# Appendix A-2

# Oxide Tailings

**Black Eagle Consulting, Inc.** 1345 Capital Boulevard, Suite A Telephone: 775/359-6600 Email: mail@blackeagleconsulting.com
**Geotechnical & Construction Services** Reno, Nevada 89502-7140 Facsimile: 775/359-7766

Mr. Rich Mattucci
Brown and Caldwell
3264 Goni Road, Suite 153
Carson City, Nevada 89706

November 3, 2009
Project No.: 0155-21-1

**RE: Summary of Site Sampling and Materials Testing – Yerington Mine Site Yerington, Nevada**

Dear Mr. Mattucci:

Black Eagle Consulting, Inc. is pleased to present the results of our site sampling and materials testing performed at the Yerington Mine site in Yerington, Nevada. All sampling and testing was performed in accordance with the scope of work outlined in the Brown and Caldwell Task Order #29 Authorization dated April 20, 2009.

**Evaporation Pond Removal**

***Field Sampling and Testing***

Sampling and field testing of the oxide tailings material proposed to cap the evaporation ponds, the tailings material present in the lined and unlined evaporation ponds, and the tailings present in the low pH tailings (Sub Area A) pond was performed in May and September 2009. The location of these areas is shown on the attached Plate 1 - Sampling Locations.

Sampling of the oxide tailings proposed for use as tailings capping material was accomplished by excavating 11 test pits using a John Deere® 160LC trackhoe, while sampling of the material present in the access road between the line and unlined ponds was performed by excavating an additional 5 test pits using the same trackhoe. The maximum depth of exploration was 20 feet and 8 feet below the existing ground surface in the oxide tailings and access road areas, respectively. Bulk samples for index testing were collected from excavation spoils obtained at specific depths in each material horizon. Due to the depth of the test pit and associated safety concerns, the depth to changes in stratigraphy and total depth of excavation in the oxide tailings material could only be approximated.

During test pit excavation within the oxide tailings material, representative material excavated from the test pit was spread out in a single approximate 18-inch-thick loose lift adjacent to the test pit and subjected to approximately 4 passes by the trackhoe. This was performed three times: at the lower bench, the middle bench, and the upper bench in the existing oxide tailings stockpile area. Nuclear density testing was then performed on the completed pads.

A geologist examined and identified all soils in the field in accordance with American Society for Testing and Materials (ASTM) D 2488. During test pitting, representative bulk samples were placed in sealed plastic bags and returned to our Reno, Nevada, laboratory for possible testing. Additional soil classification was subsequently performed in accordance with ASTM 2487 (Unified Soil Classification System [USCS]) upon completion of laboratory testing as described below. Logs of the test pits are presented as Plate 2, and a USCS chart has been included as Plate 3. Oxide tailings test pits are denoted as OX, while access road test pits are denoted as Road.

Field testing within the limits of the evaporation ponds and the Red pond was performed using a nuclear density gauge to determine the in situ moisture content and dry density of the material present at the ground surface at each test location. Vane shear testing was also performed at the surface of each test location in order to document the in situ shear strength of the material.

A summary of the sampling locations and field testing is presented in Table 1 – Evaporation Pond Removal Sampling Summary.

**TABLE 1 - EVAPORATION POND REMOVAL SAMPLING SUMMARY**

| Test Location Unlined Pond | Location Designation | Test Depth (Inches) | Moisture Content (%) | Dry Density (pcf) | Vane Shear Value | Shear Strength (kPa) | Shear Strength (psi) | UTM Coordinates | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Northings | Eastings |
| Unlined Pond (UP) | UP-1 | 4 | 35.6 | 58.6 | 80 | 121 | 18 | 4,321,112 | 308,757 |
| | UP-2 | 6 | 25.6 | 59.6 | 45 | 68 | 10 | 4,321,003 | 308,806 |
| | UP-3 | 6 | 30.6 | 63.0 | 19 | 29 | 4 | 4,320,871 | 308,868 |
| | UP-4 | 6 | 18.4 | 69.0 | 64 | 97 | 14 | 4,320,708 | 308,963 |
| | UP-5 | 6 | 11.0 | 85.0 | 74 | 112 | 16 | 4,320,533 | 309,014 |
| | UP-6 | 6 | 6.8 | 71.7 | 20 | 30 | 4 | 4,320,468 | 309,116 |
| | UP-7 | 6 | 16.7 | 86.1 | 30 | 45 | 7 | 4,320,562 | 309,217 |
| | UP-8 | 6 | 16.3 | 90.6 | 18 | 27 | 4 | 4,320,646 | 309,158 |
| | UP-9 | 6 | 22.9 | 89.3 | 72 | 109 | 16 | 4,320,784 | 309,079 |
| | UP-10 | 6 | 25.0 | 85.4 | 69 | 104 | 15 | 4,320,991 | 308,958 |
| | UP-11 | 6 | 21.1 | 78.0 | 70 | 106 | 15 | 4,321,110 | 308,894 |
| | UP-12 | 6 | 23.9 | 91.7 | 40 | 60 | 9 | 4,321,111 | 309,005 |
| | UP-13 | 6 | 25.8 | 86.1 | 60 | 91 | 13 | 4,321,018 | 309,070 |
| | UP-14 | 6 | 37.8 | 68.4 | 22 | 33 | 5 | 4,320,911 | 309,149 |
| | UP-15 | 6 | 20.2 | 75.0 | 33 | 50 | 7 | 4,320,753 | 309,289 |
| | UP-16 | 6 | 18.3 | 87.6 | 60 | 91 | 13 | 4,320,797 | 309,416 |
| | UP-17 | 6 | 22.6 | 85.0 | 66 | 100 | 14 | 4,320,963 | 309,353 |
| | UP-18 | 6 | 24.5 | 81.6 | 21 | 32 | 5 | 4,321,092 | 309,306 |
| | UP-19 | 6 | 20.3 | 90.0 | 74 | 112 | 16 | 4,321,080 | 309,391 |
| | UP-20 | 6 | 18.8 | 85.1 | 94 | 142 | 21 | 4,321,010 | 309,454 |
| | UP-21 | 6 | 18.2 | 82.1 | 84 | 127 | 18 | 4,320,935 | 309,526 |
| | UP-22 | 6 | 13.9 | 88.3 | 38 | 57 | 8 | 4,320,986 | 309,570 |
| | UP-23 | 6 | 22.9 | 89.1 | 40 | 60 | 9 | 4,321,043 | 309,555 |
| | UP-24 | 6 | 14.5 | 77.0 | 83 | 125 | 18 | 4,321,090 | 309,544 |
| | UP-25 | 6 | 17.3 | 85.4 | 46 | 70 | 10 | 4,321,064 | 309,593 |
| Lined Pond (LP) | LP-1 | 4 | 30.3 | 94.8 | 60 | 91 | 13 | 4,321,907 | 308,497 |
| | LP-2 | 2 | 43.1 | 72.4 | 35 | 53 | 8 | 4,321,909 | 308,813 |
| | LP-3 | 4 | 43.1 | 74.1 | 2 | 3 | 0 | 4,321,894 | 309,075 |
| | LP-4 | 2 | 29.2 | 80.7 | 62 | 94 | 14 | 4,321,796 | 308,425 |
| | LP-5 | 2 | 27.2 | 86.4 | 98 | 148 | 21 | 4,321,794 | 308,513 |
| | LP-6 | 4 | 28.9 | 94.9 | 63 | 95 | 14 | 4,321,759 | 308,575 |
| | LP-7 | 6 | 38.2 | 84.9 | 18 | 27 | 4 | 4,321,723 | 308,599 |
| | LP-8 | 2 | 35.2 | 77.1 | 56 | 85 | 12 | 4,321,690 | 308,539 |
| | LP-9 | 2 | 31.3 | 74.5 | 71 | 107 | 16 | 4,321,673 | 308,606 |
| | LP-10 | 6 | 31.7 | 83.5 | 8 | 12 | 2 | 4,321,553 | 308,701 |
| | LP-11 | 6 | 37.1 | 82.6 | 15 | 23 | 3 | 4,321,489 | 308,756 |
| | LP-12 | 2 | 35.9 | 84.0 | 39 | 59 | 9 | 4,321,418 | 308,898 |
| | LP-13 | 4 | 36.3 | 84.2 | 9 | 14 | 2 | 4,321,525 | 308,905 |
| | LP-14 | 4 | 42.0 | 77.6 | 20 | 30 | 4 | 4,321,665 | 308,917 |
| | LP-15 | 6 | 37.9 | 82.8 | 15 | 23 | 3 | 4,321,762 | 308,931 |
| | LP-16 | 4 | 42.1 | 76.3 | 38 | 57 | 8 | 4,321,753 | 309,105 |
| | LP-17 | 2 | 7.5 | 160.3** | NM | NM | NM | 4,321,616 | 308,082 |
| | LP-18 | 2 | 17.0 | 173.1** | NM | NM | NM | 4,321,487 | 308,965 |
| | LP-19 | 2 | 13.7 | 154.7** | 38 | 57 | 8 | 4,321,569 | 308,331 |
| | LP-20 | 2 | 32.9 | 156.6** | 7 | 11 | 2 | 4,321,557 | 308,866 |
| | LP-21 | 4 | 33.2 | 81.2 | 4 | 6 | 1 | 4,321,687 | 308,808 |
| | LP-22 | 2 | 27.6 | 157.3** | 10 | 15 | 2 | 4,321,739 | 308,639 |
| | LP-23 | 4 | 31.4 | 83.8 | 10 | 15 | 2 | 4,321,788 | 308,655 |
| | LP-24 | 4 | 28.2 | 97.1 | 38 | 57 | 8 | 4,321,767 | 308,720 |
| | LP-25 | 4 | 31.1 | 83.6 | 12 | 18 | 3 | 4,321,761 | 308,765 |
| | LP-26 | 4 | 34.7 | 75.7 | 5 | 8 | 1 | 4,321,760 | 308,847 |
| | LP-27 | 2 | 22.8 | 150.2** | 86 | 130 | 19 | 4,321,792 | 308,952 |
| | LP-28 | 2 | 24.5 | 167.8** | NM | NM | NM | 4,321,862 | 308,516 |

**TABLE 1 - EVAPORATION POND REMOVAL SAMPLING SUMMARY**

| Test Location Unlined Pond | Location Designation | Test Depth (Inches) | Moisture Content (%) | Dry Density (pcf) | Vane Shear Value | Shear Strength (kPa) | Shear Strength (psi) | UTM Coordinates | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Northings | Eastings |
| Lined Pond (LP) | LP-29 | 2 | 24.7 | 162.0** | 98 | 148 | 21 | 4,621,888 | 308,562 |
| | LP-30 | 2 | 28.3 | 166.7** | 24 | 36 | 5 | 4,321,885 | 308,607 |
| | LP-31 | 6 | 29.7 | 64.2 | 6 | 9 | 1 | 4,321,897 | 308,739 |
| | LP-32 | 6 | 29.3 | 67.5 | 0 | 0 | 0 | 4,321,860 | 308,781 |
| | LP-33 | 4 | 28.6 | 75.2 | 51 | 77 | 11 | 4,321,873 | 308,919 |
| | LP-34 | 4 | 29.0 | 79.7 | 51 | 77 | 11 | 4,321,858 | 308,118 |
| Red Pond (RP) | RP-01 | 6 | 82.4 | 49.1 | 15 | 23 | 3 | 4,319,296 | 309,947 |
| | RP-02 | 6 | 68.2 | 58.1 | 21 | 32 | 5 | 4,319,290 | 309,991 |
| | RP-03 | 6 | 51.0 | 77.4 | 23 | 35 | 5 | 4,319,250 | 309,996 |
| | RP-04 | 6 | 68.4 | 57.4 | 35 | 53 | 8 | 4,319,224 | 309,982 |
| | RP-05 | 6 | 71.3 | 54.9 | 34 | 51 | 7 | 4,319,219 | 309,927 |
| | RP-06 | 6 | 35.3 | 61.7 | 30 | 45 | 7 | 4,319,255 | 309,940 |
| | RP-07 | 6 | 35.6 | 61.2 | 8 | 12 | 2 | 4,319,287 | 309,958 |
| | RP-08 | 4 | 32.5 | 60.6 | 10 | 15 | 2 | 4,319,273 | 309,949 |
| | RP-09 | 4 | 36.4 | 64.9 | 4 | 6 | 1 | 4,319,268 | 309,976 |
| | RP-10 | 6 | 34.4 | 54.9 | 21 | 32 | 5 | 4,319,271 | 309,997 |
| | RP-11 | 4 | 33.2 | 62.0 | 24 | 36 | 5 | 4,319,246 | 309,970 |
| **Oxide Tailings Area** | | | | | | | | | |
| Lower Bench | Test Pit (TP)-01 OX | 6* | 5.2 | 111.1 | NT | NT | NT | 4,320,056 | 308,481 |
| | | 12* | 5.2 | 113.0 | NT | NT | NT | | |
| | TP-02 OX | 6* | 7.1 | 98.5 | NT | NT | NT | 4,320,172 | 308,386 |
| | | 12* | 5.4 | 114.3 | NT | NT | NT | | |
| Middle Bench | TP-03 OX | 6* | 6.4 | 104.3 | NT | NT | NT | 4,319,981 | 308,410 |
| | | 12* | 5.6 | 109.5 | NT | NT | NT | | |
| Upper Bench | TP-04 OX | 6* | 5.2 | 113.6 | NT | NT | NT | 4,319,915 | 308,358 |
| | | 12* | 4.7 | 117.6 | NT | NT | NT | | |
| | TP-05 OX | 6* | 5.2 | 113.2 | NT | NT | NT | 4,320,072 | 308,289 |
| | | 12* | 4.9 | 115.9 | NT | NT | NT | | |
| South Area | TP-06 OX | 6* | 5.7 | 115.1 | NT | NT | NT | 4,319,175 | 308,710 |
| | | 12* | 5.5 | 118.5 | NT | NT | NT | | |
| | TP-07 OX | 6* | 5.9 | 120.8 | NT | NT | NT | 4,319,204 | 308,674 |
| | | 10* | 6.0 | 121.3 | NT | NT | NT | | |
| | TP-08 OX | 6* | 6.2 | 114.0 | NT | NT | NT | 4,319,245 | 308,644 |
| | | 12* | 5.7 | 116.4 | NT | NT | NT | | |
| | TP-09 OX | 6* | 6.7 | 113.4 | NT | NT | NT | 4,319,307 | 308,601 |
| | | 12* | 6.4 | 119.1 | NT | NT | NT | | |
| | TP-10 OX | 6* | 5.0 | 121.6 | NT | NT | NT | 4,319,282 | 308,702 |
| | | 12* | 5.0 | 123.5 | NT | NT | NT | | |
| | TP-11 OX | 6* | 5.7 | 118.8 | NT | NT | NT | 4,319,328 | 308,716 |
| | | 12* | 5.7 | 122.8 | NT | NT | NT | | |
| Access Road | TP-1 Road | NT | NT | NT | NT | NT | NT | NR | NR |
| | TP-2 Road | NT | NT | NT | NT | NT | NT | NR | NR |
| | TP-3 Road | NT | NT | NT | NT | NT | NT | NR | NR |
| | TP-4 Road | NT | NT | NT | NT | NT | NT | NR | NR |
| | TP-5 Road | NT | NT | NT | NT | NT | NT | NR | NR |

NR = Not Recorded
NT = Not Tested
NM = Not Measured
* Test performed on 18-inch section of oxide tailings material spread out and compacted by 4 passes of a John Deere® 160LC trackhoe.
**Reading influenced by density of underlying asphalt liner.

***Laboratory Testing***

All soils testing performed in the Black Eagle Consulting, Inc. soils laboratory is conducted in accordance with the standards and methodologies described in Volume 4.08 of the ASTM standards. Oxide tailings samples are denoted as OX, while access road samples are denoted at Road.

Representative samples of the oxide tailings and access road fill were analyzed to determine their in situ moisture content (ASTM D 2216), grain size distribution (ASTM D 422), and plasticity index (ASTM D 4318). Test results were used to classify the soils according to ASTM D 2487 and to verify field logs, which were then updated as appropriate. Classification in this manner provides an indication of the soil's mechanical properties. Results of these tests are shown on Plate 4 - Index Test Results.

Moisture-density relationship tests (ASTM D 1557) were performed on representative samples of the oxide tailings and access road fill. The maximum density shown by this test is compared with field densities to determine the percent relative compaction. The moisture density curves are included as Plate 5 - Moisture-Density Relationship Test Results.

Specific gravity tests (ASTM D 5550) were performed on representative samples of the oxide tailings and access road fill to aid in hydrometer testing of these materials. Test results are presented in Table 2 – Oxide Tailings and Access Road Fill Laboratory Test Summary.

A summary of all the laboratory testing performed on oxide tailings and access road fill is shown in Table 2.

**TABLE 2 - OXIDE TAILINGS AND ACCESS ROAD FILL LABORATORY TEST SUMMARY**

| Sample Identification and Location Test Pit (TP) No. | Sample Depth (ft) | Sample No. | Liquid Limit (LL) | Plastic Limit (PL) | Plasticity Index (PI) | % < #200 Sieve | Max. Size (mm) | Water Content (%) | Max. Dry Density (pcf) | Optimum Moisture Content (%) | Specific Gravity | USCS Classification |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TP-01 OX | 0.0 | Bulk | 27 | 20 | 7 | 9 | 19 | 5.7 | 135.0 | 5.9 | 2.587 | SP-SC |
| TP-01 OX | 5.0 | A | 28 | 16 | 12 | 8 | 19 | 5.2 | | | | SP-SC |
| TP-02 OX | 20.0 | D | 29 | 18 | 11 | 9 | 19 | 6.5 | | | 2.667 | GP-GC |
| TP-03 OX | 0.0 | Bulk | 28 | 19 | 9 | 11 | 19 | 6.4 | 136.2 | 5.1 | 2.636 | SP-SC |
| TP-03 OX | 10.0 | B | 31 | 18 | 13 | 10 | 19 | 6.8 | | | | SP-SC |
| TP-04 OX | 15.0 | C | 28 | 20 | 8 | 9 | 19 | 7.1 | | | | GP-GC |
| TP-05 OX | 0.0 | Bulk | 27 | 20 | 7 | 12 | 19 | 6.4 | 136.8 | 5.4 | 2.643 | SP-SC |
| TP-06 OX | 0 | Bulk | 28 | 20 | 8 | 14 | 19 | 4.2 | 120.6 | 12.7 | | SC |
| TP-07 OX | 10 | C | 29 | 19 | 10 | 12 | 19 | 5.7 | | | | SC |
| TP-08 OX | 5 | B | 31 | 19 | 12 | 12 | 19 | 5.8 | | | | SP-SC |
| TP-09 OX | 0 | Bulk | 28 | 22 | 6 | 11 | 19 | 4.6 | 125.8 | 8.5 | | GP-GC |
| TP-10 OX | 15 | D | 28 | 16 | 12 | 10 | 19 | 6.9 | | | | GP-GC |
| TP-11 OX | 0 | Bulk | 31 | 19 | 12 | 12 | 19 | 6.0 | 125.9 | 10.1 | | SC |
| TP-1 Road | 0.0 | Bulk | 28 | 18 | 10 | 8 | 19 | 4.8 | | | | GP-GC |
| TP-3 Road | 0.0 | Bulk | 25 | 19 | 6 | 9 | 19 | 4.0 | 134.5 | 6.8 | | GP-GC |
| TP-5 Road | 0.0 | Bulk | 27 | 18 | 8 | 8 | 25 | 4.4 | 132.0 | 5.4 | | GP-GC |

**Seismic Design Criteria**

The 2006 *International Building Code* (ICC, 2006), adopted by the City of Yerington, requires a detailed soils evaluation to a depth of 100 feet to develop appropriate soils criteria. However, the code states that a Site Class D may be used as a default value when the soil properties are not known in sufficient detail to determine the soil profile type. The Site Class D soil profile is for stiff soils with a shear velocity between 600 and 1,200 feet per second, or with an N (Standard Penetration Test [SPT]) value between 15 and 50 or an undrained shear strength between 1,000 and 2,000 pounds per square foot (psf). Based on our experience and the geology at the Yerington mine site, it is our opinion that the default Site Class D is appropriate. With that assumption, the recommended seismic design criteria follow:

| **TABLE 3 - SEISMIC DESIGN CRITERIA USING 2006 *INTERNATIONAL BUILDING CODE* (USGS, 2007)** | |
|---|---|
| Approximate Latitude | 39.00 |
| Approximate Longitude | -119.20 |
| Spectral Response at Short Periods, $S_s$, percent of gravity | 1.246 |
| Spectral Response at 1-Second Period, $S_1$, percent of gravity | 0.478 |
| Site Class | D |
| Site Coefficient $F_a$, decimal | 1.00 |
| Site Coefficient $F_v$, decimal | 1.32 |
| Site Adjusted Spectral Response at Short Periods, $S_{MS}$, percent of gravity | 1.246 |
| Site Adjusted Spectral Response at Long Periods, $S_{M1}$, percent of gravity | 0.632 |

**Closing**

This report has been prepared with generally accepted geotechnical practices. The information submitted is based upon field exploration performed at the locations described in this letter-report. This report does not reflect soils or ground water variations that may be evident during the construction period. We recommend our firm be retained to perform construction observation in all phases of the project related to geotechnical factors. The owner shall be responsible for distribution of this geotechnical investigation to all designer and contractors whose work is related to geotechnical factors.

We appreciate being of service to you on this project. If you have any questions, or require additional information or clarification, please do not hesitate to contact us.

Sincerely,

**Black Eagle Consulting, Inc.**

PROFESSIONAL ENGINEER STATE OF NEVADA
PATRICK A. PILLING
11-3-09
CIVIL
No. 9153
Exp 12-31-09

Patrick A. Pilling, Ph.D., P.E., D.GE.
President

PAP:mrc/lmk

Enclosures: Plate 1 – Sampling Locations
Plate 2 – Test Pit Logs
Plate 3 – USCS Chart
Plate 4 – Index Test Results
Plate 5 – Moisture-Density Relationship Test Results

Copies to: Addressee (3 copies)

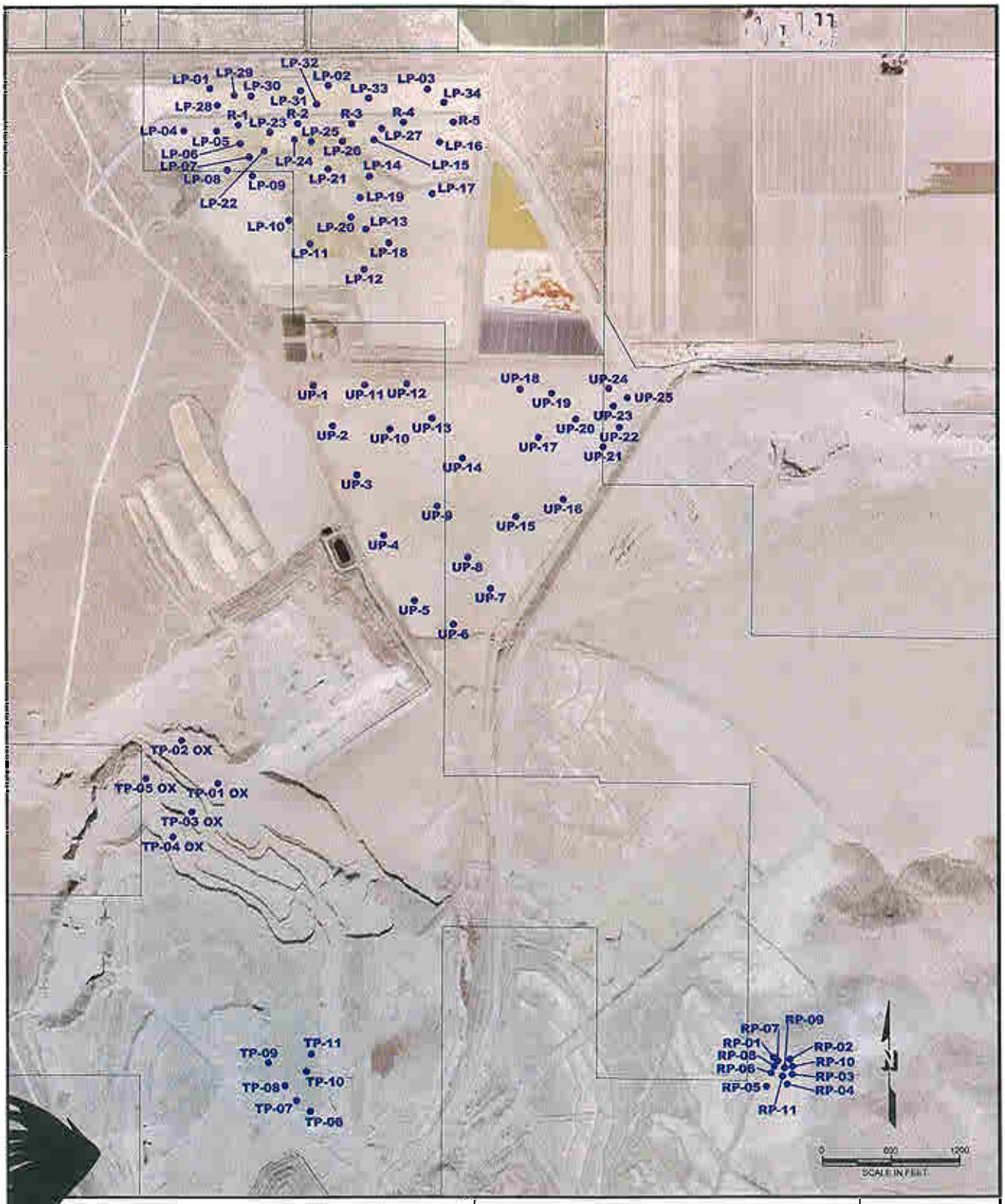
**References**:

American Society for Testing and Materials (ASTM), 2005, *Soil and Rock; Dimension Stone; Geosynthetics,* Volume 4.08.

International Code Council (ICC), 2006, *International Building Code.*

United States Geological Survey (USGS), 2007, *Earthquake Ground Motion Parameters,* Version 5.0.8.

# ENCLOSURES





**Black Eagle Consulting, Inc.**
Geotechnical & Construction Services
1345 Capital Boulevard, Suite A
Reno, Nevada 89502-7140
Telephone: 775/359-6600
Facsimile: 775/359-7766


Brown & Caldwell

## Sample Locations

Yerington Mine
Yerington, Nevada

Project No.
0155-21-1

Plate 1

# TEST PIT LOG

TEST PIT NO.: TP-01 OX

DATE: 5/27/2009

TYPE OF HOE: John Deere 160C LC

DEPTH TO GROUND WATER (ft): NE

LOGGED BY: SMM

GROUND ELEVATION (ft): NA

| SAMPLE NO. | SAMPLE TYPE | PENETROMETER (tsf) | MOISTURE (%) | PLASTICITY INDEX | DEPTH (ft) | USCS SYMBOL | LITHOLOGY | DESCRIPTION |
|---|---|---|---|---|---|---|---|---|
| | | | | | 2, 4 | SP-SC | | 0.0' - 5.0': **Poorly Graded Sand with Clay and Gravel** Brown, tan, dry to slightly moist, dense, with an estimated 10-15% non-plastic to low plasticity fines, 45-50% fine to coarse sand, and 35-40% fine to coarse angular gravel. |
| A | GRAB | | 5.2 | 12 | 6, 8, 10, 12, 14, 16, 18 | SP-SC | | 5.0' - 20.0': **Poorly Graded Sand with Clay and Gravel** Brown, dark brown, slightly moist, very dense, with 5-10% medium plasticity fines, 45-50% fine to coarse sand, and 40-45% fine to coarse angular gravel. |
| B | GRAB | | | | | | | |
| C | GRAB | | | | | | | |
| D | GRAB | | | | | | | |

Excavated in the Oxide Tailings.

Black Eagle Consulting, Inc.
1345 Capital Blvd., Suite A
Reno, Nevada 89502-7140
(775) 359-6600

**Brown & Caldwell**

**Yerington Mine**

**Yerington, NV**

PROJECT NO.: **0155-21-1**

PLATE: 2

SHEET 1 OF 1

# TEST PIT LOG

TEST PIT NO.: TP-02 OX

DATE: 5/27/2009

TYPE OF HOE: John Deere 160C LC

DEPTH TO GROUND WATER (ft): NE

LOGGED BY: SMM

GROUND ELEVATION (ft): NA

| SAMPLE NO. | SAMPLE TYPE | PENETROMETER (tsf) | MOISTURE (%) | PLASTICITY INDEX | DEPTH (ft) | USCS SYMBOL | LITHOLOGY | DESCRIPTION |
|---|---|---|---|---|---|---|---|---|
| | | | | | 2, 4 | SP-SC | | 0.0' - 5.0': **Poorly Graded Sand with Clay and Gravel** Brown, tan, dry to slightly moist, dense, with an estimated 10-15% non-plastic to low plasticity fines, 45-50% fine to coarse sand, and 35-40% fine to coarse angular gravel. |
| A | GRAB | | | | 6, 8, 10, 12, 14 | SP-SC | | 5.0' - 15.0': **Poorly Graded Sand with Clay and Gravel** Brown, dark brown, slightly moist, very dense, with an estimated 5-10% medium plasticity fines, 45-50% fine to coarse sand, and 40-45% fine to coarse angular gravel. |
| B | GRAB | | | | | | | |
| C | GRAB | | | | 16, 18 | GP-GC | | 15.0' - 20.0': **Poorly Graded Gravel with Clay and Sand** Brown, slightly moist, very dense, with 5-10% medium plasticity fines, 30-35% fine to coarse sand, and 55-60% angular gravel. |
| D | GRAB | | 6.5 | 11 | | | | |

Excavated in the Oxide Tailings.

Black Eagle Consulting, Inc.
1345 Capital Blvd., Suite A
Reno, Nevada 89502-7140
(775) 359-6600

**Brown & Caldwell**

**Yerington Mine**

**Yerington, NV**

PROJECT NO.: **0155-21-1**

PLATE: 2

SHEET 1 OF 1

# TEST PIT LOG

TEST PIT NO.: TP-03 OX

DATE: 5/28/2009

TYPE OF HOE: John Deere 160C LC

DEPTH TO GROUND WATER (ft): NE

LOGGED BY: SMM

GROUND ELEVATION (ft): NA

| SAMPLE NO. | SAMPLE TYPE | PENETROMETER (tsf) | MOISTURE (%) | PLASTICITY INDEX | DEPTH (ft) | USCS SYMBOL | LITHOLOGY | DESCRIPTION |
|---|---|---|---|---|---|---|---|---|
| | | | | | 2, 4, 6, 8, 10, 12, 14, 16, 18 | SP-SC | | 0.0' - 20.0': **Poorly Graded Sand with Clay and Gravel** Brown, dark brown, slightly moist, very dense, with an estimated 5-15% medium plasticity fines, 40-50% fine to coarse sand, and 35-45% fine to coarse angular gravel. |
| A | GRAB | | | | | | | |
| B | GRAB | | 6.8 | 13 | | | | |
| C | GRAB | | | | | | | |
| D | GRAB | | | | | | | |

Excavated in the Oxide Tailings.

Black Eagle Consulting, Inc.
1345 Capital Blvd., Suite A
Reno, Nevada 89502-7140
(775) 359-6600

**Brown & Caldwell**
**Yerington Mine**
**Yerington, NV**

PROJECT NO.: **0155-21-1**

PLATE: 2

SHEET 1 OF 1

BC LOG 0 GPJ B E.GDT 009

# TEST PIT LOG

TEST PIT NO.: TP-04 OX

DATE: 5/28/2009

TYPE OF HOE: John Deere 160C LC

DEPTH TO GROUND WATER (ft): NE

LOGGED BY: SMM

GROUND ELEVATION (ft): NA

| SAMPLE NO. | SAMPLE TYPE | PENETROMETER (tsf) | MOISTURE (%) | PLASTICITY INDEX | DEPTH (ft) | USCS SYMBOL | LITHOLOGY | DESCRIPTION |
|---|---|---|---|---|---|---|---|---|
| | | | | | 2, 4 | | | 0.0' - 12.0': **Poorly Graded Sand with Clay and Gravel** Brown, dark brown, slightly moist, very dense, with an estimated 5-15% medium plasticity fines, 40-50% fine to coarse sand, and 35-45% fine to coarse angular gravel. |
| A | GRAB | | | | 6 | SP-SC | | |
| | | | | | 8 | | | |
| B | GRAB | | | | 10 | | | |
| | | | | | 12 | | | 12.0' - 20.0': **Poorly Graded Gravel with Clay and Sand** Brown, slightly moist, very dense, with 5-10% medium plasticity fines, 40-45% fine to coarse sand, and 45-50% angular gravel. |
| | | | | | 14 | | | |
| C | GRAB | | 7.1 | 8 | 16 | GP-GC | | |
| | | | | | 18 | | | |
| D | GRAB | | | | | | | |

Excavated in the Oxide Tailings.

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**Yerington Mine**

**Yerington, NV**

PROJECT NO.: **0155-21-1**

PLATE: 2

SHEET 1 OF 1

# TEST PIT LOG

TEST PIT NO.: TP-05 OX

DATE: 5/28/2009

TYPE OF HOE: John Deere 160C LC

DEPTH TO GROUND WATER (ft): NE

LOGGED BY: SMM

GROUND ELEVATION (ft): NA

| SAMPLE NO. | SAMPLE TYPE | PENETROMETER (tsf) | MOISTURE (%) | PLASTICITY INDEX | DEPTH (ft) | USCS SYMBOL | LITHOLOGY | DESCRIPTION |
|---|---|---|---|---|---|---|---|---|
| | | | | | 2, 4, 6, 8, 10, 12, 14 | SP-SC | | 0.0' - 15.0': **Poorly Graded Sand with Clay and Gravel** Brown, dark brown, slightly moist, very dense, with an estimated 5-15% medium plasticity fines, 40-50% fine to coarse sand, and 35-45% fine to coarse angular gravel. |
| A | GRAB | | | | | | | |
| B | GRAB | | | | | | | |
| C | GRAB | | | | 16, 18 | GP-GC | | 15.0' - 20.0': **Poorly Graded Gravel with Clay and Sand** Brown, slightly moist, very dense, with 5-10% medium plasticity fines, 40-45% fine to coarse sand, and 45-50% angular gravel. |
| D | GRAB | | | | | | | |

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PROJECT NO.: **0155-21-1**

PLATE: 2

SHEET 1 OF 1

# TEST PIT LOG

TEST PIT NO.: TP-06 OX

DATE: 8/12/2009

TYPE OF HOE: Cat 160C LC

DEPTH TO GROUND WATER (ft): NE

LOGGED BY: SMM

GROUND ELEVATION (ft): NA

| SAMPLE NO. | SAMPLE TYPE | PENETROMETER (tsf) | MOISTURE (%) | PLASTICITY INDEX | DEPTH (ft) | USCS SYMBOL | LITHOLOGY | DESCRIPTION |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | 0.0' - 20.0': **Poorly Graded Sand with Clay and Gravel** Brown, dark brown, slightly moist, very dense, with an estimated 5-15% medium plasticity fines, 40-50% fine to coarse sand, and 35-45% fine to coarse angular gravel. |
| A | GRAB | | | | 2 | | | |
| | | | | | 4 | | | |
| B | GRAB | | | | 6 | | | |
| | | | | | 8 | | | |
| | | | | | 10 | SP-SC | | |
| C | GRAB | | | | 12 | | | |
| | | | | | 14 | | | |
| D | GRAB | | | | 16 | | | |
| | | | | | 18 | | | |

Excavated in the Oxide Tailings. Bulk sample collected 0 - 20'.

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PROJECT NO.: **0155-21-1**

PLATE: 2

SHEET 1 OF 2

BORING_LOG 0155211.GPJ BLKEAGLE.GDT 11/3/2009

# TEST PIT LOG

TEST PIT NO.: TP-06 OX

DATE: 8/12/2009

TYPE OF HOE: Cat 160C LC

DEPTH TO GROUND WATER (ft): NE

LOGGED BY: SMM

GROUND ELEVATION (ft): NA

| SAMPLE NO. | SAMPLE TYPE | PENETROMETER (tsf) | MOISTURE (%) | PLASTICITY INDEX | DEPTH (ft) | USCS SYMBOL | LITHOLOGY | DESCRIPTION |
|---|---|---|---|---|---|---|---|---|
| E | GRAB | | | | | | | |
| | | | | | 22 | | | |
| | | | | | 24 | | | |
| | | | | | 26 | | | |
| | | | | | 28 | | | |
| | | | | | 30 | | | |
| | | | | | 32 | | | |
| | | | | | 34 | | | |
| | | | | | 36 | | | |
| | | | | | 38 | | | |

Excavated in the Oxide Tailings. Bulk sample collected 0 - 20'.

