REPORT ON SOIL CONDITIONS

FOR

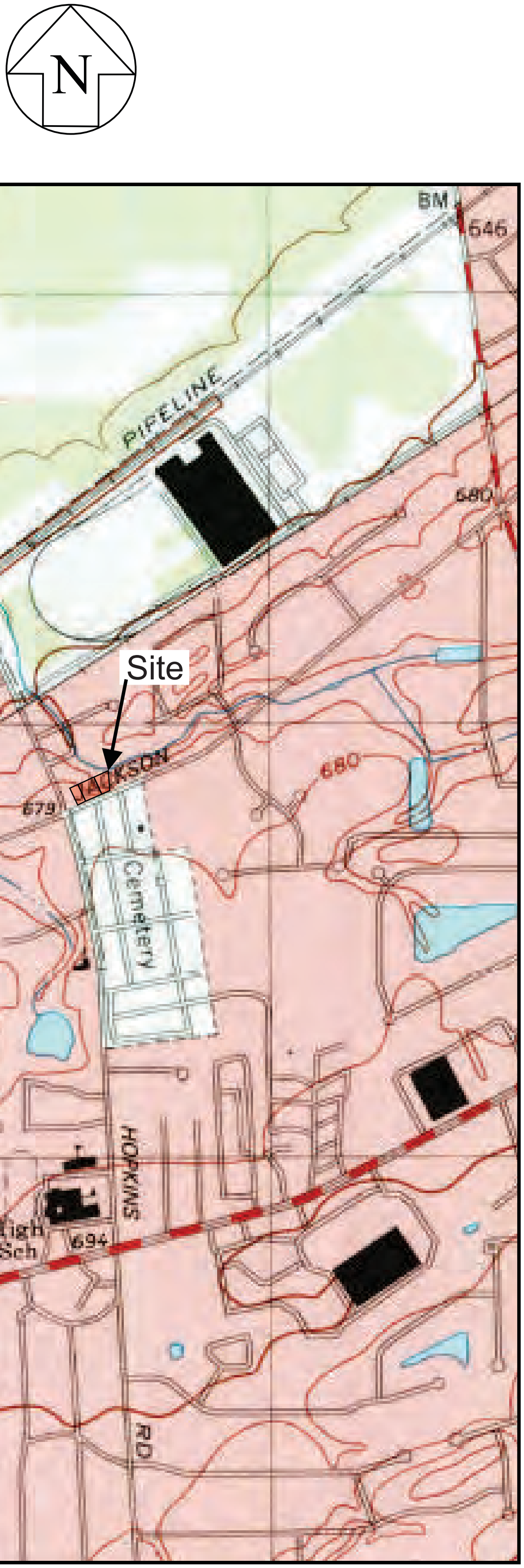
THREE PROPOSED RESIDENCES

9005, 9015, 9025 JACKSON STREET

MENTOR, OHIO

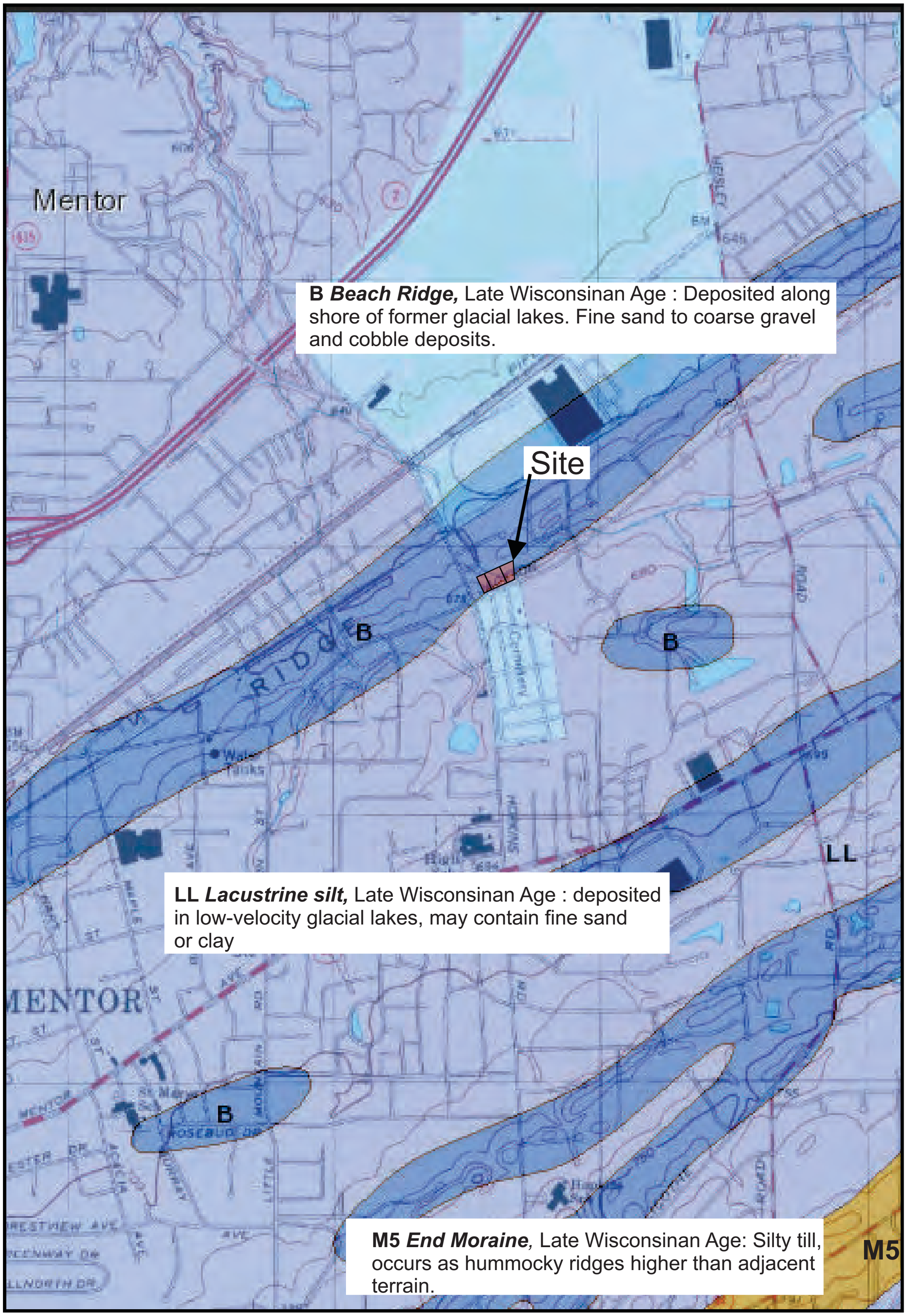
DVL Project No. C.7956

David V. Lewin Corp. / Geotechnical Engineering
Suite 340 – Caxton Building / 812 Huron Road, Cleveland, Ohio 44115-1126



