FINAL GEOTECHNICAL INVESTIGATION REPORT

Maryland Zoo
Eagle and Owl Exhibit
Baltimore, Maryland

PREPARED FOR:

Maryland Zoo

PREPARED BY:

CENTURY ENGINEERING
10710 GILROY ROAD
HUNT VALLEY, MARYLAND 21031

MAY 2025

CEI Project No. 20234710.002A

CENTURY ENGINEERING
A Kleinfelder Company

May 17, 2025

Mr./Ms. FirstName LastName
The Maryland Zoo in Baltimore
1876 Mansion House Drive
Baltimore, MD 21217

SUBJECT: The Maryland Zoo in Baltimore – Eagle and Owl Exhibit
Geotechnical Investigation Report
Baltimore, Maryland
CEI Project No. 20234710.001A

Dear Mr./Ms. Last Name:

In accordance with our proposal for engineering services, we have performed a geotechnical exploration of the proposed Eagle and Owl Exhibit site at the Zoo property in Baltimore, Maryland. The purpose of the study was to evaluate the potential subsurface conditions that may be encountered.

Project Description: The project site is located in the City of Baltimore, Maryland at the Maryland Zoo, as indicated on Figure 1 in the Appendix. The Maryland Zoo is a 135+/- acre parcel located within Druid Hill Park to the north of Druid Lake. The proposed Eagle and Owl Exhibit is an approximately 2,600 s.f. “enclosure” to be located just north of the Maryland Wilderness and west of the Children’s Zoo (see Figure 2). The structure will consist of a system of poles, anchors, and cables, covered by aviary netting. Based on the topographic information provided on the Site Plan (Figure 2), the highest elevations are on the western edge of the site from EL 243 to 251 feet above sea level (asl) and drop to the east to approximate elevations EL 231 to 236 feet asl. There is a creek along the eastern edge of the site, with two timber access bridges.

The proposed aviary construction will likely include steel support poles, aviary netting supported with wire rope, foundations, and ground anchors designed for snow loads. Structural loads were not provided, however, based upon similar projects at the Zoo, it is likely that the proposed aviary support poles will be embedded in concrete foundations consisting of 4 to 5-ft. diameter reinforced concrete piers. Center and perimeter support pole foundations will be embedded below finished grade. The perimeter pole foundations may include a tension cable and permanent earth anchor. Earth anchors consisting of screw anchors are likely to be grouted in place and designed for a 20-to-35-kip cable load in tension.

A column load of 40 to 50 kips compression load is estimated for the center support or “king post”, and a maximum perimeter post load up to 70 to 80 kips (compression). The guyed ropes will likely be attached to earth anchors required to provide ultimate resistance of 80 to 90 kips (tension).

Typical foundation loads for the central aviary building can range from 20 to 40 kips. Slab loads can be up to 80 pounds per square foot (psf). Preliminary finished site grades were included on the site plan. It is anticipated that ground disturbance within the site will be limited. Earthwork cuts and fills of no more than approximately 2 feet are expected. Utility trenches are not anticipated to exceed 4 feet in depth. A stormwater management (SWM) structure is proposed along the eastern edge of the site.

Scope of Work: The scope of the geotechnical investigation included the following:

- Drilling a total of 6 test borings to maximum depths of 20 feet below grade. The drilling of the structure and SWM borings included both standard and continuous interval Standard Penetration Testing and sampling of the soils. Due to the steep terrain along the western edge of the site, test borings HA1 and HA-2 were performed using hand auger methods and portable dynamic cone penetrometer (DCP) testing equipment.
- Performing infiltration testing in the SWM borings.
- Performing laboratory testing to determine the classification of the soils.
- Preparing boring logs and subsurface profiles.
- Evaluating the subsurface conditions and design requirements for the foundations, as well as groundwater conditions, soil bearing capacity, soil strength design parameters (phi angle and cohesion), laboratory test results, subgrade preparation, and geotechnical and construction considerations.
- Preparing a geotechnical report with findings and recommendations.

Area Geology: The Geologic Map of Maryland (1968) shows that the project site is located in the Eastern Piedmont Physiographic province where natural soils are residual materials derived from in-place weathering of the parent rock materials. The Geologic Map of the Baltimore West

Quandrangle, Maryland (1979) indicates that the project site is located in an area characterized by the James Run Formation of Cambrian age. The parent rock is mapped as the Druid Hill Amphibolite member, but the Carroll Gneiss member is also mapped adjacent to the project site. (see Figure 3). Locally, there are concentrations of lignitic, partially pyritized wood, macerated leaf and cone debris, and siderite concretions. Thin planar beds of sand and/or gravelly clay are interbedded within massive clays.

Test Borings: Six (6) test borings were drilled for structure and SWM purposes. The structure and SWM borings were drilled to a maximum depth of 20 and 10 feet below grade respectively, at the locations shown on the Boring Location Plan (Figure 2), using a Geoprobe 7822DT ATV-mounted drill rig that was equipped with hollow stem augers. For structural borings, standard penetration testing and sampling of the soils were performed at 2.5 feet intervals to 10 feet followed by 5 feet intervals thereafter to the bottom of each boring. For SWM borings, continuous standard penetration testing and sampling of the soils were performed at 2 feet intervals to the bottom of each boring. Infiltration testing was proposed for the SWM borings, however the soils located at the proposed test depths are impermeable clays and silts, therefore tests were not performed. For hand auger borings, DCP testing was performed at 1-foot intervals. DCP results are presented in the following table.

DCP Results

Boring	Depth (ft)	Blows per 1.75”	Allowable Bearing Capacity (psf)	Boring	Depth (ft)	Blows per 1.75”	Allowable Bearing Capacity (psf)
HA-1	0-0.5	3, 3, 2	1,200	HA-2	0-0.5	2, 1, 3	800
	1-1.5	3, 4, 5	1,500		1-1.5	3, 4, 3	1,300
	2-2.5	8, 12, 12	3,200		2-2.5	5, 9, 11	3,000
	3-3.5	8, 11, 11	3,000		3-3.5	14, 20	4,300
	4-4.5	14, 18	4,200		4-4.5	12, 16	3,100
	5-5.5	20	4,600				

Groundwater was not encountered within any of the borings. Cave-in and refusal depths are presented in the following table. Auger refusal depths can vary widely depending upon the type of drill equipment used. The hand auger refusal depths are likely shallower than the actual rock surface by several feet or more. The split spoon and hollow stem auger refusal depths are likely

within a foot or two of the actual rock surface. Upon completion, the borings were filled with auger cuttings. The soil samples were visually inspected and classified by a geotechnical engineer. The soil classifications were corroborated or modified based on the results of the laboratory classification tests performed on representative soil samples. The boring logs and sample analyses are included in Appendix B.

Boring Groundwater, Cave-in, and Refusal Depths

Boring	Groundwater Depth (ft)	Cave-in Depth (ft)	Refusal Depth (ft)	Comment
HA-1	Dry	-	5.5	Hand auger refusal
HA-2	Dry	-	4.5	Hand auger refusal
SB-1	Dry	12.5	13.5	Split spoon and auger refusal
SB-2	Dry	8.5	10.0	Split spoon and auger refusal
SWM-1	Dry	7.3	13.0	Split spoon and auger refusal
SWM-2	Dry	7.3	12.0	Split spoon and auger refusal

Laboratory Testing: Laboratory testing was performed on selected soil samples to determine the natural moisture contents and classifications. A total of 10 moisture content tests and 10 classification tests were performed in accordance with the following standards:

- Water Content (ASTM D2216)
- Sieve Analysis (ASTM D422)
- Atterberg Limits (ASTM D4318)
- Hydrometers (ASTM D7928)
- Standard Proctor (ASTM D698)

The laboratory test results are included in Appendix C.

Subsurface Conditions: The subsurface profile of the site is shown on Figure 4. The following soil stratum was encountered:

Residual Soils: Residual soils consisting of both fine- and coarse-grained soils are present in all borings to the boring termination depths. The soils primarily consisted of soft to very stiff, silt with sand (ml), silty clay with sand and gravel (cl-ml), and sandy lean clay with silt or gravel (cl)

with varying amounts of sand and gravel. Coarse-grained soils include loose to very dense, poorly-graded sand with silt and gravel (sp-sm), well-graded sand with gravel (sw), silty sand with gravel (sm), silty-clayey sand with gravel (sc-sm), and clayey sand with gravel (sc). The Standard Penetration Test blow counts ranged from 2 to over 50 blows per 6 inches, averaging roughly 24 blows per foot. The natural moisture content ranged from 10.3 to 23.1 percent, averaging 16.3 percent. These soils were both plastic and non-plastic with liquid limits and plasticity indices ranging from 23 to 34 percent and 4 to 17 percent, averaging 31 and 10 percent, respectively. The maximum dry density and optimum moisture content of a near surface sample was 120.9 pcf and 12.4 percent, respectively.

As stated earlier, groundwater was not encountered within any of the borings after removing the casing. Cave-in depths were encountered from 7.3 to 12.5 feet, averaging 8.9 feet. A more accurate determination of the hydrostatic water table would require the installation of monitoring wells or piezometers. It should be noted that the actual level of the hydrostatic water table and the amount and level of perched water should be anticipated to fluctuate throughout the year, depending upon variations in precipitation, surface run-off, infiltration, site topography, and drainage.

Foundation Design Recommendations: The subsurface conditions at the site generally consist of soft to stiff, silts and clays and loose to medium dense sands, with varying amounts of gravel. The depth to firm soil varies across the site from roughly 2 to 7 feet below grade. Based on the results of the field exploration and laboratory testing, the site appears to be geotechnically suitable for development. Within the following sections, foundation design recommendations and constructability considerations are provided.

Shallow Foundations: Century recommends the subgrades be evaluated prior to concrete placement. Any loose soils should be removed and replaced with compacted structural fill. Slabs or shallow spread footings constructed on structural fill or natural soil should be designed for a maximum allowable bearing pressure of 3,000 psf in conjunction with a modulus of subgrade reaction of 100 psi per inch of deflection. The edges of the slabs should be turned down to the frost depth or be constructed on free-draining fill. The surrounding ground surface should be sloped to drain away from slabs with a grade. We estimate a total settlement

potential for footings and mats of less than 1 inch. The differential settlement potential is not anticipated to exceed three-quarters of the total settlement potential.

Post Foundations: Post foundations may be utilized for support poles. Post foundations should be drilled at least 4 feet below grade, bearing on natural soil. The allowable bearing pressure is 3,000 psf. Backfill around poles may be concrete or soil compacted in 8-inch lifts bearing on a bottom concrete pad. If soil is used, it should be a well-graded, granular aggregate. Concrete should be used if high lateral forces are to be resisted. A factor of safety of 3.0 should be utilized for design.

We recommend that concrete drilled pier construction conform to all requirements of ACI 336.1, and that this specification be referenced or incorporated into the project specifications. The foundation contractor should be equipped to perform dynamic cone penetrometer (DCP) or SPT testing of the bearing stratum for all foundations, or as otherwise required for acceptance by the Engineer. Groundwater is unlikely to be encountered during construction of post foundations, however provisions for groundwater control should be included in the contract specifications.

Anchor Foundations: Ground anchors may be used to resist uplift loads. Guyed rope earth anchors consisting of pre-stressed grouted ground anchors should be considered for this project. Helical anchors are screwed into the ground and cannot be installed in very dense soils, or weathered rock, therefore they are not appropriate for this site. Due to the estimated depth to rock, it is likely that the bonded portions of the anchors will be in rock. The unbonded length of a pre-stressed anchor is typically at least 10 to 15 feet.

Grouted ground anchors can provide allowable design loads ranging from about 30 tons to 130 tons, depending upon the soil or rock conditions, grouting methods, and length of the bond zone. A small diameter straight shaft gravity grouted anchor is recommended for this project. A ground anchor is a structural element consisting of a drilled hole with a prestressing steel tendon (bar or strand) inserted into the hole and filled with grout. The drill hole is typically 6-in. diameter or less and anchor lengths of about 25-ft. to 40-ft. are typical. The ground anchor includes an unbonded length and a bonded anchor zone which should be developed beyond the critical failure surface. The bond length is the length of the prestressing steel tendon that is

bonded to the grout and transfers the tensile load to the surrounding soil or rock through frictional resistance. Estimated rock and soil design parameters are presented below.

Soil and Rock Design Parameters

Soil/Rock Unit	Depth interval (ft)	Unit Weight (pcf)	Friction angle	Undrained Shear Strength (psf)	Ultimate Bond Strength (psi)
Soft Residual	0 – 7	115	-	300	5
Stiff Residual	7 – 12	120	-	600	10
Weathered Zone	12 – 15	125	34	-	50
Bedrock	15+	150	-	-	145

Grouted anchors are installed by specialty geotechnical contractors. The ground anchor capacity will depend upon the method of drilling, size of the drill hole, length of the bond zone, and many other factors that should be determined by the anchor contractor. The design capacity of each anchor should be verified by proof testing during the construction phase. The proof test should include incremental loading by tensioning the prestessing steel element, with measurements of total movement and load recorded at 10-min. intervals, up to a load of 1.33 times the design load. After acceptance, the ground anchor should be stressed to a specified load and then “locked-off,” typically at 75 to 100 percent of the design load.

Seismic Site Class: The seismic site classification was determined based on the 2024 Edition of the International Building Code (IBC), which references Publication ASCE 7-22 “Minimum Design Loads for Buildings and Other Structures”. Borings were drilled to a maximum depth of only 20 feet, however, rock is located close to ground surface Using the Ň method for site classification, we have assumed that the typical soil profile for the area of the proposed structures can be represented by a 100 feet thick layer of very dense or very stiff soil overlying soft rock, indicating a site classification of C. The classification is based on average properties of the soil to a depth of 100 feet. For Seismic Site Class C, risk category II, the following seismic design parameters were obtained for the site location.

Period	Mapped Maximum Considered Earthquake Spectral Acceleration (Site Class BC)	Risk-Targeted MCE Spectral Response Acceleration	Design Spectral Response Acceleration
Short (0.2 sec.)	S_S = 0.160g	S_{MS} = 0.160g	S_{DS} = 0.110g
1.0 Second	S_1 = 0.041g	S_{M1} = 0.053g	S_{D1} = 0.035g

Stormwater Management: The subgrade conditions for any proposed SWM facility at the site are considered to be unsuitable for infiltrating stormwater. Two (2) infiltration tests were proposed, however, fine-grained deposits were encountered, therefore infiltration tests were not performed. To ensure that any infiltration will drain after a storm event, underdrains should be used for all proposed SWM facilities.

Dewatering and Drainage: Perched groundwater may be encountered close to ground surface, therefore limited dewatering may be required for trench and shallow foundation excavations, especially during the rainy season. Gravel-lined sump pits with pumps would likely handle most shallow excavations. Adequate above-ground drainage should be provided at the site at all times, including during construction, to minimize any increase in moisture content of the foundation soils. All run-off from adjacent areas should be diverted away from the excavation to prevent ponding of water in the excavation. After construction, all areas should be sloped away from proposed structures to prevent ponding of water around the building. The site drainage should also be such that the run-off onto adjacent properties is controlled properly.

Subgrade Preparation: The subgrade for all foundations, SWM structures and pavements should be inspected and approved by a Geotechnical Engineer or experienced Soils Technician. The effort that will be needed to properly prepare the subgrade will greatly depend upon the seasonal weather conditions. During cold and wet periods, drying and properly compacting the subgrade soils may not be possible. If any soft soils are encountered at this site, it is recommended that the subgrade be undercut and backfilled with suitable compacted structural fill.

It is recommended that the subgrade for any SWM structures consist of crushed stone (MSHA Graded Aggregate Base) placed in 8-inch layers and compacted to 95 percent of the Modified Proctor (ASTM D-1557) maximum dry density. The subgrade for pavements should be thoroughly compacted to at least 95 percent compaction (ASTM D-1557) and proof-rolled. Subgrade areas that pump should be undercut and backfilled with compacted structural fill, as required.

The subgrade for pavements should be inspected by proof-rolling using a loaded 10-ton dump truck, 8-ton drum roller, or similar equipment. Subgrade areas that are soft or “pump” during proof-rolling should be re-compacted or undercut and backfilled with compacted fill. Subgrades for the foundations should be inspected by testing with a Dynamic Cone Penetrometer (DCP) to confirm

that the subgrade is firm and acceptable for the design bearing pressure. Subgrades that are soft should be undercut to firm subgrade soil and backfilled with compacted backfill.

Fill Selection, Placement & Compaction: It is anticipated that the proposed site grading will not vary substantially from existing grades and that minimal cuts and fills will be required. All material used for fill or backfill should be inspected and approved by the Geotechnical Engineer. The on-site soils are not considered to be suitable for use as backfill for foundation walls, structural fill, and site grading. If fill material is needed for backfilling areas beneath slabs or foundations where unsuitable subgrade was undercut, it is recommended that a select granular backfill be used.

Fill that will support slabs, foundations or pavements should be placed in 8-inch layers and be compacted to at least 95 percent of the Standard Proctor maximum dry density as determined by ASTM D 698. Fill for non-structural areas should be compacted to at least 90 percent. The on-site soils have an optimum moisture content for compaction of about 20 to 30 percent. It should therefore be anticipated that some of the on-site soils will need to be spread, aerated and dried to achieve proper compaction.

Inspection & Testing: The additional foundation engineering, inspection and testing services that are recommended for this project are summarized below:

- Subgrade Inspection & Approval: A Geotechnical Engineer or experienced Soils Technician should inspect the subgrade for the duct bank and splicing vaults. If unsuitable subgrade materials are encountered, direction should be provided for any undercutting or improvement that may be needed to achieve a suitable subgrade.
- Fill Placement and Compaction: A Geotechnical Engineer or experienced Soils Technician should inspect the backfill operations and should take sufficient in-place density tests to verify that the specified degree of backfill compaction is achieved. The technician should observe and approve the backfill materials used and should determine if their existing moisture contents are suitable. A Geotechnical Engineer or experienced Soils Technician should closely monitor all backfill placement and compaction operations for the duct bank, pits, and foundations.

