REPORT OF GEOTECHNICAL EXPLORATION
COLLIER PROJECT NO. 3049-19-01
December 4, 2019

PROPOSED BUCKNER ROAD EXTENSION
BETWEEN BUCKNER LANE AND US 431 (LEWISBURG PIKE)
Thompson's Station, Tennessee

Volkert, Inc.
Franklin, Tennessee

These services were performed in general accordance with our approved Scope of Services dated July 9, 2019 and the executed Agreement dated July 31, 2019. The report is prepared for the exclusive use of Volkert, Inc. (Volkert). Use or reliance by any other party is prohibited without the written authorization of Volkert and Collier.

J. Samuel Vance, P.E.
Geotechnical Manager
Tennessee No. 102042

Nathan A. Couch, E.I.
Staff Engineer

COLLIER ENGINEERING CO., INC.
CONSULTING • DESIGN • CONSTRUCTION

2949 Nolensville Pike
Nashville, TN 37211
615.331.1441
www.collierengineering.com

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APPENDIX

PROJECT/ SITE DESCRIPTION

Proposed Improvements

The project includes a new roughly 2.3 mile long roadway between Buckner Lane and US 431 (Lewisburg Pike) in Thompson's Station, Tennessee. A depiction of the conceptual alignment (which was provided to us by you) is illustrated on Exhibit 1. We understand the alignment will exhibit a 4-lane configuration with ample shoulders, and a diverging diamond interchange with Interstate 65. Due to the preliminary nature of the project, cut and fill dimensions are undetermined.

Existing Conditions

Conditions along the route and bracketing the I-65 corridor include farmland with some woodland. Areas west of I-65 include essentially open and tilled fields and sporadic trees along fences, in clusters, or along stream beds. The interstate corridor is framed by short stretches of steep ground blanketed with dense woods. Surface expressions east of I-65 include weed or grass covered fields between wooded areas comprising deep, steeply inclined hollows or ridge flanks. Buckner Lane (west end of project) and US 431 (east end of project) are paved two lane, north-south corridors containing narrow shoulders and perceptibly adequate ditching at the planned areas of intersection. Pavement conditions at/near these road intersections were explored with shallow cores (see Exhibits 55 through 59).

Terrain west of I-65 (noted on Exhibits 1 and 2) along the proposed alignment includes gently rolling and predominately open row crop fields. Clumps or rows of trees exist along fences and near the I-65 right of way (ROW). The west side alignment traverses two small north-to-south streams including an unnamed creek adjacent to the fenced I-65 ROW and Aenon Creek about 1,100 feet west of the interstate. The streams contained flow at the time of the field work. A farm pond is located in/near a treed area between the streams. Areas west of the Interstate were explored with borings B-34 through B-49 (Exhibits 2 and 39 through 54).

At the location of the proposed interchange, the fenced Interstate 65 ROW is about 300 feet wide and the median is ditched and appears well drained. Beginning at and extending beyond the edge of the west shoulder guard rail, the heavily wooded ground surface is inclined steeply downward to the creek over a distance of just over 100 feet. Nearly 25 feet of near level, open ground is located beyond the east shoulder. From this point the ground is sloped steeply upward across densely wooded terrain over an estimated distance of 75 feet. A private graveled drive runs alongside and east of the I-65 ROW as noted on Exhibit 3. The interchange footprint was drilled using borings B-16 through B-33 (Exhibits 3 and 21 through 38)

Private farms comprise the land east of I-65. These areas include rolling, weed and grass covered fields amid sections of steep, wooded hollows containing abundant mature trees, as noted on Exhibit 4. As shown on that exhibit, existing water bodies along the route include a pond just northeast of boring B-9 and a stream bed (contained flowing water at the time of drilling) between borings B-2 and B-3. Borings B-1 through B-15 were used to explore near surface conditions east of Interstate 65 (Exhibits 4 and 6 through 20).

SUBSURFACE CONDITIONS

Forty-nine (49) soil borings were utilized to explore near surface conditions along the route. Except for borings slated for rock coring at the proposed interchange bridge, borings were terminated at a maximum depth of 15 feet unless refusal was encountered at shallower depth. The borings were positioned in open and easily accessible areas at roughly 200 to 300 foot spacing where permitted by terrain and surface conditions. As noted in previous text and as discussed for the various portions of the alignment/project in the following text, fifteen borings were drilled for the alignment east of I-65, eighteen borings were drilled for the interchange including ramps, walls, and planned abutments and a center pier, and sixteen borings were drilled for the alignment west of I-65. Rock coring was performed at each pair of borings positioned at/near the planned bridge structures.

Conditions encountered at each boring are indicated on the appended individual logs. Results of related laboratory testing are indicated thereon at appropriate strata and/or as stand alone exhibits. Stratification boundaries on the boring logs represent the perceived strata change between differing soil types; in situ, the transition may be more gradual than abrupt. A discussion of field sampling and laboratory testing procedures are included in Exhibit 79.

Exploration

Alignment East of Interstate 65 (Borings B-1 to B-15)

At the locations explored, these borings encountered relatively thin topsoil and root mat less than about 6 inches in maximum thickness (note: the landowners relayed verbally that these fields had been historically used for livestock grazing and hay production, as opposed to row crop planting and tilling). Beneath the thin topsoil cover, the associated borings, with some exceptions, typically encountered residual, lean, phosphatic clay extending to the exploration depths. The exceptions include a thick layer of alluvial sediment along the creek bottom at boring B-2, and a relatively thin layer of suspected, surficial fill at boring B-15. Six of these 15 borings encountered auger refusal at depths ranging from about 8 feet to approximately 13½ feet, as noted in the following table.

SUMMARY OF REFUSL DEPTHS, BORINGS B-1 TO B-15 (alignment east of I-65)					
Boring #	**Refusal, ft.**	**Boring #.**	**Refusal, ft.**	**Boring #**	**Refusal, ft.**
B-1	NR 15 [1]	B-6	NR 15	B-11	11½
B-2	13½	B-7	NR 15	B-12	8½
B-3	NR 15	B-8	NR 15	B-13	8
B-4	NR 15	B-9	13	B-14	8½
B-5	NR 15	B-10	15 [2]	B-15	NR 15

1. NR 15 means no refusal, boring terminated at a depth of 15 feet.
2. Weathered rock initially encountered at 13½ feet, this material was power augured to a depth of 15 feet.

Interstate 65 Interchange Ramps, Walls, and Bridge Structure (Borings B-16 to B-33)

Typically thin (less than about 6 inches) topsoil was encountered at the eastside ramp and wall borings (B-16 to B-21). A relatively thin and discontinuous layer of apparent, exiting surficial fill was noted at all the eastside ramp and wall borings except boring B-20. Below the surface materials, the eastside ramp and wall borings encountered residual, lean phosphatic clay to the limits of exploration. Of the six eastside ramp borings, only boring B-17 encountered refusal (about 13½ feet) while the others were terminated at the planned maximum exploration depth of 15 feet.

Six borings (B22 to B-27) were drilled to auger refusal and extended into bedrock by coring at/near locations of the planned abutments and center pier for the proposed bridge. Existing fill ranging from about 3 feet to approximately 10½ feet (the top of bedrock) was encountered at each of these borings. Residual lean phosphatic clay of varying thickness was encountered below the fill at two of the bridge borings. Top of bedrock was noted at depths of 8 to 12 feet at borings B-22 through B-27. Recovery and Rock Quality Designation (RQD) values were typically high (about 90 to 100 percent) for the recovered core. In addition, unconfined compressive strength test results on three specimens averaged greater than 21,000 psi.

Ramp and wall borings west of (B-28 through B-33) were mostly situated in a harvested field. Boring B-28 was located in a weed covered field that isn't typically plowed or farmed, as reported by the property manager. The generalized subsurface profile at these borings, with some exceptions, consists of residual, lean, phosphatic clay that extends to the limits of exploration. Exceptions include horizons of high plasticity residual clay that were encountered at depth below upper intervals of lean phosphatic clay at borings B-31 through B-33. Each of this group of borings refused at depths ranging from 5½ feet (boring B-29) to 14½ feet (boring B-28).

A brief summary of wall and ramp borings for the interchange is noted below. Data from the bridge borings are tabularized on Page 5.

SUMMARY OF WALL AND RAMP BORINGS AT I-65 INTERCHANGE					
Eastside Ramps and Walls			Westside Ramps and Walls		
Boring #	Refusal, ft.	Existing fill, ft.	Boring #	Refusal, ft.	Existing fill, ft.
B-16	NR 15 [1]	3	B-28	14½	-
B-17	13½	3	B-29	5½	-
B-18	NR 15	3	B-30	8	-
B-19	NR 15	3	B-31	14	-
B-20	NR 15	-	B-32	9½	-
B-21	NR 15	2	B-33	10½	-

1. NR 15 means no refusal, boring terminated at a depth of 15 feet.

SUBSURFACE CONDITIONS

SUMMARY OF BRIDGE STRUCTURE BORINGS (B-22 through B-27)				
Boring #	**Existing fill, ft.**	**Refusal, ft.**	**Core Info**	**Unconfined compressive strength (Qu) result, psi**
B-22	5	12	10 LF; Recovery = 91%, RQD = 91%	-
B-23	5	12	10 LF; Recovery = 91%, RQD = 89%	21,340
B-24	10½	10½	10 LF; Recovery = 95%, RQD = 95%	21,670
B-25	10½ [1]	10½ [1]	4½ LF; Recovery = 100%, RQD = 100%	-
B-26	3	8	10 LF; Recovery = 99%, RQD = 89%	21,710
B-27	8	11½ / 9 [2]	10 LF; Recovery = 100%, RQD = 95%	-

1. Coring was initiated at a depth of 3 feet upon auger refusal. Coring penetrated through 10½ feet of clay fill with boulders and the top of bedrock was encountered at noted depth. The engineer terminated the coring at depth upon the recovery of excellent rock within the stipulated depth.
2. Because of boulders in the upper subsurface profile and the resulting out-of-plumb borehole, coring was not performed in the original hole. Rock was cored in an offset hole (auger refusal occurred at a depth of 9 feet).

Alignment West of I-65 (Borings B-34 through B-49)

Except for borings B-36, B-37, and B-38, this group of borings were staked in recently harvested fields that are perennially used for row crop farming, according to the property manager. Boring B-36 was situated in untilled, topographically low ground near Aenon Creek. Borings B-37 and B-38 were positioned in moderately sloping grass pasture with scattered trees that is currently used for cattle grazing.

With some exceptions, the generalized near-surface profile at these borings, with some exceptions, consists of residual, lean, phosphatic clay that extends to the limits of exploration. Exceptions include dark brown, silty alluvial soil at boring B-36, which is located within the overbank or flood plain of the adjacent Aenon Creek. In addition, a horizon of high plasticity residual clay was encountered at depth below the upper interval of lean phosphatic clay at boring B-34. Similar high plasticity clay constitutes the full subsurface profile at boring B-35 (below topsoil). Further, an upper mantle of lean clay, generally absent of phosphate, was encountered above phosphatic clay at depth at borings B-44 through B-49. Twelve of these 16 borings refused at depths ranging from 6 feet (boring B-36) to 13½ feet (boring B-46).

A summary of exploration and refusal depths, where noted, is presented on Page 6 for borings B-34 through B-49.

SUMMARY OF REFUSL DEPTHS, BORINGS B-34 TO B-49 (alignment east of I-65)					
Boring #	**Refusal, ft.**	**Boring #.**	**Refusal, ft.**	**Boring #**	**Refusal, ft.**
B-34	12	B-40	NR 15 [1]	B-46	13½
B-35	11½	B-41	10	B-47	NR 15
B-36	6	B-42	13	B-48	13
B-37	9	B-43	NR 15	B-49	13
B-38	12	B-44	NR 15	-	-
B-39	9	B-45	13	-	-

1. NR 15 means no refusal, boring terminated at a depth of 15 feet.

Auger Refusal Discussion

Auger refusal is defined as the depth below the ground surface at which a test boring can no longer be advanced with the soil drilling technique being used. In man-made fill, as noted above, refusal could occur on hard items in the fill such as boulders or debris. In limestone geology, auger refusal can result on limestone suspended in the residual soil matrix ("floaters"), on rock "pinnacles" or knobs rising above the surrounding bedrock surface, in widened joints that may extend well below the surrounding bedrock surface, or on the upper surface of continuous bedrock.

Groundwater

The boreholes were checked for groundwater. With two exceptions, no water was observed in the borings while drilling, or for the short period between tool extraction and backfilling. Groundwater was noted in boring B-36 at a depth of 2 feet after completion (this boring was situated in a low area adjacent to Aenon Creek). In addition, groundwater was noted at the refusal surface (presumably the upper weathered bedrock surface) at boring B-46 upon completion. Field work for borings B-1 through B-25 was performed during a dry period in September 2019. The remaining borings were drilled in November 2019 during a generally normal, wet season.

Geology

As shown on Exhibit 5, near-surface, mapped geology for the project corridor spans adjacent quadrangles. The extreme west end of the project is mapped on the 1963 *Geologic Map of the Spring Hill Quadrangle, Tennessee* (web-based *National Geologic Map Database* as maintained by the USGS). The balance of the site falls within the west portion of the 1963 *Geologic Map of the Bethesda Quadrangle, Tennessee*, per the internet source. The literature suggest this site is underlain by Ordovician Age limestone of three units, which are (lowest to highest in this lithology) the Carters Formation, the Hermitage Formation, and the Bigby Cannon Formation.

Occupying the topographically lower areas of the project near the I-65 corridor and the mentioned stream beds is relatively pure limestone of the Carters Formation (Oc symbol on the map). This unit is mapped below approximately El. 780, as noted on Exhibit 5. This unit is described as having three units including a

thin (about 5 feet) interval of thin bedded, shaly upper unit, a middle layer of 6 to 12 inch thick bentonite, and a prominent lower member of medium to thick bedded, fine to coarse grained, occasionally cherty limestone. The Carters Formation typically weathers to form a mantle of yellow brown plastic clay, and the high plasticity interval noted in lower reaches of some borings as discussed previously is believed to have been generated from the in-place weathering of the Carters bedrock.

Mapped above approximately El. 780 across essentially the remainder of the footprint is variably phosphatic, thin to medium bedded, sandy, shaly, fossiliferous limestone of the Hermitage Formation (Oh symbol on the map). This argillaceous rock is characterized by three facies including the upper, often absent but conspicuously thin where present, Coquina member, the middle Laminated member (most prominent of the Hermitage units, 50 to 85 feet thick), and a rare lower member, Curdsville Limestone, that is only mapped to about 5 feet in maximum thickness.

As noted on Exhibit 5, a very short section of the west end of planned alignment traverses the edge of a mapped section of Bigby Cannon Limestone (symbol Obc). This rock is mapped with three units including (top to bottom) the Cannon facies, Dove-colored Limestone, and Bigby facies. The upper and middle, Cannon and Dove-colored rock units are often absent but are mapped locally with thicknesses up to 40 feet and 35 feet, respectively. Those units are thin to medium bedded and cryptocrystalline to medium grained. The lower Bigby unit is medium bedded and highly phosphatic.

Geologic Hazards

The site is underlain by carbonate limestone that is susceptible to dissolution along joints and bedding planes in the rock mass. This results in voids and solution channels within the rock strata and a highly irregular bedrock surface. The weathering of the bedrock and subsequent collapse or erosion of the overburden into these openings results in what is referred to as karst topography. The risk of sinkhole development is inherent in this setting and cannot be eliminated.

Available topographic and geologic mapping shows several closed depressions near the alignment. In particular, two rather large depressions are mapped just south of the west end of the alignment, as noted on Exhibit 5. Further, small clusters of mapped closed depressions are noted north of the east end of the corridor near US 431. Borings drilled for this commission did not disclose any obvious signs of apparent karst-related soil softening or impending overburden collapse.

Illustrated for emphasis on Exhibit 5 is an active strip mine that was mapped for the 1963 literature. The phosphate mineral that is generated at the surface of the Bigby limestone was once mined extensively in Williamson and Maury Counties due to its concentration and quality. The operation typically included generation of open mine areas to expose the concentrated pellets or flakes along bedrock joints and fractures, and amid pinnacles and knobs of rock across the irregular, upper bedrock surface. Once the material was extracted by hand, restoration would include mass backfill of previously generated spoil into the pits, and routinely without engineering controls to confirm that fill was adequately compacted or that it was free of deleterious matter (boulders, organics, etc.). The geotechnical hazard of such practice involves

the risk of excessive differential settlement of ground-based or supported elements built upon these deposits of low strength soil fill. The property manager reported that his father lived on the property during the onsite mining and confirmed the operations were generally restricted to the mapped limits noted on Exhibit 5. Moreover, he stated that the existing lakes shown on Exhibit 1 resulted from mine pits that were left open and not backfilled. The property manager stated that no other areas of the property were reportedly mined or even prospected, to his knowledge.

Natural soils containing variable levels of phosphate were encountered in our borings. Phosphate tends to hold excess moisture and reduce the soil's strength, and above normal effort could be required to stabilize these soils and obtain adequate density. Phosphatic soils could be encountered at/near finished subgrades in some areas of the project.

Pavement Cores

Existing pavement of Buckner Lane and US 431 was sampled at/near the locations of planned intersections with these roads. Details of approximate core locations and core information including photographs are presented in appended Exhibits 55 through 59. The data are summarized in brief below.

Core # / Location	Asphalt Concrete Thickness, in.	Mineral Aggregate Thickness, in.
C-1, Buckner Lane, southbound	9⅝	4½
C-2, Buckner Lane, northbound	11½	4½
C-3, US 431, southbound	6⅞	9¾
C-4, US 431, northbound	7¼	9¼

LABORATORY TESTING

Laboratory Testing

Soil Classification

Thirteen samples were subjected to a suite of laboratory testing to determine AASHTO Classification. The testing included Atterberg Limits, hydrometer, and gradation analysis to develop the criteria for classification. The results are appended in Exhibits 60 through 72, and are summarized below.

SUMMARY OF CLASSIFICATION TESTING

Boring #	Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	USC Classification	AASHTO Classification
B-3 (bulk)	31	21	10	CL	A-4
B-5 (bulk)	32	21	11	CL	A-6
B-9 (bulk)	36	21	15	CL	A-6
B-11 (bulk)	39	25	14	CL	A-6
B-14 (bulk)	30	19	11	CL	A-6
B-16 (bulk)	30	17	13	CL	A-6
B-18 (bulk)	40	23	17	CL	A-6
B-33 (bulk)	40	22	18	CL	A-6
B-38 (bulk)	27	17	10	CL	A-6
B-40 (bulk)	40	21	19	CL	A-6
B-43 (bulk)	38	22	16	CL	A-6
B-45 (bulk)	38	20	18	CL	A-6
B-47 (bulk)	39	20	19	CL	A-6

Moisture Density and Support Characteristics Testing

Bulk samples from multiple borings were combined and analyzed for moisture density relationship (standard Proctor) and California Bearing Ratio (CBR) parameters. The results are presented graphically on appended Exhibits 73 through 78, and are summarized in brief below.

SUMMARY OF MOISTURE DENSITY AND CBR RESULTS

Borings	Maximum Dry Density (pcf)	Optimum Moisture (%)	Liquid Limit (LL)	Plasticity Index (PI)	Estimated CBR [1]
B9/B14	104.9	20	33	13	10
B31/B33	109	17.1	40	22	9
B40/B43/B47	105.9	18.6	39	18	9

1. Estimated value at 98% compaction at optimum moisture. See the appended results sheets for laboratory derived values for comparison of values at different compaction and moisture levels.

GENERAL COMMENTS

The results presented in this report are based upon the data obtained from the exploration performed at the indicated locations, the laboratory testing, and from any other information discussed in this report. This report does not reflect any variations, which may occur between or beyond the points of exploration or across the site. The nature and extent of such variations may not become evident until construction.

We understand a more detailed geotechnical study would be required to formulate specific criteria and parameters for design of foundations and pavements. Such study should include additional borings at tighter spacing than used for this exploration and to depths adequate to understand the materials below the limits of proposed excavation and under the weight of new fill embankments.

The scope of geotechnical services for this project does not include any environmental or biological assessment of the site or existing structures or adjacent properties nor identification or prevention of pollutants, hazardous materials, or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

This report has been prepared for the exclusive use of our client for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices. No warranties, either express or implied, are intended or made. Site safety, excavation support, and dewatering requirements are the responsibility of others. In the event that changes in the nature, design, or location of the project as outlined in this report are planned, the data contained in this report shall not be considered applicable unless Collier reviews the changes and either verifies or modifies the information of this report in writing.

APPENDIX

N

0 400 800 Feet

BUCKNER ROAD

BUCKNER LANE

PROPOSED INTERCHANGE

≈MM 55.4

PROPOSED ALIGNMENT, TYP.

INTERSTATE 65

± 2.5 MILES TO I-840

US 431 / LEWISBURG PIKE

REVISIONS

NO	DATE	BY	DESCRIPTION

COLLIER ENGINEERING CO., INC.
CONSULTING • DESIGN • CONSTRUCTION
2949 NOLENSVILLE PIKE, NASHVILLE TN., 37211
PHONE: (615) 331-1441 FAX: (615) 331-1050

BUCKNER ROAD EXTENSION
GEOTECHNICAL EXPLORATION
VOLKERT, INC.
FRANKLIN, TENNESSEE

DATE: 12/03/2019
DESIGNED BY: JSV
DRAWN BY: NAC
SUPERVISED BY: JSV
CHECKED BY: JSV
SCALE: 1" = 400'

PROJECT LOCATION MAP

SHEET NO: **EXH. 1**

REVISIONS

NO	DATE	BY	DESCRIPTION

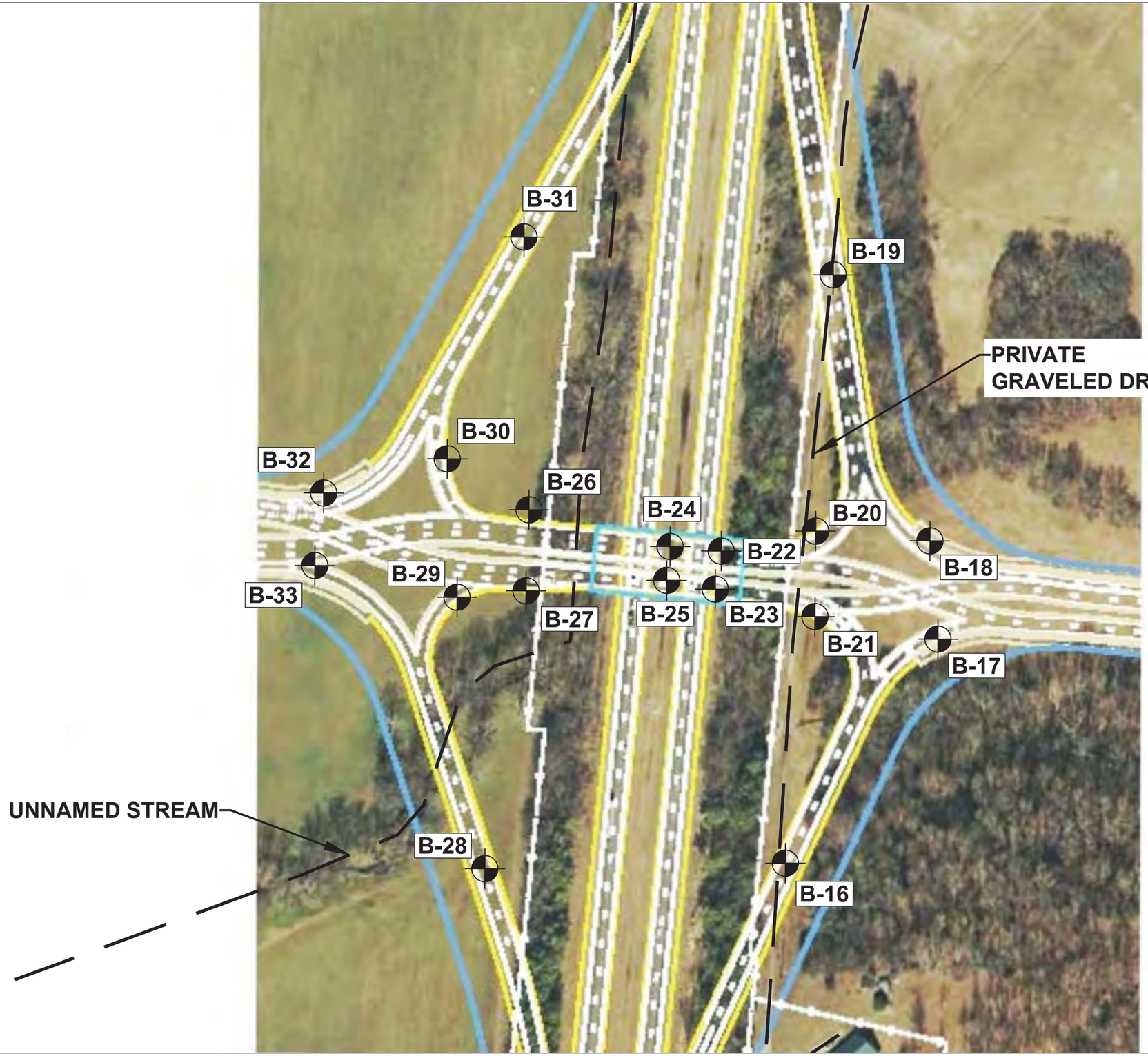
COLLIER ENGINEERING CO., INC.
CONSULTING • DESIGN • CONSTRUCTION
2949 NOLENSVILLE PIKE, NASHVILLE TN., 37211
PHONE: (615) 331-1441 FAX: (615) 331-1050

BUCKNER ROAD EXTENSION
GEOTECHNICAL EXPLORATION
VOLKERT, INC.
FRANKLIN, TENNESSEE

DATE: 12/03/2019
DESIGNED BY: JSV
DRAWN BY: NAC
SUPERVISED BY: JSV
CHECKED BY: JSV
SCALE: 1" = 400'

BORING LOCATION PLAN (W)

SHEET NO: **EXH. 2**



N

0 400 800 Feet

REVISIONS

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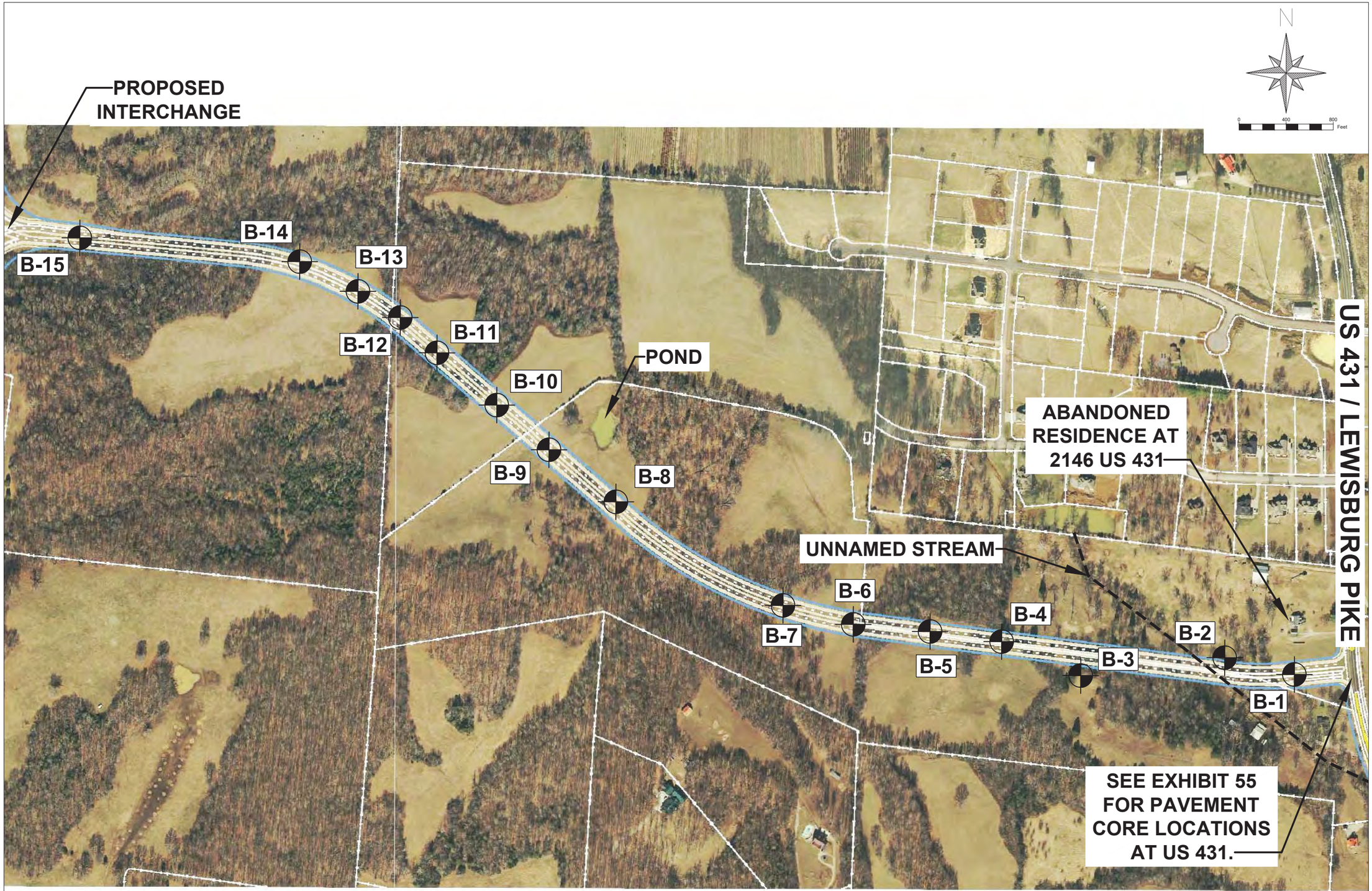
COLLIER ENGINEERING CO., INC.
CONSULTING • DESIGN • CONSTRUCTION
2949 NOLENSVILLE PIKE, NASHVILLE TN., 37211
PHONE: (615) 331-1441 FAX: (615) 331-1050

