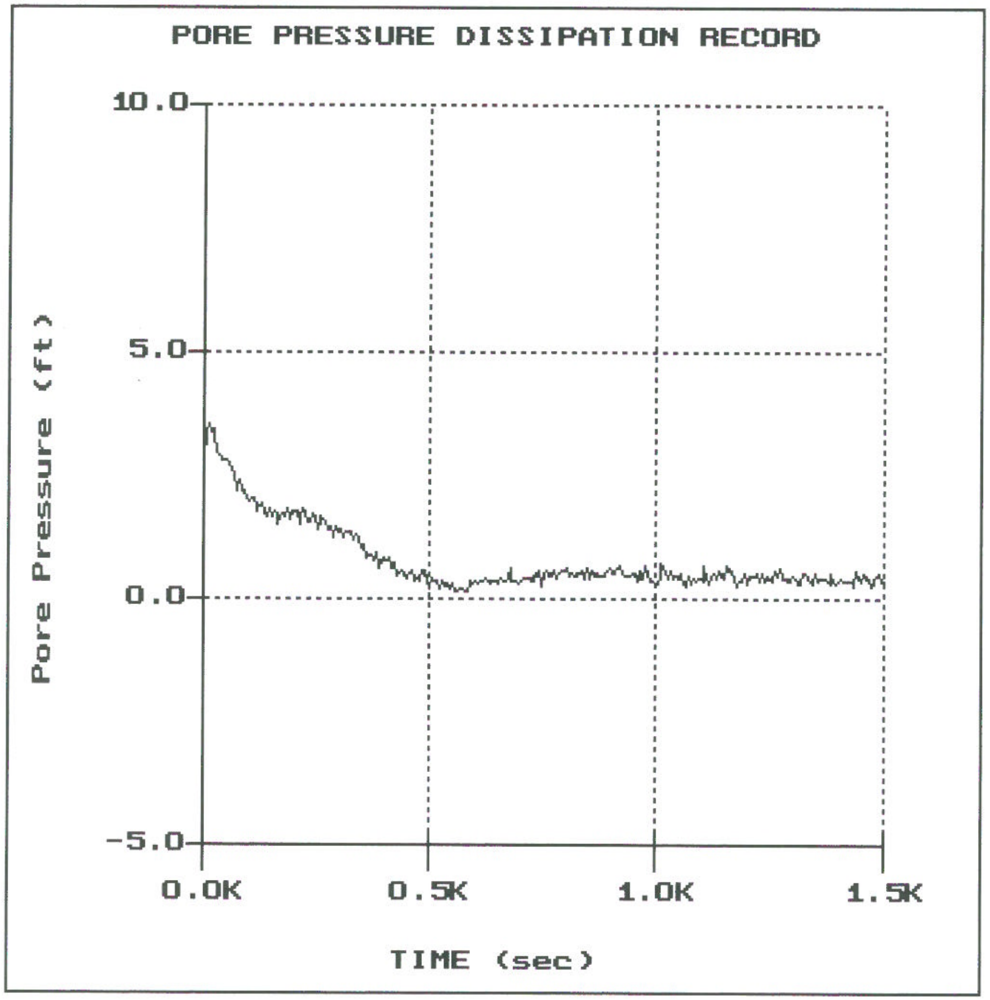
S.M. Stoller

Hole No.:CPT-0390
Location:ATLAS

Cone: 20 Ton St 183
Date:12:18:05 08:29

File: 432CP90.PPD
Depth (m): 15.35
(ft): 50.36
Duration : 1500.0s
U-min: 0.16 580.0s
U-max: 3.54 10.0s



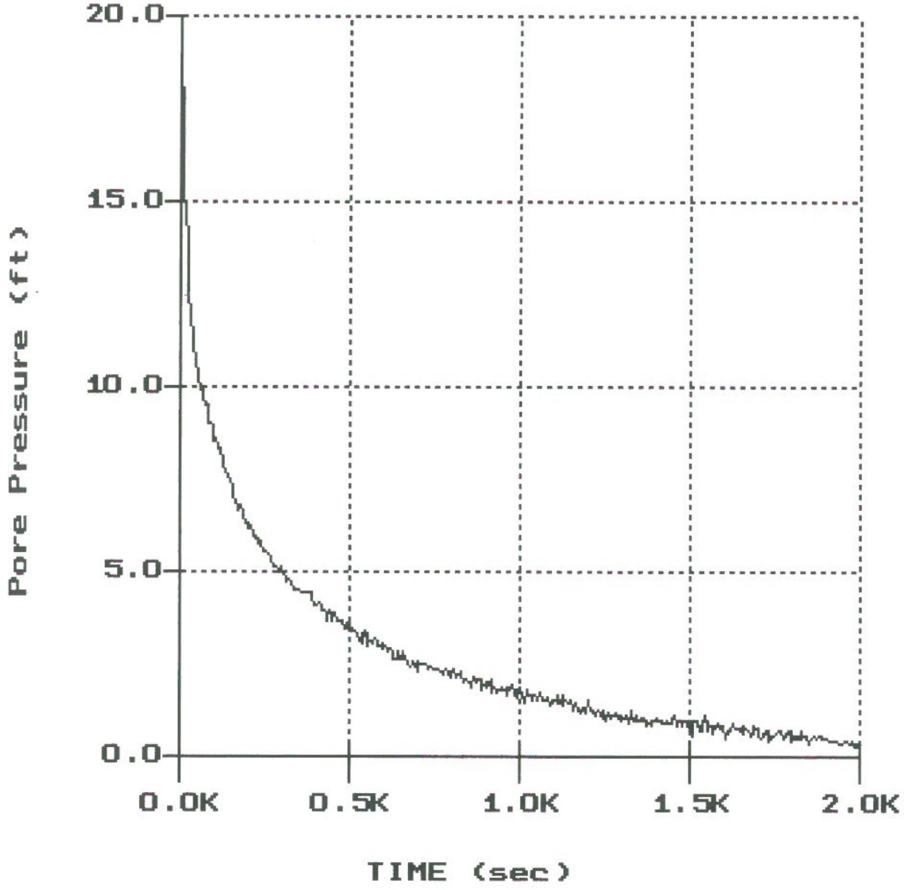
S.M. Stoller

Hole No.:oCPT-0391
Location:ATLAS

Cone: 20 Ton St 183
Date:12:15:05 10:21

File: 432CP91.PPD
Depth (m): 6.05
(ft): 19.85
Duration : 2000.0s
U-min: 0.30 1995.0s
U-max: 18.72 0.0s

PORE PRESSURE DISSIPATION RECORD

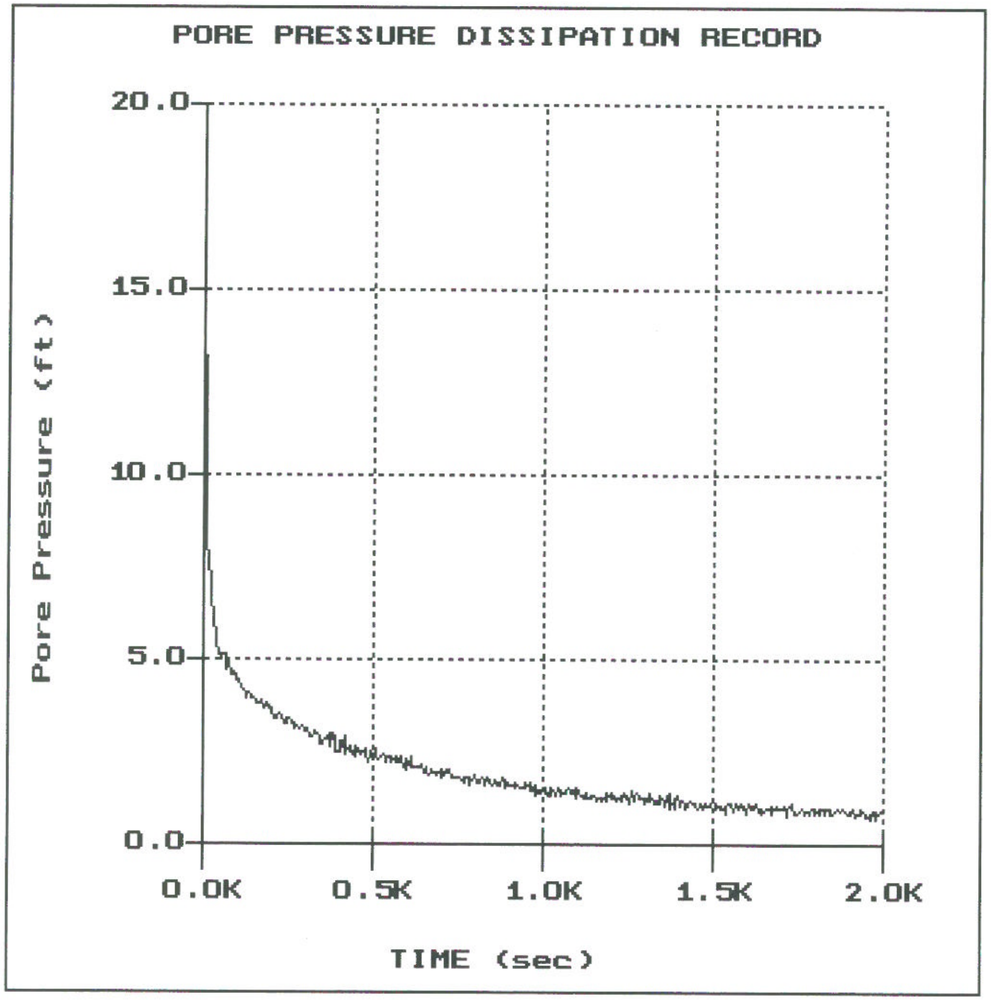


S.M. Stoller

Hole No.:oCPT-0391
Location:ATLAS

Cone: 20 Ton St 183
Date:12:15:05 10:21

File: 432CP91.PPD
Depth (m): 16.05
(ft): 52.66
Duration : 2000.0s
U-min: 0.66 1975.0s
U-max: 17.88 0.0s

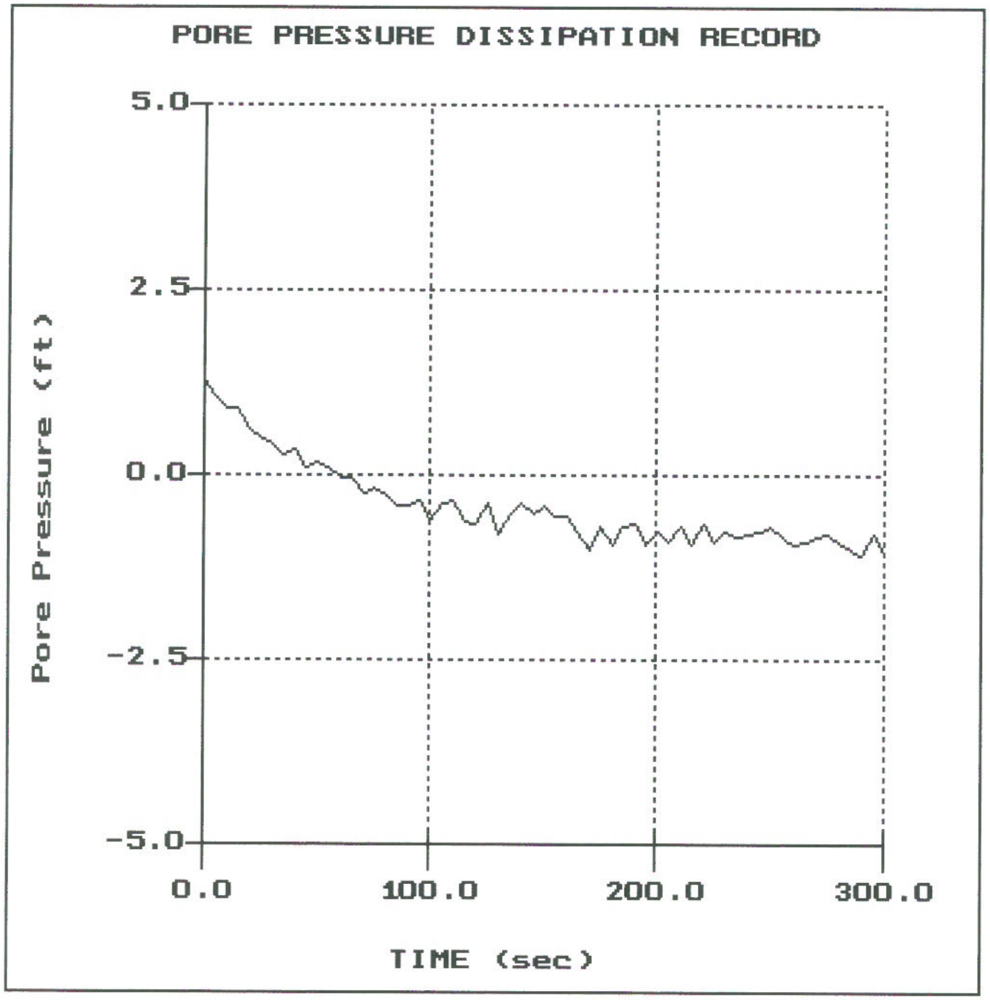


S.M. Stoller

Hole No.:oCPT-0391
Location:ATLAS

Cone: 20 Ton St 183
Date:12:15:05 10:21

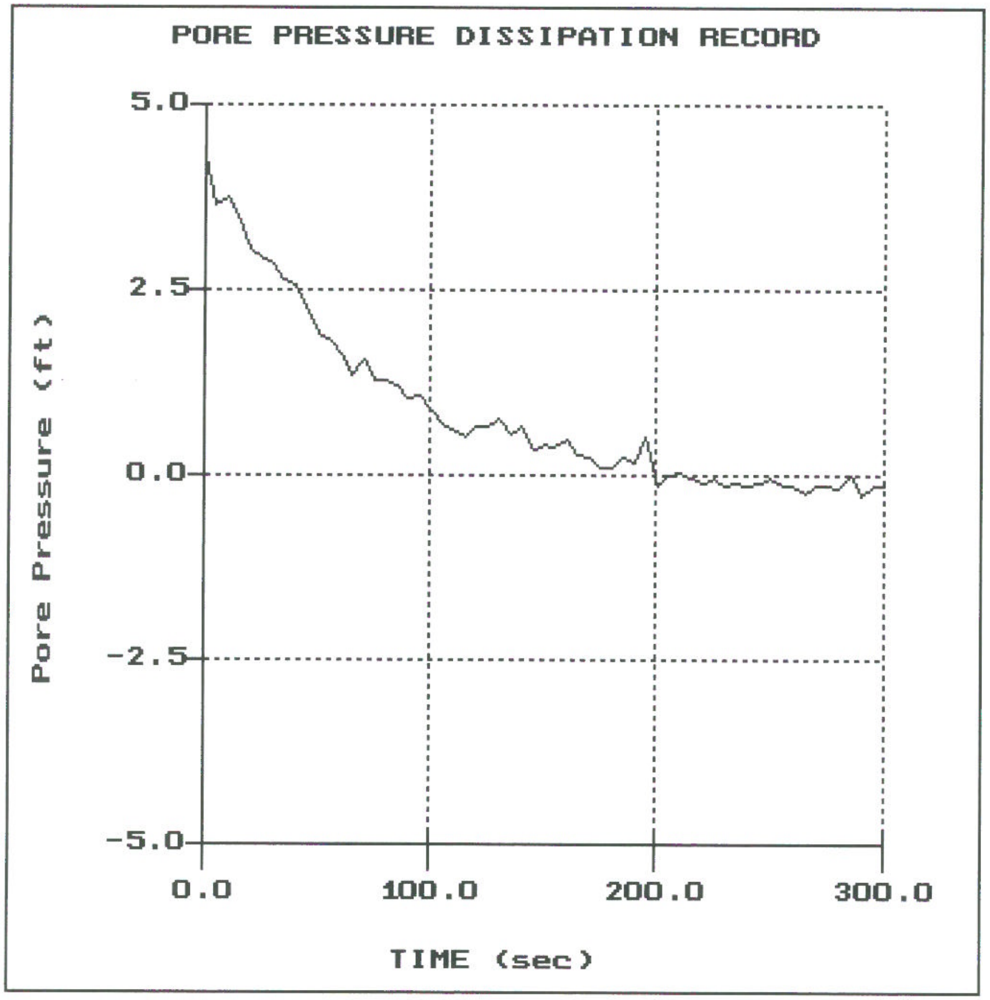
File: 432CP91.PPD
Depth (m): 18.30
(ft): 60.04
Duration : 300.0s
U-min: -1.08 290.0s
U-max: 1.27 0.0s