SITE LOCATION
Scale 1:24,000
1"=2000'±

PLATE I



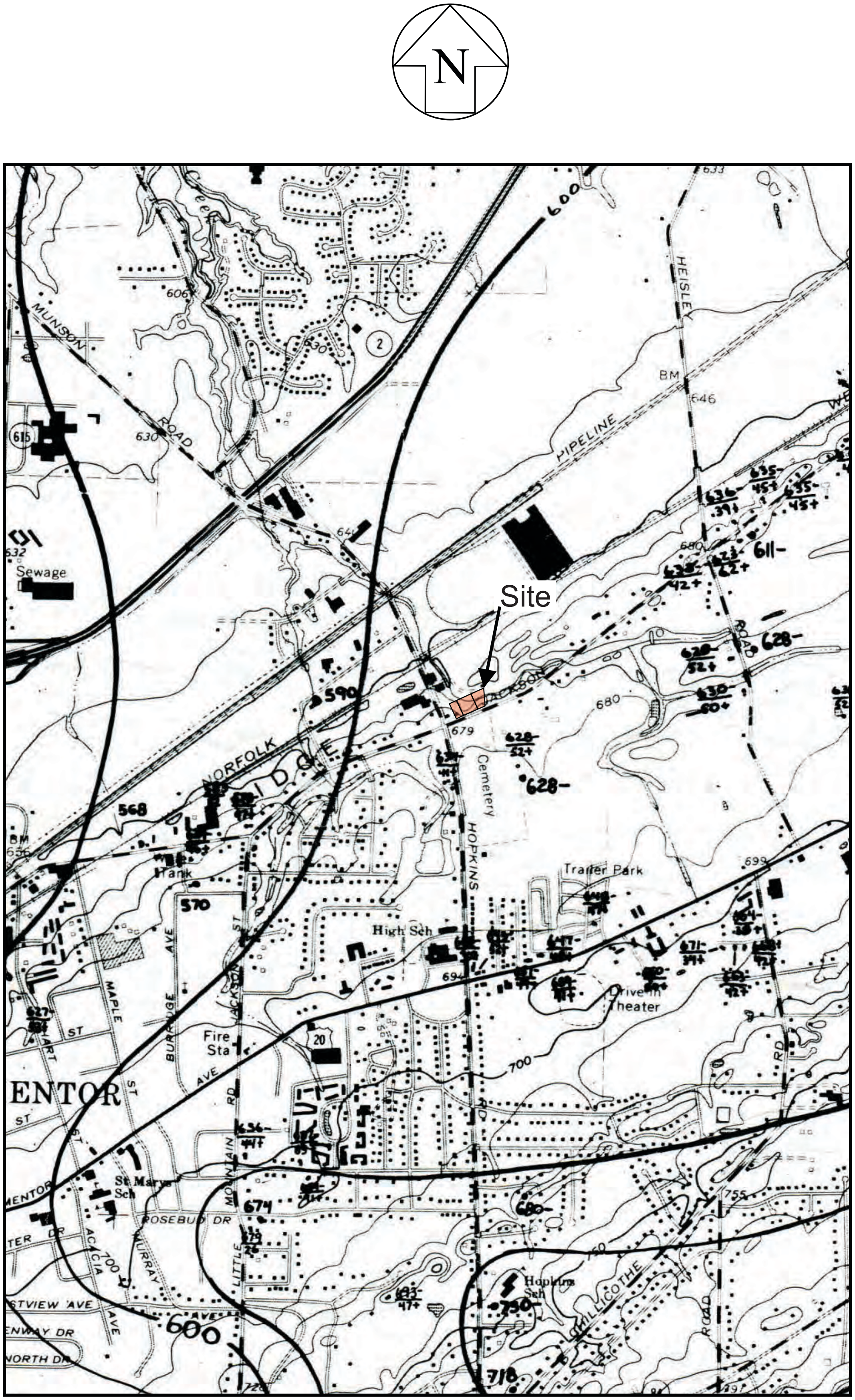
B ***Beach Ridge,*** Late Wisconsinan Age : Deposited along shore of former glacial lakes. Fine sand to coarse gravel and cobble deposits.

LL ***Lacustrine silt,*** Late Wisconsinan Age : deposited in low-velocity glacial lakes, may contain fine sand or clay

M5 ***End Moraine***, Late Wisconsinan Age: Silty till, occurs as hummocky ridges higher than adjacent terrain.

SURFICIAL GEOLOGY
Scale 1:24,000
1"=2000'±

PLATE II



BEDROCK TOPOGRAPHY
Scale 1:24,000
1"=2000'±

PLATE III

March 10, 2023

Mr. Rick Osborne Jr.
Director of Commercial Real Estate
The Osborne Group - KW Commercial
7400 Center Street
Mentor, Ohio 44060

rick.osbornejr@kw.com

Re: Three Proposed Residences
9005, 9015, 9025 Jackson Street
Mentor, Ohio
DVL Project No. C.7956

Dear Mr. Osborne:

In accordance with your request, we undertook an investigation of existing subsurface soil conditions on the subject site. The purpose of this investigation was to determine the subsurface stratification and develop soil related engineering criteria to be used for the design of the proposed residences, as well as for a general review of the of the existing slopes.

SITE LOCATION AND PROJECT DESCRIPTION

The proposed project involves construction of three new residences, one each on the three subject lots on the north side of Jackson Street, in Mentor, Ohio. Each residence is to include 2-stories above grade with a full walk-out basement and an attached 2-stall garage. The three properties sit above a slope, approximately 25 feet high, leading down to westwardly flowing Marsh Creek. The creek elevation varies from approximately elevation 651 to 648. Noncontrolled, man deposited fill has been placed to create a plateau along Jackson Street where the residences are proposed, sloping down to the creek on the order of 2 horizontal to 1 vertical. The front of the three properties is grassed and fairly level, at approximate elevation 676, the slope is un-mowed grass/weeds with a few trees, and wild grapes, leading to overgrown grass with reeds and wild grapes on Lots 1 and 2. Lot 3 is wooded along the slope and at the creek.

Lot dimension and proposed finished floor elevations were provided on the May 2022 Land Design Consultants *Site Plans* you provided, distance between the rear of the proposed residence and the creek was measured from those plans. See the table below for a summary of that information. Plate I which was developed from the 1992 U.S. Geological Survey Topographic Map of the Mentor Quadrangle shows the approximate location of the site in relation to its surroundings.

	Lot 1	**Lot 2**	**Lot 3**
Address on Jackson St	9005	9015	9025
Lake County PPN	16B-056-024	16B-056-025	16B-056-026
Lot Width *(ft)*	100	200	99.33(fr),177.91(bk)
Lot Depth *(ft)*	220	220	220
1st Floor Elev *(ft)*	680.2	678.3	679.2
Basement Elevation ***(ft)***	670.53	668.63	669.52
Garage Elev *(ft)*	678.5	676.3	677.2
Distance to Creek *(ft)*	55	27	25

GEOLOGY

The site is situated above beach ridge deposits from glacial lakes of the Wisconsin Glacial period. See the surficial geology on Plate II. The estimated top of bedrock contours are shown on Plate III. Bedrock is estimated to be near elevation 625 or on the order of 50 feet below present grades. Bedrock is believed to be part of the Ohio Shale Formation.

FIELD EXPLORATION

Borings B-1 through B-3 and H-1 through H-3A were located by our personnel measuring from Jackson Road and the existing residential structures east and west of the three lots. Boring locations were superimposed on the Land Design Site Plan and included herewith as Dwg No: 7956-1, page 11. The borings were drilled on September 1 and 2, 2022 by Ridgeway Drilling, Inc. under our general direction and in general accordance with the Specification For Subsurface Exploratory Work, included in Appendix A. Soil samples obtained in the boreholes were tested and evaluated in our laboratory.

