

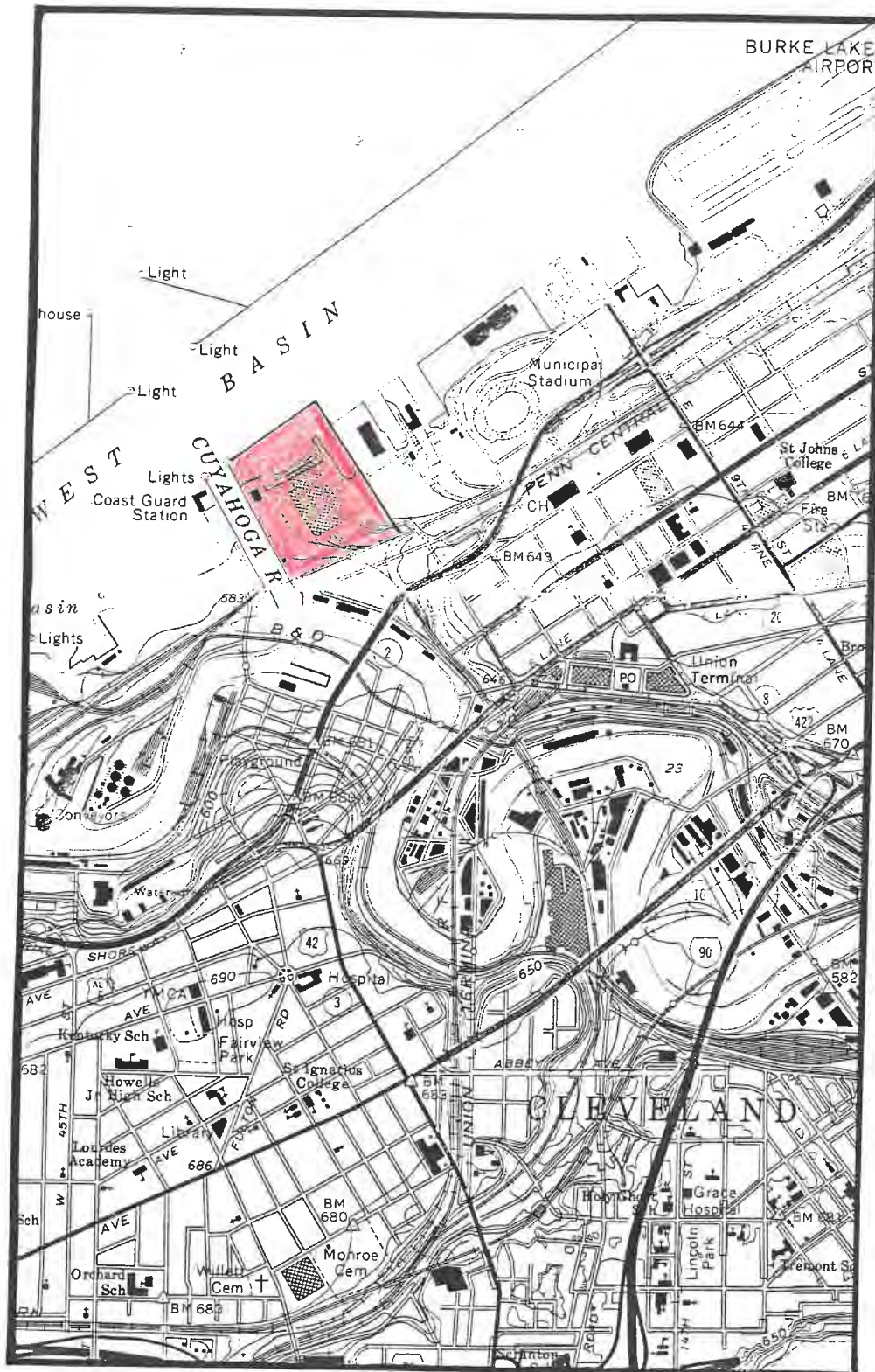


Esri, NASA, NGA, USGS, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, USDA

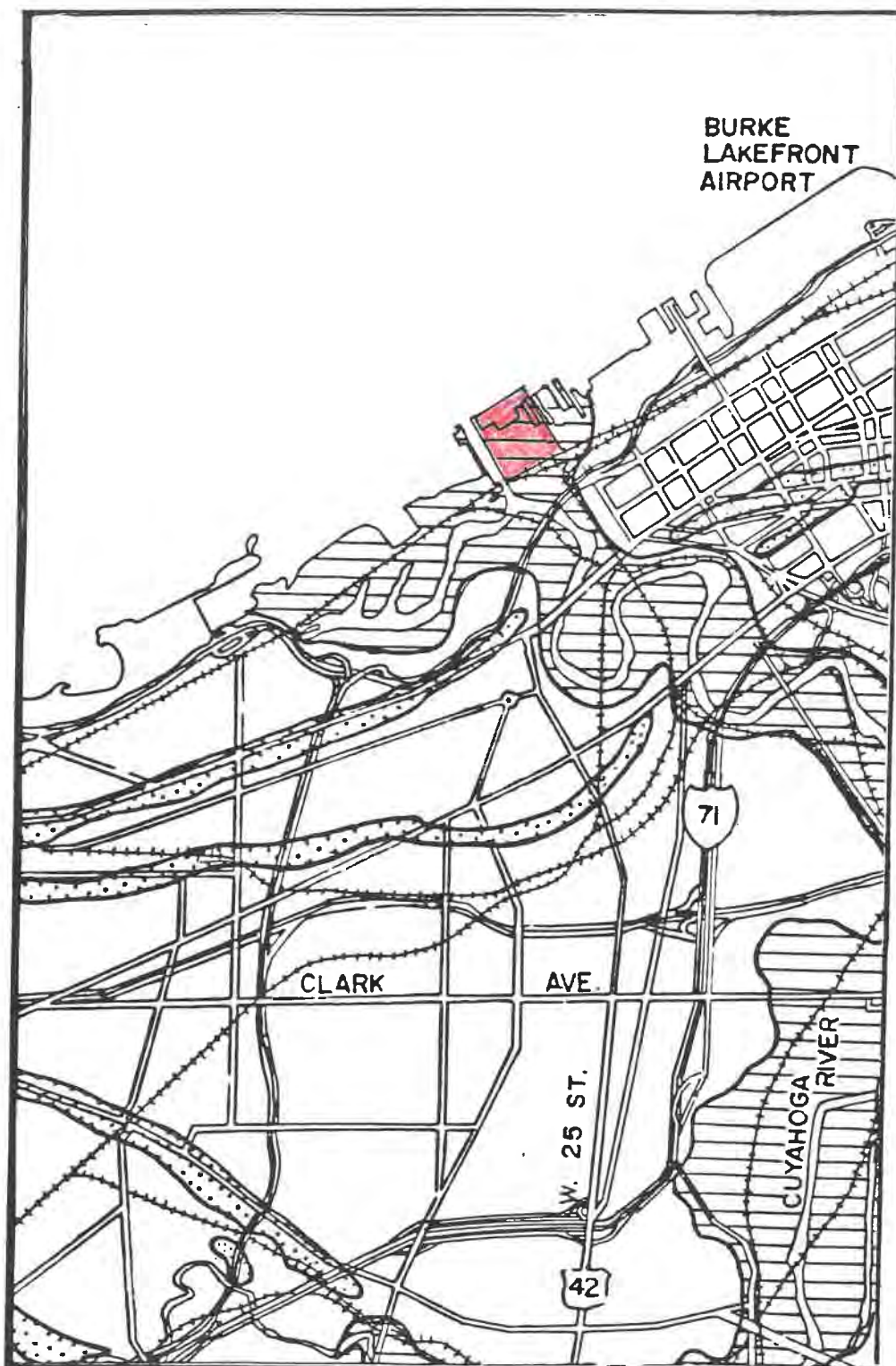
3/6/2023



1100 W. 9th St., Suite 300
Cleveland, OH 44113



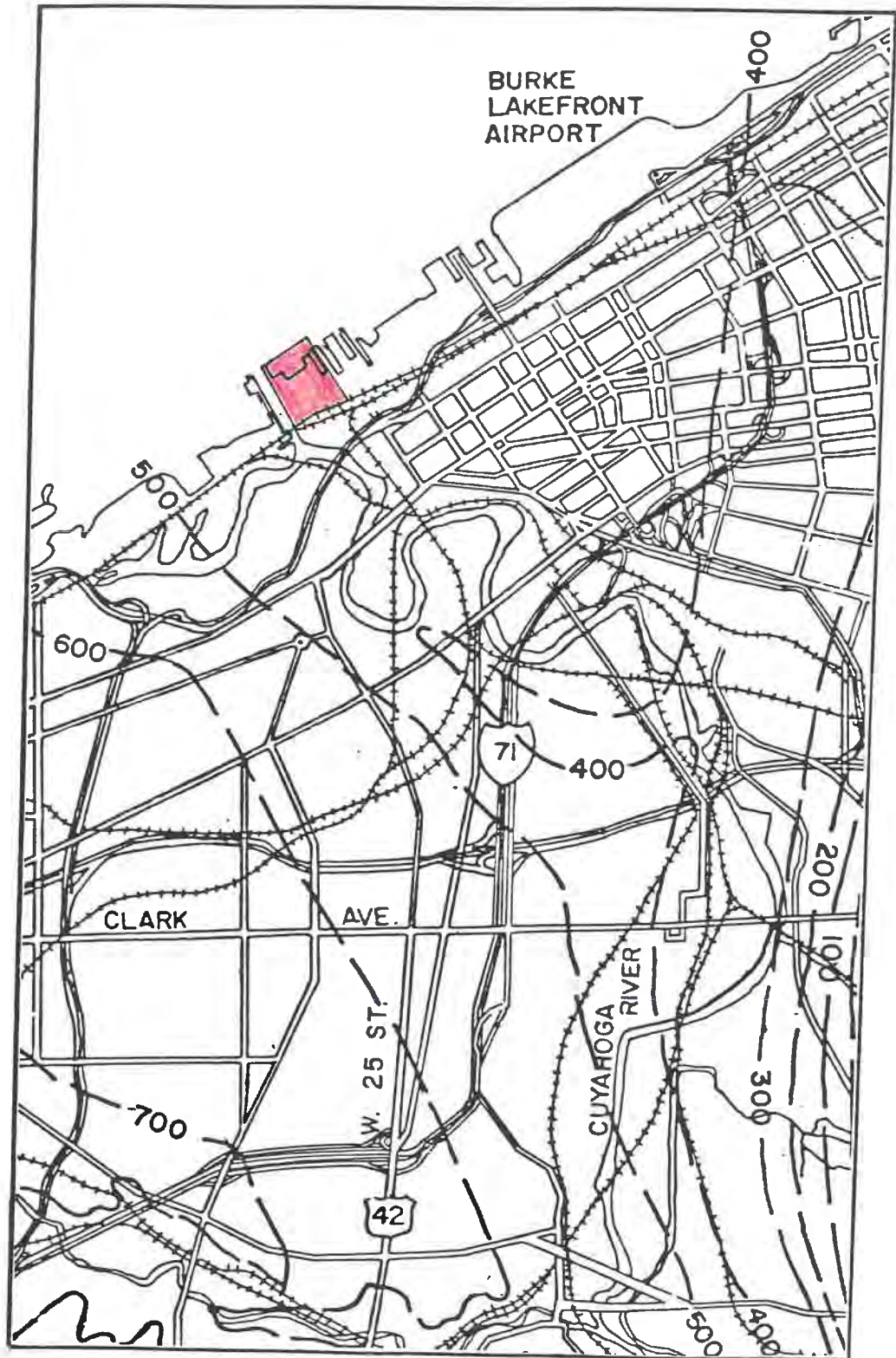
SITE LOCATION PLAN
(Scale 1" = 2000' ±)



SURFICIAL GEOLOGY
Scale: 1" = 4000' ±

LEGEND

- | | | |
|--|--|-------------------------------|
| | River Alluvium | AGE POST GLACIAL AND RECENT |
| | Glacial Lake Beach Ridge Deposits | |
| | Glacial Lake Bottom Deposits | |
| | Glacial River Terrace Deposits | |
| | Ice - Deposited Ground Moraine | WISCONSINIAN |
| | Ice - Deposited End Moraine | |
| | Water-Deposited Glacial Outwash Deposits | |



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

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 break-water, 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

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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.

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 one-tenth 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+ in boring L-8 and as high as 467+ 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+ 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.



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 $\gamma = 120$ pcf above water table
and naturally deposited sand and $\gamma' = 70$ pcf below water table
silt to approximate elevation 555: $\phi = 30^\circ$ $C = 0$

Clay - Elevation 555 to 530: $\gamma' = 70$ pcf
 $\phi = 0^\circ$ $C = 950$ psf
 $K_s = 60$ kcf

Elevation 530 to 518: $\gamma = 70$ pcf
 $\phi = 0^\circ$ $C = 1400$ psf
 $K_s = 85$ kcf

Elevation 518 to 480: $\gamma' = 70$ pcf
 $\phi = 0^\circ$ $C = 2000$ psf
 $K_s = 120$ kcf

Elevation 480 to 450: $\gamma' = 75$ pcf
 $\phi = 0^\circ$ $C = 3000$ psf

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

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

Clay - Elevation 555 to 530: $\gamma' = 70$ pcf
 $\phi = 0^\circ$ $C = 950$ psf
 $K_s = 60$ kcf

Elevation 530 to 518: $\gamma' = 70$ pcf
 $\phi = 0^\circ$ $C = 1400$ psf
 $K_s = 85$ kcf

Elevation 518 to 480: $\gamma' = 70$ pcf
 $\phi = 0^\circ$ $C = 2000$ psf
 $K_s = 120$ kcf

Elevation 480 to 450: $\gamma' = 75$ pcf
 $\phi = 0^\circ$ $C = 3000$ psf



May 22, 1991

Dock 22E (from 250+ feet north of south end to north end) and Dock 22N:

Man-deposited fill and naturally deposited sand and silt to approximate elevation 555:

$$\begin{aligned}\gamma &= 120 \text{ pcf above water table} \\ \gamma' &= 70 \text{ pcf below water table} \\ \phi &= 30^\circ \quad C = 0\end{aligned}$$

Clay - Elevation 555 to 510:

$$\begin{aligned}\gamma' &= 70 \text{ pcf} \\ \phi &= 4^\circ \quad C = 600 \text{ psf} \\ K_s &= 45 \text{ kcf}\end{aligned}$$

Elevation 510 to 480:

$$\begin{aligned}\gamma' &= 70 \text{ pcf} \\ \phi &= 0^\circ \quad C = 2000 \text{ psf} \\ K_s &= 120 \text{ kcf}\end{aligned}$$

Elevation 480 to 450:

$$\begin{aligned}\gamma' &= 75 \text{ pcf} \\ \phi &= 0^\circ \quad C = 3000 \text{ psf}\end{aligned}$$

Dock 20 (south of existing jetty):

Man-deposited heterogeneous fill and naturally deposited sand and silt to approximate elevation 555:

$$\begin{aligned}\gamma &= 120 \text{ pcf above water table} \\ \gamma' &= 70 \text{ pcf below water table} \\ \phi &= 30^\circ \quad C = 0\end{aligned}$$

Clay - Elevation 555 to 545:

$$\begin{aligned}\gamma' &= 70 \text{ pcf} \\ \phi &= 0^\circ \quad C = 1000 \text{ psf} \\ K_s &= 65 \text{ kcf}\end{aligned}$$

Elevation 545 to 530:

$$\begin{aligned}\gamma' &= 70 \text{ pcf} \\ \phi &= 4^\circ \quad C = 600 \text{ psf} \\ K_s &= 45 \text{ kcf}\end{aligned}$$

Elevation 530 to 518:

$$\begin{aligned}\gamma' &= 70 \text{ pcf} \\ \phi &= 0^\circ \quad C = 1400 \text{ psf} \\ K_s &= 85 \text{ kcf}\end{aligned}$$

Elevation 518 to 485:

$$\begin{aligned}\gamma' &= 70 \text{ pcf} \\ \phi &= 0^\circ \quad C = 2000 \text{ psf} \\ K_s &= 120 \text{ kcf}\end{aligned}$$

Elevation 485 to 440:

$$\begin{aligned}\gamma' &= 75 \text{ pcf} \\ \phi &= 0^\circ \quad C = 3000 \text{ psf}\end{aligned}$$

Dock 20 (north of south end of jetty):

Same as Dock 22N and north end of Dock 22E

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 $\gamma = 120$ pounds per cubic foot above the water table, a submerged weight $\gamma' = 70$ 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



May 22, 1991

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 $P_u = \text{adhesion} \times \text{pile circumference} \times \text{stratum penetration}$. 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_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.

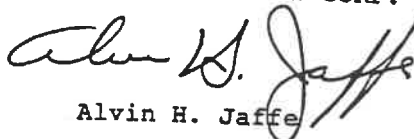
LIMITATIONS

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,

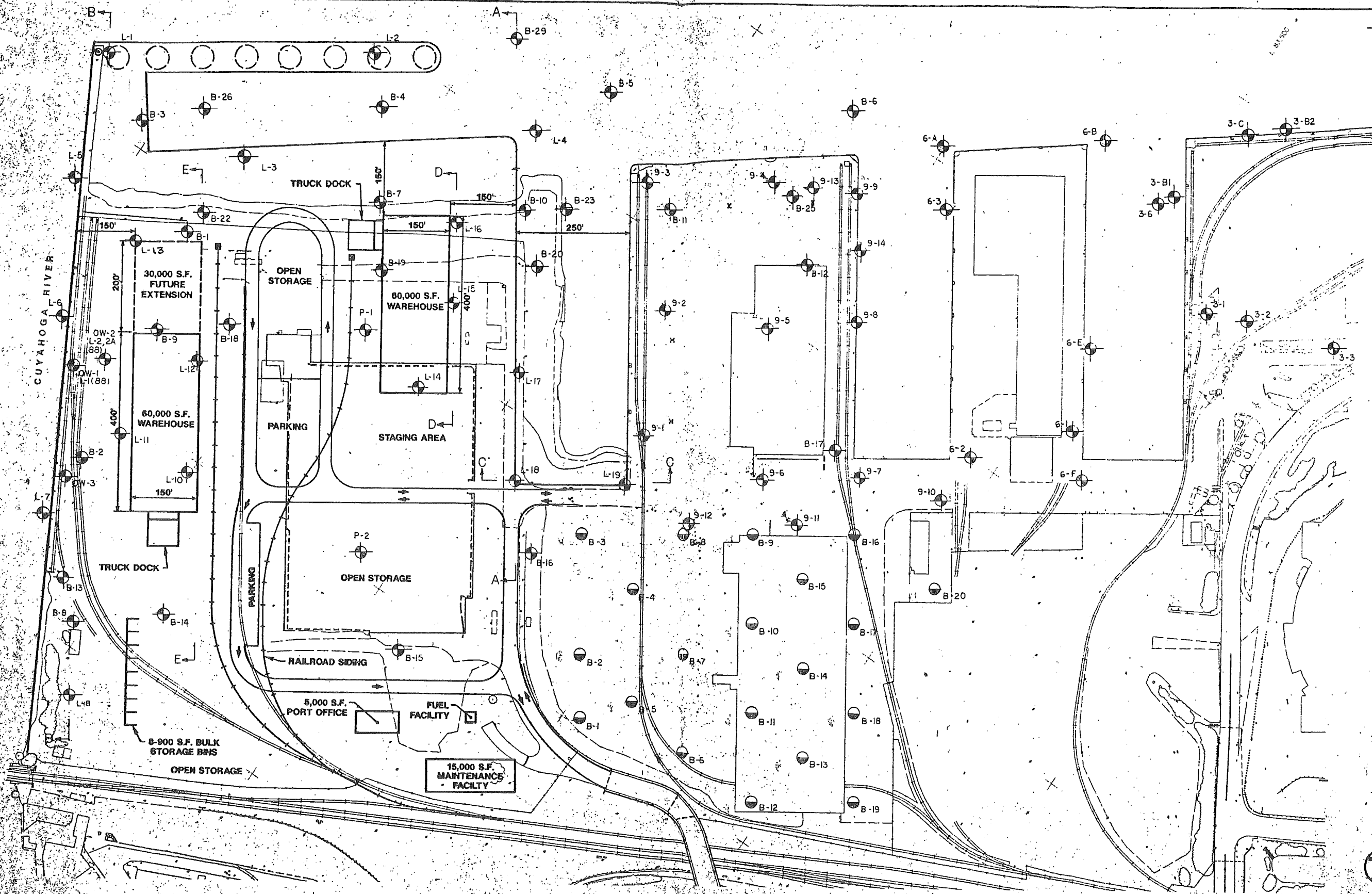
DAVID V. LEWIN CORP.


Alvin H. Jaffe

AHJ/ae

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NO.	DATE	BY	REVISION

DESIGNED BY: JLB	DATE: 1-12-90
DRAWN BY: SED	DATE: 1-12-90
CHECKED BY:	DATE:

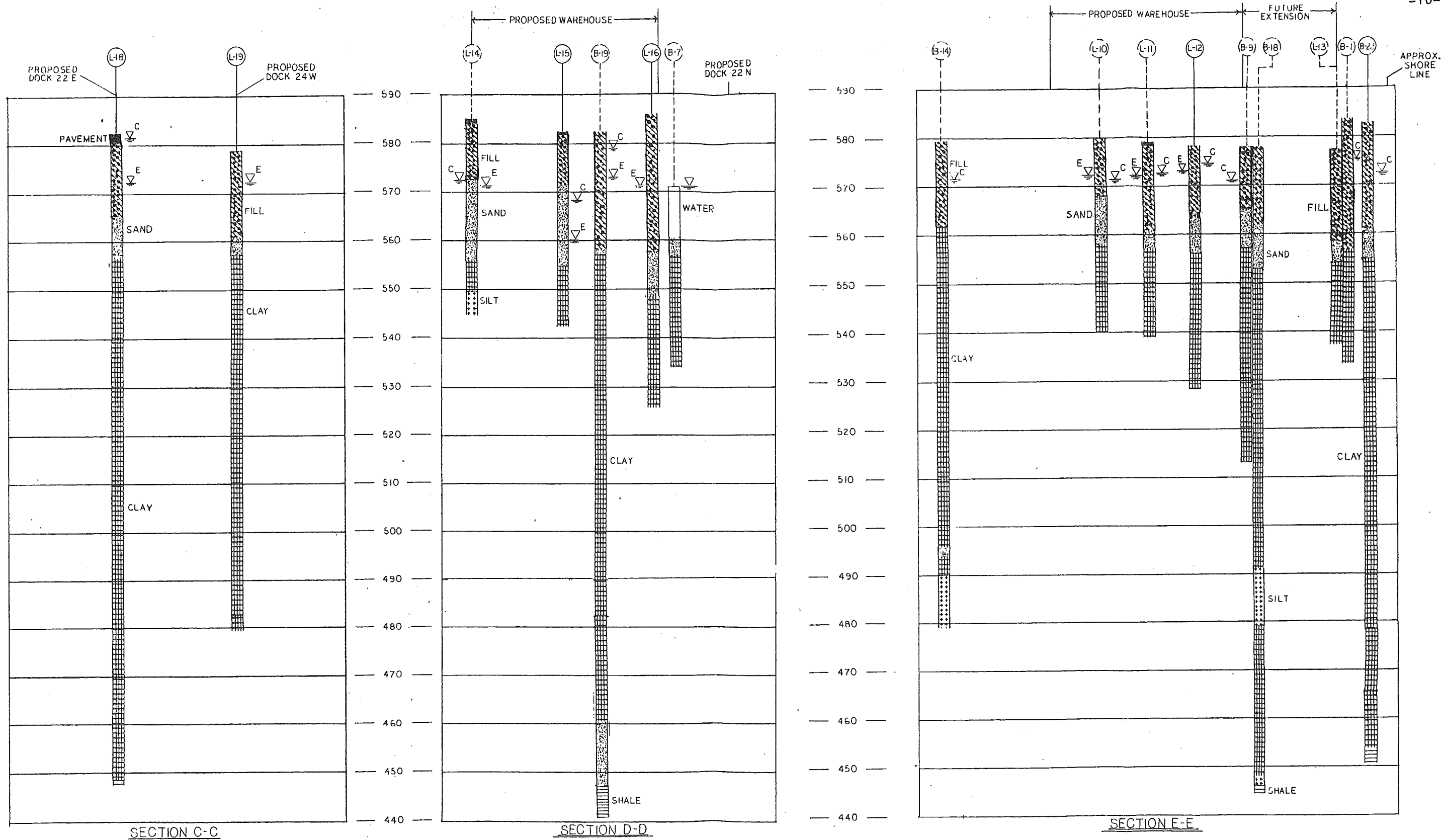
SCALE

RELOCATION OF THE
PORT OF CLEVELAND
CLEVELAND-CUYAHOGA COUNTY
PORT AUTHORITY
APPROVED BY:

CHIEF ENGINEER
DIRECTOR

GENERAL SITE PLAN

PROJECT NO. 89213-A
SHEET NO. OF



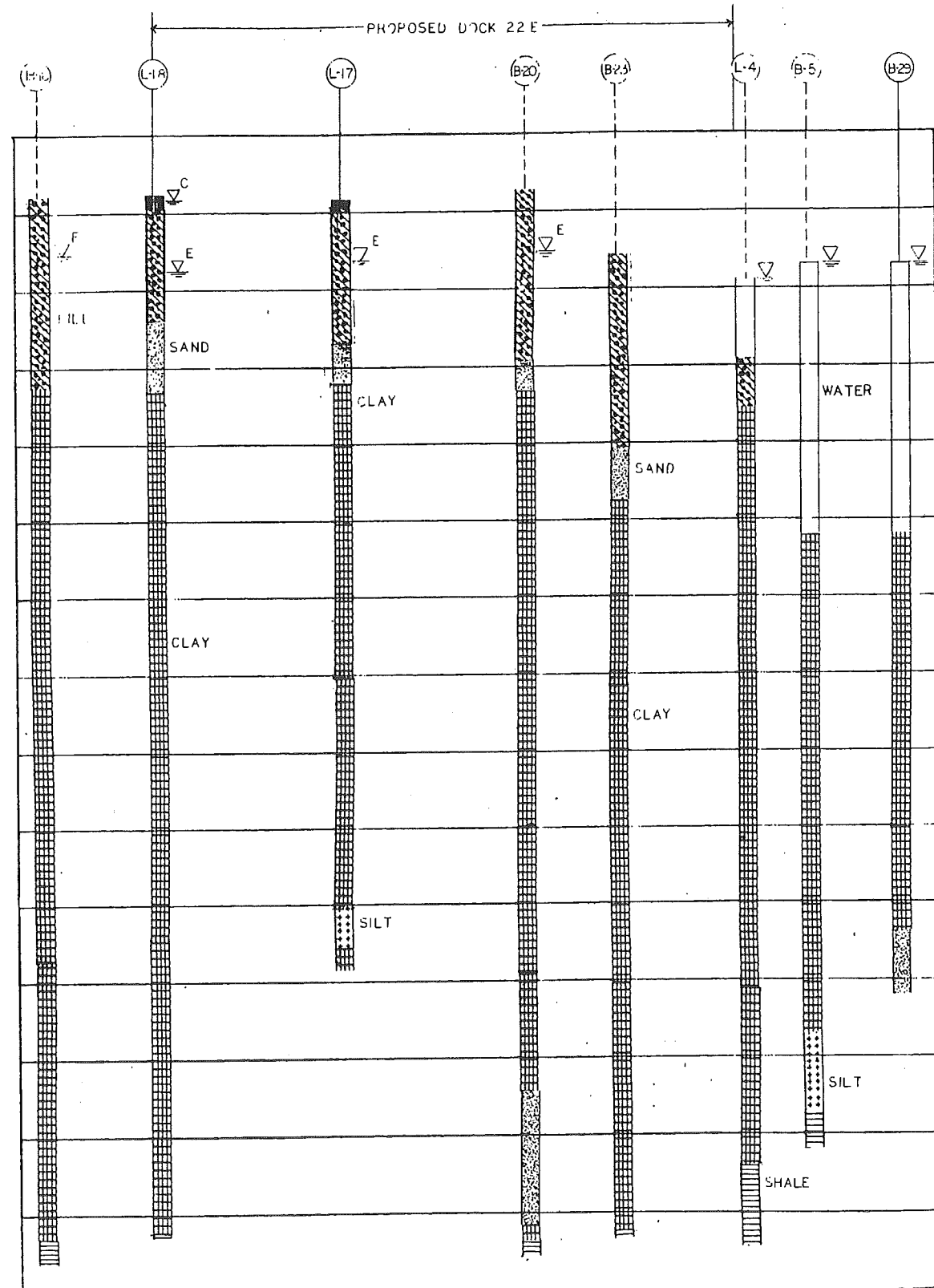
NOTE:

- INDICATES BORING NOT IN PLANE OF SECTION
- ▽ E INDICATES WATER LEVEL ENCOUNTERED DURING DRILLING
- ▽ C INDICATES WATER LEVEL UPON COMPLETION

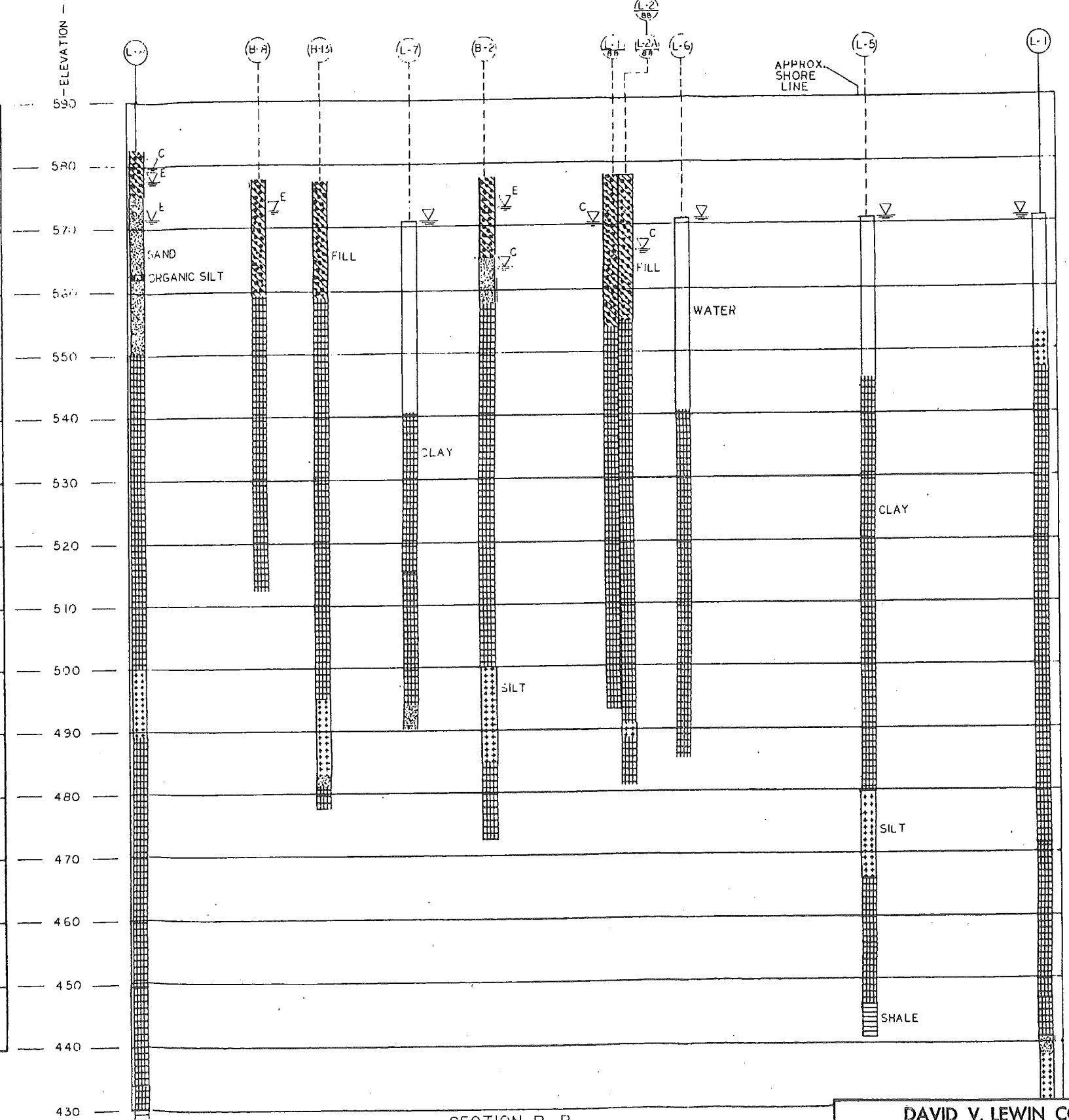
FOR COMPLETE SOIL DESCRIPTIONS AND WATER LEVEL DATA, SEE LABORATORY LOGS OF BORINGS

0 50 100
(SCALE IN FEET)

DAVID V. LEWIN CORP.		CLEVELAND, OHIO	
GEOTECHNICAL ENGINEERING			
RELOCATION OF THE PORT OF CLEVELAND CLEVELAND - CUYAHOGA COUNTY PORT AUTHORITY			
REV. No. 1	DRAWN BY PWW	SCALE AS SHOWN	DRAWING NO. 4533-3
APPROVED BY	DATE		



SECTION A-A



SECTION B-B

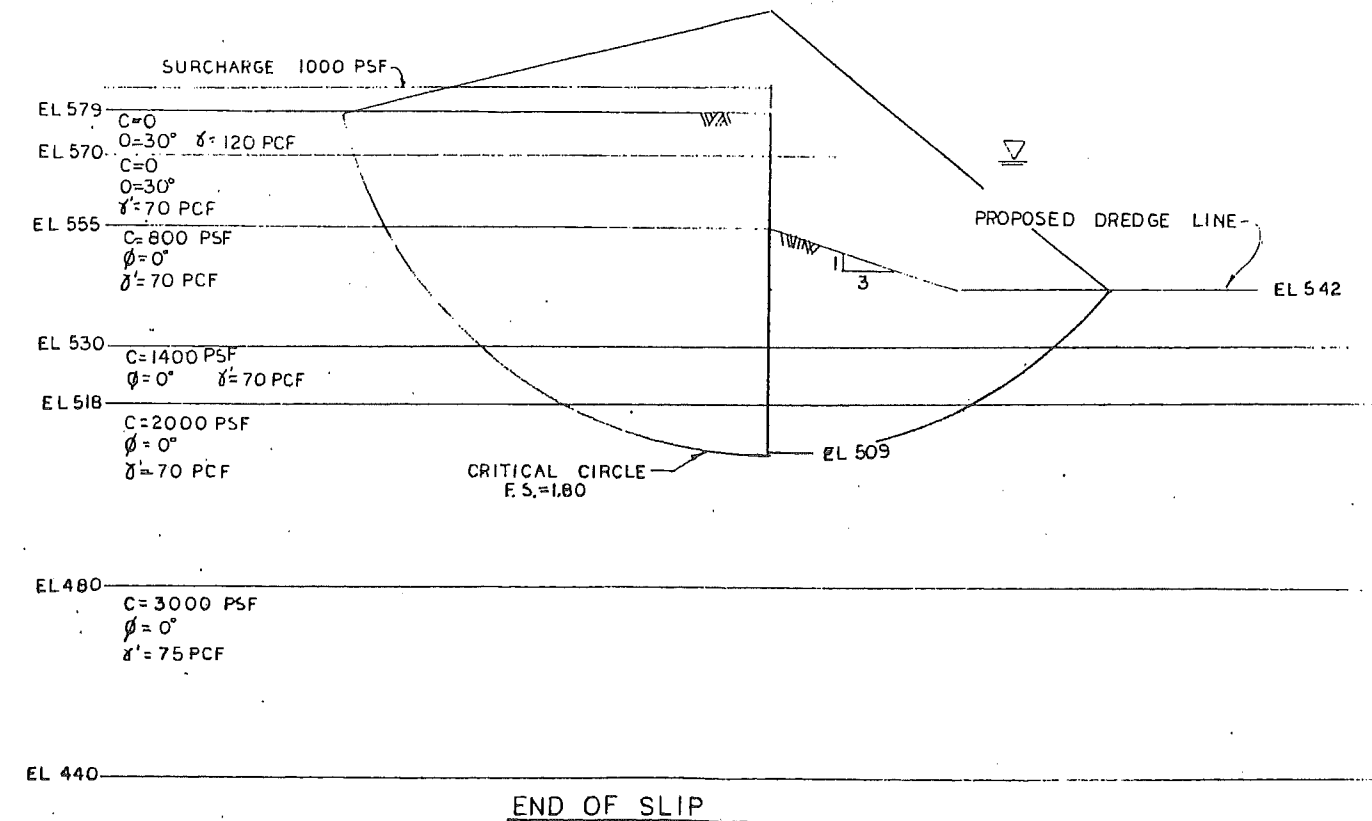
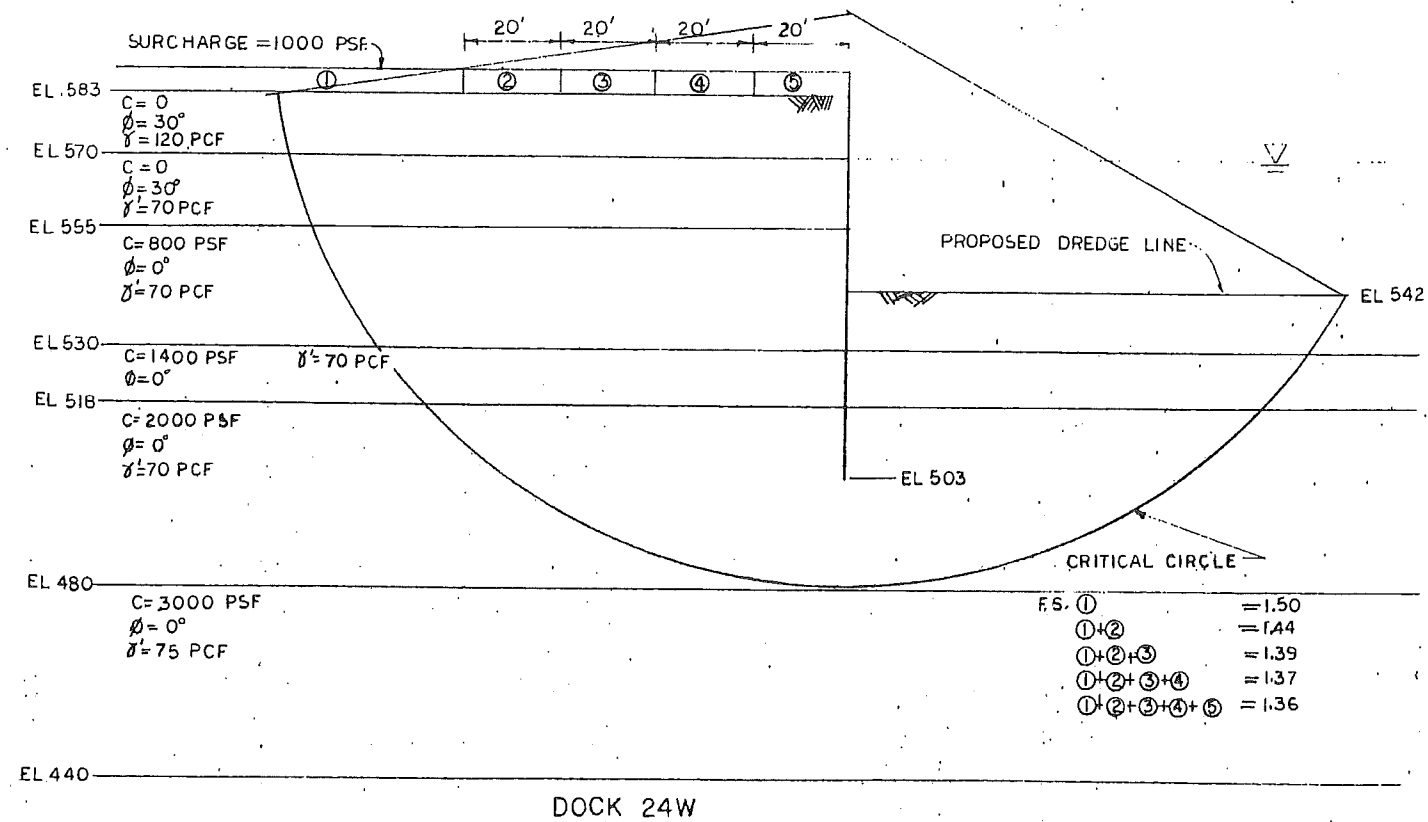
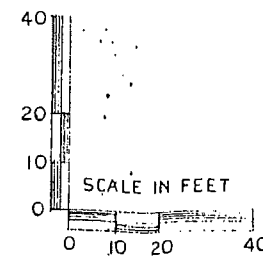
NOTE:

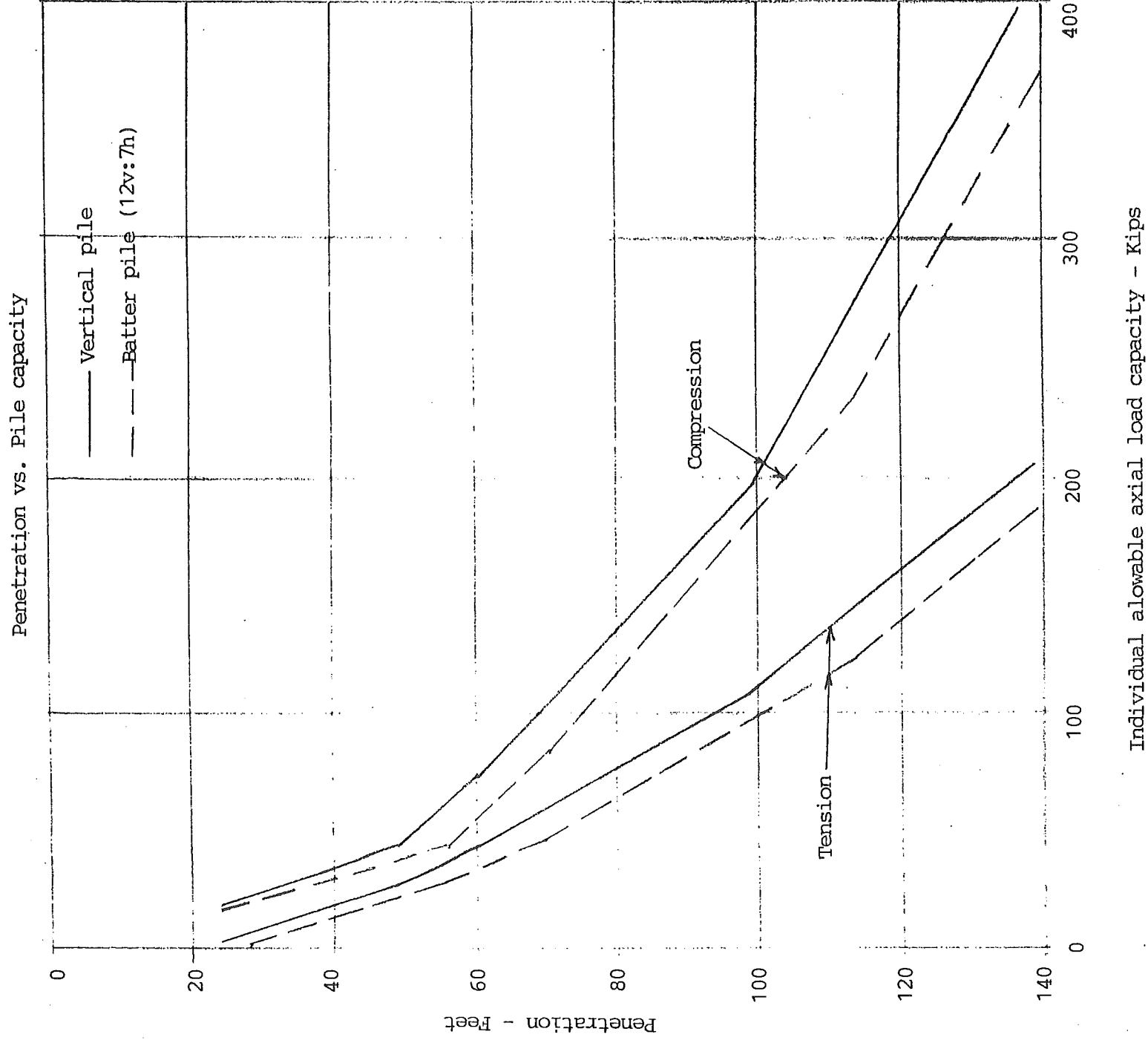
- INDICATES BORING NOT IN PLANE OF SECTION
- ▽ E INDICATES WATER LEVEL ENCOUNTERED DURING DRILLING
- ▽ C INDICATES WATER LEVEL UPON COMPLETION

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

0 50 100
(SCALE IN FEET)

DAVID V. LEWIN CORP. GEOTECHNICAL ENGINEERING CLEVELAND, OHIO			
RELOCATION OF THE PORT OF CLEVELAND CLEVELAND - CUYAHOGA COUNTY PORT AUTHORITY			
No. 4	No. 3	No. 2	REV. No. 1
DRAWN BY PWW		SCALE AS SHOWN	
APPROVED BY		DATE	
			DRAWING NO. 4533-2





LABORATORY LOG OF BORING

Method of Sampling:

Split Spoon

☐ ☐

Shelby

Alger

Boring No. L-1

Surface Elevation 570.9±

[illegible]

Method of Sampling:

Split spoon

☒ ☐

Shelby

00

Boring No. L-2

Surface Elevation 570.9±

[illegible]

LABORATORY LOG OF BORING

Method of Sampling:

Split spoon ☒ Shelby ☒
Core drill ☐ Auger ☐

Boring No. L-3

Surface Elevation 570.9±

Depth in feet	Symbol	DESCRIPTION	Blows on spoon for 12 inches	Depth to bottom of sample in feet	SUMMARY OF TEST RESULTS							
					Natural Moisture %	Liquid Limit	Plasticity Index	Unconfined Shear Stress #/Sq	Strain %	Loss on Ignition @ 600C-8	Unit Dry Weight #/cu. ft.	
10		Water										
15		Sand, gray w/s gravel & cinders	8	15.5	31.1					10.8		97
20		Clay, gray, silty w/tr. gravel	11	17.5	21.4					2.6		
25			8	21.5	29.7			490		9.9		97
30		gray, silty w/s sand & tr. gravel	9	26.5	28.7			650		13.6		97
35			24	31.5	20.9			740		13.7		104
40		gray, silty	20	36.5	24.0			775		4.7		107
45			5	41.5	31.3							
50			6	46.5	31.3							
55			S-1	52.0								
60			S-2	54.0								
65		gray, silty w/tr. gravel	11	56.5	30.9							
70			9	61.5	29.9							
75			12	66.5	30.4							
80		gray, silty w/s sand & tr. gravel	37	71.5	18.0			1310		20.0		120
85		End of boring at 76.5'	43	76.5	19.2			1505		16.3		120

REMARKS

*Shelby Tube - no recovery

Boring Completed: 10/12/89
Location: Cleveland, Ohio
Job No.: C. 4533

LABORATORY LOG OF BORING

Method of Sampling:

Split spoon	Shelby
<input checked="" type="checkbox"/>	<input type="checkbox"/>
Core drill	Auger
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Boring No. L-4

Surface Elevation 570.9±

SUMMARY OF TEST RESULTS					
	Natural Moisture %	Liquid Limit	Plasticity Index	Unconfined Shear Stress #/SF	Strain %
					R.O.D. - %
Unit Dry Weight #/cu. ft.					
Water					
Fill: gray sand, gravel, concrete black coal, sand, gravel, cinders, wood, tr. of oily substance	25 2 3	11.5 13.5 16.5			
Clay, gray, silty w/silt seams & tr. gravel	10	21.5	26.7		
* S-1 gray, silty	5 6	27.0 28.5	33.2 32.5 30.4		
	4	36.5	37.3		
	4	41.5	33.1		
	7	46.5	31.6		
	8	51.5	30.4		
	7	56.5	36.9		
gray, silty w/s sand, gravel & rock frags.	47	61.5	17.0	2250	20.0
	33	66.5	16.6	2205	20.0
	44	71.5	15.6		
sandy	55	76.5	16.8	2170	20.0
w/few sand & silt seams	62	81.5	12.2		
	70	86.5	13.4		
	50/.5	91.0			
gray, silty, sandy w/gravel & rock frags.	73	96.5	15.5		
gray, silty w/tr. shale frags.	84	101.5	19.0	2900	10.8
	73	106.0	21.7		
w/silt seams	47 50/.4	111.0 111.4	27.9		
	50/.1	115.1			
Shale, gray, hard w/s sandy shale seams	73%	120.1			0
	75%	125.1			0
End of boring at 125.1'					
REMARKS: *Shelby Tube					
Boring Completed: 10/25/89					
Location: Cleveland, Ohio					
Job No.: C. 4533					

LABORATORY LOG OF BORING

Method of Sampling:

Split spoon ☒ Shelby ☒
Core drill ☐ Auger ☐

Boring No. L-5

Surface Elevation 570.9±

Depth in feet	Symbol	DESCRIPTION	Blows on spoon for 12 inches	Depth to bottom of sample in feet	SUMMARY OF TEST RESULTS						Unit Dry Weight #/cu. ft.
					Natural Moisture %	R.Q.D. - %	Plasticity Index	Unconfined Shear Stress #/SF	Strain %	Loss on Ignition @ 600°C - %	
10		Water									
20											
30		Sand, clayey w/s gravel	4	27.0	32.4						
35		Clay, gray, silty	4	29.0	26.8						
40			7	31.5	30.1			675	13.2	5.9	105
45			6	36.5	28.9						
50		* S-1	5	39.0	28.2			495	13.6		102
55				41.5	24.5						
60					33.0						
65					30.1						
70				47.0	29.7						
75			8	48.5	30.9						
80			10	51.5	22.9			1030	18.2		110
85			18	56.5	23.6						
90		gray, silty w/shale frags. & br. sand	27	61.5	17.4			1495	20.0		112
95			25	66.5	17.8						
100			24	71.5	22.8			1540	20.0		122
105			38	76.5	21.0			1020	20.0		111
110		gray, silty w/s sand & rock frags.	39	81.5	20.9			1495	20.0		112
115			82	86.5	12.5						
120			65	91.0							
125		Silt, gray, clayey, sandy w/shale frags.	50/.2	91.2	13.0						
130			50/.4	95.4	17.4						
135			50/.3	100.3	11.7						
140		Clay, gray, silty w/s silt seams	75	106.5	19.4			1710	20.0		113
145			49	111.5	17.9						
150		w/sand seams	46	116.5	18.4						
155			41	121.5	22.6						
160		Shale, gray, hard	50/.2	125.2							
165		vertical fracture at 125.4'- 125.8'	80%		0						
170		End of boring at 130.2'		130.2							
175		REMARKS:									
180		*Shelby Tube									
185											
190											
195											
200											

Boring Completed: 10/30/89

Location: Cleveland, Ohio

Job No.: C. 4533

LABORATORY LOG OF BORING

Method of Sampling:

Split spoon ☒

Shelby ☐

Core drill ☐

Auger ☐

Boring No. L-6

Surface Elevation 570.9±

Depth in feet	Symbol	DESCRIPTION	Blows on spoon for 12 inches	Depth to bottom of sample in feet	SUMMARY OF TEST RESULTS						Unit Dry Weight #/cu. ft.
					Natural Moisture %	Liquid Limit	Plasticity Index	Unconfined Shear Stress #/Sq	Strain %	Loss on Ignition @ 600°C-8	
		Water									
		Clay, gray, silty w/s organic mat'l w/cinders & tr. oily substance at 30'-31.5'	5 8 18	31.5 33.5 36.5	34.3 31.5 28.6					5.9	
		gray, silty w/few silt seams & tr. gravel	7	41.5	29.8						
		gray, silty w/silt seams & tr. rock frags.	19 44	46.5 51.5	21.5 22.4		1135 1610	20.0 10.1			114 109
		gray, silty w/rock frags. & some sand seams	33	56.5	17.2		3015	20.0			120
			44	61.5	16.2		2490	20.0			123
			43	66.5	15.7		2535	20.0			126
			39	71.5	18.5		1825	20.0			120
			43	76.5	18.1						
		50/.5	81.0	12.8							
		50/.4	85.4	14.4							
		sand in bottom of sample									
		End of boring at 85.4'									

REMARKS

Encountered gas at 85± feet
vented overnight-gas still venting in a.m.
Water before pulling casing at 2'

Boring Completed: 9/27/89

Location: Cleveland, Ohio

Job No.: C. 4533

LABORATORY LOG OF BORING

Method of Sampling:

Split spoon ☒

Shelby ☒

Core drill ☐

Auger ☐

Boring No. L-7

Surface Elevation 570.9±

Depth in feet	Symbol	DESCRIPTION	Blows on spoon for 12 inches	Depth to bottom of sample in feet	SUMMARY OF TEST RESULTS					
					Natural Moisture %	Liquid Limit	Plasticity Index	Unconfined Shear Stress #/SF	Strain %	Unit Dry Weight #/cu. ft.
		Water								
		Clay, gray, silty	9	31.5	30.5					110
			14	33.5	22.1			945	18.9	
			13	36.5	18.7			1170	20.0	120
			12	39.5	22.9					
				42.0	19.0					
				43.5	20.7					
			* S-1	43.5	22.6			1755	20.0	111
			18	43.5	21.8			1675	20.0	109
			19	46.5	23.3					
		gray, silty w/rock frags. & some sand seams	27	51.5	17.5					123
			36	56.5	14.7			1885	17.0	123
			50	61.5	17.0			1840	20.0	124
			43	66.5	16.7			2145	20.0	122
			85	71.5	17.2			2635	20.0	119
		Sand, gray, silty, fine w/s silt seams	54	76.5	17.2			3295	20.0	119
		End of boring at 80.4'	50/.4	80.4						

REMARKS

*Shelby Tube

Encountered gas at 80± feet

Boring Completed: 10/2/89

Location: Cleveland, Ohio

Job No.: C. 4533

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

LABORATORY LOG OF BORING

Method of Sampling:

Split spoon ☒ Core drill ☐

Shelby ☐ Auger ☐

Boring No. L-8

Surface Elevation 582.4

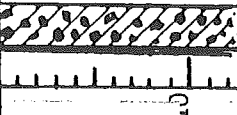
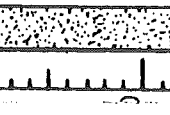
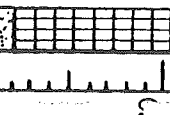
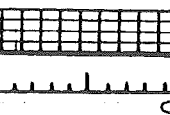
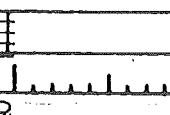
Depth in feet	Symbol	DESCRIPTION	Blows on spoon for 12 inches	Depth to bottom of sample in feet	SUMMARY OF TEST RESULTS					
					Natural Moisture %	Liquid Limit	Plasticity Index	Unconfined Shear Stress #/SF	Strain %	Unit Dry Weight #/cu. ft.
0		Fill: gray & brown silty sandy w/ gravel, limestone, red brick, cinders, slag, iron ore pellets, concrete, red brick, wood	21	3.5	17.2					
10		Sand, brown, fine to med. layered w/med. to coarse, silty w/tr. gravel	55 50/.2	6.0 6.2						
20		Organic Silt, gray & black Sand, gray, fine to med., silty w/s gravel	27	10.0	4.2					5.6
30		gray, fine to med., silty w/brown rotted wood	38	15.0	20.5					
40		Clay, gray, silty w/tr. sand w/s silt seams	8	20.0	12.6 57.5					
50		gray, silty w/fine sand	20	25.0	11.5			365	13.3	96
60		gray, silty w/silt seams, tr. sand, tr. gravel & rock frags.	3	30.0						
70			19	45.0	29.3			1040	16.8	107
80			19	50.0	24.4					
90			27	55.0	20.4			2055	15.6	111
100			39	60.0	21.5			1430	6.4	110
110			43	65.0	21.9					
120			34	70.0	18.7			2995	13.2	117
130			44	75.0	15.7			3735	20.0	119
140			42	80.0	16.8			3800	20.0	118
150		Silt, gray, sandy w/tr. clay w/ gray silty sand seams	48/.5 50/.3	84.0 84.3						
160			79	90.0	19.2					
170		Clay, gray, silty, sandy w/gravel & rock frags.	45/.5 50/.3	94.0 94.3						
180			23/.5 50/.4	99.0 99.4						
190		gray, silty, sandy w/gravel, rock frags., cobbles	74	104.5	13.8			6900	13.4	125
200			50/.4	108.9	13.2			6200	15.2	120
210			50/.4	113.9	12.1					
220			45/.5 50/.4	119.0 119.3				9450 5500	10.8 6.8	127 122

LABORATORY LOG OF BORING

Method of Sampling:

☒ Split spoon ☐ Shelby
☐ Core drill ☐ Auger

Boring No. L-10Surface Elevation 580.0

SUMMARY OF TEST RESULTS	
Unit Dry Weight #/cu. ft.	Loss on Ignition @ 600°C-%
Strain %	Unconfined Shear Stress #/SF
Plasticity Index	Liquid Limit
Natural Moisture %	Depth to bottom of sample in feet
Blows on spoon for 12 inches	DESCRIPTION
Symbol	Depth in feet
	Fill: limestone gravel black cinders, slag, coal, red brick
	Sand, black, fine to med., silty w/ tr. gravel, some organic mat'l gray, fine to med., silty w/s gravel & organic mat'l 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'

REMARKS

Encountered water at 7.5'
 Water at 8.4' on completion

Boring Completed: 12/15/90

Location: Cleveland, Ohio

Job No.: C. 4533

LABORATORY LOG OF BORING

Method of Sampling:

Split spoon ☒ Core drill ☐Shelby ☒ Auger ☐Boring No. L-11Surface Elevation 579.0

Depth in feet	Symbol	DESCRIPTION	Blows on spoon for 12 inches	Depth to bottom of sample in feet	SUMMARY OF TEST RESULTS											
					Natural Moisture %	Liquid Limit	Plasticity Index	Unconfined Shear Stress #/SF	Strain %			Unit Dry Weight #/cu. ft.				
		2" pavement Fill: 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	50/.3	1.8												
		gray sand & brick	18 14	5.0 6.5												
		Sand, gray w/s decayed wood	49	10.0												
		Clay, gray, silty w/fine sand	53	15.0												
		*	37	20.0												
			S-1	25.0	24.6				2160	7.0						105
			29	27.0	23.1				1280	5.0						106
			26	30.0	21.8				1535	12.9						111
					28.2				1245	16.0						99
		gray, silty w/s rock frags. gray, silty	20	35.0	24.4				1050	13.7						110
		*	S-2	38.5	29.3				945	10.5						96
			10	40.0	29.6 29.8				905	9.2						96
		End of boring at 40.0'														

EMARKS

Encountered water at 7.0'

Water at 6.3' on completion

*Shelby Tube

Boring Completed: 12/21/90

Location: Cleveland, Ohio

Job No.: C. 4533

-23- LABORATORY LOG OF BORING

Method of Sampling:

Split spoon ☒ Shelby ☐
 Core drill ☐ Auger ☐

Boring No. L-12

Surface Elevation 578.5

Depth in feet	Symbol	DESCRIPTION	Blows on spoon for 12 inches	Depth to bottom of sample in feet	SUMMARY OF TEST RESULTS						
					Natural Moisture %	Liquid Limit	Plasticity Index	Unconfined Shear Stress #/SF	Strain %	Loss on Ignition @ 600°C-%	Unit Dry Weight #/cu. ft.
		Fill: 3" brown sand; 6" limestone gravel brown & black layered cinders w/slag & gravel brick layer at 2.3'	20 18 44	2.5 5.0 6.5							
		green organic clayey silt Organic Silt, black w/gray, sandy Sand, brown, fine to med. w/s coarse, tr. gravel	8 9 44	10.0 15.0 20.0	32.8 52.7 61.5					8.1 13.7 15.5	
		Clay, gray, silty w/fine to med. sand seams	15	25.0	26.1			1430	11.2		106
			15	30.0	24.8			1900	12.9		107
			20	35.0	23.2			815	7.8		106
			7	40.0	28.8			480	14.8		101
			15	45.0	21.9			1970	19.2		109
			17	50.0	22.4			1985	9.9		107

End of boring at 50.0'

REMARKS: Encountered water at 5.0'
 Water at 3.5' on completion

Boring Completed: 12/17/90

Location: Cleveland, Ohio

Job No.: C. 4533

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












LABORATORY LOG OF BORING

Method of Sampling:

Split spoon ☒ Core drill ☐Shelby ☐ Auger ☐

Boring No. L-13

Surface Elevation 577.5±

Depth in feet	Symbol	DESCRIPTION	Blows on spoon for 12 inches	Depth to bottom of sample in feet	SUMMARY OF TEST RESULTS						
					Natural Moisture %	Liquid Limit	Plasticity Index	Unconfined Shear Stress #/SF	Strain %	Loss on Ignition @ 600°C-%	Unit Dry Weight #/cu. ft.
		Fill: 1" limestone gravel over iron pellets	17	2.5							
		cinders, white	15	5.0							
		cinders, gravel, slag, tr. brick, concrete, glass	19	7.5							
		slag, cinders	29	10.5							
		wood	11	15.0							
		Sand, lt. brown, fine to med.	79	20.0	16.2						
		Clay, gray, silty w/s silt seams & sand seams	10	25.0	27.2			635	6.7	1.6	104
			11	30.0	31.9						
			12	35.0	29.4			810	9.8		101
			12	40.0	28.2			730	10.2		98
		End of boring at 40.0'									

REMARKS

Encountered water at 5.0'
Hole caved at 3.5' on completion

Boring Completed: 12/17/90

Location: Cleveland, Ohio

Job No.: C. 4533

LABORATORY LOG OF BORING

Method of Sampling:

Split spoon ☒ Shelby ☐
 Core drill ☐ Auger ☐

Boring No. L-14

Surface Elevation 584.8

SUMMARY OF TEST RESULTS	
Unit Dry Weight #/cu. ft.	Loss on Ignition @ 600°C-%
Strain %	Unconfined Shear Stress #/SF
Plasticity Index	Liquid Limit
Natural Moisture %	Depth to bottom of sample in feet
Blows on spoon for 12 inches	DESCRIPTION
Symbol	Depth in feet
Fill: 6" concrete; 2" limestone Brown fine to med. sand w/s gravel cinders, gravel, tr. brick & slag w/layers of fine brown sand	48 45 9 1/1.5 3.5 5.0 7.5 10.0
Sand, brown, silty (possible fill) gray & black, fine, silty w/s med. to coarse gravel & some cobbles & sandstone frags. (possible fill)	3/1.5 15.0 17.8
Sand, gray, fine to med. w/tr. organic mat'l, tr. cobbles at 26'	14 20.0 18.4
Clay, gray, silty w/silt seams	47 25.0 26.4
Silt, gray, clayey	13 30.0 18.2 25.0
End of boring at 40.0'	12 35.0 24.3
	18 40.0 21.6
	107
	106
	113

REMARKS

Encountered water at 13.5'
 Water at 12.5' on completion

Boring Completed: 12/13/90

Location: Cleveland, Ohio


Job No.: C. 4533

LABORATORY LOG OF BORING

Method of Sampling:

☒ Pit spoon ☐ Shelby
☐ Core drill ☐ Auger

Boring No. L-15Surface Elevation 581.9

Depth in feet	Symbol	DESCRIPTION	Blows on spoon for 12 inches	Depth to bottom of sample in feet	SUMMARY OF TEST RESULTS					
					Natural Moisture %	Liquid Limit	Plasticity Index	Unconfined Shear Stress #/SF	Strain %	Unit Dry Weight #/cu. ft.
		Concrete - 12" Fill: brown silty sand Concrete	14 50/.4	2.5 3.9						
		End of boring at 8.0'								

REMARKS

Water seepage at 2.0'
 No water on completion

Boring Completed: 12/14/90

Location: Cleveland, Ohio

Job No.: C. 4533

LABORATORY LOG OF BORING

Method of Sampling:

Split spoon ☒ Shelby ☐
 Core drill ☐ Auger ☐

Boring No. L-15 ASurface Elevation 582±

Depth in feet	Symbol	DESCRIPTION	Blows on spoon for 12 inches	Depth to bottom of sample in feet	SUMMARY OF TEST RESULTS					
					Natural Moisture %	Liquid Limit	Plasticity Index	Unconfined Shear Stress #/SF	Strain %	Unit Dry Weight #/cu. ft.
		Concrete - "								
		Fill: brown fine to med. silty sand layered w/gray & brown silty sand	8	4.0	12.9					
		strongly oily odor at 5'-6.5' w/s clay & asphalt at 8.5'-10.0'	3	6.5	20.9					
			3	10.0	15.1					
		Sand, brown, fine to med. silty layered w/gray & brown	6	15.0	19.2					
			6	20.0	19.5					
		black & gray, fine to med., silty w/some organic mat'l, tr. gravel & sandstone frags.	26	25.0	21.2				4.8	
		Clay, gray, silty w/s silt seams & few organic silt seams	15	30.0	28.7				4.0	
		gray, silty	11	35.0	26.3			395	3.2	105
			13	40.0	29.7			450	6.5	100
		End of boring at 40.0'								

REMARKS

Water seepage at 5' and 22'
 Encountered water at 22'
 Water at 13.5' on completion

Boring Completed: 12/15/90

Location: Cleveland, Ohio

Job No.: C. 4533

LABORATORY LOG OF BORING

Method of Sampling:

Split spoon ☒ Shelby ☐
 core drill ☐ Auger ☐

Boring No. L-16

Surface Elevation 585.9

Depth in feet		Symbol	DESCRIPTION	Blows on spoon for 12 inches	Depth to bottom of sample in feet	SUMMARY OF TEST RESULTS								
						Natural Moisture %	Liquid Limit	Plasticity Index	Unconfined Shear Stress #/SF	Strain %	Loss on Ignition @ 600°C-%	Unit Dry Weight #/cu. ft.		
			Fill: brown sand w/gravel, brick, concrete, slag, metal, wood, asphalt black & gray sandy w/slag, gravel, brick, concrete, tr. glass	50/.3 15 42 50/.4 51	0.8 4.0 6.0 6.4 10.0									
			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	100/.3 34 50/.2 53	13.8 15.5 15.7 20.0									
			Sand, dk. gray, silty w/s silt seams & organic mat'l dk. gray w/organic mat'l	14 4	30.0 35.0	31.1 35.0					6.5 7.0			
			Clay, gray, silty	10	40.0	29.7			555	12.3			96	
				12	45.0	21.9			615	6.6			111	
				12	50.0	25.7			650	6.8			103	
				11	55.0	30.3								
			End of boring at 60.0'	10	60.0	29.9			615	20.0			100	

EMA RKS

Encountered water at 14.0'

Hole caved at 5.0' on completion

Boring Completed: 12/14/90

Location: Cleveland, Ohio

Job No.: C. 4533

LABORATORY LOG OF BORING

Method of Sampling: ☒ Split spoon

☐ Core drill ☐ Shelby

☐ Auger

Boring No. L-17

Surface Elevation 581.7

Depth in feet	Symbol	DESCRIPTION	Blows on spoon for 12 inches	Depth to bottom of sample in feet	SUMMARY OF TEST RESULTS					Unit Dry Weight #/cu. ft.
					Natural Moisture %	Liquid Limit	Plasticity Index	Unconfined Shear Stress #/SF	Strain %	
10		2" asphalt, 10" concrete fill; rock frags, cobbles, slag, sand, silt, granulated brown silty sand w/s gravel	50/5 65 17	1.5 4.0 6.5						
10		slag, sand, gravel	6	10.0						
10		some cobbles sulphur odor	10	15.0						
20		Sand, gray, coarse w/s clay seams	19	20.0	22.6					
30		Clay, gray, silty w/silt seams	17	25.0	26.0			1630	11.7	98
30		gray, silty	11	30.0	30.5			440	9.5	96
35			8	35.0	26.3			560	13.2	101
40			9	40.0	30.9					
45			9	45.0	27.6			1025	16.0	104
50		gray, silty w/s sand, tr. gravel & rock frags.	17	50.0	22.8			2000	16.5	110
55			15	55.0	20.3			1550	15.9	112
60			23	60.0	19.9			1760	20.0	115
65			30	65.0	17.1			3295	20.0	120
70			33	70.0	16.2			3570	20.0	124
75			35	75.0	14.9			5500	20.0	120
80			38	80.0	15.1			6200	17.4	130
85			104	85.0	16.0			5200	16.3	121
90			30	90.0	19.6			2665	16.9	114
95		Silt, gray, clayey w/clay seams	34	95.0	22.5					
100		Clay, gray, silty w/gravel & rock frags.	61	100.0	12.7			5950	20.0	130
100.0		End of boring at 100.0'								
110		REMARKS:								
110		Encountered water at 8.0'								
110		Hole caved at 17.0' on completion								
120		Boring Completed: 12/15/90								
120		Boring Location: Cleveland, Ohio								
120		Job No.: C. 4533								

LABORATORY LOG OF BORING

Method of Sampling:

Split spoon ☒ Shelby ☐
Core drill ☐ Auger ☐

Boring No. L-18

Surface Elevation 582.3

Depth in feet	Symbol	DESCRIPTION	Blows on spoon for 12 inches	Depth to bottom of sample in feet	SUMMARY OF TEST RESULTS						Unit Dry Weight #/cu. ft.
					Natural Moisture %	Liquid Limit	Plasticity Index	Unconfined Shear Stress #/Sq	Strain %	Loss on Ignition @ 600°C-%	
0		4" blacktop; 12" concrete Fill: brown silty sand, cinders, slag, red brick, tr. wood	35	3.5							
10			16	6.5							
20		gray fine to med. silty sand, layered coal, gravel, cinders	11	10.5							
30		Sand, gray, fine, silty w/tr. gravel	10	15.5							
40			56	20.5	22.1					1.2	
50		Clay, gray, silty	16	25.5	17.4 27.9						
60			20	30.5	25.4			855	11.8		107
70		gray, silty w/s silt seams & few sand seams	20	35.5	25.3			1390	17.0		105
80			12	40.5	29.1			850	12.9		104
90			10	45.5	31.2			440	9.6		95
100		gray, silty v/few silt seams	12	50.5	29.2			915	20.0		98
110			19	55.5	22.8			1625	12.9		110
120			20	60.5	22.7			1350	13.2		111
130			21	65.5	22.7			1800	11.4		107
140		gray, silty, sandy w/gravel, rock frags. & some silt seams	24	70.5	21.8			1655	11.3		116
150			36	75.5	15.6			2950	13.8		122
160			41	80.5	17.0			3960	20.0		118
170			52	85.5	15.8			5300	20.0		123
180			52	90.5	20.2			3690	20.0		112
190			82	95.5	13.8						
200		gray, silty, sandy w/gravel, rock frags. & cobbles	58 50/.4 50/.4	100.0 100.4 104.4	13.0 9.4			7050	20.0		124
210			50/.4	109.4	11.3						
220		gray, silty w/silt seams	98	115.0	11.0 23.7			11,300	14.5		130
230			69	120.5	21.9			2220	6.8		104
240			46	125.5	27.9						
250		sand seam at 129.0' gray, shaley	49	131.0	23.2 13.4			1150	12.9		102
260		Shale, gray, hard	50/.4 50/.2	134.4 135.2	12.7			1535	13.9		110
270											
280		End of boring at 135.2'									
290		REMARKS:									
300		Encountered water at 10.0'									
310		Water at 1.0' on completion									
320											
330											
340											
350											
360											

Boring Completed: 12/10/80

Location: Cleveland, Ohio

Job No.: C. 4533

LABORATORY LOG OF BORING

Method of Sampling:

Split spoon ☒Shelby ☐Core drill ☐Auger ☐

Boring No. L-19

Surface Elevation 578.4

Depth in feet		DESCRIPTION	Blows on spoon for 12 inches	Depth to bottom of sample in feet	SUMMARY OF TEST RESULTS						Unit Dry Weight #/cu. ft.
Symbol					Natural Moisture %	Liquid Limit	Plasticity Index	Unconfined Shear Stress #/SF	Strain %	Loss on Ignition @ 600C-8	
		Fill: black cinders, brown silty sand, slag, tr. brown cinders, brick, wood	9	3.5							
			2	6.5							
		black fine to med. silty sand w/cinders, brick & sulfur gas odor	25	10.0							
			27	15.0							
		Sand, gray, fine to med., silty w/s silt seams, black seam & sulfur gas odor	27	20.0	21.0					1.5	
		Clay, gray, silty w/tr. fine sand & some silt seams	14	25.0	25.6					4.5	
			23	30.0	24.2			945	6.7		108
		gray, silty w/tr. fine sand	34	35.0	21.8			1480	8.1		110
			6	40.0	29.0						
			9	45.0	28.5			710	12.6		101
		gray, silty, sandy w/gravel & rock frags. & some silt seams	20	50.0	22.2			815	12.9		109
			16	55.0	26.2			840	12.8		107
			28	60.0	17.7			2435	20.0		118
			27	65.0	15.8			3100	20.0		126
			32	70.0	17.0			2395	20.0		124
			31	75.0	16.4			3770	20.0		123
			38	80.0	18.0			2760	20.0		124
			39	85.0	18.7			2875	20.0		117
			22	90.0	18.5			4020	20.0		121
		gray, silty, sandy w/gravel, rock frags. & cobbles	87	95.0	11.9			7150	20.0		130
			50/.5	99.0	9.3						
		End of boring at 99.0'									
		REMARKS:									
		Encountered water at 6.5'									

End of boring at 99.0'

REMARKS:

Encountered water at 6.5'

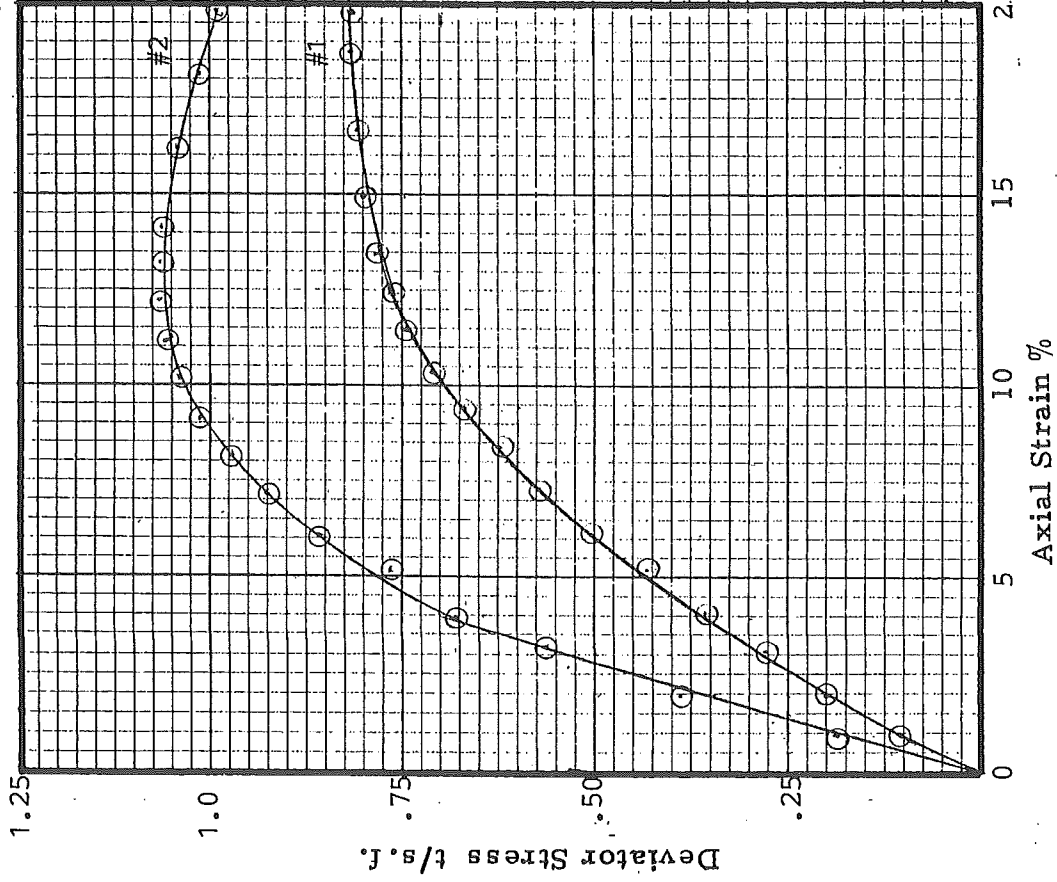
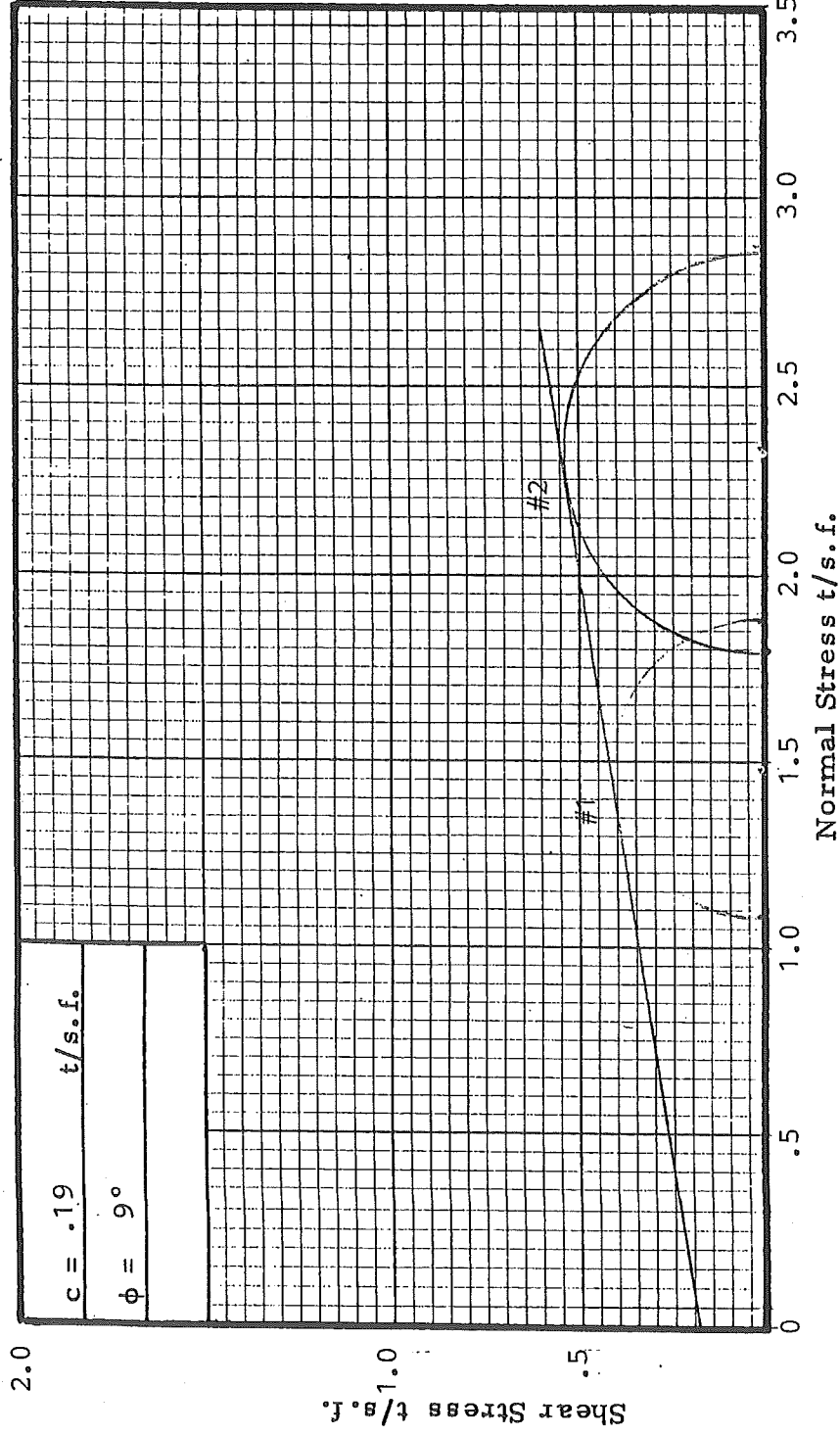
Boring Completed: 12/8/1990