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PROJECT NO.: **0155-21-1**

PLATE: 2



BORING_LOG 0155211.GPJ BLKEAGLE.GDT 11/3/2009

# TEST PIT LOG

TEST PIT NO.: TP-07 OX

DATE: 8/12/2009

TYPE OF HOE: Cat 160C LC

DEPTH TO GROUND WATER (ft): NE

LOGGED BY: SMM

GROUND ELEVATION (ft): NA

| SAMPLE NO. | SAMPLE TYPE | PENETROMETER (tsf) | MOISTURE (%) | PLASTICITY INDEX | DEPTH (ft) | USCS SYMBOL | LITHOLOGY | DESCRIPTION |
|---|---|---|---|---|---|---|---|---|
| A | GRAB | | | | 2 | SP-SC | | 0.0' - 11.0': **Poorly Graded Sand with Clay and Gravel** Brown, dark brown, slightly moist, very dense, with an estimated 5-15% medium plasticity fines, 40-50% fine to coarse sand, and 35-45% fine to coarse angular gravel. |
| | | | | | 4 | | | |
| B | GRAB | | | | 6 | | | |
| | | | | | 8 | | | |
| | | | | | 10 | | | |
| C | GRAB | | | | 12 | SP-SC | | 11.0' - 20.0': **Poorly Graded Sand with Clay and Gravel** Brown, dark brown, slightly moist, very dense, with an estimated 5-10% medium plasticity fines, 45-50% fine to coarse sand, and 40-45% fine to coarse angular gravel. |
| | | | | | 14 | | | |
| D | GRAB | | | | 16 | | | |
| | | | | | 18 | | | |

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**Yerington, NV**

PROJECT NO.: **0155-21-1**

PLATE: 2



BORING_LOG 0155211.GPJ BLKEAGLE.GDT 11/3/2009

# TEST PIT LOG

TEST PIT NO.: TP-07 OX

DATE: 8/12/2009

TYPE OF HOE: Cat 160C LC

DEPTH TO GROUND WATER (ft): NE

LOGGED BY: SMM

GROUND ELEVATION (ft): NA

| SAMPLE NO. | SAMPLE TYPE | PENETROMETER (tsf) | MOISTURE (%) | PLASTICITY INDEX | DEPTH (ft) | USCS SYMBOL | LITHOLOGY | DESCRIPTION |
|---|---|---|---|---|---|---|---|---|
| E | GRAB | | | | | | | |
| | | | | | 22 | | | |
| | | | | | 24 | | | |
| | | | | | 26 | | | |
| | | | | | 28 | | | |
| | | | | | 30 | | | |
| | | | | | 32 | | | |
| | | | | | 34 | | | |
| | | | | | 36 | | | |
| | | | | | 38 | | | |

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PROJECT NO.: **0155-21-1**

PLATE: 2



BORING_LOG 0155211.GPJ BLKEAGLE.GDT 11/3/2009

# TEST PIT LOG

TEST PIT NO.: TP-08 OX

DATE: 8/12/2009

TYPE OF HOE: Cat 160C LC

DEPTH TO GROUND WATER (ft): NE

LOGGED BY: SMM

GROUND ELEVATION (ft): NA

| SAMPLE NO. | SAMPLE TYPE | PENETROMETER (tsf) | MOISTURE (%) | PLASTICITY INDEX | DEPTH (ft) | USCS SYMBOL | LITHOLOGY | DESCRIPTION |
|---|---|---|---|---|---|---|---|---|
| A | GRAB | | | | 2 | | | 0.0' - 12.0': **Poorly Graded Sand with Clay and Gravel** Brown, dark brown, slightly moist, very dense, with an estimated 5-15% medium plasticity fines, 40-50% fine to coarse sand, and 35-45% fine to coarse angular gravel. |
| | | | | | 4 | | | |
| B | GRAB | | | | 6 | SP-SC | | |
| | | | | | 8 | | | |
| | | | | | 10 | | | |
| C | GRAB | | | | 12 | | | |
| | | | | | 14 | | | 12.0' - 20.0': **Poorly Graded Sand with Clay and Gravel** Brown, dark brown, slightly moist, very dense, with an estimated 5-10% medium plasticity fines, 45-50% fine to coarse sand, and 40-45% fine to coarse angular gravel. |
| D | GRAB | | | | 16 | SP-SC | | |
| | | | | | 18 | | | |

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**Yerington, NV**

PROJECT NO.: **0155-21-1**

PLATE: 2



BORING_LOG 0155211.GPJ BLKEAGLE.GDT 11/3/2009

# TEST PIT LOG

TEST PIT NO.: TP-08 OX

DATE: 8/12/2009

TYPE OF HOE: Cat 160C LC

DEPTH TO GROUND WATER (ft): NE

LOGGED BY: SMM

GROUND ELEVATION (ft): NA

| SAMPLE NO. | SAMPLE TYPE | PENETROMETER (tsf) | MOISTURE (%) | PLASTICITY INDEX | DEPTH (ft) | USCS SYMBOL | LITHOLOGY | DESCRIPTION |
|---|---|---|---|---|---|---|---|---|
| E | GRAB | | | | | | | |
| | | | | | 22 | | | |
| | | | | | 24 | | | |
| | | | | | 26 | | | |
| | | | | | 28 | | | |
| | | | | | 30 | | | |
| | | | | | 32 | | | |
| | | | | | 34 | | | |
| | | | | | 36 | | | |
| | | | | | 38 | | | |

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PROJECT NO.: **0155-21-1**

PLATE: 2



BORING_LOG 0155211.GPJ BLKEAGLE.GDT 11/3/2009

# TEST PIT LOG

TEST PIT NO.: TP-09 OX

DATE: 8/12/2009

TYPE OF HOE: Cat 160C LC

DEPTH TO GROUND WATER (ft): NE

LOGGED BY: SMM

GROUND ELEVATION (ft): NA

| SAMPLE NO. | SAMPLE TYPE | PENETROMETER (tsf) | MOISTURE (%) | PLASTICITY INDEX | DEPTH (ft) | USCS SYMBOL | LITHOLOGY | DESCRIPTION |
|---|---|---|---|---|---|---|---|---|
| A | GRAB | | | | 2 | | | 0.0' - 20.0': **Poorly Graded Sand with Clay and Gravel** Brown, dark brown, slightly moist, very dense, with an estimated 5-15% medium plasticity fines, 40-50% fine to coarse sand, and 35-45% fine to coarse angular gravel. |
| | | | | | 4 | | | |
| B | GRAB | | | | 6 | | | |
| | | | | | 8 | | | |
| | | | | | 10 | SP-SC | | |
| C | GRAB | | | | 12 | | | |
| | | | | | 14 | | | |
| D | GRAB | | | | 16 | | | |
| | | | | | 18 | | | |

Excavated in the Oxide Tailings. Bulk sample collected 0 - 20'.

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PROJECT NO.: **0155-21-1**

PLATE: 2



BORING_LOG 0155211.GPJ BLKEAGLE.GDT 11/3/2009

# TEST PIT LOG

TEST PIT NO.: TP-09 OX

DATE: 8/12/2009

TYPE OF HOE: Cat 160C LC

DEPTH TO GROUND WATER (ft): NE

LOGGED BY: SMM

GROUND ELEVATION (ft): NA

| SAMPLE NO. | SAMPLE TYPE | PENETROMETER (tsf) | MOISTURE (%) | PLASTICITY INDEX | DEPTH (ft) | USCS SYMBOL | LITHOLOGY | DESCRIPTION |
|---|---|---|---|---|---|---|---|---|
| E | GRAB | | | | | | | |
| | | | | | 22 | | | |
| | | | | | 24 | | | |
| | | | | | 26 | | | |
| | | | | | 28 | | | |
| | | | | | 30 | | | |
| | | | | | 32 | | | |
| | | | | | 34 | | | |
| | | | | | 36 | | | |
| | | | | | 38 | | | |

Excavated in the Oxide Tailings. Bulk sample collected 0 - 20'.

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PLATE: 2



BORING_LOG 0155211.GPJ BLKEAGLE.GDT 11/3/2009

# TEST PIT LOG

TEST PIT NO.: TP-10 OX

DATE: 8/12/2009

TYPE OF HOE: Cat 160C LC

DEPTH TO GROUND WATER (ft): NE

LOGGED BY: SMM

GROUND ELEVATION (ft): NA

| SAMPLE NO. | SAMPLE TYPE | PENETROMETER (tsf) | MOISTURE (%) | PLASTICITY INDEX | DEPTH (ft) | USCS SYMBOL | LITHOLOGY | DESCRIPTION |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | 0.0' - 20.0': **Poorly Graded Sand with Clay and Gravel** Brown, dark brown, slightly moist, very dense, with an estimated 5-15% medium plasticity fines, 40-50% fine to coarse sand, and 35-45% fine to coarse angular gravel. |
| A | GRAB | | | | 2 | | | |
| | | | | | 4 | | | |
| B | GRAB | | | | 6 | | | |
| | | | | | 8 | | | |
| | | | | | 10 | SP-SC | | |
| C | GRAB | | | | 12 | | | |
| | | | | | 14 | | | |
| D | GRAB | | | | 16 | | | |
| | | | | | 18 | | | |

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PLATE: 2



BORING_LOG 0155211.GPJ BLKEAGLE.GDT 11/3/2009

# TEST PIT LOG

TEST PIT NO.: TP-10 OX

DATE: 8/12/2009

TYPE OF HOE: Cat 160C LC

DEPTH TO GROUND WATER (ft): NE

LOGGED BY: SMM

GROUND ELEVATION (ft): NA

| SAMPLE NO. | SAMPLE TYPE | PENETROMETER (tsf) | MOISTURE (%) | PLASTICITY INDEX | DEPTH (ft) | USCS SYMBOL | LITHOLOGY | DESCRIPTION |
|---|---|---|---|---|---|---|---|---|
| E | GRAB | | | | | | | |
| | | | | | 22 | | | |
| | | | | | 24 | | | |
| | | | | | 26 | | | |
| | | | | | 28 | | | |
| | | | | | 30 | | | |
| | | | | | 32 | | | |
| | | | | | 34 | | | |
| | | | | | 36 | | | |
| | | | | | 38 | | | |

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PLATE: 2



BORING_LOG 0155211.GPJ BLKEAGLE.GDT 11/3/2009

# TEST PIT LOG

TEST PIT NO.: TP-11 OX

DATE: 8/12/2009

TYPE OF HOE: Cat 160C LC

DEPTH TO GROUND WATER (ft): NE

LOGGED BY: SMM

GROUND ELEVATION (ft): NA

| SAMPLE NO. | SAMPLE TYPE | PENETROMETER (tsf) | MOISTURE (%) | PLASTICITY INDEX | DEPTH (ft) | USCS SYMBOL | LITHOLOGY | DESCRIPTION |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | 0.0' - 20.0': **Poorly Graded Sand with Clay and Gravel** Brown, dark brown, slightly moist, very dense, with an estimated 5-15% medium plasticity fines, 40-50% fine to coarse sand, and 35-45% fine to coarse angular gravel. |
| A | GRAB | | | | 2 | | | |
| | | | | | 4 | | | |
| B | GRAB | | | | 6 | | | |
| | | | | | 8 | | | |
| | | | | | 10 | SP-SC | | |
| C | GRAB | | | | 12 | | | |
| | | | | | 14 | | | |
| D | GRAB | | | | 16 | | | |
| | | | | | 18 | | | |

Excavated in the Oxide Tailings. Bulk sample collected 0 - 20'.

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PROJECT NO.: **0155-21-1**

PLATE: 2



BORING_LOG 0155211.GPJ BLKEAGLE.GDT 11/3/2009

# TEST PIT LOG

TEST PIT NO.: TP-11 OX

DATE: 8/12/2009

TYPE OF HOE: Cat 160C LC

DEPTH TO GROUND WATER (ft): NE

LOGGED BY: SMM

GROUND ELEVATION (ft): NA

| SAMPLE NO. | SAMPLE TYPE | PENETROMETER (tsf) | MOISTURE (%) | PLASTICITY INDEX | DEPTH (ft) | USCS SYMBOL | LITHOLOGY | DESCRIPTION |
|---|---|---|---|---|---|---|---|---|
| E | GRAB | | | | | | | |
| | | | | | 22 | | | |
| | | | | | 24 | | | |
| | | | | | 26 | | | |
| | | | | | 28 | | | |
| | | | | | 30 | | | |
| | | | | | 32 | | | |
| | | | | | 34 | | | |
| | | | | | 36 | | | |
| | | | | | 38 | | | |

Excavated in the Oxide Tailings. Bulk sample collected 0 - 20'.

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PROJECT NO.: **0155-21-1**

PLATE: 2



BORING_LOG 0155211.GPJ BLKEAGLE.GDT 11/3/2009

# LOG OF TEST PIT TP-1 Road

Date Excavated: 5/28/2009 Logged by: SMM

Equipment: John Deere 160C LC Surface Elevation (ft) NA

Depth to Ground Water: NE
Comments:Excavated from the elevated roadside in the lined pond area.

| SAMPLE NUMBER | SAMPLE | POCKET PEN. (tsf) | MOISTURE (%) | PI | DEPTH (feet) | GRAPHIC LOG | MATERIAL DESCRIPTION |
|---|---|---|---|---|---|---|---|
| A | | | 4.8 | NP | 1 2 3 4 5 6 7 8 9 | GP-GM | 0.0' - 8.0': **Poorly Graded Gravel with Silt and Sand** Brown, tan, dry to slightly moist, medium dense, with 8% non-plastic fines, 42% fine to coarse sand, and 50% angular to subangular fine to coarse gravel. |

# LOG OF TEST PIT TP-2 Road

Date Excavated: 5/28/2009 Logged by: SMM

Equipment: John Deere 160C LC Surface Elevation (ft) NA

Depth to Ground Water: NE
Comments:Excavated from the elevated roadside in the lined pond area.

| SAMPLE NUMBER | SAMPLE | POCKET PEN. (tsf) | MOISTURE (%) | PI | DEPTH (feet) | GRAPHIC LOG | MATERIAL DESCRIPTION |
|---|---|---|---|---|---|---|---|
| A | | | | | 1 2 3 4 5 6 7 8 9 | GP-GM | 0.0' - 8.0': **Poorly Graded Gravel with Silt and Sand** Brown, tan, dry to slightly moist, medium dense, with an estimated 5-10% non-plastic to low plasticity fines, 40-45% fine to coarse sand, and 45-50% angular to subangular fine to coarse gravel. |

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1345 Capital Blvd., Suite A
Reno, Nevada 89502-7140
Phone: (775) 359-6600 Fax: (775) 359-7766

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**Yerington, NV 0155-21-1** Plate 2

# LOG OF TEST PIT TP-3 Road

Date Excavated: 5/28/2009 Logged by: SMM

Equipment: John Deere 160C LC Surface Elevation (ft) NA

Depth to Ground Water: NE

Comments:Excavated from the elevated roadside in the lined pond area.

| SAMPLE NUMBER | SAMPLE | POCKET PEN. (tsf) | MOISTURE (%) | PI | DEPTH (feet) | GRAPHIC LOG | MATERIAL DESCRIPTION |
|---|---|---|---|---|---|---|---|
| A | | | 4.0 | 6 | 1, 2, 3, 4, 5, 6, 7, 8 | GP-GC | 0.0' - 8.0': **Poorly Graded Gravel with Silty Clay and Sand** Brown, tan, dry to slightly moist, medium dense to dense, with 9% low plasticity fines, 40% fine to coarse sand, and 51% angular to subangular fine to coarse gravel. |
| | | | | | 9 | | |

# LOG OF TEST PIT TP-4 Road

Date Excavated: 5/28/2009 Logged by: SMM

Equipment: John Deere 160C LC Surface Elevation (ft) NA

Depth to Ground Water: NE

Comments:Excavated from the elevated roadside in the lined pond area.

| SAMPLE NUMBER | SAMPLE | POCKET PEN. (tsf) | MOISTURE (%) | PI | DEPTH (feet) | GRAPHIC LOG | MATERIAL DESCRIPTION |
|---|---|---|---|---|---|---|---|
| A | | | | | 1, 2, 3, 4, 5, 6, 7, 8 | GP-GC | 0.0' - 8.0': **Poorly Graded Gravel with Silty Clay and Sand** Brown, tan, dry to slightly moist, medium dense to dense, with an estimated 5-10% low plasticity fines, 40-45% fine to coarse sand, and 50-55% angular to subangular fine to coarse gravel. |
| | | | | | 9 | | |

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Reno, Nevada 89502-7140
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**Yerington, NV 0155-21-1** Plate 2

# LOG OF TEST PIT TP-5 Road

Date Excavated: 5/28/2009 Logged by: SMM

Equipment: John Deere 160C LC Surface Elevation (ft) NA

Depth to Ground Water: NE

Comments: Excavated from the elevated roadside in the lined pond area.

| SAMPLE NUMBER | SAMPLE | POCKET PEN. (tsf) | MOISTURE (%) | PI | DEPTH (feet) | GRAPHIC LOG | MATERIAL DESCRIPTION |
|---|---|---|---|---|---|---|---|
| A | | | 4.4 | 9 | 1, 2, 3, 4, 5, 6, 7, 8, 9 | GP-GC | 0.0' - 8.0': **Poorly Graded Gravel with Clay and Sand** Brown, tan, dry to slightly moist, medium dense to dense, with 8% low plasticity fines, 36% fine to coarse sand, and 57% angular to subangular fine to coarse gravel. |

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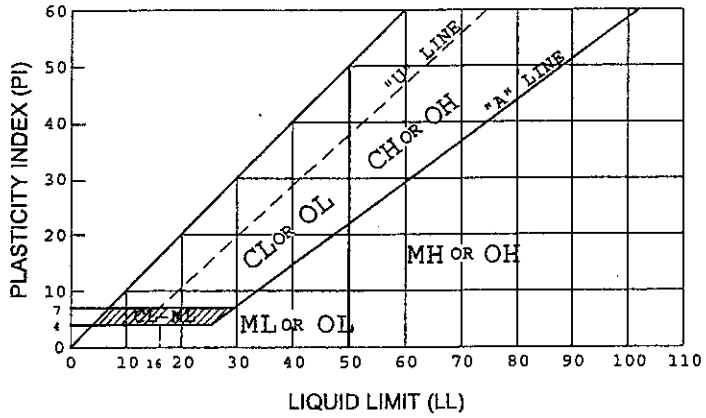
**Yerington, NV 0155-21-1** Plate 2

## SOIL CLASSIFICATION CHART

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

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS.

## PLASTICITY CHART




FOR CLASSIFICATION OF FINE-GRAINED SOILS AND FINE-GRAINED FRACTION OF COARSE-GRAINED SOILS

### EXPLORATION SAMPLE TERMINOLOGY

| Sample Type | Sample Symbol | Sample Code |
|---|---|---|
| Auger Cuttings | | Auger |
| Bulk (Grab) Sample | | Grab |
| Modified California Sampler | | MC |
| Shelby Tube | | SH or ST |
| Standard Penetration Test | | SPT |
| Split Spoon | | SS |
| No Sample | | |

### GRAIN SIZE TERMINOLOGY

| Component of Sample | Size Range |
|---|---|
| Boulders | Over 12 in. (300mm) |
| Cobbles | 12 in. to 3 in. (300mm to 75mm) |
| Gravel | 3 in. to #4 sieve (75mm to 2mm) |
| Sand | # 4 to #200 sieve (2mm to 0.074mm) |
| Silt or Clay | Passing #200 sieve (0.074mm) |

### RELATIVE DENSITY OF GRANULAR SOILS

| N - Blows/ft | Relative Density |
|---|---|
| 0 - 4 | Very Loose |
| 5 - 10 | Loose |
| 11 - 30 | Medium Dense |
| 31 - 50 | Dense |
| greater than 50 | Very Dense |

### CONSISTENCY OF COHESIVE SOILS

| Unconfined Compressive Strength, psf | N - Blows/ft | Consistency |
|---|---|---|
| less than 500 | 0 - 1 | Very Soft |
| 500 - 1,000 | 2 - 4 | Soft |
| 1,000 - 2,000 | 5 - 8 | Firm |
| 2,000 - 4,000 | 9 - 15 | Stiff |
| 4,000 - 8,000 | 16 - 30 | Very Stiff |
| 8,000 - 16,000 | 31 - 60 | Hard |
| greater than 16,000 | greater than 60 | Very Hard |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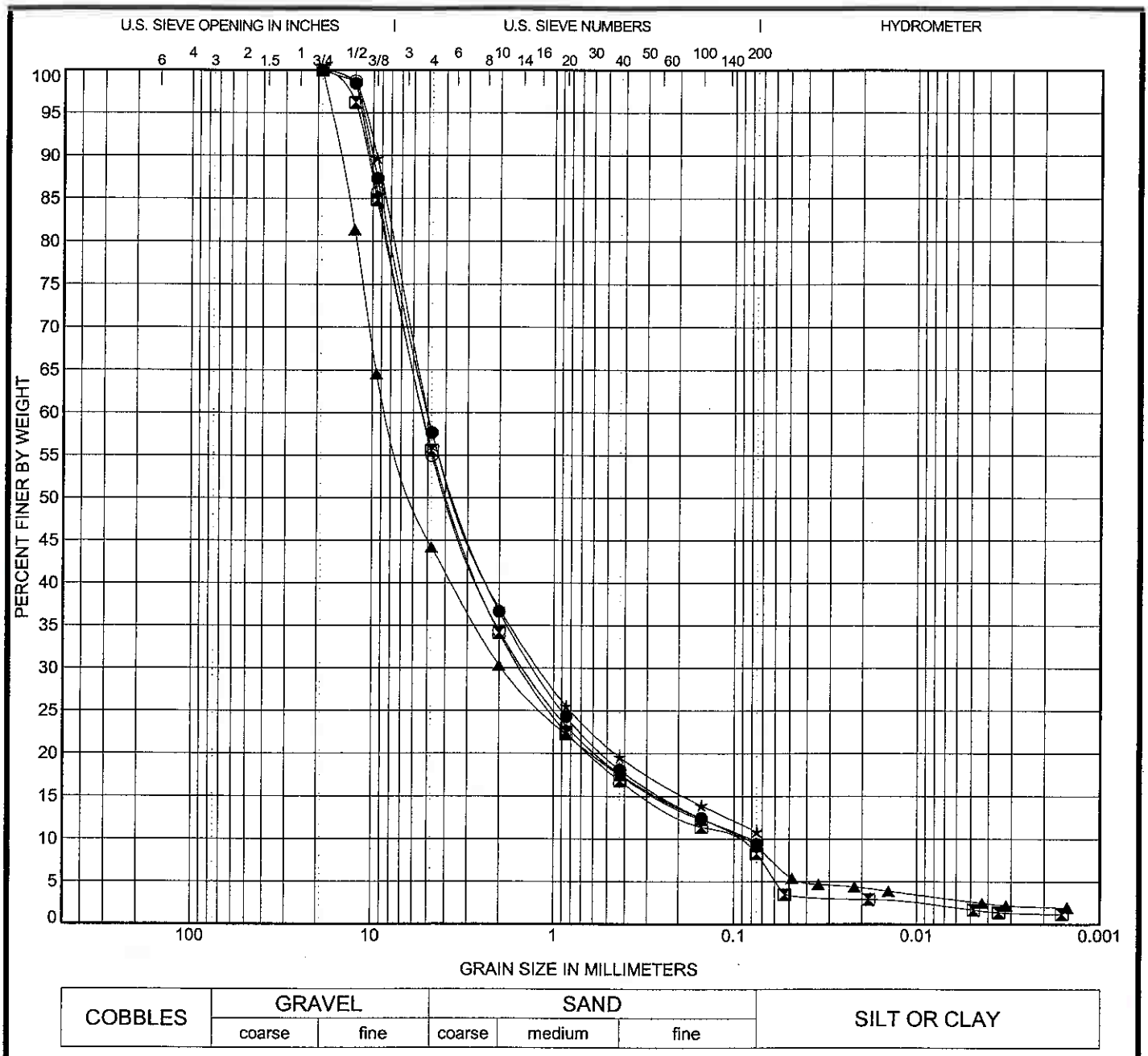
1345 Capital Blvd., Suite A
Reno, Nevada 89502-7140
Telephone: (775) 359-6600
Fax: (775) 359-7766


**USCS Soil Classification Chart**

Project: **Yerington Mine**

Location: **Yerington, NV**

Project Number: **0155-21-1** Plate: 3




| COBBLES | GRAVEL | | SAND | | | SILT OR CLAY |
|---|---|---|---|---|---|---|
| | coarse | fine | coarse | medium | fine | |

| | Specimen Identification | | USCS Classification | LL | PL | PI | Cc | Cu |
|---|---|---|---|---|---|---|---|---|
| ● | TP-01 OX | 0.0' | POORLY GRADED SAND with SILTY CLAY and GRAVEL (SP-SC) | 27 | 20 | 7 | 3.70 | 58.51 |
| ⊠ | TP-01 OX | 5.0' | POORLY GRADED SAND with CLAY and GRAVEL (SP-SC) | 28 | 16 | 12 | 3.79 | 48.17 |
| ▲ | TP-02 OX | 20.0' | POORLY GRADED GRAVEL with CLAY and SAND (GP-GC) | 29 | 18 | 11 | 5.07 | 89.55 |
| ★ | TP-03 OX | 0.0' | POORLY GRADED SAND with CLAY and GRAVEL (SP-SC) | 28 | 19 | 9 | 4.58 | 80.83 |
| ⊙ | TP-03 OX | 10.0' | POORLY GRADED SAND with CLAY and GRAVEL (SP-SC) | 31 | 18 | 13 | 4.81 | 66.47 |

| | Specimen Identification | | D100 | D60 | D30 | D10 | MC % | %Gravel | %Sand | %Silt | %Clay |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ● | TP-01 OX | 0.0' | 19 | 5.017 | 1.262 | 0.086 | 5.7 | 42.3 | 48.2 | 9.4 | |
| ⊠ | TP-01 OX | 5.0' | 19 | 5.273 | 1.479 | 0.109 | 5.2 | 44.4 | 47.3 | 6.6 | 1.7 |
| ▲ | TP-02 OX | 20.0' | 19 | 8.13 | 1.934 | 0.091 | 6.5 | 55.8 | 35.0 | 6.5 | 2.7 |
| ★ | TP-03 OX | 0.0' | 19 | 4.981 | 1.186 | | 6.4 | 42.2 | 46.9 | 10.9 | |
| ⊙ | TP-03 OX | 10.0' | 19 | 5.318 | 1.431 | 0.08 | 6.8 | 45.0 | 45.2 | 9.8 | |

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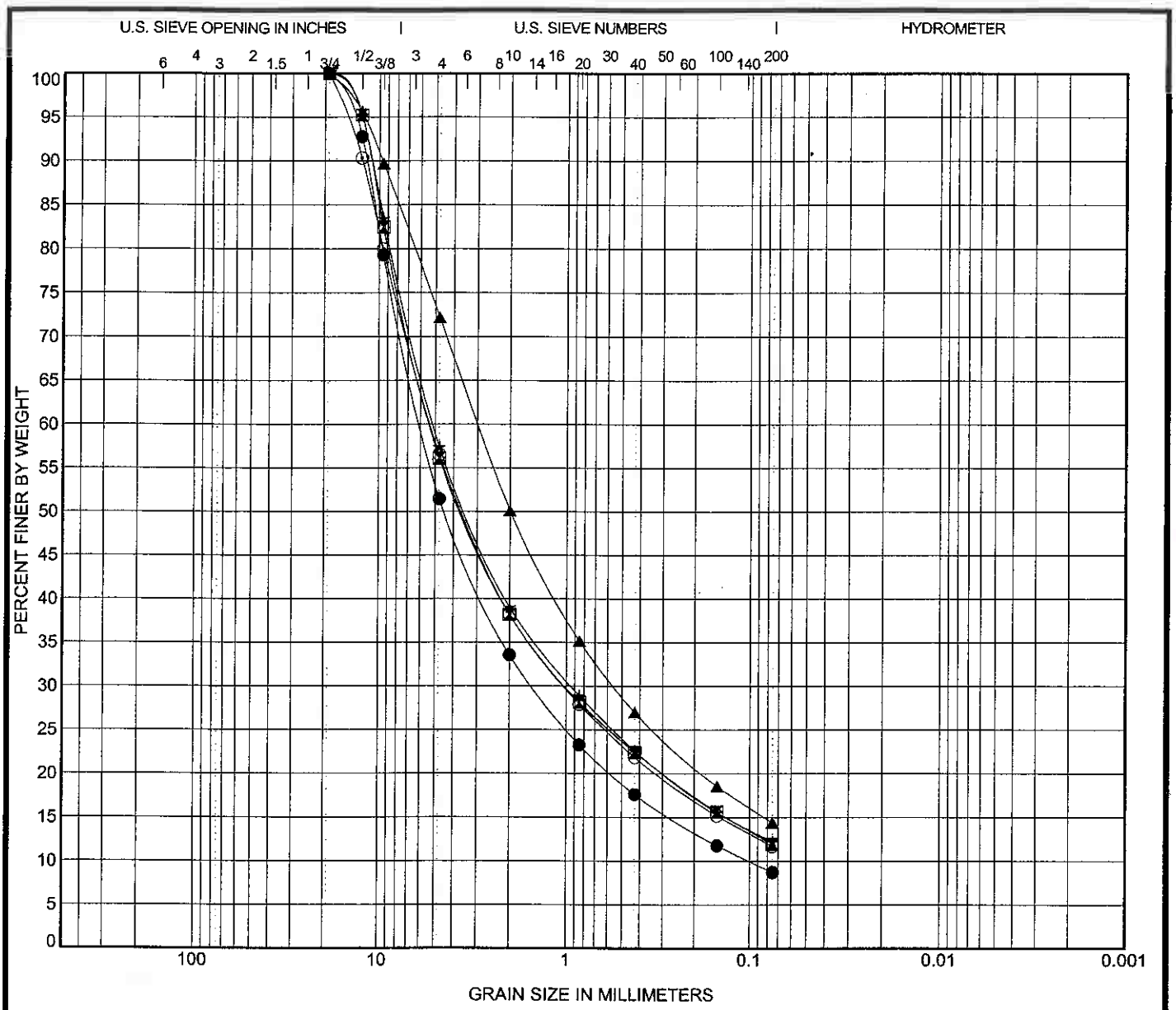
# GRAIN SIZE DISTRIBUTION

Project: **Yerington Mine**

Location: **Yerington, NV**

Project Number: **0155-21-1** Plate: 4a

US GRAIN SIZE2 0155211.GPJ US LAB.GDT 11/3/2009




| COBBLES | GRAVEL | | SAND | | | SILT OR CLAY |
|---|---|---|---|---|---|---|
| | coarse | fine | coarse | medium | fine | |

| | Specimen Identification | | USCS Classification | LL | PL | PI | Cc | Cu |
|---|---|---|---|---|---|---|---|---|
| ● | TP-04 OX | 15.0' | POORLY GRADED GRAVEL with CLAY and SAND (GP-GC) | 28 | 20 | 8 | 3.77 | 58.75 |
| ⊠ | TP-05 OX | 0.0' | POORLY GRADED SAND with SILTY CLAY and GRAVEL (SP-SC) | 27 | 20 | 7 | 3.64 | 101.88 |
| ▲ | TP-06 OX | 0.0' | CLAYEY SAND with GRAVEL (SC) | 28 | 20 | 8 | | |
| ★ | TP-07 OX | 10.0' | CLAYEY SAND with GRAVEL (SC) | 29 | 19 | 10 | 3.62 | 107.54 |
| ⊙ | TP-08 OX | 5.0' | POORLY GRADED SAND with CLAY and GRAVEL (SP-SC) | 31 | 19 | 12 | 3.62 | 98.46 |

| | Specimen Identification | | D100 | D60 | D30 | D10 | MC % | %Gravel | %Sand | %Silt | %Clay |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ● | TP-04 OX | 15.0' | 19 | 5.877 | 1.489 | 0.1 | 7.1 | 48.6 | 42.7 | 8.7 | |
| ⊠ | TP-05 OX | 0.0' | 19 | 5.263 | 0.995 | | 6.4 | 43.9 | 44.1 | 12.0 | |
| ▲ | TP-06 OX | 0.0' | 19 | 2.95 | 0.549 | | 4.2 | 27.8 | 57.8 | 14.4 | |
| ★ | TP-07 OX | 10.0' | 19 | 5.09 | 0.934 | | 5.7 | 42.6 | 45.2 | 12.2 | |
| ⊙ | TP-08 OX | 5.0' | 19 | 5.263 | 1.009 | | 5.8 | 43.5 | 44.8 | 11.7 | |

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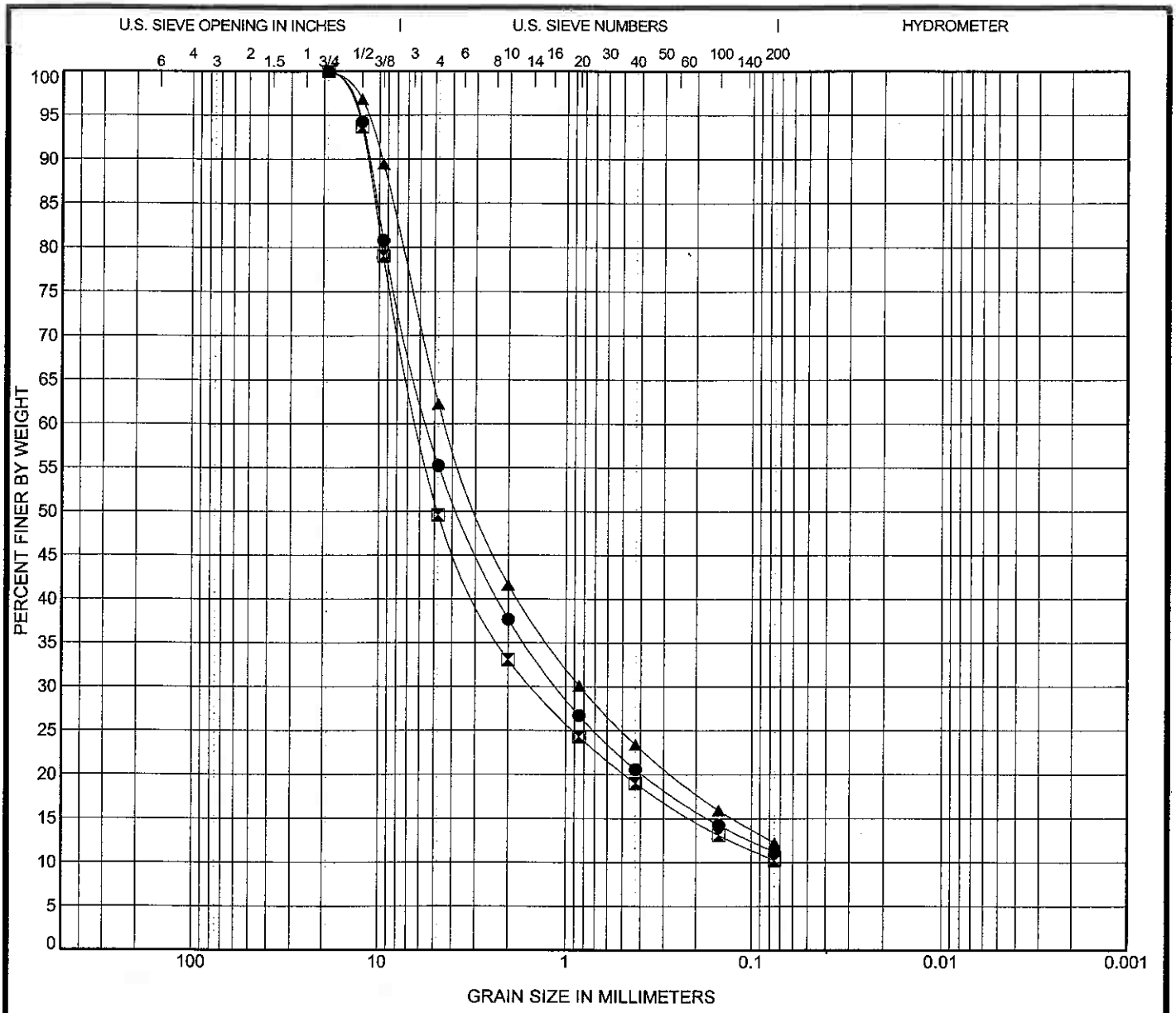
# GRAIN SIZE DISTRIBUTION

Project: **Yerington Mine**

Location: **Yerington, NV**

Project Number: **0155-21-1** Plate: 4b

US_GRAIN_SIZE2_0155211.GPJ US_LAB.GDT 11/3/2009




| COBBLES | GRAVEL | | SAND | | | SILT OR CLAY |
|---|---|---|---|---|---|---|
| | coarse | fine | coarse | medium | fine | |

| | Specimen Identification | | USCS Classification | LL | PL | PI | Cc | Cu |
|---|---|---|---|---|---|---|---|---|
| ● | TP-09 OX | 0.0 | POORLY GRADED GRAVEL with SILTY CLAY and SAND (GP-GC) | 28 | 22 | 6 | 3.88 | 94.00 |
| ⊠ | TP-10 OX | 15.0' | POORLY GRADED GRAVEL with CLAY and SAND (GP-GC) | 28 | 16 | 12 | 5.13 | 85.89 |
| ▲ | TP-11 OX | 0.0' | CLAYEY SAND with GRAVEL (SC) | 31 | 19 | 12 | 3.32 | 87.72 |

| | Specimen Identification | | D100 | D60 | D30 | D10 | MC % | %Gravel | %Sand | %Silt | %Clay |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ● | TP-09 OX | 0.0' | 19 | 5.408 | 1.099 | | 4.6 | 44.8 | 44.0 | 11.2 | |
| ⊠ | TP-10 OX | 15.0' | 19 | 6.072 | 1.484 | | 6.9 | 50.4 | 39.3 | 10.2 | |
| ▲ | TP-11 OX | 0.0' | 19 | 4.324 | 0.842 | | 6.0 | 37.8 | 50.0 | 12.2 | |