BUCKNER ROAD EXTENSION
GEOTECHNICAL EXPLORATION
VOLKERT, INC.
FRANKLIN, TENNESSEE

DATE: 12/03/2019
DESIGNED BY: JSV
DRAWN BY: NAC
SUPERVISED BY: JSV
CHECKED BY: JSV
SCALE: 1" = 400'

BORING LOCATION PLAN (INTERCHANGE)

SHEET NO: **EXH. 3**



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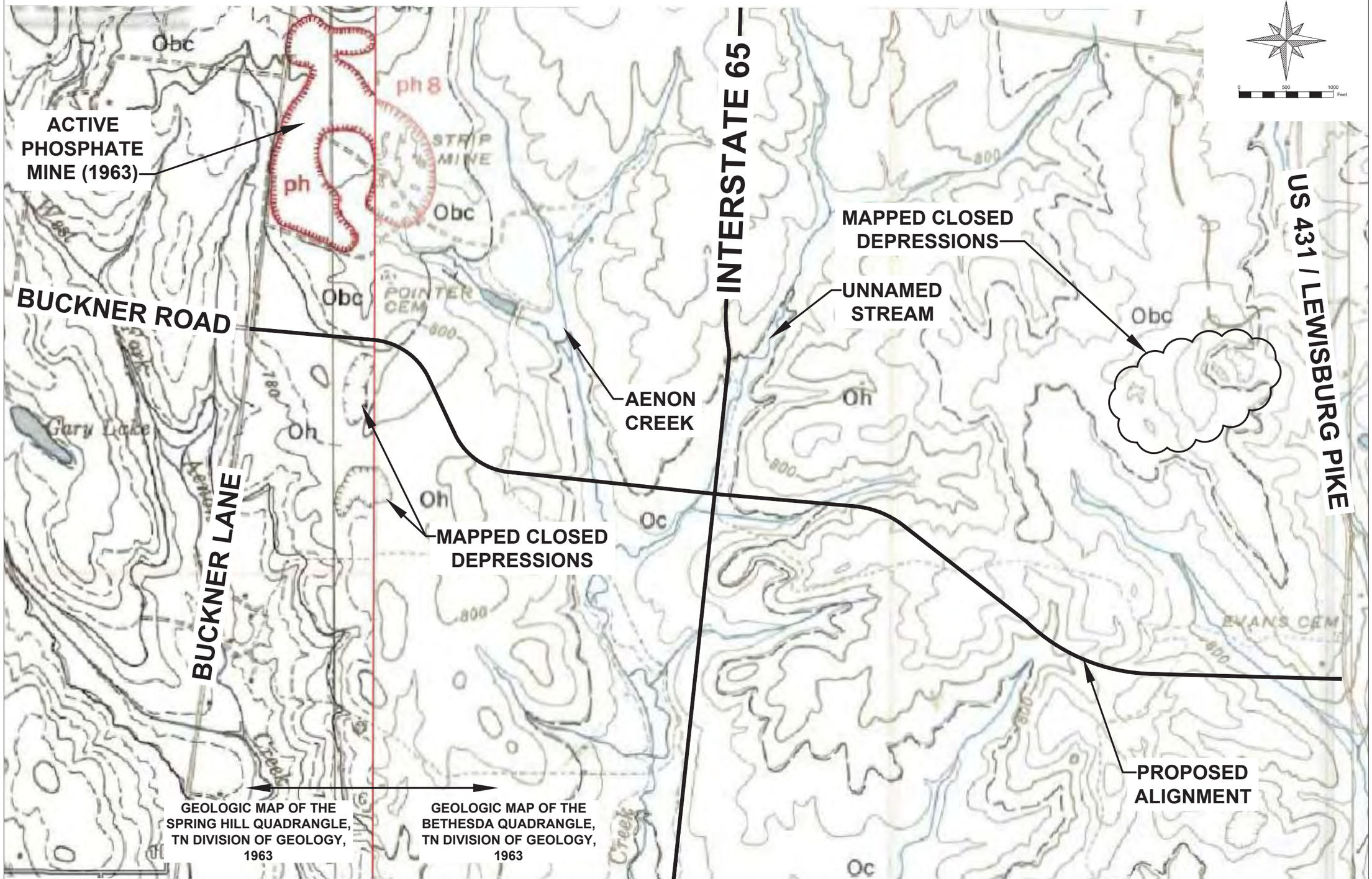
COLLIER ENGINEERING CO., INC.
CONSULTING • DESIGN • CONSTRUCTION
2949 NOLENSVILLE PIKE, NASHVILLE TN., 37211
PHONE: (615) 331-1441 FAX: (615) 331-1050

BUCKNER ROAD EXTENSION
GEOTECHNICAL EXPLORATION
VOLKERT, INC.
FRANKLIN, TENNESSEE

DATE: 12/03/2019
DESIGNED BY: JSV
DRAWN BY: NAC
SUPERVISED BY: JSV
CHECKED BY: JSV
SCALE: 1" = 400'

BORING LOCATION PLAN (E)

SHEET NO: **EXH. 4**



REVISIONS

NO	DATE	BY	DESCRIPTION

COLLIER ENGINEERING CO., INC.
CONSULTING & DESIGN CONSTRUCTION
2949 NOLENSVILLE PIKE, NASHVILLE TN., 37211
PHONE: (615) 331-1441 FAX: (615) 331-1050

BUCKNER ROAD EXTENSION
GEOTECHNICAL EXPLORATION
VOLKERT, INC.
FRANKLIN, TENNESSEE

DATE: 12/03/2019
DESIGNED BY: JSV
DRAWN BY: NAC
SUPERVISED BY: JSV
CHECKED BY: JSV
SCALE: 1" = 500'

GEOLOGY

SHEET NO: EXH. 5

COLLIER ENGINEERING CO., INC.
CONSULTING • DESIGN • CONSTRUCTION

2949 Nolensville Pike
Nashville, Tennessee 37211

LOG OF BORING B-1

Project Name: Buckner Road Extension
Site Location: Thompson's Station, TN
Collier Project Number: 3049-19-01
Client: Volkert, Inc.
Franklin, TN

Location: See Exhibit 4
*Latitude/Longitude: 35° 46' 13" / -86° 50' 36"
*Surface elevation:
* see remarks below

Depth (ft.)	Elevation (ft.)	Material Description	Depth	Groundwater	Sample type	SPT blow counts (N-value)	Laboratory hand penetrometer (psf)	Water content (%)	Dry unit weight (pcf)	Unconfined compressive strength (psf)	Atterberg Limits LL-PL-PI
		~3 inch root mat with scant topsoil	<½								
		Lean clay (CL), silty, sandy, mottled red brown/light brown/dark brown/light grey, stiff to very stiff			X	5-5-6 (11)		14			
5	-				X	27-10-6 (16)		18			
		Phosphatic with trace of weathered sandstone fragments below 6 feet			X	7-7-9 (16)		30			
10	-				X	7-8-9 (17)		26			
			15		X	5-7-7 (14)		23			
15	-	*Boring terminated at 15 feet*									
20	-										
25	-										
30	-										

Date started/completed:	**September 19, 2019**
Drilled by:	**Tri-State Drilling**
Drill rig:	**Dietrich D-50**
Hammer type:	**Autohammer**
Driller:	**D. King**
Water while drilling:	**Dry**
Water upon completion:	**Dry**
Borehole advanced by:	**Hollow stem auger**
Borehole abandoned by:	**Soil cuttings**

Remarks: Latitude/longitude data is an estimate and was obtained via approximation of the intended boring location on Google® aerial image map with reference to the horizontal alignment depicted on aerial mapping as provided by Volkert. The boring was positioned using a smart-phone app that utilizes device GPS, cell signals, and WiFi to assess location, and the position was cross referenced/checked in the field with the information provided by Volkert. Ground surface elevation was not available and is omitted from the log.

Soil descriptions are based on visual examination of the recovered samples. Stratification lines represent the inferred boundary between soil types. Insitu, the transition may be gradual.

COLLIER ENGINEERING CO., INC.
CONSULTING • DESIGN • CONSTRUCTION

2949 Nolensville Pike
Nashville, Tennessee 37211

LOG OF BORING B-2

Project Name: Buckner Road Extension
Site Location: Thompson's Station, TN
Collier Project Number: 3049-19-01
Client: Volkert, Inc.
Franklin, TN

Location: See Exhibit 4
*Latitude/Longitude: 35° 46' 13" / -86° 50' 42"
*Surface elevation:
* see remarks below

Depth (ft.)	Elevation (ft.)	Material Description	Depth	Groundwater	Sample type	SPT blow counts (N-value)	Laboratory hand penetrometer (psf)	Water content (%)	Dry unit weight (pcf)	Unconfined compressive strength (psf)	Atterberg Limits LL-PL-PI
		~3 inch root mat with scant topsoil	<½								
		Lean clay (CL), silty, sandy, brown, trace of gravel (alluvial soil along natural drainage swale), stiff	4			4-4-4 (8)		17			
5	-	Lean clay (CL), sandy, dark grey (alluvial soil along natural drainage swale), soft to medium stiff	8			6-2-2 (4) 2-2-3 (5)		15 29			
10	-	Lean clay (CL), sandy, phosphatic, mottled red brown/light brown/dark brown/light grey, stiff	13½			3-4-6 (10)		19			
15	-	*Auger refusal at 13½ feet*									
20	-										
25	-										
30	-										

Date started/completed: **September 19, 2019**
Drilled by: **Tri-State Drilling**
Drill rig: **Dietrich D-50**
Hammer type: **Autohammer**
Driller: **D. King**
Water while drilling: **Dry**
Water upon completion: **Dry**
Borehole advanced by: **Hollow stem auger**
Borehole abandoned by: **Soil cuttings**

Remarks: Latitude/longitude data is an estimate and was obtained via approximation of the intended boring location on Google® aerial image map with reference to the horizontal alignment depicted on aerial mapping as provided by Volkert. The boring was positioned using a smart-phone app that utilizes device GPS, cell signals, and WiFi to assess location, and the position was cross referenced/checked in the field with the information provided by Volkert. Ground surface elevation was not available and is omitted from the log.

Soil descriptions are based on visual examination of the recovered samples. Stratification lines represent the inferred boundary between soil types. Insitu, the transition may be gradual.

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Nashville, Tennessee 37211

LOG OF BORING B-3

Project Name: Buckner Road Extension
Site Location: Thompson's Station, TN
Collier Project Number: 3049-19-01
Client: Volkert, Inc.
Franklin, TN

Location: See Exhibit 4
*Latitude/Longitude: 35° 46' 13" / -86° 50' 48"
*Surface elevation:
* see remarks below

Depth (ft.)	Elevation (ft.)	Material Description	Depth	Groundwater	Sample type	SPT blow counts (N-value)	Laboratory hand penetrometer (psf)	Water content (%)	Dry unit weight (pcf)	Unconfined compressive strength (psf)	Atterberg Limits LL-PL-PI
		~3 inch root mat with scant topsoil	<½								
		Lean clay (CL), silty, sandy, mottled red brown/light brown/dark brown/light grey, phosphatic below 3 feet, stiff to very stiff			X	7-7-7 (14)		15			
5	-				X	4-6-6 (12)		23			Bulk sample 31-21-10
					X	4-7-5 (12)		23			
10	-				X	5-9-13 (22)		23			
15	-		15		X	4-4-8 (12)		25			
		Boring terminated at 15 feet									
20	-										
25	-										
30	-										

Date started/completed: **September 20, 2019**
Drilled by: **Tri-State Drilling**
Drill rig: **Dietrich D-50**
Hammer type: **Autohammer**
Driller: **D. King**
Water while drilling: **Dry**
Water upon completion: **Dry**
Borehole advanced by: **Hollow stem auger**
Borehole abandoned by: **Soil cuttings**

Remarks: Latitude/longitude data is an estimate and was obtained via approximation of the intended boring location on Google® aerial image map with reference to the horizontal alignment depicted on aerial mapping as provided by Volkert. The boring was positioned using a smart-phone app that utilizes device GPS, cell signals, and WiFi to assess location, and the position was cross referenced/checked in the field with the information provided by Volkert. Ground surface elevation was not available and is omitted from the log.

Soil descriptions are based on visual examination of the recovered samples. Stratification lines represent the inferred boundary between soil types. Insitu, the transition may be gradual.

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Nashville, Tennessee 37211

LOG OF BORING B-4

Project Name: Buckner Road Extension
Site Location: Thompson's Station, TN
Collier Project Number: 3049-19-01
Client: Volkert, Inc.
Franklin, TN

Location: See Exhibit 4
*Latitude/Longitude: 35° 46' 14" / -86° 50' 52"
*Surface elevation:
* see remarks below

Depth (ft.)	Elevation (ft.)	Material Description	Depth	Groundwater	Sample type	SPT blow counts (N-value)	Laboratory hand penetrometer (psf)	Water content (%)	Dry unit weight (pcf)	Unconfined compressive strength (psf)	Atterberg Limits LL-PL-PI
		~3 inch root mat with scant topsoil	<½								
		Lean clay (CL), silty, sandy, mottled red brown/light brown/dark brown/light grey, phosphatic below 2 feet, stiff to very stiff				4-7-7 (14)		20			
5	-					5-6-5 (11)		31			
						6-7-8 (15)		29			
		Weathered sandstone fragments below 8 feet				3-4-4 (8)		26			
10	-										
			15			3-4-7 (11)		28			
15	-	*Boring terminated at 15 feet*									
20	-										
25	-										
30	-										

Date started/completed: **September 20, 2019**
Drilled by: **Tri-State Drilling**
Drill rig: **Dietrich D-50**
Hammer type: **Autohammer**
Driller: **D. King**
Water while drilling: **Dry**
Water upon completion: **Dry**
Borehole advanced by: **Hollow stem auger**
Borehole abandoned by: **Soil cuttings**

Remarks: Latitude/longitude data is an estimate and was obtained via approximation of the intended boring location on Google® aerial image map with reference to the horizontal alignment depicted on aerial mapping as provided by Volkert. The boring was positioned using a smart-phone app that utilizes device GPS, cell signals, and WiFi to assess location, and the position was cross referenced/checked in the field with the information provided by Volkert. Ground surface elevation was not available and is omitted from the log.

Soil descriptions are based on visual examination of the recovered samples. Stratification lines represent the inferred boundary between soil types. Insitu, the transition may be gradual.

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Nashville, Tennessee 37211

LOG OF BORING B-5

Project Name: Buckner Road Extension
Site Location: Thompson's Station, TN
Collier Project Number: 3049-19-01
Client: Volkert, Inc.
Franklin, TN

Location: See Exhibit 4
*Latitude/Longitude: 35° 46' 14" / -86° 50' 57"
*Surface elevation:
* see remarks below

Depth (ft.)	Elevation (ft.)	Material Description	Depth	Groundwater	Sample type	SPT blow counts (N-value)	Laboratory hand penetrometer (psf)	Water content (%)	Dry unit weight (pcf)	Unconfined compressive strength (psf)	Atterberg Limits LL-PL-PI
		~3 inch root mat with scant topsoil	<½								
		Lean clay (CL), silty, sandy, mottled red brown/light brown/dark brown/light grey, phosphatic below 2 feet, stiff to very stiff				5-6-6 (12)		28			
5	-					4-8-9 (17)		32			Bulk sample 32-21-11
						5-7-7 (14)		21			
						4-5-4 (9)		31			
10	-										
						4-4-6 (10)		30			
15	-		15								
		Boring terminated at 15 feet									
20	-										
25	-										
30	-										

Date started/completed: **September 20, 2019**
Drilled by: **Tri-State Drilling**
Drill rig: **Dietrich D-50**
Hammer type: **Autohammer**
Driller: **D. King**
Water while drilling: **Dry**
Water upon completion: **Dry**
Borehole advanced by: **Hollow stem auger**
Borehole abandoned by: **Soil cuttings**

Remarks: Latitude/longitude data is an estimate and was obtained via approximation of the intended boring location on Google® aerial image map with reference to the horizontal alignment depicted on aerial mapping as provided by Volkert. The boring was positioned using a smart-phone app that utilizes device GPS, cell signals, and WiFi to assess location, and the position was cross referenced/checked in the field with the information provided by Volkert. Ground surface elevation was not available and is omitted from the log.

Soil descriptions are based on visual examination of the recovered samples. Stratification lines represent the inferred boundary between soil types. Insitu, the transition may be gradual.

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LOG OF BORING B-6

Project Name: Buckner Road Extension
Site Location: Thompson's Station, TN
Collier Project Number: 3049-19-01
Client: Volkert, Inc.
Franklin, TN

Location: See Exhibit 4
*Latitude/Longitude: 35° 46' 15" / -86° 51' 0"
*Surface elevation:
* see remarks below

Depth (ft.)	Elevation (ft.)	Material Description	Depth	Groundwater	Sample type	SPT blow counts (N-value)	Laboratory hand penetrometer (psf)	Water content (%)	Dry unit weight (pcf)	Unconfined compressive strength (psf)	Atterberg Limits LL-PL-PI
		~3 inch root mat with scant topsoil	<½								
		Lean clay (CL), silty, sandy, mottled red brown/light brown/dark brown/light grey, stiff to very stiff				5-6-6 (12)		11			
5	-					4-8-9 (17)		18			
						5-7-7 (14)		16			
						4-5-4 (9)		20			
10	-	Phosphatic below 10 feet with trace of weathered sandstone fragments									
			15			4-4-6 (10)		26			
15	-	*Boring terminated at 15 feet*									
20	-										
25	-										
30	-										

Date started/completed:	**September 20, 2019**
Drilled by:	**Tri-State Drilling**
Drill rig:	**Dietrich D-50**
Hammer type:	**Autohammer**
Driller:	**D. King**
Water while drilling:	**Dry**
Water upon completion:	**Dry**
Borehole advanced by:	**Hollow stem auger**
Borehole abandoned by:	**Soil cuttings**

Remarks: Latitude/longitude data is an estimate and was obtained via approximation of the intended boring location on Google® aerial image map with reference to the horizontal alignment depicted on aerial mapping as provided by Volkert. The boring was positioned using a smart-phone app that utilizes device GPS, cell signals, and WiFi to assess location, and the position was cross referenced/checked in the field with the information provided by Volkert. Ground surface elevation was not available and is omitted from the log.

Soil descriptions are based on visual examination of the recovered samples. Stratification lines represent the inferred boundary between soil types. Insitu, the transition may be gradual.

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LOG OF BORING B-7

Project Name: Buckner Road Extension
Site Location: Thompson's Station, TN
Collier Project Number: 3049-19-01
Client: Volkert, Inc.
Franklin, TN

Location: See Exhibit 4
*Latitude/Longitude: 35° 46' 15" / -86° 51' 4"
*Surface elevation:
* see remarks below

Depth (ft.)	Elevation (ft.)	Material Description	Depth	Groundwater	Sample type	SPT blow counts (N-value)	Laboratory hand penetrometer (psf)	Water content (%)	Dry unit weight (pcf)	Unconfined compressive strength (psf)	Atterberg Limits LL-PL-PI
		~3 inch root mat with scant topsoil	<½								
		Lean clay (CL), silty, sandy, mottled red brown/light brown/dark brown/light grey, trace of rock fragments, stiff to very stiff				18-21/50-0"		27			
5	-					7-9-7 (16)		23			
						8-9-10 (19)		25			
		Phosphatic below 8 feet with trace of weathered sandstone fragments				4-6-6 (12)		26			
10	-										
			15			3-5-5 (10)		28			
15	-	*Boring terminated at 15 feet*									
20	-										
25	-										
30	-										

Date started/completed:	**September 20, 2019**
Drilled by:	**Tri-State Drilling**
Drill rig:	**Dietrich D-50**
Hammer type:	**Autohammer**
Driller:	**D. King**
Water while drilling:	**Dry**
Water upon completion:	**Dry**
Borehole advanced by:	**Hollow stem auger**
Borehole abandoned by:	**Soil cuttings**

Remarks: Latitude/longitude data is an estimate and was obtained via approximation of the intended boring location on Google® aerial image map with reference to the horizontal alignment depicted on aerial mapping as provided by Volkert. The boring was positioned using a smart-phone app that utilizes device GPS, cell signals, and WiFi to assess location, and the position was cross referenced/checked in the field with the information provided by Volkert. Ground surface elevation was not available and is omitted from the log.

Soil descriptions are based on visual examination of the recovered samples. Stratification lines represent the inferred boundary between soil types. Insitu, the transition may be gradual.

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LOG OF BORING B-8

Project Name:	Buckner Road Extension
Site Location:	Thompson's Station, TN
Collier Project Number:	3049-19-01
Client:	Volkert, Inc.
	Franklin, TN

Location: See Exhibit 4
*Latitude/Longitude: 35° 46' 19" / -86° 51' 13"
*Surface elevation:
* see remarks below

Depth (ft.)	Elevation (ft.)	Material Description	Depth	Groundwater	Sample type	SPT blow counts (N-value)	Laboratory hand penetrometer (psf)	Water content (%)	Dry unit weight (pcf)	Unconfined compressive strength (psf)	Atterberg Limits LL-PL-PI
0		~3 inch root mat with scant topsoil	<½								
		Lean clay (CL), silty, sandy, mottled red brown/light brown/light grey, phosphatic below 3 feet, stiff to very stiff			X	3-6-7 (13)		20			
5	-				X	9-8-10 (18)		31			
					X	8-8-8 (16)		33			
10	-				X	3-4-5 (9)		29			
15	-		15		X	3-5-4 (9)		29			
		Boring terminated at 15 feet									
20	-										
25	-										
30	-										

Date started/completed:	**September 19, 2019**
Drilled by:	**Tri-State Drilling**
Drill rig:	**Dietrich D-50**
Hammer type:	**Autohammer**
Driller:	**D. King**
Water while drilling:	**Dry**
Water upon completion:	**Dry**
Borehole advanced by:	**Hollow stem auger**
Borehole abandoned by:	**Soil cuttings**

Remarks: Latitude/longitude data is an estimate and was obtained via approximation of the intended boring location on Google® aerial image map with reference to the horizontal alignment depicted on aerial mapping as provided by Volkert. The boring was positioned using a smart-phone app that utilizes device GPS, cell signals, and WiFi to assess location, and the position was cross referenced/checked in the field with the information provided by Volkert. Ground surface elevation was not available and is omitted from the log.

Soil descriptions are based on visual examination of the recovered samples. Stratification lines represent the inferred boundary between soil types. Insitu, the transition may be gradual.

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LOG OF BORING B-9

Project Name: Buckner Road Extension
Site Location: Thompson's Station, TN
Collier Project Number: 3049-19-01
Client: Volkert, Inc.
Franklin, TN

Location: See Exhibit 4
*Latitude/Longitude: 35° 46' 22" / -86° 51' 17"
*Surface elevation:
* see remarks below

Depth (ft.)	Elevation (ft.)	Material Description	Depth	Groundwater	Sample type	SPT blow counts (N-value)	Laboratory hand penetrometer (psf)	Water content (%)	Dry unit weight (pcf)	Unconfined compressive strength (psf)	Atterberg Limits LL-PL-PI
		~3 inch root mat with scant topsoil	<½								
		Lean clay (CL), sandy, mottled red brown/light brown, stiff to very stiff				4-6-6 (12)		11			
5	-					4-6-7 (13)		13			Bulk sample 36-21-15
		Phosphatic below 6 feet				4-5-6 (11)		26			
10	-					9-7-9 (16)		28			
			13								
		Auger refusal at 13 feet									
15	-										
20	-										
25	-										
30	-										

Date started/completed: **September 19, 2019**
Drilled by: **Tri-State Drilling**
Drill rig: **Dietrich D-50**
Hammer type: **Autohammer**
Driller: **D. King**
Water while drilling: **Dry**
Water upon completion: **Dry**
Borehole advanced by: **Hollow stem auger**
Borehole abandoned by: **Soil cuttings**

Remarks: Latitude/longitude data is an estimate and was obtained via approximation of the intended boring location on Google® aerial image map with reference to the horizontal alignment depicted on aerial mapping as provided by Volkert. The boring was positioned using a smart-phone app that utilizes device GPS, cell signals, and WiFi to assess location, and the position was cross referenced/checked in the field with the information provided by Volkert. Ground surface elevation was not available and is omitted from the log.

Soil descriptions are based on visual examination of the recovered samples. Stratification lines represent the inferred boundary between soil types. Insitu, the transition may be gradual.

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LOG OF BORING B-10

Project Name: Buckner Road Extension
Site Location: Thompson's Station, TN
Collier Project Number: 3049-19-01
Client: Volkert, Inc.
Franklin, TN

Location: See Exhibit 4
*Latitude/Longitude: 35° 46' 24" / -86° 51' 19"
*Surface elevation:
* see remarks below

Depth (ft.)	Elevation (ft.)	Material Description	Depth	Groundwater	Sample type	SPT blow counts (N-value)	Laboratory hand penetrometer (psf)	Water content (%)	Dry unit weight (pcf)	Unconfined compressive strength (psf)	Atterberg Limits LL-PL-PI
		~3 inch root mat with scant topsoil	<½								
		Lean clay (CL), silty, sandy, phosphatic, mottled red brown/light brown/light grey, tiff to very stiff				4-5-5 (10)		27			
5	-					29-13-13 (26)		28			
						9-11-11 (22)		26			
10	-					4-7-7 (14)		39			
		No advancement of SPT spoon at 13½ feet	13½								
		Weathered rock, thin bedded limestone									
15	-		15								
		Boring terminated at 15 feet									
20	-										
25	-										
30	-										

Date started/completed:	**September 19, 2019**
Drilled by:	**Tri-State Drilling**
Drill rig:	**Dietrich D-50**
Hammer type:	**Autohammer**
Driller:	**D. King**
Water while drilling:	**Dry**
Water upon completion:	**Dry**
Borehole advanced by:	**Hollow stem auger**
Borehole abandoned by:	**Soil cuttings**

Remarks: Latitude/longitude data is an estimate and was obtained via approximation of the intended boring location on Google® aerial image map with reference to the horizontal alignment depicted on aerial mapping as provided by Volkert. The boring was positioned using a smart-phone app that utilizes device GPS, cell signals, and WiFi to assess location, and the position was cross referenced/checked in the field with the information provided by Volkert. Ground surface elevation was not available and is omitted from the log.

Soil descriptions are based on visual examination of the recovered samples. Stratification lines represent the inferred boundary between soil types. Insitu, the transition may be gradual.

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Nashville, Tennessee 37211

LOG OF BORING B-11

Project Name: Buckner Road Extension
Site Location: Thompson's Station, TN
Collier Project Number: 3049-19-01
Client: Volkert, Inc.
Franklin, TN

Location: See Exhibit 4
*Latitude/Longitude: 35° 46' 26" / -86° 51' 22"
*Surface elevation:
* see remarks below

Depth (ft.)	Elevation (ft.)	Material Description	Depth	Groundwater	Sample type	SPT blow counts (N-value)	Laboratory hand penetrometer (psf)	Water content (%)	Dry unit weight (pcf)	Unconfined compressive strength (psf)	Atterberg Limits LL-PL-PI
		~3 inch root mat with scant topsoil	<½								
		Lean clay (CL), sandy, mottled red brown/light grey/tan, phosphatic, stiff to very stiff, with trace of weathered sandstone fragments				5-8-7 (15)		34			
5	-					3-5-6 (11)		27			Bulk sample 39-25-14
						4-4-4 (8)		27			
10	-					4-5-4 (9)		27			
			11½								
		Auger refusal at 11½ feet									
15	-										
20	-										
25	-										
30	-										

Date started/completed: **September 19, 2019**
Drilled by: **Tri-State Drilling**
Drill rig: **Dietrich D-50**
Hammer type: **Autohammer**
Driller: **D. King**
Water while drilling: **Dry**
Water upon completion: **Dry**
Borehole advanced by: **Hollow stem auger**
Borehole abandoned by: **Soil cuttings**

Remarks: Latitude/longitude data is an estimate and was obtained via approximation of the intended boring location on Google® aerial image map with reference to the horizontal alignment depicted on aerial mapping as provided by Volkert. The boring was positioned using a smart-phone app that utilizes device GPS, cell signals, and WiFi to assess location, and the position was cross referenced/checked in the field with the information provided by Volkert. Ground surface elevation was not available and is omitted from the log.

