May 8, 2024

C2RL, Inc.
240 W. Bessemer St.
Alcoa, Tennessee, 37701

ATTENTION: Mr. Chris Soro, P.E.
csoro@c2rl.com

Subject: **REPORT OF GEOTECHNICAL INVESTIGATION SERVICES**
City of Alcoa Building Distress
725 Universal Street
Alcoa, Tennessee, 37701
UES Project No. A23109.01521

Dear Mr. Soro,

We are submitting the results of the geotechnical exploration performed for the subject project. The geotechnical exploration was performed in accordance with our Proposal No. 11-23655, dated August 15, 2023. The following report presents our findings and recommendations for the proposed project. Should you have any questions regarding this report, or if we can be of any further assistance, please contact us at your convenience.

Sincerely,
UES Professional Solutions 19, LLC (UES)

Stephen R. Martin, P.E.
Geotechnical Department Manager
TN 122,250

Ibrahim M. Aklouk, P.E.
Geotechnical Project Manager
TN 127,662

REPORT OF GEOTECHNICAL INVESTIGATION SERVICES

City of Alcoa Building Distress

725 Universal Street
Alcoa, Tennessee 37701

UES Project No. A24109.01521.000

Submitted to:

C2RL, Inc.
240 W. Bessemer St.
Alcoa, Tennessee 37701

Submitted by:

UES Professional Solutions 19, LLC (UES)
2561 Willow Point Way
Knoxville, TN 37931

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1.0 INTRODUCTION

1.1 PURPOSE

The purpose of the geotechnical exploration was to explore the site's subsurface conditions and provide geotechnical conclusions and recommendations regarding the observed building distress at Alcoa Service Center Building in Alcoa, Tennessee.

1.2 PROJECT AND SITE DESCRIPTION

A site visit was conducted on August 9, 2023, between Mr. Chris Soro of C2RL, Inc. and Mr. Dennis Huckaba of UES to locate and assess the current distress in the City of Alcoa Building. We were provided with a set of 150 drawings titled City of Alcoa Service Center dated October 2006 as prepared by C2RL, Inc indicating the construction plans.

Distress has been observed along the western side and southwestern corner of the structure, which was constructed in 2007. The observed distress has included differential settlement of some foundations, mostly column locations for the overhang area, along with cracking of the concrete. The area is known to be adjacent to an existing landfill and multiple remediation efforts have been attempted over the years, which include a compaction grouting program. Previously UES observed the operation of forty-three (43) compaction grouting locations in January 2013. The injections were performed along the western wall, columns, and slab. The compaction grouting program consisted of approximately 822 linear feet and 19 cubic yards of grout. However, the building still continues to show signs of distress.

1.3 SCOPE OF STUDY

The purpose of our exploration was to explore the site subsurface conditions in the area of the observed distress and provide geotechnical recommendations as to the cause and recommendations for remediation of the observed distress. This geotechnical exploration involved site reconnaissance, ground penetrating radar of the walls/slabs where cracking was observed, field exploration, and engineering analysis. The following sections of this report present discussions of the field exploration and conclusions and recommendations. Following the text of this report figures, test boring records are attached.

The geotechnical scope of services did not include an environmental assessment for determining the presence or absence of wetlands, or hazardous or toxic materials in the soil, bedrock, surface water, groundwater, or air, on, or below, or around this site. Any statements in this report or on the boring logs regarding odors, colors, and unusual or suspicious items or conditions are strictly for informational purposes.

2.0 EXPLORATION AND TESTING PROGRAMS

2.1 FIELD EXPLORATION

The site subsurface conditions were explored by drilling three soil test borings (labeled B-1 through B-3) around the exterior of the western side of the building. The borings were located by UES personnel using a hand-held GPS unit. Prior to drilling, the area of the borings was scanned by our subcontractor to check for any underground utilities at the boring locations using ground penetration radar.

The soil test borings were drilled between April 24 and 26, 2024, and advanced using 3¼-inch hollow stem augers and a track-mounted drill rig. The approximate locations of the test borings are shown in Figure 2. The depths in this report reference the ground surface that existed at the time of the exploration. The ground surface elevations indicated on the boring logs were estimated by interpolating between contours on the provided topographic information and should be considered approximate. Detailed logs for the borings can be found in Appendix A of this report.

Standard Penetration Tests (SPT) and split-spoon sampling were performed at approximately 2½-foot intervals in the upper 10 feet and 5-foot intervals thereafter. The drill crew worked in general accordance with ASTM D6151 for Hollow Stem Auger (HSA) drilling. SPT and split-spoon sampling were performed in accordance with ASTM D1586.

In the split–spoon sampling, a standard 2-inch O.D. split-spoon sampler is driven into the bottom of the boring with a 140-pound hammer falling a distance of 30 inches. The number of blows required to advance the sampler the last 12 inches of the standard 18 inches of total penetration is recorded as the Standard Penetration Resistance (N-value). These N-values are indicated on the boring logs at the testing depth and provide an indication of the consistency of fine-grained soils and relative density of coarse-grained soils.

In addition, UES personnel completed four exterior core/hand auger borings (labeled C-1 through C-4) in close proximity to the building on May 2, 2024, to explore the subsurface conditions near the existing foundation and under the existing slab. The locations of these borings were based upon site conditions and previous information provided. The existing concrete was cored with a 4-inch diameter thin-walled core barrel and the resulting thicknesses were measured. Stone base material was hand-augured from the core holes and the approximate depth of stone base section was measured. The upper portion of the soil subgrade beneath the stone base section and underlying soils were subjected to a ½ inch diameter probe rod to evaluate relative consistency and density of the encountered soils. Upon completion, the hand auger borings were backfilled with onsite material and patched with asphalt patch. All depths in this report reference the slab elevation that existed at the time of this exploration. The approximate core/hand auger locations are shown in the attached Figure 2.

After completion of the field drilling and sampling phase of this project, the soil samples were returned to our laboratory where they were visually classified in general accordance with the Unified Soil Classification System (USCS – ASTM D2487) by a UES geotechnical professional.

2.2 GROUND PENETRATION RADAR (GPR)

GPR was utilized in the proposed coring locations along with other isolated areas of the slab to determine the underlying existing utilities, reinforcement within the concrete, and potential voids beneath the slabs. No voids were observed beneath the slabs and within the columns of the distressed areas.