Remarks: This report has been prepared to aid in the evaluation of the subsurface conditions for the site construction. It is considered that adequate recommendations have been provided to serve

as a basis for design and preparation of plans and specifications. Additional recommendations can be provided as needed.

These analyses and recommendations are, of necessity, based on the information made available to us at the time of the actual writing of the report and the on-site conditions, surface and subsurface, that existed at the time the exploratory borings were drilled. Further assumption has been made that the limited exploratory borings, in relation both to the lateral extent of the site and to depth, are representative of conditions across the site.

The nature and extent of variations between explorations may not become evident until construction. If variations from the anticipated conditions are encountered, it may be necessary to revise the recommendations in this report. We cannot accept responsibility for designs based on recommendations in this report unless we are engaged to make site visits during construction to: a) check that the subsurface conditions exposed during construction are in general conformance with our design assumptions and b) ascertain that, in general, the work is being performed in compliance with the contract documents.

Our professional services have been performed in accordance with generally accepted engineering principles and practices; no other warranty, expressed or implied, is made. Century Engineering, LLC. assumes no responsibility for interpretations made by others on the work performed by Century. We appreciate the opportunity to have been of service to you on this project. Please contact us if you have any questions or need additional information.

Sincerely,

CENTURY ENGINEERING, LLC, A KLEINFELDER COMPANY

Tristram Madden, PE, PG
Assistant Vice President

Personal Certification: I hereby certify that these documents were prepared for approved by me, and that I am a duly licensed professional engineer under the laws of the State of Maryland, License No. 27195, Expiration 3/26/2026.

cc: File
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APPENDIX A – FIGURES

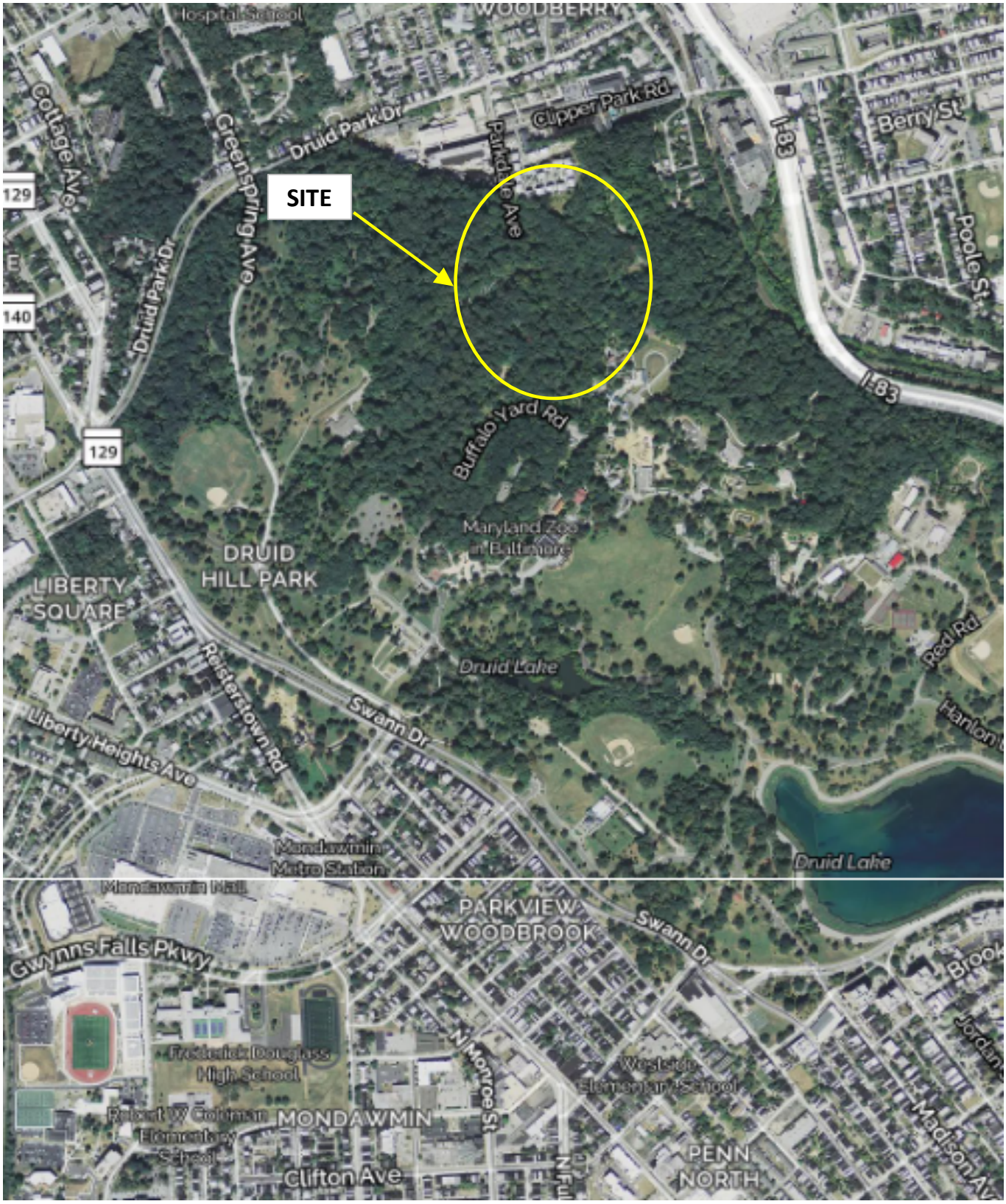
CENTURY ENGINEERING

THE MARYLAND ZOO AT BALTIMORE

BALTIMORE, MD

LOCATION MAP

Figure: 1	Designed By:	Drawn By:
Date: 5/13/2025	Project#: 20234710.001A	Scale: None



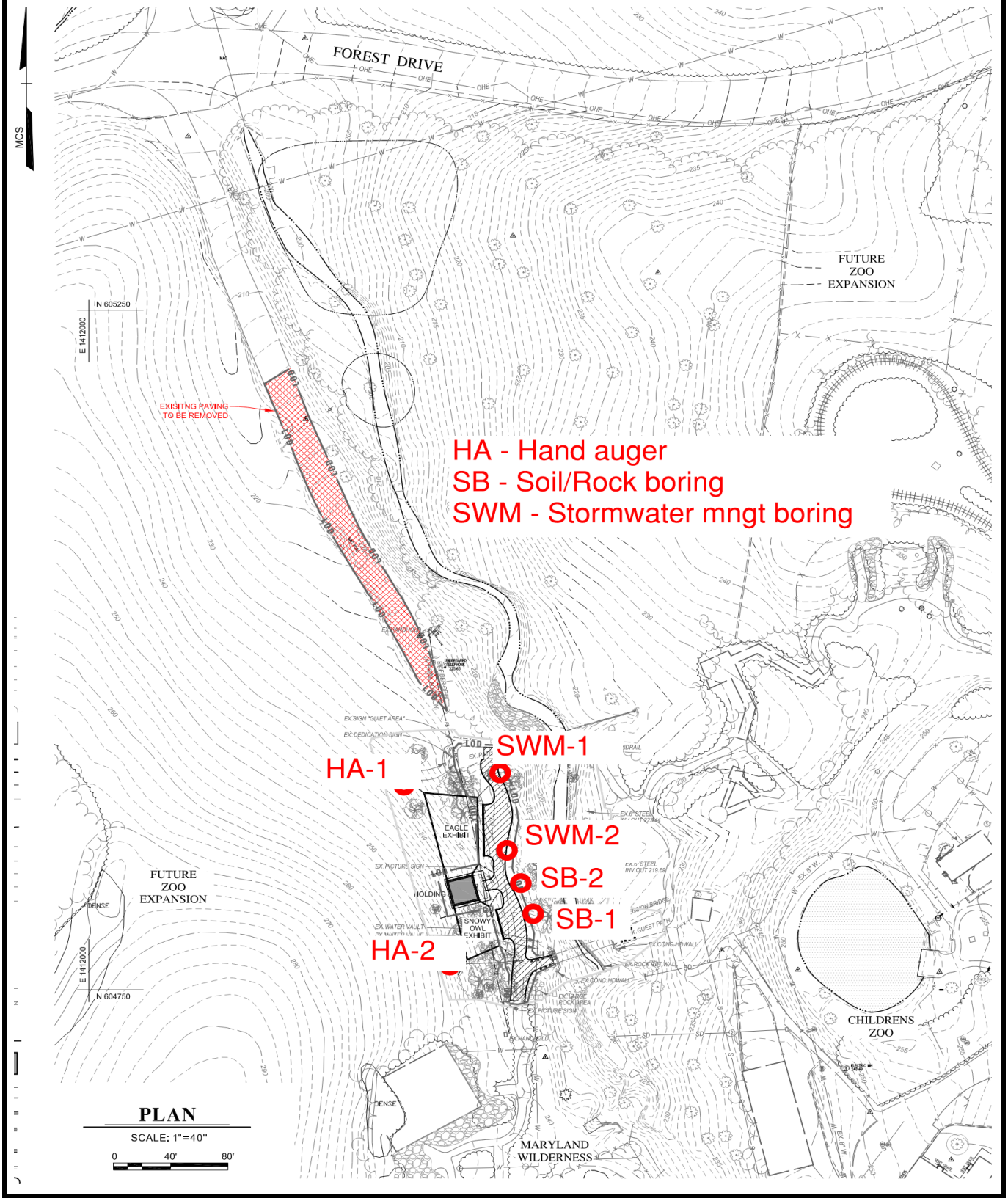
CENTURY ENGINEERING

The Maryland Zoo

Baltimore, Maryland

BORING LOCATION MAP

Figure: 2	Designed By:	Drawn By: TEM
Date: 5/13/2025	Project#: 20234710.001A	Scale: None



CENTURY ENGINEERING

THE MARYLAND ZOO AT BALTIMORE

BALTIMORE, MD

GEOLOGY MAP

Figure: 3	Designed By:	Drawn By:
Date: 5/13/2025	Project#: 20234710.001A	Scale: None

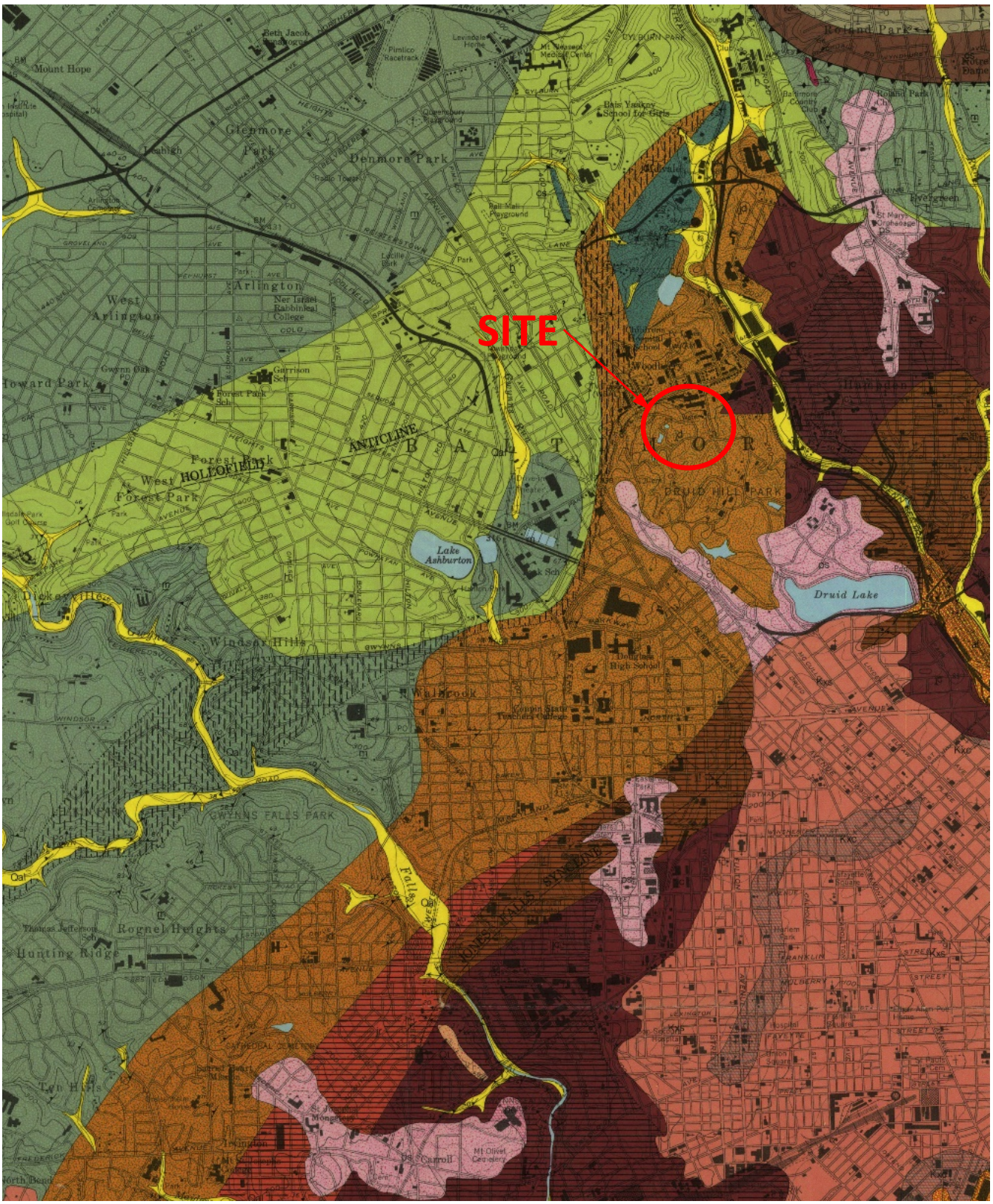


FIGURE 4a

A A'

ELEVATION (feet)

255 250 245 240 235 230 225 220 215

HA-2
El. 251.0
WC= 19.7%
LL= 33
PL= 27
PI= 6
- Practical Auger Refusal at 4.5 Feet -
- End of Boring at 4.5 Feet -

SB-1
El. 236.0
BC= 2, 3, 6
BC= 7, 17, 10
WC= 10.3%
LL= 23
PL= 19
PI= 4
-200= %
BC= 4, 8, 11
WC= 14.4%
LL= 33
PL= 20
PI= 13
BC= 5, 8, 13
BC= 50/5"
- Practical Auger Refusal at 13.5 Feet -
- End of Boring at 13.5 Feet -

SB-2
El. 235.0
BC= 1, 3, 11
BC= 4, 5, 3
BC= 4, 5, 9
WC= 16.1%
LL= 31
PL= 19
PI= 12
BC= 10, 14, 50/5"
- Practical Auger Refusal at 10 Feet -
- End of Boring at 10 Feet -

SWM-2
El. 233.0
BC= 3, 4, 8, 8
BC= 3, 4, 3, 2
BC= 1, 1, 1, 1
BC= 4, 5, 5, 9
WC= 16.4%
LL= 30
PL= 19
PI= 11
BC= 3, 6, 15, 22
BC= 8, 21, 29, 50/4"
WC= 16.0%
LL= 28
PL= 18
PI= 10
- Practical Auger Refusal at 12 Feet -
- End of Boring at 12 Feet -

HA-1
El. 243.0
WC= 23.1%
LL= 34
PL= 25
PI= 9
-200= %
- Practical Auger Refusal at 5.5 Feet -
- End of Boring at 5.5 Feet -

SWM-1
El. 231.0
BC= 4, 6, 6, 11
BC= 8, 5, 5, 5
BC= 11, 12, 12, 10
BC= 7, 7, 9, 12
WC= 19.0%
LL= 34
PL= 22
PI= 12
BC= 4, 9, 9, 13
BC= 3, 7, 7, 7
WC= 15.2%
LL= 29
PL= 20
PI= 9
BC= 7, 26, 50/3"
- Practical Auger Refusal at 13.5 Feet -
- End of Boring at 13.5 Feet -

NOTE:
REFER TO INDIVIDUAL LOGS FOR DETAILED INFORMATION AND THE GRAPHIC LEGEND KEYS FOR GRAPHICAL SYMBOL INFORMATION.

