FREEPORT-McMoRan

Tyrone Operations
P.O. Box 571
Tyrone, NM 88065

March 13, 2025

Via Electronic Mail Only

Mr. Clint Chisler
Energy, Minerals and Natural Resources Department
Mining and Minerals Division
Mining Act Reclamation Program
1220 South St. Francis Drive
Santa Fe, NM 87505

Dear Mr. Chisler:

Re: Modification 22-1 to Little Rock Mine, Permit No. GR007RE; and Modification 22-1 to Tyrone Mine, Permit No. GR010RE; Freeport-McMoRan Tyrone Inc.; Final Report on Suitability of Precambrian Granite Overburden

In letters dated August 2, 2022 and August 17, 2022 Freeport McMoRan Tyrone, Inc. (Tyrone) applied for modifications to Little Rock permit GR007RE and Tyrone permit GR010RE for the approval of Precambrian granite as Reclamation Cover Material and the termination of the USNR Test Plot Study. On November 21, 2022 Tyrone received comments from Mining and Minerals Division (MMD) which included a request for Tyrone to perform confirmation sampling and analysis of the Precambrian granite in the 9A and 9AX Waste Rock Stockpiles. Tyrone submitted a final Sampling and Analysis Plan for the confirmation study on March 31, 2023. MMD requested additional information in a comment letter dated April 21, 2023 and Tyrone responded on May 18, 2023. A conditional approval was granted by the agency on June 5, 2023 and work began shortly thereafter.

Enclosed is a report detailing the confirmation testing and analysis of the suitability of Precambrian granite and overburden as a reclamation cover material. This suitability report and the vegetation survey report of the USNR reclamation area, performed in 2024 and to be submitted in April of 2025, are the final assurance requirements to evaluate the suitability of this valuable resource as a reclamation cover material. Tyrone has fulfilled all other applicable requirements and is requesting the agencies expedite approval of these two permit modifications to ensure the changes may also be incorporated into the 2025 Tyrone Closure/Closeout Plan update.

Please contact Ms. Raechel Roberts at (575) 956-3290 if you have questions.

Sincerely,

Sherry Burt-Kested
Environmental Manager
New Mexico Operations

SBK:rmr
20250313-100

c. Brad Reid – NMED
Sean Madden – NMED

REPORT

Suitability of Precambrian Granite Overburden as a Reclamation Cover Material

Tyrone and Little Rock Mines

Submitted to:

Raechel Roberts

Freeport McMoRan Tyrone Operations
P.O. Box 571
Tyrone, New Mexico 88065

Submitted by:

WSP USA Inc.
2440 Louisiana Blvd NE Suite 400
Albuquerque, NM 87110

31406439.001

March 4, 2025

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1.0 INTRODUCTION

Freeport-McMoRan Tyrone, Inc. (Tyrone) operates the Little Rock copper mine approximately 10 miles southwest of Silver City, New Mexico. The Little Rock mine is permitted as an existing mine by the Mining and Minerals Division (MMD) under Mining Act Permit No. GR007RE. The majority of the overburden excavated at the Little Rock open pit is comprised of Precambrian granite (PCG). According to Permit GR007RE, Section 3.S, PCG is conditionally approved to be used as a reclamation cover material (RCM) to complete the closeout plan.

Over the past several years, Tyrone has strategically placed PCG mined from the Little Rock Mine at the 9A Overburden and 9AX Overburden stockpiles (9A/9AX) in preparation for reclamation activities at the Tyrone Mine. Segregated PCG is stored in the West and North In-Pit Overburden Stockpiles at Little Rock as well as the Northern Haul Road across Deadman Canyon and NRW Waste Stockpile. PCG is also stored in the historic North and West Canyon stockpiles. The PCG materials have also been used to successfully construct soil covers that currently support well-established reclaimed plant communities. In 2010, PCG borrow materials from the North Waste rock stockpile were used as cover for the Copper Leach Stockpile reclamation at Little Rock. PCG overburden sourced directly from the Little Rock pit were also used as a RCM at the USNR test plots in 2015 and larger reclaimed USNR site in 2016. In both instances, Tyrone implemented its Material Characterization and Handling Plan (MCHP, dated October 2011) to successfully selected and managed the PCG materials using mine equipment (dozers, loaders, and the shovel) to construct cover soils that achieved a balanced mix of rock fragments and fine earth materials (approximately 50% rock by volume).

Tyrone applied for a modification to the Little Rock Mine on August 2, 2022, to request approval of the Little Rock PCG to be used as RCM at the Little Rock Mine and to terminate the USNR Test Plot Study. On August 17, 2022, Tyrone also applied for a modification to the Tyrone Mine Permit No. GR010RE for approved use of the same RCM at the Tyrone Mine.

The MMD provide combined comments to the permit modifications in a letter dated November 21, 2022, with Comment 2 stating:

> "*Prior to approval of the Precambrian granite in the 9A and 9AX stockpiles as RCM, MMD requests that Tyrone performs confirmation sampling and analysis of the Precambrian granite in these waste rock piles. Tyrone shall provide a sampling and analysis work plan to MMD within 90-days for the chemical and physical sampling and analyses that will be performed.*"

WSP USA Inc. (WSP) prepared a sampling and analysis plan (SAP, WSP 2023) that detailed a scope of work to further evaluate PGC materials at the 9A/9AX Overburden Stockpiles as well as other PCG stockpiles and existing reclaimed sites that used PCG as a cover material. The SAP was developed in consultation with the MMD including a virtual meeting on January 24, 2023, and a meeting at Tyrone on March 23, 2023. The MMD approved the SAP in a letter dated June 5, 2023, with the following conditions:

1) *Tyrone must provide official verification that the ocular estimates of the rock fragment are accurate using larger screening methods, such as a grizzly or screening plant. Tyrone will submit these results to MMD in the final report.*

2) *Tyrone must verify bulk density of the fine earth fraction of the sampled material and use that sampled bulk density value to calculate total rock fragment. Tyrone will submit these results to MMD in the final report.*

At the request of Tyrone, WSP completed the SAP to provide additional chemical and physical laboratory and field analyses of the PCG to further demonstrate the suitability as a RCM for the Little Rock and Tyrone mines. WSP has prepared this report to also provide data to demonstrate the available PCG RCM at Tyrone complies with Copper Rule with respect to water holding capacity.

1.1 Background

The PCG comprises the bulk of the overburden rock mined from the Little Rock open pit. It is composed primarily of coarse-grained quartz, orthoclase, plagioclase and biotite with secondary minerals goethite and hematite, which are weathering products of oxidation of the pre-existing pyrite and chalcopyrite. Extensive testing and reporting on the geochemistry and soil suitability of over 600 PCG samples has been provided to MMD in the following reports:

- Characterization and Volumetrics of Gila Conglomerate and Precambrian Granite Reclamation Cover Materials (Golder 2020)
- Closure/Closeout Plan for the Little Rock Mine (PDTI 1999)
- United States Natural Resources (USNR) Test Plot Annual Report No. 1. (Golder 2017a)
- USNR Site and Copper Mountain South Pit Expansion CQA/CQC Report (Telesto Solutions 2014)
- DP-1236 Semiannual Monitoring Reports (Tyrone 2011 to present)
- Little Rock Mine Project - Geochemical Evaluation Technical Report (SARB Consulting 1995)
- Geochemical Modeling Update - Little Rock Mine (DBS&A, 2020)
- Waste Rock Characterization and Handling Plan - 9A and 9AX Waste Rock Stockpiles Tyrone Mine, DP-435 (Golder 2016)

Data from these studies indicate that little to no sulfide minerals occur in the PCG leach cap and acid-base account (ABA) data strongly suggest that it will not generate acid and has a moderate to high potential to neutralize acidity. Laboratory analyses indicate that the overburden is relatively uniform and has few apparent limitations as a plant growth media when compared to the surrounding native soils. The suitability of PCG as reclamation cover material is further supported by observations of the establishment of volunteer perennial native vegetation within the pit area, 9A Overburden stockpile, and on the historical North Waste and West Canyon waste rock stockpiles at Little Rock as well as the successful reclamation of the Copper Leach Stockpile at Little Rock and the USNR site.

2.0 SAMPLING PLAN

Samples were collected from test pits and as bulk grab samples from berms or existing soil cover to capture the different stockpile lifts or mining time intervals when the PCG was deposited or used as a cover material.

2.1 Field Methods

Test pits were excavated to depths of 6 to 9 feet. Excavated materials were segregated into two-foot intervals for logging and sampling. Each test pit was described by WSP soil scientists following the USDA National Soil Survey Standards (Soil Survey Division Staff 2017). The materials will be described with respect to soil texture, rock fragment volume and size classes (i.e., gravel, cobble, and stone), moisture, and reaction to weak acid.

2.1.1 Rock Volume Field Testing

As part of sample collection, WSP personnel visually estimated the volume of gravels, cobbles, and stones in the PCG overburden materials using standard field protocols (Soil Survey Division Staff 2017). As part of sample

collection, WSP used a field quality control (QC) protocol to compare initial ocular total volumetric rock estimates to field measurements determined by a sieving procedure described below. The Rock Volume QC protocol is used to maintain consistency of the ocular estimates during the course of the sampling program and confirm that the average difference between field and QC measurements are within ±5 percent.

After volumetric rock content was estimated at each sample location, a representative sample of the less than 3-inch (75 mm) diameter fraction from the excavated materials was placed in 5-gallon plastic buckets. The collected

Materials in the 5-gallon bucket were then passed through a #10 sieved (2 mm) and the fine-earth fraction placed in a graduated bucket. The retained gravels were placed in a second graduated bucket to estimate the volume of fine-earth to gravels fractions in the two buckets. Each bucket was weighed and converted to a volume based on the average particle density and field bulk density measurements (see next section). The calculated gravel volume was then be divided by the total volume of the sample (gravel + fine earth) to determine the volume of gravels. The volume of oversized rock greater than 3 inches was then added to the volume of gravel and a total rock volume for the sample was calculated and compared to the ocular estimate of total rock volume.

Following the sieving associated with the QC method, samples of the fine-earth fraction were placed directly in gallon-sized plastic bags. The sample identification and collection date were recorded on each bag, then placed in a cooler for shipping to the laboratory for testing. All excavations were backfilled and smoothed to match preexisting surface conditions.

2.1.2 Bulk Density

A sand-cone method was used to determine bulk density of the whole soil and fine-earth fraction per MMD's conditional approval of the SAP. Bulk density samples were collected on PCG reclamation covers that have well-established vegetation. A small level surface or platform was created for sand cone sampling in selected locations. Then, a shallow pit approximately 8 to 9 inches in diameter and 6-12 inches deep was dug by hand into the cover and all excavated material was placed into a 1-gallon plastic bag for laboratory analysis. The excavation was then backfilled to the pit rim with a measured volume of 10/20 filter sand to determine the volume of the excavation.

Bulk density samples were dried and sieved at WSP's laboratory in Albuquerque, New Mexico, to determine the relative proportion of the fine-earth and rock fractions, corresponding to the amount passing and retained on a #10 (2-mm) sieve respectively. The volume of the rock fraction (>2-mm) was calculated using the coarse fragment mass and particle density (assumed at 2.66 g/cm^3), and then subtracted from the total volume of the excavation to determine the volume occupied by the void and the fine-earth fraction. The mass of fine earth fraction was divided by this remaining volume to determine the fine-earth bulk density.

2.1.3 Grizzly Rock Screening

Per MMD's conditional approval of the SAP, Tyrone used a grizzly rock screen to process larger samples to determine the volume of oversized materials (>3-in) and verify that the ocular estimates of the rock fragment are accurate for oversized coarse fragments. Tyrone's grizzly has a sloped stationary screen with a nominal grid opening of 3 inches.

Two loads of PCG sourced from the 9A/9AX Overburden Stockpiles (one from each stockpile) were processed into <3-in and >3-in fractions. Following the screening, the fractions were segregated into separate piles and the dimensions of each pile were measured to determine their volume and calculate the proportion of oversized rock in the sample.

2.2 Laboratory Methods

2.2.1 Physical and Chemical Characterization

Samples for physiochemical testing were recorded on chain of custody forms and shipped to Energy Laboratory in Billings, Montana at ambient temperatures. The samples were air-dried at the laboratory prior to testing for the parameters listed in Table 1 to determine suitability relative to MMD's suitability guidelines (MMD 2022). The primary references for the analytical techniques include Agricultural Handbook No. 60 (Salinity Laboratory Staff [SLS] 1954), and Methods of Soil Analysis (ASA 1982, Klute 1986). Testing methods are included below in Table 1.

Table 1: Analytical Methods for Precambrian Granite Characterization

Analysis/Parameter	Source-Method
Physical and Chemical Testing	
Saturated Paste pH	SLS 1954, Method 2 and 21a
Electrical Conductivity, saturated paste	SLS 1954, Method 3a and 4b
Saturation Percentage	SLS 1954, Method 27a
Particle Size Analysis	ASA 1982, Method 15-5
Rock Fragment (>2mm)	Dry sieve (No. 10)/gravimetric
Organic Matter (Carbon)	ASA 1982, Method 29-3.5.2
N as Nitrate	ASA 1982, Method 33-8.1
Phosphorous (Olsen)	ASA 1982, Method 24-5.4
Potassium	ASA 1982, Method 13-3.5
Acid Base Accounts with sulfur forms*	Modified Sobek et al. (1978)
Cation Exchange Capacity	SLS 1954, Method 19
AB-DTPA extraction	ASA 1982, Method 3-5.2
Saturate Paste extraction	ASA 1982, Method 10-2.3.1
Extractable Metals (As, Cd, Cu, Fe, Pb, Mn, Mo, Ni, and Zn)	EPA Method 6010/6020
Soil Hydraulic Testing	
Hanging Column and Pressure Plate	Klute 1986
Water Potential (Dewpoint Potentiometer)	Rawlins and Campbell 1986
Relative Humidity (Box)	Campbell and Gee 1986
Moisture Retention Characteristics & Calculated Unsaturated Hydraulic Conductivity	van Genuchten 1980; van Genuchten et al. 1991
Saturated Hydraulic Conductivity	Klute and Dirksen 1986
Particle Density	Blake and Hartge 1986a
Dry Bulk Density	Blake and Hartge 1986b

Note: * for samples with pH<5

2.2.2 Soil Hydraulic Testing

2.2.2.1 Soil Water Characteristic Curves

Soil hydraulic testing was performed on selected PCG samples to develop soil water characteristic curves (SWCCs). The SWCCs were analyzed to determine the water holding capacity (WHC) to demonstrate that the constructed cover systems would meet the requirements in the New Mexico Copper Rule (20.6.7.33.F NMAC). Table 1 provides the references for the soil hydraulic analytical tests. The SWCCs were developed using retention data (laboratory water content-pressure [θ-Ψ] pairs) fit to the van Genuchten model using nonlinear least-squares parameter optimization (van Genuchten et al. 1991). The saturated water content (θ_s) was held at the lab measured value while residual water content (θ_r) and van Genuchten α and N parameters were calculated using a nonlinear least-squares parameter optimization procedure for each sample (van Genuchten 1980; van Genuchten et al. 1991).

The SWCC's were developed for the fine-earth fraction using the average field bulk density for the PCG samples (see Section 2.1.2). For the whole soil SWCC, the fine-earth θ-Ψ data were corrected using the field QC total rock volume. Specifically, the volumetric water content of the fine-earth fraction at various matric suction values was proportionally reduced in accordance with the volume of rock fragments contained in the whole soil (Bouwer and Rice 1984) as determine by the Rock Volume QC protocol described above.

2.2.2.2 Water Holding Capacity Estimation

The WHC was determined by subtracting the water held at the traditionally defined field capacity from the water held at wilting point (National Soil Survey Handbook [NSSH], Section 618.6.D.3). Because the PCG samples are consistently sandy loams and generally contain between 45 and 75% rock fragments, they were considered coarse textured and field capacity was determined at 100 cm suction. Field capacity was calculated as the water held at 100 centimeters (cm) of suction and wilting point as the water held at 15,000 cm of suction (USDA 2016) for coarse textured soils. The water content at field capacity and wilting point were determined numerically from the SWCC function developed for each sample. WSP's analyses also compared the approximate air entry value (AEV) for each sample to assigned field capacity set-point of 100 cm suction to justify that it is appropriate in relation to the site-specific SWCC and approximates field capacity for the PCG.

2.3 Recent Little Rock PCG Sampling

In addition to the samples collected under the SAP (WSP 2023a), Tyrone has also sampled stockpiled PCG that was recently mined at Little Rock to evaluate soil suitability during the construction of stockpiles and the Northern Haul Road crossing Deadman Canyon. The 21 additional samples were collected as part of New Mexico Environment Department (NMED) Discharge Plan 1236 requirements to obtain total sulfur and Acid-Base Accounting (ABA) data from blasthole cuttings to confirm stockpiled PCG does not have the potential to generate acidity. Tyrone's testing program includes collecting PCG samples during stockpile construction to demonstrate the material's suitability as a RCM. These recent samples were collected from the Northern Haul Road and the NRW and 9A Waste stockpiles and data are provided herein to further support the suitability of the PCG as a RCM.

3.0 RESULTS

Sampling of PCG overburden materials was conducted the 9A/9AX stockpiles, the USNR Test Plots and the USNR Reclamation at Tyrone and the West In-Pit Stockpile and Copper Leach Stockpile Reclamation at Little Rock. The sample locations for the PCG characterization are illustrated in Figure 1. Seven test pits were

evaluated at the 9A/9AX stockpiles. To capture the range of PCG associated with mining at Little Rock, grab samples were also collected from locations inaccessible by the excavator to represent different stockpile lifts or mining time intervals. As such, an additional six surface samples of PCG were collected from various benches within the 9A/9AX stockpiles. Five other PCG samples were collected from reclaimed cover materials at the Copper Leach Stockpile and the USNR site and one grab sample from the West In-Pit Stockpile. Photographs of the test pits and their excavated materials are included in Appendix A-1.

This section provides a summary of the field and laboratory characterization data of the PCG materials. Data includes field results from test pit logging, rock content QC results, and laboratory characterization data for soil physical, chemical, hydraulic properties.

3.1 Chemical and Physical Characterization

Results of PCG chemical characterization are summarized in Table 2 with laboratory reports provided in Appendix B. The PCG materials are considered non-saline with average electrical conductivity (EC) of 0.4 deciSiemens per meter (dS/m), ranging from 0.2 to 0.6 dS/m and pH values range from slightly acid (6.2) to moderately alkaline (7.9). Percent organic carbon and concentrations of nitrate and phosphorous are low but considered adequate to support native and adapted plant species. Notably, organic carbon is slightly higher in reclaimed PCG covers at the Copper Leach Stockpile and USNR site compared to other samples, indicating an increase in soil organic matter as the plant community develops. Cation exchange capacity averages 16.2 milliequivalents per 100 grams (meq/100 g) for the PCG samples which is higher than CECs for Aridisols, Inceptisols, and Entisols that occur in New Mexico (MMD 2022).

Metal extraction by ammonium bicarbonate-diethylenetriaminepentaacetic acid (AB-DTPA) found slightly elevated availability for extractable copper, and a few samples with elevated extractable cadmium and iron compared to guidance (Tiedemann and Lopez 1982, MMD 2022). These elevated metal concentrations data are consistent with previous observations of native soils and alluvium as well as suitable overburden borrow materials (DBS&A 1997, Golder 2005a, 2005b, and 2021a) and are expected given the mineralized nature of the cover materials. AB-DTPA extractable copper averaged 50.1 milligrams per kilogram (mg/kg) in PCG samples, which is well below potentially phytotoxic levels estimated between 275 and 375 mg/kg (Neuman et al. 1987, Paschke and Redente 2002, WSP 2024). It is also important to note that extraction using the chelating AB-DTPA is aggressive in comparison to a saturated paste extraction because the method was originally developed as a deficiency test to determine the concentration of essential trace elements for crop production. As such, AB-DTPA extractions generally yield higher concentrations of elements than a comparable saturated paste water extraction, the latter being more representative of the soil solution.

Particle size distribution results from the laboratory and field rock volume measurements are presented in Table 3. All PCG samples are classified as sandy loams. Saturation percents generally occur within a narrow range (23 to 30 percent with one sample at 40 percent), indicating uniform clay minerology. Ocular estimates of total rock volume for 22 samples of PCG overburden ranged 47 to 76 percent compared to field measured rock volume using the QC method ranging from 41 percent to 73 percent (Table 3). The average total rock content of the 9A/9AX PCG samples was 62.6 percent while the PCG cover soils at reclaimed sites averaged 48 percent rock. Average field QC measured total rock volume for all samples was 57.8 percent. The reduction in rock content between stockpiled PCG and PCG cover soils demonstrates the effectiveness of Tyrone's MCHP during the cover construction at the USNR and Copper Leach Stockpile to achieve an optimal fine earth to rock ratio.

Figure 2 compares the visual estimates of total rock volume to the QC field measurement. Overall, ocular estimates corresponded well with the QC measurements with an absolute average difference of 4.9 percent, within the ± 5 percent threshold. Figure 2 indicates that eight ocular rock estimates were higher than their corresponding field QC measurement by 5% while the rock volume was underestimated in only one sample by the same margin. The QC data demonstrates that ocular estimates by trained personnel can accurately predict the rock volume of PCG materials.

Fine-earth bulk density of in-situ reclaimed PCG cover materials was measure at five locations (Figure 1). Table 4 provides the volume and mass components used to calculate the density of these samples. On a dry weight basis, bulk densities ranged from 1.08 to 1.91 grams per cubic centimeter (g/cm^3) and the average for in-situ PCG cover soils was 1.44 g/cm^3. This value for fine-earth bulk density is comparable to native sandy loam soils and was used to calculate total rock volume and was the initial density used for the soil hydraulic testing.

Table 2: Chemical Properties of Precambrian Granite Materials

Facility / Test Pit ID	Depth (in)	Saturated Paste		Organic Carbon	Cation Exchange Capacity	P	NO_3 as N	K	AB-DTPA Extractable Metals								
		pH	Elec Cond						As	Cd	Cu	Fe	Pb	Mn	Mo	Ni	Zn
		s.u.	dS/m	%	meq/100g	mg/kg											
9AX Stockpile																	
9AX-TP1	0-90	7.7	0.6	<0.1	12	1	<1	40	0.03	<0.1	36.3	3	0.5	0.8	0.1	<0.1	3
9AX-TP2	0-72	7.7	0.4	0.1	10.6	<1	<1	34	0.03	<0.1	39.8	3	2.2	0.9	0.1	<0.1	2.3
9AX-GB1	0-18	7.9	0.3	0.1	35.8	<1	<1	131	0.03	0.3	6.6	3	0.2	0.4	<0.1	<0.1	5.3
9AX-GB2	0-18	7.8	0.4	0.1	15.2	1	2	88	0.04	<0.1	61.7	3	1.6	1.1	<0.1	<0.1	3.7
9A Stockpile																	
9A-GB1	0-18	7.4	0.4	0.2	15	2	1	73	<0.02	0.1	82.8	4	0.5	1.7	<0.1	<0.1	3.8
9A-GB2	0-18	6.2	0.3	0.2	19.8	2	2	41	<0.02	<0.1	27.6	4	0.2	4.2	0.1	<0.1	3.7
9A-GB3	0-18	7.6	0.5	0.1	14.7	1	<1	88	0.02	<0.1	26.7	4	0.8	1.1	0.2	<0.1	3.4
9A-GB4	0-18	7.8	0.3	0.1	17.1	1	<1	64	0.03	<0.1	42.7	4	1	0.6	0.2	<0.1	3.1
9A-TP1	0-90	7.9	0.5	0.1	15.4	1	<1	48	<0.02	<0.1	44.8	2	0.3	0.6	<0.1	<0.1	1.6
9A-TP2	0-54	7.8	0.3	<0.1	10.5	<1	<1	49	0.03	<0.1	63.6	4	0.6	0.8	<0.1	<0.1	2.1
9A-TP2	54-108	7.4	0.3	0.1	15.2	<1	<1	50	0.02	0.2	41.7	4	1.2	0.7	0.3	<0.1	3.8
9A-TP3	0-84	7.6	0.3	0.1	7.6	<1	<1	41	0.04	0.2	43.2	5	0.9	1.1	0.2	<0.1	4.8
9A-TP4	0-96	7.7	0.4	<0.1	18.6	<1	<1	72	0.03	0.2	26.3	4	1.4	1	0.2	<0.1	4.1
9A-TP5	0-96	7.8	0.4	<0.1	17.4	<1	<1	74	0.03	0.1	42.6	4	1.2	0.8	0.2	<0.1	3.1
Copper Leach Stockpile Reclamation																	
CuL-GB1	0-18	6.8	0.2	0.3	17.1	2	<1	78	0.03	<0.1	167	5	1.1	3.7	0.1	<0.1	2
CuL-GB2	0-18	6.5	0.3	0.5	17.8	3	2	86	0.02	<0.1	172	7	1.2	3	0.1	<0.1	2.4
USNR Test Plots																	
USNR-GB1	0-18	7.6	0.3	0.2	11.8	<1	<1	80	0.03	<0.1	11.8	3	0.4	0.6	<0.1	<0.1	4.2
USNR-GB2	0-18	7.6	0.4	0.2	17.2	<1	<1	62	0.03	0.1	18.6	5	0.5	1.3	<0.1	<0.1	3
USNR-GB3	0-18	7.6	0.3	0.2	15.3	<1	<1	68	0.03	<0.1	30.4	4	0.5	1.6	<0.1	<0.1	1.8
West In-Pit Stockpile																	
WIP-GB1	0-18	7.8	0.3	0.2	19.3	<1	<1	49	<0.02	<0.1	15.1	3	0.1	0.7	<0.1	<0.1	1

Notes: dS/m = deciSeimens per meter, meq/100 g = milliequivalents per 100 grams, mg/kg = milligrams per kilogram

Table 3: Laboratory and Field Physical Properties of Precambrian Granite Materials

Facility / Test Pit ID	Depth	Laboratory					Ocular Estimates						QC Rock
		Sand	Silt	Clay	Texture	Sat %	GR	CO	ST	BO	Total	Largest	
	in	% wt					% vol					in.	% vol
9AX Stockpile													
9AX-TP1	0-90	57	30	13	SL	28.8	53	10	2	0	65	20	71.7
9AX-TP2	0-72	65	23	12	SL	23.8	55	17	4	0	76	21	70.7
9AX-GB1	0-18	72	18	10	SL	40.4	45	15	1	0	61	20	64.5
9AX-GB2	0-18	77	16	7	SL	25	50	12	<1	0	62	--	54.5
9AX-S	--	--	--	--	--	--	56	9	6	2	73	40	61.0
9A Stockpile													
9A-GB1	0-18	70	19	11	SL	25.5	50	9	2	0	61	24	53.9
9A-GB2	0-18	71	20	9	SL	24.6	47	7	3	0	57	--	50.3
9A-GB3	0-18	71	18	11	SL	26.3	48	7	<1	0	55	14	52.4
9A-GB4	0-18	72	19	9	SL	27.9	50	10	2	<1	62	--	63.5
9A-TP1	0-90	74	16	10	SL	28.8	45	15	5	0	65	23	61.1
9A-TP2	0-54	76	16	8	SL	24.8	49	13	1	0	63	23	66.2
9A-TP2	54-108	74	17	9	SL	24.1	55	11	<1	0	66	18	71.2
9A-TP3	0-84	76	17	7	SL	22.6	63	6	<1	0	69	12	72.8
9A-TP4	0-96	70	21	9	SL	29.4	50	7	0	0	57	--	61.4
9A-TP5	0-96	68	21	11	SL	26.9	53	13	1	0	67	--	66.7
9A-S	--	--	--	--	--	--	48	9	2	1	60	32	62.6
Copper Leach Stockpile Reclamation													
CuL-GB1	0-18	66	21	13	SL	27.8	40	12	1	0	53	23	48.8
CuL-GB2	0-18	66	23	11	SL	28.1	47	7	--	0	54	14	48.9
USNR Test Plots													
USNR-GB1	0-18	70	19	11	SL	27.9	50	6	1	0	57	21	54.2
USNR-GB2	0-18	70	20	10	SL	27.6	42	4	1	0	47	6	40.9
USNR-GB3	0-18	69	20	11	SL	29.8	48	5	<1	0	53	8	49.1
West In-Pit Stockpile													
WIP-GB1	0-18	76	15	9	SL	28.3	50	8	2	<1	60	36	52.0

Note: % wt = percent weight; % vol = percent volume
SL = sandy loam, GR = gravel (2 mm-3"), CO = cobble (3-10"), ST = stone (10-24"), BO = boulder (>24")

Table 4: Density Measurements for In-Situ Precambrian Granite Soil Covers

Test Plot / Test Pit ID	Field Parameters			Dry Weight Basis					
	Volume	Total Mass	Moisture	Coarse Fragments		Fine Earth			Whole Soil
				Mass	Volume*	Mass	Volume	Bulk Density	Bulk Density
	cm^3	g	%	g	cm^3	g	cm^3	g/cm^3	
Copper Leach Stockpile Reclamation									
CuL-BD1	1500	3415	2	1735	667.3	1588	832.7	1.91	2.22
CuL-BD2	2564	5145	1	3534	1347.7	1523	1216.3	1.25	1.97
USNR Test Plots									
USNR-BD1	2108	5819	5	2535	1003.8	1534	1104.2	1.39	1.93
USNR-BD2	2418	5035	8	3567	1462.4	1036	955.6	1.08	1.90
USNR-BD3	2340	5135	2	3411	1312.0	1593	1028.0	1.55	2.14

Notes: cm^3 = cubic centimeters; g = gram; * assumes specific gravity of 2.66 g/cm^3 for coarse fragments

3.2 Soil Water Characteristic Curves

The Copper Rule defines performance requirements for the cover materials under NMAC 20.6.7.33.F.2:

> Soil cover systems shall be designed to limit net-percolation by having the capacity to store within the fine fraction at least 95 percent of the long-term average winter (December, January, and February) precipitation or at least 35% of the long-term average summer (June, July, and August) precipitation, whichever is greater. The water holding capacity of the cover system will be determined by multiplying the thickness of the cover times the incremental water holding capacity of the approved cover materials. Appropriate field or laboratory test results or published estimates of available water capacity shall be provided by the permittee to show that the proposed cover material meets this performance standard.

Based on the Fort Bayard weather record for the period from 1897 to 2010, the average winter precipitation is 2.78 inches and the average summer precipitation is 7.44 inches (WRCC 2016). Thus, the WHC requirements for a 3-foot-thick cover based on the long-term winter (2.78 inches X 0.95 = 2.64 inches or 0.88 inches per foot [in/ft]) and summer precipitation (7.44 inches X 0.35 = 2.60 inches or 0.87 in/ft) are essentially equivalent. To evaluate PCG overburden for compliance with the Copper Rule, the threshold WHC was set at 0.88 in/ft.

Soil hydraulic testing was performed on ten selected PCG samples to represent a range of physical characteristics (total rock volume and soil texture) in the development of material-specific SWCCs. The SWCCs were analyzed to determine the water holding capacity (WHC) to demonstrate that the constructed cover systems would meet the requirements in the New Mexico Copper Rule (20.6.7.33.F NMAC). The laboratory report associated with the hydraulic property testing program is provided in Appendix C.

The saturated water content (θ_s) of the <2-mm soil fraction for the PCG materials ranged between 45 and 49 percent (Table 5). Minor variations in fine earth θ_s are expected given the textural consistency of the PCG materials (Section 3.1). Whole soil θ_s ranged from 13 to 24 percent reflecting the variability of rock volumes ranging from 48.7 to 70.7 percent (Table 5). The saturated hydraulic conductivity (K_{sat}) of the <2-mm PCG samples ranged from 2.7 x 10^{-3} to 1.1 x 10^{-2} cm/s (Table 5), which comports with the range of published values for sandy loams (Klute and Dirksen 1986). Whole soil K_{sat} for ranged for from 7.1 x 10^{-4} to 1.1 x 10^{-2} cm/sec (Table 5). Other soil hydraulic parameters (residual water content [θ_r] and van Genuchten's α and N) in Table 5 compare well with standardized relationships among soil particle size and hydraulic properties of similarly textured soils (Rawls et al. 1982, Carsel and Parrish 1988).

The SWCC for each cover sample was developed using retention data (laboratory water content-pressure [θ-Ψ] pairs) fitted to the van Genuchten model using nonlinear least-squares parameter optimization (van Genuchten 1980, van Genuchten et al. 1991). The SWCCs were developed for the fine-earth fraction and for the whole soils after correction of the fine-earth fraction data for rock fragments. Specifically, the volumetric water content of the fine-earth fraction at each matric suction values was proportionally reduced relative to the volume of rock fragments in the whole soil (Bouwer and Rice 1984, Soil Survey Division Staff 2017, USDA NRCS 2019). This approach assumes the rock fragments do not hold appreciable water and are diluents in the whole soil matrix. For the fine-earth SWCC, θ_s was held at the lab measured value while residual water content (θ_r) and van Genuchten α and N parameters were calculated for each sample. The whole soil SWCCs held the α and N constant and each θ-Ψ pair was reduced proportionally based on the sample's field QC rock content. The fine-earth and whole soil SWCC for the 10 PCG samples used to determine WHC are graphical shown in Appendix C.

The WHC was determined by subtracting the water held at the traditionally defined field capacity from water held at wilting point (National Soil Survey Handbook [NSSH], Section 618.6.D.3). Because the PCG samples are all

sandy loams, they were considered coarse-textured and field capacity was determined at 100 centimeters (cm) of suction and wilting point was estimated as the water held at 15,000 cm of suction (USDA 2016). The water content at field capacity and wilting point were determined numerically (rather than graphically) from the SWCC function developed for each sample.

Figure 3 illustrates the rock-corrected SWCCs for the ten moderately coarse-textured PCG cover materials that was used to evaluate the appropriateness of the 100-cm field capacity set-point. For all PCG SWCCs, the 100-cm field capacity suction set-point is higher than their respective air-entry value (AEV, or the matric suction when air starts to enter the largest soil pores as it desaturates towards field capacity). The 100-cm suction point falls along the slope of the unsaturated transition zone between air-entry (the point where the SWCC bends sharply) and residual suctions. WSP believes the selected field capacity set point is justified for the PCG and is supported by the site-specific data.

Table 5 provides a summary of calculated fine earth and whole soil WHC for the PCG materials. Whole soil WHC is calculated by reducing the fine earth WHC in proportion to the rock fragment volumes based on the generalized relationship:

$$WHC_{ws} = WHC_{fe} \times (1 - RF_v)$$

where WHC_{ws} is whole soil WHC, WHC_{fe} is fine earth WHC and RF_v is the volume of rock fragments.

As discussed above, the target WHC_{ws} required by the Copper Rule for the PCG cover systems is 0.88 in/ft. For all ten samples, the average WHC_{ws} is 0.91 in/ft with six of the ten PCG samples exceeding the target WHC_{ws}. Figure 4 illustrates the WHC-rock fragment linear relationships developed for the PCG samples. Based on the material-specific linear relationship shown in Figure 4, a maximum rock volume that achieves the Copper Rule WHC requirement is 58.2 percent. Considering the rock contents measured in the PCG samples tested, 9A/9AX overburden samples would require a six percent rock volume reduction to achieve the WHC requirement while the PCG used in the Copper Leach Stockpile and USNR reclamation achieve the Copper Rule WHC rock content threshold. As mentioned in the previously section, Tyrone's MCHP has been effective in selecting PCG material with lower rock content to meet this requirement whether within stockpiles or at the pit face and also reducing overall rock content during the construction of cover soils.

3.3 Grizzly Rock Screening

Tyrone used an existing grizzly rock screen stationed at the 5A Stockpile to segregate rock for two PCG samples to determine the volume of oversized materials (>3-in). The use of the grizzly was a condition of MMD's approval of the SAP to verify that the ocular estimates of the rock fragment were accurate. Below is a summary of WSP's observation of the screening process. Appendix A-2 includes photos of this grizzly screening process and the PCG materials prior to and post screening.

Two loads of PCG were sourced from the 9A/9AX Overburden Stockpiles (one from each stockpile) for screening. Bulk samples (each approximately 12 cubic yards [CY]) were loaded into a rock truck and dumped near the grizzly. Prior to screening, WSP examined each bulk sample (9A-S and 9AX-S) to visually estimate rock volume. Given the large volume of the PCG materials, a 10-gallon sample was collected from each pile to evaluate the rock volume using the field testing method described in Section 2.1.1.

Table 5: Soil Hydraulic Properties and Water Holding Capacity of Precambrian Granite

Sample ID	Fine Earth Fraction (<2mm)						Whole Soil				
	K_{sat}	α	N	θ_r	θ_s	WHC	Rock	K_{sat}*	θ_r	θ_s	WHC
	(cm/sec)	1/cm	dimensionless	% vol		(in/ft)	% vol	(cm/sec)	% vol		(in/ft)
9A-TP1	1.3E-02	0.0461	1.3646	4.69	46.08	2.11	61.1	3.74E-03	1.82	17.91	0.82
9A-TP4	2.3E-02	0.0797	1.3577	4.78	47.32	2.04	61.4	6.74E-03	1.84	18.25	0.79
9A-GB2	9.7E-03	0.0502	1.4356	3.44	46.08	2.37	50.3	3.84E-03	1.71	22.89	1.18
9A-GB3	3.0E-02	0.0611	1.4214	3.46	44.55	1.92	52.4	1.12E-02	1.65	21.18	0.91
9AX-TP2	5.8E-03	0.1117	1.2929	1.03	46.04	2.02	70.7	1.26E-03	0.30	13.49	0.59
9AX-GB1	2.7E-03	0.0265	1.3383	7.73	49.38	2.72	64.5	7.13E-04	2.75	17.55	0.97
CuL-GB1	1.1E-02	0.0491	1.4126	4.40	47.01	2.24	48.8	4.69E-03	2.25	24.05	1.15
USNR-GB1	2.4E-02	0.0801	1.4046	4.14	46.46	1.87	54.2	8.68E-03	1.90	21.29	0.84
USNR-GB3	2.1E-02	0.0827	1.3998	3.86	45.50	1.83	49.1	8.55E-03	1.96	23.16	0.93
WIP-GB1	1.6E-02	0.0413	1.5957	6.22	47.13	1.93	52.0	6.21E-03	2.99	22.63	0.92

Notes: cm/sec = centimeters per second, 1/cm = per centimeter, % vol = percent by volume, in/ft = inches per foot

Tyrone's grizzly has a sloped stationary screen set at about 45 degrees with a nominal grid opening of 3 inches. The equipment is well used, and a portion of the screen has openings greater than 3 inches. A front-end loader was used to dump PCG material through the grizzly screen and segregate oversize materials. Two loader buckets of each bulk sample were processed through the grizzly.

Despite careful material loading, blockages were common when the oversized rock failed to roll off the grizzly. Blockages resulted in a portion of <3-in rock sliding off the screen into the oversized pile or remained on the screen despite gently shaking the grizzly with the loader bucket. Based on WSP's experience, the screened product did not have a sufficient amount of larger cobbles and smaller stones to provide long-term erosional stability of the cover system.

Following the screening operation, the screened and oversized rock were placed into separate piles. Note that the loader was unable to completely retrieve a portion of the <3-in material under the grizzly. To determine the volume of oversized rock to be included in the QC computation, the shape and dimensions of each pile were measured to determine their relative volumes and then calculate the proportion of oversized rock for each bulk PCG sample. For the volume of the clast-supported >3-in pile, it was assumed that 33 percent of the volume was voids. Table 6 provides the volume calculations for the grizzly fractions in comparison to ocular estimate for each bulk sample. The average absolute difference for the oversized fraction for the screened samples compared to the ocular estimate is 4 percent within the ± 5 percent threshold. This result further supports the use of ocular estimates by trained QC personnel to accurately determine the total rock volume in PCG materials.

Table 6: Grizzly Screening Compared to Field Estimates of the Oversized Rock Fraction (>3-in)

Sample ID/ Screened Fraction	Approx. Shape of Pile	Dimensions (in)		Calculated Volume (CY)			% volume		
		Base	Height	Pile	Waste*	Total	Grizzly	Ocular Estimate	Absolute Difference
9A-S									
<3-in	Cone	71.5-radius	28	4.82	0.67	5.49	90.4		
>3-in	Triangular Prism	54-wide 108-long	14	0.88	NA	0.59**	9.6	12	2.4
9AX-S									
<3-in	Cone	75-radius	36	6.82	1.5	8.32	77.3		
>3-in	Cone	60-radius	30	3.64	NA	2.44**	22.7	17	5.7

Notes: CY = cubic yard; * = approximate volume that could not be retrieved under screen; ** = assumes 33% voids in >3-in fraction (clast supported)

3.4 Little Rock PCG Samples

Little Rock PCG overburden materials were sampled in September 2023 and March 2024 by WSP. Twenty-one samples were collected from berms and test pits at the NRW and 9A Waste stockpiles, and Northern haul road (Figure 6). Appendix B provides the laboratory reports from Energy Laboratories. Chemically the Little Rock PCR samples are essentially identical to the PCG samples discussed above with respect to EC, organic matter, trace metals, and macronutrients with slightly more alkaline pH values (Table 7). Results of the physical testing of indicate the Little Rock PCG RCM samples are uniformly sandy loams (Table 8) with average volumetric rock content of 61 percent (range 51 to 71 percent) based on field gravimetric testing. Rock classes ranged from gravel to stones with occasional boulders.

Table 7: Chemical Properties of Little Rock Precambrian Granite Materials

Facility / Sample ID	Depth (in)	Saturated Paste		Organic Matter	Cation Exchange Capacity	P	NO_3 as N	K	AB-DTPA Extractable Metals								
		pH	Elec Cond						As	Cd	Cu	Fe	Pb	Mn	Mo	Ni	Zn
		s.u.	dS/m	%	meq/100g	mg/kg											
9A Stockpile																	
9A-1	0-18	8.0	0.4	<0.2	11.9	1	<1	75	0.04	0.1	66.8	7	0.6	3.5	0.3	<0.1	6.7
9A-2	0-18	7.7	0.4	<0.2	12.2	1	1	63	0.03	<0.1	63.9	7	0.5	4.0	0.2	<0.1	3.2
9A-3	0-18	7.5	0.3	<0.2	15.0	<1	1	58	0.02	<0.1	50.9	5	0.3	2.5	0.2	<0.1	2.4
Northern Haul Road																	
HR-1	0-18	7.8	0.6	<0.2	17.1	2	3	64	0.03	0.1	54.8	5	1.5	4.3	0.2	<0.1	4.6
HR-2	0-18	7.6	0.4	0.3	13.7	1	3	83	0.03	0.2	87.4	7	5.8	2.5	0.1	<0.1	8.4
HR-3	0-18	7.8	0.3	<0.2	11.1	<1	2	80	0.02	<0.1	22.8	3	0.2	2.4	0.3	<0.1	2.3
NRW Waste Stockpile																	
NRW-1	0-18	8.1	0.2	<0.2	8.8	<1	1	65	0.06	0.1	55.2	4	13.1	9.3	0.1	<0.1	12.9
NRW-2	0-18	8.0	0.3	<0.2	6.4	<1	2	64	0.14	<0.1	74.2	5	26.8	4.8	0.2	<0.1	11
NRW-3	0-18	8.0	0.2	<0.2	10.8	<1	2	62	0.03	<0.1	61.2	3	4.9	7.1	<0.1	<0.1	8.8
NRW-4	0-18	7.4	0.1	<0.2	17.4	<1	<1	72	0.02	<0.1	71.4	3	2.7	15.4	0.2	<0.1	3.8
NRW-0324-01	0-108	8.1	0.4	<0.2	12.2	<1	4	73	0.05	<0.1	29	4	0.5	1.9	0.3	<0.1	6.7
NRW-0324-02	0-108	8.1	0.3	<0.2	11.6	<1	4	85	0.05	0.1	11.6	4	1	2	0.2	<0.1	3.2
NRW-0324-03	0-108	8.1	0.3	<0.2	10.8	<1	1	67	0.04	<0.1	28.4	5	0.4	2.7	0.2	<0.1	2.4
NRW-0324-04	0-108	8.1	0.2	<0.2	13.7	<1	2	73	0.06	0.3	12.5	3	2.2	1.3	0.2	<0.1	4.6
NRW-0324-05	0-108	8.1	0.3	<0.2	9.8	<1	3	63	0.04	0.2	28.7	6	0.7	3.3	0.1	<0.1	8.4
NRW-0324-06	0-108	8.1	0.4	<0.2	7.7	<1	3	52	0.06	<0.1	146	6	0.5	3.1	0.3	<0.1	2.3
NRW-0324-07	0-108	8.2	0.2	<0.2	8.0	<1	<1	56	0.06	<0.1	113	5	0.5	3.1	0.1	<0.1	12.9
NRW-0324-08	0-108	8.1	0.3	<0.2	7.9	<1	1	60	0.06	<0.1	113	6	0.5	3.5	0.2	<0.1	11
NRW-0324-09	0-108	7.8	0.5	<0.2	8.7	<1	<1	68	0.14	0.2	63.3	4	21.1	5.6	<0.1	<0.1	8.8
NRW-0324-10	0-108	7.9	0.2	<0.2	8.7	<1	<1	67	0.06	0.1	49.3	4	14.4	4.9	0.2	<0.1	3.8
NRW-0324-WR	0-18	8.0	0.4	<0.2	17.7	<1	10	53	0.04	<0.1	121	3	0.4	1.8	0.3	<0.1	6.7

Notes: dS/m = deciSeimens per meter, meq/100 g = milliequivalents per 100 grams, mg/kg = milligrams per kilogram

Table 8: Laboratory and Field Physical Properties of Little Rock Precambrian Granite Materials

Facility/ Sample ID	Depth	Laboratory					Field Rock Estimates		
		Sand	Silt	Clay	USDA Texture	Sat %	Calc Rock	Ocular	Difference
	in	% wt					% vol		
9A Stockpile									
9A-1	0-18	70	18	12	SL	30.2	60.5	60	0.5
9A-2	0-18	70	16	14	SL	32.1	56.3	60	3.7
9A-3	0-18	72	16	12	SL	30.4	53	59	6
Northern Haul Road									
HR-1	0-18	66	18	16	SL	36.6	52.6	55	2.4
HR-2	0-18	68	16	16	SL	35.3	51.0	48	3.8
HR-3	0-18	74	14	12	SL	32.1	56.8	52	4.8
NRW Waste Stockpile									
NRW-1	0-18	74	16	10	SL	29.6	64.2	65	0.8
NRW-2	0-18	76	16	8	SL	27.9	63.8	65	1.2
NRW-3	0-18	78	12	10	SL	28.4	66.6	65	1.6
NRW-4	0-18	68	18	14	SL	38.9	55.4	60	4.6
NRW-0324-01	0-108	74	14	12	SL	33		--	
NRW-0324-02	0-108	72	14	14	SL	37.5	67	68	1
NRW-0324-03	0-108	74	14	12	SL	31.2		--	
NRW-0324-04	0-108	76	12	12	SL	37.4	62	60	2
NRW-0324-05	0-108	78	12	10	SL	31.2		--	
NRW-0324-06	0-108	80	10	10	SL	30.4	64	64	0
NRW-0324-07	0-108	78	12	10	SL	28.8		--	
NRW-0324-08	0-108	78	14	8	SL	30.1	71	68	3
NRW-0324-09	0-108	76	12	12	SL	31.4		--	
NRW-0324-10	0-108	76	14	10	SL	31.7	71	63	8
NRW-0324-WR	0-18	70	14	16	SL	43		--	

Note: % wt = percent weight; % vol = percent volume
SL = sandy loam

4.0 SUMMARY

This study further demonstrates the suitability of PCG overburden materials at Tyrone and Little Rock as a reclamation cover material (RCM) and aligns with the results of four previous characterization studies (Golder 2005a and b, 2017a, 2020). Laboratory analyses indicate that the PCG overburden from the Little Rock Mine is relatively uniform and has no inherent chemical or physical limitations for the growth of native and adapted reclamation plant species. Chemical characteristics of the PCG samples indicate they are suitable with respect to pH, salinity, nutrient levels, CEC, and extracted metal concentrations.

The PCG overburden is uniformly a moderately coarse-textured sandy loam and generally contains a moderate volume of rock fragments. Native soils with PCG as a parent material surrounding the Little Rock exhibit similar physical characteristics (PDTI 1999). Based on the material-specific linear relationship between rock content and WHC (Figure 4), a maximum rock volume of 58.2 percent achieves the Copper Rule WHC requirement (0.88 in/ft) for the PCG RMC.

With respect to volumetric rock content, the average total rock content of the 9A/9AX PCG samples was 62.6 percent and 61 percent for recent Little Rock samples while the PCG cover soils at reclaimed sites averaged 48 percent. The differences in rock content found in this study between stockpile PCG and PCG cover soils demonstrates the effectiveness of Tyrone's MCHP using mine equipment to select and manage PCG borrow to achieve a lower rock content in constructed cover systems. Additionally, FMI has constructed several cover systems with suitable overburden at Miami, Morenci, Chino, Tyrone and Little Rock. Figure 5 illustrates established vegetation on these overburden covers in Arizona and New Mexico and well as volunteer vegetation observed on the 9A Stockpile.

The study also demonstrates the use of ocular estimates by trained QC personnel can accurately determine the total rock volume in PCG materials within the ± 5 percent threshold. The absolute average difference between the ocular estimates and the QC measurements was 4.9 percent for the 22 samples including those processed with the grizzly. Observations of the grizzly screening process strongly suggests the use of screening for full scale reclamation is both inefficient and ineffective. Moreover, based on WSP's experience, the screened materials do not have a sufficient volume of larger cobbles and smaller stones to provide long-term erosional stability of the cover system.

Tyrone's MCHP cover segregation methods as a normal course large scale reclamation, providing operational procedures that have been found effective in constructing cover systems with PCG overburden materials that meet the rock fragment specification. Quality control measures in the MCHP include:

1. QC personnel visually monitoring the source material (at the shovel and/or the stockpiles) to determine whether the cover materials meet the specification and reject materials that are too coarse or have coarse materials blended with materials having a higher proportion of fines;
2. Managing materials during cover placement further reduce the overall volume of rock fragments through gravity segregation and blending; and
3. Visual inspections during the cover placement and after regrading are used to identify areas with excessive rock or surface conditions with limited fines. Areas where high concentrations of rock fragments are delineated and surveyed. The corrective action for these rocky surfaces is to amend them with finer-grained materials (i.e., having fewer rock fragments). This blending procedure was successful at increasing the fines in the seedbed in skeletal covers on the USNR test plots in 2015 (Golder 2017a).

Finally, quantitative vegetation studies further demonstrate that PCG overburden covers can support diverse and productive reclaimed plant communities that are resilient and capable of sustaining themselves under the adverse conditions typical of a semi-arid environment (Romig et al. 2023). The vegetation studies for PCG covers include those performed at the USNR (Golder 2019, 2021b, 2023b) and the Copper Leach Stockpile (Golder 2017b and 2022, WSP 2023c).

The cover requirement for the Mine/Stockpile Unit at Tyrone is approximately 13.3 million cubic yards (MCY) based on the current permit requirements. More than 32 MCY of PCG cover materials have been conservatively identified in the 9A/9AX Overburden Stockpiles (Golder 2020) with additional materials in the NRW Waste Stockpile and Northern Haul Road. The surplus of available PCG RCM will ultimately allow for flexibility in siting borrow stockpiles at Tyrone to account for closure planning, operations, and logistics.

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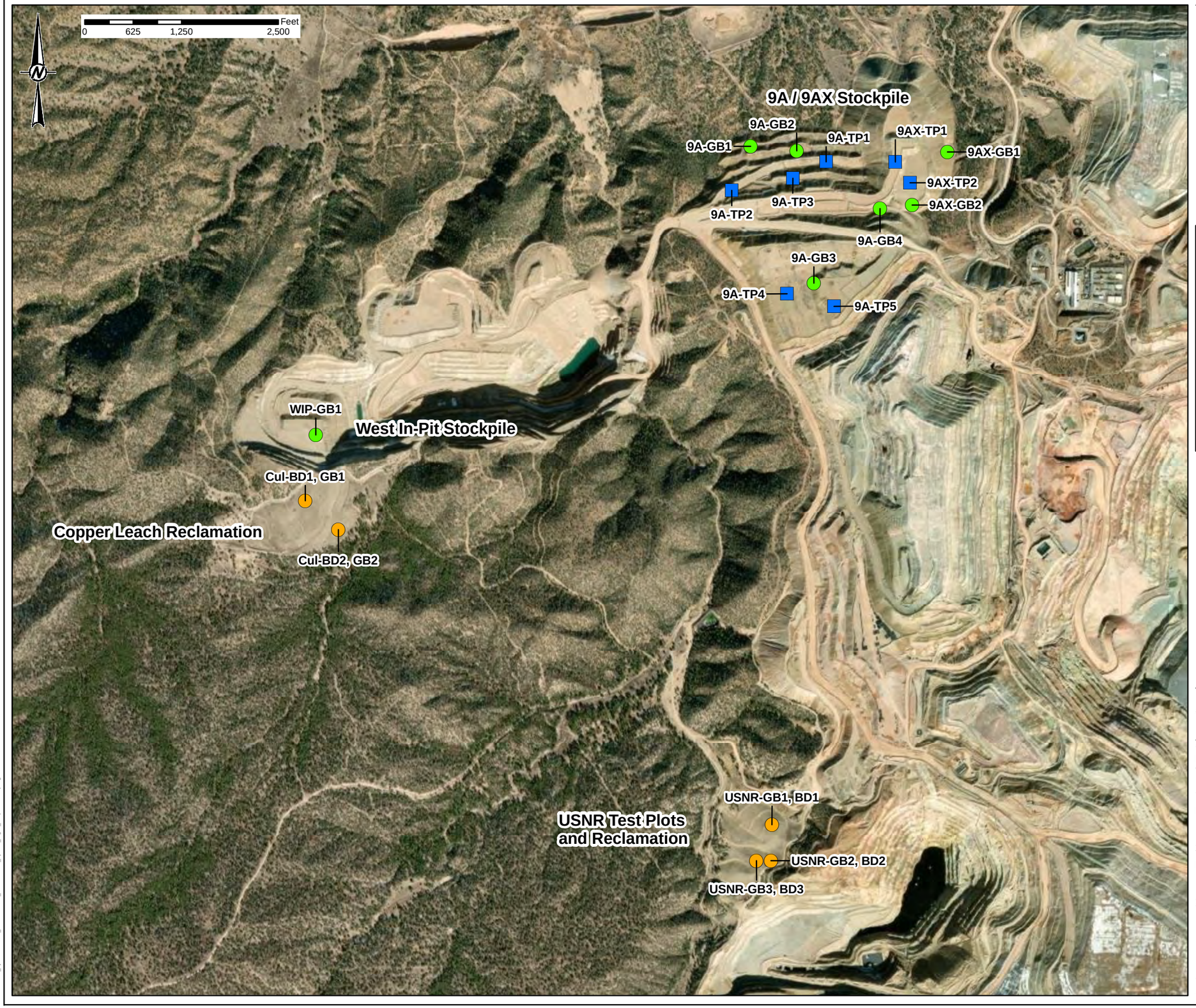
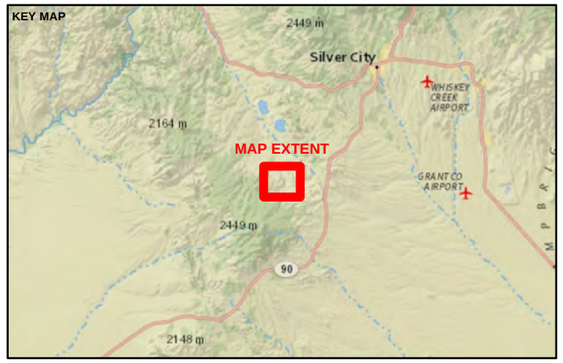
Figures



LEGEND

- GRAB SAMPLE
- TEST PIT
- GRAB SAMPLE / FIELD BULK DENSITY TEST

KEY MAP



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1. AERIAL IMAGERY: ESRI PROVIDED BASEMAP SERVICE. VIVID. MAXAR. IMAGERY CAPTURED 4/24/2022.

CLIENT

FREEPORT-MCMORAN TYRONE OPERATIONS
TYRONE, NEW MEXICO

PROJECT

PRECAMBRIAN GRANITE SUITABILITY DEMONSTRATION

TITLE

PRECAMBRIAN GRANITE SAMPLE LOCATIONS

CONSULTANT

wsp

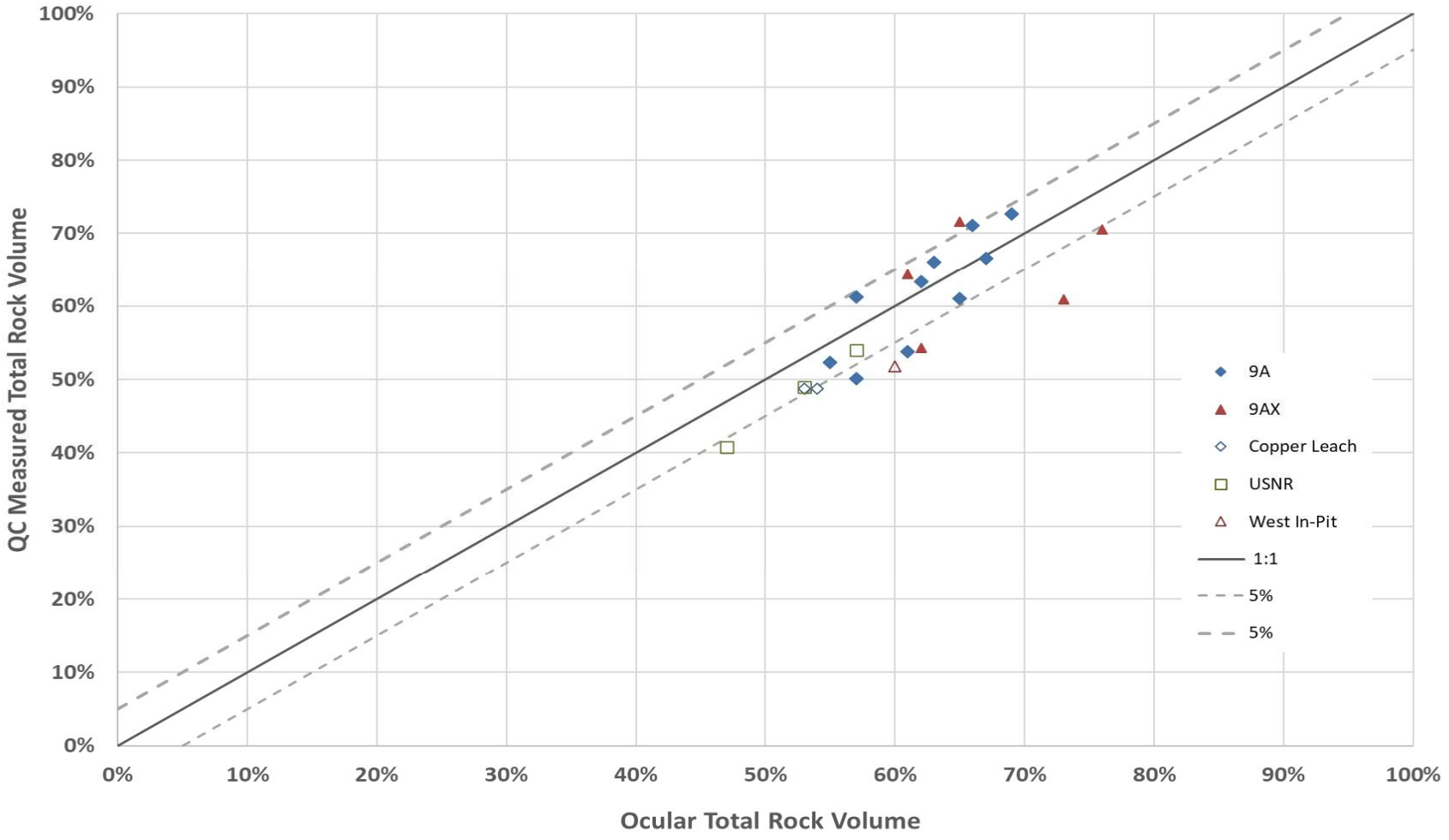
YYYY-MM-DD	2024-11-16
DESIGNED	NB
PREPARED	RHG
REVIEWED	DR
APPROVED	DR

PROJECT NO.