3.0 SUBSURFACE CONDITIONS

3.1 GEOLOGIC CONDITIONS

The project site lies in the Appalachian Valley and Ridge Physiographic Province of East Tennessee. This province is characterized by elongated, northeasterly-trending ridges formed on highly resistant sandstone and shale. Between ridges, broad valleys and rolling hills are formed primarily on less resistant limestone, dolomite, and shale.

Published geologic information indicates that the site is underlain by the Rogersville Shale formation. The Rogersville Shale consists of a brownish gray, somewhat silty shale separated into an upper and lower tongue by the Craig Limestone member. The Craig member consists of a blue limestone. In the vicinity of the site, the Rogersville Shale is interfingered with the Rutledge and Maryville Limestone formations. The Rogersville Shale weathers to a light-greenish, micaceous, residuum with weathered shale structure. The Rutledge Limestone consists of blue-gray limestone and interbedded dolomitic limestone weathering to an orange-red clay. The Maryville Limestone consists of a dark blue-gray, very fine-grained massive limestone with some argillaceous beds.

Since the Rogersville Shale is interfingered with limestone formations in this area, the site is susceptible to the hazards of irregular weathering, cave and cavern conditions, and overburden sinkholes. Carbonate rock, while appearing very hard and resistant, is soluble in slightly acidic water. This characteristic, plus differential weathering of the bedrock mass is responsible for the hazards. Of these hazards, the occurrence of sinkholes is potentially the most damaging to overlying soil-supported structures. Sinkholes occur primarily due to differential weathering of the bedrock and flushing or raveling of overburden soil into the cavities in the bedrock. The loss of solids creates a cavity or dome in the overburden.

Growth of the dome over time or excavation over the dome can create a condition in which rapid, local subsidence or collapse of the roof of the dome occurs. A certain degree of risk with respect to sinkhole formation and subsidence should be considered at any site located within carbonate geologic settings.

3.2 SUBSURFACE CONDITIONS

The following subsurface description is of a generalized nature to highlight the subsurface stratification features and material characteristics at the boring locations, The boring logs included in Appendix A of this report should be reviewed for specific information at each boring location. Information on actual subsurface conditions exists only at the specific boring locations and is relevant only to the time that this exploration was performed. Variations may occur and should be expected at the site.

3.2.1 Concrete Coring and Hand Auger

From the existing surface, each location encountered approximately 4 to 8 inches of concrete underlain by approximately 4.5 to 5 inches of basestone. The exception was location C-2, which encountered a layer of brown clayey gravel beneath the concrete layer. We note that no fines were encountered in the basestone layer of location C-3. The relative density of the basestone ranged from approximately loose to dense.

The existing subgrade consisted of brown, gray, black, green, and orangish brown lean (low plasticity) clayey soils with varying amounts of gravel and chemical odor. The consistency of the subgrade was estimated to be soft to firm within the fine-grained materials. The hand auger borings were extended to depths ranging from approximately 18 to 24 inches below existing grade.

3.2.2 Soil Test Borings

Surficial Materials
Initially each boring encountered a surficial layer. Two borings (B-1 and B-2) encountered approximately 8 inches of asphalt, followed by 6 inches of basestone, while boring B-3 encountered 7.5 inches of concrete, followed by 6.5 inches of basestone.

Apparent Fill Materials

Underlying the surficial layer, fill materials were encountered in each boring. The fill materials generally consisted of brown, reddish brown, orangish brown, tan, gray, greenish gray, and black lean and fat (high plasticity) clayey soils with varying amounts of gravel, shale fragments, chemical odor, plastic, asphalt, paper, fabric, glass, and metal fragments. The fill materials extended to depths ranging from approximately 17 to 32 feet below existing grade.

The SPT N-values within the fill materials ranged from approximately 5 to 22 bpf (blow per foot), indicating firm to very stiff consistencies within the fine gained materials. The exceptions were samples encountered in borings B-1 and B-2 at 2.5 and 7.5 feet below existing, which had SPT N-values of 4 and 2, respectively. These samples indicated soil consistencies of very soft to soft in the fine-grained materials. We note that SPT N-values greater than 13 bpf were influenced by denser materials, such as gravel, shale fragments, and asphalt fragments.

Residual Soil

Beneath the fill materials, each boring encountered apparent residual materials generally consisting of tan, orangish brown, and brown fat clays. In addition, boring B-2 encountered weathered rock at approximately 22 feet. The weathered rock was manually classified as tan and light to dark gray shale with clay. The SPT N-values within the residual materials ranged from 6 bpf to 50/1” (50 blows per 1 inches), indicating firm to hard consistencies within the fine-grained materials. We note that the SPT N-values were likely influenced by the presence of denser material, such as weathered rock within the soil matrix.

Auger Refusal

Auger refusal was encountered in each boring at depths ranging from approximately 20.4 to 37.2 feet below the existing ground. Auger refusal is a designation applied to materials that cannot be penetrated by the power auger. Auger refusal may indicate hard materials, such as rock boulders, ledges or pinnacles, or the top of continuous bedrock.

Groundwater

Groundwater was encountered in two boring (B-1 and B-2) at approximately 25.3 and 7 feet below existing grade, respectively. We note that stabilized water levels can sometimes be difficult to obtain as the encountered soils are known to be relatively impermeable. In addition, each boring was backfilled upon completion in consideration of safety so delayed water levels were not recorded.

It is possible for groundwater to exist within the depths explored during other times of the year depending upon climatic and rainfall conditions. Additionally, discontinuous zones of perched water may exist within the overburden materials. The groundwater information presented in this report is the information that was collected at the time of our field activities. The following table summarizes the approximate surficial and fill layer thicknesses, groundwater depth, and refusal depth relative to estimate surface elevation.