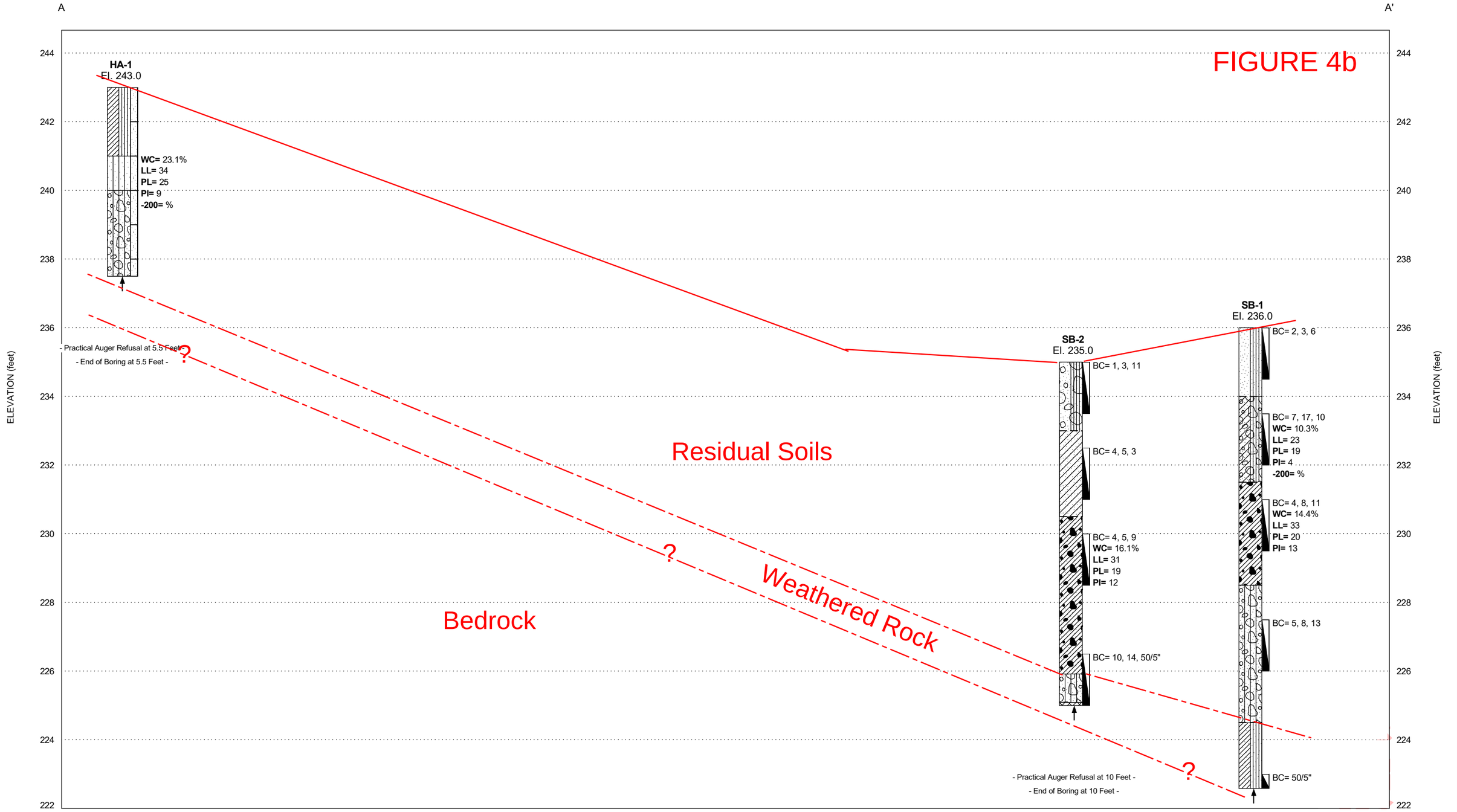
KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.: 20234710.002A
DRAWN BY:
CHECKED BY:
DATE:

SUBSURFACE CROSS-SECTION

MD Zoo -Owl and Eagle Exhibit
1 Safari Place
Baltimore, MD

FIGURE 4b



NOTE:
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KLEINFELDER
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PROJECT NO.: 20234710.002A
DRAWN BY:
CHECKED BY:
DATE:

SUBSURFACE CROSS-SECTION

MD Zoo -Owl and Eagle Exhibit
1 Safari Place
Baltimore, MD

APPENDIX B – BORING LOGS

Date Begin - End:	3/27/2025	**Drilling Company:**	DTCI	**BORING LOG HA-1**	
Logged By:	Brad Hubbard	**Drill Crew:**	Tom Atkinson		
Hor.-Vert. Datum:	Not Available	**Drilling Equipment:**	Hand Auger	**Hammer Type - Drop:**	15 lb. DCPT - 20 in.
Plunge:	-90 degrees	**Drilling Method:**	Hand Auger		
Weather:	50°F	**Auger Diameter:**	3.25 in. O.D.		

Approximate Elevation (feet)	Depth (feet)	Graphical Log	FIELD EXPLORATION: Approximate Ground Surface Elevation (ft.): 243.00 / Lithologic Description	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in.	Recovery (NR=No Recovery)	LABORATORY RESULTS: USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
			Silty CLAY with Sand and Gravel (CL): brown, moist, soft to medium stiff											
			SILT with Sand (ML): brown, moist, very stiff				CL	23.1				34	9	
240			**Silty SAND with Gravel (SM)**: brown, moist, medium dense to dense											
	5													
235														
	10													
230														
	15													

The boring was terminated because of practical auger refusal ( ) at approximately 5.5 ft. below ground surface. The boring was backfilled with bentonite on March 27, 2025.

GROUNDWATER LEVEL INFORMATION:
Groundwater was not observed during drilling or after completion.
GENERAL NOTES:
The exploration location and elevations are approximate and were estimated by Kleinfelder.
The exploration location and elevation are approximate and were estimated by Kleinfelder.

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PROJECT NO.: 20234710.002A
DRAWN BY:
CHECKED BY:
DATE:

BORING LOG HA-1

MD Zoo -Owl and Eagle Exhibit
1 Safari Place
Baltimore, MD

Date Begin - End:	3/27/2025	**Drilling Company:**	DTCI	**BORING LOG HA-2**	
Logged By:	Brad Hubbard	**Drill Crew:**	Tom Atkinson		
Hor.-Vert. Datum:	Not Available	**Drilling Equipment:**	Hand Auger	**Hammer Type - Drop:**	15 lb. DCPT - 20 in.
Plunge:	-90 degrees	**Drilling Method:**	Hand Auger		
Weather:	50°F	**Auger Diameter:**	3.25 in. O.D.		

Approximate Elevation (feet)	Depth (feet)	Graphical Log	FIELD EXPLORATION: Approximate Ground Surface Elevation (ft.): 251.00 / Lithologic Description	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in.	Recovery (NR=No Recovery)	LABORATORY RESULTS: USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
250	0		**Silty CLAY with Sand (CL-ML)**: orangish brown, moist, soft to medium stiff											
			SILT with Sand (ML): grayish brown, moist, medium dense to dense				ML	19.7				33	6	
245	5		The boring was terminated because of practical auger refusal ( ) at approximately 4.5 ft. below ground surface. The boring was backfilled with bentonite on March 27, 2025.											
240	10													
235	15													

GROUNDWATER LEVEL INFORMATION:
Groundwater was not observed during drilling or after completion.
GENERAL NOTES:
The exploration location and elevations are approximate and were estimated by Kleinfelder.
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PROJECT NO.: 20234710.002A
DRAWN BY:
CHECKED BY:
DATE:

BORING LOG HA-2

MD Zoo -Owl and Eagle Exhibit
1 Safari Place
Baltimore, MD

BORING LOG SB-1

Date Begin - End:	3/27/2025	**Drilling Company:**	DTCI		
Logged By:	Brad Hubbard	**Drill Crew:**	Tom Atkinson		
Hor.-Vert. Datum:	Not Available	**Drilling Equipment:**	Geoprobe 7822DT	**Hammer Type - Drop:**	140 lb. Auto - 30 in.
Plunge:	-90 degrees	**Drilling Method:**	Hollow Stem Auger		
Weather:	50°F	**Auger Diameter:**	4.5 in. I.D.		

FIELD EXPLORATION | LABORATORY RESULTS

Approximate Ground Surface Elevation (ft.): 236.00

Approximate Elevation (feet)	Depth (feet)	Graphical Log	Lithologic Description	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 Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
235	0		**Poorly Graded SAND with Silt (SP-SM)**: brown, moist, loose		BC=2 3 6	15"								
			Silty Clayey SAND with Gravel (SC-SM): brown, moist, medium dense		BC=7 17 10	15"	SC-SM	10.3				23	4	
	5		**Sandy Lean CLAY with Gravel (CL)**: grayish brown, moist, very stiff		BC=4 8 11	24"	CL	14.4				33	13	
230			**Silty SAND with Gravel (SM)**: brown, moist, medium dense		BC=5 8 13	20"								
	10													
225			**Silty CLAY with Sand (CL-ML)**: orangish brown, moist, very dense											
					BC=50/5"	5"								
	15													
220														

The boring was terminated because of practical auger refusal (▲) at approximately 13.5 ft. below ground surface on Bedrock (Diorite). The boring was backfilled with auger cuttings on March 27, 2025.

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

GENERAL NOTES:
The exploration location and elevations are approximate and were estimated by Kleinfelder.
Caving was observed at a depth of 12'6.
The exploration location and elevation are approximate and were estimated by Kleinfelder.

KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.: 20234710.002A
DRAWN BY:
CHECKED BY:
DATE:

BORING LOG SB-1

MD Zoo -Owl and Eagle Exhibit
1 Safari Place
Baltimore, MD

Date Begin - End:	3/27/2025	**Drilling Company:**	DTCI	**BORING LOG SB-2**	
Logged By:	Brad Hubbard	**Drill Crew:**	Tom Atkinson		
Hor.-Vert. Datum:	Not Available	**Drilling Equipment:**	Geoprobe 7822DT	**Hammer Type - Drop:**	140 lb. Auto - 30 in.
Plunge:	-90 degrees	**Drilling Method:**	Hollow Stem Auger		
Weather:	50°F	**Auger Diameter:**	4.5 in. I.D.		

Approximate Ground Surface Elevation (ft.): 235.00

Approximate Elevation (feet)	Depth (feet)	Graphical Log	Lithologic Description	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 Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
			Poorly Graded SAND with Silt and Gravel (SP-SM): brown, moist, medium dense		BC=1 3 11	14"								
			Clayey SAND with Silt (SC): brown, moist, loose		BC=4 5 3	18"								
230	5		**Sandy Lean CLAY with Silt and Gravel (CL)**: orangish brown, moist, stiff		BC=4 5 9	18"	CL	16.1				31	12	
			Silty SAND with Gravel (SM): brown, moist, medium dense		BC=10 14 50/5"	22"								
225	10		**Weathered diorite sampled as:** **SAND with Gravel (SP)**: gray, moist, very dense											
220	15													

The boring was terminated because of practical auger refusal ( ) at approximately 10 ft. below ground surface on Bedrock (Diorite). The boring was backfilled with auger cuttings on March 27, 2025.

GROUNDWATER LEVEL INFORMATION:
Groundwater was not observed during drilling or after completion.
GENERAL NOTES:
The exploration location and elevations are approximate and were estimated by Kleinfelder.
Caving was observed at a depth of 8'6.
The exploration location and elevation are approximate and were estimated by Kleinfelder.

KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.: 20234710.002A
DRAWN BY:
CHECKED BY:
DATE:

BORING LOG SB-2

MD Zoo -Owl and Eagle Exhibit
1 Safari Place
Baltimore, MD

BORING LOG SWM-1

Date Begin - End:	3/27/2025	**Drilling Company:**	DTCI		
Logged By:	Brad Hubbard	**Drill Crew:**	Tom Atkinson		
Hor.-Vert. Datum:	Not Available	**Drilling Equipment:**	Geoprobe 7822DT	**Hammer Type - Drop:**	140 lb. Auto - 30 in.
Plunge:	-90 degrees	**Drilling Method:**	Hollow Stem Auger		
Weather:	50°F	**Auger Diameter:**	4.5 in. I.D.		

FIELD EXPLORATION | LABORATORY RESULTS

Approximate Ground Surface Elevation (ft.): 231.00

Approximate Elevation (feet)	Depth (feet)	Graphical Log	Lithologic Description	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 Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
230			**Poorly Graded SAND with Silt and Gravel (SP-SM)**: brown, moist, medium dense		BC=4 6 6 11	19"								
			Silty Clayey SAND (SC-SM): orangish brown, moist, medium dense		BC=8 5 5 5	19"								
	5		**Well-Graded SAND with Gravel (SW)**: tan, moist, medium dense		BC=11 12 12 10	15"								
225			**Sandy Lean CLAY with Silt (CL)**: orangish brown, moist, stiff to very stiff		BC=7 7 9 12	24"	CL	19.0				34	12	
					BC=4 9 9 13	24"								
	10				BC=3 7 7 7	24"	CL	15.2				29	9	
220														
			Weathered diorite sampled as: **Poorly Graded SAND with Gravel (SP)**: gray, moist, very dense		BC=7 26 50/3"	12"								
	15													
215														

The boring was terminated because of practical auger refusal (▲) at approximately 13.5 ft. below ground surface on Bedrock (Diorite). The boring was backfilled with auger cuttings on March 27, 2025.

GROUNDWATER LEVEL INFORMATION:
Groundwater was not observed during drilling or after completion.
GENERAL NOTES:
The exploration location and elevations are approximate and were estimated by Kleinfelder.
Caving was observed at a depth of 7'4.
The exploration location and elevation are approximate and were estimated by Kleinfelder.

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Bright People. Right Solutions.

PROJECT NO.: 20234710.002A
DRAWN BY:
CHECKED BY:
DATE:

BORING LOG SWM-1

MD Zoo -Owl and Eagle Exhibit
1 Safari Place
Baltimore, MD

BORING LOG SWM-2

Date Begin - End:	3/27/2025	**Drilling Company:**	DTCI		
Logged By:	Brad Hubbard	**Drill Crew:**	Tom Atkinson		
Hor.-Vert. Datum:	Not Available	**Drilling Equipment:**	Geoprobe 7822DT	**Hammer Type - Drop:**	140 lb. Auto - 30 in.
Plunge:	-90 degrees	**Drilling Method:**	Hollow Stem Auger		
Weather:	50°F	**Auger Diameter:**	4.5 in. I.D.		

FIELD EXPLORATION | LABORATORY RESULTS

Approximate Ground Surface Elevation (ft.): 233.00

Approximate Elevation (feet)	Depth (feet)	Graphical Log	Lithologic Description	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 Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
			Poorly Graded SAND with Silt and Gravel (SP-SM): brown, moist, loose to medium dense		BC=3 4 8 8	17"								
					BC=3 4 3 2	NR								
230			**Sandy Lean CLAY with Gravel (CL)**: orangish brown, moist, soft to stiff		BC=1 1 1 1	16"								
	5				BC=4 5 5 9	24"	CL	16.4				30	11	
225			**Lean CLAY with Sand (CL)**: orangish brown, moist, very stiff		BC=3 6 15 22	6"								
	10				BC=8 21 29 50/4"	24"	CL	16.0				28	10	
			Weathered diortie sampled as: **Poorly Graded SAND with Gravel (SP)**: gray, moist, very dense											
220			The boring was terminated because of practical auger refusal ( ) at approximately 12 ft. below ground surface on Bedrock (Diorite). The boring was backfilled with auger cuttings on March 27, 2025.											
	15													

GROUNDWATER LEVEL INFORMATION:
Groundwater was not observed during drilling or after completion.
GENERAL NOTES:
The exploration location and elevations are approximate and were estimated by Kleinfelder.
Caving was observed at a depth of 7'4.
The exploration location and elevation are approximate and were estimated by Kleinfelder.

KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.: 20234710.002A
DRAWN BY:
CHECKED BY:
DATE:

BORING LOG SWM-2

MD Zoo -Owl and Eagle Exhibit
1 Safari Place
Baltimore, MD

INTERPRETATION OF BORING LOGS

The borings were drilled using the method(s) indicated on the boring logs. The various methods include hollow stem augers, solid flight augers, driven casing, rotary drilling, and rock coring using a diamond bit core barrel.

Penetration testing and split barrel sampling of the soils were conducted in the borings at regular intervals in accordance with ASTM Specification D-1586. The Standard Penetration Test (SPT) is conducted by driving a split-barrel sampler into the soil using a 140 lbs. hammer falling 30 inches. The sampler is attached to drilling rods and lowered to the bottom of the borehole. The sampler is first seated 6 inches into the soil to penetrate any loose material and then driven an additional 12 inches to obtain the SPT blow count. The number of blows is recorded for each 6 inch interval. For example, a blow count of 4-6-8 indicates that 4 blows were needed to drive the sampler the first 6 inches, 6 blows the next 6 inches and 8 blows the final 6 inches. The SPT blow count (blows/foot) is obtained by adding the blow counts for the second and third 6 inch interval (i.e. 6+8 = 14 blows/foot).

A representative portion of the soil obtained from each split-barrel sample is placed in a sealed glass jar and transported to our office. Descriptions of the soil samples and penetration resistance (SPT blow count) are shown on the boring logs. The soils are described by color, moisture, major component and minor components based on the following relationships:

The MAJOR component represents more than 50 percent of the soil sample. The components are described based on the following particle size designations:

Component	Particle Size
Boulders	>12"
Cobbles	3" to 12"
Gravel - coarse	3/4" to 3"
- fine	#4 sieve (4.76 mm) to 3/4"
Sand - coarse	#10 sieve (2.0 mm) to #4 sieve
- medium	#40 sieve (0.42 mm) to #10 sieve
- fine	#200 sieve (0.074 mm) to #40 sieve
Silt & Clay	< #200 sieve (0.074 mm)

The following terms are used to describe the percentage of Minor components:

Adjective	Percent
"and"	35 to 50
"some"	20 to 35
"little"	10 to 20
"trace"	0 to 10

Moisture Description

"Dry"	Dusty, Dry to touch
"Moist"	Damp
"wet"	Visible free water

The SPT blow counts are used to describe the RELATIVE DENSITY of coarse-grained soils and the CONSISTENCY of fine-grained soils according to the following relationships:

Relative Density

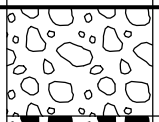
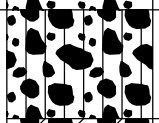
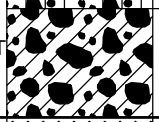
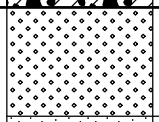
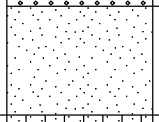
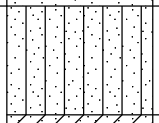
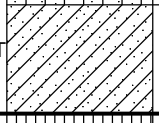
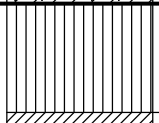
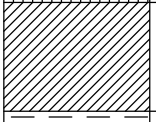
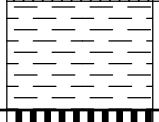
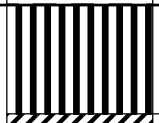
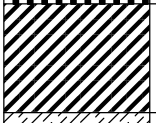
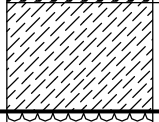
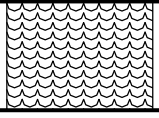
SPT (Blows/Foot)*	Relative Density
0 to 4	Very Loose
5 to 10	Loose
11 to 30	Medium Dense
31 to 50	Dense
51+	Very Dense

Consistency

SPT (Blows/Foot)*	Relative Density
0 to 2	Very Soft
3 to 4	Soft
5 to 8	Medium Stiff
9 to 15	Stiff
16 to 30	Very Stiff
31+	Hard

*Note: The notations "WOR" (weight-of-rods) and "WOH" (weight-of-hammer) mean that the sampler penetrated the soil under the weight of the rods or hammer. This penetration resistance corresponds to a SPT blow count of 0 blows per foot.

