February 19, 2025
Kleinfelder Project No.: 25004113.001A

Mr. Jacob Brumbaugh, PE
Project Manager
RJN Group, Inc.
4500 S. Garnett Road, Suite #110
Tulsa, OK 74146

Subject: **Report for Geotechnical Drilling and Laboratory Testing Services**
Sewer Rehabilitation Project
IOT2 FY24 East 101st Street
TMUA Project ES 2024-15
Tulsa, Oklahoma

Dear Mr. Brumbaugh:

Kleinfelder has completed the authorized geotechnical drilling and laboratory testing services for the above-referenced project. Per your request, Kleinfelder conducted the fieldwork by drilling two (2) soil test borings (B-1 and B-2) on February 5, 2025. The borings were located in the field by a Kleinfelder engineer using a hand-held Global Positioning System (GPS) with an accuracy of approximately 15 feet. The general site location and the approximate boring locations are shown in Figure 1, Exploration Location Plan and Vicinity Map.

FIELD EXPLORATION PROGRAM

The borings were advanced with a CME-45B truck mounted drill rig using solid stem augers. Due to utility conflict, borings B-1 and B-2 were drilled at an offset of 5 and 10 feet north, respectively. Borings were terminated at 15 feet below the existing ground surface. Representative samples were obtained by split-barrel sampling procedures (ASTM D1586), which utilizes a standard 2-inch O.D. split-barrel sampler that is driven into the bottom of the boring with a 140-pound auto-hammer (71.3% efficiency) falling 30 inches.

Samples were collected at five feet intervals to the termination depth of the borings. Soil samples were sealed and returned to our laboratory for further examination and classification. Borings were backfilled in accordance with the appropriate Oklahoma Water Resources Board (OWRB) Regulations.

Field logs included visual classification of the materials encountered during drilling, as well as drilling characteristics. Stratification boundaries indicated on the boring logs are based on observations during our fieldwork, an extrapolation of information obtained by examining samples from the borings, and comparisons of soils with similar engineering characteristics. Locations of these boundaries are approximate, and the transitions between material types may be gradual rather than clearly defined. The boring logs are presented in Attachment A.

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LABORATORY TESTING PROGRAM

Laboratory tests, including sieve analyses, Atterberg limit, and moisture contents, were performed on selected samples in general accordance with applicable standards. In addition, soil samples were visually classified in accordance with the Unified Soil Classification System (USCS). All the lab results are presented in Table B-1 in Attachment B.

GROUNDWATER OBSERVATIONS

No groundwater was encountered in any of the borings during and at the completion of the drilling operation. The materials encountered in the test borings have a wide range of permeabilities and observations over an extended period of time through the use of piezometers or cased borings would be required to better define current groundwater conditions. Piezometers were not installed at the site during this subsurface exploration. Fluctuations of groundwater levels can occur due to seasonal variations in the amount of rainfall, runoff, river/creek level, and other factors not evident at the time the borings were performed. The possibility of groundwater level fluctuations should be considered when developing the design and construction plans for the project.

SUBSURFACE CONDITIONS

Based on the laboratory tests, visual, and textural observations, the subsurface material in the borings consists of predominantly silty sand. The relative density of the silty sand ranged from loose to medium dense. Bedrock was not encountered in the borings.

EXCAVATION

It is anticipated that the excavations will be in the overburden sandy soils. Excavations into the overburden sandy soils will be possible with conventional excavations equipment. It is the contractor's responsibility to carefully review our boring logs and determine the appropriate excavation methods for construction.

Temporary dewatering such as pumping from gravel lined sumps or other methods will be required to remove water from deeper excavations if groundwater levels are elevated and encountered at the time of construction. An assessment of the impact of the planned method of dewatering on stability of the excavation side slopes and potential for subsidence should be included as part of the design of any required dewatering and excavation support systems. Dewatering analysis was not scoped as part of this work.

Excavations should be cut to a stable slope or be temporarily braced, depending upon the excavation depths and the subsurface conditions encountered. Excavation slopes should be inclined in accordance with OSHA Standard Number 1926 Subpart P App B, Sloping and Benching. Excavation deeper than 20 feet will require a registered professional engineer to design the protection. Soils (sand, gravel, and soils below groundwater) will require flatter excavation slopes. Actual slope classification must be performed by contractor's competent person based on conditions encountered and slope inclinations selected accordingly. Design of slope protection was no scoped as part of this work.