LABORATORY TESTING

Pages 15 through 21, 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 (N)” refers to the standard penetration test and indicates the number of blows of a 140-pound hammer dropped from a height of 30 inches required to drive a 2-inch outside diameter sampling spoon 12 inches into a stratum. For borings H-1 through H-3A, this column indicates the number of blows of a 60-lb hammer dropped from a height of 24 inches. The number of blows recorded should be divided by 3 to acquire the equivalent blow count (N) as this combination of load and drop distance will deliver approximately 1/3 the energy of the Standard Penetration Test method. The column entitled “Unconfined Shear Stress (psf)” refers to one half of the compressive stress at failure in the unconfined state. An asterisk indicates that the result was obtained in the laboratory using a pocket-penetrometer. Because of disturbance of the sample during sampling and the presence of 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 ground surface elevations shown on the boring logs were approximated from the Land Design *Site Plan*. Note that the elevations at the creek on the Land Design plan for Lot 3, 9025 Jackson Street, are approximately 10 feet higher than the elevation shown on the Lake County GIS topographic map.

STRATIFICATION

The material encountered in the borings is seen as 8 inches of topsoil; followed by noncontrolled, man deposited fill; overlying brown sand, or sand and gravel; and then gray silty clay. The noncontrolled, man deposited fill consists of brown silty clay with sand, gravel; concrete, brick, asphalt, rock fragments, slag, cinders; and organic matter. The fill extends to depths of 13.5 to 18 feet at the top of slope in borings B-1 and B-2, and to depths of 3 to 4.5 feet at the bottom of the slope in borings H-1 and H-2. Borings B-3 and H-3 encountered no topsoil or fill. The sand varies from loose to medium dense; the sand and gravel is medium dense; the clay is very stiff to hard.

GROUNDWATER

Water was encountered between approximately 16 and 18 feet below grade at the top of the slope and 1.5 to 2 feet below grade at the bottom of the slope. This corresponds to water elevations between approximately 655 and 659 at the top of the slope and between approximately 653 and 660.5 at the bottom of the slope.

Due to disturbance or “muddying up” of the sides of the boreholes during drilling, observations over an extended period of time would be required in order to determine the “true” groundwater levels. The observed water levels, or lack thereof, are an indication of conditions existing at the points and times of observation only. Fluctuations can be expected with the amount and rate of precipitation and with the seasons. A groundwater elevation of 661, 657 and 658.5 should be considered for design purposes, progressing from west to east across the 3 parcels. Groundwater should be allowed to drain ahead of the excavation.

SLOPE STABILITY

The site is located on a beach ridge slope above Marsh Creek. The natural slopes are not static topographic features. The forces tending to move the soil masses downward are principally gravity and seepage. Those forces resisting movement are mainly internal friction and cohesive strength of the soil. The soil masses alternate between local instability and a state of equilibrium between the driving and resisting forces. A factor of safety of one indicates that the resisting forces are equal to the driving forces.

Some of the conditions which could upset the apparent equilibrium or stability of the hillside include:

- Removal of soil from the lower portion of the hill – either by natural erosive action, such as by streams or by man-made excavation.
- An increase in the weight of the soil mass – possibly by saturating the soil, or by lowering the water table and reducing the buoyant forces.

- Addition of surcharge loads on top or along the upper portion of the slope - at the front of the proposed residences.
- An increase in seepage forces.
- A decrease in friction or cohesion within the soil.

From our analysis based on the subsurface conditions encountered at the borings, the proposed slope can be no steeper than 3.4 horizontal to 1 vertical for the slope to have a factor of safety greater than 1.5.

Serious consideration should be given to lowering the elevations of each of the proposed residences. We suggest matching the garage finished floor elevations with the existing grade and placing little to no fill on the existing slopes. Bottoms of foundations should be below a projected 3.4:1 line drawn from the bottom of the slope.

SITE PREPARATION AND MAINTENANCE

Clearing, grubbing, and removal of existing fill, trees, stumps, vegetation, topsoil, and other deleterious or unsuitable material should be done within the limits of the proposed construction, and to at least 5 feet beyond the perimeter of the proposed structures. Prior to filling, the entire area should be proofrolled with a minimum 10-ton static weight roller or approved equivalent, and where possible, making at least four overlapping passes in each of two perpendicular directions. Any excessively yielding areas revealed by the proofroll should be removed or possibly stabilized. The Geotechnical Engineer shall be the sole judge of what constitutes soft or excessively yielding material. We will be available to discuss stabilization options during construction should it become necessary.

Abandoned underground utilities traversing the sites should either be removed, grouted solid, or otherwise neutralized to prevent them from acting as conduits for groundwater. Underground utilities should be rerouted from under the proposed structures.

Benching back the excavation along a stable projected slope of two horizontal to one vertical, 2:1 is recommended. Excavations should not compromise the existing stability of the slope. Should a steeper excavation be required, it may be necessary to sheet and shore the excavation in order to prevent sloughing of the fill into the excavation and potentially compromising the integrity of the slope. Excavation could be done in sections so as not to compromise the apparent stability against slope failure. A similar 2:1 projected slope should be maintained between all excavations and the bottoms of trenches of adjacent existing or proposed underground utility lines.

The site must be maintained in a freely draining condition at all times. Ponding of water should not be permitted at any time. Ditches, swales, or other drainage facilities should be placed as necessary where excessive seepage or runoff is encountered. The contractor shall take special care to provide for both temporary and permanent drainage at the bottom of the excavations. Underdrains would have to be placed to pick up seepage exposed during excavation. Actual locations of drains would have to be determined in the field during excavation. Installation of a 6-inch diameter, perforated, rigid PVC SDR 35 gravity sewer pipe, bedded in freely draining crushed stone such as No. 57 size wrapped in a filter fabric should be considered. All drains should be led away from the structures. Wherever applicable, the drainage system should be gravity flow and outlet beyond the toe of the slope. Rip rap or some other form of energy dissipation will be required to reduce the effects of scour at the pipe outlets.

FILLING AND COMPACTION

All material to be used for fill shall be approved by the Geotechnical Engineer. No fill shall be placed on any area until that area has been observed and approved by the Geotechnical Engineer. Fill shall not be placed in a frozen condition, nor on a snow covered or frozen surface, or on the existing, noncontrolled, man deposited fill. Site fill may consist of excavated onsite soil, free of organic and other deleterious material, similar to the existing natural material on which it is placed. Alternating layers of cohesive and granular material should not be permitted. The fill should be conditioned to a moisture content within 2 percent of optimum and placed on stable surfaces in horizontal layers not exceeding 8 inches in the loose state. Each layer should be compacted until its dry density is not less than 98 percent of the maximum laboratory dry density as determined by the Moisture Density Relationship Test, ASTM D698, standard Proctor.

For placement of fill on slopes, when each layer of the fill meets the natural grade of the slope, a bench, approximately 6 feet wide shall be cut into the existing slope. The benches are to serve as keys to connect the existing grade with each layer of newly placed fill. Subsurface drains shall be installed where a pervious soil layer is found trapped between clay layers and wherever springs or seepage are encountered. Drains should be led out of the embankment and routed to the creek in such a way as to avoid softening the embankment or its toe, or producing erosion gulleys, see SITE PREPARATION AND MAINTENANCE. Care shall be taken to avoid trapping water within the fill.

All earthwork operations, proofrolling, stabilization, fill selection, testing, placement, and compaction should be monitored by our personnel.

FOUNDATIONS

The proposed structures should not be supported on the existing fill. The following foundation schemes may be considered.

