

Appendix F

Laboratory Testing Data at Twin Pines Mine



Twin Pines Minerals, LLC

LABORATORY TESTING DATA AT TWIN PINES MINE

Prepared For:

TWIN PINES MINERALS, LLC
PROPOSED HEAVY MINERALS MINE
ST. GEORGE, CHARLTON COUNTY, GEORGIA

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TTL

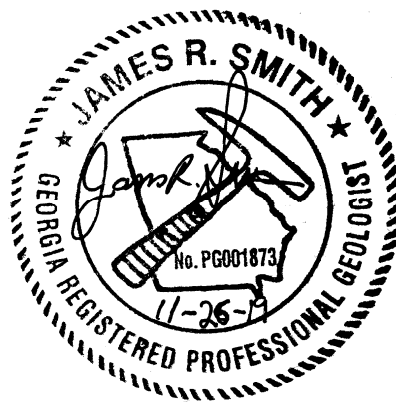


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INTRODUCTION

On July 3, 2019, Twin Pines Minerals (TPM) submitted an individual permit application to the U.S. Army Corps of Engineers for impacts to water of the United States to develop a heavy mineral sand mine along Trail Ridge in Charlton County, Georgia (Figure 1). The proposed mine is located 3.2 miles west of St. George, Georgia, along Georgia State Highway Route 94. Trail Ridge is a 0.6 to 1.2 mile wide and 99 mile long topographic ridge that separates the Okefenokee Basin and Swamp from the coastal plain of Georgia (Force and Rich, 1979). It represents the crest of a former beach complex and was formed as inland sand dunes near the proposed Twin Pines Mine (e.g., Pirkle et al. 1993). The ridge is underlain by a shallow aquifer, locally known as the surficial aquifer, which forms a hydrologic divide between the Okefenokee swamplands to the west and the Saint Mary's River to the east. At the proposed mine site, the water table is very shallow with water depths of only a few feet. The surficial aquifer is perched on the clays of the upper Hawthorn Group, which is considered to be the upper confining unit to the Floridian Aquifer in the region (e.g., Williams and Kuniansky, 2016).

The proposed permit area is approximately 2,414-acres, located southeast of the Okefenokee National Wildlife Refuge (ONWR) boundary; however, TPM will only mine an approximate 1,268-acre area located about 2.7 miles from the ONWR boundary (Figure 2). The portion of the proposed permit area extending from the western mining boundary to the edge of the permit boundary will be avoided and will provide a buffer to the ONWR.

The project study area consists of approximately 12,000-acres of land located near St. George, Charlton County, Georgia. This area is comprised of five (5) tracts identified as Loncala, Dallas Police & Fire, Keystone, TIAA, and Adirondack. To evaluate local groundwater, surface water, and precipitation, field activities were performed both within the proposed mining area and on adjacent properties outside of the proposed mining area footprint. Reference to "project study area" in this report refers to activities conducted within the proposed mining area and adjacent tracts.

The purpose of this report is to compile and discuss results of laboratory testing data of soil/sediments collected from project study area. This data compiled from the tests performed on surface and subsurface soil/sediments will assist in modeling efforts to evaluate the proposed mining activities.

SOIL/SEDIMENT SAMPLING AND ANALYSIS

Vertical Hydraulic Conductivity

Undisturbed Borings (UD)

Fourteen soil borings (designated UD-10, UD-25, UD-34, UD-43, UD-51, UD-65, UD-67, UD-93, UD-126, UD-128, UD-179, UD-231, UD-238, and UD-338) were drilled throughout the project study area for the collection of undisturbed soil samples (Figure 3). Each UD boring was advanced utilizing TTL's CME-550 all-terrain vehicle (ATV) drill rig. Due to the presence of unconsolidated sands and a high groundwater table, a mud rotary drilling technique was used to counter saturated heaving sands within each boring. Additionally, since undisturbed samples of unconsolidated sands could not be collected using standard Shelby tube sampling methods, a Denison Sampler was used to collect undisturbed samples of unconsolidated soils. A general summary of the mud rotary drilling technique and operation of the Denison Sampler is included below.

The mud rotary drilling technique used AWJ rods with an approximate 6-inch diameter wing bit to drill down to the target sampling interval in each UD boring. A bentonite slurry (i.e. drilling mud) was circulated the entire length of the borehole to counter saturated heaving sands. Once the target sampling interval was reached the AWJ rods and wing bit were removed from the borehole and the Denison Sampler was inserted. The Denison Sampler was equipped with a sample tube designed to extend ahead of the outer rotating barrel. To obtain a sample, the Denison Sampler and outer barrel were inserted through the drilling mud and set on the bottom of the borehole. The outer barrel of the sampler was slowly rotated while, at the same time, pushing downward at a steady rate. As the

sampler was pushed downward, the undisturbed soil sample was collected into a thin-wall sample tube. As the soil sample was pushed upward into the thin-wall sample tube, the drilling mud was vented to the low-pressure area on the outside of the core barrel through a disc valve. This pressure differential is what allowed the Denison Sampler to collect and retain an undisturbed unconsolidated soil sample.

Three undisturbed soil samples were collected from each of the 14 UD borings. Undisturbed samples were collected from two-foot intervals within the following general depth ranges [13 to 19 feet below ground surface (bgs), 28 to 32 feet bgs, and 43 to 50 feet bgs]. Each undisturbed sample was collected in a thin-walled sample tube that measured approximately 3-inches in diameter by 24-inches in length. Upon sample retrieval, the ends of each undisturbed sample tube were sealed, capped, and labeled. The samples were placed upright in a soil sample storage rack that was specially designed to prevent disturbance during transport. A total of 42 soil samples were transported by TTL personnel to Bowser-Morner's laboratory in Dayton, Ohio for analysis. Vertical hydraulic conductivity (Kv) analysis was performed on 41 of the 42 above-referenced undisturbed soil samples collected from select UD borings. One sample, UD-65 (43-45 feet bgs), was remolded for vertical hydraulic conductivity analysis. A summary of the Kv samples collected from the UD borings is included in Table 1. A copy of the laboratory report is included in Appendix A.

Results

Review of the laboratory report indicates that 15 of 42 UD samples were collected from semi-consolidated to consolidate sands and clayey sands. The Kv values for these samples ranged from 1.70E-08 to 6.30E-02 centimeters per second (cm/sec). A total of 27 of the 42 UD samples collected and submitted to Bowser-Morner generally classified as unconsolidated sand (SP, SM, or SP-SM classification). The results of the laboratory analyses for these unconsolidated sands indicated Kv values ranging from 2.00E-07 to 3.90E-04 cm/sec. The distribution of these Kv ranges are listed below.

Range of Kv Values (in cm/sec)	Number of Measurements	Minimum Kv Value (in cm/sec)	Maximum Kv value (in cm/sec)	Average Kv value (in cm/sec)
10 ⁻²	0	---	---	---
10 ⁻³	0	---	---	---
10 ⁻⁴	8	1.00E-04	3.90E-04	2.05E-04
10 ⁻⁵	9	1.00E-05	9.20E-05	4.07E-05
10 ⁻⁶	8	1.40E-06	7.60E-06	4.35E-06
10 ⁻⁷	2	2.00E-07	7.80E-07	4.90E-07

These Kv values appear to be about one to four orders of magnitude lower than typical Kv values for unconsolidated sand (which generally range from 10⁻² to 10⁻³ cm/sec); therefore, sample collection methodology and laboratory analysis audits were performed by TTL and Bowser-Morner. Based on the audits, it was concluded that the drilling mud used to counter saturated heaving sands most likely migrated down the open borehole, through the porous sands, and into the two-foot undisturbed target sample interval, resulting in artificially lower Kv values. Therefore, field activities were initiated for the collection of additional undisturbed samples of unconsolidated soil/sediments for Kv analysis. Collection of these additional samples was performed using alternative drilling techniques that did not use drilling mud.

For the collection of these additional undisturbed samples of unconsolidated sand, four new borings were drilled within the proposed permit area, and adjacent to existing UD borings UD25, UD43, UD2338 and UD338. A CME-550 ATV mounted drill rig equipped with hollow-stem augers was used to drill each boring. Six undisturbed samples of unconsolidated sand were collected using standard

3-inch diameter by 36-inch long steel Shelby tubes. One undisturbed soil sample was collected, using the Denison sampler, in a thin-walled sample tube that measured approximately 3-inches in diameter by 24-inches in length. No drilling mud was used during the collection of these additional samples. The undisturbed soil sample identifiers, sample intervals and collection methods are listed below:

Sample Identifier	Sample Interval (in feet below ground surface)	Collection Method
UD25R	3-5 feet	Denison Sampler
	10-12 feet	Standard Steel Shelby Tube
UD43R	5-7 feet	Standard Steel Shelby Tube
	10-12 feet	Standard Steel Shelby Tube
UD238R	6-8 feet	Standard Steel Shelby Tube
	10-12 feet	Standard Steel Shelby Tube
UD338R	9-11 feet	Standard Steel Shelby Tube

Upon sample retrieval, the ends of each undisturbed sample tube were sealed, capped, and labeled. The samples were placed upright in a soil sample storage rack that was specially designed to prevent disturbance during transport. The samples were submitted to TTL's soil laboratory in Tuscaloosa, Alabama for Kv analysis in general accordance with either ASTM D 5084 "Measurement of Hydraulic Conductivity". The laboratory also performed testing to determine grain-sized distribution and the Unified Soil Classification System (USCS) classification of each sample.

Results of the laboratory analysis indicated that the Kv values for these seven additional samples ranged from 2.30E-04 to 8.50E-04 cm/sec. Six of the samples classified as a poorly graded sand (SP) and one samples classified as poorly graded sand-silty sand (SP-SM).

The Kv laboratory results of the undisturbed unconsolidated sand samples collected from borings where drilling mud was utilized (i.e. Bowser-Morner laboratory data) were compared to samples collected from borings where drilling mud was not used (TTL laboratory data). The sets of sample data were further sorted by USCS classifications. Next, the geometric means of the sorted Kv values were calculated. The geometric means of the two data sets are shown below, and the samples collected from borings where no drilling mud have a geometric mean about one order of magnitude higher than those collected from borings where drilling mud was used, indicating that drilling mud had affected the Kv values measured by Bowser-Morner .

USCS Classification = SP			
Sample Data Set	Drilling Mud Used in Borehole?	Number of Samples	Geometric Mean of Kv (cm/sec)
Bowser-Morner Laboratory Data	Yes	17	2.65E-05
TTL Laboratory Data	No	6	4.33E-04

USCS Classification = SP-SM			
Sample Data Set	Drilling Mud Used in Borehole?	Number of Samples	Geometric Mean of Kv (cm/sec)
Bowser-Morner Laboratory Data	Yes	17	1.30E-05
TTL Laboratory Data	No	1	3.20E-04

Exploratory Borings (EB)

Exploratory borings were drilled using either a Geoprobe 8150LS Rotary Sonic Rig or Terra-Sonic Rig. Undisturbed samples of the Hawthorn Group sediments were collected from exploratory borings EB03,

EB06, and EB08. Locations of each of the 16 exploratory borings are shown on Figure 4. The undisturbed soil samples from each exploratory boring were collected by direct-push of a 3-inch diameter by 30-inch long steel thin-walled Shelby tube into the top of the Hawthorn Group sediments. Immediately upon retrieval of the undisturbed sample from each boring, the ends of each Shelby tube were sealed with wax, capped and labeled. The tubes were transported to TTL's soil laboratory in Albany, Georgia for measurement of hydraulic conductivity using a flexible wall permeameter (ASTM D5084 Method C). Select samples of "disturbed" black sands were collected directly from the sonic dill rig core samples extracted from exploratory boring EB16 at various depth intervals. A disturbed sample of Hawthorn Group sediments (fat clay) was also collected from boring EB16 (86 to 90 ft bgs). These samples were submitted to TTL's soil laboratory in Tuscaloosa, Alabama for Kv analysis in general accordance with either ASTM D 5084 "Measurement of Hydraulic Conductivity" or ASTM D 2434 "Measurement of Hydraulic Conductivity". A summary of the Kv samples collected from the exploratory borings is listed in Table 2. Results of the Kv analyses are included in Table 3. A copy of the laboratory report is included in Appendix A.

Results

Review of Table 3 indicates that the laboratory results for Kv values of the three undisturbed soil/sediment samples collected from the top of Hawthorn Group were:

- EB03 (92.5-94 feet bgs) = $1.61\text{E-}09$ cm/sec;
- EB06 (120-122 feet bgs) = $1.29\text{E-}05$ cm/sec; and
- EB08 (130-133 feet bgs) = $9.29\text{E-}09$ cm/sec

The laboratory results for Kv values of the "disturbed" black sand samples collected from exploratory boring EB16 ranged from $1.90\text{E-}02$ to $1.80\text{E-}04$ cm/sec. The Kv value of the Hawthorn Group sediments (fat clay) collected from EB16 was $1.30\text{E-}08$ cm/sec.

Piezometer Borings (PZ)

Two undisturbed samples of black humate-cemented consolidated sand were collected from the boring for piezometer PZ57D using thin-walled steel Shelby tubes. Locations of piezometers are shown on Figure 5. These two undisturbed samples were submitted to TTL's soil laboratory in Tuscaloosa, Alabama for Kv analysis. A summary of the Kv samples collected from the boring for PZ57D is listed in Table 2. Results of the Kv analyses are included in Table 3. A copy of the laboratory report is included in Appendix A.

Results

Review of Table 3 indicates that the laboratory results for Kv values of the two undisturbed samples of the black humate-cemented consolidated sand collected from the boring for PZ59D were:

- PZ59D (20-22 feet bgs) = $2.70\text{E-}08$ cm/sec; and
- PZ57D (25-27 feet bgs) = $3.47\text{E-}07$ cm/sec

Porosity

Porosity analysis was also performed on the above-referenced 42 soil samples collected from select UD borings within the project area. These samples were submitted to Bowser-Morner, Inc. for porosity analysis. Analysis for porosity was performed in general accordance with ASTM D 854 "Specific Gravity of Soils Solids by Water Pycnometer". Results of the porosity analyses are included in Table 4. A copy of the laboratory report is included in Appendix A.

Results

The table below summarizes the ranges of porosity values of the 42 soil/sediment samples undisturbed soil samples.

Range of Porosity Values (percent)	Number of Measurements	Minimum Porosity Values (percent)	Maximum Porosity Values (percent)	Average Porosity Values (percent)
30-35%	15	30.1%	34.6%	32.8%
35-40%	22	35.0%	39.8%	37.3%
40-45%	5	40.0%	43.7%	41.6%

Grain-Size Distribution

During the installation of piezometers at the site, a total 90 soil/sediment samples were collected from select boreholes and submitted to TTL's soil laboratory in Albany, Georgia and Tuscaloosa, Alabama for grain-size distribution analysis. Grain-size distribution analysis was also performed on 42 undisturbed soil samples collected using thin-walled Shelby tubes. These 42 samples were collected from select undisturbed (UD) borings within the project area and were submitted to Bowser-Morner, Inc. for grain-size distribution analysis. Grain-size distribution analysis for the 132 samples was performed in general accordance with ASTM D 422 "Particle-Size Analysis of Soils". Results of the grain-size distribution analysis are included in Table 5. A copy of the laboratory report is included in Appendix B.

Results

The table below summarizes the range of sand-size particles in the 125 soil/sediment samples collected for laboratory analyses of grain-size distribution.

Range of Sand-Size Particles (percent)	Number of Measurements
90-99%	93
80-89%	7
70-79%	4
60-69%	1
50-59%	5
40-49%	22

As noted in the above-referenced table, the majority of the soil samples classified as predominantly sand with very little silts or clays.

Soil-Moisture Retention Curves

Three undisturbed soil samples (SS-ADK-01, SS-KEY-01, and SS-TIA-01) were collected from the surface at three locations within the proposed permit area for soil moisture retention curve analysis (Figure 6). In addition, a full one-gallon Ziploc bag of loose material was collected from each location for remolded sample testing. The undisturbed soil samples were collected from near surface depths (within 0.5 to 1-foot bgs interval) using 3-inch by 3-inch stainless steel thin-walled Shelby tubes. The soils for the remolded sample testing were collected from the same near surface depths as the undisturbed samples. The samples were submitted to Daniel B. Stephens & Associates, Inc (DB Stephens) in Albuquerque, New Mexico for the following laboratory analyses.

Sample ID	Matrix	Number of Samples	Summary of Test Performed
SS-ADK-01	Soil	1	Gravimetric Moisture Content Volume Measurement Method Constant Head Rigid Wall Hanging Column Pressure Plate Dew Point Potentiometer Relative Humidity Box Calculated Unsaturated Hydraulic Conductivity
SS-KEY-01	Soil	1	
SS-TIA-01	Soil	1	

A listing of methods used in performance of the above-referenced tests are listed below:

Tests	Methods
Dry Bulk Density	ASTM D 7263
Moisture Content	ASTM D 7263, ASTM D 2216
Calculated Porosity	ASTM D 7263
Saturated Hydraulic Conductivity:	ASTM D 5856 (modified apparatus)
Hanging Column Method	ASTM D 6836 (modified apparatus)
Pressure Plate Method	ASTM D 6836 (modified apparatus)
Water Potential Method	ASTM D 6836
Relative Humidity Box	Campbell, G. and G. Gee. 1986. Water Potential: Miscellaneous Methods. Chp. 25, pp. 631-632, in A. Klute (ed.), Methods of Soil Analysis. Part 1. American Society of Agronomy, Madison, WI; Karathanasis & Hajek. 1982. Quantitative Evaluation of Water Adsorption on Soil Clays. SSA Journal 46:1321-1325.
Moisture Retention Characteristics & Calculated Unsaturated Hydraulic Conductivity	ASTM D6836; van Genuchten, M.T. 1980. A closed-form equation for predicting the hydraulic conductivity of unsaturated soils. SSSAJ 44:892-898; van Genuchten, M.T., F.J. Leij, and S.R. Yates. 1991. The RETC code for quantifying the hydraulic functions of unsaturated soils. Robert S. Kerr Environmental Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Ada, Oklahoma. EPA/600/2091/065. December 1991.

Results of the soil moisture retention curve analyses are included in the DB Stephens, Inc. report included in Appendix C.

Results

The porosity in the soil samples ranged from 38.5% to 44.8%, and the saturated hydraulic conductivity varied from 2.0E-03 cm/s to 1.6E-02 cm/s in the undisturbed samples and 3.2E-04 to 1.1E-02 cm/s in the remolded samples. The van Genuchten (1980) parameters α and n are consistent with those of well-sorted to poorly-sorted sands.

Sample ID	Porosity (-)	Ks (cm/s)	α (cm ⁻¹)	n (-)
SS-ADK-01 (Undisturbed)	44.8	1.6E-02	0.0305	3.6589
SS-ADK-01 (Remolded)	39.8	1.1E-02	0.0370	2.9456
SS-KEY-01 (Undisturbed)	38.5	2.0E-03	0.0357	1.4480
SS-KEY-01 (Remolded)	39.9	1.9E-03	0.0188	1.6228
SS-T1A-01 (Undisturbed)	42.0	2.4E-03	0.0450	1.3213
SS-T1A-01 (Remolded)	40.1	3.2E-04	0.0236	1.4332

Undisturbed (UD) Drum Sample Permeability Results

Blending of Bentonite with Processed Material from Proposed Mine Site

TTL considered that the permeability of sands returned to the mine pit during reclamation/restoration may need to be reduced to ensure that groundwater levels are appropriate for maintaining wetlands. Bench-scale studies were conducted to evaluate methods for decreasing the permeability of sands returned to the mining pit. TTL drilled 14 soil borings across the study area and collected bulk sand samples from ground surface to 50 feet below ground surface (bgs), which represents the proposed average mining impact depth. The bulk sand samples collected from 0 to 50 feet bgs were drummed by individual boring location and transported to Minerals Technologies, Inc. (MT) in Stark, Florida in order to process the material in a similar manner as the proposed mining extraction process (i.e. extraction of the humate, clays (or slime), and heavy minerals). Processing was performed on April 9, 2019. Selected photographs of the processing are included in Appendix D.

The post-processed sands, minus humate, clays (referred to by MT as slimes), and heavy minerals, were drummed and then transported to TTL's office in Tuscaloosa, Alabama for hydraulic conductivity (permeability) testing. Once at TTL's office the drums were paired as indicted on Figure 7 and the paired drums were combined to ensure that sufficient material was available for testing. The drums of paired post-processed sand were identified by the following boring identifiers: UD338/25, UD238/43, UD65/51, UD67/34, UD128/126, UD93/10, and UD231 (The drum for UD179 was not received at TTL's office). Upon opening the drums, TTL personnel noted that some liquid was present. The liquid was very dark brown in color and appeared to represent residual humate. The sand samples were placed in a steel chamber that allowed for application of a load equal to approximately 4,500 pounds over 24-hours. Prior to the addition of bentonite, three simulated in-situ samples (UD 338/25 A, B, and C) were collected from the steel chamber using drive tubes for dry bulk density, moisture content, permeability testing. This process was repeated for the permeability testing of sand samples mixed with percentages of bentonite equal to 0.35% and 1.42%, respectively. Additionally, individual samples of sand were collected directly from the UD338/25 drum and mixed with the following percentages of bentonite 5%, 7.5%, 10%, 12.5%, 15%, and 30%. After mixing each sample was remolded and tested for permeability. Bentonite used for testing was a Wyoming bentonite, high yield, high viscosity bentonite produced by Halliburton, Baroid Industrial Drilling Products. Permeability test results are provided in Table 6. A copy of the laboratory report is included in Appendix E.

Results

TTL also performed permeability tests on two undisturbed samples of black humate-cemented consolidated sand collected from the borehole for PZ57D. Results of the tests performed on the black consolidated sand samples are also listed in Table 6. Results of this bench-scale study indicated that a mixture of approximately 10% to 12.5% bentonite would be required to achieve a relative permeability similar to the results calculated for the black humate-cemented consolidated sand in the two samples from PZ57D.

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FIGURES

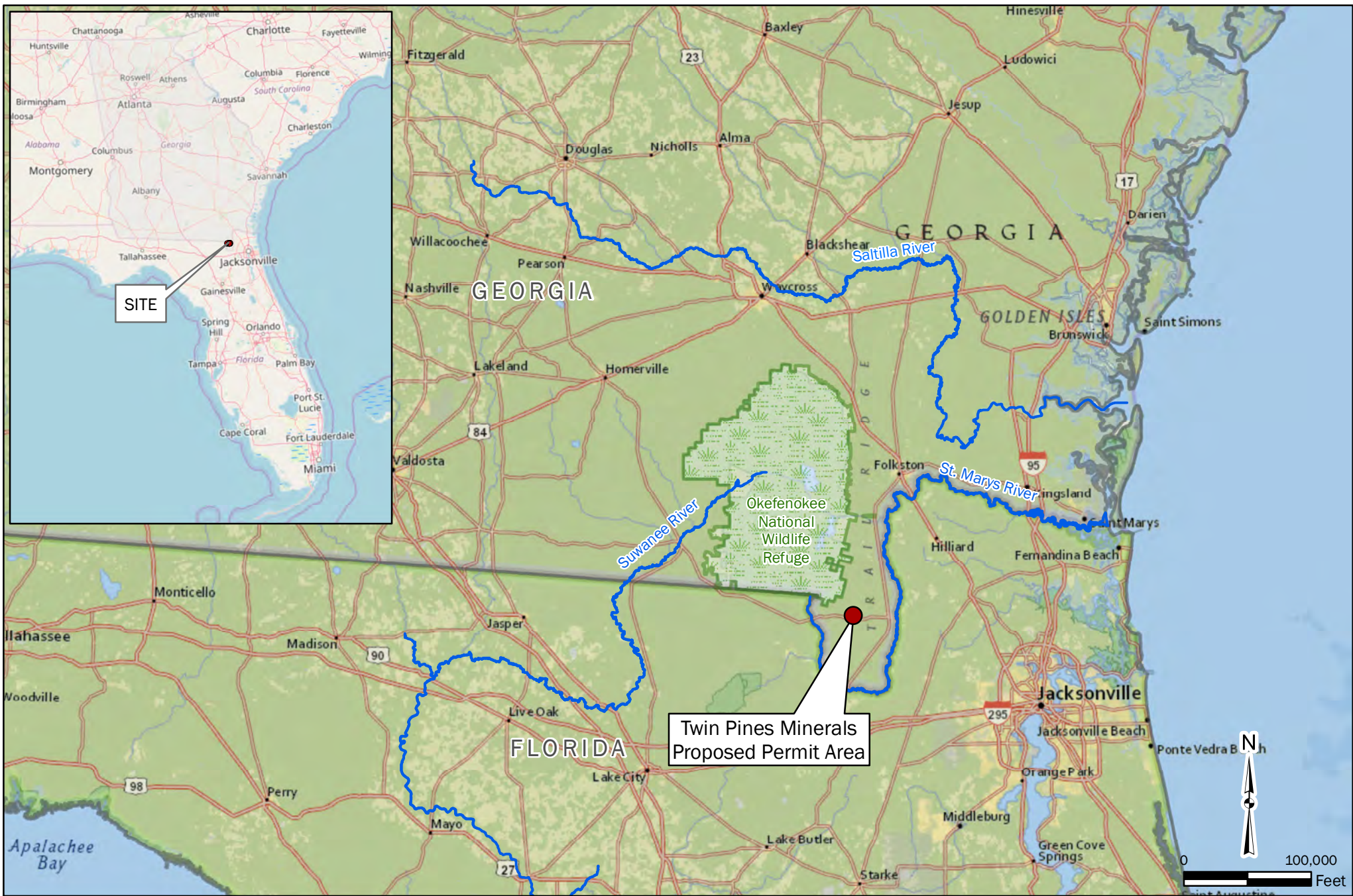


FIGURE 1: LOCATION OF THE PROPOSED TWIN PINES MINE TWIN PINES MINERALS

ST. GEORGE, CHARLTON COUNTY, GEORGIA

INSET BASEMAP: Open Street Map. BASEMAP: National Geographic World Map.

DRAWN BY: DEK
CHECKED BY: JMT
DRAWING DATE: 10/28/2019
REVISION DATE: N/A
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APPROX. SCALE: 1 in = 100,000 ft

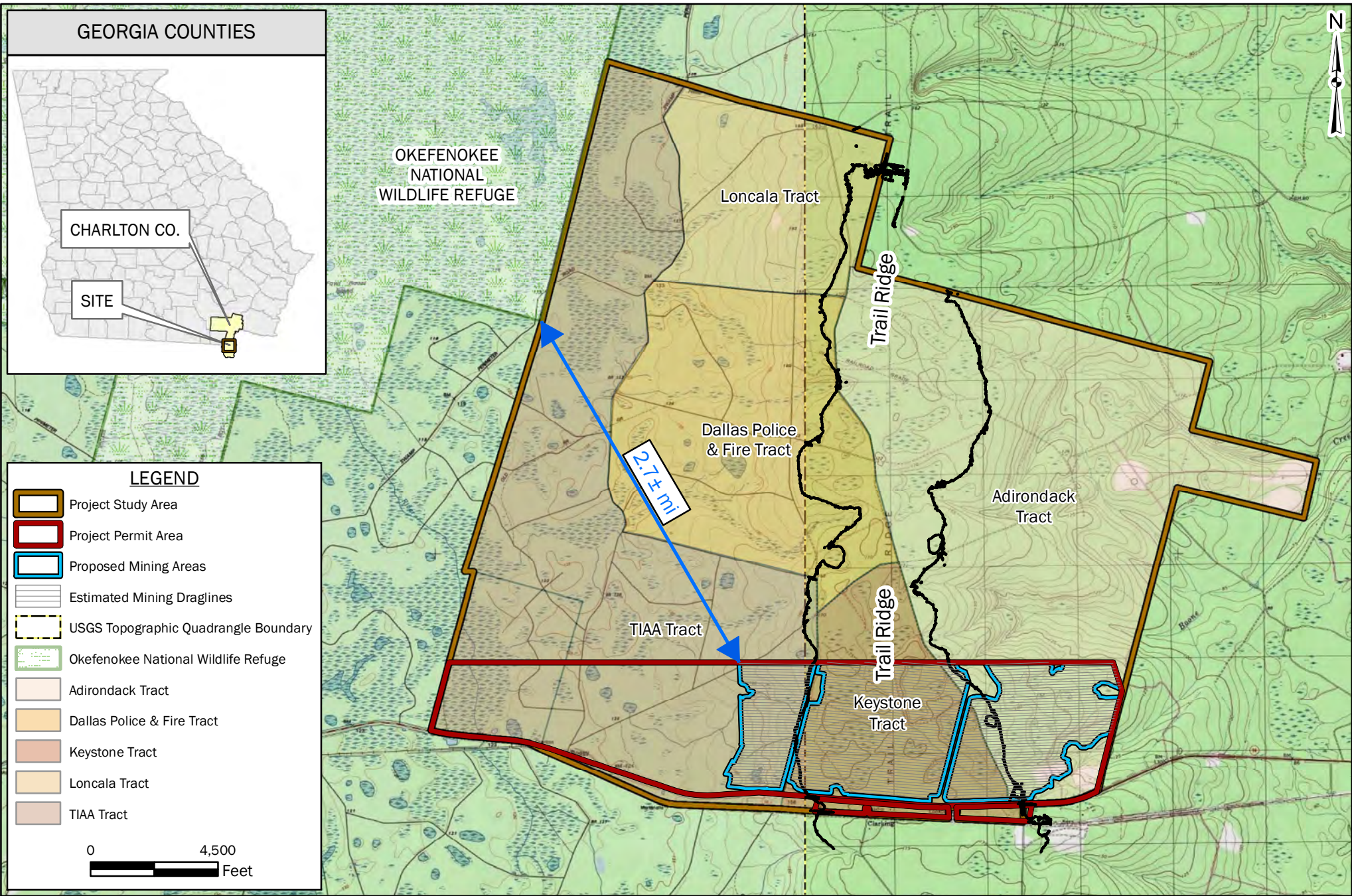


FIGURE 2: PROJECT STUDY & PROPOSED PERMIT AREA TWIN PINES MINERALS

ST. GEORGE, CHARLTON COUNTY, GEORGIA

BASEMAP: USGS 7.5 Minute Quadrangle Map, Florida & Georgia, (West) Moniac 1968 (10-ft Contour Interval), (East) Saint George 1982 (5-ft Contour Interval).

DRAWN BY: DEK
CHECKED BY: JMT
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REVISION DATE: N/A
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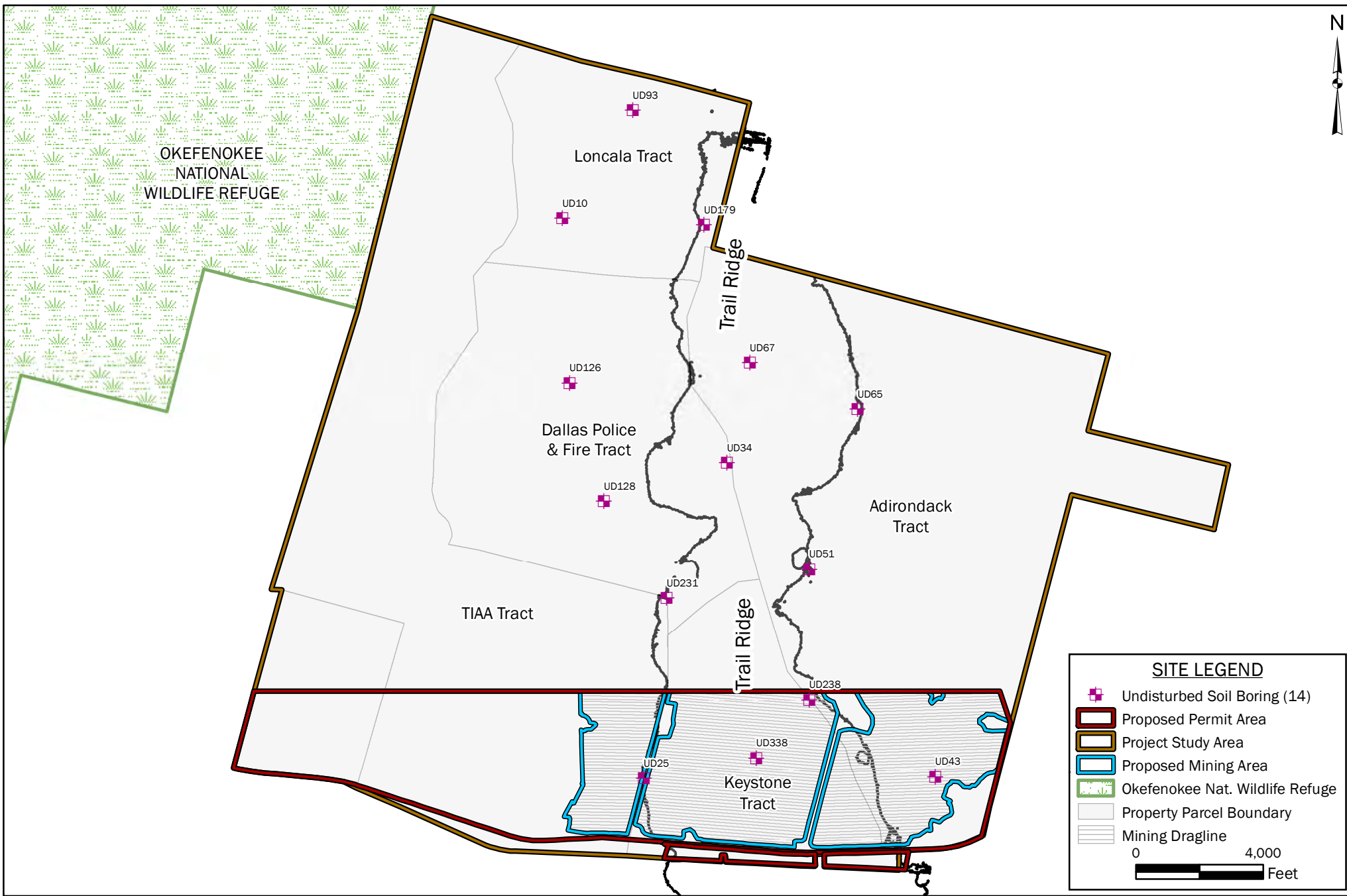


FIGURE 3: UNDISTURBED (UD) SOIL BORING LOCATION MAP
TWIN PINES MINERALS
 ST. GEORGE, CHARLTON COUNTY, GEORGIA



DRAWN BY: DEK
CHECKED BY: JRS
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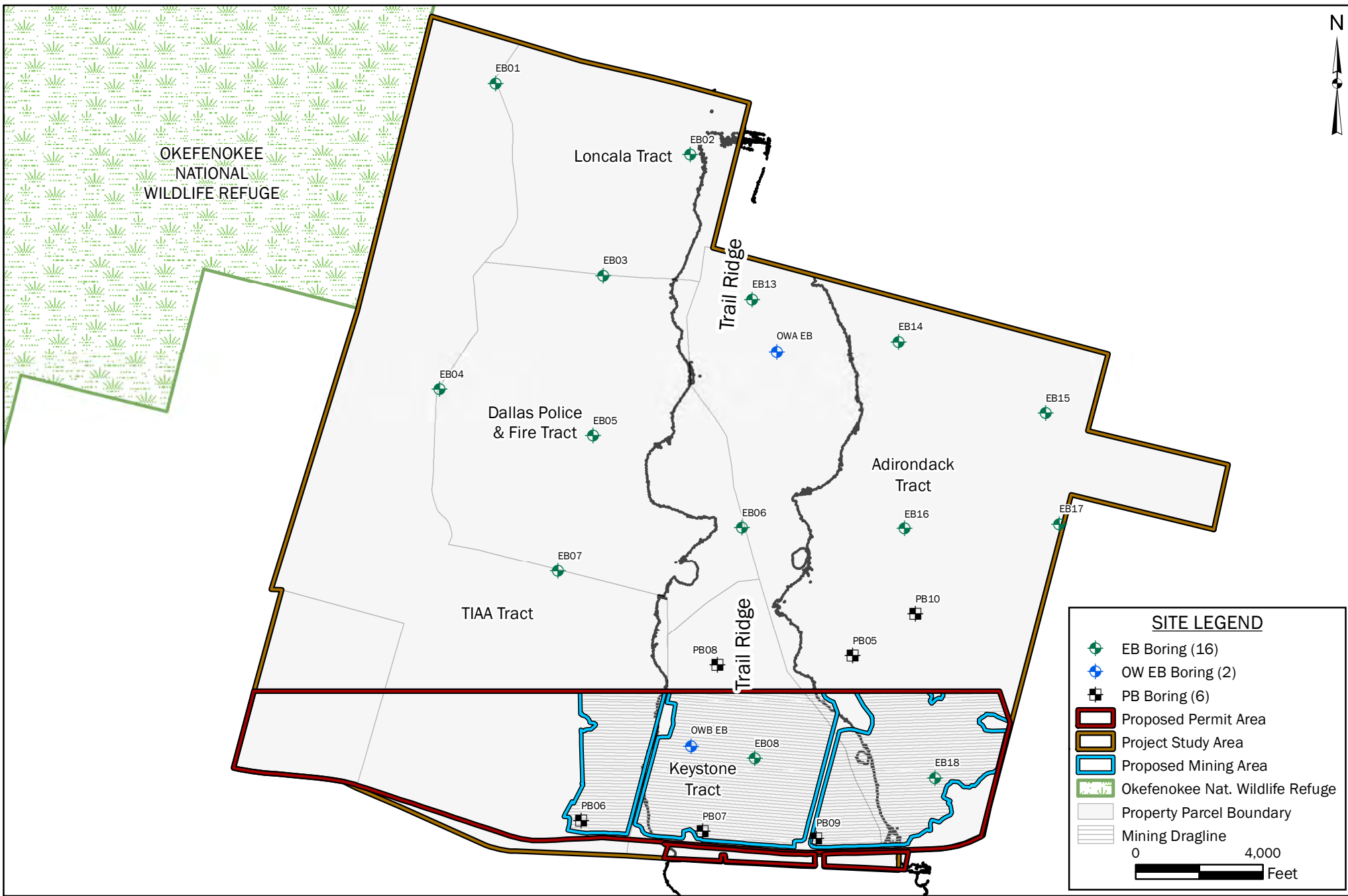


FIGURE 4: EXPLORATORY BORING LOCATION MAP
TWIN PINES MINERALS
 ST. GEORGE, CHARLTON COUNTY, GEORGIA

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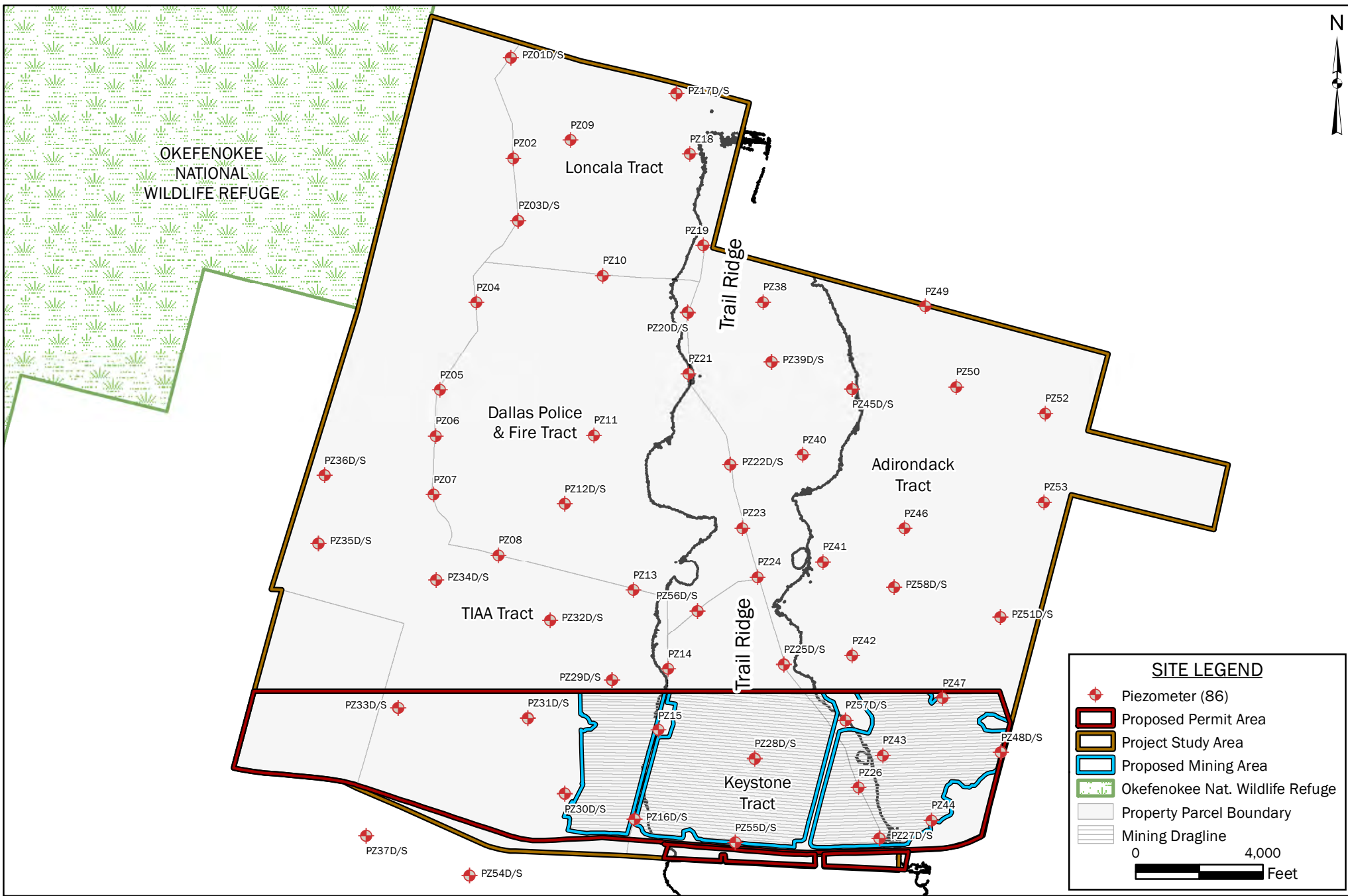


FIGURE 5: PIEZOMETER LOCATION MAP
TWIN PINES MINERALS
 ST. GEORGE, CHARLTON COUNTY, GEORGIA

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CHECKED BY: JRS
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REVISION DATE: N/A
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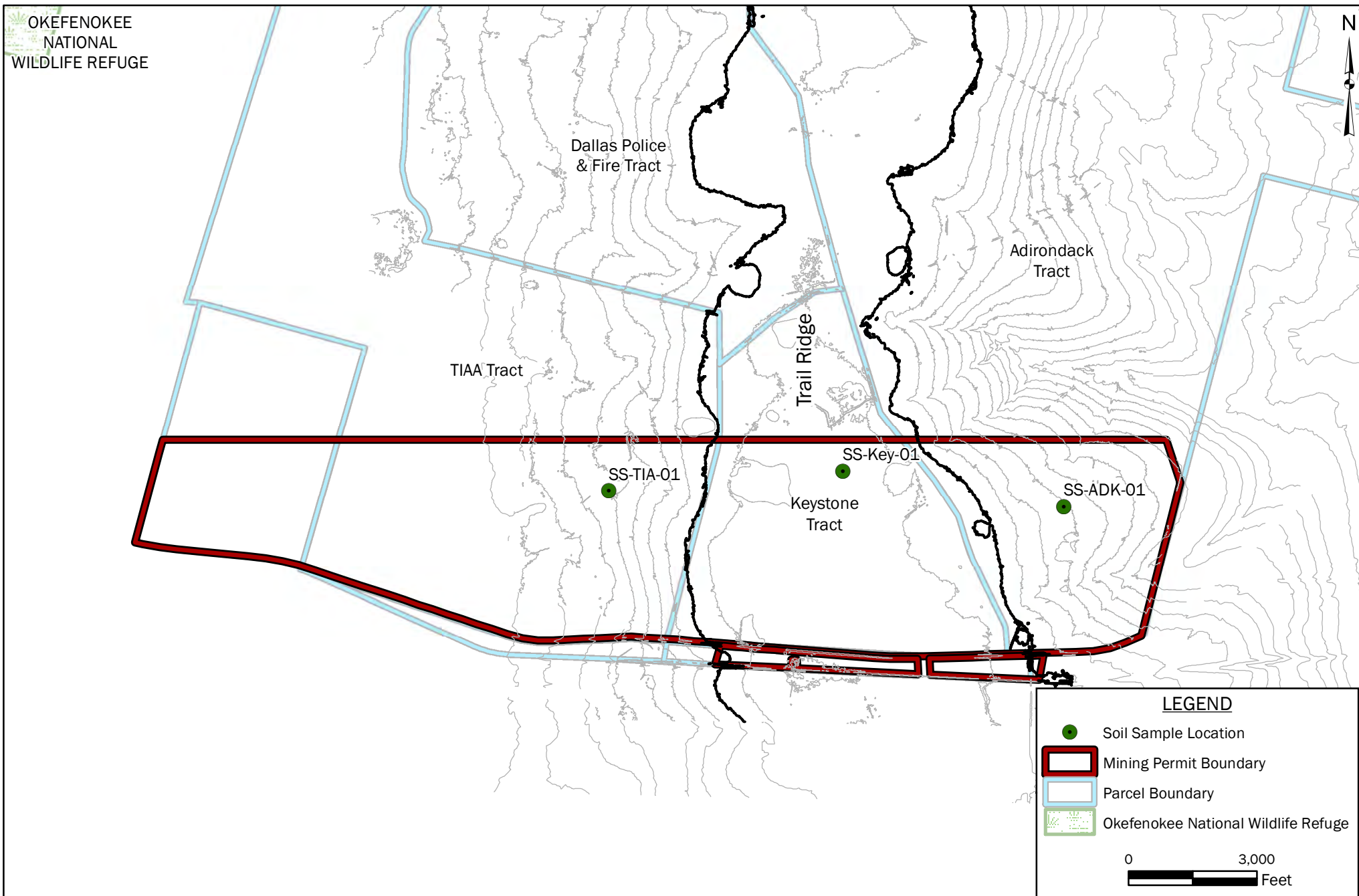


FIGURE 6: SOIL MOISTURE SAMPLING LOCATION MAP
TWIN PINES MINERALS
ST. GEORGE, CHARLTON COUNTY, GEORGIA

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CHECKED BY: JRS
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TTL JOB NO.: 000180200804.00
APPROX. SCALE: 1 in = 3,000 ft

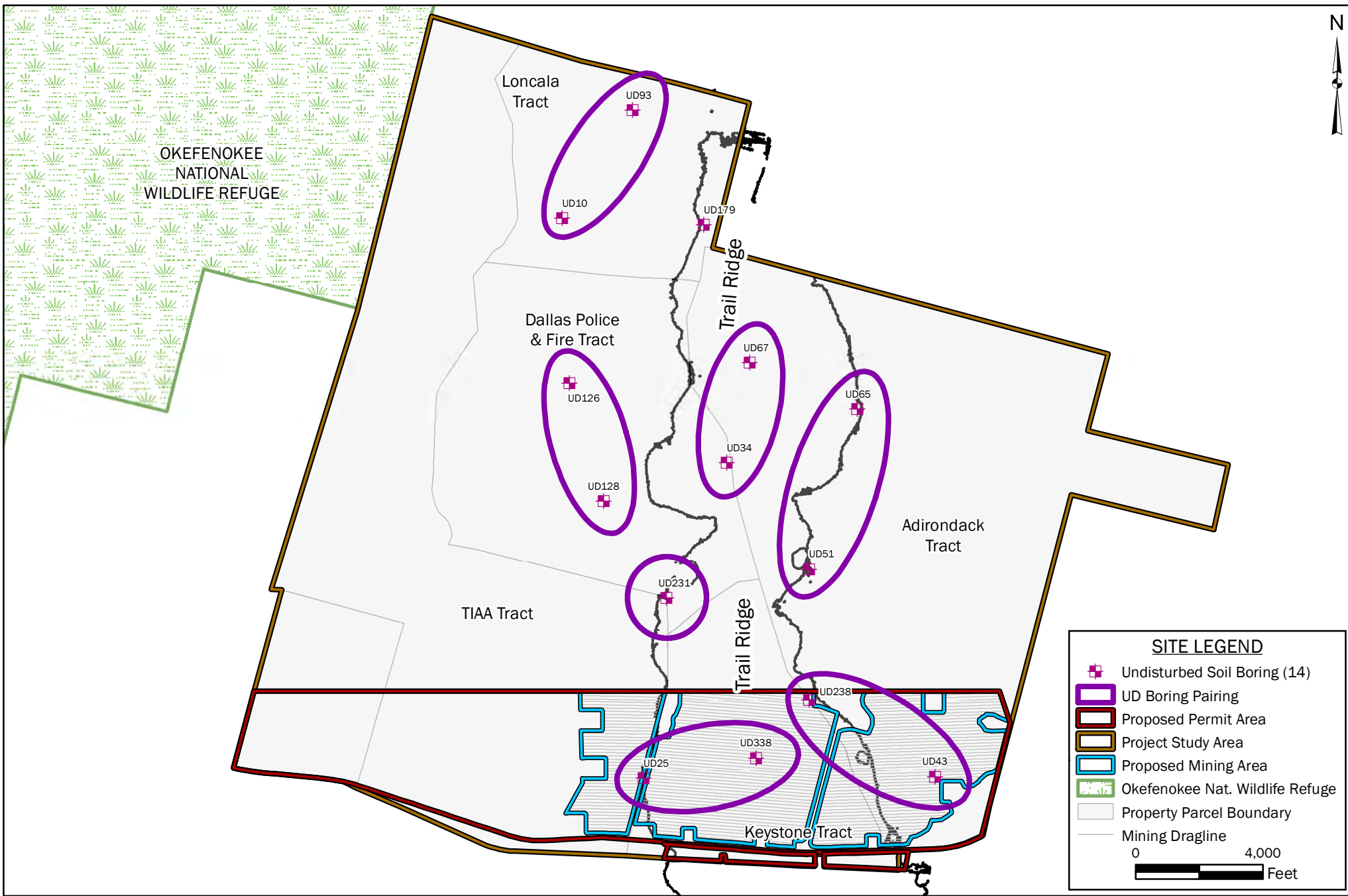


FIGURE 7: UNDISTURBED (UD) SOIL BORING LOCATION & POST MINERAL PROCESSING PAIRING MAP
TWIN PINES MINERALS
 ST. GEORGE, CHARLTON COUNTY, GEORGIA

DRAWN BY: DEK
CHECKED BY: JRS
DRAWING DATE: 10/1/2019
REVISION DATE: N/A
TTL JOB NO.: 000180200804.00
APPROX. SCALE: 1 in = 4,000 ft

TABLES

Table 1: Summary of Undisturbed Samples Collected for Vertical Hydraulic Conductivity Analysis from Undisturbed Borings; Twin Pines Minerals, LLC; St. George, Charlton County, Georgia. TTL Project No. 000180200804.00

Sample Identifier	Northing	Easting	Land Surface Elevation (ft. amsl)	Sample Depth Top (ft. bgs)	Sample Depth Bottom (ft. bgs)	Sample Depth Top (ft. amsl)	Sample Depth Bottom (ft. amsl)	Undisturbed/ Remolded?	Analytical Method	Laboratory
UD10	208093.3130	666408.7486	131.70	13	15	118.70	116.70	Undisturbed	ASTM D 5084 "Measurement of Hydraulic Conductivity"	Bowser-Morner, Inc.
UD10	208093.3130	666408.7486	131.70	28	30	103.70	101.70	Undisturbed		
UD10	208093.3130	666408.7486	131.70	43	45	88.70	86.70	Undisturbed		
UD25	190488.7166	668975.1185	165.49	15	17	150.49	148.49	Undisturbed	ASTM D 5084 "Measurement of Hydraulic Conductivity"	Bowser-Morner, Inc.
UD25	190488.7166	668975.1185	165.49	30	32	135.49	133.49	Undisturbed		
UD25	190488.7166	668975.1185	165.49	43	45	122.49	120.49	Undisturbed		
UD34	200408.2230	671582.2720	170.29	13	15	157.29	155.29	Undisturbed	ASTM D 5084 "Measurement of Hydraulic Conductivity"	Bowser-Morner, Inc.
UD34	200408.2230	671582.2720	170.29	28	29	142.29	141.29	Undisturbed		
UD34	200408.2230	671582.2720	170.29	48	50	122.29	120.29	Undisturbed		
UD43	190542.5306	678135.6130	148.55	13	15	135.55	133.55	Undisturbed	ASTM D 5084 "Measurement of Hydraulic Conductivity"	Bowser-Morner, Inc.
UD43	190542.5306	678135.6130	148.55	30	32	118.55	116.55	Undisturbed		
UD43	190542.5306	678135.6130	148.55	43	45	105.55	103.55	Undisturbed		
UD51	197065.1026	674174.9889	165.00	13	15	152.00	150.00	Undisturbed	ASTM D 5084 "Measurement of Hydraulic Conductivity"	Bowser-Morner, Inc.
UD51	197065.1026	674174.9889	165.00	28	30	137.00	135.00	Undisturbed		
UD51	197065.1026	674174.9889	165.00	43	45	122.00	120.00	Undisturbed		
UD65	202093.9328	675684.2974	166.76	17	19	149.76	147.76	Undisturbed	ASTM D 5084 "Measurement of Hydraulic Conductivity"	Bowser-Morner, Inc.
UD65	202093.9328	675684.2974	166.76	28	30	138.76	136.76	Undisturbed	ASTM D 2434 "Measurement of Hydraulic Conductivity"	
UD65	202093.9328	675684.2974	166.76	43	45	123.76	121.76	Remolded		
UD67	203551.9396	672306.1274	172.06	17	19	155.06	153.06	Undisturbed	ASTM D 5084 "Measurement of Hydraulic Conductivity"	Bowser-Morner, Inc.
UD67	203551.9396	672306.1274	172.06	28	30	144.06	142.06	Undisturbed		
UD67	203551.9396	672306.1274	172.06	43	45	129.06	127.06	Undisturbed		
UD93	211493.3310	668617.5144	150.25	13	15	137.25	135.25	Undisturbed	ASTM D 5084 "Measurement of Hydraulic Conductivity"	Bowser-Morner, Inc.
UD93	211493.3310	668617.5144	150.25	28	30	122.25	120.25	Undisturbed		
UD93	211493.3310	668617.5144	150.25	43	45	107.25	105.25	Undisturbed		
UD126	202917.1019	666640.3662	140.22	13	15	127.22	125.22	Undisturbed	ASTM D 5084 "Measurement of Hydraulic Conductivity"	Bowser-Morner, Inc.
UD126	202917.1019	666640.3662	140.22	28	30	112.22	110.22	Undisturbed		
UD126	202917.1019	666640.3662	140.22	43	45	97.22	95.22	Undisturbed		
UD128	199193.1410	667712.6820	150.52	13	15	137.52	135.52	Undisturbed	ASTM D 5084 "Measurement of Hydraulic Conductivity"	Bowser-Morner, Inc.
UD128	199193.1410	667712.6820	150.52	30	32	120.52	118.52	Undisturbed		
UD128	199193.1410	667712.6820	150.52	43	45	107.52	105.52	Undisturbed		
UD179	207884.9971	670857.1818	166.08	13	15	153.08	151.08	Undisturbed	ASTM D 5084 "Measurement of Hydraulic Conductivity"	Bowser-Morner, Inc.
UD179	207884.9971	670857.1818	166.08	28	30	138.08	136.08	Undisturbed		
UD179	207884.9971	670857.1818	166.08	43	45	123.08	121.08	Undisturbed		

Table 1: Summary of Undisturbed Samples Collected for Vertical Hydraulic Conductivity Analysis from Undisturbed Borings; Twin Pines Minerals, LLC; St. George, Charlton County, Georgia. TTL Project No. 000180200804.00

Sample Identifier	Northing	Easting	Land Surface Elevation (ft. amsl)	Sample Depth Top (ft. bgs)	Sample Depth Bottom (ft. bgs)	Sample Depth Top (ft. amsl)	Sample Depth Bottom (ft. amsl)	Undisturbed/ Remolded?	Analytical Method	Laboratory
UD231	196158.7390	669687.5038	167.53	13	15	154.53	152.53	Undisturbed	ASTM D 5084 "Measurement of Hydraulic Conductivity"	Bowser-Morner, Inc.
UD231	196158.7390	669687.5038	167.53	30	32	137.53	135.53	Undisturbed		
UD231	196158.7390	669687.5038	167.53	43	45	124.53	122.53	Undisturbed		
UD238	192952.8585	674171.2238	168.31	13	15	155.31	153.31	Undisturbed	ASTM D 5084 "Measurement of Hydraulic Conductivity"	Bowser-Morner, Inc.
UD238	192952.8585	674171.2238	168.31	28	30	140.31	138.31	Undisturbed		
UD238	192952.8585	674171.2238	168.31	43	45	125.31	123.31	Undisturbed		
UD338	191127.7310	672504.6590	173.56	13	15	160.56	158.56	Undisturbed	ASTM D 5084 "Measurement of Hydraulic Conductivity"	Bowser-Morner, Inc.
UD338	191127.7310	672504.6590	173.56	28	30	145.56	143.56	Undisturbed		
UD338	191127.7310	672504.6590	173.56	43	45	130.56	128.56	Undisturbed		
UD25R	NS	NS	NS	3	5	NS	NS	Undisturbed	ASTM D 5084 "Measurement of Hydraulic Conductivity"	TTL, Inc.
UD25R	NS	NS	NS	10	12	NS	NS	Undisturbed		
UD43R	NS	NS	NS	5	7	NS	NS	Undisturbed	ASTM D 5084 "Measurement of Hydraulic Conductivity"	TTL, Inc.
UD43R	NS	NS	NS	10	12	NS	NS	Undisturbed		
UD238R	NS	NS	NS	6	8	NS	NS	Undisturbed	ASTM D 5084 "Measurement of Hydraulic Conductivity"	TTL, Inc.
UD238R	NS	NS	NS	10	12	NS	NS	Undisturbed		
UD338R	NS	NS	NS	9	11	NS	NS	Undisturbed	ASTM D 5084 "Measurement of Hydraulic Conductivity"	TTL, Inc.

Notes: ft bgs = feet below ground surface NS = Not surveyed; borings performed within 5-10 feet of original UD boring
ft. amsl = feet above mean sea level

Table 2: Summary of Undisturbed Samples Collected for Vertical Hydraulic Conductivity Analysis from Exploratory and Piezometer Borings; Twin Pines Minerals, LLC; St. George, Charlton County, Georgia. TTL Project No. 000180200804.00

Sample Identifier	Northing	Easting	Land Surface Elevation (ft. amsl)	Sample Depth Top (ft. bgs)	Sample Depth Bottom (ft. bgs)	Sample Depth Top (ft. amsl)	Sample Depth Bottom (ft. amsl)	Undisturbed/ Remolded?	Analytical Method	Laboratory
EB03	667706.7987	206290.6294	145.44	92.5	94	52.94	51.44	Undisturbed	ASTM D 5084 "Measurement of Hydraulic Conductivity"	TTL, Inc.
EB06	672066.9668	198366.9546	171.50	120	122	51.50	49.50	Undisturbed	ASTM D 5084 "Measurement of Hydraulic Conductivity"	TTL, Inc.
EB08	672464.5741	191112.0239	173.68	130	133	43.68	40.68	Undisturbed	ASTM D 5084 "Measurement of Hydraulic Conductivity"	TTL, Inc.
EB16	677166.6458	198336.5709	140.28	12	12.5	128.28	127.78	Remolded	ASTM D 2434 "Measurement of Hydraulic Conductivity"	TTL, Inc.
EB16	677166.6458	198336.5709	140.28	15.5	17	124.78	123.28	Disturbed	ASTM D 5084 "Measurement of Hydraulic Conductivity"	TTL, Inc.
EB16	677166.6458	198336.5709	140.28	25.5	26	114.78	114.28	Remolded	ASTM D 2434 "Measurement of Hydraulic Conductivity"	TTL, Inc.
EB16	677166.6458	198336.5709	140.28	34.5	36	105.78	104.28	Remolded	ASTM D 2434 "Measurement of Hydraulic Conductivity"	TTL, Inc.
EB16	677166.6458	198336.5709	140.28	44.5	46	95.78	94.28	Remolded	ASTM D 2434 "Measurement of Hydraulic Conductivity"	TTL, Inc.
EB16	677166.6458	198336.5709	140.28	86	90	54.28	50.28	Disturbed	ASTM D 5084 "Measurement of Hydraulic Conductivity"	TTL, Inc.
PZ57D	675314.5224	192314.0733	165.62	20	22	145.62	143.62	Undisturbed	ASTM D 5084 "Measurement of Hydraulic Conductivity"	TTL, Inc.
PZ57D	675314.5224	192314.0733	165.62	25	27	140.62	138.62	Undisturbed	ASTM D 5084 "Measurement of Hydraulic Conductivity"	TTL, Inc.

Notes: ft bgs = feet below ground surface
ft. amsl = feet above mean sea level

Table 3: Laboratory Results of Soil Samples Analyzed for Vertical Hydraulic Conductivity; Twin Pines Minerals, LLC; St. George, Charlton County, Georgia. TTL Project No. 000180200804.00

Sample Identifier	Northing	Easting	Land Surface Elevation (ft. amsl)	Sample Depth Top (ft. bgs)	Sample Depth Bottom (ft. bgs)	Sample Elevation Top (ft. amsl)	Sample Elevation Bottom (ft. amsl)	USCS	Vertical Hydraulic Conductivity (Kv) (cm/sec)	Undisturbed/ Remolded?	Laboratory	Sample Notes
UD10	208093.3130	666408.7486	131.70	13	15	118.70	116.70	SP-SM	1.30E-04	Undisturbed	Bowser-Morner, Inc.	Unconsolidated Sand
UD10	208093.3130	666408.7486	131.70	28	30	103.70	101.70	SP	2.00E-05	Undisturbed		Unconsolidated Sand
UD10	208093.3130	666408.7486	131.70	43	45	88.70	86.70	SP-SM	1.90E-05	Undisturbed		Unconsolidated Sand
UD25	190488.7166	668975.1185	165.49	15	17	150.49	148.49	SP-SM	1.40E-05	Undisturbed	Bowser-Morner, Inc.	Semi-Consolidated Sand
UD25	190488.7166	668975.1185	165.49	30	32	135.49	133.49	SP	8.20E-05	Undisturbed		Unconsolidated Sand
UD25	190488.7166	668975.1185	165.49	43	45	122.49	120.49	SP	1.40E-06	Undisturbed		Unconsolidated Sand
UD34	200408.2230	671582.2720	170.29	13	15	157.29	155.29	SP-SM	1.00E-05	Undisturbed	Bowser-Morner, Inc.	Consolidated Sand
UD34	200408.2230	671582.2720	170.29	28	29	142.29	141.29	SP	7.80E-07	Undisturbed		Unconsolidated Sand
UD34	200408.2230	671582.2720	170.29	48	50	122.29	120.29	SP	4.40E-07	Undisturbed		Semi-consolidated Sand
UD43	190542.5306	678135.6130	148.55	13	15	135.55	133.55	SP	7.00E-06	Undisturbed	Bowser-Morner, Inc.	Unconsolidated Sand
UD43	190542.5306	678135.6130	148.55	30	32	118.55	116.55	SP-SM	3.80E-06	Undisturbed		Unconsolidated Sand
UD43	190542.5306	678135.6130	148.55	43	45	105.55	103.55	SC	1.70E-08	Undisturbed		Clayey Sand
UD51	197065.1026	674174.9889	165.00	13	15	152.00	150.00	SP-SM	5.20E-06	Undisturbed	Bowser-Morner, Inc.	Semi-Consolidated Sand (Black)
UD51	197065.1026	674174.9889	165.00	28	30	137.00	135.00	SP-SM	7.60E-06	Undisturbed		Unconsolidated Sand
UD51	197065.1026	674174.9889	165.00	43	45	122.00	120.00	SP	6.90E-05	Undisturbed		Unconsolidated Sand
UD65	202093.9328	675684.2974	166.76	17	19	149.76	147.76	SP	2.80E-04	Undisturbed	Bowser-Morner, Inc.	Semi-Consolidated
UD65	202093.9328	675684.2974	166.76	28	30	138.76	136.76	SP	1.10E-04	Undisturbed		Unconsolidated Sand
UD65	202093.9328	675684.2974	166.76	43	45	123.76	121.76	SP	6.30E-02	Remolded		Consolidated - Sity-Clay Sand
UD67	203551.9396	672306.1274	172.06	17	19	155.06	153.06	SP-SM	1.40E-04	Undisturbed	Bowser-Morner, Inc.	Semi-Consolidated Sand
UD67	203551.9396	672306.1274	172.06	28	30	144.06	142.06	SP	2.90E-04	Undisturbed		Unconsolidated Sand
UD67	203551.9396	672306.1274	172.06	43	45	129.06	127.06	SP	4.10E-06	Undisturbed		Unconsolidated Sand
UD93	211493.3310	668617.5144	150.25	13	15	137.25	135.25	SP	6.50E-07	Undisturbed	Bowser-Morner, Inc.	Consolidated Sand
UD93	211493.3310	668617.5144	150.25	28	30	122.25	120.25	SP-SM	2.40E-05	Undisturbed		Unconsolidated Sand
UD93	211493.3310	668617.5144	150.25	43	45	107.25	105.25	SP	2.80E-05	Undisturbed		Unconsolidated Sand
UD126	202917.1019	666640.3662	140.22	13	15	127.22	125.22	SP-SM	8.30E-05	Undisturbed	Bowser-Morner, Inc.	Consolidated Sand
UD126	202917.1019	666640.3662	140.22	28	30	112.22	110.22	SP	1.00E-05	Undisturbed		Unconsolidated Sand
UD126	202917.1019	666640.3662	140.22	43	45	97.22	95.22	SP-SM	9.30E-07	Undisturbed		Clayey Sand mixed w/ Fat Clay
UD128	199193.1410	667712.6820	150.52	13	15	137.52	135.52	SP	9.50E-05	Undisturbed	Bowser-Morner, Inc.	Semi-Consolidated Sand
UD128	199193.1410	667712.6820	150.52	30	32	120.52	118.52	SP-SM	2.20E-06	Undisturbed		Unconsolidated Sand
UD128	199193.1410	667712.6820	150.52	43	45	107.52	105.52	SP	1.70E-04	Undisturbed		Unconsolidated Sand
UD179	207884.9971	670857.1818	166.08	13	15	153.08	151.08	SP	2.10E-06	Undisturbed	Bowser-Morner, Inc.	Semi-Consolidated Sand
UD179	207884.9971	670857.1818	166.08	28	30	138.08	136.08	SP	3.90E-04	Undisturbed		Unconsolidated Sand
UD179	207884.9971	670857.1818	166.08	43	45	123.08	121.08	SP	2.00E-07	Undisturbed		Unconsolidated Sand
UD231	196158.7390	669687.5038	167.53	13	15	154.53	152.53	SP-SM	2.70E-06	Undisturbed	Bowser-Morner, Inc.	Unconsolidated Sand
UD231	196158.7390	669687.5038	167.53	30	32	137.53	135.53	SP-SM	6.00E-06	Undisturbed		Unconsolidated Sand
UD231	196158.7390	669687.5038	167.53	43	45	124.53	122.53	SP-SM	1.90E-05	Undisturbed		Semi-consolidated Sand

Table 3: Laboratory Results of Soil Samples Analyzed for Vertical Hydraulic Conductivity; Twin Pines Minerals, LLC; St. George, Charlton County, Georgia. TTL Project No. 000180200804.00

Sample Identifier	Northing	Easting	Land Surface Elevation (ft. amsl)	Sample Depth Top (ft. bgs)	Sample Depth Bottom (ft. bgs)	Sample Elevation Top (ft. amsl)	Sample Elevation Bottom (ft. amsl)	USCS	Vertical Hydraulic Conductivity (Kv) (cm/sec)	Undisturbed/ Remolded?	Laboratory	Sample Notes
UD238	192952.8585	674171.2238	168.31	13	15	155.31	153.31	SP-SM	1.00E-04	Undisturbed	Bowser-Morner, Inc.	Unconsolidated Sand
UD238	192952.8585	674171.2238	168.31	28	30	140.31	138.31	SP	3.30E-04	Undisturbed		Unconsolidated Sand
UD238	192952.8585	674171.2238	168.31	43	45	125.31	123.31	SP	1.20E-04	Undisturbed		Unconsolidated Sand
UD338	191127.7310	672504.6590	173.56	13	15	160.56	158.56	SP-SM	2.60E-06	Undisturbed	Bowser-Morner, Inc.	Semi-Consolidated Sand
UD338	191127.7310	672504.6590	173.56	28	30	145.56	143.56	SP-SM	2.20E-05	Undisturbed		Unconsolidated Sand
UD338	191127.7310	672504.6590	173.56	43	45	130.56	128.56	SP	9.20E-05	Undisturbed		Unconsolidated Sand
EB03	206290.6294	667706.7987	145.44	92.5	94	52.94	51.44	CH	1.61E-09	Undisturbed	TTL, Inc.	Clay
EB06	198366.9546	672066.9668	171.50	120	122	51.50	49.50	CL	1.29E-05	Undisturbed	TTL, Inc.	Clay
EB08	191112.0239	672464.5741	173.68	130	133	43.68	40.68	CH	9.29E-09	Undisturbed	TTL, Inc.	Clay
EB16	198336.5709	677166.6458	140.28	12	12.5	128.28	127.78	SP	9.60E-02	Remolded	TTL, Inc.	Unconsolidated Sand
EB16	198336.5709	677166.6458	140.28	15.5	17	124.78	123.28	SM	1.80E-04	Disturbed		Consolidated Sand
EB16	198336.5709	677166.6458	140.28	25.5	26	114.78	114.28	SM	2.30E-02	Remolded		Unconsolidated Sand
EB16	198336.5709	677166.6458	140.28	34.5	36	105.78	104.28	SP	1.90E-02	Remolded		Unconsolidated Sand
EB16	198336.5709	677166.6458	140.28	44.5	46	95.78	94.28	SP	2.40E-02	Remolded		Unconsolidated Sand
EB16	198336.5709	677166.6458	140.28	86	90	54.28	50.28	CH	1.30E-08	Disturbed		Clay
PZ57D	192314.0733	675314.5224	165.62	20	22	145.62	143.62	SM	2.70E-08	Undisturbed	TTL, Inc.	Consolidated Sand
PZ57D	192314.0733	675314.5224	165.62	25	27	140.62	138.62	SM	3.40E-07	Undisturbed		Consolidated Sand
UD25R	NS	NS	NS	3	5	NS	NS	SP-SM	3.20E-04	Undisturbed	TTL, Inc.	Unconsolidated Sand
UD25R	NS	NS	NS	10	12	NS	NS	SP	2.30E-04	Undisturbed		Unconsolidated Sand
UD43R	NS	NS	NS	5	7	NS	NS	SP	6.20E-04	Undisturbed	TTL, Inc.	Unconsolidated Sand
UD43R	NS	NS	NS	10	12	NS	NS	SP	4.50E-04	Undisturbed		Unconsolidated Sand
UD238R	NS	NS	NS	6	8	NS	NS	SP	8.50E-04	Undisturbed	TTL, Inc.	Unconsolidated Sand
UD238R	NS	NS	NS	10	12	NS	NS	SP	4.00E-04	Undisturbed		Unconsolidated Sand
UD338R	NS	NS	NS	9	11	NS	NS	SP	3.00E-04	Undisturbed	TTL, Inc.	Unconsolidated Sand

Notes: ft bgs = feet below ground surface
ft. amsl = feet above mean sea level

USCS = Unified Soil Classification System
cm/sec = centimeters per second

NS = Not surveyed; borings performed within 5-10 feet of original UD boring

Table 4: Laboratory Results of Soil Samples Analyzed for Porosity; Twin Pines Minerals, LLC; St. George, Charlton County, Georgia. TTL Project No. 000180200804.00

Sample Identifier	Northing	Easting	Land Surface Elevation (ft. amsl)	Sample Depth Top (ft. bgs)	Sample Depth Bottom (ft. bgs)	Sample Elevation Top (ft. amsl)	Sample Elevation Bottom (ft. amsl)	USCS	Porosity	Sample Notes
UD10	208093.3130	666408.7486	131.70	13	15	118.70	116.70	SP-SM	36.7%	Unconsolidated Sand
UD10	208093.3130	666408.7486	131.70	28	30	103.70	101.70	SP	38.7%	Unconsolidated Sand
UD10	208093.3130	666408.7486	131.70	43	45	88.70	86.70	SP-SM	35.5%	Unconsolidated Sand
UD25	190488.7166	668975.1185	165.49	15	17	150.49	148.49	SP-SM	43.7%	Semi-Consolidated Sand
UD25	190488.7166	668975.1185	165.49	30	32	135.49	133.49	SP	41.6%	Unconsolidated Sand
UD25	190488.7166	668975.1185	165.49	43	45	122.49	120.49	SP	35.0%	Unconsolidated Sand
UD34	200408.2230	671582.2720	170.29	13	15	157.29	155.29	SP-SM	32.9%	Consolidated Sand
UD34	200408.2230	671582.2720	170.29	28	29	142.29	141.29	SP	42.0%	Unconsolidated Sand
UD34	200408.2230	671582.2720	170.29	48	50	122.29	120.29	SP	40.8%	Semi-consolidated Sand
UD43	190542.5306	678135.6130	148.55	13	15	135.55	133.55	SP	39.6%	Unconsolidated Sand
UD43	190542.5306	678135.6130	148.55	30	32	118.55	116.55	SP-SM	36.6%	Unconsolidated Sand
UD43	190542.5306	678135.6130	148.55	43	45	105.55	103.55	SC	35.2%	Clayey Sand
UD51	197065.1026	674174.9889	165.00	13	15	152.00	150.00	SP-SM	33.8%	Semi-Consolidated Sand (Black)
UD51	197065.1026	674174.9889	165.00	28	30	137.00	135.00	SP-SM	39.1%	Unconsolidated Sand
UD51	197065.1026	674174.9889	165.00	43	45	122.00	120.00	SP	32.0%	Unconsolidated Sand
UD65	202093.9328	675684.2974	166.76	17	19	149.76	147.76	SP	40.0%	Semi-Consolidated
UD65	202093.9328	675684.2974	166.76	28	30	138.76	136.76	SP	37.7%	Unconsolidated Sand
UD65	202093.9328	675684.2974	166.76	43	45	123.76	121.76	SP	36.5%	Consolidated - Sity-Clay Sand
UD67	203551.9396	672306.1274	172.06	17	19	155.06	153.06	SP-SM	33.1%	Semi-Consolidated Sand
UD67	203551.9396	672306.1274	172.06	28	30	144.06	142.06	SP	39.8%	Unconsolidated Sand
UD67	203551.9396	672306.1274	172.06	43	45	129.06	127.06	SP	31.7%	Unconsolidated Sand
UD93	211493.3310	668617.5144	150.25	13	15	137.25	135.25	SP	37.7%	Consolidated Sand
UD93	211493.3310	668617.5144	150.25	28	30	122.25	120.25	SP-SM	33.7%	Unconsolidated Sand
UD93	211493.3310	668617.5144	150.25	43	45	107.25	105.25	SP	35.5%	Unconsolidated Sand
UD126	202917.1019	666640.3662	140.22	13	15	127.22	125.22	SP-SM	31.3%	Consolidated Sand
UD126	202917.1019	666640.3662	140.22	28	30	112.22	110.22	SP	31.3%	Unconsolidated Sand
UD126	202917.1019	666640.3662	140.22	43	45	97.22	95.22	SP-SM	33.0%	Clayey Sand mixed w/ Fat Clay
UD128	199193.1410	667712.6820	150.52	13	15	137.52	135.52	SP	37.5%	Semi-Consolidated Sand
UD128	199193.1410	667712.6820	150.52	30	32	120.52	118.52	SP-SM	39.1%	Unconsolidated Sand
UD128	199193.1410	667712.6820	150.52	43	45	107.52	105.52	SP	36.0%	Unconsolidated Sand
UD179	207884.9971	670857.1818	166.08	13	15	153.08	151.08	SP	38.5%	Semi-Consolidated Sand
UD179	207884.9971	670857.1818	166.08	28	30	138.08	136.08	SP	34.6%	Unconsolidated Sand
UD179	207884.9971	670857.1818	166.08	43	45	123.08	121.08	SP	34.4%	Unconsolidated Sand

Table 4: Laboratory Results of Soil Samples Analyzed for Porosity; Twin Pines Minerals, LLC; St. George, Charlton County, Georgia. TTL Project No. 000180200804.00

Sample Identifier	Northing	Easting	Land Surface Elevation (ft. amsl)	Sample Depth Top (ft. bgs)	Sample Depth Bottom (ft. bgs)	Sample Elevation Top (ft. amsl)	Sample Elevation Bottom (ft. amsl)	USCS	Porosity	Sample Notes
UD231	196158.7390	669687.5038	167.53	13	15	154.53	152.53	SP-SM	37.1%	Unconsolidated Sand
UD231	196158.7390	669687.5038	167.53	30	32	137.53	135.53	SP-SM	30.1%	Unconsolidated Sand
UD231	196158.7390	669687.5038	167.53	43	45	124.53	122.53	SP-SM	35.4%	Semi-consolidated Sand
UD238	192952.8585	674171.2238	168.31	13	15	155.31	153.31	SP-SM	33.5%	Unconsolidated Sand
UD238	192952.8585	674171.2238	168.31	28	30	140.31	138.31	SP	35.9%	Unconsolidated Sand
UD238	192952.8585	674171.2238	168.31	43	45	125.31	123.31	SP	33.2%	Unconsolidated Sand
UD338	191127.7310	672504.6590	173.56	13	15	160.56	158.56	SP-SM	33.9%	Semi-Consolidated Sand
UD338	191127.7310	672504.6590	173.56	28	30	145.56	143.56	SP-SM	37.0%	Unconsolidated Sand
UD338	191127.7310	672504.6590	173.56	43	45	130.56	128.56	SP	35.3%	Unconsolidated Sand

Notes: ft bgs = feet below ground surface
ft. amsl = feet above mean sea level

USCS = Unified Soil Classification System

Table 5 : Summary of Grain-Size Distribution Analysis of Soil Samples Collected from Borings; Twin Pines Minerals, LLC; St. George, Charlton County, Georgia. TTL Project No. 000180200804.00

Sample Identifier	Northing	Easting	Land Surface Elevation (ft. amsl)	Sample Depth Top (ft. bgs)	Sample Depth Bottom (ft. bgs)	Sample Elevation Top (ft. amsl)	Sample Elevation Bottom (ft. amsl)	Gradation Percent Sand	Gradation Percent Silt/Clay
PZ01S	213145.7250	664792.9515	122.98	6	9	116.98	113.98	84.9	15.1
PZ01S	213145.7250	664792.9515	122.98	12.5	20	110.48	102.98	95.0	5.0
PZ02	209988.5659	664881.4667	126.02	4	10	122.02	116.02	90.3	9.7
PZ02	209988.5659	664881.4667	126.02	17.5	20	108.52	106.02	95.8	4.2
PZ03S	208020.1141	665029.0251	123.77	3	7	120.77	116.77	88.9	11.1
PZ03S	208020.1141	665029.0251	123.77	18	20	105.77	103.77	92.5	7.5
PZ03D	208027.2407	665032.2313	123.50	7	12	116.50	111.50	49.5	50.5
PZ03D	208027.2407	665032.2313	123.50	36	50	87.50	73.50	48.9	51.1
PZ04	205447.0841	663720.3298	123.94	6	11	117.94	112.94	92.0	8.0
PZ04	205447.0841	663720.3298	123.94	15	20	108.94	103.94	96.1	3.9
PZ05	202705.7568	662571.7449	124.62	5	11	119.62	113.62	69.2	30.8
PZ05	202705.7568	662571.7449	124.62	15	20	109.62	104.62	90.1	9.9
PZ06	201256.8347	662436.2138	124.39	7.5	8	116.89	116.39	94.8	5.2
PZ06	201256.8347	662436.2138	124.39	14	20	110.39	104.39	78.8	21.2
PZ07	199410.2734	662371.7196	123.08	5	7	118.08	116.08	85.3	14.7
PZ07	199410.2734	662371.7196	123.08	9	20	114.08	103.08	93.2	6.8
PZ08	197508.9048	664403.2655	130.19	5	6.5	125.19	123.69	85.1	14.9
PZ08	197508.9048	664403.2655	130.19	15	20	115.19	110.19	92.5	7.5
PZ09	210549.7044	666674.5353	135.39	7	10	128.39	125.39	91.8	8.2
PZ09	210549.7044	666674.5353	135.39	27	30	108.39	105.39	95.4	4.6
PZ10	206292.4778	667689.3258	145.72	5	8	140.72	137.72	93.2	6.8
PZ10	206292.4778	667689.3258	145.72	28	30	117.72	115.72	92.4	7.6
PZ11	201281.0529	667407.6724	147.48	8	13	139.48	134.48	92.0	8.0
PZ11	201281.0529	667407.6724	147.48	13	19	134.48	128.48	98.3	1.7
PZ12S	199119.7966	666484.6179	138.16	5	9	133.16	129.16	77.6	22.4
PZ12S	199119.7966	666484.6179	138.16	19	20	119.16	118.16	92.0	8.0
PZ12D	199125.8047	666484.2013	137.52	9	19	128.52	118.52	49.2	50.8
PZ12D	199125.8047	666484.2013	137.52	26	40	111.52	97.52	47.3	52.7
PZ13	196413.6877	668652.4560	157.47	5	20	152.47	137.47	90.3	9.7
PZ13	196413.6877	668652.4560	157.47	27	28	130.47	129.47	93.4	6.6
PZ14	193936.6051	669743.4272	167.32	3	9	164.32	158.32	95.8	4.2
PZ14	193936.6051	669743.4272	167.32	27	30	140.32	137.32	97.2	2.8
PZ15	192000.6802	669433.9007	166.95	4	5.5	162.95	161.45	92.9	7.1
PZ15	192000.6802	669433.9007	166.95	6	9	160.95	157.95	84.9	15.1
PZ15	192000.6802	669433.9007	166.95	9	12	157.95	154.95	48.4	51.6
PZ15	192000.6802	669433.9007	166.95	12.5	20	154.45	146.95	95.0	5.0
PZ15	192000.6802	669433.9007	166.95	28	29	138.95	137.95	98.5	1.5
PZ16S	189192.1062	668683.7808	160.60	5	8	155.60	152.60	90.2	9.8
PZ16S	189192.1062	668683.7808	160.60	18	20	142.60	140.60	98.0	2.0
PZ16D	189193.4656	668689.3844	160.43	10	19	150.43	141.43	48.0	52.0
PZ16D	189193.4656	668689.3844	160.43	41	42.5	119.43	117.93	48.0	52.0
PZ17S	212018.9084	669994.2076	161.58	9	10	152.58	151.58	48.7	51.3
PZ17D	212015.6518	670005.1448	160.89	8	10	152.89	150.89	97.4	2.6
PZ17D	212015.6518	670005.1448	160.89	40	45	120.89	115.89	99.2	0.8
PZ18	210112.6384	670419.4050	164.38	13	18	151.38	146.38	97.0	3.0
PZ18	210112.6384	670419.4050	164.38	18	20	146.38	144.38	91.2	8.8
PZ19	207234.6924	670845.9142	169.57	6	13	163.57	156.57	98.2	1.8
PZ19	207234.6924	670845.9142	169.57	13	18	156.57	151.57	95.5	4.5
PZ20D	205134.8784	670360.6665	168.43	7	16	161.43	152.43	97.4	2.6
PZ20D	205134.8784	670360.6665	168.43	33	40	135.43	128.43	98.1	1.9
PZ21	203215.0202	670383.6651	164.61	3	5	161.61	159.61	91.1	8.9
PZ21	203215.0202	670383.6651	164.61	6	17	158.61	147.61	93.0	7.0
PZ22S	200359.9896	671694.6840	170.17	9	10	161.17	160.17	48.2	51.8

Table 5 : Summary of Grain-Size Distribution Analysis of Soil Samples Collected from Borings; Twin Pines Minerals, LLC; St. George, Charlton County, Georgia. TTL Project No. 000180200804.00

Sample Identifier	Northing	Easting	Land Surface Elevation (ft. amsl)	Sample Depth Top (ft. bgs)	Sample Depth Bottom (ft. bgs)	Sample Elevation Top (ft. amsl)	Sample Elevation Bottom (ft. amsl)	Gradation Percent Sand	Gradation Percent Silt/Clay
PZ22D	200357.7075	671700.7149	170.54	18	23	152.54	147.54	95.3	4.7
PZ22D	200357.7075	671700.7149	170.54	35	38	135.54	132.54	98.9	1.1
PZ23	198353.0813	672071.4617	169.31	12.5	15	156.81	154.31	46.3	53.7
PZ24	196807.9532	672562.2118	169.44	6	7	163.44	162.44	95.2	4.8
PZ24	196807.9532	672562.2118	169.44	10	18	159.44	151.44	93.2	6.8
PZ25S	194061.9564	673383.9824	169.99	3	5	166.99	164.99	94.9	5.1
PZ25S	194061.9564	673383.9824	169.99	13	19	156.99	150.99	95.8	4.2
PZ25D	194070.0069	673381.4148	169.68	9	11	160.68	158.68	48.9	51.1
PZ25D	194070.0069	673381.4148	169.68	28.5	29	141.18	140.68	47.3	52.7
PZ26	190199.0854	675725.3696	168.99	0	6	168.99	162.99	93.0	7.0
PZ26	190199.0854	675725.3696	168.99	13.5	20	155.49	148.99	92.9	7.1
PZ27S	188607.1176	676385.2376	168.02	9	10	159.02	158.02	47.9	52.1
PZ27D	188607.9571	676394.0349	168.01	8	13	160.01	155.01	96.1	3.9
PZ27D	188607.9571	676394.0349	168.01	24	30	144.01	138.01	97.5	2.5
PZ28D	191101.7018	672470.6111	174.13	9	19	165.13	155.13	89.3	10.7
PZ28D	191101.7018	672470.6111	174.13	27	30	147.13	144.13	74.0	26.0
PZ38	205467.2108	672734.7122	171.69	6	7	165.69	164.69	48.0	52.0
PZ39D	203579.2608	672985.6825	171.84	19	20	152.84	151.84	46.7	53.3
PZ39D	203579.2608	672985.6825	171.84	77	79	94.84	92.84	51.0	49.0
PZ40	200660.5583	673966.9078	169.48	14	15	155.48	154.48	50.4	49.6
PZ43	191206.1308	676493.9937	161.68	5.5	18	156.18	143.68	50.7	49.3
PZ45D	202715.5700	675525.2030	166.58	18	22	148.58	144.58	49.9	50.1
PZ45D	202715.5700	675525.2030	166.58	49	49.5	117.58	117.08	50.9	49.1
PZ45S	202723.2096	675524.3128	166.64	6.5	7	160.14	159.64	50.5	49.5
PZ46	198343.7772	677166.5936	139.98	4	10	135.98	129.98	45.5	54.5
PZ47	193012.6975	678365.3361	138.30	13	15	125.30	123.30	49.8	50.2
PZ49	205324.4574	677820.5368	142.97	13.5	15	129.47	127.97	48.4	51.6
PZ50	202797.9514	678800.9975	127.64	12	13	115.64	114.64	48.9	51.1
PZ53	199168.3109	681563.2307	111.31	5	8	106.31	103.31	48.3	51.7
PZ53	199168.3109	681563.2307	111.31	7	10	104.31	101.31	48.8	51.2
UD10	208093.3130	666408.7486	131.70	13	15	118.70	116.70	93.6	6.4
UD10	208093.3130	666408.7486	131.70	28	30	103.70	101.70	95.6	4.4
UD10	208093.3130	666408.7486	131.70	43	45	88.70	86.70	94.7	5.3
UD25	190488.7166	668975.1185	165.49	15	17	150.49	148.49	93.8	6.2
UD25	190488.7166	668975.1185	165.49	30	32	135.49	133.49	96.1	3.9
UD25	190488.7166	668975.1185	165.49	43	45	122.49	120.49	95.3	4.7
UD34	200408.2230	671582.2720	170.29	13	15	157.29	155.29	92.3	7.7
UD34	200408.2230	671582.2720	170.29	28	29	142.29	141.29	96.7	3.3
UD34	200408.2230	671582.2720	170.29	48	50	122.29	120.29	95.8	4.2
UD43	190542.5306	678135.6130	148.55	13	15	135.55	133.55	96.1	3.9
UD43	190542.5306	678135.6130	148.55	30	32	118.55	116.55	93.9	6.1
UD43	190542.5306	678135.6130	148.55	43	45	105.55	103.55	73.8	26.2
UD51	197065.1026	674174.9889	165.00	13	15	152.00	150.00	92.7	7.3
UD51	197065.1026	674174.9889	165.00	28	30	137.00	135.00	93.4	6.6
UD51	197065.1026	674174.9889	165.00	43	45	122.00	120.00	98.5	1.5
UD65	202093.9328	675684.2974	166.76	17	19	149.76	147.76	97.5	2.5
UD65	202093.9328	675684.2974	166.76	28	30	138.76	136.76	98.3	1.7
UD65	202093.9328	675684.2974	166.76	43	45	123.76	121.76	98.7	1.3
UD67	203551.9396	672306.1274	172.06	17	19	155.06	153.06	92.4	5.4
UD67	203551.9396	672306.1274	172.06	28	30	144.06	142.06	96.3	2.3
UD67	203551.9396	672306.1274	172.06	43	45	129.06	127.06	97.0	2.8
UD93	211493.3310	668617.5144	150.25	13	15	137.25	135.25	95.5	4.5
UD93	211493.3310	668617.5144	150.25	28	30	122.25	120.25	94.3	5.7
UD93	211493.3310	668617.5144	150.25	43	45	107.25	105.25	97.6	2.4

Table 5 : Summary of Grain-Size Distribution Analysis of Soil Samples Collected from Borings; Twin Pines Minerals, LLC; St. George, Charlton County, Georgia. TTL Project No. 000180200804.00

Sample Identifier	Northing	Easting	Land Surface Elevation (ft. amsl)	Sample Depth Top (ft. bgs)	Sample Depth Bottom (ft. bgs)	Sample Elevation Top (ft. amsl)	Sample Elevation Bottom (ft. amsl)	Gradation Percent Sand	Gradation Percent Silt/Clay
UD126	202917.1019	666640.3662	140.22	13	15	127.22	125.22	92.3	7.7
UD126	202917.1019	666640.3662	140.22	28	30	112.22	110.22	96.8	3.2
UD126	202917.1019	666640.3662	140.22	43	45	97.22	95.22	90.5	9.5
UD128	199193.1410	667712.6820	150.52	13	15	137.52	135.52	96.7	3.3
UD128	199193.1410	667712.6820	150.52	30	32	120.52	118.52	89.5	10.5
UD128	199193.1410	667712.6820	150.52	43	45	107.52	105.52	96.8	3.2
UD179	207884.9971	670857.1818	166.08	13	15	153.08	151.08	98.0	2.0
UD179	207884.9971	670857.1818	166.08	28	30	138.08	136.08	96.0	4.0
UD179	207884.9971	670857.1818	166.08	43	45	123.08	121.08	95.9	4.1
UD231	196158.7390	669687.5038	167.53	13	15	154.53	152.53	94.3	5.7
UD231	196158.7390	669687.5038	167.53	30	32	137.53	135.53	93.6	6.4
UD231	196158.7390	669687.5038	167.53	43	45	124.53	122.53	92.5	7.5
UD238	192952.8585	674171.2238	168.31	13	15	155.31	153.31	94.9	5.1
UD238	192952.8585	674171.2238	168.31	28	30	140.31	138.31	96.4	3.6
UD238	192952.8585	674171.2238	168.31	43	45	125.31	123.31	97.1	2.9
UD338	191127.7310	672504.6590	173.56	13	15	160.56	158.56	94.5	5.5
UD338	191127.7310	672504.6590	173.56	28	30	145.56	143.56	94.5	5.5
UD338	191127.7310	672504.6590	173.56	43	45	130.56	128.56	96.9	3.1
UD25R	NS	NS	NS	3	5	NS	NS	91.4	8.6
UD25R	NS	NS	NS	10	12	NS	NS	96.8	3.2
UD43R	NS	NS	NS	5	7	NS	NS	96.6	3.4
UD43R	NS	NS	NS	10	12	NS	NS	99.0	1.0
UD238R	NS	NS	NS	6	8	NS	NS	98.3	1.7
UD238R	NS	NS	NS	10	12	NS	NS	98.7	1.4
UD338R	NS	NS	NS	9	11	NS	NS	96.2	3.8

Notes: ft bgs = feet below ground surface
ft amsl = feet above mean sea level

NS = Not surveyed; borings performed within 5-10 feet of original UD boring

Table 6. Results of Bench-Scale Study Vertical Hydraulic Conductivity Testing of Post-Processed Soils Compared to Undisturbed Sample PZ57D. Hydrogeology of the Twin Pines Project Area; Twin Pines Minerals, LLC; St. George, Charlton County, Georgia. TTL Project No. 000180200804.00

Sample Identifier	Bentonite Addition (%)	Hydraulic Conductivity (cm/sec)	Sample Type	ASTM Method
Post-Processed Sand Sample UD338/25				
UD338/25-A	0% bentonite	1.1×10^{-3}	Simulated In Situ	D 5084
UD338/25-B	0% bentonite	1.1×10^{-3}	Simulated In Situ	D 5084
UD338/25-C	0% bentonite	7.2×10^{-4}	Simulated In Situ	D 5084
UD338/25-A	0.35% bentonite to sand	7.0×10^{-4}	Simulated In Situ	D 5084
UD338/25-B	0.35% bentonite to sand	5.6×10^{-4}	Simulated In Situ	D 5084
UD338/25-C	0.35% bentonite to sand	1.2×10^{-3}	Simulated In Situ	D 5084
UD338/25-A	1.42% bentonite to sand	1.7×10^{-3}	Simulated In Situ	D 5084
UD338/25-B	1.42% bentonite to sand	1.6×10^{-3}	Simulated In Situ	D 5084
UD338/25-C	1.42% bentonite to sand	1.5×10^{-3}	Simulated In Situ	D 5084
UD338/25	5% bentonite to sand	5.7×10^{-6}	Remolded	D 5084
UD338/25	7.5% bentonite to sand	2.0×10^{-6}	Remolded	D 5084
UD338/25	10% bentonite to sand	3.0×10^{-7}	Remolded	D 5084
UD338/25	10% bentonite to sand	6.8×10^{-7}	Remolded	D 5084
UD338/25	12.5% bentonite to sand	1.0×10^{-8}	Remolded	D 5084
UD338/25	15% bentonite to sand	5.8×10^{-9}	Remolded	D 5084
UD338/25	15% bentonite to sand	5.0×10^{-9}	Remolded	D 5084
UD338/25	30% bentonite to sand	2.7×10^{-9}	Remolded	D 5084
UD338/25	30% bentonite to sand	2.0×10^{-9}	Remolded	D 5084
Undisturbed Soil Sample PZ57 - Consolidated Black Sand				
PZ57D (20'-22') Black Sand	0% bentonite	2.7×10^{-8}	Undisturbed	D 5084
PZ57D (25'-27') Black Sand	0% bentonite	3.4×10^{-7}	Undisturbed	D 5084

Notes: cm/sec = centimeters per second

APPENDIX A

VERTICAL HYDRAULIC CONDUCTIVITY AND POROSITY TEST REPORTS

Attached Documents:
Bowser-Morner Laboratory Reports
TTL Laboratory Reports

BOWSER-MORNER LABORATORY REPORTS

BOWSER-MORNER, INC.

Delivery Address: 4518 Taylorsville Road • Dayton, Ohio 45424 Mailing Address: P. O. Box 51 • Dayton, Ohio 45401

AASHTO/ISO 17025 Accredited • USACE Validated



LABORATORY REPORT

Report To: TTL
Attn: Mark Tanner
3516 Greensboro Ave.
Tuscaloosa, AL 35401

Report Date: February 21, 2019
Job No.: 187609
Report No.: 430601E
No. of Pages: 8 + Appendices

Report On: Laboratory Analysis of Forty-Two Thin Wall Tube Samples – **Final Report**
Project: TTL Job No. 000180200804.00
Sample ID: Forty-Two Thin Wall Tube Samples

On November 21, 2018, forty-two thin wall tube samples were submitted for selected laboratory analysis from the above referenced project. Testing was performed as specified by the client and in accordance with the following procedures:

- ASTM D 422, "Particle-Size Analysis of Soils".
- ASTM D 854, "Specific Gravity of Soils Solids by Water Pycnometer".
- ASTM D 2216, "Laboratory Determination of Water (Moisture) Content of Soil and Rock".
- ASTM D 2434, "Permeability of Granular Soils (Constant Head)".
- ASTM D 2487, "Classification of Soils for Engineering Purposes (Unified Soil Classification System)".
- ASTM D 4318, "Liquid Limit, Plastic Limit, and Plasticity Index of Soils".
- ASTM D 5084, "Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter".
- ASTM D 7263, "Laboratory Determination of Density (Unit Weight) of Soil Specimens - Method B".

Results are summarized in the following tables and detailed on the attached data sheets found in Appendix I and Appendix II.

Should you have any questions, or if we may be of further service, please contact me at (937) 236-8805, extension 322.

Respectfully submitted,

BOWSER-MORNER, INC.

Karl A. Fletcher, Manager
Construction Materials and
Geotechnical Laboratories

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Report To: TTL
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TABLE I
 Summary of Results for Forty-Two Thin Wall Tube Samples – Boring Locations UD-10 & UD-25

Test Parameter	UD-10			UD-25		
Gradation (Cumulative % Passing)	13'-15'	28'-30'	43'-45'	15'-17'	30'-32'	43'-45'
No. 4	100.0	100.0	100.0	100.0	100.0	100.0
No. 10	100.0	99.8	100.0	100.0	100.0	99.9
No. 20	99.8	87.4	99.2	99.9	99.9	99.5
No. 40	85.7	61.8	92.6	89.1	92.7	87.2
No. 60	31.2	37.7	58.6	40.2	46.7	37.1
No. 100	10.2	12.1	14.6	9.5	14.0	11.1
No. 200	6.4	4.4	5.3	6.2	3.9	4.7
Atterberg Limits	---	---	---	---	---	---
Liquid Limit:	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic
Plastic Limit:	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic
Plasticity Index:	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic
USCS Classification:	SP-SM	SP	SP-SM	SP-SM	SP	SP
Permeability (k), cm/sec:	1.3×10^{-4}	2.0×10^{-5}	1.9×10^{-5}	1.4×10^{-5}	8.2×10^{-5}	1.4×10^{-6}
Natural Unit Weight	---	---	---	---	---	---
Apparent Specific Gravity:	2.63	2.68	2.67	2.61	2.72	2.66
Wet Unit Weight, pcf:	125.5	124.5	129.1	115.4	122.1	129.7
Dry Unit Weight, pcf:	104.1	102.6	107.4	91.7	99.0	107.9
Moisture Content, %:	20.5	21.4	20.2	25.9	23.3	20.2
Void Ratio:	0.5788	0.6303	0.5500	0.7754	0.7112	0.5387
Porosity, %:	36.7	38.7	35.5	43.7	41.6	35.0
Degree of Saturation, %:	93.4	90.9	97.9	87.0	89.0	99.7
Volume of Voids, %:	36.7	38.7	35.5	43.7	41.6	35.0
Volume of Water, %:	34.2	35.1	34.7	38.0	37.0	34.9
Volume of Solids, %:	63.3	61.3	64.5	56.3	58.4	65.0
Air Filled Voids, %:	6.6	9.1	2.1	13.0	11.0	0.3
Water Filled Voids, %:	93.4	90.9	97.9	87.0	89.0	99.7

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TABLE II
 Summary of Results for Forty-Two Thin Wall Tube Samples – Boring Locations UD-34 & UD-43

Test Parameter	UD-34			UD-43		
Gradation (Cumulative % Passing)	13'-15'	28'-29'	48'-50'	13'-15'	30'-32'	43'-45'
No. 4	100.0	100.0	100.0	100.0	100.0	100.0
No. 10	100.0	100.0	100.0	100.0	100.0	100.0
No. 20	99.2	97.0	99.6	99.6	99.4	99.3
No. 40	79.5	54.4	84.8	86.8	66.6	97.4
No. 60	39.6	17.1	33.4	34.5	16.0	91.0
No. 100	11.4	5.5	9.3	7.3	7.9	82.5
No. 200	7.7	3.3	4.2	3.9	6.1	26.2
Atterberg Limits	---	---	---	---	---	---
Liquid Limit:	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	27
Plastic Limit:	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	15
Plasticity Index:	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	12
USCS Classification:	SP-SM	SP	SP	SP	SP-SM	SC
Permeability (k), cm/sec:	1.0×10^{-5}	7.8×10^{-7}	4.4×10^{-7}	7.0×10^{-6}	3.8×10^{-6}	1.7×10^{-8}
Natural Unit Weight	---	---	---	---	---	---
Apparent Specific Gravity:	2.63	2.68	2.67	2.67	2.67	2.63
Wet Unit Weight, pcf:	130.5	120.0	122.5	123.7	128.0	127.8
Dry Unit Weight, pcf:	110.0	97.2	98.7	100.6	105.5	106.2
Moisture Content, %:	18.6	23.5	24.1	23.0	21.3	20.3
Void Ratio:	0.4913	0.7231	0.6895	0.6570	0.5781	0.5433
Porosity, %:	32.9	42.0	40.8	39.6	36.6	35.2
Degree of Saturation, %:	99.6	87.1	93.4	93.6	98.3	98.3
Volume of Voids, %:	32.9	42.0	40.8	39.6	36.6	35.2
Volume of Water, %:	32.8	36.5	38.1	37.1	36.0	34.6
Volume of Solids, %:	67.1	58.0	59.2	60.4	63.4	64.8
Air Filled Voids, %:	0.4	12.9	6.6	6.4	1.7	1.7
Water Filled Voids, %:	99.6	87.1	93.4	93.6	98.3	98.3

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TABLE III
 Summary of Results for Forty-Two Thin Wall Tube Samples – Boring Locations UD-51 & UD-65

Test Parameter	UD-51			UD-65		
Gradation (Cumulative % Passing)	13'-15'	28'-30'	43'-45'	17'-19'	28'-30'	43'-45'
No. 4	100.0	100.0	100.0	100.0	100.0	100.0
No. 10	100.0	100.0	100.0	100.0	100.0	100.0
No. 20	99.4	99.6	99.9	99.6	99.8	99.9
No. 40	88.4	80.1	85.8	80.6	89.0	92.8
No. 60	31.4	35.9	30.7	29.9	32.5	30.4
No. 100	12.5	11.5	4.1	5.5	4.4	3.2
No. 200	7.3	6.6	1.5	2.5	1.7	1.3
Atterberg Limits	---	---	---	---	---	---
Liquid Limit:	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic
Plastic Limit:	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic
Plasticity Index:	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic
USCS Classification:	SP-SM	SP-SM	SP	SP	SP	SP
Permeability (k), cm/sec:	5.2×10^{-6}	7.6×10^{-6}	6.9×10^{-5}	2.8×10^{-4}	1.1×10^{-4}	6.3×10^{-2}
Natural Unit Weight	---	---	---	---	---	---
Apparent Specific Gravity:	2.55	2.69	2.68	2.65	2.63	2.65
Wet Unit Weight, pcf:	125.7	126.0	133.1	121.1	125.3	121.7
Dry Unit Weight, pcf:	105.5	102.2	113.8	99.3	102.4	104.9
Moisture Content, %:	19.2	23.3	17.0	22.0	22.4	16.0
Void Ratio:	0.5095	0.6425	0.4701	0.6667	0.6048	0.5747
Porosity, %:	33.8	39.1	32.0	40.0	37.7	36.5
Degree of Saturation, %:	96.0	97.4	96.9	87.5	97.4	73.7
Volume of Voids, %:	33.8	39.1	32.0	40.0	37.7	36.5
Volume of Water, %:	32.4	38.1	31.0	35.0	36.7	26.9
Volume of Solids, %:	66.2	60.9	68.0	60.0	62.3	63.5
Air Filled Voids, %:	4.0	2.6	3.1	12.5	2.6	26.3
Water Filled Voids, %:	96.0	97.4	96.9	87.5	97.4	73.7

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TABLE IV
 Summary of Results for Forty-Two Thin Wall Tube Samples – Boring Locations UD-67 & UD-93

Test Parameter	UD-67			UD-93		
Gradation (Cumulative % Passing)	17'-19'	28'-30'	43'-45'	13'-15'	28'-30'	43'-45'
3/4"	100.0	100.0	100.0	100.0	100.0	100.0
1/2"	100.0	98.8	100.0	100.0	100.0	100.0
3/8"	100.0	98.8	100.0	100.0	100.0	100.0
No. 4	97.8	98.6	99.8	100.0	100.0	100.0
No. 10	97.4	98.3	99.8	100.0	100.0	100.0
No. 20	95.8	97.3	99.5	99.8	99.4	99.4
No. 40	72.6	73.6	81.9	88.7	84.4	77.9
No. 60	29.4	25.3	29.8	45.0	40.4	29.0
No. 100	9.3	5.2	6.2	9.7	10.0	6.2
No. 200	5.4	2.3	2.8	4.5	5.7	2.4
Atterberg Limits	---	---	---	---	---	---
Liquid Limit:	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic
Plastic Limit:	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic
Plasticity Index:	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic
USCS Classification:	SP-SM	SP	SP	SP	SP-SM	SP
Permeability (k), cm/sec:	1.4×10^{-4}	2.9×10^{-4}	4.1×10^{-6}	6.5×10^{-7}	2.4×10^{-5}	2.8×10^{-5}
Natural Unit Weight	---	---	---	---	---	---
Apparent Specific Gravity:	2.64	2.64	2.64	2.63	2.62	2.69
Wet Unit Weight, pcf:	129.9	119.5	131.5	124.1	128.8	129.3
Dry Unit Weight, pcf:	110.0	99.0	112.6	102.1	108.3	108.2
Moisture Content, %:	18.1	20.6	16.8	21.5	18.9	19.5
Void Ratio:	0.4949	0.6598	0.4649	0.6045	0.5077	0.5512
Porosity, %:	33.1	39.8	31.7	37.7	33.7	35.5
Degree of Saturation, %:	96.3	82.1	95.4	93.3	97.3	95.2
Volume of Voids, %:	33.1	39.8	31.7	37.7	33.7	35.5
Volume of Water, %:	31.9	32.7	30.3	35.2	32.8	33.8
Volume of Solids, %:	66.9	60.2	68.3	62.3	66.3	64.5
Air Filled Voids, %:	3.7	17.9	4.6	6.7	2.7	4.8
Water Filled Voids, %:	96.3	82.1	95.4	93.3	97.3	95.2

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TABLE V
 Summary of Results for Forty-Two Thin Wall Tube Samples – Boring Locations UD-126 & UD-128

Test Parameter	UD-126			UD-128		
Gradation (Cumulative % Passing)	13'-15'	28'-30'	43'-45'	13'-15'	30'-32'	43'-45'
No. 4	100.0	100.0	100.0	100.0	100.0	100.0
No. 10	100.0	99.9	99.7	100.0	100.0	99.9
No. 20	99.5	98.7	98.5	99.7	99.9	99.3
No. 40	84.5	79.5	92.2	87.1	97.4	95.0
No. 60	40.3	34.3	67.4	36.9	76.3	72.9
No. 100	12.2	8.4	25.5	7.9	34.9	8.7
No. 200	7.7	3.2	9.5	3.3	10.5	3.2
Atterberg Limits	---	---	---	---	---	---
Liquid Limit:	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic
Plastic Limit:	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic
Plasticity Index:	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic
USCS Classification:	SP-SM	SP	SP-SM	SP	SP-SM	SP
Permeability (k), cm/sec:	8.3×10^{-5}	1.0×10^{-5}	9.3×10^{-7}	9.5×10^{-5}	2.2×10^{-6}	1.7×10^{-4}
Natural Unit Weight	---	---	---	---	---	---
Apparent Specific Gravity:	2.60	2.67	2.64	2.65	2.68	2.66
Wet Unit Weight, pcf:	1301.0	133.9	131.0	125.3	125.9	128.7
Dry Unit Weight, pcf:	111.5	114.5	110.5	103.4	101.9	106.4
Moisture Content, %:	17.5	16.9	18.6	21.2	23.6	21.0
Void Ratio:	0.4557	0.4546	0.4921	0.5993	0.6424	0.5626
Porosity, %:	31.3	31.3	33.0	37.5	39.1	36.0
Degree of Saturation, %:	99.8	99.2	99.8	93.7	98.6	99.5
Volume of Voids, %:	31.3	31.3	33.0	37.5	39.1	36.0
Volume of Water, %:	31.2	31.0	32.9	35.1	38.6	35.8
Volume of Solids, %:	68.7	68.7	67.0	62.5	60.9	64.0
Air Filled Voids, %:	0.2	0.8	0.2	6.3	1.4	0.5
Water Filled Voids, %:	99.8	99.2	99.8	93.7	98.6	99.5

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TABLE VI
 Summary of Results for Forty-Two Thin Wall Tube Samples – Boring Locations UD-179 & UD-231

Test Parameter	UD-179			UD-231		
Gradation (Cumulative % Passing)	13'-15'	28'-30'	43'-45'	13'-15'	30'-32'	43'-45'
No. 4	100.0	100.0	100.0	100.0	100.0	100.0
No. 10	99.6	100.0	100.0	100.0	100.0	100.0
No. 20	96.9	99.5	99.0	99.9	96.4	99.8
No. 40	74.0	76.1	76.4	92.0	61.6	88.1
No. 60	27.3	21.5	31.3	51.2	25.3	42.8
No. 100	4.5	6.1	8.9	13.2	13.0	16.2
No. 200	2.0	4.0	4.1	5.7	6.4	7.5
Atterberg Limits	---	---	---	---	---	---
Liquid Limit:	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic
Plastic Limit:	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic
Plasticity Index:	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic
USCS Classification:	SP	SP	SP	SP-SM	SP-SM	SP-SM
Permeability (k), cm/sec:	2.1×10^{-6}	3.9×10^{-4}	2.0×10^{-7}	2.7×10^{-6}	6.0×10^{-6}	1.9×10^{-5}
Natural Unit Weight	---	---	---	---	---	---
Apparent Specific Gravity:	2.67	2.65	2.62	2.62	2.63	2.61
Wet Unit Weight, pcf:	123.7	129.5	128.3	124.1	133.3	127.0
Dry Unit Weight, pcf:	102.5	108.1	107.3	102.9	114.7	105.3
Moisture Content, %:	20.7	19.8	19.6	20.6	16.2	20.6
Void Ratio:	0.6261	0.5297	0.5240	0.5901	0.4299	0.5483
Porosity, %:	38.5	34.6	34.4	37.1	30.1	35.4
Degree of Saturation, %:	88.5	99.0	97.8	91.5	99.3	98.4
Volume of Voids, %:	38.5	34.6	34.4	37.1	30.1	35.4
Volume of Water, %:	34.1	34.3	33.6	34.0	29.8	34.8
Volume of Solids, %:	61.5	65.4	65.6	62.9	69.9	64.6
Air Filled Voids, %:	11.5	1.0	2.2	8.5	0.7	1.6
Water Filled Voids, %:	88.5	99.0	97.8	91.5	99.3	98.4

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TABLE VII
 Summary of Results for Forty-Two Thin Wall Tube Samples – Boring Locations UD-238 & UD-338

Test Parameter	UD-238			UD-338		
Gradation (Cumulative % Passing)	13'-15'	28'-30'	43'-45'	13'-15'	28'-30'	43'-45'
No. 4	100.0	100.0	100.0	100.0	100.0	100.0
No. 10	100.0	100.0	100.0	100.0	100.0	100.0
No. 20	99.6	99.4	99.9	98.4	99.9	99.8
No. 40	86.7	81.2	95.5	77.9	87.3	86.4
No. 60	33.8	32.9	40.3	34.4	32.9	26.5
No. 100	9.3	7.2	7.3	11.1	11.3	6.3
No. 200	5.1	3.6	2.9	5.5	5.5	3.1
Atterberg Limits	---	---	---	---	---	---
Liquid Limit:	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic
Plastic Limit:	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic
Plasticity Index:	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic
USCS Classification:	SP-SM	SP	SP	SP-SM	SP-SM	SP
Permeability (k), cm/sec:	1.0×10^{-4}	3.3×10^{-4}	1.2×10^{-4}	2.6×10^{-6}	2.2×10^{-5}	9.2×10^{-5}
Natural Unit Weight	---	---	---	---	---	---
Apparent Specific Gravity:	2.66	2.64	2.64	2.67	2.67	2.67
Wet Unit Weight, pcf:	131.1	126.5	130.4	131.2	127.7	129.3
Dry Unit Weight, pcf:	110.4	105.5	109.9	110.1	104.9	107.8
Moisture Content, %:	18.8	19.9	18.6	19.2	21.7	20.0
Void Ratio:	0.5030	0.5608	0.4981	0.5136	0.5875	0.5454
Porosity, %:	33.5	35.9	33.2	33.9	37.0	35.3
Degree of Saturation, %:	99.5	93.5	98.7	99.9	98.5	97.9
Volume of Voids, %:	33.5	35.9	33.2	33.9	37.0	35.3
Volume of Water, %:	33.3	33.6	32.8	33.9	36.4	34.5
Volume of Solids, %:	66.5	64.1	66.8	66.1	63.0	64.7
Air Filled Voids, %:	0.5	6.5	1.3	0.1	1.5	2.1
Water Filled Voids, %:	99.5	93.5	98.7	99.9	98.5	97.9

FALLING HEAD PERMEABILITY TEST
ASTM D 5084, Measurement of Hydraulic Conductivity

UNDISTURBED

Client:	TTL
Project:	TTL Job No. 000180200804.00
BMI Work Order Number:	187609
Sample Identification:	UD-10
Depth, ft:	13.0' - 15.0'
USCS Classification:	brown silty SAND

SPECIMEN DATA:

Dimension, inches	
Height:	2.788
Diameter:	2.785
Mass, lbs:	1.233
Moisture Content, %	
Initial:	20.5
Final:	19.8
Wet Unit Weight, pcf	
Initial:	125.5
Final:	124.7
Initial Dry Unit Weight, pcf:	104.1
Back Pressure Saturation, psi	
Back Pressure, Exit:	40
Back Pressure, Enter:	41
Lateral Pressure:	43

Permeability (k), cm/sec:	1.3×10^{-4}
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FALLING HEAD PERMEABILITY TEST
ASTM D 5084, Measurement of Hydraulic Conductivity

UNDISTURBED

Client:	TTL
Project:	TTL Job No. 000180200804.00
BMI Work Order Number:	187609
Sample Identification:	UD-10
Depth, ft:	28.0' - 30.0'
USCS Classification:	brown poorly graded SAND

SPECIMEN DATA:

Dimension, inches	
Height:	3.154
Diameter:	2.734
Mass, lbs:	1.334
Moisture Content, %	
Initial:	21.4
Final:	19.7
Wet Unit Weight, pcf	
Initial:	124.5
Final:	122.8
Initial Dry Unit Weight, pcf:	102.6
Back Pressure Saturation, psi	
Back Pressure, Exit:	40
Back Pressure, Enter:	41
Lateral Pressure:	43

Permeability (k), cm/sec:	2.0×10^{-5}
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FALLING HEAD PERMEABILITY TEST
ASTM D 5084, Measurement of Hydraulic Conductivity

UNDISTURBED

Client:	TTL
Project:	TTL Job No. 000180200804.00
BMI Work Order Number:	187609
Sample Identification:	UD-10
Depth, ft:	43.0' - 45.0'
USCS Classification:	brown poorly graded SAND with silt

SPECIMEN DATA:

Dimension, inches	
Height:	3.054
Diameter:	2.753
Mass, lbs:	1.358
Moisture Content, %	
Initial:	20.2
Final:	19.3
Wet Unit Weight, pcf	
Initial:	129.1
Final:	128.1
Initial Dry Unit Weight, pcf:	107.4
Back Pressure Saturation, psi	
Back Pressure, Exit:	50
Back Pressure, Enter:	53
Lateral Pressure:	57

Permeability (k), cm/sec:	1.9×10^{-5}
----------------------------------	--

FALLING HEAD PERMEABILITY TEST
ASTM D 5084, Measurement of Hydraulic Conductivity

UNDISTURBED

Client:	TTL
Project:	TTL Job No. 000180200804.00
BMI Work Order Number:	187609
Sample Identification:	UD-25
Depth, ft:	15.0' - 17.0'
USCS Classification:	brown poorly graded SAND with silt

SPECIMEN DATA:

Dimension, inches	
Height:	3.097
Diameter:	2.8
Mass, lbs:	1.273
Moisture Content, %	
Initial:	25.9
Final:	24.2
Wet Unit Weight, pcf	
Initial:	115.4
Final:	113.9
Initial Dry Unit Weight, pcf:	91.7
Back Pressure Saturation, psi	
Back Pressure, Exit:	50
Back Pressure, Enter:	52
Lateral Pressure:	55

Permeability (k), cm/sec:	1.4×10^{-5}
----------------------------------	--

FALLING HEAD PERMEABILITY TEST
ASTM D 5084, Measurement of Hydraulic Conductivity

UNDISTURBED

Client:	TTL
Project:	TTL Job No. 000180200804.00
BMI Work Order Number:	187609
Sample Identification:	UD-25
Depth, ft:	30.0' - 32.0'
USCS Classification:	dark brown poorly graded SAND

SPECIMEN DATA:

Dimension, inches	
Height:	2.962
Diameter:	2.755
Mass, lbs:	1.248
Moisture Content, %	
Initial:	23.3
Final:	21.8
Wet Unit Weight, pcf	
Initial:	122.1
Final:	120.6
Initial Dry Unit Weight, pcf:	99.0
Back Pressure Saturation, psi	
Back Pressure, Exit:	60
Back Pressure, Enter:	61
Lateral Pressure:	63

Permeability (k), cm/sec:	8.2×10^{-5}
----------------------------------	--

FALLING HEAD PERMEABILITY TEST
ASTM D 5084, Measurement of Hydraulic Conductivity

UNDISTURBED

Client:	TTL
Project:	TTL Job No. 000180200804.00
BMI Work Order Number:	187609
Sample Identification:	UD-25
Depth, ft:	43.0' - 45.0'
USCS Classification:	dark brown poorly graded SAND

SPECIMEN DATA:

Dimension, inches	
Height:	2.853
Diameter:	2.759
Mass, lbs:	1.280
Moisture Content, %	
Initial:	20.2
Final:	17.3
Wet Unit Weight, pcf	
Initial:	129.7
Final:	126.6
Initial Dry Unit Weight, pcf:	107.9
Back Pressure Saturation, psi	
Back Pressure, Exit:	50
Back Pressure, Enter:	51
Lateral Pressure:	53

Permeability (k), cm/sec:	1.4×10^{-6}
----------------------------------	--

FALLING HEAD PERMEABILITY TEST
ASTM D 5084, Measurement of Hydraulic Conductivity

UNDISTURBED

Client:	TTL
Project:	TTL Job No. 000180200804.00
BMI Work Order Number:	187609
Sample Identification:	UD-34
Depth, ft:	13.0' - 15.0'
USCS Classification:	dark brown poorly graded SAND with silt

SPECIMEN DATA:

Dimension, inches	
Height:	3.076
Diameter:	2.773
Mass, lbs:	1.403
Moisture Content, %	
Initial:	18.6
Final:	18.1
Wet Unit Weight, pcf	
Initial:	130.5
Final:	129.9
Initial Dry Unit Weight, pcf:	110.0
Back Pressure Saturation, psi	
Back Pressure, Exit:	50
Back Pressure, Enter:	51
Lateral Pressure:	53

Permeability (k), cm/sec:	1.0×10^{-5}
----------------------------------	--

FALLING HEAD PERMEABILITY TEST
ASTM D 5084, Measurement of Hydraulic Conductivity

UNDISTURBED

Client:	TTL
Project:	TTL Job No. 000180200804.00
BMI Work Order Number:	187609
Sample Identification:	UD-34
Depth, ft:	28.0' - 29.0'
USCS Classification:	brown poorly graded SAND

SPECIMEN DATA:

Dimension, inches	
Height:	2.987
Diameter:	2.776
Mass, lbs:	1.255
Moisture Content, %	
Initial:	23.5
Final:	21.9
Wet Unit Weight, pcf	
Initial:	120.0
Final:	118.5
Initial Dry Unit Weight, pcf:	97.2
Back Pressure Saturation, psi	
Back Pressure, Exit:	40
Back Pressure, Enter:	41
Lateral Pressure:	43

Permeability (k), cm/sec:	7.8×10^{-7}
----------------------------------	--

FALLING HEAD PERMEABILITY TEST
ASTM D 5084, Measurement of Hydraulic Conductivity

UNDISTURBED

Client:	TTL
Project:	TTL Job No. 000180200804.00
BMI Work Order Number:	187609
Sample Identification:	UD-34
Depth, ft:	48.0' - 50.0'
USCS Classification:	brown poorly graded SAND

SPECIMEN DATA:

Dimension, inches	
Height:	2.972
Diameter:	2.753
Mass, lbs:	1.254
Moisture Content, %	
Initial:	24.1
Final:	21.4
Wet Unit Weight, pcf	
Initial:	122.5
Final:	119.8
Initial Dry Unit Weight, pcf:	98.7
Back Pressure Saturation, psi	
Back Pressure, Exit:	40
Back Pressure, Enter:	43
Lateral Pressure:	47

Permeability (k), cm/sec:	4.4×10^{-7}
----------------------------------	--

FALLING HEAD PERMEABILITY TEST
ASTM D 5084, Measurement of Hydraulic Conductivity

UNDISTURBED

Client:	TTL
Project:	TTL Job No. 000180200804.00
BMI Work Order Number:	187609
Sample Identification:	UD-43
Depth, ft:	13.0' - 15.0'
USCS Classification:	brown poorly graded SAND

SPECIMEN DATA:

Dimension, inches	
Height:	2.981
Diameter:	2.766
Mass, lbs:	1.282
Moisture Content, %	
Initial:	23.0
Final:	20.8
Wet Unit Weight, pcf	
Initial:	123.7
Final:	121.5
Initial Dry Unit Weight, pcf:	100.6
Back Pressure Saturation, psi	
Back Pressure, Exit:	50
Back Pressure, Enter:	51
Lateral Pressure:	53

Permeability (k), cm/sec:	7.0×10^{-6}
----------------------------------	--

FALLING HEAD PERMEABILITY TEST
ASTM D 5084, Measurement of Hydraulic Conductivity

UNDISTURBED

Client:	TTL
Project:	TTL Job No. 000180200804.00
BMI Work Order Number:	187609
Sample Identification:	UD-43
Depth, ft:	30.0' - 32.0'
USCS Classification:	black/brown poorly graded SAND with silt

SPECIMEN DATA:

Dimension, inches	
Height:	3.027
Diameter:	2.768
Mass, lbs:	1.349
Moisture Content, %	
Initial:	21.3
Final:	20.9
Wet Unit Weight, pcf	
Initial:	128.0
Final:	127.5
Initial Dry Unit Weight, pcf:	105.5
Back Pressure Saturation, psi	
Back Pressure, Exit:	50
Back Pressure, Enter:	51
Lateral Pressure:	53

Permeability (k), cm/sec:	3.8×10^{-6}
----------------------------------	--

FALLING HEAD PERMEABILITY TEST
ASTM D 5084, Measurement of Hydraulic Conductivity

UNDISTURBED

Client:	TTL
Project:	TTL Job No. 000180200804.00
BMI Work Order Number:	187609
Sample Identification:	UD-43
Depth, ft:	43.0' - 45.0'
USCS Classification:	black/brown clayey SAND

SPECIMEN DATA:

Dimension, inches	
Height:	2.994
Diameter:	2.795
Mass, lbs:	1.358
Moisture Content, %	
Initial:	20.3
Final:	16.9
Wet Unit Weight, pcf	
Initial:	127.7
Final:	124.1
Initial Dry Unit Weight, pcf:	106.2
Back Pressure Saturation, psi	
Back Pressure, Exit:	50
Back Pressure, Enter:	53
Lateral Pressure:	57

Permeability (k), cm/sec:	1.7×10^{-8}
----------------------------------	--

FALLING HEAD PERMEABILITY TEST
ASTM D 5084, Measurement of Hydraulic Conductivity

UNDISTURBED

Client:	TTL
Project:	TTL Job No. 000180200804.00
BMI Work Order Number:	187609
Sample Identification:	UD-51
Depth, ft:	13.0' - 15.0'
USCS Classification:	dark brown poorly graded SAND with silt

SPECIMEN DATA:

Dimension, inches	
Height:	2.957
Diameter:	2.804
Mass, lbs:	1.328
Moisture Content, %	
Initial:	19.2
Final:	19.5
Wet Unit Weight, pcf	
Initial:	125.7
Final:	126.1
Initial Dry Unit Weight, pcf:	105.5
Back Pressure Saturation, psi	
Back Pressure, Exit:	50
Back Pressure, Enter:	51
Lateral Pressure:	53

Permeability (k), cm/sec: 5.2×10^{-6}

FALLING HEAD PERMEABILITY TEST
ASTM D 5084, Measurement of Hydraulic Conductivity

UNDISTURBED

Client:	TTL
Project:	TTL Job No. 000180200804.00
BMI Work Order Number:	187609
Sample Identification:	UD-51
Depth, ft:	28.0' - 30.0'
USCS Classification:	brown poorly graded SAND with silt

SPECIMEN DATA:

Dimension, inches	
Height:	2.994
Diameter:	2.7
Mass, lbs:	1.250
Moisture Content, %	
Initial:	23.3
Final:	20.0
Wet Unit Weight, pcf	
Initial:	126.0
Final:	122.6
Initial Dry Unit Weight, pcf:	102.2
Back Pressure Saturation, psi	
Back Pressure, Exit:	50
Back Pressure, Enter:	52
Lateral Pressure:	55

Permeability (k), cm/sec:	7.6×10^{-6}
----------------------------------	--

FALLING HEAD PERMEABILITY TEST
ASTM D 5084, Measurement of Hydraulic Conductivity

UNDISTURBED

Client: **TTL**

Project: **TTL Job No. 000180200804.00**

BMI Work Order Number: **187609**

Sample Identification: **UD-51**

Depth, ft: **43.0' - 45.0'**

USCS Classification: **brown/black poorly graded SAND**

SPECIMEN DATA:

Dimension, inches

Height: **2.957**

Diameter: **2.777**

Mass, lbs: **1.380**

Moisture Content, %

Initial: **17.0**

Final: **15.5**

Wet Unit Weight, pcf

Initial: **133.1**

Final: **131.4**

Initial Dry Unit Weight, pcf: **113.8**

Back Pressure Saturation, psi

Back Pressure, Exit: **50**

Back Pressure, Enter: **53**

Lateral Pressure: **57**

Permeability (k), cm/sec: 6.9×10^{-5}

FALLING HEAD PERMEABILITY TEST
ASTM D 5084, Measurement of Hydraulic Conductivity

UNDISTURBED

Client:	TTL
Project:	TTL Job No. 000180200804.00
BMI Work Order Number:	187609
Sample Identification:	UD-65
Depth, ft:	17.0' - 19.0'
USCS Classification:	dark brown poorly graded SAND

SPECIMEN DATA:

Dimension, inches	
Height:	3.004
Diameter:	2.802
Mass, lbs:	1.298
Moisture Content, %	
Initial:	22.0
Final:	21.3
Wet Unit Weight, pcf	
Initial:	121.1
Final:	120.5
Initial Dry Unit Weight, pcf:	99.3
Back Pressure Saturation, psi	
Back Pressure, Exit:	50
Back Pressure, Enter:	52
Lateral Pressure:	55

Permeability (k), cm/sec:	2.8×10^{-4}
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FALLING HEAD PERMEABILITY TEST
ASTM D 5084, Measurement of Hydraulic Conductivity

UNDISTURBED

Client:	TTL
Project:	TTL Job No. 000180200804.00
BMI Work Order Number:	187609
Sample Identification:	UD-65
Depth, ft:	28.0' - 30.0'
USCS Classification:	brown poorly graded SAND

SPECIMEN DATA:

Dimension, inches	
Height:	2.93
Diameter:	2.694
Mass, lbs:	1.211
Moisture Content, %	
Initial:	22.4
Final:	20.3
Wet Unit Weight, pcf	
Initial:	125.3
Final:	123.2
Initial Dry Unit Weight, pcf:	102.4
Back Pressure Saturation, psi	
Back Pressure, Exit:	40
Back Pressure, Enter:	41
Lateral Pressure:	43

Permeability (k), cm/sec:	1.1 x 10⁻⁴
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PERMEABILITY OF GRANULAR SOILS (CONSTANT HEAD)

ASTM D 2434, Measurement of Hydraulic Conductivity

LABORATORY COMPACTED

Client: TTL
Project: TTL Job No. 000180200804.00
BMI Work Order Number: 187609
Sample Identification: UD-65
Depth, ft: 43' - 45'
Material Description: brown poorly graded SAND

NATURAL UNIT WEIGHT DATA:

As Received Unit Weight (Wet), pcf: 121.7
As Received Unit Weight (Dry), pcf: 104.9
As Received MC, %: 16.0