Location: Cleveland, Ohio

Job No.: C. 4533

-32-
Triaxial Compression Test

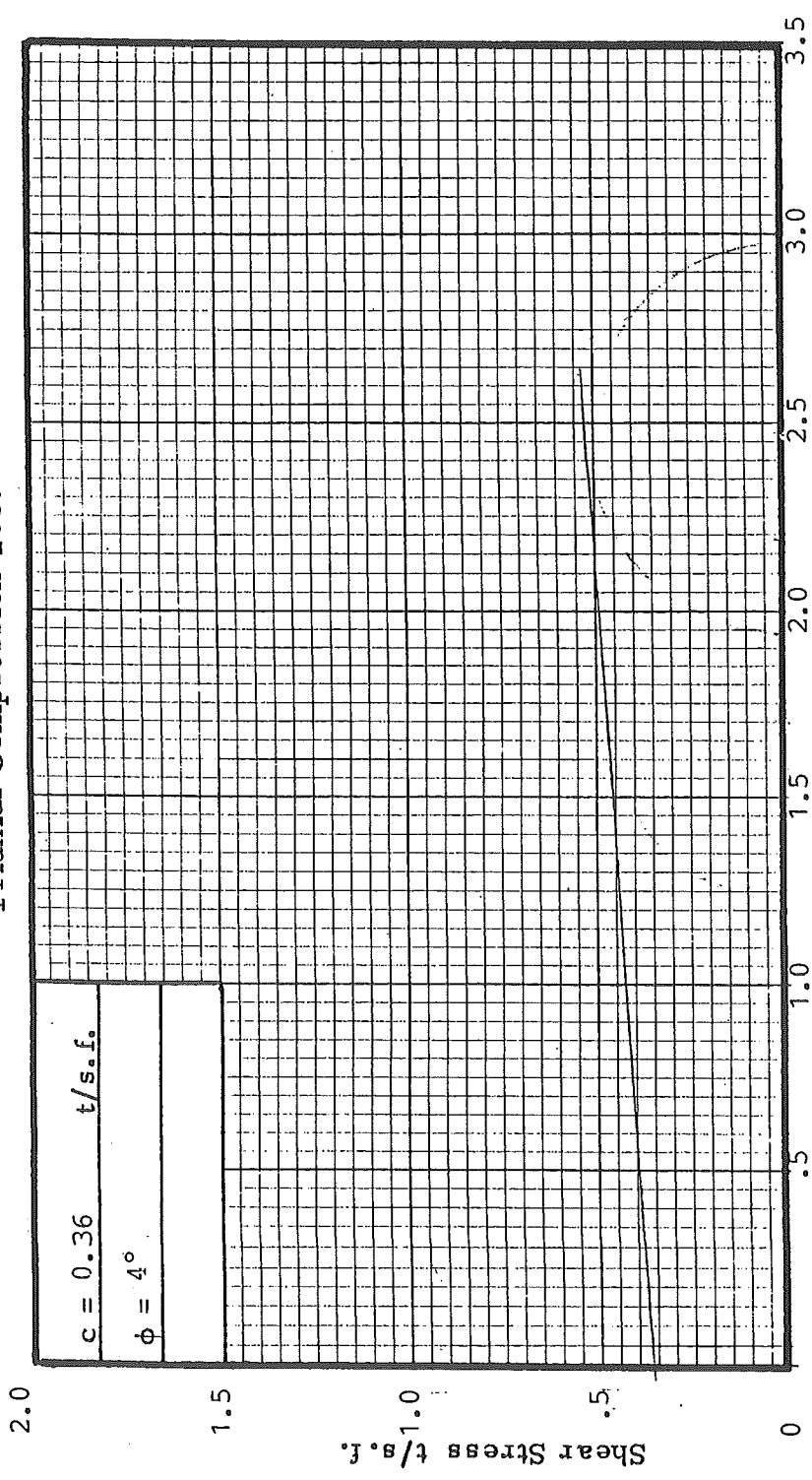
$c = .19$	$t/s.f.$
$\phi = 9^\circ$	



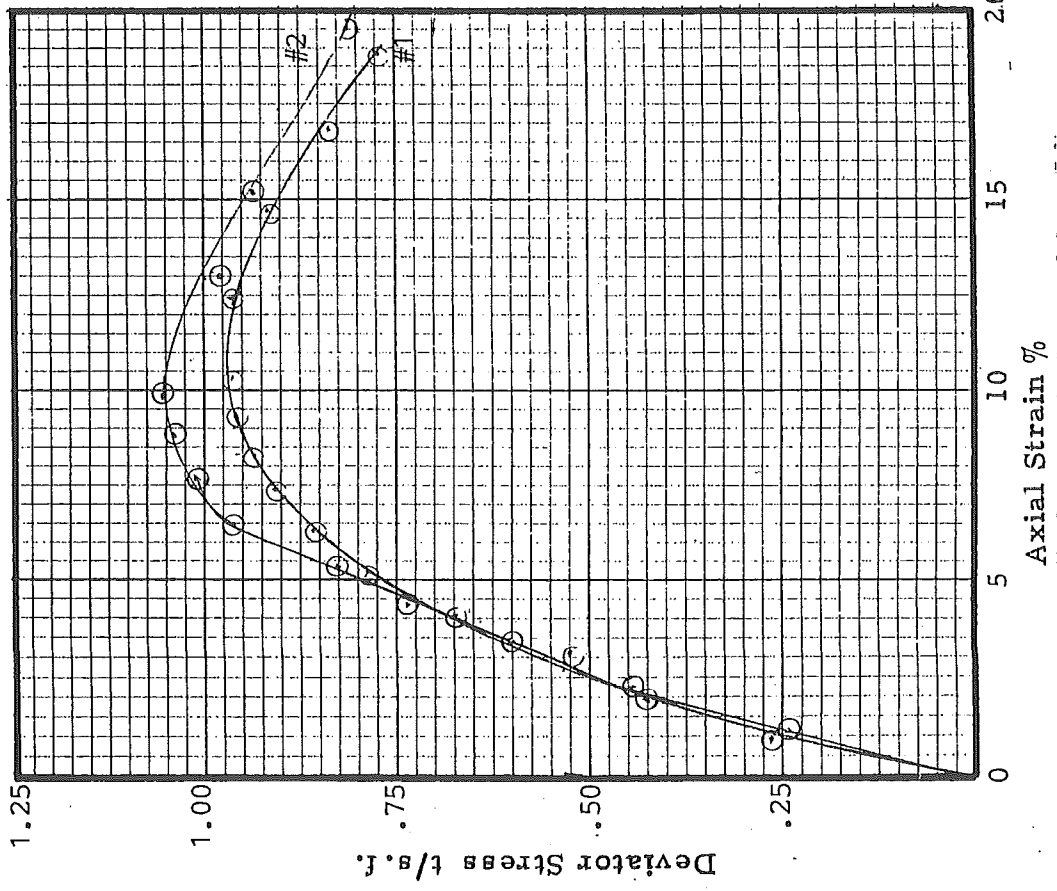
Sample No.	1	2	3
Diameter, in. D_o	2.86	2.85	
Area, in. A_o	6.42	6.38	
Height, in. H_o	4.80	4.90	
Volume, in. V_o	30.84	31.26	
Moisture Content %	30.1	28.0	
Wet Unit Weight #/cu ft γ_w	128.2	124.1	
Dry Unit Weight #/cu ft γ_d	98.5	97.1	
Void Ratio e	.730	.729	
Confining Pressure, $t/s.f.$	1.08	1.85	
Deviator Stress, $t/s.f.$.798	1.07	

Boring No.	L-5
Depth	37.0' - 39.0'
Technician	CB
C. 4533	Date 1/27/91

Triaxial Compression Test



Normal Stress $t/s.f.$



Sample No.	1	2	3
Diameter, in. D_o	2.85	2.85	
Area, in. A_o	6.38	6.38	
Height, in. H_o	4.80	4.60	
Volume, in. V_o	30.62	24.35	
Moisture Content %	32.3	28.4	
Wet Unit Weight #/ γ_w	120.3	123.7	
Dry Unit Weight #/ γ_d	90.9	96.3	
Void Ratio e	.861	.757	
Confining Press., $t/s.f.$	1.22	1.94	
Deviator Stress, $t/s.f.$.97	1.06	

Boring No. L-5

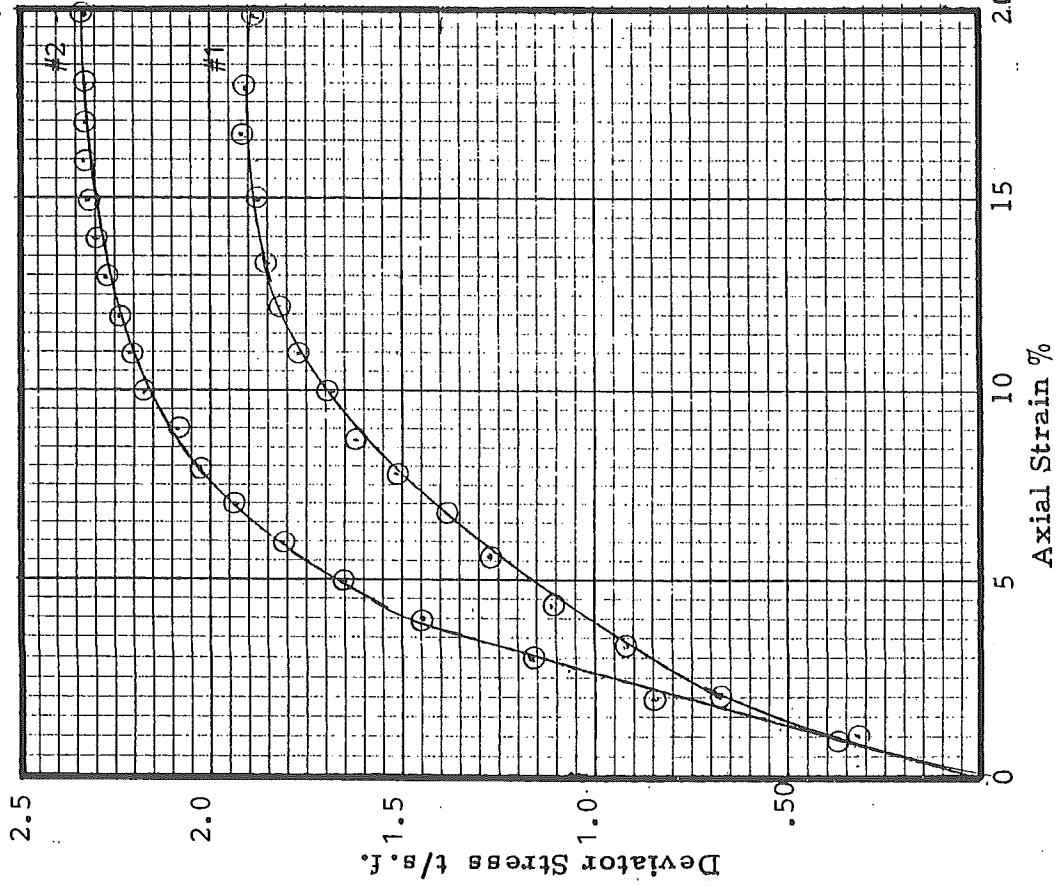
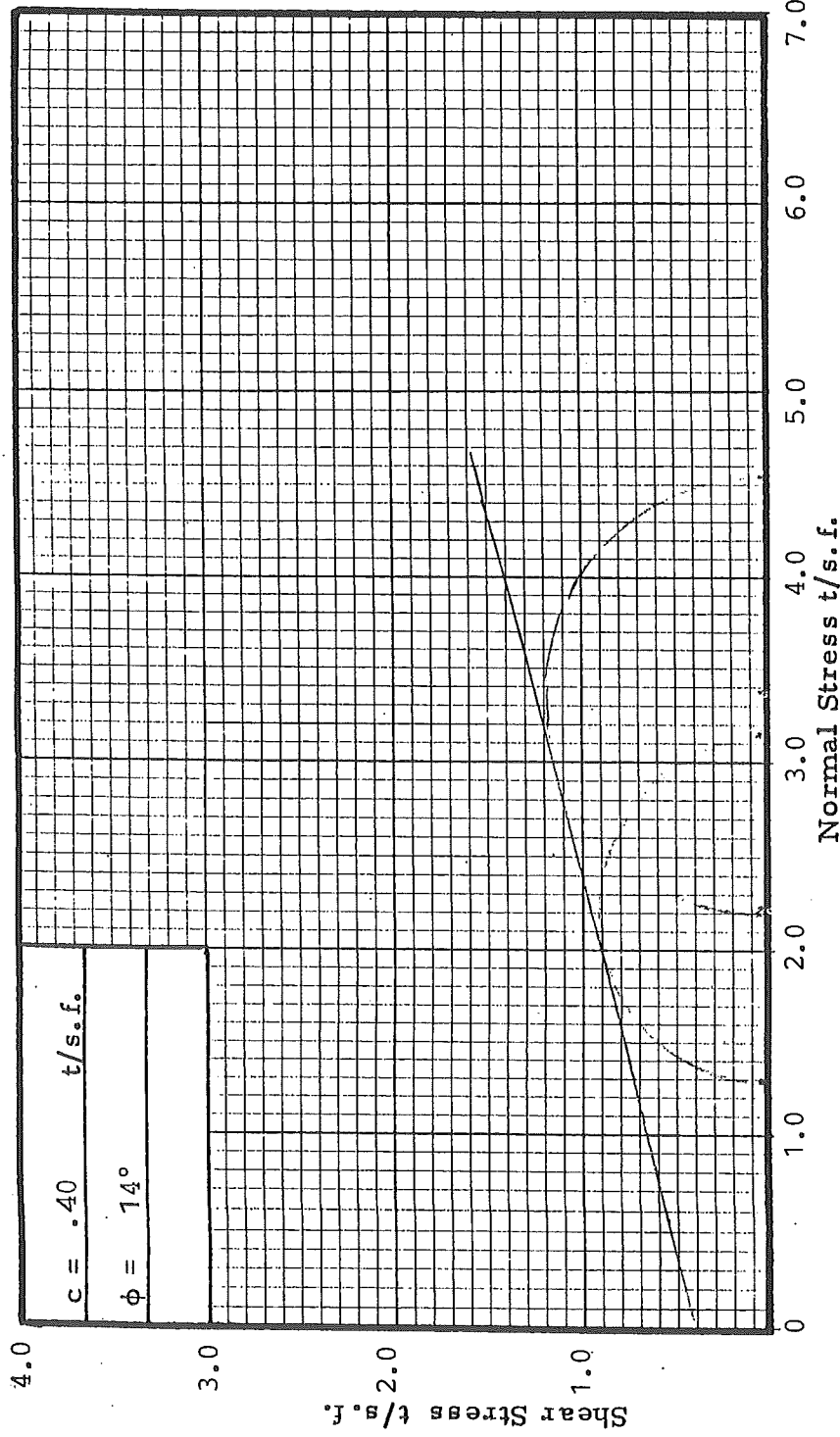
Depth 45.0' - 47.0'

Technician CB

C. 4533 Date 1/27/91

-34-
Triaxial Compression Test

c = .40	t/s.f.
$\phi = 14^\circ$	



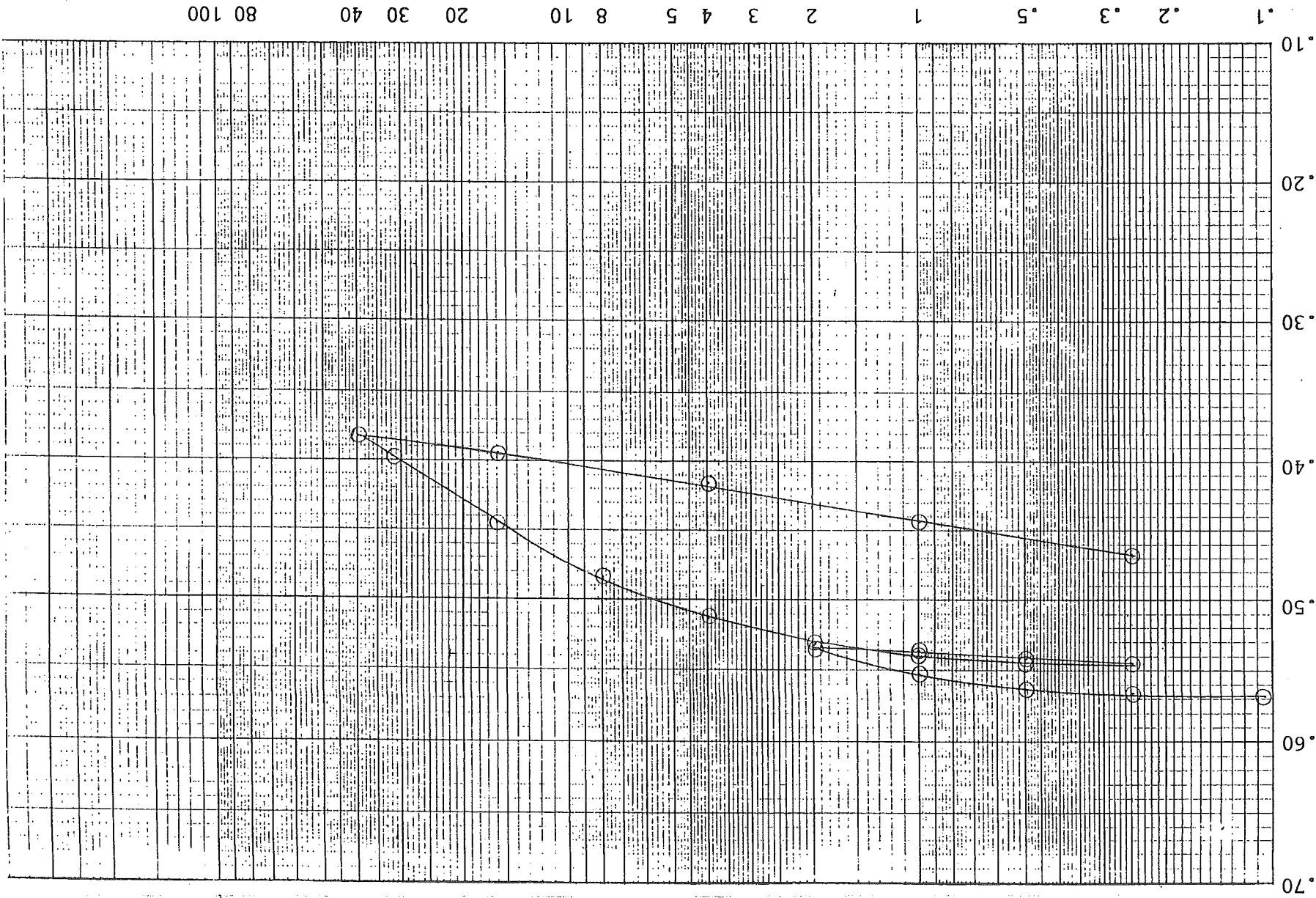
Sample No.	1	2	3
Diameter, in. D_o	2.85	2.85	
Area, in. A_o	6.38	6.38	
Height, in. H_o	4.50	5.00	
Volume, in. V_o	28.71	31.90	
Moisture Content %	21.8	21.8	
Wet Unit Weight #/cu ft γ_w	131.2	132.7	
Dry Unit Weight #/cu ft γ_d	107.7	108.9	
Void Ratio e	.577	.559	
Confining Press., t/s.f.	1.30	2.23	
Deviator Stress, t/s.f.	1.87	2.33	

Boring No. L-7

Depth 40.0' - 42.0'

Technician CB

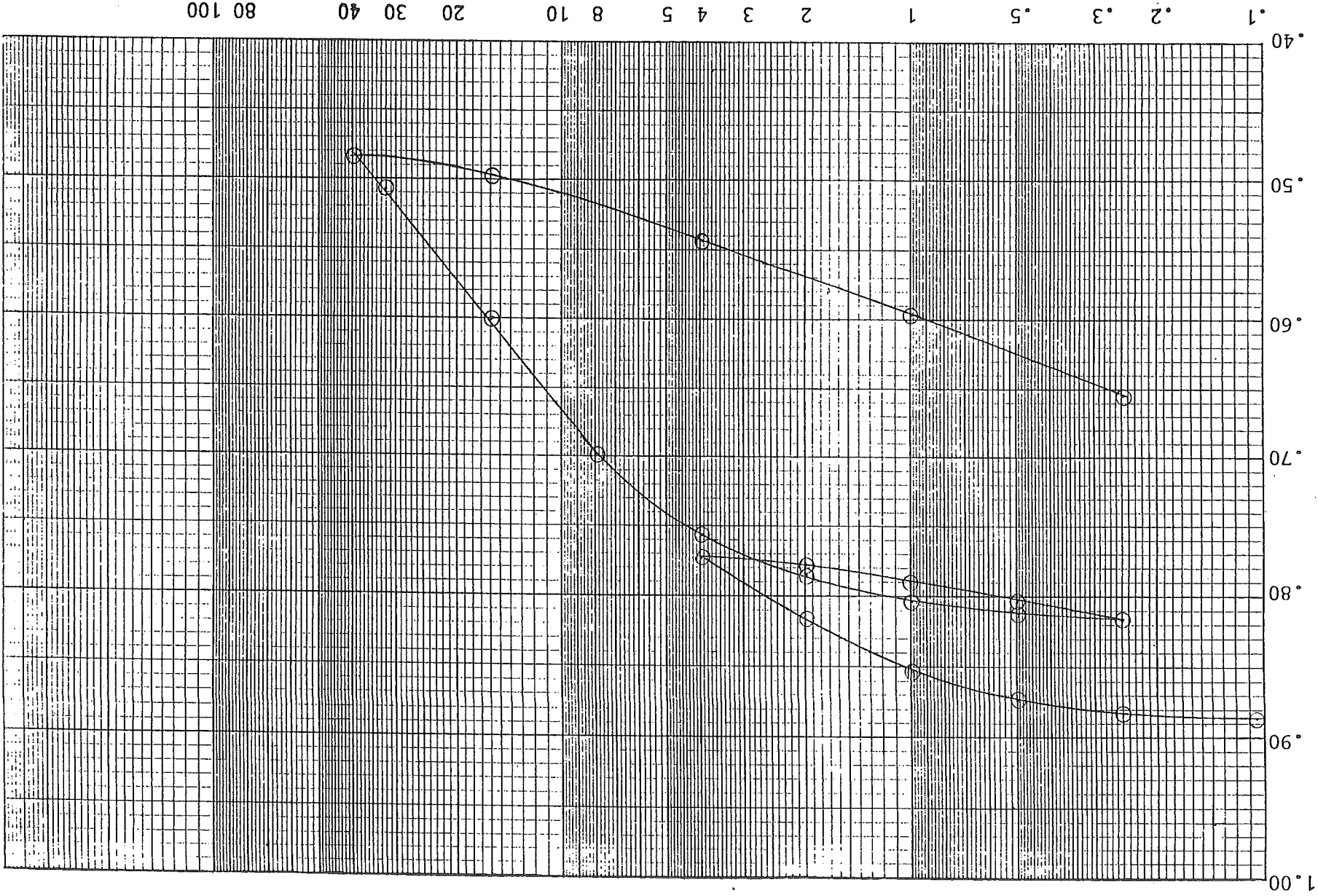
C. 4733 Date 1/27/91



Load in Kips/S.F.

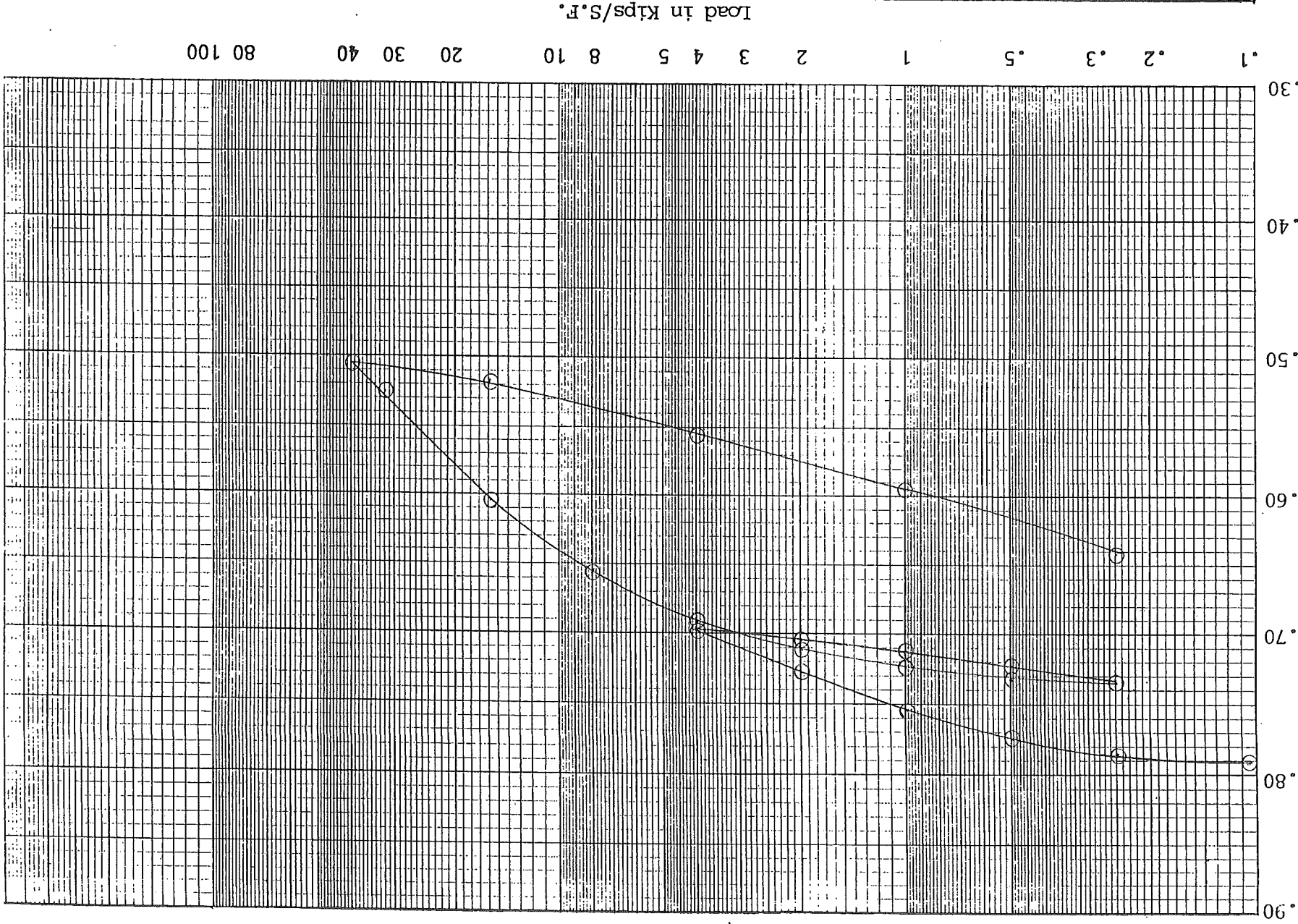
VOID RATIO VERSUS LOAD

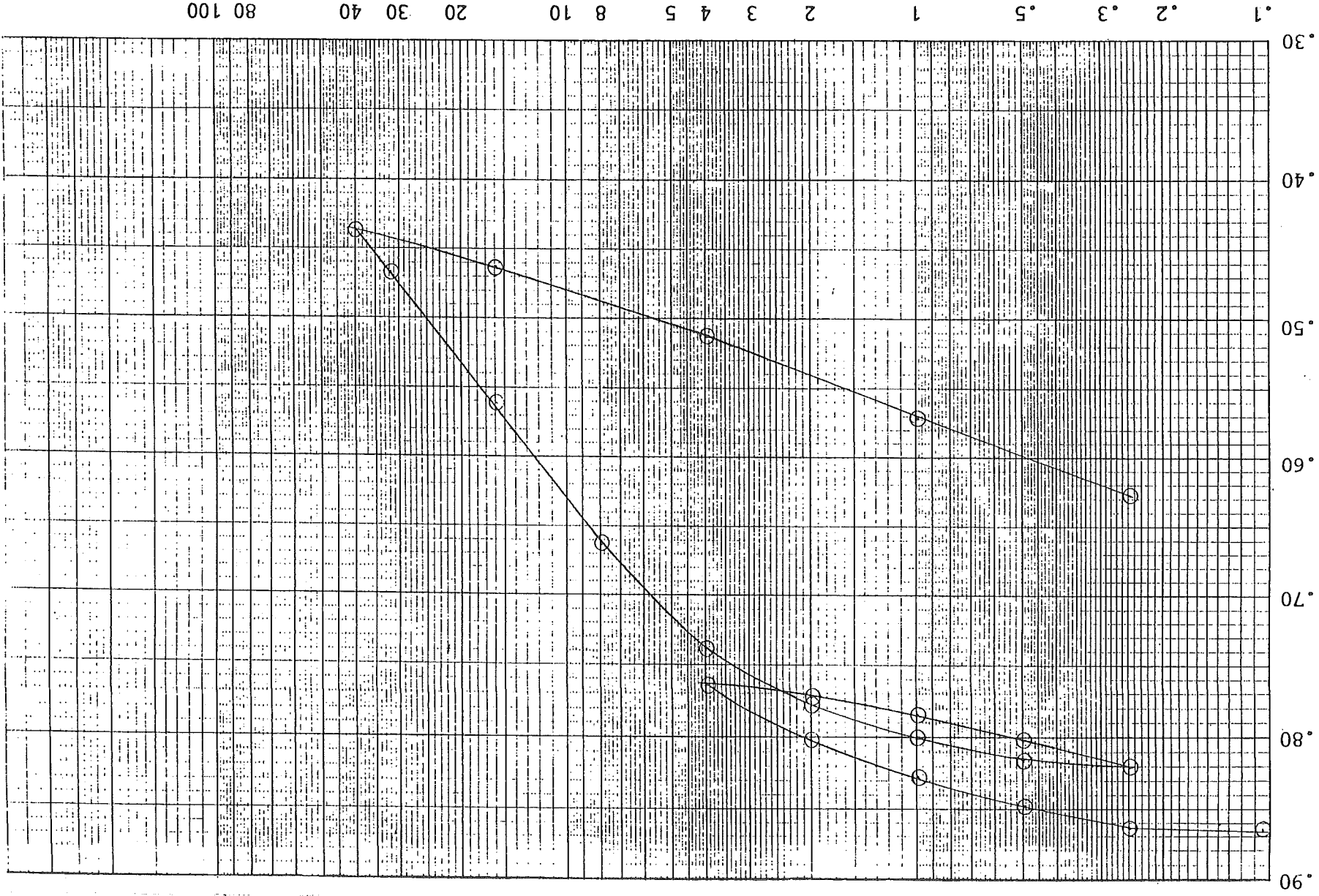
DAVID V. LEWIN CORP.								CLEVELAND, OHIO	
Moist. Cont.	L.T.	P.I.	e _o	Cc	Spec. Gravity	Gray silty clay w/s rock frags.	2.69		21.6
VOID RATIO VERSUS LOAD									
Boring No. L-1		Depth 28.0'-30.0'		Technician CB		Date 1/27/91		Sample No.	
C.4533									



VOID RATIO VERSUS LOAD					
Moist. Cont.	L.L.	P.I.	e_0	Cc	Spec. Gravity
32.5			.887		2.71
DAVID V. LEWIN CORP. CLEVELAND, OHIO					
Gray silty clay					
Boring No.	L-4	Depth	25.0'-27.0'	Technician	CB
Sample No.		C.	4533	Date	1/27/91

VOID RATIO VERSUS LOAD					
Moist. Cont.	L.L.	P.I.	e_0	Cc	Spec. Gravity
27.6			.791		2.73
			Gray silty clay		
CLEVELAND, OHIO					
Boring No. L-5 Sample No. _____ Depth 37.0'-39.0' C. 4553 Technician CB Date 1/27/91					

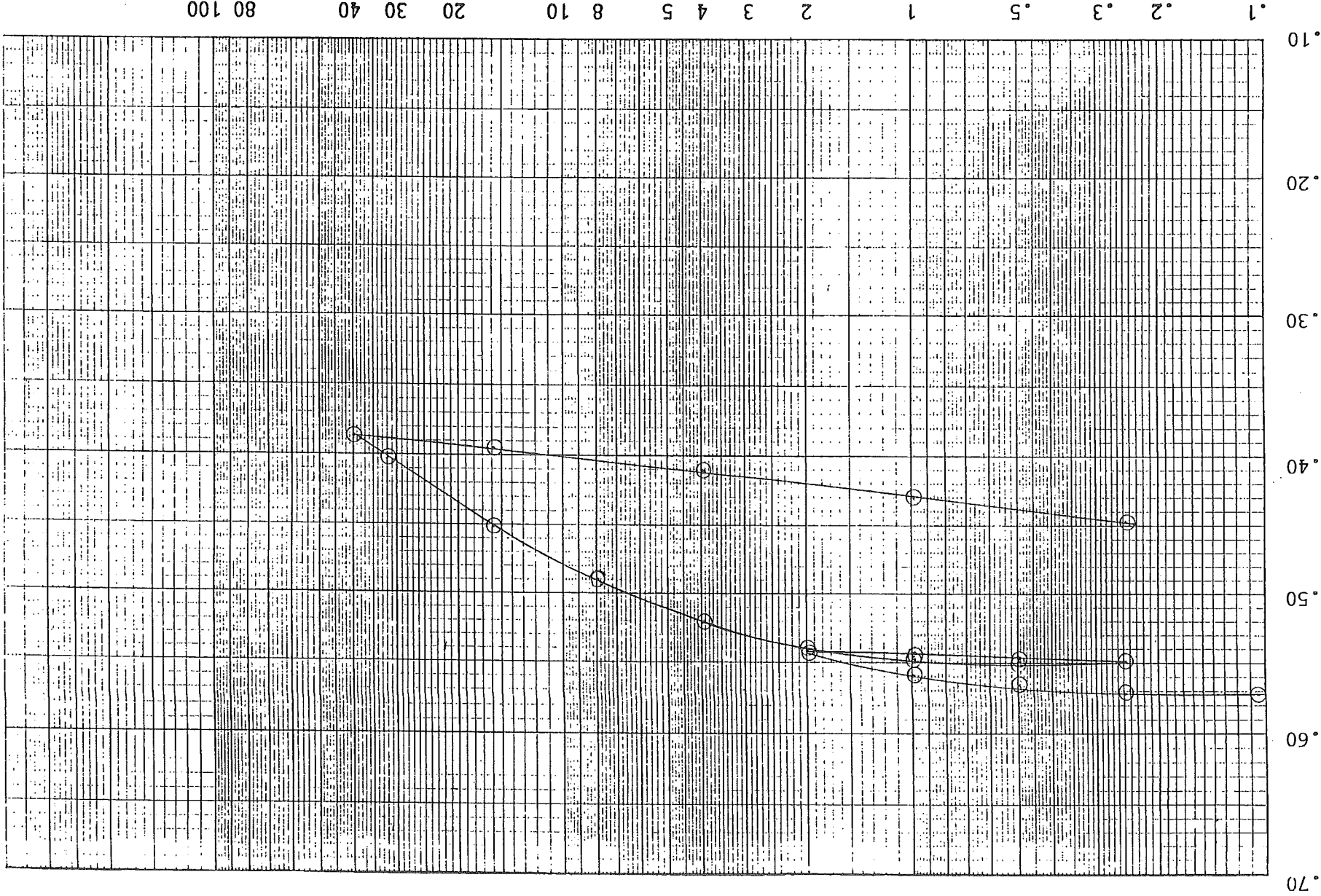




Void Ratio

Load in Kips/S.F.

VOID RATIO VERSUS LOAD							DAVID V. LEWIN CORP. CLEVELAND, OHIO					
Moist. Cont.	L.T.	P.I.	e _o	Cc	Spec. Gravity	Gray silty clay	31.5					

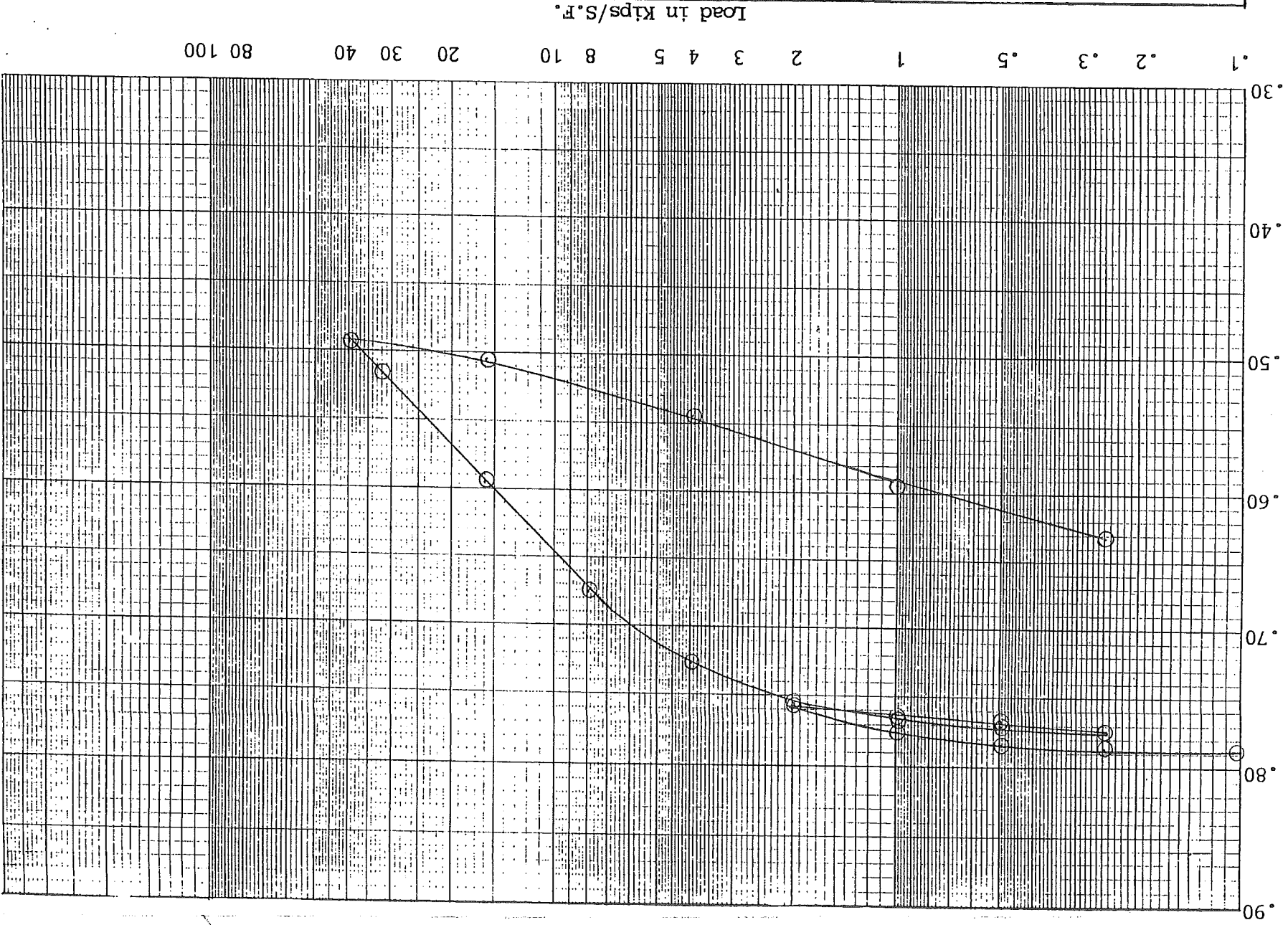


Load in Kips/S.F.

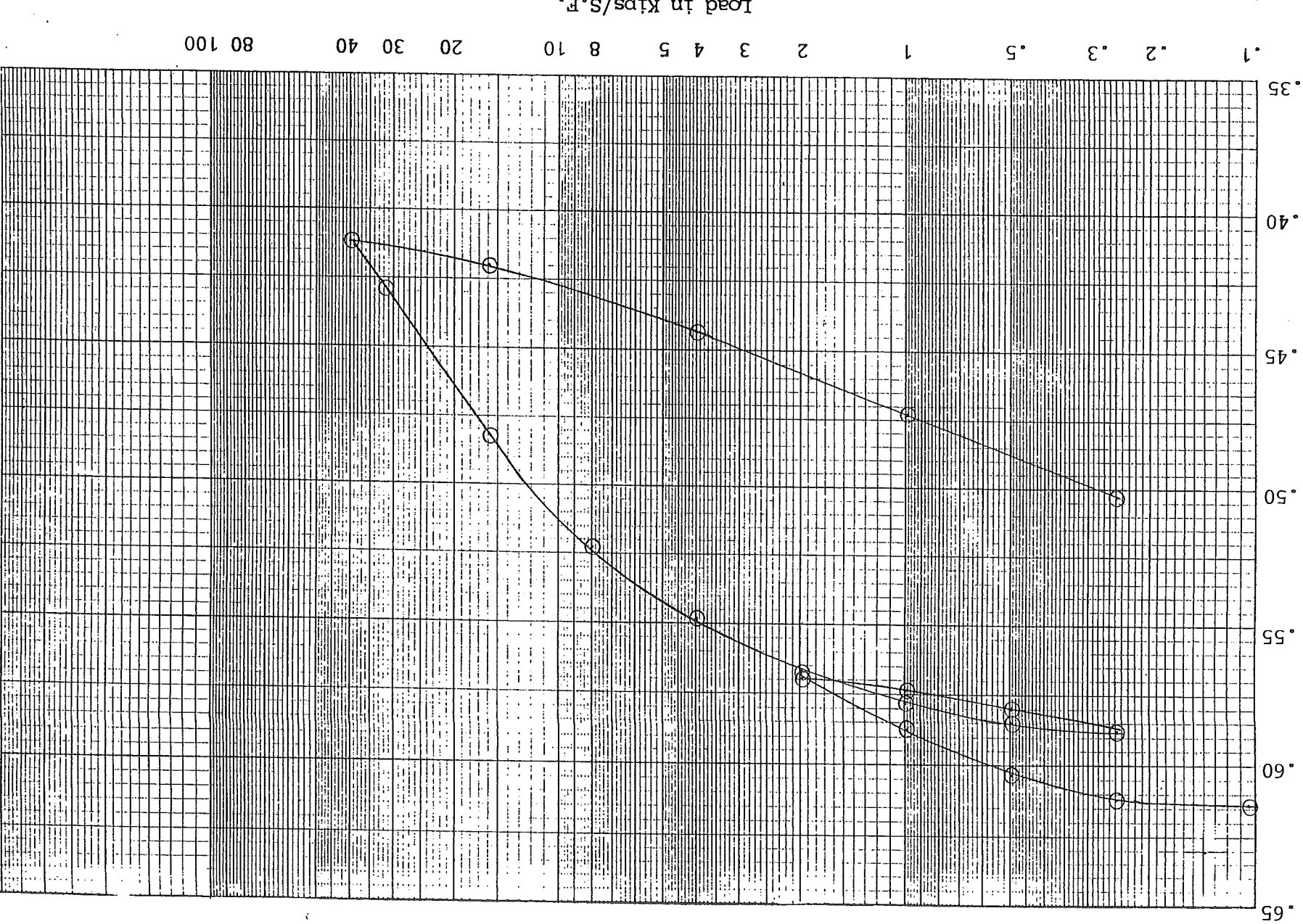
VOID RATIO VERSUS LOAD

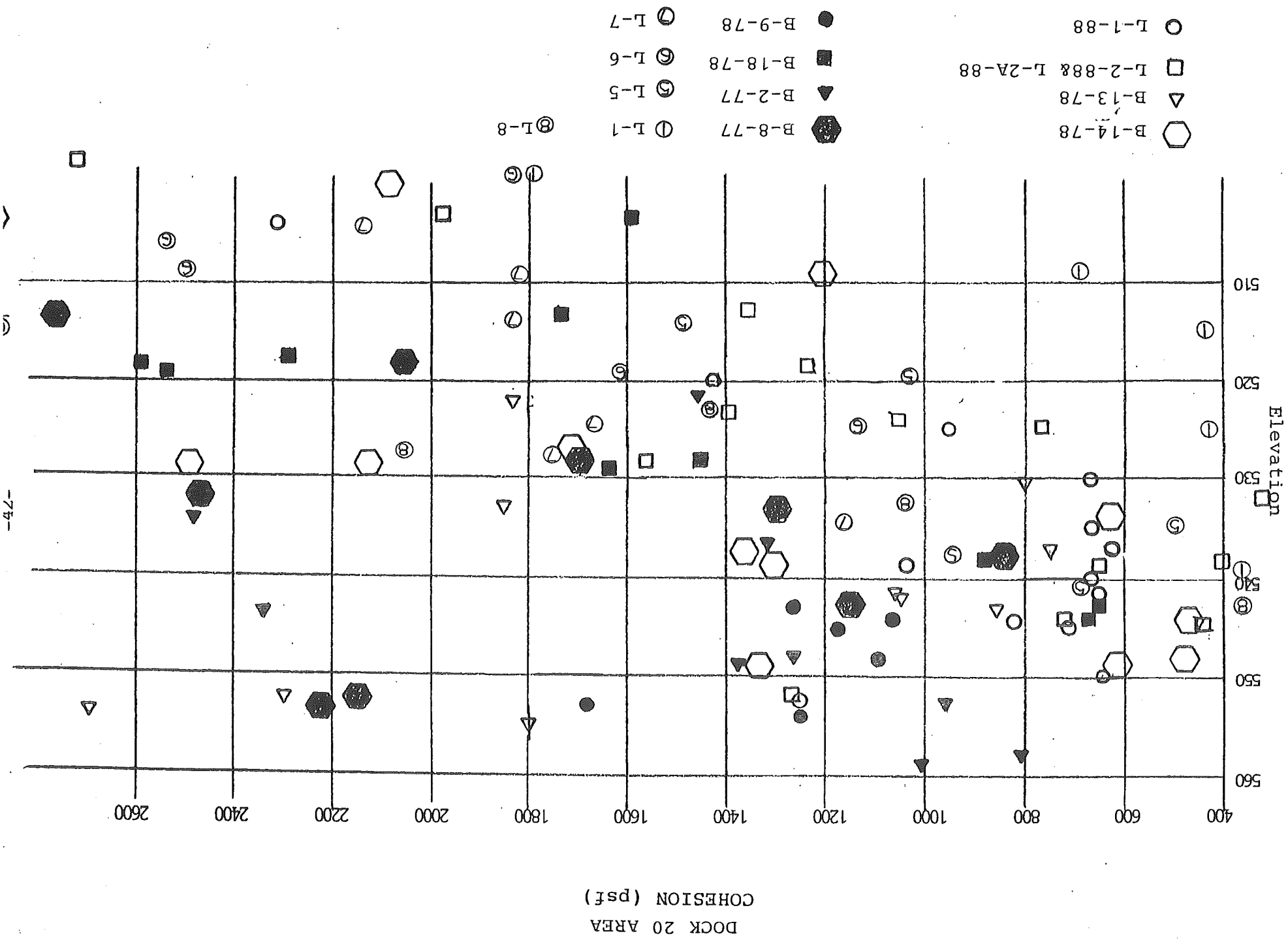
DAVID V. LEWIN CORP.							
CLEVELAND, OHIO							
Moist. Cont.	17.8						
L.T.							
P.I.							
e_o	.572						
Cc							
Spec. Gravity	2.72						
Classification	Gray silty clay						
Boring No. L-7							
Sample No.				Depth 40.0'-42.0'			
C. 4533				Technician CB			
				Date 1/27/91			

DAVID V. LEWIN CORP.							CLEVELAND, OHIO	
Moist. Cont.	L.T.	P.I.	e _o	cc	Spec. Gravity	Gray silty clay	Boring No. L-11	Sample No.
29.6			.789		2.70			
VOID RATIO VERSUS LOAD							Depth 36.5'-38.5'	Technician CB
							Date 1/27/91	

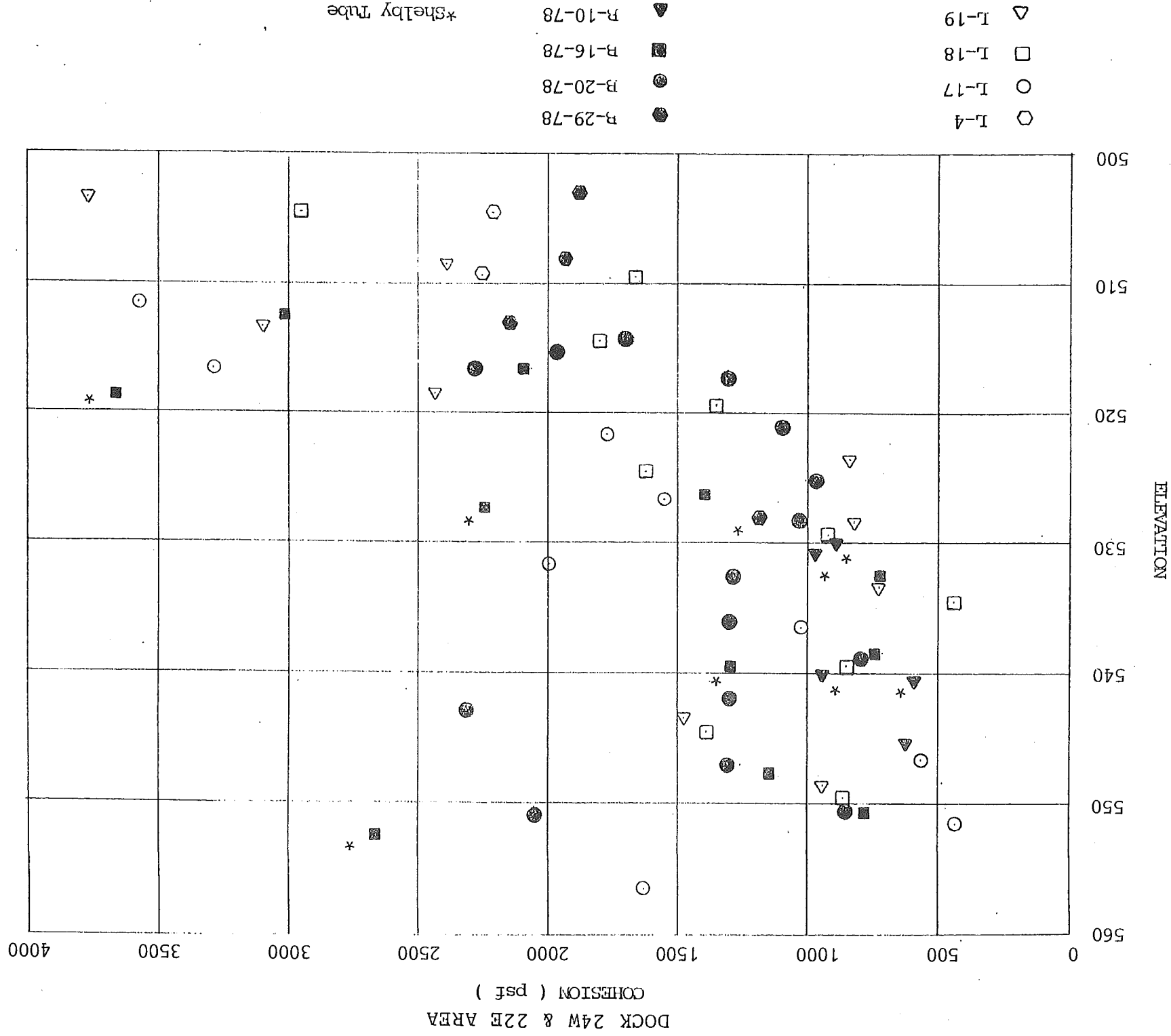


DAVID V. LEWIN CORP.						CLEVELAND, OHIO	
Moist. Cont.	L.T.	P.I.	e_0	Cc	Spec. Gravity	Gray silty clay w/silt seams	
20.6			.614		2.69		
VOID RATIO VERSUS LOAD							
Boring No. L-11		Depth 23.5'-25.5'		Technician CB		Date 1/27/91	
Sample No.		C. 4533					





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A P P E N D I X A

LABORATORY LOG OF BORING

Method of Sampling:

Split spoon ☒ Auger ☐

Shelby ☒ Auger ☐

Boring No. B-1

Surface Elevation 578 ± 579.2

Depth in feet	Symbol	DESCRIPTION	Blows on spoon for 12 inches	Depth to bottom of sample in feet	SUMMARY OF TEST RESULTS							
					Natural Moisture %	Liquid Limit	Plasticity Index	Unconfined Shear Stress #/SF	Strain %	Loss on Ignition @ 600°C. - %	Unit Dry Weight #/cu. ft.	
		Fill: brick, stone, concrete & sand	47	3.5								
		w/ some organic material	1	6.5	25.5						5.7	
		slag	12	10.0								
		slag	8	15.0								
		Sand, gray, w/ few thin silt seams										
		Clay, gray, silty, w/ some silt seams & sand seams	22	20.0								
			11	25.0	24.0	32	13	1025	8.7			105
		gray, silty, w/ trace of gravel	12	30.0	23.5							
			S-1	31.5				1190	17.0			108
			13	33.5	28.2	41	17	1160	10.8			96
				35.0	24.9							
		gray, silty	14	40.0	26.5			1540	20.0			105
			6	45.0	29.6							
			S-2	29.4				450	20.0			100
			6	48.5	30.9	36	14	855	15.8			93
		gray, silty, w/ trace of gravel & sand		31.7				1070	12.0			96
				50.0	25.9			580	20.0			107
			7	55.0	21.3			1150	20.0			110
			16	60.0	20.0	29	11	2200	20.0			117
			23	65.0	21.1			2290	20.0			115
		gray, silty, w/ some rock fragments & gravel	25	70.0	18.3			3210	20.0			119
			26	75.0	20.8			2370	20.0			113
			37	80.0	20.5			3150	20.0			112
			41	85.0	20.4			3050	20.0			109
			36	90.0								
			30	95.0	11.4			5500	9.7			131
			39	100.0	11.2			8000	15.0			130
		End of boring @ 100.0'										
		REMARKS:										
		Encountered water at 4.5'										
		Water at 13.0' on completion										

End of boring @ 100.0'

REMARKS:

Encountered water at 4.5'
Water at 13.0' on completion

Boring Completed: 10/7/77
Location: Cleveland, Ohio
Job No.: C. 3053

B-2


$$\frac{1}{94}$$

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

LABORATORY LOG OF BORING

Method of Sampling:

Split spoon ☒ Shelby ☒
Core drill ☐ Auger ☐

Boring No. B-3

Surface Elevation 584.0

Depth in feet	Symbol	DESCRIPTION	Blows on spoon for 12 inches	Depth to bottom of sample in feet	SUMMARY OF TEST RESULTS						Unit Dry Weight #/cu. ft.
					Natural Moisture %	Liquid Limit	Plasticity Index	Unconfined Shear Stress #/SF	Strain %	Loss On Ignition @ 600° C. - %	
		Fill: black cinders & slag	4	3.5							
		brown sand	8	6.5							
		black cinders, brick, limestone fragments & sand	16	10.0							
		black & brown sand w/tr. of veg., tr. of glass & cinders	13	15.0						7.6	
		black & brown silty sand w/ organic mat'l & trs. cinders	19	20.0						5.5	
		Clay, gray, silty w/some silt & sand seams	12	25.0						5.3	
		**	S-1	25.8 24.8 25.6	25.8 24.8 25.6			790 1080	20.0 13.8		102 98
		*	10	35.0	29.2						
		*	10	40.0	27.2			1130	16.7		101
		*	8	45.0	23.2						
		*	9	50.0	24.7			1050	20.0		102

F-L-1

REMARKS End of boring at 50.0'

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

Boring Completed: 2/15/73

Location: Cleveland, Ohio

*Liner sample

*See Consolidation Test

Job No.: C. 2337

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

LABORATORY LOG OF BORING

Method of Sampling:

Split spoon ☒ Shelby ☐

Core drill ☐ Auger ☐

Boring No. B-3

Surface Elevation 571 ±

Depth in feet	Symbol	DESCRIPTION	Blows on spoon for 12 inches	Depth to bottom of sample in feet	SUMMARY OF TEST RESULTS						
					Natural Moisture %	Liquid Limit	Plasticity Index	Unconfined Shear Stress #/SF	Strain %	Unit Dry Weight #/cu. ft.	
		Water									
		Sand, brown & gray	10	17.5							105
		Clay, gray, silty, w/trace of gravel & silt seams	7	22.5	28.8			950	17.0		100
		gray, silty, w/trace of gravel	7	27.5	24.9						105
			9	32.5	27.5			760	20.0		
			11	37.5	25.2			850	20.0		
		End of boring @ 37.5'									

F-L-1

EMARKS

Boring Completed: 12/19/77

Location: Cleveland, Ohio

Job No.: C. 3033 A

LABORATORY LOG OF BORING

Method of Sampling:

Split spoon ☒

Shelby ☐

Core drill ☐

Auger ☐

Boring No. B-7

Surface Elevation 571 ±

Depth in feet	Symbol	DESCRIPTION	Blows on spoon for 12 inches	Depth to bottom of sample in feet	SUMMARY OF TEST RESULTS					
					Natural Moisture %	Liquid Limit	Plasticity Index	Unconfined Shear Stress #/SF	Strain %	Unit Dry Weight #/cu. ft.
		Water								
10		Sand, brown & gray, w/some organic matter	18	12.0	29.2					
20		Clay, gray, silty, w/trace of gravel & some silt seams	10	17.0	28.5			950	20.0	101
30			11	22.0	28.3					
40		gray, silty	10	27.0	29.1					
50			11	32.0	28.0			460	15.3	101
		w/some sand & gravel	9	37.0	18.6			1900	20.0	121
		End of boring @ 37.0'								

F-L-1

EMARKS

Boring Completed: 12/19/77


Location: Cleveland, Ohio

Job No.: C. 3033 A

Boring No. B-8

Method of Sampling:		<input checked="" type="checkbox"/>	<input type="checkbox"/>
Split spoon	<input checked="" type="checkbox"/>	Shelby	
Core drill	<input type="checkbox"/>	Auger	

$$\frac{\text{Surface Elevation}}{577.6} \quad 578 \pm$$

DEPTH IN FEET		SYMBOL	DESCRIPTION	Blows on spoon for 12 inches	Depth to bottom of sample in feet	SUMMARY OF TEST RESULTS								
						Natural Moisture %	Liquid Limit	Plasticity Index	Unconfined Shear Stress #/SF	Strain %		Unit Dry Weight #/cu. ft.		
0	30		Fill: slag, sand, & red brick gray sand, w/some brick, slag, & trace of organic material gray silty sand, w/some gravel, decayed wood & trace of brick Clay, gray, silty, w/some silt seams & few sand seams trace of organic material @ 20.0'	7	3.5									
0	30			6	6.5									
0	30			14	10.0									
0	30			18	15.0									
0	30			S-1	20.0	26.8 25.7 23.5				1010 805	9.8 11.0		101 102	
0	30			7	25.0	27.8				960	12.9		100	
0	30			S-2	30.0	24.2 25.1 25.2				1380 1270	4.9 6.9		100 100	
0	30			10	35.0	21.7				2340	18.3		106	
0	30			X 9	40.0 41.5	21.8 22.6 22.3				1320	9.9		113	
0	30			S-3	45.0	21.1				2480 2180	20.0 20.0		107 107	
0	30			9	50.0	25.3								
0	30			X 12	55.0 56.5	22.0				1460	20.0		113	
0	30	10	60.0	21.7										
0	30	12	65.0	21.2										
REMARKS: End of boring @ 65.0' Water encountered at 5.0' X - Attempted shelly tube sample, no recovery														
Boring Completed: 12/30/77 Location: Cleveland, Ohio Job No.: C. 3033 A														

Method of Sampling:

Split spoon ☒ Shelby ☒
 Core drill ☐ Auger ☐

Boring No. B-9

 Surface Elevation 578 ±
577.96

-18-

Depth in feet	Symbol	DESCRIPTION	Blows on spoon for 12 inches	Depth to bottom of sample in feet	SUMMARY OF TEST RESULTS						
					Natural Moisture %	Liquid Limit	Plasticity Index	Unconfined Shear Stress #/SF	Strain %	Loss on Ignition @ 600°C. - %	Unit Dry Weight #/cu. ft.
		Fill: slag & cinders slag, cinders, sand & brick, organic material @ 3.5'	7	3.5	18.5					6.9	
		brown & gray silty sand w/ some brick @ 10.0'	9	6.5							
		Sand, gray, silty	14	10.0							
			14	15.0							
		Clay, gray, silty, w/ some silt seams & few sand seams	13	20.0	26.1			1240	6.0		99
			S-1	25.0	27.9			1670	6.9		99
					25.6						
			9	30.0	26.1			1090	16.7		102
					24.3			1170	9.9		101
			S-2		25.1			1060	7.5		101
				35.0	26.1	41	17	1260	17.5		99
			8	40.0	29.5						
			X	45.0							
			4	46.5	28.4						
			6	50.0	27.0						
		gray, silty	X	53.0							
			5	55.0	27.2						
			X	57.0							
			8	60.0	29.8						
			10	65.0	22.2						
		End of boring @ 65.0'									

REMARKS:

Water at 7.0' after casing was pulled

X - Attempted Shelby tube sample - no recovery

* - See consolidation graph

Boring Completed: 1/3/78

Location

Cleveland, Ohio

Job No.:

C. 3033 A

$$\frac{\text{Surface Elevation } 582 \pm}{586.2}$$

Depth in feet	Symbol	DESCRIPTION	Blows on spoon for 12 inches	Depth to bottom of sample in feet	SUMMARY OF TEST RESULTS							
					Natural Moisture %	Liquid Limit	Plasticity Index	Unconfined Shear Stress #/SF	Strain %	Loss on Ignition @ 600 C. - %	Unit Dry Weight #/cu. ft.	
		Fill: cinders, sand, brick, concrete & trace of wood	9	3.5								
			6	6.5								
			9	10.0								
			7	15.0	29.3						13.0	
			14	20.0								
		gray & black silty sand, w/ trace of vegetation & pieces of coal	9	25.0	33.7						8.9	
		gray & brown silty sand, w/ sandstone fragments	12	30.0								
		Clay, gray, silty, w/some silt seams trace of wood @ 35.0'	7	35.0	35.0							97
			8	36.5	29.6				610	20.0		
			S-1	42.0	33.9 31.0 28.4				585 935	6.9 9.9		90 101
		gray, silty, w/some silt seams	10	46.5	23.5							
			* S-2	52.0	31.6 33.0 31.5							
			7	56.5	25.2							92 91
		gray, silty	X	62.0								
			4	63.5	28.4							
			12	70.0	22.2							
REMARKS: End of boring @ 70.0' Water at 13.0' on completion X - Attempted Shelby tube sample-no recovery * - See consolidation graph												
Boring Completed: 1/4/78 Location: Cleveland, Ohio Job No.: C. B033A												

LABORATORY LOG OF BORING

Method of Sampling:

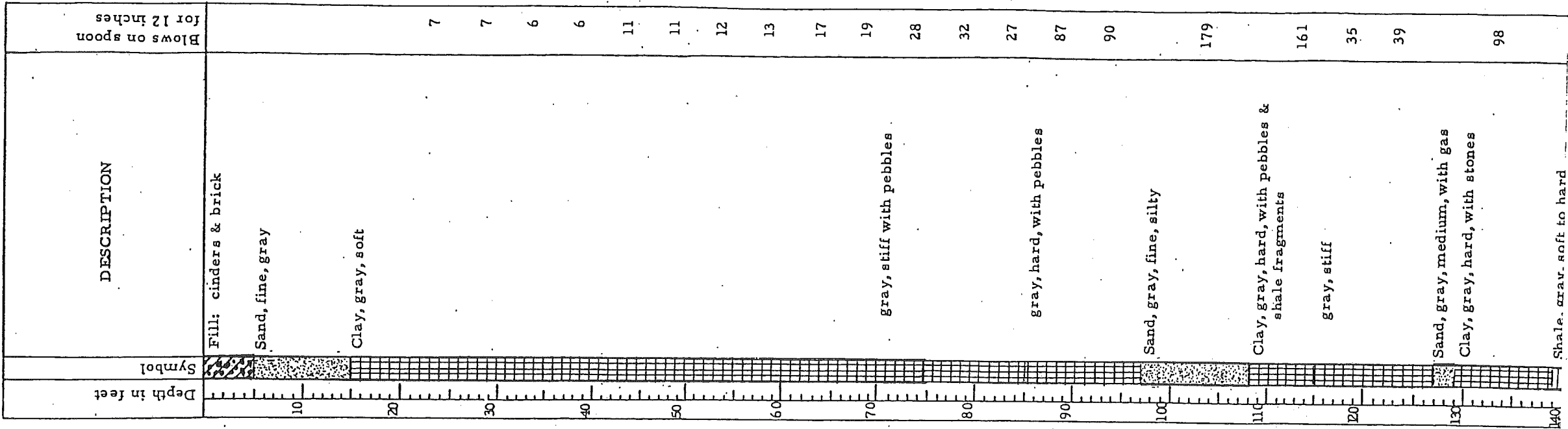
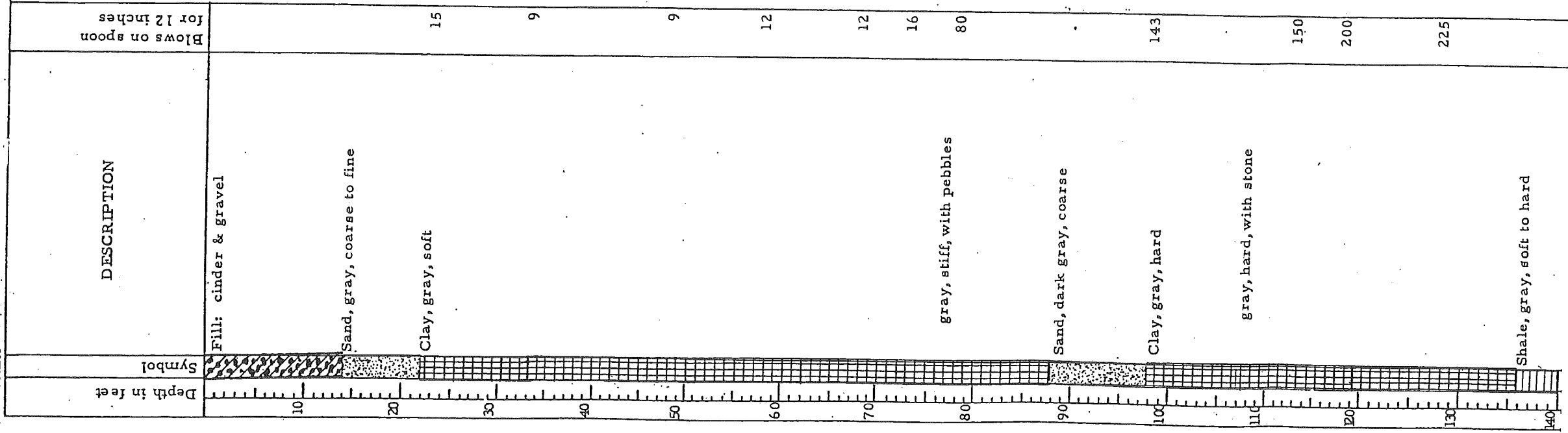
Split spoon ☒ Shelby ☒
 Core drill ☐ Auger ☐

Boring No. B-11
 Surface Elevation 578 ±
579.64

Depth in feet	Symbol	DESCRIPTION	Blows on spoon for 12 inches	Depth to bottom of sample in feet	SUMMARY OF TEST RESULTS					
					Natural Moisture %	Liquid Limit	Plasticity Index	Unconfined Shear Stress #/SF	Strain %	Unit Dry Weight #/cu. ft.
		Concrete 6" Fill: slag & limestone	30	3.5						
		black cinders & sand	13	6.5						
		gray silty sand, w/some gravel, silt seams & trace of organic material	28	10.0						
		gray silt, w/some vegetation & slag	11	15.0	21.1					
		gray silty sand, w/some vegetation, cinders & brick	7	20.0						
		boulders Sand, gray, silty	50/0	24.0						
		Clay, gray, silty, w/some silt seams	14	30.0	27.1					
			9	35.0	25.4			1960	12.9	106
			S-1	37.0	24.1			1160	5.3	98
			12	41.5	24.6			1360	8.1	101
			8	46.5	26.5			1750	15.0	105
		gray, silty	S-2	52.0	22.7			1040	20.0	102
			10	56.5	27.8			880	20.0	105
			X	60.0	24.6			1230	20.0	105
			12	61.5						
			15	65.0	21.8			1520	18.5	118
			16	70.0	21.7					
		End of boring @ 70.0'								
		REMARKS:								
		Water at 8.0' on completion								
		X - Attempted Shelby tube sample-no recovery								
		Boring Completed: 1/6/78								
		Location: Cleveland, Ohio								
		Job No.: C. 3033 A								

Surface Elevation 579.2

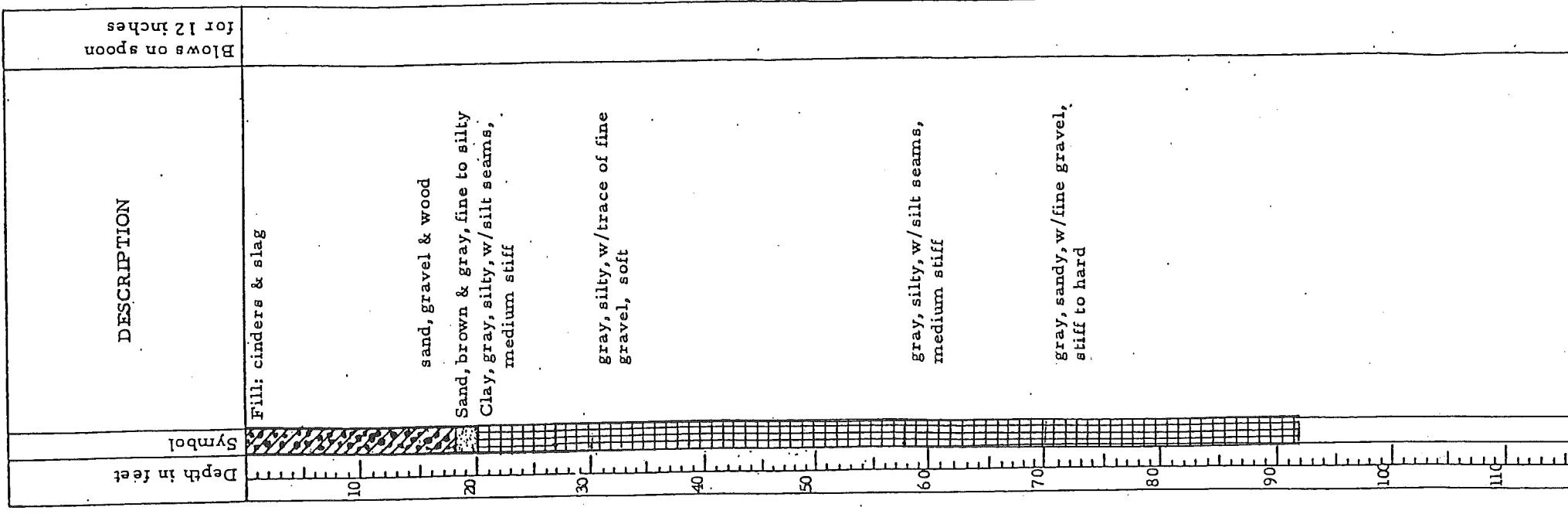
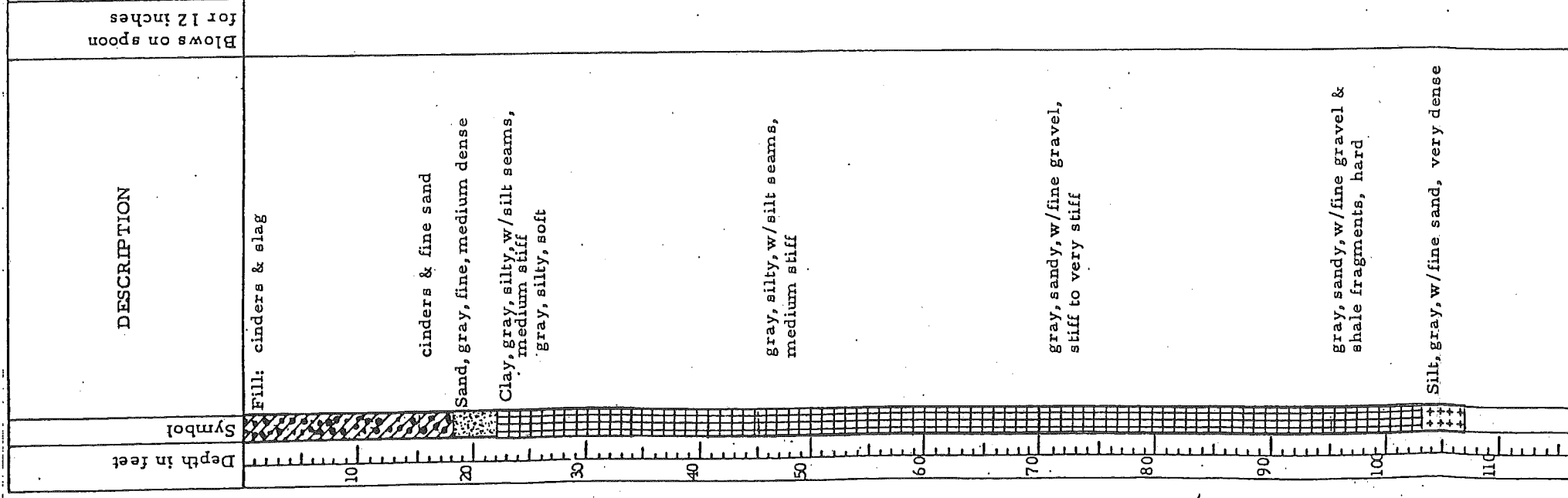
Surface Elevation 580.34



