REPORT

Characterization and Volumetrics of Gila Conglomerate and Precambrian Granite Reclamation Cover Materials

Freeport-McMoRan Tyrone Operations

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1.0 INTRODUCTION

Freeport-McMoRan Tyrone, Inc. (Tyrone) is an open pit copper mine located just off State Highway 90, approximately 10 miles southwest of Silver City in Grant County, New Mexico (Figure 1). Tyrone is permitted as an existing mine (Permit No. GR010RE) with the New Mexico Mining and Minerals Division (MMD) and discharge permit DP-1341 issued by the New Mexico Environment Department (NMED).

Potential reclamation cover materials (RCM) identified at Tyrone include native soils, recent alluvium, residual Gila Conglomerate, and Precambrian Granite and Tertiary Quartz Monzonite overburden from various open pits and stockpiles in the Tyrone area (e.g., Little Rock and 9A Waste, 9AX Waste stockpiles). On December 27, 2017, Tyrone received comments on the Updated Closure Closeout Plan (CCP) from the MMD and NMED requesting an update of the 2005 and 2006 borrow material investigations (Golder 2005b and 2006a). Specifically, the MMD requested additional information on the chemical and physical properties of Gila Conglomerate found in the Lubrication Shop area and an estimate of the volume of Gila Conglomerate available from this area. MMD also requested that Tyrone confirm there is sufficient Gila Conglomerate reclamation cover material (GCRCM) at the Mine/Stockpile Unit because portions of Borrow Source A had been covered by the 9A Waste, 9AX Waste stockpiles and Borrow Source E was no longer a practical source of cover material since reclamation of the Reclaimed 1 Leach stockpile was completed in 2009.

Additionally, during a conference call on June 18, 2018, NMED asked whether the RCM meets the water holding capacity (WHC) requirements per the New Mexico Copper Mine Rule (Copper Rule) that was codified October 30, 2012. Tyrone committed to update the previous RCM studies to comply with Copper Rule requirements as part of the Closure/Closeout Plan update. This report provides data to demonstrate the available RCM at Tyrone complies with Copper Rule.

1.1 Objectives

Golder Associated Inc, (Golder) prepared this report on behalf of Tyrone to address the agencies requests for additional information regarding RCM for the Tyrone Mine/Stockpile Unit. The objectives of this report are to:

- Update the 2005 and 2006 Borrow Source Materials reports with additional characterization data including:
  - Test pit and exposure sampling to further characterize the GCRCM in the Lubrication Shop area and Savanna Pit area.
  - Sampling Precambrian Granite reclamation cover materials (PGRCM) currently stockpiled in the 9A Waste and 9AX Waste stockpiles.
- Provide an analysis of the WHC for the GCRCM and PGRCM to determine if the covers meet requirements in the Copper Rule (20.6.7.33.F NMAC).
- Recalculate the available volume of RCM to reflect changes in the mine plan and completed reclamation efforts.

1.2 New Mexico Copper Mine Rule Cover Requirements

According to DP-1341, the covers placed on the waste rock and leach ore stockpiles shall consist of a minimum of 36 inches of Gila Conglomerate. The Copper Rule defined performance requirements for the cover materials. According to 20.6.7.33.F of the Copper Rule, the cover must meet the following criteria:

1) The cover system shall be constructed of thirty-six inches of earthen materials that are capable of sustaining plant growth without continuous augmentation and have erosion resistant characteristics. Erosion rates shall be equal to or less than stable slopes in the surrounding environment after the vegetation has reached near equilibrium cover levels. Erosion will be estimated using generally acceptable methods.

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 Tyrone's RCM for compliance with the Copper Rule, the threshold WHC was set at 0.88 in/ft.

2.0 BACKGROUND

The Gila Conglomerate and associated soils and Precambrian Granite overburden are the principal cover materials identified for use at the Tyrone Mine. The characteristics and suitability of the RCMs at Tyrone have been previously evaluated in several reports including:

- Closure/Closeout Plan, Tyrone Mine (DBS&A 1997a) including sections pertaining to the Borrow Materials Investigation (BMI) and Soil and Rock Suitability Assessment
- Preliminary Materials Characterization (DBS&A 1997b)
- Supplemental Materials Characterization (DBS&A 1997c)
- Closure/Closeout Plan for the Little Rock Mine (PDTI 2000)
- Little Rock Mine Cover Design Report and Test Plot Work Plan (Golder 2004)
- Copper Mountain Pit Expansion Leached Cap and Waste Rock Management Plan (PDTI 2005)
- Leached Cap Analysis and Vegetation Summary (Golder 2005a)
- Preliminary Borrow Source Materials Investigation Leach Ore and Waste Rock Stockpiles (Golder 2005b)
- Addendum to Preliminary Borrow Source Materials Investigation Leach Ore and Waste Rock Stockpiles (Golder 2006a)
- As-Built Report Cover, Erosion, and Revegetation Test Plot Study - Tyrone Mine Stockpiles. (Golder 2006b)
- United States Natural Resources (USNR) Test Plot – Annual Report No. 1 (Golder 2017)

A significant number of RCM samples have been collected in association with these investigations and is summarized in Table 1. Additional characterization data for the GCRCM are provided in the construction QA

reports for the reclaimed tailing impoundments and stockpile units. Sample locations, characterization data, and laboratory reports associated with the technical reports listed above are included by reference. Consolidated data for GCRCM was included in the Preliminary Borrow Source Materials Investigation report (Golder 2005b).

2.1.1 Gila Conglomerate

The Gila Conglomerate Formation is a mid-Miocene and mid-Pleistocene continental deposit that is widespread in southern New Mexico and Arizona. The composition of the Gila Conglomerate Formation varies locally depending on the source area lithology at the time of stripping and deposition. The Gila Conglomerate in the Mine/Stockpile Unit consists largely of igneous intrusive rocks originating from the ancestral Big Burro Mountains; while the Gila Conglomerate in the Mangas Valley reflects the influence of volcanic and meta-sedimentary rocks from the Little Burro Mountains.

Physically, the fine-earth fraction (i.e., < 2 millimeters [mm]) of the Gila Conglomerate and associated soils is dominantly moderately coarse-textured and mainly represented by loamy sand and sandy loam textures. Fine-, moderately fine- and coarse-textured soils occur locally. In general, the coarse textured soils are more prevalent in and around the Mine/Stockpile Unit, and the finer textured soils tend to occur on the flanks of the Little Burro Mountains east of the tailing impoundments. The soils around Tyrone typically contain about 30 to 50 percent rock fragments (>2 mm diameter) by volume. Saturation percentages for the soils generally range from 18 to 75 percent.

Chemically, the Gila Conglomerate and associated soils have few inherent limitations. The pH of the soils range from about 5.0 to 7.8 and the salinity levels are low (0.2 to 3.8 deciSiemens [dS/m]). These materials are universally nonsodic and have favorable calcium to magnesium ratios. Soluble selenium and boron levels are low. The materials range from noncalcareous to calcareous and contain 0.5 to 9.2 percent $CaCO_3$ equivalent. The highest levels of $CaCO_3$ are found in the subsurface of the soils in the Mangas Valley.

2.1.2 Precambrian Granite

The cover material generated from the Little Rock Mine consists primarily of Precambrian Burro Mountain Granite overburden (Golder 2014) that meet the approved Characterization and Material Handling Plan (PDTI 2005). This granite is composed primarily of the minerals quartz, orthoclase, plagioclase, and biotite that occur as coarse-grained crystals.

Soil testing results of the Precambrian Granite (Golder 2017) indicate that there are no inherent chemical limitations for the growth of native plants. The cover materials are slightly alkaline (pH 7.6 to 7.7) and nonsaline (electrical conductivity [EC] < 2 dS/m) and the organic matter, phosphorous, and nitrate nitrogen concentrations are considered adequate for the target plant species. No sulfide minerals are known to occur in the PGRCM confirmed by ABA data that strongly suggests it will not generate acid and has a moderate potential to neutralize acid. The range in particle size distribution for the fine-earth fractions was relatively narrow with all the samples classified as sandy loams. The rock fragment content ranges from 40 to 60 percent by volume and sizes ranges from gravel to stones. The saturation percentage data was relatively consistent increasing with clay content, suggesting that the samples are mineralogically similar.

The test plot study at the USNR (Golder 2017) is currently evaluating the suitability of PGRCM as reclamation cover. Preliminary results indicate that the USNR test plots are on the right trajectory relative to vegetation success and erosional stability. Final determination that the PGRCM is suitable to meet the revegetation, erosion,

and WHC standards for cover materials as required by the Copper Rule, MMD Permit No. GR010RE and DP-1341 is forthcoming, pending the results of further monitoring of the USNR test plots.

Over the past several years, Tyrone has strategically placed PGRCM at several locations around the mine site, including the 9A Waste, 9AX Waste stockpiles in preparation for reclamation activities.

3.0 METHODS

3.1 Field Methods

Sampling of Tyrone RCM was conducted on February 28 and March 1, 2019. Sample locations were selected in the field to get a good spatial distribution across the sites. Test pits were excavated using a mini-excavator to maximum depth of approximately 8 feet. A Golder soil scientist described the materials according to National Soil Survey Standards (Soil Survey Division Staff 1993), with respect to geological composition, soil texture, and rock fragment volume and size classes (i.e., gravel, cobble and stone). Composite samples were collected from each test pit based on depth intervals visually defined by noticeable changes in material type, texture and/or coloring. Field pH measurements and reaction with a 10% solution of hydrochloric acid (HCl) were also used to augment the sample selection process. After describing and sampling the borrow source, all excavations were backfilled with the excavated material and compacted using the excavator bucket. The surfaces were then smoothed to match preexisting land conditions.

For each sample interval, a 5 to 10 kilogram (kg) sample was collected for fine-earth characterization (particles < 2 mm in diameter) and the larger rock fragments (> 75 mm) were removed. Samples were placed directly in gallon-sized plastic bags. The sample identification, collection date, and times were recorded on each bag. Additionally, selected depth intervals representing were sampled for soil hydraulic testing. Samples for soil hydraulic analyses were placed in 5-gallon airtight plastic buckets after removing any rock fragment larger than 75 mm. All samples were recorded on chain of custody forms and shipped to contracted laboratories at ambient temperature.

3.2 Laboratory Analysis

3.2.1 Physical and Chemical Characterization

Soil samples collected for fine earth analysis were air-dried and passed through a 2 mm sieve at the laboratory. The less than 2 mm soil fraction was analyzed for the parameters listed Table 2. The primary references for the analytical techniques include Agricultural Handbook No. 60 (Salinity Laboratory Staff [SLS], 1954) and Methods of Soil Analysis (ASA Monograph No. 9, 1982). Borrow samples were analyzed by Energy Laboratory in Billings, Montana.

3.2.2 Soil Hydraulic Characterization

Seven samples were selected to capture a range of soil textures for soil hydraulic characterization at the Daniel B. Stephens & Associates (DBS&A) Laboratory in Albuquerque, New Mexico. Because the cover materials contained rock fragments, the soil hydraulic analyses were conducted on the fine-earth fraction. The bulk soil samples collected for fine-earth analysis were air-dried and passed through a 2 mm sieve at the laboratory.

Column tests were performed on < 2 mm subsamples packed to a specified target density based on established soil textural relationships (Soil Survey Division Staff, 1993). The target density for the laboratory samples was 1.4 grams per cubic centimeter (g/cm^3). Paired suction and water content measurements were made using hanging-column, pressure plate, water activity meter, and relative humidity box methods. The soil samples were

subjected to at least 5 suction points ranging from near saturation (≈ 0 cm) to about 850,000 cm. The saturated hydraulic conductivity (K_{sat}) of the fine earth fraction samples was determined by the constant-head method. The soil hydraulic testing methods are listed in Table 2.

3.2.2.1 Soil Water Characteristic Curves

Soil water characteristic curves (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 SWCC's were developed for the fine-earth fraction and for the whole soils after correction of the fine-earth fraction data for rock fragments. In particular, 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). 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).

3.2.2.2 Water Holding Capacity Estimation

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). Field capacity was estimated as the water held at 100 centimeters (cm) of suction and wilting point was estimated as the water held at 15,000 cm of suction (USDA 2016) for coarse textured soils. Because the RCM are consistently sandy loams and generally contain between 35 and 65% rock fragments, they were considered coarse textured and field capacity was determined at 100 cm suction. Field capacity was assumed to be 330 cm for a single sandy clay loam GCRCM sample. The water content at field capacity and wilting point were determined numerically (rather than graphically) from the soil water characteristic curve function developed for each sample.

4.0 RESULTS

The results of the physical, chemical and hydraulic soil testing are summarized in this section. Section 4.1 provides characterization data for GCRCM samples collected in 2019 within the Lubrication Shop area and south of the Reclaimed 1A Tailing Impoundment. Section 4.2 provides similar data for PGRCM samples collected in 2019 from the 9A Waste and 9AX Waste stockpiles. The results of the GCRCM and PGRCM soil hydraulic testing are provided in Section 4.3 for Mine/Stockpile Unit samples collected since 2005. Section 4.4 provides information on the estimated WHC for the RCM and presents a generalized relationship for predicting WHC based on material properties. Table 3 provides abbreviated field descriptions for the samples collected in 2019. Laboratory reports from Energy Laboratory are in Appendix A.

4.1 GCRCM – Lubrication Shop Area and South of Reclaimed 1A Tailing Impoundment

GCRCM samples were collected from excavated test pits, cut exposures and bermed materials in the vicinity of the Lubrication Shop and south of the Reclaimed 1A Tailing Impoundment. Samples were taken at a total of 8 locations (Figure 2).

The GCRCM are generally moderately-coarse textured (sandy loams) with moderately high volumes of rock fragments (Table 4), though moderately-fine and fine textured argillic horizons were encountered one test pit (GC-1S-2). Organic matter ranged from 0.4 to 3.2% and phosphorous and nitrate concentrations are low but considered adequate to support native and adapted plant species.

Table 5 provides chemical characterization data for the RCM samples collected in 2019. All GCRCM materials are nonsaline and ranged from very strongly acid (pH = 4.8) to moderately alkaline (pH = 7.9). Acid-base accounts (ABAs) are positive and both selenium and boron levels were below detection limits for GCRCM.

A pH of 4.8 was also measured for the 2-4' interval at test pit GC-1S-2 just below the 9A Waste, 9AX Waste stockpile. Other soil horizons at this location were also naturally acidic (pH 5.1 to 5.5) and total sulfur for these horizons are all extremely low with positive ABAs (Table 5). Slightly acid surface horizons were also found at GC-1S-3 (pH = 5.6) during this investigation.

Numerous native soils with acidic surface and subsoil horizons have been document in the vicinity of the mine as part of previous borrow material investigations and by the US. Department of Agriculture Natural Resource Conservation Service (NRCS). DBS&A (1997a) described three native soils formed in Gila Conglomerate within the mine permit area with surface pH between 5.0 and 5.5. Golder (2005a) found three native soils near the Reclaimed 1 Leach stockpile with acidic surface horizons (pH 5.1 to 5.6). These materials were used for cover in the reclamation of the Reclaimed 1 Leach stockpile. Additionally, the Soil Survey of Grant County (NRCS 1983) provided five reference pedons with acidic horizons (pH 5.4 to 5.9) within about 10 miles from the mine. These soils are found in the Big Burro Mountains and in the mountains between the mine and Cliff, NM and west of the Mangas creek. The empirical evidence suggests that the acidic conditions are relatively common in many native forest and woodland soils regionally and likely the result of soil's parent material and natural soil forming processes. Both GC-1S-2 and -3 test pit locations supported native plant species with an estimated 50% total canopy cover (Photo A).

Waste rock with a pH of 4.5 and negative ABA were encountered at the surface in test pit GC-LS-2. The test pit was located at the 6A Lookout immediately adjacent to the Savanna Pit (Photo B). The interval was approximately 4 to 6 feet thick, distinctly reddish-brown with no reaction to weak acid and a field pH below 5. Suitable GCRCM was visually distinct below 6 feet in the test pit. Further investigation of surface soils around the perimeter of the Savanna Pit found road surfaces and disturbed areas to be acidic with field pHs below 5. It is assumed that these areas were plated with mine rock with the potential to generate acid. As such, approximately 30 acres of GCRCM that underly the disturbed areas near the Lubrication Shop and the Savanna Pit are not considered available as a RCM for closure.

4.2 PGRCM – 9A Waste, 9AX Waste Stockpiles

Three PGRCM bulk samples were collected from the 9A Waste, 9AX Waste stockpiles (Figure 2). These materials are classified as sandy loams with a relatively narrow range in particle size distribution for the fine-earth fractions (Table 4). The rock fragment content ranged from 46 to 55 percent by volume and sizes ranged from gravel to stones. The saturation percentage data was relatively consistent increasing with clay content, suggesting that the samples are mineralogically similar. The materials have low organic matter contents as well as phosphorous and nitrate concentrations similar to the majority of GCRCM samples. ABAs for all the PGRCM tested (Table 5) are well above -5 tons calcium carbonate per kiloton (t $CaCO_3$/kt), which is considered suitable under MMD's guidelines (MMD 1996). The 9A Waste, 9AX Waste materials are nonsaline (EC < 1 dS/m) and moderately alkaline (pH 7.8 to 8.0). Selenium and boron levels were below detection limits (Table 5). The physical and chemical properties of the 9A Waste, 9AX Waste RCM are very similar to the materials used to construct the soil covers at the USNR test plots (Golder 2017).

Photo A: Vegetation with high canopy cover adjacent to test pit GC-1S-2 with low pH soil horizons

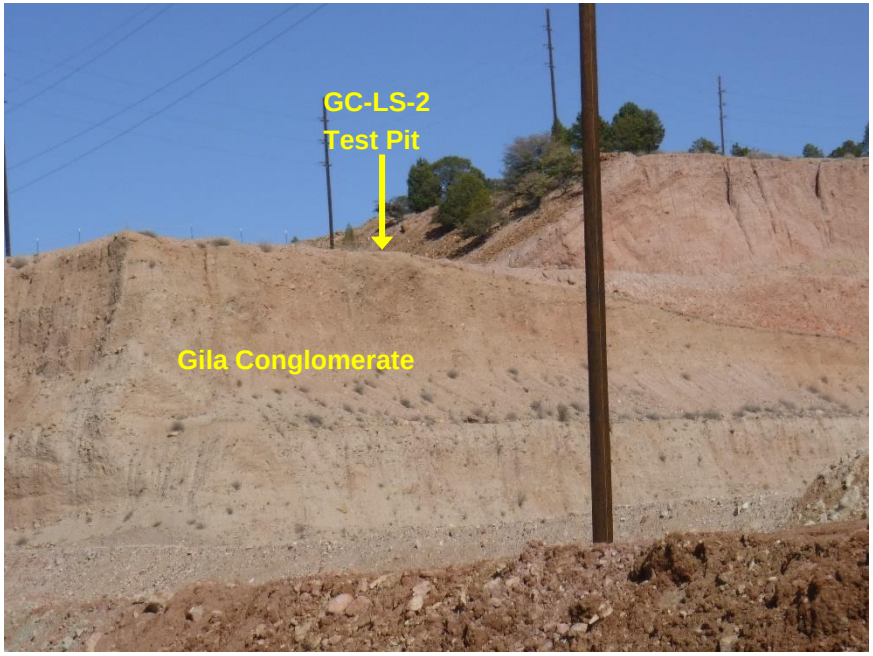

Photo B: Test pit GC-LS-2 location from below showing reddish waste rock from the Savanna Pit overlying GCRCM

4.3 Soil Hydraulic Properties

Since 1999, a total of 30 samples from the Mine/Stockpile Unit have had soil hydraulic characterization completed including 23 samples of Gila Conglomerate and 7 samples of Little Rock Precambrian Granite. Unfortunately, laboratory reports associated with early borrow investigations (DBS&A 1999) were not available to develop SWCCs and estimate WHC. Additionally, soil water retention data of 5A Waste stockpile samples (Golder 2006a) was deemed incomplete because no θ-Ψ pairs were measured for near the permanent wilting point (15,000 cm) and hygroscopic water (~31,000 cm, i.e., in equilibrium with atmosphere). The lack of information for these critical soil moisture states made WHC estimations for the 5A Waste stockpile materials inconsistent with standardized hydraulic relationships for similarly textured soils (Rawls et al. 1982, Carsel and Parrish 1988).

Soil hydraulic testing was conducted for 4 GCRCM and 3 PGRCM samples collected as part of this investigation. Soil hydraulic characterization data for an additional 11 RCM samples were also used in the soil hydraulic analyses. These samples were collected as part of the Reclaimed 1 Leach stockpile and USNR test plot studies (7 GCRCM [Golder 2006b] and 4 PGRCM [Golder 2017] respectively). The locations of soil hydraulic characterization samples are illustrated in Figure 3.

The soil hydraulic laboratory report for the RCM samples collected as part of this study are provided in Appendix B. The SWCCs for the 18 samples used to determine WHC are provided in Appendix C. The SWCC graphs display the curves for the fine-earth fraction and for the whole soil assuming the volumetric rock fragment content based on the field estimations of the materials (Table 6).

4.3.1 GCRCM

The θ_s of the < 2 mm soil fraction for GCRCM ranges between 0.34 and 0.49 cubic centimeters per cubic centimeters ([cm^3/cm^3] Table 7). Whole soil θ_s ranged from 0.15 to 0.29 cm^3/cm^3 (Table 8). The variations in saturated water content and other properties are expected given the textural range of the GCRCM (Section 4.1). The other soil hydrologic parameters (θ_r and van Genuchten α and N) 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 K_{sat} of the < 2 mm samples ranged from 1.2×10^{-5} to 4.1×10^{-2} centimeters per second ([cm/s] Table 7), which is within the range expected for sandy clay loams and sandy loams when compared to typical published values (Klute and Dirksen 1986). Whole soil K_{sat} ranged from 7.6×10^{-6} to 2.4×10^{-2} cm/s (Table 8).

4.3.2 PGRCM

The θ_s of the < 2 mm soil fraction for PGRCM was consistent among the samples, ranging between 0.46 and 0.49 cm^3/cm^3 (Table 7). Whole soil θ_s ranged from 0.21 to 0.29 cm^3/cm^3 (Table 8). The minor variations in saturated water content and other properties are expected given the textural consistency of the PGRCM (Section 4.1). The other soil hydrologic parameters (θ_r and van Genuchten α and N) 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 K_{sat} of the < 2 mm samples ranged from 1.1×10^{-2} to 8.9×10^{-2} cm/s (Table 7), which is the high end of the range expected compared to typical published values for sandy loams (Klute and Dirksen 1986). Whole soil K_{sat} for PGRCM ranged for from 5.3×10^{-3} to 2.0×10^{-2} cm/sec (Table 8).

4.4 Water Holding Capacity

The standard or conventional method for estimating WHC of soils containing rock fragments involves the determination of the WHC of the fine-earth fraction and calculating the proportional reduction in WHC associated

with rock fragments (NRCS 2014). This approach assumes the rock fragments do not hold appreciable water and are diluents in the whole soil matrix.

The estimated WHC of the fine-earth fraction ranged from about 1.55 to 2.46 in/ft for GCRCM and 1.82 to 2.43 for PGRCM (Table 9). The average WHC of the fine-earth fraction was 1.94 and 2.04 in/ft for GCRCM and PGRCM respectively. The WHC on a whole soil basis (corrected for the field rock fragment contents) ranged from about 0.71 to 1.21 in/ft for GCRCM and 0.82 to 1.31 for PGRCM (Table 9) reflecting the reduction of WHC associated with the rock fragments. The average WHC of the whole soil for GCRCM was 1.03 in/ft and 1.05 in/ft for PGRCM, each well above the 0.88 in/ft threshold WHC to comply with the Copper Rule.

Because the WHC of the cover is directly related to the quantity of rock fragments, a generalized relationship was developed using the average WHC of the fine earth fraction corrected for various rock fragment concentrations (Figure 4). The lines are described by the following equation:

$$\text{Field WHC} = (WHC_{FE}) \times (1 - RF_V)$$

Where the WHC_{FE} is the fine-earth water holding capacity and RF_V is the volumetric rock fragment content The WHC_{FE} is assumed to be average of the materials tested 1.94 in/ft for the GCRCM and 2.04 in/ft for PGRCM. This relationship will allow determination of the WHC of the cover using soil textural (i.e., rock fragment) data, which is collected as part of the cover quality control process. For example, if the PGRCM in a reclamation area had an average rock fragment content of 45% (0.45), the average field WHC would be estimated to be 1.22 in/ft (i.e., 2.04 x 1-0.45). This relationship can to be used as guidance for future design for covers using RCM at Tyrone. Based on the generalized relationships shown in Figure 4, an incremental reduction of rock fragment of approximately 5% will yield an increase in WHC of about 0.1 in/ft.

This analysis indicates that the Tyrone RCM will achieve the Copper Rule WHC requirements (≈ 2.6 inches) with the 3-foot thick cover (Section 1.2). A cover meeting this WHC requirement can be achieved with an average rock fragment content less than 55% for GCRCM or 57% for PGRCM. Based on over 140 samples of Mine/Stockpile Unit, GCRCM either stockpiled or placed as cover has and average volumetric rock fragment content (± 90% confidence interval [CI]) is about 44% (± 1.9% CI). PGRCM from Little Rock is estimated to have 50% (± 3.7% CI) average volumetric rock. Thus, the RCM at Tyrone are projected to have a WHC that exceeds the 20.6.7.F (2) NMAC requirements.

5.0 COVER MATERIAL VOLUMETRICS

Gila Conglomerate within the 5A Waste stockpile and residual Gila Conglomerate on the east side of the Main Pit (Lubrication Shop/Savanna Pit area) are considered the two primary sources of cover material in the 2013 Updated CCP. Substantial volumes of residual Gila Conglomerate also underlie the 5A Waste stockpile and will become available as mining progresses into the east side of the Main Pit (Figure 5). The use of the pit wall Gila Conglomerate or additional materials from the 5A Waste stockpile may eliminate the need to excavate borrow near the 9A Waste, 9AX Waste stockpiles.

Additional borrow areas include Little Rock Precambrian Granite overburden and residual Gila Conglomerate soils across the Mine/Stockpile Unit that may be excavated from numerous locations on the mine property (Golder 2005b). Tyrone's experience with cover excavation and placement on the Mangas Valley tailing impoundments revealed that flexibility in materials handling is critical to achieving quality control objectives and efficient management of cover soil resources. The exact location and configuration of the borrow areas will ultimately be determined during the final design and construction phases of the reclamation.

There are five GCRCM borrow areas around the Mine/Stockpile Unit identified on Figure 6 that could be used as cover sources. Furthermore, in a letter dated June 25, 2019, Tyrone applied for a permit modification to build the CSG Waste stockpile which is projected to contain approximately 32 million tons of Gila Conglomerate at full build out. In addition to the GCRCM, Tyrone has also stockpiled PGRCM from the Little Rock Mine at the following facilities:

- 9A Waste, 9AX Waste stockpiles - approximately 32 million cubic yards (MCY)
- Little Rock Pit - approximately 8 MCY

The preliminary results from the PGRCM USNR test plot study indicate that the test plots are on the right trajectory and a final determination that the PGRCM is suitable to meet the revegetation and erosion resistant cover material standards. Tyrone has also constructed large test areas using materials similar to the PGRCM (Copper Mountain Tertiary Quartz Monzonite) in the Reclaimed 7A Waste stockpile area and has learned a great deal about utilizing these types of overburden materials for cover and continues to monitor the various treatments and methods for using it successfully.

The cover requirement for the Mine/Stockpile Unit at Tyrone is approximately 12.6 MCY based on the current permit requirements. More than 23.6 MCY of GCRCM and 32 MCY of PGRCM cover materials have been conservatively identified at Tyrone (Table 10). Thus, the total volume of materials designated for the Mine/Stockpile unit is more than that needed to cover these facilities. The surplus of available RCM will ultimately allow for flexibility in siting borrow areas at Tyrone to account for operational considerations.

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Signature Page

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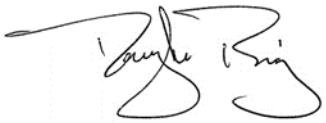

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Tables

Table 1: Previous Sampling of RCM at Tyrone Mine

Report	Characterization	
	Hydraulic	Chemical/Physical
GCRCM		
Cover Design Status Report (DBS&A 1999)	9	95
Addendum to Preliminary BMI (Golder 2006a)	3	90
No 1 Stockpile Test Plots (Golder 2006b)	7	90
PGRCM		
Little Rock CCP (PDTI 2000), Leached Cap Analysis (Golder 2005a)	0	13
USNR Test Plot Annual Report 1 (Golder 2017)	4	5

Table 2: Test Methods for Soil Physical, Chemical, and Hydraulic Characterization

Test	Methods
Saturated Paste pH	SLS 1954, Method 2 and 21a
Electrical Conductivity	SLS 1954, Method 3a and 4b
Saturation percentage	SLS 1954, Method 27a
Particle Size Distribution, including very fine sand	ASA 1982, Method 15-5
Rock Fragment (>2mm)	Dry sieve (No. 10)/gravimetric
N as Nitrate	ASA 1982, Method 33-8.1
Phosphorous (Olsen)	ASA 1982, Method 24-5.4
Organic Matter (Carbon)	ASA 1982 Method 29-3.5.2
Hot water extractable Boron	ASA 1982, Method 10-3
Hot water extractable Selenium	ASA 1982, Method 75-4.1
Acid-Base Account (with sulfur forms)	Modified Sobek (1978)
Dry Bulk Density	ASTM D7263
Moisture Content	ASTM D7263; ASTM D2216
Porosity	ASTM D7263: Klute 1986.
Saturated Hydraulic Conductivity, Constant Head (Rigid Wall)	ASTM D5856
Hanging Column	ASTM D6836; Klute, A. 1986.
Pressure Plate	ASTM D6836
Water Potential (Dewpoint Potentiometer)	ASTM D6836; Rawlins and Campbell, 1986
Relative Humidity (Box)	Karathanasis and Hajek, 1982; Campbell and Gee, 1986.
Moisture Retention Characteristics & Calculated Unsaturated Hydraulic Conductivity	ASTM D6836; van Genuchten, 1980; van Genuchten et. al, 1991
Specific Gravity (Fine)	ASTM D854

Table 3: Summary of Field Descriptions of 2019 RCM Samples

Location	Depth Interval	USDA Texture[1]	Clay (%)	Rock Fragments (%vol)				Notes
				Gravel	Cobble	Stone	Total	
GCRCM								
South of Reclaimed 1A Tailing Impoundment								
GC-1S-1	0-3	CoLS	15	40	2	trace	42	Exposure along drainage channel, grussy granite, gravels mostly < 3/4"
GC-1S-2	0-2	SCL	20	15	30	2	47	Previously disturbed, surface horizon removed, argillic horizon with pressure faces
	2-4	CL	32	10	35	7	52	
	4-6	SCL	22	20	25	5	50	
GC-1S-3	0-2	SL	15	15	3	--	18	
	2-4	SL	14	20	13	2	35	Cobbles and stones increase at 40"
	4-6.5	SL	14	20	15	2	37	
GC-1S-4	0-2.5	CoSL	12	45	3	--	48	Gully sidewall in previous borrow area, lenses of petrocalcic horizons, violent eff, gravels mostly <3/4"
GC-1S-5	bulk	SCL	23	18	20	2	40	Surface materials removed with 9A construction, dark colored A & B horizon mix
Lubrication Shop Area								
GC-LS-1	0-2	CoLS	10	35	1	--	36	Grussy granite, Uniform to 6'
	2-4	CoSL	12	35	1	--	36	
	4-6	CoSL	12	35	5	--	40	
GC-LS-2	0-2	CoSL	17	30	7	--	37	Field pH <5, reddish brown color, waste rock with possible sulfides
	2-4	CoSL	17	30	7	--	37	
	4-6	CoSL	14	35	8	trace	43	Mine rock, possibly mixed with sulfides
	6-7	CoSL	14	35	8	trace	43	Grussy granitic Gila
GC-LS-3	0-2	CoSL	12	38	2	trace	40	Road berm near powder magazines, field pH 6.5, no eff
PGRCM								
PG-9A-1	bulk	CoSL	13	23	18	14	55	Little Rock overburden, 2% boulders
PG-9A-2	bulk	CoSL	12	22	16	8	46	Little Rock overburden from top of pit, 1% boulders
PG-9AX-1	bulk	CoSL	12	25	18	8	51	Little Rock overburden from bottom of pit, trace boulders

Notes:

1) field texture: Co = coarse; LS = loamy sand; SL = sandy loam; SCL = sandy clay loam; CL = clay loam

%vol = percent by volume

Table 4: Physical and Fertility Properties of 2019 RCM Samples

Sample ID	Depth Interval (ft)	USDA Texture[1]	Sand	Silt	Clay	Very Fine Sand	Saturation Percent	Organic Matter	Organic Carbon	Nitrate as N	P
			% wt				%			mg/kg	
GCRCM											
GC-1S-1	0-3	SL	75	14	11	2	20.6	0.7	0.4	< 1	5
GC-1S-2	0-2	SCL	65	14	21	3	28.5	0.8	0.5	< 1	4
GC-1S-2	2-4	SC	49	10	41	3	56.7	0.9	0.5	< 1	14
GC-1S-2	4-6	SCL	52	18	30	5	40.2	0.6	0.3	< 1	15
GC-1S-3	0-2	SL	60	32	8	1	17.8	1.3	0.8	< 1	2
GC-1S-3	4-6	SL	55	31	14	4	23.8	1	0.6	< 1	4
GC-1S-4	0-2	SL	70	19	11	1	19.2	0.5	0.3	< 1	3
GC-1S-5	bulk	L	45	34	21	7	34.2	3.2	1.8	11	3
GC-LS-1	2-4	SL	77	14	9	1	20.1	0.5	0.3	< 1	2
GC-LS-2	0-2	SL	57	24	19	0	26.2	0.4	0.2	16	2
GC-LS-2	6-7	SL	77	8	15	5	24.6	0.5	0.3	3	6
GC-LS-3	0-2	SL	73	14	13	4	19.5	0.7	0.4	< 1	3
PGRCM											
PG-9A-1	bulk	SL	67	21	12	0	23.6	0.4	0.2	< 1	2
PG-9A-2	bulk	SL	69	21	10	4	21.7	1	0.6	< 1	2
PG-9AX-1	bulk	SL	64	24	12	0	24.5	0.4	0.3	< 1	2

Notes:

1) L = loam; SL = sandy loam; SCL = sandy clay loam

% wt = percent by weight; mg/kg = milligrams per kilogram

Table 5: Chemical Properties of 2019 RCM Samples

Sample ID	Depth Interval (ft)	Saturated Paste		Sulfur Forms					Neutralization Potential	Acid/Base Potential[1]	Selenium	Boron
		pH	EC	HCl	HNO_3	H_2O	Residual	Total				
		s.u.	dS/m	%					t $CaCO_3$/kt		mg/kg	
GCRCM												
GC-1S-1	0-3	7.9	0.5	<0.01	<0.01	<0.01	0.02	0.02	28	28	<0.1	<0.1
GC-1S-2	0-2	5.5	0.7	<0.01	<0.01	<0.01	0.02	0.03	5	5	<0.1	<0.1
GC-1S-2	2-4	4.8	1.2	<0.01	<0.01	<0.01	0.02	0.03	4	4	<0.1	<0.1
GC-1S-2	4-6	5.1	1.6	<0.01	<0.01	<0.01	0.02	0.04	5	5	<0.1	<0.1
GC-1S-3	0-2	5.6	0.3	<0.01	0.01	<0.01	0.02	0.03	6	6	<0.1	<0.1
GC-1S-3	4-6	7.3	0.7	<0.01	<0.01	<0.01	0.02	0.03	15	15	<0.1	<0.1
GC-1S-4	0-2	7.8	0.3	<0.01	<0.01	<0.01	0.02	0.02	57	57	<0.1	<0.1
GC-1S-5 Bulk	--	6.8	0.9	<0.01	<0.01	<0.01	0.02	0.04	10	10	<0.1	<0.1
GC-LS-1	2-4	5.3	1.7	<0.01	0.01	<0.01	0.02	0.04	11	11	<0.1	<0.1
GC-LS-2	0-2	4.5	1.3	<0.01	0.3	0.11	0.39	0.81	1	-8	<0.1	<0.1
GC-LS-2	6-7	7.6	0.7	<0.01	<0.01	<0.01	0.03	0.04	9	9	<0.1	<0.1
GC-LS-3	0-2	6.5	0.2	<0.01	0.02	<0.01	0.02	0.03	9	8	<0.1	<0.1
PGRCM												
PG-9A-1	bulk	7.9	0.5	<0.01	0.04	<0.01	0.02	0.06	13	12	<0.1	<0.1
PG-9A-2	bulk	8	0.9	<0.01	0.02	0.01	0.03	0.06	19	18	<0.1	<0.1
PG-9AX-1	bulk	7.8	0.3	<0.01	0.03	<0.01	0.02	0.05	17	16	<0.1	<0.1

Notes:

1) Acid/Base Potential based on pyritic sulfur (HNO_3 digestion)

dS/m = deciSiemens per meter; s.u. = standard units; t $CaCO_3$/kt = tons of $CaCO_3$ per kiloton; mg/kg = milligrams per kilogram

Table 6: Particle Size Distribution for Soil Hydraulic RCM Samples

Sample ID	USDA Texture Class[1]	Particle Size Distribution			Rock Fragments[2]
		Sand	Silt	Clay	
		(wt %)			(vol %)
GCRCM					
GC-LS-2 6-7'	SL	77	8	15	43
GC-1S-2 4-6'	SCL	52	18	30	50
GC-1S-3 2-6.5'	SL	58	32	11	36
GC-1S-4 0-2.5'	SL	70	19	11	48
No1-1-1	SL	69	16	15	62
No1-1-2	SL	71	14	15	45
No1-2-1	SL	67	12	21	50
No1-2-2	SL	71	14	15	51
No1-3-1	SL	73	13	14	45
No1-3-2	SL	72	17	11	42
No1-8-LY	SL	70	19	11	49
PGRCM					
PG-9A-1 Bulk	SL	67	21	12	55
PG-9A-2 Bulk	SL	69	21	10	46
PG-9AX-1 Bulk	SL	64	24	12	51
UTPQA-2	SL	73	19	8	55
UTPQA-3	SL	71	21	8	40
LTPQA-4	SL	71	19	10	50
T7ALRLC	SL	73	20	7	45

Notes:

1) SL = sandy loam; SCL = sandy clay loam

2) Volumetric rock content of sample interval

wt % = pecent by weight, vol % = pervent by volume

Table 7: Soil Hydraulic Properties of Tyrone RCM, Fine-Earth Fraction (< 2 mm)

Sample ID	Saturated Hydraulic Conductivity	van Genuchten Coefficients[1]				Bulk Density
		θ_s	θ_r	α	N	
	cm/s	cm^3/cm^3		1/cm	Dimensionless	g/cm^3
GCRCM						
GC-LS-2 6-7'	6.20E-03	0.454	0.059	0.0467	1.4118	1.41
GC-1S-2 4-6'	1.20E-05	0.494	0.001	0.0365	1.1777	1.4
GC-1S-3 2-6.5'	4.80E-03	0.466	0.001	0.0608	1.2361	1.4
GC-1S-4 0-2.5'	4.10E-02	0.481	0.049	0.0571	1.6606	1.4
No1-1-1	1.30E-02	0.393	0.001	0.0986	1.2127	1.39
No1-1-2	3.50E-02	0.440	0.001	0.1325	1.2144	1.4
No1-2-1	5.00E-03	0.410	0.001	0.1044	1.2096	1.39
No1-2-2	1.60E-02	0.426	0.001	0.1358	1.2159	1.41
No1-3-1	1.90E-02	0.388	0.001	0.0508	1.2131	1.39
No1-3-2	2.60E-02	0.342	0.000	0.0635	1.2061	1.39
No1-8-LY	2.59E-03	0.404	0.001	0.1234	1.2015	1.41
PGRCM						
PG-9A-2 Bulk	5.20E-02	0.480	0.039	0.0760	1.4686	1.41
PG-9A-1 Bulk	1.10E-02	0.466	0.002	0.0621	1.3049	1.41
PG-9AX-1 Bulk	3.30E-02	0.472	0.039	0.0800	1.4216	1.41
UTPQA-2	8.90E-02	0.462	0.042	0.0576	1.4590	1.4
UTPQA-3	7.00E-02	0.487	0.044	0.0621	1.4734	1.4
LTPQA-4	3.20E-02	0.478	0.044	0.0532	1.4680	1.4
T7ALRLC	2.60E-02	0.489	0.049	0.0656	1.4068	1.4

Notes:

1) recalculated from moisture retention data; θ_r = residual water content; θ_s = saturated water content; α = fitted parameter (van Genuchten 1980); N = fitted parameter (van Genuchten 1980)

cm/s = centimeters per second; cm^3 = cubic centimeters; g/cm^3 = grams per cubic centimeter

Table 8: Soil Hydraulic Properties of Tyrone RCM, Whole Soil Fraction

Sample ID	Saturated Hydraulic Conductivity[1]	van Genuchten Coefficients[2]				Rock Fragments
		θ_s	θ_r	α	N	
	cm/s	cm^3/cm^3		1/cm	Dimensionless	vol %
GCRCM						
GC-LS-2 6-7'	2.10E-03	0.259	0.034	0.0467	1.4118	43
GC-1S-2 4-6'	7.60E-06	0.247	0.001	0.0363	1.1786	50
GC-1S-3 2-6.5'	3.10E-03	0.298	0.001	0.0605	1.2370	36
GC-1S-4 0-2.5'	2.40E-02	0.250	0.025	0.0571	1.6606	48
No1-1-1	3.30E-03	0.151	0.001	0.0976	1.2148	62
No1-1-2	1.40E-02	0.243	0.001	0.1319	1.2155	45
No1-2-1	1.70E-03	0.205	0.001	0.1037	1.2109	50
No1-2-2	5.40E-03	0.207	0.001	0.1350	1.2173	51
No1-3-1	7.30E-03	0.214	0.001	0.0504	1.2143	45
No1-3-2	1.10E-02	0.200	0.000	0.0635	1.2061	42
No1-8-LY	3.80E-03	0.206	0.001	0.1227	1.2027	49
PGRCM						
PG-9A-1 Bulk	1.50E-02	0.216	0.018	0.0760	1.4686	55
PG-9A-2 Bulk	5.30E-03	0.252	0.001	0.0623	1.3039	46
PG-9AX-1 Bulk	8.20E-03	0.231	0.019	0.0800	1.4216	51
UTPQA-2	1.60E-02	0.208	0.019	0.0576	1.4590	55
UTPQA-3	2.00E-02	0.292	0.027	0.0621	1.4734	40
LTPQA-4	1.00E-02	0.239	0.022	0.0532	1.4680	50
T7ALRLC	7.20E-03	0.269	0.027	0.0656	1.4068	45

Notes:

1) lab reported conductivity based on bulk sample (<3")

2) recalculated from moisture retention data; θ_r = residual water content; θ_s = saturated water content; α = fitted parameter (van Genuchten 1980); N = fitted parameter (van Genuchten 1980)

cm/s = centimeters per second; cm^3 = cubic centimeters, vol % = percent by volume

Table 9: Estimated Water Holding Capacity of Tyrone RCM

Sample ID	Water Holding Capacity		Rock Fragment Content[2]
	Fine Earth (< 2mm)	Whole Soil1	
	(in/ft)		(vol %)
GCRCM			
GC-LS-2 6-7'	2.11	1.21	43
GC-1S-2 4-6'	1.84	0.95	50
GC-1S-3 2-6.5'	2.46	1.57	36
GC-1S-4 0-2.5'	1.55	0.80	48
No1-1-1	1.86	0.71	62
No1-1-2	1.97	1.09	45
No1-2-1	1.92	0.96	50
No1-2-2	1.90	0.92	51
No1-3-1	2.08	1.15	45
No1-3-2	1.76	1.03	42
No1-8-LY	1.83	0.93	49
PGRCM			
PG-9A-1 Bulk	1.82	0.82	55
PG-9A-2 Bulk	2.43	1.31	46
PG-9AX-1 Bulk	1.87	0.92	51
UTPQA-2	1.98	0.89	55
UTPQA-3	1.98	1.19	40
LTPQA-4	2.09	1.05	50
T7ALRLC	2.09	1.15	45

Notes:

1) Whole soil based on SWCC adjusted for field rock fragments

2) Total rock fragments based on sample interval or average for the excavation for the No. 1 Stockpile samples

in/ft = inches of water per foot of soil; vol % = percent by volume

Table 10: Borrow Source Volumetrics for Tyrone Mine

Borrow Area	Location	Area (ac)	Thickness (ft)	Volume (CY)
GCRCM				
A	South of Reclaimed 1A Tailing Impoundment	152	30	7,350,720
B	Main Mine Facility Area	56	30	2,708,160
C	Reclaimed Former Mill and Concentrator Area	4	30	193,440
D	5A Waste	63	50	5,148,400
E	Lubrication Shop Area	51	100	8,221,200
PCRCM				
E	9A Waste, 9AX Waste			32,000,000
			Total	55,621,920

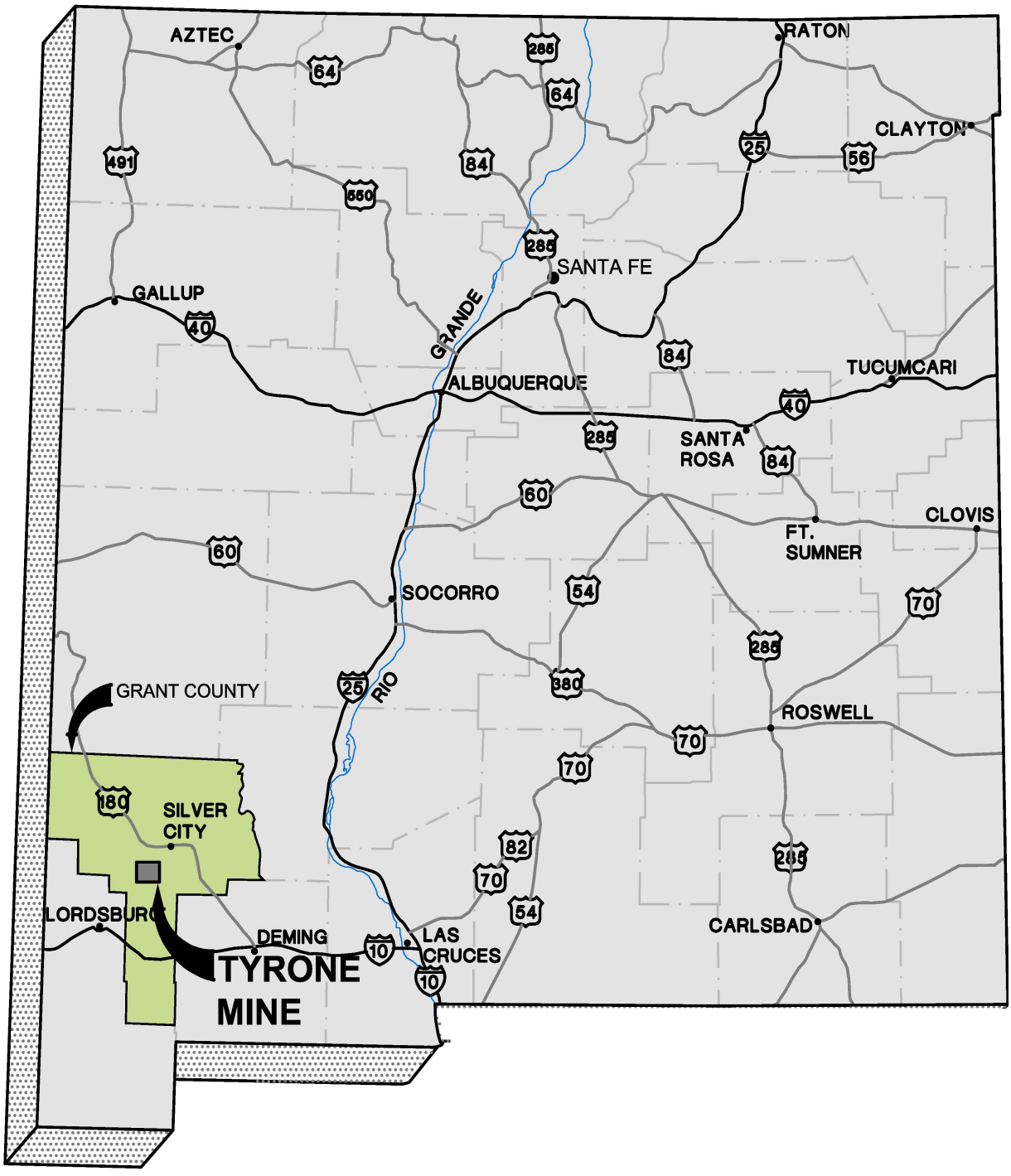
Notes:

ac = acres; CY = cubic yards

Figures

STATE OF NEW MEXICO

NOT TO SCALE



CLIENT
FREEPORT MCMORAN TYRONE, INC.
GRANT COUNTY, NEW MEXICO

PROJECT
CLOSURE CLOSEOUT PLAN
RECLAMATION COVER MATERIALS CHARACTERIZATION

CONSULTANT
GOLDER

YYYY-MM-DD	2019-06-22
DESIGNED	CM
PREPARED	DW
REVIEWED	DR
APPROVED	DR

TITLE
LOCATION OF THE TYRONE MINE

PROJECT NO.	CONTROL	REV.	FIGURE
181-06417	--	--	1

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

1 in

0

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GC-1S-5
GC-1S-1
GC-1S-4
GC-1S-3
GC-1S-2
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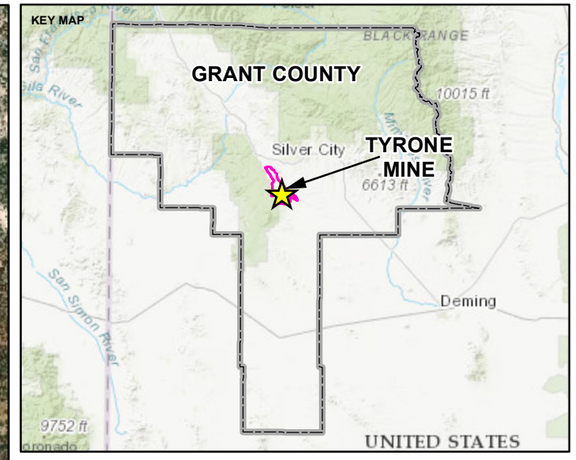
PG-9A-2
PG-9A-1
GC-LS-1
GC-LS-2
GC-LS-3

KEY MAP



LEGEND

- 2019 RCM Sample Locations
- MMD Permit Boundary

0 1,200 2,400

1 inch = 1,167 feet Feet

NOTE(S)
1. KEY MAP NOT TO SCALE
2. SAMPLE LOCATIONS ARE FROM GOLDER FIELD STAFF, FEBRUARY 2019

REFERENCE(S)
1. COORDINATE SYSTEM: NAD 1983, STATE PLANE SYSTEM - NEW MEXICO, WEST (FIPS 3003), U.S. FEET
2. IMAGERY SOURCE: DIGITALGLOBE, MARCH 2016

CLIENT
FREEPORT MCMORAN TYRONE OPERATIONS
GRANT COUNTY, NEW MEXICO

PROJECT
CLOSURE CLOSEOUT PLAN
RECLAMATION COVER MATERIALS (RCM) CHARACTERIZATION

TITLE
2019 RCM SAMPLE LOCATIONS

CONSULTANT
GOLDER

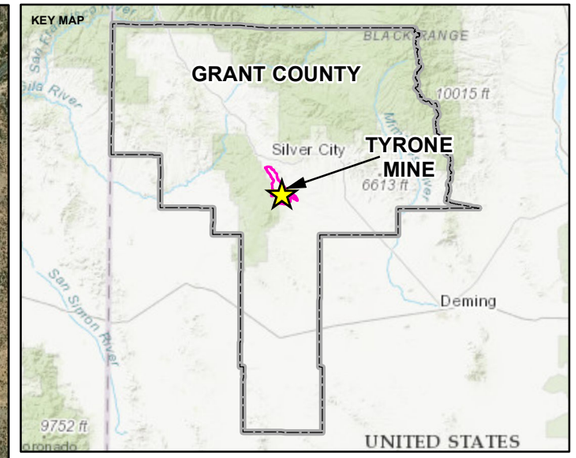
YYYY-MM-DD	2019-07-22
DESIGNED	DSW
PREPARED	DSW
REVIEWED	DR
APPROVED	DR

PROJECT NO.	CONTROL	REV.	FIGURE
181-06417	--	--	2

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

0 1in

PATH: W:\Tyrone\181-06417_TyroneCCP-BMI\MXD\181-06417_Fig2_2019Locations.mxd PRINTED ON: 2019-07-22 AT: 5:13:51 PM



LEGEND

- Reclaimed 1 Leach Stockpile TP (Golder 2007)
- USNR TP (Golder 2017)
- BMI (Golder 2019)
- MMD Permit Boundary

0 2,000 4,000

1 inch = 2,000 feet Feet

NOTE(S)
1. KEY MAP: NOT TO SCALE
2. SAMPLE LOCATIONS ARE FROM VARIOUS REPORTS AS SPECIFIED IN THE LEGEND

REFERENCE(S)
1. COORDINATE SYSTEM: NAD 1983, STATE PLANE SYSTEM - NEW MEXICO, WEST (FIPS 3003), U.S. FEET
2. IMAGERY SOURCE: VIVID, APRIL 2018