REMOLED SPECIMEN DATA:

Dimension, inches
 Height: 5.567
 Diameter: 3.000

Mass, lbs: 2.760

Moisture Content, %
 Initial: 16.0

Remolded Unit Weight (Wet), pcf
 Initial: 121.2

Remolded Unit Weight (Dry), pcf:
 Initial: 104.5
 Percent Compaction: 99.6

Permeability (k), cm/sec: 6.3×10^{-2}

FALLING HEAD PERMEABILITY TEST
ASTM D 5084, Measurement of Hydraulic Conductivity

UNDISTURBED

Client: **TTL**

Project: **TTL Job No. 000180200804.00**

BMI Work Order Number: **187609**

Sample Identification: **UD-67**

Depth, ft: **17.0' - 19.0'**

USCS Classification: **brown poorly graded SAND with silt**

SPECIMEN DATA:

Dimension, inches

 Height: **3.028**

 Diameter: **2.75**

Mass, lbs: **1.352**

Moisture Content, %

 Initial: **18.1**

 Final: **17.6**

Wet Unit Weight, pcf

 Initial: **129.9**

 Final: **129.4**

Initial Dry Unit Weight, pcf: **110.0**

Back Pressure Saturation, psi

 Back Pressure, Exit: **50**

 Back Pressure, Enter: **51**

 Lateral Pressure: **53**

Permeability (k), cm/sec: 1.4×10^{-4}

FALLING HEAD PERMEABILITY TEST
ASTM D 5084, Measurement of Hydraulic Conductivity

UNDISTURBED

Client:	TTL
Project:	TTL Job No. 000180200804.00
BMI Work Order Number:	187609
Sample Identification:	UD-67
Depth, ft:	28.0' - 30.0'
USCS Classification:	brown poorly graded SAND

SPECIMEN DATA:

Dimension, inches	
Height:	2.972
Diameter:	2.75
Mass, lbs:	1.220
Moisture Content, %	
Initial:	20.6
Final:	23.3
Wet Unit Weight, pcf	
Initial:	119.4
Final:	122.1
Initial Dry Unit Weight, pcf:	99.0
Back Pressure Saturation, psi	
Back Pressure, Exit:	50
Back Pressure, Enter:	51
Lateral Pressure:	53

Permeability (k), cm/sec:	2.9×10^{-4}
----------------------------------	--

FALLING HEAD PERMEABILITY TEST
ASTM D 5084, Measurement of Hydraulic Conductivity

UNDISTURBED

Client:	TTL
Project:	TTL Job No. 000180200804.00
BMI Work Order Number:	187609
Sample Identification:	UD-67
Depth, ft:	43.0' - 45.0'
USCS Classification:	brown poorly graded SAND

SPECIMEN DATA:

Dimension, inches	
Height:	2.948
Diameter:	2.74
Mass, lbs:	1.323
Moisture Content, %	
Initial:	16.8
Final:	18.8
Wet Unit Weight, pcf	
Initial:	131.5
Final:	133.8
Initial Dry Unit Weight, pcf:	112.6
Back Pressure Saturation, psi	
Back Pressure, Exit:	40
Back Pressure, Enter:	43
Lateral Pressure:	47

Permeability (k), cm/sec:	4.1×10^{-6}
----------------------------------	--

FALLING HEAD PERMEABILITY TEST
ASTM D 5084, Measurement of Hydraulic Conductivity

UNDISTURBED

Client:	TTL
Project:	TTL Job No. 000180200804.00
BMI Work Order Number:	187609
Sample Identification:	UD-93
Depth, ft:	13.0' - 15.0'
USCS Classification:	black poorly graded SAND

SPECIMEN DATA:

Dimension, inches	
Height:	2.994
Diameter:	2.774
Mass, lbs:	1.300
Moisture Content, %	
Initial:	21.5
Final:	20.9
Wet Unit Weight, pcf	
Initial:	124.1
Final:	123.4
Initial Dry Unit Weight, pcf:	102.1
Back Pressure Saturation, psi	
Back Pressure, Exit:	40
Back Pressure, Enter:	42
Lateral Pressure:	45

Permeability (k), cm/sec:	6.5×10^{-7}
----------------------------------	--

FALLING HEAD PERMEABILITY TEST
ASTM D 5084, Measurement of Hydraulic Conductivity

UNDISTURBED

Client: TTL

Project: TTL Job No. 000180200804.00

BMI Work Order Number: 187609

Sample Identification: UD-93

Depth, ft: 28.0' - 30.0'

USCS Classification: black poorly graded SAND with silt

SPECIMEN DATA:

Dimension, inches

 Height: 2.919

 Diameter: 2.762

Mass, lbs: 1.304

Moisture Content, %

 Initial: 18.9

 Final: 19.3

Wet Unit Weight, pcf

 Initial: 128.8

 Final: 129.2

Initial Dry Unit Weight, pcf: 108.3

Back Pressure Saturation, psi

 Back Pressure, Exit: 40

 Back Pressure, Enter: 41

 Lateral Pressure: 43

Permeability (k), cm/sec: 2.4×10^{-5}

FALLING HEAD PERMEABILITY TEST
ASTM D 5084, Measurement of Hydraulic Conductivity

UNDISTURBED

Client: **TTL**

Project: **TTL Job No. 000180200804.00**

BMI Work Order Number: **187609**

Sample Identification: **UD-93**

Depth, ft: **43.0' - 45.0'**

USCS Classification: **brown poorly graded SAND**

SPECIMEN DATA:

Dimension, inches

 Height: **2.977**

 Diameter: **2.793**

Mass, lbs: **1.365**

Moisture Content, %

 Initial: **19.5**

 Final: **19.7**

Wet Unit Weight, pcf

 Initial: **129.3**

 Final: **129.5**

Initial Dry Unit Weight, pcf: **108.2**

Back Pressure Saturation, psi

 Back Pressure, Exit: **50**

 Back Pressure, Enter: **52**

 Lateral Pressure: **55**

Permeability (k), cm/sec: 2.8×10^{-5}

FALLING HEAD PERMEABILITY TEST
ASTM D 5084, Measurement of Hydraulic Conductivity

UNDISTURBED

Client:	TTL
Project:	TTL Job No. 000180200804.00
BMI Work Order Number:	187609
Sample Identification:	UD-126
Depth, ft:	13.0' - 15.0'
USCS Classification:	brown poorly graded SAND with silt

SPECIMEN DATA:

Dimension, inches	
Height:	3.015
Diameter:	2.71
Mass, lbs:	1.318
Moisture Content, %	
Initial:	17.5
Final:	16.8
Wet Unit Weight, pcf	
Initial:	131.0
Final:	130.2
Initial Dry Unit Weight, pcf:	111.5
Back Pressure Saturation, psi	
Back Pressure, Exit:	40
Back Pressure, Enter:	41
Lateral Pressure:	43

Permeability (k), cm/sec:	8.3×10^{-5}
----------------------------------	--

FALLING HEAD PERMEABILITY TEST
ASTM D 5084, Measurement of Hydraulic Conductivity

UNDISTURBED

Client:	TTL
Project:	TTL Job No. 000180200804.00
BMI Work Order Number:	187609
Sample Identification:	UD-126
Depth, ft:	28.0' - 30.0'
USCS Classification:	brown poorly graded SAND

SPECIMEN DATA:

Dimension, inches	
Height:	3.078
Diameter:	2.745
Mass, lbs:	1.411
Moisture Content, %	
Initial:	16.9
Final:	16.3
Wet Unit Weight, pcf	
Initial:	133.9
Final:	133.2
Initial Dry Unit Weight, pcf:	114.5
Back Pressure Saturation, psi	
Back Pressure, Exit:	50
Back Pressure, Enter:	51
Lateral Pressure:	53

Permeability (k), cm/sec:	1.0×10^{-5}
----------------------------------	--

FALLING HEAD PERMEABILITY TEST
ASTM D 5084, Measurement of Hydraulic Conductivity

UNDISTURBED

Client:	TTL
Project:	TTL Job No. 000180200804.00
BMI Work Order Number:	187609
Sample Identification:	UD-126
Depth, ft:	43.0' - 45.0'
USCS Classification:	brown poorly graded SAND with silt

SPECIMEN DATA:

Dimension, inches	
Height:	2.86
Diameter:	2.753
Mass, lbs:	1.291
Moisture Content, %	
Initial:	18.6
Final:	17.9
Wet Unit Weight, pcf	
Initial:	131.0
Final:	130.3
Initial Dry Unit Weight, pcf:	110.5
Back Pressure Saturation, psi	
Back Pressure, Exit:	40
Back Pressure, Enter:	41
Lateral Pressure:	43

Permeability (k), cm/sec:	9.3×10^{-7}
----------------------------------	--

FALLING HEAD PERMEABILITY TEST
ASTM D 5084, Measurement of Hydraulic Conductivity

UNDISTURBED

Client:	TTL
Project:	TTL Job No. 000180200804.00
BMI Work Order Number:	187609
Sample Identification:	UD-128
Depth, ft:	13.0' - 15.0'
USCS Classification:	brown poorly graded SAND

SPECIMEN DATA:

Dimension, inches	
Height:	3.059
Diameter:	2.792
Mass, lbs:	1.358
Moisture Content, %	
Initial:	21.2
Final:	21.6
Wet Unit Weight, pcf	
Initial:	125.3
Final:	125.7
Initial Dry Unit Weight, pcf:	103.4
Back Pressure Saturation, psi	
Back Pressure, Exit:	40
Back Pressure, Enter:	42
Lateral Pressure:	45

Permeability (k), cm/sec:	9.5×10^{-5}
----------------------------------	--

FALLING HEAD PERMEABILITY TEST
ASTM D 5084, Measurement of Hydraulic Conductivity

UNDISTURBED

Client:	TTL
Project:	TTL Job No. 000180200804.00
BMI Work Order Number:	187609
Sample Identification:	UD-128
Depth, ft:	30.0' - 32.0'
USCS Classification:	brown poorly graded SAND with silt

SPECIMEN DATA:

Dimension, inches	
Height:	2.931
Diameter:	2.718
Mass, lbs:	1.239
Moisture Content, %	
Initial:	23.6
Final:	20.4
Wet Unit Weight, pcf	
Initial:	125.9
Final:	122.7
Initial Dry Unit Weight, pcf:	101.9
Back Pressure Saturation, psi	
Back Pressure, Exit:	40
Back Pressure, Enter:	41
Lateral Pressure:	43

Permeability (k), cm/sec:	2.2×10^{-6}
----------------------------------	--

FALLING HEAD PERMEABILITY TEST
ASTM D 5084, Measurement of Hydraulic Conductivity

UNDISTURBED

Client:	TTL
Project:	TTL Job No. 000180200804.00
BMI Work Order Number:	187609
Sample Identification:	UD-128
Depth, ft:	43.0' - 45.0'
USCS Classification:	brown/gray poorly graded SAND

SPECIMEN DATA:

Dimension, inches	
Height:	2.945
Diameter:	2.778
Mass, lbs:	1.329
Moisture Content, %	
Initial:	21.0
Final:	19.9
Wet Unit Weight, pcf	
Initial:	128.7
Final:	127.6
Initial Dry Unit Weight, pcf:	106.4
Back Pressure Saturation, psi	
Back Pressure, Exit:	40
Back Pressure, Enter:	41
Lateral Pressure:	43

Permeability (k), cm/sec:	1.7×10^{-4}
----------------------------------	--

FALLING HEAD PERMEABILITY TEST
ASTM D 5084, Measurement of Hydraulic Conductivity

UNDISTURBED

Client:	TTL
Project:	TTL Job No. 000180200804.00
BMI Work Order Number:	187609
Sample Identification:	UD-179
Depth, ft:	13.0' - 15.0'
USCS Classification:	dark brown poorly graded SAND

SPECIMEN DATA:

Dimension, inches	
Height:	3.12
Diameter:	2.776
Mass, lbs:	1.352
Moisture Content, %	
Initial:	20.7
Final:	20.4
Wet Unit Weight, pcf	
Initial:	123.7
Final:	123.4
Initial Dry Unit Weight, pcf:	102.5
Back Pressure Saturation, psi	
Back Pressure, Exit:	50
Back Pressure, Enter:	51
Lateral Pressure:	53

Permeability (k), cm/sec:	2.1×10^{-6}
----------------------------------	--

FALLING HEAD PERMEABILITY TEST
ASTM D 5084, Measurement of Hydraulic Conductivity

UNDISTURBED

Client:	TTL
Project:	TTL Job No. 000180200804.00
BMI Work Order Number:	187609
Sample Identification:	UD-179
Depth, ft:	28.0' - 30.0'
USCS Classification:	dark brown poorly graded SAND

SPECIMEN DATA:

Dimension, inches	
Height:	3.042
Diameter:	2.769
Mass, lbs:	1.373
Moisture Content, %	
Initial:	19.8
Final:	19.3
Wet Unit Weight, pcf	
Initial:	129.5
Final:	129.0
Initial Dry Unit Weight, pcf:	108.1
Back Pressure Saturation, psi	
Back Pressure, Exit:	40
Back Pressure, Enter:	41
Lateral Pressure:	43

Permeability (k), cm/sec:	3.9×10^{-4}
----------------------------------	--

FALLING HEAD PERMEABILITY TEST
ASTM D 5084, Measurement of Hydraulic Conductivity

UNDISTURBED

Client:	TTL
Project:	TTL Job No. 000180200804.00
BMI Work Order Number:	187609
Sample Identification:	UD-179
Depth, ft:	43.0' - 45.0'
USCS Classification:	dark brown/black poorly graded SAND

SPECIMEN DATA:

Dimension, inches	
Height:	2.995
Diameter:	2.718
Mass, lbs:	1.290
Moisture Content, %	
Initial:	19.6
Final:	18.0
Wet Unit Weight, pcf	
Initial:	128.3
Final:	126.6
Initial Dry Unit Weight, pcf:	107.3
Back Pressure Saturation, psi	
Back Pressure, Exit:	40
Back Pressure, Enter:	42
Lateral Pressure:	45

Permeability (k), cm/sec:	2.0×10^{-7}
----------------------------------	--

FALLING HEAD PERMEABILITY TEST
ASTM D 5084, Measurement of Hydraulic Conductivity

UNDISTURBED

Client:	TTL
Project:	TTL Job No. 000180200804.00
BMI Work Order Number:	187609
Sample Identification:	UD-231
Depth, ft:	13.0' - 15.0'
USCS Classification:	dark brown poorly graded SAND with silt

SPECIMEN DATA:

Dimension, inches	
Height:	3.021
Diameter:	2.822
Mass, lbs:	1.357
Moisture Content, %	
Initial:	20.6
Final:	20.5
Wet Unit Weight, pcf	
Initial:	124.1
Final:	124.0
Initial Dry Unit Weight, pcf:	102.9
Back Pressure Saturation, psi	
Back Pressure, Exit:	40
Back Pressure, Enter:	41
Lateral Pressure:	43

Permeability (k), cm/sec:	2.7×10^{-6}
----------------------------------	--

FALLING HEAD PERMEABILITY TEST
ASTM D 5084, Measurement of Hydraulic Conductivity

UNDISTURBED

Client:	TTL
Project:	TTL Job No. 000180200804.00
BMI Work Order Number:	187609
Sample Identification:	UD-231
Depth, ft:	30.0' - 32.0'
USCS Classification:	dark brown/black poorly graded SAND with silt

SPECIMEN DATA:

Dimension, inches	
Height:	3.065
Diameter:	2.739
Mass, lbs:	1.393
Moisture Content, %	
Initial:	16.2
Final:	16.0
Wet Unit Weight, pcf	
Initial:	133.3
Final:	133.1
Initial Dry Unit Weight, pcf:	114.7
Back Pressure Saturation, psi	
Back Pressure, Exit:	40
Back Pressure, Enter:	41
Lateral Pressure:	43

Permeability (k), cm/sec:	6.0×10^{-6}
----------------------------------	--

FALLING HEAD PERMEABILITY TEST
ASTM D 5084, Measurement of Hydraulic Conductivity

UNDISTURBED

Client:	TTL
Project:	TTL Job No. 000180200804.00
BMI Work Order Number:	187609
Sample Identification:	UD-231
Depth, ft:	43.0' - 45.0'
USCS Classification:	dark brown poorly graded SAND with silt

SPECIMEN DATA:

Dimension, inches	
Height:	2.936
Diameter:	2.734
Mass, lbs:	1.267
Moisture Content, %	
Initial:	20.6
Final:	19.0
Wet Unit Weight, pcf	
Initial:	127.0
Final:	125.3
Initial Dry Unit Weight, pcf:	105.3
Back Pressure Saturation, psi	
Back Pressure, Exit:	50
Back Pressure, Enter:	51
Lateral Pressure:	53

Permeability (k), cm/sec:	1.9×10^{-5}
----------------------------------	--

FALLING HEAD PERMEABILITY TEST
ASTM D 5084, Measurement of Hydraulic Conductivity

UNDISTURBED

Client:	TTL
Project:	TTL Job No. 000180200804.00
BMI Work Order Number:	187609
Sample Identification:	UD-238
Depth, ft:	13.0' - 15.0'
USCS Classification:	brown/gray poorly graded SAND with silt

SPECIMEN DATA:

Dimension, inches	
Height:	2.976
Diameter:	2.726
Mass, lbs:	1.318
Moisture Content, %	
Initial:	18.8
Final:	18.2
Wet Unit Weight, pcf	
Initial:	131.1
Final:	130.5
Initial Dry Unit Weight, pcf:	110.4
Back Pressure Saturation, psi	
Back Pressure, Exit:	40
Back Pressure, Enter:	41
Lateral Pressure:	43

Permeability (k), cm/sec:	1.0×10^{-4}
----------------------------------	--

FALLING HEAD PERMEABILITY TEST
ASTM D 5084, Measurement of Hydraulic Conductivity

UNDISTURBED

Client:	TTL
Project:	TTL Job No. 000180200804.00
BMI Work Order Number:	187609
Sample Identification:	UD-238
Depth, ft:	28.0' - 30.0'
USCS Classification:	dark brown poorly graded SAND

SPECIMEN DATA:

Dimension, inches	
Height:	3.046
Diameter:	2.723
Mass, lbs:	1.299
Moisture Content, %	
Initial:	19.9
Final:	21.1
Wet Unit Weight, pcf	
Initial:	126.5
Final:	127.8
Initial Dry Unit Weight, pcf:	105.5
Back Pressure Saturation, psi	
Back Pressure, Exit:	40
Back Pressure, Enter:	41
Lateral Pressure:	43
 Permeability (k), cm/sec:	 3.3 x 10 ⁻⁴

FALLING HEAD PERMEABILITY TEST
ASTM D 5084, Measurement of Hydraulic Conductivity

UNDISTURBED

Client:	TTL
Project:	TTL Job No. 000180200804.00
BMI Work Order Number:	187609
Sample Identification:	UD-238
Depth, ft:	43.0' - 45.0'
USCS Classification:	dark brown poorly graded SAND

SPECIMEN DATA:

Dimension, inches	
Height:	2.992
Diameter:	2.672
Mass, lbs:	1.266
Moisture Content, %	
Initial:	18.6
Final:	18.1
Wet Unit Weight, pcf	
Initial:	130.4
Final:	129.8
Initial Dry Unit Weight, pcf:	109.9
Back Pressure Saturation, psi	
Back Pressure, Exit:	40
Back Pressure, Enter:	41
Lateral Pressure:	43

Permeability (k), cm/sec:	1.2×10^{-4}
----------------------------------	--

FALLING HEAD PERMEABILITY TEST
ASTM D 5084, Measurement of Hydraulic Conductivity

UNDISTURBED

Client:	TTL
Project:	TTL Job No. 000180200804.00
BMI Work Order Number:	187609
Sample Identification:	UD-338
Depth, ft:	13.0' - 15.0'
USCS Classification:	brown poorly graded SAND with silt

SPECIMEN DATA:

Dimension, inches	
Height:	3.062
Diameter:	2.715
Mass, lbs:	1.346
Moisture Content, %	
Initial:	19.2
Final:	18.7
Wet Unit Weight, pcf	
Initial:	131.2
Final:	130.7
Initial Dry Unit Weight, pcf:	110.1
Back Pressure Saturation, psi	
Back Pressure, Exit:	50
Back Pressure, Enter:	51
Lateral Pressure:	53
Permeability (k), cm/sec:	2.6×10^{-6}

FALLING HEAD PERMEABILITY TEST
ASTM D 5084, Measurement of Hydraulic Conductivity

UNDISTURBED

Client:	TTL
Project:	TTL Job No. 000180200804.00
BMI Work Order Number:	187609
Sample Identification:	UD-338
Depth, ft:	28.0' - 30.0'
USCS Classification:	dark brown poorly graded SAND with silt

SPECIMEN DATA:

Dimension, inches	
Height:	2.994
Diameter:	2.716
Mass, lbs:	1.282
Moisture Content, %	
Initial:	21.7
Final:	19.6
Wet Unit Weight, pcf	
Initial:	127.7
Final:	125.5
Initial Dry Unit Weight, pcf:	104.9
Back Pressure Saturation, psi	
Back Pressure, Exit:	40
Back Pressure, Enter:	41
Lateral Pressure:	43

Permeability (k), cm/sec:	2.2×10^{-5}
----------------------------------	--

FALLING HEAD PERMEABILITY TEST
ASTM D 5084, Measurement of Hydraulic Conductivity

UNDISTURBED

Client:	TTL
Project:	TTL Job No. 000180200804.00
BMI Work Order Number:	187609
Sample Identification:	UD-338
Depth, ft:	43.0' - 45.0'
USCS Classification:	brown poorly graded SAND

SPECIMEN DATA:

Dimension, inches	
Height:	2.987
Diameter:	2.723
Mass, lbs:	1.302
Moisture Content, %	
Initial:	20.0
Final:	19.0
Wet Unit Weight, pcf	
Initial:	129.3
Final:	128.3
Initial Dry Unit Weight, pcf:	107.8
Back Pressure Saturation, psi	
Back Pressure, Exit:	40
Back Pressure, Enter:	41
Lateral Pressure:	43

Permeability (k), cm/sec:	9.2×10^{-5}
----------------------------------	--

TTL LABORATORY REPORTS



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**HYDRAULIC CONDUCTIVITY ANALYSIS
ASTM D 5084**

**Twin Pines Minerals, LLC
St. George, Georgia
TTL Project No. 000180200804.00**

September 2018

Material Description: Dark Green Fat Clay (CH)

Sample: EB-03 (92.5'-94.0')

Sample Date: September 2018

Sampled By: TTL, Inc.

In Situ Dry Density: 59.1 pcf

In Situ Moisture: 56.4 %

Hydraulic Conductivity "k": 1.6×10^{-9} cm/sec



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**HYDRAULIC CONDUCTIVITY ANALYSIS
ASTM D 5084**

**Twin Pines Minerals, LLC
St. George, Georgia
TTL Project No. 000180200804.00**

September 2018

<u>Material Description:</u>	Light Gray Lean Clay (CL)
<u>Sample:</u>	EB-06 (120.0'-122.0')
<u>Sample Date:</u>	September 2018
<u>Sampled By:</u>	TTL, Inc.
<u>In Situ Dry Density:</u>	97.1 pcf
<u>In Situ Moisture:</u>	22.3 %
<u>Hydraulic Conductivity "k":</u>	1.3×10^{-5} cm/sec



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**HYDRAULIC CONDUCTIVITY ANALYSIS
ASTM D 5084**

**Twin Pines Minerals, LLC
St. George, Georgia
TTL Project No. 000180200804.00**

September 2018

<u>Material Description:</u>	Greenish Gray Fat Clay (CH)
<u>Sample:</u>	EB-08 (130.0'-133.0')
<u>Sample Date:</u>	September 2018
<u>Sampled By:</u>	TTL, Inc.
<u>In Situ Dry Density:</u>	82.8 pcf
<u>In Situ Moisture:</u>	16.1 %
<u>Hydraulic Conductivity "k":</u>	9.3×10^{-9} cm/sec



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**HYDRAULIC CONDUCTIVITY ANALYSIS
ASTM D 2434**

**Twin Pines Minerals, LLC
St. George, Georgia
TTL Project No. 000180200804.00**

December 2018

<u>Material Description:</u>	Black Sand (SP)
<u>Sample:</u>	EB-16 (12.0'-12.5')
<u>Sample Date:</u>	December 2018
<u>Sampled By:</u>	TTL, Inc.
<u>Remolded Dry Density:</u>	99.3 pcf
<u>Remolded Moisture:</u>	10.7 %
<u>Hydraulic Conductivity "k":</u>	9.6 X 10 ⁻² cm/sec



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**HYDRAULIC CONDUCTIVITY ANALYSIS
ASTM D 5084**

**Twin Pines Minerals, LLC
St. George, Georgia
TTL Project No. 000180200804.00**

December 2018

<u>Material Description:</u>	Black Sand with Silt (SP-SM)
<u>Sample:</u>	EB-16 (15.5'-17.0')
<u>Sample Date:</u>	December 2018
<u>Sampled By:</u>	TTL, Inc.
<u>Simulated In Situ Dry Density:</u>	97.8 pcf
<u>Simulated In Situ Moisture:</u>	17.3 %
<u>Hydraulic Conductivity "k":</u>	1.8×10^{-4} cm/sec

Note: Not an undisturbed sample. Soil sample collected directly from sonic rig core.



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**HYDRAULIC CONDUCTIVITY ANALYSIS
ASTM D 2434**

**Twin Pines Minerals, LLC
St. George, Georgia
TTL Project No. 000180200804.00**

December 2018

Material Description: Black Sand (SP)

Sample: EB-16 (25.5'-26.0')

Sample Date: December 2018

Sampled By: TTL, Inc.

Remolded Dry Density: 98.5 pcf

Remolded Moisture: 17.0 %

Hydraulic Conductivity "k": 2.3×10^{-2} cm/sec



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**HYDRAULIC CONDUCTIVITY ANALYSIS
ASTM D 2434**

**Twin Pines Minerals, LLC
St. George, Georgia
TTL Project No. 000180200804.00**

December 2018

<u>Material Description:</u>	Black Sand (SP)
<u>Sample:</u>	EB-16 (34.5'-36.0')
<u>Sample Date:</u>	December 2018
<u>Sampled By:</u>	TTL, Inc.
<u>Remolded Dry Density:</u>	101.3 pcf
<u>Remolded Moisture:</u>	13.0 %
<u>Hydraulic Conductivity "k":</u>	1.9×10^{-2} cm/sec



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**HYDRAULIC CONDUCTIVITY ANALYSIS
ASTM D 2434**

**Twin Pines Minerals, LLC
St. George, Georgia
TTL Project No. 000180200804.00**

December 2018

Material Description: Black Sand (SP)

Sample: EB-16 (44.5'-46.0')

Sample Date: December 2018

Sampled By: TTL, Inc.

Remolded Dry Density: 97.6 pcf

Remolded Moisture: 21.7 %

Hydraulic Conductivity "k": 2.4×10^{-2} cm/sec



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**HYDRAULIC CONDUCTIVITY ANALYSIS
ASTM D 5084**

**Twin Pines Minerals, LLC
St. George, Georgia
TTL Project No. 000180200804.00**

December 2018

Material Description: Gray Fat Clay (CH)

Sample: EB-16 (86.0'-90.0')

Sample Date: December 2018

Sampled By: TTL, Inc.

Simulated In Situ Dry Density: 79.5 pcf

Simulated In Situ Moisture: 38.2 %

Hydraulic Conductivity "k": 1.3×10^{-8} cm/sec

Note: Not an undisturbed sample. Soil sample collected directly from sonic rig core.



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**HYDRAULIC CONDUCTIVITY ANALYSIS
ASTM D 5084**

**Twin Pines Minerals, LLC
St. George, Georgia
TTL Project No. 000180200804.00**

May 2019

Material Description: Black Sand with Silt (Visual Description)

Sample: PZ-57 (20.0'-22.0')

Sample Date: May 2019

Sampled By: TTL, Inc.

In Situ Dry Density: 104.1 pcf

In Situ Moisture: 18.9 %

Hydraulic Conductivity "k": 2.7×10^{-8} cm/sec



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**HYDRAULIC CONDUCTIVITY ANALYSIS
ASTM D 5084**

**Twin Pines Minerals, LLC
St. George, Georgia
TTL Project No. 000180200804.00**

May 2019

Material Description: Black Sand with Silt (Visual Description)

Sample: PZ-57 (25.0'-27.0')

Sample Date: May 2019

Sampled By: TTL, Inc.

In Situ Dry Density: 95.7 pcf

In Situ Moisture: 22.2 %

Hydraulic Conductivity "k": 3.4×10^{-7} cm/sec



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**HYDRAULIC CONDUCTIVITY ANALYSIS
ASTM D 5084**

**Twin Pines Minerals, LLC
St. George, Georgia
TTL Project No. 000180200804.00**

November 2019

Material Description: Light Brown Sand with Silt (SP-SM)

Sample: UD 25R (3.0'-5.0')

Sample Date: November 2019

Sampled By: TTL, Inc.

In Situ Dry Density: 100.8 pcf

In Situ Moisture: 18.2 %

Hydraulic Conductivity "k": 3.2×10^{-4} cm/sec



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**HYDRAULIC CONDUCTIVITY ANALYSIS
ASTM D 5084**

**Twin Pines Minerals, LLC
St. George, Georgia
TTL Project No. 000180200804.00**

November 2019

<u>Material Description:</u>	Black Brown Sand (SP)
<u>Sample:</u>	UD 25R (10.0'-12.0')
<u>Sample Date:</u>	November 2019
<u>Sampled By:</u>	TTL, Inc.
<u>In Situ Dry Density:</u>	97.4 pcf
<u>In Situ Moisture:</u>	24.2 %
<u>Hydraulic Conductivity "k":</u>	2.3×10^{-4} cm/sec



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**HYDRAULIC CONDUCTIVITY ANALYSIS
ASTM D 5084**

**Twin Pines Minerals, LLC
St. George, Georgia
TTL Project No. 000180200804.00**

November 2019

<u>Material Description:</u>	Black Brown Sand (SP)
<u>Sample:</u>	UD 43R (5.0'-7.0')
<u>Sample Date:</u>	November 2019
<u>Sampled By:</u>	TTL, Inc.
<u>In Situ Dry Density:</u>	101.2 pcf
<u>In Situ Moisture:</u>	18.9 %
<u>Hydraulic Conductivity "k":</u>	6.2×10^{-4} cm/sec



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**HYDRAULIC CONDUCTIVITY ANALYSIS
ASTM D 5084**

**Twin Pines Minerals, LLC
St. George, Georgia
TTL Project No. 000180200804.00**

November 2019

<u>Material Description:</u>	Black Brown Sand (SP)
<u>Sample:</u>	UD 43R (10.0'-12.0')
<u>Sample Date:</u>	November 2019
<u>Sampled By:</u>	TTL, Inc.
<u>In Situ Dry Density:</u>	101.6 pcf
<u>In Situ Moisture:</u>	18.9 %
<u>Hydraulic Conductivity "k":</u>	4.5×10^{-4} cm/sec



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**HYDRAULIC CONDUCTIVITY ANALYSIS
ASTM D 5084**

**Twin Pines Minerals, LLC
St. George, Georgia
TTL Project No. 000180200804.00**

November 2019

<u>Material Description:</u>	Black Brown Sand (SP)
<u>Sample:</u>	UD 238R (6.0'-8.0')
<u>Sample Date:</u>	November 2019
<u>Sampled By:</u>	TTL, Inc.
<u>In Situ Dry Density:</u>	100.6 pcf
<u>In Situ Moisture:</u>	18.8 %
<u>Hydraulic Conductivity "k":</u>	8.5×10^{-4} cm/sec



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**HYDRAULIC CONDUCTIVITY ANALYSIS
ASTM D 5084**

**Twin Pines Minerals, LLC
St. George, Georgia
TTL Project No. 000180200804.00**

November 2019

<u>Material Description:</u>	Black Brown Sand (SP)
<u>Sample:</u>	UD 238R (10.0'-12.0')
<u>Sample Date:</u>	November 2019
<u>Sampled By:</u>	TTL, Inc.
<u>In Situ Dry Density:</u>	95.7 pcf
<u>In Situ Moisture:</u>	17.1 %
<u>Hydraulic Conductivity "k":</u>	4.0×10^{-4} cm/sec



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**HYDRAULIC CONDUCTIVITY ANALYSIS
ASTM D 5084**

**Twin Pines Minerals, LLC
St. George, Georgia
TTL Project No. 000180200804.00**

November 2019

<u>Material Description:</u>	Black Brown Sand (SP)
<u>Sample:</u>	UD 338R (9.0'-11.0')
<u>Sample Date:</u>	November 2019
<u>Sampled By:</u>	TTL, Inc.
<u>In Situ Dry Density:</u>	108.2 pcf
<u>In Situ Moisture:</u>	19.3 %
<u>Hydraulic Conductivity "k":</u>	3.0×10^{-4} cm/sec

ATTACHMENT B

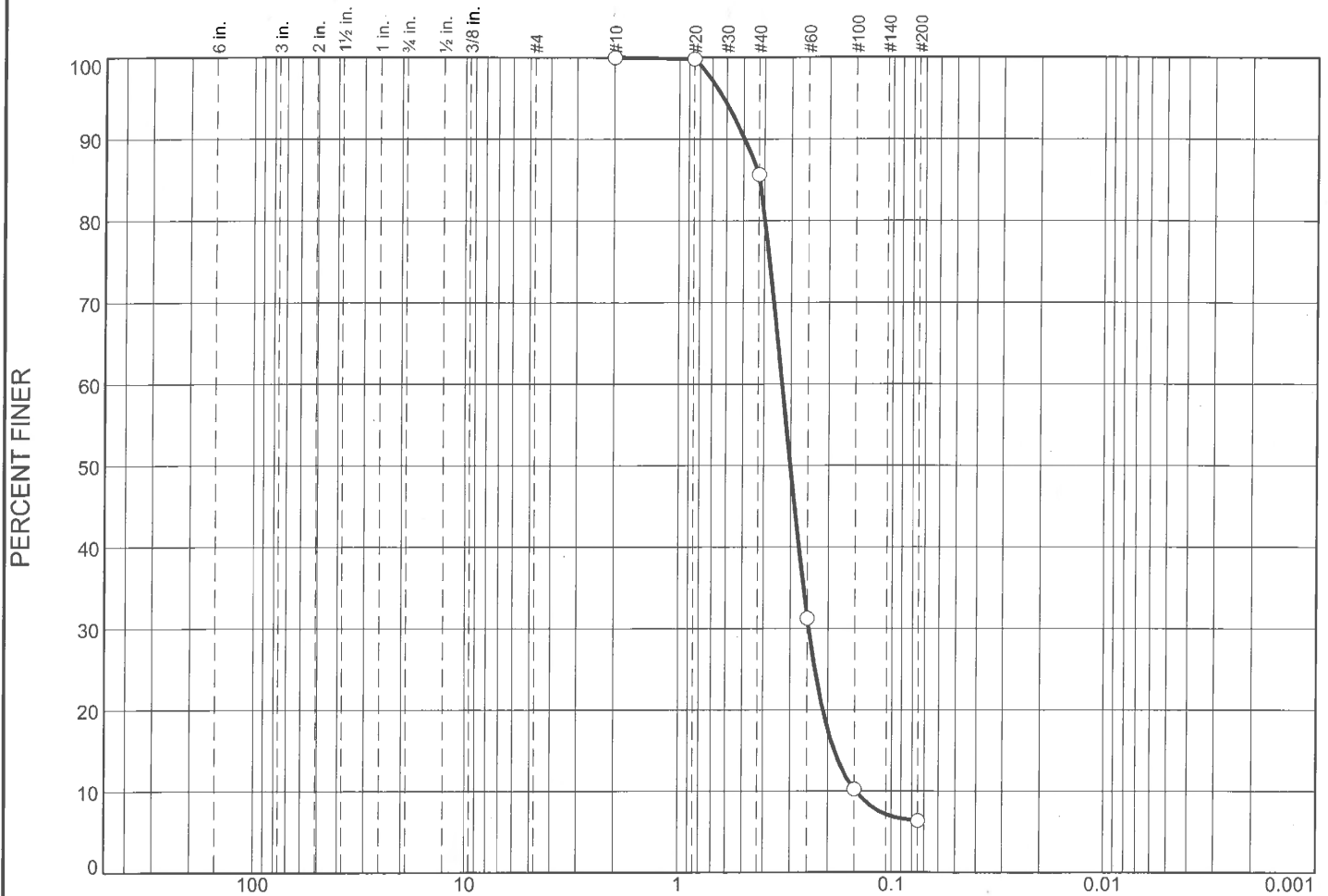
GRAIN-SIZE DISTRIBUTION TEST REPORTS

Attached Documents:

Bowser-Morner Laboratory Reports
TTL Laboratory Reports

BOWSER-MORNER LABORATORY REPORTS

GRAIN SIZE DISTRIBUTION REPORT



GRAIN SIZE - mm.

	% +3"		% Gravel		% Sand			% Fines		
			Coarse	Fine	Coarse	Medium	Fine	Silt		Clay
○	0.0		0.0	0.0	0.0	14.3	79.3	6.4		
×	LL	PL	D ₈₅	D ₆₀	D ₅₀	D ₃₀	D ₁₅	D ₁₀	C _c	C _u
○	NV	NP	0.4214	0.3292	0.3013	0.2463	0.1865	0.1474	1.25	2.23

Material Description	USCS	AASHTO
○ brown silty SAND	SP-SM	A-3

Project No. 187609 **Client:** TTL
Project: TTL Job No 000180200804
 Analysis of Forty-Two Thin Wall Tube Samples
 ○ **Source of Sample:** UD-10 **Depth:** 13' - 15' **Sample Number:** UD-10

BOWSER-MORNER, INC.

Dayton, Ohio

Remarks:

○ As Received

Moisture Content: 20.5%

GRAIN SIZE DISTRIBUTION TEST DATA

2/20/2019

Client: TTL

Project: TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

Project Number: 187609

Location: UD-10

Depth: 13' - 15'

Sample Number: UD-10

Material Description: brown silty SAND

Liquid Limit: NV

Plastic Limit: NP

USCS Classification: SP-SM

AASHTO Classification: A-3

Testing Remarks: As Received

Moisture Content: 20.5%

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
564.05	114.28	0.00	#10	0.00	100.0
			#20	0.86	99.8
			#40	64.44	85.7
			#60	309.28	31.2
			#100	403.67	10.2
			#200	420.98	6.4

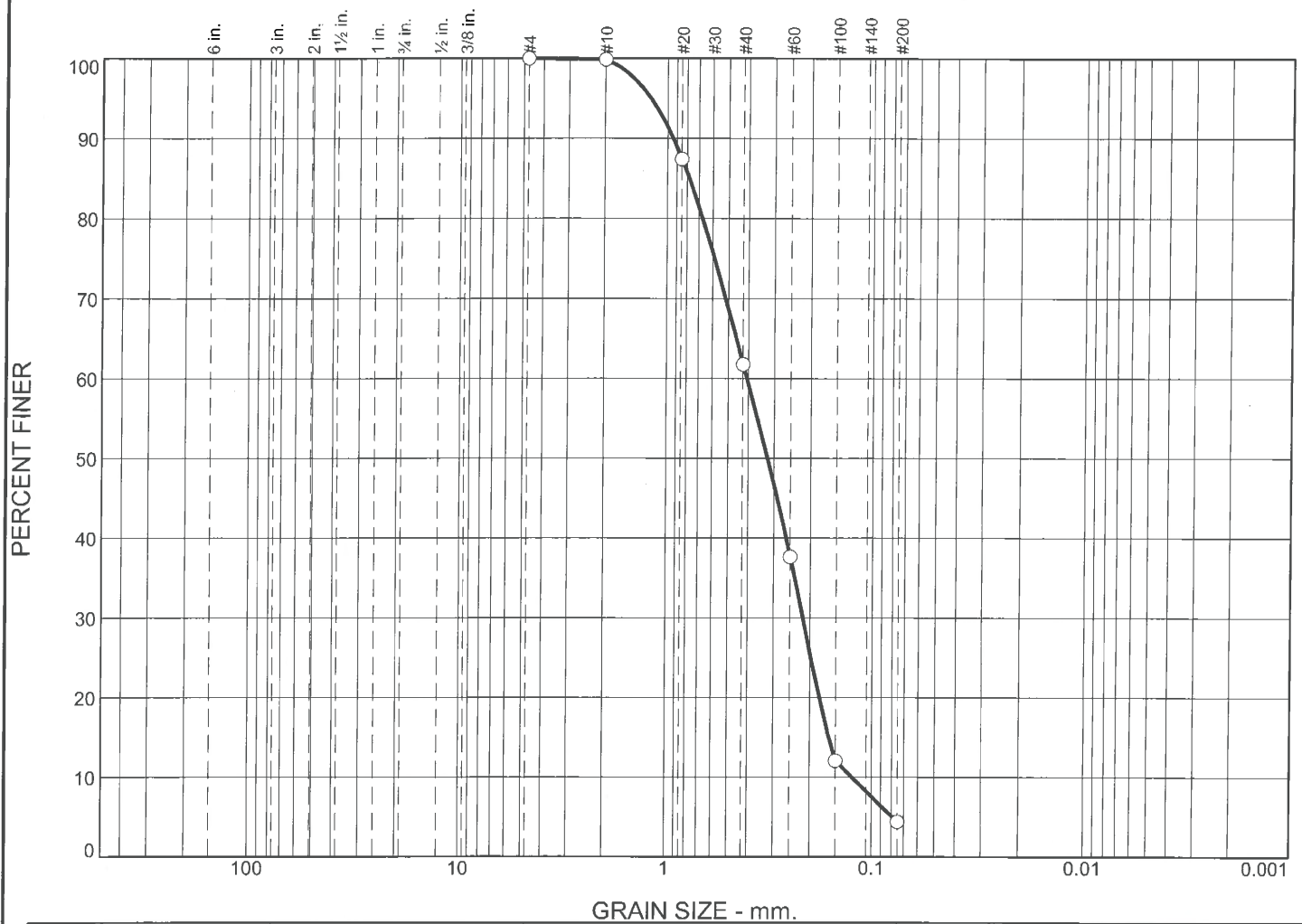
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	14.3	79.3	93.6			6.4

D ₅	D ₁₀	D ₁₅	D ₂₀	D ₃₀	D ₄₀	D ₅₀	D ₆₀	D ₈₀	D ₈₅	D ₉₀	D ₉₅
	0.1474	0.1865	0.2109	0.2463	0.2745	0.3013	0.3292	0.3977	0.4214	0.4978	0.6224

Fineness Modulus	C _u	C _c
1.46	2.23	1.25

GRAIN SIZE DISTRIBUTION REPORT



	% +3"		% Gravel		% Sand			% Fines		
			Coarse	Fine	Coarse	Medium	Fine	Silt		Clay
○	0.0		0.0	0.0	0.2	38.0	57.4	4.4		
×	LL	PL	D ₈₅	D ₆₀	D ₅₀	D ₃₀	D ₁₅	D ₁₀	C _c	C _u
○	NV	NP	0.7822	0.4074	0.3229	0.2170	0.1616	0.1244	0.93	3.28

Material Description							USCS	AASHTO
○ brown poorly graded SAND							SP	A-3

Project No. 187609 **Client:** TTL
Project: TTL Job No 000180200804
 Analysis of Forty-Two Thin Wall Tube Samples
 ○ **Source of Sample:** UD-10 **Depth:** 28' - 30' **Sample Number:** UD-10

Remarks:
 ○ As Received
 Moisture Content: 21.4%

BOWSER-MORNER, INC.

Dayton, Ohio

GRAIN SIZE DISTRIBUTION TEST DATA

2/20/2019

Client: TTL

Project: TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

Project Number: 187609

Location: UD-10

Depth: 28' - 30'

Sample Number: UD-10

Material Description: brown poorly graded SAND

Liquid Limit: NV

Plastic Limit: NP

USCS Classification: SP

AASHTO Classification: A-3

Testing Remarks: As Received

Moisture Content: 21.4%

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
293.25	117.40	0.00	#4	0.00	100.0
			#10	0.27	99.8
			#20	22.08	87.4
			#40	67.22	61.8
			#60	109.61	37.7
			#100	154.60	12.1
			#200	168.15	4.4

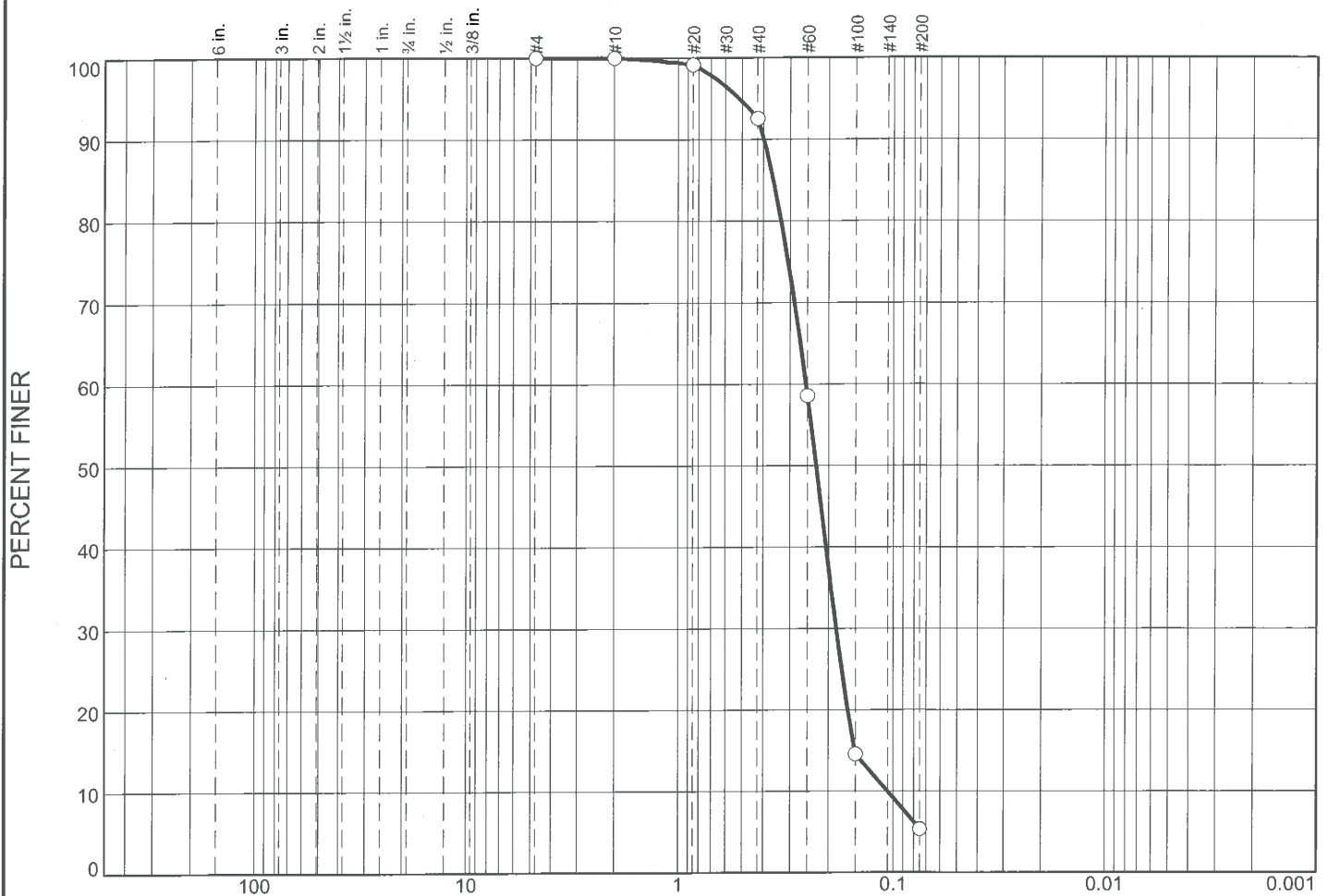
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.2	38.0	57.4	95.6			4.4

D ₅	D ₁₀	D ₁₅	D ₂₀	D ₃₀	D ₄₀	D ₅₀	D ₆₀	D ₈₀	D ₈₅	D ₉₀	D ₉₅
0.0793	0.1244	0.1616	0.1799	0.2170	0.2616	0.3229	0.4074	0.6732	0.7822	0.9379	1.2070

Fineness Modulus	C _u	C _c
1.71	3.28	0.93

GRAIN SIZE DISTRIBUTION REPORT



GRAIN SIZE - mm.

	% +3"	% Gravel		% Sand			% Fines		
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay	
☐	0.0	0.0	0.0	0.0	7.4	87.3	5.3		
☐									
☒	LL	PL	D ₈₅	D ₆₀	D ₅₀	D ₃₀	D ₁₅	D ₁₀	C _c
☐	NV	NP	0.3596	0.2540	0.2277	0.1839	0.1511	0.1065	1.25
☐									
☐									

Material Description	USCS	AASHTO
☐ brown poorly graded SAND with silt	SP-SM	A-3

Project No. 187609 **Client:** TTL
Project: TTL Job No 000180200804
 Analysis of Forty-Two Thin Wall Tube Samples
☐ **Source of Sample:** UD-10 **Depth:** 43' - 45' **Sample Number:** UD-10

Remarks:
☐ As Received
 Moisture Content: 20.2%

BOWSER-MORNER, INC.

Dayton, Ohio

GRAIN SIZE DISTRIBUTION TEST DATA

2/20/2019

Client: TTL

Project: TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

Project Number: 187609

Location: UD-10

Depth: 43' - 45'

Sample Number: UD-10

Material Description: brown poorly graded SAND with silt

Liquid Limit: NV

Plastic Limit: NP

USCS Classification: SP-SM

AASHTO Classification: A-3

Testing Remarks: As Received

Moisture Content: 20.2%

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
648.50	119.43	0.00	#4	0.00	100.0
			#10	0.04	100.0
			#20	4.42	99.2
			#40	39.35	92.6
			#60	219.06	58.6
			#100	452.09	14.6
			#200	500.77	5.3

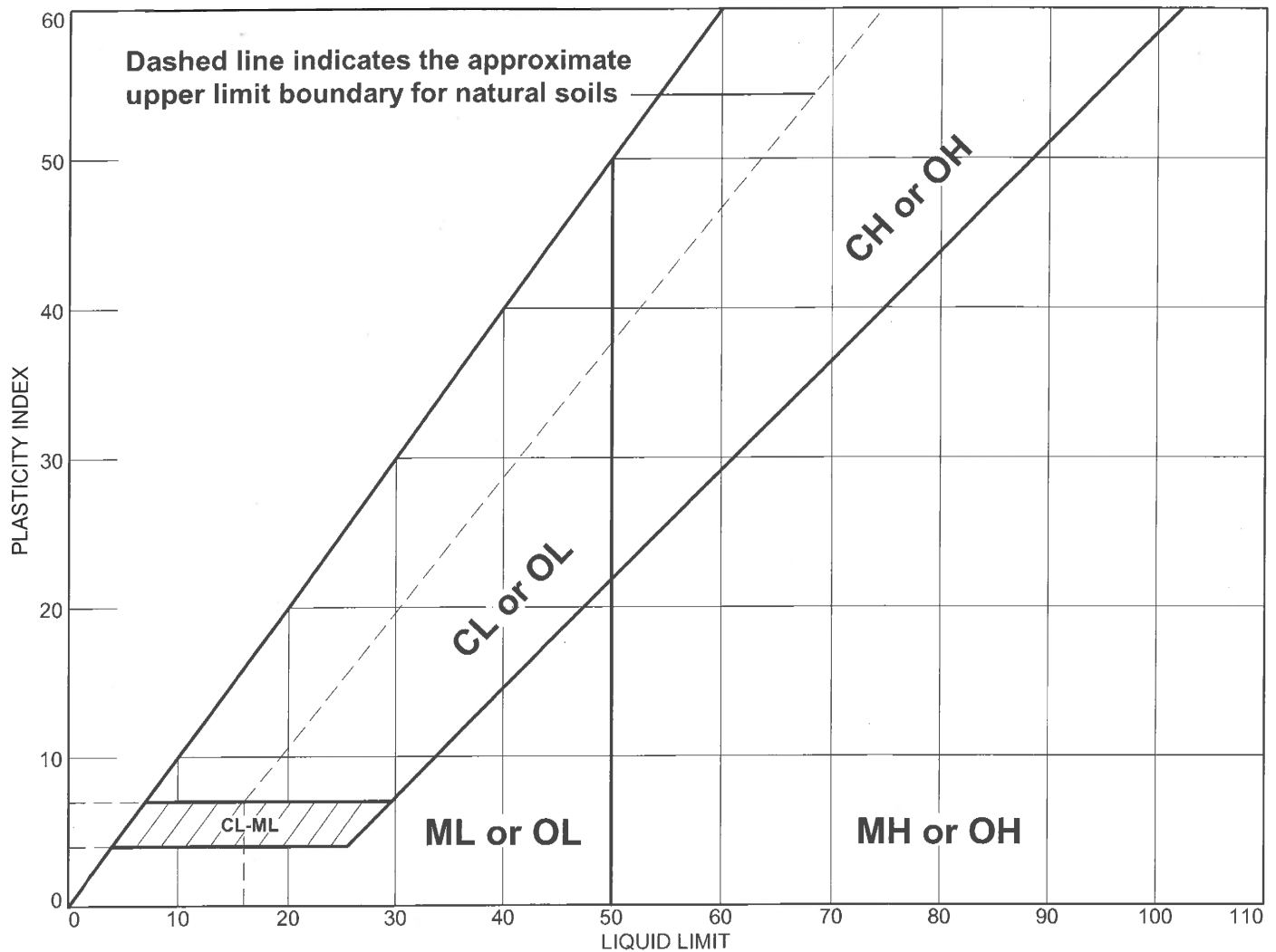
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	7.4	87.3	94.7			5.3

D ₅	D ₁₀	D ₁₅	D ₂₀	D ₃₀	D ₄₀	D ₅₀	D ₆₀	D ₈₀	D ₈₅	D ₉₀	D ₉₅
	0.1065	0.1511	0.1627	0.1839	0.2050	0.2277	0.2540	0.3304	0.3596	0.3983	0.5185

Fineness Modulus	C _u	C _c
1.16	2.39	1.25

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	brown silty SAND	NV	NP	NP	85.7	6.4	SP-SM
■	brown poorly graded SAND	NV	NP	NP	61.8	4.4	SP
▲	brown poorly graded SAND with silt	NV	NP	NP	92.6	5.3	SP-SM

Project No. 187609

Client: TTL

Project: TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

● **Source of Sample:** UD-10

Depth: 13' - 15'

Sample Number: UD-10

■ **Source of Sample:** UD-10

Depth: 28' - 30'

Sample Number: UD-10

▲ **Source of Sample:** UD-10

Depth: 43' - 45'

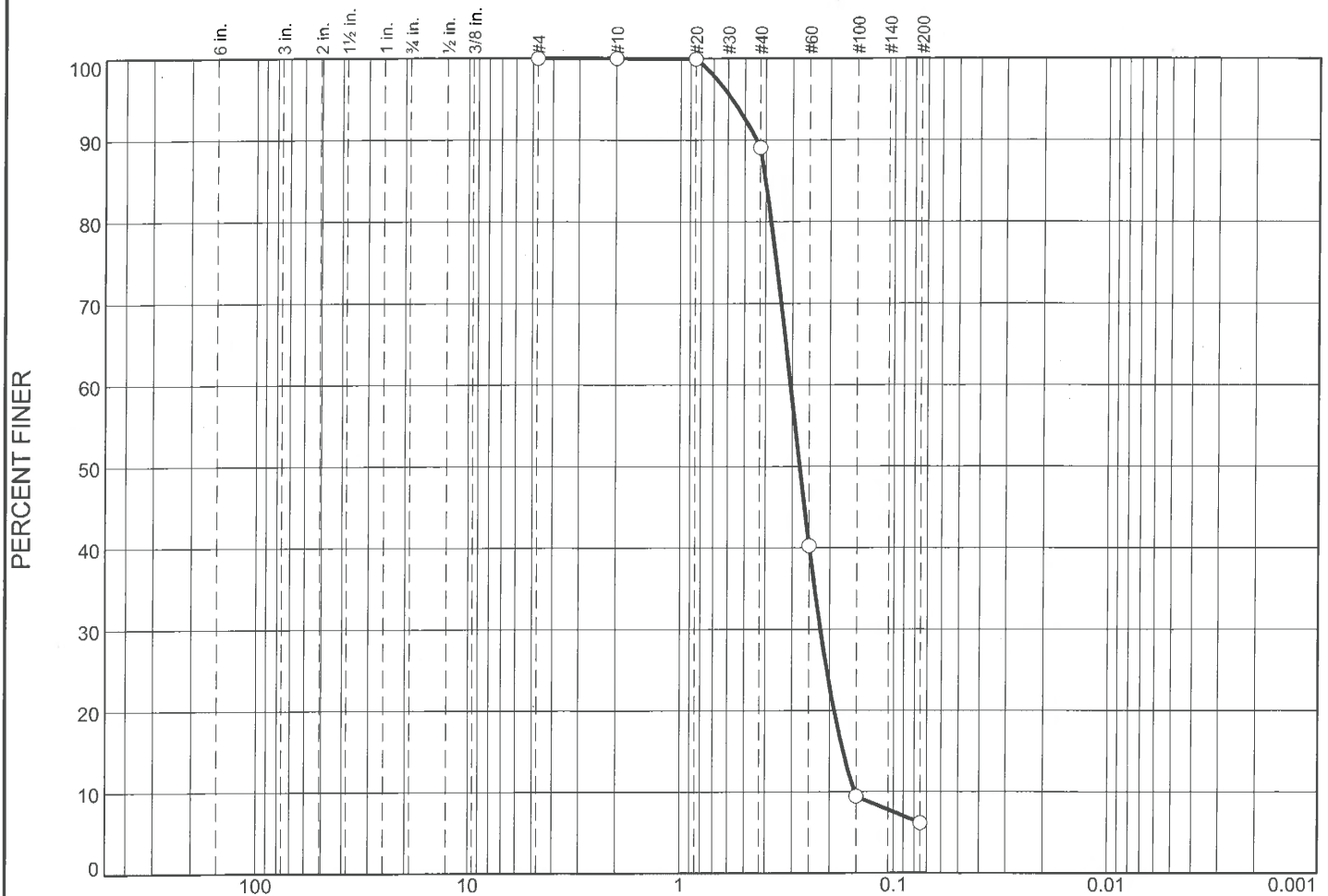
Sample Number: UD-10

Remarks:

BOWSER-MORNER, INC.

Dayton, Ohio

GRAIN SIZE DISTRIBUTION REPORT



GRAIN SIZE - mm.

	% +3"	% Gravel		% Sand			% Fines		
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay	
○	0.0	0.0	0.0	0.0	10.9	82.9	6.2		
×	LL	PL	D ₈₅	D ₆₀	D ₅₀	D ₃₀	D ₁₅	D ₁₀	C _c
○	NV	NP	0.4009	0.3058	0.2769	0.2209	0.1729	0.1526	1.05
									C _u
									2.00

Material Description

○ brown poorly graded SAND with silt

USCS

SP-SM

AASHTO

A-3

Project No. 187609

Client: TTL

Project: TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

○ **Source of Sample:** UD-25

Depth: 15' - 17'

Sample Number: UD-25

Remarks:

○ As Received

Moisture Content: 25.9%

BOWSER-MORNER, INC.

Dayton, Ohio

GRAIN SIZE DISTRIBUTION TEST DATA

2/20/2019

Client: TTL

Project: TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

Project Number: 187609

Location: UD-25

Depth: 15' - 17'

Sample Number: UD-25

Material Description: brown poorly graded SAND with silt

Liquid Limit: NV

Plastic Limit: NP

USCS Classification: SP-SM

AASHTO Classification: A-3

Testing Remarks: As Received

Moisture Content: 25.9%

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
258.43	119.52	0.00	#4	0.00	100.0
			#10	0.02	100.0
			#20	0.12	99.9
			#40	15.16	89.1
			#60	83.00	40.2
			#100	125.77	9.5
			#200	130.33	6.2

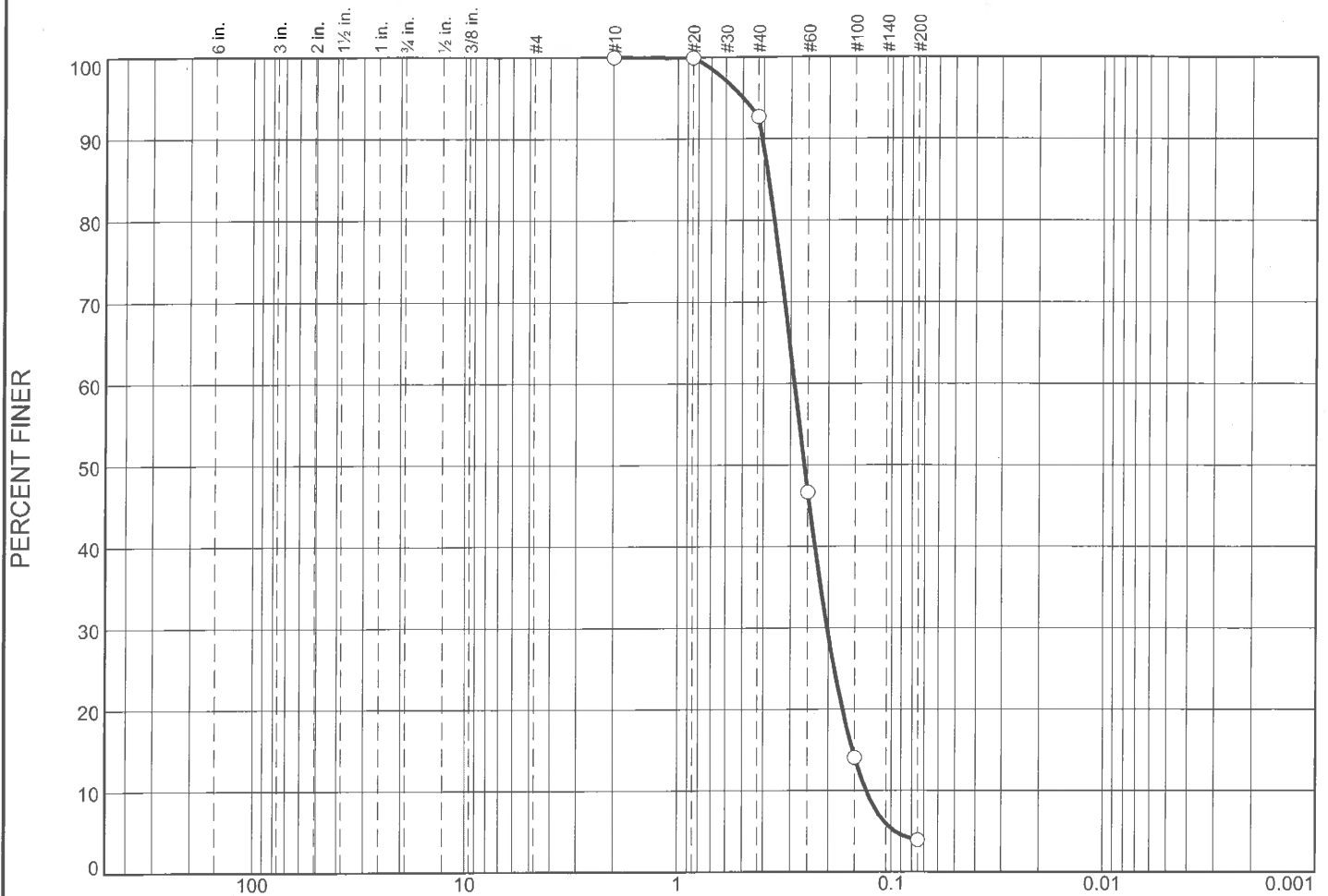
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	10.9	82.9	93.8			6.2

D ₅	D ₁₀	D ₁₅	D ₂₀	D ₃₀	D ₄₀	D ₅₀	D ₆₀	D ₈₀	D ₈₅	D ₉₀	D ₉₅
	0.1526	0.1729	0.1902	0.2209	0.2493	0.2769	0.3058	0.3768	0.4009	0.4429	0.5752

Fineness Modulus	C _u	C _c
1.37	2.00	1.05

GRAIN SIZE DISTRIBUTION REPORT



GRAIN SIZE - mm.

	% +3"		% Gravel		% Sand			% Fines		
			Coarse	Fine	Coarse	Medium	Fine	Silt		Clay
○	0.0		0.0	0.0	0.0	7.3	88.8	3.9		
×	LL	PL	D ₈₅	D ₆₀	D ₅₀	D ₃₀	D ₁₅	D ₁₀	C _c	C _u
○	NV	NP	0.3795	0.2882	0.2594	0.2023	0.1537	0.1323	1.07	2.18

Material Description	USCS	AASHTO
○ dark brown poorly graded SAND	SP	A-3

Project No. 187609 **Client:** TTL
Project: TTL Job No 000180200804
 Analysis of Forty-Two Thin Wall Tube Samples
 ○ **Source of Sample:** UD-25 **Depth:** 30' - 32' **Sample Number:** UD-25

BOWSER-MORNER, INC.

Dayton, Ohio

Remarks:

○ As Received

Moisture Content: 23.3%

GRAIN SIZE DISTRIBUTION TEST DATA

2/20/2019

Client: TTL

Project: TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

Project Number: 187609

Location: UD-25

Depth: 30' - 32'

Sample Number: UD-25

Material Description: dark brown poorly graded SAND

Liquid Limit: NV

Plastic Limit: NP

USCS Classification: SP

AASHTO Classification: A-3

Testing Remarks: As Received

Moisture Content: 23.3%

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
245.09	92.89	0.00	#10	0.00	100.0
			#20	0.14	99.9
			#40	11.10	92.7
			#60	81.18	46.7
			#100	130.83	14.0
			#200	146.25	3.9

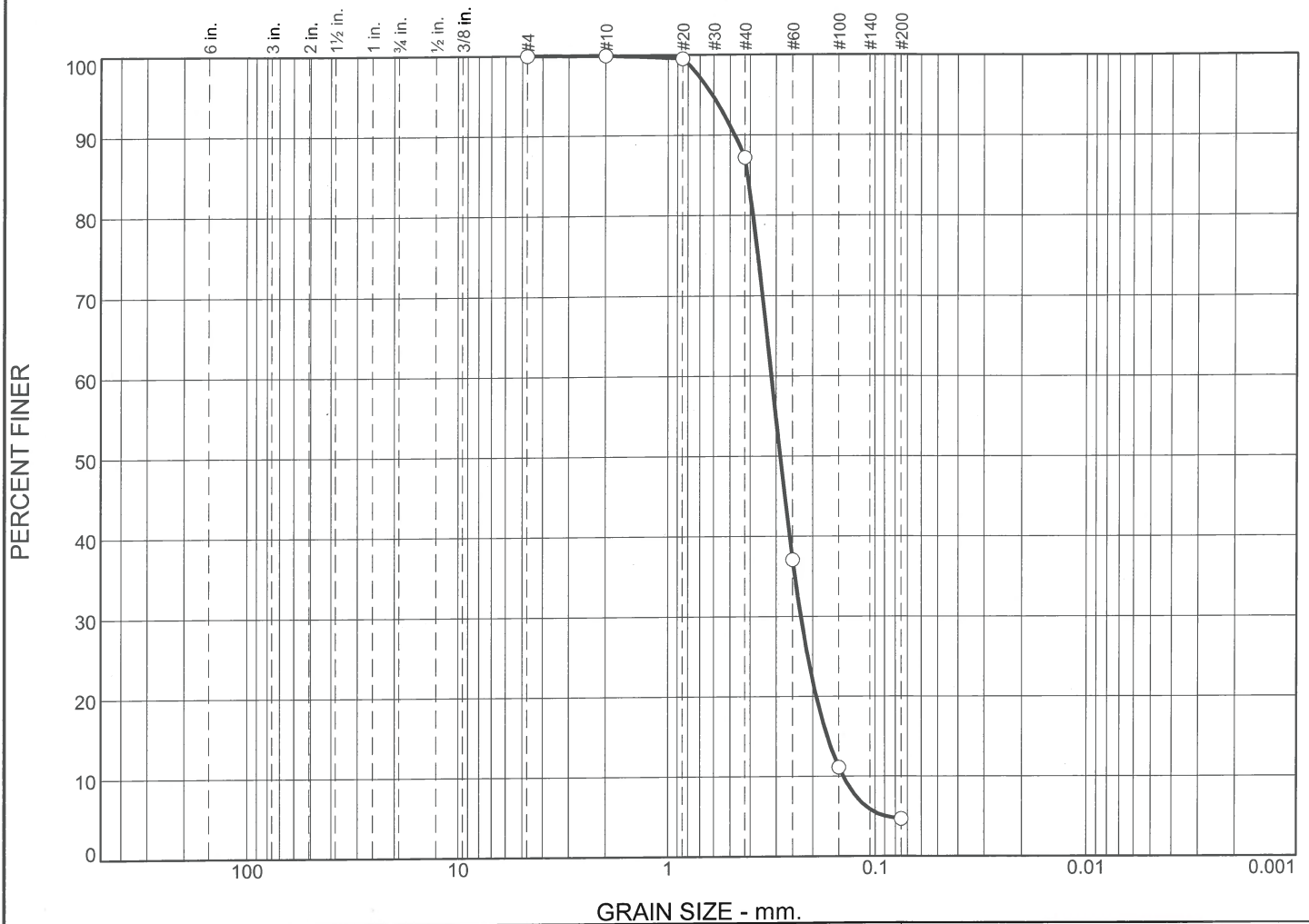
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	7.3	88.8	96.1			3.9

D ₅	D ₁₀	D ₁₅	D ₂₀	D ₃₀	D ₄₀	D ₅₀	D ₆₀	D ₈₀	D ₈₅	D ₉₀	D ₉₅
0.0964	0.1323	0.1537	0.1712	0.2023	0.2312	0.2594	0.2882	0.3570	0.3795	0.4067	0.5013

Fineness Modulus	C _u	C _c
1.25	2.18	1.07

GRAIN SIZE DISTRIBUTION REPORT



	% +3"		% Gravel		% Sand			% Fines		
			Coarse	Fine	Coarse	Medium	Fine	Silt		Clay
○	0.0		0.0	0.0	0.1	12.7	82.5	4.7		
×	LL	PL	D ₈₅	D ₆₀	D ₅₀	D ₃₀	D ₁₅	D ₁₀	C _c	C _u
○	NV	NP	0.4120	0.3159	0.2867	0.2282	0.1707	0.1429	1.15	2.21

Material Description	USCS	AASHTO
○ dark brown poorly graded SAND	SP	A-3

Project No. 187609 Client: TTL Project: TTL Job No 000180200804 Analysis of Forty-Two Thin Wall Tube Samples ○ Source of Sample: UD-25 Depth: 43' - 45' Sample Number: UD-25	Remarks: ○ As Received Moisture Content: 20.2%
BOWSER-MORNER, INC. Dayton, Ohio	

GRAIN SIZE DISTRIBUTION TEST DATA

2/20/2019

Client: TTL

Project: TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

Project Number: 187609

Location: UD-25

Depth: 43' - 45'

Sample Number: UD-25

Material Description: dark brown poorly graded SAND

Liquid Limit: NV

Plastic Limit: NP

USCS Classification: SP

AASHTO Classification: A-3

Testing Remarks: As Received

Moisture Content: 20.2%

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
348.38	114.21	0.00	#4	0.00	100.0
			#10	0.12	99.9
			#20	1.09	99.5
			#40	29.90	87.2
			#60	147.31	37.1
			#100	208.10	11.1
			#200	223.18	4.7

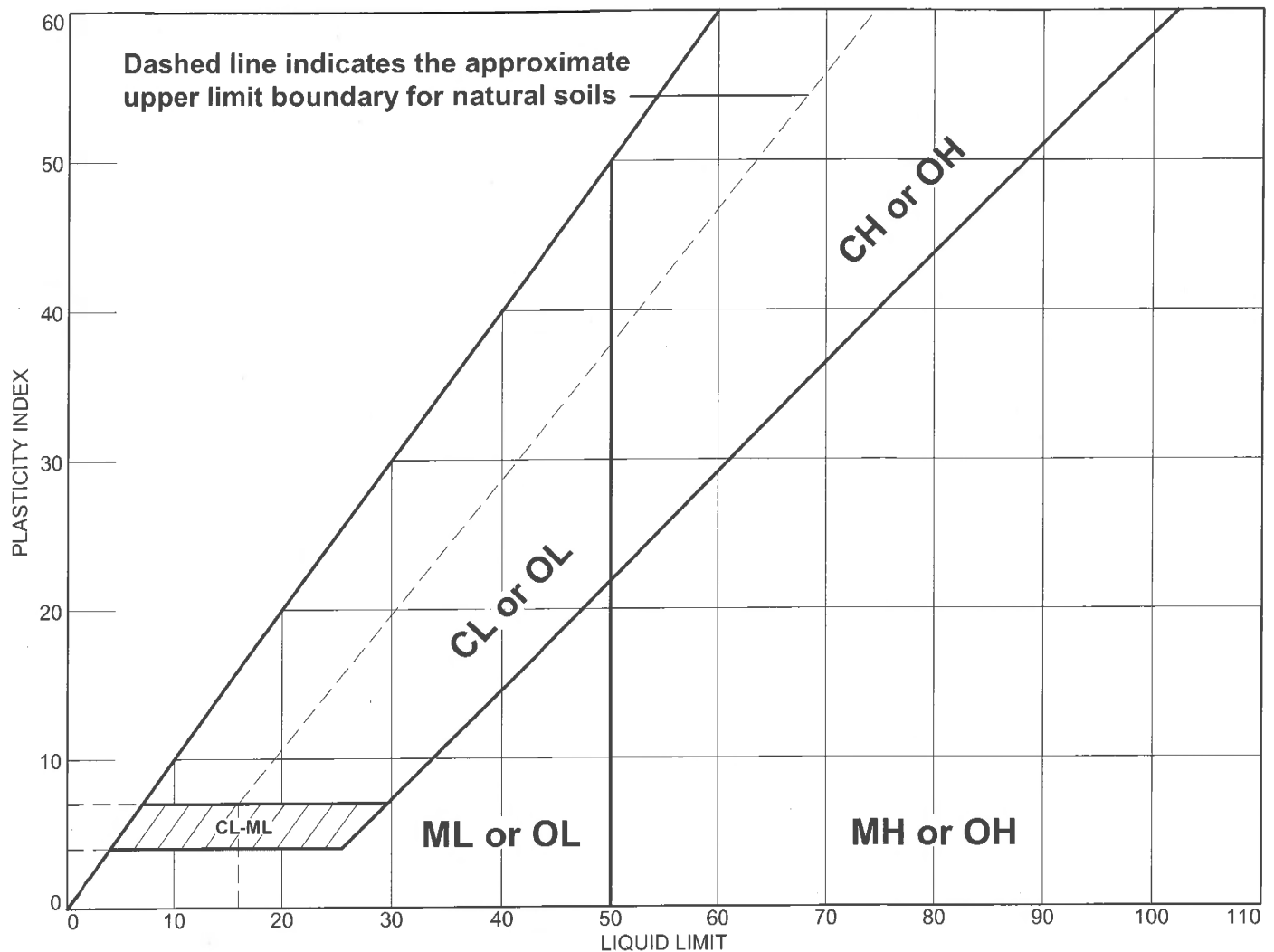
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.1	12.7	82.5	95.3			4.7

D ₅	D ₁₀	D ₁₅	D ₂₀	D ₃₀	D ₄₀	D ₅₀	D ₆₀	D ₈₀	D ₈₅	D ₉₀	D ₉₅
0.0883	0.1429	0.1707	0.1926	0.2282	0.2584	0.2867	0.3159	0.3875	0.4120	0.4765	0.6106

Fineness Modulus	C _u	C _c
1.40	2.21	1.15

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	brown poorly graded SAND with silt	NV	NP	NP	89.1	6.2	SP-SM
■	dark brown poorly graded SAND	NV	NP	NP	92.7	3.9	SP
▲	dark brown poorly graded SAND	NV	NP	NP	87.2	4.7	SP

Project No. 187609

Client: TTL

Project: TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

● Source of Sample: UD-25

Depth: 15' - 17'

Sample Number: UD-25

■ Source of Sample: UD-25

Depth: 30' - 32'

Sample Number: UD-25

▲ Source of Sample: UD-25

Depth: 43' - 45'

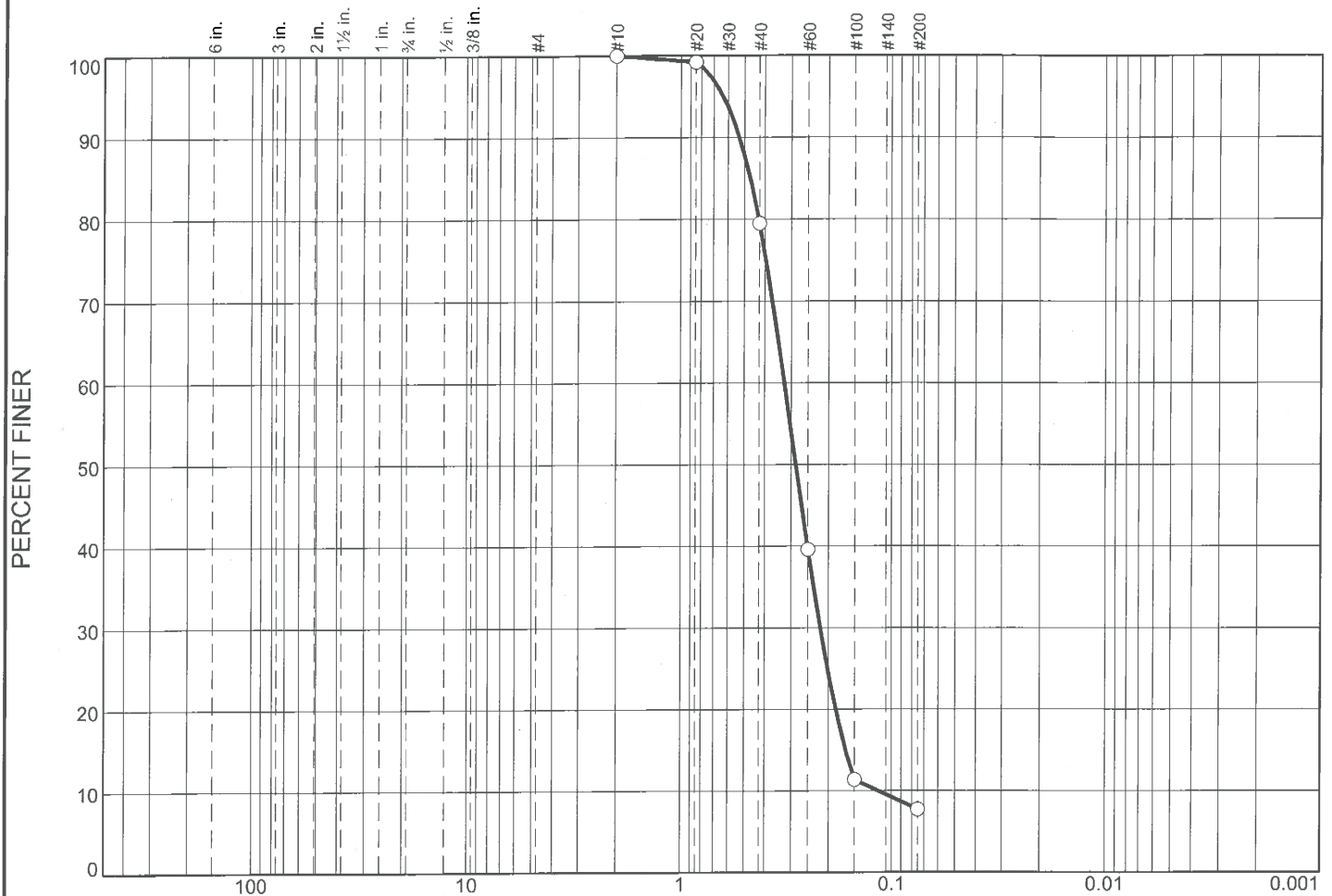
Sample Number: UD-25

Remarks:

BOWSER-MORNER, INC.

Dayton, Ohio

GRAIN SIZE DISTRIBUTION REPORT



GRAIN SIZE - mm.

	% +3"		% Gravel		% Sand			% Fines		
			Coarse	Fine	Coarse	Medium	Fine	Silt		Clay
○	0.0		0.0	0.0	0.0	20.5	71.8	7.7		
×	LL	PL	D ₈₅	D ₆₀	D ₅₀	D ₃₀	D ₁₅	D ₁₀	C _c	C _u
○	NV	NP	0.4711	0.3235	0.2856	0.2182	0.1656	0.1153	1.28	2.81

Material Description	USCS	AASHTO
○ dark brown poorly graded SAND with silt	SP-SM	A-3

Project No. 187609 **Client:** TTL
Project: TTL Job No 000180200804
 Analysis of Forty-Two Thin Wall Tube Samples
 ○ **Source of Sample:** UD-34 **Depth:** 13' - 15' **Sample Number:** UD-34

BOWSER-MORNER, INC.
 Dayton, Ohio

Remarks:
 ○ As Received
 Moisture Content: 18.6%

GRAIN SIZE DISTRIBUTION TEST DATA

2/20/2019

Client: TTL

Project: TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

Project Number: 187609

Location: UD-34

Depth: 13' - 15'

Sample Number: UD-34

Material Description: dark brown poorly graded SAND with silt

Liquid Limit: NV

Plastic Limit: NP

USCS Classification: SP-SM

AASHTO Classification: A-3

Testing Remarks: As Received

Moisture Content: 18.6%

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
204.99	112.79	0.00	#10	0.00	100.0
			#20	0.74	99.2
			#40	18.89	79.5
			#60	55.69	39.6
			#100	81.70	11.4
			#200	85.07	7.7

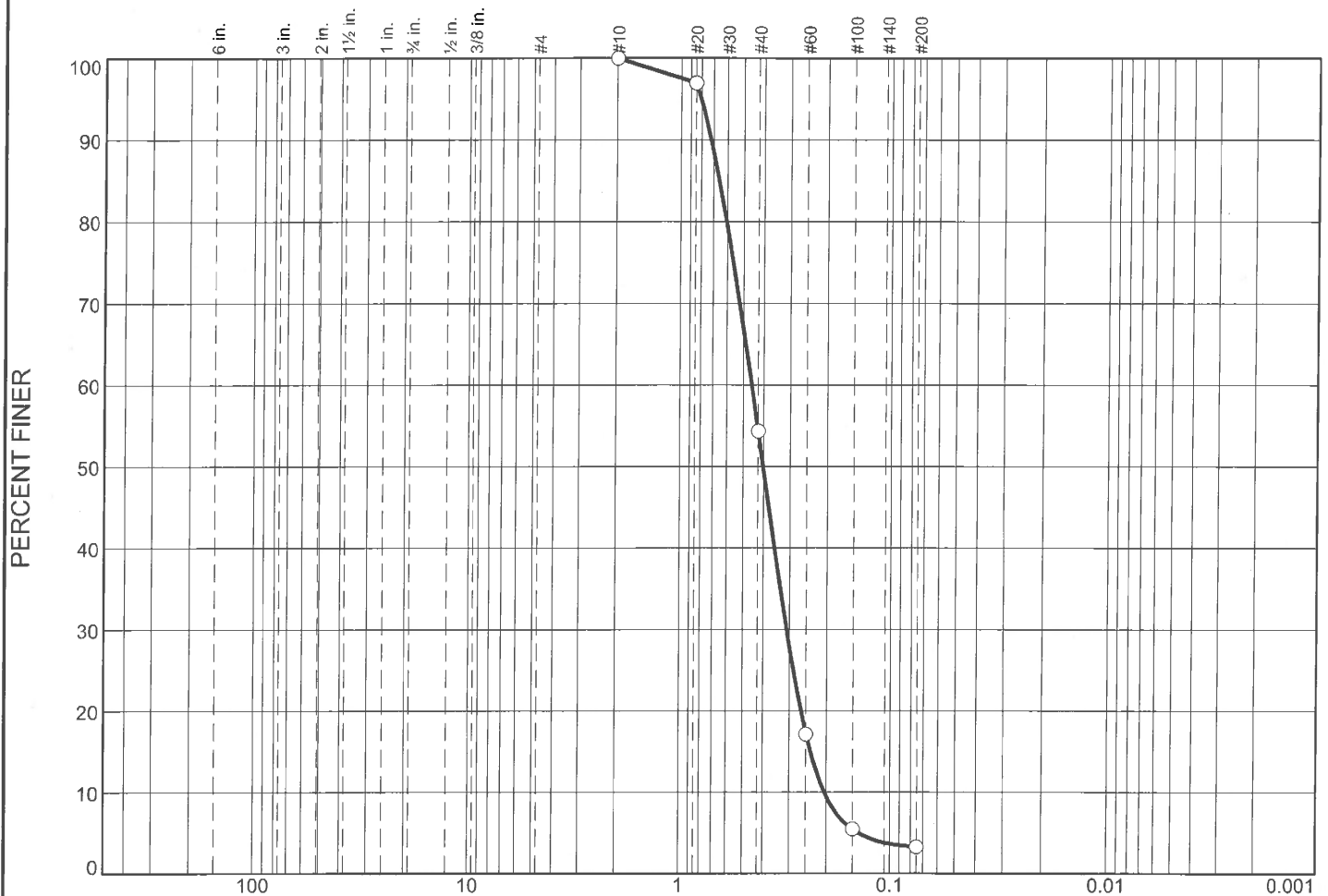
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	20.5	71.8	92.3			7.7

D ₅	D ₁₀	D ₁₅	D ₂₀	D ₃₀	D ₄₀	D ₅₀	D ₆₀	D ₈₀	D ₈₅	D ₉₀	D ₉₅
	0.1153	0.1656	0.1843	0.2182	0.2513	0.2856	0.3235	0.4285	0.4711	0.5314	0.6331

Fineness Modulus	C _u	C _c
1.41	2.81	1.28

GRAIN SIZE DISTRIBUTION REPORT



GRAIN SIZE - mm.

	% +3"		% Gravel		% Sand			% Fines		
			Coarse	Fine	Coarse	Medium	Fine	Silt		Clay
○	0.0		0.0	0.0	0.0	45.6	51.1	3.3		
⊗	LL	PL	D ₈₅	D ₆₀	D ₅₀	D ₃₀	D ₁₅	D ₁₀	C _c	C _u
○	NV	NP	0.6576	0.4569	0.4022	0.3097	0.2384	0.2048	1.02	2.23

Material Description								USCS	AASHTO
☐ brown poorly graded SAND								SP	A-3

Project No. 187609 **Client:** TTL
Project: TTL Job No 000180200804
 Analysis of Forty-Two Thin Wall Tube Samples
☐ **Source of Sample:** UD-34 **Depth:** 28' - 29' **Sample Number:** UD-34

BOWSER-MORNER, INC.
 Dayton, Ohio

Remarks:
☐ As Received
 Moisture Content: 23.5%

GRAIN SIZE DISTRIBUTION TEST DATA

2/20/2019

Client: TTL

Project: TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

Project Number: 187609

Location: UD-34

Depth: 28' - 29'

Sample Number: UD-34

Material Description: brown poorly graded SAND

Liquid Limit: NV

Plastic Limit: NP

USCS Classification: SP

AASHTO Classification: A-3

Testing Remarks: As Received

Moisture Content: 23.5%

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
271.46	119.48	0.00	#10	0.00	100.0
			#20	4.60	97.0
			#40	69.36	54.4
			#60	125.96	17.1
			#100	143.67	5.5
			#200	147.00	3.3

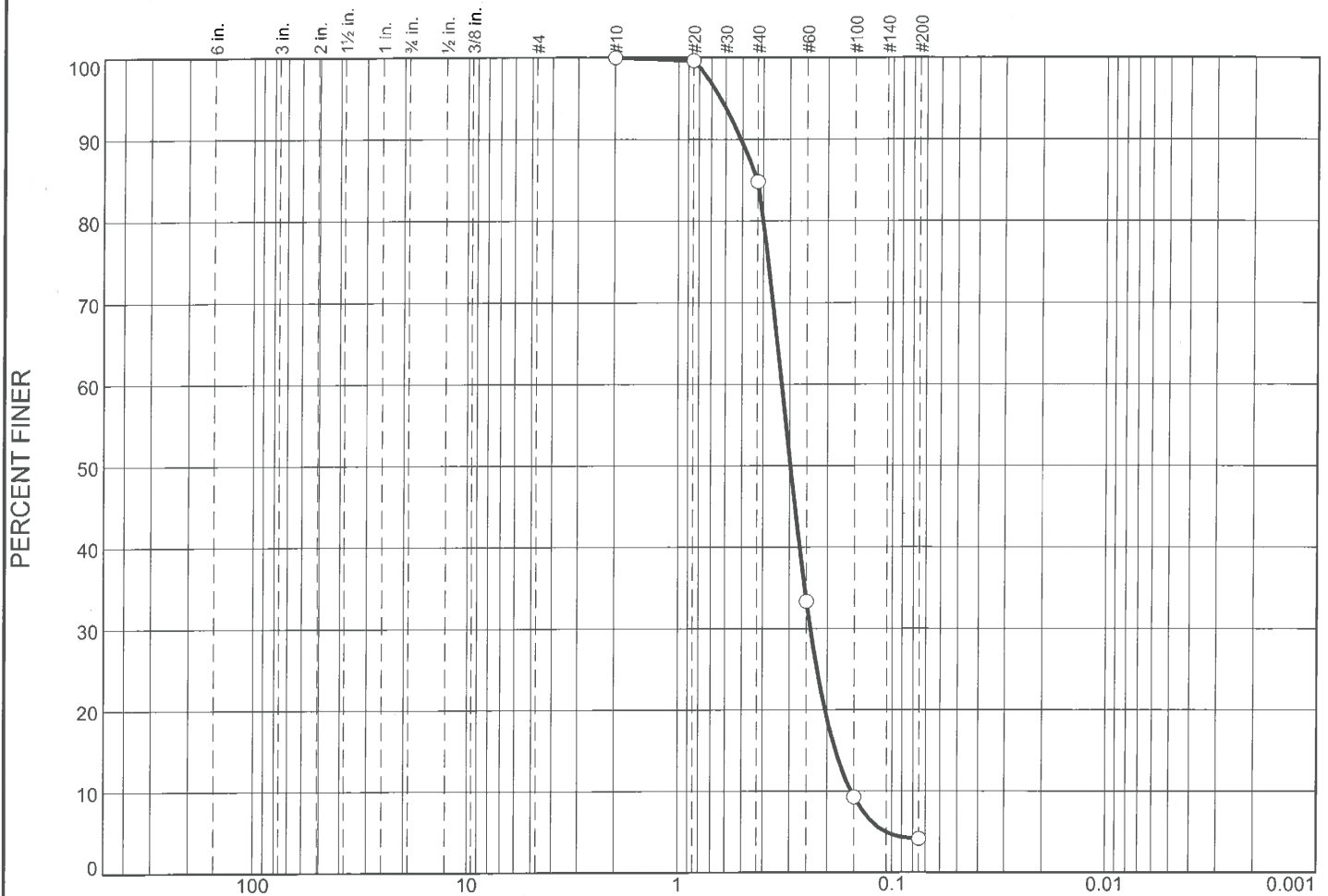
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	45.6	51.1	96.7			3.3

D ₅	D ₁₀	D ₁₅	D ₂₀	D ₃₀	D ₄₀	D ₅₀	D ₆₀	D ₈₀	D ₈₅	D ₉₀	D ₉₅
0.1405	0.2048	0.2384	0.2644	0.3097	0.3543	0.4022	0.4569	0.6056	0.6576	0.7214	0.8059

Fineness Modulus	C _u	C _c
1.89	2.23	1.02

GRAIN SIZE DISTRIBUTION REPORT



GRAIN SIZE - mm.

	% +3"	% Gravel		% Sand			% Fines		
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay	
☐	0.0	0.0	0.0	0.0	15.2	80.6	4.2		
☒	LL	PL	D ₈₅	D ₆₀	D ₅₀	D ₃₀	D ₁₅	D ₁₀	C _c
☐	NV	NP	0.4271	0.3265	0.2971	0.2397	0.1831	0.1549	1.14
									C _u
									2.11

Material Description

☐ brown poorly graded SAND

USCS

SP

AASHTO

A-3

Project No. 187609

Client: TTL

Project: TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

☐ Source of Sample: UD-34

Depth: 48' - 50'

Sample Number: UD-34

Remarks:

☐ As Received

Moisture Content: 24.1%

BOWSER-MORNER, INC.

Dayton, Ohio

GRAIN SIZE DISTRIBUTION TEST DATA

2/20/2019

Client: TTL

Project: TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

Project Number: 187609

Location: UD-34

Depth: 48' - 50'

Sample Number: UD-34

Material Description: brown poorly graded SAND

Liquid Limit: NV

Plastic Limit: NP

USCS Classification: SP

AASHTO Classification: A-3

Testing Remarks: As Received

Moisture Content: 24.1%

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
224.07	124.56	0.00	#10	0.00	100.0
			#20	0.37	99.6
			#40	15.08	84.8
			#60	66.31	33.4
			#100	90.26	9.3
			#200	95.38	4.2

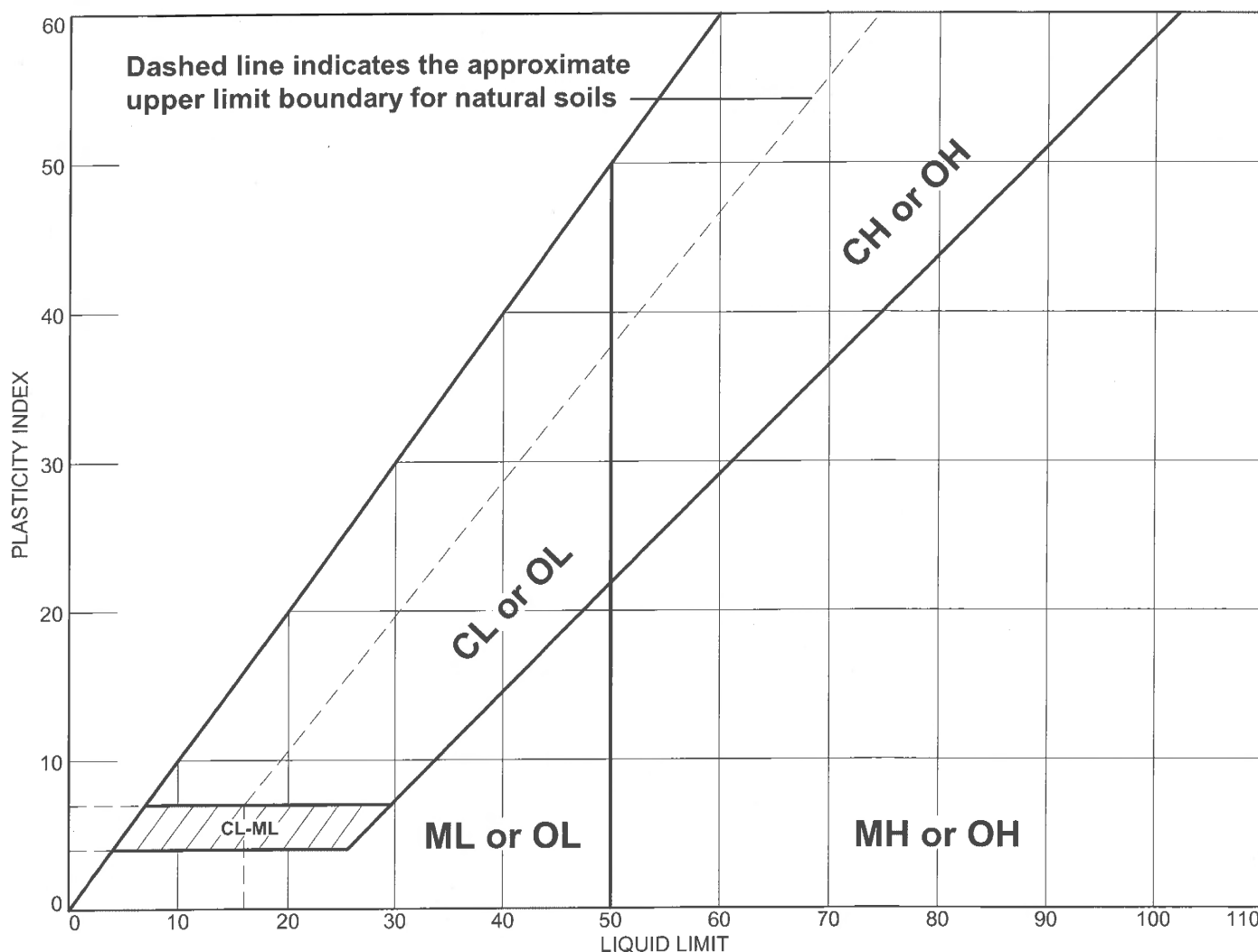
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	15.2	80.6	95.8			4.2

D ₅	D ₁₀	D ₁₅	D ₂₀	D ₃₀	D ₄₀	D ₅₀	D ₆₀	D ₈₀	D ₈₅	D ₉₀	D ₉₅
0.1070	0.1549	0.1831	0.2048	0.2397	0.2691	0.2971	0.3265	0.3999	0.4271	0.5102	0.6354

Fineness Modulus	C _u	C _c
1.46	2.11	1.14

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	dark brown poorly graded SAND with silt	NV	NP	NP	79.5	7.7	SP-SM
■	brown poorly graded SAND	NV	NP	NP	54.4	3.3	SP
▲	brown poorly graded SAND	NV	NP	NP	84.8	4.2	SP

Project No. 187609

Client: TTL

Project: TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

● **Source of Sample:** UD-34

Depth: 13' - 15'

Sample Number: UD-34

■ **Source of Sample:** UD-34

Depth: 28' - 29'

Sample Number: UD-34

▲ **Source of Sample:** UD-34

Depth: 48' - 50'

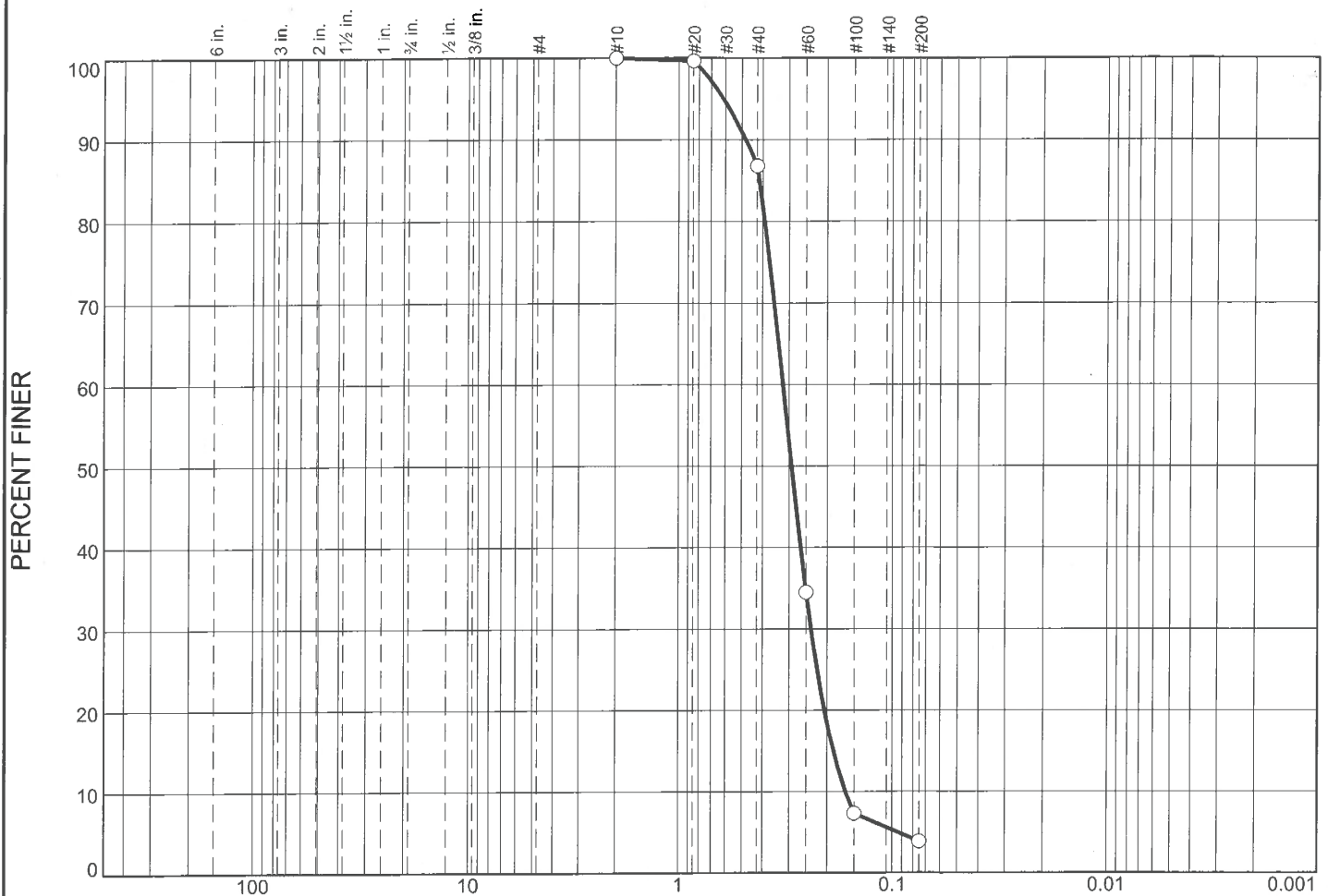
Sample Number: UD-34

Remarks:

BOWSER-MORNER, INC.

Dayton, Ohio

GRAIN SIZE DISTRIBUTION REPORT



% +3"		% Gravel		% Sand			% Fines		
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay	
○	0.0	0.0	0.0	0.0	13.2	82.9	3.9		
×	LL	PL	D ₈₅	D ₆₀	D ₅₀	D ₃₀	D ₁₅	D ₁₀	C _c
○	NV	NP	0.4148	0.3204	0.2921	0.2371	0.1868	0.1647	1.07
									C _u
									1.95

Material Description	USCS	AASHTO
○ brown poorly graded SAND	SP	A-3

Project No. 187609 **Client:** TTL
Project: TTL Job No 000180200804
 Analysis of Forty-Two Thin Wall Tube Samples
 ○ **Source of Sample:** UD-43 **Depth:** 13' - 15' **Sample Number:** UD-43

BOWSER-MORNER, INC.
 Dayton, Ohio

Remarks:
 ○ As Received
 Moisture Content: 23.0%

GRAIN SIZE DISTRIBUTION TEST DATA

2/20/2019

Client: TTL

Project: TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

Project Number: 187609

Location: UD-43

Depth: 13' - 15'

Sample Number: UD-43

Material Description: brown poorly graded SAND

Liquid Limit: NV

Plastic Limit: NP

USCS Classification: SP

AASHTO Classification: A-3

Testing Remarks: As Received

Moisture Content: 23.0%

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
225.13	96.15	0.00	#10	0.00	100.0
			#20	0.49	99.6
			#40	17.01	86.8
			#60	84.49	34.5
			#100	119.51	7.3
			#200	123.97	3.9

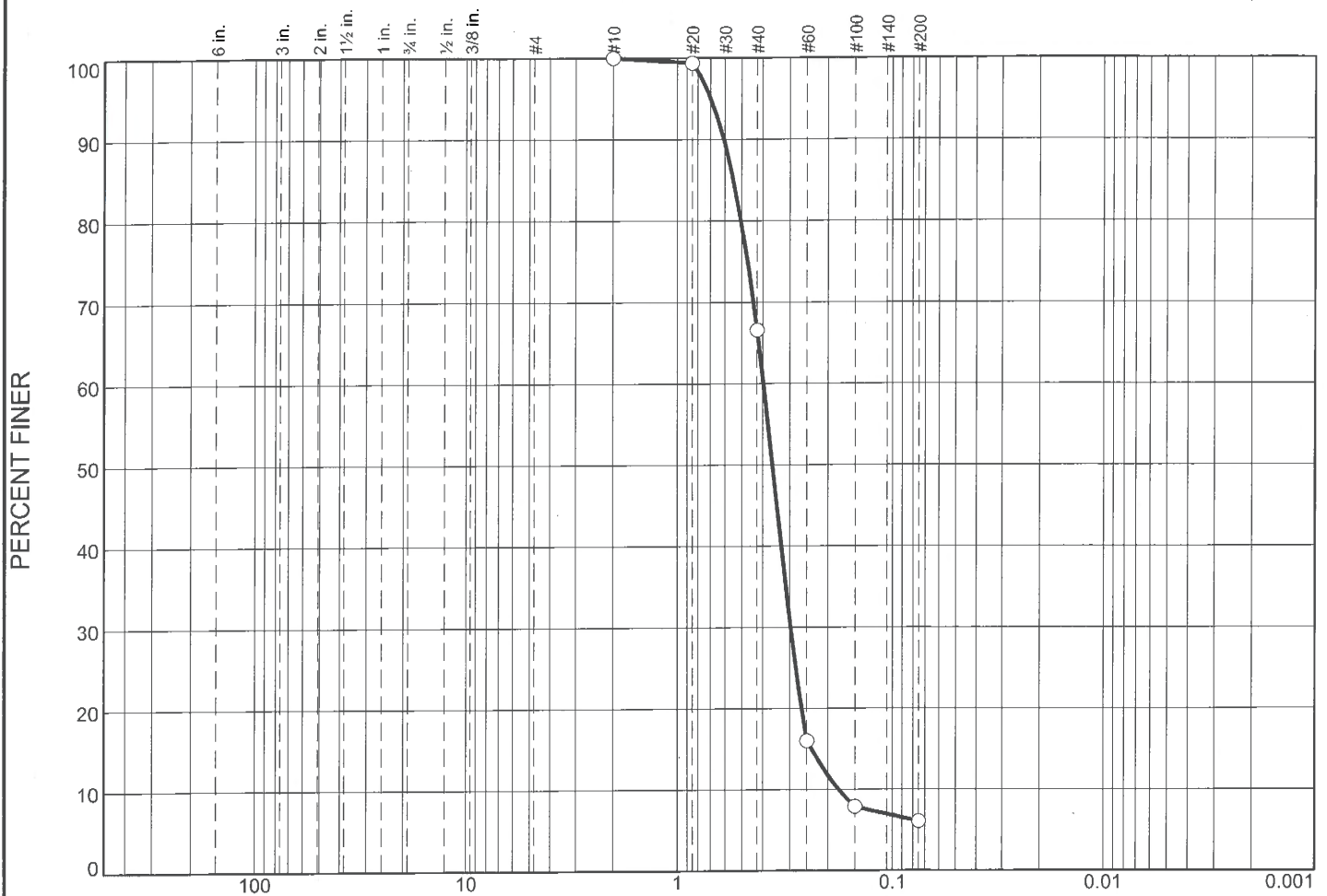
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	13.2	82.9	96.1			3.9

D ₅	D ₁₀	D ₁₅	D ₂₀	D ₃₀	D ₄₀	D ₅₀	D ₆₀	D ₈₀	D ₈₅	D ₉₀	D ₉₅
0.0938	0.1647	0.1868	0.2054	0.2371	0.2651	0.2921	0.3204	0.3906	0.4148	0.4826	0.6139

Fineness Modulus	C _u	C _c
1.45	1.95	1.07

GRAIN SIZE DISTRIBUTION REPORT



	% +3"		% Gravel		% Sand			% Fines		
			Coarse	Fine	Coarse	Medium	Fine	Silt		Clay
○	0.0		0.0	0.0	0.0	33.4	60.5	6.1		
×	LL	PL	D ₈₅	D ₆₀	D ₅₀	D ₃₀	D ₁₅	D ₁₀	C _c	C _u
○	NV	NP	0.5490	0.3968	0.3605	0.2973	0.2381	0.1784	1.25	2.22

Material Description	USCS	AASHTO
○ brown/black poorly graded SAND with silt	SP-SM	A-3

Project No. 187609 Client: TTL Project: TTL Job No 000180200804 Analysis of Forty-Two Thin Wall Tube Samples ○ Source of Sample: UD-43 Depth: 30' - 32' Sample Number: UD-43	Remarks: ○ As Received Moisture Content: 21.3%
BOWSER-MORNER, INC. Dayton, Ohio	

GRAIN SIZE DISTRIBUTION TEST DATA

2/20/2019

Client: TTL

Project: TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

Project Number: 187609

Location: UD-43

Depth: 30' - 32'

Sample Number: UD-43

Material Description: brown/black poorly graded SAND with silt

Liquid Limit: NV

Plastic Limit: NP

USCS Classification: SP-SM

AASHTO Classification: A-3

Testing Remarks: As Received

Moisture Content: 21.3%

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
185.15	97.67	0.00	#10	0.00	100.0
			#20	0.53	99.4
			#40	29.24	66.6
			#60	73.46	16.0
			#100	80.58	7.9
			#200	82.16	6.1

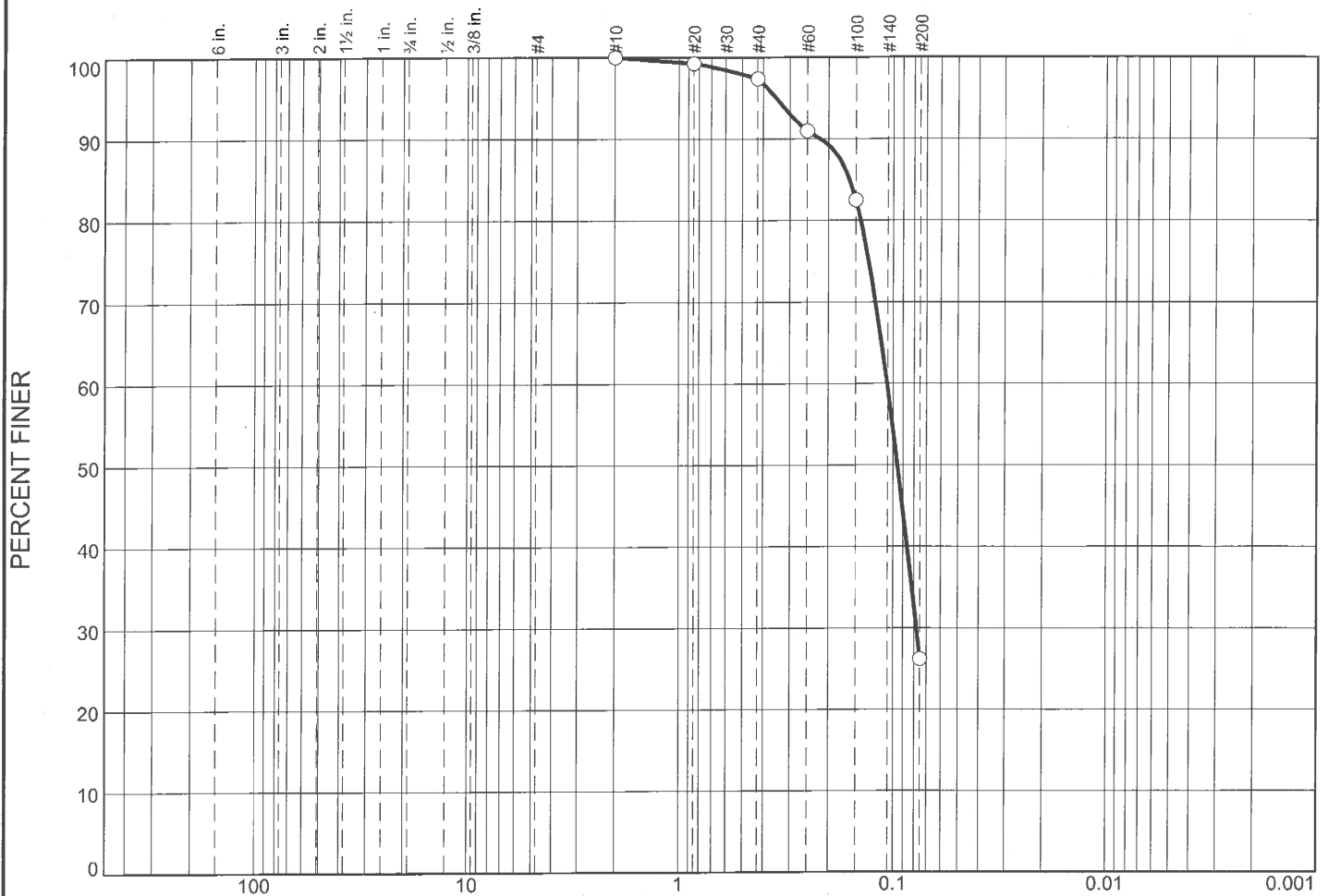
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	33.4	60.5	93.9			6.1

D ₅	D ₁₀	D ₁₅	D ₂₀	D ₃₀	D ₄₀	D ₅₀	D ₆₀	D ₈₀	D ₈₅	D ₉₀	D ₉₅
	0.1784	0.2381	0.2650	0.2973	0.3282	0.3605	0.3968	0.5050	0.5490	0.6084	0.6988

Fineness Modulus	C _u	C _c
1.72	2.22	1.25

GRAIN SIZE DISTRIBUTION REPORT



GRAIN SIZE - mm.

	% +3"	% Gravel		% Sand			% Fines		
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay	
☐	0.0	0.0	0.0	0.0	2.6	71.2	26.2		
☒	LL	PL	D ₈₅	D ₆₀	D ₅₀	D ₃₀	D ₁₅	D ₁₀	C _c
☐	27	15	0.1605	0.1068	0.0955	0.0779			C _u

Material Description	USCS	AASHTO
☐ brown/black clayey SAND	SC	A-2-6(0)

Project No. 187609 **Client:** TTL
Project: TTL Job No 000180200804
 Analysis of Forty-Two Thin Wall Tube Samples
☐ **Source of Sample:** UD-43 **Depth:** 43' - 45' **Sample Number:** UD-43

Remarks:
☐ As Received
 Moisture Content: 20.3%

BOWSER-MORNER, INC.

Dayton, Ohio

GRAIN SIZE DISTRIBUTION TEST DATA

2/20/2019

Client: TTL

Project: TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

Project Number: 187609

Location: UD-43

Depth: 43' - 45'

Sample Number: UD-43

Material Description: brown/black clayey SAND

Liquid Limit: 27

Plastic Limit: 15

USCS Classification: SC

AASHTO Classification: A-2-6(0)

Testing Remarks: As Received

Moisture Content: 20.3%

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
190.14	114.22	0.00	#10	0.00	100.0
			#20	0.56	99.3
			#40	1.99	97.4
			#60	6.84	91.0
			#100	13.28	82.5
			#200	56.04	26.2

Fractional Components

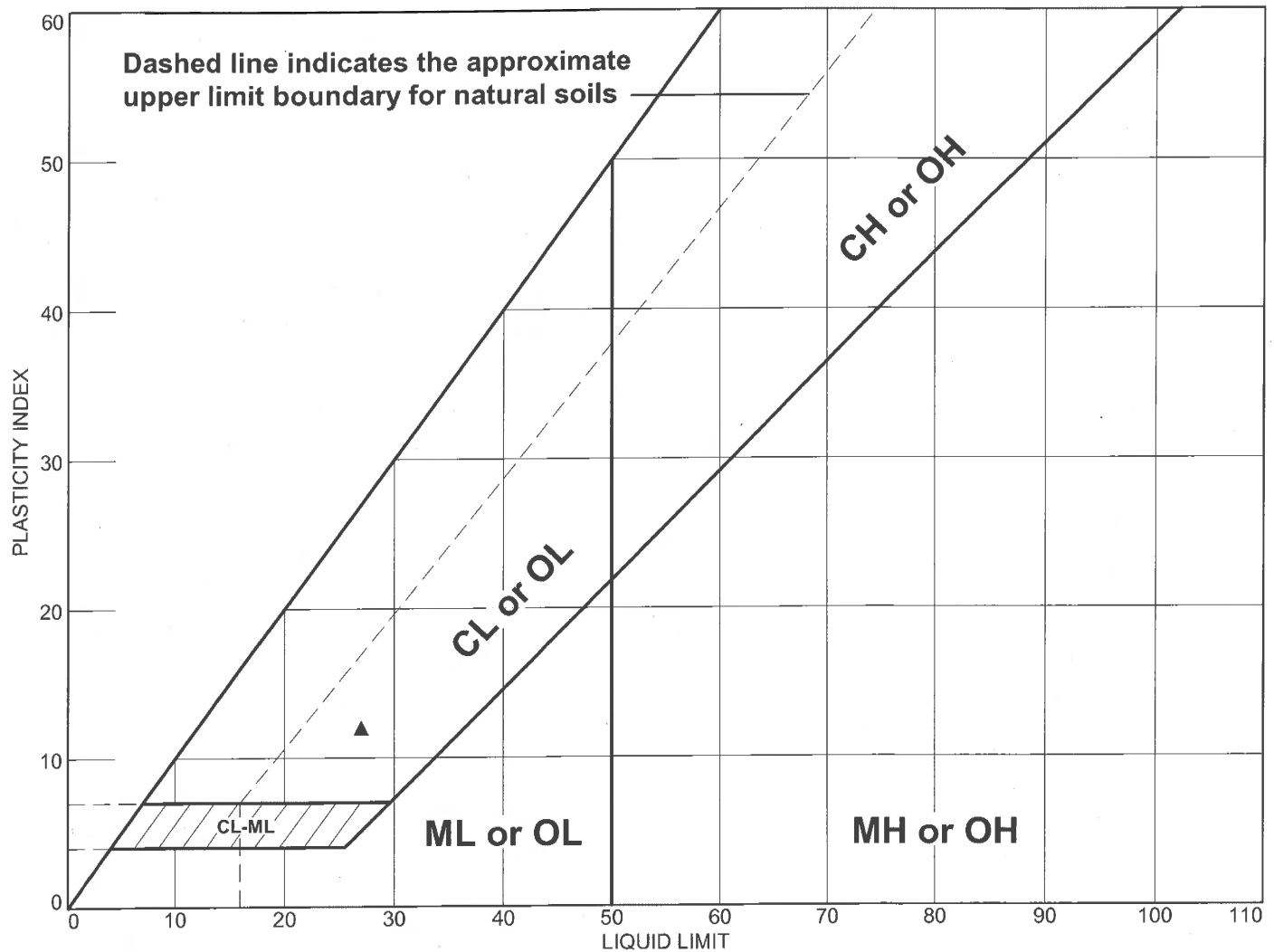
Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	2.6	71.2	73.8			26.2

D ₅	D ₁₀	D ₁₅	D ₂₀	D ₃₀	D ₄₀	D ₅₀	D ₆₀	D ₈₀	D ₈₅	D ₉₀	D ₉₅
				0.0779	0.0861	0.0955	0.1068	0.1422	0.1605	0.2178	0.3483

Fineness Modulus

0.26

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	brown poorly graded SAND	NV	NP	NP	86.8	3.9	SP
■	brown/black poorly graded SAND with silt	NV	NP	NP	66.6	6.1	SP-SM
▲	black/brown clayey SAND	27	15	12	97.4	26.2	SC

Project No. 187609

Client: TTL

Project: TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

● **Source of Sample:** UD-43

Depth: 13' - 15'

Sample Number: UD-43

■ **Source of Sample:** UD-43

Depth: 30' - 32'

Sample Number: UD-43

▲ **Source of Sample:** UD-43

Depth: 43' - 45'

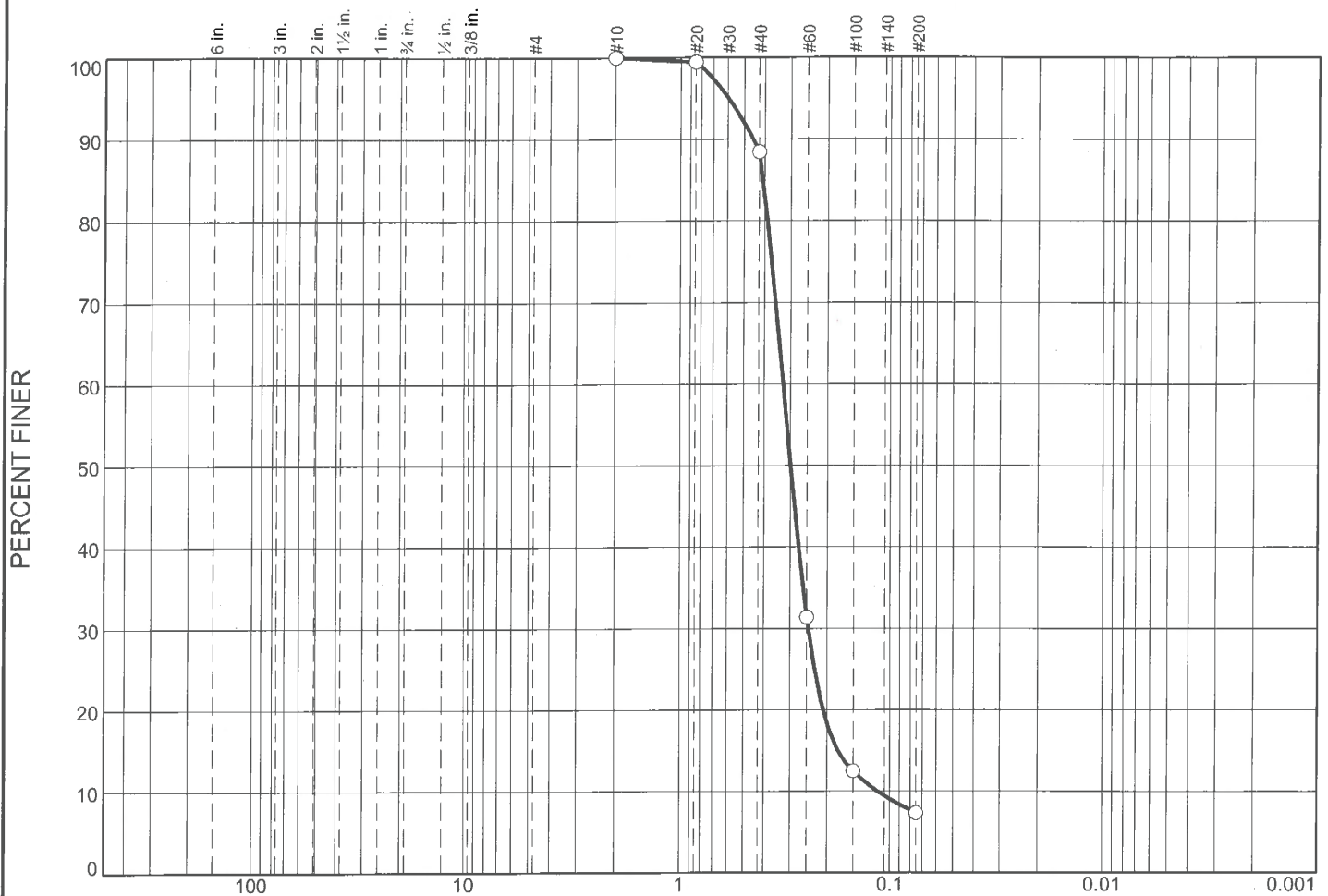
Sample Number: UD-43

Remarks:

BOWSER-MORNER, INC.

Dayton, Ohio

GRAIN SIZE DISTRIBUTION REPORT



	% +3"		% Gravel		% Sand			% Fines		
			Coarse	Fine	Coarse	Medium	Fine	Silt		Clay
○	0.0		0.0	0.0	0.0	11.6	81.1	7.3		
×	LL	PL	D ₈₅	D ₆₀	D ₅₀	D ₃₀	D ₁₅	D ₁₀	C _c	C _u
○	NV	NP	0.4082	0.3252	0.2990	0.2458	0.1776	0.1143	1.62	2.84

Material Description	USCS	AASHTO
○ dark brown poorly graded SAND with silt	SP-SM	A-3

Project No. 187609 **Client:** TTL
Project: TTL Job No 000180200804
 Analysis of Forty-Two Thin Wall Tube Samples
 ○ **Source of Sample:** UD-51 **Depth:** 13' - 15' **Sample Number:** UD-51

Remarks:
 ○ As Received
 Moisture Content: 19.2%

BOWSER-MORNER, INC.

Dayton, Ohio

GRAIN SIZE DISTRIBUTION TEST DATA

2/20/2019

Client: TTL

Project: TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

Project Number: 187609

Location: UD-51

Depth: 13' - 15'

Sample Number: UD-51

Material Description: dark brown poorly graded SAND with silt

Liquid Limit: NV

Plastic Limit: NP

USCS Classification: SP-SM

AASHTO Classification: A-3

Testing Remarks: As Received

Moisture Content: 19.2%

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
306.29	96.78	0.00	#10	0.00	100.0
			#20	1.18	99.4
			#40	24.21	88.4
			#60	143.71	31.4
			#100	183.31	12.5
			#200	194.19	7.3

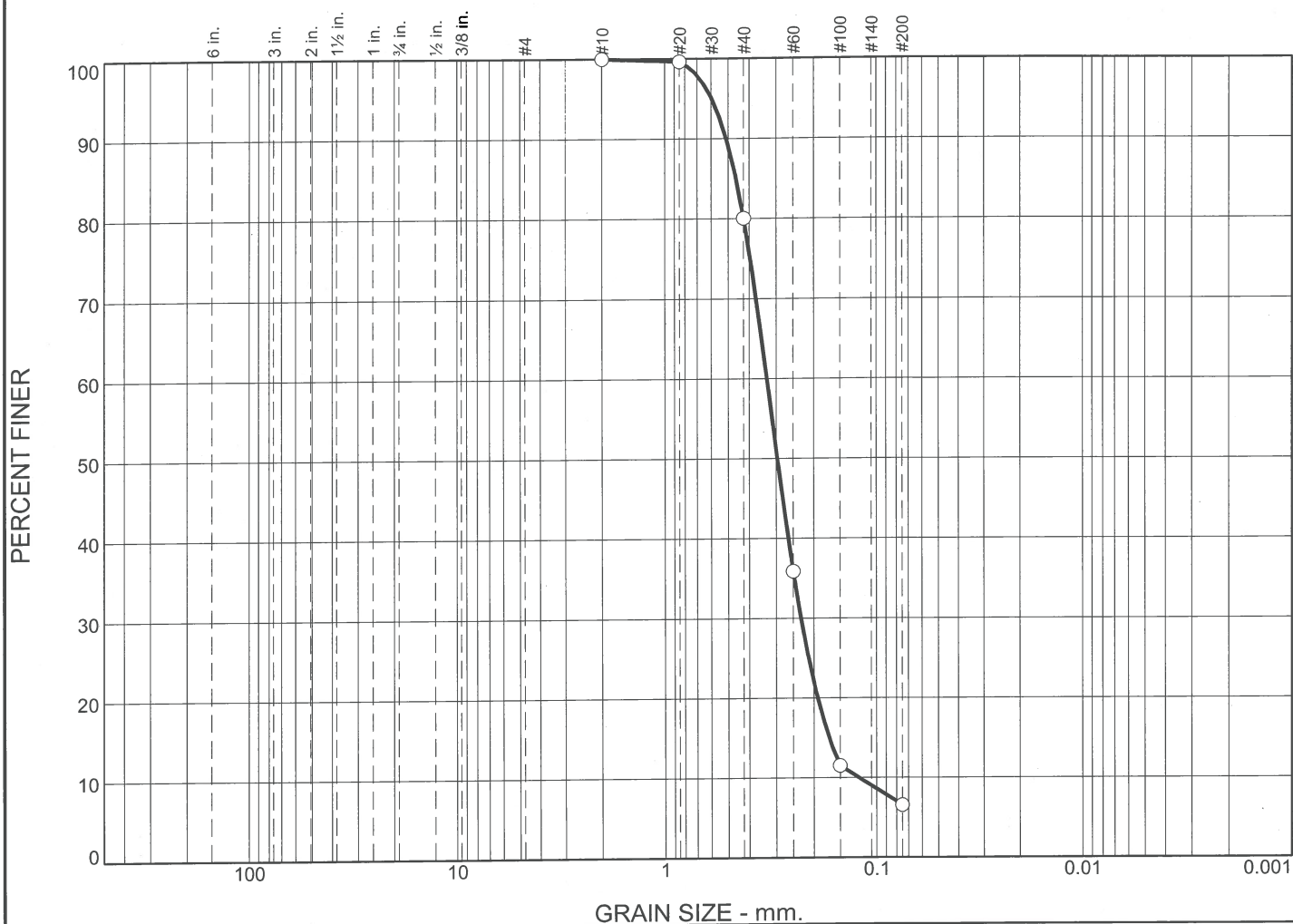
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	11.6	81.1	92.7			7.3

D ₅	D ₁₀	D ₁₅	D ₂₀	D ₃₀	D ₄₀	D ₅₀	D ₆₀	D ₈₀	D ₈₅	D ₉₀	D ₉₅
	0.1143	0.1776	0.2086	0.2458	0.2734	0.2990	0.3252	0.3876	0.4082	0.4562	0.5966

Fineness Modulus	C _u	C _c
1.42	2.84	1.62

GRAIN SIZE DISTRIBUTION REPORT



	% +3"		% Gravel		% Sand			% Fines		
			Coarse	Fine	Coarse	Medium	Fine	Silt		Clay
○	0.0		0.0	0.0	0.0	19.9	73.5	6.6		
×	LL	PL	D ₈₅	D ₆₀	D ₅₀	D ₃₀	D ₁₅	D ₁₀	C _c	C _u
○	NV	NP	0.4613	0.3313	0.2962	0.2298	0.1691	0.1213	1.31	2.73

Material Description	USCS	AASHTO
○ brown poorly graded SAND with silt	SP-SM	A-3

Project No. 187609 **Client:** TTL
Project: TTL Job No 000180200804
 Analysis of Forty-Two Thin Wall Tube Samples
 ○ **Source of Sample:** UD-51 **Depth:** 28' - 30' **Sample Number:** UD-51

Remarks:
 ○ As Received
 Moisture Content: 23.3%

BOWSER-MORNER, INC.