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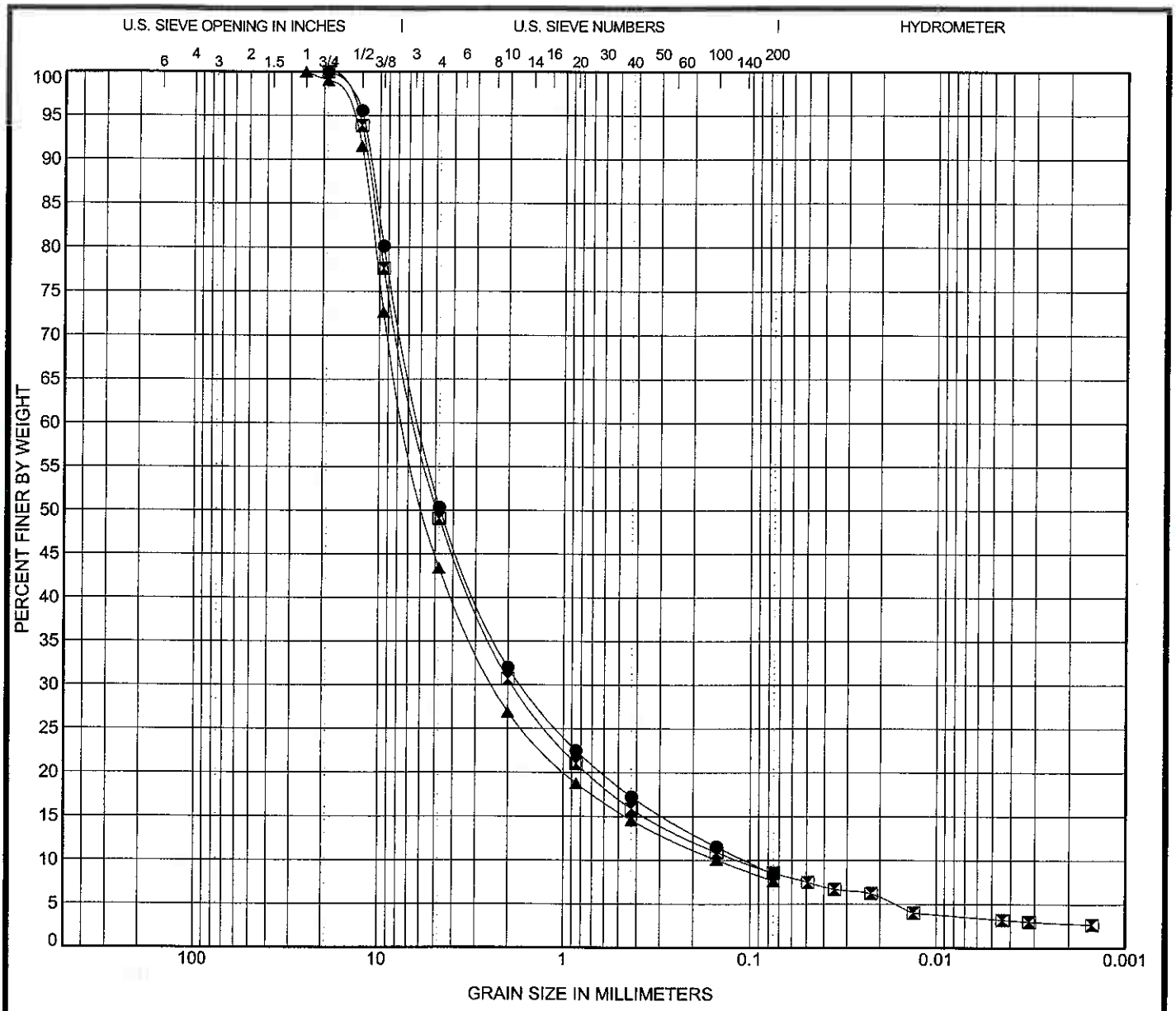
# GRAIN SIZE DISTRIBUTION

Project: **Yerington Mine**

Location: **Yerington, NV**

Project Number: **0155-21-1** Plate: 4c

US_GRAIN_SIZE2_0155211.GPJ US_LAB.GDT 11/3/2009




| COBBLES | GRAVEL | | SAND | | | SILT OR CLAY |
|---|---|---|---|---|---|---|
| | coarse | fine | coarse | medium | fine | |

| | Specimen Identification | | USCS Classification | LL | PL | PI | Cc | Cu |
|---|---|---|---|---|---|---|---|---|
| ● | TP-01 Road | 0.0' | POORLY GRADED GRAVEL with CLAY and SAND (GP-GC) | 28 | 18 | 10 | 4.42 | 55.85 |
| ⊠ | TP-03 Road | 0.0' | POORLY GRADED GRAVEL with SILTY CLAY and SAND (GP-GC) | 25 | 19 | 6 | 5.02 | 54.18 |
| ▲ | TP-05 Road | 0.0' | POORLY GRADED GRAVEL with CLAY and SAND (GP-GC) | 27 | 18 | 9 | 5.33 | 47.63 |

| | Specimen Identification | | D100 | D60 | D30 | D10 | MC % | %Gravel | %Sand | %Silt | %Clay |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ● | TP-01 Road | 0.0' | 19 | 5.947 | 1.673 | 0.106 | 4.8 | 49.7 | 41.9 | 8.4 | |
| ⊠ | TP-03 Road | 0.0' | 19 | 6.199 | 1.887 | 0.114 | 4.0 | 51.0 | 40.5 | 5.3 | 3.3 |
| ▲ | TP-05 Road | 0.0' | 25 | 7.044 | 2.355 | 0.148 | 4.4 | 56.6 | 35.7 | 7.6 | |

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Reno, Nevada 89502-7140
Telephone: (775) 359-6600
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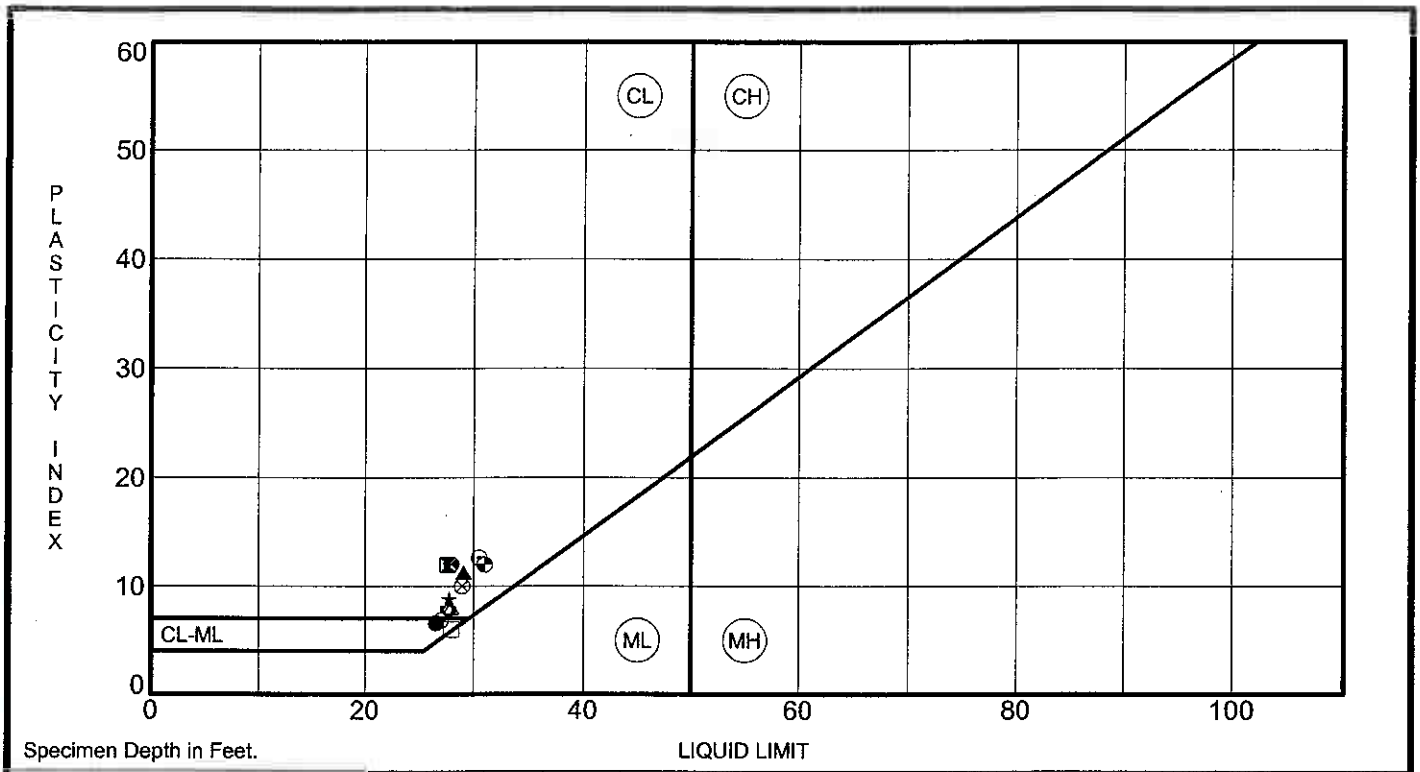
## GRAIN SIZE DISTRIBUTION

Project: **Yerington Mine**

Location: **Yerington, NV**

Project Number: **0155-21-1** Plate: 4d

US_GRAIN_SIZE2_0155211.GPJ US_LAB.GDT 11/8/2009




Specimen Depth in Feet.

| | Specimen Identification | | LL | PL | PI | Fines | USCS Classification |
|---|---|---|---|---|---|---|---|
| ● | TP-01 OX | 0.0' | 27 | 20 | 7 | 9 | POORLY GRADED SAND with SILTY CLAY and GRAVEL (SP-SC |
| ⊠ | TP-01 OX | 5.0' | 28 | 16 | 12 | 8 | POORLY GRADED SAND with CLAY and GRAVEL (SP-SC) |
| ▲ | TP-02 OX | 20.0' | 29 | 18 | 11 | 9 | POORLY GRADED GRAVEL with CLAY and SAND (GP-GC) |
| ★ | TP-03 OX | 0.0' | 28 | 19 | 9 | 11 | POORLY GRADED SAND with CLAY and GRAVEL (SP-SC) |
| ⊙ | TP-03 OX | 10.0' | 31 | 18 | 13 | 10 | POORLY GRADED SAND with CLAY and GRAVEL (SP-SC) |
| ✿ | TP-04 OX | 15.0' | 28 | 20 | 8 | 9 | POORLY GRADED GRAVEL with CLAY and SAND (GP-GC) |
| ○ | TP-05 OX | 0.0' | 27 | 20 | 7 | 12 | POORLY GRADED SAND with SILTY CLAY and GRAVEL (SP-SC |
| △ | TP-06 OX | 0.0' | 28 | 20 | 8 | 14 | CLAYEY SAND with GRAVEL (SC) |
| ⊗ | TP-07 OX | 10.0' | 29 | 19 | 10 | 12 | CLAYEY SAND with GRAVEL (SC) |
| ⊕ | TP-08 OX | 5.0' | 31 | 19 | 12 | 12 | POORLY GRADED SAND with CLAY and GRAVEL (SP-SC) |
| □ | TP-09 OX | 0.0' | 28 | 22 | 6 | 11 | POORLY GRADED GRAVEL with SILTY CLAY and SAND (GP-G |
| ⊕ | TP-10 OX | 15.0' | 28 | 16 | 12 | 10 | POORLY GRADED GRAVEL with CLAY and SAND (GP-GC) |
| ◐ | TP-11 OX | 0.0' | 31 | 19 | 12 | 12 | CLAYEY SAND with GRAVEL (SC) |

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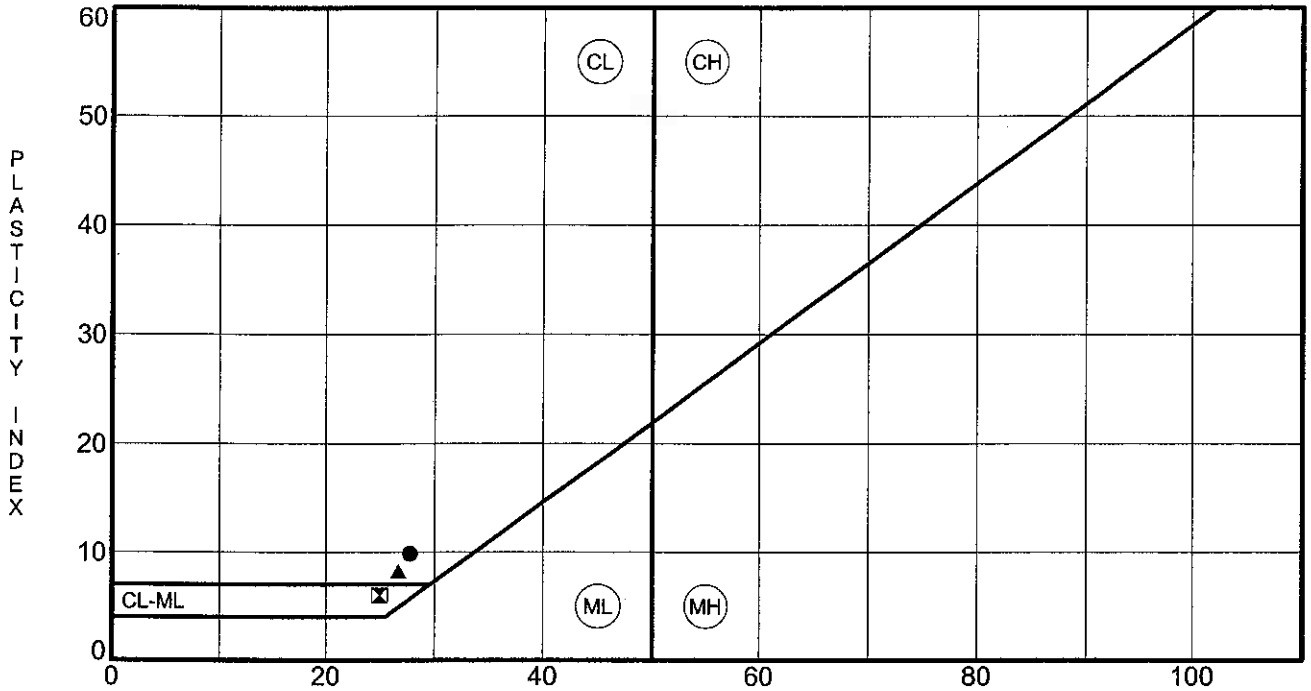
## ATTERBERG LIMITS RESULTS

Project: **Yerington Mine**
Location: **Yerington, NV**
Project Number: **0155-21-1** Plate: 4e

US ATTERBERG LIMITS 0155211.GPJ US LAB.GDT 11/3/2009




Specimen Depth in Feet.

LIQUID LIMIT

| | Specimen Identification | | LL | PL | PI | Fines | USCS Classification |
|---|---|---|---|---|---|---|---|
| ● | **TP-01 Road** | **0.0'** | **28** | **18** | **10** | **8** | **POORLY GRADED GRAVEL with CLAY and SAND (GP-GC)** |
| ⊠ | **TP-03 Road** | **0.0'** | **25** | **19** | **6** | **9** | **POORLY GRADED GRAVEL with SILTY CLAY and SAND (GP-G** |
| ▲ | **TP-05 Road** | **0.0'** | **27** | **18** | **9** | **8** | **POORLY GRADED GRAVEL with CLAY and SAND (GP-GC)** |

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Reno, Nevada 89502-7140
Telephone: (775) 359-6600
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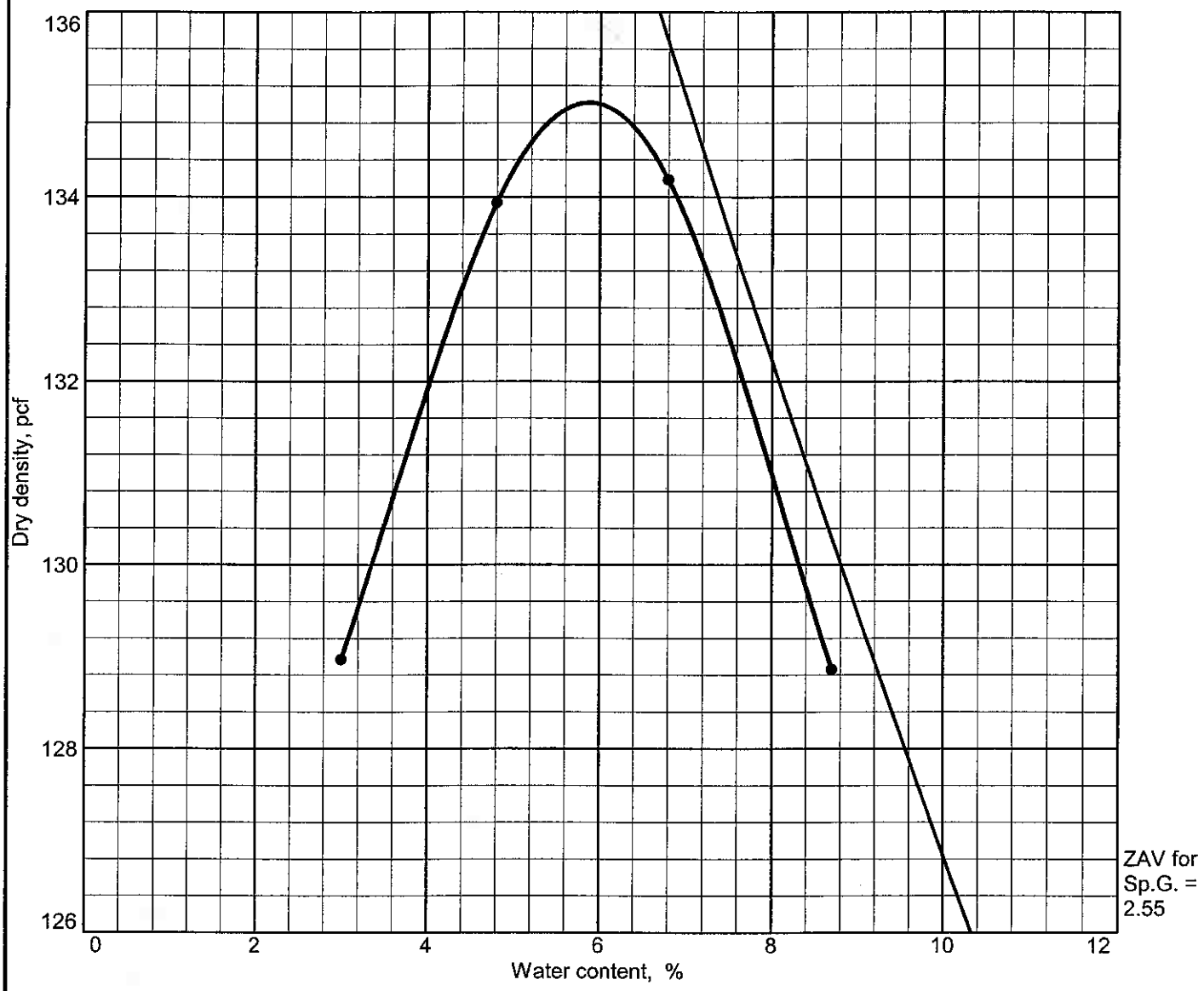
## ATTERBERG LIMITS RESULTS

Project: **Yerington Mine**
Location: **Yerington, NV**
Project Number: **0155-21-1** Plate: 4f

US ATTERBERG LIMITS 0155211.GPJ US LAB.GDT 11/3/2009

# COMPACTION TEST REPORT




Test specification: ASTM D 1557-00 Method C Modified

| Elev/ Depth | Classification | | Nat. Moist. | Sp.G. | LL | PI | % > 3/4 in. | % < No.200 |
|---|---|---|---|---|---|---|---|---|
| | USCS | AASHTO | | | | | | |
| 0.0' - 20.0' | SP - SC | | 4.8 | | 28 | 10 | 0.0 | 8.4 |

| TEST RESULTS | MATERIAL DESCRIPTION |
|---|---|
| Maximum dry density = 135.0 pcf<br>Optimum moisture = 5.9 % | Poorly Graded Sand with Silty Clay and Gravel |

**Project No.** 0155-21-1 **Client:** Brown and Caldwell
**Project:** Yerington Mine

● **Source:** TP-01 OX **Sample No.:** Bulk **Elev./Depth:** 0.0' - 20.0'

**Remarks:**
Laboratory Number 1258

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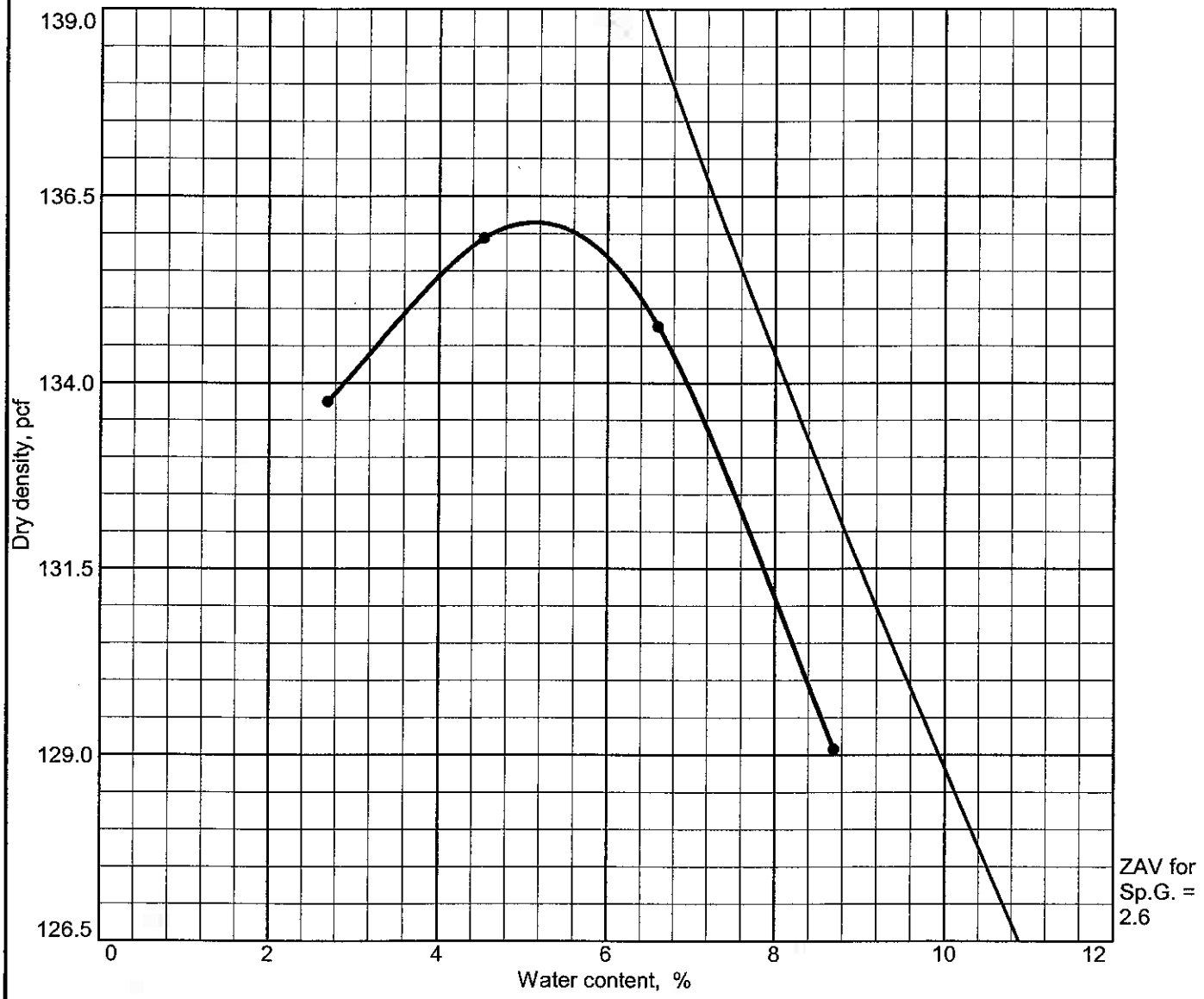
**Reno, Nevada**

Plate 5a

# COMPACTION TEST REPORT




Test specification: ASTM D 1557-00 Method C Modified

| Elev/ Depth | Classification | | Nat. Moist. | Sp.G. | LL | PI | % > 3/4 in. | % < No.200 |
|---|---|---|---|---|---|---|---|---|
| | USCS | AASHTO | | | | | | |
| 0.0' -20.0' | SP - SC | | | | 28 | 9 | 0.0 | 10.9 |

| TEST RESULTS | MATERIAL DESCRIPTION |
|---|---|
| Maximum dry density = 136.2 pcf<br>Optimum moisture = 5.1 % | Poorly Graded Sand with Clay and Gravel |

**Project No.** 0155-21-1 **Client:** Brown and Caldwell
**Project:** Yerington Mine

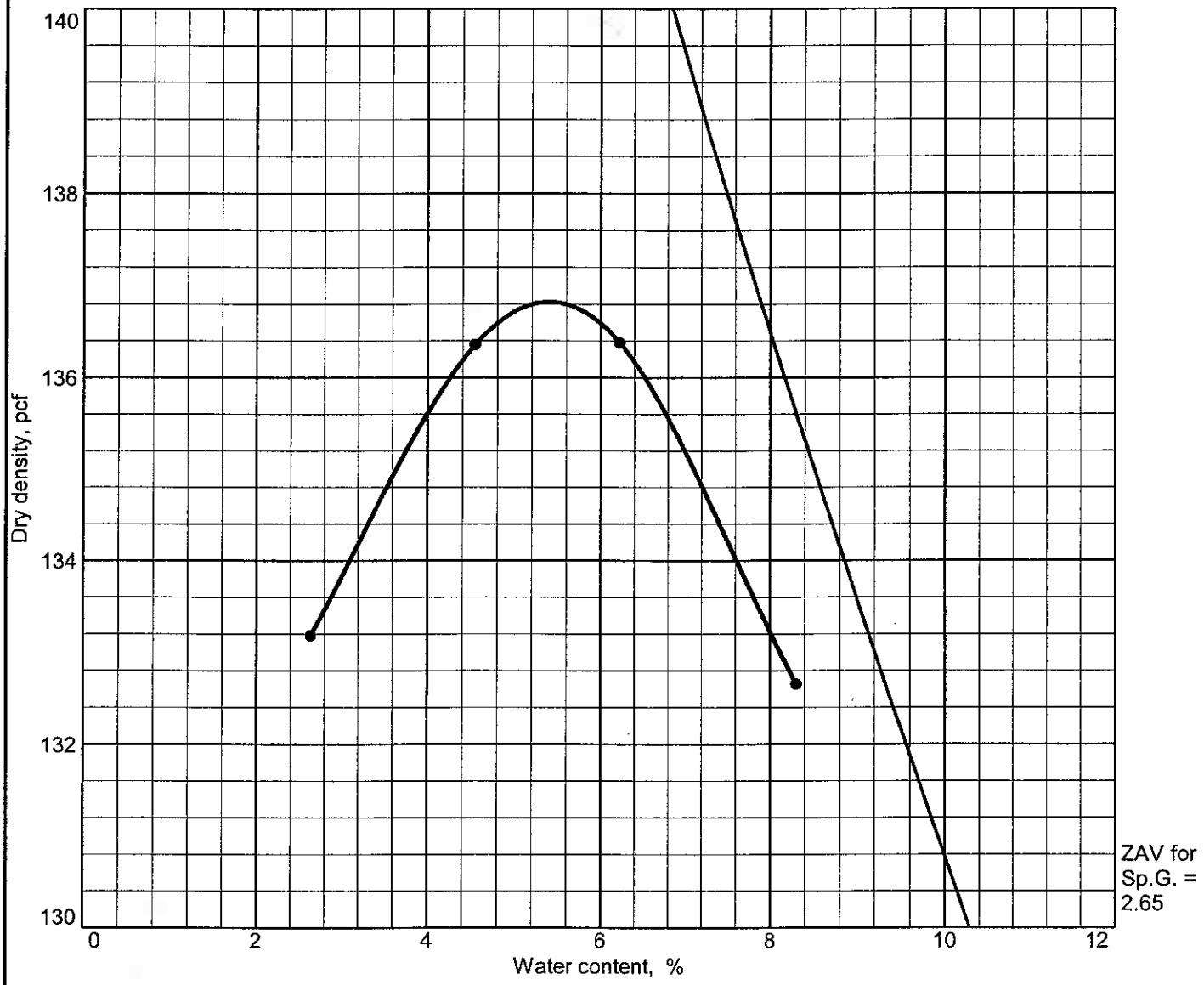
● **Source:** TP-03 OX **Sample No.:** Bulk **Elev./Depth:** 0.0' -20.0'

**Remarks:**
Laboratory Number 1273

**BLACK EAGLE CONSULTING, INC.**
**Reno, Nevada**

Plate 5b

# COMPACTION TEST REPORT




Test specification: ASTM D 1557-00 Method C Modified

| Elev/ Depth | Classification | | Nat. Moist. | Sp.G. | LL | PI | % > 3/4 in. | % < No.200 |
|---|---|---|---|---|---|---|---|---|
| | USCS | AASHTO | | | | | | |
| 0.0 ' - 20.0' | SP - SC | | | | 27 | 7 | 0.0 | 12 |

| TEST RESULTS | MATERIAL DESCRIPTION |
|---|---|
| Maximum dry density = 136.8 pcf<br>Optimum moisture = 5.4 % | Poorly Graded Sand with Silty Clay and Gravel |

**Project No.** 0155-21-1 **Client:** Brown and Caldwell
**Project:** Yerington Mine

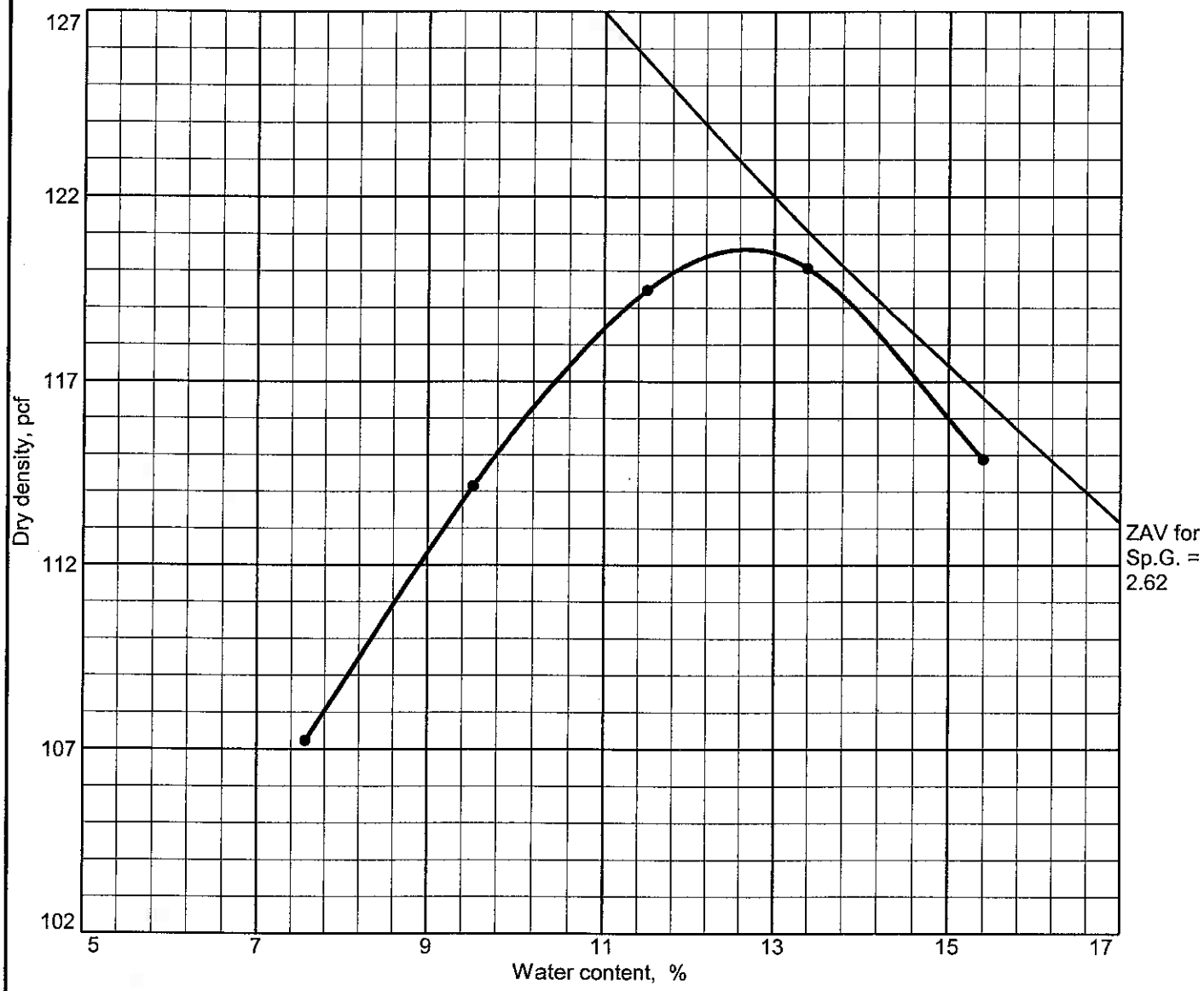
● **Source:** TP-05 OX **Sample No.:** Bulk **Elev./Depth:** 0.0 ' - 20.0'

**Remarks:**
Laboratory Number 1273

**BLACK EAGLE CONSULTING, INC.**
**Reno, Nevada**

Plate 5c

# COMPACTION TEST REPORT




Test specification: ASTM D 698-00a Method C Standard

| Elev/ Depth | Classification | | Nat. Moist. | Sp.G. | LL | PI | % > 3/4 in. | % < No.200 |
|---|---|---|---|---|---|---|---|---|
| | USCS | AASHTO | | | | | | |
| | SC | | 4.2 | | 28 | 20 | 0.0 | 14.4 |

| TEST RESULTS | MATERIAL DESCRIPTION |
|---|---|
| Maximum dry density = 120.6 pcf<br>Optimum moisture = 12.7 % | Clayey Sand with Gravel |

**Project No.** 0155-21-1 **Client:** Brown and Caldwell
**Project:** Yerington Mine

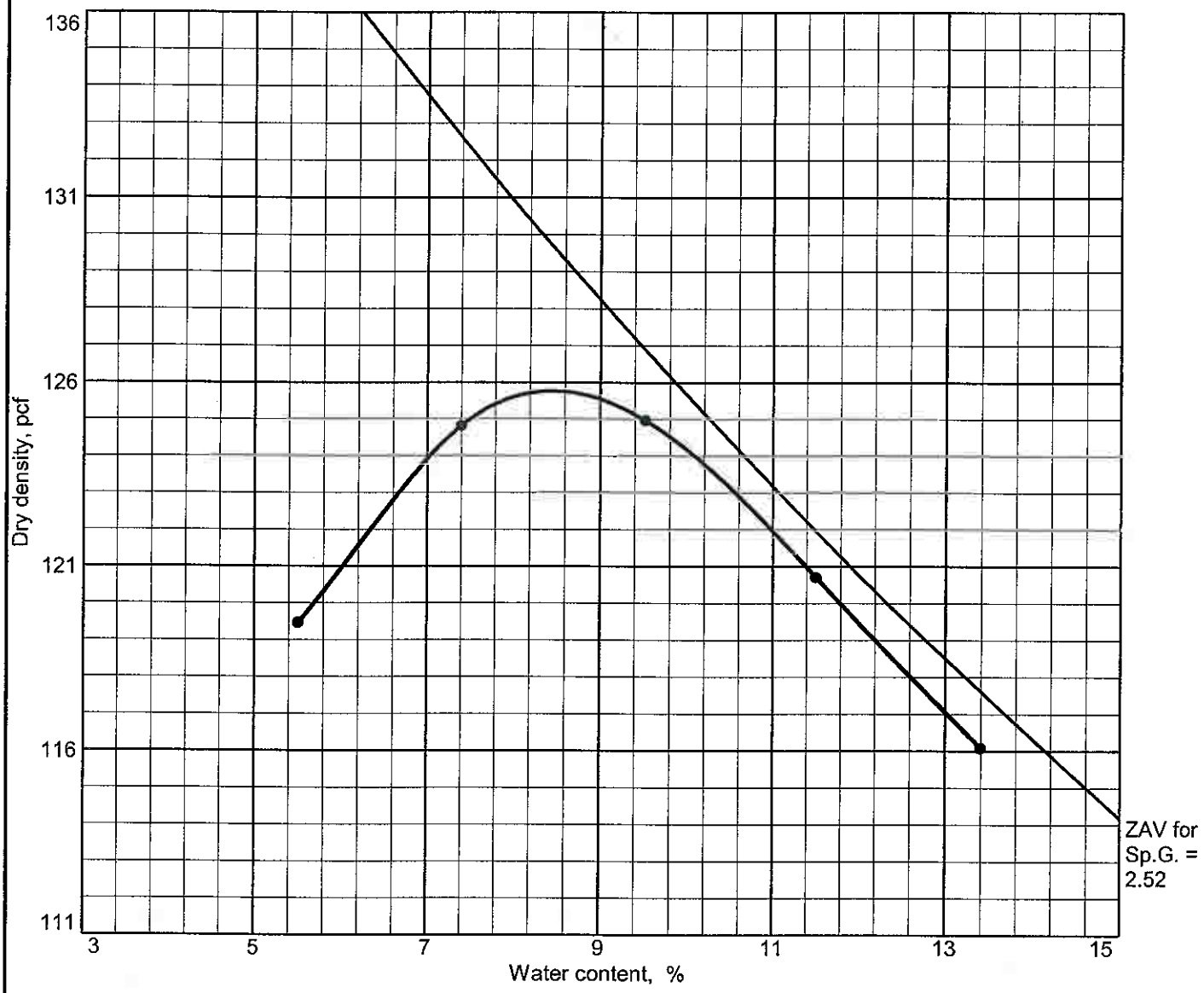
● **Source:** TP-06 OX

**Remarks:**
Laboratory Number 1449

**BLACK EAGLE CONSULTING, INC.**
**Reno, Nevada**

Plate 5d

# COMPACTION TEST REPORT




Test specification: ASTM D 698-00a Method C Standard

| Elev/ Depth | Classification | | Nat. Moist. | Sp.G. | LL | PI | % > 3/4 in. | % < No.200 |
|---|---|---|---|---|---|---|---|---|
| | USCS | AASHTO | | | | | | |
| 0.0' - 20.0' | GP - GC | | | | 28 | 6 | 0.0 | 11.1 |

| TEST RESULTS | MATERIAL DESCRIPTION |
|---|---|
| Maximum dry density = 125.8 pcf<br>Optimum moisture = 8.5 % | Poorly Graded Gravel with Silty Clay and Sand |

