Exhibit F



Report

Geotechnical Study Port of Cleveland Rail Expansion

Parsons Brinckerhoff 230 West Monroe Street, Suite 900 Chicago, IL 60606

> September 15, 2011 NTH Project No. 86-101394-00





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Mr. Richard Juvinall Senior Engineering Manager Parsons Brinckerhoff 230 West Monroe Street, Suite 900 Chicago, IL 60606 September 15, 2011 NTH Project No. 86-101394-00

RE: Report on Geotechnical Investigation Cleveland-Cuyahoga County Port Rail Expansion Project Cleveland, Ohio

Dear Mr. Juvinall:

NTH Consultants is pleased to submit this report for the geotechnical investigation performed at the site of the proposed Cleveland-Cuyahoga County Port Rail Expansion project in Cleveland, Ohio. We appreciate this opportunity to be of service to you. If you have any questions or require additional information, please call.

Sincerely,

NTH Consultants, Ltd.

Si E Mahl

Brian E. Meluch, P.E. Assistant Project Engineer

Davidh. Mart, P.E.

David G. Mast, P.E. Vice President

BEM/DGM/alh

Attachment

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1.0 BACKGROUND

The Port of Cleveland project site is located in Cleveland, Ohio, on the north side of Front Street, between the Cuyahoga River and West 3rd Street. The site is bounded by Lake Erie on the north, the Cuyahoga River on the west, West 3rd Street on the east, and existing railroad tracks on the south. The property is actively used by the Cleveland-Cuyahoga County Port Authority. The site is generally flat with concrete paved roads, asphalt paved laydown and parking areas, and gravel-covered laydown areas.

NTH understands that the Cleveland-Cuyahoga County Port Authority plans to expand railroad infrastructure at the Port of Cleveland. The proposed site improvements include bridge and roadway construction associated with the rail improvements. The bridge is designated as Structure No. 1, and it will be a 26-foot long, single-span plate-girder bridge with abutments bearing on piles. Structure No. 1 will be built between an existing silo structure and the Cuyahoga River bulkhead wall. Two other structures, Structure Nos. 2 and 3, will support the new rail elements over existing utilities. Structure No. 2 will be located where West 9th Street meets Dock 22, and Structure No. 3 will be located on the east side of the site near the proposed road and railway connections. At this time, we understand that Parsons Brinckerhoff (PB) is evaluating both a reinforced concrete structural slab-on-grade with turned-down edges, and a protective casing (culvert-type system) over the existing utilities. Both options will be designed to support rail and cargo-carrying truck traffic over the utilities.

In addition to the proposed structures, the project includes construction of approximately 4,500 feet of new railway and 2,000 feet of new roadway. Both the proposed railway and roadway will connect to existing infrastructure on the east side of the site.

2.0 GEOLOGIC SETTING

According to the "Physiographic Regions of Ohio," published by the Ohio Department of Natural Resources (ODNR), the project area is located in a geologic region referred to as the Erie Lake Plain, on the Portage Escarpment. The project site is located at the northern boundary of the Erie Lake Plain physiographic region. The site is located north of the glacial boundary line, indicating that the site was covered by soil, rock, and ice which were affected by glacial movements and deposits during the most recent glacial advance. The Erie Lake Plain is characterized by the ODNR as follows: "Edge of very low relief (10'), Ice-Age lake basin separated from modern Lake Erie by Shoreline cliffs; major streams in deep gorges; elevation 570-800 feet."

"Pleistocene-age lacustrine sand, silt, clay, and wave-planed till over Devonian- and Mississippianaged shales and sandstones."

In general, the Physiographic Map indicates that the site is characterized by flat glacially deposited moraine soils. The Glacial Map of Ohio, a separate ODNR publication, also indicates that the site is generally characterized by lake deposit soils, consisting of primarily fine-grained clay and silt-size sediments.

3.0 HISTORICAL DATA

At the start of the project, NTH received a geotechnical exploration report for a 1991 geotechnical investigation, drawings of existing Port of Cleveland facilities, and bulkhead construction plans. The historic information provided to NTH is included in Appendix B.

3.1 Previous Geotechnical Explorations

NTH was provided with a 1991 David Lewin Corp. geotechnical investigation report, which included discussion of several historical borings and which was prepared for URS Consultants and the Cleveland Port Authority. This report (designated as project number C. 4533) summarizes eighteen (18) test borings performed in 1989 and 1990, as well as other investigations performed at the Port of Cleveland. The General Site Plan shows a total of 96 test borings performed, including eighteen (18) L-series borings performed for the 1991 report and thirty (30) B-series test borings performed for David V. Lewin Corporation in 1977 and 1978 (Lewin Project Nos. C. 3033 and 3033A). NTH was not provided with test boring logs for the other forty-eight (48) test borings shown on the 1991 report's General Site Plan.

The 1991 report states, "The subsurface stratification on the site is typically seen as man-deposited heterogeneous fill underlain by relatively thin deposits of sand and/or silt which are in turn underlain by silty clay." The report also states that shale bedrock was generally encountered between elevations 440 and 445, with one location as high as elevation 467 and another location as low as elevation 429.

NTH utilized the historic test borings information during the preparation of our proposal and boring layout.

3.2 Port of Cleveland Historic Drawings

The Port of Cleveland also provided NTH with historic facilities drawings. These historic drawings show general views of the Port of Cleveland facilities, including docks 24 to 32, warehouse facilities, rail lines, and water and electric utilities.

3.3 River Bulkhead and Infrastructure Improvements 1997 Plans

NTH was provided with a 1997 set of construction documents prepared by Finkbeiner, Pettis, and Stout, Inc. (FPS) for river bulkhead improvements. The plans show existing utilities and the approximate location of the river bulkhead tieback anchors.

4.0 FIELD INVESTIGATION

The current geotechnical investigation field work was conducted from August 11 to 23, 2011. A total of thirteen (13) test borings were drilled. Prior to the start of field explorations, test borings were located in the field by an NTH engineer based upon preliminary layout, utility clearance, and site accessibility. The test borings were performed by our drilling subcontractors, Northcoast Drilling Inc. and Ohio TestBor Inc., under the full-time oversight of our engineering staff. As-drilled test boring locations are shown on the Test Boring Location Plan, Figure No. 1 in Appendix A.

4.1 Soil Sampling

Soil samples were obtained using a standard split spoon sampler in accordance with the Standard Penetration Test (SPT) method. The SPT method (ASTM D1586) consists of driving a two-inch outside diameter split-barrel sampler into the soil with a 140-pound weight falling freely through a distance of 30 inches. The sampler is generally driven three successive six-inch increments, with the number of blows for each increment being recorded. The number of blows required to advance the sampler the last 12 inches is termed the Standard Penetration Resistance (N). Within the test borings, soil samples were generally obtained at 2 ½-foot intervals to a depth of 10 feet and then at 5-foot intervals to the respective planned termination depth. Based on our assumptions during the proposal preparation, we expected to encounter bedrock at a depth of about 120 feet below the ground surface. During our investigation at test boring location B-02, we did not encounter bedrock up to a depth of 136 feet. It is our experience and within ODOT's standards that borings performed for deep foundations may be terminated prior to encountering bedrock provided that 30 feet of material with N values more than 30 blows per foot are encountered. Our test borings B-01 and B-02 were terminated after meeting this criterion. Soils meeting this criterion are generally considered suitable for support of deep foundations by developing sufficient skin resistance, which will be discussed later in this report.

Soil samples recovered from the split-barrel sampler are designated as "S" on the test boring logs. The soil samples obtained with the split-barrel sampler were sealed in jars and transported to our laboratory for further classification and testing. Samples obtained using the SPT method are generally considered disturbed.

During the field investigation, our field engineer made observations of the ground water level and apparent layer changes due to changes in drilling resistance, and other relevant observations. The NTH field engineer also directed sample collection, classified the soils in the field, and modified the field exploration as necessary to obtain appropriate subsurface information. The field engineer obtained pocket penetrometer measurements on cohesive soil samples in the field as an aid in evaluating their compressive strengths. The pocket penetrometer is designed to estimate the unconfined compressive strength for soils with strengths in the range of 1,000 to 9,000 pounds per square foot (psf). The pocket penetrometer values are indicated on the respective test boring logs included as Figure Nos. 3 to 18 in Appendix A. As a guide to the classifications and sampling methods for soil materials, NTH General Notes are presented as Figure No. 2 in Appendix A.

The stratification shown on the test boring logs represents the general subsurface conditions encountered at the actual boring locations. Variations may occur between the borings. Additionally, the stratigraphic lines represent the approximate boundary between soil types; however, the transition may be more gradual than what is shown. We have prepared the boring logs included with this report on the basis of field classification supplemented by laboratory observation and testing.

5.0 LABORATORY TESTING

A limited number of representative soil samples obtained during the field investigation were subjected to laboratory testing to determine moisture content, grain size distribution, and Atterberg limits. Results of the natural moisture content, unit weight, and unconfined compression strength tests are included on the individual Logs of Test Boring. Results for the moisture contents, Atterberg Limits, and grain-size analysis testing are presented in the Tabulation of Laboratory Test Data, Figure No. 19 in Appendix A. The grain-size distribution curves are presented as Figure Nos. 20 through 25 in Appendix A.

6.0 SUBSURFACE CONDITIONS

6.1 Roadway Borings (Test Boring Locations B-06, B-07, B-08, and B-09)

Test borings B-06, B-07, B-08, and B-09 were drilled to assess the existing subsurface soil's suitability as subgrade for the planned roadway improvements at the Port of Cleveland. At all four of these boring locations, we encountered granular fill materials from the ground surface to their planned termination depth of ten feet. The fill material consists of sand, gravel, brick, and asphalt fragments. In general the fill materials near the surface have higher N-values and are medium compact to very compact. Fill materials encountered at depths of 5 to 10 feet were generally loose to medium compact. The N-value of the fill material ranges from 5 to 42 blows per foot with an average N-value of about 16 blows per foot.

6.2 Railway Borings (Test Boring Locations B-10, B-11, B-12, and B-13)

Test borings B-10, B-11, B-12, and B-13 were drilled to assess the existing subsurface soil's suitability as subgrade for the planned railroad improvements. At all four of these boring locations, we encountered granular fill materials. The fill materials consist of sand, gravel, asphalt fragments, cinders, slag, taconite pellets, brick fragments, and limestone fragments. The N-value of the fill materials ranges from 9 to 78 blows per foot (bpf) with an average of 35 bpf. At two of the boring locations, B-10 and B-13, we encountered natural sand and sandy silt layers below the granular fills but prior to their termination depth of ten feet. The N-value of the natural sand and sandy silt ranges from 4 to 21 blows per foot with an average N-value of about 35 blows per foot.

6.3 Bridge Borings (Test Boring Locations B-01 and B-02)

Test borings B-01 and B-02 were drilled to assess existing subsurface conditions as they relate to the design of a railroad bridge with deep foundation elements.

At test boring locations B-01 and B-02, we encountered fill materials extending from ground surface to depths of 15 and 19 feet below ground surface (bgs), respectively. The fill materials are underlain by soft to medium gray silty clay to a depth of about 59 feet bgs, which is then underlain by stiff to very stiff gray silty clay to a depth of 81 feet bgs. We encountered very compact gray silt and sandy silt between 81 and 92 feet bgs. We encountered very hard sandy clay between 92 and 103 feet bgs. We encountered very compact clayey silt and compact gray sand between 103 and 118 feet bgs. We encountered compact to very compact gray silty sand from 118 to 130 feet bgs. We encountered very compact clayey silt from 130 to 136 feet bgs.

The N-value of the fill materials ranges from 9 to 65 bpf with an average of 42 bpf. The N-value of the soft to medium gray silty clay ranges from 3 to 7 bpf with an average N-value of 5 bpf. The estimated unconfined compressive strength of the soft to medium gray silty clay ranged from 500 to 2500 pounds per square foot (psf). The N-value of the stiff to very stiff gray silt clay ranges from 10 to 28 bpf with an average N-value of 18 bpf. The estimated unconfined compressive strength of the stiff to very stiff gray silt clay ranges from 10 to 28 bpf with an average from 2000 to 7000 psf. The N-value of the very compact gray silt and gray sandy silt ranges from 55 to 100 bpf with an average of about 90 bpf. The N-value of the very hard sandy clay ranges from 32 to 81 bpf with an average N-value of about 57 bpf, and it has an estimated unconfined compressive strength between depths 103 and 118 have N-values that range from 35 to 53 bpf with an average N-value of 44. The compact to very compact gray silty sands encountered from 118 to 130 feet have N-values that range from 45 to 59 bpf with an average N-value of 53 bpf. The very compact clayey silt encountered from 130 to 136 feet has an N-value of 58 bpf.

6.4 Utility Protection Structure Borings (Test Boring Locations B-03, B-04, and B-05)

Test borings B-03, B-04, and B-05 were drilled to assess subsurface conditions at the location of two planned utility protection structures. Borings B-03 and B-04 were drilled for Structure No. 2, and boring B-05 was drilled for Structure No. 3.

6.4.1 Structure No. 2 (Test Boring Locations B-03 and B-04)

We encountered loose to medium compact fill materials from ground surface to a depth of 18-1/2 feet bgs at boring location B-03. The fill materials consist of sand, gravel, rock fragments, brick fragments, and asphalt. The N-values of the fill materials range from 8 to 27 bpf with an average N-value of 19 bpf. The fill materials are underlain by very loose to loose dark gray fine sand to the boring termination depth of 25 feet. The fine sand has N-values that range from 4 to 10 bpf with an average N-value of 7 bpf.

We encountered compact fill materials from ground surface to a depth of 7 feet bgs at boring location B-04. The fill materials consist of sand, gravel, brick fragments, and concrete fragments. N-values of the fill materials range from 35 to 37 bpf. Soft black organic silty clay fill, with an N-value of 2 bpf, is present from 7 to 8 feet bgs. We encountered a gray, fine-grained sandstone boulder at a depth of 8 feet which precluded further soil sampling at location B-04. Subsequently, B-04 was offset two additional times (locations B-04a and B-04b). At both B-04a and B-04b, we encountered obstructions at depths of about 5 feet bgs and were forced to offset the borehole location again. On the third offset attempt (location B-04c), we were able to complete the boring to a depth of 25 bgs. We encountered fill materials containing black sand and slag at depths from 13 feet to 17 feet bgs. The N-value of the fill is 35 bpf. We encountered compact gray sand to a depth of 22 feet bgs, with an N-value of 30 bpf. The gray sand was underlain by medium gray clayey silt with an N-value of 6 and an estimated unconfined compressive strength of 1000 psf.

6.4.2 Structure No. 3 (Test Boring Location B-05)

We encountered fill materials from the ground surface to a depth of 12 feet bgs at test boring location B-05. The top three feet of fill consisted of medium compact clayey silt, with some sand, gravel, and asphalt and brick fragments. This fill has an N-value of 15 blows per foot. The clayey silt fill is underlain by loose to very loose sand, gravel, asphalt, and brick fragments to a depth of 12 feet. These fill materials have an N-value that ranges from 2 to 6 blows per foot with an average N-value of 4. The sand fill is underlain to a depth of 18-1/2 feet bgs by natural loose gray sand with an N-value of 8 blows per foot. We encountered stiff gray silty clay with red mottling from 18-1/2 feet to the termination depth of 25 feet. The silty clay has an N-value of 10 blows per foot and an estimated unconfined compressive strength that ranges from 3000 to 5000 psf.

6.5 Groundwater Conditions

Groundwater was encountered in test borings B-03, B-05, B-07, B-08, B-10, and B-11 during drilling. The depth to groundwater at the time of drilling ranged from 5.6 to 12.9 feet bgs. Groundwater levels at the project site are expected to vary over time and to be hydraulically connected to the Cuyahoga River and Lake Erie.

7.0 CONCLUSIONS AND RECOMMENDATIONS

7.1 Subgrade Preparation

All vegetation, topsoil, asphalt and concrete pavements, and other deleterious non-soil materials, as well as any other exposed soils containing appreciable amounts of organic matter or debris, should be removed in their entirety from within the proposed construction limits. Any abandoned utilities and underground structures located within 3 feet vertically of the proposed finished grade or the base of shallow foundations should be removed. Upon reaching the "at-grade" and "cut" subgrade elevations, proof-rolling should be performed in accordance with Item 204.06 of the Ohio Department of Transportation (ODOT) Construction and Material Specifications (CMS), January 1, 2010. We recommend the proof-rolling be performed during dry weather conditions. Areas that exhibit excessive deflections during proof-rolling should be stabilized by removing and replacing the failing materials with engineered fill.

Engineered fill required to achieve design grades should preferably consist of clean granular soils, such as natural sands. The natural on-site sandy soils may be used for engineered fill provided that they are free of organic matter and debris and significant amounts of silt and clay. We do not recommend clayey silt or clayey sand materials be used as engineered fill. These soils tend to have a very narrow moisture content range to achieve proper compaction. Engineered fill should be placed in loose lifts no more than 8 inches thick and compacted to a least 98 percent of the maximum dry density as determined by the Standard Proctor method (ASTM D698). Upon reaching the "at-grade and "cut" subgrade elevations, proof-rolling should be performed.

During the drilling of B-04 for Structure No. 2, we encountered soft organic silty clay from a depth of 7 feet to 8 feet bgs. Based on the anticipated construction scope, this material will not be encountered during

excavations, and the material may be left in place, provided the recommendations in this report are followed. If for some reason the excavations do encounter this material, we recommend removing the organic soils and replacing them with engineered fill or controlled low-strength mortar / flowable fill.

7.2 Railroad Ballast and Subballast

NTH understands that the railroad extension rails will be placed roughly at or above the existing ground surface. NTH recommends that the ballast and sub-ballast thicknesses be determined from the current edition of the American Railway Engineering and Maintenance-of-way Association (AERMA) Manual for Railway Engineering. Laboratory sieve and hydrometer analyses on selected samples indicate that the soils near the likely subgrade elevation consist of either fine-grained sand, which classifies as SM in the Unified Soil Classification System (USCS), or clayey silt, which classifies as CL. Based on the results of the grain-size distribution testing and sub-ballast stone sizing determined by the design engineer, a geotextile filter fabric may be required to segregate the subgrade soils from the railroad ballast and sub-ballast. If required by the design engineer, we recommend the geotextile fabric have a minimum tensile strength of 180 pounds, minimum tear and puncture strengths of 70 pounds, and an apparent opening size less than or equal to 0.3 mm.

7.3 Road Subgrade Design Parameters

The subgrade resulting from the satisfactory completion of site preparation operations should be suitable for the support of pavements anticipated for this project. We anticipate that the pavement subgrade will consist primarily of existing fill or engineered fill. Assuming proper subgrade preparation and considering the impact of seasonal moisture and temperature variations on the anticipated subgrade soils, we recommend an effective California Bearing Ratio (CBR) of 4 percent for development of the pavement cross-sections. The corresponding resilient modulus (Mr) of 4,800 psi can also be used for the design of the pavement section.

Consideration for drainage is of the utmost importance in order for the pavements to perform as intended, and incorporation of subsurface drainage will help to minimize the detrimental effects of groundwater that may shorten the pavement's design service life. The pavement and underlying subgrade should be adequately crowned or sloped to promote effective surface and subsurface drainage and to prevent ponding of water both above and beneath the pavement structure. It is recommended that the pavement and subgrade soils have a minimum slope of 1 percent, and preferably 1.5 percent, to achieve proper drainage.

7.4 Pavement Design

Parsons Brinkerhoff provided NTH with an anticipated traffic loading of 400 trucks per day and 100 cars per day. We have assumed this traffic consists of single axle trucks. Based on these assumptions, we have estimated the equivalent single axle load (ESAL) per day to be about 400 ESAL. For a 20 year design life of asphalt pavement, this equates to about 2,500,000 design ESALs. For a 30 year design life of concrete pavement, this equates to about 3,750,000 design ESALs.

We performed a pavement design analysis using methodology presented in the 1993 AASHTO Guide for Design of Pavement Structures. Assuming the design ESALs above, we recommend the following flexible pavement cross section:

1.25 inches of ODOT 448 Asphalt Concrete Surface Course, Type 1, medium traffic, PG64-22, over
3.00 inches of ODOT 448 Asphalt Concrete Intermediate Course, Type 2, medium traffic, PG64-28, over
3.00 inches of ODOT 301 Asphalt Concrete Base Course, PG 64-22, over
9 inches of ODOT 304 Aggregate Base.

Parsons Brinkerhoff also asked NTH to analyze a 3 inches thick asphalt pavement section. Given the traffic loading described above, we calculated a 3-inch pavement section over a 9 –inch ODOT 304 base would have a design life of approximately 10 years.

As an alternatative to the flexible pavement section, we evaluated the required cross section assuming a rigid pavement cross section. We assumed a pavement life of 30 years. The resulting concrete pavement section is as follows:

8.00 inches of reinforced Portland Cement Concrete, over6.00 inches of ODOT 304 Aggregate Base.

Results of our pavement analysis are presented on Figure Nos. 26 and 27 in Appendix A.

Design of the pavement section is based on a complete removal and replacement of existing soils and pavements to sufficient depth to accommodate the new pavement section as specified. Re-use of any of the existing pavement section or materials would need to be reviewed based on site and area-specific conditions. Re-use of existing materials or pavement structure may not be feasible due to the thickness of existing materials or restriction of elevation or grade changes. We recommend a qualified professional engineer be consulted to evaluate, on a case by case basis, reuse of the existing pavement structure. If additional design ESALs are required to support the anticipated traffic loads, additional subgrade improvements or a thicker pavement section may be necessary.

This design is based on the assumption that a total settlement of approximately one inch is acceptable for pavements founded on the existing fill materials. If this assumption is not acceptable, we recommend undercutting of the existing fill soils to a depth of up to 5 feet below the proposed subgrade and replacing the in-place soils with engineered fill. The final depth of undercut should be determined in the field by a qualified geotechnical engineer or his representative. The field personnel should be qualified to observe deleterious material and material that is adequate for support of the planned construction.

The design lives calculated using the 1993 AASHTO method are based on the assumption that the Owner institutes a regular maintenance program over the life of the pavement. This would include regular crack sealing, repair of isolated failed sections, and maintenance of adequate surface and subsurface drainage. The actual life of an asphalt pavement may be reduced considerably if these maintenance measures are not performed on a regular and frequent basis.

7.5 Groundwater Control

Groundwater was encountered at depths ranging from about 5 feet to 13 feet bgs. We anticipate light groundwater infiltration in relatively shallow excavations (less than 5 feet) for shallow foundations and utilities can be reasonably controlled by the use of localized sump pits and pumping. We anticipate that heavy precipitation can also be controlled in a similar manner. Care should be taken to ensure that excavations are left open for as little time as possible to protect the bearing soils from disturbance by ponded water or construction traffic.

If excavations deeper than five feet are necessary, we recommend the contractor utilize a water tight earth support system, such as gasketed liner plates or tight sheet piling. If watertight support systems are not utilized, groundwater infiltration may result in the piping of soils into the excavation and void development behind the excavation walls.

Likewise, if the designer of records prefers augered pile foundations to support any proposed structures, the contractor should anticipate significant groundwater inflow into the foundation excavation. We anticipate drilling mud would be necessary to maintain the excavation until foundation concrete and steel can be added.

7.6 Foundations

Structural Mat Foundations

The subgrade resulting from the satisfactory completion of site preparation operations as outlined in this report can be used for support of concrete slabs-on-grade for proposed Structure Nos. 2 and 3. In order to provide a uniform bearing surface, we recommend the slabs be designed with a minimum 8-inch thick aggregate base. We recommend the base materials be specified to meet the requirements of ODOT Item 304. The material may consist of crushed natural limestone or recycled concrete materials.

The concrete slab-on-grades should be suitably reinforced. A modulus of subgrade reaction value of 150 pounds per cubic inch (pci) can be used for design of slabs and a net allowable bearing capacity of 2000 can be utilized for slabs bearing in the upper 3 feet. Foundation elements are to be designed based on parameters presented earlier in this report. The design parameters listed above are based on the assumption that recommendations outlined in the Subgrade Preparation section of this report are adhered to. The parameters are also presented assuming the aggregate base is placed to the depth discussed above and compacted to 100 percent of maximum dry density according to the Standard Proctor method.

As part of the structural mat construction, we anticipate that the slab will have turned down edges for frost protection. The turn down portion of the slabs should be extended to a minimum depth of 42-inches below exposed finished grade for protection against frost penetration. If foundations are to be constructed during periods of freezing temperatures, they should be extended below the frost penetration depth or insulated for protection against freezing temperatures. Furthermore, care will be required during winter construction to verify that foundations are not constructed on frozen soil. The turn down portion of the slab should be at least 18-inches in width, regardless of the resulting bearing pressure.

In the area of the current roadways and where Structure Nos. 2 and 3 are proposed, we anticipate total settlement in the range of 1/8 to 1/2 inch may occur. Resistance to lateral loads may be provided by the frictional resistance at the bottom of the footings, as well as by the passive earth pressure acting against the side of the footings. An allowable interface friction factor of 0.30 may be used between the base of the foundation and the cohesionless bearing soils. Passive earth pressure available in compacted, engineered fill or undisturbed native soils may be taken as an equivalent fluid pressure of 200 pounds per square foot per foot of depth. These recommendations include a factor of safety of 2.0. All fill and backfill materials placed beneath, above and against the sides of the footings should be compacted to specified moisture content and density, as described in the Subgrade Preparations section of this report.

Driven Pile Foundations

Based on the previous geotechnical investigations, we understand that driven piles were successfully utilized for support of other structures at this site. Therefore, we did not evaluate installation of drilled piers or auger cast-in-place pile foundations. The following sections provide our recommendations for design and installation of driven steel piles.

NTH evaluated HP 10x42, HP 12x53, and 12-inch diameter pipe piles to support the proposed railroad bridge structure. We analyzed the piles for their allowable bearing capacity assuming a factor of safety (FOS) of 2.25. Based on the results of our investigation, the proposed structure may be supported on either HP-piles or pipe piles. However, the HP-piles are likely to be more effective at penetrating the upper fill layers. We anticipate that pipe piles will require some pre-drilling in the upper 20 feet to remove obstructions. The HP-piles should be driven to a minimum depth of 90 feet below the existing ground surface while the pipe piles may be driven to a depth of about 80 feet below grade. The HP 10x42 and the HP 12x53 should develop allowable capacities of 55 and 70 tons, respectively, at a depth of 90 bgs. The 12-inch pipe pile should develop an allowable capacity of 65 tons at a depth of 90 feet bgs. Output from our analyses using FHWA's software Driven 1.2 is attached for reference on Figure Nos. 26 through 28 in the Appendix. If additional

capacity is needed from each pile, the piles may be driven deeper. However, special precautions should be considered to prevent over-stressing of the piles during driving. This could include reducing the size of the pile hammer or hammer drop height.

PB provided NTH with a lateral load of 14.2 kips per pile. We utilized the program L-Pile to analyze the deflection of a vertical HP 12x53 steel pile under this lateral load. Based on the results of the testing, we anticipate less than ½-inch of horizontal deflection at the pile head may occur under a load of 14.2 kips. Please note that the lateral deflection calculation is performed using service loads, without a factor of safety being applied to the load or the deflection amount.

If the design engineer chooses to design battered piles to resist the lateral loads, they should be installed with inclinations no greater than 1H:4V, and the horizontal component of the force should be taken into consideration in the analysis.

Please note that the piles recommended for this project are not expected to reach refusal on bedrock. The presence of hard and compact glacial till soils above the bedrock should allow the piles to achieve capacity prior to encountering bedrock. Our recommended allowable capacities are based upon the skin friction component of the HP piles. Any end bearing increases the FOS beyond 2.25 used for design. For this reason, it is recommended that dynamic load tests be performed on a minimum of two (2) piles of each HP-size in accordance with ODOT Item 523 (Dynamic Load Test), and that a CAPWAP analysis be performed on at least one pile of each section tested dynamically. The dynamic load tests will allow the establishing of driving criteria. In no case, however, should the piles be allowed to refuse above Elevation 500. If the piles refuse above this elevation, we should be contacted immediately and revised recommendations will be provided, if necessary.

In accordance with FHWA recommendations, a FOS of 2.25 should be used for piles tested dynamically. If dynamic testing is not performed, a minimum FOS of 3.0 must be used for design.

The pile driving hammer type should be selected in accordance with ODOT Item 507.04, "Driving of Piles" in the CMS so as to avoid over-stressing the piles. Prior to the commencement of pile driving, the contractor should be required to submit equipment specifications such that the proposed pile hammer, along with

the induced stresses in the pile, can be evaluated by wave equation analysis. If excessive compressive or tensile stresses are predicted with this method, steps should be taken prior to pile installation to investigate alternative pile hammers or cushions in order to reduce the possibility of damage to the pile. Pile driving may also result in slight heave of previously driven piles. All piles raised during the driving of adjacent piles should be retapped.

7.7 Structures 2 and 3 Designed as Culverts

We understand PB is evaluating the concept of installing protective pipes around existing utilities for protection. We anticipate the proposed pipe materials may consist of either concrete or corrugated metal. Trench bedding below and above the pipes should conform to the Ohio Department of Transportation 2010 Construction and Material Specifications (CMS) Section 603, entitled Pipe Culverts, Sewers, and Drains. This specification details the thickness and type of bedding and other information pertinent to the proposed construction. The trench should be excavated a minimum 12 inches below the invert level of the pipe, loose materials removed, and pipe bedding should be placed along the full width of the trench bottom. The pipe bedding should be ODOT Type 1 or Type 2 structural backfill and meet the requirements set forth in the ODOT standards and specifications for gradation and compaction. The bedding materials should be clean and free of organics and other deleterious material. We recommend shale or slag not be allowed as structural backfill.

We recommend compaction procedures and equipment for the pipe bedding is chosen based on ODOT Item 603 of the 2010 CMS. Assuming concrete and / or corrugated metal pipe are to be installed, we anticipate that equipment weighing less than one ton should be used for compaction of the pipe bedding materials to at least four feet above to pipe.

Based on the ODOT specifications for Item 603, we expect that the soils excavated from the trenches will not meet the requirements for Type 1 and Type 2 structural fill and therefore will not be suitable for reuse as pipe bedding.

As mentioned previously, design of the culvert structures will be governed by the requirements of the Ohio Department of Transportation. At a minimum, Class B bedding consisting of ³/₄-inch crushed aggregate should be used below the pipe and up to the springline on each side of the pipe. Properly compacted ODOT

Item 703.11 B sand backfill (or equivalent) should be used above the springline to at least one-foot above the pipe. Alternately, and with permission of the Cleveland-Cuyahoga County Port Authority, the pipe excavation could be backfilled with lean (flowable) concrete fill. If lean concrete fill is utilized, care must be taken by the contractor to place the fill in lifts in order to prevent the flowable fill from floating the sewer pipe.

7.8 Stability of Excavations

Due to the proximity of existing roadways to the proposed shallow foundation / protective pipe locations, we anticipate the excavations will be constructed using near vertical walls with a sliding trench box, or a combination of slopes and vertical walls with properly designed and installed lateral bracing.

We expect that open cut excavations in the existing fill and loose to medium compact sands will have little stand up time. As such, construction excavations should not be left open any longer than necessary, since open excavations are subject to physical disturbance. Seepage of water into any excavation may also compromise the stability of the side slopes, the supporting capacity of the base material if the excavation is left open for an extended period of time, and could allow piping of adjacent soil materials into the excavation and undermining of existing utilities or roadways. As soon as work within the excavation is completed and accepted, the excavation should be promptly backfilled to near final grade.

Bracing systems for trenches may include portable trench boxes or sliding trench shields. In all cases, OSHA requirements must be followed and adequate protection provided for workers. Construction traffic and excavated material stockpiles should be kept away from excavations a minimum distance equal to the full depth of the excavation, unless the resulting surcharge loads are accounted for in the design of the lateral bracing system. The contractor's proposed excavations, support systems, and sequence of construction should be reviewed by a qualified engineer prior to allowing the contractor to commence work.

Temporary retaining structures that are free to move at the top should be designed on the basis of active earth pressures utilizing an active earth pressure coefficient (Ka) of 0.3. Flexible walls can be designed on the basis of an equivalent fluid pressure of 40 pounds per square foot per foot of depth (psf / ft), provided that drainage through the wall is permitted (e.g. as through a cantilever soldier pile and lagging wall). Retaining structures with bracing at the top and bottom should be designed utilizing an at rest earth pressure coefficient of 0.5, or an equivalent fluid pressure of 60 psf / ft. If free drainage is not possible through the chosen earth retention system, design loads should also include hydrostatic pressures to account for build up behind the wall.

Retaining structures will also have to consider loading from the adjacent pavement and traffic. The lateral component of surcharge loads on walls can be determined by multiplying the surcharge load by the applicable earth pressure coefficient. The lateral component of any surcharge would then be added to the earth pressures presented above.

7.9 Protection of Existing Infrastructure

Care must be taken to minimize the amount of soil that is lost from beneath the adjacent roadway and adjacent utilities, either through unsupported excavations or piping of sands. Soil that is lost from below the pavement during the excavation should be replaced with flowable fill or the pavement should be removed and subgrade re-established with compacted structural fill to provide support of the pavement.

Existing utilities, including water, storm water, gas, and other subsurface items crossing the proposed alignments must be properly protected and supported (hangers or bracing as appropriate) in the area of the proposed shallow excavations. The excavating contractor must make every effort to prevent damage to existing utilities and/or adjacent structural elements.