Dayton, Ohio

GRAIN SIZE DISTRIBUTION TEST DATA

2/20/2019

Client: TTL

Project: TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

Project Number: 187609

Location: UD-51

Depth: 28' - 30'

Sample Number: UD-51

Material Description: brown poorly graded SAND with silt

Liquid Limit: NV

Plastic Limit: NP

USCS Classification: SP-SM

AASHTO Classification: A-3

Testing Remarks: As Received

Moisture Content: 23.3%

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
214.70	114.86	0.00	#10	0.00	100.0
			#20	0.38	99.6
			#40	19.91	80.1
			#60	64.00	35.9
			#100	88.35	11.5
			#200	93.27	6.6

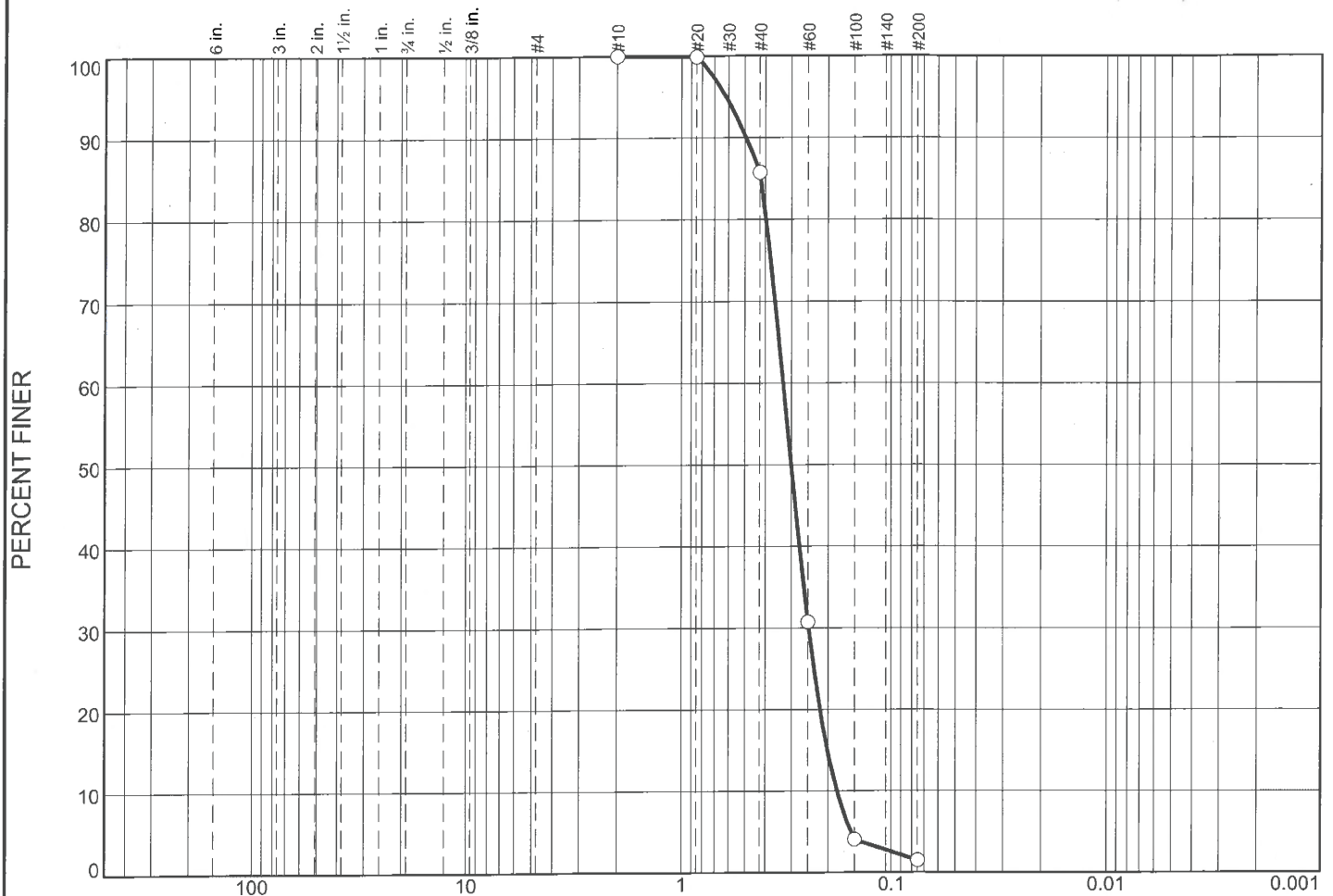
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	19.9	73.5	93.4			6.6

D ₅	D ₁₀	D ₁₅	D ₂₀	D ₃₀	D ₄₀	D ₅₀	D ₆₀	D ₈₀	D ₈₅	D ₉₀	D ₉₅
	0.1213	0.1691	0.1917	0.2298	0.2635	0.2962	0.3313	0.4246	0.4613	0.5127	0.5986

Fineness Modulus	C _u	C _c
1.43	2.73	1.31

GRAIN SIZE DISTRIBUTION REPORT



GRAIN SIZE - mm.

	% +3"	% Gravel		% Sand			% Fines		
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay	
○	0.0	0.0	0.0	0.0	14.2	84.3	1.5		
×	LL	PL	D ₈₅	D ₆₀	D ₅₀	D ₃₀	D ₁₅	D ₁₀	C _c
○	NV	NP	0.4208	0.3281	0.3004	0.2480	0.2014	0.1815	1.03
									C _u
									1.81

Material Description	USCS	AASHTO
○ brown/black poorly graded SAND	SP	A-3

Project No. 187609 Client: TTL Project: TTL Job No 000180200804 Analysis of Forty-Two Thin Wall Tube Samples ○ Source of Sample: UD-51 Depth: 43' - 45' Sample Number: UD-51	Remarks: ○ As Received Moisture Content: 17.0%
BOWSER-MORNER, INC. Dayton, Ohio	

GRAIN SIZE DISTRIBUTION TEST DATA

2/20/2019

Client: TTL

Project: TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

Project Number: 187609

Location: UD-51

Depth: 43' - 45'

Sample Number: UD-51

Material Description: brown/black poorly graded SAND

Liquid Limit: NV

Plastic Limit: NP

USCS Classification: SP

AASHTO Classification: A-3

Testing Remarks: As Received

Moisture Content: 17.0%

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
270.00	112.66	0.00	#10	0.00	100.0
			#20	0.15	99.9
			#40	22.39	85.8
			#60	108.99	30.7
			#100	150.96	4.1
			#200	154.98	1.5

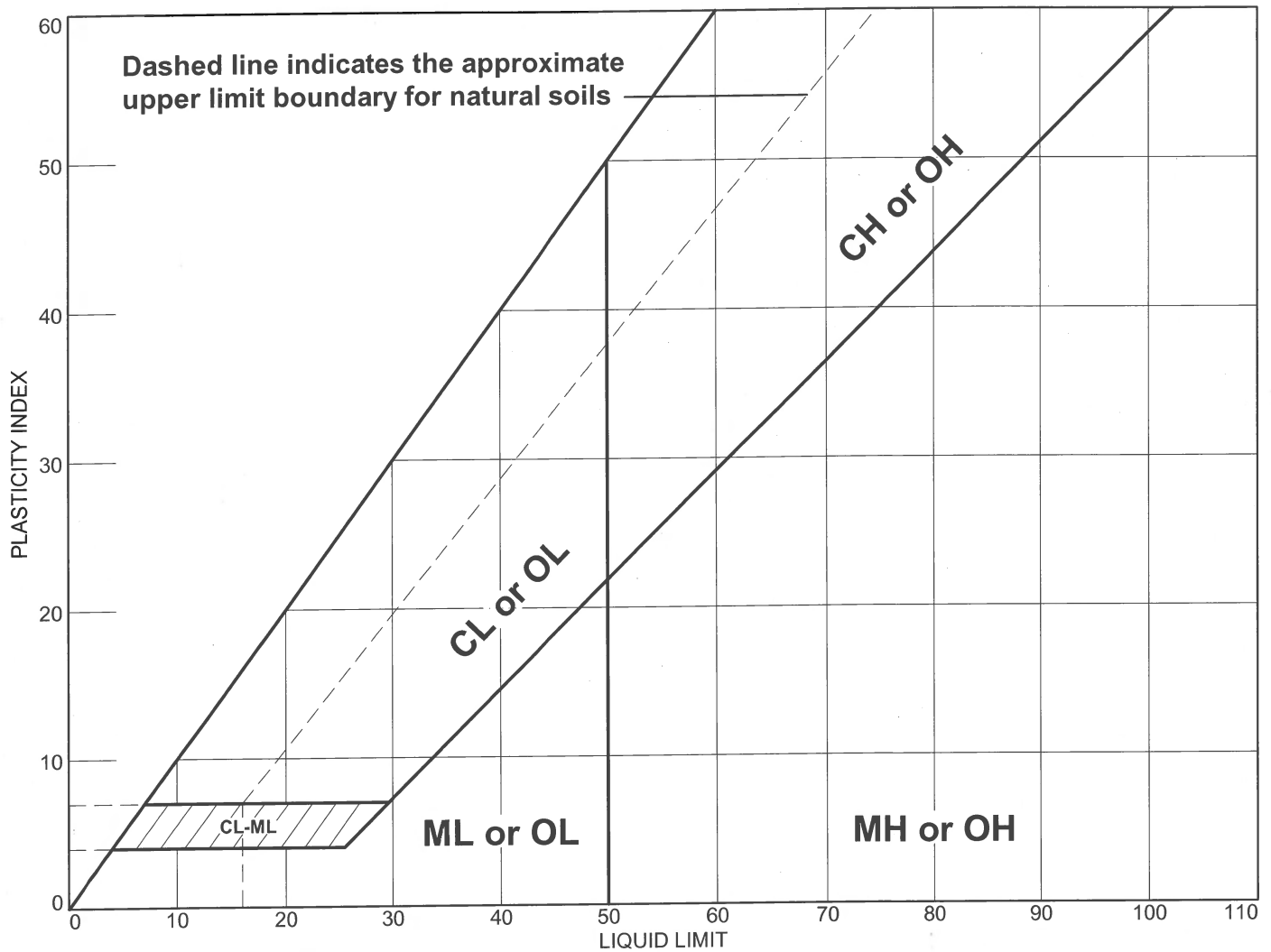
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	14.2	84.3	98.5			1.5

D ₅	D ₁₀	D ₁₅	D ₂₀	D ₃₀	D ₄₀	D ₅₀	D ₆₀	D ₈₀	D ₈₅	D ₉₀	D ₉₅
0.1561	0.1815	0.2014	0.2184	0.2480	0.2744	0.3004	0.3281	0.3969	0.4208	0.4958	0.6190

Fineness Modulus	C _u	C _c
1.52	1.81	1.03

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	dark brown poorly graded SAND with silt	NV	NP	NP	88.4	7.3	SP-SM
■	brown poorly graded SAND with silt	NV	NP	NP	80.1	6.6	SP-SM
▲	brown/black poorly graded SAND	NV	NP	NP	85.8	1.5	SP

Project No. 187609

Client: TTL

Project: TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

● Source of Sample: UD-51

Depth: 13' - 15'

Sample Number: UD-51

■ Source of Sample: UD-51

Depth: 28' - 30'

Sample Number: UD-51

▲ Source of Sample: UD-51

Depth: 43' - 45'

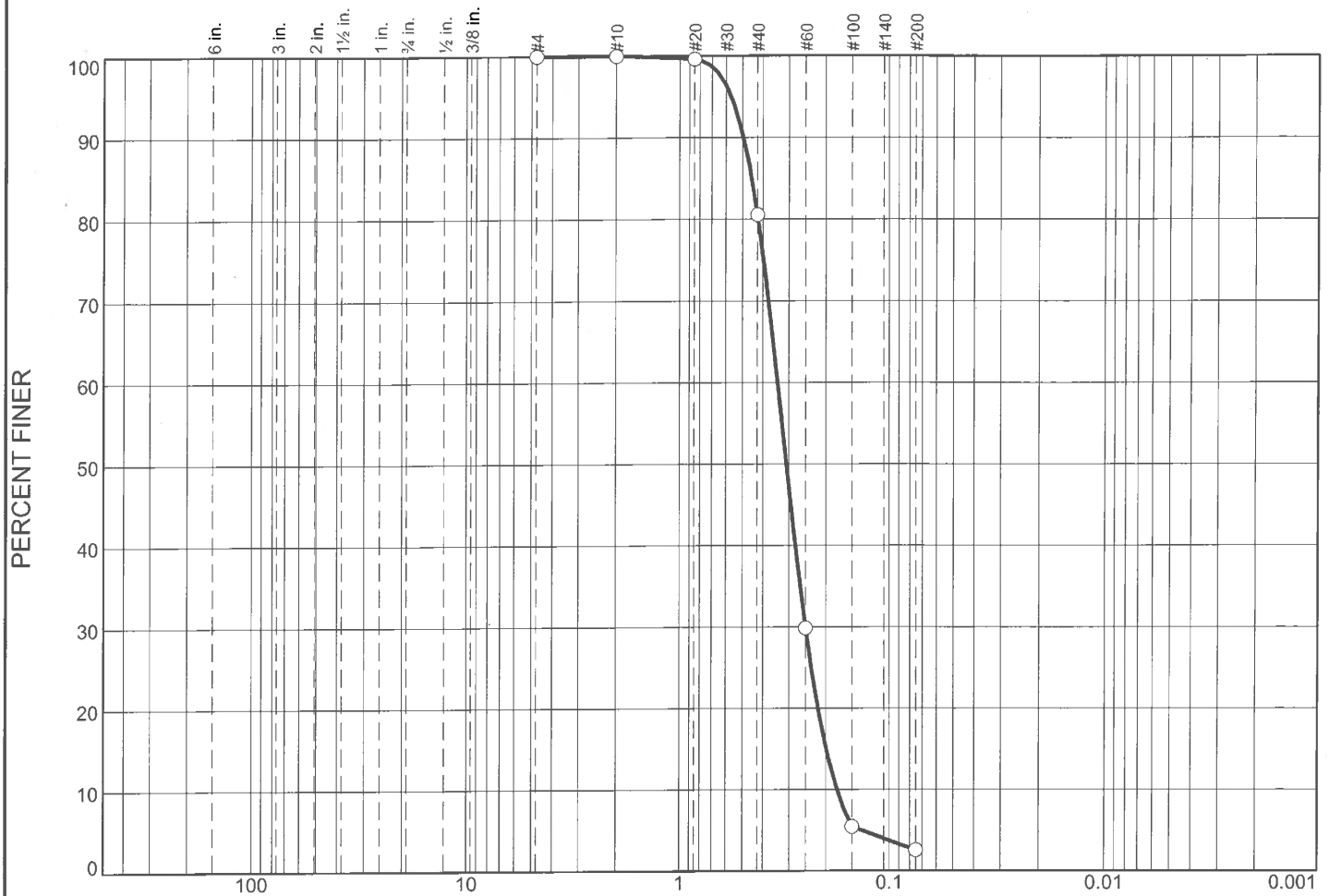
Sample Number: UD-51

Remarks:

BOWSER-MORNER, INC.

Dayton, Ohio

GRAIN SIZE DISTRIBUTION REPORT



GRAIN SIZE - mm.

	% +3"		% Gravel		% Sand			% Fines		
			Coarse	Fine	Coarse	Medium	Fine	Silt		Clay
○	0.0		0.0	0.0	0.0	19.4	78.1	2.5		
×	LL	PL	D ₈₅	D ₆₀	D ₅₀	D ₃₀	D ₁₅	D ₁₀	C _c	C _u
○	NV	NP	0.4534	0.3396	0.3084	0.2504	0.1990	0.1767	1.04	1.92

Material Description	USCS	AASHTO
○ dark brown poorly graded SAND	SP	A-3

Project No. 187609 **Client:** TTL
Project: TTL Job No 000180200804
 Analysis of Forty-Two Thin Wall Tube Samples
 ○ **Source of Sample:** UD-65 **Depth:** 17' - 19' **Sample Number:** UD-65

Remarks:
 ○ As Received
 Moisture Content: 22.0%

BOWSER-MORNER, INC.

Dayton, Ohio

GRAIN SIZE DISTRIBUTION TEST DATA

2/20/2019

Client: TTL

Project: TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

Project Number: 187609

Location: UD-65

Depth: 17' - 19'

Sample Number: UD-65

Material Description: dark brown poorly graded SAND

Liquid Limit: NV

Plastic Limit: NP

USCS Classification: SP

AASHTO Classification: A-3

Testing Remarks: As Received

Moisture Content: 22.0%

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
323.36	114.12	0.00	#4	0.00	100.0
			#10	0.02	100.0
			#20	0.84	99.6
			#40	40.68	80.6
			#60	146.72	29.9
			#100	197.83	5.5
			#200	203.94	2.5

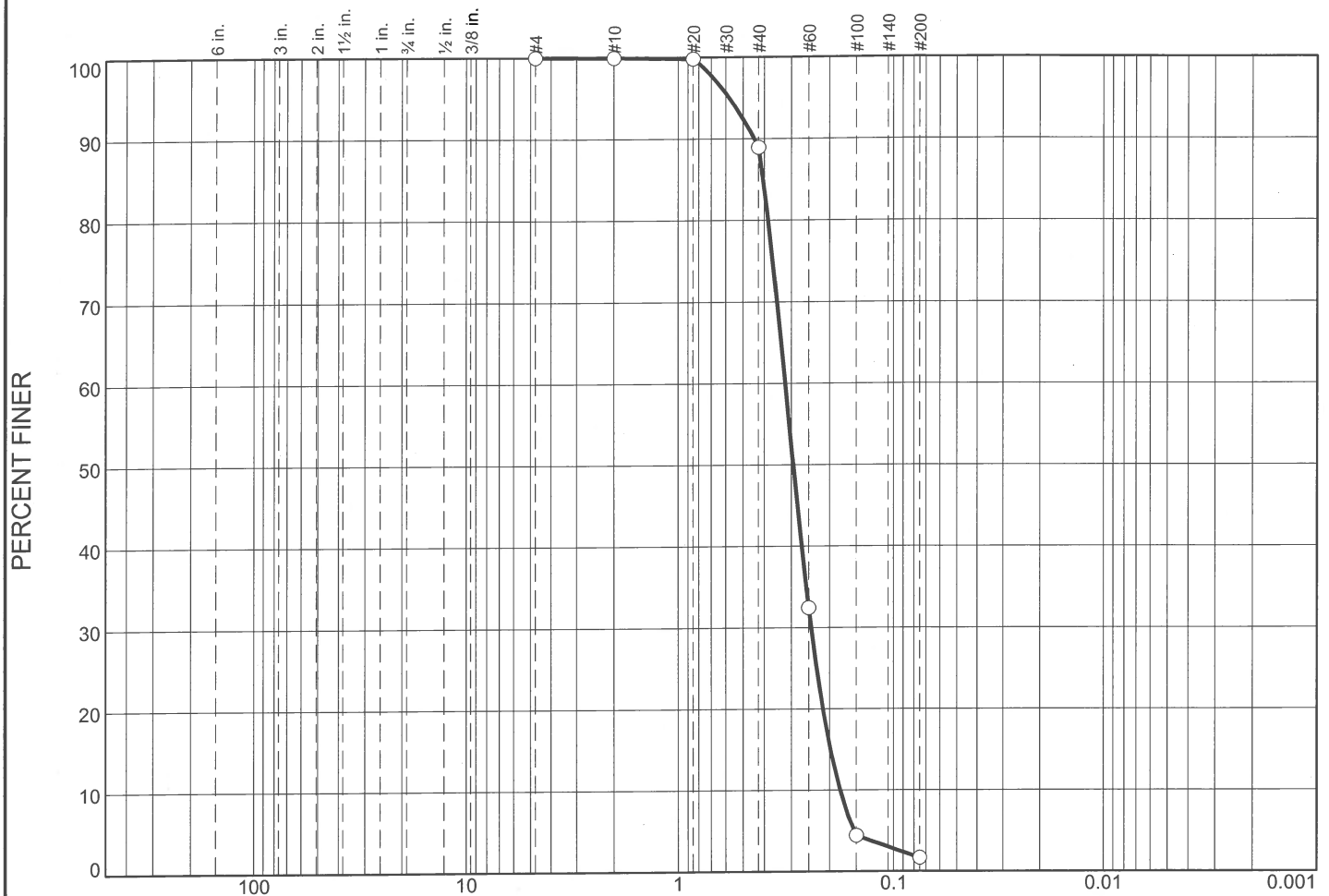
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	19.4	78.1	97.5			2.5

D ₅	D ₁₀	D ₁₅	D ₂₀	D ₃₀	D ₄₀	D ₅₀	D ₆₀	D ₈₀	D ₈₅	D ₉₀	D ₉₅
0.1347	0.1767	0.1990	0.2179	0.2504	0.2794	0.3084	0.3396	0.4219	0.4534	0.4970	0.5690

Fineness Modulus	C _u	C _c
1.51	1.92	1.04

GRAIN SIZE DISTRIBUTION REPORT



GRAIN SIZE - mm.

	% +3"		% Gravel		% Sand			% Fines		
			Coarse	Fine	Coarse	Medium	Fine	Silt		Clay
○	0.0		0.0	0.0	0.0	11.0	87.3	1.7		
×	LL	PL	D ₈₅	D ₆₀	D ₅₀	D ₃₀	D ₁₅	D ₁₀	C _c	C _u
○	NV	NP	0.4048	0.3203	0.2941	0.2435	0.1979	0.1785	1.04	1.79

Material Description	USCS	AASHTO
○ brown poorly graded SAND	SP	A-3

Project No. 187609 **Client:** TTL
Project: TTL Job No 000180200804
 Analysis of Forty-Two Thin Wall Tube Samples
 ○ **Source of Sample:** UD-65 **Depth:** 28' - 30' **Sample Number:** UD-65

Remarks:
 ○ As Received
 Moisture Content: 22.4%

BOWSER-MORNER, INC.

Dayton, Ohio

GRAIN SIZE DISTRIBUTION TEST DATA

2/20/2019

Client: TTL

Project: TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

Project Number: 187609

Location: UD-65

Depth: 28' - 30'

Sample Number: UD-65

Material Description: brown poorly graded SAND

Liquid Limit: NV

Plastic Limit: NP

USCS Classification: SP

AASHTO Classification: A-3

Testing Remarks: As Received

Moisture Content: 22.4%

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
315.14	92.86	0.00	#4	0.00	100.0
			#10	0.09	100.0
			#20	0.42	99.8
			#40	24.52	89.0
			#60	150.15	32.5
			#100	212.46	4.4
			#200	218.57	1.7

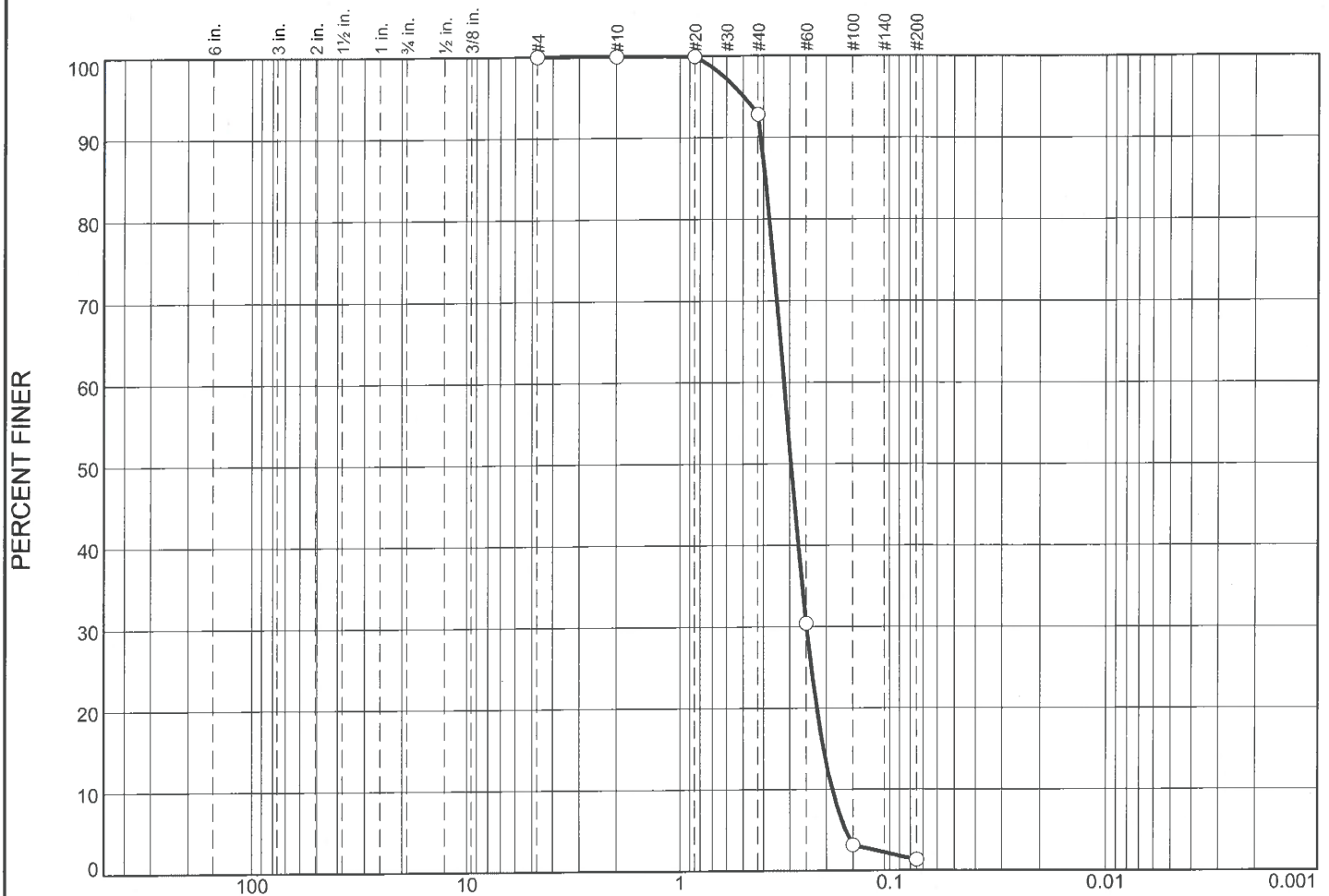
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	11.0	87.3	98.3			1.7

D ₅	D ₁₀	D ₁₅	D ₂₀	D ₃₀	D ₄₀	D ₅₀	D ₆₀	D ₈₀	D ₈₅	D ₉₀	D ₉₅
0.1536	0.1785	0.1979	0.2146	0.2435	0.2691	0.2941	0.3203	0.3837	0.4048	0.4453	0.5793

Fineness Modulus	C _u	C _c
1.48	1.79	1.04

GRAIN SIZE DISTRIBUTION REPORT



GRAIN SIZE - mm.

	% +3"		% Gravel		% Sand			% Fines	
			Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0		0.0	0.0	0.0	7.2	91.5	1.3	
×	LL	PL	D ₈₅	D ₆₀	D ₅₀	D ₃₀	D ₁₅	D ₁₀	C _c
○	NV	NP	0.3909	0.3184	0.2950	0.2490	0.2064	0.1876	1.04
									C _u
									1.70

Material Description	USCS	AASHTO
○ brown poorly graded SAND	SP	A-3

Project No. 187609 **Client:** TTL
Project: TTL Job No 000180200804
 Analysis of Forty-Two Thin Wall Tube Samples
 ○ **Source of Sample:** UD-65 **Depth:** 43' - 45' **Sample Number:** UD-65

Remarks:
 ○ As Received
 Moisture Content: 16.0%

BOWSER-MORNER, INC.

Dayton, Ohio

GRAIN SIZE DISTRIBUTION TEST DATA

2/20/2019

Client: TTL

Project: TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

Project Number: 187609

Location: UD-65

Depth: 43' - 45'

Sample Number: UD-65

Material Description: brown poorly graded SAND

Liquid Limit: NV

Plastic Limit: NP

USCS Classification: SP

AASHTO Classification: A-3

Testing Remarks: As Received

Moisture Content: 16.0%

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
356.98	112.90	0.00	#4	0.00	100.0
			#10	0.08	100.0
			#20	0.18	99.9
			#40	17.52	92.8
			#60	169.84	30.4
			#100	236.35	3.2
			#200	240.80	1.3

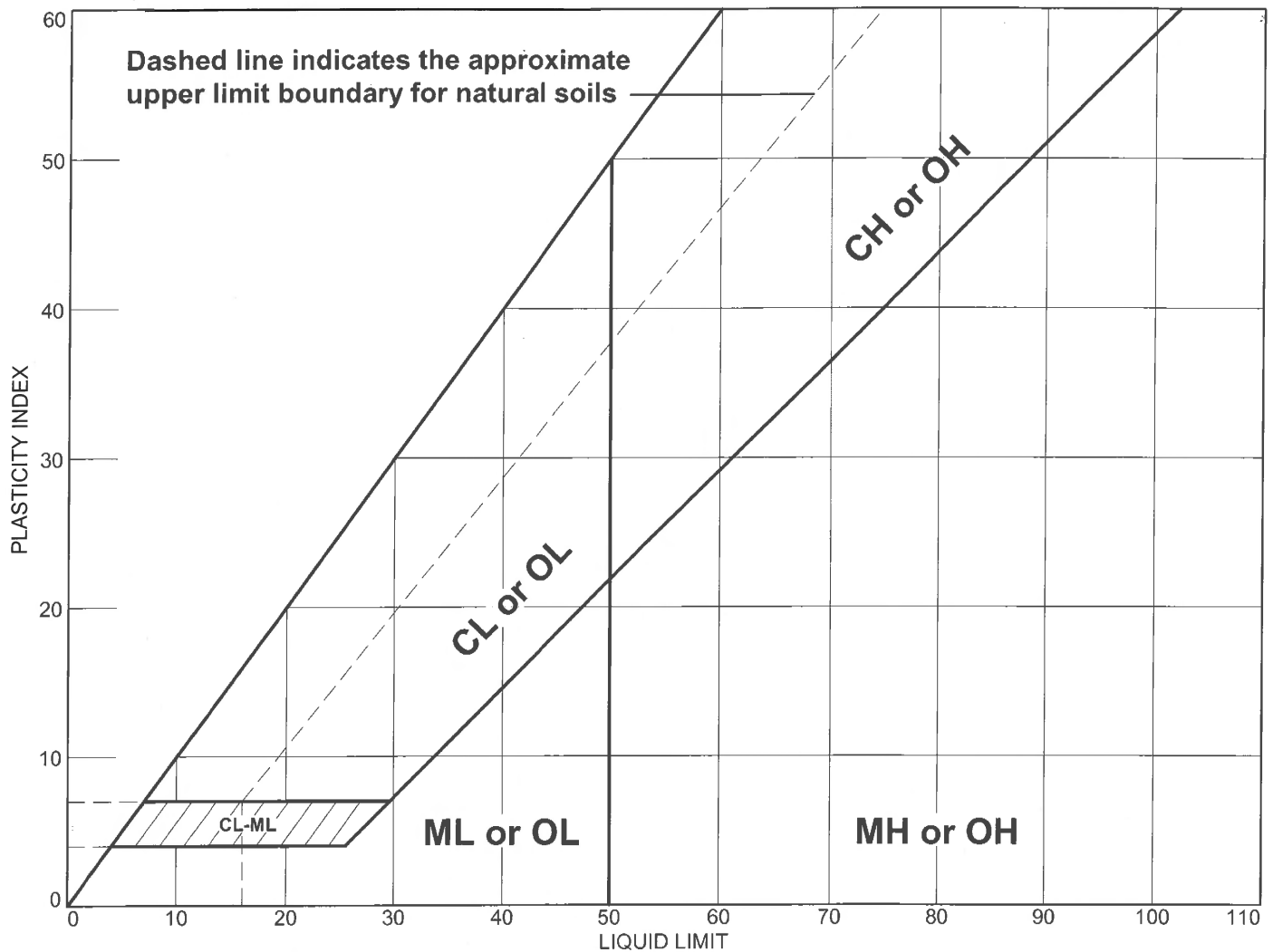
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	7.2	91.5	98.7			1.3

D ₅	D ₁₀	D ₁₅	D ₂₀	D ₃₀	D ₄₀	D ₅₀	D ₆₀	D ₈₀	D ₈₅	D ₉₀	D ₉₅
0.1626	0.1876	0.2064	0.2222	0.2490	0.2723	0.2950	0.3184	0.3735	0.3909	0.4113	0.4978

Fineness Modulus	C _u	C _c
1.48	1.70	1.04

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	dark brown poorly graded SAND	NV	NP	NP	80.6	2.5	SP
■	brown poorly graded SAND	NV	NP	NP	89.0	1.7	SP
▲	brown poorly graded SAND	NV	NP	NP	92.8	1.3	SP

Project No. 187609

Client: TTL

Project: TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

● **Source of Sample:** UD-65

Depth: 17' - 19'

Sample Number: UD-65

■ **Source of Sample:** UD-65

Depth: 28' - 30'

Sample Number: UD-65

▲ **Source of Sample:** UD-65

Depth: 43' - 45'

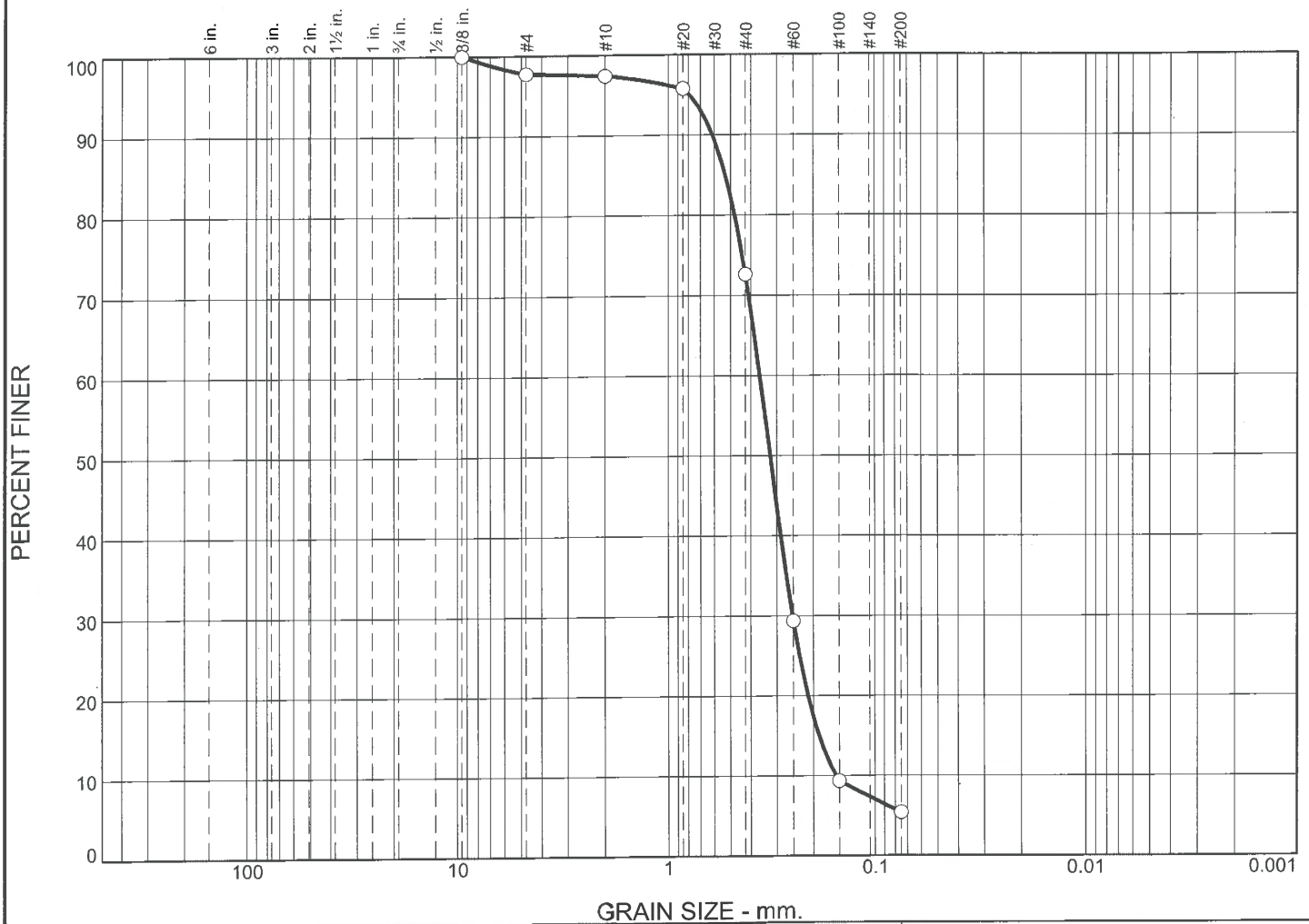
Sample Number: UD-65

BOWSER-MORNER, INC.

Dayton, Ohio

Remarks:

GRAIN SIZE DISTRIBUTION REPORT



	% +3"	% Gravel		% Sand			% Fines		
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay	
○	0.0	0.0	2.2	0.4	24.8	67.2	5.4		
×	LL	PL	D ₈₅	D ₆₀	D ₅₀	D ₃₀	D ₁₅	D ₁₀	C _c
○	NV	NP	0.5321	0.3618	0.3226	0.2524	0.1877	0.1554	1.13
									C _u
									2.33

Material Description	USCS	AASHTO
○ brown poorly graded SAND with silt	SP-SM	A-3

Project No. 187609 **Client:** TTL
Project: TTL Job No 000180200804
 Analysis of Forty-Two Thin Wall Tube Samples
 ○ **Source of Sample:** UD-67 **Depth:** 17' - 19' **Sample Number:** UD-67

Remarks:
 ○ As Received
 Moisture Content: 18.1%

BOWSER-MORNER, INC.

Dayton, Ohio

GRAIN SIZE DISTRIBUTION TEST DATA

2/20/2019

Client: TTL

Project: TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

Project Number: 187609

Location: UD-67

Depth: 17' - 19'

Sample Number: UD-67

Material Description: brown poorly graded SAND with silt

Liquid Limit: NV

Plastic Limit: NP

USCS Classification: SP-SM

AASHTO Classification: A-3

Testing Remarks: As Received

Moisture Content: 18.1%

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
398.68	112.85	0.00	0.375	0.00	100.0
			#4	6.40	97.8
			#10	7.32	97.4
			#20	12.00	95.8
			#40	78.21	72.6
			#60	201.93	29.4
			#100	259.14	9.3
			#200	270.40	5.4

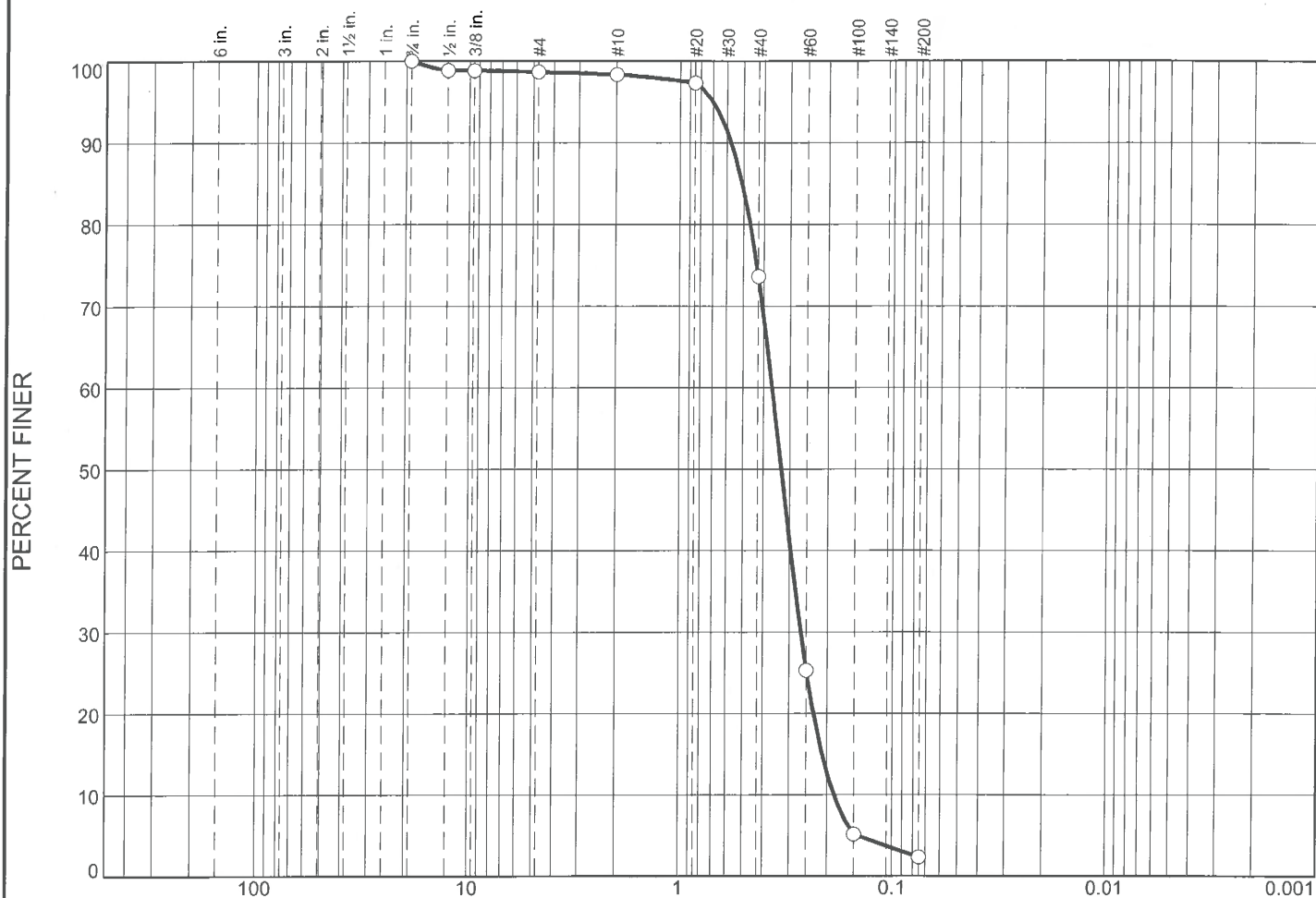
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	2.2	2.2	0.4	24.8	67.2	92.4			5.4

D ₅	D ₁₀	D ₁₅	D ₂₀	D ₃₀	D ₄₀	D ₅₀	D ₆₀	D ₈₀	D ₈₅	D ₉₀	D ₉₅
	0.1554	0.1877	0.2124	0.2524	0.2872	0.3226	0.3618	0.4791	0.5321	0.6142	0.7918

Fineness Modulus	C _u	C _c
1.66	2.33	1.13

GRAIN SIZE DISTRIBUTION REPORT



GRAIN SIZE - mm.

	% +3"		% Gravel		% Sand			% Fines		
			Coarse	Fine	Coarse	Medium	Fine	Silt		Clay
○	0.0		0.0	1.4	0.3	24.7	71.3	2.3		
×	LL	PL	D ₈₅	D ₆₀	D ₅₀	D ₃₀	D ₁₅	D ₁₀	C _c	C _u
○	NV	NP	0.5100	0.3636	0.3283	0.2653	0.2107	0.1855	1.04	1.96

Material Description							USCS	AASHTO
○ brown poorly graded SAND							SP	A-3

Project No. 187609 **Client:** TTL
Project: TTL Job No 000180200804
 Analysis of Forty-Two Thin Wall Tube Samples
 ○ **Source of Sample:** UD-67 **Depth:** 28' - 30' **Sample Number:** UD-67

BOWSER-MORNER, INC.
 Dayton, Ohio

Remarks:
 ○ As Received
 Moisture Content: 20.6%

GRAIN SIZE DISTRIBUTION TEST DATA

2/20/2019

Client: TTL

Project: TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

Project Number: 187609

Location: UD-67

Depth: 28' - 30'

Sample Number: UD-67

Material Description: brown poorly graded SAND

Liquid Limit: NV

Plastic Limit: NP

USCS Classification: SP

AASHTO Classification: A-3

Testing Remarks: As Received

Moisture Content: 20.6%

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
462.36	97.67	0.00	.75	0.00	100.0
			.5	4.26	98.8
			.375	4.33	98.8
			#4	4.96	98.6
			#10	6.04	98.3
			#20	9.83	97.3
			#40	96.17	73.6
			#60	272.41	25.3
			#100	345.89	5.2
			#200	356.23	2.3

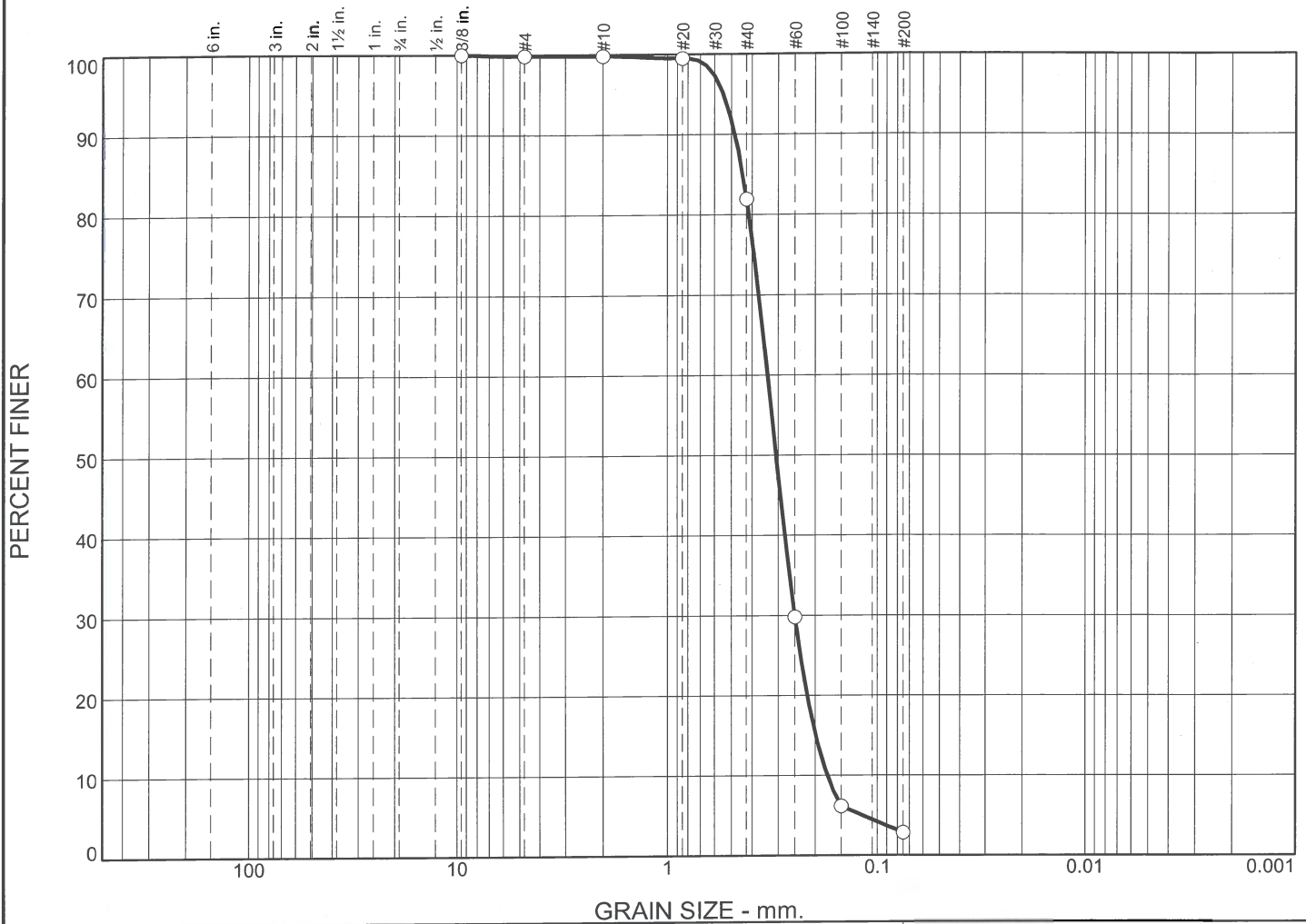
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	1.4	1.4	0.3	24.7	71.3	96.3			2.3

D ₅	D ₁₀	D ₁₅	D ₂₀	D ₃₀	D ₄₀	D ₅₀	D ₆₀	D ₈₀	D ₈₅	D ₉₀	D ₉₅
0.1444	0.1855	0.2107	0.2311	0.2653	0.2963	0.3283	0.3636	0.4660	0.5100	0.5753	0.7017

Fineness Modulus	C _u	C _c
1.69	1.96	1.04

GRAIN SIZE DISTRIBUTION REPORT



	% +3"		% Gravel		% Sand			% Fines		
			Coarse	Fine	Coarse	Medium	Fine	Silt		Clay
○	0.0		0.0	0.2	0.0	17.9	79.1	2.8		
×	LL	PL	D ₈₅	D ₆₀	D ₅₀	D ₃₀	D ₁₅	D ₁₀	C _c	C _u
○	NV	NP	0.4435	0.3371	0.3071	0.2506	0.1986	0.1747	1.07	1.93

Material Description	USCS	AASHTO
○ brown poorly graded SAND	SP	A-3

Project No. 187609 Client: TTL Project: TTL Job No 000180200804 Analysis of Forty-Two Thin Wall Tube Samples ○ Source of Sample: UD-67 Depth: 43' - 45' Sample Number: UD-67	Remarks: ○ As Received Moisture Content: 16.8%
BOWSER-MORNER, INC. Dayton, Ohio	

GRAIN SIZE DISTRIBUTION TEST DATA

2/20/2019

Client: TTL

Project: TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

Project Number: 187609

Location: UD-67

Depth: 43' - 45'

Sample Number: UD-67

Material Description: brown poorly graded SAND

Liquid Limit: NV

Plastic Limit: NP

USCS Classification: SP

AASHTO Classification: A-3

Testing Remarks: As Received

Moisture Content: 16.8%

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
401.14	96.76	0.00	.375	0.00	100.0
			#4	0.47	99.8
			#10	0.54	99.8
			#20	1.55	99.5
			#40	54.95	81.9
			#60	213.65	29.8
			#100	285.60	6.2
			#200	295.75	2.8

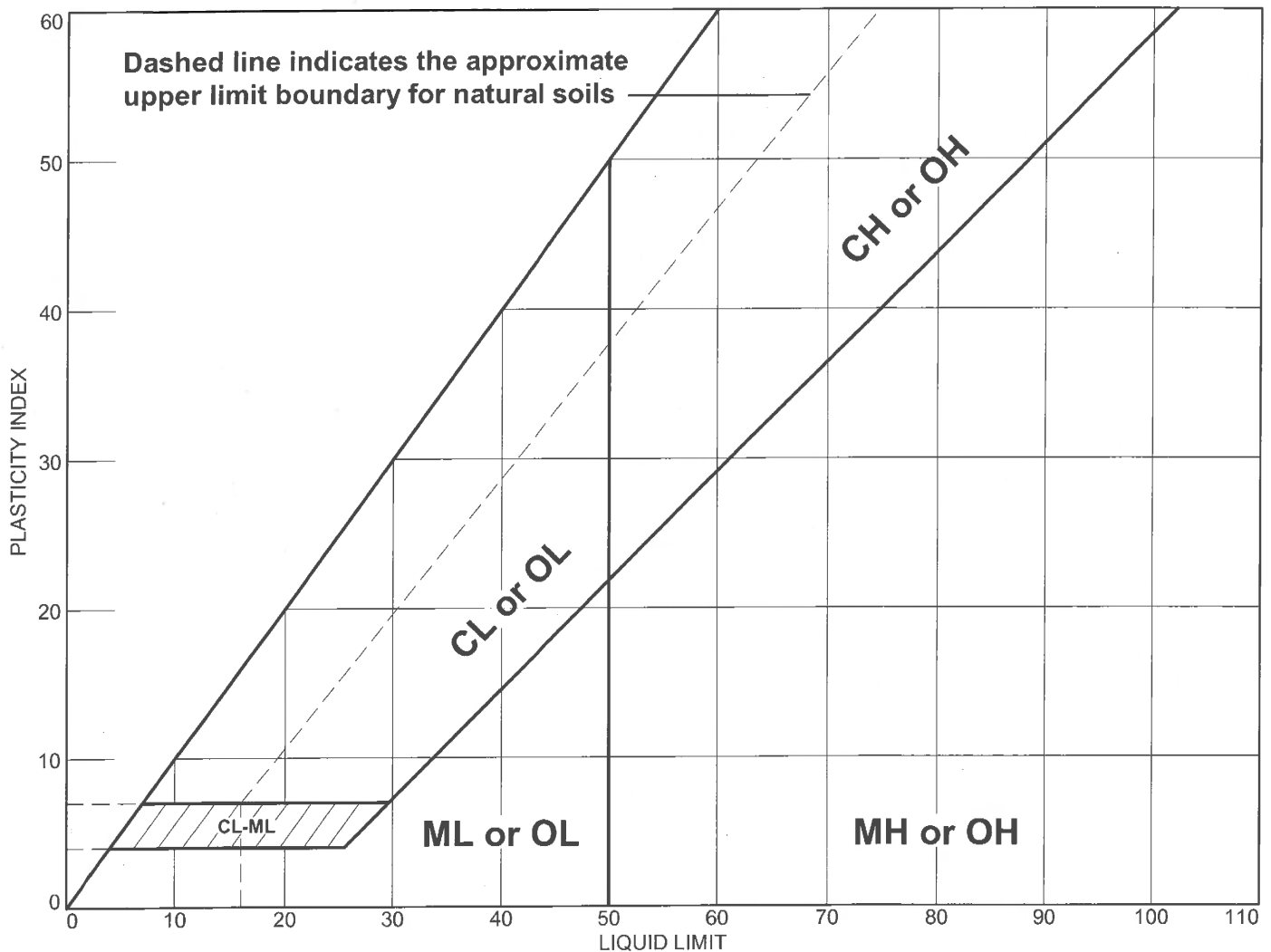
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.2	0.2	0.0	17.9	79.1	97.0			2.8

D ₅	D ₁₀	D ₁₅	D ₂₀	D ₃₀	D ₄₀	D ₅₀	D ₆₀	D ₈₀	D ₈₅	D ₉₀	D ₉₅
0.1176	0.1747	0.1986	0.2181	0.2506	0.2790	0.3071	0.3371	0.4146	0.4435	0.4831	0.5472

Fineness Modulus	C _u	C _c
1.50	1.93	1.07

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	brown poorly graded SAND with silt	NV	NP	NP	72.6	5.4	SP-SM
■	brown poorly graded SAND	NV	NP	NP	81.9	2.8	SP
▲	brown poorly graded SAND	NV	NP	NP	73.6	2.3	SP

Project No. 187609

Client: TTL

Project: TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

● Source of Sample: UD-67

Depth: 17' - 19'

Sample Number: UD-67

■ Source of Sample: UD-67

Depth: 43' - 45'

Sample Number: UD-67

▲ Source of Sample: UD-67

Depth: 28' - 30'

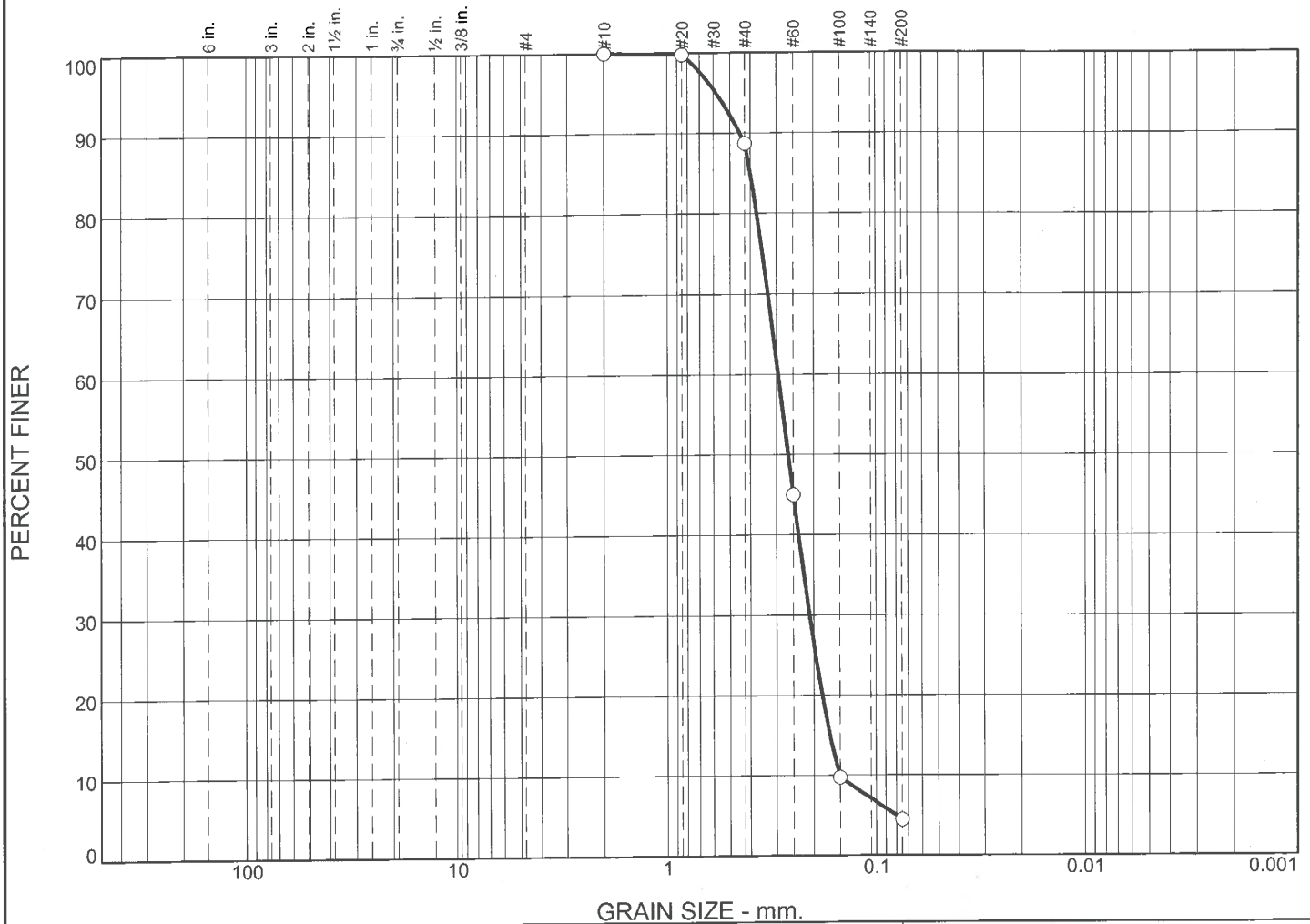
Sample Number: UD-67

Remarks:

BOWSER-MORNER, INC.

Dayton, Ohio

GRAIN SIZE DISTRIBUTION REPORT



	% +3"		% Gravel		% Sand			% Fines		
			Coarse	Fine	Coarse	Medium	Fine	Silt		Clay
○	0.0		0.0	0.0	0.0	11.3	84.2	4.5		
×	LL	PL	D ₈₅	D ₆₀	D ₅₀	D ₃₀	D ₁₅	D ₁₀	C _c	C _u
○	NV	NP	0.3998	0.2945	0.2641	0.2091	0.1673	0.1509	0.98	1.95

Material Description	USCS	AASHTO
black poorly graded SAND	SP	A-3

Project No. 187609 **Client:** TTL
Project: TTL Job No 000180200804
 Analysis of Forty-Two Thin Wall Tube Samples
 ○ **Source of Sample:** UD-93 **Depth:** 13' - 15' **Sample Number:** UD-93

Remarks:
 ○ As Received
 Moisture Content: 21.5%

BOWSER-MORNER, INC.

Dayton, Ohio

GRAIN SIZE DISTRIBUTION TEST DATA

2/20/2019

Client: TTL

Project: TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

Project Number: 187609

Location: UD-93

Depth: 13' - 15'

Sample Number: UD-93

Material Description: black poorly graded SAND

Liquid Limit: NV

Plastic Limit: NP

USCS Classification: SP

AASHTO Classification: A-3

Testing Remarks: As Received

Moisture Content: 21.5%

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
458.81	114.88	0.00	#10	0.00	100.0
			#20	0.78	99.8
			#40	38.85	88.7
			#60	189.07	45.0
			#100	310.42	9.7
			#200	328.55	4.5

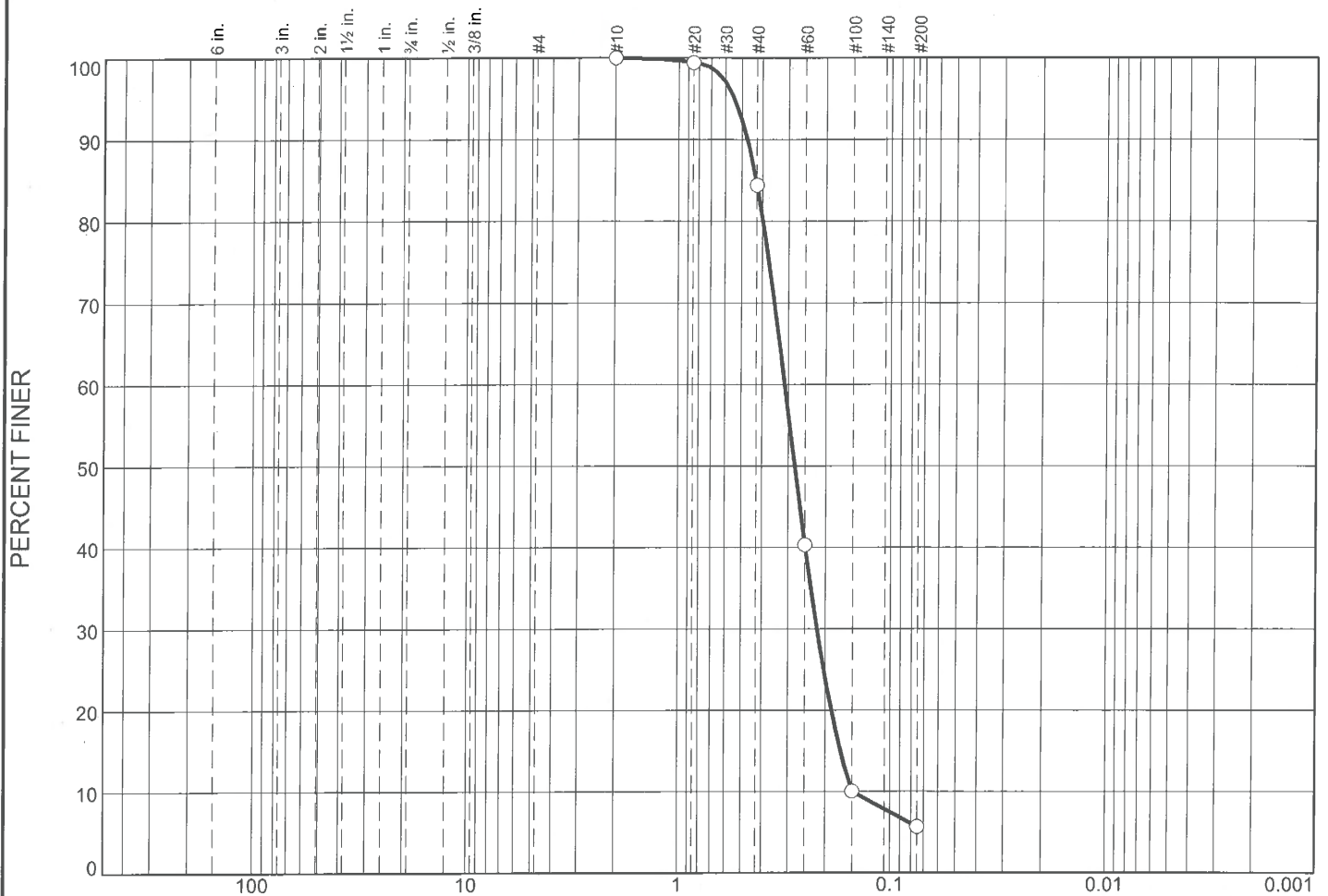
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	11.3	84.2	95.5			4.5

D ₅	D ₁₀	D ₁₅	D ₂₀	D ₃₀	D ₄₀	D ₅₀	D ₆₀	D ₈₀	D ₈₅	D ₉₀	D ₉₅
0.0804	0.1509	0.1673	0.1819	0.2091	0.2361	0.2641	0.2945	0.3724	0.3998	0.4503	0.5844

Fineness Modulus	C _u	C _c
1.33	1.95	0.98

GRAIN SIZE DISTRIBUTION REPORT



GRAIN SIZE - mm.

	% +3"	% Gravel		% Sand			% Fines		
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay	
○	0.0	0.0	0.0	0.0	15.6	78.7	5.7		
×	LL	PL	D ₈₅	D ₆₀	D ₅₀	D ₃₀	D ₁₅	D ₁₀	C _c
○	NV	NP	0.4290	0.3121	0.2794	0.2187	0.1699	0.1490	1.03
									C _u
									2.09

Material Description	USCS	AASHTO
○ black poorly graded SAND with silt	SP-SM	A-3

Project No. 187609 **Client:** TTL
Project: TTL Job No 000180200804
 Analysis of Forty-Two Thin Wall Tube Samples
 ○ **Source of Sample:** UD-93 **Depth:** 28' - 30' **Sample Number:** UD-93

BOWSER-MORNER, INC.
 Dayton, Ohio

Remarks:
 ○ As Received
 Moisture Content: 18.9%

GRAIN SIZE DISTRIBUTION TEST DATA

2/20/2019

Client: TTL

Project: TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

Project Number: 187609

Location: UD-93

Depth: 28' - 30'

Sample Number: UD-93

Material Description: black poorly graded SAND with silt

Liquid Limit: NV

Plastic Limit: NP

USCS Classification: SP-SM

AASHTO Classification: A-3

Testing Remarks: As Received

Moisture Content: 18.9%

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
518.74	96.07	0.00	#10	0.00	100.0
			#20	2.41	99.4
			#40	65.77	84.4
			#60	252.12	40.4
			#100	380.23	10.0
			#200	398.71	5.7

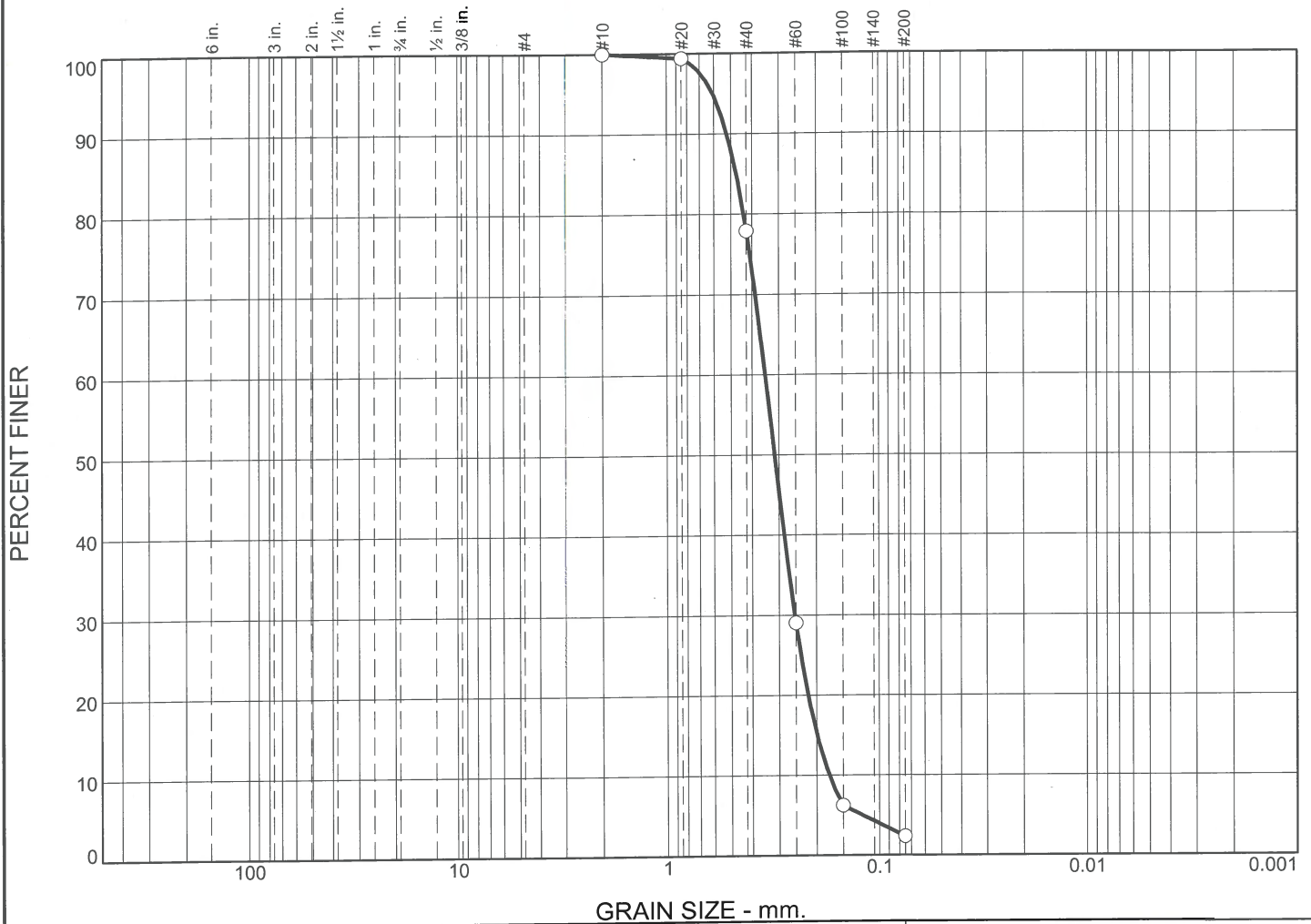
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	15.6	78.7	94.3			5.7

D ₅	D ₁₀	D ₁₅	D ₂₀	D ₃₀	D ₄₀	D ₅₀	D ₆₀	D ₈₀	D ₈₅	D ₉₀	D ₉₅
	0.1490	0.1699	0.1872	0.2187	0.2489	0.2794	0.3121	0.3974	0.4290	0.4727	0.5457

Fineness Modulus	C _u	C _c
1.37	2.09	1.03

GRAIN SIZE DISTRIBUTION REPORT



	% +3"		% Gravel		% Sand			% Fines		
			Coarse	Fine	Coarse	Medium	Fine	Silt		Clay
○	0.0		0.0	0.0	0.0	22.1	75.5	2.4		
×	LL	PL	D ₈₅	D ₆₀	D ₅₀	D ₃₀	D ₁₅	D ₁₀	C _c	C _u
○	NV	NP	0.4734	0.3473	0.3141	0.2531	0.1986	0.1742	1.06	1.99

Material Description	USCS	AASHTO
○ brown poorly graded SAND	SP	A-3

Project No. 187609 **Client:** TTL
Project: TTL Job No 000180200804
 Analysis of Forty-Two Thin Wall Tube Samples
 ○ **Source of Sample:** UD-93 **Depth:** 43' - 45' **Sample Number:** UD-93

Remarks:
 ○ As Received
 Moisture Content: 19.5%

BOWSER-MORNER, INC.

Dayton, Ohio

GRAIN SIZE DISTRIBUTION TEST DATA

2/20/2019

Client: TTL

Project: TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

Project Number: 187609

Location: UD-93

Depth: 43' - 45'

Sample Number: UD-93

Material Description: brown poorly graded SAND

Liquid Limit: NV

Plastic Limit: NP

USCS Classification: SP

AASHTO Classification: A-3

Testing Remarks: As Received

Moisture Content: 19.5%

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
484.83	114.52	0.00	#10	0.00	100.0
			#20	2.21	99.4
			#40	81.75	77.9
			#60	262.79	29.0
			#100	347.23	6.2
			#200	361.58	2.4

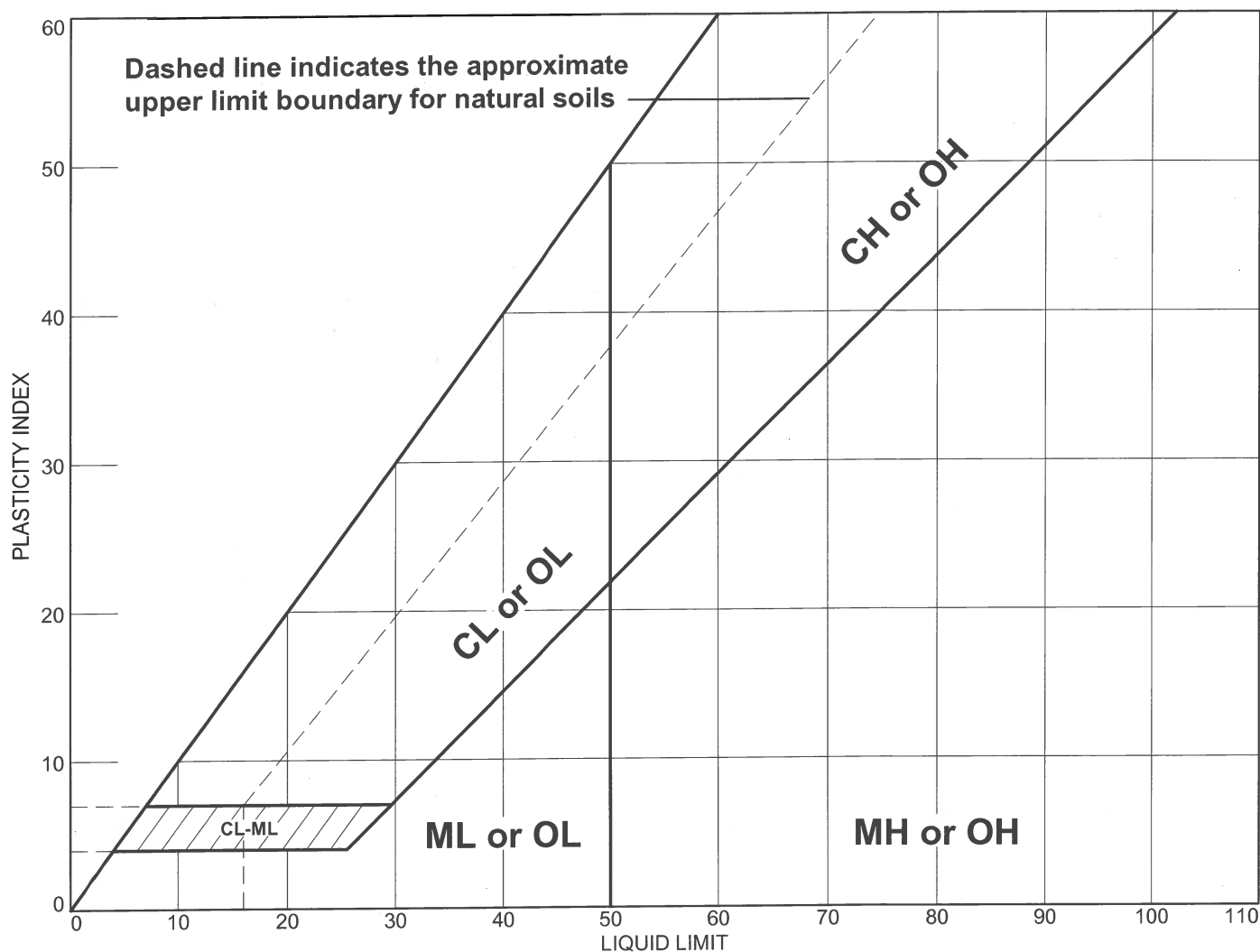
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	22.1	75.5	97.6			2.4

D ₅	D ₁₀	D ₁₅	D ₂₀	D ₃₀	D ₄₀	D ₅₀	D ₆₀	D ₈₀	D ₈₅	D ₉₀	D ₉₅
0.1203	0.1742	0.1986	0.2189	0.2531	0.2835	0.3141	0.3473	0.4374	0.4734	0.5239	0.6094

Fineness Modulus	C _u	C _c
1.54	1.99	1.06

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	black poorly graded SAND	NV	NP	NP	88.7	4.5	SP
■	black poorly graded SAND with silt	NV	NP	NP	84.4	5.7	SP-SM
▲	brown poorly graded SAND	NV	NP	NP	77.9	2.4	SP

Project No. 187609

Client: TTL

Project: TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

● Source of Sample: UD-93

Depth: 13' - 15'

Sample Number: UD-93

■ Source of Sample: UD-93

Depth: 28' - 30'

Sample Number: UD-93

▲ Source of Sample: UD-93

Depth: 43' - 45'

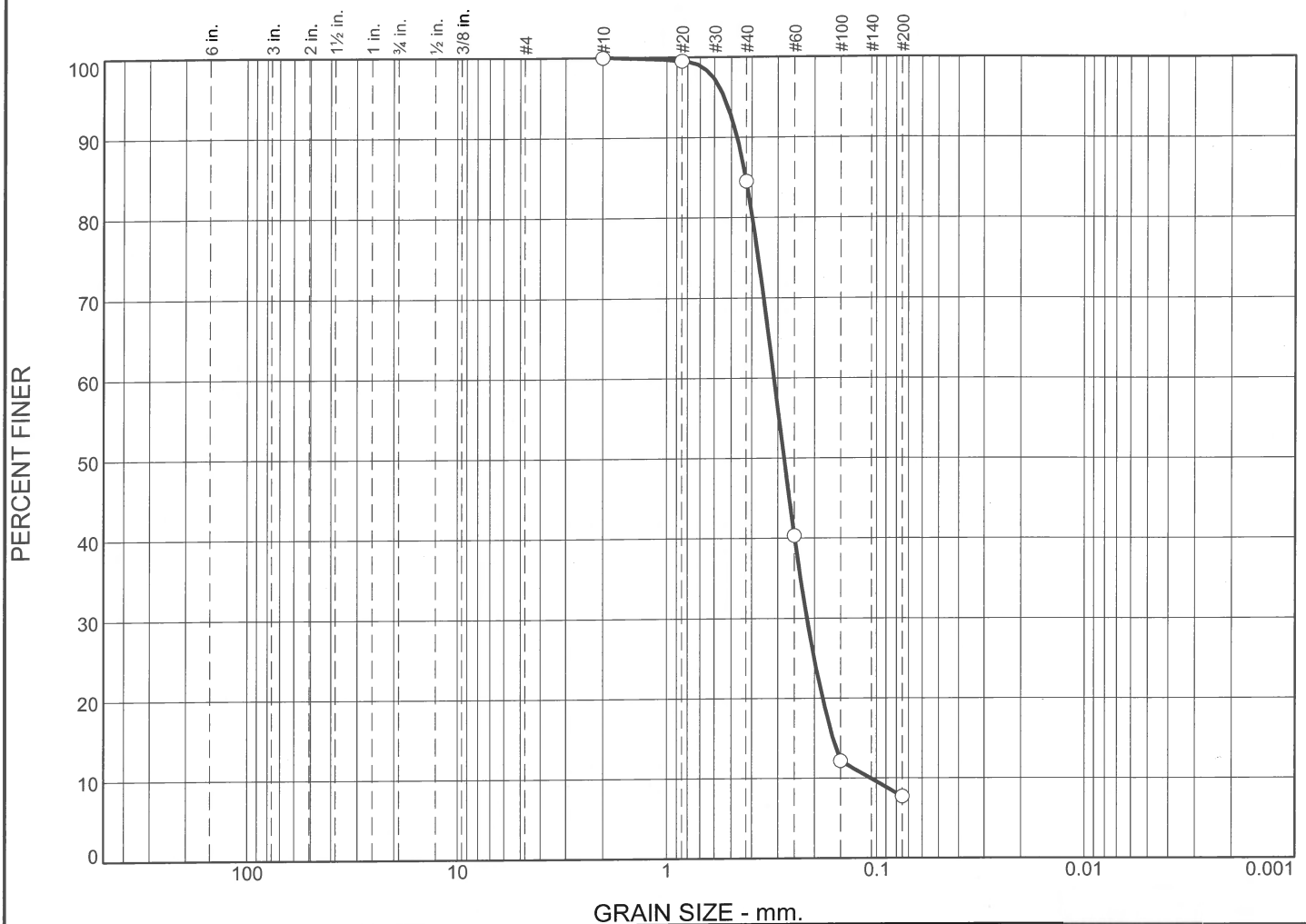
Sample Number: UD-93

BOWSER-MORNER, INC.

Dayton, Ohio

Remarks:

GRAIN SIZE DISTRIBUTION REPORT



	% +3"		% Gravel		% Sand			% Fines		
			Coarse	Fine	Coarse	Medium	Fine	Silt		Clay
☐	0.0		0.0	0.0	0.0	15.5	76.8	7.7		
☒	LL	PL	D ₈₅	D ₆₀	D ₅₀	D ₃₀	D ₁₅	D ₁₀	C _c	C _u
☐	NV	NP	0.4283	0.3129	0.2800	0.2173	0.1631	0.1069	1.41	2.93

Material Description	USCS	AASHTO
☐ brown poorly graded SAND with silt	SP-SM	A-3

Project No. 187609 Client: TTL Project: TTL Job No 000180200804 Analysis of Forty-Two Thin Wall Tube Samples ☐ Source: UD-126 Depth: 13' - 15' Sample No.: UD-126	Remarks: ☐ As Received Moisture Content: 17.5%
BOWSER-MORNER, INC. Dayton, Ohio	

GRAIN SIZE DISTRIBUTION TEST DATA

2/20/2019

Client: TTL

Project: TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

Project Number: 187609

Location: UD-126

Depth: 13' - 15'

Sample Number: UD-126

Material Description: brown poorly graded SAND with silt

Liquid Limit: NV

Plastic Limit: NP

USCS Classification: SP-SM

AASHTO Classification: A-3

Testing Remarks: As Received

Moisture Content: 17.5%

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
430.90	92.87	0.00	#10	0.00	100.0
			#20	1.63	99.5
			#40	52.32	84.5
			#60	201.71	40.3
			#100	296.85	12.2
			#200	311.93	7.7

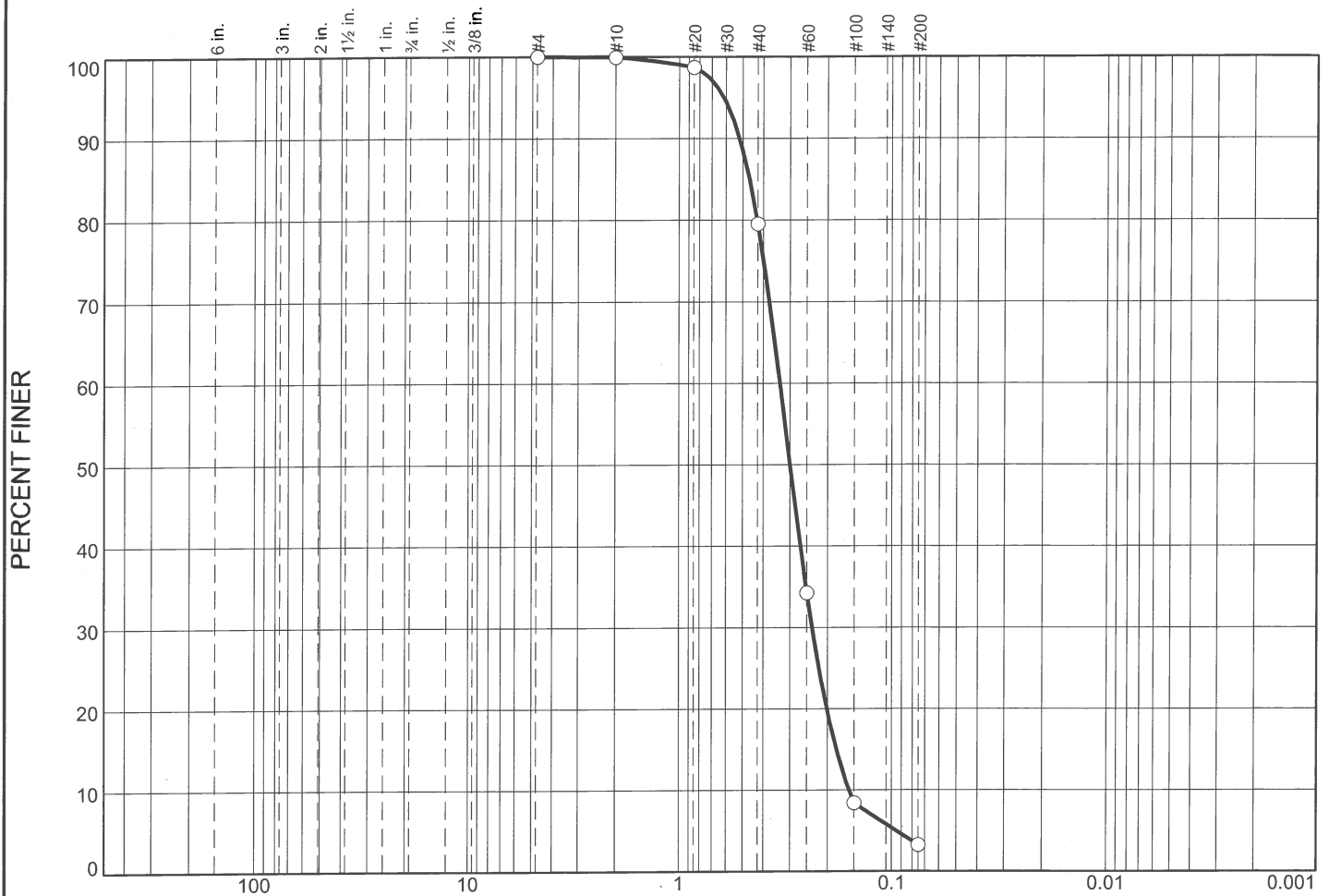
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	15.5	76.8	92.3			7.7

D ₅	D ₁₀	D ₁₅	D ₂₀	D ₃₀	D ₄₀	D ₅₀	D ₆₀	D ₈₀	D ₈₅	D ₉₀	D ₉₅
	0.1069	0.1631	0.1829	0.2173	0.2490	0.2800	0.3129	0.3973	0.4283	0.4710	0.5416

Fineness Modulus	C _u	C _c
1.35	2.93	1.41

GRAIN SIZE DISTRIBUTION REPORT



GRAIN SIZE - mm.

	% +3"	% Gravel		% Sand			% Fines		
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay	
☐	0.0	0.0	0.0	0.1	20.4	76.3	3.2		
☒	LL	PL	D ₈₅	D ₆₀	D ₅₀	D ₃₀	D ₁₅	D ₁₀	C _c
☐	NV	NP	0.4656	0.3345	0.3000	0.2362	0.1815	0.1586	1.05
									C _u
									2.11

Material Description	USCS	AASHTO
☐ brown poorly graded SAND	SP	A-3

Project No. 187609 Client: TTL Project: TTL Job No 000180200804 Analysis of Forty-Two Thin Wall Tube Samples ☐ Source: UD-126 Depth: 28' - 30' Sample No.: UD-126	Remarks: ☐ As Received Moisture Content: 16.9%
BOWSER-MORNER, INC. Dayton, Ohio	

GRAIN SIZE DISTRIBUTION TEST DATA

2/20/2019

Client: TTL

Project: TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

Project Number: 187609

Location: UD-126

Depth: 28' - 30'

Sample Number: UD-126

Material Description: brown poorly graded SAND

Liquid Limit: NV

Plastic Limit: NP

USCS Classification: SP

AASHTO Classification: A-3

Testing Remarks: As Received

Moisture Content: 16.9%

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
552.21	120.07	0.00	#4	0.00	100.0
			#10	0.27	99.9
			#20	5.65	98.7
			#40	88.45	79.5
			#60	284.08	34.3
			#100	395.82	8.4
			#200	418.11	3.2

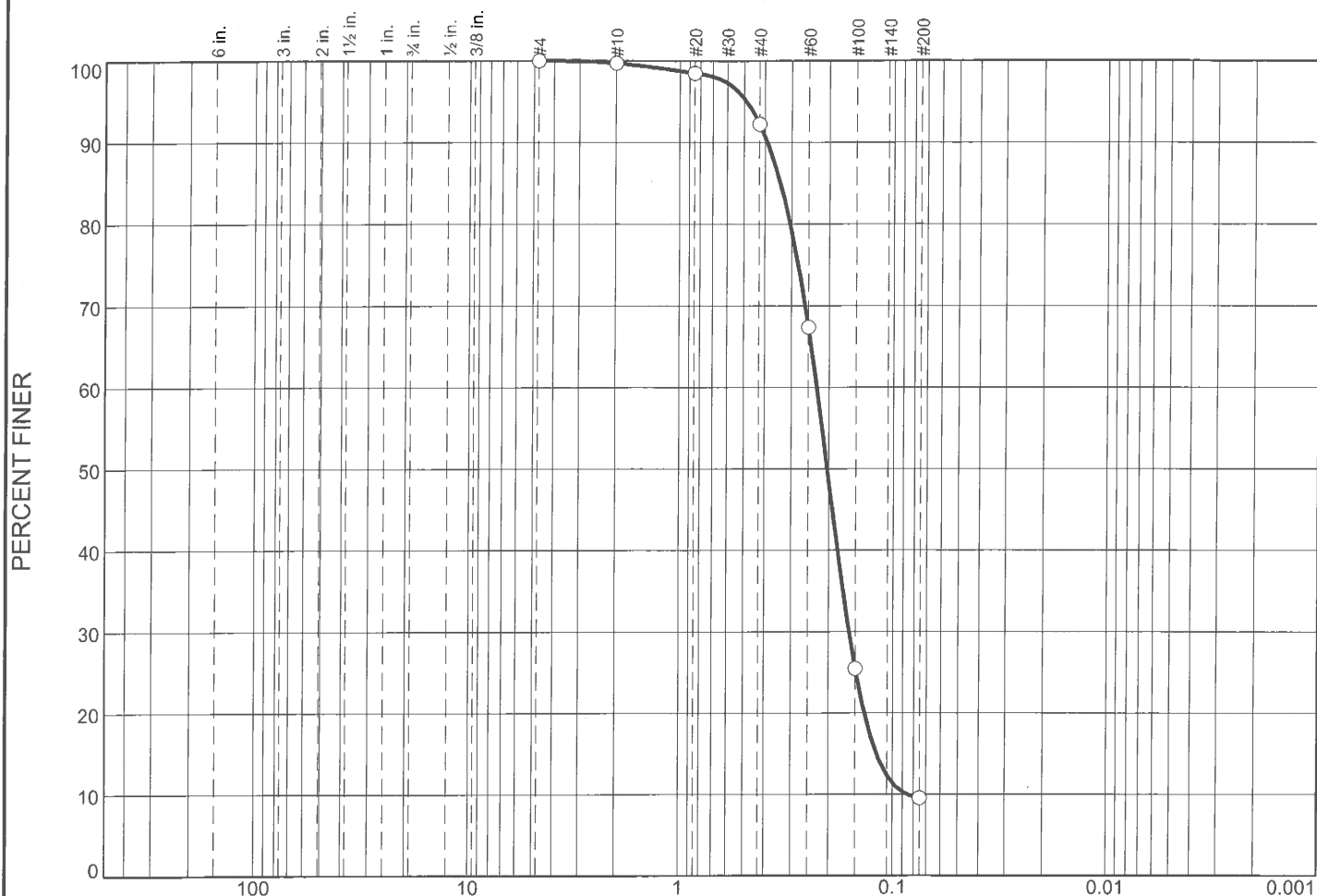
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.1	20.4	76.3	96.8			3.2

D ₅	D ₁₀	D ₁₅	D ₂₀	D ₃₀	D ₄₀	D ₅₀	D ₆₀	D ₈₀	D ₈₅	D ₉₀	D ₉₅
0.0949	0.1586	0.1815	0.2012	0.2362	0.2681	0.3000	0.3345	0.4280	0.4656	0.5195	0.6158

Fineness Modulus	C _u	C _c
1.48	2.11	1.05

GRAIN SIZE DISTRIBUTION REPORT



GRAIN SIZE - mm.

	% +3"		% Gravel		% Sand			% Fines		
			Coarse	Fine	Coarse	Medium	Fine	Silt		Clay
○	0.0		0.0	0.0	0.3	7.5	82.7	9.5		
×	LL	PL	D ₈₅	D ₆₀	D ₅₀	D ₃₀	D ₁₅	D ₁₀	C _c	C _u
○	NV	NP	0.3397	0.2280	0.2034	0.1603	0.1191	0.0856	1.32	2.66

Material Description	USCS	AASHTO
○ brown poorly graded SAND with silt	SP-SM	A-3

Project No. 187609 Client: TTL Project: TTL Job No 000180200804 Analysis of Forty-Two Thin Wall Tube Samples ○ Source: UD-126 Depth: 43' - 45' Sample No.: UD-126	Remarks: ○ As Received Moisture Content: 18.6%
BOWSER-MORNER, INC. Dayton, Ohio	

GRAIN SIZE DISTRIBUTION TEST DATA

2/20/2019

Client: TTL

Project: TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

Project Number: 187609

Location: UD-126

Depth: 43' - 45'

Sample Number: UD-126

Material Description: brown poorly graded SAND with silt

Liquid Limit: NV

Plastic Limit: NP

USCS Classification: SP-SM

AASHTO Classification: A-3

Testing Remarks: As Received

Moisture Content: 18.6%

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
352.76	112.56	0.00	#4	0.00	100.0
			#10	0.71	99.7
			#20	3.64	98.5
			#40	18.62	92.2
			#60	78.37	67.4
			#100	179.05	25.5
			#200	217.33	9.5

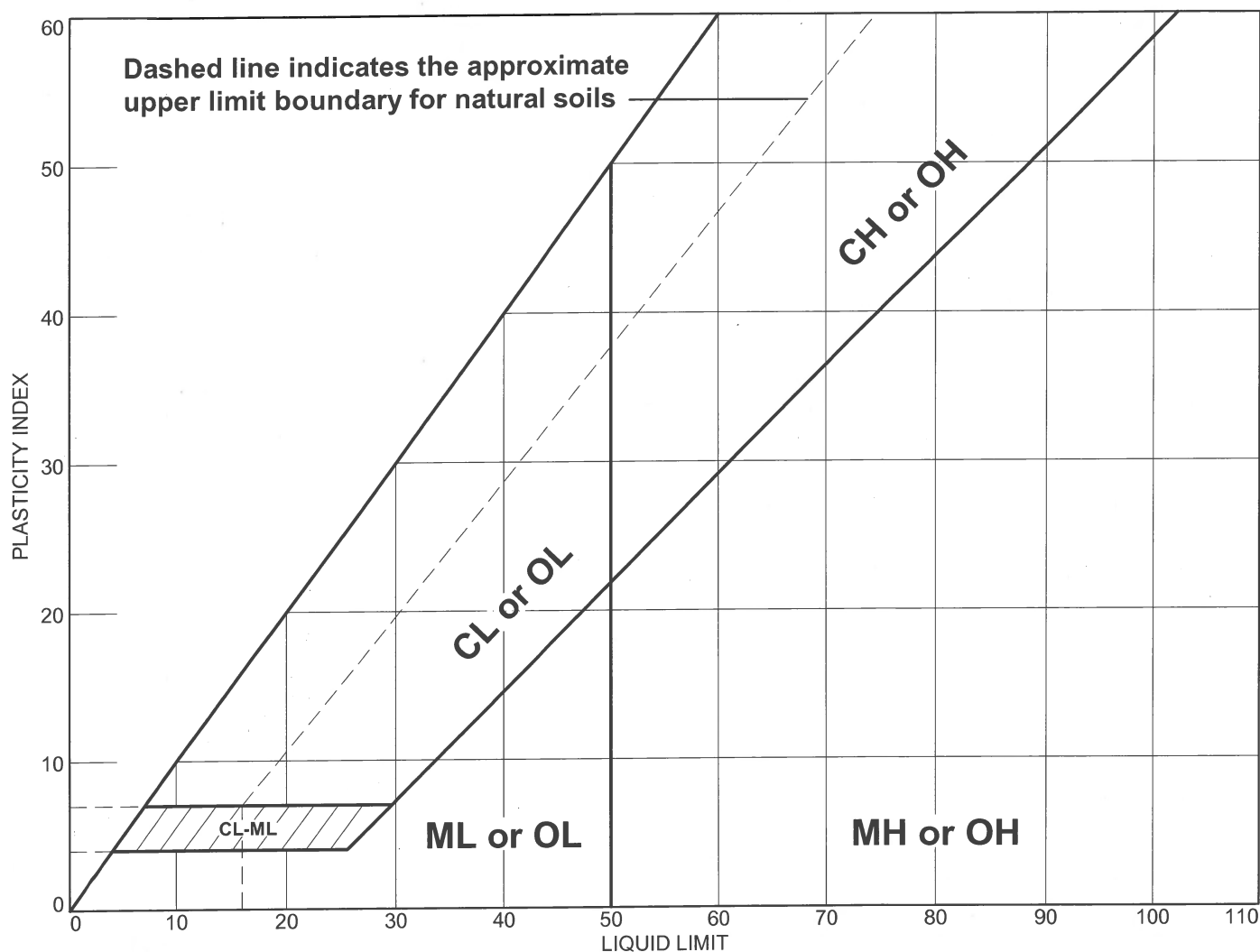
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.3	7.5	82.7	90.5			9.5

D ₅	D ₁₀	D ₁₅	D ₂₀	D ₃₀	D ₄₀	D ₅₀	D ₆₀	D ₈₀	D ₈₅	D ₉₀	D ₉₅
	0.0856	0.1191	0.1358	0.1603	0.1815	0.2034	0.2280	0.3052	0.3397	0.3909	0.4883

Fineness Modulus	C _u	C _c
0.99	2.66	1.32

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	brown poorly graded SAND with silt	NV	NP	NP	84.5	7.7	SP-SM
■	brown poorly graded SAND	NV	NP	NP	79.5	3.2	SP
▲	brown poorly graded SAND with silt	NV	NP	NP	92.2	9.5	SP-SM

Project No. 187609

Client: TTL

Project: TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

● Source of Sample: UD-126

Depth: 13' - 15'

Sample Number: UD-126

■ Source of Sample: UD-126

Depth: 28' - 30'

Sample Number: UD-126

▲ Source of Sample: UD-126

Depth: 43' - 45'

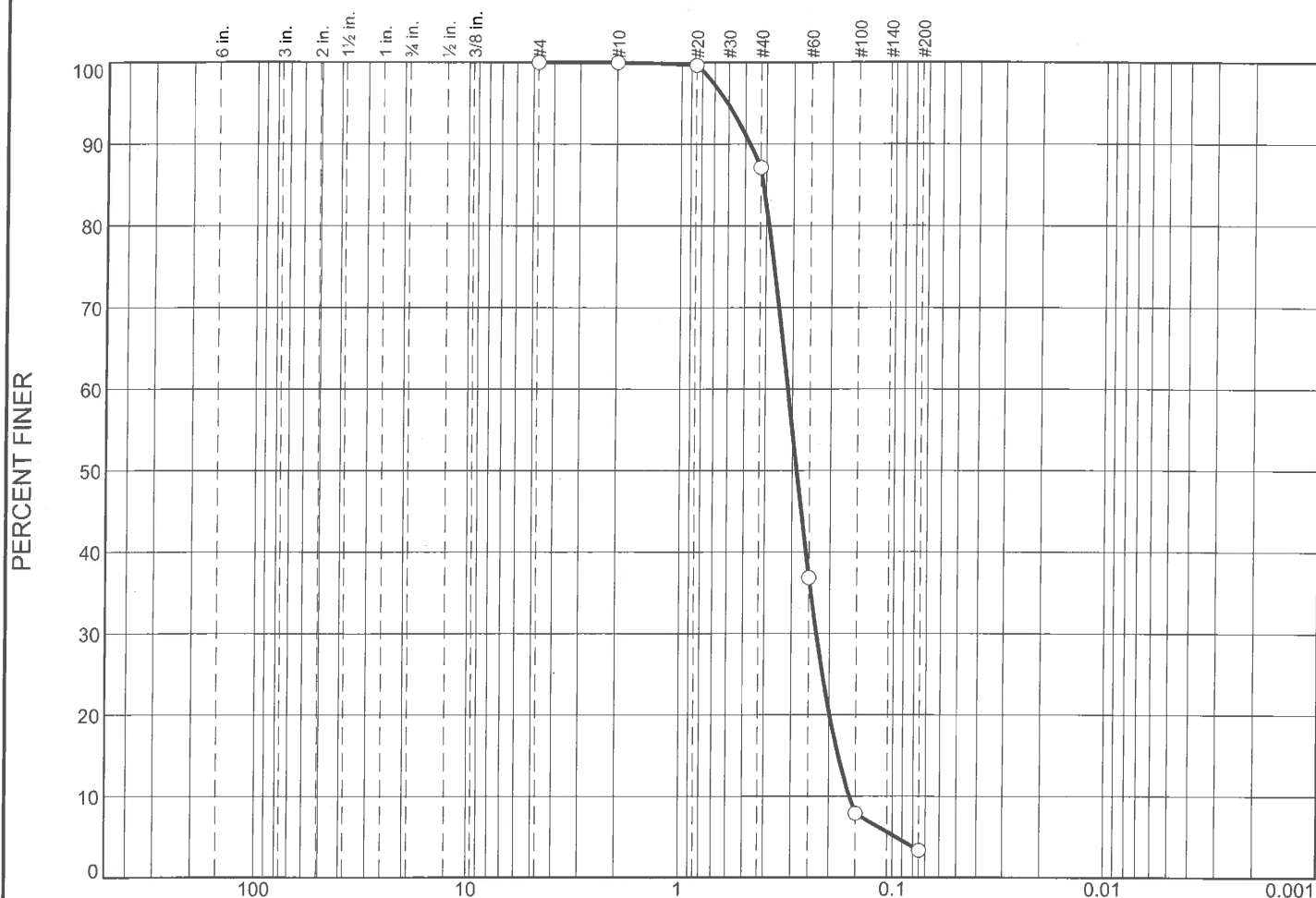
Sample Number: UD-126

BOWSER-MORNER, INC.

Dayton, Ohio

Remarks:

GRAIN SIZE DISTRIBUTION REPORT



GRAIN SIZE - mm.

	% +3"		% Gravel		% Sand			% Fines		
			Coarse	Fine	Coarse	Medium	Fine	Silt		Clay
○	0.0		0.0	0.0	0.0	12.9	83.8	3.3		
×	LL	PL	D ₈₅	D ₆₀	D ₅₀	D ₃₀	D ₁₅	D ₁₀	C _c	C _u
○	NV	NP	0.4124	0.3153	0.2863	0.2302	0.1809	0.1603	1.05	1.97

Material Description							USCS	AASHTO
○ brown poorly graded SAND							SP	A-3

Project No. 187609 **Client:** TTL
Project: TTL Job No 000180200804
 Analysis of Forty-Two Thin Wall Tube Samples
 ○ **Source:** UD-128 **Depth:** 13' - 15' **Sample No.:** UD-128

Remarks:
 ○ As Received
 Moisture Content: 21.2%

BOWSER-MORNER, INC.

Dayton, Ohio

GRAIN SIZE DISTRIBUTION TEST DATA

2/20/2019

Client: TTL

Project: TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

Project Number: 187609

Location: UD-128

Depth: 13' - 15'

Sample Number: UD-128

Material Description: brown poorly graded SAND

Liquid Limit: NV

Plastic Limit: NP

USCS Classification: SP

AASHTO Classification: A-3

Testing Remarks: As Received

Moisture Content: 21.2%

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
461.67	119.27	0.00	#4	0.00	100.0
			#10	0.03	100.0
			#20	1.09	99.7
			#40	44.03	87.1
			#60	216.13	36.9
			#100	315.33	7.9
			#200	330.94	3.3

Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	12.9	83.8	96.7			3.3

D ₅	D ₁₀	D ₁₅	D ₂₀	D ₃₀	D ₄₀	D ₅₀	D ₆₀	D ₈₀	D ₈₅	D ₉₀	D ₉₅
0.0964	0.1603	0.1809	0.1987	0.2302	0.2587	0.2863	0.3153	0.3874	0.4124	0.4772	0.6082

Fineness Modulus	C _u	C _c
1.43	1.97	1.05

PERCENT FINER



Material Description

USCS

AASHTO

SP-SM

A-3

Moisture Content: 23.6%

Dayton, Ohio

GRAIN SIZE DISTRIBUTION TEST DATA

2/21/2019

Client: TTL

Project: TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

Project Number: 187609

Location: UD-128

Depth: 30' - 32'

Sample Number: UD-128

Material Description: brown poorly graded SAND with silt

Liquid Limit: NV

Plastic Limit: NP

USCS Classification: SP-SM

AASHTO Classification: A-3

Testing Remarks: As Received

Moisture Content: 23.6%

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
418.04	96.04	0.00	#10	0.00	100.0
			#20	0.20	99.9
			#40	8.30	97.4
			#60	76.40	76.3
			#100	209.50	34.9
			#200	288.10	10.5

Fractional Components

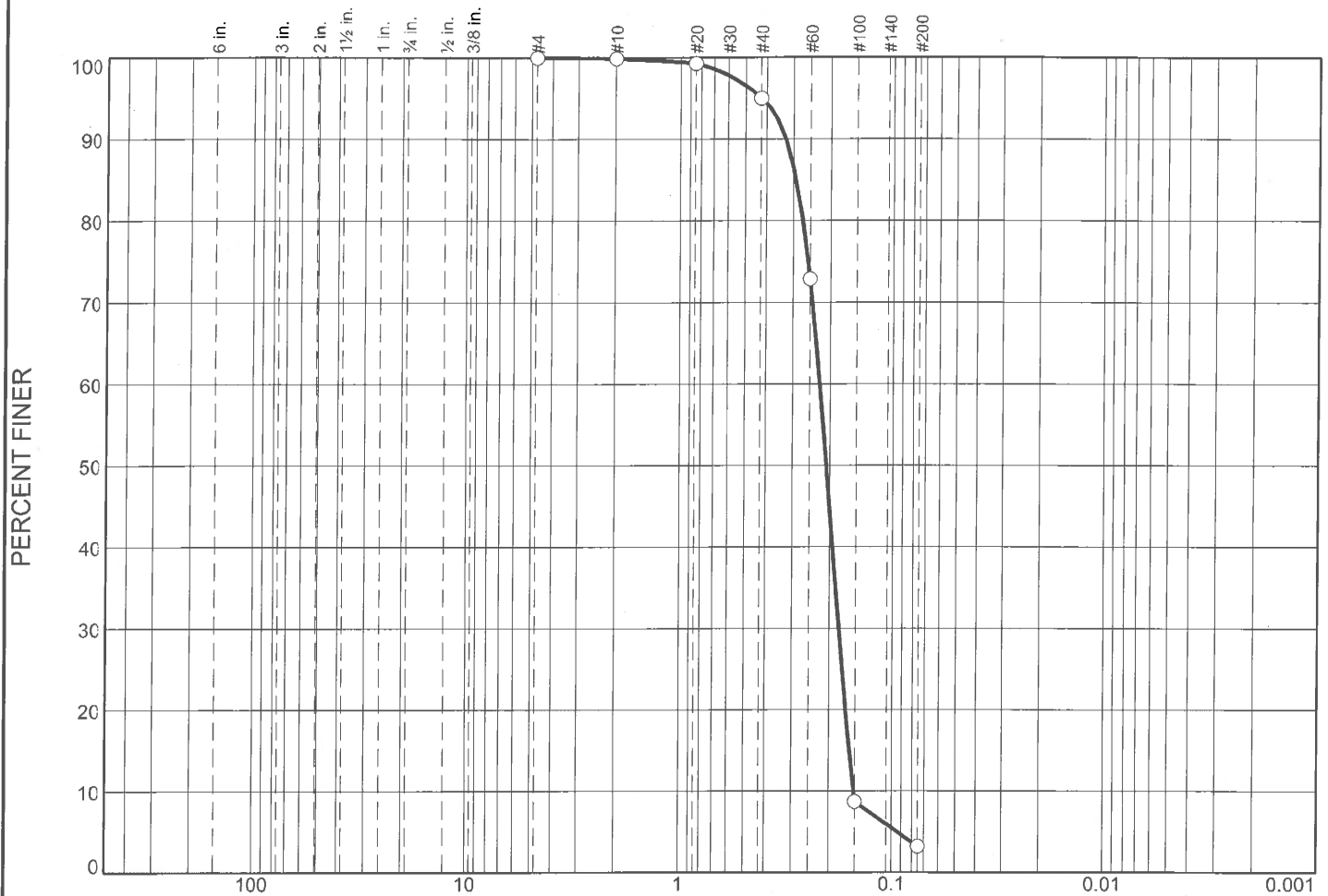
Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	2.6	86.9	89.5			10.5

D ₅	D ₁₀	D ₁₅	D ₂₀	D ₃₀	D ₄₀	D ₅₀	D ₆₀	D ₈₀	D ₈₅	D ₉₀	D ₉₅
		0.0934	0.1112	0.1387	0.1608	0.1817	0.2039	0.2646	0.2890	0.3231	0.3782

Fineness Modulus

0.79

GRAIN SIZE DISTRIBUTION REPORT



GRAIN SIZE - mm.

	% +3"		% Gravel		% Sand			% Fines		
			Coarse	Fine	Coarse	Medium	Fine	Silt		Clay
○	0.0		0.0	0.0	0.1	4.9	91.8	3.2		
×	LL	PL	D ₈₅	D ₆₀	D ₅₀	D ₃₀	D ₁₅	D ₁₀	C _c	C _u
○	NV	NP	0.2923	0.2238	0.2077	0.1799	0.1595	0.1521	0.95	1.47

Material Description	USCS	AASHTO
○ brown/gray poorly graded SAND	SP	A-3

Project No. 187609 **Client:** TTL
Project: TTL Job No 000180200804
 Analysis of Forty-Two Thin Wall Tube Samples
 ○ **Source:** UD-128 **Depth:** 43' - 45' **Sample No.:** UD-128

Remarks:
 ○ As Received
 Moisture Content: 21.0%

BOWSER-MORNER, INC.

Dayton, Ohio

GRAIN SIZE DISTRIBUTION TEST DATA

2/21/2019

Client: TTL

Project: TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

Project Number: 187609

Location: UD-128

Depth: 43' - 45'

Sample Number: UD-128

Material Description: brown/gray poorly graded SAND

Liquid Limit: NV

Plastic Limit: NP

USCS Classification: SP

AASHTO Classification: A-3

Testing Remarks: As Received

Moisture Content: 21.0%

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
567.66	96.99	0.00	#4	0.00	100.0
			#10	0.50	99.9
			#20	3.40	99.3
			#40	23.50	95.0
			#60	127.70	72.9
			#100	429.70	8.7
			#200	455.60	3.2

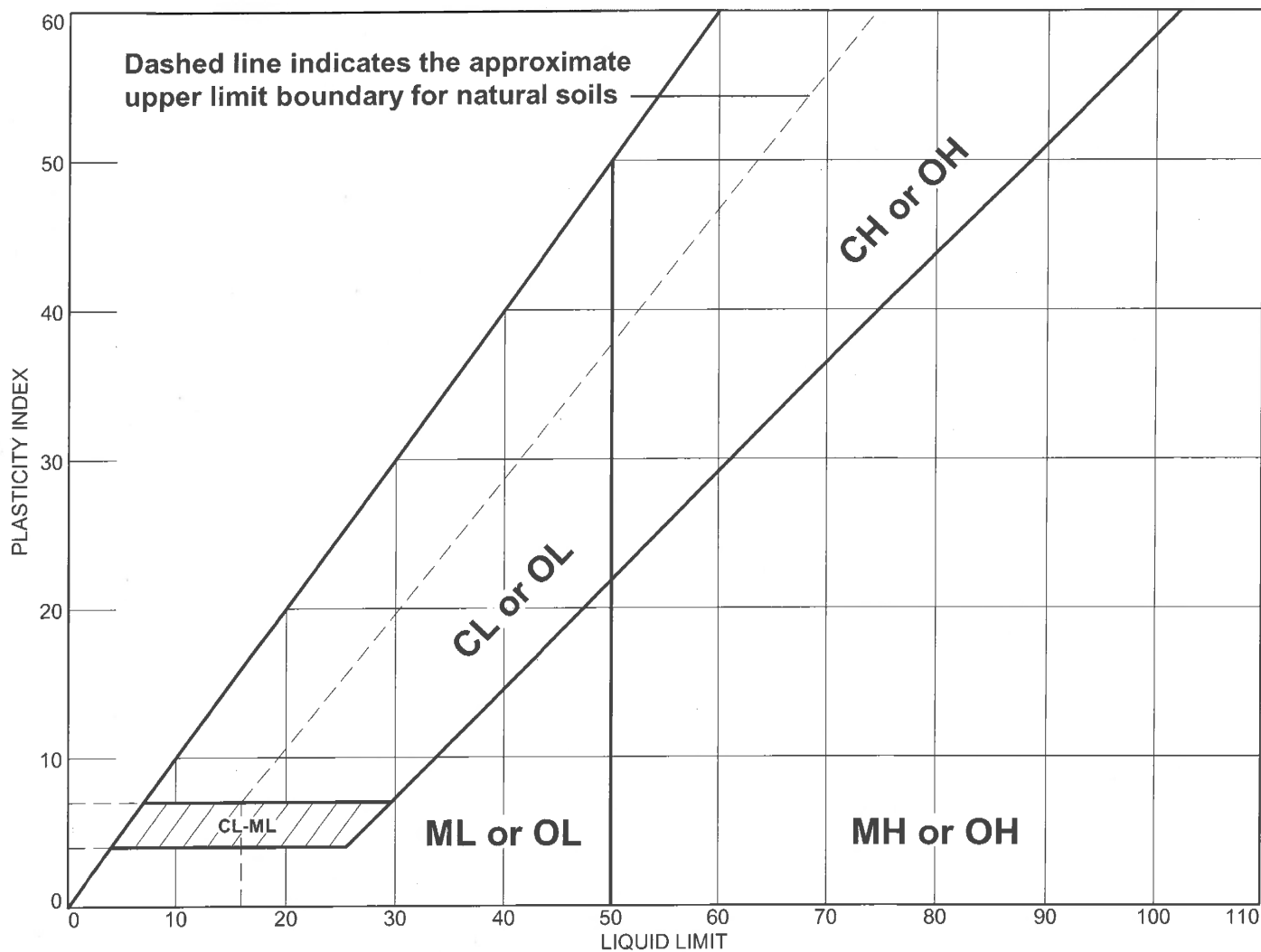
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.1	4.9	91.8	96.8			3.2

D ₅	D ₁₀	D ₁₅	D ₂₀	D ₃₀	D ₄₀	D ₅₀	D ₆₀	D ₈₀	D ₈₅	D ₉₀	D ₉₅
0.0941	0.1521	0.1595	0.1665	0.1799	0.1934	0.2077	0.2238	0.2710	0.2923	0.3265	0.4247

Fineness Modulus	C _u	C _c
1.08	1.47	0.95

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	brown poorly graded SAND	NV	NP	NP	87.1	3.3	SP
■	brown poorly graded SAND with silt	NV	NP	NP	97.4	10.5	SP-SM
▲	brown/gray poorly graded SAND	NV	NP	NP	95.0	3.2	SP

Project No. 187609

Client: TTL

Project: TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

● **Source of Sample:** UD-128

Depth: 13' - 15'

Sample Number: UD-128

■ **Source of Sample:** UD-128

Depth: 30' - 32'

Sample Number: UD-128

▲ **Source of Sample:** UD-128

Depth: 43' - 45'

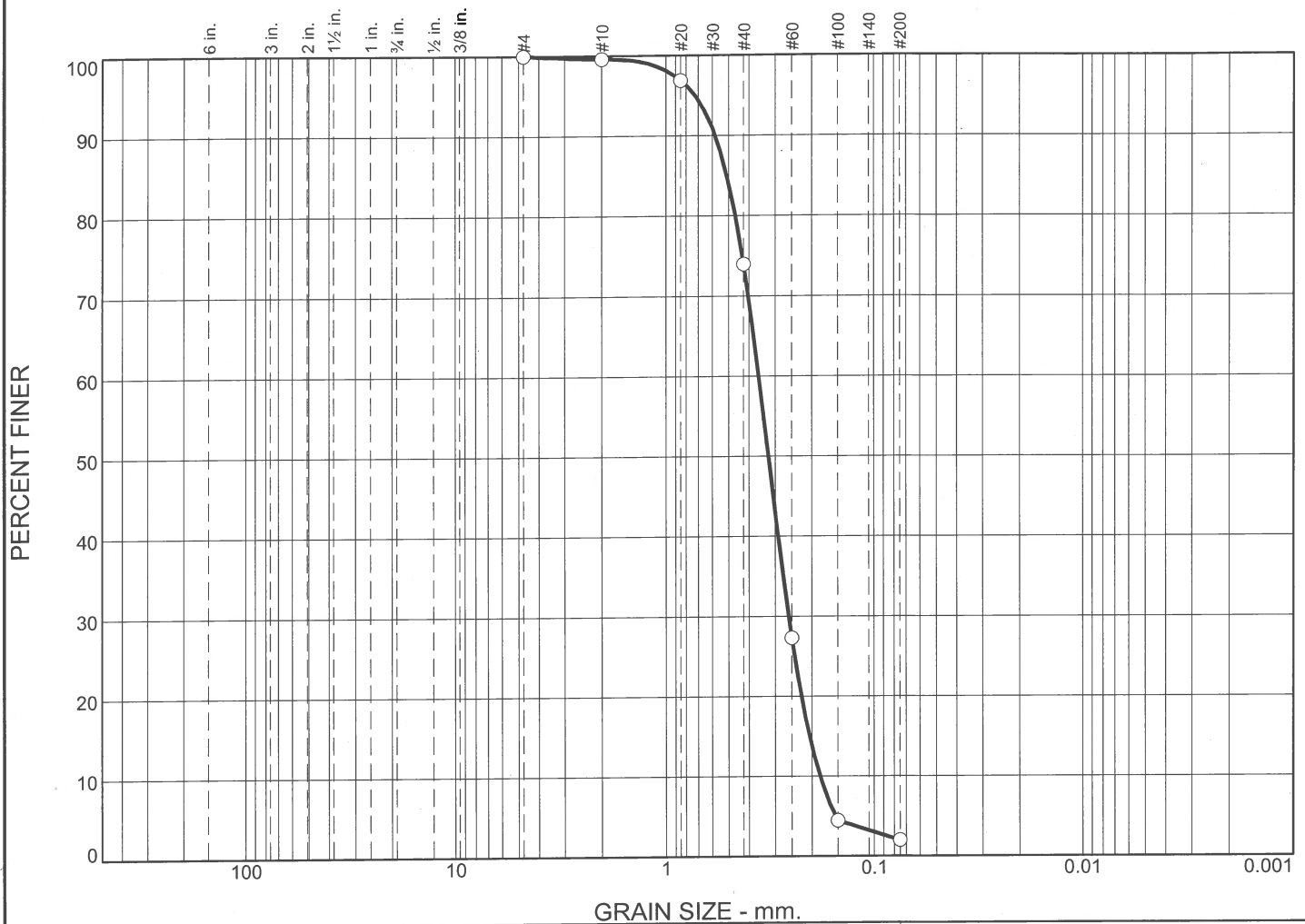
Sample Number: UD-128

BOWSER-MORNER, INC.

Dayton, Ohio

Remarks:

GRAIN SIZE DISTRIBUTION REPORT



	% +3"		% Gravel		% Sand			% Fines		
			Coarse	Fine	Coarse	Medium	Fine	Silt		Clay
○	0.0		0.0	0.0	0.4	25.6	72.0	2.0		
×	LL	PL	D ₈₅	D ₆₀	D ₅₀	D ₃₀	D ₁₅	D ₁₀	C _c	C _u
○	NV	NP	0.5128	0.3594	0.3230	0.2587	0.2051	0.1827	1.02	1.97

Material Description	USCS	AASHTO
dark brown poorly graded SAND	SP	A-3

Project No. 187609 **Client:** TTL
Project: TTL Job No 000180200804
 Analysis of Forty-Two Thin Wall Tube Samples
Source: UD-179 **Depth:** 13' - 15' **Sample No.:** UD-179

Remarks:
 ○ As Recieved
 Moisture Content: 20.7%

BOWSER-MORNER, INC.

Dayton, Ohio

GRAIN SIZE DISTRIBUTION TEST DATA

2/20/2019

Client: TTL

Project: TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

Project Number: 187609

Location: UD-179

Depth: 13' - 15'

Sample Number: UD-179

Material Description: dark brown poorly graded SAND

Liquid Limit: NV

Plastic Limit: NP

USCS Classification: SP

AASHTO Classification: A-3

Testing Remarks: As Recieved

Moisture Content: 20.7%

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
517.26	114.83	0.00	#4	0.00	100.0
			#10	1.62	99.6
			#20	12.55	96.9
			#40	104.78	74.0
			#60	292.49	27.3
			#100	384.40	4.5
			#200	394.42	2.0

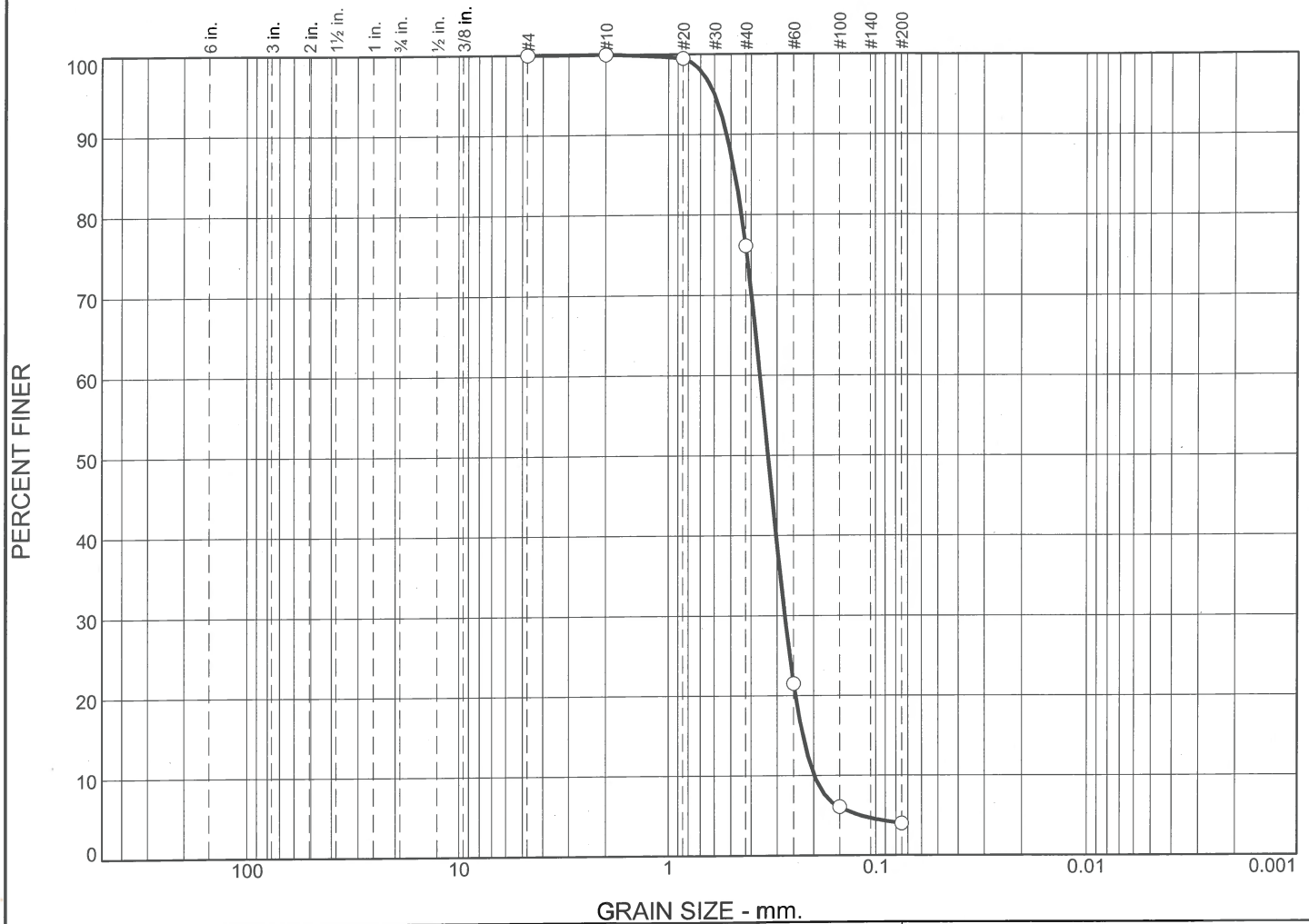
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.4	25.6	72.0	98.0			2.0

D ₅	D ₁₀	D ₁₅	D ₂₀	D ₃₀	D ₄₀	D ₅₀	D ₆₀	D ₈₀	D ₈₅	D ₉₀	D ₉₅
0.1538	0.1827	0.2051	0.2246	0.2587	0.2903	0.3230	0.3594	0.4660	0.5128	0.5835	0.7265

Fineness Modulus	C _u	C _c
1.63	1.97	1.02

GRAIN SIZE DISTRIBUTION REPORT



	% +3"		% Gravel		% Sand			% Fines		
			Coarse	Fine	Coarse	Medium	Fine	Silt		Clay
○	0.0		0.0	0.0	0.0	23.9	72.1	4.0		
×	LL	PL	D ₈₅	D ₆₀	D ₅₀	D ₃₀	D ₁₅	D ₁₀	C _c	C _u
○	NV	NP	0.4788	0.3621	0.3314	0.2755	0.2256	0.1987	1.05	1.82

Material Description	USCS	AASHTO
○ dark brown poorly graded SAND	SP	A-3

Project No. 187609 **Client:** TTL
Project: TTL Job No 000180200804
 Analysis of Forty-Two Thin Wall Tube Samples
 ○ **Source:** UD-179 **Depth:** 28' - 30' **Sample No.:** UD-179

Remarks:
 ○ As Received
 Moisture Content: 19.8%

BOWSER-MORNER, INC.

Dayton, Ohio

GRAIN SIZE DISTRIBUTION TEST DATA

2/21/2019

Client: TTL

Project: TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

Project Number: 187609

Location: UD-179

Depth: 28' - 30'

Sample Number: UD-179

Material Description: dark brown poorly graded SAND

Liquid Limit: NV

Plastic Limit: NP

USCS Classification: SP

AASHTO Classification: A-3

Testing Remarks: As Received

Moisture Content: 19.8%

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
542.64	120.06	0.00	#4	0.00	100.0
			#10	0.02	100.0
			#20	2.09	99.5
			#40	100.83	76.1
			#60	331.66	21.5
			#100	396.90	6.1
			#200	405.75	4.0

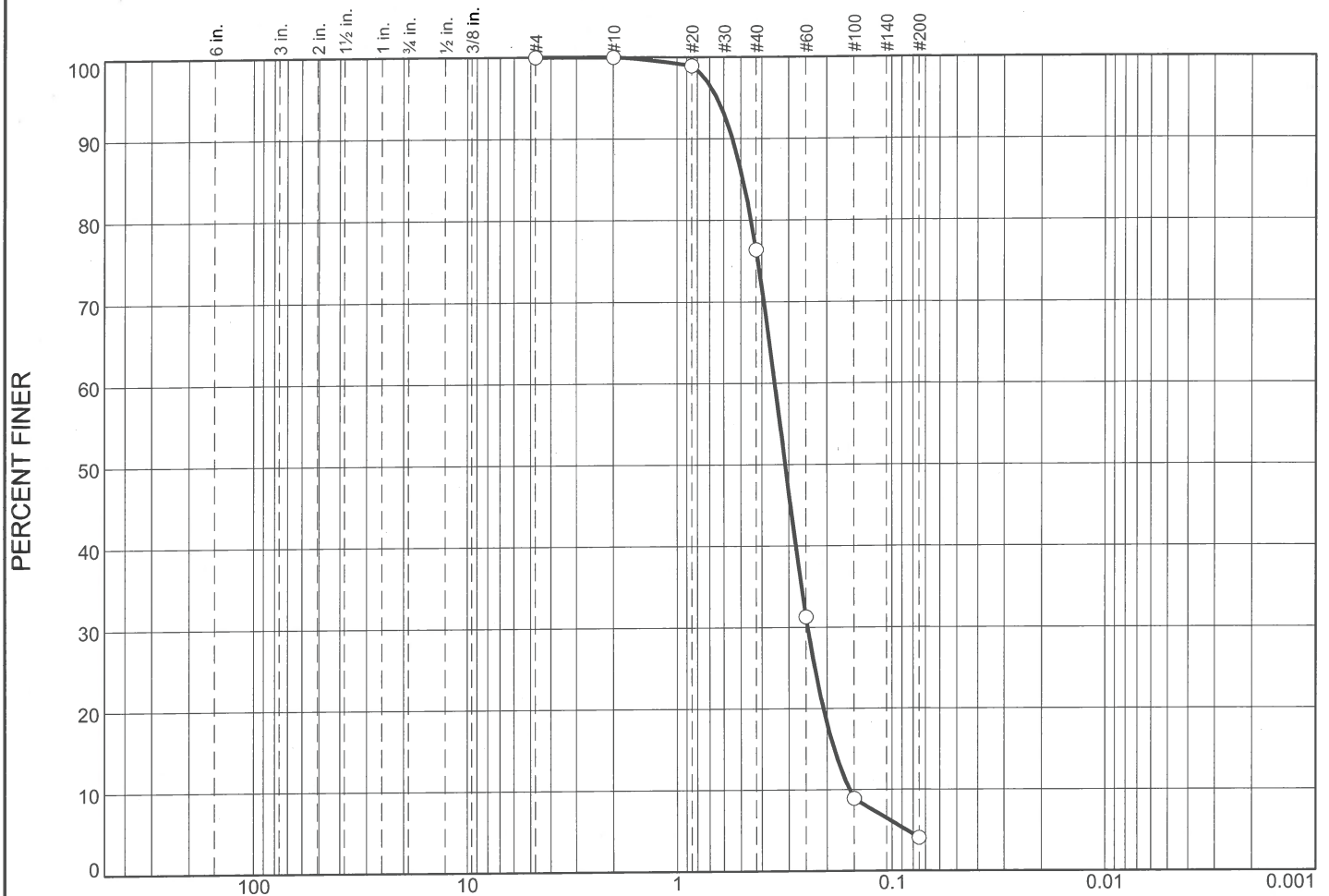
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	23.9	72.1	96.0			4.0

D ₅	D ₁₀	D ₁₅	D ₂₀	D ₃₀	D ₄₀	D ₅₀	D ₆₀	D ₈₀	D ₈₅	D ₉₀	D ₉₅
0.1182	0.1987	0.2256	0.2449	0.2755	0.3032	0.3314	0.3621	0.4456	0.4788	0.5250	0.6019

Fineness Modulus	C _u	C _c
1.60	1.82	1.05

GRAIN SIZE DISTRIBUTION REPORT



GRAIN SIZE - mm.