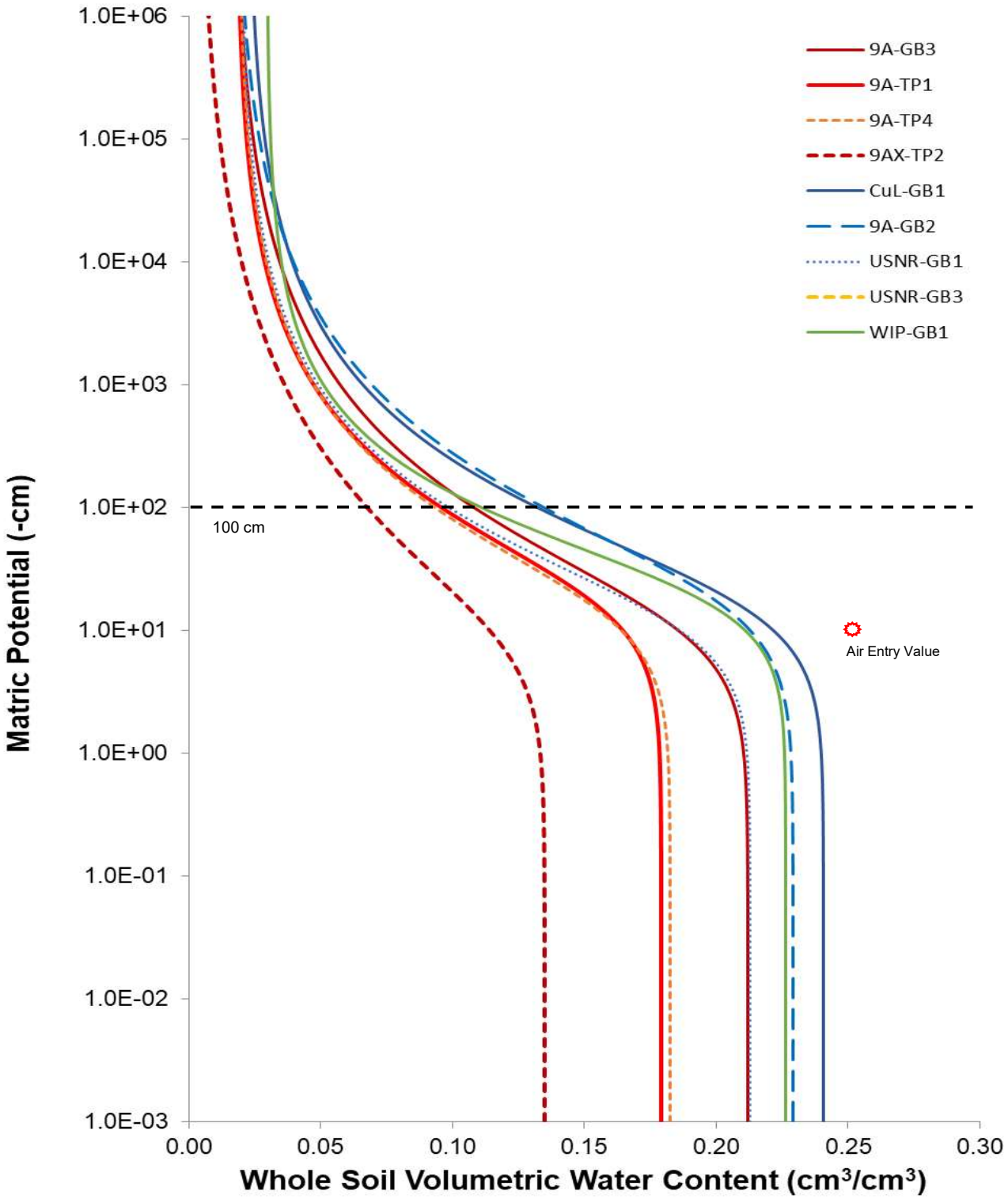
31406439.001

FIGURE

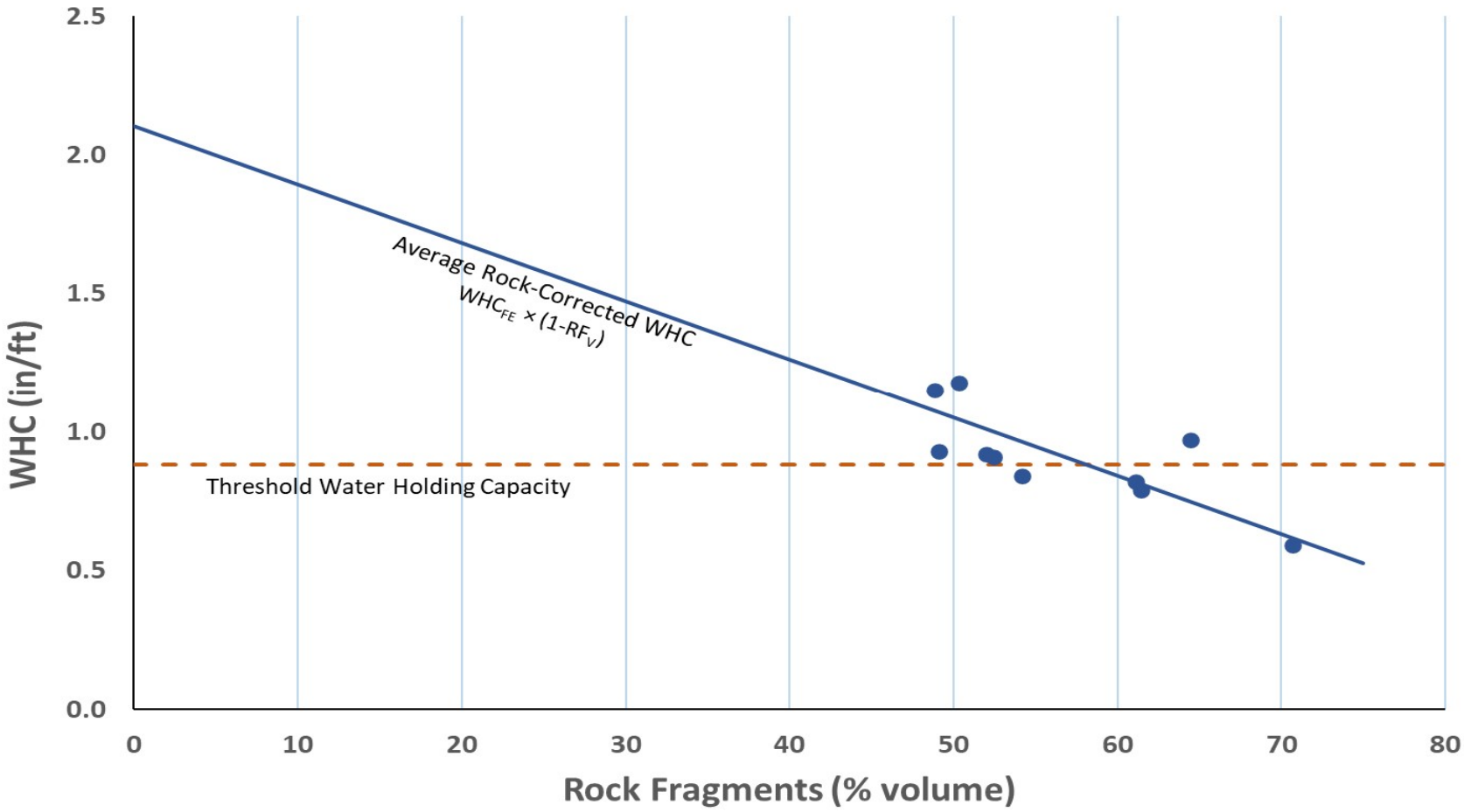
1



wsp	Title: **Ocular Versus Field Measurements of Precambrian Granite Rock Volume**		
	Project Name: Precambrian Granite Suitability Demonstration	Project No.: 31406439.001	FIGURE 2
	Client Name: Freeport-McMoRan Tyrone Operations	Date: 2/5/2025	



wsp	Title: **100 cm Suction Set Point for Field Capacity for Precambrian Granite Samples Relative to Air Entry Value**		
	Project Name: Precambrian Granite Suitability Demonstration	Project No.: 31406439.001	FIGURE 3
	Client Name: Freeport-McMoRan Tyrone Operations	Date: 2/5/2025	



wsp	Title: **Standardized Relationship for Water Holding Capacity and Volumetric Rock Fragment Content for PCG**		
	Project Name: Precambrian Granite Suitability Demonstration	Project No.: 31406439.001	FIGURE 4
	Client Name: Freeport-McMoRan Tyrone Operation	Date: 2/5/2025	

Miami LP South

Chino West Test Plots

Miami LP Discards

USNR Reclamation

MiamiMiami Lost Gulch

Copper Leach Stockpile

Morenci Rock Capping

Volunteer Vegetation at the 9A Stockpile

wsp	Title: Successful Vegetation on Overburden Soil Covers and PCG Stockpiles at FMI Mine Sites		
	Project Name: Precambrian Granite Suitability Demonstration	Project No.: 31406439.001	FIGURE 5
	Client Name: Freeport-McMoRan Tyrone Operations	Date: 2/5/2025	

LEGEND

Sample Date

- Samples Collected 03/2024
- Samples Collected 09/2023

REFERENCES

1. AERIAL IMAGERY: ESRI PROVIDED BASEMAP SERVICE. VIVID. MAXAR. IMAGERY CAPTURED 1/29/2023.

CLIENT

FREEPORT MCMORAN TYRONE MINE OPERATIONS
TYRONE, NEW MEXICO

PROJECT

PRECAMBRIAN GRANITE SUITABILITY STUDY

TITLE

LITTLE ROCK PRECAMBRIAN GRANITE SAMPLE LOCATIONS

CONSULTANT

wsp

YYYY-MM-DD	2025-02-14
DESIGNED	AR
PREPARED	JTB
REVIEWED	-
APPROVED	-

PROJECT NO.
31406439.2541

FIGURE
6

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B

PATH: M:\FMI_Tyrone\202406_Sampling\11x17_GIS\191225\76_Tyrone_Fig01c_Sampling.mxd PRINTED ON: 2025-02-14 AT: 2:53:40 PM

APPENDIX A

Project Photolog

APPENDIX A-1

Test Pit Photolog

9A-TP1 Test Pit

9A-TP1 Excavated Materials

9A-TP2 Test Pit

9A-TP2 Excavated Materials

9A-TP3 Test Pit

9A-TP3 Excavated Materials

9A-TP4 Test Pit

9A-TP4 Excavated Materials

	photo not available
9A-TP5 Test Pit	9A-TP5 Excavated Materials
	
9AX-TP1 Test Pit	9AX-TP1 Excavated Materials

9AX-TP2 Test Pit

9AX-TP2 Excavated Materials

9A-GB1 Sample Profile

9A-GB2 Sample Profile

9A-GB3 Sample Profile

9A-GB3 Overview

9A-GB4 Sample Profile

9A-GB4 Overview

	
9AX-GB1 Sample Profile	9AX-GB1 Overview
photo not available	
9AX-GB2 Sample Profile	9AX-GB2 Overview

CuL-GB1

CuL-BD1 Backfilled

CuL-BD2 Excavation

CuL-BD2 Backfilled

USNR-GB1 Soil Profile

USNR-GB1 Location

USNR-BD1 Excavation

USNR-BD1 Backfilled

USNR-GB2 Soil Profile

USNR-GB2 Location

USNR-BD2 Excavation and Partial Backfill

USNR-BD2 Backfilled

USNR-GB3 Soil Profile

USNR-GB3 Location

USNR-BD3 Excavation

USNR-BD3 Backfilled

	
WIP-GB1	WIP-GB1 Overview

APPENDIX A-2

Grizzly Demonstration Photolog

9AX-S – Looking south

9AX-S – Looking north

9A-S – Looking south

9A-S – Looking north

Loading the grizzly

Despite screen manipulation, not all material passes

Oversized rock from screening also includes fines and gravels

9A-S – Passed through grizzly, note many fragments >3”

9A-S – Removed by grizzly (>3”)

9A-S – Screened product (< 3”)

9AX-S – Removed by grizzly (>3”)

9AX-S – Screened product (<3”)

APPENDIX B

Energy Laboratory Reports

ANALYTICAL SUMMARY REPORT

September 11, 2023

WSP Albuquerque
6616 Gulton Ct NE Ste 10
Albuquerque, NM 87109-4452

Work Order: B23081947

Project Name: 31406439 01 EXP

Energy Laboratories Inc Billings MT received the following 20 samples for WSP Albuquerque on 8/18/2023 for analysis.

Lab ID	Client Sample ID	Collect Date	Receive Date	Matrix	Test
B23081947-001	9AX-TP1	07/10/23 0:00	08/18/23	Soil	ABDPTA extractable metals Cation Exchange Capacity Metals, NH4OAC Extractable Conductivity, Saturated Paste Extract Nitrate as N, KCL Extract Organic Carbon/Matter Walkley-Black pH, Saturated Paste Phosphorus-Olsen ABDTPA extraction for metals ASA3-5.2 NH4AC Soil Extraction for CEC USDA19 Ammonium Acetate Extraction ASA13-3 Saturated Paste Extraction ASA Particle Size Analysis / Texture Saturation Percentage
B23081947-002	9AX-TP2	07/11/23 13:00	08/18/23	Soil	Same As Above
B23081947-003	9AX-GB1	07/11/23 0:00	08/18/23	Soil	Same As Above
B23081947-004	9AX-GB2	08/08/23 0:00	08/18/23	Soil	Same As Above
B23081947-005	9A-GB1	07/11/23 14:45	08/18/23	Soil	Same As Above
B23081947-006	9A-GB2	07/11/23 14:58	08/18/23	Soil	Same As Above
B23081947-007	9A-GB3	07/13/23 8:00	08/18/23	Soil	Same As Above
B23081947-008	9A-GB4	07/13/23 9:00	08/18/23	Soil	Same As Above
B23081947-009	9A-TP1	07/11/23 9:15	08/18/23	Soil	Same As Above
B23081947-010	9A-TP2 [0-4.5]Feet	07/11/23 10:45	08/18/23	Soil	Same As Above
B23081947-011	9A-TP2 [4.5-8]Feet	07/11/23 11:00	08/18/23	Soil	Same As Above
B23081947-012	9A-TP3	07/11/23 11:30	08/18/23	Soil	Same As Above
B23081947-013	9A-TP4	07/12/23 0:00	08/18/23	Soil	Same As Above
B23081947-014	9A-TP5	08/02/23 0:00	08/18/23	Soil	Same As Above
B23081947-015	Cul-GB1	07/12/23 13:30	08/18/23	Soil	Same As Above
B23081947-016	Cul-GB2	08/08/23 0:00	08/18/23	Soil	Same As Above
B23081947-017	USNR-GB1	07/12/23 10:30	08/18/23	Soil	Same As Above
B23081947-018	USNR-GB2	07/12/23 0:00	08/18/23	Soil	Same As Above

ANALYTICAL SUMMARY REPORT

B23081947-019	USNR-GB3	07/12/23 10:26	08/18/23	Soil	Same As Above
B23081947-020	WIP-GB1	07/12/23 12:30	08/18/23	Soil	Same As Above

The analyses presented in this report were performed by Energy Laboratories, Inc., 1120 S 27th St., Billings, MT 59101, unless otherwise noted. Any exceptions or problems with the analyses are noted in the report package. Any issues encountered during sample receipt are documented in the Work Order Receipt Checklist.

The results as reported relate only to the item(s) submitted for testing. This report shall be used or copied only in its entirety. Energy Laboratories, Inc. is not responsible for the consequences arising from the use of a partial report.

If you have any questions regarding these test results, please contact your Project Manager.

Report Approved By:

LABORATORY ANALYTICAL REPORT

Prepared by Billings, MT Branch

Client: WSP Albuquerque
Project: 31406439 01 EXP
Workorder: B23081947

Report Date: 09/11/23
Date Received: 08/18/23

	Analysis	Sand	Silt	Clay	Texture	pH, sat_ paste	COND	Saturation	Organic Carbon	CEC	Phos, Olsen	Nitrate as N	K-NH4OAC	As-ABDTPA
	Units	%	%	%		s_u_	mmhos/cm	%	%	meq/100g	mg/kg	mg/kg	mg/kg	mg/kg
Sample ID	**Client Sample ID**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**
B23081947-001	9AX-TP1	72	18	10	SL	7.7	0.6	28.8	< 0.1	12.0	1	< 1	40	0.03
B23081947-002	9AX-TP2	77	16	7	SL	7.7	0.4	23.8	0.1	10.6	< 1	< 1	34	0.03
B23081947-003	9AX-GB1	57	30	13	SL	7.9	0.3	40.4	0.1	35.8	< 1	< 1	131	0.03
B23081947-004	9AX-GB2	65	23	12	SL	7.8	0.4	25.0	0.1	15.2	1	2	88	0.04
B23081947-005	9A-GB1	70	19	11	SL	7.4	0.4	25.5	0.2	15.0	2	1	73	< 0.02
B23081947-006	9A-GB2	71	20	9	SL	6.2	0.3	24.6	0.2	19.8	2	2	41	< 0.02
B23081947-007	9A-GB3	71	18	11	SL	7.6	0.5	26.3	0.1	14.7	1	< 1	88	0.02
B23081947-008	9A-GB4	72	19	9	SL	7.8	0.3	27.9	0.1	17.1	1	< 1	64	0.03
B23081947-009	9A-TP1	74	16	10	SL	7.9	0.5	28.8	0.1	15.4	1	< 1	48	< 0.02
B23081947-010	9A-TP2	76	16	8	SL	7.8	0.3	24.8	< 0.1	10.5	< 1	< 1	49	0.03
B23081947-011	9A-TP2	74	17	9	SL	7.4	0.3	24.1	0.1	15.2	< 1	< 1	50	0.02
B23081947-012	9A-TP3	76	17	7	SL	7.6	0.3	22.6	0.1	7.6	< 1	< 1	41	0.04
B23081947-013	9A-TP4	70	21	9	SL	7.7	0.4	29.4	< 0.1	18.6	< 1	< 1	72	0.03
B23081947-014	9A-TP5	68	21	11	SL	7.8	0.4	26.9	< 0.1	17.4	< 1	< 1	74	0.03
B23081947-015	Cul-GB1	66	21	13	SL	6.8	0.2	27.8	0.3	17.1	2	< 1	78	0.03
B23081947-016	Cul-GB2	66	23	11	SL	6.5	0.3	28.1	0.5	17.8	3	2	86	0.02
B23081947-017	USNR-GB1	70	19	11	SL	7.6	0.3	27.9	0.2	11.8	< 1	< 1	80	0.03
B23081947-018	USNR-GB2	70	20	10	SL	7.6	0.4	27.6	0.2	17.2	< 1	< 1	62	0.03
B23081947-019	USNR-GB3	69	20	11	SL	7.6	0.3	29.8	0.2	15.3	< 1	< 1	68	0.03
B23081947-020	WIP-GB1	76	15	9	SL	7.8	0.3	28.3	0.2	19.3	< 1	< 1	49	< 0.02

LABORATORY ANALYTICAL REPORT

Prepared by Billings, MT Branch

Client: WSP Albuquerque
Project: 31406439 01 EXP
Workorder: B23081947

Report Date: 09/11/23
Date Received: 08/18/23

		Analysis	Cd-ABDTPA	Cu-ABDTPA	Fe-ABDTPA	Pb-ABDTPA	Mn-ABDTPA	Mo-ABDTPA	Ni-ABDTPA	Zn-ABDTPA
		Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Sample ID	**Client Sample ID**		**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**
B23081947-001	9AX-TP1		< 0.1	36.3	3	0.5	0.8	0.1	< 0.1	3.0
B23081947-002	9AX-TP2		< 0.1	39.8	3	2.2	0.9	0.1	< 0.1	2.3
B23081947-003	9AX-GB1		0.3	6.6	3	0.2	0.4	< 0.1	< 0.1	5.3
B23081947-004	9AX-GB2		< 0.1	61.7	3	1.6	1.1	< 0.1	< 0.1	3.7
B23081947-005	9A-GB1		0.1	82.8	4	0.5	1.7	< 0.1	< 0.1	3.8
B23081947-006	9A-GB2		< 0.1	27.6	4	0.2	4.2	0.1	< 0.1	3.7
B23081947-007	9A-GB3		< 0.1	26.7	4	0.8	1.1	0.2	< 0.1	3.4
B23081947-008	9A-GB4		< 0.1	42.7	4	1.0	0.6	0.2	< 0.1	3.1
B23081947-009	9A-TP1		< 0.1	44.8	2	0.3	0.6	< 0.1	< 0.1	1.6
B23081947-010	9A-TP2		< 0.1	63.6	4	0.6	0.8	< 0.1	< 0.1	2.1
B23081947-011	9A-TP2		0.2	41.7	4	1.2	0.7	0.3	< 0.1	3.8
B23081947-012	9A-TP3		0.2	43.2	5	0.9	1.1	0.2	< 0.1	4.8
B23081947-013	9A-TP4		0.2	26.3	4	1.4	1.0	0.2	< 0.1	4.1
B23081947-014	9A-TP5		0.1	42.6	4	1.2	0.8	0.2	< 0.1	3.1
B23081947-015	Cul-GB1		< 0.1	167	5	1.1	3.7	0.1	< 0.1	2.0
B23081947-016	Cul-GB2		< 0.1	172	7	1.2	3.0	0.1	< 0.1	2.4
B23081947-017	USNR-GB1		< 0.1	11.8	3	0.4	0.6	< 0.1	< 0.1	4.2
B23081947-018	USNR-GB2		0.1	18.6	5	0.5	1.3	< 0.1	< 0.1	3.0
B23081947-019	USNR-GB3		< 0.1	30.4	4	0.5	1.6	< 0.1	< 0.1	1.8
B23081947-020	WIP-GB1		< 0.1	15.1	3	0.1	0.7	< 0.1	< 0.1	1.0

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: WSP Albuquerque **Work Order:** B23081947 **Report Date:** 09/11/23

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **ASA10-3**									Batch: 182214
Lab ID: **B23081947-009A DUP**	Sample Duplicate				Run: MISC-SOIL_230825A				08/25/23 16:31
Conductivity, sat. paste	0.470	mmhos/cm	0.10				6.2	30	
Lab ID: **B23081947-019A DUP**	Sample Duplicate				Run: MISC-SOIL_230825A				08/25/23 16:31
Conductivity, sat. paste	0.340	mmhos/cm	0.10				0.0	30	
Lab ID: **LCS-2308251631**	Laboratory Control Sample				Run: MISC-SOIL_230825A				08/25/23 16:31
Conductivity, sat. paste	4.97	mmhos/cm	0.10	97	70	130			
Lab ID: **B23081947-009A DUP**	Sample Duplicate				Run: MISC-SOIL_230825A				08/25/23 16:31
pH, sat. paste	7.90	s.u.	0.10				0.0	10	
Lab ID: **B23081947-019A DUP**	Sample Duplicate				Run: MISC-SOIL_230825A				08/25/23 16:31
pH, sat. paste	7.60	s.u.	0.10				0.0	10	
Lab ID: **LCS-2308251631**	Laboratory Control Sample				Run: MISC-SOIL_230825A				08/25/23 16:31
pH, sat. paste	7.10	s.u.	0.10	95	90	110			

Qualifiers:

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: WSP Albuquerque **Work Order:** B23081947 **Report Date:** 09/11/23

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **ASA15-5**									Batch: R408208
Lab ID: **B23081947-001A DUP**	Sample Duplicate				Run: MISC-SOIL_230905A			09/05/23 11:11	
Sand	72.0	%	1.0				0.0	30	
Silt	18.0	%	1.0				0.0	30	
Clay	10.0	%	1.0				0.0	30	
Lab ID: **B23081947-011A DUP**	Sample Duplicate				Run: MISC-SOIL_230905A			09/05/23 11:11	
Sand	75.0	%	1.0				1.3	30	
Silt	16.0	%	1.0				6.1	30	
Clay	9.00	%	1.0				0.0	30	
Lab ID: **LCS-2309051111**	Laboratory Control Sample				Run: MISC-SOIL_230905A			09/05/23 11:11	
Sand	36.0	%	1.0	100	70	130			
Silt	40.0	%	1.0	95	70	130			
Clay	24.0	%	1.0	109	70	130			

Qualifiers:

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: WSP Albuquerque **Work Order:** B23081947 **Report Date:** 09/11/23

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **ASA24-5**								Batch: OM_8-31-2023_01-18-22PM	
Lab ID: **LCS**	Laboratory Control Sample				Run: FIA205-B_230831A			08/31/23 13:19	
Phosphorus, Olsen	11	mg/kg	1.0	72	70	130			
Lab ID: **B23081947-001ADUP**	Sample Duplicate				Run: FIA205-B_230831A			08/31/23 13:27	
Phosphorus, Olsen	1.2	mg/kg	1.0				3.4	30	
Lab ID: **B23081947-001AMS**	Sample Matrix Spike				Run: FIA205-B_230831A			08/31/23 13:29	
Phosphorus, Olsen	12	mg/kg	1.0	101	70	130			
Method: **ASA24-5**								Batch: OM_8-31-2023_02-02-53PM	
Lab ID: **B23081947-011ADUP**	Sample Duplicate				Run: FIA205-B_230831A			08/31/23 14:07	
Phosphorus, Olsen	ND	mg/kg	1.0					30	
Lab ID: **B23081947-011AMS**	Sample Matrix Spike				Run: FIA205-B_230831A			08/31/23 14:09	
Phosphorus, Olsen	10	mg/kg	1.0	96	70	130			

Qualifiers:

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: WSP Albuquerque **Work Order:** B23081947 **Report Date:** 09/11/23

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **ASA29-3**									Batch: R408452
Lab ID: **LCS**	Laboratory Control Sample				Run: MISC-SOIL_230908B				09/08/23 09:38
Organic Carbon	2.45	%	0.10	111	70	130			
Lab ID: **B23081947-001ADUP**	Sample Duplicate				Run: MISC-SOIL_230908B				09/08/23 09:38
Organic Carbon	0.0644	%	0.10					30	J
Lab ID: **B23081947-011ADUP**	Sample Duplicate				Run: MISC-SOIL_230908B				09/08/23 09:38
Organic Carbon	0.120	%	0.10				4.3	30	

Qualifiers:

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

J - Estimated value - analyte was present but less than the Reporting Limit (RL)

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: WSP Albuquerque **Work Order:** B23081947 **Report Date:** 09/11/23

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **ASA33-8**								Batch: OM_8-30-2023_12-45-07PM	
Lab ID: **LCS**	Laboratory Control Sample				Run: FIA205-B_230830A			08/30/23 12:46	
Nitrate as N, KCL Extract	4.12	mg/kg	1.0	88	70	130			
Lab ID: **B23081947-003ADUP**	Sample Duplicate				Run: FIA205-B_230830A			08/30/23 13:17	
Nitrate as N, KCL Extract	0.560	mg/kg	1.0					30	J
Lab ID: **B23081947-003AMS**	Sample Matrix Spike				Run: FIA205-B_230830A			08/30/23 13:17	
Nitrate as N, KCL Extract	5.67	mg/kg	1.0	97	70	130			
Lab ID: **B23081947-013ADUP**	Sample Duplicate				Run: FIA205-B_230830A			08/30/23 13:26	
Nitrate as N, KCL Extract	ND	mg/kg	1.0					30	
Lab ID: **B23081947-013AMS**	Sample Matrix Spike				Run: FIA205-B_230830A			08/30/23 13:26	
Nitrate as N, KCL Extract	5.46	mg/kg	1.0	104	70	130			

Qualifiers:

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

J - Estimated value - analyte was present but less than the Reporting Limit (RL)

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: WSP Albuquerque **Work Order:** B23081947 **Report Date:** 09/11/23

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **SW6010B**									Batch: 182309
Lab ID: **LCS-182309**	Laboratory Control Sample				Run: ICP204-B_230830A				08/30/23 12:27
Potassium	199	mg/kg	3.0	97	70	130			
Lab ID: **B23081947-001AMS2**	Sample Matrix Spike				Run: ICP204-B_230830A				08/30/23 12:44
Potassium	693	mg/kg	3.1	129	70	130			
Lab ID: **B23081947-001ADUP**	Sample Duplicate				Run: ICP204-B_230830A				08/30/23 12:48
Potassium	49.3	mg/kg	3.0				20	30	
Lab ID: **B23081947-011AMS2**	Sample Matrix Spike				Run: ICP204-B_230830A				08/30/23 13:42
Potassium	740	mg/kg	3.1	125	70	130			
Lab ID: **B23081947-011ADUP**	Sample Duplicate				Run: ICP204-B_230830A				08/30/23 13:46
Potassium	51.8	mg/kg	3.0				4.0	30	
Lab ID: **B23082125-001AMS2**	Sample Matrix Spike				Run: ICP204-B_230830A				08/30/23 14:40
Potassium	700	mg/kg	3.1	110	70	130			
Method: **SW6010B**									Batch: 182317
Lab ID: **B23081947-004AMS2**	Sample Matrix Spike				Run: ICP204-B_230831A				08/31/23 20:24
Cadmium	4.22	mg/kg	0.10	82	50	150			
Copper	19.6	mg/kg	0.21		50	150			A
Molybdenum	9.32	mg/kg	0.21	93	50	150			
Nickel	8.29	mg/kg	0.21	83	50	150			
Lab ID: **B23081947-004ADUP**	Sample Duplicate				Run: ICP204-B_230831A				08/31/23 20:28
Copper	57.0	mg/kg	0.20				8.0	30	
Method: **SW6010B**									Batch: 182317
Lab ID: **LCS-182317**	Laboratory Control Sample				Run: ICP204-B_230901A				09/01/23 14:39
Copper	3.39	mg/kg	0.20	73	70	130			

Qualifiers:

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ND - Not detected at the Reporting Limit (RL)

A - Analyte level was greater than four times the spike level - in accordance with the method, percent recovery is not calculated

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: WSP Albuquerque **Work Order:** B23081947 **Report Date:** 09/11/23

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **SW6010B**									Batch: 182559
Lab ID: **LCS-182559**	Laboratory Control Sample				Run: ICP204-B_230907A				09/08/23 06:02
Cation Exchange Capacity	15.6	meq/100g	0.26	128	50	150			
Lab ID: **B23081947-001AMS2**	Sample Matrix Spike				Run: ICP204-B_230907A				09/08/23 06:10
Cation Exchange Capacity	59.6	meq/100g	0.27	109	50	150			
Lab ID: **B23081947-001ADUP**	Sample Duplicate				Run: ICP204-B_230907A				09/08/23 06:14
Cation Exchange Capacity	11.8	meq/100g	0.26				1.4	30	
Lab ID: **B23081947-011AMS2**	Sample Matrix Spike				Run: ICP204-B_230907A				09/08/23 07:09
Cation Exchange Capacity	62.7	meq/100g	0.45	109	50	150			
Lab ID: **B23081947-011ADUP**	Sample Duplicate				Run: ICP204-B_230907A				09/08/23 07:13
Cation Exchange Capacity	14.2	meq/100g	0.44				7.0	30	

Qualifiers:

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: WSP Albuquerque **Work Order:** B23081947 **Report Date:** 09/11/23

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **SW6020**								Batch: 182317	
Lab ID: **LCS-182317**	Laboratory Control Sample				Run: ICPMS208-B_230830A			08/31/23 00:15	
Arsenic	0.145	mg/kg	0.020	80	70	130			
Cadmium	0.0728	mg/kg	0.10	91	70	130			
Copper	3.64	mg/kg	0.10	78	70	130			
Iron	44.6	mg/kg	1.0	87	70	130			
Lead	3.05	mg/kg	0.10	77	70	130			
Manganese	12.0	mg/kg	0.10	82	70	130			
Molybdenum	0.356	mg/kg	0.10	87	70	130			
Nickel	1.87	mg/kg	0.10	124	70	130			
Zinc	4.51	mg/kg	0.10	83	70	130			
Lab ID: **B23081947-004ADUP**	Sample Duplicate				Run: ICPMS208-B_230830A			08/31/23 03:43	
Arsenic	0.0375	mg/kg	0.020				3.3	30	
Cadmium	0.0954	mg/kg	0.10					30	J
Copper	59.0	mg/kg	0.10				3.3	30	E
Iron	3.57	mg/kg	1.0				12	30	
Lead	1.64	mg/kg	0.10				1.8	30	
Manganese	1.10	mg/kg	0.10				2.5	30	
Molybdenum	0.0525	mg/kg	0.10					30	J
Nickel	0.0216	mg/kg	0.10					30	J
Zinc	3.70	mg/kg	0.10				0.5	30	
Lab ID: **B23081947-005AMS**	Sample Matrix Spike				Run: ICPMS208-B_230830A			08/31/23 03:56	
Arsenic	0.242	mg/kg	0.020	89	70	130			
Iron	27.8	mg/kg	1.0	96	70	130			E
Manganese	0.415	mg/kg	0.10		70	130			A
Molybdenum	0.238	mg/kg	0.10	78	70	130			
Nickel	0.252	mg/kg	0.10	92	70	130			
Zinc	0.603	mg/kg	0.10		70	130			A
Lab ID: **B23081947-014ADUP**	Sample Duplicate				Run: ICPMS208-B_230830A			08/31/23 05:17	
Arsenic	0.0328	mg/kg	0.020				3.3	30	
Cadmium	0.116	mg/kg	0.10				3.3	30	
Iron	4.12	mg/kg	1.0				11	30	
Lead	1.17	mg/kg	0.10				0.8	30	
Manganese	0.796	mg/kg	0.10				3.5	30	
Molybdenum	0.204	mg/kg	0.10				5.0	30	
Nickel	0.0246	mg/kg	0.10					30	J
Zinc	3.29	mg/kg	0.10				7.2	30	
Lab ID: **B23081947-015AMS**	Sample Matrix Spike				Run: ICPMS208-B_230830A			08/31/23 05:43	
Arsenic	0.251	mg/kg	0.020	90	70	130			
Cadmium	0.250	mg/kg	0.10	75	70	130			
Copper	16.1	mg/kg	0.10		70	130			AE
Iron	27.8	mg/kg	1.0	91	70	130			E
Lead	0.339	mg/kg	0.10		70	130			A

Qualifiers:

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

A - Analyte level was greater than four times the spike level - in accordance with the method, percent recovery is not calculated

E - Estimated value - result exceeds the instrument upper quantitation limit

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: WSP Albuquerque **Work Order:** B23081947 **Report Date:** 09/11/23

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **SW6020**									Batch: 182317
Lab ID: **B23081947-015AMS**	Sample Matrix Spike				Run: ICPMS208-B_230830A				08/31/23 05:43
Manganese	0.621	mg/kg	0.10		70	130			A
Nickel	0.261	mg/kg	0.10	85	70	130			
Zinc	0.423	mg/kg	0.10		70	130			A

Qualifiers:

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ND - Not detected at the Reporting Limit (RL)

A - Analyte level was greater than four times the spike level - in accordance with the method, percent recovery is not calculated

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: WSP Albuquerque **Work Order:** B23081947 **Report Date:** 09/11/23

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: USDA27a									Batch: 182214
Lab ID: B23081947-009A DUP	Sample Duplicate				Run: MISC-SOIL_230905A				09/05/23 11:14
Saturation	27.8	%	0.10				3.5	30	
Lab ID: B23081947-019A DUP	Sample Duplicate				Run: MISC-SOIL_230905A				09/05/23 11:14
Saturation	31.2	%	0.10				4.6	30	
Lab ID: LCS-2309051114	Laboratory Control Sample				Run: MISC-SOIL_230905A				09/05/23 11:14
Saturation	34.4	%	0.10	91	70	130			

Qualifiers:

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

Work Order Receipt Checklist

WSP Albuquerque

B23081947

Login completed by: Richard L. Shular
Date Received: 8/18/2023
Reviewed by: gmccartney
Received by: dnh
Reviewed Date: 8/24/2023
Carrier name: Return-FedEx Ground

Shipping container/cooler in good condition?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on all shipping container(s)/cooler(s)?	Yes ☐	No ☐	Not Present ☑
Custody seals intact on all sample bottles?	Yes ☐	No ☐	Not Present ☑
Chain of custody present?	Yes ☑	No ☐	
Chain of custody signed when relinquished and received?	Yes ☐	No ☑	
Chain of custody agrees with sample labels?	Yes ☑	No ☐	
Samples in proper container/bottle?	Yes ☑	No ☐	
Sample containers intact?	Yes ☑	No ☐	
Sufficient sample volume for indicated test?	Yes ☑	No ☐	
All samples received within holding time? (Exclude analyses that are considered field parameters such as pH, DO, Res Cl, Sulfite, Ferrous Iron, etc.)	Yes ☑	No ☐	
Temp Blank received in all shipping container(s)/cooler(s)?	Yes ☐	No ☑	Not Applicable ☐
Container/Temp Blank temperature:	28.0°C No Ice		
Containers requiring zero headspace have no headspace or bubble that is <6mm (1/4").	Yes ☐	No ☐	No VOA vials submitted ☑
Water - pH acceptable upon receipt?	Yes ☐	No ☐	Not Applicable ☑

Standard Reporting Procedures:

Lab measurement of analytes considered field parameters that require analysis within 15 minutes of sampling such as pH, Dissolved Oxygen and Residual Chlorine, are qualified as being analyzed outside of recommended holding time.

Solid/soil samples are reported on a wet weight basis (as received) unless specifically indicated. If moisture corrected, data units are typically noted as –dry. For agricultural and mining soil parameters/characteristics, all samples are dried and ground prior to sample analysis.

The reference date for Radon analysis is the sample collection date. The reference date for all other Radiochemical analyses is the analysis date. Radiochemical precision results represent a 2-sigma Total Measurement Uncertainty.

Contact and Corrective Action Comments:

The Temperature Blank temperature for shipping container 1 was 28.0°C and shipping container 2 was 27.6°C.

ENERGY LABORATORIES
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Chain of Custody & Analytical Request Record

www.energylab.com

Account Information *(Billing information)*

Company/Name	WSP Inc
Contact	Doug Romig
Phone	(505) 821-3043
Mailing Address	6616 Gulton Ct NE, Suite 10
City, State, Zip	Albuquerque, NM 87113-2208
Email	doug.romig@wsp.com
Receive Invoice	☐Hard Copy ■Email
Receive Report	☐Hard Copy ■Email
Purchase Order	
Quote	NA
Bottle Order	

Report Information *(if different than Account Information)*

Company/Name	
Contact	
Phone	
Mailing Address	
City, State, Zip	
Email	
Receive Report	☐Hard Copy ■Email

Special Report/Formats:
☐ LEVEL IV ☐ NELAC ☐ EDD/EDT *(contact laboratory)* ☐ Other_____

Comments

Project Information

Project Name, PWSID, Permit, etc.	31406439 01. EXP
Sampler Name	Doug Romig
Sampler Phone	(505) 821-3043
Sample Origin State	NM
EPA/State Compliance	☐ Yes ■ No

URANIUM MINING CLIENTS MUST indicate sample type.
☐ NOT Source or Byproduct Material
☐ Source/Processed Ore (Ground or Refined) **CALL BEFORE SENDING
☐ 11e.(2) Byproduct Material (Can ONLY be Submitted to ELI Casper Location)

Matrix Codes
A - Air
W - Water
S - Soils/Solids
V - Vegetation
B - Bioassay
O - Other
DW - Drinking Water

All turnaround times are standard unless marked as RUSH.
Energy Laboratories MUST be contacted prior to RUSH sample submittal for charges and scheduling – See Instructions Page

	Sample Identification *(Name, Location, Interval, etc.)*	Collection Date	Collection Time	Number of Containers	Matrix *(See Codes Above)*	Analysis Requested	See Attached	RUSH TAT	ELI LAB ID *Laboratory Use Only*
1	9AX-TP1	7/10/23	—				●		B23068147
2	9AX-TP2	7/11/23	1300				●		
3	9AX-GB1	7/11/23	—				●		
4	9AX-GB2	8/8/23	—				●		
5	9A-GB1	7/11/23	1445				●		
6	9A-GB2	7/11/23	1458				●		
7	9A-GB3	7/13/23	800				●		
8	9A-GB4	7/8/23	900				●		
9	9A-TP1	7/11/23	9:15				●		
10	9A-TP2 0-4.5'	7/11/23	10:45				●		

Custody Record MUST be signed	Relinquished by (print)	Date/Time	Signature	Received by (print)	Date/Time	Signature
	Relinquished by (print)	Date/Time	Signature	Received by Laboratory (print) Danielle Hamm	Date/Time 8/8/23 0900	Signature

LABORATORY USE ONLY

Shipped By	Cooler ID(s)	Custody Seals Y N C B	Intact Y N	Receipt Temp °C	Temp Blank Y N	On Ice Y N	Payment Type CC Cash Check_____	Amount $	Receipt Number *(cash/check only)*

In certain circumstances, samples submitted to Energy Laboratories, Inc. may be subcontracted to other certified laboratories in order to complete the analysis requested. This serves as notice of this possibility. All subcontracted data will be clearly notated on your analytical report.

ELI-COC-10/18 v.3

ENERGY LABORATORIES
Trust our People. Trust our Data.

Chain of Custody & Analytical Request Record

www.energylab.com

Account Information *(Billing information)*

Company/Name	WSP Inc
Contact	Doug Romig
Phone	(505) 821-3043
Mailing Address	6616 Gulton Ct NE, Suite 10
City, State, Zip	Albuquerque, NM 87113-2208
Email	doug.romig@wsp.com
Receive Invoice	☐Hard Copy ■Email
Receive Report	☐Hard Copy ■Email
Purchase Order	
Quote	NA
Bottle Order	

Report Information *(if different than Account Information)*

Company/Name	
Contact	
Phone	
Mailing Address	
City, State, Zip	
Email	
Receive Report	☐Hard Copy ■Email
Special Report/Formats:	☐ LEVEL IV ☐ NELAC ☐ EDD/EDT *(contact laboratory)* ☐ Other_____

Comments

Project Information

Project Name, PWSID, Permit, etc.	31406439 01.EXP
Sampler Name	Doug Romig
Sampler Phone	(505) 821-3043
Sample Origin State	NM
EPA/State Compliance	☐ Yes ■ No

URANIUM MINING CLIENTS MUST indicate sample type.
☐ NOT Source or Byproduct Material
☐ Source/Processed Ore (Ground or Refined) **CALL BEFORE SENDING
☐ 11e.(2) Byproduct Material (Can ONLY be Submitted to ELI Casper Location)

Matrix Codes
A - Air
W - Water
S - Soils/Solids
V - Vegetation
B - Bioassay
O - Other
DW - Drinking Water

All turnaround times are standard unless marked as RUSH.
Energy Laboratories MUST be contacted prior to RUSH sample submittal for charges and scheduling – See Instructions Page

	Sample Identification *(Name, Location, Interval, etc.)*	Collection Date	Collection Time	Number of Containers	Matrix *(See Codes Above)*	Analysis Requested	See Attached	RUSH TAT	ELI LAB ID *Laboratory Use Only*
1	9A-TP2 4.5-8'	7/11/23	1100				●		B23081947
2	9A-TP 3	7/11/23	1130				●		
3	9A-TP4	7/12/23	-				●		
4	9A-TP5	8/02/23	-				●		
5	CuL-GB1	7/12/23	1330				●		
6	CuL-GB2	8/08/23	-				●		
7	USNR-GB1	7/12/23	1030				●		
8	USNR-GB2	7/12/23	-				●		
9	USNR-GB3	7/12/23	1025				●		
10	WIP-GB1	7/12/23	1230				●		

Custody Record MUST be signed	Relinquished by (print)	Date/Time	Signature	Received by (print)	Date/Time	Signature
	Relinquished by (print)	Date/Time	Signature	Received by Laboratory (print) Danielle Hans	Date/Time 8/11/23 0900	Signature

LABORATORY USE ONLY

Shipped By	Cooler ID(s)	Custody Seals Y N C B	Intact Y N	Receipt Temp °C	Temp Blank Y N	On Ice Y N	Payment Type CC Cash Check_____	Amount $	Receipt Number *(cash/check only)*

In certain circumstances, samples submitted to Energy Laboratories, Inc. may be subcontracted to other certified laboratories in order to complete the analysis requested. This serves as notice of this possibility. All subcontracted data will be clearly notated on your analytical report.

ELI-COC-10/18 v.3

August 15, 2023

Project No. 31406439.000

Ms. Jillian Miller
Energy Laboratories Inc.
1120 South 27th Street
Billings, MT 59107

LAB ANALYSES FOR PRECAMBRIAN GRANITE SAMPLES

Dear Ms. Miller:

This letter accompanies 2 coolers with a total of 20 soil samples from the Tyrone Mine for chemical and physical characterization. Please analyze the samples for the following parameters.

Analysis/Parameter	Source-Method
Saturated Paste pH	SLS 1954, Method 2 and 21a
Electrical Conductivity, saturated paste	SLS 1954, Method 3a and 4b
Saturation Percentage	SLS 1954, Method 27a
Particle Size Analysis	ASA 1982, Method 15-5
Organic Matter (Carbon)	ASA 1982, Method 29-3.5.2
N as Nitrate	ASA 1982, Method 33-8.1
Phosphorous (Olsen)	ASA 1982, Method 24-5.4
Potassium	ASA 1982, Method 13-3.5
Acid Base Accounts with sulfur forms*	Modified Sobek et al. (1978)
Cation Exchange Capacity	SLS 1954, Method 19
AB-DTPA extraction	ASA 1982, Method 3-5.2
Saturate Paste extraction	ASA 1982, Method 10-2.3.1
Extractable Metals (As, Cd, Cu, Fe, Pb, Mn, Mo, Ni, and Zn)	EPA Method 6010/6020

Note: * for samples with pH<5

Please call (505.962.2933) or email (doug.romig@wsp.com) if you have any questions.

Sincerely,

WSP USA Inc.

Douglas Romig
Technical Principal

WSP USA Inc.
2440 Louisiana Boulevard NE, Suite 400, Albuquerque, New Mexico, USA 87110
T: +1 505 821 3043

wsp.com

ANALYTICAL SUMMARY REPORT

April 17, 2024

WSP Albuquerque
6616 Gulton Ct NE Ste 10
Albuquerque, NM 87109-4452

Work Order: B24040029 Quote ID: B17192

Project Name: US-WSP-31406439.2541

Energy Laboratories Inc Billings MT received the following 11 samples for WSP Albuquerque on 4/1/2024 for analysis.

Lab ID	Client Sample ID	Collect Date	Receive Date	Matrix	Test
B24040029-001	NRW-0324-01	03/08/24 00:00	04/01/24	Soil	ABDPTA extractable metals Cation Exchange Capacity Metals, NH4OAC Extractable Conductivity, Saturated Paste Extract Nitrate as N, KCL Extract Organic Carbon/Matter Walkley-Black pH, Saturated Paste Phosphorus-Olsen ABDTPA extraction for metals ASA3-5.2 NH4AC Soil Extraction for CEC USDA19 KCL Soil Extract ASA33-3 Ammonium Acetate Extraction ASA13-3 Saturated Paste Extraction ASA Particle Size Analysis / Texture Saturation Percentage
B24040029-002	NRW-0324-02	03/08/24 00:00	04/01/24	Soil	Same As Above
B24040029-003	NRW-0324-03	03/08/24 00:00	04/01/24	Soil	Same As Above
B24040029-004	NRW-0324-04	03/08/24 00:00	04/01/24	Soil	Same As Above
B24040029-005	NRW-0324-05	03/08/24 00:00	04/01/24	Soil	Same As Above
B24040029-006	NRW-0324-06	03/08/24 00:00	04/01/24	Soil	Same As Above
B24040029-007	NRW-0324-07	03/08/24 00:00	04/01/24	Soil	Same As Above
B24040029-008	NRW-0324-08	03/08/24 00:00	04/01/24	Soil	Same As Above
B24040029-009	NRW-0324-09	03/08/24 00:00	04/01/24	Soil	Same As Above
B24040029-010	NRW-0324-10	03/08/24 00:00	04/01/24	Soil	Same As Above
B24040029-011	NRW-0324-WR	03/08/24 00:00	04/01/24	Soil	Same As Above

The analyses presented in this report were performed by Energy Laboratories, Inc., 1120 S 27th St., Billings, MT 59101, unless otherwise noted. Any exceptions or problems with the analyses are noted in the report package. Any issues encountered during sample receipt are documented in the Work Order Receipt Checklist.

The results as reported relate only to the item(s) submitted for testing. This report shall be used or copied only in its entirety. Energy Laboratories, Inc. is not responsible for the consequences arising from the use of a partial report.

If you have any questions regarding these test results, please contact your Project Manager.

Report Approved By: Brandy A Pelzel
Technical Data Reviewer
Digitally signed by Brandy A. Pelzel
Date: 2024.04.17 13:19:34 -06:00

CLIENT: WSP Albuquerque
Project: US-WSP-31406439.2541
Work Order: B24040029

Report Date: 04/17/24

CASE NARRATIVE

Tests associated with analyst identified as ELI-H were subcontracted to Energy Laboratories, 3161 East Lyndale Ave, Helena, MT, EPA Number MT00945.

LABORATORY ANALYTICAL REPORT

Prepared by Billings, MT Branch

Client: WSP Albuquerque
Project: US-WSP-31406439.2541
Workorder: B24040029

Report Date: 04/17/24
Date Received: 04/01/24

	Analysis	Sand	Silt	Clay	Texture	pH, sat_ paste	COND	Saturation	Organic Matter	Organic Carbon	CEC	Phos, Olsen	Nitrate as N	K-NH4OAC
	Units	%	%	%		s_u_	mmhos/cm	%	%	%	meq/100g	mg/kg	mg/kg	mg/kg
Sample ID	**Client Sample ID**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**
B24040029-001	NRW-0324-01	74	14	12	SL	8.1	0.4	33.0	< 0.2	< 0.1	12.2	< 1	4	73
B24040029-002	NRW-0324-02	72	14	14	SL	8.1	0.3	37.5	< 0.2	< 0.1	11.6	< 1	4	85
B24040029-003	NRW-0324-03	74	14	12	SL	8.1	0.3	31.2	< 0.2	< 0.1	10.8	< 1	1	67
B24040029-004	NRW-0324-04	76	12	12	SL	8.1	0.2	37.4	< 0.2	< 0.1	13.7	< 1	2	73
B24040029-005	NRW-0324-05	78	12	10	SL	8.1	0.3	31.2	< 0.2	< 0.1	9.79	< 1	3	63
B24040029-006	NRW-0324-06	80	10	10	SL	8.1	0.4	30.4	< 0.2	< 0.1	7.70	< 1	3	52
B24040029-007	NRW-0324-07	78	12	10	SL	8.2	0.2	28.8	< 0.2	< 0.1	8.03	< 1	< 1	56
B24040029-008	NRW-0324-08	78	14	8	SL	8.1	0.3	30.1	< 0.2	< 0.1	7.88	< 1	1	60
B24040029-009	NRW-0324-09	76	12	12	SL	7.8	0.5	31.4	< 0.2	< 0.1	8.73	< 1	< 1	68
B24040029-010	NRW-0324-10	76	14	10	SL	7.9	0.2	31.7	< 0.2	< 0.1	8.74	< 1	< 1	67
B24040029-011	NRW-0324-WR	70	14	16	SL	8.0	0.4	43.0	< 0.2	< 0.1	17.7	< 1	10	53

LABORATORY ANALYTICAL REPORT

Prepared by Billings, MT Branch

Client: WSP Albuquerque
Project: US-WSP-31406439.2541
Workorder: B24040029

Report Date: 04/17/24
Date Received: 04/01/24

	Analysis	As-ABDTPA	Cd-ABDTPA	Cu-ABDTPA	Fe-ABDTPA	Pb-ABDTPA	Mn-ABDTPA	Mo-ABDTPA	Ni-ABDTPA	Zn-ABDTPA
	Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Sample ID	**Client Sample ID**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**
B24040029-001	NRW-0324-01	0.05	< 0.1	29.0	4	0.5	1.9	< 0.1	< 0.1	2.0
B24040029-002	NRW-0324-02	0.05	0.1	11.6	4	1.0	2.0	0.1	< 0.1	4.1
B24040029-003	NRW-0324-03	0.04	< 0.1	28.4	5	0.4	2.7	< 0.1	< 0.1	2.2
B24040029-004	NRW-0324-04	0.06	0.3	12.5	3	2.2	1.3	< 0.1	< 0.1	6.5
B24040029-005	NRW-0324-05	0.04	0.2	28.7	6	0.7	3.3	0.1	< 0.1	4.6
B24040029-006	NRW-0324-06	0.06	< 0.1	146	6	0.5	3.1	0.2	< 0.1	3.4
B24040029-007	NRW-0324-07	0.06	< 0.1	113	5	0.5	3.1	0.2	< 0.1	1.5
B24040029-008	NRW-0324-08	0.06	< 0.1	113	6	0.5	3.5	0.2	< 0.1	1.9
B24040029-009	NRW-0324-09	0.14	0.2	63.3	4	21.1	5.6	0.4	< 0.1	23.5
B24040029-010	NRW-0324-10	0.06	0.1	49.3	4	14.4	4.9	< 0.1	< 0.1	17.5
B24040029-011	NRW-0324-WR	0.04	< 0.1	121	3	0.4	1.8	< 0.1	< 0.1	3.6

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: WSP Albuquerque **Work Order:** B24040029 **Report Date:** 04/17/24

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **ASA10-3**								Analytical Run: SOIL EC_240408A	
Lab ID: **ICV_1_240404_1**	Initial Calibration Verification Standard							04/05/24 12:41	
Conductivity, sat. paste	1.43	mmhos/cm	0.10	101	90	110			
Lab ID: **CCV_1_240404_1**	Continuing Calibration Verification Standard							04/05/24 12:41	
Conductivity, sat. paste	4.90	mmhos/cm	0.10	98	90	110			
Lab ID: **CCV1_1_240404_1**	Continuing Calibration Verification Standard							04/05/24 12:42	
Conductivity, sat. paste	0.961	mmhos/cm	0.10	96	90	110			
Lab ID: **CCV_3_240404_1**	Continuing Calibration Verification Standard							04/05/24 12:50	
Conductivity, sat. paste	4.85	mmhos/cm	0.10	97	90	110			
Method: **ASA10-3**								Batch: 71133	
Lab ID: **MB-71133**	Method Blank				Run: SOIL EC_240408A			04/05/24 12:42	
Conductivity, sat. paste	ND	mmhos/cm	0.05						
Lab ID: **LCS-71133**	Laboratory Control Sample				Run: SOIL EC_240408A			04/05/24 12:43	
Conductivity, sat. paste	3.57	mmhos/cm	0.10	92	80	120			
Lab ID: **B24040029-005ADUP**	Sample Duplicate				Run: SOIL EC_240408A			04/05/24 12:47	
Conductivity, sat. paste	0.351	mmhos/cm	0.10				5.6	20	
Lab ID: **B24040029-010ADUP**	Sample Duplicate				Run: SOIL EC_240408A			04/05/24 12:53	
Conductivity, sat. paste	0.229	mmhos/cm	0.10				1.5	20	

Qualifiers:

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: WSP Albuquerque **Work Order:** B24040029 **Report Date:** 04/17/24

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **ASA10-3**									al Run: SOIL PH METER - ORION A211_240408A
Lab ID: **ICV_1_240404_1**	Initial Calibration Verification Standard								04/05/24 09:19
pH, sat. paste	7.03	s.u.	0.10	100	98.6	101.4			
Lab ID: **CCV_1_240404_1**	Continuing Calibration Verification Standard								04/05/24 09:20
pH, sat. paste	7.03	s.u.	0.10	100	98.6	101.4			
Lab ID: **CCV1_1_240404_1**	Continuing Calibration Verification Standard								04/05/24 09:21
pH, sat. paste	4.00	s.u.	0.10	100	97.5	102.5			
Lab ID: **CCV_3_240404_1**	Continuing Calibration Verification Standard								04/05/24 09:37
pH, sat. paste	7.02	s.u.	0.10	100	98.6	101.4			
Method: **ASA10-3**									Batch: 71133
Lab ID: **LCS-71133**	Laboratory Control Sample				Run: SOIL PH METER - ORION A2				04/05/24 09:22
pH, sat. paste	7.86	s.u.	0.10	99	95	105			
Lab ID: **B24040029-005ADUP**	Sample Duplicate				Run: SOIL PH METER - ORION A2				04/05/24 09:28
pH, sat. paste	8.08	s.u.	0.10				0.1	20	
Lab ID: **B24040029-010ADUP**	Sample Duplicate				Run: SOIL PH METER - ORION A2				04/05/24 09:41
pH, sat. paste	7.94	s.u.	0.10				0.3	20	

Qualifiers:

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: WSP Albuquerque **Work Order:** B24040029 **Report Date:** 04/17/24

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **ASA15-5**									Batch: 71170
Lab ID: **LCS-71170**	Laboratory Control Sample				Run: SOIL HYDROMETER_240409				04/08/24 16:31
Sand	48.0	%	1.0	100	70	130			
Silt	30.0	%	1.0	103	70	130			
Clay	22.0	%	1.0	96	70	130			
Lab ID: **B24040029-010ADUP**	Sample Duplicate				Run: SOIL HYDROMETER_240409				04/08/24 16:31
Sand	78.0	%	1.0				2.6	20	
Silt	12.0	%	1.0				15	20	
Clay	10.0	%	1.0				0.0	20	
Texture	SL		1.0						

Qualifiers:

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: WSP Albuquerque **Work Order:** B24040029 **Report Date:** 04/17/24

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **ASA24-5**								Analytical Run: SEAL AA500_240411B	
Lab ID: **CCV**	Continuing Calibration Verification Standard								04/11/24 11:35
Phosphorus, Olsen	2.5	mg/kg-dry	1.0	100	85	115			
Lab ID: **CCV**	Continuing Calibration Verification Standard								04/11/24 12:04
Phosphorus, Olsen	2.5	mg/kg-dry	1.0	100	85	115			
Lab ID: **CCV**	Continuing Calibration Verification Standard								04/11/24 12:29
Phosphorus, Olsen	2.5	mg/kg-dry	1.0	99	85	115			
Lab ID: **CCV**	Continuing Calibration Verification Standard								04/11/24 12:49
Phosphorus, Olsen	2.5	mg/kg-dry	1.0	99	85	115			
Method: **ASA24-5**								Batch: 71146	
Lab ID: **MB-71146**	Method Blank				Run: SEAL AA500_240411B				04/11/24 11:40
Phosphorus, Olsen	ND	mg/kg-dry	0.05						
Lab ID: **LCS-71146**	Laboratory Control Sample				Run: SEAL AA500_240411B				04/11/24 11:43
Phosphorus, Olsen	57	mg/kg-dry	1.0	129	70	130			
Lab ID: **B24040029-001AMS**	Sample Matrix Spike				Run: SEAL AA500_240411B				04/11/24 12:22
Phosphorus, Olsen	40	mg/kg-dry	1.0	99	80	120			
Lab ID: **B24040029-002Adup**	Sample Duplicate				Run: SEAL AA500_240411B				04/11/24 12:25
Phosphorus, Olsen	ND	mg/kg-dry	1.0					30	
Lab ID: **B24040029-011Adup**	Sample Duplicate				Run: SEAL AA500_240411B				04/11/24 12:47
Phosphorus, Olsen	ND	mg/kg-dry	1.0					30	

Qualifiers:

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: WSP Albuquerque **Work Order:** B24040029 **Report Date:** 04/17/24

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: ASA29-3									Batch: 71167
Lab ID: LCS-71167	Laboratory Control Sample				Run: MISC SOILS_240411A				04/11/24 15:23
Organic Matter	1.22	%	0.17	101	70	130			
Lab ID: MB-71167	Method Blank				Run: MISC SOILS_240411A				04/11/24 15:23
Organic Matter	ND	%	0.2						
Lab ID: B24040029-010ADUP	Sample Duplicate				Run: MISC SOILS_240411A				04/11/24 15:23
Organic Matter	ND	%	0.17						

Qualifiers:

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: WSP Albuquerque **Work Order:** B24040029 **Report Date:** 04/17/24

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **ASA33-8**								Analytical Run: SEAL AA500_240411A	
Lab ID: **ICV**	Initial Calibration Verification Standard							04/11/24 16:02	
Nitrate as N, KCL Extract	1.06	mg/kg-dry	1.0	106	90	110			
Lab ID: **CCV**	Continuing Calibration Verification Standard							04/11/24 18:03	
Nitrate as N, KCL Extract	0.958	mg/kg-dry	1.0	96	90	110			
Lab ID: **CCV**	Continuing Calibration Verification Standard							04/11/24 18:18	
Nitrate as N, KCL Extract	0.968	mg/kg-dry	1.0	97	90	110			
Lab ID: **CCV**	Continuing Calibration Verification Standard							04/11/24 18:34	
Nitrate as N, KCL Extract	0.958	mg/kg-dry	1.0	96	90	110			
Method: **ASA33-8**								Batch: 71154	
Lab ID: **MB-71154**	Method Blank				Run: SEAL AA500_240411A			04/11/24 16:56	
Nitrate as N, KCL Extract	0.4	mg/kg-dry	0.2						
Lab ID: **LCS-71154**	Laboratory Control Sample				Run: SEAL AA500_240411A			04/11/24 17:02	
Nitrate as N, KCL Extract	8.88	mg/kg-dry	1.0	111	70	130			
Lab ID: **H24040143-001AMS**	Sample Matrix Spike				Run: SEAL AA500_240411A			04/11/24 18:10	
Nitrate as N, KCL Extract	13.0	mg/kg-dry	1.0	96	80	120			
Lab ID: **B24040029-010Adup**	Sample Duplicate				Run: SEAL AA500_240411A			04/11/24 18:32	
Nitrate as N, KCL Extract	0.726	mg/kg-dry	1.0					30	
Lab ID: **B24040029-010Adup**	Sample Duplicate				Run: SEAL AA500_240411A			04/11/24 18:32	
Nitrate as N, KCL Extract	0.73	mg/kg-dry	1.0					30	

Qualifiers:

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: WSP Albuquerque **Work Order:** B24040029 **Report Date:** 04/17/24

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: SW6010B									Analytical Run: ICP2-HE_240410C
Lab ID: ICV	Initial Calibration Verification Standard								04/10/24 11:10
Sodium	41.7	mg/L	1.0	104	90	110			
Lab ID: ICSA	Interference Check Sample A								04/10/24 11:51
Sodium	0.0746	mg/L	1.0		0	0			
Lab ID: ICSAB	Interference Check Sample AB								04/10/24 11:55
Sodium	19.7	mg/L	1.0	99	80	120			
Lab ID: CCV	Continuing Calibration Verification Standard								04/11/24 08:32
Sodium	25.2	mg/L	1.0	101	90	110			
Lab ID: CCV	Continuing Calibration Verification Standard								04/11/24 09:18
Sodium	25.3	mg/L	1.0	101	90	110			
Lab ID: CCV	Continuing Calibration Verification Standard								04/11/24 09:59
Sodium	24.1	mg/L	1.0	96	90	110			
Method: SW6010B									Batch: 71144
Lab ID: MB-71144	Method Blank				Run: ICP2-HE_240410C				04/11/24 08:24
Sodium	0.4	mg/kg	0.3						
Cation Exchange Capacity	0.04	meq/100g	0.03						
Lab ID: LCS-71144	Laboratory Control Sample				Run: ICP2-HE_240410C				04/11/24 08:39
Sodium	261	mg/kg	1.0	94	70	130			
Cation Exchange Capacity	22.7	meq/100g	0.087	94	70	130			
Lab ID: B24040029-001AMS2	Sample Matrix Spike				Run: ICP2-HE_240410C				04/11/24 08:51
Sodium	626	mg/kg	1.0	97	75	125			
Cation Exchange Capacity	54.5	meq/100g	0.087	97	75	125			
Lab ID: B24040029-001AMSD2	Sample Matrix Spike Duplicate				Run: ICP2-HE_240410C				04/11/24 08:55
Sodium	645	mg/kg	1.0	101	75	125	2.9	20	
Cation Exchange Capacity	56.1	meq/100g	0.087	101	75	125	2.9	20	

Qualifiers:

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: WSP Albuquerque **Work Order:** B24040029 **Report Date:** 04/17/24

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **SW6010B**									Analytical Run: ICP2-HE_240412A
Lab ID: **ICV**	Initial Calibration Verification Standard								04/12/24 08:42
Potassium	40.7	mg/L	1.0	102	90	110			
Lab ID: **ICSA**	Interference Check Sample A								04/12/24 08:58
Potassium	0.0425	mg/L	1.0		0	0			
Lab ID: **ICSAB**	Interference Check Sample AB								04/12/24 09:02
Potassium	20.1	mg/L	1.0	100	80	120			
Lab ID: **CCV**	Continuing Calibration Verification Standard								04/12/24 11:10
Potassium	26.0	mg/L	1.0	104	90	110			
Lab ID: **CCV**	Continuing Calibration Verification Standard								04/12/24 11:54
Potassium	26.5	mg/L	1.0	106	90	110			
Lab ID: **CCV**	Continuing Calibration Verification Standard								04/12/24 12:32
Potassium	26.3	mg/L	1.0	105	90	110			
Lab ID: **CCV**	Continuing Calibration Verification Standard								04/12/24 13:18
Potassium	26.7	mg/L	1.0	107	90	110			
Method: **SW6010B**									Batch: 71152
Lab ID: **MB-71152**	Method Blank				Run: ICP2-HE_240412A				04/12/24 11:17
Potassium	3	mg/kg	1						
Lab ID: **LCS-71152**	Laboratory Control Sample				Run: ICP2-HE_240412A				04/12/24 11:25
Potassium	610	mg/kg	1.2	98	70	130			
Lab ID: **B24040029-006AMS2**	Sample Matrix Spike				Run: ICP2-HE_240412A				04/12/24 12:13
Potassium	1150	mg/kg	1.3	109	75	125			
Lab ID: **B24040029-006AMSD2**	Sample Matrix Spike Duplicate				Run: ICP2-HE_240412A				04/12/24 12:17
Potassium	1140	mg/kg	1.3	109	75	125	0.5	20	

Qualifiers:

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: WSP Albuquerque **Work Order:** B24040029 **Report Date:** 04/17/24

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **SW6020**								Analytical Run: ICPMS206-H_240412A	
Lab ID: **ICV**	Initial Calibration Verification Standard								04/12/24 16:29
Arsenic	0.0592	mg/L	0.0010	99	90	110			
Cadmium	0.0302	mg/L	0.0010	101	90	110			
Copper	0.0603	mg/L	0.0010	100	90	110			
Iron	0.302	mg/L	0.0010	101	90	110			
Lead	0.0572	mg/L	0.0010	95	90	110			
Manganese	0.313	mg/L	0.0010	104	90	110			
Molybdenum	0.0572	mg/L	0.0010	95	90	110			
Nickel	0.0601	mg/L	0.0010	100	90	110			
Lab ID: **ICSA**	Interference Check Sample A								04/12/24 16:39
Arsenic	-0.000108	mg/L	0.0010						
Cadmium	0.000132	mg/L	0.0010						
Copper	0.0000308	mg/L	0.0010						
Iron	102	mg/L	0.0010	101	70	130			
Lead	0.000841	mg/L	0.0010						
Manganese	0.000300	mg/L	0.0010		0	0			
Molybdenum	0.844	mg/L	0.0010	105	70	130			
Nickel	0.000243	mg/L	0.0010		0	0			
Lab ID: **ICSAB**	Interference Check Sample AB								04/12/24 16:45
Arsenic	0.0102	mg/L	0.0010	102	70	130			
Cadmium	0.0104	mg/L	0.0010	104	70	130			
Copper	0.0198	mg/L	0.0010	99	70	130			
Iron	101	mg/L	0.0010	101	70	130			
Lead	-0.0000525	mg/L	0.0010		0	0			
Manganese	0.0207	mg/L	0.0010	103	70	130			
Molybdenum	0.859	mg/L	0.0010	107	70	130			
Nickel	0.0203	mg/L	0.0010	101	70	130			
Lab ID: **CCV**	Continuing Calibration Verification Standard								04/12/24 19:25
Arsenic	0.0514	mg/L	0.0010	103	90	110			
Cadmium	0.0507	mg/L	0.0010	101	90	110			
Copper	0.0516	mg/L	0.0010	103	90	110			
Iron	1.35	mg/L	0.0010	104	90	110			
Lead	0.0493	mg/L	0.0010	99	90	110			
Manganese	0.0517	mg/L	0.0010	103	90	110			
Molybdenum	0.0512	mg/L	0.0010	102	90	110			
Nickel	0.0514	mg/L	0.0010	103	90	110			
Lab ID: **CCV**	Continuing Calibration Verification Standard								04/12/24 20:28
Arsenic	0.0546	mg/L	0.0010	109	90	110			
Cadmium	0.0521	mg/L	0.0010	104	90	110			
Copper	0.0530	mg/L	0.0010	106	90	110			
Iron	1.40	mg/L	0.0010	107	90	110			
Lead	0.0500	mg/L	0.0010	100	90	110			

Qualifiers:

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: WSP Albuquerque **Work Order:** B24040029 **Report Date:** 04/17/24

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **SW6020**									Analytical Run: ICPMS206-H_240412A
Lab ID: **CCV**	Continuing Calibration Verification Standard								04/12/24 20:28
Manganese	0.0520	mg/L	0.0010	104	90	110			
Molybdenum	0.0517	mg/L	0.0010	103	90	110			
Nickel	0.0525	mg/L	0.0010	105	90	110			
Lab ID: **CCV**	Continuing Calibration Verification Standard								04/12/24 21:11
Arsenic	0.0540	mg/L	0.0010	108	90	110			
Cadmium	0.0508	mg/L	0.0010	102	90	110			
Copper	0.0524	mg/L	0.0010	105	90	110			
Iron	1.34	mg/L	0.0010	103	90	110			
Lead	0.0494	mg/L	0.0010	99	90	110			
Manganese	0.0517	mg/L	0.0010	103	90	110			
Molybdenum	0.0504	mg/L	0.0010	101	90	110			
Nickel	0.0518	mg/L	0.0010	104	90	110			
Method: **SW6020**									Batch: 71156
Lab ID: **MB-71156**	Method Blank				Run: ICPMS206-H_240412A				04/12/24 19:32
Arsenic	0.005	mg/kg	0.001						
Cadmium	0.0007	mg/kg	0.0005						
Copper	0.07	mg/kg	0.01						
Iron	ND	mg/kg	0.5						
Lead	ND	mg/kg	0.005						
Manganese	ND	mg/kg	0.02						
Molybdenum	ND	mg/kg	0.002						
Nickel	ND	mg/kg	0.01						
Zinc	0.2	mg/kg	0.06						
Lab ID: **LCS-71156**	Laboratory Control Sample				Run: ICPMS206-H_240412A				04/12/24 19:35
Arsenic	0.163	mg/kg	0.10	94	70	130			
Copper	6.39	mg/kg	0.10	111	70	130			
Iron	97.2	mg/kg	1.0	83	70	130			
Lead	2.73	mg/kg	0.10	92	70	130			
Manganese	9.88	mg/kg	0.10	108	70	130			
Molybdenum	0.277	mg/kg	0.10	102	70	130			
Nickel	2.24	mg/kg	0.10	94	70	130			
Zinc	10.8	mg/kg	0.10	114	70	130			
Lab ID: **LFB-71156**	Laboratory Fortified Blank				Run: ICPMS206-H_240412A				04/12/24 20:18
Arsenic	5.74	mg/kg	0.10	115	80	120			
Cadmium	5.22	mg/kg	0.10	104	80	120			
Copper	5.75	mg/kg	0.10	115	80	120			
Lead	4.84	mg/kg	0.10	97	80	120			
Molybdenum	5.00	mg/kg	0.10	100	80	120			
Nickel	5.65	mg/kg	0.10	113	80	120			
Zinc	5.63	mg/kg	0.10	113	80	120			

Qualifiers:

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: WSP Albuquerque **Work Order:** B24040029 **Report Date:** 04/17/24

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **SW6020**									Batch: 71156
Lab ID: **B24040029-001AMS**	Sample Matrix Spike				Run: ICPMS206-H_240412A				04/12/24 20:21
Arsenic	6.00	mg/kg	0.10	119	75	125			
Cadmium	5.39	mg/kg	0.10	106	75	125			
Copper	34.4	mg/kg	0.10		75	125			A
Lead	5.37	mg/kg	0.10	97	75	125			
Molybdenum	5.24	mg/kg	0.10	103	75	125			
Nickel	5.60	mg/kg	0.10	111	75	125			
Zinc	7.72	mg/kg	0.10	111	75	125			

Qualifiers:

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

A - Analyte level was greater than four times the spike level - in accordance with the method, percent recovery is not calculated

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: WSP Albuquerque **Work Order:** B24040029 **Report Date:** 04/17/24

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **SW6020**								Analytical Run: ICPMS206-H_240414A	
Lab ID: **ICV**	Initial Calibration Verification Standard							04/14/24 13:46	
Zinc	0.0604	mg/L	0.0010	101	90	110			
Lab ID: **ICSA**	Interference Check Sample A							04/14/24 13:59	
Zinc	0.000362	mg/L	0.0010						
Lab ID: **ICSAB**	Interference Check Sample AB							04/14/24 14:05	
Zinc	0.0119	mg/L	0.0010	119	70	130			
Lab ID: **CCV**	Continuing Calibration Verification Standard							04/14/24 19:14	
Zinc	0.0520	mg/L	0.0010	104	90	110			
Lab ID: **CCV**	Continuing Calibration Verification Standard							04/14/24 19:47	
Zinc	0.0529	mg/L	0.0010	106	90	110			
Lab ID: **CCV**	Continuing Calibration Verification Standard							04/14/24 20:20	
Zinc	0.0530	mg/L	0.0010	106	90	110			
Lab ID: **ICV**	Initial Calibration Verification Standard							04/15/24 00:08	
Zinc	0.0596	mg/L	0.0010	99	90	110			
Lab ID: **ICSA**	Interference Check Sample A							04/15/24 00:18	
Zinc	0.000387	mg/L	0.0010						
Lab ID: **ICSAB**	Interference Check Sample AB							04/15/24 00:25	
Zinc	0.0117	mg/L	0.0010	117	70	130			
Method: **SW6020**								Batch: 71156	
Lab ID: **MB-71156**	Method Blank				Run: ICPMS206-H_240414A			04/14/24 19:20	
Arsenic	0.003	mg/kg	0.0005						
Cadmium	0.0003	mg/kg	0.0003						
Copper	0.06	mg/kg	0.007						
Iron	ND	mg/kg	0.2						
Lead	ND	mg/kg	0.003						
Manganese	0.02	mg/kg	0.009						
Molybdenum	0.001	mg/kg	0.0008						
Nickel	0.006	mg/kg	0.005						
Zinc	0.04	mg/kg	0.03						
Lab ID: **B24040029-004Adup**	Sample Duplicate				Run: ICPMS206-H_240414A			04/14/24 19:40	
Arsenic	0.0532	mg/kg	0.10					20	
Cadmium	0.239	mg/kg	0.10				1.8	20	
Copper	11.3	mg/kg	0.10				2.8	20	
Iron	3.31	mg/kg	1.0				3.5	20	
Lead	2.15	mg/kg	0.10				4.3	20	
Manganese	1.24	mg/kg	0.10				2.2	20	
Molybdenum	0.0524	mg/kg	0.10					20	

Qualifiers:

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: WSP Albuquerque **Work Order:** B24040029 **Report Date:** 04/17/24

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **SW6020**									Batch: 71156
Lab ID: **B24040029-004Adup**	Sample Duplicate				Run: ICPMS206-H_240414A				04/14/24 19:40
Nickel	0.00768	mg/kg	0.10					20	
Zinc	6.38	mg/kg	0.10				1.2	20	
Lab ID: **B24040029-001AMS**	Sample Matrix Spike				Run: ICPMS206-H_240414A				04/14/24 19:44
Arsenic	2.90	mg/kg	0.10	114	75	125			
Cadmium	2.60	mg/kg	0.10	101	75	125			
Copper	31.1	mg/kg	0.10		75	125			A
Lead	2.91	mg/kg	0.10	94	75	125			
Molybdenum	2.53	mg/kg	0.10	98	75	125			
Nickel	2.65	mg/kg	0.10	105	75	125			
Zinc	4.66	mg/kg	0.10	108	75	125			

Qualifiers:

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

A - Analyte level was greater than four times the spike level - in accordance with the method, percent recovery is not calculated

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: WSP Albuquerque **Work Order:** B24040029 **Report Date:** 04/17/24

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **USDA27a**									Batch: 71133
Lab ID: **LCS-71133**	Laboratory Control Sample				Run: SOIL DRYING OVEN 2_24040				04/05/24 08:18
Saturation	42.7	%	0.10	102	80	120			
Lab ID: **B24040029-005ADUP**	Sample Duplicate				Run: SOIL DRYING OVEN 2_24040				04/05/24 08:18
Saturation	30.2	%	0.10				3.3	20	
Lab ID: **B24040029-010ADUP**	Sample Duplicate				Run: SOIL DRYING OVEN 2_24040				04/05/24 08:20
Saturation	31.1	%	0.10				2.0	20	

Qualifiers:

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

Work Order Receipt Checklist

WSP Albuquerque

B24040029

Login completed by: Addison A. Gilbert
Date Received: 4/1/2024
Reviewed by: cjones
Received by: AAG
Reviewed Date: 4/3/2024
Carrier name: Return-FedEx Ground

Shipping container/cooler in good condition?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on all shipping container(s)/cooler(s)?	Yes ☐	No ☐	Not Present ☑
Custody seals intact on all sample bottles?	Yes ☐	No ☐	Not Present ☑
Chain of custody present?	Yes ☑	No ☐	
Chain of custody signed when relinquished and received?	Yes ☐	No ☑	
Chain of custody agrees with sample labels?	Yes ☑	No ☐	
Samples in proper container/bottle?	Yes ☑	No ☐	
Sample containers intact?	Yes ☑	No ☐	
Sufficient sample volume for indicated test?	Yes ☑	No ☐	
All samples received within holding time? (Exclude analyses that are considered field parameters such as pH, DO, Res Cl, Sulfite, Ferrous Iron, etc.)	Yes ☑	No ☐	
Temp Blank received in all shipping container(s)/cooler(s)?	Yes ☐	No ☑	Not Applicable ☐
Container/Temp Blank temperature:	10.8°C No Ice		
Containers requiring zero headspace have no headspace or bubble that is <6mm (1/4").	Yes ☐	No ☐	No VOA vials submitted ☑
Water - pH acceptable upon receipt?	Yes ☐	No ☐	Not Applicable ☑

Standard Reporting Procedures:

Lab measurement of analytes considered field parameters that require analysis within 15 minutes of sampling such as pH, Dissolved Oxygen and Residual Chlorine, are qualified as being analyzed outside of recommended holding time.