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS		TYPICAL DESCRIPTIONS
			GRAPH	LETTER	
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

USCS_LEGEND 6/7/11

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

APPENDIX C – LAB RESULTS

CENTURY ENGINEERING

The Maryland Zoo at Baltimore
Eagle and Owl Exhibit
Baltimore, Maryland

LABORATORY TEST SUMMARY

Boring#	Sample#	Depth (Feet)	Moisture Content (%)	Percent Fines (<#200 Sieve)	Liquid Limit	Plasticity Index	Maximum Dry Density (pcf)	Optimum Moisture Content (%)	Unified Soil Class.	USDA Soil Class.
HA-1	S-3	2 - 3	23.1	74.9	34	9			ML	
HA-2	S-3	2 - 3	19.7	76.3	33	6			ML	
SB-1	Bulk	3 - 6	13.0	56.8	34	17	120.9	12.4	CL	
SB-1	S-2	2.5 - 4	10.3	34.1	23	4			SC_SM	
SB-1	S-3	5 - 6.5	14.4	59.2	33	13			CL	
SB-2	S-3	5 - 6.5	16.1	56.5	31	12			CL	
SWM-1	S-4	6 - 8	19.0	65.6	34	12			CL	
	S-6	10 - 12	15.2	55.1	29	9			CL	Gravelly Loam
SWM-2	S-4	6 - 8	16.4	60.0	30	11			CL	
	S-6A	10 - 12	16.0	70.9	28	10			CL	Loam

JAY KAY TESTING

SUMMARY OF LABORATORY TESTING

Job Name:	**MD Zoo**	Client:	Century
Job Number:		PM/Reviewer:	TM
Location:		Tester:	ST/JT
Sample Date:		Report Date:	04/22/25

Sample Identification		Depth				Atterberg Limits				Compaction					
Boring ID	Sample ID	Top, ft	Bottom, ft	NMC, % (ASTM D-2216)	Organic Matter, % (ASTM D-2974)	Liquid Limit, % (ASTM D-4318)	Plastic Limit, % (ASTM D-4318)	Plasticity Index, % (ASTM D-4318)	Specific Gravity (ASTM D-854)	Maximum Dry Density, lb/ft³	Optimum Moisture Content, %	AASHTO Classification (M-145)	% < 0.002 mm	% Fines	USCS Classification (ASTM D-2487)
HA-1	S-3	2	3	23.1	-	34	25	9	-	-	-	A-4	-	74.9	ML
HA-2	S-3	2	3	19.7	-	33	27	6	-	-	-	A-4	-	76.3	ML
SB-1	Bulk	3	6	13.0	-	34	17	17	-	120.9	12.4	A-6	-	56.8	CL
SB-1	S-2	2.5	4	10.3	-	23	19	4	-	-	-	A-2-4	-	34.1	SC-SM
SB-1	S-3	5	6.5	14.4	-	33	20	13	-	-	-	A-6	-	59.2	CL
SB-2	S-3	5	6.5	16.1	-	31	19	12	-	-	-	A-6	-	56.5	CL
SWM-1	S-4	6	8	19.0	-	34	22	12	-	-	-	A-6	-	65.6	CL
SWM-1	S-6	10	12	15.2	-	29	20	9	-	-	-	A-4	-	55.1	CL
SWM-2	S-4	6	8	16.4	-	30	19	11	-	-	-	A-6	-	60.0	CL
SWM-2	S-6A	10	12	16.0	-	28	18	10	-	-	-	A-4	-	70.9	CL
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
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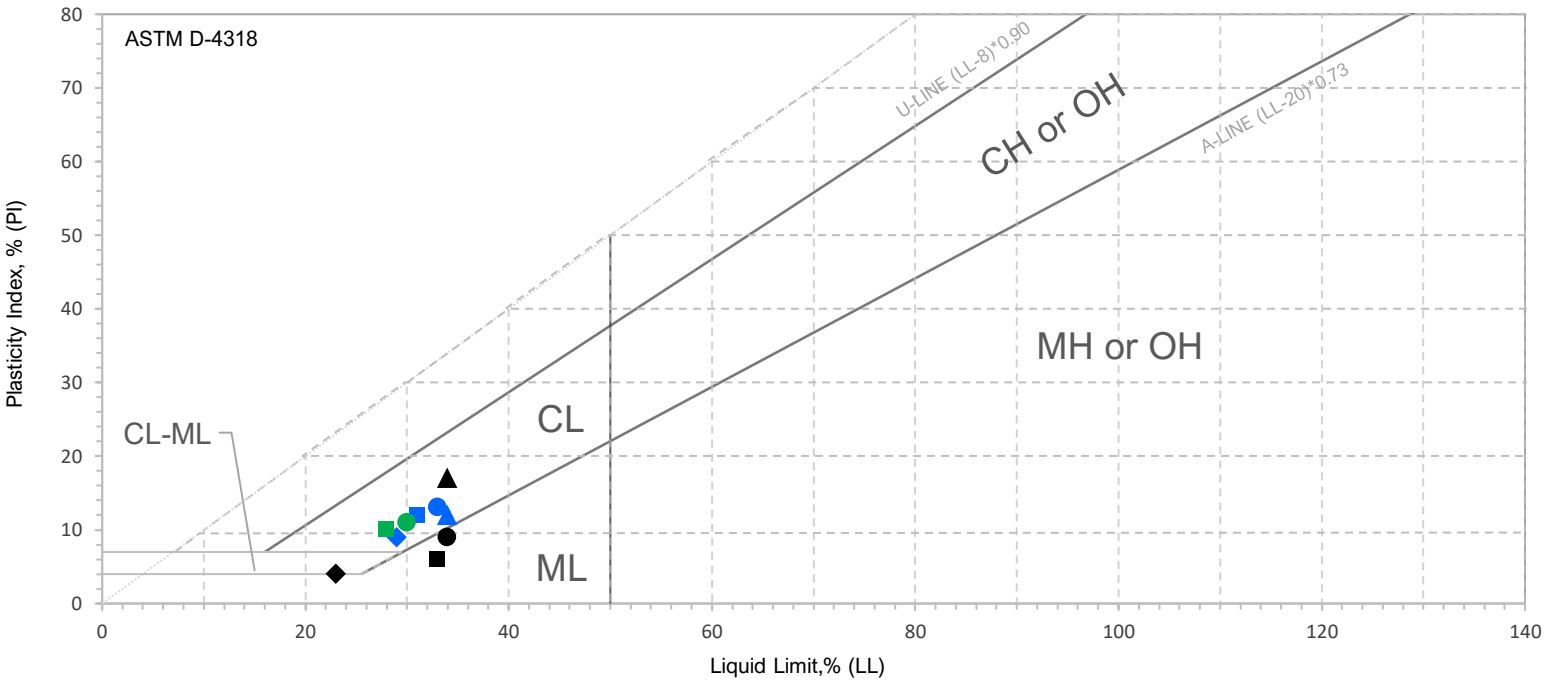
JAY KAY TESTING

SUMMARY OF ATTERBERG LIMIT TESTING

Job Name: **MD Zoo**
Job Number:
Location:
Sample Date:

Client: Century
PM/Reviewer: TM
Tester: ST/JT
Report Date: 04/22/25



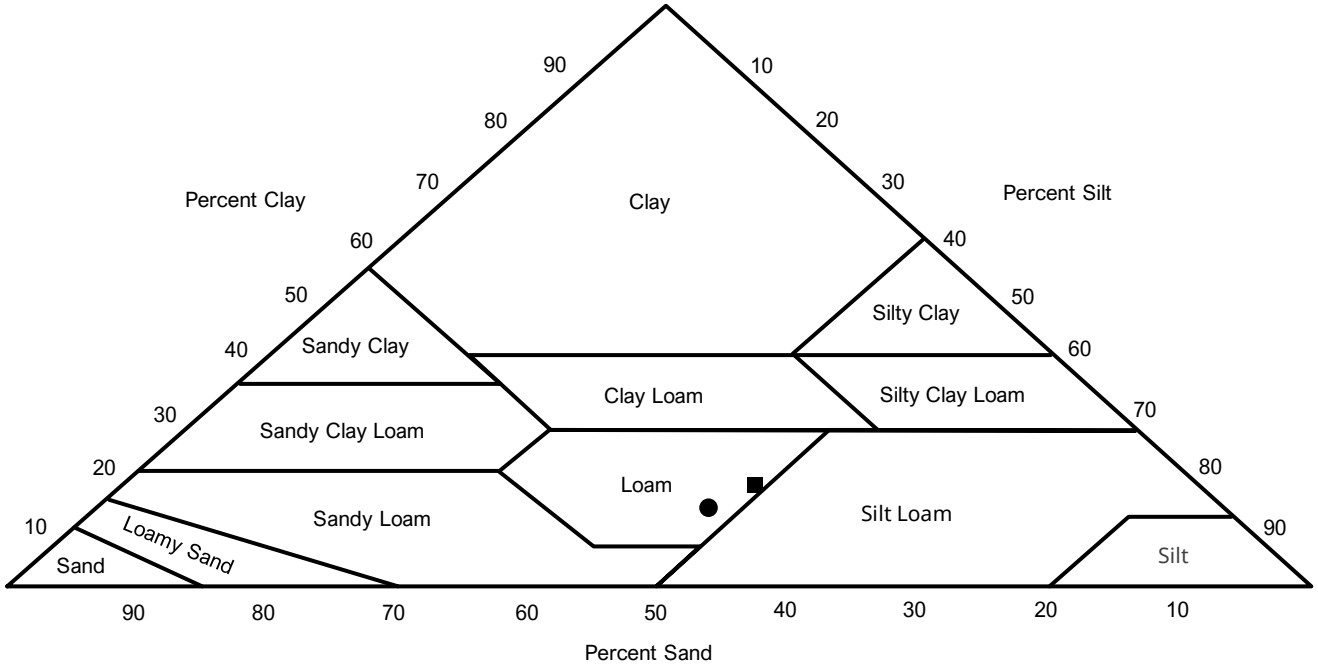
	Boring ID	Sample ID	Top	Btm	LL	PL	PI		Boring ID	Sample ID	Top	Btm	LL	PL	PI
●	HA-1	S-3	2	3	34	25	9								
■	HA-2	S-3	2	3	33	27	6								
▲	SB-1	Bulk	3	6	34	17	17								
◆	SB-1	S-2	2.5	4	23	19	4								
●	SB-1	S-3	5	6.5	33	20	13								
■	SB-2	S-3	5	6.5	31	19	12								
▲	SWM-1	S-4	6	8	34	22	12								
◆	SWM-1	S-6	10	12	29	20	9								
●	SWM-2	S-4	6	8	30	19	11								
■	SWM-2	S-6A	10	12	28	18	10								

JAY KAY TESTING

USDA SOIL TEXTURAL ANALYSIS

Job Name: **MD Zoo**
Job Number:
Location:
Sample Date:

Client: Century
PM/Reviewer: TM
Tester: ST/JT
Report Date: 04/22/25



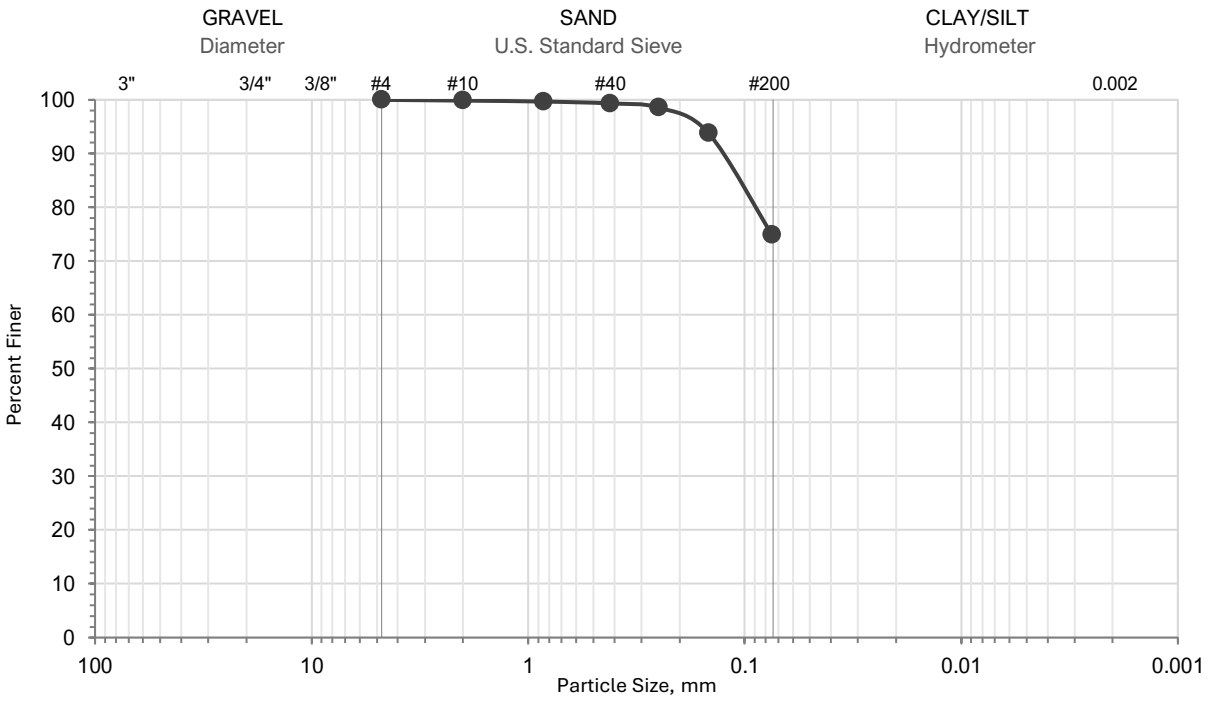
	Boring ID	Sample ID	Top	Btm	% Sand	% Silt	% Clay	USDA Texture
●	SWM-1	S-6	10	12	39.5%	47.1%	13.4%	Gravelly Loam
■	SWM-2	S-6A	10	12	34.1%	48.5%	17.4%	Loam

Job Name:	**MD Zoo**	Client:	Century
Job Number:		PM/Reviewer:	TM
Location:	-	Tester:	ST/JT
Sample Date:	-	Report Date:	04/22/25

Boring ID: **HA-1** Sample ID: **S-3** Top Depth **2'** Btm Depth **3'**

Particle-Size Distribution of Soils

ASTM D-6913

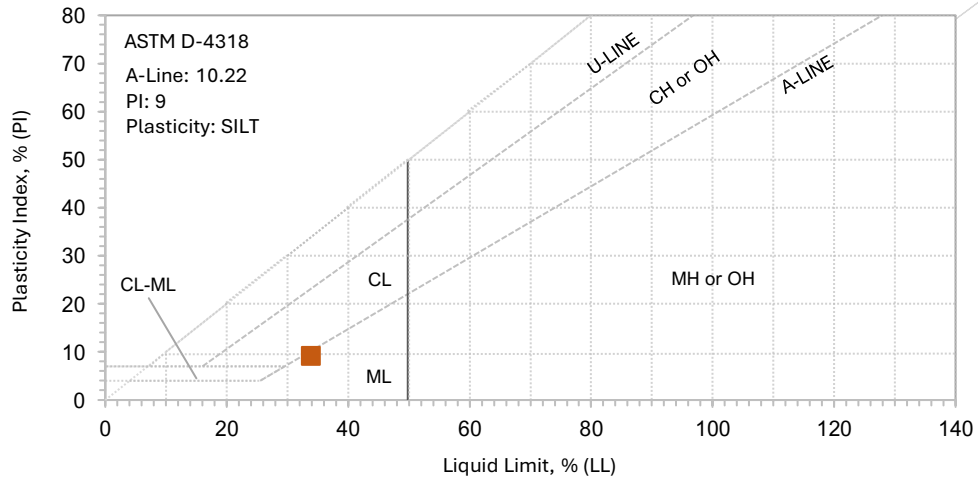


Sieve	Size	Pass, %
-	mm	%
6"	150.0	-
3"	75.0	-
2"	50.8	-
1.5"	37.5	-
1"	25.4	-
3/4"	19.0	-
1/2"	12.7	-
3/8"	9.51	-
#4	4.75	100.0
#10	2.00	99.9
#20	0.85	99.7
#40	0.42	99.3
#60	0.25	98.6
#100	0.147	93.8
#200	0.075	74.9

% Gravel (> 4.75 mm)	Coarse	0.0	% Sand (≤ 4.75 mm)	Coarse	0.1	D_{10} -	Cc -
	Fine	0.0		Medium	0.6	D_{30} -	Cu -
	Total	**0.0**		Fine	24.4	D_{60} -	
				Total	**25.1**		