S.M. Stoller

Hole No.:CPT-0392
Location:ATLAS

Cone: 20 Ton St 183
Date:12:15:05 12:38

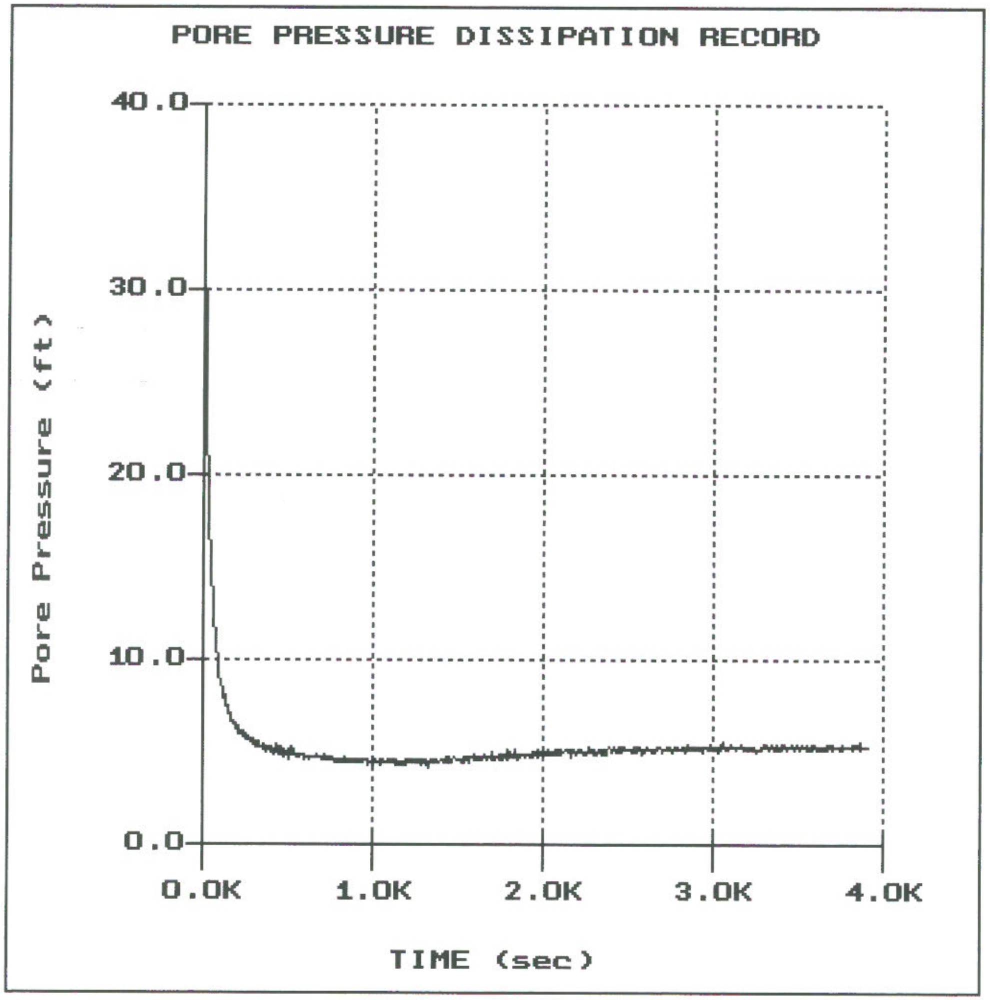

PORE PRESSURE DISSIPATION RECORD

File: 432CP92.PPD
Depth (m): 3.05
(ft): 10.01
Duration : 305.0s
U-min: -0.28 290.0s
U-max: 4.32 0.0s

S.M. Stoller

Hole No.:CPT-0392
Location:ATLAS

Cone: 20 Ton St 183
Date:12:15:05 12:38

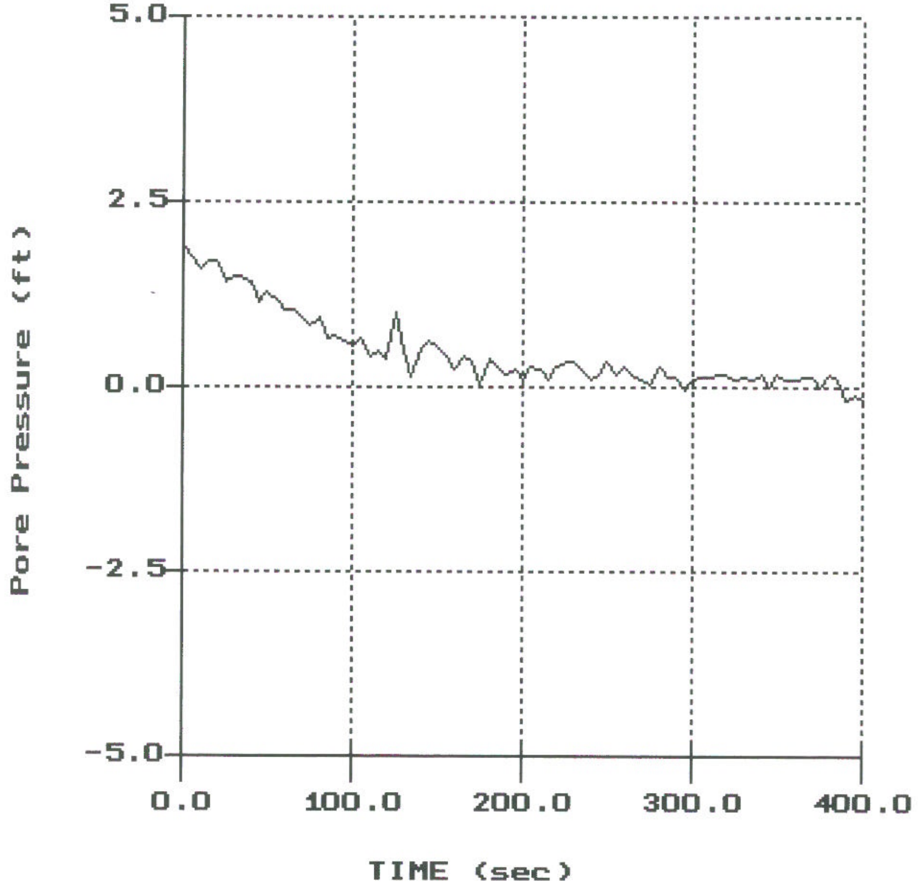


File: 432CP92.PPD
Depth (m): 6.25
(ft): 20.51
Duration : 3915.0s
U-min: 4.22 1330.0s
U-max: 30.74 5.0s

S.M. Stoller

Hole No.:CPT-0392
Location:ATLAS

Cone: 20 Ton St 183
Date:12:15:05 12:38



PORE PRESSURE DISSIPATION RECORD

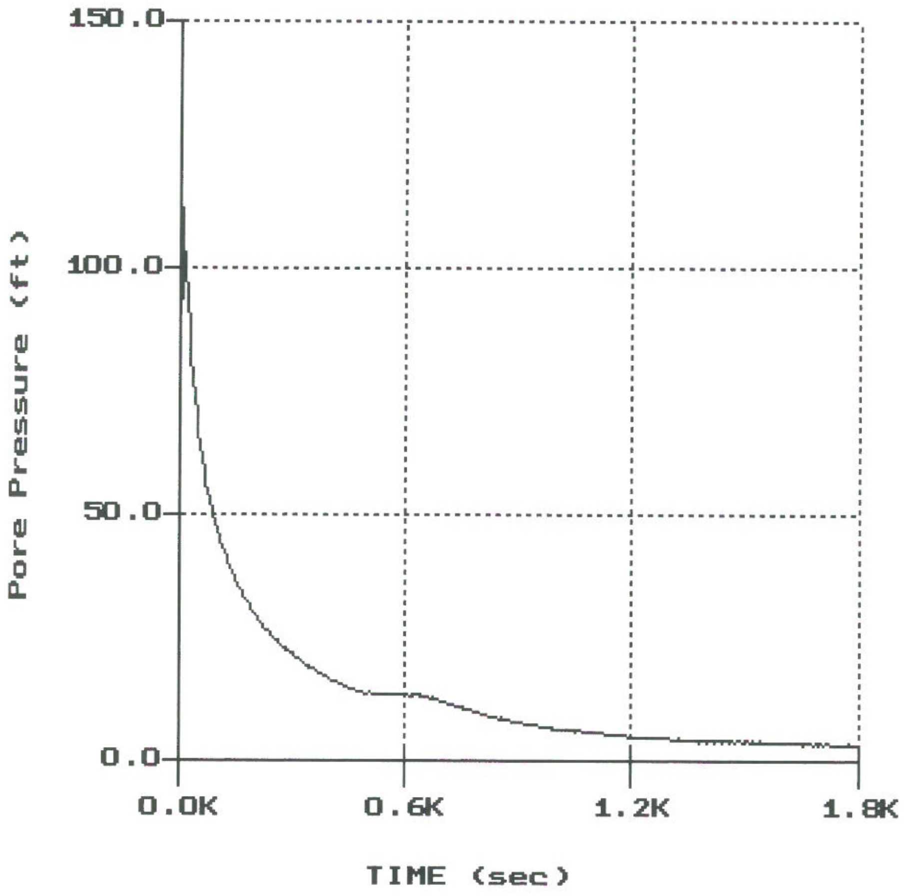
File: 432CP92.PPD
Depth (m): 9.15
(ft): 30.02
Duration : 400.0s
U-min: -0.19 400.0s
U-max: 1.92 0.0s

S.M. Stoller

Hole No.:CPT-0393
Location:ATLAS

Cone: 20 Ton St 183
Date:12:15:05 14:40

PORE PRESSURE DISSIPATION RECORD



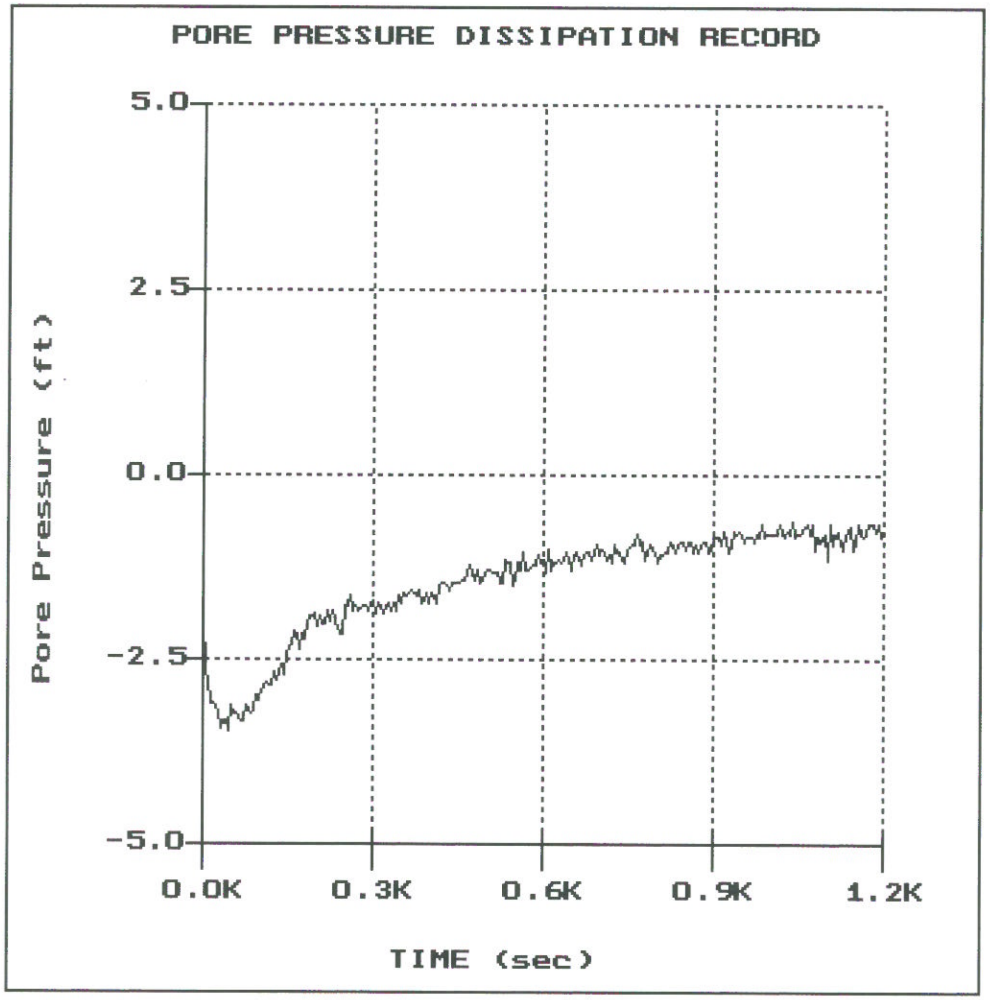
File: 432CP93.PPD
Depth (m): 2.90
(ft): 9.51
Duration : 1800.0s
U-min: 3.19 1735.0s
U-max: 112.11 5.0s

S.M. Stoller

Hole No.:CPT-0393
Location:ATLAS

Cone: 20 Ton St 183
Date:12:15:05 14:40

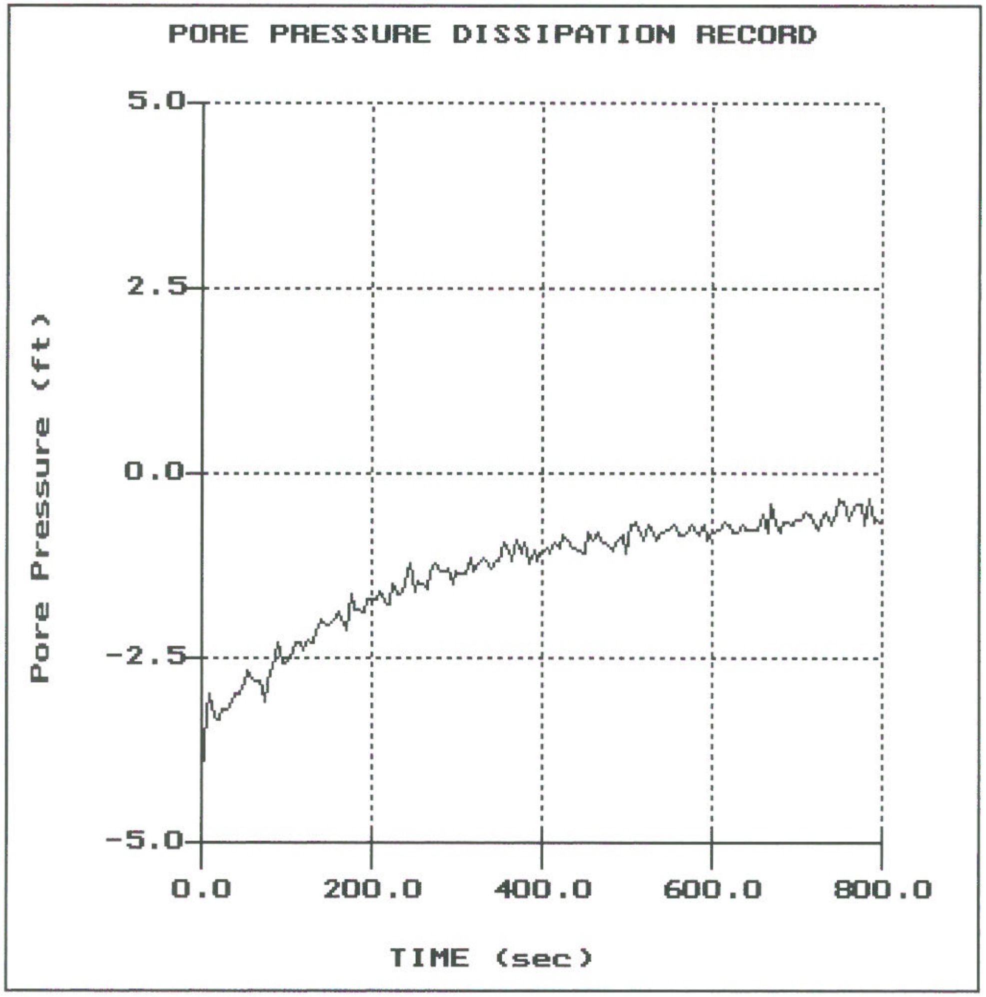
File: 432CP93.PPD
Depth (m): 6.10
(ft): 20.01
Duration : 1200.0s
U-min: -3.47 45.0s
U-max: -0.61 1040.0s



S.M. Stoller

Hole No.:CPT-0393
Location:ATLAS

Cone: 20 Ton St 183
Date:12:15:05 14:40

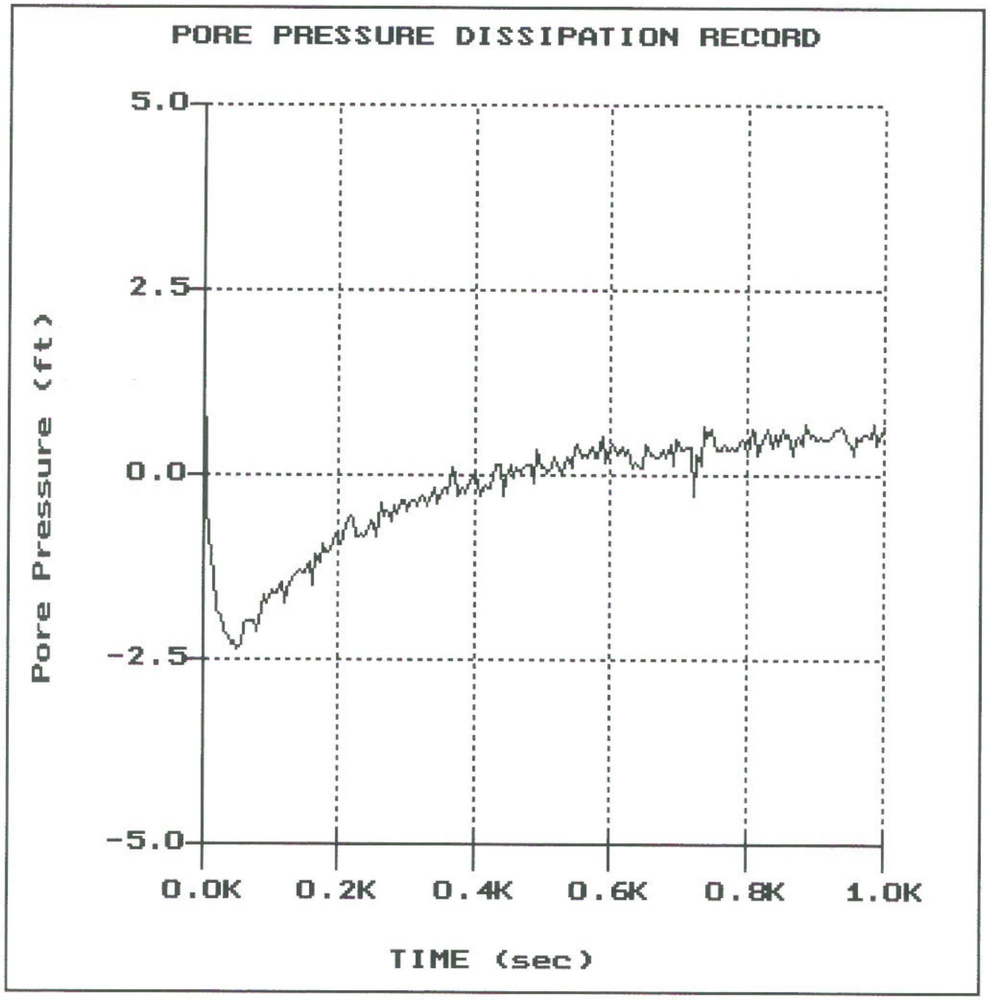


File: 432CP93.PPD
Depth (m): 9.15
(ft): 30.02
Duration : 800.0s
U-min: -4.13 0.0s
U-max: -0.33 785.0s