Solid/soil samples are reported on a wet weight basis (as received) unless specifically indicated. If moisture corrected, data units are typically noted as –dry. For agricultural and mining soil parameters/characteristics, all samples are dried and ground prior to sample analysis.

The reference date for Radon analysis is the sample collection date. The reference date for all other Radiochemical analyses is the analysis date. Radiochemical precision results represent a 2-sigma Total Measurement Uncertainty.

For methods that require zero headspace or require preservation check at the time of analysis due to potential interference, the pH is verified at analysis. Nonconforming sample pH is documented as part of the analysis and included in the sample analysis comments.

Contact and Corrective Action Comments:

Samples were received without a collection time on the Chain of Custody or sample labels.

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Chain of Custody & Analytical Request Record

www.energylab.com

Account Information *(Billing information)*

Company/Name	WSP
Contact	Doug Romig
Phone	(505) 821-3043
Mailing Address	6616 Gulton Court NE, Suite 10
City, State, Zip	Albuquerque, NM 87109
Email	doug.romig@wsp.com
Receive Invoice	☐Hard Copy ■Email
Receive Report	☐Hard Copy ■Email
Purchase Order	
Quote	B 17172
Bottle Order	

Report Information *(if different than Account Information)*

Company/Name	
Contact	
Phone	
Mailing Address	
City, State, Zip	
Email	
Receive Report	☐Hard Copy ■Email
Special Report/Formats:	☐ LEVEL IV ☐ NELAC ☐ EDD/EDT *(contact laboratory)* ☐ Other_____

Comments

Please retain samples for potential additional testing.

Project Information

Project Name, PWSID, Permit, etc.	[redacted] US-USP-3406432341
Sampler Name: Nicholas Buchanan	Sampler Phone: (951) 403-1528
Sample Origin State: NM	EPA/State Compliance: ☐ Yes ■ No

URANIUM MINING CLIENTS MUST indicate sample type.
☐ NOT Source or Byproduct Material
☐ Source/Processed Ore (Ground or Refined) **CALL BEFORE SENDING
☐ 11e.(2) Byproduct Material (Can ONLY be Submitted to ELI Casper Location)

Matrix Codes
A - Air
W - Water
S - Soils/Solids
V - Vegetation
B - Bioassay
O - Other
DW - Drinking Water

All turnaround times are standard unless marked as RUSH.
Energy Laboratories MUST be contacted prior to RUSH sample submittal for charges and scheduling – See Instructions Page

	Sample Identification (Name, Location, Interval, etc.)	Collection Date	Collection Time	Number of Containers	Matrix (See Codes Above)	See Attached	RUSH TAT	ELI LAB ID (Laboratory Use Only)
1	NRW-0324-01	3/9/24		1	S	●		B24040029
2	NRW-0324-02			1	S	●		
3	NRW-0324-03			1	S	●		
4	NRW-0324-04			1	S	●		
5	NRW-0324-05			1	S	●		
6	NRW-0324-06			1	S	●		
7	NRW-0324-07			1	S	●		
8	NRW-0324-08			1	S	●		
9	NRW-0324-09			1	S	●		
10	NRW-0324-10			1	S	●		

Custody Record MUST be signed	Relinquished by (print)	Date/Time	Signature	Received by (print)	Date/Time	Signature
	Relinquished by (print)	Date/Time	Signature	Received by Laboratory (print)	Date/Time	Signature
				[illegible]	1/8/24 0950	

LABORATORY USE ONLY

Shipped By	Cooler ID(s)	Custody Seals Y N C B	Intact Y N	Receipt Temp °C	Temp Blank Y N	On Ice Y N	Payment Type CC Cash Check_____	Amount $	Receipt Number *(cash/check only)*

In certain circumstances, samples submitted to Energy Laboratories, Inc. may be subcontracted to other certified laboratories in order to complete the analysis requested. This serves as notice of this possibility. All subcontracted data will be clearly notated on your analytical report.

ELI-COC-10/18 v.3

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Chain of Custody & Analytical Request Record

www.energylab.com

Account Information *(Billing information)*

Company/Name	WSP
Contact	Doug Romig
Phone	(505) 821-3043
Mailing Address	6616 Gulton Court NE, Suite 10
City, State, Zip	Albuquerque, NM 87109
Email	doug.romig@wsp.com
Receive Invoice	☐Hard Copy ■Email
Receive Report	☐Hard Copy ■Email
Purchase Order	
Quote	NA
Bottle Order	

Report Information *(if different than Account Information)*

Company/Name	
Contact	
Phone	
Mailing Address	
City, State, Zip	
Email	
Receive Report	☐Hard Copy ■Email
Special Report/Formats:	☐ LEVEL IV ☐ NELAC ☐ EDD/EDT *(contact laboratory)* ☐ Other_____

Comments

Please retain samples for potential additional testing.

Project Information

Project Name, PWSID, Permit, etc.	GL21455130.001
Sampler Name	Nicholas Buchanan
Sampler Phone	(951) 403-1528
Sample Origin State	NM
EPA/State Compliance	☐ Yes ■ No

URANIUM MINING CLIENTS MUST indicate sample type.
☐ NOT Source or Byproduct Material
☐ Source/Processed Ore (Ground or Refined) **CALL BEFORE SENDING
☐ 11e.(2) Byproduct Material (Can ONLY be Submitted to ELI Casper Location)

Matrix Codes

A - Air
W - Water
S - Soils/Solids
V - Vegetation
B - Bioassay
O - Other
DW - Drinking Water

All turnaround times are standard unless marked as RUSH.
Energy Laboratories MUST be contacted prior to RUSH sample submittal for charges and scheduling – See Instructions Page

	Sample Identification *(Name, Location, Interval, etc.)*	Collection Date	Collection Time	Number of Containers	Matrix *(See Codes Above)*	Analysis Requested: See Attached	RUSH TAT	ELI LAB ID *Laboratory Use Only*
1	NRW-0324-WR	3/5/24		1	S	●		B24040029
2				1	S	●		
3				1	S	●		
4				1	S	●		
5				1	S	●		
6				1	S	●		
7				1	S	●		
8				1	S	●		
9				1	S	●		
10				1	S	●		

Custody Record MUST be signed	Relinquished by (print)	Date/Time	Signature	Received by (print)	Date/Time	Signature
	Relinquished by (print)	Date/Time	Signature	Received by Laboratory (print)	Date/Time 3/8/24 0850	Signature

LABORATORY USE ONLY

Shipped By	Cooler ID(s)	Custody Seals Y N C B	Intact Y N	Receipt Temp °C	Temp Blank Y N	On Ice Y N	Payment Type CC Cash Check_____	Amount $	Receipt Number *(cash/check only)*

In certain circumstances, samples submitted to Energy Laboratories, Inc. may be subcontracted to other certified laboratories in order to complete the analysis requested.
This serves as notice of this possibility. All subcontracted data will be clearly notated on your analytical report.

ELI-COC-10/18 v.3

LABORATORY TESTING FOR TYRONE MINE – NRW STOCKPILE SOIL CHARACTERIZATION

This letter accompanies 2 coolers with 21 soil samples for the Tyrone Little Rock Mine NRW Stockpile characterization project. Please analyze the samples for the following parameters:

Analysis/Parameter	Source-Method
Saturated Paste pH	SLS 1954, Method 2 and 21a
Electrical Conductivity, saturated paste	SLS 1954, Method 3a and 4b
Saturation Percentage	SLS 1954, Method 27a
Particle Size Analysis	ASA 1982, Method 15-5
Organic Matter (Carbon)	ASA 1982, Method 29-3.5.2
N as Nitrate	ASA 1982, Method 33-8.1
Phosphorous (Olsen)	ASA 1982, Method 24-5.4
Potassium	ASA 1982, Method 13-3.5
Cation Exchange Capacity	SLS 1954, Method 19
AB-DTPA extraction	ASA 1982, Method 3-5.2
Extractable Metals (As, Cd, Cu, Fe, Pb, Mn, Mo, Ni, and Zn)	EPA Method 6010/6020

Please call (505) 962-2933 or email (doug.romig@wsp.com) if you have any questions.

Sincerely,

WSP USA Inc.

WSP USA Inc.
701 Emerson Road, Suite 250, Creve Coeur, Missouri, 63141
T: +1 314 984 8800 F: +1 314 984-8770

wsp.com

ANALYTICAL SUMMARY REPORT

April 18, 2024

WSP Albuquerque
6616 Gulton Ct NE Ste 10
Albuquerque, NM 87109-4452

Work Order: B24040039 Quote ID: B17192

Project Name: US-WSP-31406439.7541

Energy Laboratories Inc Billings MT received the following 10 samples for WSP Albuquerque on 4/1/2024 for analysis.

Lab ID	Client Sample ID	Collect Date	Receive Date	Matrix	Test
B24040039-001	9A-1	09/22/23 0:00	04/01/24	Soil	ABDPTA extractable metals Cation Exchange Capacity Metals, NH4OAC Extractable Conductivity, Saturated Paste Extract Nitrate as N, KCL Extract Organic Carbon/Matter Walkley-Black pH, Saturated Paste Phosphorus-Olsen ABDTPA extraction for metals ASA3-5.2 NH4AC Soil Extraction for CEC USDA19 KCL Soil Extract ASA33-3 Ammonium Acetate Extraction ASA13-3 Saturated Paste Extraction ASA Particle Size Analysis / Texture Saturation Percentage
B24040039-002	9A-2	09/22/23 0:00	04/01/24	Soil	Same As Above
B24040039-003	9A-3	09/22/23 0:00	04/01/24	Soil	Same As Above
B24040039-004	NRW-1	09/23/23 0:00	04/01/24	Soil	Same As Above
B24040039-005	NRW-2	09/23/23 0:00	04/01/24	Soil	Same As Above
B24040039-006	NRW-3	09/23/23 0:00	04/01/24	Soil	Same As Above
B24040039-007	NRW-4	09/23/23 0:00	04/01/24	Soil	Same As Above
B24040039-008	HR-1	09/22/23 0:00	04/01/24	Soil	Same As Above
B24040039-009	HR-2	09/22/23 0:00	04/01/24	Soil	Same As Above
B24040039-010	HR-3	09/22/23 0:00	04/01/24	Soil	Same As Above

The analyses presented in this report were performed by Energy Laboratories, Inc., 1120 S 27th St., Billings, MT 59101, unless otherwise noted. Any exceptions or problems with the analyses are noted in the report package. Any issues encountered during sample receipt are documented in the Work Order Receipt Checklist.

The results as reported relate only to the item(s) submitted for testing. This report shall be used or copied only in its entirety. Energy Laboratories, Inc. is not responsible for the consequences arising from the use of a partial report.

If you have any questions regarding these test results, please contact your Project Manager.

Report Approved By:

Technical Data Reviewer

Digitally signed by
Keri Conter
Date: 2024.04.18 10:32:57 -06:00

CLIENT: WSP Albuquerque
Project: US-WSP-31406439.7541
Work Order: B24040039

Report Date: 04/18/24

CASE NARRATIVE

Tests associated with analyst identified as ELI-H were subcontracted to Energy Laboratories, 3161 East Lyndale Ave, Helena, MT, EPA Number MT00945.

LABORATORY ANALYTICAL REPORT

Prepared by Billings, MT Branch

Client: WSP Albuquerque
Project: US-WSP-31406439.7541
Workorder: B24040039

Report Date: 04/18/24
Date Received: 04/01/24

	Analysis	Sand	Silt	Clay	Texture	pH, sat_ paste	COND	Saturation	Organic Matter	Organic Carbon	CEC	Phos, Olsen	Nitrate as N	K-NH4OAC
	Units	%	%	%		s_u_	mmhos/cm	%	%	%	meq/100g	mg/kg-dry	mg/kg-dry	mg/kg
Sample ID	**Client Sample ID**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**
B24040039-001	9A-1	70	18	12	SL	8.0	0.4	30.2	< 0.2	< 0.1	11.9	1	< 1	75
B24040039-002	9A-2	70	16	14	SL	7.7	0.4	32.1	< 0.2	< 0.1	12.2	1	1	63
B24040039-003	9A-3	72	16	12	SL	7.5	0.3	30.4	< 0.2	< 0.1	15.0	< 1	1	58
B24040039-004	NRW-1	74	16	10	SL	8.1	0.2	29.6	< 0.2	< 0.1	8.77	< 1	1	65
B24040039-005	NRW-2	76	16	8	SL	8.0	0.3	27.9	< 0.2	< 0.1	6.43	< 1	2	64
B24040039-006	NRW-3	78	12	10	SL	8.0	0.2	28.4	< 0.2	< 0.1	10.8	< 1	2	62
B24040039-007	NRW-4	68	18	14	SL	7.4	0.1	38.9	< 0.2	< 0.1	17.4	< 1	< 1	72
B24040039-008	HR-1	66	18	16	SL	7.8	0.6	36.6	< 0.2	< 0.1	17.1	2	3	64
B24040039-009	HR-2	68	16	16	SL	7.6	0.4	35.3	0.3	0.2	13.7	1	3	83
B24040039-010	HR-3	74	14	12	SL	7.8	0.3	32.1	< 0.2	< 0.1	11.1	< 1	2	80

LABORATORY ANALYTICAL REPORT

Prepared by Billings, MT Branch

Client: WSP Albuquerque
Project: US-WSP-31406439.7541
Workorder: B24040039

Report Date: 04/18/24
Date Received: 04/01/24

	Analysis	As-ABDTPA	Cd-ABDTPA	Cu-ABDTPA	Fe-ABDTPA	Pb-ABDTPA	Mn-ABDTPA	Mo-ABDTPA	Ni-ABDTPA	Zn-ABDTPA
	Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Sample ID	**Client Sample ID**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**
B24040039-001	9A-1	0.04	0.1	66.8	7	0.6	3.5	0.3	< 0.1	6.7
B24040039-002	9A-2	0.03	< 0.1	63.9	7	0.5	4.0	0.2	< 0.1	3.2
B24040039-003	9A-3	0.02	< 0.1	50.9	5	0.3	2.5	0.2	< 0.1	2.4
B24040039-004	NRW-1	0.06	0.1	55.2	4	13.1	9.3	0.1	< 0.1	12.9
B24040039-005	NRW-2	0.14	< 0.1	74.2	5	26.8	4.8	0.2	< 0.1	11.0
B24040039-006	NRW-3	0.03	< 0.1	61.2	3	4.9	7.1	< 0.1	< 0.1	8.8
B24040039-007	NRW-4	0.02	< 0.1	71.4	3	2.7	15.4	0.2	< 0.1	3.8
B24040039-008	HR-1	0.03	0.1	54.8	5	1.5	4.3	0.2	< 0.1	4.6
B24040039-009	HR-2	0.03	0.2	87.4	7	5.8	2.5	0.1	< 0.1	8.4
B24040039-010	HR-3	0.02	< 0.1	22.8	3	0.2	2.4	0.3	< 0.1	2.3

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: WSP Albuquerque **Work Order:** B24040039 **Report Date:** 04/17/24

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **ASA10-3**									Analytical Run: SOIL EC_240408A
Lab ID: **ICV_1_240404_1**	Initial Calibration Verification Standard								04/05/24 12:22
Conductivity, sat. paste	1.40	mmhos/cm	0.10	99	90	110			
Lab ID: **CCV_1_240404_1**	Continuing Calibration Verification Standard								04/05/24 12:23
Conductivity, sat. paste	5.05	mmhos/cm	0.10	101	90	110			
Lab ID: **CCV1_1_240404_1**	Continuing Calibration Verification Standard								04/05/24 12:23
Conductivity, sat. paste	0.963	mmhos/cm	0.10	96	90	110			
Lab ID: **CCV_3_240404_1**	Continuing Calibration Verification Standard								04/05/24 12:33
Conductivity, sat. paste	4.99	mmhos/cm	0.10	100	90	110			
Lab ID: **ICV_1_240404_1**	Initial Calibration Verification Standard								04/05/24 12:41
Conductivity, sat. paste	1.43	mmhos/cm	0.10	101	90	110			
Method: **ASA10-3**									Batch: 71132
Lab ID: **MB-71132**	Method Blank				Run: SOIL EC_240408A				04/05/24 12:24
Conductivity, sat. paste	ND	mmhos/cm	0.05						
Lab ID: **LCS-71132**	Laboratory Control Sample				Run: SOIL EC_240408A				04/05/24 12:24
Conductivity, sat. paste	4.01	mmhos/cm	0.10	103	80	120			
Lab ID: **B24040039-010ADUP**	Sample Duplicate				Run: SOIL EC_240408A				04/05/24 12:36
Conductivity, sat. paste	0.266	mmhos/cm	0.10				4.0	20	

Qualifiers:

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: WSP Albuquerque **Work Order:** B24040039 **Report Date:** 04/17/24

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **ASA10-3**									al Run: SOIL PH METER - ORION A211_240408A
Lab ID: **ICV_1_240404_1**	Initial Calibration Verification Standard								04/05/24 08:38
pH, sat. paste	7.04	s.u.	0.10	101	98.6	101.4			
Lab ID: **CCV_1_240404_1**	Continuing Calibration Verification Standard								04/05/24 08:39
pH, sat. paste	7.02	s.u.	0.10	100	98.6	101.4			
Lab ID: **CCV1_1_240404_1**	Continuing Calibration Verification Standard								04/05/24 08:39
pH, sat. paste	4.01	s.u.	0.10	100	97.5	102.5			
Lab ID: **CCV_3_240404_1**	Continuing Calibration Verification Standard								04/05/24 08:55
pH, sat. paste	7.00	s.u.	0.10	100	98.6	101.4			
Lab ID: **ICV_1_240404_1**	Initial Calibration Verification Standard								04/05/24 09:19
pH, sat. paste	7.03	s.u.	0.10	100	98.6	101.4			
Method: **ASA10-3**									Batch: 71132
Lab ID: **LCS-71132**	Laboratory Control Sample				Run: SOIL PH METER - ORION A2				04/05/24 08:41
pH, sat. paste	7.87	s.u.	0.10	99	95	105			
Lab ID: **B24040039-010ADUP**	Sample Duplicate				Run: SOIL PH METER - ORION A2				04/05/24 09:00
pH, sat. paste	7.80	s.u.	0.10				0.3	20	

Qualifiers:

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: WSP Albuquerque **Work Order:** B24040039 **Report Date:** 04/17/24

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **ASA15-5**									Batch: 71170
Lab ID: **LCS-71170**	Laboratory Control Sample				Run: SOIL HYDROMETER_240409				04/08/24 16:31
Sand	48.0	%	1.0	100	70	130			
Silt	30.0	%	1.0	103	70	130			
Clay	22.0	%	1.0	96	70	130			
Lab ID: **B24040039-010ADUP**	Sample Duplicate				Run: SOIL HYDROMETER_240409				04/08/24 16:31
Sand	74.0	%	1.0				0.0	20	
Silt	14.0	%	1.0				0.0	20	
Clay	12.0	%	1.0				0.0	20	
Texture	SL		1.0						

Qualifiers:

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: WSP Albuquerque **Work Order:** B24040039 **Report Date:** 04/17/24

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **ASA24-5**									Analytical Run: SEAL AA500_240417A
Lab ID: **CCV**	Continuing Calibration Verification Standard								04/17/24 10:46
Phosphorus, Olsen	2.5	mg/kg-dry	1.0	100	85	115			
Lab ID: **CCV**	Continuing Calibration Verification Standard								04/17/24 11:16
Phosphorus, Olsen	2.5	mg/kg-dry	1.0	99	85	115			
Method: **ASA24-5**									Batch: 71293
Lab ID: **MB-71293**	Method Blank				Run: SEAL AA500_240417A				04/17/24 10:50
Phosphorus, Olsen	ND	mg/kg-dry	0.05						
Lab ID: **LCS-71293**	Laboratory Control Sample				Run: SEAL AA500_240417A				04/17/24 10:52
Phosphorus, Olsen	52	mg/kg-dry	1.0	118	70	130			
Lab ID: **B24040039-001AMS**	Sample Matrix Spike				Run: SEAL AA500_240417A				04/17/24 10:55
Phosphorus, Olsen	42	mg/kg-dry	1.0	100	80	120			
Lab ID: **H24040277-001ADUP**	Sample Duplicate				Run: SEAL AA500_240417A				04/17/24 11:20
Phosphorus, Olsen	8.9	mg/kg-dry	1.0				5.3	30	

Qualifiers:

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: WSP Albuquerque **Work Order:** B24040039 **Report Date:** 04/17/24

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **ASA29-3**									Batch: 71166
Lab ID: **LCS-71166**	Laboratory Control Sample				Run: MISC SOILS_240410A				04/10/24 10:21
Organic Matter	1.26	%	0.17	104	70	130			
Lab ID: **MB-71166**	Method Blank				Run: MISC SOILS_240410A				04/10/24 10:21
Organic Matter	ND	%	0.2						
Lab ID: **B24040039-010ADUP**	Sample Duplicate				Run: MISC SOILS_240410A				04/10/24 10:21
Organic Matter	ND	%	0.17						

Qualifiers:

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: WSP Albuquerque **Work Order:** B24040039 **Report Date:** 04/17/24

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **ASA33-8**								Analytical Run: SEAL AA500_240411A	
Lab ID: **ICV**	Initial Calibration Verification Standard								04/11/24 16:02
Nitrate as N, KCL Extract	1.06	mg/kg-dry	1.0	106	90	110			
Lab ID: **CCV**	Continuing Calibration Verification Standard								04/11/24 17:46
Nitrate as N, KCL Extract	0.969	mg/kg-dry	1.0	97	90	110			
Lab ID: **CCV**	Continuing Calibration Verification Standard								04/11/24 18:03
Nitrate as N, KCL Extract	0.958	mg/kg-dry	1.0	96	90	110			
Lab ID: **ICV**	Initial Calibration Verification Standard								04/11/24 16:02
Nitrate as N, KCL Extract	1.1	mg/kg-dry	1.0	106	90	110			
Method: **ASA33-8**									Batch: 71153
Lab ID: **MB-71153**	Method Blank				Run: SEAL AA500_240411A				04/11/24 16:55
Nitrate as N, KCL Extract	0.4	mg/kg-dry	0.2						
Lab ID: **LCS-71153**	Laboratory Control Sample				Run: SEAL AA500_240411A				04/11/24 17:01
Nitrate as N, KCL Extract	8.88	mg/kg-dry	1.0	111	70	130			
Lab ID: **B24040039-001AMS**	Sample Matrix Spike				Run: SEAL AA500_240411A				04/11/24 17:56
Nitrate as N, KCL Extract	10.3	mg/kg-dry	1.0	95	80	120			
Lab ID: **B24040039-010Adup**	Sample Duplicate				Run: SEAL AA500_240411A				04/11/24 18:08
Nitrate as N, KCL Extract	1.57	mg/kg-dry	1.0				4.6	30	

Qualifiers:

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: WSP Albuquerque **Work Order:** B24040039 **Report Date:** 04/17/24

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: SW6010B								Analytical Run: ICP2-HE_240410C	
Lab ID: ICV	Initial Calibration Verification Standard							04/10/24 11:10	
Sodium	41.7	mg/L	1.0	104	90	110			
Lab ID: ICSA	Interference Check Sample A							04/10/24 11:51	
Sodium	0.0746	mg/L	1.0		0	0			
Lab ID: ICSAB	Interference Check Sample AB							04/10/24 11:55	
Sodium	19.7	mg/L	1.0	99	80	120			
Method: SW6010B								Batch: 71143	
Lab ID: MB-71143	Method Blank				Run: ICP2-HE_240410C			04/11/24 07:06	
Sodium	1	mg/kg	0.3						
Cation Exchange Capacity	0.08	meq/100g	0.03						
Lab ID: LCS-71143	Laboratory Control Sample				Run: ICP2-HE_240410C			04/11/24 07:14	
Sodium	257	mg/kg	1.0	93	70	130			
Cation Exchange Capacity	22.4	meq/100g	0.087	93	70	130			
Lab ID: B24040039-001AMS2	Sample Matrix Spike				Run: ICP2-HE_240410C			04/11/24 07:26	
Sodium	650	mg/kg	1.0	103	75	125			
Cation Exchange Capacity	56.5	meq/100g	0.087	103	75	125			
Lab ID: B24040039-001AMSD2	Sample Matrix Spike Duplicate				Run: ICP2-HE_240410C			04/11/24 07:29	
Sodium	630	mg/kg	1.0	99	75	125	3.0	20	
Cation Exchange Capacity	54.9	meq/100g	0.087	99	75	125	3.0	20	
Lab ID: B24040039-010Adup	Sample Duplicate				Run: ICP2-HE_240410C			04/11/24 08:16	
Sodium	119	mg/kg	1.0				7.3	30	H
Cation Exchange Capacity	10.3	meq/100g	0.087				7.3	30	H

Qualifiers:

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

H - Analysis performed past the method holding time

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: WSP Albuquerque **Work Order:** B24040039 **Report Date:** 04/17/24

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **SW6010B**									Analytical Run: ICP2-HE_240412A
Lab ID: **ICV**	Initial Calibration Verification Standard								04/12/24 08:42
Potassium	40.7	mg/L	1.0	102	90	110			
Lab ID: **ICSA**	Interference Check Sample A								04/12/24 08:58
Potassium	0.0425	mg/L	1.0		0	0			
Lab ID: **ICSAB**	Interference Check Sample AB								04/12/24 09:02
Potassium	20.1	mg/L	1.0	100	80	120			
Method: **SW6010B**									Batch: 71151
Lab ID: **MB-71151**	Method Blank				Run: ICP2-HE_240412A				04/12/24 09:36
Potassium	2	mg/kg	1						
Lab ID: **LCS-71151**	Laboratory Control Sample				Run: ICP2-HE_240412A				04/12/24 09:44
Potassium	584	mg/kg	1.2	94	70	130			
Lab ID: **B24040039-005AMS2**	Sample Matrix Spike				Run: ICP2-HE_240412A				04/12/24 10:31
Potassium	1140	mg/kg	1.3	107	75	125			
Lab ID: **B24040039-005AMSD2**	Sample Matrix Spike Duplicate				Run: ICP2-HE_240412A				04/12/24 10:35
Potassium	1130	mg/kg	1.3	107	75	125	0.5	20	

Qualifiers:

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: WSP Albuquerque **Work Order:** B24040039 **Report Date:** 04/17/24

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **SW6020**								Analytical Run: ICPMS206-H_240414A	
Lab ID: **ICV**	Initial Calibration Verification Standard								04/14/24 13:46
Arsenic	0.0583	mg/L	0.0010	97	90	110			
Cadmium	0.0301	mg/L	0.0010	100	90	110			
Copper	0.0596	mg/L	0.0010	99	90	110			
Iron	0.292	mg/L	0.0010	97	90	110			
Lead	0.0575	mg/L	0.0010	96	90	110			
Manganese	0.316	mg/L	0.0010	105	90	110			
Molybdenum	0.0565	mg/L	0.0010	94	90	110			
Nickel	0.0591	mg/L	0.0010	99	90	110			
Zinc	0.0604	mg/L	0.0010	101	90	110			
Lab ID: **ICSA**	Interference Check Sample A								04/14/24 13:59
Arsenic	-0.0000527	mg/L	0.0010						
Cadmium	0.000168	mg/L	0.0010						
Copper	0.0000608	mg/L	0.0010						
Iron	102	mg/L	0.0010	102	70	130			
Lead	0.000870	mg/L	0.0010						
Manganese	0.000321	mg/L	0.0010		0	0			
Molybdenum	0.872	mg/L	0.0010	109	70	130			
Nickel	0.000238	mg/L	0.0010		0	0			
Zinc	0.000362	mg/L	0.0010						
Lab ID: **ICSAB**	Interference Check Sample AB								04/14/24 14:05
Arsenic	0.0110	mg/L	0.0010	110	70	130			
Cadmium	0.0107	mg/L	0.0010	107	70	130			
Copper	0.0205	mg/L	0.0010	102	70	130			
Iron	104	mg/L	0.0010	104	70	130			
Lead	1.63E-08	mg/L	0.0010		0	0			
Manganese	0.0212	mg/L	0.0010	106	70	130			
Molybdenum	0.894	mg/L	0.0010	112	70	130			
Nickel	0.0211	mg/L	0.0010	106	70	130			
Zinc	0.0119	mg/L	0.0010	119	70	130			
Lab ID: **CCV**	Continuing Calibration Verification Standard								04/14/24 18:14
Arsenic	0.0510	mg/L	0.0010	102	90	110			
Cadmium	0.0512	mg/L	0.0010	102	90	110			
Copper	0.0512	mg/L	0.0010	102	90	110			
Iron	1.31	mg/L	0.0010	101	90	110			
Lead	0.0490	mg/L	0.0010	98	90	110			
Manganese	0.0496	mg/L	0.0010	99	90	110			
Molybdenum	0.0508	mg/L	0.0010	102	90	110			
Nickel	0.0507	mg/L	0.0010	101	90	110			
Zinc	0.0530	mg/L	0.0010	106	90	110			
Lab ID: **ICV**	Initial Calibration Verification Standard								04/15/24 00:08
Arsenic	0.0583	mg/L	0.0010	97	90	110			

Qualifiers:

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: WSP Albuquerque **Work Order:** B24040039 **Report Date:** 04/17/24

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **SW6020**								Analytical Run: ICPMS206-H_240414A	
Lab ID: **ICV**	Initial Calibration Verification Standard							04/15/24 00:08	
Cadmium	0.0294	mg/L	0.0010	98	90	110			
Copper	0.0594	mg/L	0.0010	99	90	110			
Iron	0.300	mg/L	0.0010	100	90	110			
Lead	0.0587	mg/L	0.0010	98	90	110			
Manganese	0.310	mg/L	0.0010	103	90	110			
Molybdenum	0.0561	mg/L	0.0010	94	90	110			
Nickel	0.0591	mg/L	0.0010	99	90	110			
Zinc	0.0596	mg/L	0.0010	99	90	110			
Lab ID: **ICSA**	Interference Check Sample A							04/15/24 00:18	
Arsenic	-0.0000426	mg/L	0.0010						
Cadmium	0.000140	mg/L	0.0010						
Copper	0.0000861	mg/L	0.0010						
Iron	107	mg/L	0.0010	107	70	130			
Lead	0.000915	mg/L	0.0010						
Manganese	0.000349	mg/L	0.0010		0	0			
Molybdenum	0.860	mg/L	0.0010	108	70	130			
Nickel	0.000242	mg/L	0.0010		0	0			
Zinc	0.000387	mg/L	0.0010						
Lab ID: **ICSAB**	Interference Check Sample AB							04/15/24 00:25	
Arsenic	0.0107	mg/L	0.0010	107	70	130			
Cadmium	0.0105	mg/L	0.0010	105	70	130			
Copper	0.0202	mg/L	0.0010	101	70	130			
Iron	107	mg/L	0.0010	107	70	130			
Lead	0.0000365	mg/L	0.0010		0	0			
Manganese	0.0213	mg/L	0.0010	106	70	130			
Molybdenum	0.898	mg/L	0.0010	112	70	130			
Nickel	0.0204	mg/L	0.0010	102	70	130			
Zinc	0.0117	mg/L	0.0010	117	70	130			
Method: **SW6020**								Batch: 71155	
Lab ID: **MB-71155**	Method Blank				Run: ICPMS206-H_240414A			04/14/24 18:21	
Arsenic	0.01	mg/kg	0.0005						
Cadmium	0.0007	mg/kg	0.0003						
Copper	0.04	mg/kg	0.007						
Iron	0.9	mg/kg	0.2						
Lead	ND	mg/kg	0.003						
Manganese	0.03	mg/kg	0.009						
Molybdenum	0.002	mg/kg	0.0008						
Nickel	0.008	mg/kg	0.005						
Zinc	0.05	mg/kg	0.03						
Lab ID: **LCS-71155**	Laboratory Control Sample				Run: ICPMS206-H_240414A			04/14/24 18:24	
Arsenic	0.170	mg/kg	0.10	98	70	130			

Qualifiers:

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: WSP Albuquerque **Work Order:** B24040039 **Report Date:** 04/17/24

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **SW6020**									Batch: 71155
Lab ID: **LCS-71155**	Laboratory Control Sample				Run: ICPMS206-H_240414A				04/14/24 18:24
Copper	6.04	mg/kg	0.10	105	70	130			
Iron	98.2	mg/kg	1.0	84	70	130			
Lead	2.70	mg/kg	0.10	91	70	130			
Manganese	9.25	mg/kg	0.10	101	70	130			
Molybdenum	0.263	mg/kg	0.10	97	70	130			
Nickel	2.09	mg/kg	0.10	87	70	130			
Zinc	10.9	mg/kg	0.10	115	70	130			
Lab ID: **B24040039-009Adup**	Sample Duplicate				Run: ICPMS206-H_240414A				04/14/24 19:01
Arsenic	0.0254	mg/kg	0.10					20	H
Cadmium	0.140	mg/kg	0.10				9.4	20	H
Copper	84.5	mg/kg	0.10				3.4	20	H
Iron	6.16	mg/kg	1.0				6.5	20	H
Lead	5.26	mg/kg	0.10				8.9	20	H
Manganese	2.36	mg/kg	0.10				6.4	20	H
Molybdenum	0.106	mg/kg	0.10				9.8	20	H
Nickel	0.0369	mg/kg	0.10					20	H
Zinc	7.90	mg/kg	0.10				5.8	20	H
Lab ID: **LFB-71155**	Laboratory Fortified Blank				Run: ICPMS206-H_240414A				04/14/24 19:07
Arsenic	2.89	mg/kg	0.10	116	80	120			
Cadmium	2.59	mg/kg	0.10	104	80	120			
Copper	2.74	mg/kg	0.10	110	80	120			
Lead	2.40	mg/kg	0.10	96	80	120			
Molybdenum	2.47	mg/kg	0.10	99	80	120			
Nickel	2.68	mg/kg	0.10	107	80	120			
Zinc	2.84	mg/kg	0.10	114	80	120			
Lab ID: **B24040039-001AMS**	Sample Matrix Spike				Run: ICPMS206-H_240414A				04/14/24 19:10
Arsenic	2.90	mg/kg	0.10	114	75	125			
Cadmium	2.73	mg/kg	0.10	104	75	125			
Copper	66.5	mg/kg	0.10		75	125			A
Lead	2.96	mg/kg	0.10	95	75	125			
Molybdenum	2.82	mg/kg	0.10	101	75	125			
Nickel	2.62	mg/kg	0.10	103	75	125			
Zinc	9.23	mg/kg	0.10	100	75	125			

Qualifiers:

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

A - Analyte level was greater than four times the spike level - in accordance with the method, percent recovery is not calculated

H - Analysis performed past the method holding time

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: WSP Albuquerque **Work Order:** B24040039 **Report Date:** 04/17/24

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **USDA27a**									Batch: 71132
Lab ID: **LCS-71132**	Laboratory Control Sample				Run: SOIL DRYING OVEN 2_24040				04/05/24 08:01
Saturation	40.0	%	0.10	96	80	120			
Lab ID: **B24040039-010ADUP**	Sample Duplicate				Run: SOIL DRYING OVEN 2_24040				04/05/24 08:03
Saturation	31.2	%	0.10				2.9	20	

Qualifiers:

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

Work Order Receipt Checklist

WSP Albuquerque

B24040039

Login completed by: Addison A. Gilbert
Date Received: 4/1/2024
Reviewed by: cjones
Received by: AAG
Reviewed Date: 4/3/2024
Carrier name: Return-FedEx Ground

Shipping container/cooler in good condition?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on all shipping container(s)/cooler(s)?	Yes ☐	No ☐	Not Present ☑
Custody seals intact on all sample bottles?	Yes ☐	No ☐	Not Present ☑
Chain of custody present?	Yes ☑	No ☐	
Chain of custody signed when relinquished and received?	Yes ☐	No ☑	
Chain of custody agrees with sample labels?	Yes ☑	No ☐	
Samples in proper container/bottle?	Yes ☑	No ☐	
Sample containers intact?	Yes ☑	No ☐	
Sufficient sample volume for indicated test?	Yes ☑	No ☐	
All samples received within holding time? (Exclude analyses that are considered field parameters such as pH, DO, Res Cl, Sulfite, Ferrous Iron, etc.)	Yes ☐	No ☑	
Temp Blank received in all shipping container(s)/cooler(s)?	Yes ☐	No ☑	Not Applicable ☐
Container/Temp Blank temperature:	13.0°C No Ice		
Containers requiring zero headspace have no headspace or bubble that is <6mm (1/4").	Yes ☐	No ☐	No VOA vials submitted ☑
Water - pH acceptable upon receipt?	Yes ☐	No ☐	Not Applicable ☑

Standard Reporting Procedures:

Lab measurement of analytes considered field parameters that require analysis within 15 minutes of sampling such as pH, Dissolved Oxygen and Residual Chlorine, are qualified as being analyzed outside of recommended holding time.

Solid/soil samples are reported on a wet weight basis (as received) unless specifically indicated. If moisture corrected, data units are typically noted as –dry. For agricultural and mining soil parameters/characteristics, all samples are dried and ground prior to sample analysis.

The reference date for Radon analysis is the sample collection date. The reference date for all other Radiochemical analyses is the analysis date. Radiochemical precision results represent a 2-sigma Total Measurement Uncertainty.

For methods that require zero headspace or require preservation check at the time of analysis due to potential interference, the pH is verified at analysis. Nonconforming sample pH is documented as part of the analysis and included in the sample analysis comments.

Contact and Corrective Action Comments:

Samples were received without a collection time on the Chain of Custody or sample labels.

Samples were received past the 180 day holding time for ABDPTA extractable metals, Cation Exchange Capacity, and NH4OAC Extractable Metals analyses. Samples were received past the 100 day holding time for KCL Soil Extract for Nitrate analysis. Proceed with all analyses per phone conversation with Doug Romig on 4/1/24.

ENERGY LABORATORIES
Trust our People. Trust our Data.

Chain of Custody & Analytical Request Record

www.energylab.com

Account Information *(Billing information)*

Company/Name	WSP
Contact	Doug Romig
Phone	(505) 821-3043
Mailing Address	6616 Gulton Court NE, Suite 10
City, State, Zip	Albuquerque, NM 87109
Email	doug.romig@wsp.com
Receive Invoice	☐Hard Copy ■Email
Receive Report	☐Hard Copy ■Email
Purchase Order	
Quote	317192
Bottle Order	

Report Information *(if different than Account Information)*

Company/Name	
Contact	
Phone	
Mailing Address	
City, State, Zip	
Email	
Receive Report	☐Hard Copy ■Email

Special Report/Formats:
☐ LEVEL IV ☐ NELAC ☐ EDD/EDT *(contact laboratory)* ☐ Other_____

Comments

Please retain samples for potential additional testing.

Project Information

Project Name, PWSID, Permit, etc.	~~GE21451130.001~~ US-WSP-31406439.2591
Sampler Name	Nicholas Buchanan
Sampler Phone	(951) 403-1528
Sample Origin State	NM
EPA/State Compliance	☐ Yes ■ No

URANIUM MINING CLIENTS MUST indicate sample type.
☐ NOT Source or Byproduct Material
☐ Source/Processed Ore (Ground or Refined) **CALL BEFORE SENDING
☐ 11e.(2) Byproduct Material (Can ONLY be Submitted to ELI Casper Location)

Matrix Codes
A - Air
W - Water
S - Soils/Solids
V - Vegetation
B - Bioassay
O - Other
DW - Drinking Water

All turnaround times are standard unless marked as RUSH.
Energy Laboratories MUST be contacted prior to RUSH sample submittal for charges and scheduling – See Instructions Page

	Sample Identification *(Name, Location, Interval, etc.)*	Collection Date	Collection Time	Number of Containers	Matrix *(See Codes Above)*	See Attached	RUSH TAT	ELI LAB ID *Laboratory Use Only*
1	9A-1	9/22/23		1	S	●		B24040039
2	9A-2	9/22/23		1	S	●		
3	9A-3	9/22/23		1	S	●		
4	NRW-1	9/23/23		1	S	●		
5	NRW-2	9/23/23		1	S	●		
6	NRW-3	9/23/23		1	S	●		
7	NRW-4	9/23/23		1	S	●		
8	HR-1	9/22/23		1	S	●		
9	HR-2	9/22/23		1	S	●		
10	HR-3	9/22/23		1	S	●		

Custody Record MUST be signed	Relinquished by (print)	Date/Time	Signature	Received by (print)	Date/Time	Signature
	Relinquished by (print)	Date/Time	Signature	Received by Laboratory (print) D. West	Date/Time 4 Apr 24 0450	Signature

LABORATORY USE ONLY

Shipped By	Cooler ID(s)	Custody Seals Y N C B	Intact Y N	Receipt Temp °C	Temp Blank Y N	On Ice Y N	Payment Type CC Cash Check_____	Amount $	Receipt Number *(cash/check only)*

In certain circumstances, samples submitted to Energy Laboratories, Inc. may be subcontracted to other certified laboratories in order to complete the analysis requested. This serves as notice of this possibility. All subcontracted data will be clearly notated on your analytical report.

ELI-COC-10/18 v.3

wsp

LABORATORY TESTING FOR TYRONE MINE – NRW STOCKPILE SOIL CHARACTERIZATION

This letter accompanies 2 coolers with 21 soil samples for the Tyrone Little Rock Mine NRW Stockpile characterization project. Please analyze the samples for the following parameters:

Analysis/Parameter	Source-Method
Saturated Paste pH	SLS 1954, Method 2 and 21a
Electrical Conductivity, saturated paste	SLS 1954, Method 3a and 4b
Saturation Percentage	SLS 1954, Method 27a
Particle Size Analysis	ASA 1982, Method 15-5
Organic Matter (Carbon)	ASA 1982, Method 29-3.5.2
N as Nitrate	ASA 1982, Method 33-8.1
Phosphorous (Olsen)	ASA 1982, Method 24-5.4
Potassium	ASA 1982, Method 13-3.5
Cation Exchange Capacity	SLS 1954, Method 19
AB-DTPA extraction	ASA 1982, Method 3-5.2
Extractable Metals (As, Cd, Cu, Fe, Pb, Mn, Mo, Ni, and Zn)	EPA Method 6010/6020

Please call (505) 962-2933 or email (doug.romig@wsp.com) if you have any questions.

Sincerely,

WSP USA Inc.

WSP USA Inc.
701 Emerson Road, Suite 250, Creve Coeur, Missouri, 63141
T: +1 314 984 8800 F: +1 314 984-8770

wsp.com

APPENDIX C

DBS&A Laboratory Report and Soil Water Characterization Curves

Laboratory Report
Project # 31406439 01.EXP

Prepared for

WSP Golder

Prepared by

DBS&A Soil Testing & Research Laboratory
4400 Alameda Blvd. NE, Suite C
Albuquerque, New Mexico 87113
(505) 889-7752
www.dbstephens.com
DB23.1010.00

October 10, 2023

DBS&A
a Geo-Logic Company

October 10, 2023

Doug Romig
WSP Golder
6616 Gulton Ct. #10
Albuquerque, NM 87109
(505) 962-2933

Re: DBS&A Laboratory Report for Project # 31406439 01.EXP

Dear Doug Romig:

Enclosed is the report for the requested laboratory services. 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 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

William Seward
Assistant Laboratory Manager

Joleen Hines
Laboratory Manager

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			
9A-GB3 (1.45 g/cc)	X	X		X			X	X		X	X			X								
9A-TP1 (1.45 g/cc)	X	X		X			X	X		X	X			X								
9A-TP4 (1.45 g/cc)	X	X		X			X	X		X	X			X								
9AX-TP2 (1.44 g/cc)	X	X		X			X	X		X	X			X								
9AX-GB1 (1.44 g/cc)	X	X		X			X	X		X	X			X								
CuL-GB1 (1.45 g/cc)	X	X		X			X	X		X	X			X								
CuL-GB2 (1.45 g/cc)	X	X		X			X	X		X	X			X								
USNR-GB1 (1.45 g/cc)	X	X		X			X	X		X	X			X								
USNR-GB3 (1.45 g/cc)	X	X		X			X	X		X	X			X								
WIP-GB1 (1.45 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, Kunsat = 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:
Ten samples, each as loose <2mm material in a full 1-gallon resealable bag, were hand-delivered on August 18, 2023. The samples were delivered together in a cooler and were received in good order.

Sample Preparation and Testing Notes:
A portion of each sample was remolded into a testing ring to a client-specified target density of 1.45 g/cm^3. Prior to remolding, the sub-samples were moisture adjusted in order to achieve a moisture content that would facilitate compaction. The actual dry bulk density achieved (in g/cm^3) was added to each sub-sample ID. Each of these remolded sub-samples was subjected to initial properties analysis, saturated hydraulic conductivity testing, and the hanging column and pressure chamber portions of the moisture retention testing. Separate sub-samples were obtained 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 either 2.65 or 2.85.

Summary of Sample Preparation/Volume Changes

	Target Remold Parameters[1]	Actual Remold Data			Volume Change Post Saturation[2]			Volume Change Post Drying Curve[3]		
Sample Number	Dry Bulk Density (g/cm^3)	Moisture Content (%, g/g)	Dry Bulk Density (g/cm^3)	% of Target Density (%)	Dry Bulk Density (g/cm^3)	% Volume Change (%)	% of Initial Density (%)	Dry Bulk Density (g/cm^3)	% Volume Change (%)	% of Initial Density (%)
9A-GB3 (1.45 g/cc)	1.45	10.43	1.45	99.9%	1.45	---	100%	1.45	---	100%
9A-TP1 (1.45 g/cc)	1.45	10.32	1.45	99.9%	1.45	---	100%	1.45	---	100%
9A-TP4 (1.45 g/cc)	1.45	10.38	1.45	100.1%	1.45	---	100%	1.45	---	100%
9AX-TP2 (1.44 g/cc)	1.45	10.64	1.44	99.6%	1.44	---	100%	1.57	-8.1%	109%
9AX-GB1 (1.44 g/cc)	1.45	12.07	1.44	99.3%	1.44	---	100%	1.42	+1.6%	99%
CuL-GB1 (1.45 g/cc)	1.45	10.07	1.45	100.1%	1.45	---	100%	1.45	---	100%
CuL-GB2 (1.45 g/cc)	1.45	10.22	1.45	100.0%	1.45	---	100%	1.45	---	100%
USNR-GB1 (1.45 g/cc)	1.45	10.19	1.45	100.0%	1.45	---	100%	1.45	---	100%
USNR-GB3 (1.45 g/cc)	1.45	9.99	1.45	99.9%	1.45	---	100%	1.45	---	100%
WIP-GB1 (1.45 g/cc)	1.45	10.35	1.45	99.8%	1.45	---	100%	1.45	---	100%

[1]Target Remold Parameters: Remolded to a target dry bulk density of 1.45 g/cm^3

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

[3]Volume 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)			
9A-GB3 (1.45 g/cc)	NA	NA	10.4	15.1	1.45	1.60	45.4
9A-TP1 (1.45 g/cc)	NA	NA	10.3	15.0	1.45	1.60	45.3
9A-TP4 (1.45 g/cc)	NA	NA	10.4	15.1	1.45	1.60	45.2
9AX-TP2 (1.44 g/cc)	NA	NA	10.6	15.4	1.44	1.60	45.5
9AX-GB1 (1.44 g/cc)	NA	NA	12.1	17.4	1.44	1.61	49.5
CuL-GB1 (1.45 g/cc)	NA	NA	10.1	14.6	1.45	1.60	45.2
CuL-GB2 (1.45 g/cc)	NA	NA	10.2	14.8	1.45	1.60	45.3
USNR-GB1 (1.45 g/cc)	NA	NA	10.2	14.8	1.45	1.60	45.3
USNR-GB3 (1.45 g/cc)	NA	NA	10.0	14.5	1.45	1.59	45.3
WIP-GB1 (1.45 g/cc)	NA	NA	10.4	15.0	1.45	1.60	45.4

NA = Not analyzed

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
9A-GB3 (1.45 g/cc)	3.0E-02	NA	X	
9A-TP1 (1.45 g/cc)	1.3E-02	NA	X	
9A-TP4 (1.45 g/cc)	2.3E-02	NA	X	
9AX-TP2 (1.44 g/cc)	5.8E-03	NA	X	
9AX-GB1 (1.44 g/cc)	2.7E-03	NA	X	
CuL-GB1 (1.45 g/cc)	1.1E-02	NA	X	
CuL-GB2 (1.45 g/cc)	9.7E-03	NA	X	
USNR-GB1 (1.45 g/cc)	2.4E-02	NA	X	
USNR-GB3 (1.45 g/cc)	2.1E-02	NA	X	
WIP-GB1 (1.45 g/cc)	1.6E-02	NA	X	

NA = Not applicable

Summary of Moisture Characteristics of the Initial Drainage Curve

Sample Number	Pressure Head (-cm water)	Moisture Content (%, cm^3/cm^3)
9A-GB3 (1.45 g/cc)	0	44.5
	5	44.3
	14	38.3
	53	23.9
	205	18.9
	337	17.3
	6833	8.9
	60576	5.8
	284218	4.0
	849860	3.4
9A-TP1 (1.45 g/cc)	0	46.1
	5	45.8
	14	44.2
	53	26.3
	205	19.7
	337	17.7
	8362	9.9
	58333	6.3
	327764	4.3
	849860	3.8
9A-TP4 (1.45 g/cc)	0	47.3
	5	47.1
	14	43.0
	53	25.5
	205	20.0
	337	18.0
	9688	8.8
	66899	6.3
	348160	4.7
	849860	4.3

‡‡ 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)
9AX-TP2 (1.44 g/cc)	0	46.0
	5	44.7 ⌗
	23	32.1 ⌗
	79	23.3 ⌗
	337	17.9 ⌗
	8770	7.5 ⌗
	54661	4.3 ⌗
	398130	2.6 ⌗
	849860	2.5 ⌗
9AX-GB1 (1.44 g/cc)	0	49.4
	5	49.8 ⌗
	23	49.7 ⌗
	79	34.3 ⌗
	337	27.7 ⌗
	16215	14.7 ⌗
	76485	11.6 ⌗
	334290	9.1 ⌗
	849860	7.9 ⌗
CuL-GB1 (1.45 g/cc)	0	47.0
	5	47.0
	14	44.9
	53	27.7
	205	21.1
	337	18.8
	17948	8.4
	174488	5.5
	408328	4.6
	849860	3.8

⌗ 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)
CuL-GB2 (1.45 g/cc)	0	46.5
	5	45.9
	14	44.1
	53	29.5
	205	22.1
	337	19.6
	8668	9.1
	51602	6.5
	387116	4.2
	849860	3.6
USNR-GB1 (1.45 g/cc)	0	46.5
	5	46.4
	14	39.4
	53	22.9
	205	18.5
	337	16.9
	10198	8.3
	49154	6.2
	266780	4.1
	849860	3.3
USNR-GB3 (1.45 g/cc)	0	45.5
	5	44.9
	14	38.1
	53	22.9
	205	17.8
	337	16.1
	8872	8.2
	100246	5.1
	483181	3.7
	849860	3.5

‡‡ 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)
WIP-GB1 (1.45 g/cc)	0	47.1
	5	47.0
	14	46.9
	53	25.0
	205	18.4
	337	17.0
	41404	8.3
	100144	6.2
	318280	5.6
	849860	4.8

‡‡ 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)	Oversize Corrected θ_s (% vol)
9A-GB3 (1.45 g/cc)	0.0950	1.3458	3.31	45.90	NA	NA
9A-TP1 (1.45 g/cc)	0.0597	1.4171	4.53	47.56	NA	NA
9A-TP4 (1.45 g/cc)	0.0723	1.4054	4.64	48.77	NA	NA
9AX-TP2 (1.44 g/cc)	0.1275	1.2867	0.90	47.04	NA	NA
9AX-GB1 (1.44 g/cc)	0.0324	1.3240	7.48	50.85	NA	NA
CuL-GB1 (1.45 g/cc)	0.0591	1.3943	4.24	48.52	NA	NA
CuL-GB2 (1.45 g/cc)	0.0574	1.3451	3.17	47.61	NA	NA
USNR-GB1 (1.45 g/cc)	0.0955	1.3910	4.02	48.03	NA	NA
USNR-GB3 (1.45 g/cc)	0.0963	1.3878	3.76	46.79	NA	NA
WIP-GB1 (1.45 g/cc)	0.0482	1.5706	6.15	48.85	NA	NA

NA = Not applicable

Initial Properties

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

Job Name: WSP Golder
Job Number: DB23.1010.00
Sample Number: 9A-GB3 (1.45 g/cc)
Project: 31406439 01.EXP
Fraction Tested: <2mm

	As Received	Remolded
Test Date:	NA	29-Aug-23
Field weight of sample* (g)*:*		310.17
Tare weight, ring (g)*:*		77.52
Tare weight, pan/plate (g)*:*		0.00
Tare weight, other (g)*:*		0.00
Dry weight of sample (g)*:*		210.68
Sample volume (cm^3)*:*		145.48
Assumed particle density (g/cm^3)*:*		2.65
Gravimetric Moisture Content (% g/g)*:*		10.4
Volumetric Moisture Content (% vol)*:*		15.1
Dry bulk density (g/cm^3)*:*		1.45
Wet bulk density (g/cm^3)*:*		1.60
Calculated Porosity (% vol)*:*		45.4
Percent Saturation:		33.3

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

Comments:

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

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

Job Name: WSP Golder
Job Number: DB23.1010.00
Sample Number: 9A-TP1 (1.45 g/cc)
Project: 31406439 01.EXP
Fraction Tested: <2mm

	As Received	Remolded
Test Date:	NA	29-Aug-23
Field weight of sample* (g)*:*		311.90
Tare weight, ring (g)*:*		77.00
Tare weight, pan/plate (g)*:*		0.00
Tare weight, other (g)*:*		0.00
Dry weight of sample (g)*:*		212.93
Sample volume (cm^3)*:*		146.95
Assumed particle density (g/cm^3)*:*		2.65
Gravimetric Moisture Content (% g/g)*:*		10.3
Volumetric Moisture Content (% vol)*:*		15.0
Dry bulk density (g/cm^3)*:*		1.45
Wet bulk density (g/cm^3)*:*		1.60
Calculated Porosity (% vol)*:*		45.3
Percent Saturation:		33.0

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

Comments:

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

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

Job Name: WSP Golder
Job Number: DB23.1010.00
Sample Number: 9A-TP4 (1.45 g/cc)
Project: 31406439 01.EXP
Fraction Tested: <2mm

	As Received	Remolded
Test Date:	NA	29-Aug-23
Field weight of sample* (g)*:*		306.31
Tare weight, ring (g)*:*		76.53
Tare weight, pan/plate (g)*:*		0.00
Tare weight, other (g)*:*		0.00
Dry weight of sample (g)*:*		208.17
Sample volume (cm^3)*:*		143.42
Assumed particle density (g/cm^3)*:*		2.65
Gravimetric Moisture Content (% g/g)*:*		10.4
Volumetric Moisture Content (% vol)*:*		15.1
Dry bulk density (g/cm^3)*:*		1.45
Wet bulk density (g/cm^3)*:*		1.60
Calculated Porosity (% vol)*:*		45.2
Percent Saturation:		33.3

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

Comments:

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

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

Job Name: WSP Golder
Job Number: DB23.1010.00
Sample Number: 9AX-TP2 (1.44 g/cc)
Project: 31406439 01.EXP
Fraction Tested: <2mm

	As Received	Remolded
Test Date:	NA	29-Aug-23
Field weight of sample* (g)*:*		316.00
Tare weight, ring (g)*:*		83.28
Tare weight, pan/plate (g)*:*		0.00
Tare weight, other (g)*:*		0.00
Dry weight of sample (g)*:*		210.34
Sample volume (cm^3)*:*		145.65
Assumed particle density (g/cm^3)*:*		2.65
Gravimetric Moisture Content (% g/g)*:*		10.6
Volumetric Moisture Content (% vol)*:*		15.4
Dry bulk density (g/cm^3)*:*		1.44
Wet bulk density (g/cm^3)*:*		1.60
Calculated Porosity (% vol)*:*		45.5
Percent Saturation:		33.8

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

Comments:

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

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

Job Name: WSP Golder
Job Number: DB23.1010.00
Sample Number: 9AX-GB1 (1.44 g/cc)
Project: 31406439 01.EXP
Fraction Tested: <2mm

	As Received	Remolded
Test Date:	NA	29-Aug-23
Field weight of sample* (g)*:*		321.08
Tare weight, ring (g)*:*		84.16
Tare weight, pan/plate (g)*:*		0.00
Tare weight, other (g)*:*		0.00
Dry weight of sample (g)*:*		211.40
Sample volume (cm^3)*:*		146.83
Assumed particle density (g/cm^3)*:*		2.85

Gravimetric Moisture Content (% g/g)*:*	12.1
Volumetric Moisture Content (% vol)*:*	17.4
Dry bulk density (g/cm^3)*:*	1.44
Wet bulk density (g/cm^3)*:*	1.61
Calculated Porosity (% vol)*:*	49.5
Percent Saturation:	35.1

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

Comments:

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

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

Job Name: WSP Golder
Job Number: DB23.1010.00
Sample Number: CuL-GB1 (1.45 g/cc)
Project: 31406439 01.EXP
Fraction Tested: <2mm

	As Received	Remolded
Test Date:	NA	29-Aug-23
Field weight of sample* (g)*:*		323.08
Tare weight, ring (g)*:*		89.72
Tare weight, pan/plate (g)*:*		0.00
Tare weight, other (g)*:*		0.00
Dry weight of sample (g)*:*		212.01
Sample volume (cm^3)*:*		146.06
Assumed particle density (g/cm^3)*:*		2.65
Gravimetric Moisture Content (% g/g)*:*		10.1
Volumetric Moisture Content (% vol)*:*		14.6
Dry bulk density (g/cm^3)*:*		1.45
Wet bulk density (g/cm^3)*:*		1.60
Calculated Porosity (% vol)*:*		45.2
Percent Saturation:		32.3

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

Comments:

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

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

Job Name: WSP Golder
Job Number: DB23.1010.00
Sample Number: CuL-GB2 (1.45 g/cc)
Project: 31406439 01.EXP
Fraction Tested: <2mm

	As Received	Remolded
Test Date:	NA	29-Aug-23
Field weight of sample* (g)*:*		310.33
Tare weight, ring (g)*:*		70.93
Tare weight, pan/plate (g)*:*		0.00
Tare weight, other (g)*:*		0.00
Dry weight of sample (g)*:*		217.20
Sample volume (cm^3)*:*		149.87
Assumed particle density (g/cm^3)*:*		2.65
Gravimetric Moisture Content (% g/g)*:*		10.2
Volumetric Moisture Content (% vol)*:*		14.8
Dry bulk density (g/cm^3)*:*		1.45
Wet bulk density (g/cm^3)*:*		1.60
Calculated Porosity (% vol)*:*		45.3
Percent Saturation:		32.7