LIMITATIONS

This work was performed in a manner consistent with that level of care and skill ordinarily exercised by other members of Kleinfelder's profession practicing in the same locality, under similar conditions, and at the date, the services are provided. Our conclusions and opinions are based on a limited number of observations and data. It is possible that conditions could vary between or beyond the data evaluated. Kleinfelder makes no other representation, guarantee, or warranty, express or implied, regarding the services, communication (oral or written), report, opinion, or instrument of service provided.

The report may be used only by the Client and the registered design professional in responsible charge and only for the purposes stated for this specific engagement within a reasonable time from its issuance, but in no event later than two years from the date of this report. The work performed was based on project information provided by the Client.

CLOSING

We appreciate the opportunity to be of service to you on this project. Please call us if you have any questions concerning the information presented within this letter.

Sincerely,

KLEINFELDER, INC.
Certificate of Authorization #7292, Expires 6/30/25

Venkatesh Kasaraneni
Staff Professional I

Shiyun (Simon) Wang, PE
Program Manager

Attachments:

Figure 1 – Exploration Location Plan and Vicinity Map
Attachment A – Field Exploration Program
Attachment B – Laboratory Testing Results
Attachment C - GBA Document

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Attachments

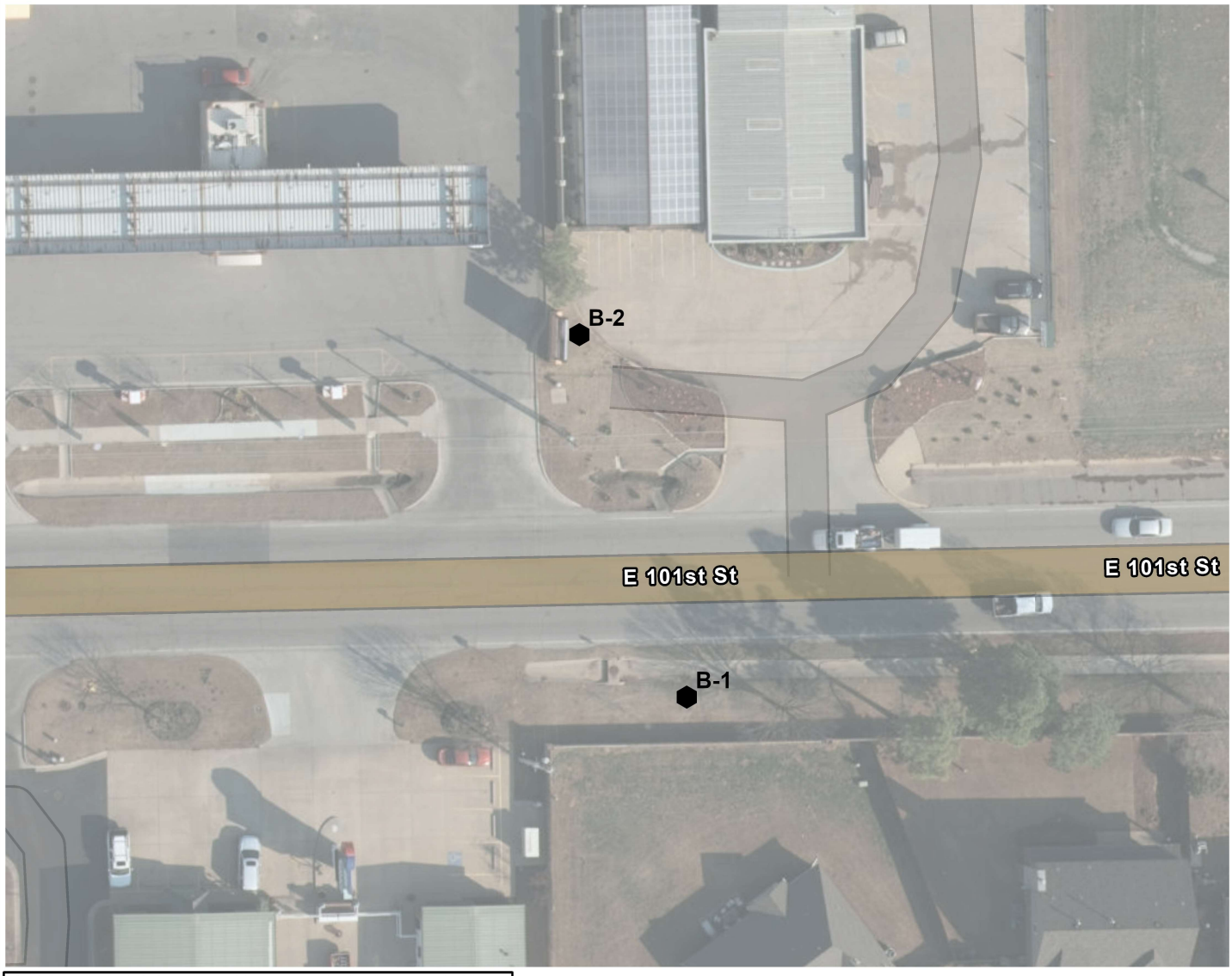
LEGEND

SOIL BORING

NOTES:
1. BASE MAPPING AND VICINITY MAP CREATED FROM LAYERS COMPILED BY ESRI PRODUCTS.
2. COORDINATE SYSTEM: NAD 1983 2011 STATEPLANE OKLAHOMA NORTH FIPS 3501

VICINITY MAP

NOT TO SCALE



0 50 100

1" = 50 SCALE IN FEET

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DATE:	02-13-2025

EXPLORATION LOCATION PLAN AND VICINITY MAP