SPREAD FOOTINGS – The existing fill should not be relied upon for support of foundations. It may be left in place if the owners are willing to accept the risk of potential cracking of floor slabs. Footings placed on the naturally deposited sand or silty clay can be designed for a bearing pressure of 2,000 pounds per square foot under the application of all loads. Total settlement could be expected to range from 1 to 1.5 inches, with potential differential settlement between adjacent footings of less than 1 inch.

To reach the naturally deposited sand will require excavations on the order of 12 to 18 feet for Lot 1 at 9005 Jackson Street; on the order of 14 feet for Lot 2 at 9015 Jackson Street; and on the order of 4 to16 feet to extend below the 3.4:1 slope for Lot 3 at 9025 Jackson Street. Cross section through each proposed residence, showing the near present-day elevations, those dating back to the year 2000, as well as the subsurface profile at the respective borings are provided for Lots 1 through 3. See Dwg No: 7956-2 through 7956-4, pages 12 through 14.

The geometry of adjacent footings at different levels should be adjusted so that the projected slope between the bottom edges of adjacent footings is not steeper than 2 horizontal to 1 vertical. Where due to soil or architectural considerations, a projected slope no steeper than 2 horizontal to 1 vertical should be maintained between bottoms of footings, and bottoms of adjacent excavations. A similar projected slope should be maintained between footings and adjacent sewers or underground utility lines. The geometry between the planned excavations and the existing utility trenches should be carefully reviewed prior to construction. Steps in continuous footings should also be designed with a 2 on 1 projected slope and vertical steps not exceeding 2 feet in height.

Foundation excavations should be cleaned of any standing water and loose, disturbed, or water softened material, and should be examined by our personnel for suitability of the bearing material just prior to placing concrete.

GROUND IMPROVEMENT – As the available capacity of the fill is not suitable to support the proposed loading, some form of ground improvement could be incorporated. Consideration could be given to techniques such as Geopiers, rammed aggregate piers, stone columns, controlled modulus columns, rigid inclusions, or other methods. Spread footings can then be placed on the improved ground. The allowable footing bearing pressure can vary with the technique used and would be determined by the ground improvement designer/specialty contractor.

Piles – Excavating 12 to 18 feet through the uncontrolled fill will require extensive shoring, alternatively deep foundations could be considered. Driven piles may be less desirable in this environment due to possible disturbance to the adjacent residence, its foundation, or its inhabitants. A single 16-inch diameter, augered cast-in-place pile, 26-foot long, could develop a capacity of 16 tons. Piles should extend at least 2 times their diameter into the hard silty clay, and at least 3 diameters below the basement finished floor. Anticipated settlement for each would be on the order of 1 inch.

At least one successful static or dynamic pile load test should be conducted for each pile type that is considered in order to verify pile capacities. The pile should be tested to 2 times the design load. The test pile will need to be instrumented to establish how the load is transferred to the soil. Dynamic testing should be used to correlate driven test piles with production piles.

Caissons – Caissons, drilled piers, might prove to be an appropriate foundation for the structures. Caissons that are drilled into the hard silty clay, on the order of 26 feet below the proposed basement floor elevations and 24 inches in diameter could sustain an applied load of 30 tons. Caissons should extend at least 2 diameters into the hard silty or clay, and at least 3 diameters below the basement finished floor.

It will be necessary to insert full length steel casing in caisson holes in order to prevent the sides from caving and permit proper cleaning and placement of concrete and reinforcing steel. Proper quality control is required. Integrity testing, such as cross hole sonic testing, of each caisson could be considered.

Anticipated settlement would be on the order of 1 inch. Larger settlements can be expected if piers of a shorter length are considered; longer, more slender piers generate a larger percentage of their capacity through skin friction, which is mobilized with small settlements.

Piles and caissons will also undergo elastic compression. This elastic compression should be considered in design by the structural engineer. Note that installation of caissons and augered cast-in-place piles will result in spoils during the drilling process.

SLABS ON GRADE

The existing fill is not competent to support the floor slab without cracking. Ideally, the floor should be structurally supported. Alternatively, the floor slabs could be supported on improved ground, or if the existing fill is removed and replaced as described in SITE PREPARATION AND MAINTENANCE, slabs may be placed on the controlled compacted engineered fill. Complete removal of the fill, may be possible for the garages, however, basement floor slabs would require a deep excavation to remove the fill. The task and cost of shoring the deep excavations could become quite onerous.

RETAINING STRUCTURES

For retaining structures whose tops are not free to deflect, such as basement walls, an at-rest earth pressure coefficient of $K_o = 0.5$ may be used. For the design of perimeter retaining structures whose tops are free to deflect, an active earth pressure coefficient of $k_a = 0.33$ together with a unit weight of retained soil of 135 pounds per cubic foot may be used. The effects of sloping backfill and surcharge loads, if any, should also be considered. Excavation on the slope should be done in 8-foot sections, measured along the slope, so as not to compromise the stability of the slope. Porous, freely draining, drained backfill, such as ODOT No. 57 crushed limestone should be placed immediately next to the wall to prevent the buildup of hydrostatic pressures.

Your project civil engineer should be consulted regarding potential retaining structures above Marsh Creek as scour from the creek and erosion at the toe of the slope will have a direct affect the required depth of that foundation. We will be available for further discussions and consultation one a design concept has been established.