Table 1 –Boring Summary Information

Location #	Estimated Ground Surface Elevation (feet MSL)	Asphalt / Concrete Thickness (inches)	Basestone Thickness (inches)	Approximate Depth of Fill (feet)	Approximate Depth of Groundwater (feet)	Approximate Refusal Depth (feet)	Approximate Refusal Elevation (feet MSL)
B-1	870	8 - AS	6	32	25.3	37.2	832.8
B-2	870	8 – AS	6	22	7	29.9	840.1
B-3	870	7.5 – C	6.5	17	NE	20.4	849.6
C-1	870	8 – C	12	0.3	NE	2*(T)	868*(T)
C-2	870	4 - C	5	0.9	NE	2*(T)	868*(T)
C-3	870	8 – C	9	0.6	NE	2*(T)	868*(T)
C-4	870	6.5 – C	4.5	0.6	NE	1.5*(T)	868.5*(T)

NOTES: *(T) – Terminated prior to encountering refusal materials. NE – Not Encountered / AS – Asphalt / C - Concrete
Elevations interpolated from provided topographic maps. Should be considered approximate.

4.0 CONCLUSIONS AND RECOMMENDATIONS

4.1 CONCLUSIONS

Fill materials were encountered in each boring and extended to depths of about 17 to 32 feet below existing grade. The fill was of variable consistency and consisted of lean clay soils with varying amounts gravel, shale fragments, chemical odor, plastic, asphalt, paper, fabric, glass, and metal fragments. The fill was underlain by clay residual soils and weathered rock with consistencies between firm to hard.

In our professional opinion, the observed distress is likely the result of ongoing settlement of the landfill materials and while the foundations themselves are likely not underlain by the deleterious materials, the fills are likely shifting adjacent soils/utilities. We note that the majority of the fill soils were classified as low plasticity (i.e., not likely subject to excessive shrinkage or swelling).

In addition, groundwater was encountered in two boring (B-1 and B-2) at approximately 25.3 and 7 feet below existing grade, respectively. However, based on our field observations and the shallow groundwater depth in boring B-2, we do not anticipate actual groundwater was encountered at 7 feet. Instead, we believe the encountered water in boring B-2 may be due to damaged utilities, as the location was near the truck wash. As such, we recommend performing a camera inspection prior to any foundation repairs and repairing the damaged pipe, if needed.

We recommend the implementation of foundation underpinning in the distressed areas using micropiles. Following that, the portions of the sidewalk which have subsided should be elevated using by the injection of grout or polyurethane. The following recommendations are further discussed below.

4.2 CAMERA INSPECTION

We recommend performing a camera inspection using a crawler mounted video camera to inspect the existing water pipe and other utilities underlying the existing slab. Specifically, the utilities around the truck wash where the encountered materials were significantly saturated in the upper zones.

Any damaged utilities noted during the camera inspection should be repaired by an appropriate contractor and properly backfilled. The excavations should be backfilled with a few inches of No. 57 stone, followed by dense graded aggregate (DGA) until existing grade elevation is reached.

The DGA used for this section should be Type A and Grading D or E in accordance with Section 903.05 of the Tennessee Department of Transportation (TDOT) specifications. The DGA fill should be placed in loose, horizontal lifts not exceeding 8 inches in loose thickness. Each lift should be compacted to at least 98 percent of maximum dry density per the standard Proctor method (ASTM D 698). Each lift should be compacted, tested by geotechnical personnel and approved before placing subsequent lifts.

4.3 MICROPILES

We recommend the client underpin the existing foundations with micropiles. Micropiles are installed by drilling a steel pipe (i.e., casing) to the underlying bedrock. The hole is then extended, through competent bedrock creating a socket (the pile bond length). Once the appropriate socket is penetrated (a function of rock quality and design bond strength), a steel reinforcing bar is often centered in the casing which extends from the bottom of the socket to the pile cut-off length. Finally, the entire pile is filled with grout using tremie methods. Upon grouting, the casing is typically lifted within the rock socket to allow for the grout to flow outside the casing and pushed back down to the bottom of the hole (i.e., pulled and plunged).

Construction techniques and methods associated with micropiles are very flexible and may vary from this general description in some ways. However, given the subsurface conditions encountered and our experience with projects in the geologic setting, we recommend all piles be fully cased. Using uncased piles could result in collapse (or necking) of the drilled excavation, resulting in an unsatisfactory pile as well as unwarranted cost overruns due to free-flowing grout.

The casing used for the design of micropiles is typically 5.5 to 9 5/8-inch diameter steel that meets ASTM standards (ASTM A 252), and which has a typical yield strength of 80 kips per square inch (ksi). UES recommends an allowable bond strength of 100 pounds per square inch (psi) between the grout and bedrock along the socket in hard, continuous bedrock.

The refusal depths encountered during the subsurface exploration were variable and ranged from approximately 20.4 to 37.2 feet in the borings. Therefore, the project budget should include contingencies for such variances during construction.

We note that boring B-2 encountered a layer of weathered and/or discontinuous rock overlying the hard; however, continuous bedrock is recommended for the micropile socket. For this reason, an allowance should be made for several feet of weathered rock/soil seam penetration to reach competent bedrock where the micropile socket will bear.

We suggest that the design and construction of micropiles be performed by a contractor specializing in this type of construction with experience in this geologic setting. Once the final design plans have been prepared, we request the opportunity to review the design plans to assure that our recommendations have been properly implemented. The design recommendations contained herein are contingent upon the observation and testing of the pile installation procedures in the field at the time of construction by UES.

4.4 SLAB LEVELING

Leveling of the exterior slab and/or improvement of the subgrade soils may be required after underpinning. If the slab is structurally connected to the foundations, then the underpinning will likely help to stop continued slab settlements. In this case, it may be desired to perform cosmetic repairs to the slab and interior portions of the structure once the shallow foundations have been underpinned.

If the slab is not structurally tied to the shallow foundations, then it may be desired to use cement or polyurethane injection to level the slab on the interior to the building. The owner may also consider extending the injections to depths of 2 to 3 feet below the slab elevation to help improve soft subgrade soils which may be present. Performing injections into the subgrade soil would further help to reduce the possibility of slab settlements in the distressed portion of the building. We note that if the slab is not structurally tied to the foundations, it would still be subject to settlements related to soft subgrade soil.

We recommend the project structural engineer be consulted regarding the leveling of the slab and to confirm the connection of the slab to the shallow foundations. We recommend the injection of cement or polyurethane to level the slab be performed by a contractor experienced with this work. A level monitoring system should be installed to monitor movements of the slab and other site or building features.