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FIGURE

1

DRILLING METHOD/SAMPLER TYPE GRAPHICS

SOLID STEM AUGER

STANDARD PENETRATION SPLIT SPOON SAMPLER (2 in. (50.8 mm.) outer diameter and 1-3/8 in. (34.9 mm.) inner diameter)

GROUND WATER GRAPHICS

- WATER LEVEL (level where first observed)
- WATER LEVEL (level after stabilizing period)
- WATER LEVEL (additional levels after exploration)
- OBSERVED SEEPAGE

NOTES

- The report and graphics key are an integral part of these logs. All data and interpretations in this log are subject to the explanations and limitations stated in the report.
- Solid lines separating strata on the logs represent approximate boundaries only, dashed lines are inferred or extrapolated boundaries. Actual transitions may be gradual or differ from those represented.
- No warranty is provided as to the continuity of soil or rock conditions between individual sample locations.
- Logs represent general soil or rock conditions observed at the point of exploration on the date indicated.
- In general, Unified Soil Classification System (ASTM D2488/D2487) designations presented on the logs were based on visual classification in the field and were modified where appropriate based on gradation and index property testing.
- Fine grained soils that plot within the hatched area on the Plasticity Chart, and coarse grained soils with between 5% and 12% passing the No. 200 sieve require dual USCS symbols, ie., CL-ML, GW-GM, GP-GM, GW-GC, GP-GC, GC-GM, SW-SM, SP-SM, SW-SC, SP-SC, SC-SM.
- If sampler is not able to be driven at least 6 inches then 50/X indicates number of blows required to drive the identified sampler X inches with a 140 pound hammer falling 30 inches.

ABBREVIATIONS

C_u - Coefficients of Uniformity
C_c - Coefficients of Curvature
WOH - Weight of Hammer
WOR - Weight of Rod

REFERENCES

1. American Society for Testing and Materials (ASTM), 2011, ASTM D2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System).

UNIFIED SOIL CLASSIFICATION SYSTEM[1]