Boring No. 9-1
Surface Elevation 579.0

Boring No. 9-2
Surface Elevation 576.5

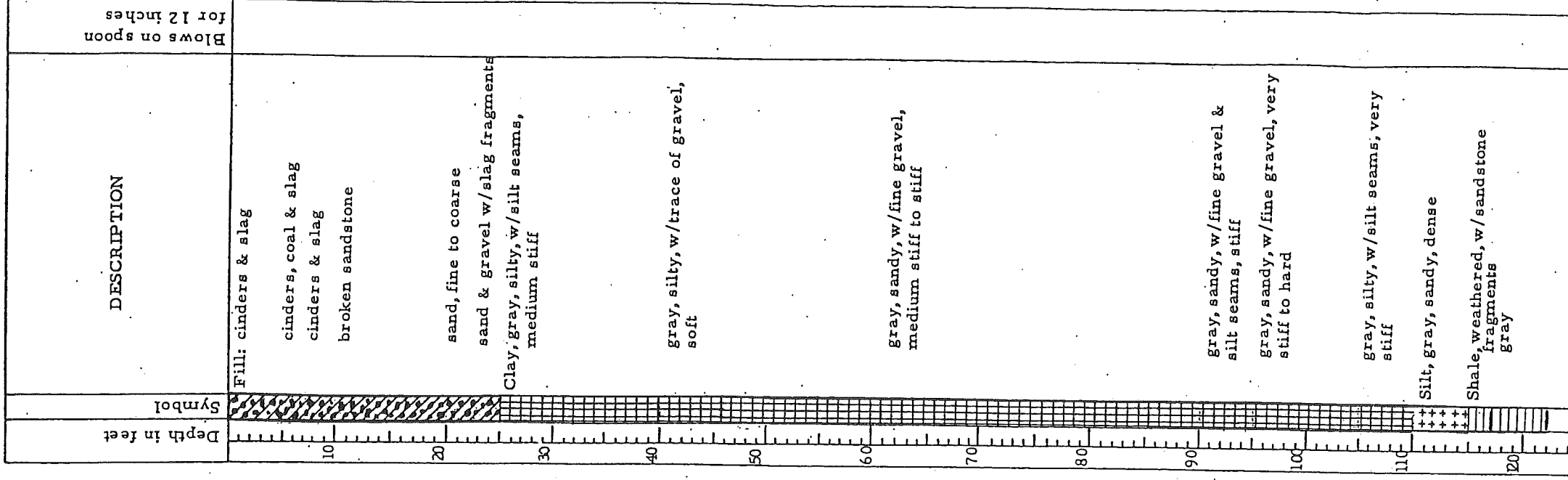
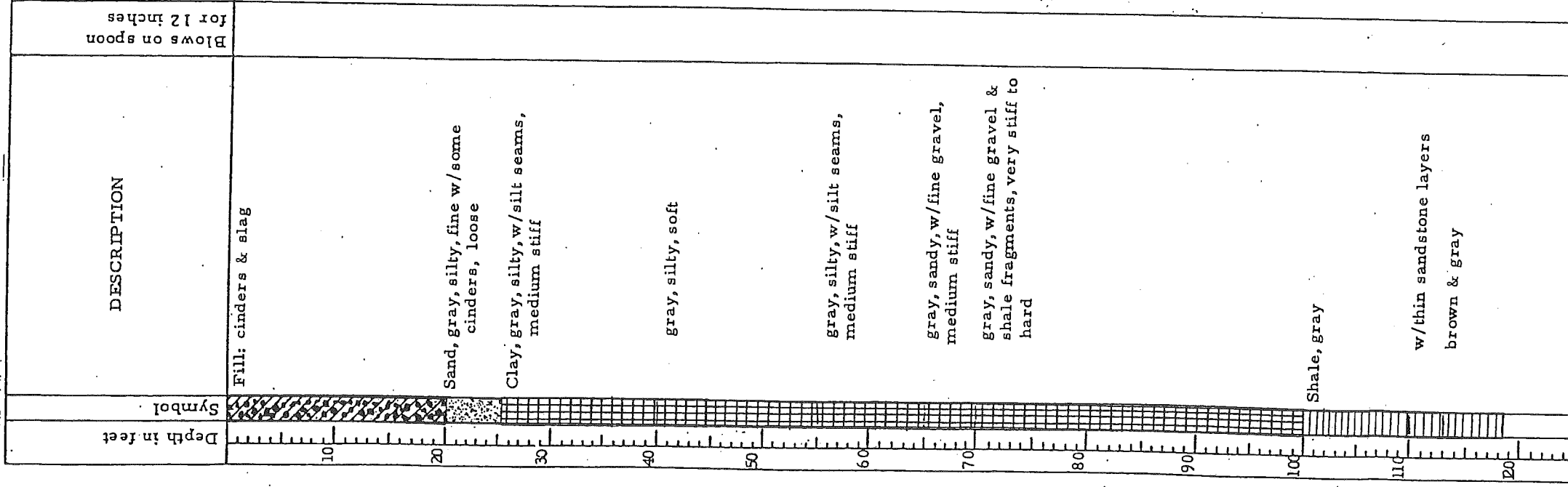
Job No. C. 3033



Boring No. 9-3
Surface Elevation 579.0

Job No. C. 3033

Boring No. 9-5
Surface Elevation 578.0



LABORATORY LOG OF BORING

Method of Sampling: ☒ Split spoon ☒ Shelby ☒
Core drill ☐ Auger ☐
Boring No. B-4
Surface Elevation 573.5

LABORATORY LOG OF BORING

Method of Sampling: ☒ Split spoon ☒ Shelby ☒
Core drill ☐ Auger ☐
Boring No. B-5
Surface Elevation 573.5

LABORATORY LOG OF BORING

Method of Sampling: ☒ Split spoon ☒ Shelby ☒
Core drill ☐ Auger ☐
Boring No. B-26
Surface Elevation 573.5

LABORATORY LOG OF BORING

Method of Sampling: ☒ Split spoon ☒ Shelby ☒
Core drill ☐ Auger ☐
Boring No. B-29
Surface Elevation 573.5

Depth in feet	Symbol	DESCRIPTION	Blows on spoon for 12 inches	Depth to bottom of sample in feet	SUMMARY OF TEST RESULTS					Unit Dry Weight p/cu. ft.
					Natural Moisture %	Liquid Limit	Plasticity Index	Unconfined Shear Stress p/SF	Strain %	
10		Water								
15		Clay, gray, silty, organic, w/sand, seams	3	16.5	45.9					
20		gray, w/silt seams	2	18.0	43.0					
25			19.5	31.6						
30			33	24.0	28.0					
35			S-1	27.0	27.2			1320	7.5	82
40			11	28.0	26.4					
45			12	35.0	34.1			580	20.0	93
50			S-2	40.0	34.8			1118	19.3	108
55			8	41.5	31.1					
60			9	45.0	30.2					
65		gray, silty, w/silt seams & trace of gravel	X	50.0						
70			21	51.5	26.8					
75			X	54.0						
80			23	55.5	24.9					
85			16	60.0	20.1					
90			37	65.0	22.4			2260	20.0	107
95			36	70.0	22.8			2410	20.0	107
100		gray, silty, w/seams gravel & rock fragments	37	75.0	21.4			2450	20.0	111
105			51	80.0	25.4			2250	20.0	106
110			63	85.0	20.7			1800	20.0	110
115			87	89.5	11.5					
120			107	94.5	12.1					
125		gray, silty, w/silt seams	52	99.0	15.2					
130		End of boring @ 104.5'	84	104.5	20.7					
REMARKS: X - Attempted shelly tube sample - no recovery										
					Boring Completed: 4/28/78 Location: Cleveland, Ohio Job No.: C-3033A					

Depth in feet	Symbol	DESCRIPTION	Blows on spoon for 12 inches	Depth to bottom of sample in feet	SUMMARY OF TEST RESULTS					Unit Dry Weight p/cu. ft.
					Natural Moisture %	Liquid Limit	Plasticity Index	Unconfined Shear Stress p/SF	Strain %	
10		Water								
15		Clay, gray	2	36.5	32.9					
20			1	38.0	35.1					
25			2	39.5	36.9					
30			4	41.0	37.2					
35					32.6					
40			S-1	45.0	37.6			380	20.0	94
45				46.5	33.7					
50			4	50.0	34.8					
55			4	55.0	37.6					
60					32.8					
65		gray, silty, w/silt seams	S-2	60.0	31.1			450	20.0	96
70			6	61.5	31.4					
75			38	65.0	23.6			1680	18.0	106
80			44	70.0	23.5			2200	20.0	101
85			42	75.0	24.1			2010	13.2	104
90			34	80.0	23.3					
95			34	85.0	19.9			2190	20.0	118
100			34	90.0	21.6			1830	17.0	109
105		gray, silty, w/gravel & rock fragments	75	94.5	16.7					
110		gray, silty, w/gravel, rock fragments & silt seams	45.5	99.0	11.6					
115		Silt, gray, w/some clay seams, gravel & rock fragments	50.5	105.3	9.4					
120			50.5	110.3						
125		Shale								
130		End of boring @ 115.0'								
REMARKS: Boring Completed: 5/7/78 Location: Cleveland, Ohio Job No.: C-3033A										

Depth in feet	Symbol	DESCRIPTION	Blows on spoon for 12 inches	Depth to bottom of sample in feet	SUMMARY OF TEST RESULTS					Unit Dry Weight p/cu. ft.
					Natural Moisture %	Liquid Limit	Plasticity Index	Unconfined Shear Stress p/SF	Strain %	
10		Water								
15		Sand, brown	14	18.8	18.8					
20		Clay, gray, silty	14	25.0	23.3					
25			S-1	28.0	24.5			1920	12.8	181
30			12	29.8	26.9			1350	16.5	105
35			130	35.0	25.5					
40		gray	S-2	39.0	28.6			250	16.0	95
45			6	40.5	31.9			550	16.0	
50		gray, silty, w/fine rock fragments	5	45.0	33.3					
55			S-3	49.0	29.4			1620	13.8	188
60			18	50.5	24.1			1240	20.0	106
65			16	55.0	19.7					
70			S-4	58.0	22.8			1220	13.1	86
75			23	59.5	24.0			855	13.8	100
80			22	65.0	24.5					
85			35	70.0	16.6			2740	20.0	119
90			43	75.0	16.6					
95			58	80.0	19.9					
100			63	85.0	20.1			3310	20.0	105
105			91	90.0	12.7					
110		gray, silty	99	95.0	12.2			5100	11.8	124
115			51/5	99.0	12.4					
120			100	104.5	20.2			2800	6.6	111
125			42	110.0	26.0					
130			97	115.0	23.8					
135		gray, w/silt sand seams	59	120.0	23.1					
140			66	125.0	23.0					
145		Shale, gray	50/0	128.5						
150		End of boring at 130.0'								
REMARKS: Boring completed 4/28/78 Location: Cleveland, Ohio Job No.: C-3033A										

Depth in feet	Symbol	DESCRIPTION	Blows on spoon for 12 inches	Depth to bottom of sample in feet	SUMMARY OF TEST RESULTS					Unit Dry Weight p/cu. ft.
					Natural Moisture %	Liquid Limit	Plasticity Index	Unconfined Shear Stress p/SF	Strain %	
10		Water								
15		Clay, gray, silty, w/trace of gravel	11	36.5	31.3					
20			12	38.0	23.1					
25			15	41.5	21.1					
30			S-1	46.5	23.6			1190	13.5	107
35			15	48.0	24.6			1170	16.5	104
40		gray, silty, w/silt seams	15	55.0	26.1					
45			33	60.0	23.4			2150	16.7	109
50			35	65.0	21.9			1930	20.0	105
55			37	70.0	22.4			1870	13.1	104
60		gray, silty, w/some gravel & trace of rock fragments	60	75.0	15.5			3210	20.0	116
65			66	80.0	15.1			3100	20.0	121
70			82	85.0	15.4			3000	20.0	122
75		Sand, gray, w/trace of gravel & some silt seams	91	90.0						
80		End of boring @ 90.0'	91	95.0						
REMARKS: Boring Completed: 5/12/78 Location: Cleveland, Ohio Job No.: C-3033A										

LABORATORY LOG OF BORING

Method of Sampling:

Split spoon	<input checked="" type="checkbox"/>	Shelby	<input checked="" type="checkbox"/>
Core drill	<input type="checkbox"/>	Auger	<input type="checkbox"/>

Boring No. B-13
Surface Elevation 577.49

Depth in feet	Symbol	DESCRIPTION	Blows on spoon for 12 inches	Depth to bottom of sample in feet	SUMMARY OF TEST RESULTS					
					Natural Moisture %	Liquid Limit	Plasticity Index	Unconfined Shear Stress σ_{SF}	Strain %	Unit Dry Weight γ_{dry} , p.c.f.
0-10		Fill, concrete, brick, sand	7	3.5						
		brown sand, cinders, sandstone	12	6.5						
			16	10.0						
		brown to gray sand, w/pieces of shale	20	15.0						
10-50		Clay, gray, silty	7	20.0	24.3					
			S-1	23.0	22.1	2880	17.9		184	
			12	24.5	21.8	2290	11.9		111	
			7	30.0	25.1		1440	11.9		105
			S-2	35.0	28.4	850	7.1		95	
			8	36.5	28.8	1040	4.7		94	
			8	40.0	28.0		740	8.9		98
			S-3	45.0	21.6	1850	12.3		107	
			11	46.5	24.5	800	11.9		104	
			10	50.0	22.3					
			17	55.0	19.7		1830	20.0		114
			15	60.0	19.6		3270	20.0		118
50-70			22	65.0	18.3					
			19	70.0	17.0		3490	20.0		121
			26	75.0	16.3		2910	20.0		118
			31	80.0	16.3		3600	14.6		119
			62	85.0	17.8					
			S-5	89.5	15.2					
70-100		Sand, gray	67	95.0						
		Clay, gray, silty, w/gravel and rock fragments	81	100.0	13.7					
		End of boring at 100.0'								
REMARKS:										
Water at 6.0' after casing was pulled										
					Boring completed, 4/25/78 Location: Cleveland, Ohio Job No. C. 033A					

LABORATORY LOG OF BORINO

Method of Sampling:			
Split spoon	<input type="checkbox"/>	Shelby	<input type="checkbox"/>
Cora drill	<input type="checkbox"/>	Auger	<input type="checkbox"/>

Boring No. B-14
Surface Elevation 579.1

Depth in feet	Symbol	DESCRIPTION	Blows on ancon for 12 inches	Depth to bottom of sample in feet	SUMMARY OF TEST RESULTS					
					Natural Moisture %	Liquid Limit	Plasticity Index	Unconfined Shear Stress σ_{SF}	Strain %	Unit Dry Weight ρ_{cs} , lb./cu. ft.
0		Fill, black slag, gravel, brick	8	3.5						
10		brown sand, w/ vegetation	9	6.5						
		gray silty sand	12	10.0						
		black and gray sand, gravel	13	15.0						
20		Clay, gray, silty.	9	20.0						
			10	25.0	25.9					
30			S-1	30.0	29.4					
			7	31.5	34.2	1130	12.6		96	
			9	35.0	30.7	610	6.0		88	
					470	8.5		97		
			9	35.0	30.3	450	9.8		95	
40			S-2	40.0	24.8	1300	8.9		103	
			7	41.5	23.3	1350	8.7		103	
			8	45.0	25.8	620	20.0		100	
50			S-3	50.0	18.5	2480	20.0		108	
			17	51.5	19.6	1700	20.0		119	
			22	55.0	19.1					
60		gray, silty, w/gravel	S-4	60.0						
			30	61.5	18.8					
			31	65.0	15.9					
70			40	70.0	18.4	1200	20.0		117	
			36	75.0	18.4	2900	20.0		115	
80			40	80.0	17.3	2050	20.0		117	
90		Sand, gray, silty	47	85.0	13.4					
		Clay, gray, silty, w/ gravel and rock fragments	89	90.0						
		Silt, gray, w/ sand seams	82	95.0	10.9					
		Silt, gray, w/ clay, w/ gravel and rock fragments	97	100.0	10.3					
100		End of boring at 100.0'								
REMARKS:										
Water at 8.0' after casing was pulled										
• No recovery										
						Boring completed: 4/27/78				
						Location: Cleveland, Ohio				
						Job. No. C 3039A				

LABORATORY LOG OF BORING

Method of Sampling: ☒ Split spoon ☐ Shelby ☐
☐ Core drill ☐ Auger ☐

Boring No. B-11
Surface Elevation 481.71

Depth in feet	Symbol	DESCRIPTION	Blows on spoon for 12 inches	Depth to bottom of sample in feet	SUMMARY OF TEST RESULTS					Unit Dry Weight p/cu. ft.
					Natural Moisture %	Liquid Limit	Plasticity Index	Unconfined Shear Stress p/sf	Strain %	
0		Asphalt - 4"								
10		Fill: cinders, stones, clay, silt, sand, & bricks	36	3.5						
			4	4.5						
			6	10.0						
20		w/some decayed wood	11	15.0						
			4	20.0						
30		Clay, gray, silty, w/low silt some	7	25.0	25.4		1190	13.3		102
			2	30.0	25.7		830	8.6		102
40			5	35.0	30.4		750	13.3		97
			5-1	37.5	25.2		1330	10.2		95
			6	40.0	32.2		1120	8.9		100
							970	13.3		99
50			X	28.8						
			5-2	28.5			960	18.4		97
				22.4			1020	12.3		100
			7	50.0	24.4		910	11.8		105
				23.7			1360	20.0		105
			5-3	23.2			2220	9.0		105
				23.2			2180	10.5		105
				22.8			2570	15.0		105
60			9	60.0	22.3		1470	20.0		111
			5-4	22.1			2570	8.2		100
		gray, silty, w/some gravel & rock fragments	65.5	21.9			2680	7.7		105
70			12	70.0	21.2		1600	15.0		107
			5-5	14.4						
				13.5			4750	20.0		123
				15.2			6800	20.0		121
80			22	80.0	16.8		3720	20.0		121
			26	85.0	16.9		3750	20.0		118
90			21	90.0	21.0		2200	16.1		106
		Silt, gray, sandy Clay, gray, silty, w/rock fragments & gravel	66	94.5	10.0					
100			50	100.0	12.7		3900	8.1		129
		Silt, gray, clayey, w/gravel	79	104.5	9.4					
110			67	109.5	11.0		3950	8.0		127
120		End of boring @ 109.5'								

REMARKS:

Water at 10.5' on completion

Water at 9.0' after pulling casing

Boring Completed: 5/1/79

Location: Cleveland, Ohio

Job No.: C 3013A

DAVID V. LEWIN CORP.
GEOTECHNICAL ENGINEERS CLEVELAND, OHIO
LOG OF SOIL BORINGS: 13, 14 & 15
CLEVELAND PELLET TERMINAL
FEB. 20

LABORATORY LOG OF BORING

Method of Sampling:
Split spoon ☒ Shelby ☒
Core drill ☐ Auger ☐Boring No. B-16
Surface Elevation 582.6

Depth in feet	Symbol	Description	SUMMARY OF TEST RESULTS					
			Blows on spoon for 12 inches	Depth to bottom of sample in feet	Natural Moisture %	Liquid Limit	Plasticity Index	Unconfined Shear Stress σ_{sf}
0		fill, cinders	3	1.5				
8			8	6.5				
10			5	10.0				
12		sand and cinders	12	14.0				
20		gray sand	20	20.0				
25		gray sand, w/pieces of brick	25	25.0				
30		lay. gray, silty, w/silt seams	30-1	30.4	22.6			105
32			32	32.0	28.7			98
35			35	35.0	28.8	1140	8.3	100
40		gray	40-20	40.4	25.0			
42			42	42.0	25.0			
44			44	44.0	25.0			
46			46	46.0	25.0			
50			50	50.0	29.1	740	20.0	98
52			52	52.0	29.0			
54			54	54.0	29.0			
56		gray, silty w/rock fragments and silt seams	56	56.0	25.4	1400	20.0	116
60			60	60.0	20.6			
64			64	64.0	20.6	1660	17.2	110
66			66	66.0	20.6	2100	18.2	109
70			70	70.0	18.8	3010	15.0	116
80			80	80.0	16.0	4600	20.0	123
83			83	83.0	15.4			
85			85	85.0	15.8	3090	13.1	110
90			90	90.0	16.9	2800	13.1	115
95			95	95.0	14.0			
100			100	100.0	12.6			
105			105	105.0	13.6	6600	13.2	123
110			110	110.0	10.1			
115			115	115.0	21.8			
120		gray, silty, w/silt seams	120	120.0	24.7	4100	11.8	102
125			125	125.0	20.6			
130			130	130.0	22.5	3150	11.6	105
135		gray, silty, w/gravel and rock fragments	135	135.0				
140		Shale, gray	140	140.0				
End of boring at 138.5'								
REMARKS: Water encountered at 7.5' No recovery								
Boring completed 4/26/78 Location: Cleveland, Ohio Job No. C. 3033A								

LABORATORY LOG OF BORING

Method of Sampling:
Split spoon ☒ Shelby ☒
Core drill ☐ Auger ☐Boring No. B-17
Surface Elevation 579.15

Depth in feet	Symbol	Description	SUMMARY OF TEST RESULTS					
			Blows on spoon for 12 inches	Depth to bottom of sample in feet	Natural Moisture %	Liquid Limit	Plasticity Index	Unconfined Shear Stress σ_{sf}
0		fill: cinders, rocks & gravel	40	3.5				
34		gray sand, w/clay seams	34	6.3				
9			9	10.0				
3		gray & black sand, w/some gravel, organic material, gray clay seams & trace of slag & metal	3	15.0				
7			7	20.0	32.6			
7		Clay, gray, silty, w/some silt seams	7	25.0	27.4			
9			9	30.0	25.6			
8-1			8-1	32.0	24.6	1280	13.1	102
10			10	33.5	27.8	1100	20.0	100
8-2		gray, silty	8-2	34.8		590	13.2	91
8			8	40.0	26.2	1280	7.1	105
41.5			41.5	55.0		420	17.0	93
9		gray	9	45.0	28.0			
8-3			8-3	49.7	33.7	930	16.5	96
10			10	50.0	30.4	930	16.0	92
10			10	55.0	28.9			
2			2	61.5	31.5			
4			4	65.0	27.6			
70.0			70.0	70.0	30.3			
71.5			71.5	71.5	30.5			
7		gray, silty, w/some silt seams	7	75.0	28.1			
40			40	80.0	22.2			
43		gray, silty, w/some gravel & rock fragments	43	85.0	14.9			
51			51	90.0	16.2	3740	20.0	119
117		gray, silty, w/some gravel, rock fragments & silt seams	117	94.5	12.0			
126			126	99.5	12.6			
104.5		Silt, gray, w/seams of sand & clay	104.5	104.0	18.7			
108.3		Shale, gray	108.3	108.3				
End of boring @ 112.0'								
REMARKS: X - Attempted shelly tube sample - no recovery								
Boring Completed: 5/9/78 Location: Cleveland, Ohio Job No. C. 3033A								

LABORATORY LOG OF BORING

Method of Sampling:
Split spoon ☒ Shelby ☒
Core drill ☐ Auger ☐Boring No. B-18
Surface Elevation 578.1

Depth in feet	Symbol	Description	SUMMARY OF TEST RESULTS					
			Blows on spoon for 12 inches	Depth to bottom of sample in feet	Natural Moisture %	Liquid Limit	Plasticity Index	Unconfined Shear Stress σ_{sf}
6		fill, cinders and rock	6	3.5				
7		brown sandy clay, w/rock fragments	7	6.5				
11		cinders and rocks	11	10.0	45.0			
5		w/black organic silt	5	15.0	43.0			
14		sand, gray, with trace of organic material	14	20.0	26.0			
18		Clay, gray, silty	18	25.0				
12			12	30.0	27.0			
35.0		gray	35.0	35.0	33.0	660	4.7	94
36.5			36.5	36.5	29.0	640	10.0	89
40.0			40.0	40.0	30.0	870	16.1	94
41.5			41.5	41.5	27.0			
45.0			45.0	45.0	26.0			
50.0		w/gravel and rock fragments	50.0	50.0	23.0	1630	16.5	108
51.5		gray, silty	51.5	51.5	21.6	1450	12.1	104
55.0			55.0	55.0	25.0			
60.0		gray, silty, with silt seams and rock fragments	60.0	60.0	22.0	2130	18.5	103
61.5			61.5	61.5	22.0	2280	16.8	108
65.0			65.0	65.0	25.0	1730	13.4	112
70.0			70.0	70.0	20.0	3280	18.5	116
71.5			71.5	71.5	17.0			
75.0			75.0	75.0	21.0	1590	10.8	113
80.0			80.0	80.0	17.0	3650	20.0	120
85.0			85.0	85.0	15.0	2410	20.0	120
90.0		Silt, gray, sandy	90.0	90.0	21.9			
95.0			95.0	95.0	20.3			
100.0		Clay, gray, silty, w/rock fragments	100.0	100.0	9.0	5200	20.0	125
104.0		gray, silty	104.0	104.0	14.2			
109.0			109.0	109.0	16.7			
114.0			114.0	114.0	14.9			
120.0			120.0	120.0	21.5			
125.0		gray	125.0	125.0	24.8			
130.0		Silt, gray, w/rock fragments	130.0	130.0	26.9	1830	15.0	104
133.5		Shale, gray	133.5	133.5				
End of boring at 133.5'								
REMARKS:								
Boring completed: 4/26/78 Location: Cleveland, Ohio Job No. C. 3033A								

LABORATORY LOG OF BORING

Method of Sampling:
 Split spoon ☒ Shelby ☒
 Core drill ☐ Auger ☐

Boring No. B-19
 Surface Elevation 581.99

Depth in feet	Symbol	DESCRIPTION	Bleed on spoon for 12 inches	Depth to bottom of sample in feet	SUMMARY OF TEST RESULTS						Unit Dry Weight p/cc. g.
					Natural Moisture %	Liquid Limit	Plasticity Index	Unconfined Shear Stress p/psf	Strain %		
17		Fill, clay, cinders, sand, rock fragments, wood	17	3.5							
11		w/o organic material	11	6.5							
2			2	10.0	22.3						
18			18	15.0	23.3						
25			25	20.0	19.3						
5		Sand, gray w/decayed wood	5	25.0	25.6						
4		Clay, gray, silty, w/silt seams	4	30.6	31.6	44	19	700	13.0		93
4		gray silty	4	32.0	30.7			1150	10.7		95
4			4	35.0	38.7			370	10.4		94
8-2			8-2	40.5	33.6	41	16	710	10.8		91
4			4	42.0	31.1						
4			4	45.0	29.9						
8-3			8-3	50.5	24.2	31	12	685	7.5		101
5			5	52.0	29.8			640	20.0		98
7			7	55.0	29.1			900	20.0		100
8-4		Gray silty w/ low rock fragments & silt seams	8-4	59.5	23.2	30	11	1980	12.2		103
17			17	61.0	23.1			1720	7.7		105
19			19	65.0	23.4			2400	16.8		106
5-6		Gray silty w/gravel and rock fragments	5-6	69.5	15.3			3238	18.0		112
11			11	71.0	16.9						
13			13	75.0	21.8						
8-6			8-6	79.5	16.1	26	10	2800	20.0		121
23			23	81.0	15.3			5018	20.8		120
								4970	20.0		119
27			27	85.0	15.5			1960	20.0		121
3-7		Gray silty w/silt seam & sand seams & rock fragments	3-7	89.0	13.3			2490	19.3		113
33			33	90.5	19.9			5350	14.9		111
39			39	95.0	13.9						
8-8			8-8	99.0	13.0			3350	17.4		122
48			48	100.5	11.6						
52			52	105.0	11.8			10350	8.5		130
94			94	109.5	13.9						
47		Gray silty w/ silt seams	47	115.0	20.0						
49			49	120.0	18.8						
36		Sand, gray with few clayey fragments	36	125.0							
27		Gray sand w/few shale fragments	27	131.5							
		Shale, gray									
100%				141.0							
End of boring at 141.0'											
REMARKS											
Water encountered at 9.0'											
Water at 3.3' upon completion											
Boring completed 4/14/78											
Location: Cleveland, Ohio											
Job No. C-3033A											

LABORATORY LOG OF BORING

Method of Sampling:
 Split spoon ☒ Shelby ☐
 Core drill ☐ Auger ☐

Boring No. B-20
 Surface Elevation 582.9

Depth in feet	Symbol	DESCRIPTION	Bleed on spoon for 12 inches	Depth to bottom of sample in feet	SUMMARY OF TEST RESULTS						Unit Dry Weight p/cc. g.
					Natural Moisture %	Liquid Limit	Plasticity Index	Unconfined Shear Stress p/psf	Strain %		
26		Fill, brick, stone, clay, sand	26	3.5							
4			4	6.5							
1/1.5			1/1.5	10.0							
8			8	15.0							
8		Sand, gray	8	20.0							
10			10	25.0							
5-1		Clay, gray, silty	5-1	30.5							
5-2			5-2	32.5							
5-3			5-3	34.5							
5-4			5-4	36.5							
5-5			5-5	38.5							
5-6			5-6	40.5							
5-7			5-7	43.0							
5-8			5-8	45.0							
5-9			5-9	47.0							
5-10			5-10	49.0							
5-11			5-11	51.0							
5-12			5-12	53.0							
5-13			5-13	55.0							
5-14			5-14	57.0							
5-15			5-15	59.0							
5-16			5-16	61.0							
5-17			5-17	63.0							
5-18			5-18	65.0							
5-19			5-19	67.0							
5-20			5-20	69.0							
14		gray, silty, with rock fragments	14	70.8	24.3						
17			17	74.5	17.7			2330	20.0		119
18			18	76.5	17.4						
5-21			5-21	79.0	17.1			3090	18.0		120
19			19	80.5	15.8			3250	18.8		119
21			21	85.0	16.6			3840	20.0		118
31			31	90.0	21.0						
30			30	95.0	20.3			3220	20.0		111
62		Silt, gray, sandy	62	100.0	11.3						
41		Clay, gray, silty, with rock fragments	41	105.0	13.3						
55			55	110.0	14.4			5100	13.2		127
51			51	115.0	17.4						
55			55	120.0	18.4						
31		Sand, gray, with few small silty seams	31	125.0							
34			34	130.0							
57			57	135.0							
500		Clay, gray, silty, w/pebbles and Shale, gray	500	138.5							
End of boring at 138.5'											
REMARKS											
Water encountered at 8.0' during drilling											
Water at 5.0' before casing was pulled											
Water at 8.5' after casing was pulled											
No recovery											
Boring completed 4/24/78											
Location: Cleveland, Ohio											
Job No. C-3033A											

LABORATORY LOG OF BORING

Method of Sampling:
 Split spoon ☒ Shelby ☒
 Core drill ☐ Auger ☐

Boring No. B-22
 Surface Elevation 582.7

Depth in feet	Symbol	DESCRIPTION	Blows on spoon for 12 inches	Depth to bottom of sample in feet	SUMMARY OF TEST RESULTS						Unit Dry Weight p/cc. R.
					Natural Moisture %	Liquid Limit	Plasticity Index	Unconfined Shear Stress p/psf	Strain %		
		Auger to 8.5									
10		Fill, black cinders and sand	9	10.0							
		black silty sand	2	15.0							
20		gravel, sand and slag	10	20.0							
		Sand, black to gray, silty	11	25.0	33.6						
30			4	30.0							
		Clay, gray, silty	3-1	32.0							
			3-2	34.0							
			3-3	36.0							
40			3-4	38.0							
			3-5	40.0							
			3-6	42.0							
			3-7	44.0							
			3-8	46.0							
0			3-9	48.0							
			3-10	50.0							
			3-11	52.0							
			3-12	54.0							
0			3-13	56.0							
			3-14	58.0							
			3-15	60.0							
			3-16	62.0							
			3-17	64.0							
			3-18	66.0							
			3-19	68.0							
			3-20	70.0							
		gray, silty, w/gravel and rock fragments	36	73.5	20.7						
			36	80.0	19.2			1170	14.5		122
			5-20	86.0	17.5			1000	20.0		119
			27	86.5	17.8			2220	20.8		117
			34	90.0	18.4						
			37	95.0	18.4			3220	20.0		114
			35	100.0	23.4						
			46	105.0	12.0			3400	20.0		123
		gray, silty, w/silt, gravel and pieces of rock	52	110.0	10.2						
			57	115.0	13.7			3490	10.2		116
			45	120.0	12.9						
			37	125.5	27.1						
		Shale, gray	504	129.4							
		End of boring at 122.0'									
		REMARKS:									
		Water at 10.0' before casing was pulled						Boring completed: 4/24/78			
		Moist caved at 8.0' after casing was pulled						Location: Cleveland, Ohio			
								Job No. C. 3031A			
		• No recovery									

LABORATORY LOG OF BORING

Method of Sampling: Split spoon ☒ Shelby ☒
Core drill ☐ Auger ☐

Boring No. B-21
Surface Elevation 574.5

Depth in feet	Symbol	DESCRIPTION	SUMMARY OF TEST RESULTS					
			Blows on spoon for 12 inches	Depth to bottom of sample in feet	Natural Moisture %	Liquid Limit	Plasticity Index	Unit Dry Weight p/cu. ft.
0		Fill, cinder and bricks	40	3.5				
10			14	6.5				
20			9	10.0				
30			4	15.0				
40			16	20.0				
50		Sand, gray	6	25.0				
60			9	30.0				
70		Clay, gray	4	35.0	34.4			
80			S-1	40.0	38.7			
90			6	41.5	37.4	808	22.9	94
100			6	45.0	28.2			
110			S-2	50.0	28.8			
120			6	51.5	34.4	480	14.0	102
130			6	55.0	32.4			
140			S-3	60.0	30.4			
150			2	61.5	32.8	340	20.0	89
160			2	65.0	31.6			
170		gray, silty, w/silt seams and traces of gravel and rock fragments	S-4	70.0	21.8			
180			23	71.5	21.0	1380	20.0	107
190			23	75.0	22.1			
200			26	79.5	18.9	3250	20.0	120
210			27	85.0	16.8			
220		gray, silty, w/gravel and rock fragments	26	90.0	18.0			
230			75	95.0	12.2			
240			62	100.0	17.3	3570	20.0	120
250			67	105.0	17.1	3130	15.0	119
260			85	110.0	12.5	6700	10.0	124
270		gray, silty, w/silt seams	102	114.5	13.1	5000	11.7	122
280			99	120.0	18.3			
290			104	124.5	20.6			
300		Shale	500	128.0				
310		End of boring at 128.0'						
320		REMARKS:						
330		• No recovery						
340		Boring completed: 5/ /78						
350		Location: Cleveland, Ohio						
360		Job No. C 3031A						

LABORATORY LOG OF BORING

Method of Sampling: Split spoon ☒ Shelby ☒
Core drill ☐ Auger ☐

Boring No. B-24
Surface Elevation 578.99

Depth in feet	Symbol	DESCRIPTION	SUMMARY OF TEST RESULTS					
			Blows on spoon for 12 inches	Depth to bottom of sample in feet	Natural Moisture %	Liquid Limit	Plasticity Index	Unit Dry Weight p/cu. ft.
0		Blacktop						
10		Fill, limestone, slag	11	1.5				
20		brown sand, slag and rock fragments	15	6.5				
30			14	10.0				
40		gray and black sand, gravel, pieces of rock, slag, cinders, w/organic material	8	15.0	18.4			
50			5	20.0	21.0			
60		gray silty sand, w/pieces of glass and organic material	5	25.0	25.6			
70		Clay, gray, silty, w/silt seams	7	30.0	28.7			
80			S-1	32.0	28.8	1828	11.8	94
90			8	35.0	29.6			
100			S-2	40.0				
110		gray, silty	6	45.0	35.4			
120			S-3	50.0	32.1	848	13.8	87
130			9	55.0	31.5			
140			S-4	60.0	28.1			
150			10	61.5	28.1			
160		gray, silty, with some silt seams	9	65.0	22.8			
170			S-5	70.0	25.9	1898	8.7	188
180			11	71.5	28.4	370	20.0	100
190			11	75.0	26.9	820	20.0	101
200			S-6	80.0	20.8	2420	11.0	112
210		gray, silty, with gravel and rock fragments	14	81.5	28.2	1498	8.9	108
220			17	85.0	17.8	1680	20.0	115
230		gray, silty, with gravel and pieces of shale	S-7	90.0	16.7	4050	20.0	117
240			25	90.5	21.1			
250			34	95.0	21.2	2860	20.0	113
260			60	99.5	11.4			
270		gray, silty, with silt seams	64	105.0	21.2			
280			S-8	109.5	18.3			
290		Shale, gray, broken	80%	117.0				
300		gray						
310		End of boring at 117.0'						
320		REMARKS:						
330		Water at 8.0' upon completion						
340		Boring completed: 4/14/78						
350		Location: Cleveland, Ohio						
360		Job No. C 3031A						
370		• No recovery						

LABORATORY LOG OF BORING

Method of Sampling: Split spoon ☒ Shelby ☒
Core drill ☐ Auger ☐

Boring No. B-25
Surface Elevation 579.44

Depth in feet	Symbol	DESCRIPTION	SUMMARY OF TEST RESULTS					
			Blows on spoon for 12 inches	Depth to bottom of sample in feet	Natural Moisture %	Liquid Limit	Plasticity Index	Unit Dry Weight p/cu. ft.
0		Blacktop						
10		Fill, brown to gray limestone gravel	27	3.5				
20		black cinder brick sand concrete	21	6.5	11.1			
30			50/0	8.5				
40		brown & gray silty clay w/s shal frag, cinders & brick	5	11.5	25.4			
50		gray silty clay w/s shal frag, cinders & brick	5	15.0	17.3			
60		black & gray sandy clay gravel, cinders & sand seams	8	20.0	16.4			
70		sand, gray silty	7	25.0				
80		Clay, gray silty, trace of gravel and some silt seams	11	30.0	28.4			
90			S-1	35.0	28.4	1740	11.7	100
100			7	36.5	28.4	1120	11.7	94
110			11	40.0	28.4	1160	10.8	101
120			S-2	45.0	21.9			
130			10	49.0	21.9	1120	11.0	104
140			9	50.0	28.4	910	20.0	103
150			S-3	55.0	28.4	1050	15.2	102
160		soft gray silty	8	60.0	31.2	1020	14.4	93
170			7	60.0	31.2			
180		firm gray silty w/low sand seams, silt seams, some gravel	S-4	65.0	28.4	1200	12.0	94
190			11	66.5	28.4			
200			14	70.0	17.4	1680	20.0	119
210			S-5	75.0	17.4	1210	14.4	119
220		firm to hard gray silty w/gravel some rock fragments	18	78.5	17.4	2970	20.0	116
230			24	80.0	17.4	2970	20.0	121
240			S-6	85.0	17.4	1900	14.4	118
250			36	82.5	18.0	1920	19.0	118
260			38	90.0	19.6			
270			S-7	95.0	14.0			
280			42	95.5	16.7	1660	20.0	116
290		hard gray silty sandy w/some layers of shale	67	100.0	11.6			
300			85	105.0	11.6			
310		Shale, gray	S-8	109.5	0.8			
320		End of boring @ 115.0'	50/0	115.0				
330		REMARKS:						
340		Water at 8.0' after casing was pulled. Roller bit refusal and spoon refusal at 115.0'						
350		Boring completed: 4/15/78						
360		Location: Cleveland, Ohio						
370		Job No. C 3031A						

A P P E N D I X B

SPECIFICATION

FOR

SUBSURFACE EXPLORATORY WORK

A. SCOPE 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. SAMPLING 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

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:

Probing 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. SAFETY AND SITE MAINTENANCE:

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 sink-hole development or artesian water conditions.

F. NOTIFICATION:

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.

HOLE NO. TBL-1 SURFACE ELEVATION _____ Sheet No. 1 of 3 Sheets
FOR DAVID V. LEWIN

LOCATION DOCK 20 CLEVELAND, OHIO
STARTED 10-16-89 COMPLETED 10-16-89 JOB NO. 89-010-186

STATION	DEPTH	Driller's Log <input checked="" type="checkbox"/>	Geologist's Log <input type="checkbox"/>	Remarks	Sample Depth	Blows on Sampler
			Mechanical Analysis <input type="checkbox"/>			
	18.0		WATER			
						28.9
19.5	1/12"					
20.0	1					
21.5	1-1					
23.0	2					
24.5	3-6					
		GRAY SILTY CLAY W/SOME ROCK FRAGMENTS				
					30.0	REC. 19"
					30.0	2
					31.5	4-5
36.5	4-4					
		GRAY SILTY CLAY W/SOME ROCK FRAGMENTS				
					41.5	3-4
46.5	2-4					
					51.5	4-4

TEST BORING RECORD

HOLE NO. TBL-1 SURFACE ELEVATION Sheet No. 2 of 3 Sheets

FOR DAVID V. LEWIN

LOCATION DOCK 20 CLEVELAND, OHIO

STARTED 10-16-89 COMPLETED 10-16-89 JOB NO. 89-010-186

Boat's Log			Blows
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Remarks	Sample Depth	on Sampler
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50.0	3
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[illegible]

BOREHOLE NO. TBL-1 SURFACE ELEVATION _____ Sheet No. 8 of 3 Sheets
 OPERATOR RICK TOSATTO
 DATE 10-23-89 TIME _____ DEPTH 140.0
 CASING HAMMER WL. _____ lbs. DROP _____ In.
 SAMPLER HAMMER WL. 140 lbs. DROP 30 In.
 SAMPLER SIZE 2 In. O.D. CASING SIZE 4 In.
 AUGER SIZE _____ In. GROUND WATER _____

FOR DAVID V. LEWINLOCATION DOCK 20 CLEVELAND, OHIOSTARTED 10-23-89 COMPLETED 10-25-89 JOB NO. 89-010-186

DEPTH	Driller's Log <input checked="" type="checkbox"/>	Geologist's Log <input type="checkbox"/> Mechanical Analysis <input type="checkbox"/>	Remarks	Sample Depth	Blows on Sampler
105.0		GRAY SILTY CLAY W/ROCK FRAGMENTS		90.0	33
				90.4	50/.4
129.0		GRAY SILTY CLAY W/TRACE OF SAND		100.0	50/
				100.3	/ .3
				105.0	19
				106.5	26-32
133.0		GRAY SILTY FINE SAND			
140.0		GRAY FINE SANDY SILT			
			ENCOUNTERED GAS AT 135.0-135.2	110.0	34
				111.3	49-50/.3
				115.0	36
				116.5	42-49
				120.0	24
				121.5	34-31
				125.0	22
				126.5	29-37
				130.0	28
				130.9	50/.4
				135.0	50/
				135.2	/ .2

TEST BORING RECORD

HOLE NO. TBL-2 SURFACE ELEVATION _____ Sheet No. 1 of 3 Sheets

FOR DAVID V. LEWIN

LOCATION DOCK 20 CLEVELAND, OHIO

STARTED 10-13-89..... COMPLETED 10-14-89..... JOB NO. 89-010-186.....

Drift's Log		Sound	Blows
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Remarks	Sample Depth	on Sampler
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[illegible][illegible]

DRILLER RICK TOSATTO
 WATER ON COMPLETION 24 HOUR WATER
 DATE TIME DEPTH 111.5
 CASING HAMMER WL. lbs. DROP in.
 SAMPLER HAMMER WL. 140 lbs. DROP 30 in.
 SAMPLER SIZE 2 in. O.D. CASING SIZE 4 in.
 AUGER SIZE in. GROUND WATER

HOLE NO. TBL-2 SURFACE ELEVATION Sheet No. 2 of 3 Shee
 FOR DAVID V. LEWIN
 LOCATION DOCK 20 CLEVELAND, OHIO
 STARTED 10-13-89 COMPLETED 10-14-89 JOB NO. 89-010-186

ELEVATION	DEPTH	Driller's Log <input checked="" type="checkbox"/>	Geologist's Log <input type="checkbox"/> Mechanical Analysis <input type="checkbox"/>	Remarks	Sample Depth	Blows on Sampler
		SOFT GRAY SILTY CLAY			50.0	2
					51.5	2-2
					53.0	1
					54.5	2-2
	56.0	STIFF GRAY SILTY CLAY W/SHALE FRAGMENTS			56.5	SHELBY
					58.5	NO REC.
					58.5	6
					60.0	10-12
					65.0	10
					66.5	12-12
		STIFF GRAY SILTY CLAY W/SHALE FRAGMENTS			70.0	11
					71.5	14-15
					75.0	12
					76.5	25-38
		STIFF GRAY SILTY CLAY W/SHALE FRAGMENTS				
					80.0	17
					81.5	25-38
	83.0	GRAY SILTY SAND		ENCOUNTERED GAS POCKET	85.0	14
					86.5	18-33
	87.0					
		GRAY SANDY CLAY W/SHALE FRAGMENTS				
					90.0	15
					91.5	22-35
		GRAY SANDY CLAY W/SHALE FRAGMENTS				
					95.0	26
					95.9	50/.4
					100.0	31

TEST BORING RECORD

HOLE NO. TBL-2 SURFACE ELEVATION _____ Sheet No. 3 of 3 Sheets

FOR DAVID V. LEWIN

LOCATION DOCK 20 CLEVELAND, OHIO

STARTED 10-13-89 COMPLETED 10-14-89 JOB NO. 89-010-186

[illegible]

TEST BORING RECORD

HOLE NO. TBL-3 SURFACE ELEVATION Sheet No. 1 of 2 Sheets
FOR DAVID V. LEWIN
.....
LOCATION DOCK 20 CLEVELAND, OHIO
STARTED 10-12-89 COMPLETED 10-12-89 JOB NO. 89-010-186

[illegible]

TEST BORING RECORD

DRILLER

HOLE NO. TBL-3 SURFACE ELEVATION Sheet No. 2 of 2 Sheets

WATER ON COMPLETION 24 HOUR WATER

DATE TIME DEPTH 76.5

CASING HAMMER Wt. lbs. DROP in.

AMPLER HAMMER WL. 140 lbs. DROP 30 in.

AMPLER SIZE 2 in. O.D. CASING SIZE 4 in.

AUGER SIZE In. GROUND WATER

FOR DAVID V. LEWIN.....

LOCATION DOCK 20 CLEVELAND, OHIO

STARTED 10-12-89..... COMPLETED 10-12-89..... JOB NO. 89-010-186.....

[illegible]

HOLE NO. TBL-4 SURFACE ELEVATION Sheet No. 1 of 3 Sheets

FOR DAVID V. LEWIN

LOCATION DOCK 20 CLEVELAND, OHIO

STARTED 10-25-89 COMPLETED 10-27-89 JOB NO. 89-010-186

Drillist's Log	<input type="checkbox"/>	Sample	Blows
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Chemical Analysis <input type="checkbox"/>	Remarks	Sample Depth	on Sampler
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[illegible][illegible]

DRILLER RICK TOSATTO
 DATE OF COMPLETION _____ 24 HOUR WATER _____
 TIME _____ DEPTH 125.1
 SING HAMMER Wt. _____ lbs. DROP _____ in.
 PLER HAMMER Wt. 140 lbs. DROP 30 in.
 PLER SIZE 2 in. O.D. CASING SIZE 4 in.
 JGER SIZE _____ in. GROUND WATER _____

HOLE NO. TBL-4 SURFACE ELEVATION _____ Sheet No. 2 of 3 Sheets
 FOR DAVID V. LEWIN
 LOCATION DOCK 20 CLEVELAND, OHIO
 STARTED 10-25-89 COMPLETED 10-27-89 JOB NO. 89-010-186

ATION	DEPTH	Driller's Log <input checked="" type="checkbox"/>	Geologist's Log <input type="checkbox"/> Mechanical Analysis <input type="checkbox"/>	Remarks	Sample Depth	Blows on Sampler
		GRAY SILTY CLAY W/TRACE OF GRAVELS				
					55.0	2
		GRAY SILTY CLAY W/TRACE OF GRAVELS			56.5	3-4
	60.0	GRAY SILTY CLAY W/ROCK FRAGMENTS			60.0	12
					61.5	17-30
		GRAY SILTY CLAY W/ROCK FRAGMENTS				
					65.0	8
		GRAY SILTY CLAY W/ROCK FRAGMENTS			66.5	16-17
		GRAY SILTY CLAY W/ROCK FRAGMENTS			70.0	10
					71.5	19-25
		GRAY SILTY CLAY W/ROCK FRAGMENTS				
					75.0	16
		GRAY SILTY CLAY W/ROCK FRAGMENTS			76.5	25-30
		GRAY SILTY CLAY W/ROCK FRAGMENTS			80.0	10
					81.5	20.42
		GRAY SILTY CLAY W/ROCK FRAGMENTS				
					85.0	17
		GRAY SILTY CLAY W/ROCK FRAGMENTS			86.5	48-22
		GRAY SILTY CLAY W/ROCK FRAGMENTS			90.0	25
					91.0	50/.5
		GRAY SILTY CLAY W/ROCK FRAGMENTS				
					95.0	13
	95.0	GRAY SILTY CLAY W/SOME SAND & GRAVEL SEAMS			96.5	43-30
		GRAY SILTY CLAY W/SOME SAND & GRAVEL SEAMS			100.0	36
					101.5	40-44
	100.0	GRAY SILTY CLAY W/SOME SAND & GRAVEL SEAMS				

M O I S T

TEST BORING RECORD

HOLE NO. TBL-4 SURFACE ELEVATION _____ Sheet No. 3 of 3 Sheets

FOR DAVID V. LEWIN

LOCATION DOCK 20 CLEVELAND, OHIO

STARTED 10-25-89 COMPLETED 10-27-89 JOB NO. 89-010-186

[illegible]

TEST BORING RECORD

HOLE NO. TBL-5 SURFACE ELEVATION _____ Sheet No. 1 of 3 Sheets

FOR DAVID V. LEWIN

LOCATION DOCK 20 CLEVELAND, OHIO

STARTED 10-28-89..... COMPLETED 10-30-89..... JOB NO. 89-010-186.....

Crist's Log	<input type="checkbox"/>	Sample	Blows
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Chemical Analysis <input type="checkbox"/>	Remarks	Sample Depth	on Sampler
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[illegible]

TEST BORING RECORD

HOLE NO. TBL-5 SURFACE ELEVATION _____ Sheet No. 2 of 3 Sheets

HOLE NO. TBL-5 SURFACE ELEVATION _____ Sheet No. 2 of 3 Sheets

FOR DAVID V. LEWIN

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LOCATION DOCK 20 CLEVELAND, OHIO

STARTED 10-28-89..... COMPLETED 10-30-89..... JOB NO. 89-010-186.....

ELEVATION	DEPTH	Driller's Log <input checked="" type="checkbox"/>	Geologist's Log <input type="checkbox"/> Mechanical Analysis <input type="checkbox"/>	Remarks	Sample Depth	Blows on Sampler
					55.0	5
					56.5	8-10
					60.0	7
	60.0				61.5	10-17
					65.0	8
					66.5	11-14
					70.0	5
					71.5	11-13
					75.0	12
					76.5	16-22
					80.0	10
					81.5	14-25
	83.0					
					85.0	16
					86.2	32-50
					90.0	28-37-50/
					91.2	/ .2
	91.2					
					95.0	50/
					95.4	/ .4
					100.0	50/
					100.3	/ .3

DRILLER RICK TOSATTO
 DATE ON COMPLETION _____ 24 HOUR WATER _____
 DATE _____ TIME _____ DEPTH 130.2
 CASING HAMMER WL. _____ lbs. DROP _____ in.
 SAMPLER HAMMER WL. 140 lbs. DROP 30 in.
 SAMPLER SIZE 2 in. O.D. CASING SIZE 4 in.
 AUGER SIZE _____ in. GROUND WATER _____

HOLE NO. TBL-5 SURFACE ELEVATION _____ Sheet No. 3 of 3 Sheets
 FOR LEWIN CORPORATION
 LOCATION DOCK 20 CLEVELAND, OHIO
 STARTED 10-28-89 COMPLETED 10-30-89 JOB NO. 89-010-186

DEPTH	Driller's Log <input checked="" type="checkbox"/>	Geologist's Log <input type="checkbox"/> Mechanical Analysis <input type="checkbox"/>	Remarks	Sample Depth	Blows on Sampler
105.0	STIFF GRAY SILT W/SHALE FRAGMENTS			105.0	15
				106.5	31-44
	STIFF GRAY SILT W/TRACE OF CLAY				
				110.0	14
				111.5	21-28
	STIFF GRAY SILT W/TRACE OF CLAY			115.0	14
				116.5	18-28
				120.0	15
				121.5	19-22
	STIFF GRAY SILT W/TRACE OF CLAY				
125.2			RUN	125.0	50/
				125.2	/.2
	GRAY HARD SHALE		125.2		
			to	4.0	
130.2			130.2		
	TERMINATION DEPTH 130.2				

TEST BORING RECORD

HOLE NO. TBL-6 SURFACE ELEVATION Sheet No. 1 of 2 Sheets.

FOR DAVID V. LEWIN

LOCATION DOCK 30 CLEVELAND OHIO

STARTED 9-27-89 COMPLETED 9-29-89 JOB NO 89-010-186

Blows			
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[illegible]

DRILLER RICK TOSATTOHOLE NO. TBL-6 SURFACE ELEVATION _____ Sheet No. 2 of 2 SheetsDATE _____ TIME _____ DEPTH 85.4FOR DAVID V. LEWIN

CASING HAMMER WL. _____ lbs. DROP _____ in.

APPLER HAMMER WL. 140 lbs. DROP 30 in.APPLER SIZE 2 in. O.D. CASING SIZE 4 in.

UGER SIZE _____ in. GROUND WATER _____

LOCATION DOCK 20 CLEVELAND, OHIOSTARTED 9-27-89 COMPLETED 9-29-89 JOB NO. 89-010-186

VATION	DEPTH	Driller's Log <input checked="" type="checkbox"/>	Geologist's Log <input type="checkbox"/> Mechanical Analysis <input type="checkbox"/>	Remarks	Sample Depth	Blows on Sampler
	55.5	GRAY SANDY SILT W/TRACE OF ROCK FRAGMENTS			55.0	9
					56.5	14-19
	65.0	GRAY SILTY CLAY W/ROCK FRAGMENTS AND SOME SAND SEAMS			60.0	9
					61.5	14-30
		GRAY SILTY CLAY W/ROCK FRAGMENTS AND SOME SAND SEAMS		M O I S T	65.0	7
					66.5	15-28
		GRAY CLAYEY SILT W/ROCK FRAGMENTS AND SOME SAND LAYERS			70.0	10
					71.5	17-22
					75.0	11
					76.5	18-25
		GRAY CLAYEY SILT W/ROCK FRAGMENTS AND SOME SAND LAYERS			80.0	24
					81.0	50/.6
	85.4			POCKET OF GAS	85.0	50/
		TERMINATION DEPTH 85.4		WATER BEFORE PULLING CASING 2'0	85.4	/,4

HOLE NO. TBL-7 SURFACE ELEVATION _____ Sheet No. 1 of 2 Sheets

HOLE NO. TBL-7 SURFACE ELEVATION _____ Sheet No. 1 of 2 Sheets

FOR DAVID V. LEWIN

LOCATION DOCK 20 CLEVELAND, OHIO

STARTED 9-30-89 COMPLETED 10-2-89 JOB NO. 89-010-186

STARTED 9-30-89 COMPLETED 10-2-89 JOB NO. 89-010-186

STARTED 9-30-89 COMPLETED 10-2-89 JOB NO. 89-010-186

[illegible]

TEST BORING RECORD

HOLE NO. TBL-7 SURFACE ELEVATION Sheet No. 2 of 2 Sheets
FOR DAVID V. LEWIN
.....
LOCATION DOCK 20 CLEVELAND, OHIO
STARTED 9-30-89 COMPLETED 10-2-89 JOB NO. 89-010-186

[illegible]

DRILLERS TEST BORING LOG

PAGE 1 of 5

TEST HOLE h-8

PROJECT: PORT OF CLEVELAND WEST 3RD

CLIENT: ATWIN CORP

WATER/ENCOUNTERED 5.0' + 11.0'

DRILLED: 12-19-90

BY: D. HERNER

WATER/COMPLETION 3'

WATER/

ELEV. FT.	SAMPLE DEPTH	SAMPLE NO.	TYPE	BLOW COUNT	CLASSIFICATION	GROUND WATER
<u>2.5'</u>	2.0	1	SS	7-11-10	GRAY & BDN CLAYY SILT SAND, W/ GRAVELS & FRAGS, W/ RED BRICK LIMESTONE GRAVEL	
	3.5				BLACK CINDERS SLAG, IRON ORE	<u>5.0' WET</u>
<u>7.5'</u>	5.0	2	SS	18-38-50	PEBBLES- CONCRETE & RED BRICK, WOOD FILL-	<u>WET</u>
	8.5	3	SS	5-10-17	MED DENSE TO DENSE HAYRED	<u>MOIST</u>
	10.0				BROWN FINE TO MED HAYRED	
	13.5	4	SS	11-15-23	W/ MED TO COARSE SILTY SAND	
	15.0				TRACE GRAVELS, POS <u>FILL?</u>	<u>WET</u>
<u>19.5'</u>	18.5	5	SS	12-4-4		
	20.0				MED DENSE GRAY FINE TO MED	
	23.5	6	SS	8-8-12	SILTY SAND W/ SOME GRAVELS	<u>WET</u>
<u>28.5'</u>	25.0					
	28.5	7	SS	1-1-2	BROWN ROTTED WOOD, HAYRED	
<u>31.5'</u>	30.0				W/ GRAY FINE TO MED SILTY SAND	<u>WET</u>
	33.5	8	SS	3-4-5	MED STIFF GRAY SILTY CLAY	
	35.0				TRACE FINE SAND	

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DRILLERS TEST BORING LOG

PAGE 2 of 5

TEST HOLE L-8

PROJECT: PORT OF CLEVELAND WEST^{3RD}

CLIENT: HCW IN CORP

WATER/ENCOUNTERED 5' + 11'

DRILLED 9-19-90

BY: D. HCPNER

WATER/COMPLETION 3'

WATER/

ELEV. FT.	SAMPLE DEPTH	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT	CLASSIFICATION	GROUND WATER
	335				MED STIFF GRAY SILTY CLAY	
	350	9	SS	3-4-5	TRACE FINE SAND, W/ SOME SMALL HAIRY CLAYY SILT	MOIST TO WET
	385					
	400	10	SS	3-4-5		
<u>420'</u>						
	435					
	450	11	SS	6-9-10	MED DENSE GRAY CLAYY SILT W/ FINE SAND	MOIST TO WET
	485					
	500	12	SS	6-8-11		
	535					
	550	13	SS	7-11-16		
<u>580</u>						
	585					
	600	14	SS	9-16-23	DENSE GRAY CLAYY SILT TRACE FINE SAND, TRACE	MOIST TO WET
	635					
	650	15	SS	10-18-25	GRAVELS & R. FRAGS	

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DRILLERS TEST BORING LOG

PAGE 3 of

TEST HOLE h-8

PROJECT: PORT OF CLEVELAND WEST 3RD

CLIENT: LEWIN CORP

WATER/ENCOUNTERED 5' 11'

DRILLED: 12-19-90

BY: D. HCPNER

WATER/COMPLETION 3'

WATER/

ELEV. FT.	SAMPLE DEPTH	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT	CLASSIFICATION	GROUND WATER
<u>66.5'</u>	—	—	—	—	—	—
—	—	—	—	—	—	—
—	—	—	—	—	—	—
—	68.5	16	SS	9-14-20	DENSE GRAY CLAY SILT SANDY W/ GRAVELS & R. FRAGS	—
—	70.0	—	—	—	—	—
—	—	—	—	—	—	—
—	—	—	—	—	—	—
—	73.5	17	SS	9-19-25	—	MOIST
—	75.0	—	—	—	—	TO
—	—	—	—	—	—	WET
—	—	—	—	—	—	—
—	78.5	18	SS	10-19-23	—	—
—	80.0	—	—	—	—	—
—	—	—	—	—	—	—
<u>82.0'</u>	—	—	—	—	—	—
—	83.5	19	SS	48-50/3"	—	—
—	84.3	—	—	—	—	—
—	—	—	—	—	—	—
—	—	—	—	—	—	—
—	88.5	20	SS	18-29-50	—	—
—	90.0	—	—	—	—	—
—	—	—	—	—	—	—
—	—	—	—	—	—	—
<u>93.0'</u>	—	—	—	—	—	—
—	93.5	21	SS	45-50/4"	—	—
—	94.4	—	—	—	—	—
—	—	—	—	—	—	—
—	—	—	—	—	—	—
—	98.5	22	SS	23-50/5"	—	—
—	99.4	—	—	—	—	—
—	—	—	—	—	—	—
—	—	—	—	—	—	—

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DRILLERS TEST BORING LOG

PAGE 4 of 5

TEST HOLE L-8

PROJECT: PORT OF CLEVELAND WETBED

CLIENT: HTWIN CORP

WATER/ENCOUNTERED 5' 11"

DRILLED: 12-19-90

BY: D. HEPNER

WATER/COMPLETION 3'

WATER/

ELEV. FT.	SAMPLE DEPTH	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT	CLASSIFICATION	GROUND WATER
103.5	104.5	23	SS	25-49	VDENSE GRAY CLAYY SILT SANDY w/ GRAVELS & R. FRAGS, LAYERS w/ GRAY	MOIST
108.5	108.9	24	SS	50/5"	SILTY CLAY SANDY w/ GRAVELS & R. FRAGS, w/ SHALE COBBLES & BOULDERS	TO
113.5	113.9	25	SS	50/5"		WCT
118.5	119.5	26	SS	45-50/4		
121.0	121.4	27	SS	50/5"		
124.0	124.9	28	SS	38-50/5"		
129.0	129.8	29	SS	46-50/4"		
131.5	134.0	30	SS	28-38-99	GRAY CLAYY SILT, SANDY TRACE GRAVELS & R. FRAGS w/ SAIL SAND & GRAYCL LAYERS	

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DRILLERS TEST BORING LOG

PAGE 5 of 5

TEST HOLE 4-8

PROJECT: PORT OF CLEVELAND WST 3RD

CLIENT: LOWIN CORP

WATER/ENCOUNTERED 5' 8 1/2

DRILLED: 12-20-90

BY: D. H. P. N. R.

WATER/COMPLETION 3'

WATER/

ELEV. FT.	SAMPLE DEPTH	SAMPLE		BLOW COUNT	CLASSIFICATION	GROUND WATER
		NO.	TYPE			
139.0 140.3	31	SS	25.44-50.4"			MOIST TO WET
144.0 145.0	32	SS	68.127	VI HARD CLAYCY SILT SANDY W/ GRAVELS & R. FRAGS W/ SHALE COBBLES & BOUNDRS		MOIST TO WET
149.0 149.2	33	SS	50.12"			
154.0 154.2	34	SS	50.12"	HARD GRAY SHALE		MOIST
				TO 154.2'		

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DRILLERS TEST BORING LOG

PAGE 1 of 2

TEST HOLE L-10

PROJECT: PORT OF CLEVELAND W^{2nd} ST

CLIENT: LEWIN CORP

WATER/ENCOUNTERED 7.5'

DRILLED: 12-15-90

BY: D. HCPNER

WATER/COMPLETION 8.4'

WATER/

ELEV. FT.	SAMPLE DEPTH	SAMPLE NO. TYPE		BLOW COUNT	CLASSIFICATION	GROUND WATER
12'	1.0	1	SS	20-10-7	LIMESTONE GRAVEL <u>FILL</u>	MOIST 7.5' WET
	2.5				BLACK CINDERS SHAG, w/ COAL RED BRICK - <u>FILL</u>	
	3.5					
	5.0	2	SS	7-7-4		
	5.0	3	SS	6-6-7		
	6.5					
12.5'	8.5	4	SS	7-13-5		WET WET
	10.0				BLACK FINE TO MED SILTY SAND TRACE GRAVELS	
14.0	13.5	5	SS	8-10-13	GRAY FINE TO MED SILTY SAND w/ SOME GRAVELS	
	15.0					
	18.5					
	20.0	6	SS	7-10-14		
22.0						MOIST TO WET
	23.5				STIFF GRAY SILTY CLAY TRACE FINE SAND w/ LAYERS CLAYCY SILT	
	25.0	7	SS	3-5-7		
	28.5					
31.0	30.0	8	SS	3-4-6		
						WET
	33.5				MED STIFF GRAY SILTY CLAY TRACE FINE SAND	
	35.0	9	SS	8-3-4		

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DRILLERS TEST BORING LOG

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TEST HOLE L-10

PROJECT: PORT OF CLEVELAND WST 320

CLIENT: hzw,n corp

WATER/ENCOUNTERED 2.5

DRILLED: 12.15.90

BY: D. HEPNER

WATER/COMPLETION 8 4/1

WATER/

ELEV. FT.	SAMPLE DEPTH	SAMPLE		BLOW COUNT	CLASSIFICATION	GROUND WATER
		NO.	TYPE			
400	385 400	10	SS	2-3-2	MED STIFF GRAY SILTY CLAY TRACE FINE SAND	
					TD 40.0	

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DRILLERS TEST BORING LOG

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TEST HOLE L-11

PROJECT: PORT OF CLEVELAND WST 3RD

CLIENT: LEWIN CORP

WATER/ENCOUNTERED 7.0'

DRILLED: 12-21-90

BY: D HEPNER

WATER/COMPLETION 6.3'

WATER/

ELEV. FT.	SAMPLE DEPTH	SAMPLE NO.	TYPE	BLOW COUNT	CLASSIFICATION	GROUND WATER
2"	—				PAVEMENT	
9.0'	1.5	1	SS	50/3"	LIMESTONE GRAVEL - FILL	
9.5'	1.8				CONCRETE	
	3.5	2	SS	6-7-11		
7.0'	5.0	3	SS	3-8-6	BLACK CINDERS, SLAG - RED BRICK FRAGS, WOOD FIBERS, IRON ORG PELLETS FILL -	MOIST
	8.5	4	SS	10-21-28	DENSE TO MEDIUM DENSE, LAYERED, BLACK & GRAY MIXED & LAYERED FINE TO MED SILTY SAND, TRACE ORGANICS	
	10.0	5	SS	6-21-32	BRICK FRAGMENTS, POSS FILL?	WET
	18.5	6	SS	12-14-23		
21.5'	20.0					
	23.5	7	SS	5-11-18	MED DENSE GRAY CLAYEY SILT W/ FINE SAND, SOME SILTY CLAY LAYERS	
	25.5	8	SS	8-12-14		
	27.0	9	SS	6-11-9		
	28.5					
	30.0					
	33.5					
	35.0	10	SS			

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TEST HOLE 4-11

WATER/

70 40.0'

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TEST HOLE L-12

PROJECT: Port of Cleveland.

CLIENT: D.V. Lewin Corp.

WATER/ENCOUNTERED 5.0'

DRILLED: 12-17-90 BY: Tom Suchan

WATER/COMPLETION 3.5'

WATER/

ELEV. FT.	SAMPLE DEPTH	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT	CLASSIFICATION	GROUND WATER
3"					Fine Brn Sand	
6"					Limestone Gravel	
		1	SS	12-10-10	Brn + Black Layered Foundry	MOIST
		2	SS	6-7-11	Sand w/ Slag + Gravels w/ Brick	
					Layer @ 2.3'	
		3	SS	2-25-19		WET
		4	SS	4-4-4		
14.0'					Green Clayey Silt	
15.0'		5	SS	9-3-6	Black w/ Gray Fine Silty Sand	WET
					Dense Brn Fine to MED w/ some	
					Course Sand + Trace Gravels	
		6	SS	12-21-23		
22.0'					Stiff Gray Silty Clay w/ small	WET
		7	SS	5-6-9	Layers Fine to MED. Sand	
		8	SS	5-7-8		WET
		9	SS	5-8-12		

w-3-4

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TEST HOLE L-12

CLIENT: D. V. Lewin Corp

WATER/ENCOUNTERED 5.0'

DRILLED: 12-17-90 BY: Tom Suchan

WATER/COMPLETION 3.5'

WATER/

50.0

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DRILLERS TEST BORING LOG

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TEST HOLE L-13

PROJECT: Port of Cleveland

CLIENT: D.V. Lewin Corp

WATER/ENCOUNTERED 5.0'

DRILLED: 12-17-90

BY: Tom Suchan

WATER/COMPLETION CAVE 3.5'

WATER/

ELEV. FT.	SAMPLE DEPTH	SAMPLE NO.	TYPE	BLOW COUNT	CLASSIFICATION	GROUND WATER
<u>1.0'</u>	—				1" Limestone Gravel over Iron ore Pellets.	
<u>2.0'</u>	—	1	SS	29-14-13	Whitish Fine to Med Sand	
	—	2	SS	4-4-11	Black Sand w/ Gravels w/ Some slag Trace Brick, Concrete, Glass.	MOIST
	—	3	SS	6-11-8		
	—	4	SS	50/2"		
	—	5	SS	13-15-14	(Fill)	WET
<u>12.0'</u>	—					
	—	6	SS	10-6-5	Fine to Med Black Sand w/ Some Gravels	
	—				(Fill)?	
<u>18.0'</u>	—					
<u>19.0'</u>	—	7	SS	33-33-46	WOOD	WET
	—				Lt Brn Fine to Med Sand	
<u>23.5'</u>	—	8	SS	2-4-6	Stiff Gray Silty Clay w/ Small Lenses silt + Sand + Possible small Layers Fine Sand.	WET
	—	9	SS	3-5-6		
	—	10	SS	4-6-6		

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TEST HOLE L-13

PROJECT: Port of Cleveland

CLIENT: D.V. Lewin Corp.

WATER/ENCOUNTERED 5.0

DRILLED: 12-12-90

BY: Tom Suchan

WATER/COMPLETION CAVE 3.5'

WATER/

[illegible]

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TEST HOLE L-14

PROJECT: Port of Cleveland

CLIENT: D.V. Lewin Corp

DRILLED: 12-13-90

BY: Tom Suchan

WATER/ENCOUNTERED 13.5'

WATER/COMPLETION 12.5'

WATER/

ELEV. FT.	SAMPLE DEPTH	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT	CLASSIFICATION	GROUND WATER
7'	—	—	—	—	6" concrete 1" to 2" Limestone	MOIST
—	—	1	SS	23-24-24	Dense Brn Fine to MED Sand w/ some Gravels	
5.5'	—	2	SS	24-26-19	(Fill)	
—	—	3	SS	7-5-4	Loose Black Foundry Sand w/ Gravels Trace Brick & Slag w/ Layers	
—	—	4	SS	w/ 1/2" - 1"	Fine Brn Sand	WET
12.0'	—	—	—	—	Loose Fine Brn Silty Sand	
15.0'	—	5	SS	1/16" - 2/2"	MED Dense Gray & Black Fine silty Sand w/ some MED TO Coarse Gravels & some cobbles	
21.5'	—	6	SS	6-7-7	Very Dense to MED Dense Fine To MED Gray Sand w/ Trace Cobbles @ 26.0'	WET
—	—	7	SS	11-17-30	stiff Gray Silty Clay w/ Fine Sand Lense	
29.0'	—	8	SS	6-6-7	—	
—	—	9	SS	3-5-7	—	—

4-8-10

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PAGE 2 of 2.

PROJECT: Part of Cleveland

CLIENT: D.V. Lewis Corp

DRILLED: 12-13-90

BY: Tom Sochan

WATER/ENCOUNTERED 13.5'

WATER/COMPLETION 12.5'

WATER/

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PAGE 1 of 1

PROJECT: Port of Cleveland

CLIENT: D.V. Levin Corp

WATER/ENCOUNTERED 2.0' Seepage

DRILLED: 12-14-90

BY: Tom Sochan

WATER/COMPLETION NONE

WATER/

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PAGE 1 of 2

TEST HOLE L-15

PROJECT: PORT OF CLEVELAND WEST 9TH

SCAPABE ZONES - 51022

CLIENT: LEWIN CORP

WATER/ENCOUNTERED 22.0'

DRILLED: 12-15-90

BY: D. HEPNER

WATER/COMPLETION 13.5'

WATER/

ELEV. FT.	SAMPLE DEPTH	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT	CLASSIFICATION	GROUND WATER
<u>7'</u>	—				CONCRETE	
	2.5	1	SS	2-3-5	VL LOOSE BROWN FINE TO MED SILTY SAND LAYERED	
	4.0					
	5.0	2	SS	2-2-1	W/ GRAY + BRN SILTY SAND	WET
	6.5				Fill-?	
	8.5	3	SS	2-2-1		ZONES
	10.0					
<u>11.0'</u>	—					
	13.5	4	SS	3-3-3	LOOSE BROWN FINE TO MED SILTY SAND LAYERED W/	WET
	15.0				GRAY + BROWN MIXED FINE	ZONES
	18.5	5	SS	2-3-3	TOMED SILTY SAND, Fill-?	
	20.0					
<u>22.0'</u>	—					22.0' WET
	23.5	6	SS	3-6-20	MED DENSE BLACK + GRAY FINE TO MED SILTY SAND TRACE GRAVELS - W/ GRAVEL LAYERS	WET
	25.0					
<u>27.5'</u>	—					
	28.5	7	SS	5-8-7	STIFF GRAY SILTY CLAY TRACE FINE SAND LAYERED W/ GRAY	MOIST
	30.0					TO
	33.5	8	SS	3-4-7	CLAYY SILT TRACE FINE SAND	WET
	35.0					

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TEST HOLE L-15

PROJECT: PORT OF CLEVELAND WEST 9TH

STAPLE ZONES 5' to 22'

CLIENT: LTWIN CORP

WATER/ENCOUNTERED 22.0

DRILLED: 12-15-90

BY: D. H. C. P. R.

WATER/COMPLETION 13.5'

WATER/

[illegible]

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DRILLERS TEST BORING LOG

PAGE 1 of 2TEST HOLE L-16PROJECT: Port of ClevelandCLIENT: D.V. Lewin CorpWATER/ENCOUNTERED 14.0'DRILLED: 12-14-90BY: Tom SuchanWATER/COMPLETION CAVE 5.0'

WATER/

ELEV. FT.	SAMPLE DEPTH	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT	CLASSIFICATION	GROUND WATER
	0.0' — 0.8' —	1	SS	3-50/4"	Brown sand w/ Gravels, Brick, concrete, slag, metal, wood. (Fill)	
4.5'	2.5' — 4.0' —	2	SS	10-9-6		
	5.0' — 6.5' —	3	SS	8-34-50/5"	Dense Black + Gray sand w/ Gravels + Brick, Concrete, Trace Glass, Slag (Fill)	moist
14.0'	8.5' — 10.0' —	4	SS	25-27-24		
		5	SS	100/4"		
		6	SS	9-25-50/2"	Dense Brown sand, Gravel, w/ Brick + Concrete into Black + Gray sand + Gravel w/ Sandstone- + Brick (Fill), Concrete	WET
20.5'		7	SS	14-27-26		
		8	SS	18-10-11	Dense Fine to med sand w/ some coarse sand + Brick Black w/ Gray Layer	
28.7'		9	SS	4-6-8	Firm Gray Fine Silty Sand.	
		10	SS	W-1-3		

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DRILLERS TEST BORING LOG

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TEST HOLE B L-16

PROJECT: Port of Cleveland

CLIENT: D. V. Lewin

WATER/ENCOUNTERED 14.0'

DRILLED: 12-14-90 BY: Tom Suchan

WATER/COMPLETION CAVE 5.0'

WATER/

ELEV. FT.	SAMPLE DEPTH	SAMPLE NO.	TYPE	BLOW COUNT	CLASSIFICATION	GROUND WATER
<u>380'</u>	—				Loose Black Fine Silty Sand	
	—					
	—					
	—	11	SS	3-4-6	Stiff Gray Silty Clay	WET
	—					
	—					
	—					
	—	12	SS	3-5-7	" "	
	—					
	—					
	—					
	—	13	SS	3-5-7		WET
	—					
	—					
	—					
<u>600'</u>	—	14	SS	3-5-6		
	—					
	—					
	—					
	—	15	SS	2-4-6		
	—					
	—					
	—					
	—					
	—					

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DRILLERS TEST BORING LOG

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TEST HOLE L-17

PROJECT: PORT OF CLEVELAND

CLIENT: D. LEWIN CORP

DRILLED: 12-15-90

BY: BUCEY

WATER/ENCOUNTERED 8.5

WATER/COMPLETION CAUG. 17.0

WATER/

ELEV. FT.	SAMPLE DEPTH	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT	CLASSIFICATION	GROUND WATER
12"	1.0				ASPHALT 2" CONCRETE 10"	
	2.5	1	SS	50/6"	(FILL) ROCK FRAGS, COBBLES, MORTAR, RED BRICK ETC.	
4.5	4.0	2	SS	20-15-50		
	5.0					
	6.5	3	SS	7-8-9	Firm Brown SAND w/ some GRAVELS	
8.0	8.5					
	10.0	4	SS	2-3-3	Loose - FILL SLAG SAND, GRAVELS	WGT
	11.0					
	12.5					
	13.5				some 6" cobbles	
	15.0	5	SS	3-4-6		
18.0	16.0					
	18.5					
	20.0	6	SS	8-11-8	Firm GRAY coarse SAND w/ clay LENSE	SATURATED
23.0	21.0					
	23.5					
	25.0	7	SS	4-7-10	U. STIFF / Firm GRAY SILT & CLAY	
28.0	26.0					
	28.5					
	30.0	8	SS	3-4-7	STIFF GRAY STICKY CLAY	
33.0	31.0					
	33.5					
	35.0	9	SS	2-4-4	SOFT TO Firm GRAY STICKY CLAY	

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DRILLERS TEST BORING LOG

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TEST HOLE L-17

PROJECT: PORT OF CLEVELAND

CLIENT: D. LEWIN CORP.

DRILLED: 12-15-90

BY: BUCEY

WATER/ENCOUNTERED

WATER/COMPLETION

WATER/

ELEV. FT.	SAMPLE DEPTH	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT	CLASSIFICATION	GROUND WATER
					Firm TO STIFF GRAY STICKY CLAY w/ SILT SEAMS	SATURATED
	38.5					
	40.0	10	SS	3-4-5		
	43.5					
	45.0	11	SS	3-4-5		
	48.5					
	50.0	12	SS	5-6-11	U. STIFF	
	53.5					
	55.0	13	SS	4-6-9		
	58.5					
	60.0	14	SS	6-8-15		
	63.5					
	65.0	15	SS	7-12-18		
	68.5					
	70.0	16	SS	7-22-21	HARD	

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DRILLERS TEST BORING LOG

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TEST HOLE L-17

PROJECT: PORT OF CLEVELAND

CLIENT: A.C.T.