Soil descriptions are based on visual examination of the recovered samples. Stratification lines represent the inferred boundary between soil types. Insitu, the transition may be gradual.

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LOG OF BORING B-12

Project Name: Buckner Road Extension
Site Location: Thompson's Station, TN
Collier Project Number: 3049-19-01
Client: Volkert, Inc.
Franklin, TN

Location: See Exhibit 4
*Latitude/Longitude: 35° 46' 28" / -86° 51' 24"
*Surface elevation:
* see remarks below

Depth (ft.)	Elevation (ft.)	Material Description	Depth	Groundwater	Sample type	SPT blow counts (N-value)	Laboratory hand penetrometer (psf)	Water content (%)	Dry unit weight (pcf)	Unconfined compressive strength (psf)	Atterberg Limits LL-PL-PI
		~3 inch root mat with scant topsoil	<½								
		Lean clay (CL), sandy, mottled red brown/light grey/tan, phosphatic, stiff to very stiff			X	4-7-7 (14)		29			
5	-				X	3-5-4 (9)		26			
					X	4-4-4 (8)		25			
			8½								
10	-	*Auger refusal at 8½ feet*									
15	-										
20	-										
25	-										
30	-										

Date started/completed: **September 19, 2019**
Drilled by: **Tri-State Drilling**
Drill rig: **Dietrich D-50**
Hammer type: **Autohammer**
Driller: **D. King**
Water while drilling: **Dry**
Water upon completion: **Dry**
Borehole advanced by: **Hollow stem auger**
Borehole abandoned by: **Soil cuttings**

Remarks: Latitude/longitude data is an estimate and was obtained via approximation of the intended boring location on Google® aerial image map with reference to the horizontal alignment depicted on aerial mapping as provided by Volkert. The boring was positioned using a smart-phone app that utilizes device GPS, cell signals, and WiFi to assess location, and the position was cross referenced/checked in the field with the information provided by Volkert. Ground surface elevation was not available and is omitted from the log.

Soil descriptions are based on visual examination of the recovered samples. Stratification lines represent the inferred boundary between soil types. Insitu, the transition may be gradual.

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LOG OF BORING B-13

Project Name:	Buckner Road Extension
Site Location:	Thompson's Station, TN
Collier Project Number:	3049-19-01
Client:	Volkert, Inc.
	Franklin, TN

Location: See Exhibit 4
*Latitude/Longitude: 35° 46' 29" / -86° 51' 29"
*Surface elevation:
* see remarks below

Depth (ft.)	Elevation (ft.)	Material Description	Depth	Groundwater	Sample type	SPT blow counts (N-value)	Laboratory hand penetrometer (psf)	Water content (%)	Dry unit weight (pcf)	Unconfined compressive strength (psf)	Atterberg Limits LL-PL-PI
		~3 inch root mat with scant topsoil	<½								
		Lean clay (CL), silty, very sandy, mottled red brown/light grey/tan/dark brown, phosphatic, stiff to very stiff, with trace of weathered sandstone fragments			X	3-5-6 (11)		24			
5	-				X	16-16-7 (23)		26			
					X	5-7-9 (16)		31			
			8								
		Auger refusal at 8 feet									
10	-										
15	-										
20	-										
25	-										
30	-										

Date started/completed:	**September 23, 2019**
Drilled by:	**Tri-State Drilling**
Drill rig:	**Dietrich D-50**
Hammer type:	**Autohammer**
Driller:	**D. King**
Water while drilling:	**Dry**
Water upon completion:	**Dry**
Borehole advanced by:	**Hollow stem auger**
Borehole abandoned by:	**Soil cuttings**

Remarks: Latitude/longitude data is an estimate and was obtained via approximation of the intended boring location on Google® aerial image map with reference to the horizontal alignment depicted on aerial mapping as provided by Volkert. The boring was positioned using a smart-phone app that utilizes device GPS, cell signals, and WiFi to assess location, and the position was cross referenced/checked in the field with the information provided by Volkert. Ground surface elevation was not available and is omitted from the log.

Soil descriptions are based on visual examination of the recovered samples. Stratification lines represent the inferred boundary between soil types. Insitu, the transition may be gradual.

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Nashville, Tennessee 37211

LOG OF BORING B-14

Project Name: Buckner Road Extension
Site Location: Thompson's Station, TN
Collier Project Number: 3049-19-01
Client: Volkert, Inc.
Franklin, TN

Location: See Exhibit 4
*Latitude/Longitude: 35° 46' 30" / -86° 51' 30"
*Surface elevation:
* see remarks below

Depth (ft.)	Elevation (ft.)	Material Description	Depth	Groundwater	Sample type	SPT blow counts (N-value)	Laboratory hand penetrometer (psf)	Water content (%)	Dry unit weight (pcf)	Unconfined compressive strength (psf)	Atterberg Limits LL-PL-PI
		~3 inch root mat with scant topsoil	<½								
		Lean clay (CL), silty, very sandy, mottled red brown/light grey/tan, phosphatic, stiff, with trace of weathered sandstone fragments				4-5-6 (11)		27			
5	-					7-5-5 (10)		34			Bulk sample 30-19-11
						5-6-7 (13)		38			
			8½								
10	-	*Auger refusal at 8½ feet*									
15	-										
20	-										
25	-										
30	-										

Date started/completed:	**September 23, 2019**
Drilled by:	**Tri-State Drilling**
Drill rig:	**Dietrich D-50**
Hammer type:	**Autohammer**
Driller:	**D. King**
Water while drilling:	**Dry**
Water upon completion:	**Dry**
Borehole advanced by:	**Hollow stem auger**
Borehole abandoned by:	**Soil cuttings**

Remarks: Latitude/longitude data is an estimate and was obtained via approximation of the intended boring location on Google® aerial image map with reference to the horizontal alignment depicted on aerial mapping as provided by Volkert. The boring was positioned using a smart-phone app that utilizes device GPS, cell signals, and WiFi to assess location, and the position was cross referenced/checked in the field with the information provided by Volkert. Ground surface elevation was not available and is omitted from the log.

Soil descriptions are based on visual examination of the recovered samples. Stratification lines represent the inferred boundary between soil types. Insitu, the transition may be gradual.

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Nashville, Tennessee 37211

LOG OF BORING B-15

Project Name: Buckner Road Extension
Site Location: Thompson's Station, TN
Collier Project Number: 3049-19-01
Client: Volkert, Inc.
Franklin, TN

Location: See Exhibit 4
*Latitude/Longitude: 35° 46' 31" / -86° 51' 42"
*Surface elevation:
* see remarks below

Depth (ft.)	Elevation (ft.)	Material Description	Depth	Groundwater	Sample type	SPT blow counts (N-value)	Laboratory hand penetrometer (psf)	Water content (%)	Dry unit weight (pcf)	Unconfined compressive strength (psf)	Atterberg Limits LL-PL-PI
		~3 inch root mat with scant topsoil	<½								
		Possible fill, lean clay (CL), brown, with rock fragments	2½		X	3-4-6 (10)		19			
5	-	Lean clay (CL), silty, trace of sand, mottled red brown/tan/light grey/dark brown, phosphatic below 3 feet, stiff to very stiff, trace of phosphate			X	11-8-9 (17)		26			
					X	7-7-9 (16)		24			
10	-	Sandy, phosphatic below 8 feet			X	4-5-5 (10)		23			
15	-		15		X	3-4-6 (10)		26			
		Boring terminated at 15 feet									
20	-										
25	-										
30	-										

Date started/completed: **September 23, 2019**
Drilled by: **Tri-State Drilling**
Drill rig: **Dietrich D-50**
Hammer type: **Autohammer**
Driller: **D. King**
Water while drilling: **Dry**
Water upon completion: **Dry**
Borehole advanced by: **Hollow stem auger**
Borehole abandoned by: **Soil cuttings**

Remarks: Latitude/longitude data is an estimate and was obtained via approximation of the intended boring location on Google® aerial image map with reference to the horizontal alignment depicted on aerial mapping as provided by Volkert. The boring was positioned using a smart-phone app that utilizes device GPS, cell signals, and WiFi to assess location, and the position was cross referenced/checked in the field with the information provided by Volkert. Ground surface elevation was not available and is omitted from the log.

Soil descriptions are based on visual examination of the recovered samples. Stratification lines represent the inferred boundary between soil types. Insitu, the transition may be gradual.

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Nashville, Tennessee 37211

LOG OF BORING B-16

Project Name: Buckner Road Extension
Site Location: Thompson's Station, TN
Collier Project Number: 3049-19-01
Client: Volkert, Inc.
Franklin, TN

Location: See Exhibit 3
*Latitude/Longitude: 35° 46' 28" / -86° 51' 48"
*Surface elevation:
* see remarks below

Depth (ft.)	Elevation (ft.)	Material Description	Depth	Groundwater	Sample type	SPT blow counts (N-value)	Laboratory hand penetrometer (psf)	Water content (%)	Dry unit weight (pcf)	Unconfined compressive strength (psf)	Atterberg Limits LL-PL-PI
		~3 inch root mat with scant topsoil	<½								
		Possible fill, lean clay (CL), brown, with rock fragments	3		X	4-6-7 (13)		14			
5	-	Lean clay (CL), silty, trace of sand, mottled red brown/tan/dark brown, phosphatic, stiff, trace of weathered sandstone fragments			X	4-4-5 (9)		31			Bulk sample 30-17-13
					X	4-5-5 (10)		32			
10	-				X	2-4-6 (10)		34			
15	-		15		X	3-4-5 (9)		28			
		Boring terminated at 15 feet									
20	-										
25	-										
30	-										

Date started/completed: **September 23, 2019**
Drilled by: **Tri-State Drilling**
Drill rig: **Dietrich D-50**
Hammer type: **Autohammer**
Driller: **D. King**
Water while drilling: **Dry**
Water upon completion: **Dry**
Borehole advanced by: **Hollow stem auger**
Borehole abandoned by: **Soil cuttings**

Remarks: Latitude/longitude data is an estimate and was obtained via approximation of the intended boring location on Google® aerial image map with reference to the horizontal alignment depicted on aerial mapping as provided by Volkert. The boring was positioned using a smart-phone app that utilizes device GPS, cell signals, and WiFi to assess location, and the position was cross referenced/checked in the field with the information provided by Volkert. Ground surface elevation was not available and is omitted from the log.

Soil descriptions are based on visual examination of the recovered samples. Stratification lines represent the inferred boundary between soil types. Insitu, the transition may be gradual.

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Nashville, Tennessee 37211

LOG OF BORING B-17

Project Name: Buckner Road Extension
Site Location: Thompson's Station, TN
Collier Project Number: 3049-19-01
Client: Volkert, Inc.
Franklin, TN

Location: See Exhibit 3
*Latitude/Longitude: 35° 46' 31" / -86° 51' 45"
*Surface elevation:
* see remarks below

Depth (ft.)	Elevation (ft.)	Material Description	Depth	Groundwater	Sample type	SPT blow counts (N-value)	Laboratory hand penetrometer (psf)	Water content (%)	Dry unit weight (pcf)	Unconfined compressive strength (psf)	Atterberg Limits LL-PL-PI
		~3 inch root mat with scant topsoil	<½								
		Possible fill, lean clay (CL), red brown with rock fragments	3		X	6-7-7 (14)		19			
5	-	Lean clay (CL), silty, sandy, mottled red brown/light grey/tan/dark brown, phosphatic, stiff to very stiff, with trace of weathered sandstone fragments			X	9-8-10 (18)		21			
					X	8-7-8 (15)		24			
10	-				X	5-8-11 (19)		33			
			13½								
15	-	*Auger refusal at 13½ feet*									
20	-										
25	-										
30	-										

Date started/completed: **September 23, 2019**
Drilled by: **Tri-State Drilling**
Drill rig: **Dietrich D-50**
Hammer type: **Autohammer**
Driller: **D. King**
Water while drilling: **Dry**
Water upon completion: **Dry**
Borehole advanced by: **Hollow stem auger**
Borehole abandoned by: **Soil cuttings**

Remarks: Latitude/longitude data is an estimate and was obtained via approximation of the intended boring location on Google® aerial image map with reference to the horizontal alignment depicted on aerial mapping as provided by Volkert. The boring was positioned using a smart-phone app that utilizes device GPS, cell signals, and WiFi to assess location, and the position was cross referenced/checked in the field with the information provided by Volkert. Ground surface elevation was not available and is omitted from the log.

Soil descriptions are based on visual examination of the recovered samples. Stratification lines represent the inferred boundary between soil types. Insitu, the transition may be gradual.

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Nashville, Tennessee 37211

LOG OF BORING B-18

Project Name: Buckner Road Extension
Site Location: Thompson's Station, TN
Collier Project Number: 3049-19-01
Client: Volkert, Inc.
Franklin, TN

Location: See Exhibit 3
*Latitude/Longitude: 35° 46' 32" / -86° 51' 45"
*Surface elevation:
* see remarks below

Depth (ft.)	Elevation (ft.)	Material Description	Depth	Groundwater	Sample type	SPT blow counts (N-value)	Laboratory hand penetrometer (psf)	Water content (%)	Dry unit weight (pcf)	Unconfined compressive strength (psf)	Atterberg Limits LL-PL-PI
		~3 inch root mat with scant topsoil	<½								
		Possible fill, lean clay (CL), brown, with rock fragments	3		X	5-6-6 (12)		16			
5	-	Lean clay (CL), silty, trace of sand, mottled red brown/tan/dark brown, phosphatic, stiff to very stiff, trace of weathered sandstone fragments			X	5-6-10 (16)		25			Bulk sample 40-23-17
					X	4-7-11 (18)		30			
10	-				X	4-6-9 (15)		30			
15	-		15		X	4-6-7 (13)		33			
		Boring terminated at 15 feet									
20	-										
25	-										
30	-										

Date started/completed:	**September 23, 2019**
Drilled by:	**Tri-State Drilling**
Drill rig:	**Dietrich D-50**
Hammer type:	**Autohammer**
Driller:	**D. King**
Water while drilling:	**Dry**
Water upon completion:	**Dry**
Borehole advanced by:	**Hollow stem auger**
Borehole abandoned by:	**Soil cuttings**

Remarks: Latitude/longitude data is an estimate and was obtained via approximation of the intended boring location on Google® aerial image map with reference to the horizontal alignment depicted on aerial mapping as provided by Volkert. The boring was positioned using a smart-phone app that utilizes device GPS, cell signals, and WiFi to assess location, and the position was cross referenced/checked in the field with the information provided by Volkert. Ground surface elevation was not available and is omitted from the log.

Soil descriptions are based on visual examination of the recovered samples. Stratification lines represent the inferred boundary between soil types. Insitu, the transition may be gradual.

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Nashville, Tennessee 37211

LOG OF BORING B-19

Project Name: Buckner Road Extension
Site Location: Thompson's Station, TN
Collier Project Number: 3049-19-01
Client: Volkert, Inc.
Franklin, TN

Location: See Exhibit 3
*Latitude/Longitude: 35° 46' 36" / -86° 51' 47"
*Surface elevation:
* see remarks below

Depth (ft.)	Elevation (ft.)	Material Description	Depth	Groundwater	Sample type	SPT blow counts (N-value)	Laboratory hand penetrometer (psf)	Water content (%)	Dry unit weight (pcf)	Unconfined compressive strength (psf)	Atterberg Limits LL-PL-PI
		~3 inch root mat with scant topsoil	<½								
		Possible fill, lean clay (CL), brown, with rock fragments	3		X	2-3-6 (9)		15			
		Lean clay (CL), silty, trace of sand, mottled red brown/tan/dark brown, medium stiff to stiff, trace of weathered sandstone fragments			X	14-7-7 (14)		18			
5	-				X	10-6-8 (14)		19			
		Phosphatic below 8 feet			X	2-3-6 (9)		29			
10	-										
			15		X	2-2-5 (7)		22			
15	-	*Boring terminated at 15 feet*									
20	-										
25	-										
30	-										

Date started/completed:	**September 23, 2019**
Drilled by:	**Tri-State Drilling**
Drill rig:	**Dietrich D-50**
Hammer type:	**Autohammer**
Driller:	**D. King**
Water while drilling:	**Dry**
Water upon completion:	**Dry**
Borehole advanced by:	**Hollow stem auger**
Borehole abandoned by:	**Soil cuttings**

Remarks: Latitude/longitude data is an estimate and was obtained via approximation of the intended boring location on Google® aerial image map with reference to the horizontal alignment depicted on aerial mapping as provided by Volkert. The boring was positioned using a smart-phone app that utilizes device GPS, cell signals, and WiFi to assess location, and the position was cross referenced/checked in the field with the information provided by Volkert. Ground surface elevation was not available and is omitted from the log.

Soil descriptions are based on visual examination of the recovered samples. Stratification lines represent the inferred boundary between soil types. Insitu, the transition may be gradual.

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Nashville, Tennessee 37211

LOG OF BORING B-20

Project Name: Buckner Road Extension
Site Location: Thompson's Station, TN
Collier Project Number: 3049-19-01
Client: Volkert, Inc.
Franklin, TN

Location: See Exhibit 3
*Latitude/Longitude: 35° 46' 33" / -86° 51' 47"
*Surface elevation:
* see remarks below

Depth (ft.)	Elevation (ft.)	Material Description	Depth	Groundwater	Sample type	SPT blow counts (N-value)	Laboratory hand penetrometer (psf)	Water content (%)	Dry unit weight (pcf)	Unconfined compressive strength (psf)	Atterberg Limits LL-PL-PI
		~3 inch root mat with scant topsoil	<½								
		Lean clay (CL), silty, trace of sand, mottled red brown/tan/dark brown/light grey, phosphatic, stiff to very stiff, trace of weathered sandstone fragments			X	4-5-7 (12)		25			
5	-				X	15-15-6 (21)		31			
					X	6-8-9 (17)		26			
					X	2-5-8 (13)		32			
10	-										
					X	3-3-5 (8)		26			
15	-		15								
		Boring terminated at 15 feet									
20	-										
25	-										
30	-										

Date started/completed:	**September 23, 2019**
Drilled by:	**Tri-State Drilling**
Drill rig:	**Dietrich D-50**
Hammer type:	**Autohammer**
Driller:	**D. King**
Water while drilling:	**Dry**
Water upon completion:	**Dry**
Borehole advanced by:	**Hollow stem auger**
Borehole abandoned by:	**Soil cuttings**

Remarks: Latitude/longitude data is an estimate and was obtained via approximation of the intended boring location on Google® aerial image map with reference to the horizontal alignment depicted on aerial mapping as provided by Volkert. The boring was positioned using a smart-phone app that utilizes device GPS, cell signals, and WiFi to assess location, and the position was cross referenced/checked in the field with the information provided by Volkert. Ground surface elevation was not available and is omitted from the log.

Soil descriptions are based on visual examination of the recovered samples. Stratification lines represent the inferred boundary between soil types. Insitu, the transition may be gradual.

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Nashville, Tennessee 37211

LOG OF BORING B-21

Project Name: Buckner Road Extension
Site Location: Thompson's Station, TN
Collier Project Number: 3049-19-01
Client: Volkert, Inc.
Franklin, TN

Location: See Exhibit 3
*Latitude/Longitude: 35° 46' 31" / -86° 51' 47"
*Surface elevation:
* see remarks below

Depth (ft.)	Elevation (ft.)	Material Description	Depth	Groundwater	Sample type	SPT blow counts (N-value)	Laboratory hand penetrometer (psf)	Water content (%)	Dry unit weight (pcf)	Unconfined compressive strength (psf)	Atterberg Limits LL-PL-PI
		~3 inch root mat with scant topsoil	<½								
		Possible fill, clean clay (CL), brown, with rock fragments	2		X	6-7-8 (15)		18			
5	-	Lean clay (CL), silty, sandy, mottled red brown/tan/dark brown/light grey, phosphatic, stiff to very stiff, trace of weathered sandstone fragments			X	3-7-9 (16)		26			
					X	3-6-8 (14)		29			
10	-				X	3-6-7 (13)		26			
15	-		15		X	3-7-9 (16)		26			
		Boring terminated at 15 feet									
20	-										
25	-										
30	-										

Date started/completed: **September 23, 2019**
Drilled by: **Tri-State Drilling**
Drill rig: **Dietrich D-50**
Hammer type: **Autohammer**
Driller: **D. King**
Water while drilling: **Dry**
Water upon completion: **Dry**
Borehole advanced by: **Hollow stem auger**
Borehole abandoned by: **Soil cuttings**

Remarks: Latitude/longitude data is an estimate and was obtained via approximation of the intended boring location on Google® aerial image map with reference to the horizontal alignment depicted on aerial mapping as provided by Volkert. The boring was positioned using a smart-phone app that utilizes device GPS, cell signals, and WiFi to assess location, and the position was cross referenced/checked in the field with the information provided by Volkert. Ground surface elevation was not available and is omitted from the log.

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Nashville, Tennessee 37211

LOG OF BORING B-22

Project Name: Buckner Road Extension
Site Location: Thompson's Station, TN
Collier Project Number: 3049-19-01
Client: Volkert, Inc.
Franklin, TN

Location: See Exhibit 3
*Latitude/Longitude: 35° 46' 32" / -86° 51' 49"
*Surface elevation:
* see remarks below

Depth (ft.)	Elevation (ft.)	Material Description	Depth	Groundwater	Sample type	SPT blow counts (N-value)	Laboratory hand penetrometer (psf)	Water content (%)	Dry unit weight (pcf)	Unconfined compressive strength (psf)	Atterberg Limits LL-PL-PI
		~3 inch root mat with scant topsoil	<½								
		FILL, clean clay (CL), mottled yellow brown/dark brown/light brown/light grey, with trace of rock fragments	5		X	6-10-12 (22)		27			
5	-	Lean clay (CL), silty, sandy, mottled red brown/tan/dark brown/light grey, phosphatic, stiff to very stiff			X	7-4-4 (8)		14			
10	-	*Auger refusal at 12 feet, began rock core operations*	12								
15	-	Limestone, light grey with dark grey and grey brown bands, trace of vugs, occasional open, horizontal bedding plane or fracture Recovery = 91%, RQD = 91%	22								
20	-										
25	-	*Coring terminated at 22 feet*									
30	-										

Date started/completed:	**September 24, 2019**
Drilled by:	**Tri-State Drilling**
Drill rig:	**Dietrich D-50**
Hammer type:	**Autohammer**
Driller:	**D. King**
Water while drilling:	**Dry (before coring)**
Water upon completion:	**Dry (before coring)**
Borehole advanced by:	**Hollow stem auger**
Borehole abandoned by:	**Soil cuttings**

Remarks: Latitude/longitude data is an estimate and was obtained via approximation of the intended boring location on Google® aerial image map with reference to the horizontal alignment depicted on aerial mapping as provided by Volkert. The boring was positioned using a smart-phone app that utilizes device GPS, cell signals, and WiFi to assess location, and the position was cross referenced/checked in the field with the information provided by Volkert. Ground surface elevation was not available and is omitted from the log.

Soil descriptions are based on visual examination of the recovered samples. Stratification lines represent the inferred boundary between soil types. Insitu, the transition may be gradual.

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2949 Nolensville Pike
Nashville, Tennessee 37211

LOG OF BORING B-23

Project Name: Buckner Road Extension
Site Location: Thompson's Station, TN
Collier Project Number: 3049-19-01
Client: Volkert, Inc.
Franklin, TN

Location: See Exhibit 3
*Latitude/Longitude: 35° 46' 32" / -86° 51' 49"
*Surface elevation:
* see remarks below

Depth (ft.)	Elevation (ft.)	Material Description	Depth	Groundwater	Sample type	SPT blow counts (N-value)	Laboratory hand penetrometer (psf)	Water content (%)	Dry unit weight (pcf)	Unconfined compressive strength (psf)	Atterberg Limits LL-PL-PI
		~3 inch root mat with scant topsoil	<½								
		FILL, clean clay (CL), mottled brown/red brown, with trace of rock fragments	5		X	10-8-9 (17)		21			
5	-	Lean clay (CL), silty, sandy, mottled red brown/tan/dark brown/light grey, phosphatic, stiff to very stiff			X	4-6-7 (13)		23			
10	-	*Auger refusal at 12 feet, began rock core operations*	12								
15	-	Limestone, light grey with dark grey and grey brown bands, trace of vugs, occasional open, horizontal bedding plane or fracture Recovery = 91%, RQD = 89% Unconfined compression test (Qu) at ~13 feet = 21,340 psi	22								
20	-										
25	-	*Coring terminated at 22 feet*									
30	-										

Date started/completed:	**September 25, 2019**
Drilled by:	**Tri-State Drilling**
Drill rig:	**Dietrich D-50**
Hammer type:	**Autohammer**
Driller:	**D. King**
Water while drilling:	**Dry (before coring)**
Water upon completion:	**Dry (before coring)**
Borehole advanced by:	**Hollow stem auger**
Borehole abandoned by:	**Soil cuttings**

Remarks: Latitude/longitude data is an estimate and was obtained via approximation of the intended boring location on Google® aerial image map with reference to the horizontal alignment depicted on aerial mapping as provided by Volkert. The boring was positioned using a smart-phone app that utilizes device GPS, cell signals, and WiFi to assess location, and the position was cross referenced/checked in the field with the information provided by Volkert. Ground surface elevation was not available and is omitted from the log.

Soil descriptions are based on visual examination of the recovered samples. Stratification lines represent the inferred boundary between soil types. Insitu, the transition may be gradual.

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Nashville, Tennessee 37211

LOG OF BORING B-24

Project Name: Buckner Road Extension
Site Location: Thompson's Station, TN
Collier Project Number: 3049-19-01
Client: Volkert, Inc.
Franklin, TN

Location: See Exhibit 3
*Latitude/Longitude: 35° 46' 32" / -86° 51' 50"
*Surface elevation:
* see remarks below

Depth (ft.)	Elevation (ft.)	Material Description	Depth	Groundwater	Sample type	SPT blow counts (N-value)	Laboratory hand penetrometer (psf)	Water content (%)	Dry unit weight (pcf)	Unconfined compressive strength (psf)	Atterberg Limits LL-PL-PI
		~3 inch root mat with scant topsoil	<½								
		FILL, clean clay (CL), mottled brown/red brown, with trace of rock fragments									
5	-				X	7-10-10 (20)		17			
		Auger refusal at 10½ feet, began rock core operations	10½		X	6-11-13 (24)		30			
10	-	Limestone, light grey with dark grey and grey brown bands, trace of vugs, occasional open, horizontal bedding plane or fracture									
		Recovery = 95%, RQD = 95%									
15	-	Unconfined compression test (Qu) at 12½ feet = 21,670 psi									
20	-		20½								
		Coring terminated at 20½ feet									
25	-										
30	-										

Date started/completed:	**September 25, 2019**
Drilled by:	**Tri-State Drilling**
Drill rig:	**Dietrich D-50**
Hammer type:	**Autohammer**
Driller:	**D. King**
Water while drilling:	**Dry (before coring)**
Water upon completion:	**Dry (before coring)**
Borehole advanced by:	**Hollow stem auger**
Borehole abandoned by:	**Soil cuttings**

Remarks: Latitude/longitude data is an estimate and was obtained via approximation of the intended boring location on Google® aerial image map with reference to the horizontal alignment depicted on aerial mapping as provided by Volkert. The boring was positioned using a smart-phone app that utilizes device GPS, cell signals, and WiFi to assess location, and the position was cross referenced/checked in the field with the information provided by Volkert. Ground surface elevation was not available and is omitted from the log.

Soil descriptions are based on visual examination of the recovered samples. Stratification lines represent the inferred boundary between soil types. Insitu, the transition may be gradual.

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Nashville, Tennessee 37211

LOG OF BORING B-25

Project Name: Buckner Road Extension
Site Location: Thompson's Station, TN
Collier Project Number: 3049-19-01
Client: Volkert, Inc.
Franklin, TN

Location: See Exhibit 3
*Latitude/Longitude: 35° 46' 32" / -86° 51' 50"
*Surface elevation:
* see remarks below

Depth (ft.)	Elevation (ft.)	Material Description	Depth	Groundwater	Sample type	SPT blow counts (N-value)	Laboratory hand penetrometer (psf)	Water content (%)	Dry unit weight (pcf)	Unconfined compressive strength (psf)	Atterberg Limits LL-PL-PI
		~3 inch root mat with scant topsoil	<½								
		FILL, clean clay (CL), brown with rock fragments *Auger refusal at 10½ feet, began rock core operations*	3								
5	-	FILL, clean clay (CL), brown with occasional boulder *Note: rock coring performed 3 to 10½ feet; note section of recovered boulder in photo*									
10	-		10½								
15	-	Limestone*, light grey with dark grey and grey brown bands, trace of vugs, occasional open, horizontal bedding plane or fracture *Fossilized coral at ~13½ to 14 feet Recovery = 100%, RQD = 100% *Coring terminated at 15 feet*	15								
20	-										
25	-										
30	-										

Date started/completed: **September 25, 2019**
Drilled by: **Tri-State Drilling**
Drill rig: **Dietrich D-50**
Hammer type: **Autohammer**
Driller: **D. King**
Water while drilling: **Dry (before coring)**
Water upon completion: **Dry (before coring)**
Borehole advanced by: **Hollow stem auger**
Borehole abandoned by: **Soil cuttings**

Remarks: Latitude/longitude data is an estimate and was obtained via approximation of the intended boring location on Google® aerial image map with reference to the horizontal alignment depicted on aerial mapping as provided by Volkert. The boring was positioned using a smart-phone app that utilizes device GPS, cell signals, and WiFi to assess location, and the position was cross referenced/checked in the field with the information provided by Volkert. Ground surface elevation was not available and is omitted from the log.