Atterberg Limits & Classification

ASTM D-4318



Specimen Data	
Atterberg Limits	■
Liquid Limit	34
Plastic Limit	25
Plasticity Index	9

AASHTO (M-145)	USCS (D-2487)
A-4	ML

Soil Description (D-2487)

Dark greenish-brown SILT with sand

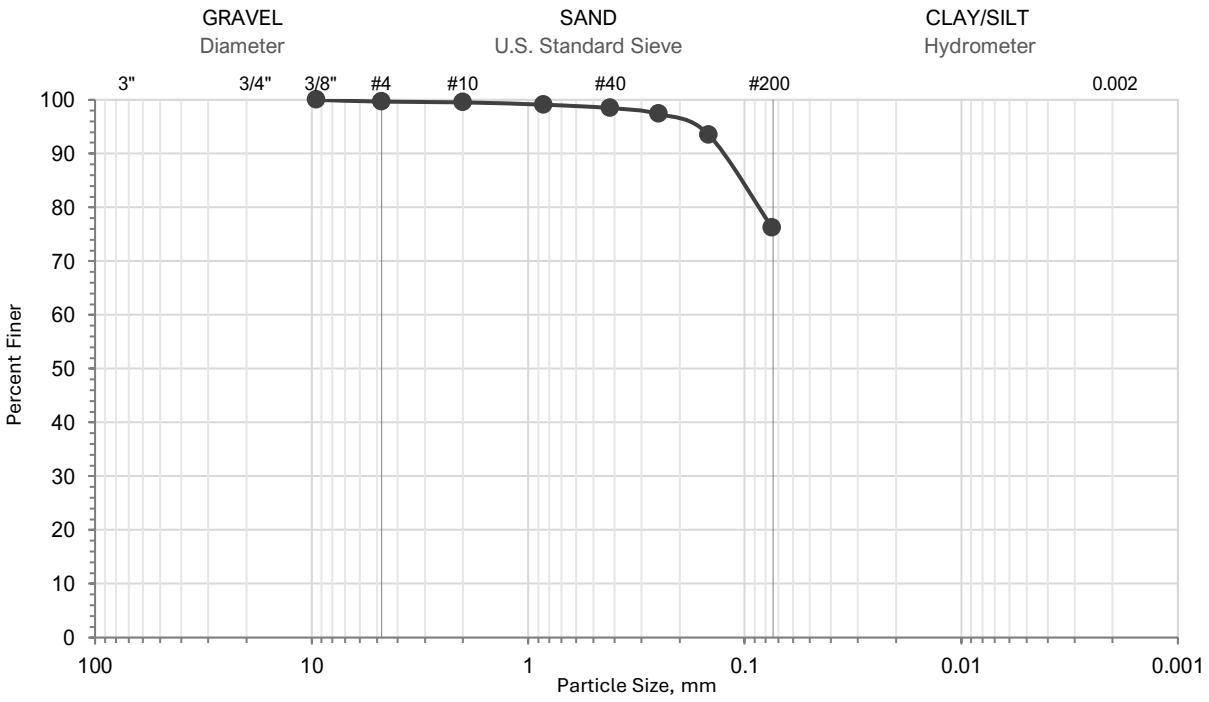
JAY KAY TESTING
(814) 404-9283 www.jaykaytesting.com

Job Name:	**MD Zoo**	Client:	Century
Job Number:		PM/Reviewer:	TM
Location:	-	Tester:	ST/JT
Sample Date:	-	Report Date:	04/22/25

Boring ID: **HA-2** Sample ID: **S-3** Top Depth **2'** Btm Depth **3'**

Particle-Size Distribution of Soils

ASTM D-6913



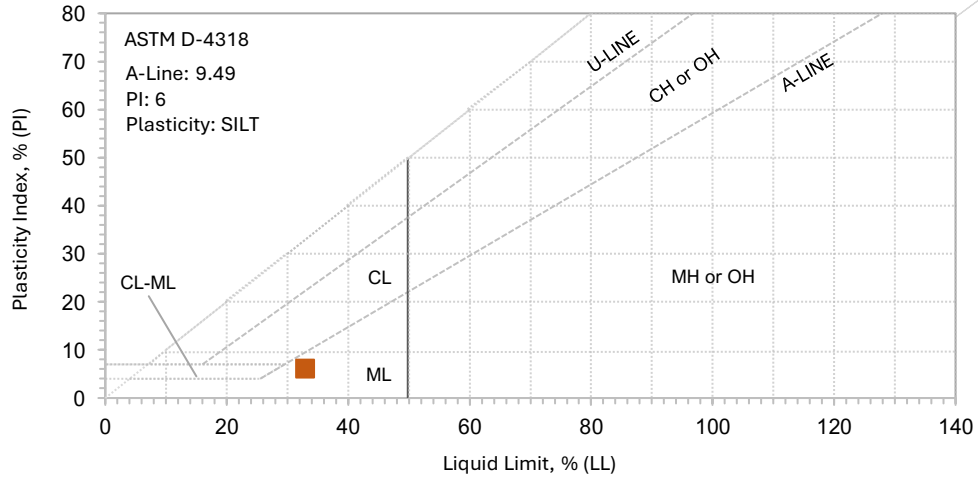
Sieve	Size	Pass, %
-	mm	%
6"	150.0	-
3"	75.0	-
2"	50.8	-
1.5"	37.5	-
1"	25.4	-
3/4"	19.0	-
1/2"	12.7	-
3/8"	9.51	100.0
#4	4.75	99.7
#10	2.00	99.5
#20	0.85	99.1
#40	0.42	98.5
#60	0.25	97.4
#100	0.147	93.5
#200	0.075	76.3

% Gravel (> 4.75 mm)	Coarse	0.0	% Sand (≤ 4.75 mm)	Coarse	0.2	D_{10}	-
	Fine	0.3		Medium	1.0	D_{30}	-
	Total	**0.3**		Fine	22.2	D_{60}	-
				Total	**23.4**		

Cc	-
Cu	-

Atterberg Limits & Classification

ASTM D-4318



Specimen Data	
Atterberg Limits	■
Liquid Limit	33
Plastic Limit	27
Plasticity Index	6

AASHTO (M-145)	USCS (D-2487)
A-4	ML

Soil Description (D-2487)

Dark greenish-brown SILT with sand

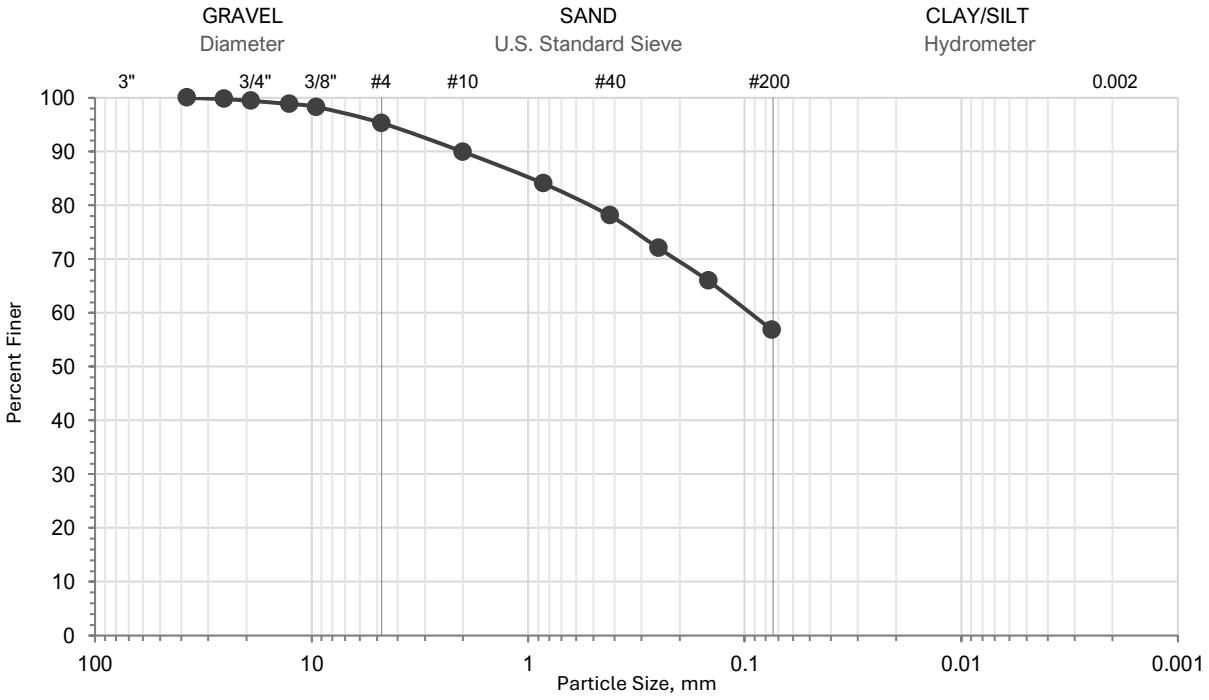
JAY KAY TESTING
(814) 404-9283 www.jaykaytesting.com

Job Name:	**MD Zoo**	Client:	Century
Job Number:		PM/Reviewer:	TM
Location:	-	Tester:	ST/JT
Sample Date:	-	Report Date:	04/22/25

Boring ID: **SB-1** Sample ID: **Bulk** Top Depth **3'** Btm Depth **6'**

Particle-Size Distribution of Soils

ASTM D-6913

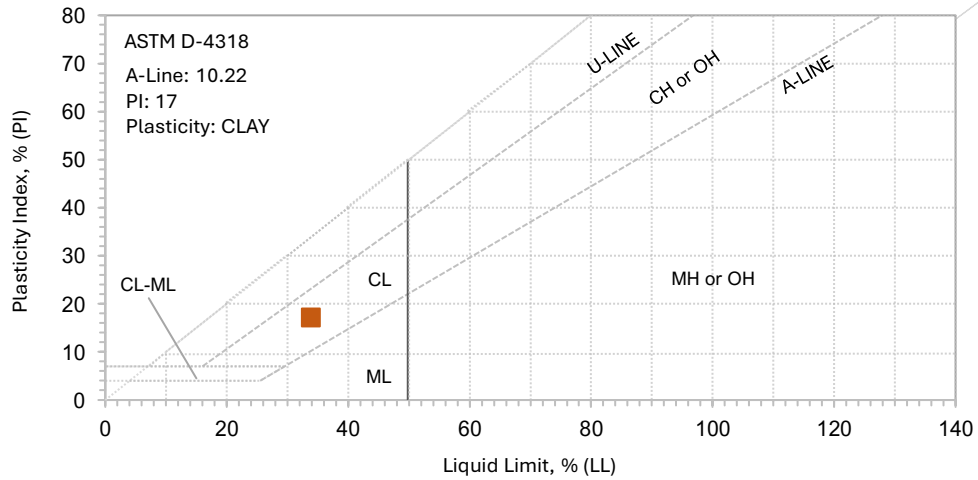


Sieve	Size	Pass, %
-	mm	%
6"	150.0	-
3"	75.0	-
2"	50.8	-
1.5"	37.5	100.0
1"	25.4	99.8
3/4"	19.0	99.4
1/2"	12.7	98.9
3/8"	9.51	98.3
#4	4.75	95.3
#10	2.00	90.0
#20	0.85	84.1
#40	0.42	78.1
#60	0.25	72.0
#100	0.147	65.9
#200	0.075	56.8

% Gravel (> 4.75 mm)	Coarse	0.6	% Sand (≤ 4.75 mm)	Coarse	5.3	D_{10} -	Cc -
	Fine	4.1		Medium	11.9	D_{30} -	Cu -
	Total	**4.7**		Fine	21.3	D_{60} -	
				Total	**38.5**		

Atterberg Limits & Classification

ASTM D-4318



Specimen Data	
Atterberg Limits	■
Liquid Limit	34
Plastic Limit	17
Plasticity Index	17

AASHTO (M-145): A-6

USCS (D-2487): CL

Soil Description (D-2487)

Brown sandy lean CLAY

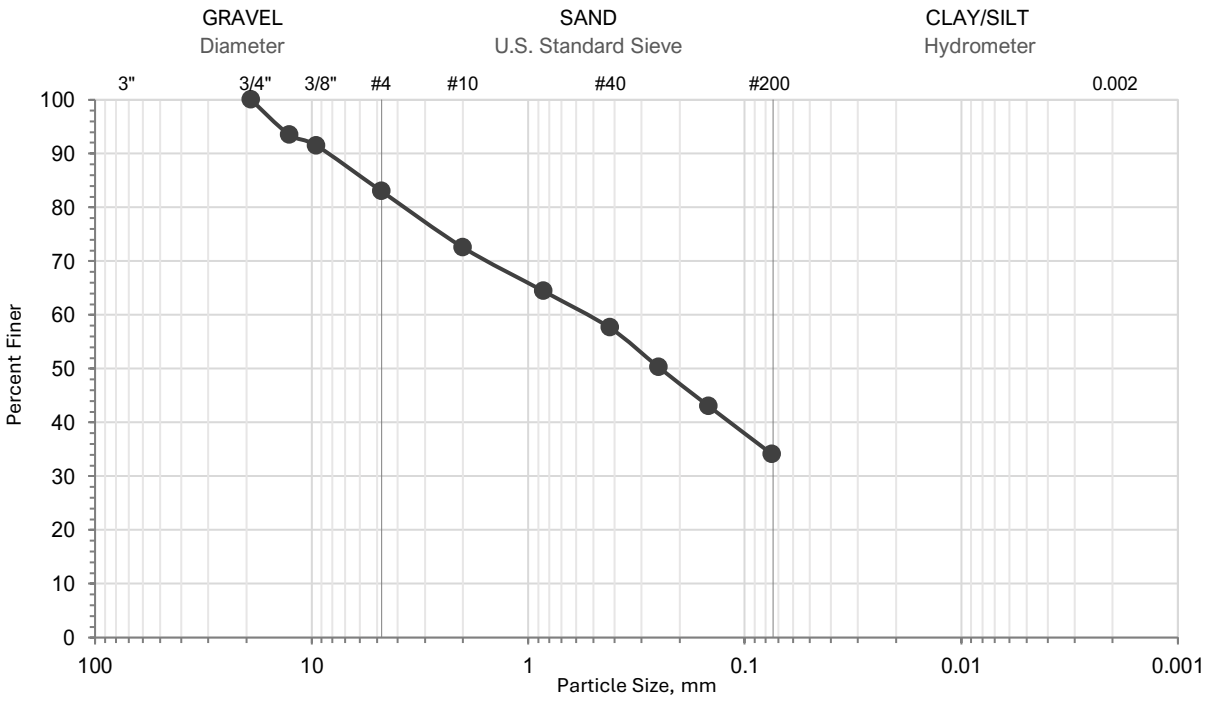
JAY KAY TESTING
(814) 404-9283 www.jaykaytesting.com

Job Name:	**MD Zoo**	Client:	Century
Job Number:		PM/Reviewer:	TM
Location:	-	Tester:	ST/JT
Sample Date:	-	Report Date:	04/22/25

Boring ID: **SB-1** Sample ID: **S-2** Top Depth **2.5'** Btm Depth **4'**

Particle-Size Distribution of Soils

ASTM D-6913

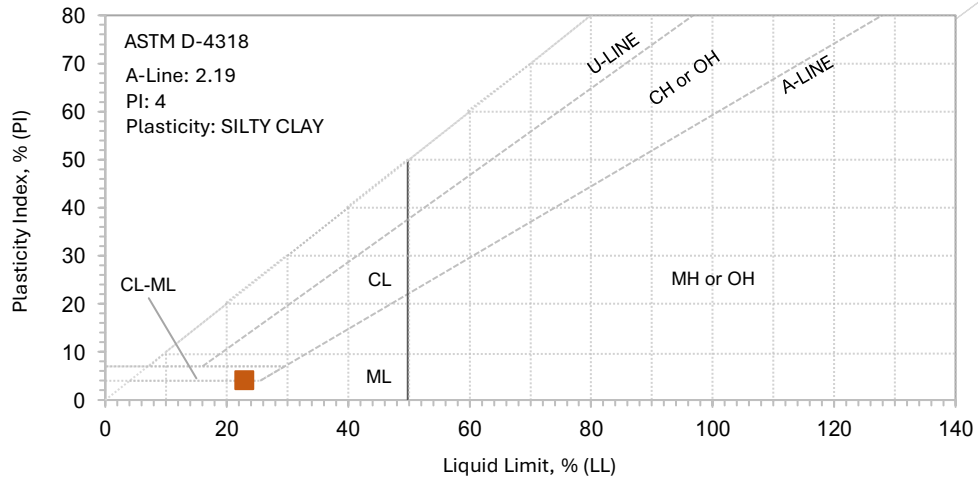


Sieve	Size	Pass, %
-	mm	%
6"	150.0	-
3"	75.0	-
2"	50.8	-
1.5"	37.5	-
1"	25.4	-
3/4"	19.0	100.0
1/2"	12.7	93.5
3/8"	9.51	91.5
#4	4.75	83.0
#10	2.00	72.5
#20	0.85	64.4
#40	0.42	57.6
#60	0.25	50.3
#100	0.147	43.1
#200	0.075	34.1

% Gravel (> 4.75 mm)	Coarse	0.0	% Sand (≤ 4.75 mm)	Coarse	10.5	D_{10} -	Cc -
	Fine	17.0		Medium	14.9	D_{30} -	Cu -
	Total	**17.0**		Fine	23.5	D_{60} -	
				Total	**48.9**		

Atterberg Limits & Classification

ASTM D-4318



Specimen Data	
Atterberg Limits	■
Liquid Limit	23
Plastic Limit	19
Plasticity Index	4