S.M. Stoller

Hole No.:CPT-0394
Location:ATLAS

Cone: 20 Ton St 183
Date:12:16:05 07:50

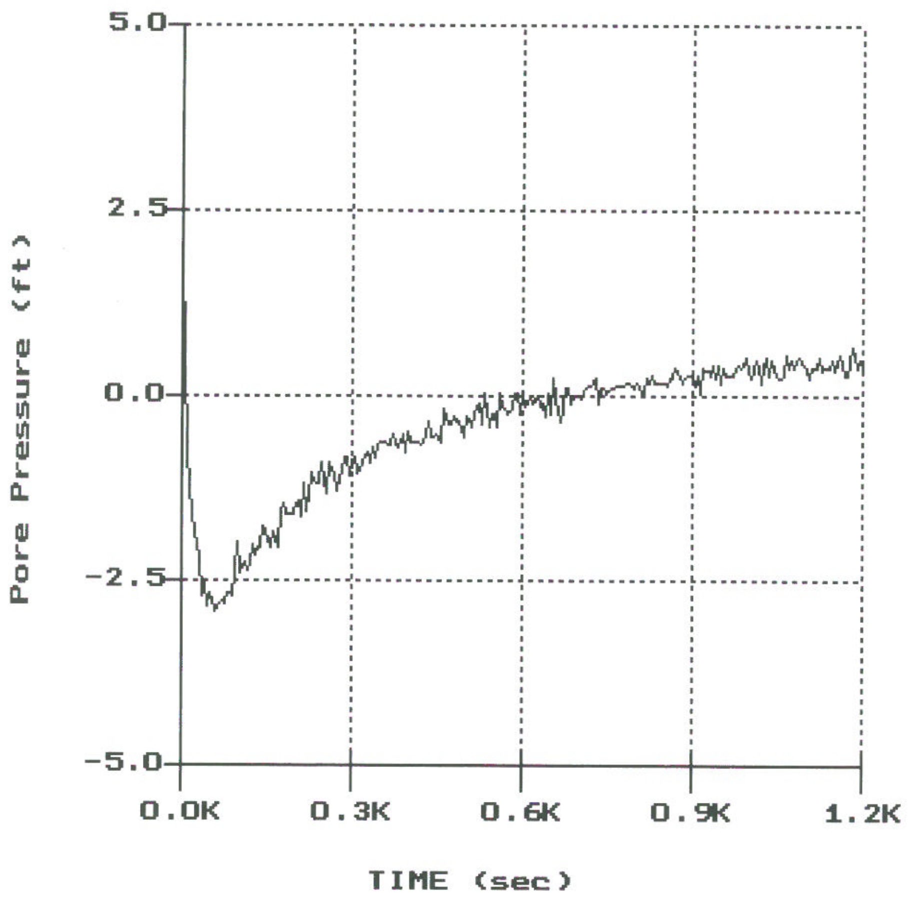


File: 432CP94.PPD
Depth (m): 3.05
(ft): 10.01
Duration : 1000.0s
U-min: -2.35 50.0s
U-max: 1.97 0.0s

S.M. Stoller

Hole No.:CPT-0394
Location:ATLAS

Cone: 20 Ton St 183
Date:12:16:05 07:50



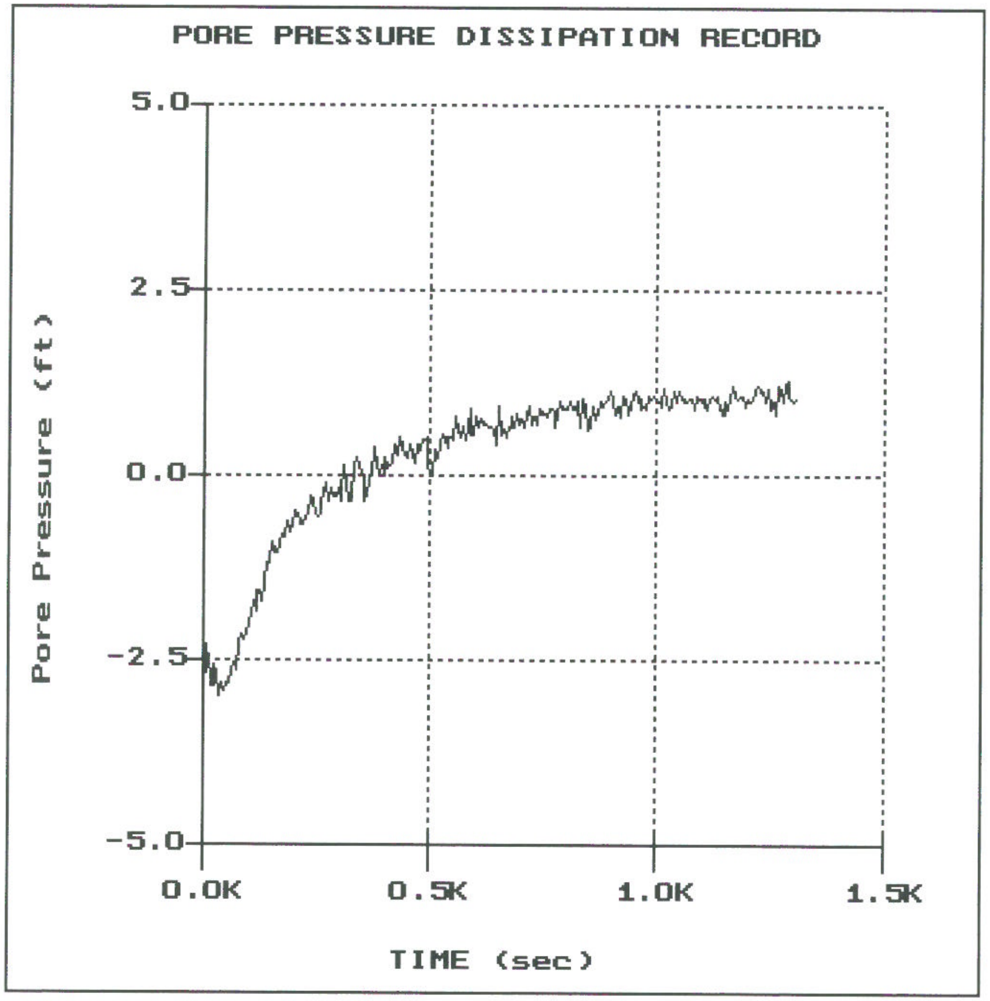
PORE PRESSURE DISSIPATION RECORD

File: 432CP94.PPD
Depth (m): 6.05
(ft): 19.85
Duration : 1205.0s
U-min: -2.91 60.0s
U-max: 1.97 0.0s

S.M. Stoller

Hole No.:CPT-0394
Location:ATLAS

Cone: 20 Ton St 183
Date:12:16:05 07:50

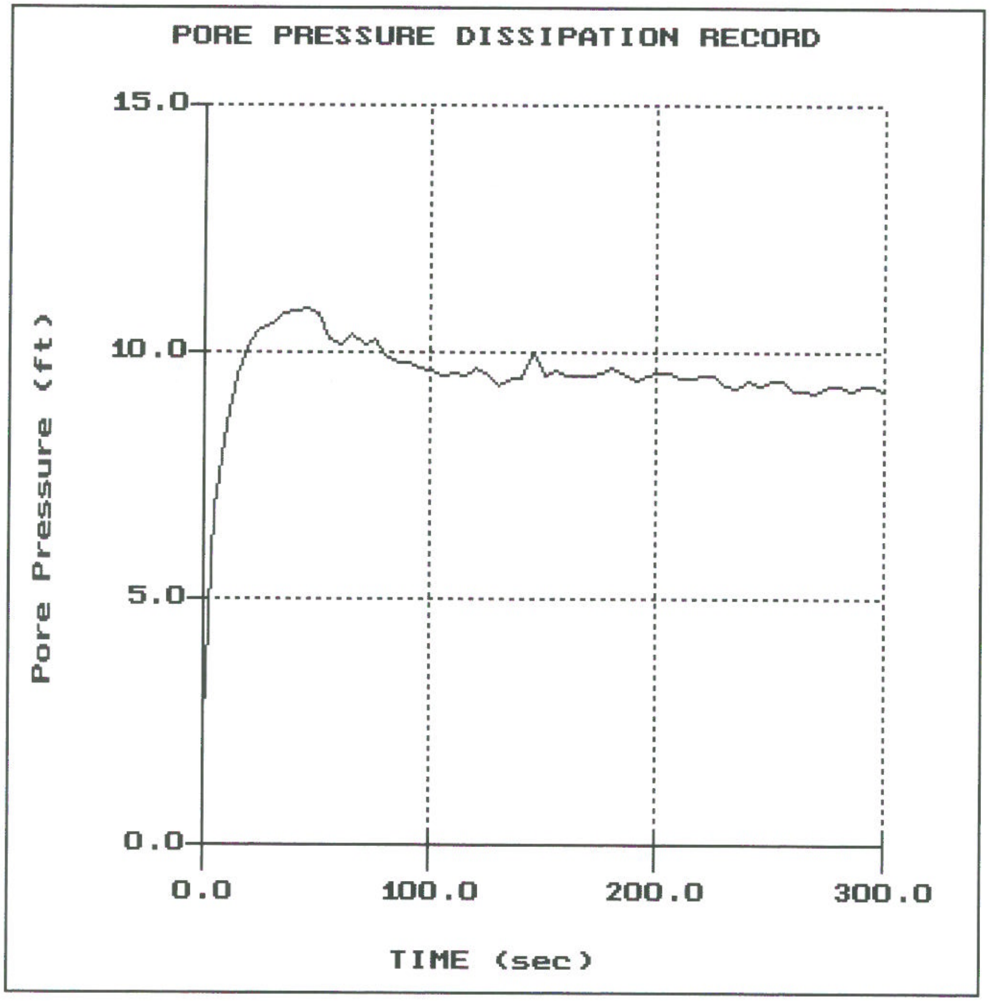


File: 432CP94.PPD
Depth (m): 9.15
(ft): 30.02
Duration : 1305.0s
U-min: -3.00 35.0s
U-max: 1.27 1285.0s

S.M. Stoller

Hole No.:CPT-0395 TOE
Location:ATLAS

Cone: 20 Ton St 183
Date:12:16:05 11:05


PORE PRESSURE DISSIPATION RECORD

File: 432CP95C.PPD
Depth (m): 6.30
(ft): 20.67
Duration : 300.0s
U-min: 2.39 0.0s
U-max: 10.89 45.0s

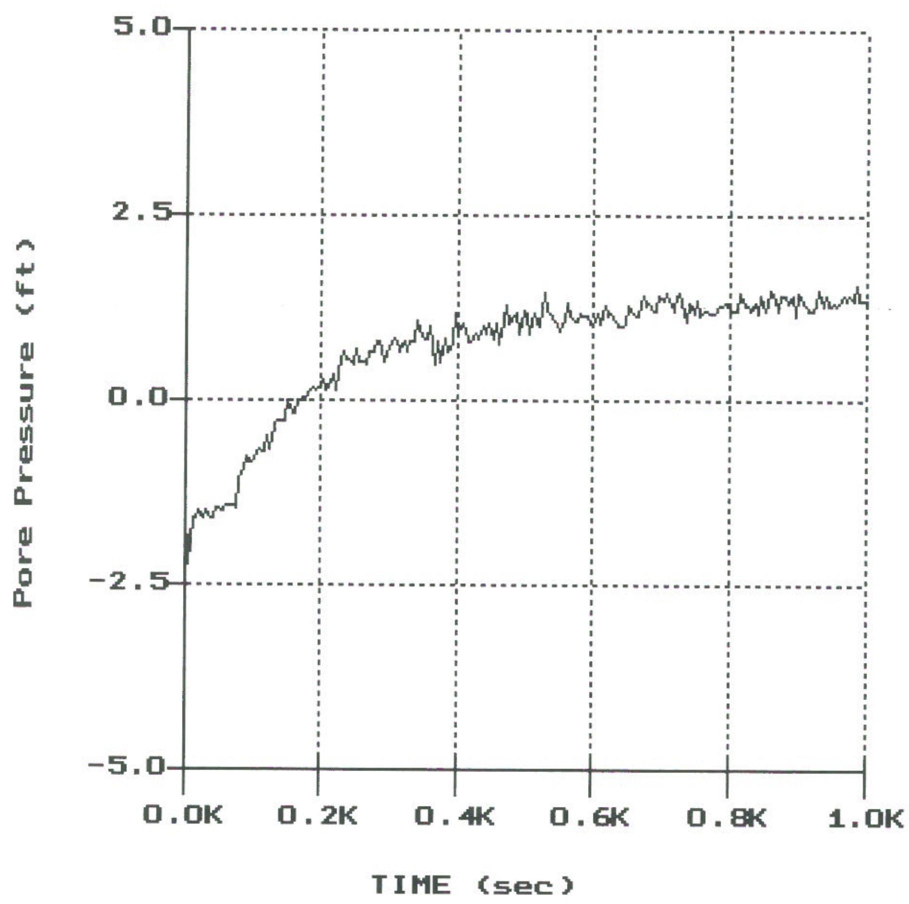
S.M. Stoller

Hole No.:CPT-0395 TOE
Location:ATLAS

Cone: 20 Ton St 183
Date:12:16:05 11:05

File: 432CP95C.PPD
Depth (m): 9.15
(ft): 30.02
Duration : 1000.0s
U-min: -2.21 5.0s
U-max: 1.55 985.0s

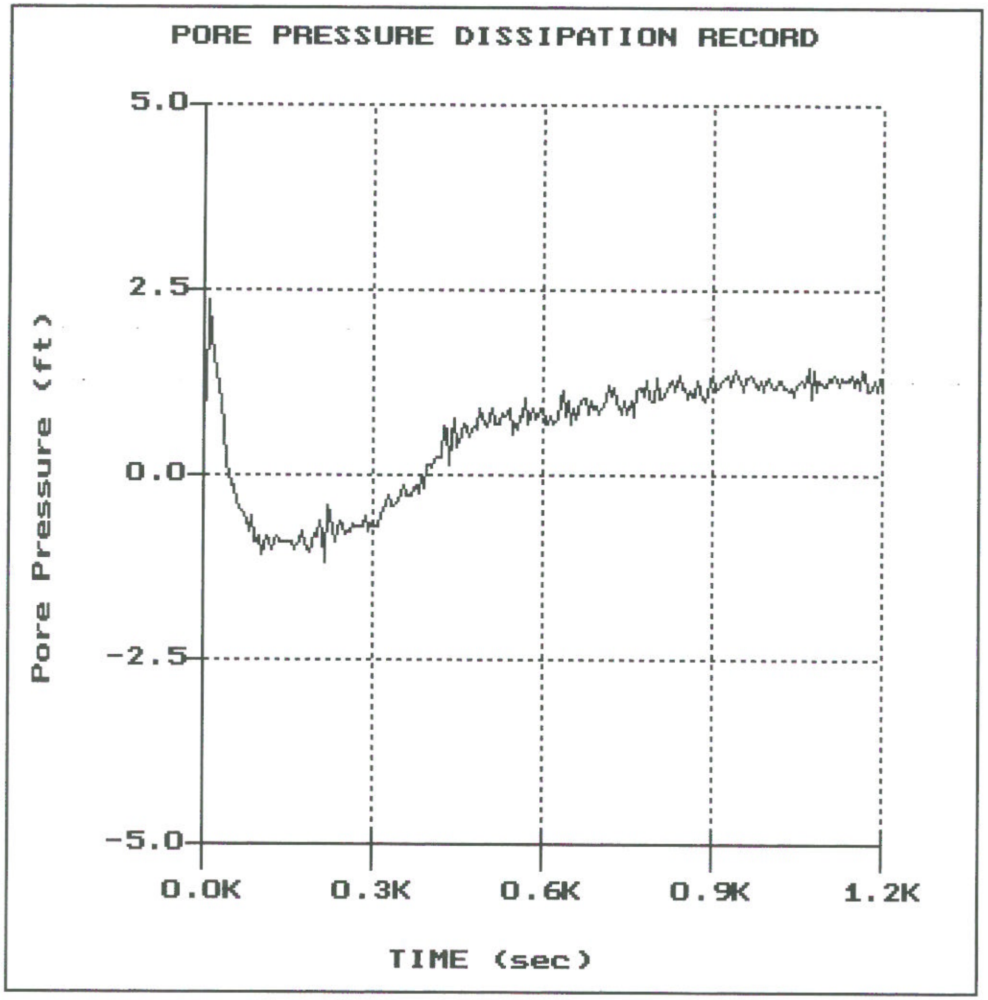
PORE PRESSURE DISSIPATION RECORD



S.M. Stoller

Hole No.:CPT-0395 TOE
Location:ATLAS

Cone: 20 Ton St 183
Date:12:16:05 11:05



File: 432CP95C.PPD
Depth (m): 12.20
(ft): 40.03
Duration : 1200.0s
U-min: -1.17 215.0s
U-max: 2.35 10.0s

U.S. Department of Energy—Grand Junction, Colorado

Calculation Cover Sheet

Calc. No.: MOA-02-05-2006-4-07-00 **Discipline:** Geotechnical Properties **No. of Sheets:** 4
Doc. No.: X0173000

Location: Attachment 5 Vol. I, Appendix G

Project: Moab UMTRA Project

Site: Crescent Junction, Utah

Feature: Seismic Rippability Investigation for the Crescent Junction Site

Sources of Data:

Sources of Formulae and References:

Hasbrouck Geophysics, Inc., 2005. *Crescent Junction Disposal Site Seismic Rippability Investigation*, Final Report, November.