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

Comments:

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

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

Job Name: WSP Golder
Job Number: DB23.1010.00
Sample Number: USNR-GB1 (1.45 g/cc)
Project: 31406439 01.EXP
Fraction Tested: <2mm

	As Received	Remolded
Test Date:	NA	29-Aug-23
Field weight of sample* (g)*:*		313.37
Tare weight, ring (g)*:*		73.99
Tare weight, pan/plate (g)*:*		0.00
Tare weight, other (g)*:*		0.00
Dry weight of sample (g)*:*		217.25
Sample volume (cm^3)*:*		149.82
Assumed particle density (g/cm^3)*:*		2.65
Gravimetric Moisture Content (% g/g)*:*		10.2
Volumetric Moisture Content (% vol)*:*		14.8
Dry bulk density (g/cm^3)*:*		1.45
Wet bulk density (g/cm^3)*:*		1.60
Calculated Porosity (% vol)*:*		45.3
Percent Saturation:		32.6

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

Comments:

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

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

Job Name: WSP Golder
Job Number: DB23.1010.00
Sample Number: USNR-GB3 (1.45 g/cc)
Project: 31406439 01.EXP
Fraction Tested: <2mm

	As Received	Remolded
Test Date:	NA	29-Aug-23
Field weight of sample* (g)*:*		314.85
Tare weight, ring (g)*:*		82.68
Tare weight, pan/plate (g)*:*		0.00
Tare weight, other (g)*:*		0.00
Dry weight of sample (g)*:*		211.08
Sample volume (cm^3)*:*		145.69
Assumed particle density (g/cm^3)*:*		2.65
Gravimetric Moisture Content (% g/g)*:*		10.0
Volumetric Moisture Content (% vol)*:*		14.5
Dry bulk density (g/cm^3)*:*		1.45
Wet bulk density (g/cm^3)*:*		1.59
Calculated Porosity (% vol)*:*		45.3
Percent Saturation:		31.9

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

Comments:

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

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

Job Name: WSP Golder
Job Number: DB23.1010.00
Sample Number: WIP-GB1 (1.45 g/cc)
Project: 31406439 01.EXP
Fraction Tested: <2mm

	As Received	Remolded
Test Date:	NA	29-Aug-23
Field weight of sample* (g)*:*		310.79
Tare weight, ring (g)*:*		81.48
Tare weight, pan/plate (g)*:*		0.00
Tare weight, other (g)*:*		0.00
Dry weight of sample (g)*:*		207.80
Sample volume (cm^3)*:*		143.59
Assumed particle density (g/cm^3)*:*		2.65
Gravimetric Moisture Content (% g/g)*:*		10.4
Volumetric Moisture Content (% vol)*:*		15.0
Dry bulk density (g/cm^3)*:*		1.45
Wet bulk density (g/cm^3)*:*		1.60
Calculated Porosity (% vol)*:*		45.4
Percent Saturation:		33.0

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

Comments:

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

Saturated Hydraulic Conductivity

Saturated Hydraulic Conductivity
Constant Head Method

Job Name: WSP Golder
Job Number: DB23.1010.00
Sample Number: 9A-GB3 (1.45 g/cc)
Project: 31406439 01.EXP
Fraction Tested: <2mm

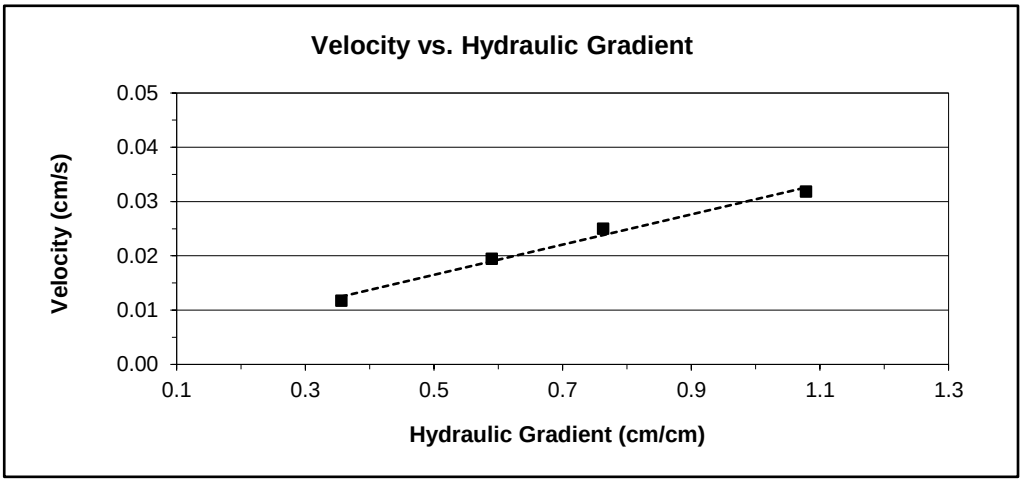
Type of water used: TAP
Collection vessel tare (g)*:* 29.37
Sample length (cm)*:* 4.92
Sample diameter (cm)*:* 6.14
Sample x-sectional area (cm^2)*:* 29.60

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:								
30-Aug-23	8:35:00	23.0	5.3	85.85	56.5	60	2.9E-02	2.7E-02
30-Aug-23	8:36:00							
Test # 2:								
30-Aug-23	9:11:00	23.0	3.75	73.77	44.4	60	3.3E-02	3.1E-02
30-Aug-23	9:12:00							
Test # 3:								
30-Aug-23	9:32:00	23.0	2.9	63.87	34.5	60	3.3E-02	3.1E-02
30-Aug-23	9:33:00							
Test # 4:								
30-Aug-23	9:52:00	23.0	1.75	50.16	20.8	60	3.3E-02	3.1E-02
30-Aug-23	9:53:00							

Average Ksat* (cm/sec)*: **3.0E-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

Saturated Hydraulic Conductivity
Constant Head Method

Job Name: WSP Golder
Job Number: DB23.1010.00
Sample Number: 9A-TP1 (1.45 g/cc)
Project: 31406439 01.EXP
Fraction Tested: <2mm

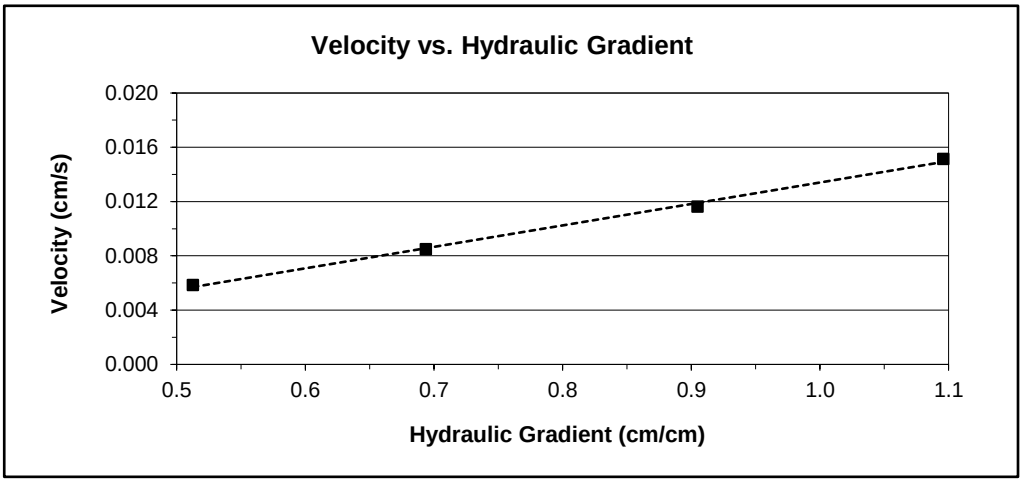
Type of water used: TAP
Collection vessel tare (g)*:* 29.46
Sample length (cm)*:* 4.97
Sample diameter (cm)*:* 6.14
Sample x-sectional area (cm^2)*:* 29.56

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:								
30-Aug-23	8:35:30	23.0	5.2	56.30	26.8	60	1.4E-02	1.3E-02
30-Aug-23	8:36:30							
Test # 2:								
30-Aug-23	9:11:30	23.0	4.25	50.08	20.6	60	1.4E-02	1.3E-02
30-Aug-23	9:12:30							
Test # 3:								
30-Aug-23	9:32:30	23.0	3.2	44.52	15.1	60	1.3E-02	1.2E-02
30-Aug-23	9:33:30							
Test # 4:								
30-Aug-23	9:52:30	23.0	2.3	39.82	10.4	60	1.3E-02	1.2E-02
30-Aug-23	9:53:30							

Average Ksat* (cm/sec)*: **1.3E-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

Saturated Hydraulic Conductivity
Constant Head Method

Job Name: WSP Golder
Job Number: DB23.1010.00
Sample Number: 9A-TP4 (1.45 g/cc)
Project: 31406439 01.EXP
Fraction Tested: <2mm

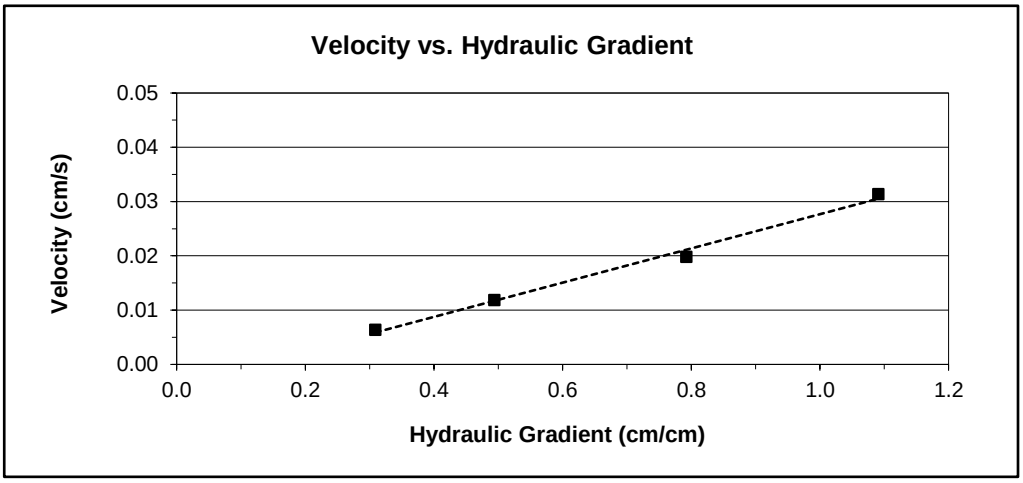
Type of water used: TAP
Collection vessel tare (g)*:* 29.37
Sample length (cm)*:* 4.86
Sample diameter (cm)*:* 6.13
Sample x-sectional area (cm^2)*:* 29.52

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:								
30-Aug-23	8:37:00	23.0	5.3	84.91	55.5	60	2.9E-02	2.7E-02
30-Aug-23	8:38:00							
Test # 2:								
30-Aug-23	9:13:00	23.0	3.85	64.42	35.1	60	2.5E-02	2.3E-02
30-Aug-23	9:14:00							
Test # 3:								
30-Aug-23	9:34:00	23.0	2.4	50.29	20.9	60	2.4E-02	2.2E-02
30-Aug-23	9:35:00							
Test # 4:								
30-Aug-23	9:54:00	23.0	1.5	40.58	11.2	60	2.0E-02	1.9E-02
30-Aug-23	9:55:00							

Average Ksat* (cm/sec)*: **2.3E-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

Saturated Hydraulic Conductivity
Constant Head Method

Job Name: WSP Golder
Job Number: DB23.1010.00
Sample Number: 9AX-TP2 (1.44 g/cc)
Project: 31406439 01.EXP
Fraction Tested: <2mm

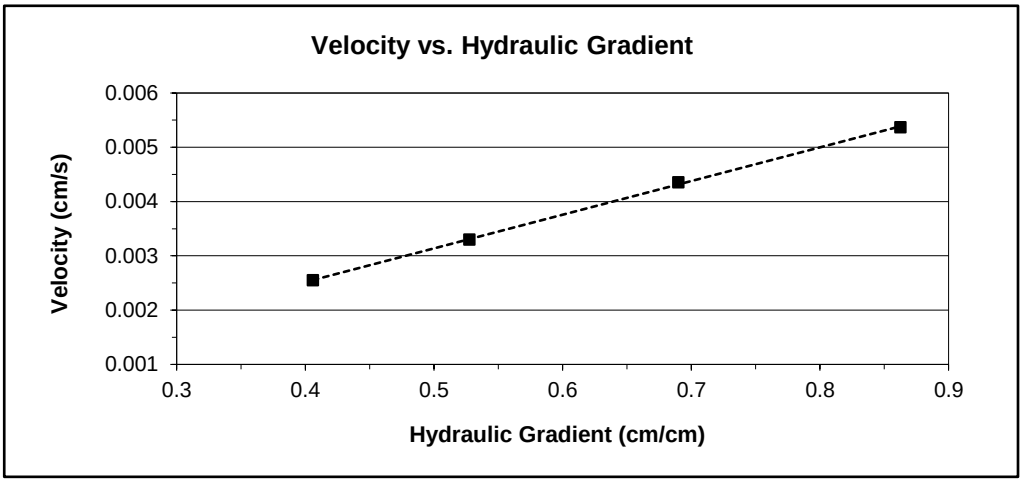
Type of water used: TAP
Collection vessel tare (g)*:* 29.26
Sample length (cm)*:* 4.93
Sample diameter (cm)*:* 6.14
Sample x-sectional area (cm^2)*:* 29.56

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:								
30-Aug-23	9:13:30	23.0	4.25	38.78	9.5	60	6.2E-03	5.8E-03
30-Aug-23	9:14:30							
Test # 2:								
30-Aug-23	9:34:30	23.0	3.4	36.98	7.7	60	6.3E-03	5.9E-03
30-Aug-23	9:35:30							
Test # 3:								
30-Aug-23	9:54:30	23.0	2.6	35.11	5.9	60	6.3E-03	5.8E-03
30-Aug-23	9:55:30							
Test # 4:								
30-Aug-23	10:10:00	23.0	2	33.78	4.5	60	6.3E-03	5.8E-03
30-Aug-23	10:11:00							

Average Ksat* (cm/sec)*: **5.8E-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

Saturated Hydraulic Conductivity
Constant Head Method

Job Name: WSP Golder
Job Number: DB23.1010.00
Sample Number: 9AX-GB1 (1.44 g/cc)
Project: 31406439 01.EXP
Fraction Tested: <2mm

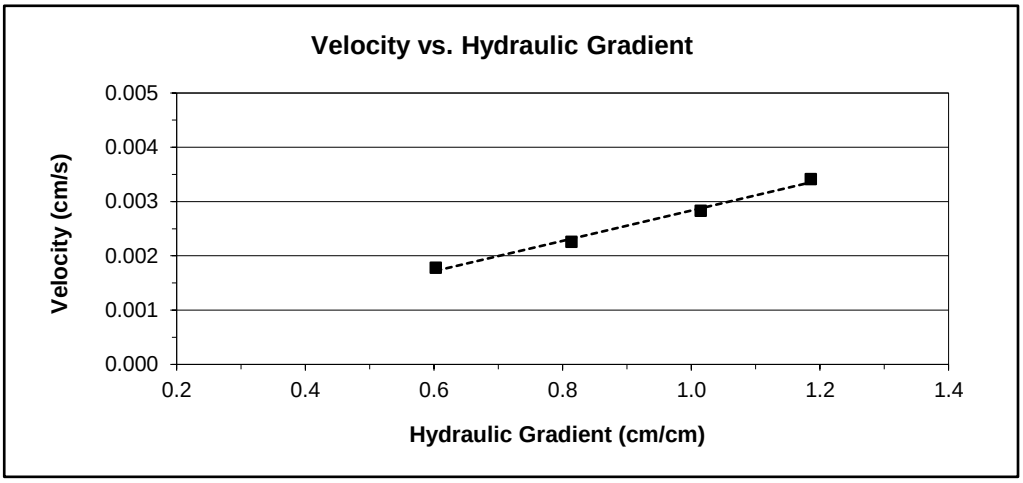
Type of water used: TAP
Collection vessel tare (g)*:* 28.93
Sample length (cm)*:* 4.98
Sample diameter (cm)*:* 6.13
Sample x-sectional area (cm^2)*:* 29.51

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:								
30-Aug-23	8:39:00	23.0	5.9	34.97	6.0	60	2.9E-03	2.7E-03
30-Aug-23	8:40:00							
Test # 2:								
30-Aug-23	9:15:00	23.0	5.05	33.94	5.0	60	2.8E-03	2.6E-03
30-Aug-23	9:16:00							
Test # 3:								
30-Aug-23	9:36:00	23.0	4.05	32.92	4.0	60	2.8E-03	2.6E-03
30-Aug-23	9:37:00							
Test # 4:								
30-Aug-23	9:56:00	23.0	3	32.08	3.2	60	2.9E-03	2.7E-03
30-Aug-23	9:57:00							

Average Ksat* (cm/sec)*: **2.7E-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

Saturated Hydraulic Conductivity
Constant Head Method

Job Name: WSP Golder
Job Number: DB23.1010.00
Sample Number: CuL-GB1 (1.45 g/cc)
Project: 31406439 01.EXP
Fraction Tested: <2mm

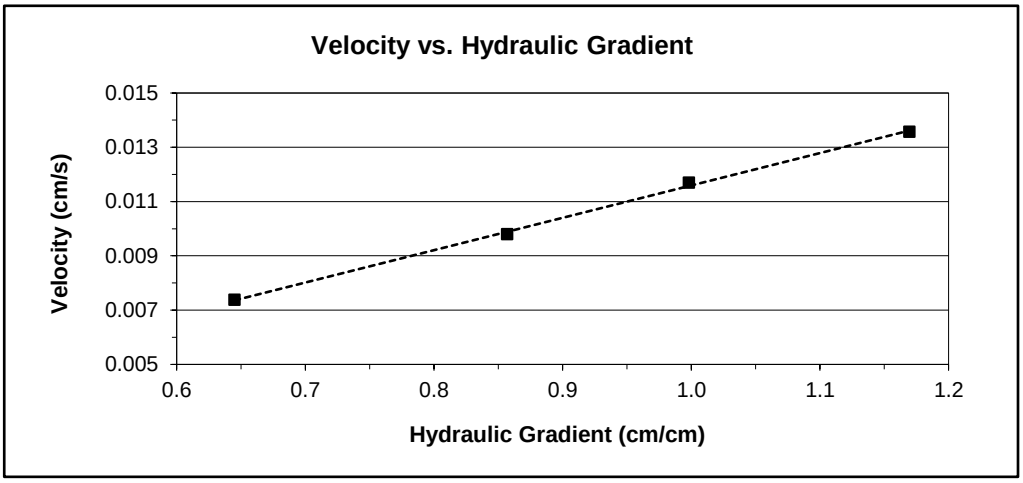
Type of water used: TAP
Collection vessel tare (g)*:* 29.95
Sample length (cm)*:* 4.96
Sample diameter (cm)*:* 6.13
Sample x-sectional area (cm^2)*:* 29.46

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:								
30-Aug-23	8:39:30	23.0	5.55	53.94	24.0	60	1.2E-02	1.1E-02
30-Aug-23	8:40:30							
Test # 2:								
30-Aug-23	9:15:30	23.0	4.7	50.63	20.7	60	1.2E-02	1.1E-02
30-Aug-23	9:16:30							
Test # 3:								
30-Aug-23	9:36:30	23.0	4	47.27	17.3	60	1.2E-02	1.1E-02
30-Aug-23	9:37:30							
Test # 4:								
30-Aug-23	9:56:30	23.0	2.95	42.99	13.0	60	1.2E-02	1.2E-02
30-Aug-23	9:57:30							

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

Saturated Hydraulic Conductivity
Constant Head Method

Job Name: WSP Golder
Job Number: DB23.1010.00
Sample Number: CuL-GB2 (1.45 g/cc)
Project: 31406439 01.EXP
Fraction Tested: <2mm

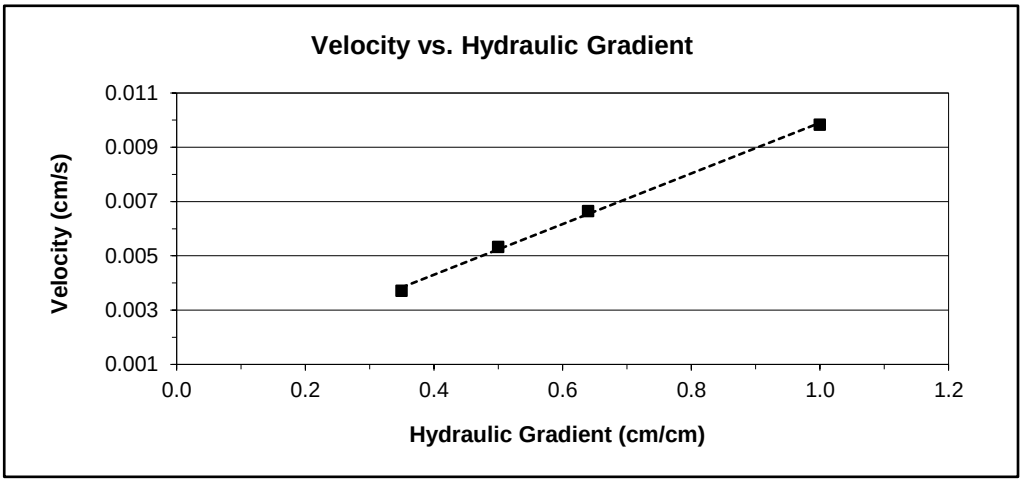
Type of water used: TAP
Collection vessel tare (g)*:* 29.48
Sample length (cm)*:* 5.00
Sample diameter (cm)*:* 6.18
Sample x-sectional area (cm^2)*:* 29.97

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:								
30-Aug-23	8:41:00	23.0	5	47.16	17.7	60	9.8E-03	9.2E-03
30-Aug-23	8:42:00							
Test # 2:								
30-Aug-23	9:38:00	23.0	3.2	41.43	12.0	60	1.0E-02	9.7E-03
30-Aug-23	9:39:00							
Test # 3:								
30-Aug-23	9:58:00	23.0	2.5	39.06	9.6	60	1.1E-02	9.9E-03
30-Aug-23	9:59:00							
Test # 4:								
30-Aug-23	10:10:30	23.0	1.75	36.15	6.7	60	1.1E-02	9.9E-03
30-Aug-23	10:11:30							

Average Ksat* (cm/sec)*: **9.7E-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

Saturated Hydraulic Conductivity
Constant Head Method

Job Name: WSP Golder
Job Number: DB23.1010.00
Sample Number: USNR-GB1 (1.45 g/cc)
Project: 31406439 01.EXP
Fraction Tested: <2mm

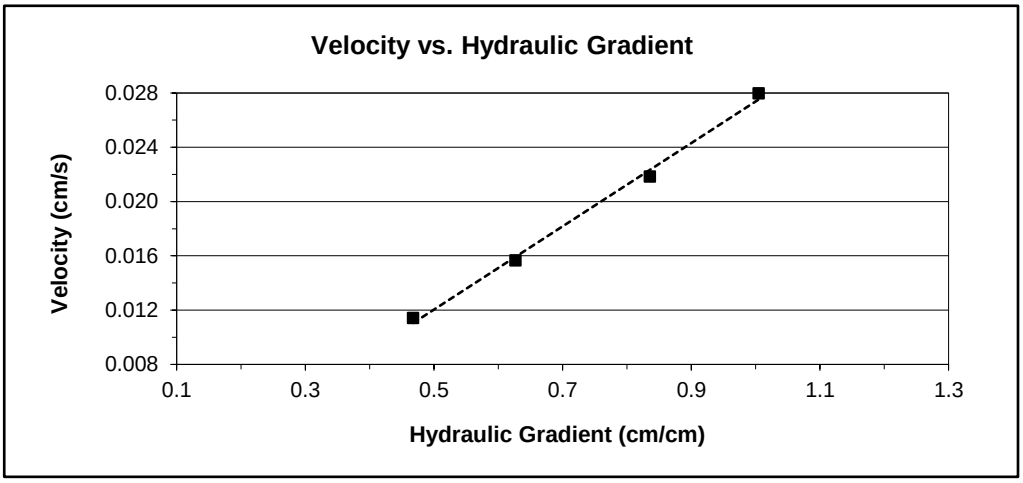
Type of water used: TAP
Collection vessel tare (g)*:* 29.06
Sample length (cm)*:* 5.02
Sample diameter (cm)*:* 6.16
Sample x-sectional area (cm^2)*:* 29.82

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:								
30-Aug-23	8:41:30	23.0	5.05	79.11	50.1	60	2.8E-02	2.6E-02
30-Aug-23	8:42:30							
Test # 2:								
30-Aug-23	9:17:30	23.0	4.2	68.13	39.1	60	2.6E-02	2.4E-02
30-Aug-23	9:18:30							
Test # 3:								
30-Aug-23	9:38:30	23.0	3.15	57.07	28.0	60	2.5E-02	2.3E-02
30-Aug-23	9:39:30							
Test # 4:								
30-Aug-23	9:58:30	23.0	2.35	49.48	20.4	60	2.4E-02	2.3E-02
30-Aug-23	9:59:30							

Average Ksat* (cm/sec)*: **2.4E-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

Saturated Hydraulic Conductivity
Constant Head Method

Job Name: WSP Golder
Job Number: DB23.1010.00
Sample Number: USNR-GB3 (1.45 g/cc)
Project: 31406439 01.EXP
Fraction Tested: <2mm

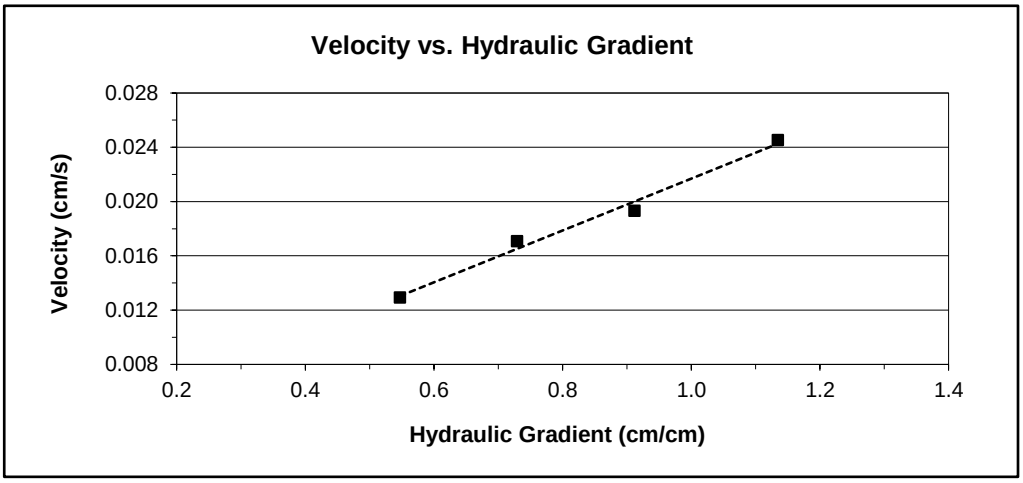
Type of water used: TAP
Collection vessel tare (g)*:* 51.04
Sample length (cm)*:* 4.94
Sample diameter (cm)*:* 6.13
Sample x-sectional area (cm^2)*:* 29.52

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:								
30-Aug-23	8:43:00	23.0	5.6	94.48	43.4	60	2.2E-02	2.0E-02
30-Aug-23	8:44:00							
Test # 2:								
30-Aug-23	9:19:00	23.0	4.5	85.25	34.2	60	2.1E-02	2.0E-02
30-Aug-23	9:20:00							
Test # 3:								
30-Aug-23	9:40:00	23.0	3.6	81.29	30.3	60	2.3E-02	2.2E-02
30-Aug-23	9:41:00							
Test # 4:								
30-Aug-23	10:00:00	23.0	2.7	73.93	22.9	60	2.4E-02	2.2E-02
30-Aug-23	10:01:00							

Average Ksat* (cm/sec)*: **2.1E-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

Saturated Hydraulic Conductivity
Constant Head Method

Job Name: WSP Golder
Job Number: DB23.1010.00
Sample Number: WIP-GB1 (1.45 g/cc)
Project: 31406439 01.EXP
Fraction Tested: <2mm

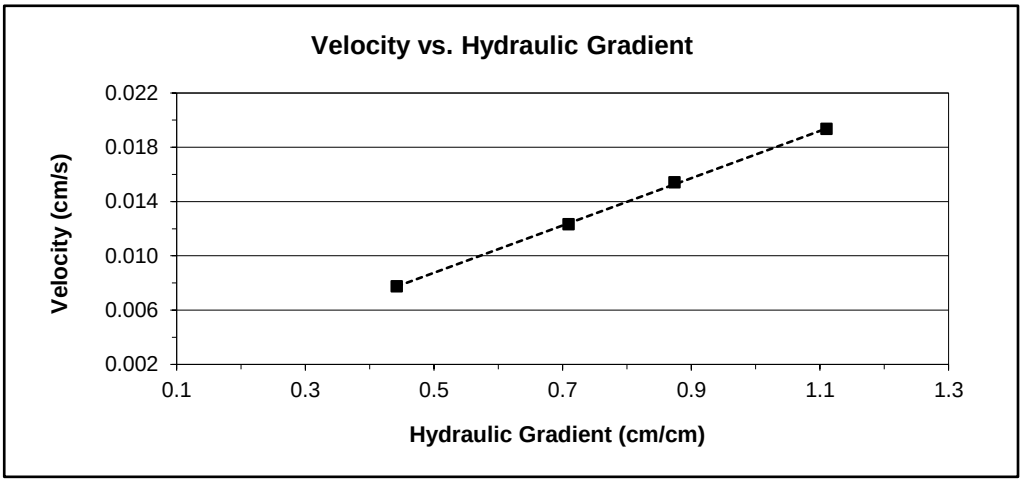
Type of water used: TAP
Collection vessel tare (g)*:* 67.91
Sample length (cm)*:* 4.86
Sample diameter (cm)*:* 6.13
Sample x-sectional area (cm^2)*:* 29.53

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:								
30-Aug-23	8:43:30	23.0	5.4	102.18	34.3	60	1.7E-02	1.6E-02
30-Aug-23	8:44:30							
Test # 2:								
30-Aug-23	9:19:30	23.0	4.25	95.21	27.3	60	1.8E-02	1.6E-02
30-Aug-23	9:20:30							
Test # 3:								
30-Aug-23	9:40:30	23.0	3.45	89.74	21.8	60	1.7E-02	1.6E-02
30-Aug-23	9:41:30							
Test # 4:								
30-Aug-23	10:00:30	23.0	2.15	81.64	13.7	60	1.8E-02	1.6E-02
30-Aug-23	10:01:30							

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

Moisture Retention Characteristics

Moisture Retention Data

Hanging Column / Pressure Plate

(Soil-Water Characteristic Curve)

Job Name: WSP Golder
Job Number: DB23.1010.00
Sample Number: 9A-GB3 (1.45 g/cc)
Project: 31406439 01.EXP
Fraction Tested: <2mm

Dry wt. of sample (g)*:* 210.68
Tare wt., ring (g)*:* 77.52
Tare wt., screen & clamp (g)*:* 27.58
Initial sample volume (cm^3)*:* 145.48
Initial dry bulk density (g/cm^3)*:* 1.45
Assumed particle density (g/cm^3)*:* 2.65
Initial calculated total porosity (%)*:* 45.35

	Date	Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content † (% vol)
Hanging column:	30-Aug-23	13:20	380.59	0	44.55
	6-Sep-23	8:00	380.23	5.0	44.30
	13-Sep-23	10:30	371.43	14.0	38.25
	20-Sep-23	10:15	350.57	53.0	23.91
	27-Sep-23	9:00	343.23	205.0	18.87
Pressure plate:	7-Oct-23	12:45	340.89	337	17.26

Volume Adjusted Data [1]

	Matric Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calculated Porosity (%)
Hanging column:	0.0	---	---	---	---
	5.0	---	---	---	---
	14.0	---	---	---	---
	53.0	---	---	---	---
	205.0	---	---	---	---
Pressure plate:	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/cm^3

‡‡ 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: W. Seward
Checked by: J. Hines

Moisture Retention Data

Dew Point Potentiometer / Relative Humidity Box

(Soil-Water Characteristic Curve)

Sample Number: 9A-GB3 (1.45 g/cc)

Initial sample bulk density (g/cm^3)*:* 1.45

Fraction of bulk sample used (<2.00mm fraction) (%): 100.00

Dry weight of dew point potentiometer sample* (g)*:* 189.90

Tare weight, jar (g)*:* 115.29

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content † (% vol)
Dew point potentiometer:	13-Sep-23	14:43	194.50	6833	8.93
	8-Sep-23	15:18	192.87	60576	5.76
	6-Sep-23	13:17	191.96	284218	4.00

Volume Adjusted Data [1]

	Water Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calc. Porosity (%)
Dew point potentiometer:	6833	---	---	---	---
	60576	---	---	---	---
	284218	---	---	---	---

Dry weight of relative humidity box sample* (g)*:* 74.74

Tare weight (g)*:* 37.57

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content † (% vol)
Relative humidity box:	29-Aug-23	12:00	75.62	849860	3.40

Volume Adjusted Data [1]

	Water Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calc. Porosity (%)
Relative humidity box:	849860	---	---	---	---

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

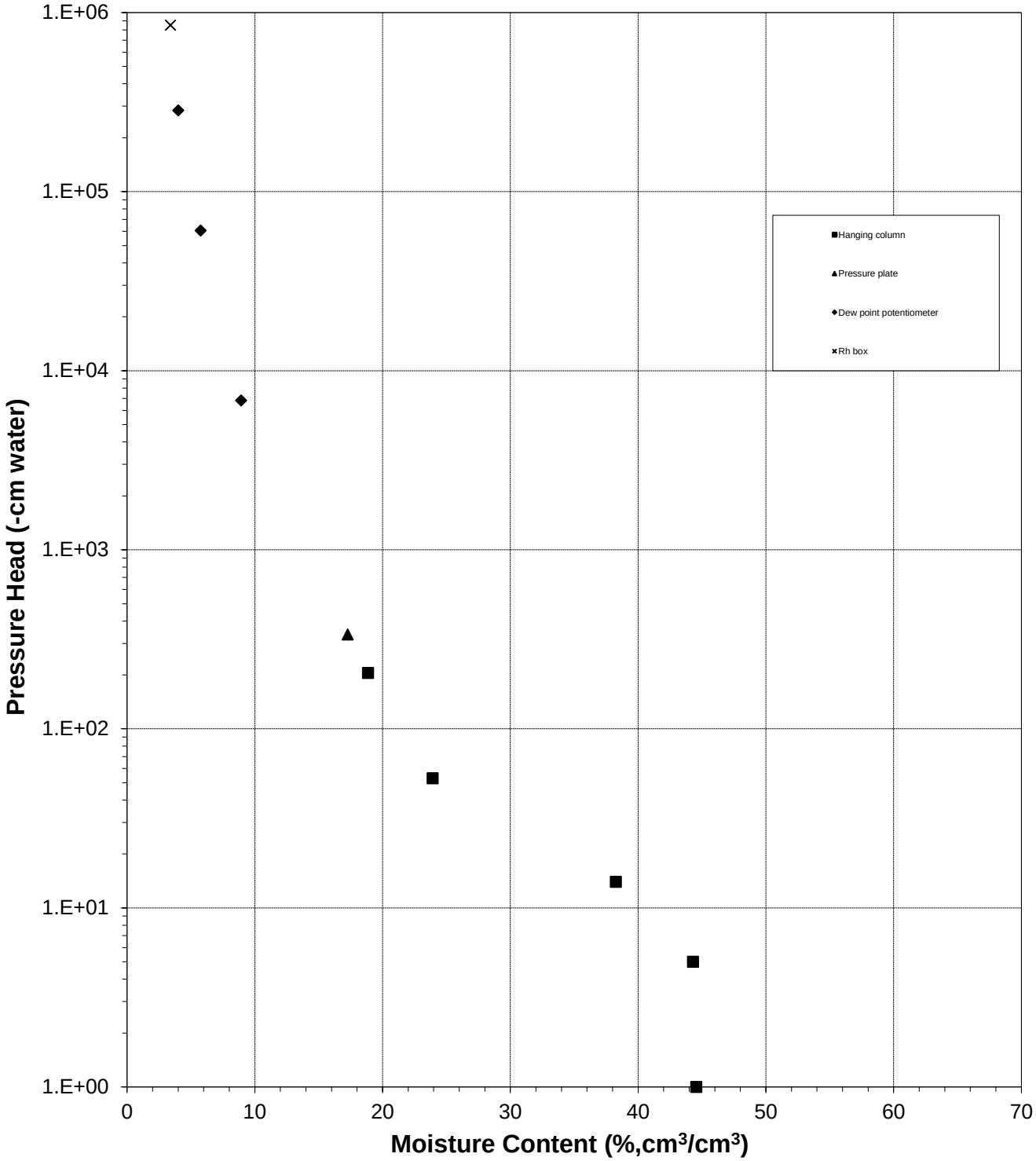
† Adjusted for >2.00mm (#10 sieve) material not used in DPP/RH testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm^3.

‡‡ 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: W. Seward
Checked by: J. Hines

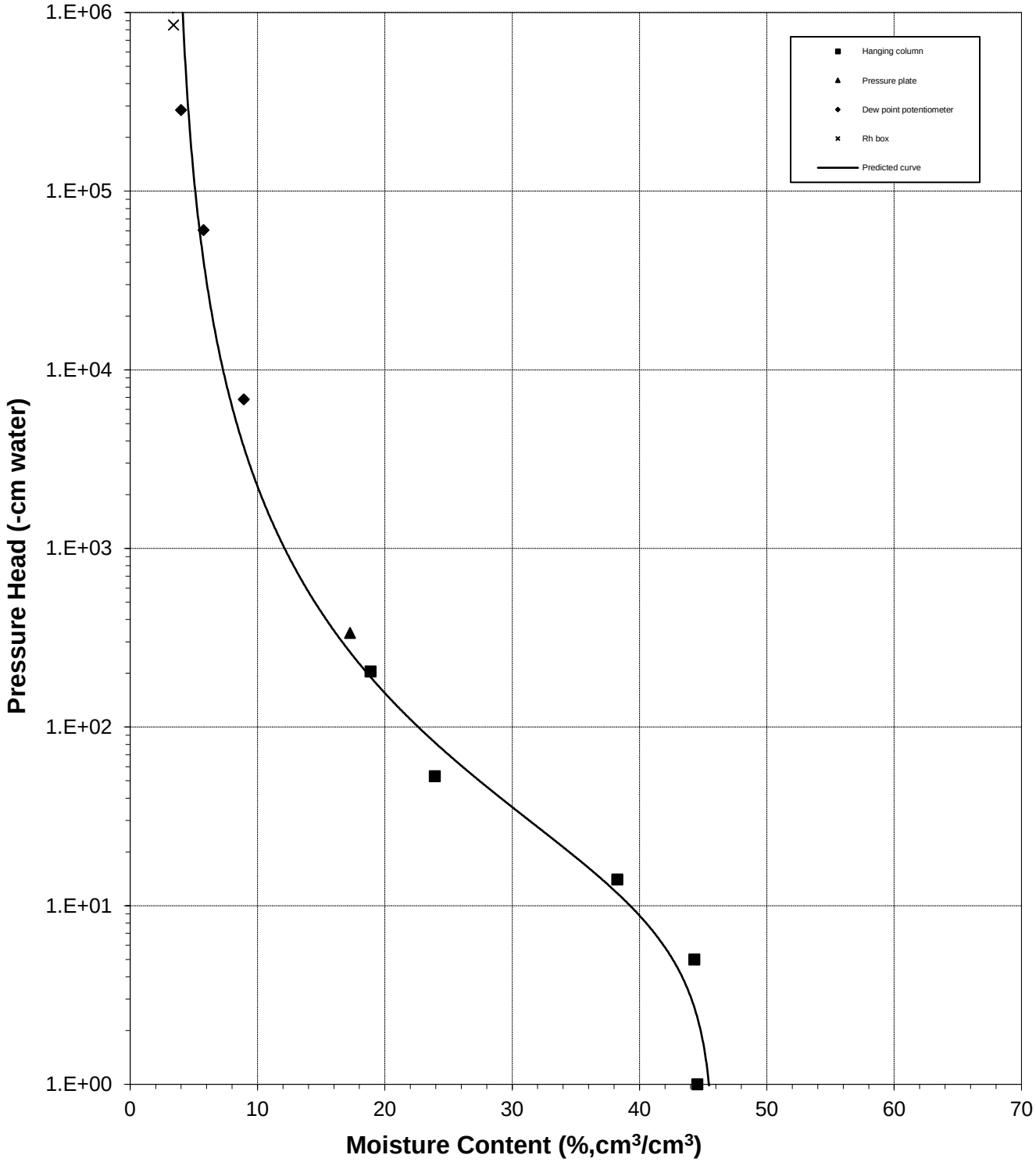
Water Retention Data Points

Sample Number: 9A-GB3 (1.45 g/cc)



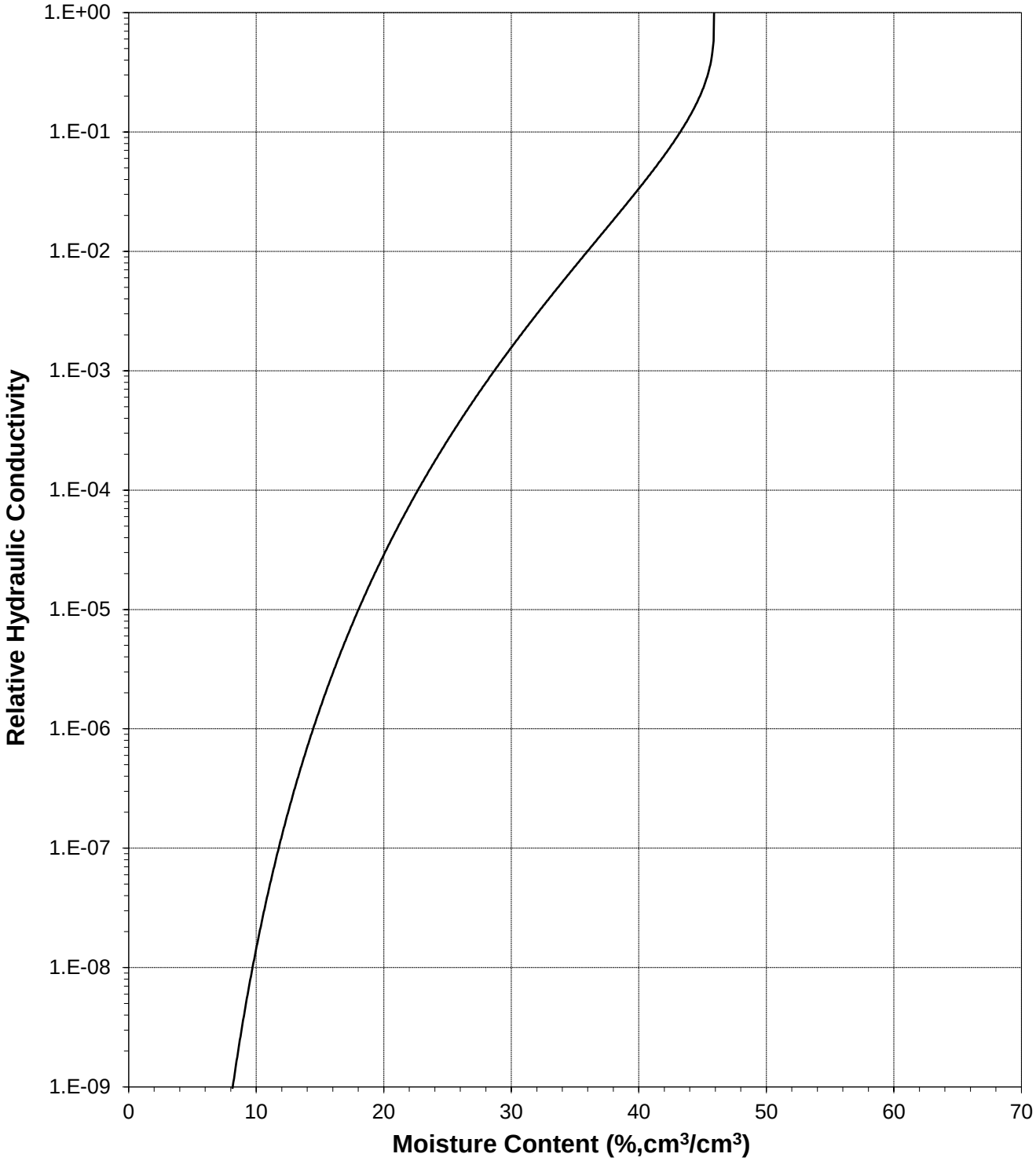
Predicted Water Retention Curve and Data Points

Sample Number: 9A-GB3 (1.45 g/cc)



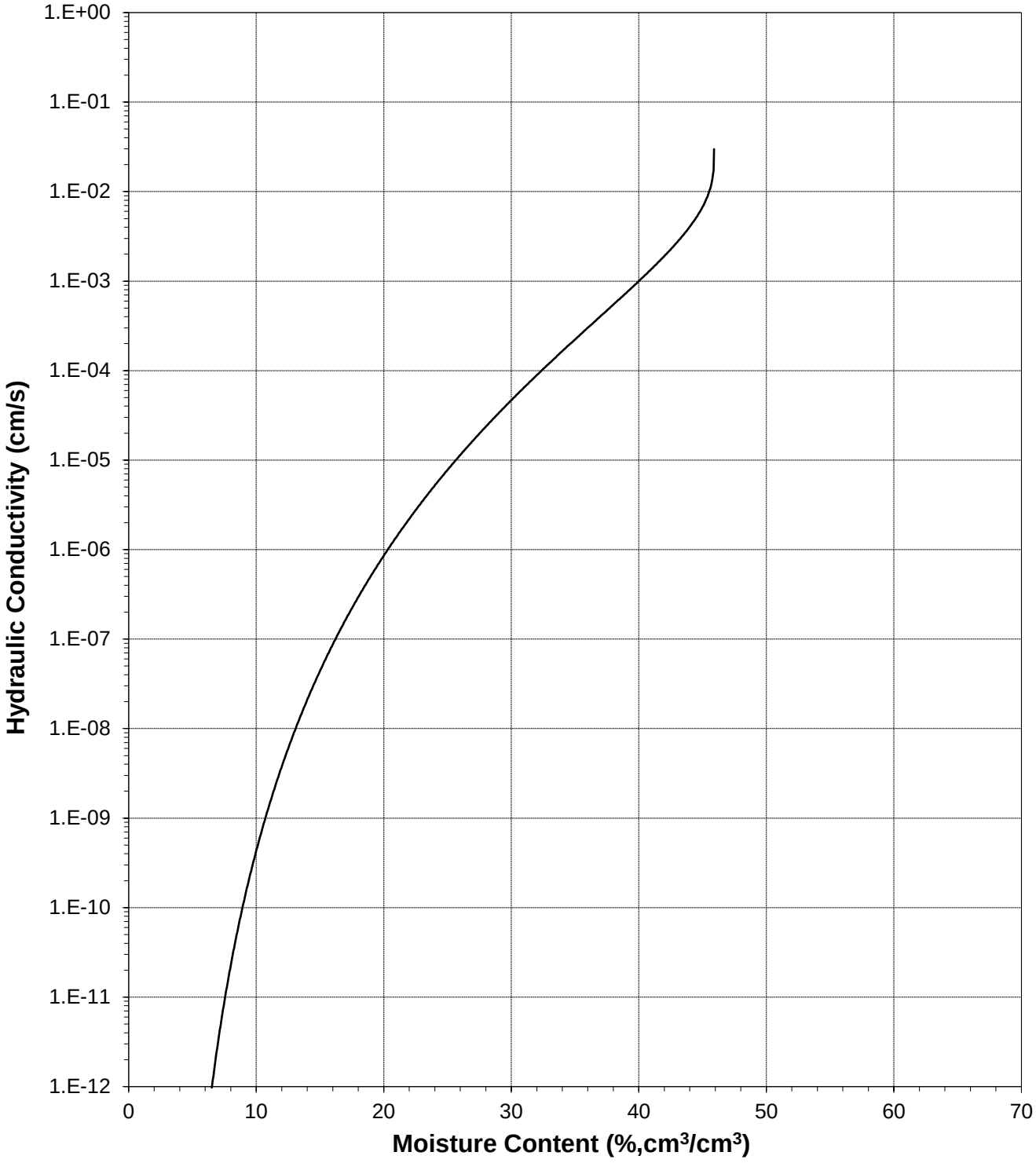
Plot of Relative Hydraulic Conductivity vs Moisture Content

Sample Number: 9A-GB3 (1.45 g/cc)



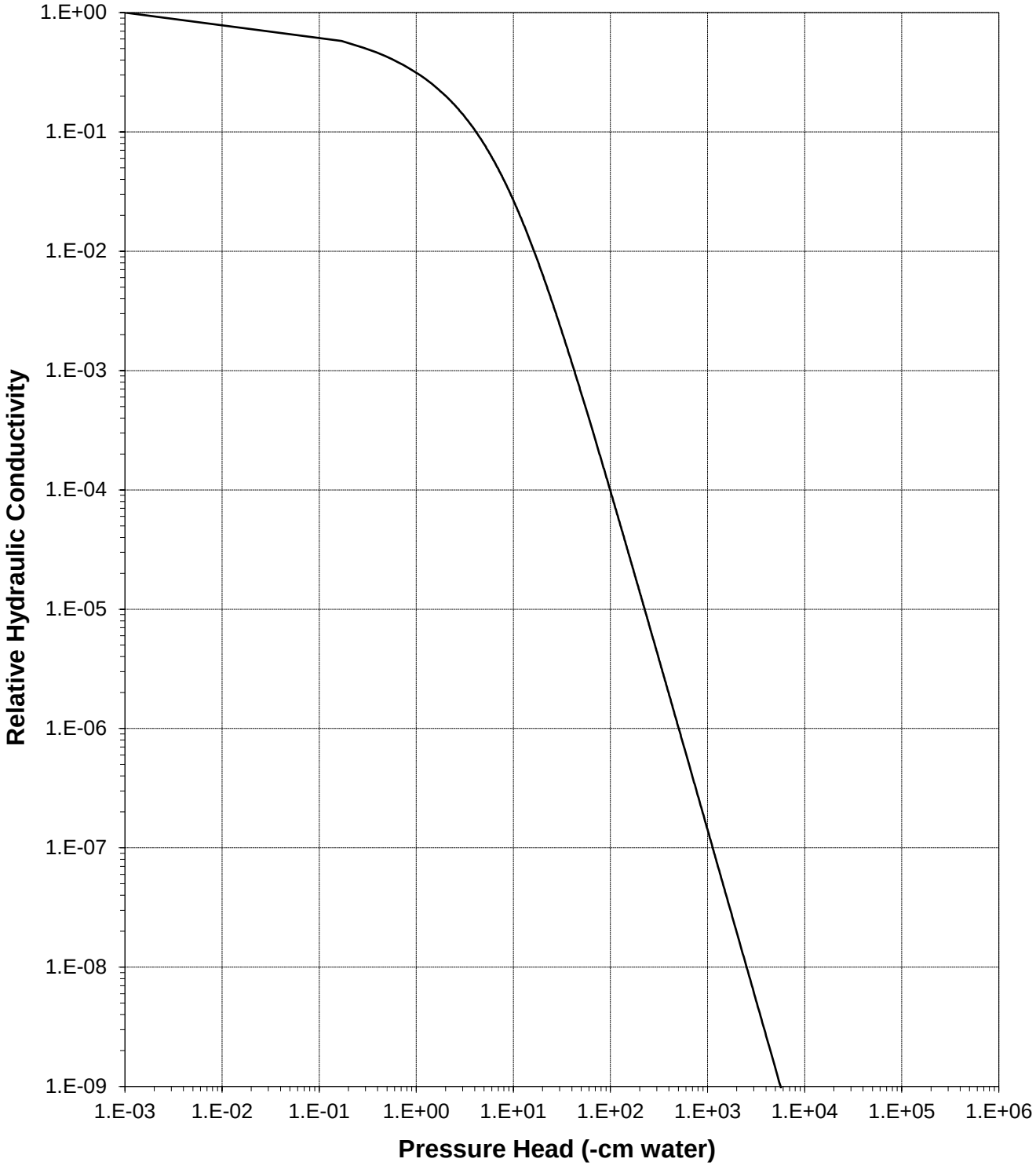
Plot of Hydraulic Conductivity vs Moisture Content

Sample Number: 9A-GB3 (1.45 g/cc)



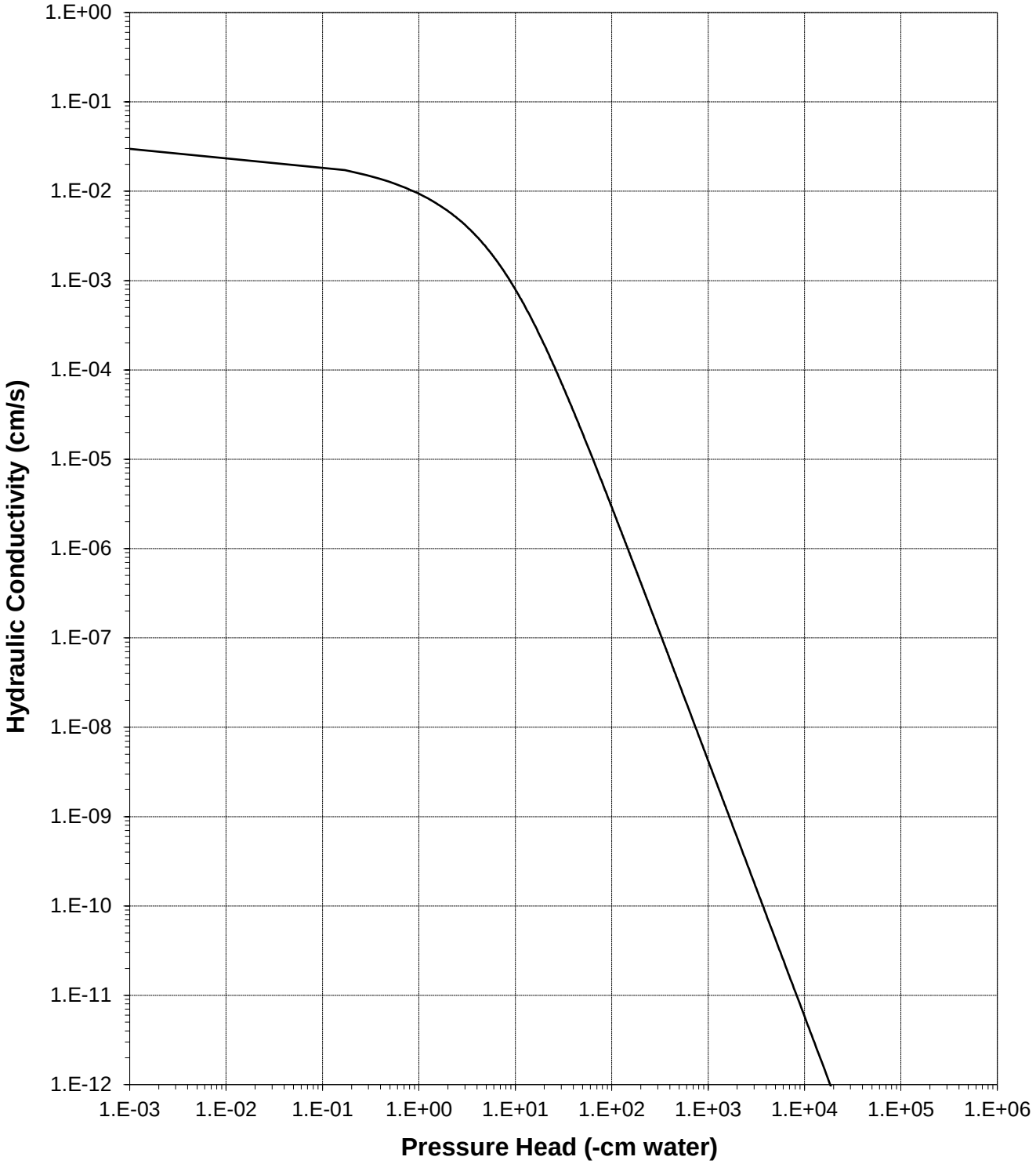
Plot of Relative Hydraulic Conductivity vs Pressure Head

Sample Number: 9A-GB3 (1.45 g/cc)



Plot of Hydraulic Conductivity vs Pressure Head

Sample Number: 9A-GB3 (1.45 g/cc)



Moisture Retention Data

Hanging Column / Pressure Plate

(Soil-Water Characteristic Curve)

Job Name: WSP Golder
Job Number: DB23.1010.00
Sample Number: 9A-TP1 (1.45 g/cc)
Project: 31406439 01.EXP
Fraction Tested: <2mm

Dry wt. of sample (g)*:* 212.93
Tare wt., ring (g)*:* 77.00
Tare wt., screen & clamp (g)*:* 26.52
Initial sample volume (cm^3)*:* 146.95
Initial dry bulk density (g/cm^3)*:* 1.45
Assumed particle density (g/cm^3)*:* 2.65
Initial calculated total porosity (%)*:* 45.32

	Date	Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content † (% vol)
Hanging column:	30-Aug-23	13:20	384.16	0	46.08
	6-Sep-23	8:00	383.74	5.0	45.79
	13-Sep-23	10:30	381.40	14.0	44.20
	20-Sep-23	10:15	355.09	53.0	26.30
	27-Sep-23	9:00	345.37	205.0	19.68
Pressure plate:	7-Oct-23	12:45	342.43	337	17.68

Volume Adjusted Data [1]

	Matric Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calculated Porosity (%)
Hanging column:	0.0	---	---	---	---
	5.0	---	---	---	---
	14.0	---	---	---	---
	53.0	---	---	---	---
	205.0	---	---	---	---
Pressure plate:	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/cm^3

‡‡ 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: W. Seward
Checked by: J. Hines

Moisture Retention Data

Dew Point Potentiometer / Relative Humidity Box

(Soil-Water Characteristic Curve)

Sample Number: 9A-TP1 (1.45 g/cc)

Initial sample bulk density (g/cm^3)*:* 1.45

Fraction of bulk sample used (<2.00mm fraction) (%): 100.00

Dry weight of dew point potentiometer sample* (g)*:* 183.38

Tare weight, jar (g)*:* 117.59

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content † (% vol)
Dew point potentiometer:	14-Sep-23	10:35	187.89	8362	9.93
	8-Sep-23	15:36	186.24	58333	6.29
	6-Sep-23	14:41	185.33	327764	4.29

Volume Adjusted Data [1]

	Water Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calc. Porosity (%)
Dew point potentiometer:	8362	---	---	---	---
	58333	---	---	---	---
	327764	---	---	---	---

Dry weight of relative humidity box sample* (g)*:* 92.56

Tare weight (g)*:* 41.59

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content † (% vol)
Relative humidity box:	29-Aug-23	12:00	93.89	849860	3.77

Volume Adjusted Data [1]

	Water Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calc. Porosity (%)
Relative humidity box:	849860	---	---	---	---

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

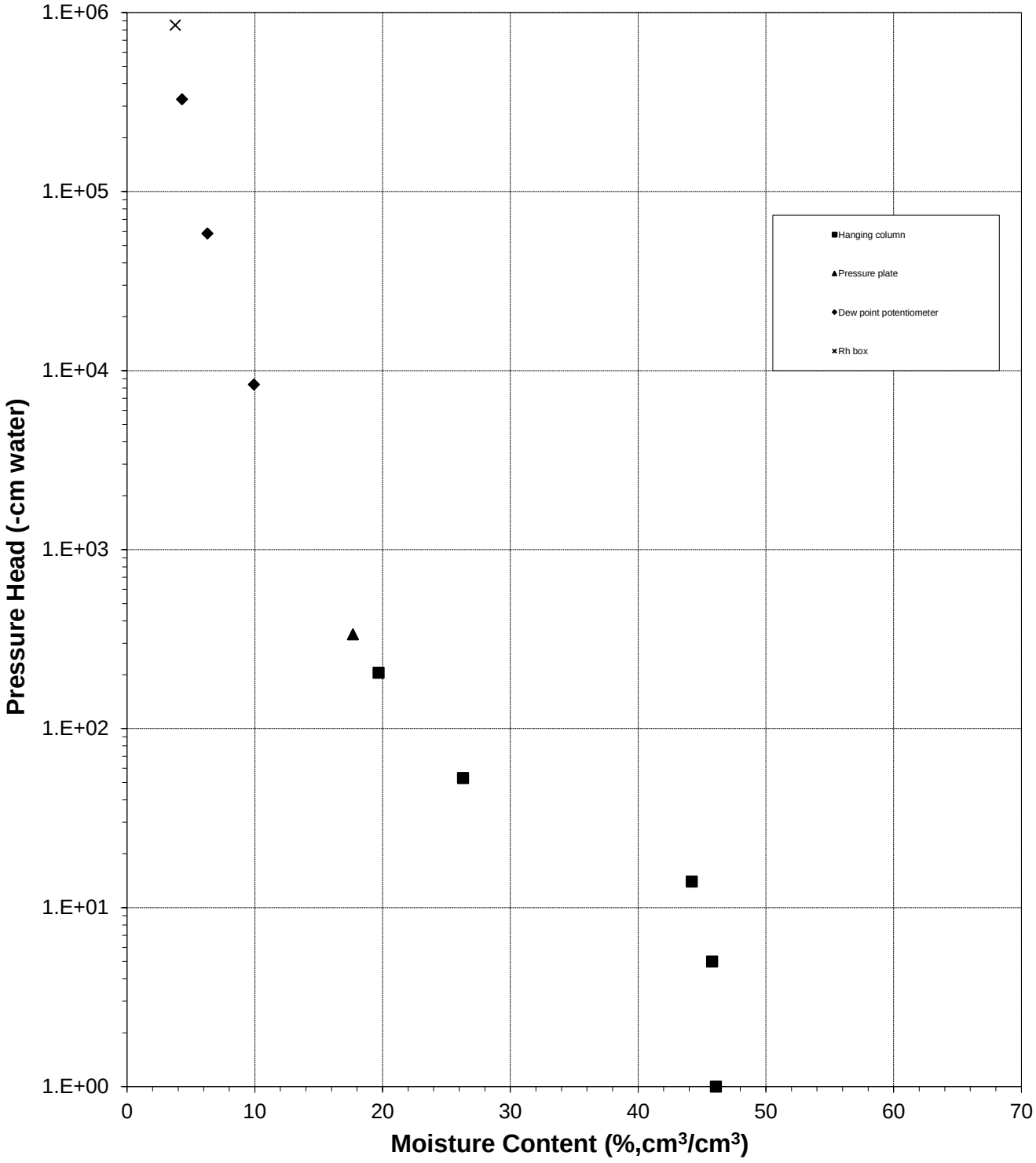
† Adjusted for >2.00mm (#10 sieve) material not used in DPP/RH testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm^3.