CLIENT
FREEPORT MCMORAN TYRONE OPERATIONS
GRANT COUNTY, NEW MEXICO

PROJECT
CLOSURE CLOSEOUT PLAN
RECLAMATION COVER MATERIALS (RCM) CHARACTERIZATION

TITLE
LOCATION OF RCM SAMPLES FOR SOIL CHARACTERIZATION

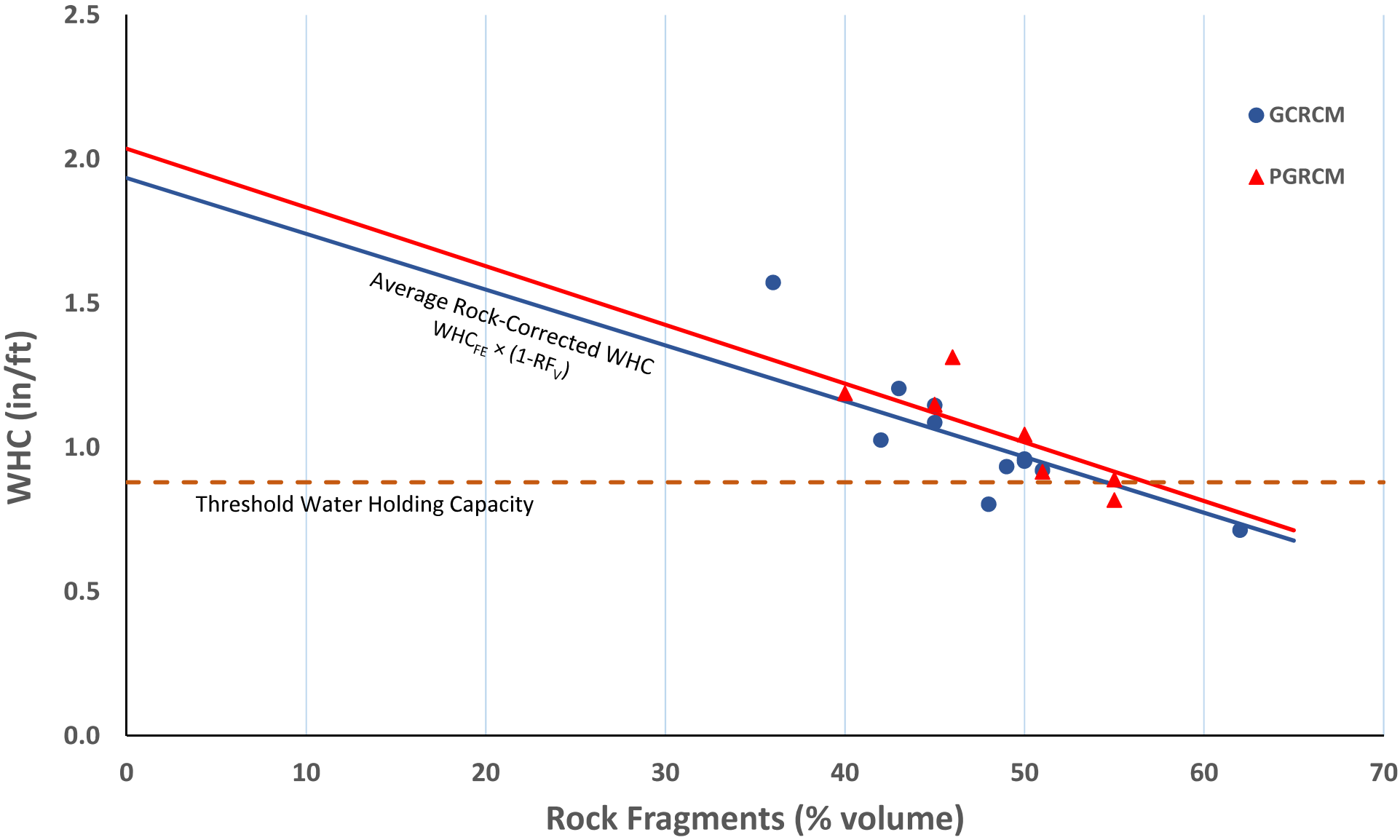
CONSULTANT
GOLDER

YYYY-MM-DD	2020-04-27
DESIGNED	DSW
PREPARED	DSW
REVIEWED	DR
APPROVED	DR

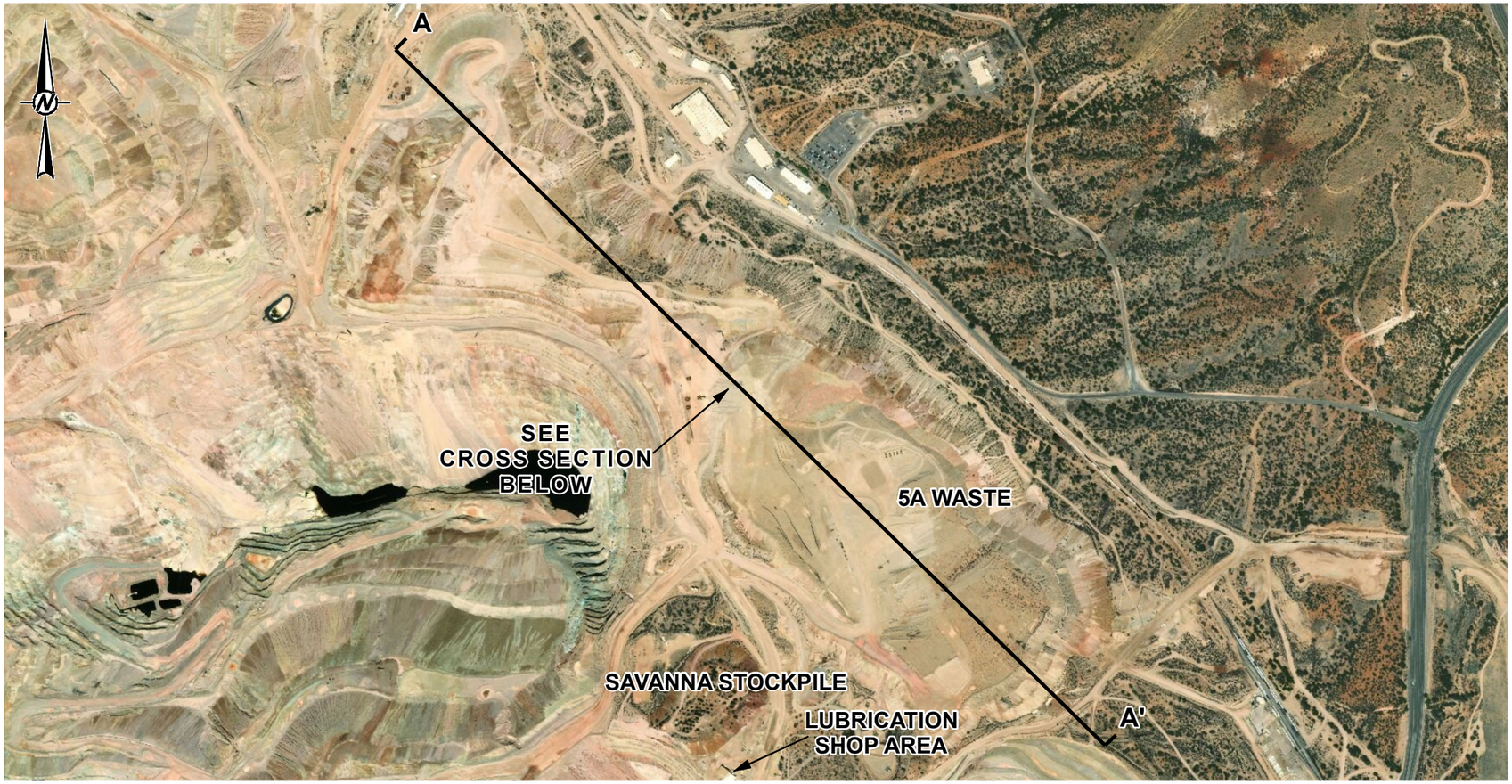
PROJECT NO.	CONTROL	REV.	FIGURE
181-06417	--	--	3

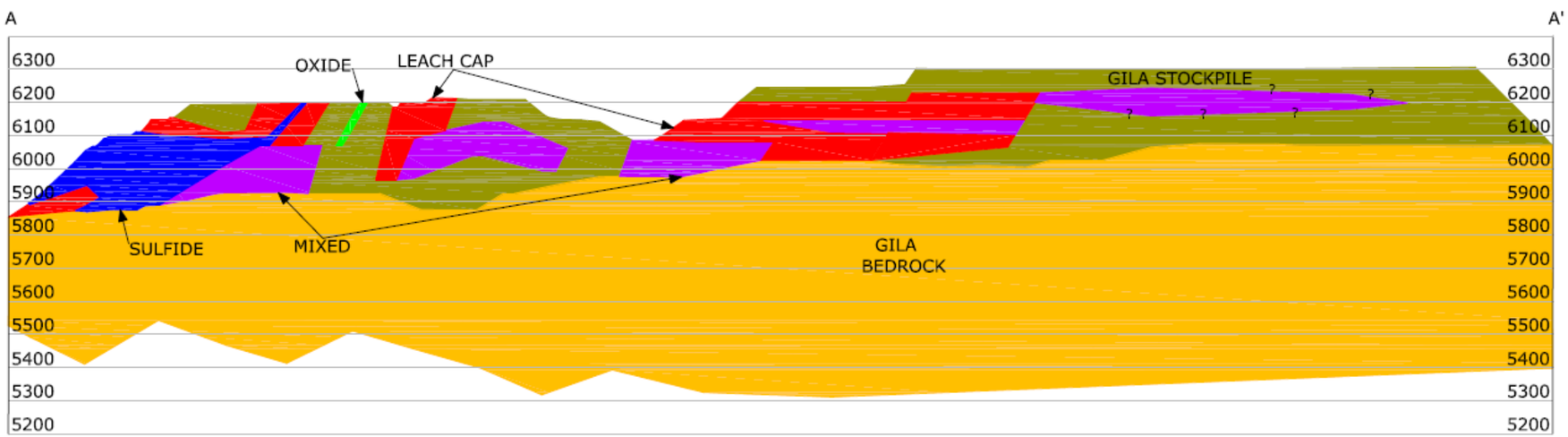
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

PATH: W:\Tyrone\181-06417_TyroneCCP-BMI\MXDs\181-06417_Fig3_AIRQMPoints.mxd PRINTED ON: 2020-04-27 AT: 2:03:51 PM



CLIENT/PROJECT FREEPORT MCMORAN TYRONE OPERATIONS GRANT COUNTY, NEW MEXICO			GOLDER				TITLE **STANDARDIZED RELATIONSHIP FOR WATER HOLDING CAPACITY AND VOLUMETRIC ROCK FRAGMENT CONTENT FOR TYRONE RCM**		
DRAWN DSW	CHECKED DR	REVIEWED DR	DATE 07-24-19	SCALE NA	JOB NO. 18106417	DWG NO. NA	SUBTITLE NA	REV. NO. 0	FIGURE **4**





LEGEND

- GILA BEDROCK
- GILA STOCKPILE
- SULFIDE
- OXIDE
- LEACH CAP
- MIXED (SULFIDE/LEACHED CAP/GILA)

NOTE(S)

1. CROSS SECTION INSET IS NOT TO SCALE
2. CROSS-SECTION PREPARED BY PHELPS DODGE TYRONE GEOLOGY STAFF: R. WAIDLER; PREVIOUSLY PUBLISHED IN PRELIMINARY BORROW SOURCE MATERIALS INVESTIGATIONS, GOLDER (2006A)

REFERENCE(S)

1. AERIAL IMAGERY: VIVID, APRIL 2018
2. COORDINATE SYSTEM: NAD 1983, STATE PLANE: NEW MEXICO, FIPS 3003 (US FEET)

CLIENT

FREEPORT MCMORAN TYRONE OPERATIONS
GRANT COUNTY, NEW MEXICO

PROJECT

CLOSURE CLOSEOUT PLAN
RECLAMATION COVER MATERIALS (RCM) CHARACTERIZATION

TITLE

CROSS-SECTION OF 5A WASTE AND UNDERLYING GILA CONGLOMERATE

CONSULTANT

GOLDER

YYYY-MM-DD	2020-04-10
DESIGNED	PD/FM
PREPARED	DSW
REVIEWED	DR
APPROVED	DR

PROJECT NO.	CONTROL	REV.	FIGURE
181-06417	--	--	5

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

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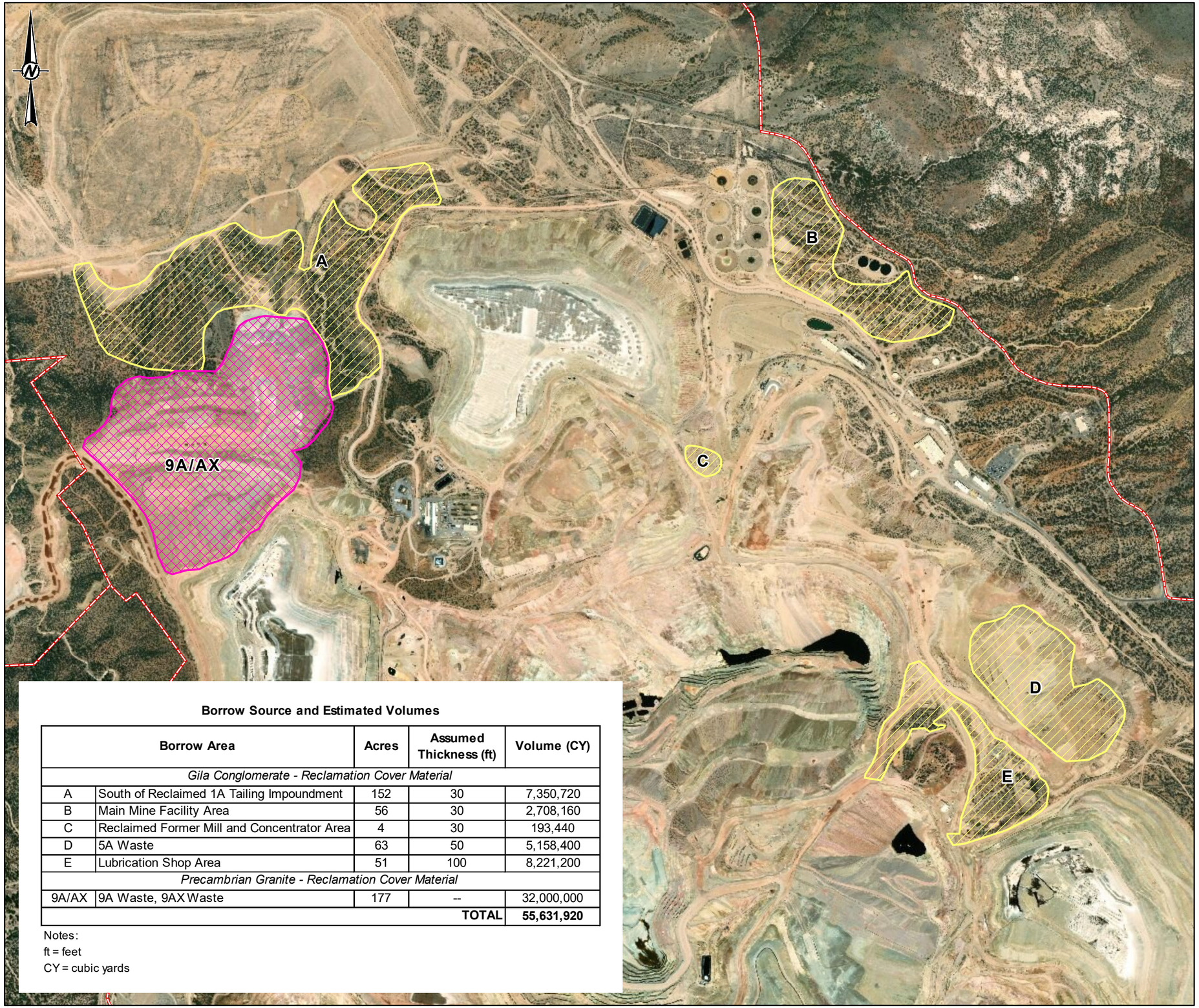
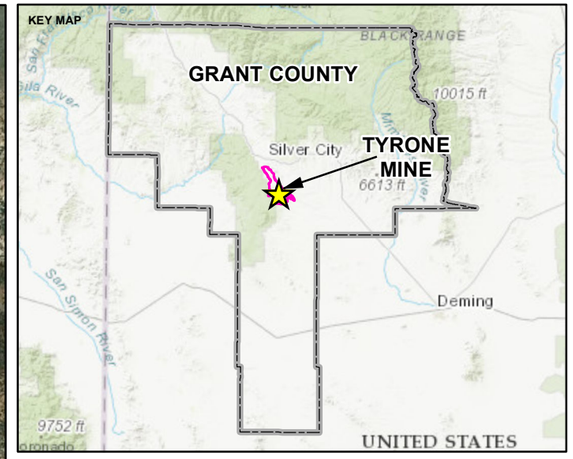




LEGEND

- Gila Conglomerate - Reclamation Cover Material
- Precambrian Granite - Reclamation Cover Material
- MMD Permit Boundary

0 1,400 2,800

1 inch = 1,400 feet Feet

NOTE(S)

1. KEY MAP: NOT TO SCALE
2. POTENTIAL BORROW AREA POLYGONS FOR B, C AND D ARE FROM GOLDER 2005
3. POTENTIAL BORROW AREAS POLYGONS 9A/AX, A AND E ARE BASED ON 2019 RCM SAMPLING AND GOLDER 2005

REFERENCE(S)

1. COORDINATE SYSTEM: NAD 1983, STATE PLANE SYSTEM - NEW MEXICO, WEST (FIPS 3003), U.S. FEET
2. IMAGERY SOURCE: VIVID, APRIL 2018

Borrow Source and Estimated Volumes

Borrow Area		Acres	Assumed Thickness (ft)	Volume (CY)
Gila Conglomerate - Reclamation Cover Material				
A	South of Reclaimed 1A Tailing Impoundment	152	30	7,350,720
B	Main Mine Facility Area	56	30	2,708,160
C	Reclaimed Former Mill and Concentrator Area	4	30	193,440
D	5A Waste	63	50	5,158,400
E	Lubrication Shop Area	51	100	8,221,200
Precambrian Granite - Reclamation Cover Material				
9A/AX	9A Waste, 9AX Waste	177	--	32,000,000
			TOTAL	**55,631,920**

Notes:
ft = feet
CY = cubic yards

CLIENT
FREEPORT MCMORAN TYRONE OPERATIONS
GRANT COUNTY, NEW MEXICO

PROJECT
CLOSURE CLOSEOUT PLAN
RECLAMATION COVER MATERIALS (RCM) CHARACTERIZATION

TITLE
POTENTIAL RCM BORROW SOURCES

CONSULTANT
GOLDER

YYYY-MM-DD	2020-04-27
DESIGNED	DSW
PREPARED	DSW
REVIEWED	DR
APPROVED	DR

PROJECT NO.	CONTROL	REV.	FIGURE
181-06417	--	--	6

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

PATH: W:\Tyrone\181-06417_TyroneCCP-BM\MXD\181-06417_Fig6_BorrowAreas.mxd PRINTED ON: 2020-04-27 AT: 2:56:55 PM

APPENDIX A

Energy Laboratory Reports

ANALYTICAL SUMMARY REPORT

March 29, 2019

Golder Associates Inc
5200 Pasadena NE Ste C
Albuquerque, NM 87113

Work Order: B19030684

Project Name: 181-06417 Tyrone CCP-BMI

Energy Laboratories Inc Billings MT received the following 6 samples for Golder Associates Inc on 3/11/2019 for analysis.

Lab ID	Client Sample ID	Collect Date	Receive Date	Matrix	Test
B19030684-001	GC-1S-1 [0-3]feet	03/01/19 0:00	03/11/19	Soil	Metals, CACL2 Extractable Acid/Base Potential Coarse Fragments Conductivity, Saturated Paste Extract Nitrate as N, KCL Extract Organic Carbon/Matter Walkley-Black pH, Saturated Paste Phosphorus-Olsen CaCl2 Hot Water Soil Extraction ASA25-9 Saturated Paste Extraction ASA Particle Size Analysis / Texture Saturation Percentage Sulfur Forms Very Fine Sand
B19030684-002	GC-1S-2 [0-2]feet	03/01/19 0:00	03/11/19	Soil	Same As Above
B19030684-003	GC-1S-2 [2-4]feet	03/01/19 0:00	03/11/19	Soil	Same As Above
B19030684-004	GC-1S-2 [4-6]feet	03/01/19 0:00	03/11/19	Soil	Same As Above
B19030684-005	GC-1S-3 [0-2]feet	03/01/19 0:00	03/11/19	Soil	Same As Above
B19030684-006	GC-1S-3 [4-6.5]feet	03/01/19 0:00	03/11/19	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 Laboratory Analytical Report, the QA/QC Summary Report, or the Case Narrative. 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: 2019.03.29 16:57:36 -06:00

LABORATORY ANALYTICAL REPORT

Prepared by Billings, MT Branch

Client: Golder Associates Inc
Project: 181-06417 Tyrone CCP-BMI
Workorder: B19030684

Report Date: 03/29/19
Date Received: 03/11/19

		Analysis	Coarse Frags	Very Fine Sand	Sand	Silt	Clay	Texture	pH, sat_ paste	COND	Saturation	Neut Potential	Acid Potential	Acid/Base Potential	S, Total
		Units	%	wt%	%	%	%		s_u_	mmhos/cm	%	t/kt	t/kt	t/kt	%
Sample ID	Client Sample ID	Depth	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results
B19030684-001	GC-1S-1	0-3	33	2	75	14	11	SL	7.9	0.5	20.6	28	0	27	0.02
B19030684-002	GC-1S-2	0-2	9	3	65	14	21	SCL	5.5	0.7	28.5	5	0	4	0.03
B19030684-003	GC-1S-2	2-4	10	3	49	10	41	SC	4.8	1.2	56.7	4	0	3	0.03
B19030684-004	GC-1S-2	4-6	15	5	52	18	30	SCL	5.1	1.6	40.2	5	0	4	0.04
B19030684-005	GC-1S-3	0-2	21	1	60	32	8	SL	5.6	0.3	17.8	6	1	5	0.03
B19030684-006	GC-1S-3	4-6.5	17	4	55	31	14	SL	7.3	0.7	23.8	15	0	14	0.03

LABORATORY ANALYTICAL REPORT

Prepared by Billings, MT Branch

Client: Golder Associates Inc
Project: 181-06417 Tyrone CCP-BMI
Workorder: B19030684

Report Date: 03/29/19
Date Received: 03/11/19

		Analysis	S, H2O Extr	S, HCL Extr	S, HNO3 Extr	S, Residual	Organic Matter	Organic Carbon	Phos, Olsen	Nitrate as N	B-CACL2	Se-CACL2
		Units	%	%	%	%	%	%	mg/kg	mg/kg	mg/kg	mg/kg
Sample ID	**Client Sample ID**	**Depth**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**
B19030684-001	GC-1S-1	0-3	< 0.01	< 0.01	< 0.01	0.02	0.7	0.4	5	< 1	< 0.1	< 0.1
B19030684-002	GC-1S-2	0-2	< 0.01	< 0.01	< 0.01	0.02	0.8	0.5	4	< 1	< 0.1	< 0.1
B19030684-003	GC-1S-2	2-4	< 0.01	< 0.01	< 0.01	0.02	0.9	0.5	14	< 1	< 0.1	< 0.1
B19030684-004	GC-1S-2	4-6	< 0.01	< 0.01	< 0.01	0.02	0.6	0.3	15	< 1	< 0.1	< 0.1
B19030684-005	GC-1S-3	0-2	< 0.01	< 0.01	0.01	0.02	1.3	0.8	2	< 1	< 0.1	< 0.1
B19030684-006	GC-1S-3	4-6.5	< 0.01	< 0.01	< 0.01	0.02	1.0	0.6	4	< 1	< 0.1	< 0.1

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: Golder Associates Inc
Report Date: 03/28/19
Project: 181-06417 Tyrone CCP-BMI
Work Order: B19030684

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **SW6010B**									Analytical Run: ICP203-B_190314A	
Lab ID: **QCS**		Initial Calibration Verification Standard							03/14/19 09:50	
Boron		0.766	mg/L	0.10	96	90	110			
Lab ID: **ICSA**		Interference Check Sample A							03/14/19 09:54	
Boron		0.00209	mg/L	0.10						
Lab ID: **ICSAB**		Interference Check Sample AB							03/14/19 09:58	
Boron		0.949	mg/L	0.10	95	80	120			
Method: **SW6010B**									Batch: 130969	
Lab ID: **MB-130969**		Method Blank				Run: ICP203-B_190314A			03/14/19 19:14	
Boron		ND	mg/kg	0.06						
Lab ID: **LCS-130969**		Laboratory Control Sample				Run: ICP203-B_190314A			03/14/19 19:26	
Boron		0.396	mg/kg	0.10	110	70	130			
Lab ID: **B19030684-001ADUP**		Sample Duplicate				Run: ICP203-B_190314A			03/14/19 19:34	
Boron		ND	mg/kg	0.10					30	
Lab ID: **B19030684-002AMS2**		Sample Matrix Spike				Run: ICP203-B_190314A			03/14/19 19:43	
Boron		10.1	mg/kg	0.10	101	70	130			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: Golder Associates Inc
Report Date: 03/28/19
Project: 181-06417 Tyrone CCP-BMI
Work Order: B19030684

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: SW6020									Analytical Run: ICPMS207-B_190314A	
Lab ID: QCS		Initial Calibration Verification Standard								03/14/19 11:32
Selenium		0.0511	mg/L	0.0010	102	90	110			
Lab ID: ICSA		Interference Check Sample A								03/14/19 12:01
Selenium		0.000546	mg/L	0.0010						
Lab ID: ICSAB		Interference Check Sample AB								03/14/19 12:05
Selenium		0.0108	mg/L	0.0010	108	80	120			
Method: SW6020									Batch: 130969	
Lab ID: MB-130969		Method Blank				Run: ICPMS207-B_190314A				03/15/19 07:34
Selenium		-0.0007	mg/kg							
Lab ID: B19030684-001AMS		Sample Matrix Spike				Run: ICPMS207-B_190314A				03/15/19 07:51
Selenium		0.255	mg/kg	0.10	103	70	130			
Lab ID: B19030684-001ADUP		Sample Duplicate				Run: ICPMS207-B_190314A				03/15/19 08:16
Selenium		-0.00539	mg/kg	0.10					30	
Method: SW6020									Analytical Run: ICPMS207-B_190315A	
Lab ID: ICSA		Interference Check Sample A								03/15/19 12:16
Selenium		0.000517	mg/L	0.0010						
Lab ID: ICSAB		Interference Check Sample AB								03/15/19 12:20
Selenium		0.0100	mg/L	0.0010	101	80	120			
Lab ID: QCS		Initial Calibration Verification Standard								03/15/19 11:51
Selenium		0.0503	mg/L	0.0010	101	90	110			
Method: SW6020									Batch: 130969	
Lab ID: MB-130969		Method Blank				Run: ICPMS207-B_190315A				03/15/19 12:50
Selenium		0.001	mg/kg	0.0008						
Lab ID: B19030689-005AMS		Sample Matrix Spike				Run: ICPMS207-B_190315A				03/15/19 14:01
Selenium		0.245	mg/kg	0.10	98	70	130			
Lab ID: B19030689-005ADUP		Sample Duplicate				Run: ICPMS207-B_190315A				03/15/19 14:09
Selenium		ND	mg/kg	0.10					30	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: Golder Associates Inc
Project: 181-06417 Tyrone CCP-BMI

Report Date: 03/29/19
Work Order: B19030684

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: ASA10-3									Batch: 130992
Lab ID: B19030684-001A DUP	Sample Duplicate				Run: MISC-SOIL_190315A				03/15/19 15:07
Conductivity, sat. paste	0.500	mmhos/cm	0.10				2.0	30	
Lab ID: LCS-1903151507	Laboratory Control Sample				Run: MISC-SOIL_190315A				03/15/19 15:07
Conductivity, sat. paste	4.39	mmhos/cm	0.10	107	70	130			
Lab ID: B19030684-001A DUP	Sample Duplicate				Run: MISC-SOIL_190315A				03/15/19 15:07
pH, sat. paste	7.90	s.u.	0.10				0.0	10	
Lab ID: LCS-1903151507	Laboratory Control Sample				Run: MISC-SOIL_190315A				03/15/19 15:07
pH, sat. paste	7.30	s.u.	0.10	97	90	110			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: Golder Associates Inc
Project: 181-06417 Tyrone CCP-BMI

Report Date: 03/29/19
Work Order: B19030684

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: ASA15-5									Batch: R317249
Lab ID: B19030684-001A DUP	Sample Duplicate				Run: MISC-SOIL_190324A				03/24/19 13:43
Sand	76.0	%	1.0					30	
Silt	13.0	%	1.0					30	
Clay	11.0	%	1.0					30	
Lab ID: LCS-1903241343	Laboratory Control Sample				Run: MISC-SOIL_190324A				03/24/19 13:43
Sand	26.0	%	1.0	108	70	130			
Silt	52.0	%	1.0	96	70	130			
Clay	22.0	%	1.0	100	70	130			
Lab ID: B19030684-001A DUP	Sample Duplicate				Run: MISC-SOIL_190324A				03/24/19 13:43
Very Fine Sand	3	wt%	1				40	50	
Lab ID: LCS-1903241343	Laboratory Control Sample				Run: MISC-SOIL_190324A				03/24/19 13:43
Very Fine Sand	7	wt%	1	88	50	150			
Method: ASA15-5									Batch: R317322
Lab ID: B19030684-001A DUP	Sample Duplicate				Run: MISC-SOIL_190325B				03/24/19 13:43
Sand	76.0	%	1.0					30	
Silt	13.0	%	1.0					30	
Clay	11.0	%	1.0					30	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: Golder Associates Inc
Project: 181-06417 Tyrone CCP-BMI

Report Date: 03/29/19
Work Order: B19030684

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: ASA24-5								Batch: OM_3-25-2019_10-03-27AMA	
Lab ID: LCS	Laboratory Control Sample				Run: FIA205-B_190325A			03/25/19 10:04	
Phosphorus, Olsen	47	mg/kg	1.0	105	70	130			
Lab ID: MBLK-NaHCO3	Method Blank				Run: FIA205-B_190325A			03/25/19 10:08	
Phosphorus, Olsen	1	mg/kg	0.1						
Lab ID: B19030684-001ADUP	Sample Duplicate				Run: FIA205-B_190325A			03/25/19 10:13	
Phosphorus, Olsen	4.7	mg/kg	1.0				5.0	30	
Lab ID: B19030684-001AMS	Sample Matrix Spike				Run: FIA205-B_190325A			03/25/19 10:15	
Phosphorus, Olsen	17	mg/kg	1.0	116	70	130			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: Golder Associates Inc
Report Date: 03/29/19
Project: 181-06417 Tyrone CCP-BMI
Work Order: B19030684

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: ASA29-3									Batch: R316761
Lab ID: B19030684-001A DUP	Sample Duplicate				Run: MISC-SOIL_190314A				03/14/19 08:49
Organic Carbon	0.380	%	0.10				5.1	30	
Organic Matter	0.654	%	0.17				5.1	30	
Lab ID: LCS-1903140849	Laboratory Control Sample				Run: MISC-SOIL_190314A				03/14/19 08:49
Organic Carbon	3.08	%	0.10	114	70	130			
Organic Matter	5.30	%	0.17	129	70	130			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

ANALYTICAL SUMMARY REPORT

April 02, 2019

Golder Associates Inc
5200 Pasadena NE Ste C
Albuquerque, NM 87113

Work Order: B19030689

Project Name: 181-06417 Tyrone CCP-BMI

Energy Laboratories Inc Billings MT received the following 9 samples for Golder Associates Inc on 3/11/2019 for analysis.

Lab ID	Client Sample ID	Collect Date	Receive Date	Matrix	Test
B19030689-001	GC-1S-4 [0-2.5]feet	03/01/19 0:00	03/11/19	Soil	Metals, CACL2 Extractable Acid/Base Potential Coarse Fragments Conductivity, Saturated Paste Extract Nitrate as N, KCL Extract Organic Carbon/Matter Walkley-Black pH, Saturated Paste Phosphorus-Olsen CaCl2 Hot Water Soil Extraction ASA25-9 Saturated Paste Extraction ASA Particle Size Analysis / Texture Saturation Percentage Sulfur Forms Very Fine Sand
B19030689-002	GC-1S-5 Bulk	03/01/19 0:00	03/11/19	Soil	Same As Above
B19030689-003	PG9AX-1 Bulk	03/01/19 0:00	03/11/19	Soil	Same As Above
B19030689-004	PG9A-1 Bulk	03/01/19 0:00	03/11/19	Soil	Same As Above
B19030689-005	PG9A-2 Bulk	03/01/19 0:00	03/11/19	Soil	Same As Above
B19030689-006	GC-LS-1 [2-4]feet	02/28/19 0:00	03/11/19	Soil	Same As Above
B19030689-007	GC-LS-2 [0-2]feet	02/28/19 0:00	03/11/19	Soil	Same As Above
B19030689-008	GC-LS-2 [6-7]feet	02/28/19 0:00	03/11/19	Soil	Same As Above
B19030689-009	GC-LS-3 [0-2]feet	02/28/19 0:00	03/11/19	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 Laboratory Analytical Report, the QA/QC Summary Report, or the Case Narrative. 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
Jillian B. Miller
Date: 2019.04.02 12:02:45 -06:00

LABORATORY ANALYTICAL REPORT
Prepared by Billings, MT Branch

Client: Golder Associates Inc
Project: 181-06417 Tyrone CCP-BMI
Workorder: B19030689

Report Date: 04/02/19
Date Received: 03/11/19

		Analysis	Coarse Frags	Very Fine Sand	Sand	Silt	Clay	Texture	pH, sat_ paste	COND	Saturation	Neut Potential	Acid Potential	Acid/Base Potential	S, Total
		Units	%	wt%	%	%	%		s_u_	mmhos/cm	%	t/kt	t/kt	t/kt	%
Sample ID	**Client Sample ID**	**Depth**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**
B19030689-001	GC-1S-4	0-2.5	24	1	70	19	11	SL	7.8	0.3	19.2	57	0	57	0.02
B19030689-002	GC-1S-5 Bulk	0-0	27	7	45	34	21	L	6.8	0.9	34.2	10	1	8	0.04
B19030689-003	PG9AX-1 Bulk	0-0	37	0	64	24	12	SL	7.8	0.3	24.5	17	2	15	0.05
B19030689-004	PG9A-1 Bulk	0-0	40	0	67	21	12	SL	7.9	0.5	23.6	13	2	11	0.06
B19030689-005	PG9A-2 Bulk	0-0	31	4	69	21	10	SL	8.0	0.9	21.7	19	1	18	0.06
B19030689-006	GC-LS-1	2-4	53	1	77	14	9	SL	5.3	1.7	20.1	11	1	10	0.04
B19030689-007	GC-LS-2	0-2	17	0	57	24	19	SL	4.5	1.3	26.2	1	22	-21	0.81
B19030689-008	GC-LS-2	6-7	44	5	77	8	15	SL	7.6	0.7	24.6	9	1	8	0.04
B19030689-009	GC-LS-3	0-2	27	4	73	14	13	SL	6.5	0.2	19.5	9	1	8	0.03

LABORATORY ANALYTICAL REPORT

Prepared by Billings, MT Branch

Client: Golder Associates Inc
Project: 181-06417 Tyrone CCP-BMI
Workorder: B19030689

Report Date: 04/02/19
Date Received: 03/11/19

		Analysis	S, H2O Extr	S, HCL Extr	S, HNO3 Extr	S, Residual	Organic Matter	Organic Carbon	Phos, Olsen	Nitrate as N	B-CACL2	Se-CACL2
		Units	%	%	%	%	%	%	mg/kg	mg/kg	mg/kg	mg/kg
Sample ID	**Client Sample ID**	**Depth**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**
B19030689-001	GC-1S-4	0-2.5	< 0.01	< 0.01	< 0.01	0.02	0.5	0.3	3	< 1	< 0.1	< 0.1
B19030689-002	GC-1S-5 Bulk	0-0	< 0.01	< 0.01	< 0.01	0.02	3.2	1.8	3	11	< 0.1	< 0.1
B19030689-003	PG9AX-1 Bulk	0-0	< 0.01	< 0.01	0.03	0.02	0.4	0.3	2	< 1	< 0.1	< 0.1
B19030689-004	PG9A-1 Bulk	0-0	< 0.01	< 0.01	0.04	0.02	0.4	0.2	2	< 1	< 0.1	< 0.1
B19030689-005	PG9A-2 Bulk	0-0	0.01	< 0.01	0.02	0.03	1.0	0.6	2	< 1	< 0.1	< 0.1
B19030689-006	GC-LS-1	2-4	< 0.01	< 0.01	0.01	0.02	0.5	0.3	2	< 1	< 0.1	< 0.1
B19030689-007	GC-LS-2	0-2	0.11	< 0.01	0.30	0.39	0.4	0.2	2	16	< 0.1	< 0.1
B19030689-008	GC-LS-2	6-7	< 0.01	< 0.01	< 0.01	0.03	0.5	0.3	6	3	< 0.1	< 0.1
B19030689-009	GC-LS-3	0-2	< 0.01	< 0.01	0.02	0.02	0.7	0.4	3	< 1	< 0.1	< 0.1

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: Golder Associates Inc
Report Date: 04/02/19
Project: 181-06417 Tyrone CCP-BMI
Work Order: B19030689

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **ASA10-3**										Batch: 130992
Lab ID: **B19030689-005A DUP**	Sample Duplicate					Run: MISC-SOIL_190315A				03/15/19 15:07
Conductivity, sat. paste		0.930	mmhos/cm	0.10				1.1	30	
Lab ID: **LCS-1903151507**	Laboratory Control Sample					Run: MISC-SOIL_190315A				03/15/19 15:07
Conductivity, sat. paste		4.39	mmhos/cm	0.10	107	70	130			
Lab ID: **B19030689-005A DUP**	Sample Duplicate					Run: MISC-SOIL_190315A				03/15/19 15:07
pH, sat. paste		8.00	s.u.	0.10				0.0	10	
Lab ID: **LCS-1903151507**	Laboratory Control Sample					Run: MISC-SOIL_190315A				03/15/19 15:07
pH, sat. paste		7.30	s.u.	0.10	97	90	110			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: Golder Associates Inc
Report Date: 04/02/19
Project: 181-06417 Tyrone CCP-BMI
Work Order: B19030689

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: ASA15-5										Batch: R317249
Lab ID: B19030689-005A DUP	3	Sample Duplicate				Run: MISC-SOIL_190324A				03/24/19 13:43
Sand		67.0	%	1.0					30	
Silt		23.0	%	1.0					30	
Clay		10.0	%	1.0					30	
Lab ID: LCS-1903241343	3	Laboratory Control Sample				Run: MISC-SOIL_190324A				03/24/19 13:43
Sand		26.0	%	1.0	108	70	130			
Silt		52.0	%	1.0	96	70	130			
Clay		22.0	%	1.0	100	70	130			
Lab ID: B19030689-005A DUP		Sample Duplicate				Run: MISC-SOIL_190324A				03/24/19 13:43
Very Fine Sand		3	wt%	1				29	50	
Lab ID: LCS-1903241343		Laboratory Control Sample				Run: MISC-SOIL_190324A				03/24/19 13:43
Very Fine Sand		7	wt%	1	88	50	150			
Method: ASA15-5										Batch: R317322
Lab ID: B19030689-005A DUP	3	Sample Duplicate				Run: MISC-SOIL_190325B				03/24/19 13:43
Sand		67.0	%	1.0					30	
Silt		23.0	%	1.0					30	
Clay		10.0	%	1.0					30	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: Golder Associates Inc
Report Date: 04/02/19
Project: 181-06417 Tyrone CCP-BMI
Work Order: B19030689

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **ASA24-5**									Batch: OM_3-25-2019_10-03-27AMA	
Lab ID: **LCS**	Laboratory Control Sample					Run: FIA205-B_190325A				03/25/19 10:04
Phosphorus, Olsen		47	mg/kg	1.0	105	70	130			
Lab ID: **MBLK-NaHCO3**	Method Blank					Run: FIA205-B_190325A				03/25/19 10:08
Phosphorus, Olsen		1	mg/kg	0.1						
Lab ID: **B19030684-001AMS**	Sample Matrix Spike					Run: FIA205-B_190325A				03/25/19 10:15
Phosphorus, Olsen		17	mg/kg	1.0	116	70	130			
Lab ID: **B19030689-005ADUP**	Sample Duplicate					Run: FIA205-B_190325A				03/25/19 10:37
Phosphorus, Olsen		2.0	mg/kg	1.0				5.9	30	
Lab ID: **B19030689-005AMS**	Sample Matrix Spike					Run: FIA205-B_190325A				03/25/19 10:39
Phosphorus, Olsen		14	mg/kg	1.0	111	70	130			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: Golder Associates Inc
Report Date: 04/02/19
Project: 181-06417 Tyrone CCP-BMI
Work Order: B19030689

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: ASA29-3										Batch: R316761
Lab ID: B19030689-005A DUP	2	Sample Duplicate				Run: MISC-SOIL_190314A				03/14/19 08:49
Organic Carbon		0.540	%	0.10				7.1	30	
Organic Matter		0.929	%	0.17				7.1	30	
Lab ID: LCS-1903140849	2	Laboratory Control Sample				Run: MISC-SOIL_190314A				03/14/19 08:49
Organic Carbon		3.08	%	0.10	114	70	130			
Organic Matter		5.30	%	0.17	129	70	130			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: Golder Associates Inc
Report Date: 04/02/19
Project: 181-06417 Tyrone CCP-BMI
Work Order: B19030689

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **ASA33-8**									Batch: OM_3-14-2019_10-13-46AM	
Lab ID: **LCS**	Laboratory Control Sample					Run: FIA205-B_190314A			03/14/19 10:14	
Nitrate as N, KCL Extract		10.8	mg/kg	1.0	99	70	130			
Lab ID: **MBLK-KCL**	Method Blank					Run: FIA205-B_190314A			03/14/19 10:16	
Nitrate as N, KCL Extract		ND	mg/kg	0.1						
Lab ID: **B19030689-004ADUP**	Sample Duplicate					Run: FIA205-B_190314A			03/14/19 10:27	
Nitrate as N, KCL Extract		0.488	mg/kg	1.0					30	
Lab ID: **B19030689-004AMS**	Sample Matrix Spike					Run: FIA205-B_190314A			03/14/19 10:27	
Nitrate as N, KCL Extract		2.77	mg/kg	1.0	44	70	130			S
Lab ID: **B19030611-001ADUP**	Sample Duplicate					Run: FIA205-B_190314A			03/14/19 10:36	
Nitrate as N, KCL Extract		8720	mg/kg-dry	290				0.7	30	
Lab ID: **B19030611-001AMS**	Sample Matrix Spike					Run: FIA205-B_190314A			03/14/19 10:36	
Nitrate as N, KCL Extract		12300	mg/kg-dry	300	120	70	130			

Qualifiers:

RL - Analyte reporting limit.
ND - Not detected at the reporting limit.
S - Spike recovery outside of advisory limits.

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: Golder Associates Inc
Report Date: 04/02/19
Project: 181-06417 Tyrone CCP-BMI
Work Order: B19030689

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: Sobek Modified										Batch: R317322
Lab ID: B19030689-001A DUP	3	Sample Duplicate				Run: MISC-SOIL_190325B				03/25/19 19:04
Neutralization Potential		56	t/kt	0.10				2.0	50	
Acid Potential		0.64	t/kt	1.0					50	
Acid/Base Potential		55	t/kt					2.0	50	
The acid-base potential was calculated from the non-sulfate sulfur %										
Lab ID: B19030689-001A DUP	5	Sample Duplicate				Run: MISC-SOIL_190325B				03/25/19 19:04
Sulfur, Total		0.0243	%	0.010				0.4	50	
Sulfur, Hot Water Extractable		0.00395	%	0.010					50	
Sulfur, HCl Extractable		ND	%	0.010					50	
Sulfur, HNO3 Extractable		ND	%	0.010					50	
Sulfur, Residual		0.0219	%	0.010				0.9	50	
Lab ID: LCS-SOLO120919032	3	Laboratory Control Sample				Run: MISC-SOIL_190325B				03/25/19 19:35
Neutralization Potential		120	t/kt	0.10	124	50	150			
Acid Potential		5.9	t/kt	1.0	74	50	150			
Acid/Base Potential		120	t/kt		128	50	150			
The acid-base potential was calculated from the non-sulfate sulfur %										
Lab ID: LCS-SOLO120919032	3	Laboratory Control Sample				Run: MISC-SOIL_190325B				03/25/19 19:35
Sulfur, Total		0.188	%	0.010	90	50	150			
Sulfur, HNO3 Extractable		0.153	%	0.010	85	50	150			
Sulfur, Residual		0.0370	%	0.010	74	50	150			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: Golder Associates Inc
Report Date: 04/02/19
Project: 181-06417 Tyrone CCP-BMI
Work Order: B19030689

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **SW6010B**									Analytical Run: ICP203-B_190314A	
Lab ID: **QCS**		Initial Calibration Verification Standard							03/14/19 09:50	
Boron		0.766	mg/L	0.10	96	90	110			
Lab ID: **ICSA**		Interference Check Sample A							03/14/19 09:54	
Boron		0.00209	mg/L	0.10						
Lab ID: **ICSAB**		Interference Check Sample AB							03/14/19 09:58	
Boron		0.949	mg/L	0.10	95	80	120			
Method: **SW6010B**									Batch: 130969	
Lab ID: **MB-130969**		Method Blank				Run: ICP203-B_190314A			03/14/19 19:14	
Boron		ND	mg/kg	0.06						
Lab ID: **LCS-130969**		Laboratory Control Sample				Run: ICP203-B_190314A			03/14/19 19:26	
Boron		0.396	mg/kg	0.10	110	70	130			
Lab ID: **B19030684-001ADUP**		Sample Duplicate				Run: ICP203-B_190314A			03/14/19 19:34	
Boron		ND	mg/kg	0.10					30	
Lab ID: **B19030684-002AMS2**		Sample Matrix Spike				Run: ICP203-B_190314A			03/14/19 19:43	
Boron		10.1	mg/kg	0.10	101	70	130			
Lab ID: **B19030689-005ADUP**		Sample Duplicate				Run: ICP203-B_190314A			03/14/19 20:32	
Boron		ND	mg/kg	0.10					30	
Lab ID: **B19030689-006AMS2**		Sample Matrix Spike				Run: ICP203-B_190314A			03/14/19 20:40	
Boron		10.3	mg/kg	0.10	103	70	130			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: Golder Associates Inc
Report Date: 04/02/19
Project: 181-06417 Tyrone CCP-BMI
Work Order: B19030689

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **SW6020**									Analytical Run: ICPMS207-B_190315A	
Lab ID: **ICSA**		Interference Check Sample A							03/15/19 12:16	
Selenium		0.000517	mg/L	0.0010						
Lab ID: **ICSAB**		Interference Check Sample AB							03/15/19 12:20	
Selenium		0.0100	mg/L	0.0010	101	80	120			
Lab ID: **QCS**		Initial Calibration Verification Standard							03/15/19 11:51	
Selenium		0.0503	mg/L	0.0010	101	90	110			
Method: **SW6020**									Batch: 130969	
Lab ID: **MB-130969**		Method Blank				Run: ICPMS207-B_190315A			03/15/19 12:50	
Selenium		0.001	mg/kg	0.0008						
Lab ID: **B19030689-005AMS**		Sample Matrix Spike				Run: ICPMS207-B_190315A			03/15/19 14:01	
Selenium		0.245	mg/kg	0.10	98	70	130			
Lab ID: **B19030689-005ADUP**		Sample Duplicate				Run: ICPMS207-B_190315A			03/15/19 14:09	
Selenium		ND	mg/kg	0.10					30	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: Golder Associates Inc
Report Date: 04/02/19
Project: 181-06417 Tyrone CCP-BMI
Work Order: B19030689

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **USDA27a**										Batch: R316859
Lab ID: **B19030689-005A DUP**	Sample Duplicate					Run: MISC-SOIL_190315A				03/15/19 15:07
Saturation		20.8	%	0.10				4.2	30	
Lab ID: **LCS-1903151507**	Laboratory Control Sample					Run: MISC-SOIL_190315A				03/15/19 15:07
Saturation		34.7	%	0.10	92	70	130			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

Work Order Receipt Checklist

Golder Associates Inc

B19030689

Login completed by: Richard L. Shular
Date Received: 3/11/2019
Reviewed by: BL2000\gmccartney
Received by: se
Reviewed Date: 3/12/2019
Carrier name: Return-UPS Ground N/C

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:	°C No Ice		
Water - VOA vials have zero headspace?	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.

Contact and Corrective Action Comments:

The temperature of the sample(s) for shipping container 1 was 4.2°C and shipping container 2 was 3.4°C.

ENERGY
Trust our People. Trust our Data.

Chain of Custody & Analytical Request Record

www.energylab.com

Account Information *(Billing information)*

Company/Name	Golder Associates, Inc.
Contact	Doug Romig
Phone	(505) 821-3043
Mailing Address	5200 Pasadena Ave. NE Suite C
City, State, Zip	Albuquerque, NM 87113-2208
Email	Doug_Romig@golder.com
Receive Invoice	☒Hard Copy ☒Email
Receive Report	☐Hard Copy ☒Email
Purchase Order	
Quote	
Bottle Order	

Report Information *(if different than Account Information)*

Company/Name	cc:
Contact	Dustin Ward
Phone	
Mailing Address	
City, State, Zip	
Email	dustin_ward@golder.com
Receive Report	☐Hard Copy ☒Email

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

Comments

:)

Project Information

Project Name, PWSID, Permit, etc.	181-06417 Tyrone CCP-BMI
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.
☐ Unprocessed Ore
☐ Processed Ore (Ground or Refined) **CALL BEFORE SENDING
☐ 11(e)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	GC-1S-4 0-2.5'	**3/1/19**		1	S		●		B1903689-001
2	GC-1S-5 BULK	3/1/19		1	S		●		-002
3	PG9AX-1 BULK	3/1/19		1	S		●		-003
4	PG9A-1 BULK	3/1/19		1	S		●		-004
5	PG9A-2 BULK	3/1/19		1	S		●		-005
6	GC-LS-1 2-4'	2/28/19		1	S		●		-006
7	GC-LS-2 0-2'	2/28/19		1	S		●		-007
8	GC-LS-2 6-7'	2/28/19		1	S		●		-008
9	GC-LS-3 0-2'	2/28/19		1	S		●		-009
10	-NA-								

Custody Record MUST be signed	Relinquished by (print)	Date/Time	Signature	Received by (print)	Date/Time	Signature
	Dustin S. Ward	2019-03-05 1200		Susie Edgar	3/6/19 9:10	Susie Edgar
	Relinquished by (print)	Date/Time	Signature	Received by Laboratory (print)	Date/Time	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.

GOLDER

March 5, 2019

Project No. 18106417

Ms. Wynn Pippin
Energy Laboratories Inc.
1120 South 27th Street
Billings, MT 59107

RE: Lab Analyses for Tyrone CCP Borrow Materials

Dear Ms. Pippin

This letter accompanies two coolers containing a total of 15 soil samples from the Tyrone mine site. Please analyze the samples for the following parameters:

Test	Method
Saturated Paste pH	SLS 1954, Method 2 and 21a
Electrical Conductivity	SLS 1954, Method 3a and 4b
Saturation percentage	SLS 1954, Method 27a
Particle Size Distribution, including very fine sand	ASA 1982, Method 15-5
Rock Fragment (>2mm)	Dry sieve (No. 10)/gravimetric
N as Nitrate	ASA 1982, Method 33-8.1
Phosphorous (Olsen)	ASA 1982, Method 24-5.4
Organic Matter	ASA 1982 Method 29-3.5.2
Hot water extractable Boron	ASA 10-3
Hot water extractable Selenium	ASA Mono. #9, Part 2, Method 75-4.1
Acid-Base Account (with sulfur forms)	Acid-Base Account (with sulfur forms)

Please retain samples until we have an opportunity to review the initial lab data as we may select specific samples for additional analyses. Please call (505.821.3043) or email (dromig@golder.com) if you have any questions.

Sincerely,

GOLDER ASSOCIATES INC.

Douglas Romig, ~~CPSS~~
Senior Soil Scientist

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: Golder Associates Inc
Project: 181-06417 Tyrone CCP-BMI

Report Date: 03/29/19
Work Order: B19030684

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: ASA33-8								Batch: OM_3-14-2019_10-13-46AM	
Lab ID: LCS	Laboratory Control Sample				Run: FIA205-B_190314A			03/14/19 10:14	
Nitrate as N, KCL Extract	10.8	mg/kg	1.0	99	70	130			
Lab ID: MBLK-KCL	Method Blank				Run: FIA205-B_190314A			03/14/19 10:16	
Nitrate as N, KCL Extract	ND	mg/kg	0.1						
Lab ID: B19030611-001ADUP	Sample Duplicate				Run: FIA205-B_190314A			03/14/19 10:36	
Nitrate as N, KCL Extract	8720	mg/kg-dry	290				0.7	30	
Lab ID: B19030611-001AMS	Sample Matrix Spike				Run: FIA205-B_190314A			03/14/19 10:36	
Nitrate as N, KCL Extract	12300	mg/kg-dry	300	120	70	130			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: Golder Associates Inc
Report Date: 03/29/19
Project: 181-06417 Tyrone CCP-BMI
Work Order: B19030684

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: Sobek Modified									Batch: R317322
Lab ID: B19030684-001A DUP	Sample Duplicate				Run: MISC-SOIL_190325B			03/25/19 18:32	
Neutralization Potential	29	t/kt	0.10				2.0	50	
Acid Potential	0.65	t/kt	1.0					50	
Acid/Base Potential	28	t/kt					2.2	50	
The acid-base potential was calculated from the non-sulfate sulfur %									
Lab ID: B19030684-001A DUP	Sample Duplicate				Run: MISC-SOIL_190325B			03/25/19 18:32	
Sulfur, Total	0.0173	%	0.010				16	50	
Sulfur, Hot Water Extractable	ND	%	0.010					50	
Sulfur, HCl Extractable	ND	%	0.010					50	
Sulfur, HNO3 Extractable	ND	%	0.010					50	
Sulfur, Residual	0.0204	%	0.010				1.9	50	
Lab ID: LCS-SOLO12091903251	Laboratory Control Sample				Run: MISC-SOIL_190325B			03/25/19 19:35	
Neutralization Potential	120	t/kt	0.10	124	50	150			
Acid Potential	5.9	t/kt	1.0	74	50	150			
Acid/Base Potential	120	t/kt		128	50	150			
The acid-base potential was calculated from the non-sulfate sulfur %									
Lab ID: LCS-SOLO12091903251	Laboratory Control Sample				Run: MISC-SOIL_190325B			03/25/19 19:35	
Sulfur, Total	0.188	%	0.010	90	50	150			
Sulfur, HNO3 Extractable	0.153	%	0.010	85	50	150			
Sulfur, Residual	0.0370	%	0.010	74	50	150			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: Golder Associates Inc
Project: 181-06417 Tyrone CCP-BMI

Report Date: 03/29/19
Work Order: B19030684

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **USDA27a**									Batch: R316859
Lab ID: **B19030684-001A DUP**	Sample Duplicate				Run: MISC-SOIL_190315A				03/15/19 15:07
Saturation	19.6	%	0.10				5.0	30	
Lab ID: **LCS-1903151507**	Laboratory Control Sample				Run: MISC-SOIL_190315A				03/15/19 15:07
Saturation	34.7	%	0.10	92	70	130			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

Work Order Receipt Checklist

Golder Associates Inc

B19030684

Login completed by: Richard L. Shular
Date Received: 3/11/2019
Reviewed by: BL2000\gmccartney
Received by: se
Reviewed Date: 3/12/2019
Carrier name: Return-UPS 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:	°C No Ice		
Water - VOA vials have zero headspace?	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.

Contact and Corrective Action Comments:

The temperature of the sample(s) for shipping container 1 was 4.2°C and shipping container 2 was 3.4°C.

ENERGY LABORATORIES
Trust our People. Trust our Data.

Chain of Custody & Analytical Request Record

www.energylab.com

Account Information *(Billing information)*

Company/Name	Golder Associates, Inc.
Contact	Doug Romig
Phone	(505) 821-3043
Mailing Address	5200 Pasadena Ave. NE Suite C
City, State, Zip	Albuquerque, NM 87113-2208
Email	Doug_Romig@golder.com
Receive Invoice	▣Hard Copy ▣Email
Receive Report	☐Hard Copy ▣Email
Purchase Order	
Quote	
Bottle Order	

Report Information *(if different than Account Information)*

Company/Name	cc:
Contact	Dustin Ward
Phone	
Mailing Address	
City, State, Zip	
Email	dustin_ward@golder.com
Receive Report	☐Hard Copy ▣Email

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

Comments

:) Cool beans.

Project Information

Project Name, PWSID, Permit, etc.	181-06417 Tyrone CCP-BMI
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.
☐ Unprocessed Ore
☐ Processed Ore (Ground or Refined) **CALL BEFORE SENDING
☐ 11(e)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	GC-1S-1 0-3'	3/1/19		1	S	●		B1903068 4-001
2	GC-1S-2 0-2'	3/1/19		1	S	●		-002
3	GC-1S-2 2-4'	3/1/19		1	S	●		-003
4	GC-1S-2 4-6'	3/1/19		1	S	●		-004
5	GC-1S-3 0-2'	3/1/19		1	S	●		-005
6	GC-1S-3 4-6.5'	3/1/19		1	S	●		-006
7	-NA-							
8								
9								
10								

Custody Record MUST be signed	Relinquished by (print)	Date/Time	Signature	Received by (print)	Date/Time	Signature
	Dustin S. Ward	2019-03-05 1200		Susie Edgar	3/11/19 9:10	
	Relinquished by (print)	Date/Time	Signature	Received by Laboratory (print)	Date/Time	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.