	% +3"		% Gravel		% Sand			% Fines		
			Coarse	Fine	Coarse	Medium	Fine	Silt		Clay
○	0.0		0.0	0.0	0.0	23.6	72.3	4.1		
×	LL	PL	D ₈₅	D ₆₀	D ₅₀	D ₃₀	D ₁₅	D ₁₀	C _c	C _u
○	NV	NP	0.4899	0.3482	0.3120	0.2456	0.1852	0.1574	1.10	2.21

Material Description

○ dark brown/black poorly graded SAND

USCS

SP

AASHTO

A-3

Project No. 187609

Client: TTL

Project: TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

○ Source: UD-179

Depth: 43' - 45'

Sample No.: UD-179

Remarks:

○ As Received

Moisture Content: 19.6%

BOWSER-MORNER, INC.

Dayton, Ohio

GRAIN SIZE DISTRIBUTION TEST DATA

2/21/2019

Client: TTL

Project: TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

Project Number: 187609

Location: UD-179

Depth: 43' - 45'

Sample Number: UD-179

Material Description: dark brown/black poorly graded SAND

Liquid Limit: NV

Plastic Limit: NP

USCS Classification: SP

AASHTO Classification: A-3

Testing Remarks: As Received

Moisture Content: 19.6%

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
367.92	97.03	0.00	#4	0.00	100.0
			#10	0.03	100.0
			#20	2.83	99.0
			#40	63.98	76.4
			#60	186.13	31.3
			#100	246.76	8.9
			#200	259.83	4.1

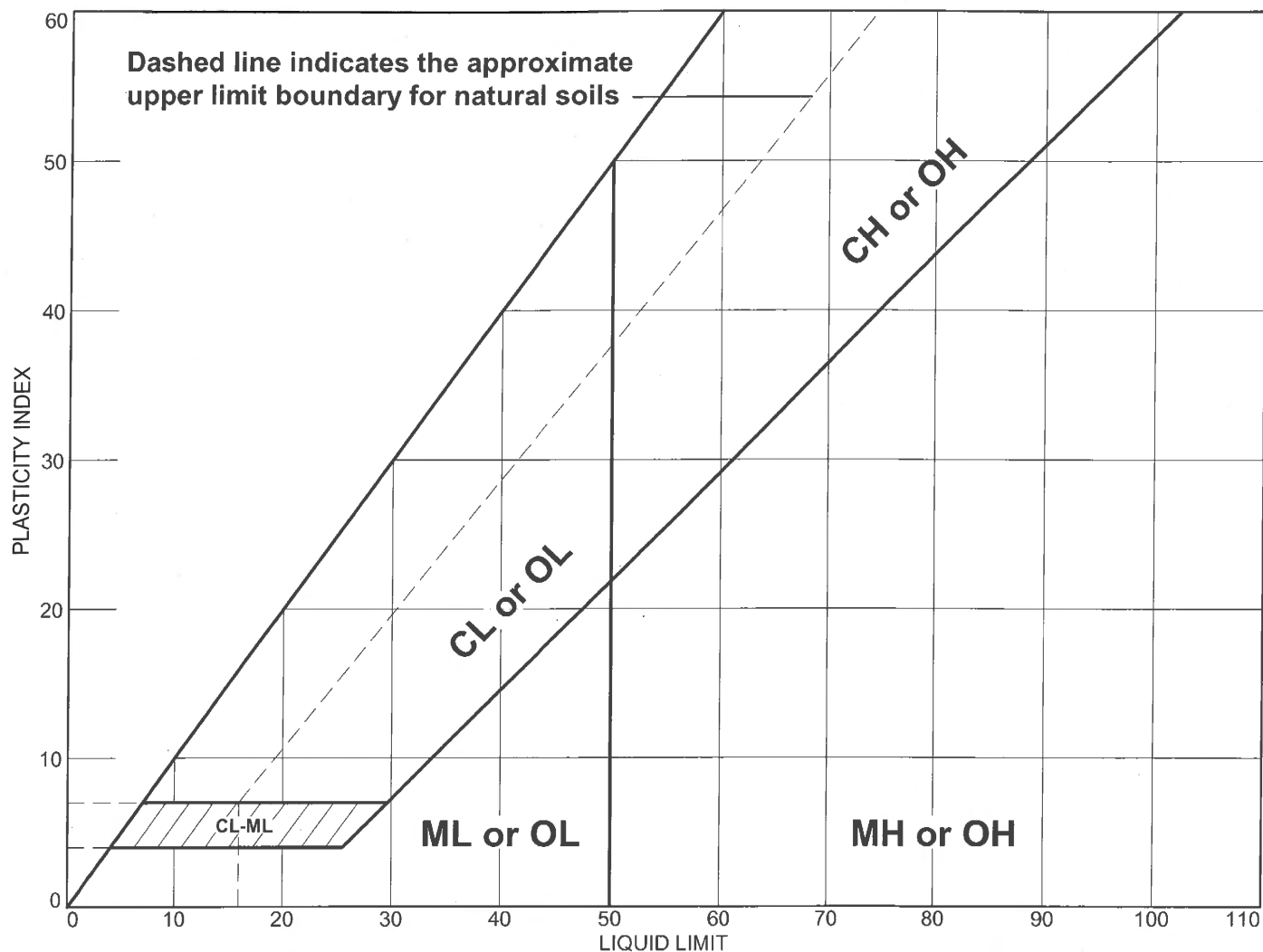
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	23.6	72.3	95.9			4.1

D ₅	D ₁₀	D ₁₅	D ₂₀	D ₃₀	D ₄₀	D ₅₀	D ₆₀	D ₈₀	D ₈₅	D ₉₀	D ₉₅
0.0856	0.1574	0.1852	0.2078	0.2456	0.2788	0.3120	0.3482	0.4487	0.4899	0.5484	0.6480

Fineness Modulus	C _u	C _c
1.52	2.21	1.10

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	dark brown poorly graded SAND	NV	NP	NP	76.1	4.0	SP
■	dark brown poorly graded SAND	NV	NP	NP	74.0	2.0	SP
▲	dark brown/black poorly graded SAND	NV	NP	NP	76.4	4.1	SP

Project No. 187609

Client: TTL

Project: TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

● Source of Sample: UD-179

Depth: 28' - 30'

Sample Number: UD-179

■ Source of Sample: UD-179

Depth: 13' - 15'

Sample Number: UD-179

▲ Source of Sample: UD-179

Depth: 43' - 45'

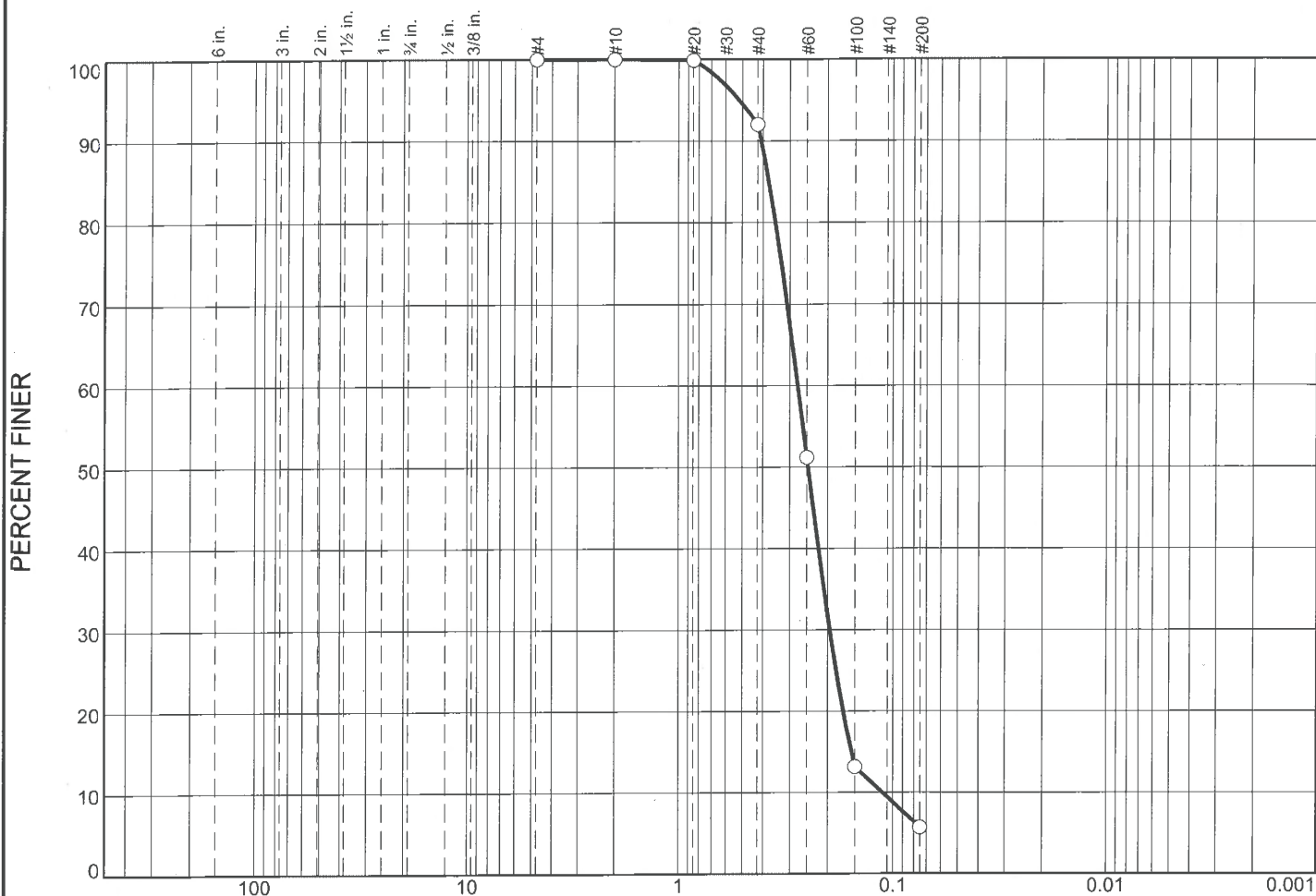
Sample Number: UD-179

Remarks:

BOWSER-MORNER, INC.

Dayton, Ohio

GRAIN SIZE DISTRIBUTION REPORT



GRAIN SIZE - mm.

	% +3"		% Gravel		% Sand			% Fines		
			Coarse	Fine	Coarse	Medium	Fine	Silt		Clay
○	0.0		0.0	0.0	0.0	8.0	86.3	5.7		
×	LL	PL	D ₈₅	D ₆₀	D ₅₀	D ₃₀	D ₁₅	D ₁₀	C _c	C _u
○	NV	NP	0.3762	0.2757	0.2467	0.1950	0.1557	0.1119	1.23	2.46

Material Description	USCS	AASHTO
dark brown poorly graded SAND with silt	SP-SM	A-3

Project No. 187609 **Client:** TTL
Project: TTL Job No 000180200804
 Analysis of Forty-Two Thin Wall Tube Samples
Source: UD-231 **Depth:** 13' - 15' **Sample No.:** UD-231

Remarks:
 ○ As Received
 Moisture Content: 20.6%

BOWSER-MORNER, INC.

Dayton, Ohio

GRAIN SIZE DISTRIBUTION TEST DATA

2/21/2019

Client: TTL

Project: TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

Project Number: 187609

Location: UD-231

Depth: 13' - 15'

Sample Number: UD-231

Material Description: dark brown poorly graded SAND with silt

Liquid Limit: NV

Plastic Limit: NP

USCS Classification: SP-SM

AASHTO Classification: A-3

Testing Remarks: As Received

Moisture Content: 20.6%

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
462.15	112.95	0.00	#4	0.00	100.0
			#10	0.01	100.0
			#20	0.34	99.9
			#40	27.85	92.0
			#60	170.41	51.2
			#100	303.25	13.2
			#200	329.34	5.7

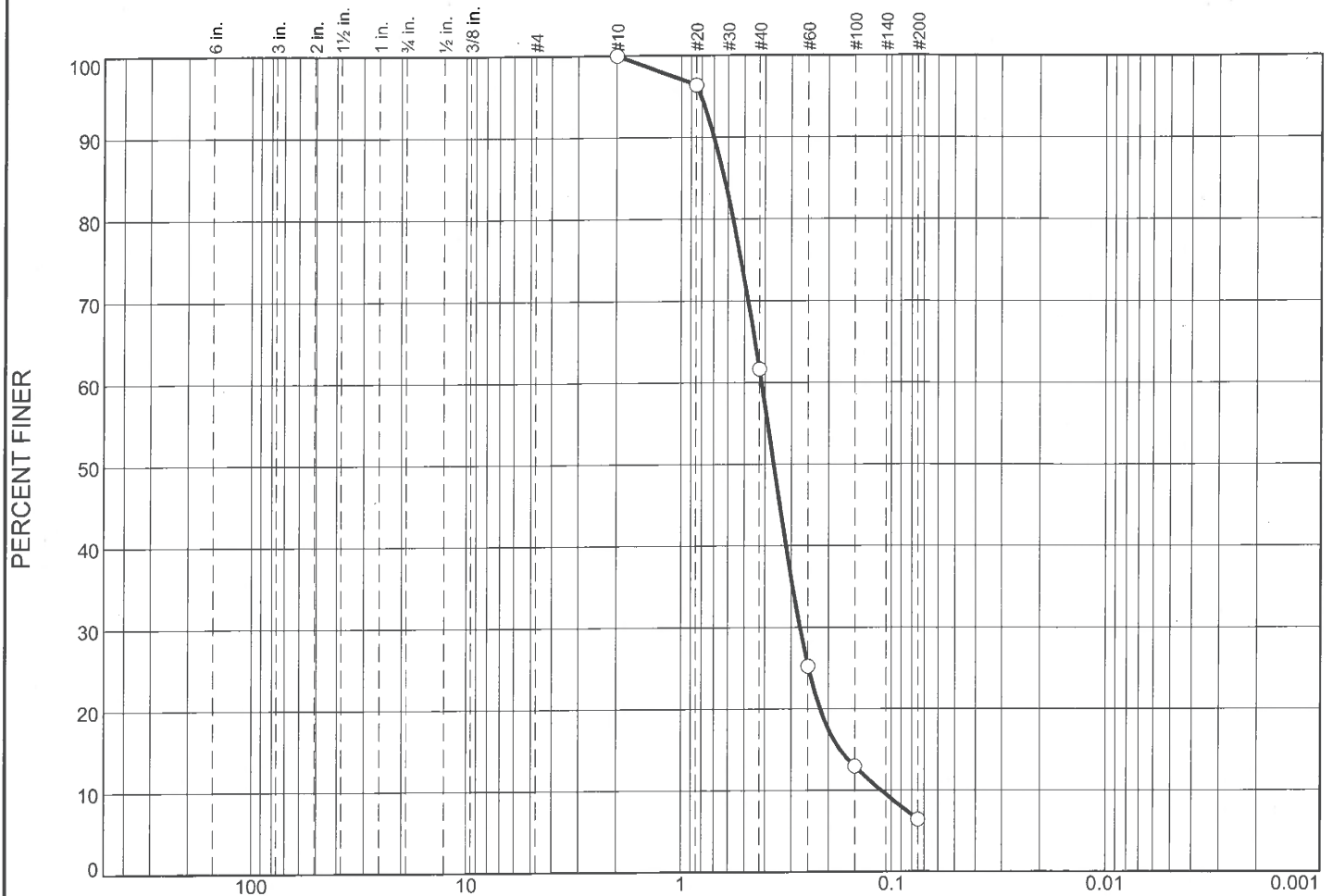
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	8.0	86.3	94.3			5.7

D ₅	D ₁₀	D ₁₅	D ₂₀	D ₃₀	D ₄₀	D ₅₀	D ₆₀	D ₈₀	D ₈₅	D ₉₀	D ₉₅
	0.1119	0.1557	0.1696	0.1950	0.2202	0.2467	0.2757	0.3504	0.3762	0.4086	0.5185

Fineness Modulus	C _u	C _c
1.23	2.46	1.23

GRAIN SIZE DISTRIBUTION REPORT



GRAIN SIZE - mm.

	% +3"	% Gravel		% Sand			% Fines		
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay	
○	0.0	0.0	0.0	0.0	38.4	55.2	6.4		
×	LL	PL	D ₈₅	D ₆₀	D ₅₀	D ₃₀	D ₁₅	D ₁₀	C _c
○	NV	NP	0.6266	0.4154	0.3632	0.2729	0.1763	0.1121	1.60
									C _u
									3.71

Material Description	USCS	AASHTO
○ dark brown/black poorly graded SAND with silt	SP-SM	A-3

Project No. 187609 **Client:** TTL
Project: TTL Job No 000180200804
 Analysis of Forty-Two Thin Wall Tube Samples
 ○ **Source:** UD-231 **Depth:** 30' - 32' **Sample No.:** UD-231

Remarks:
 ○ As Received
 Moisture Content: 16.2%

BOWSER-MORNER, INC.

Dayton, Ohio

GRAIN SIZE DISTRIBUTION TEST DATA

2/20/2019

Client: TTL

Project: TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

Project Number: 187609

Location: UD-231

Depth: 30' - 32'

Sample Number: UD-231

Material Description: dark brown/black poorly graded SAND with silt

Liquid Limit: NV

Plastic Limit: NP

USCS Classification: SP-SM

AASHTO Classification: A-3

Testing Remarks: As Received

Moisture Content: 16.2%

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
518.15	114.14	0.00	#10	0.00	100.0
			#20	14.59	96.4
			#40	154.95	61.6
			#60	301.98	25.3
			#100	351.66	13.0
			#200	378.10	6.4

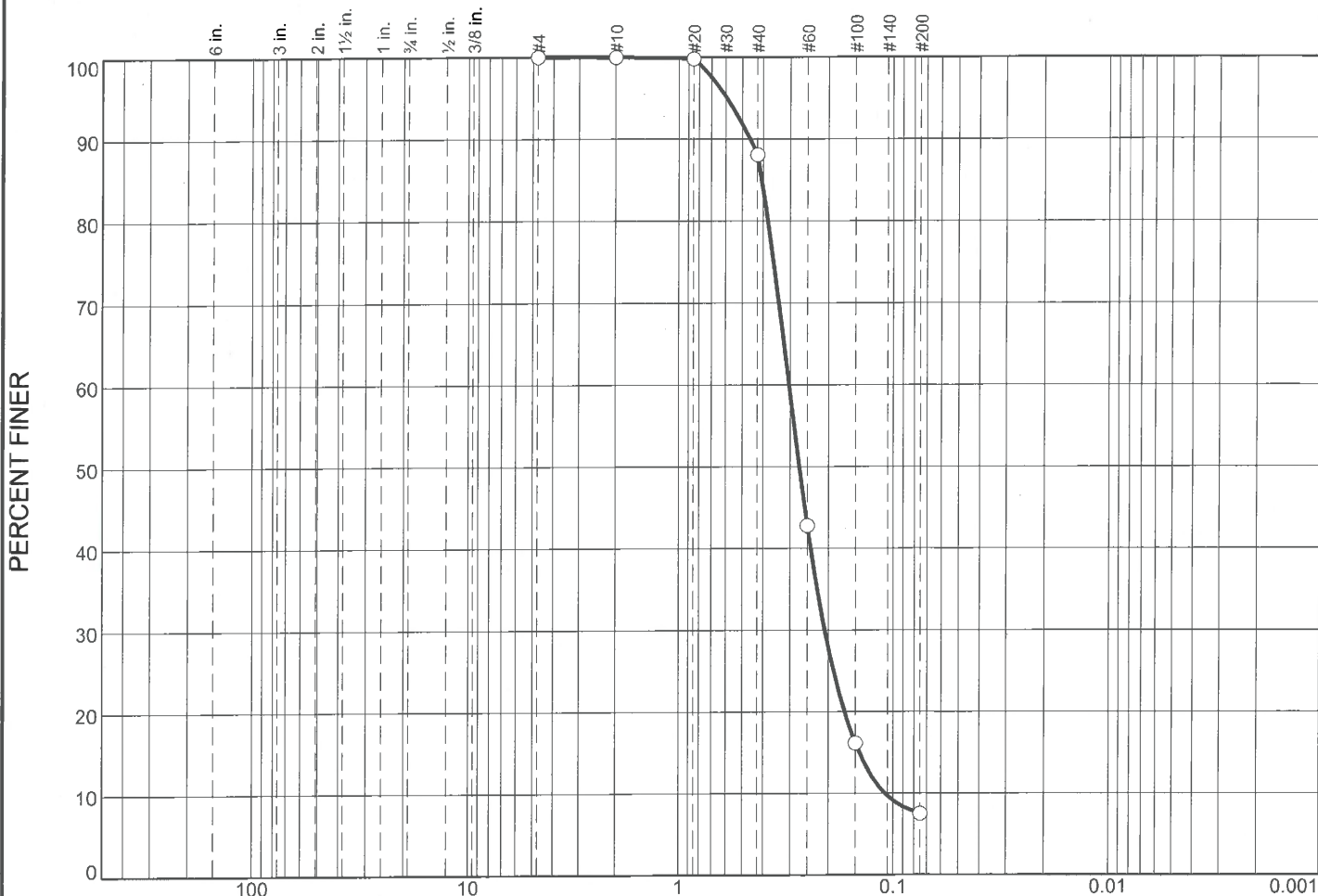
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	38.4	55.2	93.6			6.4

D ₅	D ₁₀	D ₁₅	D ₂₀	D ₃₀	D ₄₀	D ₅₀	D ₆₀	D ₈₀	D ₈₅	D ₉₀	D ₉₅
	0.1121	0.1763	0.2193	0.2729	0.3174	0.3632	0.4154	0.5683	0.6266	0.7016	0.8089

Fineness Modulus	C _u	C _c
1.70	3.71	1.60

GRAIN SIZE DISTRIBUTION REPORT



GRAIN SIZE - mm.

[illegible]

Material Description	USCS	AASHTO
○ dark brown poorly graded SAND with silt	SP-SM	A-3

Project No. 187609 **Client:** TTL
Project: TTL Job No 000180200804
 Analysis of Forty-Two Thin Wall Tube Samples
 ○ **Source:** UD-231 **Depth:** 43' - 45' **Sample No.:** UD-231

Remarks:
☐ As Received
 Moisture Content: 20.6%

BOWSER-MORNER, INC.

Dayton, Ohio

GRAIN SIZE DISTRIBUTION TEST DATA

2/21/2019

Client: TTL

Project: TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

Project Number: 187609

Location: UD-231

Depth: 43' - 45'

Sample Number: UD-231

Material Description: dark brown poorly graded SAND with silt

Liquid Limit: NV

Plastic Limit: NP

USCS Classification: SP-SM

AASHTO Classification: A-3

Testing Remarks: As Received

Moisture Content: 20.6%

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
441.29	114.22	0.00	#4	0.00	100.0
			#10	0.10	100.0
			#20	0.70	99.8
			#40	39.00	88.1
			#60	187.10	42.8
			#100	274.20	16.2
			#200	302.50	7.5

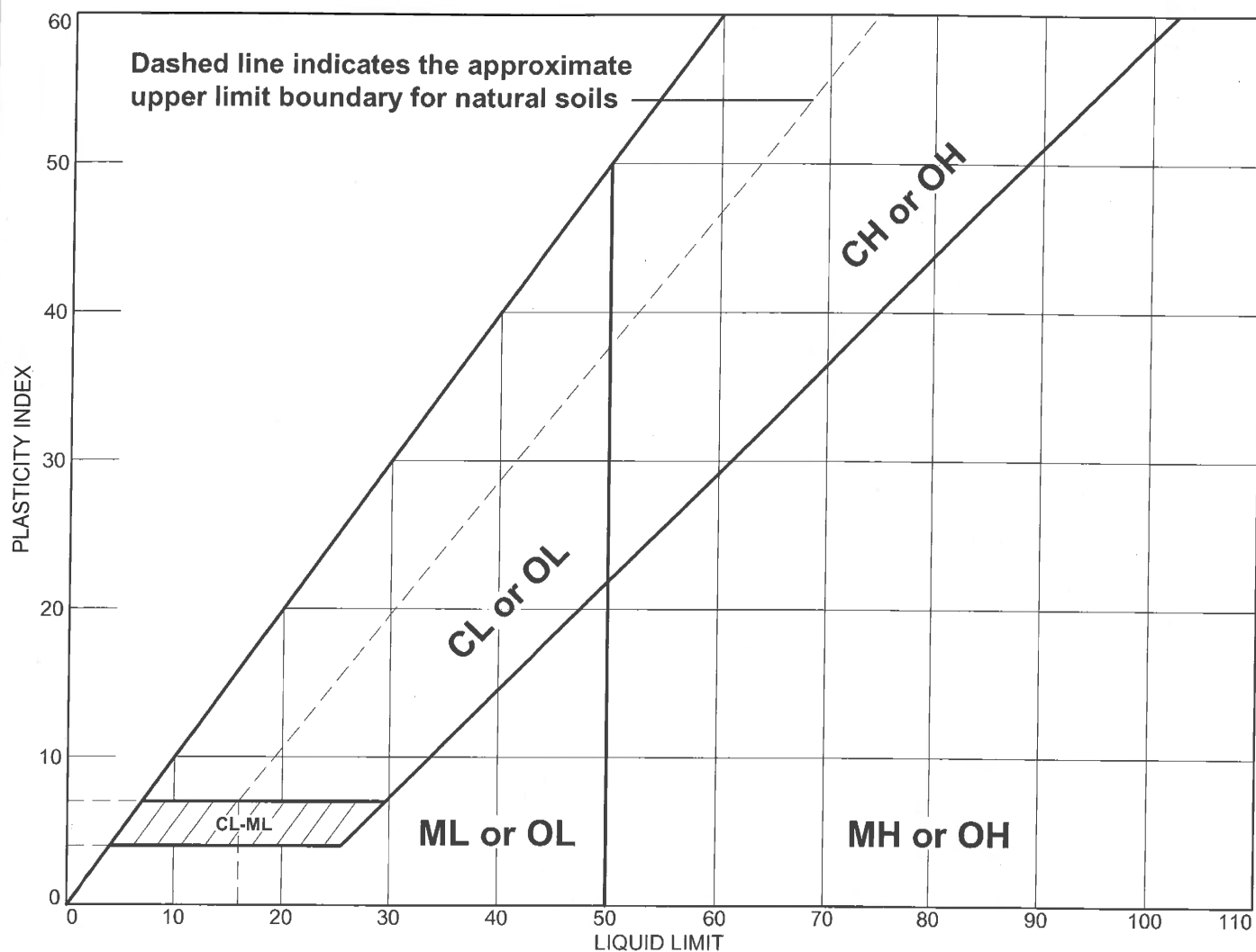
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	11.9	80.6	92.5			7.5

D ₅	D ₁₀	D ₁₅	D ₂₀	D ₃₀	D ₄₀	D ₅₀	D ₆₀	D ₈₀	D ₈₅	D ₉₀	D ₉₅
	0.1091	0.1438	0.1683	0.2076	0.2412	0.2721	0.3035	0.3796	0.4056	0.4613	0.5932

Fineness Modulus	C _u	C _c
1.30	2.78	1.30

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	dark brown poorly graded SAND with silt	NV	NP	NP	92.0	5.7	SP-SM
■	dark brown/black poorly graded SAND with silt	NV	NP	NP	61.6	6.4	SP-SM
▲	dark brown poorly graded SAND with silt	NV	NP	NP	88.1	7.5	SP-SM

Project No. 187609

Client: TTL

Project: TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

● Source of Sample: UD-231

Depth: 13' - 15'

Sample Number: UD-231

■ Source of Sample: UD-231

Depth: 30' - 32'

Sample Number: UD-231

▲ Source of Sample: UD-231

Depth: 43' - 45'

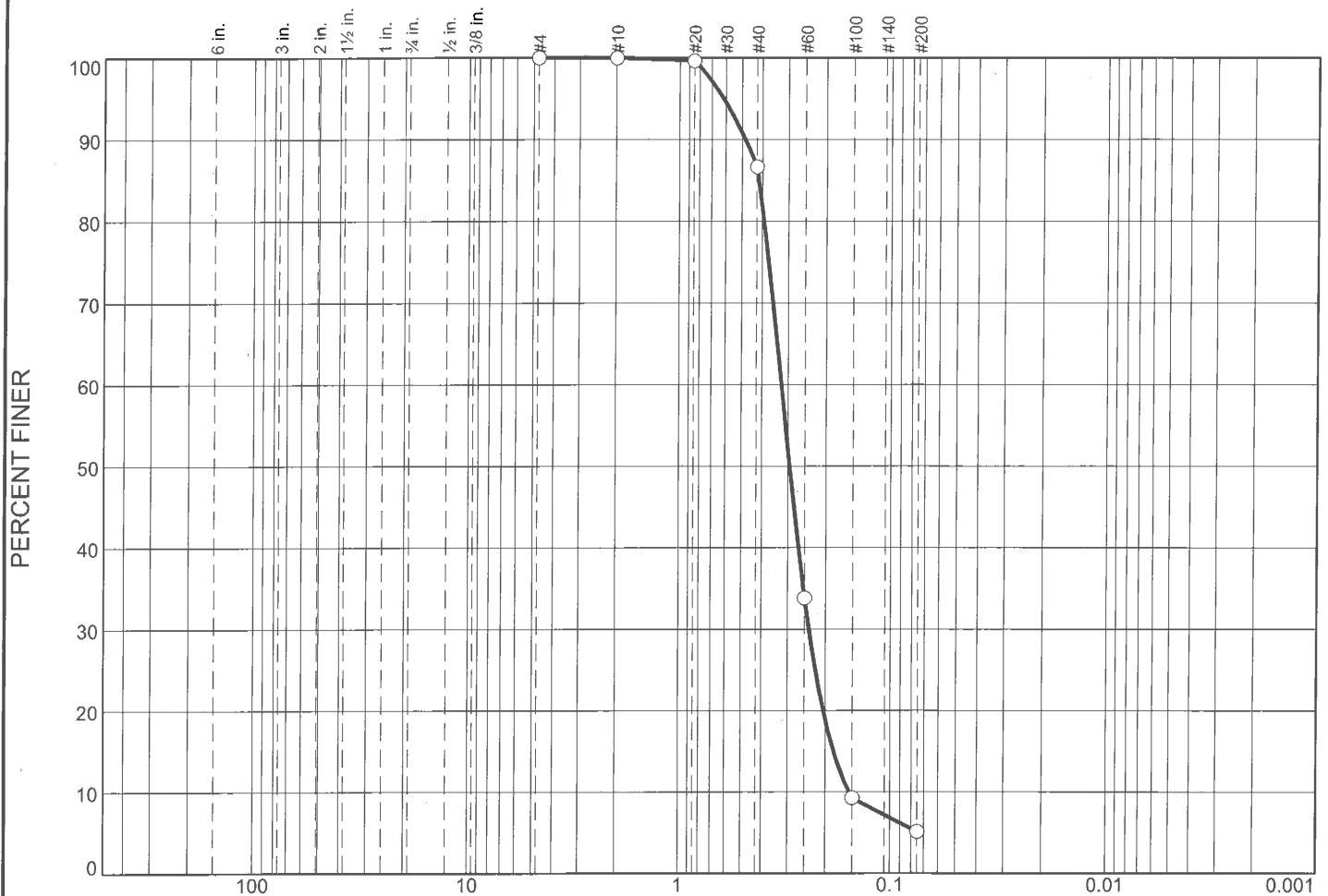
Sample Number: UD-231

Remarks:

BOWSER-MORNER, INC.

Dayton, Ohio

GRAIN SIZE DISTRIBUTION REPORT



GRAIN SIZE - mm.

	% +3"		% Gravel		% Sand			% Fines		
			Coarse	Fine	Coarse	Medium	Fine	Silt		Clay
☐	0.0		0.0	0.0	0.0	13.3	81.6	5.1		
☒	LL	PL	D ₈₅	D ₆₀	D ₅₀	D ₃₀	D ₁₅	D ₁₀	C _c	C _u
☐	NV	NP	0.4158	0.3226	0.2943	0.2386	0.1832	0.1551	1.14	2.08

Material Description	USCS	AASHTO
☐ brown/gray poorly graded SAND with silt	SP-SM	A-3

Project No. 187609 Client: TTL Project: TTL Job No 000180200804 Analysis of Forty-Two Thin Wall Tube Samples ☐ Source: UD-238 Depth: 13' - 15' Sample No.: UD-238	Remarks: ☐ As Received Moisture Content: 18.8%
BOWSER-MORNER, INC. Dayton, Ohio	

GRAIN SIZE DISTRIBUTION TEST DATA

2/21/2019

Client: TTL

Project: TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

Project Number: 187609

Location: UD-238

Depth: 13' - 15'

Sample Number: UD-238

Material Description: brown/gray poorly graded SAND with silt

Liquid Limit: NV

Plastic Limit: NP

USCS Classification: SP-SM

AASHTO Classification: A-3

Testing Remarks: As Received

Moisture Content: 18.8%

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
422.22	114.83	0.00	#4	0.00	100.0
			#10	0.10	100.0
			#20	1.20	99.6
			#40	41.00	86.7
			#60	203.40	33.8
			#100	278.90	9.3
			#200	291.70	5.1

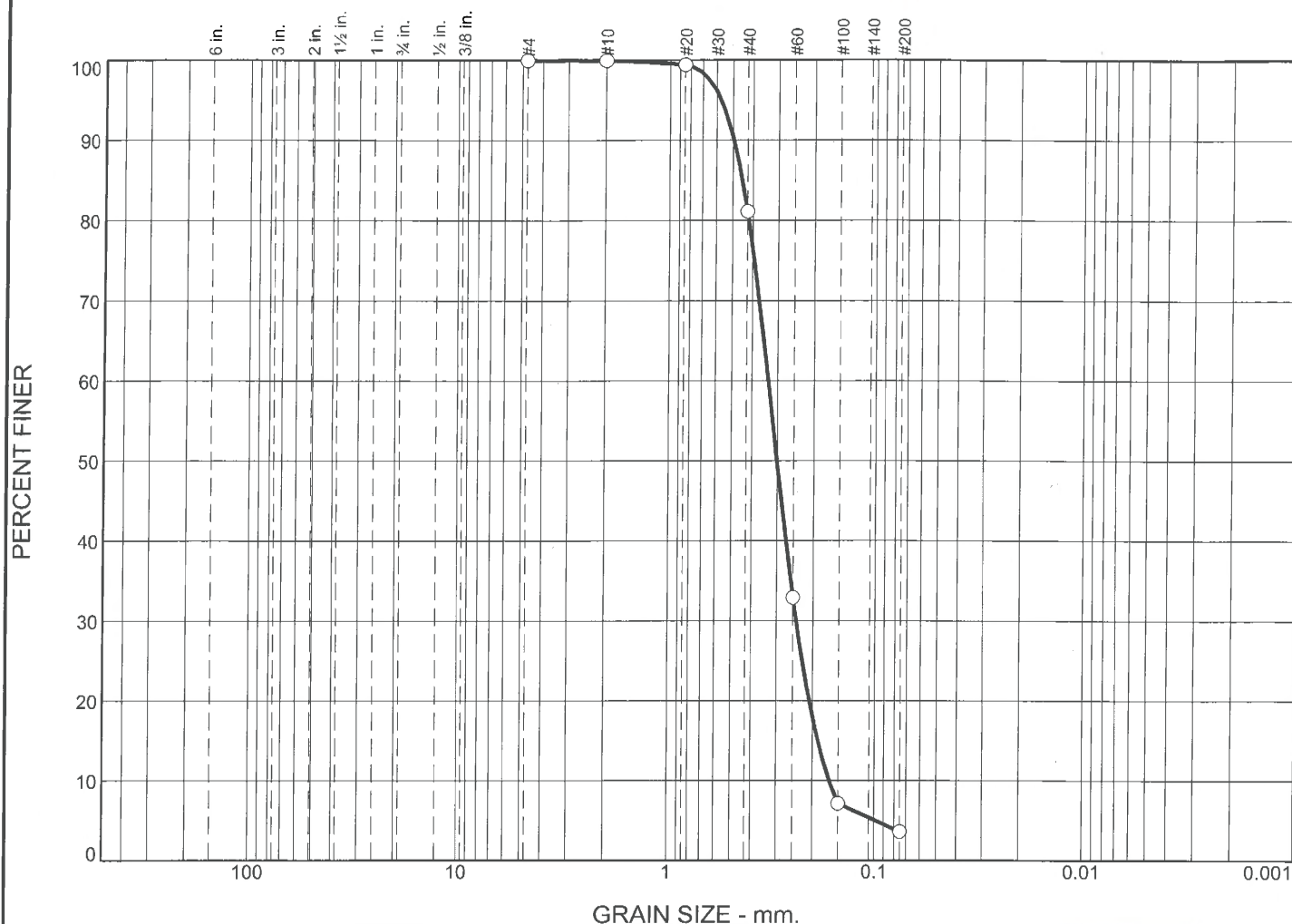
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	13.3	81.6	94.9			5.1

D ₅	D ₁₀	D ₁₅	D ₂₀	D ₃₀	D ₄₀	D ₅₀	D ₆₀	D ₈₀	D ₈₅	D ₉₀	D ₉₅
	0.1551	0.1832	0.2045	0.2386	0.2672	0.2943	0.3226	0.3920	0.4158	0.4850	0.6159

Fineness Modulus	C _u	C _c
1.44	2.08	1.14

GRAIN SIZE DISTRIBUTION REPORT



	% +3"		% Gravel		% Sand			% Fines		
			Coarse	Fine	Coarse	Medium	Fine	Silt		Clay
○	0.0		0.0	0.0	0.0	18.8	77.6	3.6		
×	LL	PL	D ₈₅	D ₆₀	D ₅₀	D ₃₀	D ₁₅	D ₁₀	C _c	C _u
○	NV	NP	0.4509	0.3333	0.3011	0.2409	0.1882	0.1658	1.05	2.01

Material Description	USCS	AASHTO
dark brown poorly graded SAND	SP	A-3

Project No. 187609 **Client:** TTL
Project: TTL Job No 000180200804
 Analysis of Forty-Two Thin Wall Tube Samples
Source: UD-238 **Depth:** 28' - 30' **Sample No.:** UD-238

Remarks:
 As Received
 Moisture Content: 19.9%

BOWSER-MORNER, INC.

Dayton, Ohio

GRAIN SIZE DISTRIBUTION TEST DATA

2/20/2019

Client: TTL

Project: TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

Project Number: 187609

Location: UD-238

Depth: 28' - 30'

Sample Number: UD-238

Material Description: dark brown poorly graded SAND

Liquid Limit: NV

Plastic Limit: NP

USCS Classification: SP

AASHTO Classification: A-3

Testing Remarks: As Received

Moisture Content: 19.9%

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
417.34	113.30	0.00	#4	0.00	100.0
			#10	0.10	100.0
			#20	1.80	99.4
			#40	57.30	81.2
			#60	203.90	32.9
			#100	282.30	7.2
			#200	293.10	3.6

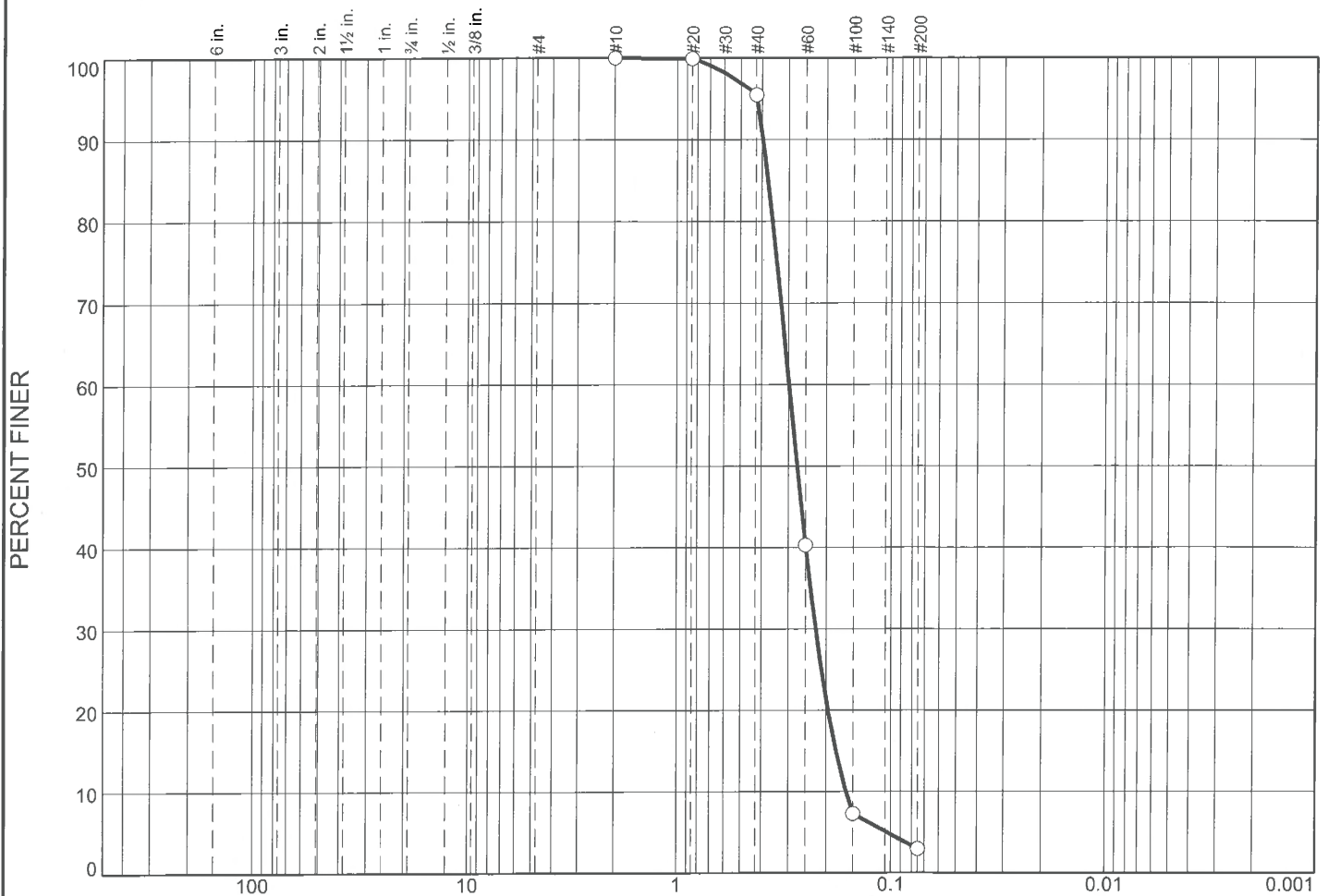
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	18.8	77.6	96.4			3.6

D ₅	D ₁₀	D ₁₅	D ₂₀	D ₃₀	D ₄₀	D ₅₀	D ₆₀	D ₈₀	D ₈₅	D ₉₀	D ₉₅
0.0986	0.1658	0.1882	0.2074	0.2409	0.2711	0.3011	0.3333	0.4182	0.4509	0.4963	0.5727

Fineness Modulus	C _u	C _c
1.47	2.01	1.05

GRAIN SIZE DISTRIBUTION REPORT



GRAIN SIZE - mm.

	% +3"		% Gravel		% Sand			% Fines		
			Coarse	Fine	Coarse	Medium	Fine	Silt		Clay
☐	0.0		0.0	0.0	0.0	4.5	92.6	2.9		
☒	LL	PL	D ₈₅	D ₆₀	D ₅₀	D ₃₀	D ₁₅	D ₁₀	C _c	C _u
☐	NV	NP	0.3744	0.2985	0.2736	0.2237	0.1797	0.1616	1.04	1.85

Material Description

☐ dark brown poorly graded SAND

USCS

SP

AASHTO

A-3

Project No. 187609

Client: TTL

Project: TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

☐ Source: UD-238

Depth: 43' - 45'

Sample No.: UD-238

Remarks:

☐ As Received

Moisture Content: 18.6%

BOWSER-MORNER, INC.

Dayton, Ohio

GRAIN SIZE DISTRIBUTION TEST DATA

2/21/2019

Client: TTL

Project: TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

Project Number: 187609

Location: UD-238

Depth: 43' - 45'

Sample Number: UD-238

Material Description: dark brown poorly graded SAND

Liquid Limit: NV

Plastic Limit: NP

USCS Classification: SP

AASHTO Classification: A-3

Testing Remarks: As Received

Moisture Content: 18.6%

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
423.86	97.66	0.00	#10	0.00	100.0
			#20	0.20	99.9
			#40	14.60	95.5
			#60	194.70	40.3
			#100	302.40	7.3
			#200	316.60	2.9

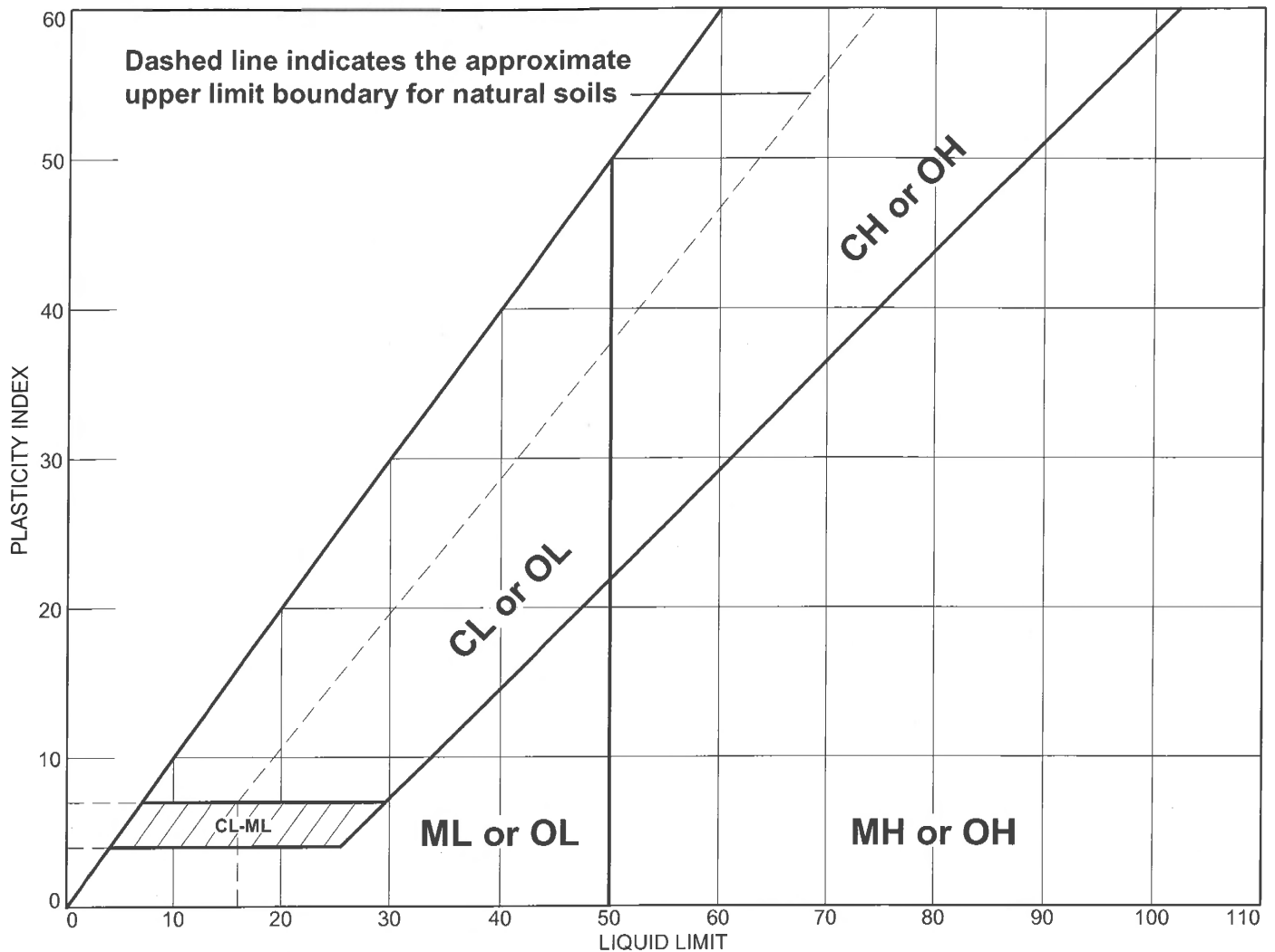
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	4.5	92.6	97.1			2.9

D ₅	D ₁₀	D ₁₅	D ₂₀	D ₃₀	D ₄₀	D ₅₀	D ₆₀	D ₈₀	D ₈₅	D ₉₀	D ₉₅
0.1041	0.1616	0.1797	0.1955	0.2237	0.2492	0.2736	0.2985	0.3564	0.3744	0.3955	0.4217

Fineness Modulus	C _u	C _c
1.34	1.85	1.04

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	brown/gray poorly graded SAND with silt	NV	NP	NP	86.7	5.1	SP-SM
■	dark brown poorly graded SAND	NV	NP	NP	81.2	3.6	SP
▲	dark brown poorly graded SAND	NV	NP	NP	95.5	2.9	SP

Project No. 187609

Client: TTL

Project: TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

● Source of Sample: UD-238

Depth: 13' - 15'

Sample Number: UD-238

■ Source of Sample: UD-238

Depth: 28' - 30'

Sample Number: UD-238

▲ Source of Sample: UD-238

Depth: 43' - 45'

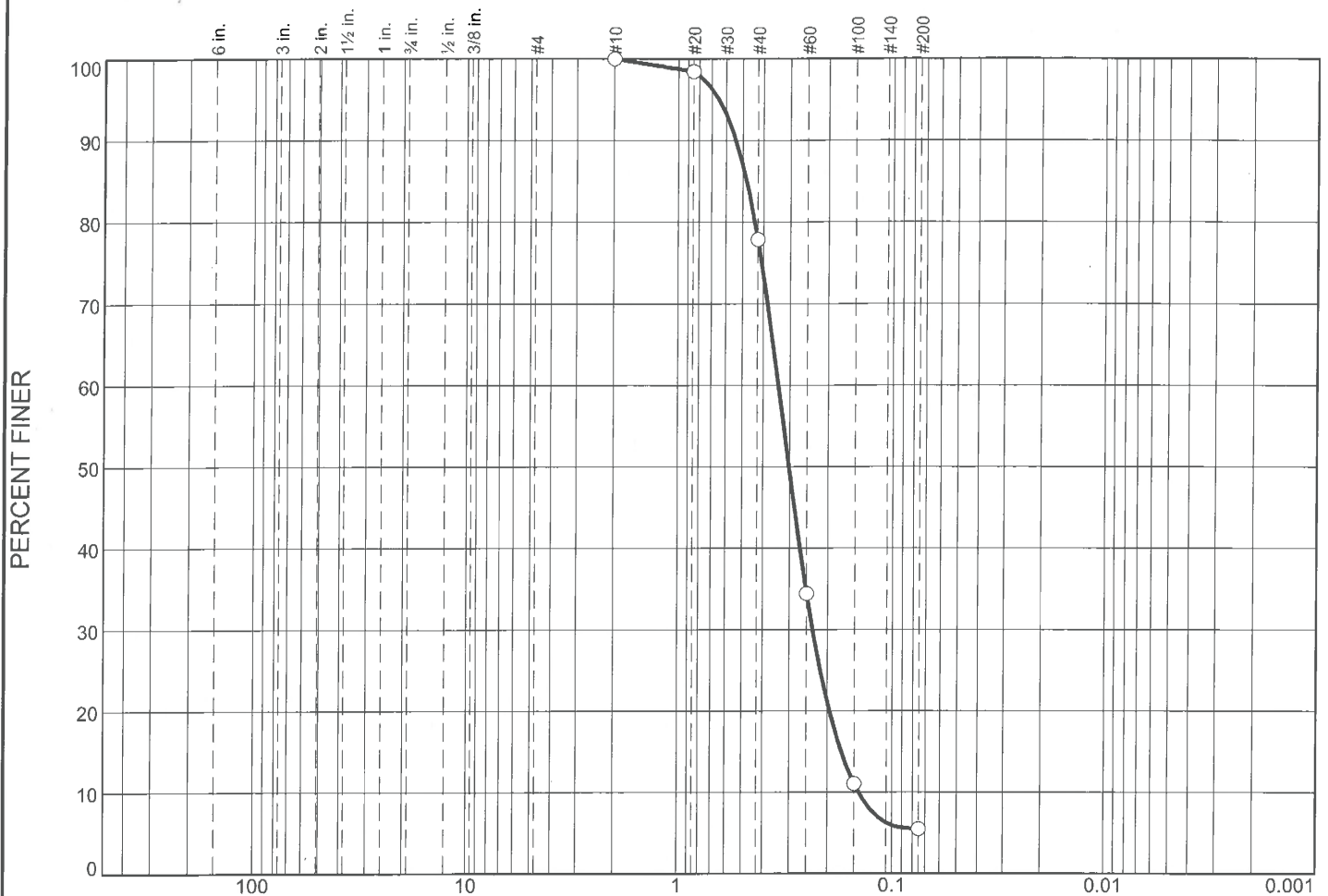
Sample Number: UD-238

BOWSER-MORNER, INC.

Dayton, Ohio

Remarks:

GRAIN SIZE DISTRIBUTION REPORT



GRAIN SIZE - mm.										
% +3"	% Gravel		% Sand			% Fines				
	Coarse	Fine	Coarse	Medium	Fine	Silt		Clay		
○	0.0	0.0	0.0	22.1	72.4	5.5				
×	LL	PL	D ₈₅	D ₆₀	D ₅₀	D ₃₀	D ₁₅	D ₁₀	C _c	C _u
○	NV	NP	0.4807	0.3390	0.3025	0.2345	0.1722	0.1430	1.13	2.37

Material Description	USCS	AASHTO
○ brown poorly graded SAND with silt	SP-SM	A-3

Project No. 187609 **Client:** TTL
Project: TTL Job No 000180200804
 Analysis of Forty-Two Thin Wall Tube Samples
 ○ **Source:** UD-338 **Depth:** 13' - 15' **Sample No.:** UD-338

Remarks:
 ○ As Received
 Moisture Content: 19.2%

BOWSER-MORNER, INC.

Dayton, Ohio

GRAIN SIZE DISTRIBUTION TEST DATA

2/21/2019

Client: TTL

Project: TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

Project Number: 187609

Location: UD-338

Depth: 13' - 15'

Sample Number: UD-338

Material Description: brown poorly graded SAND with silt

Liquid Limit: NV

Plastic Limit: NP

USCS Classification: SP-SM

AASHTO Classification: A-3

Testing Remarks: As Received

Moisture Content: 19.2%

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
463.95	119.48	0.00	#10	0.00	100.0
			#20	5.40	98.4
			#40	76.20	77.9
			#60	225.90	34.4
			#100	306.40	11.1
			#200	325.60	5.5

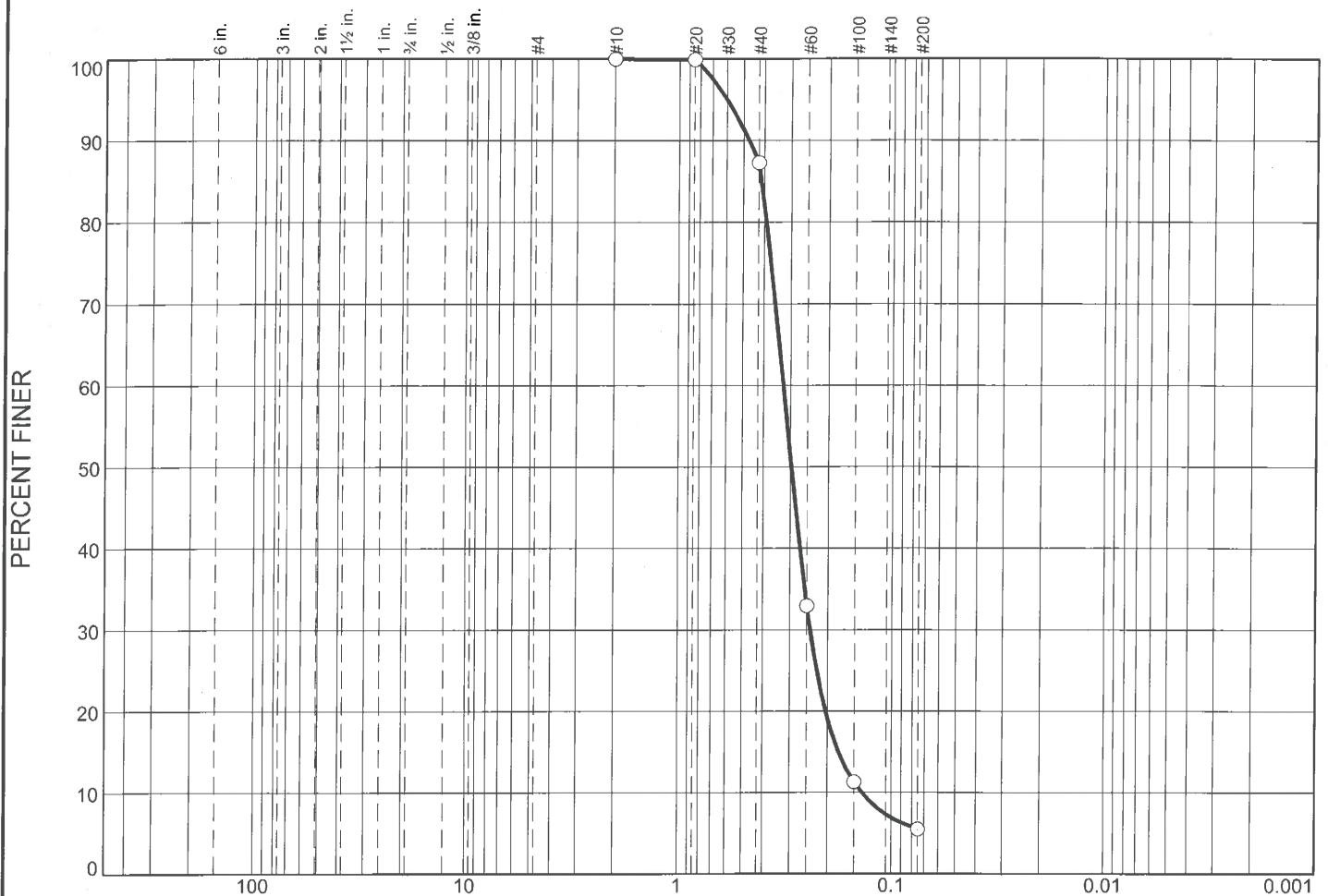
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	22.1	72.4	94.5			5.5

D ₅	D ₁₀	D ₁₅	D ₂₀	D ₃₀	D ₄₀	D ₅₀	D ₆₀	D ₈₀	D ₈₅	D ₉₀	D ₉₅
	0.1430	0.1722	0.1954	0.2345	0.2688	0.3025	0.3390	0.4393	0.4807	0.5406	0.6486

Fineness Modulus	C _u	C _c
1.47	2.37	1.13

GRAIN SIZE DISTRIBUTION REPORT



GRAIN SIZE - mm.

	% +3"		% Gravel		% Sand			% Fines		
			Coarse	Fine	Coarse	Medium	Fine	Silt		Clay
○	0.0		0.0	0.0	0.0	12.7	81.8	5.5		
×	LL	PL	D ₈₅	D ₆₀	D ₅₀	D ₃₀	D ₁₅	D ₁₀	C _c	C _u
○	NV	NP	0.4129	0.3240	0.2965	0.2410	0.1781	0.1377	1.30	2.35

Material Description	USCS	AASHTO
○ dark brown poorly graded SAND with silt	SP-SM	A-3

Project No. 187609 **Client:** TTL
Project: TTL Job No 000180200804
 Analysis of Forty-Two Thin Wall Tube Samples
 ○ **Source:** UD-338 **Depth:** 28' - 30' **Sample No.:** UD-338

Remarks:
 ○ As Received
 Moisture Content: 21.7%

BOWSER-MORNER, INC.

Dayton, Ohio

GRAIN SIZE DISTRIBUTION TEST DATA

2/21/2019

Client: TTL

Project: TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

Project Number: 187609

Location: UD-338

Depth: 28' - 30'

Sample Number: UD-338

Material Description: dark brown poorly graded SAND with silt

Liquid Limit: NV

Plastic Limit: NP

USCS Classification: SP-SM

AASHTO Classification: A-3

Testing Remarks: As Received

Moisture Content: 21.7%

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
446.38	119.46	0.00	#10	0.00	100.0
			#20	0.30	99.9
			#40	41.50	87.3
			#60	219.20	32.9
			#100	290.00	11.3
			#200	309.00	5.5

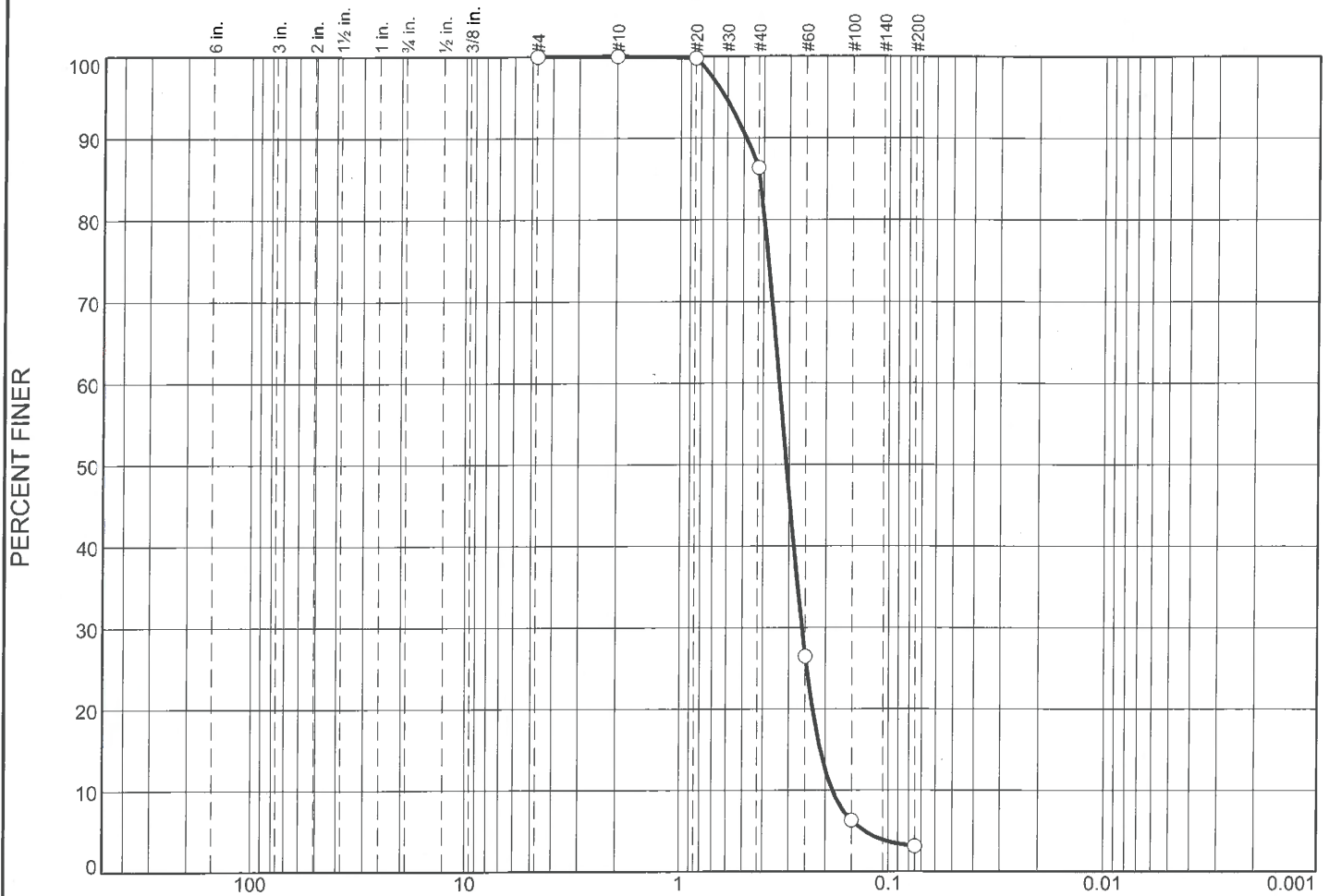
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	12.7	81.8	94.5			5.5

D ₅	D ₁₀	D ₁₅	D ₂₀	D ₃₀	D ₄₀	D ₅₀	D ₆₀	D ₈₀	D ₈₅	D ₉₀	D ₉₅
	0.1377	0.1781	0.2042	0.2410	0.2698	0.2965	0.3240	0.3905	0.4129	0.4733	0.6008

Fineness Modulus	C _u	C _c
1.42	2.35	1.30

GRAIN SIZE DISTRIBUTION REPORT



	% +3"		% Gravel		% Sand			% Fines		
			Coarse	Fine	Coarse	Medium	Fine	Silt		Clay
☐	0.0		0.0	0.0	0.0	13.6	83.3	3.1		
☒	LL	PL	D ₈₅	D ₆₀	D ₅₀	D ₃₀	D ₁₅	D ₁₀	C _c	C _u
☐	NV	NP	0.4183	0.3345	0.3089	0.2595	0.2114	0.1852	1.09	1.81

Material Description	USCS	AASHTO
☐ brown poorly graded SAND	SP	A-3

Project No. 187609 **Client:** TTL
Project: TTL Job No 000180200804
 Analysis of Forty-Two Thin Wall Tube Samples
☐ **Source:** UD-338 **Depth:** 43' - 45' **Sample No.:** UD-338

Remarks:
☐ As Received
 Moisture Content: 20.0%

BOWSER-MORNER, INC.

Dayton, Ohio

GRAIN SIZE DISTRIBUTION TEST DATA

2/20/2019

Client: TTL

Project: TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

Project Number: 187609

Location: UD-338

Depth: 43' - 45'

Sample Number: UD-338

Material Description: brown poorly graded SAND

Liquid Limit: NV

Plastic Limit: NP

USCS Classification: SP

AASHTO Classification: A-3

Testing Remarks: As Received

Moisture Content: 20.0%

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
413.54	92.80	0.00	#4	0.00	100.0
			#10	0.00	100.0
			#20	0.71	99.8
			#40	43.64	86.4
			#60	235.84	26.5
			#100	300.44	6.3
			#200	310.74	3.1

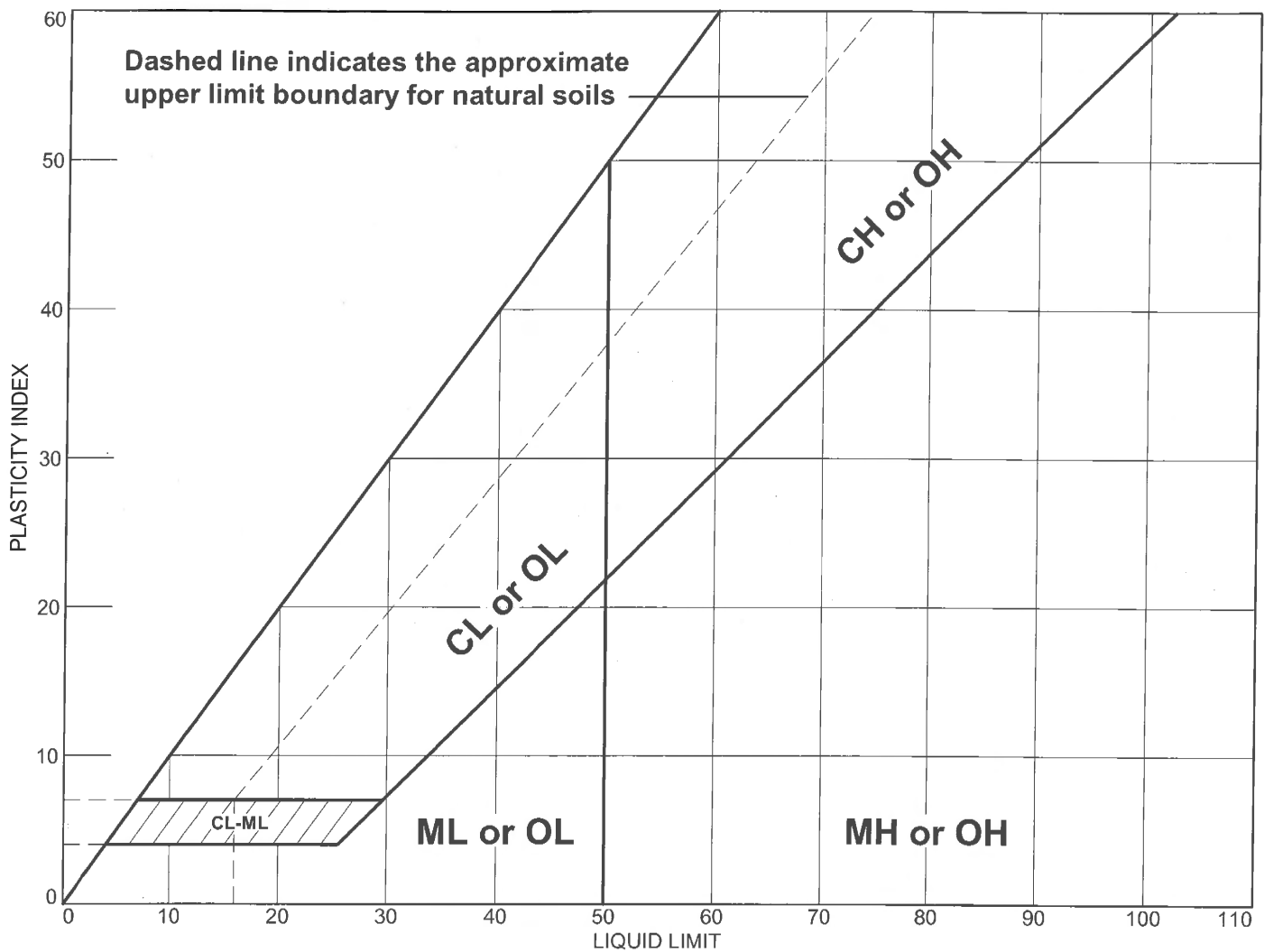
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	13.6	83.3	96.9			3.1

D ₅	D ₁₀	D ₁₅	D ₂₀	D ₃₀	D ₄₀	D ₅₀	D ₆₀	D ₈₀	D ₈₅	D ₉₀	D ₉₅
0.1295	0.1852	0.2114	0.2303	0.2595	0.2845	0.3089	0.3345	0.3971	0.4183	0.4879	0.6150

Fineness Modulus	C _u	C _c
1.53	1.81	1.09

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	brown poorly graded SAND with silt	NV	NP	NP	77.9	5.5	SP-SM
■	dark brown poorly graded SAND with silt	NV	NP	NP	87.3	5.5	SP-SM
▲	brown poorly graded SAND	NV	NP	NP	86.4	3.1	SP

Project No. 187609

Client: TTL

Project: TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

● Source of Sample: UD-338

Depth: 13' - 15'

Sample Number: UD-338

■ Source of Sample: UD-338

Depth: 28' - 30'

Sample Number: UD-338

▲ Source of Sample: UD-338

Depth: 43' - 45'

Sample Number: UD-338

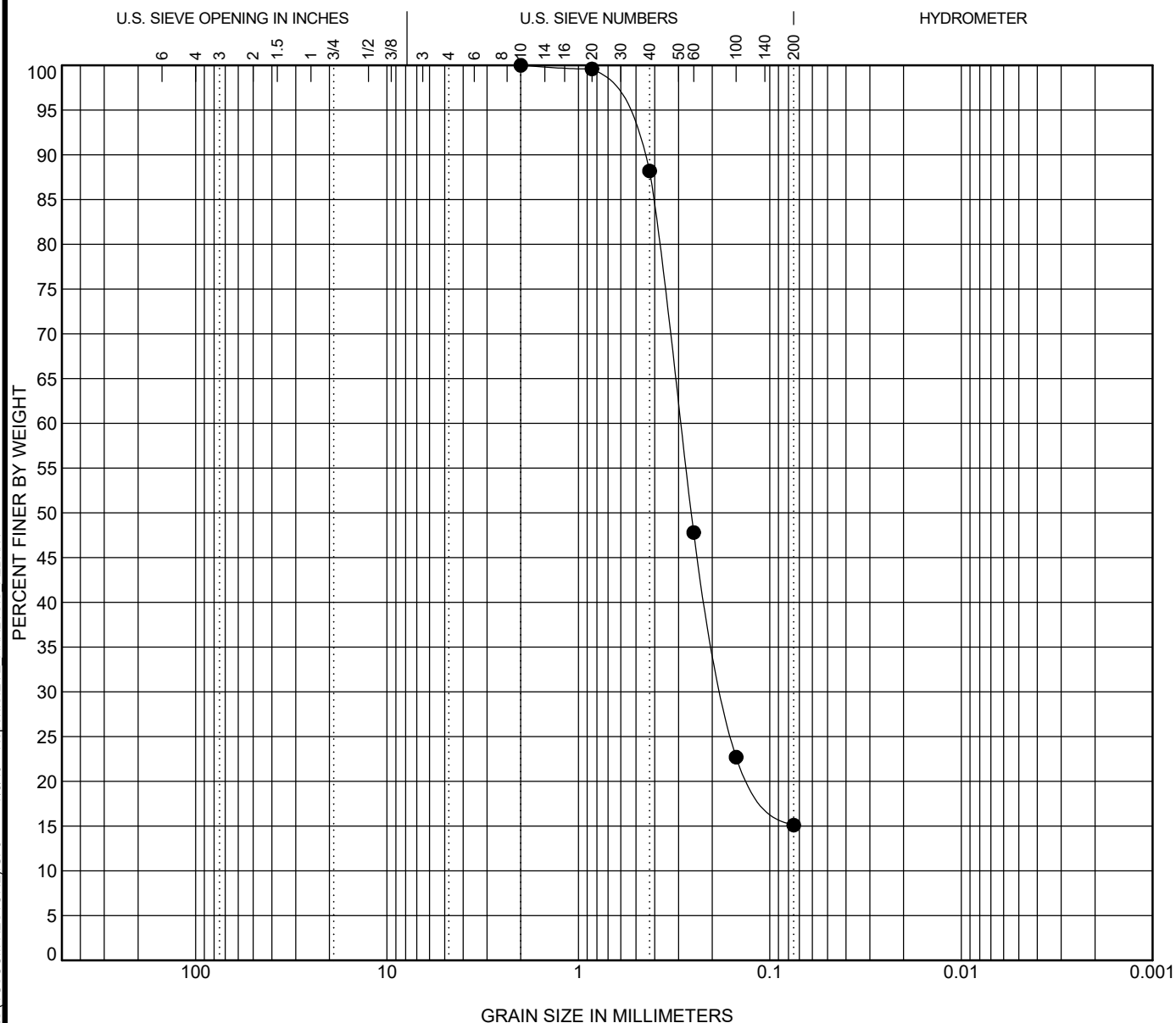
Remarks:

BOWSER-MORNER, INC.

Dayton, Ohio

TTL LABORATORY REPORTS

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID		PZ01S											
Description		6'-9'											
Sampled by:		TTL											
Sample Location:		PZ01S											
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
						2	0.3	0.2		0.0	84.9	15.1	

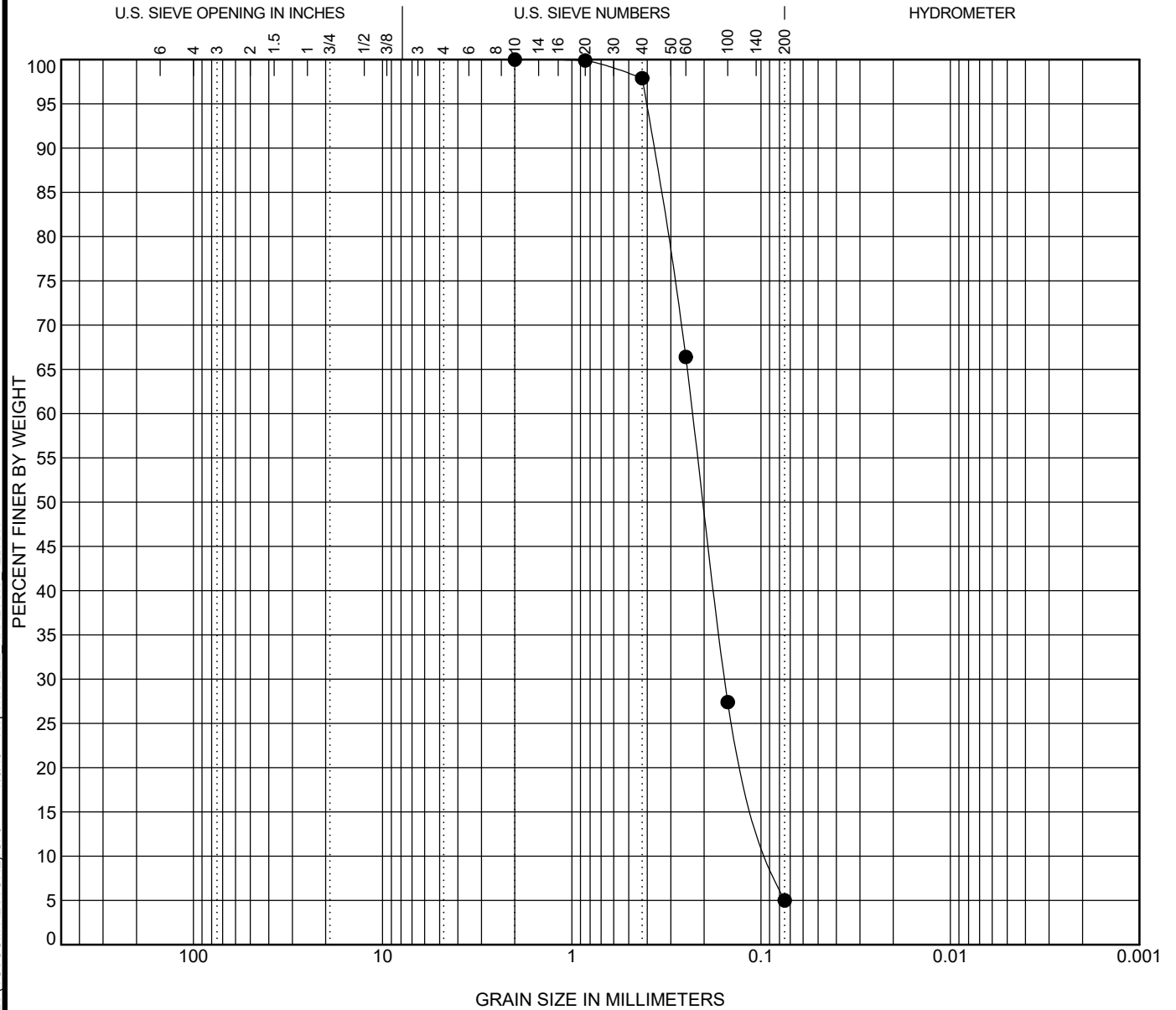


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SIEVE ANALYSIS RESULTS

Client:
 Project: Twin Pines Minerals Saunders-Loncala Reserve
 Location: Saint George, Georgia
 Project Number: 000180200804.00

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID		PZ01S											
Description		12.5'-20.0'											
Sampled by:		TTL											
Sample Location:		PZ01S											
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
				1.20	2.63	2	0.2	0.2	0.1	0.0	95.0	5.0	

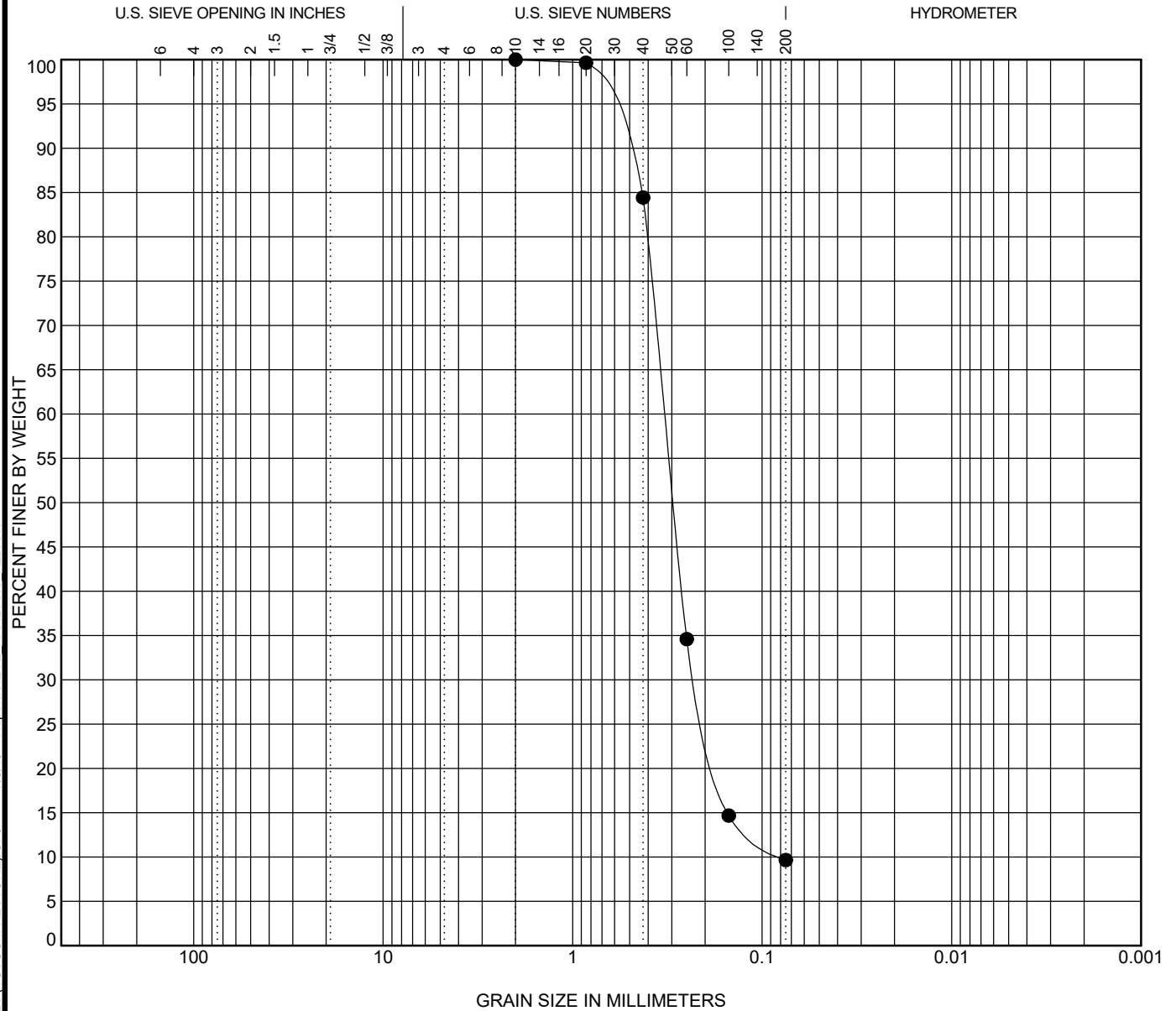
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SIEVE ANALYSIS RESULTS

Client:
 Project: Twin Pines Minerals Saunders-Loncala Reserve
 Location: Saint George, Georgia
 Project Number: 000180200804.00

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID		PZ02											
Description		4'-10'											
Sampled by:		TTL											
Sample Location:		PZ02											
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
				1.92	4.17	2	0.3	0.2	0.1	0.0	90.3	9.7	

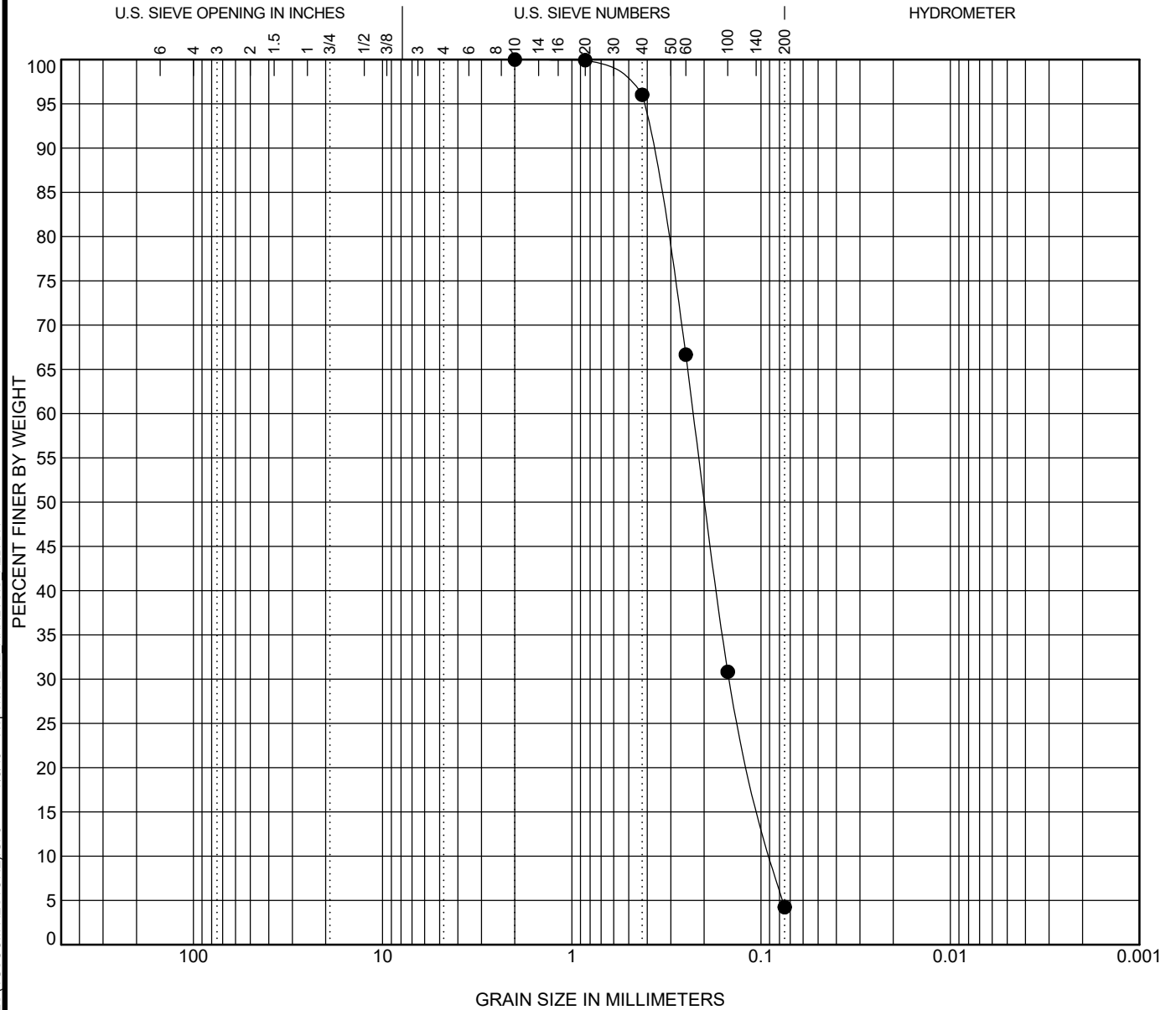


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SIEVE ANALYSIS RESULTS

Client: Twin Pines Minerals Saunders-Loncala Reserve
 Location: Saint George, Georgia
 Project Number: 000180200804.00

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID		PZ02											
Description		17.5'-20'											
Sampled by:		TTL											
Sample Location:		PZ02											
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
				1.09	2.61	2	0.2	0.1	0.1	0.0	95.8	4.2	

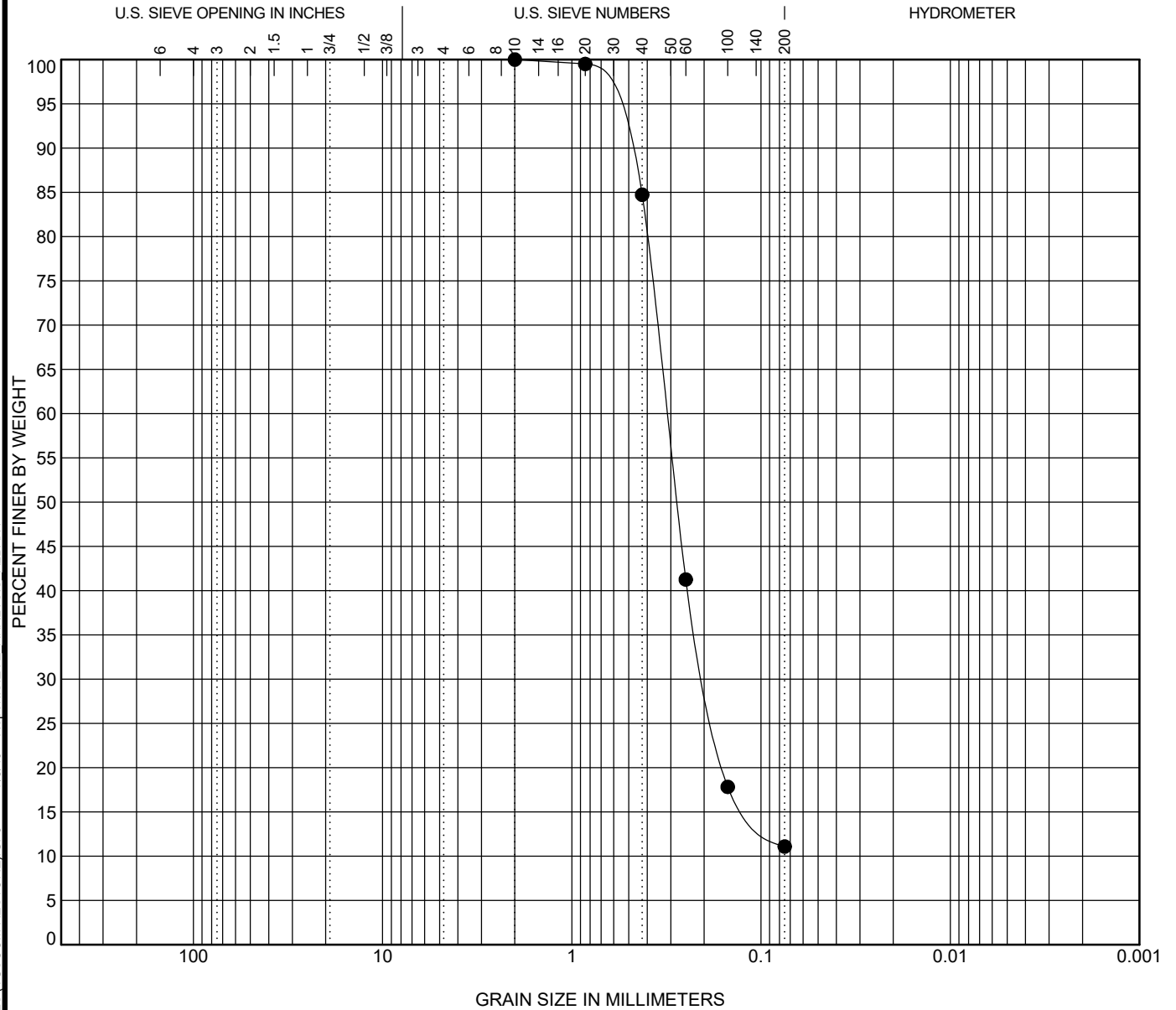


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SIEVE ANALYSIS RESULTS

Client: Twin Pines Minerals Saunders-Loncala Reserve
 Location: Saint George, Georgia
 Project Number: 000180200804.00

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID		PZ03S											
Description		3'-7"											
Sampled by:		TTL											
Sample Location:		PZ03S											
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
				1.82	4.69	2	0.3	0.2		0.0	88.9	11.1	

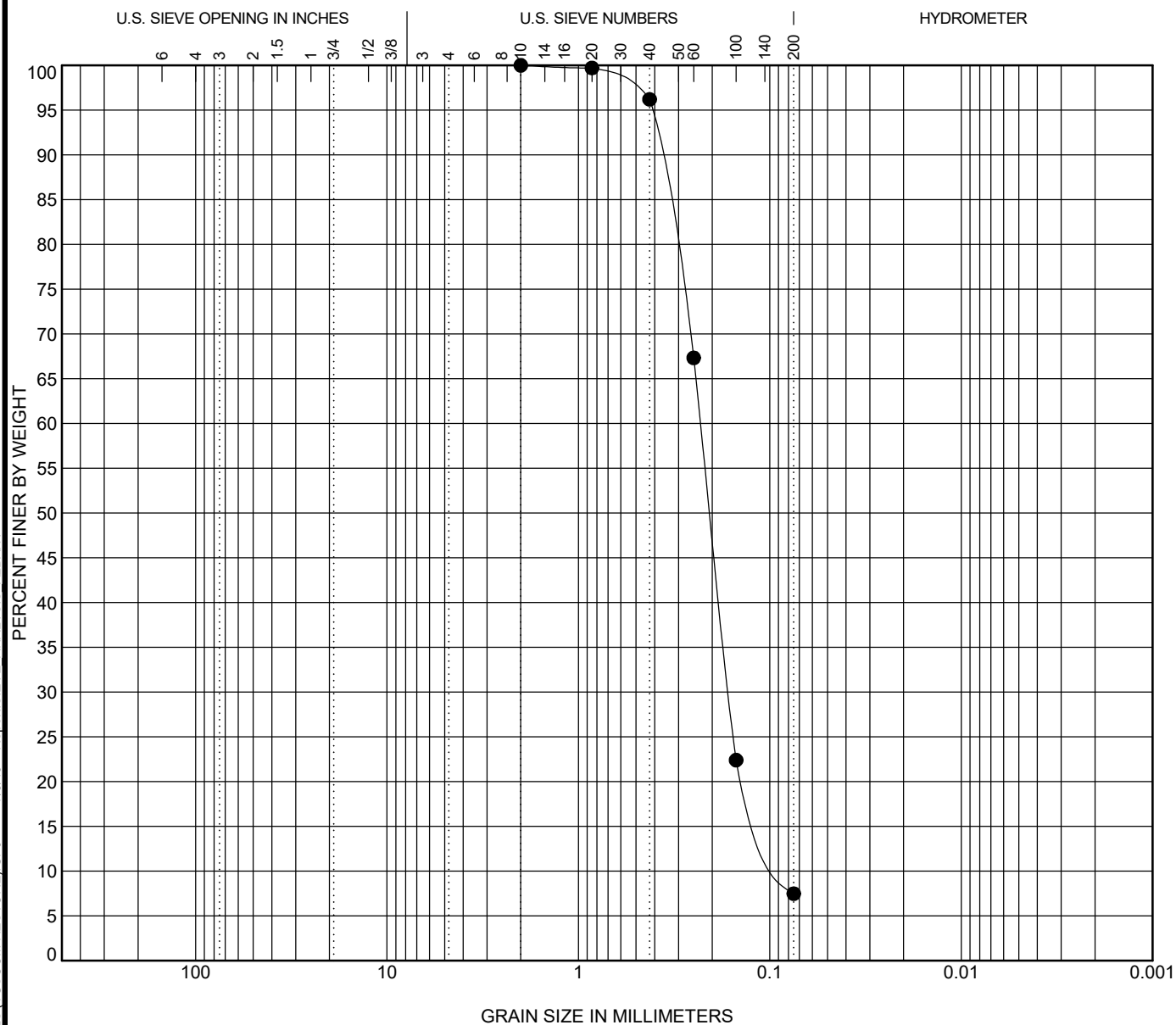
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SIEVE ANALYSIS RESULTS

Client:
Project: Twin Pines Minerals Saunders-Loncala Reserve
Location: Saint George, Georgia
Project Number: 000180200804.00

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID		PZ03S											
Description		18'-20'											
Sampled by:		TTL											
Sample Location:		PZ03S											
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
				1.38	2.73	2	0.2	0.2	0.1	0.0	92.5	7.5	

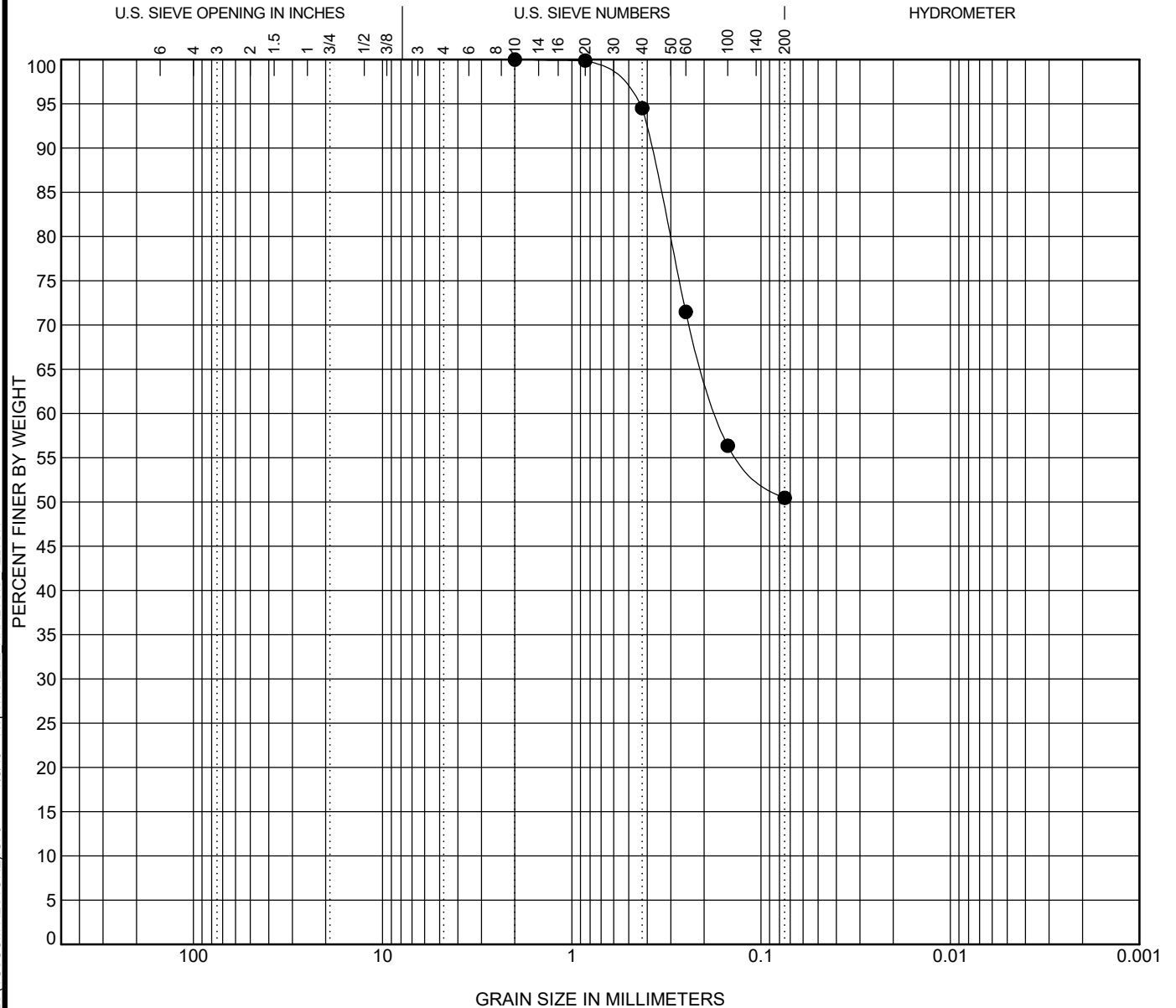
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SIEVE ANALYSIS RESULTS

Client:
Project: Twin Pines Minerals Saunders-Loncala Reserve
Location: Saint George, Georgia
Project Number: 000180200804.00

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID		PZ03D											
Description		7'-12'											
Sampled by:		TTL											
Sample Location:		PZ03D											
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
						2	0.2			0.0	49.5	50.5	

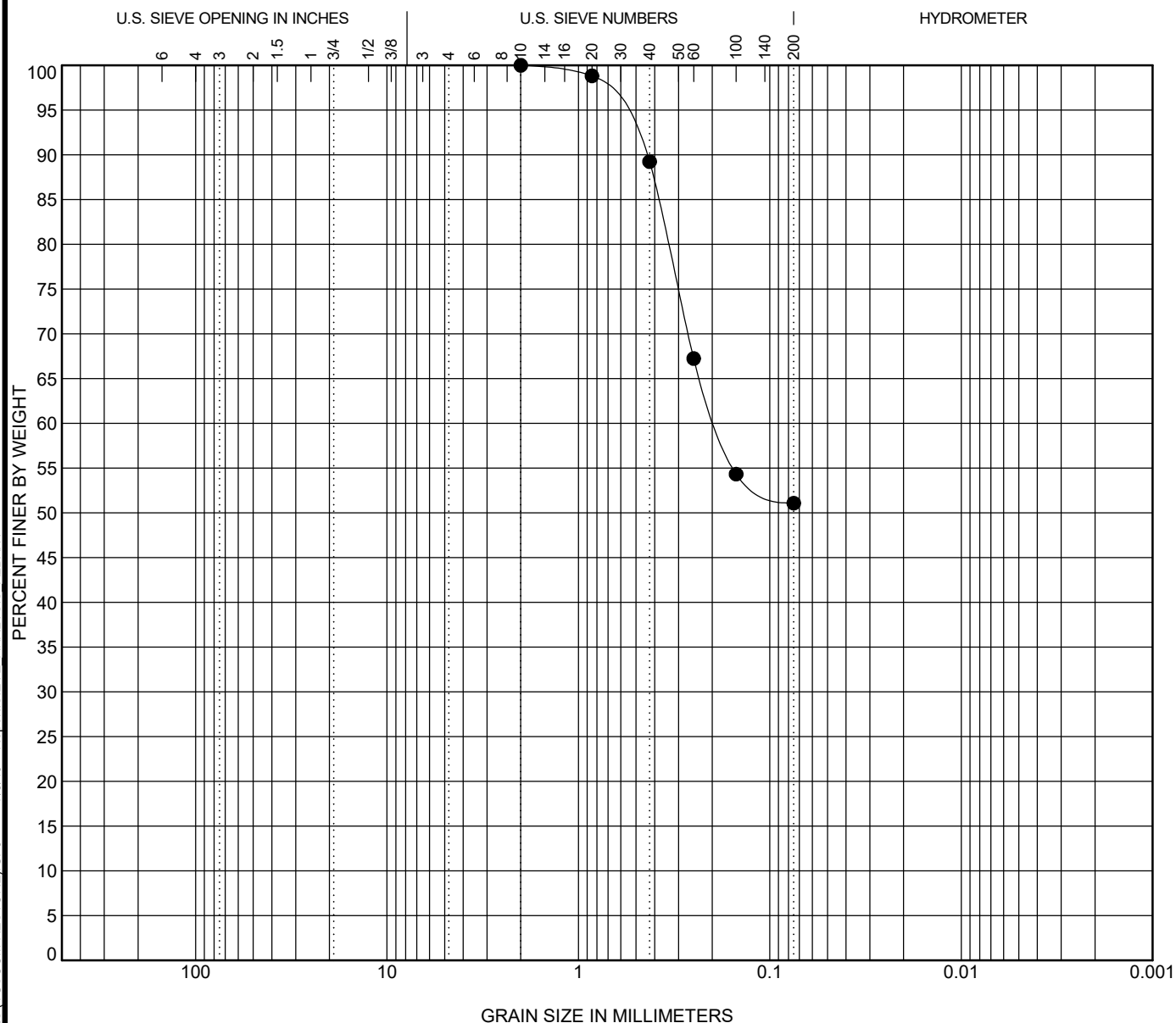


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SIEVE ANALYSIS RESULTS

Client:
 Project: Twin Pines Minerals Saunders-Loncala Reserve
 Location: Saint George, Georgia
 Project Number: 000180200804.00

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID		PZ03D											
Description		36'-50'											
Sampled by:		TTL											
Sample Location:		PZ03D											
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
						2	0.2			0.0	48.9	51.1	

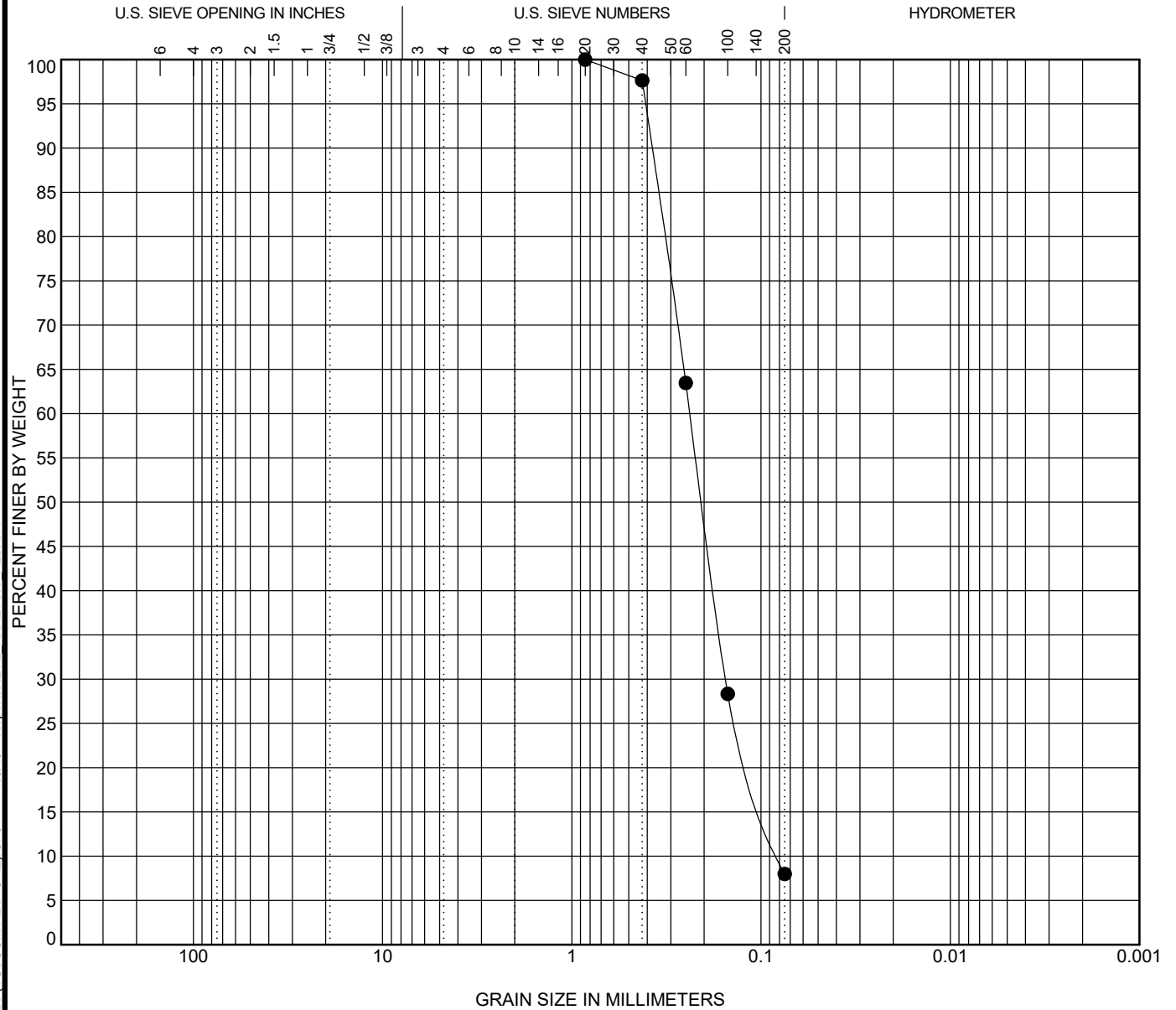


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SIEVE ANALYSIS RESULTS

Client:
 Project: Twin Pines Minerals Saunders-Loncala Reserve
 Location: Saint George, Georgia
 Project Number: 000180200804.00

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID		PZ04											
Description		6'-11'											
Sampled by:		TTL											
Sample Location:		PZ04											
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
				1.24	2.96	0.9	0.2	0.2	0.1	0.0	92.0	8.0	

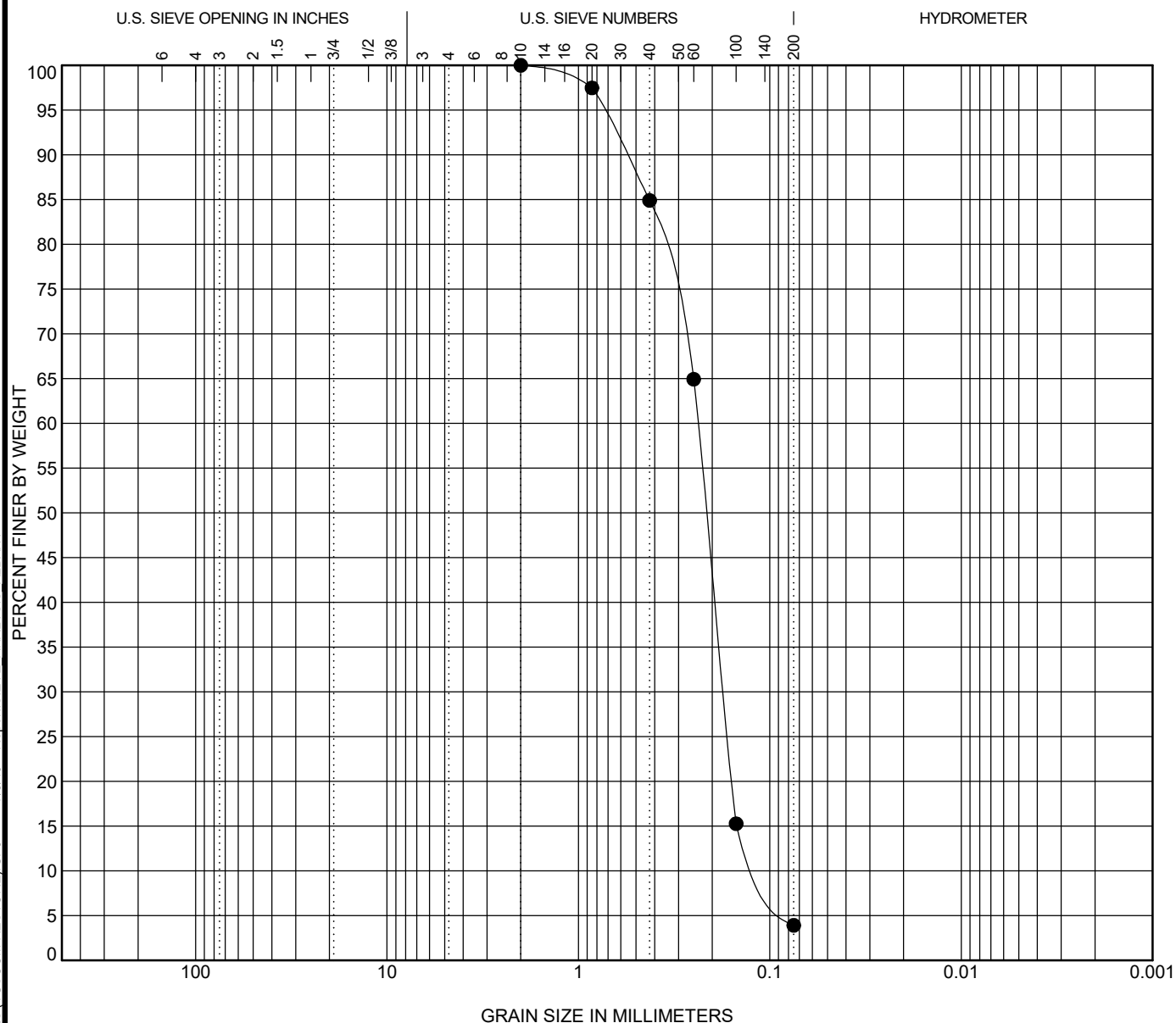
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SIEVE ANALYSIS RESULTS

Client:
 Project: Twin Pines Minerals Saunders-Loncala Reserve
 Location: Saint George, Georgia
 Project Number: 000180200804.00

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID		PZ04											
Description		15'-20'											
Sampled by:		TTL											
Sample Location:		PZ04											
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
				1.18	2.18	2	0.2	0.2	0.1	0.0	96.1	3.9	

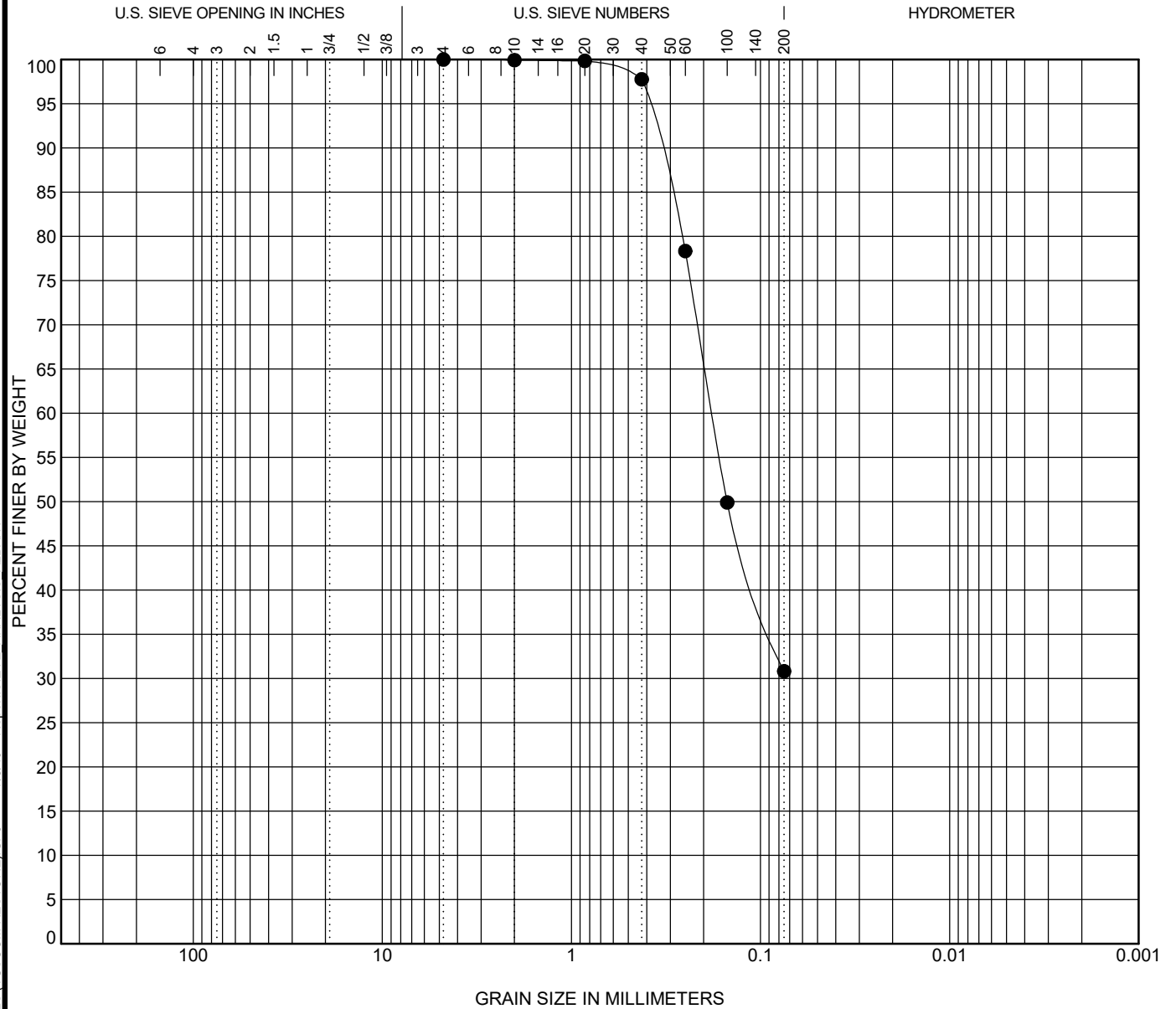
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SIEVE ANALYSIS RESULTS

Client:
 Project: Twin Pines Minerals Saunders-Loncala Reserve
 Location: Saint George, Georgia
 Project Number: 000180200804.00

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID		PZ05											
Description		5'-11'											
Sampled by:		TTL											
Sample Location:		PZ05											
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
						4.8	0.2			0.0	69.2	30.8	

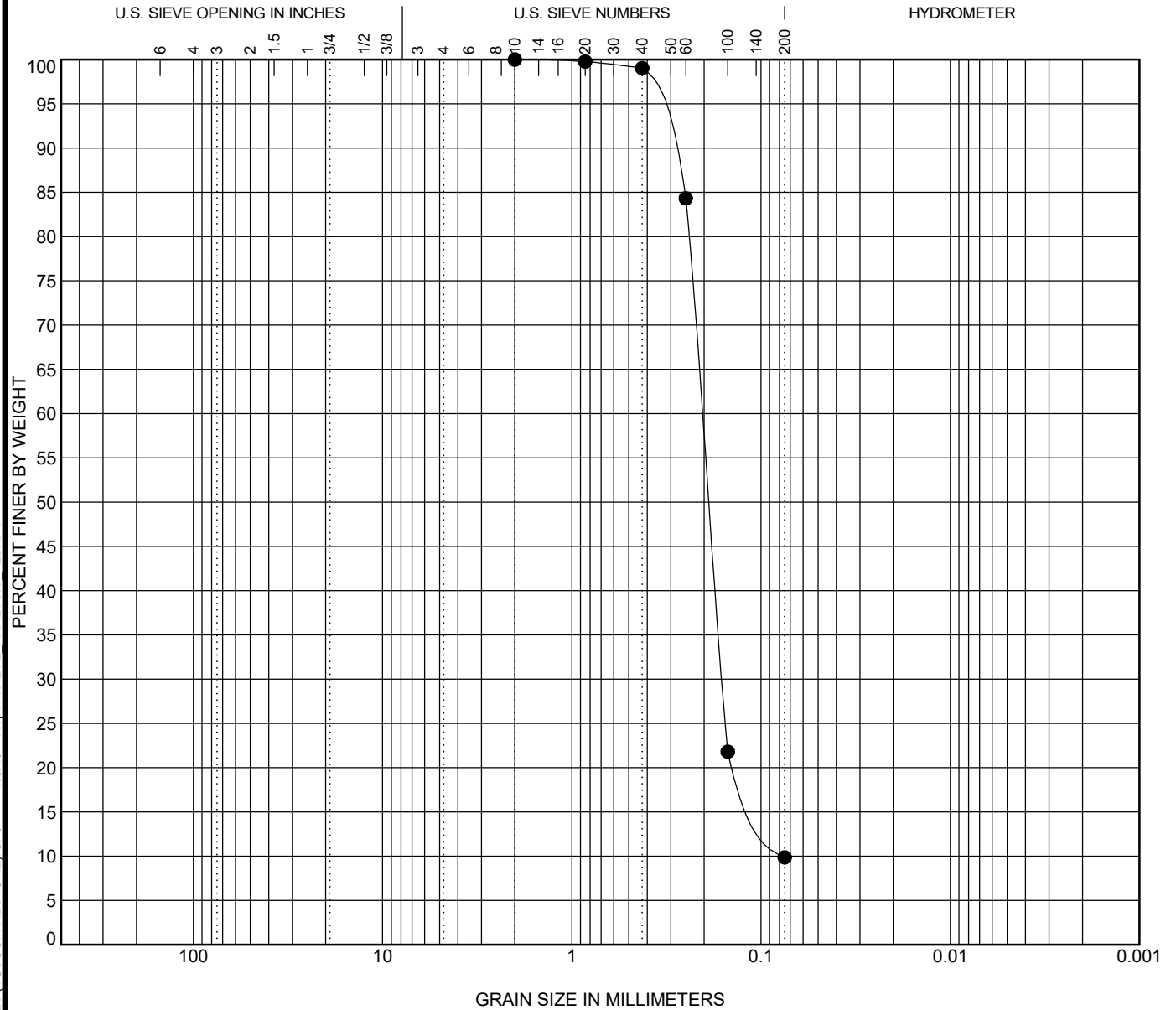


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SIEVE ANALYSIS RESULTS

Client:
 Project: Twin Pines Minerals Saunders-Loncala Reserve
 Location: Saint George, Georgia
 Project Number: 000180200804.00

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID		PZ05											
Description		15'-20'											
Sampled by:		TTL											
Sample Location:		PZ05											
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
				1.66	2.71	2	0.2	0.2	0.1	0.0	90.1		9.9

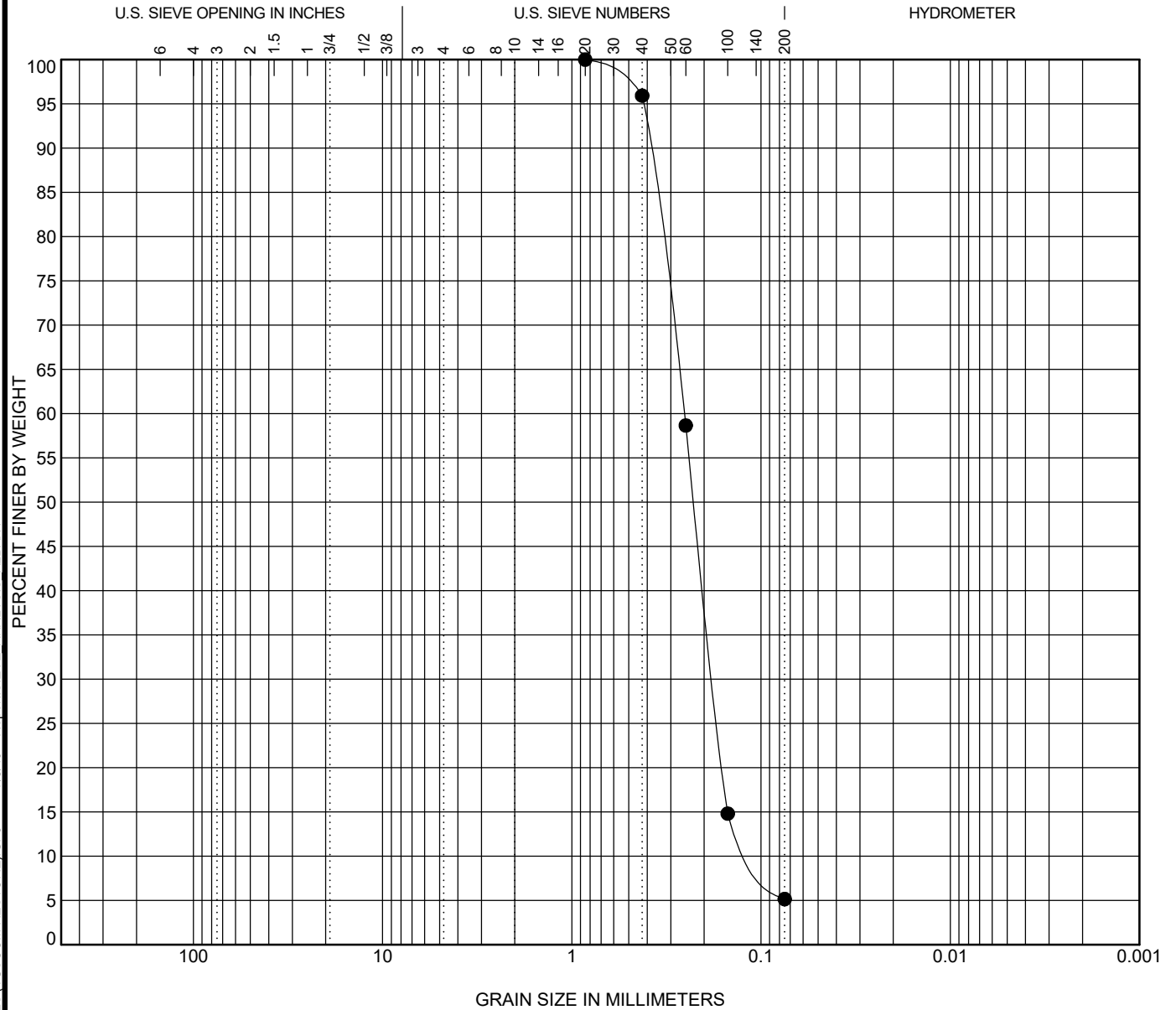
TTL

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SIEVE ANALYSIS RESULTS

Client:
Project: Twin Pines Minerals Saunders-Loncala Reserve
Location: Saint George, Georgia
Project Number: 000180200804.00

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID		PZ06											
Description		7.5'-8'											
Sampled by:		TTL											
Sample Location:		PZ06											
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
				1.18	2.40	0.9	0.3	0.2	0.1	0.0	94.8	5.2	