**Project No.** 0155-21-1 **Client:** Brown and Caldwell
**Project:** Yerington Mine

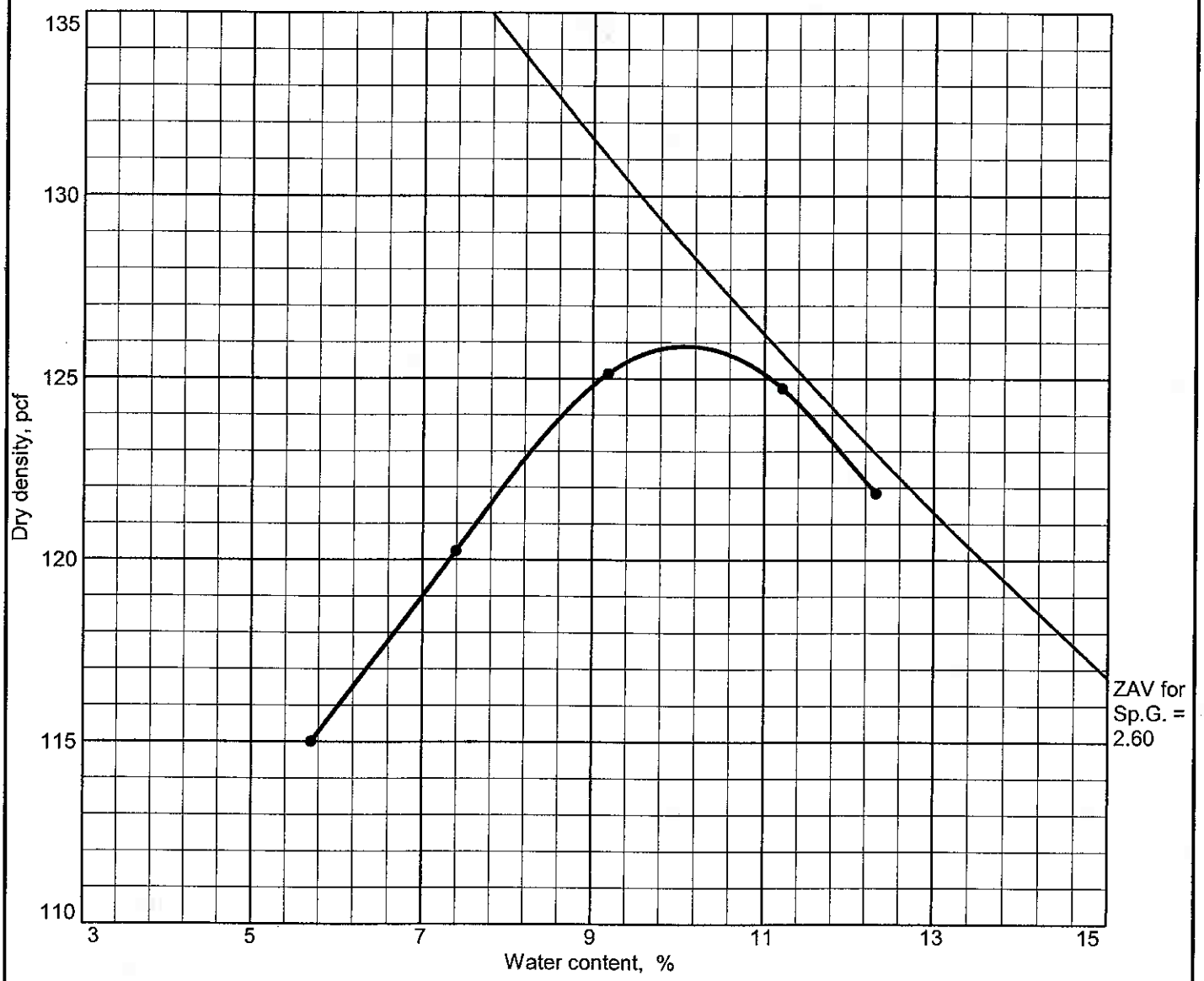
● **Source:** TP-09 OX **Sample No.:** Bulk **Elev./Depth:** 0.0' - 20.0'

**Remarks:**
Laboratory Number 1449

**BLACK EAGLE CONSULTING, INC.**
**Reno, Nevada**

Plate 5e

# COMPACTION TEST REPORT




Test specification: ASTM D 698-00a Method C Standard

| Elev/ Depth | Classification | | Nat. Moist. | Sp.G. | LL | PI | % > 3/4 in. | % < No.200 |
|---|---|---|---|---|---|---|---|---|
| | USCS | AASHTO | | | | | | |
| 0.0' - 20.0' | SC | | 6.0 | | 31 | 12 | 0.0 | 12.2 |

| TEST RESULTS | MATERIAL DESCRIPTION |
|---|---|
| Maximum dry density = 125.9 pcf<br>Optimum moisture = 10.1 % | Clayey Sand with Gravel |

**Project No.** 0155-21-1 **Client:** Brown and Caldwell
**Project:** Yerington Mine

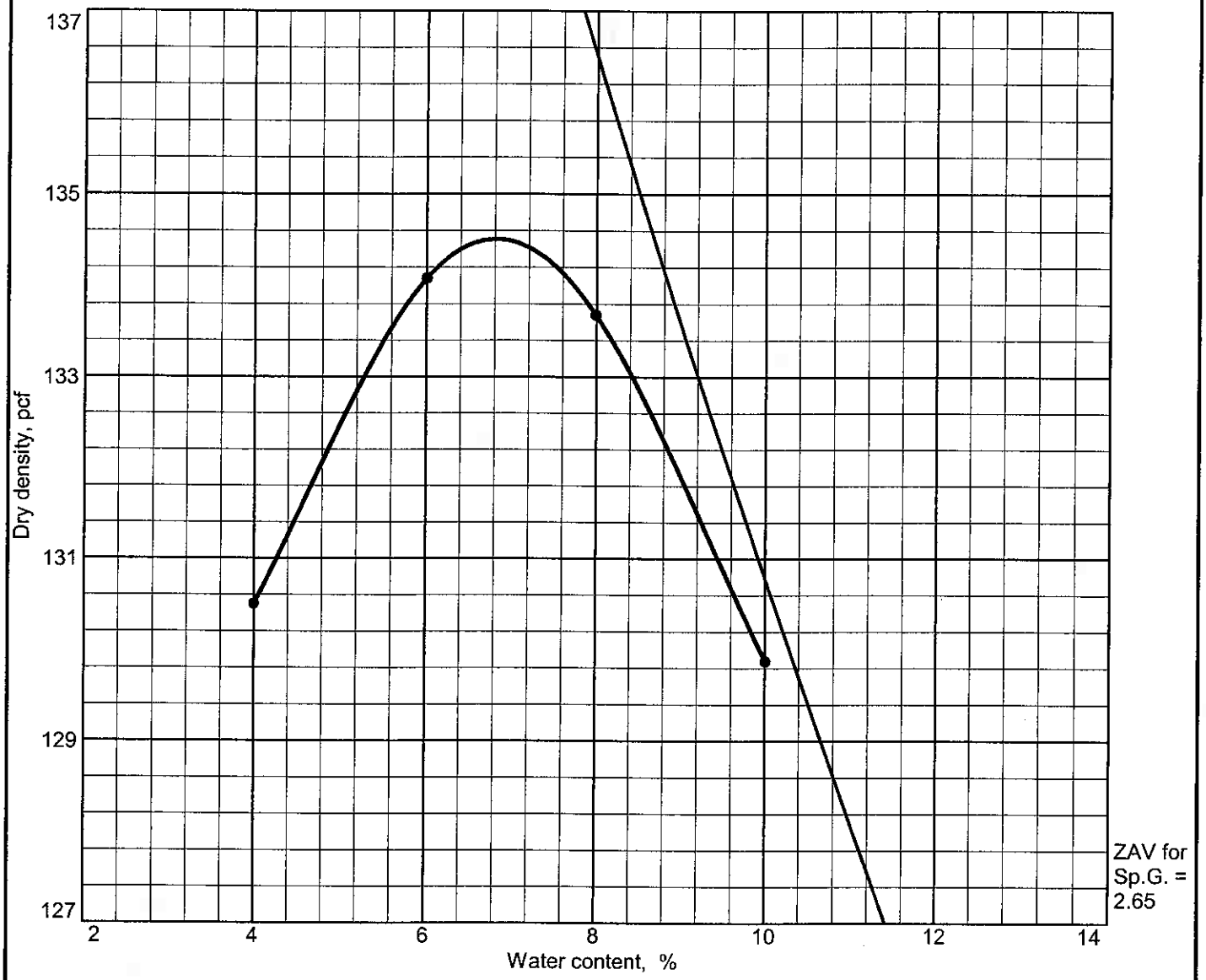
● **Source:** TP-11 OX **Sample No.:** Bulk **Elev./Depth:** 0.0' - 20.0'

**Remarks:**
Laboratory Number 1449

**BLACK EAGLE CONSULTING, INC.**
**Reno, Nevada**

Plate 5f

# COMPACTION TEST REPORT




Test specification: ASTM D 1557-00 Method C Modified

| Elev/ Depth | Classification | | Nat. Moist. | Sp.G. | LL | PI | % > 3/4 in. | % < No.200 |
|---|---|---|---|---|---|---|---|---|
| | USCS | AASHTO | | | | | | |
| 0.0' - 8.0' | GP - GC | | 4.0 | | 25 | 6 | 0.0 | 8.6 |

| TEST RESULTS | MATERIAL DESCRIPTION |
|---|---|
| Maximum dry density = 134.5 pcf<br>Optimum moisture = 6.8 % | Poorly Graded Gravel with Silty Clay and Sand |

**Project No.** 0155-21-1 **Client:** Brown and Caldwell
**Project:** Yerington Mine

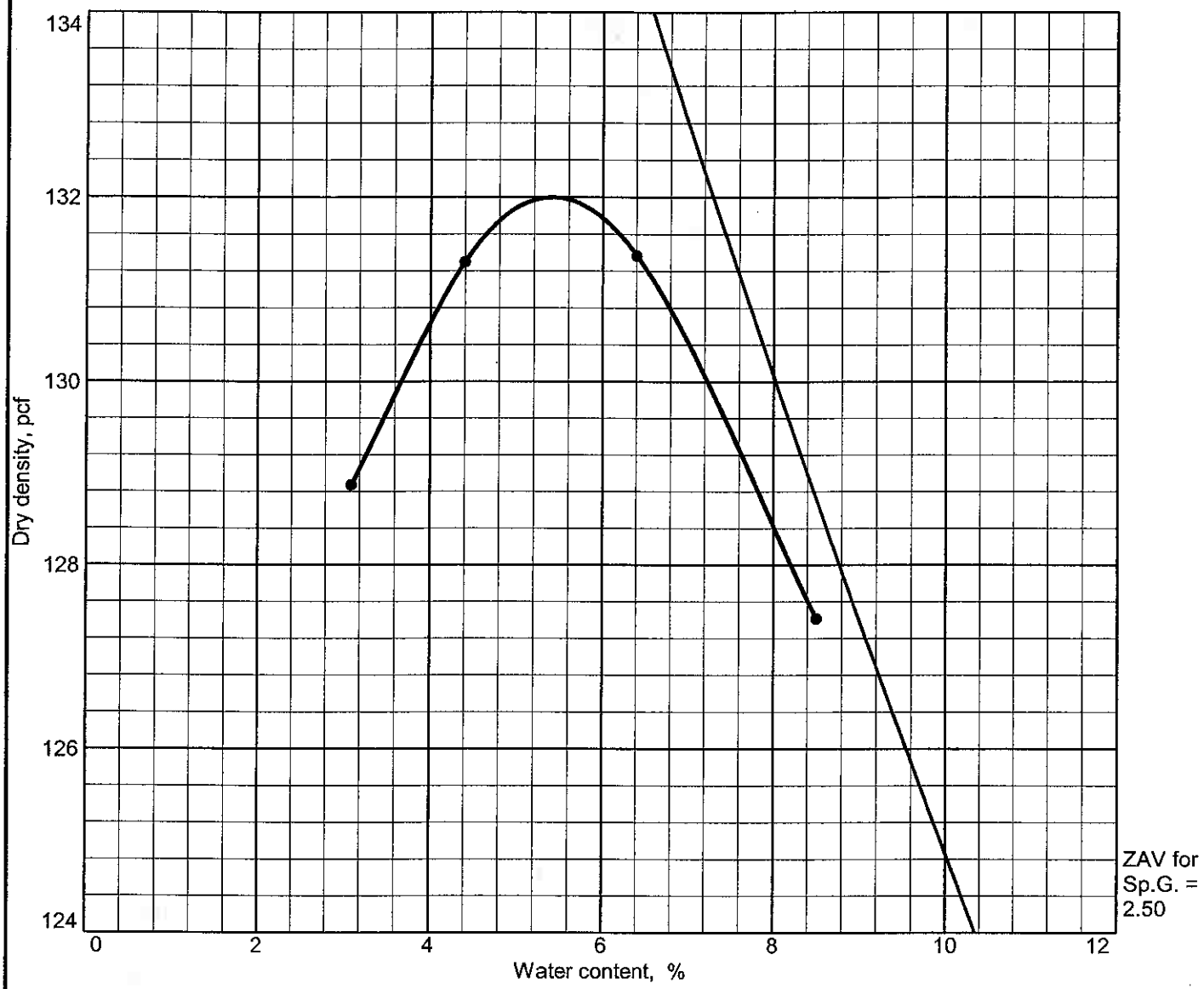
● **Source:** TP-03 Road **Sample No.:** Bulk **Elev./Depth:** 0.0' - 8.0'

**Remarks:**
Laboratory Number 1258

**BLACK EAGLE CONSULTING, INC.**
**Reno, Nevada**

Plate 5g

# COMPACTION TEST REPORT




Test specification: ASTM D 1557-00 Method C Modified

| Elev/ Depth | Classification | | Nat. Moist. | Sp.G. | LL | PI | % > 3/4 in. | % < No.200 |
|---|---|---|---|---|---|---|---|---|
| | USCS | AASHTO | | | | | | |
| 0.0' - 8.0' | GP - GC | | 4.4 | | 27 | 9 | 0.1 | 7.6 |

| TEST RESULTS | MATERIAL DESCRIPTION |
|---|---|
| Maximum dry density = 132.0 pcf<br>Optimum moisture = 5.4 % | Poorly Graded Gravel with Clay and Sand |

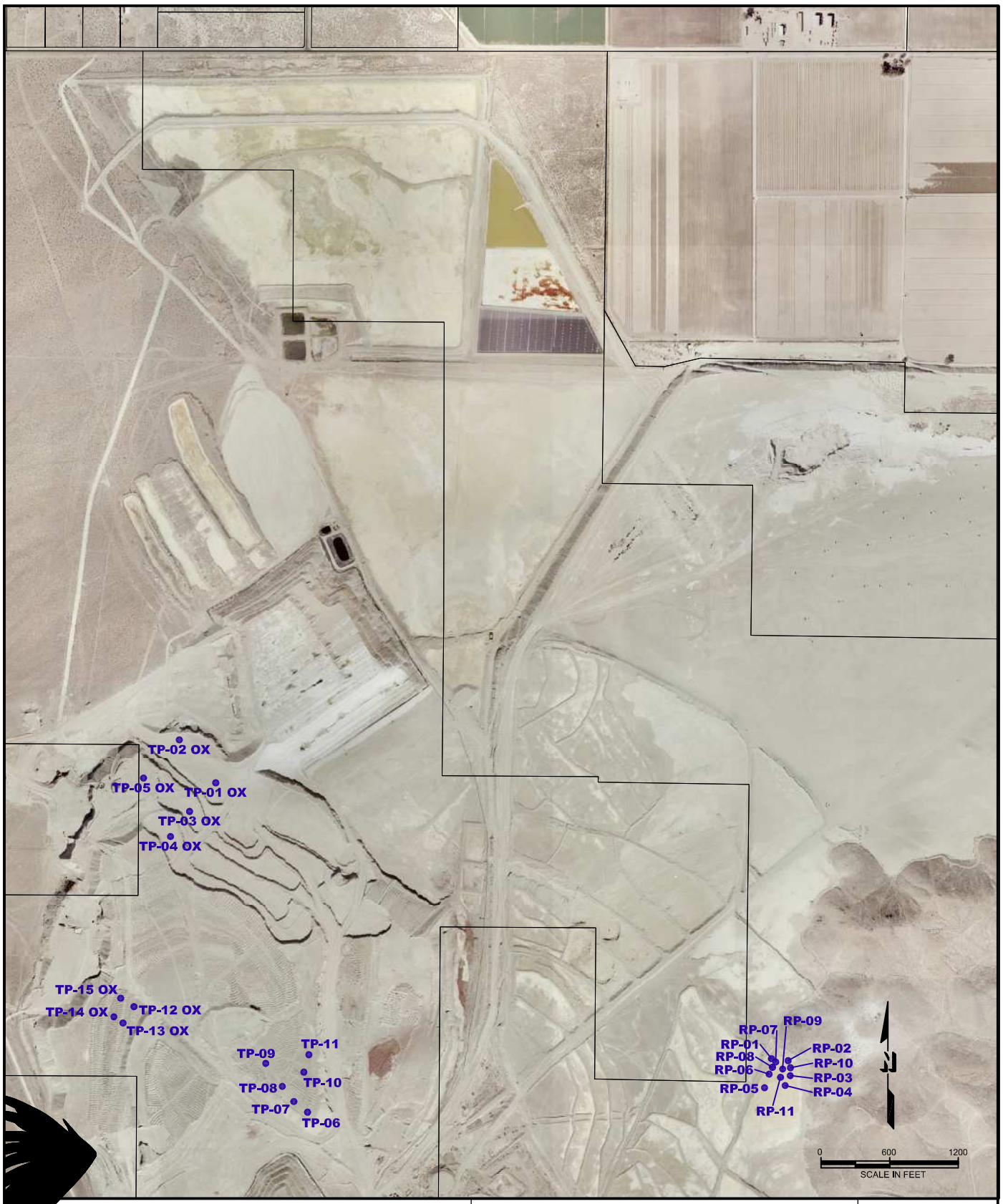
**Project No.** 0155-21-1 **Client:** Brown and Caldwell
**Project:** Yerington Mine

● **Source:** TP-05 Road **Sample No.:** Bulk **Elev./Depth:** 0.0' - 8.0'

**Remarks:**
Laboratory Number 1258

**BLACK EAGLE CONSULTING, INC.**
**Reno, Nevada**

Plate 5h




Black Eagle Consulting, Inc.
Geotechnical & Construction Services
1345 Capital Boulevard, Suite A
Reno, Nevada 89502-7140
Telephone: 775/359-6600
Facsimile: 775/359-7766

Brown & Caldwell

# Sample Locations

Yerington Mine

Yerington, Nevada

Project No.
0155-21-1

Plate 1

# Laboratory Report for

# Brown and Caldwell

## 136742.002 Preliminary Engineering for

## Evaporation Pond Removal

**July 7, 2009**

*Daniel B. Stephens & Associates, Inc.*

6020 Academy NE, Suite 100 • Albuquerque, New Mexico 87109

July 7, 2009

Mr. Richard Mattucci
Brown and Caldwell
3264 Goni Road Suite 153
Carson City, NV 89706-7969
(775) 883 4118

Re: DBS&A Laboratory Report for Brown and Caldwell 136742.002 Preliminary Engineering for Evaporation Pond Removal

Dear Mr. Mattucci:

Enclosed is the final report for the Brown and Caldwell 136742.002 Preliminary Engineering for Evaporation Pond Removal 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 final 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 final 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 Brown and Caldwell 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

Ryan Marshall
Assistant Laboratory Manager
Enclosure

***Daniel B. Stephens & Associates, Inc.***
***Soil Testing & Research Laboratory***
5840 Osuna Rd. NE
Albuquerque, NM 87109
505-889-7752
FAX 505-889-0258

# 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 | | | |
| TP-01 | | X | | X | | | X | X | | X | X | | | X | | | | | | | | |
| TP-02 | | X | | X | | | X | X | | X | X | | | X | | | | | | | | |
| TP-03 | | X | | X | | | X | X | | X | X | | | X | | | | | | | | |
| TP-04 | | X | | X | | | X | X | | X | X | | | X | | | | | | | | |
| TP-05 | | 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)

## Summary of Sample Preparation

| | Target Remold Values[1] | | | Actual Remold Data | | | |
|---|---|---|---|---|---|---|---|
| Sample Number | Moisture Content (%, g/g) | Dry Bulk Density ($g/cm^3$) | Dry Bulk Density (pcf) | Moisture Content (%, g/g) | Dry Bulk Density ($g/cm^3$) | Dry Bulk Density (pcf) | % of Target Density (%) |
| TP-01 | 5.2 | 1.80 | 112.1 | 6.1 | 1.78 | 111.1 | 99.2% |
| TP-02 | 6.3 | 1.70 | 106.4 | 7.2 | 1.70 | 106.1 | 99.8% |
| TP-03 | 6.0 | 1.71 | 106.9 | 7.1 | 1.70 | 106.1 | 99.3% |
| TP-04 | 5.0 | 1.85 | 115.6 | 5.5 | 1.85 | 115.5 | 99.9% |
| TP-05 | 5.1 | 1.84 | 114.6 | 6.9 | 1.83 | 114.2 | 99.7% |

[1]Target remold values provided by the client.

## Summary of Sample Volume Changes

| | Initial Remold Data | | | Volume Change Post Saturation[1] | | | | Volume Change Post Drying Curve[2] | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample Number | Moisture Content (%, g/g) | Dry Bulk Density ($g/cm^3$) | Dry Bulk Density (pcf) | Dry Bulk Density ($g/cm^3$) | Dry Bulk Density (pcf) | % Volume Change (%) | % of Initial Density (%) | Dry Bulk Density ($g/cm^3$) | Dry Bulk Density (pcf) | % Volume Change (%) | % of Initial Density (%) |
| TP-01 | 6.1 | 1.78 | 111.1 | 1.84 | 114.9 | (-) 2.9% | 103.4% | 1.88 | 117.4 | (-) 5.0% | 105.6% |
| TP-02 | 7.2 | 1.70 | 106.1 | 1.79 | 111.7 | (-) 5.3% | 105.3% | 1.88 | 117.4 | (-) 9.7% | 110.6% |
| TP-03 | 7.1 | 1.70 | 106.1 | 1.75 | 109.2 | (-) 2.9% | 102.9% | 1.82 | 113.6 | (-) 6.7% | 107.1% |
| TP-04 | 5.5 | 1.85 | 115.5 | 1.85 | 115.5 | --- | 100.0% | 1.85 | 115.5 | --- | 100.0% |
| TP-05 | 6.9 | 1.83 | 114.2 | 1.83 | 114.2 | --- | 100.0% | 1.83 | 114.2 | --- | 100.0% |

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

[2]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: As Received, Gravimetric (%, g/g) | Moisture Content: As Received, Volumetric (%, $cm^3/cm^3$) | Moisture Content: Remolded, Gravimetric (%, g/g) | Moisture Content: Remolded, Volumetric (%, $cm^3/cm^3$) | Dry Bulk Density ($g/cm^3$) | Wet Bulk Density ($g/cm^3$) | Calculated Porosity (%) |
|---|---|---|---|---|---|---|---|
| TP-01 | 5.5 | NA | 6.1 | 10.9 | 1.78 | 1.89 | 31.0 |
| TP-02 | 6.8 | NA | 7.2 | 12.3 | 1.70 | 1.82 | 36.4 |
| TP-03 | 6.5 | NA | 7.1 | 12.1 | 1.70 | 1.82 | 35.4 |
| TP-04 | 5.4 | NA | 5.5 | 10.3 | 1.85 | 1.95 | 29.8 |
| TP-05 | 6.7 | NA | 6.9 | 12.6 | 1.83 | 1.96 | 30.7 |

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 |
| TP-01 | 6.4E-04 | NA | X | |
| TP-02 | 2.8E-04 | NA | X | |
| TP-03 | 1.7E-03 | NA | X | |
| TP-04 | 2.1E-04 | NA | X | |
| TP-05 | 3.5E-04 | NA | X | |

## Summary of Moisture Characteristics of the Initial Drainage Curve

| Sample Number | Pressure Head (-cm water) | Moisture Content (%, $cm^3/cm^3$) |
|---|---|---|
| TP-01 | 0 | 32.1 ‡‡ |
| | 8 | 28.5 ‡‡ |
| | 24 | 23.0 ‡‡ |
| | 104 | 16.0 ‡‡ |
| | 337 | 10.2 ‡‡ |
| | 209059 | 6.1 ‡‡ |
| | 854159 | 3.9 ‡‡ |
| TP-02 | 0 | 32.4 ‡‡ |
| | 8 | 29.1 ‡‡ |
| | 28 | 22.5 ‡‡ |
| | 101 | 17.5 ‡‡ |
| | 337 | 12.0 ‡‡ |
| | 118297 | 6.4 ‡‡ |
| | 854159 | 3.7 ‡‡ |
| TP-03 | 0 | 32.2 ‡‡ |
| | 6 | 28.6 ‡‡ |
| | 18 | 25.7 ‡‡ |
| | 73 | 19.2 ‡‡ |
| | 337 | 11.9 ‡‡ |
| | 129515 | 6.6 ‡‡ |
| | 854159 | 4.1 ‡‡ |
| TP-04 | 0 | 29.2 |
| | 7 | 25.3 |
| | 23 | 20.0 |
| | 99 | 14.4 |
| | 337 | 9.2 |
| | 240673 | 5.2 |
| | 854159 | 3.7 |

‡‡ 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 (%, $cm^3/cm^3$) |
|---|---|---|
| TP-05 | 0 | 31.5 |
| | 9 | 28.5 |
| | 26 | 24.1 |
| | 102 | 17.7 |
| | 337 | 12.1 |
| | 214158 | 6.7 |
| | 854159 | 4.7 |

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

## Summary of Calculated Unsaturated Hydraulic Properties

| Sample Number | $\alpha$ ($cm^{-1}$) | N (dimensionless) | $\theta_r$ (% vol) | $\theta_s$ (% vol) | Oversize Corrected $\theta_r$ (% vol) | Oversize Corrected $\theta_s$ (% vol) |
|---|---|---|---|---|---|---|
| TP-01 | 0.0800 | 1.4409 | 4.59 | 31.96 | NA | NA |
| TP-02 | 0.1000 | 1.3411 | 4.06 | 32.47 | NA | NA |
| TP-03 | 0.0849 | 1.3509 | 4.40 | 31.74 | NA | NA |
| TP-04 | 0.1158 | 1.3891 | 3.98 | 29.11 | NA | NA |
| TP-05 | 0.0638 | 1.4061 | 5.22 | 31.35 | NA | NA |

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

NA = Not analyzed

# Laboratory Data and Graphical Plots

# Initial Properties

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

| Sample Number | Moisture Content: As Received, Gravimetric (%, g/g) | Moisture Content: As Received, Volumetric (%, $cm^3/cm^3$) | Moisture Content: Remolded, Gravimetric (%, g/g) | Moisture Content: Remolded, Volumetric (%, $cm^3/cm^3$) | Dry Bulk Density ($g/cm^3$) | Wet Bulk Density ($g/cm^3$) | Calculated Porosity (%) |
|---|---|---|---|---|---|---|---|
| TP-01 | 5.5 | NA | 6.1 | 10.9 | 1.78 | 1.89 | 31.0 |
| TP-02 | 6.8 | NA | 7.2 | 12.3 | 1.70 | 1.82 | 36.4 |
| TP-03 | 6.5 | NA | 7.1 | 12.1 | 1.70 | 1.82 | 35.4 |
| TP-04 | 5.4 | NA | 5.5 | 10.3 | 1.85 | 1.95 | 29.8 |
| TP-05 | 6.7 | NA | 6.9 | 12.6 | 1.83 | 1.96 | 30.7 |

NA = Not analyzed

--- = This sample was not remolded

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

*Job Name:* Brown and Caldwell
*Job Number:* LB09.0104.00
*Sample Number:* TP-01
*Test Locaton Unlined Pond:* Lower Bench
*Location:* NA

| | As Received | Remolded |
|---|---|---|
| *Test Date:* | 12-May-09 | 14-May-09 |
| *Field weight* of sample* (g): | 1141.30 | 557.51 |
| *Tare weight, ring* (g): | 0.00 | 133.38 |
| *Tare weight, pan/plate* (g): | 269.50 | 0.00 |
| *Tare weight, other* (g): | 0.00 | 0.00 |
| *Dry weight of sample* (g): | 826.60 | 399.75 |
| *Sample volume* ($cm^3$): | NA | 224.07 |
| *Client Provided particle density* ($g/cm^3$): | 2.59 | 2.59 |
| *Gravimetric Moisture Content* (% g/g): | 5.5 | 6.1 |
| *Volumetric Moisture Content* (% vol): | NA | 10.9 |
| *Dry bulk density* ($g/cm^3$): | NA | 1.78 |
| *Wet bulk density* ($g/cm^3$): | NA | 1.89 |
| *Calculated Porosity* (% vol): | NA | 31.0 |
| *Percent Saturation:* | NA | 35.1 |
| *Laboratory analysis by:* | K. Wright | K. Wright |
| *Data entered by:* | R. Marshall | R. Marshall |
| *Checked by:* | J. Hines | 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:* Brown and Caldwell
*Job Number:* LB09.0104.00
*Sample Number:* TP-02
*Test Locaton Unlined Pond:* Lower Bench
*Location:* NA

| | As Received | Remolded |
|---|---|---|
| *Test Date:* | 12-May-09 | 14-May-09 |
| *Field weight* of sample* (g): | 959.40 | 540.17 |
| *Tare weight, ring* (g): | 0.00 | 133.12 |
| *Tare weight, pan/plate* (g): | 292.32 | 0.00 |
| *Tare weight, other* (g): | 0.00 | 0.00 |
| *Dry weight of sample* (g): | 624.68 | 379.60 |
| *Sample volume* ($cm^3$): | NA | 223.71 |
| *Client Provided particle density* ($g/cm^3$): | 2.67 | 2.67 |
| *Gravimetric Moisture Content* (% g/g): | 6.8 | 7.2 |
| *Volumetric Moisture Content* (% vol): | NA | 12.3 |
| *Dry bulk density* ($g/cm^3$): | NA | 1.70 |
| *Wet bulk density* ($g/cm^3$): | NA | 1.82 |
| *Calculated Porosity* (% vol): | NA | 36.4 |
| *Percent Saturation:* | NA | 33.7 |
| *Laboratory analysis by:* | K. Wright | K. Wright |
| *Data entered by:* | R. Marshall | R. Marshall |
| *Checked by:* | J. Hines | 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:* Brown and Caldwell
*Job Number:* LB09.0104.00
*Sample Number:* TP-03
*Test Locaton Unlined Pond:* Middle Bench
*Location:* NA

| | As Received | Remolded |
|---|---|---|
| *Test Date:* | 12-May-09 | 14-May-09 |
| *Field weight* of sample* (g): | 739.61 | 522.50 |
| *Tare weight, ring* (g): | 0.00 | 101.41 |
| *Tare weight, pan/plate* (g): | 266.46 | 0.00 |
| *Tare weight, other* (g): | 0.00 | 0.00 |
| *Dry weight of sample* (g): | 444.30 | 393.15 |
| *Sample volume* ($cm^3$): | NA | 230.99 |
| *Client Provided particle density* ($g/cm^3$): | 2.64 | 2.64 |
| *Gravimetric Moisture Content* (% g/g): | 6.5 | 7.1 |
| *Volumetric Moisture Content* (% vol): | NA | 12.1 |
| *Dry bulk density* ($g/cm^3$): | NA | 1.70 |
| *Wet bulk density* ($g/cm^3$): | NA | 1.82 |
| *Calculated Porosity* (% vol): | NA | 35.4 |
| *Percent Saturation:* | NA | 34.1 |
| *Laboratory analysis by:* | K. Wright | K. Wright |
| *Data entered by:* | R. Marshall | R. Marshall |
| *Checked by:* | J. Hines | 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:* Brown and Caldwell
*Job Number:* LB09.0104.00
*Sample Number:* TP-04
*Test Locaton Unlined Pond:* Upper Bench
*Location:* NA

| | As Received | Remolded |
|---|---|---|
| *Test Date:* | 12-May-09 | 14-May-09 |
| *Field weight* of sample* (g): | 796.93 | 569.66 |
| *Tare weight, ring* (g): | 0.00 | 133.07 |
| *Tare weight, pan/plate* (g): | 283.86 | 0.00 |
| *Tare weight, other* (g): | 0.00 | 0.00 |
| *Dry weight of sample* (g): | 486.99 | 413.64 |
| *Sample volume* ($cm^3$): | NA | 223.73 |
| *Client Provided particle density* ($g/cm^3$): | 2.63 | 2.63 |
| *Gravimetric Moisture Content* (% g/g): | 5.4 | 5.5 |
| *Volumetric Moisture Content* (% vol): | NA | 10.3 |
| *Dry bulk density* ($g/cm^3$): | NA | 1.85 |
| *Wet bulk density* ($g/cm^3$): | NA | 1.95 |
| *Calculated Porosity* (% vol): | NA | 29.8 |
| *Percent Saturation:* | NA | 34.4 |
| *Laboratory analysis by:* | K. Wright | K. Wright |
| *Data entered by:* | R. Marshall | R. Marshall |
| *Checked by:* | J. Hines | 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:* Brown and Caldwell
*Job Number:* LB09.0104.00
*Sample Number:* TP-05
*Test Locaton Unlined Pond:* Upper Bench
*Location:* NA

| | As Received | Remolded |
|---|---|---|
| *Test Date:* | 12-May-09 | 14-May-09 |
| *Field weight* of sample* (g): | 791.36 | 569.23 |
| *Tare weight, ring* (g): | 0.00 | 132.56 |
| *Tare weight, pan/plate* (g): | 300.27 | 0.00 |
| *Tare weight, other* (g): | 0.00 | 0.00 |
| *Dry weight of sample* (g): | 460.20 | 408.58 |
| *Sample volume* ($cm^3$): | NA | 223.08 |
| *Client Provided particle density* ($g/cm^3$): | 2.64 | 2.64 |
| *Gravimetric Moisture Content* (% g/g): | 6.7 | 6.9 |
| *Volumetric Moisture Content* (% vol): | NA | 12.6 |
| *Dry bulk density* ($g/cm^3$): | NA | 1.83 |
| *Wet bulk density* ($g/cm^3$): | NA | 1.96 |
| *Calculated Porosity* (% vol): | NA | 30.7 |
| *Percent Saturation:* | NA | 41.0 |
| *Laboratory analysis by:* | K. Wright | K. Wright |
| *Data entered by:* | R. Marshall | R. Marshall |
| *Checked by:* | J. Hines | 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 |
| TP-01 | 6.4E-04 | NA | X | |
| TP-02 | 2.8E-04 | NA | X | |
| TP-03 | 1.7E-03 | NA | X | |
| TP-04 | 2.1E-04 | NA | X | |
| TP-05 | 3.5E-04 | NA | X | |

# Saturated Hydraulic Conductivity
## Constant Head Method

| | | | |
|---|---|---|---|
| *Job name:* | Brown and Caldwell | *Type of water used:* | TAP |
| *Job number:* | LB09.0104.00 | *Collection vessel tare* (g)*:* | 9.18 |
| *Sample number:* | TP-01 | *Sample length* (cm)*:* | 7.59 |
| *Test Locaton Unlined Pond:* | Lower Bench | *Sample diameter* (cm)*:* | 6.13 |
| *Location:* | NA | *Sample x-sectional area* ($cm^2$)*:* | 29.54 |

| 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: | | | | | | | | |
| 19-May-09 | 11:31:35 | 21.5 | 3.5 | 14.67 | 5.5 | 595 | 6.8E-04 | 6.5E-04 |
| 19-May-09 | 11:41:30 | | | | | | | |
| Test # 2: | | | | | | | | |
| 19-May-09 | 12:36:13 | 22.0 | 3.2 | 13.93 | 4.8 | 583 | 6.5E-04 | 6.2E-04 |
| 19-May-09 | 12:45:56 | | | | | | | |
| Test # 3: | | | | | | | | |
| 19-May-09 | 13:18:44 | 22.5 | 3 | 13.42 | 4.2 | 525 | 6.9E-04 | 6.5E-04 |
| 19-May-09 | 13:27:29 | | | | | | | |