‡‡ 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: W. Seward
Checked by: J. Hines

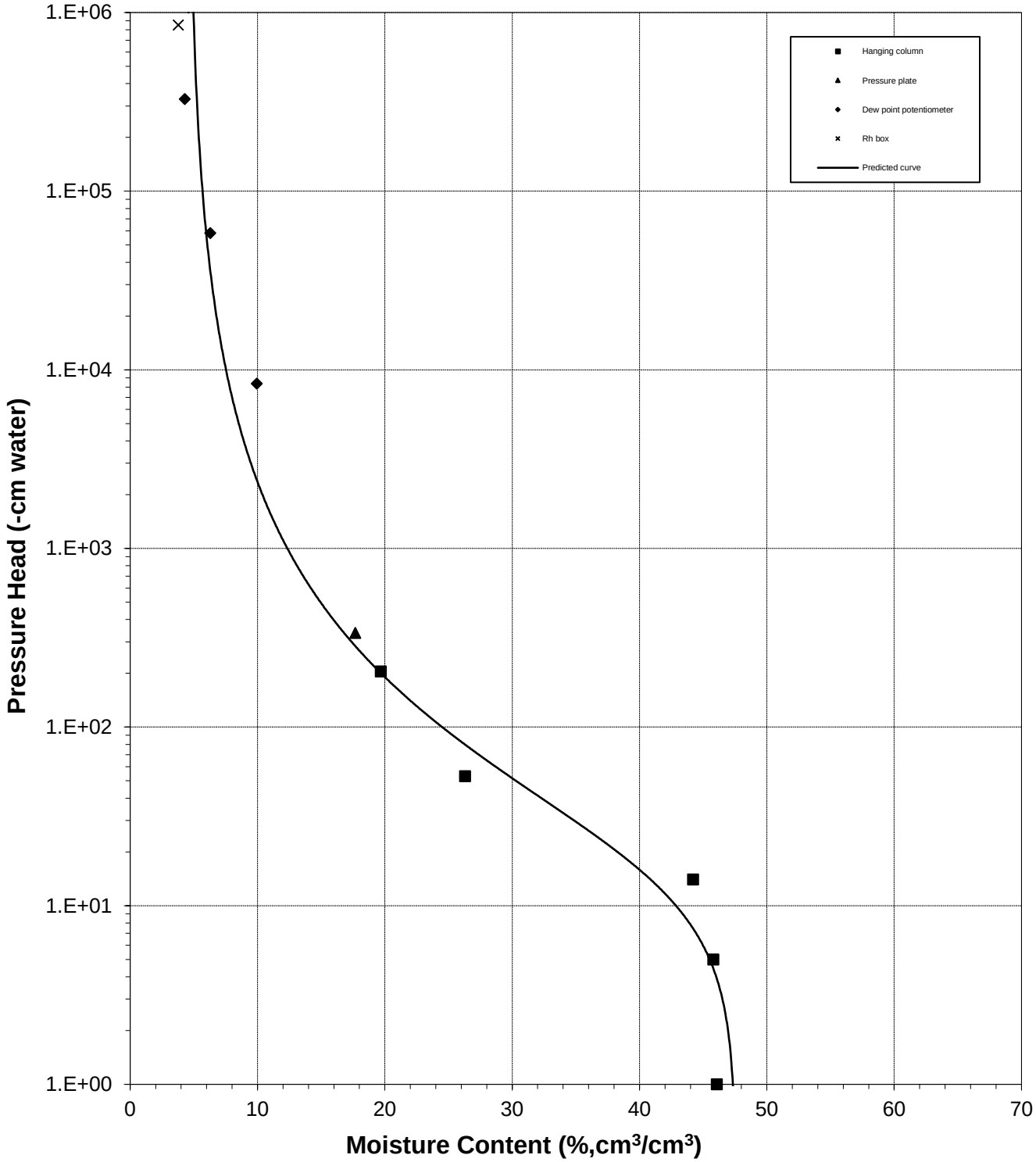
Water Retention Data Points

Sample Number: 9A-TP1 (1.45 g/cc)



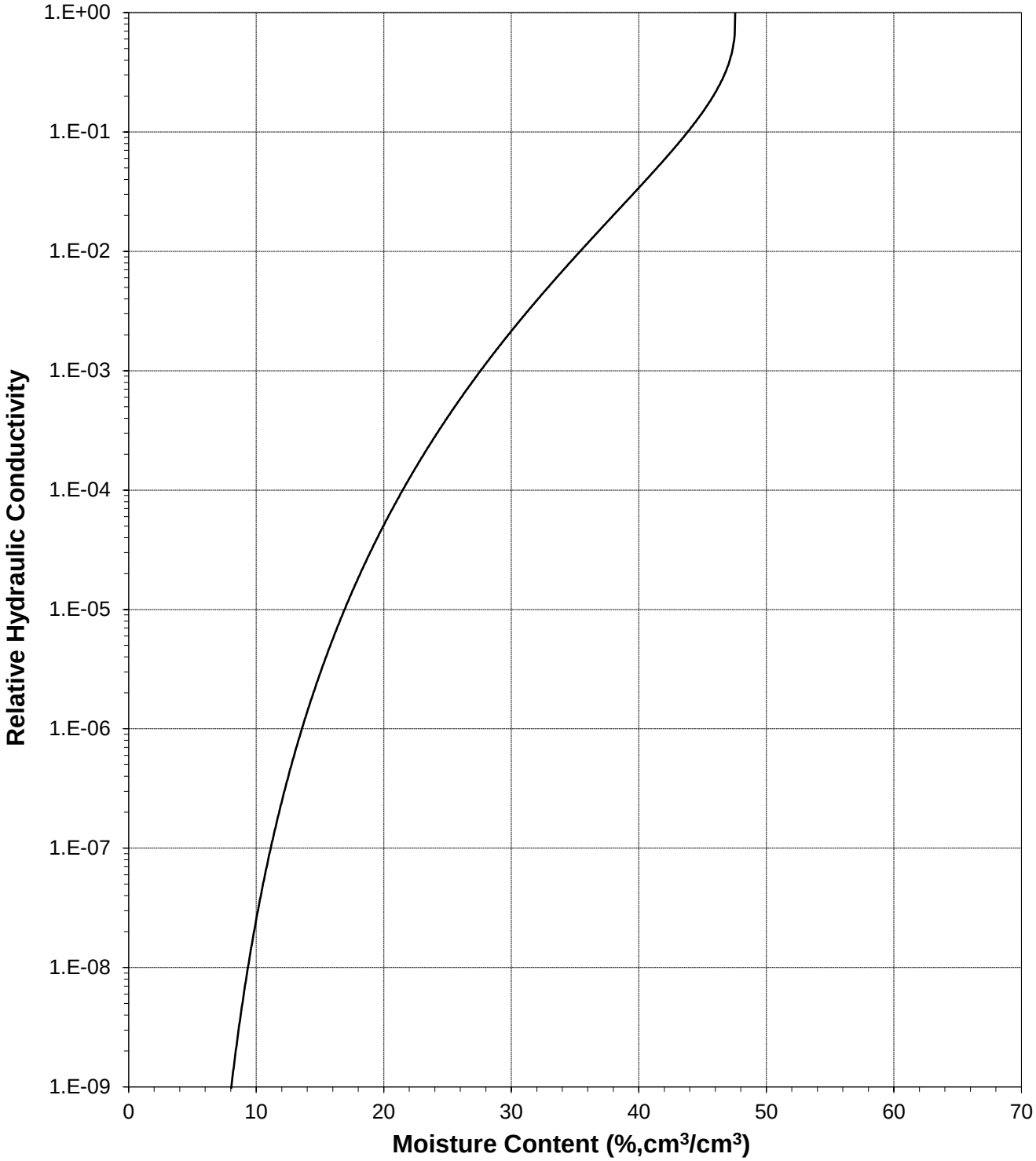
Predicted Water Retention Curve and Data Points

Sample Number: 9A-TP1 (1.45 g/cc)



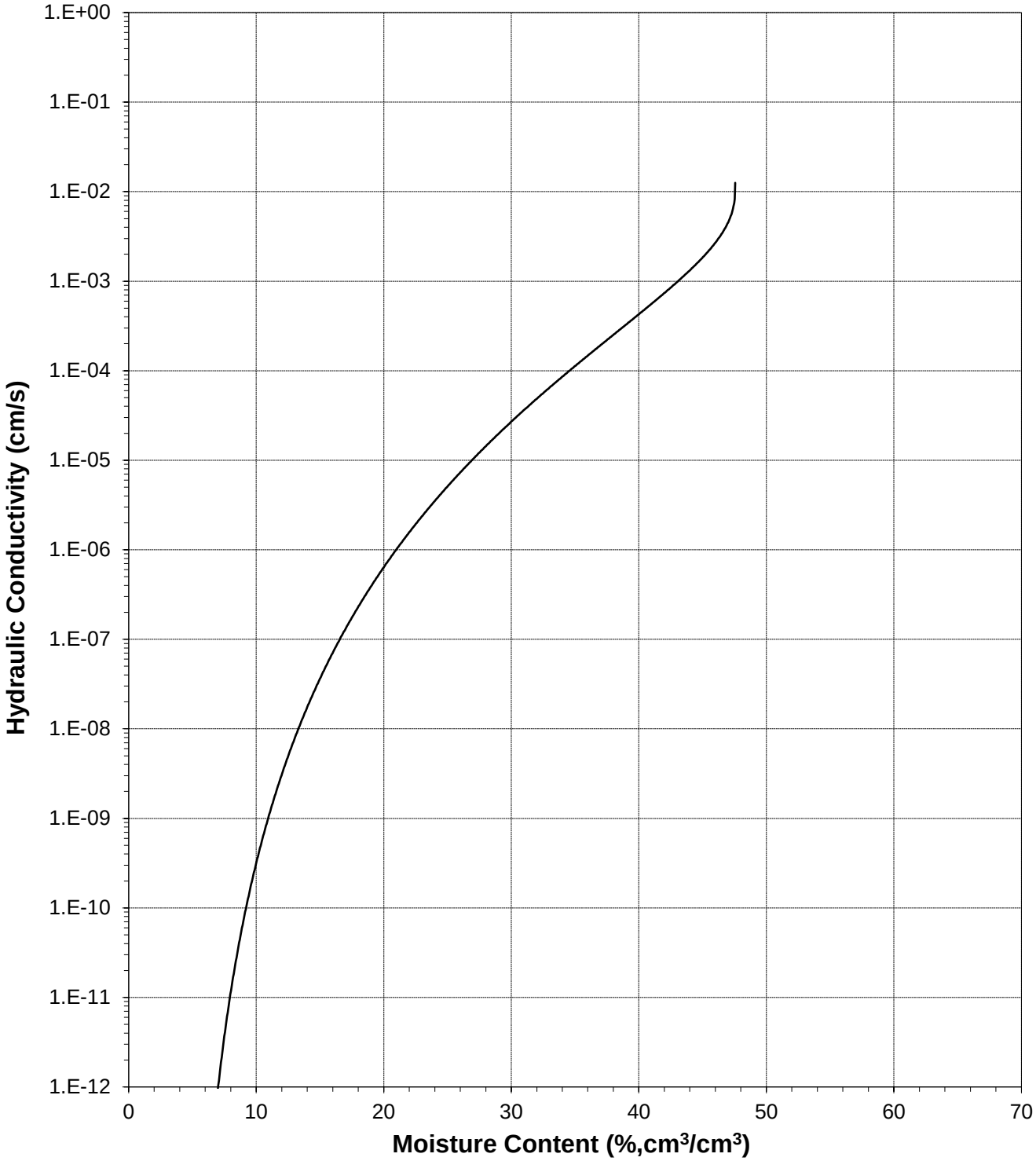
Plot of Relative Hydraulic Conductivity vs Moisture Content

Sample Number: 9A-TP1 (1.45 g/cc)



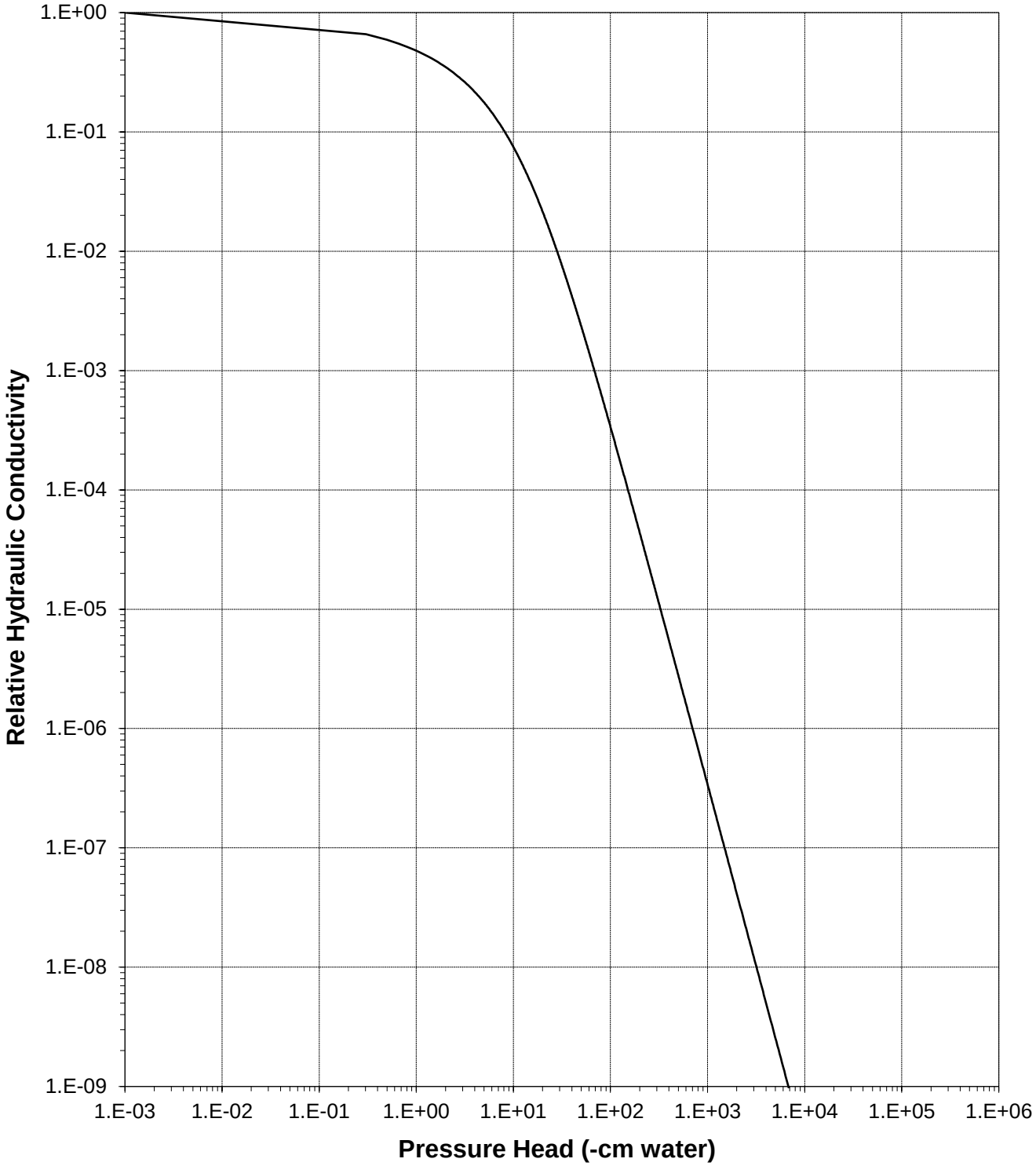
Plot of Hydraulic Conductivity vs Moisture Content

Sample Number: 9A-TP1 (1.45 g/cc)



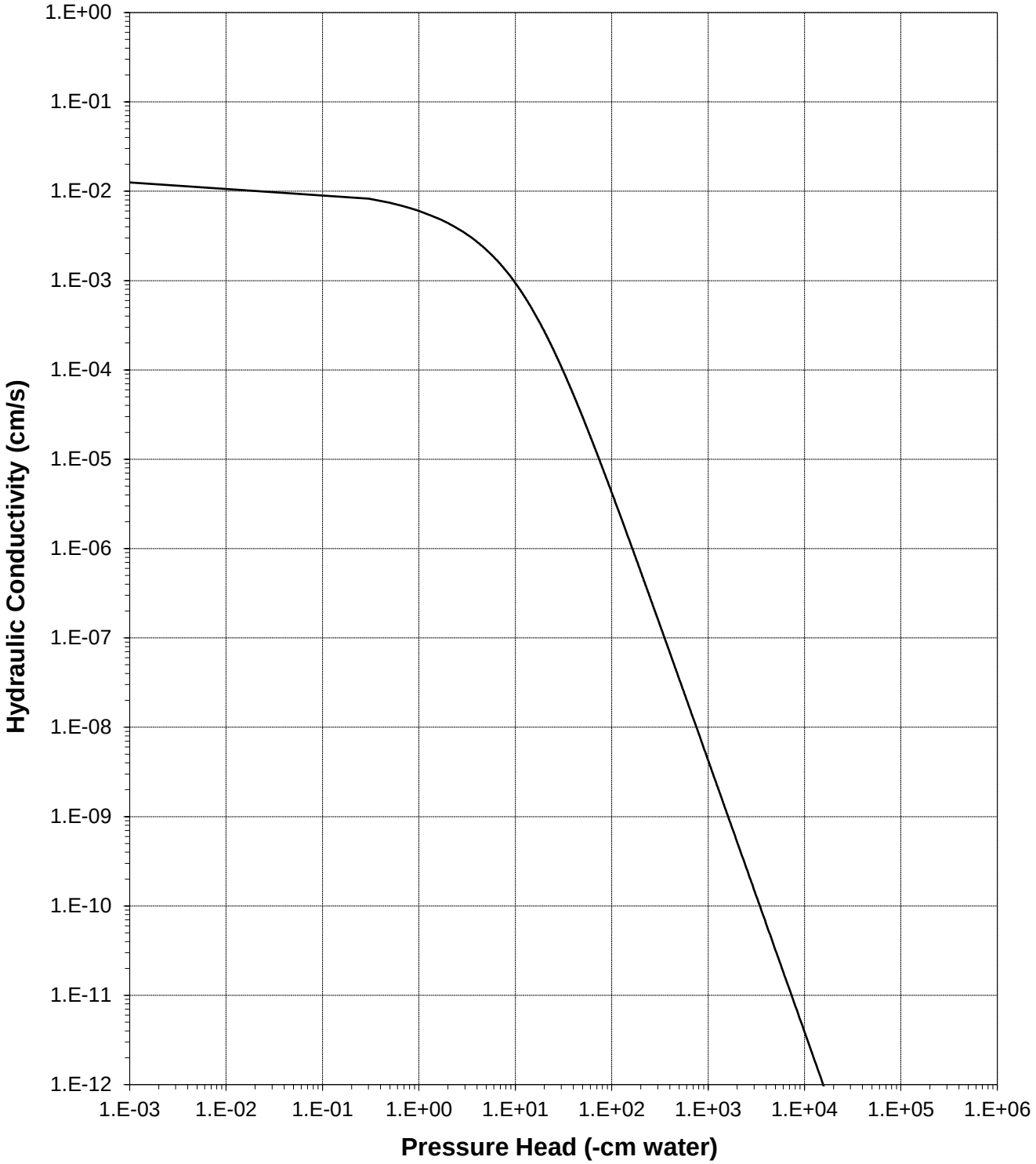
Plot of Relative Hydraulic Conductivity vs Pressure Head

Sample Number: 9A-TP1 (1.45 g/cc)



Plot of Hydraulic Conductivity vs Pressure Head

Sample Number: 9A-TP1 (1.45 g/cc)



Moisture Retention Data

Hanging Column / Pressure Plate

(Soil-Water Characteristic Curve)

Job Name: WSP Golder
Job Number: DB23.1010.00
Sample Number: 9A-TP4 (1.45 g/cc)
Project: 31406439 01.EXP
Fraction Tested: <2mm

Dry wt. of sample (g)*:* 208.17
Tare wt., ring (g)*:* 76.53
Tare wt., screen & clamp (g)*:* 27.36
Initial sample volume (cm^3)*:* 143.42
Initial dry bulk density (g/cm^3)*:* 1.45
Assumed particle density (g/cm^3)*:* 2.65
Initial calculated total porosity (%)*:* 45.23

	Date	Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content † (% vol)
Hanging column:	30-Aug-23	13:25	379.92	0	47.32
	6-Sep-23	8:00	379.61	5.0	47.10
	13-Sep-23	10:30	373.80	14.0	43.05
	20-Sep-23	10:15	348.68	53.0	25.53
	27-Sep-23	9:00	340.70	205.0	19.97
Pressure plate:	7-Oct-23	12:45	337.88	337	18.00

Volume Adjusted Data [1]

	Matric Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calculated Porosity (%)
Hanging column:	0.0	---	---	---	---
	5.0	---	---	---	---
	14.0	---	---	---	---
	53.0	---	---	---	---
	205.0	---	---	---	---
Pressure plate:	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/cm^3

‡‡ 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: W. Seward
Checked by: J. Hines

Moisture Retention Data

Dew Point Potentiometer / Relative Humidity Box

(Soil-Water Characteristic Curve)

Sample Number: 9A-TP4 (1.45 g/cc)

Initial sample bulk density (g/cm^3)*:* 1.45

Fraction of bulk sample used (<2.00mm fraction) (%): 100.00

Dry weight of dew point potentiometer sample* (g)*:* 173.88

Tare weight, jar (g)*:* 113.32

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content † (% vol)
Dew point potentiometer:	14-Sep-23	10:55	177.57	9688	8.84
	11-Sep-23	15:10	176.51	66899	6.30
	7-Sep-23	12:35	175.83	348160	4.67

Volume Adjusted Data [1]

	Water Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calc. Porosity (%)
Dew point potentiometer:	9688	---	---	---	---
	66899	---	---	---	---
	348160	---	---	---	---

Dry weight of relative humidity box sample* (g)*:* 81.34

Tare weight (g)*:* 39.40

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content † (% vol)
Relative humidity box:	29-Aug-23	12:00	82.59	849860	4.32

Volume Adjusted Data [1]

	Water Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calc. Porosity (%)
Relative humidity box:	849860	---	---	---	---

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

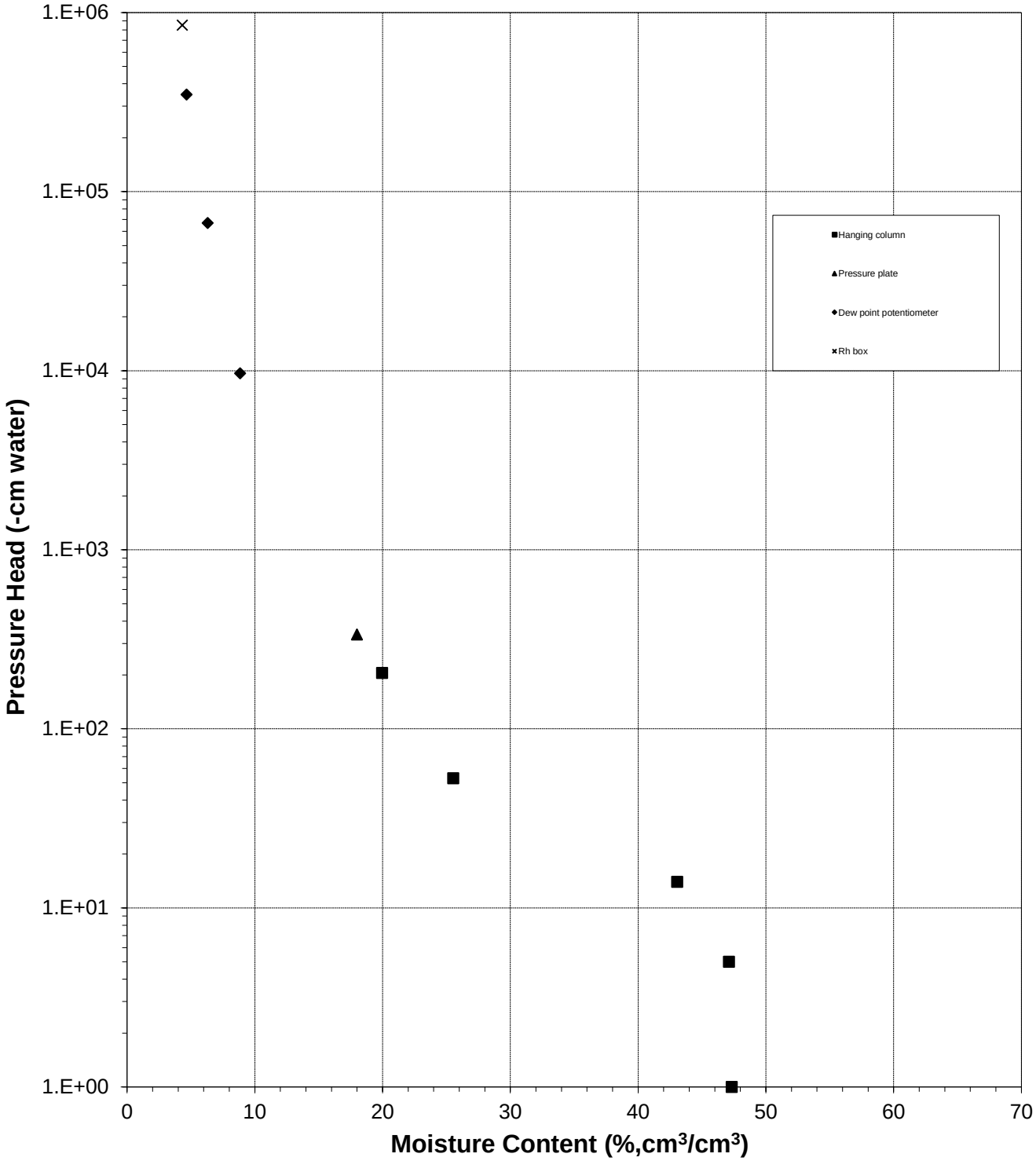
† Adjusted for >2.00mm (#10 sieve) material not used in DPP/RH testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm^3.

‡‡ 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: W. Seward
Checked by: J. Hines

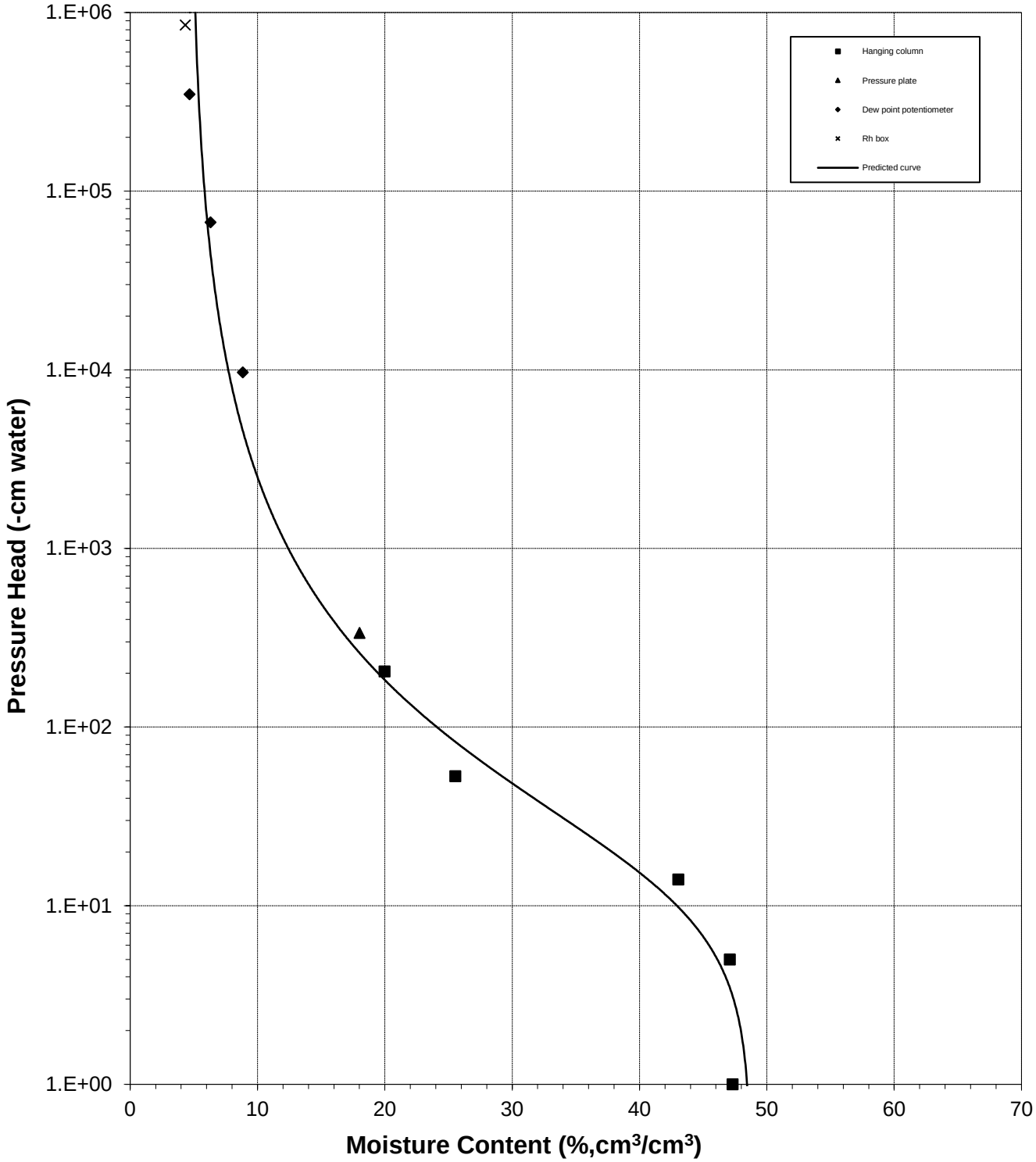
Water Retention Data Points

Sample Number: 9A-TP4 (1.45 g/cc)



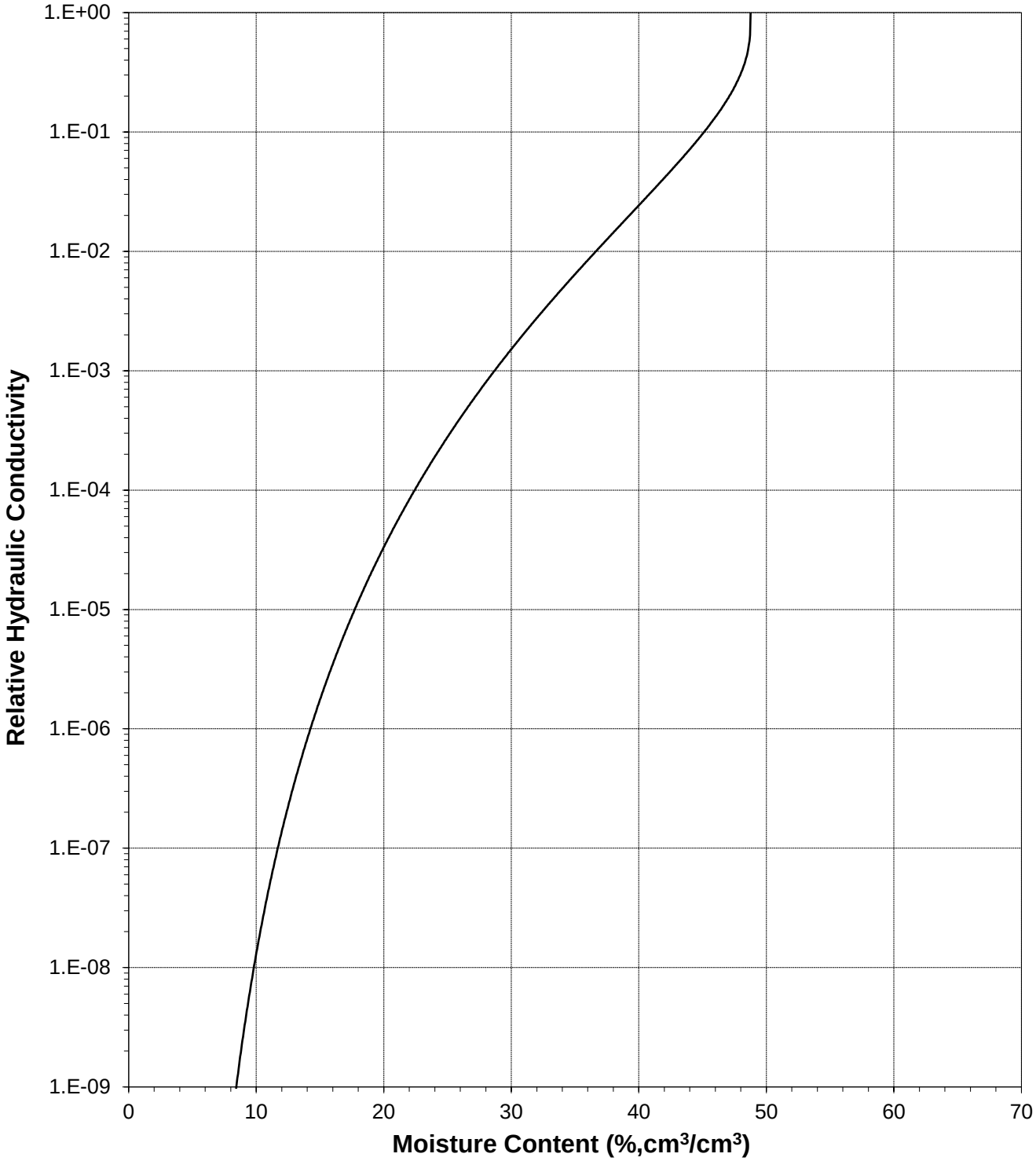
Predicted Water Retention Curve and Data Points

Sample Number: 9A-TP4 (1.45 g/cc)



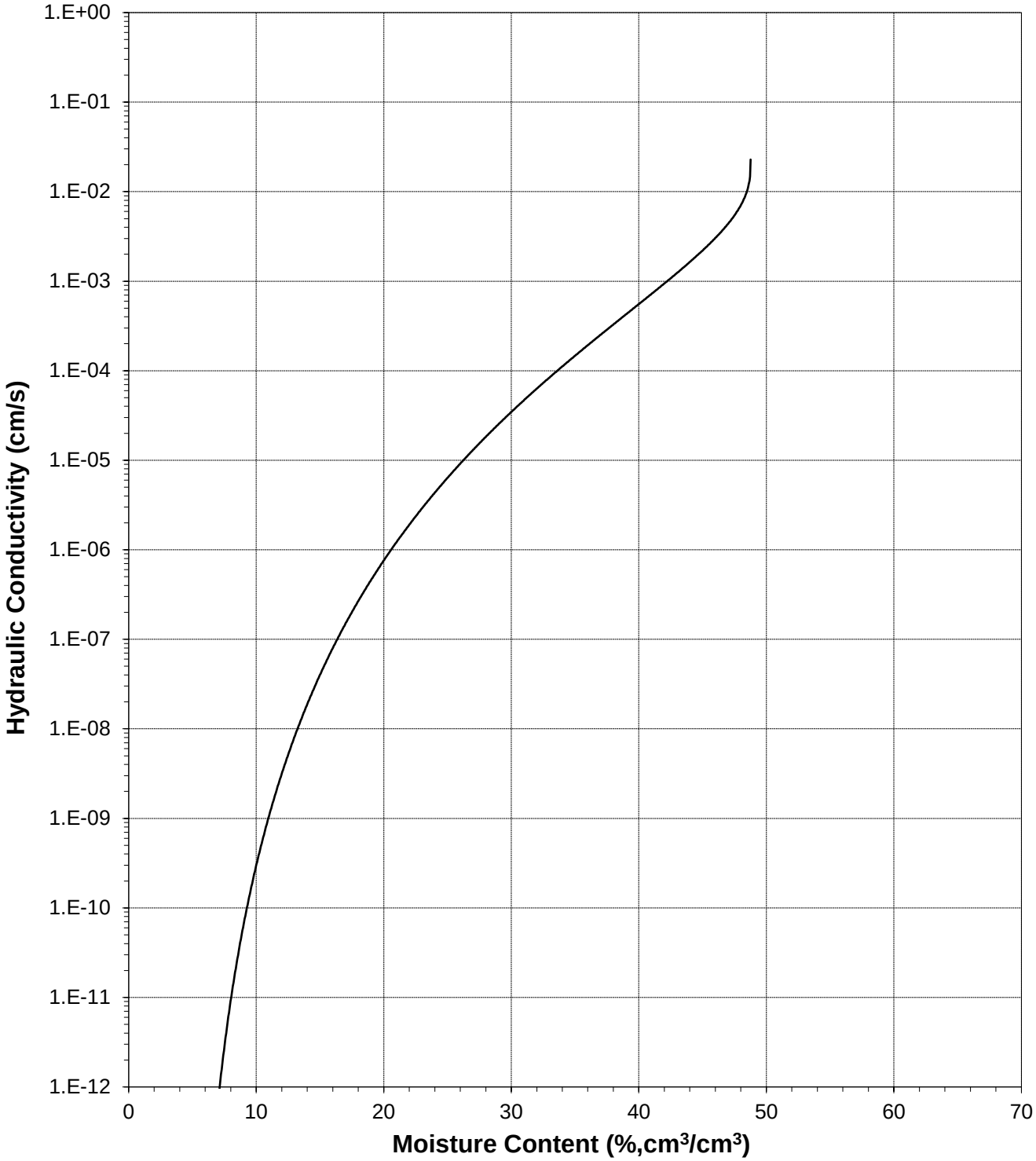
Plot of Relative Hydraulic Conductivity vs Moisture Content

Sample Number: 9A-TP4 (1.45 g/cc)



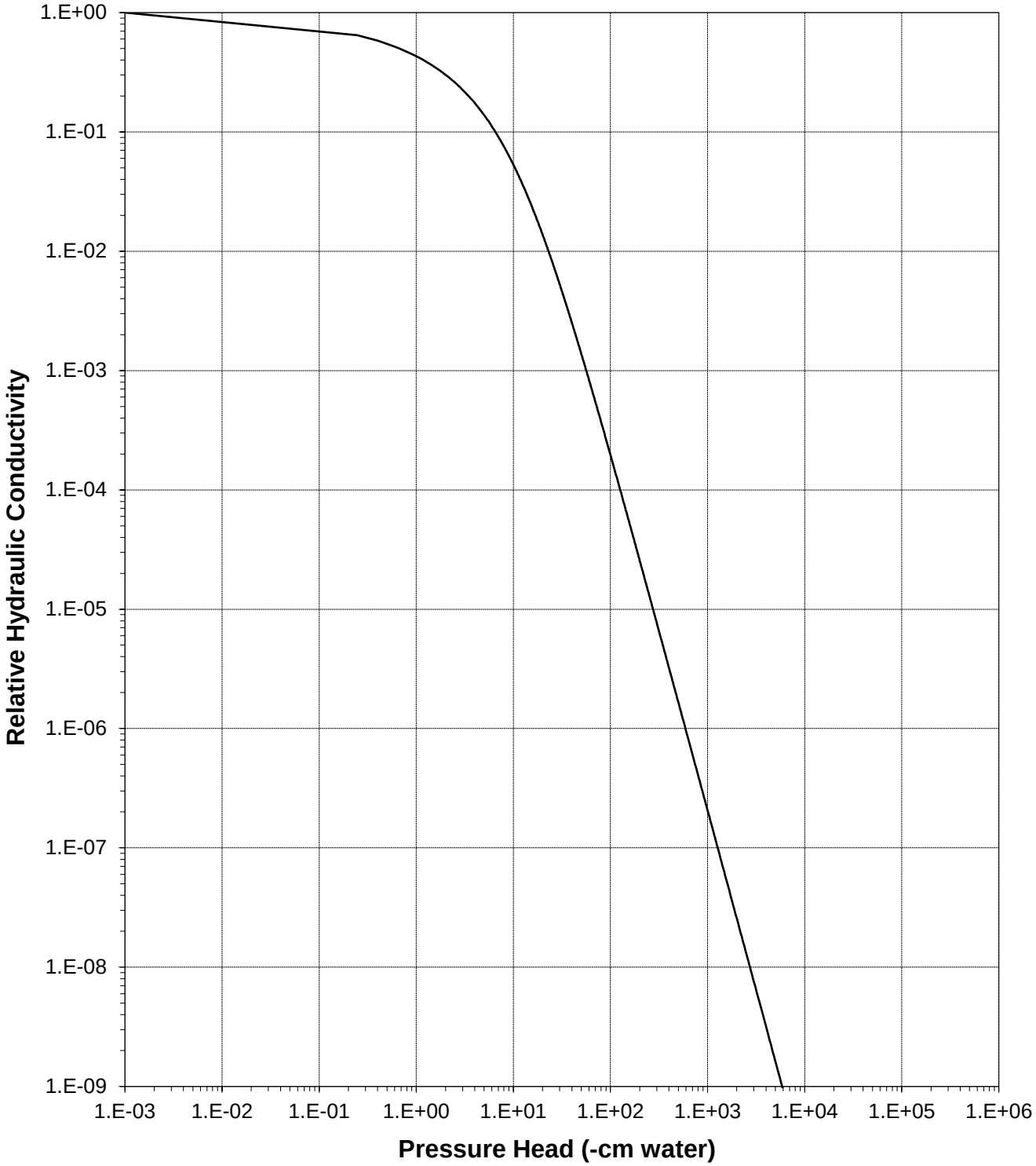
Plot of Hydraulic Conductivity vs Moisture Content

Sample Number: 9A-TP4 (1.45 g/cc)



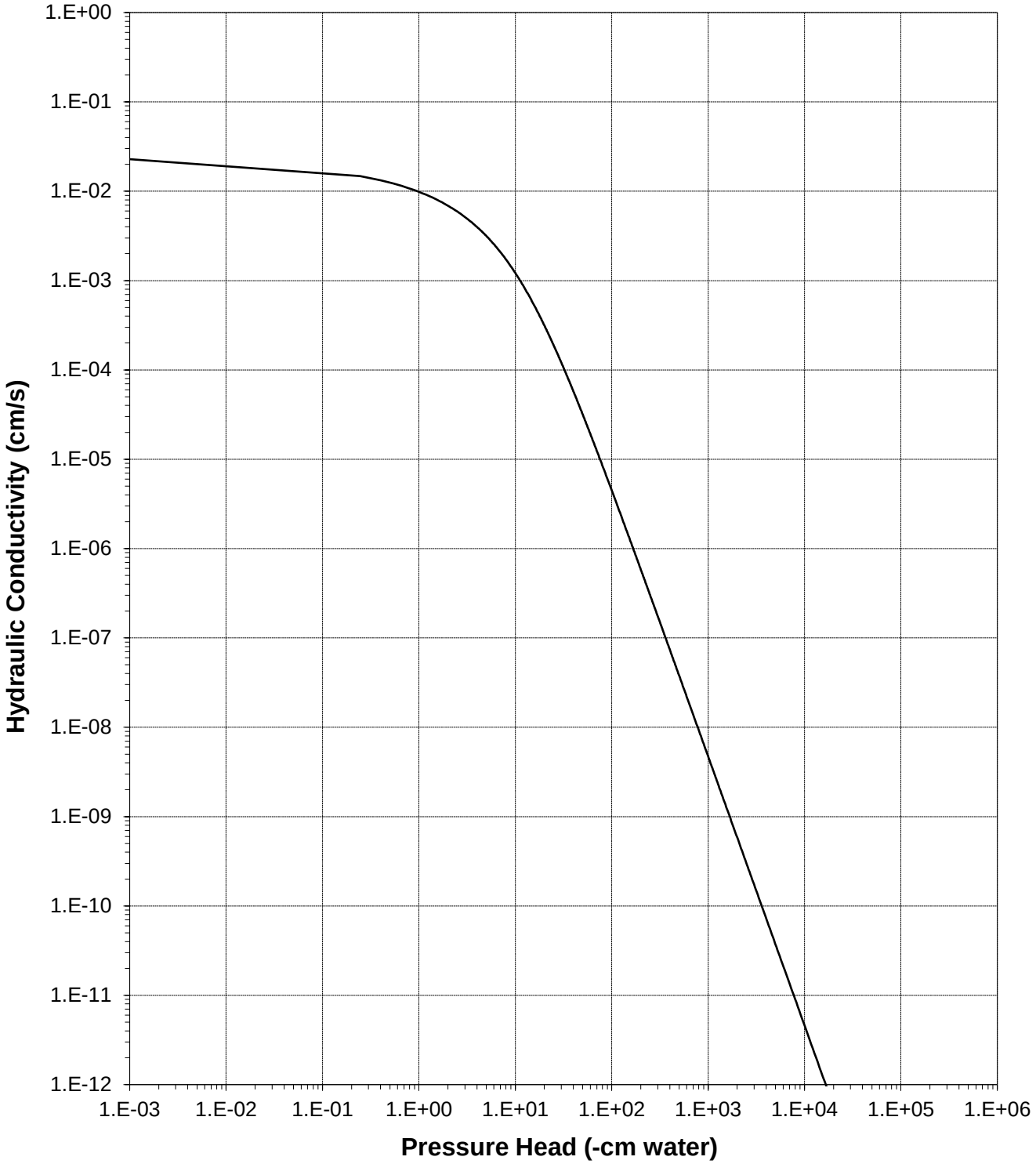
Plot of Relative Hydraulic Conductivity vs Pressure Head

Sample Number: 9A-TP4 (1.45 g/cc)



Plot of Hydraulic Conductivity vs Pressure Head

Sample Number: 9A-TP4 (1.45 g/cc)



Moisture Retention Data

Hanging Column / Pressure Plate

(Soil-Water Characteristic Curve)

Job Name: WSP Golder
Job Number: DB23.1010.00
Sample Number: 9AX-TP2 (1.44 g/cc)
Project: 31406439 01.EXP
Fraction Tested: <2mm

Dry wt. of sample (g)*:* 210.34
Tare wt., ring (g)*:* 83.28
Tare wt., screen & clamp (g)*:* 27.90
Initial sample volume (cm^3)*:* 145.65
Initial dry bulk density (g/cm^3)*:* 1.44
Assumed particle density (g/cm^3)*:* 2.65
Initial calculated total porosity (%)*:* 45.50

	Date	Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content † (% vol)	
Hanging column:	30-Aug-23	13:35	388.57	0	46.04	
	6-Sep-23	8:15	382.56	5.0	44.71	‡‡
	13-Sep-23	10:30	364.48	23.0	32.11	‡‡
	20-Sep-23	10:30	352.70	79.0	23.30	‡‡
Pressure plate:	2-Oct-23	6:30	345.50	337	17.92	‡‡

Volume Adjusted Data [1]

	Matric Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calculated Porosity (%)
Hanging column:	0.0	---	---	---	---
	5.0	136.51	-6.27%	1.54	41.86
	23.0	133.79	-8.14%	1.57	40.67
	79.0	133.79	-8.14%	1.57	40.67
Pressure plate:	337	133.79	-8.14%	1.57	40.67

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/cm^3

‡‡ 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: W. Seward
Checked by: J. Hines

Moisture Retention Data

Dew Point Potentiometer / Relative Humidity Box

(Soil-Water Characteristic Curve)

Sample Number: 9AX-TP2 (1.44 g/cc)

Initial sample bulk density (g/cm^3)*:* 1.44

Fraction of bulk sample used (<2.00mm fraction) (%): 100.00

Dry weight of dew point potentiometer sample* (g)*:* 189.62

Tare weight, jar (g)*:* 116.62

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content † (% vol)	
Dew point potentiometer:	18-Sep-23	13:02	193.09	8770	7.47	‡‡
	13-Sep-23	15:08	191.62	54661	4.32	‡‡
	7-Sep-23	15:05	190.84	398130	2.64	‡‡

Volume Adjusted Data [1]

	Water Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calc. Porosity (%)
Dew point potentiometer:	8770	133.79	-8.14%	1.57	40.67
	54661	133.79	-8.14%	1.57	40.67
	398130	133.79	-8.14%	1.57	40.67

Dry weight of relative humidity box sample* (g)*:* 76.92

Tare weight (g)*:* 37.28

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content † (% vol)	
Relative humidity box:	29-Aug-23	12:00	77.56	849860	2.53	‡‡

Volume Adjusted Data [1]

	Water Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calc. Porosity (%)
Relative humidity box:	849860	133.79	-8.14%	1.57	40.67

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

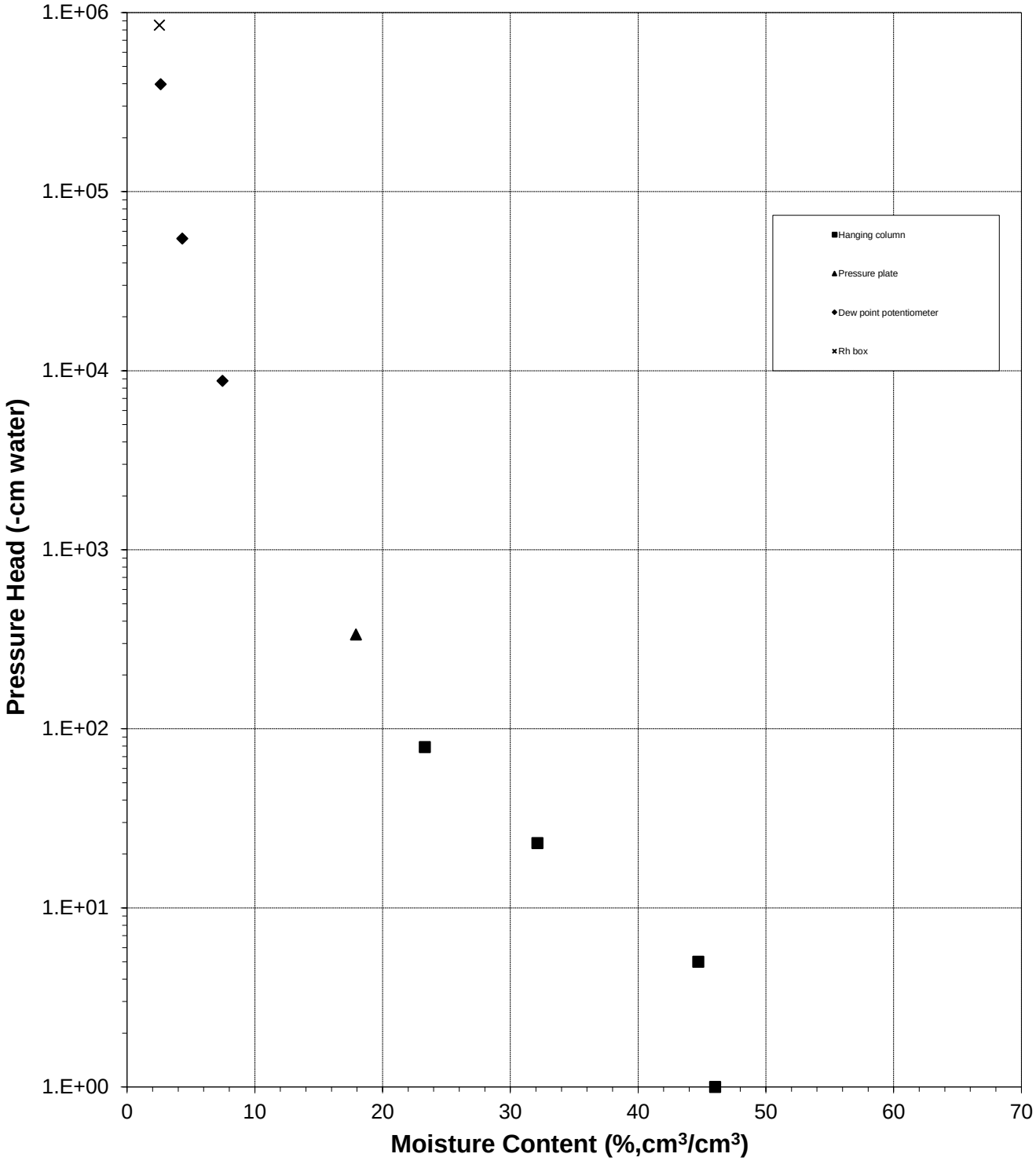
† Adjusted for >2.00mm (#10 sieve) material not used in DPP/RH testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm^3.

‡‡ 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: W. Seward
Checked by: J. Hines

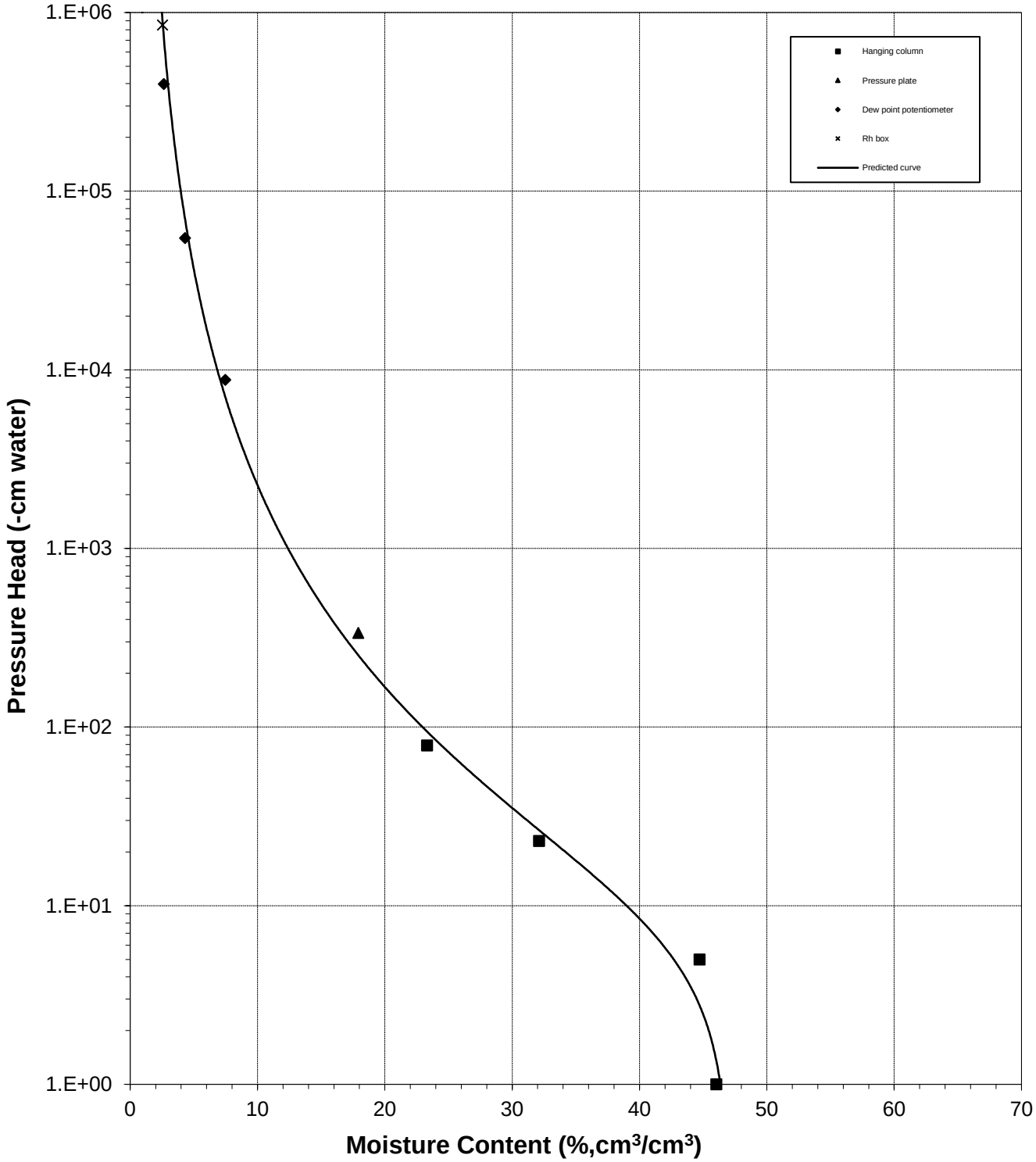
Water Retention Data Points

Sample Number: 9AX-TP2 (1.44 g/cc)



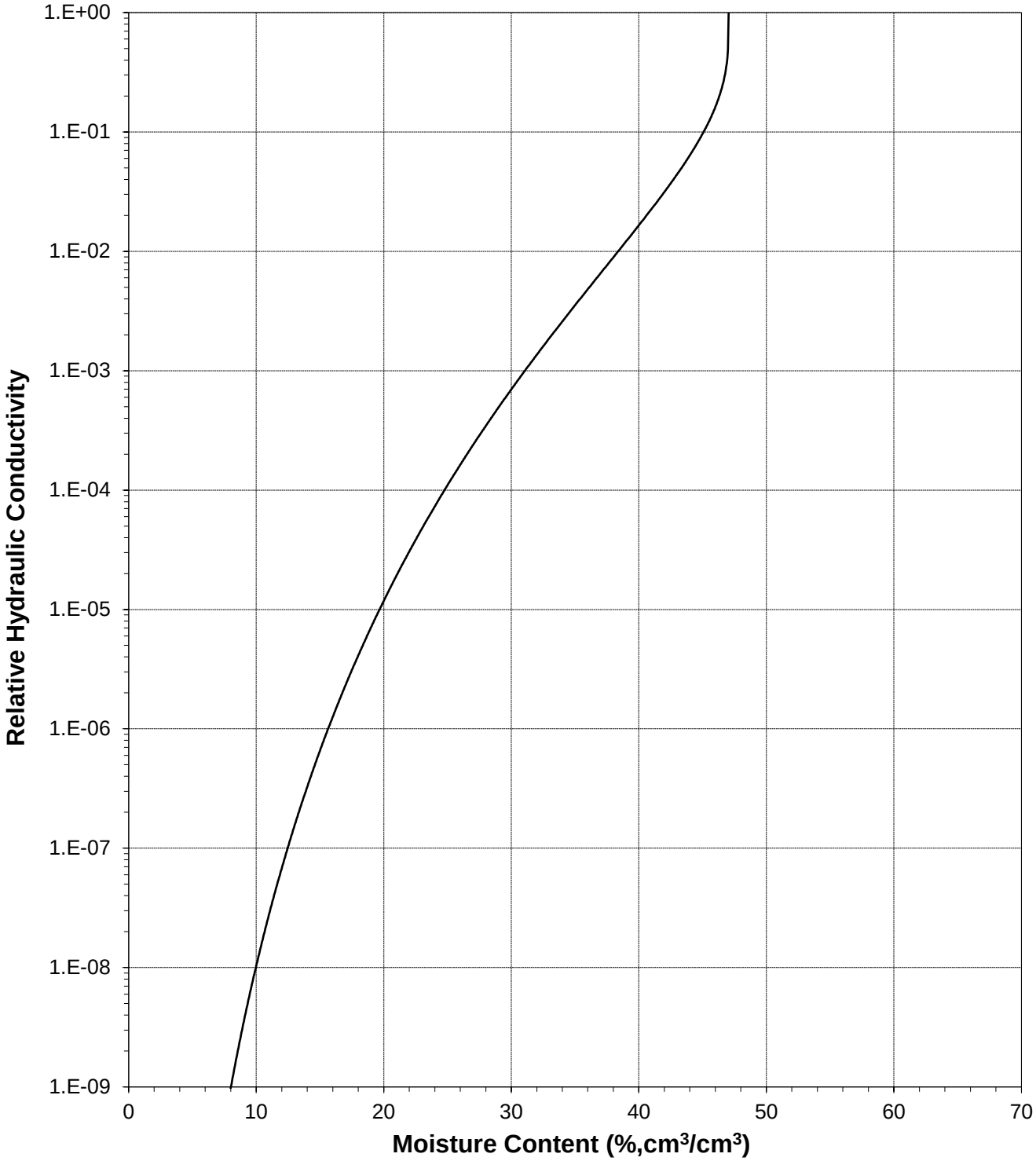
Predicted Water Retention Curve and Data Points

Sample Number: 9AX-TP2 (1.44 g/cc)



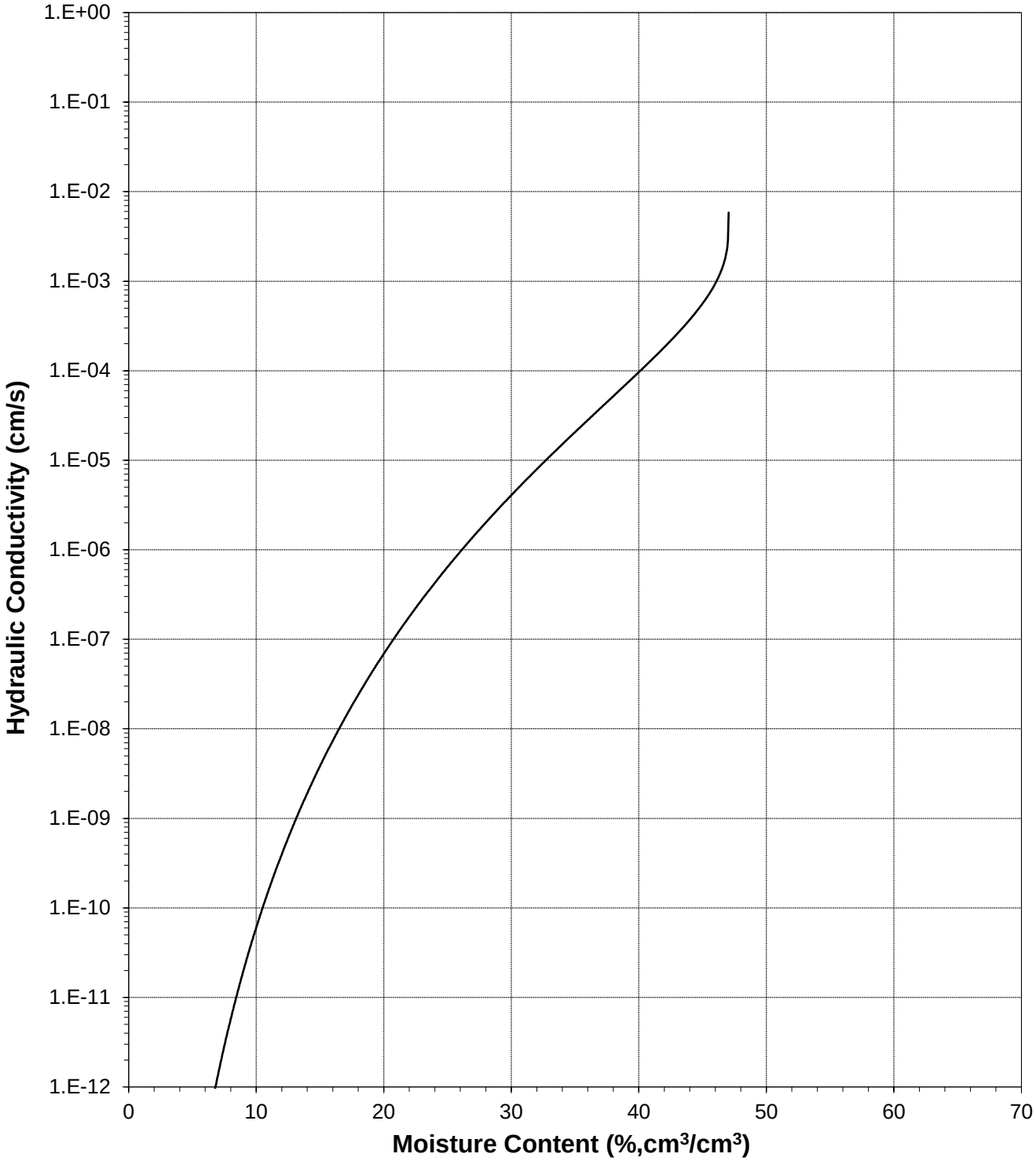
Plot of Relative Hydraulic Conductivity vs Moisture Content

Sample Number: 9AX-TP2 (1.44 g/cc)



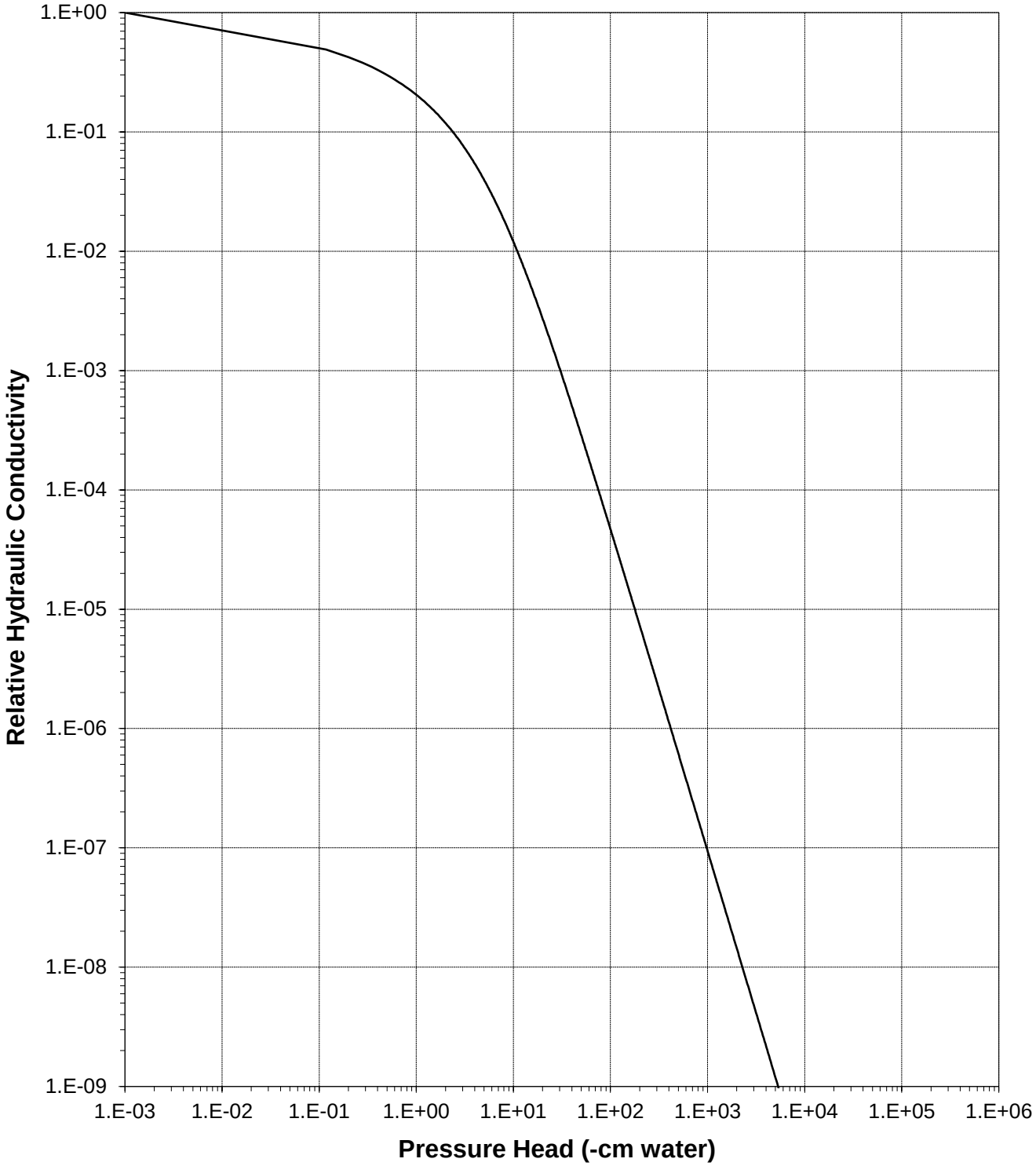
Plot of Hydraulic Conductivity vs Moisture Content

Sample Number: 9AX-TP2 (1.44 g/cc)



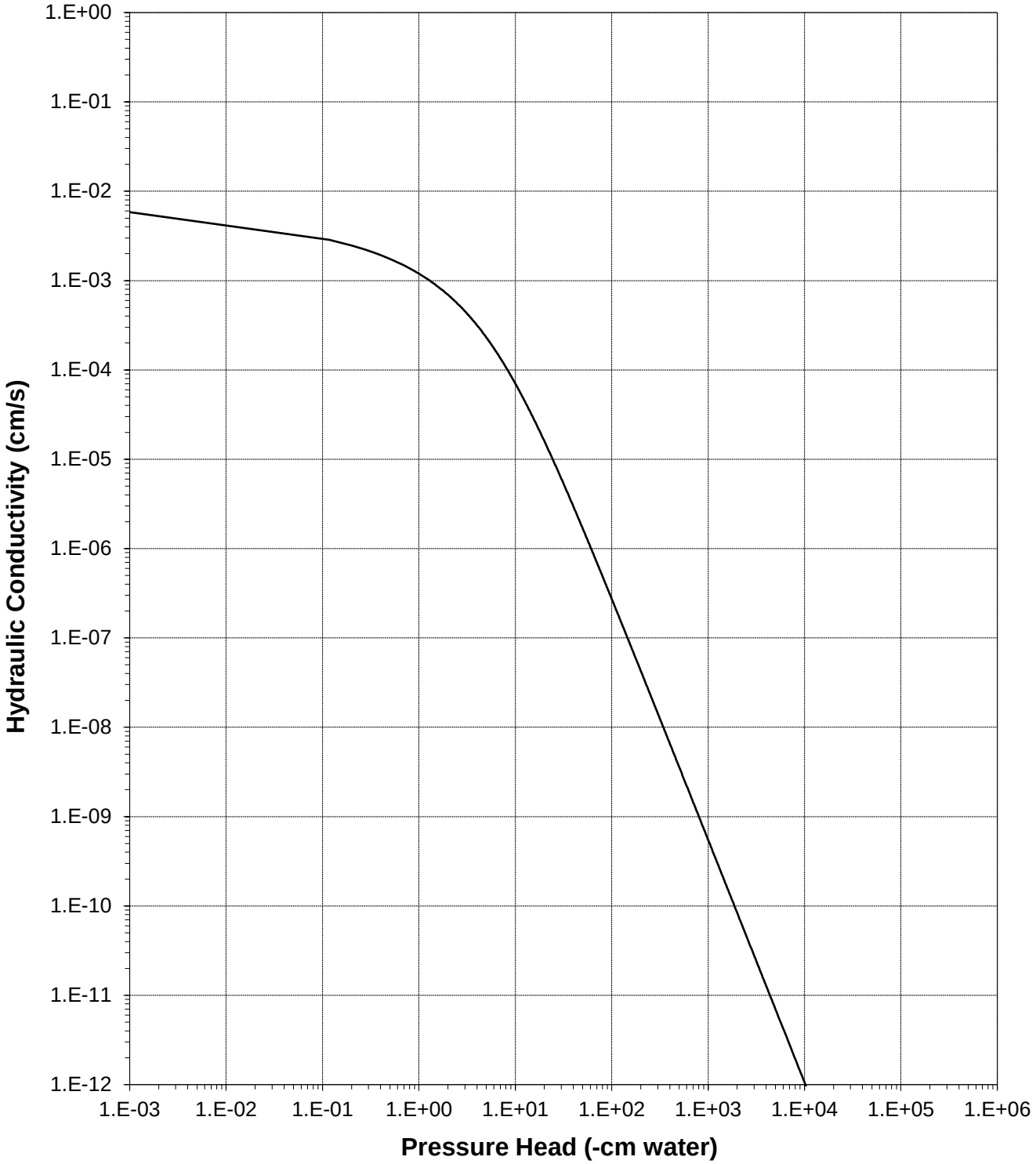
Plot of Relative Hydraulic Conductivity vs Pressure Head

Sample Number: 9AX-TP2 (1.44 g/cc)



Plot of Hydraulic Conductivity vs Pressure Head

Sample Number: 9AX-TP2 (1.44 g/cc)



Moisture Retention Data

Hanging Column / Pressure Plate

(Soil-Water Characteristic Curve)

Job Name: WSP Golder
Job Number: DB23.1010.00
Sample Number: 9AX-GB1 (1.44 g/cc)
Project: 31406439 01.EXP
Fraction Tested: <2mm

Dry wt. of sample (g)*:* 211.40
Tare wt., ring (g)*:* 84.16
Tare wt., screen & clamp (g)*:* 24.29
Initial sample volume (cm^3)*:* 146.83
Initial dry bulk density (g/cm^3)*:* 1.44
Assumed particle density (g/cm^3)*:* 2.85
Initial calculated total porosity (%)*:* 49.48

	Date	Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content † (% vol)	
Hanging column:	30-Aug-23	13:35	392.35	0	49.38	
	6-Sep-23	8:15	394.62	5.0	49.82	‡‡
	13-Sep-23	10:30	394.00	23.0	49.67	‡‡
	20-Sep-23	10:30	370.95	79.0	34.26	‡‡
Pressure plate:	2-Oct-23	6:30	361.16	337	27.70	‡‡

Volume Adjusted Data [1]

	Matric Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calculated Porosity (%)
Hanging column:	0.0	---	---	---	---
	5.0	150.07	+2.21%	1.41	50.57
	23.0	149.28	+1.67%	1.42	50.31
	79.0	149.16	+1.59%	1.42	50.27
Pressure plate:	337	149.16	+1.59%	1.42	50.27

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/cm^3

‡‡ 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: W. Seward
Checked by: J. Hines

Moisture Retention Data

Dew Point Potentiometer / Relative Humidity Box

(Soil-Water Characteristic Curve)

Sample Number: 9AX-GB1 (1.44 g/cc)

Initial sample bulk density (g/cm^3)*:* 1.44

Fraction of bulk sample used (<2.00mm fraction) (%): 100.00

Dry weight of dew point potentiometer sample* (g)*:* 174.49

Tare weight, jar (g)*:* 111.83

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content † (% vol)	
Dew point potentiometer:	15-Sep-23	9:06	180.97	16215	14.66	‡‡
	13-Sep-23	14:49	179.61	76485	11.57	‡‡
	8-Sep-23	16:39	178.53	334290	9.14	‡‡

Volume Adjusted Data [1]

	Water Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calc. Porosity (%)
Dew point potentiometer:	16215	149.16	+1.59%	1.42	50.27
	76485	149.16	+1.59%	1.42	50.27
	334290	149.16	+1.59%	1.42	50.27

Dry weight of relative humidity box sample* (g)*:* 77.97

Tare weight (g)*:* 38.79

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content † (% vol)	
Relative humidity box:	29-Aug-23	12:00	80.16	849860	7.91	‡‡

Volume Adjusted Data [1]

	Water Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calc. Porosity (%)
Relative humidity box:	849860	149.16	+1.59%	1.42	50.27

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

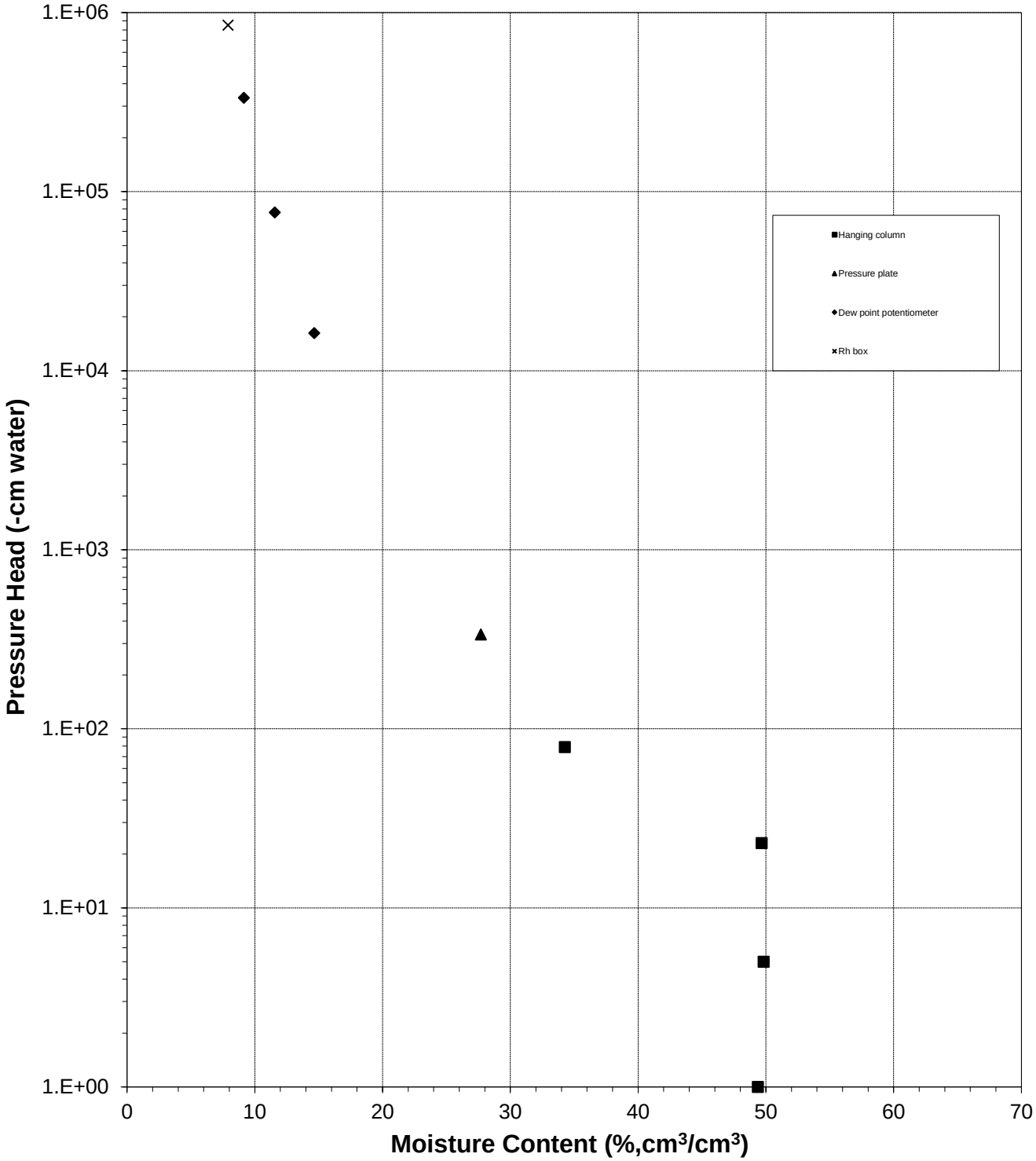
† Adjusted for >2.00mm (#10 sieve) material not used in DPP/RH testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm^3.