Mac Lean, H. D., 2005. "Review of Seismic Rippability Investigation Report", November.

Preliminary Calc. ☐ **Final Calc.** ☒ **Supersedes Calc. No.**

Author: Name 31 May 07 Date

Checked by: Name 5/25/07 Date

Name 5/30/07 Date

Name 5-31-07 Date

Name MAY 31, 07 Date

Approved by: Name 5/31/07 Date

No text for this page

Problem Statement:

Preliminary site selection performed jointly by the U.S. Department of Energy (DOE) and the Contractor has identified a 2,300-acre withdrawal area in the Crescent Flat area just northeast of Crescent Junction, Utah, as a possible site for a final disposal cell for the Moab uranium mill tailings. The proposed disposal cell would cover approximately 250 acres. Based on the preliminary site-selection process, the suitability of the Crescent Junction Disposal Site is being evaluated from several technical aspects, including geomorphic, geologic, hydrologic, seismic, geochemical, and geotechnical. The objective of this calculation set is to present results of the rippability investigation based on seismic refraction activities at the Crescent Junction Disposal Site.

This calculation will be used in the Remedial Action Plan and Site Design for Stabilization of Moab Title I Uranium Mill Tailings at the Crescent Junction, Utah, Disposal Site (RAP), and summarized in the appropriate sections of the Remedial Action Selection (RAS) Report for the Moab Site.

Method of Solution:

A refraction seismic survey was conducted along 10 seismic lines centered on existing boreholes at the Crescent Junction Site to assist in evaluation of suitability of the site for disposal of the Moab tailings. The purposes of the seismic surveys were to determine the seismic velocities of weathered and unweathered Mancos Shale deposits that underlie the site and relate those velocities to the rippability of the subsurface materials. The refraction seismic method is routinely used for rippability investigations. Data collection and analysis methods for this project were performed in accordance with the *Standard Guide for Using the Seismic Refraction Method for Subsurface Investigation*, ASTM Designation: D 5777-00.

The Final Report of the *Crescent Junction Disposal Site Seismic Rippability Investigation* is in Appendix A and a review of this report is in Appendix B.

Assumptions:

N/A

Calculation:

N/A

Discussion:

Seismic velocities and the thickness of layers underlying the proposed disposal cell to a depth of approximately 60 feet, produced by means of a refraction seismic survey, have been provided in the report. This information will be used to determine optimal and economic depths of excavation for construction of the disposal cell at the Crescent Junction Site. The suitability of selecting equipment based on the reported velocities should be based on the excavators experience with ripping machinery where seismic velocities are known. Data in this report will be used in making these determinations during the conceptual design phase of the disposal cell.

Conclusion and Recommendations:

Use of this information in the conceptual design of the disposal cell at the Crescent Junction Site will be incorporated into appropriate sections of the RAS and other design documentation.

Computer Source:

N/A

End of current text

Appendix A

Seismic Rippability Investigation Report

Hasbrouck Geophysics, Inc.
Groundwater, Engineering, Environmental & Mining

Final Report

Crescent Junction Disposal Site Seismic Rippability Investigation

for

S. M. Stoller Corporation
Grand Junction, Colorado

Registered Geophysicist
James C. Hasbrouck
No. GP 1026
State of California

James C. Hasbrouck
11/21/05

November 21, 2005

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Prescott, Arizona 86301 USA
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http://www.hasgeo.com (Homepage)

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Caterpillar D10 Tractor Ripping Chart
Caterpillar D11 Tractor Ripping Chart

CD

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Time-Distance (T-D) Plots
Modeled elevations and depths beneath each source point and geophone
Observer Reports

INTRODUCTION

Refraction seismic surveys were conducted for S. M. Stoller Corporation along ten seismic lines centered on existing boreholes at the proposed Crescent Junction Disposal Site to assist in the evaluation of the suitability of the site as a final repository for the Moab uranium mill tailings. The purposes of the seismic surveys were to determine the seismic velocities of weathered and unweathered Mancos Shale deposits that underlie the site and relate those velocities to the rippability of the subsurface materials.

The refraction seismic method is routinely used for rippability investigations. Caterpillar Inc. has prepared charts that relate seismic velocities to different sized rippers. For typical refraction seismic rippability investigations a seismic velocity versus depth or elevation profile is generated along each survey line and then the velocities are related to the Caterpillar charts so that a proper ripper can be selected by the construction contractor. Two types of refraction seismic surveys may be conducted to ascertain the rippability estimates of the subsurface: two-dimensional (2D) tomography and delay-time. The 2D tomography method offers a more detailed and gradational section of the subsurface seismic velocity, but takes a little more time in the field and thus is slightly more expensive. The delay-time method offers only a layered and averaged velocity section, but may be more familiar to construction contractors since it has been in use for a much longer time than 2D tomography. Stoller selected the delay-time method for this project.

This seismic survey was a joint effort between Bird Seismic Service, Inc. of Globe, Arizona and Hasbrouck Geophysics, Inc. of Prescott, Arizona. Bird Seismic acquired the seismic data using the survey design prepared by Hasbrouck Geophysics, while Hasbrouck Geophysics processed and interpreted all the data and prepared the final report. This final report will be reviewed by Mr. H. David MacLean of Grand Junction, Colorado. Ken Bernstein is president of Bird Seismic Services, Inc. and may be reached at ken@bridseismic.com or 928-719-1848. Jim Hasbrouck is president of Hasbrouck Geophysics, Inc. and may be contacted at jim@hasgeo.com or 928-778-6320. Dave MacLean is available at 107770.3066@compuserve.com or 970-242-1649.

DATA ACQUISITION

Seismic surveys essentially consist of recording seismic waves that have been generated by artificial sources, observing the arrival times of these waves, and producing cross-sections of variations in subsurface seismic wave velocities that can then be related to geology. The source of seismic energy for surface surveys is primarily dependent upon the target depths and local geology, and for relatively shallow surveys is generally either a sledgehammer or weight-drop system. The seismic waves are detected by geophones in surface surveys. A geophone consists of a coil suspended by springs with magnets build into the case. A seismic wave moves the case and the magnets while the coil remains relatively stationary because of its inertia. The relative movement of the magnetic field with respect to the coil generates a voltage across the coil that is proportional to the velocity of the seismic wave. The electrical voltages produced by the geophones are transmitted back to a recording instrument (seismograph) via cables. In refraction seismic surveys it is necessary, according to Snell's Law, that velocities increase with depth so that the refracted seismic waves can be detected on the surface. For refraction seismic surveys in most sedimentary environments it is typical that velocities increase with depth (i.e., there are no velocity reversals) and it is assumed that this is the case for the Crescent Junction Disposal Site.

According to Stoller, the depth to weathered bedrock in the project area is assumed to vary from two to approximately 25 feet. Unweathered bedrock may be deeper than 50 feet thus the refraction seismic survey is designed to investigate to depths somewhat greater than 50 feet using the standard rule-of-thumb for refraction seismic surveys that the first geophone to "see" a refraction from a layer will be at a distance of three to five times the expected depth. For example, if an investigation depth of 60 feet is desired then the first geophone to see a refraction, if present, from that depth will be at 180 to 300 feet along the line of geophones, or spread, with the larger distance applicable to areas with generally slower velocities. In order to accurately map the deeper horizons, several geophones must be beyond the initial geophone that records the deeper refraction thus a geophone interval of 10 feet with 30 feet far offsets (resulting in a total spread of 500 feet) is used for this project.

The refraction seismic data for this project were acquired with a 48-channel Bison *9048* seismograph with 21-bits of dynamic range, 250 milliseconds (ms) record lengths, and 0.25 ms sample intervals with Mark Products 10-Hz geophones implanted approximately three inches into the ground at intervals of 10 feet along each line. The seismic source was an Elastic Wave Generator (EWG) accelerated weight-drop mounted on the back of a 4x4 pickup and consisted of a 207-pound weight that was lifted hydraulically against large springs and then released resulting in a force much greater than the weight itself. For each seismic line data from a minimum of eleven source points were acquired (seven within the spread nominally between geophones 6 and 7, 12 and 13, 18 and 19, 24 and 25, 30 and 31, 36 and 37, and 42 and 43, and off each end at distances of 10 and 30 feet). The geophone distances were initially measured with either a tape or takeout intervals on the geophone spread cable and after completion of data acquisition every fourth geophone and each offset source point was surveyed to at least centimeter accuracy by a contractor to Stoller. Because the surface topography change was minor and the seismic lines were relatively straight it was only necessary to survey the coordinates and elevations of every fourth geophone and then interpolate values for the intermediate geophones.

The seismic data were stacked nominally four to six times (depending upon offset and noise) at each source point to increase the signal-to-noise ratio. Stacking, or signal enhancement, involved repeated source impacts at the same point into the same set of geophones. For each source point, the stacked data were recorded into the same seismic data file and theoretically the seismic signal arrived at the same time from each impact and thus was enhanced, while noise was random and tended to be reduced or canceled. After recording the data on the hard disk of the seismograph, the seismic records were copied to a personal computer at the end of each field day. These data were e-mailed nightly from the field to Mr. Hasbrouck and copies of the Observer Reports (field notes) were faxed at the same time. The quality of the seismic data ranged from very good to excellent depending primarily upon offset, and identifiable first breaks (first arrivals of seismic energy) were present along all the lines.

DATA PROCESSING

The refraction seismic data were processed using the *SIPwin* (version 2.77) set of computer programs from Rimrock Geophysics Inc., Lakewood, Colorado. The general processing flow consisted of the initial selection, or "picking", of the seismic first breaks (first arrival of seismic energy) with the *SIPIK* program, creation of data files for input into the interpretation program with the *SIPIN* program, and interpretation of the data using modeling and iterative ray-tracing techniques with the *SIPT2* program. A first break was selected as the initial downward variation of the seismic signal from a horizontal line and was generally accurate to a time between 0.5 and 1 ms. To enhance the accuracy of first break picks, the seismic record was zoomed to a time that only encompassed the breaks themselves (i.e., only the portion of the seismic record where the first breaks were visible) The *SIPT2* program uses the delay-time method to obtain a first-approximation depth model, which is then trimmed by a series of ray-tracing and model adjustment iterations to minimize any discrepancies between the picked arrival times and corresponding times traced through a 2½-dimensional model. Arrival times at two geophones, separated by some variable XY-distance, are used in refractor velocity analyses and time-depth calculations. Using the principle of migration and iterative ray-tracing within the *SIPT2* program, forward and reverse seismic rays emerge from essentially the same point on the reflector, thus requiring the reflector to be plane over only a very small distance. The ray-tracing procedure tests and corrects the estimated migrated position of points representing the locations of ray entry and emergence from the refracting horizon and takes into account the dip of the refracting horizon at those emergence points, therefore enabling accurate representation of steeply dipping horizons.

For any refraction seismic data analysis, it is important to determine accurate velocities. The *SIPT2* program employs several routines for selection of the proper velocities. For the direct arrivals through the first layer, the velocity is computed by dividing the distances from each source point to each geophone by the corresponding arrival times. These individual velocities are averaged for each source point and a weighted average is computed. For layers beneath the first layer, velocities are computed by two methods: 1) Regression, in which a straight line is fit by least squares to the arrival times representing the velocity layer and average velocities are computed by taking the reciprocals of the weighted average of the slopes of the regression lines, and 2) the Hobson-Overton method wherein velocities are computed if there are reciprocal arrivals from two opposing source points at two or more geophones. Final velocities used in the *SIPT2* inversion process are computed by taking an average of the two methods. As quality control measures, time versus distance (T-D) plots (which represent velocities) are inspected along each seismic line relative to reciprocal times, irregularity and parallelism as per ASTM D5777. The refraction seismic data for this project adequately met the requirements of each of these tests.

Included within this report are a borehole and seismic line location map, and elevation and depth versus distance refraction seismic sections for each line with annotated average velocities for each layer. Also included is a CD with output from the *SIPT2* program that includes velocity analysis tables, T-D plots indicating the picked arrival times, and modeled elevations and depths beneath each source point and geophone. Note that the distances in the modeled results have been corrected for horizontal foreshortening (i.e., corrections are made to obtain true horizontal positions). The modeled results are used to construct the elevation and depth sections, and are in Microsoft Excel format for future client use if desired.

RESULTS

According to Stoller, the geology of the project area consists of essentially three layers. The near surface is alluvial overburden composed of unconsolidated silt, clay, and sandstone fragments. Beneath the alluvium is weathered bedrock, or weathered Mancos Shale, composed of fractured, chemically weathered, siltstone, silty sandstone or clayey siltstone of variable thickness. The weathered layer is often highly fractured with calcite and gypsum fracture coatings. The Mancos Shale is present beneath the weathered layer and is increasingly competent with depth. Although the Mancos Shale appears to be a great shale mass, it is not one homogeneous unit. According to available lithologic logs for the boreholes within the project area, the Mancos Shale seems to be described as consisting not only of shale but also some sandstone layers and what has been termed a silty claystone. The lithologic logs generally indicate variations in the composition of the unweathered Mancos Shale near its top with increasing shale constituents with depth.

Interpretation of the refraction seismic data indicates three layers, representing alluvial overburden, weathered Mancos Shale and competent Mancos Shale. Table 1 indicates the range in velocities and depths for each line. The first layer velocities range from about 1160 to 1330 feet per second and are consistent with typical unsaturated alluvial overburden values. The second layer velocities range from about 4060 to 5220 feet per second and represent typical values for weathered material such as the Mancos Shale. The variation in velocity values for the interpreted weathered Mancos Shale is probably related to the degree of fracturing and the amount of calcite and/or gypsum coating of the fractures. The higher velocities may have less fracturing or the fractures may be coated with an increased amount of calcite and/or gypsum. It is not possible from the seismic results to determine which scenario exists. The third layer, or competent Mancos Shale bedrock, velocities range from about 9000 to as high as 10000 feet per second with the majority of the velocity values in a range from about 9000 to 9400 feet per second. Velocity variations of the interpreted Mancos Shale bedrock are considered relatively minor and probably related to slight changes in composition of the bedrock or some amount of fracturing. Velocity variations are present along the intersecting seismic lines at each borehole, but generally than about 5% which is reasonable given that the velocity values are averages and the subsurface geology is variable (as evidenced by changes in the lithologic logs between boreholes).

The thickness of the overburden layer (or the depth to the top of layer 2 which is interpreted as weathered Mancos Shale) ranges from about 4½ to 18 feet, while the depth to the top of layer 3 (or interpreted unweathered Mancos Shale bedrock) varies from about 24 to 60 feet. The tie point depths between intersecting lines at each borehole are generally less than about 5% which is considered reasonable and quite acceptable for seismic surveys. Depth values at intersecting points from lines oriented in different directions often vary because of anisotropy within the subsurface geological formations. Anisotropy is defined as a variation of a physical property (e.g., velocity) depending upon the direction in which it is measured. In general, surface refraction seismic data have shown a 10% to 15% variation between the actual depths to velocity layer anomalies, as verified primarily by geophysical borehole logging, and the depth predicted by the models.

Table 1: Summary of interpreted velocities and depths

Line	Layer 1 velocity (ft/s)	Layer 2 velocity (ft/s)	Layer 3 velocity (ft/s)	Depth to top of layer 2 (ft)	Depth to top of layer 3 (ft)
202NW-SE	1230	4218	10005	4.5 – 15.1	34.3 – 58.7
202SW-NE	1305	4305	9353	11.3 – 17.1	31.5 – 53.0
204NW-SE	1334	4674	9035	8.0 – 14.9	40.4 – 61.1
204SW-NE	1206	4705	9399	10.1 – 18.1	40.5 – 59.3
206NW-SE	1305	5221	9380	9.9 – 16.0	29.5 – 46.8
206SW-NE	1281	5169	9479	7.7 – 15.2	25.4 – 47.5
207NW-SE	1159	4195	9011	7.1 – 14.3	26.7 – 49.1
207SW-NE	1228	4061	9021	5.9 – 15.0	28.9 – 45.9
208NW-SE	1260	4430	9676	11.0 – 14.5	33.3 – 48.8
208SW-NE	1191	4633	9805	9.0 – 13.6	23.4 – 48.4

Inspection of either the elevation or depth sections indicates that the subsurface is far from planar, with some areas showing signs of possible incised bedrock channels (e.g., particularly possibly both lines at borehole 208). Because both the first and last approximately 30 to 50 feet, or more, of the sections have less forward and reverse raypath coverage (refer to the T-D plots), results in those areas should be viewed with some caution. Nevertheless, subsurface depth variations are present along each of the seismic lines.

According to Caterpillar's ripping charts, shale is considered rippable at seismic velocities ranging up to about 6000 to 10200 feet per second for tractor models D8 to D11, respectively. Rippable velocities are slightly different if the subsurface material is composed more of a siltstone (up to about 6500 to 9900 for a D8 to D11 tractor, respectively). Referencing the ripping charts from Caterpillar, it is reasonable to assume that all of the interpreted layer 2 or weathered Mancos Shale can be ripped with a tractor as small as a D8 (note that the Caterpillar ripping charts are not available for tractors smaller than a D8). If it is necessary to rip the interpreted competent Mancos Shale bedrock, with velocities interpreted to be greater than 9000 feet per second, it will be necessary to employ a D11 tractor.