WATER/ENCOUNTERED

DRILLED: 12-15-96

BY: Bucay

WATER/COMPLETION

WATER/

ELEV. FT.	SAMPLE DEPTH	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT	CLASSIFICATION	GROUND WATER
720	73.5				HARD GRAY STICK CLAY	SATURATED
	75.0	17	SS	9-13-22	HARD GRAY SILT CLAY w/ GRAVELS + ROCK FRAGMENTS	MOIST
	78.5					
	80.0	18	SS	8-16-22		
	83.5					
	85.0	19	SS	8-14-90		
	88.5					
	90.0	20	SS	7-11-19	U-STIFF	
920	93.5				DENSE GRAY SILT w/CLAY SEAMS	
	95.0	21	SS	7-13-21	17-13-21	
970	98.5					
	100.0	22	SS	15-21-40	HARD GRAY SILT CLAY w/ GRAVELS + ROCK FRAS.	
100.0					T.O. 100.6	

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TEST HOLE OK-18

PROJECT: PORT OF CLEVELAND

CLIENT: D. V. LEWIN CORP

WATER/ENCOUNTERED 100' WCT

DRILLED: 12-9-90 BY: H. GIBEL

WATER/COMPLETION 101

WATER/

ELEV. FT.	SAMPLE DEPTH	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT	CLASSIFICATION	GROUND WATER
<u>4'</u>	—				BLACK TOP	
<u>16"</u>	—				CONCRETE	
	2.0 3.5	1	SS	12-17-18	BROWN SILTY SAND, LINDERS	
	5.0 6.5	2	SS	9-9-7	SLAG, RED BRICK, TRACE WOOD FIBERS, FILL	MOIST
<u>11.0'</u>	9.0 10.5	3	SS	3-5-6		100' WCT
	14.0 15.5	4	SS	5-5-5	LOOSE GRAY FINE TO MED SILTY SAND W/ LAYER COAL & GRAVEL FILL?	WCT
<u>16.5'</u>	19.0 20.5	5	SS	16-24-32	VI DENSE GRAY FINE SILT SAND W/ LAYER W/ MED DENSE FINE TO MED SAND, TRACE SMALL GRAVEL LAYERS	WCT
<u>25.1'</u>	24.0 25.5	6	SS	9-7-9		
	29.0 30.5	7	SS	5-8-12	MED DENSE GRAY CLAY/SILT TRACE FINE SAND W/ SILTY CLAY LAYERS	MOIST TO WCT
	34.0 35.5	8	SS	5-9-11		

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TEST HOLE L-18

PROJECT: PORT OF CLEVELAND

CLIENT: D. V. LEWIN

WATER/ENCOUNTERED 100'

DRILLED: 12-9-90 BY: DON. HEPNER

WATER/COMPLETION 10'

WATER/

ELEV. FT.	SAMPLE DEPTH	SAMPLE NO. TYPE	BLOW COUNT	CLASSIFICATION	GROUND WATER
<u>38.5'</u>					
	39.0 40.5	9 SS	6-6-6	STIFF GRAY SILTY CLAY TRACE FINE SAND W/ LAYERS GRAY MCD DENSE CLAYCY SILT W/ FINE SAND	MOIST TO WET
	44.0 45.5	10 SS	2-4-6		
	49.0 50.5	11 SS	3-4-8		
<u>30'</u>					
	54.0 55.5	12 SS	6-7-12	STIFF GRAY SILTY CLAY TRACE FINE W/ LAYERS	MOIST TO WET
	69.0 60.5	13 SS	5-9-11	GRAY MCD DENSE CLAYCY SILT W/ FINE SAND	
	64.0 65.5	14 SS	6-8-13		
	69.0 70.5	15 SS	6-10-14		

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TEST HOLE **BL-18**

CLIENT: D. V. LEWIS

WATER/ENCOUNTERED 10.0'

DRILLED: 12-9-90 BY: DON HEPNER

WATER/COMPLETION 1.0²

WATER/

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DRILLERS TEST BORING LOG

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TEST HOLE 2.18

PROJECT: PORT OF CLEVELAND 15TH ST

CLIENT: LEWIN CORP

WATER/ENCOUNTERED 10.0'

DRILLED: 12-10-90

BY: D. HEPNER

WATER/COMPLETION 1.0'

WATER/

ELEV. FT.	SAMPLE DEPTH	SAMPLE NO.	TYPE	BLOW COUNT	CLASSIFICATION	GROUND WATER
<u>106.0'</u>	—					
	104.0	22	SS	50 F025"	VI HARD GRAY CLAYCY SILT	MOIST TO WET
	104.4				SANDY W/ GRAVELS & R. FRABS	
	109.0	23	SS	50 F025"	LAYERD W/ SILTY CLAY/SANDY	
	109.4				W/ GRAVELS & R. FRABS SOME COBBLES	
	114.0	24	SS	48-50		
<u>116.5'</u>	116.0					
	119.0	25	SS	22-31-33	HARD GRAY CLAYCY SILT	MOIST TO WET
	120.5				TRACE FINE SAND LAYERD	
	124.0	26	SS	17-21-25	W/ GRAY SILTY CLAY	
	126.5				SMALL SAND LAYERS	
	129.0	27	SS	10-16-23-111		
<u>130.5'</u>	131.0					
	134.0	28	SS	50/5"	VI HARD GRAY CLAYCY SILT SANDY	
	134.4				W/ GRAVELS & R. FRABS	

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TEST HOLE 218

CLIENT: Lewin Corp

WATER/ENCOUNTERED 12.0

DRILLED: 12-10-90

BY: P. HCPNCR

WATER/COMPLETION 1.01

WATER/

TD 135.2'

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DRILLERS TEST BORING LOG

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TEST HOLE L-19

PROJECT: PORT OF CLEVELAND

CLIENT: DAVID LEWIN CORP

WATER/ENCOUNTERED 6.5'

DRILLED: 12-8-1990 BY: DHPNCR

WATER/COMPLETION

WATER/

ELEV. FT.	SAMPLE DEPTH	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT	CLASSIFICATION	GROUND WATER
	—					
	2.0	1	SS	6-4-5	BLACK CINDRES, BRN SILTY	
	3.5				SAND, SLAG - BROWN CINDRES	moist
	5.0	2	SS	2-1-1	TRACES, BRICK, WOOD FIBRES	
	6.5					6.5'
	8.5	3	SS	7-10-15	<u>FILL</u>	
11.5	10.0					
	13.5	5	SS	5-12-15	BLACK FINE TO MED SILTY	
	15.0				SAND	wet
17.5'	16.5					
	18.5	6	SS	12-7-20	GRAY FINE TO MED SILTY SAND	
	20.0					wet
21.5'	21.5					
	23.5	7	SS	4-6-8	GRAY CLAYey SILT TRACE	
	25.0				FINE SAND	
	26.5					
	28.5	8	SS	7-10-13		wet
	30.0					
	32.5	9	SS	9-15-19		
	35.0					

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DRILLERS TEST BORING LOG

PAGE 2 of 3

TEST HOLE L-19

PROJECT: PORT OF CLEVELAND

CLIENT: DAVID LEWIN CORP

WATER/ENCOUNTERED 6.5'

DRILLED: 12-8-90

BY: D H PNER

WATER/COMPLETION

WATER/

ELEV. FT.	SAMPLE DEPTH	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT	CLASSIFICATION	GROUND WATER
<u>370'</u>						
	38.5				MCD STIFF GRAY SILTY	
	40.0	10	SS	2-3-3	CLAY TRAC FINE SAND	
						WCT
	43.5					
	45.0	11	SS	2-4-5		
<u>48.0'</u>						
	48.5					
	50.0	12	SS	4-8-12	V1 STIFF GRAY SILTY CLAY	
					SANDY W/ GRAVELS & ROCK FRAGS	
	53.5					
	55.0	13	SS	5-7-9	LAYERED, W/ GRAY CLAYY SILT	
					SANDY W/ GRAVELS & R. FRAGS	WCT
	58.5					
	60.0	14	SS	8-11-17		
	63.5					
	65.0	15	SS	7-11-16		
	68.5					
	70.0	16	SS	8-13-19		

OHIO TEST BOR, INC.

6711 Sunderland Drive • Parma, Ohio 44129 • (216) 842-5454

DRILLERS TEST BORING LOG

PAGE 3 of 3

TEST HOLE L-19

PROJECT: PORT OF CLEVELAND

CLIENT: DAVID LEWIN CORP

WATER/ENCOUNTERED 6.5'

DRILLED: 12-8-90

BY: D. HEPLER

WATER/COMPLETION

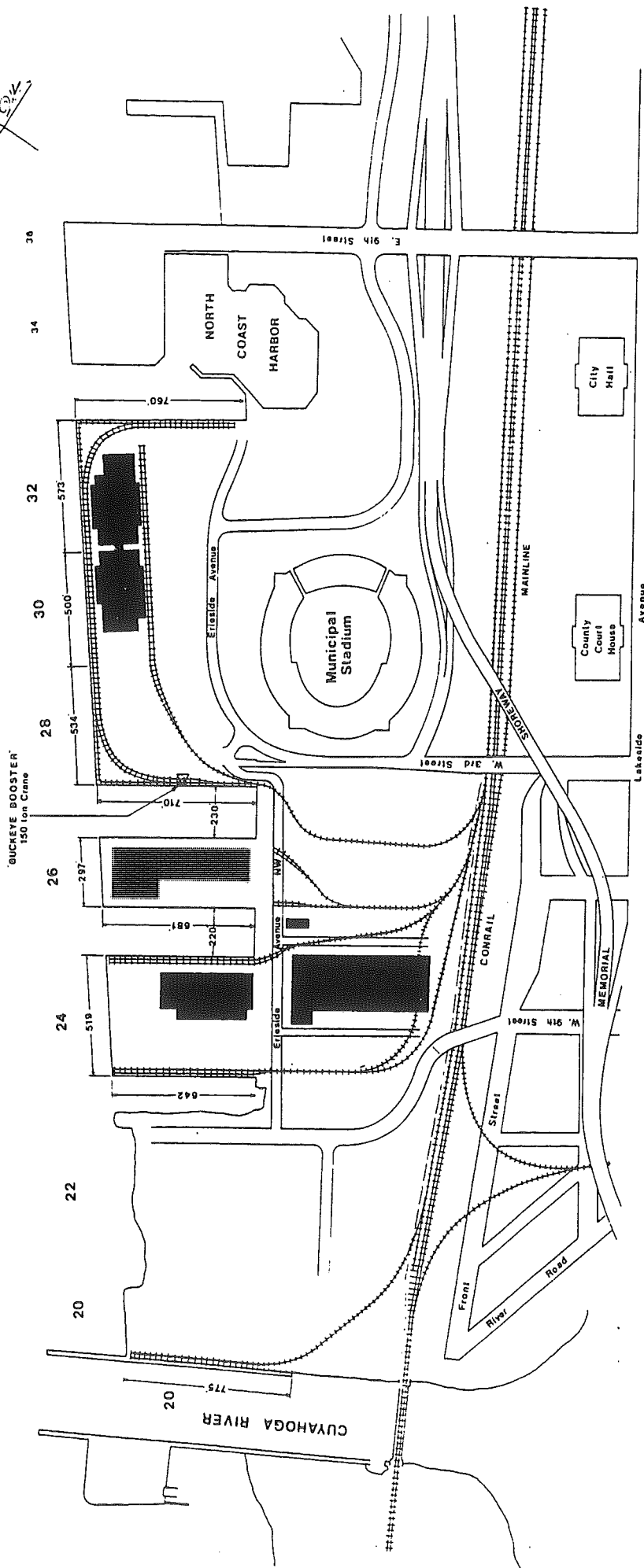
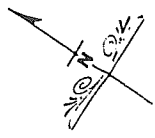
WATER/

ELEV. FT.	SAMPLE DEPTH	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT	CLASSIFICATION	GROUND WATER
	73.5				V. STIFF GRAY SILTY CLAY SANDY	
	75.0	17	SS	9-14-17	W/ GRAVELS & R. FRAGS L.A./CRD	
					W/ GRAY CLAYCY SILT SANDY	MOIST
	78.5					TO
	80.0	18	SS	10-17-21	W/ GRAVELS & R. FRAGS	DUCT
	83.5					
	85.0	19	SS	12-17-22		
	88.5					
	90.0	20	SS	7-9-13		
91.0'						
	93.5				HARD GRAY CLAYCY SILT SANDY	MOIST
	94.5	21	SS	25-62	W/ GRAVELS & R. FRAGS, SOME	
					COBBLES,	
	98.5					
99.0	99.0	22	SS	57 FOR 6"		
					TD 99.0'	

OHIO TESTBOR, INC.

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CLEVELAND HARBOR

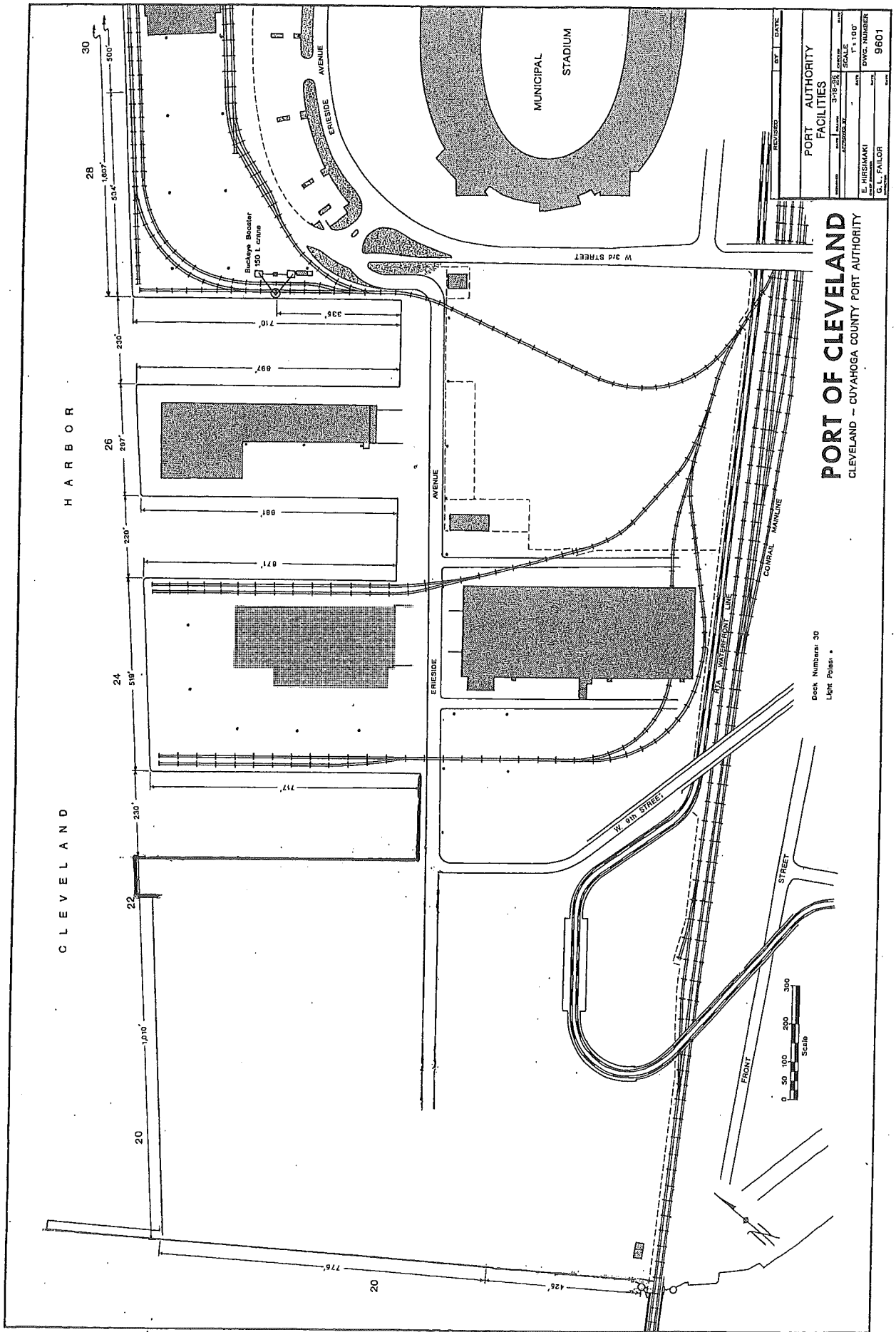


DOCK NUMBERS: 24



PORT OF CLEVELAND
CLEVELAND - CUYAHOGA COUNTY PORT AUTHORITY

REVISED	BY	DATE
1	A	1/1/71
PORT AUTHORITY FACILITIES		
J.H. 21571	DATE	1/1/71
E.E. HIRSIMAKI	DATE	1/1/71
A.F. FUGARO	DATE	1/1/71
DWC NUMBER		8700



Cleveland

22



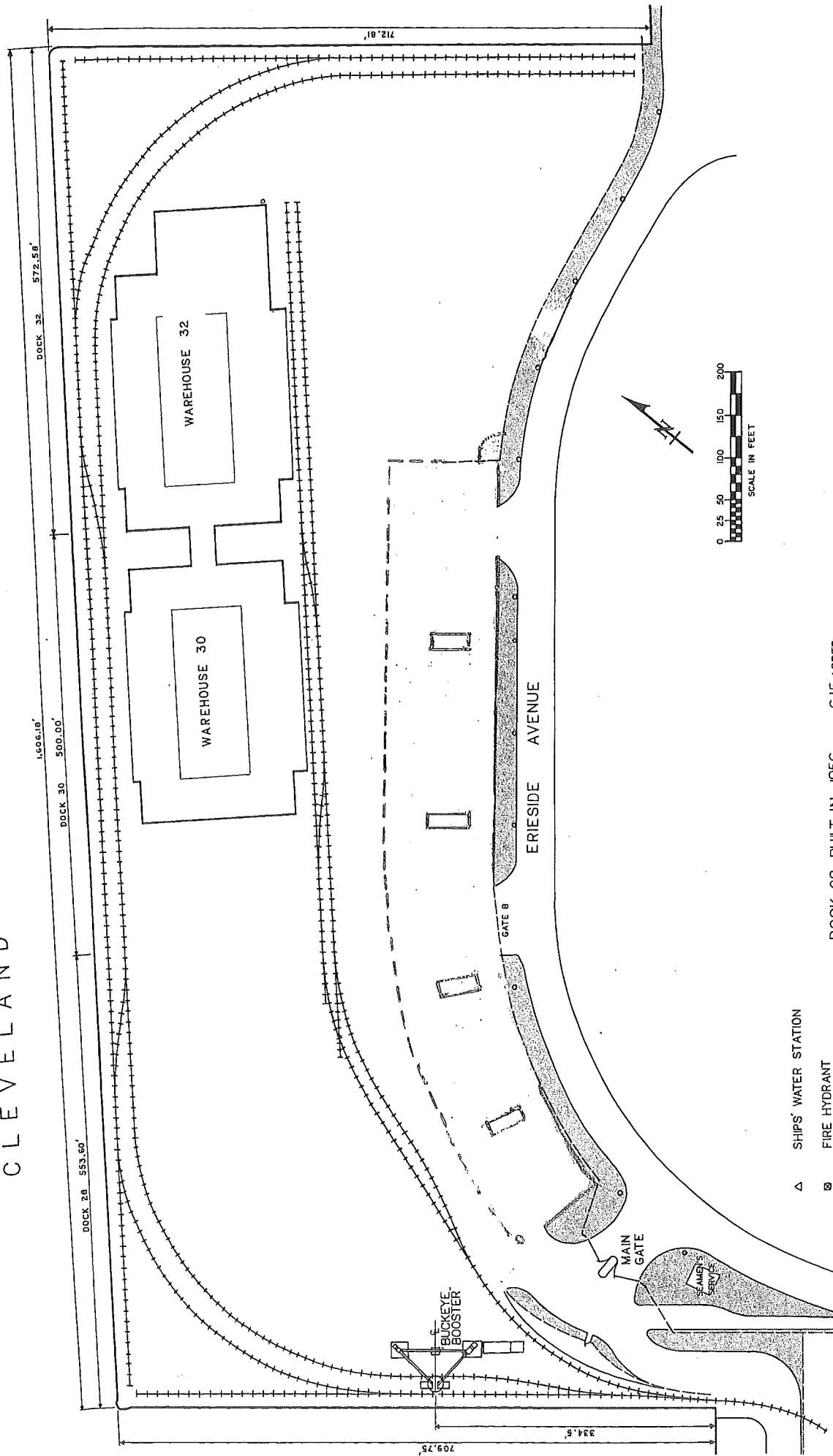
• Light Pole
--- Fence

REVISED	BY	DATE
GENERAL PLAN port Facilities		
DESIGNED BY	EN	DATE
APPROVED BY	9-23-92	
SHEET NO.		DATE
1		1" = 100'
DWC NUMBER		
2000		
DESIGNED BY	DATE	
A. F. Pugliese		
APPROVED BY	DATE	

PORT OF CLEVELAND

CLEVELAND - CUYAHOGA COUNTY PORT AUTHORITY

CLEVELAND HARBOR



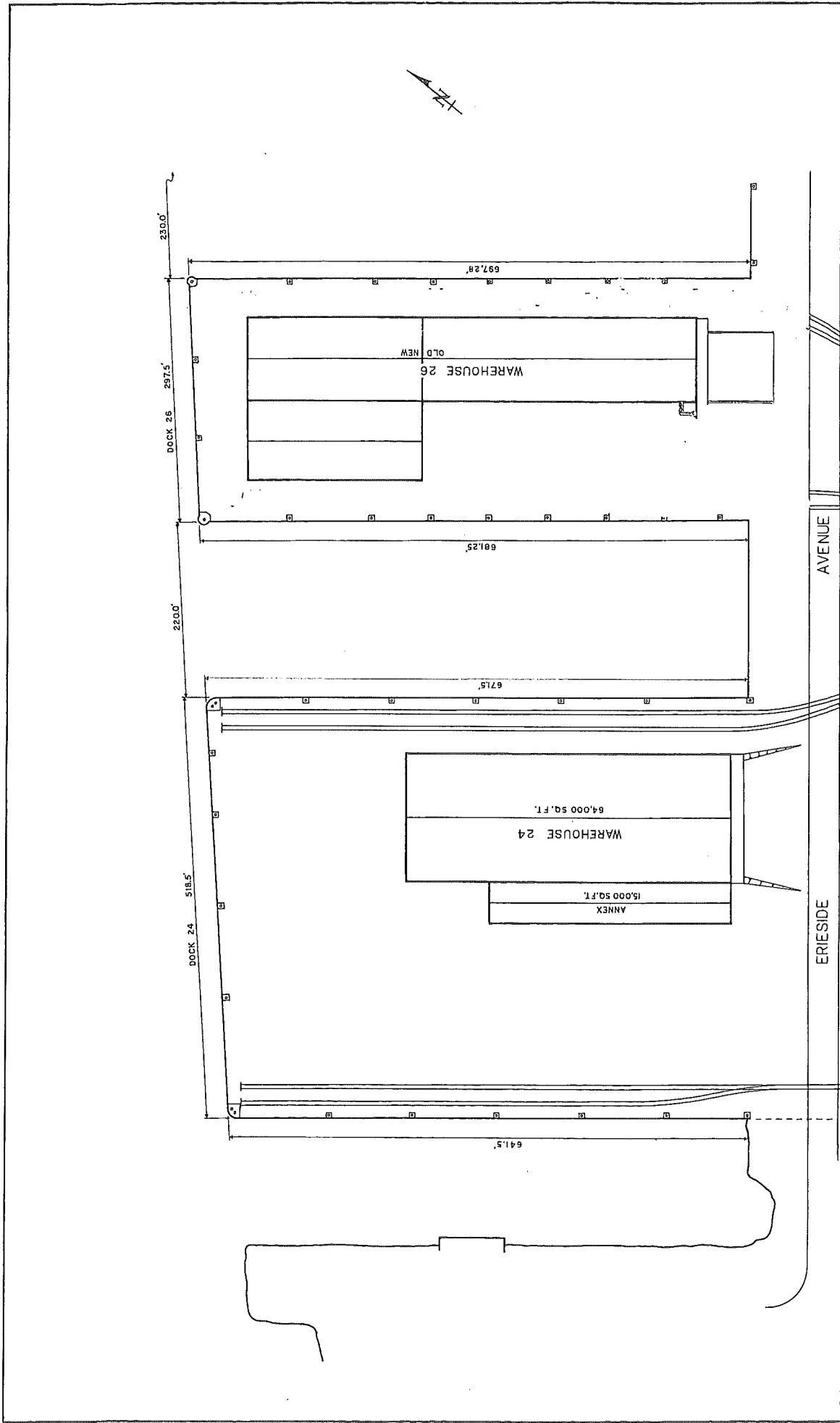
DOCK 28	BUILT IN 1956	6.15 ACRES
DOCK 30	BUILT IN 1961	5.58 ACRES
DOCK 32	BUILT IN 1961	7.86 ACRES
TOTAL:		19.59 ACRES

- △ SHIPS' WATER STATION
- FIRE HYDRANT
- CHAIN LINK FENCE
- TELEPHONE POLE
- GRASS

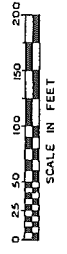
GENERAL PLAN DOCKS 28 - 30 - 32	
DATE	SCALE
1/1/61	1" = 50'
DESIGNED BY E. E. HIRSIMAKI	DWG. NUMBER 1086-1
CHECKED BY C. J. BURKE	DATE

PORT OF CLEVELAND

CLEVELAND - CUYAHOGA COUNTY PORT AUTHORITY



DOCK 24 BUILT IN 1966 9.87 ACRES
 DOCK 26 BUILT IN 1958 5.85 ACRES
 (ABOVE ACREAGE INCLUDES LAND IN ERIESIDE AVENUE)



GENERAL PLAN DOCKS 24-26			
DATE	BY	CHECKED	SCALE
10/86	E. F. HIRSIMAKI	A. F. FUGARO	1" = 50'
DWG. NUMBER	1086-20		

PORT OF CLEVELAND CLEVELAND — CUYAHOGA COUNTY PORT AUTHORITY

ERIESIDE AVENUE

Harbor

Cleveland

32

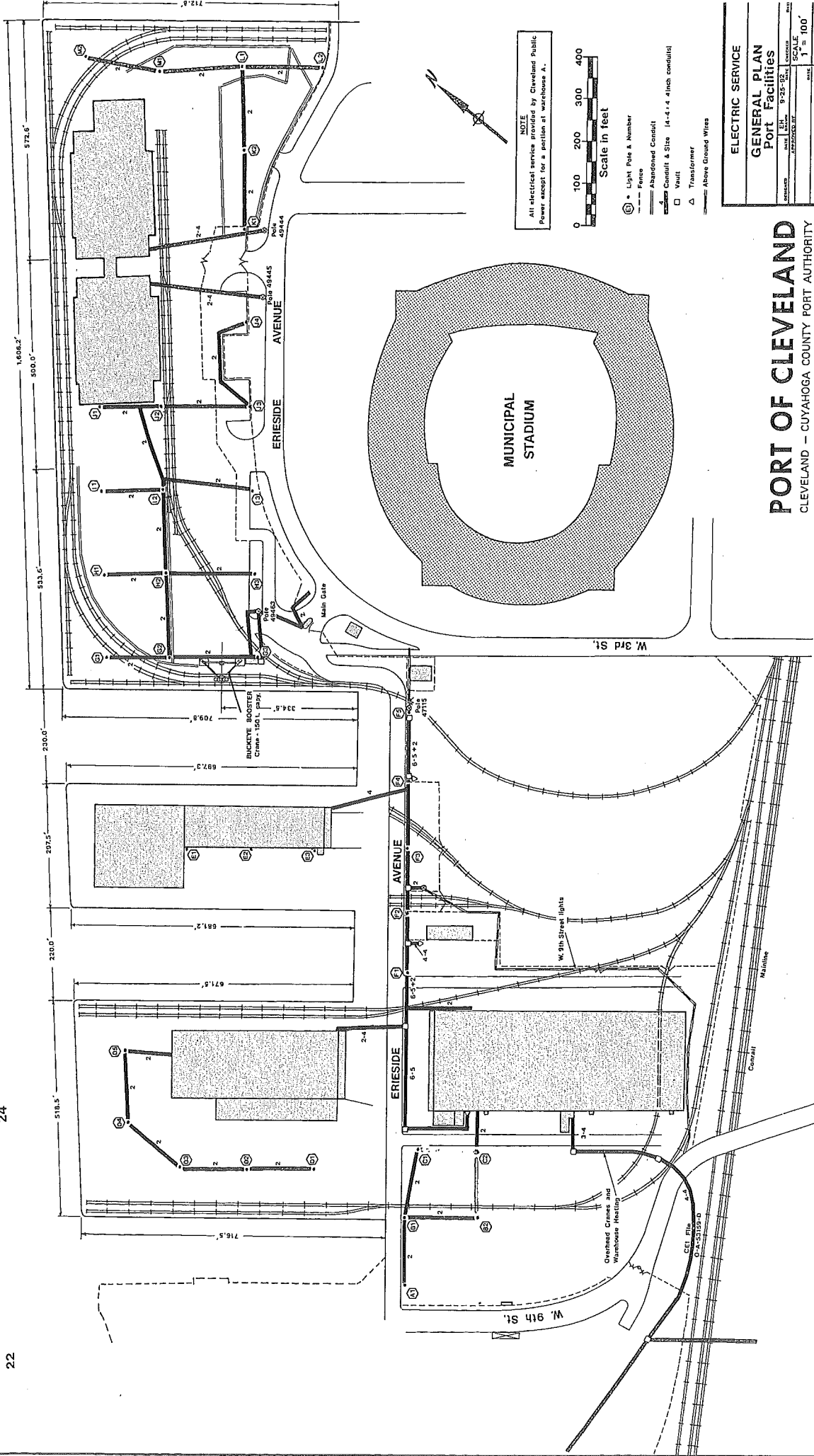
30

28

26

24

22



ELECTRIC SERVICE			
GENERAL PLAN			
Port Facilities			
DESIGNED BY	DATE	LOCATED BY	DATE
ENGINEER	DATE	APPROVED BY	DATE
SCALE		SCALE	
1" = 100'		1" = 100'	
DWG. NUMBER		DWG. NUMBER	
2000E		2000E	

PORT OF CLEVELAND

CLEVELAND - CUYAHOGA COUNTY PORT AUTHORITY

Harbor

Cleveland

32

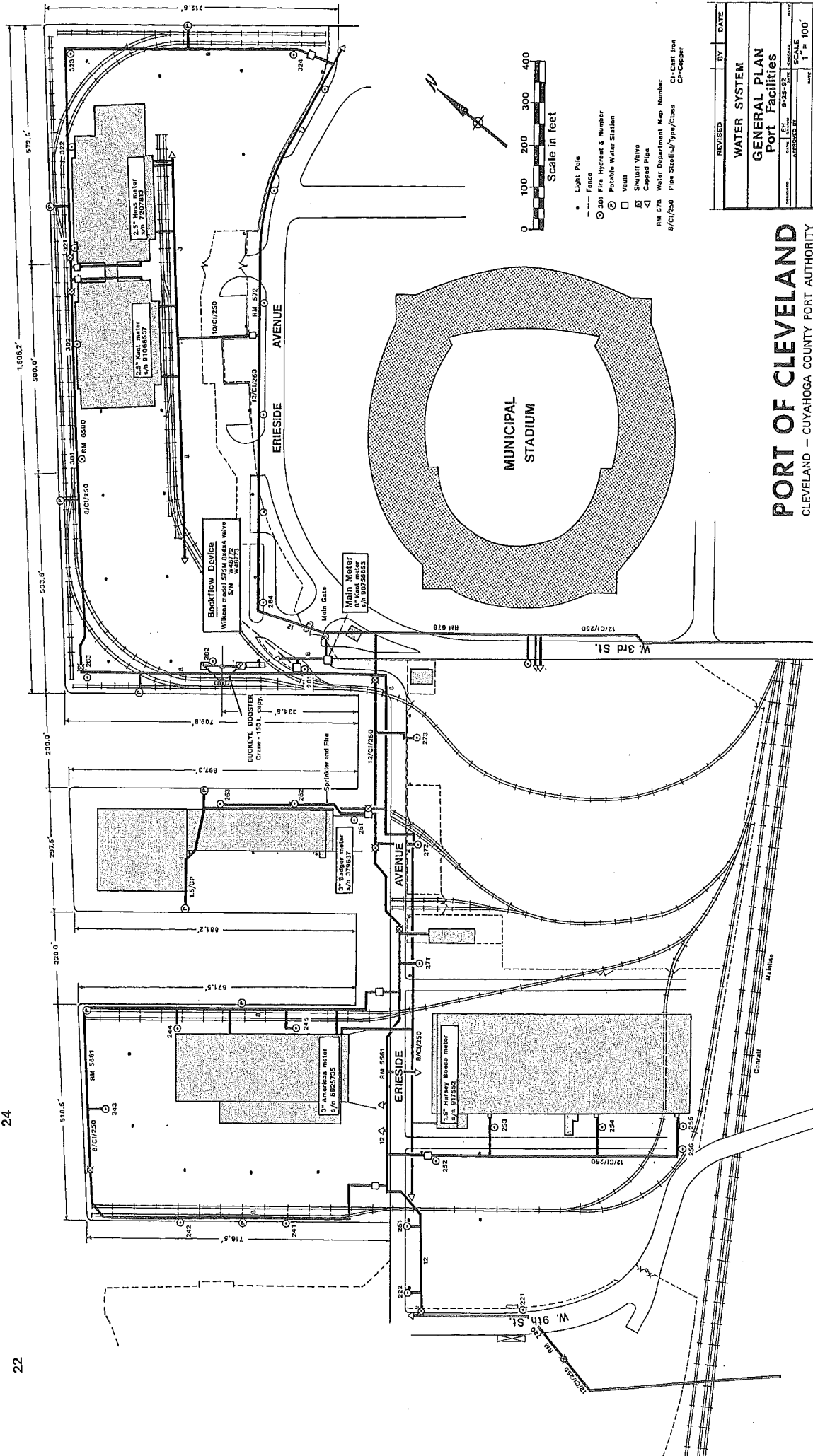
30

28

26

24

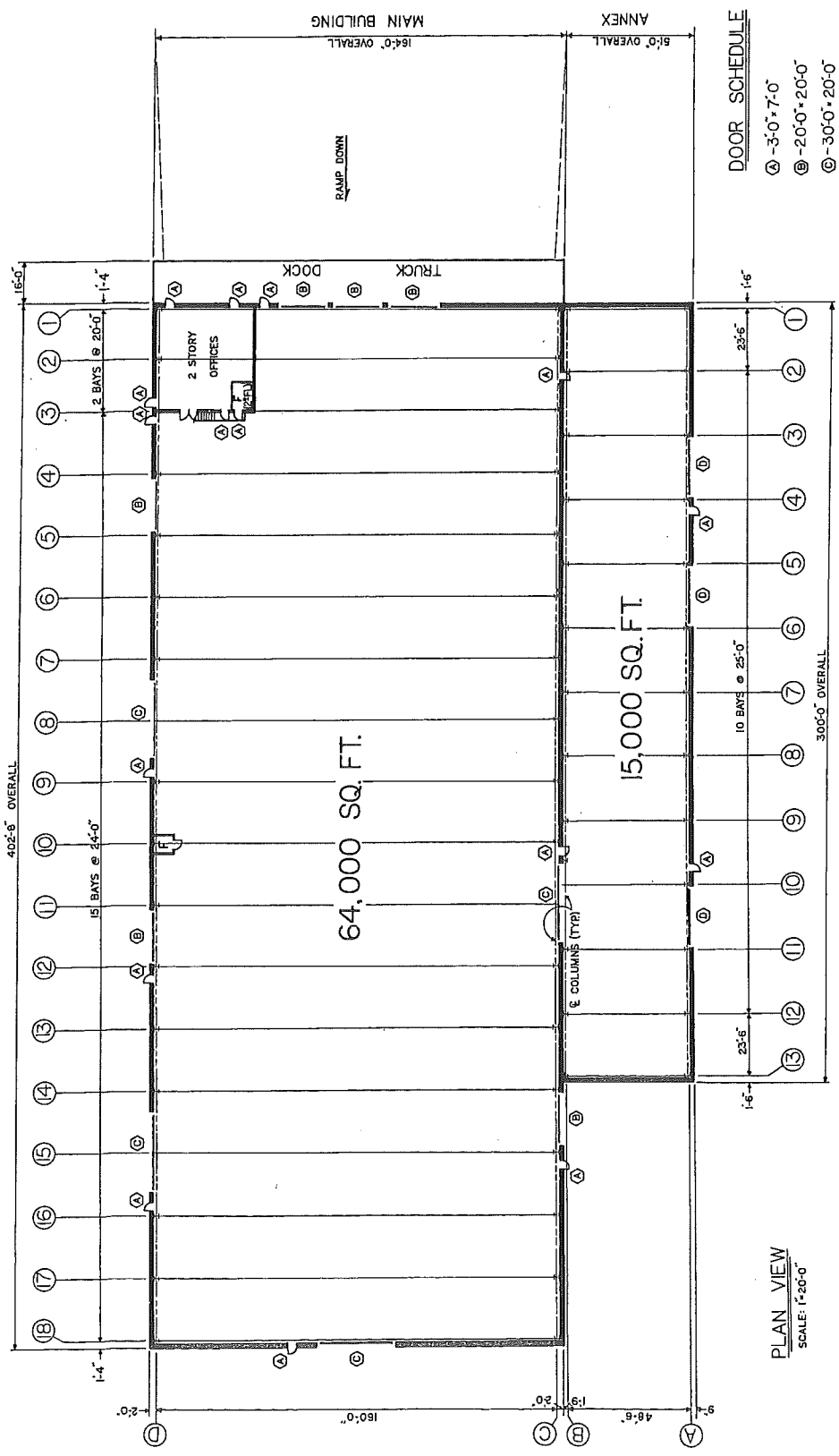
22



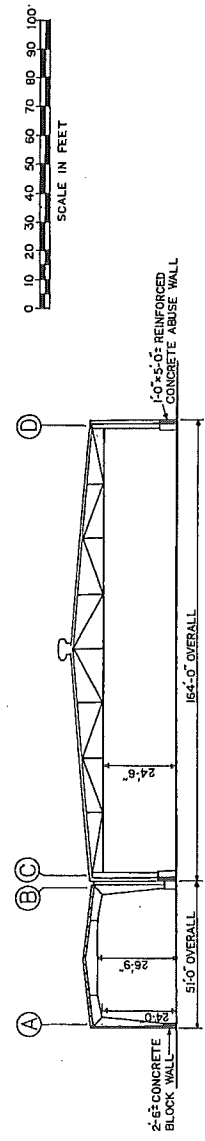
PORT OF CLEVELAND

CLEVELAND - CUYAHOGA COUNTY PORT AUTHORITY

REVISED	BY	DATE
WATER SYSTEM		
GENERAL PLAN		
Port Facilities		
DESIGNED	DATE	SCALE
10/1/72	10/1/72	1" = 100'
DRAWN	DATE	DWG. NUMBER
E. E. Wiersma	10/1/72	2000W
A. E. Fugere		



PLAN VIEW
SCALE: 1"=20'-0"



TYPICAL SECTION
SCALE: 1"=20'-0"

DOOR SCHEDULE

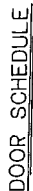
- A - 3'-0" x 7'-0"
- B - 20'-0" x 20'-0"
- C - 30'-0" x 20'-0"
- D - 24'-0" x 24'-0"

NOTE: TYPE A AND B DOORS ARE
OVERHEAD ROLLING STEEL DOORS
F - RISER FOR SPRINKLER SYSTEM

REVISED	BY	DATE
WAREHOUSE	24	
GENERAL PLAN AND SECTION OF BUILDING		
DESIGNED BY	DATE	SCALE
E. HIRSHBAUM		AS NOTED
PROJECT NUMBER	2486-1	
CLIENT	C. T. BURKE	

PORT OF CLEVELAND
CLEVELAND - CUYAHOGA COUNTY PORT AUTHORITY

MAIN BUILDING BUILT IN 1970
ANNEX MOVED FROM DOCK 20 IN 1980



- Ⓐ $3\text{'}-0\text{'}$ \times $7\text{'}-0\text{'}$
 Ⓑ $17\text{'}-4\text{'}$ \times $14\text{'}-0\text{'}$
 Ⓒ $12\text{'}-0\text{'}$ \times $14\text{'}-0\text{'}$
 Ⓓ $22\text{'}-0\text{'}$ \times $18\text{'}-0\text{'}$
 Ⓔ $19\text{'}-0\text{'}$ \times $19\text{'}-0\text{'}$
 Ⓕ $29\text{'}-4\text{'}$ \times $20\text{'}-0\text{'}$

NOTE: ALL DOORS EXCEPT TYPE (A) DOORS ARE OVERHEAD ROLLING STEEL DOORS.

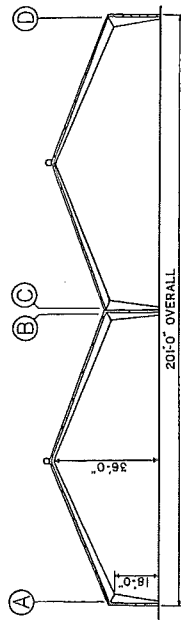
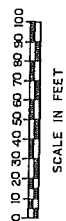
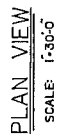
F- RISER FOR SPRINKLER SYSTEM OR OUTSIDE WALL HYDRANTS.

REMOVED ASBESTOS IN MAIN BUILDING	EN	12/17/89
ENLARGED OVERHEAD DOORS	CH	1/14/89
REMOVED	BY	DATE
WAREHOUSE 26		
GENERAL PLAN AND SECTION OF BUILDING		
APPROVED	DRAWN BY	DATE
	ATTACHED SET	SCALE
	DATE 12-20-89	AS NOTED
E. HIRSHWAKI		DWG. NUMBER
CHIEF ENGINEER		2686-1

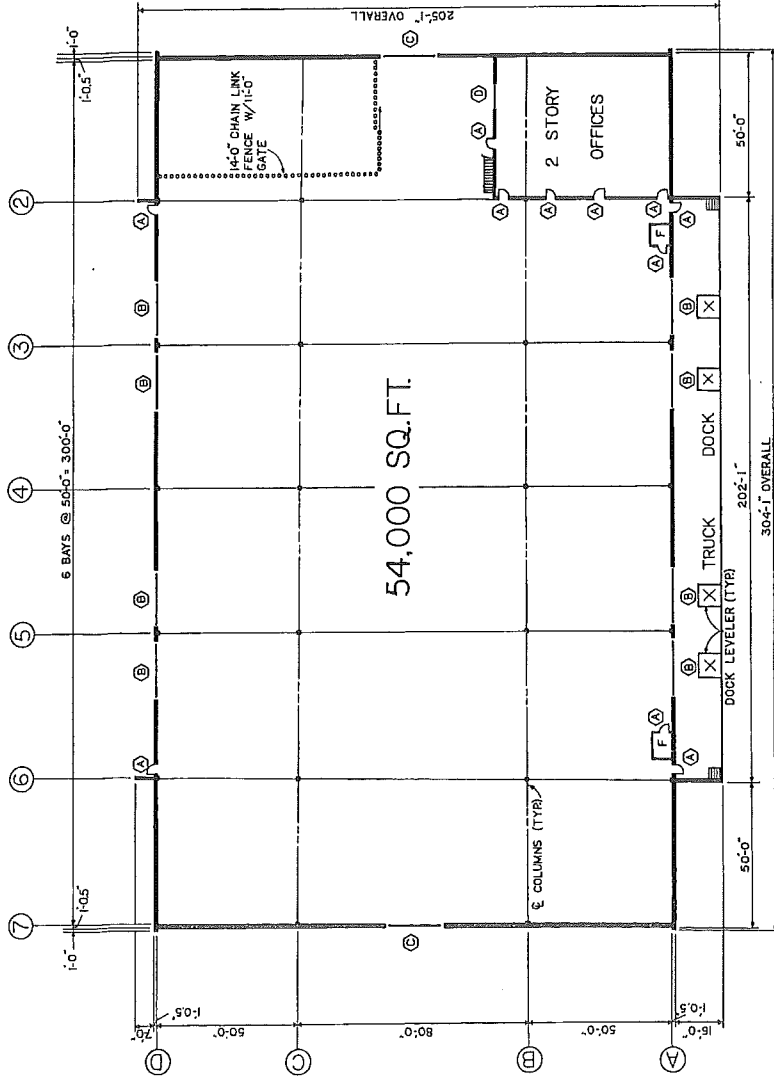
PORT OF CLEVELAND
CLEVELAND -- CUYAHOGA COUNTY PORT AUTHORITY

CLEVELAND -- CUYAHOGA COUNTY PORT AUTHORITY

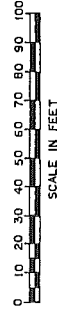
MAIN BUILDING BUILT IN 1959
ANNEX BUILT IN 1973 (EDA PROJECT NO: 06-1-0098)



TYPICAL SECTION IN ANNEX



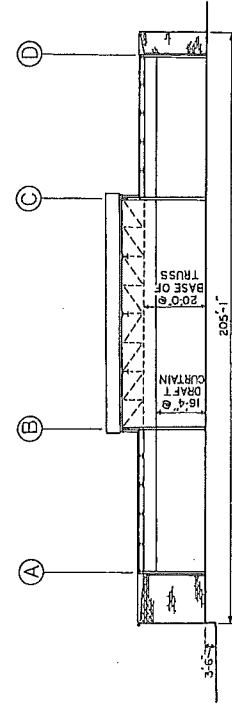
PLAN VIEW
SCALE: 1" = 20'-0"



NOTE: ALL DOORS EXCEPT TYPE (A) DOORS ARE
OVERHEAD ROLLING STEEL DOORS
F--RISER FOR SPRINKLER SYSTEM

DOOR SCHEDULE

- (A) 3'-0" x 7'-0"
- (B) 20'-0" x 16'-0"
- (C) 20'-0" x 18'-0"
- (D) 8'-0" x 9'-10"

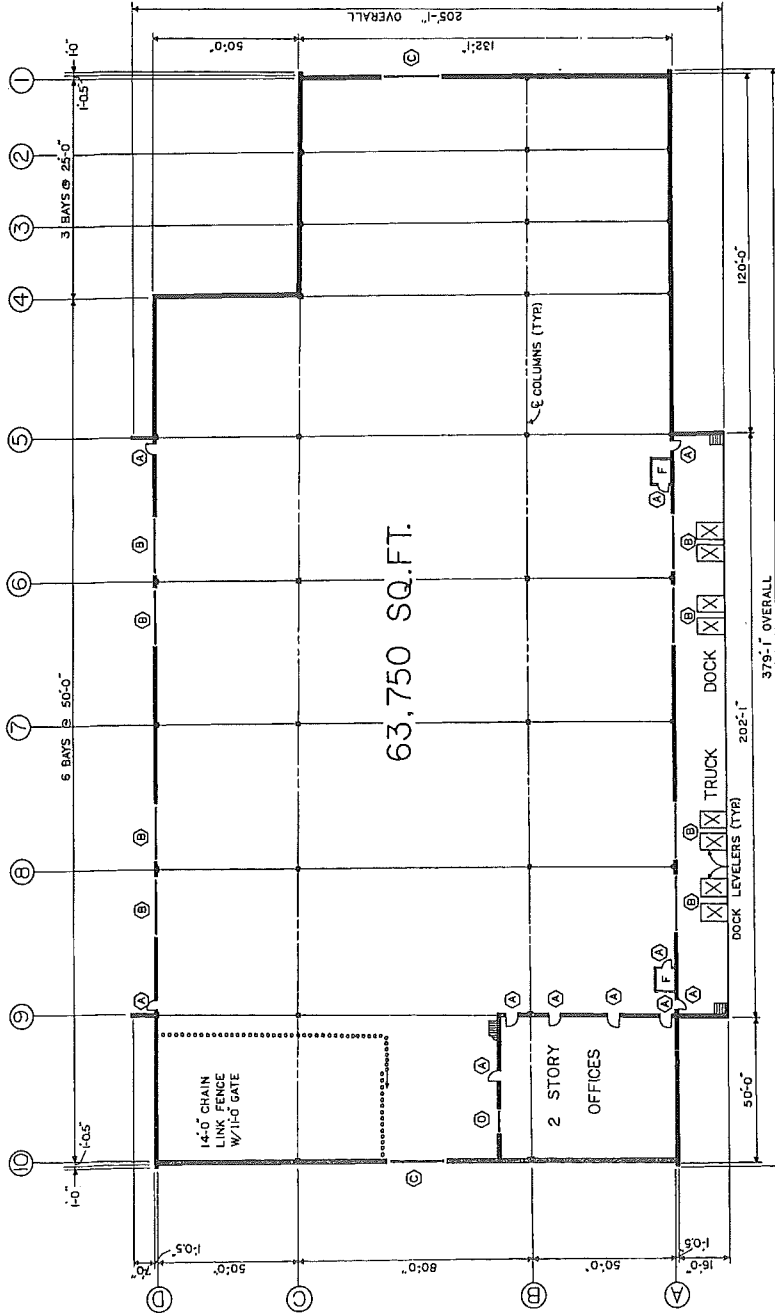


SECTION @ (5)
SCALE: 1" = 20'-0"

PORT OF CLEVELAND
CLEVELAND - CUYAHOGA COUNTY PORT AUTHORITY

BUILT IN 1964

REVISED	BY	DATE
WAREHOUSE	30	
GENERAL PLAN AND SECTION OF BUILDING		
DESIGNED BY	DATE	SCALE
DRAWN BY	DATE	SCALE
CHECKED BY	DATE	SCALE
APPROVED BY	DATE	SCALE
E. HIRSHMAN		
C. T. BURKE		
PROJECT NUMBER	3086-1	



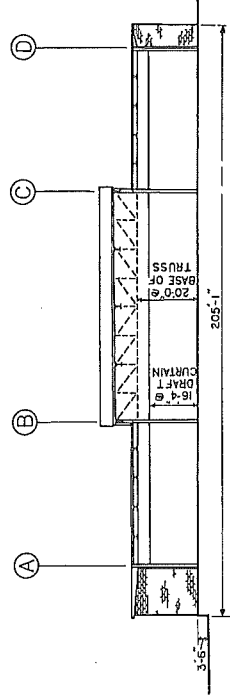
PLAN VIEW
SCALE: 1"=20'-0"



NOTE: ALL DOORS EXCEPT TYPE A DOORS ARE
OVERHEAD ROLLING STEEL DOORS
F - RISER FOR SPRINKLER SYSTEM

DOOR SCHEDULE

- A 3'-0" x 7'-0"
- B 20'-0" x 16'-0"
- C 20'-0" x 18'-0"
- D 8'-0" x 9'-10"



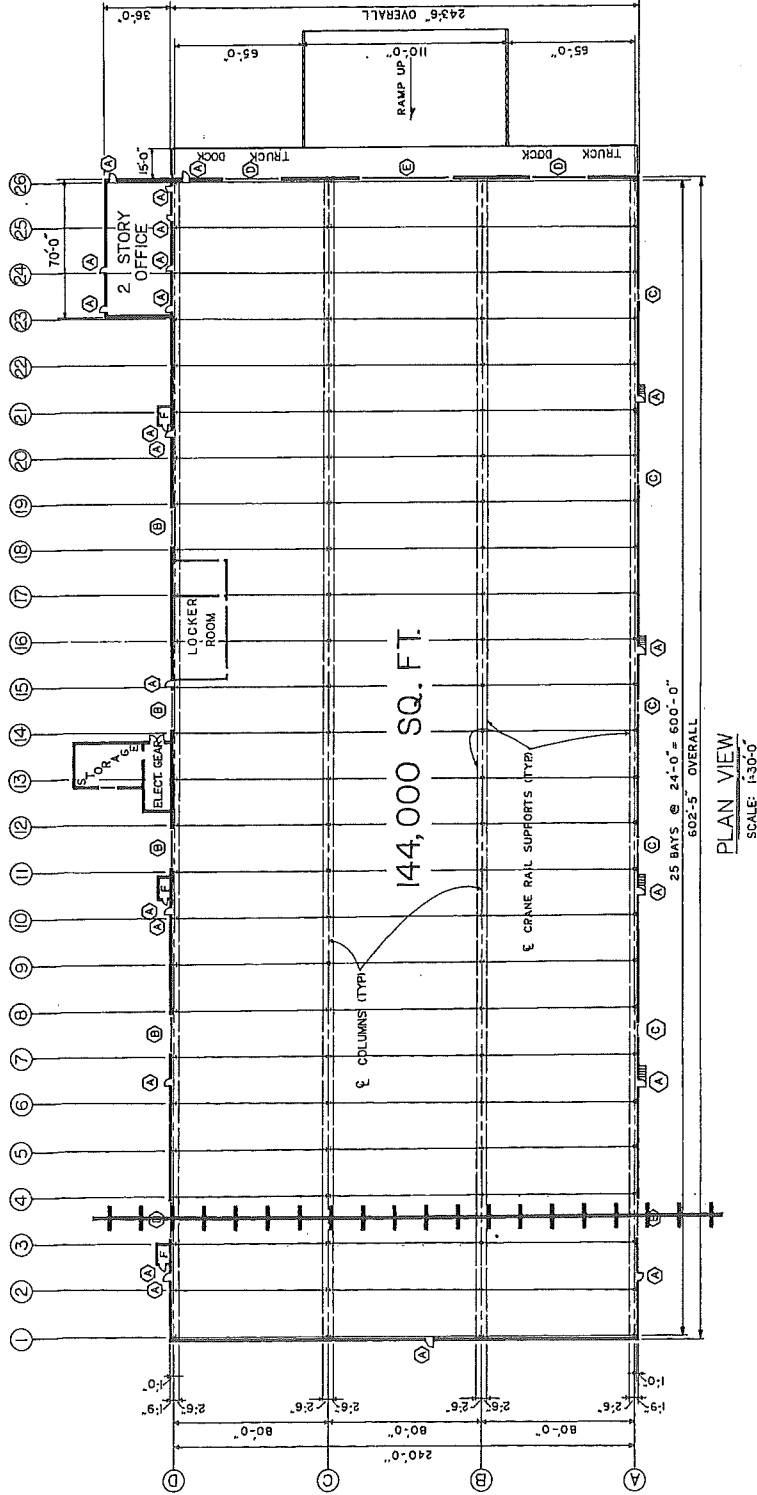
SECTION @ 7
SCALE: 1"=20'-0"

PORT OF CLEVELAND
CLEVELAND - CUYAHOGA COUNTY PORT AUTHORITY

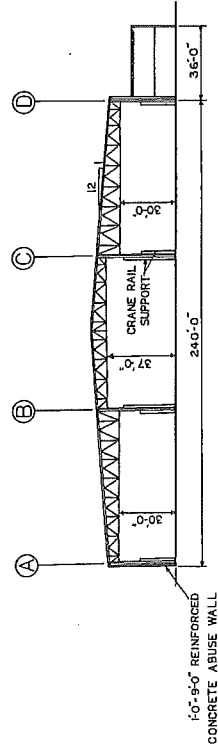
REVISED	BY	DATE
WAREHOUSE 32		
GENERAL PLAN AND SECTION OF BUILDING		
DESIGNED BY	SCALE	AS NOTED
DRAWN BY	DATE	DWG. NUMBER
E. HIRSIMAKI		3286-1
C. T. BURKE		

BUILT IN 1967

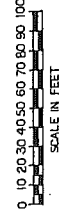
REMARKS



PLAN VIEW
SCALE: 1/32" = 1'-0"



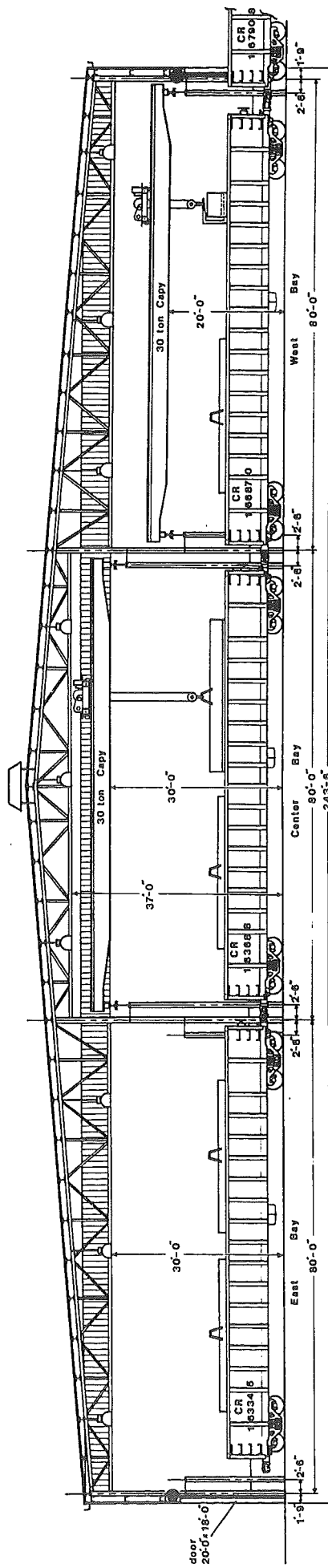
SECTION AT 25
SCALE: 1/32" = 1'-0"



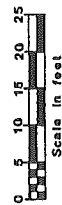
EDA PROJECT NO. 06-1-00998
HOAG WISNAR JOB NO. 1220
BUILT IN 1975

PORT OF CLEVELAND
CLEVELAND - CUYAHOGA COUNTY PORT AUTHORITY

REVISED	BY	DATE
WAREHOUSE	A	
GENERAL PLAN AND SECTION OF BUILDING		
DESIGNED BY	ARCHITECT	SCALE
E. HIRSHMAN	J.E.H.	2-12-86
DWG. NUMBER	AS NOTED	
2586-1		
C. T. BURKE		

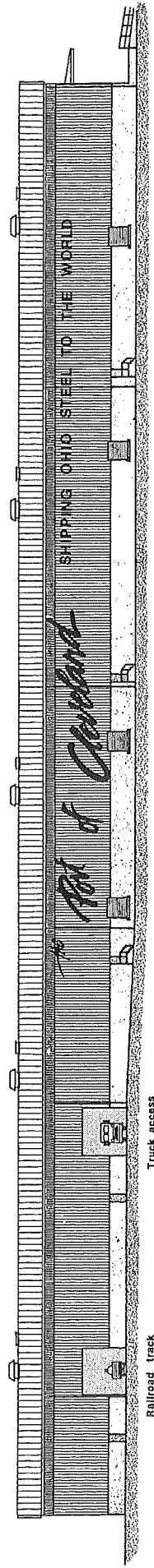


SECTION THRU TRAIN BAY



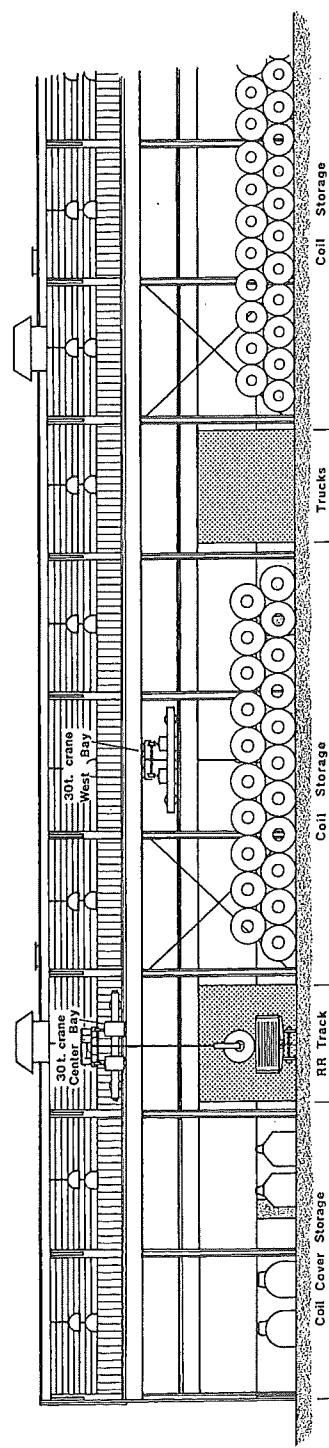
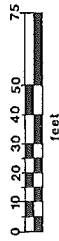
REVISED	BY	DATE
WAREHOUSE "A"		
Steel Handling Facility		
DESIGNED BY	DATE	SCALE
E. E. HIRSHIMAKI		1/8" = 1'-0"
CHECKED BY	DATE	SCALE
A. F. FUGARO		

PORT OF CLEVELAND CLEVELAND - CUYAHOGA COUNTY PORT AUTHORITY



EAST ELEVATION

Scale: 1" = 20'



SECTION THRU CENTER OF WAREHOUSE

Scale: 1" = 10'



REVISED	BY	DATE
WAREHOUSE 'A'		
DETAILS OF PROPOSED IMPROVEMENTS		
DESIGNED BY	DATE	SCALE
AS NOTED		
DWG. NUMBER		
E. E. HIRSIMAKI		
A. F. FUGARO		

PORT OF CLEVELAND CLEVELAND - CUYAHOGA COUNTY PORT AUTHORITY

REPORT ON SOIL CONDITIONS

FOR

CLEVELAND PORT AUTHORITY

RELOCATION PROJECT

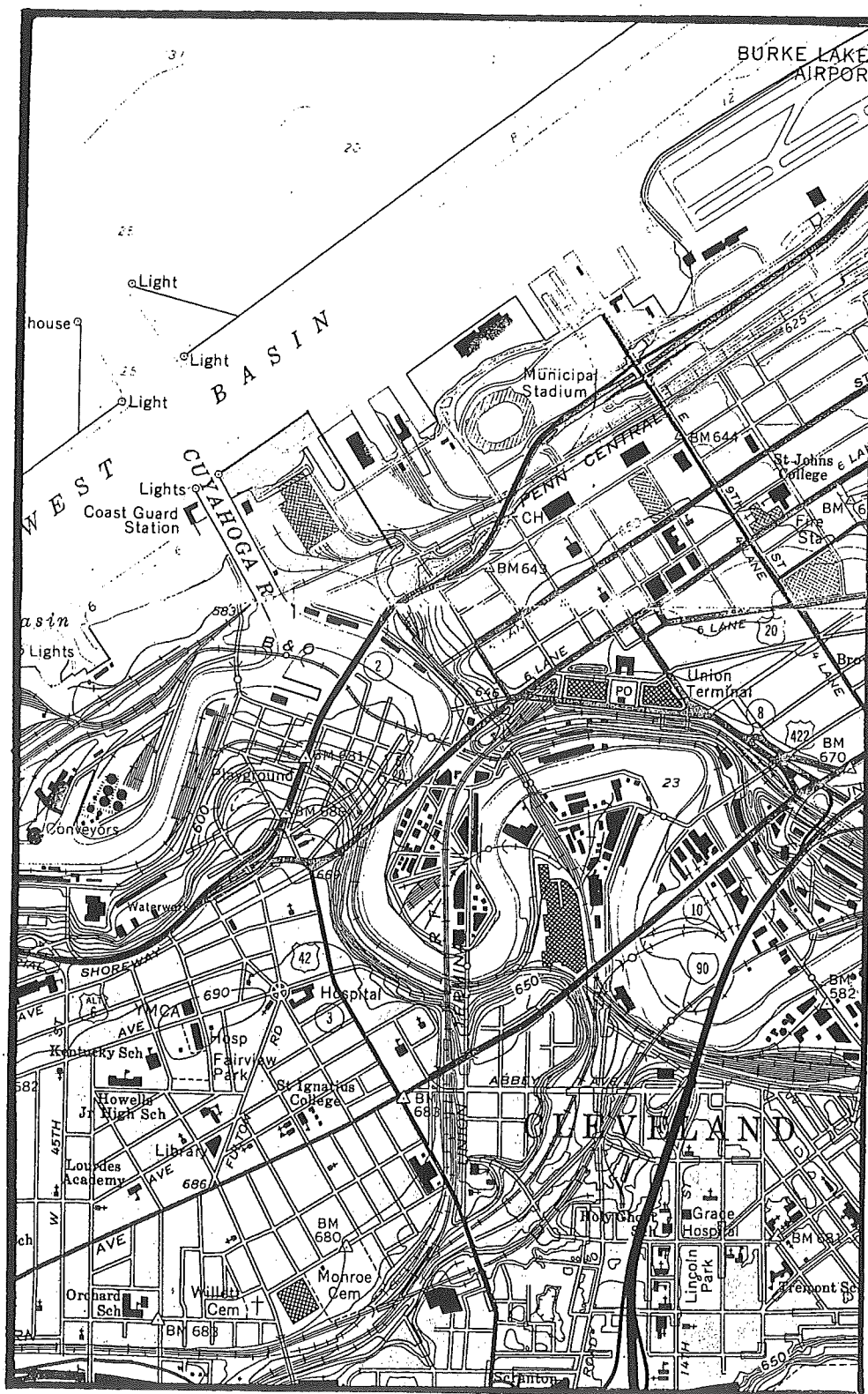
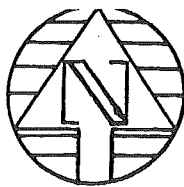
P. O. NO. 2430

C. 4533

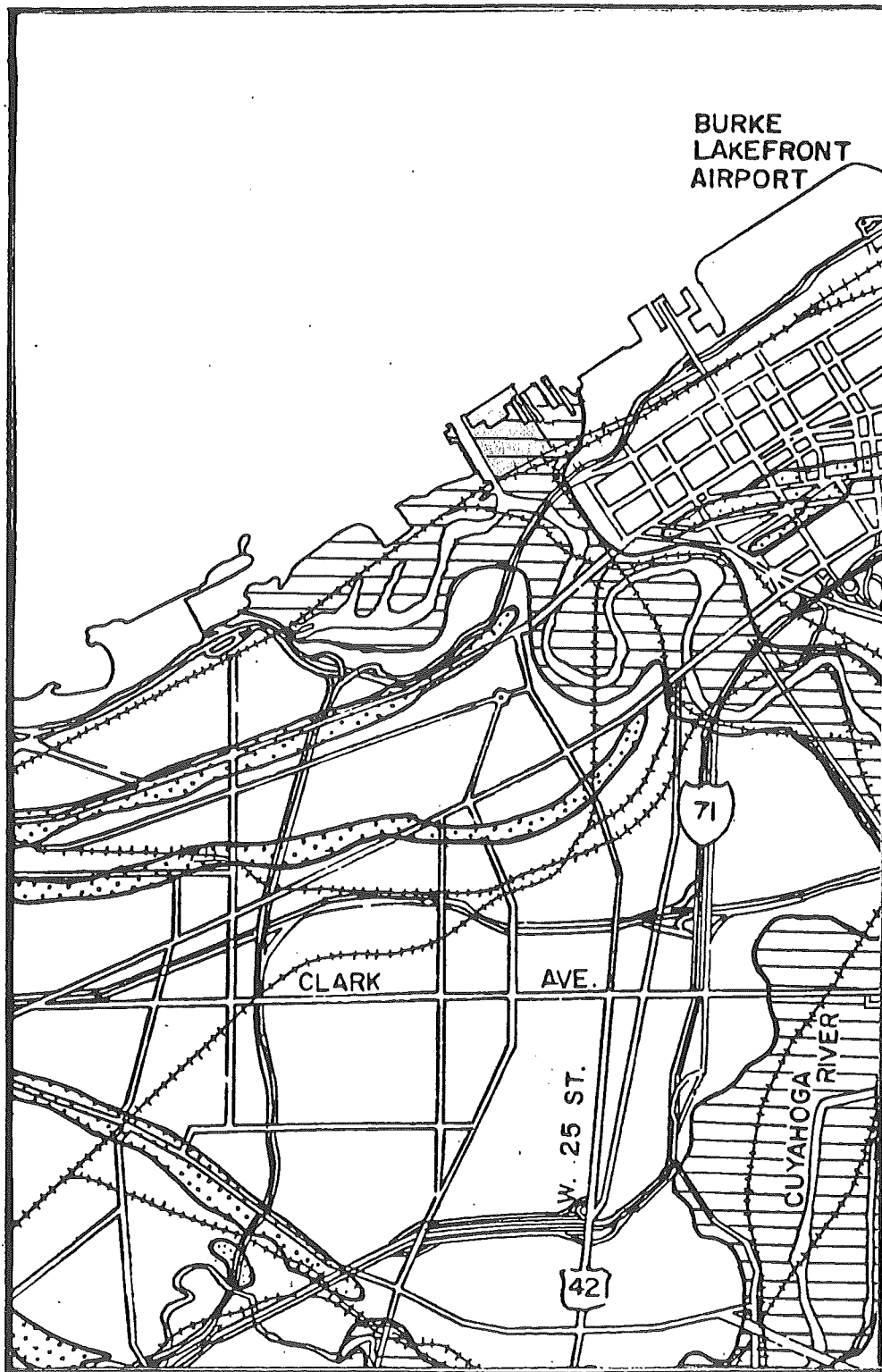
David V. Lowin Corp./Geotechnical Engineering

400 Bulkeley Bldg./1501 Euclid Ave., Cleveland, Ohio 44115












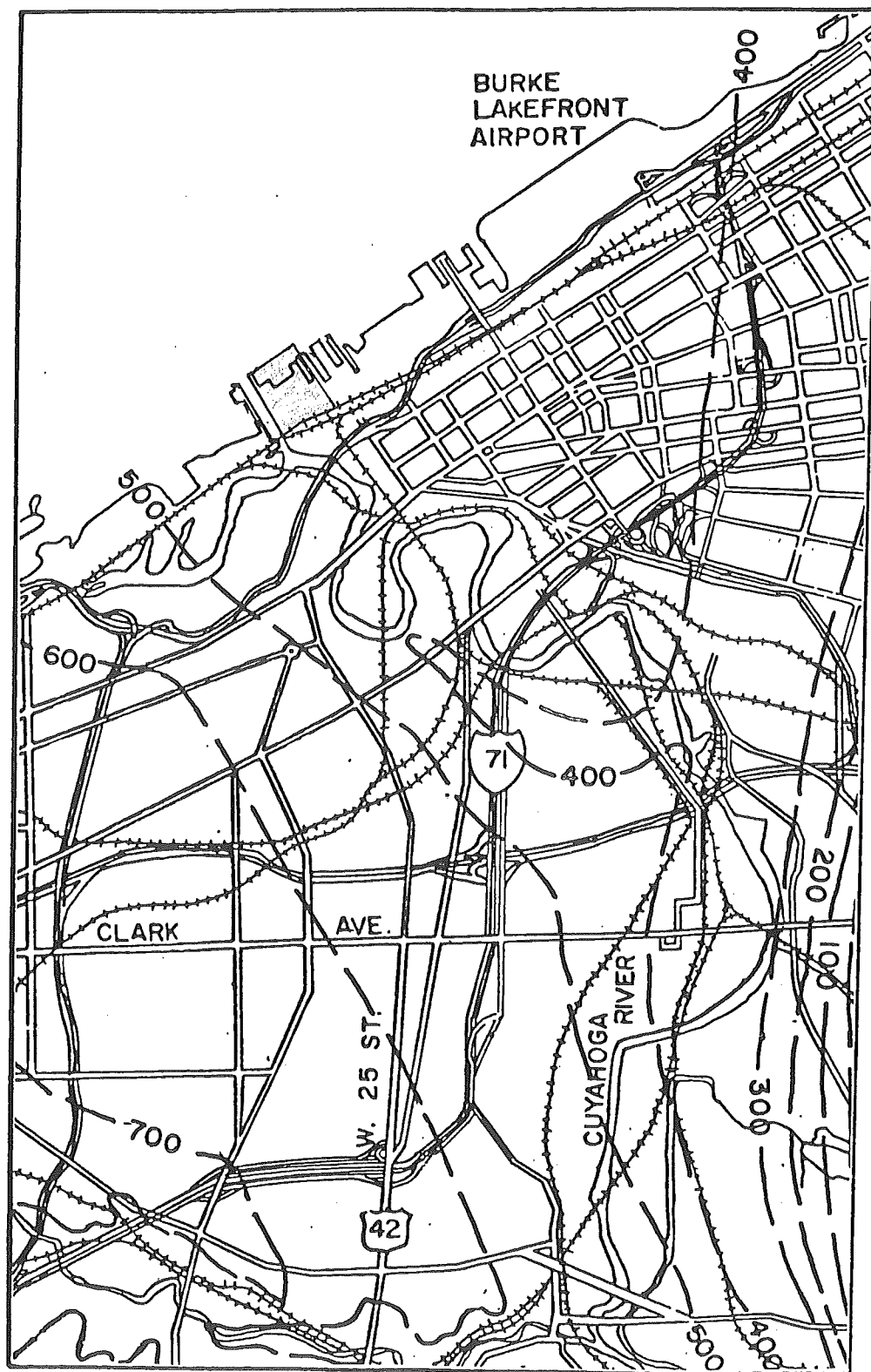
SITE LOCATION PLAN
(Scale 1" = 2000' ±)



LEGEND

-  River Alluvium
 -  Glacial Lake Beach Ridge Deposits
 -  Glacial Lake Bottom Deposits
 -  Glacial River Terrace Deposits
 -  Ice - Deposited Ground Moraine
 -  Ice - Deposited End Moraine
 -  Water-Deposited Glacial Outwash Deposits
- AGE POST GLACIAL AND RECENT
WISCONSINIAN

SURFICIAL GEOLOGY
Scale: 1" = 4000' ±



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

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.

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 one-tenth 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+ in boring L-8 and as high as 467+ 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+ 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.



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 and naturally deposited sand and silt to approximate elevation 555: $\gamma = 120$ pcf above water table
 $\gamma' = 70$ pcf below water table
 $\phi = 30^\circ$ $C = 0$

Clay - Elevation 555 to 530:

$\gamma' = 70$ pcf
 $\phi = 0^\circ$ $C = 950$ psf
 $K_B = 60$ kcf

Elevation 530 to 518:

$\gamma' = 70$ pcf
 $\phi = 0^\circ$ $C = 1400$ psf
 $K_B = 85$ kcf

Elevation 518 to 480:

$\gamma' = 70$ pcf
 $\phi = 0^\circ$ $C = 2000$ psf
 $K_B = 120$ kcf

Elevation 480 to 450:

$\gamma' = 75$ pcf
 $\phi = 0^\circ$ $C = 3000$ psf

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

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

Clay - Elevation 555 to 530:

$\gamma' = 70$ pcf
 $\phi = 0^\circ$ $C = 950$ psf
 $K_B = 60$ kcf

Elevation 530 to 518:

$\gamma' = 70$ pcf
 $\phi = 0^\circ$ $C = 1400$ psf
 $K_B = 85$ kcf

Elevation 518 to 480:

$\gamma' = 70$ pcf
 $\phi = 0^\circ$ $C = 2000$ psf
 $K_B = 120$ kcf

Elevation 480 to 450:

$\gamma' = 75$ pcf
 $\phi = 0^\circ$ $C = 3000$ psf



Dock 22E (from 250+ feet north of south end to north end) and Dock 22N:

Man-deposited fill and naturally deposited sand and silt to approximate elevation 555: $\gamma = 120$ pcf above water table
 $\gamma' = 70$ pcf below water table
 $\phi = 30^\circ$ $c = 0$

Clay - Elevation 555 to 510: $\gamma' = 70$ pcf
 $\phi = 4^\circ$ $c = 600$ psf
 $K_s = 45$ kcf

Elevation 510 to 480: $\gamma' = 70$ pcf
 $\phi = 0^\circ$ $c = 2000$ psf
 $K_s = 120$ kcf

Elevation 480 to 450: $\gamma' = 75$ pcf
 $\phi = 0^\circ$ $c = 3000$ psf

Dock 20 (south of existing jetty):

Man-deposited heterogeneous fill and naturally deposited sand and silt to approximate elevation 555: $\gamma = 120$ pcf above water table
 $\gamma' = 70$ pcf below water table
 $\phi = 30^\circ$ $c = 0$

Clay - Elevation 555 to 545: $\gamma' = 70$ pcf
 $\phi = 0^\circ$ $c = 1000$ psf
 $K_s = 65$ kcf

Elevation 545 to 530: $\gamma' = 70$ pcf
 $\phi = 4^\circ$ $c = 600$ psf
 $K_s = 45$ kcf

Elevation 530 to 518: $\gamma' = 70$ pcf
 $\phi = 0^\circ$ $c = 1400$ psf
 $K_s = 85$ kcf

Elevation 518 to 485: $\gamma' = 70$ pcf
 $\phi = 0^\circ$ $c = 2000$ psf
 $K_s = 120$ kcf

Elevation 485 to 440: $\gamma' = 75$ pcf
 $\phi = 0^\circ$ $c = 3000$ psf

Dock 20 (north of south end of jetty):

Same as Dock 22N and north end of Dock 22E

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 $\gamma = 120$ pounds per cubic foot above the water table, a submerged weight $\gamma' = 70$ 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



May 22, 1991

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

FILES

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 $P_u = \text{adhesion} \times \text{pile circumference} \times \text{stratum penetration}$. 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_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.

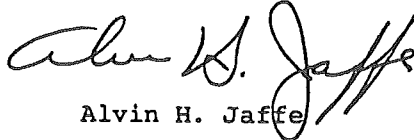
LIMITATIONS

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



WAREHOUSE B

July 17, 1995

HWH Architects Engineers Planners Inc.
1150 West Third Street
Cleveland, Ohio 44113
Attn: Mr. Peter P. Jancar

Re: Proposed Warehouse
Cleveland-Cuyahoga County
Port Authority
Erieside Avenue and
West Third Avenue
Cleveland, Ohio
J.477

Dear Mr. Jancar:

At your request, we have completed the investigation of subsurface conditions for the warehouse, which is to be built for the Cleveland-Cuyahoga County Port Authority. The purpose of the investigation was to determine the general subsurface stratification, establish some of the properties of the materials encountered and to observe any conditions peculiar to the site, which may influence design or construction procedures. The information obtained was used to establish some of the criteria needed for the design of foundations.

The warehouse is to be located on the south side of Erieside Avenue about 360 feet west of West Third Street. The warehouse is expected to be a one-story structure, about 246 feet by 420 feet in plan, with a finished floor level at elevation 582.5. Vertical column loads are expected to range from 25 to 128.2 kips. Horizontal column loads are expected to range from 3 to 15 kips. The sketch titled "Location of Borings LB-1", page 8, shows the location of the warehouse in relation to the site, the locations of the eight borings, B-21 through B-28, which were drilled as part of this investigation, and the locations of boring B-20 and #10 which were drilled at the site in 1973 and 1965. Copies of the logs of borings B-20 and #10 are included for reference in Appendix B.