GOLDER

March 5, 2019

Project No. 18106417

Ms. Wynn Pippin
Energy Laboratories Inc.
1120 South 27th Street
Billings, MT 59107

RE: Lab Analyses for Tyrone CCP Borrow Materials

Dear Ms. Pippin

This letter accompanies two coolers containing a total of 15 soil samples from the Tyrone mine site. Please analyze the samples for the following parameters:

Test	Method
Saturated Paste pH	SLS 1954, Method 2 and 21a
Electrical Conductivity	SLS 1954, Method 3a and 4b
Saturation percentage	SLS 1954, Method 27a
Particle Size Distribution, including very fine sand	ASA 1982, Method 15-5
Rock Fragment (>2mm)	Dry sieve (No. 10)/gravimetric
N as Nitrate	ASA 1982, Method 33-8.1
Phosphorous (Olsen)	ASA 1982, Method 24-5.4
Organic Matter	ASA 1982 Method 29-3.5.2
Hot water extractable Boron	ASA 10-3
Hot water extractable Selenium	ASA Mono. #9, Part 2, Method 75-4.1
Acid-Base Account (with sulfur forms)	Acid-Base Account (with sulfur forms)

Please retain samples until we have an opportunity to review the initial lab data as we may select specific samples for additional analyses. Please call (505.821.3043) or email (dromig@golder.com) if you have any questions.

Sincerely,

GOLDER ASSOCIATES INC.

Douglas Romig, CPSS
Senior Soil Scientist

T:

APPENDIX B

Daniel B. Stephens and Associates Laboratory Reports

Laboratory Report for

Golder Associates

Project: CCP-BMI 181-06417

May 31, 2019

Daniel B. Stephens & Associates, Inc.

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

May 31, 2019

Doug Romig
Golder Associates, Inc.
5200 Pasadena NE, Suite C
Albuquerque, NM 87113
(505) 821-3043

Re: DBS&A Laboratory Report for the Golder Associates, Inc. CCP-BMI 181-06417 Project

Dear Mr. Romig:

Enclosed is the report for the Golder Associates, Inc. CCP-BMI 181-06417 project samples. Please review this report and provide any comments as samples will be held for a maximum of 30 days. After 30 days samples will be returned or disposed of in an appropriate manner.

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

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

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

Sincerely,

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

Joleen Hines
Laboratory Supervising Manager

Enclosure

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			
GC-LS-2 6-7'																		X				
GC-LS-2 6-7' (1.41 g/cc)	X	X		X			X			X	X			X								
GC-1S-2 4-6'																		X				
GC-1S-2 4-6' (1.40 g/cc)	X	X			X		X	X		X	X			X								
GC-1S-3 2-6.5'																		X				
GC-1S-3 2-6.5' (1.40 g/cc)	X	X		X			X			X	X			X								
GC-1S-4 0-2.5'																		X				
GC-1S-4 0-2.5' (1.40 g/cc)	X	X		X			X			X	X			X								
PG-9A-2 Bulk																		X				
PG-9A-2 Bulk (1.41 g/cc)	X	X		X			X			X	X			X								
PG-9A-1 Bulk																		X				
PG-9A-1 Bulk (1.41 g/cc)	X	X		X			X			X	X			X								
PG-9AX-1 Bulk																		X				
PG-9AX-1 Bulk (1.41 g/cc)	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:
Seven samples, each as loose material in a mostly full 5-gallon bucket sealed with a lid, were hand-delivered on April 5, 2019. All samples were received in good order.

Sample Preparation and Testing Notes:
Each of the samples was subjected to specific gravity testing.

A portion of each of the samples was remolded into a testing ring to target a dry bulk density of 1.40 g/cm^3 as specified by the client. Prior to remolding, particles larger than 2mm were removed from the bulk material and the moisture content of each sub-sample was adjusted in order to facilitate compaction. 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.

The actual dry bulk density achieved (in g/cm^3) was added to each sub-sample ID.

Oversize correction calculations are presented if the fraction removed was greater than 5% of the bulk sample mass.

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

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	Moisture Content (%, g/g)	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 (%)
GC-LS-2 6-7' (1.41 g/cc)	--	1.40	7.9	1.41	100.6%	1.41	---	100%	1.45	-3.0%	103%
GC-1S-2 4-6' (1.40 g/cc)	--	1.40	12.1	1.40	100.3%	1.40	---	100%	1.40	---	100%
GC-1S-3 2-6.5' (1.40 g/cc)	--	1.40	6.3	1.40	99.9%	1.40	---	100%	1.64	-14.6%	117%
GC-1S-4 0-2.5' (1.40 g/cc)	--	1.40	6.9	1.40	100.1%	1.40	---	100%	1.53	-8.1%	109%
PG-9A-2 Bulk (1.41 g/cc)	--	1.40	7.0	1.41	100.4%	1.41	---	100%	1.70	-17.2%	121%
PG-9A-1 Bulk (1.41 g/cc)	--	1.40	9.3	1.41	100.5%	1.41	---	100%	1.45	-3.1%	103%
PG-9AX-1 Bulk (1.41 g/cc)	--	1.40	8.2	1.41	100.6%	1.41	---	100%	1.46	-3.3%	103%

[1]Target Remold Parameters: Provided by the client: Remold to 1.40 g/cc at the as received moisture content.

[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)			
GC-LS-2 6-7' (1.41 g/cc)	NA	NA	7.9	11.0	1.41	1.52	47.3
GC-1S-2 4-6' (1.40 g/cc)	NA	NA	12.1	16.9	1.40	1.57	48.1
GC-1S-3 2-6.5' (1.40 g/cc)	NA	NA	6.3	8.8	1.40	1.49	47.6
GC-1S-4 0-2.5' (1.40 g/cc)	NA	NA	6.9	9.7	1.40	1.50	47.6
PG-9A-2 Bulk (1.41 g/cc)	NA	NA	7.0	9.9	1.41	1.50	47.4
PG-9A-1 Bulk (1.41 g/cc)	NA	NA	9.3	13.1	1.41	1.54	48.1
PG-9AX-1 Bulk (1.41 g/cc)	NA	NA	8.2	11.6	1.41	1.52	47.5

NA = Not analyzed

--- = This sample was not remolded

Summary of Saturated Hydraulic Conductivity Tests

Sample Number	K_{sat} (cm/sec)	Oversize Corrected K_{sat} (cm/sec)	Method of Analysis	
			Constant Head	Falling Head
GC-LS-2 6-7' (1.41 g/cc)	6.2E-03	2.1E-03	X	
GC-1S-2 4-6' (1.40 g/cc)	1.2E-05	7.6E-06		X
GC-1S-3 2-6.5' (1.40 g/cc)	4.8E-03	3.1E-03	X	
GC-1S-4 0-2.5' (1.40 g/cc)	4.1E-02	2.4E-02	X	
PG-9A-2 Bulk (1.41 g/cc)	1.1E-02	5.3E-03	X	
PG-9A-1 Bulk (1.41 g/cc)	5.2E-02	1.5E-02	X	
PG-9AX-1 Bulk (1.41 g/cc)	3.3E-02	8.2E-03	X	

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass
NR = Not requested
NA = Not applicable

Summary of Moisture Characteristics of the Initial Drainage Curve

Sample Number	Pressure Head (-cm water)	Moisture Content (%, cm^3/cm^3)
GC-LS-2 6-7' (1.41 g/cc)	0	45.4
	7	45.9 ⌗
	10	45.7 ⌗
	45	29.5 ⌗
	220	21.0 ⌗
	4487	12.2 ⌗
	27841	9.4 ⌗
	280955	5.7 ⌗
	854732	4.9 ⌗
GC-1S-2 4-6' (1.40 g/cc)	0	49.4
	18	49.0
	54	40.5
	125	35.4
	337	31.8
	16113	17.1
	52724	13.3
	296150	9.0
	854732	7.5
GC-1S-3 2-6.5' (1.40 g/cc)	0	46.6
	7	42.6 ⌗
	10	41.4 ⌗
	45	36.4 ⌗
	220	25.5 ⌗
	2855	13.6 ⌗
	24169	8.2 ⌗
	255766	4.7 ⌗
	854732	3.3 ⌗

⌗ 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)
GC-1S-4 0-2.5' (1.40 g/cc)	0	48.1
	7	46.1 ⌗
	10	43.8 ⌗
	45	24.7 ⌗
	220	13.8 ⌗
	3671	8.4 ⌗
	44667	5.5 ⌗
	236390	3.9 ⌗
	854732	3.4 ⌗
	854732	3.4 ⌗
PG-9A-2 Bulk (1.41 g/cc)	0	46.6
	7	42.8 ⌗
	10	40.6 ⌗
	45	34.6 ⌗
	220	19.5 ⌗
	5813	8.3 ⌗
	40078	4.4 ⌗
	355706	2.5 ⌗
	854732	1.9 ⌗
	854732	1.9 ⌗
PG-9A-1 Bulk (1.41 g/cc)	0	48.0
	7	47.4 ⌗
	10	41.4 ⌗
	45	24.0 ⌗
	220	17.7 ⌗
	8872	7.8 ⌗
	63839	5.1 ⌗
	318484	3.2 ⌗
	854732	2.8 ⌗
	854732	2.8 ⌗

⌗ 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)
PG-9AX-1 Bulk (1.41 g/cc)	0	47.2
	7	46.1
	10	41.1 ⌗
	45	24.8 ⌗
	220	17.8 ⌗
	3263	10.3 ⌗
	47931	5.1 ⌗
	228333	4.3 ⌗
	854732	2.9 ⌗
	854732	2.9 ⌗

⌗ 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)
GC-LS-2 6-7' (1.41 g/cc)	0.0623	1.3862	5.69	47.63	2.77	23.55
GC-1S-2 4-6' (1.40 g/cc)	0.0430	1.1756	0.00	50.46	0.00	39.22
GC-1S-3 2-6.5' (1.40 g/cc)	0.0470	1.2422	0.00	45.38	0.00	35.41
GC-1S-4 0-2.5' (1.40 g/cc)	0.0651	1.6073	4.40	49.23	3.12	35.76
PG-9A-2 Bulk (1.41 g/cc)	0.0495	1.3279	0.62	45.60	0.37	29.32
PG-9A-1 Bulk (1.41 g/cc)	0.0923	1.4348	3.41	49.67	1.43	21.16
PG-9AX-1 Bulk (1.41 g/cc)	0.0976	1.3909	3.28	48.72	1.25	18.87

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

NR = Not requested

NA = Not applicable

Summary of Specific Gravity Tests

	<4.75 mm Fraction			>4.75 mm Fraction			Bulk Sample
Sample Number	Specific Gravity	Particle Size	% of Bulk Sample	Specific Gravity	Particle Size	% of Bulk Sample	Specific Gravity[1]
GC-LS-2 6-7	2.67	<4.75 mm	34.0%	NR	>4.75 mm	66.0%	2.67
GC-1S-2 4-6	2.71	<4.75 mm	64.4%	NR	>4.75 mm	35.6%	2.71
GC-1S-3 2-6.5	2.67	<4.75 mm	65.0%	NR	>4.75 mm	35.0%	2.67
GC-1S-4 0-2.5	2.68	<4.75 mm	58.2%	NR	>4.75 mm	41.8%	2.68
PG-9A-2 Bulk	2.68	<4.75 mm	48.6%	NR	>4.75 mm	51.4%	2.68
PG-9A-1 Bulk	2.71	<4.75 mm	27.8%	NR	>4.75 mm	72.2%	2.71
PG-9AX-1 Bulk	2.69	<4.75 mm	24.9%	NR	>4.75 mm	75.1%	2.69

[1]Based on the <4.75mm material

NA = Not Applicable since specificed fraction is less than 5% of composite sample mass

NR = Test not Requested

Initial Properties

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

Sample Number	Moisture Content				Dry Bulk Density (g/cm^3)	Wet Bulk Density (g/cm^3)	Calculated Porosity (%)
	As Received		Remolded				
	Gravimetric (%, g/g)	Volumetric (%, cm^3/cm^3)	Gravimetric (%, g/g)	Volumetric (%, cm^3/cm^3)			
GC-LS-2 6-7' (1.41 g/cc)	NA	NA	7.9	11.0	1.41	1.52	47.3
GC-1S-2 4-6' (1.40 g/cc)	NA	NA	12.1	16.9	1.40	1.57	48.1
GC-1S-3 2-6.5' (1.40 g/cc)	NA	NA	6.3	8.8	1.40	1.49	47.6
GC-1S-4 0-2.5' (1.40 g/cc)	NA	NA	6.9	9.7	1.40	1.50	47.6
PG-9A-2 Bulk (1.41 g/cc)	NA	NA	7.0	9.9	1.41	1.50	47.4
PG-9A-1 Bulk (1.41 g/cc)	NA	NA	9.3	13.1	1.41	1.54	48.1
PG-9AX-1 Bulk (1.41 g/cc)	NA	NA	8.2	11.6	1.41	1.52	47.5

NA = Not analyzed

--- = This sample was not remolded

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

Job Name: Golder Associates, Inc.
Job Number: DB19.1112.00
Sample Number: GC-LS-2 6-7' (1.41 g/cc)
Project Name: CCP-BMI 181-06417
Depth: 6'-7'

	As Received	Remolded
Test Date:	NA	14-Apr-19
Field weight of sample* (g)*:*		473.28
Tare weight, ring (g)*:*		136.97
Tare weight, pan/plate (g)*:*		0.00
Tare weight, other (g)*:*		0.00
Dry weight of sample (g)*:*		311.83
Sample volume (cm^3)*:*		221.58
Measured particle density (g/cm^3)*:*		2.67
Gravimetric Moisture Content (% g/g)*:*		7.9
Volumetric Moisture Content (% vol)*:*		11.0
Dry bulk density (g/cm^3)*:*		1.41
Wet bulk density (g/cm^3)*:*		1.52
Calculated Porosity (% vol)*:*		47.3
Percent Saturation:		23.4

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

Comments:

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

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

Job Name: Golder Associates, Inc.
Job Number: DB19.1112.00
Sample Number: GC-1S-2 4-6' (1.40 g/cc)
Project Name: CCP-BMI 181-06417
Depth: 4'-6'

	As Received	Remolded
Test Date:	NA	14-Apr-19
Field weight of sample* (g)*:*		482.40
Tare weight, ring (g)*:*		136.14
Tare weight, pan/plate (g)*:*		0.00
Tare weight, other (g)*:*		0.00
Dry weight of sample (g)*:*		309.01
Sample volume (cm^3)*:*		220.14
Measured particle density (g/cm^3)*:*		2.71
Gravimetric Moisture Content (% g/g)*:*		12.1
Volumetric Moisture Content (% vol)*:*		16.9
Dry bulk density (g/cm^3)*:*		1.40
Wet bulk density (g/cm^3)*:*		1.57
Calculated Porosity (% vol)*:*		48.1
Percent Saturation:		35.2

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

Comments:

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

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

Job Name: Golder Associates, Inc.
Job Number: DB19.1112.00
Sample Number: GC-1S-3 2-6.5' (1.40 g/cc)
Project Name: CCP-BMI 181-06417
Depth: 2'-6.5'

	As Received	Remolded
Test Date:	NA	14-Apr-19
Field weight of sample* (g)*:*		462.90
Tare weight, ring (g)*:*		136.40
Tare weight, pan/plate (g)*:*		0.00
Tare weight, other (g)*:*		0.00
Dry weight of sample (g)*:*		307.23
Sample volume (cm^3)*:*		219.83
Measured particle density (g/cm^3)*:*		2.67
Gravimetric Moisture Content (% g/g)*:*		6.3
Volumetric Moisture Content (% vol)*:*		8.8
Dry bulk density (g/cm^3)*:*		1.40
Wet bulk density (g/cm^3)*:*		1.49
Calculated Porosity (% vol)*:*		47.6
Percent Saturation:		18.4

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

Comments:

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

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

Job Name: Golder Associates, Inc.
Job Number: DB19.1112.00
Sample Number: GC-1S-4 0-2.5' (1.40 g/cc)
Project Name: CCP-BMI 181-06417
Depth: 0'-2.5'

	As Received	Remolded
Test Date:	NA	14-Apr-19
Field weight of sample* (g)*:*		469.20
Tare weight, ring (g)*:*		137.39
Tare weight, pan/plate (g)*:*		0.00
Tare weight, other (g)*:*		0.00
Dry weight of sample (g)*:*		310.43
Sample volume (cm^3)*:*		221.54
Measured particle density (g/cm^3)*:*		2.68
Gravimetric Moisture Content (% g/g)*:*		6.9
Volumetric Moisture Content (% vol)*:*		9.7
Dry bulk density (g/cm^3)*:*		1.40
Wet bulk density (g/cm^3)*:*		1.50
Calculated Porosity (% vol)*:*		47.6
Percent Saturation:		20.3

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

Comments:

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

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

Job Name: Golder Associates, Inc.
Job Number: DB19.1112.00
Sample Number: PG-9A-2 Bulk (1.41 g/cc)
Project Name: CCP-BMI 181-06417
Depth: NA

	As Received	Remolded
Test Date:	NA	14-Apr-19
Field weight of sample* (g)*:*		468.80
Tare weight, ring (g)*:*		137.59
Tare weight, pan/plate (g)*:*		0.00
Tare weight, other (g)*:*		0.00
Dry weight of sample (g)*:*		309.42
Sample volume (cm^3)*:*		220.15
Measured particle density (g/cm^3)*:*		2.67

Gravimetric Moisture Content (% g/g)*:*	7.0
Volumetric Moisture Content (% vol)*:*	9.9
Dry bulk density (g/cm^3)*:*	1.41
Wet bulk density (g/cm^3)*:*	1.50
Calculated Porosity (% vol)*:*	47.4
Percent Saturation:	20.9

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

Comments:

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

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

Job Name: Golder Associates, Inc.
Job Number: DB19.1112.00
Sample Number: PG-9A-1 Bulk (1.41 g/cc)
Project Name: CCP-BMI 181-06417
Depth: NA

	As Received	Remolded
Test Date:	NA	14-Apr-19
Field weight of sample* (g)*:*		477.80
Tare weight, ring (g)*:*		137.88
Tare weight, pan/plate (g)*:*		0.00
Tare weight, other (g)*:*		0.00
Dry weight of sample (g)*:*		310.94
Sample volume (cm^3)*:*		221.16
Measured particle density (g/cm^3)*:*		2.71

Gravimetric Moisture Content (% g/g)*:*	9.3
Volumetric Moisture Content (% vol)*:*	13.1
Dry bulk density (g/cm^3)*:*	1.41
Wet bulk density (g/cm^3)*:*	1.54
Calculated Porosity (% vol)*:*	48.1
Percent Saturation:	27.2

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

Comments:

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

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

Job Name: Golder Associates, Inc.
Job Number: DB19.1112.00
Sample Number: PG-9AX-1 Bulk (1.41 g/cc)
Project Name: CCP-BMI 181-06417
Depth: NA

	As Received	Remolded
Test Date:	NA	14-Apr-19
Field weight of sample* (g)*:*		471.96
Tare weight, ring (g)*:*		137.07
Tare weight, pan/plate (g)*:*		0.00
Tare weight, other (g)*:*		0.00
Dry weight of sample (g)*:*		309.47
Sample volume (cm^3)*:*		219.83
Measured particle density (g/cm^3)*:*		2.68

Gravimetric Moisture Content (% g/g)*:*	8.2
Volumetric Moisture Content (% vol)*:*	11.6
Dry bulk density (g/cm^3)*:*	1.41
Wet bulk density (g/cm^3)*:*	1.52
Calculated Porosity (% vol)*:*	47.5
Percent Saturation:	24.3

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

Comments:

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

Saturated Hydraulic Conductivity

Summary of Saturated Hydraulic Conductivity Tests

Sample Number	K_{sat} (cm/sec)	Oversize Corrected K_{sat} (cm/sec)	Method of Analysis	
			Constant Head	Falling Head
GC-LS-2 6-7' (1.41 g/cc)	6.2E-03	2.1E-03	X	
GC-1S-2 4-6' (1.40 g/cc)	1.2E-05	7.6E-06		X
GC-1S-3 2-6.5' (1.40 g/cc)	4.8E-03	3.1E-03	X	
GC-1S-4 0-2.5' (1.40 g/cc)	4.1E-02	2.4E-02	X	
PG-9A-2 Bulk (1.41 g/cc)	1.1E-02	5.3E-03	X	
PG-9A-1 Bulk (1.41 g/cc)	5.2E-02	1.5E-02	X	
PG-9AX-1 Bulk (1.41 g/cc)	3.3E-02	8.2E-03	X	

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass
NR = Not requested
NA = Not applicable

Saturated Hydraulic Conductivity
Constant Head Method

Job Name: Golder Associates, Inc.
Job Number: DB19.1112.00
Sample Number: GC-LS-2 6-7' (1.41 g/cc)
Project Name: CCP-BMI 181-06417
Depth: 6'-7'

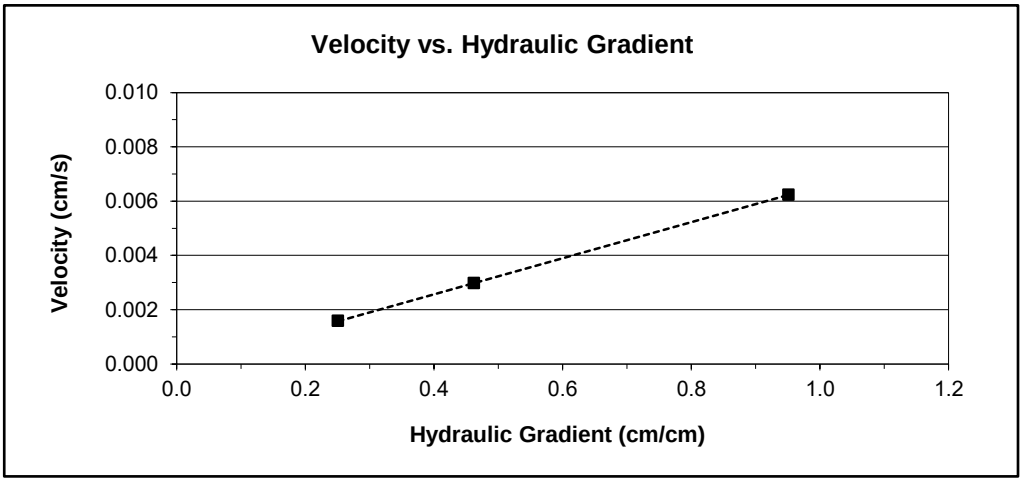
Type of water used: TAP
Collection vessel tare (g)*:* 10.99
Sample length (cm)*:* 7.57
Sample diameter (cm)*:* 6.11
Sample x-sectional area (cm^2)*:* 29.28

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:								
17-Apr-19	16:24:00	21.5	7.2	32.89	21.9	120	6.6E-03	6.3E-03
17-Apr-19	16:26:00							
Test # 2:								
17-Apr-19	16:38:00	21.5	3.5	21.42	10.4	120	6.4E-03	6.2E-03
17-Apr-19	16:40:00							
Test # 3:								
17-Apr-19	17:09:00	21.5	1.9	16.54	5.6	120	6.3E-03	6.1E-03
17-Apr-19	17:11:00							

Average Ksat* (cm/sec)*: **6.2E-03**
Oversize Corrected Ksat* (cm/sec)*: **2.1E-03**

Comments:

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



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

Oversize Correction Data Sheet

Job Name: Golder Associates, Inc.
Job Number: DB19.1112.00
Sample Number: GC-LS-2 6-7' (1.41 g/cc)
Project Name: CCP-BMI 181-06417
Depth: 6'-7'

Split (3/4", 3/8", #4): #10
Calculated Porosity of Fines (% vol)*:* 47.3

	Coarse Fraction*	Fines Fraction	Composite
Subsample Mass (g)*:*	14554.51	7506.58	22061.09
Bulk Density (g/cm^3)*:*	2.67	1.41	2.04
Volume of Solids (cm^3)*:*	5454.51	2813.20	8267.71
Volume of Voids (cm^3)*:*	0.00	2520.78	2520.78
Total Volume (cm^3)*:*	5454.51	5333.98	10788.49
Volumetric Fraction (%)*:*	50.56	49.44	100.00
Mass Fraction (%)*:*	65.97	34.03	100.00
Ksat (cm/sec)*:*	NM	6.2E-03	2.1E-03

* = Porosity and moisture content of coarse fraction assumed to be zero.
--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass
NM = Not measured

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

Saturated Hydraulic Conductivity
Falling Head Method

Job Name: Golder Associates, Inc.
Job Number: DB19.1112.00
Sample Number: GC-1S-2 4-6' (1.40 g/cc)
Project Name: CCP-BMI 181-06417
Depth: 4'-6'

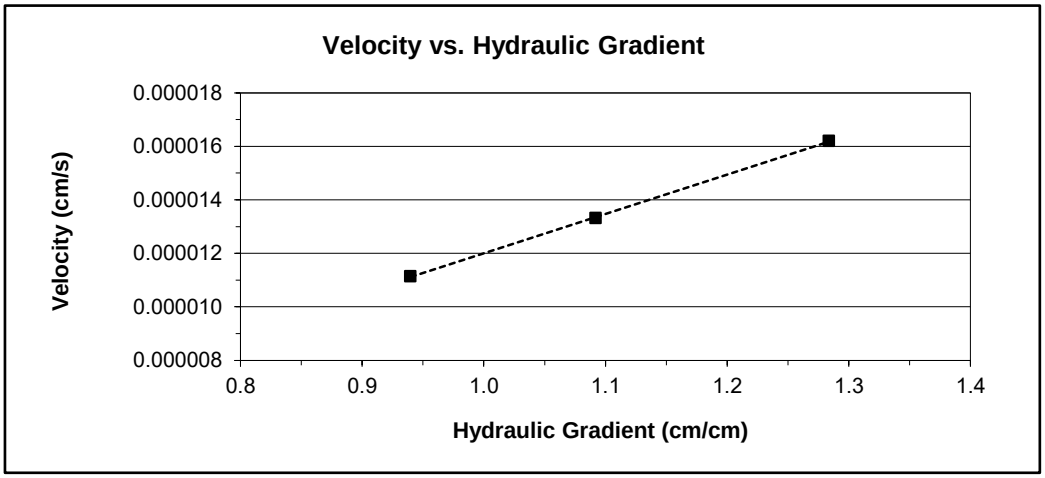
Type of water used: TAP
Backpressure (psi)*:* 0.0
Offset (cm)*:* 3.8
Sample length (cm)*:* 7.56
Sample x-sectional area (cm^2)*:* 29.14
Reservoir x-sectional area (cm^2)*:* 0.70

Date	Time	Temp (°C)	Reservoir head (cm)	Corrected head (cm)	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1:							
19-Apr-19	14:51:30	21.4	14.4	10.6	2671	1.3E-05	1.2E-05
19-Apr-19	15:36:01	21.4	12.6	8.8			
Test # 2:							
19-Apr-19	15:36:01	21.4	12.6	8.8	1985	1.2E-05	1.2E-05
19-Apr-19	16:09:06	21.4	11.5	7.7			
Test # 3:							
19-Apr-19	16:09:06	21.4	11.5	7.7	2589	1.2E-05	1.2E-05
19-Apr-19	16:52:15	21.4	10.3	6.5			

Average Ksat* (cm/sec)*: **1.2E-05**
Oversize Corrected Ksat* (cm/sec)*: **7.6E-06**

Comments:

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



Laboratory analysis by: A. Bland
Data entered by: A. Bland
Checked by: J. Hines

Oversize Correction Data Sheet

Job Name: Golder Associates, Inc.
Job Number: DB19.1112.00
Sample Number: GC-1S-2 4-6' (1.40 g/cc)
Project Name: CCP-BMI 181-06417
Depth: 4'-6'

Split (3/4", 3/8", #4): #10
Calculated Porosity of Fines (% vol)*:* 48.1

	Coarse Fraction*	Fines Fraction	Composite
Subsample Mass (g)*:*	6291.16	11388.65	17679.81
Bulk Density (g/cm^3)*:*	2.71	1.40	1.69
Volume of Solids (cm^3)*:*	2324.80	4208.50	6533.31
Volume of Voids (cm^3)*:*	0.00	3904.87	3904.87
Total Volume (cm^3)*:*	2324.80	8113.37	10438.17
Volumetric Fraction (%)*:*	22.27	77.73	100.00
Mass Fraction (%)*:*	35.58	64.42	100.00
Ksat (cm/sec)*:*	NM	1.2E-05	7.6E-06

* = Porosity and moisture content of coarse fraction assumed to be zero.
--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass
NM = Not measured

Laboratory analysis by: A. Bland
Data entered by: A. Bland
Checked by: J. Hines

Saturated Hydraulic Conductivity
Constant Head Method

Job Name: Golder Associates, Inc.
Job Number: DB19.1112.00
Sample Number: GC-1S-3 2-6.5' (1.40 g/cc)
Project Name: CCP-BMI 181-06417
Depth: 2'-6.5'

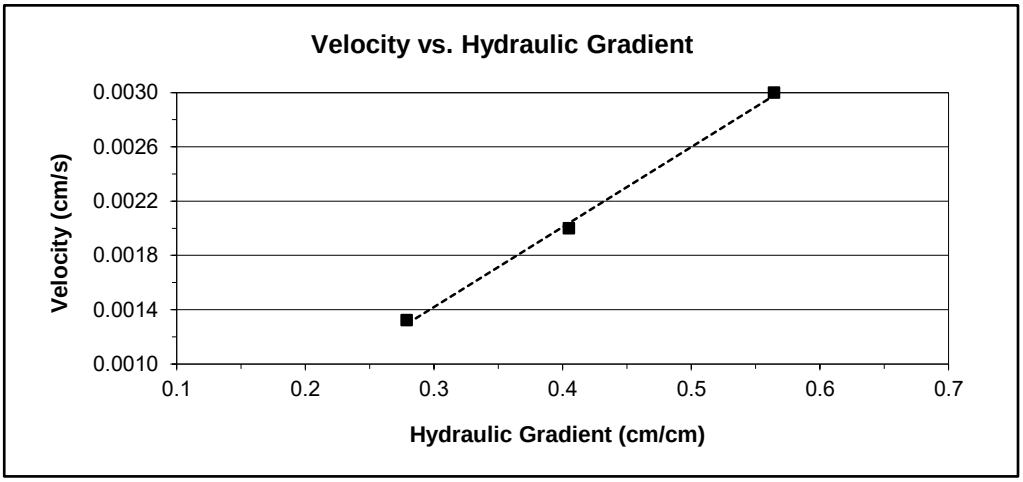
Type of water used: TAP
Collection vessel tare (g)*:* 11.02
Sample length (cm)*:* 7.53
Sample diameter (cm)*:* 6.10
Sample x-sectional area (cm^2)*:* 29.21

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:								
17-Apr-19	16:29:30	21.5	4.25	21.53	10.5	120	5.3E-03	5.1E-03
17-Apr-19	16:31:30							
Test # 2:								
17-Apr-19	16:44:00	21.5	3.05	18.02	7.0	120	4.9E-03	4.8E-03
17-Apr-19	16:46:00							
Test # 3:								
17-Apr-19	17:15:00	21.5	2.1	15.65	4.6	120	4.7E-03	4.6E-03
17-Apr-19	17:17:00							

Average Ksat* (cm/sec)*: **4.8E-03**
Oversize Corrected Ksat* (cm/sec)*: **3.1E-03**

Comments:

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



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

Oversize Correction Data Sheet

Job Name: Golder Associates, Inc.
Job Number: DB19.1112.00
Sample Number: GC-1S-3 2-6.5' (1.40 g/cc)
Project Name: CCP-BMI 181-06417
Depth: 2'-6.5'

Split (3/4", 3/8", #4): #10
Calculated Porosity of Fines (% vol)*:* 47.6

	Coarse Fraction*	Fines Fraction	Composite
Subsample Mass (g)*:*	7929.97	14745.71	22675.68
Bulk Density (g/cm^3)*:*	2.67	1.40	1.68
Volume of Solids (cm^3)*:*	2972.52	5527.37	8499.89
Volume of Voids (cm^3)*:*	0.00	5023.51	5023.51
Total Volume (cm^3)*:*	2972.52	10550.88	13523.40
Volumetric Fraction (%)*:*	21.98	78.02	100.00
Mass Fraction (%)*:*	34.97	65.03	100.00
Ksat (cm/sec)*:*	NM	4.8E-03	3.1E-03

* = Porosity and moisture content of coarse fraction assumed to be zero.
--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass
NM = Not measured

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

Saturated Hydraulic Conductivity
Constant Head Method

Job Name: Golder Associates, Inc.
Job Number: DB19.1112.00
Sample Number: GC-1S-4 0-2.5' (1.40 g/cc)
Project Name: CCP-BMI 181-06417
Depth: 0'-2.5'

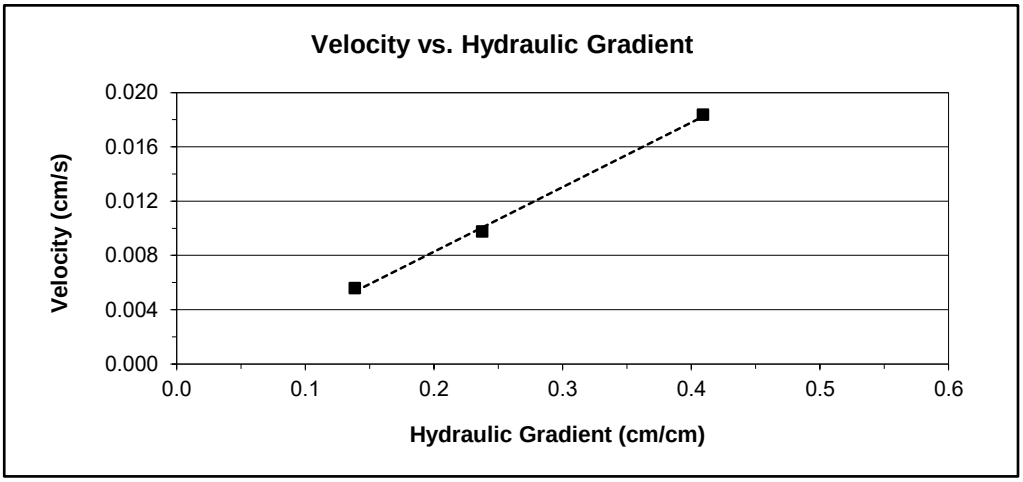
Type of water used: TAP
Collection vessel tare (g)*:* 29.46
Sample length (cm)*:* 7.57
Sample diameter (cm)*:* 6.10
Sample x-sectional area (cm^2)*:* 29.25

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:								
17-Apr-19	16:27:00	21.5	3.1	61.69	32.2	60	4.5E-02	4.3E-02
17-Apr-19	16:28:00							
Test # 2:								
17-Apr-19	16:41:00	21.5	1.8	63.67	34.2	120	4.1E-02	4.0E-02
17-Apr-19	16:43:00							
Test # 3:								
17-Apr-19	17:12:00	21.5	1.05	48.98	19.5	120	4.0E-02	3.9E-02
17-Apr-19	17:14:00							

Average Ksat* (cm/sec)*: **4.1E-02**
Oversize Corrected Ksat* (cm/sec)*: **2.4E-02**

Comments:

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



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

Oversize Correction Data Sheet

Job Name: Golder Associates, Inc.
Job Number: DB19.1112.00
Sample Number: GC-1S-4 0-2.5' (1.40 g/cc)
Project Name: CCP-BMI 181-06417
Depth: 0'-2.5'

Split (3/4", 3/8", #4): #10
Calculated Porosity of Fines (% vol)*:* 47.6

	Coarse Fraction*	Fines Fraction	Composite
Subsample Mass (g)*:*	10756.69	14967.81	25724.50
Bulk Density (g/cm^3)*:*	2.68	1.40	1.75
Volume of Solids (cm^3)*:*	4020.90	5595.04	9615.94
Volume of Voids (cm^3)*:*	0.00	5086.63	5086.63
Total Volume (cm^3)*:*	4020.90	10681.67	14702.57
Volumetric Fraction (%)*:*	27.35	72.65	100.00
Mass Fraction (%)*:*	41.81	58.19	100.00
Ksat (cm/sec)*:*	NM	4.1E-02	2.4E-02

* = Porosity and moisture content of coarse fraction assumed to be zero.
--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass
NM = Not measured

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

Saturated Hydraulic Conductivity
Constant Head Method

Job Name: Golder Associates, Inc.
Job Number: DB19.1112.00
Sample Number: PG-9A-2 Bulk (1.41 g/cc)
Project Name: CCP-BMI 181-06417
Depth: NA

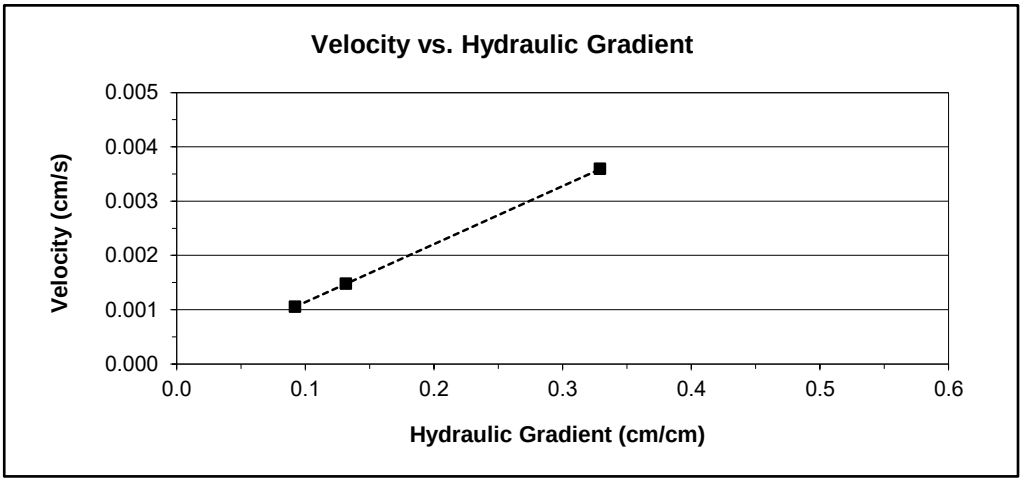
Type of water used: TAP
Collection vessel tare (g)*:* 10.96
Sample length (cm)*:* 7.60
Sample diameter (cm)*:* 6.08
Sample x-sectional area (cm^2)*:* 28.99

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:								
17-Apr-19	16:29:00	21.5	2.5	23.45	12.5	120	1.1E-02	1.1E-02
17-Apr-19	16:31:00							
Test # 2:								
17-Apr-19	16:43:30	21.5	1	16.10	5.1	120	1.1E-02	1.1E-02
17-Apr-19	16:45:30							
Test # 3:								
17-Apr-19	17:14:30	21.5	0.7	14.62	3.7	120	1.1E-02	1.1E-02
17-Apr-19	17:16:30							

Average Ksat* (cm/sec)*: **1.1E-02**
Oversize Corrected Ksat* (cm/sec)*: **5.3E-03**

Comments:

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



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

Oversize Correction Data Sheet

Job Name: Golder Associates, Inc.
Job Number: DB19.1112.00
Sample Number: PG-9A-2 Bulk (1.41 g/cc)
Project Name: CCP-BMI 181-06417
Depth: NA

Split (3/4", 3/8", #4): #10
Calculated Porosity of Fines (% vol)*:* 47.4

	Coarse Fraction*	Fines Fraction	Composite
Subsample Mass (g)*:*	12678.51	12004.12	24682.63
Bulk Density (g/cm^3)*:*	2.67	1.41	1.86
Volume of Solids (cm^3)*:*	4742.58	4490.31	9232.89
Volume of Voids (cm^3)*:*	0.00	4050.36	4050.36
Total Volume (cm^3)*:*	4742.58	8540.67	13283.25
Volumetric Fraction (%)*:*	35.70	64.30	100.00
Mass Fraction (%)*:*	51.37	48.63	100.00
Ksat (cm/sec)*:*	NM	1.1E-02	5.3E-03

* = Porosity and moisture content of coarse fraction assumed to be zero.
--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass
NM = Not measured

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

Saturated Hydraulic Conductivity
Constant Head Method

Job Name: Golder Associates, Inc.
Job Number: DB19.1112.00
Sample Number: PG-9A-1 Bulk (1.41 g/cc)
Project Name: CCP-BMI 181-06417
Depth: NA

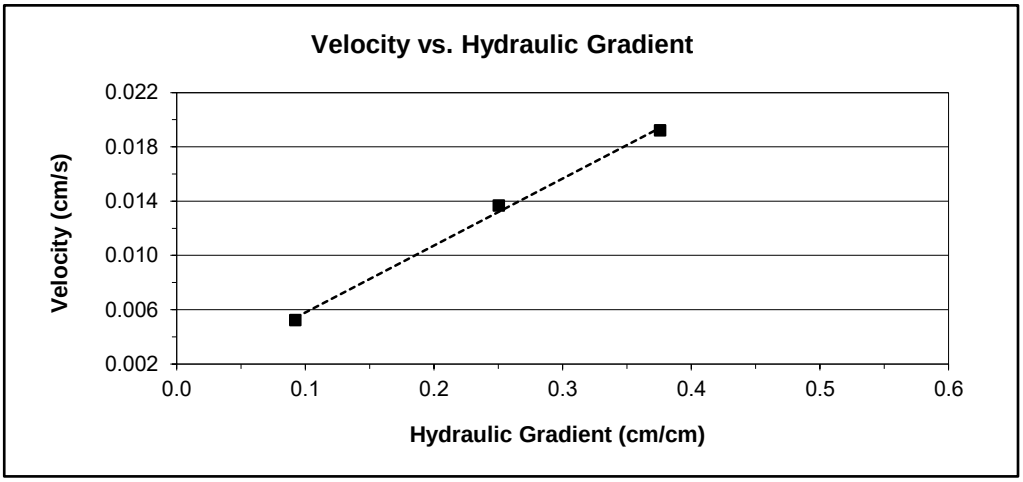
Type of water used: TAP
Collection vessel tare (g)*:* 51.06
Sample length (cm)*:* 7.58
Sample diameter (cm)*:* 6.10
Sample x-sectional area (cm^2)*:* 29.18

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:								
17-Apr-19	16:23:30	21.5	2.85	118.26	67.2	120	5.1E-02	4.9E-02
17-Apr-19	16:25:30							
Test # 2:								
17-Apr-19	16:37:30	21.5	1.9	98.86	47.8	120	5.4E-02	5.3E-02
17-Apr-19	16:39:30							
Test # 3:								
17-Apr-19	17:08:30	21.5	0.7	69.32	18.3	120	5.6E-02	5.5E-02
17-Apr-19	17:10:30							

Average Ksat* (cm/sec)*: **5.2E-02**
Oversize Corrected Ksat* (cm/sec)*: **1.5E-02**

Comments:

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



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

Oversize Correction Data Sheet

Job Name: Golder Associates, Inc.
Job Number: DB19.1112.00
Sample Number: PG-9A-1 Bulk (1.41 g/cc)
Project Name: CCP-BMI 181-06417
Depth: NA

Split (3/4", 3/8", #4): #10
Calculated Porosity of Fines (% vol)*:* 48.1

	Coarse Fraction*	Fines Fraction	Composite
Subsample Mass (g)*:*	18031.67	6946.72	24978.39
Bulk Density (g/cm^3)*:*	2.71	1.41	2.15
Volume of Solids (cm^3)*:*	6657.48	2564.80	9222.29
Volume of Voids (cm^3)*:*	0.00	2376.14	2376.14
Total Volume (cm^3)*:*	6657.48	4940.94	11598.43
Volumetric Fraction (%)*:*	57.40	42.60	100.00
Mass Fraction (%)*:*	72.19	27.81	100.00
Ksat (cm/sec)*:*	NM	5.2E-02	1.5E-02

* = Porosity and moisture content of coarse fraction assumed to be zero.
--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass
NM = Not measured

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

Saturated Hydraulic Conductivity
Constant Head Method

Job Name: Golder Associates, Inc.
Job Number: DB19.1112.00
Sample Number: PG-9AX-1 Bulk (1.41 g/cc)
Project Name: CCP-BMI 181-06417
Depth: NA

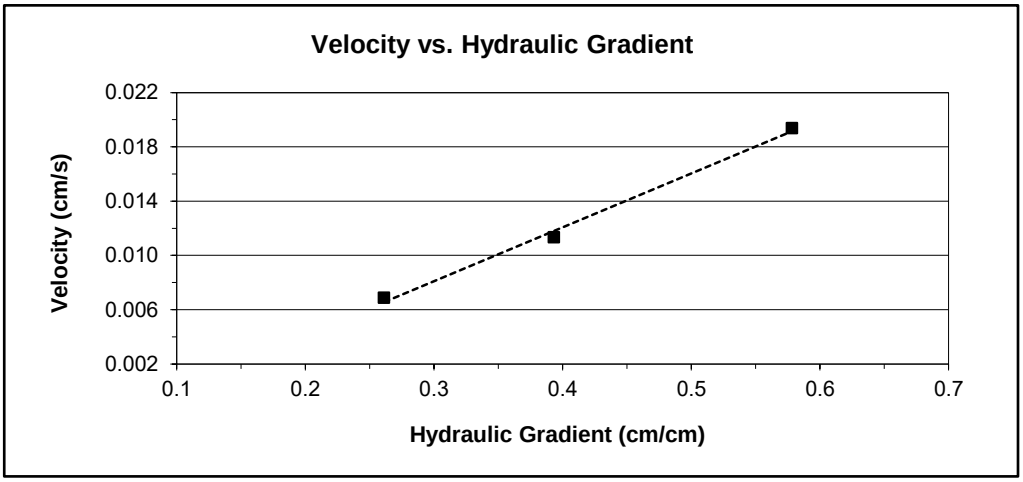
Type of water used: TAP
Collection vessel tare (g)*:* 29.08
Sample length (cm)*:* 7.57
Sample diameter (cm)*:* 6.08
Sample x-sectional area (cm^2)*:* 29.04

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:								
17-Apr-19	15:58:30	21.5	4	62.83	33.8	60	3.7E-02	3.5E-02
17-Apr-19	15:59:30							
Test # 2:								
17-Apr-19	16:40:30	21.5	2.6	68.53	39.5	120	3.3E-02	3.2E-02
17-Apr-19	16:42:30							
Test # 3:								
17-Apr-19	17:11:30	21.5	1.6	53.01	23.9	120	3.2E-02	3.1E-02
17-Apr-19	17:13:30							

Average Ksat* (cm/sec)*: **3.3E-02**
Oversize Corrected Ksat* (cm/sec)*: **8.2E-03**

Comments:

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



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

Oversize Correction Data Sheet

Job Name: Golder Associates, Inc.
Job Number: DB19.1112.00
Sample Number: PG-9AX-1 Bulk (1.41 g/cc)
Project Name: CCP-BMI 181-06417
Depth: NA

Split (3/4", 3/8", #4): #10
Calculated Porosity of Fines (% vol)*:* 47.5

	Coarse Fraction*	Fines Fraction	Composite
Subsample Mass (g)*:*	17580.25	5830.02	23410.27
Bulk Density (g/cm^3)*:*	2.68	1.41	2.19
Volume of Solids (cm^3)*:*	6551.37	2172.59	8723.95
Volume of Voids (cm^3)*:*	0.00	1968.65	1968.65
Total Volume (cm^3)*:*	6551.37	4141.24	10692.60
Volumetric Fraction (%)*:*	61.27	38.73	100.00
Mass Fraction (%)*:*	75.10	24.90	100.00
Ksat (cm/sec)*:*	NM	3.3E-02	8.2E-03

* = Porosity and moisture content of coarse fraction assumed to be zero.
--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass
NM = Not measured

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

Moisture Retention Characteristics

Summary of Moisture Characteristics of the Initial Drainage Curve

Sample Number	Pressure Head (-cm water)	Moisture Content (%, cm^3/cm^3)
GC-LS-2 6-7' (1.41 g/cc)	0	45.4
	7	45.9 ⌗
	10	45.7 ⌗
	45	29.5 ⌗
	220	21.0 ⌗
	4487	12.2 ⌗
	27841	9.4 ⌗
	280955	5.7 ⌗
	854732	4.9 ⌗
GC-1S-2 4-6' (1.40 g/cc)	0	49.4
	18	49.0
	54	40.5
	125	35.4
	337	31.8
	16113	17.1
	52724	13.3
	296150	9.0
	854732	7.5
GC-1S-3 2-6.5' (1.40 g/cc)	0	46.6
	7	42.6 ⌗
	10	41.4 ⌗
	45	36.4 ⌗
	220	25.5 ⌗
	2855	13.6 ⌗
	24169	8.2 ⌗
	255766	4.7 ⌗
	854732	3.3 ⌗

⌗ 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)
GC-1S-4 0-2.5' (1.40 g/cc)	0	48.1
	7	46.1 ⌗
	10	43.8 ⌗
	45	24.7 ⌗
	220	13.8 ⌗
	3671	8.4 ⌗
	44667	5.5 ⌗
	236390	3.9 ⌗
	854732	3.4 ⌗
	854732	3.4 ⌗
PG-9A-2 Bulk (1.41 g/cc)	0	46.6
	7	42.8 ⌗
	10	40.6 ⌗
	45	34.6 ⌗
	220	19.5 ⌗
	5813	8.3 ⌗
	40078	4.4 ⌗
	355706	2.5 ⌗
	854732	1.9 ⌗
	854732	1.9 ⌗
PG-9A-1 Bulk (1.41 g/cc)	0	48.0
	7	47.4 ⌗
	10	41.4 ⌗
	45	24.0 ⌗
	220	17.7 ⌗
	8872	7.8 ⌗
	63839	5.1 ⌗
	318484	3.2 ⌗
	854732	2.8 ⌗
	854732	2.8 ⌗

⌗ 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)
PG-9AX-1 Bulk (1.41 g/cc)	0	47.2
	7	46.1
	10	41.1 ⌗
	45	24.8 ⌗
	220	17.8 ⌗
	3263	10.3 ⌗
	47931	5.1 ⌗
	228333	4.3 ⌗
	854732	2.9 ⌗
	854732	2.9 ⌗

⌗ 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)
GC-LS-2 6-7' (1.41 g/cc)	0.0623	1.3862	5.69	47.63	2.77	23.55
GC-1S-2 4-6' (1.40 g/cc)	0.0430	1.1756	0.00	50.46	0.00	39.22
GC-1S-3 2-6.5' (1.40 g/cc)	0.0470	1.2422	0.00	45.38	0.00	35.41
GC-1S-4 0-2.5' (1.40 g/cc)	0.0651	1.6073	4.40	49.23	3.12	35.76
PG-9A-2 Bulk (1.41 g/cc)	0.0495	1.3279	0.62	45.60	0.37	29.32
PG-9A-1 Bulk (1.41 g/cc)	0.0923	1.4348	3.41	49.67	1.43	21.16
PG-9AX-1 Bulk (1.41 g/cc)	0.0976	1.3909	3.28	48.72	1.25	18.87

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

NR = Not requested

NA = Not applicable

Moisture Retention Data

Hanging Column / Pressure Plate

(Soil-Water Characteristic Curve)

Job Name: Golder Associates, Inc.
Job Number: DB19.1112.00
Sample Number: GC-LS-2 6-7' (1.41 g/cc)
Project Name: CCP-BMI 181-06417
Depth: 6'-7'

Dry wt. of sample (g): 311.83
Tare wt., ring (g): 136.97
Tare wt., screen & clamp (g): 27.58
Initial sample volume (cm^3): 221.58
Initial dry bulk density (g/cm^3): 1.41
Measured particle density (g/cm^3): 2.67
Initial calculated total porosity (%): 47.26

	Date	Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content † (% vol)	
Hanging column:	18-Apr-19	8:00	577.00	0	45.41	
	25-Apr-19	13:50	577.35	7.0	45.94	‡‡
	2-May-19	7:45	574.57	10.0	45.68	‡‡
	9-May-19	8:30	539.77	45.0	29.49	‡‡
	16-May-19	10:45	521.42	220.0	20.95	‡‡

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	---	---	---	---
	7.0	219.76	-0.82%	1.42	46.82
	10.0	214.96	-2.99%	1.45	45.64
	45.0	214.96	-2.99%	1.45	45.64
	220.0	214.96	-2.99%	1.45	45.64

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/A. Bland
Data entered by: C. Krous
Checked by: J. Hines

Moisture Retention Data

Dew Point Potentiometer / Relative Humidity Box

(Soil-Water Characteristic Curve)

Sample Number: GC-LS-2 6-7' (1.41 g/cc)

Initial sample bulk density (g/cm^3)*:* 1.41

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

Dry weight of dew point potentiometer sample* (g)*:* 172.35

Tare weight, jar (g)*:* 114.84

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content † (% vol)	
Dew point potentiometer:	23-May-19	10:45	177.20	4487	12.24	‡‡
	20-May-19	10:39	176.07	27841	9.39	‡‡
	14-May-19	11:46	174.62	280955	5.73	‡‡

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:	4487	214.96	-2.99%	1.45	45.64
	27841	214.96	-2.99%	1.45	45.64
	280955	214.96	-2.99%	1.45	45.64

Dry weight of relative humidity box sample* (g)*:* 73.22

Tare weight (g)*:* 41.74

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content † (% vol)	
Relative humidity box:	16-May-19	17:00	74.28	854732	4.89	‡‡

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:	854732	214.96	-2.99%	1.45	45.64

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.