COARSE GRAINED SOILS (More than 50% retained on No. 200 Sieve)	**GRAVELS** (More than 50% of coarse fraction retained on No. 4 Sieve)	CLEAN GRAVEL WITH <5% FINES	**GW**	WELL-GRADED GRAVEL, WELL-GRADED GRAVEL WITH SAND
			GP	POORLY GRADED GRAVEL, POORLY GRADED GRAVEL WITH SAND
		GRAVELS WITH 5% TO 12% FINES	**GW-GM**	WELL-GRADED GRAVEL WITH SILT, WELL-GRADED GRAVEL WITH SILT AND SAND
			GW-GC	WELL-GRADED GRAVEL WITH CLAY (OR SILTY CLAY), WELL-GRADED GRAVEL WITH CLAY AND SAND (OR SILT CLAY AND SAND)
			GP-GM	POORLY GRADED GRAVEL WITH SILT, POORLY GRADED GRAVEL WITH SILT AND SAND
			GP-GC	POORLY GRADED GRAVEL WITH CLAY (OR SILTY CLAY), POORLY GRADED GRAVEL WITH CLAY AND (OR SILTY CLAY AND SAND)
		GRAVELS WITH > 12% FINES	**GM**	SILTY GRAVEL, SILTY GRAVEL WITH SAND
			GC	CLAYEY GRAVEL, CLAYEY GRAVEL WITH SAND
			GC-GM	SILTY, CLAYEY GRAVEL SILTY, CLAYEY GRAVEL WITH SAND
	SANDS (50% or more of coarse fraction passes the No. 4 Sieve)	CLEAN SANDS WITH <5% FINES	**SW**	WELL-GRADED SAND, WELL-GRADED SAND WITH GRAVEL
			SP	POORLY GRADED SAND, POORLY GRADED SAND WITH GRAVEL
		SANDS WITH 5% TO 12% FINES	**SW-SM**	WELL-GRADED SAND WITH SILT, WELL-GRADED SAND WITH SILT AND GRAVEL
			SW-SC	WELL-GRADED SAND WITH CLAY (OR SILTY CLAY), WELL-GRADED SAND WITH CLAY AND GRAVEL (OR SILTY CLAY AND GRAVEL)
			SP-SM	POORLY GRADED SAND WITH SILT, POORLY GRADED SAND WITH SILT AND GRAVEL
			SP-SC	POORLY GRADED SAND WITH CLAY, POORLY GRADED SAND WITH CLAY AND GRAVEL (OR SILTY CLAY AND GRAVEL)
		SANDS WITH > 12% FINES	**SM**	SILTY SAND, SILTY SAND WITH GRAVEL
			SC	CLAYEY SAND, CLAYEY SAND WITH GRAVEL
			SC-SM	SILTY, CLAYEY SAND, SILTY, CLAYEY SAND WITH GRAVEL
FINE GRAINED SOILS (50% or more passes the No. #200 sieve)	SILTS AND CLAYS (Liquid Limit less than 50)		**ML**	SILT, SILT WITH SAND, SILT WITH GRAVEL
			CL	LEAN CLAY, LEAN CLAY WITH SAND, LEAN CLAY WITH GRAVEL
			CL-ML	SILTY CLAY, SILTY CLAY WITH SAND, SILTY CLAY WITH GRAVEL
			OL	ORGANIC CLAY, ORGANIC CLAY WITH SAND, ORGANIC CLAY WITH GRAVEL, ORGANIC SILT, ORGANIC SILT WITH SAND, ORGANIC SILT WITH GRAVEL
	SILTS AND CLAYS (Liquid Limit 50 or greater)		**MH**	ELASTIC SILT. ELASTIC SILT WITH SAND, ELASTIC SILT WITH GRAVEL
			CH	FAT CLAY, FAT CLAY WITH SAND, FAT CLAY WITH GRAVEL
			OH	ORGANIC CLAY, ORGANIC CLAY WITH SAND, ORGANIC CLAY WITH GRAVEL, ORGANIC SILT, ORGANIC SILT WITH SAND, ORGANIC SILT WITH GRAVEL

NOTE: USE MATERIAL DESCRIPTION ON THE LOG TO DEFINE A GRAPHIC THAT MAY NOT BE PROVIDED ON THIS LEGEND.

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GRAPHICS KEY

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FIGURE
A-1

GRAIN SIZE[1]

DESCRIPTION		ALTERNATIVE SIEVE DESIGNATION	STANDARD SIEVE DESIGNATION
Boulders		>12 in	300 mm
Cobbles		3 - 12 in	75 - 300 mm
Gravel	coarse	3/4 -3 in	19 - 75 mm
	fine	#4 - 3/4 in	4.75 - 19 mm
Sand	coarse	#10 - #4	2 - 4.75 mm
	medium	#40 - #10	425 µm - 2 mm
	fine	#200 - #40	75 - 425 µm
Fines		Passing #200	<75 µm

