highly fractured seam 27'9-28'2")
25										28'10"
30										Boring terminated at 28'10" Advanced test boring with hollow stem auger casing. Boring cave in 5'0". 96" diameter x 5' deep hole backfilled with #2 crushed stone.
35										
40										

N=No. of Blows to Drive 2" Spoon 12" with 140 lb. Wt. 30" Ea. Blow
C=No. of Blows to Drive__ Casing___with___ lb. Wt.___ Ea. Blow
Transitional Depths are Estimated Based on Field Observations

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Project Subsurface Investigation, West Side Coal Pier, Oswego, New York
Client Ravi Engineering & Land Surveying, P.C., 2110 South Clinton Avenue, Suite 1, Rochester, New York 14618
Elevation _____ Start 8/10/17 Completed 8/10/17 Driller N. Short
Water Level - During Drilling 5'0" Inspector _____
Water Level - At Completion 4'0", cave in 4'0"
Seasonal and climatic changes may alter observed water levels.

	C	Blows on Sampler 0"/6"	6"/12"	12"/18"	18"/24"	Sample N	Rec.	No.	Depth	Visual Soil and Rock Information Remarks
0		6	6							Compact brown damp coarse to fine sand and
				28	12	34	7"	1	0'0"-2'0"	coarse to fine gravel, some cinders (fill)
5		3	3							Loose brown-black saturated (some wood)
				2	2	5	3"	2	5'0"-7'0"	
10		21	11							Firm brown saturated (no cinders or wood noted)
				6	4	17	6"	3	10'0"-12'0"	
15		25	9							Very dense brown saturated (some wood)
				50/4		59/10	8"	4	15'0"-15'4"	Advanced augers to refusal 15'6"
20										Boring terminated at 15'6"
25										Advanced test boring with hollow stem auger casing.
30										Boring cave in 4'0". 18" diameter x 4' deep hole backfilled with #2 crushed stone.
35										
40										

N=No. of Blows to Drive 2" Spoon 12" with 140 lb. Wt. 30" Ea. Blow
C=No. of Blows to Drive__ Casing___with___ lb. Wt.___ Ea. Blow
Transitional Depths are Estimated Based on Field Observations