Although the seismic survey covered only a very small portion of the proposed Crescent Junction Disposal Site it is reasonable to assume that excavation in the proposed site will be impacted by the variable weathered and unweathered bedrock depths. Although the author of this report is not aware of the design depth of the proposed disposal site excavation, if it is say 40 feet then there will be areas encountered with much higher velocity material at depth which will require either larger rippers or other means of excavation. For example, if material is ripped along the borehole 207 SW to NE seismic line to a depth of 40 feet materials with average velocities of around 4000 and 9000 feet per second will both be encountered. Obviously, a D8 tractor would not be able to rip to a depth of 40 feet along the entire length of this line.

LIMITATIONS OF INVESTIGATION

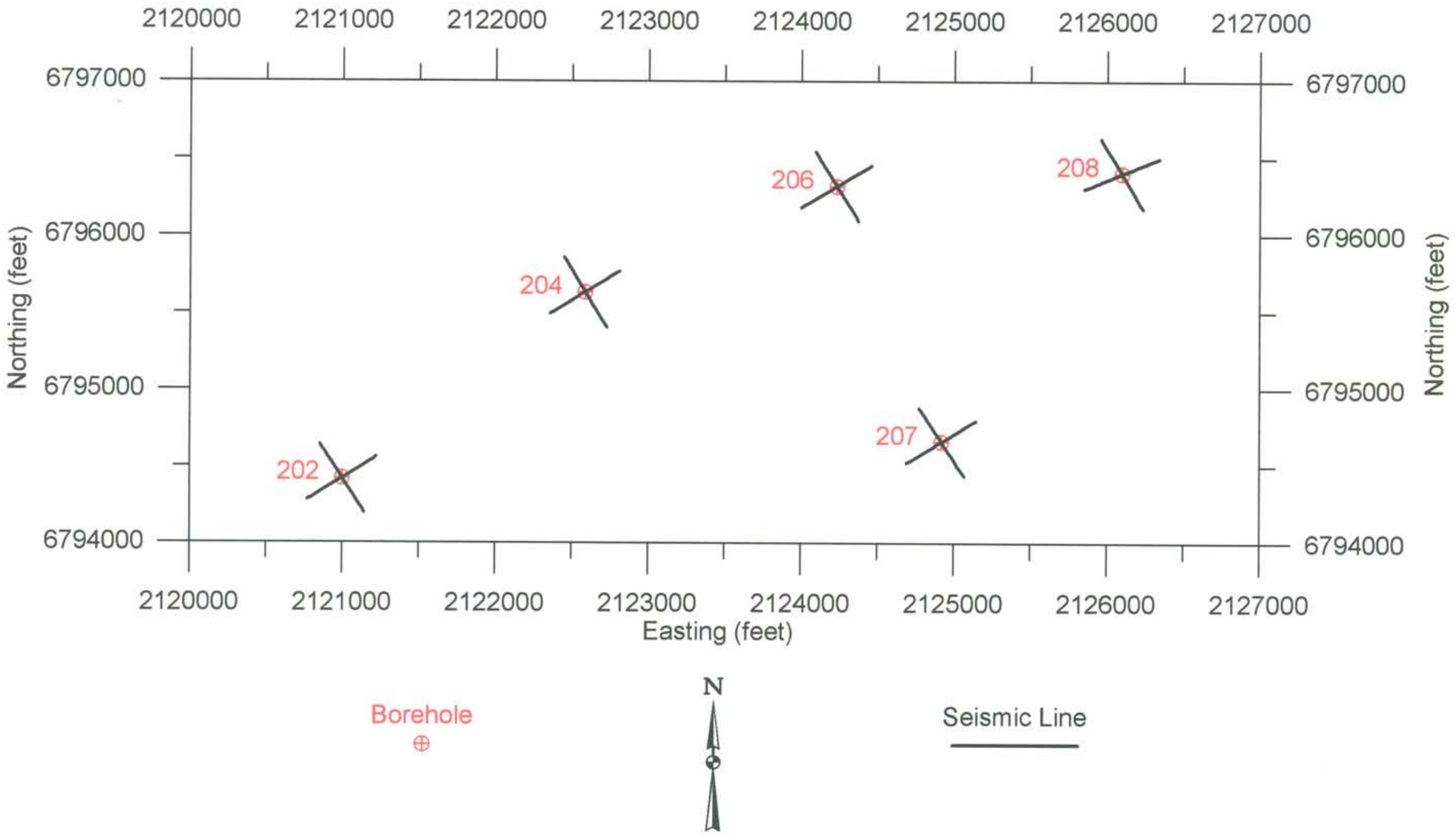
Although a refraction seismic investigation is the most cost-effective way to determine rippability of material in a project area (versus sporadic boreholes that offer only localized information), it must be realized that according to Caterpillar ripping is still more art than science, and much will depend upon operator skill and experience. Caterpillar states in their Handbook that tooth penetration is often the key to ripping success, regardless of seismic velocity. Low seismic velocities in sedimentary rocks can indicate probable rippability. However, if the fractures and bedding joints do not allow tooth penetration then the material may not be ripped effectively. Pre-blasting or “popping” may induce sufficient fracturing to permit tooth entry.

This survey was conducted with state-of-the-art instrumentation operated by experienced geophysicists, the data were processed by an experienced and licensed geophysicist with a commercial software package utilized on projects with similar objectives, and the results were interpreted by an experienced and licensed geophysicist. However, no warranty, either expressed or implied, is made as to the usability of the results of this survey. Additionally, the ripper performance charts developed by Caterpillar are intended for estimating purposes only and neither Caterpillar Inc. nor Hasbrouck Geophysics, Inc. warrant that the tractors will perform as estimated.

REFERENCE

Caterpillar Performance Handbook, Edition 30, October 1999, *Use of Seismic Velocity Charts*, pp. 1-71 to 1-78.

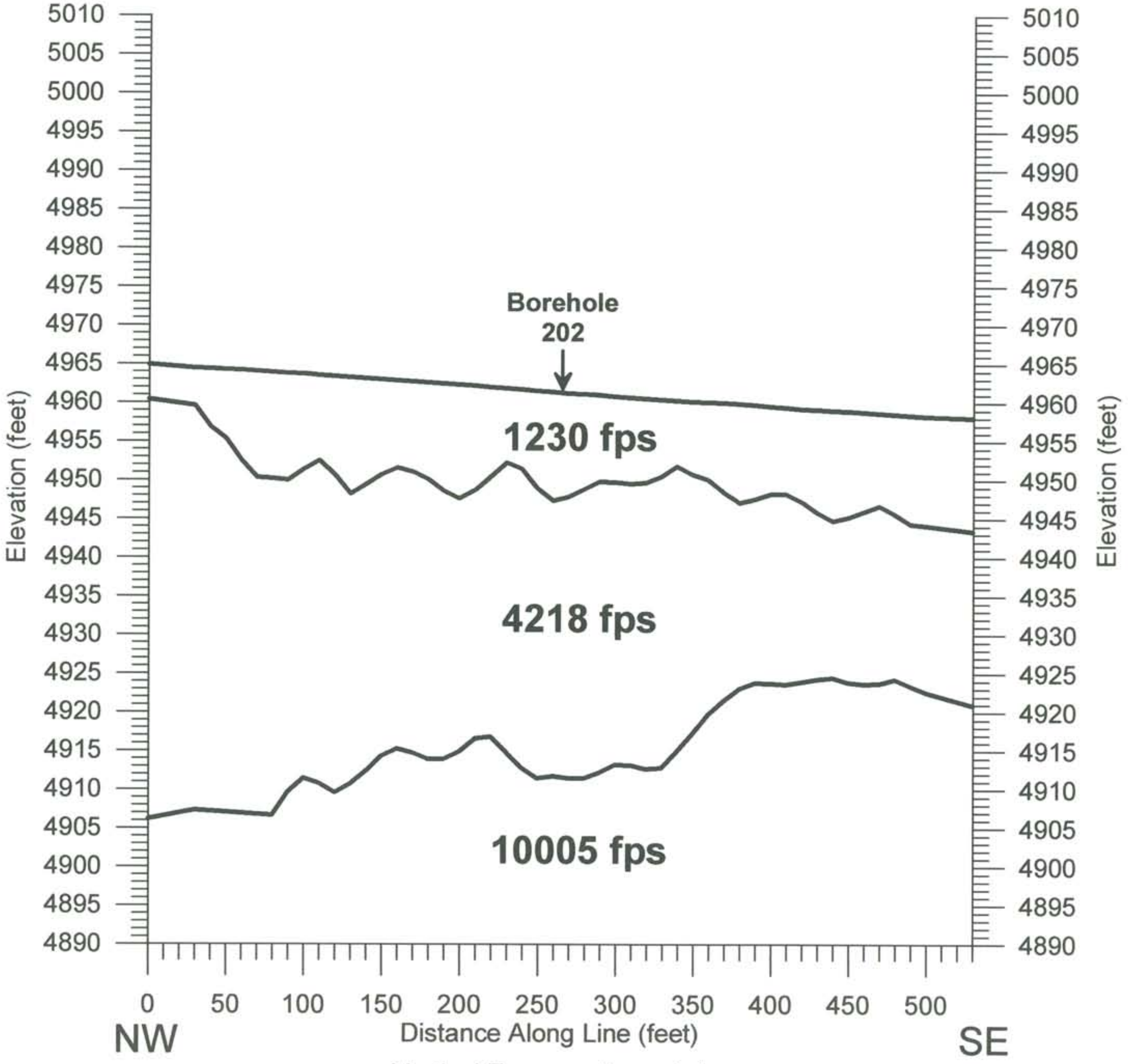
Seismic Rippability Investigation
Crescent Junction Disposal Site
Borehole and Seismic Line Locations



Hasbrouck Geophysics, Inc.

Borehole&LineLocations.grf

Seismic Rippability Investigation
Crescent Junction Disposal Site
Borehole 202 NW to SE Seismic Line
Elevation Section



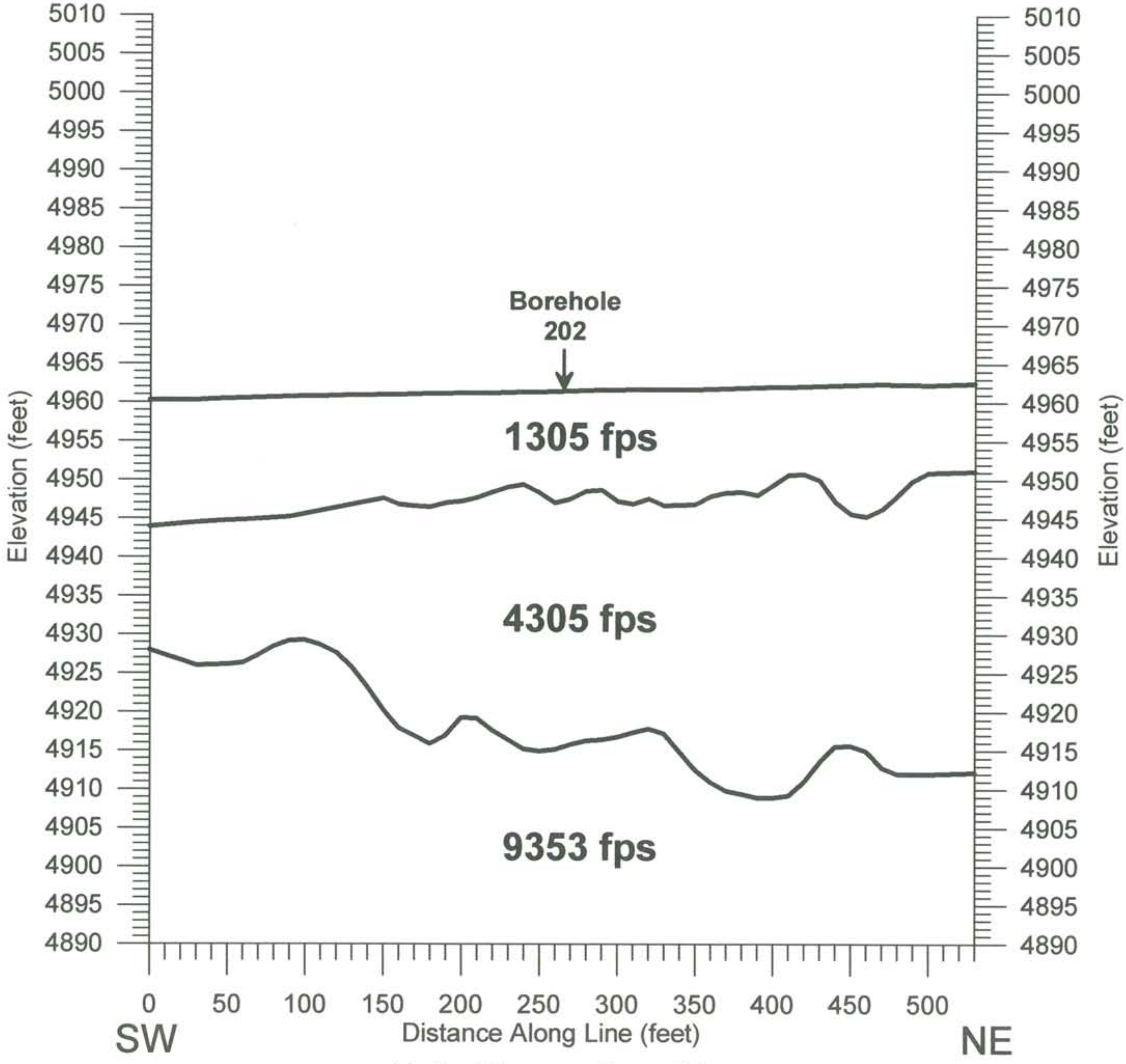
Vertical Exaggeration = 4.4

Velocities in feet per second (fps)

Hasbrouck Geophysics, Inc.

Borehole202NSElev2D.grf

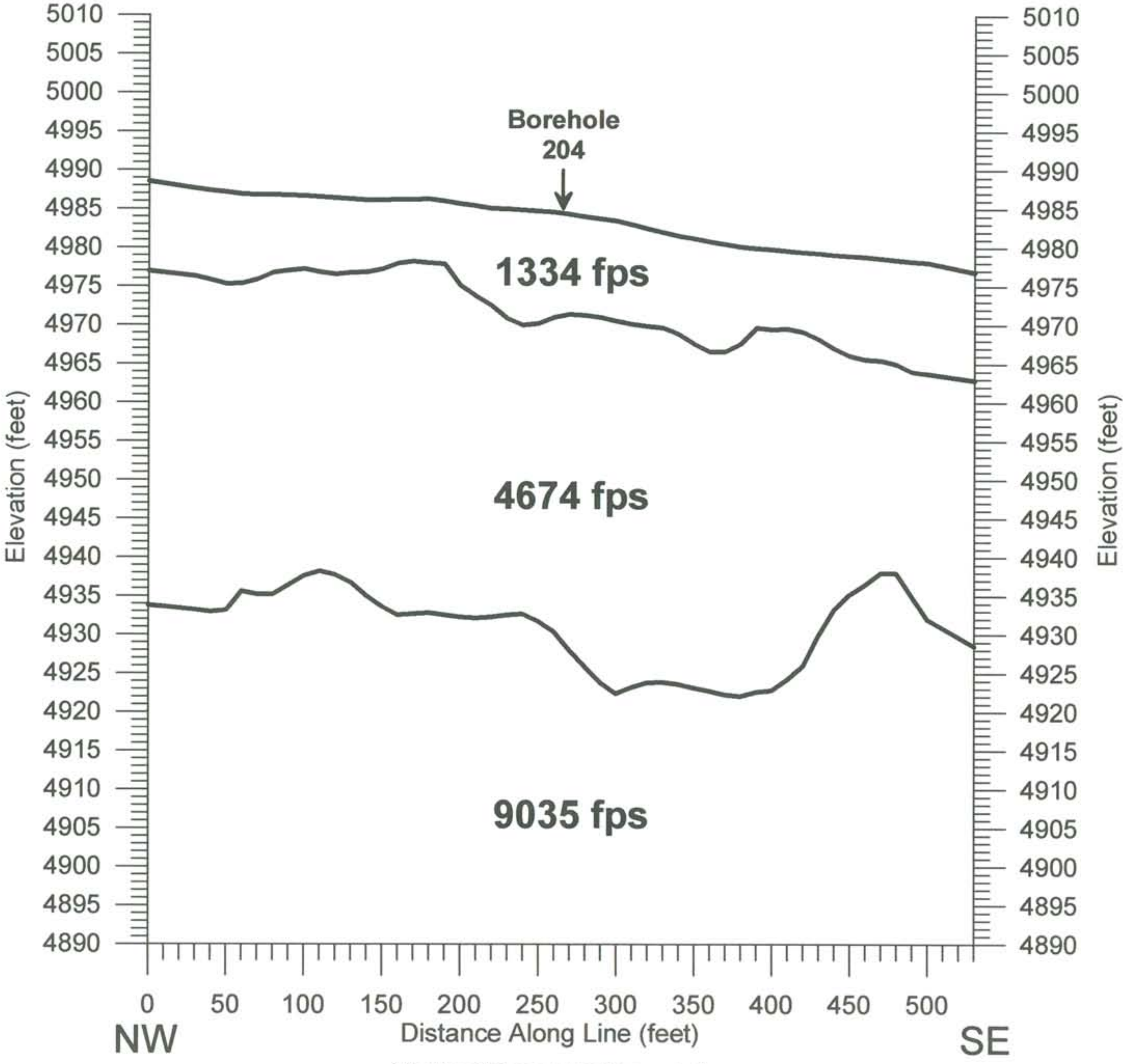
Seismic Rippability Investigation
Crescent Junction Disposal Site
Borehole 202 SW to NE Seismic Line
Elevation Section