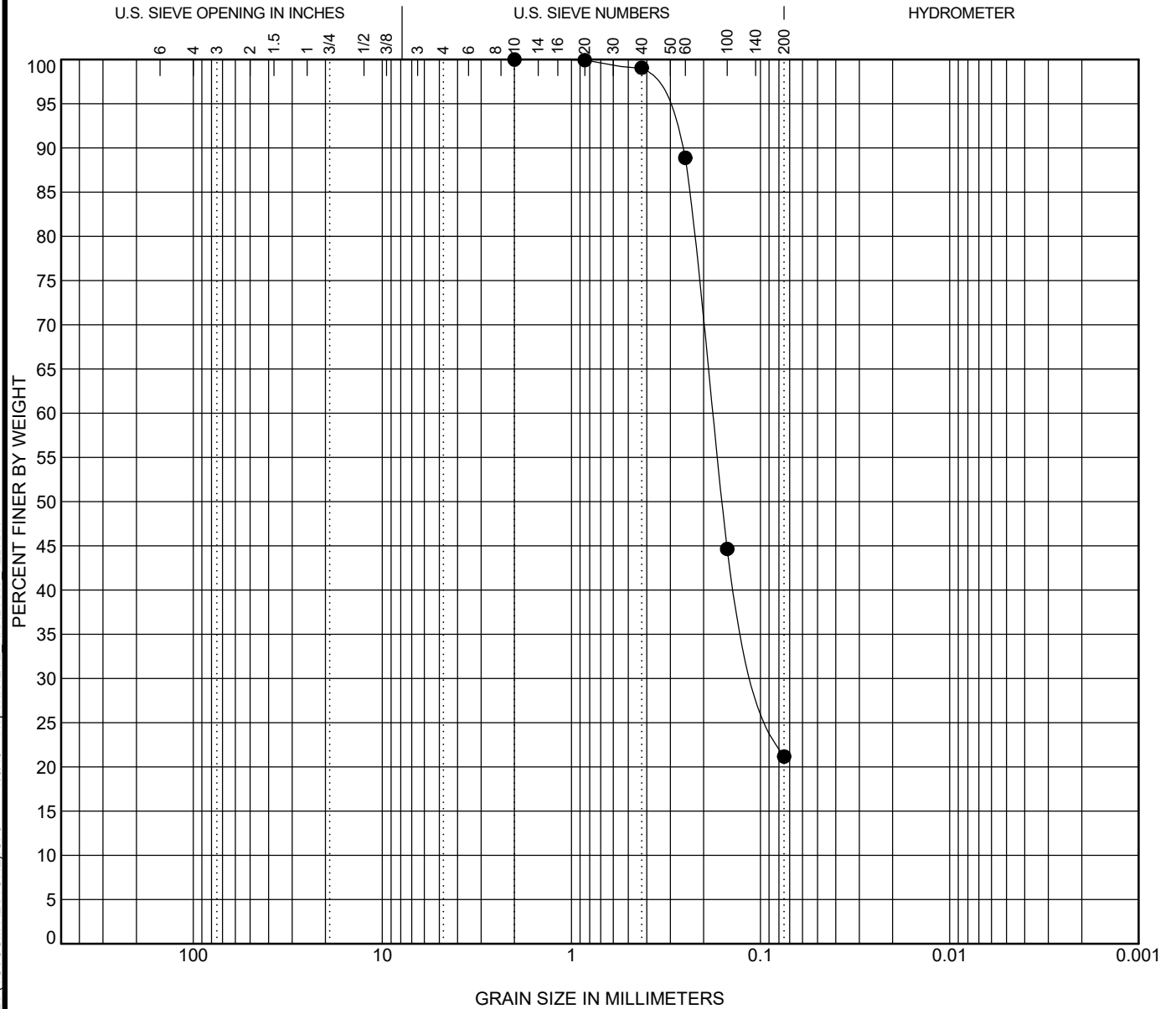


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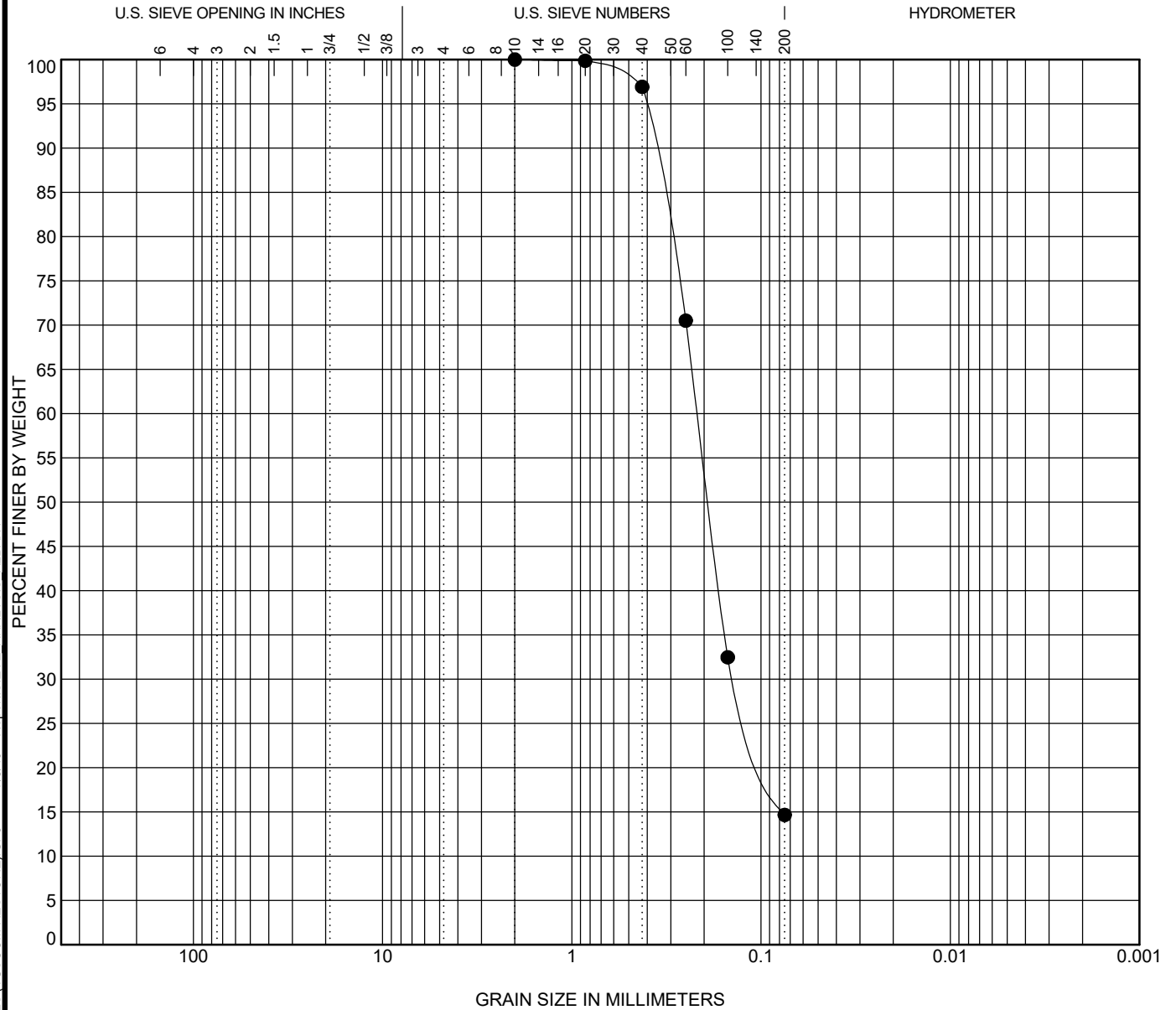
SIEVE ANALYSIS RESULTS

Client:
 Project: Twin Pines Minerals Saunders-Loncala Reserve
 Location: Saint George, Georgia
 Project Number: 000180200804.00

GRAIN SIZE DISTRIBUTION



GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID		PZ07											
Description		5'-7'											
Sampled by:		TTL											
Sample Location:		PZ07											
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
						2	0.2	0.1		0.0	85.3	14.7	

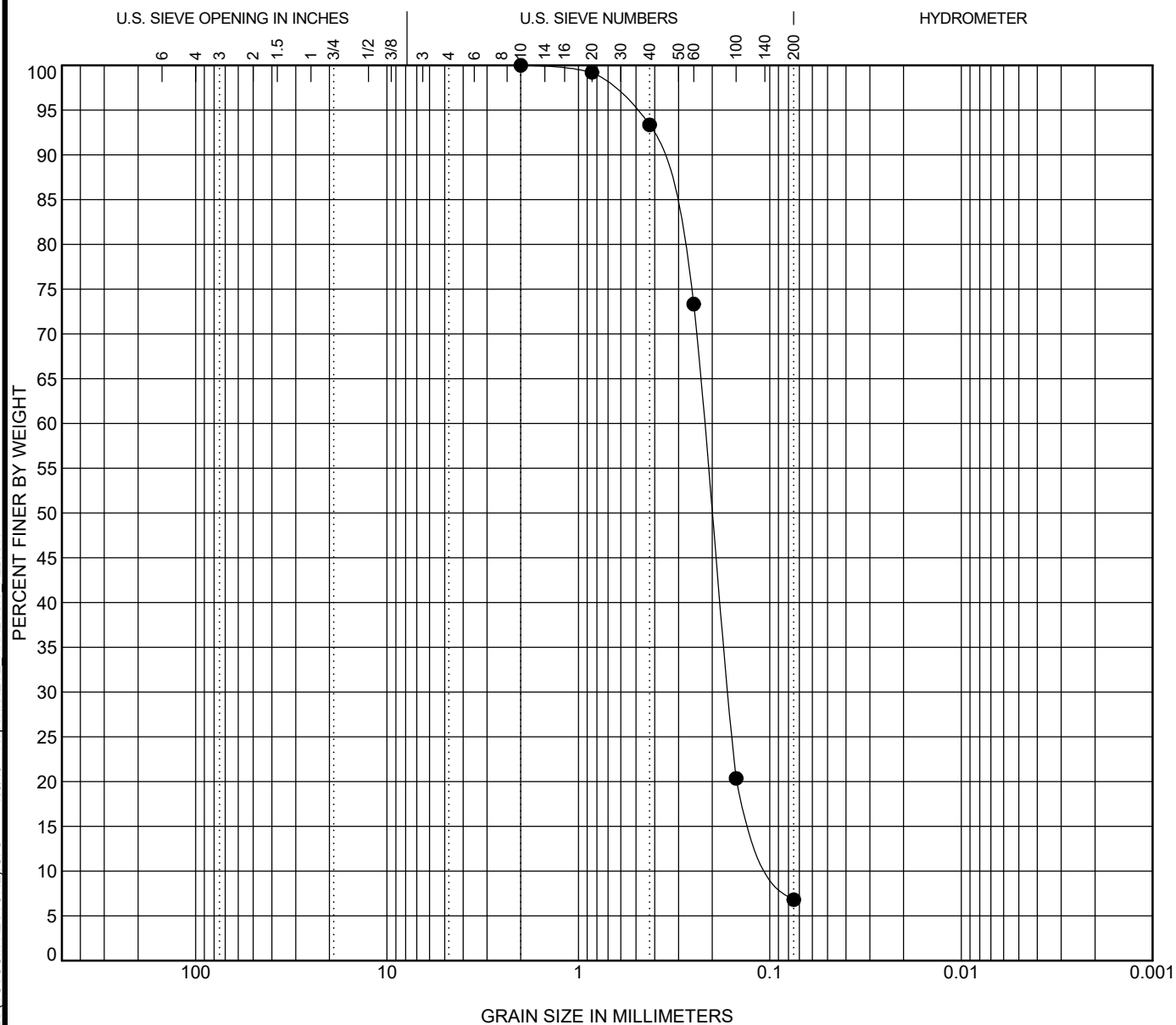
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SIEVE ANALYSIS RESULTS

Client:
 Project: Twin Pines Minerals Saunders-Loncala Reserve
 Location: Saint George, Georgia
 Project Number: 000180200804.00

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID		PZ07											
Description		9'-20'											
Sampled by:		TTL											
Sample Location:		PZ07											
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
				1.40	2.49	2	0.2	0.2	0.1	0.0	93.2	6.8	

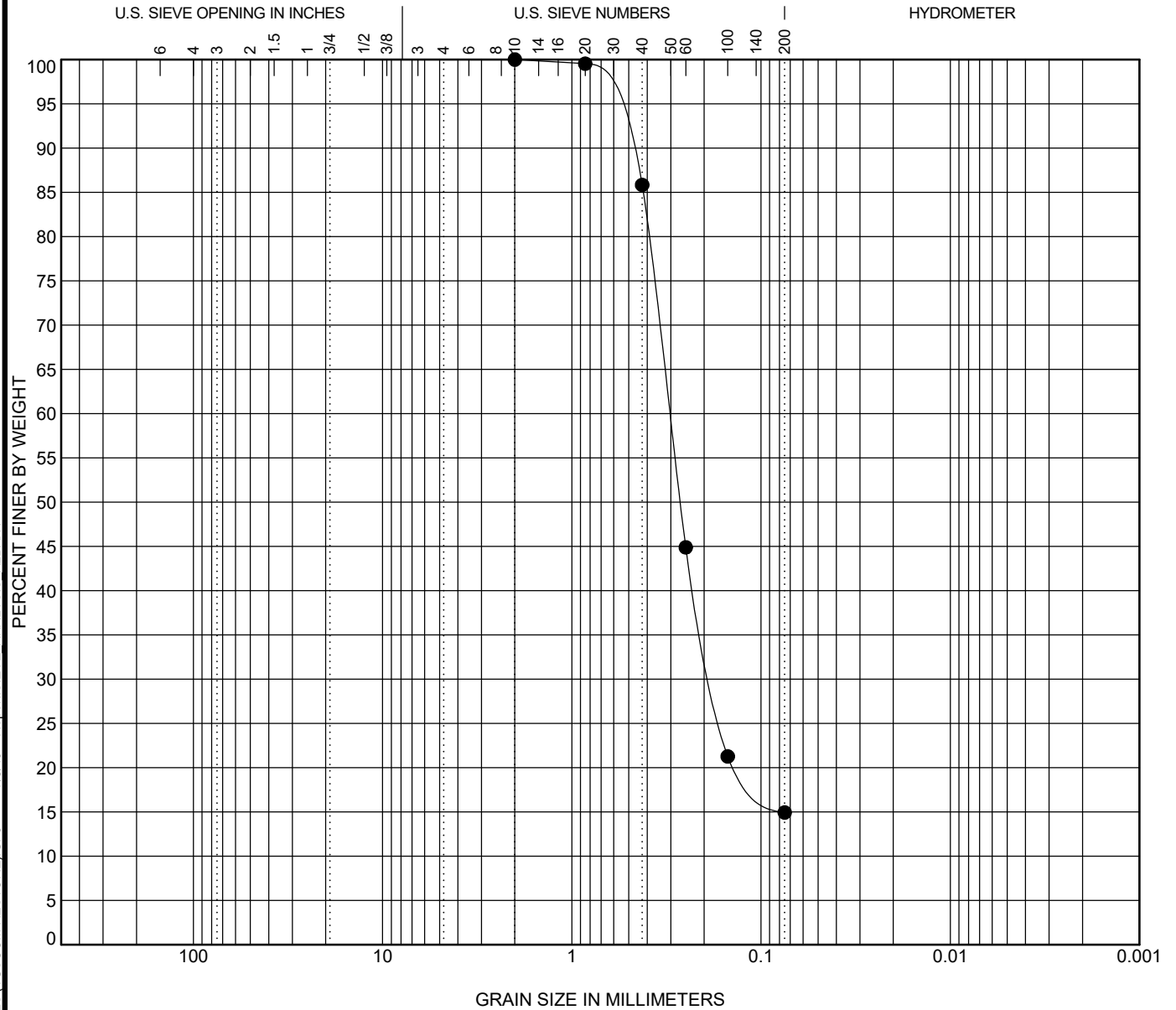
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SIEVE ANALYSIS RESULTS

Client:
 Project: Twin Pines Minerals Saunders-Loncala Reserve
 Location: Saint George, Georgia
 Project Number: 000180200804.00

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID		PZ08											
Description		5'-6.5'											
Sampled by:		TTL											
Sample Location:		PZ08											
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
						2	0.3	0.2		0.0	85.1	14.9	

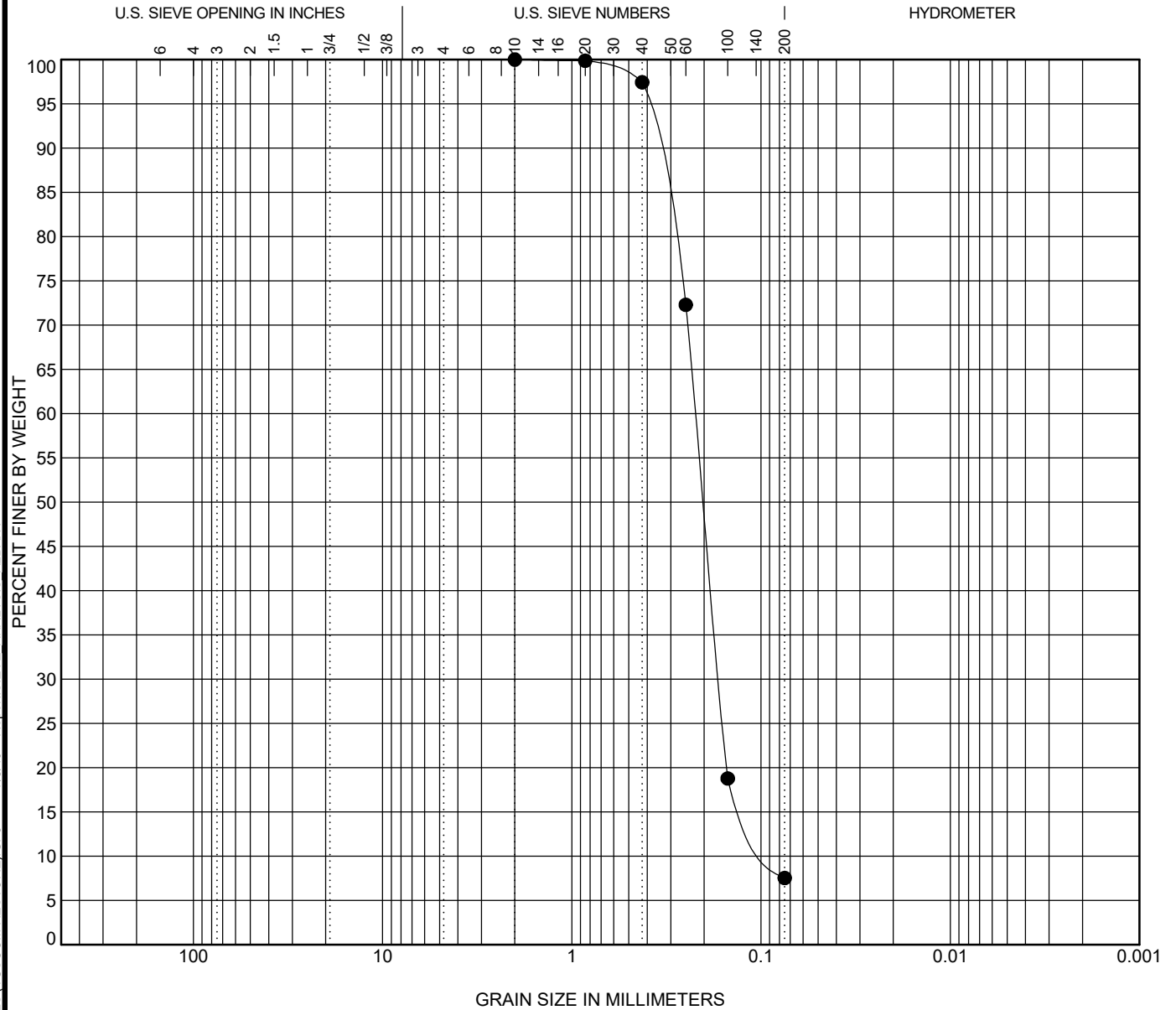
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SIEVE ANALYSIS RESULTS

Client:
 Project: Twin Pines Minerals Saunders-Loncala Reserve
 Location: Saint George, Georgia
 Project Number: 000180200804.00

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID		PZ08											
Description		15'-20'											
Sampled by:		TTL											
Sample Location:		PZ08											
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
				1.44	2.55	2	0.2	0.2	0.1	0.0	92.5	7.5	

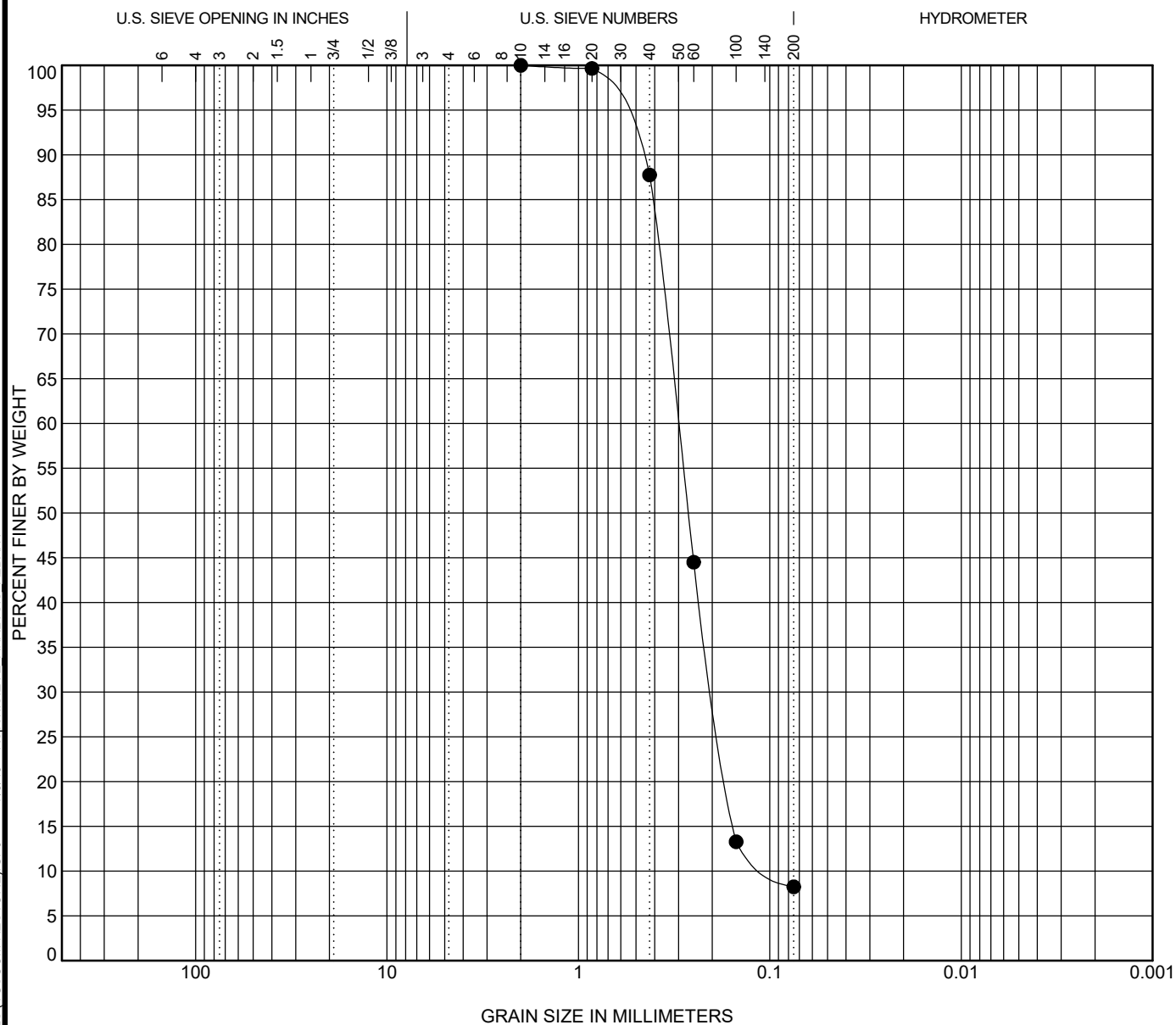
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SIEVE ANALYSIS RESULTS

Client:
 Project: Twin Pines Minerals Saunders-Loncala Reserve
 Location: Saint George, Georgia
 Project Number: 000180200804.00

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID		PZ09											
Description		7'-10'											
Sampled by:		TTL											
Sample Location:		PZ09											
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
				1.35	3.16	2	0.3	0.2	0.1	0.0	91.8	8.2	

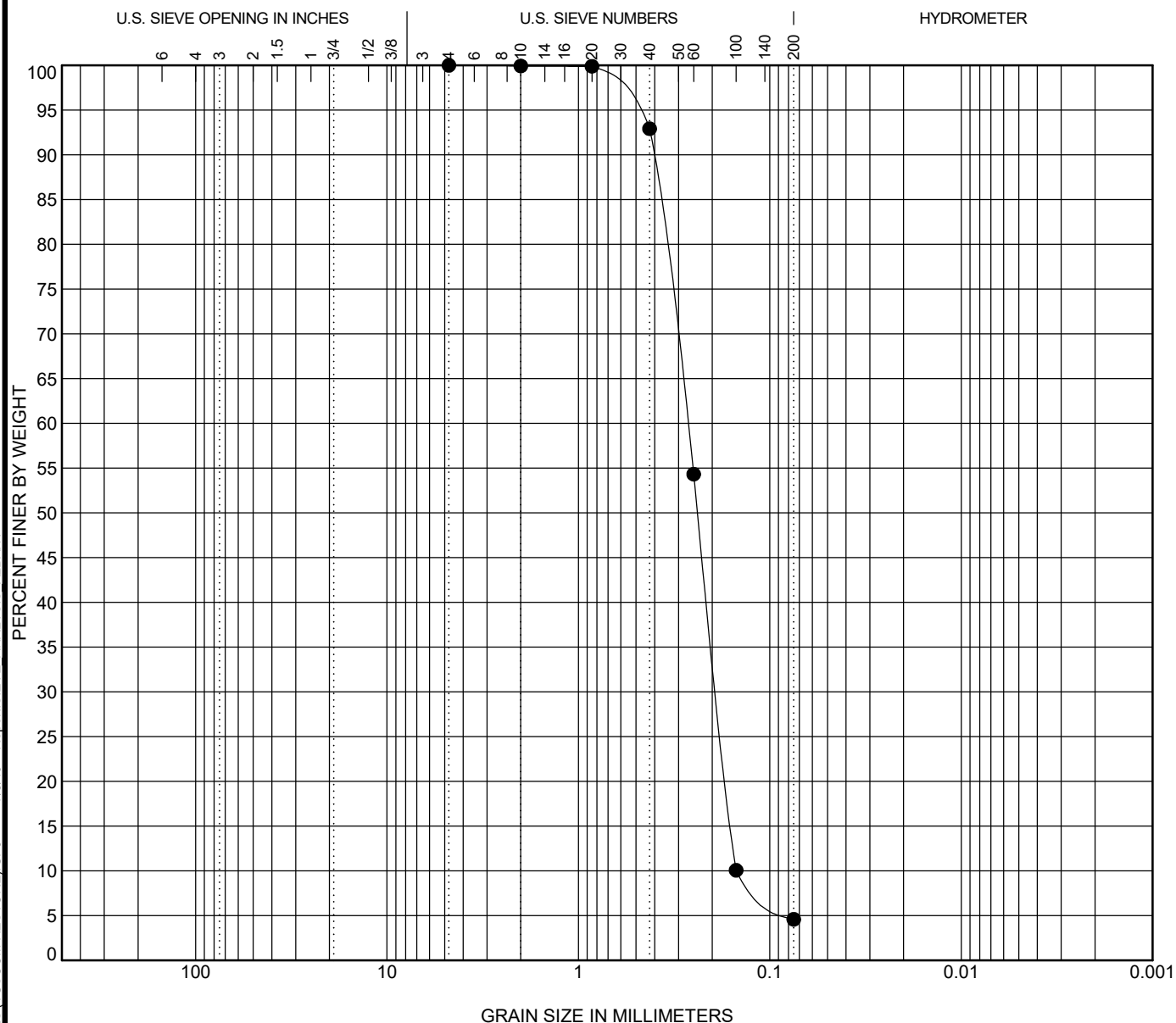
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SIEVE ANALYSIS RESULTS

Client:
Project: Twin Pines Minerals Saunders-Loncala Reserve
Location: Saint George, Georgia
Project Number: 000180200804.00

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID		PZ09											
Description		27'-30'											
Sampled by:		TTL											
Sample Location:		PZ09											
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
				0.89	1.82	4.8	0.3	0.2	0.1	0.0	95.4	4.6	

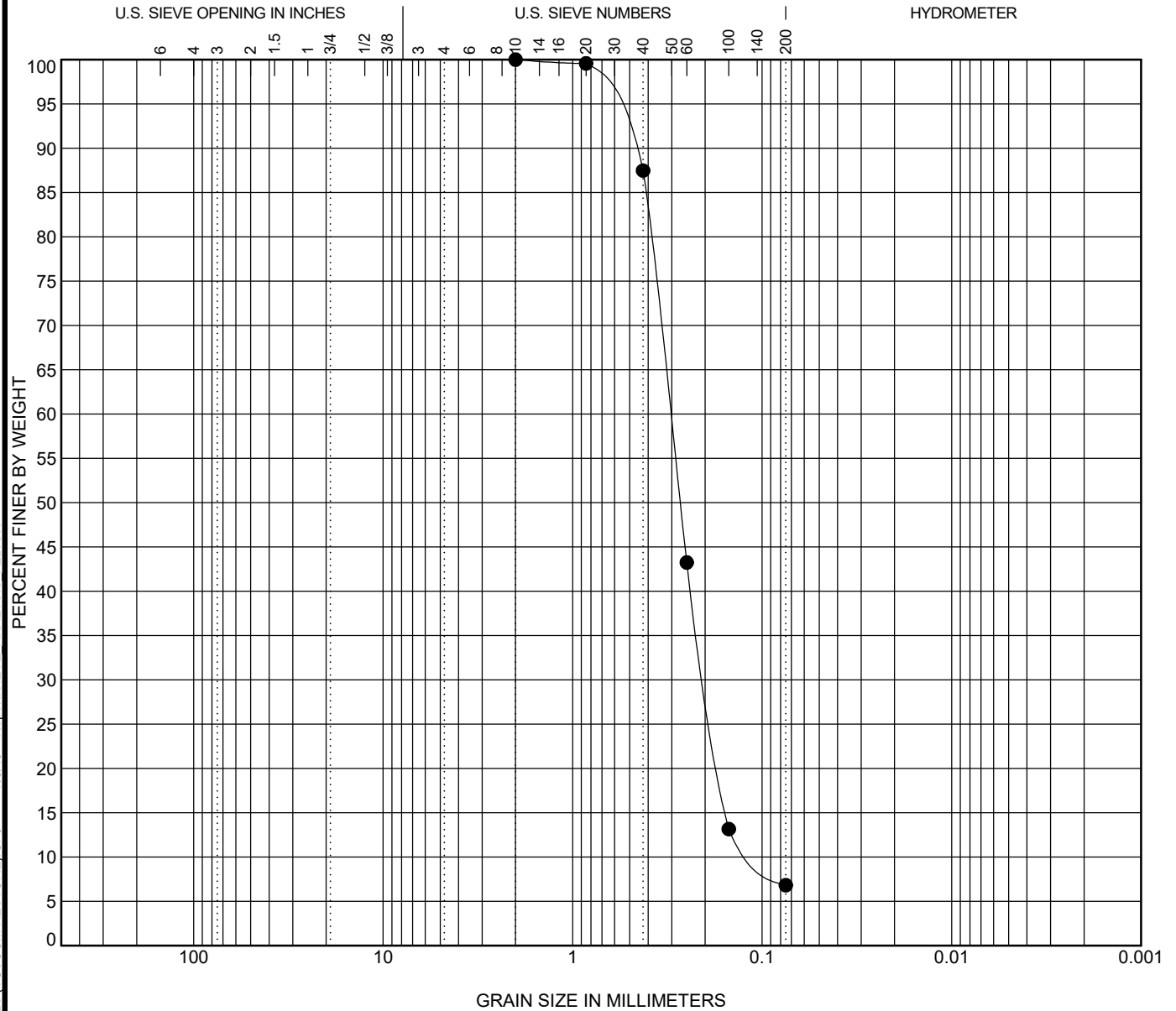
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SIEVE ANALYSIS RESULTS

Client:
 Project: Twin Pines Minerals Saunders-Loncala Reserve
 Location: Saint George, Georgia
 Project Number: 000180200804.00

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID		PZ10											
Description		5'-8'											
Sampled by:		TTL											
Sample Location:		PZ10											
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
				1.23	2.88	2	0.3	0.2	0.1	0.0	93.2	6.8	

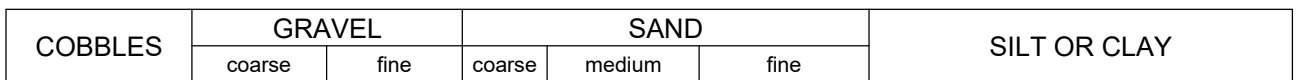
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SIEVE ANALYSIS RESULTS

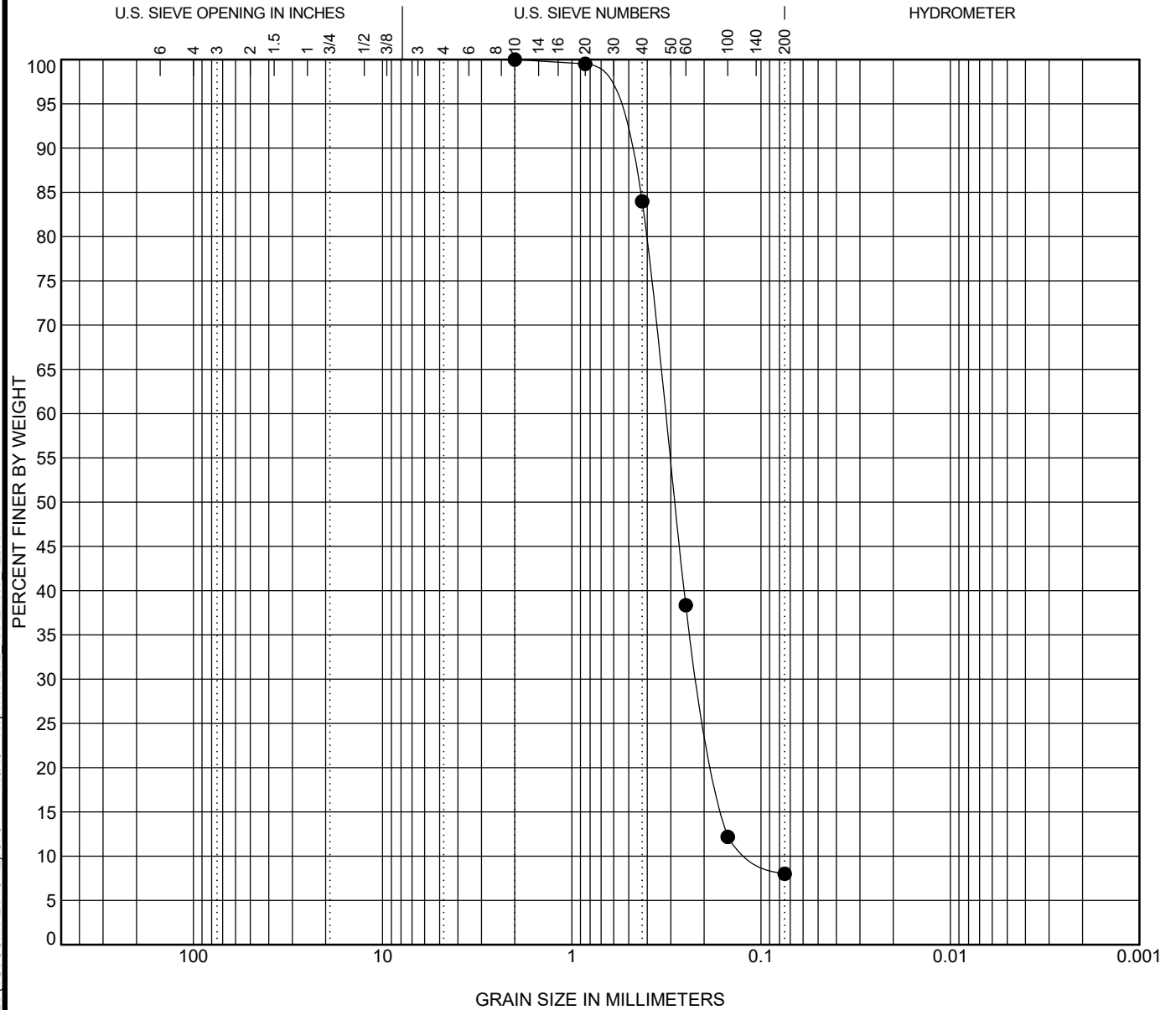
Client:
Project: Twin Pines Minerals Saunders-Loncala Reserve
Location: Saint George, Georgia
Project Number: 000180200804.00

Report	Sieve Analysis	Albany
C:\WORK\TWIN PINES\GINT DATABASE\EXCEL DUMMY\804-LOGS WITH WELLS (TUSCOM RESTORE).GPJ	7/8/19	Report

**TTL**

Client:
Project: Twin Pines Minerals Saunders-Loncalá Reserve
Location: Saint George, Georgia
Project Number: 000180200804.00

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID		PZ11											
Description		8'-13'											
Sampled by:		TTL											
Sample Location:		PZ11											
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
				1.34	3.08	2	0.3	0.2	0.1	0.0	92.0	8.0	

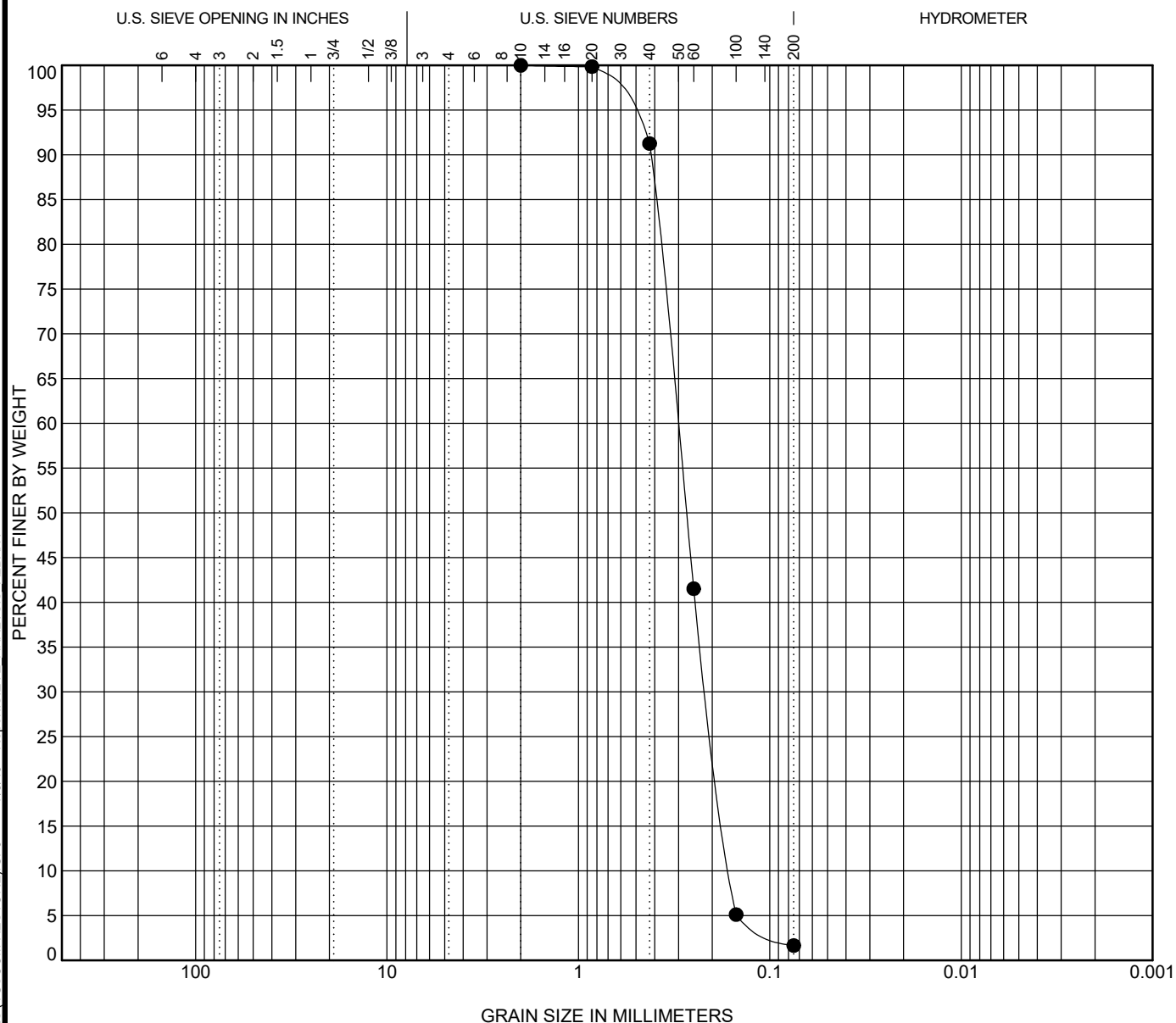
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SIEVE ANALYSIS RESULTS

Client:
 Project: Twin Pines Minerals Saunders-Loncala Reserve
 Location: Saint George, Georgia
 Project Number: 000180200804.00

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID		PZ11											
Description		13'-19'											
Sampled by:		TTL											
Sample Location:		PZ11											
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
				0.92	1.90	2	0.3	0.2	0.2	0.0	98.3	1.7	

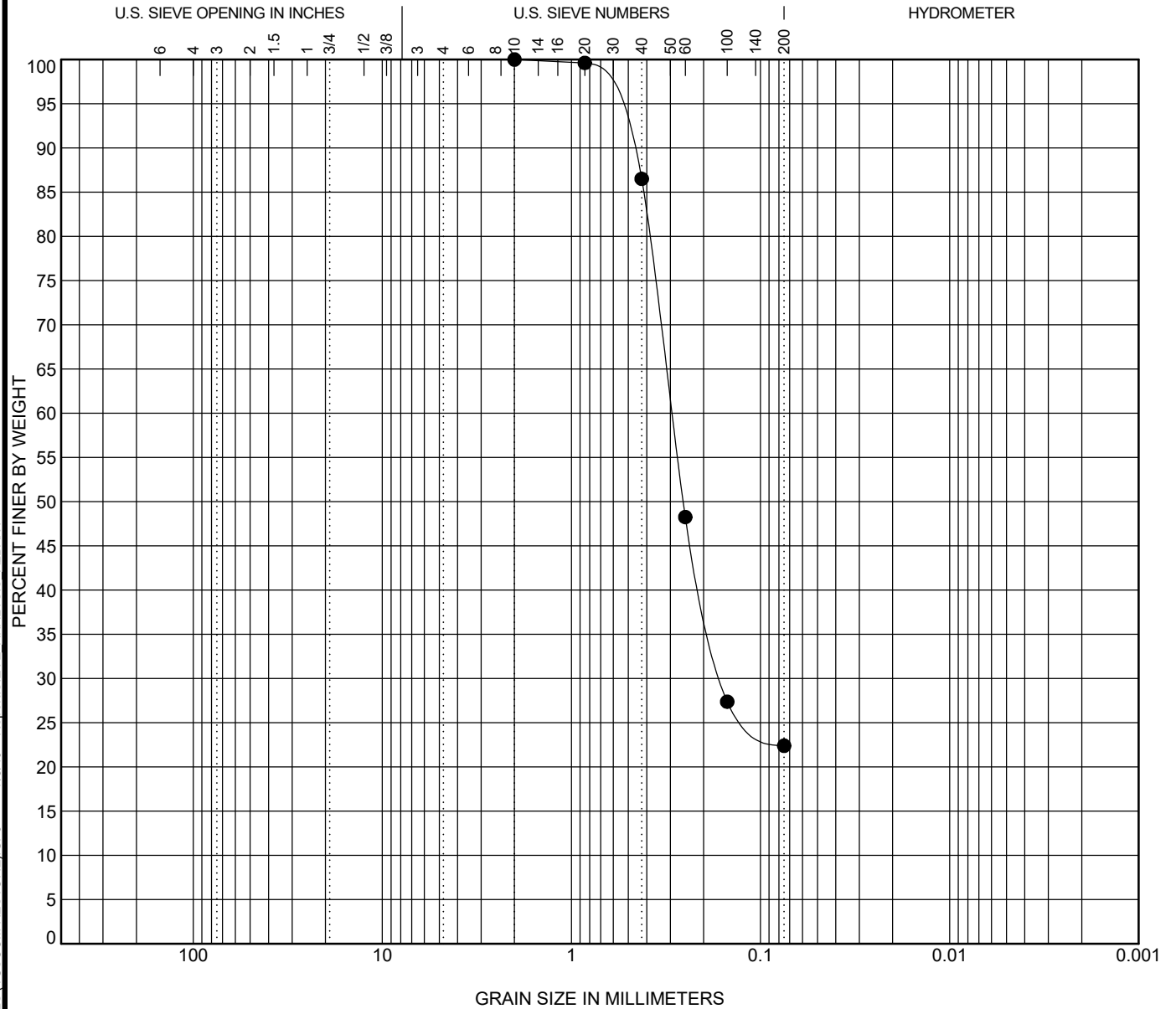
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SIEVE ANALYSIS RESULTS

Client:
 Project: Twin Pines Minerals Saunders-Loncala Reserve
 Location: Saint George, Georgia
 Project Number: 000180200804.00

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID		PZ12S											
Description		5'-9'											
Sampled by:		TTL											
Sample Location:		PZ12S											
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
						2	0.3	0.2		0.0	77.6	22.4	

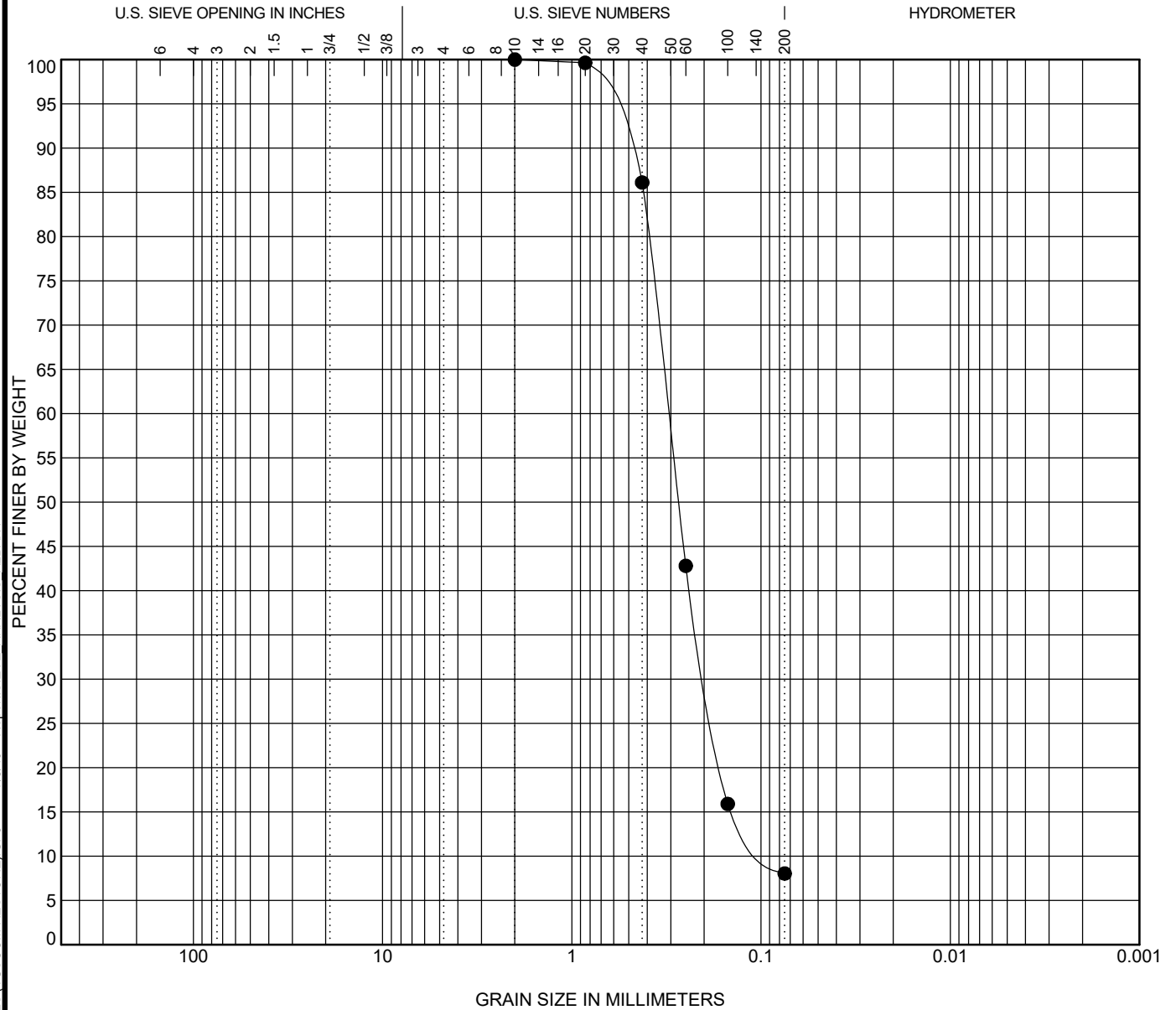


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SIEVE ANALYSIS RESULTS

Client:
 Project: Twin Pines Minerals Saunders-Loncala Reserve
 Location: Saint George, Georgia
 Project Number: 000180200804.00

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID		PZ12S											
Description		19'-20'											
Sampled by:		TTL											
Sample Location:		PZ12S											
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
				1.40	3.46	2	0.3	0.2	0.1	0.0	92.0	8.0	

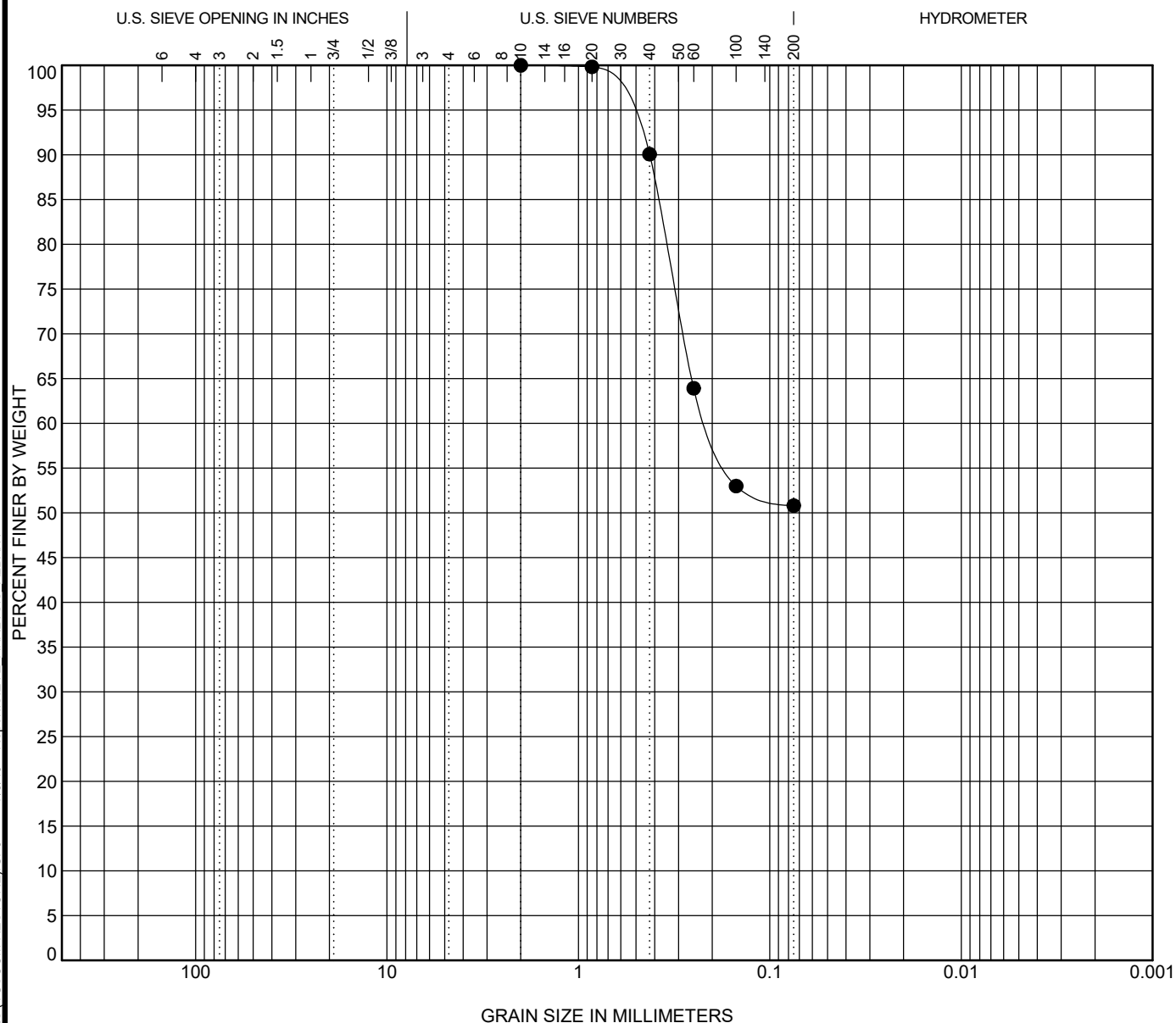
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SIEVE ANALYSIS RESULTS

Client:
 Project: Twin Pines Minerals Saunders-Loncala Reserve
 Location: Saint George, Georgia
 Project Number: 000180200804.00

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID		PZ12D											
Description		9'-19'											
Sampled by:		TTL											
Sample Location:		PZ12D											
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
						2	0.2			0.0	49.2	50.8	

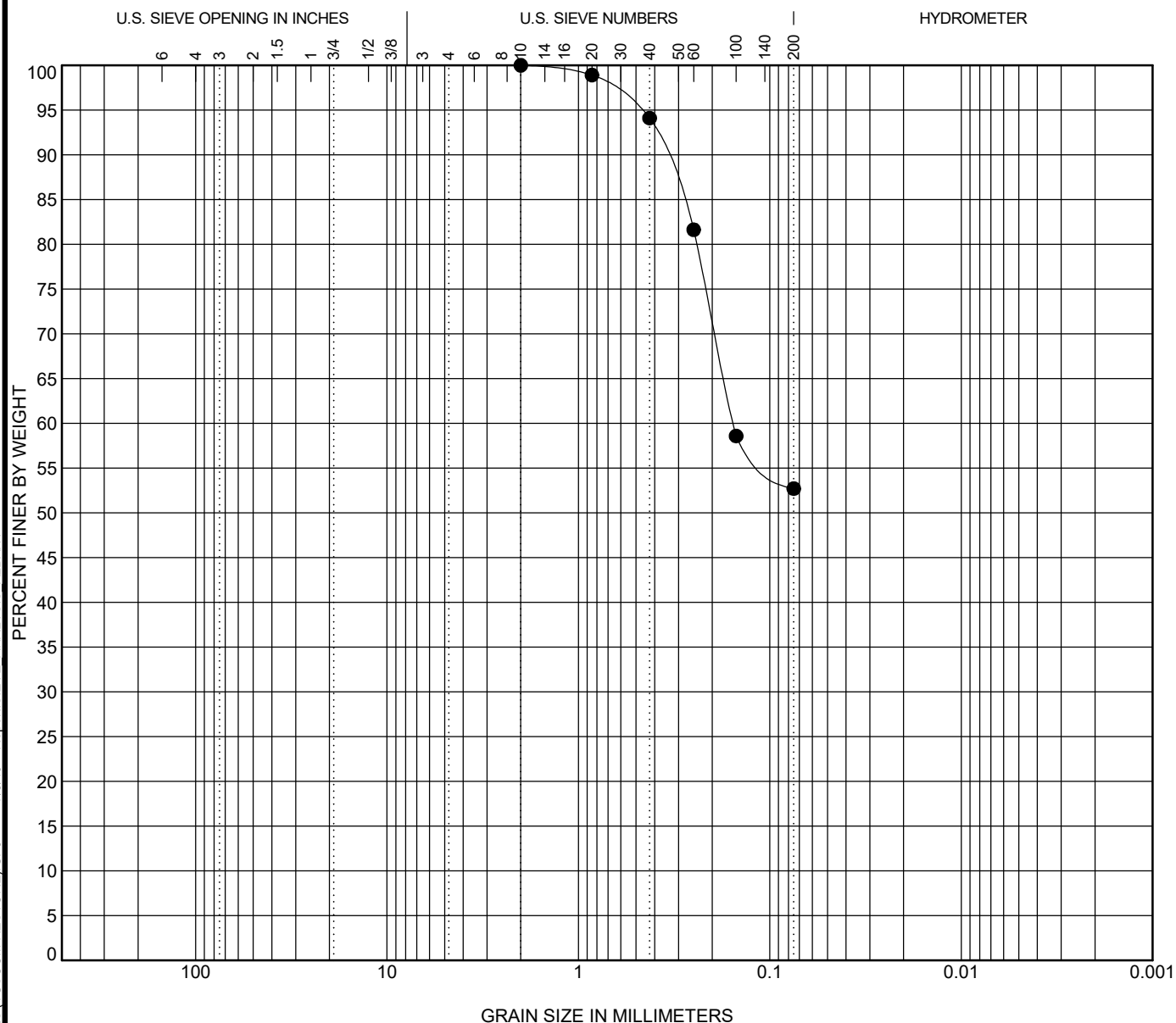
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SIEVE ANALYSIS RESULTS

Client:
 Project: Twin Pines Minerals Saunders-Loncala Reserve
 Location: Saint George, Georgia
 Project Number: 000180200804.00

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID		PZ12D											
Description		26'-40'											
Sampled by:		TTL											
Sample Location:		PZ12D											
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
						2	0.2			0.0	47.3	52.7	

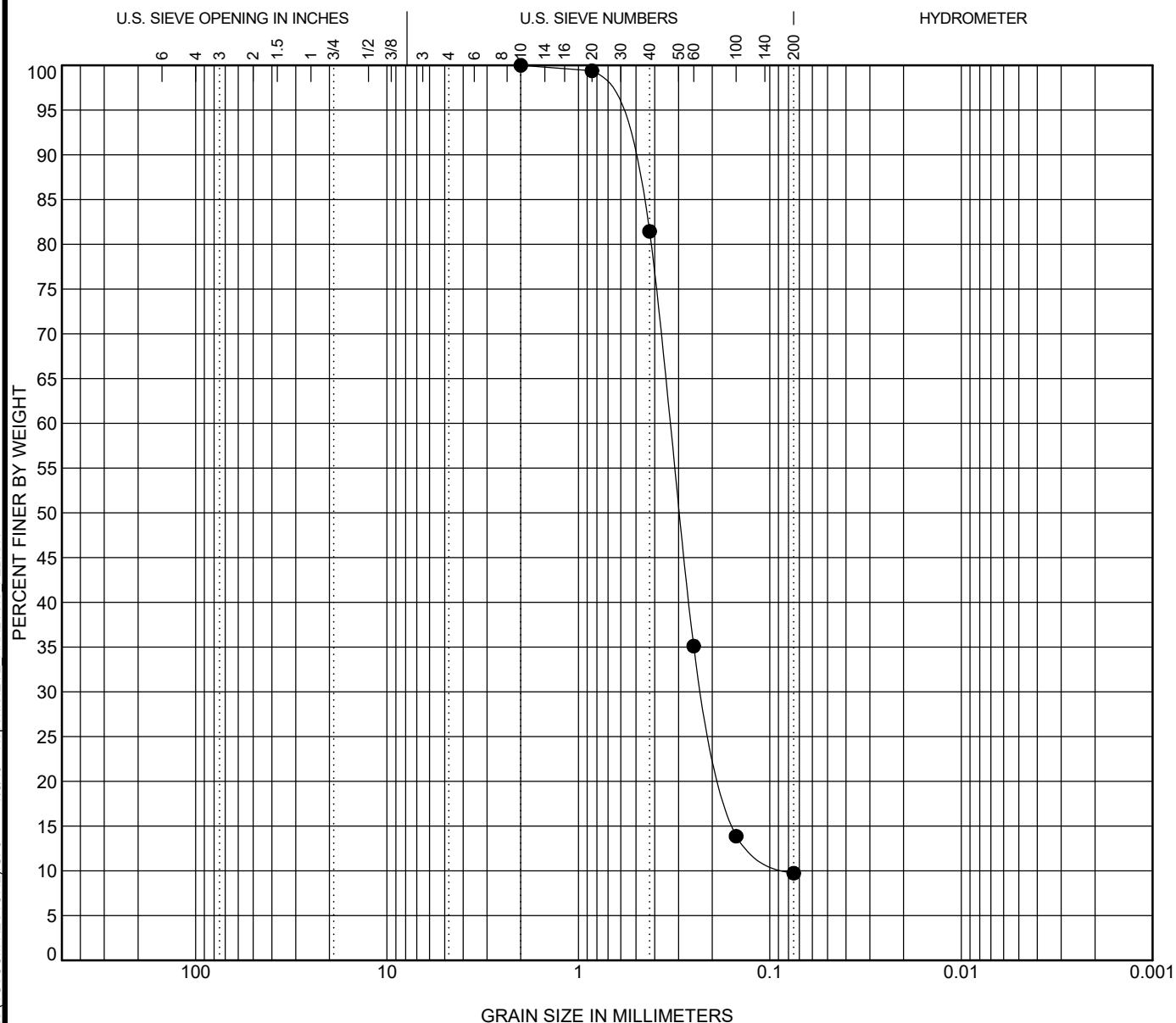
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SIEVE ANALYSIS RESULTS

Client:
 Project: Twin Pines Minerals Saunders-Loncala Reserve
 Location: Saint George, Georgia
 Project Number: 000180200804.00

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID		PZ13											
Description		5'-20'											
Sampled by:		TTL											
Sample Location:		PZ13											
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
				1.87	4.24	2	0.3	0.2	0.1	0.0	90.3	9.7	

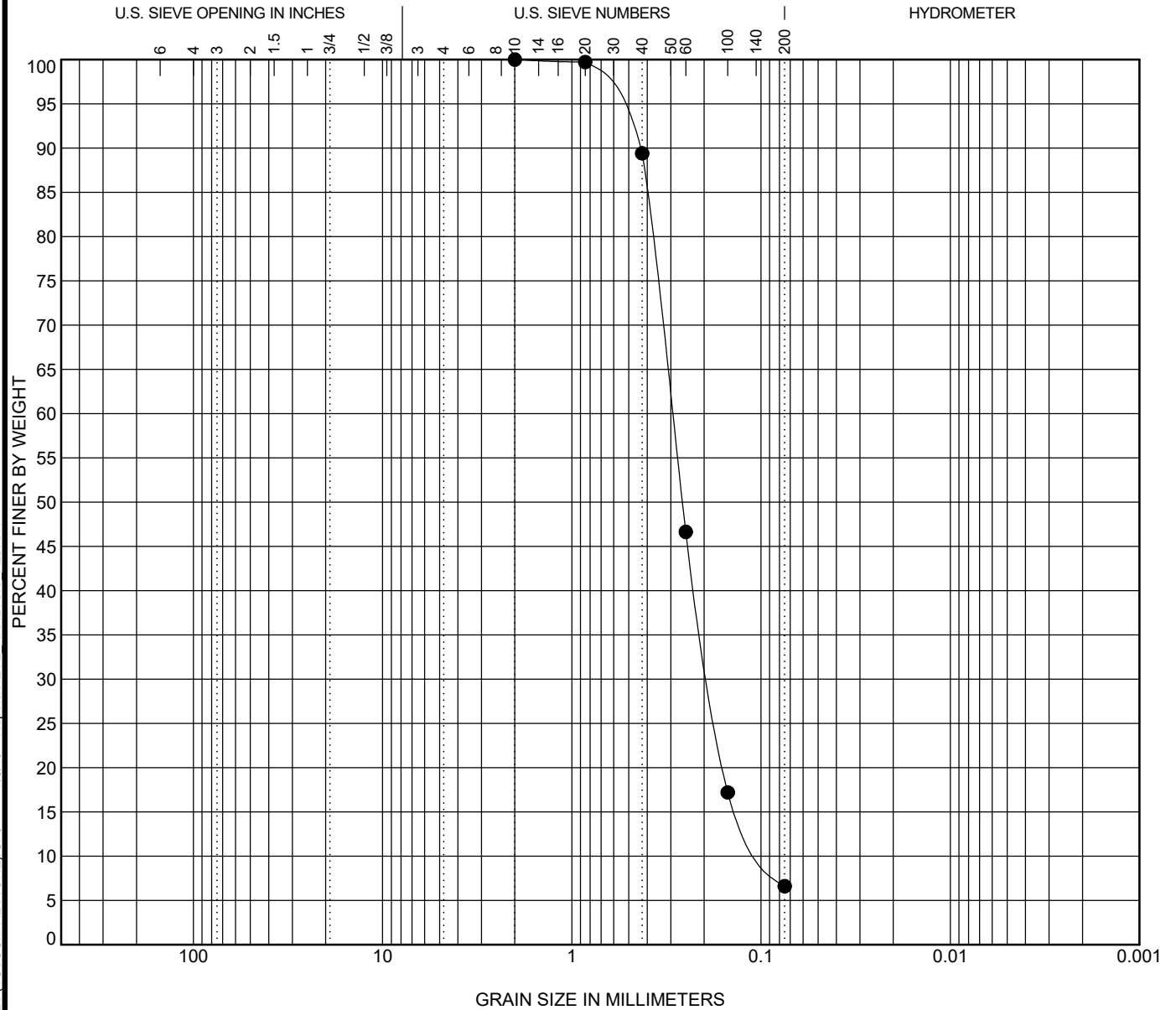
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SIEVE ANALYSIS RESULTS

Client:
 Project: Twin Pines Minerals Saunders-Loncala Reserve
 Location: Saint George, Georgia
 Project Number: 000180200804.00

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID		PZ13											
Description		27'-28'											
Sampled by:		TTL											
Sample Location:		PZ13											
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
				1.27	3.15	2	0.3	0.2	0.1	0.0	93.4	6.6	

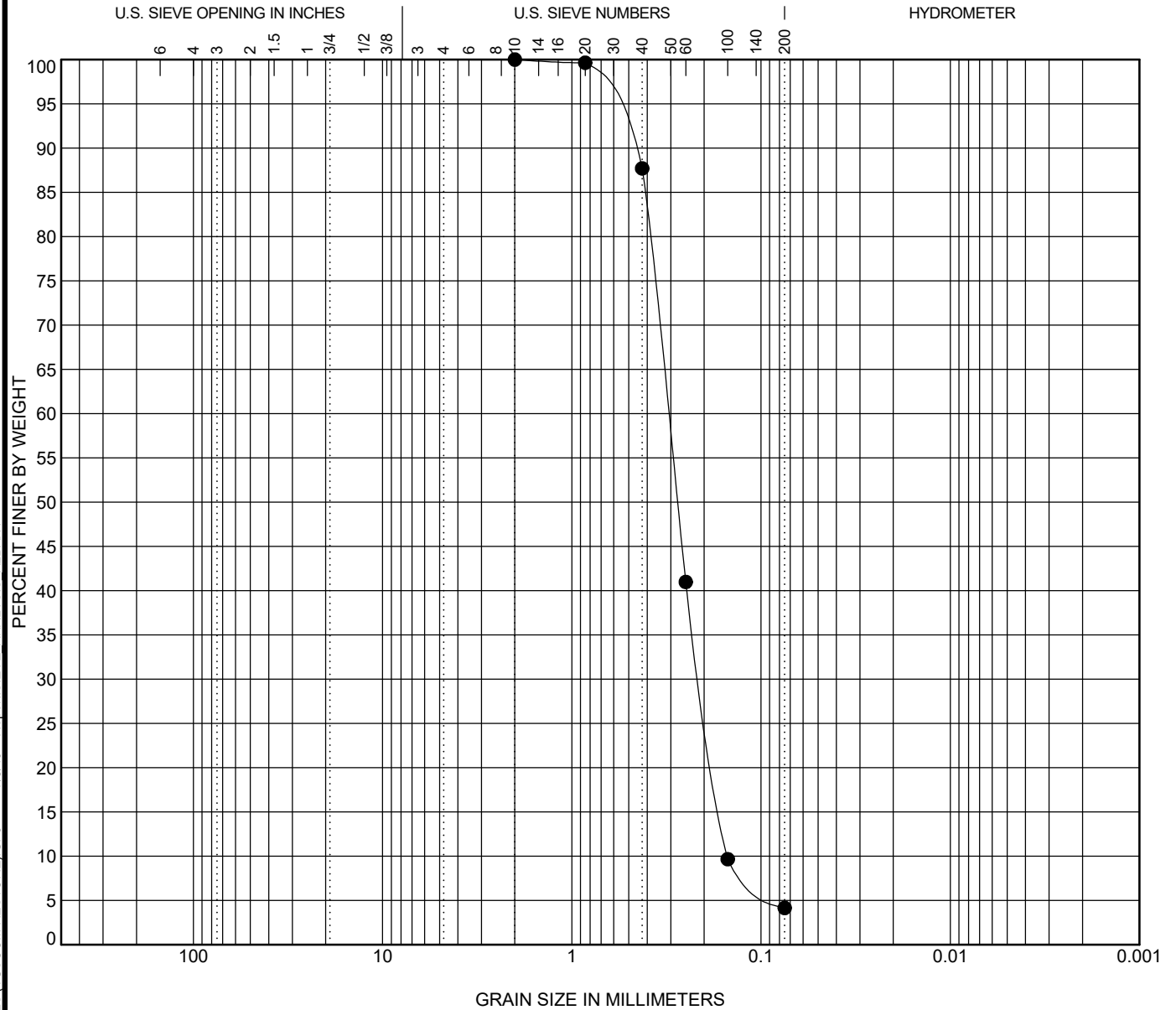
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SIEVE ANALYSIS RESULTS

Client:
 Project: Twin Pines Minerals Saunders-Loncala Reserve
 Location: Saint George, Georgia
 Project Number: 000180200804.00

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID		PZ14											
Description		3'-9"											
Sampled by:		TTL											
Sample Location:		PZ14											
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
				0.93	2.06	2	0.3	0.2	0.2	0.0	95.8	4.2	

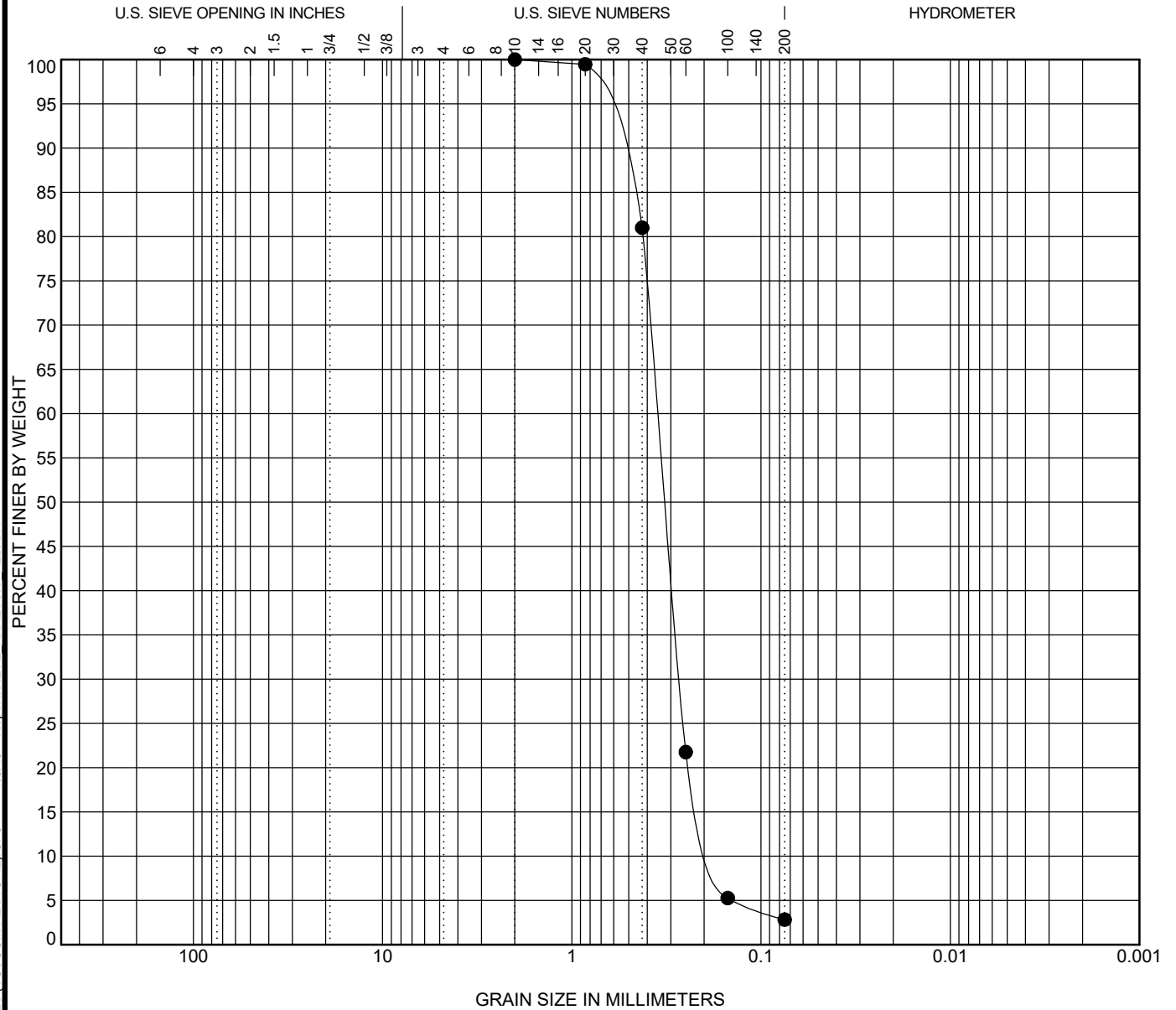
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SIEVE ANALYSIS RESULTS

Client:
 Project: Twin Pines Minerals Saunders-Loncala Reserve
 Location: Saint George, Georgia
 Project Number: 000180200804.00

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID		PZ14											
Description		27'-30'											
Sampled by:		TTL											
Sample Location:		PZ14											
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
				1.18	2.03	2	0.4	0.3	0.2	0.0	97.2	2.8	

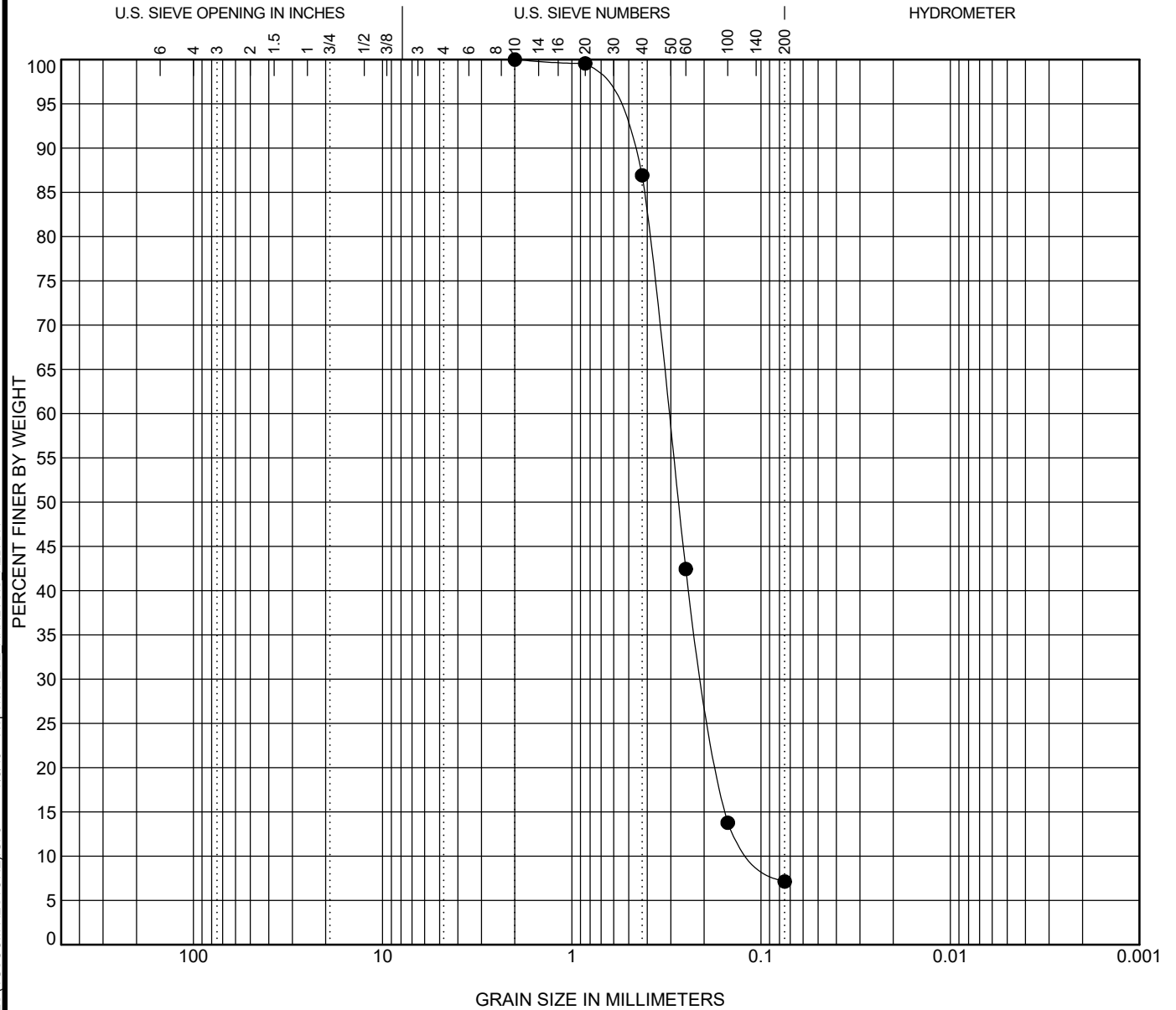
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SIEVE ANALYSIS RESULTS

Client:
Project: Twin Pines Minerals Saunders-Loncala Reserve
Location: Saint George, Georgia
Project Number: 000180200804.00

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID		PZ15											
Description		4'-5.5'											
Sampled by:		TTL											
Sample Location:		PZ15											
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
				1.29	3.05	2	0.3	0.2	0.1	0.0	92.9	7.1	

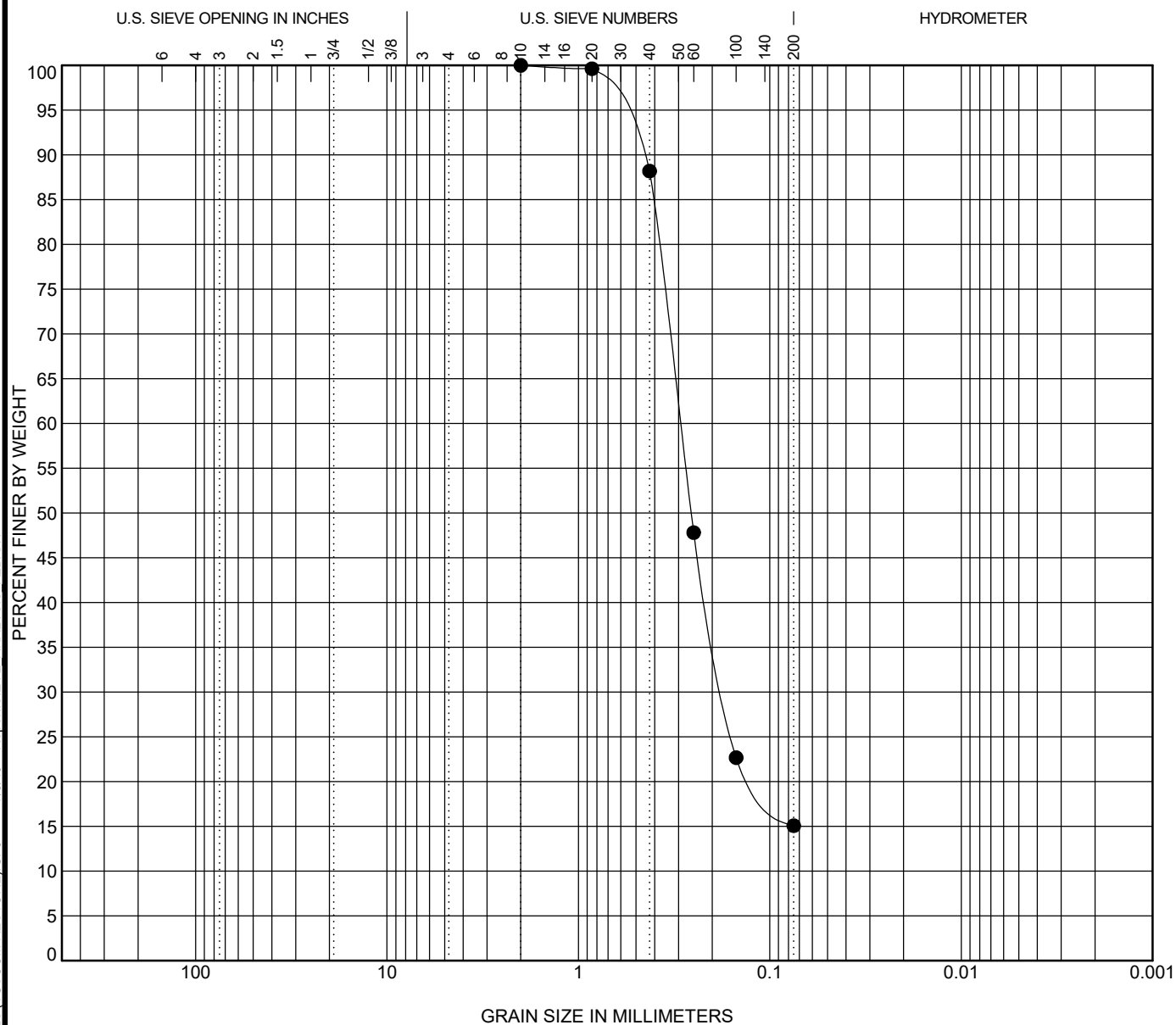


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SIEVE ANALYSIS RESULTS

Client:
 Project: Twin Pines Minerals Saunders-Loncala Reserve
 Location: Saint George, Georgia
 Project Number: 000180200804.00

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID		PZ15											
Description		6'-9"											
Sampled by:		TTL											
Sample Location:		PZ15											
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
						2	0.3	0.2		0.0	84.9	15.1	

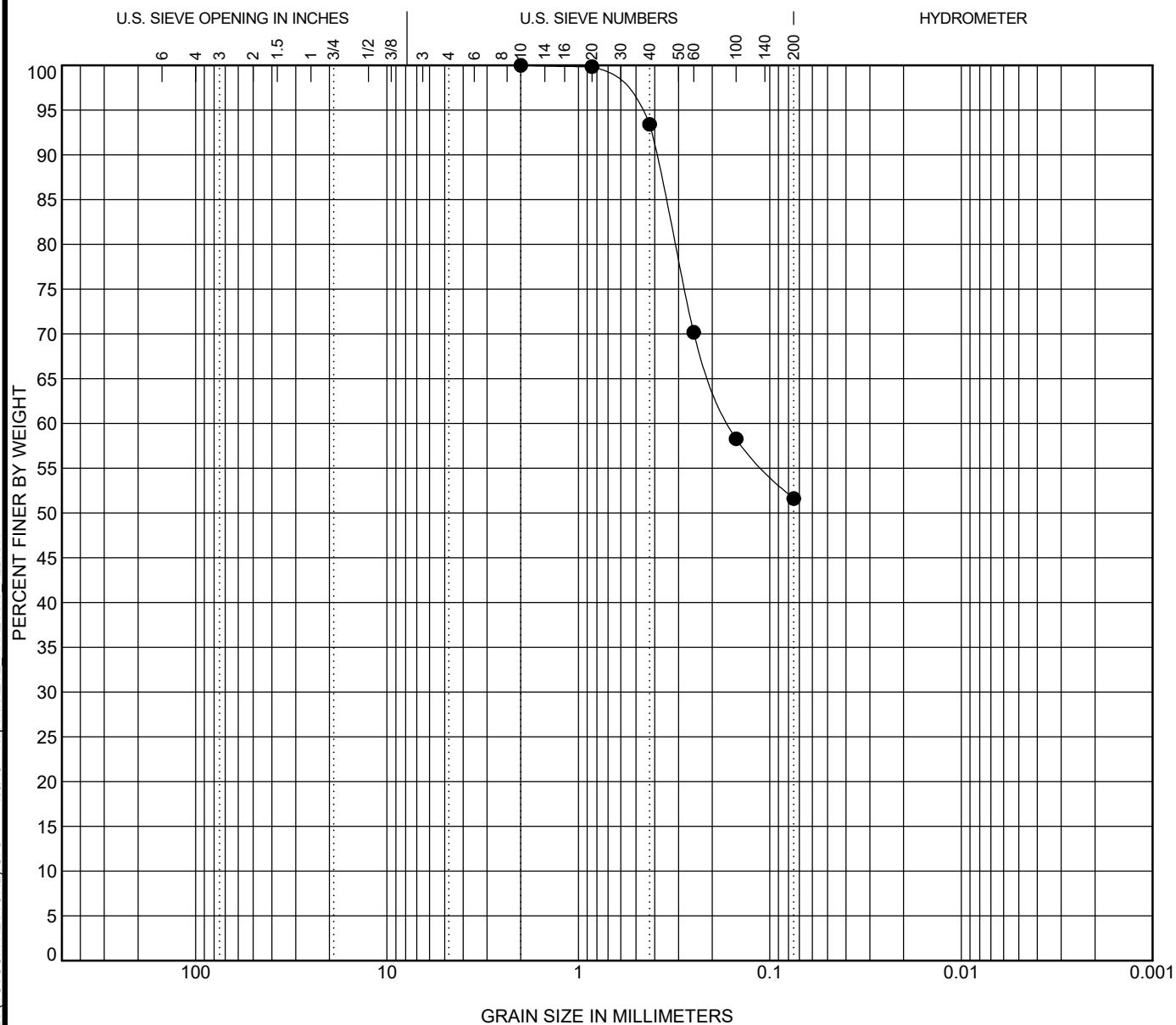
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SIEVE ANALYSIS RESULTS

Client:
 Project: Twin Pines Minerals Saunders-Loncala Reserve
 Location: Saint George, Georgia
 Project Number: 000180200804.00

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID		PZ15											
Description		9'-12'											
Sampled by:		TTL											
Sample Location:		PZ15											
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
						2	0.2			0.0	48.4	51.6	

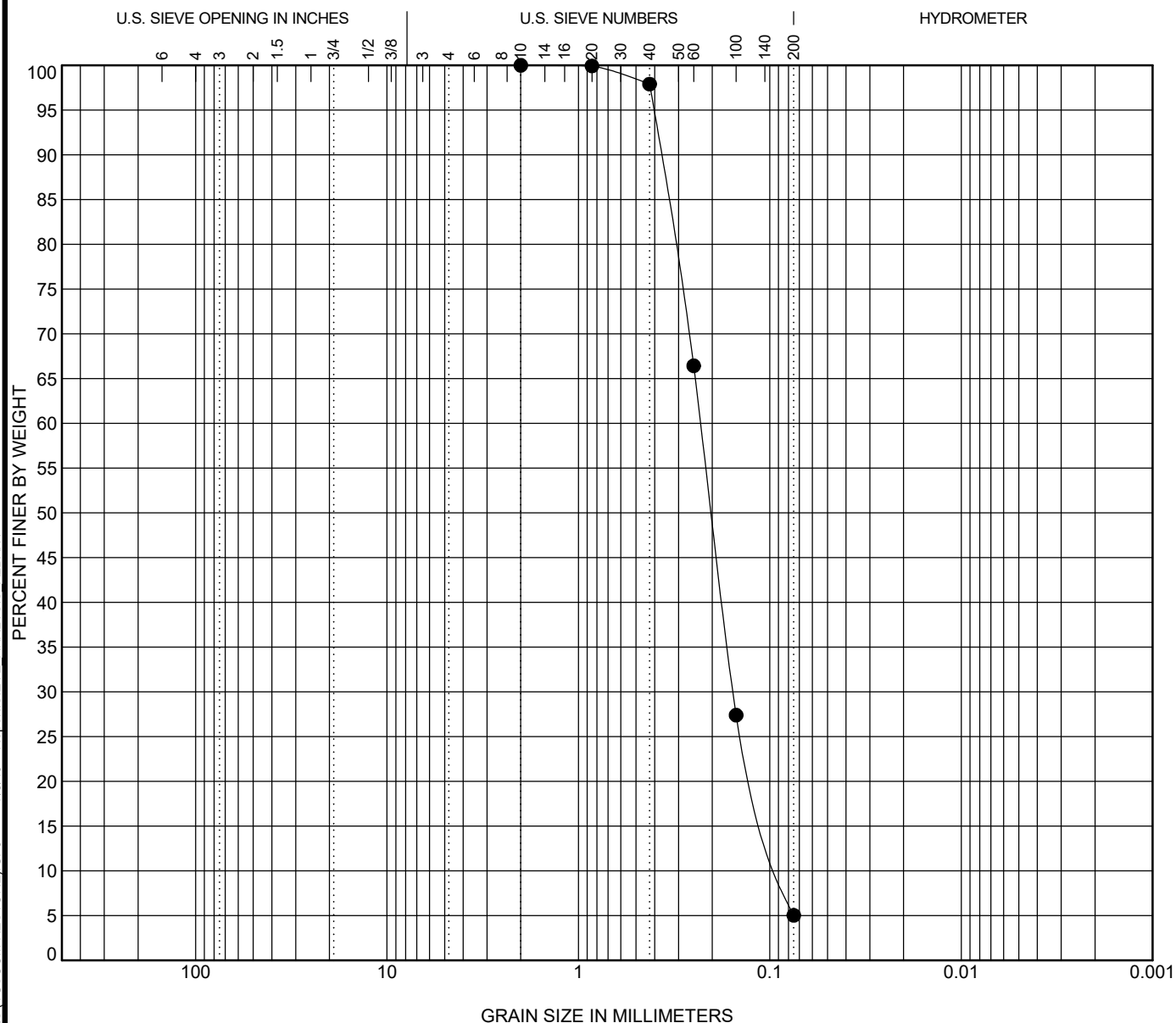
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SIEVE ANALYSIS RESULTS

Client:
 Project: Twin Pines Minerals Saunders-Loncala Reserve
 Location: Saint George, Georgia
 Project Number: 000180200804.00

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID		PZ15											
Description		12.5'-20'											
Sampled by:		TTL											
Sample Location:		PZ15											
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
				1.20	2.63	2	0.2	0.2	0.1	0.0	95.0	5.0	

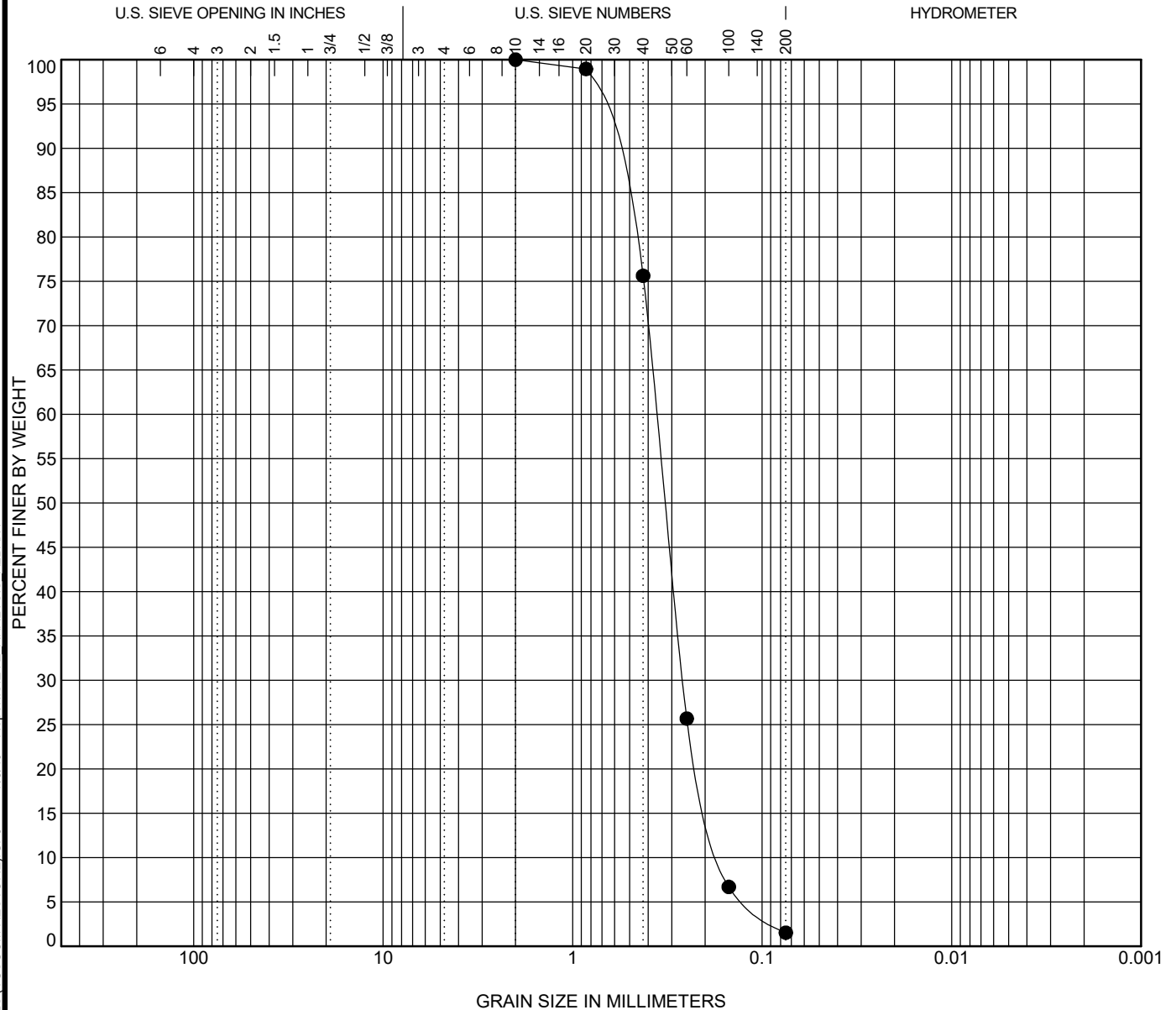
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SIEVE ANALYSIS RESULTS

Client:
 Project: Twin Pines Minerals Saunders-Loncala Reserve
 Location: Saint George, Georgia
 Project Number: 000180200804.00

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID		PZ15											
Description		28'-29'											
Sampled by:		TTL											
Sample Location:		PZ15											
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
				1.16	2.20	2	0.4	0.3	0.2	0.0	98.5	1.5	

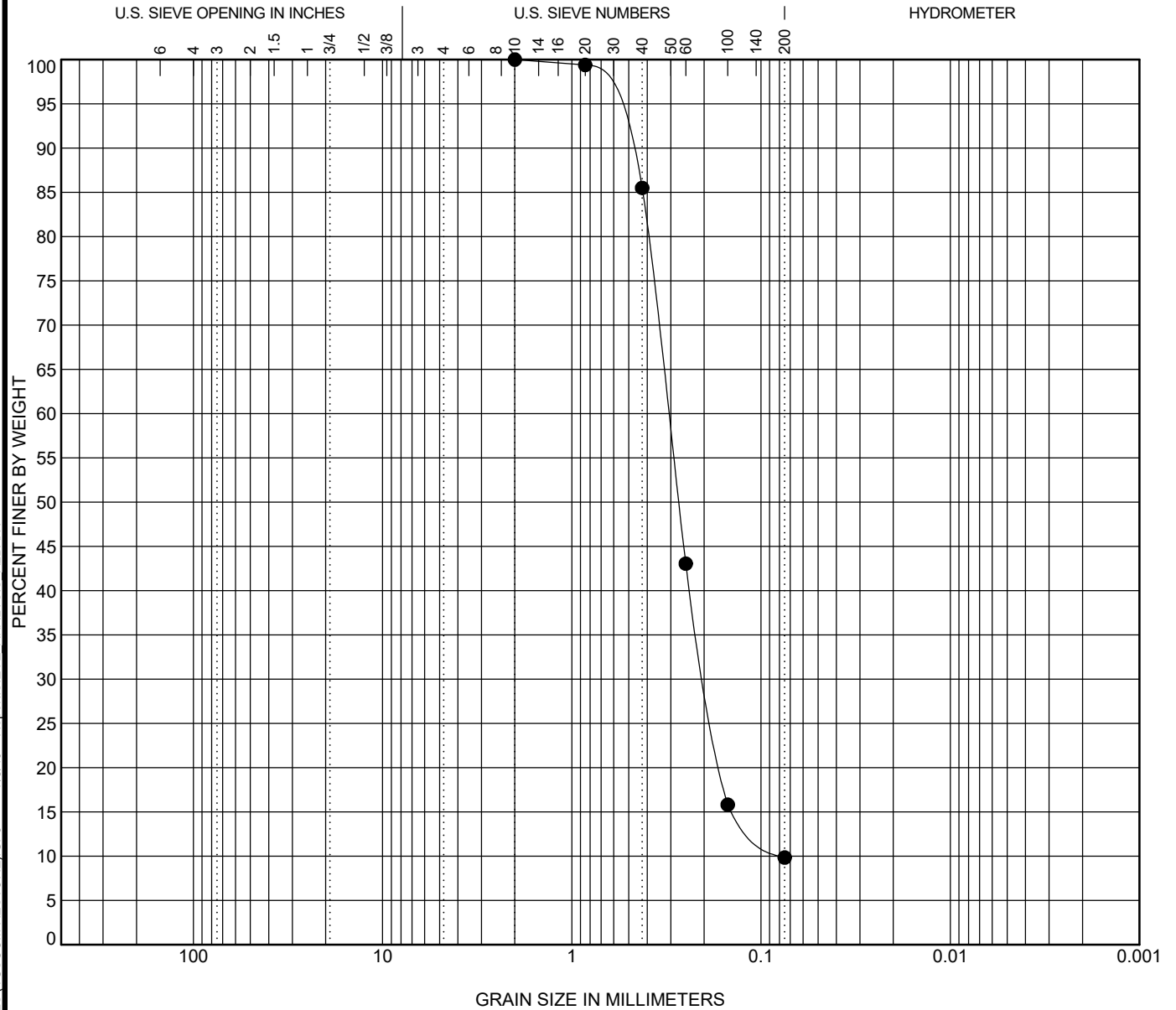
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SIEVE ANALYSIS RESULTS

Client:
Project: Twin Pines Minerals Saunders-Loncala Reserve
Location: Saint George, Georgia
Project Number: 000180200804.00

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID		PZ16S											
Description		5'-8'											
Sampled by:		TTL											
Sample Location:		PZ16S											
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
				1.62	4.05	2	0.3	0.2	0.1	0.0	90.2	9.8	

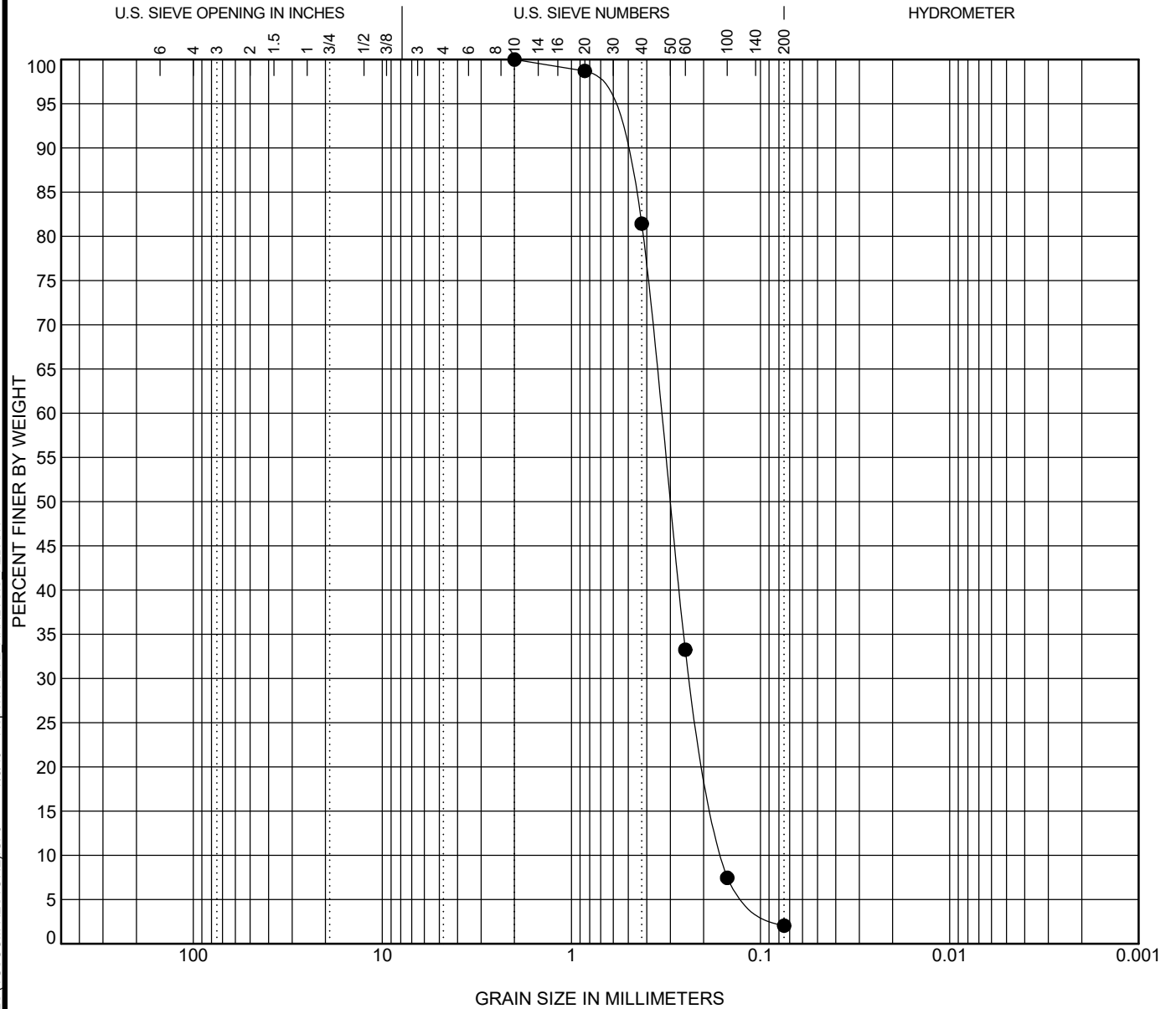
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SIEVE ANALYSIS RESULTS

Client:
Project: Twin Pines Minerals Saunders-Loncala Reserve
Location: Saint George, Georgia
Project Number: 000180200804.00

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID		PZ16S											
Description		18'-20'											
Sampled by:		TTL											
Sample Location:		PZ16S											
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
				1.04	2.13	2	0.3	0.2	0.2	0.0	98.0	2.0	



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SIEVE ANALYSIS RESULTS

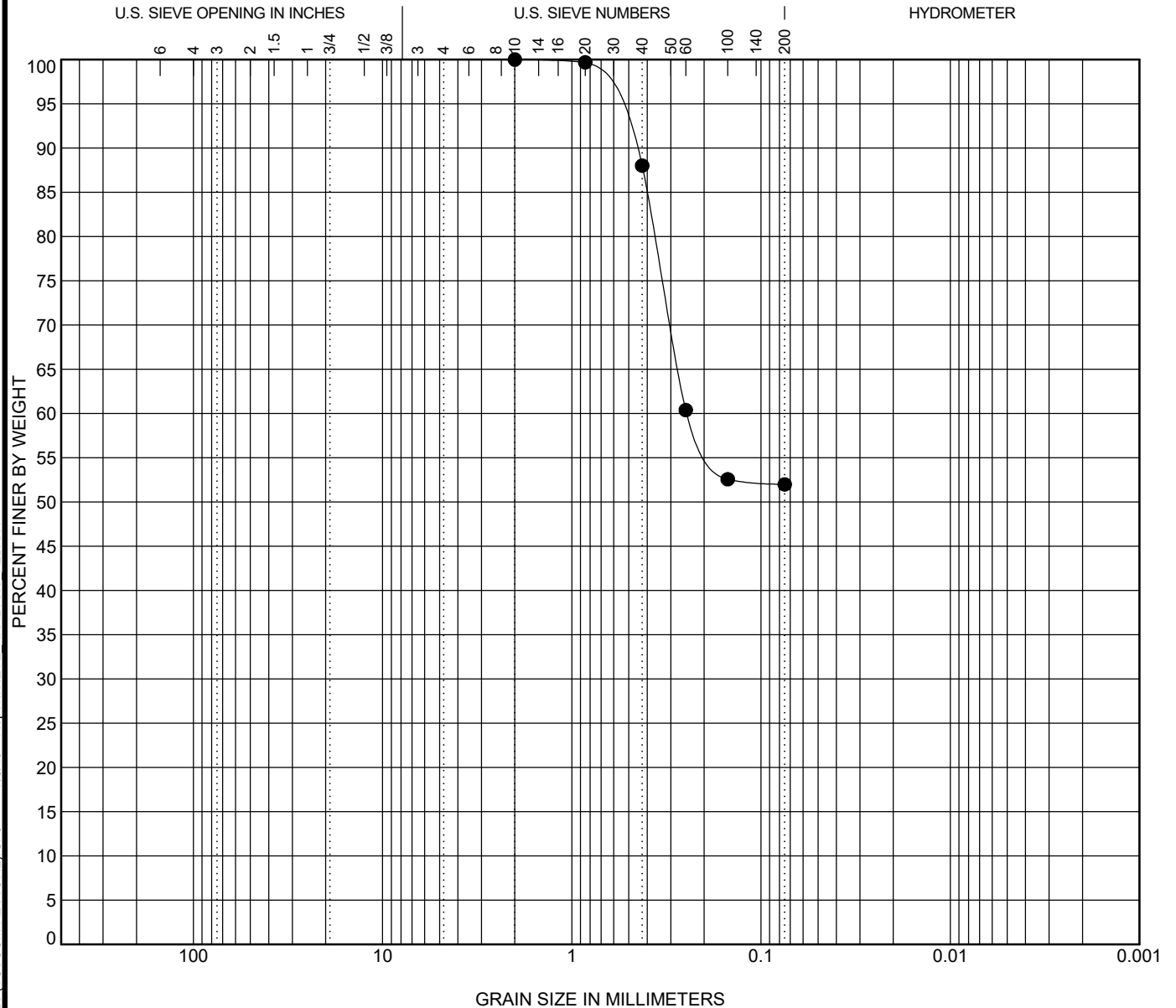
Client:

Project: Twin Pines Minerals Saunders-Loncala Reserve

Location: Saint George, Georgia

Project Number: 000180200804.00

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID		PZ16D											
Description		10'-19'											
Sampled by:		TTL											
Sample Location:		PZ16D											
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
						2	0.2			0.0	48.0	52.0	

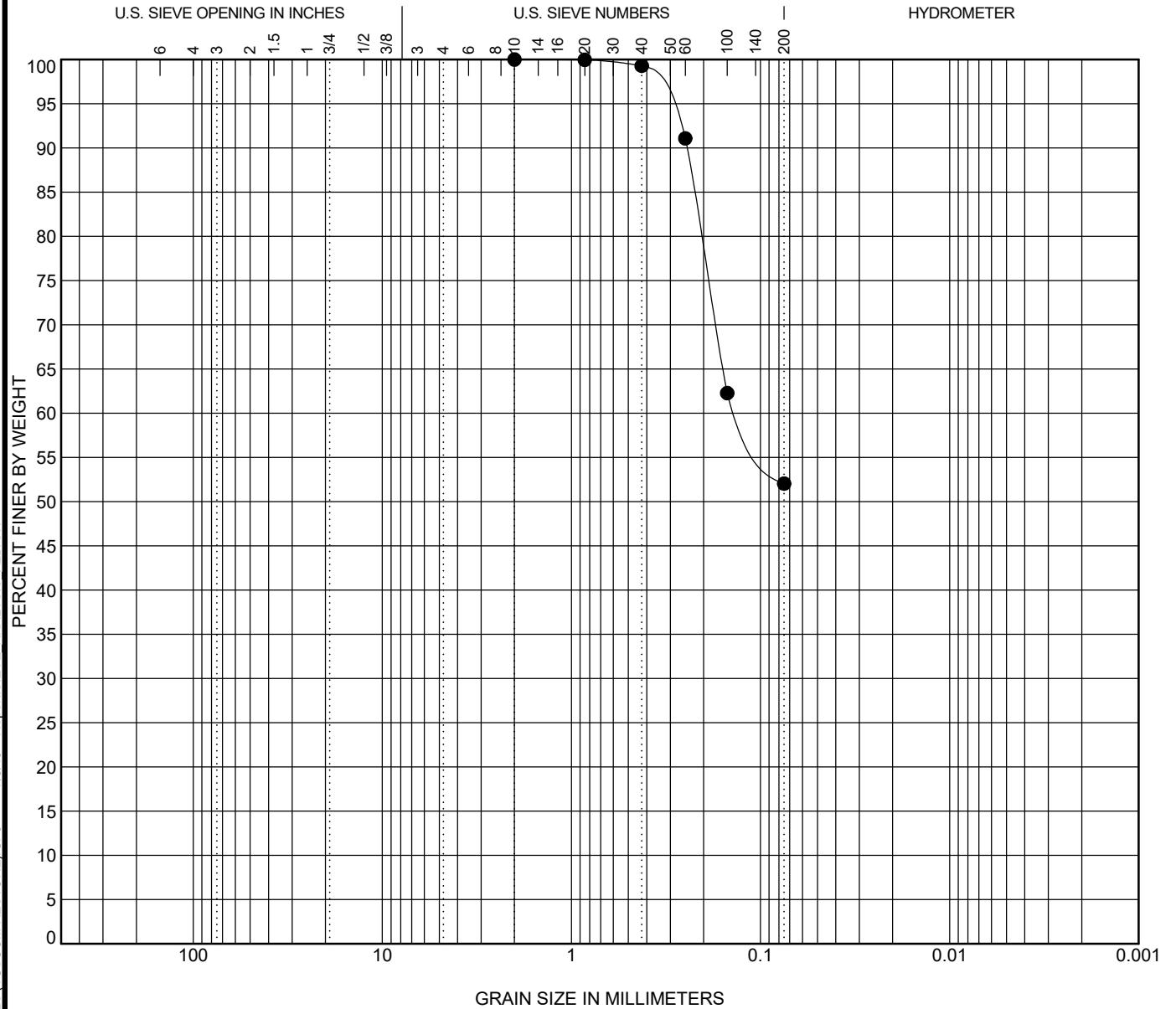


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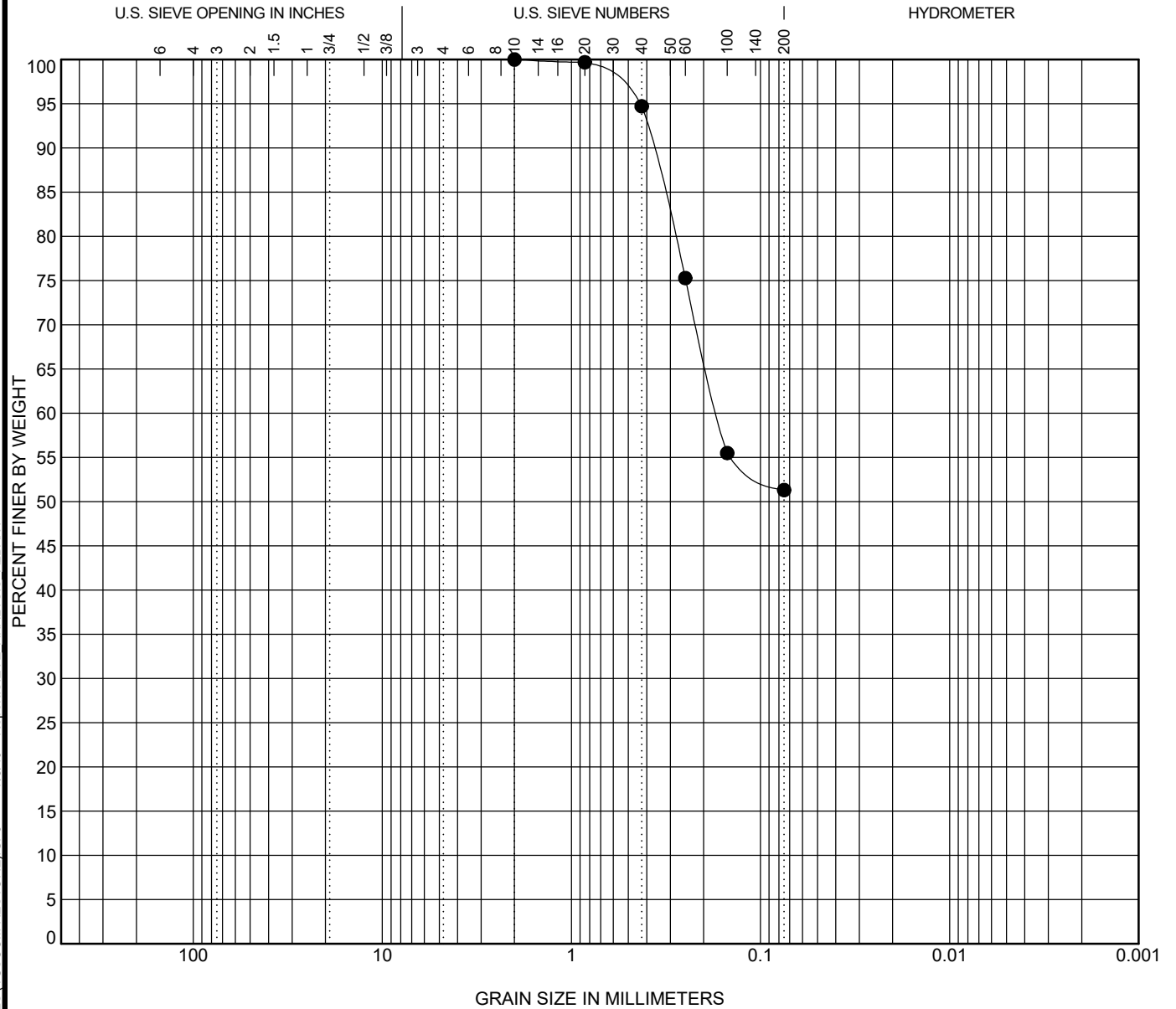
SIEVE ANALYSIS RESULTS

Client:
 Project: Twin Pines Minerals Saunders-Loncala Reserve
 Location: Saint George, Georgia
 Project Number: 000180200804.00

GRAIN SIZE DISTRIBUTION



GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID		PZ17S											
Description		9'-10'											
Sampled by:		TTL											
Sample Location:		PZ17S											
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
						2	0.2			0.0	48.7	51.3	

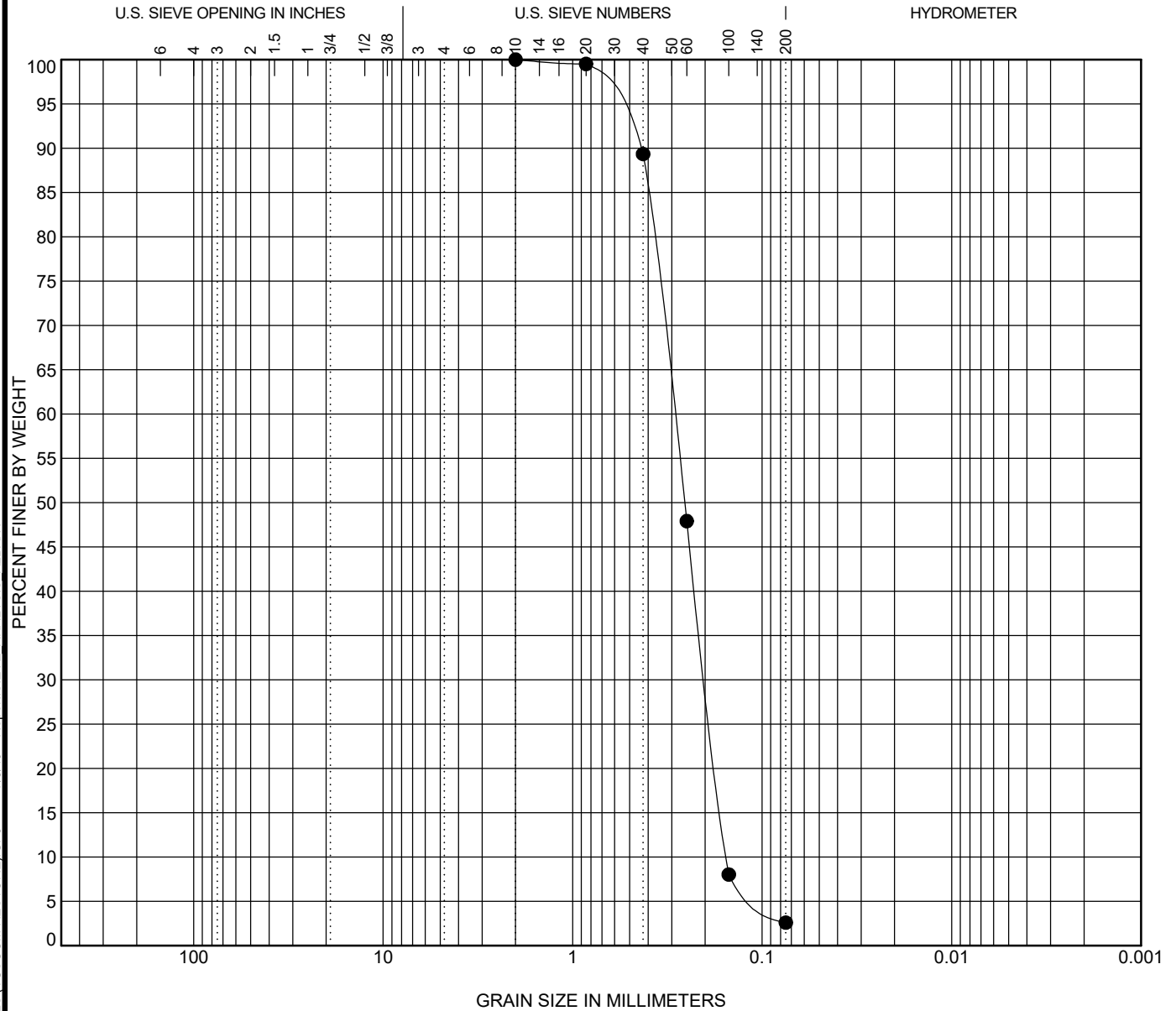


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SIEVE ANALYSIS RESULTS

Client: Twin Pines Minerals Saunders-Loncala Reserve
 Location: Saint George, Georgia
 Project Number: 000180200804.00

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID		PZ17D											
Description		8'-10'											
Sampled by:		TTL											
Sample Location:		PZ17D											
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
				0.88	1.90	2	0.3	0.2	0.2	0.0	97.4	2.6	

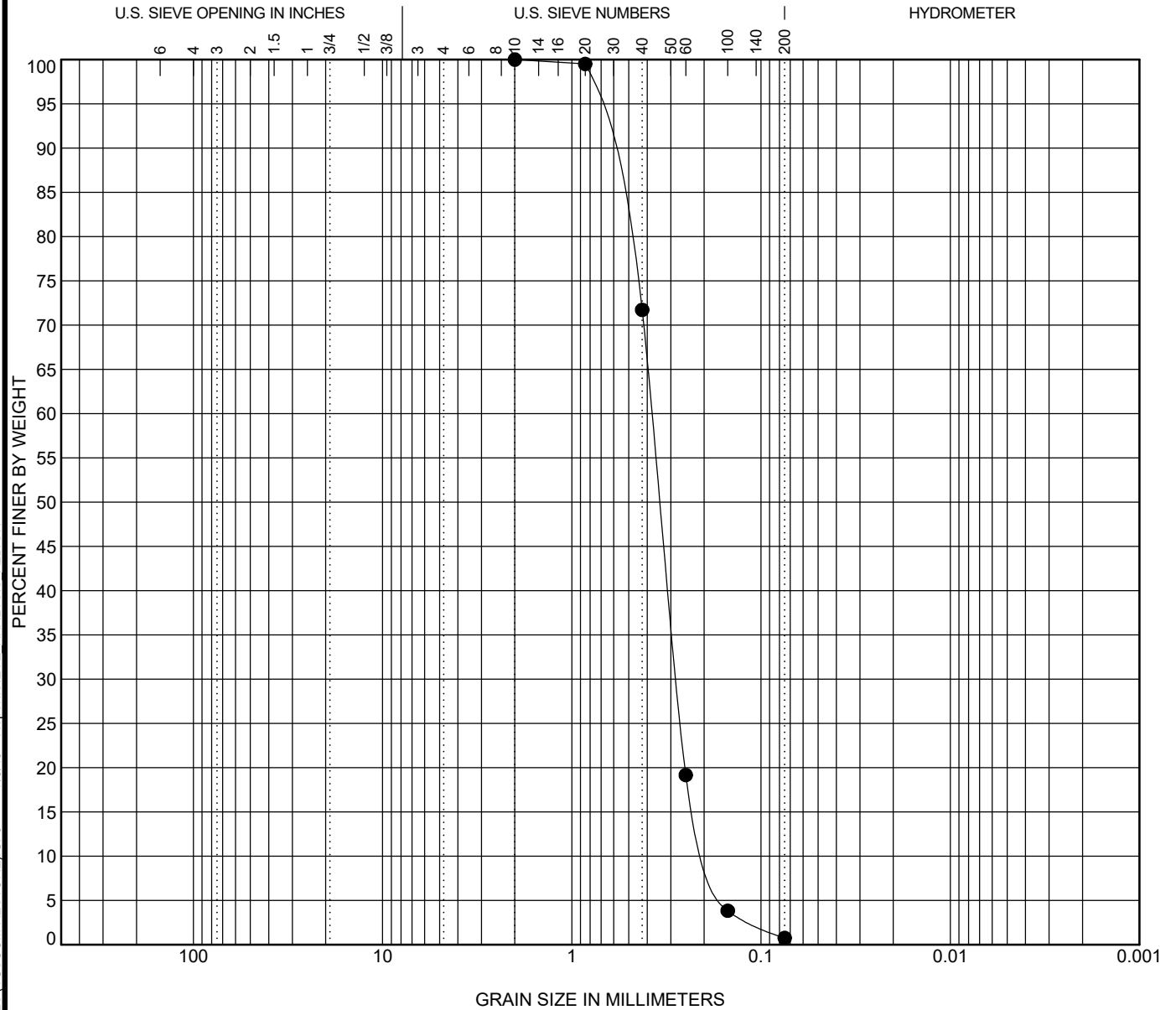
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SIEVE ANALYSIS RESULTS

Client:
 Project: Twin Pines Minerals Saunders-Loncala Reserve
 Location: Saint George, Georgia
 Project Number: 000180200804.00

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID		PZ17D											
Description		40'-49'											
Sampled by:		TTL											
Sample Location:		PZ17D											
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
				1.12	2.05	2	0.4	0.3	0.2	0.0	99.2	0.8	

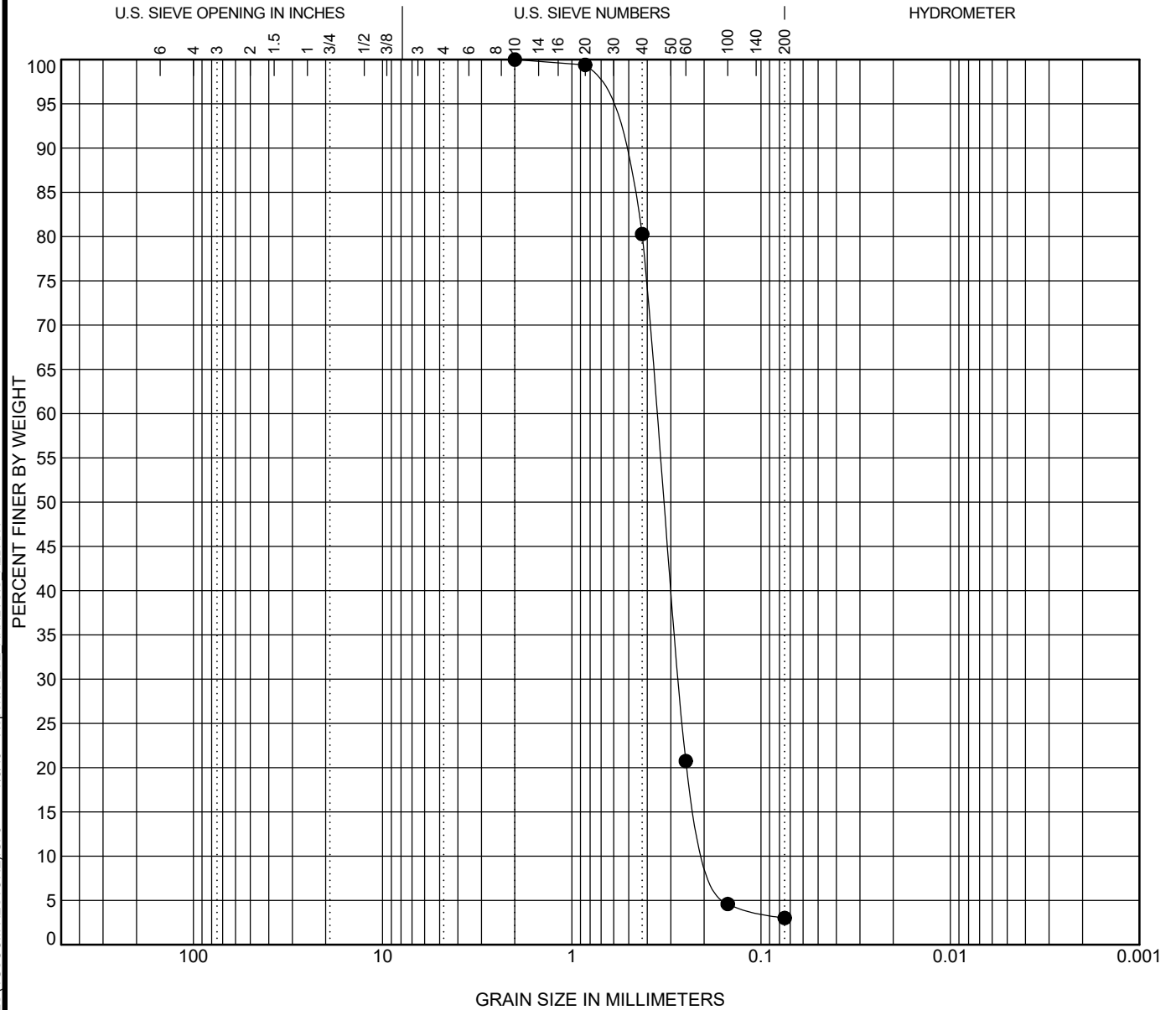
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SIEVE ANALYSIS RESULTS

Client:
Project: Twin Pines Minerals Saunders-Loncala Reserve
Location: Saint George, Georgia
Project Number: 000180200804.00

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID		PZ18											
Description		13'-18'											
Sampled by:		TTL											
Sample Location:		PZ18											
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
				1.17	1.99	2	0.4	0.3	0.2	0.0	97.0	3.0	

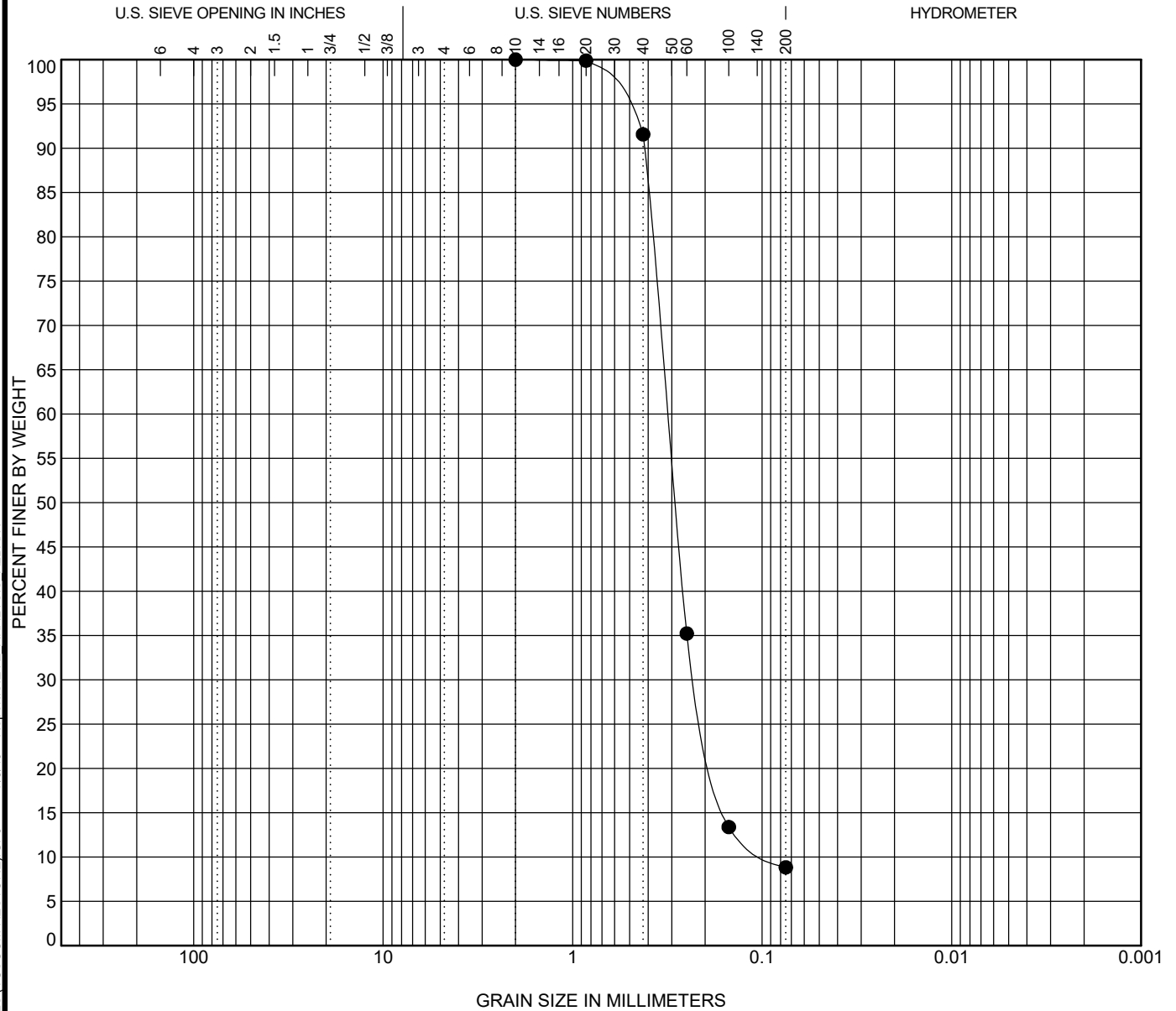
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SIEVE ANALYSIS RESULTS