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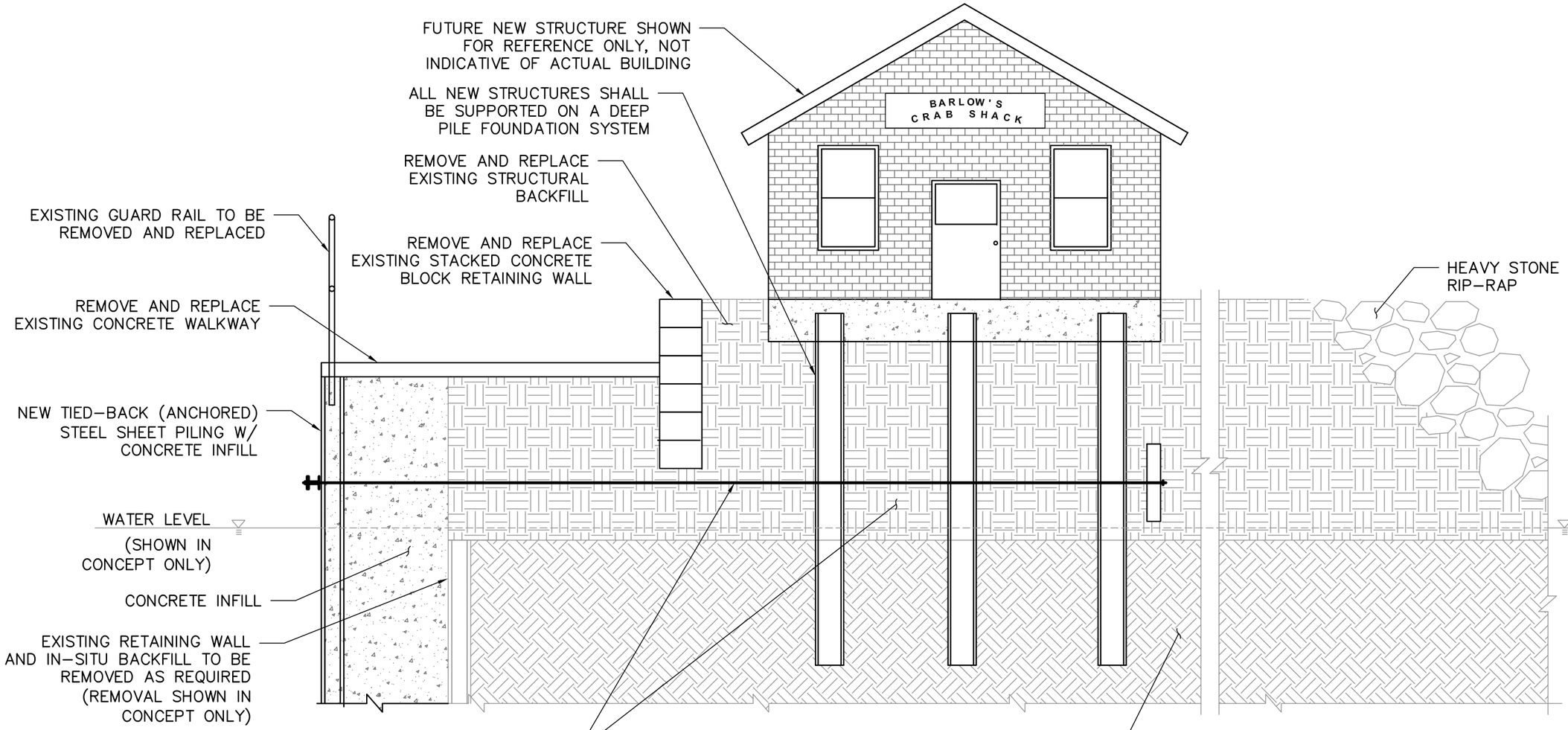
Project Subsurface Investigation, West Side Coal Pier, Oswego, New York
Client Ravi Engineering & Land Surveying, P.C., 2110 South Clinton Avenue, Suite 1, Rochester, New York 14618
Elevation _____ Start 8/10/17 Completed 8/10/17 Driller N. Short
Water Level - During Drilling 5'0" Inspector _____
Water Level - At Completion 4'0", cave in 4'0"
Seasonal and climatic changes may alter observed water levels.

0	C	Blows on Sampler 0"/6"	6"/12"	12"/18"	18"/24"	Sample N	Rec.	No.	Depth	Visual Soil and Rock Information Remarks
		2	5							Firm brown-black damp coarse to fine sand and
				8	10	13	15"	1	0'0"-2'0"	coarse to fine gravel, some brick, little cinders (fill)
5		2	5							Firm brown-red saturated (no cinders)
				7	50/3	12	7"	2	5'0"-6'9"	Advanced augers to refusal 7'2"
10										
15										Boring terminated at 7'2" Advanced test boring with hollow stem auger casing. Boring cave in 4'0". 18" diameter x 4' deep hole backfilled with #2 crushed stone.
20										
25										
30										
35										
40										

N=No. of Blows to Drive 2" Spoon 12" with 140 lb. Wt. 30" Ea. Blow
C=No. of Blows to Drive__ Casing___with___ lb. Wt.___ Ea. Blow
Transitional Depths are Estimated Based on Field Observations



POTENTIAL REPLACEMENT/REDEVELOPMENT CONCEPT

NOT TO SCALE

OSWEGO CANAL CORRIDOR
BROWNFIELD OPPORTUNITY AREA
STEP III IMPLEMENTATION STRATEGY
CITY OF OSWEGO, NEW YORK

PROJECT NO: 40-16-175
DATE: MAY 2017
SCALE: AS NOTED
DRAWING NO: SK-2

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