Vertical Exaggeration = 4.4

Velocities in feet per second (fps)

Seismic Rippability Investigation
Crescent Junction Disposal Site
Borehole 204 NW to SE Seismic Line
Elevation Section



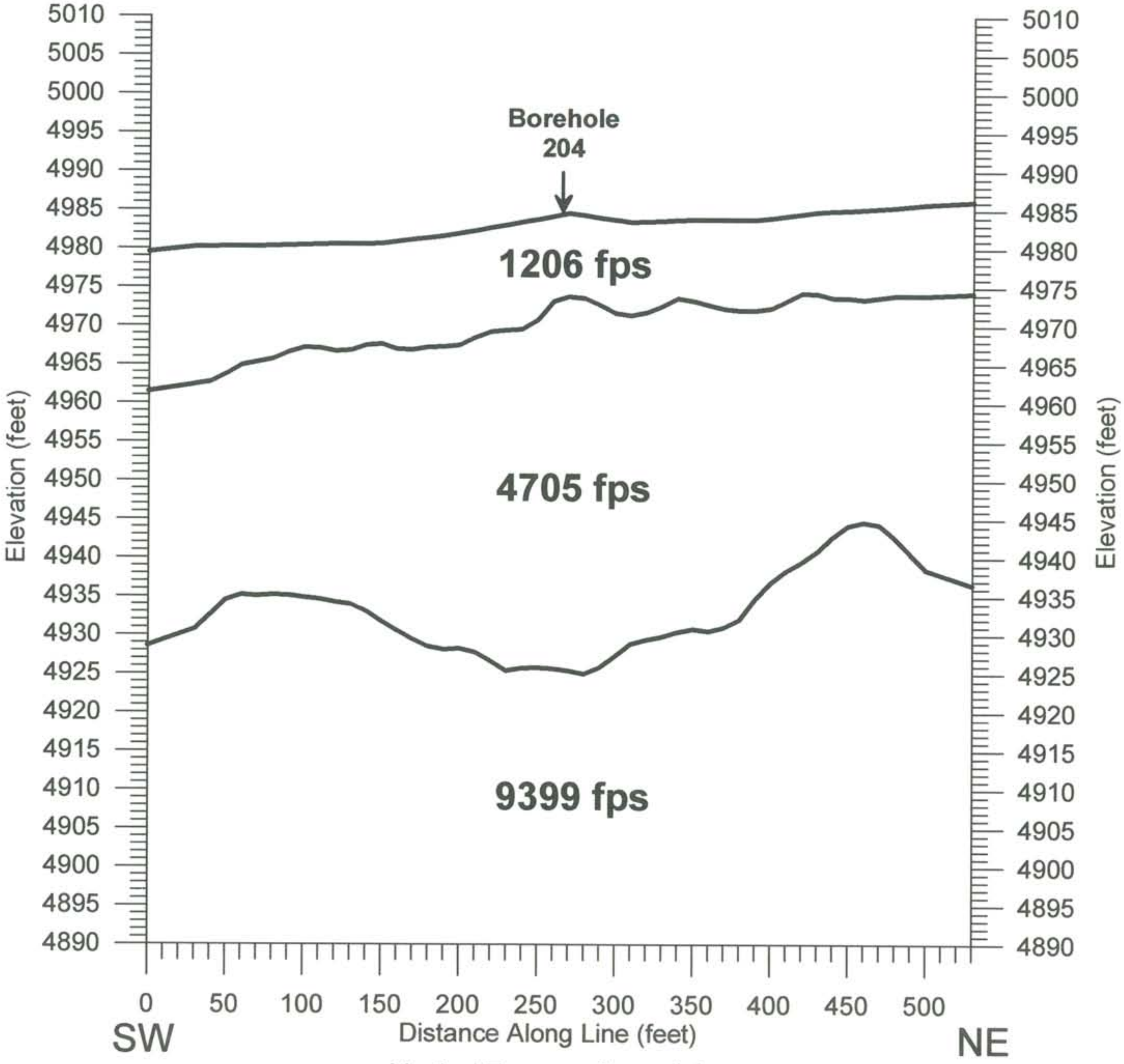
Vertical Exaggeration = 4.4

Velocities in feet per second (fps)

Hasbrouck Geophysics, Inc.

Borehole204NSElev2D.grf

Seismic Rippability Investigation
Crescent Junction Disposal Site
Borehole 204 SW to NE Seismic Line
Elevation Section



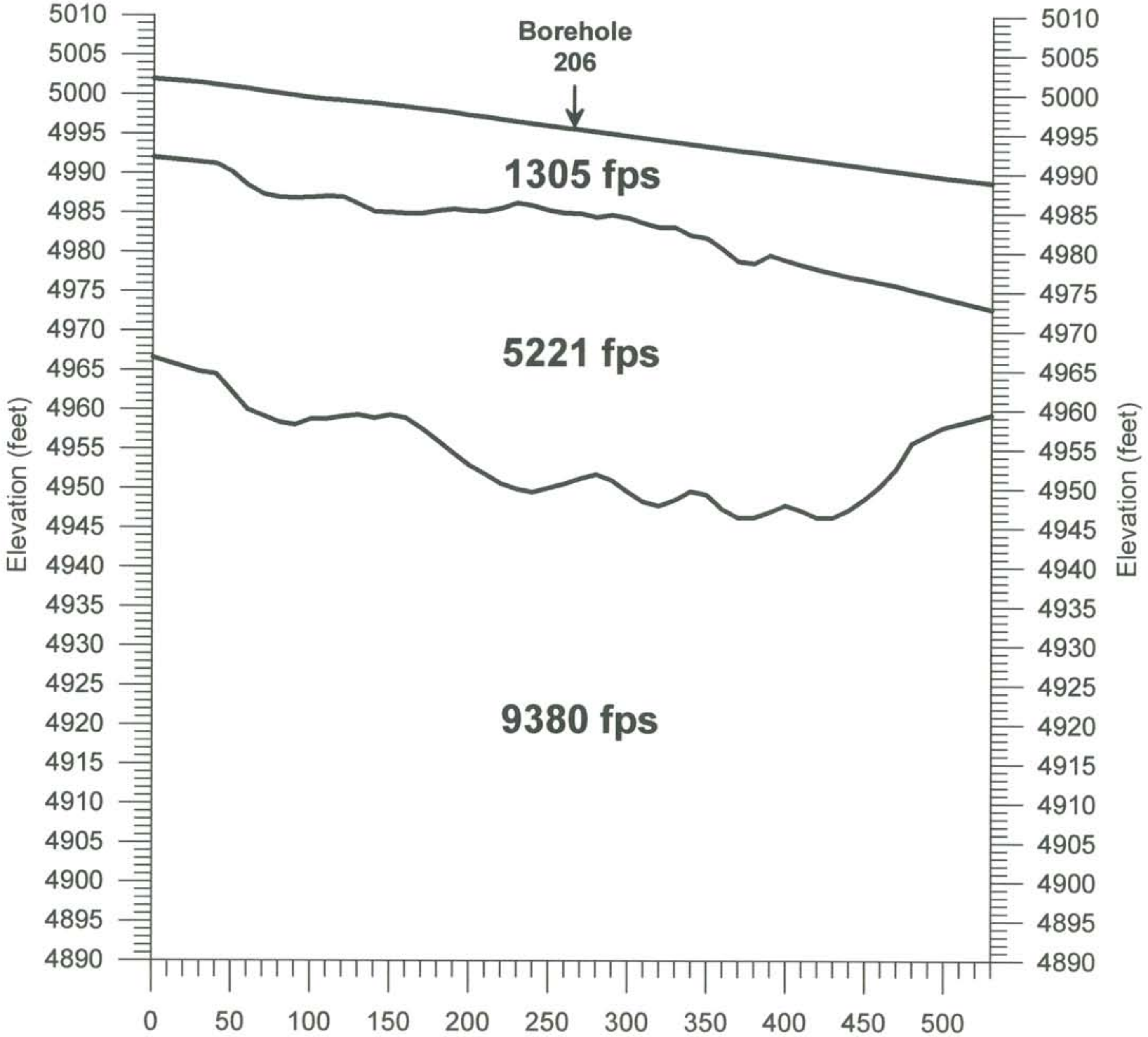
Vertical Exaggeration = 4.4

Velocities in feet per second (fps)

Hasbrouck Geophysics, Inc.

Borehole204EWElev2D.grf

Seismic Rippability Investigation
Crescent Junction Disposal Site
Borehole 206 NW to SE Seismic Line
Elevation Section



Vertical Exaggeration = 4.4

Velocities in feet per second (fps)

Hasbrouck Geophysics, Inc.

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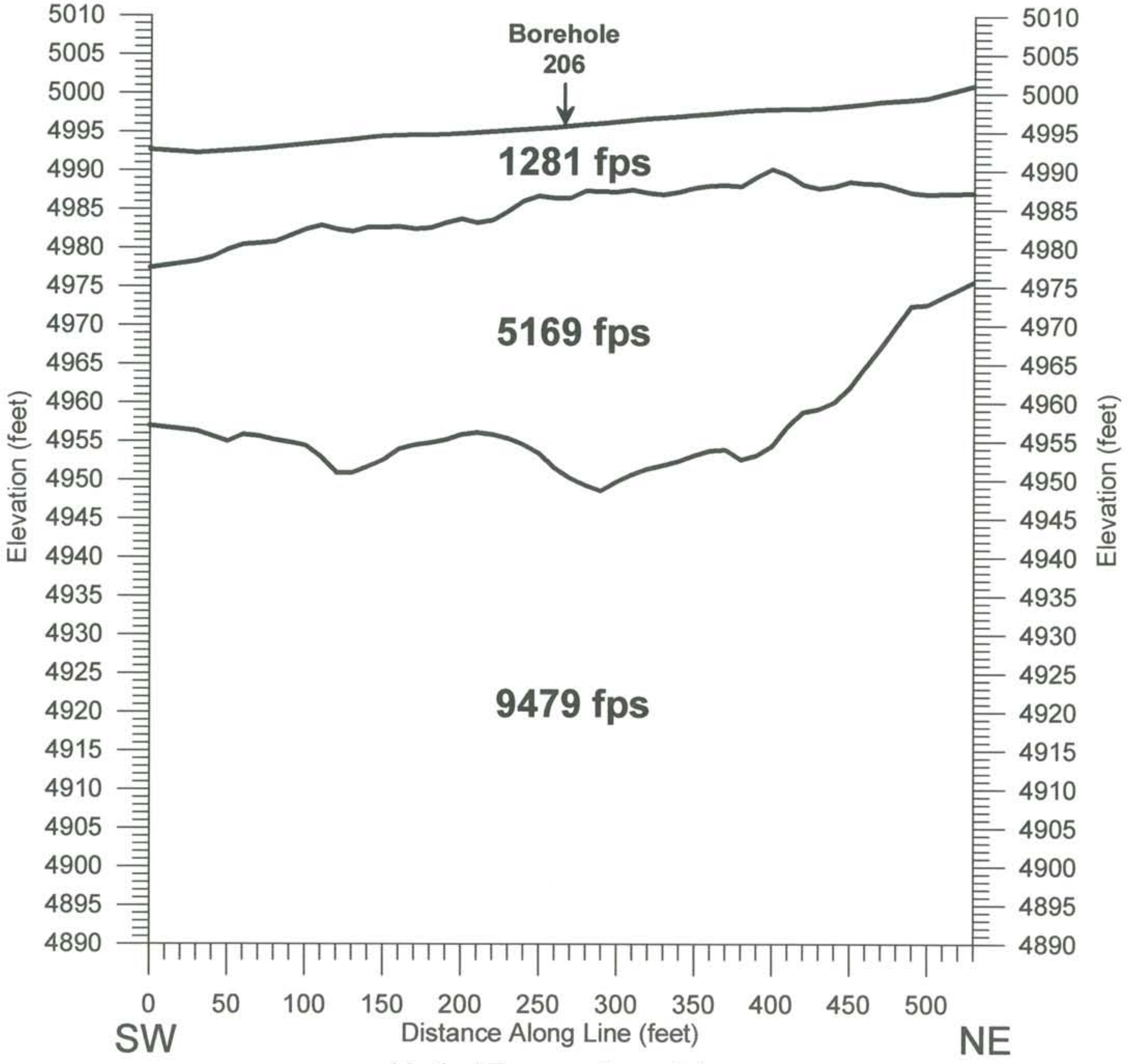
Seismic Rippability Investigation
Crescent Junction Disposal Site
Borehole 206 SW to NE Seismic Line
Elevation Section



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Velocities in feet per second (fps)

Hasbrouck Geophysics, Inc.

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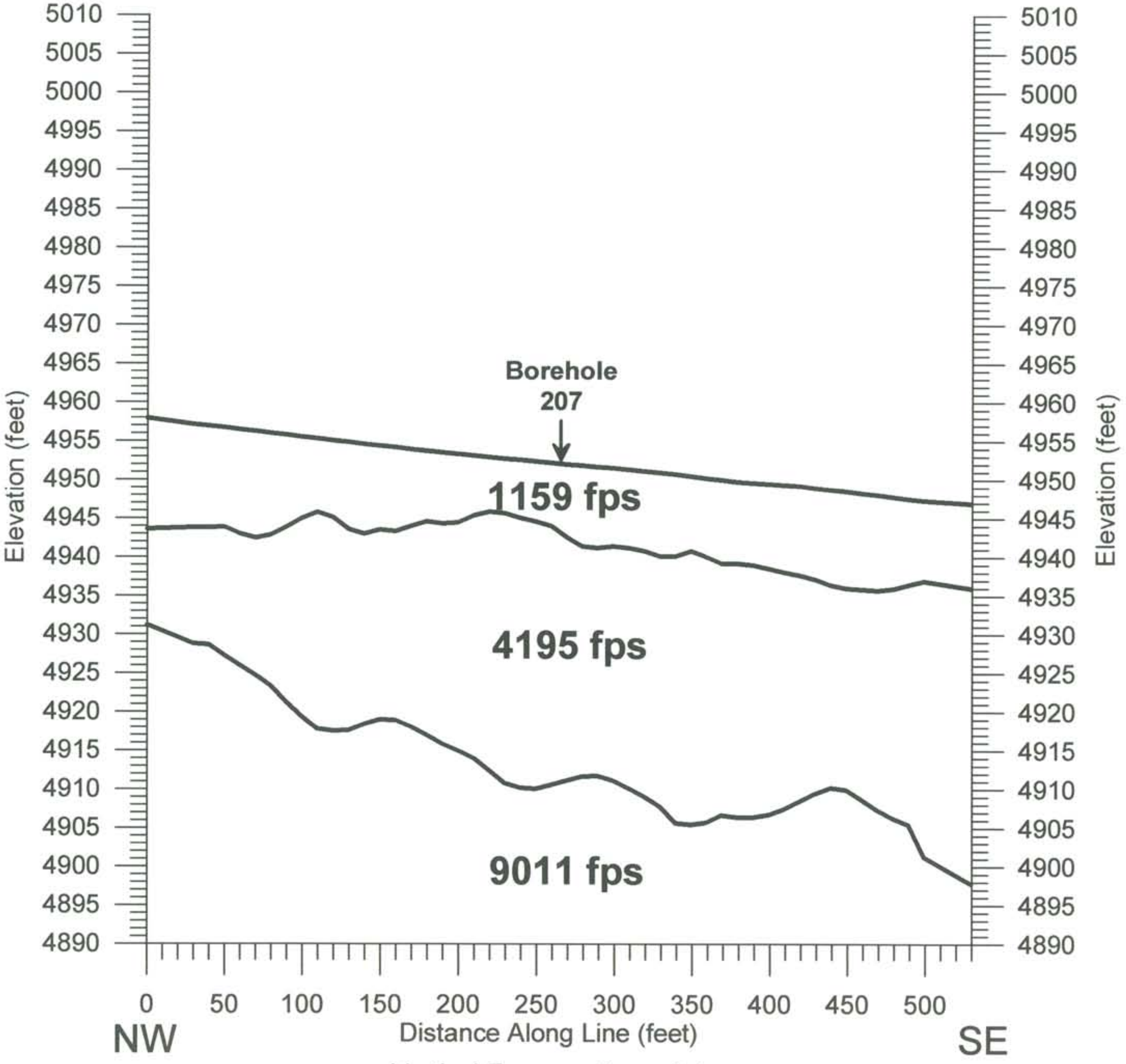
Seismic Rippability Investigation
Crescent Junction Disposal Site
Borehole 207 NW to SE Seismic Line
Elevation Section



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Velocities in feet per second (fps)

Hasbrouck Geophysics, Inc.