8.0 DESIGN REVIEW AND MONITORING

Experience indicates that the actual subsurface conditions at a site can vary from those generalized on the basis of test borings made at specific locations. Therefore, in order to maintain consistency between design and construction, the project geotechnical engineer should be retained to provide construction monitoring services during the foundation and subrgrade construction phases of the proposed project. It is very important that construction monitoring be performed to verify compliance with the design concepts, specifications and recommendations contained in this report. Also, field monitoring allows design changes to be made in the event that subsurface conditions differ from those described herein.

9.0 LIMITATIONS

This report is specifically intended for the design of the proposed Port of Cleveland Rail Expansion Project project in Cleveland, Ohio. The work was performed in accordance with the prevailing standard of practice in this area at the time the work was performed. No other warranty, expressed or implied, is provided or intended.

Soil samples obtained during this investigation will be held at our Cleveland, Ohio office for 90 days. At that time, PB will have the option to take possession of the samples for continued storage, or we will make arrangements for sample disposal.

The scope of service for this exploration was limited to an evaluation of subsurface conditions for the support of planned road and railroad improvements including a railroad bridge and other related aspects of the proposed construction. No environmental surveys, hydrological studies or chemical testing or analyses were performed as part of this geotechnical investigation.

We appreciate the opportunity to serve PB on the Port of Cleveland Rail Expansion project. Should you have any questions regarding the recommendations presented in this report or if you need additional assistance, please call.

Respectfully Submitted,

NTH Consultants, Ltd.

B-igmilk

Brian E. Meluch, P.E. Assistant Project Engineer

b. Mart, P.E.

David G. Mast, P.E Vice President



APPENDIX A



N



GENERAL NOTES

TERMINOLOGY

Unless otherwise noted, all terms utilized herein refer to the Standard Definitions presented in ASTM D 653.

PARTICLE SIZES

CLASSIFICATION

The major soil constituent is the principal noun, i.e., clay, silt, sand, gravel. The second major soil constituent and other minor constituents are reported as follows:

Boulders	-	Greater than 12 inches (305mm)	minor constituents are reported a	5 10110 105.
Cobbles	-	3 inches (76.2mm) to 12 inches (305mm)	Second Major Constituent	Minor Constituents
Gravel - Coarse	-	3/4 inches (19.05 mm) to 3 inches (76.2mm)	(percent by weight)	(percent by weight)
Fine	-	No. 4 - 3/16 inches (4.75mm) to 3/4 inches (19.05 mm)		
Sand - Coarse	-	No. 10 (2.00mm) to No. 4 (4.75mm)	Trace - 1 to 12%	Trace - 1 to 12%
Medium	-	No. 40 (0.425mm) to No. 10 (2.00mm)		
Fine	-	No. 200 (0.074mm) to No. 40 (0.425mm)	Adjective - 12 to 35%	Little - 12 to 23%
Silt	-	0.005mm to 0.074mm	(clayey, silty, etc.)	
Clay	-	Less than 0.005mm		Some - 23 to 33%
			And - Over 35%	

COHESIVE SOILS

If clay content is sufficient so that clay dominates soil properties, clay becomes the principal noun with the other major soil constituent as modified; i.e., silty clay. Other minor soil constituents may be included in accordance with the classification breakdown for cohesionless soils; i.e., silty clay, trace of sand, little gravel.

Consistency	Unconfined Compressive Strength (psf)	Approximate Range of (N)
Consistency	Strength (psi)	Kange of (14)
Very Soft	Below 500	0 - 2
Soft	500 - 1000	3 - 4
Medium	1000 - 2000	5 - 8
Stiff	2000 - 4000	9 - 15
Very Stiff	4000 - 8000	16 - 30
Hard	8000 - 16000	31 - 50
Very Hard	Over 16000	Over 50

Consistency of cohesive soils is based upon an evaluation of the observed resistance to deformation under load and not upon the Standard Penetration Resistance (N).

COHESIONLESS SOILS

Density Classification	Relative Density %	Approximate Range of (N)
Very Loose	0 - 15	0 - 4
Loose	16 - 35	5 - 10
Medium Compact	36 - 65	11 - 30
Compact	66 - 85	31 - 50
Very Compact	86 - 100	Over 50

Relative density of cohesionless soils is based upon the evaluation of the Standard Penetration Resistance (N), modified as required for depth effects, sampling effects, etc.

SAMPLE DESIGNATIONS

- AS Auger Sample directly from auger flight
- BS Miscellaneous Sample bottle or bag S Split Spoon Sample ASTM D 1586
- LS Split Spoon Sample S with Liner Insert 3 inches in length
- ST Shelby Tube Sample 3 inch diameter unless otherwise noted
- PS Piston Sample 3 inch diameter unless otherwise noted
 RC Rock Core NX core unless otherwise noted
- CS Continuous Sample from rock core barrel or continuous sampling device
- VS Vane Shear

STANDARD PENETRATION TEST (ASTM D 1586) - 2.0" outside-diameter, 1-3/8" inside-diameter, split barrel sampler is driven into undisturbed soil by means of a 140 pound weight falling freely through a vertical distance of 30 inches. The sample is normally driven three successive 6-inch increments. The total number of blows required for the final 12 inches of penetration is the Standard Penetration Resistance (N).

LC Proj Proj	ect Nan ect Loca	ne:	ST BORING NO: B-01 Cleveland Port Authority Expansion Cleveland, OH			7		NT	TH Co NTH Pro Checke	ONSU oj. No.: d By:	Itants	s, Lto 1394-00	d.
			SUBSURFACE PROFILE					SOI	L SAM	PLE D	ATA	12.57.07	
ELEV. (FT)	PRO- FILE	ELEV	GROUND SURFACE ELEVATION: 580.0(±)	DEPTH	DEPTH (FT)	SAMPLE TYPE/NO.	BLOWS/ 6-INCHES	STD. PEN RESIST. (N)	REC (in)	PID (ppm)	MOIST. CONTENT (%)	DRY DENSITY (PCF)	UNCONF COMP ST (PSF)
000		579.8.	· Topsoil	02	4								
			FILL: Very Compact Brown and Gray SILTY SAND, Little Gravel, Contains CI	ay		<u>S-1</u>	23 41 41 39	82	18				-
575			Pockets and Brick Pieces		5	S-2	43 29 3	72	18				-
		573.0		7.0		<u>S-3</u>	16 50	66	13				_
570		568.5		11.5	10	S-4	50	50/6"	1				
		565.5	FILL: Medium Compact Gray SILTY SAND, Trace Gravel, Contains Wood Pieces	14.5		-	27						
 		560.0	Loose Gray SANDY GRAVEL, Trace S	ilt 20.0	 20	<u>S-5</u>	16 2 4 2	6	18				-
 <u>555</u>			Medium Gray SILTY CLAY, Frequent S Seams and Pockets	ilt	 25	S-7	1 2 4	6	18				1000*
		550 3		29 7		ST-1	PUSH 1 4		_24		28.4	98.3	2900
550 Total Drillin Drillin Inspe Contr Drille	Depth: ng Start ng End l ector: ractor: r:	Date: Date:	115 FT 8/19/11 8/23/11 J. Brown, R. Kral, Ohio TestBor Inc. J.Minchak	Wate Gro of v obs	30 r Level bundwat vash rot servatio	<u>S-8</u> Observ ter enco tary dril ns.	2 vation: buntere ling me	6 d at 8.0 thods, p	10 ' during preclude	drilling əd furth	21.4 operat	ions. T Indwate	<u>2500*</u> he use er
Drillir Trac 7/8' Plugg Bore	n g Meth ck Mour " Tricone ging Pro ehole se	od: hted D = wash cedure ealed w	50 Drill Rig using 3 1/4" HSA to 18.5'. 2 bore to end of boring. : ith cement-bentonite grout	GPS	ocket P Coordin	enetron nates:	neter				Fig	jure No	o. 3

Project Name: Cleveland Port Authority Expansion Project Location: Cleveland, OH



NTH Consultants, Ltd. NTH Proj. No.: 86-101394-00 Checked By:

	SUBSURFACE PROFILE							SOII	SAM	PLE D	ATA	5	
ELEV. (FT)	PRO- FILE	ELEV	GROUND SURFACE ELEVATION: 580.0(2)	DEPTH	DEPTH (FT)	SAMPLE TYPE/NO.	BLOWS/ 6-INCHES	STD. PEN RESIST. (N)	REC (in)	PID (ppm)	MOIST. CONTENT (%)	DRY DENSITY (PCF)	UNCONF. COMP ST (PSF)
<u>550</u> 545 540 		538.0	Very Soft Gray SILTY CLAY, Little Sand, Trace Gravel	42.0	 - 35 40	S-9 ST-2 S-10	1 2 2 PUSH WOH 2 2	4	18 24 18		27.5 27.6 35.5	96.6	500 1240 500
			Medium to Stiff Gray CLAYEY SILT, Trace Sand, Contains Few Silt Lenses and Pockets		<u>45</u> 50 -	<u>S-11</u> <u>ST-3</u> <u>S-12</u> <u>S-13</u>	1 3 6 9 9 9 9 4 6 8 3 5 6	9 14 11			22.7 21.1 20.7 22.1	109.5	2000* 4000 3000* 1000*
520 520 515 515		521.5	Very Stiff Gray SILTY CLAY, Little Fine Sand, Trace Fine Gravel, Contains Many Silt and Fine Sand Seams and Pockets	58.5	60 65 	<u>S-14</u> <u>S-15</u>	4 7 10 5 7 9	17 16	13		22.3		4000*- 4500* 4000*- 4500*

Project Name: Cleveland Port Authority Expansion Project Location: Cleveland, OH

OF TEST BORING 86-101394-00.GPJ NTH CORPORATE NEW.GDT 9/2/11

8

Sheet 3 of 4



NTH Consultants, Ltd.

NTH Proj. No.: 86-101394-00 Checked By:

SUBSURFACE PROFILE SOIL SAMPLE DATA STD. PEN RESIST. (N) MOIST. CONTENT (%) UNCONF. COMP ST (PSF) GROUND DRY DENSITY (PCF) ELEV. (FT) PRO-FILE SAMPLE TYPE/NO. DEPTH BLOWS/ 6-INCHES REC PID ELEV DEPTH SURFACE ELEVATION: 580.0(1) (FT) (in) (ppm) 512.0 5 5000*-7000* 8 10 510 70 S-16 18 15 13.8 Very Stiff Gray SILTY CLAY, Little Fine 5 8 Sand, Contains Many Silt and Fine Sand 505 75 S-17 19 15 16.2 7000* 11 Seams and Pockets, Trace Fine Gravel 6 10 14 500 80 S-18 7000* 24 15 15.8 499.0 81.0 30 50/5" <u>S-19</u> 50/5" 10 14.7 495 85 Very Compact Gray SILT, Little Sand, Trace Clay 23 20 35 490 S-20 90 55 16 21.0 115.2 488.0 92.0 17 26 40 485 95 S-21 15 >9000* 66 11.4 Hard Gray SILTY CLAY, Trace Sand and 15 22 33 Gravel 100 S-22 480 12.4 55 14 130.4 >9000* 50/1" S-23 50/1" 1 11.3 105 475

Project Name: Cleveland Port Authority Expansion Project Location: Cleveland, OH



NTH Consultants, Ltd. NTH Proj. No.: 86-101394-00

Checked By: 2521

	SUBSURFACE PROFILE						SOIL SAMPLE DATA								
ELEV (FT)	1.	PRO- FILE	ELEV	GROUND SURFACE ELEVATION: 580.0 😫	DEPTH	DEPTH (FT)	SAMPLE TYPE/NO.	BLOWS/ 6-INCHES	STD. PEN RESIST. (N)	REC (in)	PID (ppm)	MOIST. CONTENT (%)	DRY DENSITY (PCF)	UNCONF. COMP ST (PSF)	
- - - 470 -			474.0	Hard Gray SILTY CLAY, Trace Sand and Gravel		 <u>110</u>	S-24	9 14 18	32	16		28.2		>9000*	
- - _ 465 -		11	467.0 465.0	Compact Gray Sand END OF BORING AT 115.0 FEET.	113.0 115.0	 115	<u>S-25</u>	13 15 17	32	15				_	
- - <u>460</u> -															
- - 455 -															
450															
PJ NTH CORPORATE NEW	-														
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		of 4													

LC Proj)G Ol ect Nan	F TE	EST BORING NO: B-02 Cleveland Port Authority Expansion					NT		onsu	Itan 86-1
Proj	ect Loc	ation:	Cleveland, OH			4		ʻ (Checke	d By:	he
			SUBSURFACE PROFILE	W				SOII	L SAM	PLE C	ΑΤΑ
ELEV. (FT)	PRO- FILE	ELEV	GROUND SURFACE ELEVATION: 580.0(±)	DEPTH	DEPTH (FT)	SAMPLE TYPE/NO.	BLOWS/ 6-INCHES	STD. PEN RESIST. (N)	REC (in)	PID (ppm)	MOIS CONTE (%)
		<u>579.8</u> / 578.0	Topsoil FILL: Compact Brown SILTY SAND, Tra Gravel, Contains Brick Fragments	0.: ce 2.0	2		15 27				
		576.0	FILL: Very Compact Gray SILTY SAND Trace Gravel	', 4.(<u> </u>	38 15	65	14		
575		572 0	FILL: Loose to Medium Compact Dark Brown SILTY SAND, Trace Gravel, Trac Clay	e 7		S-2	8	21	5		
		575.0		7.		S-3	1 2 8	10	13		
570			GRAVEL, Some Silt, Contains Brick Pieces			<u>S-4</u>	7 15 9	24	12		
		567.5		12.5	<u>-</u> -	-					
565		564 0	FILL: Loose Gray SANDY GRAVEL, Litt Silt	le 16 (S-5	13 5 4	9	12		
· -		564.0	FILL: Very Loose Gray SAND, Trace Gravel	16.0		-					
 560		561.0		19.0	20	S-6	2 2 3	5	18		
			Medium Gray SILTY CLAY, Trace Sand	1		-					
555			and Gravel, Contains Frequent Silt Sean	IS	25	S-7	2 3 4	7	18		
· -		553.5		26.5		1					
			Medium Gray SILTY CLAY, Trace San	1			3 3				

TH Consultants, Ltd.

NTH Proj. No.: 86-101394-00 Checked By:

MOIST. CONTENT (%)

UNCONF. COMP ST (PSF)

DRY DENSITY (PCF)

		573.0	Clay	7.0		-	1						
- 2-						S-3	2 8	10	13				
570			FILL: Medium Compact Brown SANDY GRAVEL, Some Silt, Contains Brick Pieces		10		7 15 9	24	12				_
		567.5		12.5		-							
565			FILL: Loose Gray SANDY GRAVEL, Little Silt		 15	S-5	13 5 4	9	12				_
		564.0		16.0	.								
 			FILL: Very Loose Gray SAND, Trace Gravel										
560		561.0		19.0	20	S-6	2 2 3	5	18				2000*
· _			Medium Gray SILTY CLAY, Trace Sand and Gravel, Contains Frequent Silt Seams										
555					25	S-7	2 3 4	7	18				2000*
		553.5	Medium Gray SILTY CLAY, Trace Sand	26.5	 30	S-8	3 3 4	7	18		25.3	92.7	2000*
Total Drillin Drillin Inspe Contr	Depth: ng Star ng End ctor: ractor:	t Date: Date:	135 FT 8/16/11 8/18/11 J. Brown Ohio TestBor Inc.	Wate Gro use obs	Level undwa of was ervatio	Observ ter enco th rotary ns.	vation: ountere v drilling	d at 13. g metho	5' durin ds, pre	g drillin cluded	g opera further	ations. ground	The water
Drille Drillin Trai 7/8'	r: ng Meth ck Mou ' Tricon	nod: nted D e Wash	J.Minchak 50 Drill Rig using 3 1/4" HSA to 23.5'. 2 abore to end of boring.	Notes * Po	: ocket P	enetron	neter						
Plugg Bor	jing Pro ehole s	ocedure ealed w	e: vith cement-bentonite grout	GPS	Coordi	nates:							
			neeres termen estat statistica a substatistica esperande 🖌 🖌 Babbali								Fig	ure No	o. 4

Cleveland Port Authority Expansion Project Name:



NTH Consultants, Ltd. NTH Proj. No.: 86-101394-00

NA

Checked By:

Project Location: Cleveland, OH



Cleveland Port Authority Expansion Project Name:



NTH Consultants, Ltd.

NTH Proj. No.: 86-101394-00 Checked By: 397711

Project Location: Cleveland, OH

	SUBSURFACE PROFILE					SOIL SAMPLE DATA								
ELEV (FT)	. PRO FIL	D- E	ELEV	GROUND SURFACE ELEVATION: 580.0 (±)	DEPTH	DEPTH (FT)	SAMPLE TYPE/NO.	BLOWS/ 6-INCHES	STD. PEN RESIST. (N)	REC (in)	PID (ppm)	MOIST. CONTENT (%)	DRY DENSITY (PCF)	UNCONF COMP ST (PSF)
- - 510 -			512.0			70	S-16	6 8 11	19	18		20.6		4500*
- - <u>505</u>				Stiff to Very Stiff Gray SILTY CLAY, Trace Sand and Gravel			S-17	4 5 9	14	18		17.2		3000*
- - 500			503.0	Very Stiff Gray SILTY CLAY, Little Sand	77.0	 <u>80</u>	S-18	7 10 18	28	16		16.6		7000*
- - - 495			498.8	Very Compact Gray SILT	81.2	 85		28 41 50/4"	91	16		21.1		-
- - - 490			<u>191.7</u>	Very Compact Gray SANDY SILT, Trace	88.3	 90	<u>S-20</u>	40 50/4"	50/4"	10		19.5		-
			488.3	Gravel	91.7			20						
485 		· · · · · · · · · · · ·		Very Hard Gray SANDY CLAY, Little Silt, Trace Gravel		<u>95</u> 	<u>S-21</u>	34 47	81	13		10.4		>9000*
480		•					<u>S-22</u>	14 21 32	53	18		13.5		-
475 Shee			76.7	Very Compact Gray CLAYEY SILT, Trace Sand and Gravel	103.3	105	S-23	15 23 29	52	18		18.9		-

Cleveland Port Authority Expansion Project Name:



NTH Consultants, Ltd. NTH Proj. No.: 86-101394-00

Proj	ect Loc	ation:	Cleveland, OH			4		C	Checke	d By:	by	21	
			SUBSURFACE PROFILE					SOII	SAM	PLE D	ATA		
ELEV. (FT)	PRO- FILE	ELEV	GROUND SURFACE ELEVATION: 580.0 (±)	DEPTH	DEPTH (FT)	SAMPLE TYPE/NO.	BLOWS/ 6-INCHES	STD. PEN RESIST. (N)	REC (in)	PID (ppm)	MOIST. CONTENT (%)	DRY DENSITY (PCF)	UNCONF. COMP ST (PSF)
 470		474.0	Compact Gray SAND, Trace Silt and	<u>106.0</u> /	 <u>110</u>	S-24	12 15 20	35	15		10.7		-
 <u>465</u> 		462.0	Gravel	118.0	 <u>115</u> 	S-25	15 17 22	39	14		12.8		
 460 		402.0		118.0	 <u>120</u> 	<u>S-26</u>	30 45		11		5.7		-
 <u>455</u> 			Compact to Very Compact Gray SAND, Little Gravel, Trace Silt, Trace Clay, Contains Clay Pockets		 <u>125</u> 	<u>S-27</u>	20 35 34	69	12		13.8		
450		449.9	Very Compact Gray CLAYEY SILT, Trace To Little Sand	130.1		S-28	15 21 24	45	14		18.0		
445		445.0 _		135.0	135	S-29	15 24 34	58	18		8.0		-
440			END OF BORING AT 135.0 FEET.										

ELEV. F	PRO- FILE	ELEV	SUBSURFACE PROFILE									the second se			
ELEV. F	PRO- FILE	ELEV	GROUND					SOII	SAM	PLE D	ATA				
			SURFACE ELEVATION: 583.0(±)	DEPTH	DEPTH (FT)	SAMPLE TYPE/NO.	BLOWS/ 6-INCHES	STD. PEN RESIST. (N)	REC (in)	PID (ppm)	MOIST. CONTENT (%)	DRY DENSITY (PCF)	UNCONF COMP ST (PSF)		
	*****	582.7~	Asphalt	0.3/											
580						S-1	3 9 11	20	13				-		
	****		Some Gravel, Contains Brick Fragments		5	S-2	11 16	27	10		7.8		-		
575						S-3	6 12 10	22	10				-		
X	*****	574.5		8.5		1	5								
					10	S-4	5 6 10	16	10				_		
			FILL: Medium Compact Brown SAND, Little Gravel, Contains Asphalt fragments from 9.8' to 10.0'				10	10	10				-		
570		569.5		13.5											
			FILL: Loose Dark Brown And Gray Mottled with Black, Fine SAND, Trace Silt Slightly Organic			S-5	4 4 4	8	10						
565				10.5											
		004.0	# 12	18.5	20	S-6	3 2 2	4	6				-		
 <u>560</u>			Very Loose to Loose Dark Gray Fine SAND, Trace Silt												
🐼							1								
		558.0		25.0	25	S-7	9	10	18		18.5				
 <u>- 555</u> 															
Total De	epth:		25 FT	Wate	r Level	Observ	ation:								
Drilling Start Date: 8/11/11 Drilling End Date: 8/11/11 Inspector: R. Kral Contractor: Northcoast Drilling Inc. Driller: C. Pools			Gro gro cav	Groundwater encountered at 12.9' during drilling operations, groundwater at 16.0' after drilling operations completion. Borehole caved at 15.0'.											
CME 7 Compl	Meth 75 Tru pletion	od: Ick Mo	ounted Drill Rig Using 4 1/4" HSA to Boring	Notes	5:										
Plugging Boreho hole p	Plugging Procedure: Borehole was backfilled with auger cuttings and bentonite hole plug					GPS Coordinates: Figure No. 5									

LC Proj Proj	ect Nar ect Loc	F TE ne: ation:	ST BORING NO: B-04 Cleveland Port Authority Expansion Cleveland, OH	NTH Consultants, Ltd. NTH Proj. No.: 86-101394-00 Checked By:										
			SUBSURFACE PROFILE					SOI	L SAM	IPLE D	ATA			
ELEV. (FT)	PRO- FILE	ELEV	GROUND SURFACE ELEVATION: 582.0 (±)	DEPTH	DEPTH (FT)	SAMPLE TYPE/NO.	BLOWS/ 6-INCHES	STD. PEN RESIST. (N)	REC (in)	PID (ppm)	MOIST. CONTENT (%)	DRY DENSITY (PCF)	UNCONF COMP ST (PSF)	
		580.9	Granular Base	1.1										
580		578.5	FILL: Compact Dark Brown SAND, Some Gravel, Contains Brick and Concrete Fragments	3.5		<u>S-1</u>	4 13 22	35	13				-	
			FILL: Compact Dark Gray and Black SAND, Some Gravel, Contains Brick and Concrete Fragments		5	S-2	11 27 10	37	12				-	
575		575.0 573.8	FILL: Very Soft Black Organic SILTY CLAY, Little Gravel, Contains Brick Fragments.	7.0		S-3 S-4	2 1 1 50/2"	2	6				-	
			END OF BORING AT 8.2 FEET.											
570	-													
 <u>565</u>														
 <u>560</u> 														
555														
Total Drillin Drillin Inspe Contr Drille	Total Depth: 8.2 FT Drilling Start Date: 8/12/11 Drilling End Date: 8/12/11 Inspector: R. Kral Contractor: Northcoast Drilling Inc. Driller: G. Beck		Wate No ope	Water Level Observation: No groundwater encountered during or at completion of drilling operations										
Drillin CM Cor	Drilling Method: CME 75 Truck Mounted Drill Rig Using 4 1/4" HSA to Boring Completion			Notes: - Auger Refusal at 8.2' Encountered Gray Fine Grained Sandstone BoulderOffset to B-04a										
Bor	ging Pro rehole v	vas ba	re: ckfilled with auger cuttings	GPS	Coordi	nates:					Fig	ure No	b. 6	
LOG OF TEST BORING NO: B-04a

Project Name: Cleveland Port Authority Expansion Project Location: Cleveland, OH



NTH Consultants, Ltd. NTH Proj. No.: 86-101394-00

Checked By:

			SUBSURFACE PROFILE	SOIL SAMPLE DATA									
ELE\ (FT)	7. PRO- FILE	ELEV	GROUND SURFACE ELEVATION: 582.0 (#)	DEPTH	DEPTH (FT)	SAMPLE TYPE/NO.	BLOWS/ 6-INCHES	STD. PEN RESIST. (N)	REC (in)	PID (ppm)	MOIST CONTENT (%)	DRY DENSITY (PCF)	UNCONF COMP ST (PSF)
- - -		577.0	Profile Drill to 5.0 '	5.0									
			END OF BORING AT 5.0 FEET.										
- - -	-												
- - 570	-												
-	-												
- 565	-												
- - 560	-										8		
.GDT 9/2/11	-												
	-												
Tot Dril Dril Dril Dril Dril Dril	al Depth ling Stat ling Enc bector: htractor: ler:	: rt Date: I Date:	5 FT 8/12/11 8/12/11 R. Kral Northcoast Drilling Inc. G. Beck	Wate No ope	r Level ground erations	Observ water e	vation: ncounte	ered du	ring or a	at comp	oletion d	of drillin	g
Drill C C	ling Met ME 75 7 ompletic	hod: Γruck Μοι In	inted Drill Rig Using 4 1/4" HSA to Borii	ng - Al Bou	s: ıger Re ılderOfi	fusal a fset to E	t 5.0' Er 3-04b	ncounte	red Gra	ay Fine	Graineo	d Sands	stone
	gging Pi orehole	rocedure was back	filled with auger cuttings	GPS	Coordi	nates:					Fig	ure No	o. 7