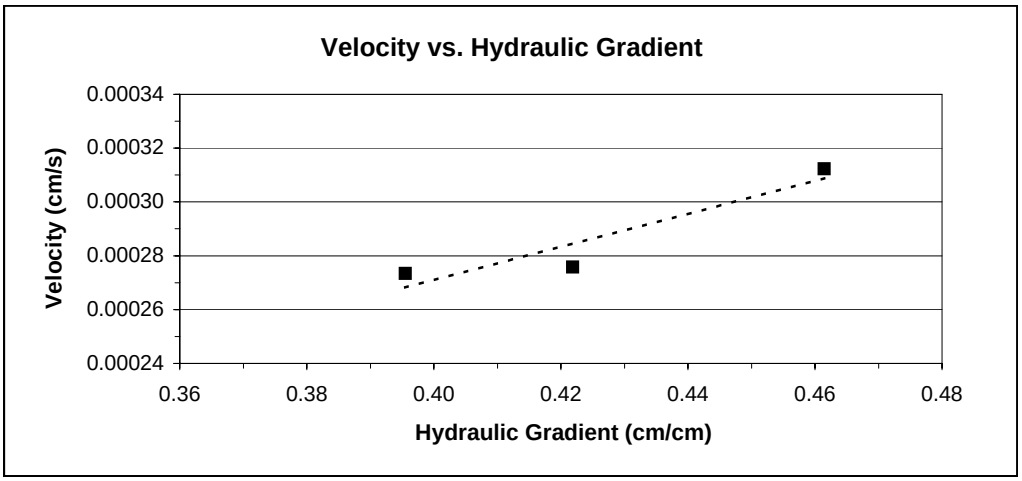
***Average Ksat* (cm/sec)*:*** **6.4E-04**

***Oversize Corrected Ksat* (cm/sec)*:*** **NA**

*Comments:*

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

NA = Not analyzed




*Laboratory analysis by:* K. Wright

*Data entered by:* K. Wright

*Checked by:* J. Hines

# Saturated Hydraulic Conductivity
## Constant Head Method

| | | | |
|---|---|---|---|
| *Job name:* | Brown and Caldwell | *Type of water used:* | TAP |
| *Job number:* | LB09.0104.00 | *Collection vessel tare* (g)*:* | 9.19 |
| *Sample number:* | TP-02 | *Sample length* (cm)*:* | 7.59 |
| *Test Locaton Unlined Pond:* | Lower Bench | *Sample diameter* (cm)*:* | 6.13 |
| *Location:* | NA | *Sample x-sectional area* ($cm^2$)*:* | 29.47 |

| 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: | | | | | | | | |
| 19-May-09 | 10:35:20 | 21.5 | 2 | 10.33 | 1.1 | 484 | 3.0E-04 | 2.9E-04 |
| 19-May-09 | 10:43:24 | | | | | | | |
| Test # 2: | | | | | | | | |
| 19-May-09 | 12:36:39 | 22.0 | 2.8 | 11.04 | 1.9 | 590 | 2.9E-04 | 2.8E-04 |
| 19-May-09 | 12:46:29 | | | | | | | |
| Test # 3: | | | | | | | | |
| 19-May-09 | 13:19:08 | 22.5 | 2.5 | 10.92 | 1.7 | 639 | 2.8E-04 | 2.6E-04 |
| 19-May-09 | 13:29:47 | | | | | | | |

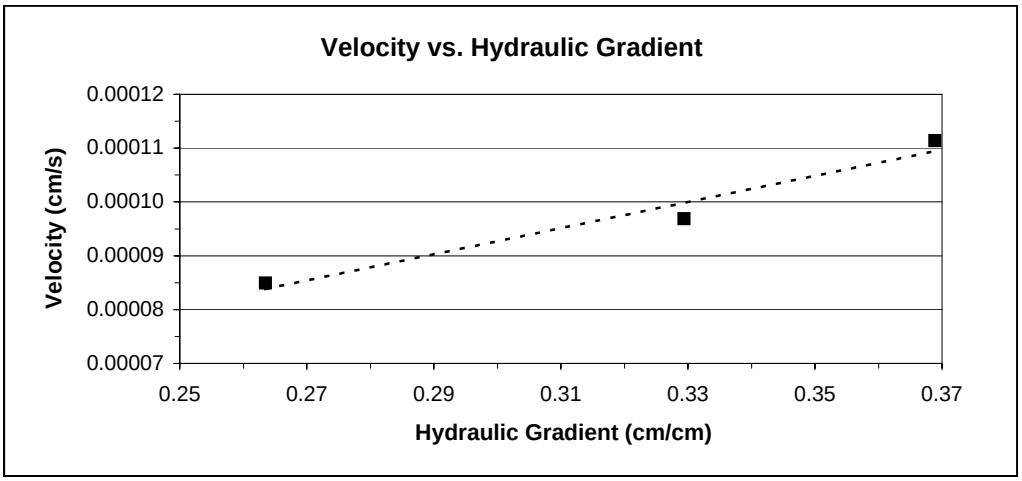
***Average Ksat* (cm/sec)*:*** **2.8E-04**

***Oversize Corrected Ksat* (cm/sec)*:*** **NA**

*Comments:*

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

NA = Not analyzed




*Laboratory analysis by:* K. Wright

*Data entered by:* K. Wright

*Checked by:* J. Hines

# Saturated Hydraulic Conductivity
## Constant Head Method

| | | | |
|---|---|---|---|
| *Job name:* | Brown and Caldwell | *Type of water used:* | TAP |
| *Job number:* | LB09.0104.00 | *Collection vessel tare* (g)*:* | 9.18 |
| *Sample number:* | TP-03 | *Sample length* (cm)*:* | 7.60 |
| *Test Locaton Unlined Pond:* | Middle Bench | *Sample diameter* (cm)*:* | 6.22 |
| *Location:* | NA | *Sample x-sectional area* ($cm^2$)*:* | 30.41 |

| 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: | | | | | | | | |
| 19-May-09 | 10:35:30 | 21.5 | 1.8 | 16.15 | 7.0 | 506 | 1.9E-03 | 1.8E-03 |
| 19-May-09 | 10:43:56 | | | | | | | |
| Test # 2: | | | | | | | | |
| 21-May-09 | 9:28:12 | 22.0 | 3 | 17.64 | 8.5 | 380 | 1.9E-03 | 1.8E-03 |
| 21-May-09 | 9:34:32 | | | | | | | |
| Test # 3: | | | | | | | | |
| 21-May-09 | 10:32:37 | 22.0 | 2.3 | 15.30 | 6.1 | 401 | 1.7E-03 | 1.6E-03 |
| 21-May-09 | 10:39:18 | | | | | | | |

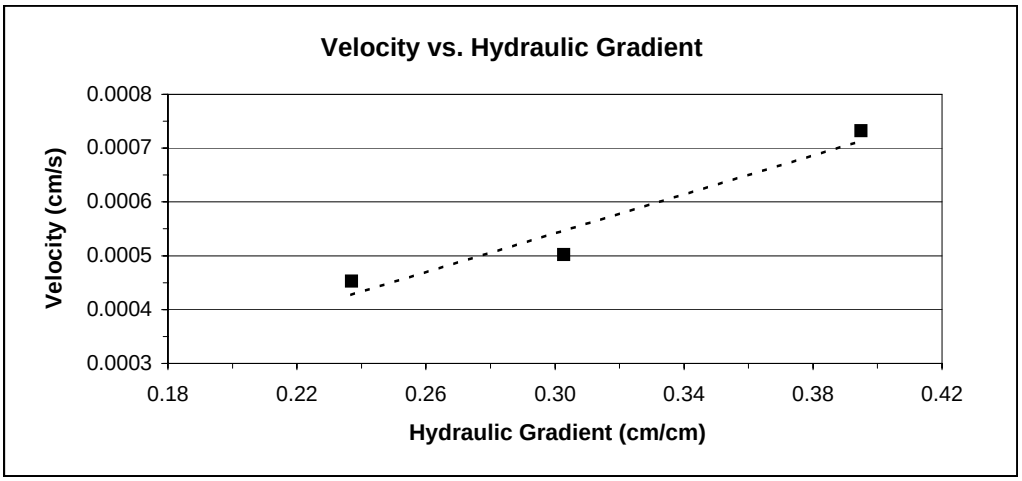
***Average Ksat* (cm/sec)*:*** **1.7E-03**

***Oversize Corrected Ksat* (cm/sec)*:*** **NA**

*Comments:*

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

NA = Not analyzed




*Laboratory analysis by:* K. Wright

*Data entered by:* K. Wright

*Checked by:* J. Hines

# Saturated Hydraulic Conductivity
## Constant Head Method

| | | | |
|---|---|---|---|
| *Job name:* | Brown and Caldwell | *Type of water used:* | TAP |
| *Job number:* | LB09.0104.00 | *Collection vessel tare* (g): | 9.17 |
| *Sample number:* | TP-04 | *Sample length* (cm): | 7.60 |
| *Test Locaton Unlined Pond:* | Upper Bench | *Sample diameter* (cm): | 6.12 |
| *Location:* | NA | *Sample x-sectional area* ($cm^2$): | 29.45 |

| 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: | | | | | | | | |
| 19-May-09 | 10:36:08 | 21.5 | 3 | 10.55 | 1.4 | 529 | 2.2E-04 | 2.2E-04 |
| 19-May-09 | 10:44:57 | | | | | | | |
| Test # 2: | | | | | | | | |
| 19-May-09 | 12:36:23 | 22.0 | 2.8 | 10.92 | 1.8 | 715 | 2.3E-04 | 2.2E-04 |
| 19-May-09 | 12:48:18 | | | | | | | |
| Test # 3: | | | | | | | | |
| 19-May-09 | 13:19:45 | 22.5 | 2.5 | 10.37 | 1.2 | 553 | 2.2E-04 | 2.1E-04 |
| 19-May-09 | 13:28:58 | | | | | | | |

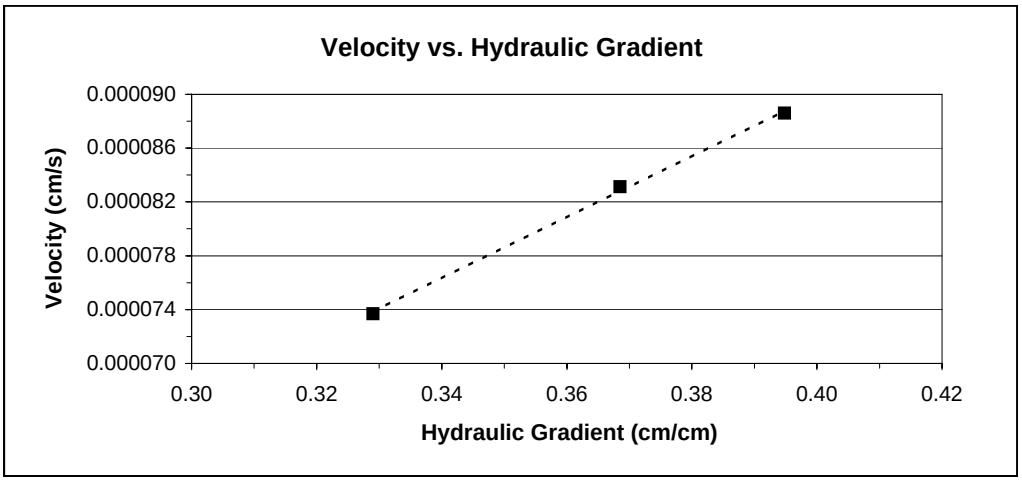
***Average Ksat* (cm/sec):** **2.1E-04**

***Oversize Corrected Ksat* (cm/sec):** **NA**

*Comments:*

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

NA = Not analyzed




*Laboratory analysis by:* K. Wright

*Data entered by:* K. Wright

*Checked by:* J. Hines

# Saturated Hydraulic Conductivity
## Constant Head Method

| | | | |
|---|---|---|---|
| *Job name:* | Brown and Caldwell | *Type of water used:* | TAP |
| *Job number:* | LB09.0104.00 | *Collection vessel tare* (g): | 9.17 |
| *Sample number:* | TP-05 | *Sample length* (cm): | 7.60 |
| *Test Locaton Unlined Pond:* | Upper Bench | *Sample diameter* (cm): | 6.12 |
| *Location:* | NA | *Sample x-sectional area* ($cm^2$): | 29.37 |

| 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: | | | | | | | | |
| 19-May-09 | 11:31:52 | 21.5 | 2.8 | 12.05 | 2.9 | 693 | 3.8E-04 | 3.7E-04 |
| 19-May-09 | 11:43:25 | | | | | | | |
| Test # 2: | | | | | | | | |
| 19-May-09 | 12:36:56 | 22.0 | 2.6 | 11.53 | 2.4 | 668 | 3.5E-04 | 3.4E-04 |
| 19-May-09 | 12:48:04 | | | | | | | |
| Test # 3: | | | | | | | | |
| 19-May-09 | 13:19:57 | 22.5 | 2.4 | 11.08 | 1.9 | 587 | 3.5E-04 | 3.3E-04 |
| 19-May-09 | 13:29:44 | | | | | | | |

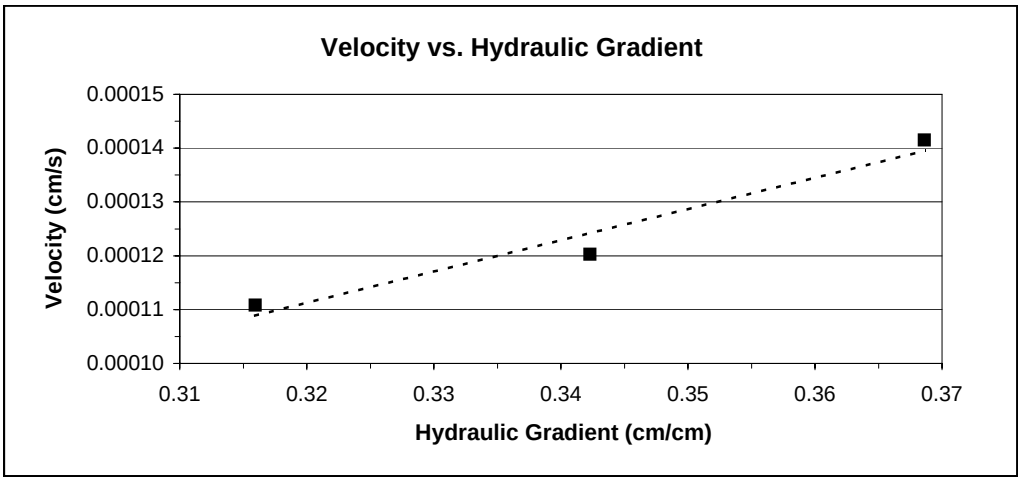
***Average Ksat* (cm/sec):** **3.5E-04**

***Oversize Corrected Ksat* (cm/sec):** **NA**

*Comments:*

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

NA = Not analyzed




*Laboratory analysis by:* K. Wright

*Data entered by:* K. Wright

*Checked by:* J. Hines

# Moisture Retention Characteristics

## Summary of Moisture Characteristics of the Initial Drainage Curve

| Sample Number | Pressure Head (-cm water) | Moisture Content (%, $cm^3/cm^3$) |
|---|---|---|
| TP-01 | 0 | 32.1 ‡‡ |
| | 8 | 28.5 ‡‡ |
| | 24 | 23.0 ‡‡ |
| | 104 | 16.0 ‡‡ |
| | 337 | 10.2 ‡‡ |
| | 209059 | 6.1 ‡‡ |
| | 854159 | 3.9 ‡‡ |
| TP-02 | 0 | 32.4 ‡‡ |
| | 8 | 29.1 ‡‡ |
| | 28 | 22.5 ‡‡ |
| | 101 | 17.5 ‡‡ |
| | 337 | 12.0 ‡‡ |
| | 118297 | 6.4 ‡‡ |
| | 854159 | 3.7 ‡‡ |
| TP-03 | 0 | 32.2 ‡‡ |
| | 6 | 28.6 ‡‡ |
| | 18 | 25.7 ‡‡ |
| | 73 | 19.2 ‡‡ |
| | 337 | 11.9 ‡‡ |
| | 129515 | 6.6 ‡‡ |
| | 854159 | 4.1 ‡‡ |
| TP-04 | 0 | 29.2 |
| | 7 | 25.3 |
| | 23 | 20.0 |
| | 99 | 14.4 |
| | 337 | 9.2 |
| | 240673 | 5.2 |
| | 854159 | 3.7 |

‡‡ 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 (%, $cm^3/cm^3$) |
|---|---|---|
| TP-05 | 0 | 31.5 |
| | 9 | 28.5 |
| | 26 | 24.1 |
| | 102 | 17.7 |
| | 337 | 12.1 |
| | 214158 | 6.7 |
| | 854159 | 4.7 |

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

## Summary of Calculated Unsaturated Hydraulic Properties

| Sample Number | $\alpha$ ($cm^{-1}$) | N (dimensionless) | $\theta_r$ (% vol) | $\theta_s$ (% vol) | Oversize Corrected $\theta_r$ (% vol) | Oversize Corrected $\theta_s$ (% vol) |
|---|---|---|---|---|---|---|
| TP-01 | 0.0800 | 1.4409 | 4.59 | 31.96 | NA | NA |
| TP-02 | 0.1000 | 1.3411 | 4.06 | 32.47 | NA | NA |
| TP-03 | 0.0849 | 1.3509 | 4.40 | 31.74 | NA | NA |
| TP-04 | 0.1158 | 1.3891 | 3.98 | 29.11 | NA | NA |
| TP-05 | 0.0638 | 1.4061 | 5.22 | 31.35 | NA | NA |

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

NA = Not analyzed

# Moisture Retention Data

## Hanging Column / Pressure Plate

(Soil-Water Characteristic Curve)

*Job Name:* Brown and Caldwell
*Job Number:* LB09.0104.00
*Sample Number:* TP-01
*Test Locaton Unlined Pond:* Lower Bench
*Location:* NA

*Dry wt. of sample* (g): 399.75
*Tare wt., ring* (g): 133.38
*Tare wt., screen & clamp* (g): 26.80
*Initial sample volume* ($cm^3$): 224.07
*Initial dry bulk density* ($g/cm^3$): 1.78
*Client Provided particle density* ($g/cm^3$): 2.59
*Initial calculated total porosity* (%): 31.04

| | Date | Time | Weight* (g) | Matric Potential (-cm water) | Moisture Content† (% vol) | |
|---|---|---|---|---|---|---|
| *Hanging column:* | 20-May-09 | 14:20 | 629.69 | 0 | 32.07 | ‡‡ |
| | 26-May-09 | 10:30 | 621.85 | 8.0 | 28.47 | ‡‡ |
| | 2-Jun-09 | 9:05 | 609.34 | 24.0 | 23.05 | ‡‡ |
| | 8-Jun-09 | 10:10 | 593.91 | 104.0 | 15.96 | ‡‡ |
| *Pressure plate:* | 16-Jun-09 | 9:42 | 581.57 | 337 | 10.17 | ‡‡ |

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 | 217.52 | -2.93% | 1.84 | 28.96 |
| | 8.0 | 217.52 | -2.93% | 1.84 | 28.96 |
| | 24.0 | 214.38 | -4.32% | 1.86 | 27.92 |
| | 104.0 | 212.88 | -5.00% | 1.88 | 27.41 |
| *Pressure plate:* | 337 | 212.88 | -5.00% | 1.88 | 27.41 |

*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).

*Technician Notes:*

*Laboratory analysis by:* K. Wright/ R. Marshall
*Data entered by:* R. Marshall
*Checked by:* J. Hines

# Moisture Retention Data

**Dew Point Potentiometer / Relative Humidity Box**

(Soil-Water Characteristic Curve)

*Sample Number:* TP-01

*Dry weight* of dew point potentiometer sample* (g)*:* 153.35
*Tare weight, jar* (g)*:* 115.66
*Initial sample bulk density* (g/cm$^3$)*:* 1.78

| | Date | Time | Weight* (g) | Water Potential (-cm water) | Moisture Content† (% vol) | |
|---|---|---|---|---|---|---|
| *Dew point potentiometer:* | 20-May-09 | 8:30 | 154.57 | 209059 | 6.09 | ‡‡ |

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:* | 209059 | 212.88 | -5.00% | 1.88 | 27.41 |

*Dry weight* of relative humidity box sample* (g)*:* 65.39
*Tare weight* (g)*:* 44.10
*Initial sample bulk density* (g/cm$^3$)*:* 1.78

| | Date | Time | Weight* (g) | Water Potential (-cm water) | Moisture Moisture Content† (% vol) | |
|---|---|---|---|---|---|---|
| *Relative humidity box:* | 19-May-09 | 8:10 | 65.83 | 854159 | 3.89 | ‡‡ |

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:* | 854159 | 212.88 | -5.00% | 1.88 | 27.41 |

*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

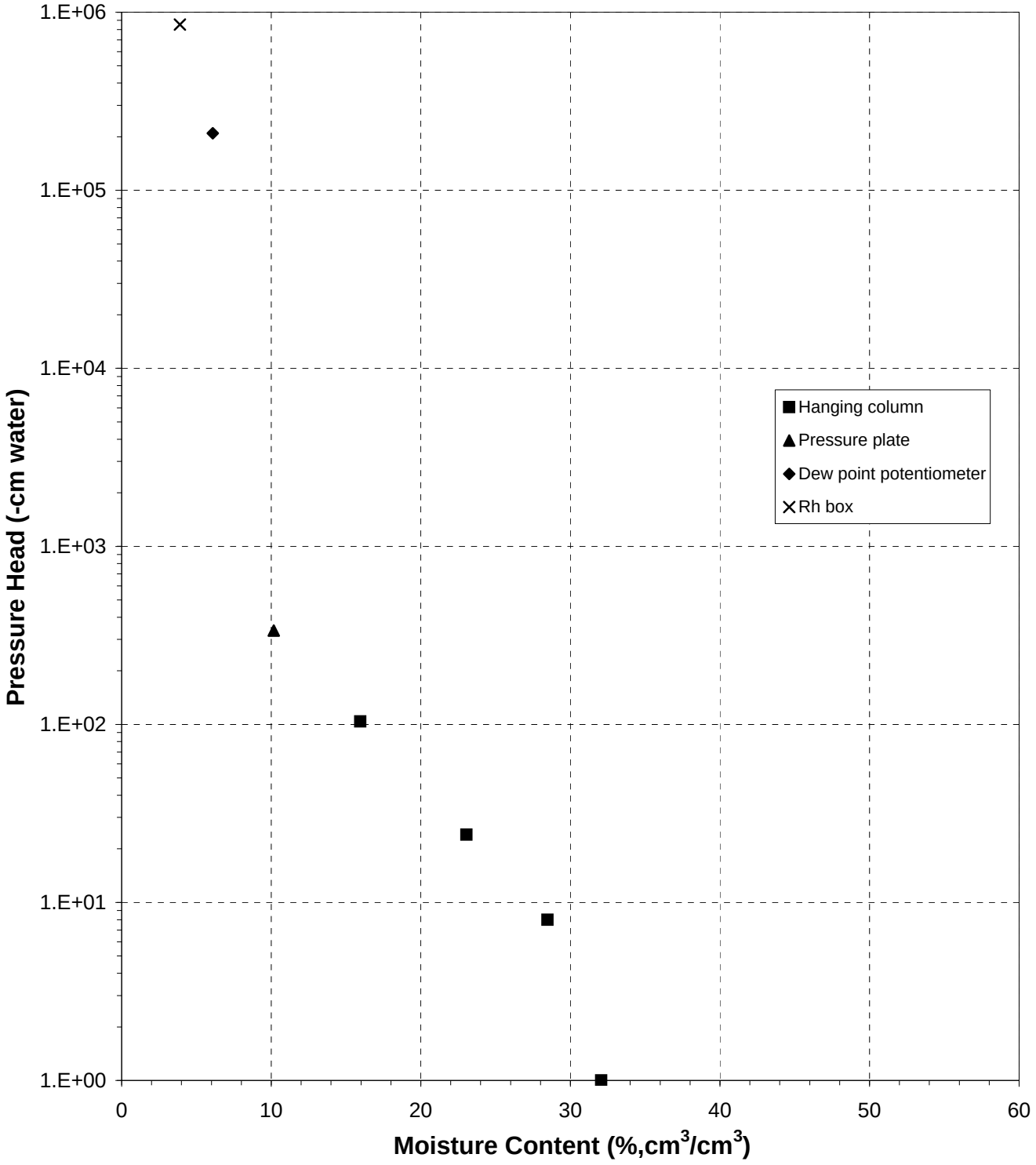
† Assumed density of water is 1.0 g/cm$^3$

‡‡ Volume adjustments are applicable at this matric potential (see comment #1).

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

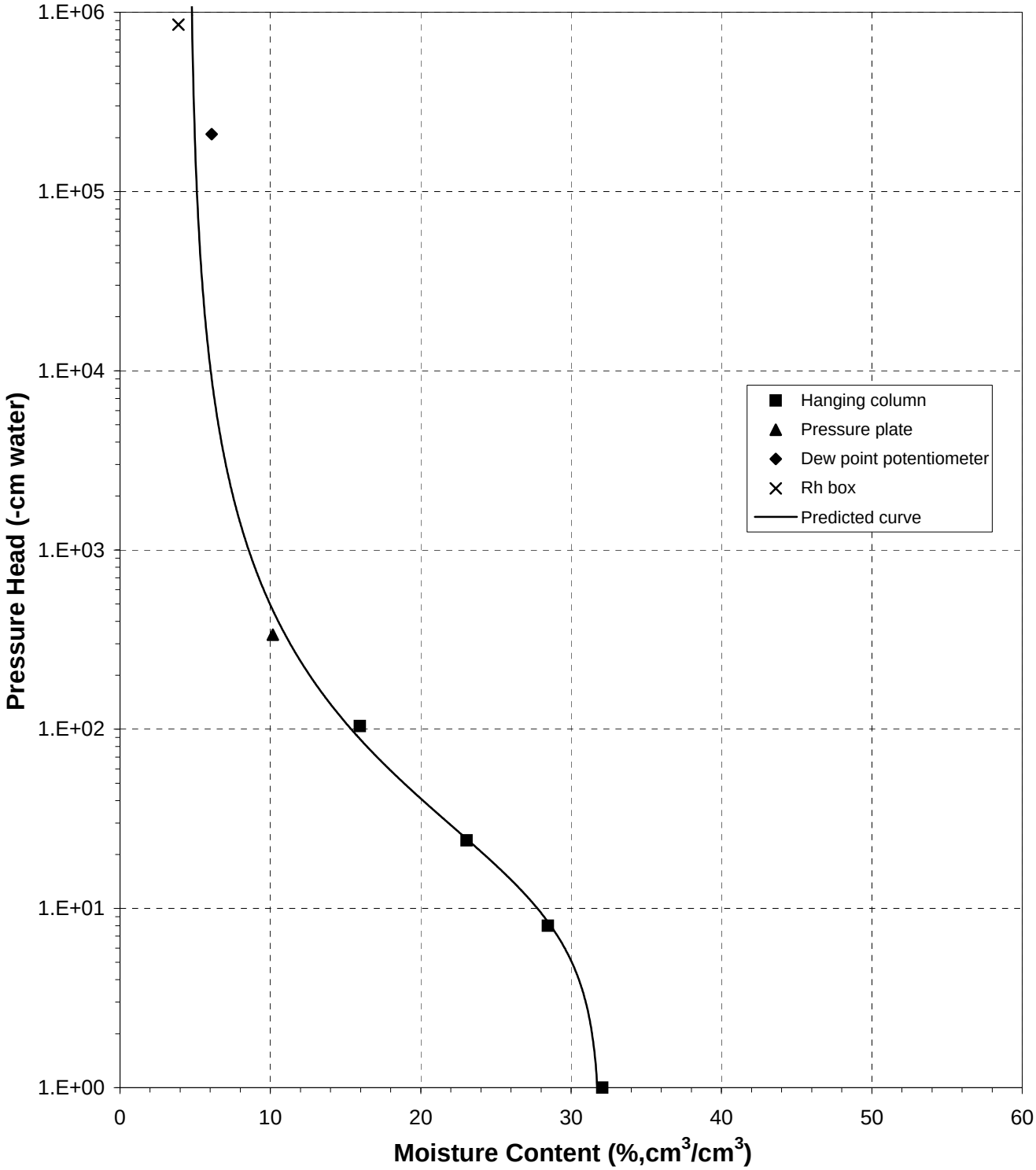
## Water Retention Data Points

*Sample Number: TP-01*



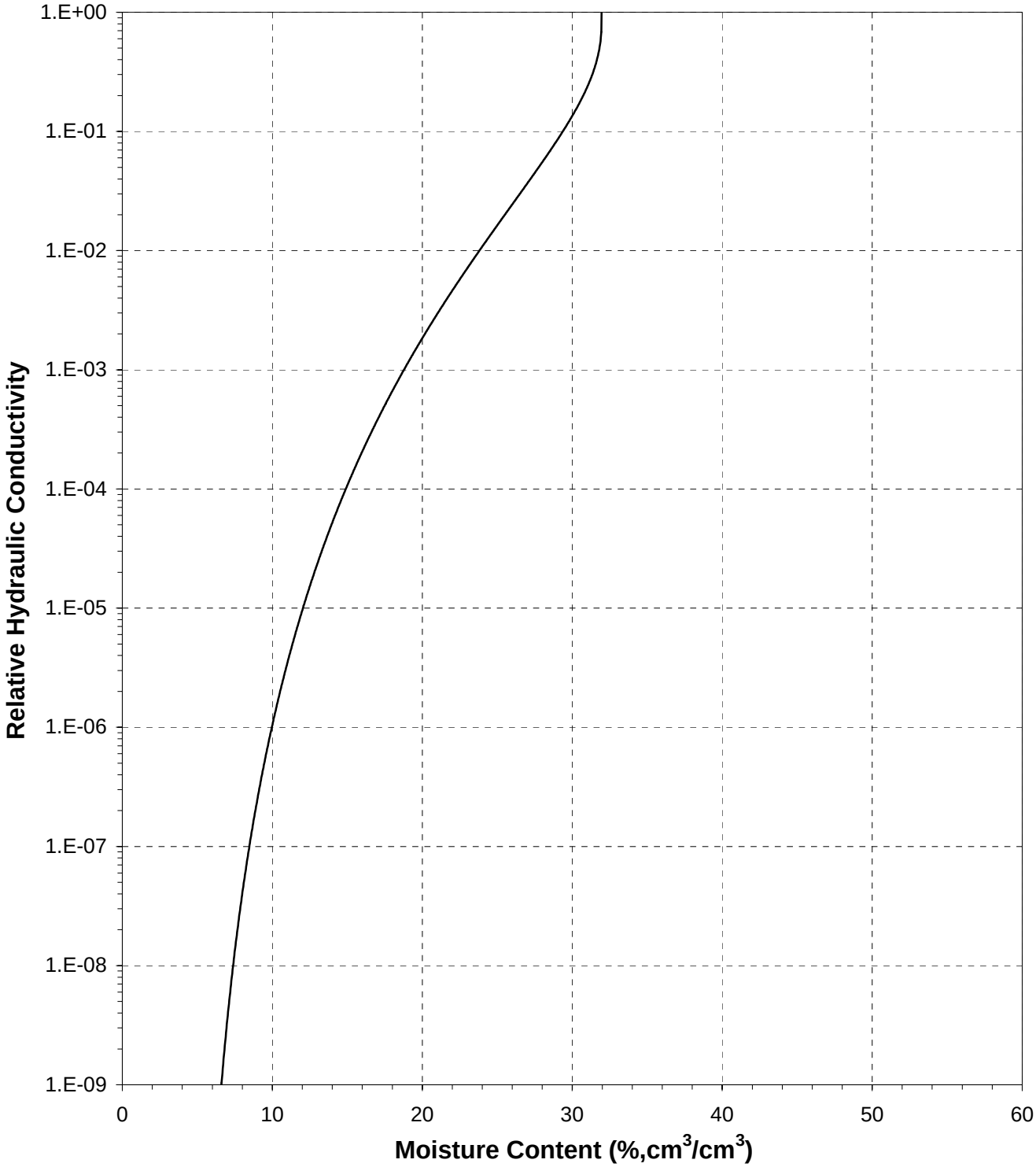
## Predicted Water Retention Curve and Data Points

*Sample Number: TP-01*



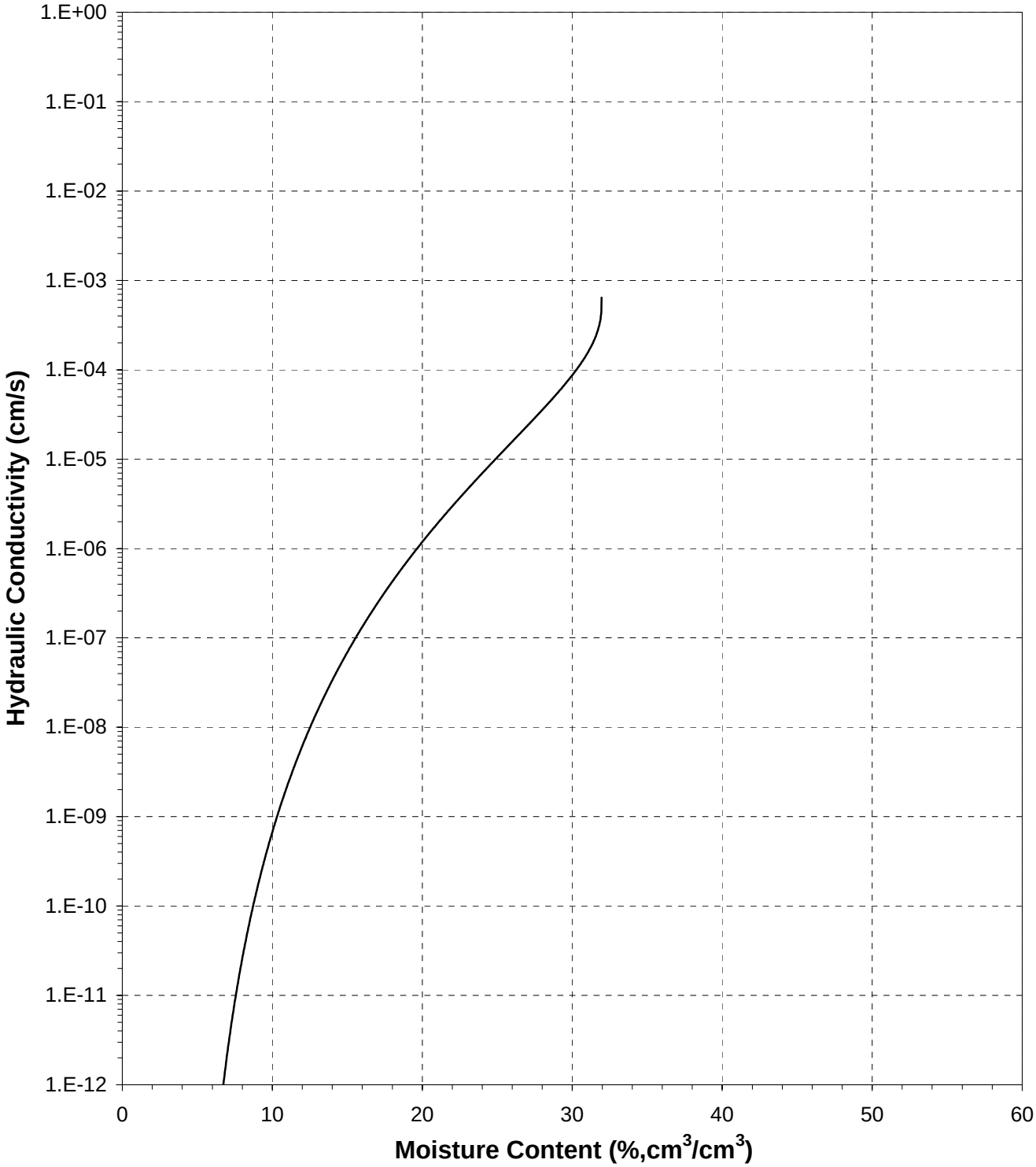
## Plot of Relative Hydraulic Conductivity vs Moisture Content