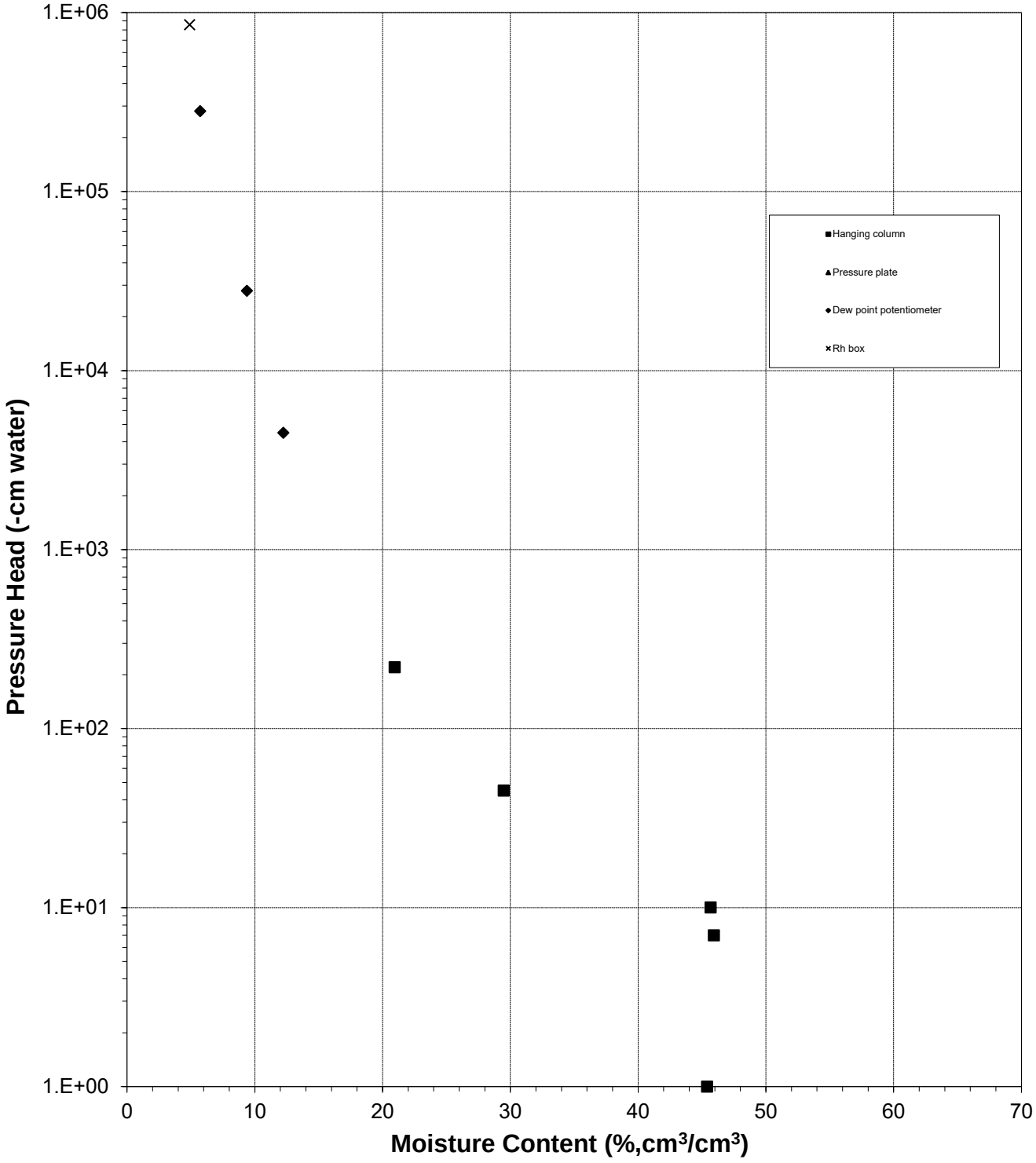
Laboratory analysis by: L. Thurgood/C. Krous

Data entered by: C. Krous

Checked by: J. Hines

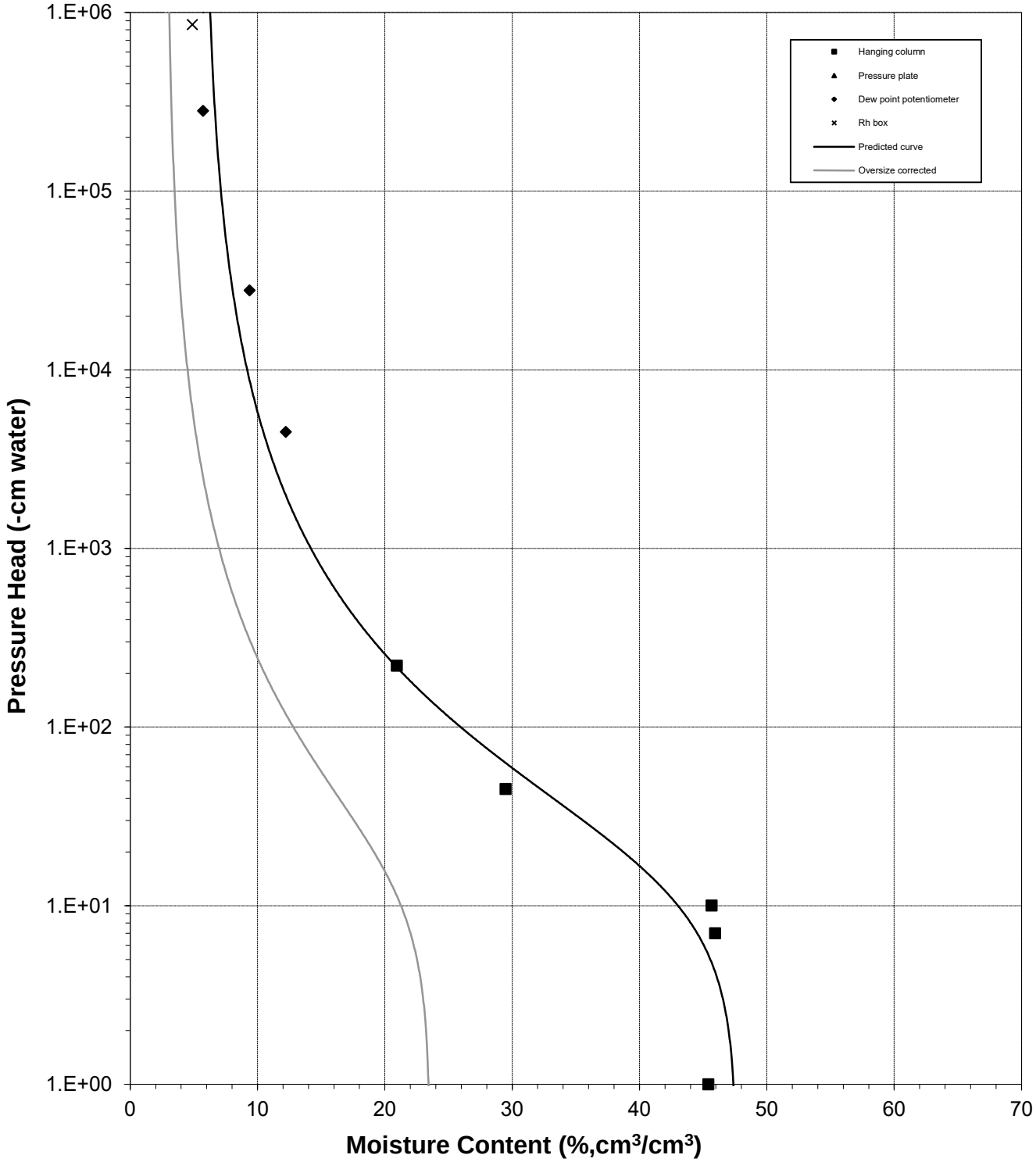
Water Retention Data Points

Sample Number: GC-LS-2 6-7' (1.41 g/cc)



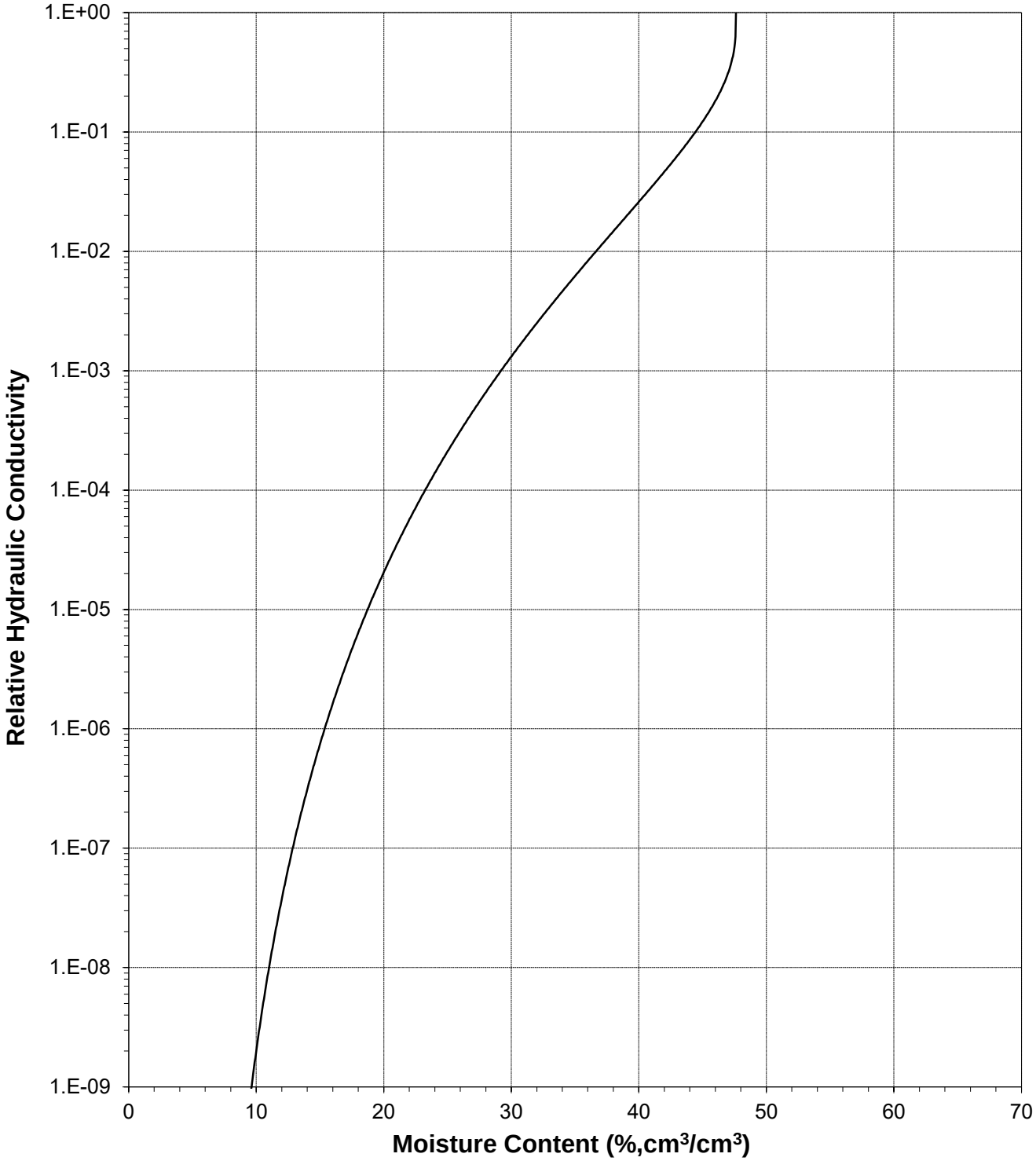
Predicted Calibration Curve and Data Points

Sample Number: GC-LS-2 6-7' (1.41 g/cc)



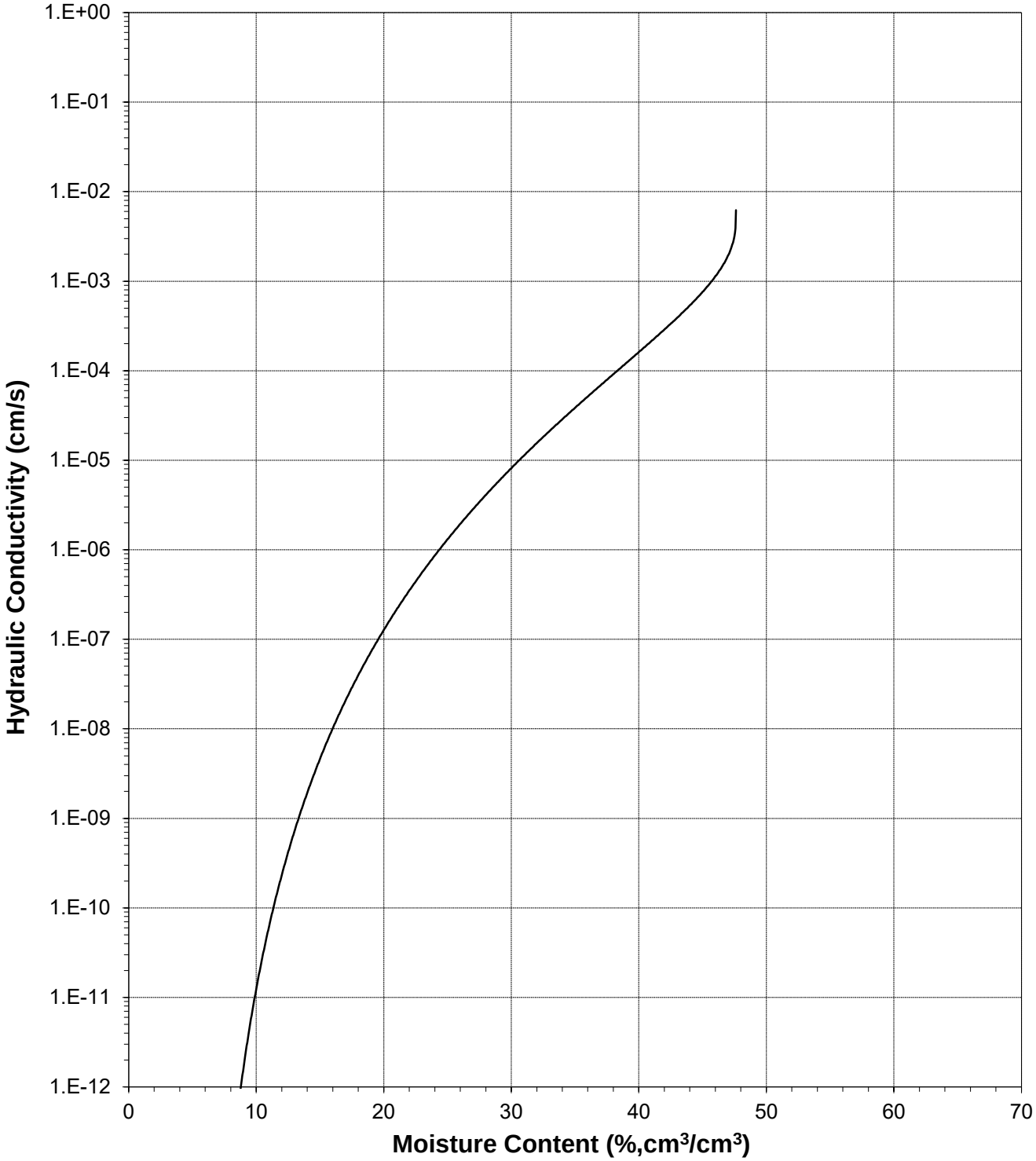
Plot of Relative Hydraulic Conductivity vs Moisture Content

Sample Number: GC-LS-2 6-7' (1.41 g/cc)



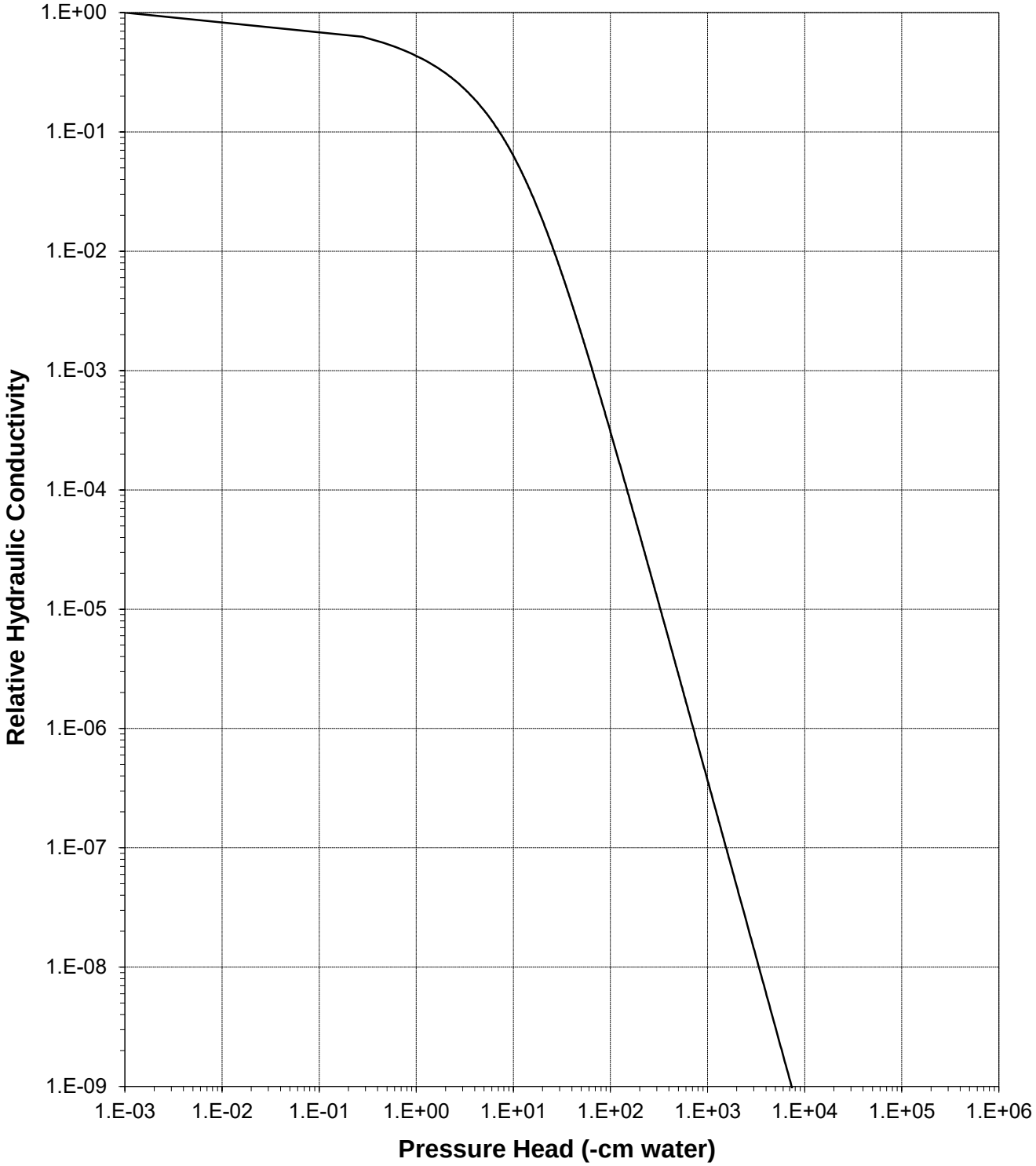
Plot of Hydraulic Conductivity vs Moisture Content

Sample Number: GC-LS-2 6-7' (1.41 g/cc)



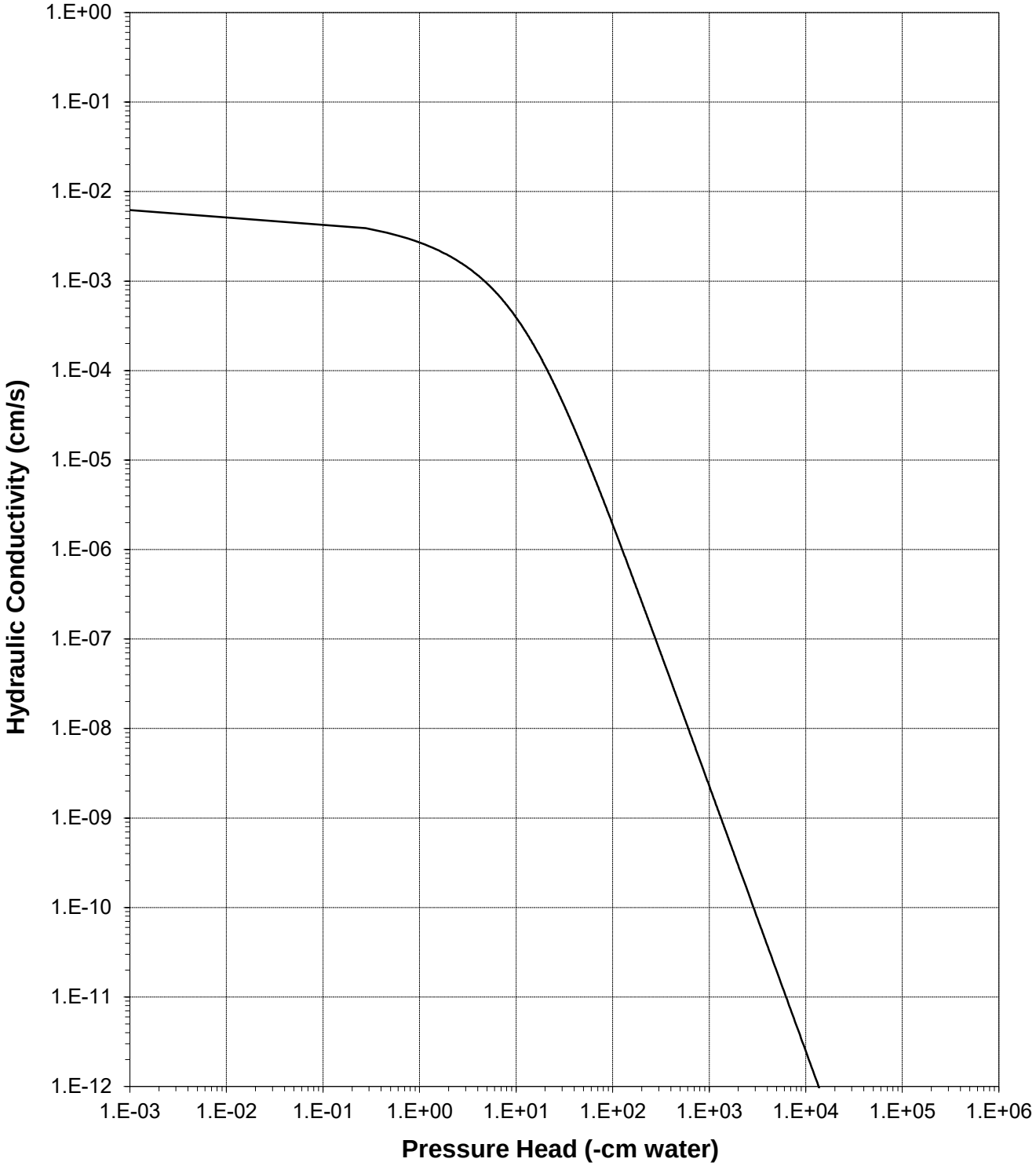
Plot of Relative Hydraulic Conductivity vs Pressure Head

Sample Number: GC-LS-2 6-7' (1.41 g/cc)



Plot of Hydraulic Conductivity vs Pressure Head

Sample Number: GC-LS-2 6-7' (1.41 g/cc)



Oversize Correction Data Sheet

Job Name: Golder Associates, Inc.
Job Number: DB19.1112.00
Sample Number: GC-LS-2 6-7' (1.41 g/cc)
Project Name: CCP-BMI 181-06417
Depth: 6'-7'

Split (3/4", 3/8", #4): #10

	Coarse Fraction*	Fines Fraction**	Composite
Subsample Mass (g):	14554.51	7506.58	22061.09
Mass Fraction (%):	65.97	34.03	100.00
Initial Sample θ_i			
Bulk Density (g/cm^3):	2.67	1.41	2.04
Calculated Porosity (% vol):	0.00	47.26	23.37
Volume of Solids (cm^3):	5454.51	2813.20	8267.71
Volume of Voids (cm^3):	0.00	2520.78	2520.78
Total Volume (cm^3):	5454.51	5333.98	10788.49
Volumetric Fraction (%):	50.56	49.44	100.00
Initial Moisture Content (% vol):	0.00	11.05	5.46
Saturated Sample θ_s			
Bulk Density (g/cm^3):	2.67	1.41	2.04
Calculated Porosity (% vol):	0.00	47.26	23.37
Volume of Solids (cm^3):	5454.51	2813.20	8267.71
Volume of Voids (cm^3):	0.00	2520.78	2520.78
Total Volume (cm^3):	5454.51	5333.98	10788.49
Volumetric Fraction (%):	50.56	49.44	100.00
Saturated Moisture Content (% vol):	0.00	47.63	23.55
Residual Sample θ_r			
Bulk Density (g/cm^3):	2.67	1.45	2.08
Calculated Porosity (% vol):	0.00	45.64	22.22
Volume of Solids (cm^3):	5454.51	2813.20	8267.71
Volume of Voids (cm^3):	0.00	2361.47	2361.47
Total Volume (cm^3):	5454.51	5174.67	10629.19
Volumetric Fraction (%):	51.32	48.68	100.00
Residual Moisture Content (% vol):	0.00	5.69	2.77
Ksat (cm/sec):	NM	6.2E-03	2.1E-03

* = Porosity and moisture content of coarse fraction assumed to be zero.
** = Volume adjusted, if applicable. See notes on Moisture Retention Data pages.
NM = Not measured

Laboratory analysis by: D. O'Dowd/A. Bland
Data entered by: C. Krous
Checked by: J. Hines

Moisture Retention Data

Hanging Column / Pressure Plate

(Soil-Water Characteristic Curve)

Job Name: Golder Associates, Inc.
Job Number: DB19.1112.00
Sample Number: GC-1S-2 4-6' (1.40 g/cc)
Project Name: CCP-BMI 181-06417
Depth: 4'-6'

Dry wt. of sample (g)*:* 309.01
Tare wt., ring (g)*:* 136.14
Tare wt., screen & clamp (g)*:* 27.73
Initial sample volume (cm^3)*:* 220.14
Initial dry bulk density (g/cm^3)*:* 1.40
Measured particle density (g/cm^3)*:* 2.71
Initial calculated total porosity (%)*:* 48.13

	Date	Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content † (% vol)
Hanging column:	23-Apr-19	13:00	581.73	0	49.45
	30-Apr-19	15:55	580.73	18.0	48.99
	7-May-19	14:45	562.01	54.0	40.49
	14-May-19	15:15	550.82	125.0	35.40
Pressure plate:	23-May-19	10:30	542.99	337	31.85

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	---	---	---	---
	18.0	---	---	---	---
	54.0	---	---	---	---
	125.0	---	---	---	---
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/A. Bland
Data entered by: A. Albay-Yenney
Checked by: J. Hines

Moisture Retention Data

Dew Point Potentiometer / Relative Humidity Box

(Soil-Water Characteristic Curve)

Sample Number: GC-1S-2 4-6' (1.40 g/cc)

Initial sample bulk density (g/cm^3)*:* 1.40

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

Dry weight of dew point potentiometer sample* (g)*:* 172.23

Tare weight, jar (g)*:* 114.72

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content † (% vol)
Dew point potentiometer:	28-May-19	10:51	179.23	16113	17.09
	22-May-19	11:06	177.67	52724	13.27
	17-May-19	14:40	175.93	296150	9.02

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:	16113	---	---	---	---
	52724	---	---	---	---
	296150	---	---	---	---

Dry weight of relative humidity box sample* (g)*:* 65.18

Tare weight (g)*:* 38.02

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content † (% vol)
Relative humidity box:	16-May-19	17:00	66.62	854732	7.45

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:	854732	---	---	---	---

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.

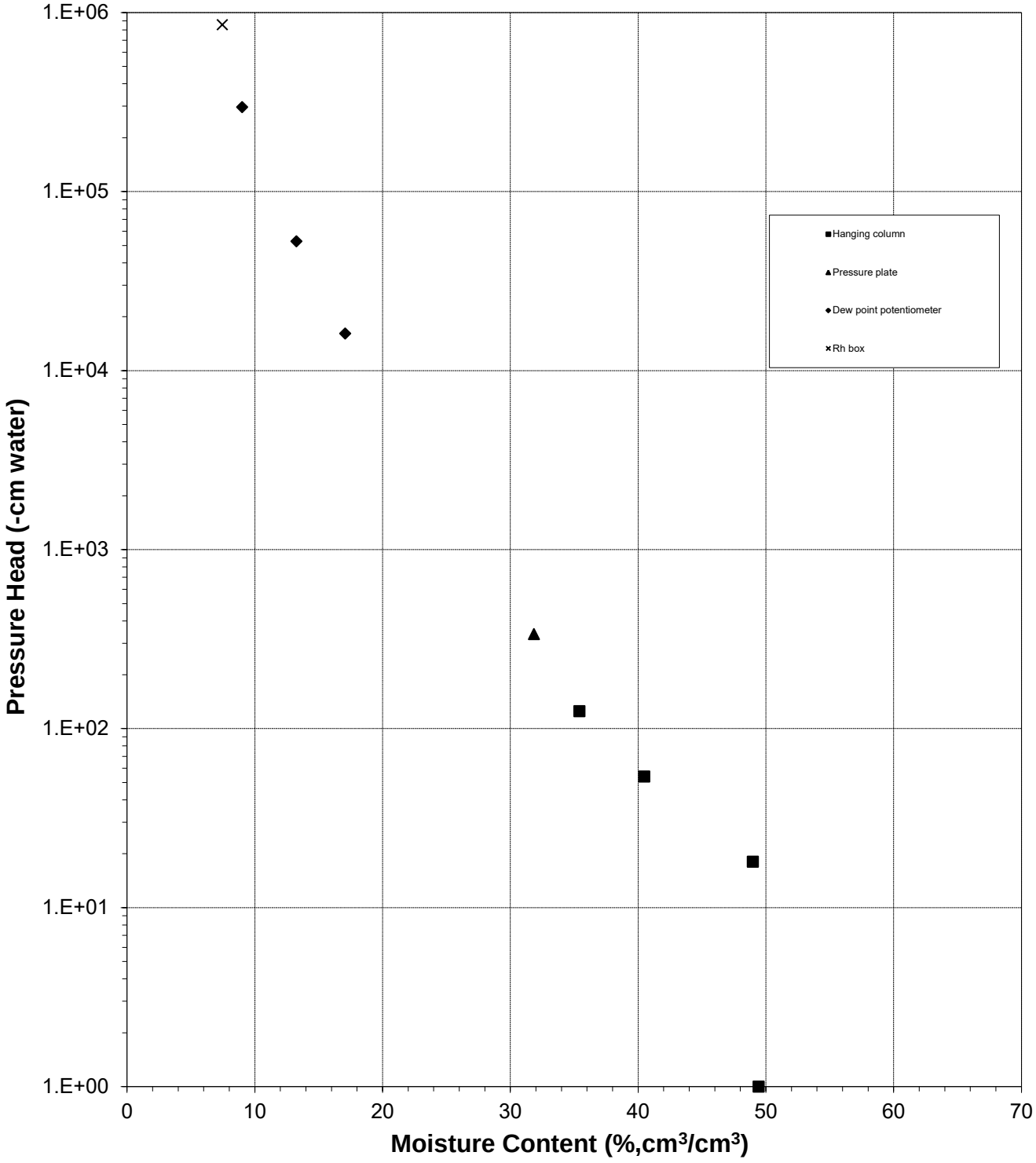
Laboratory analysis by: L. Thurgood/C. Krous

Data entered by: A. Albay-Yenney

Checked by: J. Hines

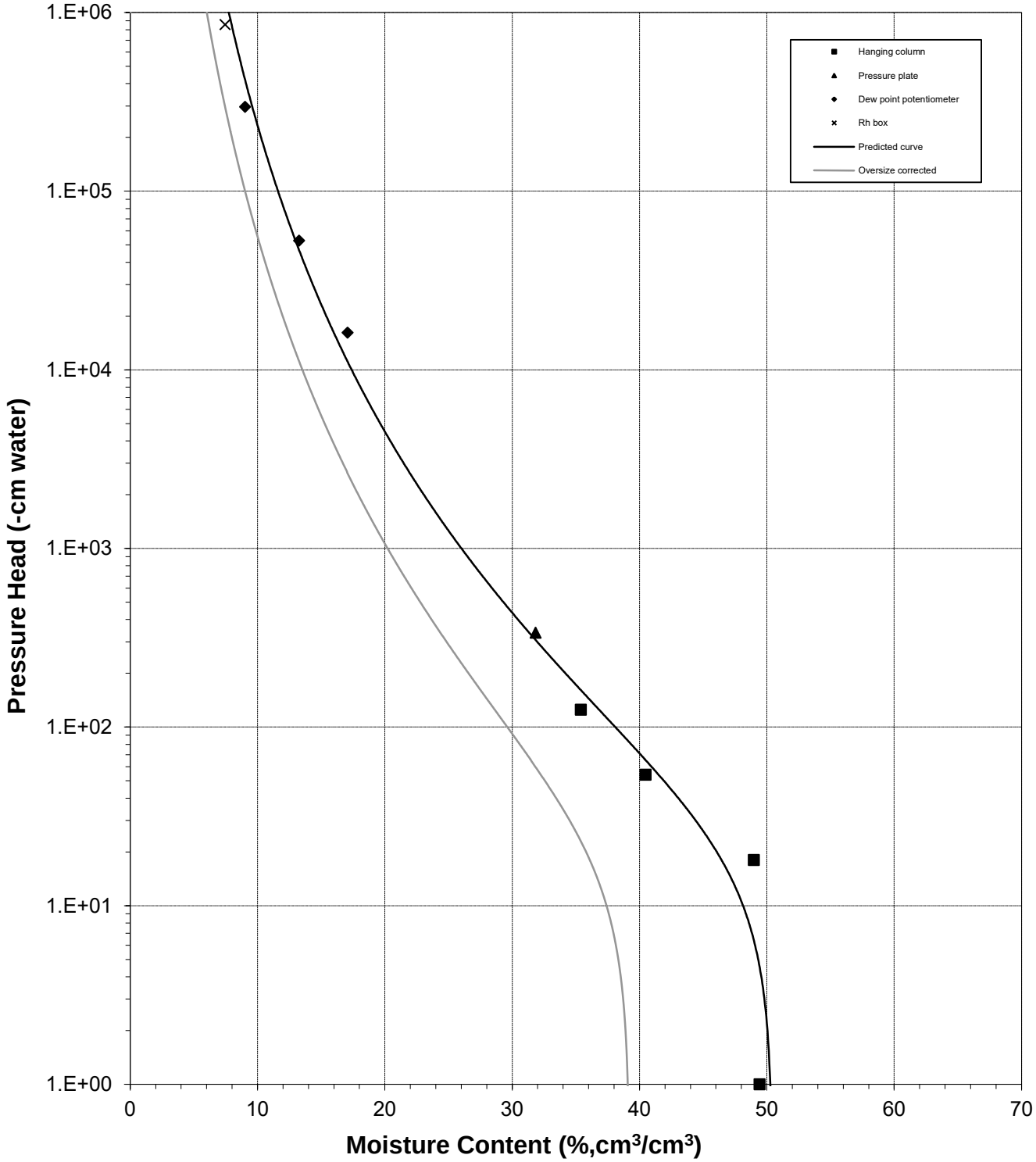
Water Retention Data Points

Sample Number: GC-1S-2 4-6' (1.40 g/cc)



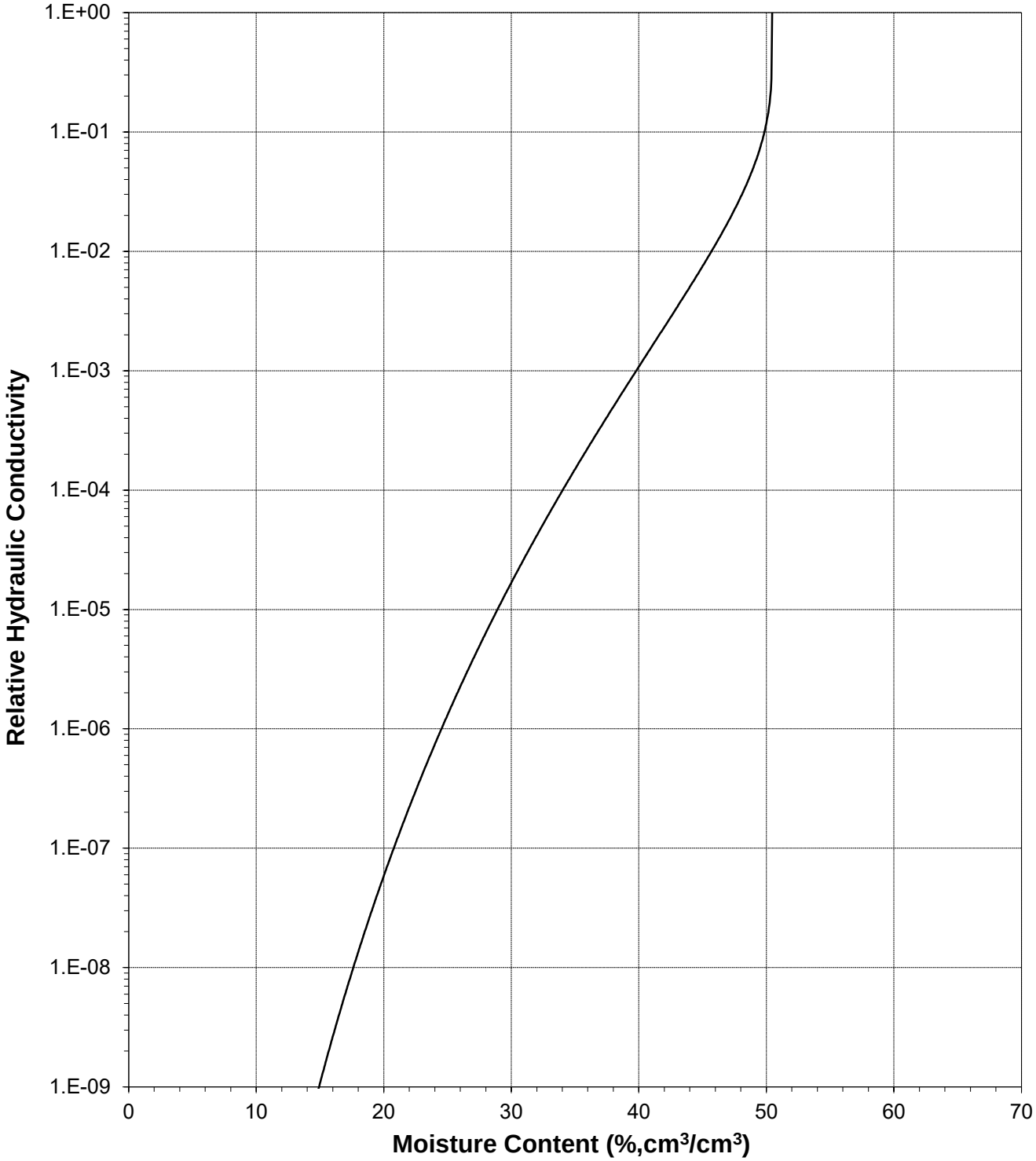
Predicted Calibration Curve and Data Points

Sample Number: GC-1S-2 4-6' (1.40 g/cc)



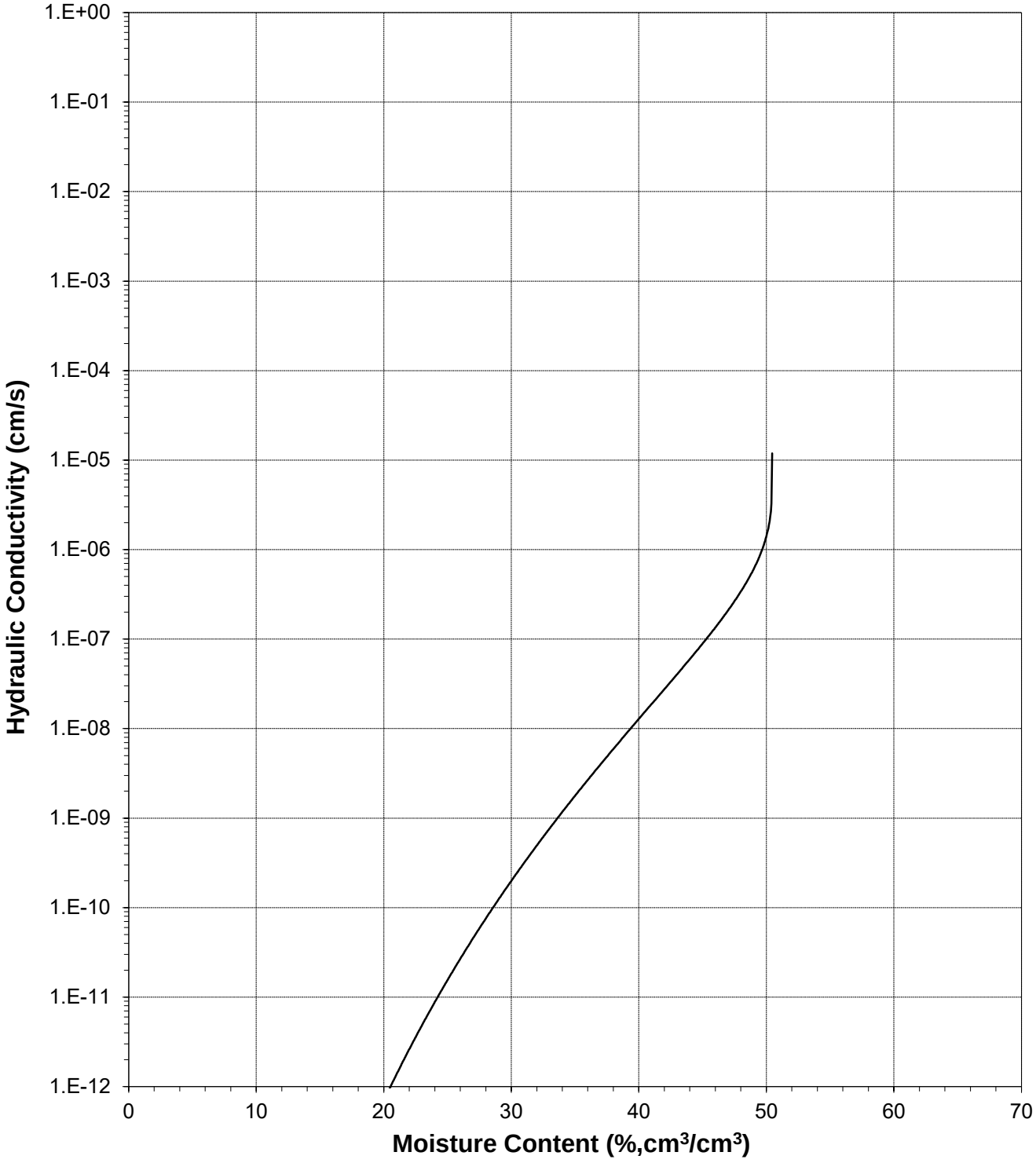
Plot of Relative Hydraulic Conductivity vs Moisture Content

Sample Number: GC-1S-2 4-6' (1.40 g/cc)



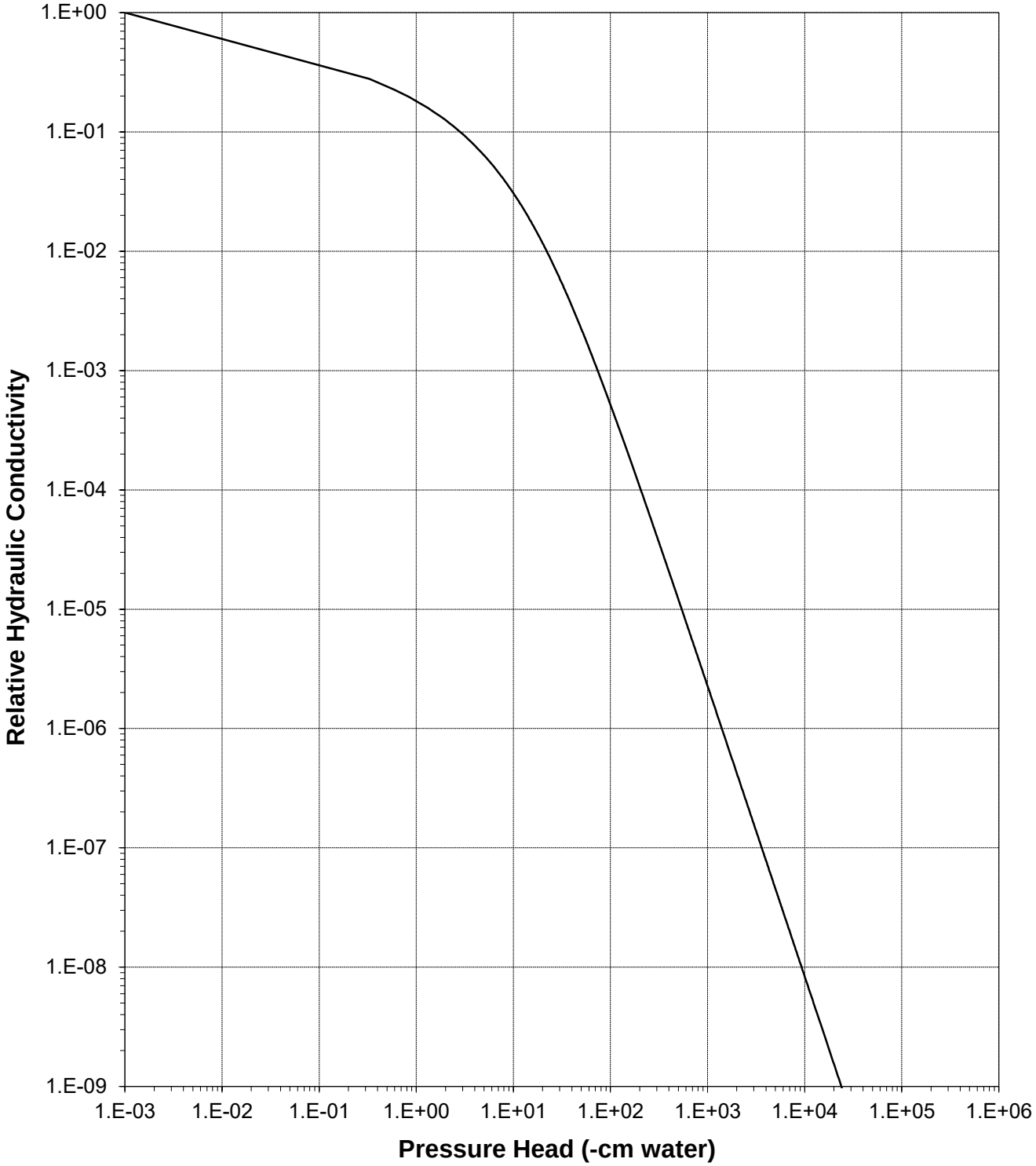
Plot of Hydraulic Conductivity vs Moisture Content

Sample Number: GC-1S-2 4-6' (1.40 g/cc)



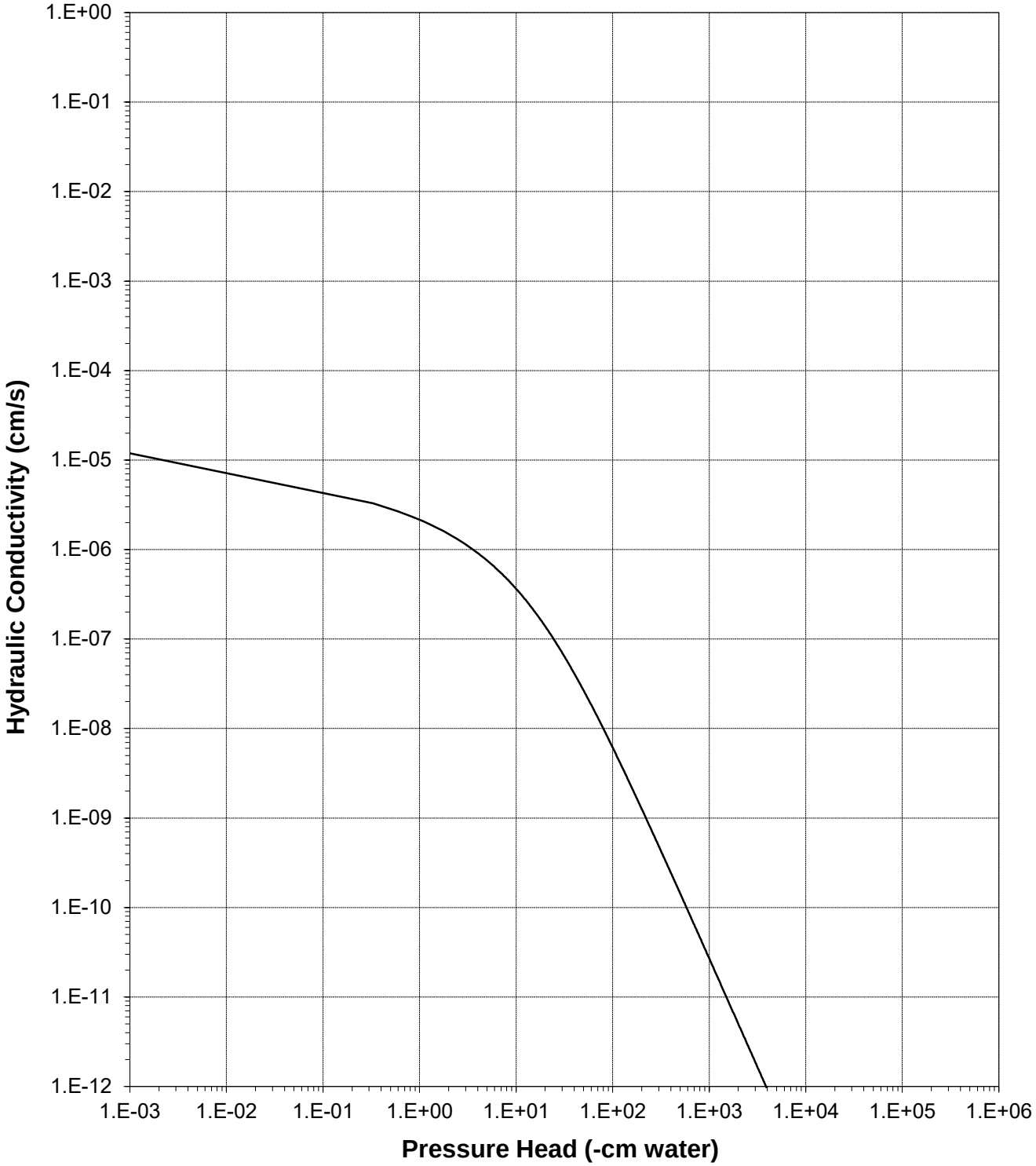
Plot of Relative Hydraulic Conductivity vs Pressure Head

Sample Number: GC-1S-2 4-6' (1.40 g/cc)



Plot of Hydraulic Conductivity vs Pressure Head

Sample Number: GC-1S-2 4-6' (1.40 g/cc)



Oversize Correction Data Sheet

Job Name: Golder Associates, Inc.
Job Number: DB19.1112.00
Sample Number: GC-1S-2 4-6' (1.40 g/cc)
Project Name: CCP-BMI 181-06417
Depth: 4'-6'

Split (3/4", 3/8", #4): #10

	Coarse Fraction*	Fines Fraction**	Composite
Subsample Mass (g):	6291.16	11388.65	17679.81
Mass Fraction (%):	35.58	64.42	100.00
Initial Sample θ_i			
Bulk Density (g/cm^3):	2.71	1.40	1.69
Calculated Porosity (% vol):	0.00	48.13	37.41
Volume of Solids (cm^3):	2324.80	4208.50	6533.31
Volume of Voids (cm^3):	0.00	3904.87	3904.87
Total Volume (cm^3):	2324.80	8113.37	10438.17
Volumetric Fraction (%):	22.27	77.73	100.00
Initial Moisture Content (% vol):	0.00	16.92	13.15
Saturated Sample θ_s			
Bulk Density (g/cm^3):	2.71	1.40	1.69
Calculated Porosity (% vol):	0.00	48.13	37.41
Volume of Solids (cm^3):	2324.80	4208.50	6533.31
Volume of Voids (cm^3):	0.00	3904.87	3904.87
Total Volume (cm^3):	2324.80	8113.37	10438.17
Volumetric Fraction (%):	22.27	77.73	100.00
Saturated Moisture Content (% vol):	0.00	50.46	39.22
Residual Sample θ_r			
Bulk Density (g/cm^3):	2.71	1.40	1.69
Calculated Porosity (% vol):	0.00	48.13	37.41
Volume of Solids (cm^3):	2324.80	4208.50	6533.31
Volume of Voids (cm^3):	0.00	3904.87	3904.87
Total Volume (cm^3):	2324.80	8113.37	10438.17
Volumetric Fraction (%):	22.27	77.73	100.00
Residual Moisture Content (% vol):	0.00	0.00	0.00
Ksat (cm/sec):	NM	1.2E-05	7.6E-06

* = Porosity and moisture content of coarse fraction assumed to be zero.
** = Volume adjusted, if applicable. See notes on Moisture Retention Data pages.
NM = Not measured

Laboratory analysis by: D. O'Dowd/A. Bland
Data entered by: A. Albay-Yenney
Checked by: J. Hines

Moisture Retention Data

Hanging Column / Pressure Plate

(Soil-Water Characteristic Curve)

Job Name: Golder Associates, Inc.
Job Number: DB19.1112.00
Sample Number: GC-1S-3 2-6.5' (1.40 g/cc)
Project Name: CCP-BMI 181-06417
Depth: 2'-6.5'

Dry wt. of sample (g): 307.23
Tare wt., ring (g): 136.40
Tare wt., screen & clamp (g): 27.57
Initial sample volume (cm^3): 219.83
Initial dry bulk density (g/cm^3): 1.40
Measured particle density (g/cm^3): 2.67
Initial calculated total porosity (%): 47.61

	Date	Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content † (% vol)	
Hanging column:	18-Apr-19	8:00	573.54	0	46.55	
	25-Apr-19	13:50	552.00	7.0	42.63	‡‡
	2-May-19	7:45	548.96	10.0	41.43	‡‡
	9-May-19	8:30	539.59	45.0	36.44	‡‡
	16-May-19	10:45	519.06	220.0	25.50	‡‡

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	---	---	---	---
	7.0	189.54	-13.78%	1.62	39.24
	10.0	187.70	-14.61%	1.64	38.65
	45.0	187.70	-14.61%	1.64	38.65
	220.0	187.70	-14.61%	1.64	38.65

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/A. Bland
Data entered by: C. Krous
Checked by: J. Hines

Moisture Retention Data

Dew Point Potentiometer / Relative Humidity Box

(Soil-Water Characteristic Curve)

Sample Number: GC-1S-3 2-6.5' (1.40 g/cc)

Initial sample bulk density (g/cm^3)*:* 1.40

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

Dry weight of dew point potentiometer sample* (g)*:* 175.08

Tare weight, jar (g)*:* 114.59

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content † (% vol)	
Dew point potentiometer:	24-May-19	10:11	180.12	2855	13.63	‡‡
	20-May-19	10:14	178.12	24169	8.23	‡‡
	14-May-19	12:10	176.83	255766	4.75	‡‡

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:	2855	187.70	-14.61%	1.64	38.65
	24169	187.70	-14.61%	1.64	38.65
	255766	187.70	-14.61%	1.64	38.65

Dry weight of relative humidity box sample* (g)*:* 82.26

Tare weight (g)*:* 40.97

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content † (% vol)	
Relative humidity box:	16-May-19	17:00	83.10	854732	3.33	‡‡

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:	854732	187.70	-14.61%	1.64	38.65

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.