F F	L O Proje	ect Nar	F TE ne: ation:	ST BORING NO: B-C Cleveland Port Authority Expansi Cleveland, OH) 4b ion				NT r	TH C NTH Pr Checke	onsu oj. No.: ed By:	Itants 86-101	s, Lto 394-00	.
				SUBSURFACE PROFIL	LE				SOI	L SAN	IPLE D	ATA		
EL((F	EV. T)	PRO- FILE	ELEV	GROUND SURFACE ELEVATION:	582.0 (±) DEP	TH DEPTH (FT)	SAMPLE TYPE/NO.	BLOWS/ 6-INCHES	STD. PEN RESIST. (N)	REC (in)	PID (ppm)	MOIST. CONTENT (%)	DRY DENSITY (PCF)	UNCONF. COMP ST (PSF)
- <u>5</u> 8 -	- <u>30</u> -		577.0	Profile Drill to 5.0'		-	-							
		~~~~		END OF BORING AT 5.0 F	EET.									
- - -	75													
- - - - -	- 7 <u>0</u> -													
- - 56	- 													
- - 56														
	-													
	otal rillin spe ontr rillen rillen CML	Depth: Ig Start Ig End ctor: actor: r: Ig Meth E 75 Tr aplotion	t Date: Date: nod: uck Mo	5 FT 8/12/11 8/12/11 R. Kral Northcoast Drilling Inc. G. Beck unted Drill Rig Using 4 1/4" HSA	Wa No to Boring R	ter Level o ground oerations tes: Auger Ri oulder. (	l <b>Obser</b> dwater e s efusal a Offset to	vation: encount t 5.0' Er B-04c	ered du ncounte	ring or red Gra	at comp ay Fine	oletion o Graine	of drillin d Sands	g stone
	ugg Bore	ing Pro ing Pro ehole v	o <b>cedure</b> vas bac	e: kfilled with auger cuttings	GP	S Coordi	inates:	<u>D-04</u> 0				Fig	ure No	0 8

### LOG OF TEST BORING NO: B-04c

Project Name: Cleveland Port Authority Expansion Project Location: Cleveland, OH



NTH Consultants, Ltd. NTH Proj. No.: 86-101394-00

Checked By: 6970

SUBSURFACE PROFILE SOIL SAMPLE DATA STD. PEN RESIST. (N) GROUND MOIST. CONTENT DRY DENSITY (PCF) UNCONF. COMP ST (PSF) ELEV. (FT) PRO-FILE SAMPLE TYPE/NO. BLOWS/ 6-INCHES DEPTH REC PID ELEV DEPTH (FT) SURFACE ELEVATION: 582.0(+) (in) (ppm) (%) 580 5 Profile Drill to 13.5', Encountered Cobbles 575 at 8.5' 10 570 568.5 13.5 5 12 23 S-5 15 35 18 FILL: Compact Black Sand, Contains Slag 565 565.0 17.0 5 12 **Compact Gray SAND** <u>S-6</u> 20 18 18 30 560 560.0 22.0 Medium Gray CLAYEY SILT, Trace Sand 2 3 25 S-7 557.0 25.0 12 1000* 3 6 26.6 END OF BORING AT 25.0 FEET. 555 Total Depth: Drilling Start Date: Drilling End Date: 25 FT Water Level Observation: 8/23/11 No groundwater encountered during or at completion of drilling 8/23/11 operations Inspector: B. Meluch Contractor: Ohio TestBor Inc. Driller: J.Minchak Notes: **Drilling Method:** * Pocket Penetrometer Track Mounted D 50 Drill Rig using 3 1/4" HSA to end of boring **Plugging Procedure: GPS** Coordinates: Borehole was backfilled with auger cuttings Figure No. 9

CORPORATE NEW GDT 9/2/1

NTH

86-101394-00.GPJ

BORING

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Pro Pro	<b>)G O</b> ject Nar ject Loc	F TE ne: ation:	ST BORING NO: B-05 Cleveland Port Authority Expansion Cleveland, OH					NT N	H C NTH Pr Checke	onsu oj. No.: d By:	Itants 86-101	s, Lto 394-00	<b>d</b> .
			SUBSURFACE PROFILE					SOI	SAM	IPLE D	ATA		
ELEV. (FT)	PRO- FILE	ELEV	GROUND SURFACE ELEVATION: 580.0 (±)	DEPTH	DEPTH (FT)	SAMPLE TYPE/NO.	BLOWS/ 6-INCHES	STD. PEN RESIST. (N)	REC (in)	PID (ppm)	MOIST. CONTENT (%)	DRY DENSITY (PCF)	UNCONF COMP S (PSF)
000		579.0	Granular Base	1.0									
		577.0	FILL: Medium Compact Gray Brown and Black CLAYEY SILT, Some Sand, Some Gravel, Contains Asphalt and Brick Fragments	3.0			1 4 11	15	10				>9000'
575		574.5	FILL: Loose Brown, Dark Gray and Black SAND, Little Gravel, Contains Asphalt and Brick Fragments	5.5		S-2	1 4 2	6	12				-
		572.0	FILL: Very Loose Brown, Black, and Gray SAND, Some Silty Clay, Some Gravel, Contains Brick and Asphalt Fragments	8.0		S-3	2 1 1	2	6		20.9		_
570			FILL: Very Loose Black, Gray and Brown GRAVEL and SAND, Contains Shell, Asphalt and Brick Ergements			S-4	3 2 2	4	4				-
		568.0		12.0		-							
- 565			Loose Gray SAND, Trace Fine Gravel			<u>S-5</u>	4 4 4	8	18		22.8		-
- · - · ·		561.5		18.5	  20	S-6	2 4 6	10	8				3000*
			Stiff to Very Stiff Gray Mottled Red SILTY CLAY, Contains Few Silt and Sand Pockets and Lenses										
 555	112.	555.0	END OF BORING AT 25.0 FEET.	25.0	25	S-7	2 5 5	10	16		19.8		3000*- 5000*
	-												
Tota Drilli Drilli Inspe Cont	Depth: ng Start ng End ector: ractor:	t Date: Date:	25 FT 8/12/11 8/12/11 R. Kral Northcoast Drilling Inc. G. Beck	Wate Gro grou 5.5	r Level undwa undwat after a	Observ ter enco ter enco augers r	vation: ountere ountered emoved	d at 5.6 d at 8.0' d. Boreh	' during after c iole ca	g drilling ompleti ved at 8	operat on. Gro 3.7'.	ions, undwa	ter at
Drilli CN Co	ng Meth 1E 75 Tr mpletior	nod: ruck Mo n	ounted Drill Rig Using 4 1/4" HSA to Boring	Notes * Po	s: ocket P	Penetror	neter						
Plug Boi hol	ging Pro rehole w e plug	ocedur as bac	e: kfilled with auger cuttings and bentonite	GPS	Coordi	nates:					Figu	re No.	10

LOG	OF	TEST	BORING	NO:	B-06

Project Name: Cleveland Port Authority Expansion



#### NTH Consultants, Ltd. NTH Proj. No.: 86-101394-00

By:

MOIST. CONTENT (%)

7.3

DRY DENSITY (PCF)

UNCONF. COMP ST (PSF)

Proje	ect Loca	ation:	Cleveland, OH			7		c	Checke	d By:	V
			SUBSURFACE PROFILE					SOII	L SAM	IPLE D	ATA
ELEV. (FT)	PRO- FILE	ELEV	GROUND SURFACE ELEVATION: 583.0 (±)	DEPTH	DEPTH (FT)	SAMPLE TYPE/NO.	BLOWS/ 6-INCHES	STD. PEN RESIST. (N)	REC (in)	PID (ppm)	MOIS CONTE (%)
- - 580		579.5	FILL: Very Compact Gray Gravel Some Sand	3.5		S-1	4 50/6"		12		7.3
-		578.3	FILL: Medium Compact Brown SAND, Little Gravel FILL: Medium Compact Brown and Black	4.7		S-2T S-2B	7		10		
575		577.0	SAND and GRAVEL, Contains Asphalt Fragments FILL: Medium Compact Red and Brown BRICK FRAGMENTS and SAND	6.0		S-3	6 6 7	13	8		
		574.5 573.0	FILL: Loose Gray SANDY SILT, Trace Brick Fragments	8.5	  10	S-4	4 5 3	8	10		
-			END OF BORING AT 10.0 FEET.								
570											
_											-
- 565											
-											
-											
<u>560</u> -											

101394-00.GPJ NTH CORPORATE NEW.GDT 9/2/11 86-BORING TEST OG OF

555

Water Level Observation:	
No groundwater encountered during or a operations	at completion of drilling
borehole caved at 7.7'	

**GPS** Coordinates:

Notes:

Drilling Method: CME 75 Truck Mounted Drill Rig Using 4 1/4" HSA to Boring Completion

Northcoast Drilling Inc.

**Plugging Procedure:** 

Borehole was backfilled with auger cuttings

10 FT 8/11/11

8/11/11 R. Kral

G. Beck

Driller:

Figure No. 11

LC Proj Proj	<b>)G O</b> ject Nar ject Loc	F TE ne: ation:	ST BORING NO: B-07 Cleveland Port Authority Expansion Cleveland, OH					NT	TH CONTH Pr Checke	onsu oj. No.: d By:	Itant:	s, Lto 1394-00	<b>d</b> .
			SUBSURFACE PROFILE					SOI	L SAM	IPLE D	ATA		
ELEV. (FT)	PRO- FILE	ELEV	GROUND SURFACE ELEVATION: 581.0 (#)	DEPTH	DEPTH (FT)	SAMPLE TYPE/NO.	BLOWS/ 6-INCHES	STD. PEN RESIST. (N)	REC (in)	PID (ppm)	MOIST. CONTENT (%)	DRY DENSITY (PCF)	UNCONF COMP ST (PSF)
500		580.3	Asphalt	0.7									
		578.0	FILL: Medium Compact Dark Gray and Brown SAND, Some Gravel, Contains Asphalt and Brick Fragments	3.0		<u>S-1</u>	3 10 10	20	13				-
			FILL: Loose Dark Brown SAND Some to		5	S-2	7 4 3	7	13				
			And Gravel, Contains Asphalt and Brick Fragments			<u>S-3</u>	2 2 3	5	6				-
	-	572.0	FILL Medium Compact Grav SAND and	9.0	-	-	4						
		571.0	GRAVEL, Contains Brick Fragments	10.0	10	S-4	7	13	6				-
 565  560  555   555													
Total Drillin Drillin Inspe Contr Drille Drillin Con	Depth: ng Start ng End ector: ractor: er: ng Meth nE 75 Tr mpletior	Date: Date: od: uck Mo	10 FT 8/12/11 8/12/11 R. Kral Northcoast Drilling Inc. G. Beck Dunted Drill Rig Using 4 1/4" HSA to Boring	Wate Gro gro 7.3 Notes	r Level bundwa undwat ' after a s:	Observ ter enco er enco ugers r	vation: ountere ountered emoved	d at 7.5 d at 8.3' d. Boreh	' during after c ole cav	r drilling ompleti ved at7.	operat on. Gro 5'.	ions, undwa	ter at
Plugg Bor	ging Pro rehole w	ocedur vas bac	<b>e:</b> ckfilled with auger cuttings	GPS	Coordi	nates:					Figu	re No.	12

LC Proj Proj	OG O ect Nar ect Loc	F TE ne: ation:	ST BORING NO: B-08 Cleveland Port Authority Expansion Cleveland, OH					NT	TH CONTH Pr Checke	<b>onsu</b> oj. No.: d By:	Itants 86-101	s, Lto 394-00	Ы. )
			SUBSURFACE PROFILE					SOI	SAM		ATA	6	
ELEV. (FT)	PRO- FILE	ELEV	GROUND SURFACE ELEVATION: 582.0 (±)	DEPTH	DEPTH (FT)	SAMPLE TYPE/NO.	BLOWS/ 6-INCHES	STD. PEN RESIST. (N)	REC (in)	PID (ppm)	MOIST. CONTENT (%)	DRY DENSITY (PCF)	UNCONF. COMP ST (PSF)
		581.0	Granular Base	10									
 <u>580</u> 			FILL: Medium Compact Dark Gray SAND and FINE GRAVEL, Trace Silt	1.0		<u>S-1</u>	3 14 12	26	14				-
		577.5		4.5		1	10						
					5	S-2	9 4	13	11				-
 <u>575</u>		570 5	FILL: Medium Compact Brown and Dark Gray SAND, Little Gravel, Contains Brick Fragments	0.5		<u>S-3</u>	3 4 3	7	3				-
		5/3.5		8.5			3						
		572.0	FILL: Loose Brown and Gray SAND	10.0	10	S-4	2 3	5	6		9.1		-
			END OF BORING AT 10.0 FEET.						601				
Drillir Drillir Contr Drille Drille Drillir Con	ng Start ng End ector: ractor: r: ng Meth E 75 Tr npletior	t Date: Date: nod: ruck Ma	8/12/11 8/12/11 R. Kral Northcoast Drilling Inc. G. Beck ounted Drill Rig Using 4 1/4" HSA to Boring	Grc gro Notes	oundwa undwat s:	ter enco ler enco	ountere ountered	d at 7.9 d at com	' during pletion	drilling Boreh	operat iole cav	ions, no ed at 7	5'.
Bor	<b>ging Pro</b> ehole w	ocedui vas ba	<b>re:</b> ckfilled with auger cuttings	GPS	Coordi	nates:					Figu	re No.	13

LC Proj Proj	ect Nar ect Loc	F TE ne: ation:	<b>EST BORING NO: B-09</b> Cleveland Port Authority Expansion Cleveland, OH					NT	H CONTH Pr Checke	<b>onsu</b> oj. No.: d By:	Itants 86-101	s, Lta .394-00	<b>d</b> .
			SUBSURFACE PROFILE					SOI	SAM	IPLE D	ATA		<del></del>
ELEV. (FT)	PRO- FILE	ELEV	GROUND SURFACE ELEVATION: 584.0(±)	DEPTH	DEPTH (FT)	SAMPLE TYPE/NO.	BLOWS/ 6-INCHES	STD. PEN RESIST. (N)	REC (in)	PID (ppm)	MOIST. CONTENT (%)	DRY DENSITY (PCF)	UNCONF COMP ST (PSF)
		582.7	Granular Base	1.3	L .								
			FILL: Medium Compact to Compact Dark			<u>S-1</u>	10 19 23	42	12	-			-
 		578.0	Asphalt and Brick Fragments	6.0		S-2	9 11 11	22	14				-
			FILL: Loose to Medium Compact Dark Gray, Brown, and Black SAND and	0.0		<u>S-3</u>	10 14 7	21	10				-
575		574.0	GRAVEL, Contains Asphalt and Brick Fragments	10.0			8 5 4	9	10				
 <u>570</u>   <u>565</u>  <u>560</u> 													
Total Drillir Drillir Inspe Contr Drille Drille	Depth: ng Stari ng End ctor: actor: r: ng Meth	t Date: Date:	10 FT 8/12/11 8/12/11 R. Kral Northcoast Drilling Inc. G. Beck	Wate No ope	r Level ground erations s:	<b>Obsern</b> Iwater e s, boreh	vation: encount ole cav	ered du ed at 5.	ring or 7'	at comp	pletion o	of drillin	g
CM Cor Plugg Bor	Ē 75 Tr npletior <b>jing Pro</b> ehole w	ruck M n <b>ocedu</b> vas ba	ounted Drill Rig Using 4 1/4" HSA to Boring <b>re:</b> ckfilled with auger cuttings	GPS	Coordi	nates:					Figu	re No.	14

## LOG OF TEST BORING NO: B-10

Project Name: Cleveland Port Authority Expansion



# NTH Consultants, Ltd. NTH Proj. No.: 86-101394-00 Checked By:

Project Location: Cleveland, OH

Base         PEC         Base         SURFACE ELEVATION: 581.000         DEFN         PAPEL BLOOK         BLOOK         PEC         DOI         DOI         DEFN         PEC         BLOOK         PEC         DOI         DEFN         PEC         BLOOK         PEC         BLOOK         PEC         BLOOK         PEC         DOI         DEFN         PEC         BLOOK         PEC         BLOOK         BEC         DOI         DEFN         PEC         BLOOK         BEC         DOI         DEFN         PEC         DEFN				SUBSURFACE PROFILE					SOI	L SAM	IPLE D	ATA		
500       Sea.2.1       Topsoil       /	ELEV. (FT)	PRO- FILE	ELEV	GROUND SURFACE ELEVATION: 581.0 (#	) DEPTH	DEPTH (FT)	SAMPLE TYPE/NO.	BLOWS/ 6-INCHES	STD. PEN RESIST. (N)	REC (in)	PID (ppm)	MOIST. CONTENT (%)	DRY DENSITY (PCF)	UNCONF COMP ST (PSF)
50         FILL: Compact Gray SLAG, Contains Brick         5         5-2         30         6         12         17.7           575         FILL: Very Compact Black SAND. Contains Cinders Stag and Taconite 914.7         5         5-2         18         66         12         17.7         .           575         Contains Cinders Stag and Taconite 92         6         5         2-2         9         1         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .         .	500	XXXXX	580.9	\ Topsoil	/ O.	Ľ						1		
FILL: Compact Gray SLAG, Contains Brick         S:1         36         7         1           575         FILL: Vary Compact Black SAND, Contains Cinders Slag and Taconite Pellets         5         5:2         11         6         12         17.7           575         Contains Cinders Slag and Taconite Pellets         63         5         5:2         10         6         12         17.7         1           576         Loose to Medium Compact Brown SAND, Trace Slit         5:3         5:2         10         10         5:4         9         13         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1	580						-							
FILL: Compact Gray SLAG, Contains Brick       S-1       16       36       7       1         575       FILL: Very Compact Black SAND, Contains Cinders Slag and Taconite Pellets       5       S-2       10       6       12       17.7         576       Contains Cinders Slag and Taconite Pellets       63       5       S-2       10       6       12       17.7         100       Contains Cinders Slag and Taconite Pellets       63       5       S-3       14       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1 </td <td>L.</td> <td></td> <td>4</td> <td></td> <td></td> <td></td> <td></td> <td>20</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>	L.		4					20						
S75         S2         11 50         0         12         17.7           S75         Contains Cinders Slag and Taconite Pellets         6.3         5         2         1         10         60         12         17.7         17.7           Loose to Medium Compact Brown SAND, Trace Silt         6.3         5         5         1         6         10         5         10         5         10         10         5         10         10         5         10         10         5         10         10         5         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10	E 1			FILL: Compact Gray SLAG, Contains B	rick	Γ.	S-1	16	36	7				-
S76.5         FILL: Very Compact Black SAND, Drar Pellets         5         S-2         10 50         0         17.7           57.5         Contains Cinders Stag and Taconite Pellets         63         12         17.7         -           57.5         Loose to Medium Compact Brown SAND, Trace Sit         5         S-3         12         17.7         -           57.0         END OF BORING AT 10.0 FEET.         10.0         10         S-4         4         9         13         -         -           57.0         END OF BORING AT 10.0 FEET.         10.0         10         S-4         4         9         13         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -	- ·						-	e						
Dp:5         FILL: Very Compact Black SAND, Contains Clinders Slag and Taconite         4.8         5         8.2         18         68         12         17.7         1           575         Contains Clinders Slag and Taconite         6.3         5         2         9         1         17.7         1           576         Loose to Medium Compact Brown SAND, Trace Silt         10.0         10         54         9         13         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1	L .					L.		11						
575       Contains Cindens Stalling and Taccinte Pellets       63       0       12       177       1         575       Contains Cindens Stalling and Taccinte Pellets       63       5       5       2       9       1         1       Loose to Medium Compact Brown SAND, Trace Silt       100       10       54       9       13       1         570       END OF BORING AT 10.0 FEET.       10.0       10       54       9       13       1       1         565       END OF BORING AT 10.0 FEET.       10.0       10       54       9       13       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1 <td></td> <td></td> <td>576.5</td> <td>FILL: Ven/ Compact Black SAND</td> <td>4.</td> <td>5</td> <td>5.2</td> <td>18</td> <td>68</td> <td>12</td> <td></td> <td>177</td> <td></td> <td></td>			576.5	FILL: Ven/ Compact Black SAND	4.	5	5.2	18	68	12		177		
575       Ex.7       Pellets       6.2         Loose to Medium Compact Brown SAND, Trace Silt       52       21       9         570       END OF BORING AT 10.0 FEET.       8       9       13         570       END OF BORING AT 10.0 FEET.       8       9       13         560       555       9       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10	1			Contains Cinders Slag and Taconite			0-2	- 50	00	12		11.1		
Image: Site of the second stress of the s	575		574.7	Pellets	6.3	3	-			5				
Loose to Medium Compact Brown SAND, Trace Silt       S3       5       21       9       -         570       END OF BORING AT 10.0 FEET.       100       10       S4       9       13       -         565       END OF BORING AT 10.0 FEET.       10       10       S4       9       13       -         565       END OF BORING AT 10.0 FEET.       10       10       S4       9       13       -         565       END OF BORING AT 10.0 FEET.       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10       10 <td< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>5</td><td></td><td></td><td></td><td></td><td></td><td></td></td<>								5						
Image: Design of the set			1			E i	S-3	9	21	9				-
570       END OF BORING AT 10.0 FEET.         570       END OF BORING AT 10.0 FEET.         566       Image: Construction of the second s	F -			Loose to Medium Compact Brown SAN	۱D,		-							
String       100       100       54       4       9       13         String       END OF BORING AT 10.0 FEET.       Image: String and S			1	Trace Ont		Ļ .		8						
570       END OF BORING AT 10.0 FEET.         565       565         560         560         555         555         555         555         555         555         560         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555 </td <td></td> <td></td> <td>571.0</td> <td></td> <td>10.0</td> <td>10</td> <td>S-4</td> <td>5</td> <td>9</td> <td>13</td> <td></td> <td></td> <td></td> <td>-</td>			571.0		10.0	10	S-4	5	9	13				-
360       565         565       565         560       565         560       565         560       565         560       565         560       565         560       565         555       565         555       555         555       555         555       555         555       555         555       555         555       555         555       555         555       555         555       555         555       555         555       555         555       555         555       555         555       555         555       555         555       555         555       555         555       55         555       55         555       55         555       55         555       55         555       55         555       55         555       55         555       55         555       55	570			END OF BORING AT 10.0 FEET.										
565         566         566         566         566         566         566         566         566         566         566         566         566         566         566         566         566         566         566         566         566         566         566         567         568         569         569         560         561         562         563         564         565         565         566         567         568         569         569         560         561         562         563         564         565         565         566         567         568         569         569         561         561         5	570													
565         565         560         560         560         555         555         555         555         555         556         557         558         558         555         555         556         557         558         558         559         559         550         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         556         557         558         559         550         560         561         561         562         563         5		-												
365       365         566       60         560       60         560       60         565       60         565       60         555       60         555       60         555       60         555       60         555       60         555       7         555       7         555       7         555       7         555       7         555       7         555       7         555       7         555       7         555       7         555       7         555       7         555       7         555       7         555       7         555       7         555       7         555       7         555       7         555       7         555       7         555       7         555       7         555       7         555       7         566       8 <td></td>														
365         365         366         366         367         368         369         360         360         360         360         361         362         363         364         365         365         366         367         368         369         369         360         360         361         362         363         364         365         365         366         367         368         369         369         361         362         363         364         365         365         365         365         365         366         367         368         368         369         369         369         369         369         3														
565         565         566         567         568         569         569         560         560         560         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         5		1												
565       -         560       -         560       -         560       -         555       -         555       -         555       -         555       -         555       -         555       -         555       -         555       -         555       -         555       -         555       -         555       -         555       -         555       -         555       -         555       -         555       -         555       -         555       -         555       -         556       -         557       -         560       -         561       -         555       -         565       -         566       -         567       -         568       -         569       -         560       -         561       -         562       -		-												
560       560         560       555         555       555         555       555         555       555         555       555         555       555         555       555         555       555         555       555         555       555         555       555         555       60         555       70         555       80         555       80         555       80         555       80         555       90         555       90         555       90         555       90         555       90         555       90         555       90         555       90         111       110         111       110         111       110         111       110         1111       110         1111       110         1111       110         1111       110         1111       110         11110       110	565													
560         560         560         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         5														
560       560         560       555         555       555         555       555         555       555         555       555         555       555         555       555         555       555         555       555         555       555         555       555         555       555         555       555         555       555         555       555         555       555         555       55         555       55         555       55         555       55         555       55         555       55         555       55         55       55         55       55         55       55         55       55         56       55         57       55         57       55         57       55         57       55         57       55         57       55         57       55														
560         560         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         55         555         555         555         555         555         555         555         555         555         555         555         555         555         55         55         55         55         55         55         55         55         55         55         55         55         56          57 <td>F -</td> <td></td>	F -													
560         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         5														
560         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         5	Г ⁻	1												
560														
Total Depth:       10 FT         Drilling Start Date:       8/11/11         Drilling Start Date:       8/11/11         Drilling Start Date:       8/11/11         Drilling Start Date:       8/11/11         Drilling Method:       Start Dilling Inc.         Drilling Method:       Notes:         CME 75 Truck Mounted Drill Rig Using 4 1/4" HSA to Boring Completion       GPS Coordinates:         Borehole was backfilled with auger cuttings       GPS Coordinates:	_ 560													
Total Depth:       10 FT         Drilling Start Date:       8/11/11         Drilling End Date:       8/11/11         Drilling End Date:       8/11/11         Drilling End Date:       8/11/11         Drilling End Date:       8/11/11         Drilling Method:       G. Beck         Drilling Method:       Notes:         Completion       Plugging Procedure:         Borehole was backfilled with auger cuttings       GPS Coordinates:														
Total Depth:       10 FT         Drilling Start Date:       8/11/11         Drilling Start Date:       8/11/11         Drilling Start Date:       8/11/11         B. Meluch       Groundwater encountered at 9.5' during drilling operations, no groundwater encountered at completion. Borehole caved at 4.0'.         Drilling Method:       Notes:         CME 75 Truck Mounted Drill Rig Using 4 1/4" HSA to Boring Completion       GPS Coordinates:         Borehole was backfilled with auger cuttings       GPS Coordinates:	F -													
555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         5		-												
555       10 FT       Water Level Observation:         Drilling Start Date:       8/11/11       Groundwater encountered at 9.5' during drilling operations, no groundwater encountered at 2.5' during drilling operations, no groundwater encountered at completion. Borehole caved at 4.0'.         Drilling Start Date:       8/11/11       Groundwater encountered at 9.5' during drilling operations, no groundwater encountered at completion. Borehole caved at 4.0'.         Drilling Method:       Notts:         CME 75 Truck Mounted Drill Rig Using 4 1/4" HSA to Boring Completion       Notes:         Plugging Procedure:       GPS Coordinates:         Borehole was backfilled with auger cuttings       GPS Coordinates:	L _													
555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         55         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         555         55														
555         555         555         556         557         557         558         559         559         559         559         550         550         550         550         550         550         550         550         550         550         550         550         550         550         550         550         550         550         550         550         550         550         550         550         550         550         550         550         550         550         550         550         50         50         50         50         50         50         50         50         50         50         50														
Total Depth:       10 FT         Drilling Start Date:       8/11/11         Drilling End Date:       8/11/11         Inspector:       B. Meluch         Contractor:       Northcoast Drilling Inc.         Drilling Method:       Off 75 Truck Mounted Drill Rig Using 4 1/4" HSA to Boring Completion         Plugging Procedure:       GPS Coordinates:         Borehole was backfilled with auger cuttings       GPS Coordinates:	555													
Total Depth:       10 FT         Drilling Start Date:       8/11/11         Drilling End Date:       8/11/11         Inspector:       B. Meluch         Contractor:       Northcoast Drilling Inc.         Drilling Method:       Notes:         CME 75 Truck Mounted Drill Rig Using 4 1/4" HSA to Boring         Completion         Plugging Procedure:         Borehole was backfilled with auger cuttings														
Total Depth:       10 FT         Drilling Start Date:       8/11/11         Drilling End Date:       8/11/11         Inspector:       B. Meluch         Contractor:       Northcoast Drilling Inc.         Drilling Method:       Notes:         CME 75 Truck Mounted Drill Rig Using 4 1/4" HSA to Boring         Completion         Plugging Procedure:         Borehole was backfilled with auger cuttings														
Total Depth:       10 FT         Drilling Start Date:       8/11/11         Drilling End Date:       8/11/11         Inspector:       B. Meluch         Contractor:       Northcoast Drilling Inc.         Drilling Method:       CME 75 Truck Mounted Drill Rig Using 4 1/4" HSA to Boring Completion         Plugging Procedure:       Borehole was backfilled with auger cuttings														
Total Depth:       10 FT         Drilling Start Date:       8/11/11         Drilling End Date:       8/11/11         Inspector:       B. Meluch         Contractor:       Northcoast Drilling Inc.         Drilling Method:       Notes:         CME 75 Truck Mounted Drill Rig Using 4 1/4" HSA to Boring Completion       GPS Coordinates:         Plugging Procedure:       GPS Coordinates:														
Total Depth:       10 FT       Water Level Observation:         Drilling Start Date:       8/11/11       Groundwater encountered at 9.5' during drilling operations, no groundwater encountered at completion. Borehole caved at 4.0'.         Drilling End Date:       8/11/11       Groundwater encountered at completion. Borehole caved at 4.0'.         Inspector:       B. Meluch       Groundwater encountered at completion. Borehole caved at 4.0'.         Driller:       G. Beck       Notes:         Drilling Method:       CME 75 Truck Mounted Drill Rig Using 4 1/4" HSA to Boring Completion         Plugging Procedure:       GPS Coordinates:         Borehole was backfilled with auger cuttings       Figure New 45														
Drilling Start Date:       8/11/11         Drilling End Date:       8/11/11         Drilling End Date:       8/11/11         Inspector:       B. Meluch         Contractor:       Northcoast Drilling Inc.         Drilling Method:       G. Beck         CME 75 Truck Mounted Drill Rig Using 4 1/4" HSA to Boring Completion         Plugging Procedure:       Borehole was backfilled with auger cuttings	Total	Depth:		10 FT	Wate	r Level	Observ	ation:						
Inspector:       B. Meluch         Contractor:       Northcoast Drilling Inc.         Driller:       G. Beck         Drilling Method:       Notes:         CME 75 Truck Mounted Drill Rig Using 4 1/4" HSA to Boring         Completion         Plugging Procedure:         Borehole was backfilled with auger cuttings	Drillin	ng Start	Date:	8/11/11	Gro	oundwa	ter enco	ountered	d at 9.5	' during	drilling	operati	ons, no	)
Contractor:       Northcoast Drilling Inc.         Driller:       G. Beck       Notes:         Drilling Method:       Notes:         CME 75 Truck Mounted Drill Rig Using 4 1/4" HSA to Boring Completion       GPS Coordinates:         Plugging Procedure:       GPS Coordinates:         Borehole was backfilled with auger cuttings       Figure Na. 45	Inspe	ctor:	Date:	B Meluch	gro	undwat	er enco	untered	at com	pletion	. Boreh	ole cav	ed at 4.	0'.
Driller:       G. Beck       Notes:         Drilling Method:       CME 75 Truck Mounted Drill Rig Using 4 1/4" HSA to Boring Completion       Completion         Plugging Procedure:       GPS Coordinates:         Borehole was backfilled with auger cuttings       Figure New 45	Contr	actor:		Northcoast Drilling Inc.										
Drilling Method:       Indies.         CME 75 Truck Mounted Drill Rig Using 4 1/4" HSA to Boring         Completion         Plugging Procedure:         Borehole was backfilled with auger cuttings	Drille	r:		G. Beck	Note									
Completion  Plugging Procedure: Borehole was backfilled with auger cuttings  GPS Coordinates:  Figure No. 45  GPS Coordinates:  Circuit Age Contended Conte	Drillin		od:	ounted Drill Dig Lloing 4.4/4" LICA to David	note	5.								
Plugging Procedure: GPS Coordinates: Borehole was backfilled with auger cuttings	Cor	npletion	ICK IVIC	Junieu Dhii Riy Using 4 1/4 HSA to Borii	ng									
Plugging Procedure:       GPS Coordinates:         5       Borehole was backfilled with auger cuttings	00/													
Borenole was backfilled with auger cuttings	Plugg	ing Pro	cedur		GPS	Coordi	nates:							
	Bon	enole w	as bac	ckniled with auger cuttings								-		
L Figure No. 15	Church	4 - 5 4										Figui	re No.	15

LC Pro Pro	DG O ject Nar ject Loc	F TE ne: :ation:	ST BORING NO: B-11 Cleveland Port Authority Expansion Cleveland, OH					NT r	TH CONTH Pr Checke	onsu roj. No.: ed By:	Itants 86-101	s, Lto 394-00	<b>d.</b>
			SUBSURFACE PROFILE					SOI	L SAN	IPLE D	ATA		
ELEV. (FT)	PRO- FILE	ELEV	GROUND SURFACE ELEVATION: 579.0(±)	DEPTH	DEPTH (FT)	SAMPLE TYPE/NO.	BLOWS/ 6-INCHES	STD. PEN RESIST. (N)	REC (in)	PID (ppm)	MOIST. CONTENT (%)	DRY DENSITY (PCF)	UNCONF COMP ST (PSF)
		578.3	Gravel	0.8									
		~~~~~	FILL: Compact Dark Gray SAND, Little Silty Clay, Contains Slag, Plastics, Cinders, and Brick			<u>S-1</u>	6 15 24 14	39	16				-
L .					5	S-2	17	40	15				-
		573.5	FILL: Medium Compact Gray GRAVEL and SAND, Contains Slag and Limestone Fragments	<u>5.5</u> 8.0		<u>S-3</u>	5 7 4	11	18				-
570			FILL: Medium Compact Black SLAG				2 9						
		569.0	END OF BORING AT 10.0 FEET.	10.0	10	<u>S-4</u>	12	21	6				-
550													
Tota Drilli Drilli Cont Drille Drille CM Co	I Depth: ng Star ng End ector: ractor: ar: ng Meti ng Meti ng Pletion	t Date: Date: nod: ruck Ma	10 FT 8/11/11 8/11/11 B. Meluch Northcoast Drilling Inc. G. Beck Dunted Drill Rig Using 4 1/4" HSA to Boring	Wate Gro gro	r Level bundwa undwa s:	Observ ter enco ter enco	vation: ountere ountered	d at 7.0 d at 5.5	' during ' compl	g drilling letion. È	g operat Borehole	tions, e caved	' at 6.0'
Plug Boi	ging Pr rehole v	ocedur vas bac	e: kfilled with auger cuttings	GPS	Coordi	nates:					Figu	ire No.	16

LOG OF	TEST	BORING	NO:	B-12
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Project Name: Cleveland Port Authority Expansion



NTH Consultants, Ltd. NTH Proj. No.: 86-101394-00 Checked By:

Project Location: Cleveland, OH

				SUBSURFACE PROFILE		SOIL SAMPLE DATA								
E (LEV. FT)	PRO- FILE	ELEV	GROUND SURFACE ELEVATION: 584.0 @	DEPTH	DEPTH (FT)	SAMPLE TYPE/NO.	BLOWS/ 6-INCHES	STD. PEN RESIST. (N)	REC (in)	PID (ppm)	MOIST. CONTENT (%)	DRY DENSITY (PCF)	UNCONF COMP ST (PSF)
							S-1	24 50/2"	50/2"	6				-
╞							S-2	3 38 40	78	12				-
5	80			FILL: Very Compact Gray Gravel , Some Sand, Consisting of Concrete and Brick			S-3	10 50/2"	50/2"	8				-
-				Fragments		5	-							
	_						S-4	14 41 20	61	8				
- 5	75		576.0	FILL: Compact Gray and Brown GRAVEL	8.0			12						
			574.0	Some Sand, Little Clayey Silt	10.0	10	<u>S-5</u>	13 12 12	27	8				-
ł	-													
	_													
5	70													
F	_													
F	-													
5	65													
-	-													
_	_													
- 5	60													
	_													
LEW.GU	_													
	_													
5	55													
	otal rillin rillin	Depth: ig Start ig End	t Date: Date:	10 FT 8/11/11 8/11/11	Wate No ope	r Level ground trations	Observ water e	vation: encounte	ered du ed at 3.	ring or a 8'	at com	oletion c	of drillin	g
	ontr rille	ctor: actor: r:		R. Krai Northcoast Drilling Inc. G. Beck										
	rillin CME Con	g Meth E 75 Tr npletior	iod: uck Ma	ounted Drill Rig Using 4 1/4" HSA to Boring	Notes	3:								
P	lugg	ing Pro	ocedur	e: chilled with auger cuttings	GPS	Coordi	nates:							
				Shined with auger cullings		185						Figu	re No.	17

LC Project Project	DG O Name: Locatio	F TE Clev on: Clev	ST BORING NO: B-13 veland Port Authority Expansion veland, OH			1		NT	TH C NTH Pr Checke	onsu oj. No.: d By:	Itant: 86-10-	s, Lto 1394-00	J.
	1		SUBSURFACE PROFILE			<u> </u>		SOII	L SAN	IPLE C	ATA	·	
ELEV. (FT)	PRO- FILE	ELEV	GROUND SURFACE ELEVATION: 583.0(±)	DEPTH	DEPTH (FT)	SAMPLE TYPE/NO.	BLOWS/ 6-INCHES	STD. PEN RESIST. (N)	REC (in)	PID (ppm)	MOIST. CONTENT (%)	DRY DENSITY (PCF)	UNCONF. COMP ST (PSF)
		582.3	Asphalt	0.7									
580		****	FILL: Very Compact Gray SAND and GRAVEL, Contains Asphalt Fragments	8		<u>S-1</u>	13 40 17	57	14				-
-		579.0	FILL: Loose Brown SAND, Little Claye Silt	4.C Y	5	S-2	10 5 4	9	10		20.6		-
- 575		576.5	Loose Gray SILT and SAND, Trace Cla	6.5 iy		<u>S-3</u>	7 5 5	10	10				-
-		574.0 573.0	Very Loose Brown and Gray SANDY SIL	9.0 T, <u>10.0</u>	10	S-4	2 2 2	4	6				-
<u>570</u> - - - - - - - - - - - - - - - - - - -													
Total Drillir Drillir Inspe Contr Drille Drillir Con	Depth: ng Start ng End cctor: ractor: r: ng Meth E 75 Tr mpletior	t Date: Date: nod: ruck Mo	10 FT 8/12/11 R. Kral Northcoast Drilling Inc. G. Beck punted Drill Rig Using 4 1/4" HSA to Borin	Wate No ope Note	r Level ground erations s:	Observ water e , boreh	ration: ncount ole cav	ered dui ed at 5.7	ring or . 7'	at comp	oletion o	of drillin	g
Plugg Bor	jing Pro ehole w	ocedur /as bac	e: ckfilled with auger cuttings	GPS	Coordi	nates:					Figu	re No.	18

PROJECT NO. 86-101394-00

NTH CONSULTANTS, LTD.

TABULATION OF LABORATORY TEST DATA UNCONFINED COMPRESSIVE STRENGTH (PSF) ATTERBERG PARTICLE SIZE DISTRIBUTION (%) PERMEABILITY (CM/SEC) LIMITS (%) SAMPLE IN-PLACE DRY DENSITY (LBS/CU.FT) SAMPLE TIP (%) BORING / TEST PIT / PROBE DESIGNATION NATURAL WATER Content (% of dry weight) Failure Strain (%) APPARENT SPECIFIC GRAVITY LOSS ON IGNITION PLASTICITY INDEX SAMPLE NUMBER UNIFIED SOIL CLASSIFICATION ELEVATION OF S TIP (FT) COARSE SAND MEDIUM SAND PLASTIC LIMIT LIQUID LIMIT DEPTH OF ((FT) FINE SAND Colloids GRAVEL СLAY SILT B-1 ST-1 0 38 13 CL 27.5 2900 28.4 98.3 69 0 0 0 0 25 12.7 -31 S-8 30.0 21.4 --S-9 35.0 --27.5 ST-2 38.5 1240 27.6 96.6 0 67 20 8 3 33 22 CL 15.0 1 1 11 -S-10 40.0 35.5 --S-11 45.0 -22.7 -ST-3 4000 0 47 0 CL-ML 48.5 15.0 21.1 109.5 48 3 1 1 28 19 9 -S-12 20.7 50.0 --S-13 22.1 55.0 --S-14 60.0 -22.3 -S-15 65.0 -16.5 -S-16 70.0 --13.8 S-17 75.0 16.2 --S-18 80.0 15.8 --S-19 85.0 14.7 --S-20 90.0 21.0 115.2 --S-21 95.0 -11.4 -S-22 100.0 12.4 130.4 --S-23 105.0 11.3 --S-24 110.0 -28.2 -

FIGURE NO. 19

PROJECT NO. 86-101394-00

NTH CONSULTANTS, LTD.