SECONDARY CONSTITUENT[1]

Term of Use	AMOUNT	
	Secondary Constituent is Fine Grained	Secondary Constituent is Coarse Grained
Trace	<5%	<15%
With	5 to <15%	15 to <30%
Modifier	≥15%	≥30%

PLASTICITY[1]

DESCRIPTION	CRITERIA
Non-Plastic	A 1/8 in. (3 mm) thread cannot be rolled at any water content.
Low	The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit.
Medium	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be rerolled after reaching the plastic limit. The lump crumbles when drier than the plastic limit.
High	It takes considerable time rolling and kneading to reach the plastic limit. The thread can be rerolled several times after reaching the plastic limit. The lump can be formed without crumbling when drier than the plastic limit.

MOISTURE CONTENT[1]

DESCRIPTION	FIELD TEST
Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, usually soil is below water table

CONSISTENCY - COHESIVE SOIL[2, 3]

CONSISTENCY	SPT - N (# blows / ft)	Pocket Pen (tsf)	UNCONFINED COMPRESSIVE STRENGTH (Q_u)(psf)	VISUAL / MANUAL CRITERIA
Very Soft	0 - 2	PP < 0.25	<500	Thumb will penetrate soil more than 1" (25 mm)
Soft	2 - 4	0.25 ≤ PP <0.5	500 - 1,000	Thumb will penetrate soil about 1" (25 mm)
Medium Stiff	4 - 8	0.5 ≤ PP <1	1,000 - 2,000	Thumb will penetrate soil about 1/4" (6 mm)
Stiff	8 - 16	1 ≤ PP <2	2,000 - 4,000	Can be imprinted with considerable pressure from thumb
Very Stiff	16 - 32	2 ≤ PP <4	4,000 - 8,000	Thumb will not indent soil but readily indented with thumbnail
Hard	>32	4 ≤ PP	>8,000	Thumbnail will not indent soil

APPARENT DENSITY - NON-COHESIVE SOIL[2]

APPARENT DENSITY	SPT-N (# blows / ft)
Very Loose	0 - 4
Loose	5 - 10
Medium Dense	11 - 30
Dense	31 - 50
Very Dense	>50

STRUCTURE[1]

DESCRIPTION	CRITERIA
Stratified	Alternating layers of varying material or color with layers at least 1/4-in. (6mm) thick, note thickness.
Laminated	Alternating layers of varying material or color with the layers less than 1/4-in. (6 mm) thick, note thickness.
Fissured	Breaks along definite planes of fracture with little resistance to fracturing.
Slickensided	Fracture planes appear polished or glossy, sometimes striated.
Blocky	Cohesive soil that can be broken down into small angular lumps which resist further breakdown.
Lensed	Inclusion of small pockets of different soils, such as small lenses of sand scattered through a mass of clay; note thickness.
Homogeneous	Same color and appearance throughout

ANGULARITY[1]

DESCRIPTION	CRITERIA
Angular	Particles have sharp edges and relatively plane sides with unpolished surfaces.
Subangular	Particles are similar to angular description but have rounded edges.
Subrounded	Particles have nearly plane sides but have well-rounded corners and edges.
Rounded	Particles have smoothly curved sides and no edges.

REACTION WITH HYDROCHLORIC ACID[1]

DESCRIPTION	FIELD TEST
None	No visible reaction
Weak	Some reaction, with bubbles forming slowly
Strong	Violent reaction, with bubbles forming immediately

CEMENTATION[1]

DESCRIPTION	FIELD TEST
Weakly	Crumbles or breaks with handling or little finger pressure
Moderately	Crumbles or breaks with considerable finger pressure
Strongly	Will not crumble or break with finger pressure

REFERENCES

1. American Society for Testing and Materials (ASTM), 2017, ASTM D2488: Standard Practice for Description and Identification of Soils (Visual Manual Procedures).
2. Terzaghi, K and Peck, R., 1948, Soil Mechanics in Engineering Practice, John Wiley & Sons, New York.
3. United States Department of the Interior Bureau of Reclamation (USBR), 1998, Earth Manual, Part I.