AASHTO (M-145)	USCS (D-2487)
A-2-4	SC-SM

Soil Description (D-2487)

Brown silty clayey SAND with gravel

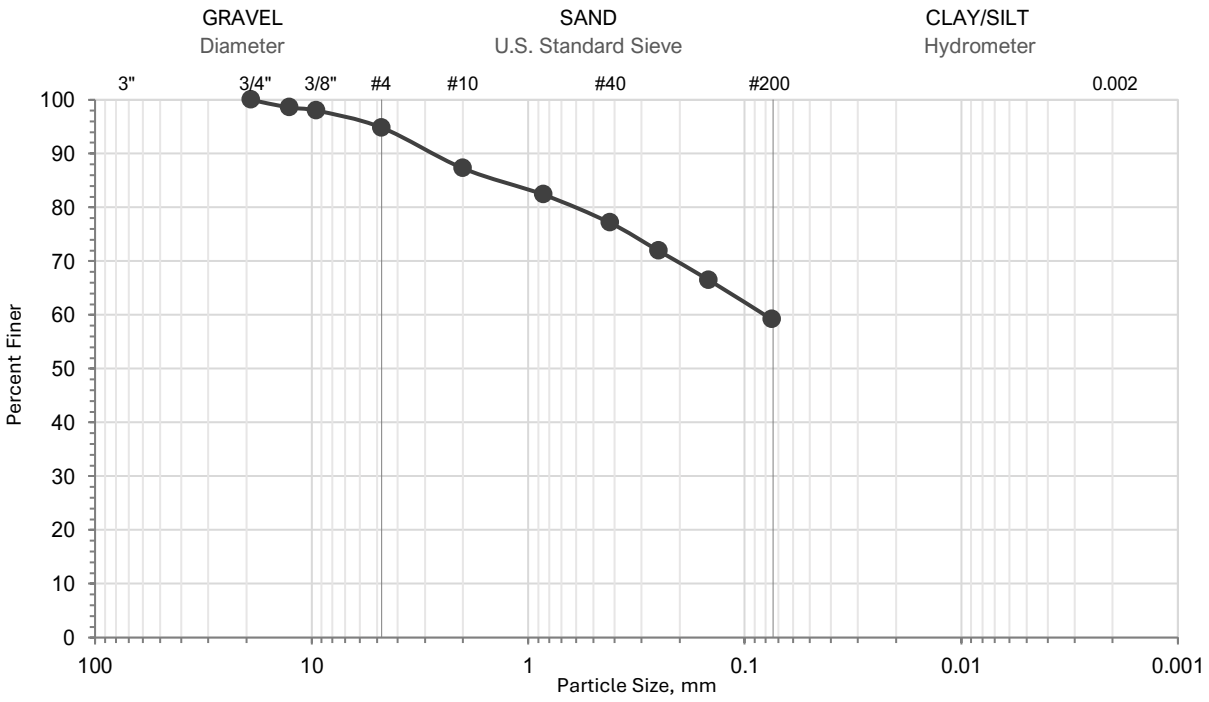
JAY KAY TESTING
(814) 404-9283 www.jaykaytesting.com

Job Name:	**MD Zoo**	Client:	Century
Job Number:		PM/Reviewer:	TM
Location:	-	Tester:	ST/JT
Sample Date:	-	Report Date:	04/22/25

Boring ID: **SB-1** Sample ID: **S-3** Top Depth **5'** Btm Depth **6.5'**

Particle-Size Distribution of Soils

ASTM D-6913

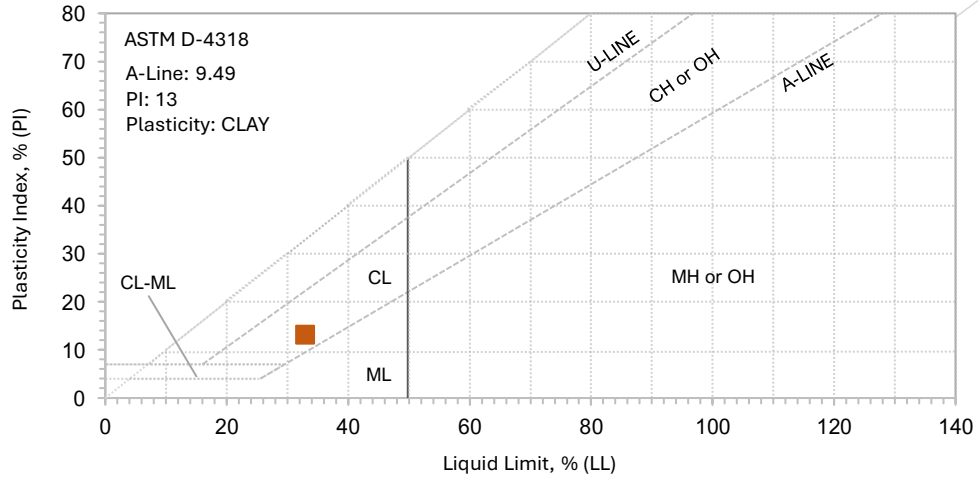


Sieve	Size	Pass, %
-	mm	%
6"	150.0	-
3"	75.0	-
2"	50.8	-
1.5"	37.5	-
1"	25.4	-
3/4"	19.0	100.0
1/2"	12.7	98.6
3/8"	9.51	98.0
#4	4.75	94.8
#10	2.00	87.3
#20	0.85	82.4
#40	0.42	77.1
#60	0.25	71.9
#100	0.147	66.5
#200	0.075	59.2

% Gravel (> 4.75 mm)	Coarse	0.0	% Sand (≤ 4.75 mm)	Coarse	7.5	D_{10} -	Cc -
	Fine	5.2		Medium	10.2	D_{30} -	Cu -
	Total	**5.2**		Fine	17.9	D_{60} -	
				Total	**35.6**		

Atterberg Limits & Classification

ASTM D-4318



Specimen Data	
Atterberg Limits	■
Liquid Limit	33
Plastic Limit	20
Plasticity Index	13

AASHTO (M-145)	USCS (D-2487)
A-6	CL

Soil Description (D-2487)

Brown sandy lean CLAY

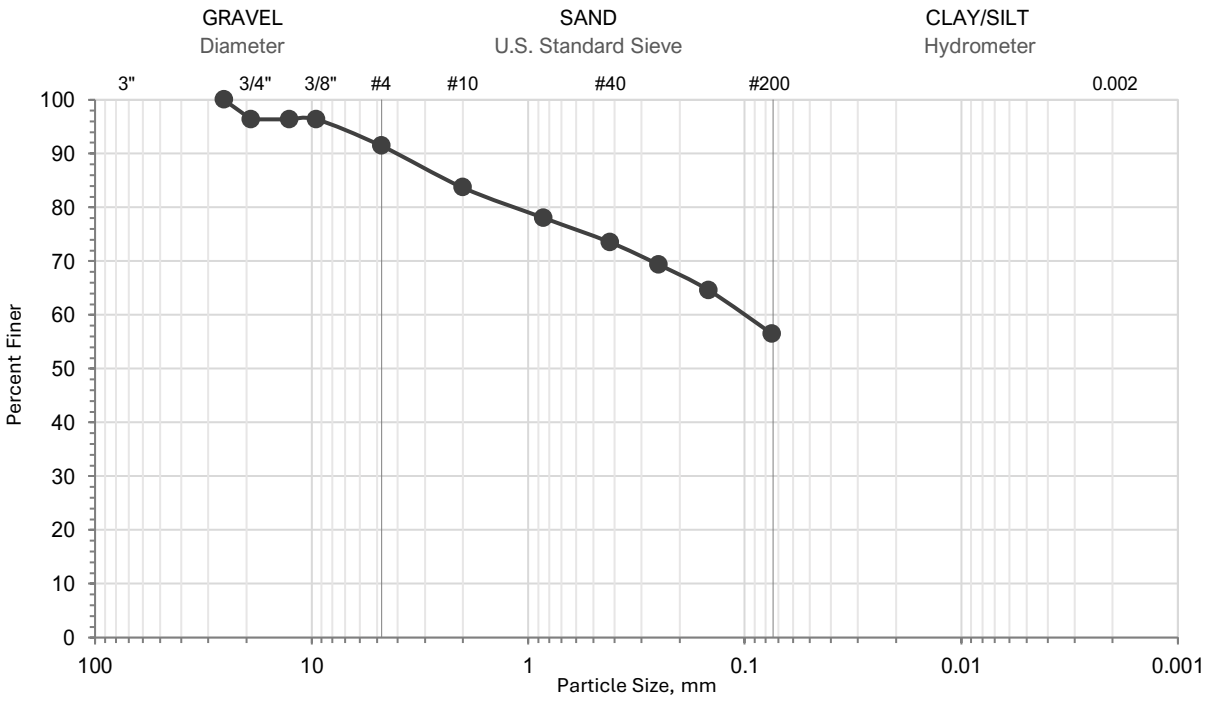
JAY KAY TESTING
(814) 404-9283 www.jaykaytesting.com

Job Name:	**MD Zoo**	Client:	Century
Job Number:		PM/Reviewer:	TM
Location:	-	Tester:	ST/JT
Sample Date:	-	Report Date:	04/22/25

Boring ID: **SB-2** Sample ID: **S-3** Top Depth **5'** Btm Depth **6.5'**

Particle-Size Distribution of Soils

ASTM D-6913

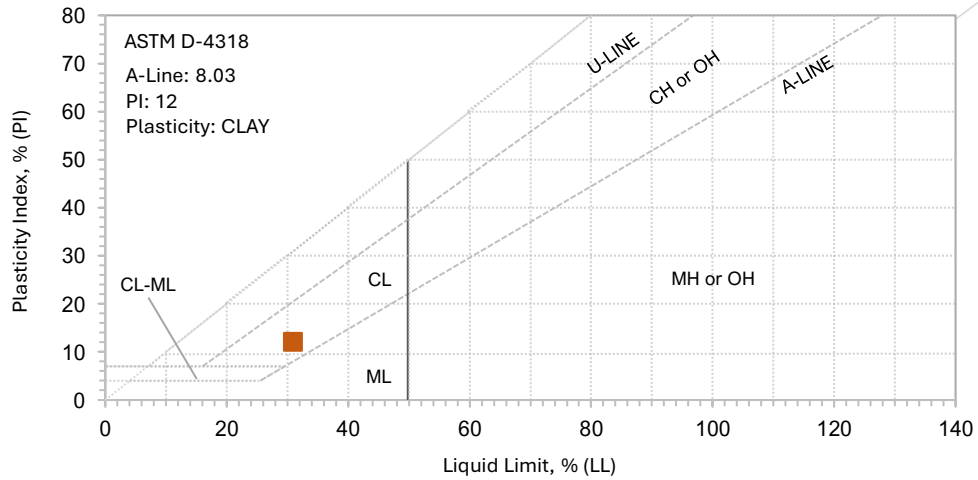


Sieve	Size	Pass, %
-	mm	%
6"	150.0	-
3"	75.0	-
2"	50.8	-
1.5"	37.5	-
1"	25.4	100.0
3/4"	19.0	96.4
1/2"	12.7	96.4
3/8"	9.51	96.4
#4	4.75	91.4
#10	2.00	83.7
#20	0.85	78.1
#40	0.42	73.5
#60	0.25	69.4
#100	0.147	64.6
#200	0.075	56.5

% Gravel (> 4.75 mm)	Coarse	3.6	% Sand (≤ 4.75 mm)	Coarse	7.7	D_{10} -	Cc -
	Fine	5.0		Medium	10.2	D_{30} -	Cu -
	Total	**8.6**		Fine	17.0	D_{60} -	
				Total	**34.9**		

Atterberg Limits & Classification

ASTM D-4318



Specimen Data	
Atterberg Limits	■
Liquid Limit	31
Plastic Limit	19
Plasticity Index	12

AASHTO (M-145): A-6

USCS (D-2487): CL

Soil Description (D-2487)

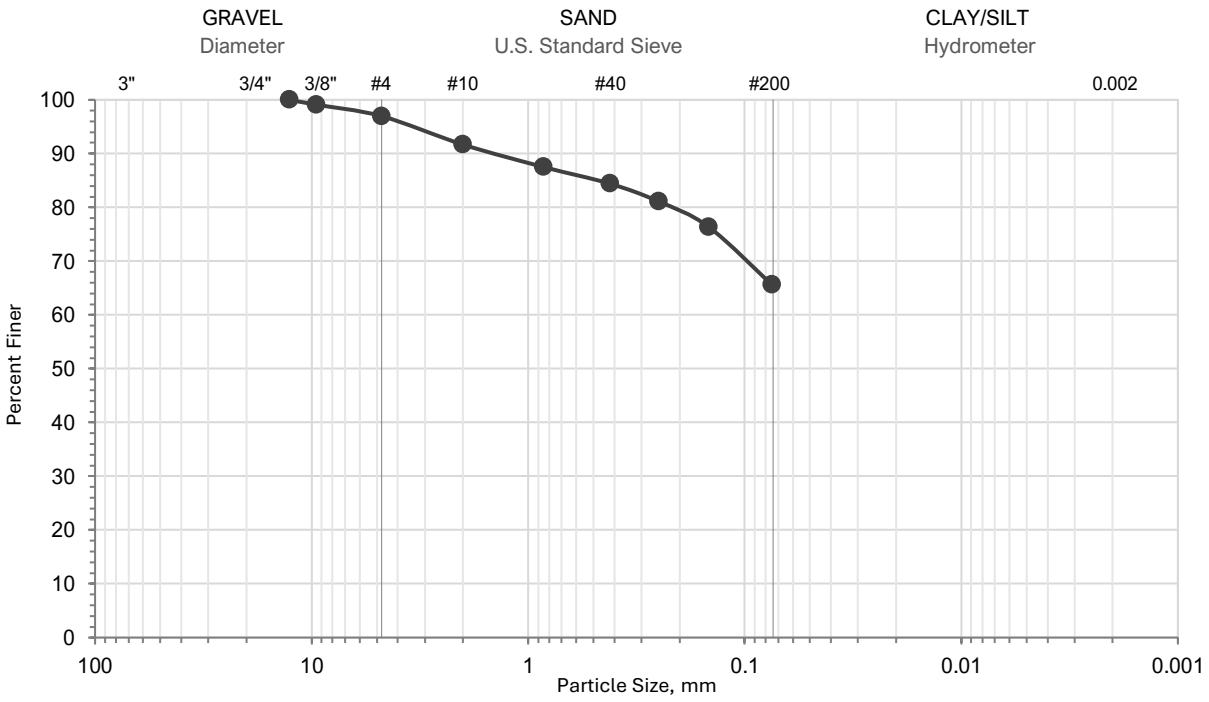
Brown sandy lean CLAY

JAY KAY TESTING
(814) 404-9283 www.jaykaytesting.com

Job Name:	**MD Zoo**	Client:	Century
Job Number:		PM/Reviewer:	TM
Location:	-	Tester:	ST/JT
Sample Date:	-	Report Date:	04/22/25

Boring ID: **SWM-1** Sample ID: **S-4** Top Depth **6'** Btm Depth **8'**

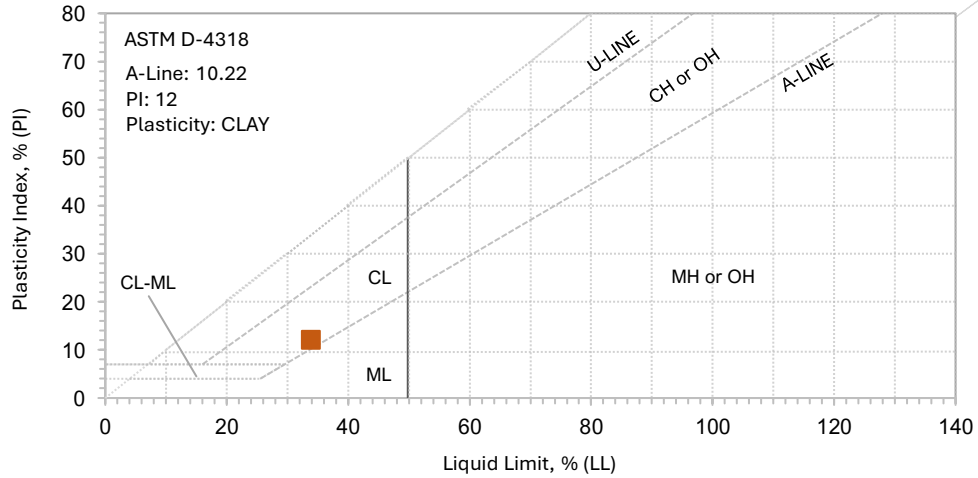
Particle-Size Distribution of Soils ASTM D-6913



Sieve	Size	Pass, %
-	mm	%
6"	150.0	-
3"	75.0	-
2"	50.8	-
1.5"	37.5	-
1"	25.4	-
3/4"	19.0	-
1/2"	12.7	100.0
3/8"	9.51	99.1
#4	4.75	97.0
#10	2.00	91.7
#20	0.85	87.5
#40	0.42	84.4
#60	0.25	81.1
#100	0.147	76.4
#200	0.075	65.6

% Gravel (> 4.75 mm)	Coarse	0.0	% Sand (≤ 4.75 mm)	Coarse	5.3	D_{10} -	Cc -
	Fine	3.0		Medium	7.3	D_{30} -	Cu -
	Total	**3.0**		Fine	18.8	D_{60} -	
				Total	**31.4**		

Atterberg Limits & Classification ASTM D-4318



Specimen Data	
Atterberg Limits	■
Liquid Limit	34
Plastic Limit	22
Plasticity Index	12

AASHTO (M-145)	USCS (D-2487)
A-6	CL

Soil Description (D-2487)