SHEET 2 OF 3

TABULATION OF LABORATORY TEST DATA UNCONFINED COMPRESSIVE STRENGTH (PSF) ATTERBERG PARTICLE SIZE DISTRIBUTION (%) PERMEABILITY (CM/SEC) LIMITS (%) IN-PLACE DRY DENSITY (LBS/CU.FT) ELEVATION OF SAMPLE TIP (FT) DEPTH OF SAMPLE TIP (FT) (%) APPARENT SPECIFIC GRAVITY BORING / TEST PIT / PROBE DESIGNATION NATURAL WATER Content (% of DRY weight) Failure Strain (%) LOSS ON IGNITION PLASTICITY INDEX SAMPLE NUMBER UNIFIED SOIL CLASSIFICATION COARSE SAND MEDIUM SAND PLASTIC LIMIT LIQUID LIMIT FINE SAND Colloids GRAVEL СLAY SILT B-2 S-8 92.7 30.0 25.3 --S-9 35.0 -30.0 -S-10 40.0 -24.2 101.4 -S-11 45.0 21.8 --S-12 50.0 23.1 111.9 -_ S-13 55.0 32.5 --S-14 29.9 60.0 --S-15 65.0 22.4 --S-16 70.0 -20.6 -S-17 75.0 -17.2 -S-18 80.0 -16.6 -S-19 85.0 -21.1 -S-20 90.0 19.5 --S-21 95.0 10.4 --S-22 100.0 13.5 --S-23 105.0 -18.9 -S-24 110.0 10.7 --S-25 115.0 12.8 --S-26 120.0 5.7 --S-27 125.0 -13.8 -S-28 130.0 18.0 --S-29 135.0 8.0 --

PROJECT NO. 86-101394-00

NTH CONSULTANTS, LTD.

TABULATION OF LABORATORY TEST DATA UNCONFINED COMPRESSIVE STRENGTH (PSF) ATTERBERG PARTICLE SIZE DISTRIBUTION (%) PERMEABILITY (CM/SEC) LIMITS (%) IN-PLACE DRY DENSITY (LBS/CU.FT) ELEVATION OF SAMPLE TIP (FT) DEPTH OF SAMPLE TIP (FT) LOSS ON IGNITION (%) APPARENT SPECIFIC GRAVITY BORING / TEST PIT / PROBE DESIGNATION FAILURE STRAIN (%) NATURAL WATER Content (% of dry weight) PLASTICITY INDEX SAMPLE NUMBER UNIFIED SOIL CLASSIFICATION COARSE SAND MEDIUM SAND PLASTIC LIMIT LIQUID LIMIT FINE SAND COLLOIDS GRAVEL СLAY SILT B-3 S-3 7.5 7.8 --S-7 25.0 -18.5 -B-4 S-7 25.0 26.6 _ -B-5 S-3 7.5 20.9 13 40 26 11 5 5 CL -----S-5 15.0 89 0 0 SM 22.8 2 8 -----S-7 25.0 19.8 23 17 6 -----_ -----B-6 S-1 2.5 -7.3 --8 17 21 13 41 SM --B-8 S-4 2 81 SM 10.0 _ -9.1 --17 0 0 B-10 S-2 5.0 17.7 16 42 21 17 SM 4 -----B-13 S-2 CL 5.0 -20.6 -11 50 36 2 0 1 ---

FIGURE NO. 19



NTH Consultants, Ltd. 820 West Superior Ave. - Suite 320 Cleveland, OH 44113

Phone: 216.344.4040 Fax: 216.344.4044

Aggre	egate	e/Soil	Test	Rep	ort			Report No	D: MAT:86-10139	4-00-S001 Issue No: 1
Client:	Parso	ns Brincke	erhoff					This la Associ Officia	boratory is accredited by the ation of State Highway and T s (AASHTO). The tests repo	American ransportation
Project:	Port o Geote	of Clevelar echnical In	nd Rail Exp vestigation	ansion				comple	sted in accordance with the te	arms of the
Job No:	86-10	1394-00						Date o Appro	of Issue: 8/26/2011 ved Signatory: Ron Kral	
Sample D	etails							Atterberg L	imit:	
Boring No Field Sam Sample D Date Sam Sampled LWO No:	o: Iple No: epth: pled: By:		B-1 ST-1 27.5 8/19/20 Brian M W0094)11 1eluch 63				L P Plas Linear Sh	iquid Limit: 38 lastic Limit: 25 ticity Index: 13 rinkage (%): N/A	
Sample L	LWO No: W009463 Sample Location: Cleveland Port Authority							Sample Des	scription:	
								Gray SILTY	CLAY	
De diele (Grading: Partie	See Avelysis of Sofic - Serve & Hydrometer (ASTM D 4	62 - 07]
Particle	bize Disti	nouuon						Drying by: Date Tested:	Natural 8/25/2011	
% Pa	ssing									
90 - · · 80 - ·					\backslash		······	Sieve Size No.20 No.40 No.60	% Passing 100 100 100 100	Limits
70			•••••••••	••••••	······\	$\overline{\mathbf{x}}$	•••••	No.200 24.7 μm	100 98.4	
60 + · 50 - ·	· · · · · · · · · · · · · · · · · · ·		····	·····	·····	\mathbf{X}		16.0 μm 11.6 μm	95.5 91.5	
40 -			•••••					9.6 μm 7.1 μm 5.2 μm	87.5 78.6 70.6	
30+·· 20+·				·····	· · · · · · · · · · · · · · · · · · ·	·····		3.8 μm 2.7 μm	61.7 55.7	
10	·····				·····		•••••	Π.2 μm	30.8	
04	0.40	10.60 1.100	.200 -			5 F				
z	. Z	Z Z	ž	Sieve	11.1 9.1 7.7	3.1	÷			
COBBLES	GRA	VEL		SAND		FI	NES			
(0.0%)	Coarse (0.0%)	Fine (0.0%)	Coarse (0.0%)	Medium (0.0%)	Fine (0.0%)	Silt (30.7%)	Clay (69.3%)			





NTH Consultants, Ltd. 820 West Superior Ave. - Suite 320 Cleveland, OH 44113

Issue No: 1

Konald A. Kral

Liquid Limit: 28 Plastic Limit: 19 Plasticity Index: 9 Linear Shrinkage (%): N/A Sample Description: Gray CLAYEY SILT, Trace Sand Grading: Paride Sate Aneyets of Sate - Same & Hydrometer (#STMD 422 - 07) Natural Date Tested: 8/25/2011 % Passing Limits 100 100 99 99 98 97 96 95 85.2 79.1 71 1 67.1 7.8 µm 57.1 20 5.7 µm 50.1 4.1 µm 42.1 10 2.9 µm 40.1 1.2 µm 28.1 0 No.10 No.40 No.60 No.100 No.200 No.4 No.20 E 5555555 3/8in Ē 17.4 12.7 10.6 5.7 4.1 2.9 2 26.7 Sieve COBBLES GRAVEL SAND FINES Coarse Fine Coarse Medium Fine Silt Clay (46.6%) (0.0%)(0.0%)(0.0%)(1.0%)(1.0%)(3.0%)(48.4%)

NTH Consultants, Ltd.







NTH Consultants, Ltd. 820 West Superior Ave. - Suite 320 Cleveland, OH 44113

Issue No: 1

Limits

100

99

99

98

97

93

82

61

37.3

26.2

20.2

18.2

14.1

12.1

10.1

8.1

6.1

4.5 µm

3.1 µm

1.3 µm

8/26/2011

No.10

GRAVEL

No.20

Fine

(1.0%)

No.40 No.60 No.100 No.200

Coarse

(0.0%)

10

0

COBBLES

(0.0%)

3/8in

No.4

Coarse

(0.0%)

Silt

(50.3%)

20.9 µm 15.1 µm 12.4 µm 8.9 µm 6.3 µm 4.5 µm 3.1 µm

Fine

(36.0%)

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31.8

Sieve

SAND

Medium

(2.0%)

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3

Clay

(10.7%)

FINES

WinPAS

Pavement Thickness Design According to

1993 AASHTO Guide for Design of Pavements Structures

American Concrete Pavement Association

Flexible Design Inputs

Agency:	Cleveland-Cuyahoga County Port Authority
Company:	NTH Consultants, Ltd.
Contractor:	
Project Description:	Port of Cleveland Rail Expansion
Location:	Cleveland, Ohio

Flexible Pavement Design/Evaluation

Structural Number	4.17	Soil Resilient Modulus	4,800.00 psi	1962
Design ESALs	2,434,600.00	Initial Serviceability	4.50	
Reliability	85.00 percent	Terminal Serviceability	2.00	
Overall Deviation	0.49			

Layer Thickness Determination

Layer Material	Layer Coefficient	Drainage Coefficient	Layer Thickness	Layer SN
Asphalt Cement Concrete	0.43	1.00	1.25	0.54
Asphalt Cement Concrete	0.43	1.00	3.00	1.29
Asphalt Cement Concrete	0.36	1.00	3.00	1.08
Crushed Stone Base	0.14	1.00	9.00	1.26
			- 011	4 47

WinPAS

Pavement Thickness Design According to

1993 AASHTO Guide for Design of Pavements Structures

American Concrete Pavement Association

Rigid Pavement Design

Agency:	Cleveland-Cuyahoga County Port Authority
Company:	NTH Consultants, Ltd.
Contractor:	
Project Description:	Port of Cleveland Rail Expansion
Location:	Cleveland, Ohio

Rigid Pavement Design/Evaluation

PCC Thickness Design ESALs	7.19 3,750,000.00	inches	Load Transfer, J Mod. Subgrade Reaction, k	2.70 206 psi/in
Reliability	80.00	percent	Drainage Coefficient, Cd	1.00
Overall Deviation	0.39		Initial Serviceability	4.20
Modulus of Rupture	700	psi	Terminal Serviceability	2.50
Modulus of Elasticity	5,000,000	psi		

Modulus of Subgrade F	Reaction	(k-value)	Determination

Resilient Modulus of the Subgrade	4,118	psi
Resilient Modulus of the Subbase	15,000	psi
Subbase Thickness	4.00	inches
Depth to Rigid Foundation		feet
Loss of Support Value (0,1,2,3)		
Modulus of Subgrade Reaction	206.30	psi/in



APPENDIX B

CD-ROM ATTACHED TO REPORT



			PROPO	SED WAREHOUSE			(Pi
PROPOSED DOCK 22 E	DOCK 24 W			(±15) (B·19) (L-16 (B-7) PROPOSE D DOCK 22 N	530		
		580			11/135	580	1	
y y E	. ↓ ↓ E	570	C ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓			570		Ē
SAND	FILL	560	SAND		WATER	560		SAND
		550				550		
	CLAY	<u> </u>				540		
		530				530	GLAY	
		<u> </u>			## 	520		
· · · · · · · · · · · · · · · · · · ·		510		CLAY		510	· · ·	
CLAY		500				500		
		490				490		
		480				480		
		470				470 ·		
		460				460		
		450				<u> </u>		
SECTION C	<u> C</u>	440		SECTION D-D)	440		

NOTE: ·



FOR COMPLETE SOIL DESCRIPTIONS AND WATER LEVEL DATA SEE LABORATORY LOGS OF BORINGS

0 50 100 (SCALE IN FEET)



1

-PROPOSED DOCK 22 E ELEVA TION (H· H) (HI) (B-2) (L-7) (8-29) ·Β-5, (B?.3) (B-20) L+4, ((-17) 6.18 (ind) 590 V 580 ----29.93 X K 100 ₽ ∇ ŢΣ V 570 -----A CONTRACT Net St SAND ILL 11.1 ORGANIC SILT SAND 5.00 GLAY WATER 550 SAND CLAY ----- 530 CLAY ----- 520 -----CLAY --- 510 _____ SILT ---- 500 SILT - 490 -------- 480 Ø Щ ----- 470 ____ SILT - 460 _____ 甘 SHALE ---- 450 ----囲 目 囲 440 SECTION A-A NOTE: INDICATES BORING NOT IN PLANE OF SECTION 430 _____ SECTION B-B FOR COMPLETE SOIL DESCRIPTIONS AND WATER LEVEL DATA SEE LABORATORY ■ E INDICATES WATER LEVEL
■ ENCOUNTERED DURING DRILLING LOGS OF BORINGS 0 50 100 ∇^{C} INDICATES WATER LEVEL (SCALE IN FEET)

1 A







C-4533

David V. Lewin Corp. / GEOTECHNICAL ENGINEERING

-12-

'₩ 'nɔ/# 570.9± 96 97 Unit Dry Weight 99 104 116 123 11 RESULTS 127 600°C-8 Loss on Ignition 8 8.6 7.3 Surface Elevation_ % niert2 6.3 TEST 9.7 13.6 9.8 16.4 20.0 20.0 15.2 Boring No. Shear Stress #/SF 365 420 425 685 1015 1800 1240 4760 0F Uncontined LABORATORY LOG OF BORING 49.7 44.4 29.0 30.9 29.5 21.4 22.9 34.8 31.9 29.6 33.1 25.3 20.9 18.5 19.3 21.8 15.0 12.1 11.9 27.3 24.3 22.4 23.7 21.3 12.6 teet ni elqmas 19.5 21.5 24.5 30.0 31.5 36.5 41.5 46.5 51.5 56.5 61.5 66.5 71.5 76.5 81.5 85.9 90.9 95.4 00.3 06.5 Depth to bottom of 16.5 11.3 26.5 ŝ 30.9 35.7 5 sadoni SI rot B - N 6 5-2 9 nooqa no awold 7 9 8 50/.. 50/.1 50/.4 50/.3 50/.4 5 2 42 38 51 60 58 50/. 50/ 5 65 66 * rock frags. gray, clayey w/few gravel organic & oil odor Seamo . sean w/s at 135' to frags. 00 sanj rock silt silt DESCRIPTION Shelby Auger silty w/rock w/s w/tr sand & gravel shale frags. a 135.7' gray, line w/few End of boring at 140.0' u/s silty gray, silty silty silty silty Method of Sampling: Split spoon 🖾 Core drill 🛛 **Y**pucs gray, gray, frags. gray, gray, gray, угау, Silt, Clay, Sand, SILC, **** Iodmyz ****** Depth in feet <u>y</u> <u>uul</u>iii <u>metricitum li manul matri</u> Ş 8 8

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to 135.2'

at 135.0'

gas

*Shelby Tube Encountered _c

REMARKS:

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ng No. .ce El	OF TE	Shear Stress #/SF	5			and a standard and a standard and a standard and a standard a standard a standard a standard a standard a stand	ann an San San San San San San San San S				935 1	995 1	255 2	110 2		150		15 12	алан адаа ул _т ал та стала са се	-			10/1		
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а 2		sample in feet Depth to bottom of						14.5 16.5	51.5	4.5	0.0	6.5	ů.	و ی	د		.5	6.	- 9	-5	-5		<u>д</u> ,	<u> </u>	Discon graderica
		Blows on spoon soft 12 inches		annon a fair a fairne a faireann	darge (b. R. H. J		- Sconcepter & - Sconcepter & -	<u>່</u> ເກ m	ন্য ব্য	য় ব	S-1 22 22	24 6	29 7	66 7	8 63	51 8(57 91	0/.4	0/.4100	66 106	111 20			Ree Balley and a subscription of	
od of Sampling: spoon & Shelby [] drill [] Auger []		DESCRIPTION			Water			Clay, gray, silty w/s organic mat'l		gray, silty w/s sand & shale					gray, silty, sandy w/s gravel	4 shale trags.			5 Struy, silty w/s silt seams		Silt, gray, clayey	End of boring at 111.5' REWARKS.	*Shelby Tube	EUCONTERED GAS POCKET AT 85 TO 87 FEET	
Meth Split Core		Depth in feet	يسلسب	<u> </u>	<u>l</u>		يالىسىل		<u></u>			بالللة	Luu	يبينا									1		
		an an fan daar en en een een een een de seen de se				<u></u>	<u></u>	aniyoono aniyoono ah	<u>n</u>		9	7	•	8		6	<u> </u>		3		1	ĥ	3	<u>ਸ</u>	

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-14-ATORY LOG OF B

Prion Prion V/tr. gravel & tr % sand & tr % sand & tr	LABORATORY LOG OF BO eiby G w/tr. gravel B 11 17.5 20 36.5 21 55.0 31.5 2 5 41.5 31.5 2 5 41.5 31.5 2 5 41.5 31.5 2 5 41.5 5 41.5 5 41.5 6 46.5 37 71.5 37 71.5 19 66.5 37 71.5 37 76.5 37 76.5 37 51 51 61 62 63 64 65 70.5 37 51 52 65
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LABORATORY LOG OF BORING -15-

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Method of Sampling: Split spoon Z Shelby K Core drill Z Auger

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-16laboratory log of boring

Boring No. <u>1.4</u> Surface Elevation 570.9±

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SI SI	Jnit Dry Weight //cu, ft.	#		- d unit - <u>di contenen</u> te po			an a					123	124		127					08				an an table of a second se					angewaren in an angera (
SUL.	8.Q.D %	I					and y Congression		4-1-0-0							0-740	- 15					Debelgi ging <u>aan saaraan</u>								
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DF TE	Uncontined Shear Stress #/SF	5										250	205		170 2					000		6		- -		10/2	nd, O	an an she says in fragme	50.,	
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SUN	% əruteioM leruteN			26.7	33.2	30 . 4 32.1	37.3	33.1	31.6	30.4	36.9	17.0	16.6	15.6	16.8	12.2	13.4		5.5	0.6	1.7	7.9				ring (cation b No.:			
	Depth to bottom of Bample in feet		11.5	16.5 21.5	27.0	31.5	36.5	41.5	46.5	51.5	56.5	61.5	66.5	71.5	76.5	31.5	36.5	1.0	6.5 1	1.5	10-9	1.0 2	5.1	5.1	******* <u>~</u>	<u> </u>	<u>01</u> <u>1</u>			
ag the Development	Blows on spoon for 12 inches		, 25 25	n 6	5	o u	4	4	~	ω	2	47	EE	44	55	62		0/.5	<u>د</u>	34	. 10	.4 11	3% 11 12	58 12					1997 - Carlo Carlos - La Carlo	
_	DESCRIPTION	Water	Fill: gray sand, gravel, concrete black coal, sand, gravel, cinders, wood, tr. of oily substance	Clay, gray, silty w/silt seams & tr. gravel	9ray, silty *						·	gray, silty w/s sand, gravel & rock frags.				sandy	w/few sand & silt seams		gray, silty, sandy w/gravel & 7 rock frags.	gray, silty w/tr. shale frags.		w/silt seams	iale, gray, hard w/s sandy shale 70 seams		d of boring at 125.1'	MARKS: helby Turbe				
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ØO Shelby Auger Method of Sampling: Split spoon 🛛 Core drill 🛛

-17-LABORATORY LOG OF BORING

ĥ Boring No.

570.9±	
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ſ		Depth to bottom of sample in feet		27.0 29.0 31.5	36.5 39.0	17.0 51.5	5.5	1.5		1.5	6.5	1.5	6.5	1.0		.5	-5	-5 16	2 22	1 0	-	ġ ğ	Ör
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				an a	<u>ہ</u> *	* 	,	~~~~	17	Ň	m 	М	87	50/ 50/	50/	75	49	46	41	80%	-		
		DESCRIPTION	Water	c. Sand, clayey w/s gravel Clay, gray, silty				Tray, silty w/shale frags. a tr. sand				gray, silty w/s sand & rock	trags.	Silt, gray, clayey, sandy w/shale frays.		Clay, gray, silty w/s silt seams		w/sand seams		viale, gray, hard vertical fracture at 126.4'- 126.8'	End of boring at 130.2'	*Shelby Tube	
		Depth in feet	<u>uning</u>	سيابينيابينيا	للبينيا	<u> </u>								ttooorr	****	•••		ΠШ		ШЦ			
L		₩₩₽₽₩₩₽₽₽₩₽₩₽₽₩₽₩₽₽₩₽₽₩₽₽₩₽₽₩₽₽₩₽₽₩₽₽₩₽	H	<u> </u>		<u> </u>	<u>ب</u>)	70		80		0	2	8			Q		<u>M</u>	<u> </u>	<u> </u>	<u> </u>

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0.9±	IS	Init Dry Weight /cu. ft.	#					114	109	120	123	126	120	ginnessation (franks) ag sadag				
n 57	ESUL	00°C-% oss on Ignition @	9 T			5.9			ang dan sa a		- 		.		in the second			
L-6 evatic	STR	% risi3	S					0.0	0.1	0.0	0.0	0.0	0.0	Warden and a star and a star and a star and a star a star and a star			9/27/8	(111(
lg No.	OF TE	Jncontined Shear Streag #/SF	5					135 2	610 1	015 2	490 21	535 2(325 20			Manana ang pangang pangkang panggang panggang panggang panggang panggang panggang panggang panggang panggang pa	sted: veland 4533	
Borii Surfa	RY (Plasticity Index	C C	Alter all annotation and a share and a state of the stat				<u> </u>		Ř	Ň.	S.	μ.				C.e.	TT T.A
~~ ~4	MMA	timid biupid	P					an a the analysis of the second s							and a competence	ann Company and an anna an an anna an	ng Co	T FT
	SUI	% ərutaioM IsrutaN				34.3 31.5 28.6	29.8	21.5	22.4	17.2	16.2	15.7	18.5	18.1	12.8	14.4	Borir Local Job N	UNI C
		Depth to bottom of Depth to bottom of				31.5 33.5 36.5	41.5	46.5	51.5	56.5	61.5	66.5	71.5	76.5	81.0	85.4	E	INEEI
		Blows on spoon for l2 inches				3 8 C	7	19	44	33	44	43	6E	43	0/.5	0/.4	g in a	ENC
of Sampling: oon 🖾 Shelby 🛛 ill 🔲 Auger 🔘		DESCRIPTION		Water	·	Clay, gray, silty w/s organic mat'l w/cinders & tr. oily substance at 30'-31.5'		gray, silty w/few silt seams & tr. gravel	gray, silty w/silt seams & tr. rock frags.	gray, silty w/rock frags. & some sand seams						sand in bottom of sample 5 Id of boring at 85.4'	Fncountered gas at 85± feet vented overnight-gas still ventin Water before pulling casing at 2'	V. LEWIN CORP. /GEOTECHNICA]
t ap e dr		Symbol													HH	<u>a</u>	RKS	A I
Met Spli Cor		Depth in feet	<u></u> 2	8	<u>يدنيني</u> ج	<u>uuluu</u> S	<u>↓</u> ≩	l S	<u>d.</u> 3	ن <u>ا بينې</u> س	Jun					Hung H	EMA	DAV
		· · · · · · · · · · · · · · · · · · ·					and and a second s	· ,		:								

LABORATORY LOG OF BORING -18-

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Split Core	Depth in seet	<u>uuluu</u>	Luntu	<u></u>	<u>u.l.</u>	- Line	<u>l.</u>		<u></u>	<u></u> S	<u></u> 	Luy	Juri	للعبين	لسا		<u>کتا</u> بارر	ul	سيا	EMAI
	Symbol						田日								HH	の 日上教授	385	ы		RKS
oon KJ Shelby KJ 11 O Auger O	DESCRIPTION		Water .			clay, gray, silty					gray, silty w/rock frags. & some sand seams				·	and, gray, silty, fine w/s silt	seams	nd of boring at 80.4'		*Shelby Tube
	Blows on spoon soft is inches			and an and a first state of the		0 4 1	13	12	* 18-1 18-1	91	27	36	50	43	85	54	50/.4			
	Depth to bottom of Bample in feet					31.5 33.5	36.5	39.5	42.0 43.5	46.5	51.5	56.5	61.5	66.5	71.5	76.5	80.4		the second s	
sur	Natural Moisture N		რემელი იღელი ითლევე მიმი რერ მის მა სამე არ კათ და თახე იფერი და მარ კათ და მა			30.5	18.7	22.0	20.7 21.8	23.3	17.5	14.7	17.0	16.7	17.2	17.2			an a suite an	Bori
Su	Liquid Limit													00 - 200 - 200 g a gas d <u>arman</u> teng			2	and the second secon		Dg Con
rface E Y OF J	Plasticity Index					945	1170		1755	1675		1885	1840	2145	2635	3295				unleted.
Clevation FST RF	3 				00000000000000000000000000000000000000	18.9	20.0	,	20.0	20.0		17.0	20.0	20.0	20,0	20.0	and have been a subject of the subje			- 10/2/80
1 570.9±	Unit Dry Weight			n)egel gezogen gilteren Kineg			120		اللہ میں ا اللہ میں اللہ	105	123	123	124	122	119	119			ang sa far an	
	*11 .uo/#	• 1				_							and the second	and a formula sold an anna a subse						

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-19-LABORATORY LOG OF BORING

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DAVID V. LEWIN CORP. /GEOTECHNICAL ENGINEERING/CLEVELAND. OHIO 4533 ບໍ No.: do J

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-20-LABORATORY LOG OF BORING

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2.4	SI	Jnit Dry Weight //cu. ft.	*								96		107	111	110		717	119	118	eredenmenning-decentres			.25	20		-	<u>ت</u>
n 582	ESUL						5.6									and a second second	nen ingrature		**************************************	in an							<u> </u>
L-8 svatio	ST RJ	% nisit3	;				#Internet in Index of State	<u></u>	 		13.3		16.8	15.6	6.4		3.2	0.0	0.0	- <u> </u>	110-1		4.4	.2			· 03
ig No. ce El	OF TE	Uncontined Shear Stress #/SF	•								365		1040	2055	1430	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	2995 1	3735 2	3800 2				900 II	200 15		-	50 10,
lorir Iurfa	RY	Plasticity Index											·····	. <u></u>				-irung ander-ree		40 <u></u>			•	<u>.</u>			
ы N N N N	AMA	timid biupid	1				999											****									
	SUN	% ərntsioM lerntsN	17.2	(4- V	20.5	12.6	11.5		35.0	32.5	29.3	24.4	20.4	21.5	21.9	18.7	15.7	16.8	18.3	19.2	0.3	1.8	3.8	3.2	2.1	1.8
		Depth to bottom of Depth in feet	3.5	6.0 6.2	0.0	15.0	20.0	25.0	30,0	35.0	40.0	45.0	50.0	55.0	60.0	65.0	70.0	75.0	80.0	14.0	0.0	4.0	9.0	04.5 1	1 6.9	3.91	9.31
		Blows on spoon tor 12 inches	21	50 7. 2	7	. 38	83	20	m	6	6	19	19	27	ec.	43	VE M	रू रू	city	8/.5 8/.3 80/.3	6 62	5/.5 0/.3 9	37.5	74 1(0/.4 10	11 2-70	0/-5 11 11-4 11
Shelby D Auger D		CRIPTION	brown silty sandy el, rock frags., red limestone gravel	cinders, slăg, iron llets, concrete, red wood fine to med. layered	to coarse, silty w/tr.		, gray & black fine to med., silty	Təvə	fine to med., silty n rotted wood	silty w/tr. sand w/s eams		silty w/fine sand			outry W/SIIE scams, Nd, tr. gravel & rock				Pro- 147-177-2	andy w/tr. clay w/ lty sand seams		ilty, sanıly w/gravel 4 frags.	ilty, sandy w/gravel, 5 ags., cobbles		<u> </u>	<u></u>	40.0
of Sampling: oon 🖾 iii 🗍		DES	Fill: gray & Wyrav brick,	black ore po brick, Sand, brown,	w/med. gravel		Organic Silt Sand, gray,	16 s/m	gray, w/brow	Clay, gray, silt s		gray, s			truy, " trags.					Silt, gray, s gray si		clay, gray, s. & rock	gray, si rock fra				
lod drif		lodmy2	X.	1A					NX 1							TH.			Ħ:	****	* * * *				EET	1111	
Met Split Core		Depth in leet		يسبا		Lu	سلیں R	سلب	<u>لم الم</u>		<u>ياب</u>	سلب	يبلين	Lu	بيايت		y	<u>dur</u>			بابر		لينيك سيلي		LUA LUA	+TTT LLLL	

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 OG OF BORING
LABORATORY I

Method of Sampling: _plit spoon 🖾 ore drill

00 Shelby Auger

580.0 L-10 Boring No.

Surface Elevation

ſ		<u> </u>										
TS	Unit Dry Weight #/cu. ft.						94	104	_	92		
ESUL	00°C-% Loss on Ignition @				4°. 980	6 6 7	and information of the second	an da alat da kanan mangada	2		an an far an	1 7/15/0(
LST R	% nisrt8						9 °2	9.6		6.7		
DF TE	Unconfined Shear Stress #/SF						610	565		570		L late
RY (Plasticity Index			4				to gray man the same of a same of	ingingang panating <u>p</u> anonan		<u></u>	
MMA	timid biupid				n a faith an		and a factor of a second s	-24-2° Majorgan _i sh		kapita di manana mangan dan kabupatén di panina di panina	ali annan ann an Annaise ann an Anna	
SU	% ərutsioM lsrutsN				30.1 23.7	18.0	32.1	27.3	31.4	32.6	n na sea ann an tha ann an tha ann ann an tha ann ann an tha ann ann ann ann an tha ann ann ann ann ann ann ann	- µ
	Depth to bottom of Depth to bottom of	2.5	5°0 6°1	10.0	15.0	20.0	25.0	30.0	35.0	40.0	94999 Martin dan Belehinti yang meningkang	-
	for 12 inches Blows on spoon	17	- M	18	53	24	2	0	~	<u>ب</u>	27994200), mmma 2000202 <u>9794 (mmba apra</u>	
	DESCRIPTION	Fill: limestone gravel black cinders, slag, coal,	red brick		Sand, black, fine to med., silty w tr. gravel, some organic met'l gray, fine to med., silty w/s	gray, med.	Clay, gray, silty w/tr. fine sand w/clayey silt seams	gray, silty w/tr. fine sand			End of boring at 40.0'	S Encountered water at 7.5' Water at 8.4' on completion
	Symbol	The second se	Y/1/,								93 Tanil - Calman ann an	ARK
ŀ	Depth in teet				<u>undr</u>	<u>uul</u>	سلب	بىلىپ	بلبب	<u>م</u> م		M.

C. 4533 Job No.:

Cleveland, Ohio Location:

on 579.0	LESULTS	Unit Dry Weight #/cu. ft.				aling in the second	*Černičko-štirkarazer 2007.00.000.000.000 	105 106 111	66	110	ତ ତ ତ		
evati	ST R	% nisrtS						7.0 5.0 12.9	16.0	13.7	10°50 200		
lg No. ce El	DF TE	Unconfined Shear Stress #/SF						2160 1280 1535	1245	1050	9045 705	elate Tre By ATTE Action of Segment young	
or ir Surfa	RY C	Plasticity Index			ana ang kanang kang kang kang kang kang	ahda Williamada pağlanı	anna a star a	annan an a		Sanahour ann an	at may be for a second seco	atta a a a a a a a a a a a a a a a a a	
- 01	MMA	timid biupid			500001 <u>00000000000000000000000000000000</u>	and a second	2	ergeletingdon legen de legen d		Bi la de consecutivo de prancesco de con			
	SUI	% əruteioM Istuts ^N						22324	28.2	24.4 20.3	20 20 20 20 20 20 20 20 20 20 20 20 20 2	3-4-70-74-7-1-73-97-7-1-79-	
		to motton of damage in feet	1.8	5°0 0°2	10.0	15.0	20.0	25.0 27.0	30.0	35.0	38.5 40.0	ana orazon da antendo	
		Blows on spoon Blows on spoon	50/.3	С <u>С</u> 8 4	49	23	37	S-1 29	26	20	S-2 10		
Sampling: 1 (S Shelby E Auger D		DESCRIPTION	pavement 11: limestone gravel	concrete black cinders, slag, red brick frags., wood, iron ore pellets	black & gray layered silty sand, fine to med., tr.brick frags., cinders, organic mat'l	gray sand & brick	nd, gray w/s decayed wood	ay, gray, silty w/fine sand *		gray, silty w/s rock frags. gray, silty	-k	l of boring at 40.0'	
od of spoo drill		γλωροj	NE VZ				й Г	ठ इ स्तास				日	
Meth Split Core		Depth in feet				- <u>~~</u> //	<u>8002</u>	<u> </u>			uuda g	ىلىپى	<u> </u>

LABORATORY LOG OF BORING -22-

C. 4533 Job No.:

Location: Cleveland, Chio

	BORING
-23-	SORATORY LOG OF BC
	L.A

Method of Sampling: Split spoon 🖾 Sore drill

00 Shelby Auger

L-12 Boring No.

578.5 Surface Elevation

ស៊	Unit Dry Weight #/cu. ft.		*	2000-2000 - 2000 - 2000 - 2000 - 2000 - 2000 - 2000 - 2000 - 2000 - 2000 - 2000 - 2000 - 2000 - 2000 - 2000 - 2		106	107	106	101	109	107	
ENULT	oiting1 on Ignition و 200°2-8	n frankreit geschichtigt ihregter zurstenigt ihreiter		21-1-1 2-1-1-1 2-1-1-1	ngan nga baran sa nga nga nga nga nga	ağınlaşanlarındu çet⊯ φ∑ası anlın ağışağığı	22			and an and an		0/17/0
212	% nisrt8			an ú trá tra bha an Bharg tra ann agus		11.2	12.9	7.8	14.8	19.2	9.9	ed:
	Unconfined Shear Stress #/SF					1430	1900	815	480	1970	1985	molete
ЧЧ	Plasticity Index			a generation and an						and and an	Portage	о С
MMA	timid biupid			n a tha an		n <u>nar</u>	unnen figenjeren en anderen et					orin
202	% ərvtsioM lsrutsN			507.00 0.7.700	16.0	26.1	24.8	23.2	28.8	21.9	22.4	ф
	to motton to bottom of Depth to bottom of	2°5 5°0 6°5	10.0	15.0	20.0	25.0	30°0	35.0	40.0	45.0	50.0	
Rectainment	for 12 inches Blows on spoon	20 28 18 44	ω	σ	44	, U	15	20	~	15	17	
	DESCRIPTION	Fill: 3" brown sand; 6" limestone gravel brown & black layered cinders w/slag & gravel brick laver at 2.3'	1	green organic clayey silt Organic Silt, black w/gray, sandy Sand, brown, fine to med. w/s	coarse, tr. gravel	Clay, gray, silty w/fine to med. sand seams						coring at 50.0' Encountered water at 5.0'
periodik papan	IodmyZ	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	ES ES								匪	of b RKS:
	Depth in feet		<u> </u>		<u>u</u>	<u></u>	ى_لى	سلب	يراب	ساست	<u> </u>	י פרע דעשו

on completion Encountered water at 5.0' Water at 3.5' . EMARKS:

4533 ບໍ Job No.:

Cleveland, Ohio Location:

LEWIN CORP. /GEOTECHNICAL ENGINEERING/CLEVELAND, OHIO

DAVID V.