Borehole207NSElev2D.grf

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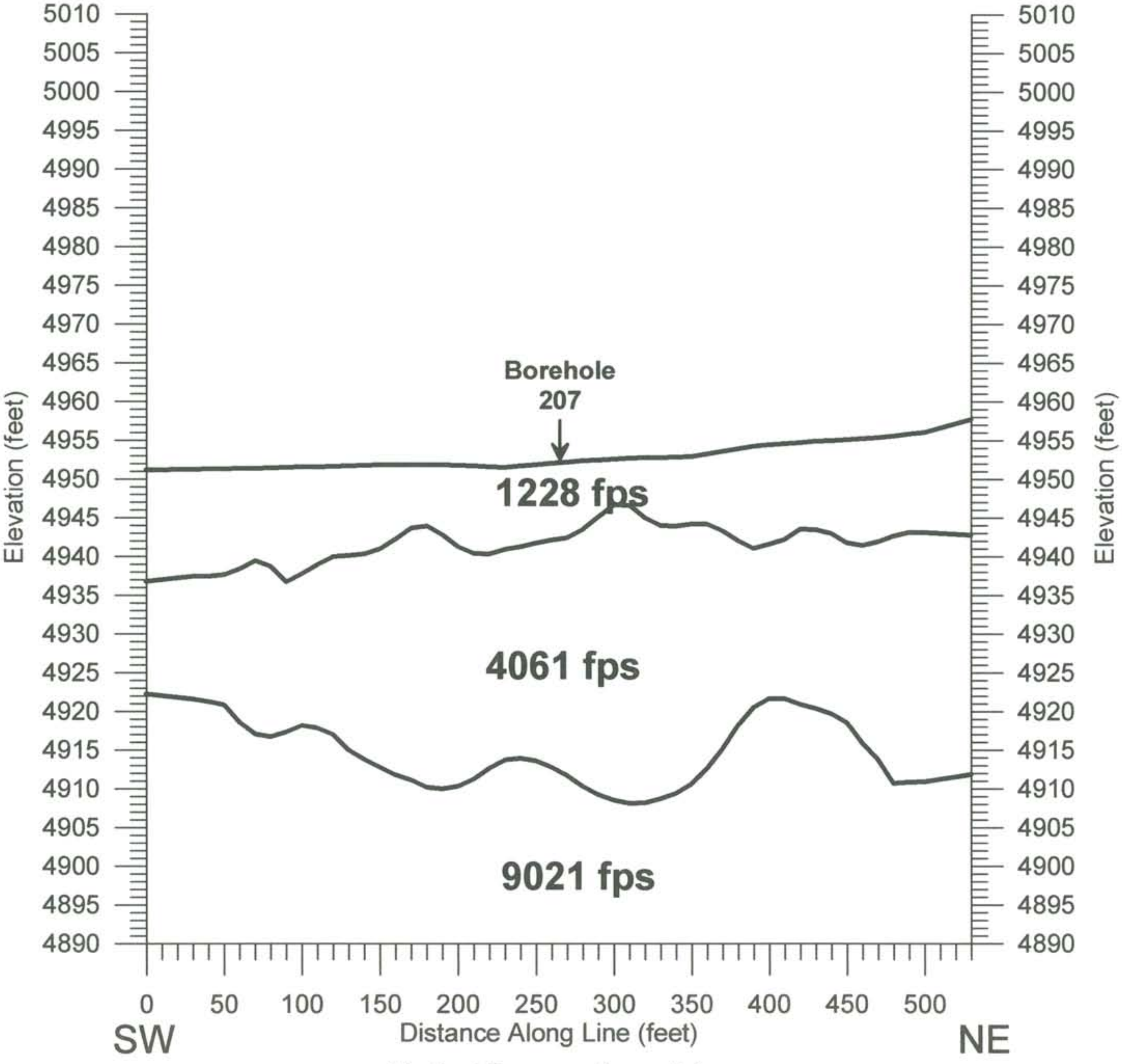
Crescent Junction Disposal Site
Borehole 207 SW to NE Seismic Line
Elevation Section



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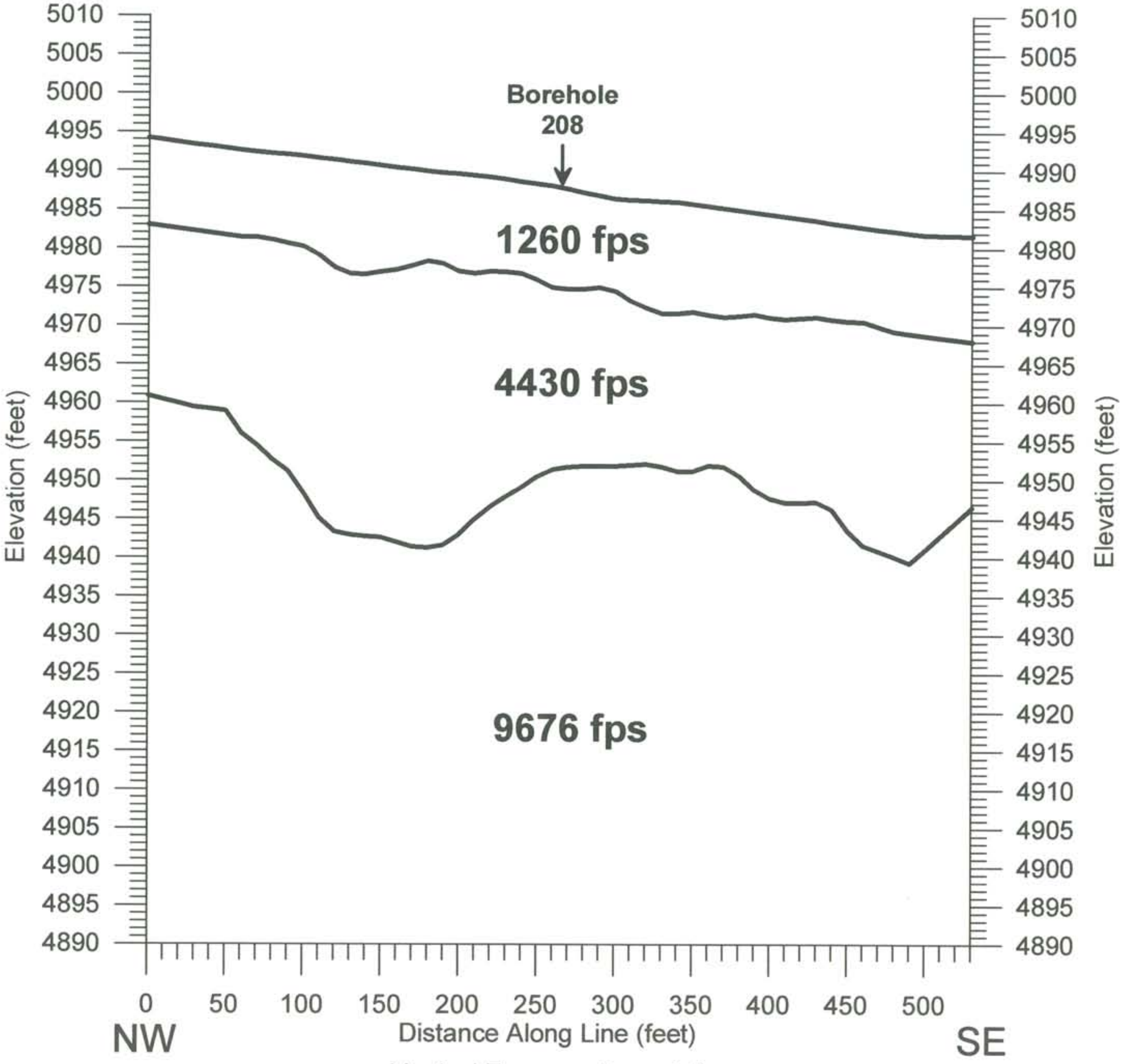
Velocities in feet per second (fps)

Hasbrouck Geophysics, Inc.

Borehole207EWElev2D.grf

Seismic Rippability Investigation
Crescent Junction Disposal Site
Borehole 208 NW to SE Seismic Line
Elevation Section



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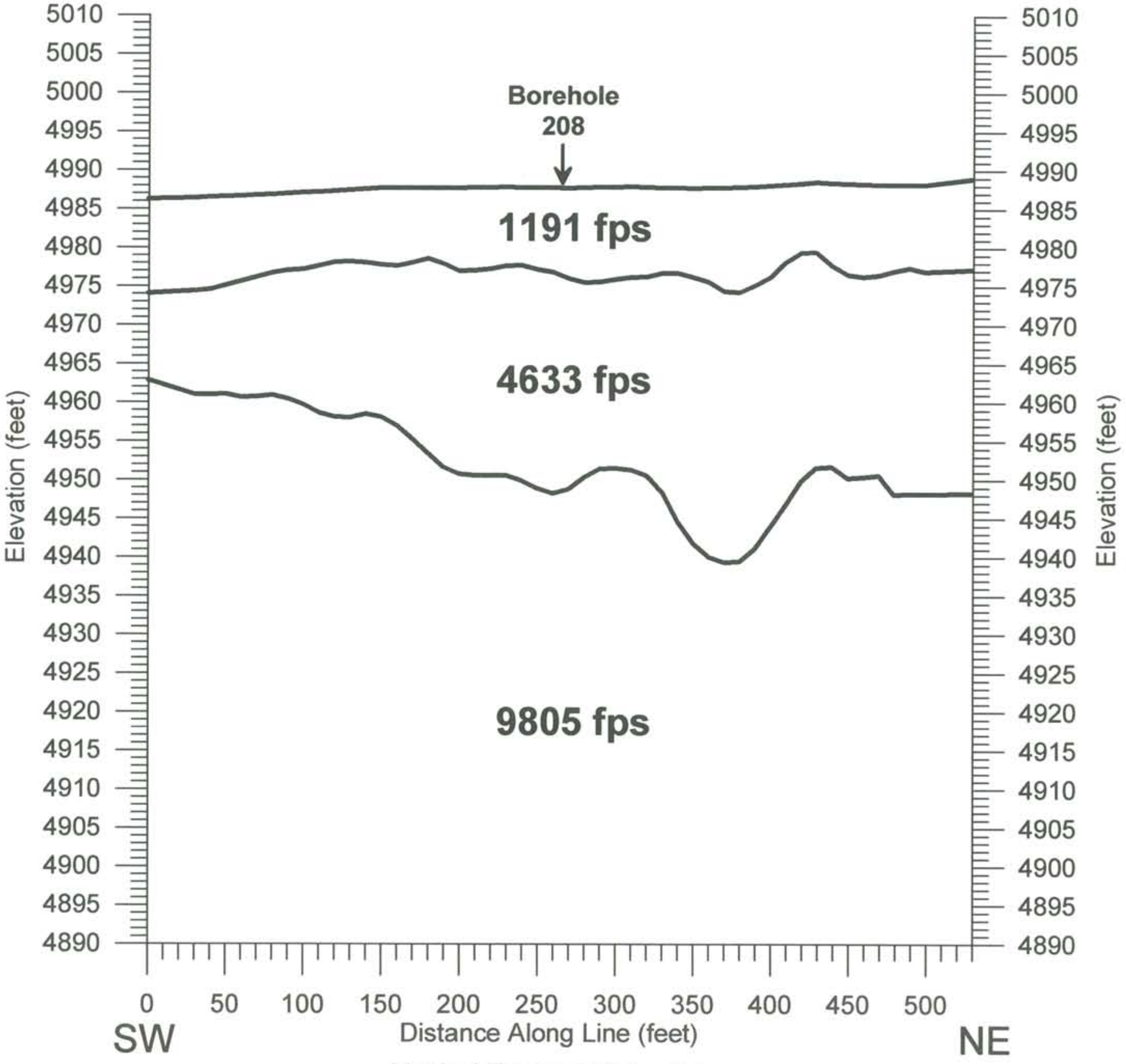
Velocities in feet per second (fps)

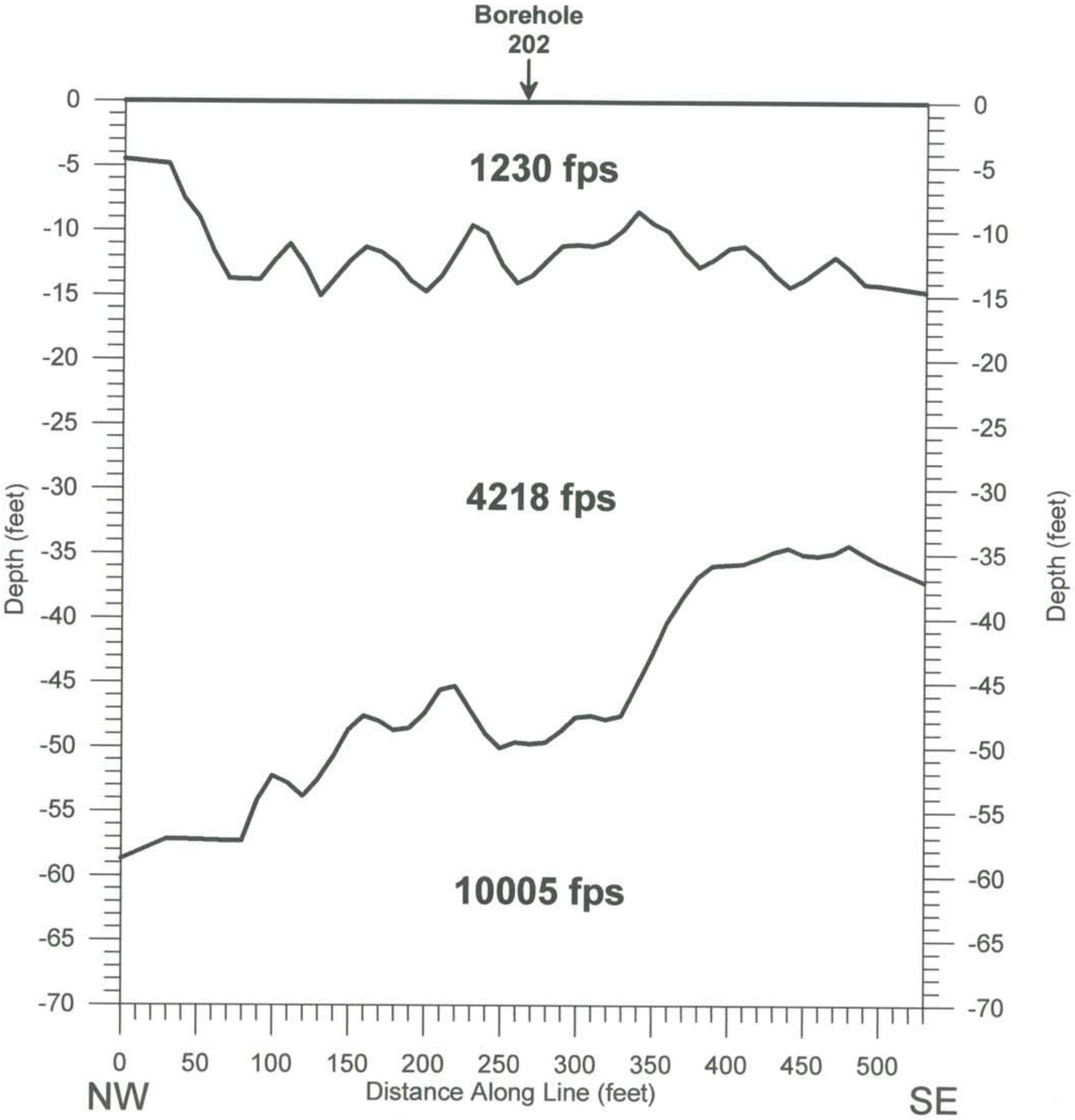
Seismic Rippability Investigation
Crescent Junction Disposal Site
Borehole 208 SW to NE Seismic Line
Elevation Section



Vertical Exaggeration = 4.4

Velocities in feet per second (fps)

Seismic Rippability Investigation
Crescent Junction Disposal Site
Borehole 202 NW to SE Seismic Line
Depth Section



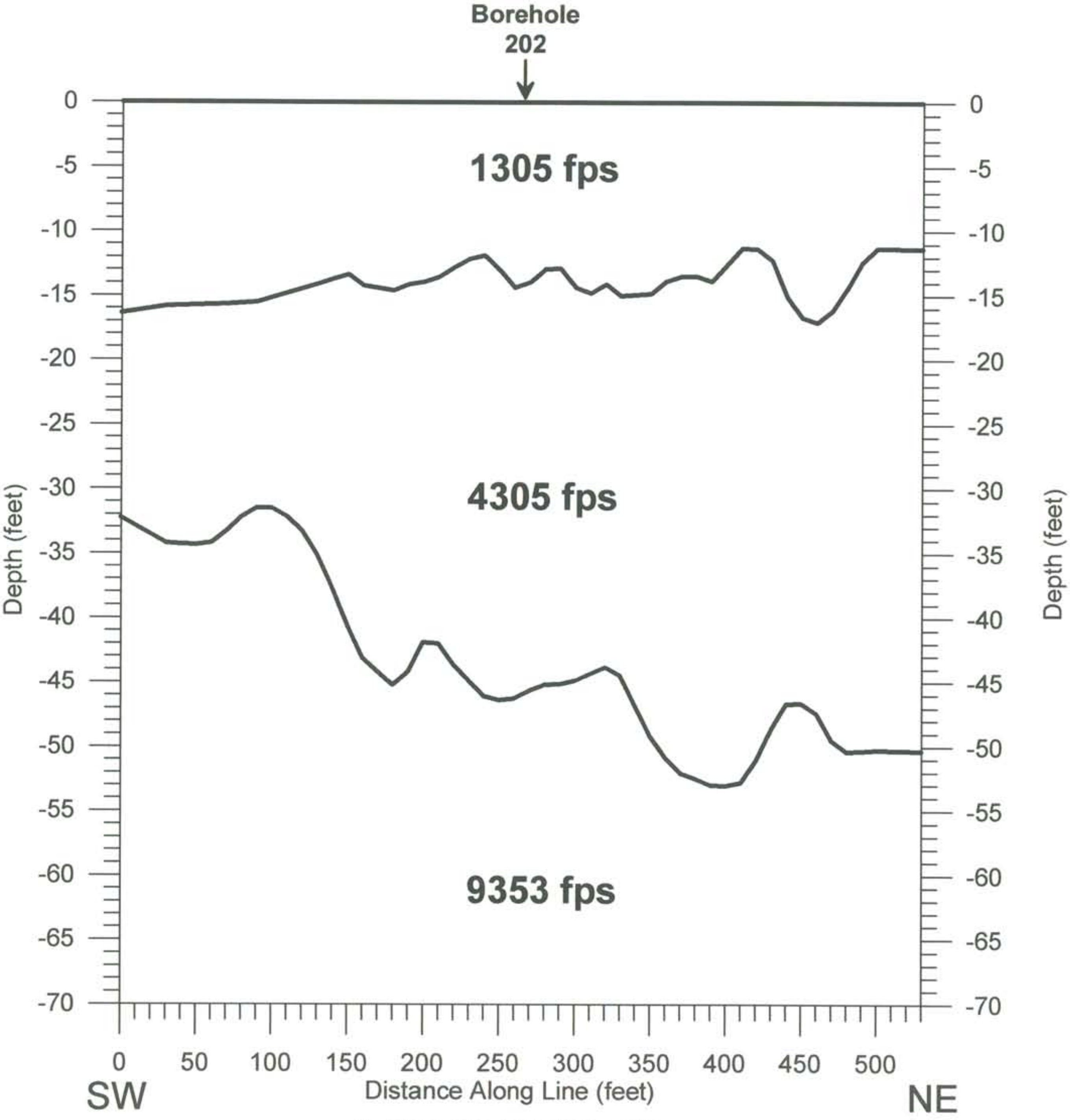
Vertical Exaggeration = 7.6

Velocities in feet per second (fps)

Hasbrouck Geophysics, Inc.