Client:
Project: Twin Pines Minerals Saunders-Loncala Reserve
Location: Saint George, Georgia
Project Number: 000180200804.00

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID		PZ18											
Description		18'-20'											
Sampled by:		TTL											
Sample Location:		PZ18											
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
				1.73	3.52	2	0.3	0.2	0.1	0.0	91.2	8.8	

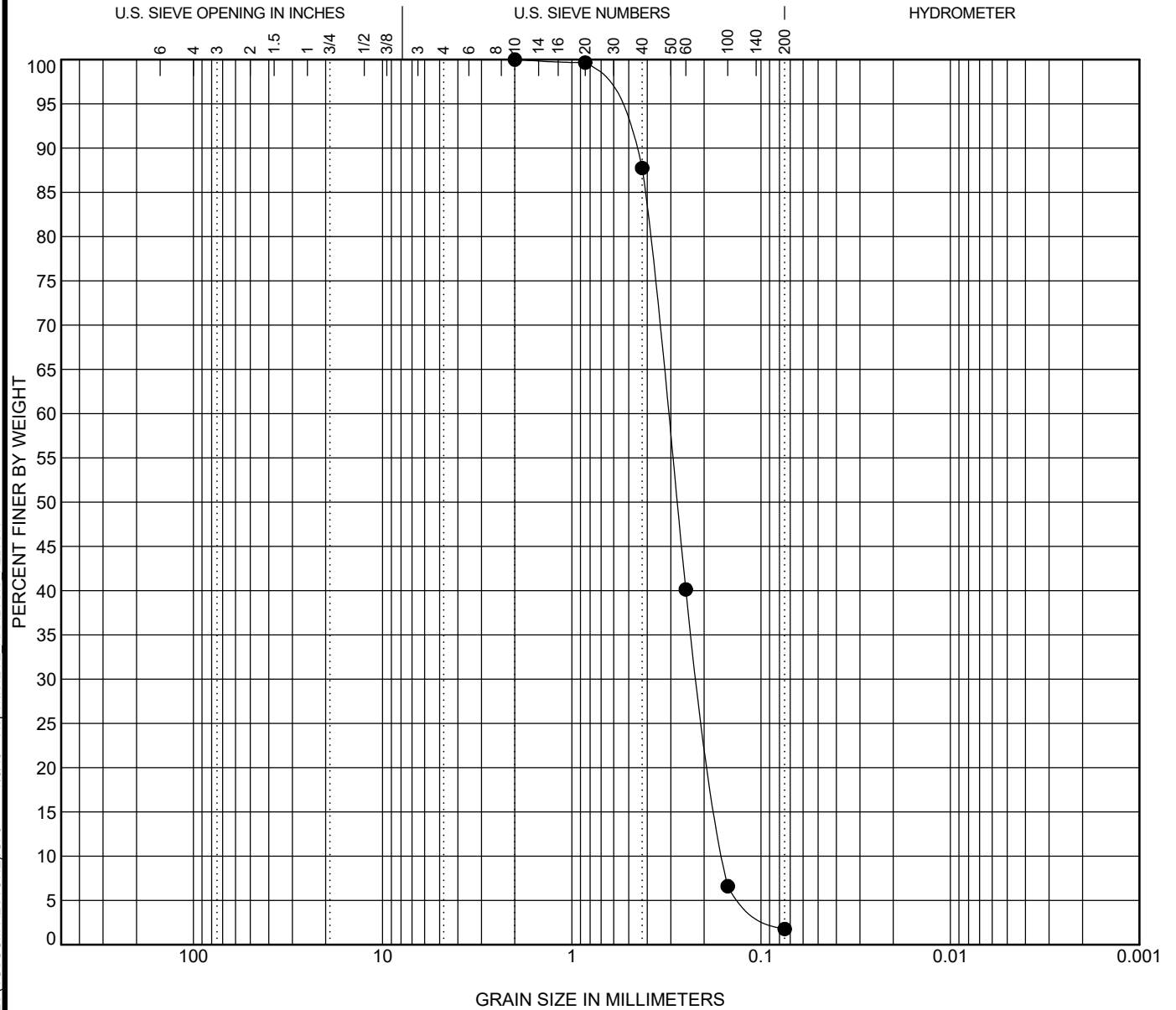


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SIEVE ANALYSIS RESULTS

Client:
 Project: Twin Pines Minerals Saunders-Loncala Reserve
 Location: Saint George, Georgia
 Project Number: 000180200804.00

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID		PZ19											
Description		6'-13'											
Sampled by:		TTL											
Sample Location:		PZ19											
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
				0.93	1.97	2	0.3	0.2	0.2	0.0	98.2	1.8	

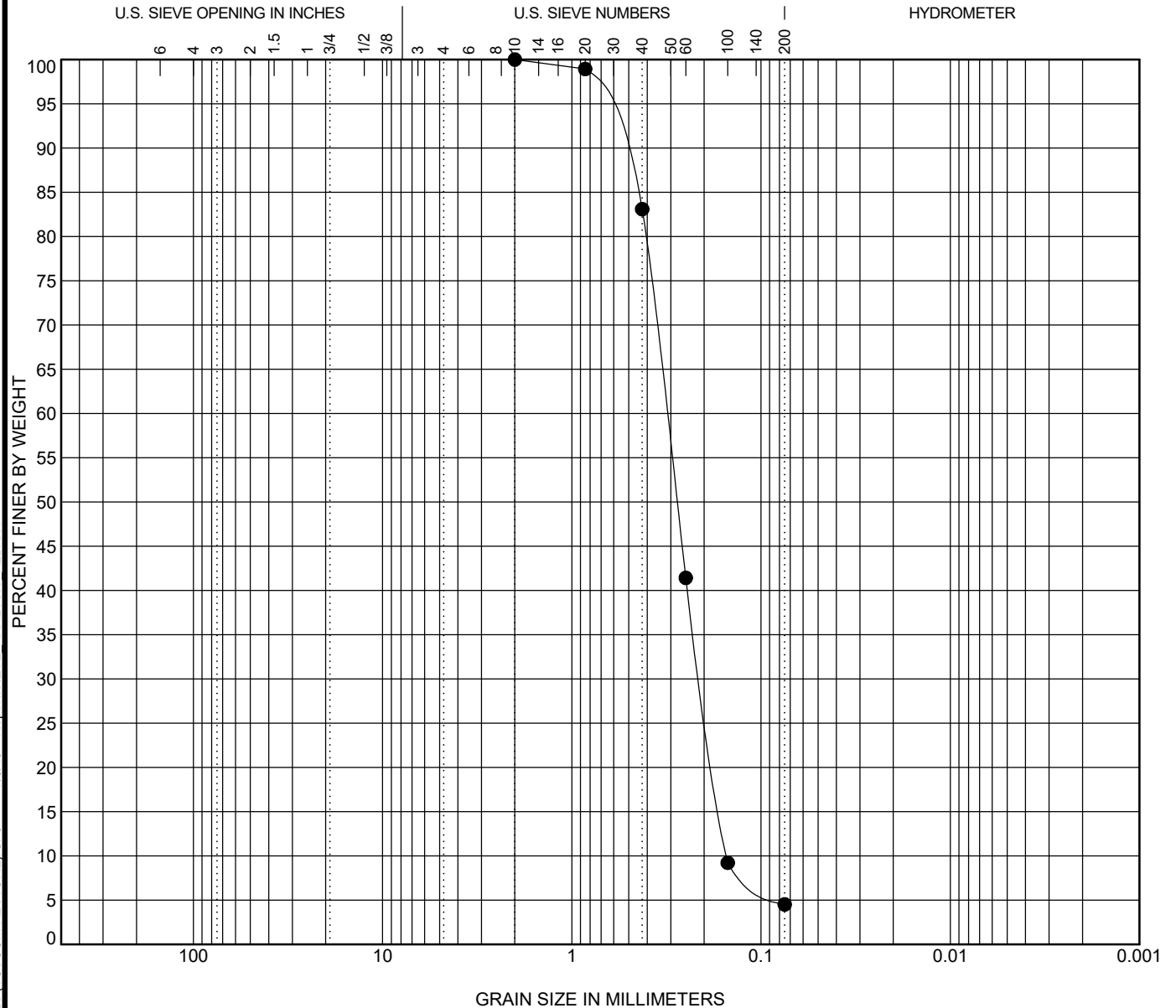
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SIEVE ANALYSIS RESULTS

Client:
 Project: Twin Pines Minerals Saunders-Loncala Reserve
 Location: Saint George, Georgia
 Project Number: 000180200804.00

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID		PZ19											
Description		13'-18'											
Sampled by:		TTL											
Sample Location:		PZ19											
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
				0.90	2.09	2	0.3	0.2	0.2	0.0	95.5	4.5	

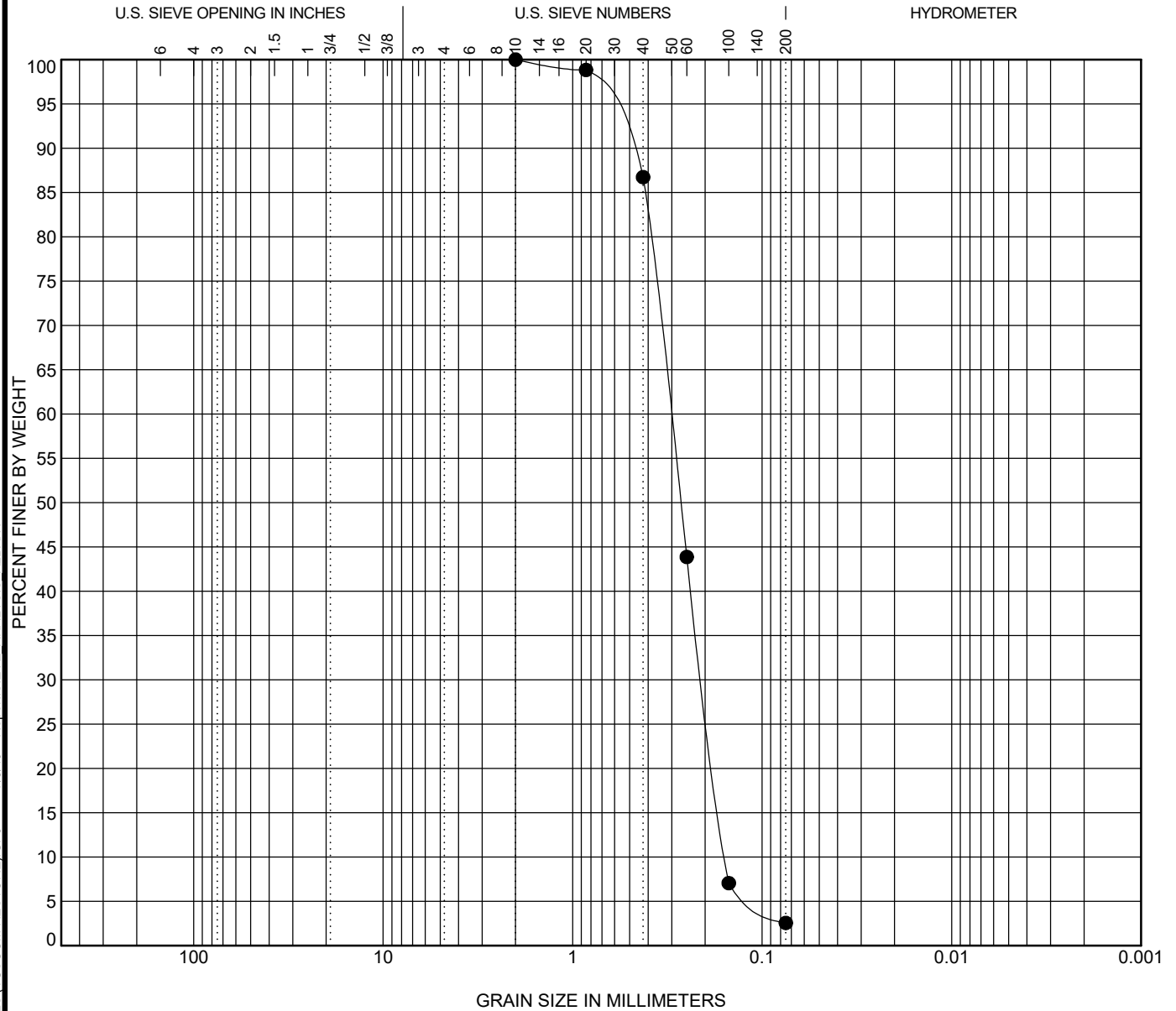
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SIEVE ANALYSIS RESULTS

Client:
 Project: Twin Pines Minerals Saunders-Loncala Reserve
 Location: Saint George, Georgia
 Project Number: 000180200804.00

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID		PZ20D											
Description		7'-16'											
Sampled by:		TTL											
Sample Location:		PZ20D											
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
				0.89	1.95	2	0.3	0.2	0.2	0.0	97.4	2.6	

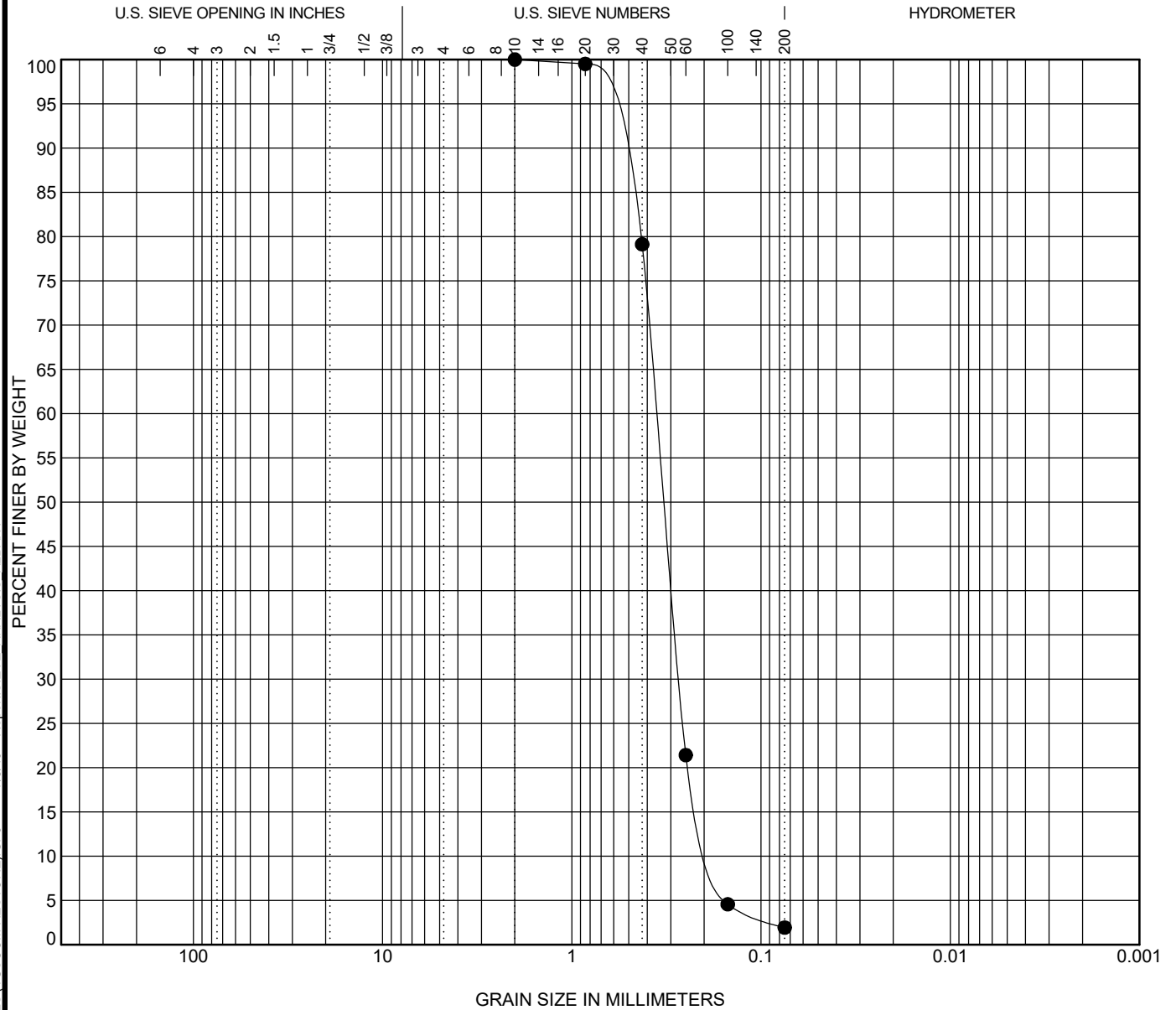


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SIEVE ANALYSIS RESULTS

Client:
 Project: Twin Pines Minerals Saunders-Loncala Reserve
 Location: Saint George, Georgia
 Project Number: 000180200804.00

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID		PZ20D											
Description		33'-40'											
Sampled by:		TTL											
Sample Location:		PZ20D											
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
				1.16	2.02	2	0.4	0.3	0.2	0.0	98.1	1.9	

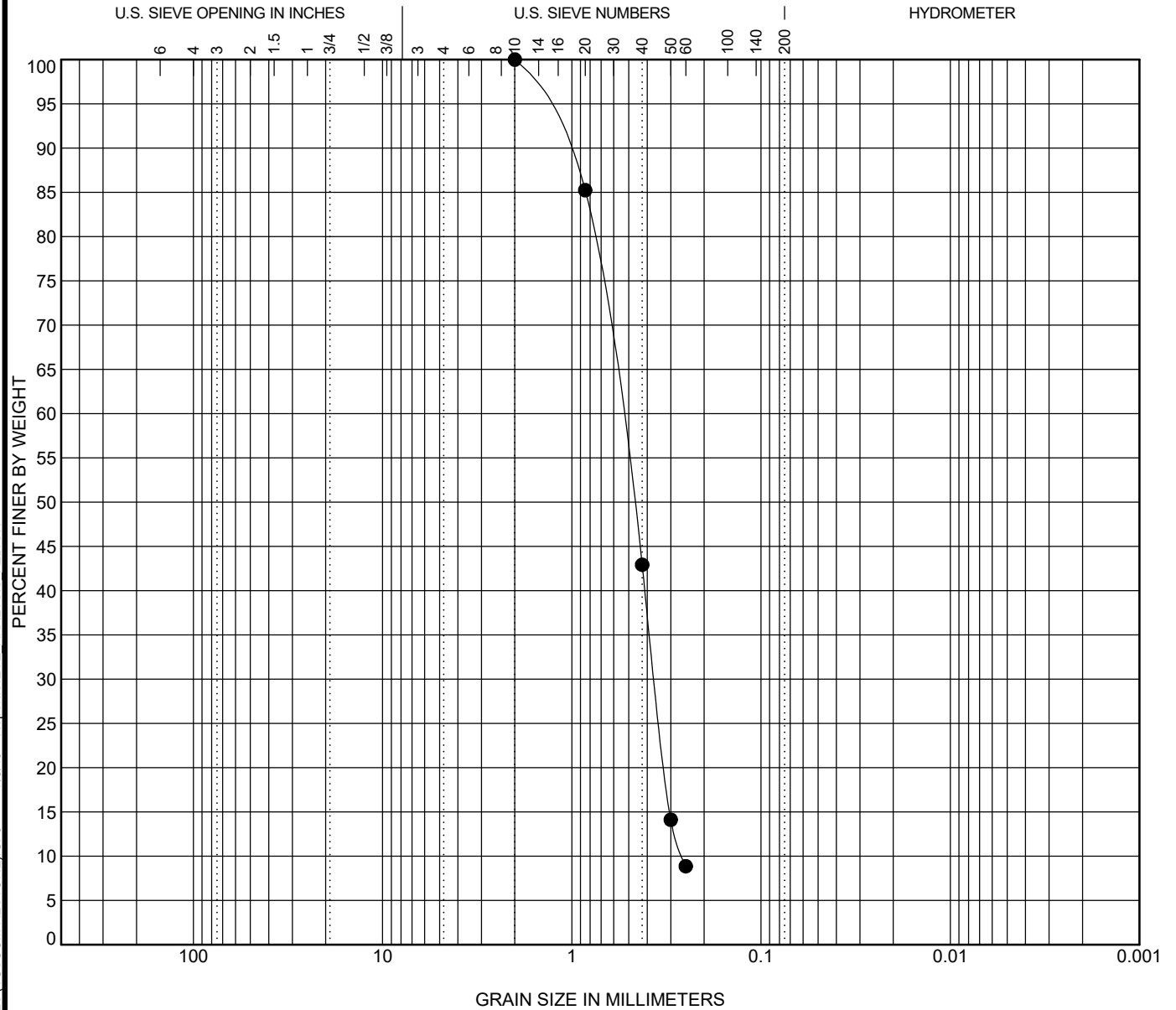
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SIEVE ANALYSIS RESULTS

Client:
 Project: Twin Pines Minerals Saunders-Loncala Reserve
 Location: Saint George, Georgia
 Project Number: 000180200804.00

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID		PZ21											
Description		3'-5'											
Sampled by:		TTL											
Sample Location:		PZ21											
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
				0.90	2.16	2	0.6	0.4	0.3	0.0			

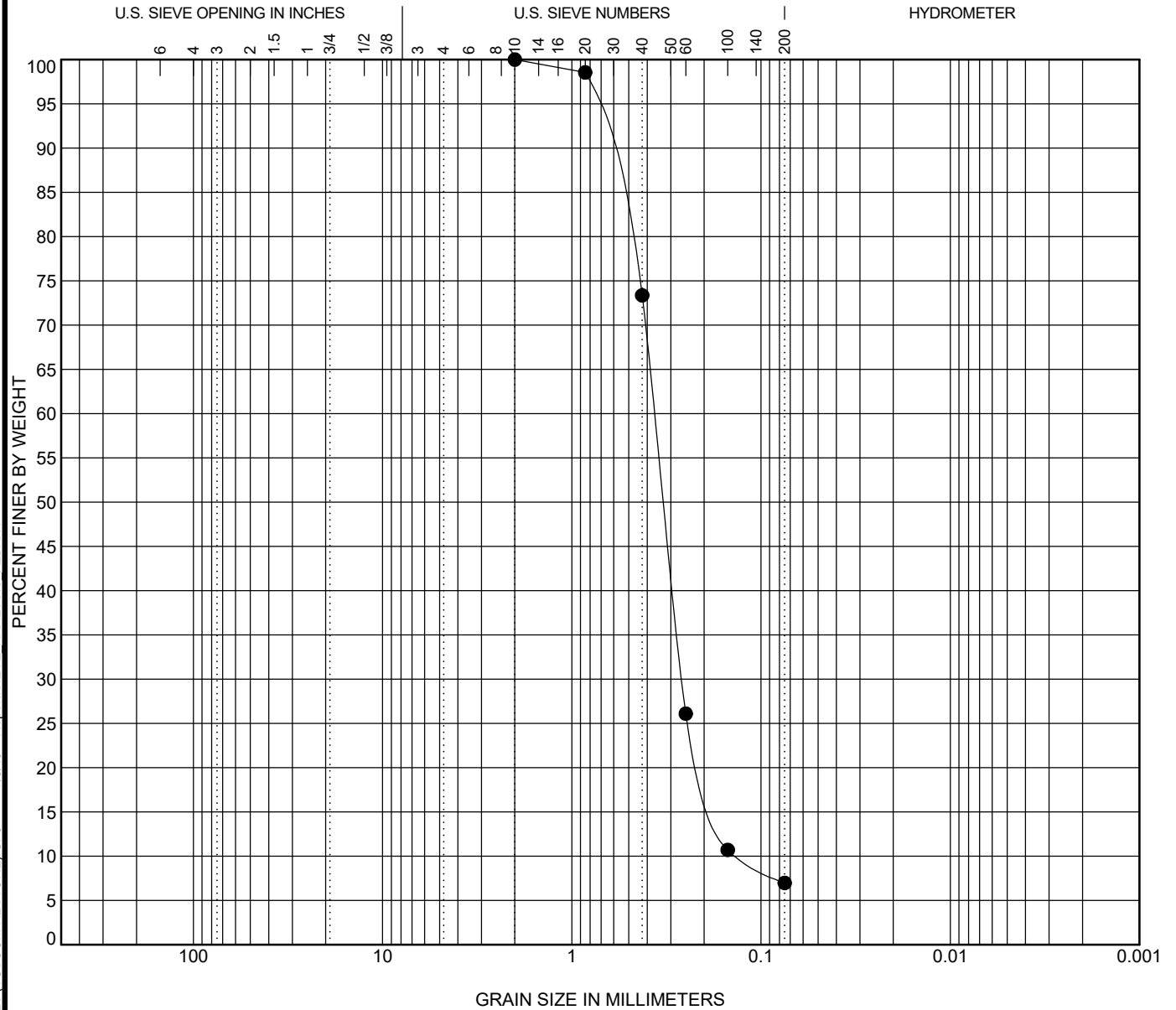
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SIEVE ANALYSIS RESULTS

Client:
 Project: Twin Pines Minerals Saunders-Loncala Reserve
 Location: Saint George, Georgia
 Project Number: 000180200804.00

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID		PZ21											
Description		6'-17'											
Sampled by:		TTL											
Sample Location:		PZ21											
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
				1.42	2.78	2	0.4	0.3	0.1	0.0	93.0	7.0	

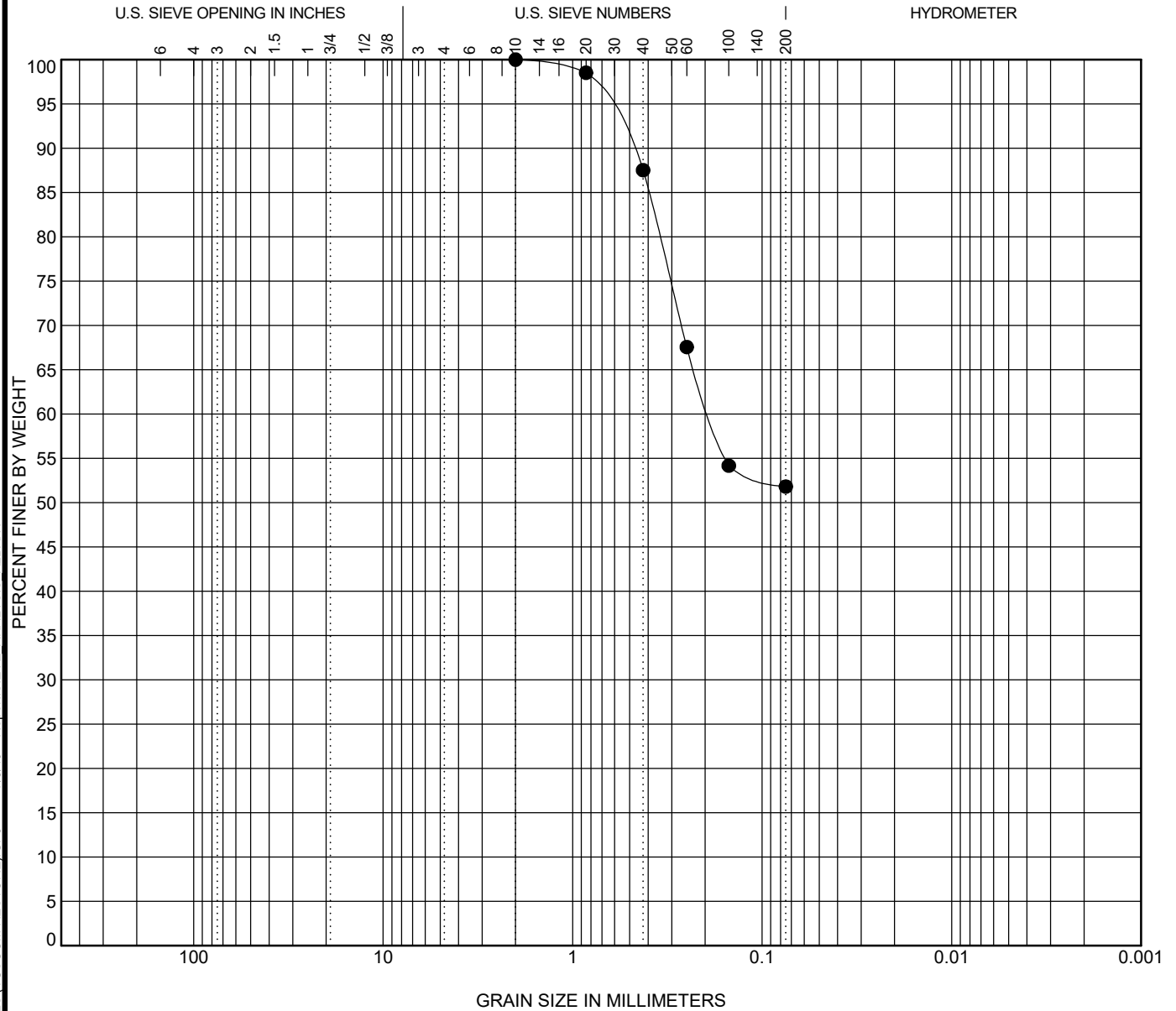
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SIEVE ANALYSIS RESULTS

Client:
 Project: Twin Pines Minerals Saunders-Loncala Reserve
 Location: Saint George, Georgia
 Project Number: 000180200804.00

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID		P222S											
Description		9'-10'											
Sampled by:		TTL											
Sample Location:		P222S											
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
						2	0.2			0.0	48.2	51.8	

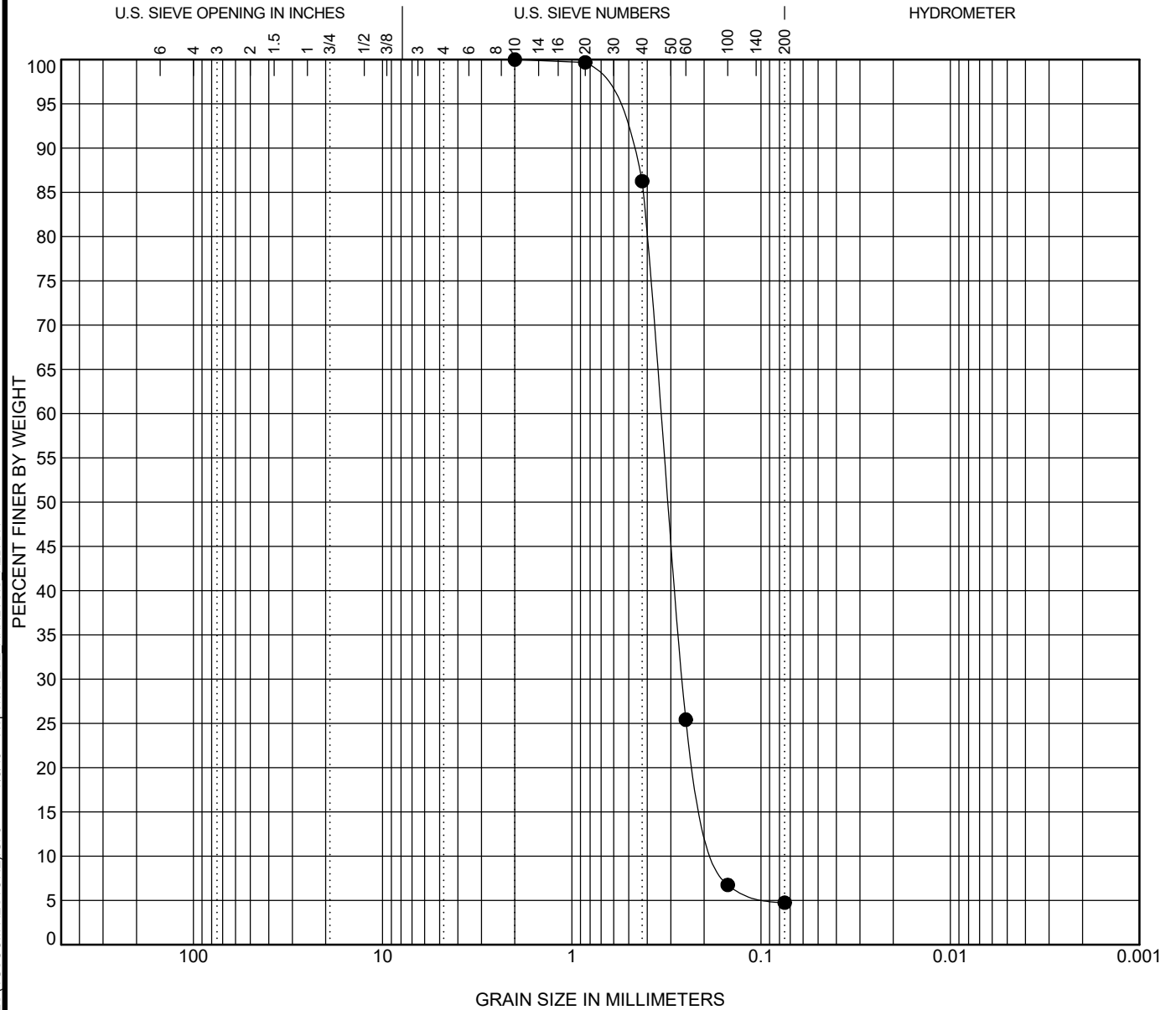


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SIEVE ANALYSIS RESULTS

Client:
 Project: Twin Pines Minerals Saunders-Loncala Reserve
 Location: Saint George, Georgia
 Project Number: 000180200804.00

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID		PZ22D											
Description		18'-23'											
Sampled by:		TTL											
Sample Location:		PZ22D											
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
				1.22	2.06	2	0.3	0.3	0.2	0.0	95.3		4.7

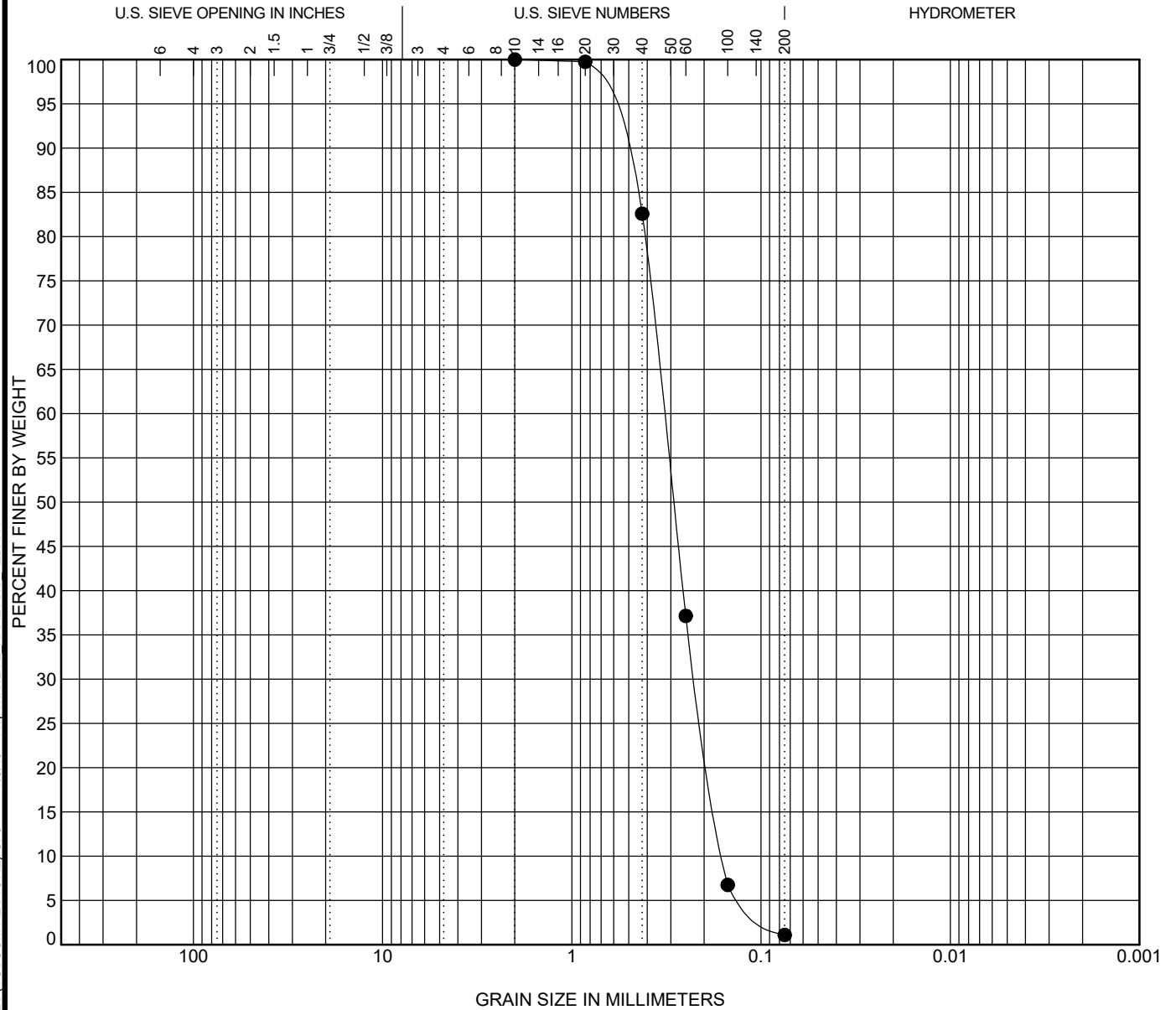
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SIEVE ANALYSIS RESULTS

Client:
 Project: Twin Pines Minerals Saunders-Loncala Reserve
 Location: Saint George, Georgia
 Project Number: 000180200804.00

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID		PZ22D											
Description		35'-38'											
Sampled by:		TTL											
Sample Location:		PZ22D											
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
				0.95	2.06	2	0.3	0.2	0.2	0.0	98.9	1.1	

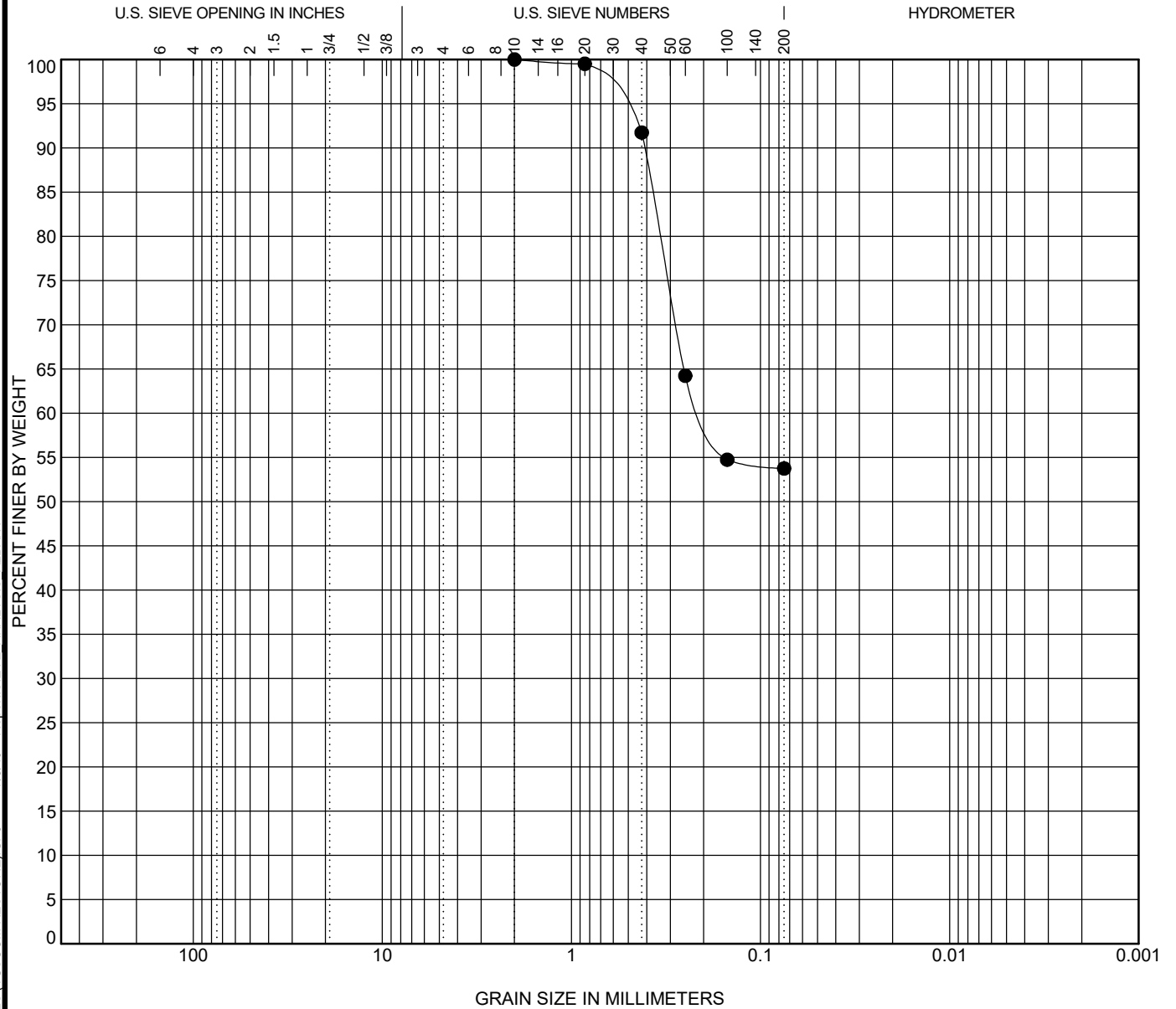
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SIEVE ANALYSIS RESULTS

Client:
 Project: Twin Pines Minerals Saunders-Loncala Reserve
 Location: Saint George, Georgia
 Project Number: 000180200804.00

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID		PZ23											
Description		12.5'-15'											
Sampled by:		TTL											
Sample Location:		PZ23											
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
						2	0.2			0.0	46.3	53.7	

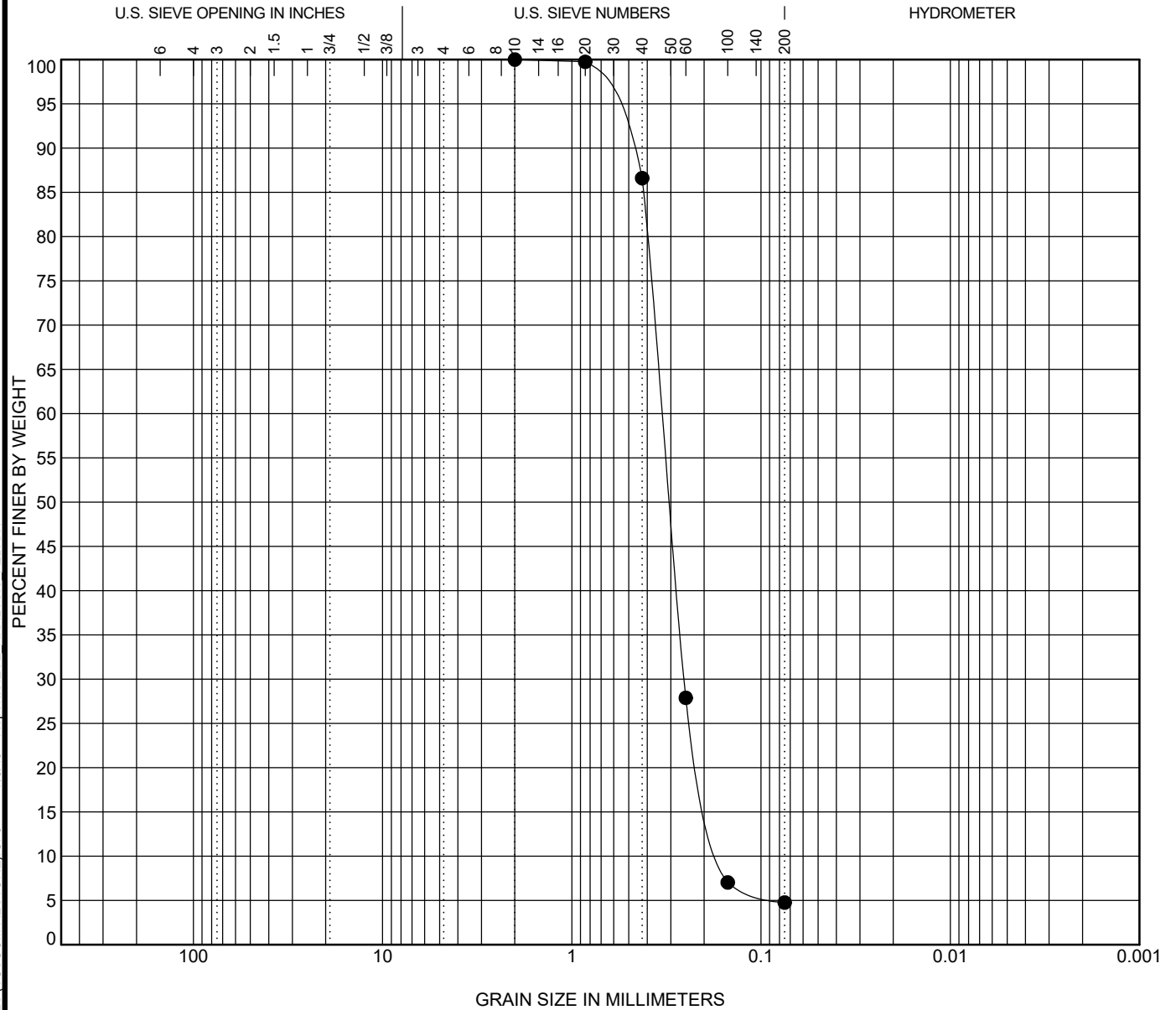


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SIEVE ANALYSIS RESULTS

Client:
 Project: Twin Pines Minerals Saunders-Loncala Reserve
 Location: Saint George, Georgia
 Project Number: 000180200804.00

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID		PZ24											
Description		6'-7'											
Sampled by:		TTL											
Sample Location:		PZ24											
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
				1.20	2.07	2	0.3	0.3	0.2	0.0	95.2	4.8	

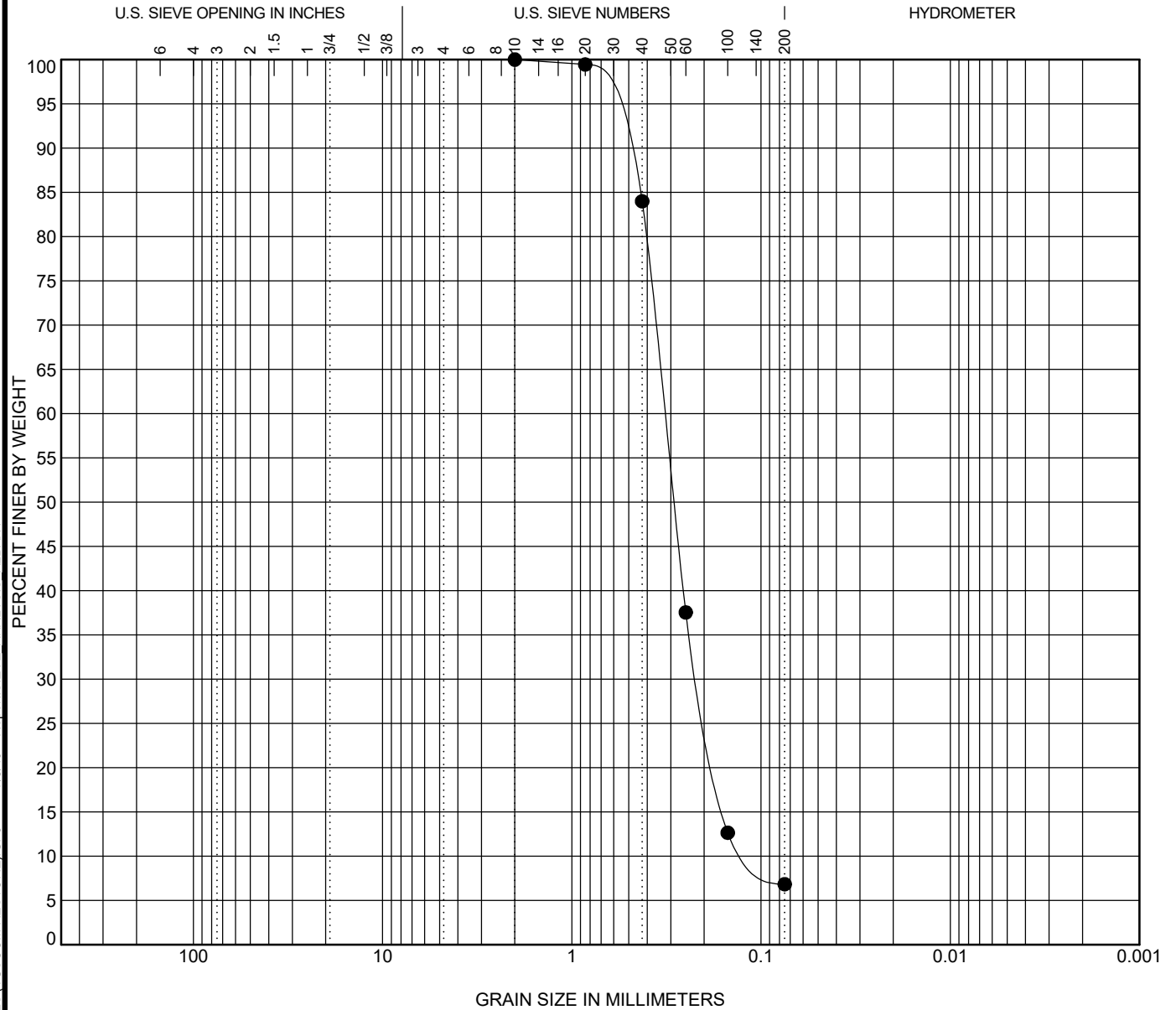
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SIEVE ANALYSIS RESULTS

Client:
Project: Twin Pines Minerals Saunders-Loncala Reserve
Location: Saint George, Georgia
Project Number: 000180200804.00

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID		PZ24											
Description		10'-18'											
Sampled by:		TTL											
Sample Location:		PZ24											
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
				1.30	2.95	2	0.3	0.2	0.1	0.0	93.2	6.8	

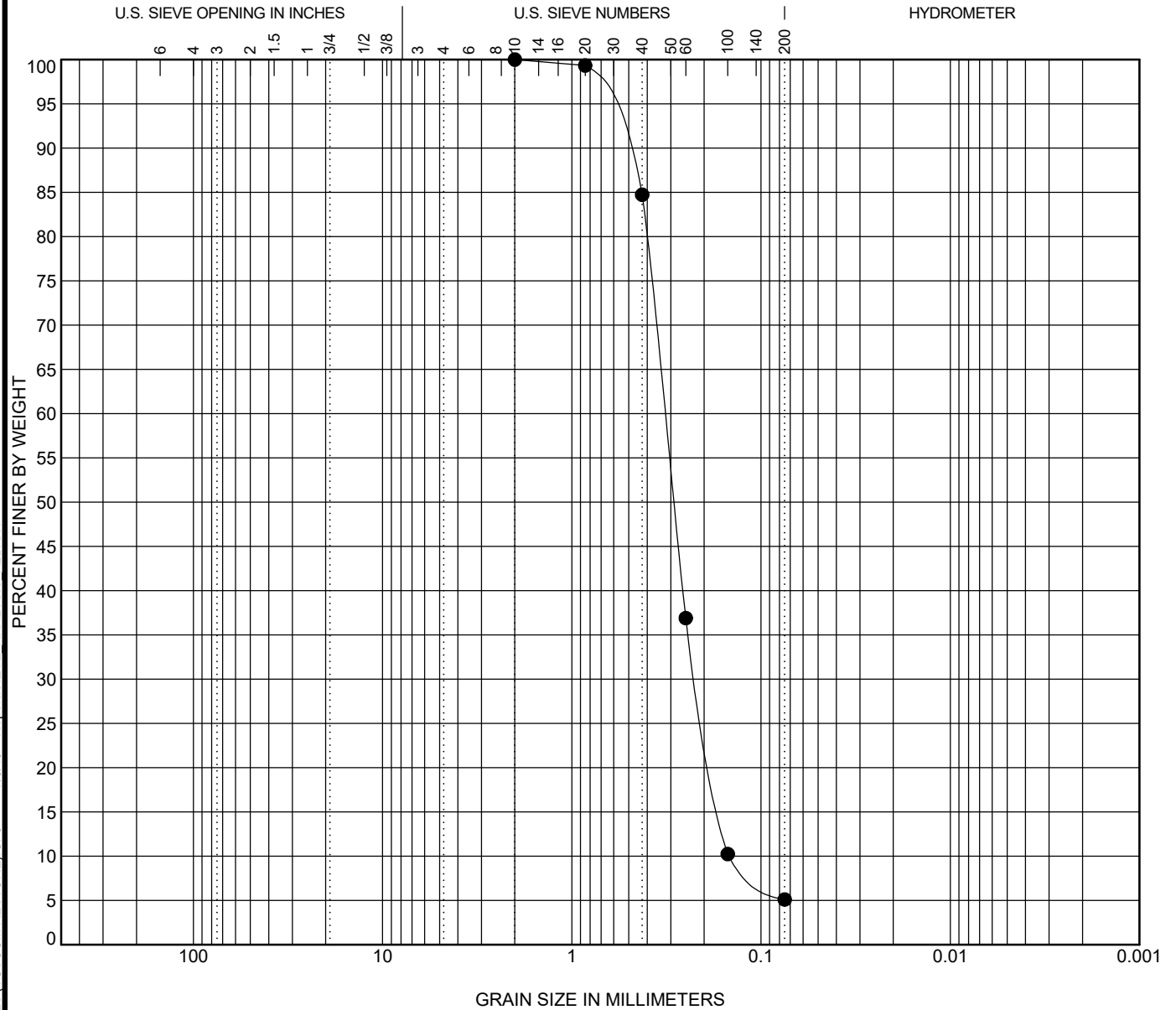
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SIEVE ANALYSIS RESULTS

Client:
 Project: Twin Pines Minerals Saunders-Loncala Reserve
 Location: Saint George, Georgia
 Project Number: 000180200804.00

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID		PZ25S											
Description		3'-5'											
Sampled by:		TTL											
Sample Location:		PZ25S											
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
				1.02	2.22	2	0.3	0.2	0.1	0.0	94.9	5.1	

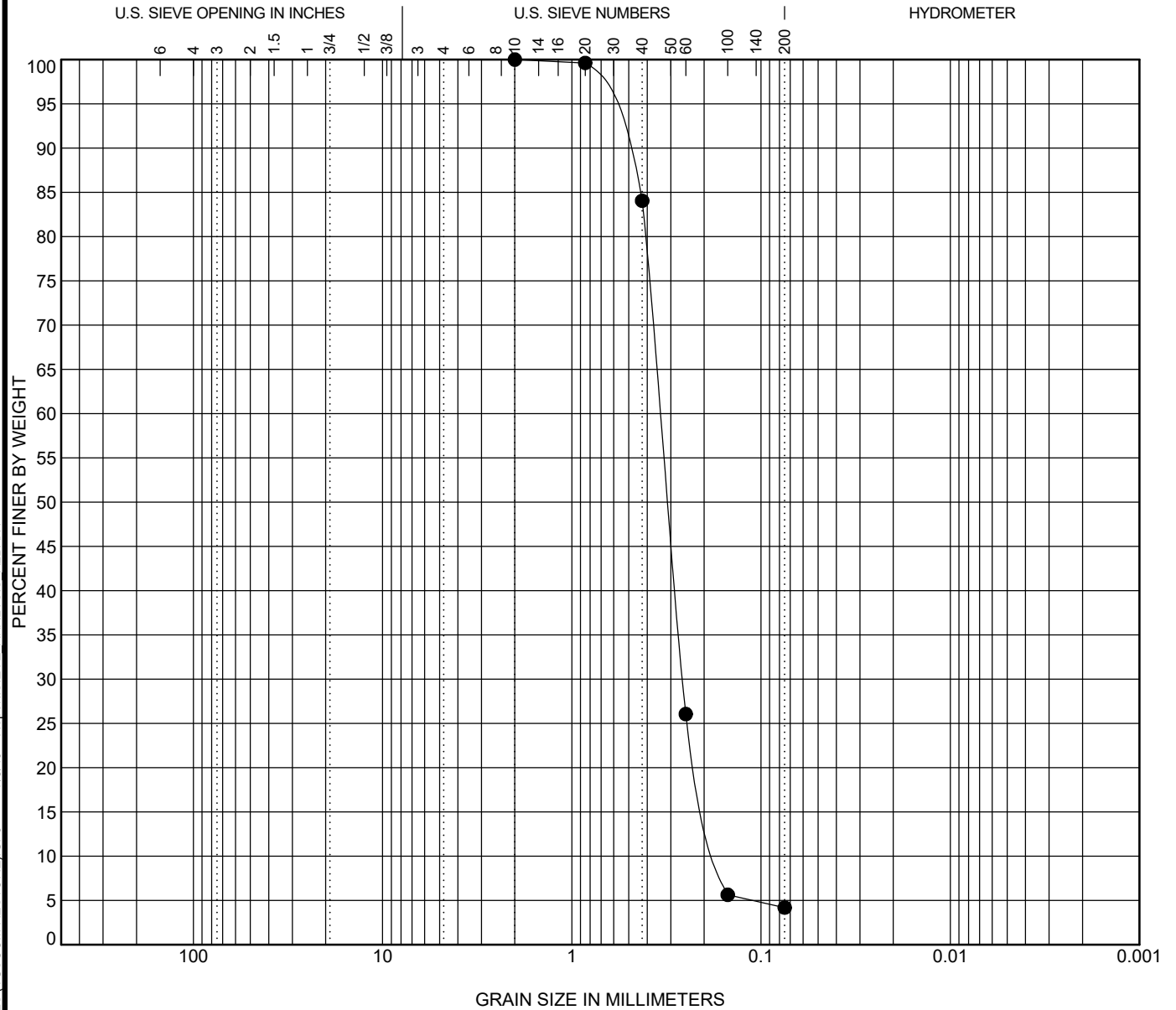
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SIEVE ANALYSIS RESULTS

Client:
 Project: Twin Pines Minerals Saunders-Loncala Reserve
 Location: Saint George, Georgia
 Project Number: 000180200804.00

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID		PZ25S											
Description		13'-19'											
Sampled by:		TTL											
Sample Location:		PZ25S											
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
				1.18	2.04	2	0.3	0.3	0.2	0.0	95.8	4.2	

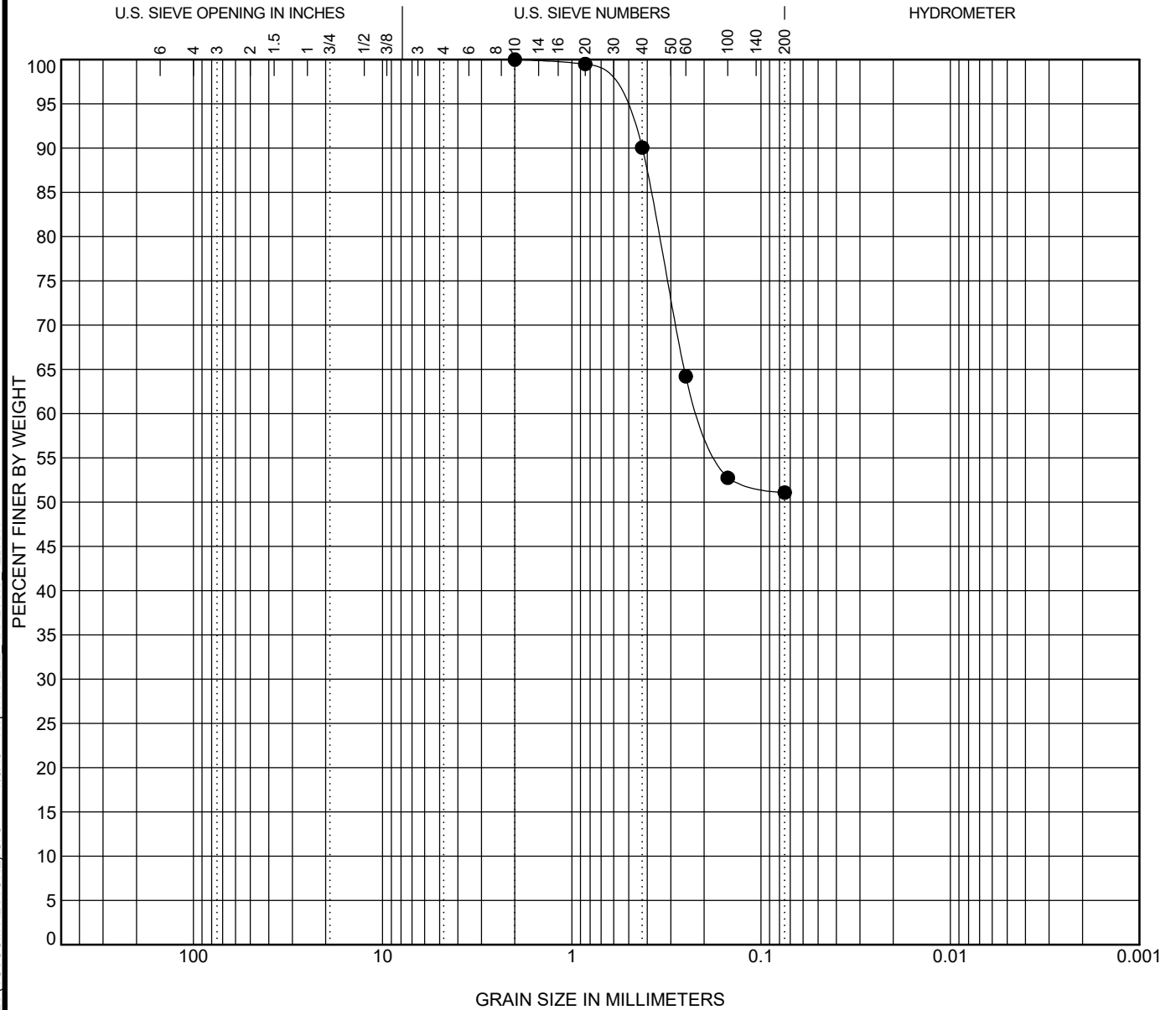
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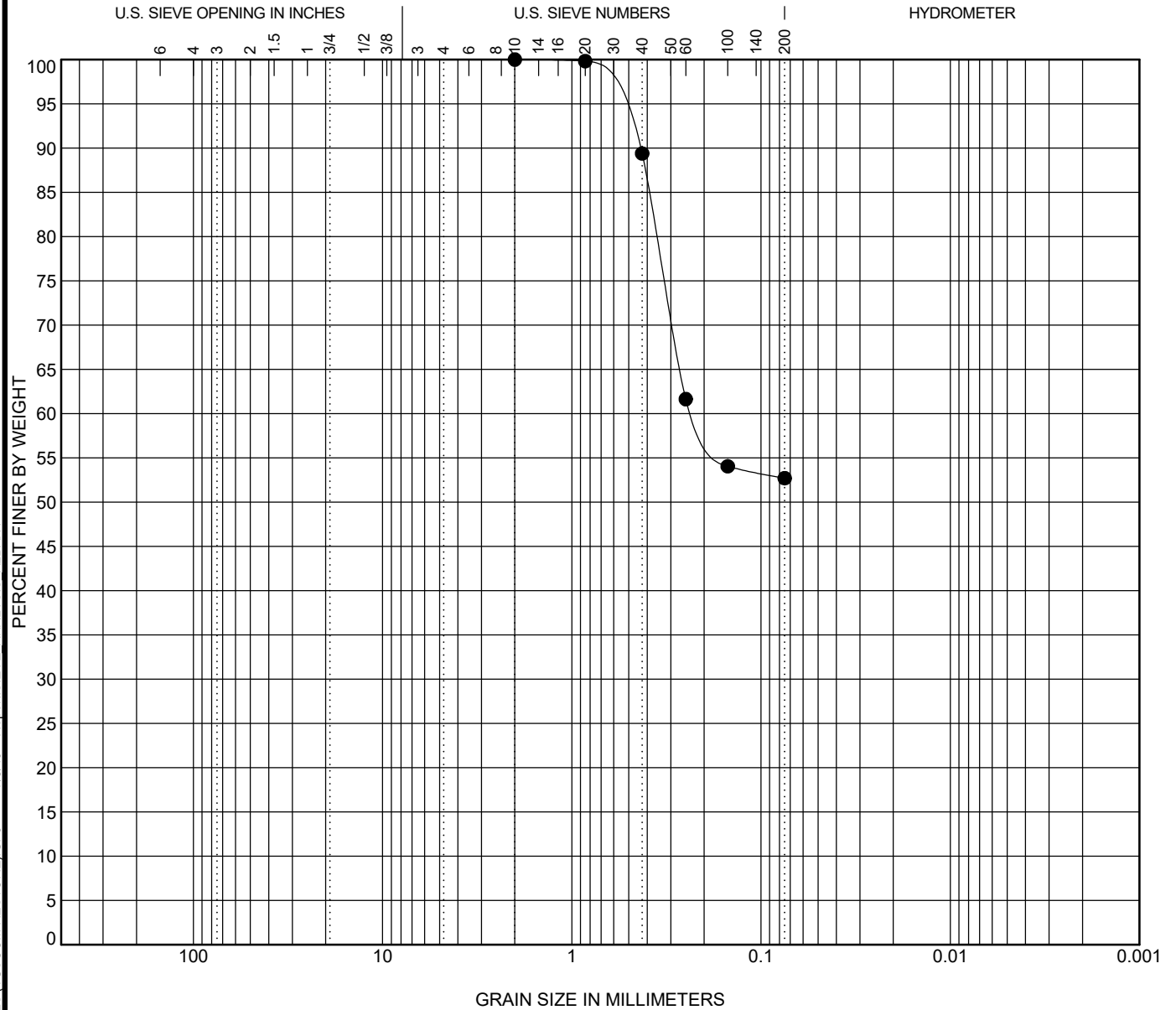
SIEVE ANALYSIS RESULTS

Client:
Project: Twin Pines Minerals Saunders-Loncala Reserve
Location: Saint George, Georgia
Project Number: 000180200804.00

GRAIN SIZE DISTRIBUTION



GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID		PZ25D											
Description		28.5'-29'											
Sampled by:		TTL											
Sample Location:		PZ25D											
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
						2	0.2			0.0	47.3	52.7	

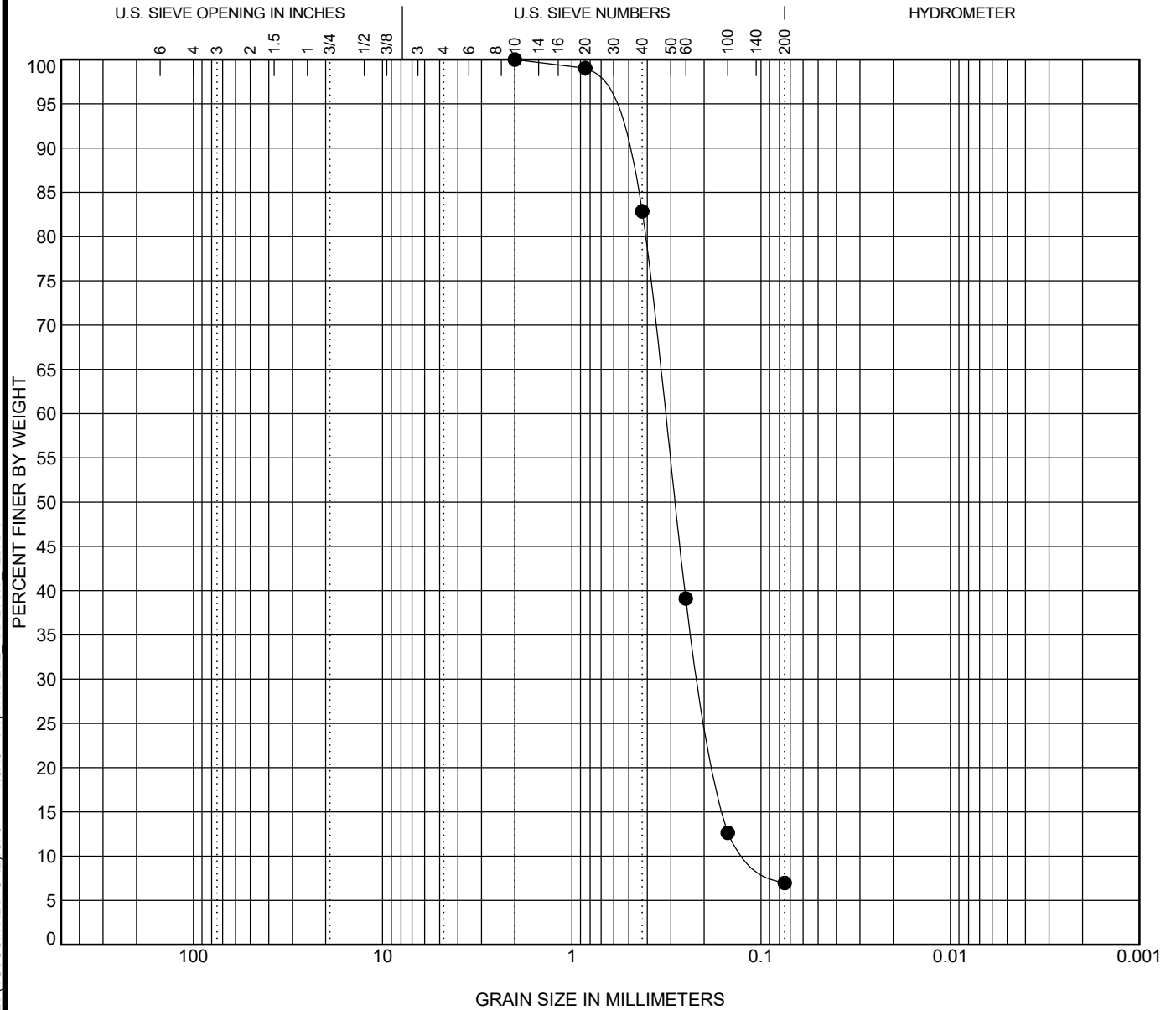
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SIEVE ANALYSIS RESULTS

Client:
 Project: Twin Pines Minerals Saunders-Loncala Reserve
 Location: Saint George, Georgia
 Project Number: 000180200804.00

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID		PZ26											
Description		0'-6"											
Sampled by:		TTL											
Sample Location:		PZ26											
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
				1.26	2.96	2	0.3	0.2	0.1	0.0	93.0	7.0	

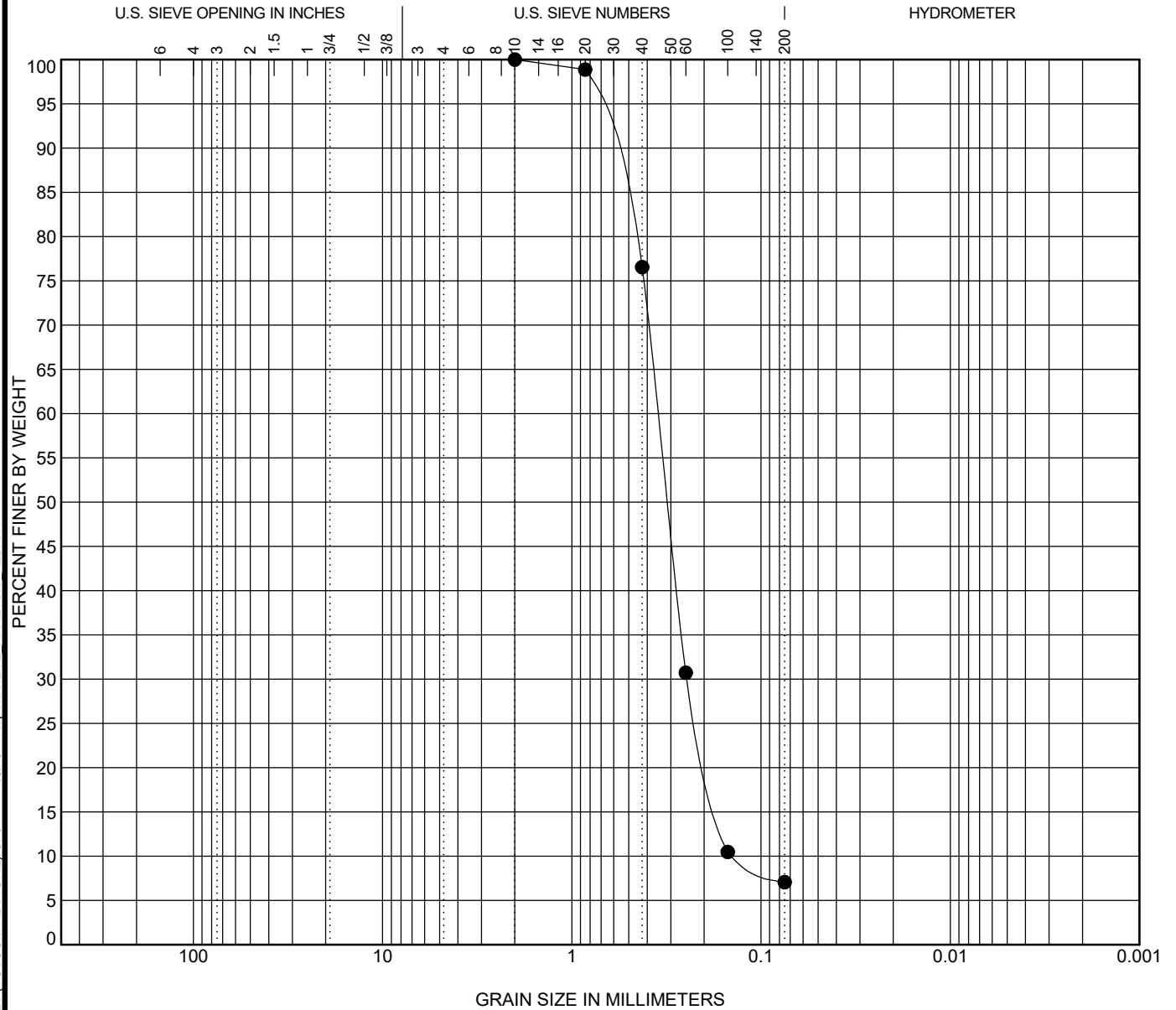
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SIEVE ANALYSIS RESULTS

Client:
 Project: Twin Pines Minerals Saunders-Loncala Reserve
 Location: Saint George, Georgia
 Project Number: 000180200804.00

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID		PZ26											
Description		13.5'-20'											
Sampled by:		TTL											
Sample Location:		PZ26											
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
				1.26	2.58	2	0.4	0.2	0.1	0.0	92.9	7.1	

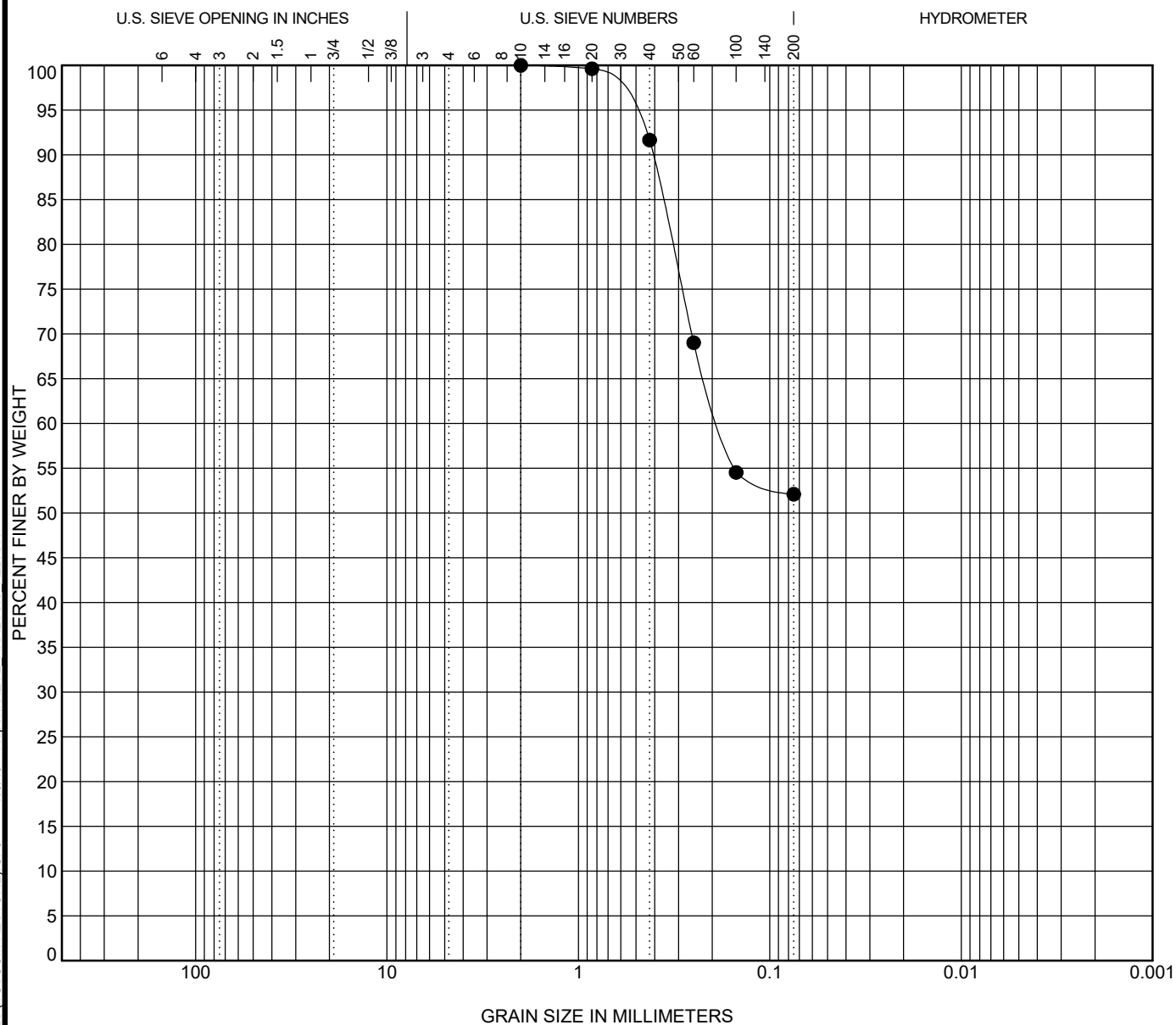
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SIEVE ANALYSIS RESULTS

Client:
 Project: Twin Pines Minerals Saunders-Loncala Reserve
 Location: Saint George, Georgia
 Project Number: 000180200804.00

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID		PZ27S											
Description		9'-10'											
Sampled by:		TTL											
Sample Location:		PZ27S											
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
						2	0.2			0.0	47.9	52.1	

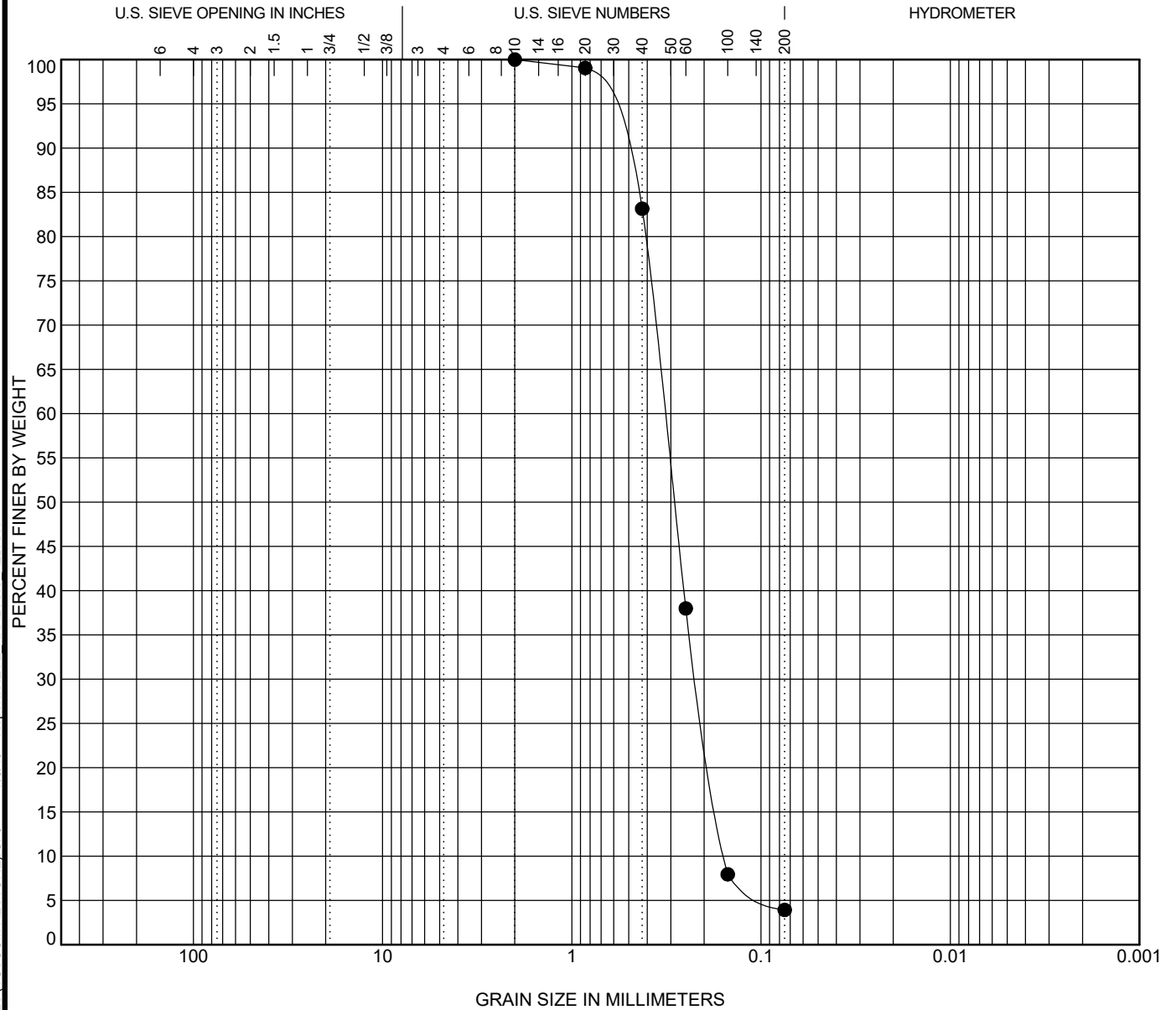
TTL

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SIEVE ANALYSIS RESULTS

Client:
 Project: Twin Pines Minerals Saunders-Loncala Reserve
 Location: Saint George, Georgia
 Project Number: 000180200804.00

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID		PZ27D											
Description		8'-13'											
Sampled by:		TTL											
Sample Location:		PZ27D											
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
				0.95	2.08	2	0.3	0.2	0.2	0.0	96.1	3.9	

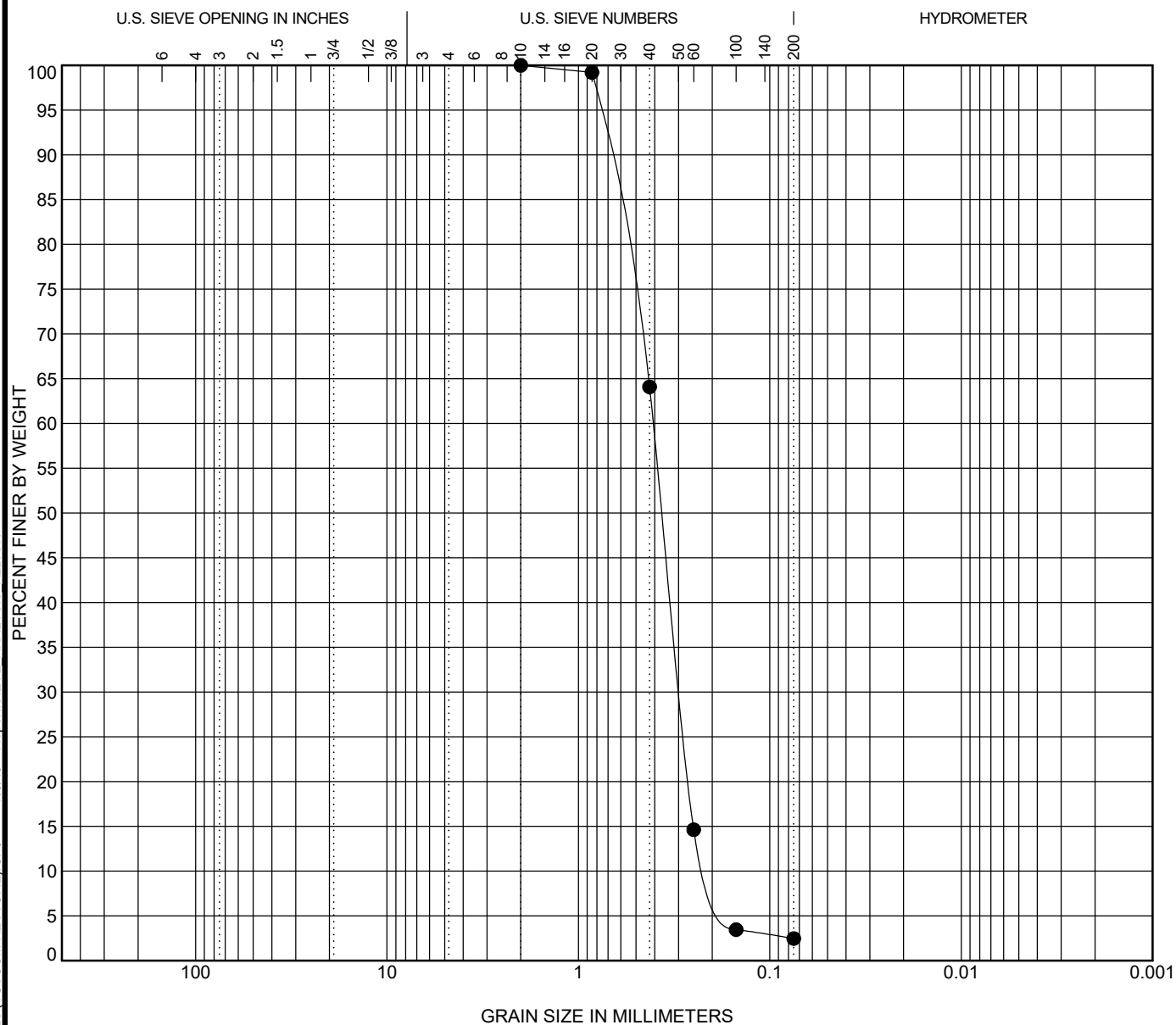
TTL

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SIEVE ANALYSIS RESULTS

Client:
 Project: Twin Pines Minerals Saunders-Loncala Reserve
 Location: Saint George, Georgia
 Project Number: 000180200804.00

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID		PZ27D											
Description		24'-30'											
Sampled by:		TTL											
Sample Location:		PZ27D											
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
				1.06	2.01	2	0.4	0.3	0.2	0.0	97.5	2.5	

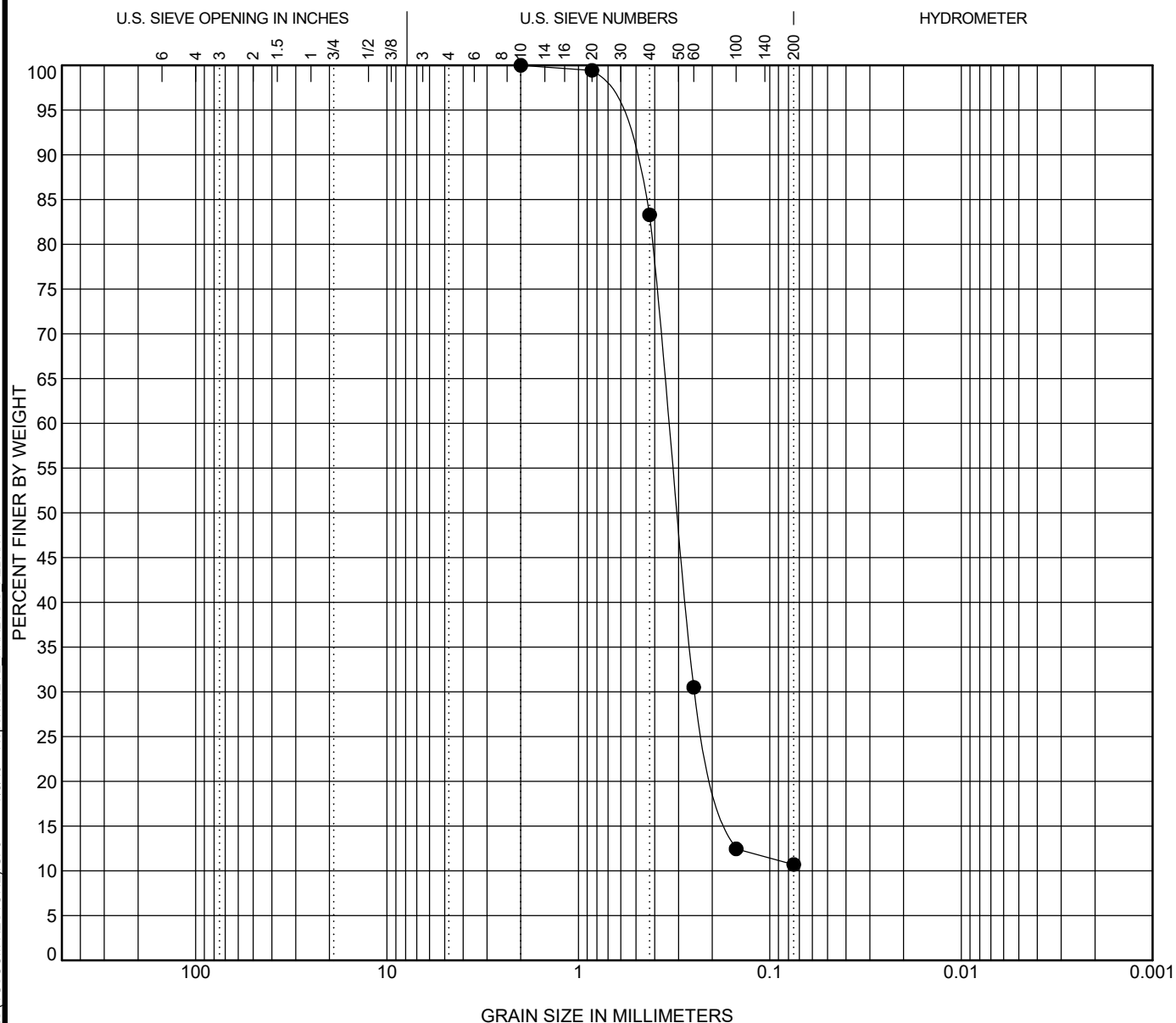
TTL

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SIEVE ANALYSIS RESULTS

Client:
 Project: Twin Pines Minerals Saunders-Loncala Reserve
 Location: Saint George, Georgia
 Project Number: 000180200804.00

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID		PZ28D											
Description		9'-19'											
Sampled by:		TTL											
Sample Location:		PZ28D											
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
				3.19	5.94	2	0.3	0.2		0.0	89.3	10.7	

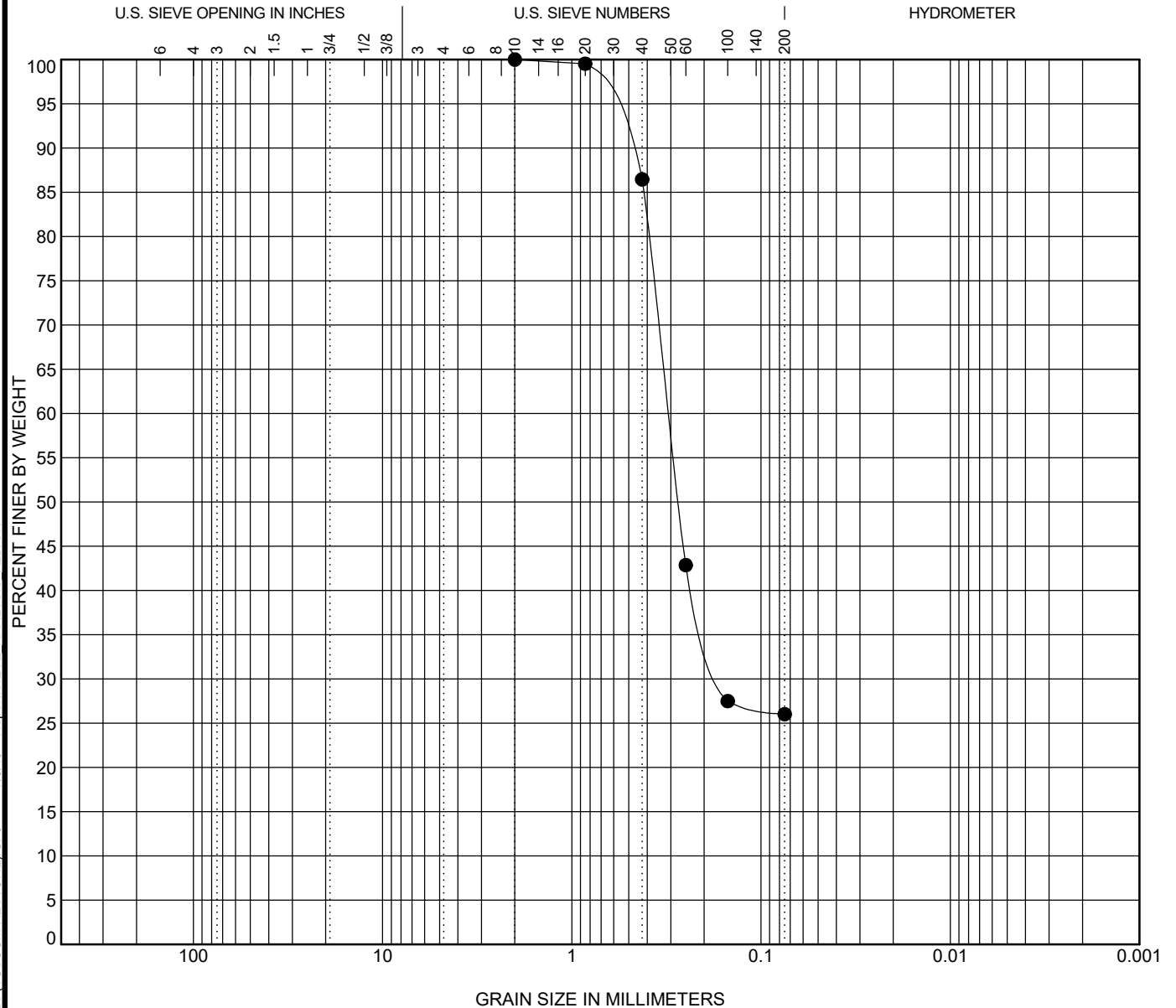
TTL

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SIEVE ANALYSIS RESULTS

Client:
 Project: Twin Pines Minerals Saunders-Loncala Reserve
 Location: Saint George, Georgia
 Project Number: 000180200804.00

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID		PZ28D											
Description		27'-30'											
Sampled by:		TTL											
Sample Location:		PZ28D											
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
						2	0.3	0.2		0.0	74.0	26.0	

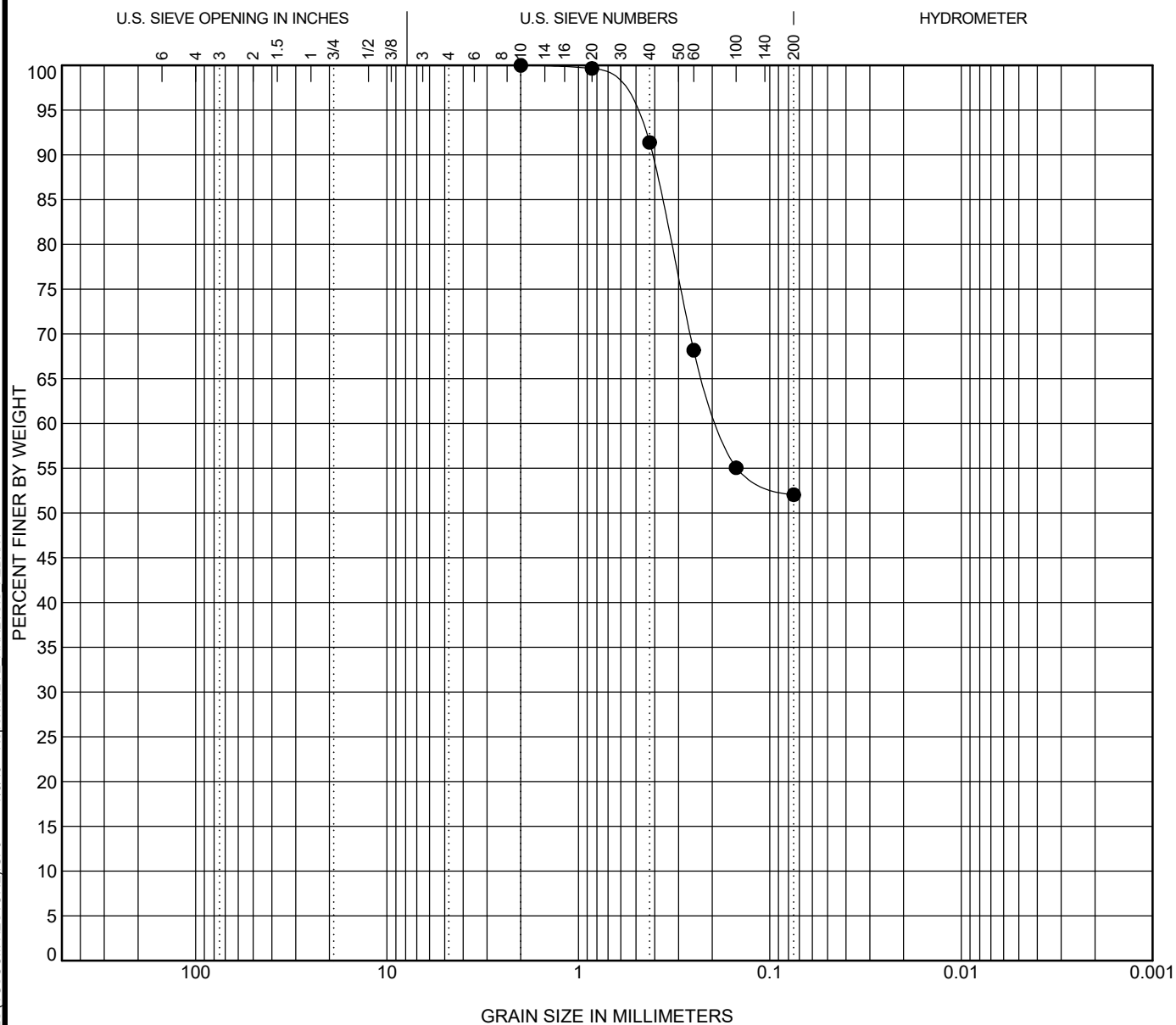


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SIEVE ANALYSIS RESULTS

Client:
 Project: Twin Pines Minerals Saunders-Loncala Reserve
 Location: Saint George, Georgia
 Project Number: 000180200804.00

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID		PZ38											
Description		6'-7'											
Sampled by:		TTL											
Sample Location:		PZ38											
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
						2	0.2			0.0	48.0	52.0	

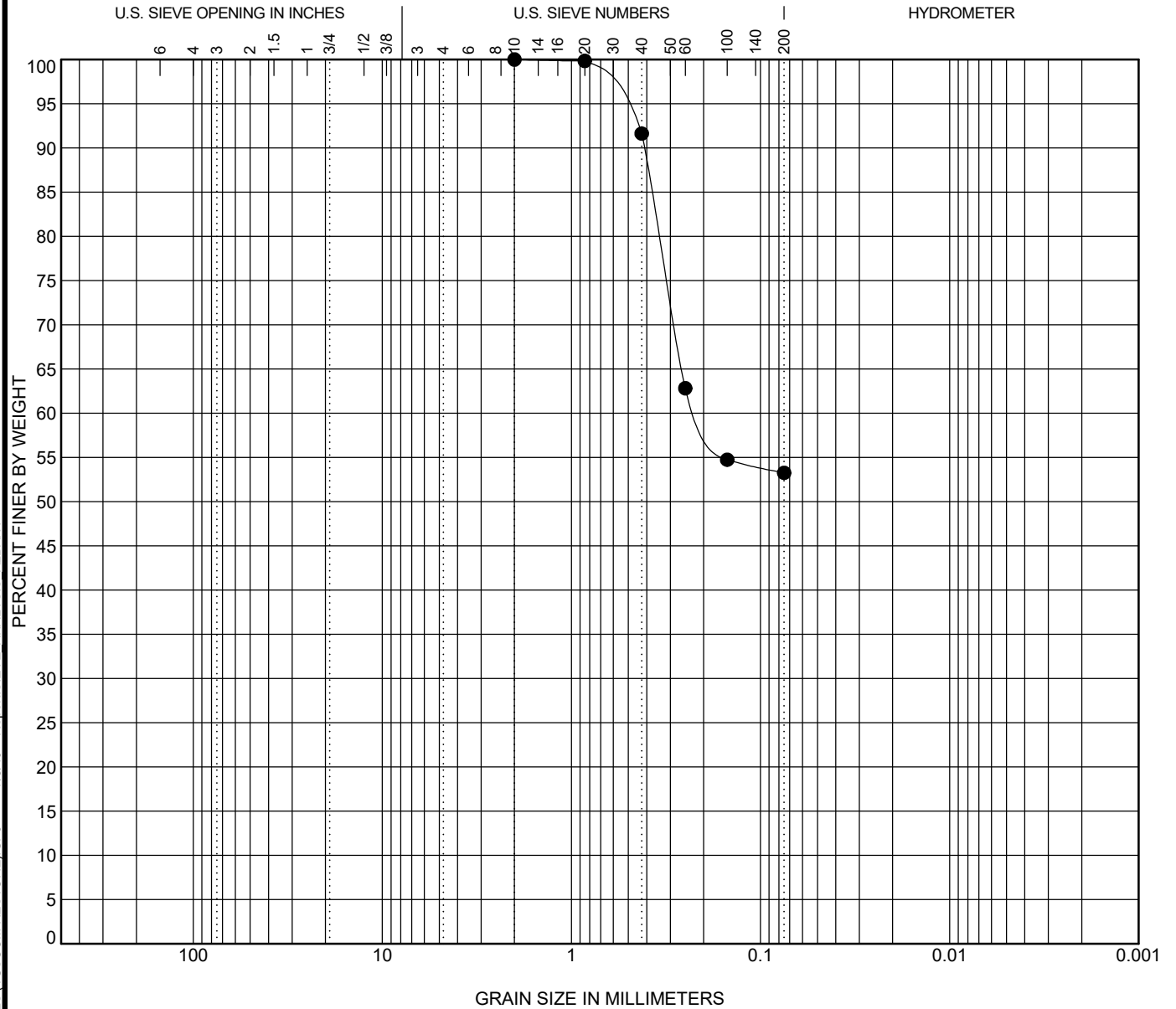
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SIEVE ANALYSIS RESULTS

Client:
 Project: Twin Pines Minerals Saunders-Loncala Reserve
 Location: Saint George, Georgia
 Project Number: 000180200804.00

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID		PZ39D/OWA3D											
Description		19'-20'											
Sampled by:		TTL											
Sample Location:		PZ39D/OWA3D											
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
						2	0.2			0.0	46.7	53.3	

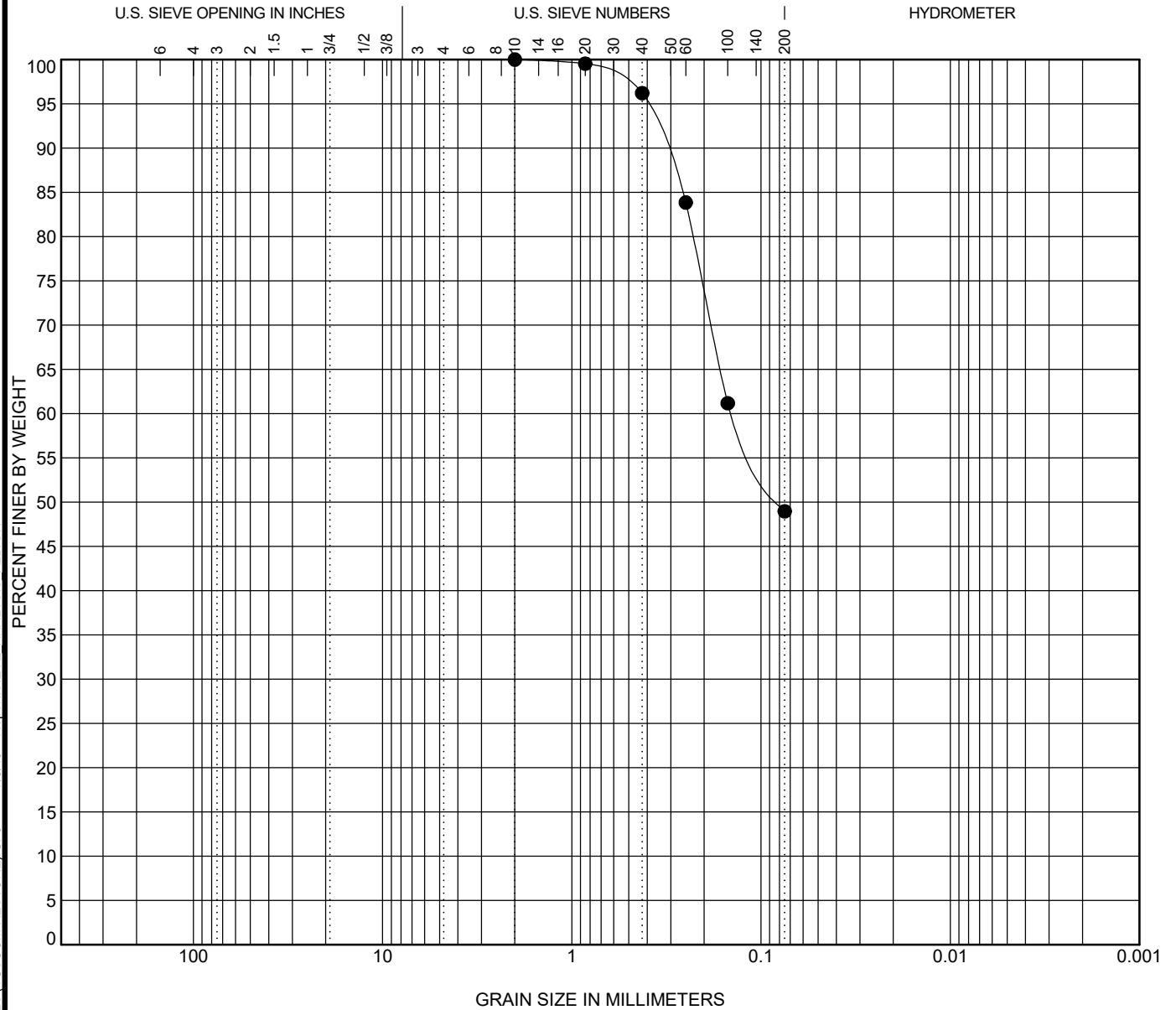


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SIEVE ANALYSIS RESULTS

Client: Twin Pines Minerals Saunders-Loncala Reserve
 Location: Saint George, Georgia
 Project Number: 000180200804.00

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID		PZ39D/OWA3D											
Description		77'-79'											
Sampled by:		TTL											
Sample Location:		PZ39D/OWA3D											
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
						2	0.1			0.0	51.0	49.0	

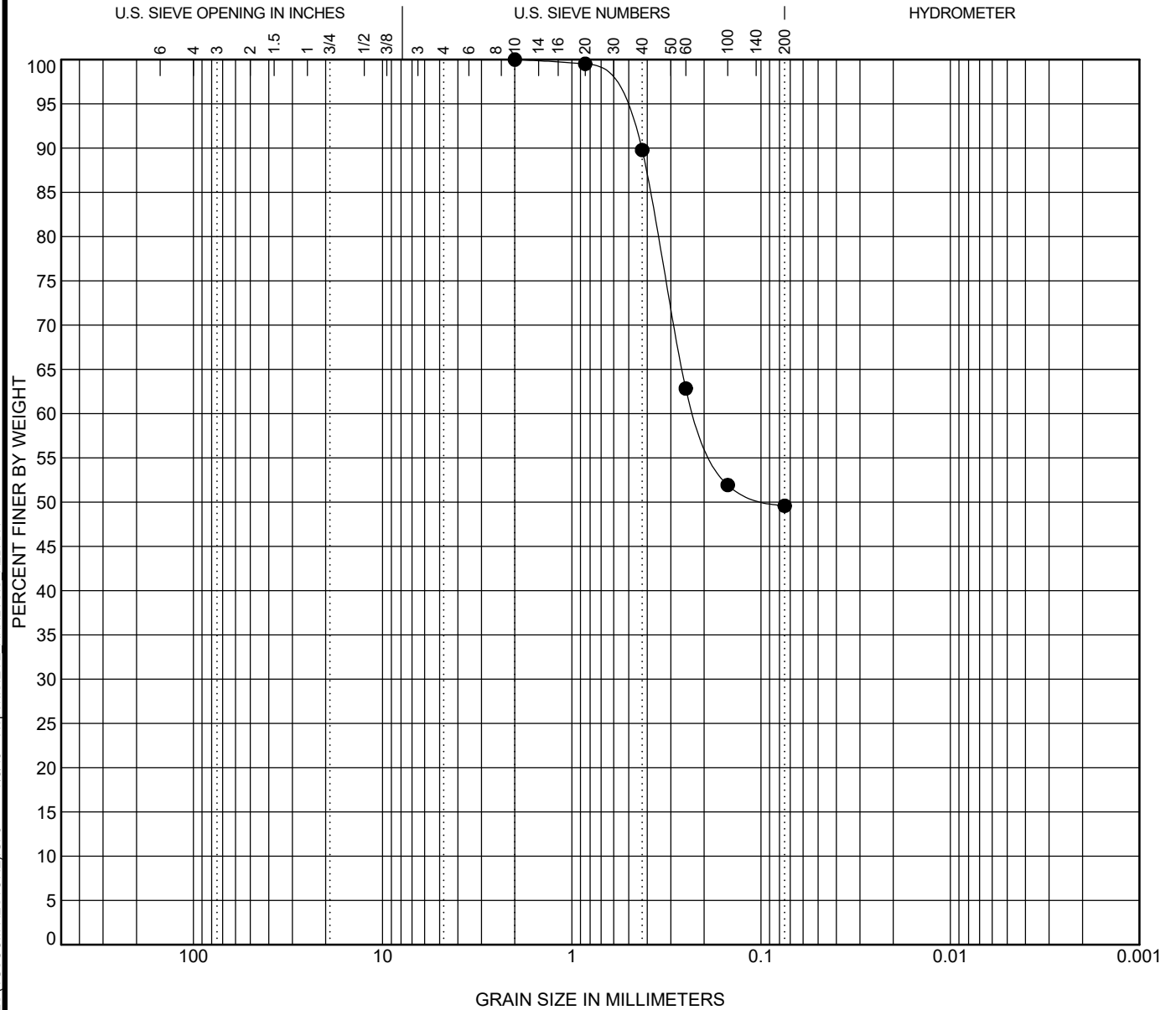


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SIEVE ANALYSIS RESULTS

Client:
 Project: Twin Pines Minerals Saunders-Loncala Reserve
 Location: Saint George, Georgia
 Project Number: 000180200804.00

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID		PZ40											
Description		14'-15'											
Sampled by:		TTL											
Sample Location:		PZ40											
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
						2	0.2			0.0	50.4	49.6	

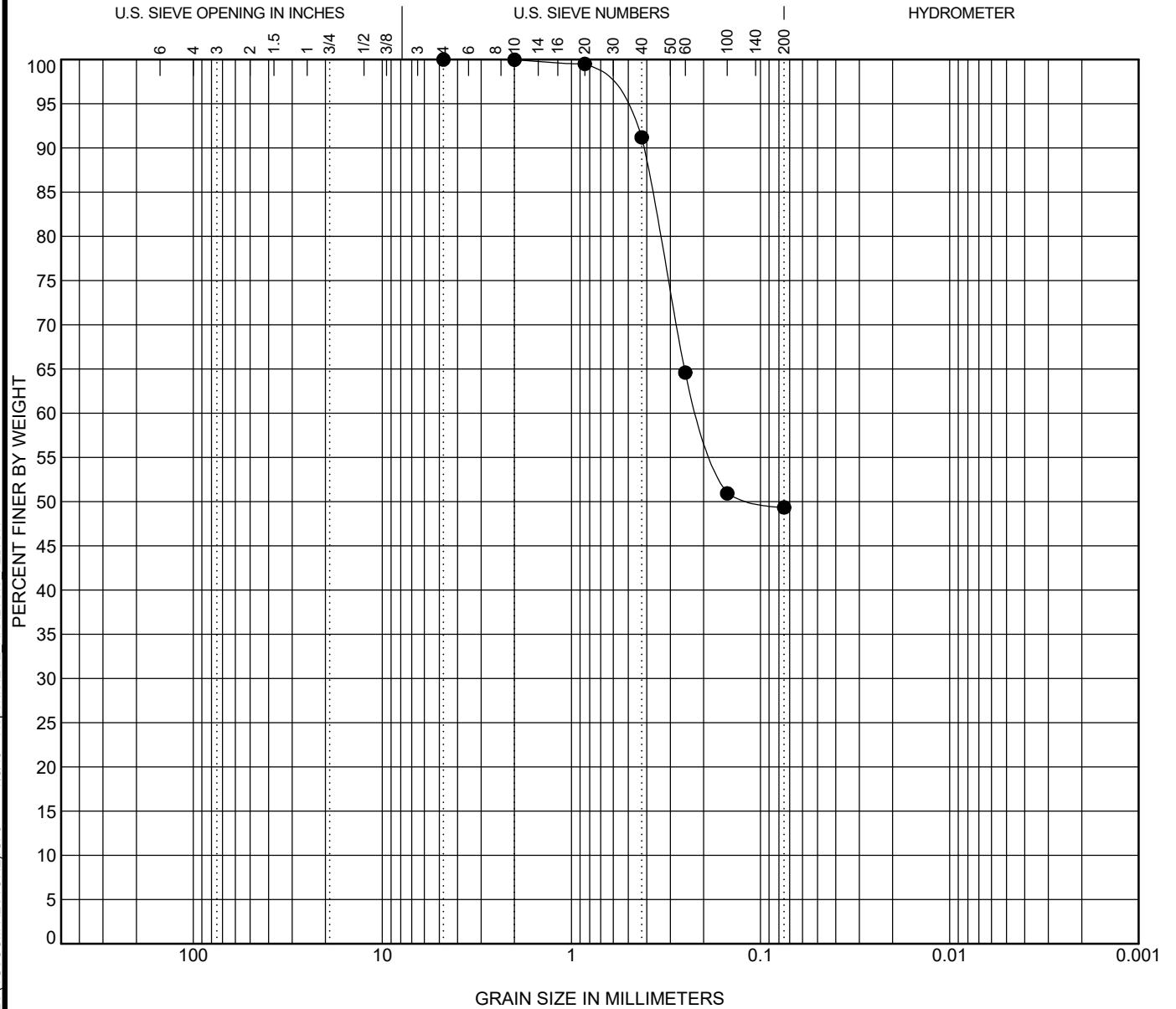
TTL

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SIEVE ANALYSIS RESULTS

Client:
 Project: Twin Pines Minerals Saunders-Loncala Reserve
 Location: Saint George, Georgia
 Project Number: 000180200804.00

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID					PZ43									
Description					5.5'-15'									
Sampled by:					TTL									
Sample Location:					PZ43									
Date Sampled:														
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	
						4.8	0.2			0.0	50.7	49.3		

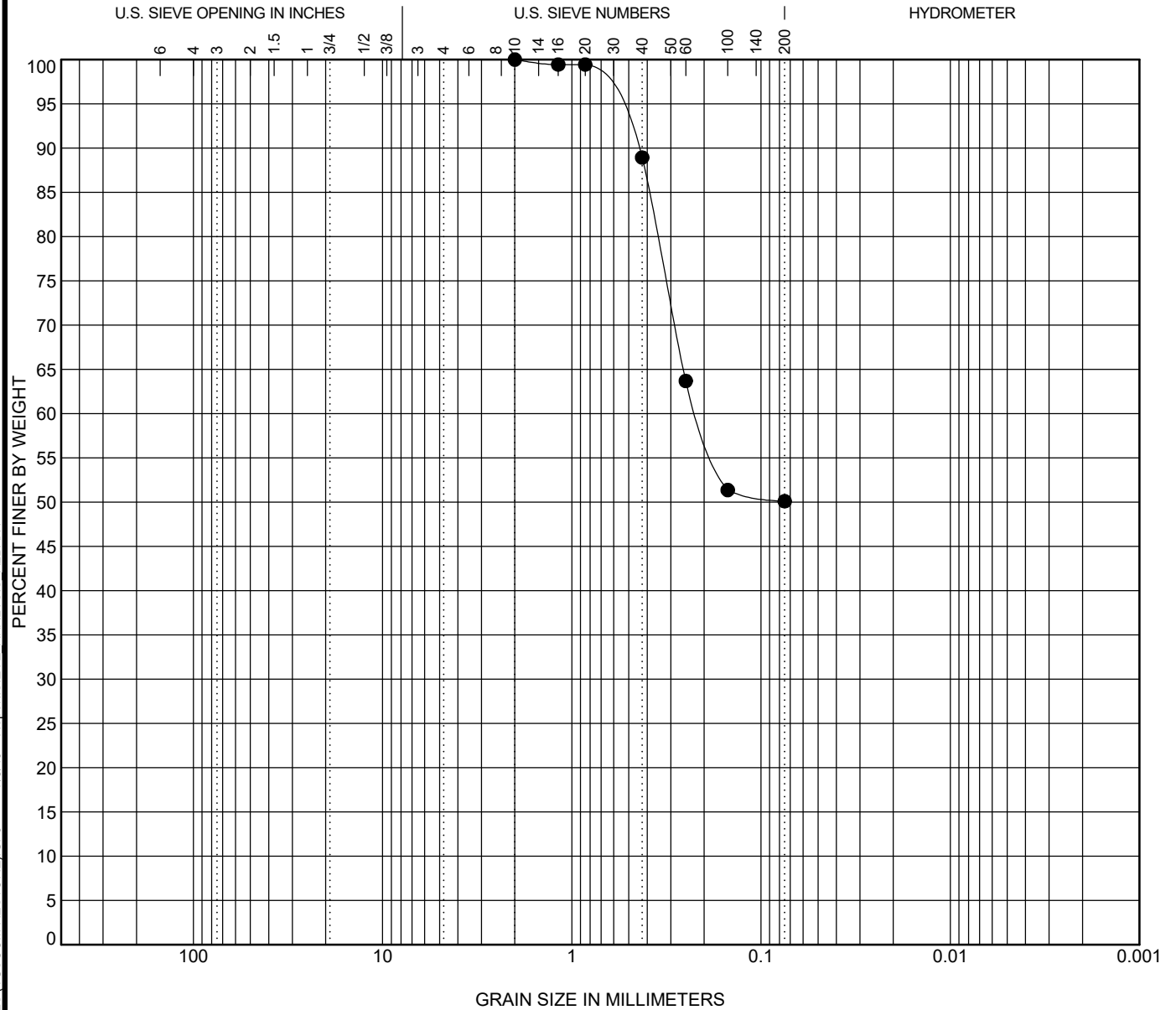


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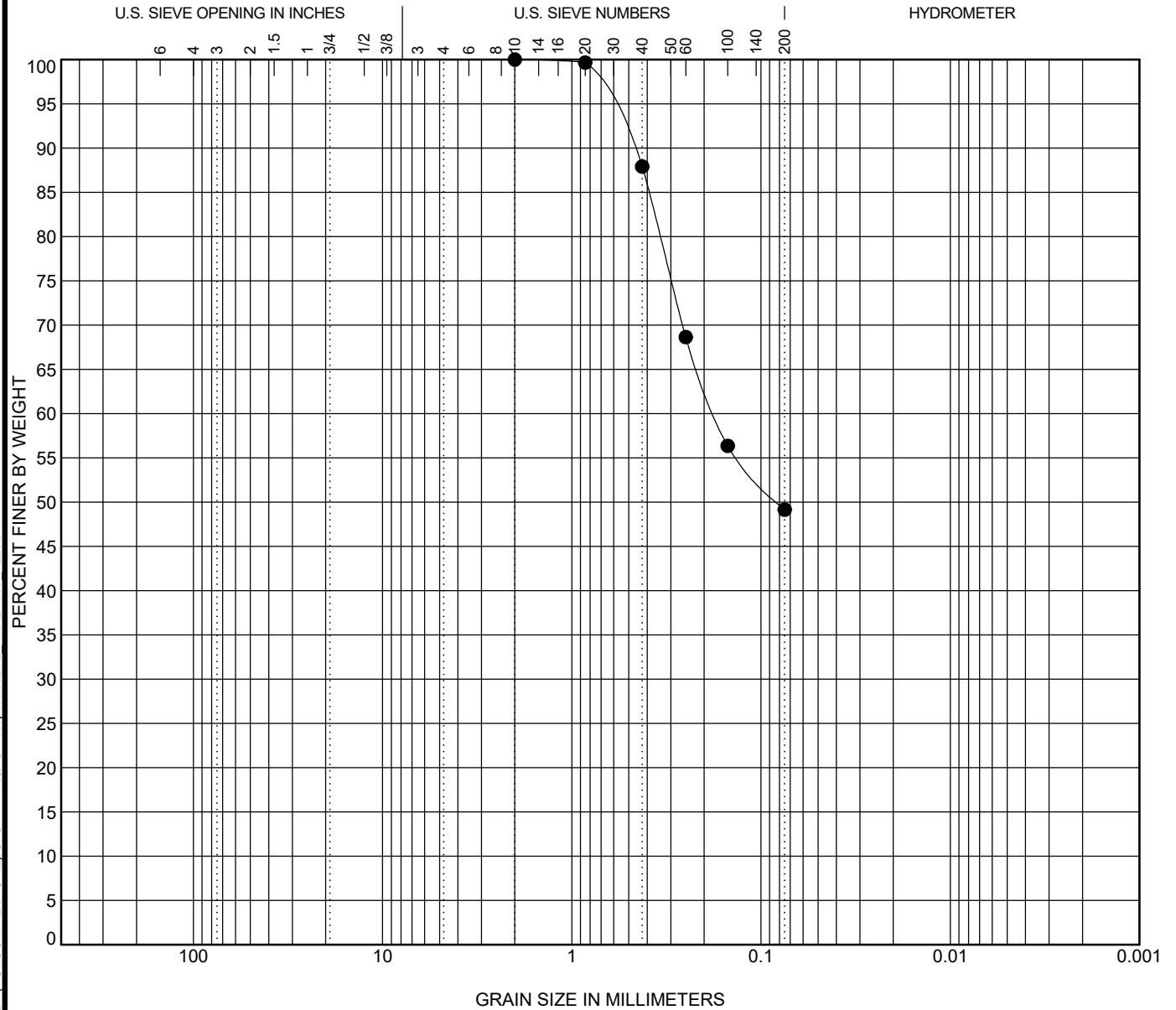
SIEVE ANALYSIS RESULTS

Client:
 Project: Twin Pines Minerals Saunders-Loncala Reserve
 Location: Saint George, Georgia
 Project Number: 000180200804.00

GRAIN SIZE DISTRIBUTION



GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID		PZ45D											
Description		49'-49.5'											
Sampled by:		TTL											
Sample Location:		PZ45D											
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
						2	0.2			0.0	50.9	49.1	

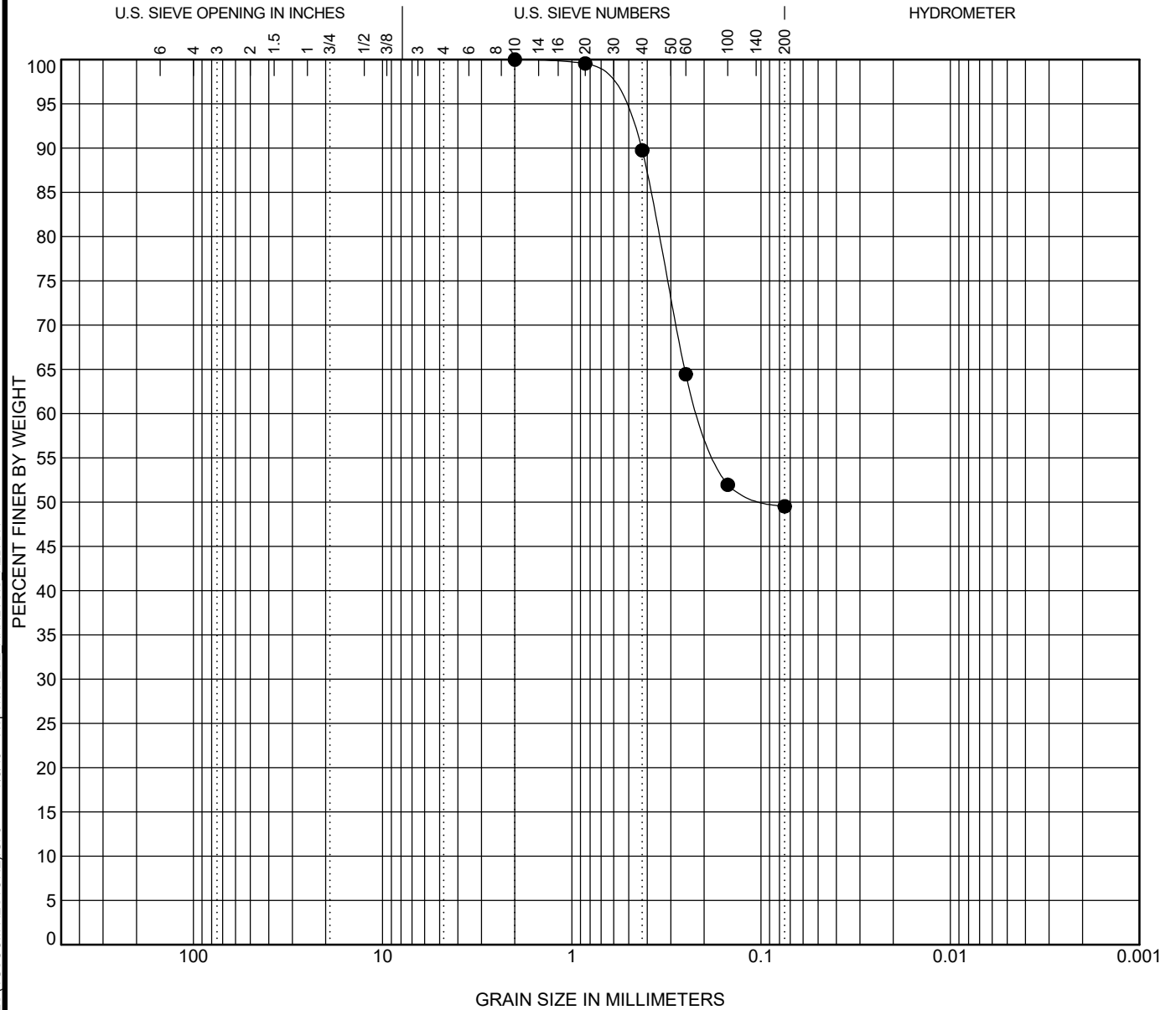
TTL

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SIEVE ANALYSIS RESULTS

Client:
Project: Twin Pines Minerals Saunders-Loncala Reserve
Location: Saint George, Georgia
Project Number: 000180200804.00

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID		PZ45S											
Description		6.5											
Sampled by:		TTL											
Sample Location:		PZ45S											
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
						2	0.2			0.0	50.5	49.5	