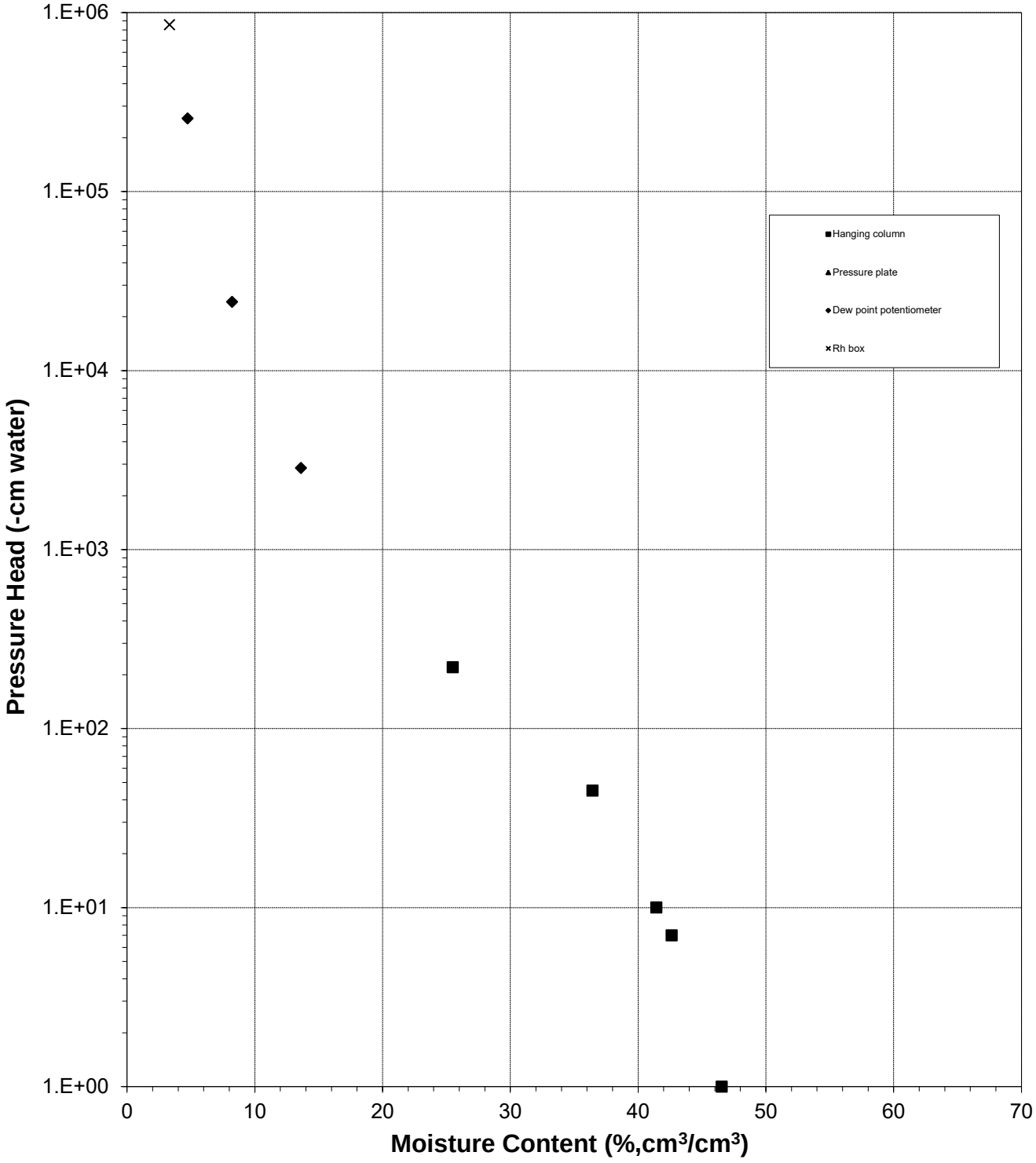
Laboratory analysis by: L. Thurgood/C. Krous

Data entered by: C. Krous

Checked by: J. Hines

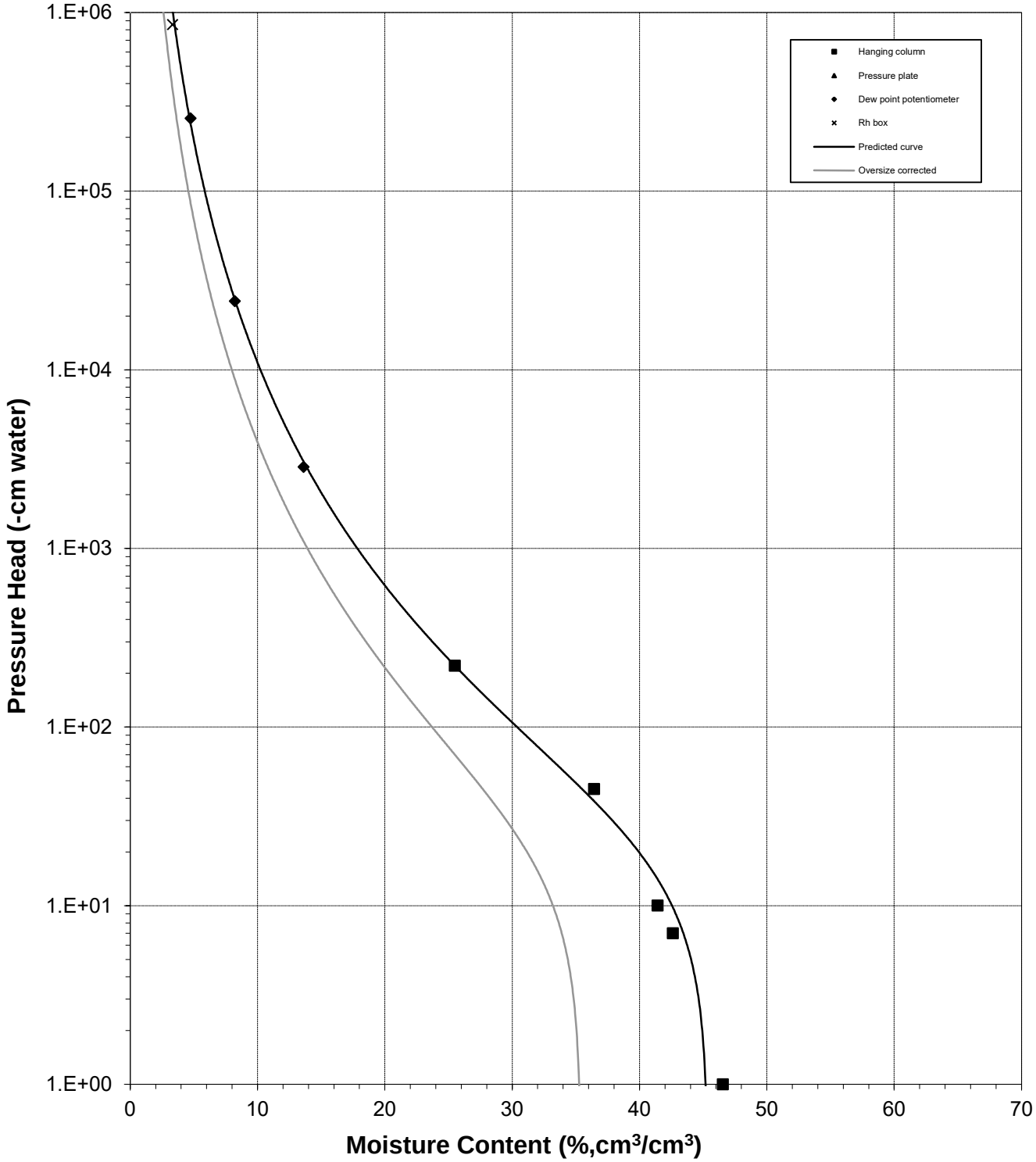
Water Retention Data Points

Sample Number: GC-1S-3 2-6.5' (1.40 g/cc)



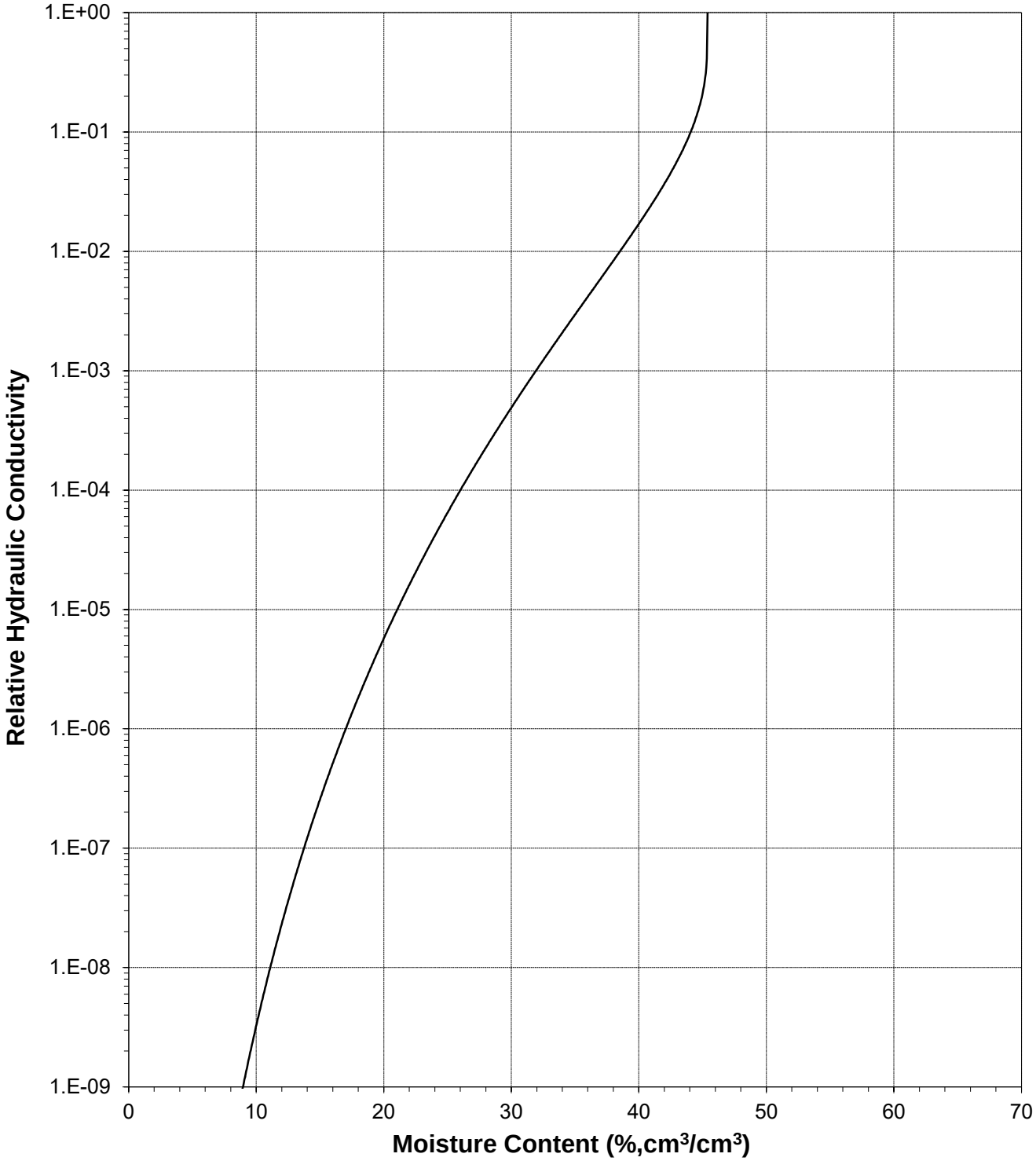
Predicted Calibration Curve and Data Points

Sample Number: GC-1S-3 2-6.5' (1.40 g/cc)



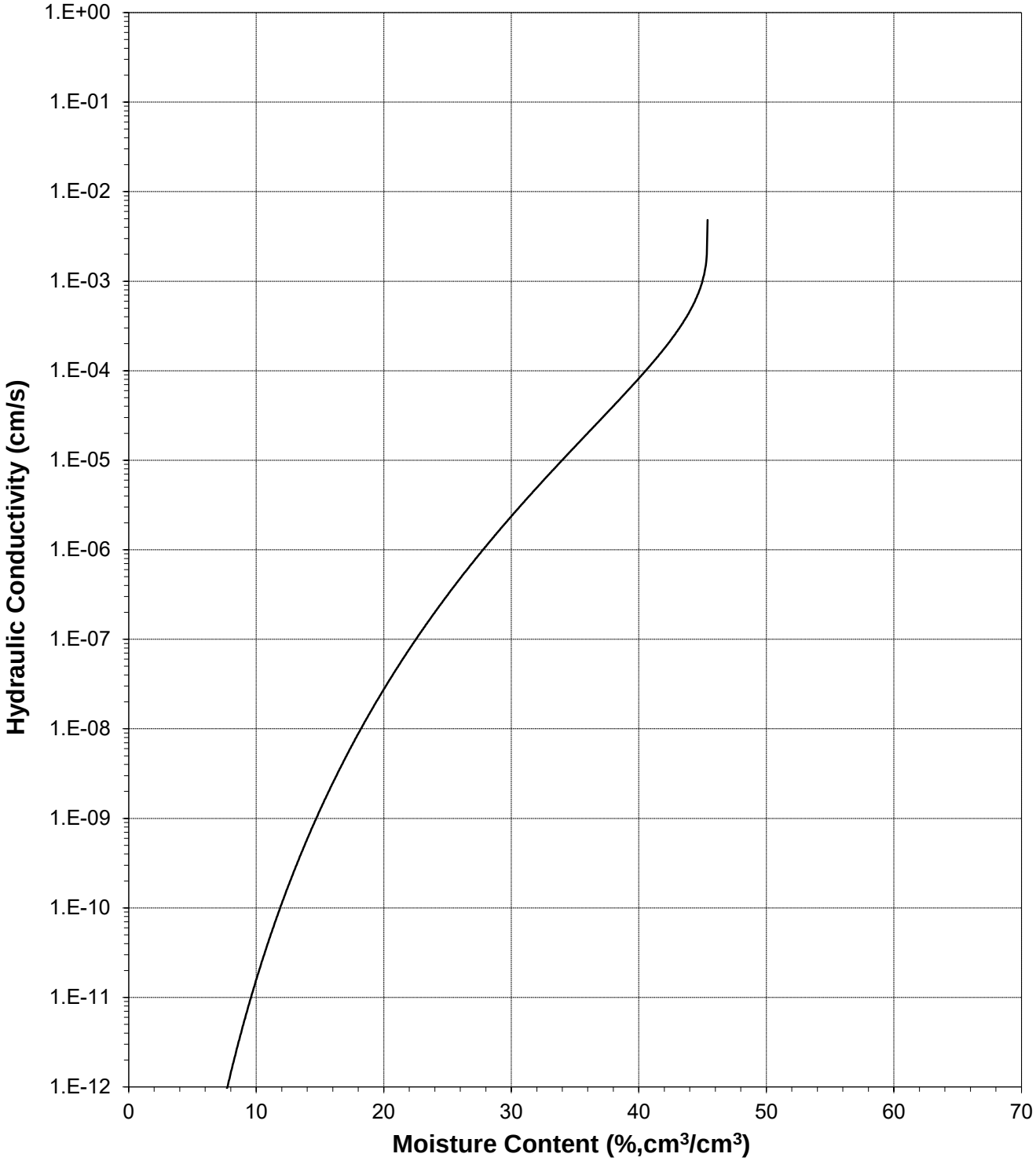
Plot of Relative Hydraulic Conductivity vs Moisture Content

Sample Number: GC-1S-3 2-6.5' (1.40 g/cc)



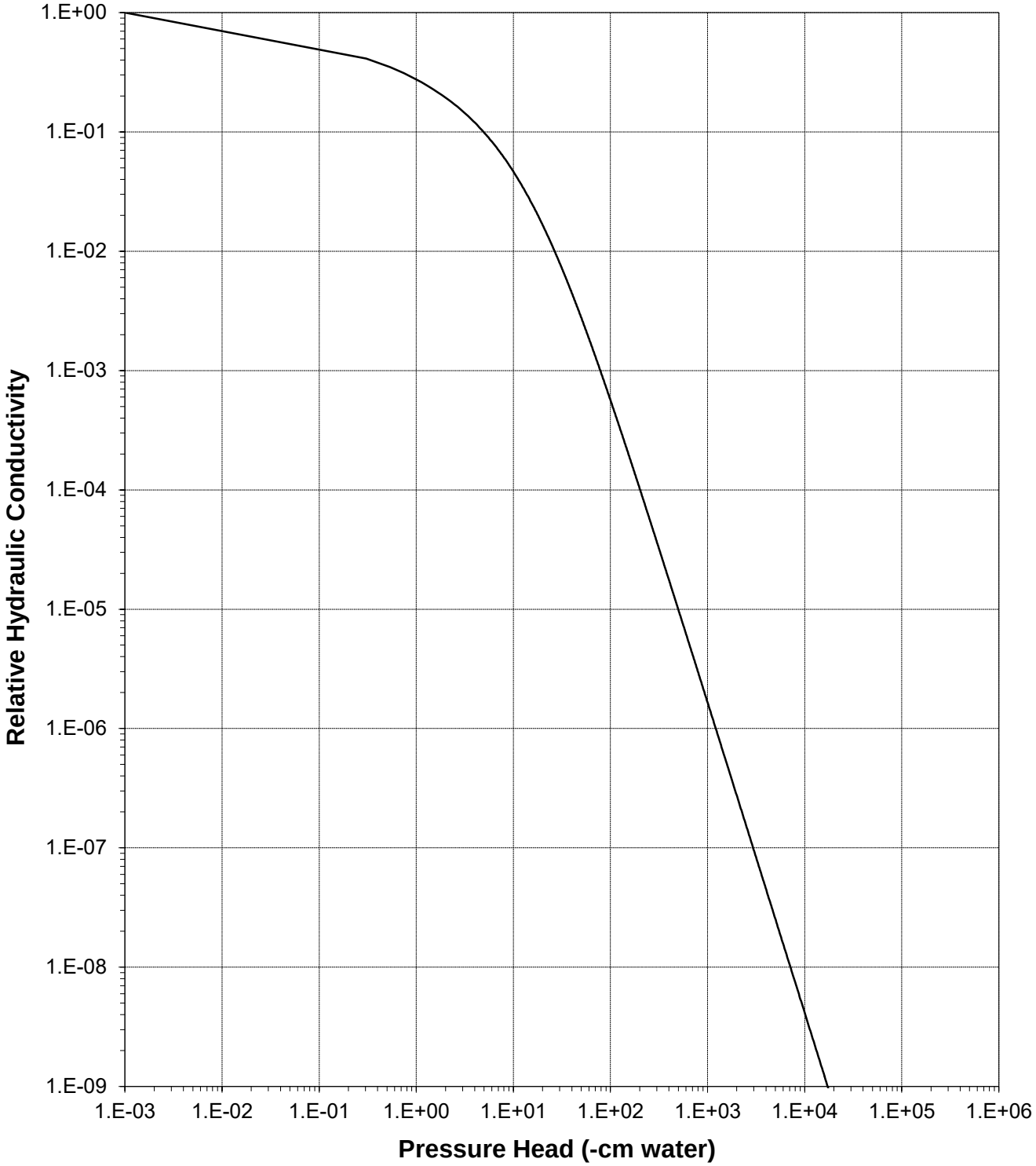
Plot of Hydraulic Conductivity vs Moisture Content

Sample Number: GC-1S-3 2-6.5' (1.40 g/cc)



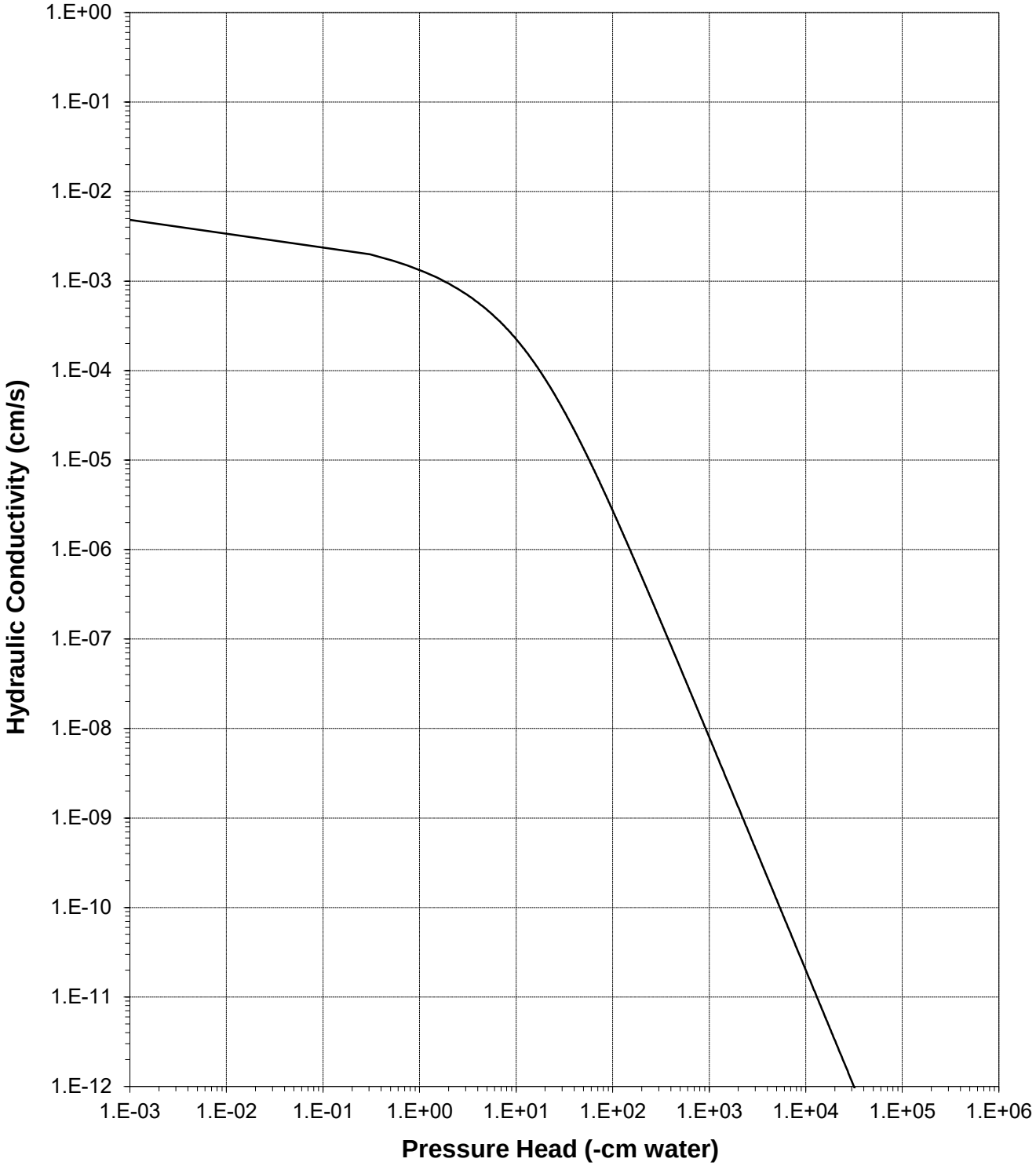
Plot of Relative Hydraulic Conductivity vs Pressure Head

Sample Number: GC-1S-3 2-6.5' (1.40 g/cc)



Plot of Hydraulic Conductivity vs Pressure Head

Sample Number: GC-1S-3 2-6.5' (1.40 g/cc)



Oversize Correction Data Sheet

Job Name: Golder Associates, Inc.
Job Number: DB19.1112.00
Sample Number: GC-1S-3 2-6.5' (1.40 g/cc)
Project Name: CCP-BMI 181-06417
Depth: 2'-6.5'

Split (3/4", 3/8", #4): #10

	Coarse Fraction*	Fines Fraction**	Composite
Subsample Mass (g):	7929.97	14745.71	22675.68
Mass Fraction (%):	34.97	65.03	100.00
Initial Sample θ_i			
Bulk Density (g/cm^3):	2.67	1.40	1.68
Calculated Porosity (% vol):	0.00	47.61	37.15
Volume of Solids (cm^3):	2972.52	5527.37	8499.89
Volume of Voids (cm^3):	0.00	5023.51	5023.51
Total Volume (cm^3):	2972.52	10550.88	13523.40
Volumetric Fraction (%):	21.98	78.02	100.00
Initial Moisture Content (% vol):	0.00	8.77	6.84
Saturated Sample θ_s			
Bulk Density (g/cm^3):	2.67	1.40	1.68
Calculated Porosity (% vol):	0.00	47.61	37.15
Volume of Solids (cm^3):	2972.52	5527.37	8499.89
Volume of Voids (cm^3):	0.00	5023.51	5023.51
Total Volume (cm^3):	2972.52	10550.88	13523.40
Volumetric Fraction (%):	21.98	78.02	100.00
Saturated Moisture Content (% vol):	0.00	45.38	35.41
Residual Sample θ_r			
Bulk Density (g/cm^3):	2.67	1.64	1.89
Calculated Porosity (% vol):	0.00	38.65	29.06
Volume of Solids (cm^3):	2972.52	5527.37	8499.89
Volume of Voids (cm^3):	0.00	3481.60	3481.60
Total Volume (cm^3):	2972.52	9008.97	11981.49
Volumetric Fraction (%):	24.81	75.19	100.00
Residual Moisture Content (% vol):	0.00	0.00	0.00
Ksat (cm/sec):	NM	4.8E-03	3.1E-03

* = Porosity and moisture content of coarse fraction assumed to be zero.
** = Volume adjusted, if applicable. See notes on Moisture Retention Data pages.
NM = Not measured

Laboratory analysis by: D. O'Dowd/A. Bland
Data entered by: C. Krous
Checked by: J. Hines

Moisture Retention Data

Hanging Column / Pressure Plate

(Soil-Water Characteristic Curve)

Job Name: Golder Associates, Inc.
Job Number: DB19.1112.00
Sample Number: GC-1S-4 0-2.5' (1.40 g/cc)
Project Name: CCP-BMI 181-06417
Depth: 0'-2.5'

Dry wt. of sample (g): 310.43
Tare wt., ring (g): 137.39
Tare wt., screen & clamp (g): 24.18
Initial sample volume (cm^3): 221.54
Initial dry bulk density (g/cm^3): 1.40
Measured particle density (g/cm^3): 2.68
Initial calculated total porosity (%): 47.62

	Date	Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content † (% vol)	
Hanging column:	18-Apr-19	8:00	578.55	0	48.10	
	25-Apr-19	13:50	568.21	7.0	46.15	‡‡
	2-May-19	7:45	561.20	10.0	43.84	‡‡
	9-May-19	8:30	522.34	45.0	24.74	‡‡
	16-May-19	10:45	500.03	220.0	13.77	‡‡

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	---	---	---	---
	7.0	208.49	-5.89%	1.49	44.34
	10.0	203.49	-8.15%	1.53	42.97
	45.0	203.49	-8.15%	1.53	42.97
	220.0	203.49	-8.15%	1.53	42.97

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/A. Bland
Data entered by: C. Krous
Checked by: J. Hines

Moisture Retention Data

Dew Point Potentiometer / Relative Humidity Box

(Soil-Water Characteristic Curve)

Sample Number: GC-1S-4 0-2.5' (1.40 g/cc)

Initial sample bulk density (g/cm^3)*:* 1.40

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

Dry weight of dew point potentiometer sample* (g)*:* 172.18

Tare weight, jar (g)*:* 114.63

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content † (% vol)	
Dew point potentiometer:	24-May-19	10:24	175.34	3671	8.38	‡‡
	17-May-19	13:20	174.24	44667	5.46	‡‡
	13-May-19	11:41	173.65	236390	3.91	‡‡

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:	3671	203.49	-8.15%	1.53	42.97
	44667	203.49	-8.15%	1.53	42.97
	236390	203.49	-8.15%	1.53	42.97

Dry weight of relative humidity box sample* (g)*:* 75.99

Tare weight (g)*:* 40.00

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content † (% vol)	
Relative humidity box:	16-May-19	17:00	76.79	854732	3.37	‡‡

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:	854732	203.49	-8.15%	1.53	42.97

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.

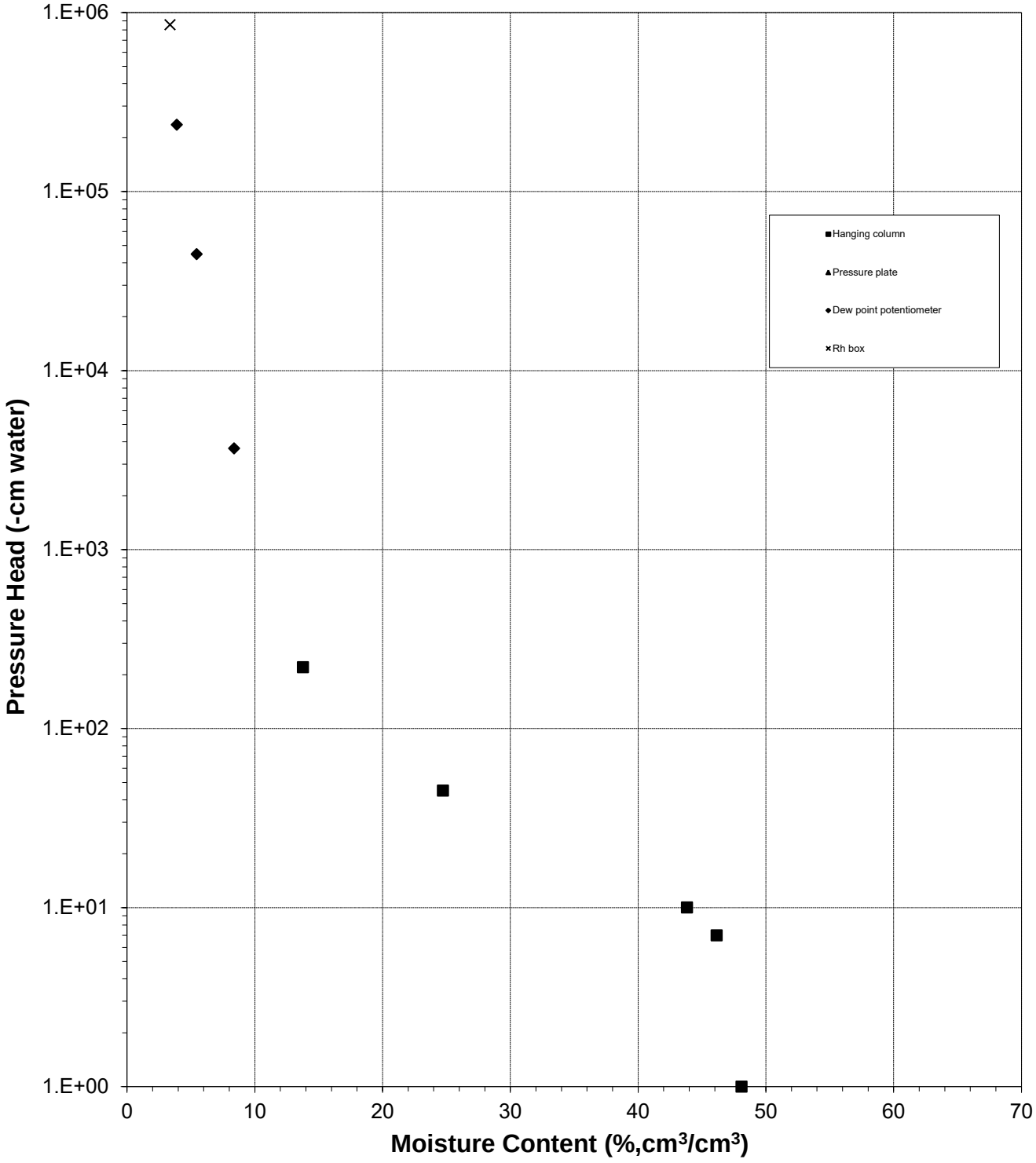
Laboratory analysis by: L. Thurgood/C. Krous

Data entered by: C. Krous

Checked by: J. Hines

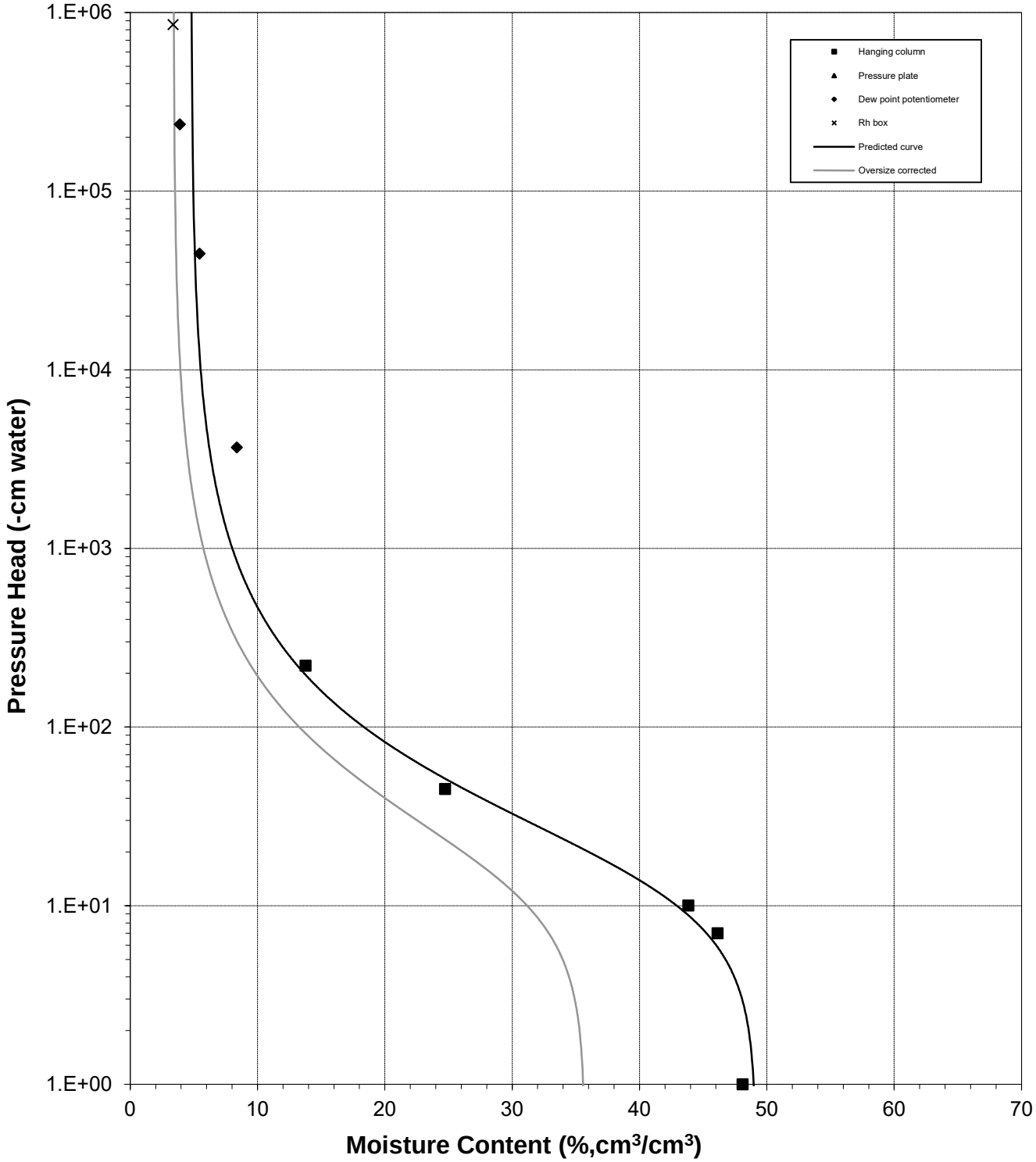
Water Retention Data Points

Sample Number: GC-1S-4 0-2.5' (1.40 g/cc)



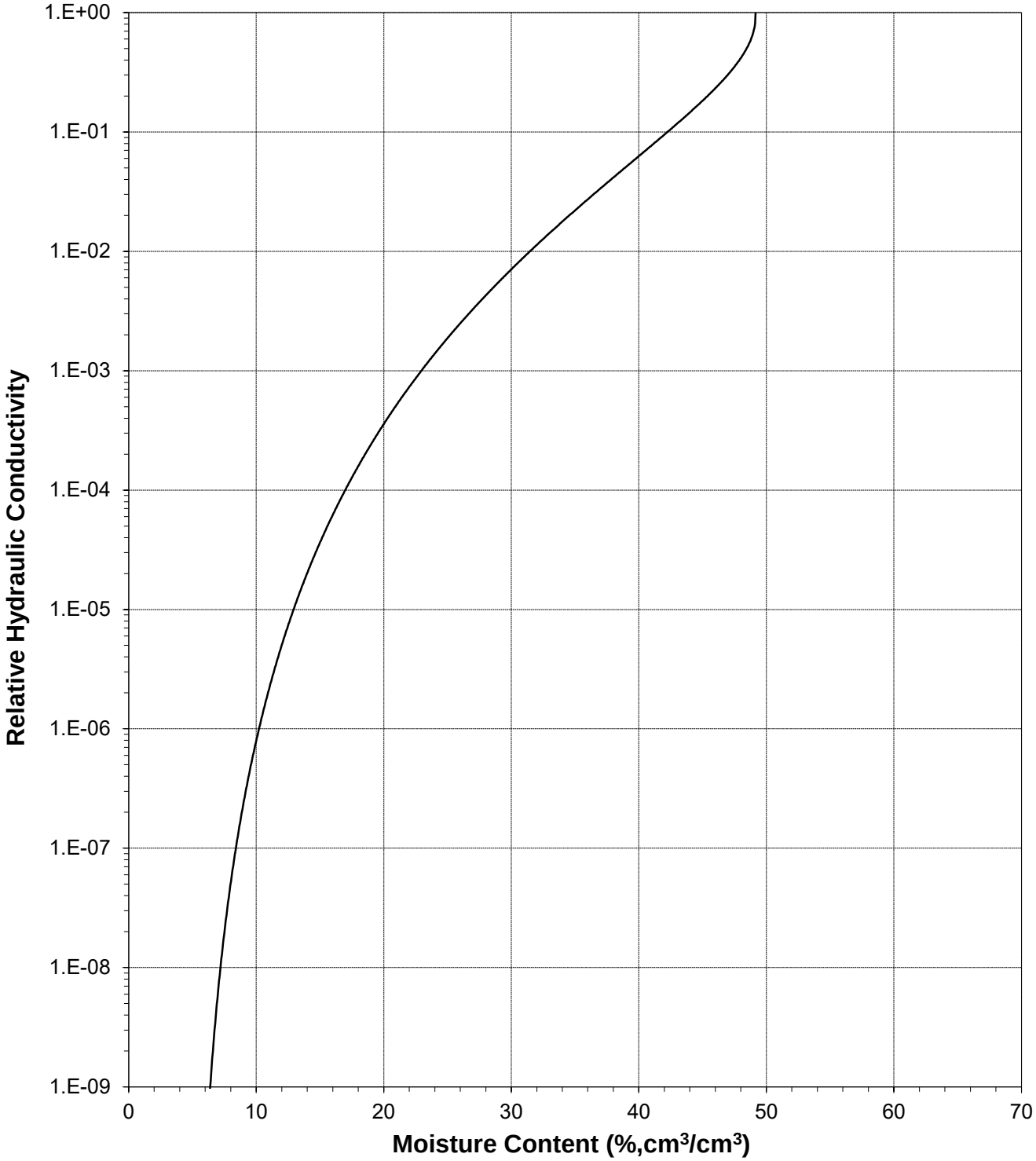
Predicted Calibration Curve and Data Points

Sample Number: GC-1S-4 0-2.5' (1.40 g/cc)



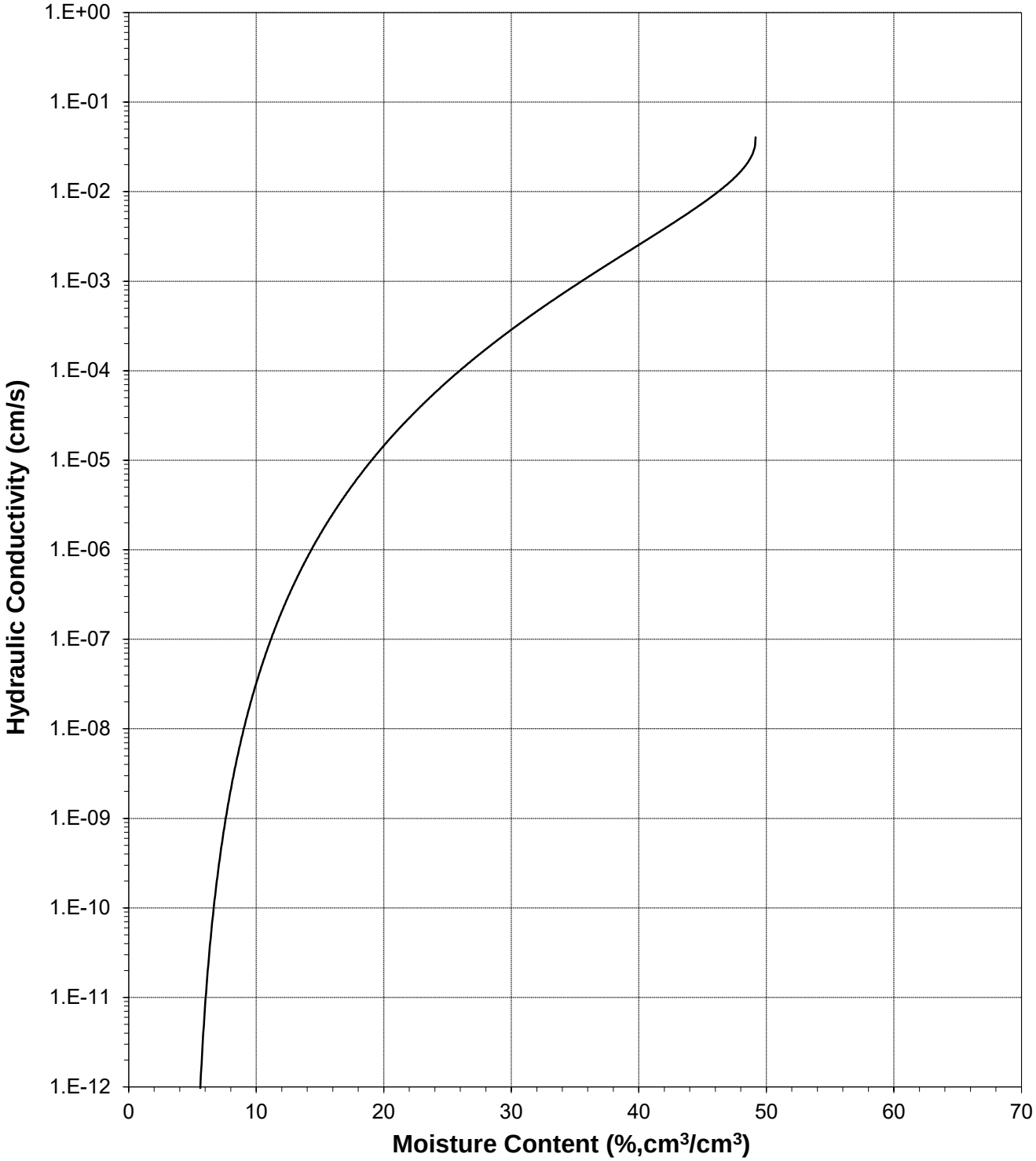
Plot of Relative Hydraulic Conductivity vs Moisture Content

Sample Number: GC-1S-4 0-2.5' (1.40 g/cc)



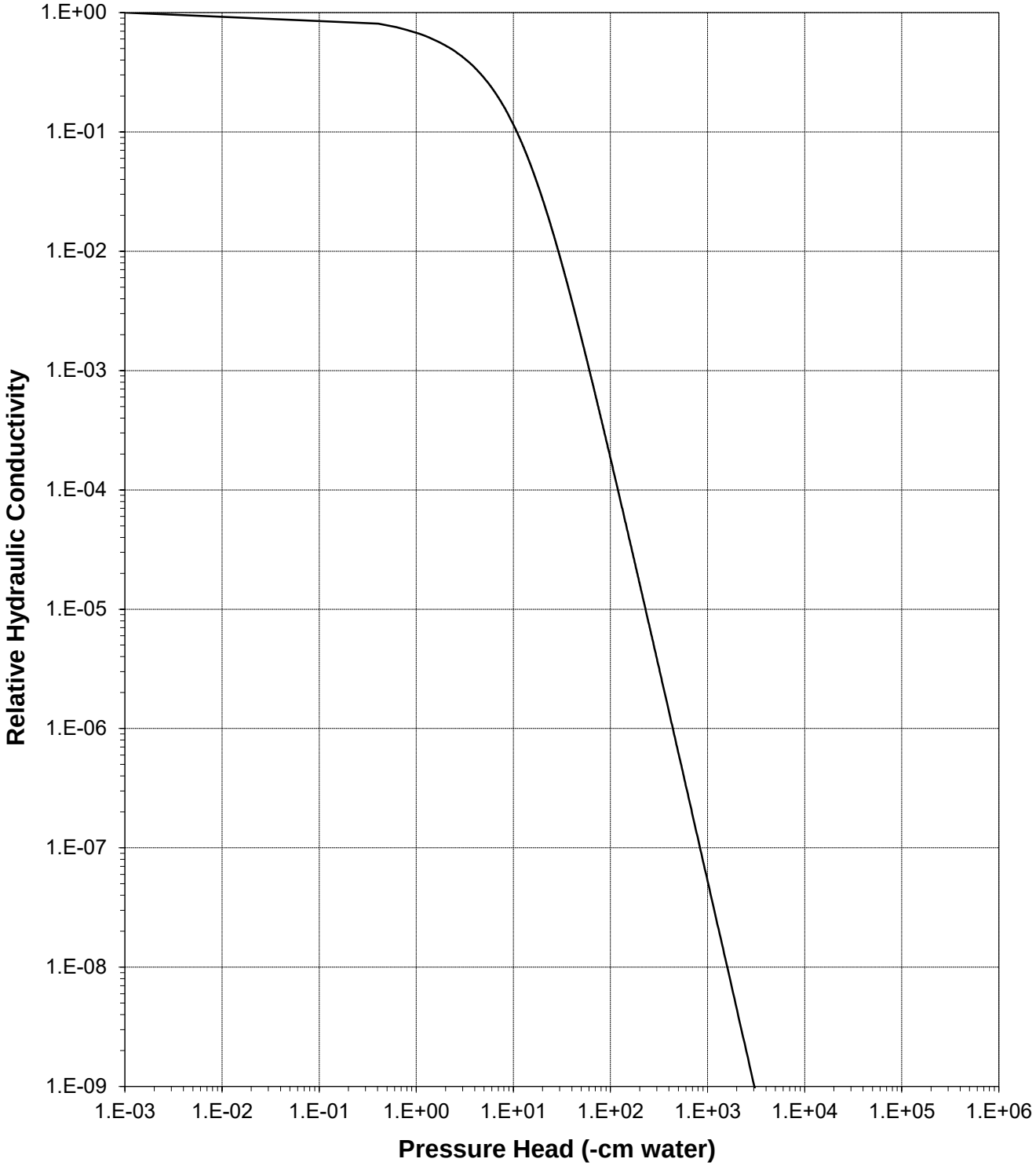
Plot of Hydraulic Conductivity vs Moisture Content

Sample Number: GC-1S-4 0-2.5' (1.40 g/cc)



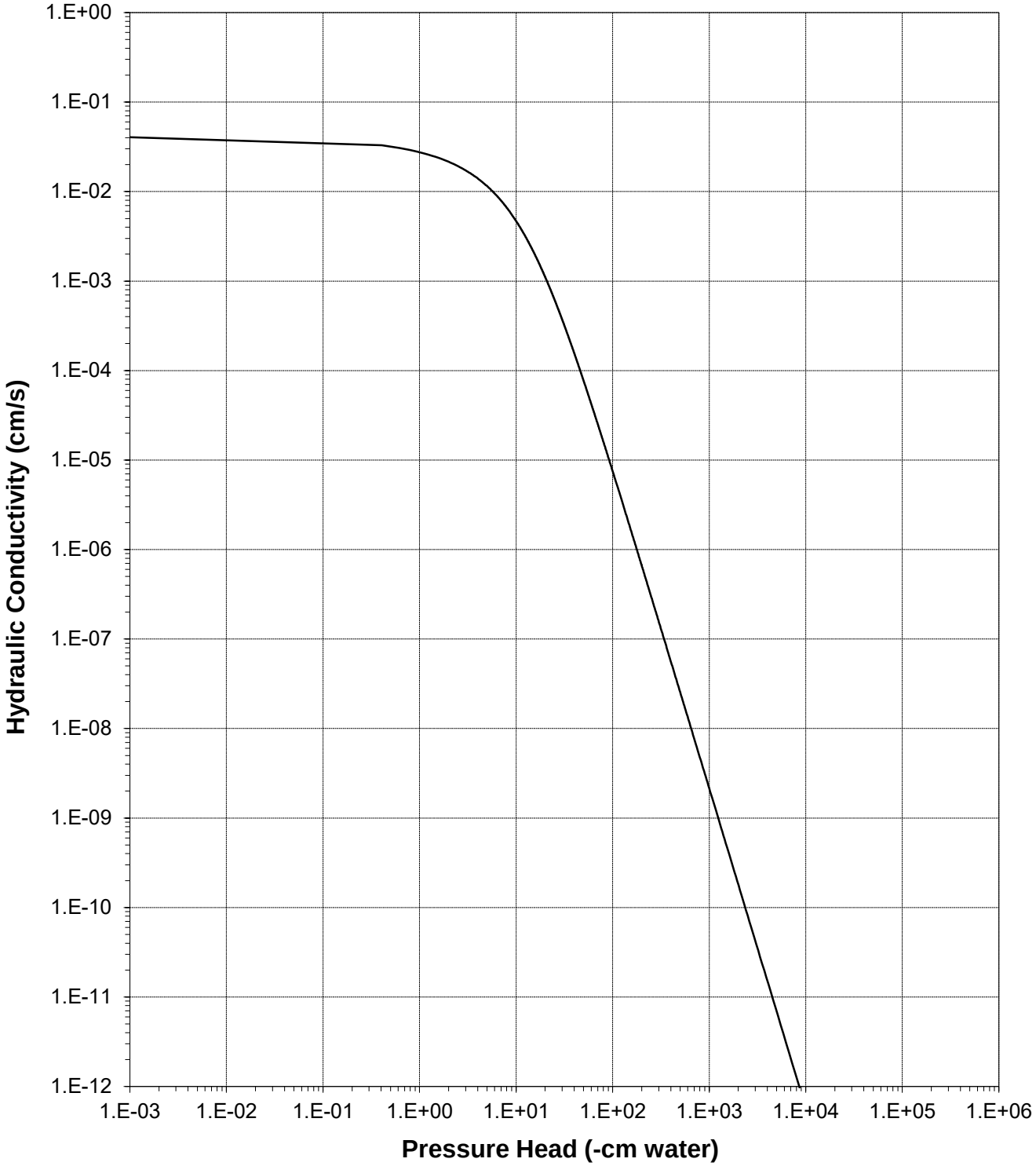
Plot of Relative Hydraulic Conductivity vs Pressure Head

Sample Number: GC-1S-4 0-2.5' (1.40 g/cc)



Plot of Hydraulic Conductivity vs Pressure Head

Sample Number: GC-1S-4 0-2.5' (1.40 g/cc)



Oversize Correction Data Sheet

Job Name: Golder Associates, Inc.
Job Number: DB19.1112.00
Sample Number: GC-1S-4 0-2.5' (1.40 g/cc)
Project Name: CCP-BMI 181-06417
Depth: 0'-2.5'

Split (3/4", 3/8", #4): #10

	Coarse Fraction*	Fines Fraction**	Composite
Subsample Mass (g):	10756.69	14967.81	25724.50
Mass Fraction (%):	41.81	58.19	100.00
Initial Sample θ_i			
Bulk Density (g/cm^3):	2.68	1.40	1.75
Calculated Porosity (% vol):	0.00	47.62	34.60
Volume of Solids (cm^3):	4020.90	5595.04	9615.94
Volume of Voids (cm^3):	0.00	5086.63	5086.63
Total Volume (cm^3):	4020.90	10681.67	14702.57
Volumetric Fraction (%):	27.35	72.65	100.00
Initial Moisture Content (% vol):	0.00	9.65	7.01
Saturated Sample θ_s			
Bulk Density (g/cm^3):	2.68	1.40	1.75
Calculated Porosity (% vol):	0.00	47.62	34.60
Volume of Solids (cm^3):	4020.90	5595.04	9615.94
Volume of Voids (cm^3):	0.00	5086.63	5086.63
Total Volume (cm^3):	4020.90	10681.67	14702.57
Volumetric Fraction (%):	27.35	72.65	100.00
Saturated Moisture Content (% vol):	0.00	49.16	35.71
Residual Sample θ_r			
Bulk Density (g/cm^3):	2.68	1.53	1.86
Calculated Porosity (% vol):	0.00	42.97	30.48
Volume of Solids (cm^3):	4020.90	5595.04	9615.94
Volume of Voids (cm^3):	0.00	4216.36	4216.36
Total Volume (cm^3):	4020.90	9811.40	13832.30
Volumetric Fraction (%):	29.07	70.93	100.00
Residual Moisture Content (% vol):	0.00	4.78	3.39
Ksat (cm/sec):	NM	4.1E-02	2.4E-02

* = Porosity and moisture content of coarse fraction assumed to be zero.
** = Volume adjusted, if applicable. See notes on Moisture Retention Data pages.
NM = Not measured

Laboratory analysis by: D. O'Dowd/A. Bland
Data entered by: C. Krous
Checked by: J. Hines

Moisture Retention Data

Hanging Column / Pressure Plate

(Soil-Water Characteristic Curve)

Job Name: Golder Associates, Inc.
Job Number: DB19.1112.00
Sample Number: PG-9A-2 Bulk (1.41 g/cc)
Project Name: CCP-BMI 181-06417
Depth: NA

Dry wt. of sample (g)*:* 309.42
Tare wt., ring (g)*:* 137.59
Tare wt., screen & clamp (g)*:* 25.69
Initial sample volume (cm^3)*:* 220.15
Initial dry bulk density (g/cm^3)*:* 1.41
Measured particle density (g/cm^3)*:* 2.67
Initial calculated total porosity (%)*:* 47.42

	Date	Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content † (% vol)	
Hanging column:	18-Apr-19	8:00	575.29	0	46.60	
	25-Apr-19	13:50	550.75	7.0	42.81	‡‡
	2-May-19	7:45	546.64	10.0	40.56	‡‡
	9-May-19	8:30	535.86	45.0	34.64	‡‡
	16-May-19	10:45	508.30	220.0	19.53	‡‡

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	---	---	---	---
	7.0	182.32	-17.18%	1.70	36.52
	10.0	182.32	-17.18%	1.70	36.52
	45.0	182.32	-17.18%	1.70	36.52
	220.0	182.32	-17.18%	1.70	36.52

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/A. Bland
Data entered by: C. Krous
Checked by: J. Hines

Moisture Retention Data

Dew Point Potentiometer / Relative Humidity Box

(Soil-Water Characteristic Curve)

Sample Number: PG-9A-2 Bulk (1.41 g/cc)

Initial sample bulk density (g/cm^3)*:* 1.41

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

Dry weight of dew point potentiometer sample* (g)*:* 176.92

Tare weight, jar (g)*:* 117.42

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content † (% vol)	
Dew point potentiometer:	23-May-19	10:18	179.84	5813	8.32	‡‡
	16-May-19	16:15	178.46	40078	4.39	‡‡
	9-May-19	15:03	177.78	355706	2.45	‡‡

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:	5813	182.32	-17.18%	1.70	36.52
	40078	182.32	-17.18%	1.70	36.52
	355706	182.32	-17.18%	1.70	36.52

Dry weight of relative humidity box sample* (g)*:* 70.85

Tare weight (g)*:* 39.93

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content † (% vol)	
Relative humidity box:	16-May-19	17:00	71.19	854732	1.88	‡‡

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:	854732	182.32	-17.18%	1.70	36.52

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.