*Sample Number: TP-01*



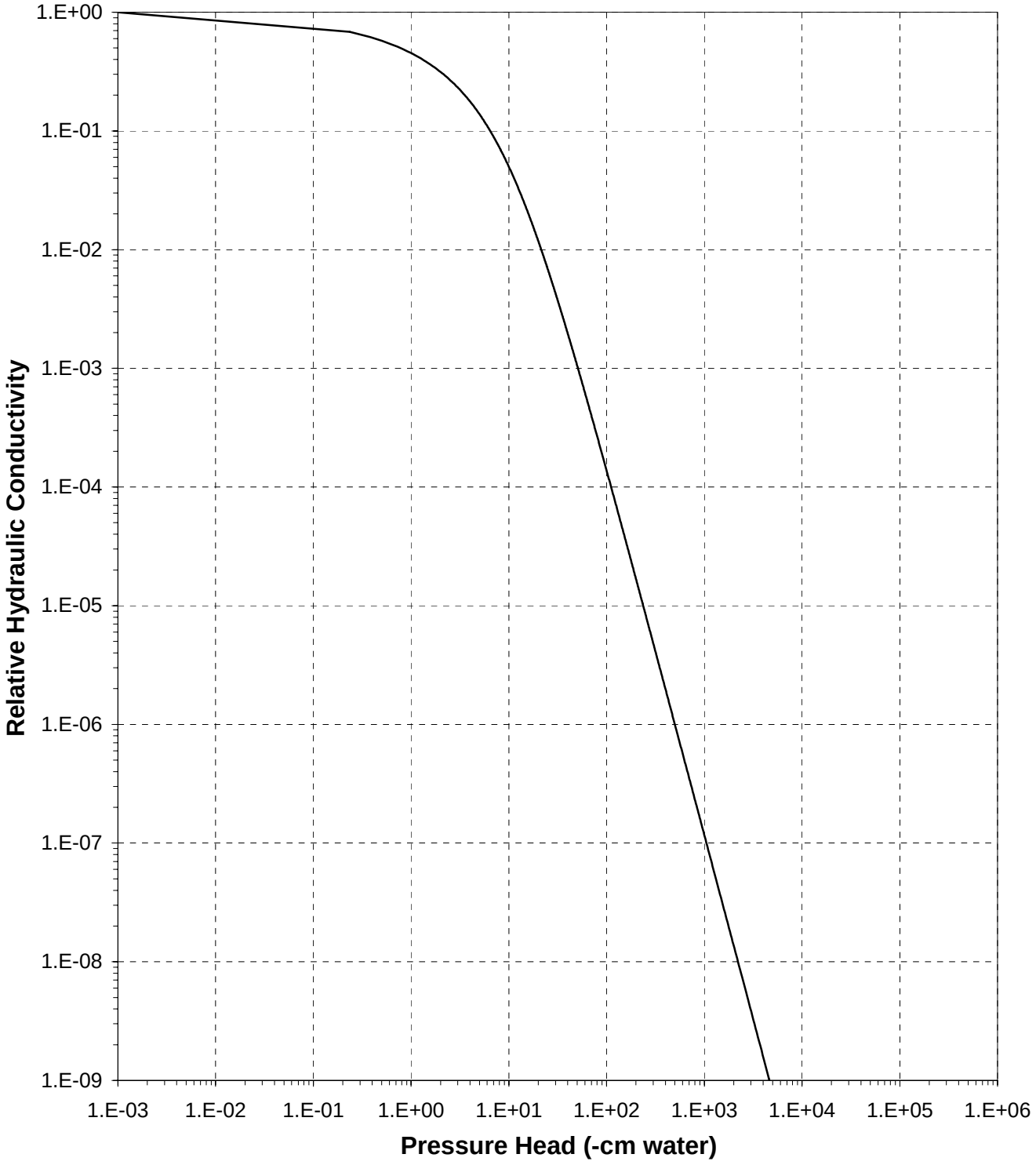
## Plot of Hydraulic Conductivity vs Moisture Content

*Sample Number: TP-01*



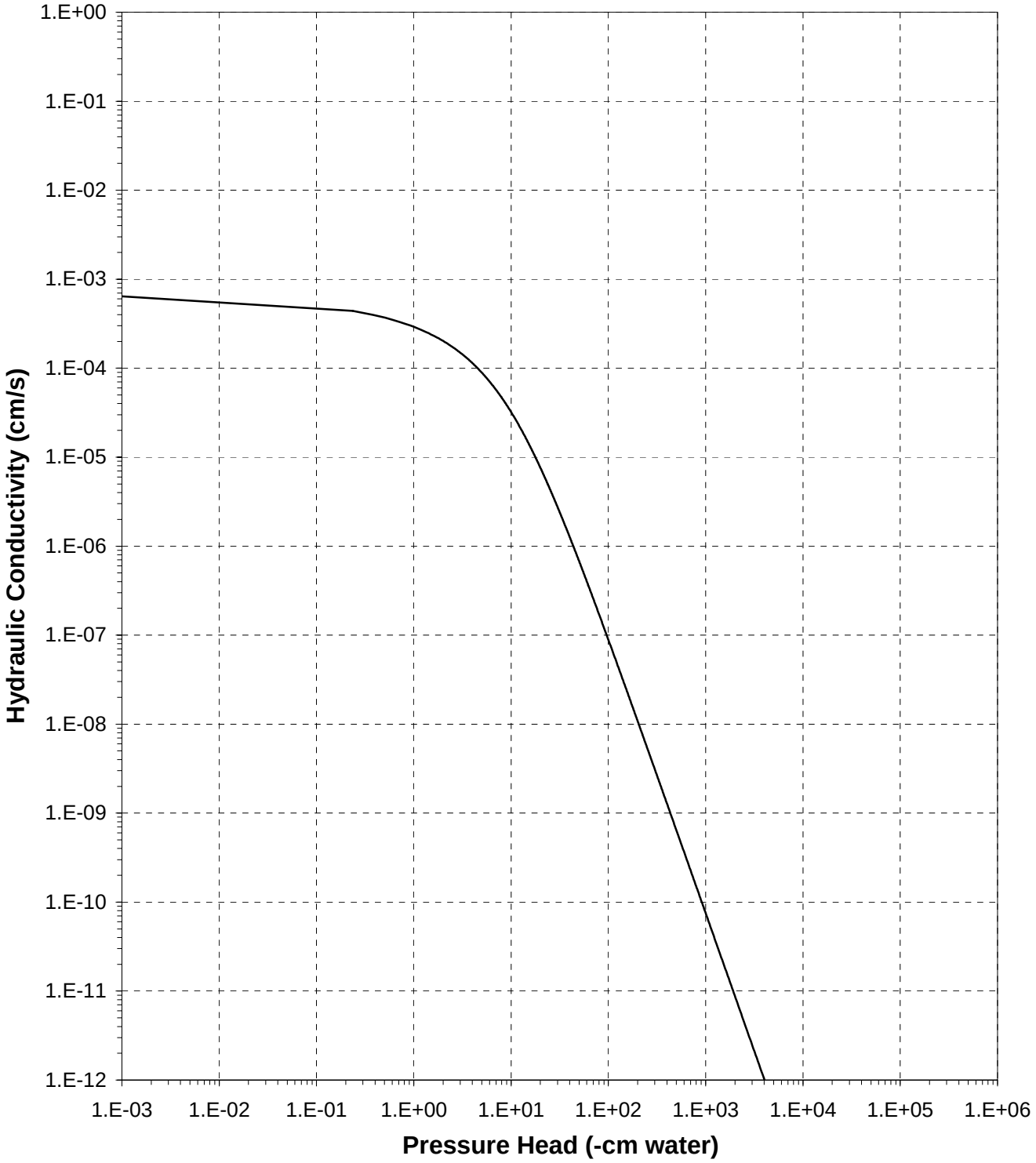
## Plot of Relative Hydraulic Conductivity vs Pressure Head

*Sample Number: TP-01*



## Plot of Hydraulic Conductivity vs Pressure Head

*Sample Number: TP-01*



# Moisture Retention Data

## Hanging Column / Pressure Plate

(Soil-Water Characteristic Curve)

| | | | |
|---|---|---|---|
| *Job Name:* | Brown and Caldwell | *Dry wt. of sample* (g): | 379.60 |
| *Job Number:* | LB09.0104.00 | *Tare wt., ring* (g): | 133.12 |
| *Sample Number:* | TP-02 | *Tare wt., screen & clamp* (g): | 28.19 |
| *Test Locaton Unlined Pond:* | Lower Bench | *Initial sample volume* ($cm^3$): | 223.71 |
| *Location:* | NA | *Initial dry bulk density* ($g/cm^3$): | 1.70 |
| | | *Client Provided particle density* ($g/cm^3$): | 2.67 |
| | | *Initial calculated total porosity* (%): | 36.38 |

| | Date | Time | Weight* (g) | Matric Potential (-cm water) | Moisture Content† (% vol) | |
|---|---|---|---|---|---|---|
| *Hanging column:* | 20-May-09 | 14:10 | 609.48 | 0 | 32.36 | ‡‡ |
| | 26-May-09 | 10:25 | 600.88 | 7.5 | 29.05 | ‡‡ |
| | 2-Jun-09 | 9:10 | 587.32 | 27.5 | 22.48 | ‡‡ |
| | 8-Jun-09 | 10:20 | 576.98 | 101.0 | 17.48 | ‡‡ |
| *Pressure plate:* | 16-Jun-09 | 9:34 | 565.12 | 337 | 11.99 | ‡‡ |

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 | 211.89 | -5.28% | 1.79 | 32.83 |
| | 7.5 | 206.41 | -7.73% | 1.84 | 31.04 |
| | 27.5 | 206.41 | -7.73% | 1.84 | 31.04 |
| | 101.0 | 206.41 | -7.73% | 1.84 | 31.04 |
| *Pressure plate:* | 337 | 201.99 | -9.71% | 1.88 | 29.53 |

*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).

*Technician Notes:*

*Laboratory analysis by:* K. Wright/ R. Marshall
*Data entered by:* R. Marshall
*Checked by:* J. Hines

# Moisture Retention Data

**Dew Point Potentiometer / Relative Humidity Box**

(Soil-Water Characteristic Curve)

*Sample Number:* TP-02

*Dry weight* of dew point potentiometer sample* (g)*:* 150.22
*Tare weight, jar* (g)*:* 116.33
*Initial sample bulk density* ($g/cm^3$)*:* 1.70

| | Date | Time | Weight* (g) | Water Potential (-cm water) | Moisture Content† (% vol) | |
|---|---|---|---|---|---|---|
| *Dew point potentiometer:* | 19-May-09 | 14:15 | 151.37 | 118297 | 6.42 | ‡‡ |

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:* | 118297 | 201.99 | -9.71% | 1.88 | 29.53 |

*Dry weight* of relative humidity box sample* (g)*:* 67.50
*Tare weight* (g)*:* 40.97
*Initial sample bulk density* ($g/cm^3$)*:* 1.70

| | Date | Time | Weight* (g) | Water Potential (-cm water) | Moisture Moisture Content† (% vol) | |
|---|---|---|---|---|---|---|
| *Relative humidity box:* | 19-May-09 | 8:10 | 68.01 | 854159 | 3.66 | ‡‡ |

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:* | 854159 | 201.99 | -9.71% | 1.88 | 29.53 |

*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

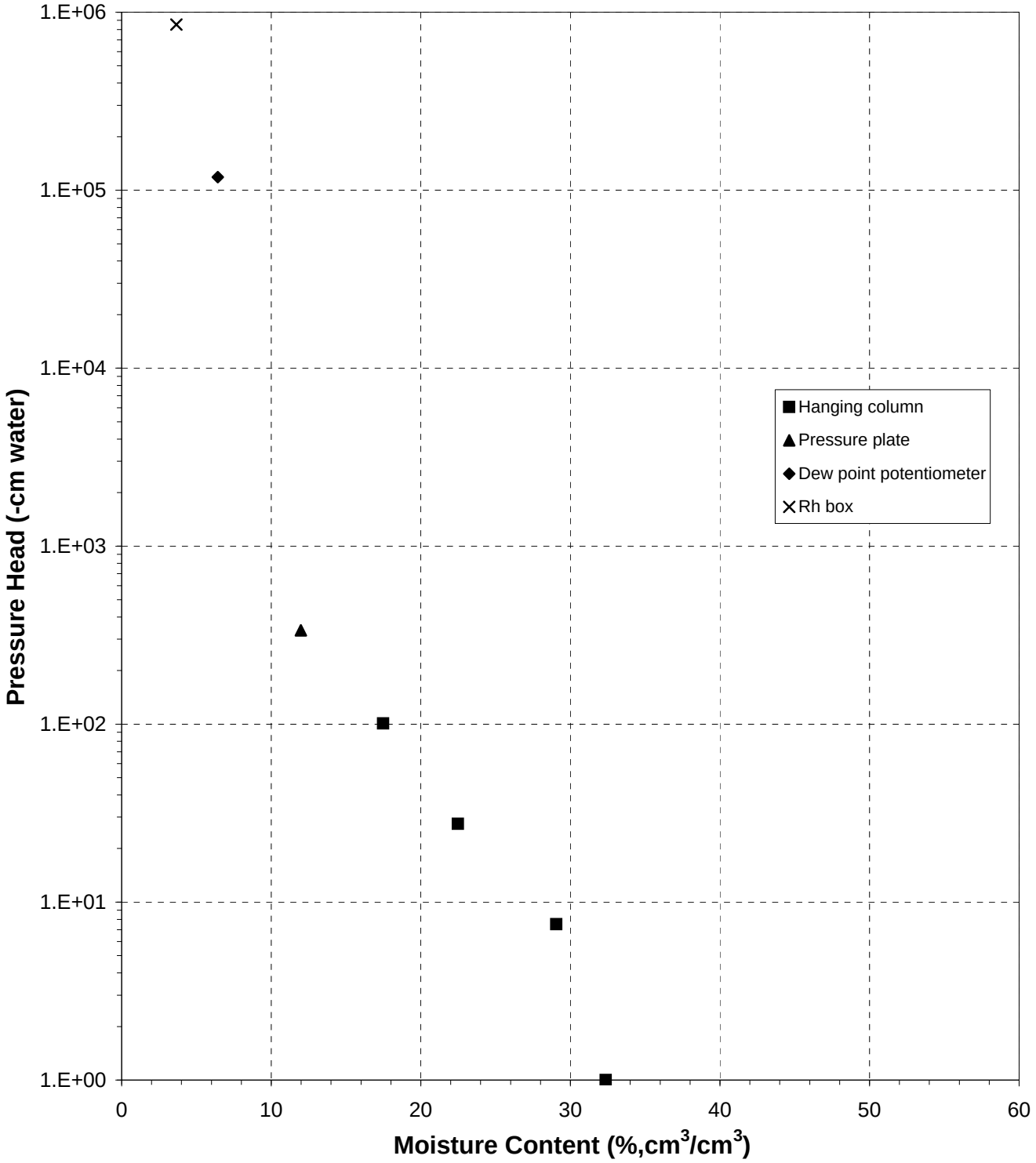
† Assumed density of water is 1.0 $g/cm^3$

‡‡ Volume adjustments are applicable at this matric potential (see comment #1).

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

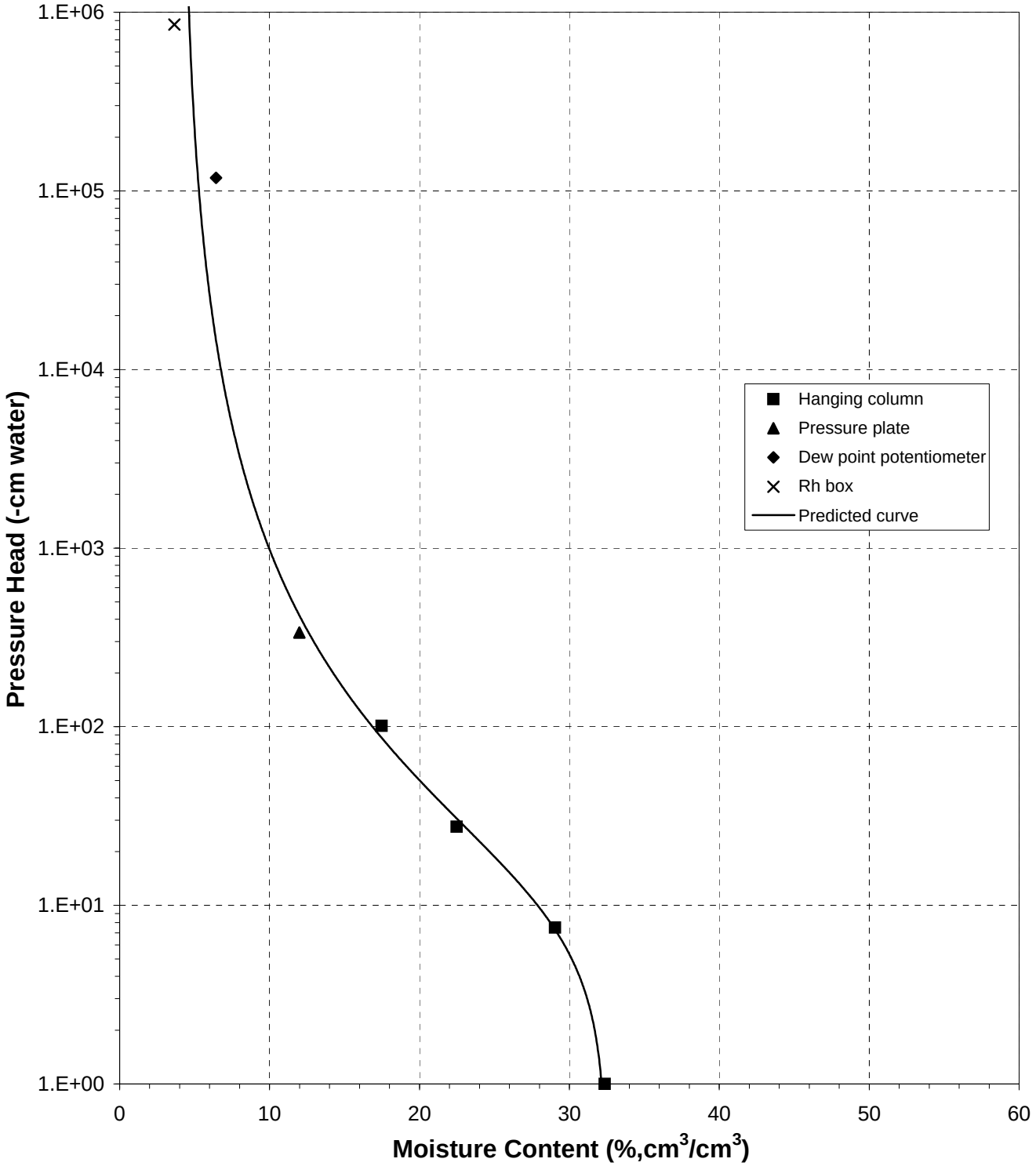
## Water Retention Data Points

*Sample Number: TP-02*



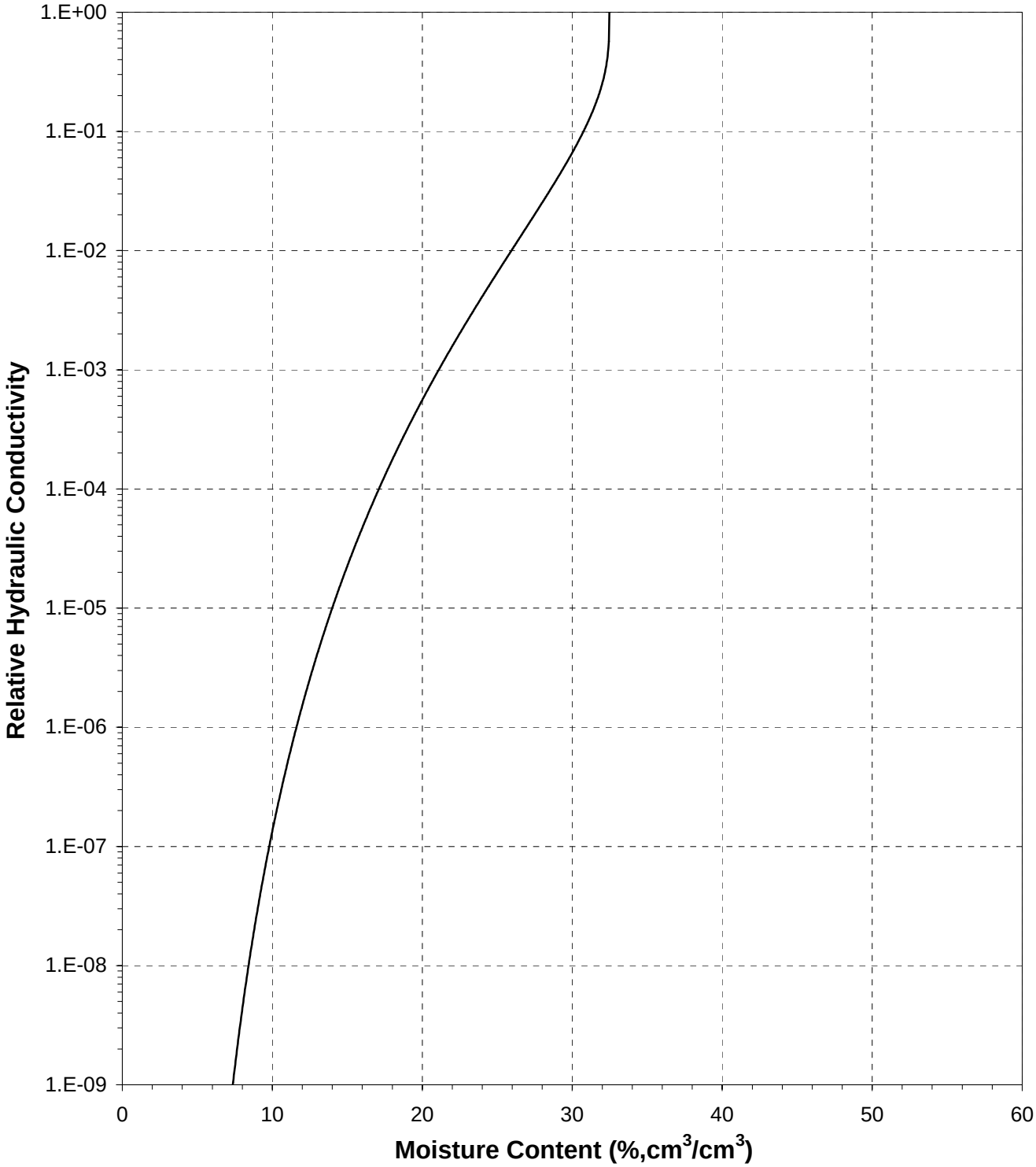
## Predicted Water Retention Curve and Data Points

*Sample Number: TP-02*



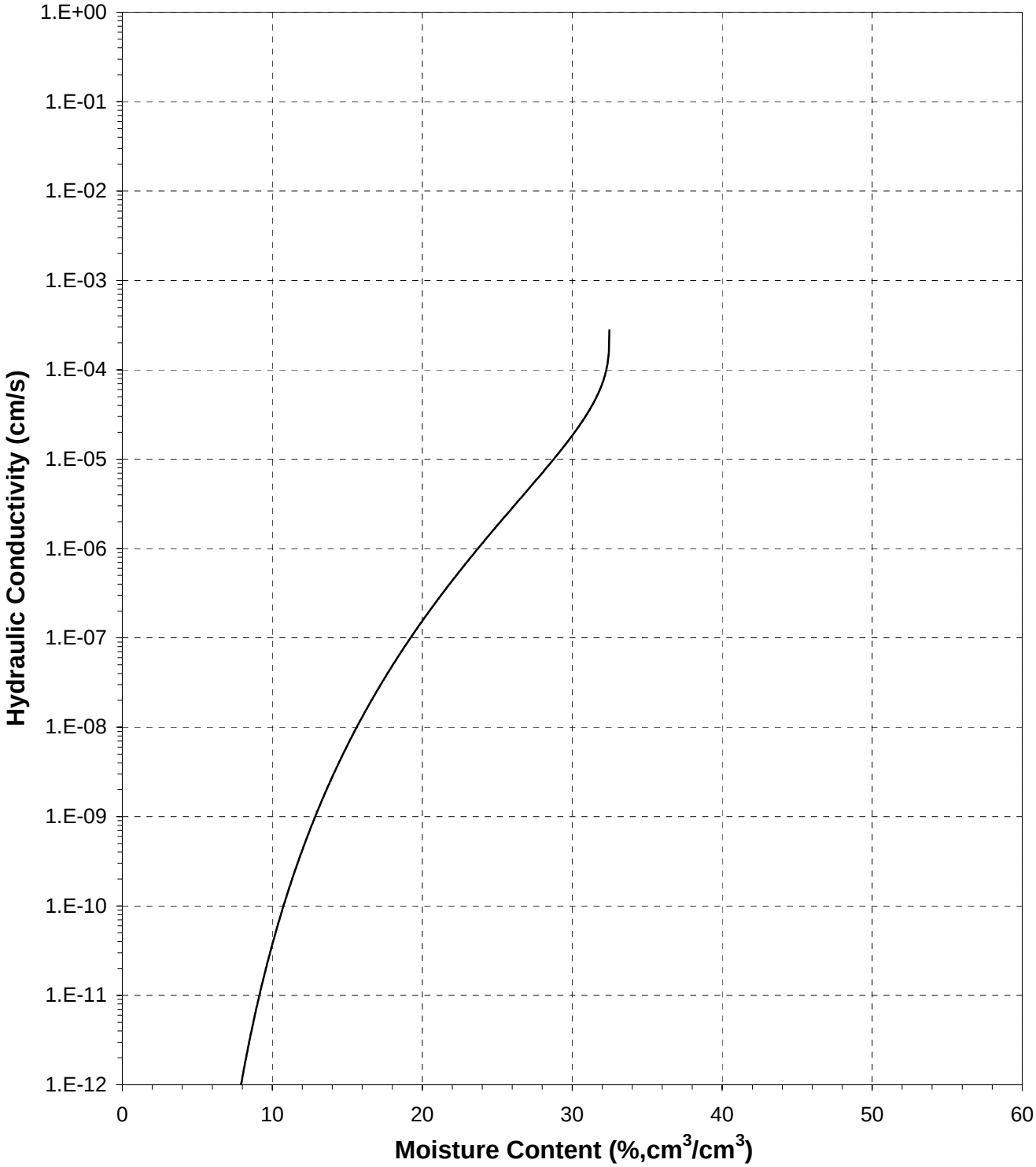
## Plot of Relative Hydraulic Conductivity vs Moisture Content

*Sample Number: TP-02*



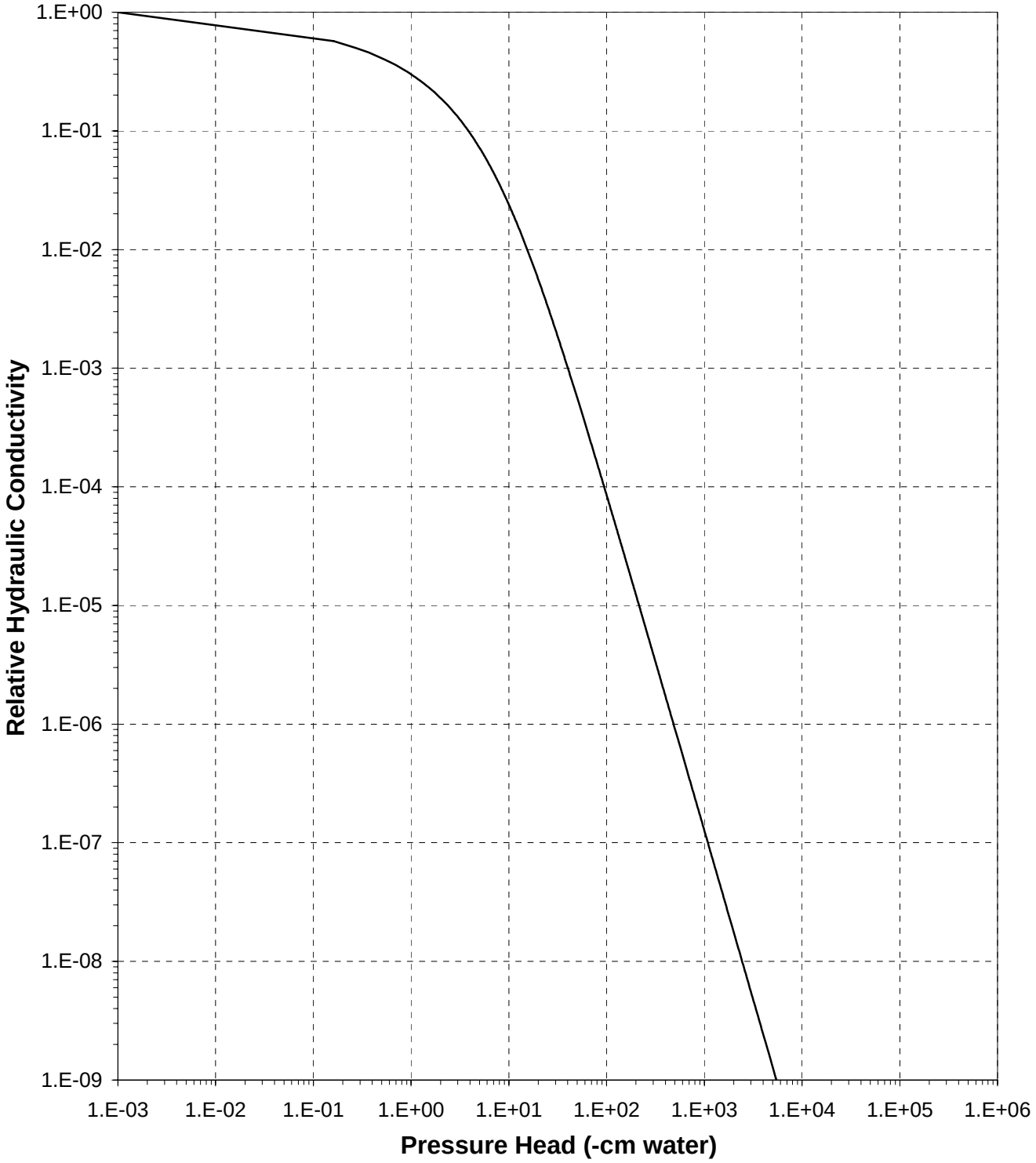
## Plot of Hydraulic Conductivity vs Moisture Content

*Sample Number: TP-02*



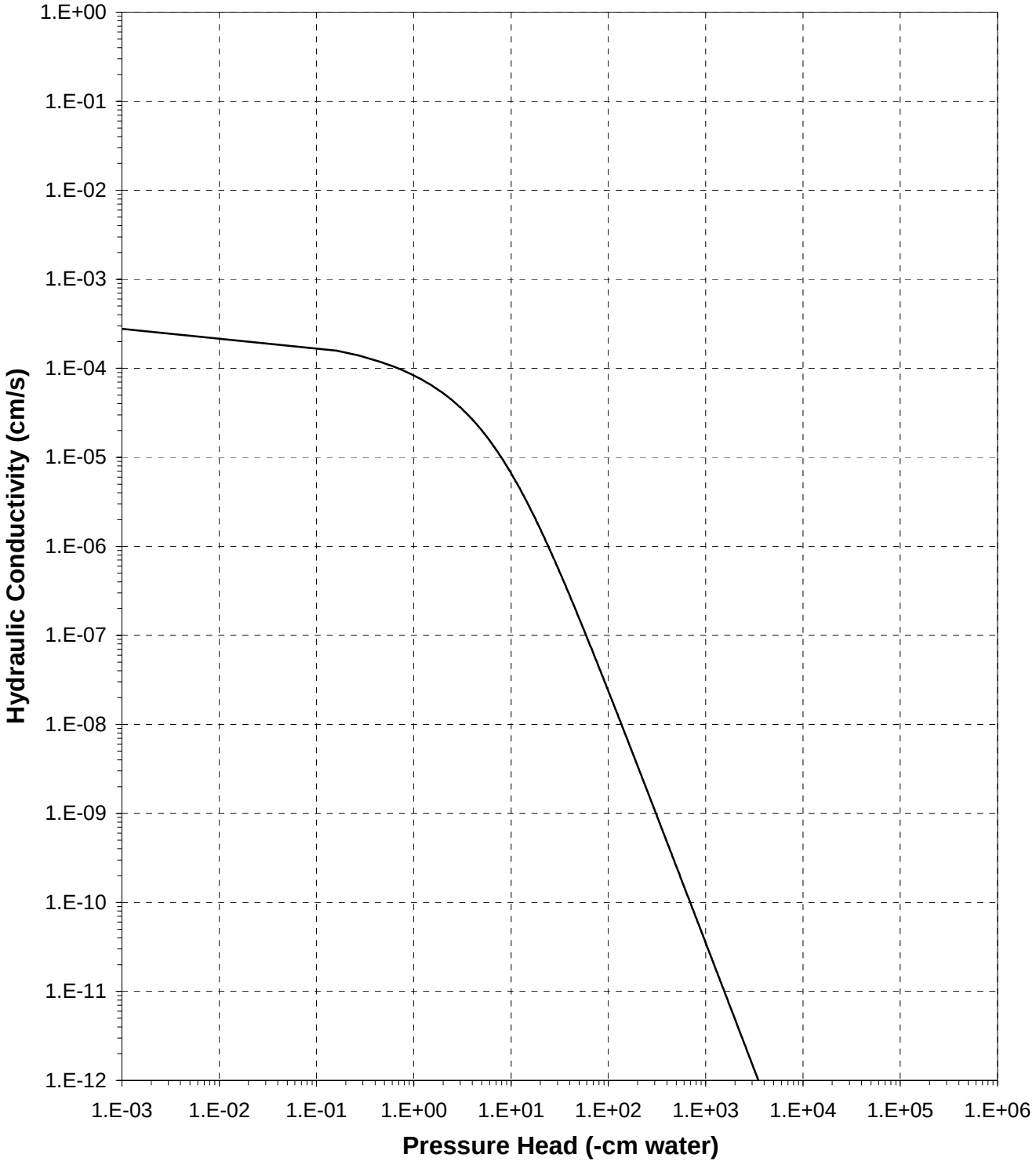
## Plot of Relative Hydraulic Conductivity vs Pressure Head

*Sample Number: TP-02*



## Plot of Hydraulic Conductivity vs Pressure Head

*Sample Number: TP-02*



# Moisture Retention Data

## Hanging Column / Pressure Plate

(Soil-Water Characteristic Curve)

| | | | |
|---|---|---|---|
| *Job Name:* | Brown and Caldwell | *Dry wt. of sample* (g): | 393.15 |
| *Job Number:* | LB09.0104.00 | *Tare wt., ring* (g): | 101.41 |
| *Sample Number:* | TP-03 | *Tare wt., screen & clamp* (g): | 28.75 |
| *Test Locaton Unlined Pond:* | Middle Bench | *Initial sample volume* ($cm^3$): | 230.99 |
| *Location:* | NA | *Initial dry bulk density* ($g/cm^3$): | 1.70 |
| | | *Client Provided particle density* ($g/cm^3$): | 2.64 |
| | | *Initial calculated total porosity* (%): | 35.43 |

| | Date | Time | Weight* (g) | Matric Potential (-cm water) | Moisture Content† (% vol) | |
|---|---|---|---|---|---|---|
| *Hanging column:* | 21-May-09 | 12:40 | 595.57 | 0 | 32.21 | ‡‡ |
| | 27-May-09 | 9:20 | 587.37 | 5.5 | 28.56 | ‡‡ |
| | 2-Jun-09 | 9:35 | 579.32 | 18.0 | 25.68 | ‡‡ |
| | 8-Jun-09 | 10:05 | 564.66 | 73.0 | 19.19 | ‡‡ |
| *Pressure plate:* | 16-Jun-09 | 9:35 | 549.02 | 337 | 11.93 | ‡‡ |

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 | 224.33 | -2.88% | 1.75 | 33.51 |
| | 5.5 | 224.33 | -2.88% | 1.75 | 33.51 |
| | 18.0 | 218.07 | -5.59% | 1.80 | 31.61 |
| | 73.0 | 215.51 | -6.70% | 1.82 | 30.79 |
| *Pressure plate:* | 337 | 215.51 | -6.70% | 1.82 | 30.79 |

*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).

*Technician Notes:*

*Laboratory analysis by:* K. Wright/ R. Marshall
*Data entered by:* R. Marshall
*Checked by:* J. Hines

# Moisture Retention Data

## Dew Point Potentiometer / Relative Humidity Box

(Soil-Water Characteristic Curve)

*Sample Number:* TP-03

*Dry weight* of dew point potentiometer sample* (g)*:* 150.06
*Tare weight, jar* (g)*:* 116.51
*Initial sample bulk density* ($g/cm^3$)*:* 1.70

| | Date | Time | Weight* (g) | Water Potential (-cm water) | Moisture Content† (% vol) | |
|---|---|---|---|---|---|---|
| *Dew point potentiometer:* | 20-May-09 | 11:25 | 151.28 | 129515 | 6.59 | ‡‡ |

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:* | 129515 | 215.51 | -6.70% | 1.82 | 30.79 |

*Dry weight* of relative humidity box sample* (g)*:* 66.30
*Tare weight* (g)*:* 41.72
*Initial sample bulk density* ($g/cm^3$)*:* 1.70

| | Date | Time | Weight* (g) | Water Potential (-cm water) | Moisture Moisture Content† (% vol) | |
|---|---|---|---|---|---|---|
| *Relative humidity box:* | 19-May-09 | 8:10 | 66.85 | 854159 | 4.10 | ‡‡ |

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:* | 854159 | 215.51 | -6.70% | 1.82 | 30.79 |

*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

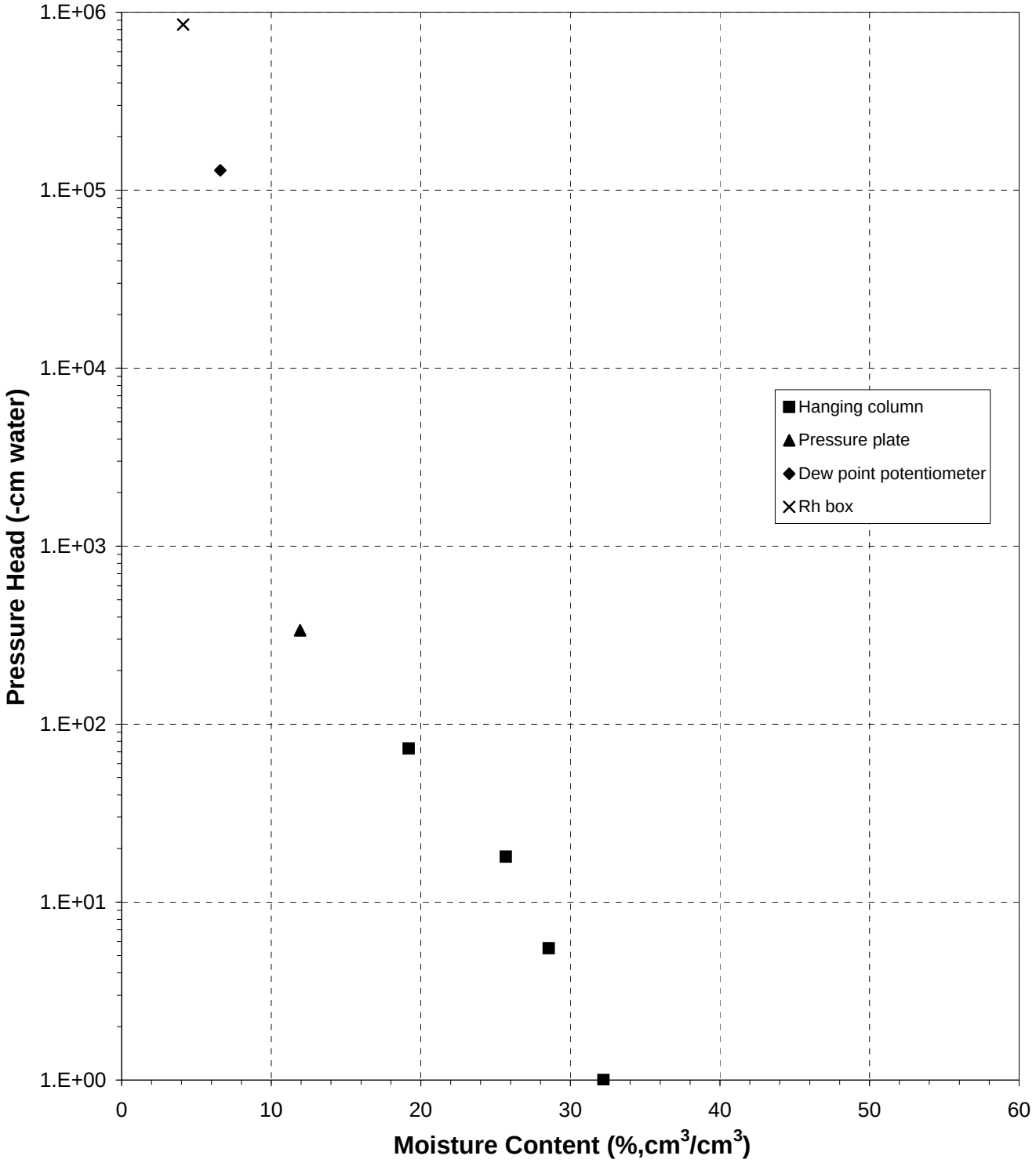
† Assumed density of water is 1.0 $g/cm^3$

‡‡ Volume adjustments are applicable at this matric potential (see comment #1).