The materials which were encountered at the property can be better understood by reviewing briefly the geologic and recent land use history of the area. According to a bedrock contour map of the area, the property is located over a deep valley which was eroded into the bedrock surface before glaciers entered Ohio. A secondary bedrock valley eroded into the main valley wall appears to be present south of the property. The expected depth to rock is in the order of about 120 feet or more. The bedrock valley was filled in by soil deposits which formed as several continental ice sheets invaded the area. As each ice sheet advanced from the north, the outlets of the streams flowing in the former bedrock valleys were blocked, resulting in the formation of lakes in which sediments were deposited. As the ice sheets continued their advance south of the property, the lake waters were displaced, and the sediments which were laid down in them were displaced and squeezed by the weight of the advancing ice. When the ice sheets retreated, sediments carried by the ice were left behind and new sediments were deposited in lakes which existed till the retreat of the ice sheets progressed far enough north to uncover outlets that would drain the lakes. Streams are likely to have formed when the land was uncovered. It is likely that these streams eroded some of the materials which were deposited before their formation. The last retreat of the ice sheets from the area was accompanied by the formation of several glacial lake stages which preceded present lake Erie. One interpretation of the glacial lake stages which preceded present lake Erie is included on page 9. The early stage of lake Erie was somewhat lower than the present lake level. This means that it was possible for the Cuyahoga River to erode to levels lower than the present lake level. This lower level of erosion would then have been filled in with soft sediments as the lake level rose. According to an 1835 map of Cleveland, an excerpt of which is included on page 10, the property was part of lake Erie. West Third Street was then known as Seneca Street. According to the 1874 Lake Atlas, an excerpt of which is also included on page 10, the area south of the property was filled in for the construction of railroads and the Union Passenger Depot. Excerpts of the 1881 Hopkins Atlas and the 1898 Krause Atlas are included on page 11. They show that the property was still part of lake Erie. An excerpt of the 1896 Sanborn Atlas with revisions to 1910, which is included on page 12, shows that most or all of the warehouse site was still under lake Erie. An excerpt of the 1912-13 Sanborn Atlas on which the warehouse location is very roughly superposed is included on page 13. It appears to show that the western edge of the warehouse and the southwest

corner had been filled. The 1912 Hopkins Atlas with corrections to 1921 shows that the south and east end of the warehouse site had been filled and that parts of the west edge of the warehouse site which was filled in 1912-13 had sloughed into lake Erie. An excerpt from this atlas on which the warehouse location has been very roughly superposed, is included on page 14. An excerpt of the 11 October 1935 map of Cleveland Harbor on which the warehouse has been very roughly superposed, is included on page 15. It shows that the warehouse area had been filled in, and that railroad tracks were present near the east end of the warehouse. An excerpt of the 1932 Hopkins Atlas with revisions to 1941-42 on which the warehouse location has been superposed, is included on page 16. It shows that a drainage ditch had been excavated across the middle of the property. The ditch is narrow at the south end of the warehouse and wider at the north end of the warehouse. It is possible that the flow in the former ditch is being carried by the sewer which is present in the warehouse area. An excerpt of the 1978 Cuyahoga County Sanitary Engineering Department topographic map on which the proposed warehouse has been superposed is included on page 17. It shows that a pile of material about 20 feet high was stockpiled over the southwest corner of the warehouse in 1978.

The materials which were encountered consisted of man-deposited fill extending to depths ranging between approximate elevations 559.21 and 566.32, overlying sand. Except at borings B-22, B-23 and B-26, the level of the bottom of the fill was consistent with the expected level of a lake bed. The lower level of fill at boring B-22 appears to be due to the penetration of what appears to be organic materials dumped into the lake, into the sand layer. The lower level of fill at borings B-23 and B-26 may be due to the earlier excavation of a drainage ditch across the site. The density of the fill is variable as indicated by standard penetration blow counts ranging from 53 to 1 blow for 2.0 feet. The composition of the fill is variable. It contains compressible organic material in some areas, and sandstone boulders, cemented slag and rubble with possible voids in others. At least one former railroad track may be present near the east end of the building. The driller reported difficulty in augering through the fill and maintaining the plumbness of the drilled hole through the fill. The sand under the fill extended to depths ranging between approximate elevations 556.71 and 559.90. The gradation of the sand (see Appendix C) indicates that it was deposited in a former lake. We infer that this former lake preceded the generally recognized glacial lake stages preceding present lake Erie,

which are shown on page 9. The sand was underlain by clay which extended at least to approximate elevation 503.31, the full depth explored. All of the clay possesses a varved structure which is characteristic of material deposited in glacial lakes. The term "varved" refers to a soil consisting of alternating layers of fine sand, silt and clay. The upper clay to depths ranging between approximate elevations 526.40 and 538.84 at borings B-21 through B-27 contained samples where the varves were inclined significantly to the horizontal. We infer that the inclination of the varves is due to ice action and classified this material as till even though it does not necessarily meet the usual definition of the term till. This upper till layer at these locations has water contents generally less than 30 and dry densities generally above 100 lbs. per cubic foot. The clay below the upper till at borings B-21 through B-24, B-26 and B-27 and below the sand at boring B-28 showed horizontal varves, water contents generally above 30 and dry densities generally under 100 lbs. per cubic foot. Even though this clay has been pre-compressed to pressures in excess of the present overburden pressure by glacial ice, it was classified as a lake deposit on the boring logs. The lake-deposited clay at borings B-23 and B-26 extended to elevations 528.74 and 529.29, the full depths explored. At borings B-21, B-22, B-24, B-27 and B-28 the lake-deposited clay extended to depths ranging between approximate elevations 509.45 and 534.31 and was underlain by clay till which extended to depths ranging between approximate elevations 503.31 and 505.34, the full depths explored. This lower till contains some material having characteristics of typical tills and much varved clay which has been compressed by glacial ice. This till generally exhibits water contents less than 25 and dry densities generally higher than 105 lbs. per cubic foot. The material under the sand at boring B-25 consisted of till to approximate elevation 503.40, the full depth explored. The till above approximate elevation 526.40 has many of the characteristics of the upper till at the remainder of the borings. The till below this depth has many of the characteristics of the lower till at the remainder of the borings. As may be expected, fill dumped into the lake penetrated into the surface of the sand at the bottom of the lake. Where the penetration was minimal, the material was classified as sand. Where the penetration was significant, the material was classified as fill. The clay under the sand appears to be material which was formed in a glacial lake and then displaced by glacial ice. This means that there is less than usual continuity of the strata horizontally and vertically at the site.

Ground water levels during exploration ranged between approximate elevations 573.24 and 575.74. Ground water levels should be expected to fluctuate, depending on the level of water in lake Erie and on variations in the amount and rate of precipitation.

The building columns cannot be supported on the existing fill. The ground conditions are not favorable to the safe and economic use of drilled caissons. The building can be supported on piles. Augered piles are likely to be more economical than driven piles and we recommend them for your consideration. Obstructions which are present in the fill may cause difficulty with both driven and augered piles. We recommend that the site preparation procedures discussed below be followed to minimize such difficulties. We estimate that a 14 inch diameter augered pile extending to elevation 520 can develop a design load of 25 tons or more. In order to confirm the design capacity, we recommend that at least one pile test be performed at or close to boring B-28. In order to ensure proper quality control, a positive displacement pump calibrated to a stroke counter, flighting without gaps and auger hoisting equipment that allows smooth and steady withdrawal of augers at a constant rate must be used. Grout volume per foot must be recorded and plotted during withdrawal of the augers and compared to the theoretical volume. Piles which are required to resist horizontal loads should be reinforced. Even though heavy floor loads are planned, the soils under the fill can support those loads without experiencing large settlements. Much of the settlement under the floor load will develop in the fill. The following site preparation procedures can be used to reduce the floor settlement.

For best results, all of the existing man-deposited fill should be removed. The ground should then be brought to the required grade by placing clean, inert, granular fill to about a foot above the water line. The ground should then be rolled with at least 20 overlapping passes of a heavy (at least 10 tons) vibratory roller. Additional material will need to be added as the fill compacts under the rolling. The ground should then be brought to the desired grade by placing clean, inert, granular fill in thin (10 inches maximum), horizontal layers and compacting each layer with at least 5 overlapping passes of the heavy, vibratory roller. The existing granular fill, including rubble and boulders, may be reused, provided that the rubble and boulders are appropriately located and worked into the layer being compacted.

If the above procedure is not cost effective, the following alternate which will require more maintenance of the warehouse floor can be used. The building area should be excavated to about a foot above the water table at the time of construction. The fill at the column locations and the organic sand in the fill near boring B-26 should be removed entirely and be replaced with clean, inert, granular fill which is small enough to permit easy augering of the piles. The ground should then be rolled with at least 20 overlapping passes of a heavy (at least 10 tons) vibratory roller. The ground should then be brought to the desired grade by placing clean, inert, granular fill in thin (10" maximum), horizontal layers and compacted with at least 5 passes of the vibratory roller. Rubble and boulders from the existing fill can be worked into the new fill, if they are appropriately located and are properly worked into the lift being compacted.

An existing sewer is to be rerouted outside the building area. The abandoned segment of sewer should either be removed or filled with concrete.

Our findings were based on the following information and are subject to the limitations given below.

The eight locations, B-21 through B-28, which are shown on page 8, were selected for exploration and staked out in the field by G & T Associates Inc.. Borings were drilled at these locations by Ohio TestBor, Inc. between June 22 and July 6, 1995 in general accord with the "Specification for Subsurface Exploration" which is included for reference in Appendix A. Samples of the materials obtained in the field were brought to our laboratory, reviewed and tested.

Pages 18 - 25 titled "Laboratory Log of Boring" graphically show the materials encountered and the results of some of the tests performed. The column titled "Blow Count" refers to the standard penetration test and indicates the number of blows of a 140 lbs. 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 1/2.0 appears in the same column, it indicates that one blow on the spoon resulted in a penetration of 2.0 feet. The column titled "Unconfined Shear Stress p.s.f." refers to one-half of the unconfined compressive stress at failure. Because of disturbance during sampling and the occurrence of inclined varves in some of the samples tested, the strength of the materials in the field may differ from the strength indicated

HWH Architects Engineers
Planners Inc.

- 7 -

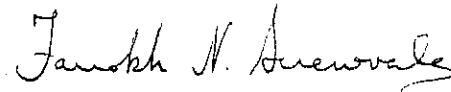
July 17, 1995

by the laboratory tests. This was allowed for. Results of sieve analyses done on some of the samples of granular material are presented in Appendix C.

The above was based on a limited number of borings on the assumption that the materials encountered do not vary significantly between the points explored. This assumption must be verified during construction.

Yours sincerely,

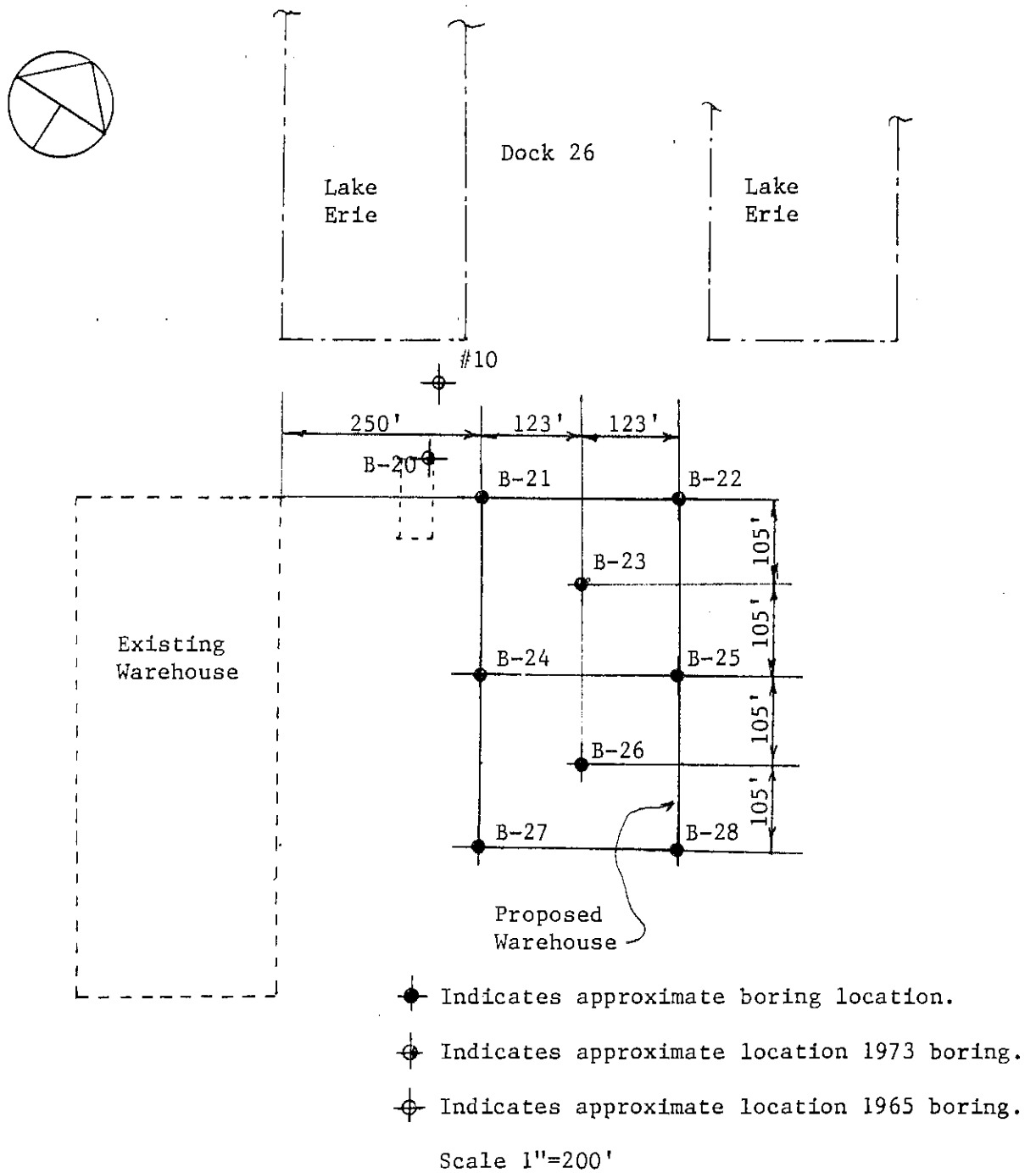
FARROKH N. SCREWVALA INC.

A handwritten signature in cursive script, reading "Farrokh N. Screwvala".

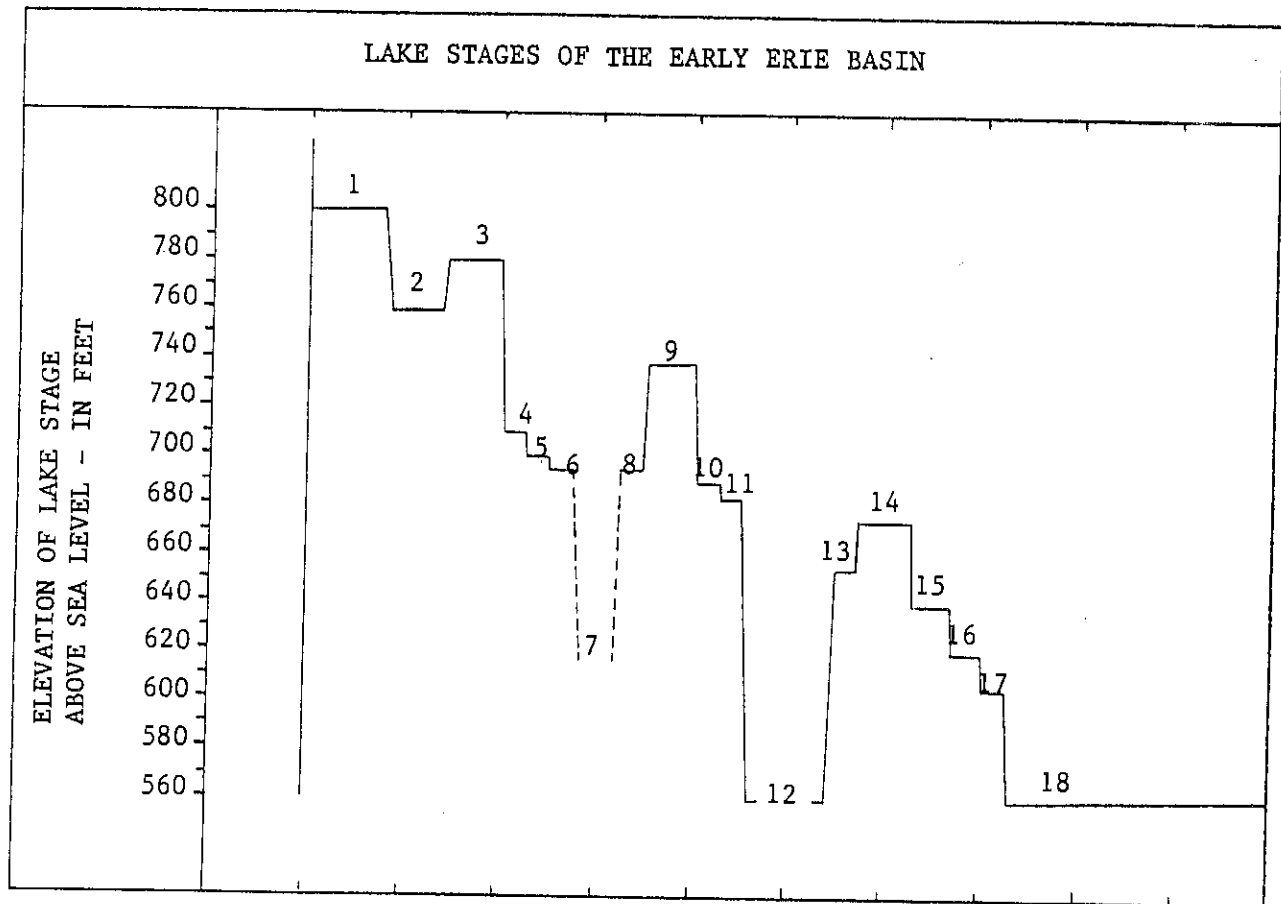
Farrokh N. Screwvala
President

FNS/js

July 17, 1995

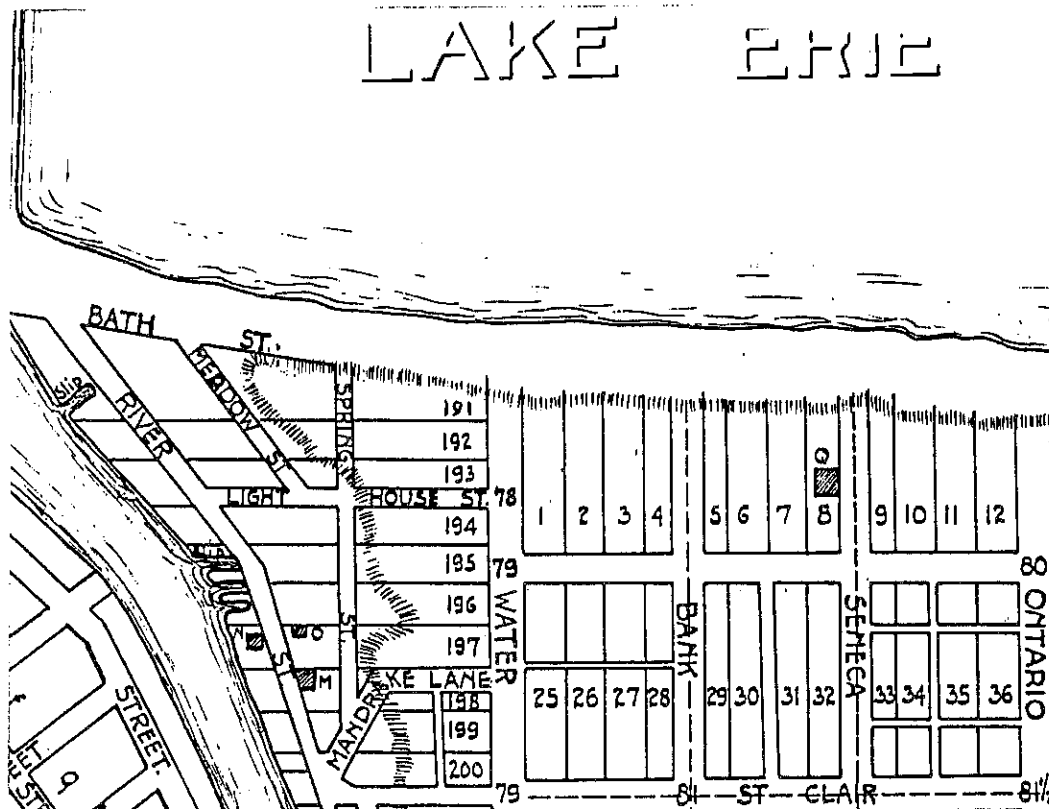


Location of Borings LB-1

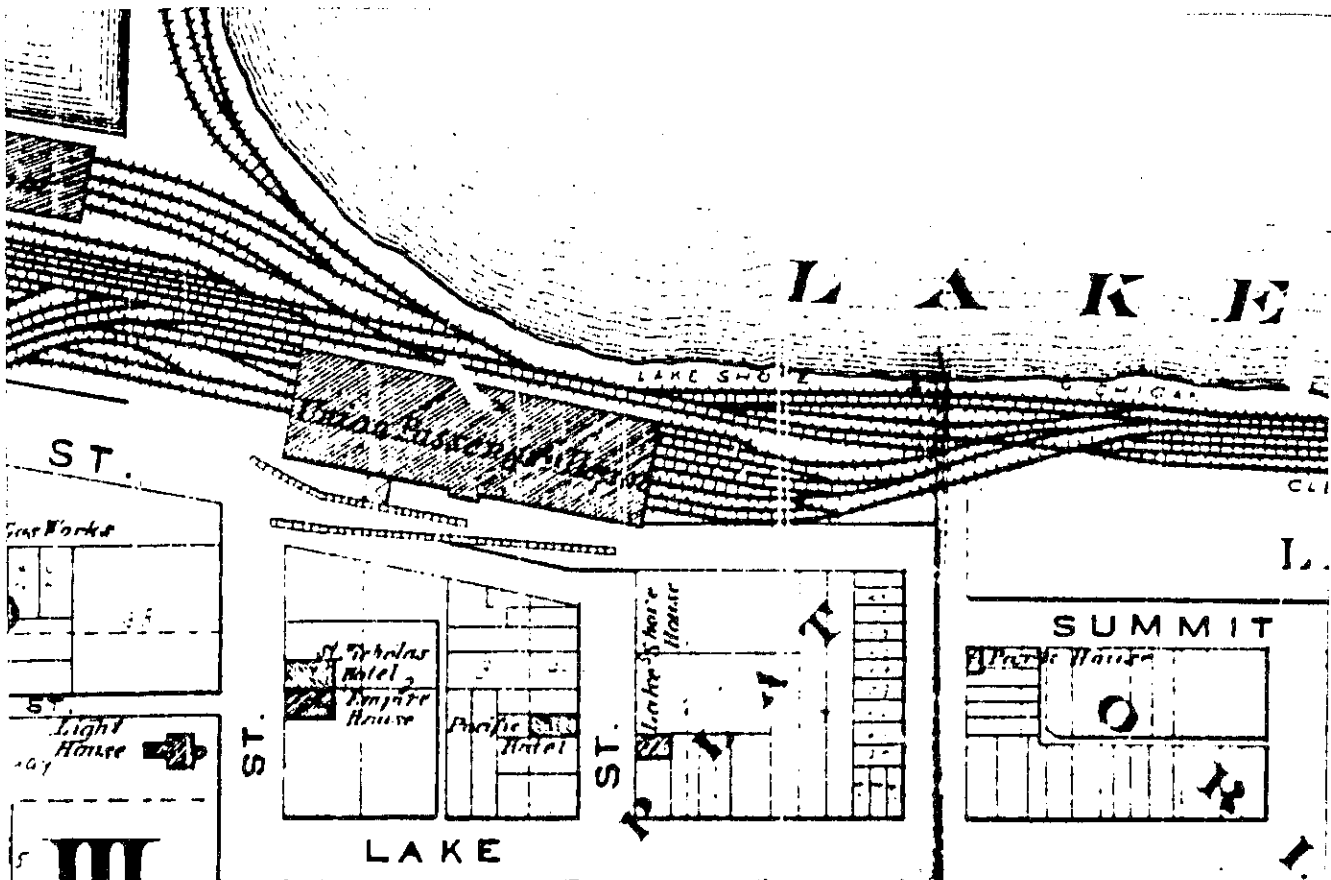


- 1 - Highest Lake Maumee 800
- 2 - Lowest Lake Maumee 760
- 3 - Middle Lake Maumee 780
- 4 - Highest Lake Arkona 710
- 5 - Middle Lake Arkona 700
- 6 - Lowest Lake Arkona 695
- 7 - Possible Low Stage
- 8 - Lowest Lake Arkona II 695
- 9 - Lake Whittlesey 738
- 10 - Highest Lake Warren 690
- 11 - Middle Lake Warren 682
- 12 - Two Creeks ?
- 13 - Lake Wayne 655
- 14 - Lowest Lake Warren 675
- 15 - Lake Grassmere 640
- 16 - Lake Lundy 620
- 17 - Early Lake Algonquin 605
- 18 - Early Lake Erie

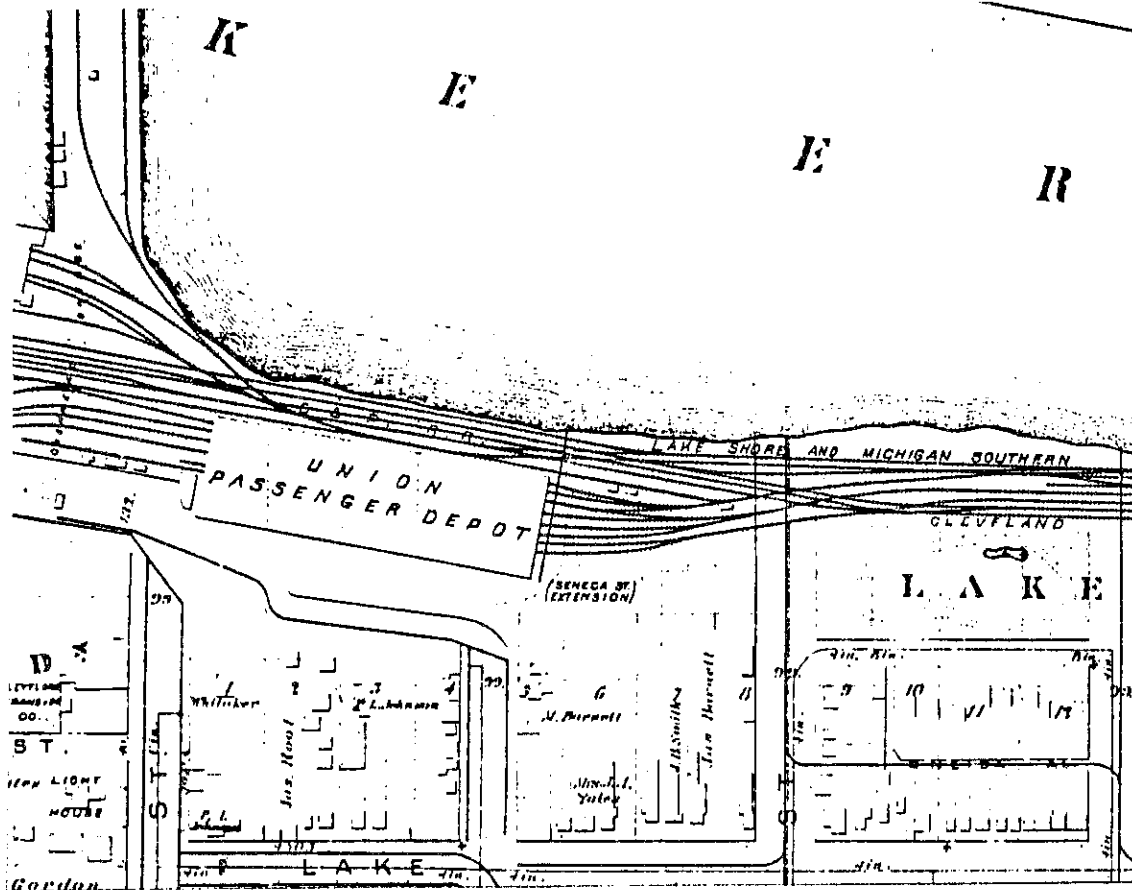
LAKE STAGES PRECEDING PRESENT LAKE ERIE (After Hough)



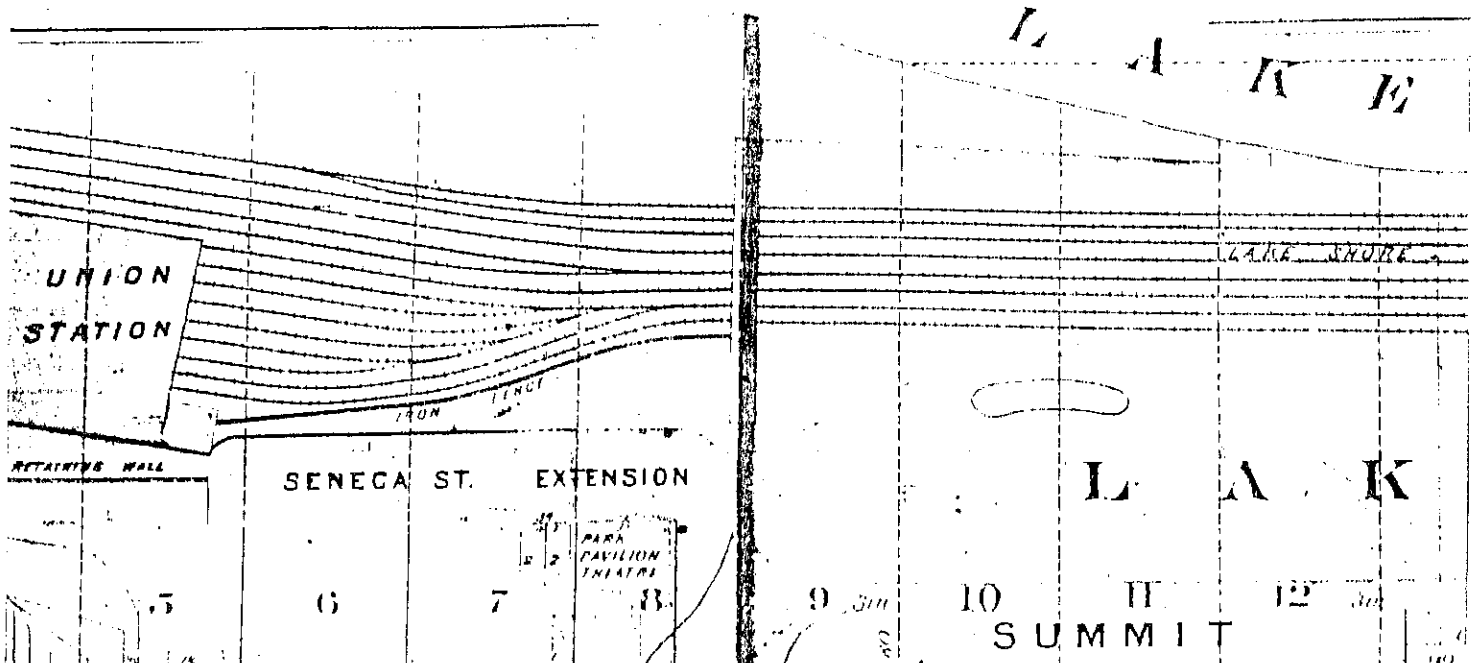
Excerpt from 1835 Map of Cleveland



Excerpt from 1874 Lake Atlas of Cuyahoga County
FARROKH N. SCREWVALA INC. • CLEVELAND, OHIO

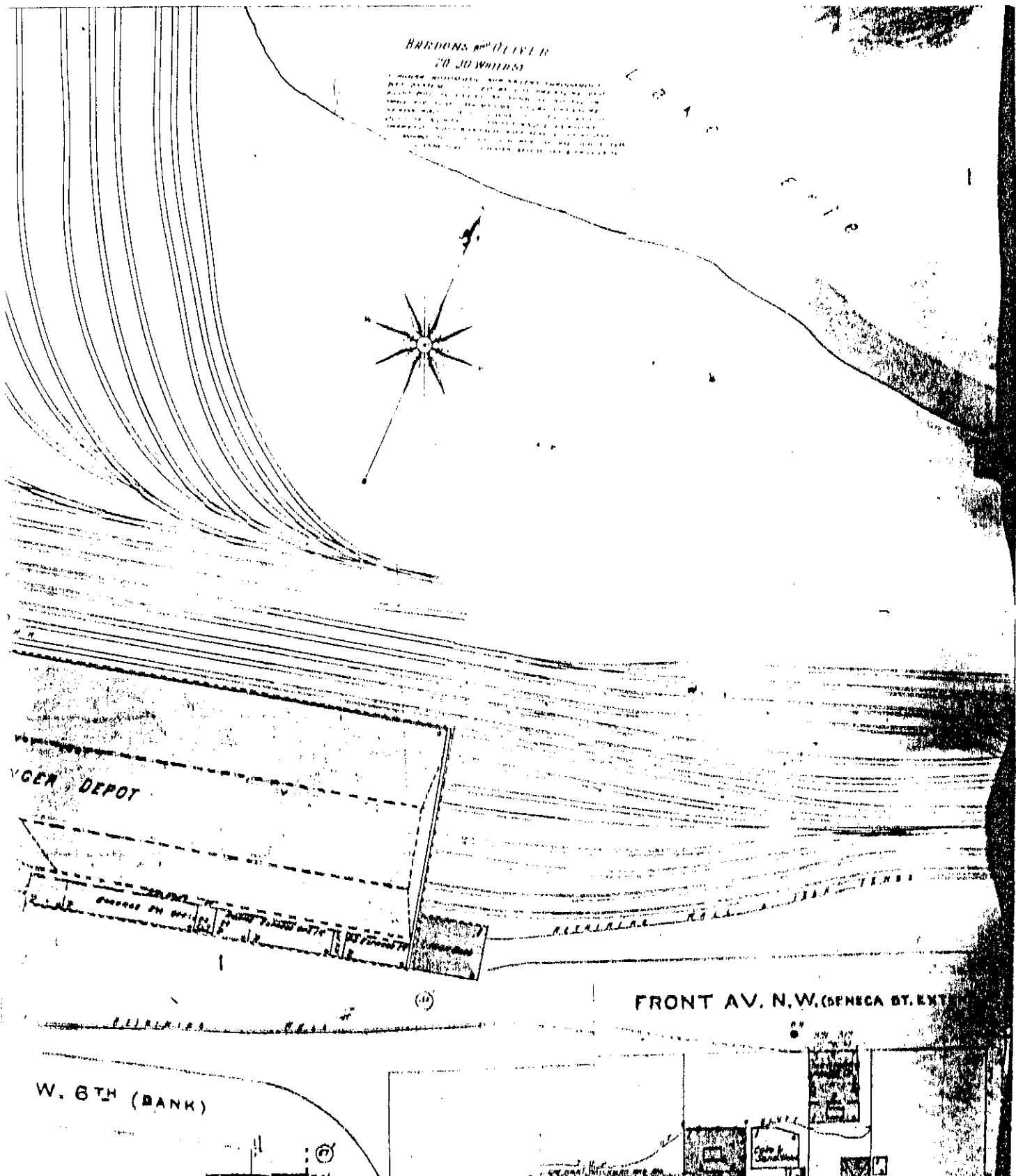


Excerpt from 1881 Hopkins Atlas



Excerpt from 1898 Krause Atlas

July 17, 1995

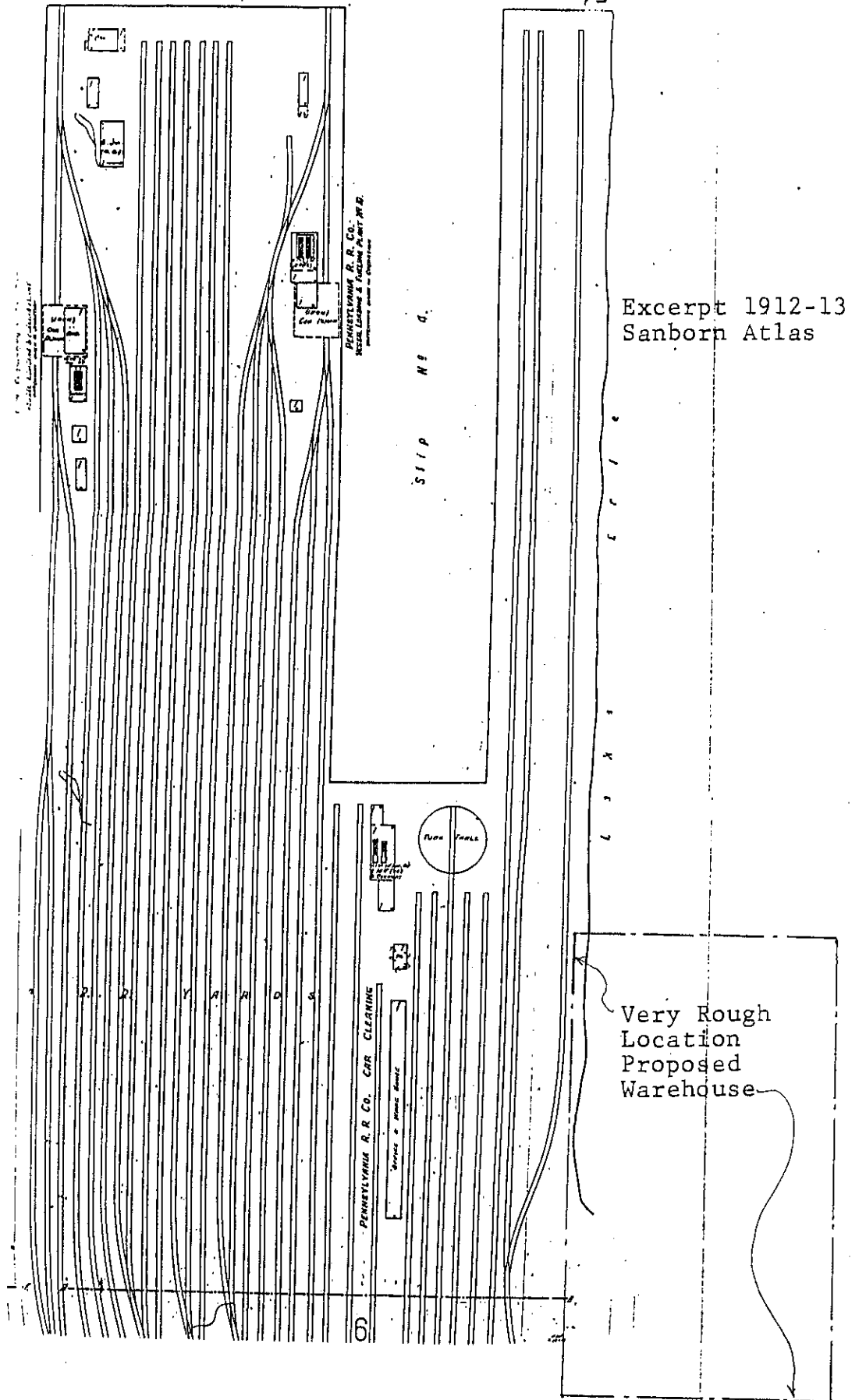


Excerpt from 1896 Sanborn Atlas with Revisions to 1910

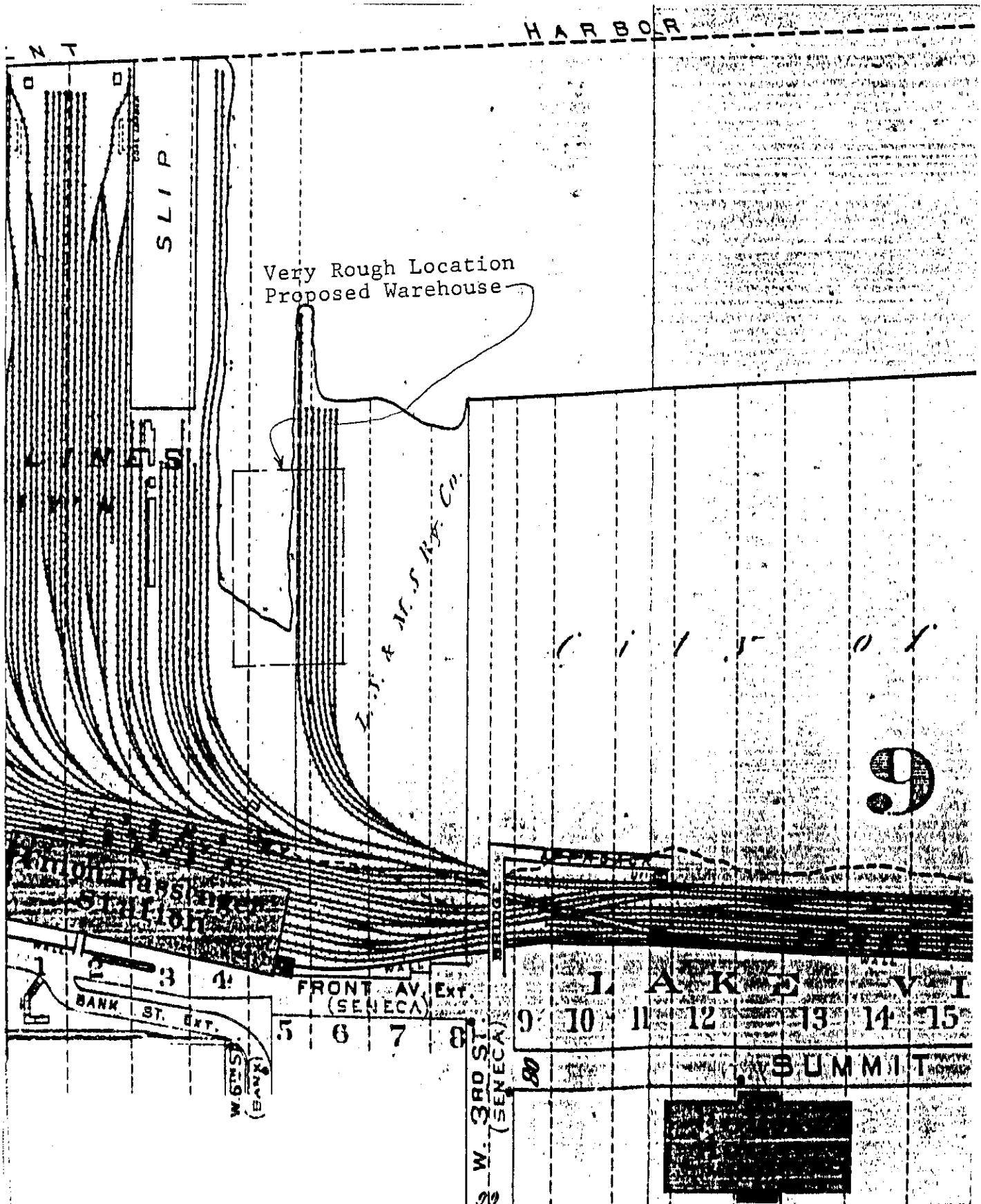
July 17, 1995

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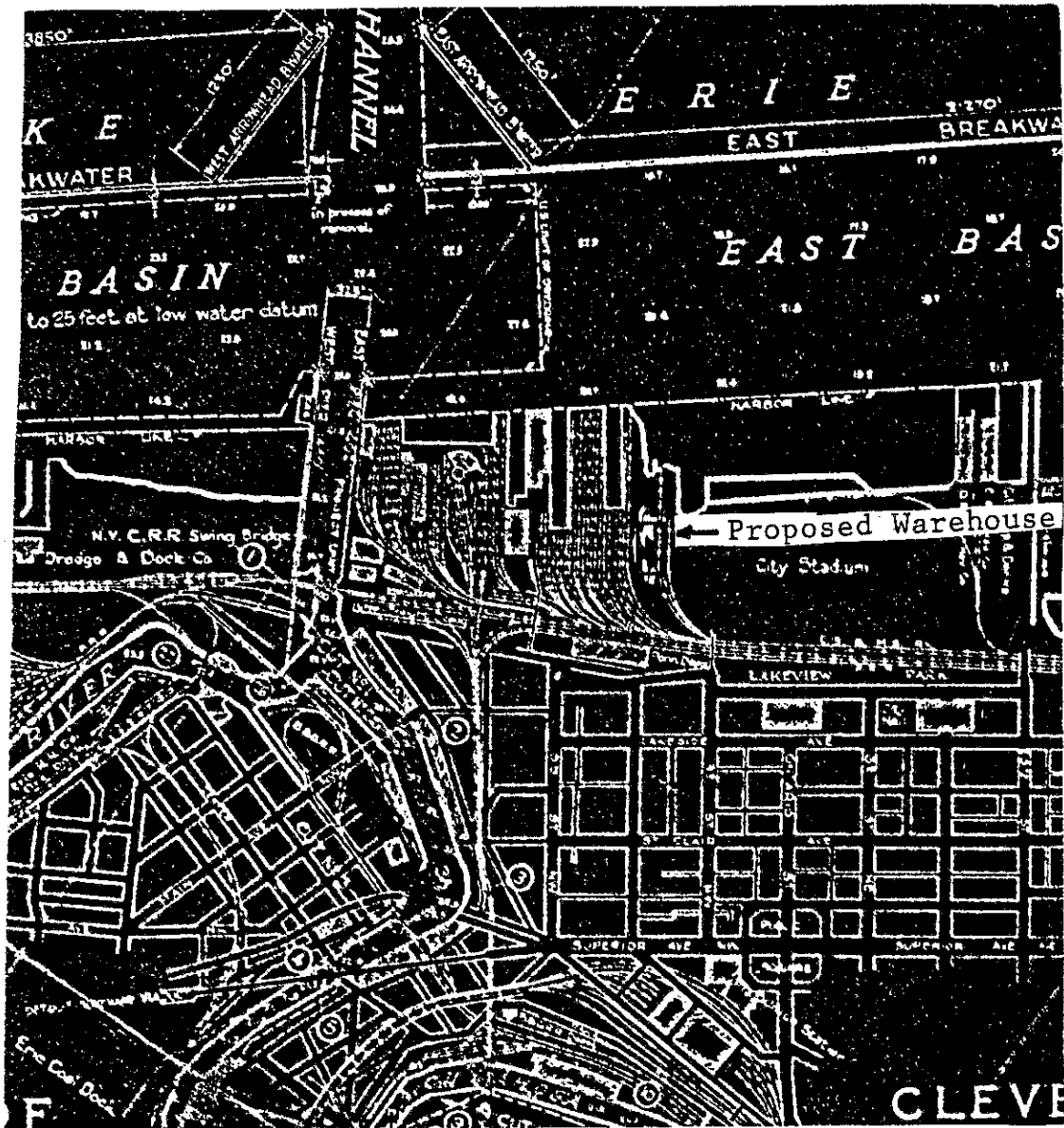
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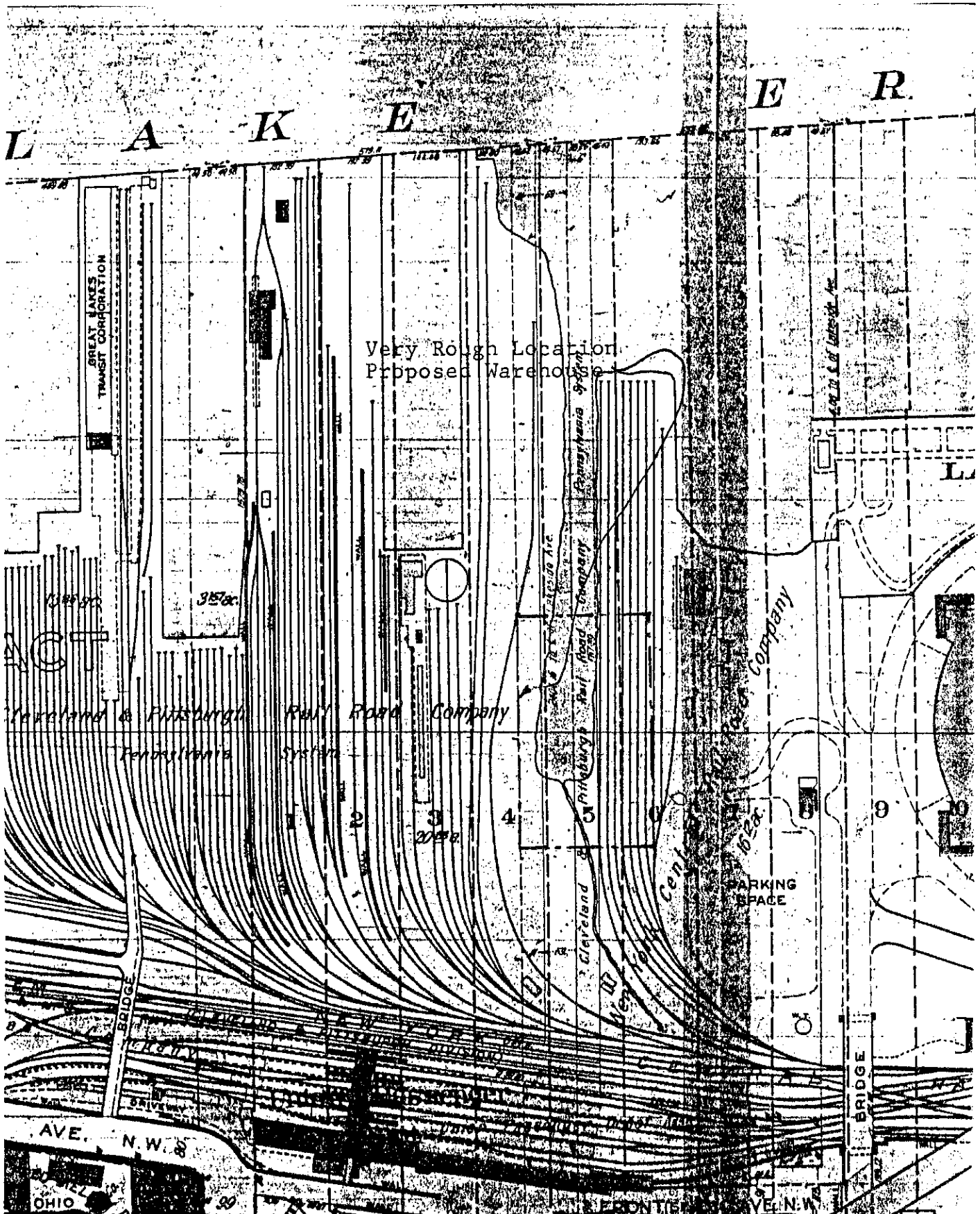
July 17, 1995



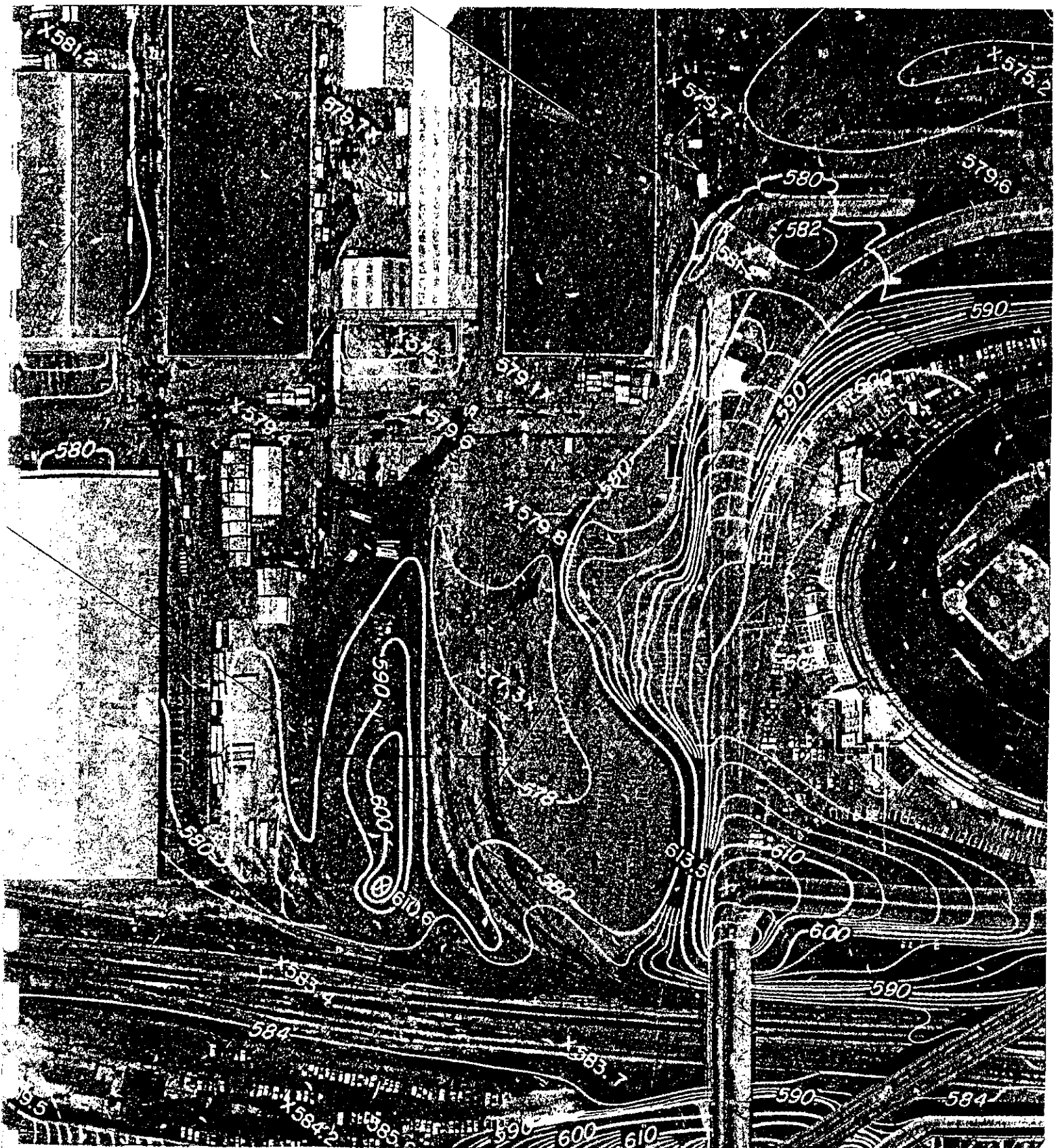
Excerpt from 1912 Hopkins Atlas with Corrections to 1921



Excerpt from 11 October 1935 Map of Cleveland Harbor



Excerpt from 1932 Hopkins Atlas with Revisions to 1941-42



Excerpt from 1978 Cuyahoga County
Sanitary Engineering Department Topographic Map

Surface Elevation 578.95

Boring No. B-21

Depth in feet	Sample	Blow Count	Symbol	Description	Water Content %	Liquid Limit	Plasticity Index	Unconfined Shear Stress p.s.f.	Strain %	Dry Density p.c.f.
12				Fill: asphalt (3"), limestone gravel (5") wood railroad tie (8") black cinders and slag with sand seams and traces of glass and wood						
11		2/5								
10		3/5		black and brown cinders and slag with sand and slag boulders and cobbles						
37										
6/5		36/5								
20				Sand, gray with some silt, traces of gravel and white precipitate (lake deposit)						
17										
3/5		5/5		Clay, gray, silty with seams of fine sand and silt and traces of gravel, varved with inclined varves (till)	28.2			378	11.7	98
5/5					26.8			811	19.7	102
30					26.1			1,160	15.3	105
3/5		5/5			26.4			1,084	19.5	105
40		4/5			24.6			769	17.2	103
6/5										
2/5		3/5		, gray, silty with seams of fine sand and silt, varved (lake deposit)	30.7			523	11.8	97
3/5					31.3			631	19.7	99
2/5		4/5			33.9			603	20.5	91
4/5					33.3			564	18.6	
3/5					32.5			578	20.3	98
7					33.3			451	20.4	95
4/5		8/5		, gray silty clay with seams of fine sand and silt and traces of gravel and rock fragments, varved with inclined varves (till)	19.8			1,796	19.7	120
8/5		15/5			16.6			2,406	19.4	121
15/5				End of boring at 75.0 ft.						
80				Encountered water at 6.0 ft. Water at 5'-5" on completion. For definition of geologic terms see text.	Date Started:	7-6-95				
					Date Completed:	7-7-95				
					Location:	Cleveland, Ohio				
					Job No.:	J.477				

LABORATORY LOG OF BORING

Surface Elevation 578.71

Boring No. B-22

Depth in feet	Sample	Blow Count	Symbol	Description	Water Content %	Liquid Limit	Plasticity Index	Unconfined Shear Stress p.s.f.	Strain %	Dry Density p.c.f.
12				Fill: dense slag and limestone gravel with sand brown sand, slag, gravel, bricks, wood and sandstone with chemical odor at 4.0 ft.						
17		4/5 7/5								
18	*	5/5 9/5		sand, gravel, sandstone cobbles and rubble						
				gray sand with peatlike organic inclusions, cinders and chemical odor						
20		38		Sand, gray with traces of gravel, silt and cinders (lake deposit)	41.9					
		9		Clay, gray, silty with seams of fine sand and silt, varved, with thin inclusions of organic matter to 32.5 ft. and some inclined varves (till)	29.2			722	18.2	102
30		5/5 8/5			27.8			706	20.1	102
		9			27.5			1,290	20.1	99
40		11			27.0			879	13.4	101
		4		, gray, silty with seams of fine sand and silt, varved (lake deposit)	33.5			462	20.5	93
50		4			32.2			456	20.2	94
		7		, gray, silty with rock fragments and inclusions of varved clay (till)	26.6			1,002	20.7	103
60		16			23.8			1,303	20.2	105
		18			23.5			1,709	16.2	106
70		10/5 15/5			19.1			1,506	17.0	115
		28		End of boring at 75.0 ft.	18.7			2,341	19.9	114
80				Encountered water at 6.0 ft. Water at 4.0 ft. on completion. Water at 4'-6" on July 7, 1995. For definition of geologic terms see text. * Indicates no recovery	Date Started:	6-23-95	Date Completed:	6-23-95	Location:	Cleveland, Ohio
					Job No.:	J.477				

- 20 -
LABORATORY LOG OF BORING

Surface Elevation 578.74

Boring No. B-23

Depth in feet	Sample	Blow Count	Symbol	Description	Water Content %	Liquid Limit	Plasticity Index	Unconfined Shear Stress p.s.f.	Strain %	Dry Density p.c.f.
		11/5		Fill: cinders, slag and limestone gravel						
		7/5		brown and black sand with gravel, cinders, slag, red brick and organic silt	41.6					
		9								
		2/5								
		16/4		red brick rubble, possible concrete rubble, possible voids and sand with possible hydrocarbon odor	38.3					
10		1/2.0		black organic silt with possible hydrocarbon odor	76.1					
		4/5								
		6/5		sand with wood, cinders and possible hydrocarbon odor	59.2			228	17.4	66
20		11/5		Sand, gray with some silt and traces of gravel, slag and cinders (lake deposit)						
		18/5								
		14		Clay, gray silty with rock fragments, organic inclusion and many seams of varved clay with inclined varves (till)	23.0			1,925	18.4	108
		4/5								
		6/5			25.6			1,001	20.3	102
30		4/5								
		6/5			21.6			872	17.7	109
		4/5								
		6/5			26.8			663	15.0	106
40		4		, gray silty with seams of fine sand and silt, varved (lake deposit)	31.2			601	20.4	97
		4								
50		4		End of boring at 50.0 ft.	30.0			542	20.4	98

Remarks: Encountered water at 6.0 ft.
Water at 5'-9" on completion.
Water at 5'-6" on July 7, 1995.
For definition of geologic terms see text

Date Started 7-6-95
Date Completed 7-6-95
Location: Cleveland, Ohio
Job No. J.477

LABORATORY LOG OF BORING

Surface Elevation 579.25

Boring No. B-24

Depth in feet	Sample	Blow Count	Symbol	Description	Water Content %	Liquid Limit	Plasticity Index	Unconfined Shear Stress p.s.f.	Strain %	Dry Density p.c.f.
10/5 16/5				Fill: cinders, slag, gravel and sand brown, gray and black sand, cinders, slag, coal, wood, bricks and glass						
3/5 2/5										
1/5 1/1.0										
11										
6/5 10/5				Sand, gray and black, with traces of silt, slag and cinders (lake deposit)						
				, gray with some silt and traces of gravel and vegetation (lake deposit)						
34										
6/5 9/5				Clay, gray, silty with seams of fine sand and silt, varved with inclined varves and thin organic seams (till)	24.4	28	6	1,695	20.2	107
7					28.9			811	18.8	100
9					28.7			930	20.3	101
5/5 9/5					25.4			955	20.8	102
6/5 11/5					26.3			843	20.1	102
				, gray, silty with seams of fine sand and silt, varved (lake deposit)						
2/5 3/5					32.6			558	20.2	93
3/5					31.8	34	11	516	20.7	95
2/5 3/5					30.3			756	19.9	97
6					28.8			728	21.1	100
8/5 12/5				, gray, silty with gravel and rock fragments and inclusions of varved clay (till)	17.1 18.0			2,138 2,501	20.1 20.1	113 120
22				End of boring at 75.0 ft.	15.7			2,807	20.1	122
Encountered water at 6.0 ft. Water at 5'-8" on completion. Water at 5'-6" on July 6, 1995 For definition of geologic terms see text.					Date Started: 6-27-95 Date Completed: 6-27-95 Location: Cleveland, Ohio Job No.: J.477					

Depth in feet	Sample	Blow Count	Symbol	Description	Water Content %	Liquid Limit	Plasticity Index	Unconfined Shear Stress p.s.f.	Strain %	Dry Density p.c.f.
		8		Fill: cinders, coarse and fine slag, limestone gravel, clay and wood						
		4								
		7								
10		7								
		16		Sand, gray with traces of silt and cinders (lake deposit)						
20		11		Gravel, gray with some sand (lake deposit)						
		12		Clay, gray, silty with seams of fine sand and silt, varved with some inclined varves (till)	26.3			549	14.4	108
		12			28.2			1,200	20.1	99
30		9			27.1			640	20.3	103
		7			26.7			451	14.9	96
40		9			27.2			917	20.5	107
		6			29.2			471	15.6	103
50		7			24.6			881	20.3	107
		14		, gray, silty with gravel rock fragments and many inclusions of varved clay (till)	21.7			1,709	20.5	111
60		16			22.5			1,443	19.6	109
		16			23.2			1,804	20.1	109
0		15/5 23/5			15.3			3,875	19.8	125
		36			16.0			2,461	20.9	129
				End of boring at 75.0 ft.						
Encountered water at 2.0 ft. Water at 2'-2" on completion. Water at 2'-2" on June 26, 1995. Water at 2'-5" on July 6, 1995. For definition of geologic terms see text.					Date Started: 6-22-95 Date Completed: 6-22-95 Location: Cleveland, Ohio Job No.: J.477					

- 23 -
LABORATORY LOG OF BORING

Surface Elevation 579.29

Boring No. B-26

Depth in feet	Sample	Blow Count	Symbol	Description	Water Content %	Liquid Limit	Plasticity Index	Unconfined Shear Stress p.s.f.	Strain %	Dry Density p.c.f.
		44		Fill: cinders, slag, gravel and sand						
		17		brown and gray sand, with gravel,						
		1 1/2		slag, cinders, bricks, sandstone						
		3 1/2		cobbles, glass and wood	100.0					
10		8		black organic silty sand	60.6					
				sand with gravel, slag, cinders,						
				bricks, sandstone cobbles and wood						
		17								
20		20 1/2		Sand, gray with traces of brown, with						
		11 1/2		traces of silt and gravel (lake						
				deposit)						
				Clay, gray silty with inclusions of varved	23.6					
				clay with inclined varves and traces						
				of organic matter and rock fragments						
				(till)						
		19			21.4			3,007	17.1	113
30		6 1/2								
		10 1/2			23.8			1,662	16.7	107
		12			25.2			1,575	14.9	105
40		6 1/2								
		10 1/2			22.7			1,199	19.8	107
		2 1/2		, gray silty with seams of fine sand						
		3 1/2		and silt, varved (lake deposit)	31.1			501	20.8	99
50		4								
				End of boring at 50.0 ft.	30.6			503	20.5	100

Remarks: Encountered water at 6.5 ft.
Water at 3'-5" on completion.
Water at 5'-0" on July 7, 1995
For definition of geologic terms see text.

Date Started 7-5-95
Date Completed 7-6-95
Location: Cleveland, Ohio
Job No. J.457

LABORATORY LOG OF BORING

Surface Elevation 580.34

Boring No. B-27

Depth in feet	Sample	Blow Count	Symbol	Description	Water Content %	Liquid Limit	Plasticity Index	Unconfined Shear Stress p.s.f.	Strain %	Dry Density p.c.f.
53				Fill: cinders, slag, gravel and sand						
48				brown, silty sand with cinders, slag, wood, brick, and sandstone boulders						
37.5				brown, black and gray sand with cinders, slag, gravel, wood, bricks and sandstone						
25										
23				Sand, gray with traces of silt (lake deposit)						
14				Clay, gray, silty with seams of fine sand and silt and thin inclusions of organic matter, varved with inclined varves (till)	23.4			1,394	19.9	103
24					23.1			1,079	10.1	106
7					29.1			471	20.2	98
8					26.7			644	20.3	102
14					23.1			637	20.3	106
2/5 3/5				, gray, silty with seams of fine sand and silt, varved with traces of gravel and rock fragments (lake deposit)	31.1			640	20.0	101
2/5 3/5					30.8			479	20.3	94
2/5 3/5					30.2			481	20.7	94
14				, gray, silty with gravel and rock fragments and inclusions of varved clay (till)	18.0 24.4			902 1,289	19.7 20.6	115 108
12					23.8			993	20.8	108
18					23.3			1,369	20.9	106
37				End of boring at 75.0 ft.	16.4			2,764	20.2	121
Encountered seepage at 6.0 ft. Encountered water at 7.0 ft. Water at 5'-10" on completion. Water at 4'-7" on July 6, 1995. For definition of geologic terms see text.					Date Started: 6-26-95 Date Completed: 6-27-95 Location: Cleveland, Ohio Job No.: J.477					

LABORATORY LOG OF BORING

Surface Elevation 578.31

Boring No. B-28

Depth in feet	Sample	Blow Count	Symbol	Description	Water Content %	Liquid Limit	Plasticity Index	Unconfined Shear Stress p.s.f.	Strain %	Dry Density p.c.f.
10		21 3/5 7/5		Fill: fine to coarse slag, gravel, cinders, bricks and wood, possible abandoned railroad track						
		22		fine and coarse sand with gravel, slag with some cementation, cinders and bricks						
20		40								
		23		Sand, gray with traces of silt, gravel and wood (lake deposit)						
		4/5 6/5		, gray with some gravel and traces of silt, wood and vegetation (lake deposit)	29.0			633	18.2	99
		6		Clay, gray, silty with seams of fine sand and silt, varved (lake deposit)	31.0			442	20.5	99
30		7			29.1			789	20.2	99
		9			27.3			734	20.7	99
40		5			35.8			408	17.0	96
		4		, gray, silty with seams of fine sand and silt, varved with inclined varves and inclusion of possible slate arrowhead at 50.0 feet (till)	26.5			769	20.0	104
50		7			26.1			682	20.7	103
		4/5 6/5			26.4			791	20.4	105
60		11			25.2			1,068	19.3	105
		17		, gray, silty with gravel and rock fragments and inclusions of varved clay (till)	22.8			1,957	20.7	107
70		19			18.9			1,184	19.8	112
		26			14.7			2,049	20.0	123
				End of boring at 75.0 ft.						
80				Encountered water at 5.5 ft.						
				Encountered wet zone from 5.5 ft. to 75.0 ft.						
				Water at 3.9 ft. on completion.						
				Water at 3'-9" on June 26, 1995.						
				Water at 3'-9" on July 6, 1995.						
				For definition of geologic terms see text.						
90										
				Date Started: 6-22-95						
				Date Completed: 6-23-95						
				Location: Cleveland, Ohio						
				Job No.: J.477						

APPENDIX A

SPECIFICATION
FOR
SUBSURFACE EXPLORATION

A. SCOPE OF WORK:

The work required includes advancing of drill holes, sampling of the materials encountered, classifying and reporting the depth and thickness of each stratum, and observing and reporting the ground water conditions.

The contractor shall drill borings at the locations shown on the attached drawing, perform such other labor and services as may be necessary and reasonably incidental to obtaining and classifying samples of the materials encountered and shall submit complete and accurate logs of all of the borings drilled.

The contractor shall satisfy himself of the locations of all underground installations such as gas lines, water lines, sewers, electrical cables, telephone cables, or other structures; advise the appropriate owners of such installations of his operations; and shall exercise precaution to avoid damage to such installations.

The following data shall be determined and reported on the logs:

1. A true cross-section and visual classification of the materials encountered in each borehole showing the depth and thickness of each stratum.
2. All available information on ground water conditions and a record of the ground water levels. Water level readings should include at least a water level upon completion and a water level 24 hours after completion. When a 24 hour reading is not possible, a reading prior to backfilling shall be obtained and the time after completion noted.
3. The hardness or compactness of the stratum as determined by a penetration test performed, in accordance with ASTM D 1586-67, while sampling with a split barrel sampler.
4. Indications of obstructions encountered, such as boulders, rubble, or old foundations.

5. The depth and thickness of voids or cavities as determined by tool drops or other means.
6. The depths at which drilling water was lost into the ground.
7. The depths at which seepage is encountered.
8. The depths, if any, at which sudden changes in the water level occurred.
9. The length of sample recovered during coring for each run of the core barrel.

All incompleated borings shall be reported in the same manner as completed borings. The contractor shall include on the log of each incompleated boring the reason for not completing the hole.

Samples of the materials obtained shall be delivered to the laboratory of Farrokh N. Screwvala Inc., 343 The Arcade, Cleveland, Ohio 44114. Samples shall be packaged and shipped in a way that will avoid freezing or disturbance of the samples.

All work shall be performed in accordance with applicable building codes, city, state, and federal and as specified herein.

B. DRILLING OF BOREHOLES:

Borings are to be drilled to about the depths shown on the attached drawing. The work shall be performed so as to permit the taking of frequent undisturbed samples.

Borings shall be drilled vertically, unless indicated otherwise, in accordance with standard, sound drilling practices. The size of borings and casings shall be large enough to accommodate the size of samples to be obtained.

C. SAMPLING:

Unless otherwise indicated, samples shall be obtained at 5 ft. intervals or at every change in stratum, whichever is more frequent.

Samples in soil and soft or weathered rock shall be obtained with a split barrel sampler in accordance with the standard method for "Penetration Test and Split Barrel Sampling of Soils," ASTM D 1586-67. In soft cohesive soils the engineer may require samples to be obtained with a thin-walled metal tube. Such samples shall

be obtained in accordance with the standard method for "Thin-Walled Tube Sampling of Soils," ASTM D 1587-74. In rock or in soils which are too hard to sample by soil sampling methods, the engineer may require diamond core drilling to secure intact samples. Cores shall be obtained in accordance with the standard method for "Diamond Core Drilling for Site Investigation," ASTM D 2113-70. For this work, cores shall not be less than 2-1/8 inches in diameter.

Wherever possible, the length of samples delivered shall be at least 4 inches.

In some instances, as determined by the engineer, disturbed samples from auger borings or probes may be sufficient. Such borings shall be performed in accordance with the standard method for "Soil Investigation and Sampling by Auger Borings," ASTM D 1452-65.

D. SAFETY AND SITE MAINTENANCE

The drilling contractor shall comply 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 injury to the public or other workmen.

Upon completion of the boring and the ground water observations, the contractor shall fill the drilled hole and restore the area as closely as possible to its original condition. Drill holes shall be filled in such a manner as to insure against subsequent settlement of the backfill, resulting in a hole hazardous to persons, animals or equipment.

APPENDIX B







LABORATORY LOG OF BORING

Method of Sampling:

Split spoon ☒ Shelby ☐
 Core drill ☐ Auger ☐

Boring No. B-20

Surface Elevation 579.4

Depth in feet	Symbol	DESCRIPTION	Blows on spoon for 12 inches	Depth to bottom of sample in feet	SUMMARY OF TEST RESULTS					
					Natural Moisture %	Liquid Limit	Plasticity Index	Unconfined Shear Stress #/SF	Strain %	Unit Dry Weight #/cu. ft.
		Fill: brown & black sand, cinders & brick	5	3.5						
		brown clay w/gravel & sand	4	6.5	19.8					
		black cinders & slag	6	10.0						
		gray sand w/trs. of cinders	12	15.0						
		brown & gray silty sand w/trs. of cinders	18	20.0						
		Clay, gray, silty	14	25.0	25.8			880	10.9	101
		End of boring at 25.0'								

F-T-1

REMARKS

Water at 6.0' upon completion

Boring Completed: 2/24/73

Location: Cleveland, Ohio

Job No.: C. 2337

TESTING ENGINEERS AND SOILS CONSULTANTS

"AS A MUTUAL PROTECTION TO CLIENTS, THE PUBLIC, AND OURSELVES, ALL REPORTS ARE SUBMITTED AS THE CONFIDENTIAL PROPERTY OF CLIENTS, AND AUTHORIZATION FOR PUBLICATION OF STATEMENTS, CONCLUSIONS, OR EXTRACTS FROM OR REGARDING OUR REPORTS IS RESERVED PENDING OUR WRITTEN APPROVAL."

2-26-65 jh

Page 1 of 2

TEST BORING REPORT

CLIENT Beiswenger, Hoch, Arnold & Associates ORDER No. 2861.9
 PROJECT West Ninth Street Pier, Cleveland, Ohio HOLE No. 10
 LOCATION As shown on plan
 DRILLER W. Martin DRILL No. 18 DATE STARTED 2-15-65
 ELEVATION REFERENCE 578.0' + DATE COMPLETED 2-17-65
 CASING: DIAMETER 3.5" I.D. Hollow Stem Augers HAMMER WT. FALL
 SAMPLER: DIAMETER & TYPE 2" O.D. Split Spoon HAMMER WT. 140# FALL 30"
 DEPTH TO WATER: IMMEDIATE 7.5' UPON COMPLETION Hole caved at 7'
 DEPTH TO WATER DAYS AFTER COMPLETION WATER USED IN DRILLING No

ELEVATION	DEPTH	DESCRIPTION OF MATERIALS	SAMPLE No.	SAMPLE DEPTH	TYPE OF SAMPLE	BLOWS PER 6" ON SAMPLER or 1/2 Core Rec.	Hammer Blows on Casing per Foot
578.0'	0'						
		5' Cinders, moist - loose to very loose	1	0-1.5	SS	4-4-5	
			2	2.5-4	SS	1-1/2-1/2	
573.0	5'	2.5' Slag and cinders, moist - loose	3	5-6.5	SS	3-2-3	
570.5	7.5'		4	7.5-9	SS	2-3-4	
		10' Slag and cinders, wet - loose to medium dense	5	10-11.5	SS	4-9-10	
			6	12.5-14	SS	9-18-12	
560.5	17.5		7	15-16.5	SS	3-2-7	
		2.5' Brown fine sand, wet - loose	8	17.5-19	SS	2-3-5	
558.0	20'		9	20-21.5	SS	9-10-12	
		2.5' Brown fine sand and wood, wet - medium dense					
555.5	22.5		10	22.5-24	SS	3-4-5	
		17.5' Gray silty clay with silt lenses, moist - soft to medium stiff	S1	25-27	ST		
			11	27-28.5	SS	4-5-6	
			12	30-31.5	SS	3-5-8	
			S2	35-37	ST		
			13	37-38.5	SS	3-3-5	
538.0	40'		14	40-41.5	SS	2-3-4	

REMARKS:

Respectfully submitted,

THE H. C. NUTTING CO.

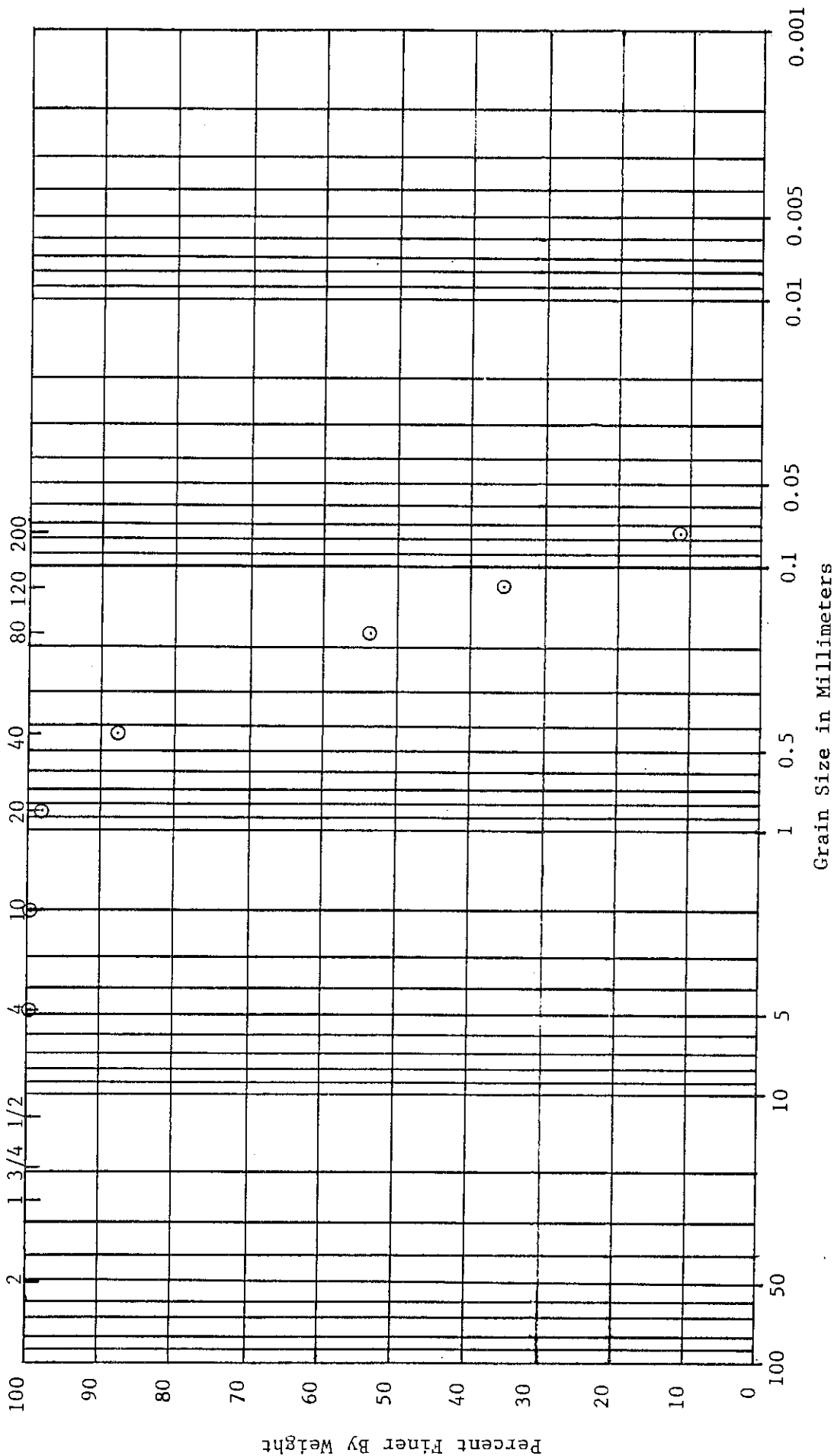
By E. R. Linnell

As a mutual protection to the owners and ourselves, the engineer in the owner's behalf shall check this report with the samples submitted prior to the purchase of property, or designing of structures.