-24-LABORATORY LOG OF BORING

Method of Sampling: Split spoon

00 Shelby Auger

Boring No.

L-13

577.5± Surface Elevation

Ņ	Unit Dry Weight #/cu. ft.				dinterent angele kan nge kan nge kan nge kan nge kan nge	104	inderson and a second game	101	98	21650mm, gagar mga mana ay ng]
EULI	600°C-% Loss on Ignition @		a oʻli — Jopa-adiji Cui	₽Ğkavişîng <u>t</u> ale <u>s</u> tendîşiyê	an iya an	۵ ۲	₩	anonya ang akarang ang ang ang ang ang ang ang ang ang		Maaraan aana an ar	17/90
ST RI	% nisrt2			si≣anka <u>n</u> anannanyady ∙og		6.7	inan dilitarati na mandala di	ຜື້ດ	10.2	nangan karan Baranan karan karan tangan tangan sebagai karan	ed:12/
OF TE	Unconined Shear Stress #/SF			and a second	an a	635		810	730	nantanoopen kananga panangapaka <u>a</u> ng	mplet
RY (Plasticity Index	angene and an			n Than an Anna an Anna Anna Anna Anna Angara		latin te di tang sy	n general a sinnen dirika daripada			
AMA	timid biupid	and Tableson and the second	(************************************	<u></u>				#10 ⁰	haloonii)genyner astaane	androgene (management of the second of t	oring
SUN	% əruteioM IsruteN		and Texason And	200000000000000000000000000000000000000	16.2	27.2	31.9	29.4	28.2	ntaan yaat da khanisti kagangiyi waxa geregene	Щ
	lepth to bottom of sample in feet	2.5 5.0 7.5	10.5	15.0	20.0	25.0	30°0	35.0	40°0	۳۵-գեգուց (գետի հետ է գետր ۳۵-ին հետ է Սիննի հետ է Սիննի հետ	
	for 12 inches Blows on spoon	17 15 19	29	kans kaas	79	0	5	12	2	1888-9 (billing gennig <u>en gene</u> gen <u>en g</u> en ge	
	DESCRIPTION	Fill: 1" linestone gravel over iron cinders, white cinders, gravel, slag, tr. brick, concrete, glass		slag, cinders	wood Sand, lt. brown, fine to med.	Clay, gray, silty w/s silt seams & sand seams				End of boring at 40.0'	S Encountered water at 5.0' Hole caved at 3.5' on completi
	IodmyZ		C/J								ARK
	Depth in feet		ц g	uul.	<u>l</u> <u>8</u>	سليد	8	بليب	بيرار ج	<u></u> 8	LEM.

Hole caved at 3.5' on completion

C. 4533 Job No.:

Cleveland, Ohio

Location:

Method of Sampling: Split spoon 🕱 Core drill

Shelby C

Boring No. L-14

-25-LABORATORY LOG OF BORING Surface Elevation 584.8

.ST	Unit Dry Weight #/cu. ft.		•				107	106	113	n an] 。
ESUL'	000°C-% bottingI no seol			anna an	2.0	<u>،</u> ۲	1 4	75-to W-strikting by the dataset		Sight Shutaning a summaries a family	2/13/9
ST R	% nisrt2			ill-nammortanationy-ochydrasen	anna an tha a	φαικά δει τη του	9.8	16.7	10.1	99999 - C. M. Marcell, Space - C. M. Marcell, 1997	d: b
OF TE	Unconfined Shear Stress #/SF					iteraniyasi ya Katanin ya Katani	1320	2205	2530		mplete
RY (Plasticity Index	n Santako Barona Kurio di menandari na kategori dan yang yang yang yang yang yang yang ya		79.49.599.59.64.6000,mg,r, <u>19</u> 7		ĸĸĸŇĸŢĸĸŢŦŢŢŎĊĬĬĬĬĊĔĬĬĸĬĸĬĸŢŎ <u>ĿŢŦĬ</u> Ŏĸ	almoanni inn an a		analogan ya mada ya gu gu gu gu		Cor
MMA	timid biupid			and a second	Z		an ta tha tha tha tha ta tha tha tha tha t	an a		ĊĸĸĸġĸĸĸġĊĊĊĸġŎġĊĬĬĬĬĬŎŎŎŎŎŎŎŎŎŎŎŎŎ	oring
INS	% ərvteioM lervteN			17.8	18.4	26.4	18.2 25.0	24.3	21.6	formalitik santania katika pilikapitan masarrada kating	щ
	Depth to bottom of Demple in feet	3.5 5.0 7.5	10.0	15.0	20.0	25.0	30.0	35.0	40.0		
	Blows on spoon shor 12 inches	45 45 9	1/1.5	3/1.5	ተ	47	ň	12	80		
	DESCRIPTION	Fill: 6" concrete; 2" limestone Brown fine to med. sand w/s gravel cinders, gravel, tr. brick & slag w/layers of fine brown	sand	<pre>Sand, brown, silty (possible fill) gray & black, fine, silty w/s med. to coarse gravel & some</pre>	cobbles & sandstone frags. (possible fill)	<pre>Sand, gray, fine to med. w/tr. organic mat'l, tr. cobbles at 26'</pre>	Clay, gray, silty w/silt seams	Silt, gray, clayey		End of boring at 40.0'	<pre>LS Encountered water at 13.5' Water at 12.5' on completion</pre>
	շչտնօլ		<u>Na</u>	201					• + + • + +		ARK
	Depth in feet		<u>д</u>		ц. 8	<u></u>	ыл Ж	سلب		<u></u> 8	EM

Cleveland, Ohio

Location:

4533

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Job No.:

LABORATORY LOG OF BORING -92-

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.guild.	Ø	0
Method of San	plit spoon	ore drill

00 helby tuger

L-15 Boring No.

581.9 Surface Elevation

IS	Unit Dry Weight #/cu. ft.	
ESUL'		
ST R	% nisrtZ	
OF TE	Uncontined Uncontined	
RY (Plasticity Index	
AMA	timid biupid	
SUN	% əruteioM lsrutsN	
	Depth to bottom of sample in feet	ດ ດ ເຕ
	for 12 inches Blows on spoon	14 50/.4
	DESCRIPTION	Concrete - 12" Fill: brown silty sand Concrete End of boring at 8.0'
	շչանօլ	
	Depth in feet	

Water seepage at 2.0' No water on completion .

Cleveland, Ohio Location:

Boring Completed: 12/14/90

C. 4533 Job No.:

+	IS	Unit Dry Weight #/cu. ft.								105	100		06			-
n 582	ESUL					and a second		4 . 8	4°0	3.6		distriktion same opposite gypersystems som	2/15/9	Ohio		•
I evatio	ST RJ	% niert2		7.2000000000000000000000000000000000000	9 9	alannoola oo	<u>ne</u>	na (and an	aannegenne oorthogdyddag felgage	3.2	6.5	<u></u>	di.	land,	33	
lg No. ce El	DF TE	Uncontined Shear Stress #/SF				ingentionen auf erstätten som statut auf erst		uuunkaan daga daga ay sa ay	Salan Elementaria reg agegag	395	450		mplete	Cleve	C. 45	
Borir Surfa	RY (Plasticity Index		dino- <u>net n</u> unuuu	anno an Canada ann	alle and a second and a second se		anna de sector de la communação y				-10711-10-00-00000000000000000000000000	C C C	ion:		
	MMA	timid biupid		ing and a second second		9	₩-dis*onnengrytyboen	an a				an ya an	orin	ocati	ob N(
	su	% ərutsioM lstutsV	12.9	20.9	15.1	19.2	19°.5	21.2	28.7	26.3	29.7	an Anna ann an tao ann	- Ф	Ч	, T	
		Depth to bottom of Depth to bottom of	4.0	6.5	10.0	15.0	20.0	25.0	30.0	35.0	40.0	₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩				
		Blows on spoon Blows on spoon	ω	m	m	ى	9	26	۲Ü ۲	kanar kaani	ň	440-94				
Shelby 🔲 Auger 🔲		RIPTION	ne to med. silty sand v/gray & brown silty	-y odor at 5'-6.5'	Lay & aspnalt at 10.0'	.ne to med. silty v/gray & brown		<pre>pray, fine to med., some organic mat'l, al & sandstone frags.</pre>	.ty w/s silt seams & uic silt seams	ty	·	t 40.0'	page at 5' and 22' ed water at 22' 13.5' on completion			
of Sampling: ooon 🛛 🗃 cill		DESCI	<u>Concrete - /"</u> Fill: brown fir layered w	sand strang oil	w/s c1 8.5'-1	Sand, brown, fi layered w		black & g silty w/s tr. grave	Clay, gray, sil few organ	gray, sil		End of boring a	<pre>KS Water see Encounter Water at</pre>			
thod it s _I ie dı		Symbol	1/2/2	<u>A</u>	E X	1 1					Ħ	anna a chuir a chuir a chuir an ann an ann ann ann ann ann ann ann	ARF			
Me Spl Cor	L	Depth in feet				<u>undi</u>	لىبىـ <u>8</u>		<u></u>		<u></u>	<u></u>				

DAVID V. LEWIN CORP. /GEOTECHNICAL ENGINEERING/CLEVELAND, OHIO

LABORATORY LOG OF BORING -27-

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-28-LABORATORY LOG OF BORING

Auger Shell Method of Sampling: ^cplit spoon

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by	er

Boring No. L-16

Surface Elevation 585.9

ST	Unit Dry Weight #/cu. ft.					96	t	103		100].
ESUL	600°C-% Ioss on Ignition @			6 . 5	7.0				нбад Тоблиция с на учерени учерени учерени и области и области и области и области и области и области и област •		4/9 0 io
LST R	% nisrt2			92999 <u>60000000000000000000000000000000000</u>		12.3	6 .6	و ° 8		20.0	12/1 nd, Oh
OF TE	Unconfined Shear Streag #/SF					555	615	650		515	leted: levela
RY (Plasticity Index		ου με το	<u>,</u>						<u> </u>	
MMA	timid biupid	an an an ann an an an an an an an an an	na fan yn		<u> </u>						ing C ation No.:
SUJ	% orviaioM IsruisN			31 - 1	35.0	29.7	21.9	25.7	30.3	29.9	Bor Loc Job
	sample in feet Depth to bottom of	0.8 4.0 6.0 6.4	13.8 15.5 15.7 20.0 25.0	30.0	35.0	40.0	45.0	50.0	55.0	60.0	
	Blows on spoon soft is inches	50/.3 15 42 50/.4 51	100/.3 34 50/.2 53 21 21	4	Ţ	0	2	27	fana. Fana	10	ਸ਼ ਸ਼
	DESCRIPTION	Fill: brown sand w/gravel, brick, concrete, slag, metal, wood, asphalt black & gray sandy w/slag, gravel, brick, concrete, tr. glass	brown sand, gravel w/brick, concrete into black & gray sand & gravel w/sandstone & brick, concrete black w/gray layer fine to med. sand w/s coarse & brick	Sand, dk. gray, silty w/s silt seams	& organic mat l dk. gray w/organic mat'l	Clay, gray, silty		•		End of boring at 60.0'	KS Encountered water at 14.0' Hole caved at 5.0' on completic
	IodmyZ									EE	LA RI
I	Depth in feet		<u>un manulun</u>	<u> </u>	سلب	<u>u d</u> u	يبلب	uil.	ىيلىپ	<u>u</u> ll	E E E

LEWIN CORP. /GEOTECHNICAL ENGINEERING/CLEVELAND, OHIO DAVID V.

81.7	L IS	Unit Dry Weight #/cu. ft.		·····		98	96	101		104	110	112	115	120	124	120	130	121	114		130		<u> </u>		
L-17 vation 5	T RESU	% nisrt8				۲. ۲	9.5	3.2		6.0	6.5	ۍ ب	0.0	0-0	0.0	-0-	4	m	6.				5/ 3 0	land, chi	
ing No ace Ele	OF TES	Unconfined Shear Stress #/SF				1630	440	560 1		1025 1	2000	1550 1	1760 2	3295 2	570 21	500 2(200 17	200 16	665 16		950 20		d: 12/1:	. Clevel	
Bori Surfi	ARY	Plasticity Index												<u> </u>	<u> </u>		<u>.</u>	<u></u>	<u>5</u>	•• •••			uplete	cation C. 453	· · · · · · · · · · · · · · · · · · ·
	SUMM	Vatural Mointure % Liquid Limit			2.6	0.0	.5	m	6	9	8		6		2	6		0	9				<u>ğ</u>		
		le mottod ot dams uepth in leet	6.5	5.0	20.0	5.0 26	0.0	5.0 26	0.0 30	5.0 27	0.0 22	5.0 20	0.0 19.	0 17.	0 16.	.0 14.	.0 15.	-0 16.	0 19.	0 22-1	.0 12.			ION TO TO	
		Blows on spoon for 12 inches	50/.5 65 17	, 0 ,	19	17		۳	9	و 4	17 5	15	23 60	30 65	33 70	35 75	38 80	34 35	05	4 95.	1 00.		<u></u>		<u> </u>
d of Sampling: poon 🔯 Shelby 🛛 Irill 🗍 Auger 🗍		DESCRIPTION	2" asphalt; 10" concrete Fill: rock frags, cobbles, wood, brick, sand, silt, granulated slag brown silty sand v/s gravel slag, sand, gravel	some cobbles sulphur odor	Sand, gray, coarse w/s clay seams	Clay, gray, silty w/silt seams	gray, silty				gray, silty w/s sand, tr. gravel & rock frags.							10		Silt, gray, clayey w/clay seams 3	Clay, gray, silty w/gravel & rock 6	End of boring at 100.0'	REMARKS: Encountered	Hole caved at 17.0' on completion	
letho plit a	-	Depth in feet	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	\$* <i>***</i> ***	<u>۲۹۹۲</u>	يلىبىد											Ħ		ЩĽ	****	III_				
A N U	L	anna papa sa sana ang sa			ର		କ୍ଷ		₹		8		- 8 -		2		<u></u>		<u></u>	بدلت	بيلغب	سلب	<u>-ц</u>	uuluu	yluu i

-29-Laboratory log of boring

Method of Sampling:

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LABORATORY LOG OF BORING -30-

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Shelby Auger Method of Sampling: Split spoon (3) Core drill (1)

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add 5.3 3.1 1.1 10.5 5.1 10.5 send, 10 15.5 22.1 1 10.5 1.2 26 20.5 22.1 2 21.5 21.5 1.2 26 20.5 25.5 25.2 17.90 17.0 105 20 30.5 25.4 855 11.90 107 105 20 35.5 25.2 11.30 17.0 106 107 20 35.5 25.2 21.2 440 9.6 107 21 40.5 31.2 440 9.6 107 107 20 35.5 22.2 13.20 13.2 13.2 110 21 40.5 31.2 13.2 13.2 13.2 110 21 52.5 15.6 35.6 13.2 13.2 110 21 52.5 15.6 25.7 1300 11.4 107 21	wood 1.3 3.3 3.1 4.1 1.0.5 4.1 1.0.5 r, wood, connidense (10 10.5 20.5 20.5 20.5 1.1.6 1.1.5 r, wood, connidense (10 20.5 20.5 20.5 1.2.5 1.1.6 1.1.6 20 20.5 20.5 25.4 895 11.40 10.6 20 30.5 20.5 20.5 20.5 20.6 90.5 10.6 20 30.5 20.7 80.6 10.70 90.6 10.6 10 45.5 31.2 40.6 90.5 10.70 10.6 11 80.5 10.5 20.7 90.7 10.7 10.7 20 80.5 15.6 20.6 10.6 10.7 10.7 20 80.5 15.6 20.6 10.7 10.7 20 80.5 15.6 20.6 10.7 10.7 21 80.5 15.6 20.6 10.7 <th>ders,</th>	ders,
10 15.5 22.1 1 1.2 16 25.5 27.5 25.4 855 11.2 20 30.5 25.4 855 11.2 105 20 30.5 25.4 855 11.2 105 20 30.5 25.4 856 12.9 105 20 30.5 25.4 856 12.9 106 11 40.5 31.2 440 9.6 95 11 95.5 20.2 11.3 11.4 107 11 95.5 20.2 11.4 9.6 11.2 11 95.5 20.5 11.3 11.4 107 12 90.5 11.3 13.0 11.4 107 13 15.6 15.6 15.6 11.3 116 14 80.5 15.6 15.6 11.3 116 20 60.5 20.1 150.6 12.6 12.6	10 15.5 22.1 4 1.2 16 20.5 27.5 17.4 1.2 16 20.5 27.5 17.4 1.2 20 30.5 25.4 553 11.2 105 20 30.5 25.3 1390 17.0 105 20 30.5 25.3 1390 17.0 105 20 30.5 25.3 1390 17.0 105 20 30.5 20.3 13.2 105 105 10 45.5 31.2 440 9.6 90 11 90.5 12.5 13.5 13.5 110 20 60.5 22.7 1360 13.2 110 21 90.5 17.4 9.6 112 112 20 60.5 17.0 140 107 112 20.1 10.5 11.5 1150 112 112 20 60.5 <td>wood Y sar</td>	wood Y sar
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Boring Campleted: 12/10/90 Location: Cleveland, Chio Job No.: C. 4533	Boring Campleted: 12/10/90 Location: Cleveland, Chio Job No.: C. 4533	4.00
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-31-Laboratory log of boring

Method of Sampling: Split spoon 🖾 Shelby Core drill 🔲 Auger

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Boring No. L-19

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Elevation_	
Surface	

		1						and the second secon																		
. ß	Unit Dry Weight #/cu, ft.			•				108	110		101	109	107	118	126	124	123	124	117	121	30					
ESUL	600C-% Loss on Ignition @					1.5	4,5			lFterneren gegene	<u></u>								· · · · ·	ر						
ST R	% nisr38		_			•		6.7	8.1		12.6	12.9	12.8	20.0	50.0	0-0	0.0	0.0	0.0	0.0	0.0	Waldowan a 🗤		oju oju oju oju oju oju	te anternatio	
DF TE	Uncontined Shear Stress #/SF							945	1480	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	01.2	815	840	435	100	395	770 2	760 2	375 2	020 2	50 21			: 12/5 land,	m	
RY 0	Plasticity Index														<u> </u>	<u>N</u>	m	N	Ř	40	7			Lered	22	
MMA	timid biupid			·														. <u> </u>								
su	% stutsioM IstutsN					21.0	25.6	24.2	21.8	29.0	28.5	22.2	26.2	17.7	15.8	17.0	16.4	18.0	8.7	8.5	1.9	9.3		or 19 ocatio	<u></u> ਸ਼ੁ	
	Depth to bottom of sample in feet	3.5	6.5	10.0	15.0	20.0	25.0	0.0	5.0	0.0	5.0	0.0	2.0	0.0	0.0	0			<u>-</u> -				¢	<u> </u>		
	Blows on spoon for l 2 inches	. 6	ы	52	57	57		 	94 	6	9 4	<u>. v</u>	<u>نت</u> بو	<u>ق</u> ھ	- 65		- 72		85	06	95	-5 99.			·····	
		v.		g					(.)			N 	ر	Ň		М		8	6ñ 	52	87	50/				
	DESCRIPTION	Fill: black cinders, brown silty sand, slag, tr. brown cinder brick, wood		black fine to med. silty sar	w/cinders, brick & sulfur gas odor	Sand, gray, fine to med., silty w/ silt seams, black seam å sulfur gas odor	Clay, gray, silty w/tr. fine sand & some silt seams		Grav. siltv v/tr fine con			gray, silty, sandy w/gravel / rock frags. & some silt seam								gray, silty, sandy w/gravel, rock frace "	toon lidys, & copples		d of boring at 99.0' MARKS:	countered water at 6.5'		
	Γοάπγε	U.S.	A Star				IIII							TTT	TIT	FFFF		TELLI		HIII	TIT		日間	<u>යි</u>		<u> </u>
	Depth in leet	····	Lu	ىيلى	щ	سيلب	سليت	سليد	سلس	سليت	سلب	ulu				ينليد	IIII									
L				<u> </u>		<u>N</u>		<u></u>		<u>-</u>		ជ		9		20		°.		- <u>S</u>	للساسات	-84		ىبىخە	<u>un na /u>	ய



GEOTECHNICAL ENGINEERING -David V. Lewin Corp.



/ GEOTECHNICAL ENGINEERING David V. Lewin Corp.



GEOTECHNICAL ENGINEERING ~ David V. Lewin Corp.

	an a	an a	dia pananakana mandara ana kanang menganan kanan darakan darakan darakan darakan darakan darakan darakan darak				ND' OHIO	CLEVELA	<u>, 1997), 1997, 1997, 1997, 1997</u> , 1997, 1997, 1997, 1997, 1997, 1997, 1997, 1997, 1997, 1997, 1997, 1997, 1997, 1997	- vezer szecimentegy (filmer- szeleneyinne	N COBD.	O A° I'EMI	IIVAD
	16/27/1	Date	СВ		Techn	ттада. ту сіау	м\в госк Gray sil	5°69		69S °	1999-1999-1999-1999-1999-1999-1999-199		9.12
		C* #233	,-30°0	28°0	лерси	.cation	iliaasLD	Gravity Spec.	ు	0 ₉	b'I'	L.L.	.JaioM .JaioM
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-35

Void Ratio

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Void Ratio



Void Ratio

-37-

	ND, OHIO	CLEVEL	и совъ°	DAVID V. LEWI
Technician CB Date 1/27/91	Стау зіlty сlay	۲°2	₱ 98 •	31.5
Depth 45.0'-47.0' C. 4533	Classification	Spec. CC Gravity	P.I. ^e o	Moist. L.L.
Boring No. L-5 Sample No.	an a	QAOJ SUSAT	VOID RATIO VI	
	Kips/s.F.	ni beal	ŦŢŢŢŢġĊŎĊŎŎŎŎŎŎŎŎŎŎŎŎŎŎŎŎŎŎŎŎŎŎŎŎŎŎŎŎŎŎŎ	nan an minan yang ang manang ang manang ang manang ang mang m
50 30 40 80 100	01 8 3	534	د ۲	٤، ۲
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Void Ratio

	OIHO , OHIO	CLEVEL	N COBP.	DYAID V. LEWI
Technician CB Date 1/27/91	стау відту сіау	2L°Z	°272	8.71
рерѣѣ 40.0'.0'.2₽_10.0 с. 4533	Classification	CC CTAVIEY	P.I. ^e o	Cont. L.L.
Boring No. L-7 Sample No.	Na 2012 million de Carlo de Sala de Sal	CAQJ SUSAF	IV OITAR DIOV	
	.4.2\sqiX n	ii beal		
50 30 40 80 100	01 8 5	534	l S.	د . ۲. ۲.

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Void Ratio

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16/12		CB	Technician	үтту стау.	is yard	2° 70	anna ann ann ann ann ann ann ann ann an	682°'			59°67
	C* #233	-38°£	Ъер±ћ36.5.	ication	Classif	Gravity Spec.	သ	0 ₉	P.I.	L.L.	• JUOD • JELOM
°ON	l alqms2	11-Л	Boring No.		₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩	₹D	EKSUS LO	V OITAR	AUID		
•			n - en	E.	. S\sqiy	ni bsol	nitan , 1994 (1996 - 1997 - 1999 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 -				
	001 08	(50 30 40	01	8 9	3 4	2	L	S°	۲ °3	•

-40-

Void Ratio



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Void Ratio

(jsd) NOISEHOD DOCK SO AREA

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. <u>B-1</u> levation 578 ± 579.2	ST RESULTS	*ain % ** on Ignition 00°C % 00°C % u. ft.	str Los 0 6 1 1 1 1 1 1 2		5.7			7 105	0	96	105	001 83	107	117	115	. 119	113	112	109		131	130	
ORING Boring No Surface E	SUMMARY OF TH	stural Molature iquid Limit asticity Index confined ear Stress #/SF	945 40 14 17)) 32 13 1025 8 .	1190 17.	41 17 1160 10.	1540 20.0	36 14 855 15.8 1070 12.0	1150 20.0	9 11 2200 20.0	2290 20.0	3210 20.0	2370 20.0	3150 20.0	3050 20.0	-	5500 9.7	8000 15.0	leted: 10/7/77 veland, Dhio 3033
a 0 0 0 1 0		noora no avoit siowa on apoon softo fototo to motto botto fagin i sigma	and H t E s	al 1 6.5 25	12 10.0	8 15.0	22 20.0	11 25.0 24.0	1 12 30.0 23.5	S-1 33 5 29.6 13 35.0 24.9	14 40.0 26.5	6 45.0 29.6 S-2 29.4 5 50.0 25.9	7 55.0 21.3	16 60.0 20.0 Z	23 65.0 21.1	25 70.0 18.3	26 75.0 20.8	37 80.0 20.5	1 85.0 20.4	5 90.0	95.0 11.4	100.0 11.2	Ностир Ностир Досанри: Cie Лор No. : Cie
10d of Sampling: 1 spoon & Shelby & drill D Auger D		DESCRIPTION	Fill: brick, stone, concrete & s	w/some organic materli	Blag	slag Sand, gray, w/few thin silt searns	Clay, gray, silty, w/some silt sear & sand served		gray, silty, w/trace of grave		gray, silty		stav, suity, w/trace of gravel & sand		gray, silty, w/some rock fragments	gravel a gravel		£	4	36	0 m	End of boring @ 100.0' 39	KS: tered water at 4.5' t 13.0' on completion
Meth Split		Depth in feet				A		للللل للللل 8				l 	1111 1			<u></u>	اللل سريا سريا		اللل	<u> </u>			HC REMAR Encount Water a

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OF BORING

	Shelby	Auger
npling:	ច	D
Method of Sar	Split spoon	Core drill

80

Boring No.

Surface Elevation

TEST RESULTS

Ч С

SUMMARY

578 ± 577.94 ₿-2

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% nisr32

Uncontined Plasticity Index

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isel ni siqmis

Blows on spoon asfori SI roles

13.4

25.8

10.0

80

& sandstone

gray sand

걸

15.0

23

Sand, gray, w/trace of gravel silty

3.5 6.5

19 8

w/some organic material

brick, rocks, wood, coal

շչտնօւ

Depth in feet

Unit Dry Weight

Loss on Ignition @ 600°C. - %

Shear Stress #/SF

% sruteioM IsruteN

Depth to bottom of

DESCRIPTION

1113 105

000 20.0

20. 14. 8.

1300 2480 3110 1700

21.2 20.1 19.5 22.9

48.5 50.0

10 S-2

45.0

10

114

20.0

2050

20.7

60.0

16

0

22.

55.0

13

123

17.7

2760

15.8

65.0

28

gray, silty, w/gravel & rock fragments

122

20.0

3130

15.5

70.0

30

120

16.2

3700

17.2

75.0

32

123

3.4

5350

13.7

80.0

с Ф

gray, clayey, w/some sand

Silt,

aeams

13.4

84.5

113

12.7

89.5

205

11.9

95.0

105

rock

<u>مع</u>

Clay, gray, silty, w/gravel fragments

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12.

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11.0

105.0

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End of boring @ 105.0'

w/sand seams

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REMARKS: Encountered water at 4.5' Water at 14.0' on completion

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17.8 10.5 13.9

2220 2150 2860

22.9 24.45 22.44 23.7 21.8

S-1

28.0

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25.0

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19.8

20.0

11

Clay, gray, silty, w/silt seams

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107

20.0

1150

24.7

35.0

gray, silty, w/trace of gravel

107

20.0

850

29.0

40.0

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se of gravel, sand

gray, silty, w/trace rock fragments & s

g

LABORATORY LOG OF BORING

Method of Sampling: Split spoon Split spoon Core drill

 $\boxtimes \mathbf{O}$ Shelby Auger

В-3 Boring No.

584.0 Surface Elevation

										Sector and the sector of the s				•
ΓS	Unit Dry Weight #/cu. ft.								102 88		101		102	
ESUL'	noitingI nO aao. 0000 C %					7.6	2.2	2° 3				and an and an and an and		
ST R.	% niert2								20.0 13.8		16.7		20.0	ר קיי עקי
OF TE	Unconfined Shear Stress #/SF								1 0 8 0		1130		1050	+0[~~~
RY (Plasticity Index				Talan da kata ya kata y	200400-02-02-02-02-00-02-000			00 ¹ 001903 (10772-9920010-00009-00-6029		angalang kanagginan ang kanagana sa kana			ζ ι
MMA	timid biupid				**************************************			ng yakang pangkang g					<i>Notažątunopulii</i>	
SUN	% ərutaioM lsıntsN			2)Gullerry-p			, ,		225 2545 2545	29.2	27.2	23. 2	24.7	μ
	Depth to bottom of Depth to bottom of		ц n	6.5	10.0	15.0	20.0	25.0		35. 0	40.0	45.0	50.0	
	for l2 inches Blows on spoon		4	œ	16	13	61	12	Š1 М	0	0 1	ω	6	- - -
	DESCRIPTION	Fill: black cinders & slag	brown sand		black cinders, brick, limestone fragments & sand	black & brown sand w/tr. of veg.,tr. of glass & cinders	black & brown silty sand w/ organic mat'l & trs. cinders		Clay, gray, silty w/some silt & sand seams **		*		*	KS End of boring at 50.0'
	Zymbol	e e		N	<u> <u> </u></u>	KINY.		YZZ			Шļ		Ħ	LAR
	Depth in feet		لىب			<u></u>	8	بيد	<u>8</u>	<u></u>		بليب	 ट्वि	LEN.

*See Consolidation Test *Liner sam**ple**

Water at 8.0' upon completion Water at 6.6' on 2/24/73

2337

Location: Cleveland, Ohio

Job No.: C.

DAVID V. LEWIN CORP. /GEOTECHNICAL ENGINEERING/CLEVELAND, OHIO

F-L-1

BORING
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-+	TS	Unit Dry Weight #/cu. ft.			105		100	105		
-3 n 571	TNSE						n 517 Pernes- may be gue hage and	and		
B	ST RJ	% nisrtZ	an a	ing mining dari dar sama sana dara pang dan gidan	17.0	n generalise of the second states and the second states of the second states of the second states of the second	20.0	20.0	Land Contraction of C	
lg No. ce El	DF TE	Unconfined Shear Streas #/SF		n an	950		760	850		
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	MMA	timid biupid		and and a more and a final second for					۰ _۲	Bananan kan da majar kan gangan kan gangan kan sa
	SU.	% ərutsioM lsıntsN			28.8	24.9	27.5	25.2		
		Io motton ot dtgans Depth to bottom of		17.5	22.5	27.5	32.5	37.5	2007 North South Connex (
		nooqa no awolB for 12 inchea		01	~	7	σ	r=4 r=4	nan managan kana kana kana kana kana kana kan	
d of Sampling: poon 🖄 Shelby 🛛 Irill 🔲 Auger 🛄		DESCRIPTION	Water	Sand, brown & gray	Clay, gray, silty, w/trace of gravel & silt seams	gray, silty, w/trace of gravel			End of boring @ 37.5'	
thoc Lit s re d		Symbol	. 1		┋┋┋			1	1	9-11-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-
Sp] Coj		Denth in feet		<u>8</u>	3			<u></u>	2	<u></u>

LEWIN CORP. /GEOTECHNICAL ENGINEERING/CLEVELAND, OHIO

DAVID V.

C. 3033 A

Location: Cleveland, Ohio

Boring Completed: 12/19/77

Job No.:

EMARKS

-14-

LABORATORY LOG OF BORING

Method of Sampling: Split spoon Split spoon Core drill

 \Box Shelby Auger

Boring No.

B-7

571 ± Surface Elevation

					•		The Pointer with the second			F-L-1	_
'TS	Unit Dry Weight #/cu. ft.			101	alauf fer fan fan ster fan		101	17 17			
ST RESUL	% nisrt2		Berdahani amayin ing 1994 kecasala	20.0			15.3	20.0			8
OF TES	Uncomined Shear Stress #/SF		ngandalarangan ngangargang nanananakat	950	Summunan and a start and a		460	1900		daðanin Marsoninov, sen skuns sampan hyfirin	
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SUN	%'ərutsioM IsrutsN		29.2	28.5	28. 3	29. 1	28.0	18.6		<u>4</u>	
	fo motton of dams. Depth to bottom of		12.0	17.0	22.0	27.0	32.0	37.0		nen ander en	
2 contra da da	Blows on spoon Blows inches		00 F1	01	r=1 r=1	0	bund bund	σ			
	DESCRIPTION	Water	Sand, brown & gray, w/some organic matter	Clay, gray, sılty, w/trace oi gravel & some silt seams			gray, silty	w/some sand & gravel	End of boring @ 37.0'		S
	ĮodmyZ										ARK
"	Depth in feet			<u></u>	1	Lu	<u>Ц</u>	ىتىك	<u>ياب</u>	uluu 8	EMA

LEWIN CORP. /GEOTECHNICAL ENGINEERING/CLEVELAND, OHIO DAVID V.

Ohio

Location: Cleveland,

3033 A

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Job No.:

-16-

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Shelby 🛛 Auger 🖸

Boring No.