5.0 LIMITATIONS

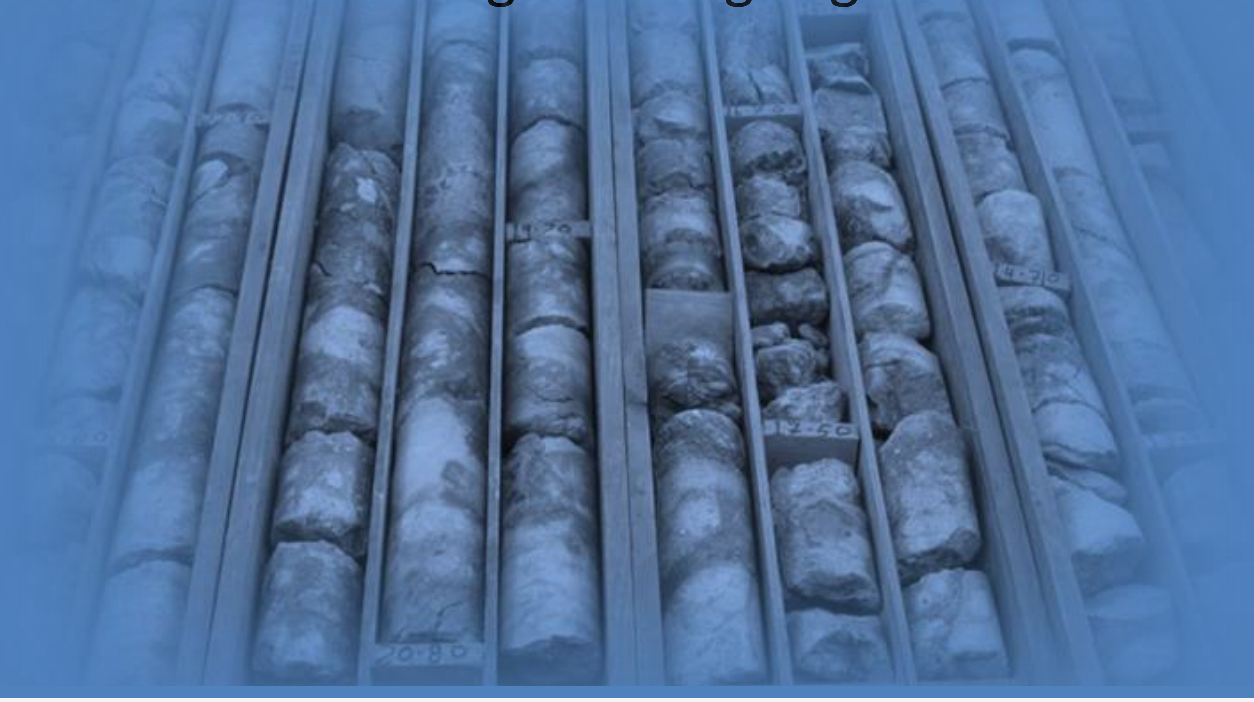
This report has been prepared in accordance with generally accepted geotechnical engineering practice for specific application to this project. This report is for our geotechnical work only, and no environmental assessment efforts have been performed. The conclusions and recommendations contained in this report are based upon applicable standards of our practice in this geographic area at the time this report was prepared. No other warranty, express or implied, is made.

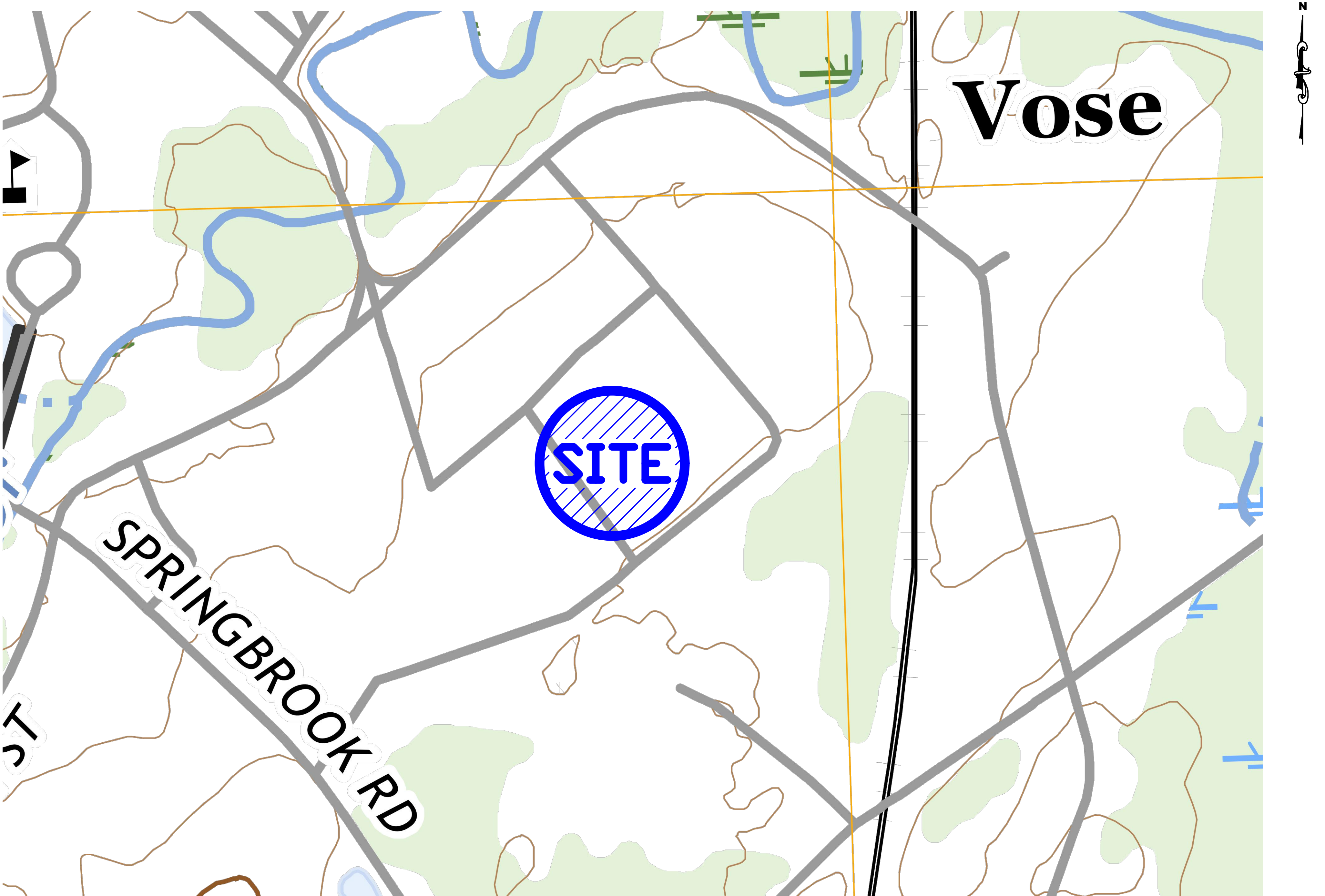
The analyses and recommendations submitted herein are based, in part, upon the data obtained from the exploration. The nature and extent of variations between the borings will not become evident until construction. If variations appear evident, then we will re-evaluate the recommendations of this report. In the event that any changes in the nature, design, or location of the structures are planned, the conclusions and recommendations contained in this report will not be considered valid unless the changes are reviewed, and conclusions modified or verified in writing. Also, if the scope of the project should change significantly from that described herein, these recommendations may need to be re-evaluated.