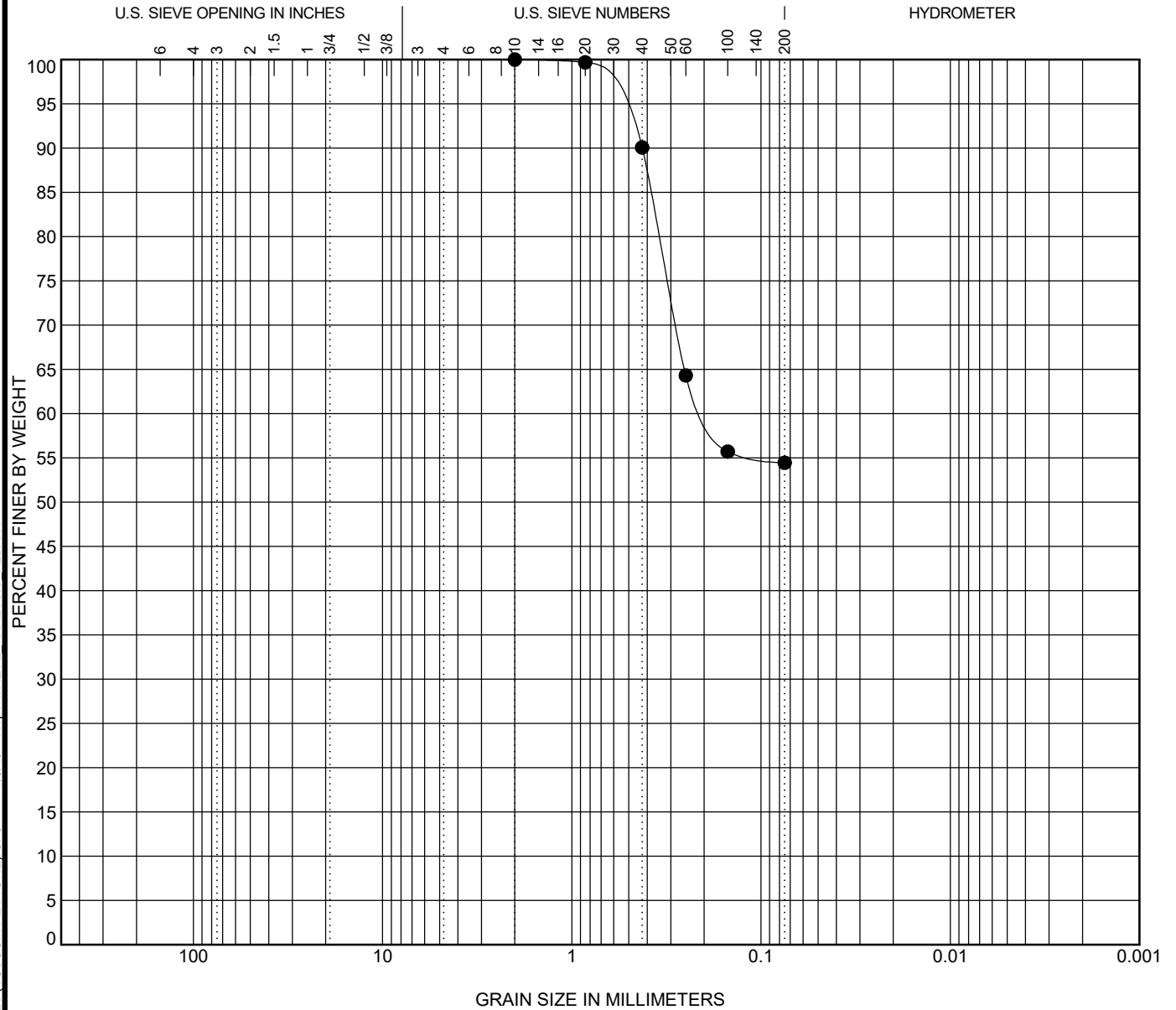
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SIEVE ANALYSIS RESULTS

Client:
 Project: Twin Pines Minerals Saunders-Loncala Reserve
 Location: Saint George, Georgia
 Project Number: 000180200804.00

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID		PZ46											
Description		4'-10'											
Sampled by:		TTL											
Sample Location:		PZ46											
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
						2	0.2			0.0	45.5	54.5	

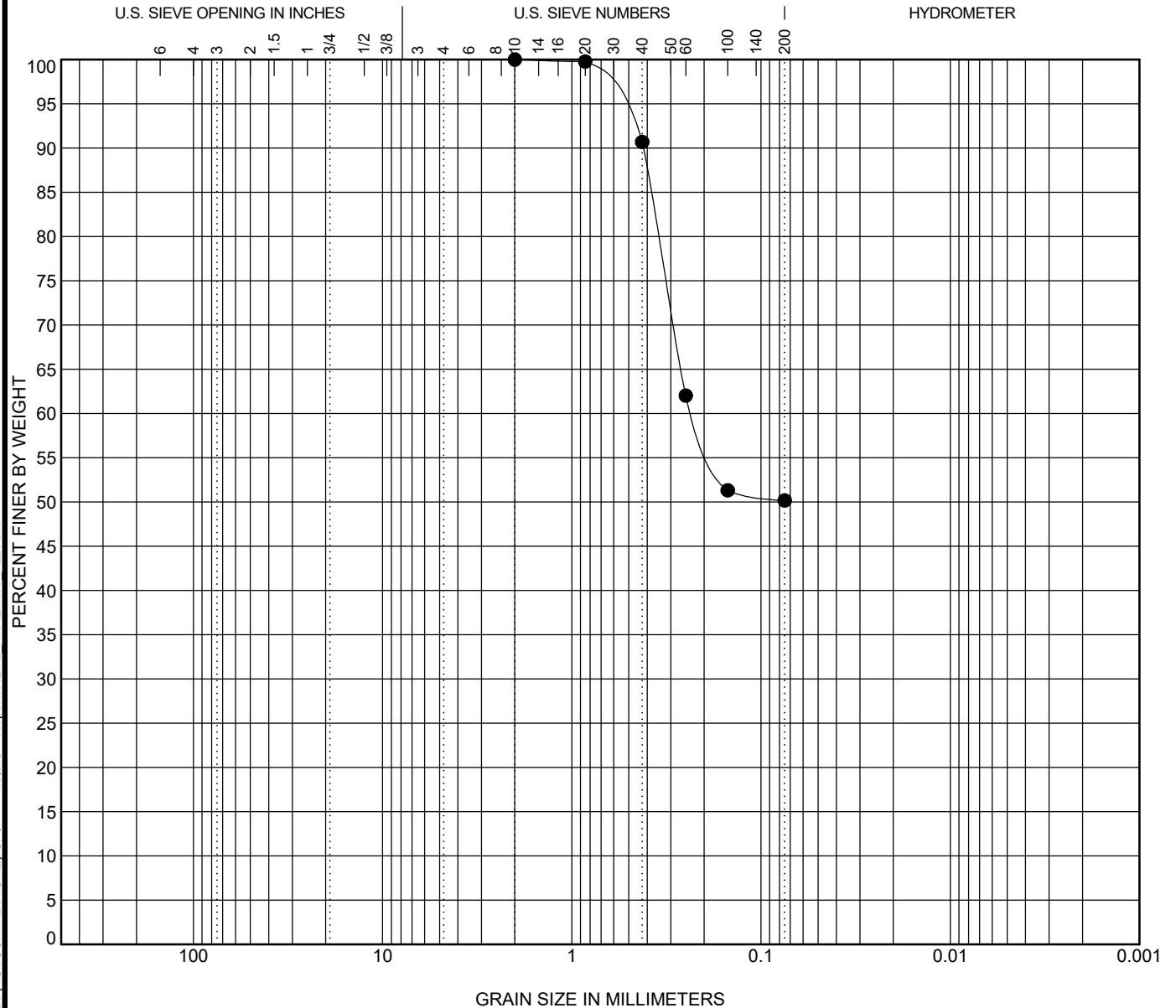
TTL

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SIEVE ANALYSIS RESULTS

Client:
Project: Twin Pines Minerals Saunders-Loncala Reserve
Location: Saint George, Georgia
Project Number: 000180200804.00

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID		PZ47											
Description		13'-15'											
Sampled by:		TTL											
Sample Location:		PZ47											
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
						2	0.2			0.0	49.8	50.2	

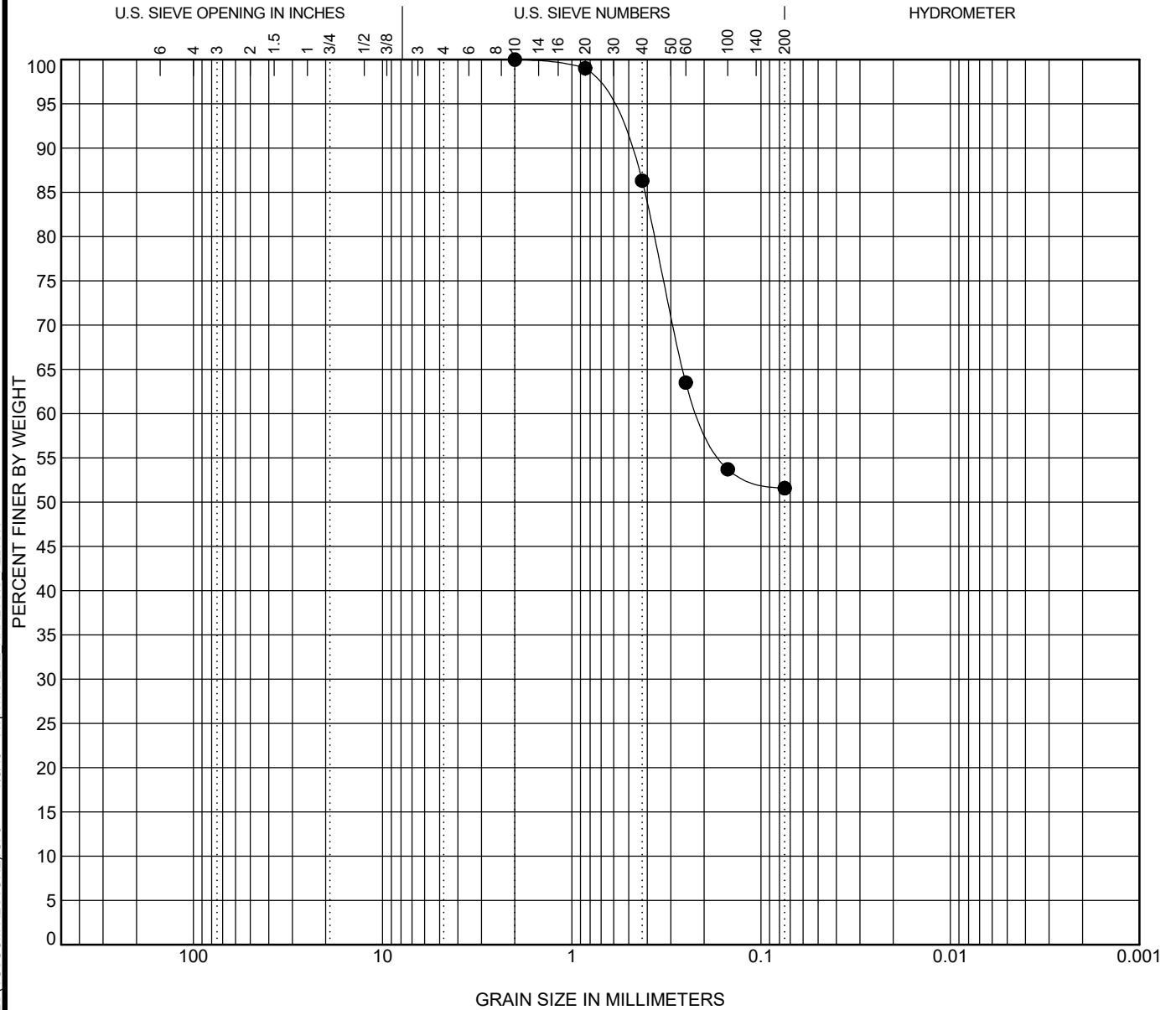


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SIEVE ANALYSIS RESULTS

Client:
 Project: Twin Pines Minerals Saunders-Loncala Reserve
 Location: Saint George, Georgia
 Project Number: 000180200804.00

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID		PZ49											
Description		13.5'-15'											
Sampled by:		TTL											
Sample Location:		PZ49											
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
						2	0.2			0.0	48.4	51.6	

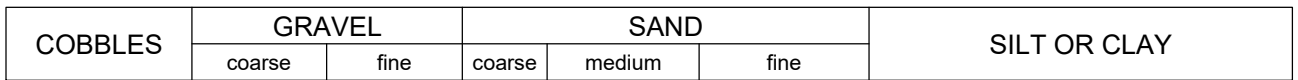
TTL

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SIEVE ANALYSIS RESULTS

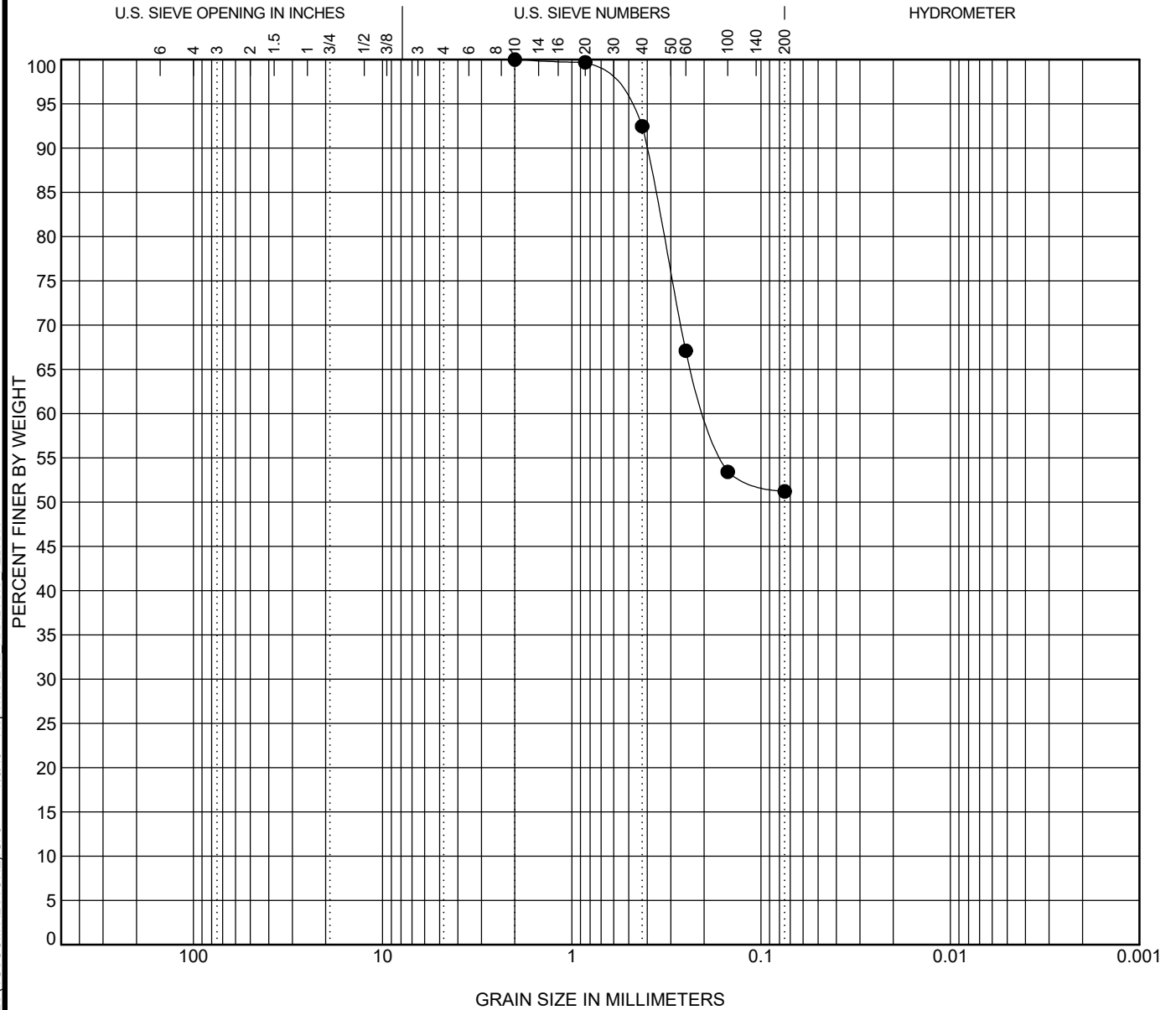
Client:
 Project: Twin Pines Minerals Saunders-Loncala Reserve
 Location: Saint George, Georgia
 Project Number: 000180200804.00

C:\WORK\TWIN PINES\GINT DATABASE\EXCEL FILE\GINT DUMMY\804-LOGS WITH WELLS (TUSCOM RESTORE).GPJ 7/8/19 Report:SIEVE ANALYSIS ALBANY

**TTL**

Client:
Project: Twin Pines Minerals Saunders-Loncalá Reserve
Location: Saint George, Georgia
Project Number: 000180200804.00

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID		PZ53											
Description		7'-10'											
Sampled by:		TTL											
Sample Location:		PZ53											
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
						2	0.2			0.0	48.8	51.2	

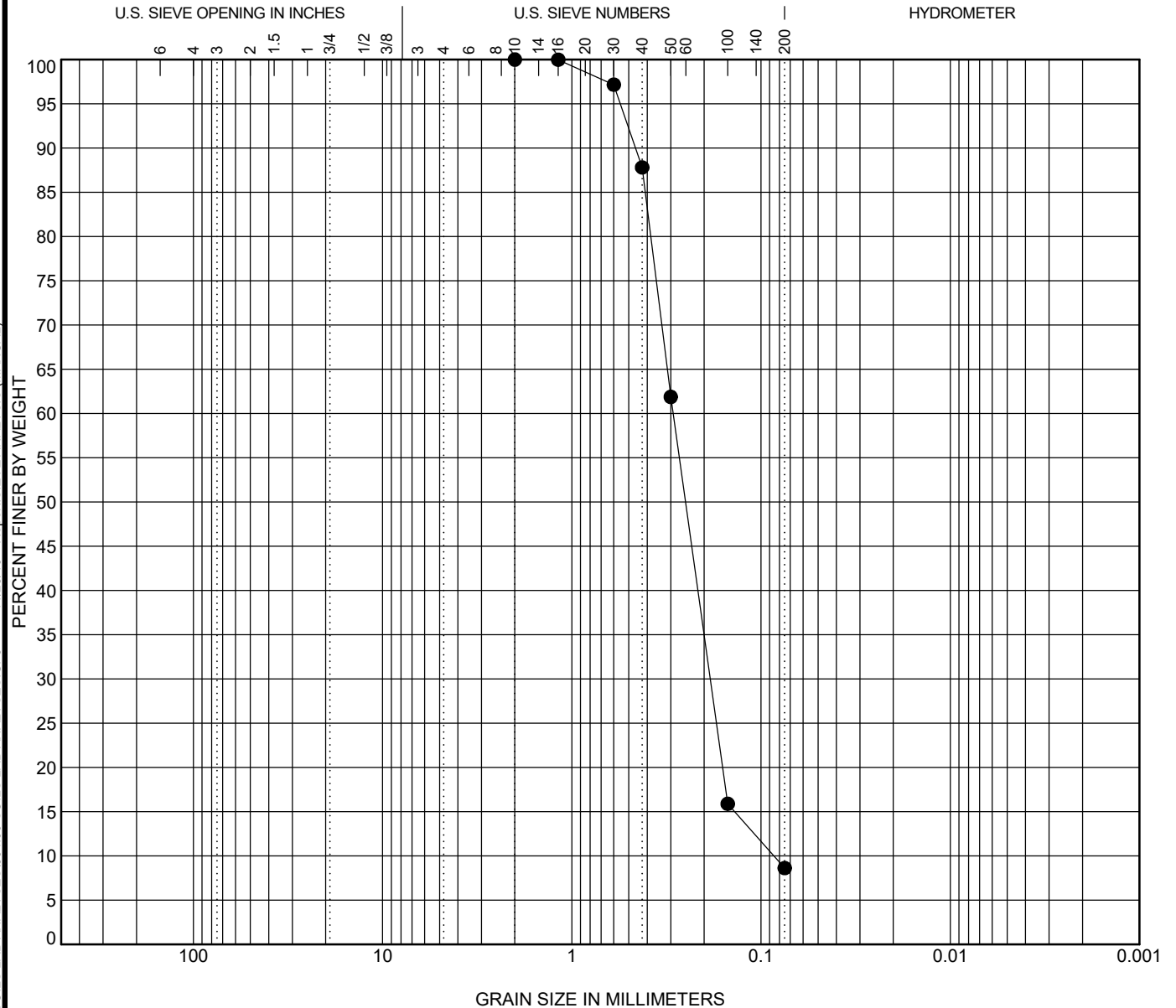


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SIEVE ANALYSIS RESULTS

Client:
 Project: Twin Pines Minerals Saunders-Loncala Reserve
 Location: Saint George, Georgia
 Project Number: 000180200804.00

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

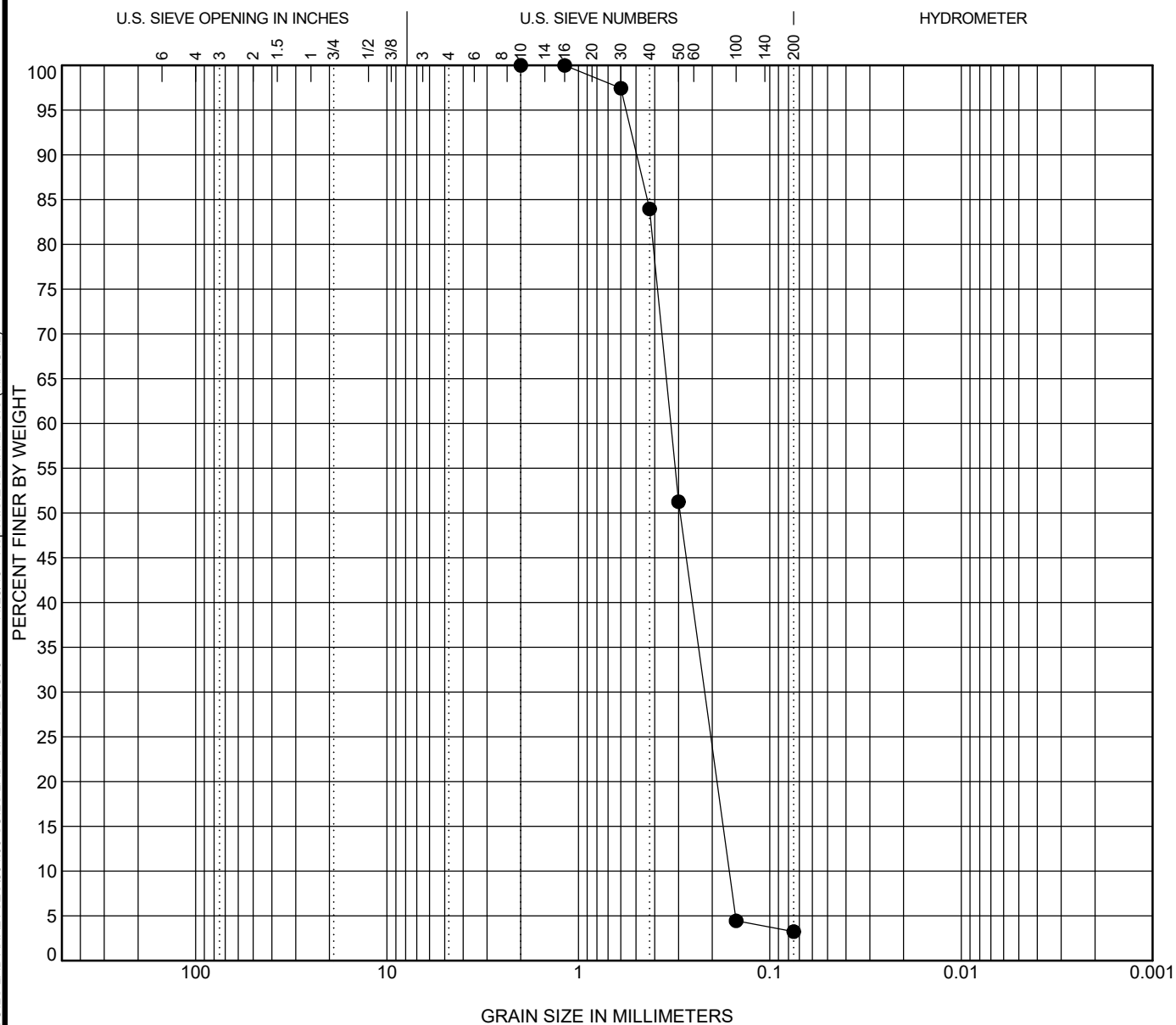
Sample ID		UD-25R											
Description		Light Brown Sand with Silt (SP-SM)											
Sampled by:		TTL, Inc.											
Sample Location:		3'-5'											
Date Sampled:		11/19/2019											
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
18	NP	NP	NP	1.4	3.4	2	0.29	0.19	0.086	0.0	91.4	8.6	



SIEVE ANALYSIS RESULTS

Client: Twin Pines Minerals, LLC
 Project: Twin Pines Minerals Permitting Services
 Location: Charlton County, Georgia
 Project Number: 000180200804.00

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

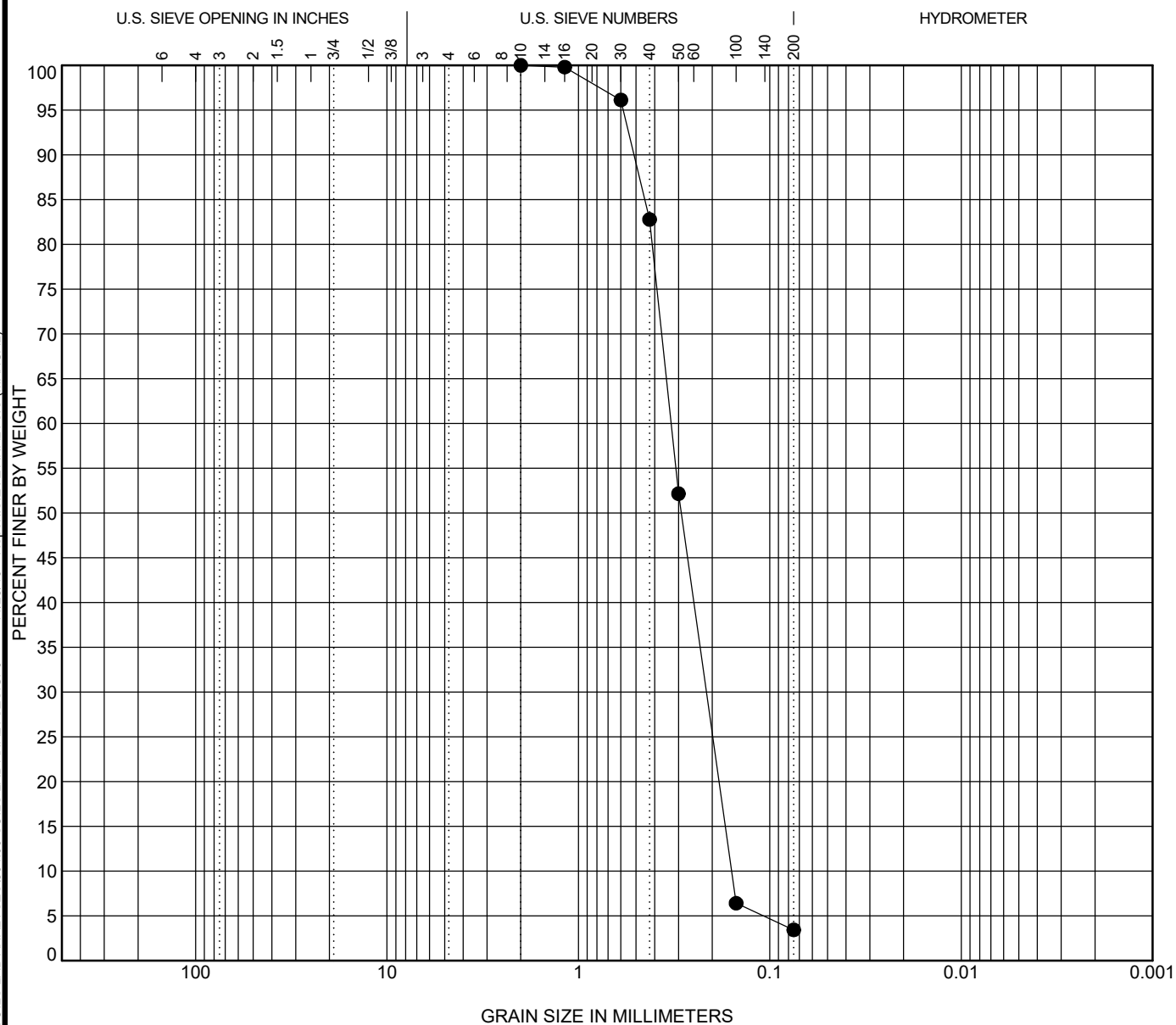
Sample ID		UD-25R											
Description		Black/Brown Sand (SP)											
Sampled by:		TTL, Inc.											
Sample Location:		10'-12'											
Date Sampled:		11/19/2019											
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
24	NP	NP	NP	0.9	2.0	2	0.33	0.22	0.163	0.0	96.8	3.2	



SIEVE ANALYSIS RESULTS

Client: Twin Pines Minerals, LLC
 Project: Twin Pines Minerals Permitting Services
 Location: Charlton County, Georgia
 Project Number: 000180200804.00

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

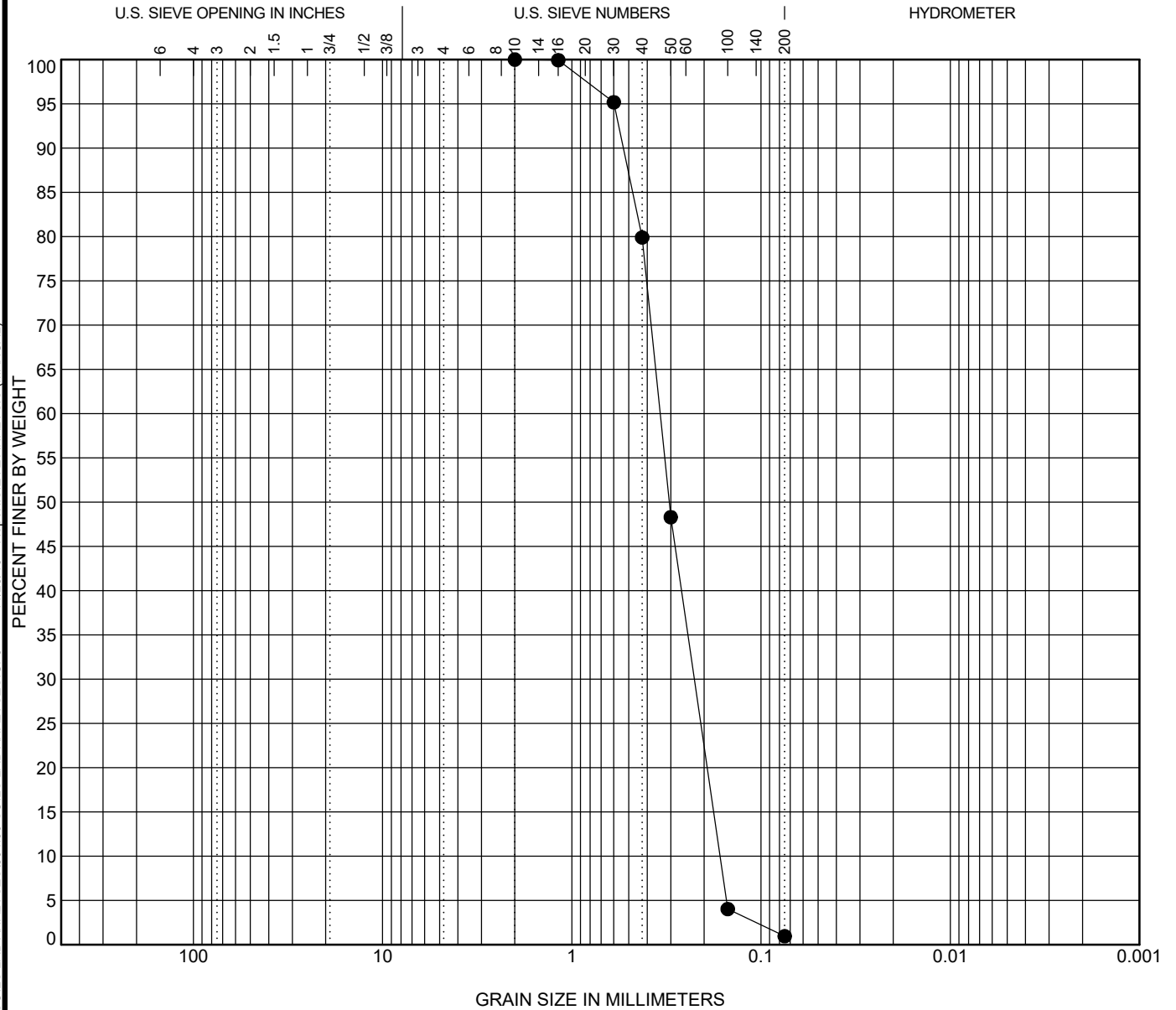
Sample ID		UD-43R											
Description		Black/Brown Sand (SP)											
Sampled by:		TTL, Inc.											
Sample Location:		5'-7'											
Date Sampled:		11/19/2019											
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
19	NP	NP	NP	0.9	2.1	2	0.33	0.21	0.158	0.0	96.6	3.4	



SIEVE ANALYSIS RESULTS

Client: Twin Pines Minerals, LLC
 Project: Twin Pines Minerals Permitting Services
 Location: Charlton County, Georgia
 Project Number: 000180200804.00

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

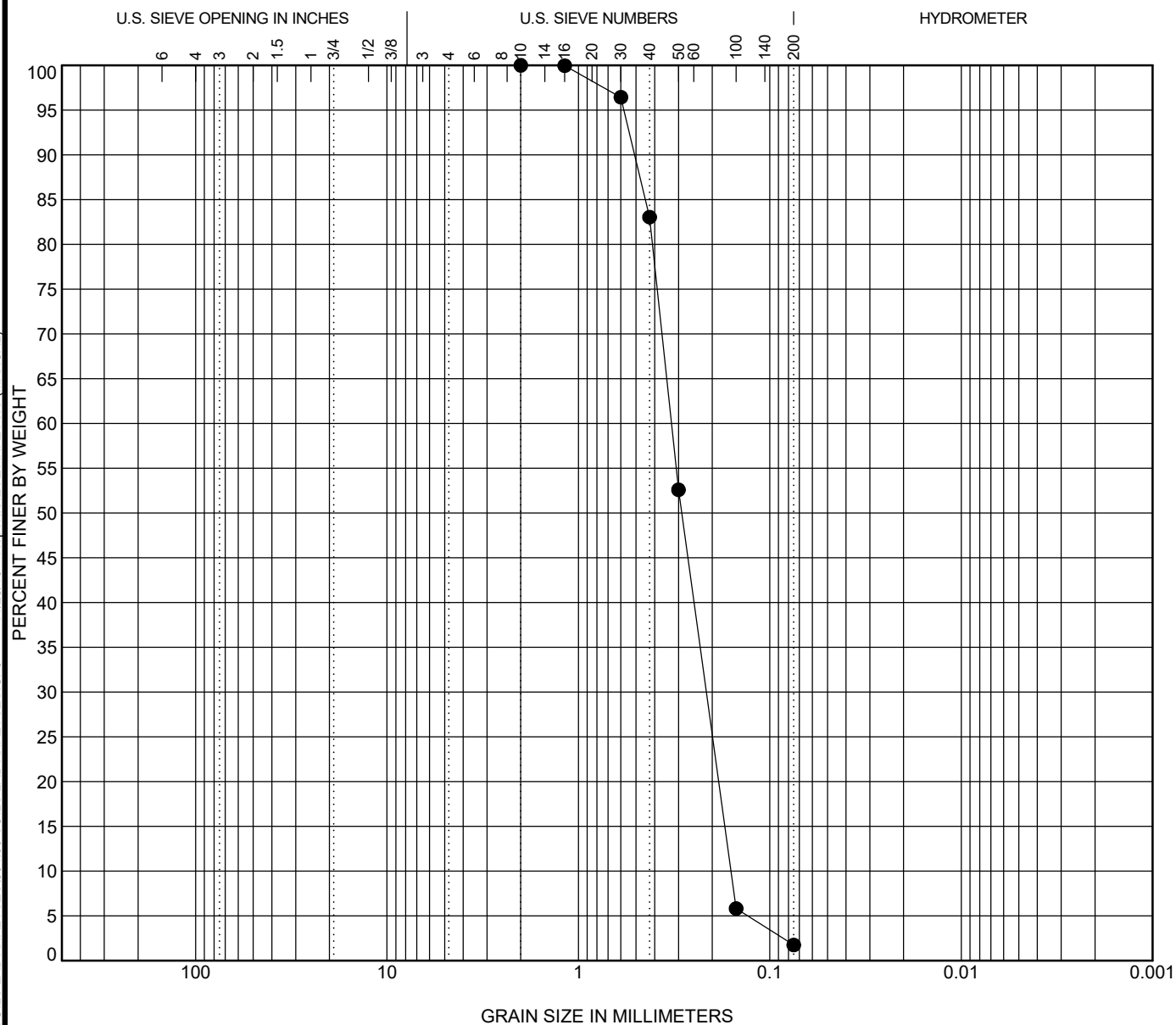
Sample ID		UD-43R											
Description		Black/Brown Sand (SP)											
Sampled by:		TTL, Inc.											
Sample Location:		10'-12'											
Date Sampled:		11/19/2019											
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
19	---	---	---	0.9	2.1	2	0.34	0.23	0.165	0.0	99.0	1.0	



SIEVE ANALYSIS RESULTS

Client: Twin Pines Minerals, LLC
 Project: Twin Pines Minerals Permitting Services
 Location: Charlton County, Georgia
 Project Number: 000180200804.00

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

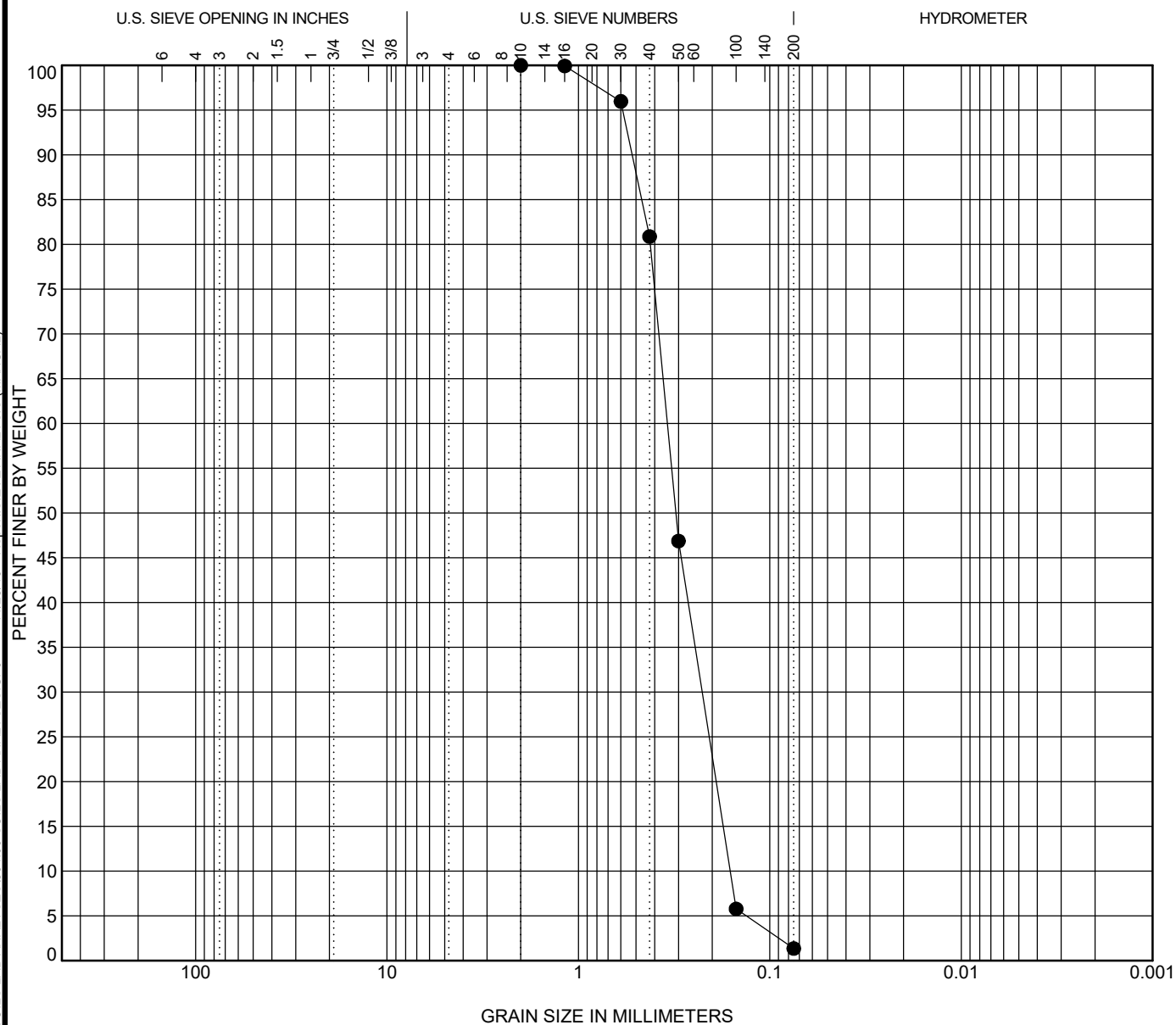
Sample ID		UD-238R											
Description		Black/Brown Sand (SP)											
Sampled by:		TTL, Inc.											
Sample Location:		6'-8'											
Date Sampled:		11/19/2019											
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
19	---	---	---	0.9	2.0	2	0.33	0.21	0.16	0.0	98.3	1.7	



SIEVE ANALYSIS RESULTS

Client: Twin Pines Minerals, LLC
 Project: Twin Pines Minerals Permitting Services
 Location: Charlton County, Georgia
 Project Number: 000180200804.00

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

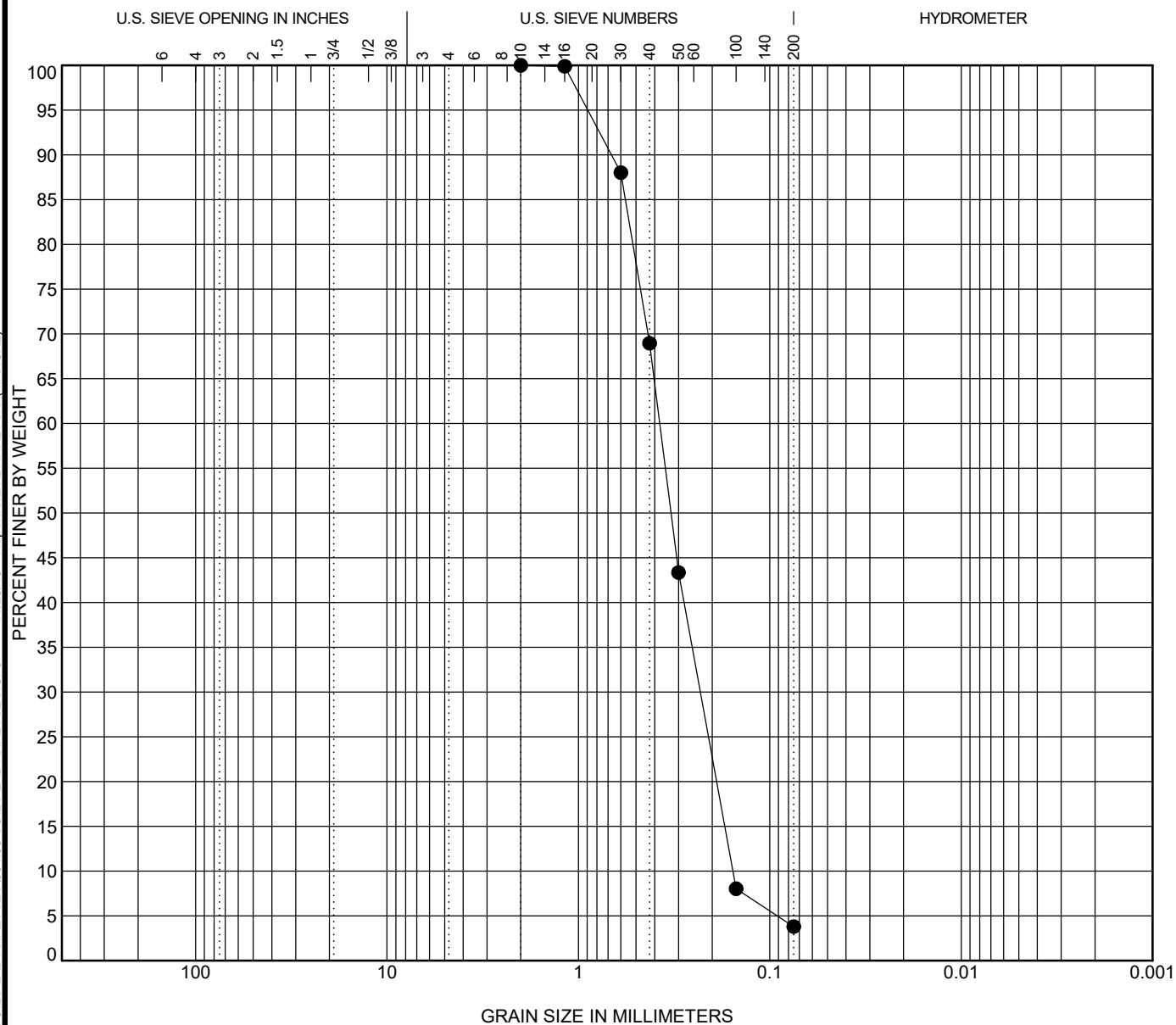
Sample ID		UD-238R											
Description		Black/Brown Sand (SP)											
Sampled by:		TTL, Inc.											
Sample Location:		10'-12'											
Date Sampled:		11/19/2019											
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
17	---	---	---	0.9	2.1	2	0.34	0.23	0.161	0.0	98.7	1.4	



SIEVE ANALYSIS RESULTS

Client: Twin Pines Minerals, LLC
 Project: Twin Pines Minerals Permitting Services
 Location: Charlton County, Georgia
 Project Number: 000180200804.00

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID		UD-338R											
Description		Black/Brown Sand (SP)											
Sampled by:		TTL, Inc.											
Sample Location:		9'-11'											
Date Sampled:		11/19/2019											
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
19	---	---	---	0.9	2.4	2	0.38	0.23	0.156	0.0	96.2	3.8	



SIEVE ANALYSIS RESULTS

Client: Twin Pines Minerals, LLC
 Project: Twin Pines Minerals Permitting Services
 Location: Charlton County, Georgia
 Project Number: 000180200804.00

ATTACHMENT C

**Daniel B. Stephens & Associates, Inc
Soil Moisture Retention Curve Test Report**

Laboratory Report for TTL, Inc.

Project: Twin Pines, 000180200804.00

October 7, 2019



Daniel B. Stephens & Associates, Inc.

4400 Alameda Blvd. NE, Suite C • Albuquerque, New Mexico 87113



October 7, 2019

Jim Smith
TTL, Inc.
4589 Val North Drive
Valdosta, GA 31602
(727) 490-0858

Re: DBS&A Laboratory Report for the TTL, Inc. Twin Pines Project

Dear Mr. Smith:

Enclosed is the report for the TTL Inc. Twin Pines project samples. Please review this report and provide any comments as samples will be held for a maximum of 30 days. After 30 days samples will be returned or disposed of in an appropriate manner.

All testing results were evaluated subjectively for consistency and reasonableness, and the results appear to be reasonably representative of the material tested. However, DBS&A does not assume any responsibility for interpretations or analyses based on the data enclosed, nor can we guarantee that these data are fully representative of the undisturbed materials at the field site. We recommend that careful evaluation of these laboratory results be made for your particular application.

The testing utilized to generate the enclosed report employs methods that are standard for the industry. The results do not constitute a professional opinion by DBS&A, nor can the results affect any professional or expert opinions rendered with respect thereto by DBS&A. You have acknowledged that all the testing undertaken by us, and the report provided, constitutes mere test results using standardized methods, and cannot be used to disqualify DBS&A from rendering any professional or expert opinion, having waived any claim of conflict of interest by DBS&A.

We are pleased to provide this service to TTL, Inc. and look forward to future laboratory testing on other projects. If you have any questions about the enclosed data, please do not hesitate to call.

Sincerely,

DANIEL B. STEPHENS & ASSOCIATES, INC.
SOIL TESTING & RESEARCH LABORATORY

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Enclosure

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Soil Testing & Research Laboratory

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Summaries



Summary of Tests Performed

Laboratory Sample Number	Initial Soil Properties ¹			Saturated Hydraulic Conductivity ²			Moisture Characteristics ³								Particle Size ⁴			Specific Gravity ⁵		Air Perm- eability	Atterberg Limits	Proctor Compaction
	G	VM	VD	CH	FH	FW	HC	PP	FP	DPP	RH	EP	WHC	K _{unsat}	DS	WS	H	F	C			
SS-ADK-01 (Undisturbed) (1.46 g/cc)	X	X		X			X			X	X			X								
SS-ADK-01 (1.60 g/cc)	X	X		X			X			X	X			X								
SS-KEY-01 (Undisturbed) (1.63 g/cc)	X	X		X			X			X	X			X								
SS-KEY-01 (1.59 g/cc)	X	X		X			X	X		X	X			X								
SS-T1A-01 (Undisturbed) (1.54 g/cc)	X	X		X			X			X	X			X								
SS-T1A-01 (1.59 g/cc)	X	X		X			X	X		X	X			X								

¹ G = Gravimetric Moisture Content, VM = Volume Measurement Method, VD = Volume Displacement Method

² CH = Constant Head Rigid Wall, FH = Falling Head Rigid Wall, FW = Falling Head Rising Tail Flexible Wall

³ HC = Hanging Column, PP = Pressure Plate, FP = Filter Paper, DPP = Dew Point Potentiometer, RH = Relative Humidity Box, EP = Effective Porosity, WHC = Water Holding Capacity, K_{unsat} = Calculated Unsaturated Hydraulic Conductivity

⁴ DS = Dry Sieve, WS = Wet Sieve, H = Hydrometer

⁵ F = Fine (<4.75mm), C = Coarse (>4.75mm)



Notes

Sample Receipt:

Three samples were received on March 25, 2019. Each sample was received as two 3" x 3" stainless steel sleeves sealed with endcaps and duct tape (labeled as samples 'A' and 'B'), and one full 1-gallon bag of loose material (labeled as sample 'C'). All samples were packaged together with packing material in a 5-gallon bucket, and all were received in good order.

Sample Preparation and Testing Notes:

The entire 'B' sleeve was used for the 'undisturbed' sample testing. The loose material 'C' was used for remolded sample testing. Each of the samples was subjected to initial properties analysis, saturated hydraulic conductivity testing, and the hanging column and pressure chamber portions of the moisture retention testing. The (Undisturbed) label and dry bulk densities achieved (in g/cc) were added to the sub-sample ID's.

Adjacent sample trimmings were used for the dewpoint potentiometer and relative humidity chamber portions of the moisture retention testing.

Porosity calculations are based on the use of an assumed specific gravity value of 2.65.

Volumetric water contents were adjusted for changes in volume, where applicable. Due to the irregularities formed on the sample surfaces during settling, volume measurements obtained after the initial reading should be considered estimates.



Summary of Sample Preparation/Volume Changes

Sample Number	Initial Sample Data ¹		Volume Change Post Saturation ²			Volume Change Post Drying Curve ³		
	Moisture Content (%, g/g)	Dry Bulk Density (g/cm ³)	Dry Bulk Density (g/cm ³)	% Volume Change (%)	% of Initial Density (%)	Dry Bulk Density (g/cm ³)	% Volume Change (%)	% of Initial Density (%)
SS-ADK-01 (Undisturbed) (1.46 g/cc)	2.7	1.46	1.46	---	100.0%	1.52	-4.0%	104.2%
SS-ADK-01 (1.60 g/cc)	4.4	1.60	1.60	---	100.0%	1.60	---	100.0%
SS-KEY-01 (Undisturbed) (1.63 g/cc)	17.8	1.63	1.63	---	100.0%	1.63	---	100.0%
SS-KEY-01 (1.59 g/cc)	20.3	1.59	1.59	---	100.0%	1.59	---	100.0%
SS-T1A-01 (Undisturbed) (1.54 g/cc)	25.3	1.54	1.54	---	100.0%	1.54	---	100.0%
SS-T1A-01 (1.59 g/cc)	21.1	1.59	1.59	---	100.0%	1.59	---	100.0%

¹Initial Sample Data: The 'as received' dry bulk density and moisture content.

²Volume Change Post Saturation: Volume change measurements were obtained after saturated hydraulic conductivity testing.

³Volume Change Post Drying Curve: Volume change measurements were obtained throughout hanging column and pressure plate testing. The 'Volume Change Post Drying Curve' values represent the final sample dimensions after the last pressure plate point.

Notes:

"+" indicates sample swelling, "-" indicates sample settling, and "---" indicates no volume change occurred.



**Summary of Initial Moisture Content, Dry Bulk Density
Wet Bulk Density and Calculated Porosity**

Sample Number	Moisture Content				Dry Bulk Density (g/cm ³)	Wet Bulk Density (g/cm ³)	Calculated Porosity (%)
	As Received		Remolded				
	Gravimetric (%, g/g)	Volumetric (%, cm ³ /cm ³)	Gravimetric (%, g/g)	Volumetric (%, cm ³ /cm ³)			
SS-ADK-01 (Undisturbed) (1.46 g/cc)	2.7	3.9	---	---	1.46	1.50	44.8
SS-ADK-01 (1.60 g/cc)	NA	NA	4.4	6.9	1.60	1.66	39.8
SS-KEY-01 (Undisturbed) (1.63 g/cc)	17.8	29.0	---	---	1.63	1.92	38.5
SS-KEY-01 (1.59 g/cc)	NA	NA	20.3	32.4	1.59	1.92	39.9
SS-T1A-01 (Undisturbed) (1.54 g/cc)	25.3	38.9	---	---	1.54	1.93	42.0
SS-T1A-01 (1.59 g/cc)	NA	NA	21.1	33.5	1.59	1.92	40.1

NA = Not analyzed

--- = This sample was not remolded



Summary of Saturated Hydraulic Conductivity Tests

Sample Number	K _{sat} (cm/sec)	Oversize Corrected K _{sat} (cm/sec)	Method of Analysis	
			Constant Head	Falling Head
SS-ADK-01 (Undisturbed) (1.46 g/cc)	1.6E-02	NA	X	
SS-ADK-01 (1.60 g/cc)	1.1E-02	NA	X	
SS-KEY-01 (Undisturbed) (1.63 g/cc)	2.0E-03	NA	X	
SS-KEY-01 (1.59 g/cc)	1.9E-03	NA	X	
SS-T1A-01 (Undisturbed) (1.54 g/cc)	2.4E-03	NA	X	
SS-T1A-01 (1.59 g/cc)	3.2E-04	NA	X	

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NR = Not requested

NA = Not applicable



Summary of Moisture Characteristics of the Initial Drainage Curve

Sample Number	Pressure Head (-cm water)	Moisture Content (%, cm^3/cm^3)
SS-ADK-01 (Undisturbed) (1.46 g/cc)	0	44.0
	6	42.1 ‡
	19	40.9 ‡
	49	14.4 ‡
	186	10.0 ‡
	4283	3.3 ‡
	18866	2.0 ‡
	366414	1.2 ‡
	852439	0.7 ‡
SS-ADK-01 (1.60 g/cc)	0	40.4
	5	39.9
	13	39.6
	52	10.8
	197	8.2
	9280	1.6
	34265	0.9
	265760	0.7
	846993	0.4
SS-KEY-01 (Undisturbed) (1.63 g/cc)	0	36.9
	6	36.1
	19	35.3
	49	23.0
	186	17.7
	3773	3.3
	37733	1.2
	267901	0.9
	852439	0.6

‡ Volume adjustments are applicable at this matric potential (see data sheet for this sample).



**Summary of Moisture Characteristics
of the Initial Drainage Curve (Continued)**

Sample Number	Pressure Head (-cm water)	Moisture Content (%, cm ³ /cm ³)
SS-KEY-01 (1.59 g/cc)	0	39.8
	4	39.8
	25	36.4
	337	12.7
	9178	2.6
	39568	1.2
	303492	0.8
	846993	0.4
SS-T1A-01 (Undisturbed) (1.54 g/cc)	0	40.1
	6	39.7
	19	39.3
	49	27.4
	186	19.5
	4079	10.5
	37631	3.3
	173162	1.7
	852439	0.6
SS-T1A-01 (1.59 g/cc)	0	38.1
	11	37.7
	32	35.5
	99	21.6
	337	18.4
	2448	6.0
	37325	1.4
	251381	1.0
	846993	0.7

Volume adjustments are applicable at this matric potential (see data sheet for this sample).



Summary of Calculated Unsaturated Hydraulic Properties

Sample Number	α (cm ⁻¹)	N (dimensionless)	θ_r (% vol)	θ_s (% vol)	Oversize Corrected	
					θ_r (% vol)	θ_s (% vol)
SS-ADK-01 (Undisturbed) (1.46 g/cc)	0.0305	3.6589	3.28	43.45	NA	NA
SS-ADK-01 (1.60 g/cc)	0.0370	2.9456	2.02	40.86	NA	NA
SS-KEY-01 (Undisturbed) (1.63 g/cc)	0.0357	1.4480	0.00	37.56	NA	NA
SS-KEY-01 (1.59 g/cc)	0.0188	1.6228	0.61	39.97	NA	NA
SS-T1A-01 (Undisturbed) (1.54 g/cc)	0.0450	1.3213	0.00	41.31	NA	NA
SS-T1A-01 (1.59 g/cc)	0.0236	1.4332	0.00	39.00	NA	NA

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NR = Not requested

NA = Not applicable

Initial Properties



**Summary of Initial Moisture Content, Dry Bulk Density
Wet Bulk Density and Calculated Porosity**

Sample Number	Moisture Content				Dry Bulk Density (g/cm ³)	Wet Bulk Density (g/cm ³)	Calculated Porosity (%)
	As Received		Remolded				
	Gravimetric (%, g/g)	Volumetric (%, cm ³ /cm ³)	Gravimetric (%, g/g)	Volumetric (%, cm ³ /cm ³)			
SS-ADK-01 (Undisturbed) (1.46 g/cc)	2.7	3.9	---	---	1.46	1.50	44.8
SS-ADK-01 (1.60 g/cc)	NA	NA	4.4	6.9	1.60	1.66	39.8
SS-KEY-01 (Undisturbed) (1.63 g/cc)	17.8	29.0	---	---	1.63	1.92	38.5
SS-KEY-01 (1.59 g/cc)	NA	NA	20.3	32.4	1.59	1.92	39.9
SS-T1A-01 (Undisturbed) (1.54 g/cc)	25.3	38.9	---	---	1.54	1.93	42.0
SS-T1A-01 (1.59 g/cc)	NA	NA	21.1	33.5	1.59	1.92	40.1

NA = Not analyzed

--- = This sample was not remolded



Daniel B. Stephens & Associates, Inc.

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: TTL, Inc.
Job Number: DB19.1098.00
Sample Number: SS-ADK-01 (Undisturbed) (1.46 g/cc)
Project Name: Twin Pines
Project Number: 000180200804.00

	<u>As Received</u>	<u>Remolded</u>
Test Date:	4-Apr-19	---
Field weight* of sample (g):	685.11	
Tare weight, ring (g):	254.90	
Tare weight, pan/plate (g):	0.00	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	418.99	
Sample volume (cm ³):	286.20	
Assumed particle density (g/cm ³):	2.65	
Gravimetric Moisture Content (% g/g):	2.7	
Volumetric Moisture Content (% vol):	3.9	
Dry bulk density (g/cm ³):	1.46	
Wet bulk density (g/cm ³):	1.50	
Calculated Porosity (% vol):	44.8	
Percent Saturation:	8.8	

Laboratory analysis by: D. O'Dowd
Data entered by: D. O'Dowd
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded



Daniel B. Stephens & Associates, Inc.

**Data for Initial Moisture Content,
Bulk Density, Porosity, and Percent Saturation**

Job Name: TTL, Inc.
Job Number: DB19.1098.00
Sample Number: SS-ADK-01 (1.60 g/cc)
Project Name: Twin Pines
Project Number: 000180200804.00

	<u>As Received</u>	<u>Remolded</u>
Test Date:	NA	14-Aug-19
Field weight* of sample (g):		515.39
Tare weight, ring (g):		140.92
Tare weight, pan/plate (g):		0.00
Tare weight, other (g):		0.00
Dry weight of sample (g):		358.85
Sample volume (cm ³):		224.93
Assumed particle density (g/cm ³):		2.65
Gravimetric Moisture Content (% g/g):		4.4
Volumetric Moisture Content (% vol):		6.9
Dry bulk density (g/cm ³):		1.60
Wet bulk density (g/cm ³):		1.66
Calculated Porosity (% vol):		39.8
Percent Saturation:		17.4
Laboratory analysis by:		D. O'Dowd
Data entered by:		D. O'Dowd
Checked by:		J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded



Daniel B. Stephens & Associates, Inc.

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: TTL, Inc.
Job Number: DB19.1098.00
Sample Number: SS-KEY-01 (Undisturbed) (1.63 g/cc)
Project Name: Twin Pines
Project Number: 000180200804.00

	<u>As Received</u>	<u>Remolded</u>
Test Date:	4-Apr-19	---
Field weight* of sample (g):	792.70	
Tare weight, ring (g):	245.11	
Tare weight, pan/plate (g):	0.00	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	464.92	
Sample volume (cm ³):	285.47	
Assumed particle density (g/cm ³):	2.65	
Gravimetric Moisture Content (% g/g):	17.8	
Volumetric Moisture Content (% vol):	29.0	
Dry bulk density (g/cm ³):	1.63	
Wet bulk density (g/cm ³):	1.92	
Calculated Porosity (% vol):	38.5	
Percent Saturation:	75.1	

Laboratory analysis by: D. O'Dowd
Data entered by: D. O'Dowd
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded



Daniel B. Stephens & Associates, Inc.

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: TTL, Inc.
Job Number: DB19.1098.00
Sample Number: SS-KEY-01 (1.59 g/cc)
Project Name: Twin Pines
Project Number: 000180200804.00

	<u>As Received</u>	<u>Remolded</u>
Test Date:	NA	14-Aug-19
Field weight* of sample (g):		559.42
Tare weight, ring (g):		137.30
Tare weight, pan/plate (g):		0.00
Tare weight, other (g):		0.00
Dry weight of sample (g):		350.79
Sample volume (cm ³):		220.36
Assumed particle density (g/cm ³):		2.65
Gravimetric Moisture Content (% g/g):		20.3
Volumetric Moisture Content (% vol):		32.4
Dry bulk density (g/cm ³):		1.59
Wet bulk density (g/cm ³):		1.92
Calculated Porosity (% vol):		39.9
Percent Saturation:		81.1
Laboratory analysis by:		D. O'Dowd
Data entered by:		D. O'Dowd
Checked by:		J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded



Daniel B. Stephens & Associates, Inc.

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: TTL, Inc.
Job Number: DB19.1098.00
Sample Number: SS-T1A-01 (Undisturbed) (1.54 g/cc)
Project Name: Twin Pines
Project Number: 000180200804.00

	<u>As Received</u>	<u>Remolded</u>
Test Date:	4-Apr-19	---
Field weight* of sample (g):	795.02	
Tare weight, ring (g):	245.30	
Tare weight, pan/plate (g):	0.00	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	438.64	
Sample volume (cm ³):	285.39	
Assumed particle density (g/cm ³):	2.65	
Gravimetric Moisture Content (% g/g):	25.3	
Volumetric Moisture Content (% vol):	38.9	
Dry bulk density (g/cm ³):	1.54	
Wet bulk density (g/cm ³):	1.93	
Calculated Porosity (% vol):	42.0	
Percent Saturation:	92.7	

Laboratory analysis by: D. O'Dowd
Data entered by: D. O'Dowd
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded



Daniel B. Stephens & Associates, Inc.

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: TTL, Inc.
Job Number: DB19.1098.00
Sample Number: SS-T1A-01 (1.59 g/cc)
Project Name: Twin Pines
Project Number: 000180200804.00

	<u>As Received</u>	<u>Remolded</u>
Test Date:	NA	14-Aug-19
Field weight* of sample (g):		570.50
Tare weight, ring (g):		140.50
Tare weight, pan/plate (g):		0.00
Tare weight, other (g):		0.00
Dry weight of sample (g):		354.98
Sample volume (cm ³):		223.74
Assumed particle density (g/cm ³):		2.65
Gravimetric Moisture Content (% g/g):		21.1
Volumetric Moisture Content (% vol):		33.5
Dry bulk density (g/cm ³):		1.59
Wet bulk density (g/cm ³):		1.92
Calculated Porosity (% vol):		40.1
Percent Saturation:		83.6
Laboratory analysis by:		D. O'Dowd
Data entered by:		D. O'Dowd
Checked by:		J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Saturated Hydraulic Conductivity



Summary of Saturated Hydraulic Conductivity Tests

Sample Number	K _{sat} (cm/sec)	Oversize Corrected K _{sat} (cm/sec)	Method of Analysis	
			Constant Head	Falling Head
SS-ADK-01 (Undisturbed) (1.46 g/cc)	1.6E-02	NA	X	
SS-ADK-01 (1.60 g/cc)	1.1E-02	NA	X	
SS-KEY-01 (Undisturbed) (1.63 g/cc)	2.0E-03	NA	X	
SS-KEY-01 (1.59 g/cc)	1.9E-03	NA	X	
SS-T1A-01 (Undisturbed) (1.54 g/cc)	2.4E-03	NA	X	
SS-T1A-01 (1.59 g/cc)	3.2E-04	NA	X	

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NR = Not requested

NA = Not applicable



Daniel B. Stephens & Associates, Inc.

Saturated Hydraulic Conductivity Constant Head Method

Job Name: TTL, Inc.
Job Number: DB19.1098.00
Sample Number: SS-ADK-01 (Undisturbed) (1.46 g/cc)
Project Name: Twin Pines
Project Number: 000180200804.00

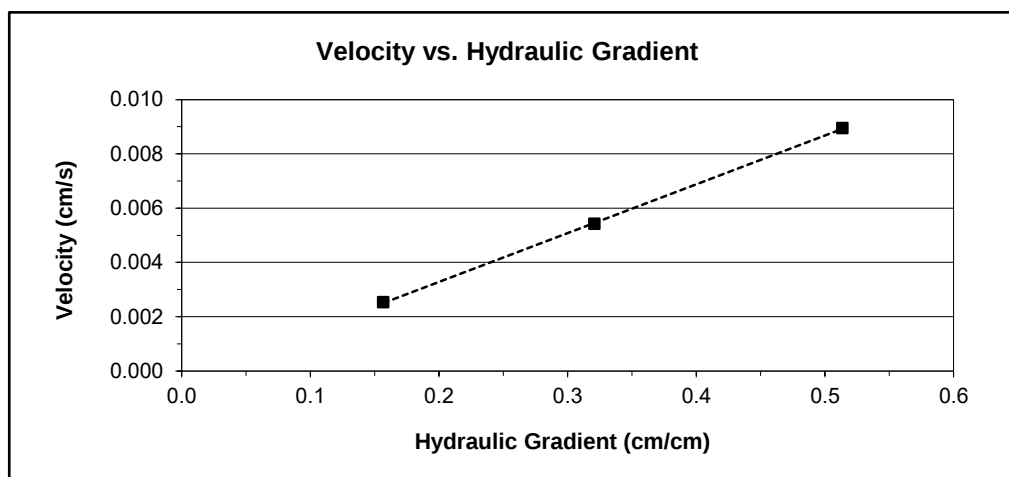
Type of water used: TAP
Collection vessel tare (g): 66.44
Sample length (cm): 7.01
Sample diameter (cm): 7.21
Sample x-sectional area (cm²): 40.84

Date	Time	Temp (°C)	Head (cm)	Q + Tare (g)	Q (cm ³)	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1:								
5-Apr-19	12:32:00	21.0	3.6	132.17	65.7	180	1.7E-02	1.7E-02
5-Apr-19	12:35:00							
Test # 2:								
5-Apr-19	12:52:00	21.0	2.25	106.23	39.8	180	1.7E-02	1.7E-02
5-Apr-19	12:55:00							
Test # 3:								
5-Apr-19	13:12:00	21.0	1.1	85.00	18.6	180	1.6E-02	1.6E-02
5-Apr-19	13:15:00							

Average Ksat (cm/sec): 1.6E-02
Oversize Corrected Ksat (cm/sec): NA

Comments:

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass
NA = Not applicable



Laboratory analysis by: D. O'Dowd
Data entered by: D. O'Dowd
Checked by: J. Hines



Daniel B. Stephens & Associates, Inc.

Saturated Hydraulic Conductivity Constant Head Method

Job Name: TTL, Inc.
Job Number: DB19.1098.00
Sample Number: SS-ADK-01 (1.60 g/cc)
Project Name: Twin Pines
Project Number: 000180200804.00

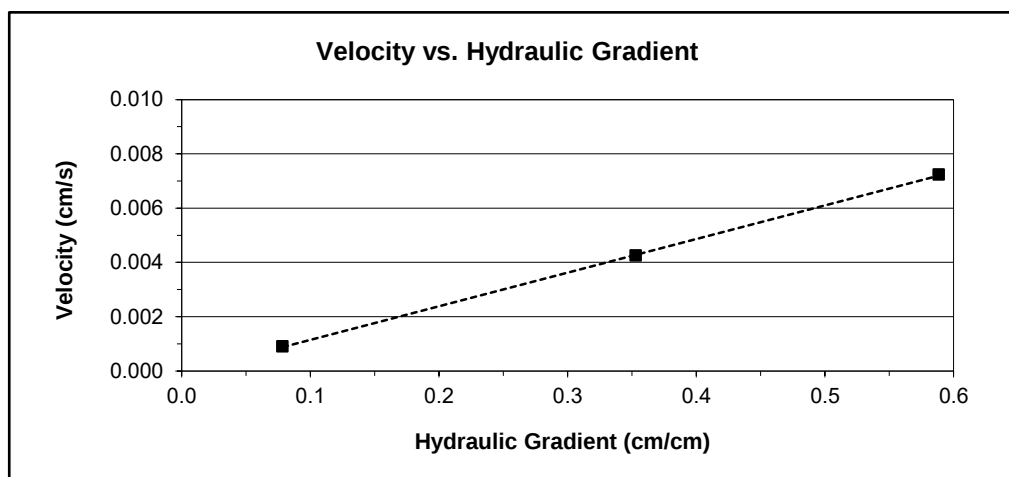
Type of water used: TAP
Collection vessel tare (g): 29.47
Sample length (cm): 7.64
Sample diameter (cm): 6.12
Sample x-sectional area (cm²): 29.43

Date	Time	Temp (°C)	Head (cm)	Q + Tare (g)	Q (cm ³)	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1:								
20-Aug-19	10:05:30	22.5	4.5	67.76	38.3	180	1.2E-02	1.2E-02
20-Aug-19	10:08:30							
Test # 2:								
20-Aug-19	10:18:30	22.5	2.7	51.94	22.5	180	1.2E-02	1.1E-02
20-Aug-19	10:21:30							
Test # 3:								
20-Aug-19	10:31:30	22.5	0.6	34.23	4.8	180	1.1E-02	1.1E-02
20-Aug-19	10:34:30							

Average Ksat (cm/sec): 1.1E-02
Oversize Corrected Ksat (cm/sec): NA

Comments:

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass
NA = Not applicable



Laboratory analysis by: D. O'Dowd
Data entered by: D. O'Dowd
Checked by: J. Hines



Daniel B. Stephens & Associates, Inc.

Saturated Hydraulic Conductivity Constant Head Method

Job Name: TTL, Inc.
Job Number: DB19.1098.00
Sample Number: SS-KEY-01 (Undisturbed) (1.63 g/cc)
Project Name: Twin Pines
Project Number: 000180200804.00

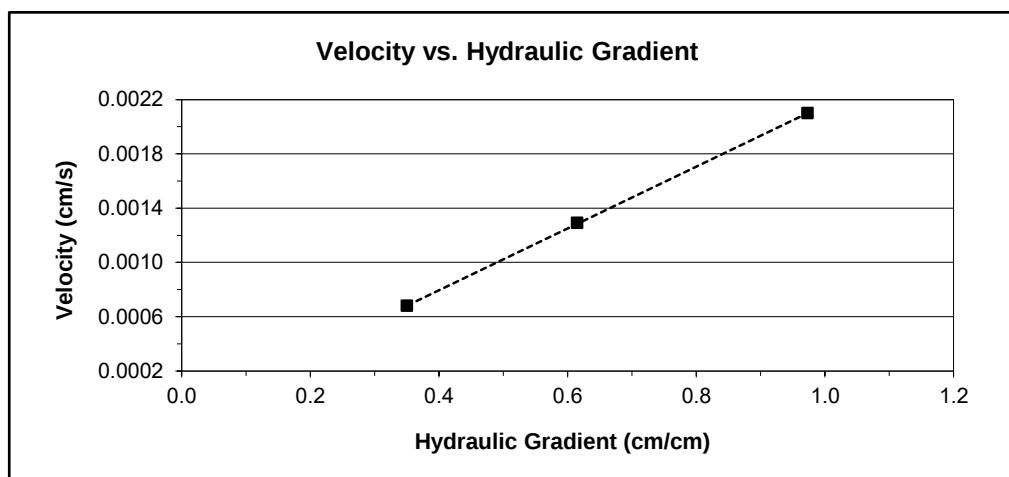
Type of water used: TAP
Collection vessel tare (g): 68.01
Sample length (cm): 6.99
Sample diameter (cm): 7.21
Sample x-sectional area (cm²): 40.85

Date	Time	Temp (°C)	Head (cm)	Q + Tare (g)	Q (cm ³)	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1:								
5-Apr-19	12:30:00	21.0	6.8	83.44	15.4	180	2.2E-03	2.1E-03
5-Apr-19	12:33:00							
Test # 2:								
5-Apr-19	12:50:00	21.0	4.3	77.49	9.5	180	2.1E-03	2.1E-03
5-Apr-19	12:53:00							
Test # 3:								
5-Apr-19	13:10:00	21.0	2.45	73.01	5.0	180	1.9E-03	1.9E-03
5-Apr-19	13:13:00							

Average Ksat (cm/sec): 2.0E-03
Oversize Corrected Ksat (cm/sec): NA

Comments:

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass
NA = Not applicable



Laboratory analysis by: D. O'Dowd
Data entered by: D. O'Dowd
Checked by: J. Hines



Daniel B. Stephens & Associates, Inc.

Saturated Hydraulic Conductivity Constant Head Method

Job Name: TTL, Inc.
Job Number: DB19.1098.00
Sample Number: SS-KEY-01 (1.59 g/cc)
Project Name: Twin Pines
Project Number: 000180200804.00

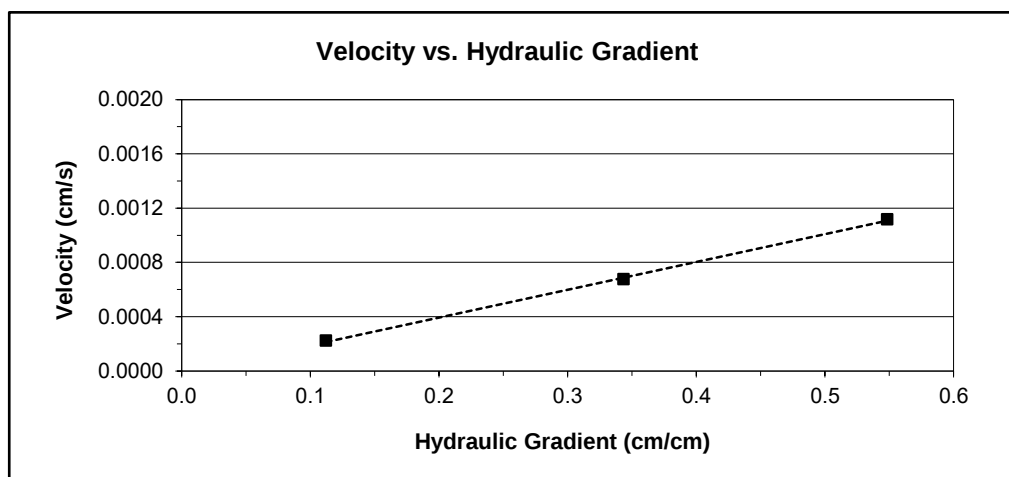
Type of water used: TAP
Collection vessel tare (g): 29.36
Sample length (cm): 7.57
Sample diameter (cm): 6.09
Sample x-sectional area (cm²): 29.13

Date	Time	Temp (°C)	Head (cm)	Q + Tare (g)	Q (cm ³)	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1:								
20-Aug-19	10:06:00	22.5	4.15	35.21	5.9	180	2.0E-03	1.9E-03
20-Aug-19	10:09:00							
Test # 2:								
20-Aug-19	10:19:00	22.5	2.6	32.90	3.5	180	2.0E-03	1.9E-03
20-Aug-19	10:22:00							
Test # 3:								
20-Aug-19	10:32:00	22.5	0.85	30.52	1.2	180	2.0E-03	1.9E-03
20-Aug-19	10:35:00							

Average Ksat (cm/sec): 1.9E-03
Oversize Corrected Ksat (cm/sec): NA

Comments:

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass
NA = Not applicable



Laboratory analysis by: D. O'Dowd
Data entered by: D. O'Dowd
Checked by: J. Hines



Daniel B. Stephens & Associates, Inc.

Saturated Hydraulic Conductivity Constant Head Method

Job Name: TTL, Inc.
Job Number: DB19.1098.00
Sample Number: SS-T1A-01 (Undisturbed) (1.54 g/cc)
Project Name: Twin Pines
Project Number: 000180200804.00

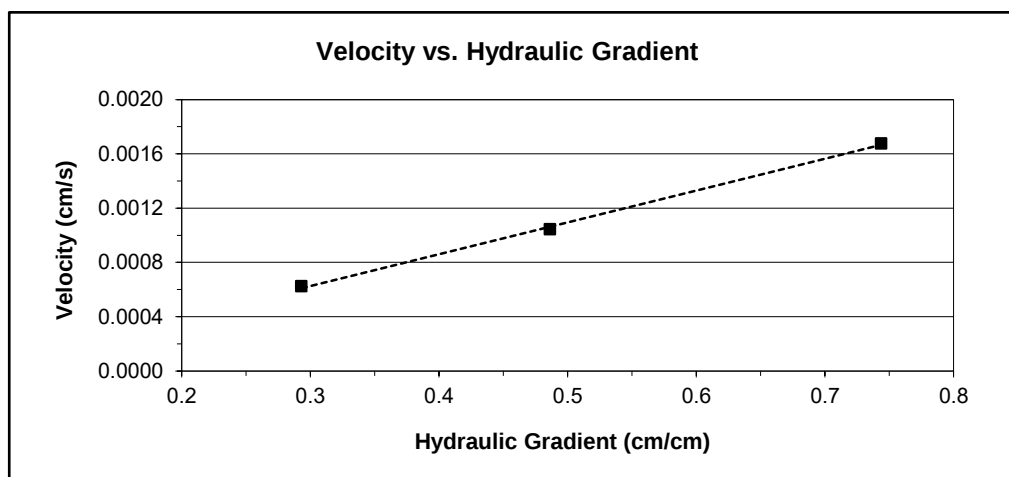
Type of water used: TAP
Collection vessel tare (g): 67.96
Sample length (cm): 6.99
Sample diameter (cm): 7.21
Sample x-sectional area (cm²): 40.83

Date	Time	Temp (°C)	Head (cm)	Q + Tare (g)	Q (cm ³)	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1:								
5-Apr-19	12:31:00	21.0	4.85	80.27	12.3	180	2.4E-03	2.4E-03
5-Apr-19	12:34:00							
Test # 2:								
5-Apr-19	12:51:00	21.0	3.05	76.14	8.2	192	2.4E-03	2.3E-03
5-Apr-19	12:54:12							
Test # 3:								
5-Apr-19	13:11:00	21.0	1.7	72.53	4.6	180	2.6E-03	2.5E-03
5-Apr-19	13:14:00							

Average Ksat (cm/sec): 2.4E-03
Oversize Corrected Ksat (cm/sec): NA

Comments:

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass
NA = Not applicable



Laboratory analysis by: D. O'Dowd
Data entered by: D. O'Dowd
Checked by: J. Hines



Daniel B. Stephens & Associates, Inc.

Saturated Hydraulic Conductivity Constant Head Method

Job Name: TTL, Inc.
Job Number: DB19.1098.00
Sample Number: SS-T1A-01 (1.59 g/cc)
Project Name: Twin Pines
Project Number: 000180200804.00

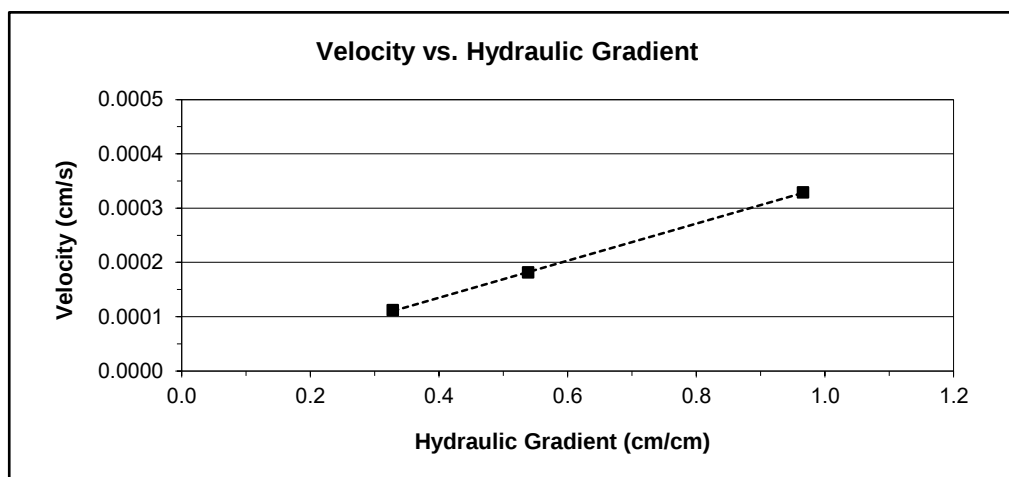
Type of water used: TAP
Collection vessel tare (g): 29.37
Sample length (cm): 7.61
Sample diameter (cm): 6.12
Sample x-sectional area (cm²): 29.42

Date	Time	Temp (°C)	Head (cm)	Q + Tare (g)	Q (cm ³)	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1:								
20-Aug-19	10:05:00	22.5	7.35	31.11	1.7	180	3.4E-04	3.2E-04
20-Aug-19	10:08:00							
Test # 2:								
20-Aug-19	10:18:00	22.5	4.1	30.33	1.0	180	3.4E-04	3.2E-04
20-Aug-19	10:21:00							
Test # 3:								
20-Aug-19	10:31:00	22.5	2.5	29.96	0.6	180	3.4E-04	3.2E-04
20-Aug-19	10:34:00							

Average Ksat (cm/sec): 3.2E-04
Oversize Corrected Ksat (cm/sec): NA

Comments:

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass
NA = Not applicable



Laboratory analysis by: D. O'Dowd
Data entered by: D. O'Dowd
Checked by: J. Hines

Moisture Retention Characteristics



Summary of Moisture Characteristics of the Initial Drainage Curve

Sample Number	Pressure Head (-cm water)	Moisture Content (%, cm^3/cm^3)
SS-ADK-01 (Undisturbed) (1.46 g/cc)	0	44.0
	6	42.1 ‡
	19	40.9 ‡
	49	14.4 ‡
	186	10.0 ‡
	4283	3.3 ‡
	18866	2.0 ‡
	366414	1.2 ‡
	852439	0.7 ‡
SS-ADK-01 (1.60 g/cc)	0	40.4
	5	39.9
	13	39.6
	52	10.8
	197	8.2
	9280	1.6
	34265	0.9
	265760	0.7
	846993	0.4
SS-KEY-01 (Undisturbed) (1.63 g/cc)	0	36.9
	6	36.1
	19	35.3
	49	23.0
	186	17.7
	3773	3.3
	37733	1.2
	267901	0.9
	852439	0.6

‡ Volume adjustments are applicable at this matric potential (see data sheet for this sample).



Summary of Moisture Characteristics of the Initial Drainage Curve (Continued)

Sample Number	Pressure Head (-cm water)	Moisture Content (%, cm ³ /cm ³)
SS-KEY-01 (1.59 g/cc)	0	39.8
	4	39.8
	25	36.4
	337	12.7
	9178	2.6
	39568	1.2
	303492	0.8
	846993	0.4
SS-T1A-01 (Undisturbed) (1.54 g/cc)	0	40.1
	6	39.7
	19	39.3
	49	27.4
	186	19.5
	4079	10.5
	37631	3.3
	173162	1.7
	852439	0.6
SS-T1A-01 (1.59 g/cc)	0	38.1
	11	37.7
	32	35.5
	99	21.6
	337	18.4
	2448	6.0
	37325	1.4
	251381	1.0
	846993	0.7

Volume adjustments are applicable at this matric potential (see data sheet for this sample).



Summary of Calculated Unsaturated Hydraulic Properties

Sample Number	α (cm ⁻¹)	N (dimensionless)	θ_r (% vol)	θ_s (% vol)	Oversize Corrected	
					θ_r (% vol)	θ_s (% vol)
SS-ADK-01 (Undisturbed) (1.46 g/cc)	0.0305	3.6589	3.28	43.45	NA	NA
SS-ADK-01 (1.60 g/cc)	0.0370	2.9456	2.02	40.86	NA	NA
SS-KEY-01 (Undisturbed) (1.63 g/cc)	0.0357	1.4480	0.00	37.56	NA	NA
SS-KEY-01 (1.59 g/cc)	0.0188	1.6228	0.61	39.97	NA	NA
SS-T1A-01 (Undisturbed) (1.54 g/cc)	0.0450	1.3213	0.00	41.31	NA	NA
SS-T1A-01 (1.59 g/cc)	0.0236	1.4332	0.00	39.00	NA	NA

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NR = Not requested

NA = Not applicable



Daniel B. Stephens & Associates, Inc.

Moisture Retention Data
Hanging Column / Pressure Plate
 (Soil-Water Characteristic Curve)

Job Name: TTL, Inc.
 Job Number: DB19.1098.00
 Sample Number: SS-ADK-01 (Undisturbed) (1.46 g/cc)
 Project Name: Twin Pines
 Project Number: 000180200804.00

Dry wt. of sample (g): 418.99
 Tare wt., ring (g): 254.90
 Tare wt., screen & clamp (g): 26.68
 Initial sample volume (cm³): 286.20
 Initial dry bulk density (g/cm³): 1.46
 Assumed particle density (g/cm³): 2.65
 Initial calculated total porosity (%): 44.76

	Date	Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content [†] (% vol)	
<i>Hanging column:</i>	5-Apr-19	15:00	826.47	0	43.99	
	15-Apr-19	17:00	816.19	6.0	42.08	##
	22-Apr-19	16:00	812.97	18.5	40.91	##
	29-Apr-19	13:55	740.23	49.0	14.43	##
	7-May-19	14:40	728.16	186.0	10.04	##

Volume Adjusted Data¹

	Matric Potential (-cm water)	Adjusted Volume (cm ³)	% Volume Change ² (%)	Adjusted Density (g/cm ³)	Adjusted Calculated Porosity (%)
<i>Hanging column:</i>	0.0	---	---	---	---
	6.0	274.77	-4.00%	1.52	42.46
	18.5	274.77	-4.00%	1.52	42.46
	49.0	274.77	-4.00%	1.52	42.46
	186.0	274.77	-4.00%	1.52	42.46

Comments:

¹ Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent each of the volume change measurements obtained after saturated hydraulic conductivity testing and throughout hanging column/pressure plate testing. "---" indicates no volume changes occurred.

² Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '---' denotes no volume change occurred.

* Weight including tares

[†] Assumed density of water is 1.0 g/cm³

Volume adjustments are applicable at this matric potential (see comment #1). Changes in volume, if applicable, are estimated based on obtainable measurements of changes in sample length and diameter.

Technician Notes:

Laboratory analysis by: D. O'Dowd/A. Bland
Data entered by: C. Krous
Checked by: J. Hines



Moisture Retention Data

Dew Point Potentiometer / Relative Humidity Box (Soil-Water Characteristic Curve)

Sample Number: SS-ADK-01 (Undisturbed) (1.46 g/cc)

Initial sample bulk density (g/cm³): 1.46

Fraction of bulk sample used (<2.00mm fraction) (%): 100.00

Dry weight* of dew point potentiometer sample (g): 164.88

Tare weight, jar (g): 112.64

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content [†] (% vol)	
Dew point potentiometer:	26-Apr-19	10:31	166.02	4283	3.33	##
	18-Apr-19	9:05	165.56	18866	1.97	##
	10-Apr-19	15:27	165.30	366414	1.22	##

Volume Adjusted Data¹

	Water Potential (-cm water)	Adjusted Volume (cm ³)	% Volume Change ² (%)	Adjusted Density (g/cm ³)	Adjusted Calc. Porosity (%)
Dew point potentiometer:	4283	274.77	-4.00%	1.52	42.46
	18866	274.77	-4.00%	1.52	42.46
	366414	274.77	-4.00%	1.52	42.46

Dry weight* of relative humidity box sample (g): 75.67

Tare weight (g): 39.42

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content [†] (% vol)	
Relative humidity box:	23-Apr-19	9:40	75.84	852439	0.71	##

Volume Adjusted Data¹

	Water Potential (-cm water)	Adjusted Volume (cm ³)	% Volume Change ² (%)	Adjusted Density (g/cm ³)	Adjusted Calc. Porosity (%)
Relative humidity box:	852439	274.77	-4.00%	1.52	42.46

Comments:

¹ Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent the volume change measurements obtained after the last hanging column or pressure plate point. "---" indicates no volume changes occurred.

² Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '-' denotes no volume change occurred.

* Weight including tares

[†] Adjusted for >2.00mm (#10 sieve) material not used in DPP/RH testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm³.

Volume adjustments are applicable at this matric potential (see comment #1). Changes in volume, if applicable, are estimated based on obtainable measurements of changes in sample length and diameter.

Laboratory analysis by: C. Krous/D. O'Dowd

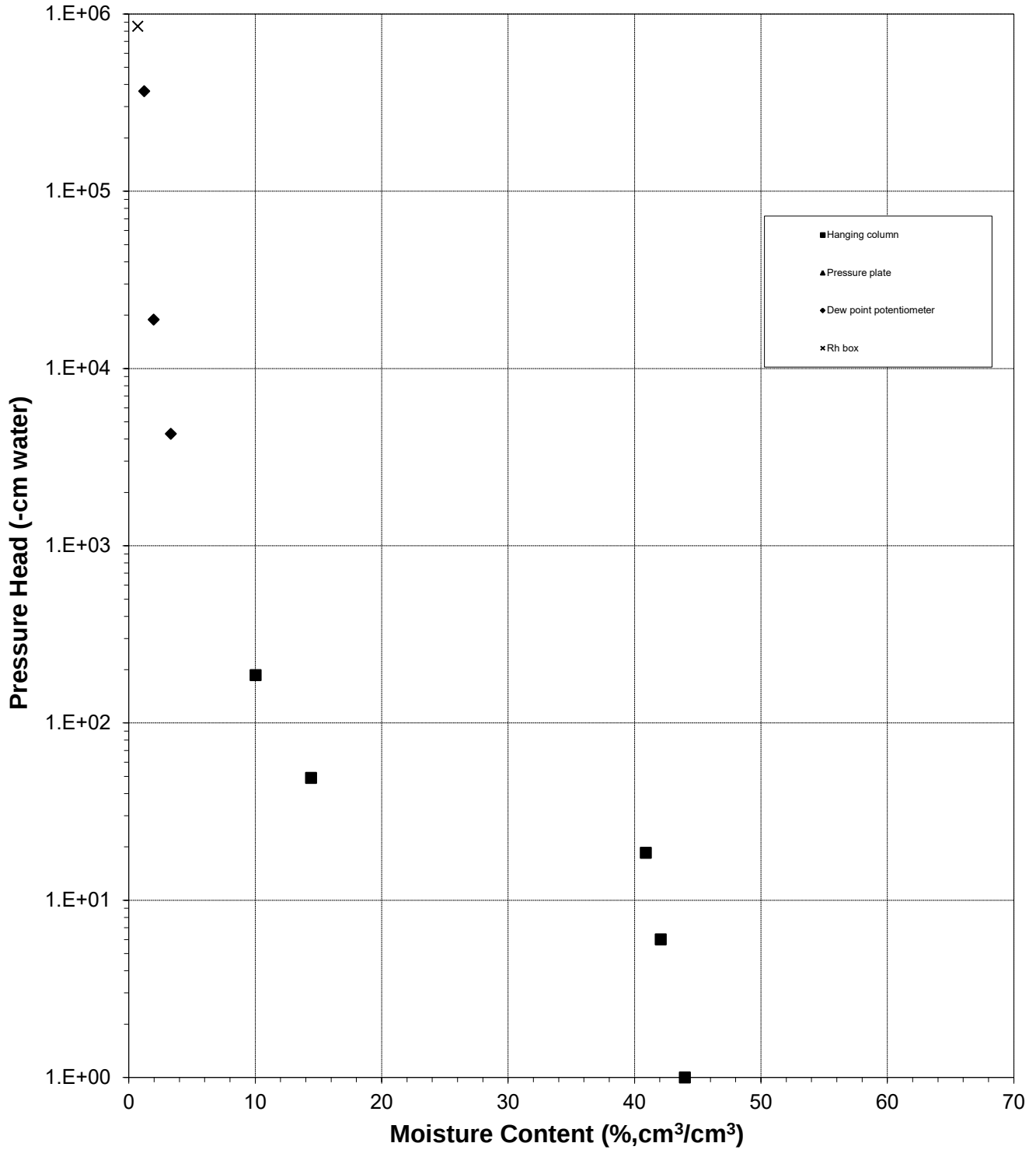
Data entered by: C. Krous

Checked by: J. Hines



Water Retention Data Points

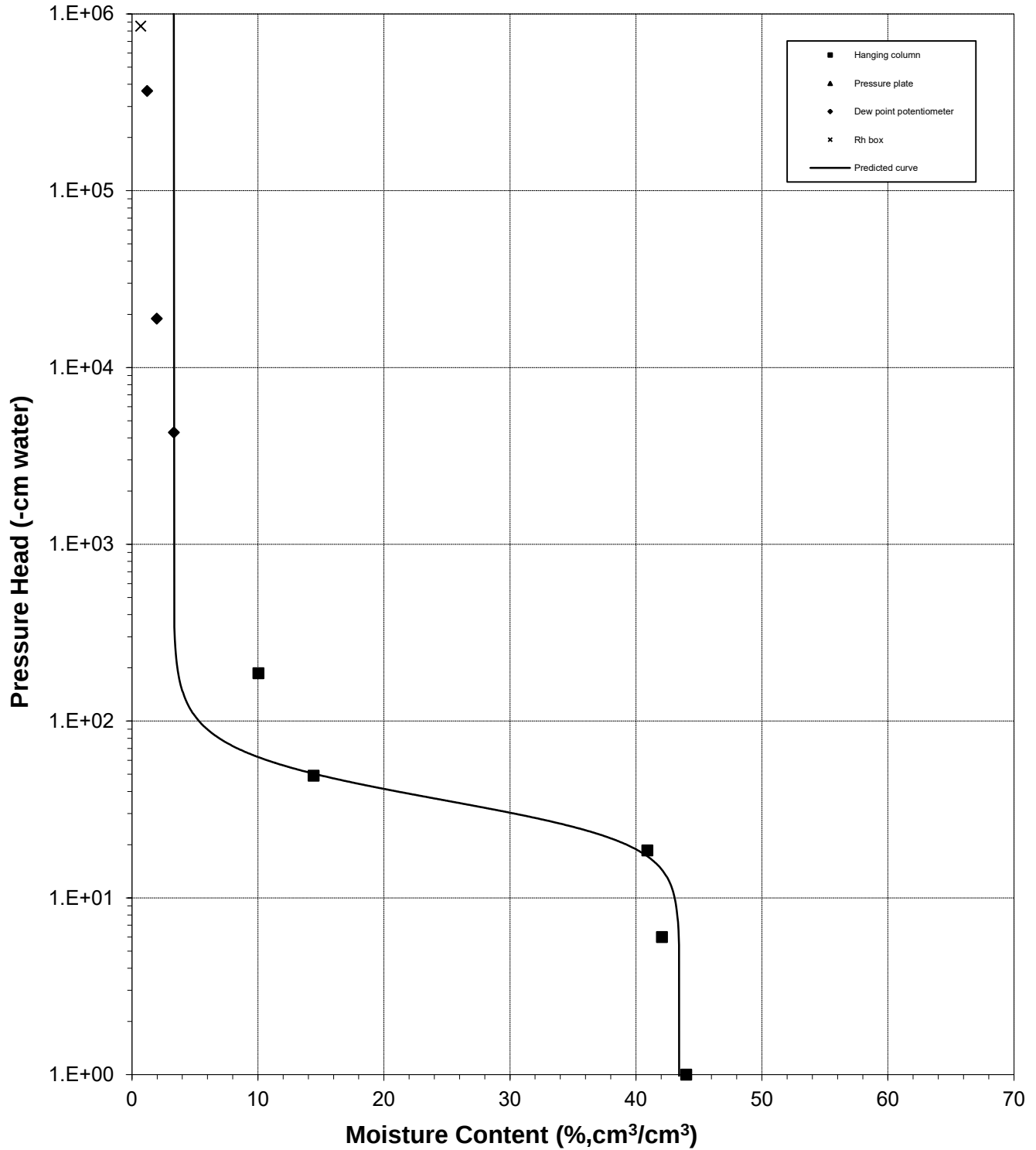
Sample Number: SS-ADK-01 (Undisturbed) (1.46 g/cc)





Predicted Calibration Curve and Data Points

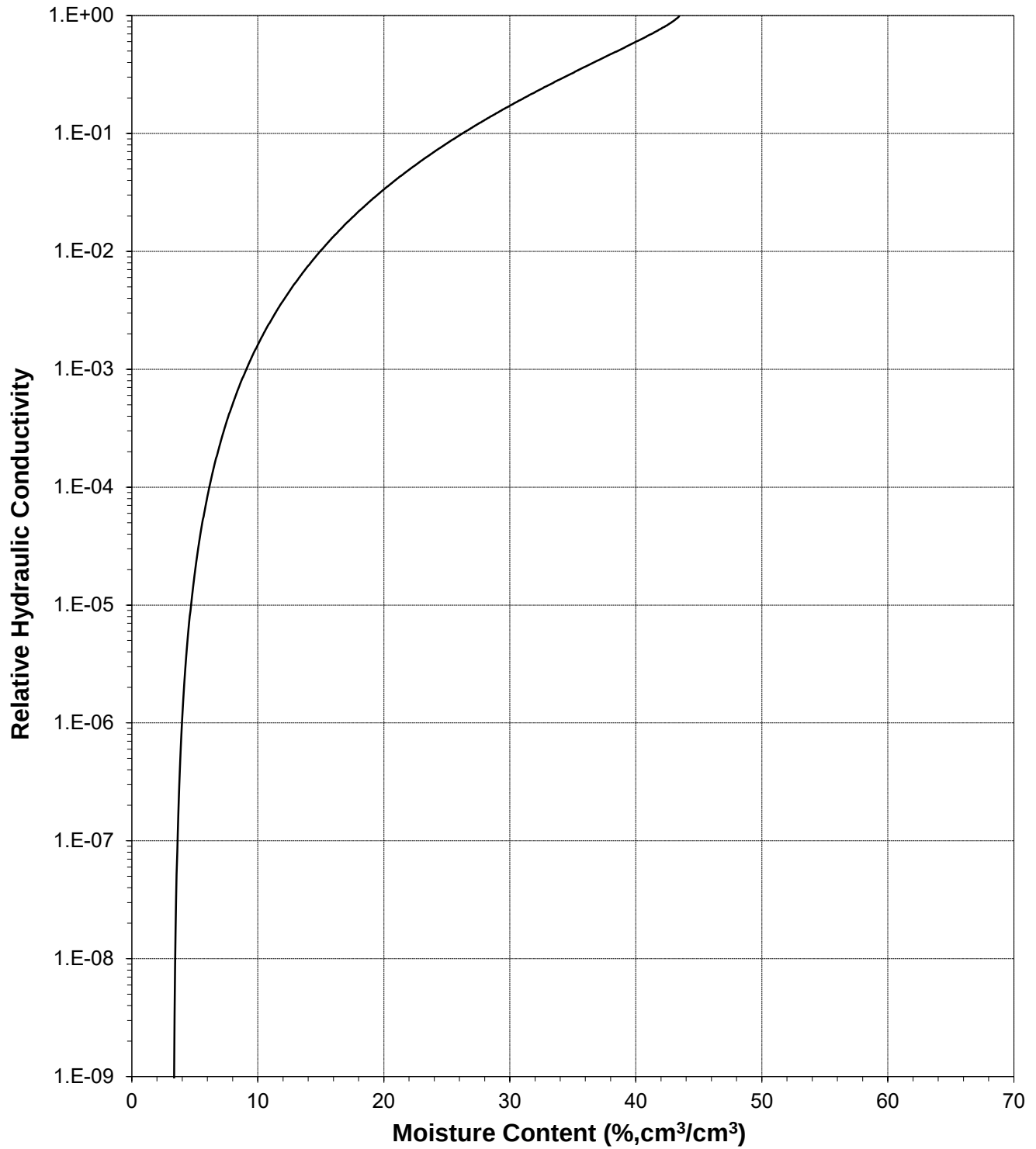
Sample Number: SS-ADK-01 (Undisturbed) (1.46 g/cc)





Plot of Relative Hydraulic Conductivity vs Moisture Content

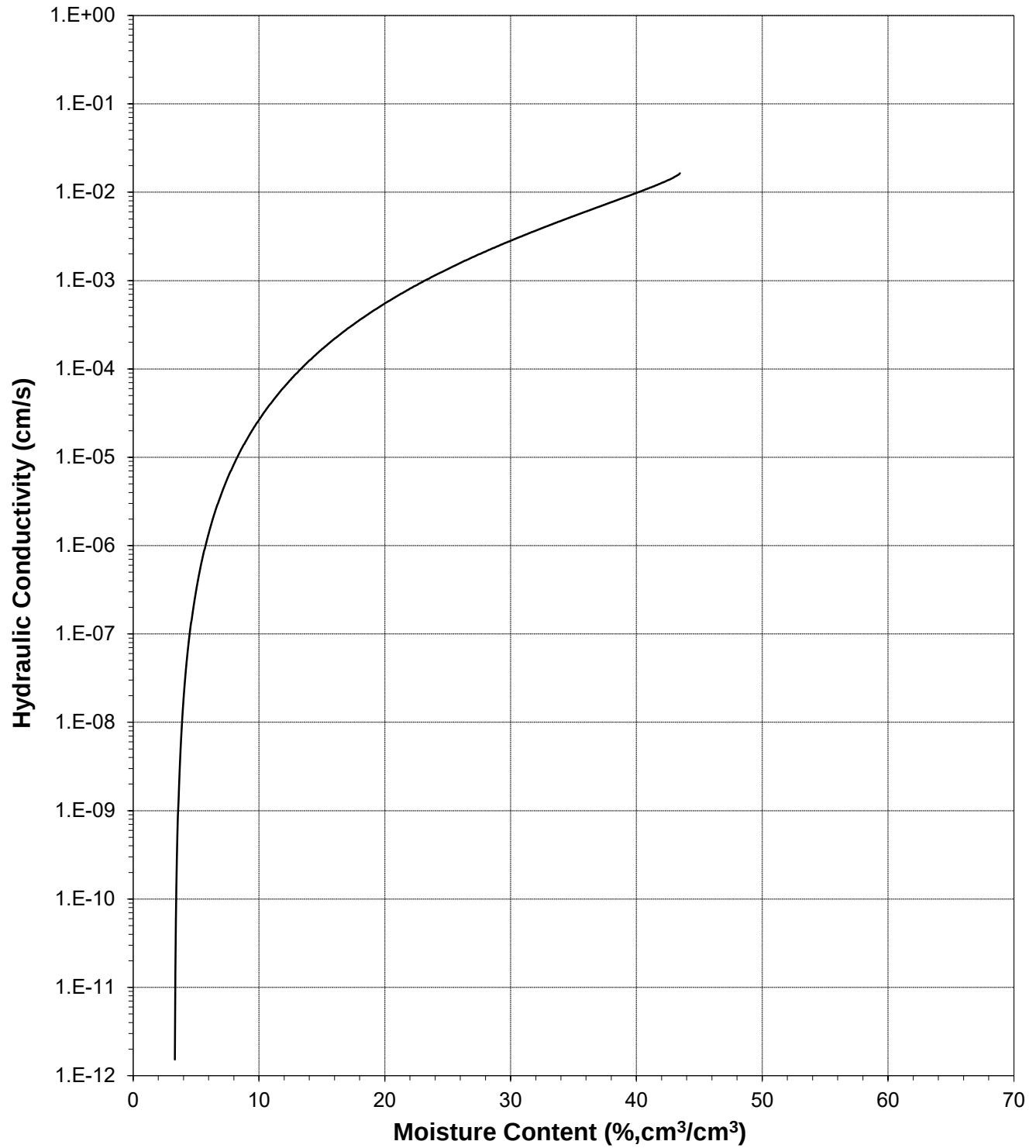
Sample Number: SS-ADK-01 (Undisturbed) (1.46 g/cc)





Plot of Hydraulic Conductivity vs Moisture Content

Sample Number: SS-ADK-01 (Undisturbed) (1.46 g/cc)

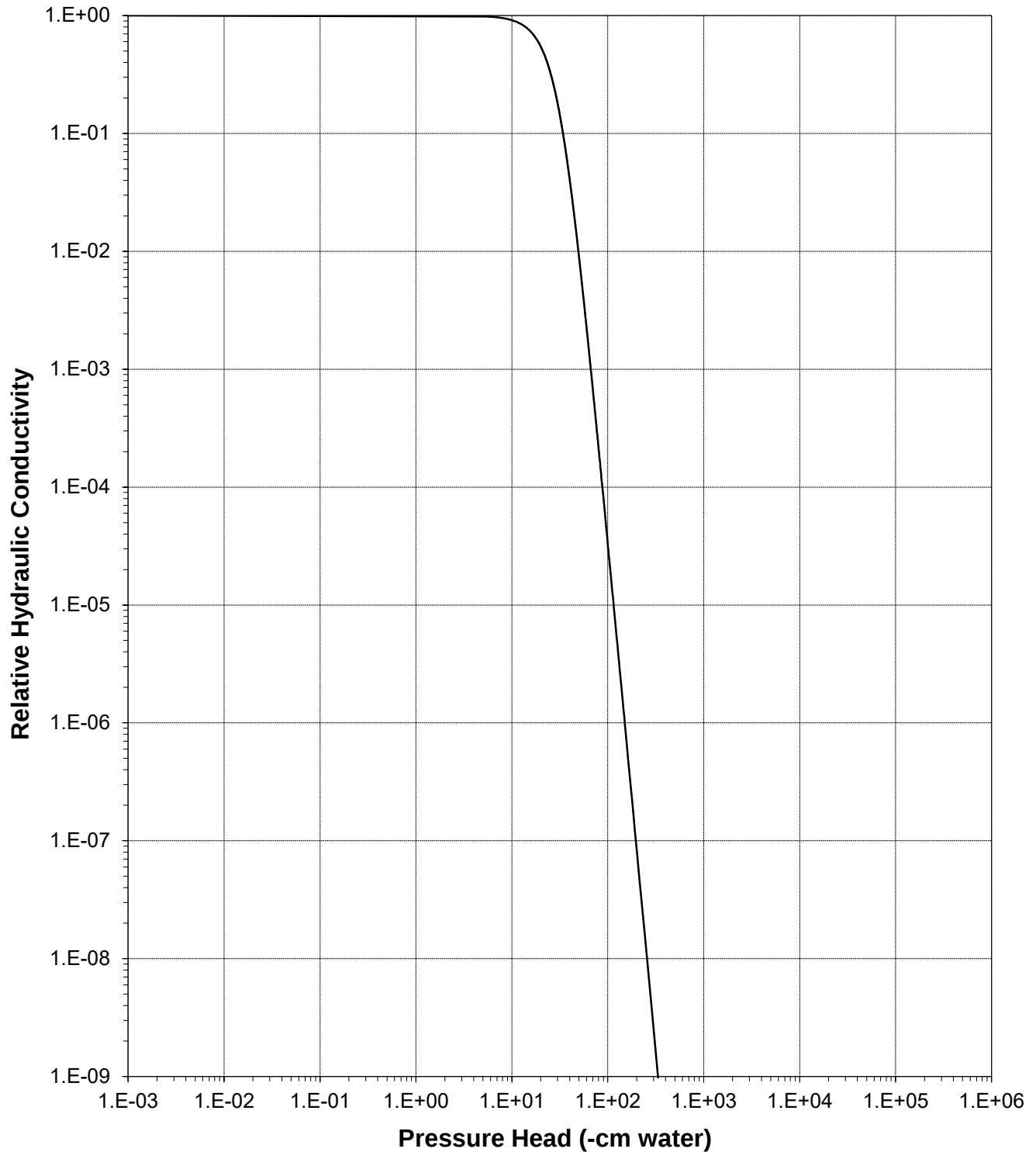




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Plot of Relative Hydraulic Conductivity vs Pressure Head

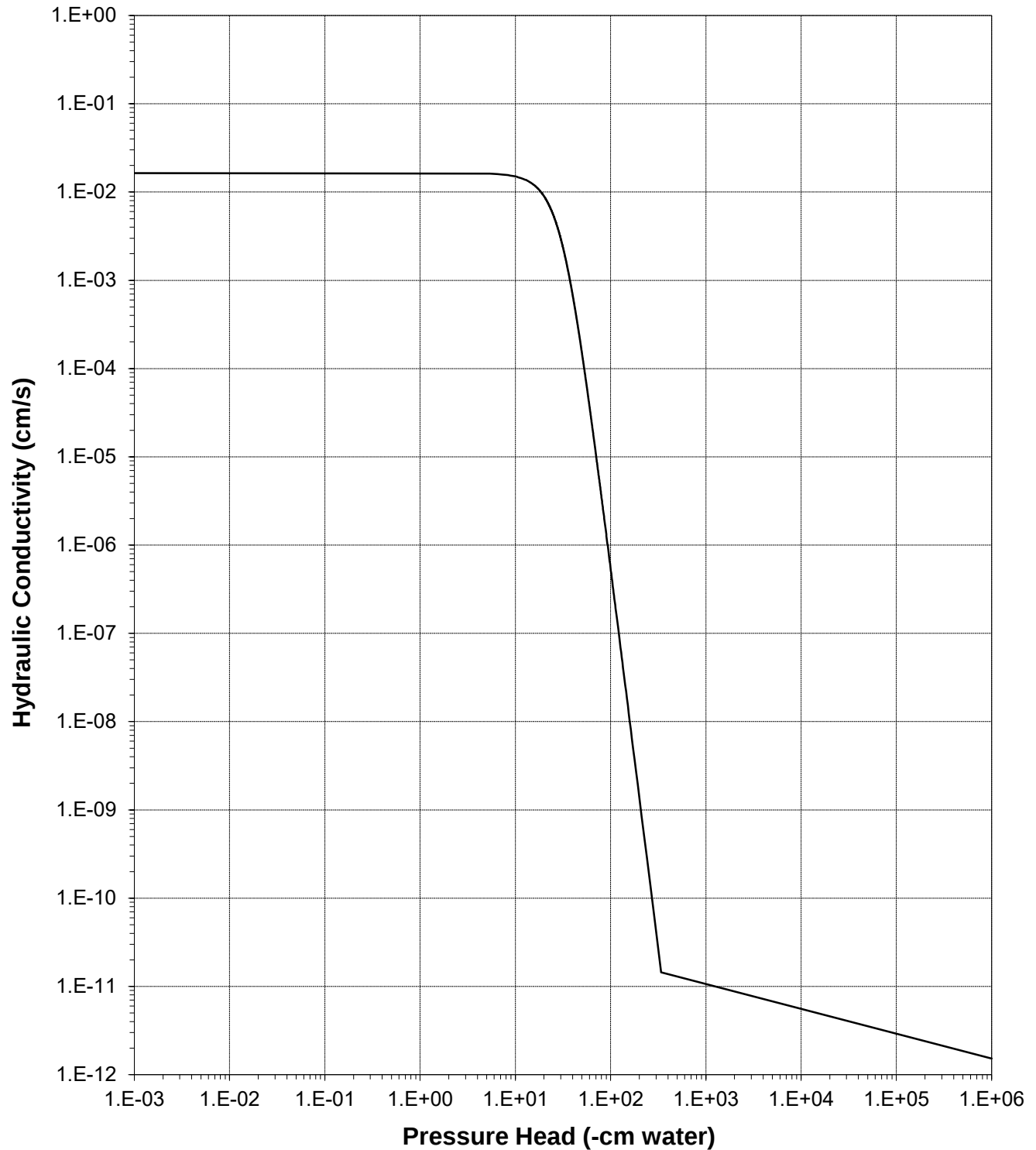
Sample Number: SS-ADK-01 (Undisturbed) (1.46 g/cc)





Plot of Hydraulic Conductivity vs Pressure Head

Sample Number: SS-ADK-01 (Undisturbed) (1.46 g/cc)





Daniel B. Stephens & Associates, Inc.

Moisture Retention Data
Hanging Column / Pressure Plate
 (Soil-Water Characteristic Curve)

Job Name: TTL, Inc.
 Job Number: DB19.1098.00
 Sample Number: SS-ADK-01 (1.60 g/cc)
 Project Name: Twin Pines
 Project Number: 000180200804.00

Dry wt. of sample (g): 358.85
 Tare wt., ring (g): 140.92
 Tare wt., screen & clamp (g): 28.00
 Initial sample volume (cm³): 224.93
 Initial dry bulk density (g/cm³): 1.60
 Assumed particle density (g/cm³): 2.65
 Initial calculated total porosity (%): 39.80

	Date	Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content [†] (% vol)
<i>Hanging column:</i>	20-Aug-19	14:00	618.70	0	40.43
	27-Aug-19	9:30	617.53	5.0	39.91
	3-Sep-19	16:40	616.89	13.0	39.62
	10-Sep-19	11:30	552.17	52.0	10.85
	17-Sep-19	15:30	546.18	197.0	8.18

Volume Adjusted Data¹

	Matric Potential (-cm water)	Adjusted Volume (cm ³)	% Volume Change ² (%)	Adjusted Density (g/cm ³)	Adjusted Calculated Porosity (%)
<i>Hanging column:</i>	0.0	---	---	---	---
	5.0	---	---	---	---
	13.0	---	---	---	---
	52.0	---	---	---	---
	197.0	---	---	---	---

Comments:

¹ Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent each of the volume change measurements obtained after saturated hydraulic conductivity testing and throughout hanging column/pressure plate testing. "---" indicates no volume changes occurred.

² Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '---' denotes no volume change occurred.

* Weight including tares

[†] Assumed density of water is 1.0 g/cm³

[‡] Volume adjustments are applicable at this matric potential (see comment #1). Changes in volume, if applicable, are estimated based on obtainable measurements of changes in sample length and diameter.

Technician Notes:

Laboratory analysis by: D. O'Dowd
Data entered by: A. Albay-Yenney
Checked by: J. Hines



Moisture Retention Data

Dew Point Potentiometer / Relative Humidity Box (Soil-Water Characteristic Curve)

Sample Number: SS-ADK-01 (1.60 g/cc)

Initial sample bulk density (g/cm³): 1.60

Fraction of bulk sample used (<2.00mm fraction) (%): 98.96

Dry weight* of dew point potentiometer sample (g): 194.65

Tare weight, jar (g): 113.34

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content [†] (% vol)
Dew point potentiometer:	4-Sep-19	14:55	195.48	9280	1.61
	28-Aug-19	8:13	195.12	34265	0.91
	26-Aug-19	10:20	194.99	265760	0.66

Volume Adjusted Data¹

	Water Potential (-cm water)	Adjusted Volume (cm ³)	% Volume Change ² (%)	Adjusted Density (g/cm ³)	Adjusted Calc. Porosity (%)
Dew point potentiometer:	9280	---	---	---	---
	34265	---	---	---	---
	265760	---	---	---	---

Dry weight* of relative humidity box sample (g): 89.64

Tare weight (g): 41.74

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content [†] (% vol)
Relative humidity box:	21-Aug-19	10:15	89.75	846993	0.37

Volume Adjusted Data¹

	Water Potential (-cm water)	Adjusted Volume (cm ³)	% Volume Change ² (%)	Adjusted Density (g/cm ³)	Adjusted Calc. Porosity (%)
Relative humidity box:	846993	---	---	---	---

Comments:

¹ Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent the volume change measurements obtained after the last hanging column or pressure plate point. "—" indicates no volume changes occurred.

² Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '---' denotes no volume change occurred.

* Weight including tares

[†] Adjusted for >2.00mm (#10 sieve) material not used in DPP/RH testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm³.

[‡] Volume adjustments are applicable at this matric potential (see comment #1). Changes in volume, if applicable, are estimated based on obtainable measurements of changes in sample length and diameter.

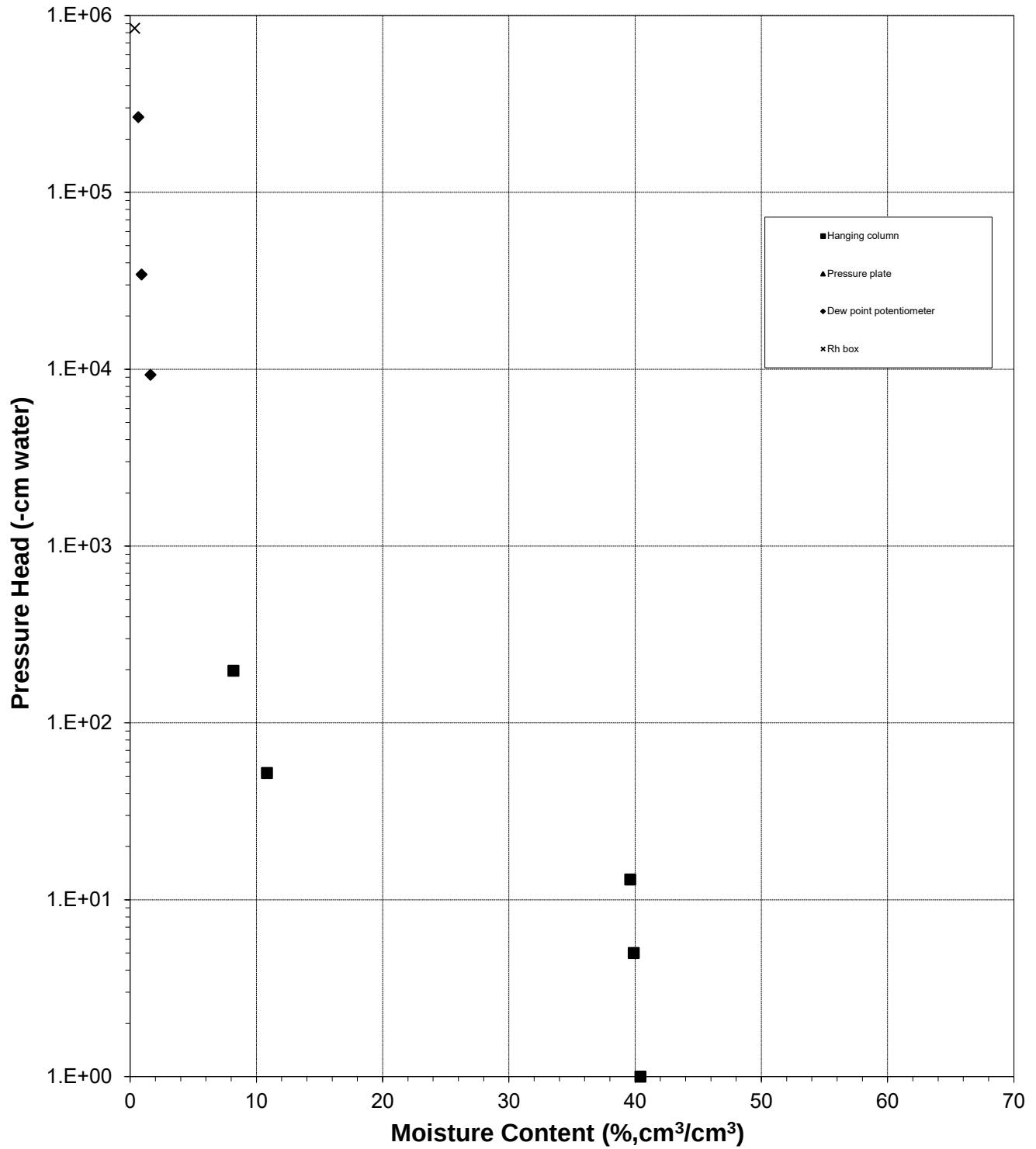
Laboratory analysis by: D. O'Dowd

Data entered by: A. Albay-Yenney

Checked by: J. Hines



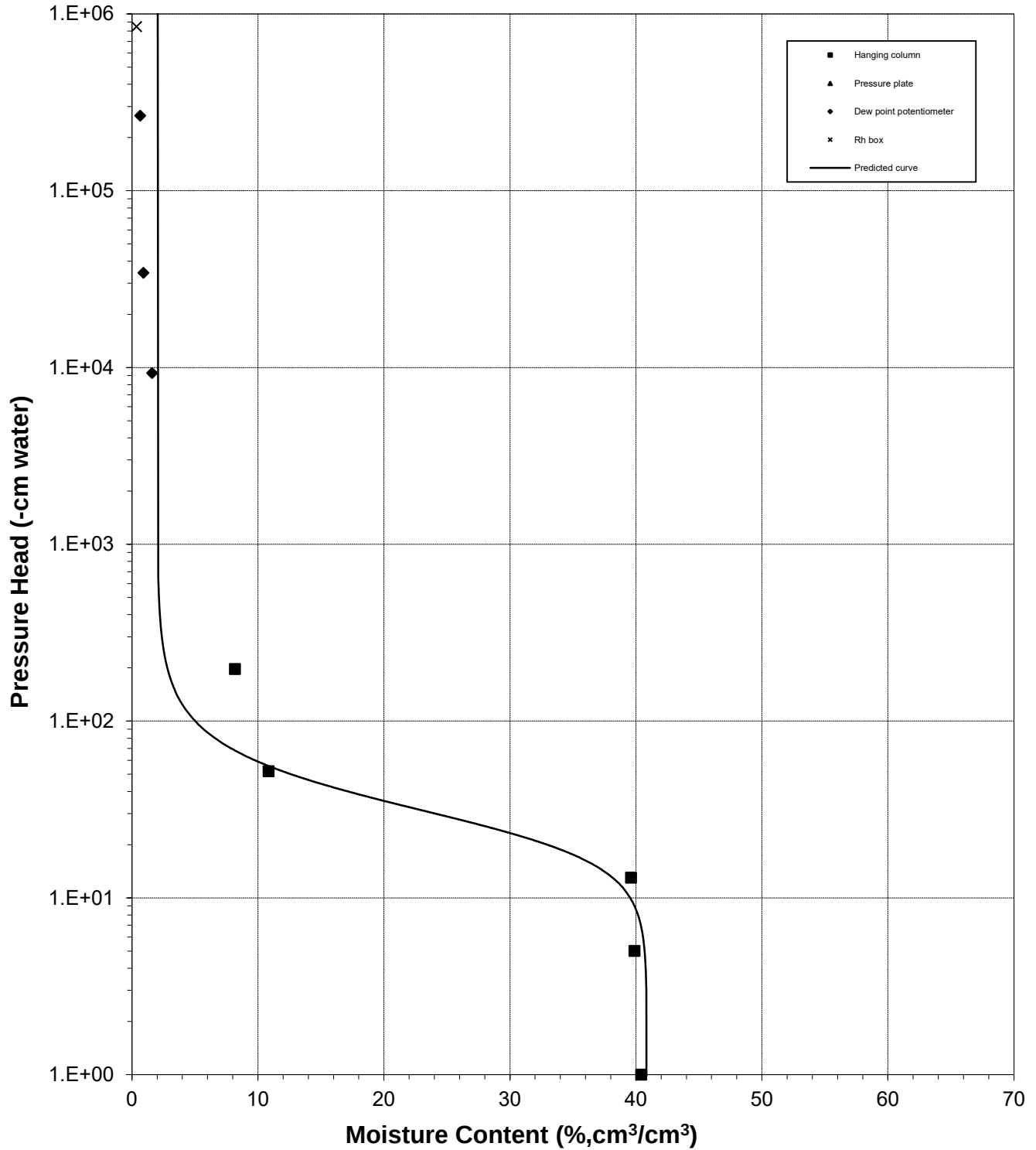
Water Retention Data Points
Sample Number: SS-ADK-01 (1.60 g/cc)





Predicted Calibration Curve and Data Points

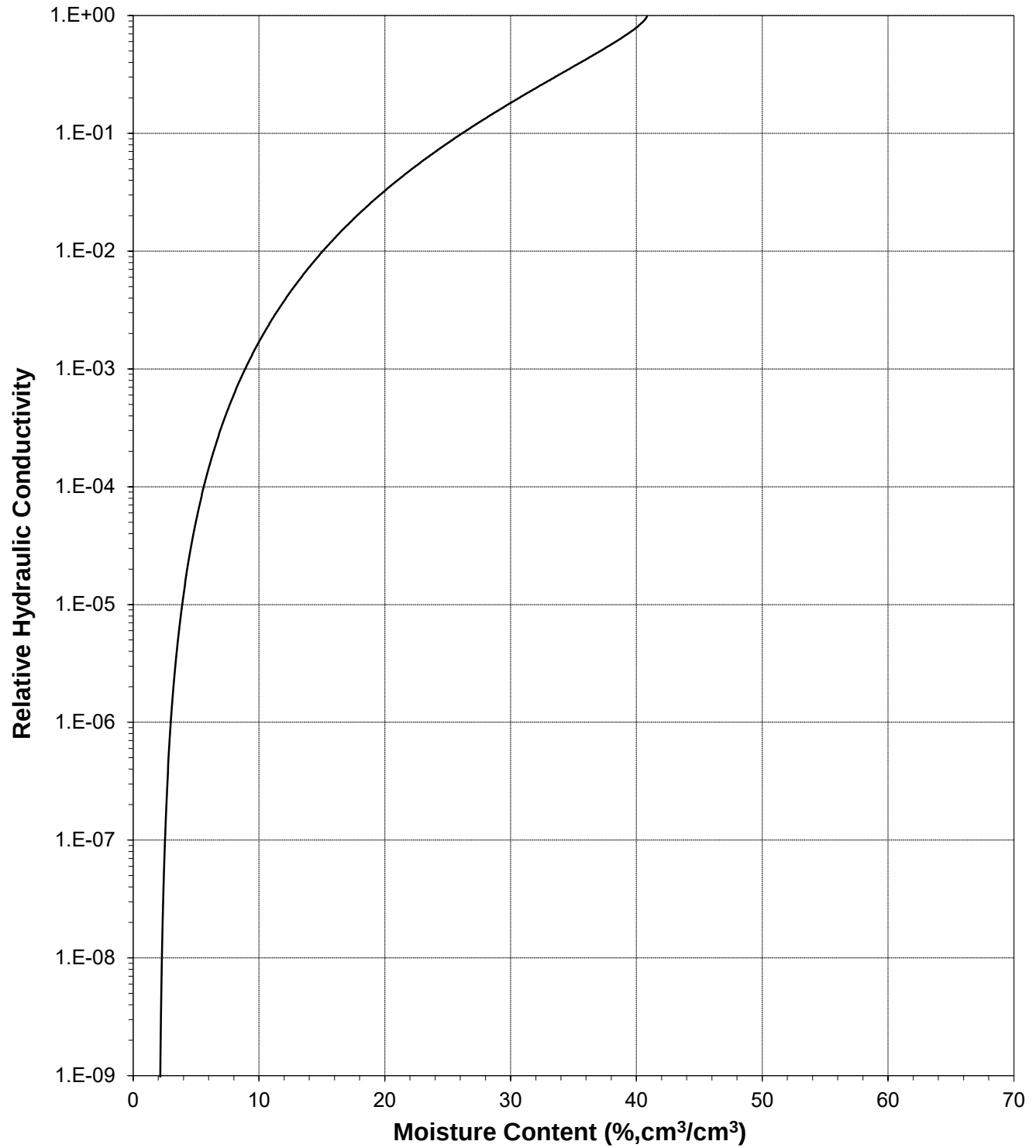
Sample Number: SS-ADK-01 (1.60 g/cc)





Plot of Relative Hydraulic Conductivity vs Moisture Content

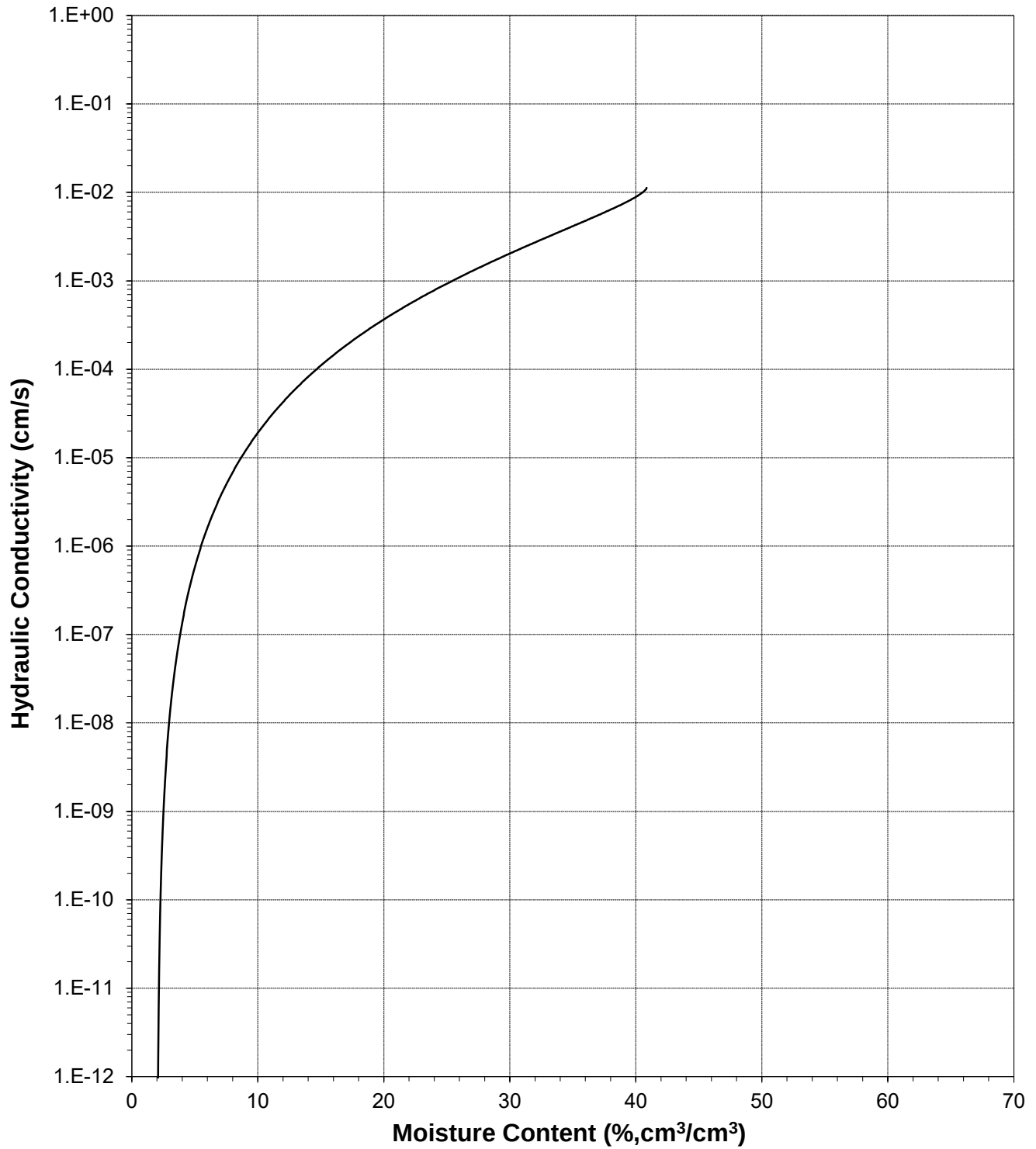
Sample Number: SS-ADK-01 (1.60 g/cc)





Plot of Hydraulic Conductivity vs Moisture Content

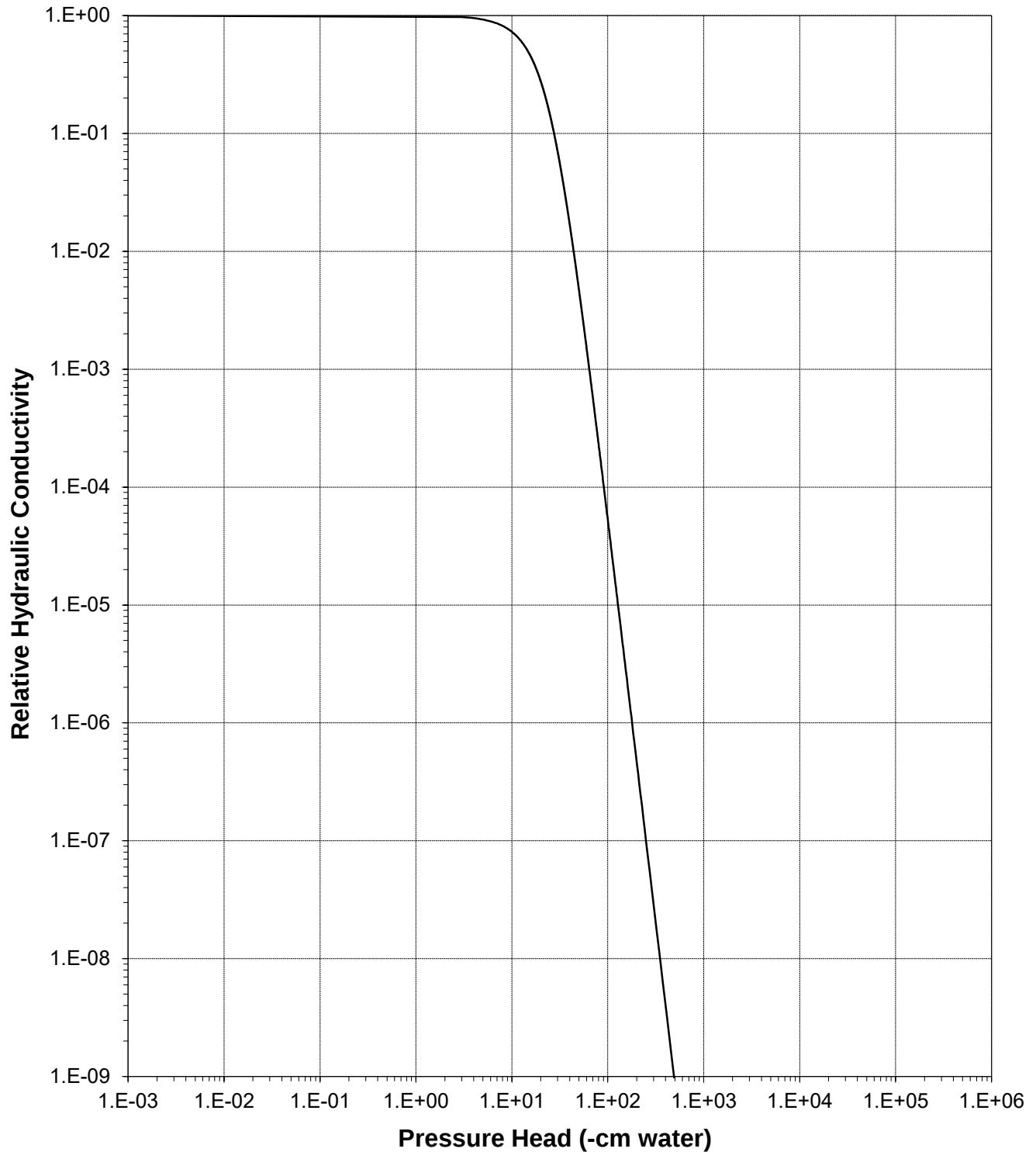
Sample Number: SS-ADK-01 (1.60 g/cc)





Plot of Relative Hydraulic Conductivity vs Pressure Head

Sample Number: SS-ADK-01 (1.60 g/cc)

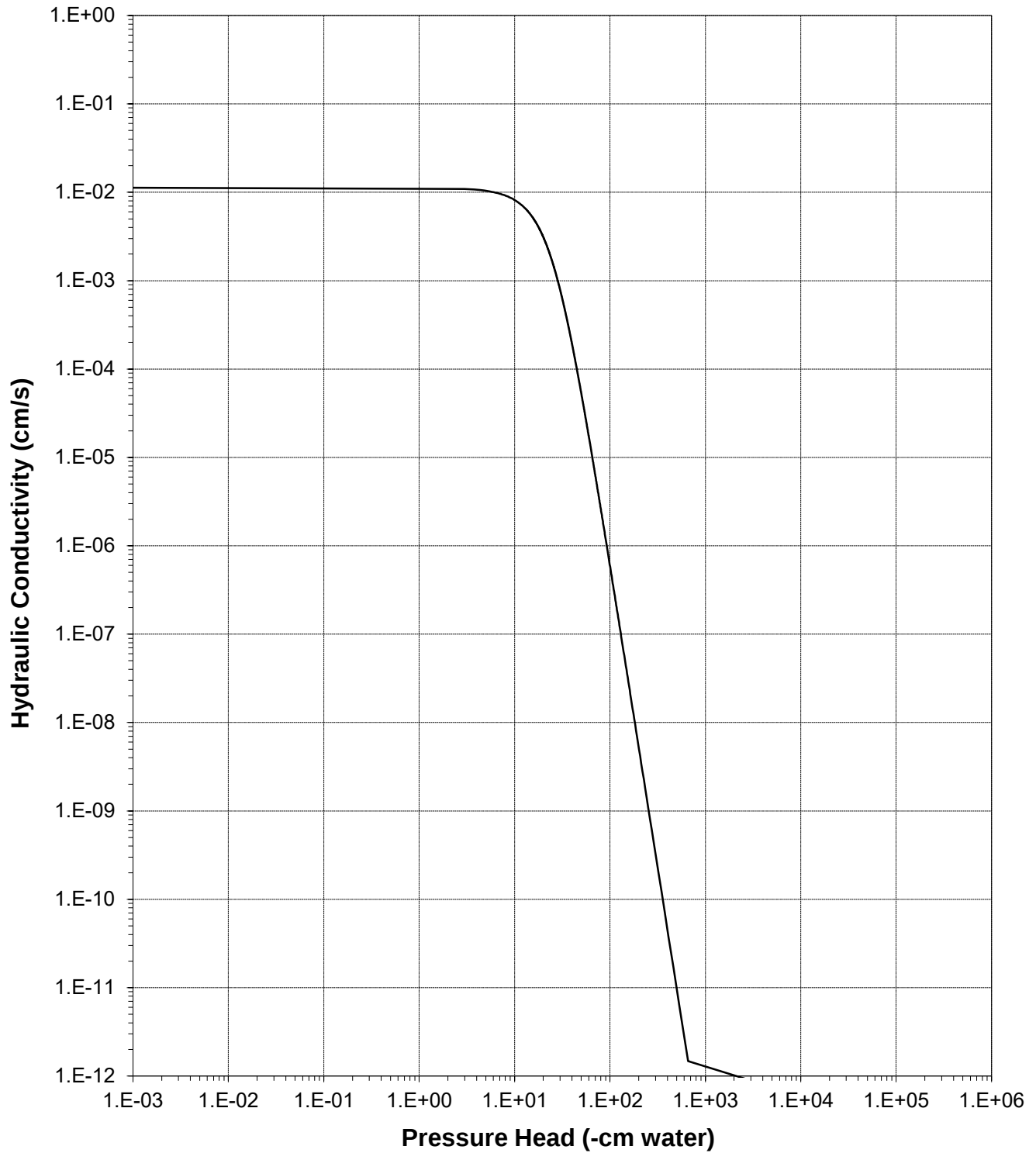




Daniel B. Stephens & Associates, Inc.