PROJECT West Ninth Street Pier, Cleveland, OhioHOLE No. 10

ELEVATION	DEPTH	DESCRIPTION OF MATERIALS	SAMPLE No.	SAMPLE DEPTH	TYPE OF SAMPLE	BLOWS PER 6" ON SAMPLER or 1/4 Core Rec.	Hammer Blows on Casing per Foot
538.0'	40'						
		16' Gray silty clay, very moist - soft	S3	45-47	ST		
			15	47-48.5	SS	2-3-4	
			16	50-51.6	SS	1-2-3	
522.0'	56'		S4	55-57	ST		
		14' Gray sandy clay with fine gravel, moist - medium stiff	17	57-58.5	SS	5-7-8	
			18	60-61.5	SS	3-6-10	
			S5	65-67	ST		
508.0	70'		19	67-68.5	SS	4-7-11	
		5' Gray silty clay with trace of fine gravel, moist - medium stiff	20	70-71.5	SS	3-4-7	
503.0	75'		S6	75-77	ST		
		12' Gray sandy clay with fine gravel, moist - stiff	21	77-78.5	SS	6-11-16	
			22	80-81.5	SS	6-11-18	
			S7	85-87	ST		
491.0	87'		23	87-88.5	SS	15-28-36	
		3' Gray sandy clay with fine gravel and fine sand seams, moist - hard					
488.0	90'		24	90-91.5	SS	22-30-33	
		11' Gray sandy clay with fine gravel, moist - hard	25	94.5-96	SS	28-47-81	
			26	99.5-101	SS	28-36-70	
477.0	101'						
		Boring Completed					

APPENDIX C



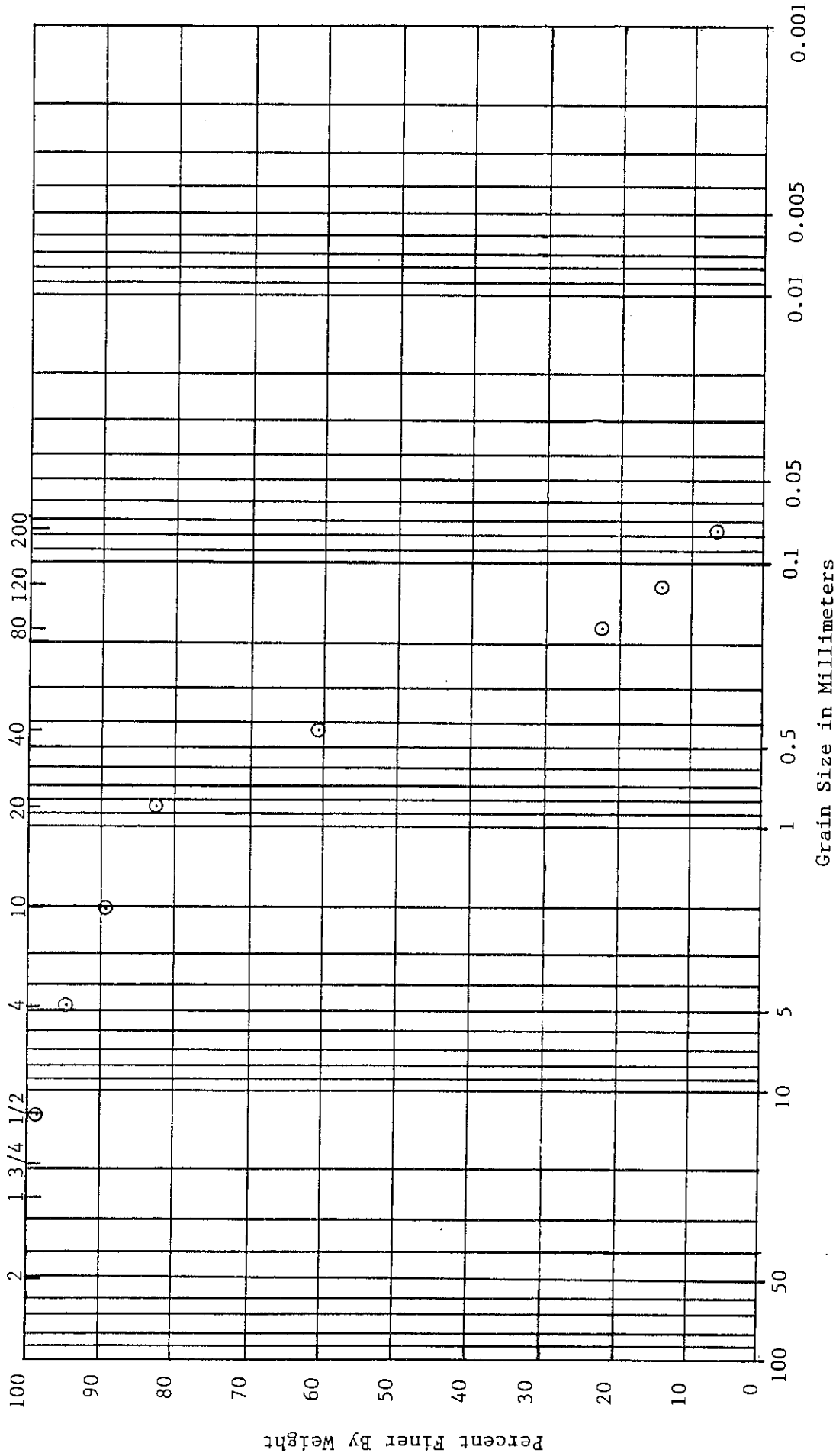
GRAVEL		SAND		SILT OR CLAY	
Coarse	Fine	Coarse	Medium	Fine	

CLASSIFICATION DATA				
Water Content	L.L.	P.L.	P.I.	CLASSIFICATION
				Sand, gray with some silt, traces of gravel and white precipitate
FARROKH N. SCREWVALA INC. • CLEVELAND, OHIO				

Boring No. <u>B-21</u>	Sample No. _____
Depth <u>18.5'-20.0'</u>	<u>J.477</u>
By <u>FNS</u>	Date <u>7-12-95</u>

U. S. Std. Sieve Openings In. U. S. Standard Sieve Numbers

Hydrometer



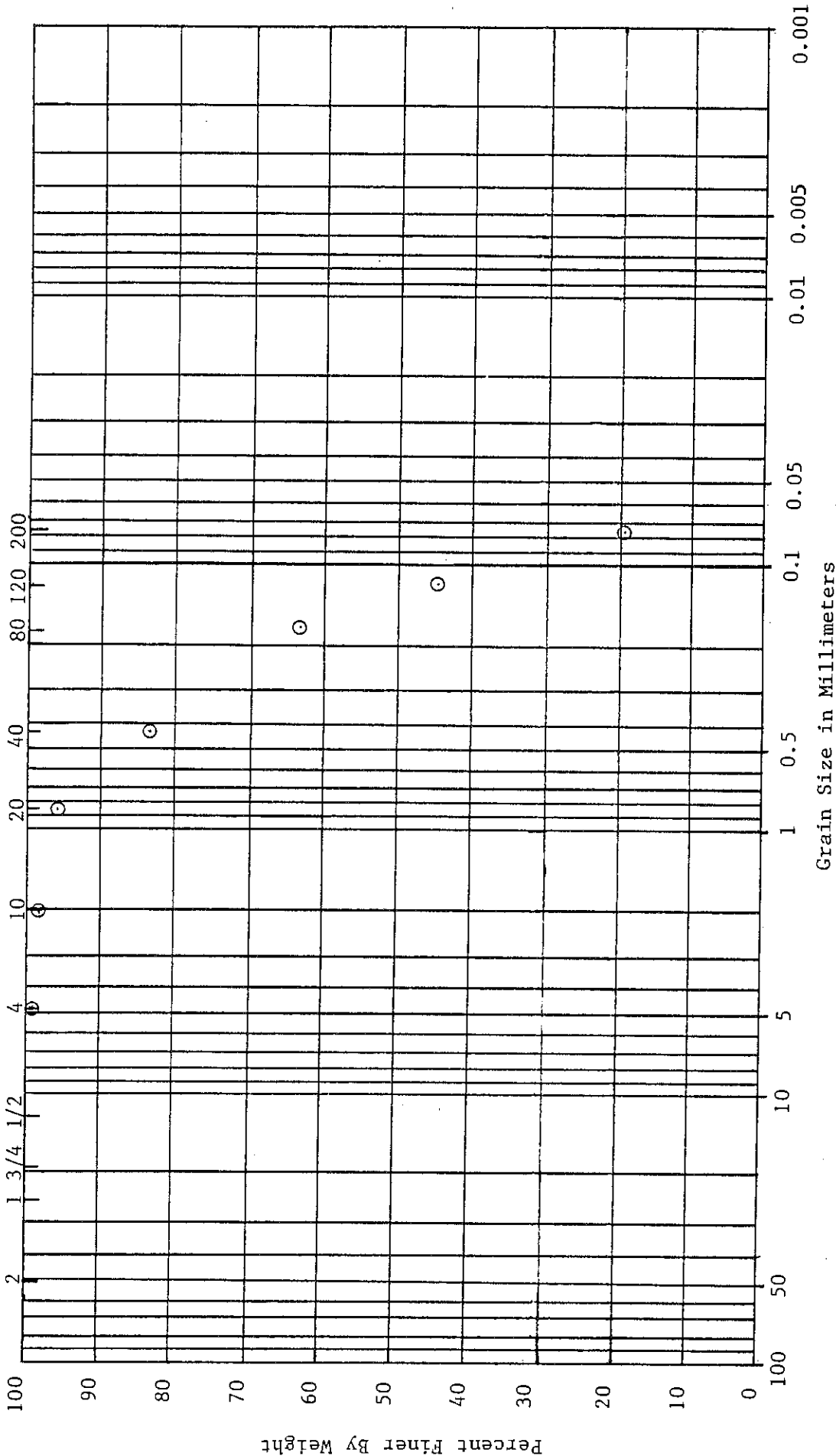
Grain Size in Millimeters

GRAVEL		SAND		SILT OR CLAY	
Coarse	Fine	Coarse	Fine		

CLASSIFICATION DATA				Boring No. B-22	Sample No.
Water Content	L.L.	P.L.	P.I.	Depth 18.5'-20.0'	bottJ.477
				By FNS	Date 6-30-95
Sand, gray with traces of gravel, silt and cinders					
FARROKH N. SCREWVALA INC. • CLEVELAND, OHIO					

U. S. Std. Sieve Openings In. U. S. Standard Sieve Numbers

Hydrometer

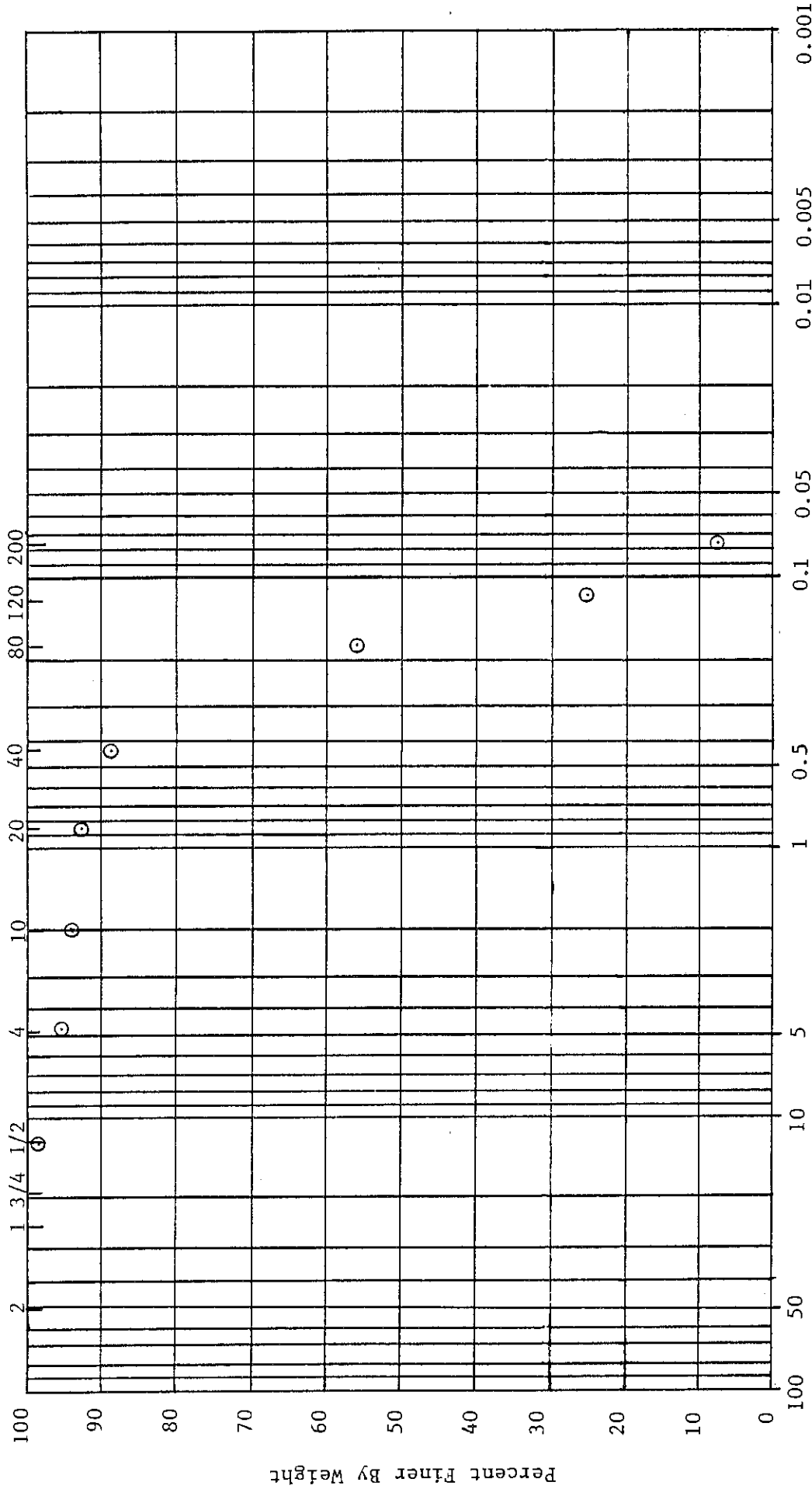


GRAVEL		SAND		SILT OR CLAY	
Coarse	Fine	Coarse	Fine		

CLASSIFICATION DATA				Boring No. <u>B-23</u>	Sample No. _____
Water Content	L.L.	P.L.	P.I.	Depth <u>18.5'-20.0'</u>	J.477
				By <u>FNS</u>	Date <u>7-12-95</u>
FARROKH N. SCREWVALA INC. • CLEVELAND, OHIO					

U. S. Std. Sieve Openings In. U. S. Standard Sieve Numbers

Hydrometer



Grain Size in Millimeters

GRAVEL		SAND		SILT OR CLAY
Coarse	Fine	Coarse	Fine	

CLASSIFICATION DATA

Water Content	L.L.	P.L.	P.I.	CLASSIFICATION
				Sand, gray with traces of silt, slag, cinders and wood

FARROKH N. SCREWVALA INC. • CLEVELAND, OHIO

Boring No. B-24 Sample No. _____
Depth 13.5'-15.0' J. 477
By FNS Date 7-6-95

SUMMARY OF FINDINGS, SITE GEOTECHNICAL INVESTIGATION DOCK NO. 22E IMPROVEMENTS PORT OF CLEVELAND, OHIO

Prepared for:
Cleveland-Cuyahoga County Port Authority
101 Erieside Avenue
Cleveland, Ohio 44114-1095

Woodward-Clyde 

30775 Bainbridge Road
Suite 200
Solon, Ohio 44139
(V)440.349.2708
(F)440.349.1514
Project No. 8E06114

OCT 07 1998

July 24, 1998

Mr. E. M. Jacobsen, Jr.
Mr. Eric E. Hirsimaki
Cleveland-Cuyahoga County Port Authority
101 Erieside Avenue
Cleveland, Ohio 44114-1095

Subject: Summary of Findings – Site Geotechnical Investigation
Dock No. 22E Improvements – Port of Cleveland, Ohio

Gentlemen:

In accordance with your authorization, we are pleased to present Woodward-Clyde International America's (WC's) Summary of Findings from our site geotechnical investigation of Dock 22E, located along Lake Erie at the Port of Cleveland, Ohio. The review was conducted in accordance with our May 19, 1998 proposal letter, July 8, 1998 Preliminary Findings Letter, and several related meetings and telephone conversations.

PROJECT DESCRIPTION

The Cleveland-Cuyahoga County Port Authority (CCCPA), in conjunction with URS Greiner Inc. (URS), is currently in the final design stages of improvements to Dock 22E. Proposed improvements include widening and lengthening the existing slip to accommodate larger vessels, and an increase in port traffic. Approximately 1200 feet of new sheet pile bulkhead and 800 feet of new deadman wall are proposed, along with related demolition of existing structures, dredging / fill activities in the slip and the lake, and miscellaneous utility work.

WC was retained by the CCCPA to perform a site geotechnical investigation. The primary purpose of the investigation was identification of potential underground obstructions, which could impede installation of the proposed sheet piles. The investigation also focused on clarification of the site specific subsurface conditions as they relate to constructability of the proposed improvements, and the proposed contractual agreement between the owner (CCCPA) and potential contractor(s). The investigation involved four primary tasks:

1. A review of historic site usage to identify the type and location of structures which previously occupied the site.
2. A review of previous geotechnical explorations and analyses to identify the generalized subsurface stratigraphy, and underground obstructions which could impede sheet pile installation.



Woodward-Clyde

Mr. E. M. Jacobsen, Jr.
Mr. Eric E. Hirsimaki
Cleveland-Cuyahoga County Port Authority
July 24, 1998
Page 2

3. Auger drilling along the proposed sheet pile alignments to identify underground obstructions which could impede installation.
4. Excavation of test trenches to identify abandoned foundations, and underground obstructions which could impede sheet pile installation and/or impact the dredging and fill activities.

The following discussion presents the results of the site geotechnical investigation including a summary of findings from the review of historic site usage and the previous geotechnical investigations. The discussion also presents the results of the current geotechnical subsurface explorations, including a graphic presentation of the boring logs and test trench logs, and a summary of the site specific subsurface conditions which could potentially impact the proposed improvements.

REVIEW OF HISTORIC SITE USAGE

A review of historic site usage was conducted for the proposed site. The following references were utilized for the review:

- Preliminary Site Evaluation, Cleveland Aquarium, Dock 20; URS Consultants; April 2, 1992.
- Sanborn Insurance Maps; Volumes 1 & 1A; 1912-1972.
- Hopkins Plat Maps; 1920-1927.

Drawing WC-1, which incorporates these references, was developed to illustrate previous structures which occupied the site. The references indicate that early site usage (i.e. 1853 to 1953) was primarily transportation related. The site appears to have functioned as a major trans-shipment area between both railroads and ships. Based on the early twentieth century maps, major landmarks included:

- A 90-foot tall iron chimney and its parent building; the chimney probably rested on deep foundations. The parent structure is most likely a two story power plant which likely rested on deep foundations. A trestle is also shown just west of the parent building, foundation type for the trestle is unknown.
- A cluster of buildings including a mule house, engine room, iron car dump, and incline. The car dump was confirmed as bearing on deep foundations (refer to URS drawing C224).
- Two small office buildings.
- A supply house.



Woodward-Clyde

Mr. E. M. Jacobsen, Jr.
Mr. Eric E. Hirsimaki
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- Numerous railroad spurs. Drawing C224 indicates that the iron car dump was built on several abandoned rail grillages; the grillage structures appear to be specific to the car dump, but could exist elsewhere.
- The site appears to have been smaller than current limits, indicating that some of the random fill was placed subsequent to 1953.

The references indicate that the majority of the transportation related structures were demolished, to at least existing grade, by 1953. In 1953-54, the site became home to the Railway Parcel Post Terminal. As illustrated on drawing WC-1, the northern portion of the Terminal was occupied by a truck service garage; the southern portion included the primary Terminal building, and a loading dock. An underground storage tank (UST) and 75 feet of related underground piping were noted near the northeast corner of the truck service garage. The extension for West 9th Street was shown just east of the Terminal.

The Parcel Post Terminal was reportedly demolished in 1985. The foundations for the Terminal structures, and what appears to be West 9th Street still exist on the site. The proposed deadman wall is aligned within the foundations for the parcel post terminal. Details for these foundations are illustrated on URS drawings C221, C222, and C223.

Several utility lines were also shown in the Preliminary Site Evaluation. The utilities include, a 15-inch storm sewer line and a 12-inch potable water line.

The Preliminary Site Evaluation included interviews to determine past site usage. The interviewees included: Mr. Hirsimaki and Mr. Raymond Conklin - a retired bridge and building supervisor for the New York Central Railroad.

Mr. Hirsimaki made several comments which relate to the current site, including:

- The site was composed of fill material by at least the turn of the century;
- The former postal building was constructed at the same location where the railroad round house was located in 1919;
- The postal building was constructed in 1953 and removed in 1985;
- The postal building had an underground storage tank which was removed from the northeast corner of the building during demolition;

Mr. Conklin made several comments which relate to the current site, including:

- At an old round house formerly located in the northeast corner of the site, only light service on steam locomotives was performed.
- Wooden piles were used to support the parcel post terminal;
- A lot of rock was used as fill along the northern edge of the site.



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REVIEW OF PREVIOUS GEOTECHNICAL INVESTIGATIONS

Previous geotechnical investigations for other projects near the site, and the proposed bulkhead, were reviewed to identify potential underground obstructions. The geotechnical investigations include:

- Geotechnical Investigation for Dock 22E, Port of Cleveland; *Raamot* Associates, P.C.; March 19, 1993.
- Report of Soil Conditions for Cleveland Port Authority Relocation Project; David V. *Lewin* Corporation; May 22, 1991.

The investigation and report by Raamot was prepared for the Dock 22E bulkhead design. The report included the relevant borings presented by Lewin, and several additional borings performed for the bulkhead. Refer to drawing WC-2 for boring locations, and Appendix A for copies of the boring logs.

The report prepared by Lewin was part of investigations for other projects. The report included several borings within the current project limits; refer to drawing WC-2 for boring locations, and Appendix A for copies of the boring logs.

The site specific subsurface stratigraphy illustrated on drawing WC-3 was developed from a review of the previous geotechnical investigations. In general, surficial conditions near the proposed bulkhead consist of 0 to 14 inches of asphalt and concrete, underlain by 10 to 35 feet of man-placed fill. The fill is very random and consists of cinders, brick, concrete, stone, coal, wood, metal, and glass; boring B93-2 noted "large pieces of reinforced concrete building debris". The random fill is underlain by 0 to 10 feet of silty sand, followed by silty clay.

The report prepared by Raamot mentioned that the large pieces of concrete and other debris in the random fill must be removed along the proposed alignment prior to installation of sheeting.

CURRENT GEOTECHNICAL SUSURFACE INVESTIGATION

Subsurface Exploration

Subsurface conditions at the site, which could potentially impede sheet pile installation, were evaluated by drilling twenty-two (22) exploratory borings. The borings were drilled from July 15, 1998 to July 16, 1998 by Summit Drilling, of Akron, Ohio. A DK-5, truck-mounted drill rig was used in conjunction with 2¼-inch hollow-stem augers; soil samples were not retrieved.



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The borings ranged from 23 to 38 ft below existing grade, i.e. the lower limits of the random fill deposit as identified by inspection of the auger spoils and the previous geotechnical investigations. The borings were situated along the proposed sheet pile and deadman wall alignments. Boring locations were based on the proposed alignment at the time of drilling; the final alignment is approximately 8 ft west of the final boring locations. Boring locations were also dictated by site restrictions, i.e. at the time of drilling steel coils occupied a portion of the deadman wall alignment. Final boring locations are illustrated on drawing WC-2.

The purpose of the borings was to auger through the random fill deposits (stopping at the natural soils) and observe slow or difficult drilling conditions, or auger refusal; obstructions which resulted in difficult drilling or auger refusal could potentially impede sheet pile installation. The auger spoils were logged to identify the generalized subsurface stratigraphy. A graphic representation of the boring logs is presented in Appendix B.

Three (3) test trenches were excavated on July 17, 1998 by Nerone & Sons, of Cleveland, Ohio. A Linkbelt 3400 Trackhoe was used to excavate the trenches; soil samples were not retrieved.

The trenches ranged from 10 to 18 ft below existing grade, as dictated by trench wall stability and ground water. The trenches were situated at locations of existing structures (i.e. the exposed concrete dock), and historic structures, which were identified in the historic review of site usage.

The purpose of the trenches was to observe abandoned foundations and structures, and underground obstructions which could impede sheet pile installation and/or impact the dredging and fill activities.

Subsurface Conditions

The following section summarizes the site specific subsurface conditions. The discussion is based on the current subsurface exploration, and focuses on the tasks presented in the project description.

The current borings and test trenches revealed subsurface stratigraphy which was similar to that presented in the previous geotechnical investigations. In general, surficial conditions near the proposed bulkhead and deadman walls consist of 17 to 35 feet of man-placed fill. The fill is very random and consists of black slag and cinders, and brown silty sand and clay, with some brick, concrete, stone, coal, wood, metal, and glass; the miscellaneous debris was found to exist in sizes ranging from less than 1-inch to greater than 10 ft. Portions of the site, i.e. within the existing road, have up to 14 inches



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of asphalt and concrete overlaying the random fill. The random fill is underlain by 0 to 10 feet of silty sand, followed by silty clay.

The following is a summary of significant items encountered in the borings; refer to Appendix B, drawing WC-2, and the Photo Journal for more detailed information.

Boring WC-1:

- the driller noted difficult drilling from 5 ft to 11 ft below grade;
- several copper wires were observed in the spoils; at completion of drilling a piece of rebar was wrapped around the auger bit;
- at completion of drilling the top 2 feet of the hole had collapsed to approximately 2 ft in diameter, 2" to 1' pieces of concrete, brick, stone and rebar were observed in the hole.

Boring WC-2:

- the driller noted difficult drilling from 0 ft to 18 ft below grade.

Boring WC-3:

- the driller noted difficult drilling from 0 ft to 8 ft below grade;
- at 8 ft below grade the auger bit fell off of the augers and the hole was abandoned.

Boring WC-6:

- at 4.5 ft the driller noted that the auger dropped approximately 18 inches; a storm sewer manhole was observed in the vicinity;
- the driller noted difficult drilling from 22 ft to 23 ft below grade;
- at completion of drilling a piece of wood was logged in the end of the auger bit.

Boring WC-10:

- the driller noted difficult drilling from 0 ft to 12 ft below grade.

Boring WC-11:

- the driller noted difficult drilling at 14 ft below grade;
- at completion of drilling the auger bit was missing.

Boring WC-12:

- at 5 ft below grade the driller noted an obstruction which was pushed aside by the auger;
- at 7 ft below grade the driller noted a piece of rubber or plastic;
- at 23 ft the driller notes that the debris above 23 ft is causing difficulty drilling;
- at completion of drilling a thin stranded steel cable was observed wrapped around the auger bit.

Boring WC-13:

- the driller noted difficult drilling at 14 ft below grade;

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- at 20 ft the augers produced large pieces of brick, most likely generated near the surface.

Boring WC-15:

- the driller noted difficult drilling at 15 ft below grade;

Boring WC-16:

- the driller noted difficult drilling from 0 ft to 1 ft below grade, the hole was relocated approximately 2 ft south of original location.

Boring WC-20:

- the driller noted obstructions and difficult drilling from 7 ft to 10 ft below grade;
- at completion of drilling a piece of railroad tie was logged in the end of the auger bit.

The test trenches revealed numerous abandoned foundation units, timber pilings, and miscellaneous debris of significant size. The following is a summary of items encountered in the test trenches; refer to Appendix C, drawing WC-2, and the Photo Journal for more detailed information.

Test Trench #1 (TT-1):

- encountered numerous 1 inch to 1 ft pieces of concrete, brick, sandstone, wood, metal and glass;
- three 2 ft by 6 ft pieces of sandstone were excavated from the trench, other large pieces of sandstone were observed in the north and south sides of the trench;
- encountered numerous 5 ft long by 1 ft diameter pieces of wood;
- encountered numerous 1 to 2 ft pieces of concrete and several metal pipes;
- abandoned foundations were not encountered in the vicinity of the power plant, chimney and trestle, but an abandoned foundation was uncovered approximately 65 ft east of boring WC-12; the foundation was broken up and a timber pile was observed under the foundation; no rebar was observed; the foundation was observed in the north and south sides of the trench.

Test Trench #2 (TT-2):

- numerous 4 ft by 4 ft pieces of reinforced concrete were observed resting in the surface of the exposed concrete dock, and the surface of the trench;
- encountered numerous 1 inch to 3 ft pieces of concrete, brick, sandstone, wood, metal and glass;
- encountered one 7 ft by 7 ft piece of concrete, two 7 ft by 6 inch diameter stranded steel cables, and four 7 ft by 2 inch diameter solid steel cables.
- timber piles and 1 ft to 3 ft pieces of rock were found under the east side of the exposed concrete dock, and a concrete footing was found under the west side;



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- a series of abandoned foundation units were encountered west of the exposed concrete dock; it appears that foundation units are the car dump and its related structures. The structures were up to 12' thick and timber piles were encountered under the foundations; rebar was encountered and the trackhoe was unable to break up the foundations; the foundation was observed in the north and south sides of the trench.

Test Trench #3 (TT-3):

- encountered numerous 1 inch to 2 ft pieces of concrete, brick, sandstone, wood, metal and glass;
- encountered numerous 1ft to 8 ft pieces of concrete, brick, and stone, large pieces of debris were pulled out of the trench with each pass of the trackhoe; the trench opened to approximately 10 ft wide due to the numerous pieces of large debris;
- encountered four abandoned railroad ties;
- encountered a 4 ft piece of sandstone in the south side of the trench;

Surficial Conditions

The shoreline for the entire site is lined with large (up to 10' by 10') pieces of stone and reinforced concrete; other miscellaneous debris including large (2' by 40') trees were also observed lining the shoreline. The large debris was most likely placed as shoreline protection and is expected to extend to the lake bed and the slip bed. The large debris is also expected to extend laterally into the lake and the slip. See photos 1 and 2 in the attached Photo Journal for more information.

Brick and concrete were observed at the surface in the northern and eastern portions of the site, i.e. from the road to the lake and the road to the existing slip, see photo 3. The current borings which were drilled in these portions of the site recorded difficult drilling and revealed miscellaneous debris in the upper 10 to 30 ft of the fill. The eastern portion of the site has numerous piles of miscellaneous construction debris above grade; the piles consist of asphalt, concrete, brick, stone and other debris, and ranged in height from 3 to 5 feet.

SUMMARY OF FINDINGS

The review of historic references indicate that early site usage (i.e. 1853 to 1953) was primarily transportation related. The site appears to have functioned as a major trans-shipment area; several structures and numerous railroad spurs occupied the site. The historic references indicate that the majority of the transportation related structures were demolished, to at least existing grade, by 1953. Results of the current geotechnical investigation indicate that foundations for at least some of these structures still exist on the site; it appears that the car dump foundation is situated west of the exposed concrete

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dock. Other miscellaneous foundations were also encountered along the eastern portion of the site, indicating that the foundations for the structures illustrated on Drawing WC-1 may still exist in other portions of the site. The railroad related foundations (including timber piles), and miscellaneous related debris was generally found between 5 and 15 ft below existing grade.

In 1953-54, the site became home to the Railway Parcel Post Terminal. The Terminal was reportedly demolished in 1985, however the foundations for the Terminal structures, and what appears to be West 9th Street still exist at the current grade elevation. Details for these foundations are illustrated on contract drawings C221, C222, and C223.

The previous geotechnical investigations indicated that the surficial conditions near the proposed bulkhead consist of 10 to 35 feet of man-placed fill. The fill was noted to be very random, and generally described as cinders, brick, concrete, stone, coal, wood, metal, glass; and large pieces of reinforced concrete building debris.

The current geotechnical subsurface explorations confirmed the limits and composition of the random fill deposits. The northern and eastern portions of the site (i.e. from boring WC-6 north, and from the east side of the road east) appear to contain the majority of the random debris. Abandoned concrete foundations, timber piles, and other debris (including cinders, brick, concrete, stone, coal, wood, metal, and glass) were encountered throughout these portions of the site. The foundations, piles and miscellaneous debris ranged in size from 1 inch to 20 ft, and was found throughout the extent of the random fill. The size and quantity of the foundations and debris could potentially impede sheet pile installation in these portions of the site. The debris will also influence equipment selection and duration of the proposed dredging activities, as well as reuse of the random fill for the proposed improvements.

The size and quantity of debris found in the remainder of the site (i.e. from boring WC-6 south, and from the east side of the road west) was marginal. Miscellaneous debris associated with the railroad, in particular abandoned railroad ties, were encountered in borings WC-20, WC-21 and WC-22. The railroad ties were found to exist approximately 6 to 10 ft below existing grade and could potentially impede sheet pile installation. The size and quantity of debris found in the remainder of the borings in this portion of the site is not expected to impede sheet pile installation.



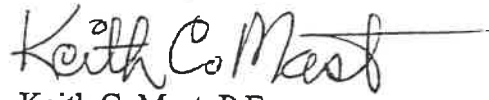
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We appreciate the opportunity to be of service to you on this project, and look forward to discussing the findings. If you have any questions or need additional information, please do not hesitate to call.

Respectfully submitted,


Peter J. Kusky
Senior Staff Engineer


Keith C. Mast, P.E.
Partner

PJK:pjk

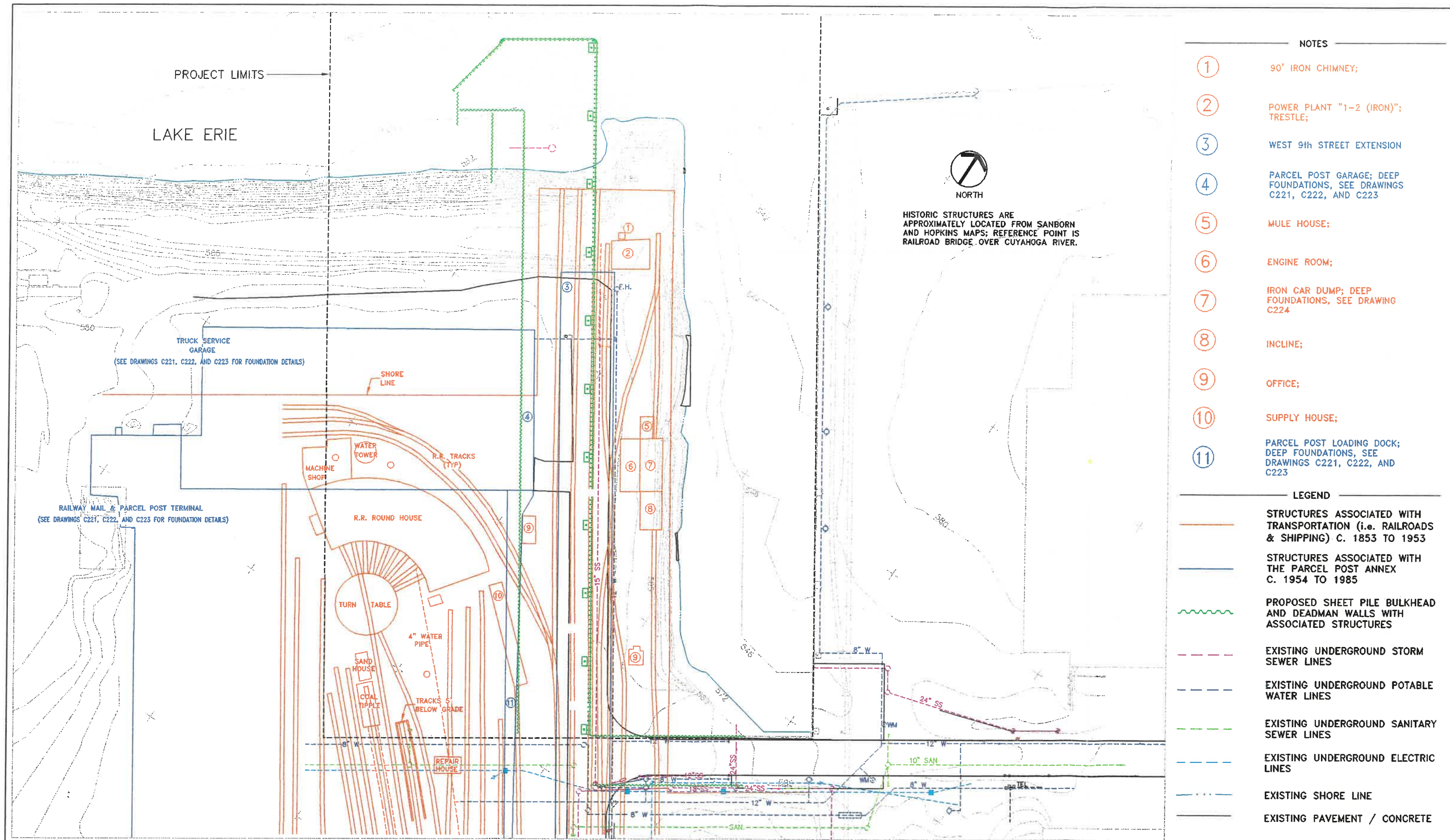
Attachments

cc: Mr. Larry Jacobson, URS Greiner, Inc.



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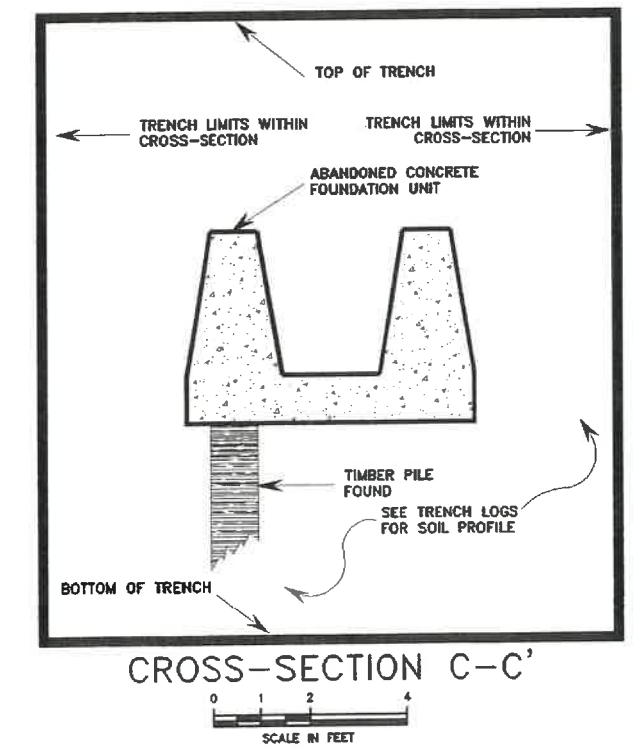
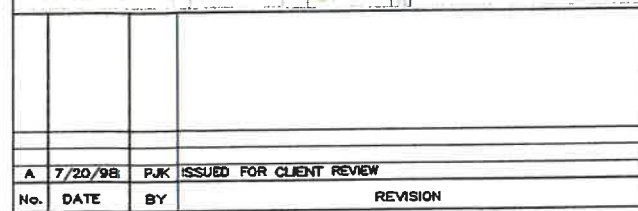
Figures



- NOTES
- ① 90' IRON CHIMNEY;
 - ② POWER PLANT "1-2 (IRON)"; TRESTLE;
 - ③ WEST 9th STREET EXTENSION
 - ④ PARCEL POST GARAGE; DEEP FOUNDATIONS, SEE DRAWINGS C221, C222, AND C223
 - ⑤ MULE HOUSE;
 - ⑥ ENGINE ROOM;
 - ⑦ IRON CAR DUMP; DEEP FOUNDATIONS, SEE DRAWING C224
 - ⑧ INCLINE;
 - ⑨ OFFICE;
 - ⑩ SUPPLY HOUSE;
 - ⑪ PARCEL POST LOADING DOCK; DEEP FOUNDATIONS, SEE DRAWINGS C221, C222, AND C223

- LEGEND
- STRUCTURES ASSOCIATED WITH TRANSPORTATION (i.e. RAILROADS & SHIPPING) C. 1853 TO 1953
 - STRUCTURES ASSOCIATED WITH THE PARCEL POST ANNEX C. 1954 TO 1985
 - PROPOSED SHEET PILE BULKHEAD AND DEADMAN WALLS WITH ASSOCIATED STRUCTURES
 - EXISTING UNDERGROUND STORM SEWER LINES
 - EXISTING UNDERGROUND POTABLE WATER LINES
 - EXISTING UNDERGROUND SANITARY SEWER LINES
 - EXISTING UNDERGROUND ELECTRIC LINES
 - EXISTING SHORE LINE
 - EXISTING PAVEMENT / CONCRETE

				JOB No. 8E06114	DESIGNED: KCM	PROJECT ENGINEER: KCM	<div>URS Greiner</div> <div>800 West St. Clair Ave. Cleveland, Ohio 44113</div>			CLEVELAND - CUYAHOGA COUNTY PORT AUTHORITY CLEVELAND, OHIO		DOCK 22E IMPROVEMENTS HISTORIC SITE USAGE AND EXISTING SITE UTILITIES		SHEET		
				SCALE: AS SHOWN	DRAWN BY: PJK	APPROVED BY:				CAD FILE NUMBER: U:\8E06114\6114_HIST.DWG	DRAWING NUMBER: WC-1		REV. B	SHT. OF		
					CHECKED BY: KCM	DATE: 7/6/98										









REFER TO DRAWING WC-1 FOR DESCRIPTIONS OF HISTORIC SITE USAGE AND SITE UTILITIES.

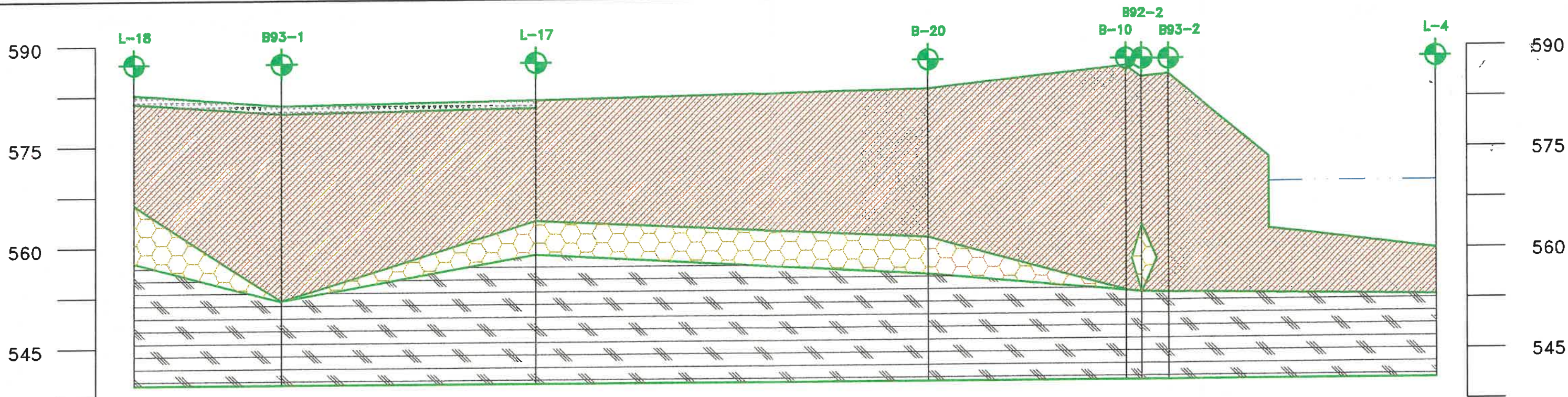
LOCATIONS OF BULKHEAD AND DEADMAN WALLS ARE BASED ON ORIGINAL ALIGNMENT.

LOCATIONS OF WOODWARD-CLYDE (WC) BORINGS WERE BASED ON REVISED ALIGNMENT.

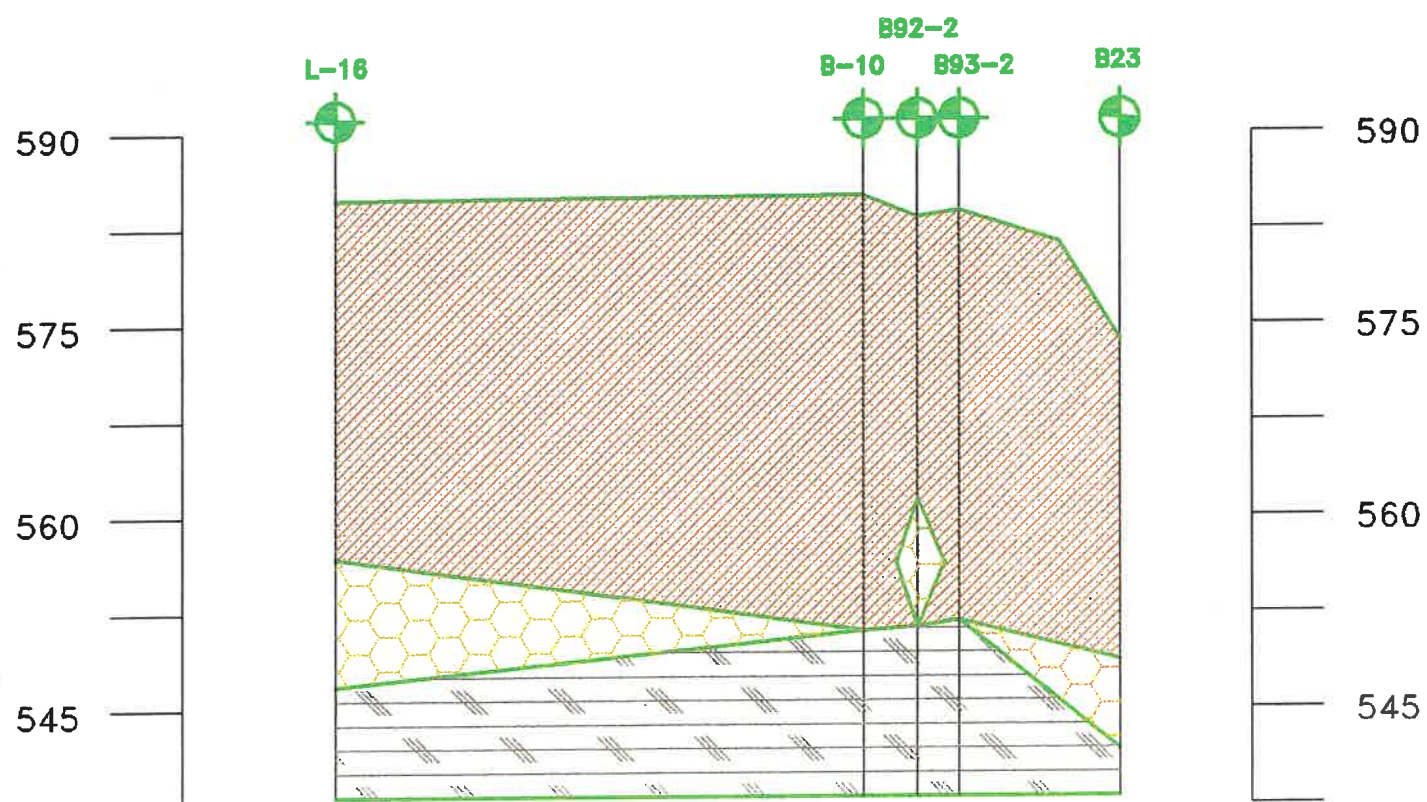
LEGEND

	SOIL BORINGS PERFORMED BY LEWIN (1978, 1989, 1990) AND RAAMOT (1992, 1993); REFER TO APPENDIX A.
	SOIL BORINGS PERFORMED BY WOODWARD-CLYDE (1998); REFER TO APPENDIX B.
	TEST TRENCHES PERFORMED BY WOODWARD-CLYDE (1998); REFER TO APPENDIX C.
	PROPOSED SHEET PILE BULKHEAD AND DEADMAN WALLS WITH ASSOCIATED STRUCTURES
	SUBSURFACE STRATIGRAPHIC CROSS-SECTION LOCATIONS, SEE DRAWING WC-3

JOB No. 8E06114	DESIGNED: .	PROJECT ENGINEER: KCM		CLEVELAND – CUYAHOGA COUNTY PORT AUTHORITY CLEVELAND, OHIO	DOCK 22E IMPROVEMENTS SOIL BORING & TEST TRENCH LOCATION PLAN				
SCALE: AS SHOWN	DRAWN BY: PJK	APPROVED BY: .			800 West St. Clair Ave. Cleveland, Ohio 44113	CAD FILE NUMBER: U:\8E06114\6114_FIELD1.DWG	DRAWING NUMBER: WC-2	REV. 1	SHT. ____ OF ____
	CHECKED BY: KCM	DATE: 7/20/98							



CROSS-SECTION A-A'



CROSS-SECTION B-B'

0 30 60 120
HORIZONTAL SCALE IN FEET

0 7.5 15 30
VERTICAL SCALE IN FEET
(EXAGGERATED 4X)

LEGEND	
	APPROXIMATE SOIL STRATA BOUNDARY
	ASPHALT OVERLAYING CONCRETE
	RANDOM FILL
	SILTY SAND
	SILTY CLAY

NOTES:
 SURFACE TOPOGRAPHY IS INTERPOLATED FROM BORING DATA.
 STRATIGRAPHY INTERPOLATED FROM BORINGS WHICH RETREIVED SAMPLES, AND MAY VARY FROM WHAT IS SHOWN.
 STRATIGRAPHY HAS BEEN SIMPLIFIED TO REFLECT GENERAL TRENDS.
 BORING DEPTHS ARE LIMITED TO SHOW EXTENTS OF RANDOM FILL.

LOC. PORT OF CLEVELAND SEND TO
 PROJ. PIER 22 IMPROV. PHONE
 PROJ. # 8E06114
 TASK #
 DATE 7/6/98
 SCALE: AS SHOWN

REV	DESCRIPTION OF REVISION	BY	DATE

Woodward-Clyde
 Engineering & sciences applied to the earth & its environment
 30775 Bainbridge Road, Suite 200
 Solon, Ohio 44139

DESIGNED	
DRAWN	PJK
CHECKED	KCM
PEER REVIEWED	
PROJECT MANAGER	KCM
DATE	7/6/98

DOCK 22E IMPROVEMENTS
 SUBSURFACE STRATIGRAPHIC CROSS-SECTIONS
 CLEVELAND - CUYAHOGA COUNTY PORT AUTHORITY
 PORT OF CLEVELAND
 CLEVELAND, OHIO

REVISION	
PROJECT	8E06114
DRAWING	WC-3
SHEET	X OF X

Appendix A

LABORATORY LOG OF BORING

Method of Sampling:

Split spoon ☒ Shelby ☐
Core drill ☐ Auger ☐

Boring No. L-17

Surface Elevation 581.7

Depth in feet	Symbol	DESCRIPTION	Blows on spoon for 12 inches	Depth to bottom of sample in feet	SUMMARY OF TEST RESULTS					
					Natural Moisture %	Liquid Limit	Plasticity Index	Unconfined Shear Stress #/SF	Strain %	Unit Dry Weight #/cu. ft.
0		2" asphalt; 10" concrete	50/.5	1.5						
1		Fill: rock frags., cobbles, wood,	65	4.0						
2		brick, sand, silt, granulated	17	6.5						
3		slag								
4		brown silty sand w/s gravel								
5		slag, sand, gravel	6	10.0						
10		some cobbles	10	15.0						
11		sulphur odor								
20		Sand, gray, coarse w/s clay seams	19	20.0	22.6					
25		Clay, gray, silty w/silt seams	17	25.0	26.0			1630	11.7	98
30		gray, silty	11	30.0	30.5			440	9.5	96
35			8	35.0	26.3			560	13.2	101
40			9	40.0	30.9					
45			9	45.0	27.6			1025	16.0	104
50		gray, silty w/s sand, tr.	17	50.0	22.8			2000	16.5	110
51		gravel & rock frags.								
55			15	55.0	20.3			1550	15.9	112
60			23	60.0	19.9			1760	20.0	115
65			30	65.0	17.1			3295	20.0	120
70			33	70.0	16.2			3570	20.0	124
75			35	75.0	14.9			5500	20.0	120
80			30	80.0	15.1			6200	17.4	130

LABORATORY LOG OF BORING

Method of Sampling:

☐

□

Boring No. L-17 (Cont.)

Surface Elevation 581.7

Depth in feet	Symbol	DESCRIPTION	Blows on spoon for 12 inches	Depth to bottom of sample in feet	SUMMARY OF TEST RESULTS					
					Natural Moisture %	Liquid Limit	Plasticity Index	Unconfined Shear Stress #/SF	Strain %	Unit Dry Weight #/cu. ft.
90		Silt, gray, clayey w/clay seams	104	85.0	16.0		5200	16.3	121	
			30	90.0	19.6		2665	16.9	114	
			34	95.0	22.5					
100		Clay, gray, silty w/gravel & rock frags.	61	100.0	12.7		5950	20.0	130	
		End of boring at 100.0'								
110		REMARKS:				Boring Completed: 12/15/90				
		Encountered water at 8.0'				Boring Location: Cleveland, Ohio				
		Hole caved at 17.0' on completion				Job No.: C. 4533				
120										

Surface Elevation $582 \pm$
586.2

Depth in feet	Symbol	DESCRIPTION	Blows on spoon for 12 inches	Depth to bottom of sample in feet	SUMMARY OF TEST RESULTS						
					Natural Moisture %	Liquid Limit	Plasticity Index	Unconfined Shear Stress #/SF	Strain %	Loss on Ignition @ 600 °C. - %	Unit Dry Weight #/cu. ft.
		Fill: cinders, sand, brick, concrete & trace of wood	9	3.5							
			6	6.5							
10			9	10.0							
			7	15.0	29.3					13.0	
20		gray & black silty sand, w/ trace of vegetation & pieces of coal	14	20.0							
			9	25.0	33.7					8.9	
30		gray & brown silty sand, w/ sandstone fragments	12	30.0							
		Clay, gray, silty, w/some silt seams trace of wood @ 35.0'	7	35.0	35.0						
			8	36.5	29.6			610	20.0		97
40			S-1		33.9						
				42.0	31.0			585	6.9		90
		gray, silty, w/some silt seams			28.4			935	9.9		101
50			10	46.5	23.5						
			* S-2		31.6						
				52.0	33.0			970	11.0		92
					31.5	40	17	890	10.9		91
60		gray, silty	7	56.5	25.2						
			X	62.0							
			4	63.5	28.4						
70			12	70.0	22.2						
80		End of boring @ 70.0'									

REMARKS:

Water at 13.0' on completion

X - Attempted shelly tube sample - no recovery

* - See consolidation graph

Boring Completed: 1/4/78
Location: Cleveland, Ohio
Job No.: C. 3033 A

LABORATORY LOG OF BORING

Method of Sampling:

Split spoon ☒ Shelby ☐
 Core drill ☐ Auger ☐

Boring No. B-20

Surface Elevation 582.9

Depth in feet	Symbol	DESCRIPTION	Blows on spoon for 12 inches	Depth to bottom of sample in feet	SUMMARY OF TEST RESULTS					
					Natural Moisture %	Liquid Limit	Plasticity Index	Unconfined Shear Stress σ/SF	Strain %	Unit Dry Weight $\rho/cu. ft.$
10		Fill, brick, stone, clay, sand	26	3.5						
			4	6.5						
			11.5	10.0						
			8	15.0						
			8	20.0						
		Sand, gray	10	25.0						
		Clay, gray, silty	S-1	30.5						
			S-2	32.5						
			S-3	34.5						
			S-4	36.5						
			S-5	38.5						
			S-6	40.5						
			S-7	43.0						
			S-8	45.0						
			S-9	47.0						
			S-10	49.0						
			S-11	51.0						
			S-12	53.0						
			S-13	55.0						
			S-14	57.0						
			S-15	59.0						
			S-16	61.0						
			S-17	63.0						
			S-18	65.0						
			S-19	67.0						
			S-20	69.0						
		gray, silty, with rock fragments	14	70.0	24.3					
			17	74.5	17.7			2330	20.0	119
			18	76.5	17.4					
			S-21	79.0	17.7			3090	18.0	120
			19	80.5	17.7			3230	18.8	119
			21	85.0	16.6			3640	20.0	118

LABORATORY LOG OF BORING

Method of Sampling:

D



□

Boring No. B-20 (cont.)

Surface Elevation 582.9

Depth in feet	Symbol	DESCRIPTION	Blows on spoon for 12 inches	Depth to bottom of sample in feet	SUMMARY OF TEST RESULTS					
					Natural Moisture %	Liquid Limit	Plasticity Index	Unconfined Shear Stress σ/SF	Strain %	Unit Dry Weight $\rho/cu. ft.$
90			31	90.0	21.0					
80		Silt, gray, sandy	30	95.0	20.3		3220	20.0		111
70			62	100.0	11.3					
60		Clay, gray, silty, with rock fragments	41	105.0	13.3					
50			55	110.0	14.4		5100	13.2		127
40			51	115.0	17.4					
30			35	120.0	18.4					
20		Sand, gray, with few small silty seams	31	125.0						
10			34	130.0						
0		Clay, gray, silty, w/pebbles and Shale, gray	57	135.0						
		End of boring at 138.5'	900	138.5						
REMARKS: Water encountered at 8.0' during drilling Water at 5.0' before casing was pulled Water at 8.5' after casing was pulled • No recovery										
Boring completed 4/24/78 Location: Cleveland, Ohio Job. No. C. 1033A										

LABORATORY LOG OF BORING

Method of Sampling:

Split spoon ☒ Shelby ☒
 Core drill ☐ Auger ☐

Boring No. B-23

Surface Elevation 574.5

Depth in feet	Symbol	DESCRIPTION	Blows on spoon for 12 inches	Depth to bottom of sample in feet	SUMMARY OF TEST RESULTS					
					Natural Moisture %	Liquid Limit	Plasticity Index	Unconfined Shear Stress $\theta/5F$	Strain %	Unit Dry Weight $\rho/cu. ft.$
10		Fill, clader and bricks.	40	3.5						
			14	6.5						
			9	10.0						
			4	15.0						
			16	20.0						
		Sand, gray	6	25.0						
			9	30.0						
		Clay, gray	4	35.0	34.4					
			S-1	40.0	30.8			576	20.0	96
			6	41.5	30.7					
			6	45.0	28.2					
			S-2	50.0	28.8			480	14.0	102
			6	51.5	24.7					
			6	55.0	32.4					
			S-3	60.0	30.8			340	20.0	89
			2	61.5	31.0					
			2	65.0	31.6					
		gray, silty, w/silt seams and traces of gravel and rock fragments	S-4	70.0	21.5			1380	20.0	107
			23	71.5	21.0					
			23	75.0	22.1					
			26	79.5	18.9			3250	20.0	120

LABORATORY LOG OF BORING

Method of Sampling:

Split spoon ☒

Shelby ☒

Core drill ☐

Auger ☐

Boring No. B-23 (cont.)

Surface Elevation 574.5

Depth in feet	Symbol	DESCRIPTION	Blows on spoon for 12 inches	Depth to bottom of sample in feet	SUMMARY OF TEST RESULTS					
					Natural Moisture %	Liquid Limit	Plasticity Index	Unconfined Shear Stress $\phi/5F$	Strain %	Unit Dry Weight $\phi/cu. ft.$
27			85.0	16.8						
26			90.0	18.0						
75		gray, silty, w/gravel and rock fragments	95.0	17.2						
62			100.0	17.3				3570	20.0	120
67			105.0	17.1				3130	15.0	119
85			110.0	12.5				6700	10.0	124
102		gray, silty, w/silt seams	114.5	13.1				5000	11.7	122
99			120.0	18.5						
104			124.5	20.4						
500		Shale	128.0							
End of boring at 128.0'										
REMARKS:										
• No recovery										
						Boring completed: 5/ /78				
						Location: Cleveland, Ohio				
						Job No.: C-303A				

RAAMOT ASSOCIATES, P.C.

LOG OF BORING

DATE: 4-15-92 to 4-22-92

BORING NO: B92-2

PROJECT: Dock 22 E, Port of Cleveland

GROUND ELEV. 584.5

CONTRACTOR: R & R International

GND. WATER ELEV. -

		Sample Blows/6"		SOIL DESCRIPTION	Depth Elev.	Classification and Vane Shear Data
		0-6	6-12			
		12-18	18-24			
Depth in Feet	0					
	5	S-1	4 50/4"	8	FILL: Grey Sand, Silt, Gravel and Slag	FILL
	10	S-2	6 2	5		
	15	S-3	12 13	12		
	20	S-4	10 5	6		
	25	S-5	2 5	3	Grey coarse to fine SAND, trace Silt	SP
	30	S-6	4 7	5		
	35	S-7	3 3	2		
	40	V-1	36.5'			
	45	U-1	push=24" rec=24"		Grey Silty CLAY	4.5 ft. lbs.
	45	V-2	41.5'			
	45	S-8	2 3	2		
	50	V-3	46.5'			
		U-2	push=24" rec=24"		116.0 ft. lbs.	
		V-4	51.5'			
					110.0 ft. lbs.	

RAAMOT ASSOCIATES, P.C.

LOG OF BORING

DATE: 4-15-92 to 4-22-92

BORING NO: B92-2

PROJECT: Dock 22 E, Port of Cleveland

GROUND ELEV. 584.5

CONTRACTOR: R & R International

GND. WATER ELEV. -

		Sample Blows/6"		SOIL DESCRIPTION	Depth Elev.	Classification and Vane Shear Data	
		0-6	6-12				
SAMPLE SAMPLE No.		12-18	18-24				
Depth In Feet	55	S-9	4 5	3	Grey Silty CLAY	31.0 ft. lbs.	
		V-5		57.0'		CL	
		U-3	push=24" rec=24"			100.5 ft. lbs.	
	60	V-6		62.0'			
		S-10	5 7	7		50.0 ft. lbs.	
		V-7		67.0'			
		U-4	push=24" rec=0"			55.0 ft. lbs.	
		V-8		72.0'			
	75	S-11	11 22	13		74.0 (510.5)	ML
	80	S-12	11 25	17			
		S-13	13 23	17			
		S-14	11 26	15			
			End of Boring		90.0 (494.5)		
			Note: 1. Unified Soil Classification System is used. 2. S = Split Spoon Sample (SPT) U = Undisturbed Sample V = Vane Shear Test				
95							
100							
105							

RAAMOT ASSOCIATES, P.C.

LOG OF BORING

DATE: 2-1-93 to 2-2-93

BORING NO: B93-1

PROJECT: Dock 22 E, Port of Cleveland

GROUND ELEV. 581.0

CONTRACTOR: Professional Service Industries, Inc.

GND. WATER ELEV: 572.7

Depth In Feet	SAMPLE NO.	Sample Blows/6"		SOIL DESCRIPTION	Depth Elev.	Classification and Vane Shear Data
		0-6	6-12			
		12-18	18-24			
0						
5	S-1	8	10			
		8				
10	S-2	1	2	FILL: Black/Brown SAND, some Gravel, some Slag, trace Clay in upper part		FILL
		3				
15	S-3	5	6			
		7				
20	S-4	4	4			
		12				
25	S-5	2	3			
		3				
30					29.1	
					(551.9)	
	V-1	31.25'				30.0 ft. lbs. @ 10°
	U-1	push=24" rec=24"				
35	V-2	35.25'				120.0 ft. lbs. @ 45°
	S-6	5	7			
		10				
40	V-3	39.5'				50.0 ft. lbs.
	U-2	push=24" rec=24"		Grey Silty CLAY		CL
45	V-4	45.5'				45.0 ft. lbs.
	S-7	3	4			
		5				
50						
	V-5	51.5'				60.0 ft. lbs. @ 36°

LOG OF BORING

BORING NO: B93-1

GROUND ELEV. 581.0

GND. WATER ELEV: 572.7

Note:

1. Unified Soil Classification System is used.
2. S = Split Spoon Sample (SPT)
U = Undisturbed Sample
V = Vane Shear Test
3. Sample blows have been adjusted to account for 24" instead of a 30" hammer stroke.

RAAMOT ASSOCIATES, P.C.

LOG OF BORING

DATE: 2-3-93 to 2-4-93

BORING NO: B93-2

PROJECT: Dock 22 E, Port of Cleveland

GROUND ELEV. 585.0

CONTRACTOR: Professional Service Industries, Inc.

GND. WATER ELEV. 572.5 to 568.7

Depth in Feet	SAMPLE NO.	Sample Blows/6"		SOIL DESCRIPTION	Depth Elev.	Classification and Vane Shear Data
		0-6	6-12			
		12-18	18-24			
0						
5						
10				FILL: Dark Grey SAND, some Gravel, some Slag and misc. Fill including large pieces of reinforced concrete building debris		FILL
15				(Drilled without sampling 0 to 28.5 ft.)		
20						
25						
30	S-1	5 8	6	FILL: Grey SAND, some Gravel, trace Clay	32.0 (553.0)	
35	S-2	3 4	3			
	V-1		36.0'			60.0 ft. lbs. @ 45°
	U-1	push=24" rec=24"		Grey Silty CLAY		CL
40	V-2		42.0'			29.0 ft. lbs. @ 50°
45	S-3	2 5	3			
	V-3		48.0'			62.0 ft. lbs. @ 48°
50	U-2	push=24" rec=24"				

LOG OF BORING

BORING NO: B93-2

GROUND ELEV. 585.0

GND. WATER ELEV: 572.5 to 568.7

Note:

LABORATORY LOG OF BORING

Method of Sampling:

Split spoon ☒ Shelby ☒
 Core drill ☒ Auger ☐

Boring No. L-4

Surface Elevation 570.9±

Depth in feet	Symbol	DESCRIPTION	Blows on spoon for 12 inches	Depth to bottom of sample in feet	SUMMARY OF TEST RESULTS						
					Natural Moisture %	Liquid Limit	Plasticity Index	Unconfined Shear Stress #/SF	Strain %	R.Q.D. - %	Unit Dry Weight #/cu. ft.
		Water									
10		Fill: gray sand, gravel, concrete	25	11.5							
		black coal, sand, gravel,	2	13.5							
		cinders, wood, tr. of oily	3	16.5							
		substance									
20		Clay, gray, silty w/silt seams &									
		tr. gravel	10	21.5	26.7						
		gray, silty									
			* S-1	27.0	33.2						
30			5	28.5	32.5						
			6	31.5	30.4						
					32.1						
			4	36.5	37.3						
40											
			4	41.5	33.1						
			7	46.5	31.6						
50											
			8	51.5	30.4						
			7	56.5	36.9						
60		gray, silty w/s sand, gravel									
		& rock frags.	47	61.5	17.0			2250	20.0		123
			33	66.5	16.6			2205	20.0		124
70											
			44	71.5	15.6						

LABORATORY LOG OF BORING

Method of Sampling:

Split spoon ☒ Shelby ☒
Core drill ☒ Auger ☐

Boring No. L-4 (cont.)

Surface Elevation 570.9±

Depth in feet	Symbol	DESCRIPTION	Blows on spoon for 12 inches	Depth to bottom of sample in feet	SUMMARY OF TEST RESULTS						
					Natural Moisture %	Liquid Limit	Plasticity Index	Unconfined Shear Stress #/SF	Strain %	R.Q.D. - %	Unit Dry Weight #/cu. ft.
80		sandy	55	76.5	16.8			2170	20.0		127
		w/few sand & silt seams	62	81.5	12.2						
			70	86.5	13.4						
90			50/.5	91.0							
		gray, silty, sandy w/gravel & rock frags.	73	96.5	15.5						
100		gray, silty w/tr. shale frags.	84	101.5	19.0			2900	10.8		108
			73	106.0	21.7						
110		w/silt seams	47	111.0	27.9						
			50/.4	111.4							
			50/.1	115.1							
120		Shale, gray, hard w/s sandy shale seams	73%	120.1						0	
			75%	125.1						0	
130		End of boring at 125.1'									
140		REMARKS: *Shelby Tube									
150											

Boring Completed: 10/25/89

Location: Cleveland, Ohio

Job No.: C. 4533




LABORATORY LOG OF BORING

Method of Sampling:

Split spoon ☒ Shelby ☐
 Core drill ☐ Auger ☐

Boring No. L-15

Surface Elevation 581.9

Depth in feet	Symbol	DESCRIPTION	Blows on spoon for 12 inches	Depth to bottom of sample in feet	SUMMARY OF TEST RESULTS					
					Natural Moisture %	Liquid Limit	Plasticity Index	Unconfined Shear Stress #/SF	Strain %	Unit Dry Weight
		Concrete - 12"								
		Fill: brown silty sand	14	2.5						
		Concrete	50/.4	3.9						
10		End of boring at 8.0'								
20										
30										
40										
50										

REMARKS

Water seepage at 2.0'
 No water on completion

Boring Completed: 12/14/90

Location: Cleveland, Ohio

Job No.: C. 4533

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

LABORATORY LOG OF BORING

Method of Sampling:

Split spoon ☒ Shelby ☐
 Core drill ☐ Auger ☐

Boring No. L-15 A

Surface Elevation 582±

Depth in feet	Symbol	DESCRIPTION	Blows on spoon for 12 inches	Depth to bottom of sample in feet	SUMMARY OF TEST RESULTS					
					Natural Moisture %	Liquid Limit	Plasticity Index	Unconfined Shear Stress #/SF	Strain %	Unit Dry Weight
		Concrete - 1"								
		Fill: brown fine to med. silty sand	8	4.0	12.9					
		layered w/gray & brown silty sand	3	6.5	20.9					
		strongly odor at 5'-6.5'								
		w/s clay & asphalt at								
		8.5'-10.0'	3	10.0	15.1					
10		Sand, brown, fine to med. silty								
		layered w/gray & brown	6	15.0	19.2					
20			6	20.0	19.5					
		black & gray, fine to med.,								
		silty w/some organic mat'l,	26	25.0	21.2				4.8	
		tr. gravel & sandstone frags.								
30		Clay, gray, silty w/s silt seams &	15	30.0	28.7				4.0	
		few organic silt seams								
		gray, silty	11	35.0	26.3			395	3.2	3.6
40										105
			13	40.0	29.7			450	6.5	100
		End of boring at 40.0'								

REMARKS

Water seepage at 5' and 22'
 Encountered water at 22'
 Water at 13.5' on completion

Boring Completed: 12/15/90

Location: Cleveland, Ohio

Job No.: C. 4533

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

LABORATORY LOG OF BORING

Method of Sampling:

Split spoon ☒ Shelby ☐
 Core drill ☐ Auger ☐

Boring No. L-16

Surface Elevation 585.9

Depth in feet	Symbol	DESCRIPTION	Blows on spoon for 12 inches	Depth to bottom of sample in feet	SUMMARY OF TEST RESULTS						
					Natural Moisture %	Liquid Limit	Plasticity Index	Unconfined Shear Stress #/SF	Strain %	Loss on Ignition @ 600°C-%	Unit Dry Weight
10		Fill: brown sand w/gravel, brick, concrete, slag, metal, wood, asphalt black & gray sandy w/slag, gravel, brick, concrete, tr. glass	50/.3	0.8							
			15	4.0							
			42	6.0							
			50/.4	6.4							
			51	10.0							
20		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	100/.3	13.8							
			34	15.5							
			50/.2	15.7							
			53	20.0							
30		Sand, dk. gray, silty w/s silt seams & organic mat'l dk. gray w/organic mat'l	21	25.0							
			14	30.0	31.1					6.5	
40		Clay, gray, silty	4	35.0	35.0					7.0	
			10	40.0	29.7			555	12.3		96
			12	45.0	21.9			615	6.6		111
50			12	50.0	25.7			650	6.8		103
			11	55.0	30.3						
60		End of boring at 60.0'	10	60.0	29.9			615	20.0		100

REMARKS

Encountered water at 14.0'
 Hole caved at 5.0' on completion

Boring Completed: 12/14/90

Location: Cleveland, Ohio

Job No.: C. 4533

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

LABORATORY LOG OF BORING

Method of Sampling:

Split spoon ☒ Shelby ☐
Core drill ☐ Auger ☐

Boring No. L-18

Surface Elevation 582.3

Depth in feet	Symbol	DESCRIPTION	Blows on spoon for 12 inches	Depth to bottom of sample in feet	SUMMARY OF TEST RESULTS						
					Natural Moisture %	Liquid Limit	Plasticity Index	Unconfined Shear Stress #/SF	Strain %	Loss on Ignition @ 600°C-%	Unit Dry Weight #/cu. ft.
		4" blacktop; 12" concrete									
		Fill: brown silty sand, cinders, slag, red brick, tr. wood	85	3.5							
			16	6.5							
10		gray fine to med. silty sand, layered coal, gravel, cinders	11	10.5							
			10	15.5							
20		Sand, gray, fine, silty w/tr. gravel	56	20.5	22.1					1.2	
			16	25.5	17.4 27.2						
30		Clay, gray, silty	20	30.5	25.4			855	11.8		107
			20	35.5	25.3			1390	17.0		105
40		gray, silty w/s silt seams & few sand seams	12	40.5	29.1			850	12.9		104
			10	45.5	31.2			440	9.6		95
50			12	50.5	29.2			915	20.0		98
		gray, silty w/few silt seams	19	55.5	22.8			1625	12.9		110
60			20	60.5	22.7			1350	13.2		111
			21	65.5	22.1			1800	11.4		107
70			24	70.5	21.8			1655	11.3		116
		gray, silty, sandy w/gravel, rock frags. & some silt seams	36	75.5	15.6			2950	13.8		122
80			41	80.5	17.0			3960	20.0		118

Method of Sampling:



10

Surface Elevation 582.3

Depth in feet	Symbol	DESCRIPTION	Blows on spoon for 12 inches	Depth to bottom of sample in feet	SUMMARY OF TEST RESULTS						
					Natural Moisture %	Liquid Limit	Plasticity Index	Unconfined Shear Stress #/SF	Strain %	Loss on Ignition @ 600°C-%	Unit Dry Weight #/cu. ft.
90			52	85.5	15.8			5300	20.0		123
			52	90.5	20.2			3690	20.0		112
			82	95.5	13.8						
100		gray, silty, sandy w/gravel, rock frags. & cobbles	58 50/.4	100.0 100.4	13.0			7050	20.0		124
			50/.4	104.4	9.4						
110			50/.4	109.4	11.3			11,300	14.5		130
		gray, silty w/silt seams	98	115.0	11.0 23.7			2220	6.8		104
120		gray, silty w/fine sand layers	69								
			46								
			49								
130		gray, silty, sandy w/ gravel and rock frags.									
		Shale, gray, hard	50/.4								
140		End of boring at 135.2'	50/.2								
<p>Note: Information below a depth of 120 feet is from the "Drillers Test Boring Log" by Ohio Test Boring, Inc.</p>											

Appendix B

Project: Pier 22 Improvements - Port of Cleveland
 Project Number: 8E06114
 Project Location: Cleveland, Ohio

Log of Boring WC-1
 Sheet 1 of 1

Date Drilled:	7/16/98	Logged By:	PJK	Checked By:	KCM
Drilled By:	Summit Drilling	Drill Rig:	DK-5	Drill Method:	2 1/4" H.S.A.
Location:	See Drawing WC-2	Driller:	S. Lindsey	Approx. Surface Elev:	586.0

Depth (ft)	Drill Time	Graphic Log	MATERIAL DESCRIPTION OF AUGER SPOILS	OBSTRUCTIONS & FIELD NOTES
1034			No spoils	
1036				
5	1039		No spoils Brick, concrete, stone, and slag (whole pieces and fragments), with some black slag and silty sand and clay, and trace wood fragments.	5' to 11' Driller notes difficult drilling. ↓
10	1045			
15	1052			17' Piece of stranded copper wire in spoils 18' Piece of solid copper wire in spoils.
20			Gray, silty, SAND, with some rock fragments, gravel, and trace wood fragments.	
25				
30	1056		Gray, silty CLAY, with trace sandstone fragments and gravel.	
35	1057			
40			End of Boring at 32.0 ft.	At completion of drilling, when the augers were removed from the hole, a piece of rebar was wrapped around the auger bit. At completion of drilling, the top 2 feet of the bore hole had collapsed to approximately 2 ft. in diameter; observed large (2"-1') pieces of brick, concrete, stone, pipe and rebar in the hole; see photograph 4 in Photo Journal.