Soil descriptions are based on visual examination of the recovered samples. Stratification lines represent the inferred boundary between soil types. Insitu, the transition may be gradual.

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2949 Nolensville Pike
Nashville, Tennessee 37211

LOG OF BORING B-26

Project Name: Buckner Road Extension
Site Location: Thompson's Station, TN
Collier Project Number: 3049-19-01
Client: Volkert, Inc.
Franklin, TN

Location: See Exhibit 3
*Latitude/Longitude: 35° 46' 32" / -86° 51' 51"
*Surface elevation:
* see remarks below

Depth (ft.)	Elevation (ft.)	Material Description	Depth	Groundwater	Sample type	SPT blow counts (N-value)	Laboratory hand penetrometer (psf)	Water content (%)	Dry unit weight (pcf)	Unconfined compressive strength (psf)	Atterberg Limits LL-PL-PI
		~4 inch root mat with scant topsoil	<½								
		FILL, clean clay (CL), mottled brown/red brown, with trace of organics, rock fragments	3		X	1-1-2 (3)		17			
5	-	Lean clay (CL), silty, sandy, mottled red brown/tan/dark brown/light grey, phosphatic, stiff to very stiff			X	2-3-4 (7)		14			
		Auger refusal at 8 feet, began rock core operations	8		X	2-4-4 (8)		13			
10	-	Limestone, light grey with dark grey and grey brown bands, occasional calcite stringer, trace of vugs, occasional open, stained, horizontal bedding plane or joint, fossil coral inclusion at ~12 feet Recovery = 99%, RQD = 89% Unconfined compression test (Qu) at ~11 feet = 21,710 psi									
15	-		18								
		Coring terminated at 18 feet									
20	-										
25	-										
30	-										

Date started/completed:	**November 14, 2019**
Drilled by:	**Tri-State Drilling**
Drill rig:	**Dietrich D-50**
Hammer type:	**Autohammer**
Driller:	**C. Gracey**
Water while drilling:	**Dry (before coring)**
Water upon completion:	**Dry (before coring)**
Borehole advanced by:	**Hollow stem auger**
Borehole abandoned by:	**Soil cuttings**

Remarks: Latitude/longitude data is an estimate and was obtained via approximation of the intended boring location on Google® aerial image map with reference to the horizontal alignment depicted on aerial mapping as provided by Volkert. The boring was positioned using a smart-phone app that utilizes device GPS, cell signals, and WiFi to assess location, and the position was cross referenced/checked in the field with the information provided by Volkert. Ground surface elevation was not available and is omitted from the log.

Soil descriptions are based on visual examination of the recovered samples. Stratification lines represent the inferred boundary between soil types. Insitu, the transition may be gradual.

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2949 Nolensville Pike
Nashville, Tennessee 37211

LOG OF BORING B-27

Project Name: Buckner Road Extension
Site Location: Thompson's Station, TN
Collier Project Number: 3049-19-01
Client: Volkert, Inc.
Franklin, TN

Location: See Exhibit 3
*Latitude/Longitude: 35° 46' 31" / -86° 51' 51"
*Surface elevation:
* see remarks below

Depth (ft.)	Elevation (ft.)	Material Description	Depth	Groundwater	Sample type	SPT blow counts (N-value)	Laboratory hand penetrometer (psf)	Water content (%)	Dry unit weight (pcf)	Unconfined compressive strength (psf)	Atterberg Limits LL-PL-PI
5	-	FILL, clean clay (CL), mottled brown/red brown, with trace of organics, rock fragments			X	1-3-4 (7)		20			
					X	2-2-3 (5)		17			
					X	2-3-4 (7)		17			
			8								
10	-	Lean clay (CL), silty, sandy, dark grey, very stiff			X	2-7-10 (17)		25			
			*11½								
		*Auger refusal at 11 ½ feet in original hole; *because the original hole was crooked and upper reaches the hole were rimmed with boulders, an offset hole was augered to top of rock at 9 feet, and began core operations*									
15	-	Limestone, light grey with dark grey and grey brown bands, occasional calcite stringer, occasional open, stained, horizontal bedding plane or joint; diagonal fractures at 10 feet and 17½ feet, trace of vugs Recovery = 100%, RQD = 95%									
			*19								
20	-	**Coring terminated at 19 feet; (coring performed in offset hole which refused at 9 feet)*									
25	-										
30	-										

Date started/completed:	**November 15, 2019**
Drilled by:	**Tri-State Drilling**
Drill rig:	**Dietrich D-50**
Hammer type:	**Autohammer**
Driller:	**C. Gracey**
Water while drilling:	**Dry (before coring)**
Water upon completion:	**Dry (before coring)**
Borehole advanced by:	**Hollow stem auger**
Borehole abandoned by:	**Soil cuttings**

Remarks: Latitude/longitude data is an estimate and was obtained via approximation of the intended boring location on Google® aerial image map with reference to the horizontal alignment depicted on aerial mapping as provided by Volkert. The boring was positioned using a smart-phone app that utilizes device GPS, cell signals, and WiFi to assess location, and the position was cross referenced/checked in the field with the information provided by Volkert. Ground surface elevation was not available and is omitted from the log.

Soil descriptions are based on visual examination of the recovered samples. Stratification lines represent the inferred boundary between soil types. Insitu, the transition may be gradual.

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Nashville, Tennessee 37211

LOG OF BORING B-28

Project Name:	Buckner Road Extension
Site Location:	Springhill, TN
Collier Project Number:	Thompson's Station, TN
Client:	Volkert, Inc.
	Franklin, TN

Location: See Exhibit 3
*Latitude/Longitude: 35° 46' 27.49" / -86° 51' 52.96"
*Surface elevation:
* see remarks below

Depth (ft.)	Elevation (ft.)	Material Description	Depth	Groundwater	Sample type	SPT blow counts (N-value)	Laboratory hand penetrometer (psf)	Water content (%)	Dry unit weight (pcf)	Unconfined compressive strength (psf)	Atterberg Limits LL-PL-PI
		~12 inches topsoil with roots	1								
		Lean clay (CL), silty, sandy, mottled red brown/yellow brown/brown/light grey, phosphatic, trace of weathered sandstone fragments, medium stiff to stiff			X	2-3-3 (6)		18			
5	-				X	2-4-5 (9)		19			
					X	3-4-6 (10)		22			
10	-				X	3-5-8 (13)		20			
			14½		X	2-50/3"		25			
15	-	*Auger refusal at 14 ½ feet*									
20	-										
25	-										
30	-										

Date started/completed:	**November 14, 2019**
Drilled by:	**Tri-State Drilling**
Drill rig:	**Dietrich D-50**
Hammer type:	**Autohammer**
Driller:	**C. Gracey**
Water while drilling:	**Dry**
Water upon completion:	**Dry**
Borehole advanced by:	**Hollow stem auger**
Borehole abandoned by:	**Soil cuttings**

Remarks: Latitude/longitude data is an estimate and was obtained via approximation of the intended boring location on Google® aerial image map with reference to the horizontal alignment depicted on aerial mapping as provided by Volkert. The boring was positioned using a smart-phone app that utilizes device GPS, cell signals, and WiFi to assess location, and the position was cross referenced/checked in the field with the information provided by Volkert. Ground surface elevation was not available and is omitted from the log.

Soil descriptions are based on visual examination of the recovered samples. Stratification lines represent the inferred boundary between soil types. Insitu, the transition may be gradual.

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Nashville, Tennessee 37211

LOG OF BORING B-29

Project Name: Buckner Road Extension
Site Location: Thompson's Station, TN
Collier Project Number: 3049-19-01
Client: Volkert, Inc.
Franklin, TN

Location: See Exhibit 3
*Latitude/Longitude: 35° 46' 30.84" / -86° 51' 53.84"
*Surface elevation:
* see remarks below

Depth (ft.)	Elevation (ft.)	Material Description	Depth	Groundwater	Sample type	SPT blow counts (N-value)	Laboratory hand penetrometer (psf)	Water content (%)	Dry unit weight (pcf)	Unconfined compressive strength (psf)	Atterberg Limits LL-PL-PI
		~12 inches topsoil with roots	1								
		Lean clay (CL), silty, sandy, mottled dark brown/dark grey, occasional gravel, medium stiff to stiff			X	1-2-2 (4)		22			
5	-				X	3-5-7 (12)		19			
			5½								
		Auger refusal at 5 ½ feet									
10	-										
15	-										
20	-										
25	-										
30	-										

Date started/completed: **November 14, 2019**
Drilled by: **Tri-State Drilling**
Drill rig: **Dietrich D-50**
Hammer type: **Autohammer**
Driller: **C. Gracey**
Water while drilling: **Dry**
Water upon completion: **Dry**
Borehole advanced by: **Hollow stem auger**
Borehole abandoned by: **Soil cuttings**

Remarks: Latitude/longitude data is an estimate and was obtained via approximation of the intended boring location on Google® aerial image map with reference to the horizontal alignment depicted on aerial mapping as provided by Volkert. The boring was positioned using a smart-phone app that utilizes device GPS, cell signals, and WiFi to assess location, and the position was cross referenced/checked in the field with the information provided by Volkert. Ground surface elevation was not available and is omitted from the log.

Soil descriptions are based on visual examination of the recovered samples. Stratification lines represent the inferred boundary between soil types. Insitu, the transition may be gradual.

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LOG OF BORING B30

Project Name: Buckner Road Extension
Site Location: Thompson's Station, TN
Collier Project Number: 3049-19-01
Client: Volkert, Inc.
Franklin, TN

Location: See Exhibit 3
*Latitude/Longitude: 35° 46' 33.24" / -86° 51' 53.9"
*Surface elevation:
* see remarks below

Depth (ft.)	Elevation (ft.)	Material Description	Depth	Groundwater	Sample type	SPT blow counts (N-value)	Laboratory hand penetrometer (psf)	Water content (%)	Dry unit weight (pcf)	Unconfined compressive strength (psf)	Atterberg Limits LL-PL-PI
		~12 inches topsoil with roots	1								
5	-	Lean clay (CL), silty, sandy, mottled yellow brown/tan/light grey/red brown, trace of weathered rock fragments, very soft to stiff	8		X	WOH (0) 3-4-5 (9) 3-5-6 (11)		20 18 19			
		Auger refusal at 8 feet									
10	-										
15	-										
20	-										
25	-										
30	-										

Date started/completed:	**November 14, 2019**
Drilled by:	**Tri-State Drilling**
Drill rig:	**Dietrich D-50**
Hammer type:	**Autohammer**
Driller:	**C. Gracey**
Water while drilling:	**Dry**
Water upon completion:	**Dry**
Borehole advanced by:	**Hollow stem auger**
Borehole abandoned by:	**Soil cuttings**

Remarks: Latitude/longitude data is an estimate and was obtained via approximation of the intended boring location on Google® aerial image map with reference to the horizontal alignment depicted on aerial mapping as provided by Volkert. The boring was positioned using a smart-phone app that utilizes device GPS, cell signals, and WiFi to assess location, and the position was cross referenced/checked in the field with the information provided by Volkert. Ground surface elevation was not available and is omitted from the log. WOH = weight of hammer

Soil descriptions are based on visual examination of the recovered samples. Stratification lines represent the inferred boundary between soil types. Insitu, the transition may be gradual.

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Nashville, Tennessee 37211

LOG OF BORING B-31

Project Name: Buckner Road Extension
Site Location: Thompson's Station, TN
Collier Project Number: 3049-19-01
Client: Volkert, Inc.
Franklin, TN

Location: See Exhibit 3
*Latitude/Longitude: 35° 46' 36.55" / -86° 51' 52.57"
*Surface elevation:
* see remarks below

Depth (ft.)	Elevation (ft.)	Material Description	Depth	Groundwater	Sample type	SPT blow counts (N-value)	Laboratory hand penetrometer (psf)	Water content (%)	Dry unit weight (pcf)	Unconfined compressive strength (psf)	Atterberg Limits LL-PL-PI
		~12 inches topsoil with roots	1								
		Lean clay (CL), silty, sandy, mottled red brown/yellow brown/tan, phosphatic, trace of weathered sandstone fragments, medium stiff to very stiff				WOH-2-2 (4)		20			
5	-					5-7-10 (17)		14			
			8			7-10-12 (22)		16			
		Lean to fat clay (CL/CH), yellow brown with black mineral stains, stiff				3-5-7 (12)		18			
10	-										
			14			10-50/2"		35			
15	-	*Auger refusal at 14 feet*									
20	-										
25	-										
30	-										

Date started/completed: **November 14, 2019**
Drilled by: **Tri-State Drilling**
Drill rig: **Dietrich D-50**
Hammer type: **Autohammer**
Driller: **C. Gracey**
Water while drilling: **Dry**
Water upon completion: **Dry**
Borehole advanced by: **Hollow stem auger**
Borehole abandoned by: **Soil cuttings**

Remarks: Latitude/longitude data is an estimate and was obtained via approximation of the intended boring location on Google® aerial image map with reference to the horizontal alignment depicted on aerial mapping as provided by Volkert. The boring was positioned using a smart-phone app that utilizes device GPS, cell signals, and WiFi to assess location, and the position was cross referenced/checked in the field with the information provided by Volkert. Ground surface elevation was not available and is omitted from the log. WOH = weight of hammer.

Soil descriptions are based on visual examination of the recovered samples. Stratification lines represent the inferred boundary between soil types. Insitu, the transition may be gradual.

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Nashville, Tennessee 37211

LOG OF BORING B-32

Project Name: Buckner Road Extension
Site Location: Thompson's Station, TN
Collier Project Number: 3049-19-01
Client: Volkert, Inc.
Franklin, TN

Location: See Exhibit 3
*Latitude/Longitude: 35° 46' 32.98" / -86° 51' 55.48"
*Surface elevation:
* see remarks below

Depth (ft.)	Elevation (ft.)	Material Description	Depth	Groundwater	Sample type	SPT blow counts (N-value)	Laboratory hand penetrometer (psf)	Water content (%)	Dry unit weight (pcf)	Unconfined compressive strength (psf)	Atterberg Limits LL-PL-PI
		~12 inches topsoil with roots	1								
5	-	Lean clay (CL), silty, sandy, mottled red brown/yellow brown/brown, phosphatic, trace of weathered sandstone fragments, stiff to very stiff			X	2-2-4 (6)		25			
					X	4-6-7 (13)		22			
			8		X	4-7-9 (16)		21			
		Fat clay (CH), yellow brown with chert fragments, stiff	9½		X	4-50/0		31			
10	-	*Auger refusal at 9½ feet*									
15	-										
20	-										
25	-										
30	-										

Date started/completed: **November 14, 2019**
Drilled by: **Tri-State Drilling**
Drill rig: **Dietrich D-50**
Hammer type: **Autohammer**
Driller: **C. Gracey**
Water while drilling: **Dry**
Water upon completion: **Dry**
Borehole advanced by: **Hollow stem auger**
Borehole abandoned by: **Soil cuttings**

Remarks: Latitude/longitude data is an estimate and was obtained via approximation of the intended boring location on Google® aerial image map with reference to the horizontal alignment depicted on aerial mapping as provided by Volkert. The boring was positioned using a smart-phone app that utilizes device GPS, cell signals, and WiFi to assess location, and the position was cross referenced/checked in the field with the information provided by Volkert. Ground surface elevation was not available and is omitted from the log.

Soil descriptions are based on visual examination of the recovered samples. Stratification lines represent the inferred boundary between soil types. Insitu, the transition may be gradual.

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Nashville, Tennessee 37211

LOG OF BORING B-33

Project Name: Buckner Road Extension
Site Location: Thompson's Station, TN
Collier Project Number: 3049-19-01
Client: Volkert, Inc.
Franklin, TN

Location: See Exhibit 3
*Latitude/Longitude: 35° 46' 31.65" / -86° 51' 55.63"
*Surface elevation:
* see remarks below

Depth (ft.)	Elevation (ft.)	Material Description	Depth	Groundwater	Sample type	SPT blow counts (N-value)	Laboratory hand penetrometer (psf)	Water content (%)	Dry unit weight (pcf)	Unconfined compressive strength (psf)	Atterberg Limits LL-PL-PI
		~8 inches topsoil with roots	<1								
5	-	Lean clay (CL), sandy, mottled red brown/yellow brown/brown, phosphatic, trace of weathered sandstone fragments, medium stiff to very stiff	8		X	1-2-3 (5)		20			
					X	2-3-4 (7)		21			Bulk sample 40-18-22
					X	3-4-5 (9)		19			
10	-	Fat clay (CH), yellow brown with black mineral stains and chert, stiff	10½		X	2-4-4 (8)		22			
		Auger refusal at 10½ feet									
15	-										
20	-										
25	-										
30	-										

Date started/completed: **November 14, 2019**
Drilled by: **Tri-State Drilling**
Drill rig: **Dietrich D-50**
Hammer type: **Autohammer**
Driller: **C. Gracey**
Water while drilling: **Dry**
Water upon completion: **Dry**
Borehole advanced by: **Hollow stem auger**
Borehole abandoned by: **Soil cuttings**

Remarks: Latitude/longitude data is an estimate and was obtained via approximation of the intended boring location on Google® aerial image map with reference to the horizontal alignment depicted on aerial mapping as provided by Volkert. The boring was positioned using a smart-phone app that utilizes device GPS, cell signals, and WiFi to assess location, and the position was cross referenced/checked in the field with the information provided by Volkert. Ground surface elevation was not available and is omitted from the log.

Soil descriptions are based on visual examination of the recovered samples. Stratification lines represent the inferred boundary between soil types. Insitu, the transition may be gradual.

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Nashville, Tennessee 37211

LOG OF BORING B-34

Project Name: Buckner Road Extension
Site Location: Thompson's Station, TN
Collier Project Number: 3049-19-01
Client: Volkert, Inc.
Franklin, TN

Location: See Exhibit 2
*Latitude/Longitude: 35° 46' 32.55" / -86° 51' 57.37"
*Surface elevation:
* see remarks below

Depth (ft.)	Elevation (ft.)	Material Description	Depth	Groundwater	Sample type	SPT blow counts (N-value)	Laboratory hand penetrometer (psf)	Water content (%)	Dry unit weight (pcf)	Unconfined compressive strength (psf)	Atterberg Limits LL-PL-PI
		~8 inches topsoil with roots	<1								
		Lean clay (CL), sandy, mottled brown/red brown/tan, phosphatic, trace of weathered rock fragments, very stiff	3		X	3-4-4 (8)		19			
5	-	Fat clay (CH), mottled yellow brown/light grey with black mineral stains, stiff			X	4-6-7 (13)		29			
					X	4-8-10 (18)		28			
10	-				X	4-6-6 (12)		29			
			12								
		Auger refusal at 12 feet									
15	-										
20	-										
25	-										
30	-										

Date started/completed: **November 14, 2019**
Drilled by: **Tri-State Drilling**
Drill rig: **Dietrich D-50**
Hammer type: **Autohammer**
Driller: **C. Gracey**
Water while drilling: **Dry**
Water upon completion: **Dry**
Borehole advanced by: **Hollow stem auger**
Borehole abandoned by: **Soil cuttings**

Remarks: Latitude/longitude data is an estimate and was obtained via approximation of the intended boring location on Google® aerial image map with reference to the horizontal alignment depicted on aerial mapping as provided by Volkert. The boring was positioned using a smart-phone app that utilizes device GPS, cell signals, and WiFi to assess location, and the position was cross referenced/checked in the field with the information provided by Volkert. Ground surface elevation was not available and is omitted from the log.

Soil descriptions are based on visual examination of the recovered samples. Stratification lines represent the inferred boundary between soil types. Insitu, the transition may be gradual.

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Nashville, Tennessee 37211

LOG OF BORING B-35

Project Name: Buckner Road Extension
Site Location: Thompson's Station, TN
Collier Project Number: 3049-19-01
Client: Volkert, Inc.
Franklin, TN

Location: See Exhibit 2
*Latitude/Longitude: 35° 46' 32.59" / -86° 52' 0.19"
*Surface elevation:
* see remarks below

Depth (ft.)	Elevation (ft.)	Material Description	Depth	Groundwater	Sample type	SPT blow counts (N-value)	Laboratory hand penetrometer (psf)	Water content (%)	Dry unit weight (pcf)	Unconfined compressive strength (psf)	Atterberg Limits LL-PL-PI
		~8 inches topsoil with roots	<1								
		Lean to fat clay (CL/CH), sandy, mottled red brown/yellow brown/light grey, phosphatic, trace of weathered sandstone fragments, stiff			X	3-5-6 (11)		22			
5	-				X	2-4-5 (9)		30			
					X	3-4-6 (10)		26			
10	-				X	3-4-5 (9)		37			
			11½								
		Auger refusal at 11 ½ feet									
15	-										
20	-										
25	-										
30	-										

Date started/completed:	**November 14, 2019**
Drilled by:	**Tri-State Drilling**
Drill rig:	**Dietrich D-50**
Hammer type:	**Autohammer**
Driller:	**C. Gracey**
Water while drilling:	**Dry**
Water upon completion:	**Dry**
Borehole advanced by:	**Hollow stem auger**
Borehole abandoned by:	**Soil cuttings**

Remarks: Latitude/longitude data is an estimate and was obtained via approximation of the intended boring location on Google® aerial image map with reference to the horizontal alignment depicted on aerial mapping as provided by Volkert. The boring was positioned using a smart-phone app that utilizes device GPS, cell signals, and WiFi to assess location, and the position was cross referenced/checked in the field with the information provided by Volkert. Ground surface elevation was not available and is omitted from the log.

Soil descriptions are based on visual examination of the recovered samples. Stratification lines represent the inferred boundary between soil types. Insitu, the transition may be gradual.

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LOG OF BORING B-36

Project Name: Buckner Road Extension
Site Location: Thompson's Station, TN
Collier Project Number: 3049-19-01
Client: Volkert, Inc.
Franklin, TN

Location: See Exhibit 2
*Latitude/Longitude: 35° 46' 32.72" / -86° 52' 4.11"
*Surface elevation:
* see remarks below

Depth (ft.)	Elevation (ft.)	Material Description	Depth	Groundwater	Sample type	SPT blow counts (N-value)	Laboratory hand penetrometer (psf)	Water content (%)	Dry unit weight (pcf)	Unconfined compressive strength (psf)	Atterberg Limits LL-PL-PI
		~12 inches topsoil with roots	1								
		Lean clay (CL), silty, sandy, mottled dark brown/dark grey, occasional gravel, very soft to soft (alluvium along creek bottom)		▼	X	WOH (0)		37			
5	-				X	1-2-2 (4)		38			
			6								
		Auger refusal at 6 feet									
10	-										
15	-										
20	-										
25	-										
30	-										

Date started/completed: **November 14, 2019**
Drilled by: **Tri-State Drilling**
Drill rig: **Dietrich D-50**
Hammer type: **Autohammer**
Driller: **C. Gracey**
Water while drilling: **Dry**
Water upon completion: **2 feet ▼**
Borehole advanced by: **Hollow stem auger**
Borehole abandoned by: **Soil cuttings**

Remarks: Latitude/longitude data is an estimate and was obtained via approximation of the intended boring location on Google® aerial image map with reference to the horizontal alignment depicted on aerial mapping as provided by Volkert. The boring was positioned using a smart-phone app that utilizes device GPS, cell signals, and WiFi to assess location, and the position was cross referenced/checked in the field with the information provided by Volkert. Ground surface elevation was not available and is omitted from the log. WOH = weight of hammer.

Soil descriptions are based on visual examination of the recovered samples. Stratification lines represent the inferred boundary between soil types. Insitu, the transition may be gradual.

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Nashville, Tennessee 37211

LOG OF BORING B-37

Project Name: Buckner Road Extension
Site Location: Thompson's Station, TN
Collier Project Number: 3049-19-01
Client: Volkert, Inc.
Franklin, TN

Location: See Exhibit 2
*Latitude/Longitude: 35° 46' 32.96" / -86° 52' 7.51"
*Surface elevation:
* see remarks below

Depth (ft.)	Elevation (ft.)	Material Description	Depth	Groundwater	Sample type	SPT blow counts (N-value)	Laboratory hand penetrometer (psf)	Water content (%)	Dry unit weight (pcf)	Unconfined compressive strength (psf)	Atterberg Limits LL-PL-PI
		~12 inches topsoil with roots	1								
		Lean clay (CL), very silty, dark brown, trace of gravel and organics, soft	3		X	3-5-6 (11)		18			
5	-	Lean clay (CL), mottled brown/tan, with trace of fine sand, slightly phosphatic, medium stiff			X	2-4-5 (9)		18			
					X	3-4-6 (10)		24			
			9								
10	-	*Auger refusal at 9 feet*									
15	-										
20	-										
25	-										
30	-										

Date started/completed: **November 13, 2019**
Drilled by: **Tri-State Drilling**
Drill rig: **Dietrich D-50**
Hammer type: **Autohammer**
Driller: **C. Gracey**
Water while drilling: **Dry**
Water upon completion: **Dry**
Borehole advanced by: **Hollow stem auger**
Borehole abandoned by: **Soil cuttings**

Remarks: Latitude/longitude data is an estimate and was obtained via approximation of the intended boring location on Google® aerial image map with reference to the horizontal alignment depicted on aerial mapping as provided by Volkert. The boring was positioned using a smart-phone app that utilizes device GPS, cell signals, and WiFi to assess location, and the position was cross referenced/checked in the field with the information provided by Volkert. Ground surface elevation was not available and is omitted from the log.

Soil descriptions are based on visual examination of the recovered samples. Stratification lines represent the inferred boundary between soil types. Insitu, the transition may be gradual.

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Nashville, Tennessee 37211

LOG OF BORING B-38

Project Name: Buckner Road Extension
Site Location: Thompson's Station, TN
Collier Project Number: 3049-19-01
Client: Volkert, Inc.
Franklin, TN

Location: See Exhibit 2
*Latitude/Longitude: 35° 46' 33.41" / -86° 52' 12.46"
*Surface elevation:
* see remarks below

Depth (ft.)	Elevation (ft.)	Material Description	Depth	Groundwater	Sample type	SPT blow counts (N-value)	Laboratory hand penetrometer (psf)	Water content (%)	Dry unit weight (pcf)	Unconfined compressive strength (psf)	Atterberg Limits LL-PL-PI
		~12 inches topsoil with roots	1								
5	-	Lean clay (CL), mottled tan/brown/yellow brown with black mineral stains, slightly phosphatic, trace of sand, stiff to very stiff			X	WOH-3 (3)		21			
					X	2-3-5 (8)		19			
					X	3-4-4 (8)		17			Bulk sample 27-17-10
10	-				X	3-5-12 (17)		26			
			12								
		Auger refusal at 12 feet									
15	-										
20	-										
25	-										
30	-										

Date started/completed: **November 13, 2019**
Drilled by: **Tri-State Drilling**
Drill rig: **Dietrich D-50**
Hammer type: **Autohammer**
Driller: **C. Gracey**
Water while drilling: **Dry**
Water upon completion: **Dry**
Borehole advanced by: **Hollow stem auger**
Borehole abandoned by: **Soil cuttings**

Remarks: Latitude/longitude data is an estimate and was obtained via approximation of the intended boring location on Google® aerial image map with reference to the horizontal alignment depicted on aerial mapping as provided by Volkert. The boring was positioned using a smart-phone app that utilizes device GPS, cell signals, and WiFi to assess location, and the position was cross referenced/checked in the field with the information provided by Volkert. Ground surface elevation was not available and is omitted from the log. WOH = weight of hammer.

Soil descriptions are based on visual examination of the recovered samples. Stratification lines represent the inferred boundary between soil types. Insitu, the transition may be gradual.