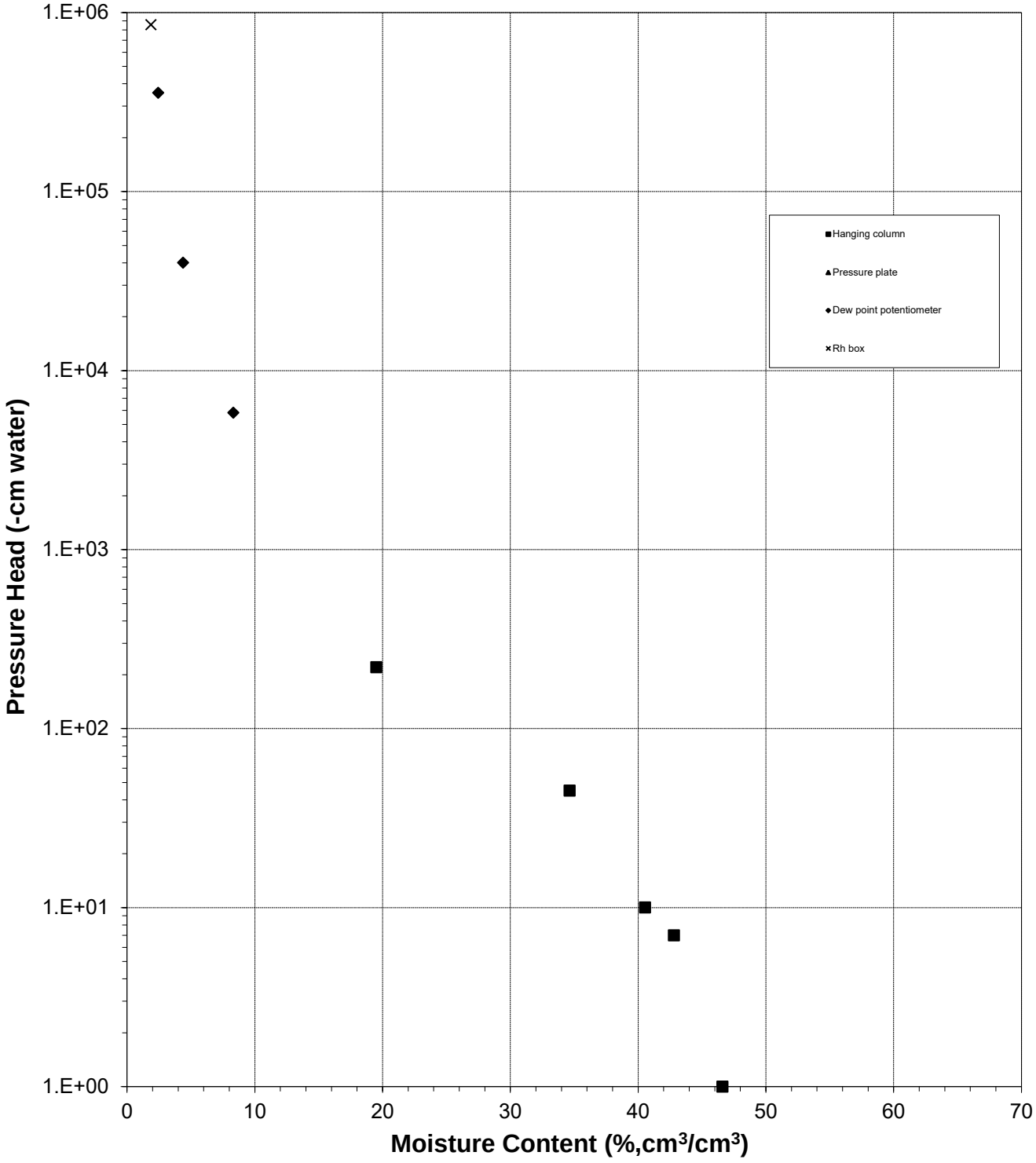
Laboratory analysis by: L. Thurgood/C. Krous

Data entered by: C. Krous

Checked by: J. Hines

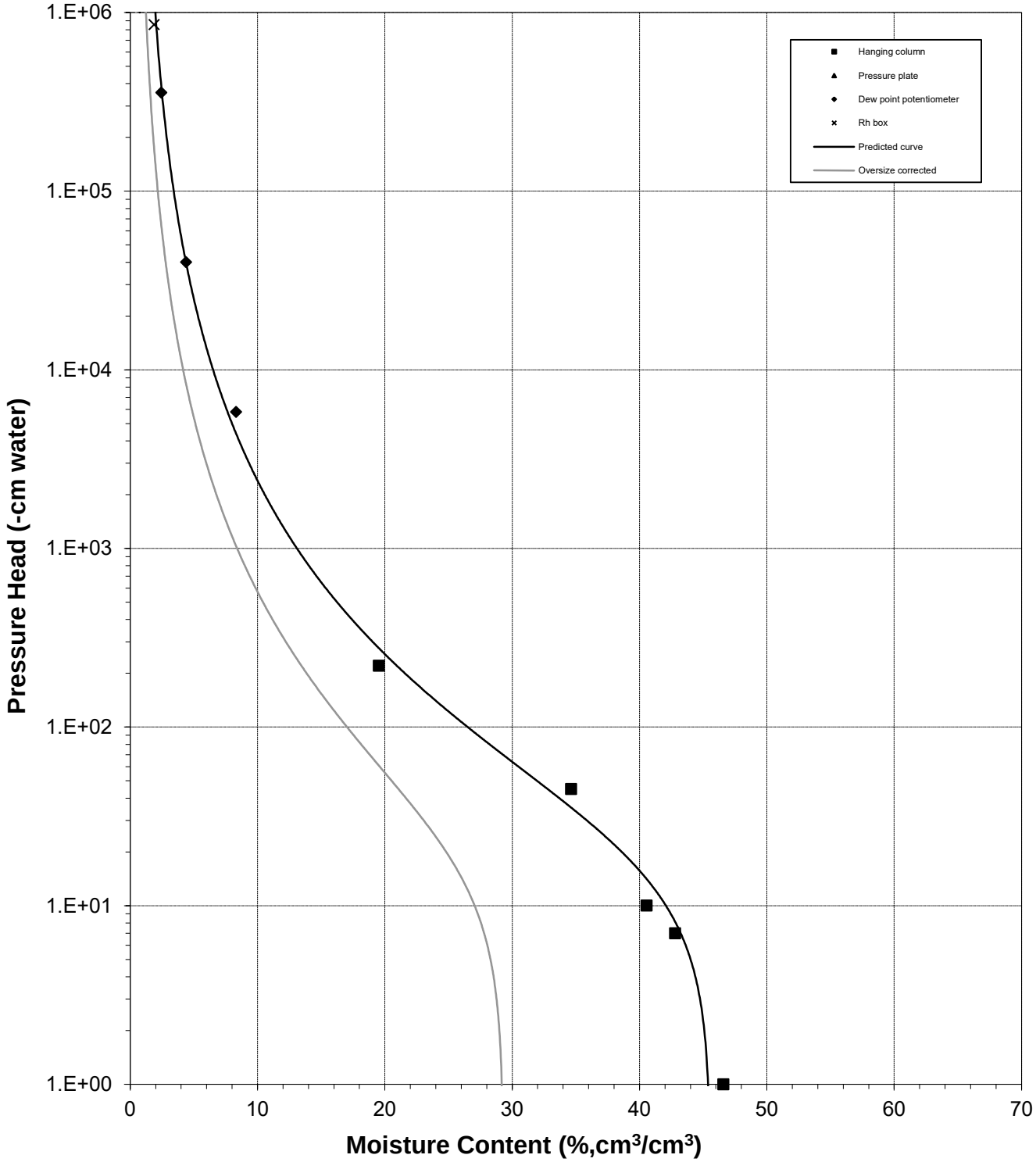
Water Retention Data Points

Sample Number: PG-9A-2 Bulk (1.41 g/cc)



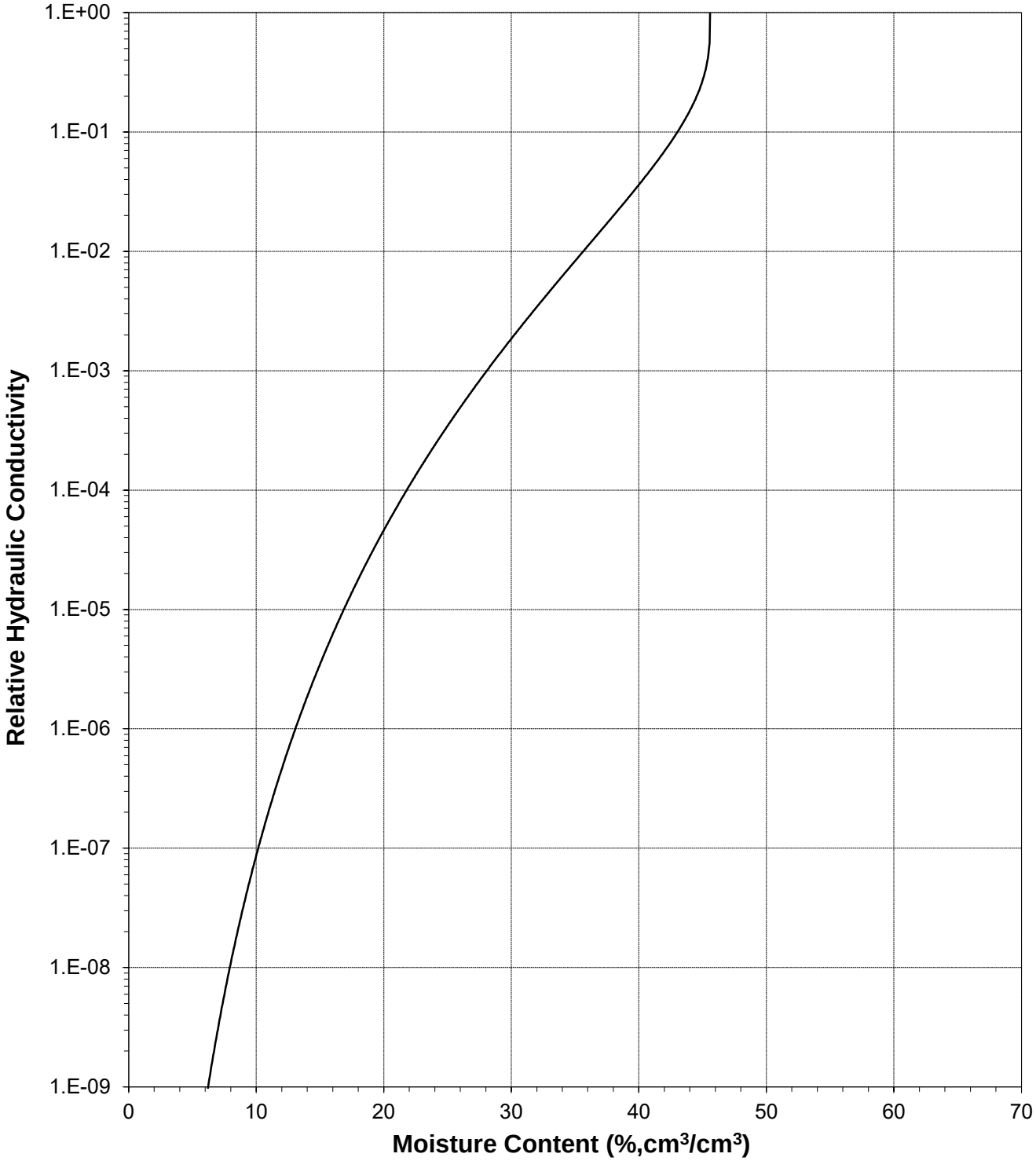
Predicted Calibration Curve and Data Points

Sample Number: PG-9A-2 Bulk (1.41 g/cc)



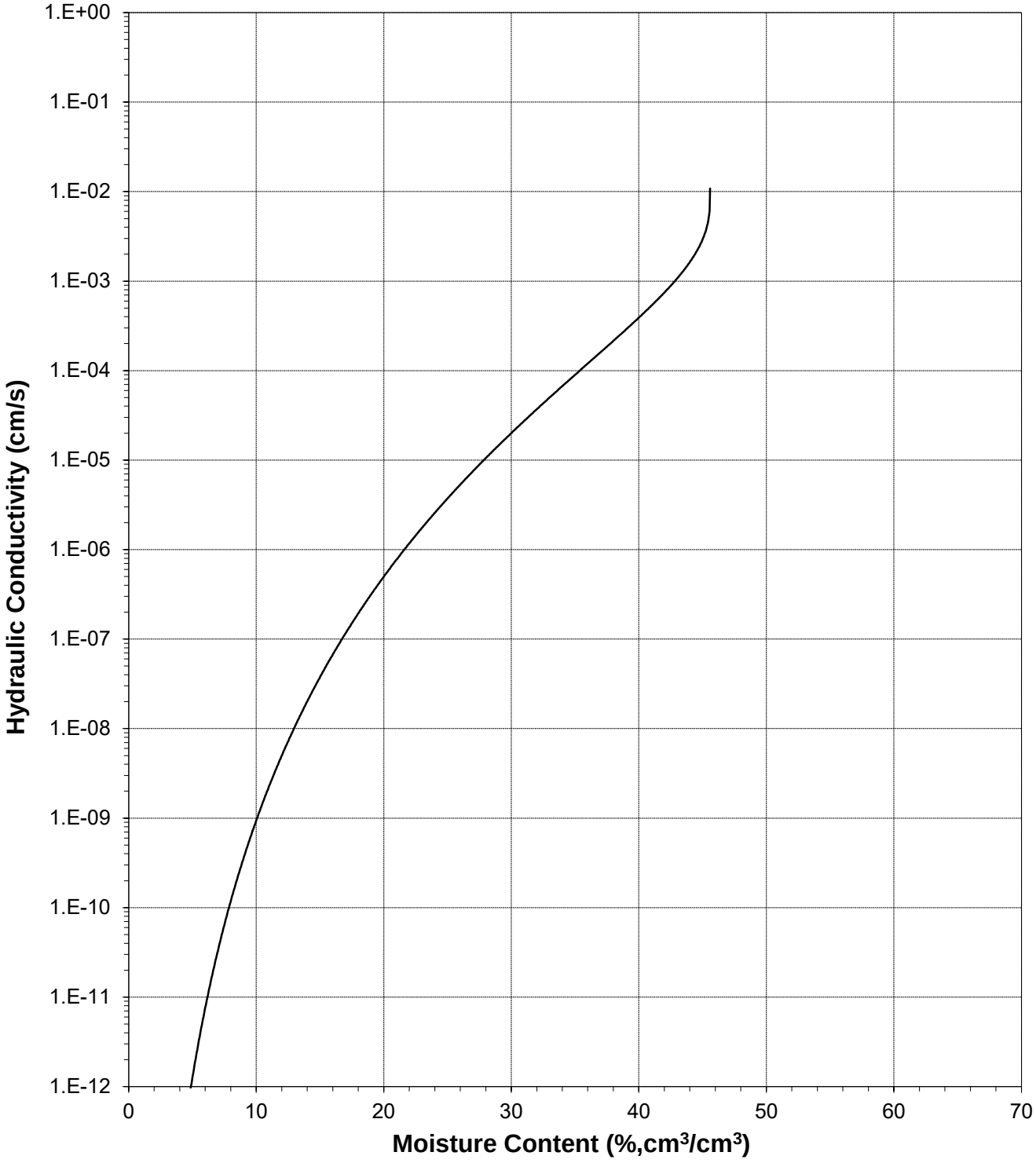
Plot of Relative Hydraulic Conductivity vs Moisture Content

Sample Number: PG-9A-2 Bulk (1.41 g/cc)



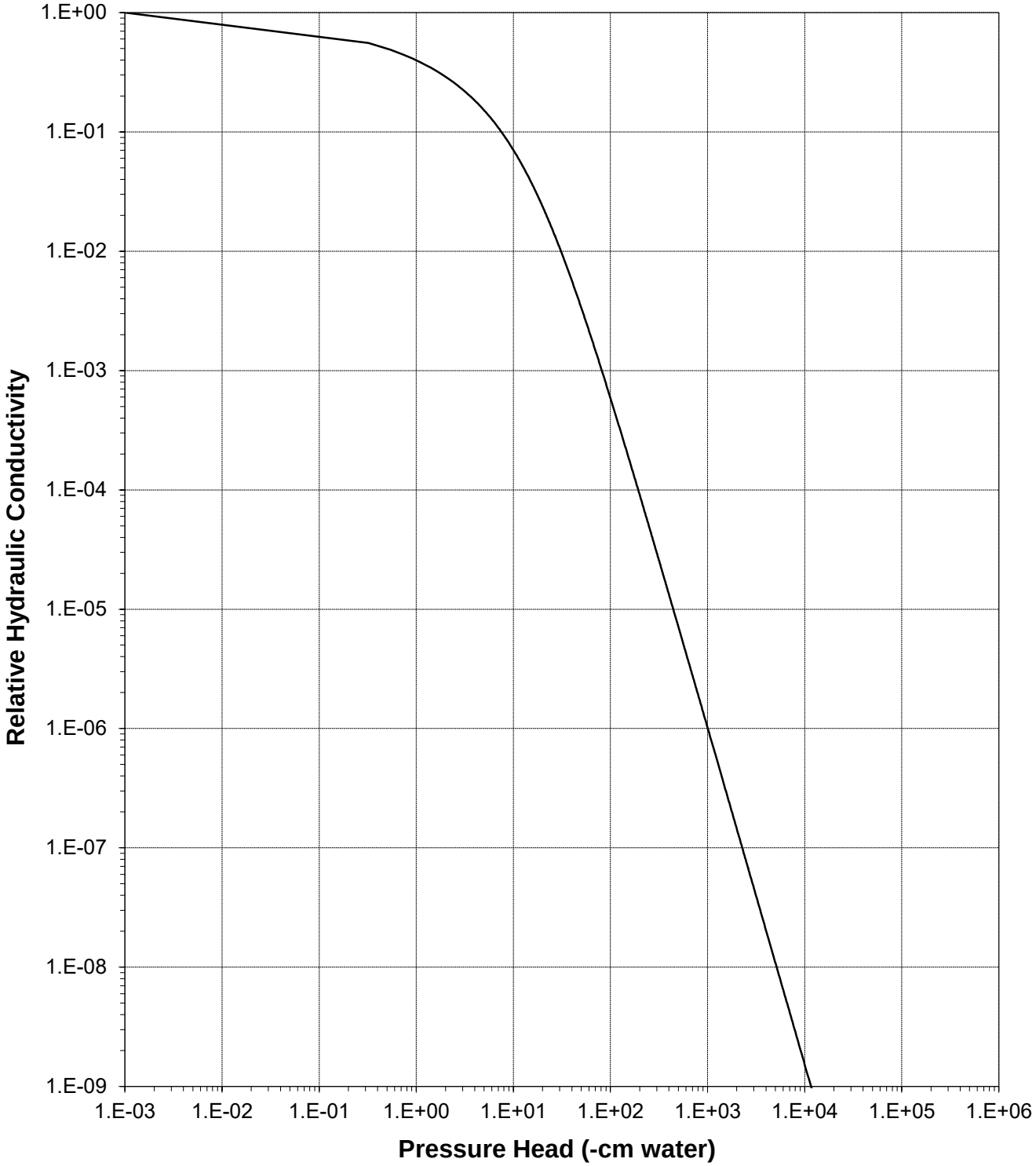
Plot of Hydraulic Conductivity vs Moisture Content

Sample Number: PG-9A-2 Bulk (1.41 g/cc)



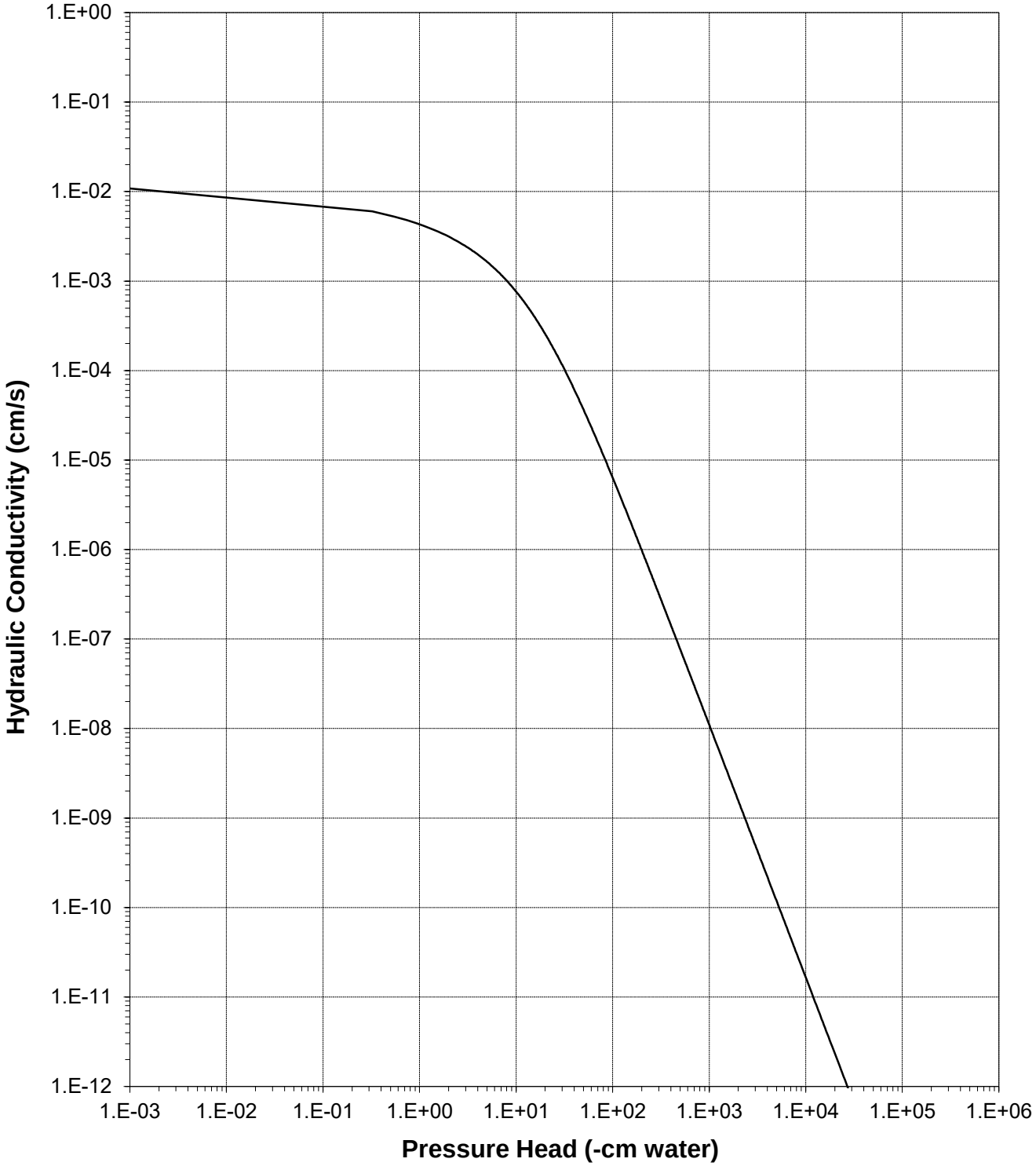
Plot of Relative Hydraulic Conductivity vs Pressure Head

Sample Number: PG-9A-2 Bulk (1.41 g/cc)



Plot of Hydraulic Conductivity vs Pressure Head

Sample Number: PG-9A-2 Bulk (1.41 g/cc)



Oversize Correction Data Sheet

Job Name: Golder Associates, Inc.
Job Number: DB19.1112.00
Sample Number: PG-9A-2 Bulk (1.41 g/cc)
Project Name: CCP-BMI 181-06417
Depth: NA

Split (3/4", 3/8", #4): #10

	Coarse Fraction*	Fines Fraction**	Composite
Subsample Mass (g):	12678.51	12004.12	24682.63
Mass Fraction (%):	51.37	48.63	100.00
Initial Sample θ_i			
Bulk Density (g/cm^3):	2.67	1.41	1.86
Calculated Porosity (% vol):	0.00	47.42	30.49
Volume of Solids (cm^3):	4742.58	4490.31	9232.89
Volume of Voids (cm^3):	0.00	4050.36	4050.36
Total Volume (cm^3):	4742.58	8540.67	13283.25
Volumetric Fraction (%):	35.70	64.30	100.00
Initial Moisture Content (% vol):	0.00	9.90	6.36
Saturated Sample θ_s			
Bulk Density (g/cm^3):	2.67	1.41	1.86
Calculated Porosity (% vol):	0.00	47.42	30.49
Volume of Solids (cm^3):	4742.58	4490.31	9232.89
Volume of Voids (cm^3):	0.00	4050.36	4050.36
Total Volume (cm^3):	4742.58	8540.67	13283.25
Volumetric Fraction (%):	35.70	64.30	100.00
Saturated Moisture Content (% vol):	0.00	45.58	29.31
Residual Sample θ_r			
Bulk Density (g/cm^3):	2.67	1.70	2.09
Calculated Porosity (% vol):	0.00	36.52	21.86
Volume of Solids (cm^3):	4742.58	4490.31	9232.89
Volume of Voids (cm^3):	0.00	2582.87	2582.87
Total Volume (cm^3):	4742.58	7073.19	11815.76
Volumetric Fraction (%):	40.14	59.86	100.00
Residual Moisture Content (% vol):	0.00	0.71	0.42
Ksat (cm/sec):	NM	1.1E-02	5.3E-03

* = Porosity and moisture content of coarse fraction assumed to be zero.
** = Volume adjusted, if applicable. See notes on Moisture Retention Data pages.
NM = Not measured

Laboratory analysis by: D. O'Dowd/A. Bland
Data entered by: C. Krous
Checked by: J. Hines

Moisture Retention Data

Hanging Column / Pressure Plate

(Soil-Water Characteristic Curve)

Job Name: Golder Associates, Inc.
Job Number: DB19.1112.00
Sample Number: PG-9A-1 Bulk (1.41 g/cc)
Project Name: CCP-BMI 181-06417
Depth: NA

Dry wt. of sample (g)*:* 310.94
Tare wt., ring (g)*:* 137.88
Tare wt., screen & clamp (g)*:* 25.25
Initial sample volume (cm^3)*:* 221.16
Initial dry bulk density (g/cm^3)*:* 1.41
Measured particle density (g/cm^3)*:* 2.71
Initial calculated total porosity (%)*:* 48.09

	Date	Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content † (% vol)	
Hanging column:	18-Apr-19	8:00	580.22	0	48.00	
	25-Apr-19	13:50	577.66	7.0	47.43	‡‡
	2-May-19	7:45	562.69	10.0	41.37	‡‡
	9-May-19	8:30	525.48	45.0	24.00	‡‡
	16-May-19	10:45	512.08	220.0	17.74	‡‡

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	---	---	---	---
	7.0	218.42	-1.24%	1.42	47.44
	10.0	214.22	-3.14%	1.45	46.41
	45.0	214.22	-3.14%	1.45	46.41
	220.0	214.22	-3.14%	1.45	46.41

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/A. Bland
Data entered by: C. Krous
Checked by: J. Hines

Moisture Retention Data

Dew Point Potentiometer / Relative Humidity Box

(Soil-Water Characteristic Curve)

Sample Number: PG-9A-1 Bulk (1.41 g/cc)

Initial sample bulk density (g/cm^3)*:* 1.41

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

Dry weight of dew point potentiometer sample* (g)*:* 170.69

Tare weight, jar (g)*:* 113.37

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content † (% vol)	
Dew point potentiometer:	20-May-19	10:26	173.77	8872	7.80	‡‡
	15-May-19	11:48	172.72	63839	5.13	‡‡
	10-May-19	12:46	171.97	318484	3.24	‡‡

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	214.22	-3.14%	1.45	46.41
	63839	214.22	-3.14%	1.45	46.41
	318484	214.22	-3.14%	1.45	46.41

Dry weight of relative humidity box sample* (g)*:* 82.60

Tare weight (g)*:* 47.61

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content † (% vol)	
Relative humidity box:	16-May-19	17:00	83.28	854732	2.81	‡‡

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:	854732	214.22	-3.14%	1.45	46.41

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.

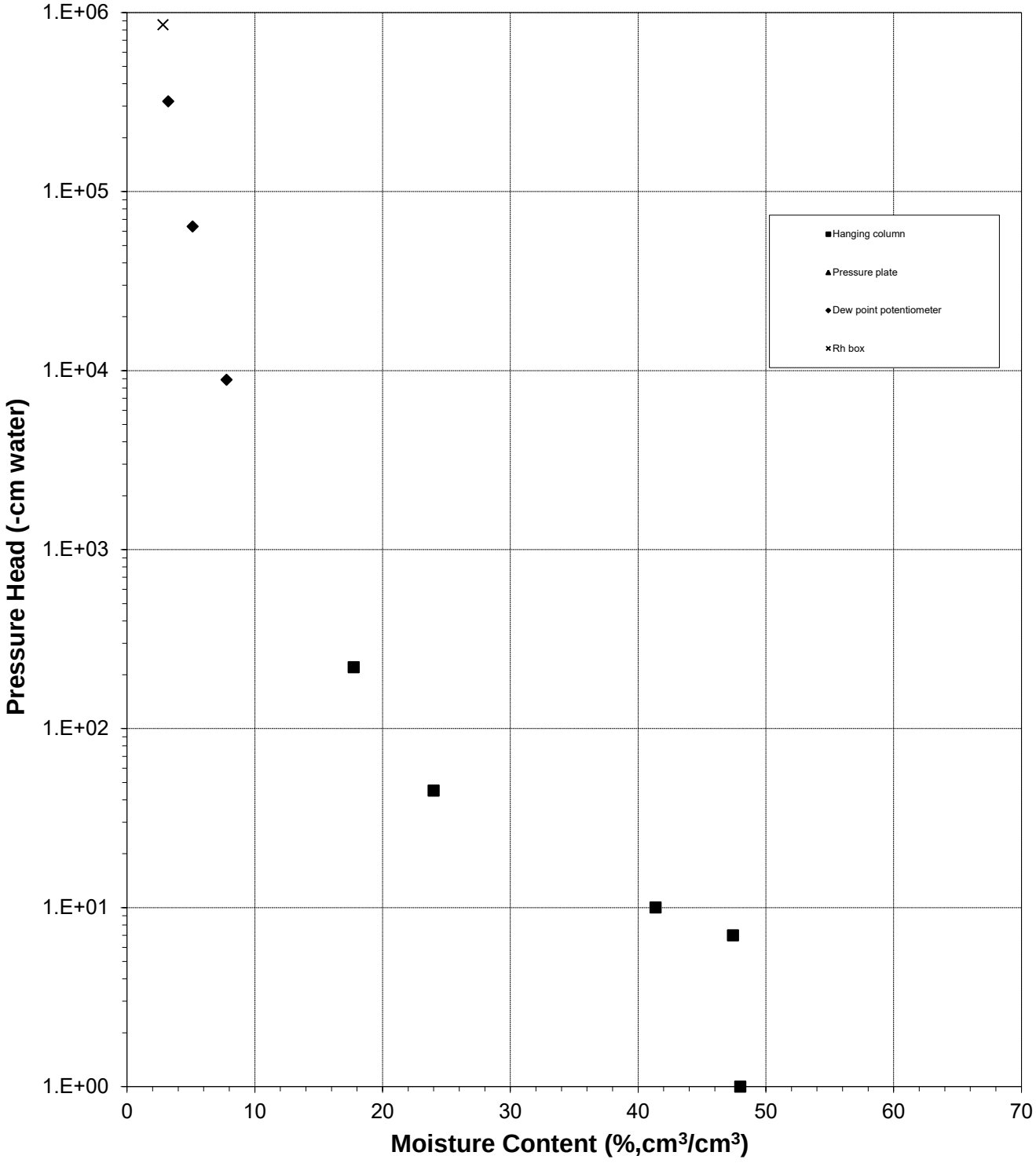
Laboratory analysis by: L. Thurgood/C. Krous

Data entered by: C. Krous

Checked by: J. Hines

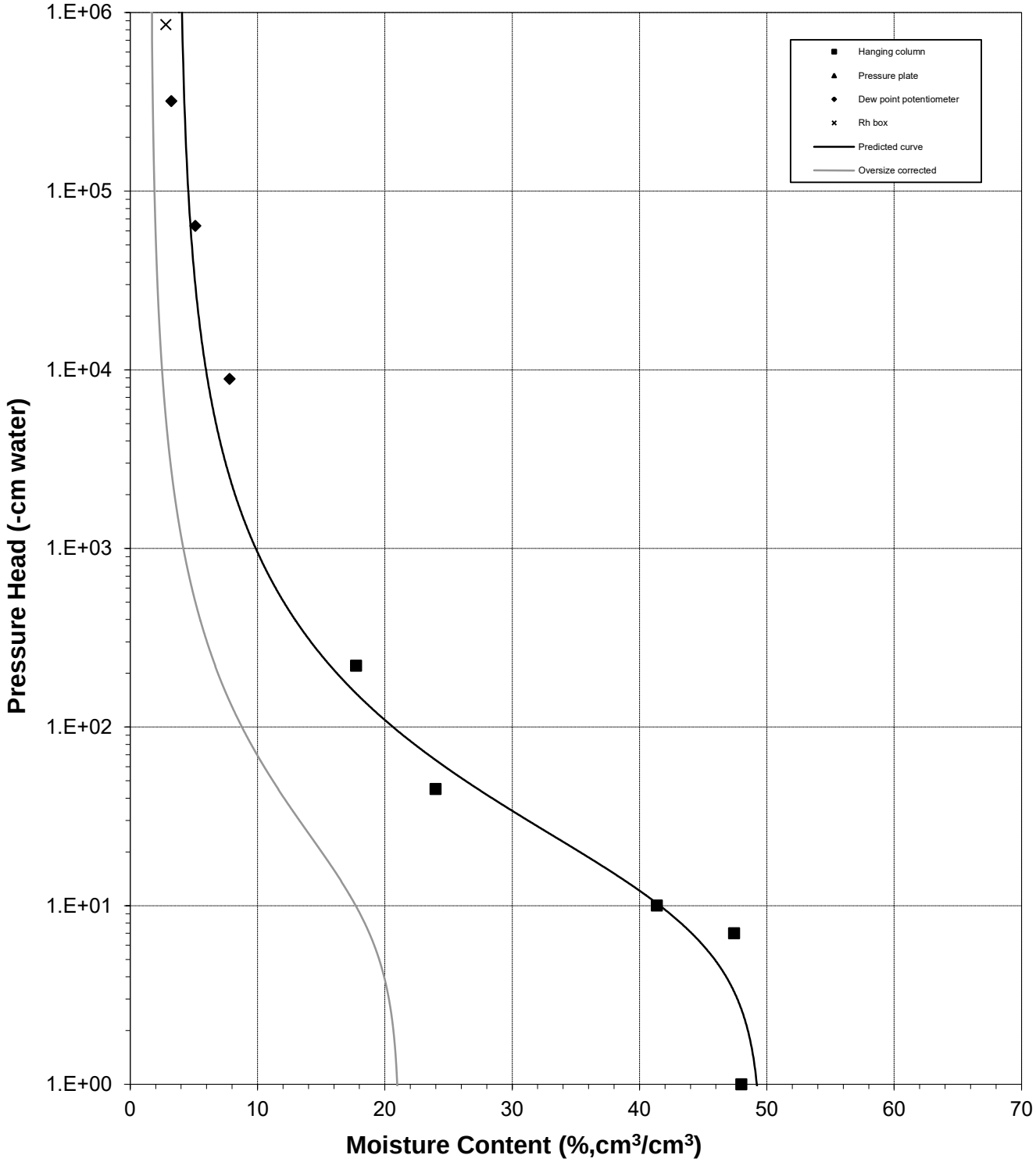
Water Retention Data Points

Sample Number: PG-9A-1 Bulk (1.41 g/cc)



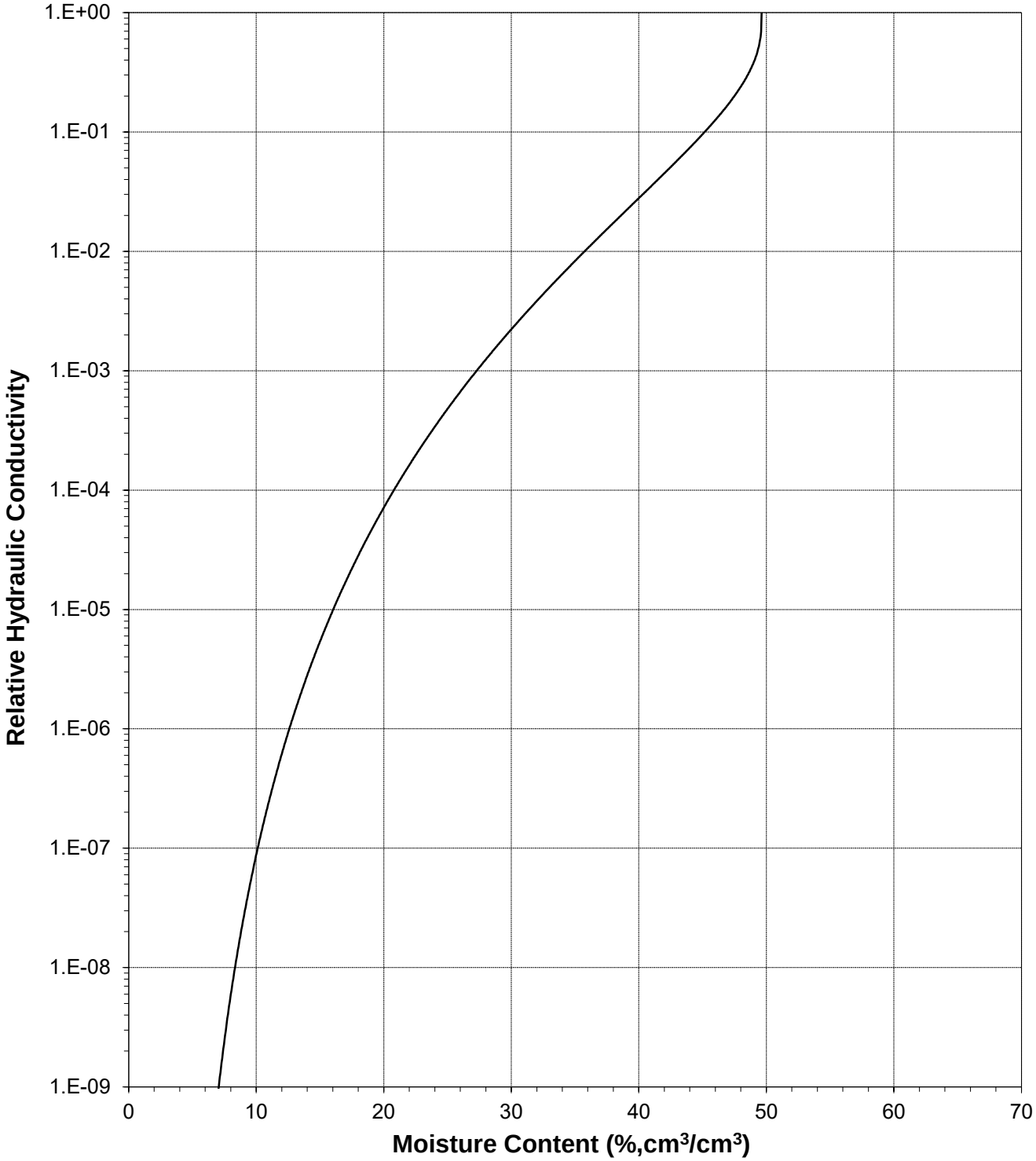
Predicted Calibration Curve and Data Points

Sample Number: PG-9A-1 Bulk (1.41 g/cc)



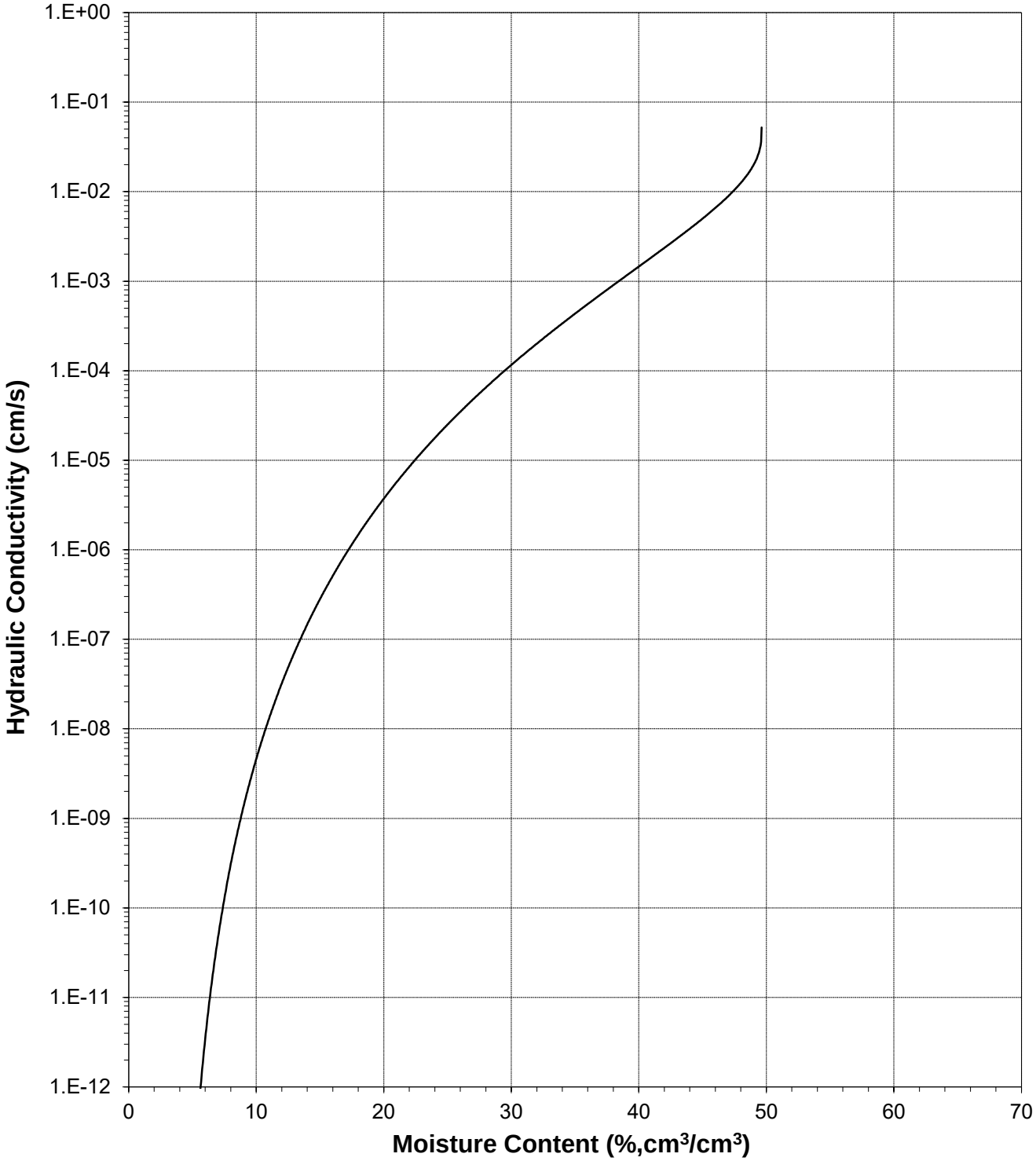
Plot of Relative Hydraulic Conductivity vs Moisture Content

Sample Number: PG-9A-1 Bulk (1.41 g/cc)



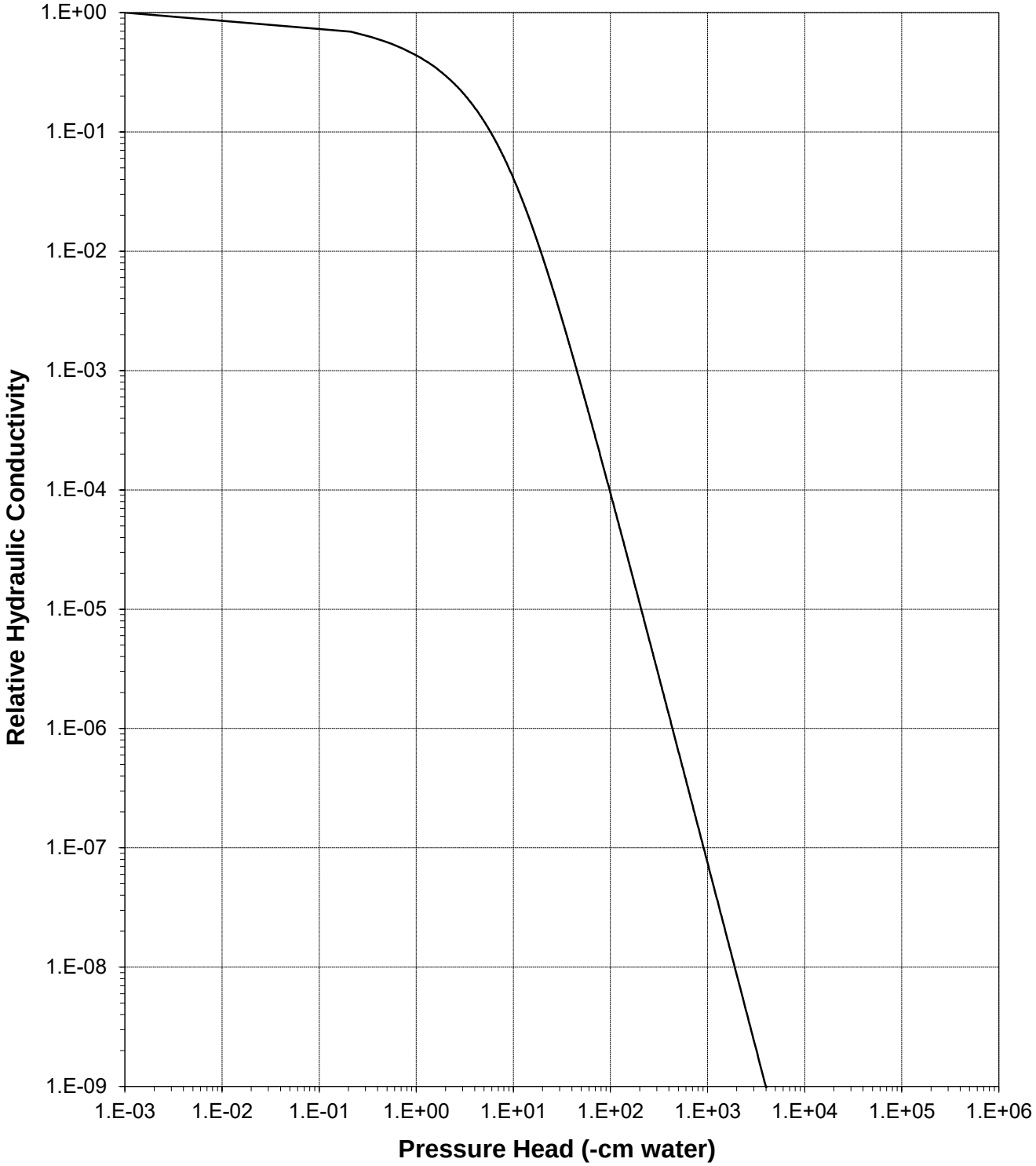
Plot of Hydraulic Conductivity vs Moisture Content

Sample Number: PG-9A-1 Bulk (1.41 g/cc)



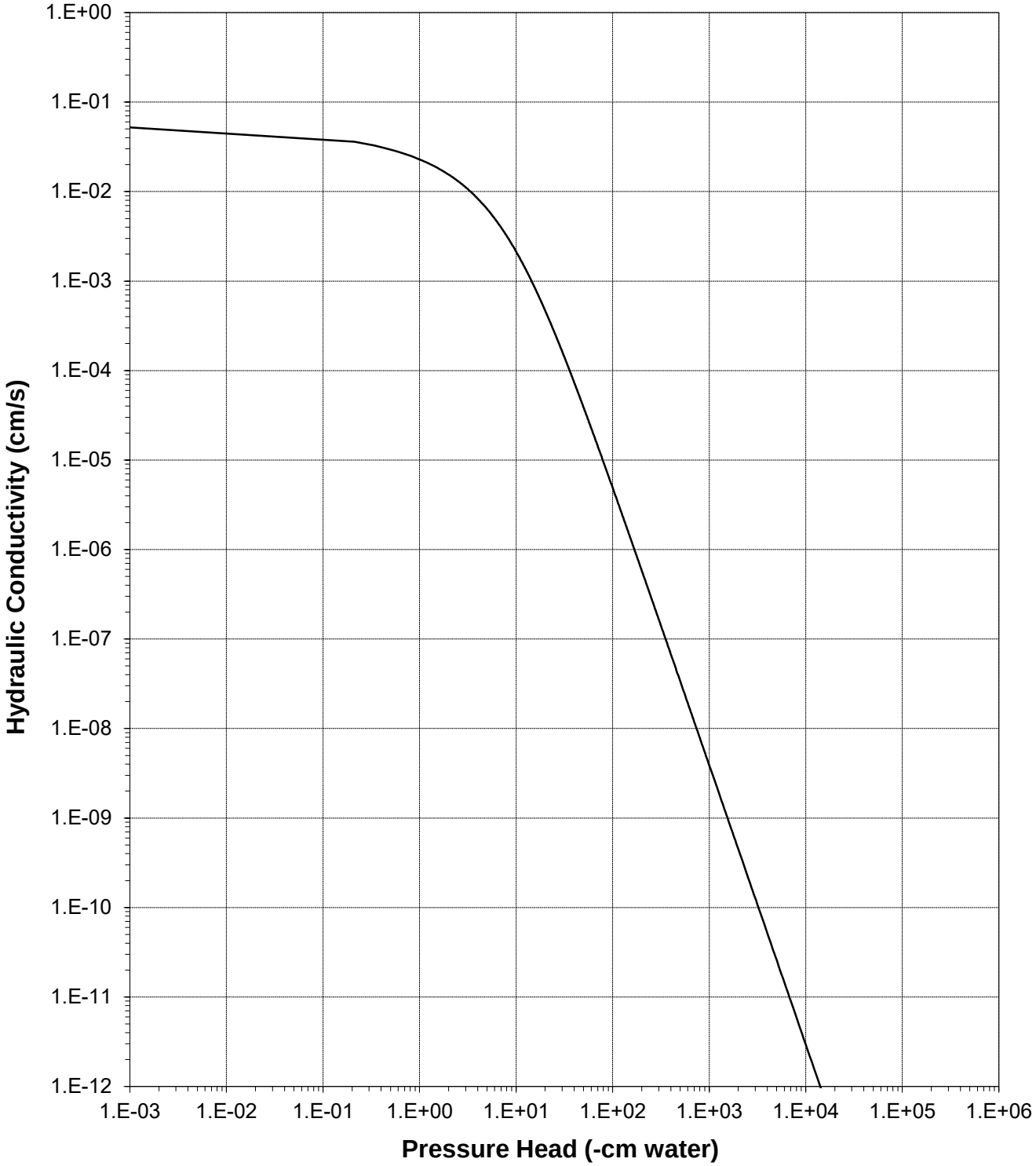
Plot of Relative Hydraulic Conductivity vs Pressure Head

Sample Number: PG-9A-1 Bulk (1.41 g/cc)



Plot of Hydraulic Conductivity vs Pressure Head

Sample Number: PG-9A-1 Bulk (1.41 g/cc)



Oversize Correction Data Sheet

Job Name: Golder Associates, Inc.
Job Number: DB19.1112.00
Sample Number: PG-9A-1 Bulk (1.41 g/cc)
Project Name: CCP-BMI 181-06417
Depth: NA

Split (3/4", 3/8", #4): #10

	Coarse Fraction*	Fines Fraction**	Composite
Subsample Mass (g):	18031.67	6946.72	24978.39
Mass Fraction (%):	72.19	27.81	100.00
Initial Sample θ_i			
Bulk Density (g/cm^3):	2.71	1.41	2.15
Calculated Porosity (% vol):	0.00	48.09	20.49
Volume of Solids (cm^3):	6657.48	2564.80	9222.29
Volume of Voids (cm^3):	0.00	2376.14	2376.14
Total Volume (cm^3):	6657.48	4940.94	11598.43
Volumetric Fraction (%):	57.40	42.60	100.00
Initial Moisture Content (% vol):	0.00	13.10	5.58
Saturated Sample θ_s			
Bulk Density (g/cm^3):	2.71	1.41	2.15
Calculated Porosity (% vol):	0.00	48.09	20.49
Volume of Solids (cm^3):	6657.48	2564.80	9222.29
Volume of Voids (cm^3):	0.00	2376.14	2376.14
Total Volume (cm^3):	6657.48	4940.94	11598.43
Volumetric Fraction (%):	57.40	42.60	100.00
Saturated Moisture Content (% vol):	0.00	49.64	21.15
Residual Sample θ_r			
Bulk Density (g/cm^3):	2.71	1.45	2.18
Calculated Porosity (% vol):	0.00	46.41	19.41
Volume of Solids (cm^3):	6657.48	2564.80	9222.29
Volume of Voids (cm^3):	0.00	2221.00	2221.00
Total Volume (cm^3):	6657.48	4785.80	11443.29
Volumetric Fraction (%):	58.18	41.82	100.00
Residual Moisture Content (% vol):	0.00	3.80	1.59
Ksat (cm/sec):	NM	5.2E-02	1.5E-02

* = Porosity and moisture content of coarse fraction assumed to be zero.
** = Volume adjusted, if applicable. See notes on Moisture Retention Data pages.
NM = Not measured

Laboratory analysis by: D. O'Dowd/A. Bland
Data entered by: C. Krous
Checked by: J. Hines

Moisture Retention Data

Hanging Column / Pressure Plate

(Soil-Water Characteristic Curve)

Job Name: Golder Associates, Inc.
Job Number: DB19.1112.00
Sample Number: PG-9AX-1 Bulk (1.41 g/cc)
Project Name: CCP-BMI 181-06417
Depth: NA

Dry wt. of sample (g): 309.47
Tare wt., ring (g): 137.07
Tare wt., screen & clamp (g): 27.48
Initial sample volume (cm^3): 219.83
Initial dry bulk density (g/cm^3): 1.41
Measured particle density (g/cm^3): 2.68
Initial calculated total porosity (%): 47.54

	Date	Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content † (% vol)	
Hanging column:	18-Apr-19	8:00	577.83	0	47.22	
	25-Apr-19	13:50	575.25	7.0	46.05	
	2-May-19	7:45	561.42	10.0	41.11	‡‡
	9-May-19	8:30	526.67	45.0	24.77	‡‡
	16-May-19	10:45	511.85	220.0	17.79	‡‡

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	---	---	---	---
	7.0	---	---	---	---
	10.0	212.59	-3.29%	1.46	45.75
	45.0	212.59	-3.29%	1.46	45.75
	220.0	212.59	-3.29%	1.46	45.75

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/A. Bland
Data entered by: C. Krous
Checked by: J. Hines

Moisture Retention Data

Dew Point Potentiometer / Relative Humidity Box

(Soil-Water Characteristic Curve)

Sample Number: PG-9AX-1 Bulk (1.41 g/cc)

Initial sample bulk density (g/cm^3)*:* 1.41

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

Dry weight of dew point potentiometer sample* (g)*:* 169.89

Tare weight, jar (g)*:* 114.82

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content † (% vol)	
Dew point potentiometer:	23-May-19	10:20	173.80	3263	10.34	‡‡
	15-May-19	11:31	171.82	47931	5.10	‡‡
	10-May-19	12:14	171.53	228333	4.33	‡‡

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:	3263	212.59	-3.29%	1.46	45.75
	47931	212.59	-3.29%	1.46	45.75
	228333	212.59	-3.29%	1.46	45.75

Dry weight of relative humidity box sample* (g)*:* 29.77

Tare weight (g)*:* 6.49

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content † (% vol)	
Relative humidity box:	16-May-19	17:00	30.23	854732	2.88	‡‡

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:	854732	212.59	-3.29%	1.46	45.75

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.