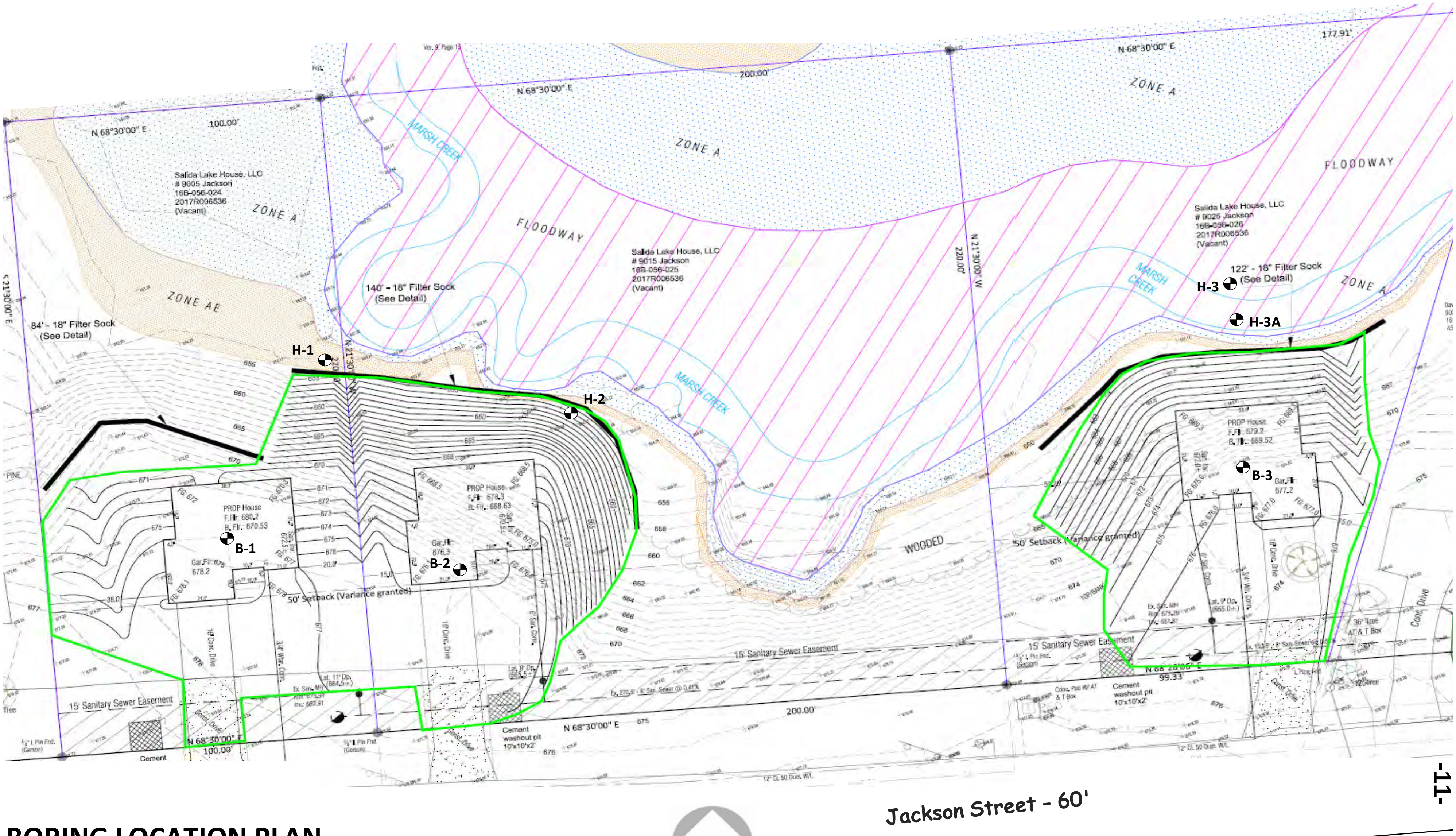
LIMITATIONS

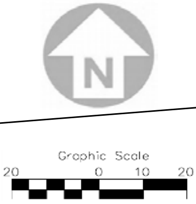
The above considerations are based on the soil information developed. The number of test borings is necessarily limited. The assumption was made that the material encountered in the borings is representative of those across the site. Any changes in the construction plans or in the subsurface conditions encountered, which are different from those shown or described in this report should be brought to our attention so we can determine if changes in our recommendations are required. We will be available to assist you during construction and will provide you with a proposal upon your request. We would also like the opportunity to review the construction plans when they become available.

Respectfully submitted,
DAVID V. LEWIN CORP.