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

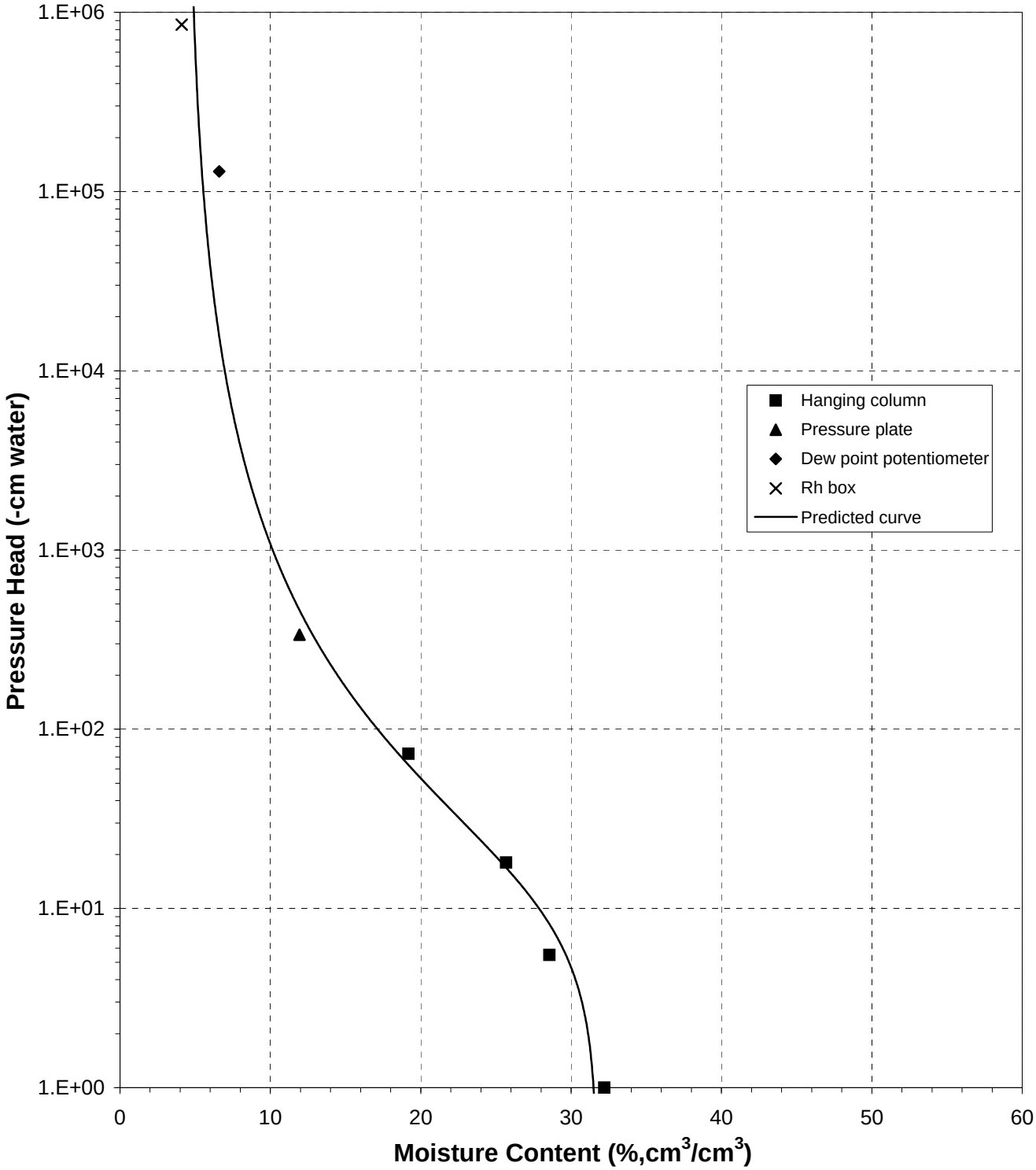
## Water Retention Data Points

*Sample Number: TP-03*



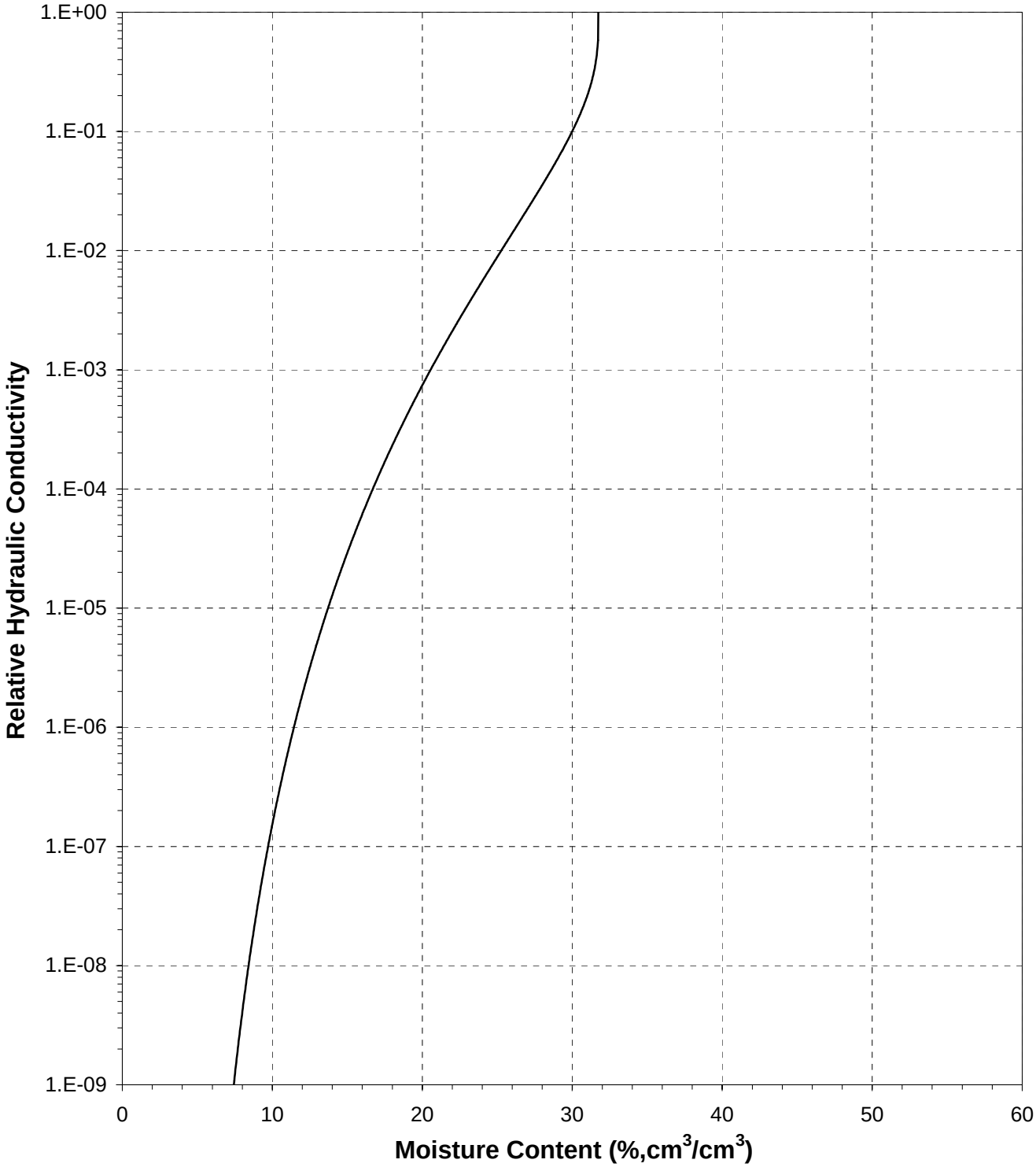
## Predicted Water Retention Curve and Data Points

*Sample Number: TP-03*



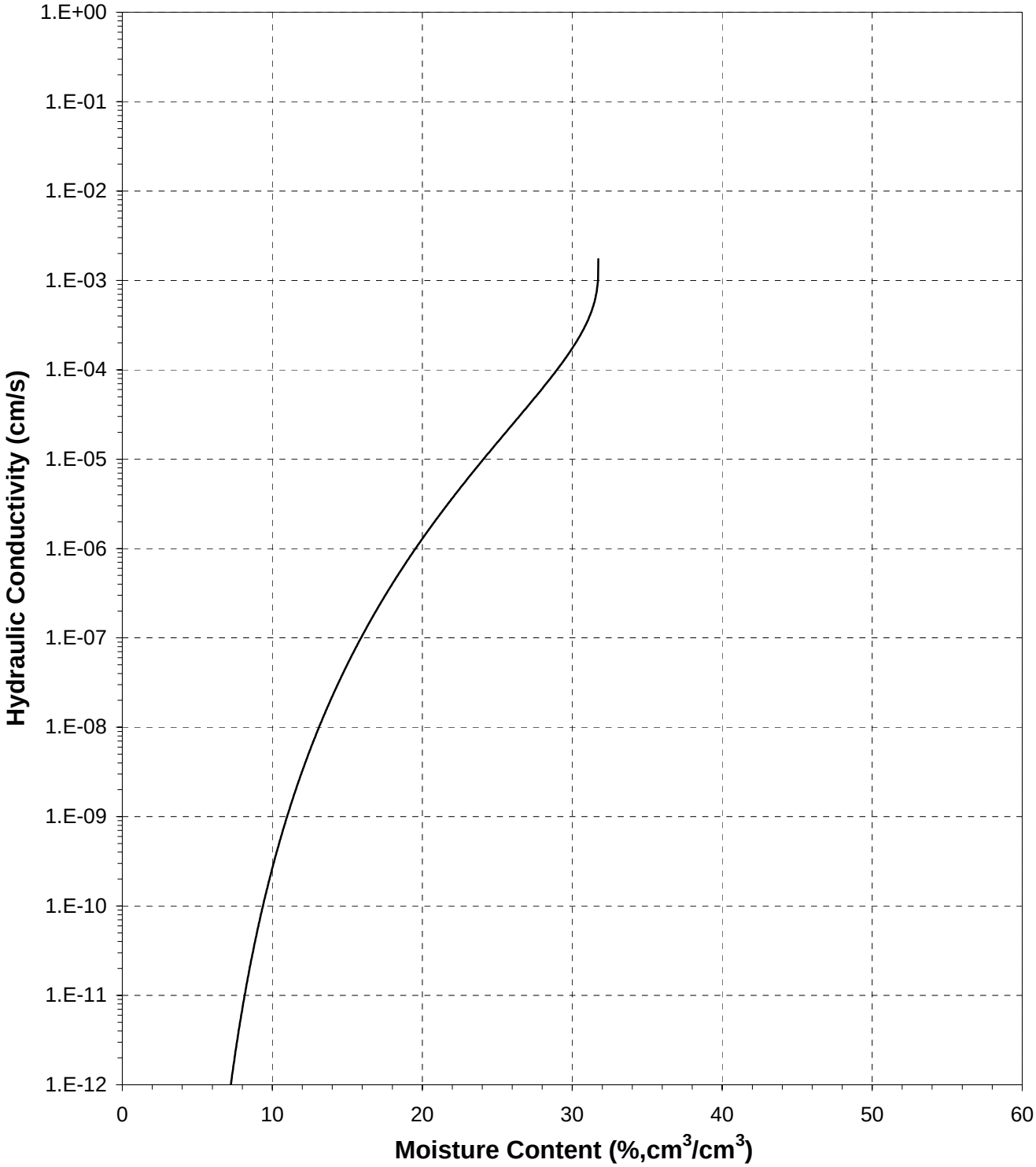
## Plot of Relative Hydraulic Conductivity vs Moisture Content

*Sample Number: TP-03*



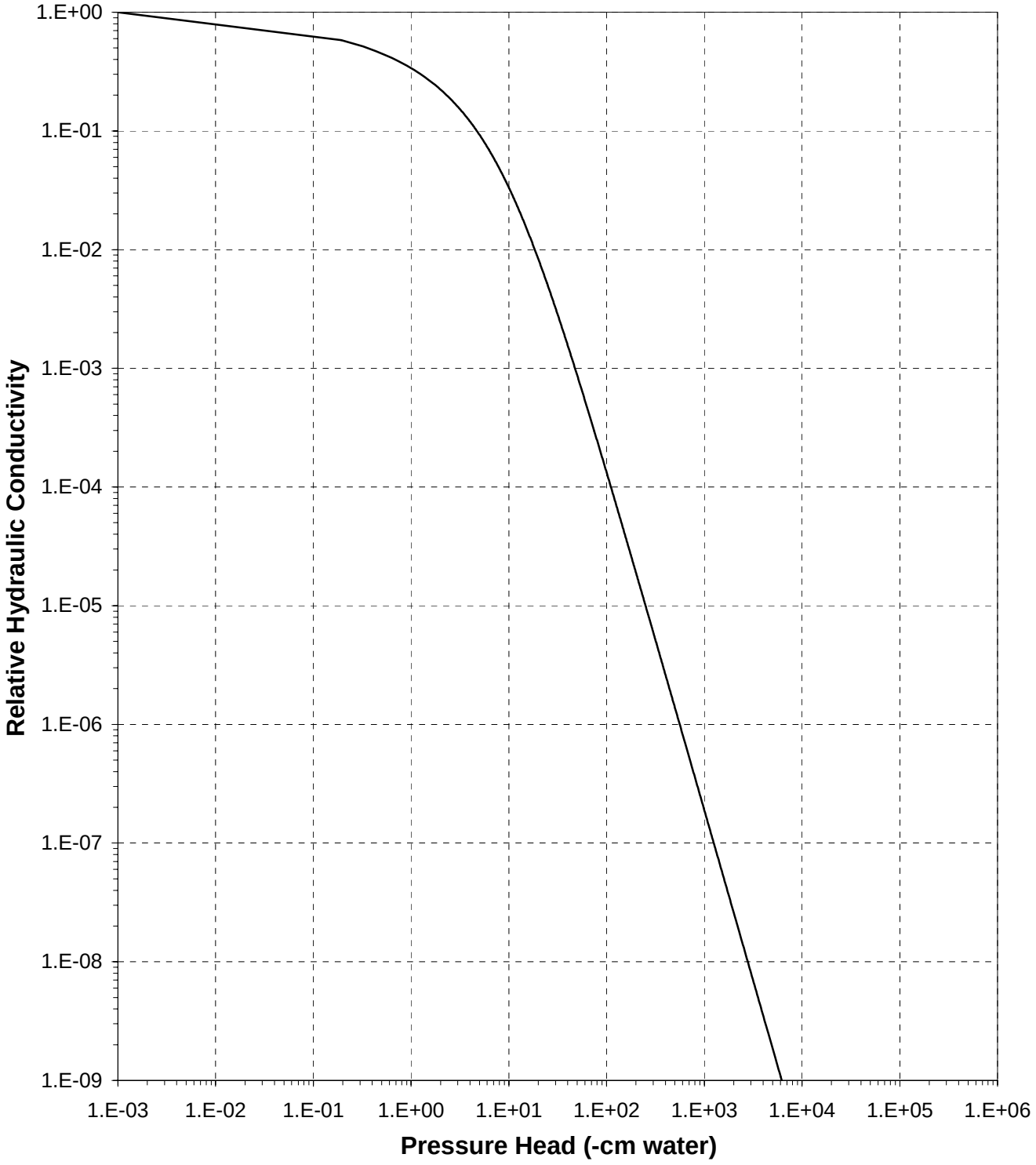
## Plot of Hydraulic Conductivity vs Moisture Content

*Sample Number: TP-03*



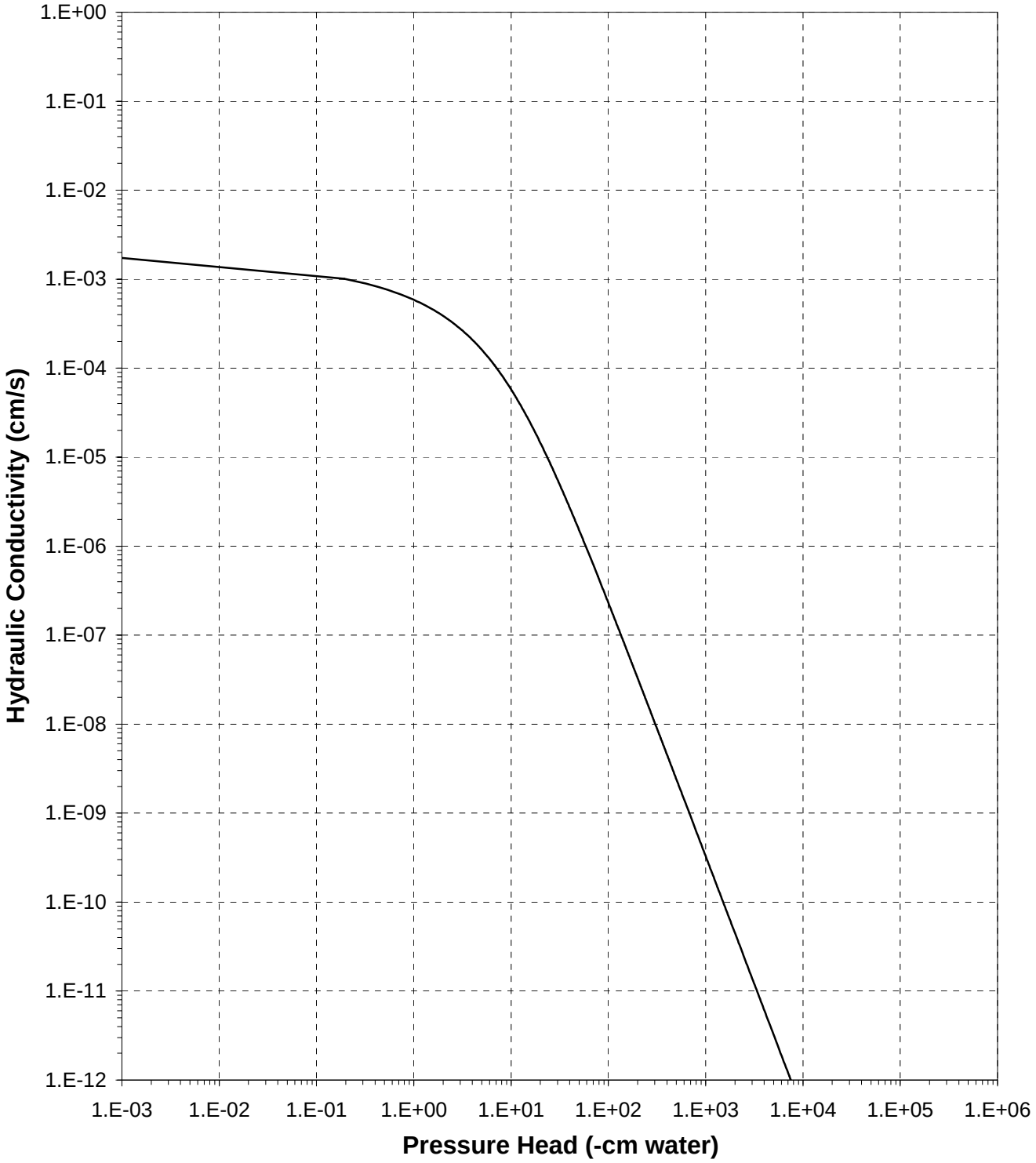
## Plot of Relative Hydraulic Conductivity vs Pressure Head

*Sample Number: TP-03*



## Plot of Hydraulic Conductivity vs Pressure Head

*Sample Number: TP-03*



# Moisture Retention Data

## Hanging Column / Pressure Plate

(Soil-Water Characteristic Curve)

*Job Name:* Brown and Caldwell
*Job Number:* LB09.0104.00
*Sample Number:* TP-04
*Test Locaton Unlined Pond:* Upper Bench
*Location:* NA

*Dry wt. of sample* (g): 413.64
*Tare wt., ring* (g): 133.07
*Tare wt., screen & clamp* (g): 27.97
*Initial sample volume* ($cm^3$): 223.73
*Initial dry bulk density* ($g/cm^3$): 1.85
*Client Provided particle density* ($g/cm^3$): 2.63
*Initial calculated total porosity* (%): 29.78

| | Date | Time | Weight* (g) | Matric Potential (-cm water) | Moisture Content† (% vol) |
|---|---|---|---|---|---|
| *Hanging column:* | 20-May-09 | 14:00 | 639.96 | 0 | 29.18 |
| | 26-May-09 | 10:25 | 631.36 | 7.0 | 25.33 |
| | 2-Jun-09 | 9:30 | 619.35 | 23.0 | 19.97 |
| | 8-Jun-09 | 10:00 | 606.85 | 99.0 | 14.38 |
| *Pressure plate:* | 16-Jun-09 | 9:30 | 595.34 | 337 | 9.23 |

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 | --- | --- | --- | --- |
| | 23.0 | --- | --- | --- | --- |
| | 99.0 | --- | --- | --- | --- |
| *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).

*Technician Notes:*

*Laboratory analysis by:* K. Wright/ R. Marshall
*Data entered by:* R. Marshall
*Checked by:* J. Hines

# Moisture Retention Data

**Dew Point Potentiometer / Relative Humidity Box**

(Soil-Water Characteristic Curve)

*Sample Number:* TP-04

*Dry weight* of dew point potentiometer sample* (g)*:* 146.58
*Tare weight, jar* (g)*:* 112.93
*Initial sample bulk density* (g/cm$^3$)*:* 1.85

| | Date | Time | Weight* (g) | Water Potential (-cm water) | Moisture Content† (% vol) |
|---|---|---|---|---|---|
| *Dew point potentiometer:* | 20-May-09 | 12:20 | 147.53 | 240673 | 5.24 |

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:* | 240673 | --- | --- | --- | --- |

*Dry weight* of relative humidity box sample* (g)*:* 67.22
*Tare weight* (g)*:* 40.74
*Initial sample bulk density* (g/cm$^3$)*:* 1.85

| | Date | Time | Weight* (g) | Water Potential (-cm water) | Moisture Moisture Content† (% vol) |
|---|---|---|---|---|---|
| *Relative humidity box:* | 19-May-09 | 8:10 | 67.75 | 854159 | 3.66 |

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:* | 854159 | --- | --- | --- | --- |

*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

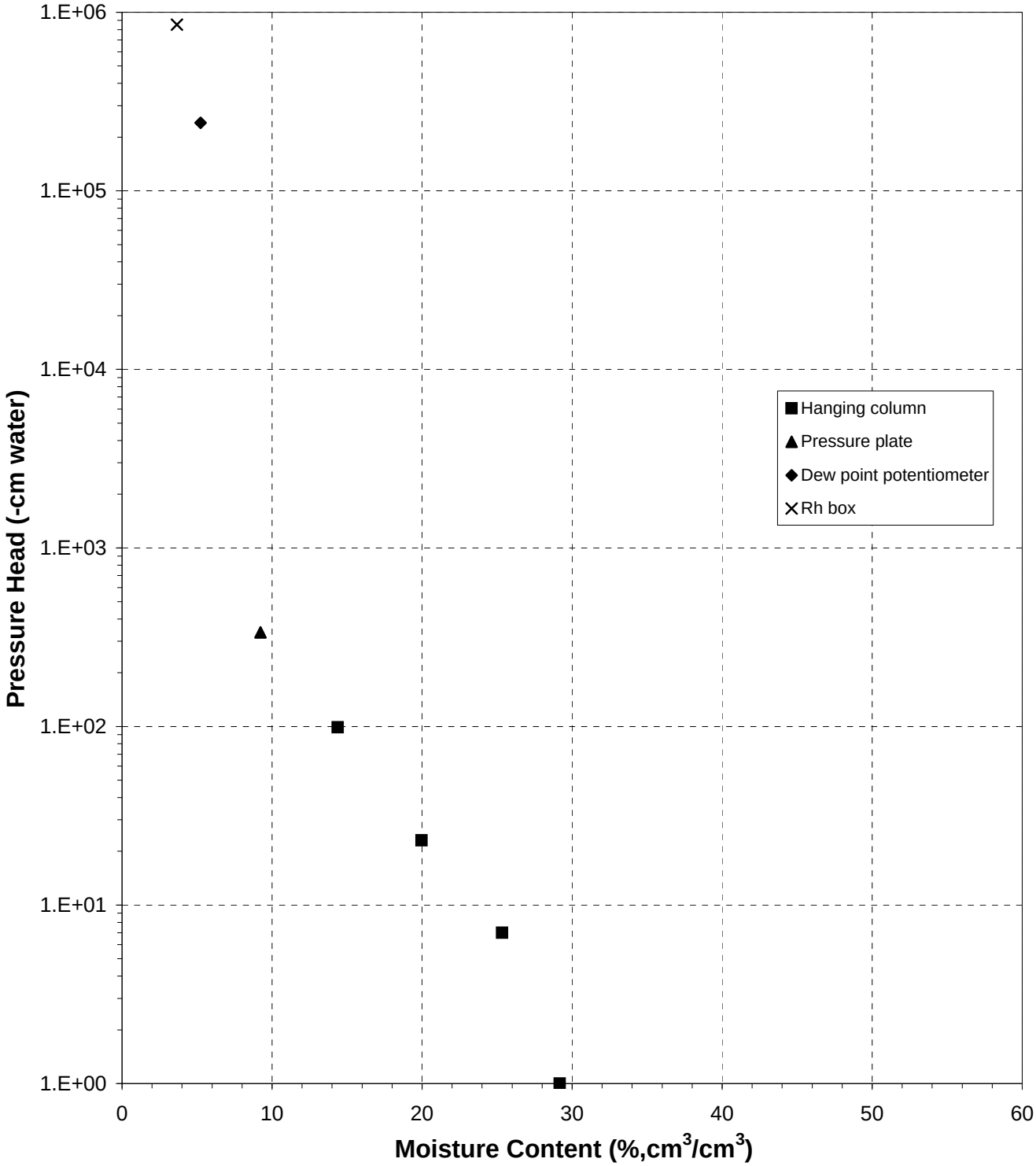
† Assumed density of water is 1.0 g/cm$^3$

‡‡ Volume adjustments are applicable at this matric potential (see comment #1).

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

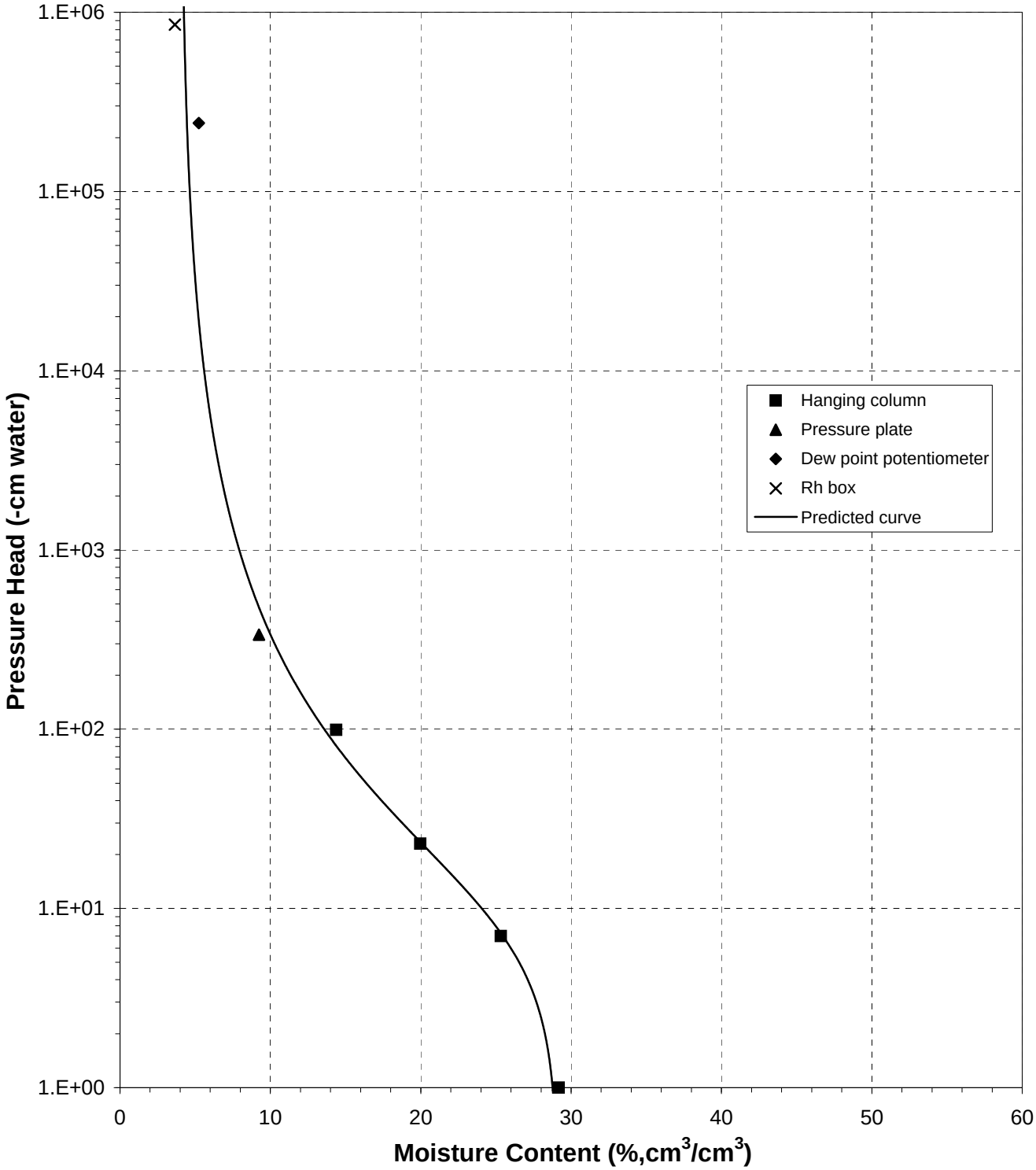
## Water Retention Data Points

*Sample Number: TP-04*



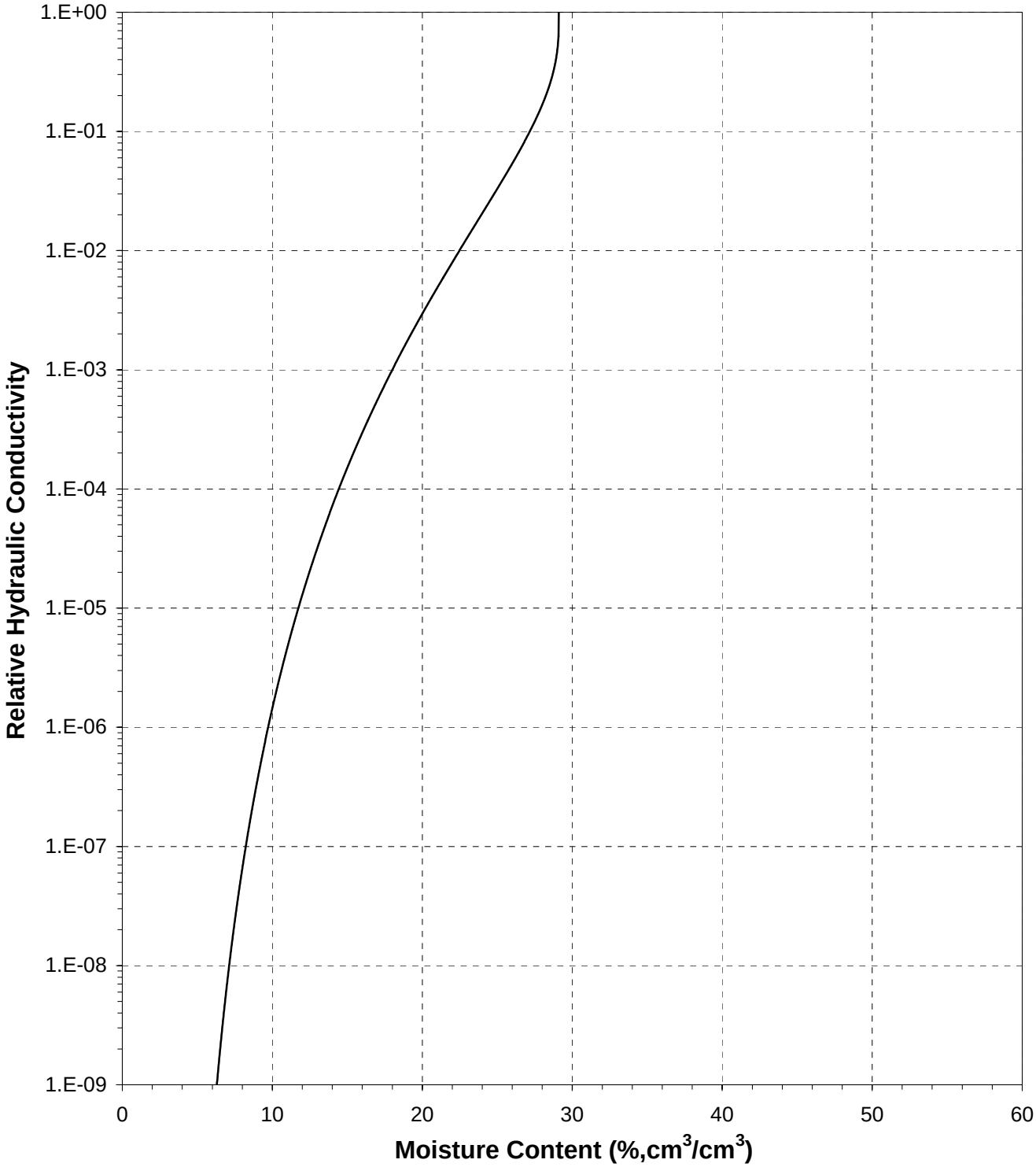
## Predicted Water Retention Curve and Data Points