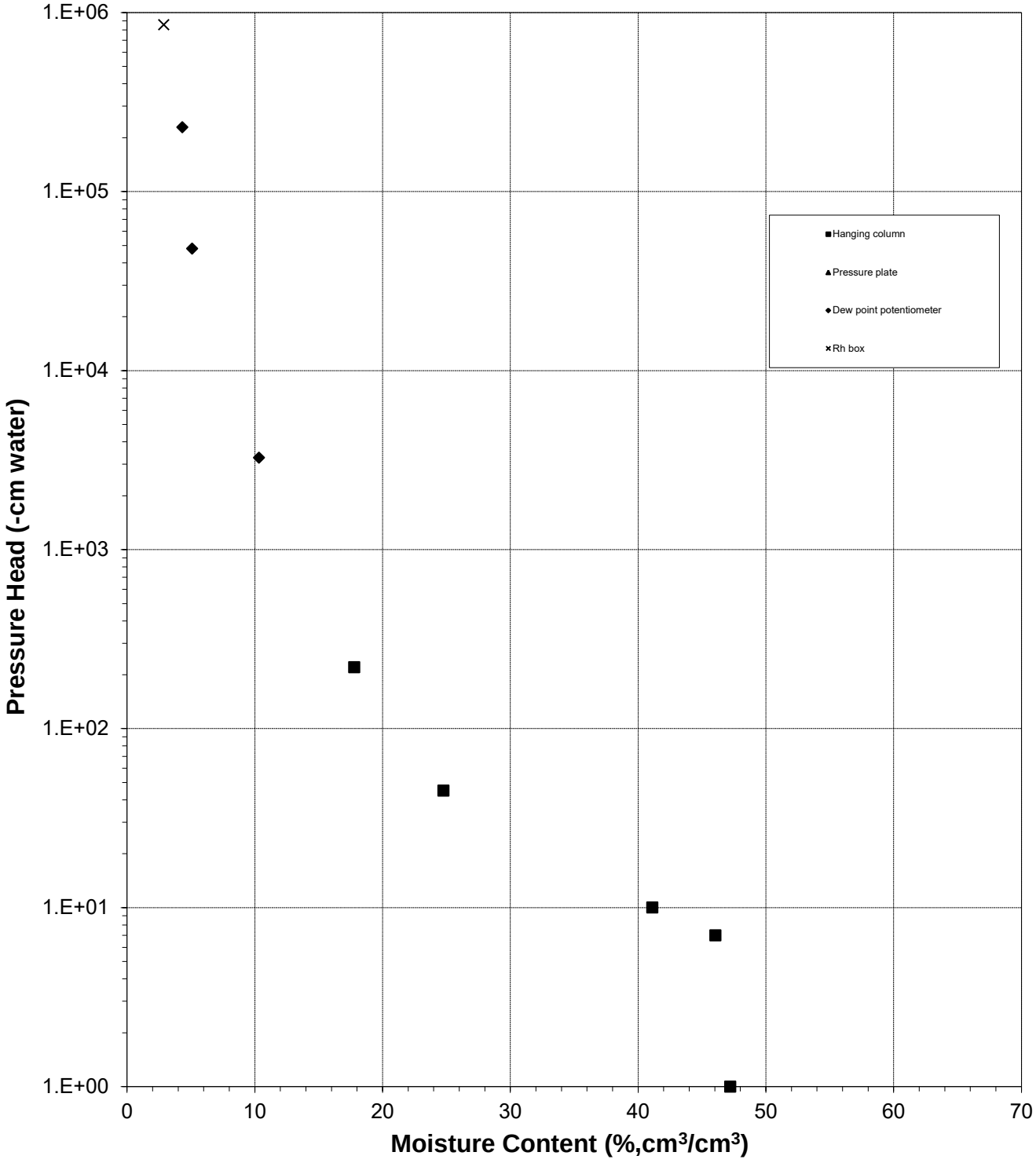
Laboratory analysis by: L. Thurgood/C. Krous

Data entered by: C. Krous

Checked by: J. Hines

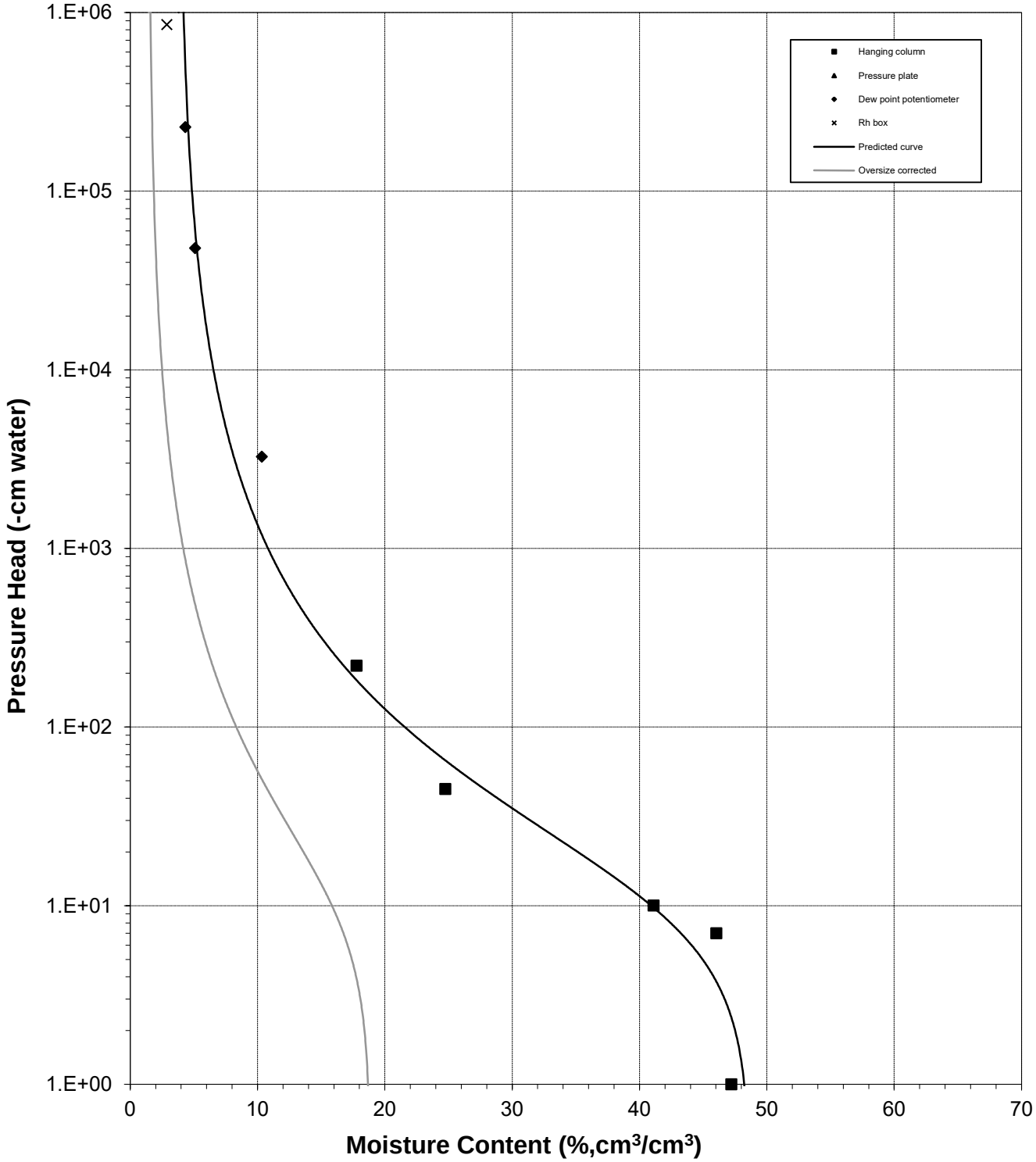
Water Retention Data Points

Sample Number: PG-9AX-1 Bulk (1.41 g/cc)



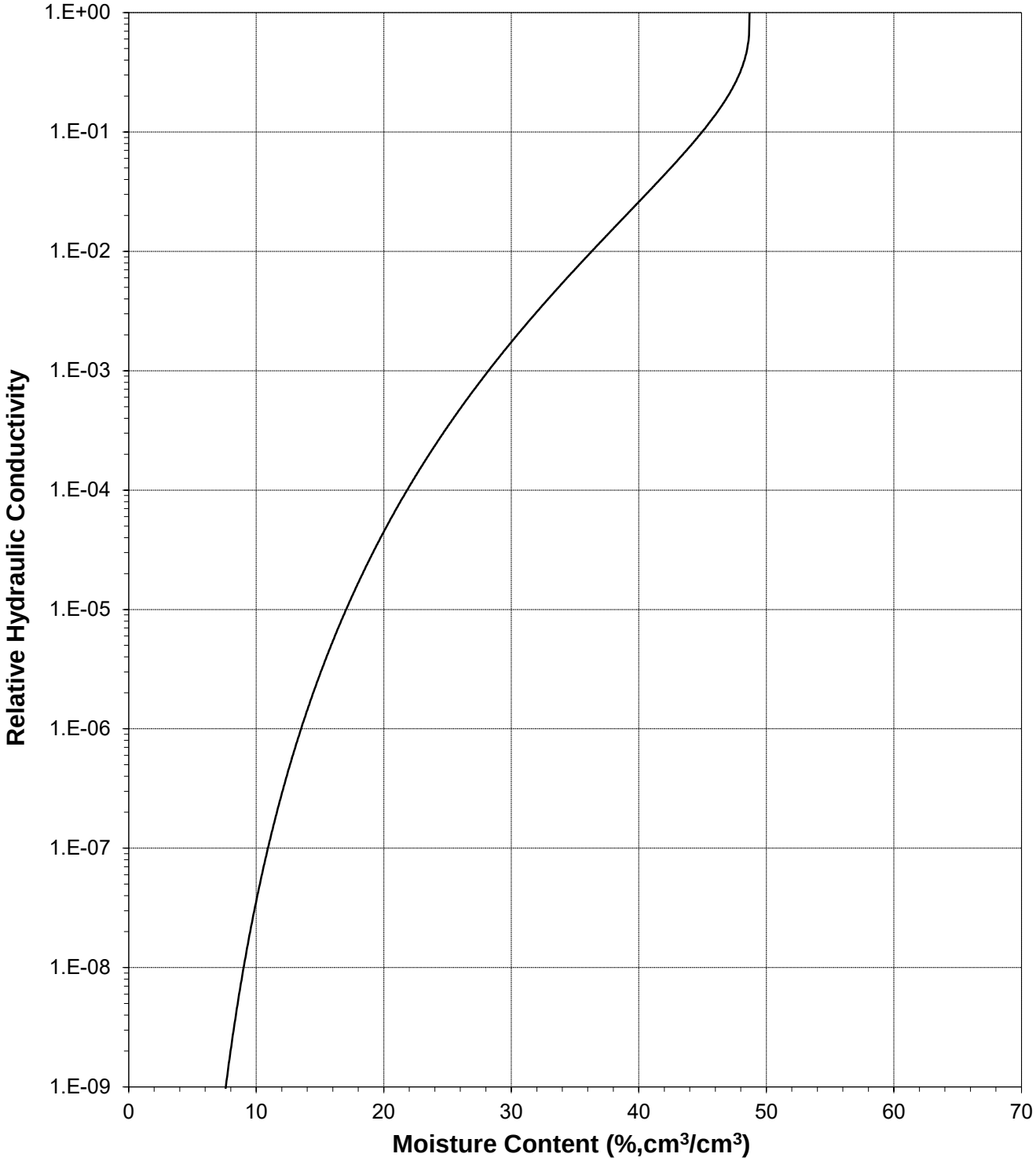
Predicted Calibration Curve and Data Points

Sample Number: PG-9AX-1 Bulk (1.41 g/cc)



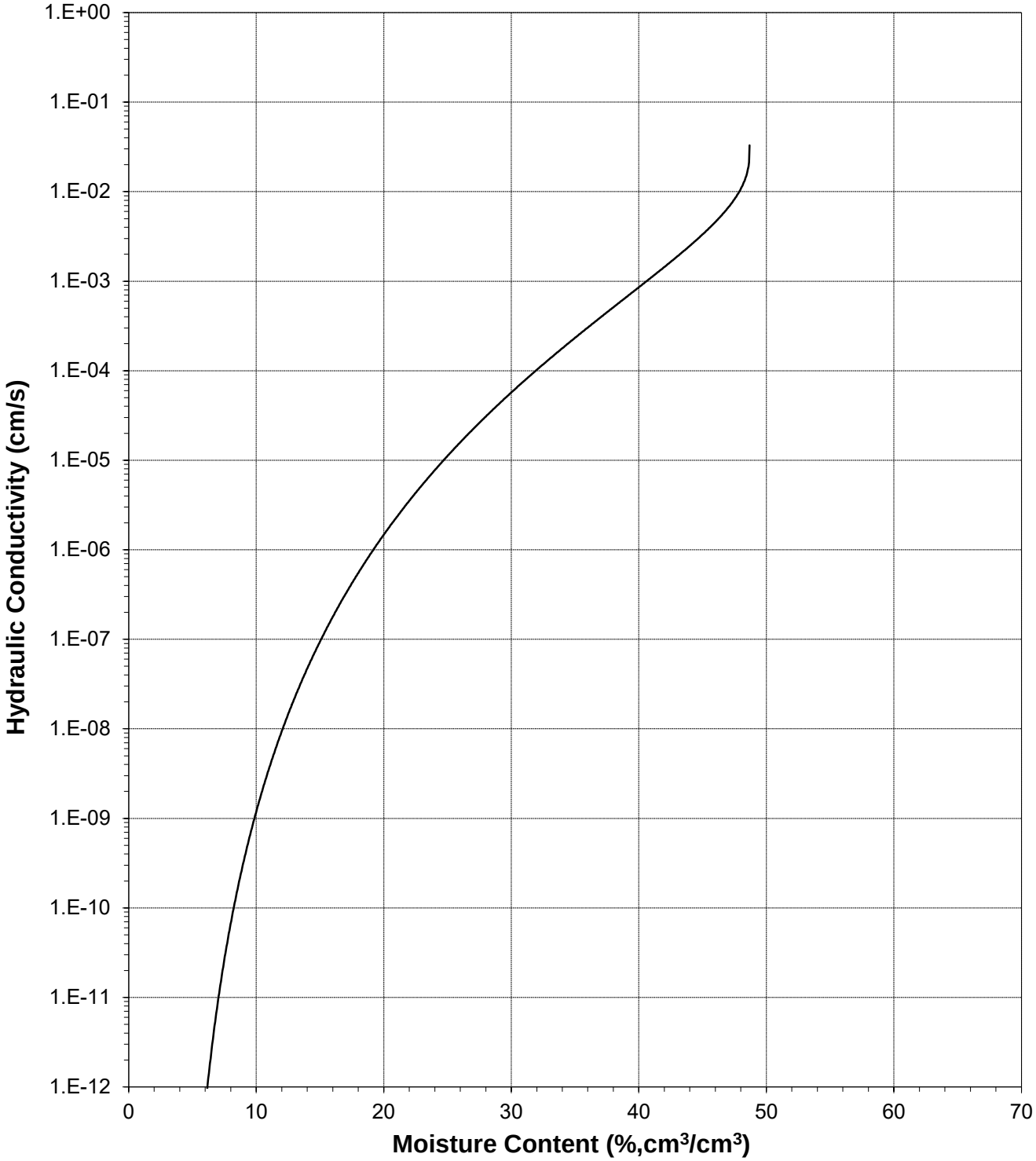
Plot of Relative Hydraulic Conductivity vs Moisture Content

Sample Number: PG-9AX-1 Bulk (1.41 g/cc)



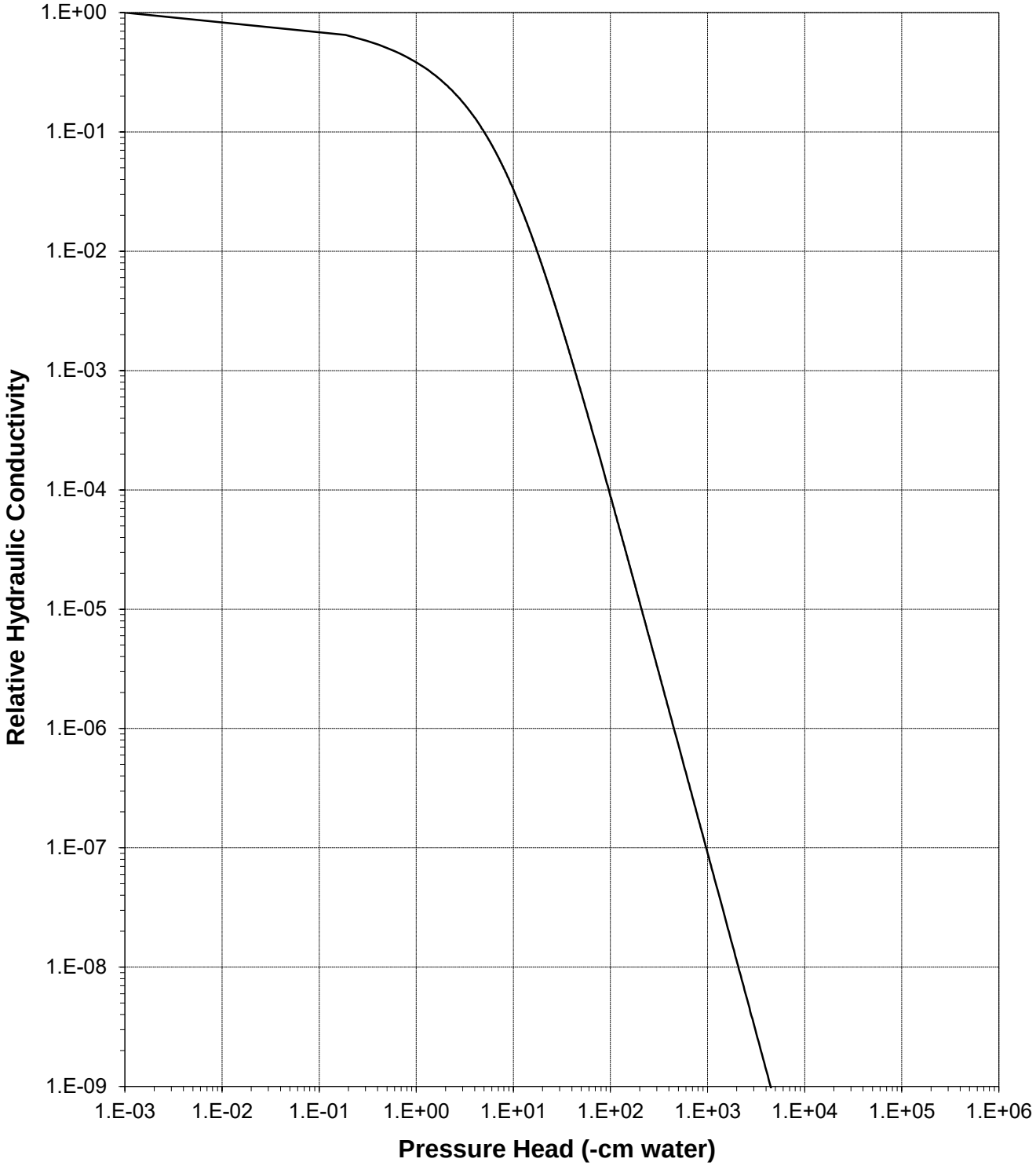
Plot of Hydraulic Conductivity vs Moisture Content

Sample Number: PG-9AX-1 Bulk (1.41 g/cc)



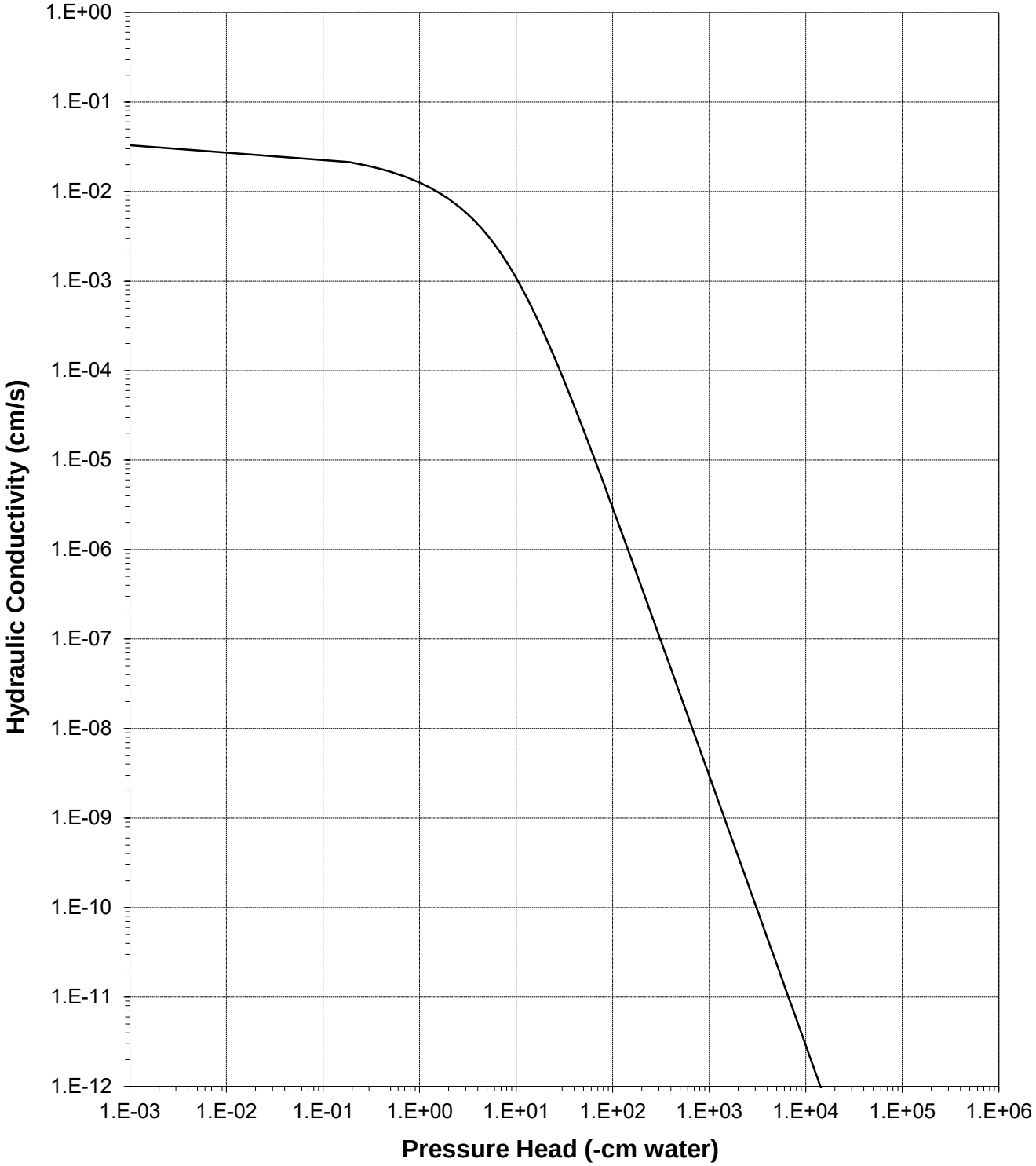
Plot of Relative Hydraulic Conductivity vs Pressure Head

Sample Number: PG-9AX-1 Bulk (1.41 g/cc)



Plot of Hydraulic Conductivity vs Pressure Head

Sample Number: PG-9AX-1 Bulk (1.41 g/cc)



Oversize Correction Data Sheet

Job Name: Golder Associates, Inc.
Job Number: DB19.1112.00
Sample Number: PG-9AX-1 Bulk (1.41 g/cc)
Project Name: CCP-BMI 181-06417
Depth: NA

Split (3/4", 3/8", #4): #10

	Coarse Fraction*	Fines Fraction**	Composite
Subsample Mass (g):	17580.25	5830.02	23410.27
Mass Fraction (%):	75.10	24.90	100.00
Initial Sample θ_i			
Bulk Density (g/cm^3):	2.68	1.41	2.19
Calculated Porosity (% vol):	0.00	47.54	18.41
Volume of Solids (cm^3):	6551.37	2172.59	8723.95
Volume of Voids (cm^3):	0.00	1968.65	1968.65
Total Volume (cm^3):	6551.37	4141.24	10692.60
Volumetric Fraction (%):	61.27	38.73	100.00
Initial Moisture Content (% vol):	0.00	11.56	4.48
Saturated Sample θ_s			
Bulk Density (g/cm^3):	2.68	1.41	2.19
Calculated Porosity (% vol):	0.00	47.54	18.41
Volume of Solids (cm^3):	6551.37	2172.59	8723.95
Volume of Voids (cm^3):	0.00	1968.65	1968.65
Total Volume (cm^3):	6551.37	4141.24	10692.60
Volumetric Fraction (%):	61.27	38.73	100.00
Saturated Moisture Content (% vol):	0.00	48.69	18.86
Residual Sample θ_r			
Bulk Density (g/cm^3):	2.68	1.46	2.22
Calculated Porosity (% vol):	0.00	45.75	17.36
Volume of Solids (cm^3):	6551.37	2172.59	8723.95
Volume of Voids (cm^3):	0.00	1832.41	1832.41
Total Volume (cm^3):	6551.37	4005.00	10556.37
Volumetric Fraction (%):	62.06	37.94	100.00
Residual Moisture Content (% vol):	0.00	3.77	1.43
Ksat (cm/sec):	NM	3.3E-02	8.2E-03

* = Porosity and moisture content of coarse fraction assumed to be zero.
** = Volume adjusted, if applicable. See notes on Moisture Retention Data pages.
NM = Not measured

Laboratory analysis by: D. O'Dowd/A. Bland
Data entered by: C. Krous
Checked by: J. Hines

Specific Gravity

Summary of Specific Gravity Tests

	<4.75 mm Fraction			>4.75 mm Fraction			Bulk Sample
Sample Number	Specific Gravity	Particle Size	% of Bulk Sample	Specific Gravity	Particle Size	% of Bulk Sample	Specific Gravity[1]
GC-LS-2 6-7	2.67	<4.75 mm	34.0%	NR	>4.75 mm	66.0%	2.67
GC-1S-2 4-6	2.71	<4.75 mm	64.4%	NR	>4.75 mm	35.6%	2.71
GC-1S-3 2-6.5	2.67	<4.75 mm	65.0%	NR	>4.75 mm	35.0%	2.67
GC-1S-4 0-2.5	2.68	<4.75 mm	58.2%	NR	>4.75 mm	41.8%	2.68
PG-9A-2 Bulk	2.68	<4.75 mm	48.6%	NR	>4.75 mm	51.4%	2.68
PG-9A-1 Bulk	2.71	<4.75 mm	27.8%	NR	>4.75 mm	72.2%	2.71
PG-9AX-1 Bulk	2.69	<4.75 mm	24.9%	NR	>4.75 mm	75.1%	2.69

[1]Based on the <4.75mm material

NA = Not Applicable since specificed fraction is less than 5% of composite sample mass

NR = Test not Requested

Data for Specific Gravity of Sample: GC-LS-2 6-7'

Job Name: Golder Associates, Inc.
Job Number: DB19.1112.00
Sample Number: GC-LS-2 6-7'
Project Name: CCP-BMI 181-06417
Depth: 6'-7'

ASTM D854 (<2.00mm Fraction)

Test Date:	17-May-19	
Percent of Test Sample (% g/g):	34.0	
Percent of Bulk Sample (% g/g):	34.0	
	Trial 1	*Trial 2*
Weight of pycnometer filled w/air (g):	92.39	90.30
Weight of pycnometer filled w/soil (g):	143.26	140.66
Weight of pycnometer filled w/soil & water (g):	373.46	371.09
Weight of pycnometer filled w/water (g):	341.60	339.57
Specific Gravity (g/g):	2.68	2.67
Observed temperature (°C):	22.70	22.70
Density of water at observed temperature (g/cm^3):	0.9976	0.9976
Correction factor, K:	0.9994	0.9994
Specific Gravity at 20°C (g/g):	2.67	2.67
Average Specific Gravity (g/g):	2.67	
Average Particle Density (g/cm^3):	2.67	

ASTM C127 (>2.00mm) Fraction

Test Date:	NR	Test not Requested
Percent of Test Sample (% g/g):	66.0	
Percent of Bulk Sample (% g/g):	66.0	
Tare Weight (g):	---	
Saturated Surface Dry (SSD) mass in Air & Tare (g):	---	
Saturated Apparent mass in Water & Tare (g):	---	
Oven Dry (OD) mass in Air & Tare (g):	---	
SSD Specific Gravity (g/g):	---	
Apparent Specific Gravity (g/g):	---	
OD Specific Gravity (g/g):	---	
Percent Absorption (%):	---	
Observed Temperature (°C):	---	
Density of water at observed temperature (g/m^3):	---	
Correction Factor, K:	---	
Specific Gravity (Apparent), Corrected to 20° C:	---	
Particle Density (Apparent), Corrected to 20° C (g/cm^3):	---	

Specific Gravity (Apparent) of Sample*:	**2.67**	** Based on <4.75mm Fraction*
Particle Density (Apparent) of Sample (g/cm^3)*:	2.67	

Laboratory analysis by: A. Baldridge
Data entered by: A. Baldridge
Checked by: J. Hines

Data for Specific Gravity of Sample: GC-1S-2 4-6'

Job Name: Golder Associates, Inc.
Job Number: DB19.1112.00
Sample Number: GC-1S-2 4-6'
Project Name: CCP-BMI 181-06417
Depth: 4'-6'

ASTM D854 (<2.00mm Fraction)

Test Date:	17-May-19	
Percent of Test Sample (% g/g):	64.4	
Percent of Bulk Sample (% g/g):	64.4	
	Trial 1	*Trial 2*
Weight of pycnometer filled w/air (g):	93.03	102.79
Weight of pycnometer filled w/soil (g):	144.62	152.85
Weight of pycnometer filled w/soil & water (g):	374.75	383.60
Weight of pycnometer filled w/water (g):	342.13	352.05
Specific Gravity (g/g):	2.72	2.70
Observed temperature (°C):	22.10	22.10
Density of water at observed temperature (g/cm^3):	0.9978	0.9978
Correction factor, K:	0.9995	0.9995
Specific Gravity at 20°C (g/g):	2.72	2.70
Average Specific Gravity (g/g):	2.71	
Average Particle Density (g/cm^3):	2.71	

ASTM C127 (>2.00mm) Fraction

Test Date:	NR	Test not Requested
Percent of Test Sample (% g/g):	35.6	
Percent of Bulk Sample (% g/g):	35.6	
Tare Weight (g):	---	
Saturated Surface Dry (SSD) mass in Air & Tare (g):	---	
Saturated Apparent mass in Water & Tare (g):	---	
Oven Dry (OD) mass in Air & Tare (g):	---	
SSD Specific Gravity (g/g):	---	
Apparent Specific Gravity (g/g):	---	
OD Specific Gravity (g/g):	---	
Percent Absorption (%):	---	
Observed Temperature (°C):	---	
Density of water at observed temperature (g/m^3):	---	
Correction Factor, K:	---	
Specific Gravity (Apparent), Corrected to 20° C:	---	
Particle Density (Apparent), Corrected to 20° C (g/cm^3):	---	

Specific Gravity (Apparent) of Sample*:	**2.71**	** Based on <4.75mm Fraction*
Particle Density (Apparent) of Sample (g/cm^3)*:	2.71	

Laboratory analysis by: A. Baldridge
Data entered by: A. Baldridge
Checked by: J. Hines

Data for Specific Gravity of Sample: GC-1S-3 2-6.5'

Job Name: Golder Associates, Inc.
Job Number: DB19.1112.00
Sample Number: GC-1S-3 2-6.5'
Project Name: CCP-BMI 181-06417
Depth: 2'-6.5'

ASTM D854 (<2.00mm Fraction)

Test Date:	17-May-19	
Percent of Test Sample (% g/g):	65.0	
Percent of Bulk Sample (% g/g):	65.0	
	Trial 1	*Trial 2*
Weight of pycnometer filled w/air (g)*:*	94.27	89.66
Weight of pycnometer filled w/soil (g)*:*	144.40	139.72
Weight of pycnometer filled w/soil & water (g)*:*	374.74	370.38
Weight of pycnometer filled w/water (g)*:*	343.43	338.97
Specific Gravity (g/g)*:*	2.66	2.68
Observed temperature (°C)*:*	22.70	22.70
Density of water at observed temperature (g/cm^3)*:*	0.9976	0.9976
Correction factor, K:	0.9994	0.9994
Specific Gravity at 20°C (g/g)*:*	2.66	2.68
Average Specific Gravity (g/g):	2.67	
Average Particle Density (g/cm^3):	2.67	

ASTM C127 (>2.00mm) Fraction

Test Date:	NR	Test not Requested
Percent of Test Sample (% g/g):	35.0	
Percent of Bulk Sample (% g/g):	35.0	
Tare Weight (g):	---	
Saturated Surface Dry (SSD) mass in Air & Tare (g):	---	
Saturated Apparent mass in Water & Tare (g):	---	
Oven Dry (OD) mass in Air & Tare (g):	---	
SSD Specific Gravity (g/g):	---	
Apparent Specific Gravity (g/g):	---	
OD Specific Gravity (g/g):	---	
Percent Absorption (%):	---	
Observed Temperature (°C):	---	
Density of water at observed temperature (g/m^3):	---	
Correction Factor, K:	---	
Specific Gravity (Apparent), Corrected to 20° C:	---	
Particle Density (Apparent), Corrected to 20° C (g/cm^3)*:*	---	

Specific Gravity (Apparent) of Sample*:	**2.67**	** Based on <4.75mm Fraction*
Particle Density (Apparent) of Sample (g/cm^3)**:*	2.67	

Laboratory analysis by: A. Baldridge
Data entered by: A. Baldridge
Checked by: J. Hines

Data for Specific Gravity of Sample: GC-1S-4 0-2.5'

Job Name: Golder Associates, Inc.
Job Number: DB19.1112.00
Sample Number: GC-1S-4 0-2.5'
Project Name: CCP-BMI 181-06417
Depth: 0'-2.5'

ASTM D854 (<2.00mm Fraction)

Test Date:	17-May-19	
Percent of Test Sample (% g/g):	58.2	
Percent of Bulk Sample (% g/g):	58.2	
	Trial 1	*Trial 2*
Weight of pycnometer filled w/air (g):	95.79	93.97
Weight of pycnometer filled w/soil (g):	146.23	145.66
Weight of pycnometer filled w/soil & water (g):	376.57	375.57
Weight of pycnometer filled w/water (g):	344.92	343.18
Specific Gravity (g/g):	2.68	2.68
Observed temperature (°C):	22.70	22.70
Density of water at observed temperature (g/cm^3):	0.9976	0.9976
Correction factor, K:	0.9994	0.9994
Specific Gravity at 20°C (g/g):	2.68	2.68
Average Specific Gravity (g/g):	2.68	
Average Particle Density (g/cm^3):	2.68	

ASTM C127 (>2.00mm) Fraction

Test Date:	NR	Test not Requested
Percent of Test Sample (% g/g):	41.8	
Percent of Bulk Sample (% g/g):	41.8	
Tare Weight (g):	---	
Saturated Surface Dry (SSD) mass in Air & Tare (g):	---	
Saturated Apparent mass in Water & Tare (g):	---	
Oven Dry (OD) mass in Air & Tare (g):	---	
SSD Specific Gravity (g/g):	---	
Apparent Specific Gravity (g/g):	---	
OD Specific Gravity (g/g):	---	
Percent Absorption (%):	---	
Observed Temperature (°C):	---	
Density of water at observed temperature (g/m^3):	---	
Correction Factor, K:	---	
Specific Gravity (Apparent), Corrected to 20° C:	---	
Particle Density (Apparent), Corrected to 20° C (g/cm^3):	---	

Specific Gravity (Apparent) of Sample*:	**2.68**	** Based on <4.75mm Fraction*
Particle Density (Apparent) of Sample (g/cm^3)*:	2.68	

Laboratory analysis by: A. Baldridge
Data entered by: A. Baldridge
Checked by: J. Hines

Data for Specific Gravity of Sample: PG-9A-2 Bulk

Job Name: Golder Associates, Inc.
Job Number: DB19.1112.00
Sample Number: PG-9A-2 Bulk
Project Name: CCP-BMI 181-06417
Depth: NA

ASTM D854 (<2.00mm Fraction)

Test Date:	17-May-19	
Percent of Test Sample (% g/g):	48.6	
Percent of Bulk Sample (% g/g):	48.6	
	Trial 1	*Trial 2*
Weight of pycnometer filled w/air (g)*:*	89.00	91.18
Weight of pycnometer filled w/soil (g)*:*	142.67	141.22
Weight of pycnometer filled w/soil & water (g)*:*	371.95	371.91
Weight of pycnometer filled w/water (g)*:*	338.32	340.54
Specific Gravity (g/g)*:*	2.68	2.68
Observed temperature (°C)*:*	22.10	22.70
Density of water at observed temperature (g/cm^3)*:*	0.9978	0.9976
Correction factor, K:	0.9995	0.9994
Specific Gravity at 20°C (g/g)*:*	2.68	2.68
Average Specific Gravity (g/g):	2.68	
Average Particle Density (g/cm^3):	2.67	

ASTM C127 (>2.00mm) Fraction

Test Date:	NR	Test not Requested
Percent of Test Sample (% g/g):	51.4	
Percent of Bulk Sample (% g/g):	51.4	
Tare Weight (g):	---	
Saturated Surface Dry (SSD) mass in Air & Tare (g):	---	
Saturated Apparent mass in Water & Tare (g):	---	
Oven Dry (OD) mass in Air & Tare (g):	---	
SSD Specific Gravity (g/g):	---	
Apparent Specific Gravity (g/g):	---	
OD Specific Gravity (g/g):	---	
Percent Absorption (%):	---	
Observed Temperature (°C):	---	
Density of water at observed temperature (g/m^3):	---	
Correction Factor, K:	---	
Specific Gravity (Apparent), Corrected to 20° C:	---	
Particle Density (Apparent), Corrected to 20° C (g/cm^3)*:*	---	

Specific Gravity (Apparent) of Sample*:	**2.68**	** Based on <4.75mm Fraction*
Particle Density (Apparent) of Sample (g/cm^3)**:*	2.67	

Laboratory analysis by: A. Baldridge
Data entered by: A. Baldridge
Checked by: J. Hines

Data for Specific Gravity of Sample: PG-9A-1 Bulk

Job Name: Golder Associates, Inc.
Job Number: DB19.1112.00
Sample Number: PG-9A-1 Bulk
Project Name: CCP-BMI 181-06417
Depth: NA

ASTM D854 (<2.00mm Fraction)

Test Date:	17-May-19	
Percent of Test Sample (% g/g):	27.8	
Percent of Bulk Sample (% g/g):	27.8	
	Trial 1	*Trial 2*
Weight of pycnometer filled w/air (g)*:*	94.22	100.49
Weight of pycnometer filled w/soil (g)*:*	144.30	151.12
Weight of pycnometer filled w/soil & water (g)*:*	374.97	381.70
Weight of pycnometer filled w/water (g)*:*	343.40	349.66
Specific Gravity (g/g)*:*	2.71	2.72
Observed temperature (°C)*:*	22.70	22.10
Density of water at observed temperature (g/cm^3)*:*	0.9976	0.9978
Correction factor, K:	0.9994	0.9995
Specific Gravity at 20°C (g/g)*:*	2.70	2.72
Average Specific Gravity (g/g):	2.71	
Average Particle Density (g/cm^3):	2.71	

ASTM C127 (>2.00mm) Fraction

Test Date:	NR	Test not Requested
Percent of Test Sample (% g/g):	72.2	
Percent of Bulk Sample (% g/g):	72.2	
Tare Weight (g):	---	
Saturated Surface Dry (SSD) mass in Air & Tare (g):	---	
Saturated Apparent mass in Water & Tare (g):	---	
Oven Dry (OD) mass in Air & Tare (g):	---	
SSD Specific Gravity (g/g):	---	
Apparent Specific Gravity (g/g):	---	
OD Specific Gravity (g/g):	---	
Percent Absorption (%):	---	
Observed Temperature (°C):	---	
Density of water at observed temperature (g/m^3):	---	
Correction Factor, K:	---	
Specific Gravity (Apparent), Corrected to 20° C:	---	
Particle Density (Apparent), Corrected to 20° C (g/cm^3)*:*	---	

Specific Gravity (Apparent) of Sample*:	**2.71**	** Based on <4.75mm Fraction*
Particle Density (Apparent) of Sample (g/cm^3)**:*	2.71	

Laboratory analysis by: A. Baldridge
Data entered by: A. Baldridge
Checked by: J. Hines

Data for Specific Gravity of Sample: PG-9AX-1 Bulk

Job Name: Golder Associates, Inc.
Job Number: DB19.1112.00
Sample Number: PG-9AX-1 Bulk
Project Name: CCP-BMI 181-06417
Depth: NA

ASTM D854 (<2.00mm Fraction)

Test Date:	17-May-19	
Percent of Test Sample (% g/g):	24.9	
Percent of Bulk Sample (% g/g):	24.9	
	Trial 1	*Trial 2*
Weight of pycnometer filled w/air (g):	89.54	91.50
Weight of pycnometer filled w/soil (g):	139.69	124.69
Weight of pycnometer filled w/soil & water (g):	370.46	361.55
Weight of pycnometer filled w/water (g):	338.83	340.76
Specific Gravity (g/g):	2.71	2.68
Observed temperature (°C):	22.70	20.60
Density of water at observed temperature (g/cm^3):	0.9976	0.9981
Correction factor, K:	0.9994	0.9999
Specific Gravity at 20°C (g/g):	2.71	2.68
Average Specific Gravity (g/g):	2.69	
Average Particle Density (g/cm^3):	2.69	

ASTM C127 (>2.00mm) Fraction

Test Date:	NR	Test not Requested
Percent of Test Sample (% g/g):	75.1	
Percent of Bulk Sample (% g/g):	75.1	
Tare Weight (g):	---	
Saturated Surface Dry (SSD) mass in Air & Tare (g):	---	
Saturated Apparent mass in Water & Tare (g):	---	
Oven Dry (OD) mass in Air & Tare (g):	---	
SSD Specific Gravity (g/g):	---	
Apparent Specific Gravity (g/g):	---	
OD Specific Gravity (g/g):	---	
Percent Absorption (%):	---	
Observed Temperature (°C):	---	
Density of water at observed temperature (g/m^3):	---	
Correction Factor, K:	---	
Specific Gravity (Apparent), Corrected to 20° C:	---	
Particle Density (Apparent), Corrected to 20° C (g/cm^3):	---	

Specific Gravity (Apparent) of Sample*:	**2.69**	** Based on <4.75mm Fraction*
Particle Density (Apparent) of Sample (g/cm^3)*:	2.69	

Laboratory analysis by: A. Baldridge
Data entered by: A. Baldridge
Checked by: J. Hines

Laboratory Tests and Methods

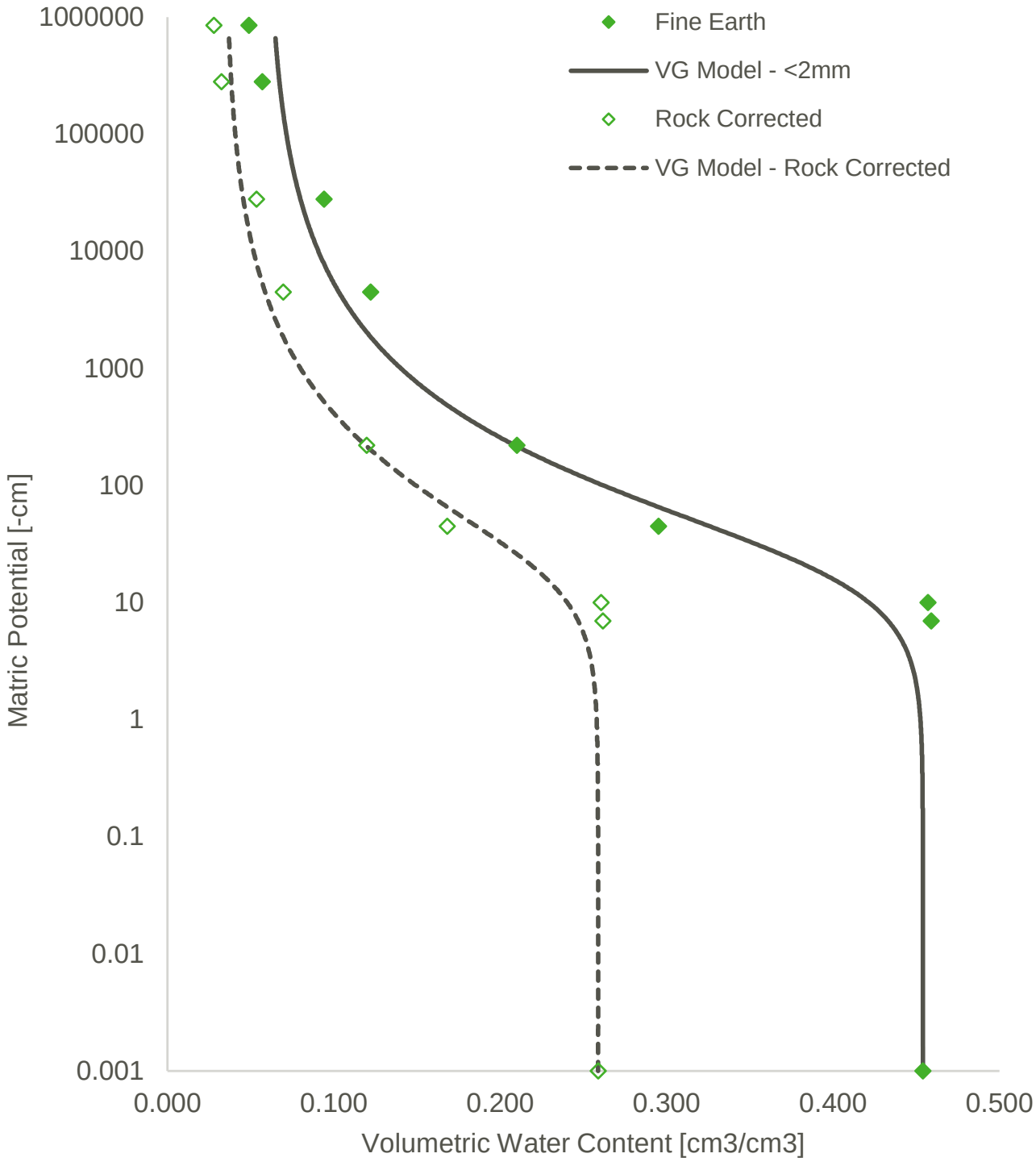
Tests and Methods

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 D5856
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
Specific Gravity Fine:	ASTM D854
Coarse Fraction (Gravel) Correction (calc):	ASTM D4718; Bouwer, H. and Rice, R.C. 1984. Hydraulic Properties of Stony Vadose Zones. Groundwater Vol. 22, No. 6

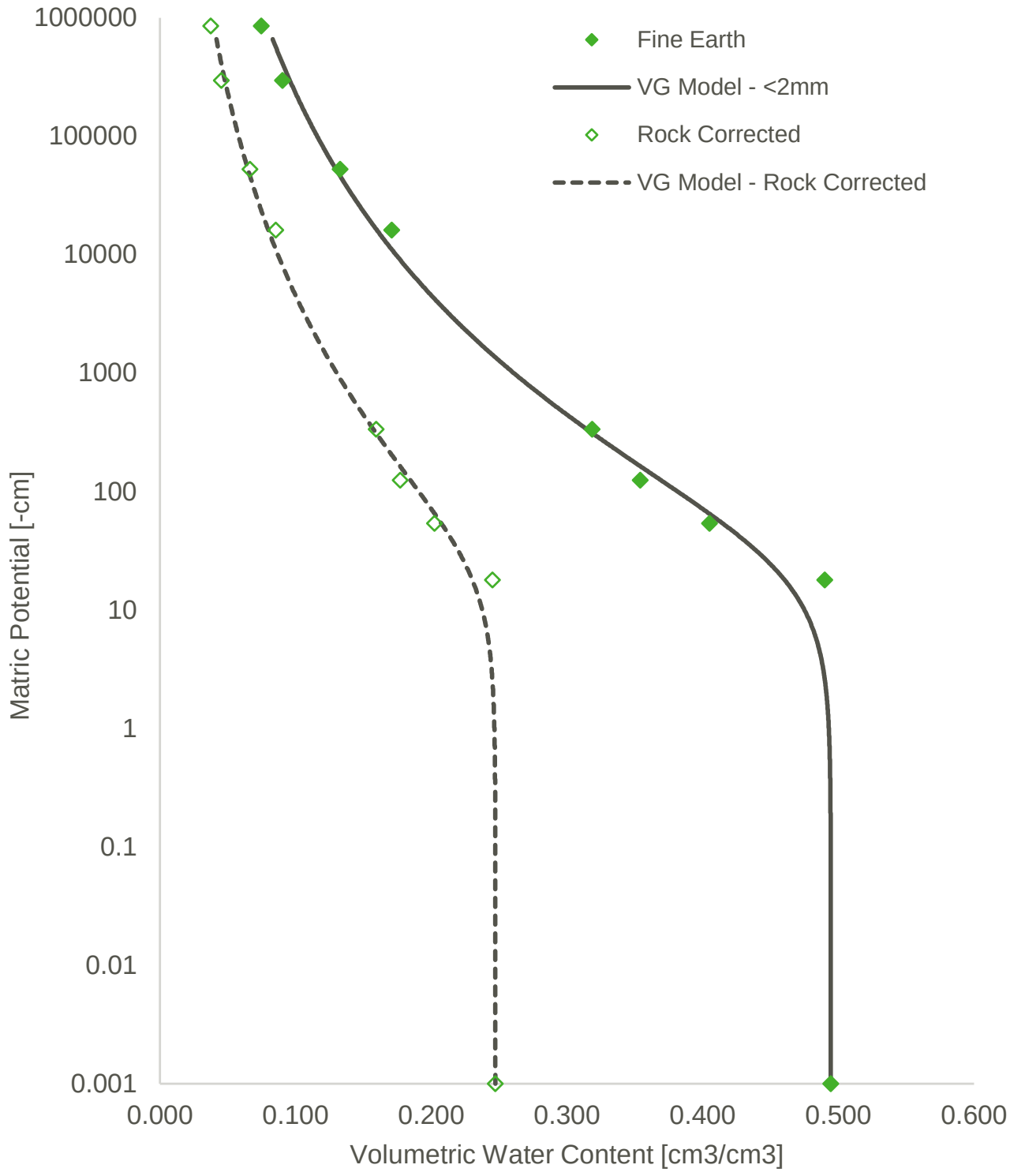
APPENDIX C

Soil Water Characteristic Curves

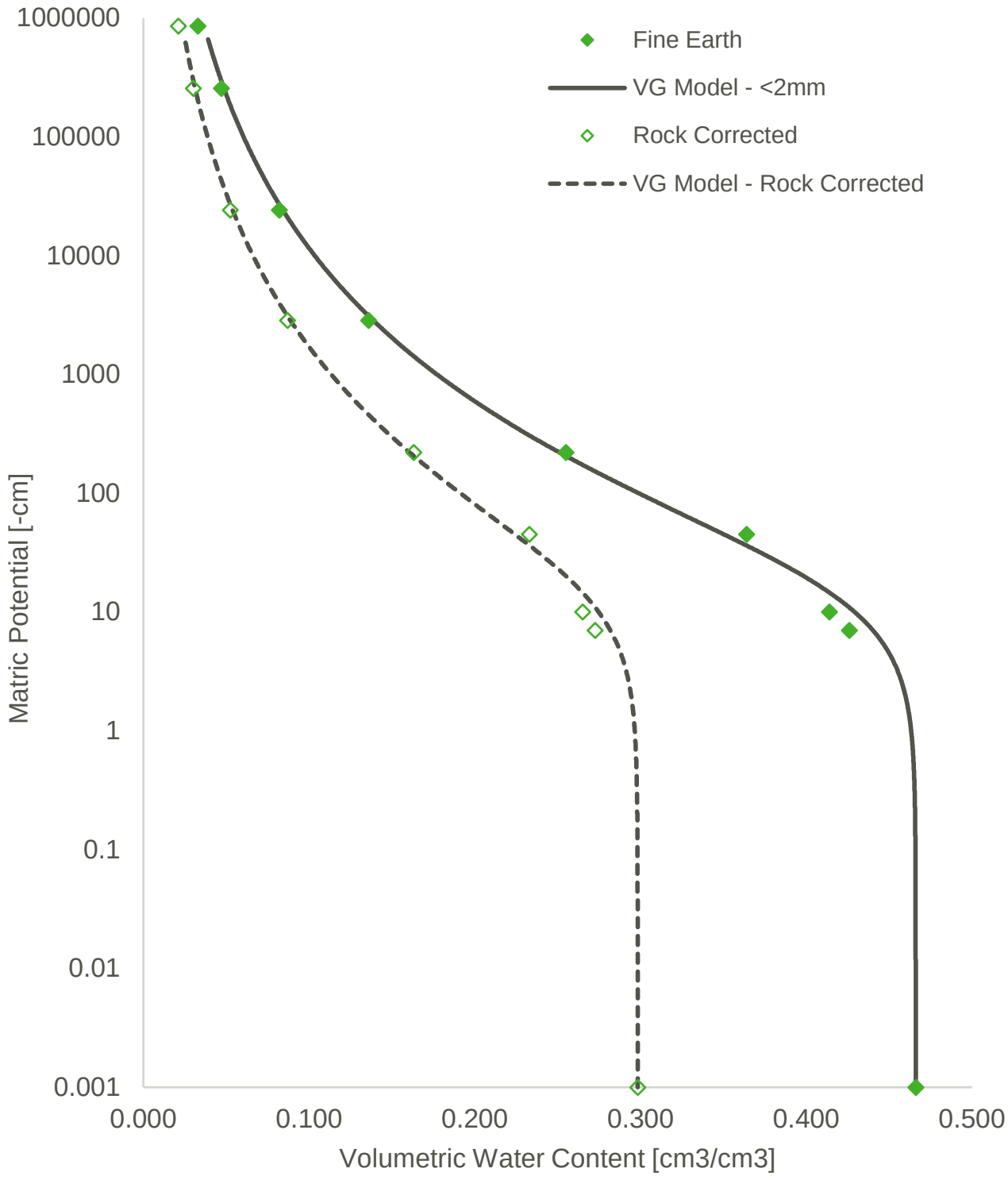
Soil Water Characteristic Curve GC-LS-2 6-7'