JAR

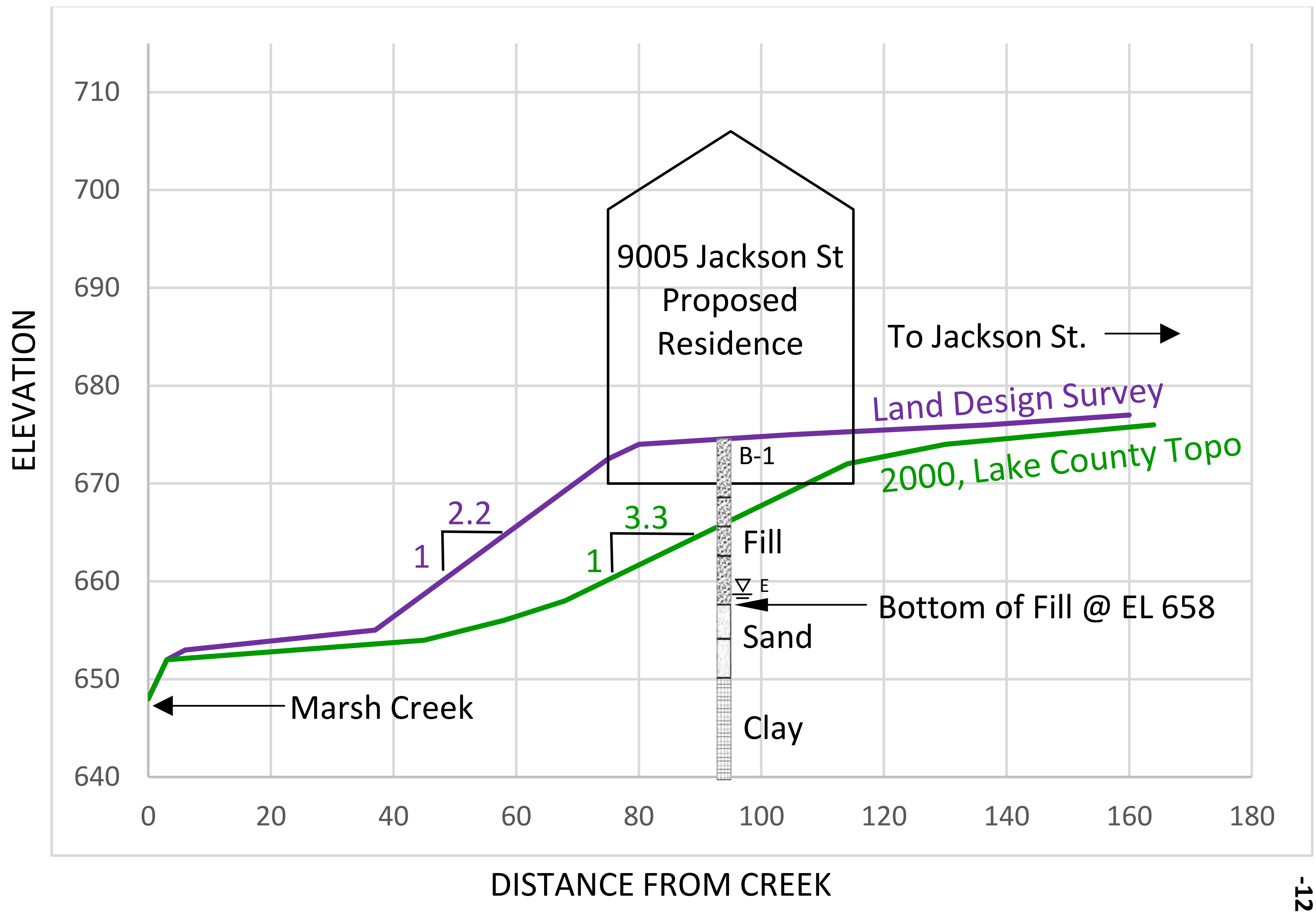
Duane J. Schreiber, PE





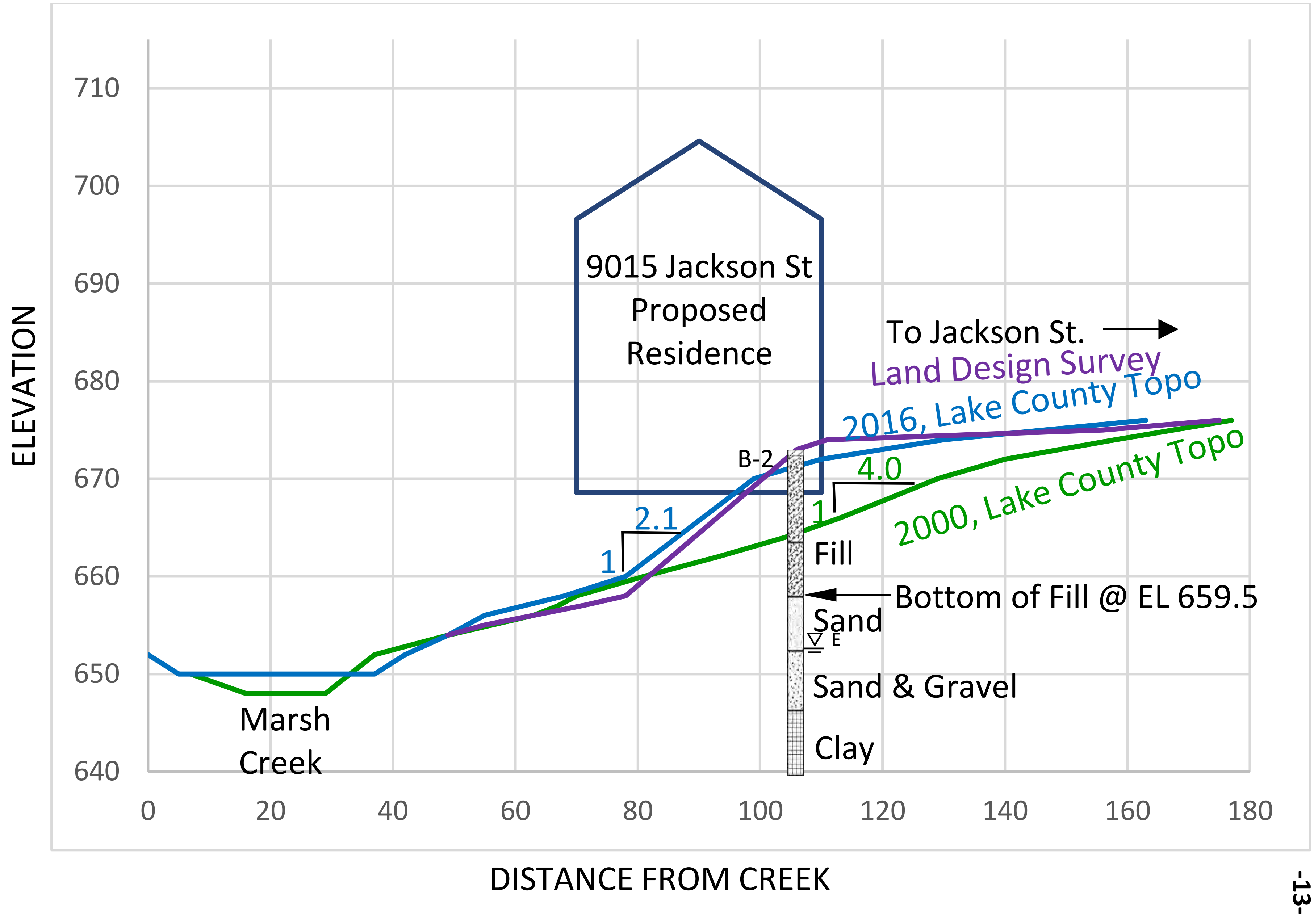
BORING LOCATION PLAN
THREE PROPOSED RESIDENCES
9005 - 9025 JACKSON STREET
MENTOR, OHIO

David V. Lewin Corporation
Geotechnical Engineering
Date: March 10, 2023 Dwg No: 7956-1



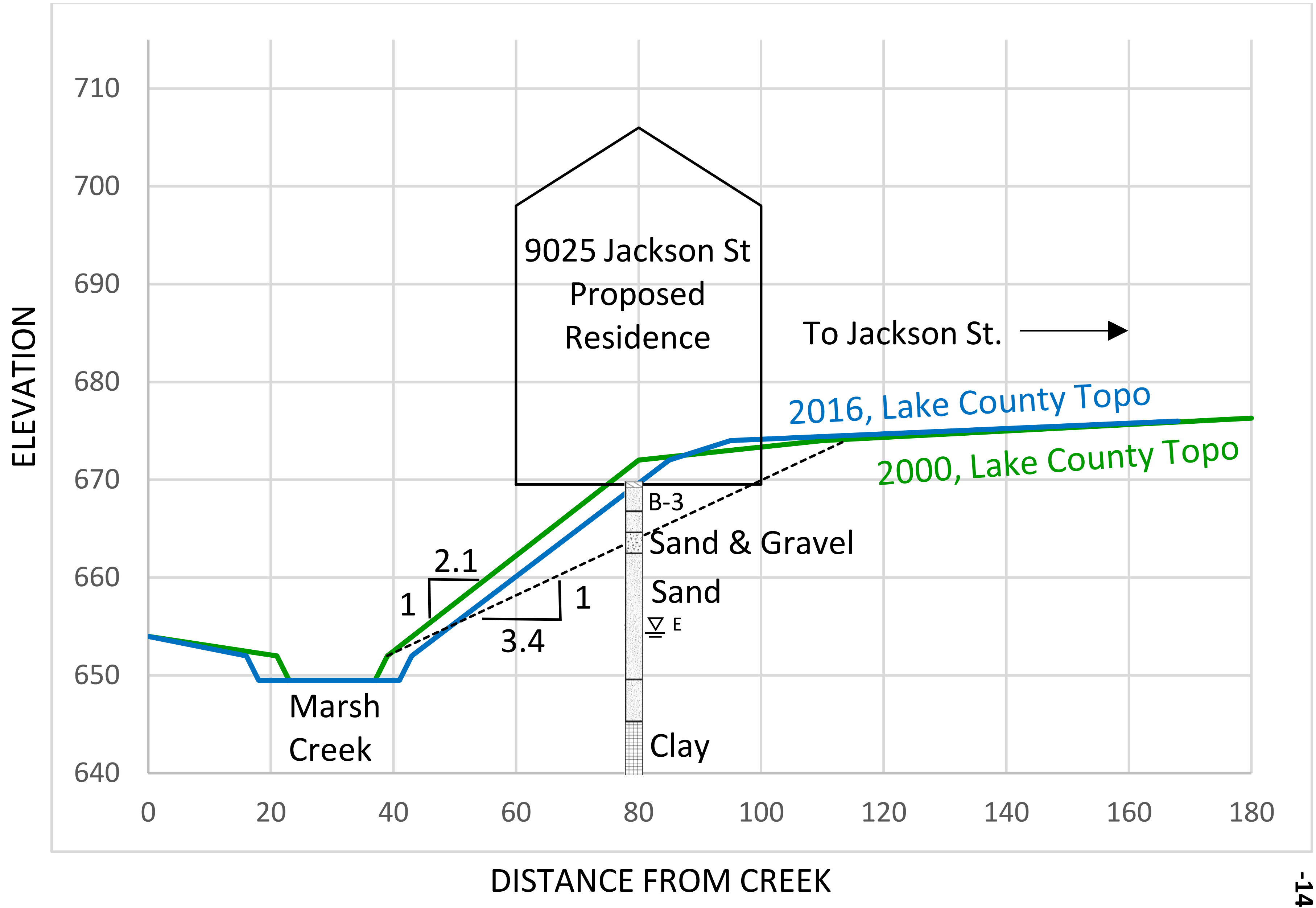
CROSS SECTION THROUGH
PROPOSED RESIDENCE
9005 JACKSON STREET
MENTOR, OHIO

David V. Lewin Corporation
Geotechnical Engineering
Date: March 3, 2023 Dwg No: 7956-2



CROSS SECTION THROUGH
PROPOSED RESIDENCE
9015 JACKSON STREET
MENTOR, OHIO

David V. Lewin Corporation
Geotechnical Engineering
Date: March 6, 2023 Dwg No: 7956-3



CROSS SECTION THROUGH
PROPOSED RESIDENCE
9025 JACKSON STREET
MENTOR, OHIO

David V. Lewin Corporation
Geotechnical Engineering
Date: March 3, 2023 Dwg No: 7956-4