‡‡ 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: W. Seward
Checked by: J. Hines

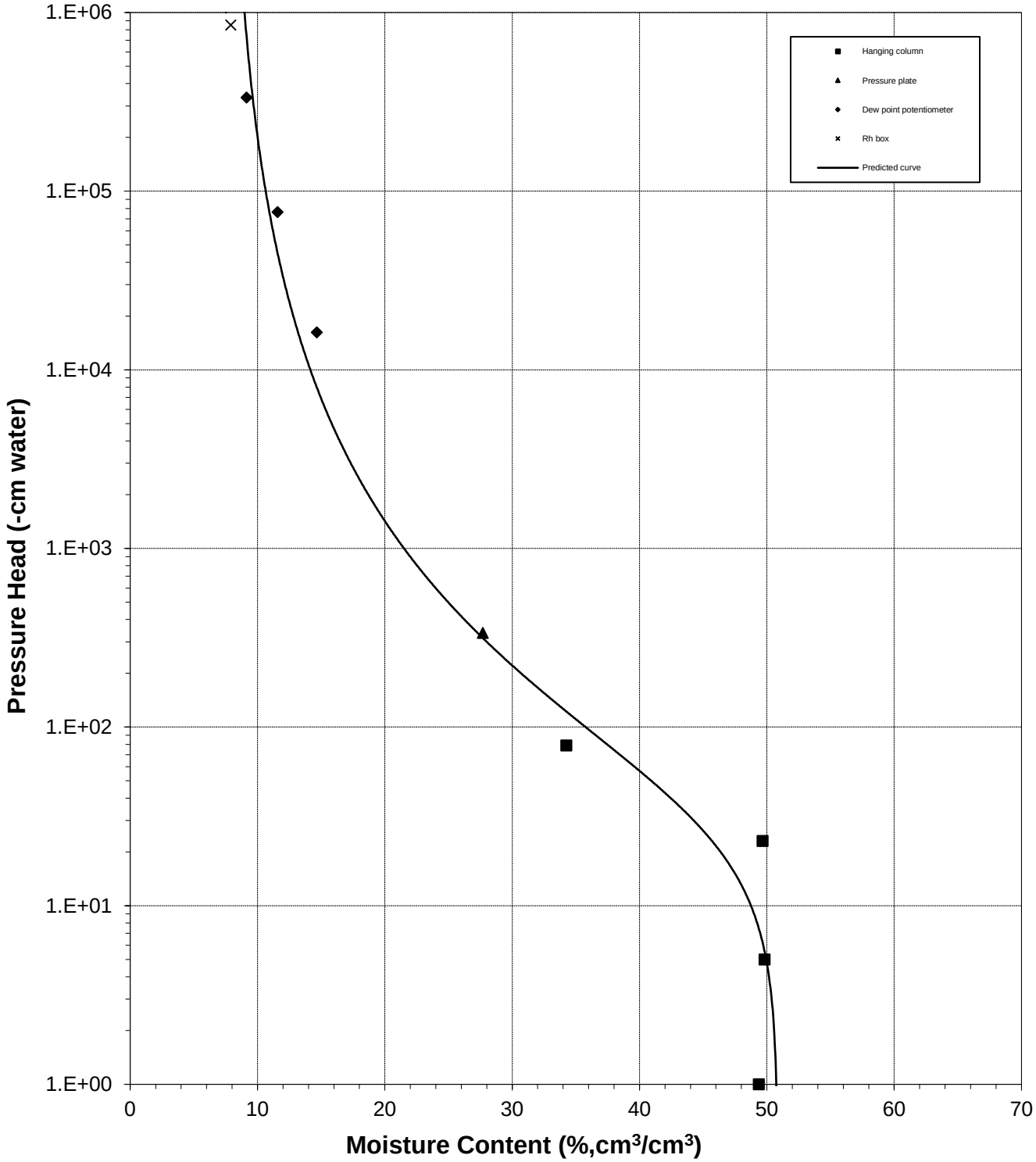
Water Retention Data Points

Sample Number: 9AX-GB1 (1.44 g/cc)



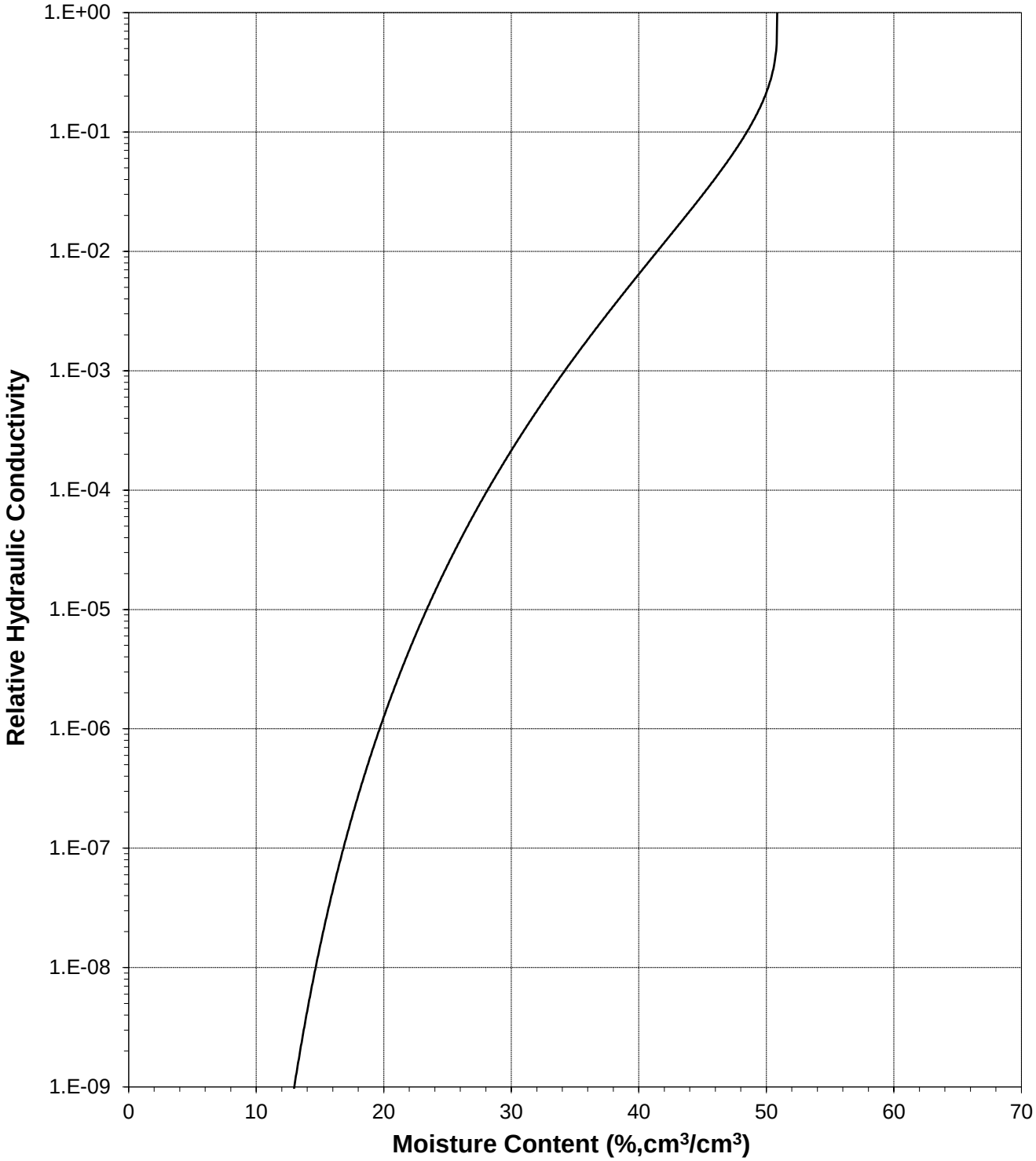
Predicted Water Retention Curve and Data Points

Sample Number: 9AX-GB1 (1.44 g/cc)



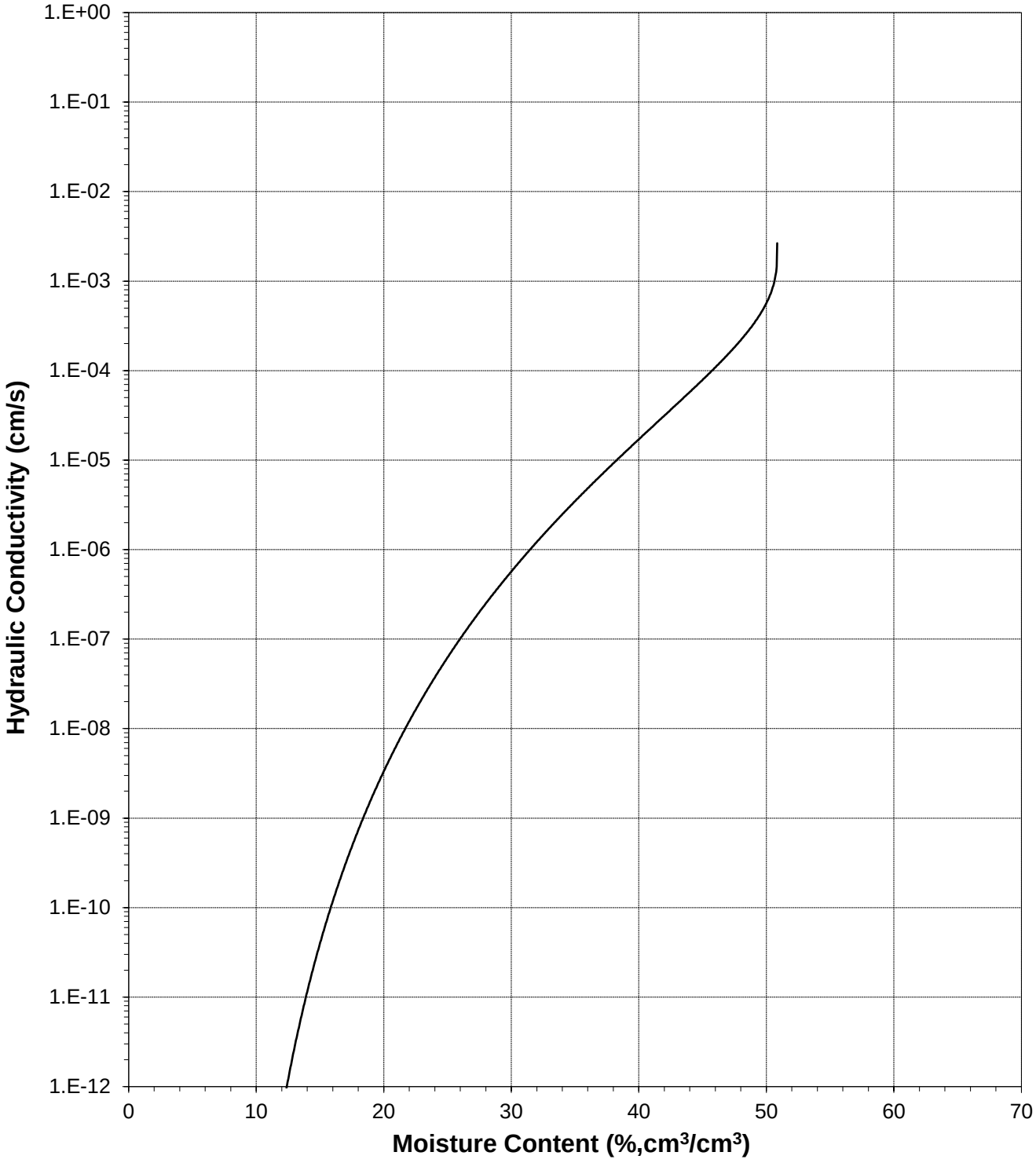
Plot of Relative Hydraulic Conductivity vs Moisture Content

Sample Number: 9AX-GB1 (1.44 g/cc)



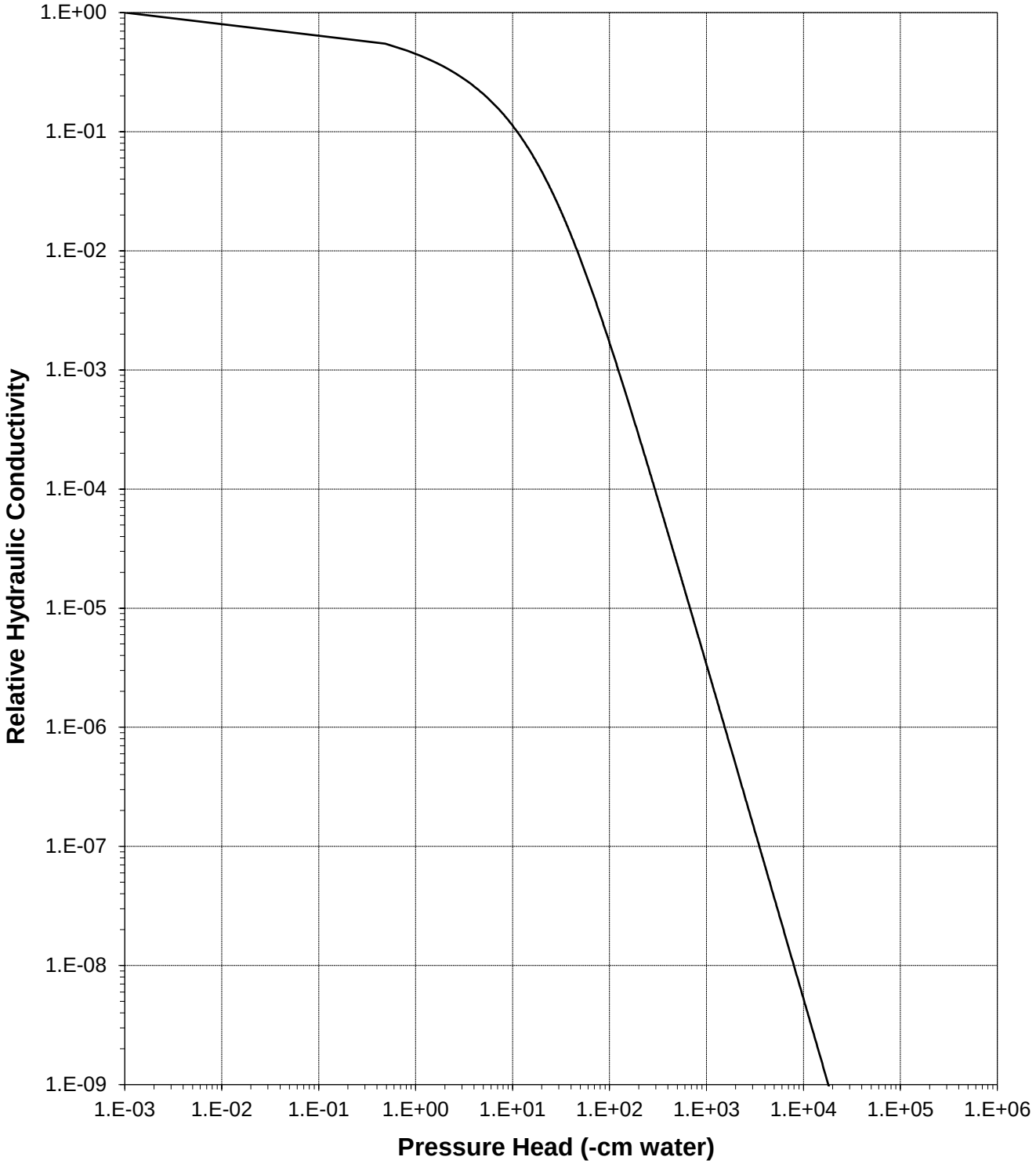
Plot of Hydraulic Conductivity vs Moisture Content

Sample Number: 9AX-GB1 (1.44 g/cc)



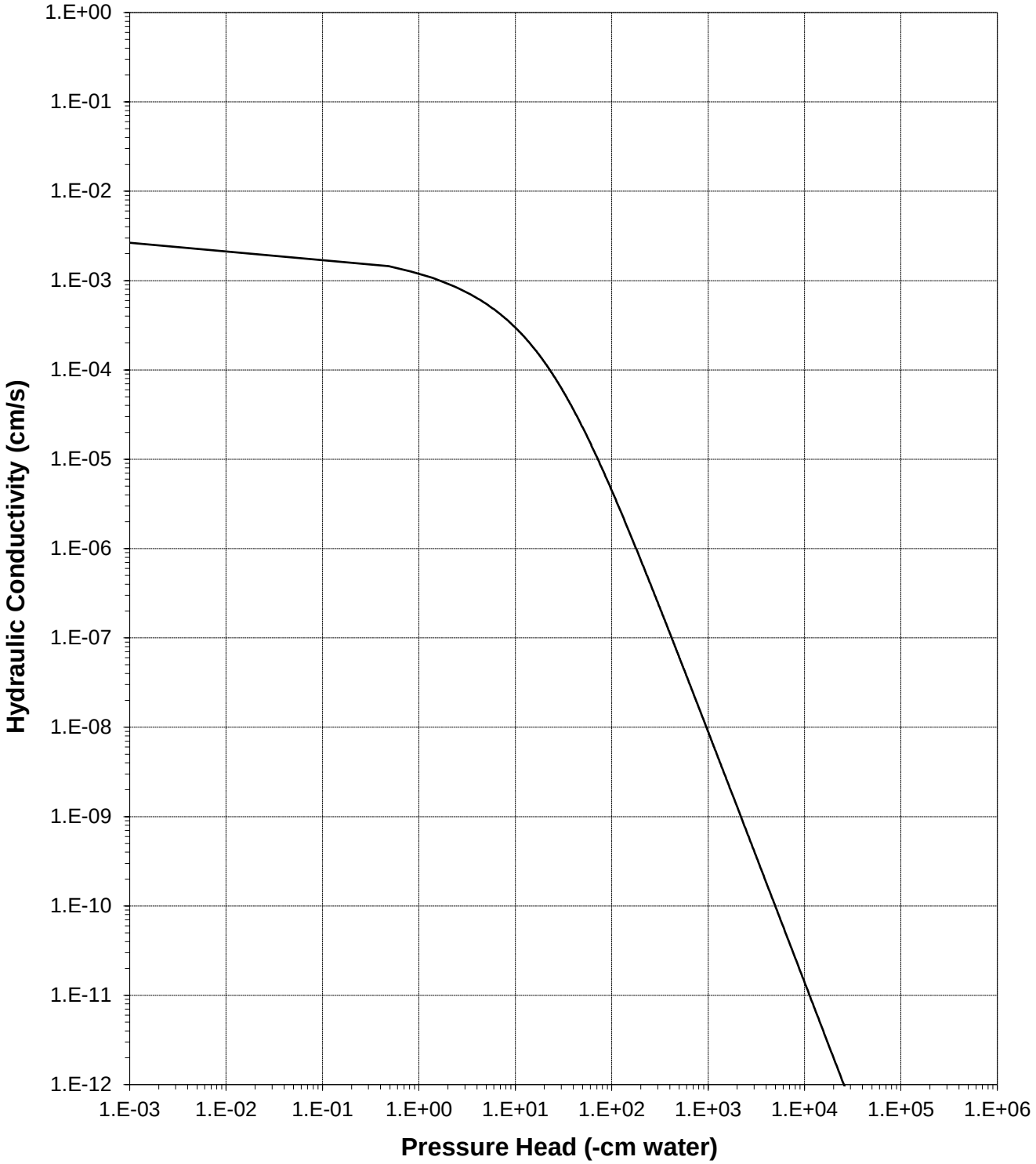
Plot of Relative Hydraulic Conductivity vs Pressure Head

Sample Number: 9AX-GB1 (1.44 g/cc)



Plot of Hydraulic Conductivity vs Pressure Head

Sample Number: 9AX-GB1 (1.44 g/cc)



Moisture Retention Data

Hanging Column / Pressure Plate

(Soil-Water Characteristic Curve)

Job Name: WSP Golder
Job Number: DB23.1010.00
Sample Number: CuL-GB1 (1.45 g/cc)
Project: 31406439 01.EXP
Fraction Tested: <2mm

Dry wt. of sample (g)*:* 212.01
Tare wt., ring (g)*:* 89.72
Tare wt., screen & clamp (g)*:* 24.11
Initial sample volume (cm^3)*:* 146.06
Initial dry bulk density (g/cm^3)*:* 1.45
Assumed particle density (g/cm^3)*:* 2.65
Initial calculated total porosity (%)*:* 45.22

	Date	Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content † (% vol)
Hanging column:	30-Aug-23	13:40	394.50	0	47.01
	6-Sep-23	8:00	394.49	5.0	47.00
	13-Sep-23	10:30	391.35	14.0	44.85
	20-Sep-23	10:15	366.23	53.0	27.65
	27-Sep-23	9:00	356.61	205.0	21.07
Pressure plate:	7-Oct-23	12:45	353.37	337	18.85

Volume Adjusted Data [1]

	Matric Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calculated Porosity (%)
Hanging column:	0.0	---	---	---	---
	5.0	---	---	---	---
	14.0	---	---	---	---
	53.0	---	---	---	---
	205.0	---	---	---	---
Pressure plate:	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/cm^3

‡‡ 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: W. Seward
Checked by: J. Hines

Moisture Retention Data

Dew Point Potentiometer / Relative Humidity Box

(Soil-Water Characteristic Curve)

Sample Number: CuL-GB1 (1.45 g/cc)

Initial sample bulk density (g/cm^3)*:* 1.45

Fraction of bulk sample used (<2.00mm fraction) (%): 100.00

Dry weight of dew point potentiometer sample* (g)*:* 190.28

Tare weight, jar (g)*:* 111.60

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content † (% vol)
Dew point potentiometer:	14-Sep-23	13:10	194.84	17948	8.41
	8-Sep-23	16:09	193.27	174488	5.52
	7-Sep-23	12:33	192.78	408328	4.61

Volume Adjusted Data [1]

	Water Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calc. Porosity (%)
Dew point potentiometer:	17948	---	---	---	---
	174488	---	---	---	---
	408328	---	---	---	---

Dry weight of relative humidity box sample* (g)*:* 83.02

Tare weight (g)*:* 45.48

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content † (% vol)
Relative humidity box:	29-Aug-23	12:00	84.00	849860	3.81

Volume Adjusted Data [1]

	Water Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calc. Porosity (%)
Relative humidity box:	849860	---	---	---	---

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/cm^3.

‡‡ 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.

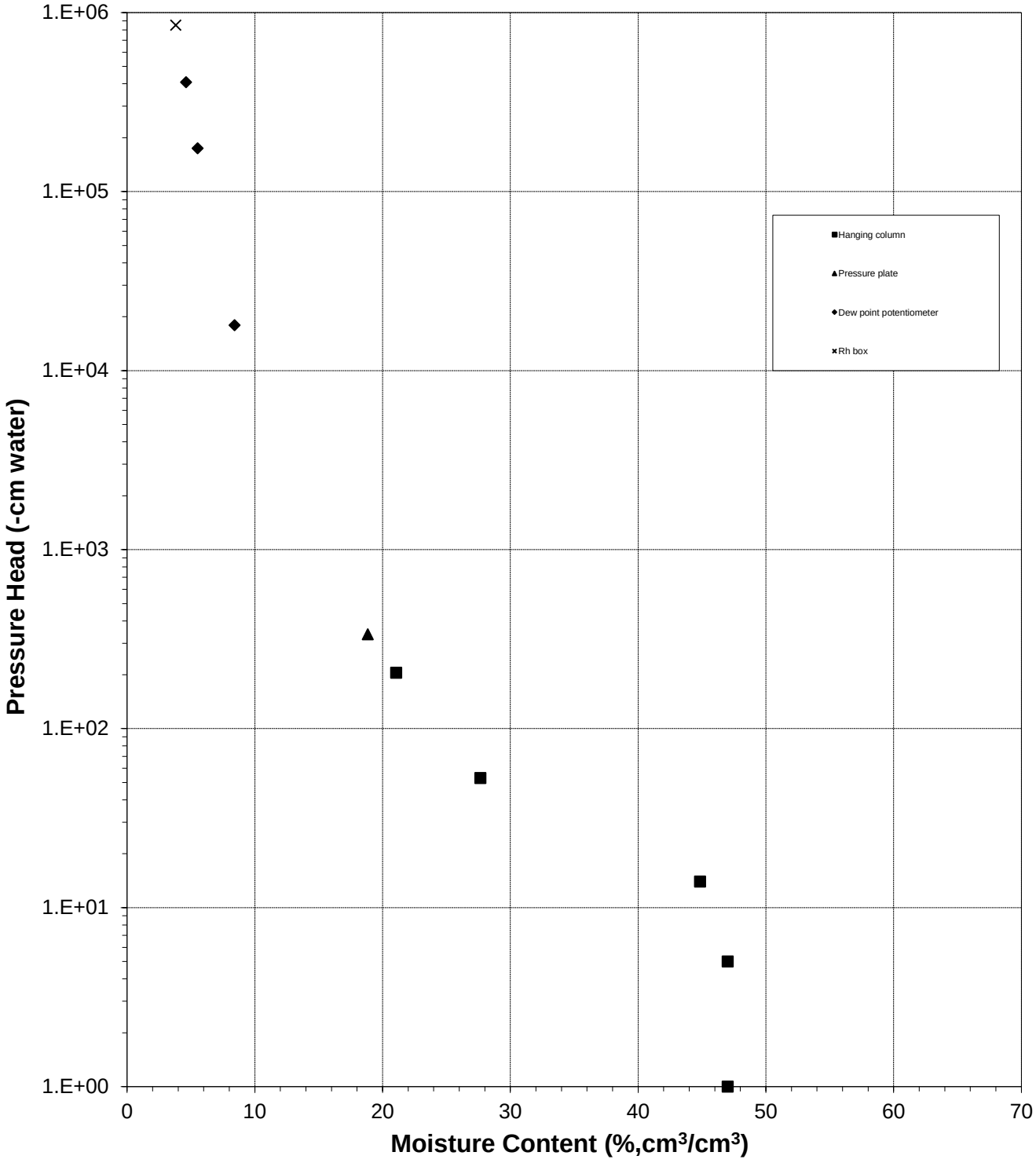
Laboratory analysis by: D. O'Dowd

Data entered by: W. Seward

Checked by: J. Hines

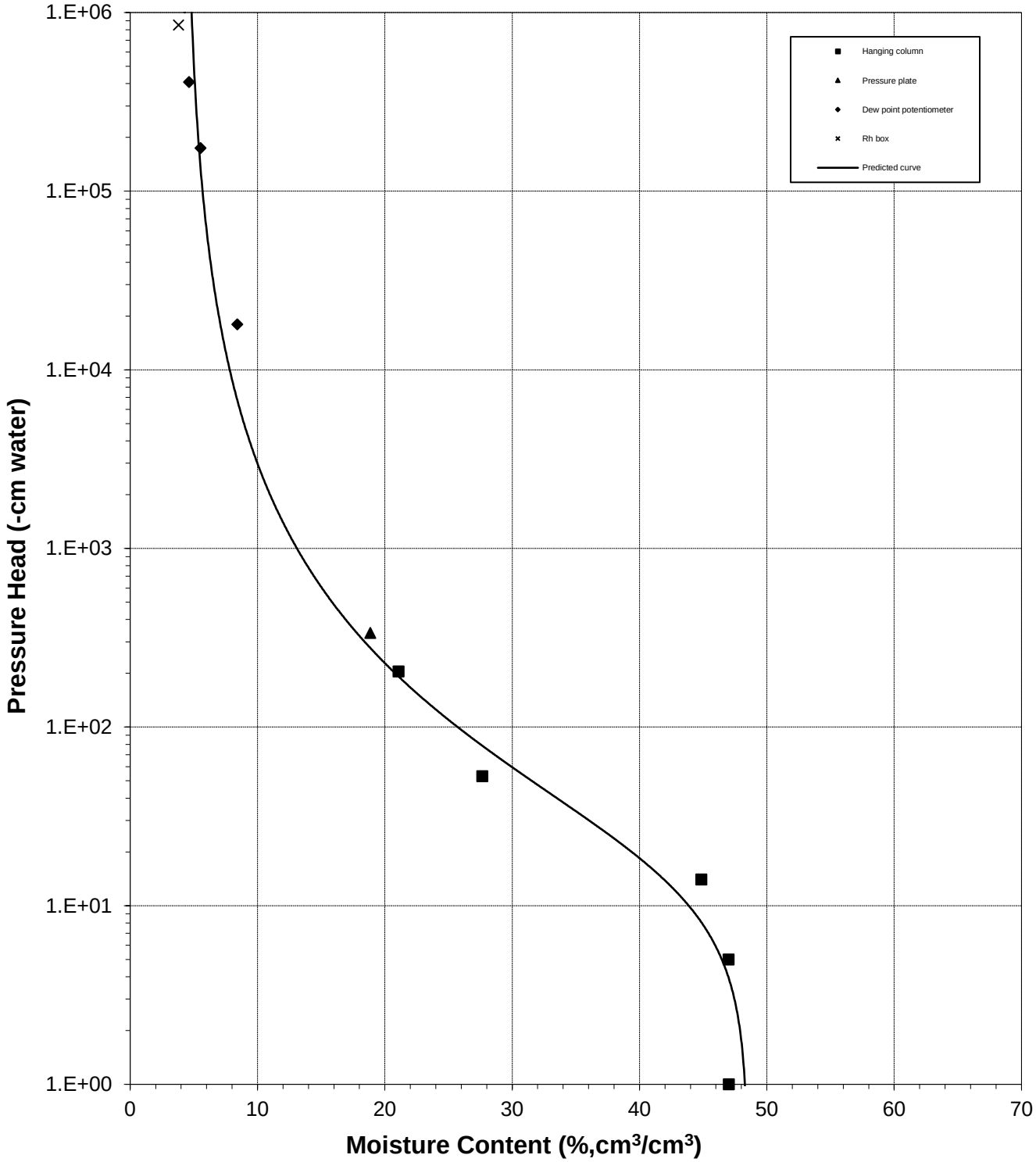
Water Retention Data Points

Sample Number: CuL-GB1 (1.45 g/cc)



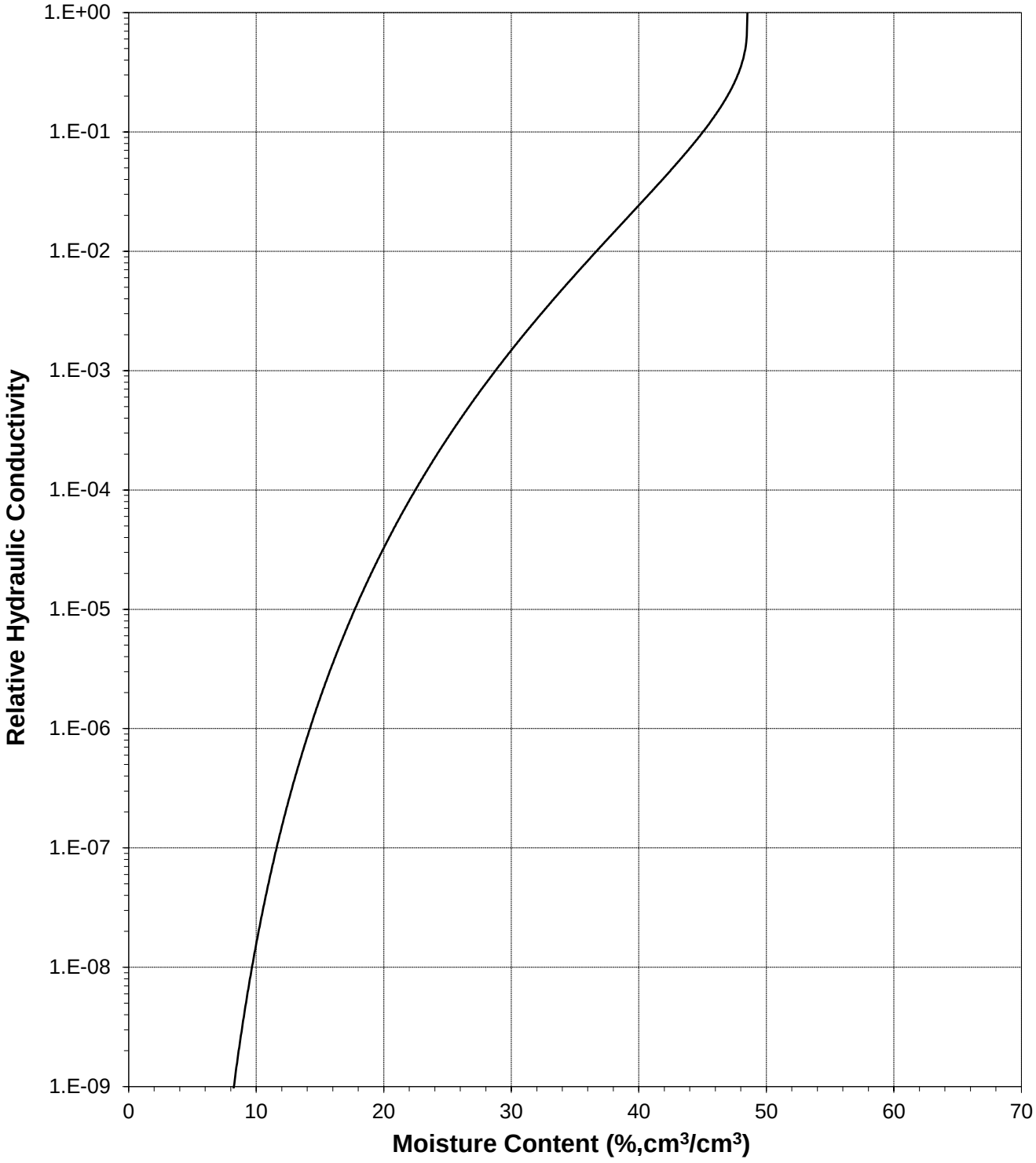
Predicted Water Retention Curve and Data Points

Sample Number: CuL-GB1 (1.45 g/cc)



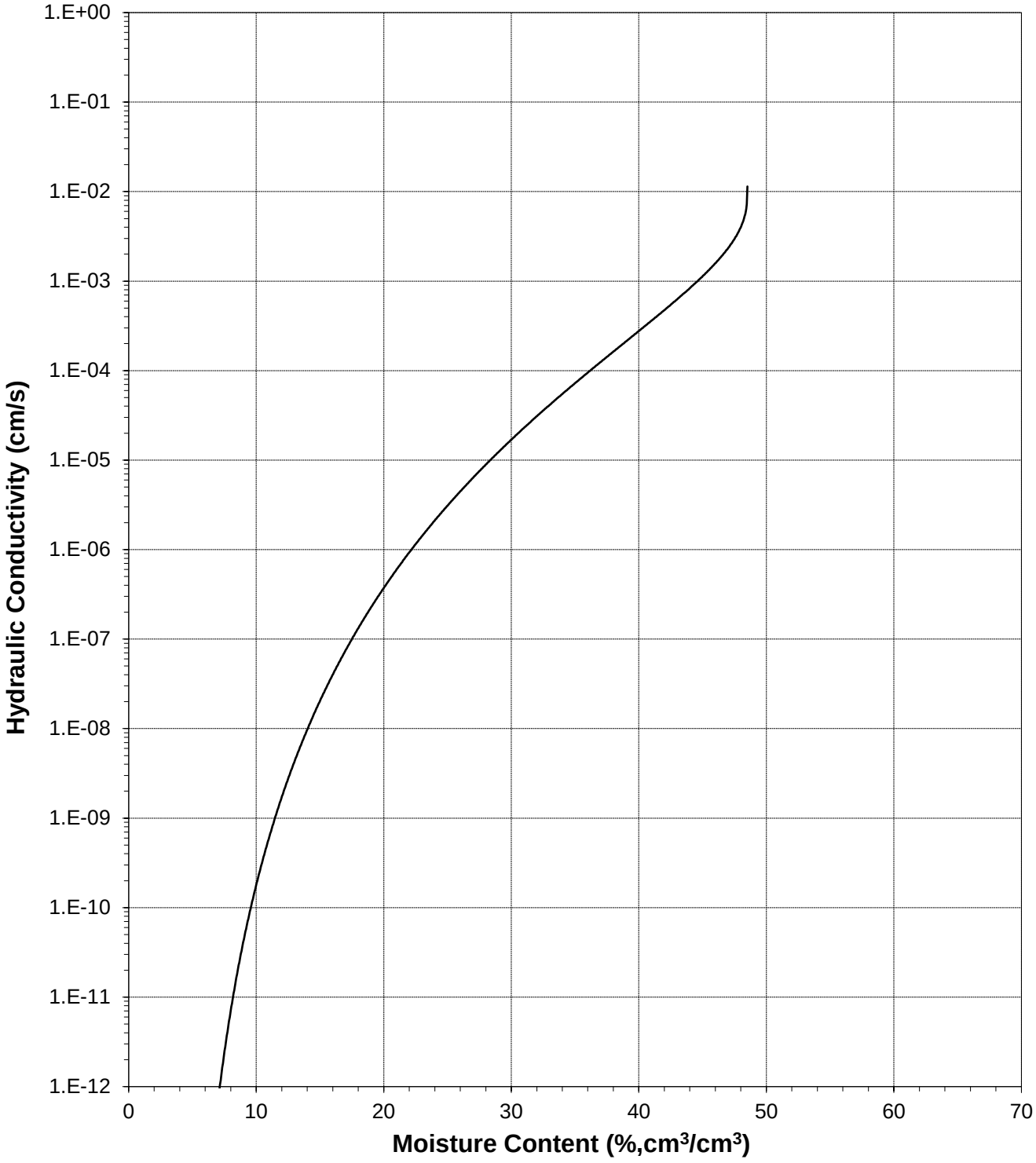
Plot of Relative Hydraulic Conductivity vs Moisture Content

Sample Number: CuL-GB1 (1.45 g/cc)



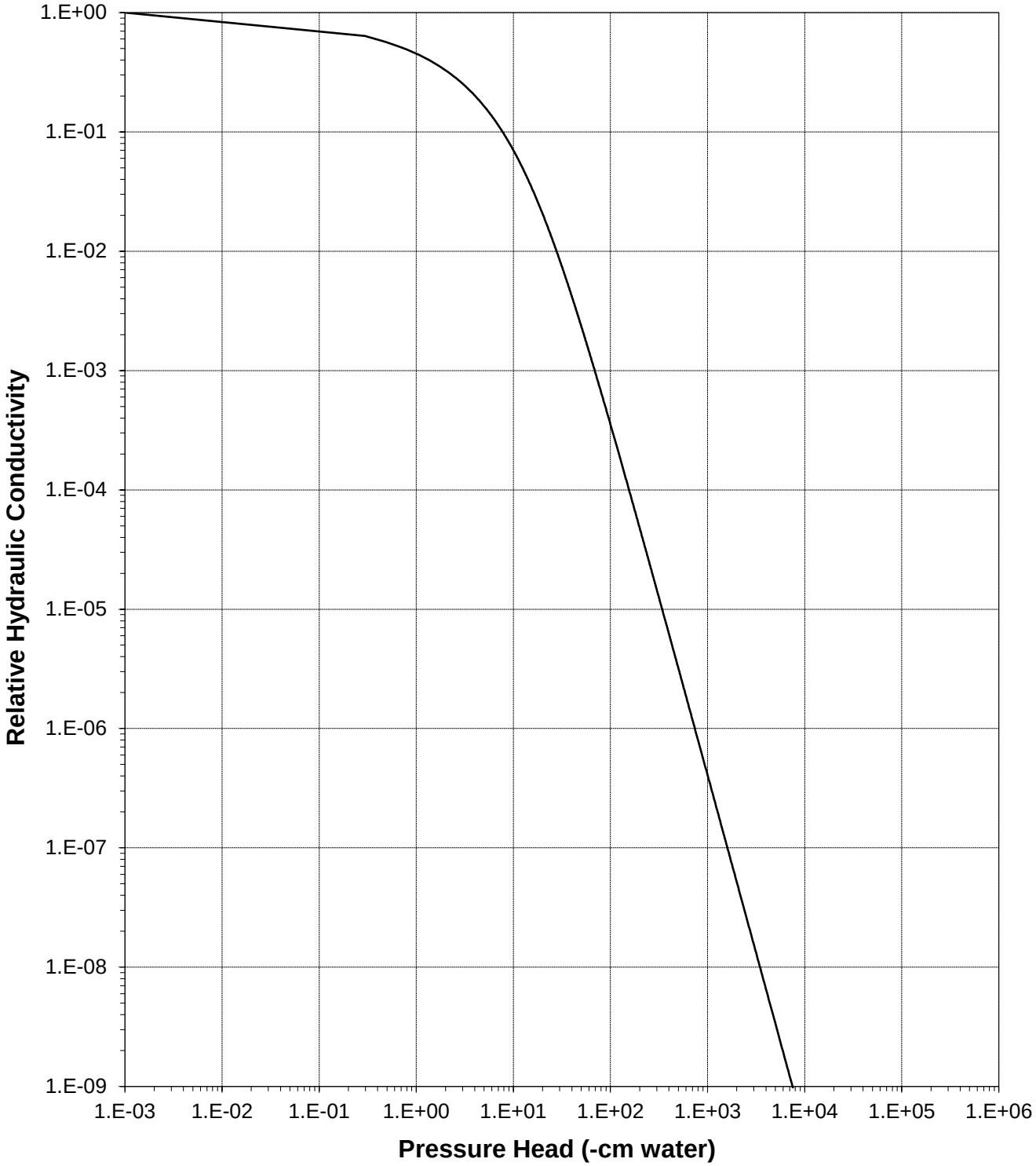
Plot of Hydraulic Conductivity vs Moisture Content

Sample Number: CuL-GB1 (1.45 g/cc)



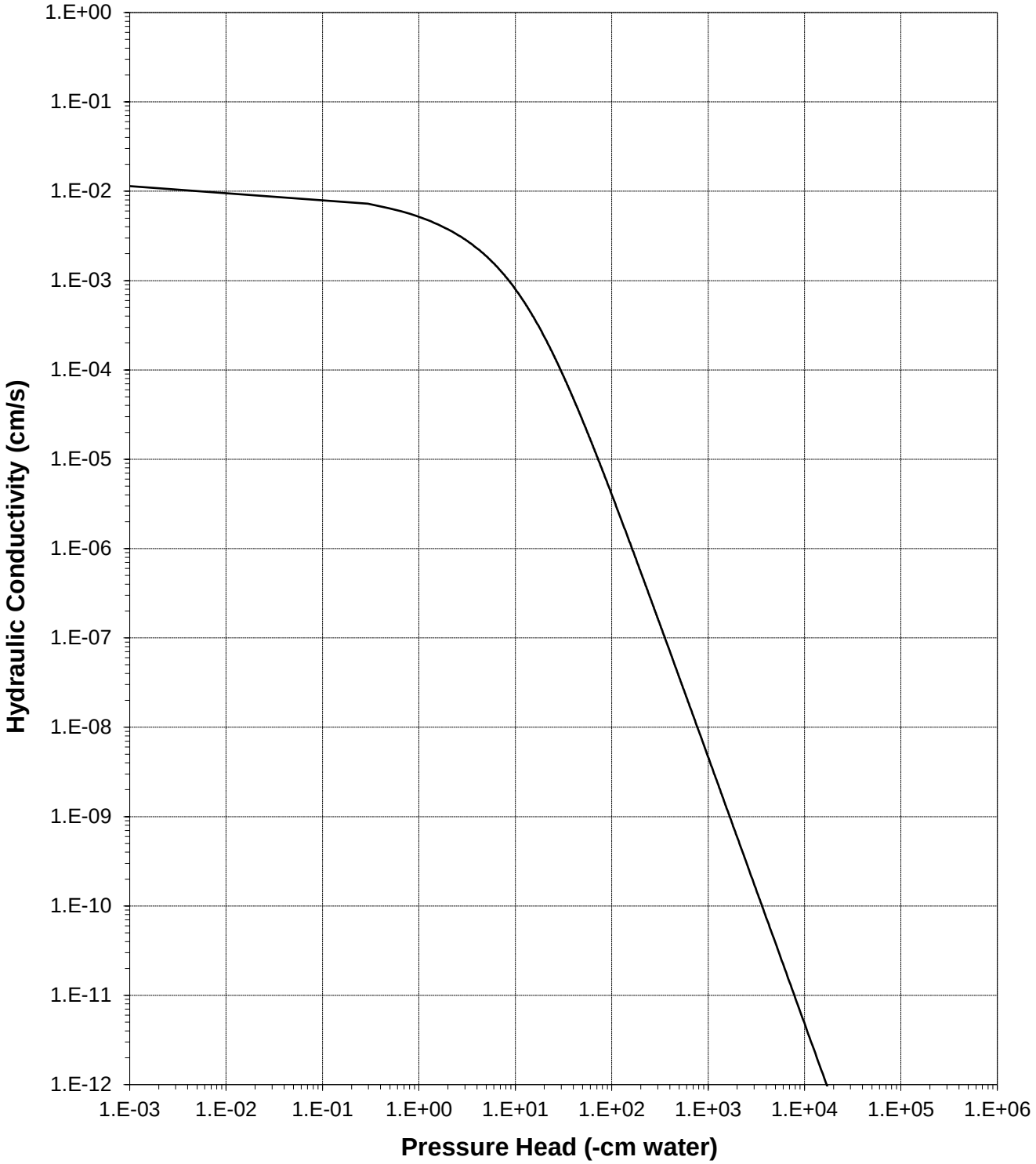
Plot of Relative Hydraulic Conductivity vs Pressure Head

Sample Number: CuL-GB1 (1.45 g/cc)



Plot of Hydraulic Conductivity vs Pressure Head

Sample Number: CuL-GB1 (1.45 g/cc)



Moisture Retention Data

Hanging Column / Pressure Plate

(Soil-Water Characteristic Curve)

Job Name: WSP Golder
Job Number: DB23.1010.00
Sample Number: CuL-GB2 (1.45 g/cc)
Project: 31406439 01.EXP
Fraction Tested: <2mm

Dry wt. of sample (g)*:* 217.20
Tare wt., ring (g)*:* 70.93
Tare wt., screen & clamp (g)*:* 27.38
Initial sample volume (cm^3)*:* 149.87
Initial dry bulk density (g/cm^3)*:* 1.45
Assumed particle density (g/cm^3)*:* 2.65
Initial calculated total porosity (%)*:* 45.31

	Date	Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content † (% vol)
Hanging column:	30-Aug-23	13:45	385.27	0	46.55
	6-Sep-23	8:00	384.27	5.0	45.88
	13-Sep-23	10:30	381.60	14.0	44.10
	20-Sep-23	10:15	359.78	53.0	29.54
	27-Sep-23	9:00	348.69	205.0	22.14
Pressure plate:	7-Oct-23	12:45	344.88	337	19.60

Volume Adjusted Data [1]

	Matric Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calculated Porosity (%)
Hanging column:	0.0	---	---	---	---
	5.0	---	---	---	---
	14.0	---	---	---	---
	53.0	---	---	---	---
	205.0	---	---	---	---
Pressure plate:	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/cm^3

‡‡ 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: W. Seward
Checked by: J. Hines

Moisture Retention Data

Dew Point Potentiometer / Relative Humidity Box

(Soil-Water Characteristic Curve)

Sample Number: CuL-GB2 (1.45 g/cc)

Initial sample bulk density (g/cm^3)*:* 1.45

Fraction of bulk sample used (<2.00mm fraction) (%): 100.00

Dry weight of dew point potentiometer sample* (g)*:* 190.07

Tare weight, jar (g)*:* 110.55

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content † (% vol)
Dew point potentiometer:	15-Sep-23	9:55	195.07	8668	9.11
	11-Sep-23	15:47	193.61	51602	6.46
	7-Sep-23	13:04	192.37	387116	4.20

Volume Adjusted Data [1]

	Water Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calc. Porosity (%)
Dew point potentiometer:	8668	---	---	---	---
	51602	---	---	---	---
	387116	---	---	---	---

Dry weight of relative humidity box sample* (g)*:* 93.24

Tare weight (g)*:* 42.57

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content † (% vol)
Relative humidity box:	29-Aug-23	12:00	94.49	849860	3.57

Volume Adjusted Data [1]

	Water Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calc. Porosity (%)
Relative humidity box:	849860	---	---	---	---

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

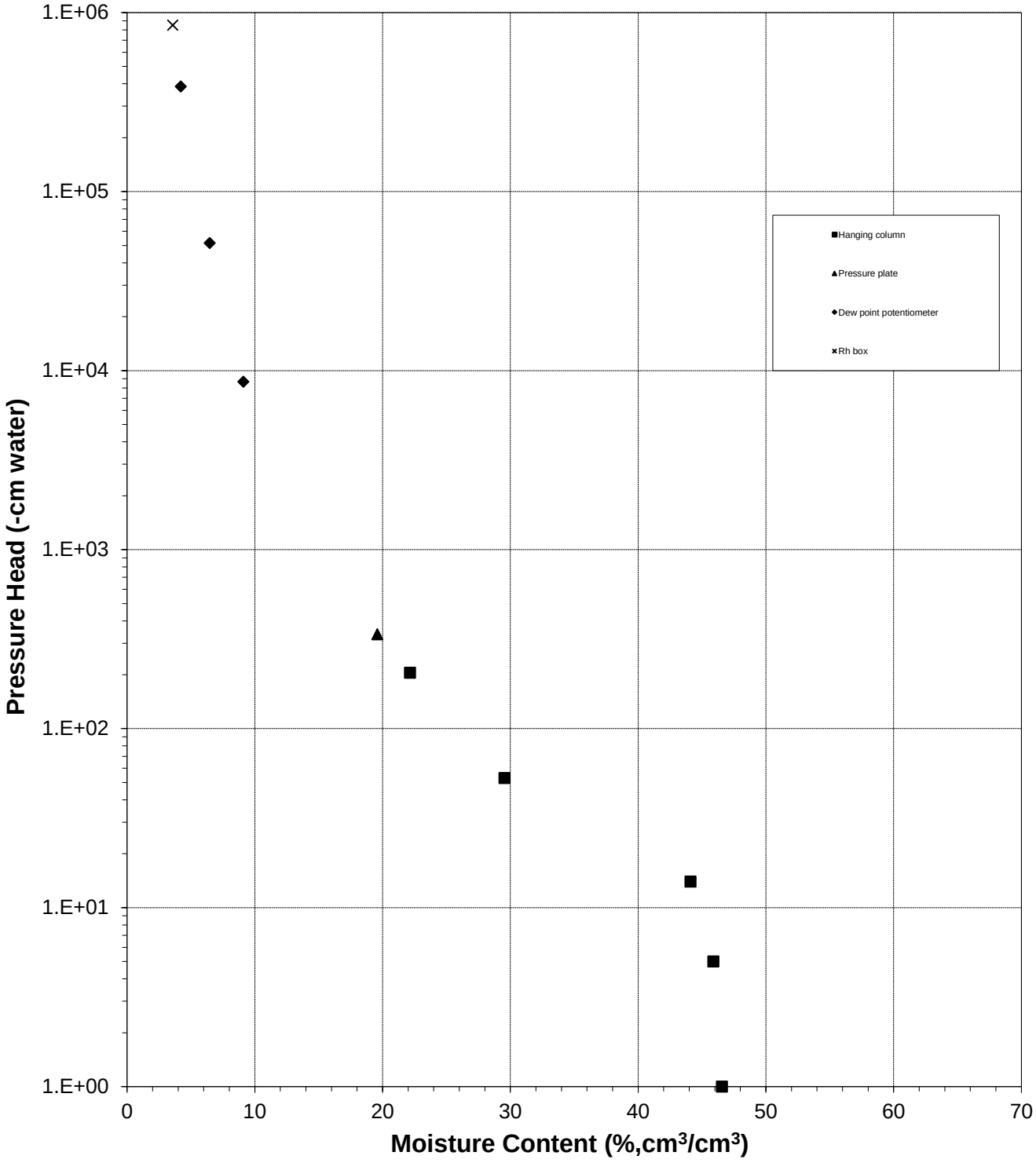
† Adjusted for >2.00mm (#10 sieve) material not used in DPP/RH testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm^3.