APPENDICES

APPENDIX A

Figures, General Notes, Boring Logs, & Hand Auger Boring Logs





NOTES:

1.) BASE MAP: USGS QUADRANGLE (MARYVILLE, TENNESSEE)

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2561 Willow Point Way, Knoxville, TN 37931
Office: 865-539-8242 Fax: 865-539-8252

SITE VICINITY MAP

CITY OF ALCOA

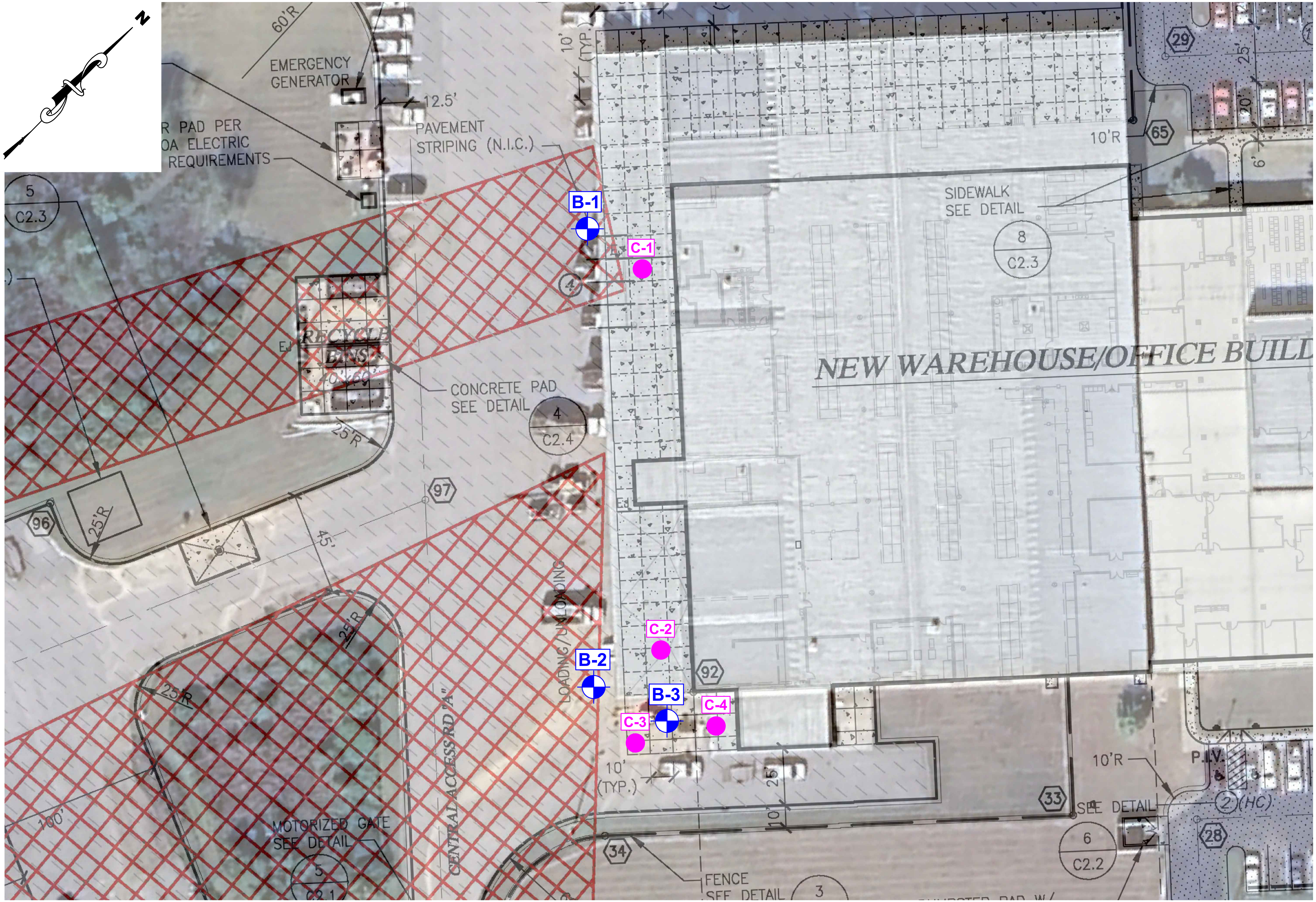
BUILDING DISTRESS

725 UNIVERSAL STREET, ALCOA, TN 37701

DRAWN BY:	KSR
APPROVED BY:	SRM
SCALE:	N.T.S.
JOB NO.:	A24109.01521.000
DATE:	4/17/24

FIGURE

1



NOTES:

1.) BORING AND CORING LOCATIONS ARE SHOWN IN GENERAL ARRANGEMENT ONLY.
2.) DO NOT USE BORING OR CORING LOCATIONS FOR DETERMINATIONS OF DISTANCES OR QUANTITIES.
3.) BASE MAP PROVIDED BY: C2RL, Inc.