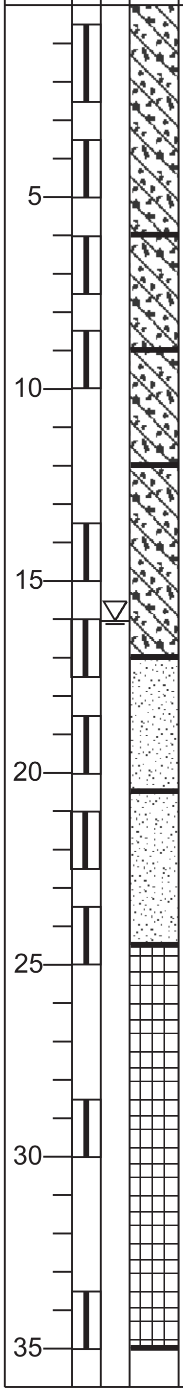
LABORATORY LOG OF BORING

Method of Sampling:
Split Spoon X
Core Drill
Shelby Tube
Auger

Water Level:
Encountered 16.0’
Completion Dry, Blocked @ 10.0’
@ 24 hours

Boring Number: B-1

Surface Elevation: 675±



DESCRIPTION	Blows on Spoon for 12 inches (N)	Natural Moisture (%)	Liquid Limit	Plasticity Index	Unconfined Shear Stress (psf)	Strain (%)	Loss on Ignition @ 600°C (%)	Dry Unit Weight (pcf)
Fill: brown silty clay, little sand, trace gravel, asphalt, brick and rock fragments	8	19.5						
					4500*			
	7	11.6						
Fill: gray silty clay, trace sand and rock fragments	3	23.3			3000*			110
Fill: brown and gray silty clay, trace asphalt fragments, slag, and cinders	6	11.5						
Fill: dark brown trace black silty sand, trace gravel and organic matter								
	8	27.0						
Sand, brown, silty, trace gravel and rock fragments	2							
	1							
Sand, gray, trace silt and rock fragments	10							
Clay, gray, silty, trace sand and gravel	28	12.4			3940	18.3		132
	42	13.1			3500			
End of Boring 35.0 ft.								

REMARKS: * Pocket Penetrometer

Boring Completed: 9/1/22
Location: Mentor, Ohio
DVL Job No.: C.7956

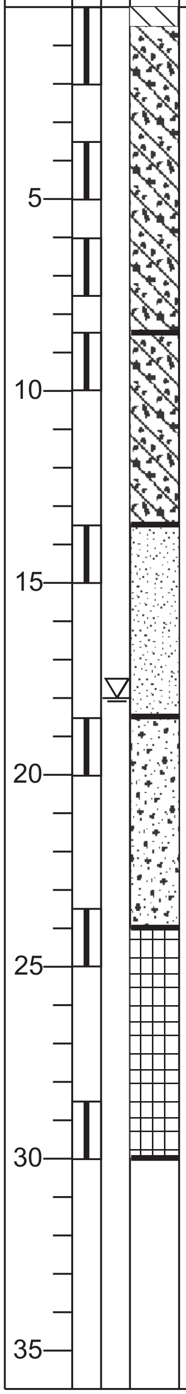
LABORATORY LOG OF BORING

Method of Sampling:
Split Spoon X
Core Drill
Shelby Tube
Auger

Water Level:
▽ Encountered 18.0’
▽ Completion Dry, Blocked @ 12.8’
▼ @ 24 hours

Boring Number: B-2

Surface Elevation: 673±



DESCRIPTION	Blows on Spoon for 12 inches (N)	Natural Moisture (%)	Liquid Limit	Plasticity Index	Unconfined Shear Stress (psf)	Strain (%)	Loss on Ignition @ 600°C (%)	Dry Unit Weight (pcf)
Topsoil 8”								
Fill: brown trace gray silty sandy clay, trace brick and rock fragments	11	26.3						
	8	15.4			3000*			
	8	15.1						
Fill: dark brown and brown sand, trace iron filings, rock fragments and silt	7	12.6						
Sand, brown, trace gravel and silt	7							
Sand & Gravel, brown, trace silt	23							
Clay, gray, silty, trace sand and gravel	32	12.6			3250*			
End of Boring 30.0 ft.	34	13.6			4500*			

SUMMARY OF TEST RESULTS

REMARKS: * Pocket Penetrometer

Boring Completed: 9/2/22
Location: Mentor, Ohio
DVL Job No.: C.7956

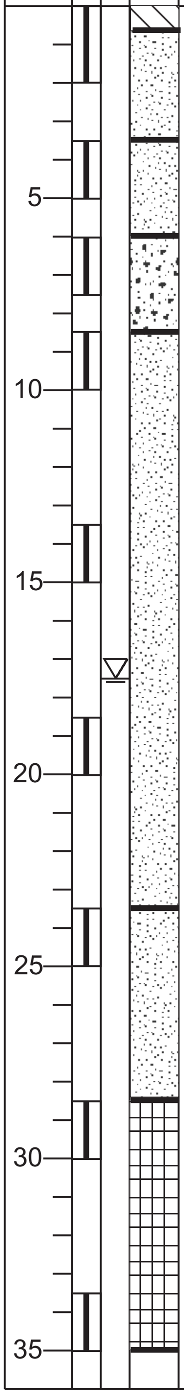
LABORATORY LOG OF BORING

Method of Sampling:
Split Spoon X
Core Drill ___
Shelby Tube ___
Auger ___

Water Level:
Encountered 17.5’
Completion Blocked @ 18.0’
@ 24 hours

Boring Number: B-3

Surface Elevation: 674±



DESCRIPTION	Blows on Spoon for 12 inches (N)	Natural Moisture (%)	Liquid Limit	Plasticity Index	Unconfined Shear Stress (psf)	Strain (%)	Loss on Ignition @ 600°C (%)	Dry Unit Weight (pcf)
Topsoil 8” Sand, brown, trace silt and gravel	2							
Sand, brown, some gravel, trace silt	5							
Sand & Gravel, brown, trace silt	5							
Sand, brown, trace gravel and silt	6							
	6							
	18							
Sand, gray, trace silt and clay, occasional clay seams	15							
Clay, gray, silty, trace sand and gravel	36	13.2						
End of Boring 35.0 ft.	30	11.9						

REMARKS:

Boring Completed: 9/2/22
Location: Mentor, Ohio
DVL Job No.: C.7956

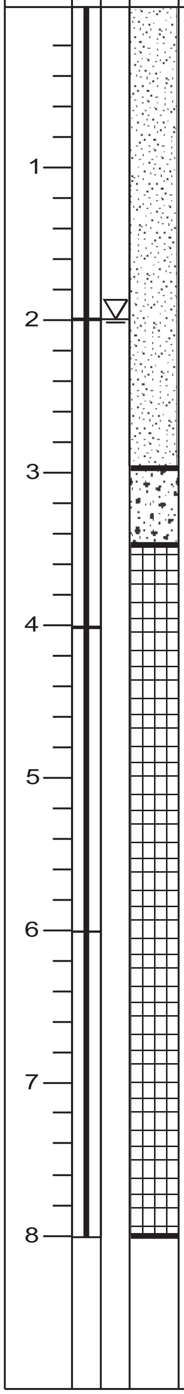
LABORATORY LOG OF BORING

Method of Sampling:
Split Spoon X
Core Drill ___
Shelby Tube ___
Auger ___

Water Level:
▽ Encountered 2.0’
▽ Completion
▼ @ 24 hours

Boring Number: H-1

Surface Elevation: 654±



DESCRIPTION	Blows on Spoon for 6 inches	Natural Moisture (%)	Liquid Limit	Plasticity Index	Unconfined Shear Stress (psf)	Strain (%)	Loss on Ignition @ 600°C (%)	Dry Unit Weight (pcf)
		SUMMARY OF TEST RESULTS						
Sand, gray, dark gray, silty, trace organic matter (Possible Fill)								
	3							
Sand & Gravel, brown, trace silt								
Clay, gray, silty, trace sand and gravel	8	14.7			4500*			
	55	12.9			4415	8.6		129
	49	12.1			6400	9.8		137
End of Boring @ 8.0 ft.								