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В-8

Surface Elevation 578 ± 577.6

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ST	Unit Dry Weight #/cu. ft.					Gargers Scotter & Ard and	101	100	100	106	113	107 107		113		en de mografie de la composition de la	77
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CST R	% nisrt2			-			9.8 11.0	12.9	4. 6.9	18, 3	6 . 6	20. 0 20. 0		20.0	<u>Antonio teripti di Aneng</u>		ted: eland)33 A
OF TI	Dhear Stress #/SF Uncontined						1010 805	960	1380 1270	2340	1320	2480 2180	,	1460	<u></u>		omple Clev C. 3
RY	Plasticity Index								ana di kato ana manga kato ang								tion tion
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su	% əruteioM lsruteN		1120-00 volume				26.8 25.7 23.5	27.8	24.2 25.1 25.2	21.7	21.8	22.3	25.3	22.0	21.7	21.2	
	Depth to bottom of Bample in feet		3.5	6.5	10.0	15.0	20.0	25.0	30.0	35.0	40.0 41.5	45.0	50.0	55.0 56.5	60.0	65.0	very
	Blows on spoon for 12 inches		2	9	14 44	8	S-1	~	S-2	10	X٥	S - 3	6	12 12	10	12	0: 0 0 H
	DESCRIPTION	Fill: slåg, sand, & red brick		<pre>% gray sand, w/some brick, slag, % trace of organic material gray silty sand, w/some</pre>	gravel, decayed wood & trace of brick		Clay, gray, silty, w/some silt seams & few sand seams	LIACE OF OF BAILT MALETAL					gray, silty, w/some silt seams			End of boring @ 65.0'	REMARKS: Water encountered at 5.0' X - Attempted shelby tube sample, n
	Symbol	×2		<u>B</u>	<u> </u>	<u>Sy</u>											
	Depth in feet				<u></u>	<u>u</u>	بسيلة	<u>l</u>	- R	u.l.		تتلت	<u>i</u> li.	للمتلغب		ببلبب	سايد

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	578.± 577.9	JLTS	C. ⁻ -%	009 @	6				and a state of the		, F					*************	Tr <u>incille (discu</u> nces)			2005-000-000-000-000-000-000-000-000-000	and the second
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	evati	ILS	%	niertZ						6.9 6.9	16.7	17.9								1/3/ , Oh	
ng No	EE EJ	OF TI	fined Fined #/SF	Zyesr Uncom						1240 1670	1090	1170 1060 1260			,				A Peziti a faka ka	ted: reland 033 A	
Bori	Surfa	RY (city Index	Plasti			1769 Tone of the sec	an de la Constitución de la Constit	<u> </u>		Saffe You Halt you you you you yo	17								C. B. B.	
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		SU	% ərutaioM Is	stuteN	18.5					26. J 25. 6	26.1	24.3 25.1 26.1	29.5	28.4	27.0) 1 7	2.1.2	29.8	22.2	Borin Locat Job N	
			to mottod ot te in feet	ntquas Depth	3 . 5	6.5	10.0	15.0	20.0	25.0	30.0	35.0	40.0	45.0 46.5	50.0	53.0	57.0	60.0	65.0	very	Angele Lagrange
-			inchea on spoon	awold Si roi	2	6	14	ы 4	13	S-1	6	S-2	œ	X 4	9	X	° X	. ∞	0	с чес	No.
Sampling: m m	Auger		DESCRIPTION	L . 0	er stag « cinders, sand & brick, organic material @ 3.5'	brown & gray silty sand	w/some brick @ 10.0'	d, gray, silty	v grav siltv w /some silt seams	& few sand seams		3 t			gray, silty				日 日 日 一 日 一 日	AARKS: er at 7.0' after casing was pulled Attempted shelby tube sample-ric	See consolidation graph
d of	spoo lrill		i i i i i i i i i i i i i i i i i i i			. 6 . 10	721	N N N	" []							1 1 1				X A K	۱ *
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ž	S C	L	· •••• ·	<u></u> 1+∽•Ц	┝┻┹┹╇┻		9		<u>. 1</u> 8		<u>ы</u> цы . Я.	<u>uul</u>	പപ്പ		ىلىب	<u></u>	ىبىل	ц <u>у</u>	ىلىب	mhrr	Ц

- 18 -

LABORATORY LOG OF BORING

Method of Sampling: Split spoon 🖾 Core drill 🛛

Shelby Auger

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Surface Elevation 582 ± 586.2 B-10 Boring No._

	'ir 'na/	u l														and a second
Ĕ	Juit Dry Weight	n							79	101		92 91				
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EST R	% nisti	5							20.0	6.9 9.9		11.0				, Ohice
OF T]	nconfined AZ\# assist Stread	S 1							610	585 935		970 890	ang territor en orgen and territor			ted: /eland 033 A
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SI	% ərutsioM Isruts ^V	(29.3		33.7		35.0 29.6	33.9 31.0 28.4	23.5	31.6 31.5 31.5	25.2	28.4	22.2	Borin Job
	so motton of days temple in feet	1 S.	6.5	10.0	I5.0	20.0	25.0	30.0	35. 0 36. 5	42.0	46.5	52.0	56.5	62. 0 63. 5	70.0	ery Y
	or 12 inches	ۍ ۲	· •	6	۲	т П	¢.	12	8 1	S-1	10	S-2	~	X 4	12	о о о н
	DESCRIPTION	Fill: cinders, sand, brick, concrete & trace of wood					gray & black silty sand,w/ trace of vegetation & pieces of coal	gray & brown silty sand,w/ sandstone fragments	Clay, gray, silty, w/some silt seams trace of wood @ 35.0'		gray, silty, w/some silt seams	** **		Bray, siiry		End of boring @ 70.0' REMARKS: Water at 13.0' on completion X - Attempted shelby tube sample-no * - See consolidation graph
-	IodmyZ	1 des	QZ.	1.52	LE EX	<u>SS</u>	<u> Alexandres</u>	<u> AL</u>								
	Depth in feet	h	سلب	ىلىد	سيناب	ىلىد	سلس	y	ulu	ينييل	بيتا	سىلىن	لسب	Juui	ىلىت	ليسبي
and the second sec		-				<u>N</u>		m		<u>4</u>		শ	3)	~	8

-61-

LABORATORY LOG OF BORING

Method of Sampling: Split spoon G Core drill D

Shelby Auger

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Surface Elevation

578 ± 579.64 B-11 Boring No.

	11 'no/#	-		000000000000000000000000000000000000000					an a sua									and the second secon		decourse of the second		
SI	Unit Dry Weight					antes antes						106	101	105	102	105	105		118			
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ST R	% nisrt2					*****	an a		•		9-08-03-	15 15	i ™ i	15.0	0.0	.0.	0.0		8. 5 8	darmanidet en e		/6/78 Ohid
E TE	Uncontined Shear Stress #/SF		and a second		, ,					an a		960	360	750	040	880 2	230 2		520 1	t <u>a la la co</u> ntracta a co	lakiluga saga sa sa sa	ed: 1 eland, 133 A
RYO	Plasticity Index	\square	1		2767261	Pillainin - pigen									ann an		-		P4		an a su a	C. 30 C. 30
MMA	timid bivpid		Steractoge Biogramming			1				2 diamata <u>ana</u>			ang ana a kalandi ng mga ga	Ter Pri ⁿ ter and		and a subsection of the subsection of t					NI TAKÎ MÎN	lg.:
su	% ərutaioM IsrutsN		forences	7-5			21.1				27.1	25 40	24 1 24 6	24.9	26.5	22.7 27.8 24.6	26.0		21.8	1 	21.7	Bor I Local Job N
	Depth to bottom of Depth to bottom of		ч ч	6.5	10.0		15.0	20.0	24.0		30.0	35.0	37.0	41.5	46.5	52.0	56.5	60.0 61.5	65.0	C	70.0	rery
	Blows on spoon soft is inches		30	13	28			~	50/0		41 41	6	S-1	12	ω	S-2	0	XŽ	15		 ۲	reco.
	DESCRIPTION	Fill: slag & limestone	1.000 P	gray silty sand, w/some	gravel, silt seams & trace of organic material	gray silt, w/some vegetation	gray silty sand, w/some vegetation, cinders & brick		boulders Sand, gray, silty	Clay, gray, silty, w/ some silt seams						gray, silty					End of boring @ 70.0' REMARKS:	Water at 8.0' on completion X - Attempted shelby tube sample-ro
	IodmyZ	Ľ	SS)	LÆ	<u> </u>	X	Nor B	<u>SI </u>	(AA)	Ш	Ш								Ħ	Ħ		
	Depth in feet	μ	لىب	LLL	ىلى	uu	L	<u>.l.</u>	ىلىب	<u> </u>	<u>l</u> .	ىلىد	ىبىر	لىب	بيبل	Jun	ببيك	بيايد	علب	யி	Lu	ىلىسى
			in a mailing in a		at which the second		ingen annen an binnelig	, N	www.unitekawag-	(Y			<u>7</u>			<u>чо</u>		<u> </u>		<u> </u>		

-20-

Blows on apoon for l2 inches 2 ~ 9 179 Ś Ц 12 19 28 11 13 17 32 27 87 90 161 39 35 98 2 Surface Elevation 580.34 with pebbles ebble, ard, with pebbl Sand, gray, medium, with DESCRIPTION brick silty with cinders & fine, fragm oft fine, gray 'n stiff stiff Sand, Clay, 73 Ioquiks Staff Blows on apoon for l2 inches 15 σ 6 12 12 16 80 150 143 200 225 579.2 with pebbles DESCRIPTION e & gravel Elevation coa gray, Clay, gray, hard Clay, gray, soft cinder Surface ay, Fill: Iodmy2 Depth in feet <u>uuluul</u> and the first starting the second starting of the second starting and the second s ន 2 R Q 8 60 80 ន

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Blows on apoon for 12 inches to silty w/fine gravel, gray, silty, w/trace of fine gravel, soft ŝ poo. -576 silt silt DESCRIPTION alag sand, gravel & Sand, brown & gray, Clay, gray, silty, w/ medium stiff Surface Elevation gray, sandy, v stiff to hard silty, م cinders gray, mediu Ζλωροι In a find the strend of the st and the electricity of the ref. Depth in feet <u>.</u> . . . ò 90 Ч. Q 8 2 • ; Blows on apoon sedoni S I rot . dense gravel & lard dens 0 79. cinders & fine sand gray, sandy, w/fine shale fragments, h Clay, gray, silty, w/silt . medium stiff DESCRIPTION gray, sandy, w/fin stiff to very stiff ū Sand, gray, fine, mediu Bill elag , silty, soft Elevation gray, silty, w/s medium stiff w/fin nder Surface Silt, Fill: Iodmy2 <u>anting to a boundary bound to be a bound to</u> a martin de la constance es et er er Depth in feet 11111 20 30 8 8 g Я 8

Boring No.

-Boring No.

3033 ij Job No. -1
Blows on spoon tot l S inches aveľ, very w/slag fragm చ avel gray, sandy, w/fine gravel silt seams, stiff Surface Elevation 578.0 w/fine gra to stiff gray, silty, w/silt se nedium stiff slag ð gray, silty, w/silt sea stiff w/fine DESCRIPTION coars broken sandstone gray, sandy, w/fine stiff to hard gray, sandy, dense coal & & slag cinders & slag & gravel gray, sandy, w medium stiff t sand, fine to Shale, weathered, v fragments gray silty, cinders cinders, gray, soft sand Fill: Silt, AY ANY YYYY IodmyZ ***** Teet In feet . . I LLL . Interelinger 10 R ିନ୍ନ 00 80 6 ଘ • -Blows on spoon tor l2 inches . ne gravel & very stiff to gravel seams 579.0 w/thin sandstone layers fine DESCRIPTION silt Clay, gray, silty, w/silt medium stiff gray, sandy, w/fin medium stiff gray, silty, fine cinders, loose Surface Elevation gray, silty, soft Blag gray, silty, w/ medium stiff gray, sandy, shale fragme hard gray à 2 H brown cind gray Sand, Fill: · Iodmy2 Depth in leet Burnhund and the large transferrational granter of . . . ! R 80 6 ສ -

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Job No. C. 3033

Boring No.

Boring No. 5

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	Method	i of Sc	mpling	1	LA	BOR	Ator	7 LO	07	OR D	5	Boris	g No.	<u>.</u>	1		M	lathod	ef Sam	plingi	- A - H	1480	natoi Natoi	IY LO	3 of 2	BORIN	с 8	oring	No	B-5	-	•	Meth	od of	Sampl:	ngi D	g Daiby	abor Ø	ATOR)	r rọg	of 5	ORING	Boi	ing No	<u>B-7</u>	<u>.</u>		Method Split s	of Samj	, plingi 121 1	L. Baiby	TAROE	day la	50 07 :	ð or in	3 Bos	ing No	. <u> </u>	9	
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	Depth in feel Symbol		92	CRIPT	TION	· · .	· · · · · · · · · · · · · · · · · · ·	Blowe on epicon (on 13 meber	Depth to bottom af	Natural Molekure 2 5	Liquid Limia	Plaeticity Indea	Veccediaed Shear Stress 8/SF	ST R	SUL	Unit Dry Weight a		Depth in feet Symbol		DEH	cripti	ON		Blows on spoon for 12 Jackson	Depth to bottom of sample in feet	Natural Moletare 9 G	Liquid Limit	Plaoticity Index (0)	Shear Stress 2/SF	r rrs	JULT	Var Iny weight a	r Depth in feet	Symbol		DESCR	IPTIO	¥	· · ·	Blows on spoon for 12 inches	Depth to bottom of sample in feet	Natural Molature %	Liquid Limit W	Uncontined Shear Stress #/ST		Solution Dev Welche	9/ca. A.	T. Depth in feat Symbol	Water	descr.	IP TION		Rices on stoom	for 12 inches Depth to bottom of	Natural Moisture %	Liquid Limit	Uncontined Shear Stress #/SF	Strain %	Unit Dry Weight 8/cm. A.	R
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N DUMANT OF VERT HAULTY DUMANT OF VERT HAULTY DUMANT OF VERT HAULTY 1 0	LABORATORY LOG OF BORIN Method of Sempling: Split spoon S Shelby S Core drill C Auger C	Dering No. <u>B-13</u> Me Boring No. <u>B-13</u> Me Burface Elevation <u>577, 49</u> Co.	LABORATORY LOG OF BORING fethod of Sampling: plit spoon I Shelby I ore drill I Auger I	Boring No. <u>B-14</u> Metho Split Burface Elevation <u>579, 1</u> Cora	LABORATORY LOG OF DOS od of Bampling; spoon 9 Shelby 19 drill 0 Augor 0	BIG Boring No. <u>B. 11</u> Surface Elevenium <u>143, 71</u>
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 	Fill, concrete, brick, sand 7 3, 5 brown sand, cinders, sandstone 12 6, 5 10 brown to gray sand, w/piece 20 15, 0 20 cishals 7 20, 0 24, 3 20 cishals 7 20, 0 24, 3 20 cishals 7 20, 0 24, 3 20 cishals 7 30, 0 25, 1 20 cishals 7 30, 0 25, 1 20 sandstone 8, 2 35, 0 28, 9 30 8 40, 0 28, 0 28, 9 30 8 40, 0 28, 0 28, 0 30 8 40, 0 28, 0 21, 6 30 8 40, 0 28, 0 21, 6 31 14, 65, 5 21, 6 21, 6 21, 6 30 8 40, 0 28, 0 21, 6 31 14, 65, 5 22, 1 10 50, 0 22, 2 30 10 50, 0 22, 3 17 17 55, 0 <td>2898 15:2 184 2290 11.9 111 1440 11.9 105 30 850 7.1 96 1858 6:2 99 740 8.5 98 60 1850 12.3 107 800 11.9 104 50 1830 20.0 114</td> <td> Fill, black slag, gravel, brick brown sand, w/ vegetation gray silty sand l2 l0,0 black and gray sand, gravel l3 l5,0 Clay, gray, silty. 20,0 25,0 s-1 30,0 25,4 34,2 35,0 36,2 31,5 30,3 g-2 40,0 24,8 17 50,0 25,8 8 45,0 25,8 g-3 50,0 g-1 <lig-1< li=""> <li< td=""><td>1 330 12.6 96 470 8.7 95 1350 8.7 103 1350 8.7 103 620 20.0 100 1300 8.7 103 620 20.0 100 1300 8.7 103 620 20.0 100 2198 28.6 109 117 90 117</td><td>Appent: 40 W C L 4 Fill: cinders, sinses, clay, silz, sand, & bricks 36 3.3 W/some decayed wood 4 6.5 W/some decayed wood 4 20.0 Ulay, gray, siliy, w/few silt seeme 7 25.0 S-1 37.5 25 6 40.0 32 X 5 35.0 X 5 35.0 X 5 35.0 X 5 35.0 X 2 30.0 X 2 30.0 <</td><td>· · · · · · · · ·</td></li<></lig-1<></td>	2898 15:2 184 2290 11.9 111 1440 11.9 105 30 850 7.1 96 1858 6:2 99 740 8.5 98 60 1850 12.3 107 800 11.9 104 50 1830 20.0 114	 Fill, black slag, gravel, brick brown sand, w/ vegetation gray silty sand l2 l0,0 black and gray sand, gravel l3 l5,0 Clay, gray, silty. 20,0 25,0 s-1 30,0 25,4 34,2 35,0 36,2 31,5 30,3 g-2 40,0 24,8 17 50,0 25,8 8 45,0 25,8 g-3 50,0 g-1 <lig-1< li=""> <li< td=""><td>1 330 12.6 96 470 8.7 95 1350 8.7 103 1350 8.7 103 620 20.0 100 1300 8.7 103 620 20.0 100 1300 8.7 103 620 20.0 100 2198 28.6 109 117 90 117</td><td>Appent: 40 W C L 4 Fill: cinders, sinses, clay, silz, sand, & bricks 36 3.3 W/some decayed wood 4 6.5 W/some decayed wood 4 20.0 Ulay, gray, siliy, w/few silt seeme 7 25.0 S-1 37.5 25 6 40.0 32 X 5 35.0 X 5 35.0 X 5 35.0 X 5 35.0 X 2 30.0 X 2 30.0 <</td><td>· · · · · · · · ·</td></li<></lig-1<>	1 330 12.6 96 470 8.7 95 1350 8.7 103 1350 8.7 103 620 20.0 100 1300 8.7 103 620 20.0 100 1300 8.7 103 620 20.0 100 2198 28.6 109 117 90 117	Appent: 40 W C L 4 Fill: cinders, sinses, clay, silz, sand, & bricks 36 3.3 W/some decayed wood 4 6.5 W/some decayed wood 4 20.0 Ulay, gray, siliy, w/few silt seeme 7 25.0 S-1 37.5 25 6 40.0 32 X 5 35.0 X 5 35.0 X 5 35.0 X 5 35.0 X 2 30.0 X 2 30.0 <	· · · · · · · · ·
	1- 50 15 60.0 19.6 22 65.0 18.3 70 19 70.0 17.0 10 26 75.0 16.3 80 31 80.0 16.3 80 Silt, gray, w/clay seams and trace of gravel and rock fragments 62 85.0 17.6 90 Sand, gray 67 95.0 15.2 10 Clay, gray, silty, w/gravel and rock fragments 81 100.0 13.7 End of boring at 100.0' REMARKS1 Water at 6.0' after casing was pulled 10 13.7	3270 20, C 118 60 3490 20, C 121 70 2910 20, C 121 70 3600 14, 6 119 80 90 90 90 10 10 10 10 10 10 10 10 10 1	gray, sility, w/gravs1 g-40 30 60, 0 61, 5 31 65, 0 15, 5 40 70, 0 18, 6 36 75, 0 18, 6 36 75, 0 18, 6 40 80, 0 17, 3 Clay, gray, sility, w/ gravel and rock fragments 47 85, 0 13, 6 Silit, gray, aw/ sand seame 89 90, 0 13, 6 Silit, gray, aw/ sand seame 82 95, 0 10, 5 Silt, gray, aw/ sand seame 97 100, 0 10, 3 End of boring at 100, 0' REMARKS1 97 100, 0 10, 3	1200 20, C 117 70 2900 20, C 115 2050 20, C 117 80 90 117 80 90	 35. 5 35. 5 36. 0 37. 6 38. 5 38. 5 39. 60. 0 30. 0 30. 0 31. 10. 0 32. 10. 0 33. 10. 0 34. 3 35. 10. 0 36. 10. 0 37. 31. 10. 0 38. 10. 0 39. 0 31. 10. 0 31. 10. 0 32. 10. 0 33. 10. 0 34. 3 35. 10. 0 36. 0 37. 10. 0 38. 10. 0 39. 0 39. 0 31. 10. 0 31. 10. 0 32. 10. 0 33. 10. 0 34. 3 35. 10. 0 36. 0 37. 10. 0 38. 10. 0 39. 0 39. 0 31. 10. 0 31. 10. 0 32. 10. 0 33. 10. 0 34. 3 35. 10. 0 36. 0 37. 10. 0 37. 10. 0 38. 10. 0 39. 0 39. 0 31. 0 31. 0 32. 0 33. 0 34. 0 35. 0 35. 0 36. 0 37. 0 37. 0 38. 0 39. 0 39. 0 39. 0 31. 0 31. 0 31. 0 32. 0 33. 0 34. 0 35. 0 35. 0 36. 0 37. 0 37. 0 38. 0 39. 0 39. 0 39. 0 39. 0 31. 0 31. 0 32. 0 33. 0 <li< td=""><td>8 2570 13.6 105 5 1470 20.6 111 1 170 8.2 100 2 1604 7.1 105 2 1604 7.1 105 2 1604 7.1 105 2 1604 15.6 107 3 4750 20.6 123 4750 20.6 121 9 3750 20.6 121 9 3750 20.6 121 9 3750 20.6 121 9 3750 20.6 121 9 3750 20.6 121 9 3750 20.6 120 10 1229 100 100 11 129 129 120 13950 3.6 327</td></li<>	8 2570 13.6 105 5 1470 20.6 111 1 170 8.2 100 2 1604 7.1 105 2 1604 7.1 105 2 1604 7.1 105 2 1604 15.6 107 3 4750 20.6 123 4750 20.6 121 9 3750 20.6 121 9 3750 20.6 121 9 3750 20.6 121 9 3750 20.6 121 9 3750 20.6 121 9 3750 20.6 120 10 1229 100 100 11 129 129 120 13950 3.6 327

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		Moth Split Coro	od ef Sampling: : 1900a 🕄 Solby 関 drill 🖸 Auger 🖸	•		. •	B (Su	oring N riaco I	o. <u> </u>	19 • <u>\$81,99</u>		Metho Bplit Core	LABORATC od of Sampling; spoon (2) (Aleby (2) drill (2) Augor (2)	DRY LOG C	f Borin	C Bor Surf	ing No. <u>.</u> ace Elevi	B-20 ation <u>582,9</u>	2000-11-12-20 2000-11-12-0	Method Split spi Core dri	LABORATO of Sampling; oon S Bolby S III Augor S
•	•	TT Dopth in feet	DESCRIPTION Fill, Clay, claders, gand, rock	Blevs en spon	lor 1.2 inches Depth to bottom of	sample is loss Astural Moleture % in A	WMAR simil Limit	Vacordined 0.8	EST RE	Unit Dry Weight		Depth in fact	DESCRIPTION	310ers eta spoca or 12 inches Dervit to battom of	earrpie in feat Natural Moisture % C	Liquid Limit	Uncoullbad Shear Stress #/SF	RESULTS	/(ca. g.	Depth la fect	DESCRIPTION
			fragments, wood w/s organic material Nand, gray w/decayed wood. Clay, gray w/decayed wood. gray silty	17 11 2 18 25 5 5 5-1 4 4	7 3. 6. 10. 15. 20. 25. 30. 6 32. 0 35. 0	5 5 0 22.3 0 23.3 0 19.3 0 25.6 32.6 32.6 31.0 30,7 39.7	44 19	1798	13:07	83 94	20 10	and	Fill, brick, stone, clay, sand Sand, gray	26 3 4 6 1/1.5 10 8 15 8 20 10 25, 5-1 30, 9-2 32,	. 5 . 5 0 0 0					2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	Auger to 8, 5 Fill, black cinders and sand black silly sand gfavel, black and slag and, black to gray, silty
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.• :			igray silty w/silt seam à sem saad seams à rock fragment	13 8-6 23 27 3-7 33 33 34 5-8 40	75.0 79.5 81.0 85.0 99.0 90.5 95.0	21.8 16.1 15.5 15.5 17.3 19.9 13.9 12.8	5 10	2800 3010 4970 1960 2888 5350	9, 0 20, 0 20, 0 19, 3 14, 9	121 115 121 115 111 115 111	8 99 1		gray, ality, with rock fragmonts	14 70,1 17 74, 16 76, 5-21 79,1 21 H5,0 31 90,0 30 95,0	24, 3 17, 7 17, 7 17, 1 16, 4 21, q 20, 3	33 3 3 3 3 3	30, 20, 0 090 B. 0 230 B. 0 140 20, 0	119 120 119 - 118 111	90		gray, silty, w/gravol and rock fragments
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•	hx hc ; ; ; ; ; ; ; ; ; ; ; ; ; ; ; ; ; ;	and a set of the set	Oray cased w/few shale fragments hale, gray End of boring at 141.0' EMARKS fater encountered at 9.0' fater at 3.3' upon completion	27 1	131, s . 41, c	B. L. Jc	oring c ocation 10. No.	ompiet i Ciev t C303	ød: 4/14 elend, (3A	4 78 Dilo		ه ۸ ۲ ۲ ۲ ۲ ۲	Clay, BfBy Pily, MBobbles and Shalo, gray End of boring at 138, 5' REMARKSi Water ancountered at 8, 0' during dr Water at 5, 0' before casing was pub Water at 8, 5' after casing was pub-	34 130, c 37 135, c 500 138, e 1110, 104 d	'Bc Lc Jo	ring com atlen: C, No, C,	p etod k/ 10valajid 2033A	24/ B , Olio		Sbald REM Wate Mole	e, gray End of boring at 132, 0' ARKS: Pr at 10, 0' Esfore casing was pull caved at 8, 0' after casing was p recovery

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Split spoon S Shelby S Core drill O Auger O	Boring No. <u>B-21</u> Burface Elevation <u>574, 5</u> BUMMARY OF TEST RESULTS	LABORATO Method of Sampling: Split spoon S Shelby D Core drill Auger D	RY LOG OF BORING Boring No. <u>B-24</u> Burlace Elevation <u>578,99</u>	LABORATORY LCG OF BORDIG Method of Sampling: Split spoon (2) Shelby (3) Core drill (1) Auger (1)	Boring No. <u>B-25</u> Burinco Elevenium \$79.66
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A P P E N D I X B

SPECIFICATION

FOR

SUBSURFACE EXPLORATORY WORK

A. <u>SCOPE</u> OF WORK:

The work required is to include exploratory soil boring, sampling, and reporting the classification of each soil stratum bored through; the ground water levels in each boring, and the depth below ground surface at which solid rock is encountered, if said rock is encountered before the individual boring meets the specified depth.

At locations indicated on the attached drawing, the contractor shall drill sampling borings and shall perform such other labor and services as may be necessary and reasonably incidental to the gathering and classification of soil samples, and submit a complete and comprehensive log of borings. The following exploratory data shall be determined:

- 1. A true cross-section and visual classification of the soil passed through in each exploratory borehole showing the thickness of each soil stratum found between the surface and the bottom of the borehole and including the elevation of existing ground surface at each boring.
- 2. Each uncompleted boring shall be reported in the same manner as completed borings, together with the reason for not completing the hole.
- 3. All available information on ground water conditions encountered and elevation of water level. This should include water level readings upon completion of boring and 24 hours after completion. When a 24 hour reading is not possible, a reading just prior to backfilling shall be obtained and the time after completion noted. Any encounters or losses of water during or after drilling should be noted.
- 4. A record of compactness or hardness of each soil stratum encountered in each borehole, determined by the number of blows required to drive a 2" O.D. sampling tube one foot with a 140 lb. weight falling 30 inches. The total penetration depth should be 18 inches and the number of blows every 6 inches shall be recorded.
- 5. Indication of obstructions or unusual conditions encountered, such as boulders, cobbles, odors, gas and the like. Depths at which squeezing or caving of the sides of the hole occur.
- 6. Existence, depth and nature of filled ground.

- 7. Indication of any offset or relocation of boring from staked location.
- 8. The classification of the rock cores shall be reported, together with the percentage of core recovery and other pertinent data that may be useful to the Owner.

Samples of soil and rock cores shall be saved, carefully preserved, and delivered to the soils laboratory of David V. Lewin Corp., Suite 400 - Bulkley Building, 1501 Euclid Avenue, Cleveland, Ohio 44115.

All work shall be performed in accordance with the applicable building codes, city and state, and as specified in these specifications. The Contractor shall secure any necessary permits and check for the presence of any underground facilities or buried lines with the Owner and local utilities and pipeline companies before starting work.

B. <u>SAMPLING</u> BORINGS:

All borings are intended to be carried below the existing ground surface to about the depths shown on the attached drawing. The boring work shall be so performed that frequent undisturbed soil samples may be taken from the boreholes.

Borings shall be made as nearly vertical as is possible; all in accord with standard, sound drilling practices. Unless otherwise directed, drilling, sampling, and reporting shall be performed in accordance with ASTM Standard Methods for: Penetration Test and Split-Barrel Sampling of Soils, ASTM D 1586, Thin-Walled Tube Sampling of Soils, ASTM D 1587, and Diamond Core Drilling for Site Investigation, ASTM D 2113.

The drill hole must be kept open and clean to ensure that the penetration test or pushing of the sampling tube is performed on undisturbed soil. Care must be taken to ensure that the material to be sampled is not disturbed by the drilling operation or by hydrostatic uplift for samples at or below ground water level. Hollow stem augers, casing, or drilling mud may be used to maintain the integrity of the hole. The level of water or drilling fluid in the hole must be maintained above the ground water level. Size of boring and casing shall be sufficient to accommodate the particular type of sampling spoons or other sampling or coring equipment to be utilized by the Contractor.

Unless otherwise directed, samples of soil shall be taken at the ground surface, at 2.5, 5, and 8.5 feet below existing grade and at each change in soil stratification or soil consistency, but not further apart than five feet.

Samples shall be taken by means of a 2" O.D. split-barrel sampler. Samples recovered shall be carefully wrapped in Saran wrapping and put in wide-mouth glass jars. The lid of the jar is to be dipped in

-2-

paraffin and tightly screwed on. Care should be taken to minimize any disturbance of the sample in the sampling, jarring and shipping processes. The length of the samples delivered to the laboratory shall not be less than 4 inches.

In soft cohesive material (10 blows per foot of penetration or less), the Engineer may request some samples taken by pushing a 3 inch outside diameter thin walled sampling tube (Shelby tube) at least 30 inches long into the soil. A piston sampler may be required where poor recovery or sample disturbance occurs with an open-tube sampler. When sample is brought to the surface it shall immediately be sealed at both ends of the tube.

C. PROBES AND AUGER BORINGS:

Probings or auger borings may be required. No split-barrel soil samples will be required in these probings or auger borings. Representative auger samples in each stratum should however be obtained and the hole logged. See ASTM D 1452.

D. CORING ROCK:

When rock is encountered in a soil sampling boring, the elevation thereof shall be recorded by the Contractor, and the rock cored to the depth required. For the purpose of this exploration work, rock cores not less than 2-1/8 inch diameter will be satisfactory. Unless otherwise directed, core runs shall be five feet long. In addition to the report data require By ASTM D 2113, the time required for each core run and the cumulative length of pieces of rock recovered in each run in sections of 4 inches long or longer should be recorded. Rock cores shall be preserved in a wooden core box having a hinged lid, and each core shall be suitable identified.

E. <u>SAFETY AND SITE MAINTENANCE:</u>

The Drilling Contractor shall comply at all times with all applicable safety regulations. Drill holes shall not be left open and unattended. When holes are left open to permit observation of ground water conditions, they shall be provided with a cover or other means to prevent access or injury by the public or other workmen. Unless specifically directed, all holes should be backfilled and the drilling area restored as closely as possible to its original condition before the Drilling Contractor leaves the site. Grouting of the full or partial length of each hole shall be done where required by local regulations or where coring has been done in an area prone to sinkhole development or artesian water conditions.

F. <u>NOTIFICATION:</u>

Contractor shall contact the David V. Lewin Corp. Tel. 216-696-8151, or its field representative upon arrival on the site and before starting to drill in order to verify drilling sequence, depths, and sampling procedures and frequency.

TEST BORING RECORD

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FOR DAVID V. LEWIN

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SOFT GRAY SILTY CLAY

LAKE DRILLING CO. INC. • P.O. BOX 33284 • CLEVELAND, OHIO 44133

TEST BORING RECORI

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FOR DAVID V. LEWIN

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AKE DRILLING CO. INC. • P.O. BOX 33284 • CLEVELAND, OHIO 44133

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TEST BORING RECORD

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		STIFF GRA	Y STLT	W/SOME	CLAY							110.0	
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	111.5												
		TERMINATI	ON DEPI	CH 111	• 5								
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	Receiption of the second second second second second second second second second second second second second se						· .						