Comments: Borings were advanced with hollow stem augers to observe possible obstructions, samples were not retrieved. Material descriptions and stratigraphy are generalized from the auger spoils, driller notes, and previous (1978 - 1993) borings, which retrieved samples.

Project: Pier 22 Improvements - Port of Cleveland
 Project Number: 8E06114
 Project Location: Cleveland, Ohio

Log of Boring WC-2
 Sheet 1 of 1

Date Drilled: 7/16/98	Logged By: PJK	Checked By: KCM
Drilled By: Summit Drilling	Drill Rig: DK-5	Drill Method: 2 1/4" H.S.A.
Location: See Drawing WC-2	Driller: S. Lindsey	Approx. Surface Elev: 587.0

Depth (ft)	Drill Time	Graphic Log	MATERIAL DESCRIPTION OF AUGER SPOILS	OBSTRUCTIONS & FIELD NOTES
0	1111		Brick, concrete, sandstone, and slag (whole pieces and fragments).	0' to 10' Driller notes difficult drilling. 10' to 18' Driller notes very difficult drilling.
5	1115		Brick, concrete, sandstone, and slag (whole pieces and fragments), with some black slag and silty sand and clay, and trace wood fragments.	
10	1132			
15	1137			
18	1138			
20			Gray, silty, SAND, with some sandstone fragments, gravel, and trace wood fragments.	
25	1142			
30	1144		Gray, silty CLAY, with trace sandstone fragments and gravel.	
33.5	1147		End of Boring at 33.5 ft.	

Comments: Borings were advanced with hollow stem augers to observe possible obstructions, samples were not retrieved. Material descriptions and stratigraphy are generalized from the auger spoils, driller notes, and previous (1978 - 1993) borings, which retrieved samples.

Project: Pier 22 Improvements - Port of Cleveland
 Project Number: 8E06114
 Project Location: Cleveland, Ohio

Log of Boring WC-3
 Sheet 1 of 1

Date Drilled: 7/16/98	Logged By: PJK	Checked By: KCM
Drilled By: Summit Drilling	Drill Rig: DK-5	Drill Method: 2 1/4" H.S.A.
Location: See Drawing WC-2	Driller: S. Lindsey	Approx. Surface Elev: 587.0

Depth (ft)	Drill Time	Graphic Log	MATERIAL DESCRIPTION OF AUGER SPOILS	OBSTRUCTIONS & FIELD NOTES
0	1001		Brick, concrete, sandstone, and slag (whole pieces and fragments).	0' to 8' Driller notes difficult drilling. ↓
3	1003			
5				
6	1009		Brick, concrete, sandstone, and slag (whole pieces and fragments), with some black slag and silty sand and clay,	8' lost auger bit and hole was abandoned.
7	1014		and trace wood fragments.	
8			End of Boring at 8 ft.	
9				
10				
11				
12				
13				
14				
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Comments: Borings were advanced with hollow stem augers to observe possible obstructions, samples were not retrieved. Material descriptions and stratigraphy are generalized from the auger spoils, driller notes, and previous (1978 - 1993) borings, which retrieved samples.

Project: Pier 22 Improvements - Port of Cleveland
 Project Number: 8E06114
 Project Location: Cleveland, Ohio

Log of Boring WC-4
 Sheet 1 of 1

Date Drilled: 7/16/98	Logged By: PJK	Checked By: KCM
Drilled By: Summit Drilling	Drill Rig: DK-5	Drill Method: 2 1/4" H.S.A.
Location: See Drawing WC-2	Driller: S. Lindsey	Approx. Surface Elev: 581.5

Depth (ft)	Drill Time	Graphic Log	MATERIAL DESCRIPTION OF AUGER SPOILS	OBSTRUCTIONS & FIELD NOTES
1228			Brick, concrete, sandstone, and slag fragments.	
1230			Brown silty sand with some brick, concrete, sandstone, and slag fragments	
			Black slag and cinders with some sand and gravel, and some brick, concrete and sandstone fragments, trace wood fragments.	
5				
1232				
10				
1235			Continues, slag and cinders observed in 1"-2" pieces.	
15				
1240				
20				
			Gray, silty CLAY, with trace sandstone fragments and gravel.	
25				
1245				
30			End of Boring at 27.5 ft; hole backfilled with cuttings.	
35				
40				

Comments: Borings were advanced with hollow stem augers to observe possible obstructions, samples were not retrieved. Material descriptions and stratigraphy are generalized from the auger spoils, driller notes, and previous (1978 - 1993) borings, which retrieved samples.

Project: Pier 22 Improvements - Port of Cleveland
 Project Number: 8E06114
 Project Location: Cleveland, Ohio

Log of Boring WC-5
 Sheet 1 of 1

Date Drilled:	7/16/98	Logged By:	PJK	Checked By:	KCM
Drilled By:	Summit Drilling	Drill Rig:	DK-5	Drill Method:	2¼" H.S.A.
Location:	See Drawing WC-2	Driller:	S. Lindsey	Approx. Surface Elev:	581.5

Depth (ft)	Drill Time	Graphic Log	MATERIAL DESCRIPTION OF AUGER SPOILS	OBSTRUCTIONS & FIELD NOTES
1503			Gravel and Cinders.	
			Black slag with some cinders, gravel, and trace sandstone fragments.	
1505				
5				
10				
			Continues, slag and cinders observed in 1"-2" pieces.	
1510				
15				
1513				
20				
1515				
25			End of Boring at 23.5 ft; hole backfilled with cuttings.	
30				
35				
40				

Comments: Borings were advanced with hollow stem augers to observe possible obstructions, samples were not retrieved. Material descriptions and stratigraphy are generalized from the auger spoils, driller notes, and previous (1978 - 1993) borings, which retrieved samples.

Project: Pier 22 Improvements - Port of Cleveland
 Project Number: 8E06114
 Project Location: Cleveland, Ohio

Log of Boring WC-6
 Sheet 1 of 1

Date Drilled: 7/16/98	Logged By: PJK	Checked By: KCM
Drilled By: Summit Drilling	Drill Rig: DK-5	Drill Method: 2 1/4" H.S.A.
Location: See Drawing WC-2	Driller: S. Lindsey	Approx. Surface Elev: 581.5

Depth (ft)	Drill Time	Graphic Log	MATERIAL DESCRIPTION OF AUGER SPOILS	OBSTRUCTIONS & FIELD NOTES
1330			Gavel, slag, and 2" to 3" brick fragments	
1333			Black slag and cinders with some sand and gravel, and some brick, concrete and sandstone fragments, trace wood fragments.	4.5' driller notes that auger dropped 18"; observed storm sewer manhole in vicinity of boring location.
5				
1337				
10				
1340			Continues, slag and cinders observed in 1"-2" pieces.	
15				
1342				
20				
1350				22' to 23' Driller notes difficult drilling.
25			Gray, silty CLAY, with trace sandstone fragments and gravel.	
1352				
30			End of Boring at 28.5 ft; hole backfilled with cuttings.	At completion of drilling, when the augers were removed from the hole, a piece of wood was observed logged in the end of the auger bit.
35				
40				

Comments: Borings were advanced with hollow stem augers to observe possible obstructions, samples were not retrieved. Material descriptions and stratigraphy are generalized from the auger spoils, driller notes, and previous (1978 - 1993) borings, which retrieved samples.

Project: Pier 22 Improvements - Port of Cleveland
 Project Number: 8E06114
 Project Location: Cleveland, Ohio

Log of Boring WC-7
 Sheet 1 of 1

Date Drilled: 7/16/98	Logged By: PJK	Checked By: KCM
Drilled By: Summit Drilling	Drill Rig: DK-5	Drill Method: 2 1/4" H.S.A.
Location: See Drawing WC-2	Driller: S. Lindsey	Approx. Surface Elev: 581.5

Depth (ft)	Drill Time	Graphic Log	MATERIAL DESCRIPTION OF AUGER SPOILS	OBSTRUCTIONS & FIELD NOTES
1440			Concrete 6"	
			Brown, SAND with some gravel	
5				
10				
1445				
1447				
15			Brown, silty, sandy, CLAY with some gravel and sandstone fragments.	
1450				
20				
1453				
25			End of Boring at 23.5 ft; hole backfilled with cuttings.	
30				
35				
40				

Comments: Borings were advanced with hollow stem augers to observe possible obstructions, samples were not retrieved. Material descriptions and stratigraphy are generalized from the auger spoils, driller notes, and previous (1978 - 1993) borings, which retrieved samples.

Project: Pier 22 Improvements - Port of Cleveland
 Project Number: 8E06114
 Project Location: Cleveland, Ohio

Log of Boring WC-8
 Sheet 1 of 1

Date Drilled: 7/16/98	Logged By: PJK	Checked By: KCM
Drilled By: Summit Drilling	Drill Rig: DK-5	Drill Method: 2 1/4" H.S.A.
Location: See Drawing WC-2	Driller: S. Lindsey	Approx. Surface Elev: 581.5

Depth (ft)	Drill Time	Graphic Log	MATERIAL DESCRIPTION OF AUGER SPOILS	OBSTRUCTIONS & FIELD NOTES
1410			Concrete 6"	
1413			Brown, coarse, SAND with some gravel	
5				
1416				
10				
1420			Brown, silty, sandy, CLAY with some gravel and sandstone fragments; creosote odor.	
15				
1423				
20				
1426				
25			End of Boring at 23.5 ft; hole backfilled with cuttings.	
30				
35				
40				

Comments: Borings were advanced with hollow stem augers to observe possible obstructions, samples were not retrieved. Material descriptions and stratigraphy are generalized from the auger spoils, driller notes, and previous (1978 - 1993) borings, which retrieved samples.

Project: Pier 22 Improvements - Port of Cleveland
 Project Number: 8E06114
 Project Location: Cleveland, Ohio

Log of Boring WC-9
 Sheet 1 of 1

Date Drilled: 7/15/98	Logged By: PJK	Checked By: KCM
Drilled By: Summit Drilling	Drill Rig: DK-5	Drill Method: 2 1/4" H.S.A.
Location: See Drawing WC-2	Driller: S. Lindsey	Approx. Surface Elev: 581.5

Depth (ft)	Drill Time	Graphic Log	MATERIAL DESCRIPTION OF AUGER SPOILS	OBSTRUCTIONS & FIELD NOTES
1550			Concrete 12"	
1554			Brown, silty CLAY with some brick fragments	
5			Black slag with some cinders, brick and sandstone fragments.	
1556			Continues with no spoils.	
10			Continues with no spoils.	
1600			Continues with no spoils.	
15			Continues with no spoils.	
1604			Continues with no spoils.	
20			Brown, silty, sandy, CLAY with some gravel and sandstone fragments; creosote odor.	
1606				
25			End of Boring at 27.5 ft; hole backfilled with cuttings.	
1608				
30				
35				
40				

Comments: Borings were advanced with hollow stem augers to observe possible obstructions, samples were not retrieved. Material descriptions and stratigraphy are generalized from the auger spoils, driller notes, and previous (1978 - 1993) borings, which retrieved samples.

Project: Pier 22 Improvements - Port of Cleveland
 Project Number: 8E06114
 Project Location: Cleveland, Ohio

Log of Boring WC-10
 Sheet 1 of 1

Date Drilled:	7/15/98	Logged By:	PJK	Checked By:	KCM
Drilled By:	Summit Drilling	Drill Rig:	DK-5	Drill Method:	2¼" H.S.A.
Location:	See Drawing WC-2	Driller:	S. Lindsey	Approx. Surface Elev:	585.0

Depth (ft)	Drill Time	Graphic Log	MATERIAL DESCRIPTION OF AUGER SPOILS	OBSTRUCTIONS & FIELD NOTES
0	0920		Brick, concrete, sandstone, and slag.	0' t 12' slight difficulty drilling.
5				
10	0932		No spoils.	
15				
20	0937		Black, slag with some cinders, gravel, silty sand, and trace wood fragments.	
25				
30	0943			
35				
40	0946			
	0950		Gray, silty CLAY, with trace sandstone fragments and gravel.	
	0957			
			End of Boring at 33.5 ft.	

Comments: Borings were advanced with hollow stem augers to observe possible obstructions, samples were not retrieved. Material descriptions and stratigraphy are generalized from the auger spoils, driller notes, and previous (1978 - 1993) borings, which retrieved samples.

Project: Pier 22 Improvements - Port of Cleveland
 Project Number: 8E06114
 Project Location: Cleveland, Ohio

Log of Boring WC-11
 Sheet 1 of 1

Date Drilled: 7/16/98	Logged By: PJK	Checked By: KCM
Drilled By: Summit Drilling	Drill Rig: DK-5	Drill Method: 2 1/4" H.S.A.
Location: See Drawing WC-2	Driller: S. Lindsey	Approx. Surface Elev: 585.5

Depth (ft)	Drill Time	Graphic Log	MATERIAL DESCRIPTION OF AUGER SPOILS	OBSTRUCTIONS & FIELD NOTES
0912			Brick, concrete, sandstone, and slag.	
5	0916		Black, slag with some cinders, gravel and silty sand.	
10			Spoils become wet and clayey with some wood fragments.	
15	0920		Continues, wood fragments have creosote odor.	14' slight difficulty drilling.
20	0922		Black, slag with some cinders, gravel and silty sand.	
25	0925			
30	0930		Gray, silty CLAY, with trace sandstone fragments and gravel.	
			Continues, 2" piece of sandstone observed in spoils.	
35	0932		End of Boring at 33.5 ft.	At completion of drilling, when the augers were removed from the hole, the auger bit was missing.
40				

Comments: Borings were advanced with hollow stem augers to observe possible obstructions, samples were not retrieved. Material descriptions and stratigraphy are generalized from the auger spoils, driller notes, and previous (1978 - 1993) borings, which retrieved samples.

Project: Pier 22 Improvements - Port of Cleveland
 Project Number: 8E06114
 Project Location: Cleveland, Ohio

Log of Boring WC-12
 Sheet 1 of 1

Date Drilled: 7/15/98	Logged By: PJK	Checked By: KCM
Drilled By: Summit Drilling	Drill Rig: DK-5	Drill Method: 2 1/4" H.S.A.
Location: See Drawing WC-2	Driller: S. Lindsey	Approx. Surface Elev: 585.0

Depth (ft)	Drill Time	Graphic Log	MATERIAL DESCRIPTION OF AUGER SPOILS	OBSTRUCTIONS & FIELD NOTES
0	0820		Brick, concrete, sandstone, and slag, with trace plastic fragments.	
5	0825			5' driller notes hit large piece of debris which was pushed aside by the auger.
			Black slag with some cinders, sand and gravel, and some brick, concrete and sandstone fragments, trace wood fragments.	7' driller notes piece of plastic or rubber.
10	0827			
	0834			
15				
	0837		Continues with no spoils.	
20				
	0843			0' to 23' driller notes debris is causing slight difficulty drilling.
25				
	0847			
30			Gray, silty CLAY, with trace sandstone fragments and gravel.	
	0852			
35				
	0858			
40			End of Boring at 38.0 ft.	At completion of drilling, when the augers were removed from the hole, a thin stranded steel was wrapped around the auger bit.

Comments: Borings were advanced with hollow stem augers to observe possible obstructions, samples were not retrieved. Material descriptions and stratigraphy are generalized from the auger spoils, driller notes, and previous (1978 - 1993) borings, which retrieved samples.

Project: Pier 22 Improvements - Port of Cleveland
 Project Number: 8E06114
 Project Location: Cleveland, Ohio

Log of Boring WC-13
 Sheet 1 of 1

Date Drilled:	7/16/98	Logged By:	PJK	Checked By:	KCM
Drilled By:	Summit Drilling	Drill Rig:	DK-5	Drill Method:	2 1/4" H.S.A.
Location:	See Drawing WC-2	Driller:	S. Lindsey	Approx. Surface Elev:	582.0

Depth (ft)	Drill Time	Graphic Log	MATERIAL DESCRIPTION OF AUGER SPOILS	OBSTRUCTIONS & FIELD NOTES
0835			Brick, concrete, stone, and slag (whole pieces and fragments),	
0840			with some black slag and silty sand and clay,	
0845			and trace wood fragments; creosote odor.	
5			Black slag and cinders with some sand and gravel, and some	
			brick, concrete and sandstone fragments, trace wood fragments;	
			creosote odor.	
10	0847		Continues with more sandstone fragments	
	0848			14' slight difficulty drilling.
15				
20	0853			20' augers produced large full-size pieces
	0855		Gray, silty, SAND, with some rock fragments, gravel,	of brick, most like generated near the surface.
			and trace wood fragments.	
25			Gray, silty CLAY, with trace sandstone fragments and gravel.	
30				
	0858			
			End of Boring at 32 ft.	
35				
40				

Comments: Borings were advanced with hollow stem augers to observe possible obstructions, samples were not retrieved.
 Material descriptions and stratigraphy are generalized from the auger spoils, driller notes,
 and previous (1978 - 1993) borings, which retrieved samples.

Project: Pier 22 Improvements - Port of Cleveland
 Project Number: 8E06114
 Project Location: Cleveland, Ohio

Log of Boring WC-14
 Sheet 1 of 1

Date Drilled: 7/15/98	Logged By: PJK	Checked By: KCM
Drilled By: Summit Drilling	Drill Rig: DK-5	Drill Method: 2 1/4" H.S.A.
Location: See Drawing WC-2	Driller: S. Lindsey	Approx. Surface Elev: 581.5

Depth (ft)	Drill Time	Graphic Log	MATERIAL DESCRIPTION OF AUGER SPOILS	OBSTRUCTIONS & FIELD NOTES
1020			Concrete 12" Black slag and cinders with some sand and gravel, and some brick, concrete and sandstone fragments, trace wood fragments.	
5				
1025			Continues with more sandstone fragments. Continues, becomes soupy.	
10				
1028				
15				
1031			Continues with more wood fragments, trace glass fragments, and creosote odor.	
20				
1035				
25			Continues with more sandstone and gravel.	
1038			Brown, silty, sandy, CLAY with some gravel and sandstone fragments.	
30				
1042				
			End of Boring at 23.0 ft; hole backfilled with cuttings.	
35				
40				

Comments: Borings were advanced with hollow stem augers to observe possible obstructions, samples were not retrieved. Material descriptions and stratigraphy are generalized from the auger spoils, driller notes, and previous (1978 - 1993) borings, which retrieved samples.

Project: Pier 22 Improvements - Port of Cleveland
 Project Number: 8E06114
 Project Location: Cleveland, Ohio

Log of Boring WC-15

Sheet 1 of 1

Date Drilled: 7/15/98	Logged By: PJK	Checked By: KCM
Drilled By: Summit Drilling	Drill Rig: DK-5	Drill Method: 2 1/4" H.S.A.
Location: See Drawing WC-2	Driller: S. Lindsey	Approx. Surface Elev: 581.5

Depth (ft)	Drill Time	Graphic Log	MATERIAL DESCRIPTION OF AUGER SPOILS	OBSTRUCTIONS & FIELD NOTES
1104			Asphalt 3", Concrete 12"	
1106			Black slag and cinders with some sand and gravel, and some brick, concrete and sandstone fragments, trace wood fragments.	
5				
1109				
10				
1112			Continues with increasing moisture and gravel, trace clay.	
15				15' driller notes slight difficulty drilling.
1115			Continues with some clay.	
20				
1118			Brown, silty, sandy, CLAY with some gravel and sandstone fragments.	
25				
1122				
30			End of Boring at 27.5 ft; hole backfilled with cuttings.	
35				
40				

Comments: Borings were advanced with hollow stem augers to observe possible obstructions, samples were not retrieved. Material descriptions and stratigraphy are generalized from the auger spoils, driller notes, and previous (1978 - 1993) borings, which retrieved samples.

Project: Pier 22 Improvements - Port of Cleveland
 Project Number: 8E06114
 Project Location: Cleveland, Ohio

Log of Boring WC-16
 Sheet 1 of 1

Date Drilled: 7/15/98	Logged By: PJK	Checked By: KCM
Drilled By: Summit Drilling	Drill Rig: DK-5	Drill Method: 2 1/4" H.S.A.
Location: See Drawing WC-2	Driller: S. Lindsey	Approx. Surface Elev: 581.5

Depth (ft)	Drill Time	Graphic Log	MATERIAL DESCRIPTION OF AUGER SPOILS	OBSTRUCTIONS & FIELD NOTES
1242			Asphalt 3", Concrete 12"	0' to 1' driller note difficulty drilling through misc. debris; original location was abandoned and hole was relocated approx. 2' south.
1245			Black slag and cinders with some sand and gravel, and some brick, concrete and sandstone fragments, trace wood fragments.	
5				
1248				
10			Becomes wet.	
1251				
15				
1254				
20				
1256			Brown, silty, sandy, CLAY with some gravel and sandstone fragments.	
25				
1258				
30			End of Boring at 27.5 ft; hole backfilled with cuttings.	
35				
40				

Comments: Borings were advanced with hollow stem augers to observe possible obstructions, samples were not retrieved. Material descriptions and stratigraphy are generalized from the auger spoils, driller notes, and previous (1978 - 1993) borings, which retrieved samples.

Project: Pier 22 Improvements - Port of Cleveland
 Project Number: 8E06114
 Project Location: Cleveland, Ohio

Log of Boring WC-17
 Sheet 1 of 1

Date Drilled: 7/15/98	Logged By: PJK	Checked By: KCM
Drilled By: Summit Drilling	Drill Rig: DK-5	Drill Method: 2¼" H.S.A.
Location: See Drawing WC-2	Driller: S. Lindsey	Approx. Surface Elev: 581.5

Depth (ft)	Drill Time	Graphic Log	MATERIAL DESCRIPTION OF AUGER SPOILS	OBSTRUCTIONS & FIELD NOTES
1136			Asphalt 3", Concrete 12"	
1139			Black slag and cinders with some sand and gravel, and some brick, concrete and sandstone fragments, trace wood fragments.	
5				
1143				
10				
1145			Trace to some clay.	
15				
1147			Becomes soupy.	
20				
1150			Brown, silty, sandy, CLAY with some gravel and sandstone fragments.	
25				
1258				
30			End of Boring at 27.5 ft; hole backfilled with cuttings.	
35				
40				

Comments: Borings were advanced with hollow stem augers to observe possible obstructions, samples were not retrieved. Material descriptions and stratigraphy are generalized from the auger spoils, driller notes, and previous (1978 - 1993) borings, which retrieved samples.

Project: Pier 22 Improvements - Port of Cleveland
 Project Number: 8E06114
 Project Location: Cleveland, Ohio

Log of Boring WC-18
 Sheet 1 of 1

Date Drilled: 7/15/98	Logged By: PJK	Checked By: KCM
Drilled By: Summit Drilling	Drill Rig: DK-5	Drill Method: 2 1/4" H.S.A.
Location: See Drawing WC-2	Driller: S. Lindsey	Approx. Surface Elev: 581.5

Depth (ft)	Drill Time	Graphic Log	MATERIAL DESCRIPTION OF AUGER SPOILS	OBSTRUCTIONS & FIELD NOTES
1310			Asphalt 3", Concrete 12"	
1314			Black slag and cinders with some sand and gravel, and some brick, concrete and sandstone fragments, trace wood fragments.	
5				
1318				
10				
1320				
15				
1322				
20				
1325			Brown, silty, sandy, CLAY with some gravel and sandstone fragments.	
25				
1327				
30			End of Boring at 27.5 ft; hole backfilled with cuttings.	
35				
40				

Comments: Borings were advanced with hollow stem augers to observe possible obstructions, samples were not retrieved. Material descriptions and stratigraphy are generalized from the auger spoils, driller notes, and previous (1978 - 1993) borings, which retrieved samples.

Project: Pier 22 Improvements - Port of Cleveland
 Project Number: 8E06114
 Project Location: Cleveland, Ohio

Log of Boring WC-19
 Sheet 1 of 1

Date Drilled: 7/15/98	Logged By: PJK	Checked By: KCM
Drilled By: Summit Drilling	Drill Rig: DK-5	Drill Method: 2 1/4" H.S.A.
Location: See Drawing WC-2	Driller: S. Lindsey	Approx. Surface Elev: 581.5














Depth (ft)	Drill Time	Graphic Log	MATERIAL DESCRIPTION OF AUGER SPOILS	OBSTRUCTIONS & FIELD NOTES
1337			Asphalt 3", Concrete 12"	
1340			Black slag and cinders with some sand and gravel, and some brick, concrete and sandstone fragments, trace wood fragments.	
5				
1344				
10			Becomes wet.	
1346				
15				
1349				
20				
1350			Brown, silty, sandy, CLAY with some gravel and sandstone fragments.	
25				
1354				
30			End of Boring at 27.5 ft; hole backfilled with cuttings.	
35				
40				

Comments: Borings were advanced with hollow stem augers to observe possible obstructions, samples were not retrieved. Material descriptions and stratigraphy are generalized from the auger spoils, driller notes, and previous (1978 - 1993) borings, which retrieved samples.

Project: Pier 22 Improvements - Port of Cleveland
 Project Number: 8E06114
 Project Location: Cleveland, Ohio

Log of Boring WC-20
 Sheet 1 of 1

Date Drilled: 7/15/98	Logged By: PJK	Checked By: KCM
Drilled By: Summit Drilling	Drill Rig: DK-5	Drill Method: 2 1/4" H.S.A.
Location: See Drawing WC-2	Driller: S. Lindsey	Approx. Surface Elev: 581.5

Depth (ft)	Drill Time	Graphic Log	MATERIAL DESCRIPTION OF AUGER SPOILS	OBSTRUCTIONS & FIELD NOTES
1409			Asphalt 3", Concrete 12"	
1412			Black slag and cinders with some sand and gravel, and some brick, concrete and sandstone fragments, trace wood fragments.	
5				
1416			Becomes brown.	7' to 10' driller notes obstruction and difficult drilling. ↓
10				
			Becomes wet and dark brown.	
1419			Becomes soupy.	
15				
1421				
20				
1424			Brown, silty, sandy, CLAY with some gravel and sandstone fragments.	
25				
1428				
30			End of Boring at 27.5 ft; hole backfilled with cuttings.	At completion of drilling, when the augers were removed from the hole, a piece of railroad tie was logged in the end of the auger bit.
35				
40				

Comments: Borings were advanced with hollow stem augers to observe possible obstructions, samples were not retrieved. Material descriptions and stratigraphy are generalized from the auger spoils, driller notes, and previous (1978 - 1993) borings, which retrieved samples.

Project: Pier 22 Improvements - Port of Cleveland
 Project Number: 8E06114
 Project Location: Cleveland, Ohio

Log of Boring WC-21
 Sheet 1 of 1

Date Drilled: 7/15/98	Logged By: PJK	Checked By: KCM
Drilled By: Summit Drilling	Drill Rig: DK-5	Drill Method: 2 1/4" H.S.A.
Location: See Drawing WC-2	Driller: S. Lindsey	Approx. Surface Elev: 581.5

Depth (ft)	Drill Time	Graphic Log	MATERIAL DESCRIPTION OF AUGER SPOILS	OBSTRUCTIONS & FIELD NOTES
1444			Asphalt 3", Concrete 12"	
1447			Black slag and cinders with some sand and gravel, and some brick, concrete and sandstone fragments, trace wood fragments.	
5				
1451				7' driller notes obstruction, did not slow drilling.
10				
1454			Becomes wet.	
15				
1456			Becomes soupy.	
20				
1458			Brown, silty, sandy, CLAY with some gravel and sandstone fragments.	
25				
1500				
30			End of Boring at 27.5 ft; hole backfilled with cuttings.	
35				
40				

Comments: Borings were advanced with hollow stem augers to observe possible obstructions, samples were not retrieved. Material descriptions and stratigraphy are generalized from the auger spoils, driller notes, and previous (1978 - 1993) borings, which retrieved samples.

Project: Pier 22 Improvements - Port of Cleveland
 Project Number: 8E06114
 Project Location: Cleveland, Ohio

Log of Boring WC-22
 Sheet 1 of 1

Date Drilled: 7/15/98	Logged By: PJK	Checked By: KCM
Drilled By: Summit Drilling	Drill Rig: DK-5	Drill Method: 2 1/4" H.S.A.
Location: See Drawing WC-2	Driller: S. Lindsey	Approx. Surface Elev: 581.5

Depth (ft)	Drill Time	Graphic Log	MATERIAL DESCRIPTION OF AUGER SPOILS	OBSTRUCTIONS & FIELD NOTES
1514			Black slag and cinders with some sand and gravel, and some brick, concrete and sandstone fragments, trace wood fragments.	
1516				
5				6' driller notes obstruction, did not slow drilling.
1519				
10				
1522			Becomes wet.	
15				
1525			Becomes soupy.	
20				
1527			Brown, silty, sandy, CLAY with some gravel and sandstone fragments.	
25				
1529				
30			End of Boring at 27.5 ft; hole backfilled with cuttings.	
35				
40				

Comments: Borings were advanced with hollow stem augers to observe possible obstructions, samples were not retrieved. Material descriptions and stratigraphy are generalized from the auger spoils, driller notes, and previous (1978 - 1993) borings, which retrieved samples.

Appendix C

Project:	Pier 22 Improvements - Port of Cleveland	Log of Exploration Trench 1
Project Number:	8E06114	TT-1
Project Location:	Cleveland, Ohio	Sheet 1 of 2

Date Excavated:	7/17/98	Logged By:	PJK	Checked By:	KCM
Excavated By:	Nerone & Sons	Equipment:	Linkbelt 3400 Trackhoe	Approx. Width:	4 ft.
Location:	5' to 60' east of WC-12	Operator:	George	Approx. Surface Elev:	See drawing WC-2

Depth (ft)	APPROXIMATE STRATIGRAPHIC TREND	OBSTRUCTIONS & FIELD NOTES
— — — — 5 — — — — 10 — — — — 15 — — — — — 20 — — — — 25 — — — — — 30 — — — — — 35 — — — — — 40 — —	<p>Brown silty sand and clay with (6" to 2") pieces of brick, concrete and sandstone, and miscellaneous debris including rebar metal cables, wood and glass.</p> <p>Black slag and cinders with (6" to 2") pieces of brick, concrete and sandstone, and miscellaneous debris including rebar, metal cables, wood and glass.</p> <p>Black slag, cinders, sandstone and gravel with less debris.</p> <p>End of Pit, varies 10 ft. to 18 ft.</p>	<p>Approximate depth to water was 13'</p> <p>10' east of boring WC-12 excavated trench to 18' below grade.</p> <p>15' to 20' east of WC-12 excavated trench to 18' below grade; encountered 3 large (2'x6') pieces of sandstone at 2' and 8' below grade, observed large pieces of sandstone in north and south sides of trench;</p> <p>4' below grade encountered two 5' long by 6" dia. pieces of wood;</p> <p>5' to 10' below grade encountered large (1' to 2') pieces of concrete and several metal pipes.</p> <p>40' east of boring WC-12 excavated trench to 16' below grade.</p>
Comments:		

Woodward-Clyde

Project:	Pier 22 Improvements - Port of Cleveland	Log of Exploration Trench 1
Project Number:	8E06114	TT-1
Project Location:	Cleveland, Ohio	Sheet 2 of 2

Date Excavated:	7/17/98	Logged By:	PJK	Checked By:	KCM
Excavated By:	Nerone & Sons	Equipment:	Linkbelt 3400 Trackhoe	Approx. Width:	4 ft.
Location:	60' to 90' east of WC-12	Operator:	George	Approx. Surface Elev:	See drawing WC-2

Depth (ft)	APPROXIMATE STRATIGRAPHIC TREND	OBSTRUCTIONS & FIELD NOTES
_____	Black slag & cinders w/ (6"-2') pieces of brick & sandstone, (1'-5') pieces of concrete, (5'-20') long pieces of rebar, a tire, and other misc. debris including wood, metal and glass.	Approximate depth to water was 13'
5	Brown silty sand & clay w/ (6"-2') pieces of brick & stone, (1'-5') pieces of concrete, (5'-20') long pieces of rebar, and other misc. debris including wood, metal and glass.	65' east of boring WC-12 excavated trench to 13' below grade; opened trench an additional 5' north, abandoned foundation was observed on the north and south sides of the trench, from approx. 5' to 9' below grade. broke up foundation (no rebar) and encountered timber piles under the foundation.
10	Black slag, cinders, sandstone and gravel with less debris.	65' TO 90' east of boring WC-12 excavated trench to 13' below grade; encountered numerous (approx. 7) approx. 5' long by 1' dia. pieces of wood from 0' to 10' below grade;
_____	End of Pit, varies 10 ft. to 13 ft.	see photos 5 & 6 and drawing WC-2 for more information.
15		
20		
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35		
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Comments:

Woodward-Clyde

Project: Pier 22 Improvements - Port of Cleveland
 Project Number: 8E06114
 Project Location: Cleveland, Ohio

Log of Exploration Trench 2
 TT-2
 Sheet 1 of 1

Date Excavated: 7/17/98	Logged By: PJK	Checked By: KCM
Excavated By: Nerone & Sons	Equipment: Linkbelt 3400 Trackhoe	Approx. Width: See drawing WC-2
Location: 37' to 98' east of WC-15	Operator: George	Approx. Surface Elev: See drawing WC-2

Depth (ft)	APPROXIMATE STRATIGRAPHIC TREND	OBSTRUCTIONS & FIELD NOTES
_____	Brown silty sand and clay with (1'-6") pieces of reinforced concrete, brick, sandstone and other misc. debris including wood, metal and glass.	37' to 48' east of WC-15 excavated trench to 10' below grade; encountered small (1') pieces of debris.
5	Black slag and cinders with pieces of brick, concrete and sandstone, and miscellaneous debris including rebar, metal, wood and glass.	48' to 86' east of WC-15 excavated trench to 10' below grade encountered a series of abandoned foundation units which extend into the north and south sides of the trench; see photos 10 - 14 and drawing WC-2 for more information.
10		74' to 86' east of WC-15 excavated trench to 10' below grade and an additional 13' north and 12' south; 0' to 2' below grade encountered numerous large pieces of concrete, one 7' piece of concrete; approx. 3' below grade encountered two 7' piece of 6" dia steel pipe and four 2" dia solid steel pipes.
15	End of Pit, varies 10 ft. to 14 ft.	86' to 98' east of boring WC-15 concrete dock at ground surface, dock extends north and south along shoreline as seen on drawings WC-2; the dock is 12' long perpendicular to the shoreline, 3' deep on the west edge and approx. 8' deep on east edge (i.e shoreline); numerous (approx. 4'x4') pieces of reinforced concrete were observed on the surface of the dock; (1'-3") pieces of rock and timber piles were encountered under the east face (shoreline) of the dock; concrete footing was observed under west face of dock, excavated trench to 14' below grade (4' below footing) and encountered 2" dia. solid steel cable, timber piles, 3' piece of concrete and some coal. see photos 12 & 13 for more information.
20		
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Comments:

Woodward-Clyde

Project:	Pier 22 Improvements - Port of Cleveland	Log of Exploration Trench 3
Project Number:	8E06114	TT-3
Project Location:	Cleveland, Ohio	Sheet 1 of 1

Date Excavated:	7/17/98	Logged By:	PJK	Checked By:	KCM
Excavated By:	Nerone & Sons	Equipment:	Linkbelt 3400 Trackhoe	Approx. Width:	10 ft.
Location:	8' to 96' east of WC-12	Operator:	George	Approx. Surface Elev:	See drawing WC-2

Depth (ft)	APPROXIMATE STRATIGRAPHIC TREND	OBSTRUCTIONS & FIELD NOTES
—	Black slag & cinders w/ (6"-2") pieces of brick & sandstone, numerous (1'-8") pieces of concrete, and other misc. debris.	Approximate depth to water was 13'
—	Brown silty sand & clay w/ (6"-2") pieces of brick & stone, numerous (1'-8") pieces of concrete, and other misc. debris.	8' to 30' east of boring WC-16 excavated trench to 13' below grade;
5		less debris than remainder of trench, pieces were generally less than 2'.
—	Black slag & cinders w/ (6"-2") pieces of brick & sandstone, numerous (1'-8") pieces of concrete, and other misc. debris.	9' east of boring WC-16 excavated trench to 13' below grade;
10		at 10' below grade encountered abandoned railroad tie running north and south.
—		18' east of boring WC-16 excavated trench to 13' below grade;
—		at 10' below grade encountered abandoned railroad tie running north and south.
15	End of Pit, varies 10 ft. to 13 ft.	30' east of boring WC-16 excavated trench to 13' below grade;
—		at 10' below grade encountered abandoned railroad tie running north and south.
20		at 10' below grade encountered 4' piece of sandstone on south side of trench.
—		30' to 96' east of boring WC-16 excavated trench to 10' - 13' below grade;
25		throughout trench depth encountered numerous large (1' to 8') pieces of concrete brick and stone, operator pulled out large pieces of debris in almost every pass.
—		trench opened up to 10' width due to large pieces of debris.
30		see photos 16 through 18 and drawing WC-2 for more information.
—		
35		
—		
40		
—		

Comments:

Woodward-Clyde

Photo Journal



Photo 1: View of north shoreline, standing at approximate location of bulkhead wall looking west.
Note large pieces of concrete, stone, and other miscellaneous debris.



Photo 2: View of north shoreline, standing at approximate location of bulkhead wall looking east.
Note large pieces of concrete, stone, and other miscellaneous debris.



Photo 3: View of northern portion of site, standing at approximate location of bulkhead wall looking west. Note the pieces of brick and other miscellaneous debris exposed at the surface.



Photo 4: View of boring WC-1 at completion of drilling. Note the steel pipes, large rock and other miscellaneous debris in upper portion of hole.



Photo 5: View of test trench #1 (TT-1) standing at the approximate location of boring WC-10 looking east. Note the steel pipe, large rocks and other miscellaneous debris.

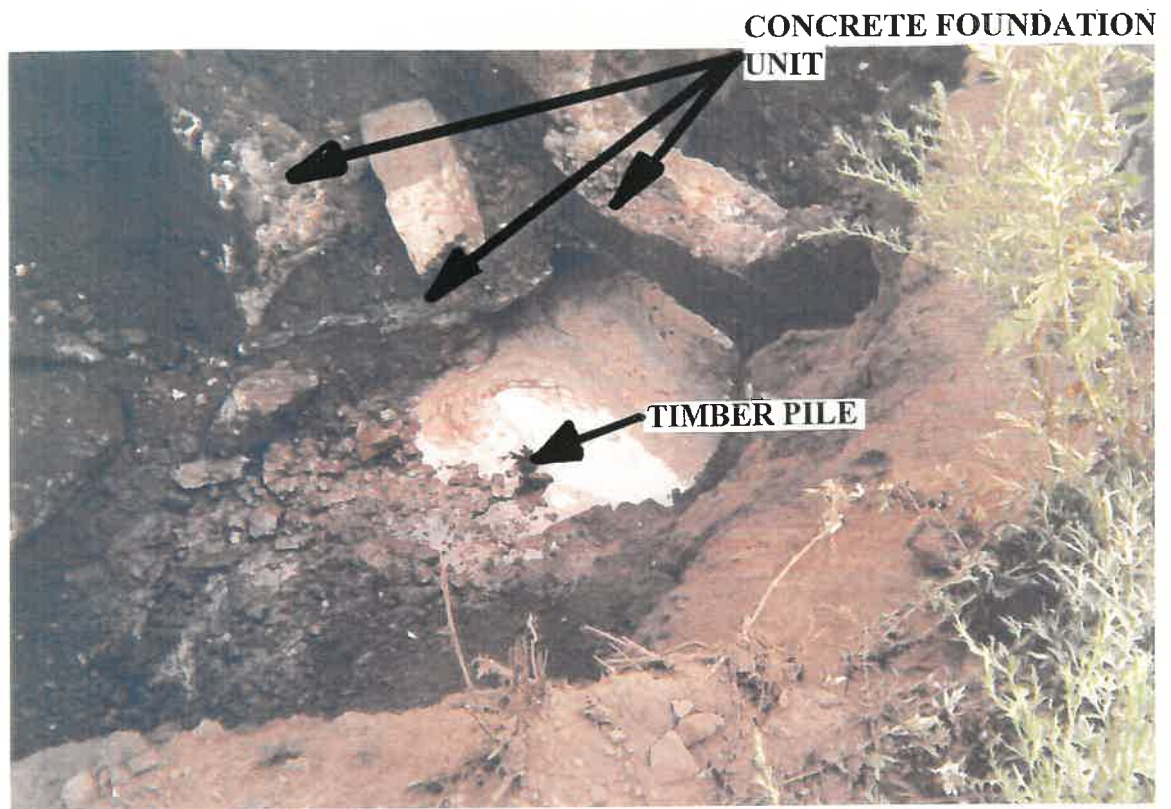


Photo 6: View of test trench #1 (TT-1) standing approximately 60' east of boring WC-10 looking east. Note the concrete foundation and timber pile.



Photo 7: View of spoils from test trench #1 (TT-1).



Photo 8:

View of spoils from test trench #1 (TT-1).



Photo 9:

View of spoils from test trench #1 (TT-1).

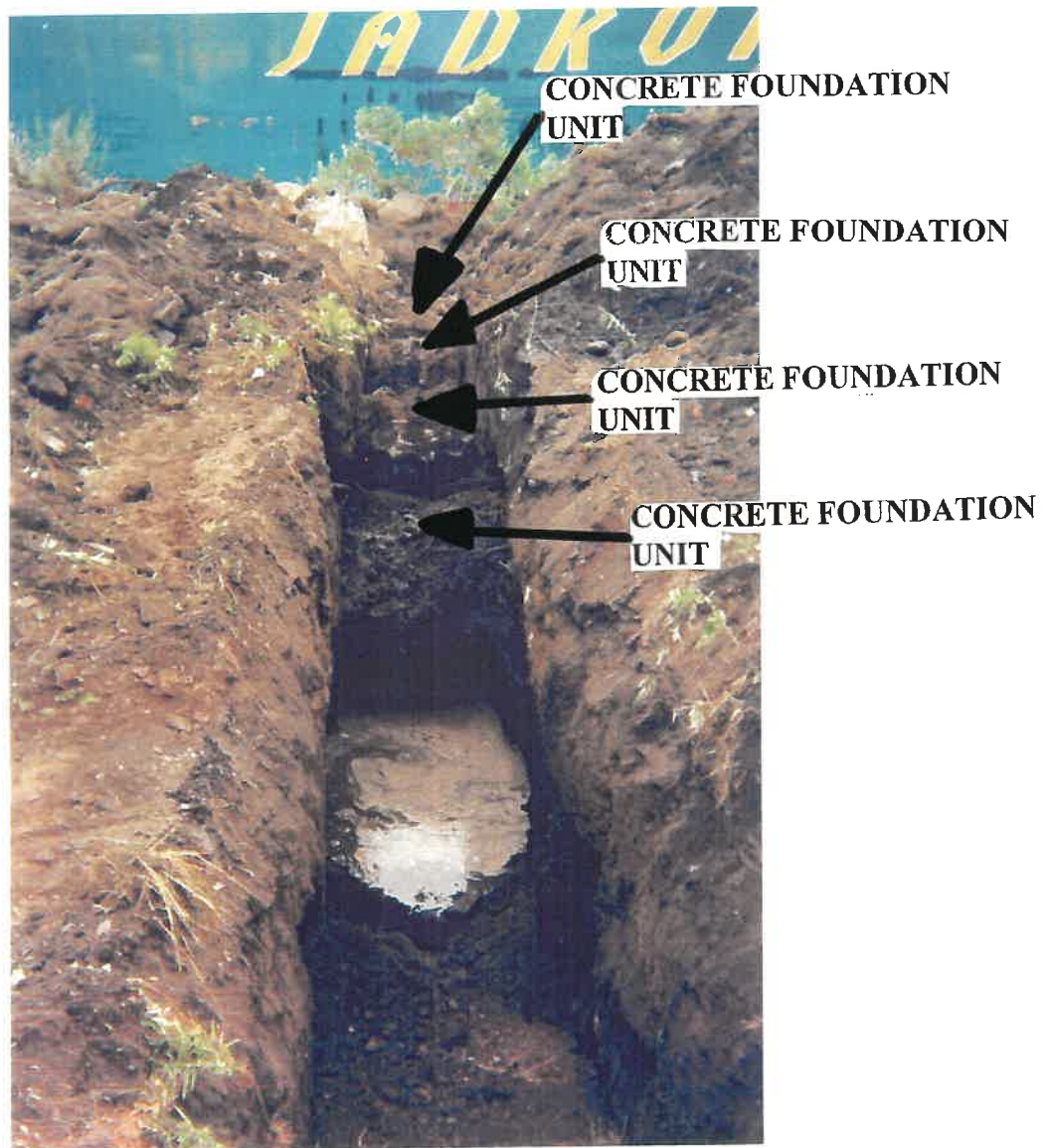


Photo 10: View of test trench #2 (TT-2) standing approximately 38' east of boring WC-10 looking east. Note the numerous concrete foundation units.



Photo 11: View of test trench #2 (TT-2) standing approximately 92' east of boring WC-10 looking west. Note the large concrete foundation units.

CONCRETE DOCK



Photo 12: View of northeastern portion of test trench #2 (TT-2) standing approximately 92' east of boring WC-10 looking northwest. The concrete in the upper part of the picture is the western face of the exposed concrete dock. Note concrete footing under dock.

CONCRETE FOOTING

CONCRETE DOCK

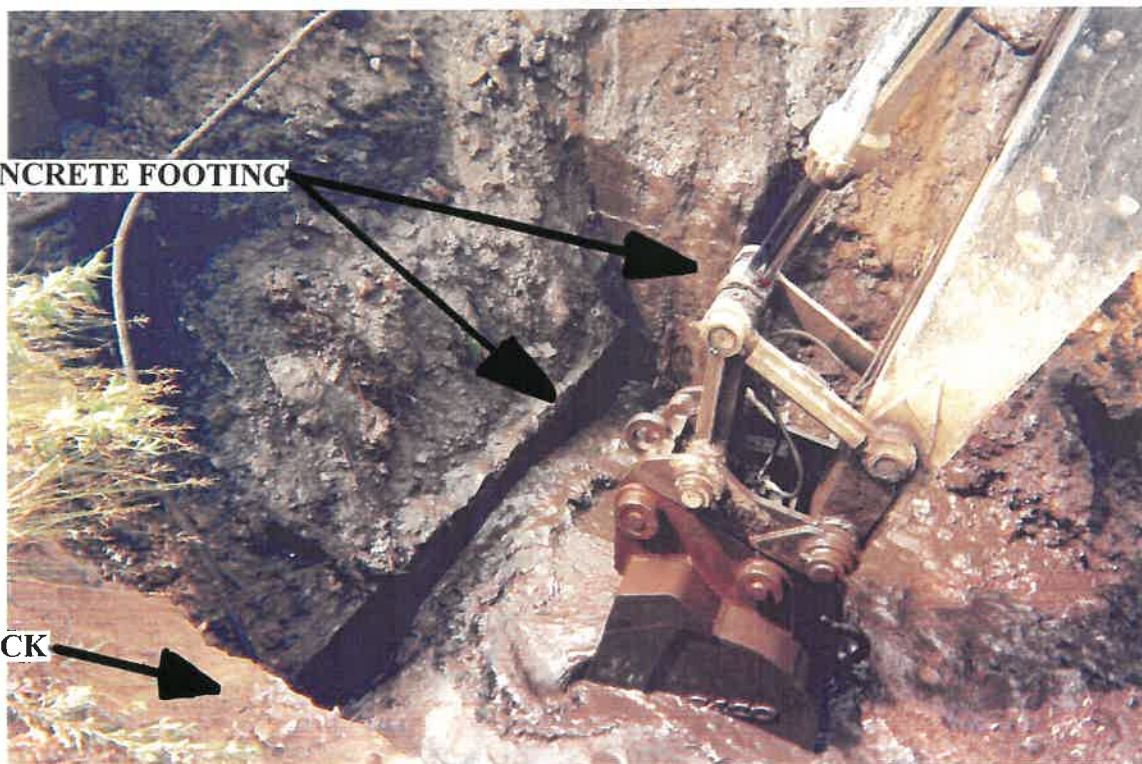


Photo 13: View of northeastern portion of test trench #2 (TT-2) standing approximately 100' east of boring WC-10 looking southwest. View is 180 degrees from view in photo 12. Timber piles were found under concrete footing, which supports dock.



Photo 14:

View of spoils from test trench #2 (TT-2).



Photo 15:

View of spoils from test trench #2 (TT-2).

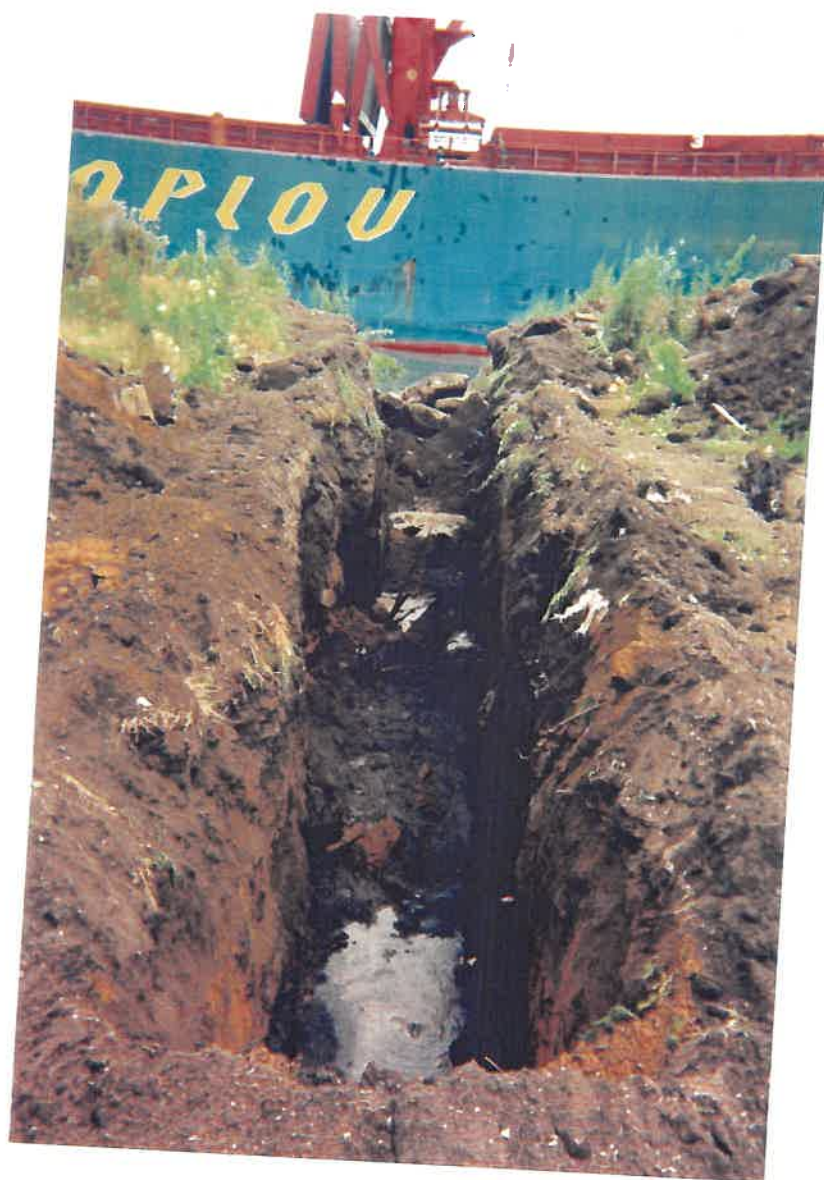


Photo 16: View of test trench #3 (TT-3) standing approximately 18' east of boring WC-16 looking east. Note the large pieces of concrete, stone and other miscellaneous debris.



Photo 17:

View of spoils from test trench #3 (TT-3).



Photo 18:

View of spoils from test trench #3 (TT-3).

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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Suite 320
Cleveland, OH 44113





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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.

A handwritten signature in blue ink that reads 'Brian E. Meluch'.

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

A handwritten signature in blue ink that reads 'David G. Mast, 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 Mississippian-aged 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 silty 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 silty clay ranged 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 greater than 9000 psf. The very compact clayey silt and compact gray sands encountered 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 alternative 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, over
6.00 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 $\frac{3}{4}$ -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 (K_a) 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 subgrade 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.



Brian E. Meluch, P.E.

Assistant Project Engineer



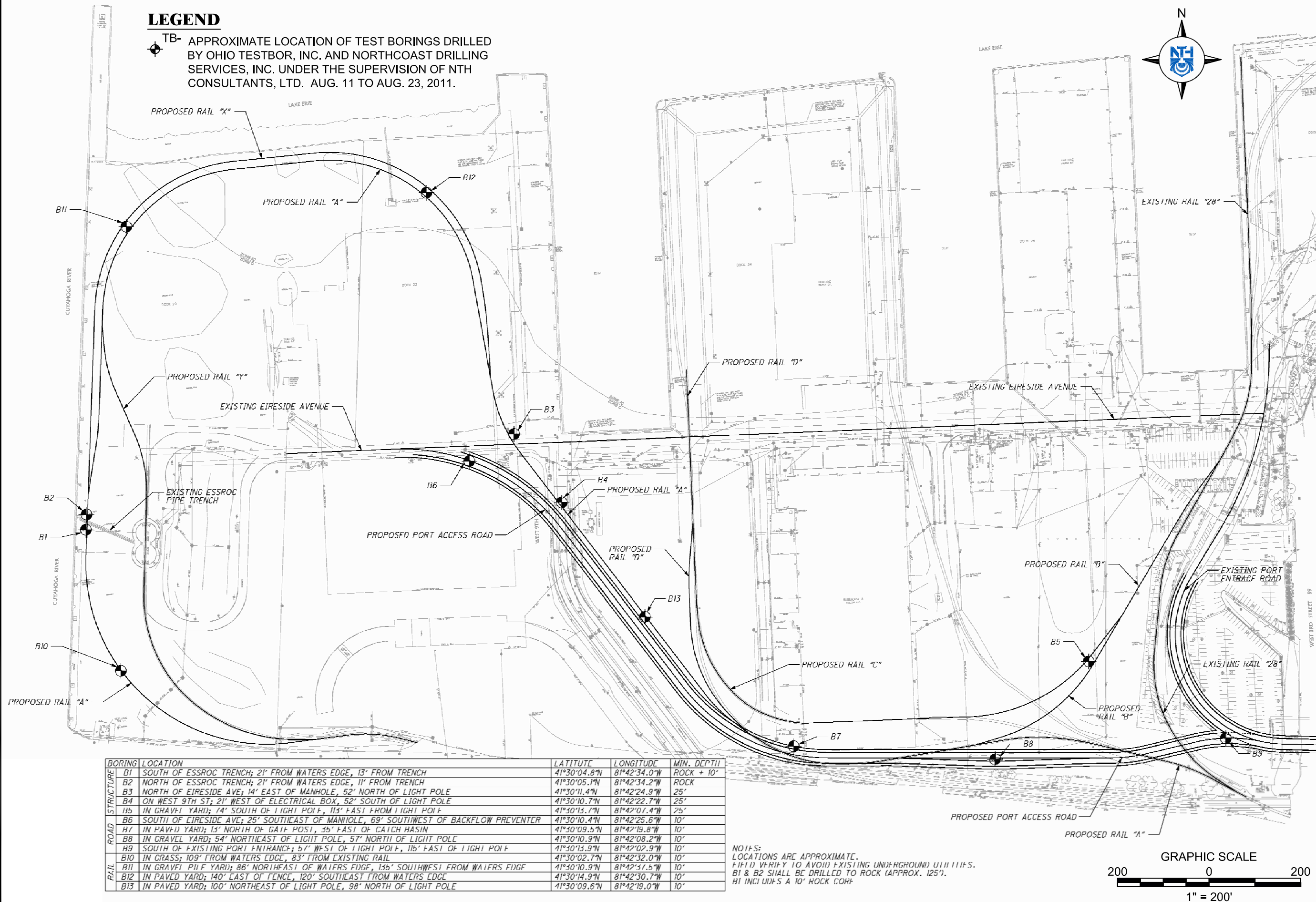
David G. Mast, P.E.

Vice President



APPENDIX A

TB- APPROXIMATE LOCATION OF TEST BORINGS DRILLED BY OHIO TESTBOR, INC. AND NORTHCOAST DRILLING SERVICES, INC. UNDER THE SUPERVISION OF NTH CONSULTANTS, LTD. AUG. 11 TO AUG. 23, 2011.



**Infrastructure Engineering
and Environmental Services**

WITH PROJECT NO.:	86-101394-00	CAD FILE NAME:	86-101394-00
DESIGNED BY:	BEM	INCEP DATE:	AUG. 2011
DRAWN BY:	TCG	DRAWING SCALE:	AS SHOWN
CHECKED BY:	DGM	PLOT DATE:	SEPT. 2011

TEST BORING LOCATION PLAN

PORT OF CLEVELAND
CLEVELAND, OHIO

FIGURE No.

I

GENERAL NOTES

TERMINOLOGY

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

PARTICLE SIZES

Boulders	- Greater than 12 inches (305mm)
Cobbles	- 3 inches (76.2mm) to 12 inches (305mm)
Gravel - Coarse	- 3/4 inches (19.05 mm) to 3 inches (76.2mm)
Gravel - 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)
Sand - Medium	- No. 40 (0.425mm) to No. 10 (2.00mm)
Sand - Fine	- No. 200 (0.074mm) to No. 40 (0.425mm)
Silt	- 0.005mm to 0.074mm
Clay	- Less than 0.005mm

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:

Second Major Constituent (percent by weight)	Minor Constituents (percent by weight)
Trace - 1 to 12%	Trace - 1 to 12%
Adjective - 12 to 35% (clayey, silty, etc.)	Little - 12 to 23%
And - Over 35%	Some - 23 to 33%

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)
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).

LOG OF TEST BORING NO: B-01

Project Name: *Cleveland Port Authority Expansion*

Project Location: *Cleveland, OH*



NTH Consultants, Ltd.

NTH Proj. No.: 86-101394-00

Checked By: *BEA*

SUBSURFACE PROFILE

SOIL SAMPLE DATA

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)
580		579.8	Topsoil	0.2									
						S-1	23 41 41	82	18				-
			FILL: Very Compact Brown and Gray SILTY SAND, Little Gravel, Contains Clay Pockets and Brick Pieces										
575					5	S-2	39 43 29	72	18				-
		573.0		7.0		S-3	3 16 50	66	13				-
			FILL: Concrete Rubble and Debris										
570					10	S-4	50	50/6"	1				-
		568.5		11.5									
			FILL: Medium Compact Gray SILTY SAND, Trace Gravel, Contains Wood Pieces										
565		565.5		14.5	15	S-5	2 7 16	23	18				-
			Loose Gray SANDY GRAVEL, Trace Silt										
560		560.0		20.0	20	S-6	2 4 2	6	18				-
555			Medium Gray SILTY CLAY, Frequent Silt Seams and Pockets		25	S-7	1 2 4	6	18				1000*
						ST-1	PUSH		24		28.4	98.3	2900
550		550.3		29.7	30	S-8	1 4 2	6	10		21.4		2500*

Total Depth: 115 FT
Drilling Start Date: 8/19/11
Drilling End Date: 8/23/11
Inspector: J. Brown, R. Kral,
Contractor: Ohio TestBor Inc.
Driller: J. Minchak
Drilling Method:
 Track Mounted D 50 Drill Rig using 3 1/4" HSA to 18.5'; 2
 7/8" Tricone Washbore to end of boring.

Plugging Procedure:
 Borehole sealed with cement-bentonite grout

Water Level Observation:

Groundwater encountered at 8.0' during drilling operations. The use of wash rotary drilling methods, precluded further groundwater observations.

Notes:

* Pocket Penetrometer

GPS Coordinates:

Figure No. 3

LOG OF TEST BORING NO: B-01

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



NTH Consultants, Ltd.

NTH Proj. No.: 86-101394-00

Checked By: *BGM*

SUBSURFACE PROFILE					SOIL SAMPLE DATA									
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)	
550														
			Very Soft Gray SILTY CLAY, Little Sand, Trace Gravel											
545					35	S-9	1 2 2	4	18			27.5		500
						ST-2	PUSH		24			27.6	96.6	1240
540					40	S-10	2 2	4	18			35.5		500
		538.0		42.0										
535			Medium to Stiff Gray CLAYEY SILT, Trace Sand, Contains Few Silt Lenses and Pockets		45	S-11	1 3 6	9	18		22.7		2000*	
						ST-3	PUSH		24			21.1	109.5	4000
530					50	S-12	4 6 8	14	18			20.7		3000*
525					55	S-13	3 5 6	11	7			22.1		1000*
		521.5		58.5										
520			Very Stiff Gray SILTY CLAY, Little Fine Sand, Trace Fine Gravel, Contains Many Silt and Fine Sand Seams and Pockets		60	S-14	4 7 10	17	13		22.3		4000* 4500*	
515					65	S-15	5 7 9	16	18			16.5		4000* 4500*

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

LOG OF TEST BORING NO: B-01

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



NTH Consultants, Ltd.

NTH Proj. No.: 86-101394-00

Checked By: *[Signature]*

SUBSURFACE PROFILE

SOIL SAMPLE DATA

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)
510		512.0			70	S-16	5 8 10	18	15		13.8		5000*- 7000*
505			Very Stiff Gray SILTY CLAY, Little Fine Sand, Contains Many Silt and Fine Sand Seams and Pockets, Trace Fine Gravel		75	S-17	5 8 11	19	15		16.2		7000*
500					80	S-18	6 10 14	24	15		15.8		7000*
495		499.0		81.0									
490			Very Compact Gray SILT, Little Sand, Trace Clay		85	S-19	30 50/5"	50/5"	10		14.7		-
485					90	S-20	23 20 35	55	16		21.0	115.2	-
480		488.0		92.0									
475			Hard Gray SILTY CLAY, Trace Sand and Gravel		95	S-21	17 26 40	66	15		11.4		>9000*
					100	S-22	15 22 33	55	14		12.4	130.4	>9000*
						S-23	50/1"	50/1"	1		11.3		-
					105								

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

LOG OF TEST BORING NO: B-01

Project Name: *Cleveland Port Authority Expansion*

Project Location: *Cleveland, OH*



NTH Consultants, Ltd.

NTH Proj. No.: 86-101394-00

Checked By: *BEH*

SUBSURFACE PROFILE

SOIL SAMPLE DATA

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	Hard Gray SILTY CLAY, Trace Sand and Gravel										
					110	S-24	9 14 18	32	16		28.2		>9000*
		467.0		113.0									
465		465.0	Compact Gray Sand	115.0	115	S-25	13 15 17	32	15				-
			END OF BORING AT 115.0 FEET.										
460													
455													
450													
445													
440													

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

LOG OF TEST BORING NO: B-02

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



NTH Consultants, Ltd.

NTH Proj. No.: 86-101394-00

Checked By: *BEM*

SUBSURFACE PROFILE

SOIL SAMPLE DATA

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)
580		579.8	Topsoil	0.2									
		578.0	FILL: Compact Brown SILTY SAND, Trace Gravel, Contains Brick Fragments	2.0		S-1	15 27 38	65	14				-
		576.0	FILL: Very Compact Gray SILTY SAND, Trace Gravel	4.0			15 13 8	21	5				-
575		573.0	FILL: Loose to Medium Compact Dark Brown SILTY SAND, Trace Gravel, Trace Clay	7.0		S-2	1 2 8	10	13				-
570		567.5	FILL: Medium Compact Brown SANDY GRAVEL, Some Silt, Contains Brick Pieces	10		S-3	7 15 9	24	12				-
565		564.0	FILL: Loose Gray SANDY GRAVEL, Little Silt	15		S-4	13 5 4	9	12				-
560		561.0	FILL: Very Loose Gray SAND, Trace Gravel	19.0		S-5	2 2 3	5	18				2000*
555		553.5	Medium Gray SILTY CLAY, Trace Sand and Gravel, Contains Frequent Silt Seams	25		S-6	2 3 4	7	18				2000*
550		550.0	Medium Gray SILTY CLAY, Trace Sand	30		S-7	3 3 4	7	18		25.3	92.7	2000*

Total Depth: 135 FT
Drilling Start Date: 8/16/11
Drilling End Date: 8/18/11
Inspector: J. Brown
Contractor: Ohio TestBor Inc.
Driller: J. Minchak
Drilling Method:
Track Mounted D 50 Drill Rig using 3 1/4" HSA to 23.5' 2 7/8" Tricone Washbore to end of boring.

Plugging Procedure:
Borehole sealed with cement-bentonite grout

Water Level Observation:

Groundwater encountered at 13.5' during drilling operations. The use of wash rotary drilling methods, precluded further groundwater observations.

Notes:

* Pocket Penetrometer

GPS Coordinates:

Figure No. 4

LOG OF TEST BORING NO: B-02

Project Name: *Cleveland Port Authority Expansion*

Project Location: *Cleveland, OH*



NTH Consultants, Ltd.

NTH Proj. No.: 86-101394-00

Checked By: *Ben*

SUBSURFACE PROFILE

SOIL SAMPLE DATA

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)
550													
			Medium Gray SILTY CLAY, Trace Sand										
545					35	S-9	2 2 2	4	12		30.0		2500*
		542.5		37.5									
540			Soft Gray SILTY CLAY, Trace Sand		40	S-10	1 1 2	3	18		24.2	101.4	<500*
		538.0		42.0									
535					45	S-11	1 2 4	6	18		21.8		1000*
530			Medium Gray SILTY CLAY, Trace Sand and Gravel		50	S-12	2 2 4	6	18		23.1	111.9	1000*
525					55	S-13	2 3 4	7	3		32.5		-
520		520.9		59.1	60	S-14	2 4 6	10	2		29.9		2000*
515			Stiff to Very Stiff Gray SILTY CLAY, Trace Sand and Gravel		65	S-15	4 7 8	15	18		22.4		4000*

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

LOG OF TEST BORING NO: B-02

Project Name: *Cleveland Port Authority Expansion*

Project Location: *Cleveland, OH*



NTH Consultants, Ltd.

NTH Proj. No.: 86-101394-00

Checked By: *BEW*

SUBSURFACE PROFILE

SOIL SAMPLE DATA

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)
510		512.0			70	S-16	6 8 11	19	18		20.6		4500*
			Stiff to Very Stiff Gray SILTY CLAY, Trace Sand and Gravel										
505					75	S-17	4 5 9	14	18		17.2		3000*
		503.0		77.0									
500			Very Stiff Gray SILTY CLAY, Little Sand		80	S-18	7 10 18	28	16		16.6		7000*
		498.8		81.2									
495			Very Compact Gray SILT		85	S-19	28 41 50/4"	91	16		21.1		-
		491.7		88.3									
490			Very Compact Gray SANDY SILT, Trace Gravel		90	S-20	40 50/4"	50/4"	10		19.5		-
		488.3		91.7									
485					95	S-21	20 34 47	81	13		10.4		>9000*
			Very Hard Gray SANDY CLAY, Little Silt, Trace Gravel										
480					100	S-22	14 21 32	53	18		13.5		-
		476.7		103.3									
475			Very Compact Gray CLAYEY SILT, Trace Sand and Gravel		105	S-23	15 23 29	52	18		18.9		-

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

LOG OF TEST BORING NO: B-02

Project Name: Cleveland Port Authority Expansion

Project Location: Cleveland, OH



NTH Consultants, Ltd.

NTH Proj. No.: 86-101394-00

Checked By: *BGM*

SUBSURFACE PROFILE

SOIL SAMPLE DATA

ELEV. (FT)	PRO- FILE	ELEV	GROUND SURFACE ELEVATION: 580.0 (a)	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		106.0	110	S-24	12 15 20	35	15		10.7		-
465			Compact Gray SAND, Trace Silt and Gravel		115	S-25	15 17 22	39	14		12.8		-
460		462.0		118.0	120	S-26	30 45		11		5.7		-
455			Compact to Very Compact Gray SAND, Little Gravel, Trace Silt, Trace Clay, Contains Clay Pockets		125	S-27	20 35 34	69	12		13.8		-
450		449.9		130.1	130	S-28	15 21 24	45	14		18.0		-
445		445.0	Very Compact Gray CLAYEY SILT, Trace To Little Sand		135	S-29	15 24 34	58	18		8.0		-
			END OF BORING AT 135.0 FEET.										
440													

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

LOG OF TEST BORING NO: B-03

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



NTH Consultants, Ltd.

NTH Proj. No.: 86-101394-00

Checked By: *BGM*

SUBSURFACE PROFILE

SOIL SAMPLE DATA

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)
		582.7	Asphalt	0.3									
580						S-1	3 9 11	20	13				-
			FILL: Medium Compact Brown SAND Some Gravel, Contains Brick Fragments		5	S-2	4 11 16	27	10		7.8		-
575						S-3	6 12 10	22	10				-
		574.5		8.5									
			FILL: Medium Compact Brown SAND, Little Gravel, Contains Asphalt fragments from 9.8' to 10.0'		10	S-4	5 6 10	16	10				-
570													
		569.5		13.5									
			FILL: Loose Dark Brown And Gray Mottled with Black, Fine SAND, Trace Silt Slightly Organic		15	S-5	4 4 4	8	10				-
565													
		564.5		18.5									
			Very Loose to Loose Dark Gray Fine SAND, Trace Silt		20	S-6	3 2 2	4	6				-
560													
		558.0		25.0	25	S-7	1 1 9	10	18		18.5		-
			END OF BORING AT 25.0 FEET.										
555													

Total Depth: 25 FT
Drilling Start Date: 8/11/11
Drilling End Date: 8/11/11
Inspector: R. Kral
Contractor: Northcoast Drilling Inc.
Driller: G. Beck
Drilling Method:
CME 75 Truck Mounted Drill Rig Using 4 1/4" HSA to Boring Completion

Water Level Observation:
Groundwater encountered at 12.9' during drilling operations,
groundwater at 16.0' after drilling operations completion. Borehole
caved at 15.0'.

Notes:

Plugging Procedure:
Borehole was backfilled with auger cuttings and bentonite
hole plug

GPS Coordinates:

Figure No. 5

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

LOG OF TEST BORING NO: B-04

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



NTH Consultants, Ltd.

NTH Proj. No.: 86-101394-00

Checked By: *BSM*

SUBSURFACE PROFILE**SOIL SAMPLE DATA**

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			FILL: Compact Dark Brown SAND, Some Gravel, Contains Brick and Concrete Fragments	3.5		S-1	4 13 22	35	13				-
		578.5											
			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		7.0		S-3	2 1 1	2	6				-
		573.8	FILL: Very Soft Black Organic SILTY CLAY, Little Gravel, Contains Brick Fragments.	8.2		S-4	50/2"	50/2"	2				-
			END OF BORING AT 8.2 FEET.										
570													
565													
560													
555													

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

Water Level Observation:
 No groundwater encountered during or at completion of drilling
 operations

Notes:
 - Auger Refusal at 8.2' Encountered Gray Fine Grained Sandstone
 Boulder Offset to B-04a

Plugging Procedure:
 Borehole was backfilled with auger cuttings

GPS Coordinates:


Figure No. 6

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

LOG OF TEST BORING NO: B-04aProject Name: *Cleveland Port Authority Expansion*Project Location: *Cleveland, OH***NTH Consultants, Ltd.**

NTH Proj. No.: 86-101394-00

Checked By: *BN***SUBSURFACE PROFILE****SOIL SAMPLE DATA**

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		Profile Drill to 5.0'											
		577.0	5.0		5	END OF BORING AT 5.0 FEET.							
575													
570													
565													
560													
555													

Total Depth: 5 FT
Drilling Start Date: 8/12/11
Drilling End Date: 8/12/11
Inspector: R. Kral
Contractor: Northcoast Drilling Inc.
Driller: G. Beck
Drilling Method:
CME 75 Truck Mounted Drill Rig Using 4 1/4" HSA to Boring Completion

Plugging Procedure:
Borehole was backfilled with auger cuttings

Water Level Observation:
No groundwater encountered during or at completion of drilling operations

Notes:
- Auger Refusal at 5.0' Encountered Gray Fine Grained Sandstone Boulder Offset to B-04b

GPS Coordinates:

Figure No. 7

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

LOG OF TEST BORING NO: B-04bProject Name: *Cleveland Port Authority Expansion*Project Location: *Cleveland, OH***NTH Consultants, Ltd.**

NTH Proj. No.: 86-101394-00

Checked By: *BGM***SUBSURFACE PROFILE****SOIL SAMPLE DATA**

ELEV (FT)	PRO- FILE	ELEV	GROUND SURFACE ELEVATION: 582.0 (a)	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			Profile Drill to 5.0'										
		577.0	END OF BORING AT 5.0 FEET.	5.0	5								
575													
570													
565													
560													
555													

Total Depth: 5 FT
Drilling Start Date: 8/12/11
Drilling End Date: 8/12/11
Inspector: R. Kral
Contractor: Northcoast Drilling Inc.
Driller: G. Beck
Drilling Method:
CME 75 Truck Mounted Drill Rig Using 4 1/4" HSA to Boring Completion

Plugging Procedure:
Borehole was backfilled with auger cuttings

Water Level Observation:
No groundwater encountered during or at completion of drilling operations

Notes:
- Auger Refusal at 5.0' Encountered Gray Fine Grained Sandstone Boulder. Offset to B-04c

GPS Coordinates:

Figure No. 8

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

LOG OF TEST BORING NO: B-04cProject Name: *Cleveland Port Authority Expansion*Project Location: *Cleveland, OH***NTH Consultants, Ltd.**

NTH Proj. No.: 86-101394-00

Checked By: *BSM***SUBSURFACE PROFILE****SOIL SAMPLE DATA**

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													
					5								
575			Profile Drill to 13.5', Encountered Cobbles at 8.5'										
					10								
570													
		568.5		13.5									
			FILL: Compact Black Sand, Contains Slag		15	S-5	5 12 23	35	18				-
565		565.0		17.0									
			Compact Gray SAND		20	S-6	5 12 18	30	18				-
560		560.0		22.0									
			Medium Gray CLAYEY SILT, Trace Sand				2 3 3						
		557.0		25.0	25	S-7		6	12		26.6		1000*
			END OF BORING AT 25.0 FEET.										
555													

Total Depth: 25 FT
Drilling Start Date: 8/23/11
Drilling End Date: 8/23/11
Inspector: B. Meluch
Contractor: Ohio TestBor Inc.
Driller: J. Minchak
Drilling Method:
 Track Mounted D 50 Drill Rig using 3 1/4" HSA to end of
 boring

Plugging Procedure:
 Borehole was backfilled with auger cuttings

Water Level Observation:
 No groundwater encountered during or at completion of drilling
 operations

Notes:
 * Pocket Penetrometer

GPS Coordinates:

Figure No. 9

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

LOG OF TEST BORING NO: B-05

Project Name: *Cleveland Port Authority Expansion*

Project Location: *Cleveland, OH*



NTH Consultants, Ltd.

NTH Proj. No.: 86-101394-00

Checked By: *B. J. M.*

SUBSURFACE PROFILE

SOIL SAMPLE DATA

ELEV. (FT)	PRO- FILE	ELEV	GROUND SURFACE ELEVATION: 580.0 (a)	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													
		579.0	Granular Base	1.0									
			FILL: Medium Compact Gray Brown and Black CLAYEY SILT, Some Sand, Some Gravel, Contains Asphalt and Brick Fragments	3.0		S-1	1 4 11	15	10				>9000*
		577.0											
			FILL: Loose Brown, Dark Gray and Black SAND, Little Gravel, Contains Asphalt and Brick Fragments	5.5		S-2	1 4 2	6	12				-
575		574.5											
			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		-
		572.0											
570			FILL: Very Loose Black, Gray and Brown GRAVEL and SAND, Contains Shell, Asphalt and Brick Fragments	12.0		S-4	3 2 2	4	4				-
		568.0											
			Loose Gray SAND, Trace Fine Gravel	18.5		S-5	4 4 4	8	18		22.8		-
565													
		561.5				S-6	2 4 6	10	8				3000*
560			Stiff to Very Stiff Gray Mottled Red SILTY CLAY, Contains Few Silt and Sand Pockets and Lenses	25.0		S-7	2 5 5	10	16		19.8		3000*- 5000*
555		555.0	END OF BORING AT 25.0 FEET.										
550													

Total Depth: 25 FT
Drilling Start Date: 8/12/11
Drilling End Date: 8/12/11
Inspector: R. Kral
Contractor: Northcoast Drilling Inc.
Driller: G. Beck
Drilling Method:
 CME 75 Truck Mounted Drill Rig Using 4 1/4" HSA to Boring Completion

Water Level Observation:
 Groundwater encountered at 5.6' during drilling operations, groundwater encountered at 8.0' after completion. Groundwater at 5.5' after augers removed. Borehole caved at 8.7'.

Notes:
 * Pocket Penetrometer

Plugging Procedure:
 Borehole was backfilled with auger cuttings and bentonite hole plug

GPS Coordinates:

Figure No. 10

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

LOG OF TEST BORING NO: B-06

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



NTH Consultants, Ltd.

NTH Proj. No.: 86-101394-00

Checked By: *[Signature]*

SUBSURFACE PROFILE						SOIL SAMPLE DATA							
ELEV. (FT)	PRO-FILE	ELEV	GROUND SURFACE ELEVATION: 583.0 (H)	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		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	4.7	5	S-2T	7 12	23	10				-
		577.0	FILL: Medium Compact Brown and Black SAND and GRAVEL, Contains Asphalt Fragments	6.0		S-2B	11						-
575		574.5	FILL: Medium Compact Red and Brown BRICK FRAGMENTS and SAND	8.5		S-3	6 6 7	13	8				-
		573.0	FILL: Loose Gray SANDY SILT, Trace Brick Fragments	10.0	10	S-4	4 5 3	8	10				-
			END OF BORING AT 10.0 FEET.										
570													
565													
560													
555													

Total Depth: 10 FT
Drilling Start Date: 8/11/11
Drilling End Date: 8/11/11
Inspector: R. Kral
Contractor: Northcoast Drilling Inc.
Driller: G. Beck
Drilling Method: CME 75 Truck Mounted Drill Rig Using 4 1/4" HSA to Boring Completion

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

Notes:

Plugging Procedure:
Borehole was backfilled with auger cuttings

GPS Coordinates:

Figure No. 11

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

LOG OF TEST BORING NO: B-07

Project Name: *Cleveland Port Authority Expansion*

Project Location: *Cleveland, OH*



NTH Consultants, Ltd.