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Nashville, Tennessee 37211

LOG OF BORING B-39

Project Name: Buckner Road Extension
Site Location: Thompson's Station, TN
Collier Project Number: 3049-19-01
Client: Volkert, Inc.
Franklin, TN

Location: See Exhibit 2
*Latitude/Longitude: 35° 46' 34.05" / -86° 52' 16.65"
*Surface elevation:
* see remarks below

Depth (ft.)	Elevation (ft.)	Material Description	Depth	Groundwater	Sample type	SPT blow counts (N-value)	Laboratory hand penetrometer (psf)	Water content (%)	Dry unit weight (pcf)	Unconfined compressive strength (psf)	Atterberg Limits LL-PL-PI
		~18 inches topsoil with roots	1½								
		Lean clay (CL), mottled tan/brown/yellow brown, slightly phosphatic, trace of sand and weathered sandstone fragments, medium stiff to stiff				WOH-3 (3)		22			
5	-					4-4-6 (10)		21			
						4-5-6 (11)		25			
			9			6-50/0		12			
10	-	*Auger refusal at 9 feet*									
15	-										
20	-										
25	-										
30	-										

Date started/completed: **November 13, 2019**
Drilled by: **Tri-State Drilling**
Drill rig: **Dietrich D-50**
Hammer type: **Autohammer**
Driller: **C. Gracey**
Water while drilling: **Dry**
Water upon completion: **Dry**
Borehole advanced by: **Hollow stem auger**
Borehole abandoned by: **Soil cuttings**

Remarks: Latitude/longitude data is an estimate and was obtained via approximation of the intended boring location on Google® aerial image map with reference to the horizontal alignment depicted on aerial mapping as provided by Volkert. The boring was positioned using a smart-phone app that utilizes device GPS, cell signals, and WiFi to assess location, and the position was cross referenced/checked in the field with the information provided by Volkert. Ground surface elevation was not available and is omitted from the log. WOH = weight of hammer.

Soil descriptions are based on visual examination of the recovered samples. Stratification lines represent the inferred boundary between soil types. Insitu, the transition may be gradual.

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Nashville, Tennessee 37211

LOG OF BORING B-40

Project Name: Buckner Road Extension
Site Location: Thompson's Station, TN
Collier Project Number: 3049-19-01
Client: Volkert, Inc.
Franklin, TN

Location: See Exhibit 2
*Latitude/Longitude: 35° 46' 35.36" / -86° 52' 19.54"
*Surface elevation:
* see remarks below

Depth (ft.)	Elevation (ft.)	Material Description	Depth	Groundwater	Sample type	SPT blow counts (N-value)	Laboratory hand penetrometer (psf)	Water content (%)	Dry unit weight (pcf)	Unconfined compressive strength (psf)	Atterberg Limits LL-PL-PI
		~12 inches topsoil with roots	1								
		Lean clay (CL), mottled tan/brown/yellow brown, phosphatic, trace of sand and weathered sandstone fragments, stiff to very stiff			X	6-8-8 (16)		41			
5	-				X	3-3-5 (8)		35			
					X	3-4-5 (9)		41			Bulk sample 40-21-19
10	-				X	3-4-4 (8)		34			
			15		X	2-3-5 (8)		47			
15	-	*Boring terminated at 15 feet*									
20	-										
25	-										
30	-										

Date started/completed: **November 13, 2019**
Drilled by: **Tri-State Drilling**
Drill rig: **Dietrich D-50**
Hammer type: **Autohammer**
Driller: **C. Gracey**
Water while drilling: **Dry**
Water upon completion: **Dry**
Borehole advanced by: **Hollow stem auger**
Borehole abandoned by: **Soil cuttings**

Remarks: Latitude/longitude data is an estimate and was obtained via approximation of the intended boring location on Google® aerial image map with reference to the horizontal alignment depicted on aerial mapping as provided by Volkert. The boring was positioned using a smart-phone app that utilizes device GPS, cell signals, and WiFi to assess location, and the position was cross referenced/checked in the field with the information provided by Volkert. Ground surface elevation was not available and is omitted from the log.

Soil descriptions are based on visual examination of the recovered samples. Stratification lines represent the inferred boundary between soil types. Insitu, the transition may be gradual.

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LOG OF BORING B-41

Project Name: Buckner Road Extension
Site Location: Thompson's Station, TN
Collier Project Number: 3049-19-01
Client: Volkert, Inc.
Franklin, TN

Location: See Exhibit 2
*Latitude/Longitude: 35° 46' 38.19" / -86° 52' 22"
*Surface elevation:
* see remarks below

Depth (ft.)	Elevation (ft.)	Material Description	Depth	Groundwater	Sample type	SPT blow counts (N-value)	Laboratory hand penetrometer (psf)	Water content (%)	Dry unit weight (pcf)	Unconfined compressive strength (psf)	Atterberg Limits LL-PL-PI
		~12 inches topsoil with roots	1								
		Lean clay (CL), mottled tan/brown/yellow brown, phosphatic, trace of sand and weathered sandstone fragments, stiff			X	3-4-5 (9)		40			
5	-				X	2-4-5 (9)		37			
					X	3-5-7 (12)		31			
			10		X	3-5-8 (13)		24			
10	-	*Auger refusal at 10 feet*									
15	-										
20	-										
25	-										
30	-										

Date started/completed: **November 13, 2019**
Drilled by: **Tri-State Drilling**
Drill rig: **Dietrich D-50**
Hammer type: **Autohammer**
Driller: **C. Gracey**
Water while drilling: **Dry**
Water upon completion: **Dry**
Borehole advanced by: **Hollow stem auger**
Borehole abandoned by: **Soil cuttings**

Remarks: Latitude/longitude data is an estimate and was obtained via approximation of the intended boring location on Google® aerial image map with reference to the horizontal alignment depicted on aerial mapping as provided by Volkert. The boring was positioned using a smart-phone app that utilizes device GPS, cell signals, and WiFi to assess location, and the position was cross referenced/checked in the field with the information provided by Volkert. Ground surface elevation was not available and is omitted from the log.

Soil descriptions are based on visual examination of the recovered samples. Stratification lines represent the inferred boundary between soil types. Insitu, the transition may be gradual.

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Nashville, Tennessee 37211

LOG OF BORING B-42

Project Name: Buckner Road Extension
Site Location: Thompson's Station, TN
Collier Project Number: 3049-19-01
Client: Volkert, Inc.
Franklin, TN

Location: See Exhibit 2
*Latitude/Longitude: 35° 46' 41.16" / -86° 52' 23.72"
*Surface elevation:
* see remarks below

Depth (ft.)	Elevation (ft.)	Material Description	Depth	Groundwater	Sample type	SPT blow counts (N-value)	Laboratory hand penetrometer (psf)	Water content (%)	Dry unit weight (pcf)	Unconfined compressive strength (psf)	Atterberg Limits LL-PL-PI
		~12 inches topsoil with roots	1								
		Lean clay (CL), mottled tan/brown/yellow brown, phosphatic, trace of sand and weathered sandstone fragments, stiff to very stiff			X	2-4-5 (9)		25			
5	-				X	2-5-6 (11)		25			
					X	3-5-5 (10)		32			
10	-				X	2-2-3 (5)		31			
			13								
		Auger refusal at 13 feet									
15	-										
20	-										
25	-										
30	-										

Date started/completed: **November 13, 2019**
Drilled by: **Tri-State Drilling**
Drill rig: **Dietrich D-50**
Hammer type: **Autohammer**
Driller: **C. Gracey**
Water while drilling: **Dry**
Water upon completion: **Dry**
Borehole advanced by: **Hollow stem auger**
Borehole abandoned by: **Soil cuttings**

Remarks: Latitude/longitude data is an estimate and was obtained via approximation of the intended boring location on Google® aerial image map with reference to the horizontal alignment depicted on aerial mapping as provided by Volkert. The boring was positioned using a smart-phone app that utilizes device GPS, cell signals, and WiFi to assess location, and the position was cross referenced/checked in the field with the information provided by Volkert. Ground surface elevation was not available and is omitted from the log.

Soil descriptions are based on visual examination of the recovered samples. Stratification lines represent the inferred boundary between soil types. Insitu, the transition may be gradual.

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LOG OF BORING B-43

Project Name: Buckner Road Extension
Site Location: Thompson's Station, TN
Collier Project Number: 3049-19-01
Client: Volkert, Inc.
Franklin, TN

Location: See Exhibit 2
*Latitude/Longitude: 35° 46' 43.74" / -86° 52' 25.95"
*Surface elevation:
* see remarks below

Depth (ft.)	Elevation (ft.)	Material Description	Depth	Groundwater	Sample type	SPT blow counts (N-value)	Laboratory hand penetrometer (psf)	Water content (%)	Dry unit weight (pcf)	Unconfined compressive strength (psf)	Atterberg Limits LL-PL-PI
		~12 inches topsoil with roots	1								
		Lean clay (CL), mottled tan/red brown/brown/light grey, slightly phosphatic, trace of sand and weathered sandstone fragments, medium stiff to very stiff			X	2-2-4 (6)		25			
5	-				X	4-6-7 (13)		30			
					X	4-8-10 (18)		29			Bulk sample 38-22-16
10	-				X	5-10-15 (25)		27			
			15		X	4-8-12 (20)		26			
15	-	*Boring terminated at 15 feet*									
20	-										
25	-										
30	-										

Date started/completed: **November 14, 2019**
Drilled by: **Tri-State Drilling**
Drill rig: **Dietrich D-50**
Hammer type: **Autohammer**
Driller: **C. Gracey**
Water while drilling: **Dry**
Water upon completion: **Dry**
Borehole advanced by: **Hollow stem auger**
Borehole abandoned by: **Soil cuttings**

Remarks: Latitude/longitude data is an estimate and was obtained via approximation of the intended boring location on Google® aerial image map with reference to the horizontal alignment depicted on aerial mapping as provided by Volkert. The boring was positioned using a smart-phone app that utilizes device GPS, cell signals, and WiFi to assess location, and the position was cross referenced/checked in the field with the information provided by Volkert. Ground surface elevation was not available and is omitted from the log.

Soil descriptions are based on visual examination of the recovered samples. Stratification lines represent the inferred boundary between soil types. Insitu, the transition may be gradual.

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Nashville, Tennessee 37211

LOG OF BORING B-44

Project Name: Buckner Road Extension
Site Location: Thompson's Station, TN
Collier Project Number: 3049-19-01
Client: Volkert, Inc.
Franklin, TN

Location: See Exhibit 2
*Latitude/Longitude: 35° 46' 45.5" / -86° 52' 27.56"
*Surface elevation:
* see remarks below

Depth (ft.)	Elevation (ft.)	Material Description	Depth	Groundwater	Sample type	SPT blow counts (N-value)	Laboratory hand penetrometer (psf)	Water content (%)	Dry unit weight (pcf)	Unconfined compressive strength (psf)	Atterberg Limits LL-PL-PI
		~12 inches topsoil with roots	1								
		Lean clay (CL), brown, with mineral nodules, medium stiff to stiff			X	2-2-2 (4)		25			
5	-				X	3-3-4 (7)		23			
			8		X	3-4-5 (9)		24			
		Lean clay (CL), mottled tan/red brown/yellow brown/light grey, phosphatic, trace of sand and weathered sandstone fragments, stiff			X	3-5-8 (13)		26			
10	-										
			15		X	3-4-5 (9)		16			
15	-	*Boring terminated at 15 feet*									
20	-										
25	-										
30	-										

Date started/completed: **November 14, 2019**
Drilled by: **Tri-State Drilling**
Drill rig: **Dietrich D-50**
Hammer type: **Autohammer**
Driller: **C. Gracey**
Water while drilling: **Dry**
Water upon completion: **Dry**
Borehole advanced by: **Hollow stem auger**
Borehole abandoned by: **Soil cuttings**

Remarks: Latitude/longitude data is an estimate and was obtained via approximation of the intended boring location on Google® aerial image map with reference to the horizontal alignment depicted on aerial mapping as provided by Volkert. The boring was positioned using a smart-phone app that utilizes device GPS, cell signals, and WiFi to assess location, and the position was cross referenced/checked in the field with the information provided by Volkert. Ground surface elevation was not available and is omitted from the log.

Soil descriptions are based on visual examination of the recovered samples. Stratification lines represent the inferred boundary between soil types. Insitu, the transition may be gradual.

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Nashville, Tennessee 37211

LOG OF BORING B-45

Project Name: Buckner Road Extension
Site Location: Thompson's Station, TN
Collier Project Number: 3049-19-01
Client: Volkert, Inc.
Franklin, TN

Location: See Exhibit 2
*Latitude/Longitude: 35° 46' 46.57" / -86° 52' 31.45"
*Surface elevation:
* see remarks below

Depth (ft.)	Elevation (ft.)	Material Description	Depth	Groundwater	Sample type	SPT blow counts (N-value)	Laboratory hand penetrometer (psf)	Water content (%)	Dry unit weight (pcf)	Unconfined compressive strength (psf)	Atterberg Limits LL-PL-PI
		~12 inches topsoil with roots	1								
5	-	Lean clay (CL), brown, with mineral nodules, medium stiff to stiff	8		X	2-2-4 (6)		24			Bulk sample 38-20-18
					X	3-4-6 (10)		24			
					X	3-5-7 (12)		29			
10	-	Lean clay (CL), mottled tan/red brown/yellow brown/light grey, phosphatic, trace of sand and weathered sandstone fragments, very stiff	13		X	3-7-8 (15)		29			
15	-	*Auger refusal at 13 feet*									
20	-										
25	-										
30	-										

Date started/completed: **November 14, 2019**
Drilled by: **Tri-State Drilling**
Drill rig: **Dietrich D-50**
Hammer type: **Autohammer**
Driller: **C. Gracey**
Water while drilling: **Dry**
Water upon completion: **Dry**
Borehole advanced by: **Hollow stem auger**
Borehole abandoned by: **Soil cuttings**

Remarks: Latitude/longitude data is an estimate and was obtained via approximation of the intended boring location on Google® aerial image map with reference to the horizontal alignment depicted on aerial mapping as provided by Volkert. The boring was positioned using a smart-phone app that utilizes device GPS, cell signals, and WiFi to assess location, and the position was cross referenced/checked in the field with the information provided by Volkert. Ground surface elevation was not available and is omitted from the log.

Soil descriptions are based on visual examination of the recovered samples. Stratification lines represent the inferred boundary between soil types. Insitu, the transition may be gradual.

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Nashville, Tennessee 37211

LOG OF BORING B-46

Project Name:	Buckner Road Extension
Site Location:	Thompson's Station, TN
Collier Project Number:	3049-19-01
Client:	Volkert, Inc.
	Franklin, TN

Location: See Exhibit 2
*Latitude/Longitude: 35° 46' 46.8" / -86° 52' 34.26"
*Surface elevation:
* see remarks below

Depth (ft.)	Elevation (ft.)	Material Description	Depth	Groundwater	Sample type	SPT blow counts (N-value)	Laboratory hand penetrometer (psf)	Water content (%)	Dry unit weight (pcf)	Unconfined compressive strength (psf)	Atterberg Limits LL-PL-PI
		~12 inches topsoil with roots	1								
5	-	Lean clay (CL), brown, with mineral nodules, medium stiff to stiff	8			2-2-3 (5) 2-3-4 (7) 3-3-5 (8)		23 26 28			
10	-	Lean clay (CL), mottled tan/red brown/yellow brown/light grey, phosphatic, trace of sand and weathered sandstone fragments, very stiff	13½	▼		3-4-4 (8) 50/1"		19			
15	-	*Auger refusal at 13 ½ feet*									
20	-										
25	-										
30	-										

Date started/completed:	**November 14, 2019**
Drilled by:	**Tri-State Drilling**
Drill rig:	**Dietrich D-50**
Hammer type:	**Autohammer**
Driller:	**C. Gracey**
Water while drilling:	**Dry**
Water upon completion:	**13½ ft. (refusal) ▼**
Borehole advanced by:	**Hollow stem auger**
Borehole abandoned by:	**Soil cuttings**

Remarks: Latitude/longitude data is an estimate and was obtained via approximation of the intended boring location on Google® aerial image map with reference to the horizontal alignment depicted on aerial mapping as provided by Volkert. The boring was positioned using a smart-phone app that utilizes device GPS, cell signals, and WiFi to assess location, and the position was cross referenced/checked in the field with the information provided by Volkert. Ground surface elevation was not available and is omitted from the log.

Soil descriptions are based on visual examination of the recovered samples. Stratification lines represent the inferred boundary between soil types. Insitu, the transition may be gradual.

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Nashville, Tennessee 37211

LOG OF BORING B-47

Project Name: Buckner Road Extension
Site Location: Thompson's Station, TN
Collier Project Number: 3049-19-01
Client: Volkert, Inc.
Franklin, TN

Location: See Exhibit 2
*Latitude/Longitude: 35° 46' 47.19" / -86° 52' 37.14"
*Surface elevation:
* see remarks below

Depth (ft.)	Elevation (ft.)	Material Description	Depth	Groundwater	Sample type	SPT blow counts (N-value)	Laboratory hand penetrometer (psf)	Water content (%)	Dry unit weight (pcf)	Unconfined compressive strength (psf)	Atterberg Limits LL-PL-PI
		~12 inches topsoil with roots	1								
		Lean clay (CL), brown, with mineral nodules, medium stiff to stiff			X	2-2-4 (6)		20			
5	-				X	2-3-4 (7)		20			Bulk sample 39-20-19
			6								
		Lean clay (CL), sandy, mottled tan/red brown/yellow brown, phosphatic, trace of weathered sandstone fragments, stiff			X	3-3-4 (7)		27			
10	-				X	3-6-9 (15)		26			
15	-		15		X	3-4-6 (10)					
		Boring terminated at 15 feet									
20	-										
25	-										
30	-										

Date started/completed: **November 14, 2019**
Drilled by: **Tri-State Drilling**
Drill rig: **Dietrich D-50**
Hammer type: **Autohammer**
Driller: **C. Gracey**
Water while drilling: **Dry**
Water upon completion: **Dry**
Borehole advanced by: **Hollow stem auger**
Borehole abandoned by: **Soil cuttings**

Remarks: Latitude/longitude data is an estimate and was obtained via approximation of the intended boring location on Google® aerial image map with reference to the horizontal alignment depicted on aerial mapping as provided by Volkert. The boring was positioned using a smart-phone app that utilizes device GPS, cell signals, and WiFi to assess location, and the position was cross referenced/checked in the field with the information provided by Volkert. Ground surface elevation was not available and is omitted from the log.

Soil descriptions are based on visual examination of the recovered samples. Stratification lines represent the inferred boundary between soil types. Insitu, the transition may be gradual.

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Nashville, Tennessee 37211

LOG OF BORING B-48

Project Name: Buckner Road Extension
Site Location: Thompson's Station, TN
Collier Project Number: 3049-19-01
Client: Volkert, Inc.
Franklin, TN

Location: See Exhibit 2
*Latitude/Longitude: 35° 46' 47.57" / -86° 52' 40.23"
*Surface elevation:
* see remarks below

Depth (ft.)	Elevation (ft.)	Material Description	Depth	Groundwater	Sample type	SPT blow counts (N-value)	Laboratory hand penetrometer (psf)	Water content (%)	Dry unit weight (pcf)	Unconfined compressive strength (psf)	Atterberg Limits LL-PL-PI
		~12 inches topsoil with roots	1								
		Lean clay (CL), brown/red brown, with mineral nodules, stiff	4		X	2-3-6 (9)		32			
5	-	Lean clay (CL), mottled tan/brown/yellow brown/light grey, phosphatic, trace of sand and weathered sandstone fragments, stiff			X	3-4-6 (10)		27			
					X	4-4-6 (10)		28			
10	-				X	3-4-5 (9)		18			
			13								
		Auger refusal at 13 feet									
15	-										
20	-										
25	-										
30	-										

Date started/completed: **November 14, 2019**
Drilled by: **Tri-State Drilling**
Drill rig: **Dietrich D-50**
Hammer type: **Autohammer**
Driller: **C. Gracey**
Water while drilling: **Dry**
Water upon completion: **Dry**
Borehole advanced by: **Hollow stem auger**
Borehole abandoned by: **Soil cuttings**

Remarks: Latitude/longitude data is an estimate and was obtained via approximation of the intended boring location on Google® aerial image map with reference to the horizontal alignment depicted on aerial mapping as provided by Volkert. The boring was positioned using a smart-phone app that utilizes device GPS, cell signals, and WiFi to assess location, and the position was cross referenced/checked in the field with the information provided by Volkert. Ground surface elevation was not available and is omitted from the log.

Soil descriptions are based on visual examination of the recovered samples. Stratification lines represent the inferred boundary between soil types. Insitu, the transition may be gradual.

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Nashville, Tennessee 37211

LOG OF BORING B-49

Project Name: Buckner Road Extension
Site Location: Thompson's Station, TN
Collier Project Number: 3049-19-01
Client: Volkert, Inc.
Franklin, TN

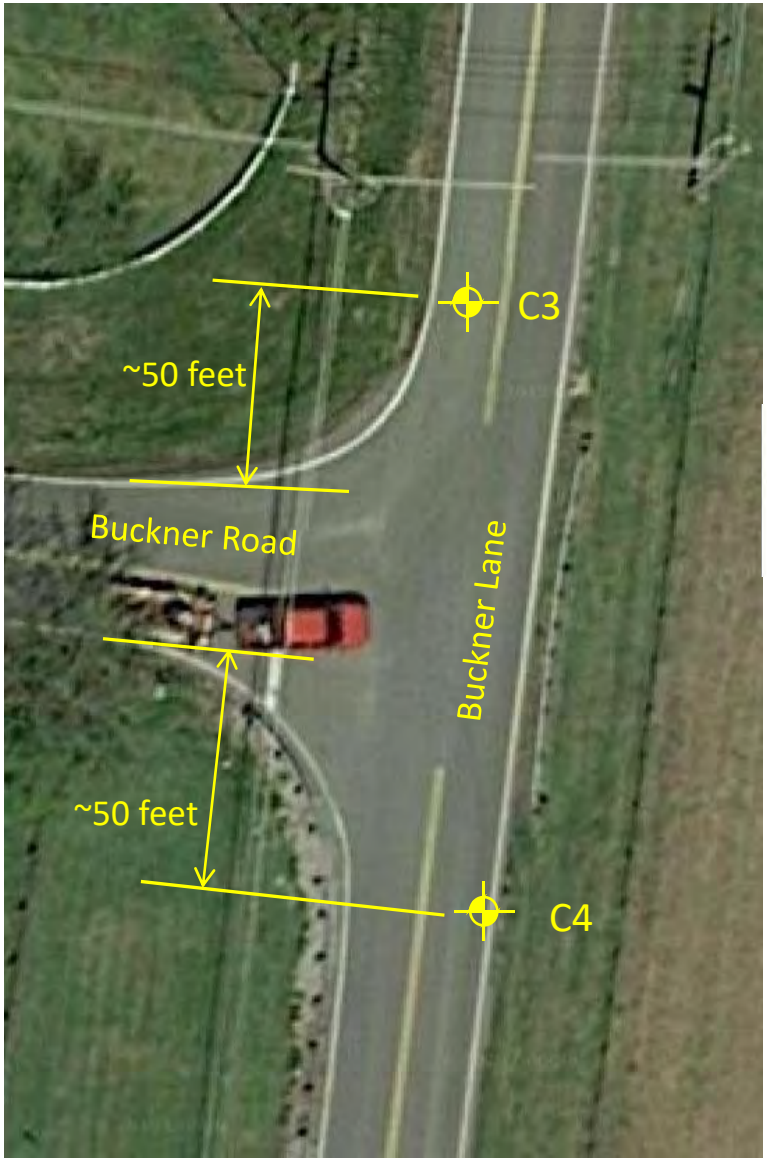
Location: See Exhibit 2
*Latitude/Longitude: 35° 46' 47.85" / -86° 52' 43.08"
*Surface elevation:
* see remarks below

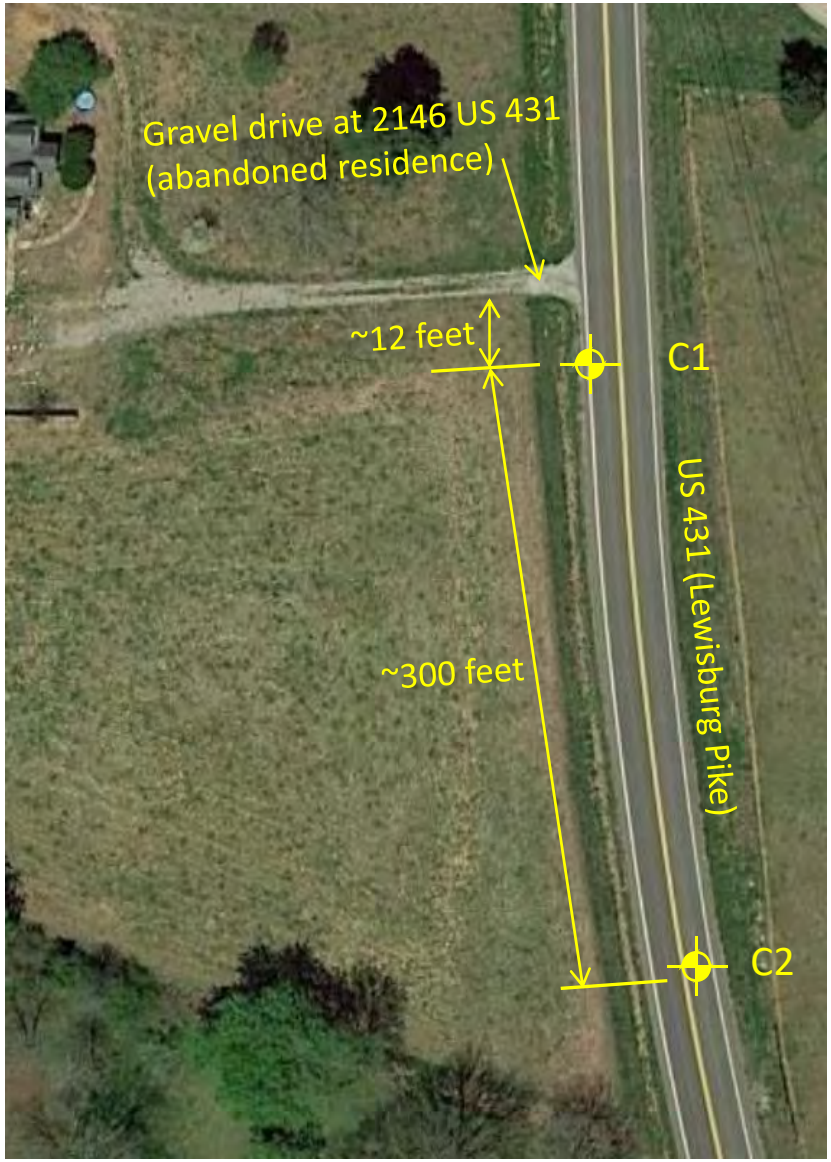
Depth (ft.)	Elevation (ft.)	Material Description	Depth	Groundwater	Sample type	SPT blow counts (N-value)	Laboratory hand penetrometer (psf)	Water content (%)	Dry unit weight (pcf)	Unconfined compressive strength (psf)	Atterberg Limits LL-PL-PI
		~12 inches topsoil with roots	1								
		Lean clay (CL), brown/red brown, with mineral nodules, stiff	3		X	2-3-5 (8)		26			
5	-	Lean to fat clay (CL/CH), mottled tan/brown/yellow brown/light grey, phosphatic, trace of sand and weathered sandstone fragments, stiff			X	4-6-7 (13)		31			
					X	5-7-10 (17)		33			
10	-				X	3-4-6 (10)		26			
			13								
		Auger refusal at 13 feet									
15	-										
20	-										
25	-										
30	-										

Date started/completed: **November 13, 2019**
Drilled by: **Tri-State Drilling**
Drill rig: **Dietrich D-50**
Hammer type: **Autohammer**
Driller: **C. Gracey**
Water while drilling: **Dry**
Water upon completion: **Dry**
Borehole advanced by: **Hollow stem auger**
Borehole abandoned by: **Soil cuttings**

Remarks: Latitude/longitude data is an estimate and was obtained via approximation of the intended boring location on Google® aerial image map with reference to the horizontal alignment depicted on aerial mapping as provided by Volkert. The boring was positioned using a smart-phone app that utilizes device GPS, cell signals, and WiFi to assess location, and the position was cross referenced/checked in the field with the information provided by Volkert. Ground surface elevation was not available and is omitted from the log.

Soil descriptions are based on visual examination of the recovered samples. Stratification lines represent the inferred boundary between soil types. Insitu, the transition may be gradual.