‡‡ 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: W. Seward
Checked by: J. Hines

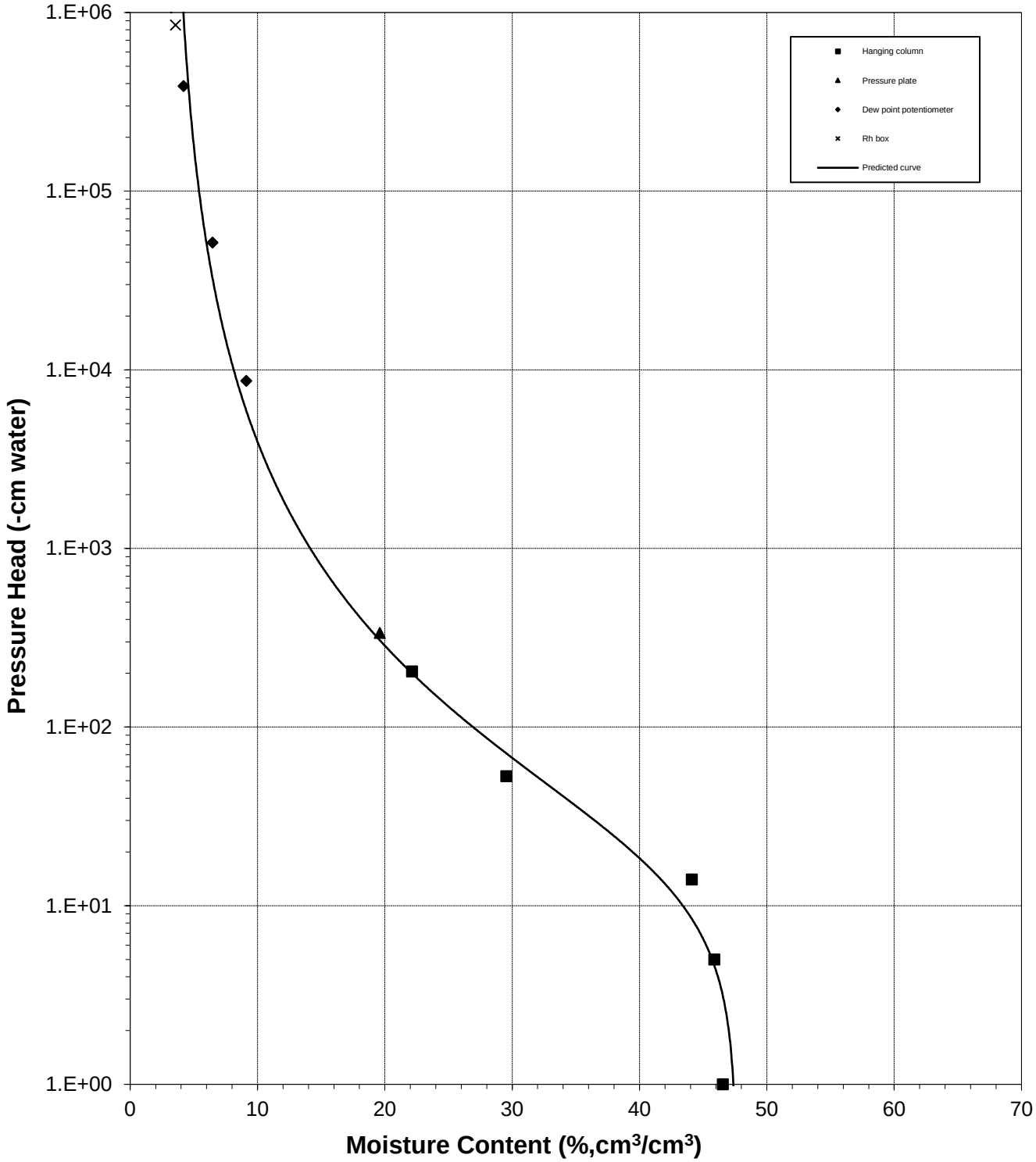
Water Retention Data Points

Sample Number: CuL-GB2 (1.45 g/cc)



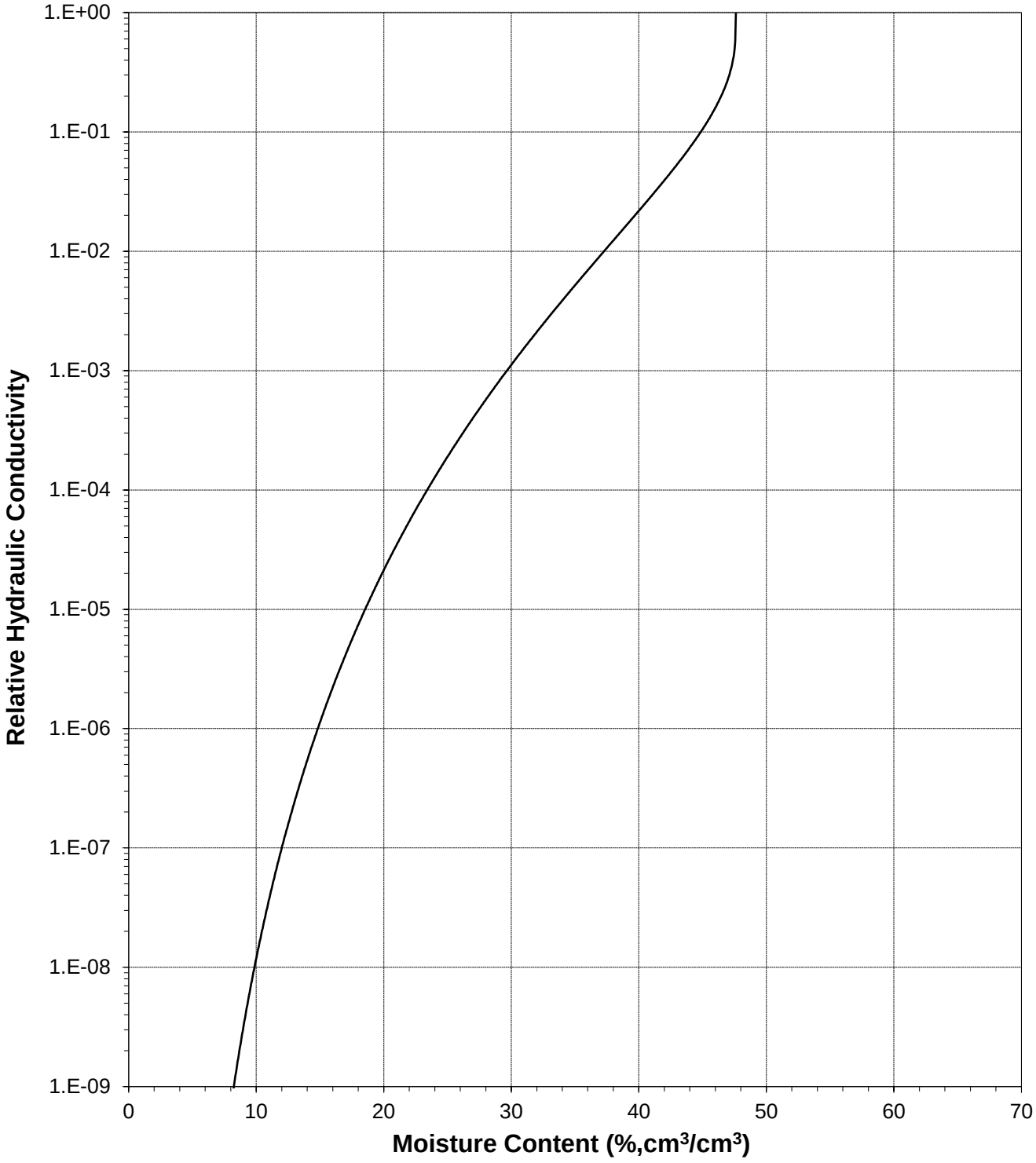
Predicted Water Retention Curve and Data Points

Sample Number: CuL-GB2 (1.45 g/cc)



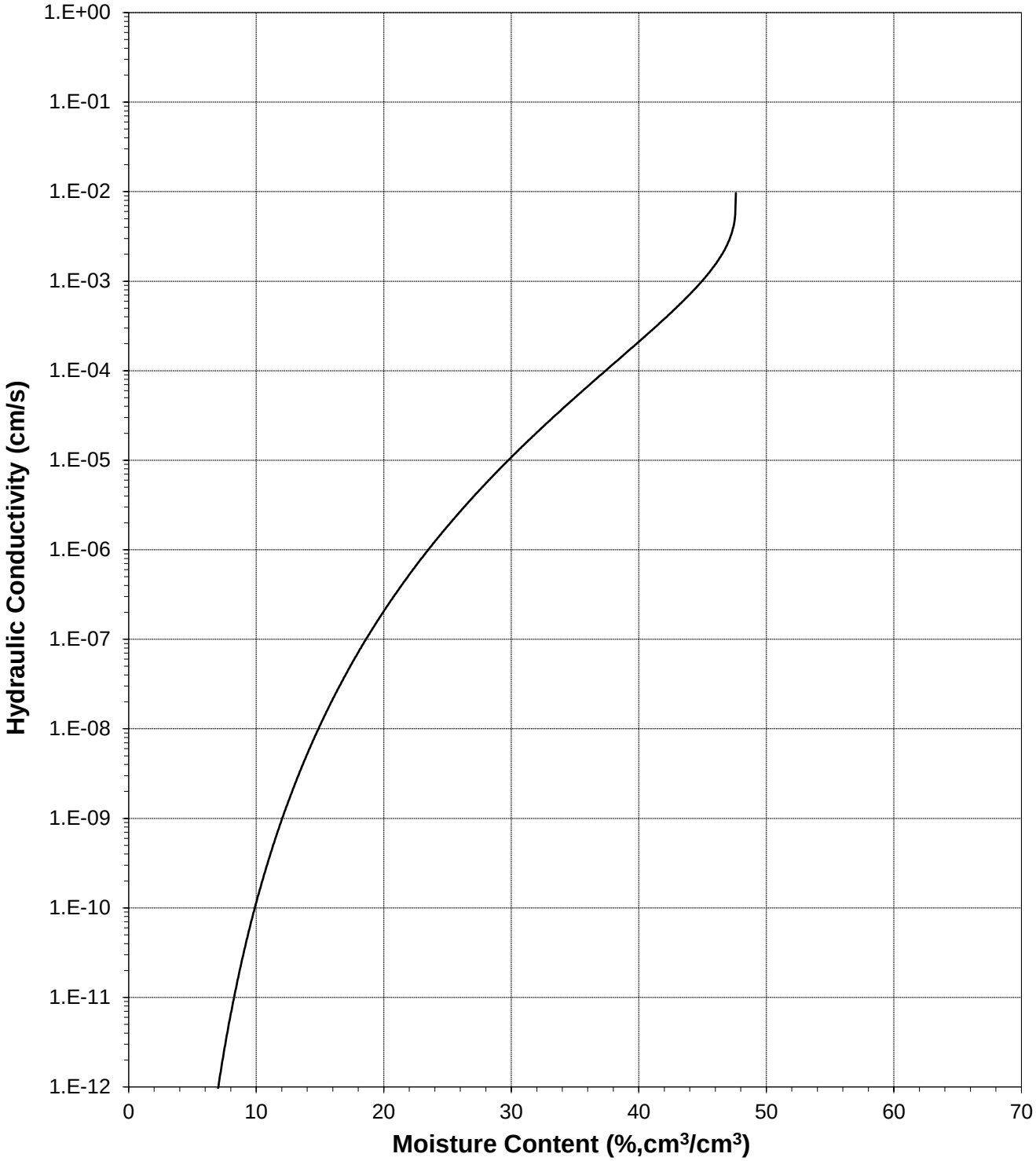
Plot of Relative Hydraulic Conductivity vs Moisture Content

Sample Number: CuL-GB2 (1.45 g/cc)



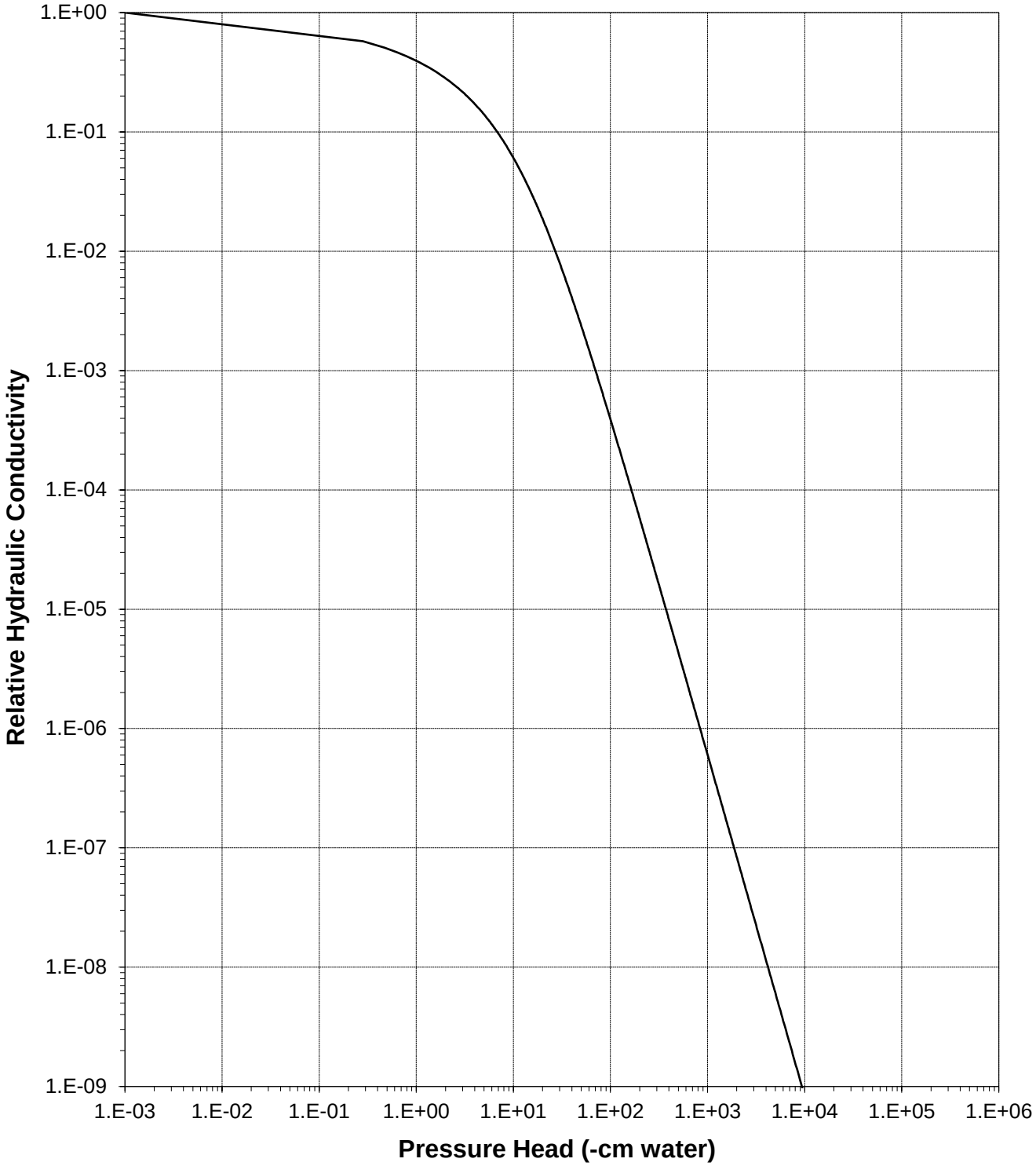
Plot of Hydraulic Conductivity vs Moisture Content

Sample Number: CuL-GB2 (1.45 g/cc)



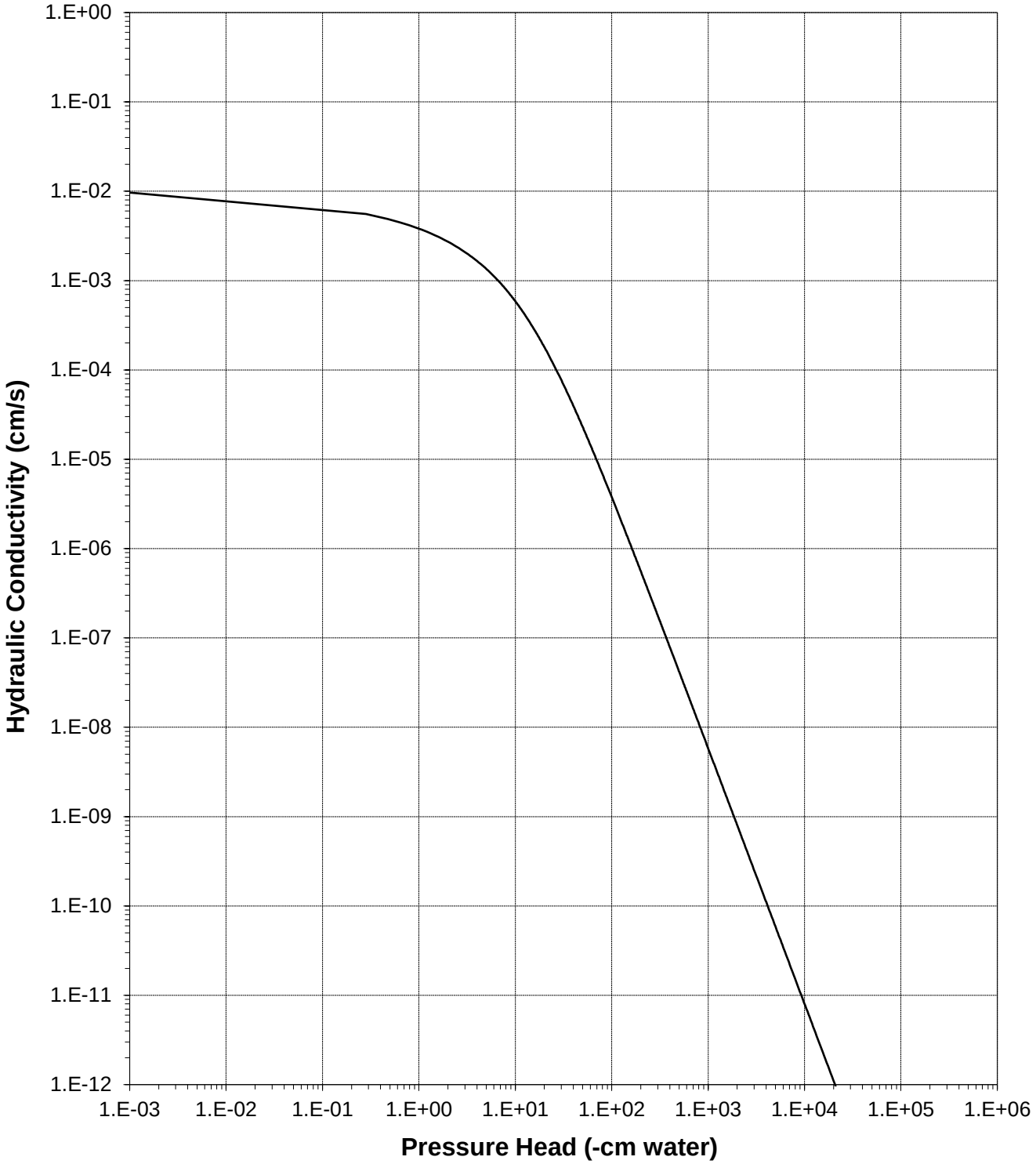
Plot of Relative Hydraulic Conductivity vs Pressure Head

Sample Number: CuL-GB2 (1.45 g/cc)



Plot of Hydraulic Conductivity vs Pressure Head

Sample Number: CuL-GB2 (1.45 g/cc)



Moisture Retention Data

Hanging Column / Pressure Plate

(Soil-Water Characteristic Curve)

Job Name: WSP Golder
Job Number: DB23.1010.00
Sample Number: USNR-GB1 (1.45 g/cc)
Project: 31406439 01.EXP
Fraction Tested: <2mm

Dry wt. of sample (g)*:* 217.25
Tare wt., ring (g)*:* 73.99
Tare wt., screen & clamp (g)*:* 28.02
Initial sample volume (cm^3)*:* 149.82
Initial dry bulk density (g/cm^3)*:* 1.45
Assumed particle density (g/cm^3)*:* 2.65
Initial calculated total porosity (%)*:* 45.28

	Date	Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content † (% vol)
Hanging column:	30-Aug-23	13:55	388.87	0	46.46
	6-Sep-23	8:00	388.78	5.0	46.40
	13-Sep-23	10:30	378.24	14.0	39.37
	20-Sep-23	10:15	353.53	53.0	22.87
	27-Sep-23	9:00	346.91	205.0	18.45
Pressure plate:	7-Oct-23	12:45	344.58	337	16.90

Volume Adjusted Data [1]

	Matric Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calculated Porosity (%)
Hanging column:	0.0	---	---	---	---
	5.0	---	---	---	---
	14.0	---	---	---	---
	53.0	---	---	---	---
	205.0	---	---	---	---
Pressure plate:	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/cm^3

‡‡ 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: W. Seward
Checked by: J. Hines

Moisture Retention Data

Dew Point Potentiometer / Relative Humidity Box

(Soil-Water Characteristic Curve)

Sample Number: USNR-GB1 (1.45 g/cc)

Initial sample bulk density (g/cm^3)*:* 1.45

Fraction of bulk sample used (<2.00mm fraction) (%): 100.00

Dry weight of dew point potentiometer sample* (g)*:* 172.01

Tare weight, jar (g)*:* 113.35

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content † (% vol)
Dew point potentiometer:	18-Sep-23	13:25	175.35	10198	8.26
	14-Sep-23	13:37	174.50	49154	6.16
	7-Sep-23	14:14	173.65	266780	4.06

Volume Adjusted Data [1]

	Water Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calc. Porosity (%)
Dew point potentiometer:	10198	---	---	---	---
	49154	---	---	---	---
	266780	---	---	---	---

Dry weight of relative humidity box sample* (g)*:* 87.24

Tare weight (g)*:* 46.66

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content † (% vol)
Relative humidity box:	29-Aug-23	12:00	88.18	849860	3.35

Volume Adjusted Data [1]

	Water Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calc. Porosity (%)
Relative humidity box:	849860	---	---	---	---

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

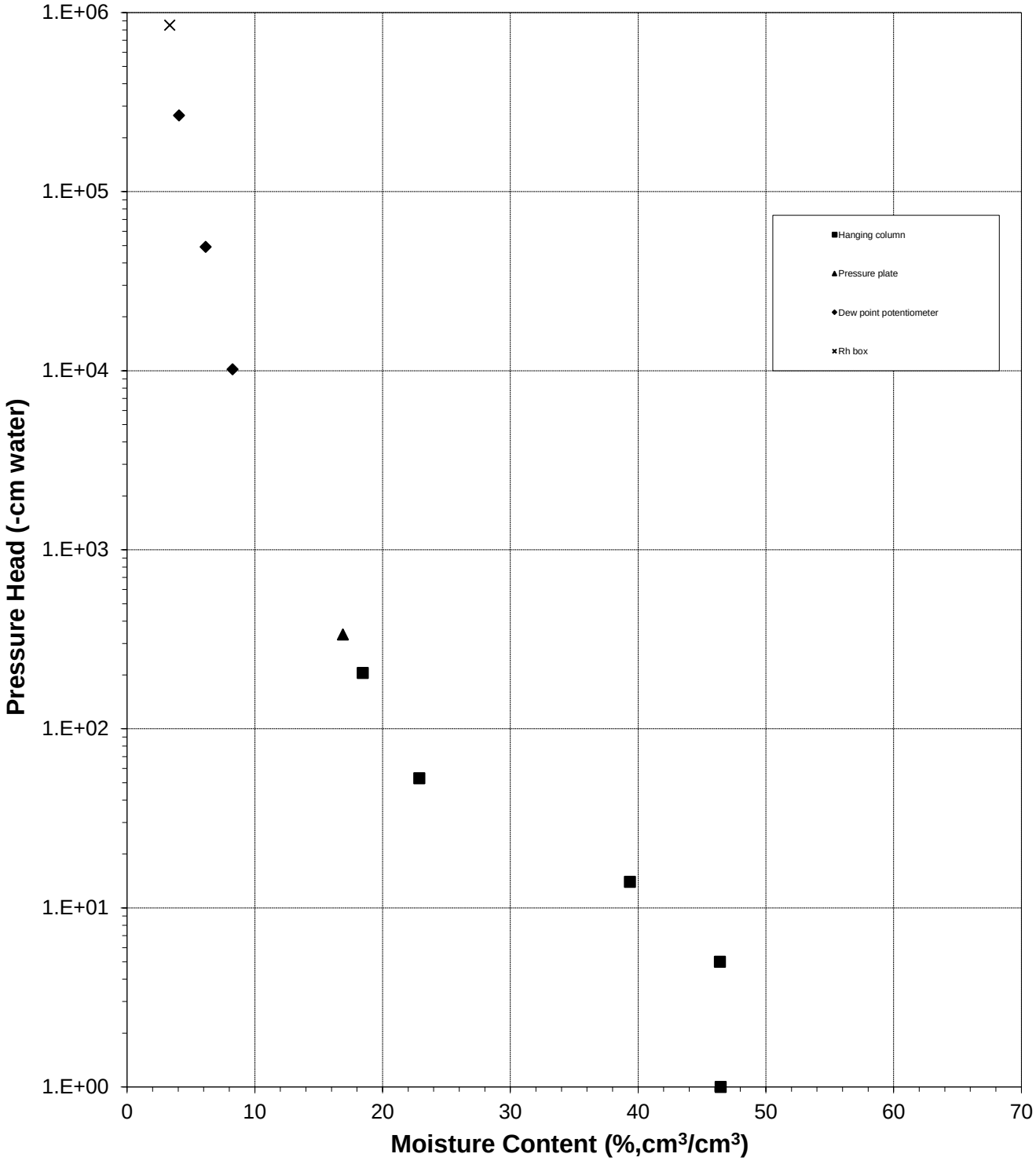
† Adjusted for >2.00mm (#10 sieve) material not used in DPP/RH testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm^3.

‡‡ 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: W. Seward
Checked by: J. Hines

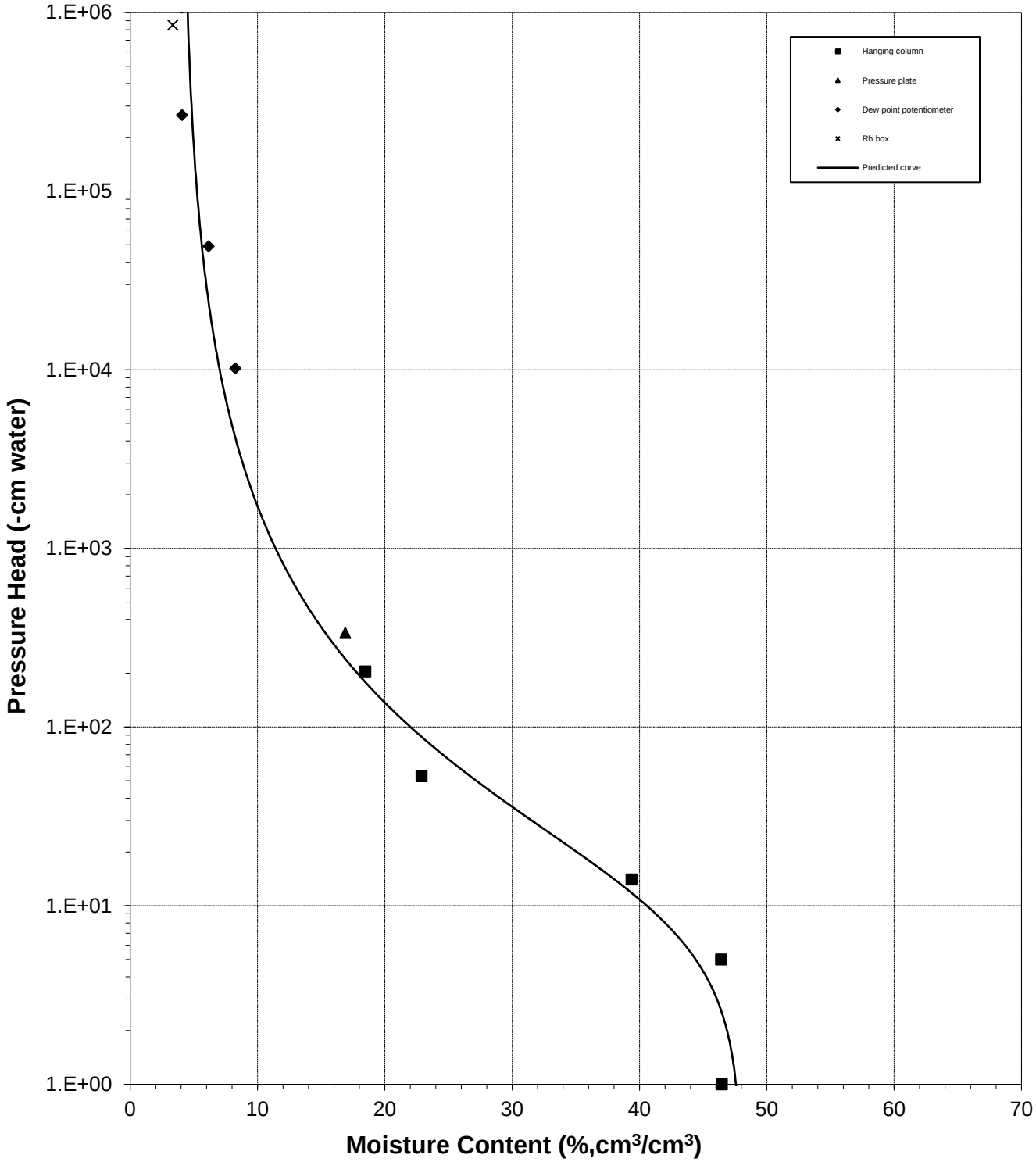
Water Retention Data Points

Sample Number: USNR-GB1 (1.45 g/cc)



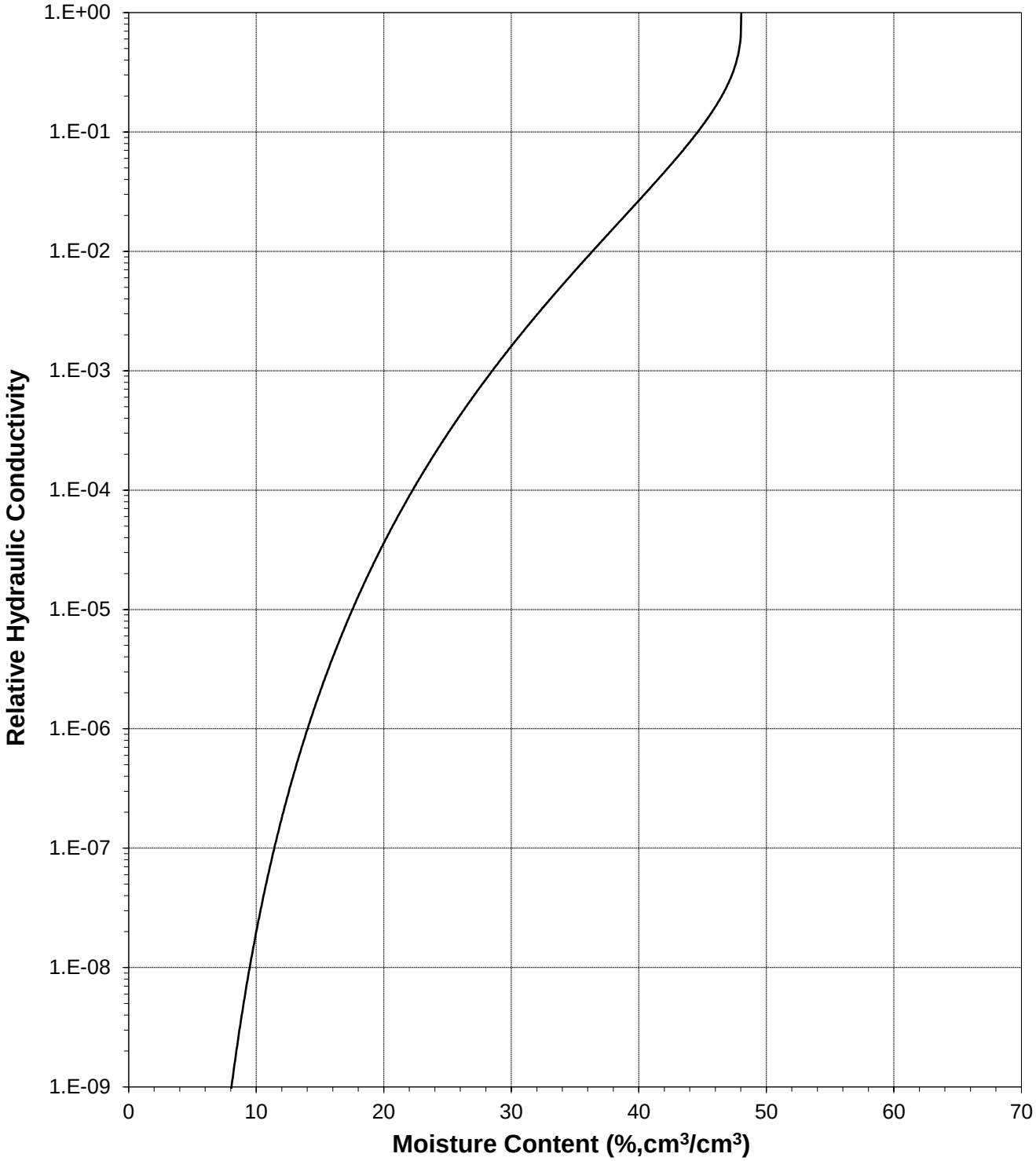
Predicted Water Retention Curve and Data Points

Sample Number: USNR-GB1 (1.45 g/cc)



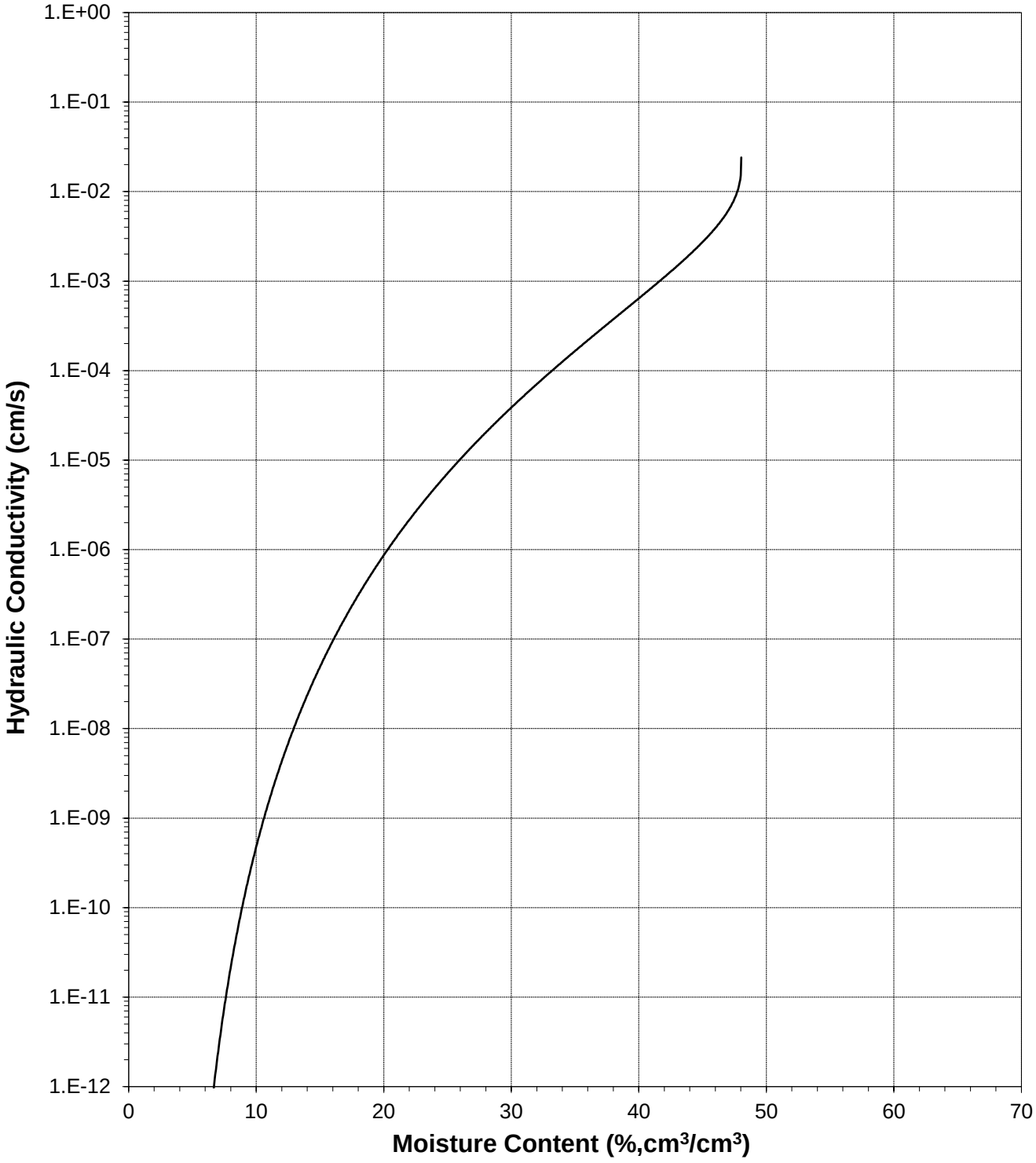
Plot of Relative Hydraulic Conductivity vs Moisture Content

Sample Number: USNR-GB1 (1.45 g/cc)



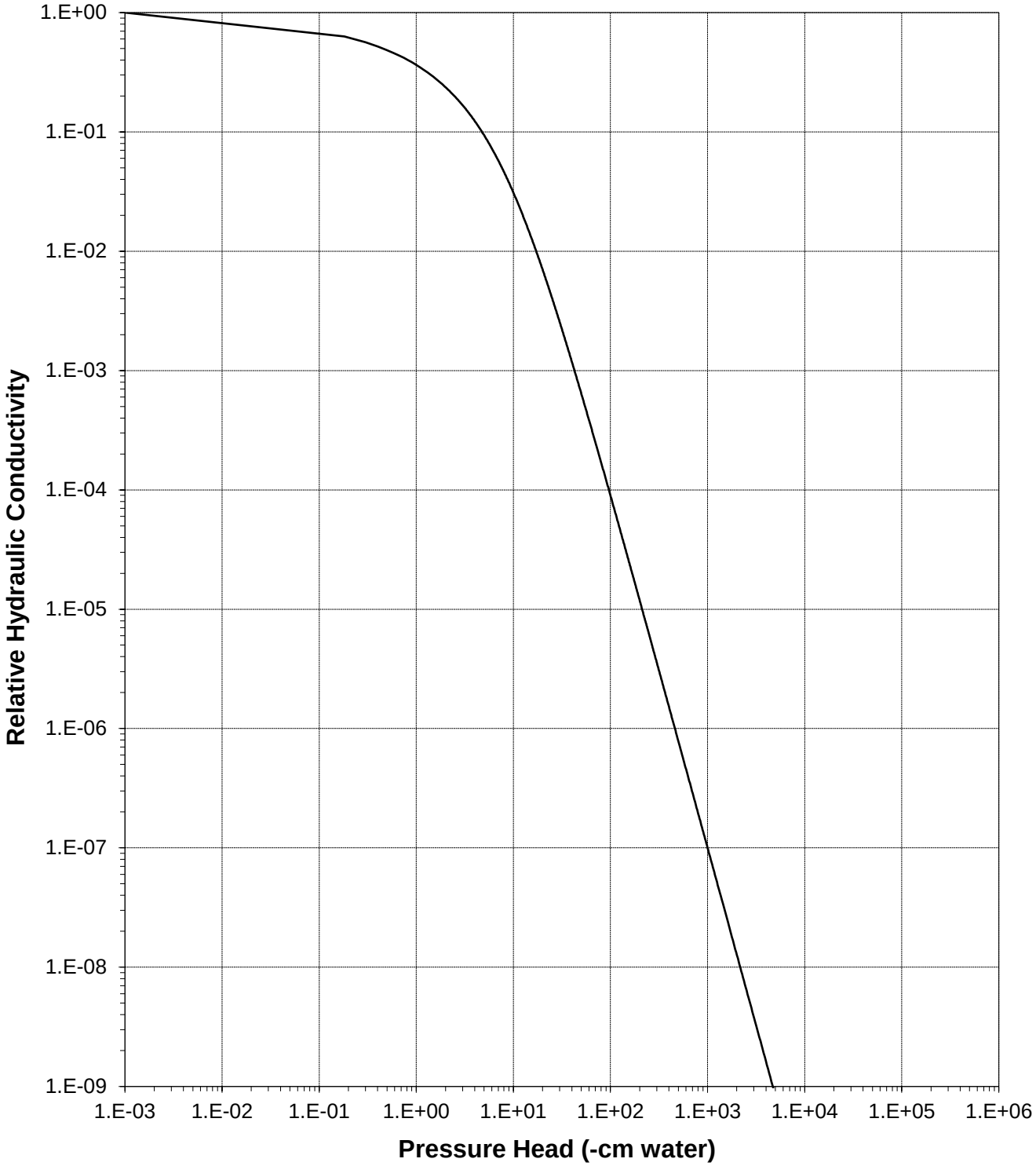
Plot of Hydraulic Conductivity vs Moisture Content

Sample Number: USNR-GB1 (1.45 g/cc)



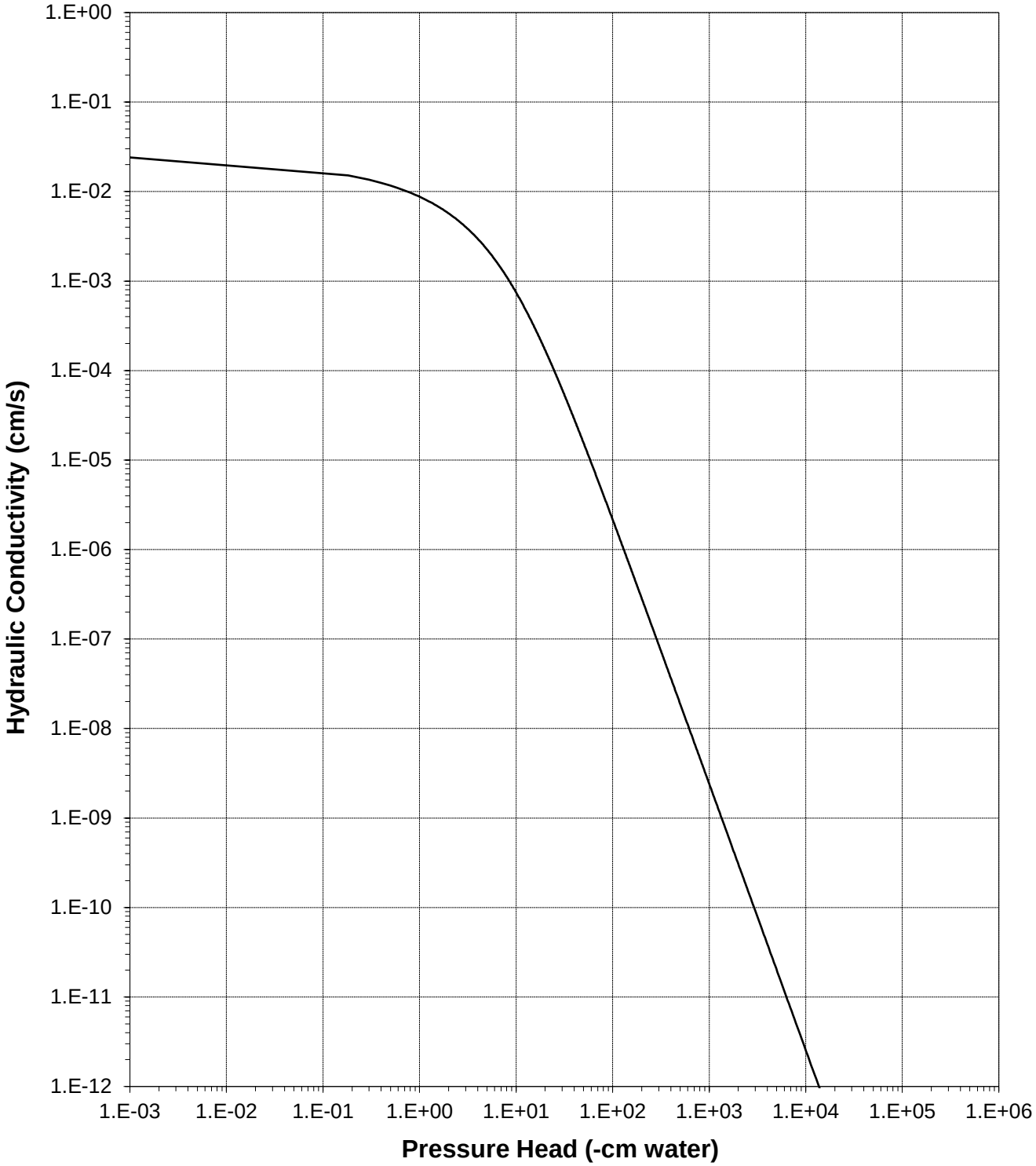
Plot of Relative Hydraulic Conductivity vs Pressure Head

Sample Number: USNR-GB1 (1.45 g/cc)



Plot of Hydraulic Conductivity vs Pressure Head

Sample Number: USNR-GB1 (1.45 g/cc)



Moisture Retention Data

Hanging Column / Pressure Plate

(Soil-Water Characteristic Curve)

Job Name: WSP Golder
Job Number: DB23.1010.00
Sample Number: USNR-GB3 (1.45 g/cc)
Project: 31406439 01.EXP
Fraction Tested: <2mm

Dry wt. of sample (g)*:* 211.08
Tare wt., ring (g)*:* 82.68
Tare wt., screen & clamp (g)*:* 27.89
Initial sample volume (cm^3)*:* 145.69
Initial dry bulk density (g/cm^3)*:* 1.45
Assumed particle density (g/cm^3)*:* 2.65
Initial calculated total porosity (%)*:* 45.33

	Date	Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content † (% vol)
Hanging column:	30-Aug-23	14:00	387.94	0	45.50
	6-Sep-23	8:00	387.02	5.0	44.87
	13-Sep-23	10:30	377.14	14.0	38.09
	20-Sep-23	10:15	355.01	53.0	22.90
	27-Sep-23	9:00	347.52	205.0	17.76
Pressure plate:	7-Oct-23	12:45	345.14	337	16.12

Volume Adjusted Data [1]

	Matric Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calculated Porosity (%)
Hanging column:	0.0	---	---	---	---
	5.0	---	---	---	---
	14.0	---	---	---	---
	53.0	---	---	---	---
	205.0	---	---	---	---
Pressure plate:	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/cm^3

‡‡ 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: W. Seward
Checked by: J. Hines

Moisture Retention Data

Dew Point Potentiometer / Relative Humidity Box

(Soil-Water Characteristic Curve)

Sample Number: USNR-GB3 (1.45 g/cc)

Initial sample bulk density (g/cm^3)*:* 1.45

Fraction of bulk sample used (<2.00mm fraction) (%): 100.00

Dry weight of dew point potentiometer sample* (g)*:* 185.42

Tare weight, jar (g)*:* 111.95

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content † (% vol)
Dew point potentiometer:	19-Sep-23	10:54	189.58	8872	8.20
	14-Sep-23	13:50	188.01	100246	5.11
	8-Sep-23	17:15	187.31	483181	3.73

Volume Adjusted Data [1]

	Water Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calc. Porosity (%)
Dew point potentiometer:	8872	---	---	---	---
	100246	---	---	---	---
	483181	---	---	---	---

Dry weight of relative humidity box sample* (g)*:* 99.88

Tare weight (g)*:* 40.67

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content † (% vol)
Relative humidity box:	29-Aug-23	12:00	101.30	849860	3.48

Volume Adjusted Data [1]

	Water Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calc. Porosity (%)
Relative humidity box:	849860	---	---	---	---

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/cm^3.

‡‡ 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.

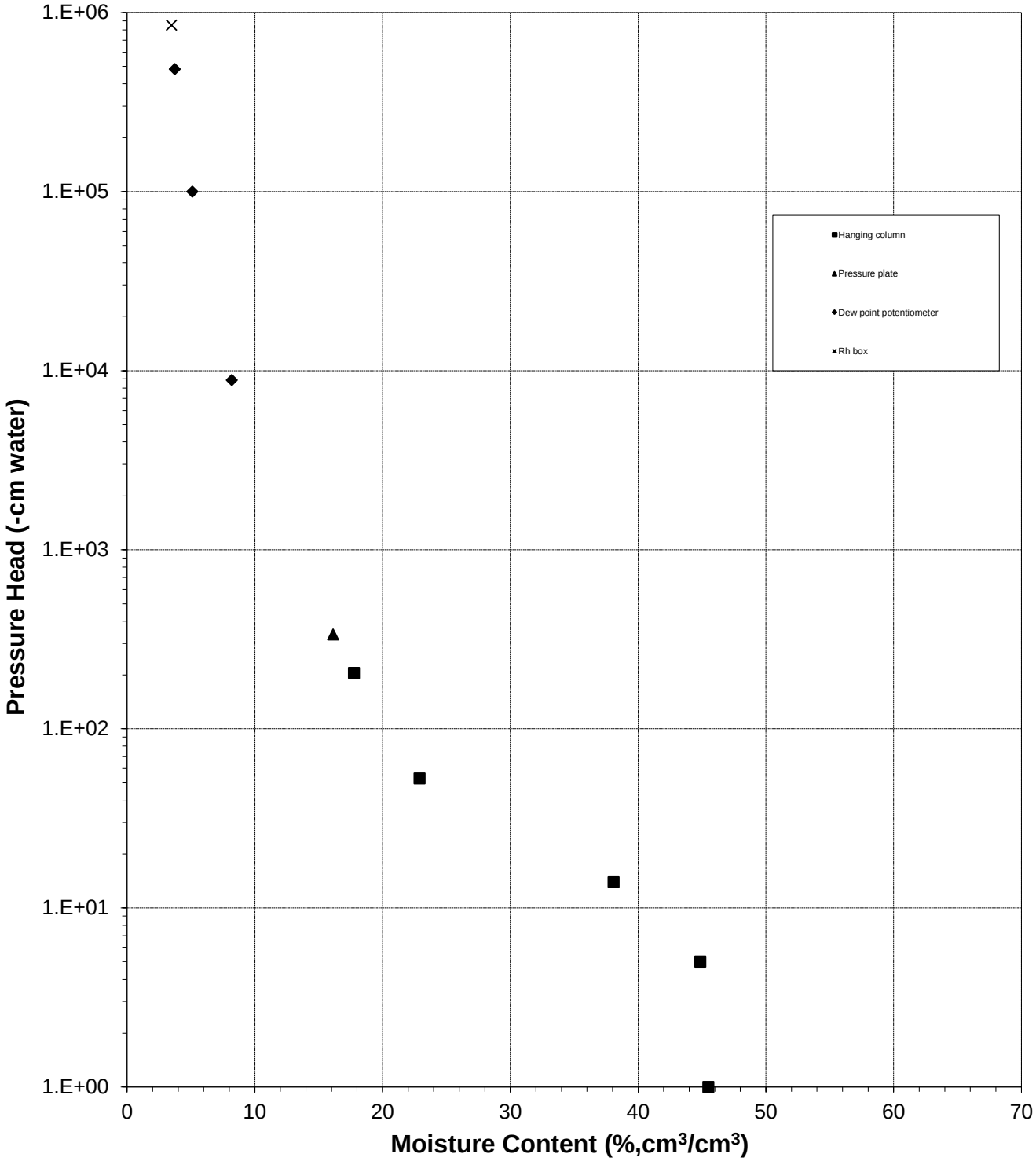
Laboratory analysis by: D. O'Dowd

Data entered by: W. Seward

Checked by: J. Hines

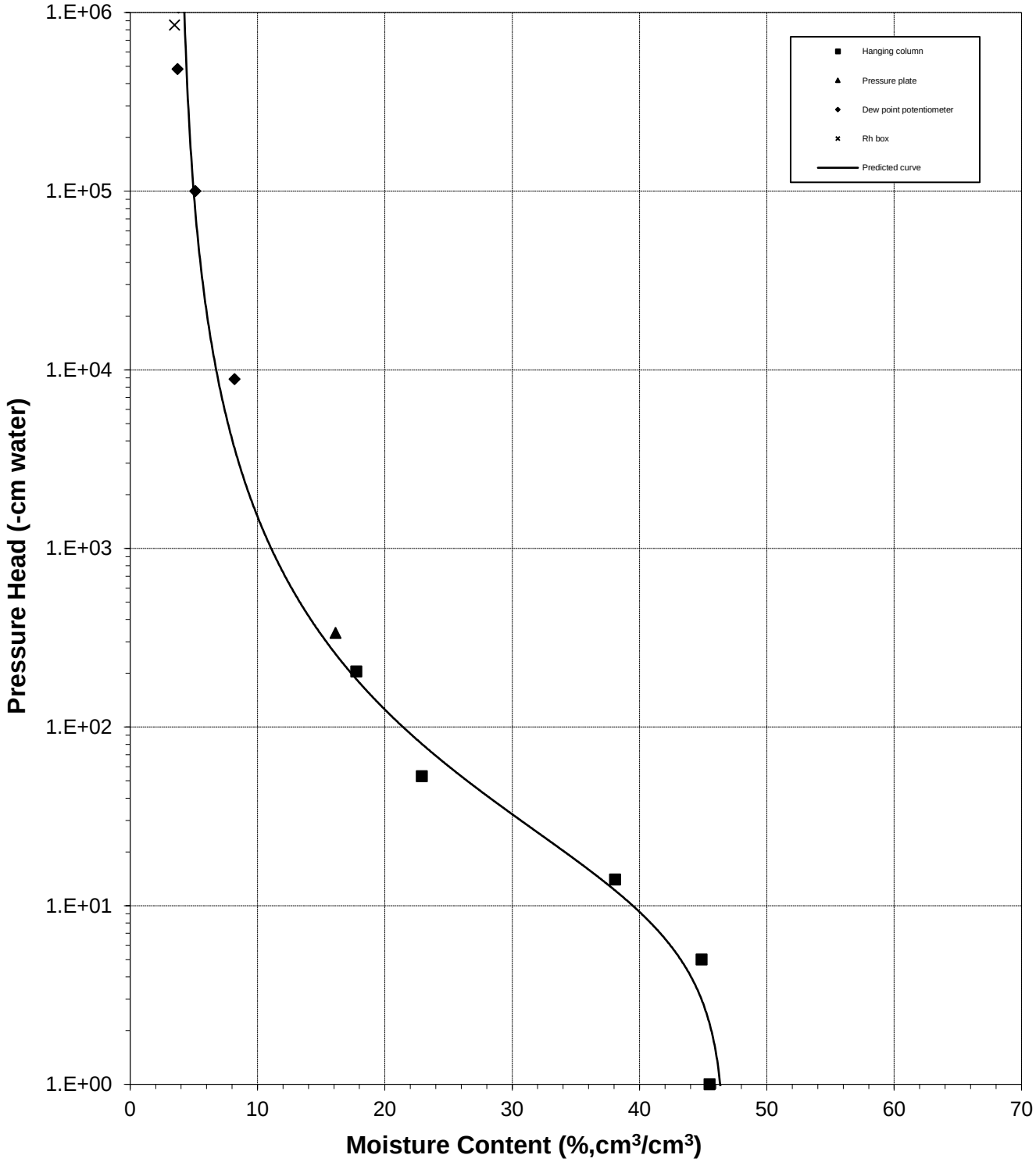
Water Retention Data Points

Sample Number: USNR-GB3 (1.45 g/cc)



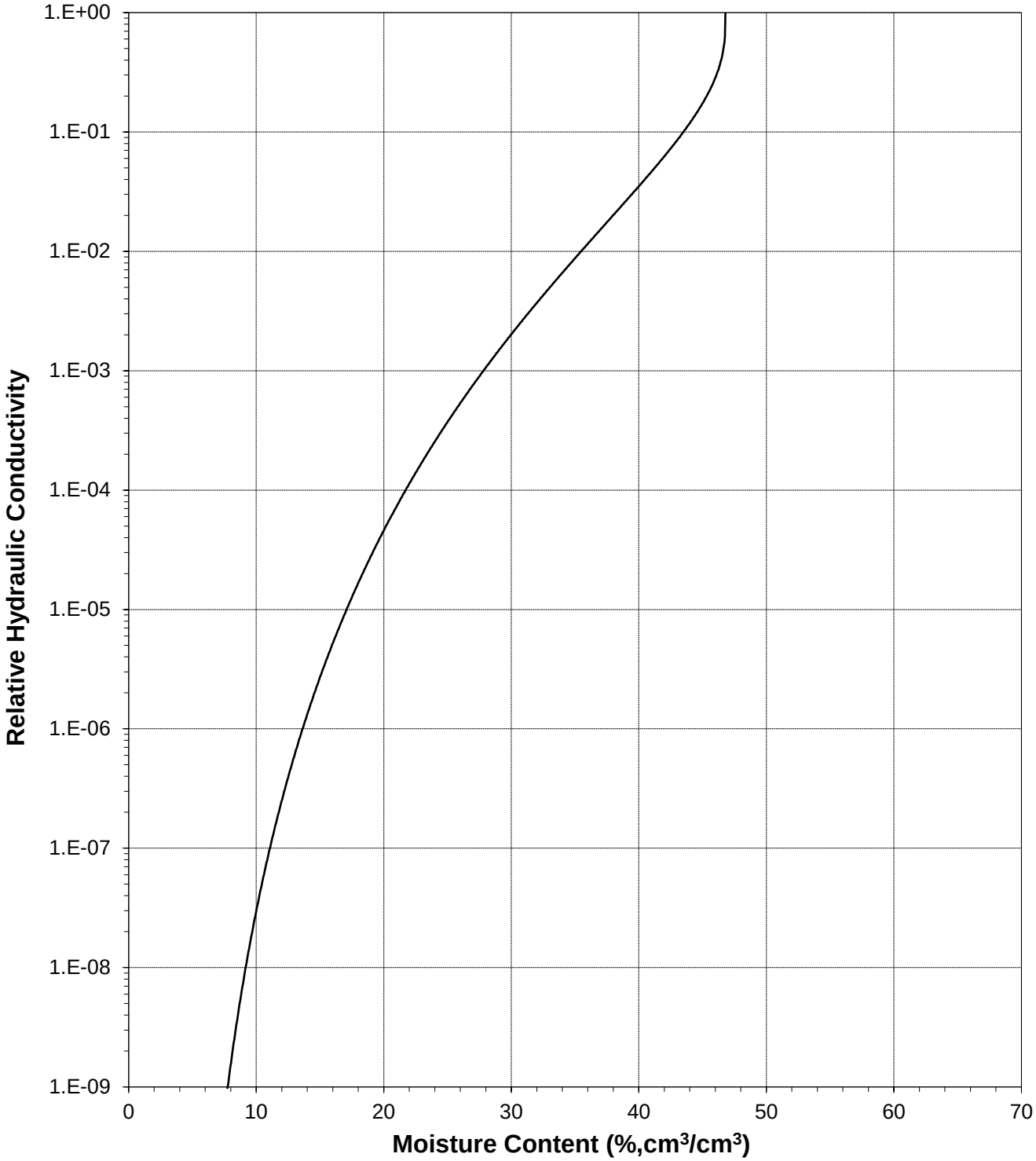
Predicted Water Retention Curve and Data Points

Sample Number: USNR-GB3 (1.45 g/cc)



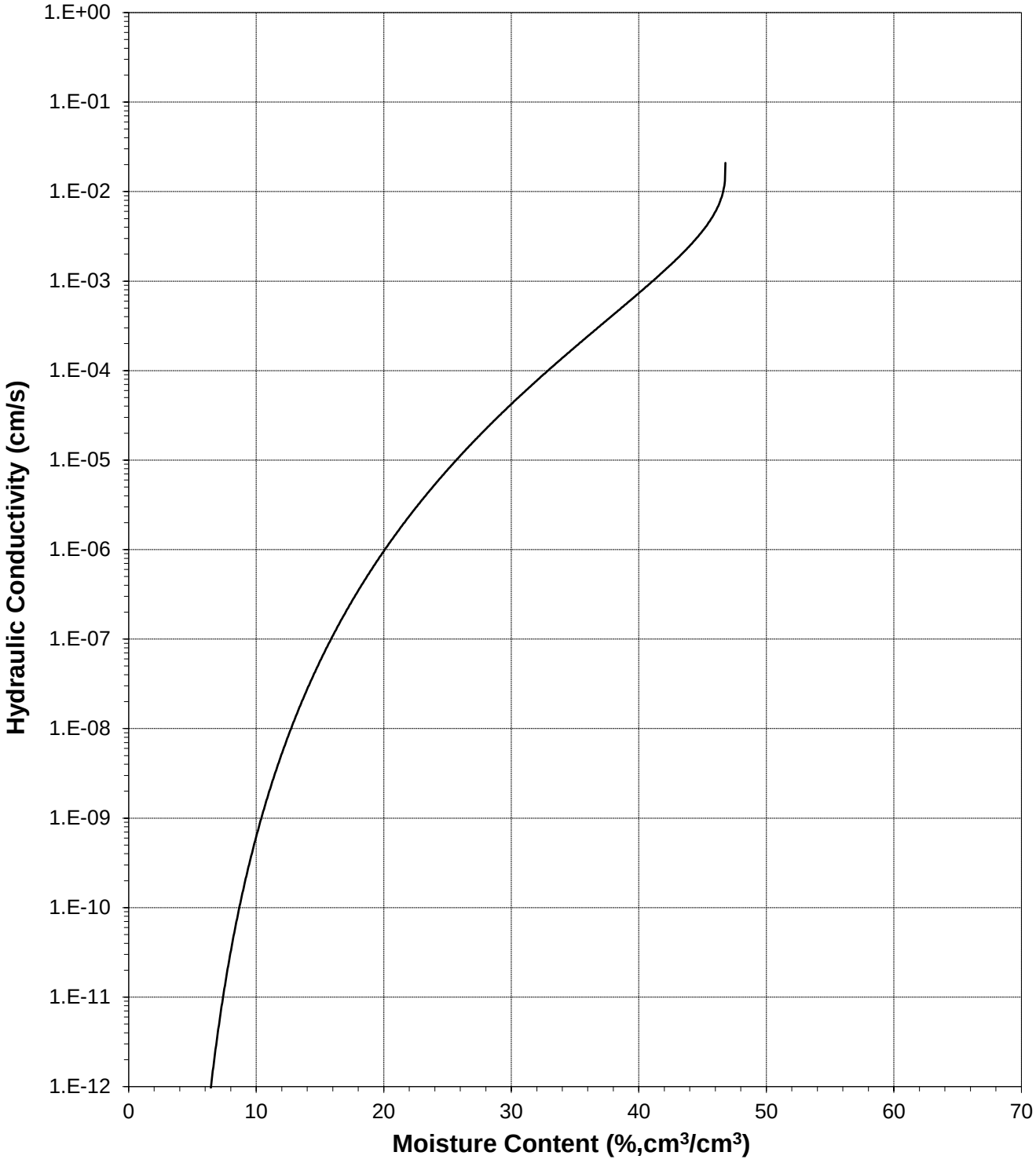
Plot of Relative Hydraulic Conductivity vs Moisture Content

Sample Number: USNR-GB3 (1.45 g/cc)



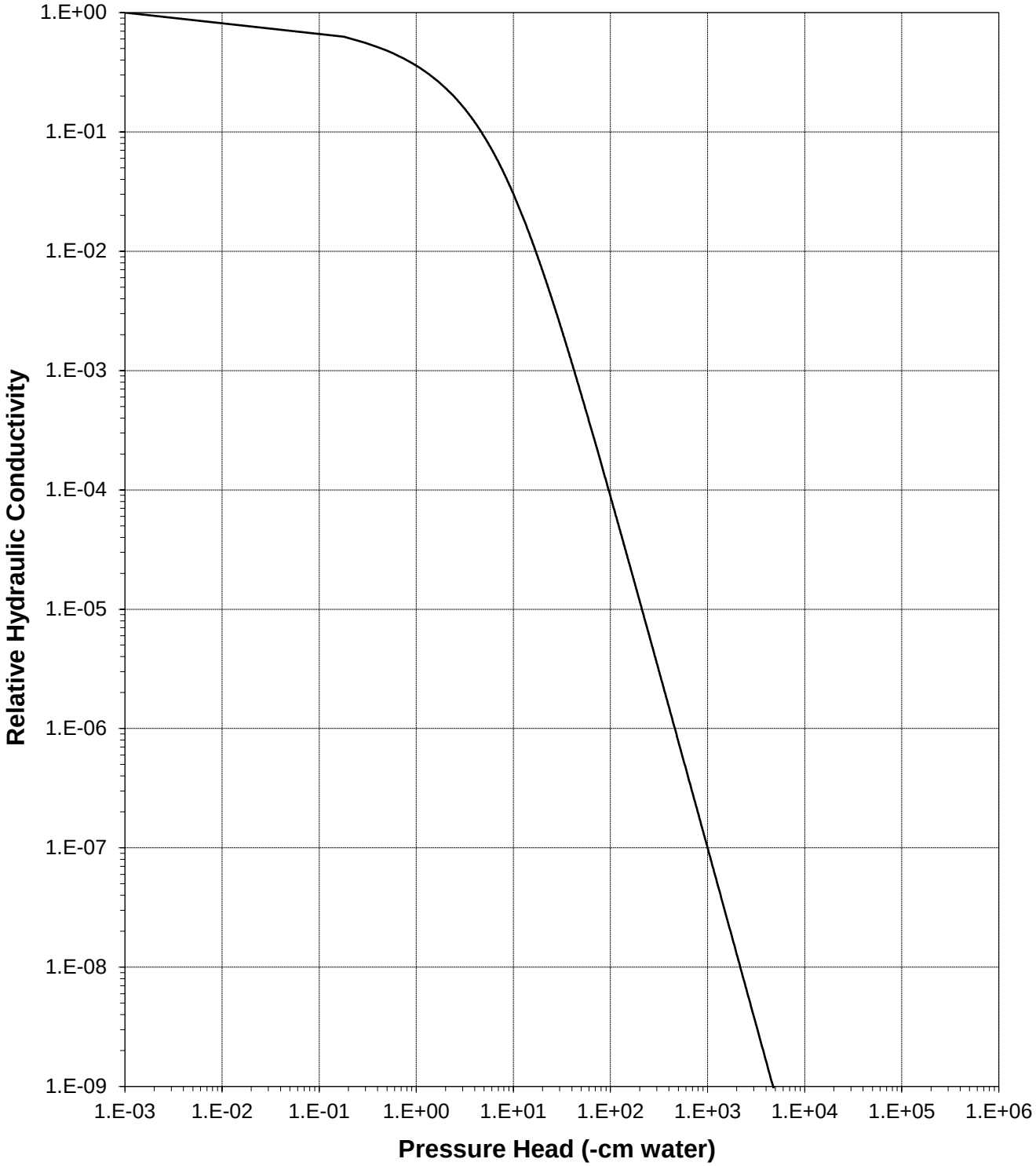
Plot of Hydraulic Conductivity vs Moisture Content

Sample Number: USNR-GB3 (1.45 g/cc)



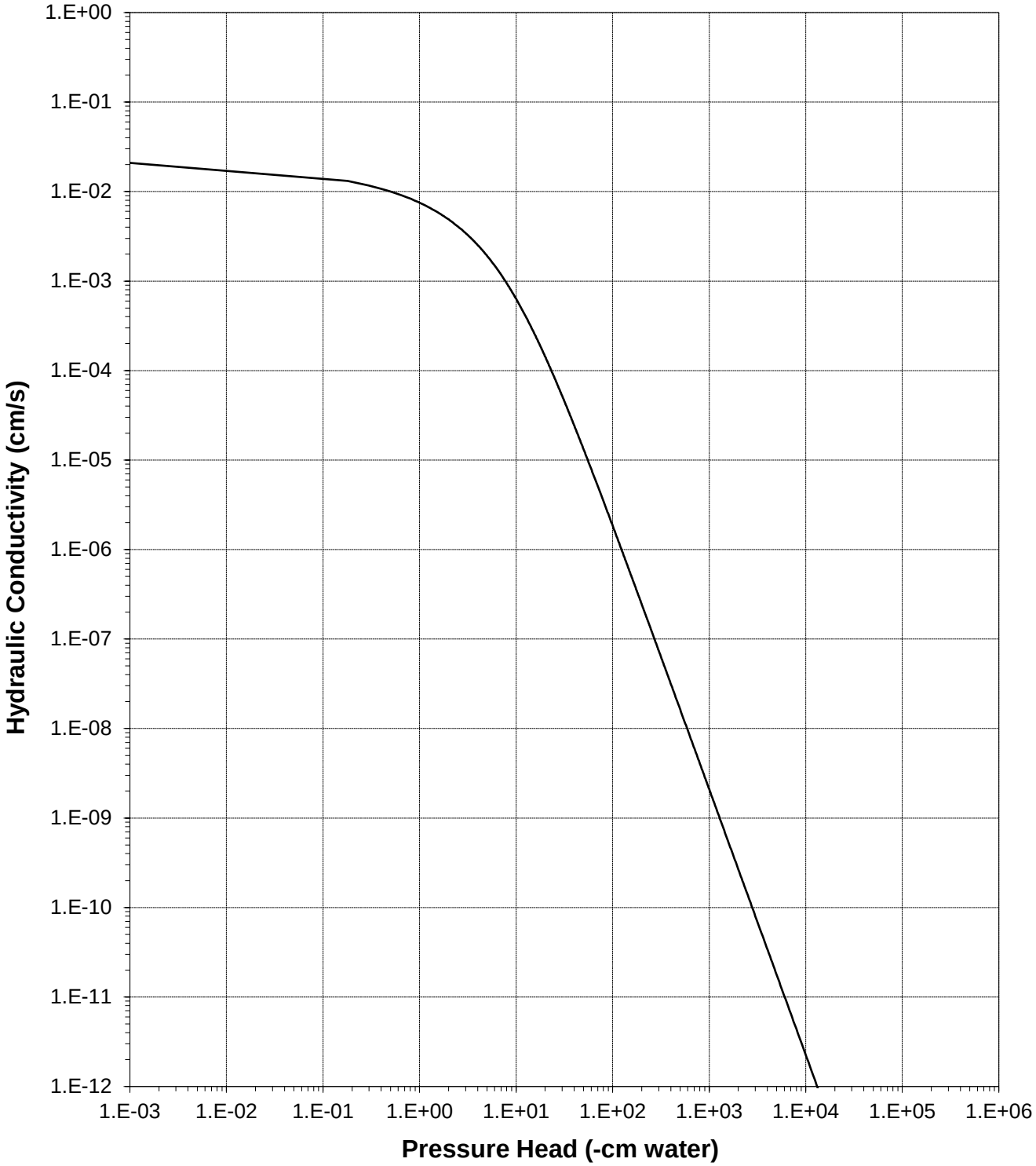
Plot of Relative Hydraulic Conductivity vs Pressure Head

Sample Number: USNR-GB3 (1.45 g/cc)



Plot of Hydraulic Conductivity vs Pressure Head

Sample Number: USNR-GB3 (1.45 g/cc)



Moisture Retention Data

Hanging Column / Pressure Plate

(Soil-Water Characteristic Curve)

Job Name: WSP Golder
Job Number: DB23.1010.00
Sample Number: WIP-GB1 (1.45 g/cc)
Project: 31406439 01.EXP
Fraction Tested: <2mm

Dry wt. of sample (g)*:* 207.80
Tare wt., ring (g)*:* 81.48
Tare wt., screen & clamp (g)*:* 24.25
Initial sample volume (cm^3)*:* 143.59
Initial dry bulk density (g/cm^3)*:* 1.45
Assumed particle density (g/cm^3)*:* 2.65
Initial calculated total porosity (%)*:* 45.39

	Date	Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content † (% vol)
Hanging column:	30-Aug-23	13:05	381.20	0	47.13
	6-Sep-23	8:00	381.08	5.0	47.05
	13-Sep-23	10:30	380.88	14.0	46.91
	20-Sep-23	10:15	349.47	53.0	25.03
	27-Sep-23	9:00	339.95	205.0	18.40
Pressure plate:	7-Oct-23	12:45	337.96	337	17.01

Volume Adjusted Data [1]

	Matric Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calculated Porosity (%)
Hanging column:	0.0	---	---	---	---
	5.0	---	---	---	---
	14.0	---	---	---	---
	53.0	---	---	---	---
	205.0	---	---	---	---
Pressure plate:	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/cm^3

‡‡ 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: W. Seward
Checked by: J. Hines

Moisture Retention Data

Dew Point Potentiometer / Relative Humidity Box

(Soil-Water Characteristic Curve)

Sample Number: WIP-GB1 (1.45 g/cc)

Initial sample bulk density (g/cm^3)*:* 1.45

Fraction of bulk sample used (<2.00mm fraction) (%): 100.00

Dry weight of dew point potentiometer sample* (g)*:* 195.00

Tare weight, jar (g)*:* 114.66

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content † (% vol)
Dew point potentiometer:	15-Sep-23	10:31	199.58	41404	8.25
	11-Sep-23	16:22	198.46	100144	6.23
	8-Sep-23	17:21	198.08	318280	5.56

Volume Adjusted Data [1]

	Water Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calc. Porosity (%)
Dew point potentiometer:	41404	---	---	---	---
	100144	---	---	---	---
	318280	---	---	---	---

Dry weight of relative humidity box sample* (g)*:* 74.99

Tare weight (g)*:* 39.91

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content † (% vol)
Relative humidity box:	29-Aug-23	12:00	76.14	849860	4.76

Volume Adjusted Data [1]

	Water Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calc. Porosity (%)
Relative humidity box:	849860	---	---	---	---

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/cm^3.