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SOIL DESCRIPTION KEY
(For additional tables, see ASTM D2488)

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FIGURE
A-2

Date Begin - End:	2/05/2025	**Drilling Company:**	Hinderliter	**BORING LOG B-1**	
Logged By:	V. Kasaraneni	**Drill Crew:**	H. Corbin		
Hor.-Vert. Datum:	Not Available	**Drilling Equipment:**	CME-45B	**Hammer Type - Drop:**	140 lb. Auto - 30 in.
Plunge:	-90 degrees	**Drilling Method:**	Solid Stem Auger	**Hammer Efficiency:**	71.3%
Weather:	41° F Cloudy	**Auger Diameter:**	6 in. O.D.	**Hammer Cal. Date:**	8/02/2024

Latitude: 36.01726°
Longitude: -95.94659°
Location Offset: 5 feet north
Surface Condition: Grass

Depth (feet)	Graphical Log	Lithologic Description	Sample Number	Sample Type	Blow Counts(BC)= Uncorr. blows/6 in	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limits	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
		TOPSOIL: 6 inches												
		Silty SAND (SM): brown and light brown, moist, loose to medium dense												
			SS-1		BC=3 3 3	18"	SM	9.6		100	50	NP	NP	
5														
		- medium dense below 8.5 feet	SS-2		BC=3 5 7	18"		13.9						
10														
			SS-3		BC=5 9 10	18"	SM	9.2		100	28	NP	NP	
15														

The boring was terminated at approximately 15 ft. below ground surface. The boring was backfilled with auger cuttings and bentonite on February 05, 2025.

GROUNDWATER LEVEL INFORMATION:
Groundwater was not observed during drilling or after completion.

GENERAL NOTES:
A handheld GPS unit was used to locate the exploration with an accuracy of 15 feet.

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BORING LOG B-1

Sewer Rehabilitation Project
IOT2 FY24, East 101st Street
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BORING
B-1
PAGE: 1 of 1

Date Begin - End:	2/05/2025	**Drilling Company:**	Hinderliter	**BORING LOG B-2**	
Logged By:	V. Kasaraneni	**Drill Crew:**	H. Corbin		
Hor.-Vert. Datum:	Not Available	**Drilling Equipment:**	CME-45B	**Hammer Type - Drop:**	140 lb. Auto - 30 in.
Plunge:	-90 degrees	**Drilling Method:**	Solid Stem Auger	**Hammer Efficiency:**	71.3%
Weather:	41° F Cloudy	**Auger Diameter:**	6 in. O.D.	**Hammer Cal. Date:**	8/02/2024

Latitude: 36.01756°
Longitude: -95.94669°
Location Offset: 10 feet north
Surface Condition: Grass

Depth (feet)	Graphical Log	Lithologic Description	Sample Number	Sample Type	Blow Counts(BC)= Uncorr. blows/6 in	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limits	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
		TOPSOIL: 6 inches												
		Silty SAND (SM): brown and light brown, moist, loose to medium dense												
			SS-1		BC=2 3 3	18"	SM	10.1		100	36	NP	NP	
5														
		- medium dense below 8.5 feet	SS-2		BC=3 5 5	18"	SM	10.9		100	50	NP	NP	
10														
			SS-3		BC=2 4 8	18"		4.4						
15														

The boring was terminated at approximately 15 ft. below ground surface. The boring was backfilled with auger cuttings and bentonite on February 05, 2025.

GROUNDWATER LEVEL INFORMATION:
Groundwater was not observed during drilling or after completion.

GENERAL NOTES:
A handheld GPS unit was used to locate the exploration with an accuracy of 15 feet.

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BORING LOG B-2

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BORING
B-2
PAGE: 1 of 1

Exploration ID	Depth (ft.)	Sample No.	Sample Description	Water Content (%)	Dry Unit Wt. (pcf)	Sieve Analysis (%)			Atterberg Limits			Additional Tests
						Passing 3/4"	Passing #4	Passing #200	Liquid Limit	Plastic Limit	Plasticity Index	
B-1	3.5 - 5.0	SS-1	SILTY SAND (SM)	9.6		100	100	50	NP	NP	NP	
B-1	8.5 - 10.0	SS-2		13.9								
B-1	13.5 - 15.0	SS-3	SILTY SAND (SM)	9.2		100	100	28	NP	NP	NP	
B-2	3.5 - 5.0	SS-1	SILTY SAND (SM)	10.1		100	100	36	NP	NP	NP	
B-2	8.5 - 10.0	SS-2	SILTY SAND (SM)	10.9		100	100	50	NP	NP	NP	
B-2	13.5 - 15.0	SS-3		4.4								