Source: Google®

ILLUSTRATION NOT INTENDED FOR CONSTRUCTION OR LAYOUT PURPOSES

Project Manager: SV	Project No. 3049-19-01
Drawn by:	Scale: N.T.S.
Checked by: NC	File Name: Exh. 55
Approved by:	Date: 02Dec2019

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2949 Nolensville Pike Nashville, Tennessee 37027
PH. (615) 331-1441 FAX. (615) 331-1050

ROAD CORE LOCATION PLAN

Proposed Buckner Road Extension
Between Buckner Lane and US 431
Thompson's Station, TN

Exh. 55

COLLIER ENGINEERING CO., INC.
CONSULTING ● DESIGN ● CONSTRUCTION

Report of Asphalt Coring and Near-Surface Exploration

Project:	Buckner Road Extension	Date:	9/26/2019
Client:	Volkert	Core Identification:	C1
Project Location:	Springhill, TN	Corridor:	HWY 431 / Lewisburg Pike

Core Location:	~12' S of 2146 Lewisburg Pike, Southbound

Core Notes

Layer	Apparent Material	Thickness (in)
AC Layer 1	Surface	1 5/8
AC Layer 2	Surface	1 7/8
AC Layer 3	Surface	1 7/8
AC Layer 4	Surface	1 3/4
AC Layer 5	Binder	2 1/2
AC Layer 6		
Base	Crushed Aggregate	4 1/2
Subgrade Notes:	Firm to Stiff Yellowish Brown Lean Clay	

Photograph of Specimen

Tech: Bilyeu Date: 12/3/2019 Reviewed By:

Exhibit 56

COLLIER ENGINEERING CO., INC.
CONSULTING ● DESIGN ● CONSTRUCTION

Report of Asphalt Coring and Near-Surface Exploration

Project:	Buckner Road Extension	Date:	9/26/2019
Client:	Volkert	Core Identification:	C2
Project Location:	Springhill, TN	Corridor:	HWY 431 / Lewisburg Pike

Core Location:	~312' S of 2146 Lewisburg Pike, Northbound

Photograph of Specimen

Core Notes

Layer	Apparent Material	Thickness (in)
AC Layer 1	Surface	7/8
AC Layer 2	Surface	1 1/8
AC Layer 3	Surface	1/2
AC Layer 4	Surface	1 1/4
AC Layer 5	Surface	1
AC Layer 6	Surface	3/4
AC Layer 7	Binder	1 1/2
AC Layer 8	Binder	1 1/2
AC Layer 9	Surface	2
AC Layer 10	Binder	1
Base	Crushed Aggregate	4 1/2
Subgrade Notes:	Firm to Stiff Yellowish Brown Lean Clay	

Tech: Bilyeu Date: 12/3/2019 Reviewed By:

Exhibit 57

COLLIER ENGINEERING CO., INC.
CONSULTING ● DESIGN ● CONSTRUCTION

Report of Asphalt Coring and Near-Surface Exploration

Project:	Buckner Road Extension	Date:	9/26/2019
Client:	Volkert	Core Identification:	C3
Project Location:	Springhill, TN	Corridor:	Buckner Lane

Core Location:	~50' N of Bucker Road Intersection, South Bound

Core Notes

Layer	Apparent Material	Thickness (in)
AC Layer 1	Surface	1 1/8
AC Layer 2	Surface	7/8
AC Layer 3	Surface	1
AC Layer 4	Surface	3/4
AC Layer 5	Surface	1 1/4
AC Layer 6	Binder	1 7/8
Base	Crushed Aggregate	9 3/4
Subgrade Notes:	Firm to Stiff Yellowish Brown Lean Clay	

Photograph of Specimen

Tech: Bilyeu Date: 12/3/2019 Reviewed By:

Exhibit 58

COLLIER ENGINEERING CO., INC.
CONSULTING ● DESIGN ● CONSTRUCTION

Report of Asphalt Coring and Near-Surface Exploration

Project:	Buckner Road Extension	Date:	9/26/2019
Client:	Volkert	Core Identification:	C4
Project Location:	Springhill, TN	Corridor:	Buckner Lane

Core Location:	~50' S of Bucker Road Intersection, North Bound

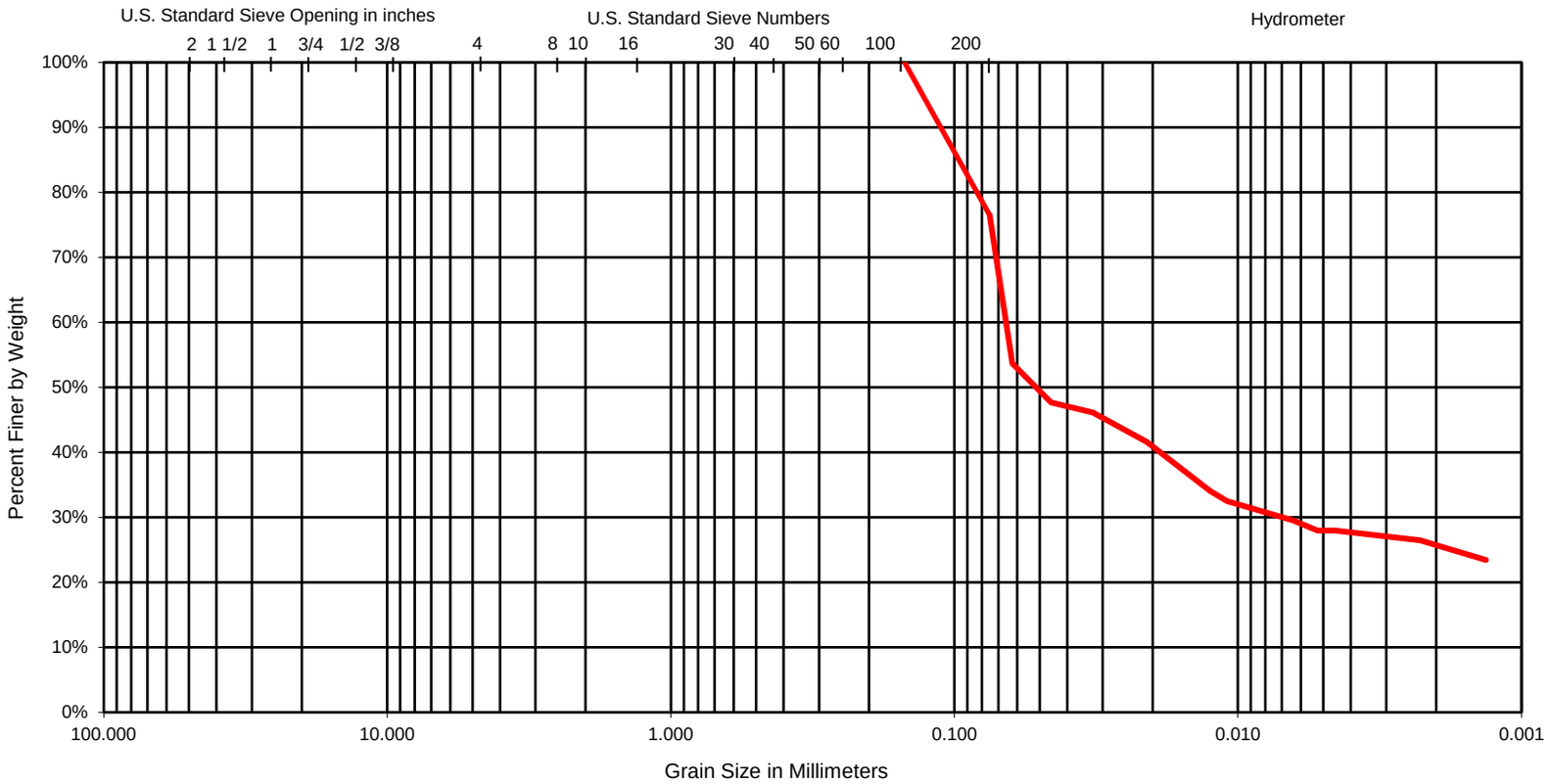
Core Notes

Layer	Apparent Material	Thickness (in)
AC Layer 1	Surface	1 3/4
AC Layer 2	Binder	3 1/2
AC Layer 3	Surface	2
AC Layer 4		
AC Layer 5		
AC Layer 6		
Base	Crushed Aggregate	9 1/4
Subgrade Notes:	Firm to Stiff Yellowish Brown Lean Clay	

Photograph of Specimen

Tech: Bilyeu Date: 12/3/2019 Reviewed By:

Exhibit 59



GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

Boring	Sample	Depth	Description	AASHTO	Natural Moisture	LL	PL	PI	Fineness Modulus
3	Bulk		Dark Brown Silty Clay	A-4		31	21	10	

PM	HB
Drawn by:	HB
Checked by:	JB
Approved by:	JB

Project No.	3049-19-1
Scale:	N/A
File Name:	Exhibit 60
Date:	10/9/19

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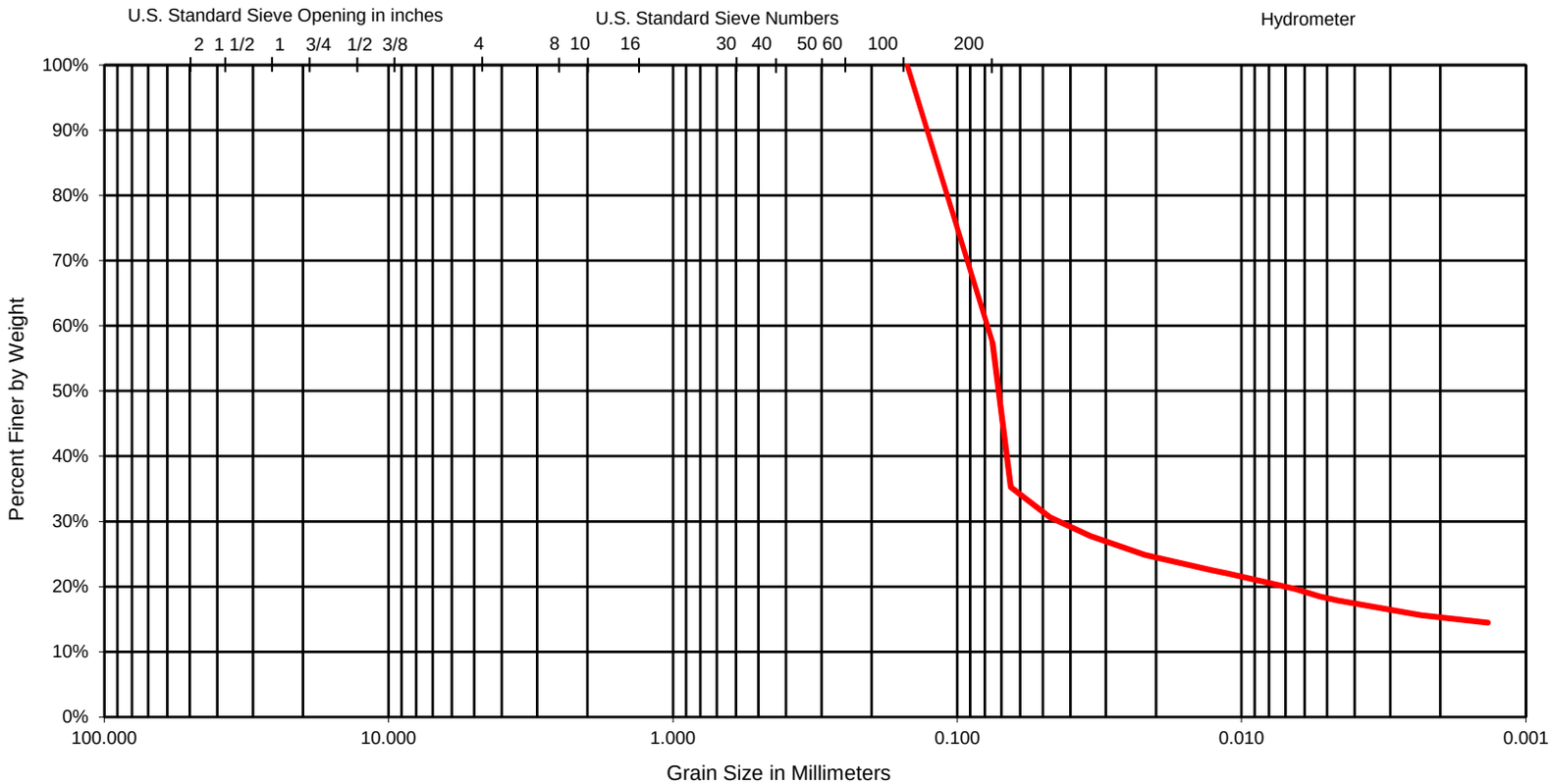
GRADATION ANALYSIS

Buckner Road Extension
Buckner Lane to Lewisburg Pike
Thompson's Station, TN

Exhibit
60



GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

Boring	Sample	Depth	Description	AASHTO	Natural Moisture	LL	PL	PI	Fineness Modulus
5	6		Brown Lean Clay	A-6		32	21	11	

PM	HB
Drawn by:	HB
Checked by:	JB
Approved by:	JB

Project No.	3049-19-1
Scale:	N/A
File Name:	Exhibit 61
Date:	10/9/19

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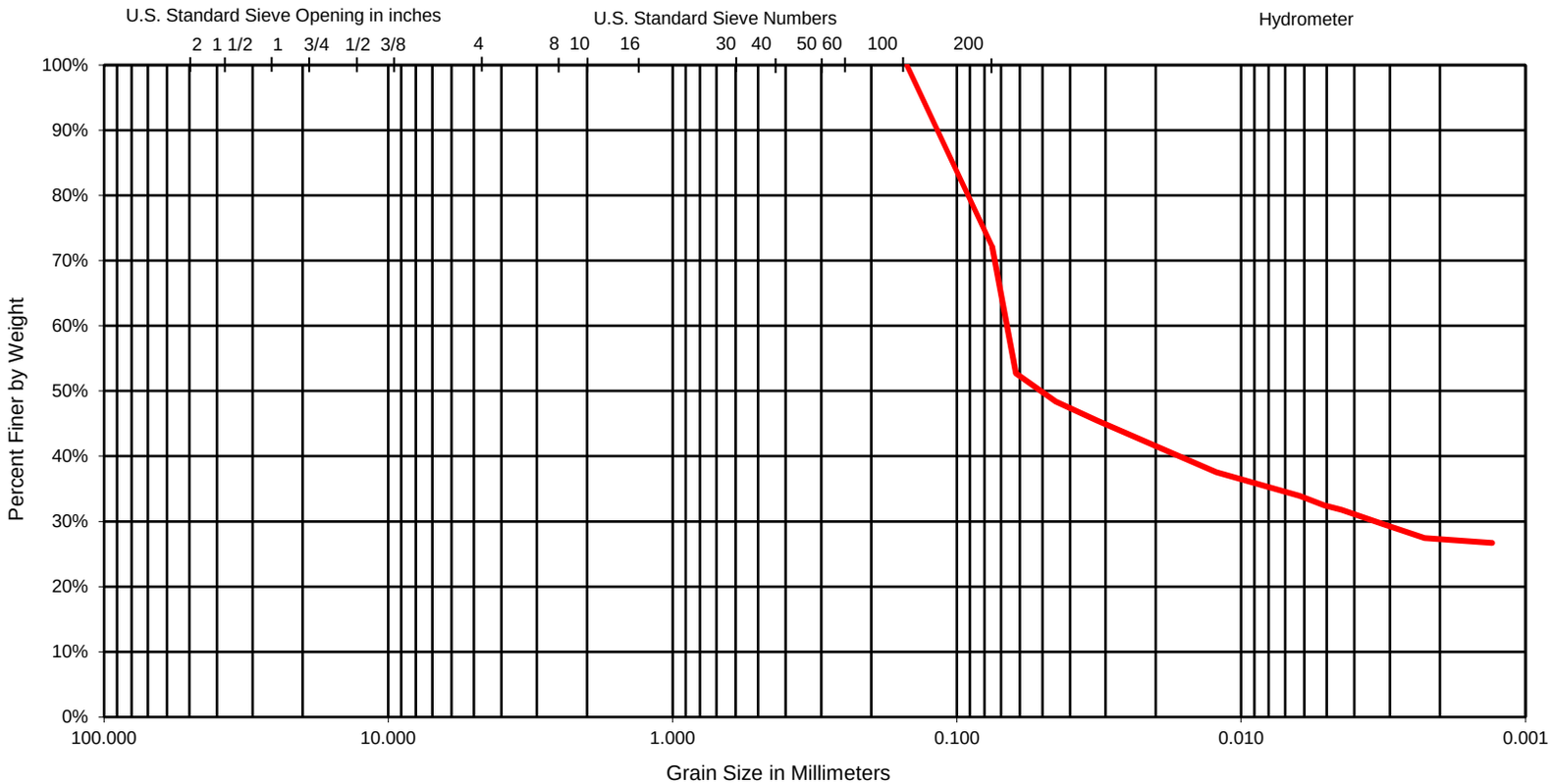
GRADATION ANALYSIS

Buckner Road Extension
Buckner Lane to Lewisburg Pike
Thompson's Station, TN

Exhibit
61



GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

Boring	Sample	Depth	Description	AASHTO	Natural Moisture	LL	PL	PI	Fineness Modulus
9	2		Strong Brown Lean Clay	A-6		36	21	15	

PM	HB
Drawn by:	HB
Checked by:	JB
Approved by:	JB

Project No.	3049-19-1
Scale:	N/A
File Name:	Exhibit 62
Date:	10/9/19

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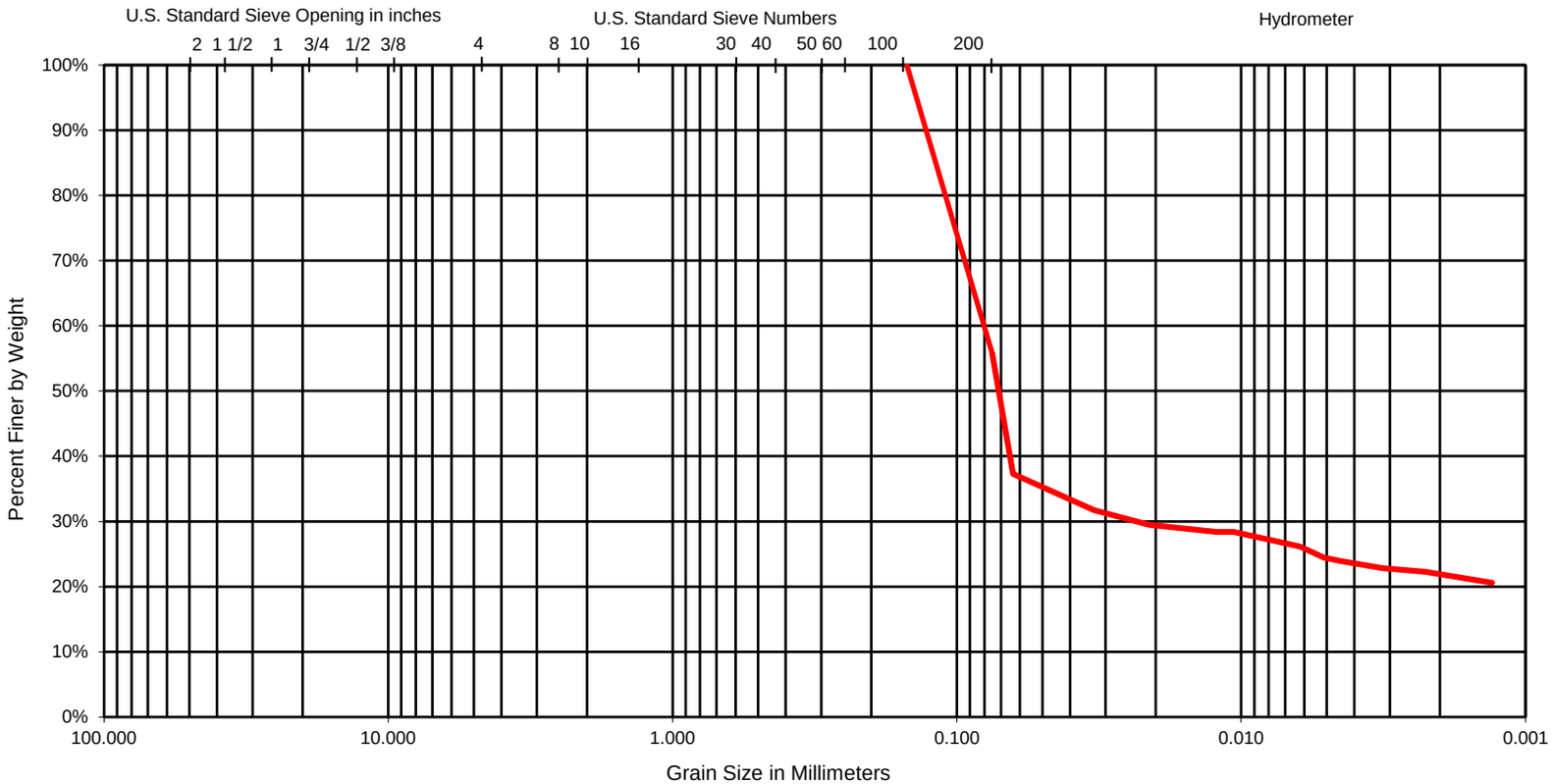
GRADATION ANALYSIS

Buckner Road Extension
Buckner Lane to Lewisburg Pike
Thompson's Station, TN

Exhibit
62



GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

Boring	Sample	Depth	Description	AASHTO	Natural Moisture	LL	PL	PI	Fineness Modulus
11	5		Light Brown Silty Clay	A-6		39	25	14	

PM	HB
Drawn by:	HB
Checked by:	JB
Approved by:	JB

Project No.	3049-19-1
Scale:	N/A
File Name:	Exhibit 63
Date:	10/9/19

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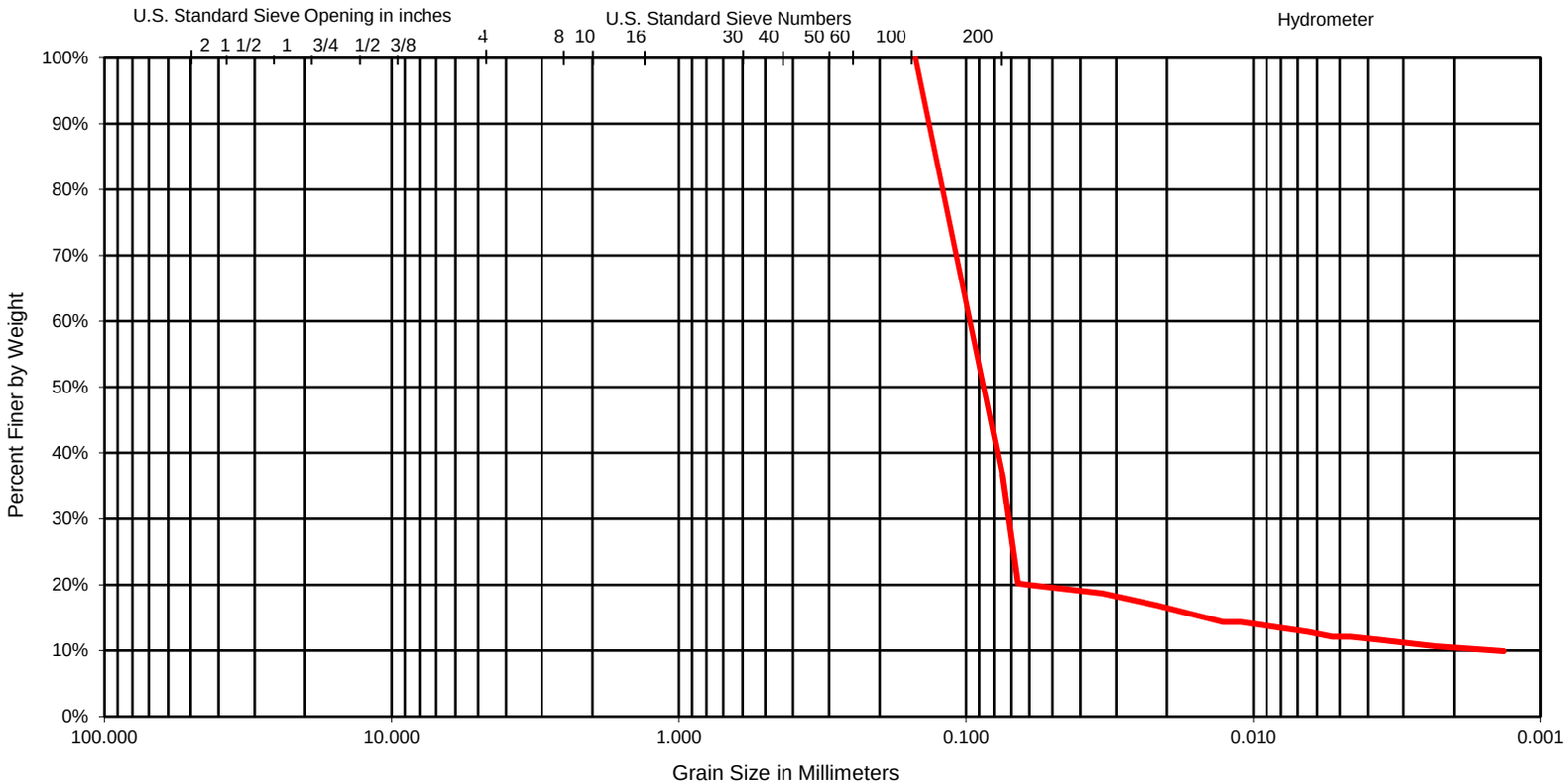
GRADATION ANALYSIS

Buckner Road Extension
Buckner Lane to Lewisburg Pike
Thompson's Station, TN

Exhibit
63



GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

Boring	Sample	Depth	Description	AASHTO	Natural Moisture	LL	PL	PI	Fineness Modulus
14	Bulk		Brown Lean Clay	A-6		30	19	11	

PM	HB
Drawn by:	HB
Checked by:	JB
Approved by:	JB

Project No.	3049-19-1
Scale:	N/A
File Name:	Exhibit 64
Date:	10/9/19

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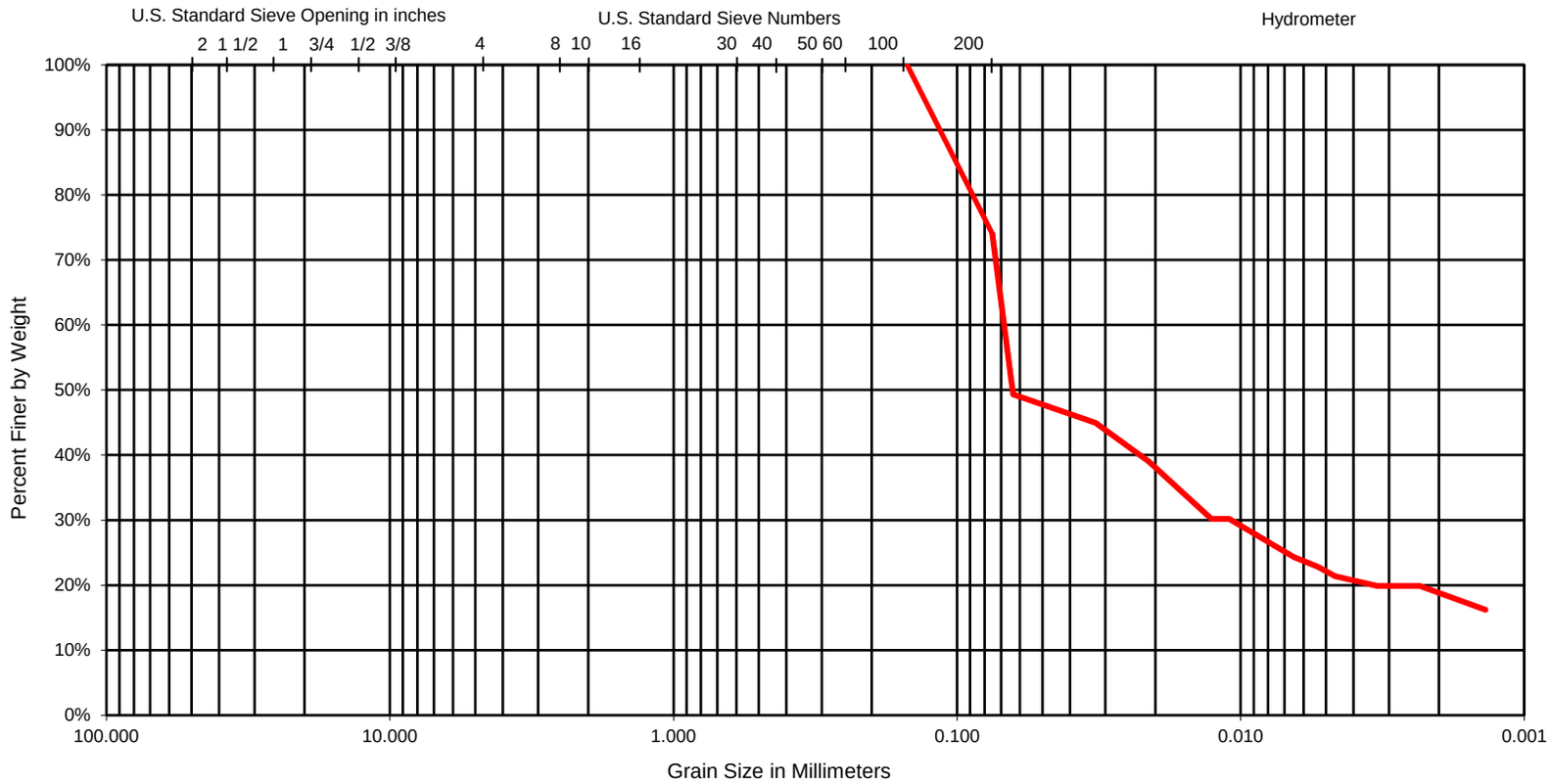
GRADATION ANALYSIS