NTH Proj. No.: 86-101394-00

Checked By: *[Signature]*

SUBSURFACE PROFILE

SOIL SAMPLE DATA

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)
580		580.3	Asphalt	0.7									
			FILL: Medium Compact Dark Gray and Brown SAND, Some Gravel, Contains Asphalt and Brick Fragments	3.0		S-1	3 10 10	20	13				-
		578.0											
			FILL: Loose Dark Brown SAND Some to And Gravel, Contains Asphalt and Brick Fragments	5		S-2	7 4 3	7	13				-
575													
						S-3	2 2 3	5	6				-
		572.0		9.0									
		571.0	FILL: Medium Compact Gray SAND and GRAVEL, Contains Brick Fragments	10.0	10	S-4	4 6 7	13	6				-
570			END OF BORING AT 10.0 FEET.										
565													
560													
555													

Total Depth: 10 FT
Drilling Start Date: 8/12/11
Drilling End Date: 8/12/11
Inspector: R. Kral
Contractor: Northcoast Drilling Inc.
Driller: G. Beck

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

Plugging Procedure:
Borehole was backfilled with auger cuttings

Water Level Observation:
Groundwater encountered at 7.5' during drilling operations, groundwater encountered at 8.3' after completion. Groundwater at 7.3' after augers removed. Borehole caved at 7.5'.

Notes:

GPS Coordinates:

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

LOG OF TEST BORING NO: B-08

Project Name: *Cleveland Port Authority Expansion*

Project Location: *Cleveland, OH*



NTH Consultants, Ltd.

NTH Proj. No.: 86-101394-00

Checked By: *[Signature]*

SUBSURFACE PROFILE						SOIL SAMPLE DATA							
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	1.0	5								
580			FILL: Medium Compact Dark Gray SAND and FINE GRAVEL, Trace Silt			S-1	3 14 12	26	14				-
		577.5	4.5			S-2	10 9 4	13	11				-
575			FILL: Medium Compact Brown and Dark Gray SAND, Little Gravel, Contains Brick Fragments			S-3	3 4 3	7	3				-
		573.5	8.5				3 2 3	5	6			9.1	
		572.0	FILL: Loose Brown and Gray SAND	10.0	10	S-4							-
		END OF BORING AT 10.0 FEET.											
570													
565													
560													
555													

Total Depth: 10 FT
Drilling Start Date: 8/12/11
Drilling End Date: 8/12/11
Inspector: R. Kral
Contractor: Northcoast Drilling Inc.
Driller: G. Beck

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

Plugging Procedure:
 Borehole was backfilled with auger cuttings

Water Level Observation:

Groundwater encountered at 7.9' during drilling operations, no
 groundwater encountered at completion. Borehole caved at 7.5'.

Notes:

GPS Coordinates:

Figure No. 13

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

LOG OF TEST BORING NO: B-09


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



NTH Consultants, Ltd.

NTH Proj. No.: 86-101394-00

Checked By: *BEY*

SUBSURFACE PROFILE						SOIL SAMPLE DATA								
ELEV. (FT)	PRO- FILE	ELEV	GROUND SURFACE ELEVATION: 584.0 (a)	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			10 19 23	42	12					
580			FILL: Medium Compact to Compact Dark Gray, Brown and Black GRAVEL Contains Asphalt and Brick Fragments	5	S-1	9 11 11	22	14					-	
		578.0	6.0			S-2	10 14 7	21	10					-
575			FILL: Loose to Medium Compact Dark Gray, Brown, and Black SAND and GRAVEL, Contains Asphalt and Brick Fragments	10.0	S-3	8 5 4	9	10						-
		574.0	10.0	10	S-4									-
		END OF BORING AT 10.0 FEET.												
570														
565														
560														
555														

Total Depth: 10 FT
Drilling Start Date: 8/12/11
Drilling End Date: 8/12/11
Inspector: R. Kral
Contractor: Northcoast Drilling Inc.
Driller: G. Beck
Drilling Method: CME 75 Truck Mounted Drill Rig Using 4 1/4" HSA to Boring Completion
Plugging Procedure: Borehole was backfilled with auger cuttings

Water Level Observation:
No groundwater encountered during or at completion of drilling operations, borehole caved at 5.7'

Notes:

GPS Coordinates:

Figure No. 14

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

LOG OF TEST BORING NO: B-10

Project Name: Cleveland Port Authority Expansion

Project Location: Cleveland, OH



NTH Consultants, Ltd.

NTH Proj. No.: 86-101394-00

Checked By: *BEA*

SUBSURFACE PROFILE

SOIL SAMPLE DATA

ELEV. (FT)	PRO-FILE	ELEV	GROUND SURFACE ELEVATION: 581.0(4)	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		580.9	Topsoil	0.1									
			FILL: Compact Gray SLAG, Contains Brick			S-1	20 20 16	36	7				-
		576.5	FILL: Very Compact Black SAND, Contains Cinders Slag and Taconite Pellets	4.5	5	S-2	11 18 50	68	12		17.7		-
575		574.7		6.3		S-3	5 12 9	21	9				-
			Loose to Medium Compact Brown SAND, Trace Silt				8 5 4	9	13				-
		571.0	END OF BORING AT 10.0 FEET.	10.0	10	S-4							-
570													
565													
560													
555													

Total Depth: 10 FT
Drilling Start Date: 8/11/11
Drilling End Date: 8/11/11
Inspector: B. Meluch
Contractor: Northcoast Drilling Inc.
Driller: G. Beck
Drilling Method: CME 75 Truck Mounted Drill Rig Using 4 1/4" HSA to Boring Completion

Water Level Observation:
 Groundwater encountered at 9.5' during drilling operations, no groundwater encountered at completion. Borehole caved at 4.0'.

Notes:

Plugging Procedure:
 Borehole was backfilled with auger cuttings

GPS Coordinates:

Figure No. 15

LOG OF TEST BORING 86-101394-00.GPJ NTH CORPORATE NEW.GDT 9/15/11

LOG OF TEST BORING NO: B-11Project Name: *Cleveland Port Authority Expansion*Project Location: *Cleveland, OH***NTH Consultants, Ltd.**

NTH Proj. No.: 86-101394-00

Checked By: *[Signature]***SUBSURFACE PROFILE****SOIL SAMPLE DATA**

ELEV. (FT)	PRO- FILE	ELEV	GROUND SURFACE ELEVATION: 579.0 (a)	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									
575			FILL: Compact Dark Gray SAND, Little Silty Clay, Contains Slag, Plastics, Cinders, and Brick		5	S-1	6 15 24	39	16				-
		573.5		5.5		S-2	14 23 17	40	15				-
			FILL: Medium Compact Gray GRAVEL and SAND, Contains Slag and Limestone Fragments			S-3	5 7 4	11	18				-
570		571.0		8.0									
			FILL: Medium Compact Black SLAG			S-4	2 9 12	21	6				-
		569.0		10.0	10								
			END OF BORING AT 10.0 FEET.										
565													
560													
555													
550													

Total Depth: 10 FT
Drilling Start Date: 8/11/11
Drilling End Date: 8/11/11
Inspector: B. Meluch
Contractor: Northcoast Drilling Inc.
Driller: G. Beck
Drilling Method:
 CME 75 Truck Mounted Drill Rig Using 4 1/4" HSA to Boring Completion

Water Level Observation:

Groundwater encountered at 7.0' during drilling operations, groundwater encountered at 5.5' completion. Borehole caved at 6.0'

Notes:

Plugging Procedure:
 Borehole was backfilled with auger cuttings

GPS Coordinates:

Figure No. 16

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

LOG OF TEST BORING NO: B-12

Project Name: *Cleveland Port Authority Expansion*

Project Location: *Cleveland, OH*



NTH Consultants, Ltd.

NTH Proj. No.: 86-101394-00

Checked By: *[Signature]*

SUBSURFACE PROFILE

SOIL SAMPLE DATA

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)
580			FILL: Very Compact Gray Gravel, Some Sand, Consisting of Concrete and Brick Fragments			S-1	24 50/2"	50/2"	6				-
						S-2	3 38 40	78	12				-
						S-3	10 50/2"	50/2"	8				-
				5									
		576.0		8.0		S-4	14 41 20	61	8				-
575			FILL: Compact Gray and Brown GRAVEL, Some Sand, Little Clayey Silt				12 15 12						
		574.0		10.0	10	S-5	12	27	8				-
			END OF BORING AT 10.0 FEET.										
570													
565													
560													
555													

Total Depth: 10 FT
Drilling Start Date: 8/11/11
Drilling End Date: 8/11/11
Inspector: R. Kral
Contractor: Northcoast Drilling Inc.
Driller: G. Beck
Drilling Method:
 CME 75 Truck Mounted Drill Rig Using 4 1/4" HSA to Boring Completion

Water Level Observation:
 No groundwater encountered during or at completion of drilling operations, borehole caved at 3.8'

Notes:

Plugging Procedure:
 Borehole was backfilled with auger cuttings

GPS Coordinates:

LOG OF TEST BORING 86-101394-00.GPJ NTH CORPORATE NEW.GDT 9/15/11

Figure No. 17

LOG OF TEST BORING NO: B-13

Project Name: Cleveland Port Authority Expansion

Project Location: Cleveland, OH



NTH Consultants, Ltd.

NTH Proj. No.: 86-101394-00

Checked By: *[Signature]*

SUBSURFACE PROFILE						SOIL SAMPLE DATA							
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			S-1	13 40 17	57	14				-
		579.0	FILL: Loose Brown SAND, Little Clayey Silt	4.0	5	S-2	10 5 4	9	10		20.6		-
575		576.5	Loose Gray SILT and SAND, Trace Clay	6.5		S-3	7 5 5	10	10				-
		574.0	Very Loose Brown and Gray SANDY SILT, Little Clay	9.0			2 2 2						
		573.0		10.0	10	S-4	2 2 2	4	6				-
			END OF BORING AT 10.0 FEET.										
570													
565													
560													
555													

Total Depth: 10 FT
Drilling Start Date: 8/12/11
Drilling End Date: 8/12/11
Inspector: R. Kral
Contractor: Northcoast Drilling Inc.
Driller: G. Beck
Drilling Method:
 CME 75 Truck Mounted Drill Rig Using 4 1/4" HSA to Boring Completion

Water Level Observation:
 No groundwater encountered during or at completion of drilling operations, borehole caved at 5.7'

Notes:

Plugging Procedure:
 Borehole was backfilled with auger cuttings

GPS Coordinates:

Figure No. 18

LOG OF TEST BORING 86-101394-00.GPJ NTH CORPORATE NEW.GDT 9/15/11

TABULATION OF LABORATORY TEST DATA

BORING / TEST PIT / PROBE DESIGNATION	SAMPLE NUMBER	DEPTH OF SAMPLE TIP (FT)	ELEVATION OF SAMPLE TIP (FT)	UNCONFINED COMPRESSIVE STRENGTH (PSF)	FAILURE STRAIN (%)	NATURAL WATER CONTENT (% OF DRY WEIGHT)	IN-PLACE DRY DENSITY (LBS/CU.FT)	PERMEABILITY (CM/SEC)	PARTICLE SIZE DISTRIBUTION (%)							ATTERBERG LIMITS (%)			APPARENT SPECIFIC GRAVITY	LOSS ON IGNITION (%)	UNIFIED SOIL CLASSIFICATION
									COLLOIDS	CLAY	SILT	FINE SAND	MEDIUM SAND	COARSE SAND	GRAVEL	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX			
B-1	ST-1	27.5		2900	12.7	28.4	98.3	-	0	69	31	0	0	0	0	38	25	13			CL
	S-8	30.0		-	-	21.4															
	S-9	35.0		-	-	27.5															
	ST-2	38.5		1240	15.0	27.6	96.6	-	0	67	20	8	3	1	1	33	22	11			CL
	S-10	40.0		-	-	35.5															
	S-11	45.0		-	-	22.7															
	ST-3	48.5		4000	15.0	21.1	109.5	-	0	47	48	3	1	1	0	28	19	9			CL-ML
	S-12	50.0		-	-	20.7															
	S-13	55.0		-	-	22.1															
	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															

TABULATION OF LABORATORY TEST DATA

BORING / TEST PIT / PROBE DESIGNATION	SAMPLE NUMBER	DEPTH OF SAMPLE TIP (FT)	ELEVATION OF SAMPLE TIP (FT)	UNCONFINED COMPRESSIVE STRENGTH (PSF)	FAILURE STRAIN (%)	NATURAL WATER CONTENT (% OF DRY WEIGHT)	IN-PLACE DRY DENSITY (LBS/CU.FT)	PERMEABILITY (CM/SEC)	PARTICLE SIZE DISTRIBUTION (%)							ATTERBERG LIMITS (%)			APPARENT SPECIFIC GRAVITY	LOSS ON IGNITION (%)	UNIFIED SOIL CLASSIFICATION
									COLLOIDS	CLAY	SILT	FINE SAND	MEDIUM SAND	COARSE SAND	GRAVEL	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX			
B-2	S-8	30.0		.	.	25.3	92.7														
	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	60.0		.	.	29.9															
	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															

TABULATION OF LABORATORY TEST DATA

BORING / TEST PIT / PROBE DESIGNATION	SAMPLE NUMBER	DEPTH OF SAMPLE TIP (FT)	ELEVATION OF SAMPLE TIP (FT)	UNCONFINED COMPRESSIVE STRENGTH (PSF)	FAILURE STRAIN (%)	NATURAL WATER CONTENT (% OF DRY WEIGHT)	IN-PLACE DRY DENSITY (LBS/CU.FT)	PERMEABILITY (CM/SEC)	PARTICLE SIZE DISTRIBUTION (%)						ATTERBERG LIMITS (%)			APPARENT SPECIFIC GRAVITY	LOSS ON IGNITION (%)	UNIFIED SOIL CLASSIFICATION
									COLLOIDS	CLAY	SILT	FINE SAND	MEDIUM SAND	COARSE SAND	GRAVEL	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX		
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		-	-	22.8	-	-	-	2		89	8	0	0					SM
	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	10.0		-	-	9.1	-	-	-	2		17	81	0	0					SM
B-10	S-2	5.0		-	-	17.7	-	-	-	16		42	21	4	17					SM
B-13	S-2	5.0		-	-	20.6	-	-	-	11	50	36	2	0	1					CL

Aggregate/Soil Test Report

Report No: MAT:86-101394-00-S001

Issue No: 1

Client: Parsons Brinckerhoff
Project: Port of Cleveland Rail Expansion
Geotechnical Investigation
Job No: 86-101394-00

This laboratory is accredited by the American Association of State Highway and Transportation Officials (AASHTO). The tests reported have been completed in accordance with the terms of the



Ronald A. Kral

Date of Issue: 8/26/2011
Approved Signatory: Ron Kral

Sample Details

Boring No: B-1
Field Sample No: ST-1
Sample Depth: 27.5
Date Sampled: 8/19/2011
Sampled By: Brian Meluch
LWO No: W009463
Sample Location: Cleveland Port Authority

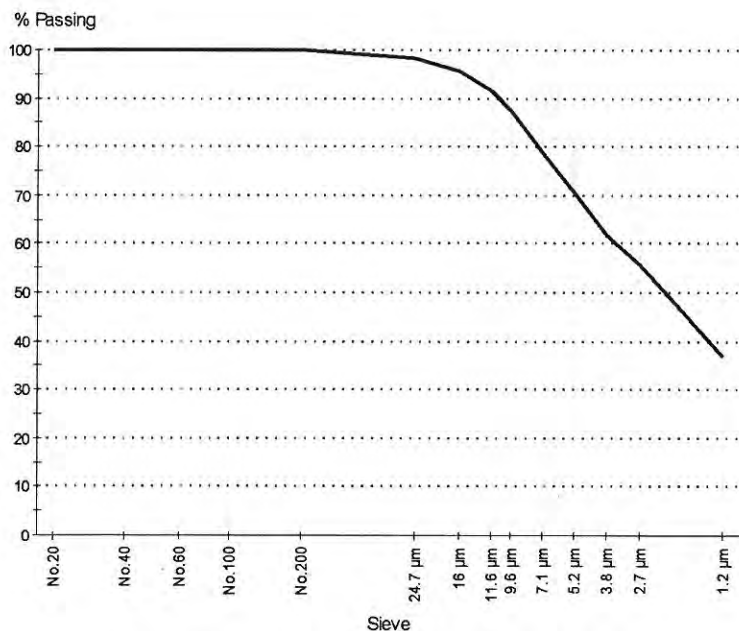
Atterberg Limit:

Liquid Limit: 38
Plastic Limit: 25
Plasticity Index: 13
Linear Shrinkage (%): N/A

Sample Description:

Gray SILTY CLAY

Particle Size Distribution



Grading: Particle Size Analysis of Soil - ASTM D 422 / 29

Drying by: Natural
Date Tested: 8/25/2011

Sieve Size	% Passing	Limits
No. 20	100	
No. 40	100	
No. 60	100	
No. 100	100	
No. 200	100	
24.7 µm	98.4	
16.0 µm	95.5	
11.6 µm	91.5	
9.6 µm	87.5	
7.1 µm	78.6	
5.2 µm	70.6	
3.8 µm	61.7	
2.7 µm	55.7	
1.2 µm	36.8	

COBBLES	GRAVEL		SAND			FINES	
(0.0%)	Coarse (0.0%)	Fine (0.0%)	Coarse (0.0%)	Medium (0.0%)	Fine (0.0%)	Silt (30.7%)	Clay (69.3%)

Aggregate/Soil Test Report

Report No: MAT:86-101394-00-S002

Issue No: 1

Client: Parsons Brinckerhoff
Project: Port of Cleveland Rail Expansion
Geotechnical Investigation
Job No: 86-101394-00

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Ronald A. Kral

Date of Issue: 8/26/2011
Approved Signatory: Ron Kral

Sample Details

Boring No: B-1
Field Sample No: ST-2
Sample Depth: 38
Date Sampled: 8/19/2011
Sampled By: Brian Meluch
LWO No: W009463
Sample Location: Cleveland Port Authority

Atterberg Limit:

Liquid Limit: 33
Plastic Limit: 22
Plasticity Index: 11
Linear Shrinkage (%): N/A

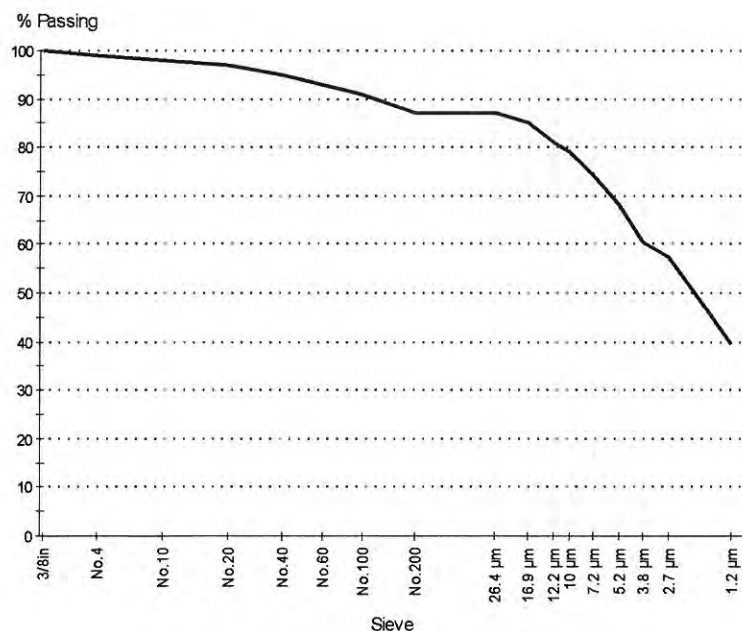
Sample Description:

Gray SILTY CLAY, Little Sand, Trace Fine Gravel

Grading: Particle Size Analysis of Soils - Liquid & Plastic Limits (ASTM D 1557 - 07)

Drying by: Natural
Date Tested: 8/25/2011

Particle Size Distribution



Sieve Size	% Passing	Limits
3/8in	100	
No. 4	99	
No. 10	98	
No. 20	97	
No. 40	95	
No. 60	93	
No. 100	91	
No. 200	87	
26.4 µm	87.2	
16.9 µm	85.2	
12.2 µm	81.2	
10.0 µm	79.2	
7.2 µm	74.3	
5.2 µm	68.3	
3.8 µm	60.4	
2.7 µm	57.5	
1.2 µm	39.6	

COBBLES	GRAVEL		SAND			FINES	
(0.0%)	Coarse (0.0%)	Fine (1.0%)	Coarse (1.0%)	Medium (3.0%)	Fine (8.0%)	Silt (19.8%)	Clay (67.2%)

Aggregate/Soil Test Report

Report No: MAT:86-101394-00-S003

Issue No: 1

Client: Parsons Brinckerhoff
Project: Port of Cleveland Rail Expansion
Geotechnical Investigation
Job No: 86-101394-00

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Ronald A. Kral

Date of Issue: 8/26/2011
Approved Signatory: Ron Kral

Sample Details

Boring No: B-1
Field Sample No: ST-3
Sample Depth: 48
Date Sampled: 8/19/2011
Sampled By: Brian Meluch
LWO No: W009463
Sample Location: Cleveland Port Authority

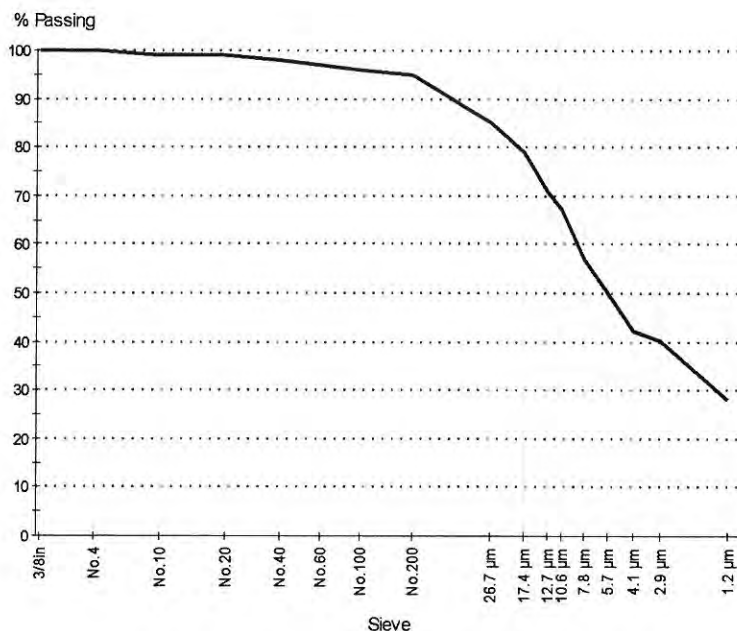
Atterberg Limit:

Liquid Limit: 28
Plastic Limit: 19
Plasticity Index: 9
Linear Shrinkage (%): N/A

Sample Description:

Gray CLAYEY SILT, Trace Sand

Particle Size Distribution



Grading: Provide Size Analysis of Soil - Soil & Hydraulics (ASTM D 422-07)

Drying by: Natural
Date Tested: 8/25/2011

Sieve Size	% Passing	Limits
3/8in	100	
No.4	100	
No.10	99	
No.20	99	
No.40	98	
No.60	97	
No.100	96	
No.200	95	
26.7 µm	85.2	
17.4 µm	79.1	
12.7 µm	71.1	
10.6 µm	67.1	
7.8 µm	57.1	
5.7 µm	50.1	
4.1 µm	42.1	
2.9 µm	40.1	
1.2 µm	28.1	

COBBLES	GRAVEL		SAND			FINES	
(0.0%)	Coarse (0.0%)	Fine (0.0%)	Coarse (1.0%)	Medium (1.0%)	Fine (3.0%)	Silt (48.4%)	Clay (46.6%)



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and Environmental Services

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Aggregate/Soil Test Report

Report No: MAT:86-101394-00-S038

Issue No: 1

Client: Parsons Brinckerhoff
Project: Port of Cleveland Rail Expansion
Geotechnical Investigation
Job No: 86-101394-00

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Ronald A. Kral

Date of Issue: 8/26/2011
Approved Signatory: Ron Kral

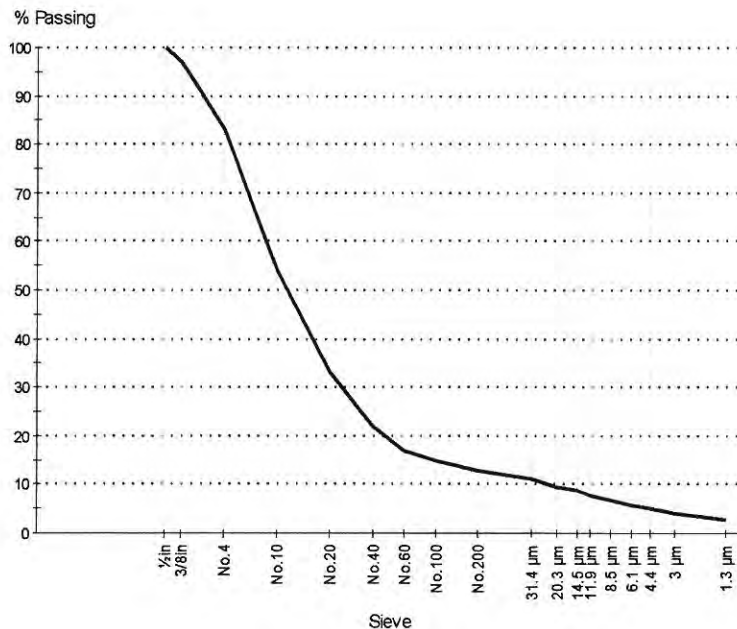
Sample Details

Boring No: B-2
Field Sample No: S-25
Sample Depth: 115
Date Sampled: 8/19/2011
Sampled By: Brian Meluch
LWO No: W009463
Sample Location: Cleveland Port Authority

Sample Description:

Gray SAND, Little Gravel, Trace Silt, Trace Clay

Particle Size Distribution



Grading: For the Size Analysis of Soil - Sieve & Hydrometer [ASTM D 422 - 07]

Drying by: Natural
Date Tested: 8/26/2011

Sieve Size	% Passing	Limits
1/2 in	100	
3/8 in	97	
No. 4	83	
No. 10	54	
No. 20	33	
No. 40	22	
No. 60	17	
No. 100	15	
No. 200	13	
31.4 µm	11.2	
20.3 µm	9.6	
14.5 µm	8.7	
11.9 µm	7.9	
8.5 µm	6.8	
6.1 µm	5.7	
4.4 µm	4.9	
3.0 µm	4.1	
1.3 µm	2.7	

COBBLES	GRAVEL		SAND			FINES	
(0.0%)	Coarse (0.0%)	Fine (17.0%)	Coarse (29.0%)	Medium (32.0%)	Fine (9.0%)	Silt (7.8%)	Clay (5.2%)

Aggregate/Soil Test Report

Report No: MAT:86-101394-00-S051

Issue No: 1

Client: Parsons Brinckerhoff
Project: Port of Cleveland Rail Expansion
Geotechnical Investigation
Job No: 86-101394-00

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Officials (AASHTO). The tests reported have been
completed in accordance with the terms of the



Ronald A. Kral

Date of Issue: 8/26/2011
Approved Signatory: Ron Kral

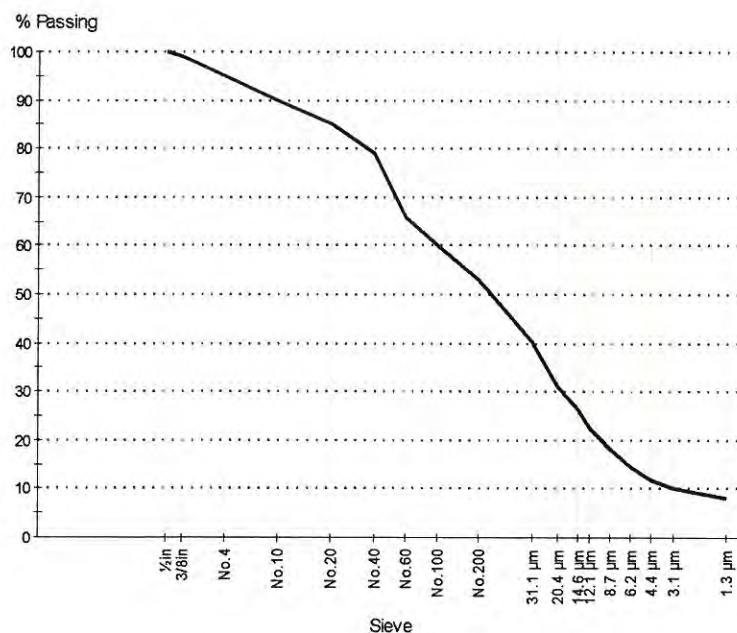
Sample Details

Boring No: B-5
Field Sample No: S-3
Sample Depth: 7.5
Date Sampled: 8/11/2011
Sampled By: Ronald Kral
LWO No: W009492
Sample Location: Cleveland Port Authority

Sample Description:

FILL: Brown, Black and Gray SAND and
SILT, Little Clay, Trace Gravel

Particle Size Distribution



Grading: Particle Size Analysis of Soils - Bureau of Reclamation (ASTM D 422 - 07)

Drying by: Natural
Date Tested: 8/26/2011

Sieve Size	% Passing	Limits
1/2 in	100	
3/8 in	99	
No. 4	95	
No. 10	90	
No. 20	85	
No. 40	79	
No. 60	66	
No. 100	60	
No. 200	53	
31.1 µm	40.1	
20.4 µm	31.0	
14.6 µm	26.4	
12.1 µm	22.8	
8.7 µm	18.2	
6.2 µm	14.6	
4.4 µm	11.8	
3.1 µm	10.0	
1.3 µm	8.2	

COBBLES	GRAVEL		SAND			FINES	
(0.0%)	Coarse (0.0%)	Fine (5.0%)	Coarse (5.0%)	Medium (11.0%)	Fine (26.0%)	Silt (40.3%)	Clay (12.7%)

Report No: MAT:86-101394-00-S052

Issue No: 1

Aggregate/Soil Test Report

Client: Parsons Brinckerhoff
Project: Port of Cleveland Rail Expansion
Geotechnical Investigation
Job No: 86-101394-00

This laboratory is accredited by the American Association of State Highway and Transportation Officials (AASHTO). The tests reported have been completed in accordance with the terms of the



Ronald A Kral

Date of Issue: 8/26/2011
Approved Signatory: Ron Kral

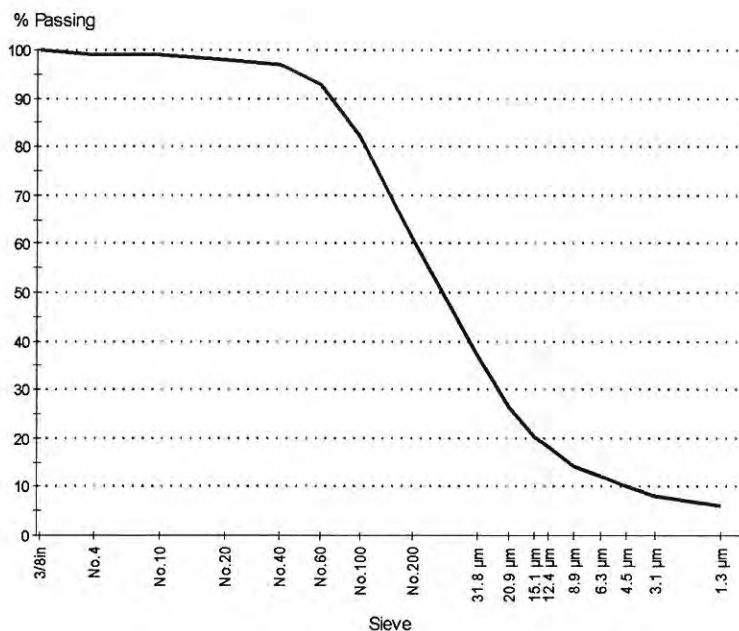
Sample Details

Boring No: B-13
Field Sample No: S-2
Sample Depth: 5.0
Date Sampled: 8/11/2011
Sampled By: Ronald Kral
LWO No: W009492
Sample Location: Cleveland Port Authority

Sample Description:

FILL: Brown SILT and Fine SAND, Little Clay, Trace Fine Gravel

Particle Size Distribution



Grading: Particle Size Analysis of Soil - (ASTM D 1557 - 07)

Drying by: Natural
Date Tested: 8/26/2011

Sieve Size	% Passing	Limits
3/8in	100	
No. 4	99	
No. 10	99	
No. 20	98	
No. 40	97	
No. 60	93	
No. 100	82	
No. 200	61	
31.8 µm	37.3	
20.9 µm	26.2	
15.1 µm	20.2	
12.4 µm	18.2	
8.9 µm	14.1	
6.3 µm	12.1	
4.5 µm	10.1	
3.1 µm	8.1	
1.3 µm	6.1	

COBBLES	GRAVEL		SAND			FINES	
(0.0%)	Coarse (0.0%)	Fine (1.0%)	Coarse (0.0%)	Medium (2.0%)	Fine (36.0%)	Silt (50.3%)	Clay (10.7%)

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
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
			Σ SN	4.17

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	7.19 inches	Load Transfer, J	2.70
Design ESALs	3,750,000.00	Mod. Subgrade Reaction, k	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 Reaction (k-value) Determination

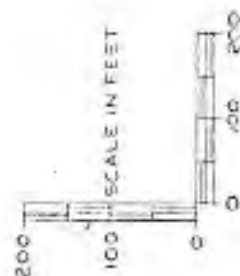
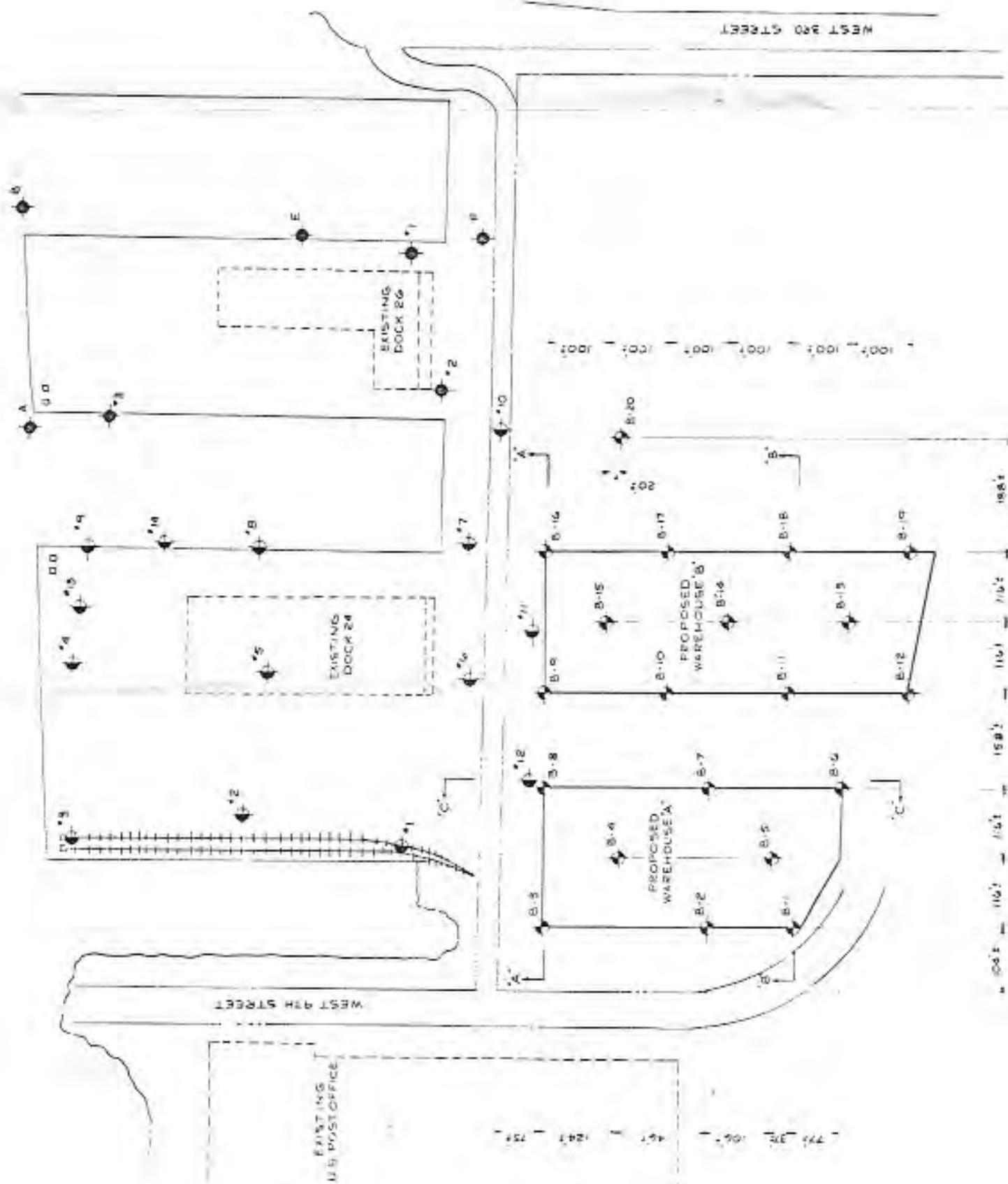
Resilient Modulus of the Subgrade	4,118 psi
Resilient Modulus of the Subbase	15,000 psi
Subbase Thickness	4.00 inches
Depth to Rigid Foundation	feet
Loss of Support Value (0,1,2,3)	

Modulus of Subgrade Reaction	206.30 psi/in
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APPENDIX B

CD-ROM ATTACHED TO REPORT

LAKE ERIE



INDICATES LOCATION OF BORING
DRILLED FEB. 1973

INDICATES LOCATION OF BORINGS
PREVIOUSLY DRILLED FOR THE WEST
4TH ST. PIER AS SHOWN ON DWG NO.
HCN-1 BY THE H.C. NUTTING COMPANY

INDICATES LOCATION OF BORINGS
PREVIOUSLY DRILLED FOR THE WEST
4TH ST. PIER AS SHOWN ON DWG NO.
GEB-1A BY CITY OF CLEVELAND
DEPARTMENT OF PORT CONTROL

ENGINEERING COUNSELLOR		DAVID V. LEWIN	CLEVELAND, OHIO
LOCATION OF BORINGS		WAREHOUSES FOR CLEVELAND	
CUYAHOGA COUNTY PORT AUTHORITY		CLEVELAND, OHIO	
DATE OF PLAN	DATE OF REVISION	DATE OF REVISION	DATE OF REVISION
1/22/73	1/22/73	1/22/73	1/22/73

LABORATORY LOG OF BORING

Method of Sampling:

Split spoon ☒ Shelby ☐
 Core drill ☐ Auger ☐

Boring No. B-1

Surface Elevation 583.4

Depth in feet	Symbol	DESCRIPTION	Blows on spoon for 12 inches	Depth to bottom of sample in feet	SUMMARY OF TEST RESULTS						
					Natural Moisture %	Liquid Limit	Plasticity Index	Unconfined Shear Stress #/SF	Strain %	Loss On Ignition @ 600° C. - %	Unit Dry Weight #/cu. ft.
		Fill: black cinders & slag	5	3.5							
			6	6.5							
10		brown & black sand, cinders & brick	7	10.0							
		black sand w/tr. of vegetation, some slag & brick	14	15.0						5.0	
20		brown & gray silty sand w/tr. of slag & cinders	17	20.0							
			9	25.0							
30		Clay, gray, silty w/some silt seams & trs. of organic mat'l	10	30.0	27.8			640	11.9		101
			* 11	35.0	24.3			1160	20.0		100
40		Clay, gray, silty	8	40.0	25.8			635	9.2		102
			10	45.0	28.5			880	14.1		100
50			* 7	50.0	29.4			565	20.0		93

REMARKS End of boring at 50.0'

Water at 8.0' upon completion
 Water at 7.5' on 2/24/73

Boring Completed: 2/13/73

Location: Cleveland, Ohio

Job No.: C. 2337

*Liner sample

LABORATORY LOG OF BORING

Method of Sampling:

Split spoon ☒ Shelby ☐
 Core drill ☐ Auger ☐

Boring No. B-2

Surface Elevation 584.2

Depth in feet	Symbol	DESCRIPTION	Blows on spoon for 12 inches	Depth to bottom of sample in feet	SUMMARY OF TEST RESULTS					
					Natural Moisture %	Liquid Limit	Plasticity Index	Unconfined Shear Stress #/SF	Strain %	Unit Dry Weight #/cu. ft.
		Fill: cinders & slag								
		brown sand	11	3.5						
		black cinders tr. of veg.	7	6.5						
10		gray & black sand w/tr. veg, trs. of cinders, coal, brick & glass	9	10.0						
			18	15.0						
20		Sand, brown & gray, silty	15	20.0						
		Clay, gray, silty w/silt seams	11	25.0	29.3					
30		Clay, gray, silty	6	30.0	30.8					
			*	7	35.0	28.3		950	17.0	96
40			8	40.0	29.0					
			9	45.0	28.1					
50			*	9	50.0	28.4		1085	20.0	97

REMARKS End of boring at 50.0'

Water at 9.0' upon completion
 Water at 3.4' on 2/24/73

Boring Completed: 2/14/73

Location: Cleveland, Ohio

Job No.: C. 2337

*Liner sample

LABORATORY LOG OF BORING

Method of Sampling:

Split spoon ☒ Shelby ☒
 Core drill ☐ Auger ☐

Boring No. B-3

Surface Elevation 584.0

Depth in feet	Symbol	DESCRIPTION	Blows on spoon for 12 inches	Depth to bottom of sample in feet	SUMMARY OF TEST RESULTS						
					Natural Moisture %	Liquid Limit	Plasticity Index	Unconfined Shear Stress #/SF	Strain %	Loss On Ignition @ 600° C. - %	Unit Dry Weight #/cu. ft.
		Fill: black cinders & slag									
		brown sand	4	3.5							
			8	6.5							
10		black cinders, brick, limestone fragments & sand	16	10.0							
		black & brown sand w/tr. of veg., tr. of glass & cinders	13	15.0						7.6	
20		black & brown silty sand w/ organic mat'l & trs. cinders	19	20.0						5.5	
			12	25.0						5.3	
30		Clay, gray, silty w/some silt & sand seams	S-1		25.8 24.6 25.6			790 1080	20.0 13.8		102 98
		**	10	35.0	29.2						
40		*	10	40.0	27.2			1130	16.7		101
			8	45.0	23.2						
50		*	9	50.0	24.7			1050	20.0		102

REMARKS End of boring at 50.0'

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

Boring Completed: 2/15/73

Location: Cleveland, Ohio

Job No.: C. 2337

*Liner sample
 **See Consolidation Test

LABORATORY LOG OF BORING

Method of Sampling:

Split spoon ☒ Shelby ☐
Core drill ☐ Auger ☐

Boring No. B-4

Surface Elevation 583.4

Depth in feet	Symbol	DESCRIPTION	Blows on spoon for 12 inches	Depth to bottom of sample in feet	SUMMARY OF TEST RESULTS						
					Natural Moisture %	Liquid Limit	Plasticity Index	Unconfined Shear Stress #/SF	Strain %	Loss On Ignition @ 600° C, - %	Unit Dry Weight #/cu. ft.
		Fill: black & brown sand, cinders & slag	7	3.5						6.5	
			7	6.5							
10		cinders, brick, wood & some sand	3	10.0							
			13	15.0							
20		Sand, brown & gray, silty	22	20.0							
			13	25.0							
30		Clay, gray, silty w/silt seams, sand seams & tr. of organic mat'l	8	30.0	28.6						
		*	7	35.0	29.9			550	16.7		93
40			7	40.0	28.4			880	18.6		100
		*	9	45.0	30.1			670	20.0		95
50			6	50.0	28.6						

REMARKS End of boring at 50.0'

Boring Completed: 2/19/73

Water at 8.0' upon completion

Water at 8.0' 24 hours after completion

Water at 5.0' on 2/24/73

Location: Cleveland, Ohio

Job No.: C. 2337

*Liner sample

LABORATORY LOG OF BORING

Method of Sampling:

Split spoon ☒ Shelby ☐
 Core drill ☐ Auger ☐

Boring No. B-5

Surface Elevation 583.4

Depth in feet	Symbol	DESCRIPTION	Blows on spoon for 12 inches	Depth to bottom of sample in feet	SUMMARY OF TEST RESULTS					
					Natural Moisture %	Liquid Limit	Plasticity Index	Unconfined Shear Stress #/SF	Strain %	Unit Dry Weight #/cu. ft.
10		Fill: black cinders & sand brown sand w/tr. of clay & few pebbles black, brown & gray sand w/ cinders, tr. of clay, veg., & few pieces of brick	13	3.5						
			5	6.5						
			10	10.0						
			18	15.0						
20		Sand, brown & gray	13	20.0						
		Clay, gray, silty w/silt seams & tr. of organic material	12	25.0	25.3					
30		Sand, gray	13	30.0						
		Clay, gray, silty w/silt seams	* 14	35.0	25.4			630	10.4	100
40		Clay, gray, silty	6	40.0	26.4			570	11.3	102
			* 5	45.0	30.8			600	20.0	94
50		Clay, gray, silty w/few silt seams & tr. of gravel	11	50.0	18.4			1640	20.0	118

REMARKS End of boring at 50.0'

Boring Completed: 2/19/73

Water at 4.5' on 2/24/73

Location: Cleveland, Ohio

*Liner sample

Job No.: C. 2337

LABORATORY LOG OF BORING

 Boring No. B-6

Method of sampling:

 Surface elevation 582.0

 Split spoon ☒

 Shelby ☒

 Sheet No. 6 of 20

Depth in feet	Blows on spoon for 12 inches	Symbol	DESCRIPTION	Sample No.	SUMMARY OF TEST RESULTS					
					Natural Moisture %	Liquid Limit	Plasticity Index	Unconfined Shear Stress #/SF	Strain %	Loss On Ignition @ 600° C. - %
10 <										

LABORATORY LOG OF BORING

Method of Sampling:

Split spoon ☒ Shelby ☒
 Core drill ☐ Auger ☐

Boring No. B-7

Surface Elevation 582.3

Depth in feet	Symbol	DESCRIPTION	Blows on spoon for 12 inches	Depth to bottom of sample in feet	SUMMARY OF TEST RESULTS					
					Natural Moisture %	Liquid Limit	Plasticity Index	Unconfined Shear Stress #/Sq	Strain %	Unit Dry Weight #/cu. ft.
		Fill: black sand & cinders								
		brown & black sand w/tr. of clay, few cinders & pieces of brick	5	3.5						
		brown & black sand & cinders	5	7.0						
10		brown & black sand & cinders	9	10.0						
		brown & gray sand w/few cinders	6	15.0						
20		Sand, brown & gray	19	20.0						
		Clay, gray, silty w/silt seams	7	25.0	28.2					
30		gray, silty w/silt seams & few pebbles	S-1		26.9 27.6			860	20.0	98
			7	35.0	29.3					
40			S-2		24.7 25.5 23.4			1680	7.2	100
			6	45.0	25.4			890	20.0	103
50		gray, silty w/few pebbles	4	50.0	30.1					

REMARKS End of boring at 50.0'

Water at 2.0' upon completion
 Water at 8.3' on 2/24/73

Boring Completed: 2/20/73

Location: Cleveland, Ohio

Job No.: C. 2337

LABORATORY LOG OF BORING

Method of Sampling:

Split spoon ☒ Shelby ☐
Core drill ☐ Auger ☐

Boring No. B-8

Surface Elevation 582.1

Depth in feet	Symbol	DESCRIPTION	Blows on spoon for 12 inches	Depth to bottom of sample in feet	SUMMARY OF TEST RESULTS					
					Natural Moisture %	Liquid Limit	Plasticity Index	Unconfined Shear Stress #/SF	Strain %	Unit Dry Weight #/cu. ft.
0		Fill: black sand & cinders								
1		brown & black sand w/few cinders	6	3.5						
2		brown, gray & black sand w/seams of silty clay	3	7.0						
3		brown & gray sand w/few cinders	16	10.0						
4		brown & black sand w/some silt, pieces of brick & rock fragments	3	15.0						
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20		Sand, black	22	20.0						
21										
22										
23										
24										
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29										
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49										
50										

REMARKS

Water at 7.3' upon completion
Water at 7.9' on 2/24/73

*Liner sample

Boring Completed: 2/20/73

Location: Cleveland, Ohio

Job No.: C. 2337

LABORATORY LOG OF BORING

Method of Sampling:

Split spoon ☒ Shelby ☐
 Core drill ☐ Auger ☐

Boring No. B-9

Surface Elevation 579.4

Depth in feet	Symbol	DESCRIPTION	Blows on spoon for 12 inches	Depth to bottom of sample in feet	SUMMARY OF TEST RESULTS					
					Natural Moisture %	Liquid Limit	Plasticity Index	Unconfined Shear Stress #/SF	Strain %	Unit Dry Weight #/cu. ft.
10		Fill: cinders & slag brown & black sand w/clay, cinders & brick	13	3.5						
		gray silt w/some brick, wood & vegetation	4	6.5	20.4					
			3	10.0	21.3					
			6	15.0	22.3					
20		black cinders, wood & brick	2	20.0						
			5	25.0						
30		Clay, gray, silty w/some silt seams & traces of organic material	6	30.0	26.9					
			* 9	35.0	26.2			1130	20.0	98
40			8	40.0	23.3			2760	20.0	106
		End of boring at 40.0'								

REMARKS

Water at 12.0' upon completion

*Liner sample

Boring Completed: 2/19/73

Location: Cleveland, Ohio

Job No.: C. 2337

LABORATORY LOG OF BORING

Method of Sampling:

Split spoon ☒ Shelby ☒
 Core drill ☐ Auger ☐

Boring No. B-10

Surface Elevation 581.2

Depth in feet	Symbol	DESCRIPTION	Blows on spoon for 12 inches	Depth to bottom of sample in feet	SUMMARY OF TEST RESULTS					
					Natural Moisture %	Liquid Limit	Plasticity Index	Unconfined Shear Stress #/SF	Strain %	Unit Dry Weight #/cu. ft.
		Fill: black & brown sand & cinders	9	3.5						
		gray, blue & red cinders, wood & pieces of brick	1	7.0						
10		gray & black cinders, sand & wood	10	10.0						
		brown, gray & black sand w/ some cinders	4	15.0						
20		Sand, brown & gray	17	20.0						
		Clay, gray, silty w/silt seams	9	25.0	22.6					
30			S-1		21.0 24.5 24.3			1960	9.0	101
		gray, silty w/few pebbles	7	35.0	26.0					
40			S-2		25.9 25.6 28.3			1130 1620	16.6 10.4	102 101
			3	45.0	30.6					
50			*	6	50.0	20.4		1720	20.0	113

REMARKS End of boring at 50.0'

Boring Completed: 2/21/73

Water at 7.0' upon completion

Water at 7.3' on 2/24/73

Location: Cleveland, Ohio

Job No.: C. 2337

*Liner sample





LABORATORY LOG OF BORING

Method of Sampling:

Split spoon ☒ Shelby ☒
 Core drill ☐ Auger ☐

Boring No. B-11

Surface Elevation 582.1

Depth in feet	Symbol	DESCRIPTION	Blows on spoon for 12 inches	Depth to bottom of sample in feet	SUMMARY OF TEST RESULTS					
					Natural Moisture %	Liquid Limit	Plasticity Index	Unconfined Shear Stress #/SF	Strain %	Unit Dry Weight #/cu. ft.
10		Fill: black cinders, ashes, rock & brick	9	3.5						
			4	6.5						
		brown & black sand, wood, brick & steel	7	10.0						
20			15	15.0						
		Sand, brown & gray, silty	22	20.0						
		Silt, gray, clayey w/trs. of organic material	12	25.0	24.6			1630	20.0	106
30			12	30.0	21.2					
			*	21	35.0	22.2		2030	15.2	107
					24.6			1520	8.4	102
40		Clay, gray, silty w/few pebbles	** S-1		24.7	36	14	1360	12.0	103
			6	45.0	28.1			820	20.0	98
			** S-2		33.3			1120	12.4	101
50					29.4					
					29.7					

REMARKS End of boring at 50.0'

Water at 10.0' upon completion

Boring Completed: 2/22/73

Location: Cleveland, Ohio

Job No.: C. 2337

*Liner sample

**See Consolidation Test








LABORATORY LOG OF BORING

Method of Sampling:

Split spoon ☒ Shelby ☒
 Core drill ☐ Auger ☐

Boring No. B-12

Surface Elevation 582.3

Depth in feet	Symbol	DESCRIPTION	Blows on spoon for 12 inches	Depth to bottom of sample in feet	SUMMARY OF TEST RESULTS					
					Natural Moisture %	Liquid Limit	Plasticity Index	Unconfined Shear Stress #/SF	Strain %	Unit Dry Weight #/cu. ft.
10		Fill: black sand & cinders brown sand w/tr. of clay & few pieces of brick	3	3.5						
			3	7.0						
		brown, black & gray sand w/ some coal, cinders & wood	8	10.0						
		brown & gray sand w/some coal	18	15.0						
			4	20.0						
20		Clay, gray, silty w/silt seams	S-1		29.7 32.8 28.6			580	10.5	92
30		gray, silty w/few pebbles	7	30.0	24.5			1640	20.0	106
		gray & red, silty w/few pebbles*	7	35.0	23.3			1100	15.2	100
40		gray, silty	10	40.0	26.9			1130	20.0	102
		gray, silty w/silt seams	10	45.0	24.2			1190	12.4	103
50		gray, silty w/silt seams	6	50.0	24.5					

REMARKS End of boring at 50.0'

Boring Completed: 2/21/73

Water at 7.7' on 2/24/73

Location: Cleveland, Ohio

*Liner sample

Job No.: C. 2337

LABORATORY LOG OF BORING

Method of Sampling:

Split spoon ☒ Shelby ☐
 Core drill ☐ Auger ☐

Boring No. B-13

Surface Elevation 580.8

Depth in feet	Symbol	DESCRIPTION	Blows on spoon for 12 inches	Depth to bottom of sample in feet	SUMMARY OF TEST RESULTS					
					Natural Moisture %	Liquid Limit	Plasticity Index	Unconfined Shear Stress #/SF	Strain %	Unit Dry Weight #/cu. ft.
		Fill: black cinders, brick & wood	6	3.5						
			5	6.5						
10		brown sand, cinders & brick	2	10.0						
		Sand, brown & gray, silty	14	15.0						
20			8	20.0						
		Clay, gray, silty w/silt seams & tra of organic material	8	25.0	23.7					
30			9	30.0	26.7			840	8.0	104
			9	35.0	26.8					
40			9	40.0	26.4			570	6.3	101
		End of boring at 40.0'								

REMARKS

Water at 8.0' upon completion
 Hole caved at 4.0' 24 hours after completion

Boring Completed: 2/22/73

Location: Cleveland, Ohio

Job No.: C. 2337

LABORATORY LOG OF BORING

Method of Sampling:

Split spoon ☒ Shelby ☒
Core drill ☐ Auger ☐

Boring No. B-14

Surface Elevation 580.1

Depth in feet	Symbol	DESCRIPTION	Blows on spoon for 12 inches	Depth to bottom of sample in feet	SUMMARY OF TEST RESULTS					
					Natural Moisture %	Liquid Limit	Plasticity Index	Unconfined Shear Stress #/SF	Strain %	Unit Dry Weight #/cu. ft.
10		Fill: black cinders, coal, sand & some wood	11	3.5						
		black & brown cinders & wood	1/18	7.0						
		brown, black & gray sand, cinders, some wood & tr. clay	3	10.0						
		brown, gray & black sand w/ tr. of wood	23	15.0						
20		Sand, brown & gray	25	20.0						
		Clay, gray w/few silt seams & trs. of organic material	4	25.0	28.8					
30			*	6	30.0	32.0		620	20.0	96
		gray, silty	4	35.0	29.4					
40			*	3	40.0	31.8		410	15.3	90
		gray, silty w/silt seams	S-1		25.8 20.4 21.8	30	11	2810 2110	10.6 20.6	102 112
50		End of boring at 45.0'								

REMARKS

Water at 5.6' upon completion

Water at 5.9' on 2/24/73

Boring Completed: 2/22/73

Location: Cleveland, Ohio

Job No.: C. 2337

*Liner sample

**See Consolidation Test

LABORATORY LOG OF BORING

Method of Sampling:

Split spoon ☒ Shelby ☐
 Core drill ☐ Auger ☐

Boring No. B-15

Surface Elevation 579.1

Depth in feet	Symbol	DESCRIPTION	Blows on spoon for 12 inches	Depth to bottom of sample in feet	SUMMARY OF TEST RESULTS					
					Natural Moisture %	Liquid Limit	Plasticity Index	Unconfined Shear Stress #/SF	Strain %	Unit Dry Weight #/cu. ft.
		Fill: black cinders, slag & brick								
			9	3.5						
		brown sand w/tr. of vegetation	5	6.5						
10		sand, cinders, wood & brick	12	10.0						
		brown & gray sand w/some cinders	10	15.0						
20			20	20.0						
		Silt, gray, clayey w/some sand seams & tr. of organic mat'l	17	25.0	22.3			2620	16.9	106
30			10	30.0	22.5			2450	20.0	109
		Clay, gray, silty w/some silt seams	11	35.0	28.1					
40			6	40.0	25.5			1400	20.0	102
		End of boring at 40.0'								
50										

REMARKS

Water at 12.0' upon completion
 Water at 4.3' on 2/24/73

Boring Completed: 2/22/73

Location: Cleveland, Ohio

Job No.: C. 2337

LABORATORY LOG OF BORING

 Boring No. B-16

Method of sampling:

 Surface elevation 579.1

 Split spoon ☒

 Shelby ☐

 Sheet No. 16 of 20

Depth in feet	Blows on spoon for 12 inches	Symbol	DESCRIPTION	Sample No.	SUMMARY OF TEST RESULTS					
					Natural Moisture %	Liquid Limit	Plasticity Index	Unconfined Shear Stress #/SF	Strain %	Loss On Ignition @ 600° C. - %
	16		Fill: black & brown cinders & sand	1						
	1		brown sand	2						
	2/18		brown & gray clayey sand w/some brick & wood	3	26.8					
	7		gray silty clay w/sand seams	4						
			black sand, cinders & wood							
	2		gray & black sand	5					32.8	
			gray & black organic sand w/coal & wood							
	6		Clay, gray, silty w/silt seams & trs. of organic mat'l	6	26.8					
	30		12	gray, silty w/few silt seams	* 7	23.1		1460	17.1	
	9		8	27.2		1410	15.9		101	
	4	gray, silty	9	36.8						





LABORATORY LOG OF BORING

Method of Sampling:

Split spoon ☒ Shelby ☐
 Core drill ☐ Auger ☐

Boring No. B-17

Surface Elevation 579.1

Depth in feet	Symbol	DESCRIPTION	Blows on spoon for 12 inches	Depth to bottom of sample in feet	SUMMARY OF TEST RESULTS					
					Natural Moisture %	Liquid Limit	Plasticity Index	Unconfined Shear Stress #/SF	Strain %	Unit Dry Weight #/cu. ft.
10		Fill: black cinders, sand, brick & wood	3	3.5						
			3	6.5						
			9	10.0						
		black & gray silty sand w/some coal & cinders	13	15.0						
		gray silty sand w/pcs. of wood	9	20.0						
20		Clay, gray, silty	5	25.0	27.8					
30			*	5	30.0	30.2		700	20.0	92
			5	35.0	30.2					
40			*	6	40.0	30.6		760	20.0	95
		End of boring at 40.0'								

REMARKS

Water at 5.0' upon completion
 Water at 2.5' on 2/24/73

Boring Completed: 2/23/73

Location: Cleveland, Ohio

Liner sample

Job No.: C. 2337

LABORATORY LOG OF BORING

Method of Sampling:

Split spoon ☒ Shelby ☐
 Core drill ☐ Auger ☐

Boring No. B-18

Surface Elevation 580.3

Depth in feet	Symbol	DESCRIPTION	Blows on spoon for 12 inches	Depth to bottom of sample in feet	SUMMARY OF TEST RESULTS					
					Natural Moisture %	Liquid Limit	Plasticity Index	Unconfined Shear Stress #/SF	Strain %	Unit Dry Weight #/cu. ft.
		Fill: black cinders, brick & wood	3	3.5						
			2	6.5						
10		cinders, sand & rock frags.	9	10.0						
		black & gray silty sand w/tr. of gravel	12	15.0						
20		Sand, brown w/few clay seams	12	20.0						
		Clay, gray, silty w/some silt seams	10	25.0	27.9					
30		gray, silty w/some tr. of gravel	8	30.0	30.2			770	14.9	95
			* 9	35.0	27.1			1000	20.0	95
40			16	40.0	24.7			540	9.2	101
			8	45.0	24.0					
50			8	50.0	31.1					

REMARKS End of boring at 50.0'

Water at 7.5' upon completion
 Water at 4.0' 24 hours after completion

Boring Completed: 2/23/73

Location: Cleveland, Ohio

Job No.: C. 2337

*Liner sample

LABORATORY LOG OF BORING

Method of Sampling:

Split spoon ☒ Shelby ☒
 Core drill ☐ Auger ☐

Boring No. B-19

Surface Elevation 582.0

Depth in feet	Symbol	DESCRIPTION	Blows on spoon for 12 inches	Depth to bottom of sample in feet	SUMMARY OF TEST RESULTS					
					Natural Moisture %	Liquid Limit	Plasticity Index	Unconfined Shear Stress #/Sq	Strain %	Unit Dry Weight #/cu. ft.
0		Fill: black & brown cinders, sand & coal	9	3.5						
10		brown sand w/some rock frags	21	7.0						
		wood	45	10.0						
		brown, gray & black sand w/ some wood	10	15.0						
20		Clay, gray, silty w/few silt seams	4	20.0						
		gray & red, silty **	S-1		29.2			1140	16.0	95
					28.3	41	16			
30			2	30.0	35.9					
		gray, silty w/silt seams & trs. of organic material	6	35.0	29.1					
40		gray, silty	14	40.0	25.8			940	15.4	100
			17	45.0	25.2			1010	14.3	103
50			7	50.0	29.0					

REMARKS End of boring at 50.0'

Water at 7.5' upon completion

Boring Completed: 2/24/73

Location: Cleveland, Ohio

Job No.: C. 2337

**See Consolidation Test

LABORATORY LOG OF BORING

Method of Sampling:

Split spoon ☒ Shelby ☐
 Core drill ☐ Auger ☐

Boring No. B-20

Surface Elevation 579.4

Depth in feet	Symbol	DESCRIPTION	Blows on spoon for 12 inches	Depth to bottom of sample in feet	SUMMARY OF TEST RESULTS					
					Natural Moisture %	Liquid Limit	Plasticity Index	Unconfined Shear Stress #/SF	Strain %	Unit Dry Weight #/cu. ft.
0		Fill: brown & black sand, cinders & brick	5	3.5						
10		brown clay w/gravel & sand	4	6.5	19.8					
		black cinders & slag	6	10.0						
		gray sand w/trs. of cinders	12	15.0						
20		brown & gray silty sand w/trs. of cinders	18	20.0						
		Clay, gray, silty	14	25.0	25.8			880	10.9	101
30		End of boring at 25.0'								
40										
50										

REMARKS

Water at 6.0' upon completion

Boring Completed: 2/24/73

Location: Cleveland, Ohio

Job No.: C. 2337

BORING NO. 1

ELEV. 57+12

CASING DRIVING RECORD		FEET		NO BLOWS		SAMPLE #1	
FEET	NO. BLOWS	FEET	NO. BLOWS	FEET	NO. BLOWS	FEET	NO. BLOWS
WATER TO 2'		80	81	82	83	SAMPLE #1	
CASING FOLLOWED		81	82	83	84	10'-11' 3 BLOWS	
DRILL TO 35'		82	83	84	85	SAMPLE #2	
		83	84	85	86	18'-19' 1 BLOW	
		84	85	86	87	SAMPLE #3	
		85	86	87	88	26'-27' 2 BLOWS	
		86	87	88	89	SAMPLE #4	
		87	88	89	90	34'-35' 4 BLOWS	
		88	89	90	91	SAMPLE #5	
		89	90	91	92	40'-41' 4 BLOWS	
		90	91	92	93	SAMPLE #6	
		91	92	93	94	46'-47' 5 BLOWS	
		92	93	94	95	SAMPLE #7	
		93	94	95	96	52'-53' 12 BLOWS	
		94	95	96	97	SAMPLE #8	
		95	96	97	98	58'-59' 14 BLOWS	
		96	97	98	99	SAMPLE #9	
		97	98	99	100	64'-65' 12 BLOW	
		98	99	100	101	SAMPLE #10	
		99	100	101	102	70'-71' 14 BLOW	
		100	101	102	103	SAMPLE #11	
		101	102	103	104	76'-77' 40 BLOW	
		102	103	104	105	SAMPLE #12	
		103	104	105	106	83'-84' 31 BLOW	
		104	105	106	107	SAMPLE #13	
		105	106	107	108	89'-90' 45 BLOW	
		106	107	108	109	SAMPLE #14	
		107	108	109	110	96'-97' 136 BLOW	
		108	109	110	111	SAMPLE #15	
		109	110	111	112	102'-103' 126 BLOW	
		110	111	112	113	SAMPLE #16	
		111	112	113	114	110'-111' 27 BLOW	
		112	113	114	115		
		113	114	115	116		
		114	115	116	117		
		115	116	117	118		
		116	117	118	119		
		117	118	119	120		
		118	119	120	121		
		119	120	121	122		
		120	121	122	123		
		121	122	123	124		
		122	123	124	125		
		123	124	125	126		
		124	125	126	127		
		125	126	127	128		
		126	127	128	129		
		127	128	129	130		
		128	129	130	131		
		129	130	131	132		
		130	131	132	133		

L/S # DESIGNATES CAPITAL LINER S SAMPLES.

NOTE:

GAS FLOW HIT AT 83'; SAMPLE #5 ONLY 8.5" LONG LOWER PORTION LOST; JAR SAMPLE #15 MEAGER; RECOVERY JUST SUFFICIENT FOR LINER SAMPLE #16.
 14 LINER SAMPLES (UNDISTURBED SAMPLES) TAKEN WITH OPEN CORE BARREL, ENGINEERING RESEARCH INSTITUTE TYPE; UNIVERSITY OF MICHIGAN, ANN ARBOR, MICH.; SAMPLES IN LINERS WAVED, TAPPED AND PREPARED FOR SHIPMENT TO LABORATORY FOR ANALYSIS AND REPORT.

175 LB OPEN

SAMPLE HAMMER WEIGHT 140# DROP 30" SIZE SAMPLE TUBE 1 1/2" I.D. TYPE BARREL

CASING HAMMER WEIGHT 360# DROP 30" CASING SIZE 4" WATER LEVEL 62.8

ENGINEER: DR. HOUSE

INSPECTOR: PENN. RR. CO.

DRILLER: V. MALLON; FOREMAN: E. FUREY — 816 # 18 — 6/25/53 TO 7/9/53

BORING NO. 2

ELEV. 573.9+

CASING DRIVING RECORD

FEET	NO. BLOWS	FEET	NO. BLOWS	WATER	7'-0"
4" CASING FOLLOWED DRILL TO 25'				MEDIUM COARSE SAND	18'-0"
25 - 26	4	71 - 72	11		
26 - 27	4	72 - 73	11		
27 - 28	4	73 - 74	11		
28 - 29	3	74 - 75	12		
29 - 30	4	75 - 76	13		
30 - 31	7	76 - 77	14		
31 - 32	4	77 - 78	15		
32 - 33	5	78 - 79	16		
33 - 34	5	79 - 80	16	SOFT GREY CLAY	
34 - 35	4	80 - 81	17		
35 - 36	3	81 - 82	18		
36 - 37	4	82 - 83	17		
37 - 38	3	83 - 84	15	1/2" 12, 13, 14, 15, 16 25'-0"	
38 - 39	5	84 - 85	20		
39 - 40	5	85 - 86	20		
40 - 41	4	86 - 87	21	STIFF GREY CLAY	
41 - 42	4	87 - 88	21		
42 - 43	5	88 - 89	24		
43 - 44	4	89 - 90	24		
44 - 45	4	90 - 91	24		
45 - 46	4	91 - 92	25	1/2" 7, 8, 9, 10 75'-0"	
46 - 47	6	92 - 93	25		
47 - 48	5	93 - 94	26	GREY SILT & CLAY W/1	
48 - 49	5	94 - 95	29	1/2" 11 85'-0"	
49 - 50	5				
50 - 51	6			NO CASING BELOW 95'	
51 - 52	6			HARD CLAY & PEBBLES	
52 - 53	6			1/2" 12, 13 85'-0"	
53 - 54	6			VERY HARD CLAY & STONES	
54 - 55	7			1/2" 14 100'-0"	
55 - 56	7			HARD CLAY & STONES	
56 - 57	7			1/2" 15 114'-0"	
57 - 58	8			STIFF SILTY CLAY	
58 - 59	7			1/2" 16, 17 126'-0"	
59 - 60	8			GREY SHALE SOFT	
60 - 61	9			HARD GREY SHALE	
61 - 62	9			DRILLING DISCONTINUED AT 130'	
62 - 63	10				
63 - 64	10				
64 - 65	10				
65 - 66	11				
66 - 67	10				
67 - 68	10				
68 - 69	11				
69 - 70	10				
70 - 71	11				

L/S * DESIGNATES CAPITAL LITER S SAMPLES

NOTE:

CAS AT 81'; HOLE MAKING WATER IN SILT AT 80'
LOST SAMPLE AT 113'-114'; SAMPLE TUBE DAMAGED, BOULDERS.
SAMPLE #15 NOT SUFFICIENT FOR JAR SAMPLE.
17 LINE SAMPLES (UNDISTURBED SAMPLES) TAKEN, WAXED AND PREPARED
FOR SHIPMENT TO ENGINEERING RESEARCH INSTITUTE, UNIVERSITY
OF MICHIGAN, ANN ARBOR, MICH. FOR LAB ANALYSIS AND REPORT.

SAMPLE HARNER WEIGHT 142# DROP 30" SIZE SAMPLE TUBE 1.75 ID TYPE OPEN
CASING HARNER WEIGHT 360# DROP 30" SIZE CASING 4" WATER LEVEL 45 SHOWN
ENGINEER: DR. HOUSEL
INSPECTOR: PENN. RR. CO.
DRILLER: V. MALLEN; FOREMAN: E. FURRY RIG #18 7/10/53 TO 7/17/53

BORING NO. 3

ELEV. 578.04

CASING DRIVING LOG-2

MISC. FILL, CINFERS, SLAG

FEET	NO. BLOWS	FEET	NO. BLOWS		
11 CASING FOLLOWED DRILL TO 24'		70 - 71	28	FINE GRAY SAND, NET	17'-0"
24 - 25	14	71 - 72	29		22'-6"
25 - 26	15	72 - 73	29	GRAY SILT & CLAY	28'-0"
26 - 27	14	73 - 74	29		
27 - 28	15	74 - 75	29		
28 - 29	15	75 - 76	28		
29 - 30	14	76 - 77	29		
30 - 31	15	77 - 78	30	SOFT GRAY CLAY	
31 - 32	16	78 - 79	31		
32 - 33	16	79 - 80	32		
33 - 34	14	80 - 81	34		
34 - 35	16	81 - 82	35		
35 - 36	16	82 - 83	36		
36 - 37	14	83 - 84	41	L/S # 2, 3, 4, 5, 6	58'-0"
37 - 38	17	84 - 85	42		
38 - 39	17	85 - 86	45	STIFF PEBBLY CLAY	
39 - 40	17	86 - 87	46		
40 - 41	18	87 - 88	48		
41 - 42	18	88 - 89	49		
42 - 43	19	89 - 90	52	L/S # 7, 8	72'-0"
43 - 44	20	90 - 91	53		
44 - 45	21	91 - 92	54	FINE SAND COMPACT NET	
45 - 46	21	92 - 93	57		
46 - 47	22	93 - 94	58	L/S # 9, 10	87'-0"
47 - 48	23	94 - 95	57	HARD CLAY & GRAVEL	
48 - 49	23	95 - 96	61	L/S # 11	89'-0"
49 - 50	24	96 - 97	65	CLAY & GRAVEL	91'-0"
50 - 51	24	97 - 98	65	VERY HARD CLAY & GRAVEL	
51 - 52	24	98 - 99	67	L/S # 12	92'-0"
52 - 53	25	99 - 100	71		
53 - 54	24	100 - 101	80	CLAY GRAVEL & FINE SILT	
54 - 55	25	101 - 102	85		
55 - 56	25	102 - 103	89		
56 - 57	25	103 - 104	91	L/S # 13, 14	101'-0"
57 - 58	26	104 - 105	92		
58 - 59	27	105 - 106	97	HARD CLAY & STONES	
59 - 60	27	106 - 107	98	L/S # 15	120'-0"
60 - 61	28	107 - 108	99		
61 - 62	26	108 - 109	98		
62 - 63	28	109 - 110	97	STIFF CLAY & PEBBLES	
63 - 64	28	110 - 111	101		
64 - 65	29	111 - 112	104		
65 - 66	29			L/S # 17, 18	138'-0"
66 - 67	29			VERY HARD CLAY	142'-0"
67 - 68	29			GRAY SAND SOFT	148'-0"
68 - 69	29			HARD GRAY SLAG	155'-0"
69 - 70	29			DRILLING DISCONTINUED AT 155'	

NOTE:

GAS AT 84' TO 90' HOLE MAKES WATER IN SILT AT 72'-24' GAS AT 100'
 SAMPLER DAMAGED, STONES AT 85'-88.5'. 18 LIVER SAMPLED (UNDISTURBED
 SAMP 13) TAKEN AND SHIPPED TO ENGINEERING INSTITUTE UNIVERSITY OF
 MINN. AND ALBANY, NICH. FOR LAB ANALYSIS & REPORT.

SAMPLE HAMMER WEIGHT	140#	DROP	30"	SIZE SAMPLE TUBE	1 1/2" OD	OPEN
CASING HAMMER WEIGHT	350#	DROP	30"	SIZE CASING	4"	TYPE BARREL
ENGINEER :	DR. HOSSEL					
INSPECTOR :	PENN. & CO.					
DRILLER :	V. MALLEN ;	FORMAN :	E. FUREY	R.G. NO. 22	7/2/53 TO 7/20/53	

BORING NO. 4

ELEV. 576.32

CASING DRIVING RECORD

FEET	NO. BLOWS
CASING FOLLOWED DRILL TO 15'	
15 - 16	8
16 - 17	10
17 - 18	10
18 - 19	11
19 - 20	12
20 - 21	12
21 - 22	12
22 - 23	14
23 - 24	13
24 - 25	14
25 - 26	13
26 - 27	15
27 - 28	14
28 - 29	14
29 - 30	15
30 - 31	15
31 - 32	16
32 - 33	15
33 - 34	16
34 - 35	16
35 - 36	16
36 - 37	18
37 - 38	16
38 - 39	16
39 - 40	16
40 - 41	17
41 - 42	16
42 - 43	16
43 - 44	17
44 - 45	17
45 - 46	17
46 - 47	17
47 - 48	17
48 - 49	16
49 - 50	18
50 - 51	18
51 - 52	14
52 - 53	18
53 - 54	19
54 - 55	19
55 - 56	18
56 - 57	21
57 - 58	21
58 - 59	22
59 - 60	24
60 - 61	24
61 - 62	26
62 - 63	27

FEET	NO. BLOWS
63 - 64	27
64 - 65	27
65 - 66	26
66 - 67	28
67 - 68	27
68 - 69	30
69 - 70	34
70 - 71	38
71 - 72	38
72 - 73	40
73 - 74	41
74 - 75	42
75 - 76	40
76 - 77	38
77 - 78	38
78 - 79	35
79 - 80	36
80 - 81	36
81 - 82	32
82 - 83	30
83 - 84	30
84 - 85	28
85 - 86	26
86 - 87	26
87 - 88	25
88 - 89	27
89 - 90	26
90 - 91	26
91 - 92	28
92 - 93	26
93 - 94	30
94 - 95	31
95 - 96	32
96 - 97	31
97 - 98	34
98 - 99	36
99 - 100	32

CINDER & SLAG FILL

SILTY GREY CLAY

L/S # 1, 2, 3

SOFT GREY CLAY

L/S # 4, 5, 6

STIFF PEBBLY CLAY

L/S # 7, 8, 9

VERY FINE SAND MOIST

L/S # 10

VERY FINE SAND WET

L/S # 11

HARD PEBBLY CLAY

L/S # 12, 13, 14, 15

STIFF PEBBLY CLAY

L/S # 16, 17

CLAY & GRAVEL

L/S # 18

CLAY SILT & GRAVEL

L/S # 19

CLAY SILT & GRAVEL

L/S # 20

SOFT BLACK SHALE

HARD CLAY SILT

DRILLING DISCONTINUED AT 150'

NOTE:

GAS AND WATER IN VERY FINE SAND AT 75'; WATER LEVEL 6'.
20 LINER SAMPLES (UNDISTURBED) TAKEN, PREPARED AND SHIPPED TO U.
OF MICH. ENGINEERING RESEARCH INSTITUTE, ANN ARBOR, FOR ANALYSIS.

SAMPLE HAMMER WEIGHT 140#

CASING HAMMER WEIGHT 360#

ENGINEER: DR. HOUSEL

INSPECTOR: PENN. RR CO.

DRILLER: V. MALLON

DROP 30"

DROP 30"

SIZE SAMPLE TUBE 1.75 O.D.

SIZE CASING 4"

1.75 O.D.

1.75 I.D.

TYPE OPEN

TYPE RABBIT

WATER LEVEL 6'

FORMAN: E. FUREY

RIG NO. 21

7/22/53 TO 7/29/53