Refer to the Geotechnical Evaluation Report or the supplemental plates for the method used for the testing performed above.
NP = NonPlastic
NA = Not Available

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LABORATORY TEST RESULT SUMMARY

Sewer Rehabilitation Project
IOT2 FY24, East 101st Street
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Tulsa, Oklahoma

TABLE
B-1

Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, you can benefit from a lowered exposure to problems associated with subsurface conditions at project sites and development of them that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed herein, contact your GBA-member geotechnical engineer. Active engagement in GBA exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Understand the Geotechnical-Engineering Services Provided for this Report

Geotechnical-engineering services typically include the planning, collection, interpretation, and analysis of exploratory data from widely spaced borings and/or test pits. Field data are combined with results from laboratory tests of soil and rock samples obtained from field exploration (if applicable), observations made during site reconnaissance, and historical information to form one or more models of the expected subsurface conditions beneath the site. Local geology and alterations of the site surface and subsurface by previous and proposed construction are also important considerations. Geotechnical engineers apply their engineering training, experience, and judgment to adapt the requirements of the prospective project to the subsurface model(s). Estimates are made of the subsurface conditions that will likely be exposed during construction as well as the expected performance of foundations and other structures being planned and/or affected by construction activities.

The culmination of these geotechnical-engineering services is typically a geotechnical-engineering report providing the data obtained, a discussion of the subsurface model(s), the engineering and geologic engineering assessments and analyses made, and the recommendations developed to satisfy the given requirements of the project. These reports may be titled investigations, explorations, studies, assessments, or evaluations. Regardless of the title used, the geotechnical-engineering report is an engineering interpretation of the subsurface conditions within the context of the project and does not represent a close examination, systematic inquiry, or thorough investigation of all site and subsurface conditions.

Geotechnical-Engineering Services are Performed for Specific Purposes, Persons, and Projects, and At Specific Times

Geotechnical engineers structure their services to meet the specific needs, goals, and risk management preferences of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client.

Likewise, geotechnical-engineering services are performed for a specific project and purpose. For example, it is unlikely that a geotechnical-engineering study for a refrigerated warehouse will be the same as one prepared for a parking garage; and a few borings drilled during a preliminary study to evaluate site feasibility will not be adequate to develop geotechnical design recommendations for the project.

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project or purpose;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, the reliability of a geotechnical-engineering report can be affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying the recommendations in it. A minor amount of additional testing or analysis after the passage of time – if any is required at all – could prevent major problems.

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read the report in its entirety. Do not rely on an executive summary. Do not read selective elements only. *Read and refer to the report in full.*

You Need to Inform Your Geotechnical Engineer About Change

Your geotechnical engineer considered unique, project-specific factors when developing the scope of study behind this report and developing the confirmation-dependent recommendations the report conveys. Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the elevation, configuration, location, orientation, function or weight of the proposed structure and the desired performance criteria;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project or site changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept*

responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface using various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing is performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgement to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team through project completion to obtain informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, they are not final, because the geotechnical engineer who developed them relied heavily on judgement and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* exposed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a continuing member of the design team, to:

- confer with other design-team members;
- help develop specifications;
- review pertinent elements of other design professionals' plans and specifications; and
- be available whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction-phase observations.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for information purposes only.* To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. This happens in part because soil and rock on project sites are typically heterogeneous and not manufactured materials with well-defined engineering properties like steel and concrete. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually provide environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures.* If you have not obtained your own environmental information about the project site, ask your geotechnical consultant for a recommendation on how to find environmental risk-management guidance.

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, the engineer's services were not designed, conducted, or intended to prevent migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, ***proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration. Confront the risk of moisture infiltration*** by including building-envelope or mold specialists on the design team. ***Geotechnical engineers are not building-envelope or mold specialists.***

GEOPROFESSIONAL BUSINESS ASSOCIATION

Telephone: 301/565-2733
e-mail: info@geoprofessional.org www.geoprofessional.org