Buckner Road Extension
Buckner Lane to Lewisburg Pike
Thompson's Station, TN

Exhibit
64



GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

Boring	Sample	Depth	Description	AASHTO	Natural Moisture	LL	PL	PI	Fineness Modulus
16	3		Dark Brown Lean Clay with Sand	A-6		30	17	13	

PM	HB
Drawn by:	HB
Checked by:	JB
Approved by:	JB

Project No.	3049-19-1
Scale:	N/A
File Name:	Exhibit 65
Date:	10/9/19

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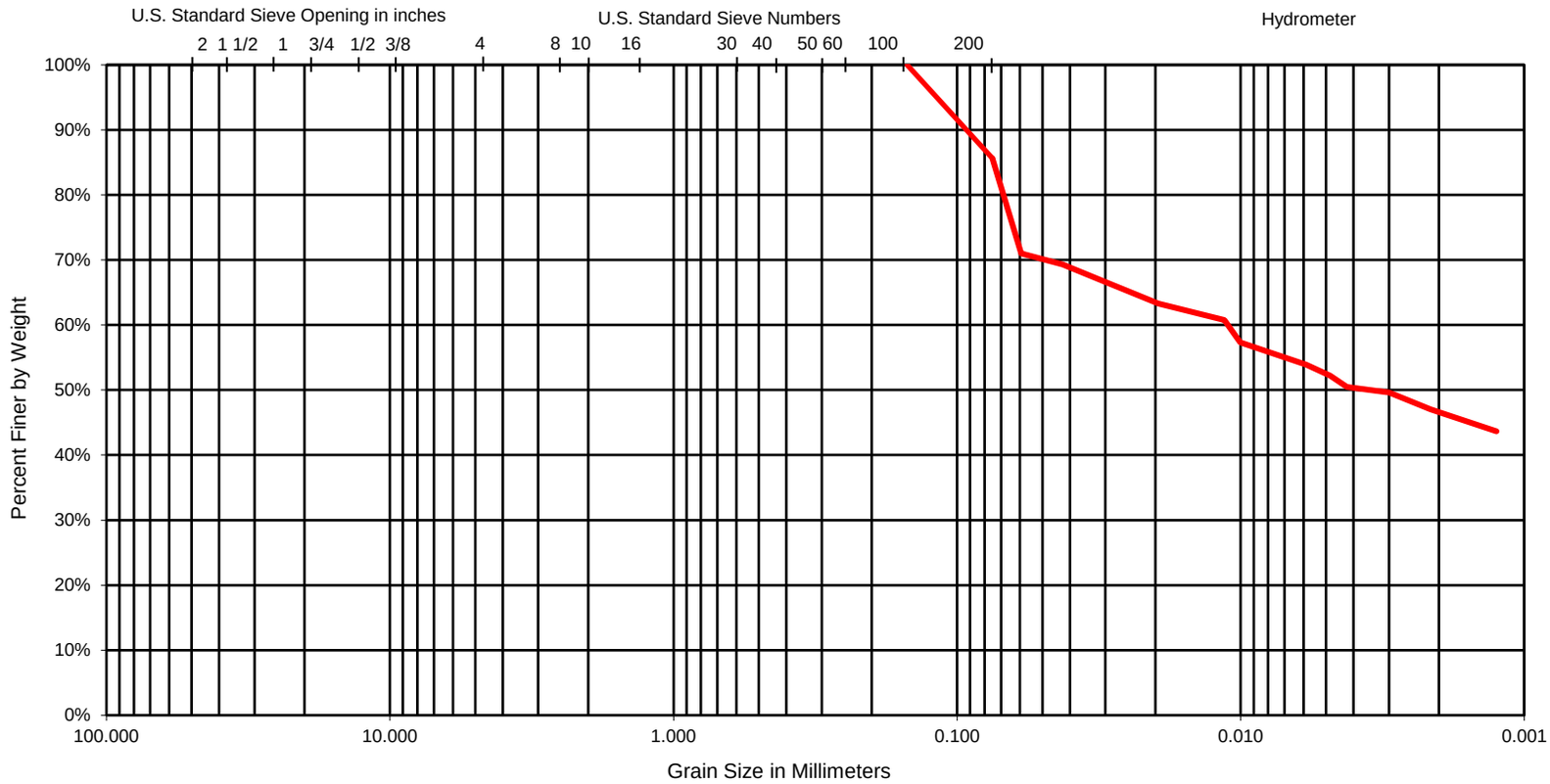
GRADATION ANALYSIS

Buckner Road Extension
Buckner Lane to Lewisburg Pike
Thompson's Station, TN

Exhibit
65



GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

Boring	Sample	Depth	Description	AASHTO	Natural Moisture	LL	PL	PI	Fineness Modulus
18	Bulk		Brown Lean Clay	A-6		40	23	17	

PM	HB
Drawn by:	HB
Checked by:	JB
Approved by:	JB

Project No.	3049-19-1
Scale:	N/A
File Name:	Exhibit 66
Date:	10/9/19

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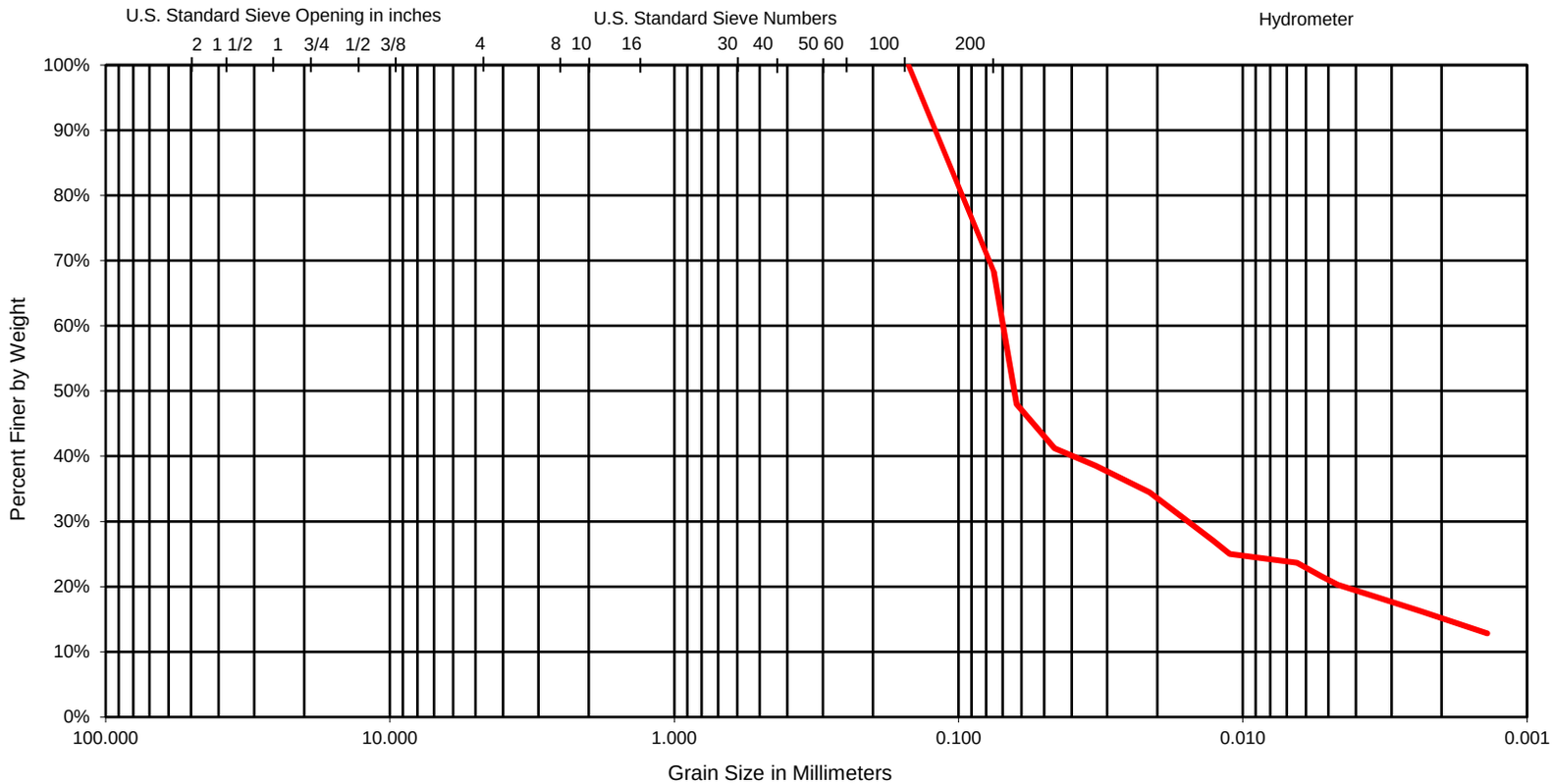
Buckner Road Extension
Buckner Lane to Lewisburg Pike
Thompson's Station, TN

Exhibit
66



GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

Boring	Sample	Depth	Description	AASHTO	Natural Moisture	LL	PL	PI	Fineness Modulus
33	Bulk		Dark Brown Lean Clay	A-6		40	22	18	

PM	HB
Drawn by:	HB
Checked by:	JB
Approved by:	JB

Project No.	3049-19-1
Scale:	N/A
File Name:	Exhibit 67
Date:	12/3/19

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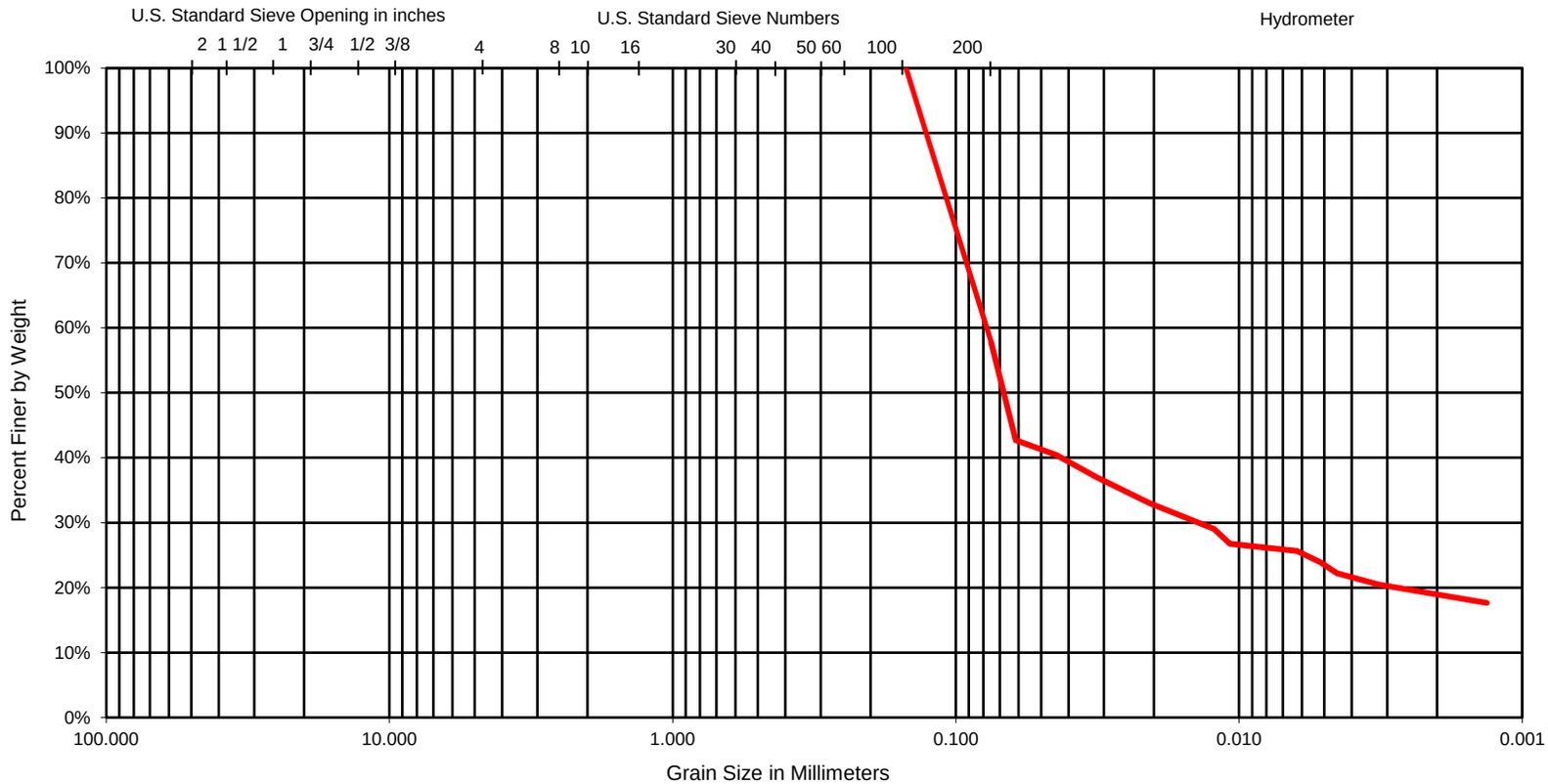
GRADATION ANALYSIS

Buckner Road Extension
Buckner Lane to Lewisburg Pike
Thompson's Station, TN

Exhibit
67



GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

Boring	Sample	Depth	Description	AASHTO	Natural Moisture	LL	PL	PI	Fineness Modulus
38	Bulk		Dark Yellowish Brown Lean Clay	A-6		27	17	10	

PM	HB
Drawn by:	HB
Checked by:	JB
Approved by:	JB

Project No.	3049-19-1
Scale:	N/A
File Name:	Exhibit 68
Date:	12/3/19

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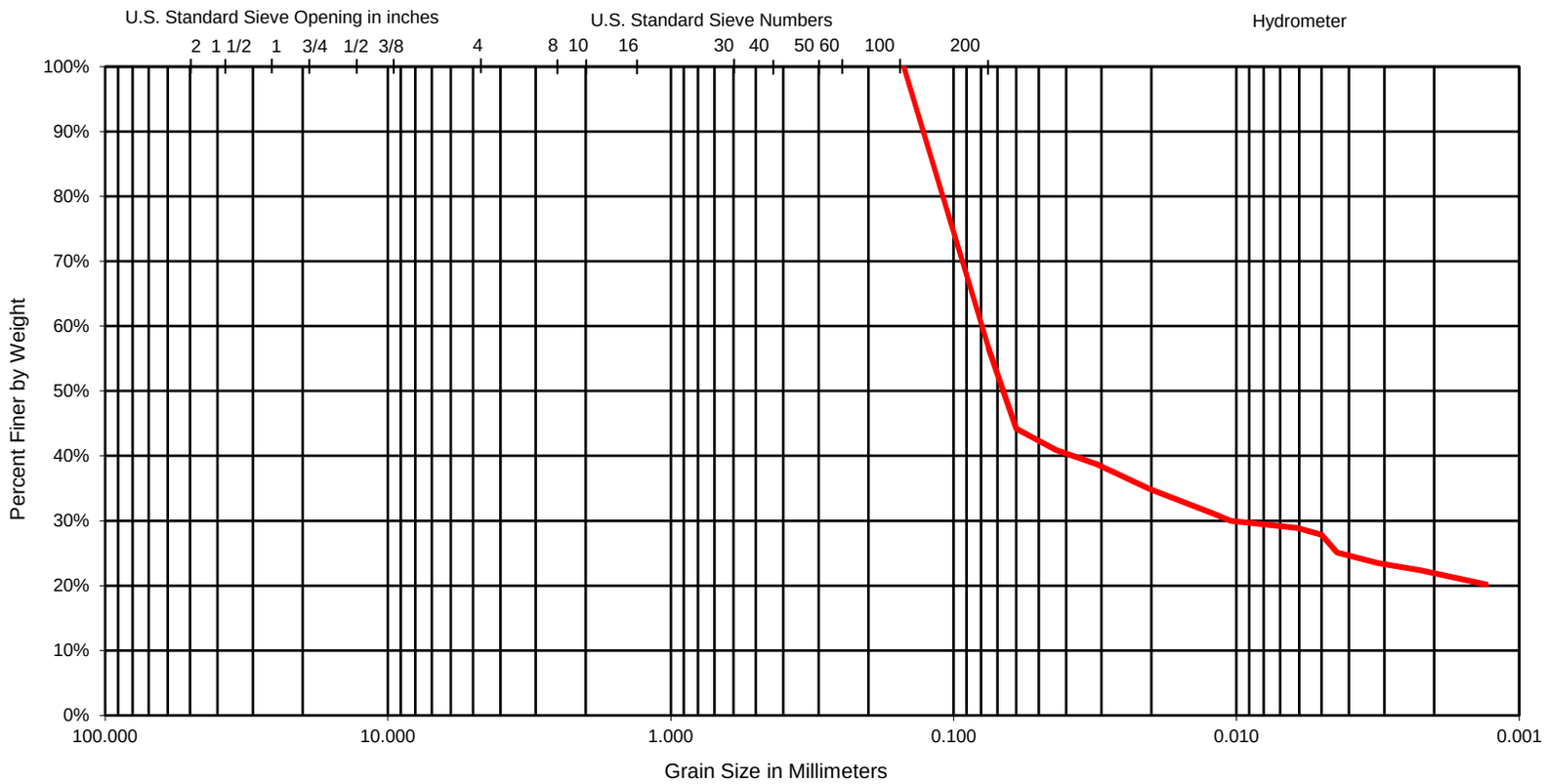
GRADATION ANALYSIS

Buckner Road Extension
Buckner Lane to Lewisburg Pike
Thompson's Station, TN

Exhibit
68



GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

Boring	Sample	Depth	Description	AASHTO	Natural Moisture	LL	PL	PI	Fineness Modulus
40	Bulk		Dark Yellowish Brown Lean Clay	A-6		40	21	19	

PM	HB
Drawn by:	HB
Checked by:	JB
Approved by:	JB

Project No.	3049-19-1
Scale:	N/A
File Name:	Exhibit 69
Date:	12/3/19

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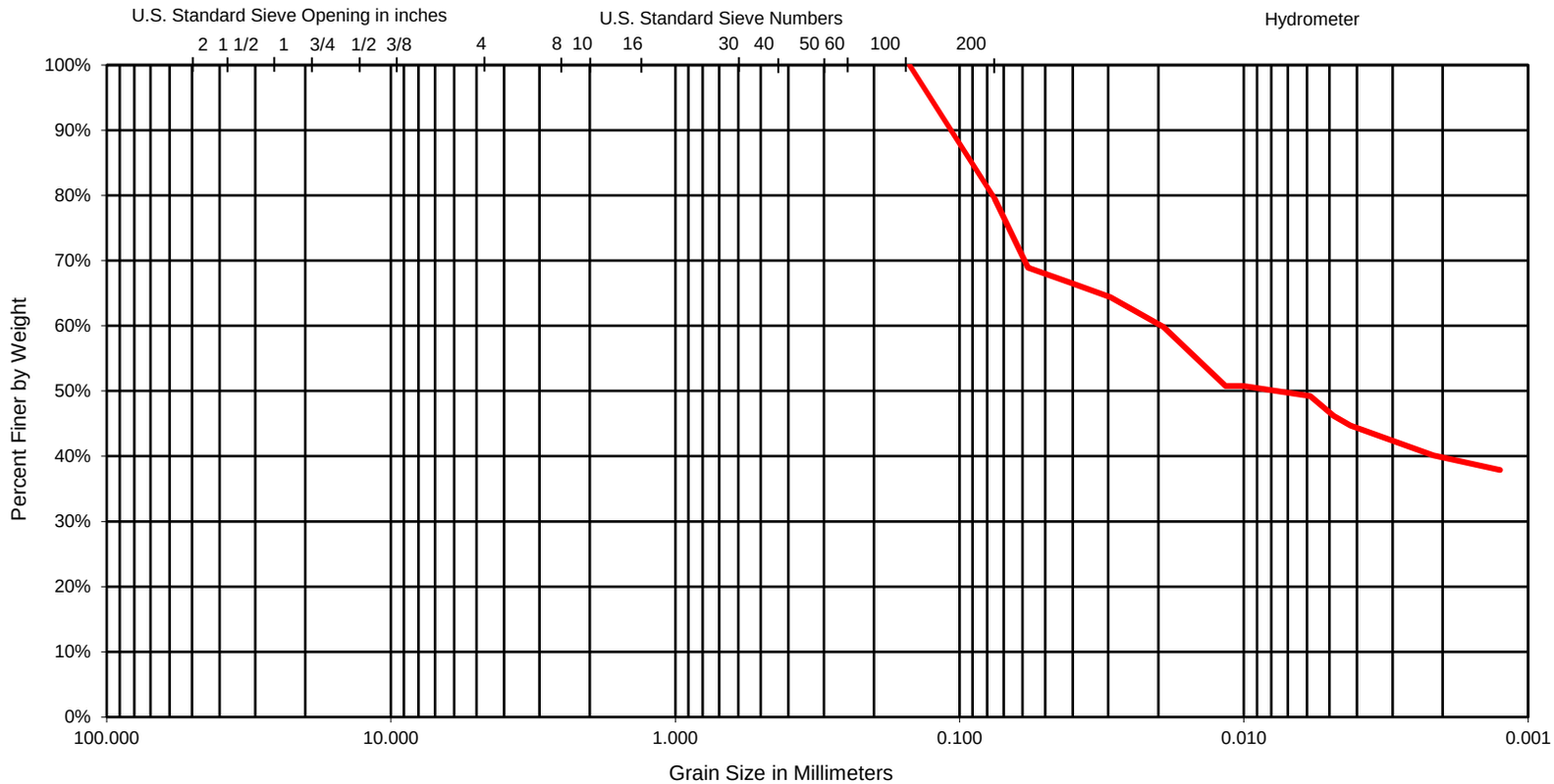
GRADATION ANALYSIS

Buckner Road Extension
Buckner Lane to Lewisburg Pike
Thompson's Station, TN

Exhibit
69



GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

Boring	Sample	Depth	Description	AASHTO	Natural Moisture	LL	PL	PI	Fineness Modulus
43	Bulk		Strong Brown Lean Clay	A-6		38	22	16	

PM	HB
Drawn by:	HB
Checked by:	JB
Approved by:	JB

Project No.	3049-19-1
Scale:	N/A
File Name:	Exhibit 70
Date:	12/3/19

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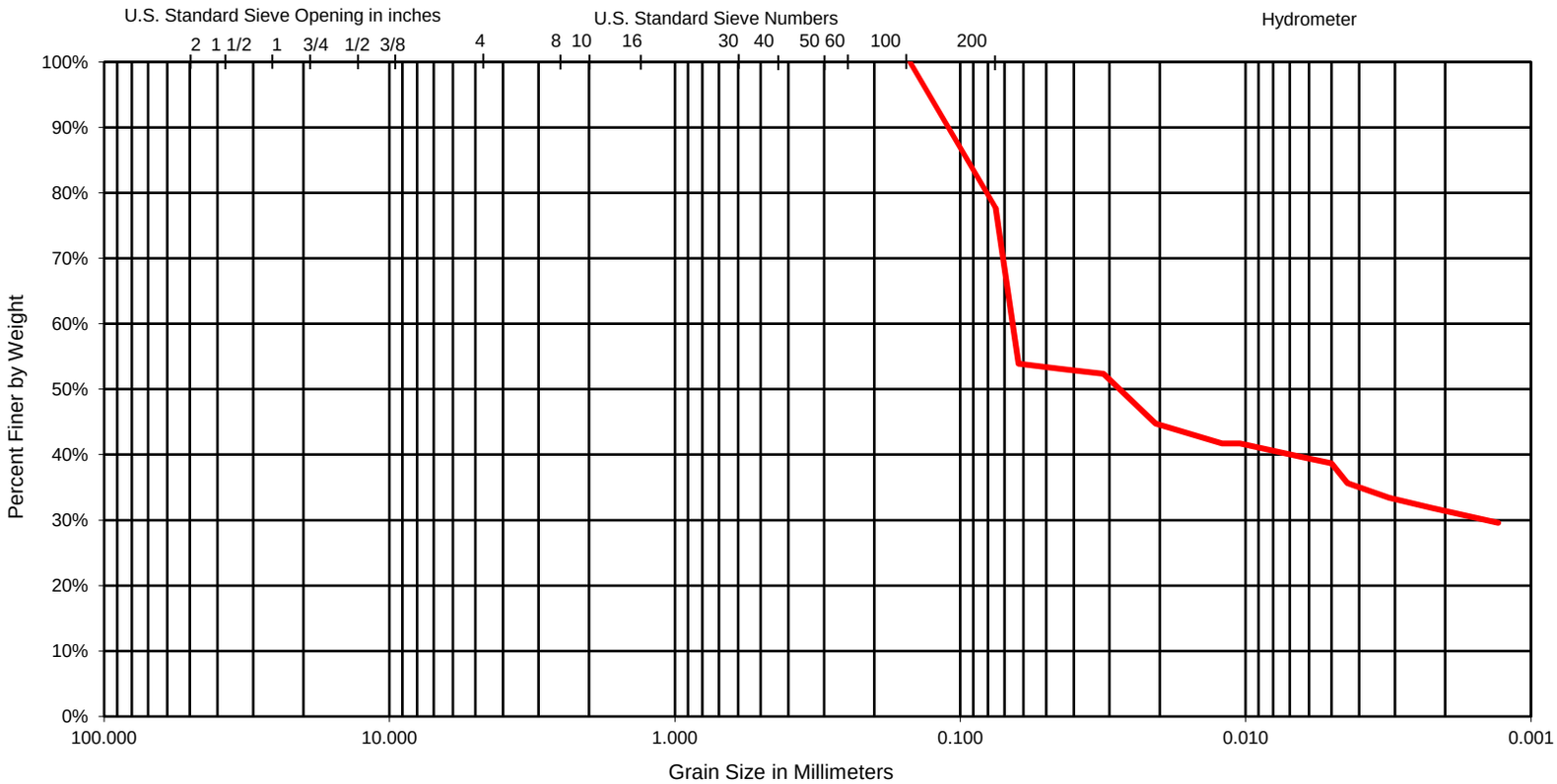
GRADATION ANALYSIS

Buckner Road Extension
Buckner Lane to Lewisburg Pike
Thompson's Station, TN

Exhibit
70



GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

Boring	Sample	Depth	Description	AASHTO	Natural Moisture	LL	PL	PI	Fineness Modulus
45	Bulk		Dark Yellowish Brown Lean Clay	A-6		38	20	18	

PM	HB
Drawn by:	HB
Checked by:	JB
Approved by:	JB

Project No.	3049-19-1
Scale:	N/A
File Name:	Exhibit 71
Date:	12/3/19

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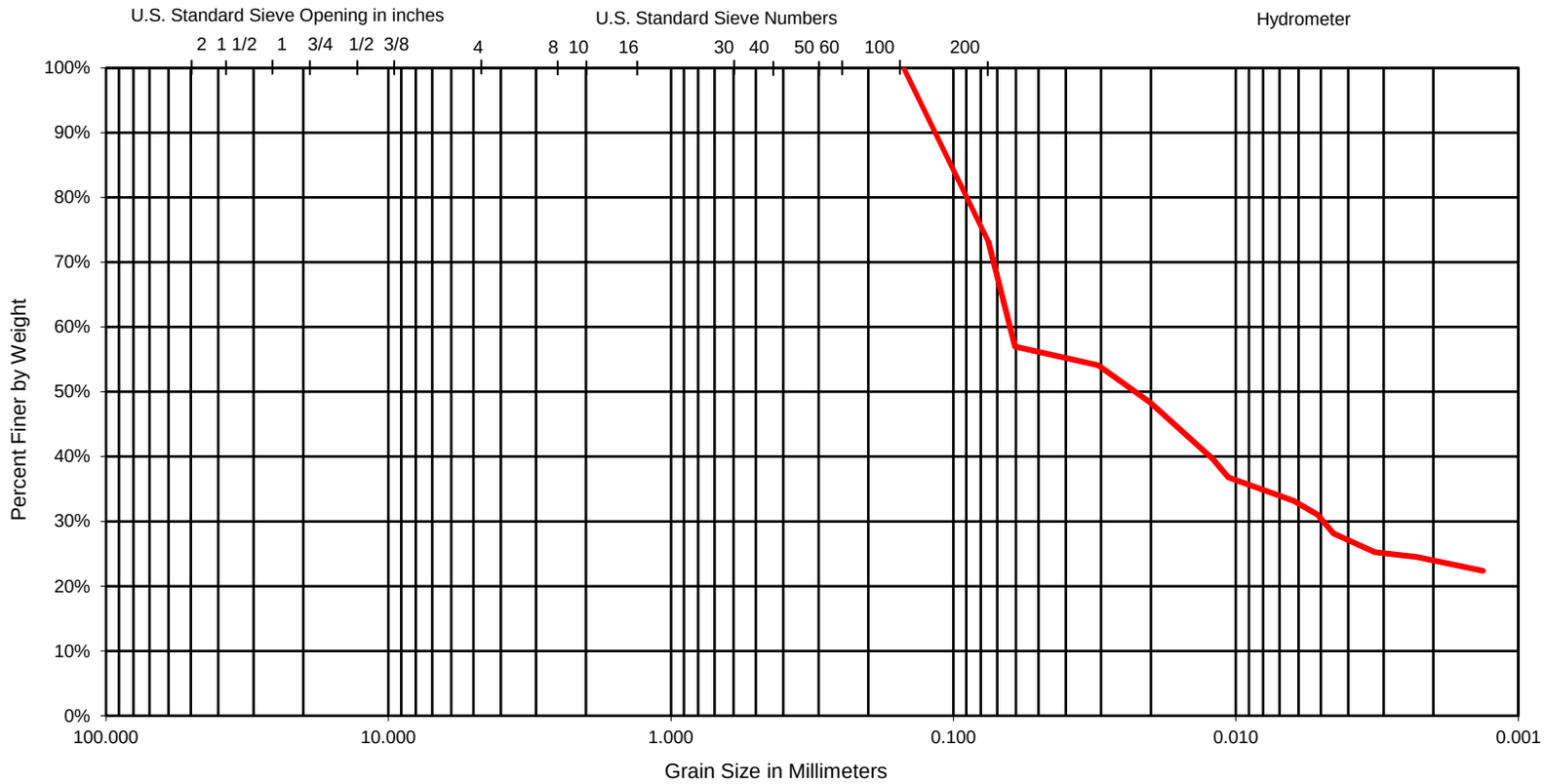
GRADATION ANALYSIS