Brown sandy lean CLAY

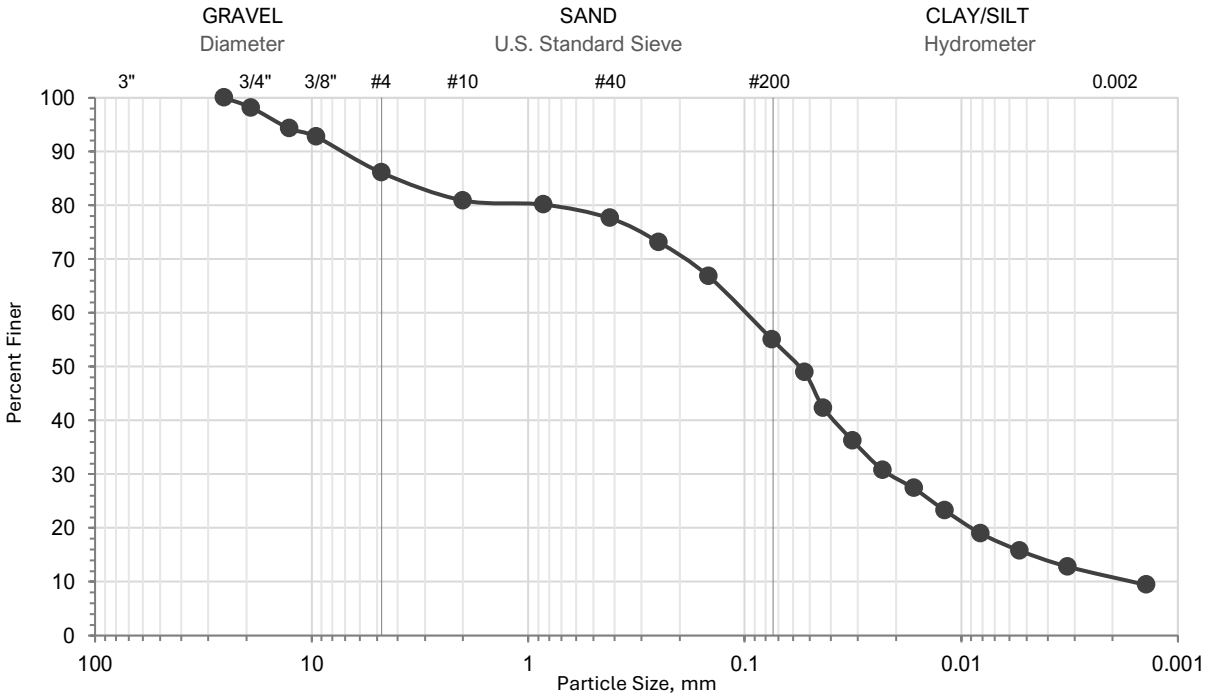
JAY KAY TESTING
(814) 404-9283 www.jaykaytesting.com

Job Name:	**MD Zoo**	Client:	Century
Job Number:		PM/Reviewer:	TM
Location:	-	Tester:	ST/JT
Sample Date:	-	Report Date:	04/22/25

Boring ID: **SWM-1** Sample ID: **S-6** Top Depth **10'** Btm Depth **12'**

Particle-Size Distribution of Soils

ASTM D-6913 / ASTM D-7928

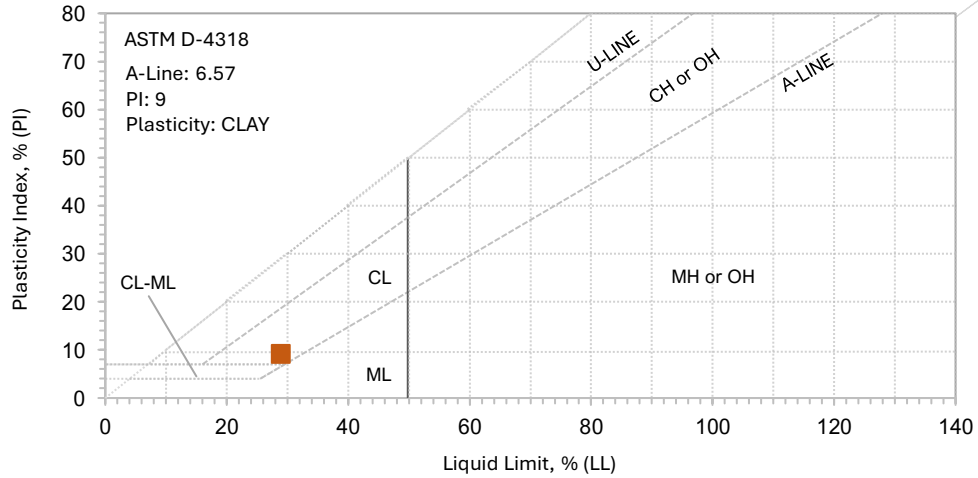


Sieve	Size	Pass, %
-	mm	%
6"	150.0	-
3"	75.0	-
2"	50.8	-
1.5"	37.5	-
1"	25.4	100.0
3/4"	19.0	98.2
1/2"	12.7	94.3
3/8"	9.51	92.8
#4	4.75	86.1
#10	2.00	80.9
#20	0.85	80.2
#40	0.42	77.6
#60	0.25	73.2
#100	0.147	66.8
#200	0.075	55.1

% Gravel (> 4.75 mm)			% Sand (≤ 4.75 mm)			D_{10}	D_{30}	D_{60}	Cc	Cu	Specific gravity* (assumed)
	Coarse	1.8		Coarse	5.2	-	-	-	-	-	2.70
	Fine	12.1		Medium	3.3						
	Total	**13.9**		Fine	22.5						
				Total	**31.0**						

Atterberg Limits & Classification

ASTM D-4318



Specimen Data	
Atterberg Limits	■
Liquid Limit	29
Plastic Limit	20
Plasticity Index	9

AASHTO (M-145)	USCS (D-2487)
A-4	CL

Soil Description (D-2487)

Brown sandy lean CLAY

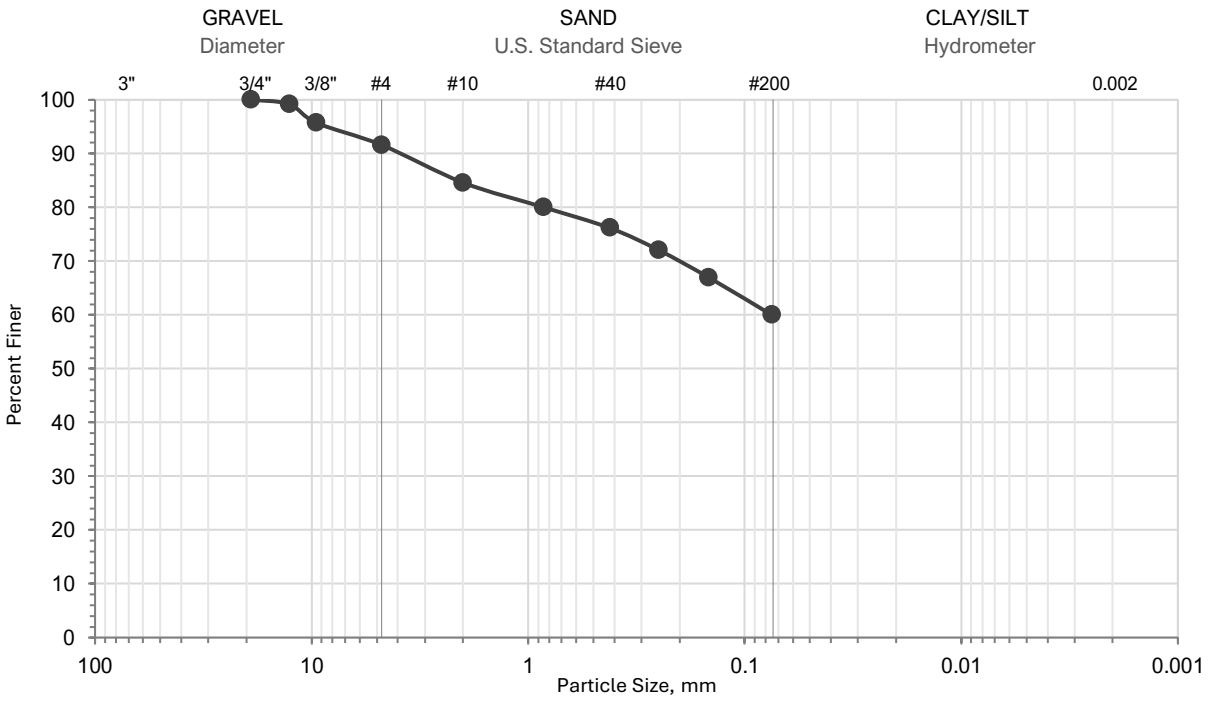
JAY KAY TESTING
(814) 404-9283 www.jaykaytesting.com

Job Name:	**MD Zoo**	Client:	Century
Job Number:		PM/Reviewer:	TM
Location:	-	Tester:	ST/JT
Sample Date:	-	Report Date:	04/22/25

Boring ID: **SWM-2** Sample ID: **S-4** Top Depth **6'** Btm Depth **8'**

Particle-Size Distribution of Soils

ASTM D-6913

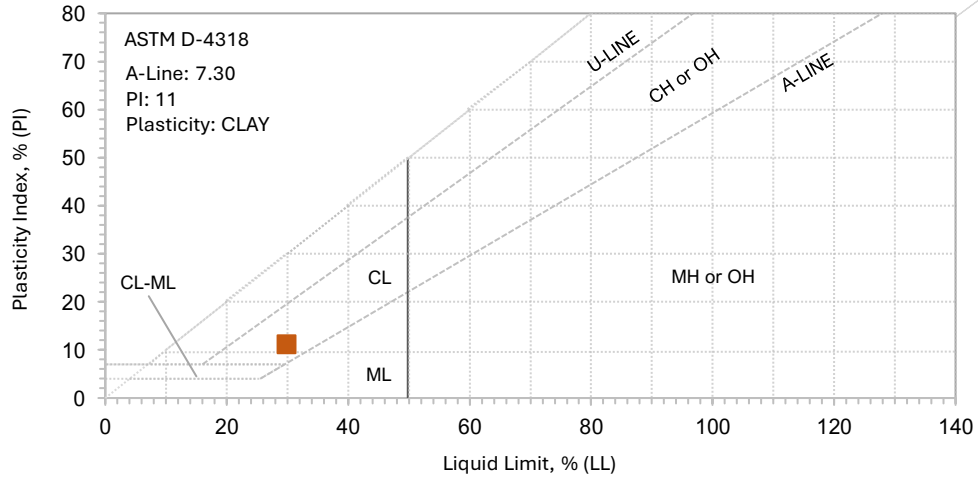


Sieve	Size	Pass, %
-	mm	%
6"	150.0	-
3"	75.0	-
2"	50.8	-
1.5"	37.5	-
1"	25.4	-
3/4"	19.0	100.0
1/2"	12.7	99.2
3/8"	9.51	95.7
#4	4.75	91.6
#10	2.00	84.6
#20	0.85	80.0
#40	0.42	76.2
#60	0.25	72.1
#100	0.147	67.0
#200	0.075	60.0

% Gravel (> 4.75 mm)	Coarse	0.0	% Sand (≤ 4.75 mm)	Coarse	7.0	D_{10} -	Cc -
	Fine	8.4		Medium	8.4	D_{30} -	Cu -
	Total	**8.4**		Fine	16.2	D_{60} -	
				Total	**31.6**		

Atterberg Limits & Classification

ASTM D-4318



Specimen Data	
Atterberg Limits	■
Liquid Limit	30
Plastic Limit	19
Plasticity Index	11

AASHTO (M-145)	USCS (D-2487)
A-6	CL

Soil Description (D-2487)

Brown sandy lean CLAY

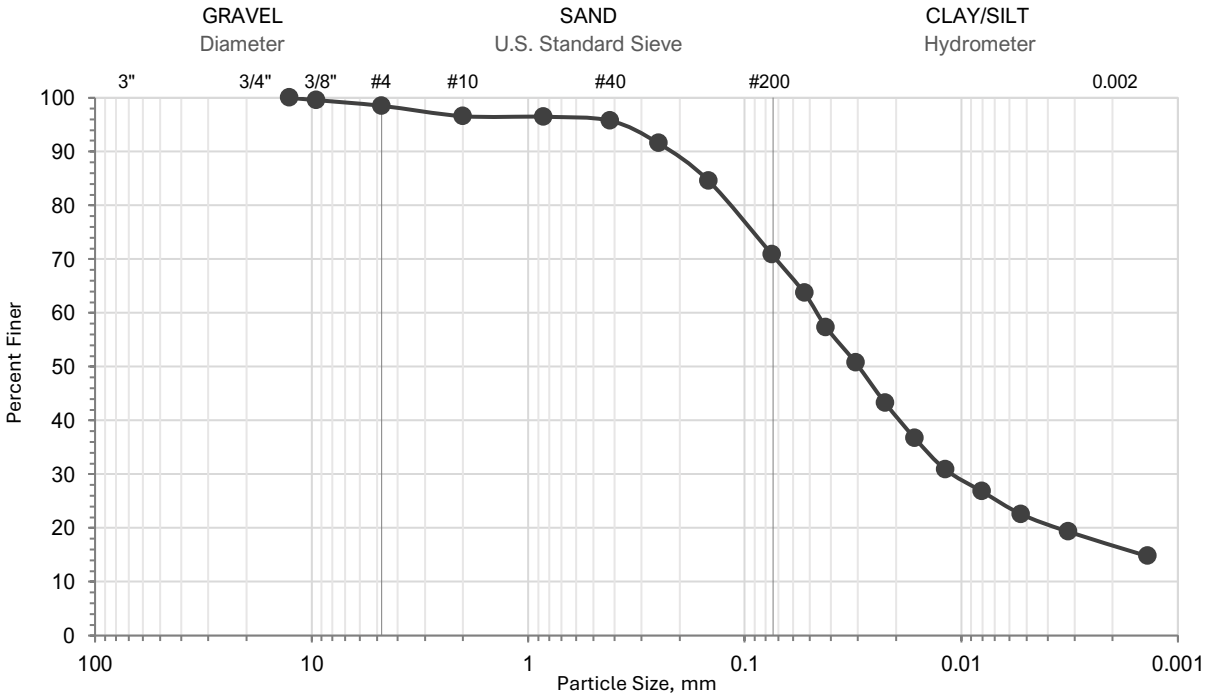
JAY KAY TESTING
(814) 404-9283 www.jaykaytesting.com

Job Name:	**MD Zoo**	Client:	Century
Job Number:		PM/Reviewer:	TM
Location:	-	Tester:	ST/JT
Sample Date:	-	Report Date:	04/22/25

Boring ID: **SWM-2** Sample ID: **S-6A** Top Depth **10'** Btm Depth **12'**

Particle-Size Distribution of Soils

ASTM D-6913 / ASTM D-7928

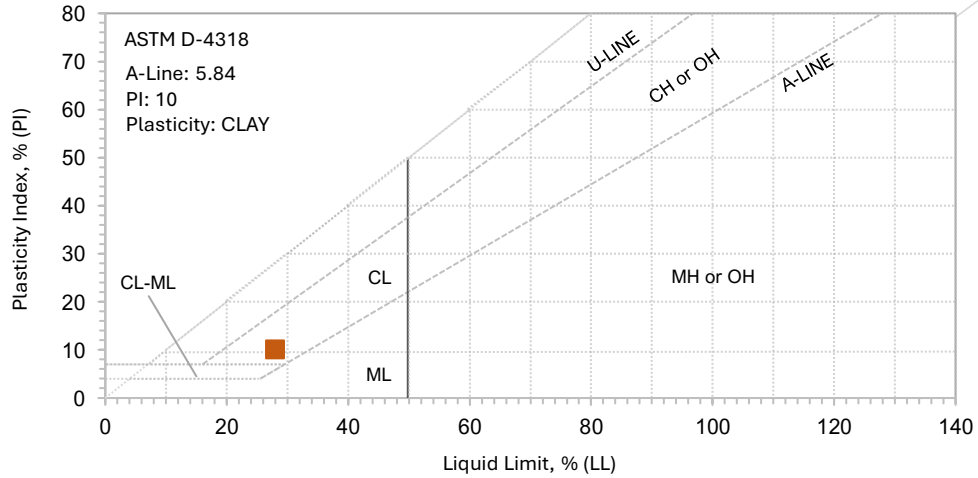


Sieve	Size	Pass, %
-	mm	%
6"	150.0	-
3"	75.0	-
2"	50.8	-
1.5"	37.5	-
1"	25.4	-
3/4"	19.0	-
1/2"	12.7	100.0
3/8"	9.51	99.6
#4	4.75	98.5
#10	2.00	96.6
#20	0.85	96.5
#40	0.42	95.8
#60	0.25	91.5
#100	0.147	84.6
#200	0.075	70.9

% Gravel (> 4.75 mm)			% Sand (≤ 4.75 mm)			D_{10}	-	Cc	-	Specific gravity*
	Coarse	0.0		Coarse	1.9	D_{30}	-	Cu	-	(assumed)
	Fine	1.5		Medium	0.8	D_{60}	-			2.70
	Total	**1.5**		Fine	24.9					
				Total	**27.6**					

Atterberg Limits & Classification

ASTM D-4318



Specimen Data	
Atterberg Limits	■
Liquid Limit	28
Plastic Limit	18
Plasticity Index	10

AASHTO (M-145)	USCS (D-2487)
A-4	CL

Soil Description (D-2487)