- LOCATION OF SOIL TEST BORINGS
- LOCATION OF CONCRETE CORE

SOIL TEST BORING AND CONCRETE CORING LOCATION PLAN

CITY OF ALCOA

BUILDING DISTRESS

725 UNIVERSAL STREET, ALCOA, TN 37701

DRAWN BY:	KSR
APPROVED BY:	SRM
SCALE:	N.T.S.
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Figure 2

GENERAL NOTES

FINE AND COARSE GRAINED SOIL PROPERTIES

PARTICLE SIZE

BOULDERS:	GREATER THAN 300 mm
COBBLES:	75 mm to 300 mm
GRAVEL:	4.74 mm to 75 mm
COARSE SAND:	2 mm to 4.74 mm
MEDIUM SAND:	0.425 mm to 2 mm
FINE SAND:	0.075 mm to 0.425 mm
SILTS & CLAYS:	LESS THAN 0.075 mm

COARSE GRAINED SOILS (SANDS & GRAVELS)

N-VALUE	RELATIVE DENSITY
0 - 4	VERY LOOSE
5 - 10	LOOSE
11 - 30	MEDIUM DENSE
31 - 50	DENSE
OVER 50	VERY DENSE

FINE GRAINED SOILS (SILTS & CLAYS)

N-VALUE	CONSISTENCY	Qu, PSF
0 - 2	VERY SOFT	0-500
3 - 4	SOFT	500 -1000
5 - 8	FIRM	1000 - 2000
9 - 15	STIFF	2000 - 4000
16 - 30	VERY STIFF	4000 - 8000
OVER 31	HARD	8000 +

STANDARD PENETRATION TEST (ASTM D1586)

THE STANDARD PENETRATION TEST AS DEFINED BY ASTM D1586 IS A METHOD TO OBTAIN A DISTURBED SOIL SAMPLE FOR EXAMINATION AND TESTING AND TO OBTAIN RELATIVE DENSITY AND CONSISTENCY INFORMATON. THE 1.4 INCH I.D./2.0 INCH O.D. SAMPLER IS DRIVEN 3-SIX INCH INCREMENTS WITH A 140-LB. HAMMER FALLING 30 INCHES. THE BLOW COUNTS REQUIRED TO DRIVE THE SAMPLER THE FINAL 2 INCREMENTS ARE ADDED TOGETHER AND DESIGNATED THE N-VALUE. AT TIMES, THE SAMPLER CAN NOT BE DRIVEN THE FULL 18 INCHES. THE FOLLOWING REPRESENTS OUR INTERPRETATION OF THE STANDARD PENETRATION TEST WITH VARIATIONS.

BLOWS/FOOT (N-VALUE)	DESCRIPTION
25	25 BLOWS DROVE SAMPLER 12" AFTER INITIAL 6" SEATING
75/10"	75 BLOWS DROVE SAMPLER 10" AFTER INITIAL 6" SEATING
50/PR	PENETRATION REFUSAL OF SAMPLER AFTER INITIAL 6" SEATING

SAMPLING SYMBOLS

ST:	UNDISTURBED SAMPLE
SS:	SPLIT SPOON SAMPLE
CORE:	ROCK CORE SAMPLE
AU:	AUGER OR BAG SAMPLE

SOIL PROPERTY SYMBOLS

N:	STANDARD PENETRATION, BPF
M:	MOISTURE CONTENT %
LL:	LIQUID LIMIT %
PI:	PLASTICITY INDEX%
Qp:	POCKET PENETROMETER VALUE, TSF
Qu:	UNCONFINED COMPRESSIVE STRENGTH, TSF
DUW:	DRY UNIT WEIGHT, PCF

ROCK PROPERTIES

ROCK QUALITY DESIGNATION (RQD)

PERCENT	QUALITY
90 TO 100	EXCELLENT
75 TO 90	GOOD
50 TO 75	FAIR
25 TO 50	POOR
O TO 25	VERY POOR

ROCK HARDNESS

VERY SOFT:	ROCK DISINTEGRATES OR EASILY COMPRESSES TO TOUCH: CAN BE HARD TO VERY HARD SOIL.
SOFT:	ROCK IS COHERANT BUT BREAKS EASILY TO THUMB PRESSURE AT SHARP EDGES AND IT CRUMBLES WITH FIRM HAND PRESSURE.
MODERATELY HARD:	SMALL PIECES CAN BE BROKEN OFF ALONG SHARP EDGES BY CONSIDERABLE HARD THUMB PRESSURE: CAN BE BROKEN BY LIGHT HAMMER BLOWS.
HARD:	ROCK CAN NOT BE BROKEN BY THUMB PRESSURE, BUT CAN BE BROKEN BY MODERATE HAMMER BLOWS.
VERY HARD:	ROCK CAN BE BROKEN BY HEAVY HAMMER BLOWS.

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KEY TO SYMBOLS

LITHOLOGIC SYMBOLS (Unified Soil Classification System)

- ASPHALT: Asphalt
- CH: USCS High Plasticity Clay
- CL: USCS Low Plasticity Clay
- CL-ML: USCS Low Plasticity Silty Clay
- CONCRETE: Concrete
- DOLOMITE: Dolomite
- GRAVEL: Gravel / Basestone
- LIMESTONE: Limestone
- ML: USCS Silt
- SANDSTONE: Sandstone
- SC: USCS Clayey Sand
- SC-SM: USCS Silty Clayey Sand
- SHALE: Shale
- SLATE: Slate
- SM: USCS Silty Sand
- SW: USCS Well-graded Sand
- SP: USCS Poorly-graded Sand
- TOPSOIL: Topsoil
- WEATHERED ROCK: Weathered Bedrock
- WOOD: Wood / Mulch

SAMPLE SYMBOLS

- Grab Sample
- No Recovery
- Rock Core
- Shelby Tube
- Split Spoon
- AUGER: Auger Probe

COLOR CODES FOR LITHOLOGIC SYMBOLS

- RED: Fill
- GREEN: Cultivated
- BLUE: Residuum
- MAGENTA: Alluvium
- PINK: Colluvium
- LIGHT GRAY: Weathered Rock
- ORANGE: Loess
- DARK GRAY: Rock Core
- YELLOW: Void
- TEAL: Glacial Outwash / Glacial Till / Glaciolacustrine
- PURPLE: Marine