LER	RICK T	OSA		HOLE NO. TBL-3	SURFACE ELEVATION	Sheet No.	I ofZ Si
ER ON COM	VPLETION	TIME .	DEPTH	FOR DAVID V	. LEWIN		•
SING HAM	IMER Wt		lbs. DROP in.				
IPLER HA	MMER WI1	40	lbs. DROP	DOCK			
APLER SIZ	ZE		in. O.D. CASING SIZE	LOCATION		12-89	NO 89-010-18
GER SIZE			Geo	logist's Log		Bampla	Blows
ATION	DEPTH		Driller's Log 🖾 Mec	hanical Analysis	Remarks	Depth	on Sampler
						· <u>··</u> ·····	
	,						
			WATER				
			WATER				
ļ	14.0			Manual Antonio and a substance of the su		14.0	<u> </u>
						16.0	3
			GRAY SAND AND GRAVELS			17.5	4-7
	18.5			,			
-		—				20.0	2
			GRAY SILT W/CLAY W/TRACE OF	GRAVELS		21.5	3-5
ļ							
					•	25.0	3
						20.5	3-0
		\vdash	GRAY SILT W/CLAY W/TRACE OF	GRAVELS		-	
1					мотят	30.0	
						31.5	11-13
		-	GRAY SILT W/CLAY W/TRACE OF	GRAVELS			
		-				35.0	7
	36.0					36.5	10-10
		j					
		-	GRAY SILTY CLAY W/TRACE OF	GRAVELS			
	39.5			an an an an an an an an an an an an an a	-	40.0	1
	•		GRAY STLTY CLAY			41.5	2-3
		-					
				·		<u>/ F 0</u>	
						45.0	2-4
			· · · · · · · · · · · · · · · · · · ·				
			CDAY STIRY OF AV			FO O	
			GRAI SILTI CLAY			50.0	SHELBY

_AKE DRILLING CO. INC. • P.O. BOX 33284 • CLEVELAND, OHIO 44133

TEST BORING RECORD

RTCK	TOSATTO	
111011	TODIATO	

DBILLEB	RICK	1095	<u>*110</u>			•••••
ATER ON CO	MPLETION		••••••	24 HOUR WATER DEPTH	76,5	
CASING HA AMPLER H AMPLER S AUGER SIZI	MMER WI AMMER WI IZE	140 2	ibs ibs in. O.E ir	s. DROP s. DROP D. CASING SI n. GROUND V	30 ze4 vater	in. in. in.
EVATION	DEPTH		Driller's	Log 🔀		C N

FOR DAVID V. LEWIN

1]	DEPTH		Driller's Log 🔀	Geologist's Lo Mechanical A	g 🔲	Remarks	Sample Depth	Blows on Sampler
		-+	an an an an an an an an an an an an an a				50.0	SHELBY
							52.0	NO REC.
							52.0	SHELBY
			GRAY SILTY CLAY				54.0	NO REC.
1							55.0	3
<u> </u>	56.0			<u></u>	enter de destruitententer	-	56.5	5-6
			DILFF GRAI SILII GLA)	WIFEW RUCK			60.0	4
			r RAGHEN 15				61.5	5-4
						NOT C	m	
						MUIS	1	
		\vdash						
		\square				t t	65.0	6
							66.5	6-6
			STIFF GRAY SILTY CLAY	W/FEW ROCK				
			FRAGMENTS	,			70.0	8
							71.5	15-22
							· · · · · · · · · · · · · · · · · · ·	
							75.0	
							75.0	
7	76.5				-		/6.5	1/-26
		\square				WATER ON COMP	,	
							•	
			TERMINATION DEPTH 76	5.5				
ł			Indianation but in 70					
		\vdash						
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		$ \neg $						
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1		1 1				1	l	1

= ON COL	APLETION						
••••••	1	FIME .	DEPTH 125.1 FOR 1	AVID V.	LEWIN		
─VGHAM	MER WI	140	ibs. DROP in. ibs. DROP				
LER SI	2E	2	In. O.D. CASING SIZE	N DOCK	20 CLEVE	LAND, OHIO	
	·····		In. GROUND WATER STARTED	10-25-0	COMPLETED I. Q	JOB1	Blows
TION	DEPTH		Driller's Log 🛛 Mechanical An	alysis 🗆	Remarks	Sample Depth	on Sampler
			WATER				
			WATER				
	10.0					10.0	13
			CDAN GAND AND CDANELO			11.5	13-12
	13.0		GRAY SAND AND GRAVELS			13.5	1-1
ľ						15.0	<u></u>
			BLACK COAL, SAND AND GRAVEL			16.5	1-2
ŀ	16.9						
			GRAY STLTY CLAY W/TRACE OF GRAVLES				
						20.0	2
					L	21.5	4-0
						25.0	SHELBY TUBE
ļ				×	MOIS	r 27.0	12"
						27.0	2-3
1							
·						30.0	3-3
r							
		-					
						35.0	1
						36.5	1-3
r F							
						40.0	1
-						41.5	2-2
					.		
						45.0	2
r						46.5	

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TEST BORING RECORD

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Ľ	DAILLING CO. INC.	-	1.0.1
	RICK TOSATTO		

-ATION

NIEB KI	CK TUSAL	<u>ĻU</u>				
B ON COMPLETION	· ·		IOUR WATER			
	TIME	. TIME DEPTH				
SING HAMMER WL		lbs.	DROP in.			
PLEB HAMMER W	n <u>140</u>	lbs.	DROP 30 In.			
PLER SIZE	2	in. O.D.	CASING SIZE4 In.			
JGER SIZE		in.	GROUND WATER			

FOR DAVID V. LEWIN

imer Wt <u>l</u> :	40 bs. DROP	In. LOCATIONDOCK	20 CLEVE	LAND, OHIO 27-89 JOBN	o 89-010-186
DEPTH	Driller's Log 🔀	Geologist's Log Mechanical Analysis	Remarks	Sample Depth	Blows on Sampler
	GRAY SILTY CLAY W/TRA	CE OF GRAVELS		55.0 56.5	2 3-4
60.0	GRAY SILTY CLAY W/TRA	CE OF GRAVELS	-	60.0	12
	GRAY SILTY CLAY W/ROC	K FRAGMENTS		65.0	8
1 				66.5	16-17
				70.0	10 19-25
	GRAY SILTY CLAY W/ROC	K FRAGMENTS		75.0	16 25-30
			MOIST	80.0	10 20.42
				85.0	17 48-22
	GRAY SILTY CLAY W/ROC	K FRAGMENTS		90.0 91.0	25 50/.5
95.0				95.0 96.5	13 43-30
100.0	SEAMS	E SAND & GKAVEL		100.0 101.5	36 40-44

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RICK TOSATTO

CASING HAMMER Wt. Ibs. SAMPLER HAMMER Wt. 140 lbs.

AMPLER SIZE 2 in. O.D.

DRILLER

TEST BORING RECORD

HOLE NO	TBL-4	SURFACE ELEVATION .		Sheet No		of3	Sheets
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FOR DAVID V. LEWIN DROP in. LOCATION DOCK 20 CLEVELAND, OHIO STARTED 10-25-89 COMPLETED 10-27-89 JOB NO. 89-010-186 GROUND WATER

AUGER SIZE		in. GRC	UND WATER	STARTED .1.0	-25-8	9 COMF	PLETED 1.0-	2789 JOB N	10.89-010-186
LEVATION	DEPTH	Driller's Log 🔀		Geologist's Log Mechanical Analysi		Ren	narks	Sample Depth	Blows on Sampler
1		STIFF GRAY	SILTY CLAY	W/SHALE FRAGME	NTS			105.0	15
						MOIS	5 T	106.0	32-41
		STIFF GRAY	SILTY CLAY V	W/SHALE FRAGME	NTS			110.0	10 37-50/.4
1					وروب وروب وروب وروب وروب وروب وروب وروب	RUN	REC.	115.0	50/
		BLACK HARD	SHALE	•		115.1 to	3'8"		
	120.1	BLACK HARD	SHALE			120.1 to	319"		· · · · · · · · · · · · · · · · · · ·
	125.1	TERMINATION	DEPTH 12	5.1	, 	125.1			
				•					

LLER	RICK	LOSA	<u>110</u>			HOLE NOT.BL.		SURF/	ACEELEV	ATION .		Sheet No	1 of
TER ON CO	WPLETION	TIME		DEPTH1	.3.02	FOR	LDV.	LE	WIN				
SING HAM	IMER WI		lbs.	DROP	ir	h.							
MPLER HA	MMER Wt		lbs.	DROP	.3.0ir				•••••			· · · · · · · · · · · · · · · · · · ·	
MPLER SIZ	ZE	2	In. O.D.	CASING SIZE	4 Ir	LOCATION)CK	2.0		CLEY	VELA	ND., OHIO	- 00 010 104
GER SIZE		 T	in.	GROUND WATE	:H	Genteriatia Ler	<u>_00.</u> ;	9 I	COMPL	LETED	<u>I</u> .U=	1.30-8.9	0.89-010-18t
VATION	DEPTH	[Driller's Lo	₽ ² Gt		Mechanical Analysis			Rem	arks		Sample Depth	on Sampler
				<u></u>									
					•								
													·
					WATER								
						1997 - C.						ļ	
					WATER								
		$\left - \right $											
		$\left - \right $										<u> </u>	
					WATER					•			
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					WATER								
													+
												1	
												25.5	1
ŀ	23.5	╞═╡										27.0	1-3
		$\left - \right $										29.0	2=2
													<u> </u>
			GRAY SIL	TY CLAY								30.0	2
											•	31.5	3-4
		$\left - \right $											
			GRAY STI	TY CLAY					4			35.0	2
												36.5	2-4
								мс) Т	S	т	SHELBY	REC.
									,	U	*	37.0	24!
			CDAV CTT	ጥህ ሮ፣አህ								40.0	1
			JUNI JIL	III ULAI					I			41.5	2-3
												ļ	
													+
1			an	10177								SHELBY	REC.
			GRAY SIL	TY CLAY								45.0	
												47.0	24"
												47.0	2
ĺ												48.5	4-4
								I					

RILLER	RICK TO	SATTO	HOLE NO	. SURFACE ELEVATION	Sheet No	
ATER ON CO	APLETION			LEWIN		
ATE	TIM	E DEPTH DEPTH			,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	
ASING HAM	MMER WI	0 lbs. DROP	in			
AMPLER SIZ	'E	2 In. O.D. CASING SIZE	In. LOCATION DOCK	20 CLE	VELAND, OHIO	
UGER SIZE		in. GROUND WATER	STARTED 10-28-8	Z COMPLETED	<u>, U-3U-89</u> JOBN	10. 89-0.10-1.86 Blows
EVATION	DEPTH	Driller's Log 🛛	Geologist's Log L	Remarks	Sample Depth	on
		na na kana na k	Mechanical Indigons	<u>anna air air an ann a' fan Co</u> graphian ann ann ann air ann		
		- GRAY SILTY CLAY				
		_			55.0	5
				•	56.5	8-10
		-			60.0	7
	60.0				61.5	10-17
		GRAY SILTY CLAY W/S	HALE FRAGMENTS			· .
		AND TRACE OF SAND			65.0	8
					66.5	11-14
		_				
1	_					-
					70.0	5
:					71.5	11-13
		_				
	-					
ļ					75.0	12
		_ GRAY SILTY CLAY W/S	HALE FRAGMENTS		76.5	16-22
		AND TRACE OF SAND				
		-				
		-			80.0	10
					81.5	14-25
1		_				· · · · · · · · · · · · · · · · · · ·
ŀ	83.0	and the second se				
		GRAY SILTY CLAY W/S	OME SAND AND ROCK		85.0	16
	_	FRAGMENTS			86.2	32-50
	-					
	-					
	L L				90.0	28-37-50/
	91.2				91.2	1.2
t	-				· <u>····································</u>	
	-	- STIFF GRAY SILT W/S	HALE FRAGMENTS			
					95.0	50/
	Ĺ				95.4	/.4
	-					
					100.0	50/
	-	-			100.3	/.3

AKE DRILLING CO. INC. • P.O. BOX 33284 • CLEVELAND, OHIO 44133 **TEST BORING RECORD** RICK TOSATTO ILLER ... FOR LEWIN CORPORATION DROP in. CASING HAMMER Wt. Ibs. LOCATION DOCK 20 CLEVELAND, OHIO STARTED 10-28-89 COMPLETED 10-30-89 JOB NO. 89-010-186 AUGER SIZE In. GROUND WATER Blows Geologist's Log Sample Depth on Sampler Remarks TVATION DEPTH Driller's Log 🔀 Mechanical Analysis 🛛 STIFF GRAY SILT W/SHALE FRAGMENTS 105.0 15 105.0 106.5 31-44 STIFF GRAY SILT W/TRACE OF CLAY 110.0 14 21-28 111.5 115.0 14 STIFF GRAY SILT W/TRACE OF CLAY 116.5 18 - 28120.0 15 121.5 19-22 STIFF GRAY SILT W/TRACE OF CLAY 125.0 50/ REC 125.2 RUN 125.2 1.2 125.2 GRAY HARD SHALE to 4.0 130.2 130.2 TERMINATION DEPTH 130.2

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TEST BORING RECORD

ALLER	RICK TO	OSA	TT0		HOLE NO. TBL-6	SURFACE EI	EVATION	Sheet No	1 of
ATER ON CO	MPLETION		24 HOUR WATER		FOR DAVID	V. LEWIN			
ASING HAN	MMER WI	40		in.					
MPLER SI	ZE	2	in. O.D. CASING SIZE	In.	LOCATION DOCK			LEVELAND, OH	10
UGER SIZE			In. GROUND WATER	Geo	logist's Log	<u></u>	APLETED	Sampla	Blows
EVATION	DEPTH		Driller's Log 🛛	Mec	hanical Analysis 🔲	Re	emarks	Depth	on Sampler
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			WA	ΓER					
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			WAS	ſER					
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	30.0		and a gradient processing to a second processing of the second second second second second second second second		ageneration of a sciencific for a science of the sc			30.0	2_3
' 			·				1	32.0	3
								33.5	4-4
		$\left - \right $			OD ATTET O			35.0	6
			GRAY SILTY CLAY W/IM	ACE OF C	JRAVELS		ι.	36.5	8-10
		$\left - \right $	•			мо	IST		
	•							40.0	3
								41.5	3-4
		$\left - \right $							
		\vdash							
			GRAY SILTY CLAY W/TR	ACE OF (GRAVELS			45.0	_5
			· · · · · · · · · · · · · · · · · · ·					46.5	3-4
		<u> </u>					ļ		
r				·					
			ł			1		50 0 51 5	10 10 05

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ER ON CON ATE ASING HAM APLER HA APLER SIZE UGER SIZE	IPLETION TIN IMER Wt	24 HOUR WATER	. LEWIN 20 CLEVEI 9 completed	AND, OHIO	0.89-010-186
VATION	DEPTH	Driller's Log 🔀 Geologist's Log 🗆	Remarks	Sample Depth	on Sampler
	55.5	GRAY SANDY SILT W/TRACE OF ROCK FRAGMENTS		55.0 56.5	9 14-19
		GRAY SILTY CLAY W/ROCK FRAGMENTS AND SOME SAND SEAMS		60.0 61.5	9 14-30
	65.0	GRAY SILTY CLAY W/ROCK FRAGMENTS AND SOME SAND SEAMS	MOIST	65.0 66.5	7 15-28
		GRAY CLAYEY SILT W/ROCK FRAGMENTS AND SOME SAND LAYERS		70.0	10
				71.5	17-22
				75.0 76.5	11 18-25
	-	GRAY CLAYEY SILT W/ROCK FRAGMENTS AND SOME SAND LAYERS		80.0 81.0	24 50/.6
t			POCKET OF GAS	85.0	50/
	85.4	TERMINATION DEPTH 85.4	WATER BEFORE PULLING CASING 2'0	85.4	/.4
1					



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TEST BORING RECORD

	RICK	TOSATTO
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TER ON CO	MPLETION	•		OUR WATER		
UATE		IME		DEPTH	80,4	
CASING HA	MMER Wt.	140	lbs.	DROP	30	. in. . in.
MPLER N	IZE	2	in. O.D.	CASING SIZ	E	. in.
AUGER SIZE			in.	GROUND W	AIER	
VATION	DEPTH		Driller's Log	y 🖾		ľ

FOR DAVID V. LEWIN

T			Geologist's Log		Sample	Blows
N	DEPTH		Driller's Log 🖾 Mechanical Analysis 🛛	Remarks	Depth	Sampler
			·			
			GRAY SILTY CLAY W/ROCK FRAGMENTS			
			AND SOME SAND SEAMS		<u> </u>	
					55.0	9
					56.5	14-22
					60.0	15
				, I	61.5	22-28
			GRAY SILTY CLAY W/RUCK FRAGMENTS			
			AND SOME SAIND BEAMS			
				мотят	65.0	17
					66 5	10_24
					00,5	19-24
			GRAY SILTY CLAY W/ROCK FRAGMENTS		71.5	25
			AND SOME SAND SEAMS		11.5	
					75.0	16
	76.5				70.5	23-31
ſ			ODAY OTIMY BINE GAND H/GOME CITY			-
			SEAMS			
	80 /			GAS POCKET	80.0	
$\left \right $	00.4				-00.4	/ . 4
					· · · · · · · · · ·	
			TERMINATION DEPTH 80.4			
			,			
		<u> </u>				
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PAGE 1 of 5

TEST HOLE 1-8

PROJEC	T: PART	T a	٥F	C.IZUZLAN	D WEST 3RD	TESTHOLE	<u>h 0</u>
CLIENT:	hrwin		2P			WATER/ENCOUNTERE	ED 5,0'+11,0'
DRILLED): 12-19	-90		вү: D./	Hrpnre	WATER/COMPLETION	3'
			laan tool an y aan og noor y de grage ge	ŢĸĬĬŦŢġĸĬĊŢĬĸĬĬŢĬĸĬĬĬŦĬĬĬĬĬĬĬĬĬĬ		WATER/	·
ELEV. FT.	SAMPLE DEPTH	SAN NO.	APLE TYPE	BLOW COUNT	CLASSIFICAT	ION	GROUND WATER
2.5		1	55	7-11-10	GRAY & BEN CIAVEY SHIT & R.FRABS ; WIRTD BR BLACK CINOERS S	F SANDY WI BRAULS PICK LIMESTONE BRAULL LAG, IRON ORE	Sil' Lig F
7,5	5.0, 6.15	2	55	18-38-50101	Fill-	+ led BRICK, wood	weT
	8.5 10.0'	3	L SS	5-10-17	MED DENSE TO DE	NSE hayred	MOIST
	3.5	4	55	11-15-23	BROWN FINE TO, WI MTO TO COURSE TRACE GRAVELS, F	ned LAYERO	WET
195	18.5_ 20.0_	Ś	- 55 ,	12-21-21		an an an an an an an an an an an an an a	
L		6	SS	8-8-12	MED DENSE 68A	OME GRAVELS	LDET
285 315	28.5 30.0	7	SS	1-1-2	BROWN ROTTED WOO WIGRAY FINC TO,	D, LAYERD MED SILTY SAND	we T
	33.5_ 35.0_	8	ŚŚ	3-4-5	MED STIFF GRAY TRACE FINE SAND	SILTY CIAY	

PAGE _____ of _____

TEST HOLE 2-8

PROJECT	r: PORT	6	F	CIEVEL AN	0 WCS7 340	
CLIENT:	hew in	JC	ORF)	WATER/ENCOUNTE	HEUSAI
DRILLED	<u>9-19-9</u>	0		BY: 1),	HCPNCE WATER/COMPLETIC	<u> </u>
P1 P1/	1.0	1	401.0		WATER/	
ELEV. FT.	DEPTH	NO.	TYPE	COUNT	CLASSIFICATION	WATER
4/2.0'	335 35.0 	9.	55	3-4-5 3-4-5	MED STIFF GRAY SILTY CIAY TRACE FINE SAND, WI SOME SMAN HAJTRS CIAYTY SILT	MOIST TO WET
	435 45.0	11	22	6-9-10	MED DENSE GRAY CLAYEY SILT WI FINE SAND	MOULT
	4/85 50.0	12	55	6-8-11		TO
580	535- 53:0- 	13	<u>s</u>	7-11-16		<i>P C T</i>
	585 60.0 - 635	14/-	SS ,	9-16-23	PENSE GRAY CIANELY SILT TRACE FINC SAND, TRACE	MOK T TO
(65.0_	15	کد.	10-18-00	GRAVICS & R. FRMOS	wet

PAGE _____ of _____

TEST HOLE L-8

CLIENT:	LEWIN COR	P	W	ATER/ENCOUNTERED	'an '
DRILLEE	D: 12-19-90	BY: D. H.	PNCR W	ATER/COMPLETION 3	·
	l		W	ATER/	Hannan and a state of a state of the state o
ELEV. FT.	SAMPLE SAMPLE DEPTH NO. TYPE	BLOW	CLASSIFICATION	GF W	ROUND
<u>lab.5</u>	685 700 16 SS	9-141-20	DENSE GRAY CIAY SILT WI GRAVELS & R. P	SHNDY FRALS	
	735 ⁴ 75.0 ⁴ 17 55 -	9-19-25		m	015 T 70
	785-18 SS 800-18 SS	10-19.23			uc T
8 <i>.7.0</i> '	835 843-19 SS	418.5013"	VIDENSE GRAY FI	NE SANDY	
93.n'		18- J9-50	GRAY FINC TOMED SAND-	SILTY	c 7
<u>(~, y</u>	935 - 94,4 - 21 55 	45-50/4 # 23-50/5"	VIDENSE GRAY CI SANDY WIGRANCES WILAYERS GRAY S	A.JC. J SILT A.FRAGS MO ILTY CIAY	015T TO 15

PAGE 4 of 5

TEST HOLE L-8

PROJECT	: PORT	OF	CITUE LAI	10 12:3-		BED E'
CLIENT:	hTWIN	J COR			WATER/ENCOUNTL	N al
DRILLED	12-19-9	υ	BY: U, H	epper.	WATER/	<u></u>
ELEV.		SAMPLE	BLOW	CLASS		GROUND
31.5	1035 104,5 104,5 108,9 108,9 108,9 108,9 108,9 108,9 113,5 113	23 SS 24 SS 25 SS 26 SS 26 SS 27 SS 28 SS 28 SS 29 SS 20 SS	25-49 50/5' 50/5' 45-50/4 38-50/5'' 46-50/4'' 28-38-\$9	VIDENSE SILT SAND, SILT SAND, SILT Y CIA, GRAVELS & R COBBIES & BOU GRAY CIAYEY TEALE GRAVES GRAY CIAYEY TEALE GRAVES	SPAN CIANCY I WI BRAVIDS Dyced WI BRAN SANDY WI REPACS, WISHAIE HOTES I SINT, SANDY S & D. FRADS S & D. FRADS S & D. FRADS S & D. FRADS	MoisT TO WCT

PAGE 5 of 5

TEST HOLE L.8

CLIENT: LORP WATER/ENCOUNTERED 5'311 DRILLED: 12-20-90 BY: D. Hernel WATER/COMPLETION 3' WATER/ WATER/COMPLETION 3' WATER/COMPLETION 3'	
DRILLED: 12-20-90 BY: D. HrPNeR WATER/COMPLETION 3' WATER/	
WATER/	1124 1
TT DEPTH NO TYPE COUNT CLASSIFICATION WATER	
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70	
139.5 31 55 25-44 50/4 1 Wet	
14/0,5 14/0,3	
- VIHARD CIA, ICY SILT SANDY	
1440 2020 10122	
1450 3255 68.10 WI GRAVELS & R. FRAGS WI MOIST	
CHAIT CORRIGE + BAULDERS TO	
- STATE COSTA & CONTRACT 70	
wer	
12780 3355 5012"	
VYY.S	
153.0' -	
1540 34 SS SOLD' HARD GRA, SHALE MONST	
154.2 154.2	
- TD 1542'	

PAGE ____ of 2

TEST HOLE L-10

PROJECT: PC	RT OF	CITUCLAN	$D W^{3} ST$	
CLIENT: Low	VIN COR	WATER/ENC	OUNTERED 7,5	
DRILLED: 12	-15-90	Hepner WATER/CON	APLETION 8,4'	
		WATER/		
ELEV. SAM FT. DEP	PLE <u>SAMPLE</u> TH NO. ITYP	BLOW E COUNT	CLASSIFICATION	GROUND
			LIMESTONE LOANEL SUI	
1.2 1.0			ATTACSTONC BARDLO FU	
2.5		0~10-7	BLACK CINDERS CHAR 4	
3.5		7-7-4	perior cirkets shig o	MOIST
3.0			COAL RED BRICK - FILL	
50	-305	6-6.1		75inst
85	- 4 55	7-13-5		
			BLACK FINCTOMED SIL	TY UNIT
140			SAND TRAIT GRAVILS	0507
13.5	- 555	8-10-13		
130			GRAY FINE TOMED SILLY	SAND
			WIL SOME GRAVELS	
10 5	1270varas -			WET
200	- 655	7.10.14		
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jdd.D				
225	_			
25.0	- 7 55	3-5-7	STIFF GRAY STERY CIA	
_			TRACE FINE SAND WILL	ijels
			CLARCE SILT	MOIST
100			Liny y Stat	TO
20.0	- 8 55	3-4-6		
31.0 -		2		wet
			MED STIFF LOAN SILT.	/
126y - Ras	- 9 55	8-3-4	TRACE CALL DAIN	
- 12-1			CIAY INNICE MINE SAND	

PAGE 2 of 2

TESTHOLE L-10

PROJEC	r: ρ _e μ	2T	Ó	F CIEVEL	AND WST380		
CLIENT:	howin	JC	ORP		WATER/ENCOUNTERED 2.5		
DRILLED	: 12.15	5-90		BY: D. 1	WATER/COMPLETION & 4/2		
						WATER/	
ELEV. FT.	SAMPLE DEPTH	SAN NO.	APLE TYPE	BLOW COUNT	CLASSIFICA	GROUND WATER	
					MEDSTIFF 6 LA.		
					TRACE FINE SAND		•
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					TD 40.0		
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TEST HOLE L-11

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	PROJEC	T: Poe	T	OF	CITURL	AND WST3RD	an de se ander se ander se ander se ander se ander se ander se ander se ander se ander se ander se ander se and	
	CLIENT:	Lewis	10	RP	<u></u>		WATER/ENCOUNTERE	D7.0'
	DBILLED	: 12-21	- 90		BY: D	HEPNER	WATER/COMPLETION	6.3'
					an an an an an an an an an an an an an a	na sana ani ka sa ka na sa na ka sa na	WATER/	
	ELEV.	SAMPLE	SAN	APLE	BLOW			GROUND
n11	FT.	DEPTH	NO.	TYPE	COUNT.	CLASSIFICAT	ION	WATER
J 		1.5	1	< <	50/21	LIMESTENC GRAV	eL - F <u>III</u>	•
3	10 [°]	1,8			3013	LONCRETE		
2	<u> </u>	5.0	2	55	6-7-11	BLACK CINDERS, SI	AQ - RED BRILK	mois7
ヮ	A	5.0 _	3	55	3-8-6	FRADS, WOOD FIB-RS,	Ilow ere privets	
		8,5	4	55	12-21-28	PENSE TO VIDENSE	LAYCED BLACK	
				20		SGRAY MIXED & LA	JEED FINE TO	
		_		0		MED SILTY SAND,	TRACC ORGANICS	
		13.5 _ 150	5	SS	6-21-32	BRICK FRAGMENTS	Poss FIII ?	1 . 7
								WE I
		18.5		< «	17-14-23			
2	1 «	900 <u> </u>		Š				
_d	<u>1.3</u>	—						9. Names - Caracter Anna - Anna - Anna - Anna - Anna - Anna - Anna - Anna - Anna - Anna - Anna - Anna - Anna - Anna - Anna -
		Q3,5 &5.5	7	Søc.	B.JTUBE	MED DENSE GER	y CIAJCY SILT	
1		05.5 27.0	8	s s	5-11-18	WI FINC SAND	SOME SILTY	
		285				CIAN LANCES		
		30.0	2	55	8-12-14			
		22.5		-				
		35.0	10	55	6-11-9			
			<u> </u>		· · ·		I	
PAGE 2 of 2

TEST HOLE 6-11

PROJEC	T: POR	<u> </u>	F	CITVELA	N.O	an go an an an an an an an an an an an an an	
CLIENT:	hewi	N C	colt	0	and firstan commune to a second second second second second second second second second second second second se	WATER/ENCOUNTERE	D 70'
DRILLED	: 12-21	-90		BY: D./	IPPNER	WATER/COMPLETION	6.3
			analisio di sensi su su			WATER/	
ELEV. FT.	SAMPLE	SAN	<u>APLE</u> Itype	BLOW	CLASSIFICA	TION	GROUND
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TESTHOLE L-12

PROJEC	T: Port	ofC	leveland.	ĸĸĸĸĸĔĸġĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸ		nan an ann a bhair an an an an ann
CLIENT:	D.U.L	ewin	Corp.	V	VATER/ENCOUNTER	ED 5.01
DRILLED	12-17	-90	BY: Ton	Suchan V	VATER/COMPLETION	3.5
				V	VATER/	and generative and generative systems and the
ELEV.	SAMPLE	SAMPLE	BLOW	CI ASSIEIOATION		GROUND
3"				Fine Bin Sund		WATER
<u> </u>				Limestone Gravel		
		1 55	12-10-10	BON + Black Laver	ed Foundate	•
				6 and willing the		MOIST
)		2 55	6-7-11	June wy stag & Grai	rels wy prick	
				Luyer @ 2.3		
	_	3 55	2-25-19			
			U U U U			1.1
		4 55	4-4-4			WEF
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	<i>commo</i>					
, t						
14.0	420000-00-	810		Green Clayey Silt		ب ف
15.0	errenterrenerren biderret		19-3-6	Black W/ Gray Fine Silt.	Sund	· ·
	ezonate			Names Arit'.	•	WET
	-			Serie ISPN Fine to V	MED W SOME	
				Course Sand + Trace	- Gravels	
		655	12-21-23			
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30.0						
				Griffe L. Eller		WET
		2 55	5-6-9	Stitt Gray Silly Clo	y w/ small	
			t	Layers Fine to MED.	Sand	
	633-44			• •		
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		리'	5-7-8			
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			w-3-4		2000 - 1994 - 1994 - 1997 - 199	and and any setting a standard and an and an and an and an and an and an and an and an and an and an and an and
			Uhio	IESTBOR. INC.		
	6711	Sunder	land Drive 🛛	Parma. Ohio 44129 • (21	6 842-5454	

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TEST HOLE L-12

PROJECT	: Port	of.	Lle	eveland		WATER/ENCOUNTER	D mal
CLIENT:	0.0.1	WATER/COMPLETION	5.0				
DRILLED	12-17	-90		BY: lom	Suchan	WATER/	3.5
ELEV.	SAMPLE	SAM	PLE	BLOW	CLASSIFICAT		GROUND
ΕΤ.	DEPTH	10 11	55 55	W-3-4 5-7-8	soft to Stiff	Gray Silty	WEST
50.0		12	55	5-7-10			WET
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PAGE_____ of_____

TESTHOLE L-13

PROJECT	: fort	<u>of</u>	CI.	eveland							
CLIENT:	CLIENT: DU Lewin Corp WATER/ENCOUNTERED										
DRILLED:	12-17	-90		BY: Tor	n Suchan	WATER/COMPLETION	CAVE 3.5				
i						WATER/					
ELEV.	SAMPLE	SAN	APLE	BLOW							
					1" Limestone Gravel	OVER I FON OIR					
1.0			-		Pellets.	$a \in A$					
2.0			5	29-14-13	whitish five in ter	1 7440	B				
		2	55	4-4-11	Black Sand wy 1	M615T					
		–			Some Slug Trace	= Brick, Concrete					
	salaman*	3	55	6-11-8	blass.	, ,					
		4	55	50/2"			۰۰ ۲				
(_ 5 55 13-15-14 (Fill)					WET					
12.0	1773-11-11-12-										
	ectrometer for			-	Fine to MED Blac	k Sund 1					
		6	55	10-6-5	Some Gravels						
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18.0	*00740539				(Fill)?		PUET				
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<u>. o. s. s.</u>		0	<5								
				<i>d</i> -9-0	Stiff Group Sil	Hy Clay w/	•				
	40000000		1		Small Lewses s	ilt + Sand +					
					Possible small 1						
		9	55	3-5-6		ayers fine sand.	WEI				
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	420500-edd				· .						
		10	55	4-6-6							
	a <u></u>										

PAGE 2 of 2

TEST HOLE L-13

PROJECT	: Port	of	Cla	evelan	Y					-
CLIENT:	0.0.0	20	inc	orn.			WATER/ENCOL	INTER	ED 5.0	-
DRILLED:	12-17	-90	>	BY: T	om	Suchan	WATER/COMPL	ETION	CAVE 3.5'	-
	<u>}_v</u> v		na na manangan na mana na mana na mana na mana na mana na mana na mana na mana na mana na mana na mana na mana	an an an an an an an an an an an an an a	-X	ante en ante de la companya de la companya de la companya de la companya de la companya de la companya de la co	WATER/			-
ELEV. FT.	SAMPLE DEPTH	SAN NO.	APLE	BLOW	V T ·	CLASSIFICA	TION		GROUND WATER	
Company of the second second second second second second second second second second second second second second						Stiff Gray Silt	y clay			3
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	Ramona -									