REMARKS: Hand Hole sampling, 60-lb. hammer dropped 24”
* Pocket Penetrometer

Boring Completed: 9/2/22
Location: Mentor, Ohio
DVL Job No.: C. 7956

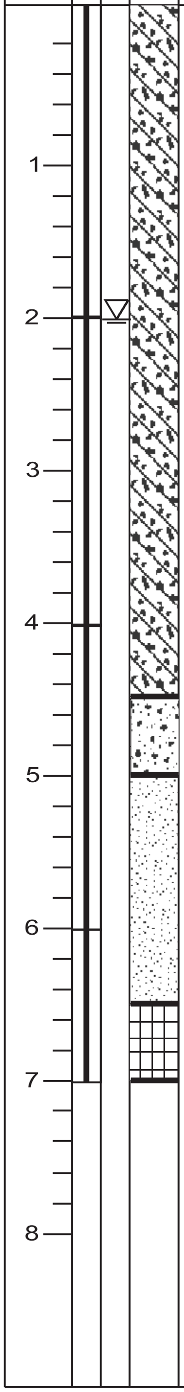
LABORATORY LOG OF BORING

Method of Sampling:
Split Spoon X
Core Drill ___
Shelby Tube ___
Auger ___

Water Level:
Encountered 2.0’
Completion
@ 24 hours

Boring Number: H-2

Surface Elevation: 655±



DESCRIPTION	Blows on Spoon for 6 inches	SUMMARY OF TEST RESULTS						
		Natural Moisture (%)	Liquid Limit	Plasticity Index	Unconfined Shear Stress (psf)	Strain (%)	Loss on Ignition @ 600°C (%)	Dry Unit Weight (pcf)
Sand, brown, trace gravel, silt, and roots (Possible Fill)								
	9							
	23							
Sand and Gravel, brown, silty								
Sand, brown, silty, with gravel	20							
Clay, gray, silty, trace sand and rock fragments	48/.5	14.8						
End of Boring @ 7.0 ft.								

REMARKS: Hand Hole sampling, 60-lb. hammer dropped 24”

Boring Completed: 9/2/22
Location: Mentor, Ohio
DVL Job No.: C. 7956

LABORATORY LOG OF BORING

Method of Sampling:
Split Spoon X
Core Drill ___
Shelby Tube ___
Auger ___

Water Level:
∇ Encountered 2.0’
∇ Completion
▼ @ 24 hours

Boring Number: H-3

Surface Elevation: 662±

						SUMMARY OF TEST RESULTS						
Depth in feet	Sample	Water Level	Symbol	DESCRIPTION	Blows on Spoon for 6 inches	Natural Moisture (%)	Liquid Limit	Plasticity Index	Unconfined Shear Stress (psf)	Strain (%)	Loss on Ignition @ 600°C (%)	Dry Unit Weight (pcf)
		∇		Sand, brown trace gray, silty, some gravel	13							
2				Clay, gray, silty, trace sand, gravel and cobbles	66^							
4				End of Boring @ 4.0 ft.								

REMARKS: Hand Hole sampling, 60-lb. hammer dropped 24”
^Drove Rock @ 2.0’, No Recovery

Boring Completed: 9/2/22
Location: Mentor, Ohio
DVL Job No.: C. 7956

LABORATORY LOG OF BORING

Method of Sampling:
Split Spoon X
Core Drill ___
Shelby Tube ___
Auger ___

Water Level:
▽ Encountered 0.0’
▽ Completion 0.0’
▼ @ 24 hours

Boring Number: H-3A

Surface Elevation: 660±

Depth in feet	Sample	Water Level	Symbol	DESCRIPTION	Blows on Spoon for 6 inches	Natural Moisture (%)	Liquid Limit	Plasticity Index	Unconfined Shear Stress (psf)	Strain (%)	Loss on Ignition @ 600°C (%)	Dry Unit Weight (pcf)
		▽		Water surface in Creek, EL 660±								
1			▦	Clay, gray, silty, trace sand and rock fragments	27/.5	13.7			4890	16.5		136
2				End of Boring @ 1.67 ft.								
3												
4												
5												
6												
7												
8												

REMARKS: Hand Hole sampling, 60-lb. hammer dropped 24”
Offset into Creek
Obstruction at 1.67 ft - Stopped sampling

Boring Completed: 9/2/22
Location: Mentor, Ohio
DVL Job No.: C. 7956

APPENDIX A

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 groundwater 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, shall perform such other labor and services as may be necessary and reasonably incidental to the gathering and classification of soil samples, and shall submit a complete and comprehensive field log of each boring. 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 groundwater 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 encountered or losses of water during or after drilling should be noted. The depth at which any blockage of the hole is encountered after the hole is completed should be recorded together with the level of standing water, or the lack thereof.

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 and times at which squeezing or caving of the sides of the hole occur.

6. Existence, depth and nature of topsoil, paving sections and filled ground.

7. Indication of any offset or relocation of boring from staked location, including an estimated elevation difference.

8. Weather and site conditions at the time of exploration.

9. 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 340 – Caxton Building, 812 Huron Rd., E., 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, area underground protection services, 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 D1586, Thin-Walled Tube Sampling of Soils, ASTM D1587, 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 groundwater 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 groundwater 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 cut to length, wrapped in Saran wrapping and put in approximately 5 inch high by 2± inch diameter glass jars. The lid of the jar is to be self sealing and tightly screwed on. Care should be taken to avoid freezing and to minimize any disturbance of the sample in the sampling, jarring and shipping processes. Jars should be labeled with the boring number, depth at which sample was taken, blows per each 6 inches of penetration, and project number. The length of the samples delivered to the laboratory shall not be less than 4 inches. Where a material change is encountered in the split-barrel sampler, a sample of each of the materials should be cut, wrapped in Saran and placed in separate jars.

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 sampler is brought to the surface it shall immediately be sealed at both ends of the tube.

C. PROBES AND AUGER BORINGS:

Probings or auger borings may be required. No split-barrel soil samples will be required in these probings or auger borings. Representative auger samples in each stratum should however be obtained and the hole logged. See ASTM D1452.

D. CORING ROCK:

When rock is encountered in a soil sampling boring, the elevation of the top of rock 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 required 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 suitably 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 groundwater conditions, they shall be provided with a cover or other means to prevent access or injury by the public or other workmen. Unless specifically directed, all holes should be backfilled and the drilling area restored as closely as possible to its original condition before the Drilling Contractor leaves the site. Grouting of the full or partial length of each hole shall be done where required by local regulations or where coring has been done in an area prone to sinkhole development or artesian water conditions.

F. NOTIFICATION:

Contractor shall contact the David V. Lewin Corp., Tel. 1-216-696-8151, 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.