ABBREVIATIONS

LL - LIQUID LIMIT (%)
PI - PLASTIC INDEX (%)
W - MOISTURE CONTENT (%)
DD - DRY DENSITY (PCF)
NP - NON PLASTIC
-200 - PERCENT PASSING NO. 200 SIEVE
PP - POCKET PENETROMETER (TSF)

▽ Water Level at Time Drilling, or as Shown
▼ Water Level at End of Drilling, or as Shown
▼ Water Level After 24 Hours, or as Shown

TV - TORVANE
PID - PHOTOIONIZATION DETECTOR
UC - UNCONFINED COMPRESSION
ppm - PARTS PER MILLION

BORING NUMBER B-1

PROJECT NAME City of Alcoa Building Distress
GEOServices PROJECT# A24109.01521.000
DATE 4/24/24
PROJECT LOCATION 725 Universal Street, Alcoa, Tennessee, 37701
DRILLING CONTRACTOR Southeast Drilling Solutions, LLC
LOGGED BY KSR **ON-SITE REP.** ---
DRILLING METHOD B-51, Auto Hammer
LATITUDE / LONGITUDE ---
GROUND ELEVATION 870 ft **PROPOSED FFE** ---
NORTHING / EASTING ---
REFUSAL Depth 37.2 ft / Elev 832.8 ft
TOP OF ROCK ---
GROUND WATER LEVELS:
BEGAN CORING ---
∇ **AT END OF DRILLING** 25.30 ft / Elev 844.70 ft
FOOTAGE CORED (LF) ---
AFTER 1 HOUR --- Backfilled
BOTTOM OF HOLE Depth 37.2 ft / Elev 832.8 ft
AFTER 24 HOURS --- Backfilled

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX
0	870.0	Asphalt (8 Inches)						
		Basestone (6 Inches)						
		(CL) **Lean CLAY** - with gravel, shale fragments, and slight chemical odor - brown, reddish brown, tan, light gray, and dark gray - moist to very moist (FILL)	SS 1		2-2-2 (4)			
			SS 2		1-3-5 (8)			
5	865.0	(CH) **Fat CLAY** - with gravel, shale fragments, trace plastic, and chemical odor - greenish gray, reddish brown, dark gray, and dark brown - very moist (FILL)	SS 3		2-3-4 (7)			
		(CH) **Fat CLAY** - with gravel, trace asphalt fragments, and strong chemical odor - dark gray, light gray, and brown - moist (FILL)	SS 4		3-8-5 (13)			
10	860.0							
		(CL) **Lean CLAY** - with gravel, plastic, paper, and chemical odor - dark brown, dark gray, greenish gray, and orangish brown - moist (FILL)						
15	855.0		SS 5		3-3-3 (6)			
20	850.0		SS 6		3-4-5 (9)			

NOTES:

(Continued Next Page)

BORING NUMBER B-1

PROJECT NAME City of Alcoa Building Distress
GEOServices PROJECT# A24109.01521.000
DATE 4/24/24
PROJECT LOCATION 725 Universal Street, Alcoa, Tennessee, 37701
DRILLING CONTRACTOR Southeast Drilling Solutions, LLC
LOGGED BY KSR **ON-SITE REP.** ---
DRILLING METHOD B-51, Auto Hammer
LATITUDE / LONGITUDE ---
GROUND ELEVATION 870 ft **PROPOSED FFE** ---
NORTHING / EASTING ---
REFUSAL Depth 37.2 ft / Elev 832.8 ft
TOP OF ROCK ---
BEGAN CORING ---
FOOTAGE CORED (LF) ---
BOTTOM OF HOLE Depth 37.2 ft / Elev 832.8 ft

GROUND WATER LEVELS:
▽ **AT END OF DRILLING** 25.30 ft / Elev 844.70 ft
AFTER 1 HOUR --- Backfilled
AFTER 24 HOURS --- Backfilled

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX
20	850.0		(CL) **Lean CLAY** - with gravel, plastic, paper, and chemical odor - dark brown, dark gray, greenish gray, and orangish brown - moist (FILL) *(continued)*						
			(CH) **Fat CLAY** - with fabric, plastic, glass fragments, and slight chemical odor - tan, orangish brown, dark gray, and dark brown - moist (FILL)	SS 7		2-3-4 (7)			
25	845.0	▽							
			(CH) **Fat CLAY** - with metal and glass fragments - orangish brown and dark brown - moist (FILL)	SS 8		2-3-4 (7)			
30	840.0								
			(CH) **Fat CLAY** - brown, orangish brown, and tan - very moist - hard (RESIDUUM)	SS 9		2-50/4"			
35	835.0								

Refusal at 37.2 feet.
Bottom of borehole at 37.2 feet.

NOTES:

BORING NUMBER B-2

PROJECT NAME City of Alcoa Building Distress
GEOServices PROJECT# A24109.01521.000
DATE 4/24/24
PROJECT LOCATION 725 Universal Street, Alcoa, Tennessee, 37701
DRILLING CONTRACTOR Southeast Drilling Solutions, LLC
LOGGED BY KSR **ON-SITE REP.** ---
DRILLING METHOD B-51, Auto Hammer
LATITUDE / LONGITUDE ---
GROUND ELEVATION 870 ft **PROPOSED FFE** ---
NORTHING / EASTING ---
REFUSAL Depth 29.9 ft / Elev 840.1 ft
TOP OF ROCK ---
BEGAN CORING ---
FOOTAGE CORED (LF) ---
BOTTOM OF HOLE Depth 29.9 ft / Elev 840.1 ft

GROUND WATER LEVELS:
▽ **AT END OF DRILLING** 7.00 ft / Elev 863.00 ft
AFTER 1 HOUR --- Backfilled
AFTER 24 HOURS --- Backfilled

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX
0	870.0		Asphalt (8 Inches)						
			Basestone (6 Inches)						
			(CL) **Lean CLAY** - with gravel and shale fragments - brown, reddish brown, tan, greenish gray, and dark gray - moist (FILL)	SS 1		3-2-5 (7)			
5	865.0			SS 2		1-2-3 (5)			
		▽		SS 3		1-1-1 (2)			
			(CL) **Gravelly Lean CLAY** - with fabric - brown, tan, and orangish brown - wet (FILL)	SS 4		0-1-8 (9)			
10	860.0								
			(CL) **Lean CLAY** - with glass fragments, organics, paper, fabric, trace gravel, and strong chemical odor - black, reddish brown, tan, and orangish brown - wet (FILL)	SS 5		2-3-3 (6)			
15	855.0								
			(CL) **Lean CLAY** - with metal and trace gravel - tan, orangish brown, black, and brown - wet (FILL)	SS 6		3-3-3 (6)			
20	850.0								