Buckner Road Extension
Buckner Lane to Lewisburg Pike
Thompson's Station, TN

Exhibit
71



GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

Boring	Sample	Depth	Description	AASHTO	Natural Moisture	LL	PL	PI	Fineness Modulus
47	Bulk		Dark Yellowish Brown Lean Clay	A-6		39	20	19	

PM	HB
Drawn by:	HB
Checked by:	JB
Approved by:	JB

Project No.	3049-19-1
Scale:	N/A
File Name:	Exhibit 72
Date:	12/3/19

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GRADATION ANALYSIS

Buckner Road Extension
Buckner Lane to Lewisburg Pike
Thompson's Station, TN

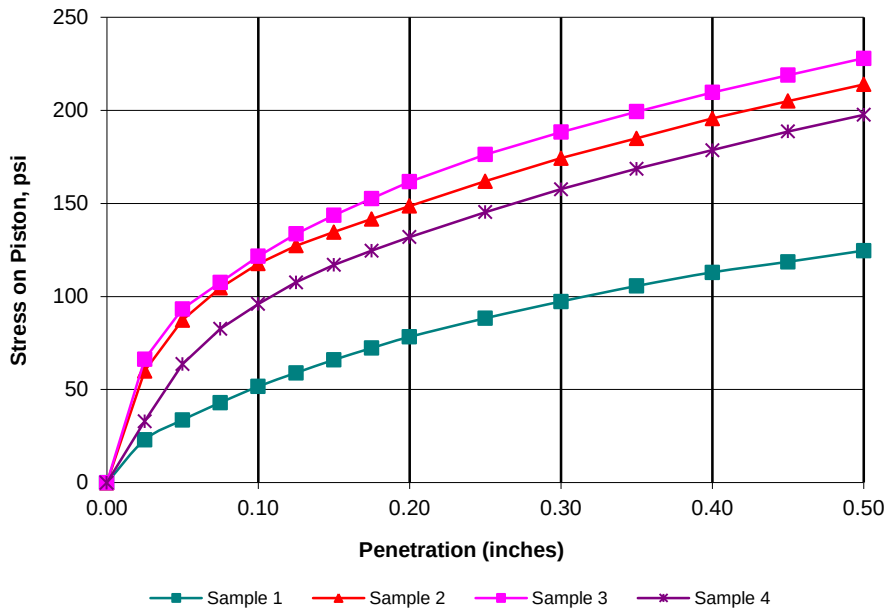
Exhibit
72

California Bearing Ratio of Laboratory-Compacted Soils

Sample Information

Sample Number:	Bulk	Proctor Method:	D698
Boring Number:	B14 B9	Maximum Dry Density (pcf):	104.9
Sample Location:	Composite	Optimum Moisture (%):	20.0
Depth:	1.0 - 5.0	Liquid Limit:	33
		Plasticity Index:	13

Material Description: Brown Lean Clay



Test information

Surcharge Wgt (lbs):	10
Soaked:	X
Unsoaked:	
Length of Soak (hrs):	96
Load Penetration Curve Correction Required:	No

Test Results

Test Sample No.	1	2	3	4
Density Data				
Dry Density before Soaking, (pcf)	100.9	103.6	104.1	103.0
Degree of Compaction, (%)	96.2	98.8	99.2	98.2
Dry Density after Soaking, (pcf)	99.9	103.4	104.0	102.7
Moisture Content, (%)				
Before Compaction	16.4	17.8	20.4	22.2
After Compaction	16.4	17.8	20.4	22.2
Top 1" After Soaking	19.4	21.5	22.6	22.8
Average After Soaking	19.1	21.0	21.7	22.5
Swell, (%)	1.6	0.6	0.2	0.2
Bearing Ratio				
@ 0.100 inch	5.2	11.8	12.2	9.6
@ 0.200 inch	5.2	9.9	10.8	8.8

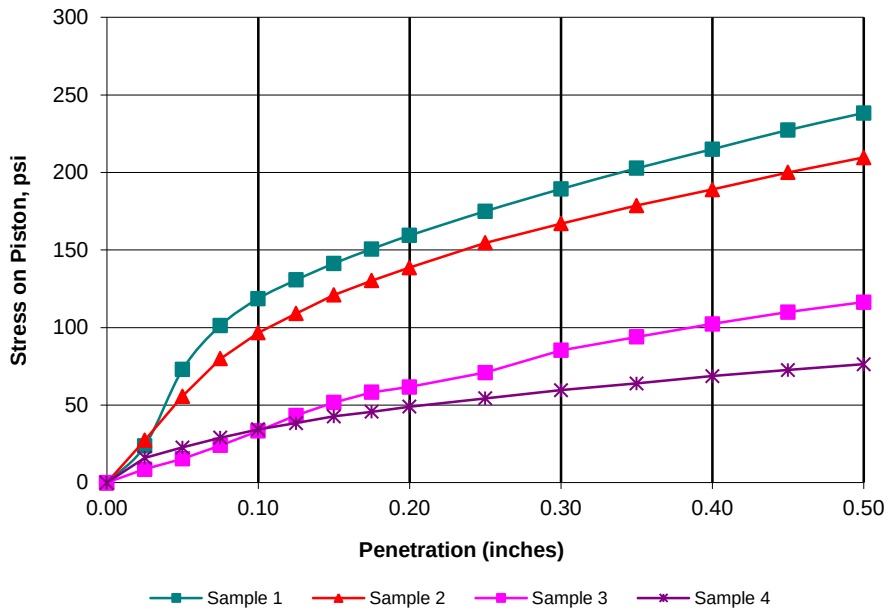
Project Mngr. SV	Project No. 3049-19-01	COLLIER ENGINEERING CO., INC. CONSULTING • DESIGN • CONSTRUCTION	CBR of Lab Compacted Soils	EXHIBIT
Drawn By: HDB	Scale As Shown		Buckner Road Extension	
Checked By: HDB	File No. 3049-19-01	5560 Franklin Pike Circle Office	Buckner to Lewisburg	73
Approved By: HDB	Date: 12/3/2019	Brentwood, TN 37027 615-331-1050	Thompson's Station, TN	

California Bearing Ratio of Laboratory-Compacted Soils

Sample Information

Sample Number:	Bulk	Proctor Method:	D698
Boring Number:	B31 B33	Maximum Dry Density (pcf):	109.0
Sample Location:	Composite	Optimum Moisture (%):	17.1
Depth:	1.0 - 5.0	Liquid Limit:	40
		Plasticity Index:	22

Material Description: Dark Brown Lean Clay



Test information

Surcharge Wgt (lbs):	10
Soaked:	X
Unsoaked:	
Length of Soak (hrs):	96
Load Penetration Curve Correction Required:	No

Test Results

Test Sample No.	1	2	3	4
Density Data				
Dry Density before Soaking, (pcf)	108.2	109.0	106.1	102.2
Degree of Compaction, (%)	99.3	100.0	97.3	93.7
Dry Density after Soaking, (pcf)	107.8	108.5	106.1	102.1
Moisture Content, (%)				
Before Compaction	15.7	17.1	18.9	20.2
After Compaction	15.7	17.1	18.9	20.2
Top 1" After Soaking	19.2	18.0	19.4	21.5
Average After Soaking	18.8	18.4	19.4	20.7
Swell, (%)	0.4	0.3	0.3	0.3
Bearing Ratio				
@ 0.100 inch	11.9	9.7	3.3	3.4
@ 0.200 inch	10.6	9.2	4.1	3.3

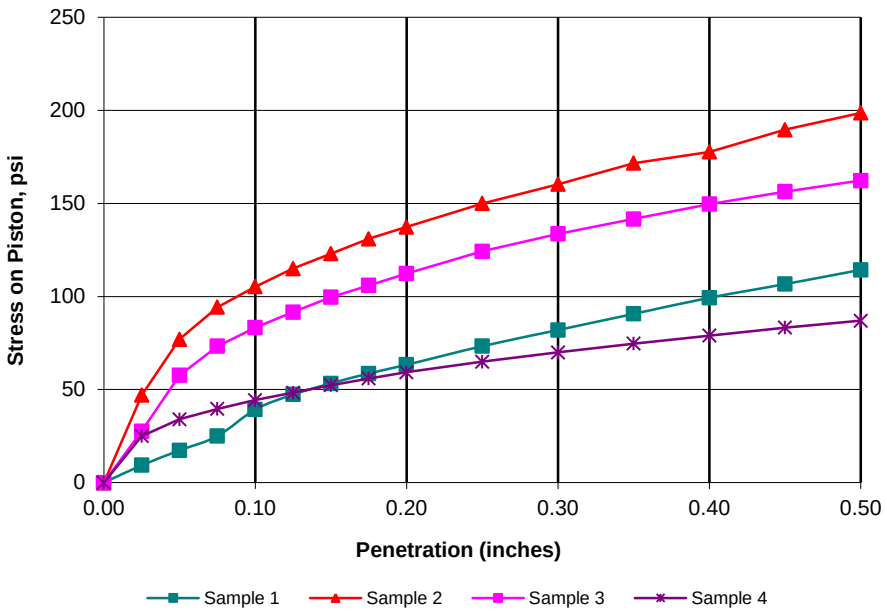
Project Mngr. SV	Project No. 3049-19-01	COLLIER ENGINEERING CO., INC. CONSULTING • DESIGN • CONSTRUCTION	CBR of Lab Compacted Soils	EXHIBIT
Drawn By: HDB	Scale As Shown		Buckner Road Extension	
Checked By: HDB	File No. 3049-19-01	5560 Franklin Pike Circle Office	Buckner to Lewisburg	74
Approved By: HDB	Date: 12/3/2019	Brentwood, TN 37027 615-331-1050	Thompson's Station, TN	

California Bearing Ratio of Laboratory-Compacted Soils

Sample Information

Sample Number:	Bulk	Proctor Method:	D698
Boring Number:	B40 B43 B47	Maximum Dry Density (pcf):	105.9
Sample Location:	Composite	Optimum Moisture (%):	18.6
Depth:	1.0 - 5.0	Liquid Limit:	39
		Plasticity Index:	18

Material Description: Dark Yellowish Brown Lean Clay



Test information

Surcharge Wgt (lbs):	10
Soaked:	X
Unsoaked:	
Length of Soak (hrs):	96
Load Penetration Curve Correction Required:	No

Test Results

Test Sample No.	1	2	3	4
Density Data				
Dry Density before Soaking, (pcf)	101.0	102.9	101.5	97.4
Degree of Compaction, (%)	95.3	97.2	95.8	91.9
Dry Density after Soaking, (pcf)	100.3	102.8	101.0	96.9
Moisture Content, (%)				
Before Compaction	17.7	20.3	22.1	24.6
After Compaction	17.7	20.3	22.1	24.6
Top 1" After Soaking	22.9	22.5	24.1	26.9
Average After Soaking	21.9	22.0	23.1	25.9
Swell, (%)	1.6	0.5	0.5	0.2
Bearing Ratio				
@ 0.100 inch	3.9	10.5	8.3	4.4
@ 0.200 inch	4.2	9.2	7.5	4.0

Project Mngr. SV	Project No. 3049-19-01	COLLIER ENGINEERING CO., INC. CONSULTING • DESIGN • CONSTRUCTION	CBR of Lab Compacted Soils	EXHIBIT
Drawn By: HDB	Scale As Shown		Buckner Road Extension	
Checked By: HDB	File No. 3049-19-01	5560 Franklin Pike Circle Office	Buckner to Lewisburg	75
Approved By: HDB	Date: 12/3/2019	Brentwood, TN 37027 615-331-1050	Thompson's Station, TN	

Laboratory Compaction Characteristics of Soil

Sample Information

Sample Number:	Bulk	Material Designation:	1
Boring Number:	B14 B9	Test Method:	D698
Sample Location:	Composite	Test Procedure:	A
Depth (ft):	1.0 - 5.0	Sample Preparation:	Wet
		Rammer: Mechanical	
		Manual	X

Sample Description: Brown Lean Clay

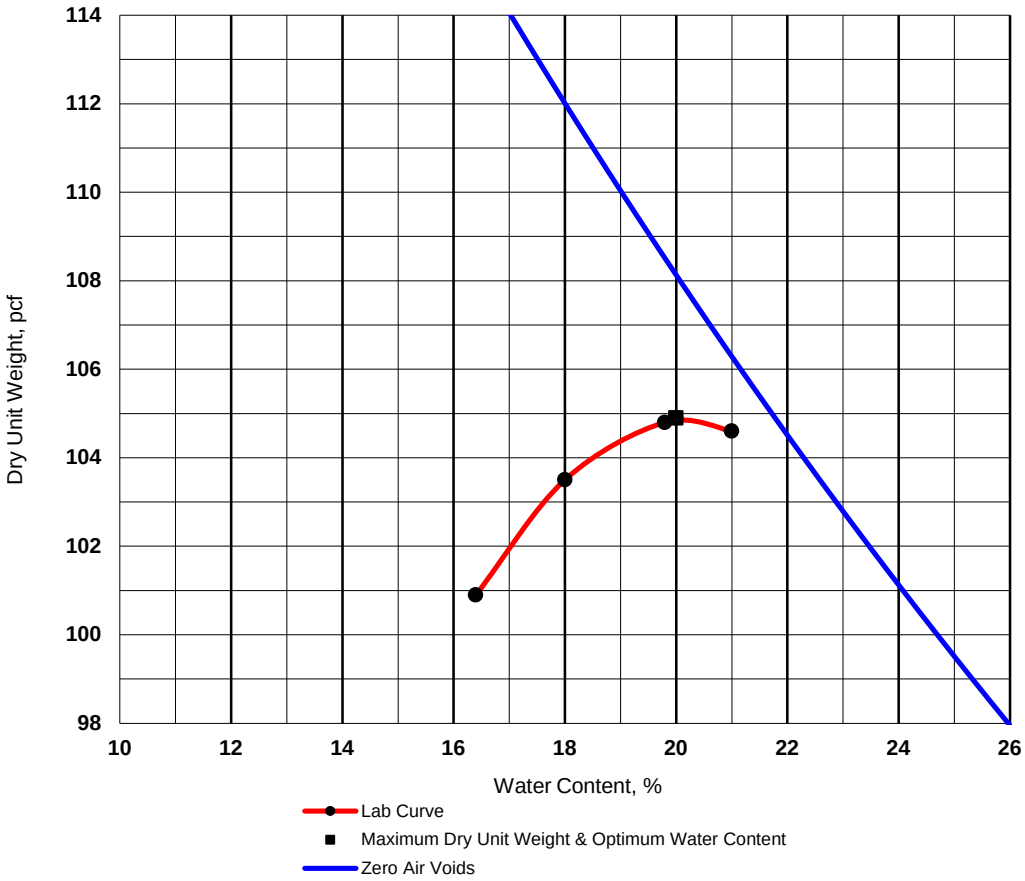
Atterberg Limits:

Liquid Limit:	33
Plastic Limit:	20
Plasticity Index:	13
Natural Moisture (%):	13.9

TEST RESULTS

Maximum Dry Unit Wt.:	104.9	pcf
Optimum Water Content:	20.0	%

Zero air voids for specific gravity of 2.65



Project Mngr. SV	Project No. 3049-19-01	COLLIER ENGINEERING CO., INC. CONSULTING • DESIGN • CONSTRUCTION	Laboratory Standard Proctor Test	EXHIBIT
Drawn By: HDB	Scale As Shown	5560 Franklin Pike Circle Office Brentwood, TN 37027 615-331-1050	Buckner Road Extension	
Checked By: HDB	File No. 3049-19-01		Buckner to Lewisburg	76
Approved By: HDB	Date: 12/3/2019		Thompson's Station, TN	

Laboratory Compaction Characteristics of Soil

Sample Information

Sample Number:	Bulk	Material Designation:	1
Boring Number:	B31 B33	Test Method:	D698
Sample Location:	Composite	Test Procedure:	A
Depth (ft):	1.0 - 5.0	Sample Preparation:	Wet
		Rammer: Mechanical	
		Manual	X

Sample Description: Dark Brown Lean Clay

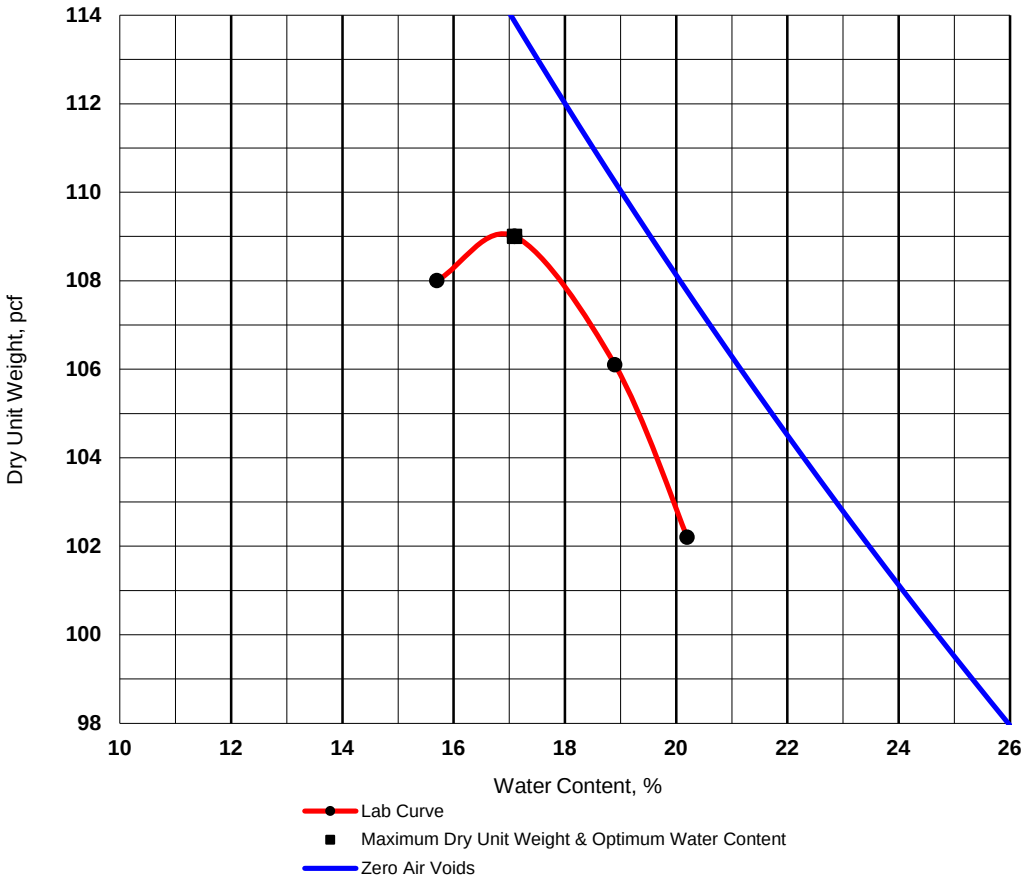
Atterberg Limits:

Liquid Limit:	40
Plastic Limit:	18
Plasticity Index:	22
Natural Moisture (%):	13.9

TEST RESULTS

Maximum Dry Unit Wt.:	109.0	pcf
Optimum Water Content:	17.1	%

Zero air voids for specific gravity of 2.65



Project Mngr. SV	Project No. 3049-19-01	COLLIER ENGINEERING CO., INC. CONSULTING • DESIGN • CONSTRUCTION	Laboratory Standard Proctor Test	EXHIBIT
Drawn By: HDB	Scale As Shown	5560 Franklin Pike Circle Office Brentwood, TN 37027 615-331-1050	Buckner Road Extension	
Checked By: HDB	File No. 3049-19-01		Buckner to Lewisburg	77
Approved By: HDB	Date: 12/3/2019		Thompson's Station, TN	

Laboratory Compaction Characteristics of Soil

Sample Information

Sample Number:	Bulk	Material Designation:	1
Boring Number:	B40 B43 B47	Test Method:	D698
Sample Location:	Composite	Test Procedure:	A
Depth (ft):	1.0 - 5.0	Sample Preparation:	Wet
		Rammer: Mechanical	
		Manual	X

Sample Description: Dark Yellowish Brown Lean Clay

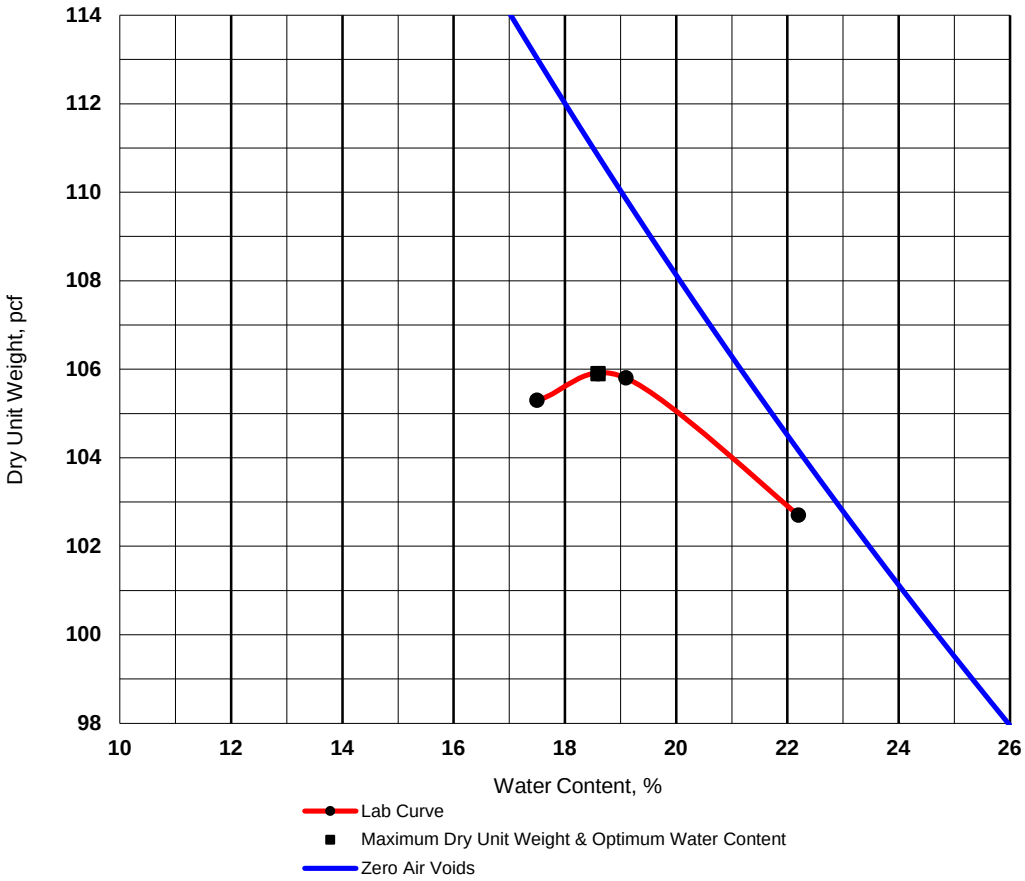
Atterberg Limits:

Liquid Limit:	39
Plastic Limit:	21
Plasticity Index:	18
Natural Moisture (%):	13.9

TEST RESULTS

Maximum Dry Unit Wt.:	105.9	pcf
Optimum Water Content:	18.6	%

Zero air voids for specific gravity of 2.65



Project Mngr. SV	Project No. 3049-19-01	COLLIER ENGINEERING CO., INC. CONSULTING • DESIGN • CONSTRUCTION	Laboratory Standard Proctor Test	EXHIBIT
Drawn By: HDB	Scale As Shown	5560 Franklin Pike Circle Office Brentwood, TN 37027 615-331-1050	Buckner Road Extension	
Checked By: HDB	File No. 3049-19-01		Buckner to Lewisburg	78
Approved By: HDB	Date: 12/3/2019		Thompson's Station, TN	

Supporting Notes and Information

Standard Penetration Test (SPT)

Standard penetration resistance - the number of blows required to advance a standard 2-inch O.D. split-spoon sampler the last 12 inches of the total 18-inch penetration with a 140-pound safety hammer falling 30 inches (using a cathead and rope) is considered the "Standard Penetration" or "N-value". An automatic hammer was used and the greater efficiency realized with this tool has been considered in the interpretation and analysis of the subsurface information for this report. The SPT field test procedure was performed in general accordance with ASTM D1586.

Lab Testing

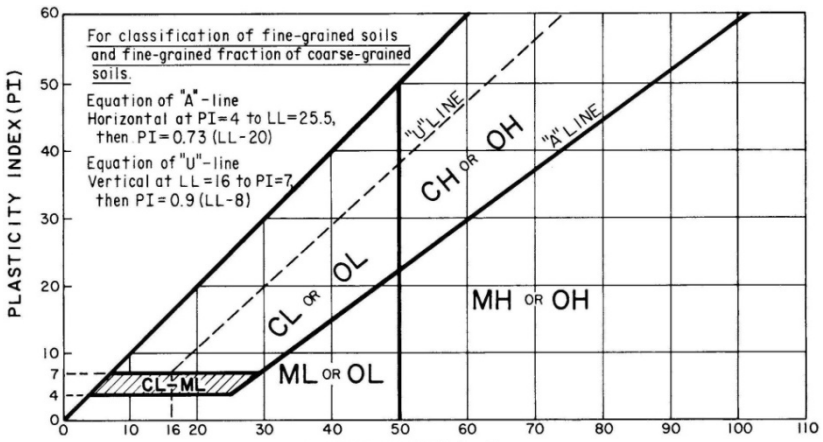
Selected SPT samples were subjected to laboratory testing to assess natural moisture content, Atterberg Limits, and particle size gradation, and results were utilized to determine the soils' AASHTO classification. Combined bulk samples were tested to determine the soils' moisture-density relationship (standard Proctor) and support capability (California Bearing Ratio or CBR). Soil samples not consumed by the testing will be stored and discarded after 60 days. Selected rock core specimens were tested for unconfined compressive strength. Test results are included on boring logs or in stand-alone results reports.

Soil Strength Terms

RELATIVE DENSITY OF COARSE-GRAINED SOILS Density determined by Standard Penetration Resistance		**CONSISTENCY OF FINE-GRAINED SOILS** Consistency determined by laboratory shear strength testing, field visual-manual procedures, or standard penetration resistance		
Descriptive Term (Density)	**Standard Penetration or N-Value (blows/ft.)**	**Descriptive Term (Consistency)**	**Correlated Unconfined Compressive Strength (psf)**	**Standard Penetration or N-Value (blows/ft.)**
Very loose	0-3	Very soft	Less than 500	<2
Loose	4-9	Soft	500 to 1,000	2-4
Medium dense	10-29	Firm/medium stiff	1,000 to 2,000	4-8
Dense	30-50	Stiff	2,000 to 4,000	8-15
Very dense	>50	Very stiff	4,000 to 8,000	15-30
		Hard	>8,000	>30

USCS Discussion and Plasticity Chart

Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; their principal descriptors are: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are principally described as clays if they are plastic and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.



Grain Size Terminology	
Major component of sample	**Range in particle size**
Boulder	>12 inches (300 mm)
Cobble	3 to 12 inches (75 to 300 mm)
Gravel	#4 sieve to 3 inches (4.75 mm to 75 mm)
Sand	#200 sieve to #4 sieve (0.075 mm to 4.75 mm)
Silt or clay	Passing #200 sieve (<0.075 mm)

References: NAVFAC Soil Mechanics Design Manual 7.1 – May 1982;
Excerpt from ASTM D 2487 *Standard Practice for Classification of Soils for Engineering Purposes (USCS)*