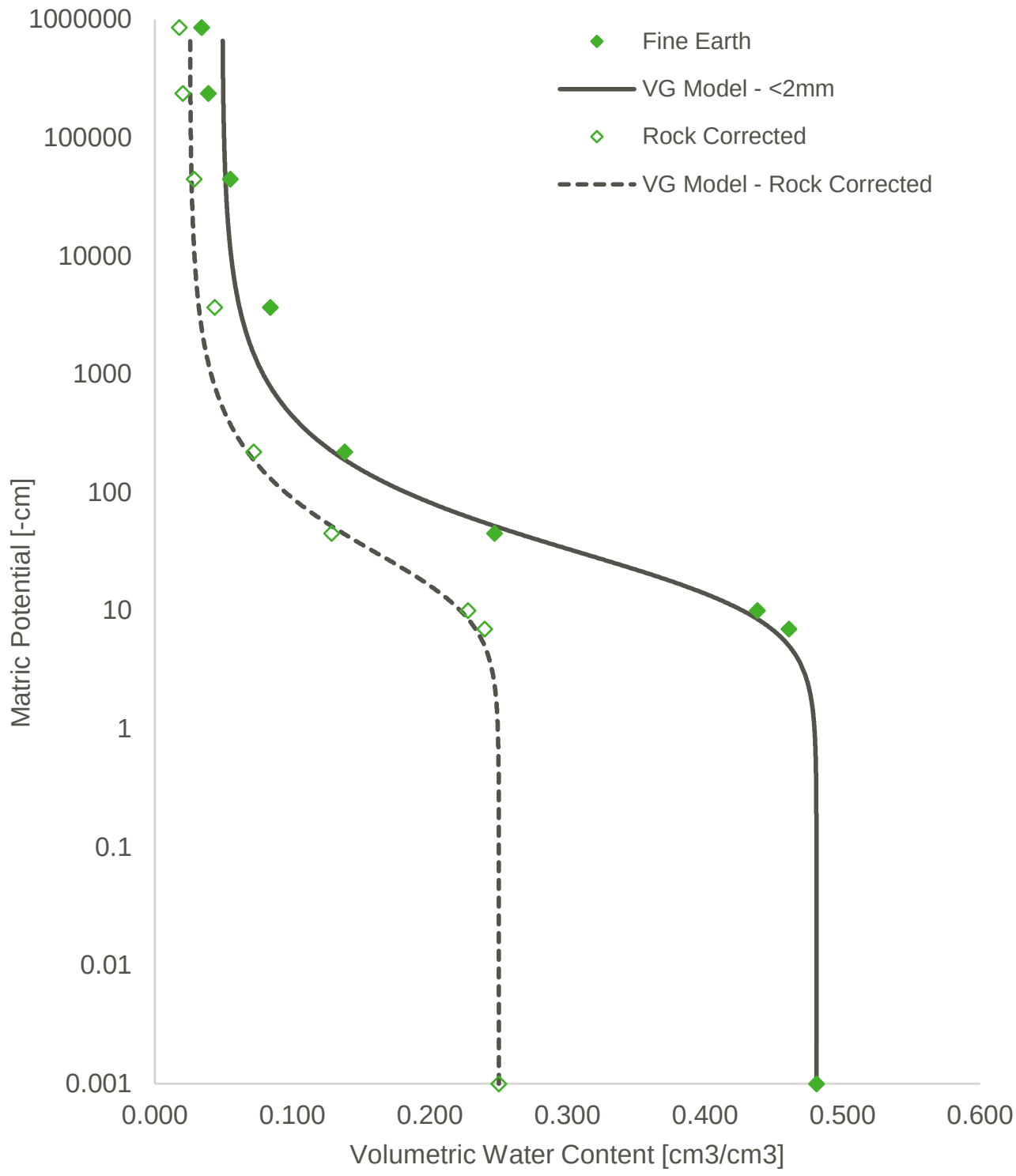
Soil Water Characteristic Curve GC-1S-2 4-6'



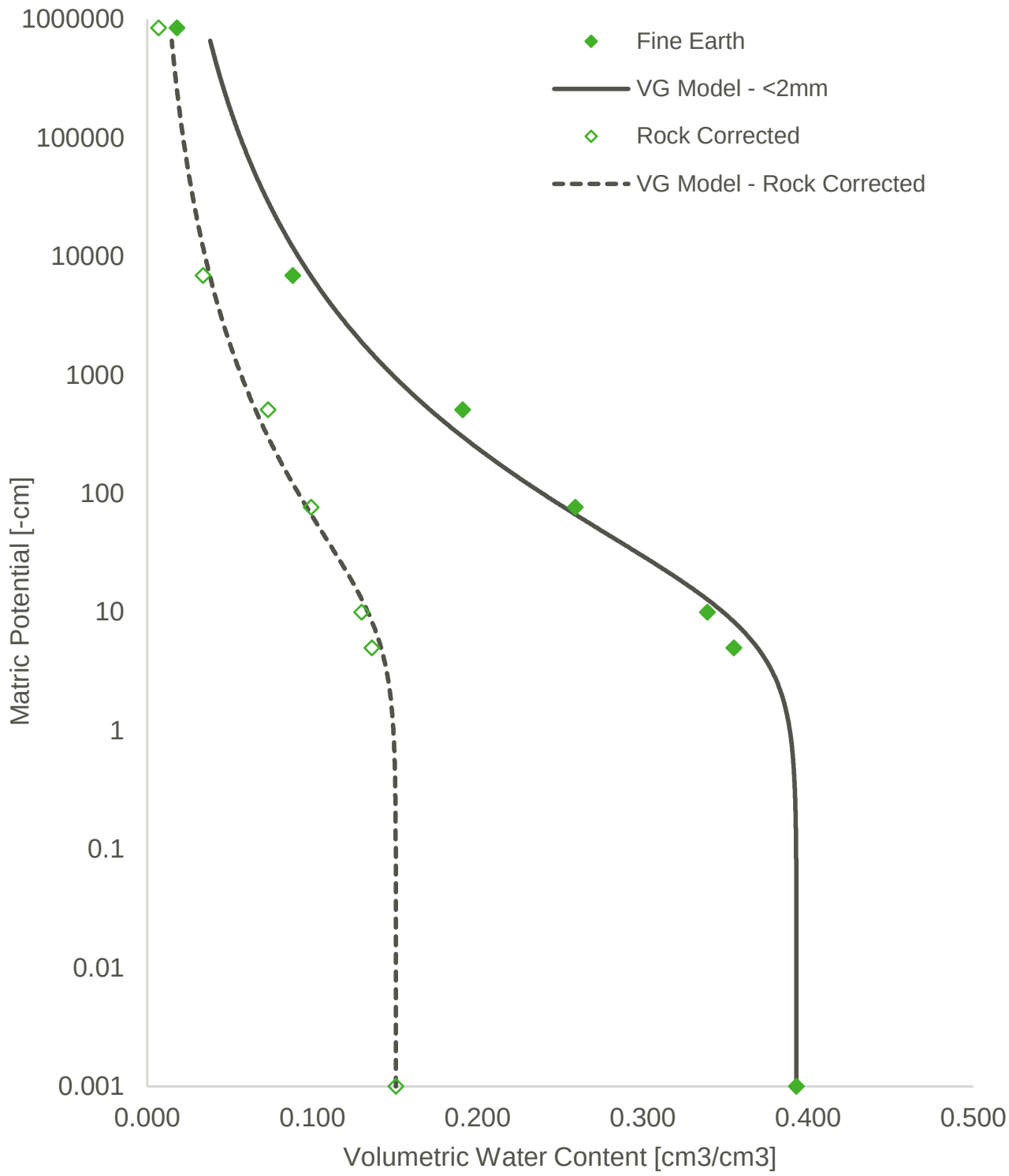
Soil Water Characteristic Curve GC-1S-3 2-6.5'



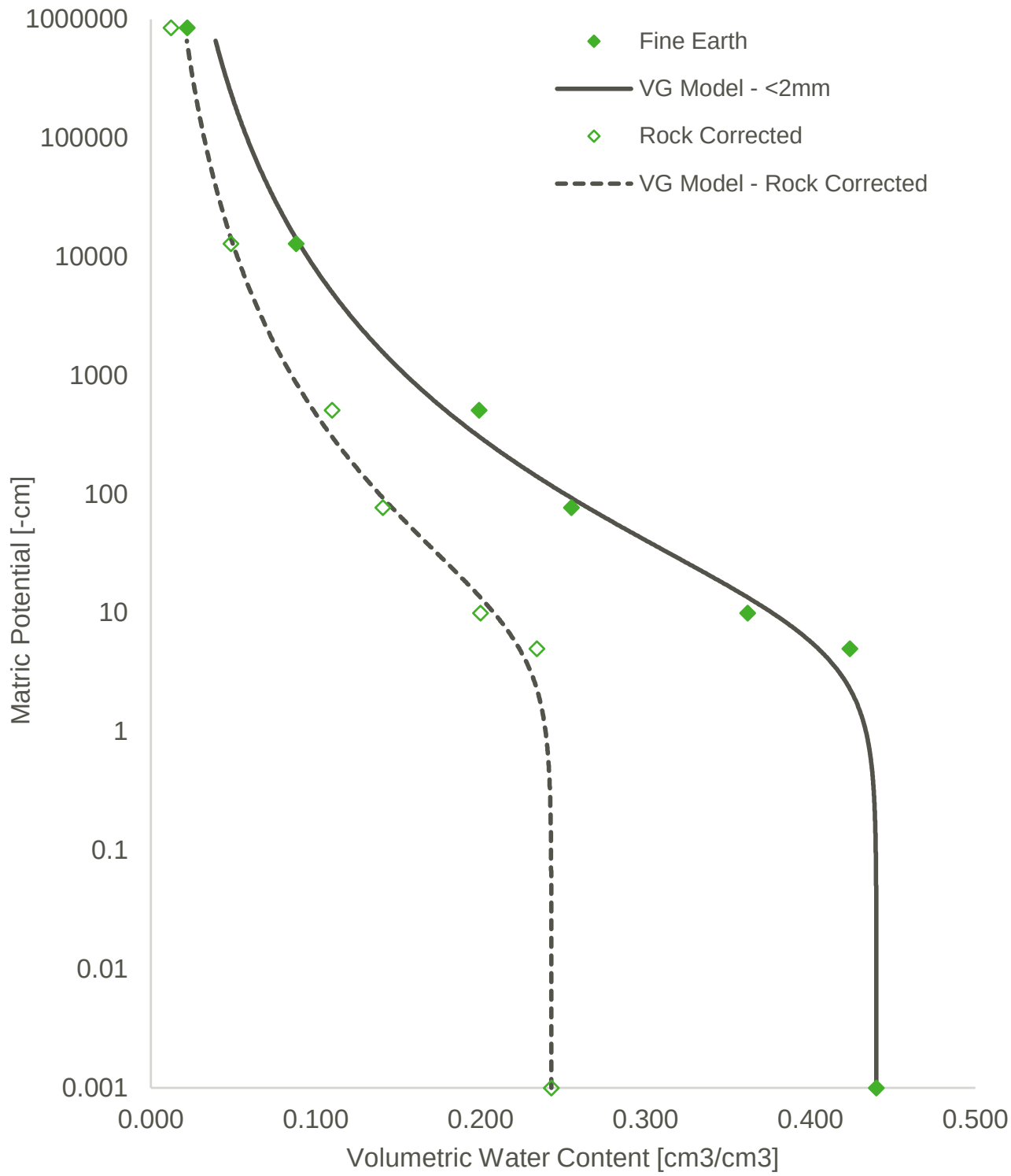
Soil Water Characteristic Curve GC-1S-4 0-2.5'



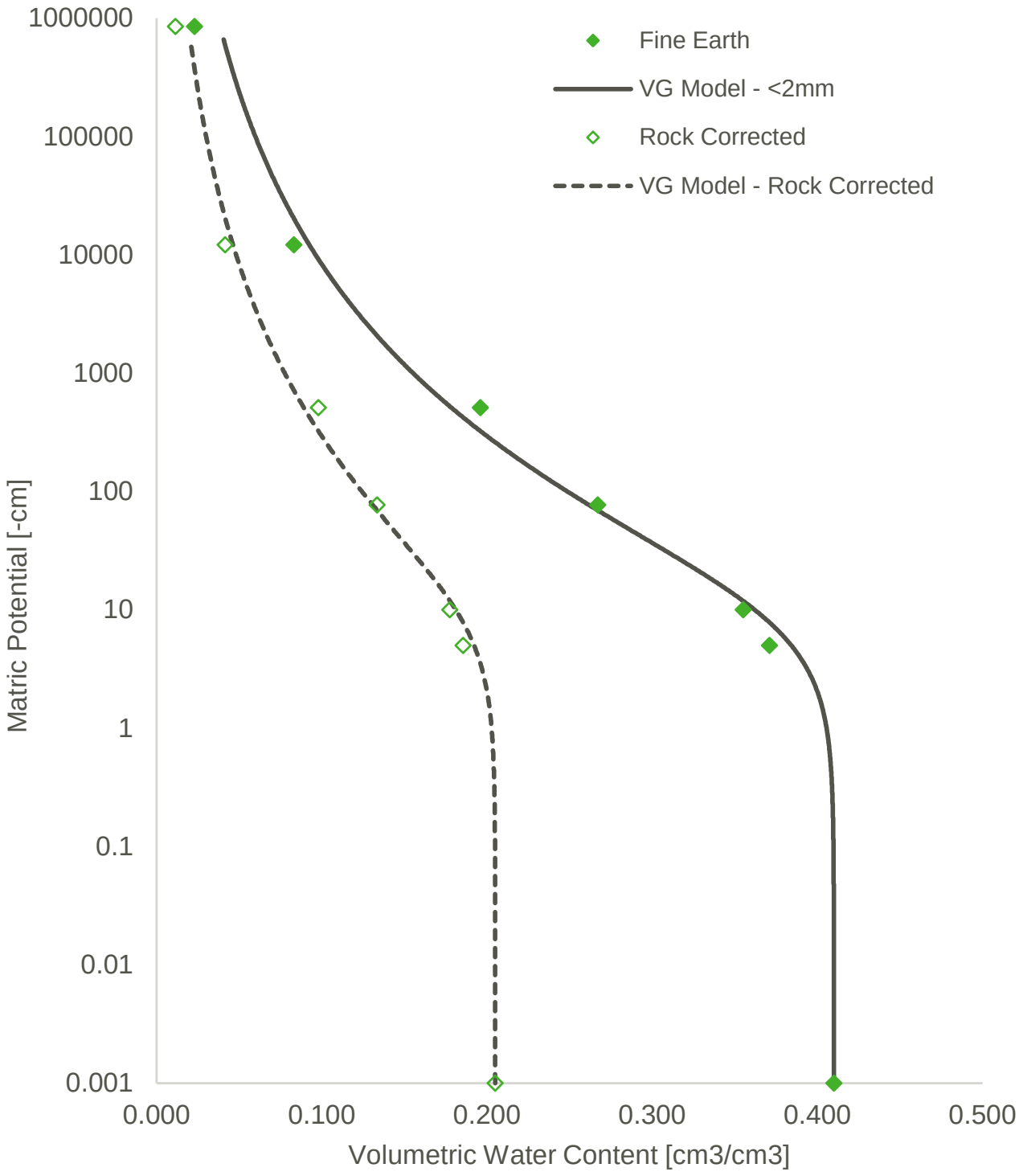
Soil Water Characteristic Curve No1-1-1



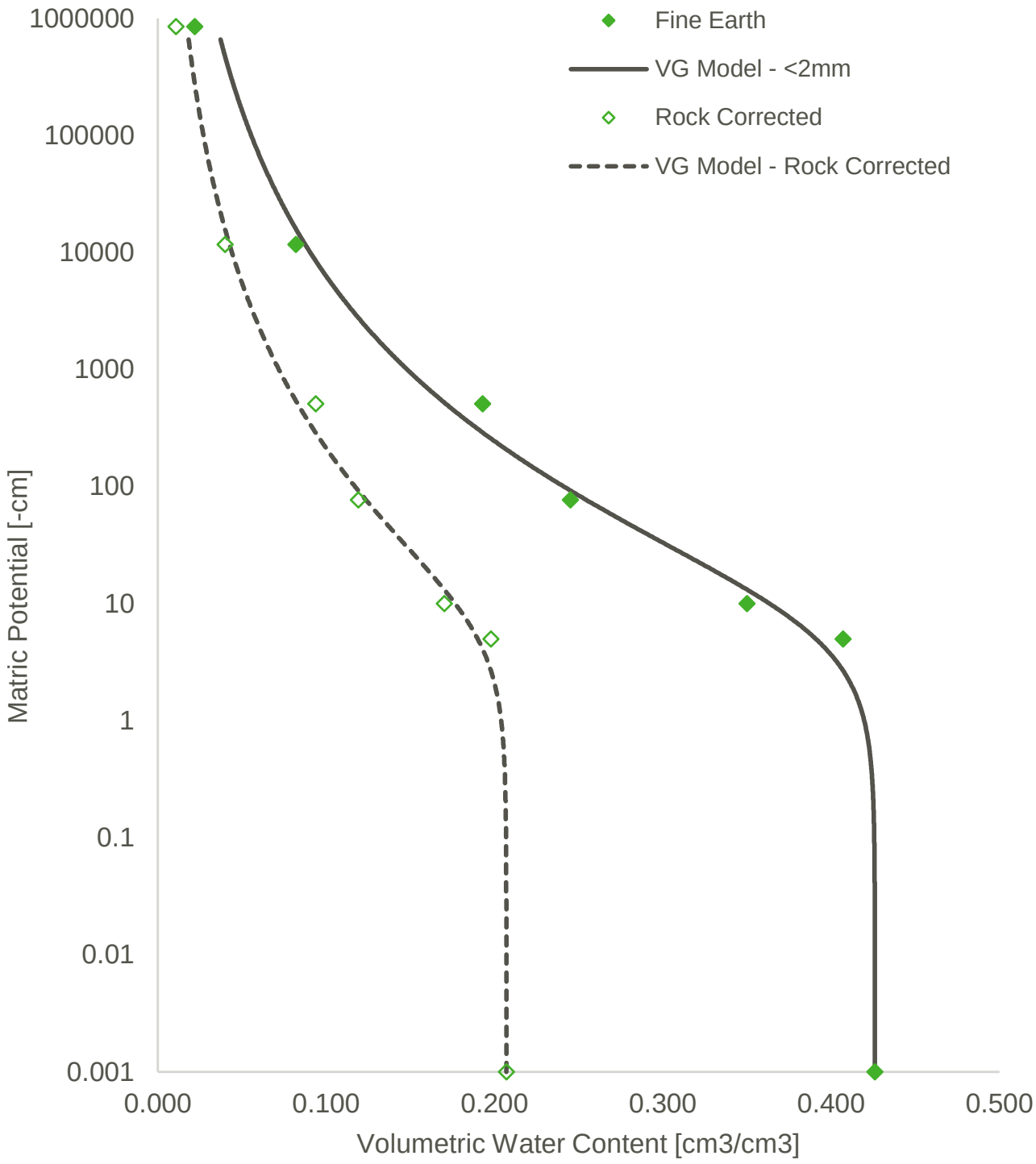
Soil Water Characteristic Curve No1-1-2



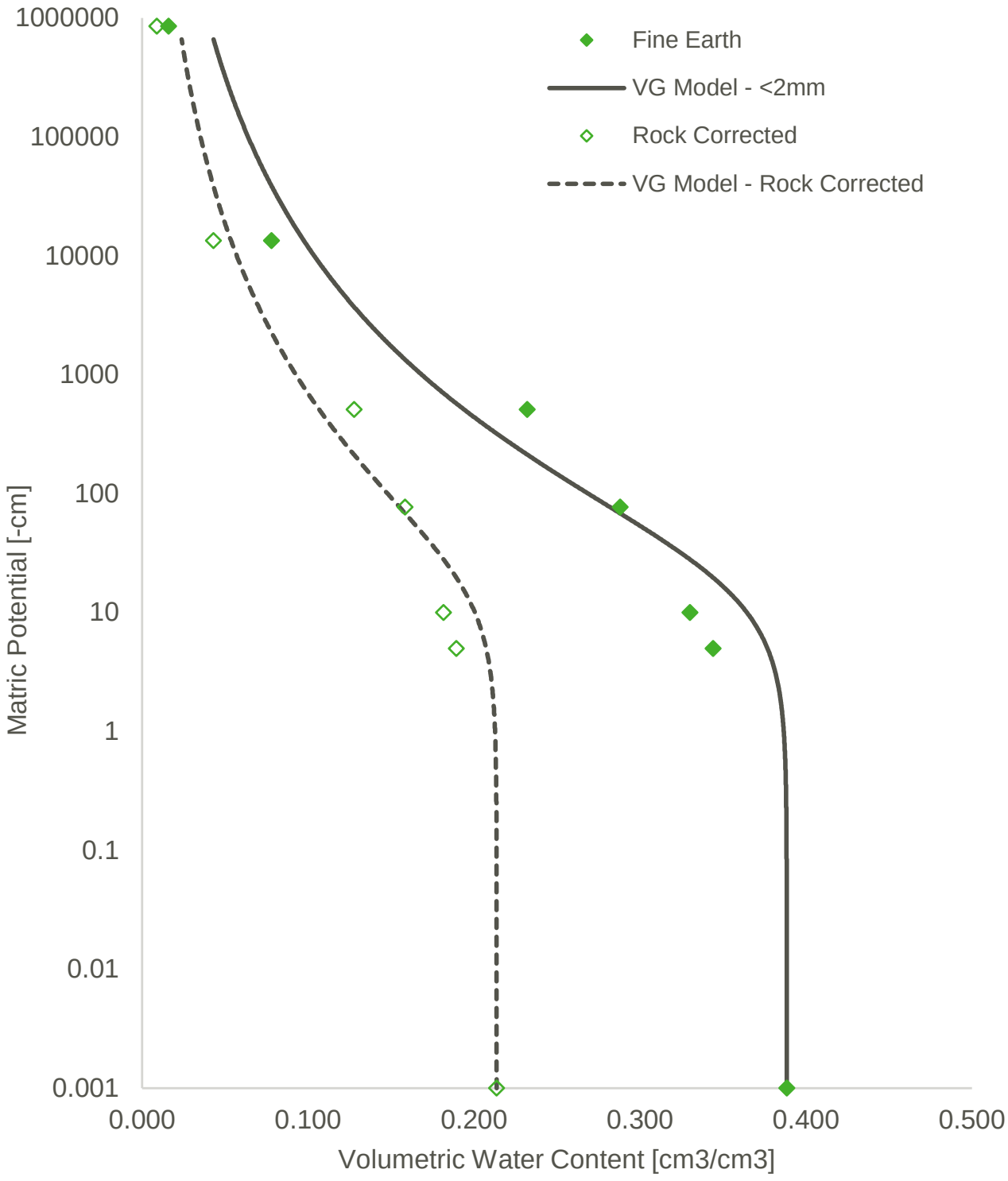
Soil Water Characteristic Curve No1-2-1



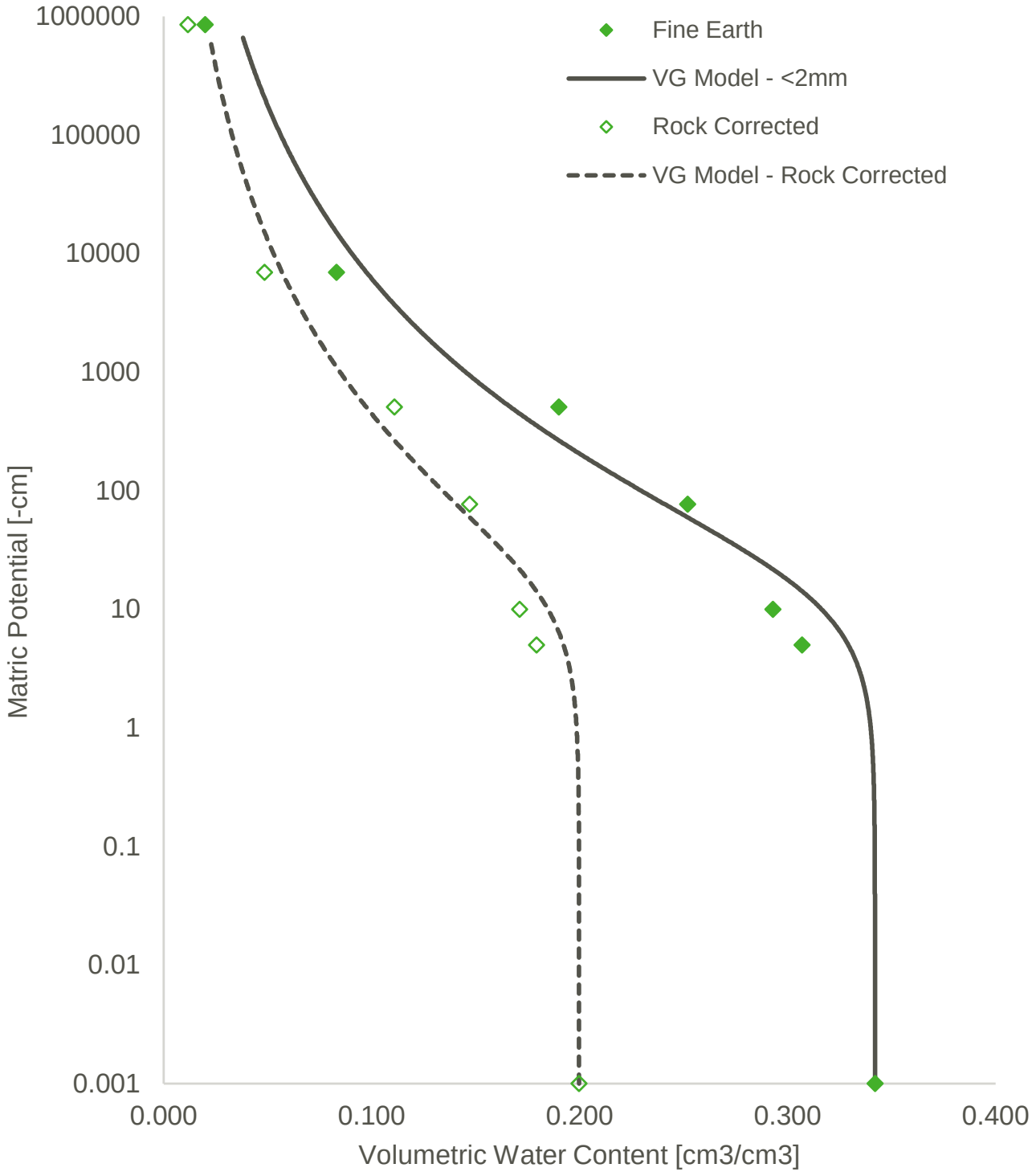
Soil Water Characteristic Curve No1-2-2



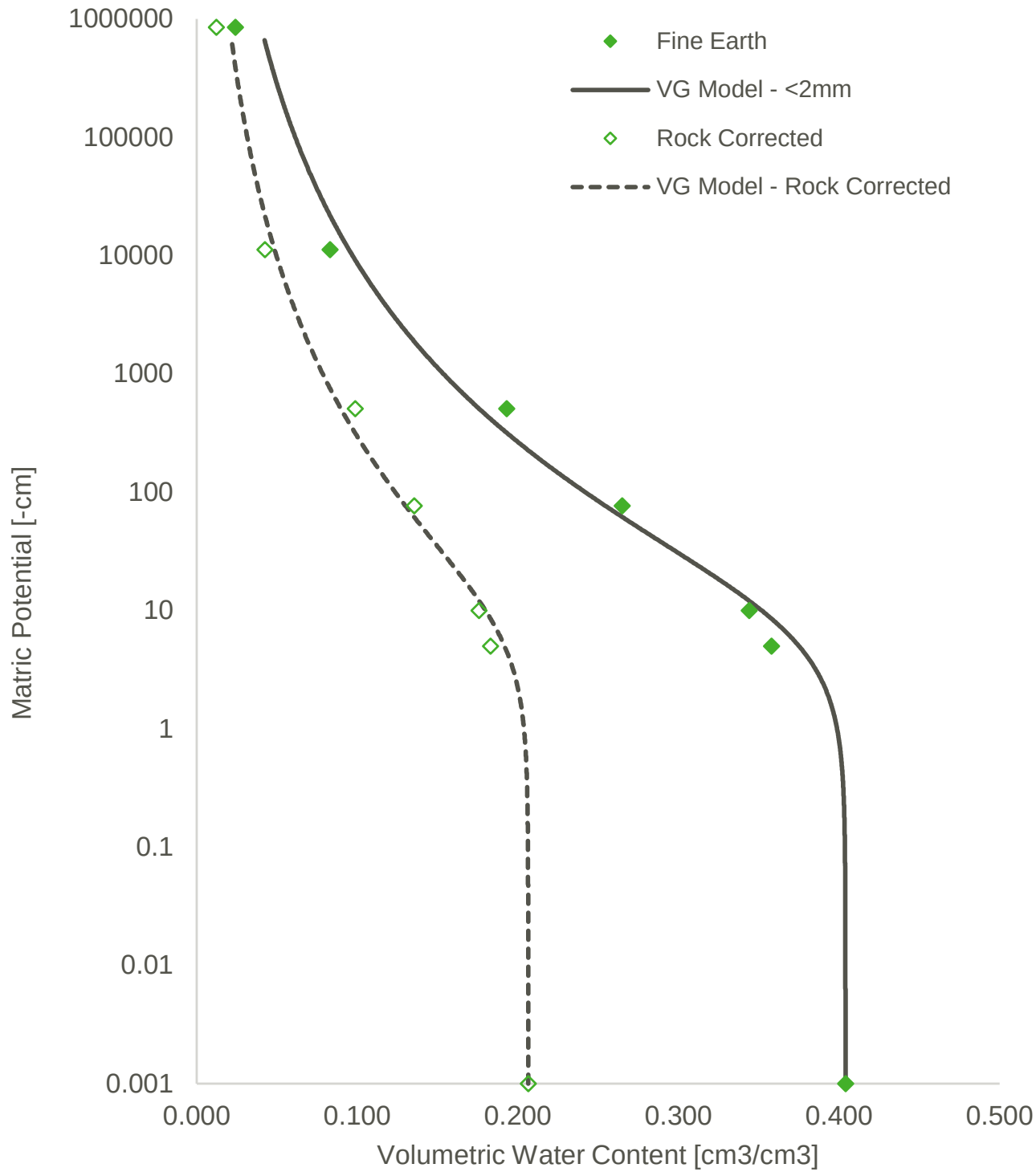
Soil Water Characteristic Curve No1-3-1



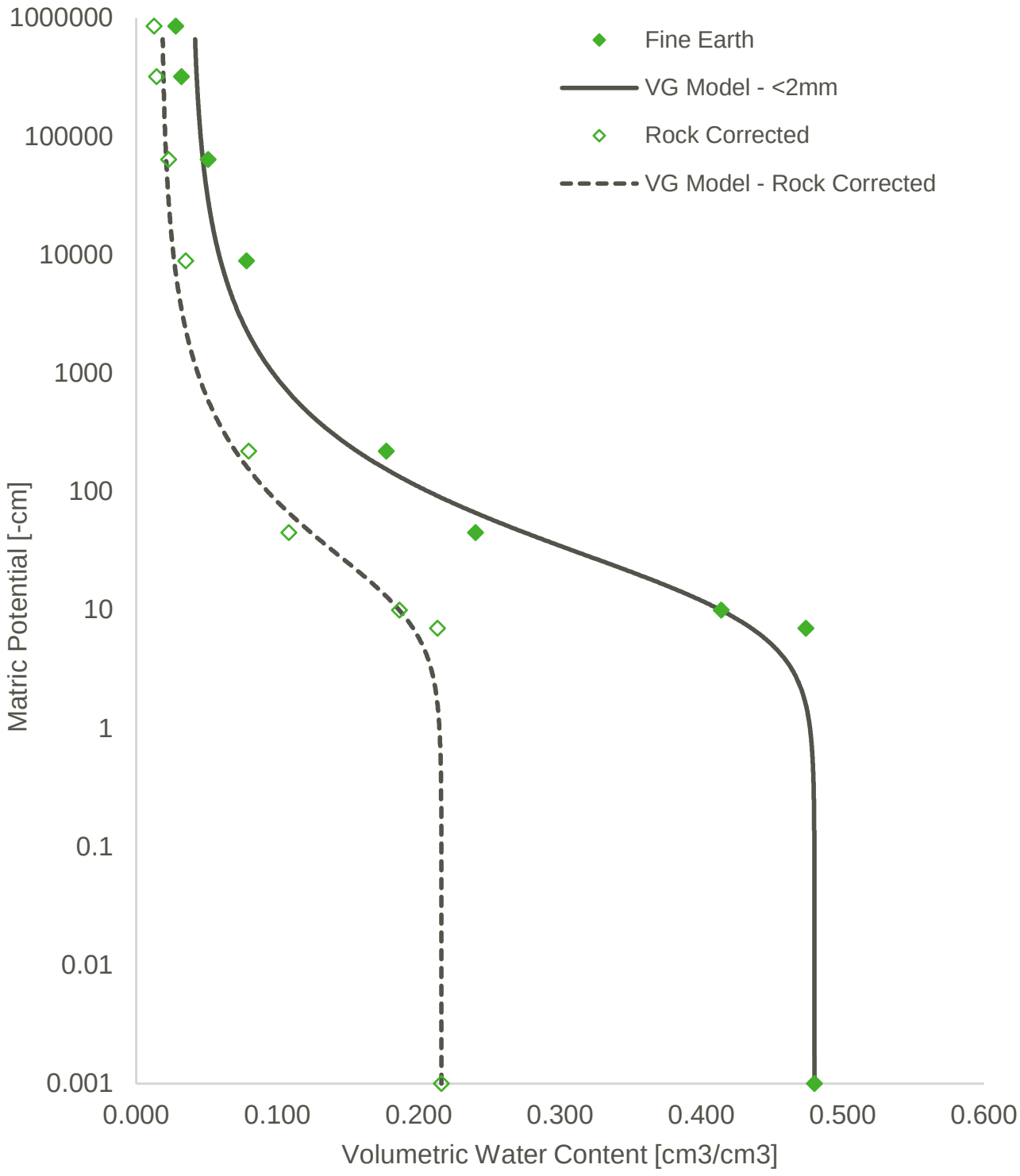
Soil Water Characteristic Curve No1-3-2



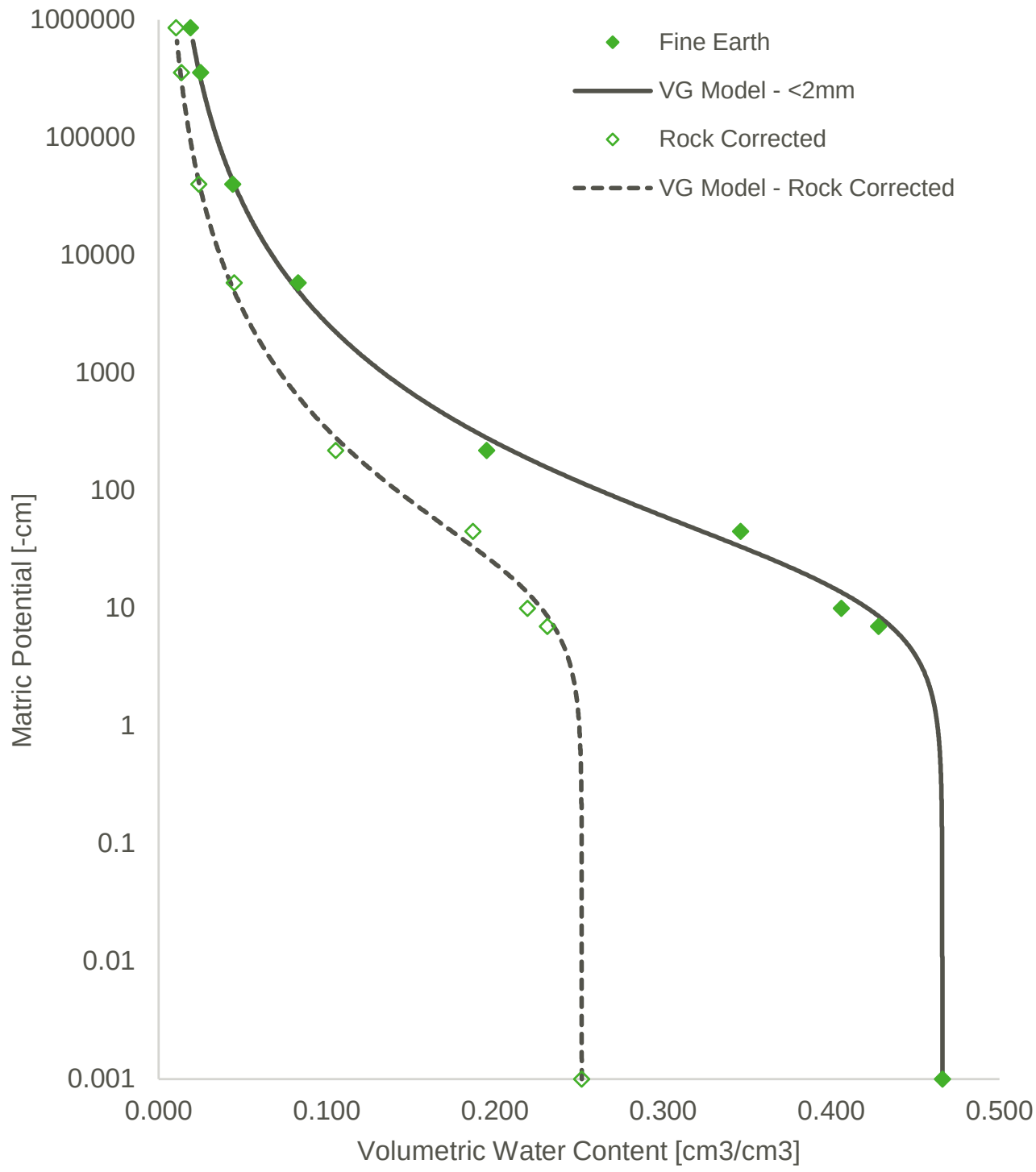
Soil Water Characteristic Curve No1-8-LY



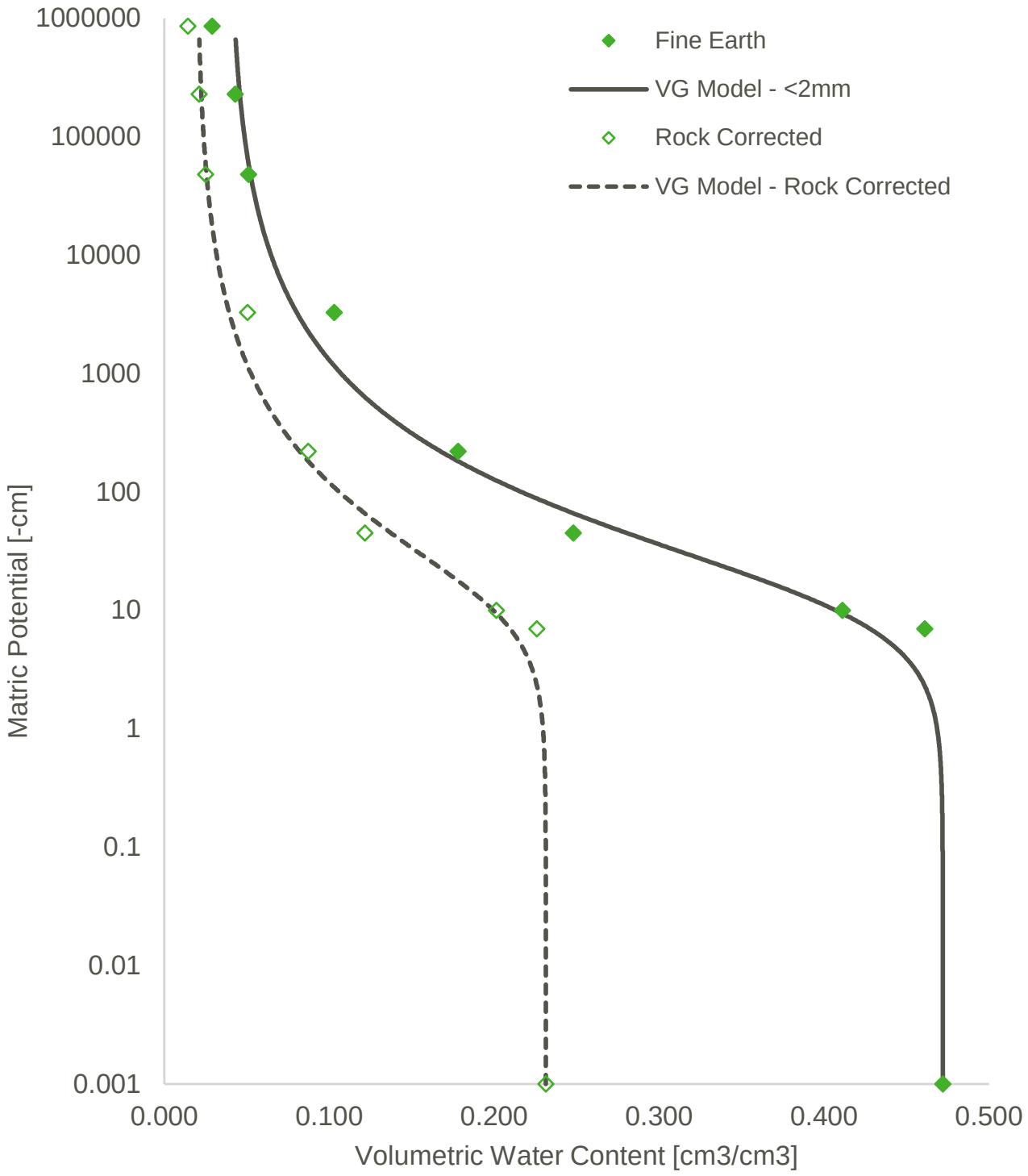
Soil Water Characteristic Curve PG-9A-1 Bulk



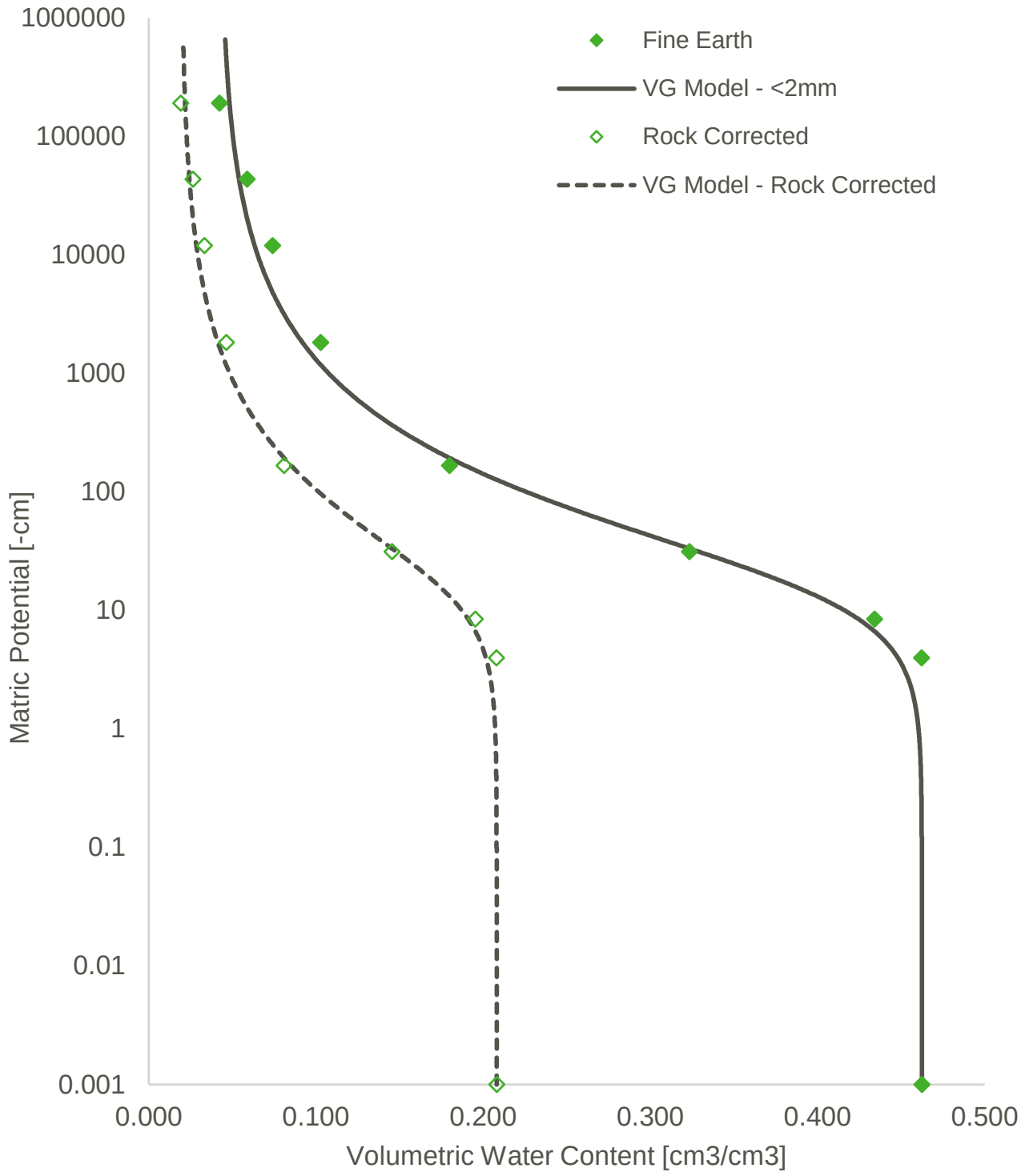
Soil Water Characteristic Curve PG-9A-2 Bulk



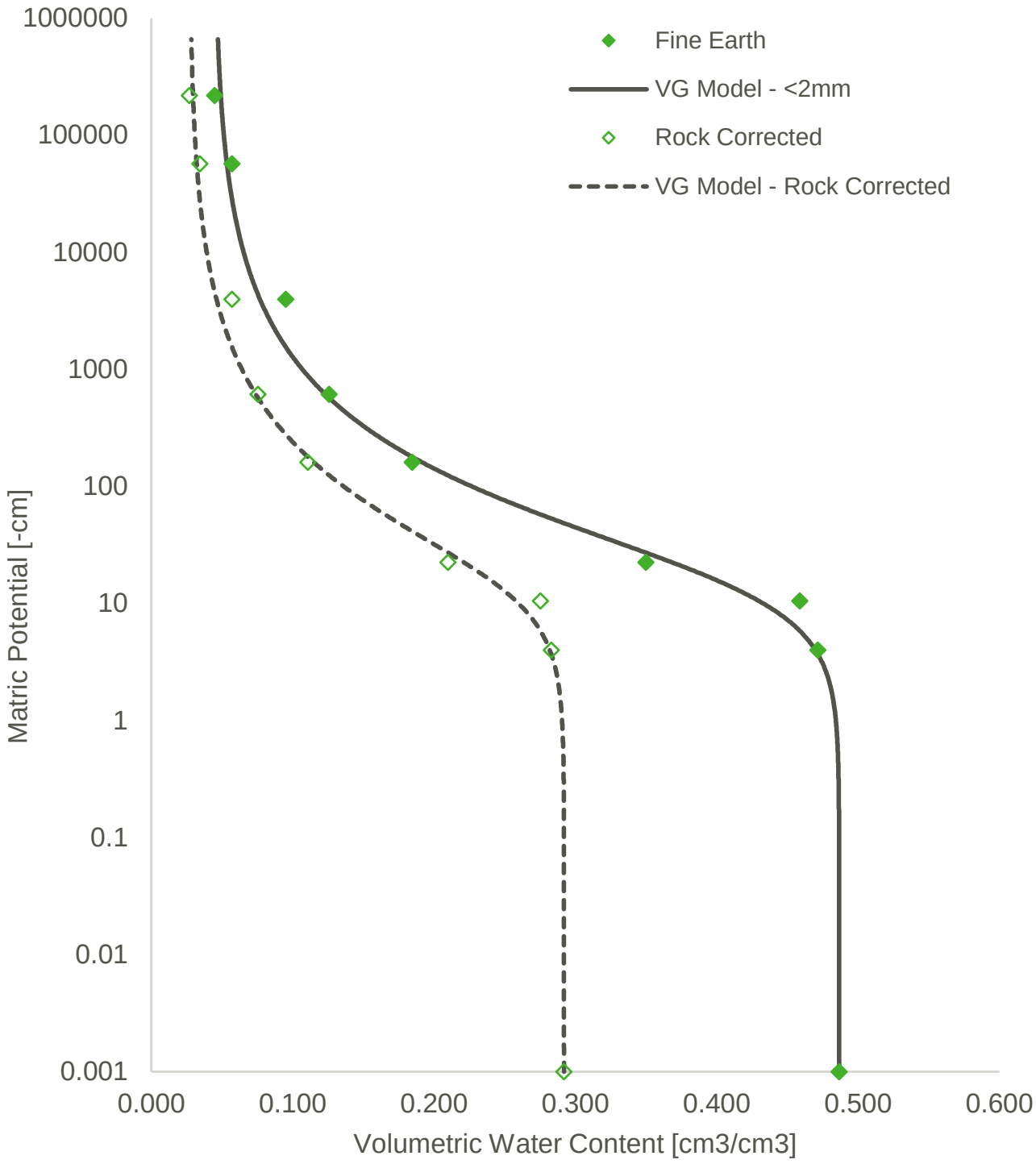
Soil Water Characteristic Curve PG-9AX-1 Bulk



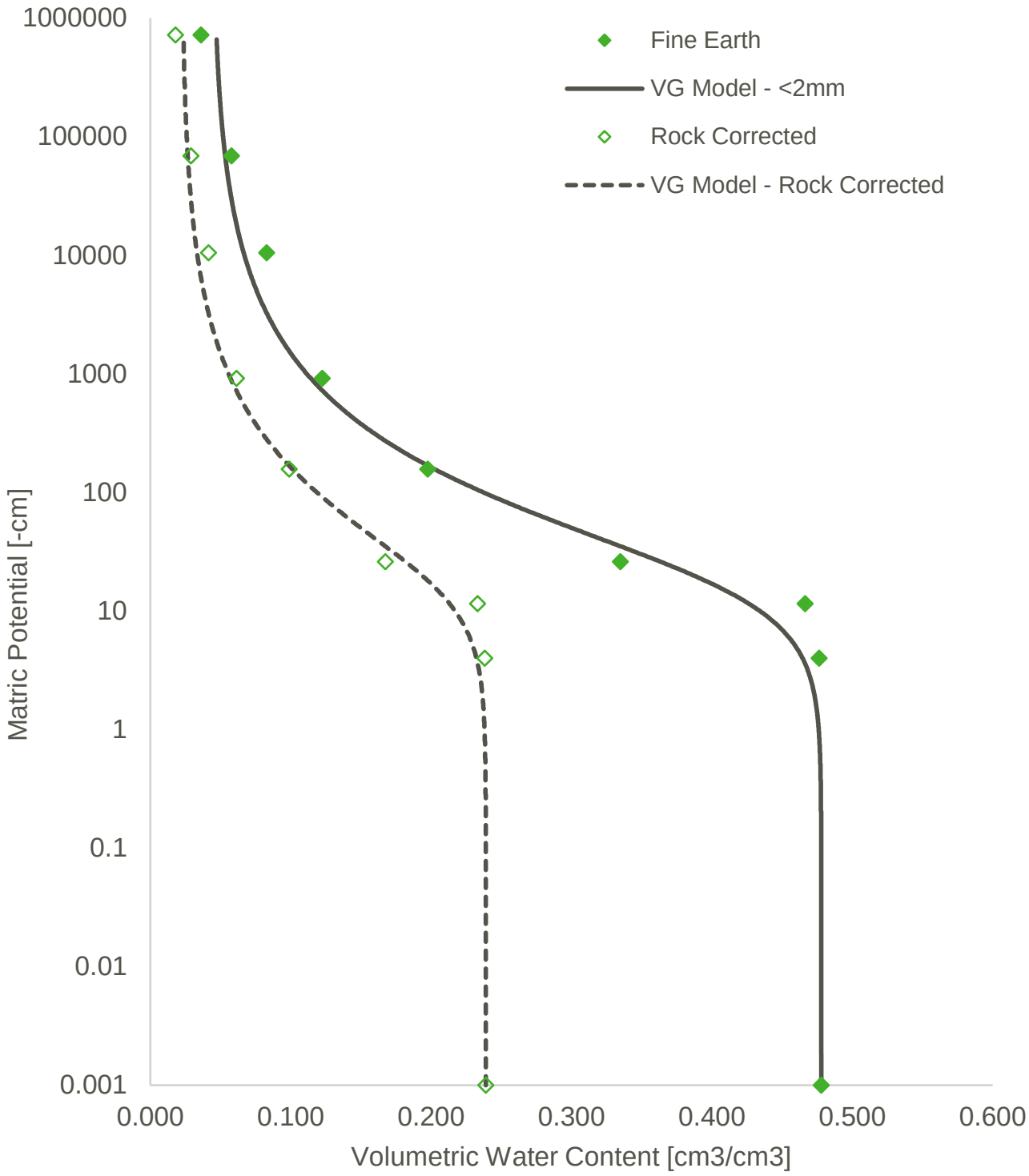
Soil Water Characteristic Curve UTPQA-2



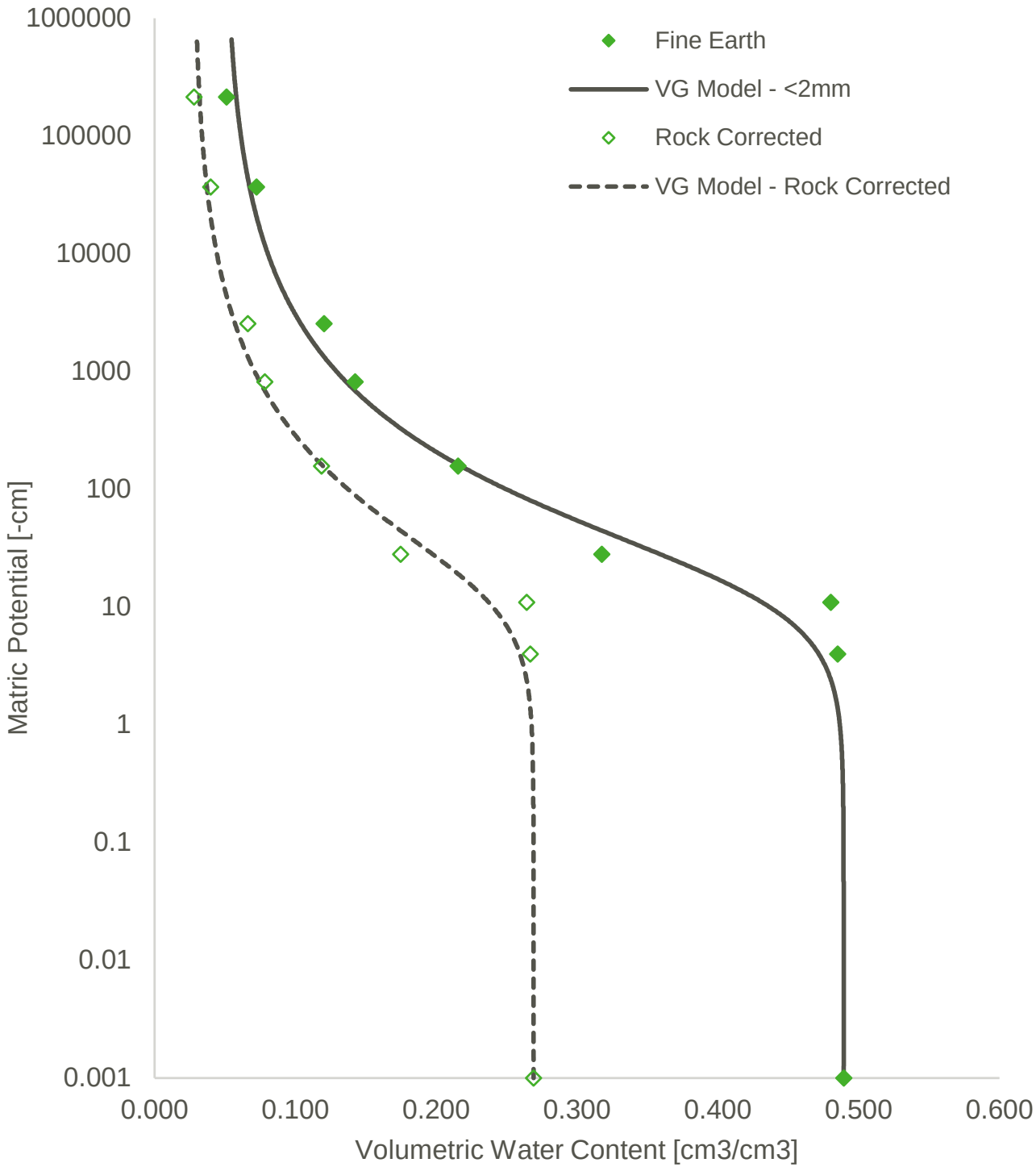
Soil Water Characteristic Curve UTPQA-3



Soil Water Characteristic Curve LTPQA-4



Soil Water Characteristic Curve T7ALRLC



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