*Sample Number: TP-04*



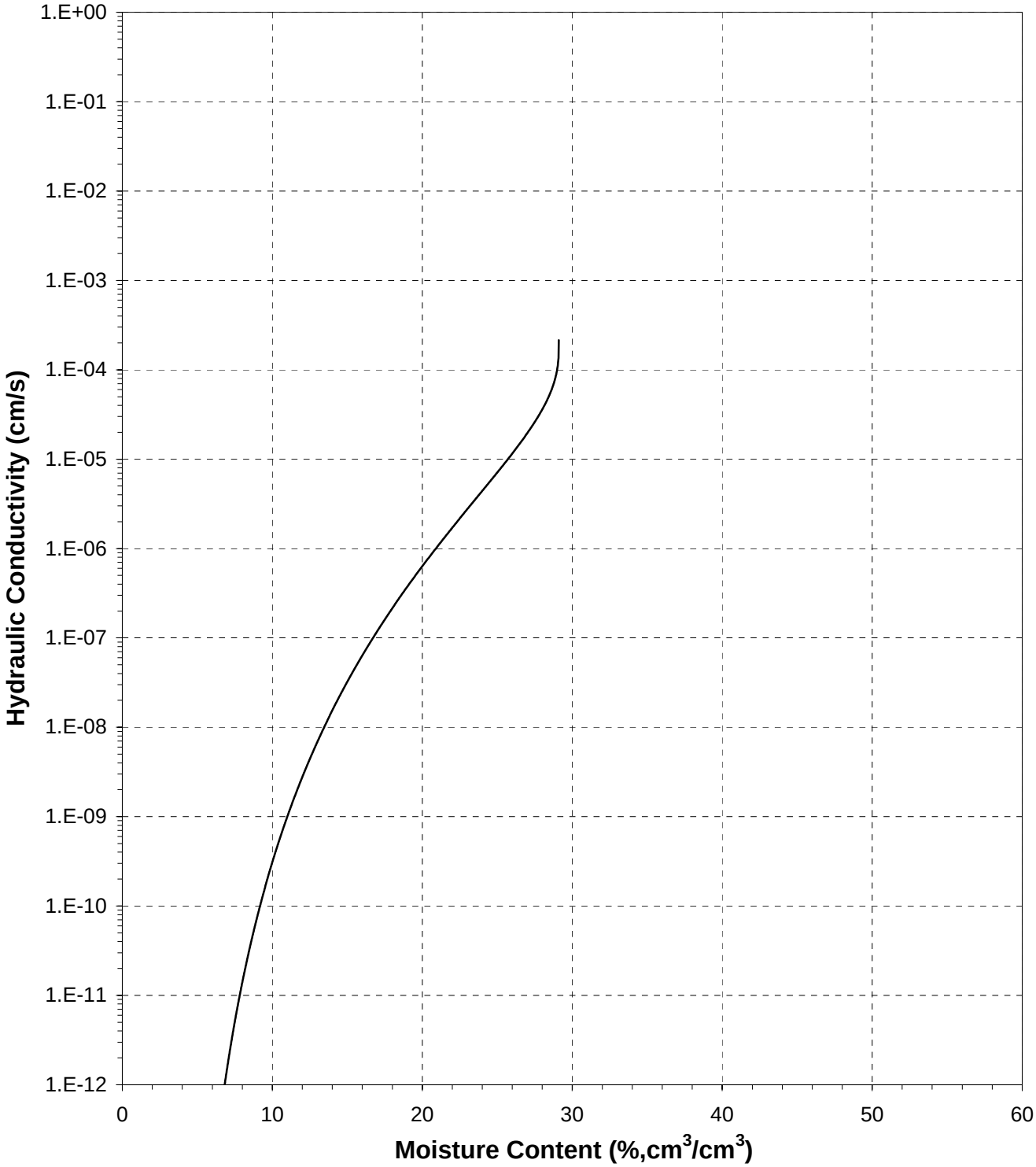
## Plot of Relative Hydraulic Conductivity vs Moisture Content

*Sample Number: TP-04*



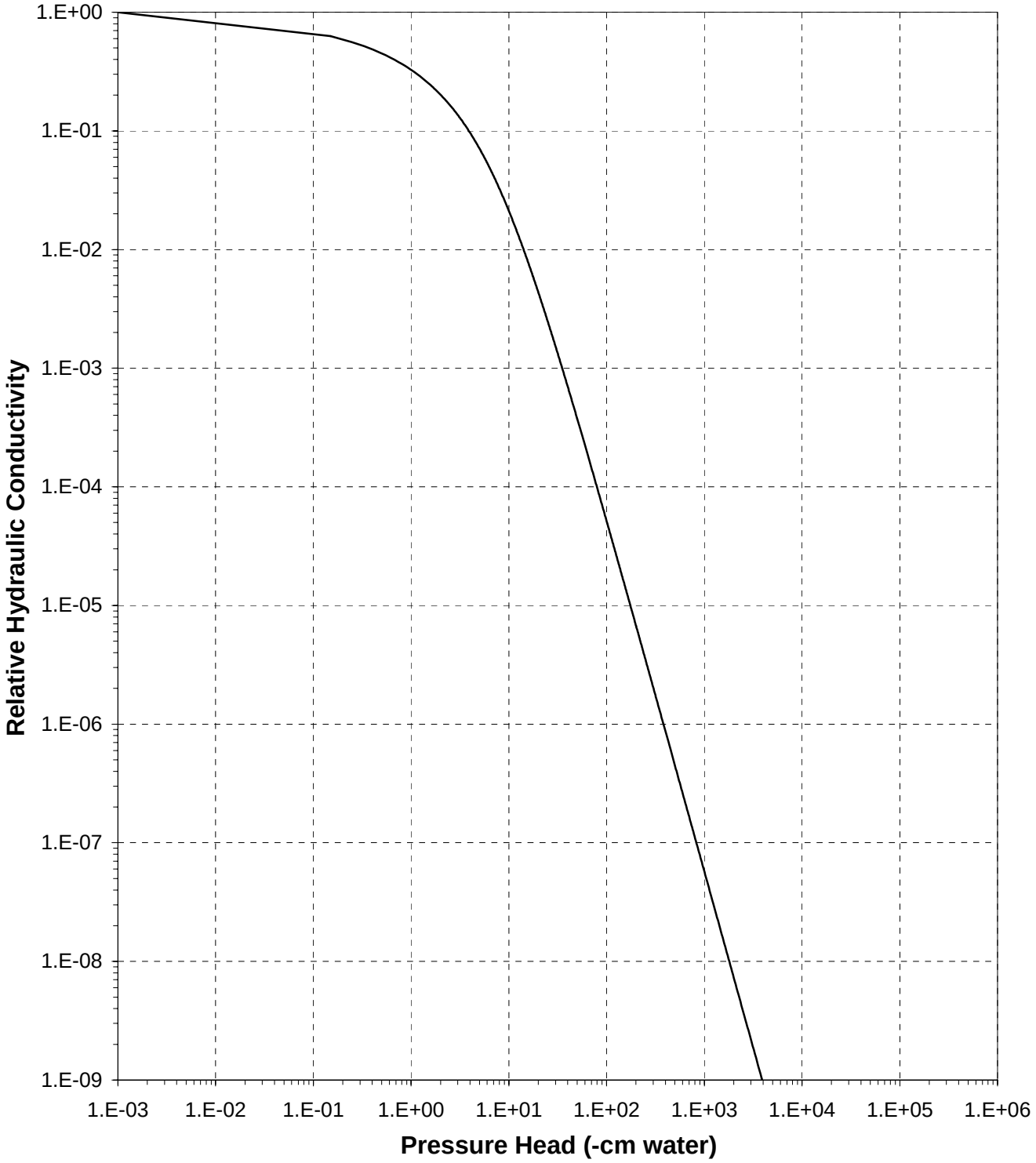
## Plot of Hydraulic Conductivity vs Moisture Content

*Sample Number: TP-04*



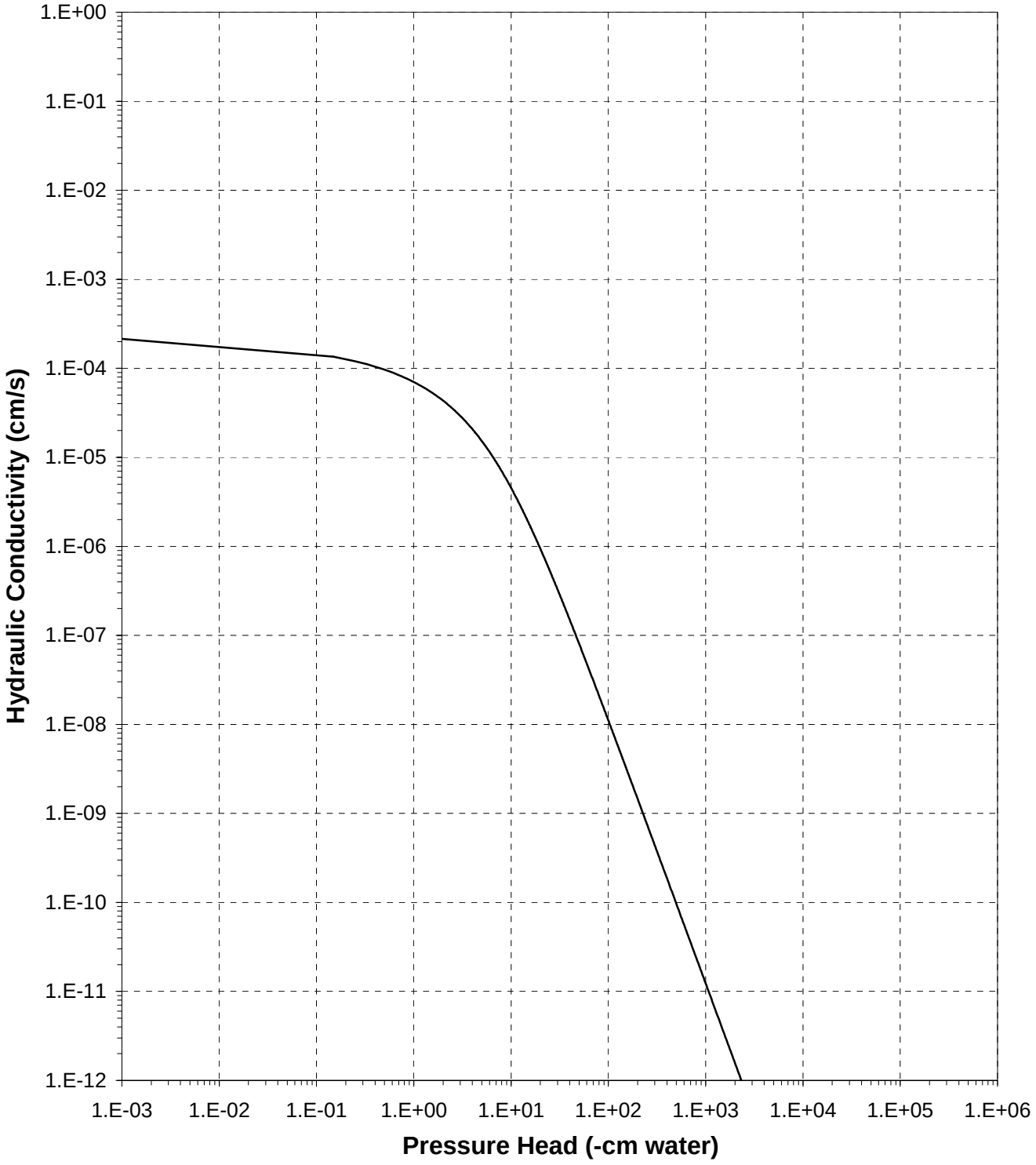
## Plot of Relative Hydraulic Conductivity vs Pressure Head

*Sample Number: TP-04*



## Plot of Hydraulic Conductivity vs Pressure Head

*Sample Number: TP-04*



# Moisture Retention Data

## Hanging Column / Pressure Plate

(Soil-Water Characteristic Curve)

*Job Name:* Brown and Caldwell
*Job Number:* LB09.0104.00
*Sample Number:* TP-05
*Test Locaton Unlined Pond:* Upper Bench
*Location:* NA

*Dry wt. of sample* (g): 408.58
*Tare wt., ring* (g): 132.56
*Tare wt., screen & clamp* (g): 28.23
*Initial sample volume* ($cm^3$): 223.08
*Initial dry bulk density* ($g/cm^3$): 1.83
*Client Provided particle density* ($g/cm^3$): 2.64
*Initial calculated total porosity* (%): 30.70

| | Date | Time | Weight* (g) | Matric Potential (-cm water) | Moisture Content† (% vol) |
|---|---|---|---|---|---|
| *Hanging column:* | 20-May-09 | 13:50 | 639.54 | 0 | 31.45 |
| | 26-May-09 | 10:20 | 632.93 | 9.0 | 28.49 |
| | 2-Jun-09 | 9:05 | 623.14 | 26.0 | 24.10 |
| | 8-Jun-09 | 10:00 | 608.89 | 101.5 | 17.72 |
| *Pressure plate:* | 16-Jun-09 | 9:30 | 596.47 | 337 | 12.15 |

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 | --- | --- | --- | --- |
| | 9.0 | --- | --- | --- | --- |
| | 26.0 | --- | --- | --- | --- |
| | 101.5 | --- | --- | --- | --- |
| *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).

*Technician Notes:*

*Laboratory analysis by:* K. Wright/ R. Marshall
*Data entered by:* R. Marshall
*Checked by:* J. Hines

# Moisture Retention Data

## Dew Point Potentiometer / Relative Humidity Box

(Soil-Water Characteristic Curve)

*Sample Number:* TP-05

*Dry weight* of dew point potentiometer sample* (g)*:* 144.56
*Tare weight, jar* (g)*:* 116.42
*Initial sample bulk density* ($g/cm^3$)*:* 1.83

| | Date | Time | Weight* (g) | Water Potential (-cm water) | Moisture Content† (% vol) |
|---|---|---|---|---|---|
| *Dew point potentiometer:* | 19-May-09 | 12:20 | 145.59 | 214158 | 6.72 |

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:* | 214158 | --- | --- | --- | --- |

*Dry weight* of relative humidity box sample* (g)*:* 65.36
*Tare weight* (g)*:* 38.35
*Initial sample bulk density* ($g/cm^3$)*:* 1.83

| | Date | Time | Weight* (g) | Water Potential (-cm water) | Moisture Moisture Content† (% vol) |
|---|---|---|---|---|---|
| *Relative humidity box:* | 19-May-09 | 8:10 | 66.06 | 854159 | 4.73 |

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:* | 854159 | --- | --- | --- | --- |

*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

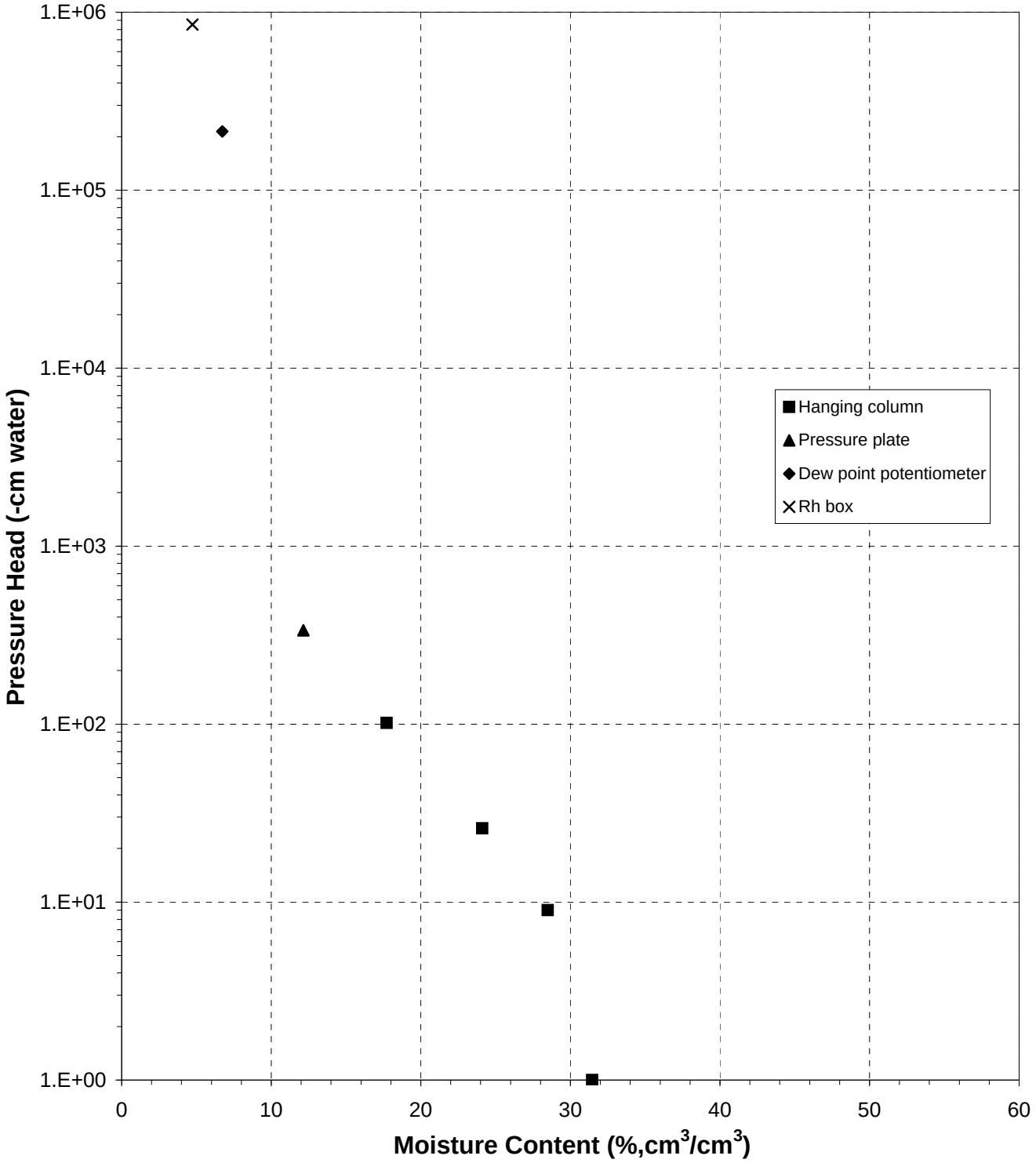
† Assumed density of water is 1.0 $g/cm^3$

‡‡ Volume adjustments are applicable at this matric potential (see comment #1).

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

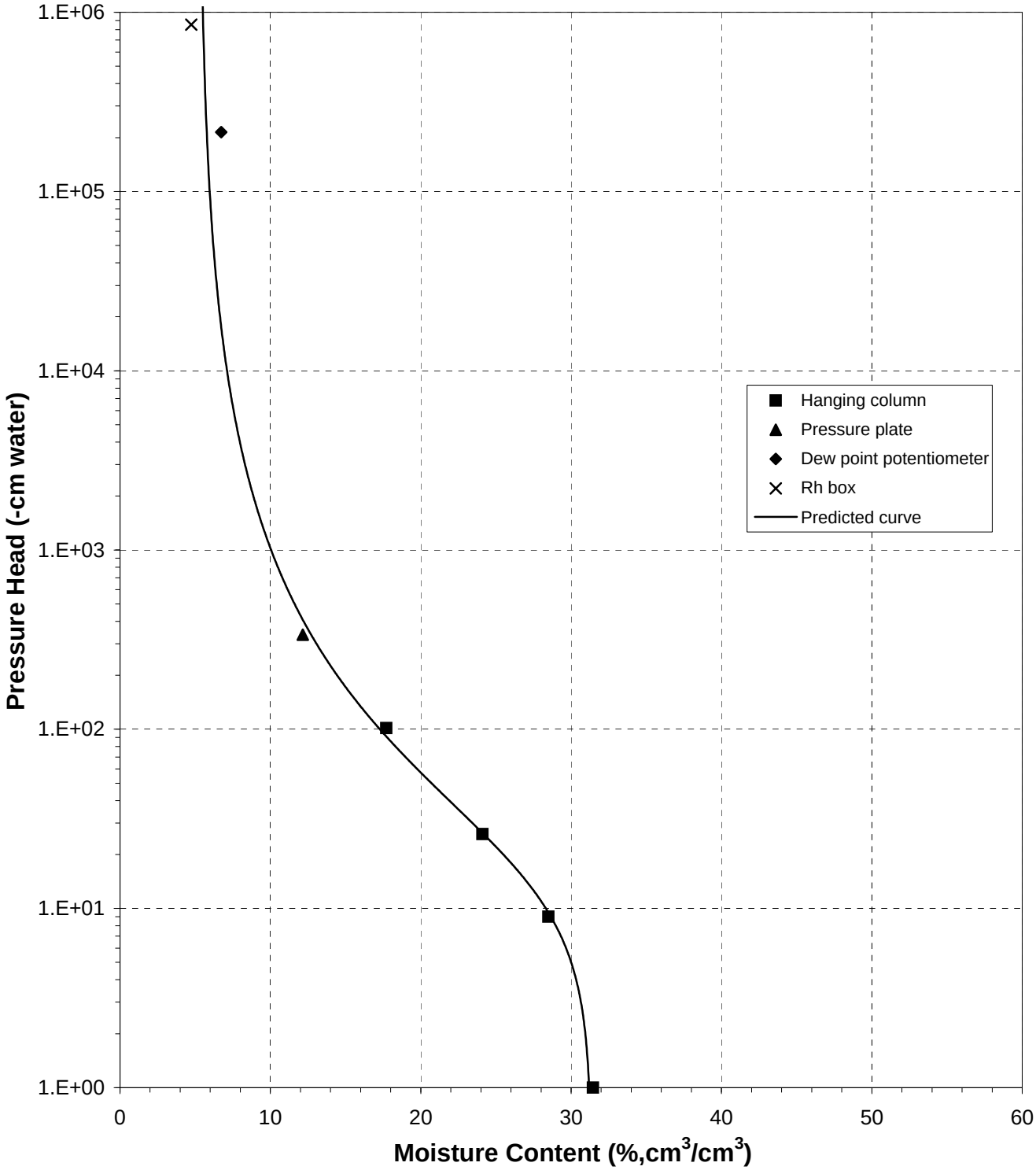
## Water Retention Data Points

*Sample Number: TP-05*



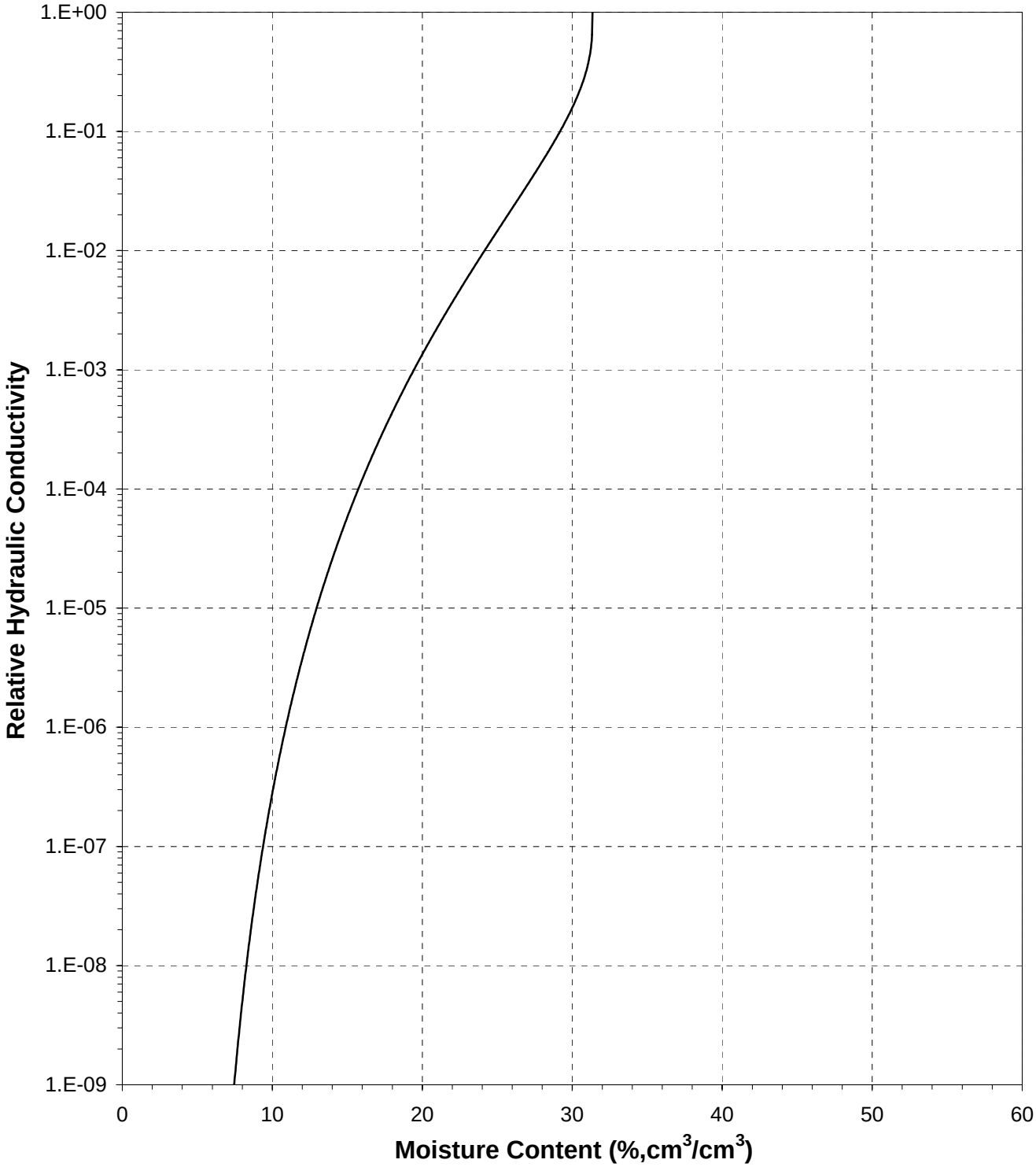
## Predicted Water Retention Curve and Data Points

*Sample Number: TP-05*



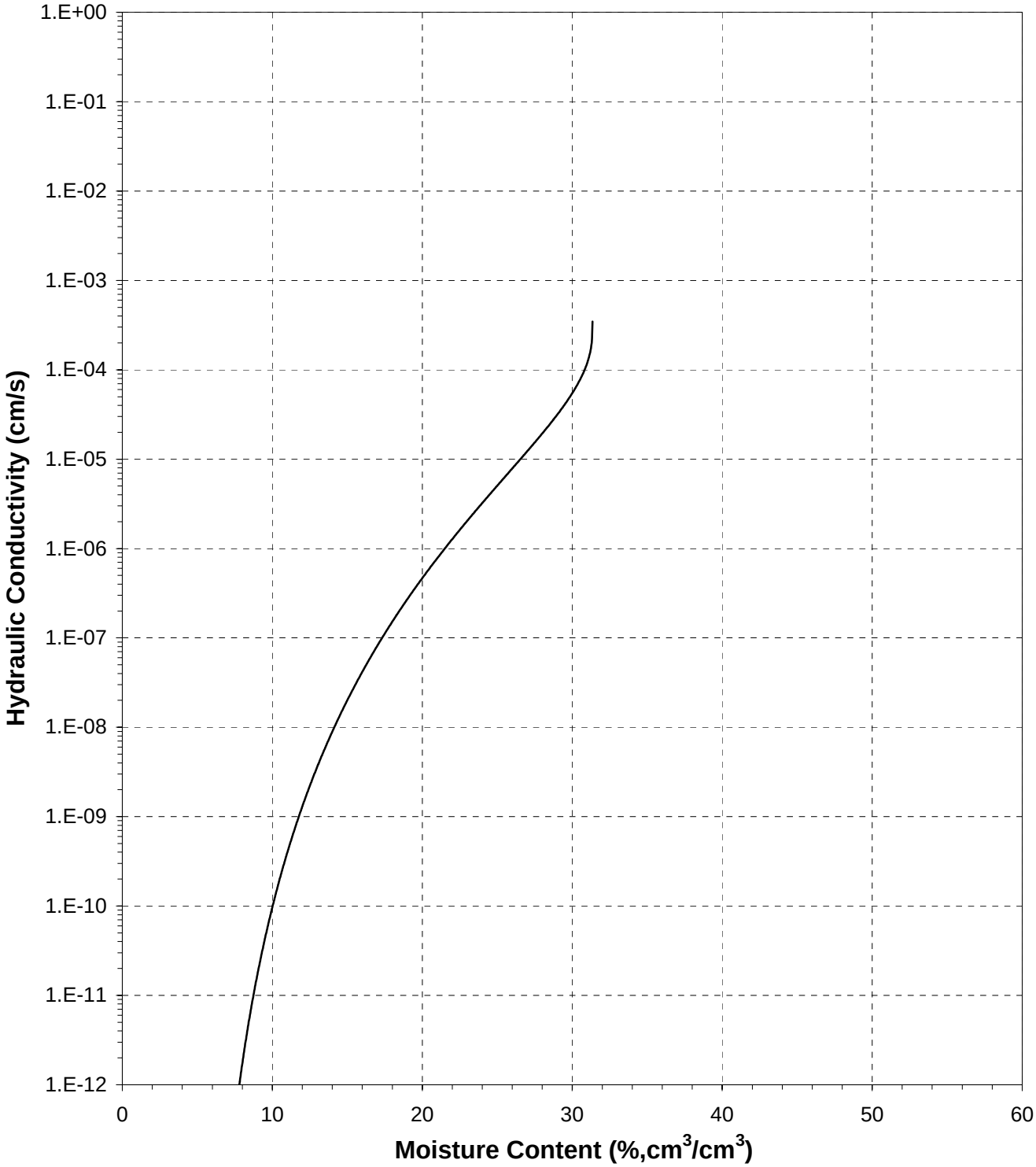
## Plot of Relative Hydraulic Conductivity vs Moisture Content

*Sample Number: TP-05*



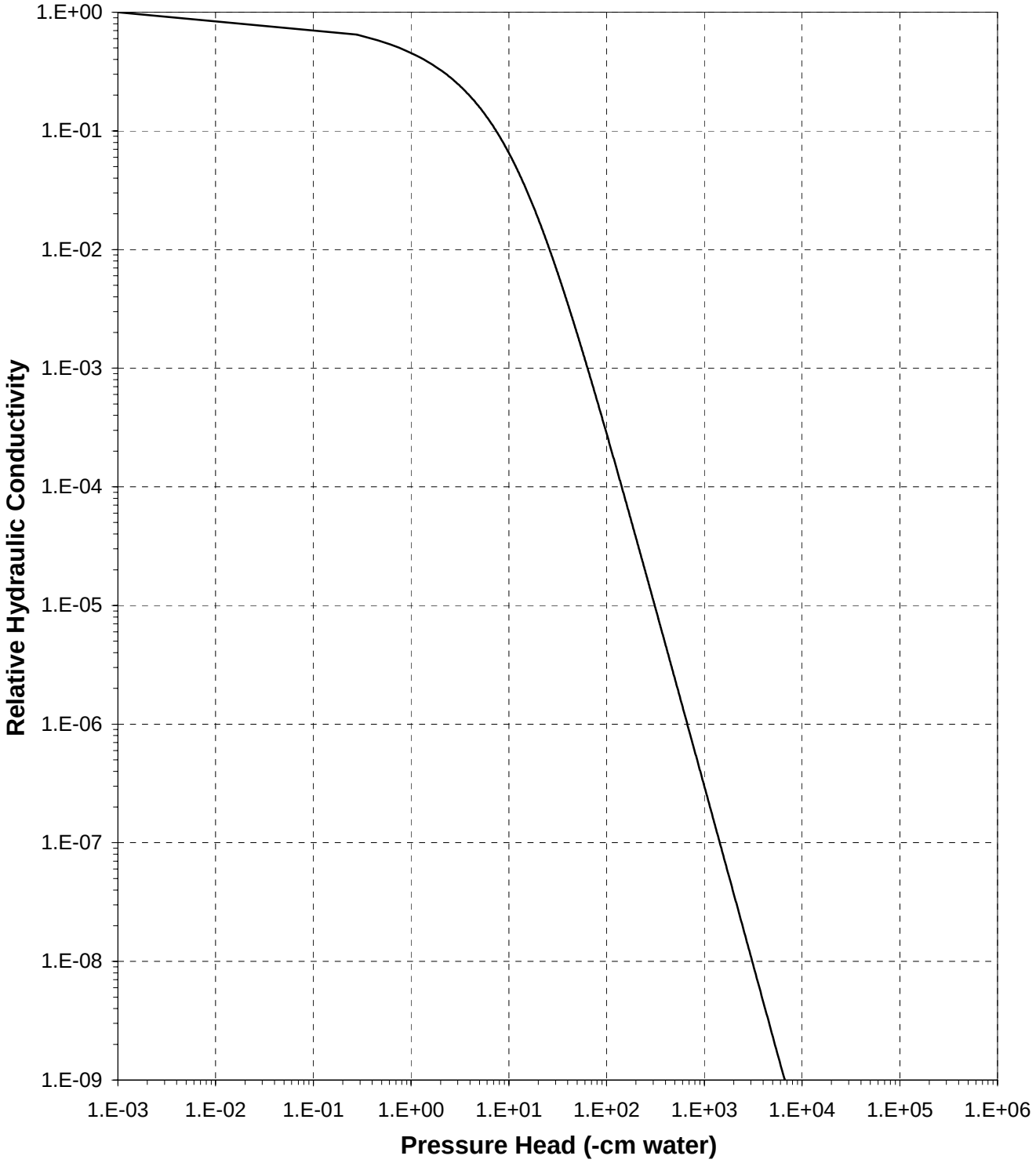
## Plot of Hydraulic Conductivity vs Moisture Content

*Sample Number: TP-05*



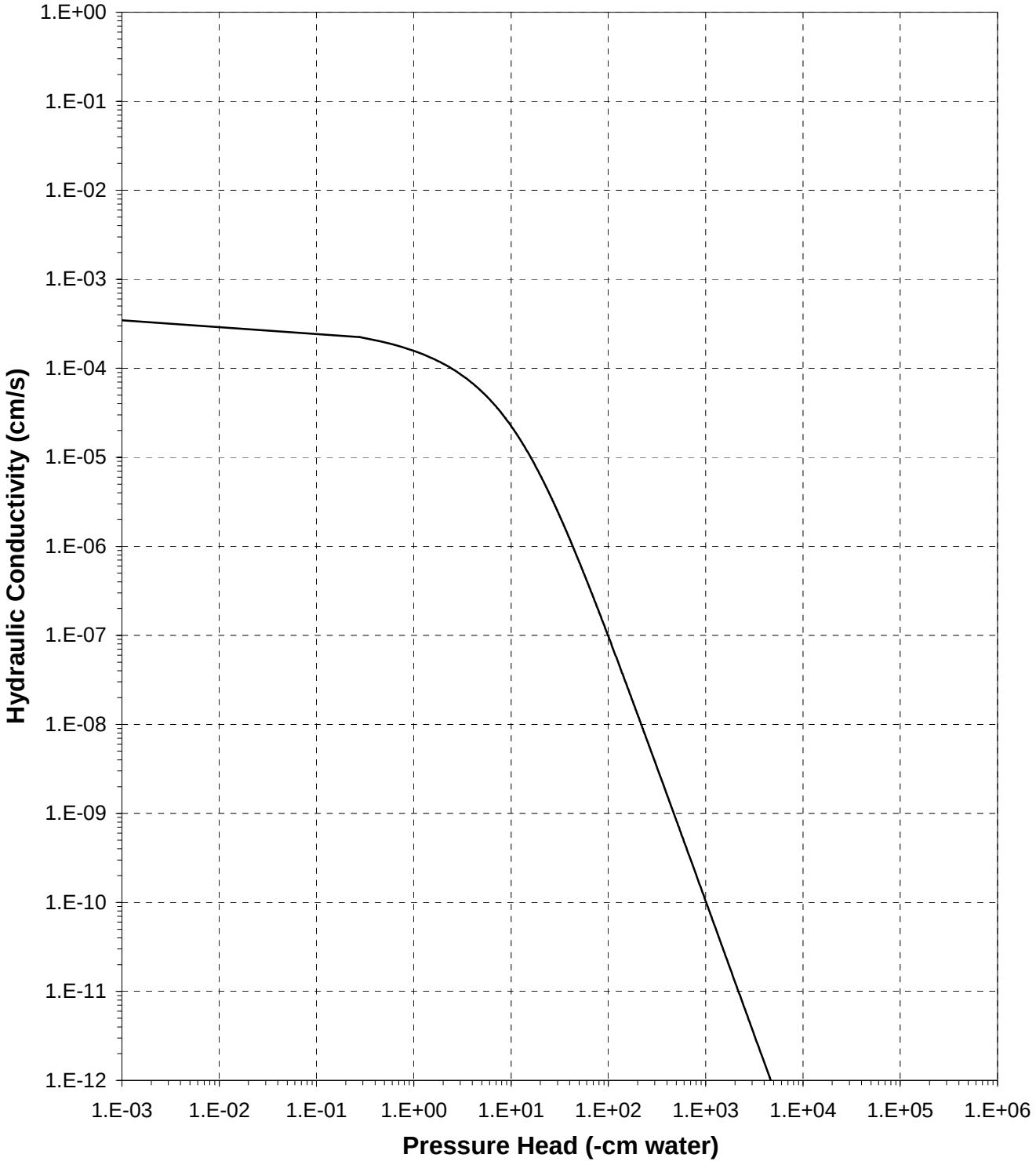
## Plot of Relative Hydraulic Conductivity vs Pressure Head

*Sample Number: TP-05*



## Plot of Hydraulic Conductivity vs Pressure Head

*Sample Number: TP-05*



# Laboratory Tests and Methods

# Tests and Methods

| | |
|---|---|
| Dry Bulk Density: | ASTM D6836 |
| Moisture Content: | ASTM D2216; ASTM D6836 |
| Calculated Porosity: | ASTM D6836 |
| Saturated Hydraulic Conductivity: | |
| Constant Head: (Rigid Wall) | ASTM D 2434 (modified apparatus) |
| Hanging Column Method: | ASTM D6836; Klute, A. 1986. Porosity. Chp.26, in A. Klute (ed.), Methods of Soil Analysis, American Society of Agronomy, Madison, WI |
| Pressure Plate Method: | ASTM D6836; ASTM D2325 |
| Water Potential (Dewpoint Potentiometer) Method: | ASTM D6836; Rawlins, S.L. and G.S. Campbell, 1986. Water Potential: Thermocouple Psychrometry. Chp. 24, pp. 597-619, in A. Klute (ed.), Methods of Soil Analysis, Part 1. American Society of Agronomy, Madison, WI. |
| Relative Humidity (Box) Method: | Karathanasis & Hajek. 1982. Quantitative Evaluation of Water Adsorption on Soil Clays.SSA Journal 46:1321-1325; Campbell, G. and G. Gee. 1986. Water Potential: Miscellaneous Methods.Chp. 25, pp. 631-632, in A. Klute (ed.), Methods of Soil Analysis, American Society of Agronomy, Madison, WI |
| 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 |