NOTES: 0 = Weight of Hammer

(Continued Next Page)

BORING NUMBER B-2

PROJECT NAME City of Alcoa Building Distress

GEOServices PROJECT# A24109.01521.000

DATE 4/24/24

PROJECT LOCATION 725 Universal Street, Alcoa, Tennessee, 37701

DRILLING CONTRACTOR Southeast Drilling Solutions, LLC

LOGGED BY KSR **ON-SITE REP.** ---

DRILLING METHOD B-51, Auto Hammer

LATITUDE / LONGITUDE ---

GROUND ELEVATION 870 ft **PROPOSED FFE** ---

NORTHING / EASTING ---

REFUSAL Depth 29.9 ft / Elev 840.1 ft

TOP OF ROCK ---

BEGAN CORING ---

FOOTAGE CORED (LF) ---

BOTTOM OF HOLE Depth 29.9 ft / Elev 840.1 ft

GROUND WATER LEVELS:

▽ **AT END OF DRILLING** 7.00 ft / Elev 863.00 ft

AFTER 1 HOUR --- Backfilled

AFTER 24 HOURS --- Backfilled

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX
20	850.0		(CL) **Lean CLAY** - with metal and trace gravel - tan, orangish brown, black, and brown - wet (FILL) *(continued)*						
			Weathered ROCK - shale with clay at depth - light gray, dark gray, and tan - moist to wet - hard (RESIDUUM)						
				SS 7		28-28-29 (57)			
25	845.0								
				SS 8		0-50/1"			

Refusal at 29.9 feet.
Bottom of borehole at 29.9 feet.

NOTES: 0 = Weight of Hammer

BORING NUMBER B-3

PROJECT NAME City of Alcoa Building Distress
GEOServices PROJECT# A24109.01521.000
DATE 4/26/24
PROJECT LOCATION 725 Universal Street, Alcoa, Tennessee, 37701
DRILLING CONTRACTOR Southeast Drilling Solutions, LLC
LOGGED BY KSR **ON-SITE REP.** ---
DRILLING METHOD B-51, Auto Hammer
LATITUDE / LONGITUDE ---
GROUND ELEVATION 870 ft **PROPOSED FFE** ---
NORTHING / EASTING ---
REFUSAL Depth 20.4 ft / Elev 849.6 ft
TOP OF ROCK ---
BEGAN CORING ---
FOOTAGE CORED (LF) ---
BOTTOM OF HOLE Depth 20.4 ft / Elev 849.6 ft

GROUND WATER LEVELS:
AT END OF DRILLING --- Dry
AFTER 1 HOUR --- Backfilled
AFTER 24 HOURS --- Backfilled

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX
0	870.0		Concrete (7.5 Inches)						
			Basestone (6.5 Inches)						
			(CL) **Lean CLAY** - with gravel, shale fragments, and paper - tan, greenish gray, dark brown, and reddish brown - moist (FILL)	SS 1		3-3-4 (7)			
			(CL) **Lean CLAY** - with gravel - greenish gray, dark brown, and reddish brown - moist (FILL)	SS 2		2-6-7 (13)			
5	865.0			SS 3		4-4-5 (9)			
			(CH) **Fat CLAY** - with trace gravel - dark brown and reddish brown - moist (FILL)	SS 4		3-6-8 (14)			
10	860.0								
			(CL) **Lean CLAY** - with gravel and shale fragments - tan, dark brown, and greenish gray - moist (FILL)	SS 5		4-10-12 (22)			
15	855.0								
			(CH) **Fat CLAY** - tan, orangish brown, and brown - moist - firm (RESIDUUM)	SS 6		3-3-3 (6)			
20	850.0								

Refusal at 20.4 feet.
Bottom of borehole at 20.4 feet.

NOTES:

Hand Auger Boring Logs

City of Alcoa Building Distress - Alcoa, TN Date: May 2, 2024
UES Project No. A24109.01521
Personnel: Ibrahim Aklouk, P.E.

Location	Depth (in.)		Material Type	Description	Comments
	from	to			
C-1	0.0	8.0	Surface	Concrete (8 inches)	
	8.0	20.0	Surface	Basestone - slightly moist (12 inches)	Dense.
	20.0	24.0	Soil	Lean CLAY (CL) - with gravel and chemical odor - dark gray, brown, and black - moist	Firm.
		24.0		Hand auger boring terminated at a depth of 24.0 inches.	

Location	Depth (in.)		Material Type	Description	Comments
	from	to			
C-2	0.0	4.0	Surface	Concrete (4 inches)	
	4.0	8.0	Surface	Clayey gravel - brown - wet	
	8.0	13.0	Surface	Basestone - with clay - wet (5 inches)	Dense.
	13.0	24.0	Soil	Lean CLAY (CL) - with gravel - gray, brown, green, and orangish brown - moist to very moist	Soft.
		24.0		Hand auger boring terminated at a depth of 24.0 inches.	

Location	Depth (in.)		Material Type	Description	Comments
	from	to			
C-3	0.0	8.0	Surface	Concrete (8 inches)	
	8.0	17.0	Surface	Basestone - wet (9 inches)	Loose. No Fines.
	17.0	24.0	Soil	Lean CLAY (CL) - with gravel - green, gray, brown, and orangish brown - moist to very moist	Soft to Firm.
		24.0		Hand auger boring terminated at a depth of 24.0 inches.	

Location	Depth (in.)		Material Type	Description	Comments
	from	to			
C-4	0.0	6.5	Surface	Concrete (6.5 inches)	
	6.5	11.0	Surface	Basestone - wet (4.5 inches)	Medium Dense.
	11.0	18.0	Soil	Lean CLAY (CL) - with gravel - green, gray, brown, black, and orangish brown - moist to very moist	Firm.
		18.0		Hand auger boring terminated at a depth of 18.0 inches.	