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TESTHOLE L-14

PROJECT	: Port	- 01	<u>EU</u>	eveland		ĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸ	and the second second second second second second second second second second second second second second secon
CLIENT:	<u>D.U.</u>	te.	win.	Lorp		WATER/ENCOUNTERE	D 13.5
DRILLED	12-17	3-9	Ö	BY: Tom	Suchan	WATER/COMPLETION	125
	9 				•	WATER/	
ELEV. FT.	SAMPLE DEPTH	SAN	<u>MPLE</u>	BLOW	CLASSIFICAT	ION	GROUND
					6" concrete 1"To.	2" Limestone	
				17 74.24	Dense Bra Fine	to MED Sand	
			lss	63.91.01	WI Some branche		
	400,000,000				(some chargers	>	
5.5	(They because of	2	55	24-26-19	(Fill)		*
					LOOSE Black Found	Iry Sand will Gravels	Maist
	Aproxycem	3	5>	7-5-4	Trace Brick + Sla	A WILLUGES	
					Fine Bin Sund	7 1-1013	
	E100034084099	4	55	W12-1			
1	A ECONTRACTOR				· · ·		
120	-				May key and an an an an an an an an an an an an an	and the second second second second second second second second second second second second second second second	
. ,					LOOSE Fine Bin S	silty Sand	
15.0		5	55	1/10"-2/2"			
	, etc.illicoco			•	Aa		157
i .	with the second				MED Dense Gray	+ Black Fine	wev
· .					sitty Sand w/ Som	E MED TO	
	-theorematic	6	55	6-7-7	Course bravels +	some cobbles	i
215							·
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		and the state of the state of the state of the state of the state of the state of the state of the state of the			Very Dense to p	1ED Devise Fine	
:		7	55	11-17-30	TO MED Gray Sun	d witracet	
			ļ		Lobbles @ 26.0'		
	4.5eccurate			S			WET
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29.0		8	55	6-6-7	ch m buy they the	1 with This Sund Louse	
					Stee Dreed Sixing Cian	y by Five Jener Cruse	
	Contractor -				•	, kj	
		9	55.	2-5-7			
		<u> </u>		4.8-10	՟ՠՠ֍ՠՠՠՠՠՠՠՠՠՠՠՠՠՠՠՠՠՠՠՠՠՠՠՠՠՠՠՠՠՠՠՠՠՠ		and a second second second second second second second second second second second second second second second
					TESTROD INC		
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TEST HOLE L-14

	PROJECT	: Port	of	'Cle	velond		gennut zohnnuteren zohnnuteren ander an en son ander en son ander ander ander ander ander ander ander ander and	and a state of the second state of the state
	CLIENT:	D.V.	Leu	nn.	WATER/ENCOUNTERE	D 13.5'		
	DRILLED:	12-15	3-9	Ö	BY: Tow	Sochan	WATER/COMPLETION	12.5'
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	ELEV.	SAMPLE	SAN	APLE	BLOW			GROUND
	FT.	DEPTH	NO.	TYPE	COUNT	CLASSIFICA	TION	WATER
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-/-	<u> </u>				and a second second second second second second second second second second second second second second second	alan yang mang mang mang mang mang mang mang m	ﻮﺭ, , , , , , , , , , , , , , , , , , ,	and a second second second second second second second second second second second second second second second
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TESTHOLE 6-15

PROJEC	T: Port	<u>b£</u>	Cle	veland	າມແຫລະແຜ່ມັນມີກາງດາງແຫລະແຫລ່ວມກະຕິເຫັນເປັນຫຼາງ <u>ແລະ ແມງແຫລະມີການສູງແມ່ນຫຼາຍເປັນແຜ່ນັດ</u> ແຜ່ນັດແມ່ນຫຼາງກາງການກາງການກາ		ar na gana da			
CLIENT:	CLIENT: p.V. Levin Corp WATER/ENCOUNTERED									
DRILLED	: 12-19	1-9	Ö	BY: Jom	Suchan	WATER/COMPLETION	NONE			
1						WATER/				
ELEV.	SAMPLE	SAN	APLE	BLOW			GROUND			
· · · · · · · · · · · · · · · · · · ·		NO.		COUNT	GLASSIFICA	non				
1.0	1.0', -	ļ	Ļ		Concrete					
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					TEST HOLE	<u>L-15</u>
PROJECT	T: POR-	TOFO	ICUCHANC	Westgin	50	PALE ZONES-STOR
CLIENT:	Lewi	N COR	P		WATER/ENCOUNTERE	D Q.J.O'
DRILLED	: 12-15-	90	вү: Д.	HEPNER	WATER/COMPLETION	13.5'
					WATER/	
ELEV. FT.	SAMPLE DEPTH	SAMPLE NO. TYPE	BLOW COUNT	CLASSIFICAT	ION	GROUND WATER
7"				CONCRETE		
11.0'	2.5 4.0 5.0 6.5 8.5 10.0	1 55 2 55 3 55	2-3-5 2-2-1 2-2-1	VILOOSE BROW MFD SILTI SA WI GRAY + BRN EHI- ?	A FINE TO AND & ANJERD SILTY SAND	WCT ZONCS
	_ 35 50 _	4 55	3-3-3	LOOSE BROWN A SILTY SAND LA GRAJ SBROWN	EINE TOMED A, JELD WI MIXED FINC	WZT ZONRS
22.0'	185_ 200_ _	555	2-3-3	TOMED SILTY	SAND, F111-7	22.0'WE T
27.5		655	3-6-20	MED DENSE BU FINE TOMED SIG GRAVELS- WI GR	ACK SERAY LTY SAND TRACE AUTL LAYTES	WET
	085_ 30.0	755	5-8-7	STIFF 6RAJ SIL FINC SAND WAJ	T. CIAY TRACE	MOIST TO
	33.5_ 35.0_	8 55	3-41-7	CIAJEY SIZT 7 SAND	PALE FINE	We T

PAGE 2 of 2

						TEST HO	LE L-D
PROJECT	r: <u>Por</u>	T O	FO	<u>LITVILAND</u>	WEST OTH	<u>Sr</u>	APALE ZONES 5'1022
CLIENT:	LEWI	، لم	oRf	2		WATER/ENCOUN	TERED 22.0
DRILLED	: 12-15	5-9D		BY: D.H	c PNER	WATER/COMPLET	TION 13.5'
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ELEV.	SAMPLE	SAN	APLE	BLOW			GROUND
<u> </u>	DEPTH	NO.	TYPE	COUNT	CLASSIFICA	TION	WATER
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TEST HOLE L-16

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CLIEN	CLIENT: D.U. Lewin Corp WATER/ENCOUNTEREI									
DRILLI	DRILLED: 12-14-90 BY: Jon Suchan WATER/COMPLETION									
		1				WATER/	anning an an an an an an an an an an an an an			
ELEV. FT.	. SAMPLE DEPTH	SAN NO.	APLE TYPE	BLOW COUNT	CLASSIFICAT	ION	GROUND WATER			
	0,0°, 0,8° 	(55	3-50/4"	Bru Sand wy br concrete, stag,	revels, Brick, netal, wood.				
4.5		2	55	10-9-6 8-34-50/3	· Dense Black +	Growy Sand				
	B.5	4	55	25-27-24	W (brovels + Bro Trace Glass,	Slag	M0157			
			~ ~		(Fill)					
		0 0	55	9-25-50/2"	Dense Horn Sond Brick + Loncrete	, Gravel, wy				
20.5		7	55	14-27-26	+ Grey Sand + 6 + Brick (Fill)	ravel wy Saudston Concrete	WET			
		B	55	18-10-11	Dense Fine to M Some Course Sand Polack wy Gray La	to sand wy + Brick	· ·			
28.7		9	Ś\$	4-6-8	Firm breng Fine Si	wy sand.				
		10	\$\$	W-1-3						

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PAGE_2 of 2

TEST HOLE 12-16

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CLIENT:	P. U.	Lei	vin	an ang mang mang mang mang mang mang man	WATER/ENCOUNTERED 14.0			
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TEST HOLE L-17

CLIENT:	P. LEU	WATER/ENCOUN	NCOUNTERED 85			
DRILLED	: 12.15-9.	0		BY: BUCG	1 WATER/COMPLE	TION CAUG. No
					WATER/	
ELEV. FT.	SAMPLE DEPTH	SAI NO,		BLOW COUNT	CLASSIFICATION	GROUND · WATER
12"					ASPHAUT 2" CONCRETE 10"	معني المحاطية
	2.5 -	1	55	50/6"	Fill) ROCK FRASS, CODDISS, WOUCH RED BR	-1 Ctc
4.5	4.0	2	<u>s</u> s	20-15.50	ET C.	
<i></i>	5.0				Firm BROWN SAND MSUME BRAVER	- 5
	6:-	5	<u>ss</u>	1.9.2		
8.0	8.< -		<u></u>		Logse Fill SIAS SAND, SEDULS	W&7
	- 0 01	4	55	23.3		
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	13.5				Some L'explies	
	K.o	5	\$\$	3-4-6		
	Annalysis					
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	20.0	6	SS	8.11.8		Onivicie
						
23:0		х.			LISTIFUL FILM GRAY SITT + CLAY	
	250	<u>ר</u>	55	4.7.10		
	and the second se					
28.0					CTIER CLAA STINGA CLAA	
	30.0 -	8	55	3-4.7	or the owned of the order	
A7 -				т •. •		
33.0	_				SUFT OF FIRM GRAY. STICKY CLAY	
	39.1	9	50	2.4.4		

BORING LOG

TEST HOLE L-17

PAGE 2 of 3



6711 Sunderland Drive
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PAGE <u>3</u> of <u>3</u>

TEST HOLE L-17

CLIENT:	A.C.T.				WATER/ENCOUNTERI	WATER/ENCOUNTERED		
DRILLED:	12-15-9	16		BY: BUCG	WATER/COMPLETION	, , , , , , , , , , , , , , , , , , ,		
					WATER/	· · ·		
ELEV. FT.	SAMPLE DEPTH	SAI NO.	MPLE TYPE	BLOW COUNT	CLASSIFICATION	GROUND WATER		
720	4 4				HARD GRAY STICK CLAY	SATURATO		
	73:< 75:0	17	SS	9-13-22	HARD GRAY SIT CLAY WGRAVELS + Rock FRASMENTS	moist		
	78.5 <u>-</u> 80° <u>-</u>	18	\$5	8-16-22				
	83.× 85.~	19	55	8-14-90				
ð	88.5 <u>-</u>	29	SS	7-11-19	U.STIFP			
920	- -				NENSE ROAN SETT WICHNISEM	5 5		
	93.< 95.2 	Ч	55	7-13-21		· ·		
97,0								
	1000	12	55	15-21-40.	HARD GRAY SITT CLAY WARAVELS + Rock FRAS.			
00.0					T.D. 100.6			

PAC	ΞE_	<u>l</u>	_ of _	5
HOLE	B	1	18	3

	$\hat{\mathbf{O}}$					TEST HOLE	<u>k-18</u>
PROJECT	<u>r: Pc</u>	<u>2RT</u>	<u> </u>	of Cl	EUELAND	ઌૢૢૢૢૢઌૡઌઌઌઌઌઌઌઌઌઌઌઌઌઌઌઌઌઌઌઌઌઌઌઌઌઌઌઌઌઌ	
CLIENT:	D.	<u>J. h</u>	EL	C Vic	orp	WATER/ENCOUNTERED	10.0 WET
DRILLED	12-9	7-9	0	<u>вү: </u>	Gibel	WATER/COMPLETION	101
<i></i>					1	WATER/	
ELEV. FT.	SAMPLE DEPTH	SAMPI	LE YPE	BLOW COUNT	CLASSIFICATION	١	GROUND WATER
ey a					BLACK TOP		
16"					LONCRICE		
].C].S	[S	25	12-17-18	BROWN SILTY -	AND; CINDRES	
	5.0	25	is q	7-9-7	SLAG, RED BRICK	TRACE .	70157
:	9:0 -	2 0	4	3.5.k	WOOD FIBELS, F	=	100'wet
_11.0' _16.5 '	105	3 S 4 S 5 S	5 1	5-5-5 4-7432	LOOSE GRAJ FINC T SAND HAJERO COAL FIIT-? VIDENSE GRAJ FI LAJERD WIMED D TOMED SAND, TRACT	TOMED SILTY L & & PAVEL NC SILTSAND CNSE FINC C SMAIL	WC T VC T
251'	24.0 - 255 - 	65	s 9	-7-9	GRAVEL HAJERS		a Barana an an Anana an an Anana an Anana an Anana an Anana an Anana an Anana an Anana an Anana an Anana an An
	 39.0 30.5 34.0 35.5-	7 5.	s s	5-9-11	DED DENSE GRAJ TRACE FINE SAND CIAJ LAJERS	CIA.JC.JSTET	MOIST TO WE T

PAGE 2 of 5

	D.	0- 0	FCIEN	FLAND	TEST HOLE	1-18	
PROJECT	· FOI	ET O	I CLEU		WATER/ENCOUNTER	EDIOG	
	$\frac{D}{D}$	- 90		ON HEPNER	WATER/COMPLETION		
DHILLED.	<u>'at 1</u>		<u>ףו. שנ</u>	<u>ne liure</u>	WATER/	<u>i</u>	
ELEV. FT.	SAMPLE DEPTH	SAMPLE NO. TYPE	BLOW	CLASSIFICA	TION	GROUND WATER	
38.5'							
- -	39.0 - \$/0.5	9 55	6.6.6	STIRE GRAY SI	hANJERS GRAY		
4	44.0 45.5	/t: SS	0-4-6	MCD DONSE CIA; FINC SAND	ycy SILTWI	MOIST TO	
- 2 a t		11 55	3- <i>: 41-</i> 8			Wet	
<u>, , , , , , , , , , , , , , , , , , , </u>	540 555 - -	1255	6-7-12	VISTIFF GRAY TRACE FINC 1	SILT. CIA.		
		13 55	5-9-11	GRAJ MED DENS	SAND	MOIST 70	
		14.55	6-8-13			Wel	
	69.0- 70,5-	15 55	6-10-14		An an a star and a star and a star and a star and a star and a star and a star and a star and a star and a star		

			DRILLE	ERS TEST BORING	LOG PAG	E_3 of
· . ·	0				TEST HOLE	S -18
PROJECT:	TOPT	04	CLEU	IELAND		
CLIENT:	<u>). V. L</u>	Eu;	<u>~</u>	1100.00	WATER/ENCOUNTER	D 10.0
DRILLED:	2-4-4		BY: DC	IN HEPNER	WATER/COMPLETION	<u>]:0 </u>
ELEV. S		APLE	BLOW		WAICh/	GROUND
FT. C	EPTH NO.	TYPE	COUNT	CLASSIFICAT	rion	WATER
	Wentline and a second					
12,5	· · · ·					-
	-				and a second second	
74	10-16	55 9	.15-21	HARD ERAY SILTY	CIA. SANNY ~1	
25	S_/~			ERAVILS SR.FRAGS	LAYERO WI	
				CIN - PILT CAN	or istheraules	
				Crayey Ster Stind	capit lad firs	
17	5 17	55 9	7-17-24	+ R. FRACE TRACE	370 111 (00010	
84	10-10	00 1	2.22.20			
85	5-18	5.5 10	1-00-00			
	patronom					
	-					
89	0 19	55 12	-22-30			
90.	5_4					
94	0-20\$	5 19	-32-50			
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TEST HOLE 2.18

CLIENT:	Lewi	·N	60	RP		WATER/ENCOUNTER	ED 10.01
DRILLED): 12-10	-90		BY: D. J-	ICPNER	WATER/COMPLETION	1.01
					ann san Che-suide y na ann a' Ruisean de Alexandra Y ann an Alexandra (ann an Alexandra) an Alexandra (ann an A	WATER/	
ELEV. FT.	SAMPLE DEPTH	SAN NO,		BLOW COUNT	CLASSIFICAT	ION	GROUND WATER
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	104.0 104.0 104.4 109.0 109.4 109.4 114.0	22 23	<u>چ</u> ح چح	50 F0R 5 '' 50 F0R 5 ''	VIHARO ERAY SANOY WI ERA LAJERO WI SIL WIERASELS JR. COBBIES	CIAYCY SILT VILS J. E. E.A. 65 LTY CIAY SANDY ERA6S SOME	MOIST TO WCY
116.5 1 30,5	19.0 	25	\$5	JJ-31-38 17-J1-J5 10-16-33-111	HADD GRAJ CIA TPALE FORC S. WI GRAJ SILT, SMAIL SAND LAY	AND KAJCED I CIAJ ICRS	MOIST
	131.0_ 134.0 34.4	28 5	55	50/5"	VILARD GRAY CI, WIGRAVELS FR. FR.	9.1 - y SILT SANDY 965	

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PRO	јест: Ро	et	Ø	P	Cleve	LA	NO WST3RD ST	F		
CLIEN	NT: LC	w11	N.	CC	RP			WATER/ENCOUNTERE	D 1001	
DRILI	LED: 12	-10-	-90	,	BY: 7	D. /	ICPNCR.	WATER/COMPLETION	1.01	-
								WATER/		-
ELE	V. SAM		SAM	PLE	BLOW	.			GROUND	
134.5		<u> </u>	<u>NU. </u>	IYPE	COUNT		CLASSIFICAT	IUN .	WAIER	a
10110						4			5	
	135.0					ŀ	HALP GEAJ SHAI	E		
135.2	1350	5 1	29 \$	55	5010,1					
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TEST HOLE 2-19

PROJEC	Г: <i>Гое</i>	T	OF	Clevel	AND		and the sector of the sector o
CLIENT:	DAU	<u>O</u>	<u>k e i</u>	VIN CO.	RP	WATER/ENCOUNTERI	D 6.5
DRILLED	: 12-8	-19	90	BY: DA	TOPNER	WATER/COMPLETION	a CH CH CH CH M THE CH CH CH CH CH CH CH CH CH CH CH CH CH
<u></u>				1		WATEH/	
ELEV. FT.	DEPTH	NO.	TYPE		CLASSIFICA	TION	WATER
<u>11.5</u>	DEPTH 	NO. 1 2 3 5	SS SS SS	6-4-5 2-1-1 7-10-15 5-12-15	BLACK CINORES SAND, SLAG- BA TRACCS, BRICK, SINI BLACK FINE TO SAND	BRN SILTY POWN CINDERS WOOD FIBERS MED SILTY	WATEH MOIST 6.5 ***
17.5 21.5		6	5.	12-7-20	GRAJ FINE TO M	TO SHETY SAND	eve T
	235_ 250_ _	7.	22	4-6-8	GRAJ CIAJ EY FINC SAND	SILT TRAIE	
	985_ 300	8 9	کلا	7-10-13			We T
	335 _ 350 _	25	Es	9.15-19	· · ·		

PAGE 2 of 3

TEST HOLE 2-19

PROJEC	T: POLT	T O	F	CLEVELA	NO	area and a substantial and a substantial and a substantial and a substantial and a substantial and a substantia		
CLIENT:	DAVI.	DE	7011	N CORP		WATER/ENCOUNTERED 6.5		
DRILLED	: 12-8.	.90		BY: D/	HEPNER	WATER/COMPLETION	1	
•		-				WATER/	۰ ۲	
ELEV. FT.	SAMPLE DEPTH	SAM	IPLE TYPE	BLOW COUNT	CLASSIFICAT	ION	GROUND WATER	
270'	Parrice and a second second second second second second second second second second second second second second							
370	38.5				MCD STIFF GR.	R.J. SILTY		
	-	10	55	2-5-5	CIAJ TRALE FIN	NCSAND	WC T	
4.8.0'	433_ 45 <u>0</u> 	11	- 5 <i>S</i> -	2.4.5				
•	48.5 50.0	12	SS	c/.8-12	VISTIFF GRAY ST	S & POCK FRAGS		
	535 55.0	13 .	55	5-7-9	LAJERD, WI GRAJ SANDJ WIGRAUTL	I CIAYEY SILT S & R.F.RALS	wet	
	38.5 60,0	14 5	55	8-11-17			•	
	63.5 650 18.5 ⁴	15 5	5	7-11-16				
	70.0	65	s l	8-13-19				

PAGE 3 of 3

TEST HOLE L-19

PROJECT: POLT OF CIEVELAND	
CLIENT: DAVID LEWIN CORP	WATER/ENCOUNTERED 6.5'
DRILLED: 12-8.90 BY: D.HEPNER	WATER/COMPLETION
	WATER/

•	ELEV.	SAMPLE	SAI	MPLE	BLOW		GROUND
	FT.	DEPTH	INO.			CLASSIFICATION	WATER
		- 73.5 750 -	17	5.5	9.14.17	VISTIFF GRAY SULTY CIAY SANDY WIGRAUCLS & R. FRAGS LA. JCRD	
			18	SS	j0-17-21	WIGRAY CLAYPY SILT SANDY	MOIST TO ENCT
		835_ 850	19	ss	1]-17-22		
2	<u>/.</u> 0'	885_ 90.0_	20	دى	7-9-13		
		 935 9 \$15 	21	<i>د</i> ک	95-62	HARD bRAJ CIAJCJ SILT SANDY WIBRAUCLS & R.F.RALS, SOME COBBIES,	MOIST
9	9.0	8.5 99.0	9J	55	57Foll'		
						TD 99.0"	





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REPORT ON SOIL CONDITIONS. FOR

CLEVELAND PORT AUTORIORTY

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P , 0 , N 0 , 2 4 3 0

C. 4533

David V. Lowin Corp./Geotechnical Engineering 400 Bulkley Bldg./1501 Euclid Ave., Cleveland, Ohio 44115





SITE LOCATION PLAN (Scale 1" = 2000' ±)





SURFICIAL GEOLOGY Scale: 1" = 4000'±





APPROXIMATE BEDROCK CONTOURS, U.S.G.S. DATUM (Scale 1" = 4000' ±)

PLATE III

May 22, 1991

URS Consultants 3605 Warrensville Center Road Cleveland, Ohio 44122-5203

Attn: Mr. David Pyzoha

Re: Cleveland Port Authority Relocation Project P.O. No. 2430 C. 4533

Gentlemen:

In accordance with your request, we undertook an investigation of existing subsurface soil conditions for the subject project. The object of this investigation was to determine the subsurface stratification and the engineering properties of the strata encountered. The data developed was used in establishing soil related engineering criteria for use in the design of a breakwater, quay walls, slope stability, earthwork, warehouse foundations, and other substructures.

LOCATION

The area of the Port included within this investigation is generally bounded by Dock 24W on the east and the Cuyahoga River on the west. Plate I was prepared from the U.S. Geological Survey Topographic Map of the Cleveland North (1970) and Cleveland South (1984) quadrangles and shows the location of the area in relation to its surroundings.

GEOLOGY

The surficial geology of the area is shown on Plate II. The site is underlain by river alluvium followed by soils deposited on the



bottom of glacial lakes which preceded the current Lake Erie. Note the beaches of some of the glacial lake stages formed during the advance and retreat of the Wisconsin period glacial ice sheet. Wisconsin period glacial till is generally found between the deep lake bottom deposits and the underlying bedrock, believed to be part of the Chagrin Shale Formation. Plate III shows estimated contours of the bedrock surface.

-2-

FIELD EXPLORATION

Several previous investigations were made on this site by our office and by others. A copy of our Report C. 4288, Bulk Storage Capability-Dock 20, dated March 16, 1988 was sent to you previously. Boring data developed by our office in connection with an investigation for a proposed ore pellet terminal extending over Docks 20 and 24, C. 3033 and C. 3033A, warehouse structures south of Dock 24, C. 2337, and other projects by our office and others was reviewed. Some of this data is included in Appendix A for your information. A series of 19 supplemental test boring locations, L-1 through L-19, were selected by our office. Borings were located in the field by your surveyors.

Borings L-1 through L-7 were drilled in the water from a barge. Boring L-9 was not accessible due to a pile of stored material along Dock 20. The borings in the lake and river were drilled in September and October of 1989. The remaining borings, L-8 and L-10 through L-19, were drilled in December, 1990. Approximate locations of these, and previously drilled borings were added to a copy of your general site plan as shown on page 8. Soil and rock core samples obtained were brought to our laboratory for testing and evaluation.

LABORATORY TESTING

Pages 13 through 31, entitled "Laboratory Log of Boring", graphically show the strata encountered as well as the results of some tests performed. The column entitled "Blows on spoon for 12 inches" refers to the standard penetration test and indicates the number of blows of a 140 lb. hammer dropped from a height of 30 inches required to drive a 2 inch O.D. sampling spoon 12 inches into a stratum. Where a figure such as 50/.1 appears in the same column, it means that 50 blows resulted in a penetration of onetenth of a foot. The column entitled "Unconfined Shear Stress #/SF" refers to one-half of the compressive stress at failure in the unconfined state. Because of disturbance during sampling and the presence of silt or sand seams in some of the samples, the strength of the material in place in the field may differ somewhat from the strength indicated by the laboratory tests. Allowance was made for this in interpreting the strength test data. The column entitled "Loss on Ignition at 600°C.-%" refers to the percent loss in weight of a dried sample of soil when fired in an oven at 600°C. The loss on ignition is indicative of the organic content of the sample. Material exhibiting a loss on ignition of



3 percent or less can generally be considered free of significant concentrations of organic matter. Three inch diameter Shelby Tube samples were obtained at various depths so that tests could be performed on representative "undisturbed" samples. The results of triaxial compression and consolidation tests performed on some of these samples are shown in graphic form on pages 32 through 41. Summaries of shear values determined in the Dock 20 area and Dock 24W and Dock 22E areas are shown on pages 42 and 43.

STRATIFICATION

The subsurface stratification on the site is typically seen as man-deposited heterogeneous fill underlain by relatively thin deposits of sand and/or silt which are in turn underlain by silty clay. Shale bedrock was encountered beneath the site at varying elevations, generally between elevations 440 to 455, but as low as elevation $429\pm$ in boring L-8 and as high as $467\pm$ in borings B-16 and B-24. The surface of the shale is typically irregular due in part to differential weathering and abrasion from the glaciers. A layer of sand or silt is frequently found immediately over the shale in this area. Gas was encountered in several borings, at depths of 80 to 85 feet in borings L-2, L-6, and L-7, and at a depth of 135 \pm feet in L-1. Such gas encounters are not uncommon in the area and are believed to be pockets of gas.

The man-deposited fill encountered on the site varies in both composition and consistency. The materials in the fill range from sand, slag, coal, iron pellets, and cinders to building debris such as bricks, concrete, asphalt, glass, and wood. Oil or sulphur odors were noted in some of the fill samples. Organic contamination of the fill and the underlying silt and sand deposits may reflect not only those organics which may have been deposited with the fill, but also the presence of natural organic sediments on the lake bottom.

Idealized soil sections through the site are shown on Drawings 4533-2 and 4533-3, pages 9 and 10. These are only intended as an aid to visualizing general relationships between the materials encountered in the borings. Actual transitions in the field from one type of material to another may be expected to be more gradual and irregular than might be inferred from either the soil sections or logs of borings.

GROUNDWATER

Free water was reported in the boreholes at various depths as noted on the logs of borings. As expected, the water levels generally reflect the lake level. Seasonal fluctuations can be expected.



 $\forall' = 70 \text{ pcf}$ $\phi = 0^{\circ}$

 $\dot{K}_{g} = 60 \text{ kcf}$

 \forall = 70 pcf

 $K_{g} = 85 \text{ kcf}$

 $K_{d} = 120 \text{ kcf}$

 $\phi = 0^{\circ}$ C = 1400 psf

 $\chi' = 70 \text{ pcf}$ $\phi = 0^{\circ} \text{ c} = 2000 \text{ psf}$

 $\phi = 0^{\circ}$ C = 950 psf

 $\phi = 0^\circ$ C = 1400 psf

C = 950 psf

RETAINING STRUCTURES

We believe that the following soil parameters may be used for the computation of lateral pressures.

Dock 24W and End of Slip:

Man-deposited heterogeneous fill $\chi = 120 \text{ pcf above water table}$ $\delta' = 70$ pcf below water table and naturally deposited sand and silt to approximate elevation 555: $\phi = 30^{\circ}$ C = 0

Clay - Elevation 555 to 530:

Elevation 530 to 518:

Elevation 518 to 480:

Elevation 480 to 450:

Dock 22E (from south end of slip to 250+ ft. north):

 \forall = 120 pcf above water table Man-deposited heterogeneous fill and naturally-deposited sand and $\forall = 70 \text{ pcf}$ below water table silt to approximate elevation 555: $\phi = 30^{\circ}$ C = 0

Clay - Elevation 555 to 530:

Elevation 530 to 518:

Elevation 518 to 480:

 $\chi' = 70 \text{ pcf}$ $\varphi = 0^{\circ} \text{ c} = 2000 \text{ psf}$ $K_{g} = 120 \text{ kcf}$

 $\delta' = 70 \text{ pcf}$

 $K_{g} = 60 \text{ kcf}$

 $\delta' = 70 \text{ pcf}$

 $K_g = 85 \text{ kcf}$

Elevation 480 to 450:

 $\delta' = 75 \text{ pcf}$ $\phi = 0^{\circ}$ C = 3000 psf



URS Consultants

May 22, 1991

Dock 22E (from 250+ feet north of south end to north end) and Dock 22N: Man-deposited fill and naturally \aleph = 120 pcf above water table $\delta' = 70 \text{ pcf}$ below water table $\phi = 30^{\circ} \text{ c} = 0$ deposited sand and silt to approximate elevation 555: ຮ່≕ 70 pcf Clay - Elevation 555 to 510: $\phi = 4^{\circ}$ C = 600 psf $K_{d} = 45 \text{ kcf}$ Elevation 510 to 480: C = 2000 psf $K_g = 120 \text{ kcf}$ $\forall = 75 \text{ pcf}$ $\phi = 0^{\circ} \text{ c} = 3000 \text{ psf}$ Elevation 480 to 450: Dock 20 (south of existing jetty): Man-deposited heterogeneous fill $\chi = 120 \text{ pcf above water table}$ and naturally deposited sand and $\chi' = 70 \text{ pcf below water table}$ silt to approximate elevation 555: $\phi = 30^{\circ}$ C = 0 X = 70 pcfClay - Elevation 555 to 545: $\phi = 0^{\circ}$ C = 1000 psf $K_{g} = 65 \text{ kcf}$ $\delta' = 70 \text{ pcf}$ $\phi = 4^{\circ} \text{ c} = 600 \text{ psf}$ Elevation 545 to 530: $K'_{g} = 45 \text{ kcf}$ $\chi' = 70 \text{ pcf}$ Elevation 530 to 518: $\phi = 0^{\circ}$ C = 1400 psf $K_{g} = 85 \text{ kcf}$ δ[']= 70 pcf Elevation 518 to 485: $\phi = 0^{\circ}$ C = 2000 psf $K_g = 120 \text{ kcf}$ {'= 75 pcf Elevation 485 to 440: $\phi = 0^{\circ}$ C = 3000 psf Dock 20 (north of south end of jetty): Same as Dock 22N and north end of Dock 22E

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It appears that a single sheet pile retaining wall may not be appropriate for the dock walls along the lake and along the river



in the area of the existing jetty because of the increased depth of softer clays in these areas. Consideration might be given to the use of cofferdams in these areas as well as for the proposed breakwall.

Lateral pressures for controlled granular backfill may be determined on the basis of a unit weight $\forall = 120$ pounds per cubic foot above the water table, a submerged weight $\forall' = 70$ pounds per cubic foot, and an angle of internal friction $\phi = 32^{\circ}$. Materials that are actually going to be used for filling should be reviewed when they are available so that the parameters can be checked.

STABILITY ANALYSIS

Stability analyses of both the Dock 24W extension and the end of the Dock 24W slip were made. The dock section and the soil profiles and properties used in this analysis are shown on Drawing C. 4533-4, page 11. The effect of several positions of an assumed 1000 pound per square foot surcharge relative to the face of the dock was evaluated as shown. Based on this analysis, it appears that a factor of safety of 1.50 can be obtained if the surcharge is kept at least 80 feet back of the face of the dock. The factor of safety is reduced to 1.36 when the surcharge is placed up to the dock face. Note the effect of a reduced dock height and the berm on the water side of the bulkhead on the factor of safety calculated for the bulkhead at the end of the slip. The berm should be constructed of select granular material and should be built with a slope no steeper than three horizontal to one vertical. Scour and washouts may result if suitable armoring is not provided.

EXCAVATION

The material to be excavated for the slips generally consists of man-deposited fill, a layer of silt and/or sand, much of which is contaminated with organic or other matter, followed by silty clay. This material is in general not suitable for use as structural fill in other areas of the site. Should a significant amount of clean, inert material be encountered during excavation, we will be available to discuss the possible use of such material at that time. The sides of unretained excavations should not be expected to stand vertically. Instability may be experienced along temporary slopes as flat as two horizontal to one vertical. Erosion protection will be required along slopes and wherever materials are exposed to the action of water. Your attention is called to the importance of construction methods and sequence with regard to excavation, the installation of retaining structures, and subsequent backfilling. This should be taken into consideration during the design stage and carefully reviewed before and during construction. The possible presence of the



remains of previous docks, structures, and/or shore protection should also be considered.

PILES

A sketch showing the relationships between estimated individual allowable axial pile capacity versus penetration for 12 3/4 inch diameter pipe piles in compression and in tension in the area of Dock 24W was previously sent you and is included on page 12 for reference. The curves were developed for vertical piles and for piles driven at an angle of 30° from the vertical. Ultimate loads were estimated to be $P_{\rm u}$ = adhesion x pile circumference x stratum penetration. An additional allowance for bearing at the tip was added for piles in compression. Based on our experience with pile tests in this area, we have assumed that adhesion equals the unconfined shear stress for compression piles and varies from 0.7 to 0.5 times the unconfined shear stress for tension piles. A factor of safety of two was applied to $P_{\rm u}$ in order to determine allowable capacity.

Note that gas was reported in some of the borings at depths of 80 to 85 feet as previously discussed. It is possible that some gas may be encountered during the installation of piles and sheet piling. The environmental and construction implications of any such encounters, if any, should be considered.

LIMITATIONS

The above considerations are based on a substantial but necessarily limited number of borings on the assumption that the materials encountered do not vary significantly between the points explored. This assumption should be verified during construction. Environmental analysis, evaluation or testing were not included in the scope of our investigation.

With the exception of the Dock 24W extension and the end of its slip, we understand the design is still in the early stages. We will be providing recommendations for proposed warehouse structures, storage areas and other facilities as your plans are developed.

Sincerely yours,

DAVID V. LEWIN CORP. Alvin H. Jaffe

AHJ/ae