Plot of Hydraulic Conductivity vs Pressure Head

Sample Number: SS-ADK-01 (1.60 g/cc)





Daniel B. Stephens & Associates, Inc.

Moisture Retention Data
Hanging Column / Pressure Plate
 (Soil-Water Characteristic Curve)

Job Name: TTL, Inc.
 Job Number: DB19.1098.00
 Sample Number: SS-KEY-01 (Undisturbed) (1.63 g/cc)
 Project Name: Twin Pines
 Project Number: 000180200804.00

Dry wt. of sample (g): 464.92
 Tare wt., ring (g): 245.11
 Tare wt., screen & clamp (g): 27.04
 Initial sample volume (cm³): 285.47
 Initial dry bulk density (g/cm³): 1.63
 Assumed particle density (g/cm³): 2.65
 Initial calculated total porosity (%): 38.54

	Date	Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content [†] (% vol)
<i>Hanging column:</i>	5-Apr-19	15:00	842.47	0	36.92
	15-Apr-19	17:00	840.26	6.0	36.15
	22-Apr-19	16:00	837.87	18.5	35.31
	29-Apr-19	13:55	802.77	49.0	23.02
	7-May-19	14:45	787.71	186.0	17.74

Volume Adjusted Data¹

	Matric Potential (-cm water)	Adjusted Volume (cm ³)	% Volume Change ² (%)	Adjusted Density (g/cm ³)	Adjusted Calculated Porosity (%)
<i>Hanging column:</i>	0.0	---	---	---	---
	6.0	---	---	---	---
	18.5	---	---	---	---
	49.0	---	---	---	---
	186.0	---	---	---	---

Comments:

¹ Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent each of the volume change measurements obtained after saturated hydraulic conductivity testing and throughout hanging column/pressure plate testing. "---" indicates no volume changes occurred.

² Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '---' denotes no volume change occurred.

* Weight including tares

[†] Assumed density of water is 1.0 g/cm³

[‡] Volume adjustments are applicable at this matric potential (see comment #1). Changes in volume, if applicable, are estimated based on obtainable measurements of changes in sample length and diameter.

Technician Notes:

Laboratory analysis by: D. O'Dowd/A. Bland
Data entered by: C. Krous
Checked by: J. Hines



Moisture Retention Data

Dew Point Potentiometer / Relative Humidity Box (Soil-Water Characteristic Curve)

Sample Number: SS-KEY-01 (Undisturbed) (1.63 g/cc)

Initial sample bulk density (g/cm³): 1.63

Fraction of bulk sample used (<2.00mm fraction) (%): 100.00

Dry weight* of dew point potentiometer sample (g): 166.85

Tare weight, jar (g): 116.56

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content [†] (% vol)
Dew point potentiometer:	25-Apr-19	11:00	167.88	3773	3.32
	17-Apr-19	15:05	167.22	37733	1.20
	10-Apr-19	15:15	167.13	267901	0.90

Volume Adjusted Data¹

	Water Potential (-cm water)	Adjusted Volume (cm ³)	% Volume Change ² (%)	Adjusted Density (g/cm ³)	Adjusted Calc. Porosity (%)
Dew point potentiometer:	3773	---	---	---	---
	37733	---	---	---	---
	267901	---	---	---	---

Dry weight* of relative humidity box sample (g): 64.16

Tare weight (g): 40.69

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content [†] (% vol)
Relative humidity box:	23-Apr-19	9:40	64.25	852439	0.60

Volume Adjusted Data¹

	Water Potential (-cm water)	Adjusted Volume (cm ³)	% Volume Change ² (%)	Adjusted Density (g/cm ³)	Adjusted Calc. Porosity (%)
Relative humidity box:	852439	---	---	---	---

Comments:

¹ Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent the volume change measurements obtained after the last hanging column or pressure plate point. "---" indicates no volume changes occurred.

² Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '-' denotes no volume change occurred.

* Weight including tares

[†] Adjusted for >2.00mm (#10 sieve) material not used in DPP/RH testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm³.

[‡] Volume adjustments are applicable at this matric potential (see comment #1). Changes in volume, if applicable, are estimated based on obtainable measurements of changes in sample length and diameter.

Laboratory analysis by: C. Krous/D. O'Dowd

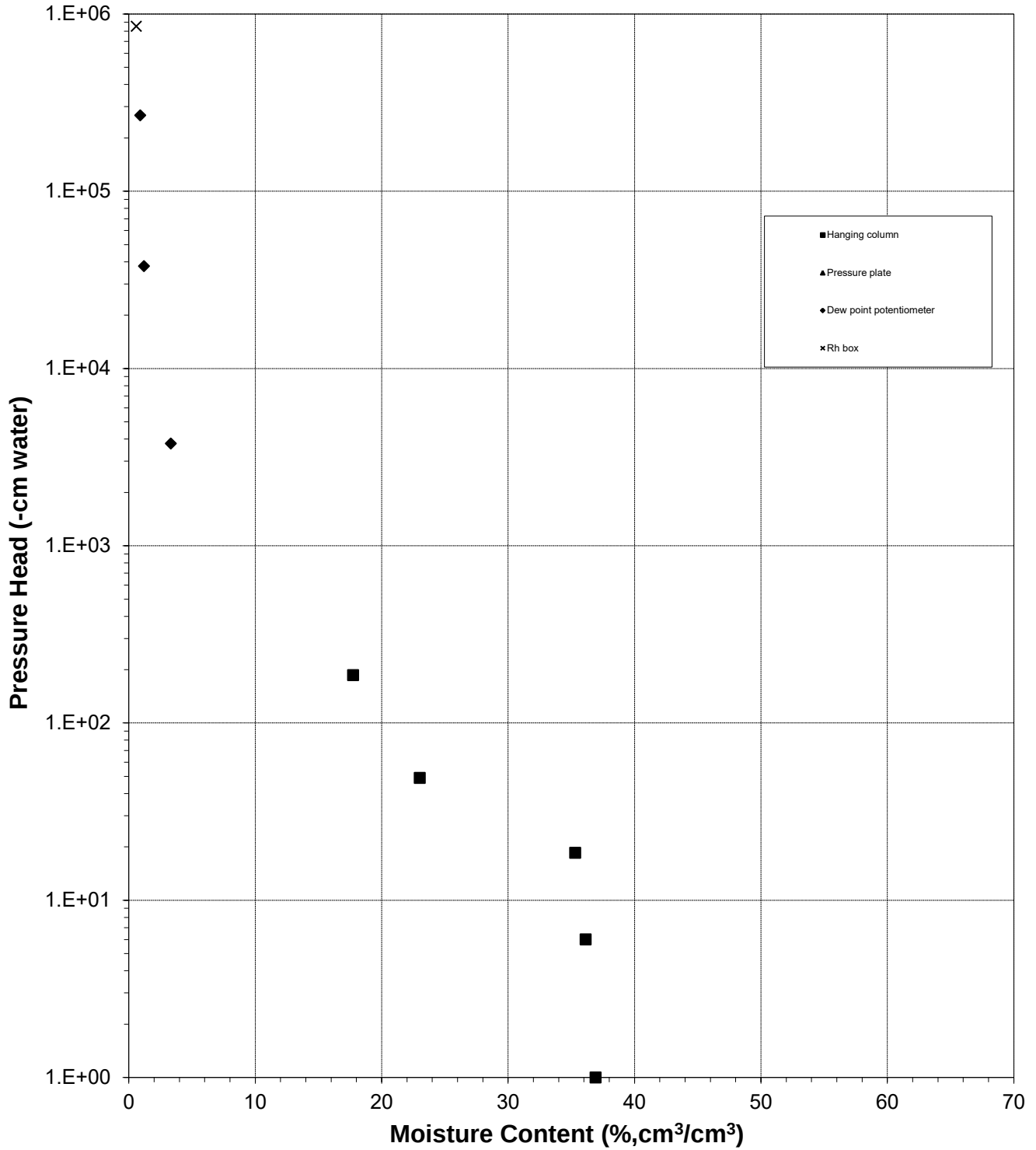
Data entered by: C. Krous

Checked by: J. Hines



Water Retention Data Points

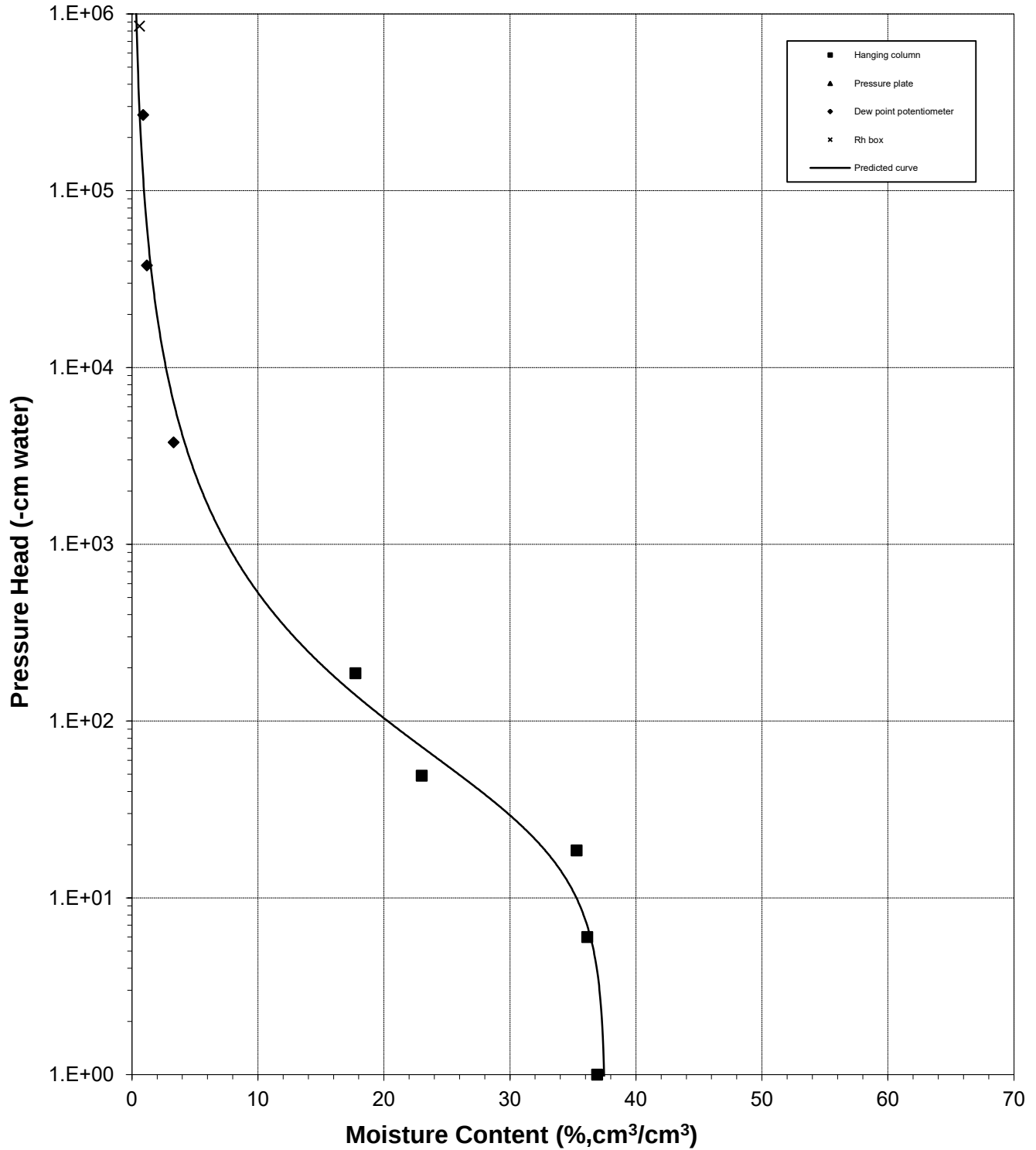
Sample Number: SS-KEY-01 (Undisturbed) (1.63 g/cc)





Predicted Calibration Curve and Data Points

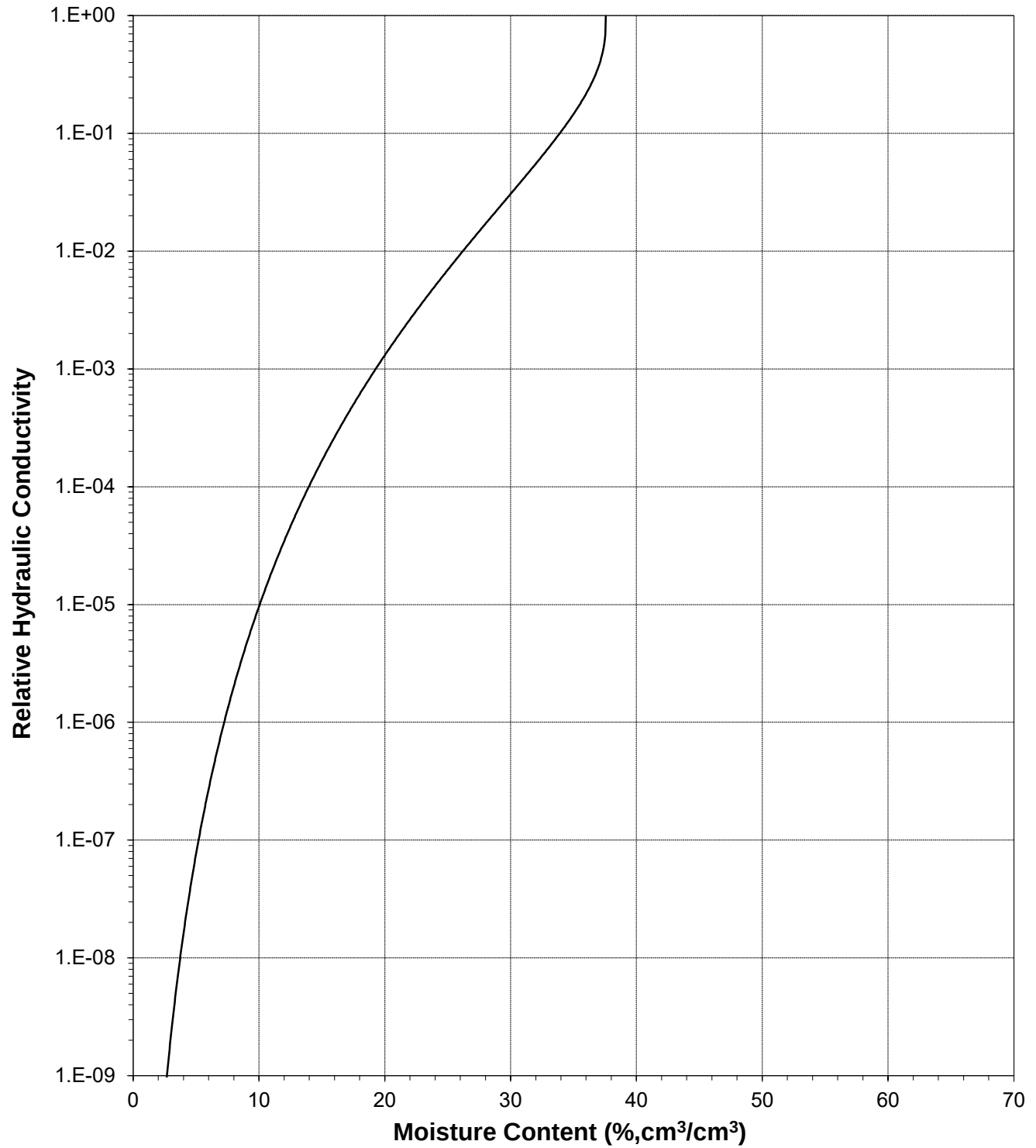
Sample Number: SS-KEY-01 (Undisturbed) (1.63 g/cc)





Plot of Relative Hydraulic Conductivity vs Moisture Content

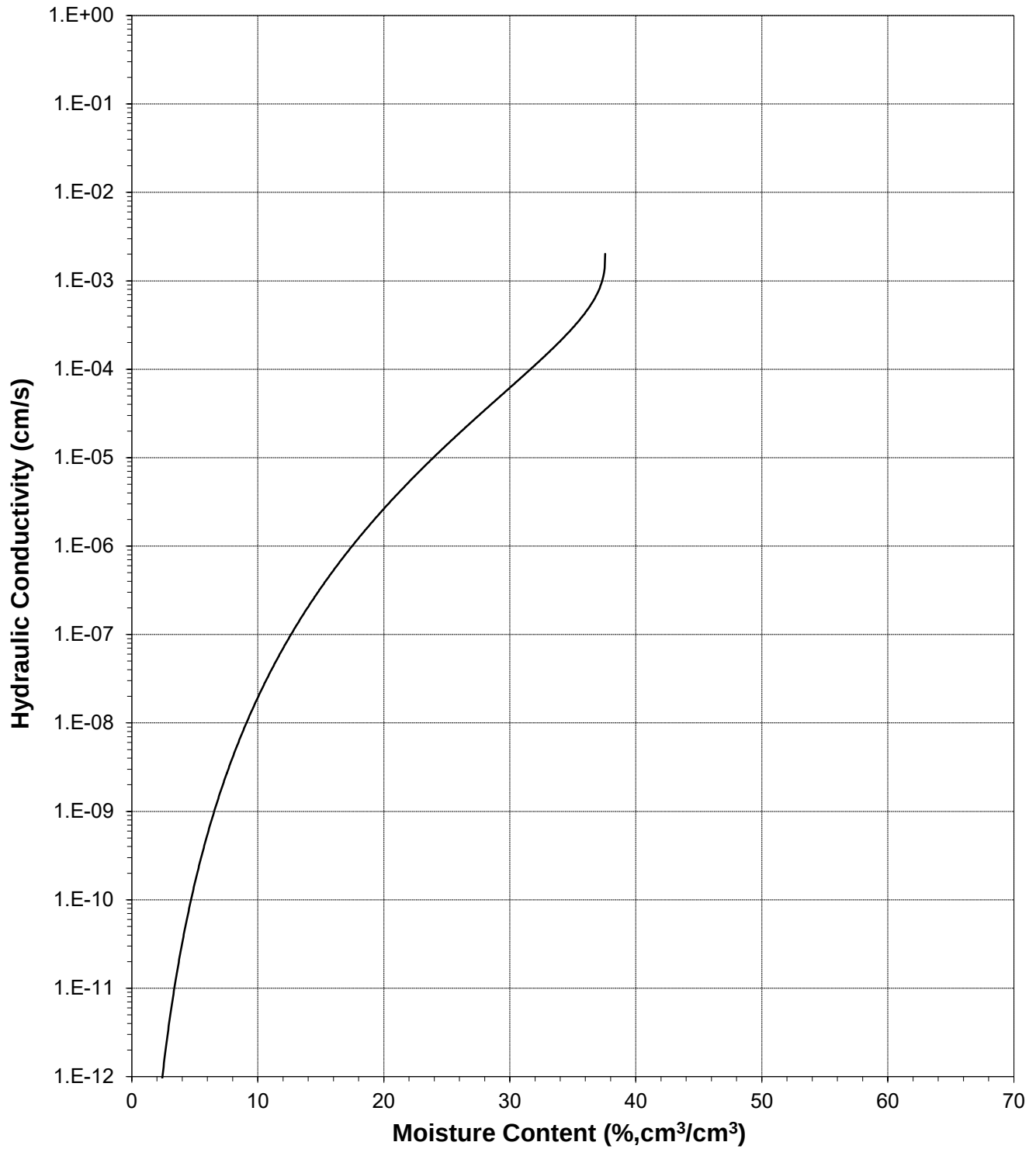
Sample Number: SS-KEY-01 (Undisturbed) (1.63 g/cc)





Plot of Hydraulic Conductivity vs Moisture Content

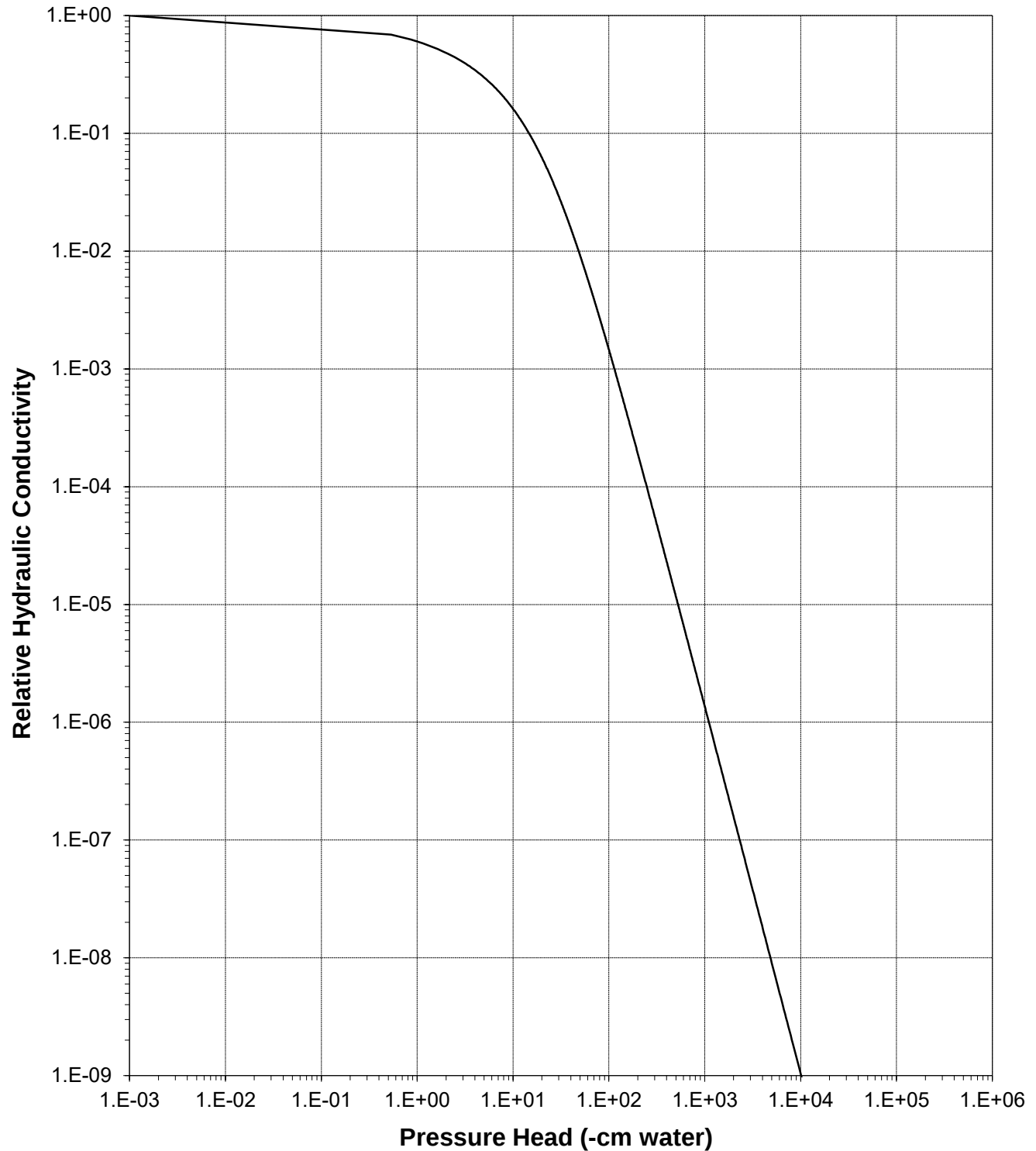
Sample Number: SS-KEY-01 (Undisturbed) (1.63 g/cc)





Plot of Relative Hydraulic Conductivity vs Pressure Head

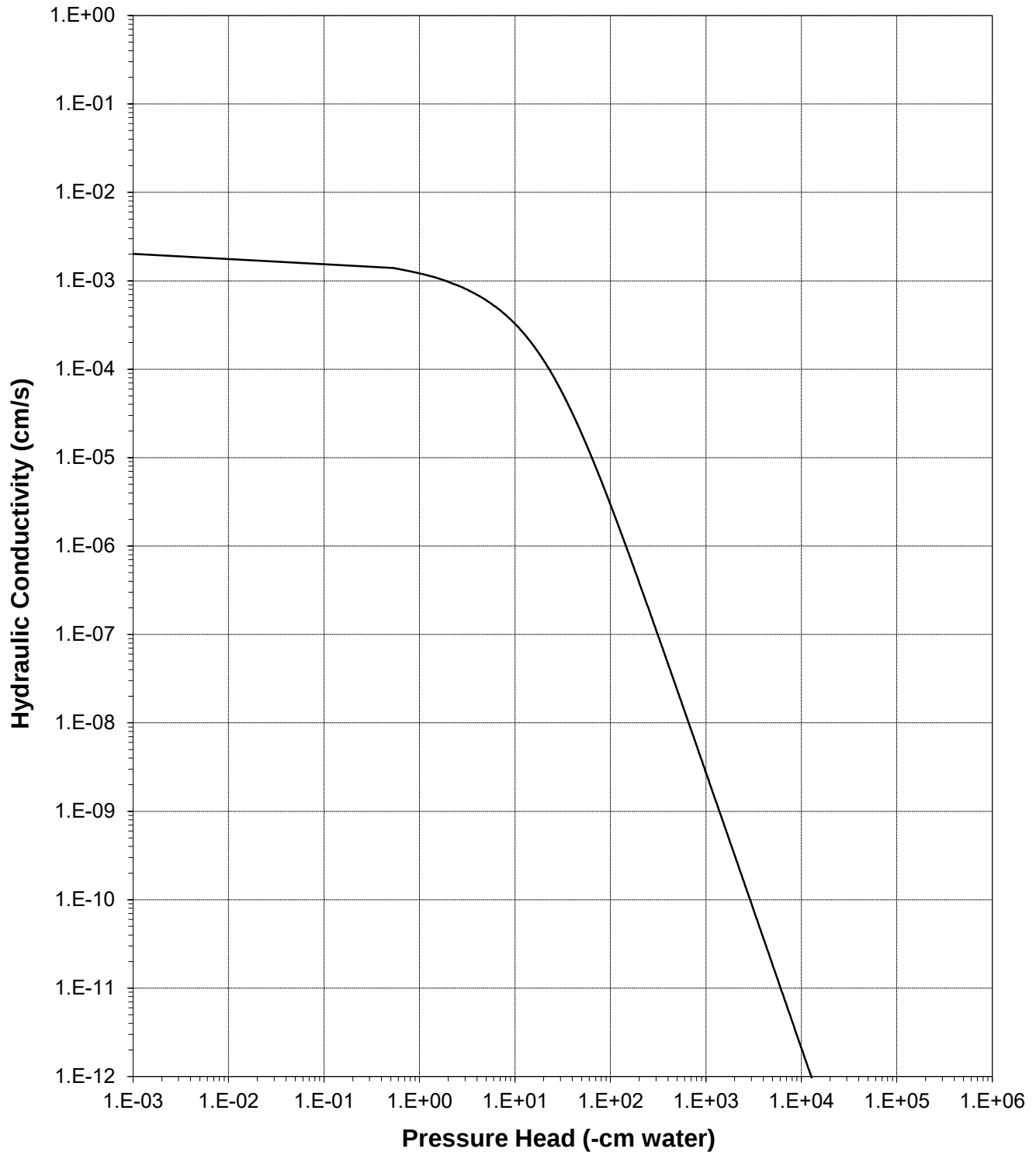
Sample Number: SS-KEY-01 (Undisturbed) (1.63 g/cc)





Plot of Hydraulic Conductivity vs Pressure Head

Sample Number: SS-KEY-01 (Undisturbed) (1.63 g/cc)





Daniel B. Stephens & Associates, Inc.

Moisture Retention Data
Hanging Column / Pressure Plate
 (Soil-Water Characteristic Curve)

Job Name: TTL, Inc.
 Job Number: DB19.1098.00
 Sample Number: SS-KEY-01 (1.59 g/cc)
 Project Name: Twin Pines
 Project Number: 000180200804.00

Dry wt. of sample (g): 350.79
 Tare wt., ring (g): 137.30
 Tare wt., screen & clamp (g): 26.32
 Initial sample volume (cm³): 220.36
 Initial dry bulk density (g/cm³): 1.59
 Assumed particle density (g/cm³): 2.65
 Initial calculated total porosity (%): 39.93

	Date	Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content [†] (% vol)
<i>Hanging column:</i>	20-Aug-19	14:00	602.19	0	39.83
	27-Aug-19	9:30	602.12	4.0	39.80
	3-Sep-19	16:40	594.57	25.0	36.38
<i>Pressure plate:</i>	19-Sep-19	15:35	542.40	337	12.70

Volume Adjusted Data¹

	Matric Potential (-cm water)	Adjusted Volume (cm ³)	% Volume Change ² (%)	Adjusted Density (g/cm ³)	Adjusted Calculated Porosity (%)
<i>Hanging column:</i>	0.0	---	---	---	---
	4.0	---	---	---	---
	25.0	---	---	---	---
<i>Pressure plate:</i>	337	---	---	---	---

Comments:

¹ Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent each of the volume change measurements obtained after saturated hydraulic conductivity testing and throughout hanging column/pressure plate testing. "---" indicates no volume changes occurred.

² Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '---' denotes no volume change occurred.

* Weight including tares

[†] Assumed density of water is 1.0 g/cm³

[‡] Volume adjustments are applicable at this matric potential (see comment #1). Changes in volume, if applicable, are estimated based on obtainable measurements of changes in sample length and diameter.

Technician Notes:

Laboratory analysis by: D. O'Dowd
Data entered by: A. Albay-Yenney
Checked by: J. Hines



Moisture Retention Data

Dew Point Potentiometer / Relative Humidity Box (Soil-Water Characteristic Curve)

Sample Number: SS-KEY-01 (1.59 g/cc)

Initial sample bulk density (g/cm³): 1.59

Fraction of bulk sample used (<2.00mm fraction) (%): 99.08

Dry weight* of dew point potentiometer sample (g): 198.76

Tare weight, jar (g): 114.85

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content [†] (% vol)
Dew point potentiometer:	4-Sep-19	14:40	200.16	9178	2.63
	28-Aug-19	8:05	199.38	39568	1.17
	26-Aug-19	10:10	199.21	303492	0.85

Volume Adjusted Data¹

	Water Potential (-cm water)	Adjusted Volume (cm ³)	% Volume Change ² (%)	Adjusted Density (g/cm ³)	Adjusted Calc. Porosity (%)
Dew point potentiometer:	9178	---	---	---	---
	39568	---	---	---	---
	303492	---	---	---	---

Dry weight* of relative humidity box sample (g): 74.29

Tare weight (g): 38.02

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content [†] (% vol)
Relative humidity box:	21-Aug-19	10:15	74.38	846993	0.39

Volume Adjusted Data¹

	Water Potential (-cm water)	Adjusted Volume (cm ³)	% Volume Change ² (%)	Adjusted Density (g/cm ³)	Adjusted Calc. Porosity (%)
Relative humidity box:	846993	---	---	---	---

Comments:

¹ Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent the volume change measurements obtained after the last hanging column or pressure plate point. "---" indicates no volume changes occurred.

² Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '-' denotes no volume change occurred.

* Weight including tares

[†] Adjusted for >2.00mm (#10 sieve) material not used in DPP/RH testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm³.

[‡] Volume adjustments are applicable at this matric potential (see comment #1). Changes in volume, if applicable, are estimated based on obtainable measurements of changes in sample length and diameter.

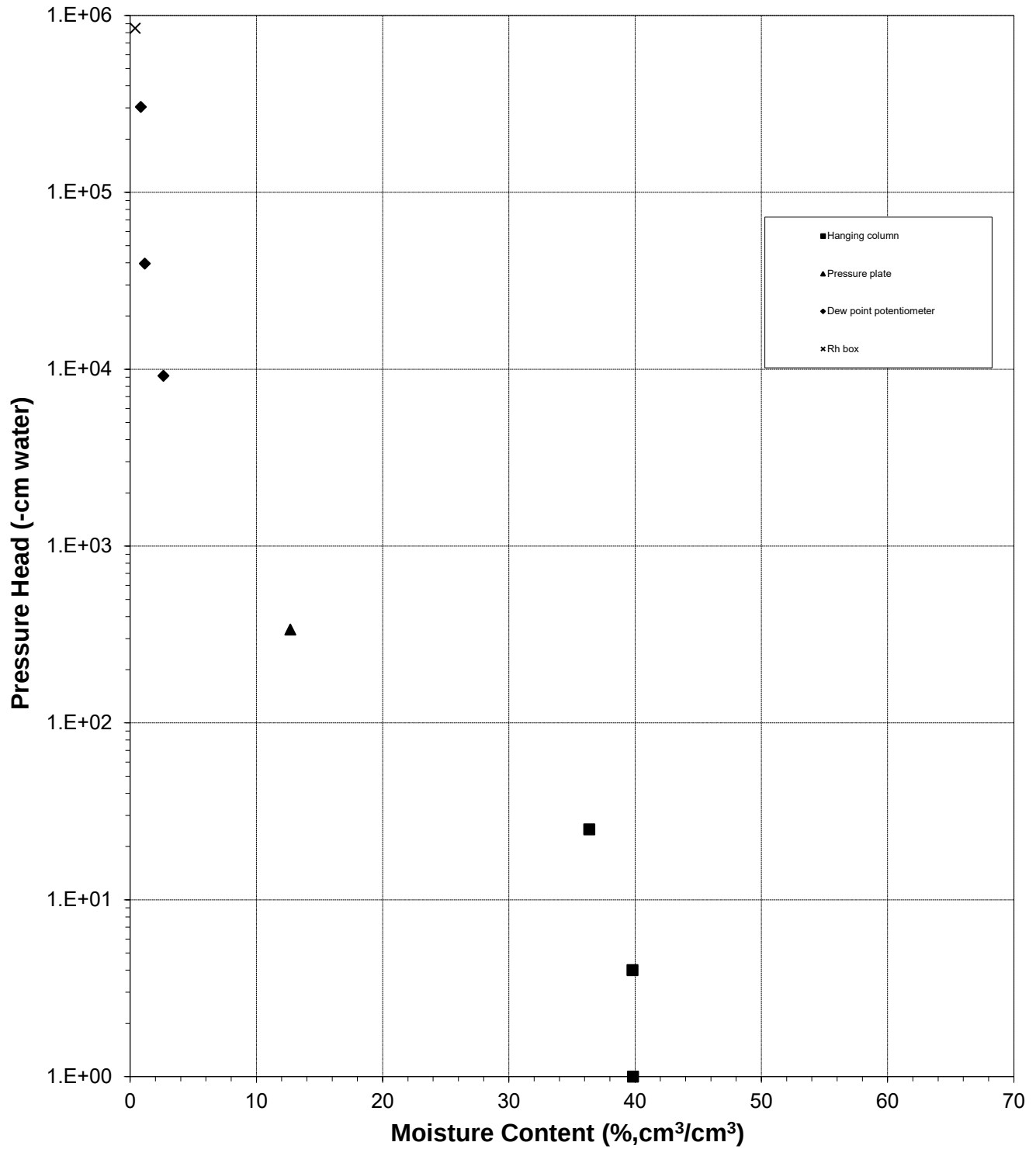
Laboratory analysis by: D. O'Dowd

Data entered by: A. Albay-Yenney

Checked by: J. Hines



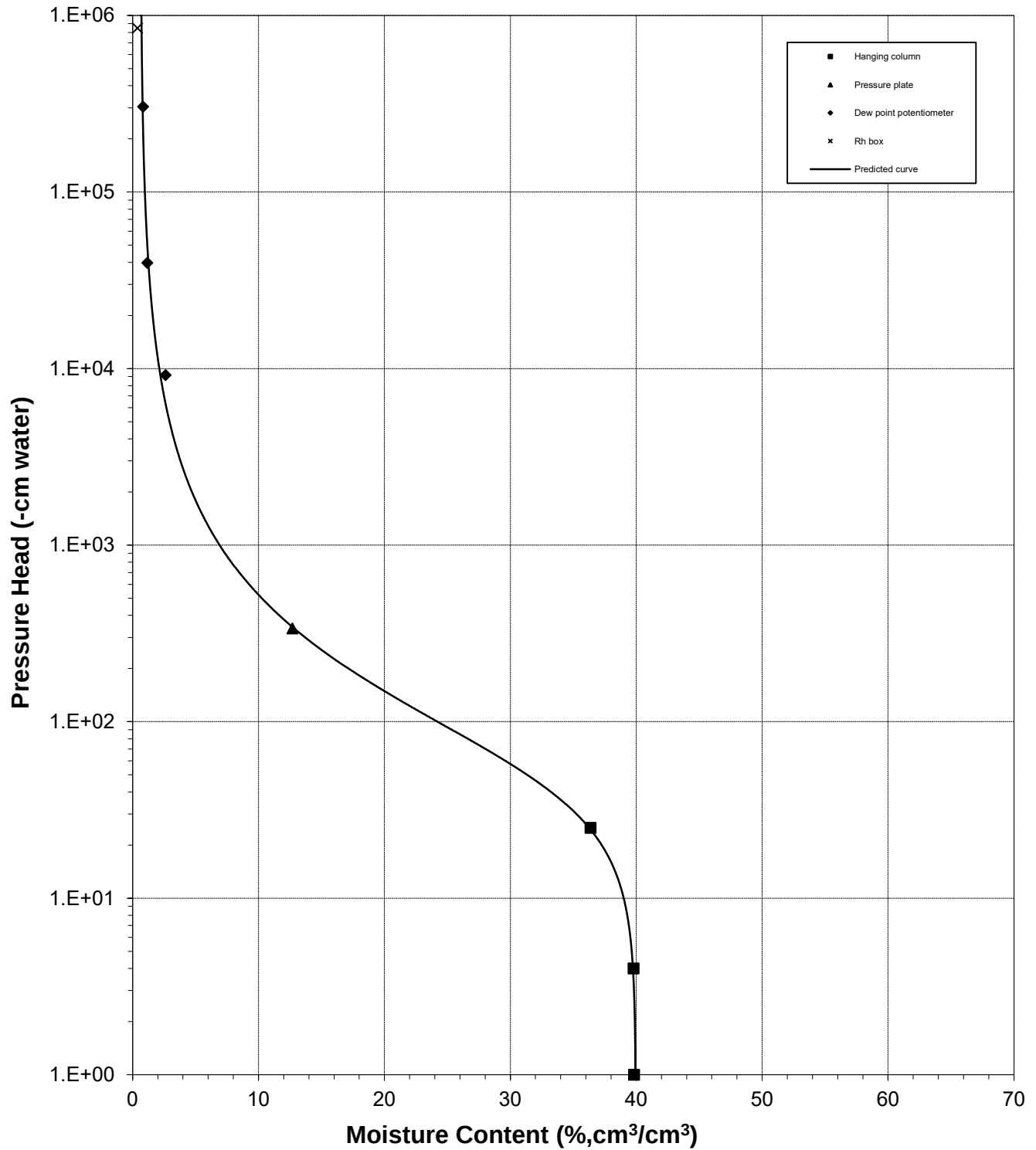
Water Retention Data Points
Sample Number: SS-KEY-01 (1.59 g/cc)





Predicted Calibration Curve and Data Points

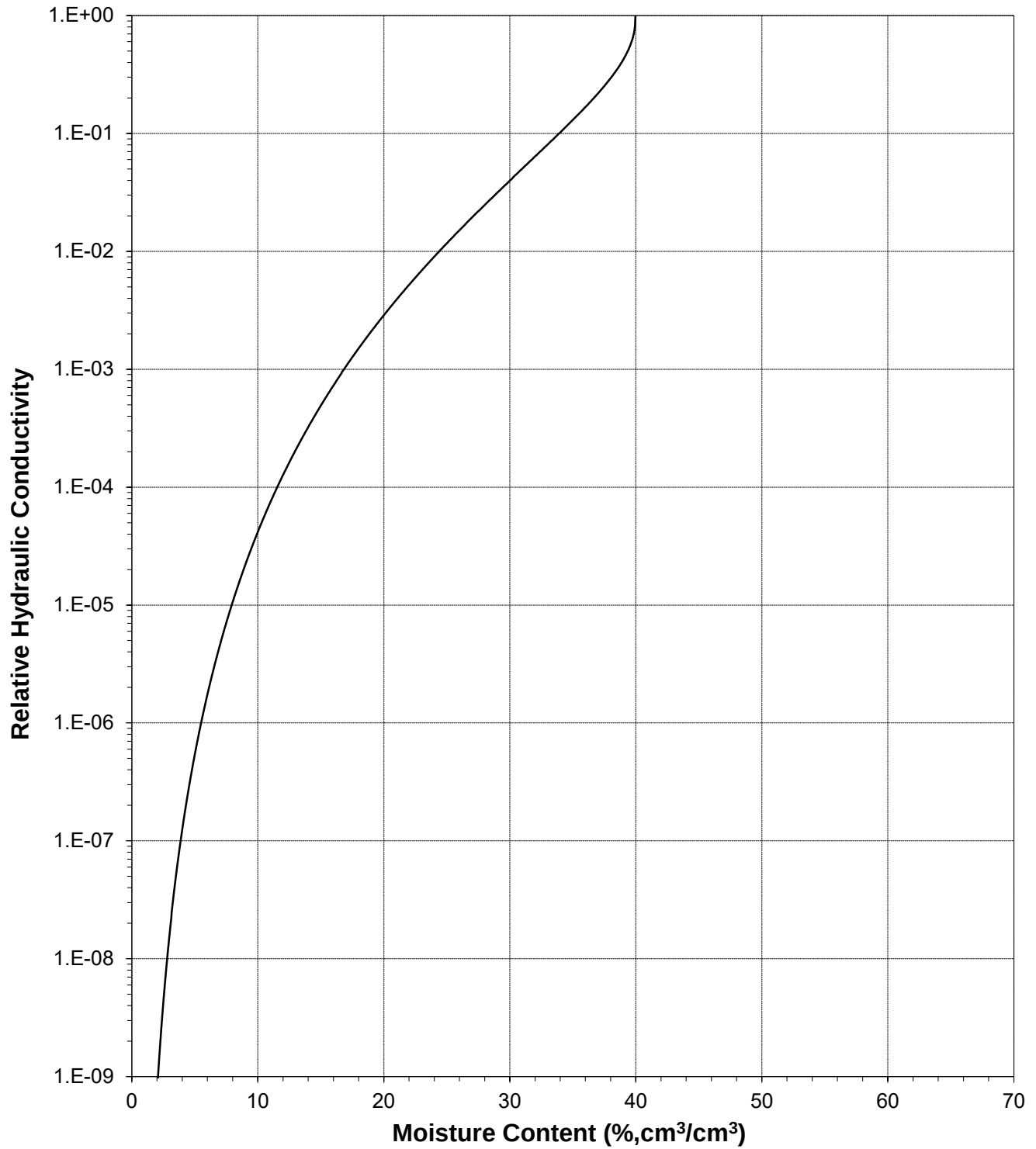
Sample Number: SS-KEY-01 (1.59 g/cc)





Plot of Relative Hydraulic Conductivity vs Moisture Content

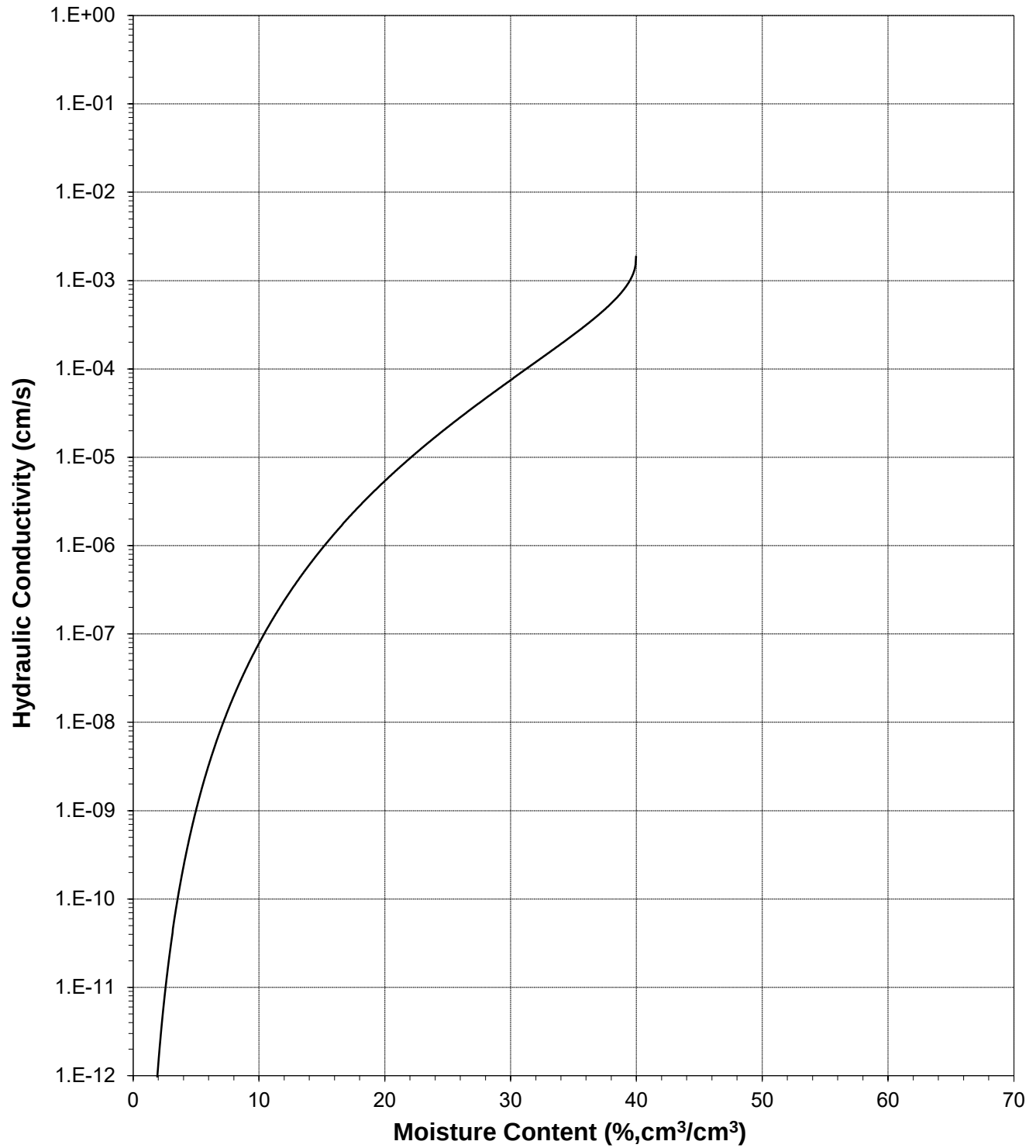
Sample Number: SS-KEY-01 (1.59 g/cc)





Plot of Hydraulic Conductivity vs Moisture Content

Sample Number: SS-KEY-01 (1.59 g/cc)

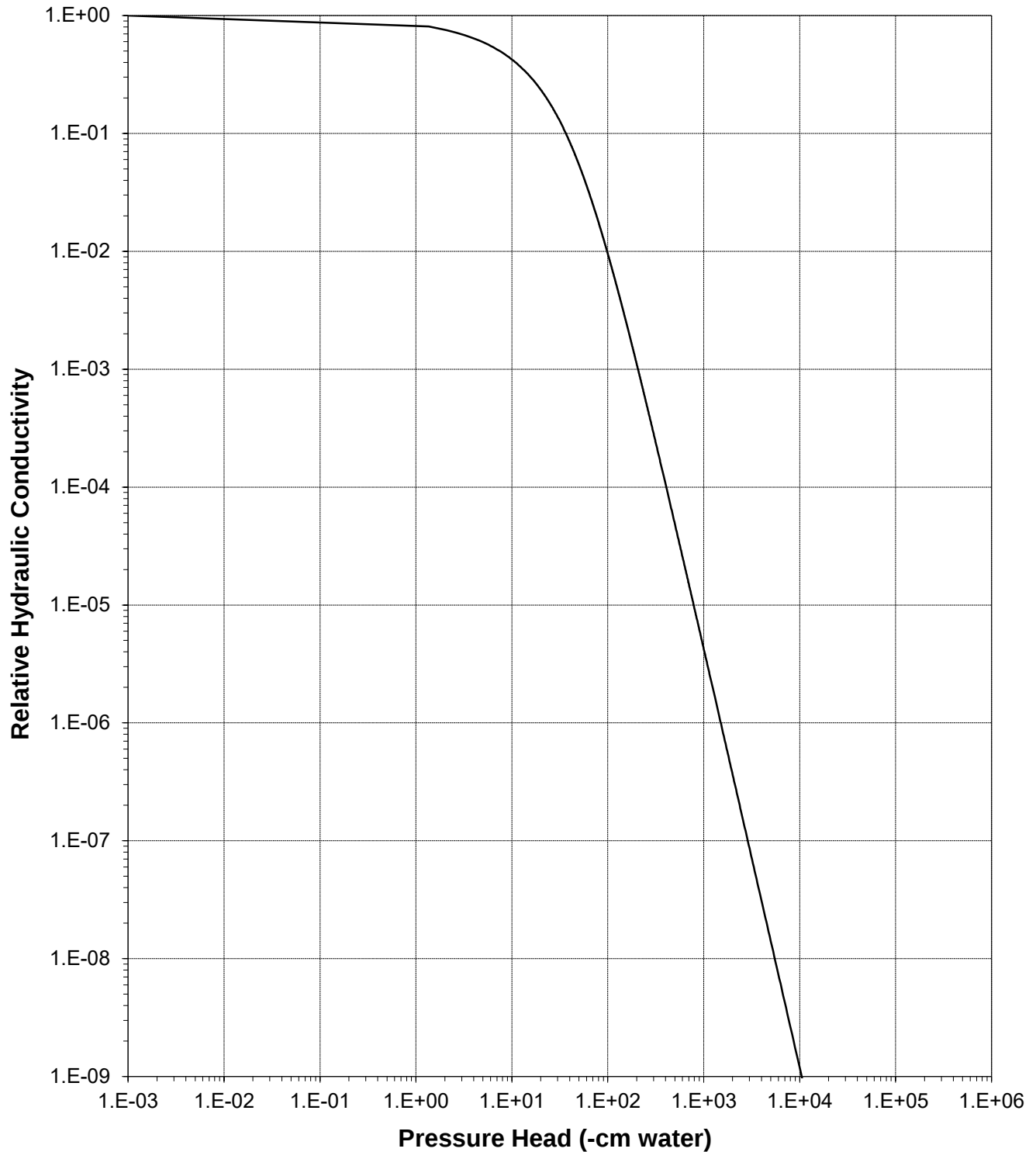




Daniel B. Stephens & Associates, Inc.

Plot of Relative Hydraulic Conductivity vs Pressure Head

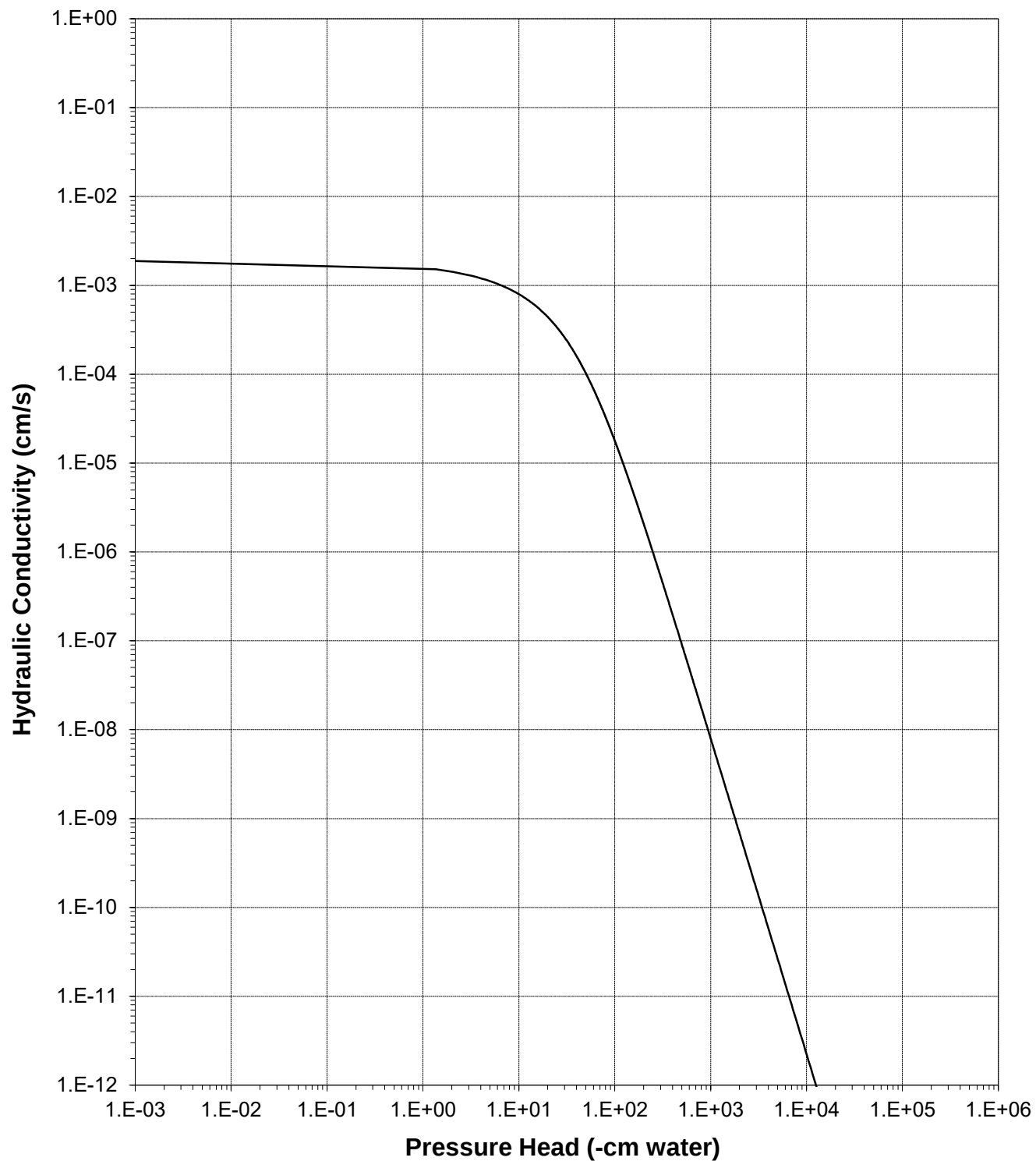
Sample Number: SS-KEY-01 (1.59 g/cc)





Plot of Hydraulic Conductivity vs Pressure Head

Sample Number: SS-KEY-01 (1.59 g/cc)





Daniel B. Stephens & Associates, Inc.

Moisture Retention Data
Hanging Column / Pressure Plate
 (Soil-Water Characteristic Curve)

Job Name: TTL, Inc.
 Job Number: DB19.1098.00
 Sample Number: SS-T1A-01 (Undisturbed) (1.54 g/cc)
 Project Name: Twin Pines
 Project Number: 000180200804.00

Dry wt. of sample (g): 438.64
 Tare wt., ring (g): 245.30
 Tare wt., screen & clamp (g): 26.61
 Initial sample volume (cm³): 285.39
 Initial dry bulk density (g/cm³): 1.54
 Assumed particle density (g/cm³): 2.65
 Initial calculated total porosity (%): 42.00

	Date	Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content [†] (% vol)
<i>Hanging column:</i>	5-Apr-19	15:00	824.87	0	40.06
	15-Apr-19	17:00	823.96	6.0	39.74
	22-Apr-19	16:00	822.67	18.5	39.29
	29-Apr-19	13:55	788.75	49.0	27.40
	7-May-19	14:45	766.15	186.0	19.48

Volume Adjusted Data¹

	Matric Potential (-cm water)	Adjusted Volume (cm ³)	% Volume Change ² (%)	Adjusted Density (g/cm ³)	Adjusted Calculated Porosity (%)
<i>Hanging column:</i>	0.0	---	---	---	---
	6.0	---	---	---	---
	18.5	---	---	---	---
	49.0	---	---	---	---
	186.0	---	---	---	---

Comments:

¹ Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent each of the volume change measurements obtained after saturated hydraulic conductivity testing and throughout hanging column/pressure plate testing. "---" indicates no volume changes occurred.

² Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '---' denotes no volume change occurred.

* Weight including tares

[†] Assumed density of water is 1.0 g/cm³

[‡] Volume adjustments are applicable at this matric potential (see comment #1). Changes in volume, if applicable, are estimated based on obtainable measurements of changes in sample length and diameter.

Technician Notes:

Laboratory analysis by: D. O'Dowd/A. Bland
Data entered by: C. Krous
Checked by: J. Hines



Moisture Retention Data

Dew Point Potentiometer / Relative Humidity Box (Soil-Water Characteristic Curve)

Sample Number: SS-T1A-01 (Undisturbed) (1.54 g/cc)

Initial sample bulk density (g/cm³): 1.54

Fraction of bulk sample used (<2.00mm fraction) (%): 100.00

Dry weight* of dew point potentiometer sample (g): 154.19

Tare weight, jar (g): 113.15

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content [†] (% vol)
Dew point potentiometer:	2-May-19	11:26	156.98	4079	10.46
	18-Apr-19	10:05	155.06	37631	3.27
	10-Apr-19	15:35	154.66	173162	1.75

Volume Adjusted Data¹

	Water Potential (-cm water)	Adjusted Volume (cm ³)	% Volume Change ² (%)	Adjusted Density (g/cm ³)	Adjusted Calc. Porosity (%)
Dew point potentiometer:	4079	---	---	---	---
	37631	---	---	---	---
	173162	---	---	---	---

Dry weight* of relative humidity box sample (g): 58.66

Tare weight (g): 41.90

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content [†] (% vol)
Relative humidity box:	23-Apr-19	9:40	58.73	852439	0.62

Volume Adjusted Data¹

	Water Potential (-cm water)	Adjusted Volume (cm ³)	% Volume Change ² (%)	Adjusted Density (g/cm ³)	Adjusted Calc. Porosity (%)
Relative humidity box:	852439	---	---	---	---

Comments:

¹ Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent the volume change measurements obtained after the last hanging column or pressure plate point. "---" indicates no volume changes occurred.

² Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '-' denotes no volume change occurred.

* Weight including tares

[†] Adjusted for >2.00mm (#10 sieve) material not used in DPP/RH testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm³.

[‡] Volume adjustments are applicable at this matric potential (see comment #1). Changes in volume, if applicable, are estimated based on obtainable measurements of changes in sample length and diameter.

Laboratory analysis by: C. Krous/D. O'Dowd

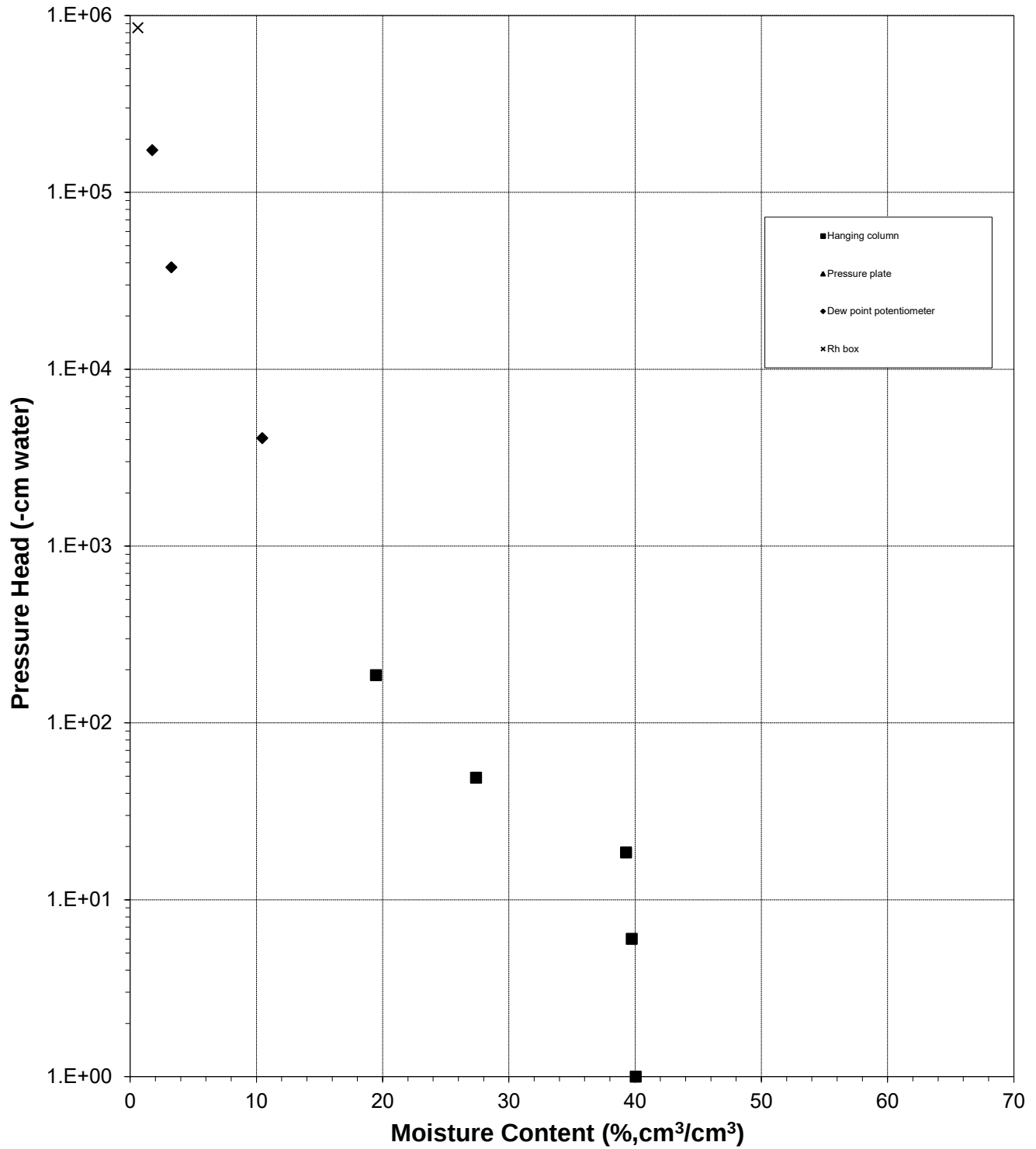
Data entered by: C. Krous

Checked by: J. Hines



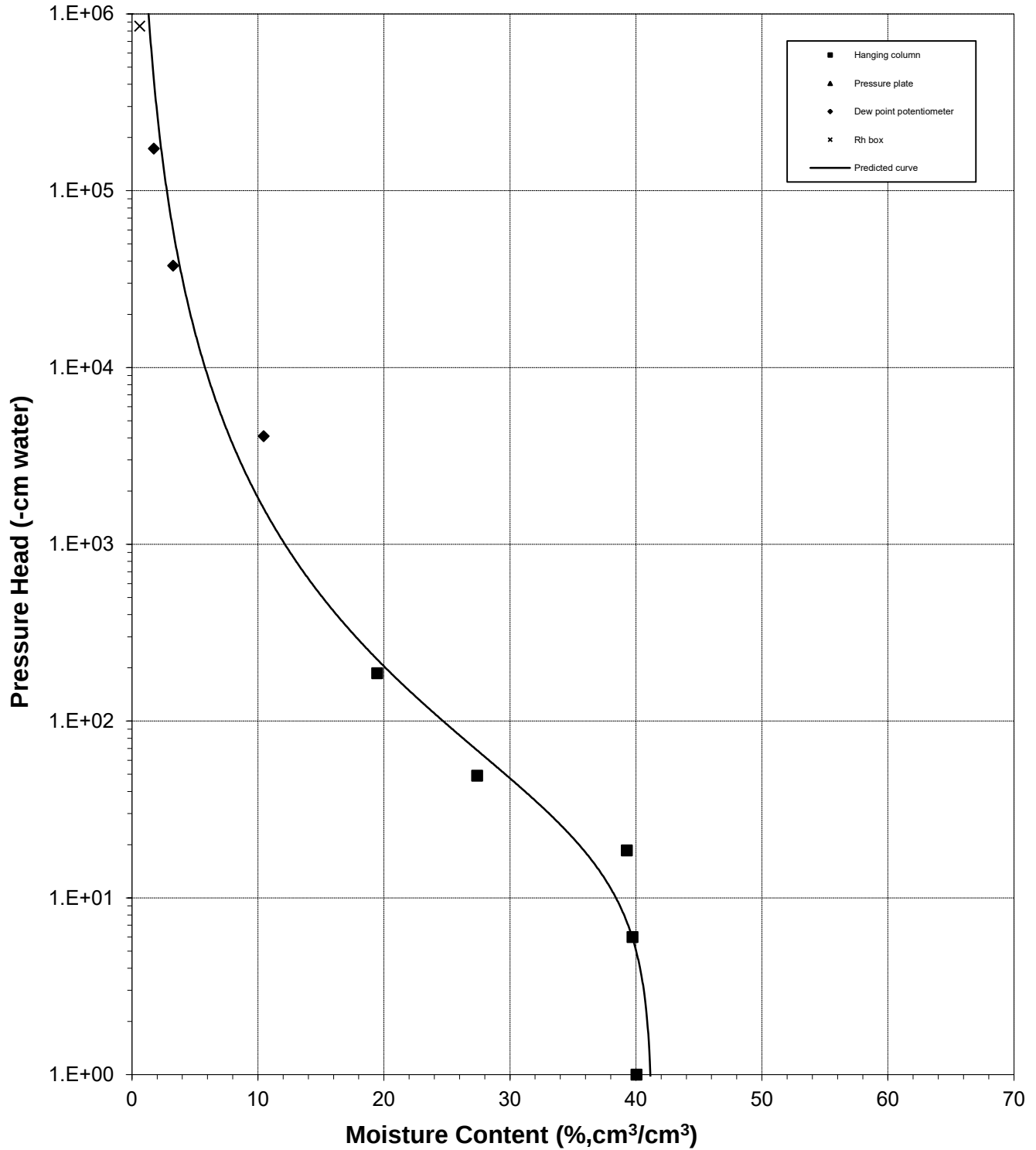
Water Retention Data Points

Sample Number: SS-T1A-01 (Undisturbed) (1.54 g/cc)





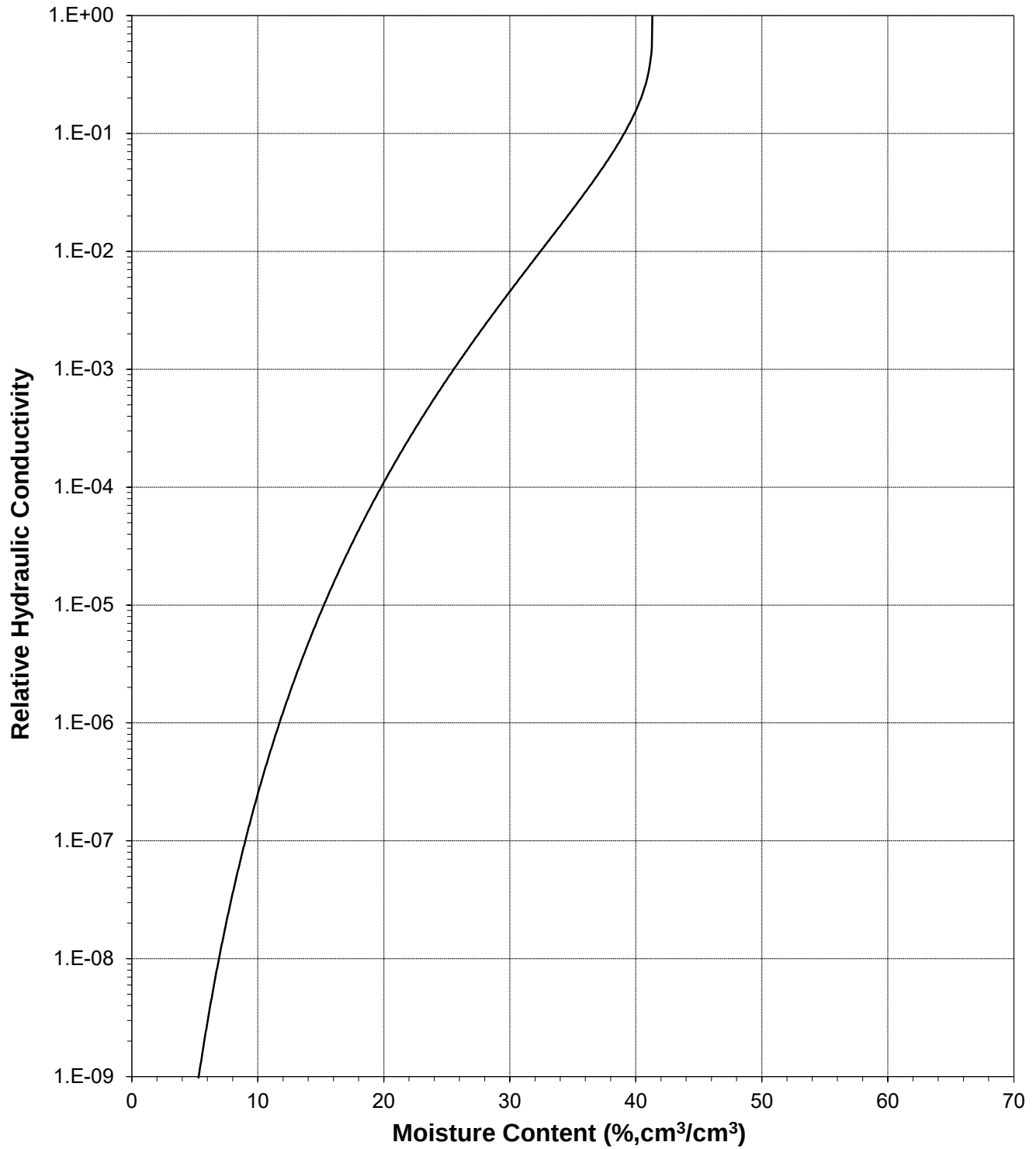
Predicted Calibration Curve and Data Points
Sample Number: SS-T1A-01 (Undisturbed) (1.54 g/cc)





Plot of Relative Hydraulic Conductivity vs Moisture Content

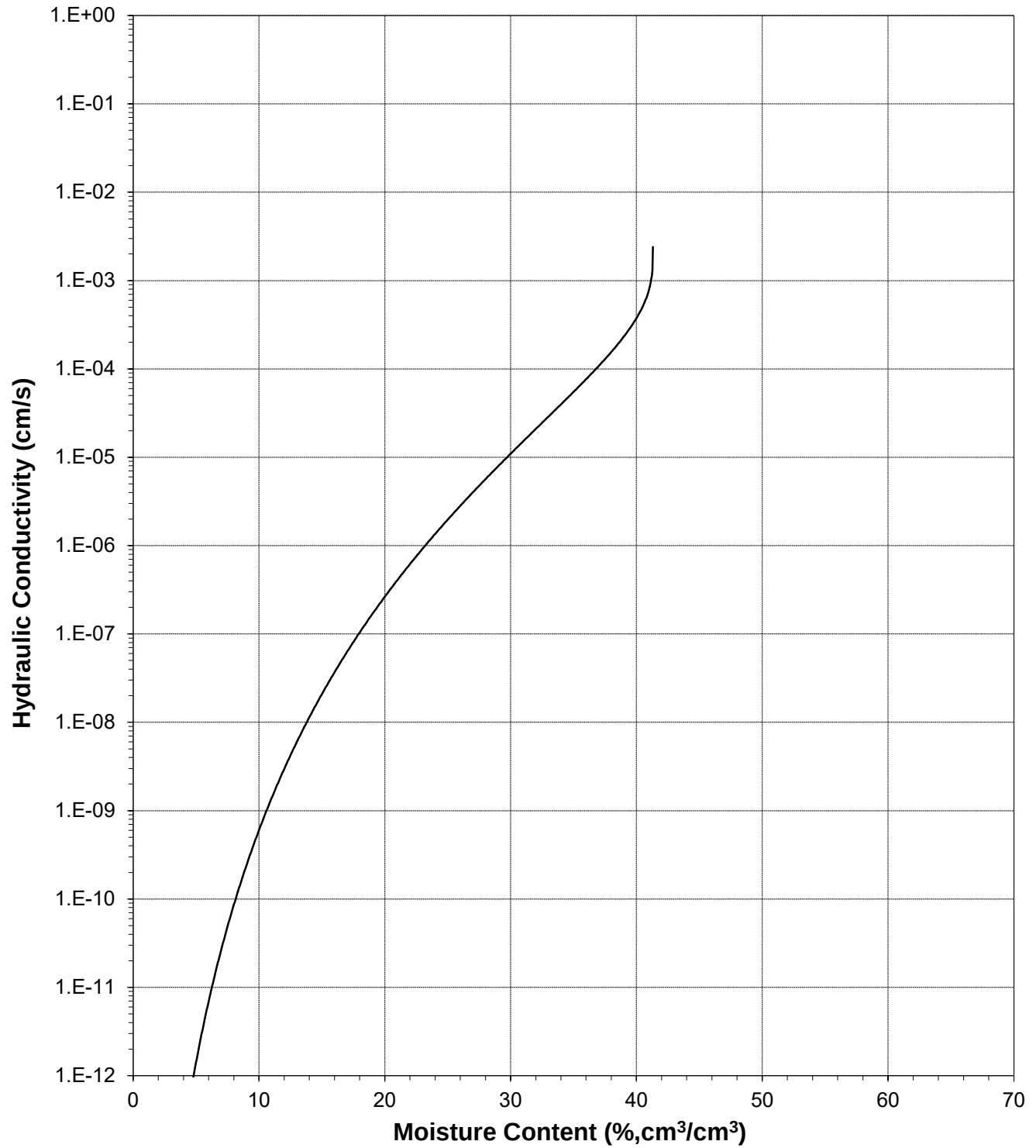
Sample Number: SS-T1A-01 (Undisturbed) (1.54 g/cc)





Plot of Hydraulic Conductivity vs Moisture Content

Sample Number: SS-T1A-01 (Undisturbed) (1.54 g/cc)

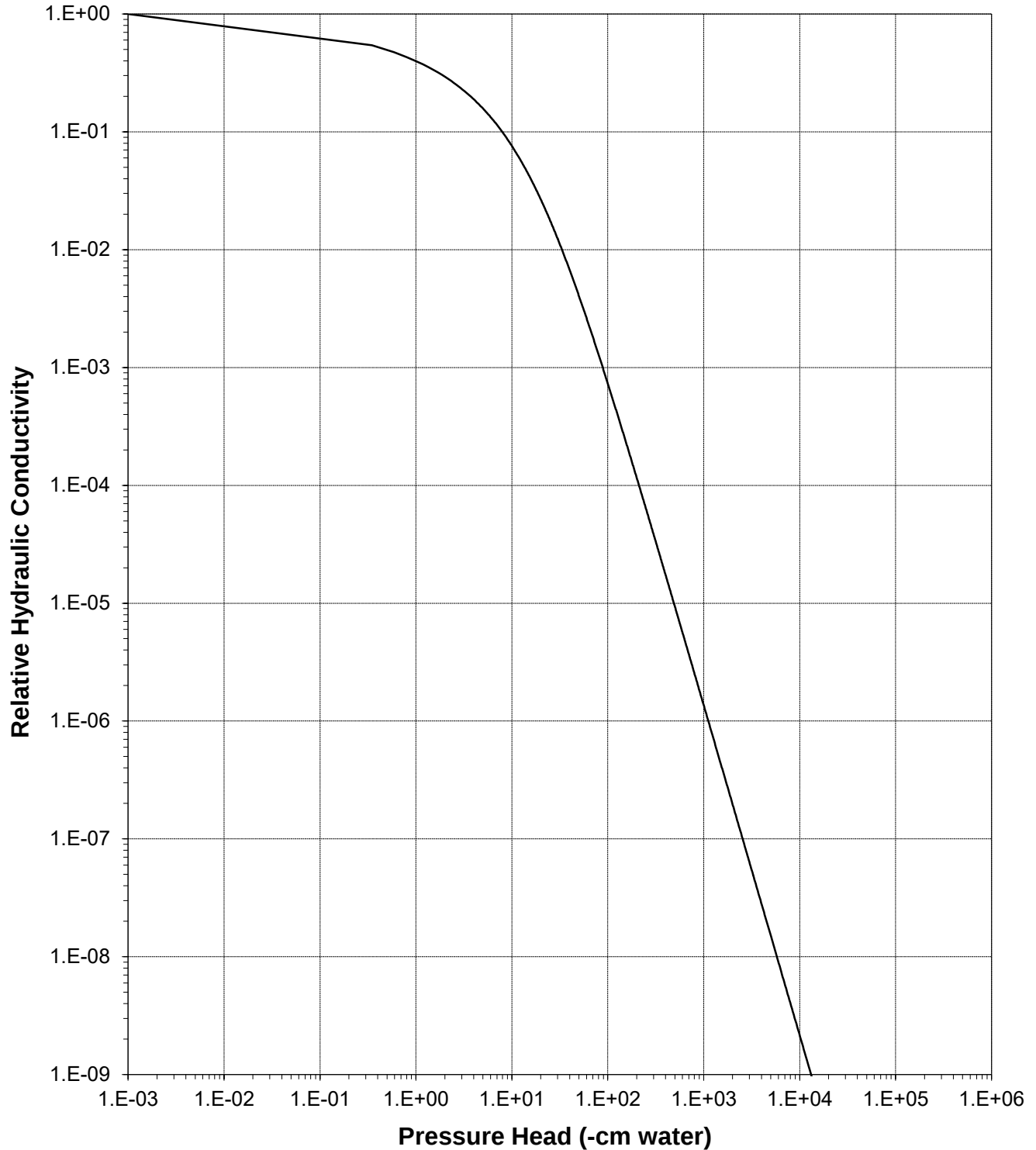




Daniel B. Stephens & Associates, Inc.

Plot of Relative Hydraulic Conductivity vs Pressure Head

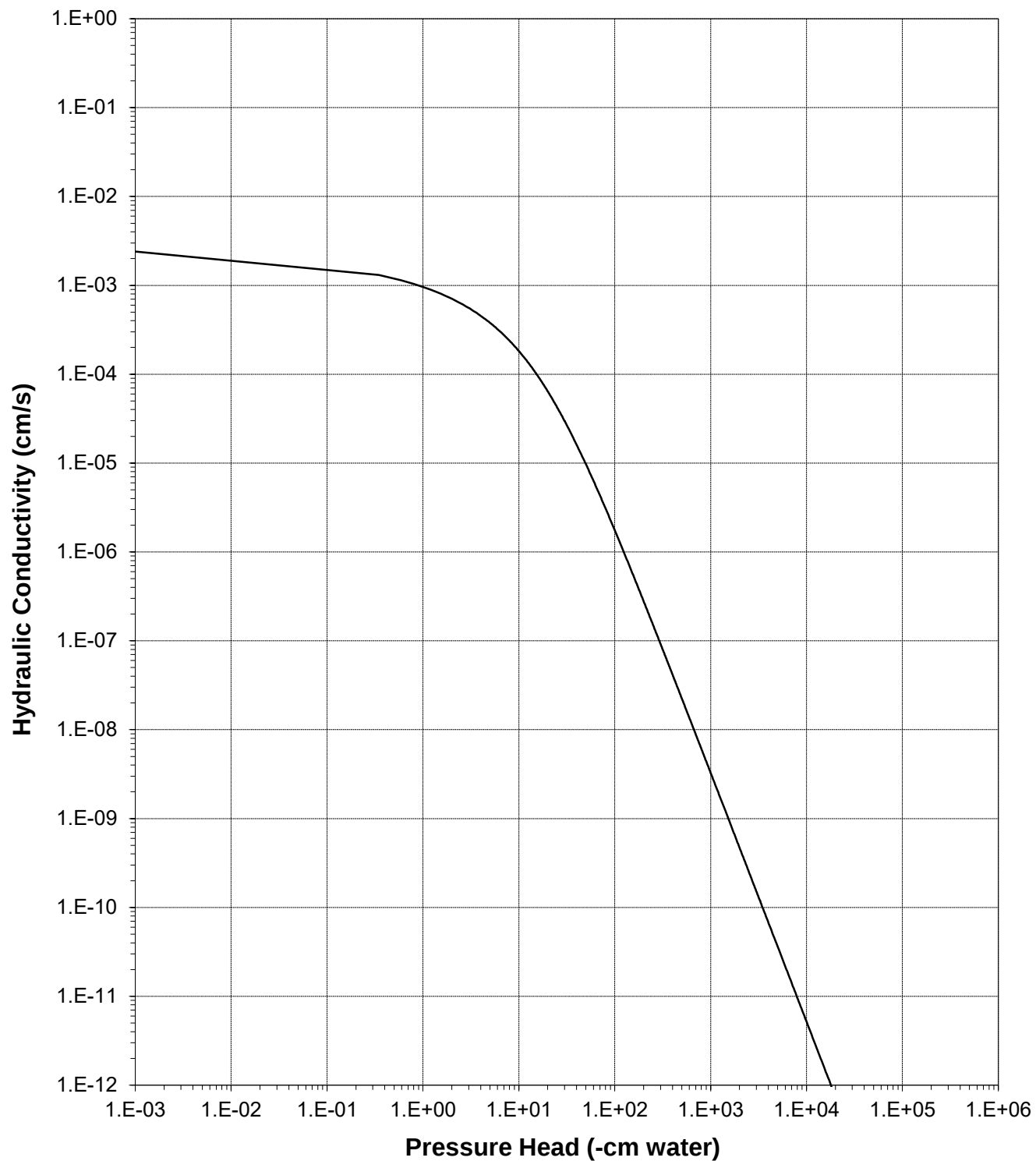
Sample Number: SS-T1A-01 (Undisturbed) (1.54 g/cc)





Plot of Hydraulic Conductivity vs Pressure Head

Sample Number: SS-T1A-01 (Undisturbed) (1.54 g/cc)





Daniel B. Stephens & Associates, Inc.

Moisture Retention Data
Hanging Column / Pressure Plate
 (Soil-Water Characteristic Curve)

Job Name: TTL, Inc.
 Job Number: DB19.1098.00
 Sample Number: SS-T1A-01 (1.59 g/cc)
 Project Name: Twin Pines
 Project Number: 000180200804.00

Dry wt. of sample (g): 354.98
 Tare wt., ring (g): 140.50
 Tare wt., screen & clamp (g): 28.07
 Initial sample volume (cm³): 223.74
 Initial dry bulk density (g/cm³): 1.59
 Assumed particle density (g/cm³): 2.65
 Initial calculated total porosity (%): 40.13

	Date	Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content [†] (% vol)
<i>Hanging column:</i>	20-Aug-19	14:00	608.78	0	38.09
	27-Aug-19	9:30	608.00	11.0	37.74
	3-Sep-19	16:40	603.05	32.0	35.53
	10-Sep-19	11:30	571.82	99.0	21.57
<i>Pressure plate:</i>	19-Sep-19	15:30	564.71	337	18.40

Volume Adjusted Data¹

	Matric Potential (-cm water)	Adjusted Volume (cm ³)	% Volume Change ² (%)	Adjusted Density (g/cm ³)	Adjusted Calculated Porosity (%)
<i>Hanging column:</i>	0.0	---	---	---	---
	11.0	---	---	---	---
	32.0	---	---	---	---
	99.0	---	---	---	---
<i>Pressure plate:</i>	337	---	---	---	---

Comments:

¹ Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent each of the volume change measurements obtained after saturated hydraulic conductivity testing and throughout hanging column/pressure plate testing. "---" indicates no volume changes occurred.

² Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '---' denotes no volume change occurred.

* Weight including tares

[†] Assumed density of water is 1.0 g/cm³

[‡] Volume adjustments are applicable at this matric potential (see comment #1). Changes in volume, if applicable, are estimated based on obtainable measurements of changes in sample length and diameter.

Technician Notes:

*Laboratory analysis by: D. O'Dowd
 Data entered by: A. Albay-Yenney
 Checked by: J. Hines*



Moisture Retention Data

Dew Point Potentiometer / Relative Humidity Box (Soil-Water Characteristic Curve)

Sample Number: SS-T1A-01 (1.59 g/cc)

Initial sample bulk density (g/cm³): 1.59

Fraction of bulk sample used (<2.00mm fraction) (%): 97.84

Dry weight* of dew point potentiometer sample (g): 183.78

Tare weight, jar (g): 111.98

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content [†] (% vol)
Dew point potentiometer:	9-Sep-19	9:25	186.57	2448	6.03
	28-Aug-19	8:10	184.41	37325	1.36
	26-Aug-19	10:30	184.23	251381	0.97

Volume Adjusted Data¹

	Water Potential (-cm water)	Adjusted Volume (cm ³)	% Volume Change ² (%)	Adjusted Density (g/cm ³)	Adjusted Calc. Porosity (%)
Dew point potentiometer:	2448	---	---	---	---
	37325	---	---	---	---
	251381	---	---	---	---

Dry weight* of relative humidity box sample (g): 79.68

Tare weight (g): 42.90

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content [†] (% vol)
Relative humidity box:	21-Aug-19	10:15	79.84	846993	0.66

Volume Adjusted Data¹

	Water Potential (-cm water)	Adjusted Volume (cm ³)	% Volume Change ² (%)	Adjusted Density (g/cm ³)	Adjusted Calc. Porosity (%)
Relative humidity box:	846993	---	---	---	---

Comments:

¹ Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent the volume change measurements obtained after the last hanging column or pressure plate point. "---" indicates no volume changes occurred.

² Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '-' denotes no volume change occurred.

* Weight including tares

[†] Adjusted for >2.00mm (#10 sieve) material not used in DPP/RH testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm³.

[‡] Volume adjustments are applicable at this matric potential (see comment #1). Changes in volume, if applicable, are estimated based on obtainable measurements of changes in sample length and diameter.

Laboratory analysis by: D. O'Dowd

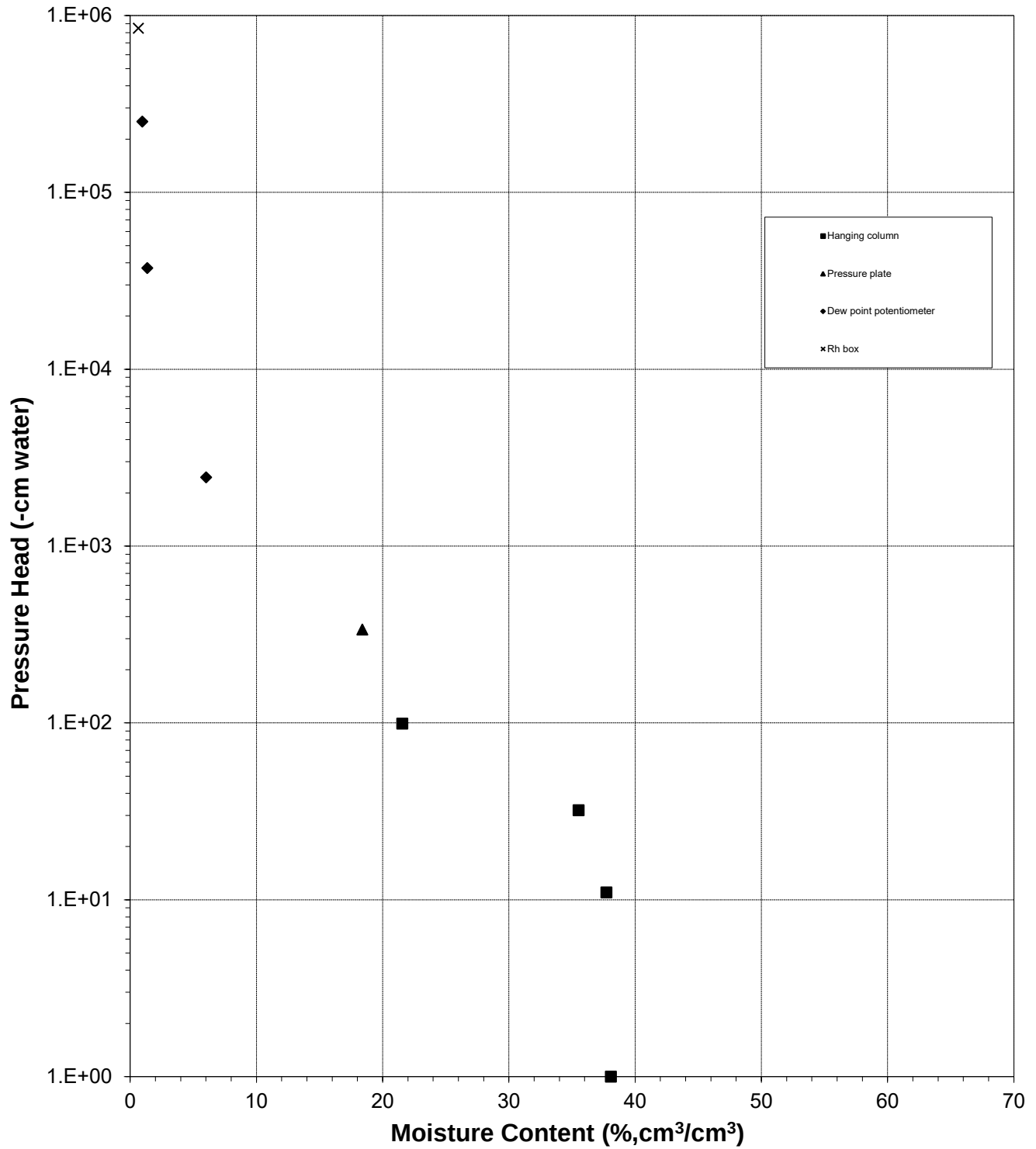
Data entered by: A. Albay-Yenney

Checked by: J. Hines



Water Retention Data Points

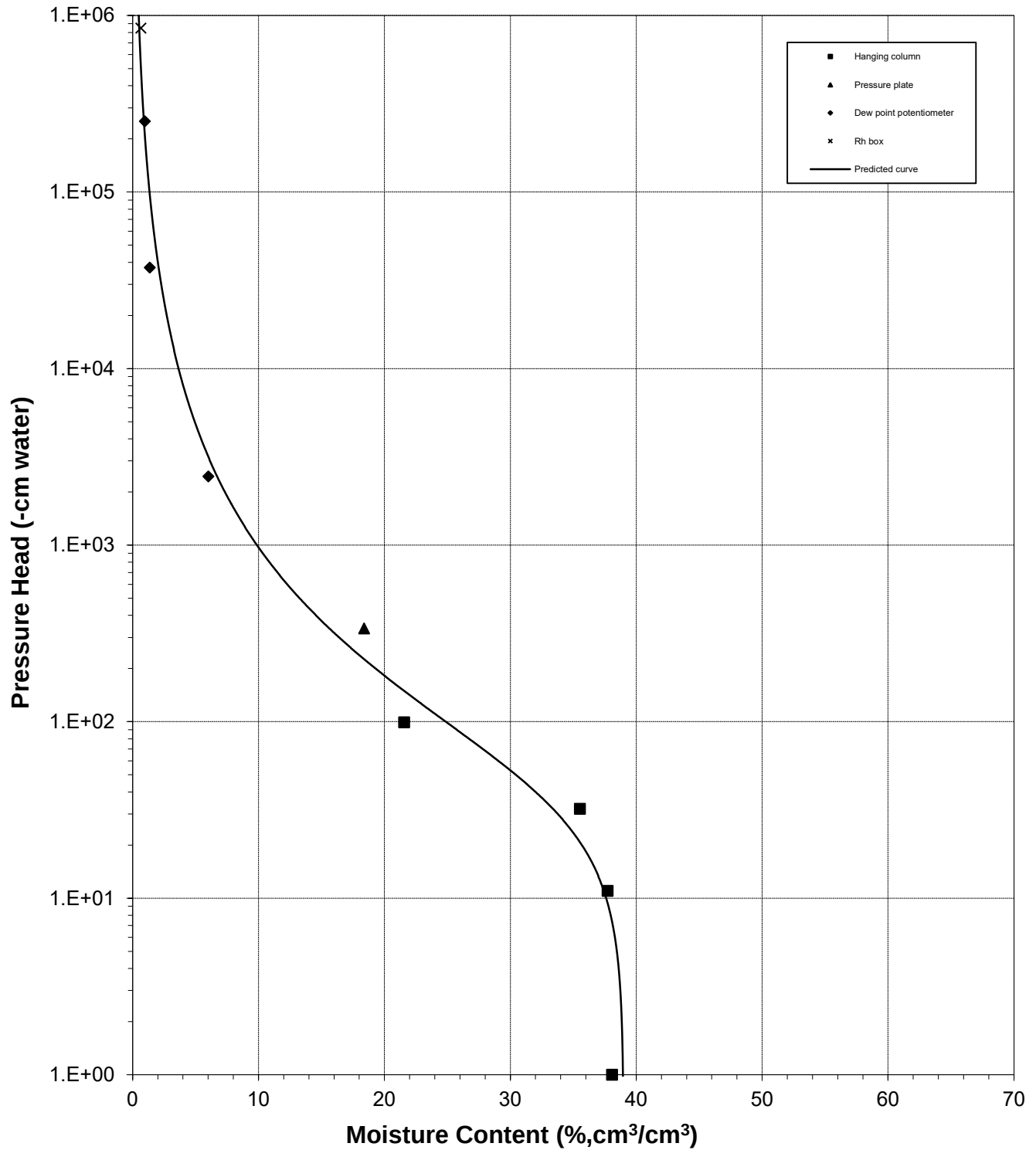
Sample Number: SS-T1A-01 (1.59 g/cc)





Predicted Calibration Curve and Data Points

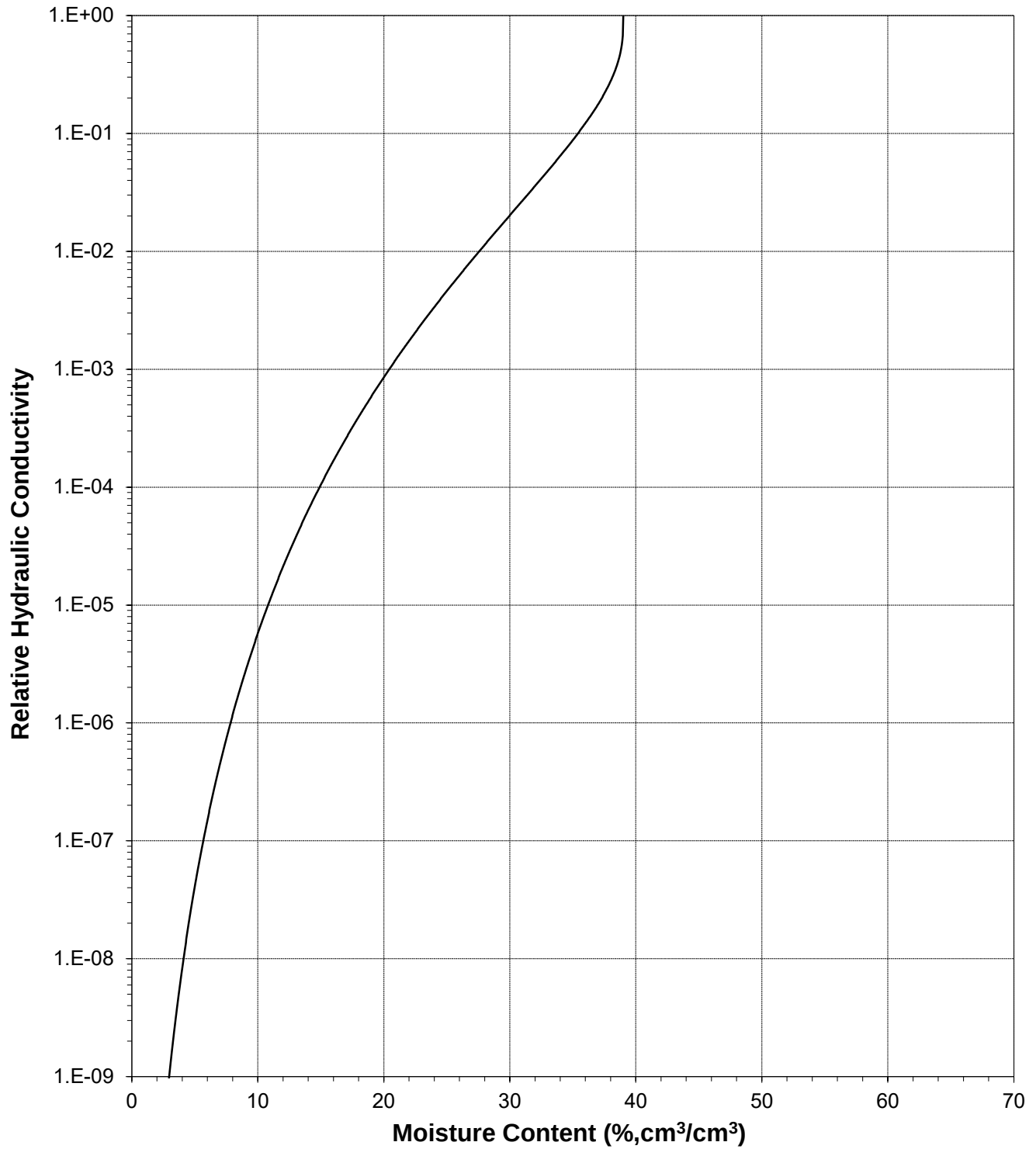
Sample Number: SS-T1A-01 (1.59 g/cc)





Plot of Relative Hydraulic Conductivity vs Moisture Content

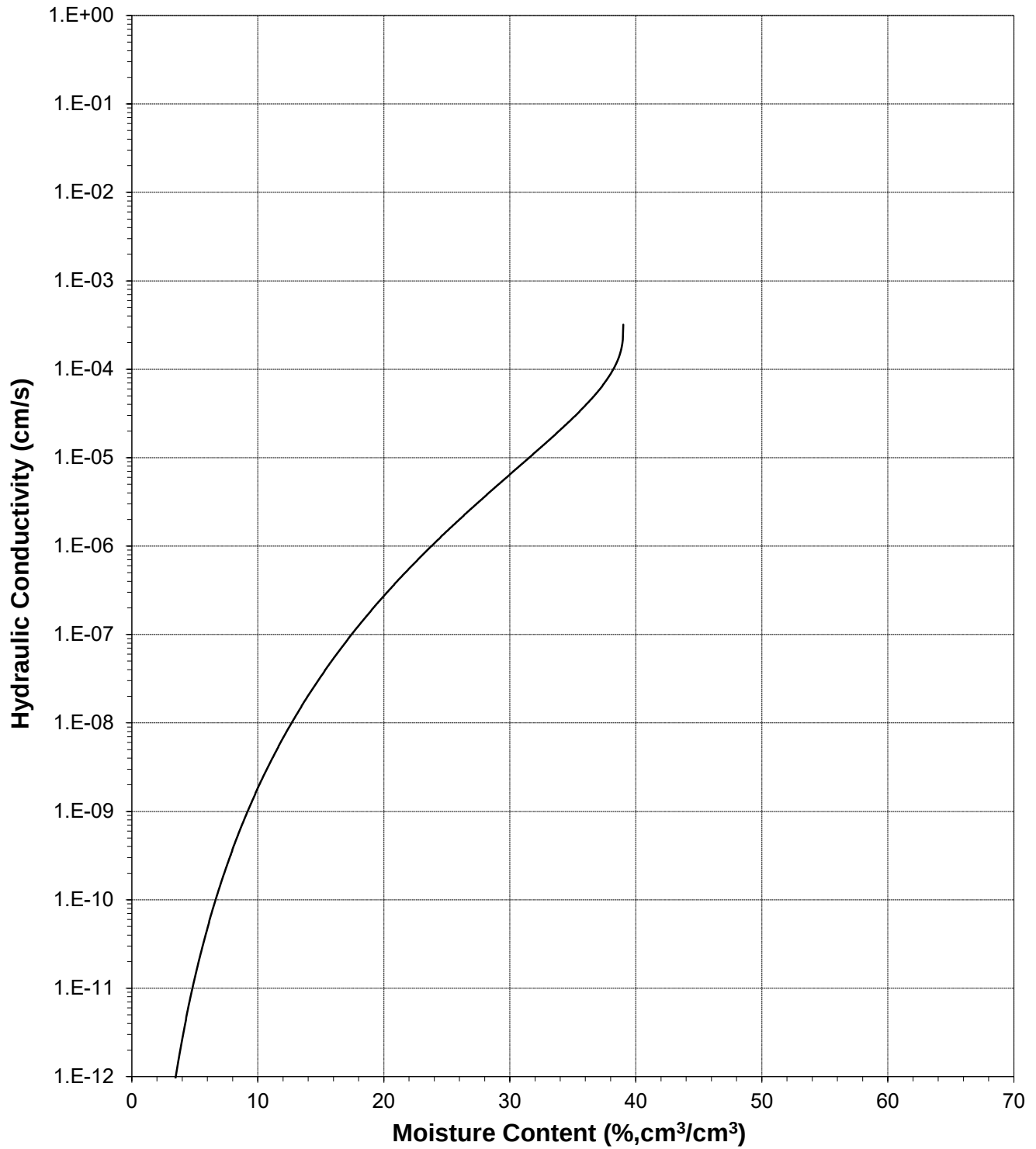
Sample Number: SS-T1A-01 (1.59 g/cc)





Plot of Hydraulic Conductivity vs Moisture Content

Sample Number: SS-T1A-01 (1.59 g/cc)

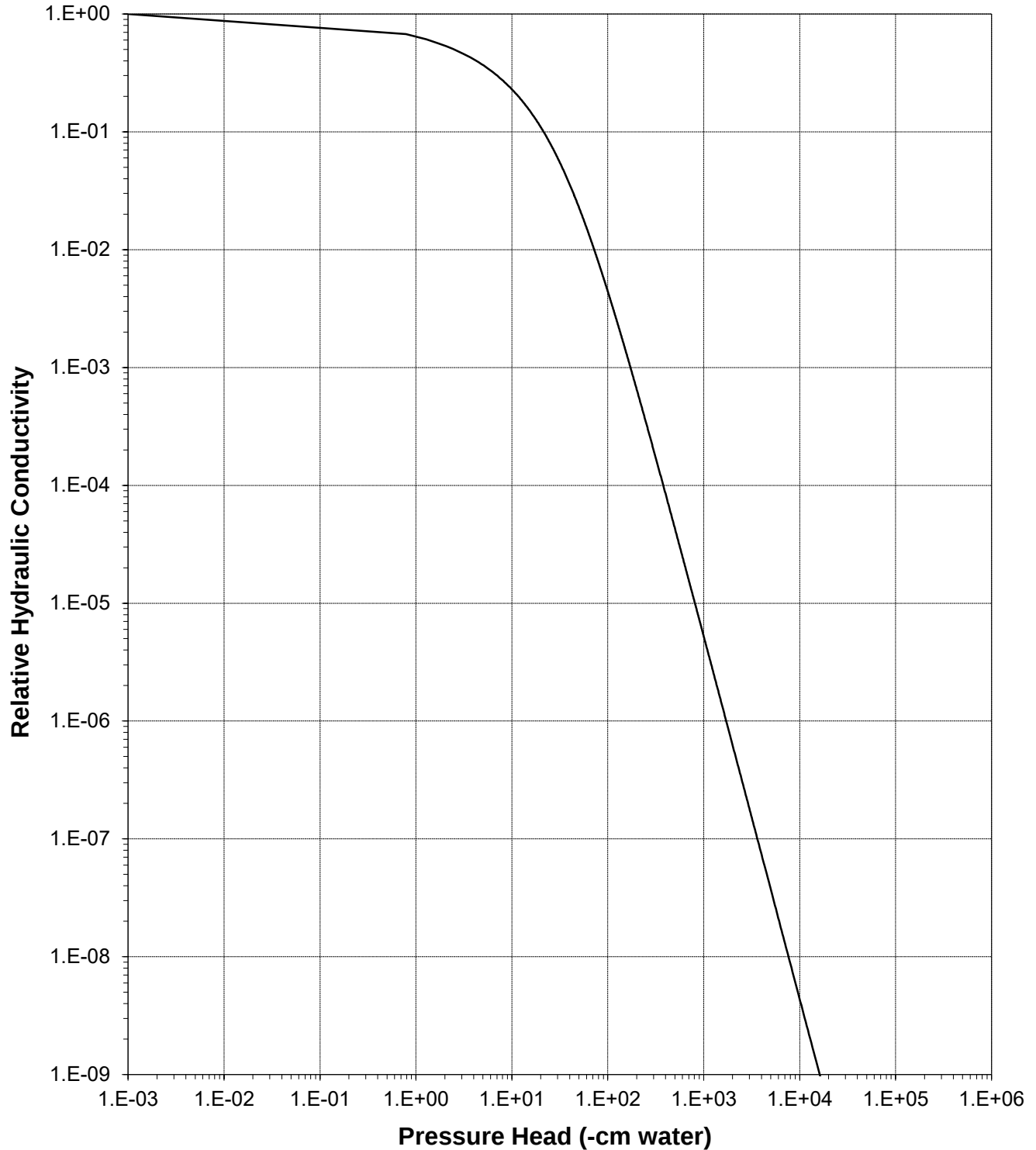




Daniel B. Stephens & Associates, Inc.

Plot of Relative Hydraulic Conductivity vs Pressure Head

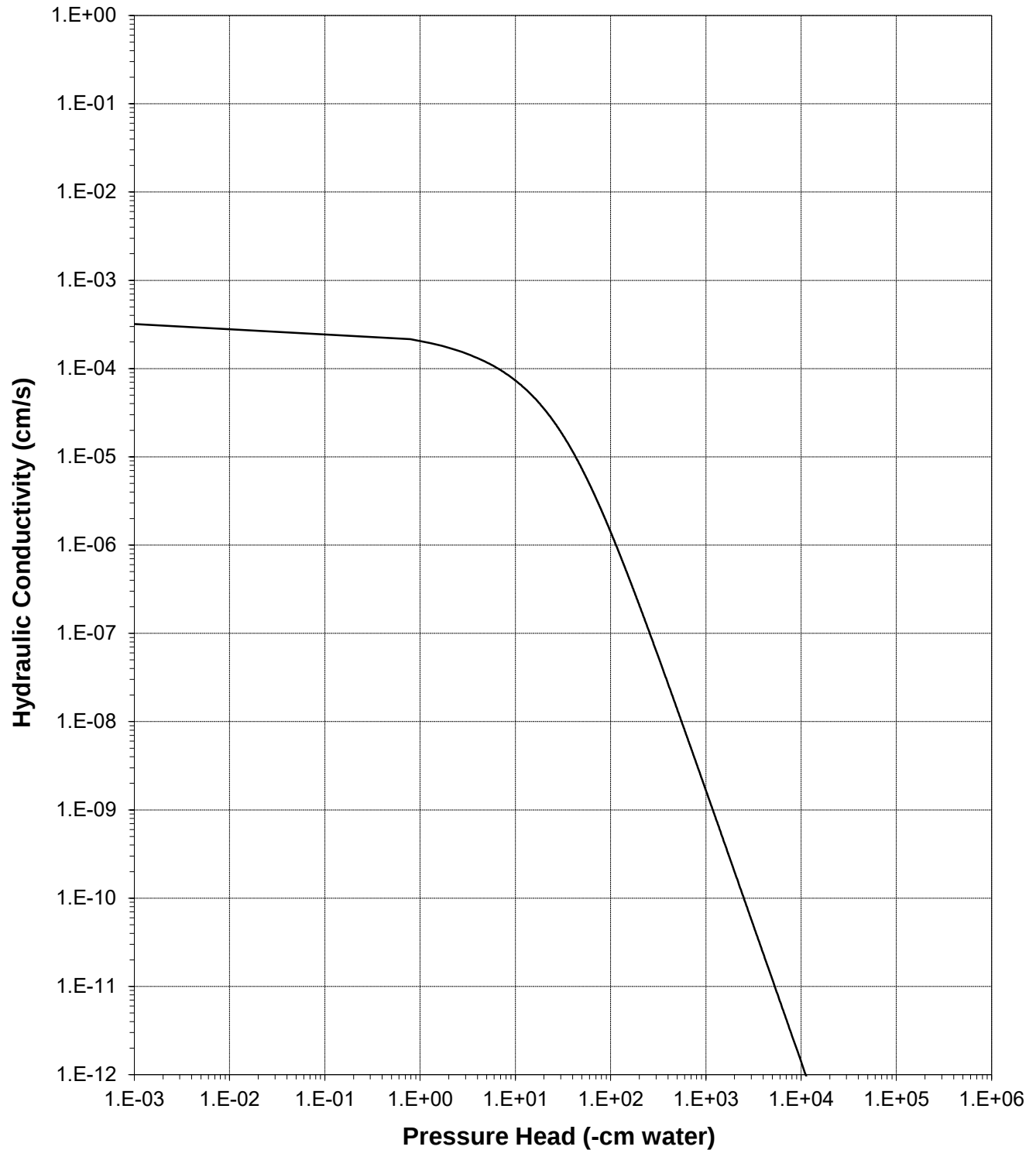
Sample Number: SS-T1A-01 (1.59 g/cc)





Plot of Hydraulic Conductivity vs Pressure Head

Sample Number: SS-T1A-01 (1.59 g/cc)



Laboratory Tests and Methods



Tests and Methods

Dry Bulk Density:	ASTM D7263
Moisture Content:	ASTM D7263, ASTM D2216
Calculated Porosity:	ASTM D7263
Saturated Hydraulic Conductivity:	
Constant Head: (Rigid Wall)	ASTM D 5856 (modified apparatus)
Hanging Column Method:	ASTM D6836 (modified apparatus)
Pressure Plate Method:	ASTM D6836 (modified apparatus)
Water Potential (Dewpoint Potentiometer) Method:	ASTM D6836
Relative Humidity (Box) Method:	Campbell, G. and G. Gee. 1986. Water Potential: Miscellaneous Methods. Chp. 25, pp. 631-632, in A. Klute (ed.), Methods of Soil Analysis. Part 1. American Society of Agronomy, Madison, WI; Karathanasis & Hajek. 1982. Quantitative Evaluation of Water Adsorption on Soil Clays. SSA Journal 46:1321-1325
Moisture Retention Characteristics & Calculated Unsaturated Hydraulic Conductivity:	ASTM D6836; van Genuchten, M.T. 1980. A closed-form equation for predicting the hydraulic conductivity of unsaturated soils. SSSAJ 44:892-898; van Genuchten, M.T., F.J. Leij, and S.R. Yates. 1991. The RETC code for quantifying the hydraulic functions of unsaturated soils. Robert S. Kerr Environmental Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Ada, Oklahoma. EPA/600/2091/065. December 1991

ATTACHMENT D

Photographs of Heavy Minerals Processing of Drummed UD Samples & Bench-Scale Study Testing

APPENDIX H
SUPPORTING PHOTOGRAPHS



Photograph 1. Processing of UD boring drummed soil through mineral extraction processing plant.

APPENDIX H
SUPPORTING PHOTOGRAPHS



Photograph 2. Processing of UD drummed soil through mineral extraction processing plant by Mineral Technologies personnel.

APPENDIX H
SUPPORTING PHOTOGRAPHS



Photograph 3. Processing of UD drummed soil through mineral extraction processing plant by Mineral Technologies personnel.

APPENDIX H
SUPPORTING PHOTOGRAPHS



Photograph 4. Sand mixed with water flowing through heavy mineral separation spirals.

APPENDIX H
SUPPORTING PHOTOGRAPHS



Photograph 5. Alternate view of sand mixed with water flowing through heavy mineral separation spirals.

APPENDIX H
SUPPORTING PHOTOGRAPHS



Photograph 6. Outfall for process sand.

APPENDIX H
SUPPORTING PHOTOGRAPHS



Photograph 7. Processed sand minus heavy mineral and any humate and/or clays returned to drum.

APPENDIX H
SUPPORTING PHOTOGRAPHS



Photograph 8. Post-processed drummed sand delivered to TTL's office in Tuscaloosa, Alabama.



Photograph 9. Steel chamber used for applying load to processed sand.

APPENDIX H
SUPPORTING PHOTOGRAPHS



Photograph 10. Sand from drum UD338/25 being transferred into steel chamber.

APPENDIX H
SUPPORTING PHOTOGRAPHS



Photograph 11. Steel chamber sealed with lid for load application via pneumatic jack.

APPENDIX H
SUPPORTING PHOTOGRAPHS



Photograph 12. Load applied via pneumatic jack.



Photograph 13. Alternate view of pneumatic jack.

APPENDIX H
SUPPORTING PHOTOGRAPHS



Photograph 14. Bentonite used for bench-scale testing.

ATTACHMENT E

Bench-Scale Study - Vertical Hydraulic Conductivity Test Reports



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**HYDRAULIC CONDUCTIVITY ANALYSIS
ASTM D 5084**

**Twin Pines Minerals, LLC
St. George, Georgia
TTL Project No. 000180200804.00**

May 2019

Material Description: Black Sand with Silt (Visual Description)

Sample: UD 338/25 - A

Sample Date: May 2019

Sampled By: TTL, Inc.

Simulated In Situ Dry Density: 98.9 pcf

Simulated In Situ Moisture: 15.1 %

Hydraulic Conductivity "k": 1.1×10^{-3} cm/sec



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**HYDRAULIC CONDUCTIVITY ANALYSIS
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St. George, Georgia
TTL Project No. 000180200804.00**

May 2019

Material Description: Black Sand with Silt (Visual Description)

Sample: UD 338/25 - B

Sample Date: May 2019

Sampled By: TTL, Inc.

Simulated In Situ Dry Density: 98.9 pcf

Simulated In Situ Moisture: 15.2 %

Hydraulic Conductivity "k": 1.1×10^{-3} cm/sec



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TTL Project No. 000180200804.00**

May 2019

Material Description: Black Sand with Silt (Visual Description)

Sample: UD 338/25 - C

Sample Date: May 2019

Sampled By: TTL, Inc.

Simulated In Situ Dry Density: 100.1 pcf

Simulated In Situ Moisture: 15.2 %

Hydraulic Conductivity "k": 7.2×10^{-4} cm/sec



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St. George, Georgia
TTL Project No. 000180200804.00**

June 2019

Material Description: Black Sand with Silt (Visual Description)

Sample: UD 338/25 - A (0.35% Bentonite)

Sample Date: May 2019

Sampled By: TTL, Inc.

Simulated In Situ Dry Density: 93.4 pcf

Simulated In Situ Moisture: 16.5 %

Hydraulic Conductivity "k": 7.0×10^{-4} cm/sec



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June 2019

Material Description: Black Sand with Silt (Visual Description)

Sample: UD 338/25 - B (0.35% Bentonite)

Sample Date: May 2019

Sampled By: TTL, Inc.

Simulated In Situ Dry Density: 91.5 pcf

Simulated In Situ Moisture: 16.5 %

Hydraulic Conductivity "k": 5.6×10^{-4} cm/sec



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June 2019

Material Description: Black Sand with Silt (Visual Description)

Sample: UD 338/25 - C (0.35% Bentonite)

Sample Date: May 2019

Sampled By: TTL, Inc.

Simulated In Situ Dry Density: 88.9 pcf

Simulated In Situ Moisture: 16.5 %

Hydraulic Conductivity "k": 1.2×10^{-3} cm/sec



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June 2019

Material Description: Black Sand with Silt (Visual Description)

Sample: UD 338/25 – A (1.42% Bentonite)

Sample Date: May 2019

Sampled By: TTL, Inc.

Simulated In Situ Dry Density: 93.7 pcf

Simulated In Situ Moisture: 15.7 %

Hydraulic Conductivity "k": 1.7×10^{-3} cm/sec



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**Twin Pines Minerals, LLC
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TTL Project No. 000180200804.00**

June 2019

Material Description: Black Sand with Silt (Visual Description)

Sample: UD 338/25 - B (1.42% Bentonite)

Sample Date: May 2019

Sampled By: TTL, Inc.

Simulated In Situ Dry Density: 90.3 pcf

Simulated In Situ Moisture: 15.7 %

Hydraulic Conductivity "k": 1.6×10^{-3} cm/sec



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June 2019

Material Description: Black Sand with Silt (Visual Description)

Sample: UD 338/25 - C (1.42% Bentonite)

Sample Date: May 2019

Sampled By: TTL, Inc.

Simulated In Situ Dry Density: 92.7 pcf

Simulated In Situ Moisture: 15.7 %

Hydraulic Conductivity "k": 1.5×10^{-3} cm/sec



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June 2019

Material Description: Black Sand with Silt (Visual Description)

Sample: UD 338/25 - (5% Bentonite)

Sample Date: May 2019

Sampled By: TTL, Inc.

Remolded Dry Density: 98.5 pcf

Remolded Moisture: 22.1 %

Hydraulic Conductivity "k": 5.7×10^{-6} cm/sec



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St. George, Georgia
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June 2019

Material Description: Black Sand with Silt (Visual Description)

Sample: UD 338/25 – (7.5% Bentonite)

Sample Date: May 2019

Sampled By: TTL, Inc.

Remolded Dry Density: 98.5 pcf

Remolded Moisture: 22.1 %

Hydraulic Conductivity "k": 2.0×10^{-6} cm/sec



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June 2019

Material Description: Black Sand with Silt (Visual Description)

Sample: UD 338/25 – (10% Bentonite)

Sample Date: May 2019

Sampled By: TTL, Inc.

Remolded Dry Density: 111.0 pcf

Remolded Moisture: 16.5 %

Hydraulic Conductivity “k”: 3.0×10^{-7} cm/sec



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June 2019

Material Description: Black Sand with Silt (Visual Description)

Sample: UD 338/25 - (12.5% Bentonite)

Sample Date: May 2019

Sampled By: TTL, Inc.

Remolded Dry Density: 98.5 pcf

Remolded Moisture: 22.1 %

Hydraulic Conductivity "k": 1.0×10^{-8} cm/sec



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TTL Project No. 000180200804.00**

June 2019

Material Description: Black Sand with Silt (Visual Description)

Sample: UD 338/25 – (15% Bentonite)

Sample Date: May 2019

Sampled By: TTL, Inc.

Remolded Dry Density: 113.6 pcf

Remolded Moisture: 15.2 %

Hydraulic Conductivity "k": 5.8×10^{-9} cm/sec



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June 2019

Material Description: Black Sand with Silt (Visual Description)

Sample: UD 338/25 - (30% Bentonite)

Sample Date: May 2019

Sampled By: TTL, Inc.

Remolded Dry Density: 110.9 pcf

Remolded Moisture: 15.9 %

Hydraulic Conductivity "k": 2.7×10^{-9} cm/sec



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June 2019

Material Description: Black Sand with Silt (Visual Description)

Sample: UD 338/25 - (10% Bentonite)

Sample Date: May 2019

Sampled By: TTL, Inc.

Remolded Dry Density: 102.9 pcf

Remolded Moisture: 21.8 %

Hydraulic Conductivity "k": 6.8×10^{-7} cm/sec



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June 2019

Material Description: Black Sand with Silt (Visual Description)

Sample: UD 338/25 - (15% Bentonite)

Sample Date: May 2019

Sampled By: TTL, Inc.

Remolded Dry Density: 107.5 pcf

Remolded Moisture: 19.6 %

Hydraulic Conductivity "k": 5.0×10^{-9} cm/sec



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June 2019

Material Description: Black Sand with Silt (Visual Description)

Sample: UD 338/25 – (30% Bentonite)

Sample Date: May 2019

Sampled By: TTL, Inc.

Remolded Dry Density: 106.9 pcf

Remolded Moisture: 19.4 %

Hydraulic Conductivity "k": 2.0×10^{-9} cm/sec