Brown lean CLAY with sand

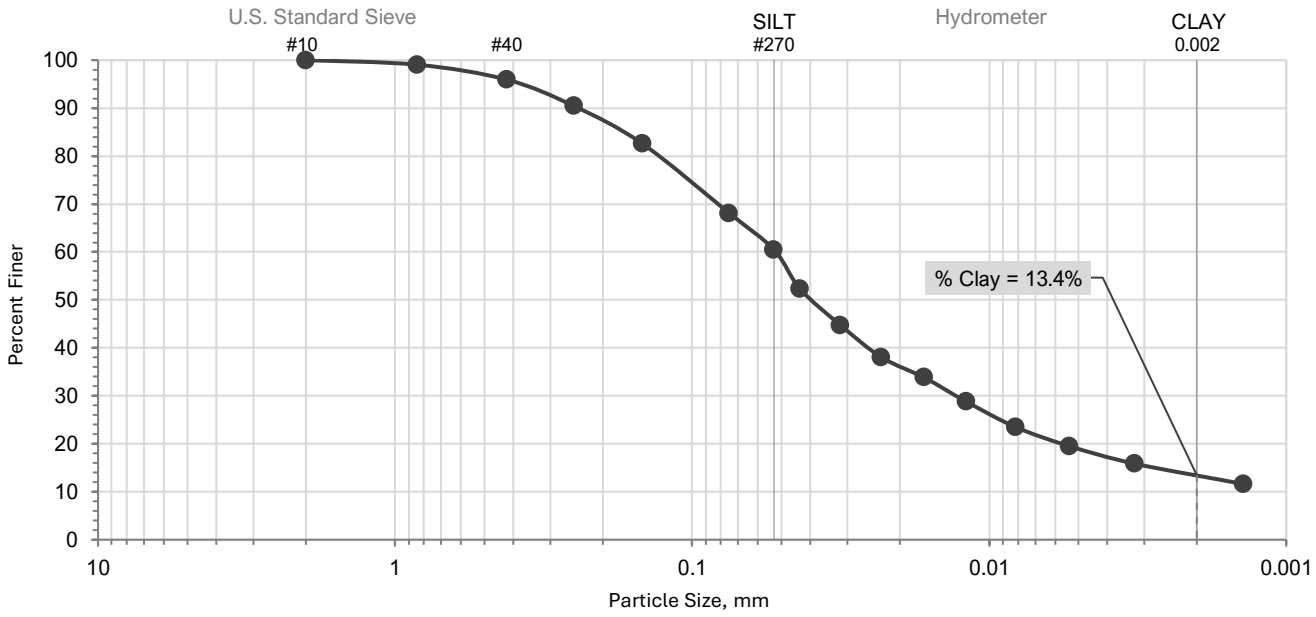
JAY KAY TESTING
(814) 404-9283 www.jaykaytesting.com

Job Name:	**MD Zoo**	Client:	Century
Job Number:		PM/Reviewer:	TM
Location:	-	Tester:	ST/JT
Sample Date:	-	Report Date:	04/22/25

Boring ID: **SWM-1** Sample ID: **S-6** Top Depth **10'** Btm Depth **12'**

USDA Summation Curve

ASTM D-6913 / ASTM D-7928



Total % (>2 mm)
19.1%

% SAND
39.5

% SILT
47.1

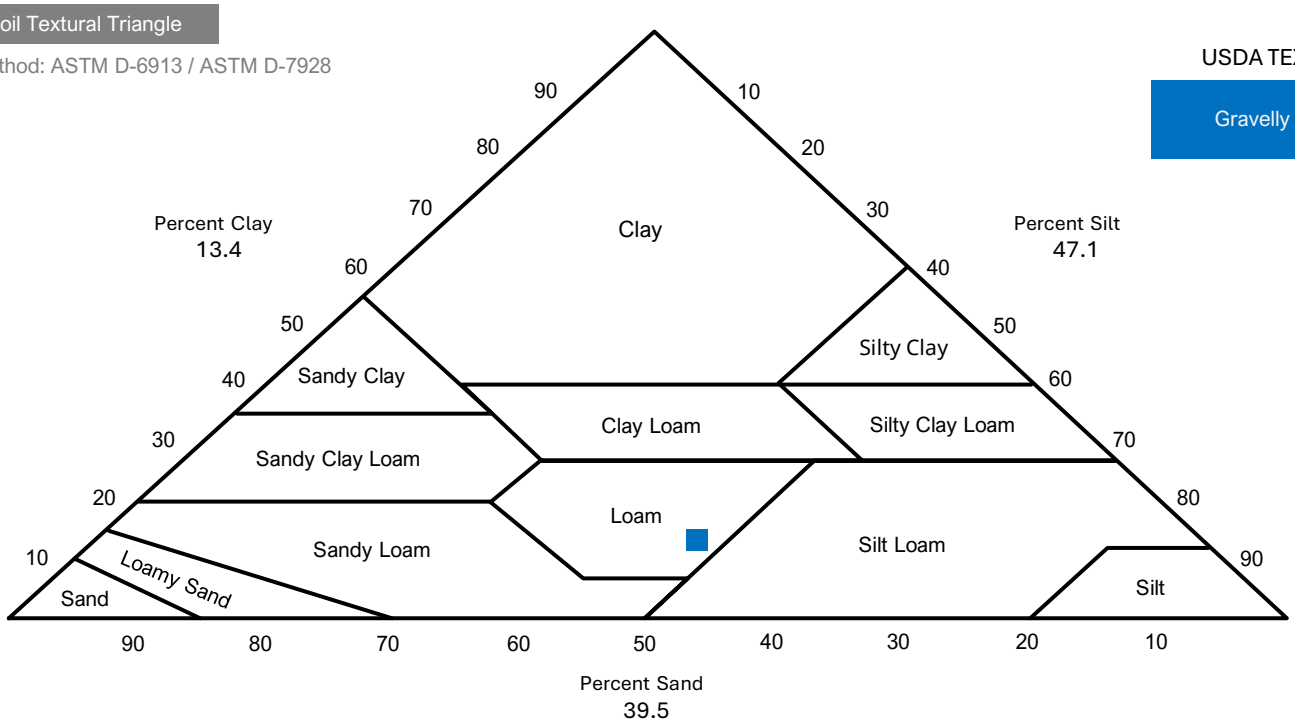
% CLAY
13.4

Soil Texture includes only fine-earth fraction (≤2 mm). "Whole-soil Particle-Size Distribution" includes fine-earth fraction (≤2 mm) and coarse fragments (>2 mm). USDA page 2-36.

USDA Soil Textural Triangle

Test Method: ASTM D-6913 / ASTM D-7928

USDA TEXTURE
Gravelly Loam



NMC	LL	PL	PI
15.2%	29%	20%	9%

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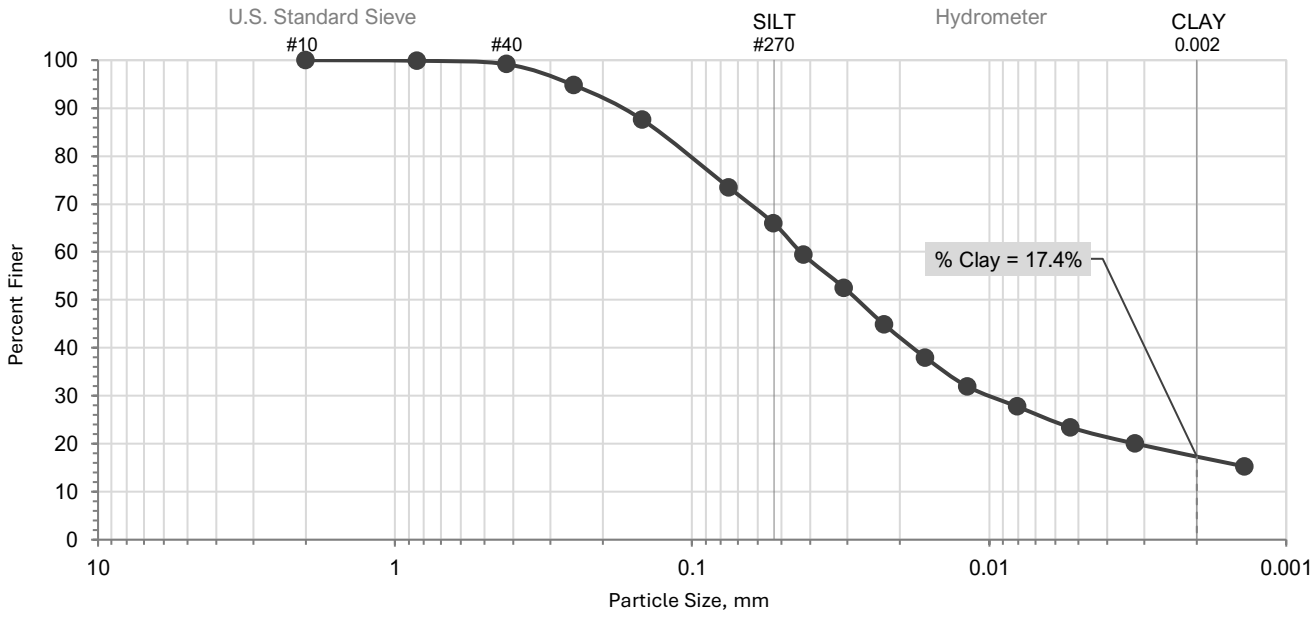
Job Name:	**MD Zoo**	Client:	Century
Job Number:		PM/Reviewer:	TM
Location:	-	Tester:	ST/JT
Sample Date:	-	Report Date:	04/22/25

Boring ID: **SWM-2** Sample ID: **S-6A** Top Depth **10'** Btm Depth **12'**

USDA Summation Curve

ASTM D-6913 / ASTM D-7928



Total % (>2 mm)
3.4%

% SAND
34.1

% SILT
48.5

% CLAY
17.4

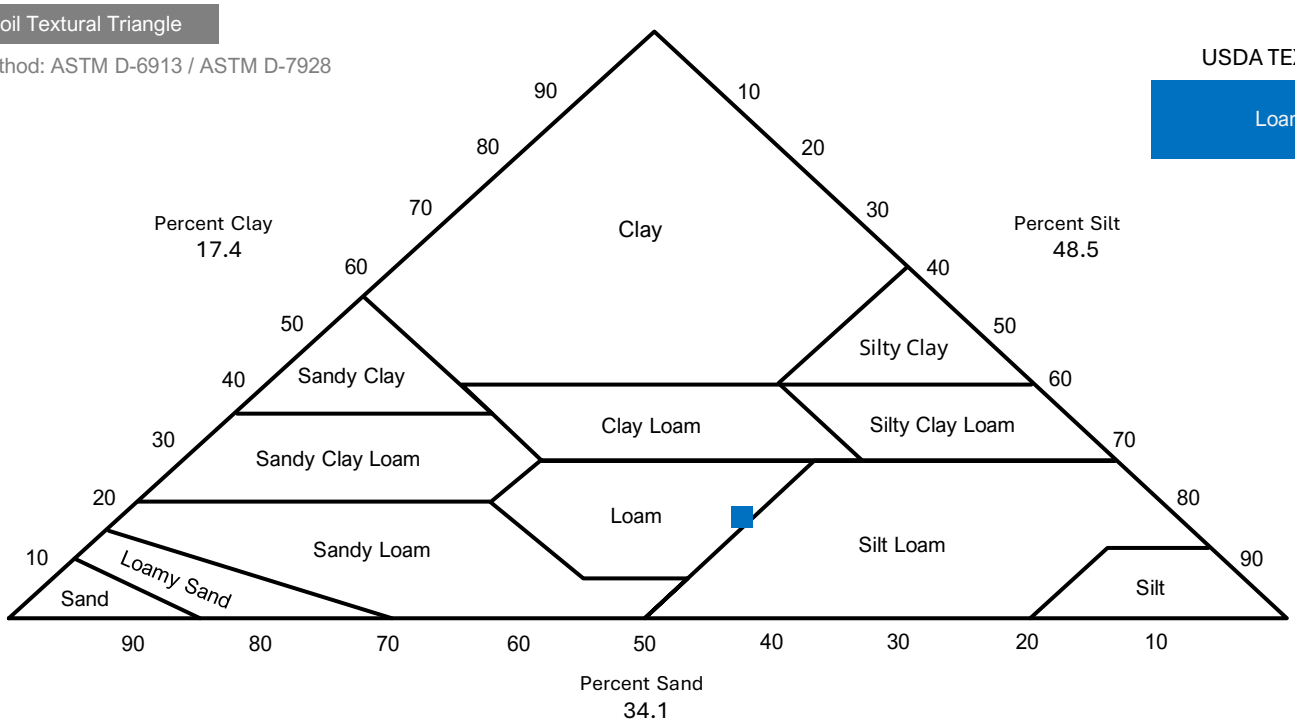
Soil Texture includes only fine-earth fraction (≤2 mm). "Whole-soil Particle-Size Distribution" includes fine-earth fraction (≤2 mm) and coarse fragments (>2 mm). USDA page 2-36.

USDA Soil Textural Triangle

Test Method: ASTM D-6913 / ASTM D-7928

USDA TEXTURE

Loam



NMC	LL	PL	PI
16.0%	28%	18%	10%

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Job Name:	**MD Zoo**	Client:	Century
Job Number:		PM/Reviewer:	TM
Location:	-	Tester:	ST/JT
Sample Date:	-	Report Date:	04/22/25

Boring ID: **SB-1** Sample ID: **Bulk** Top Depth **3'** Btm Depth **6'**

Moisture-Density Relationship of Soils

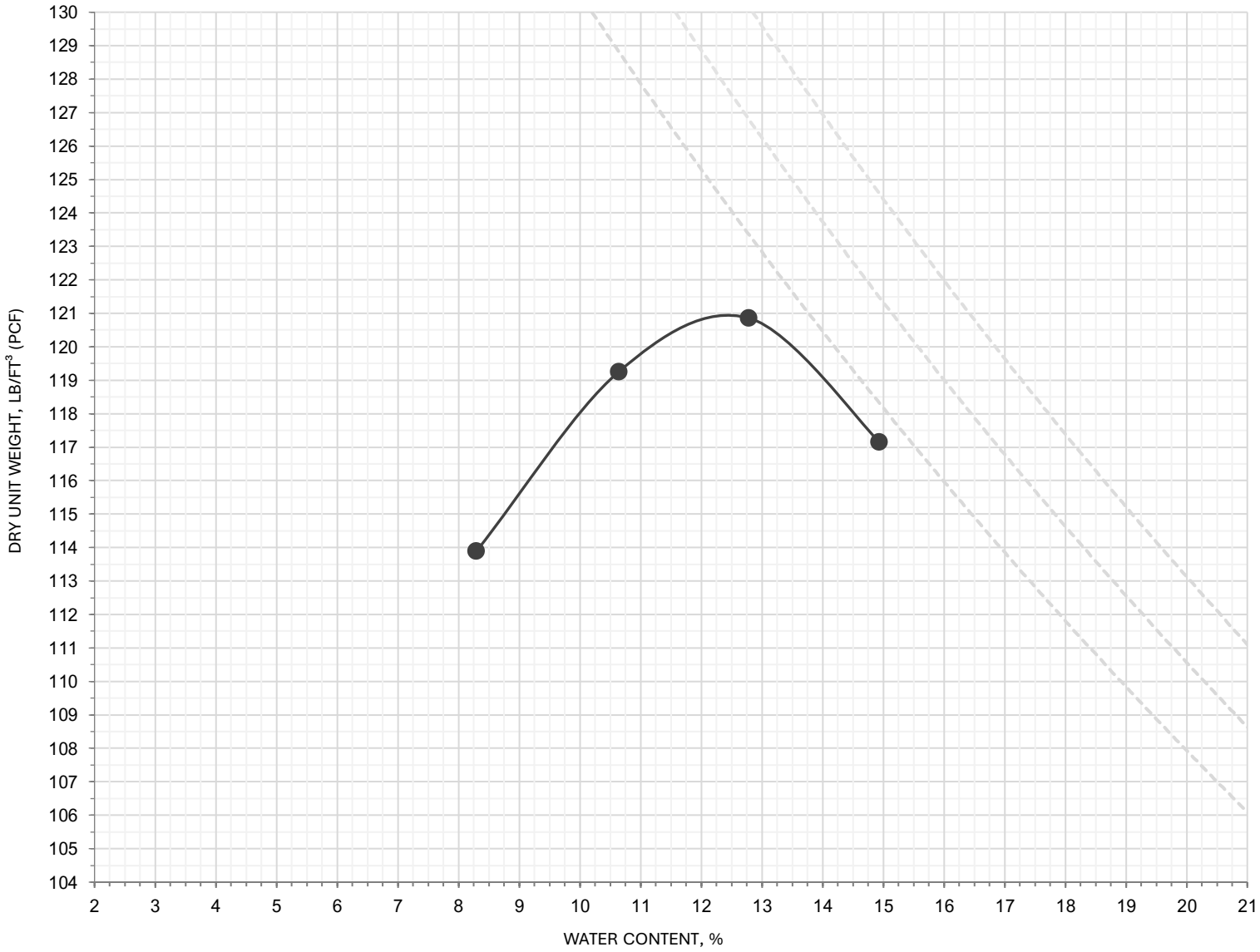
Standard Proctor
Test Method: ASTM D-698 (B)

Percent oversize particles: 1.7%
Oversized particles sieve: 3/8-in.
Threshold for correction: >= 5.0%

	Uncorrected	Corrected*
Maximum dry unit weight, lb/ft³	120.9	-
Optimum water content	12.4%	-

*Threshold not met for oversized particle correction.

Maximum Dry Unit Weight	Optimum Water Content
120.9	12.4%
lb/ft³ (PCF)	



Zero Air Voids (100% Saturation) Curves: 2.65, 2.75, 2.85

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NMC	LL	PL	PI	% Fines	USCS	AASHTO	Soil Description (D-2487)
13.0%	34%	17%	17%	56.8	CL	A-6	Brown sandy lean CLAY