‡‡ 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.

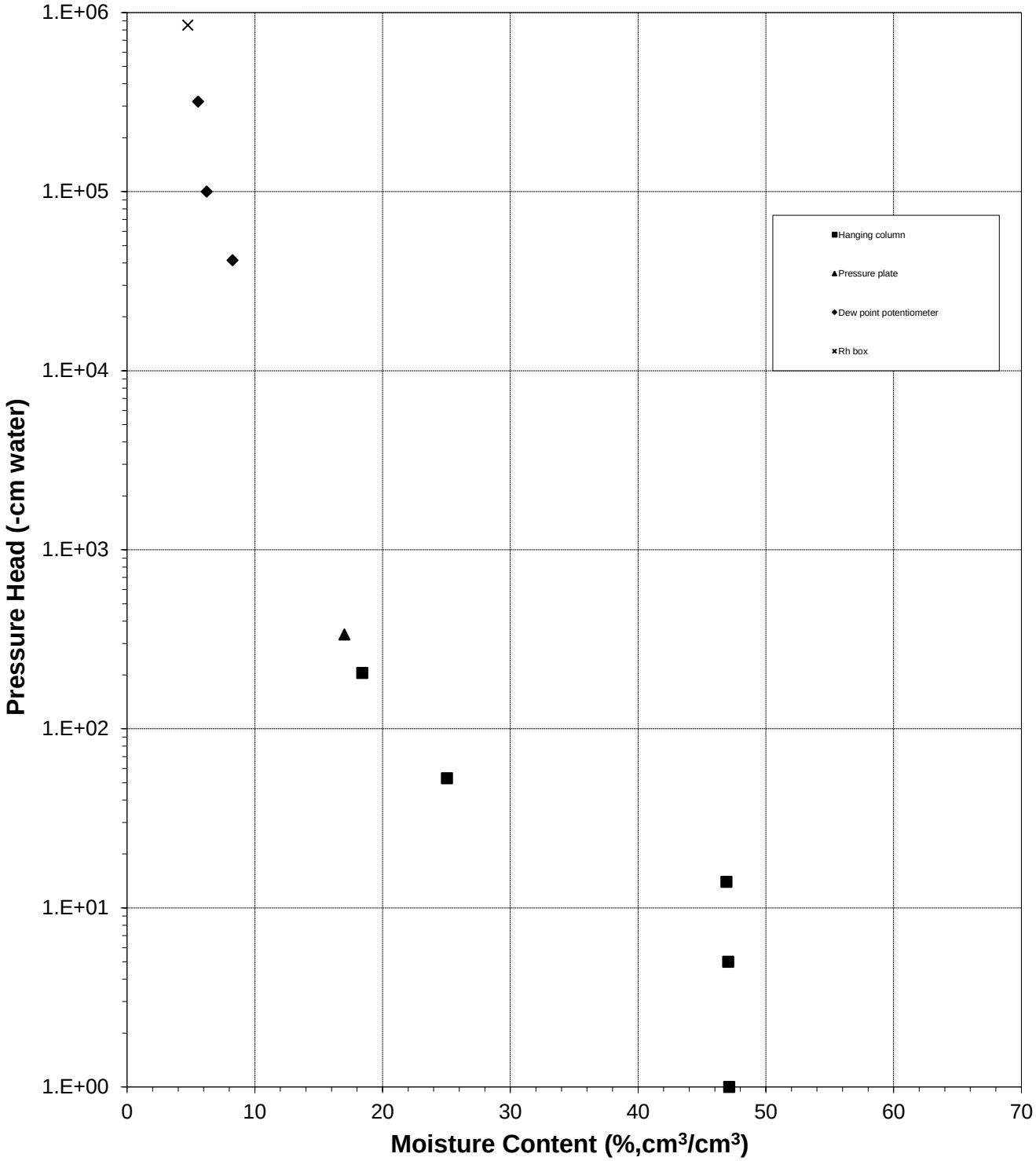
Laboratory analysis by: D. O'Dowd

Data entered by: W. Seward

Checked by: J. Hines

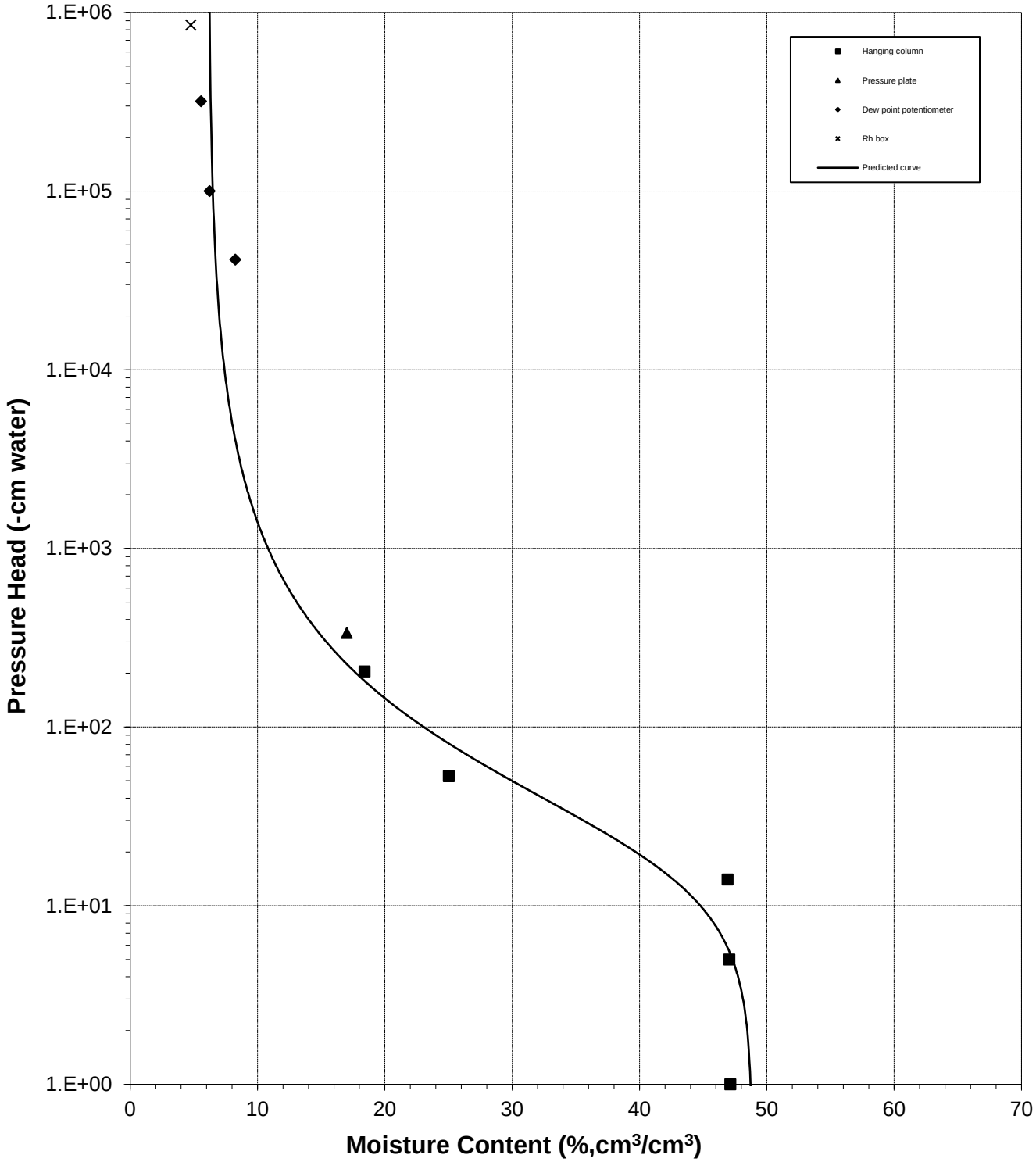
Water Retention Data Points

Sample Number: WIP-GB1 (1.45 g/cc)



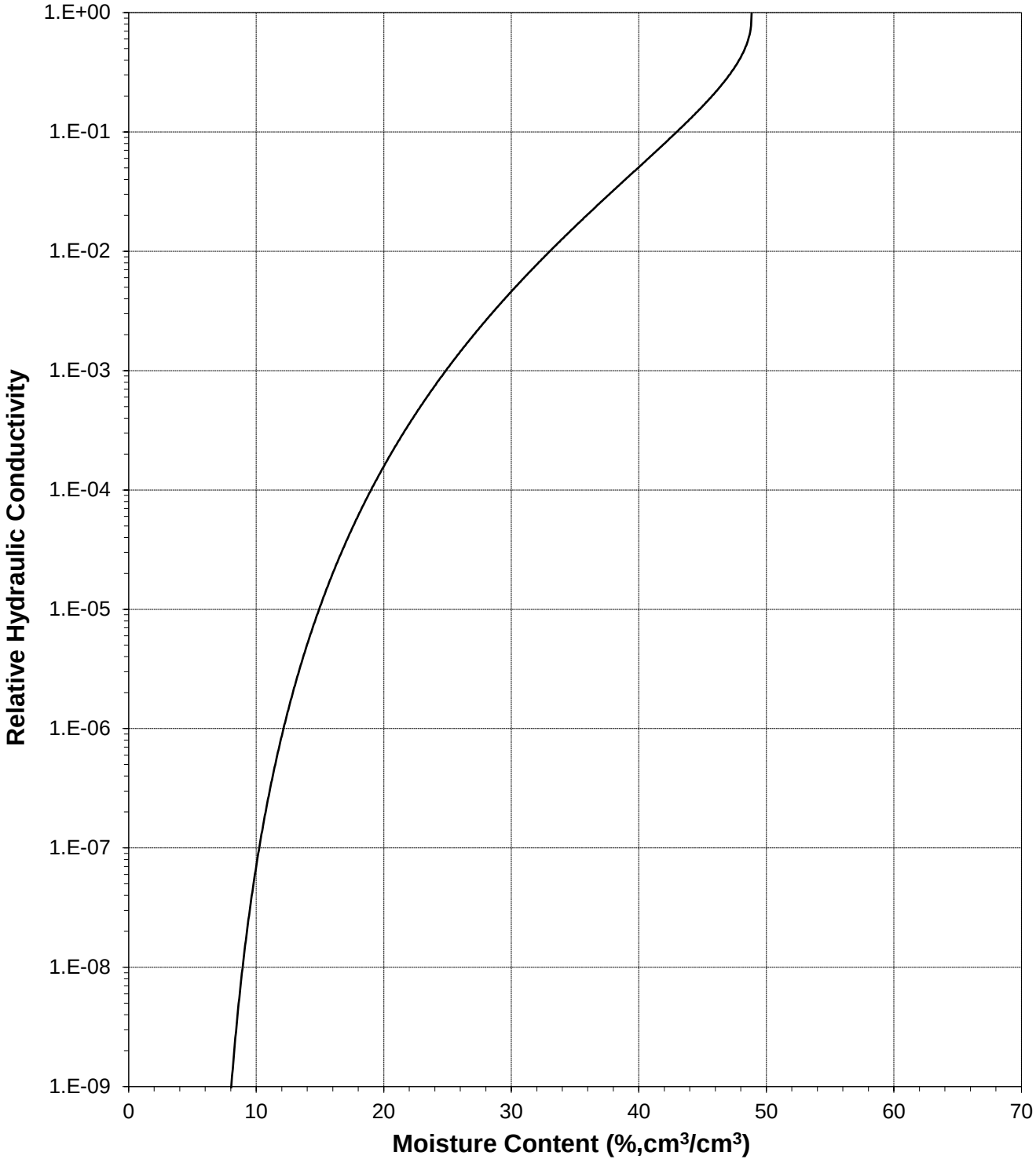
Predicted Water Retention Curve and Data Points

Sample Number: WIP-GB1 (1.45 g/cc)



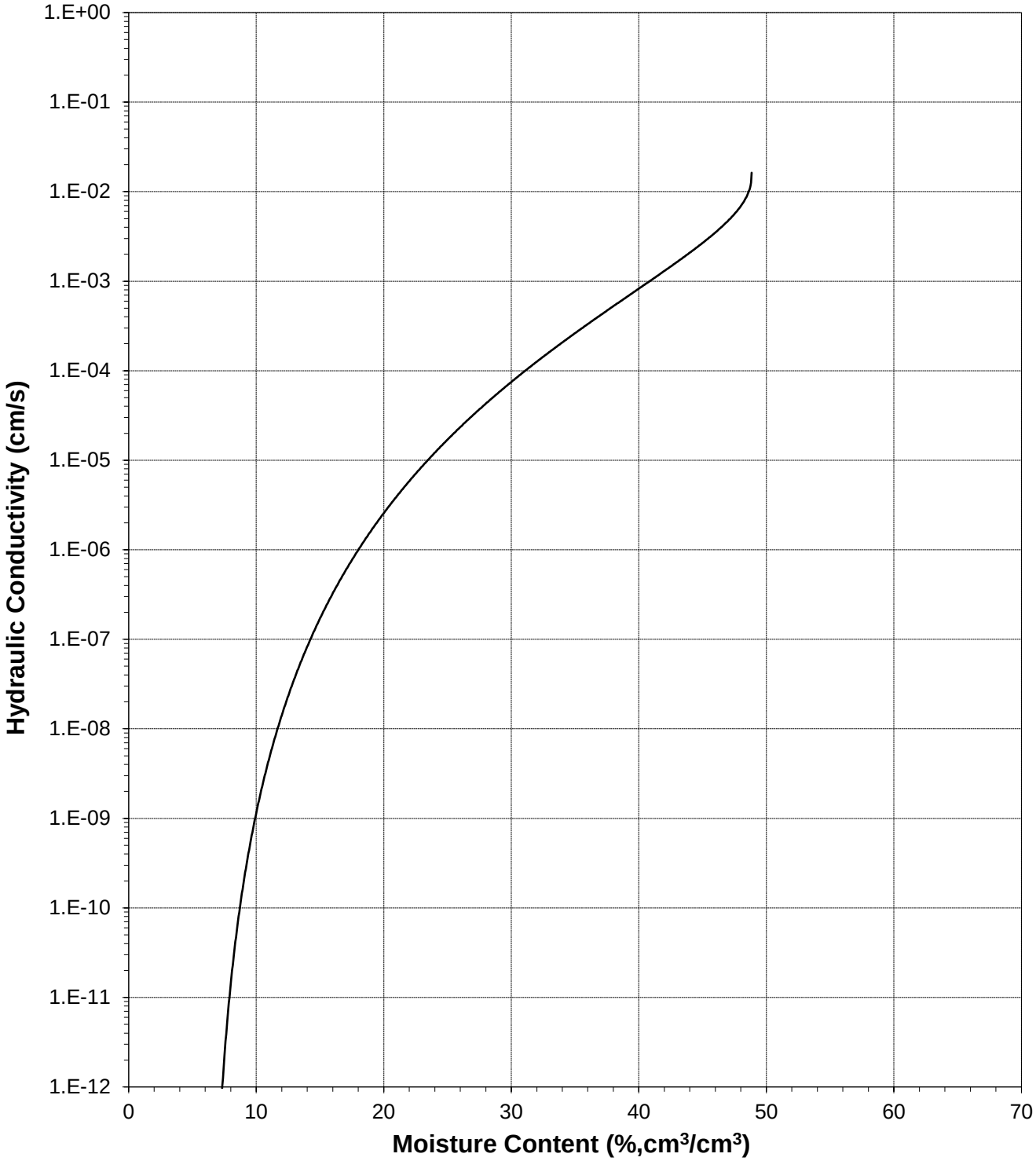
Plot of Relative Hydraulic Conductivity vs Moisture Content

Sample Number: WIP-GB1 (1.45 g/cc)



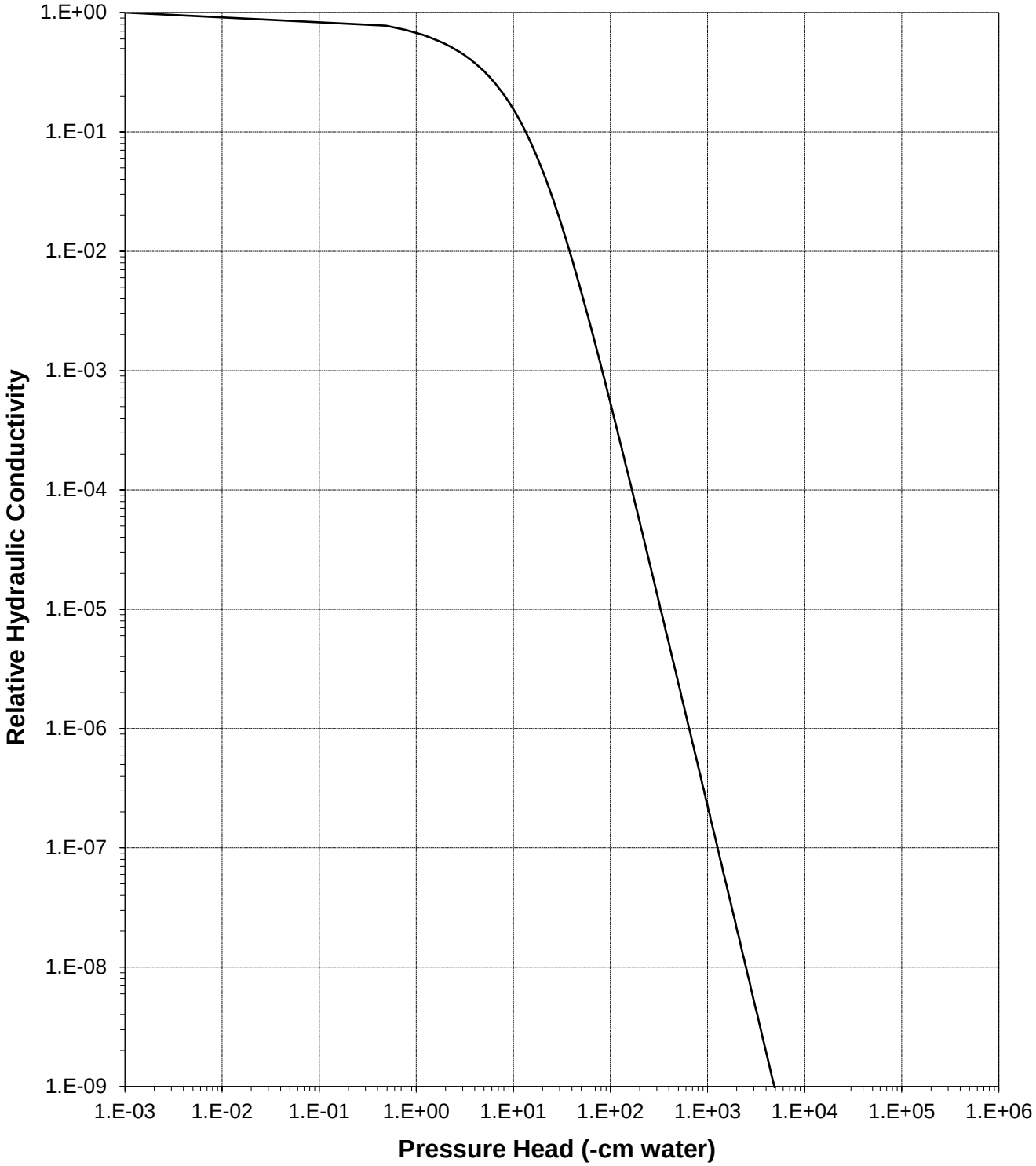
Plot of Hydraulic Conductivity vs Moisture Content

Sample Number: WIP-GB1 (1.45 g/cc)



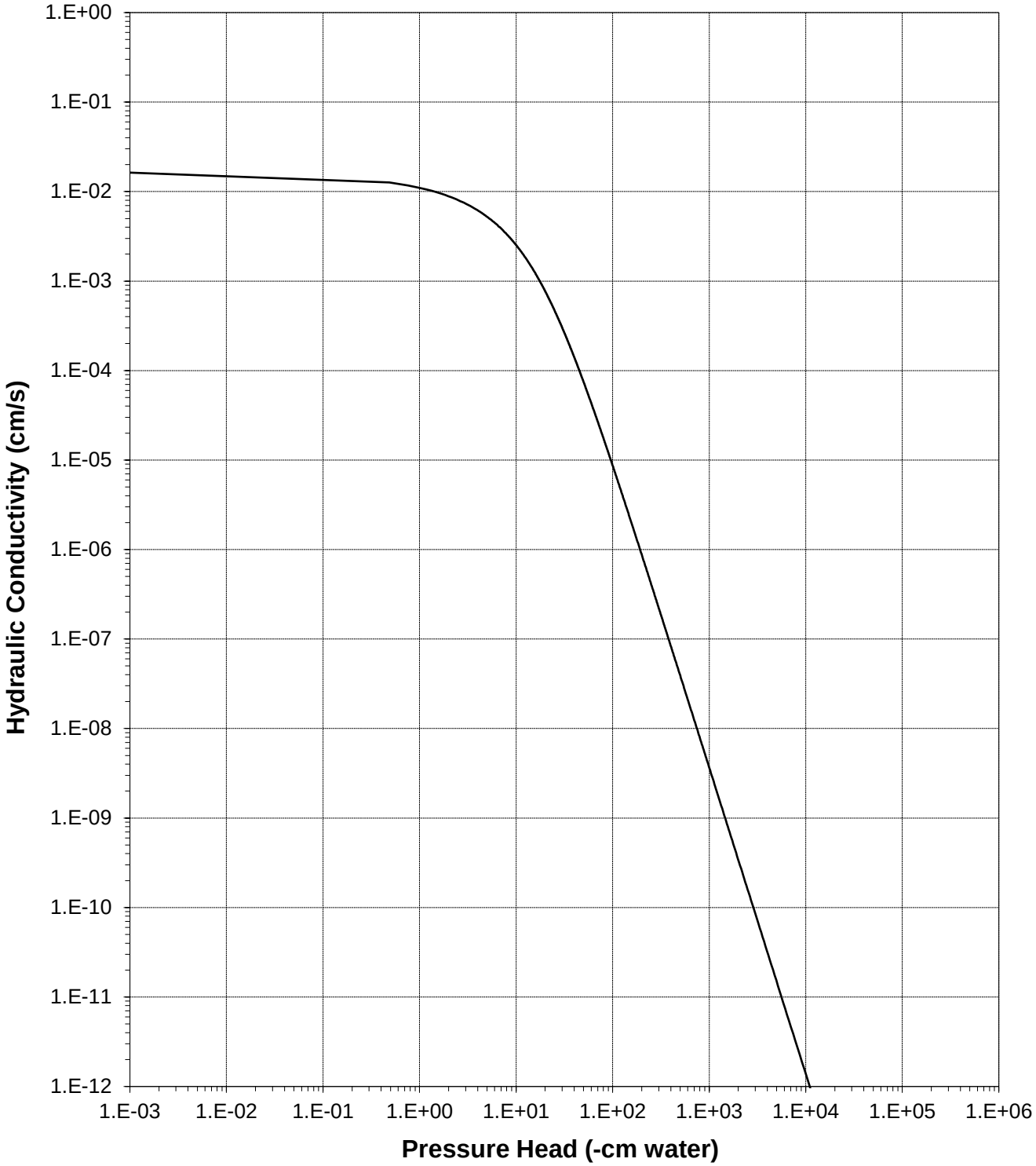
Plot of Relative Hydraulic Conductivity vs Pressure Head

Sample Number: WIP-GB1 (1.45 g/cc)



Plot of Hydraulic Conductivity vs Pressure Head

Sample Number: WIP-GB1 (1.45 g/cc)



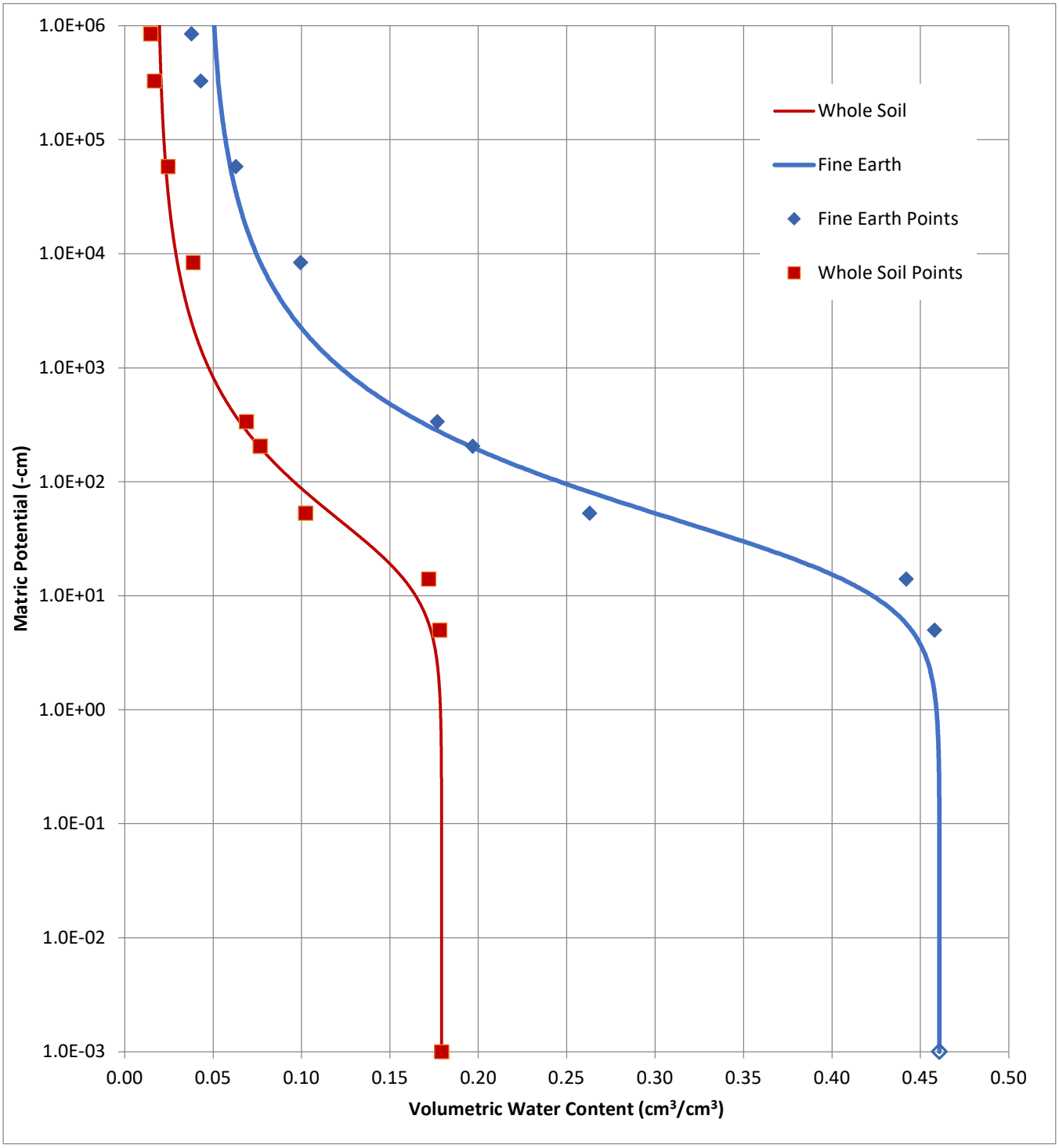
Laboratory Tests and Methods

Tests and Methods

Dry Bulk Density:	ASTM D7263
Moisture Content:	ASTM D7263, ASTM D2216
Calculated Porosity:	ASTM D7263
Saturated Hydraulic Conductivity:	
Falling or Constant Head: (Rigid Wall)	ASTM D5856M
Hanging Column Method:	ASTM D6836 (modified apparatus)
Pressure Plate Method:	ASTM D6836
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

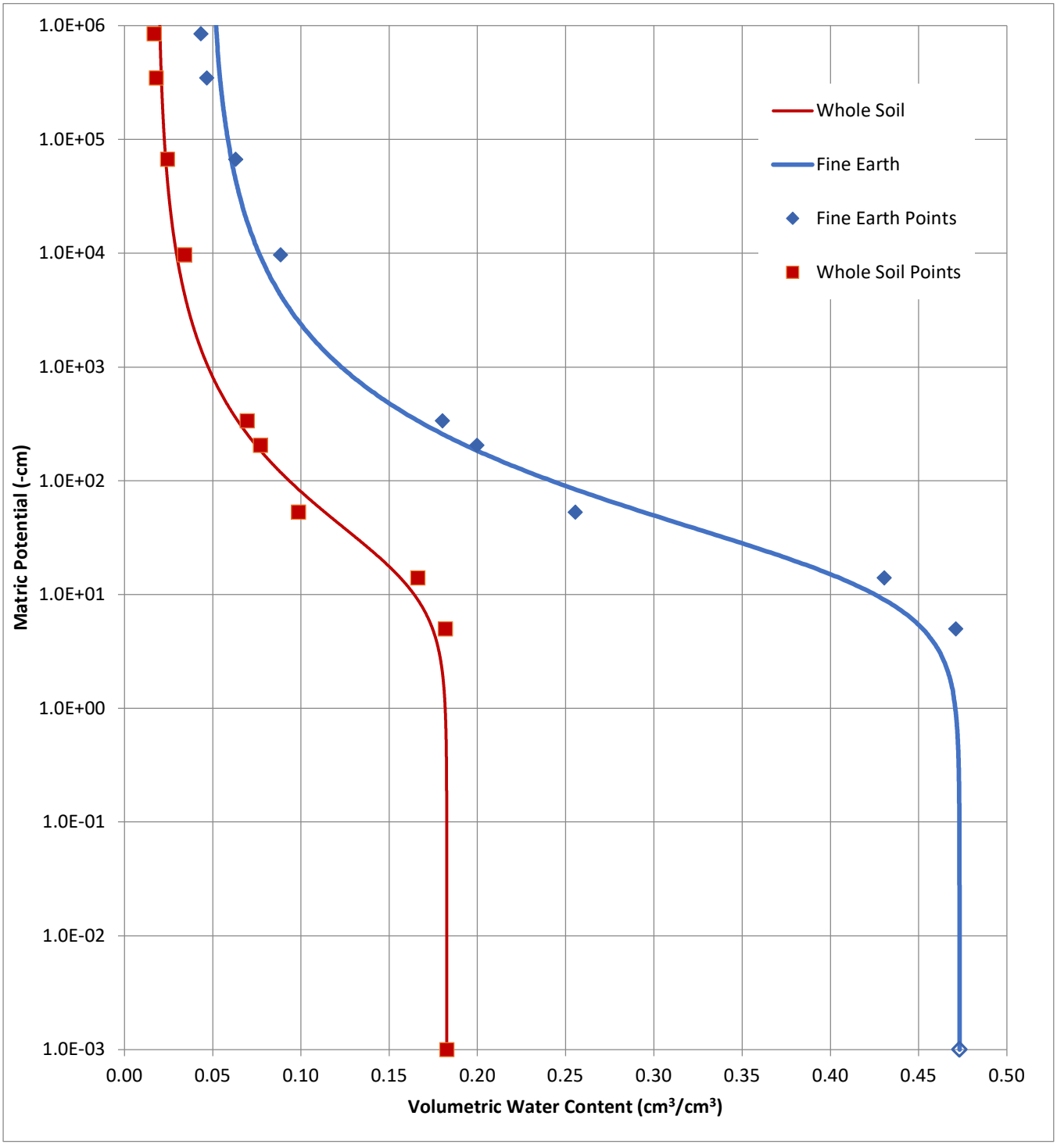
Soil Water Characteristic Curve

9A-TP1



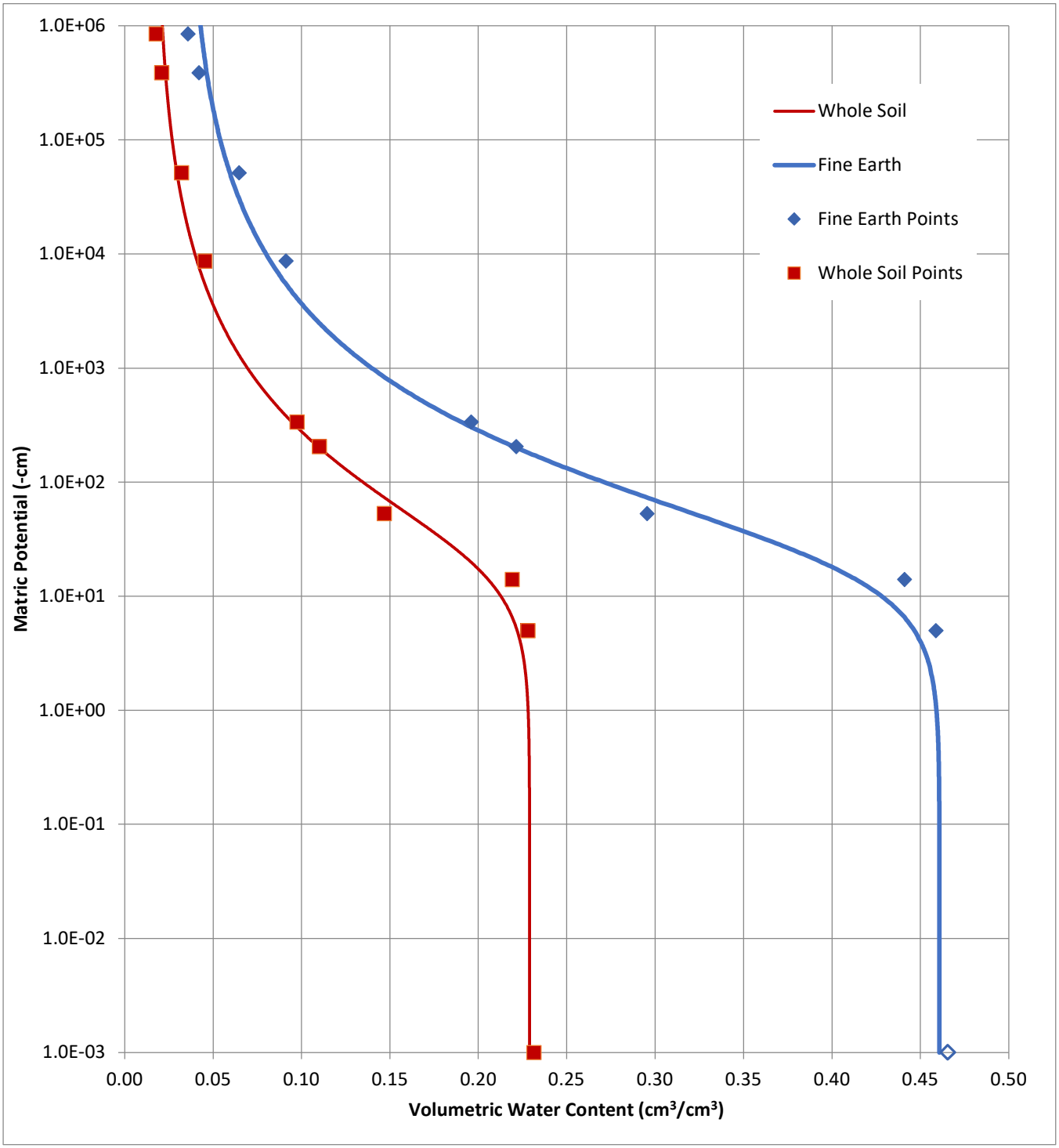
Soil Water Characteristic Curve

9A-TP4



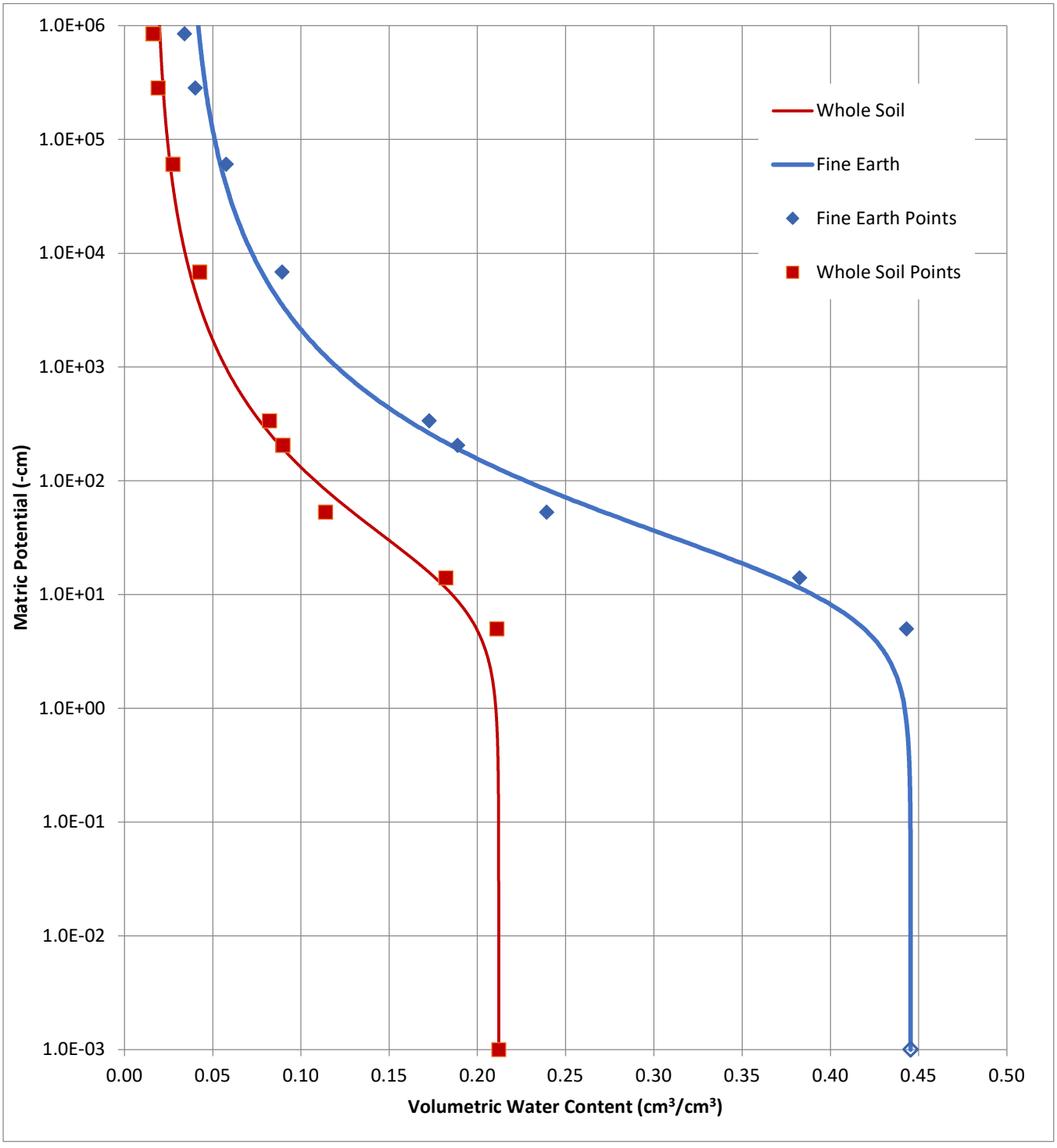
Soil Water Characteristic Curve

9A-TP4



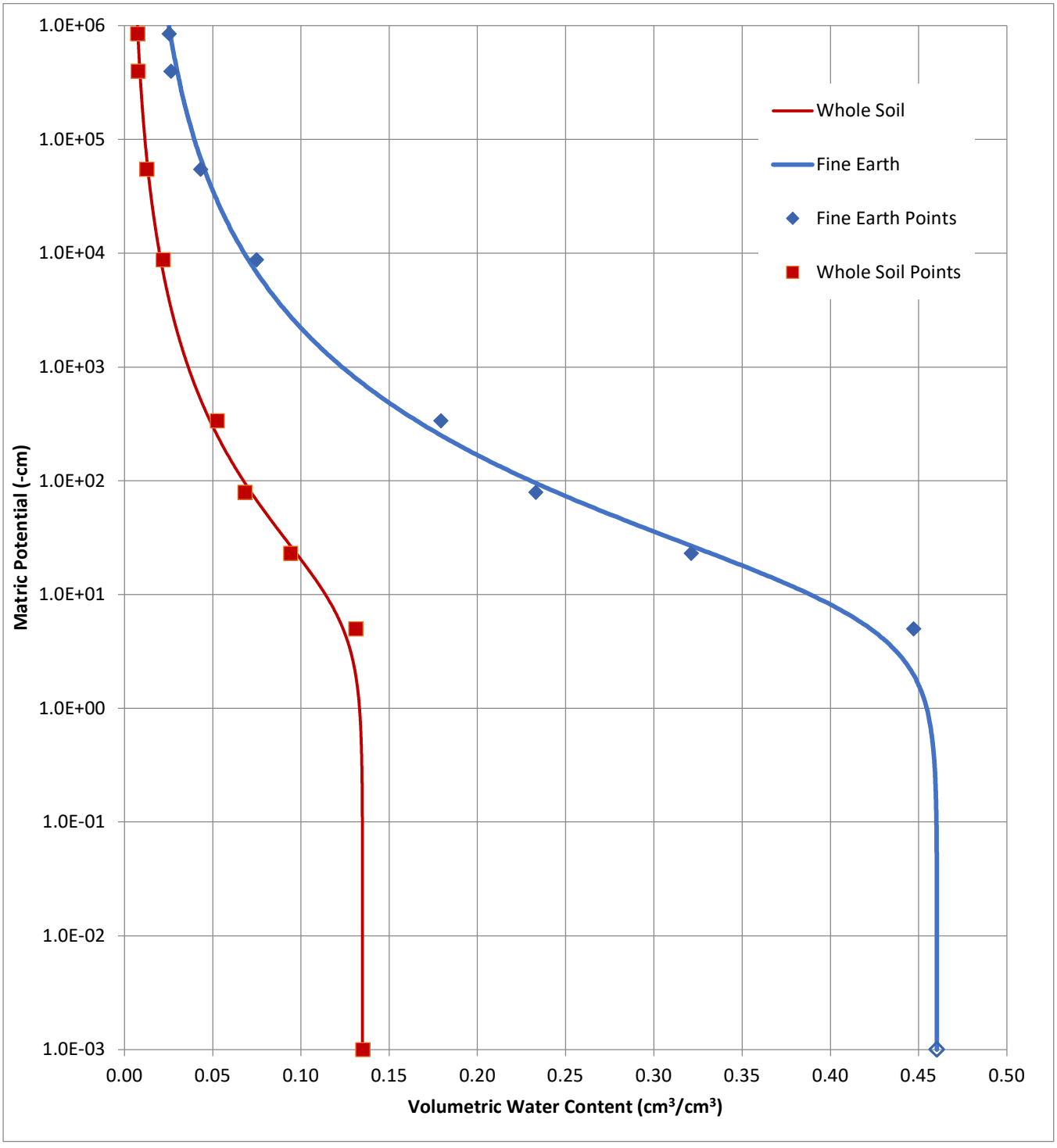
Soil Water Characteristic Curve

9A-GB3



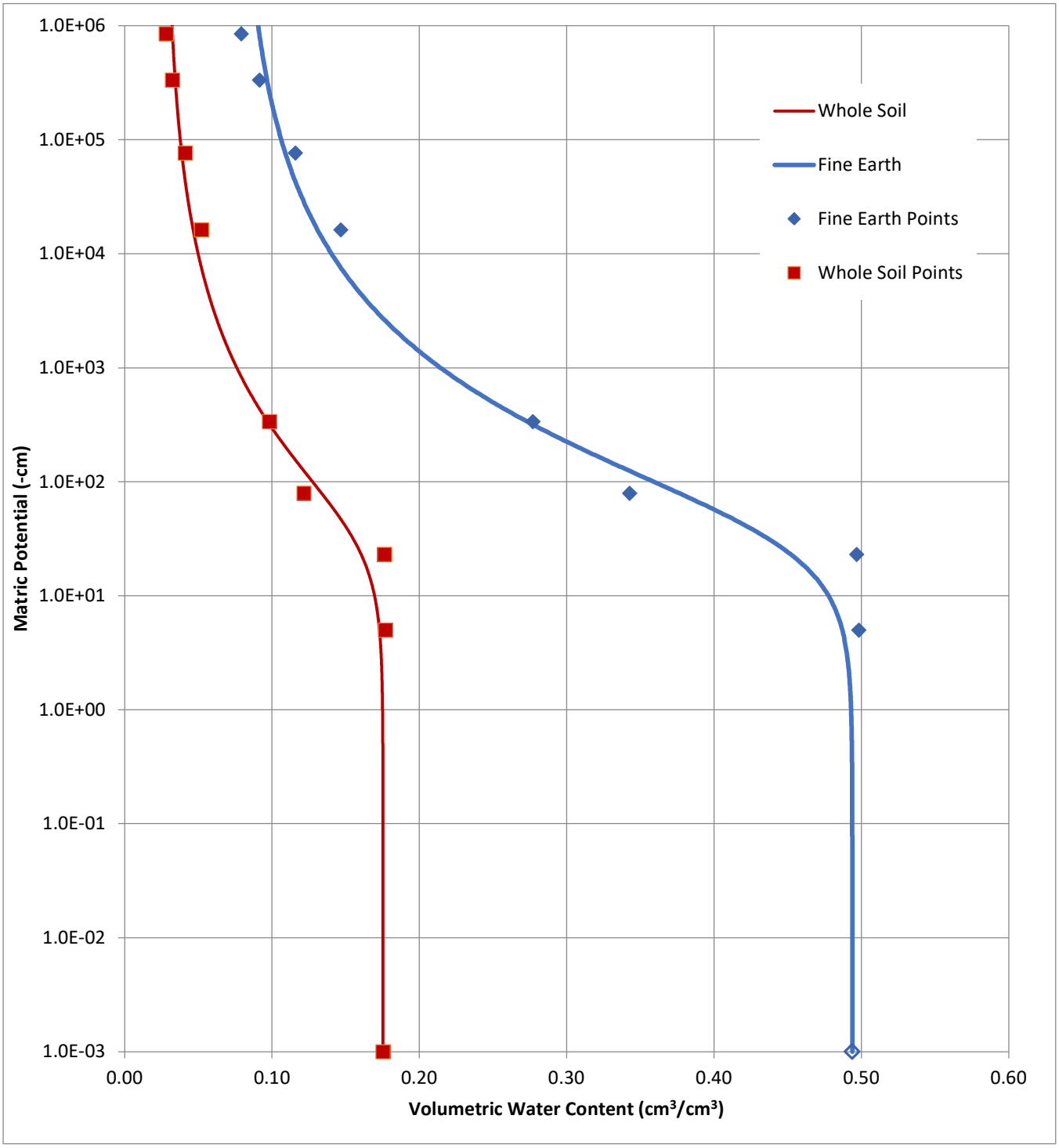
Soil Water Characteristic Curve

9AX-TP2



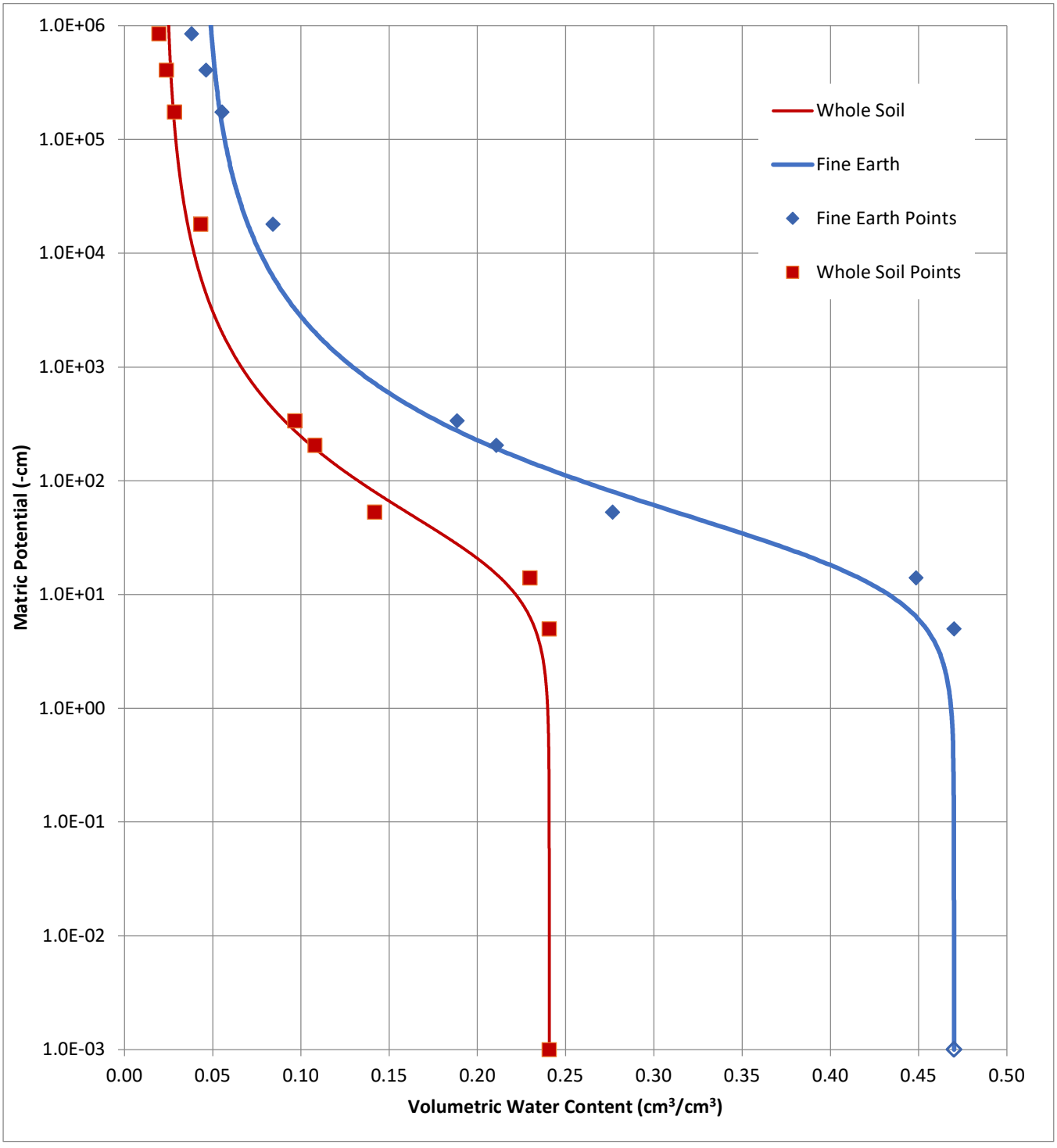
Soil Water Characteristic Curve

9AX-GB1



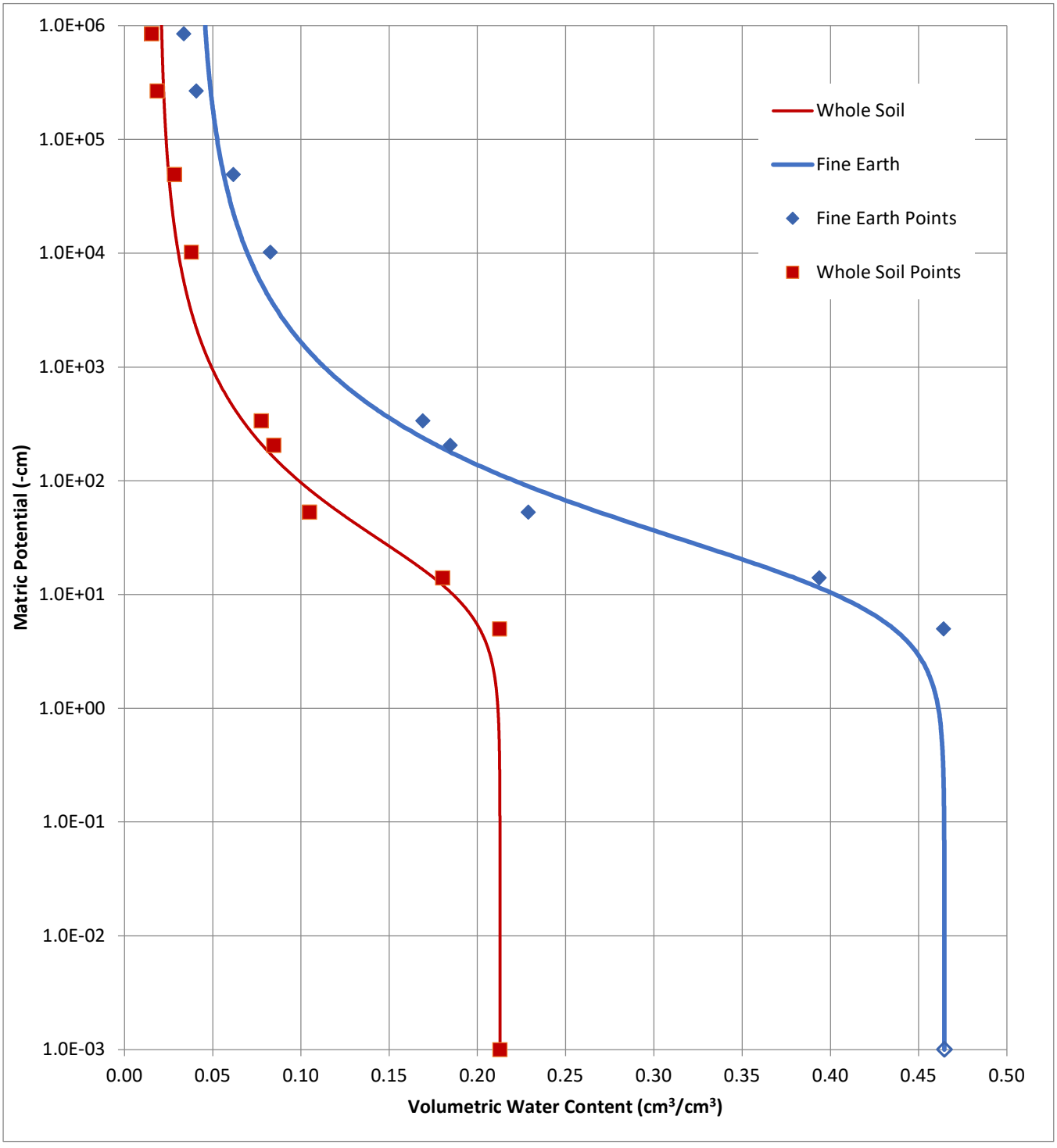
Soil Water Characteristic Curve

CuL-GB1



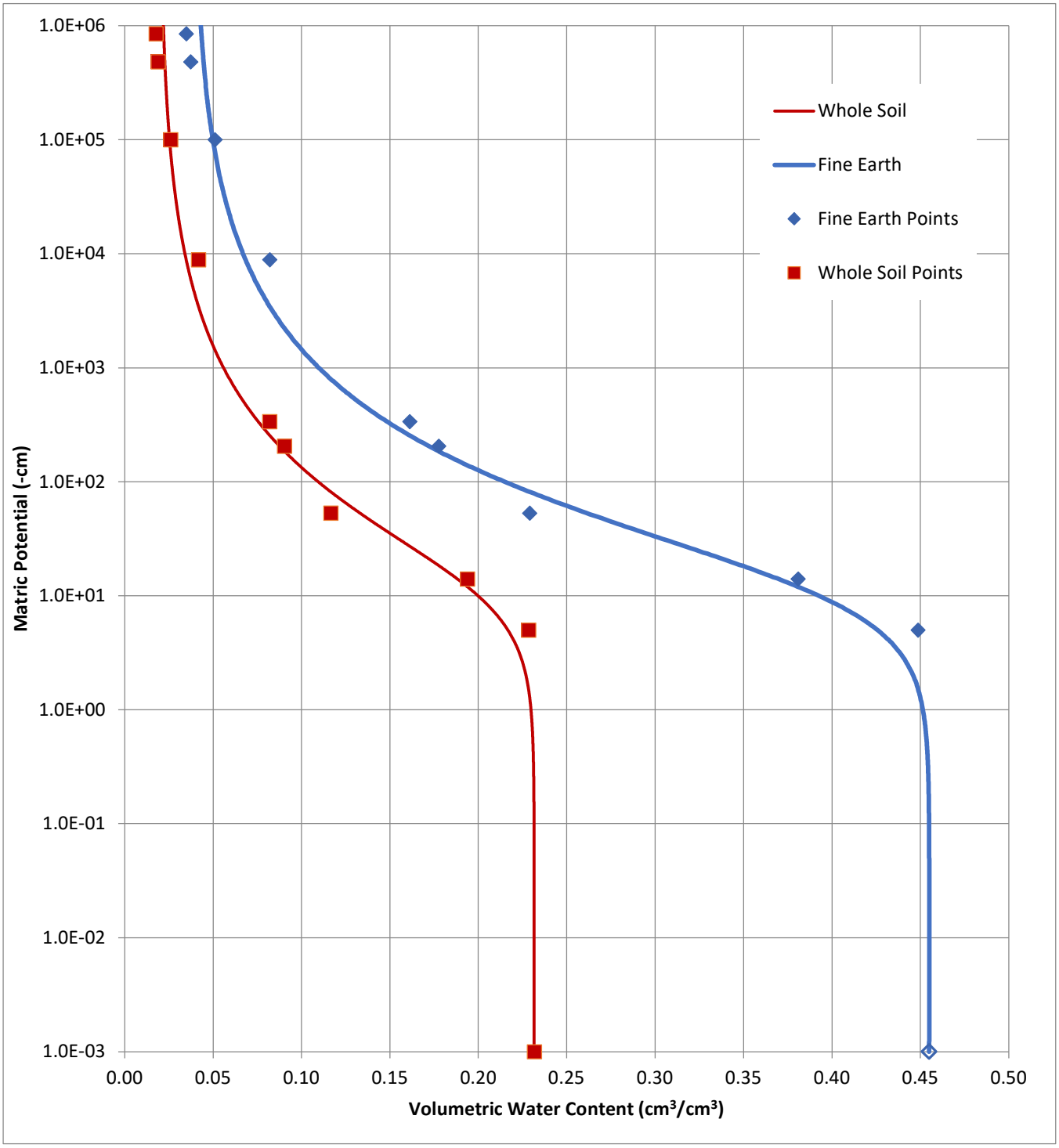
Soil Water Characteristic Curve

USNR-GB1



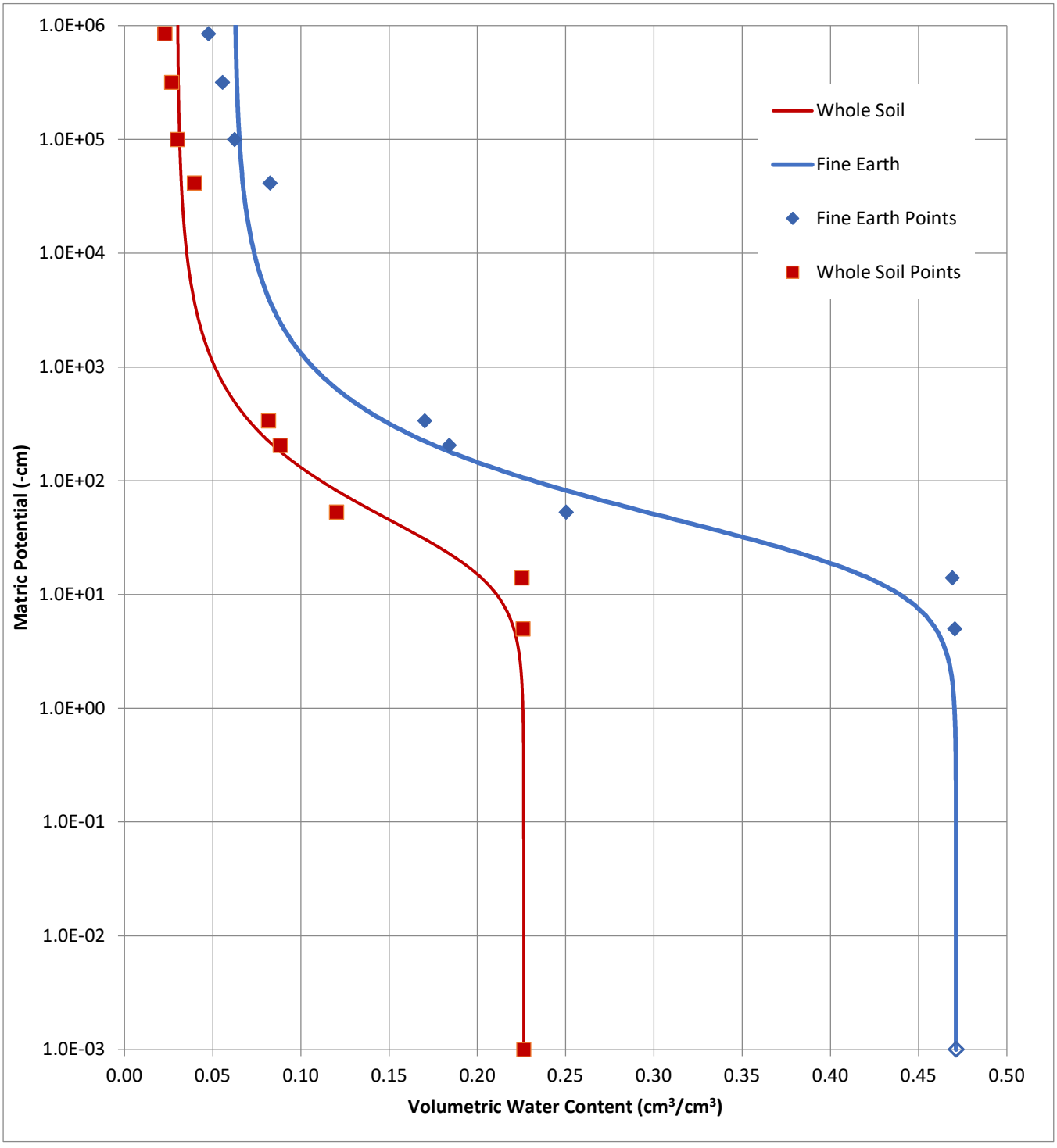
Soil Water Characteristic Curve

USNR-GB3 (<2mm) (1.65 g/cc)



Soil Water Characteristic Curve

WIP-GB1



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