Borehole202NSDepth2D.grf

Seismic Rippability Investigation
Crescent Junction Disposal Site
Borehole 202 SW to NE Seismic Line
Depth Section



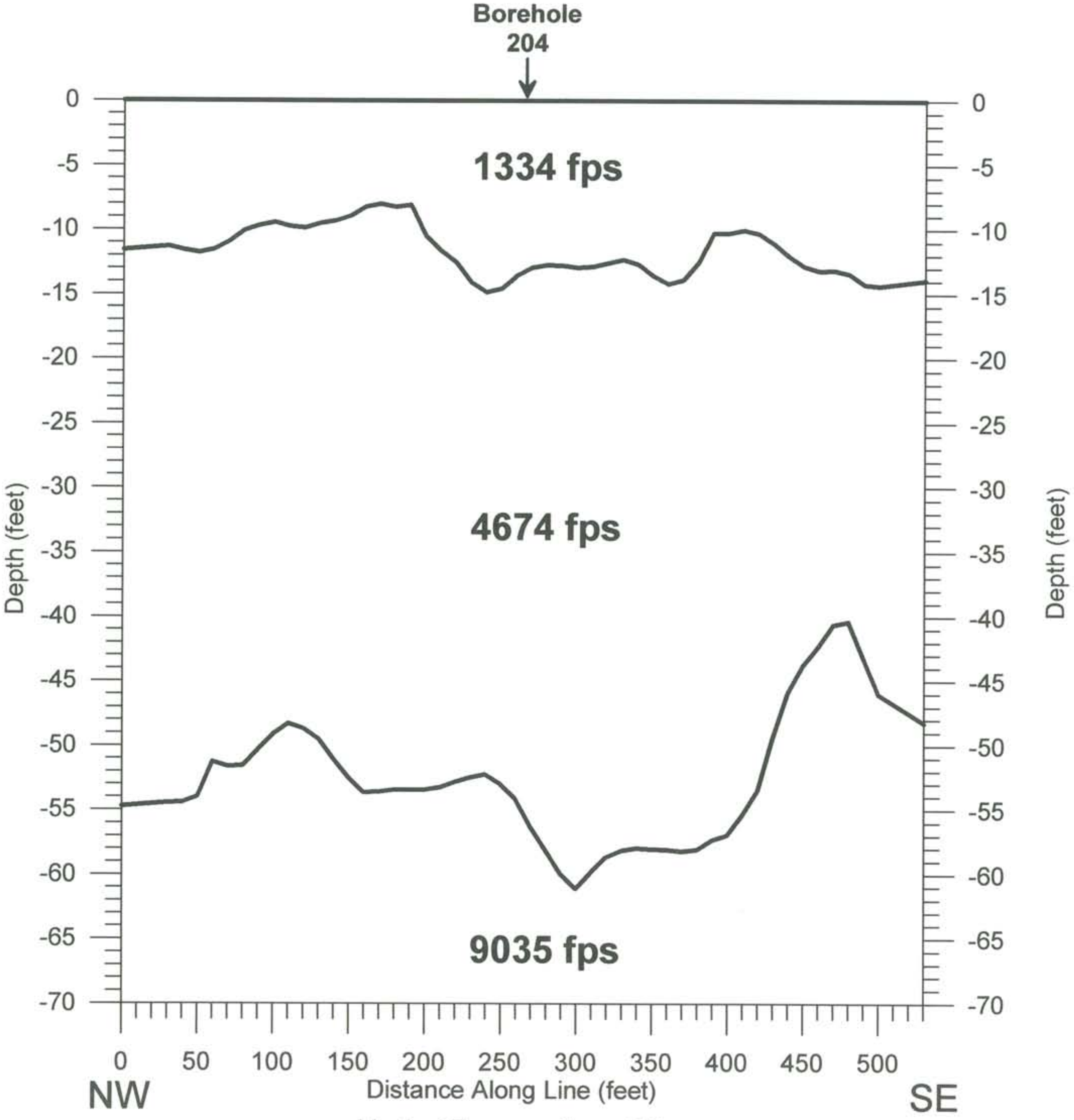
Vertical Exaggeration = 7.6

Velocities in feet per second (fps)

Hasbrouck Geophysics, Inc.

Borehole202EWDepth2D.grf

Seismic Rippability Investigation
Crescent Junction Disposal Site
Borehole 204 NW to SE Seismic Line
Depth Section



Vertical Exaggeration = 7.6

Velocities in feet per second (fps)

Hasbrouck Geophysics, Inc.

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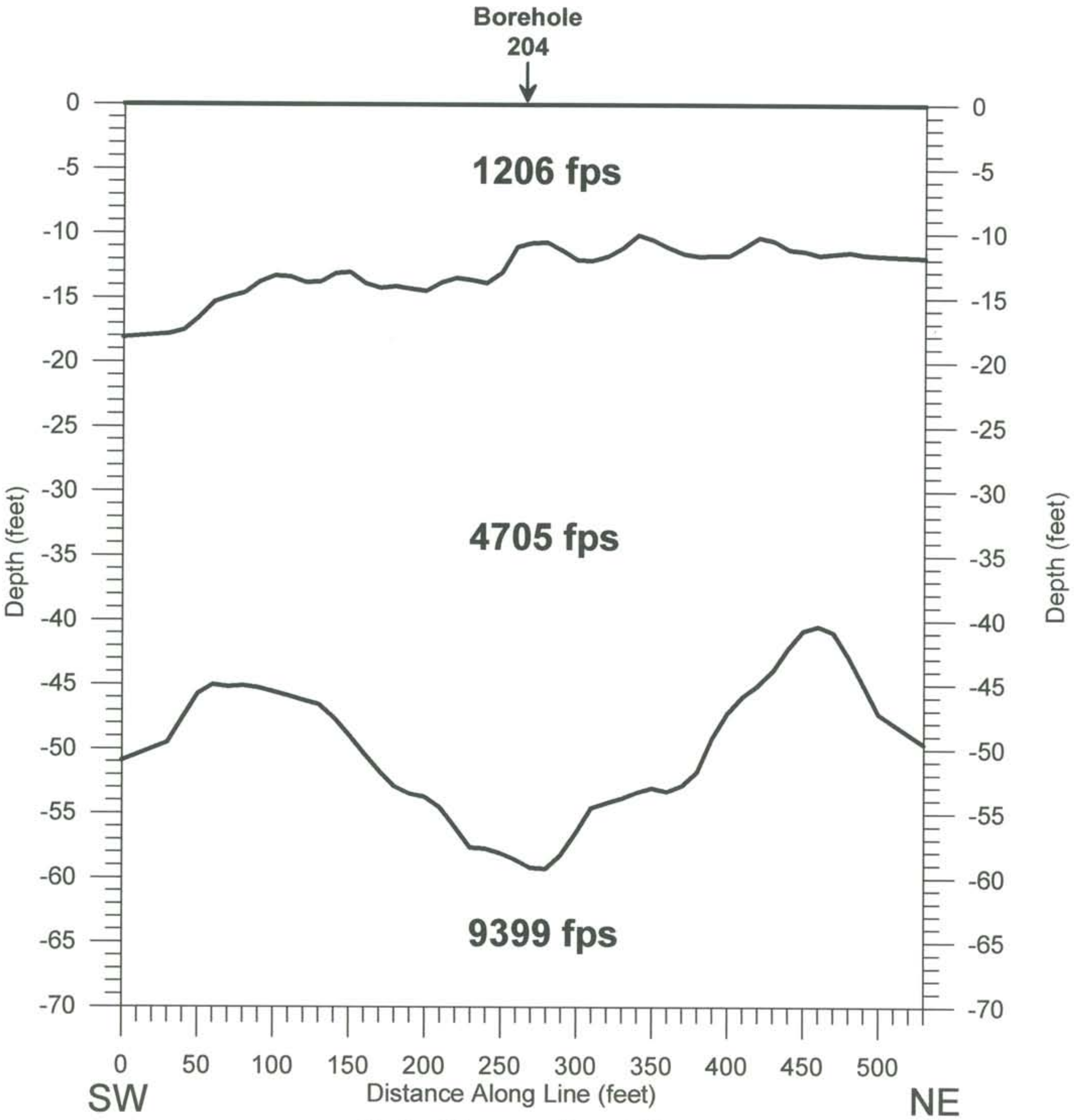
Seismic Rippability Investigation
Crescent Junction Disposal Site
Borehole 204 SW to NE Seismic Line
Depth Section



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Velocities in feet per second (fps)

Hasbrouck Geophysics, Inc.

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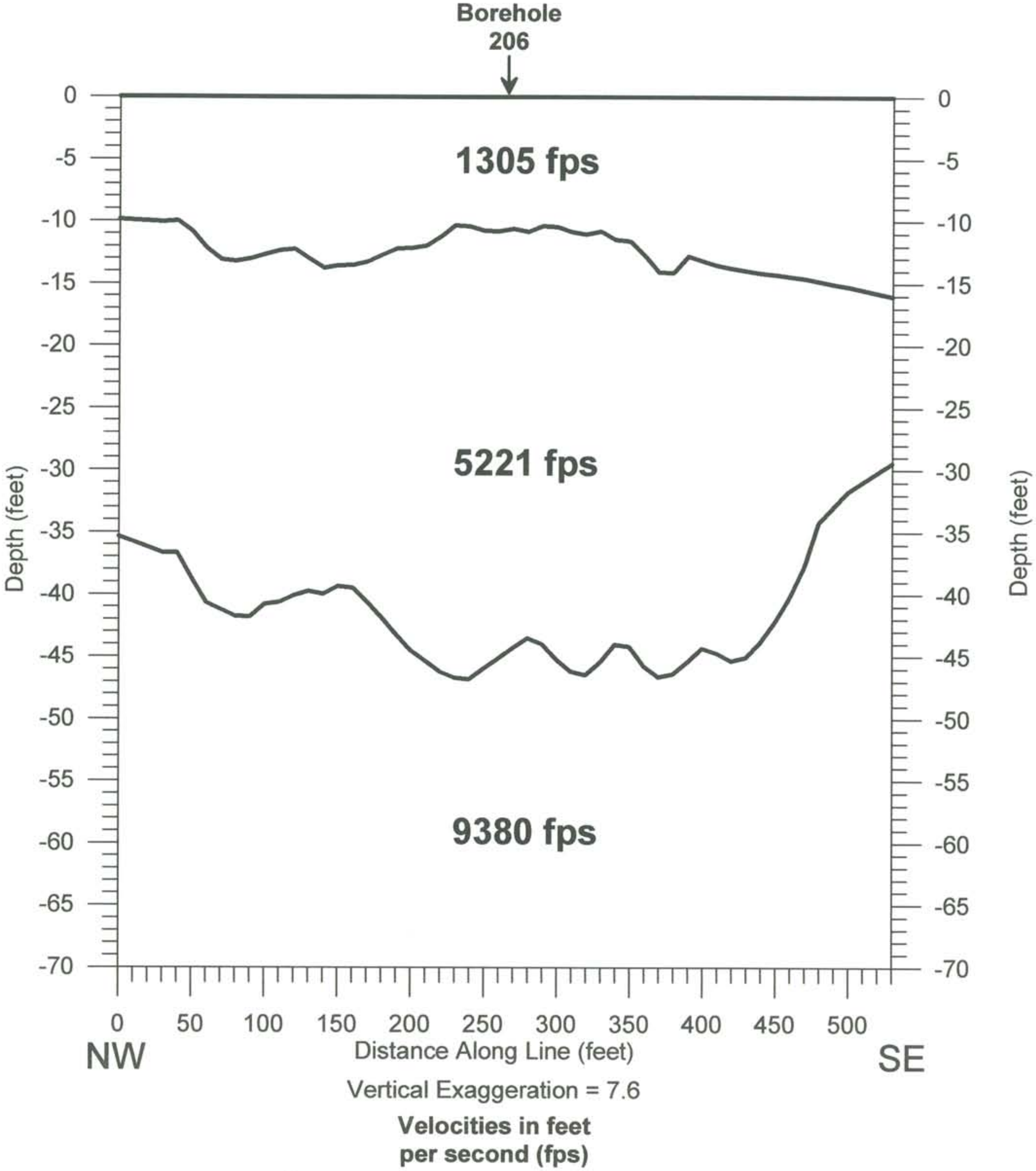
Seismic Rippability Investigation
Crescent Junction Disposal Site
Borehole 206 NW to SE Seismic Line
Depth Section



Hasbrouck Geophysics, Inc.

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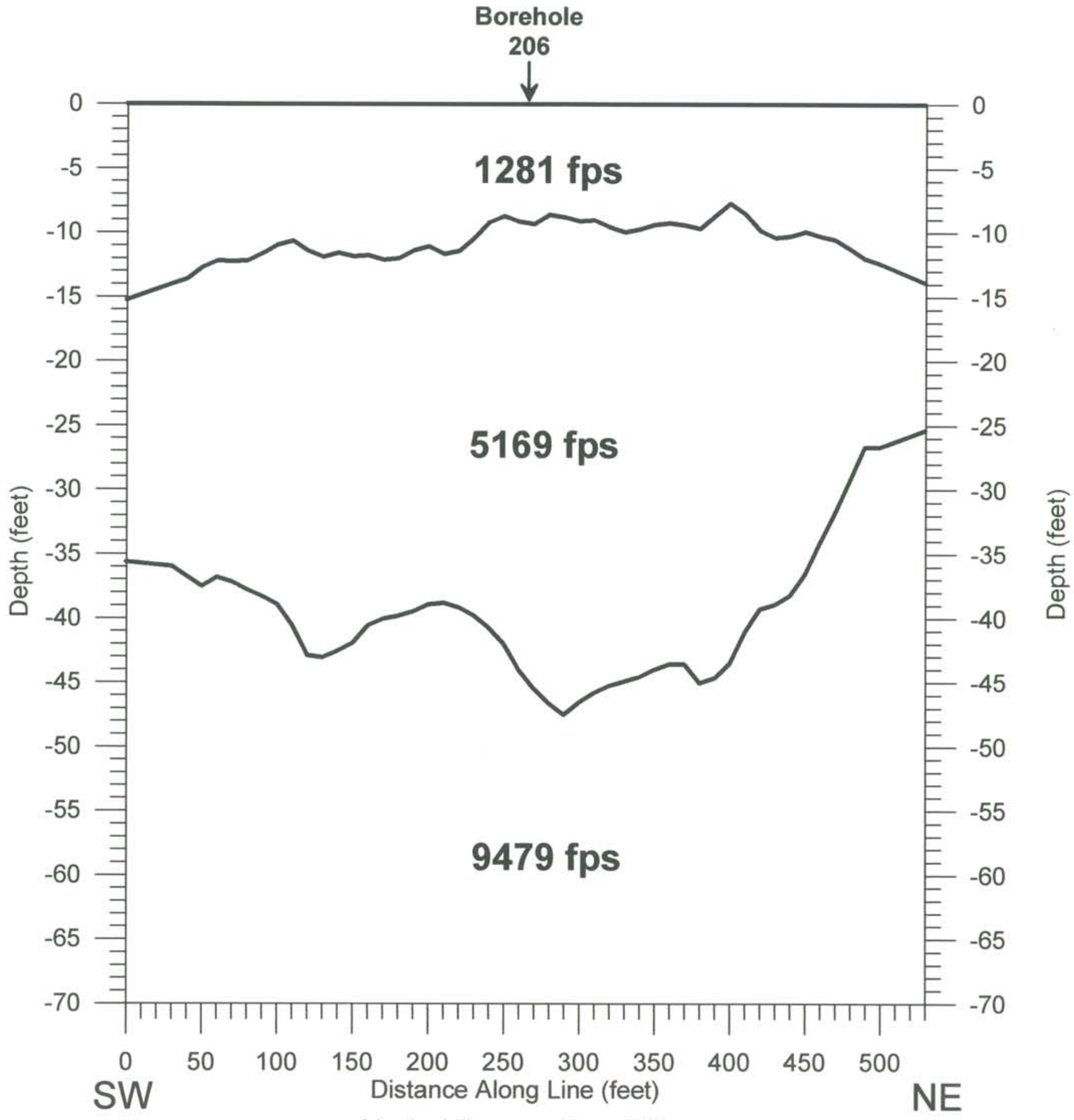
Seismic Rippability Investigation
Crescent Junction Disposal Site
Borehole 206 SW to NE Seismic Line
Depth Section



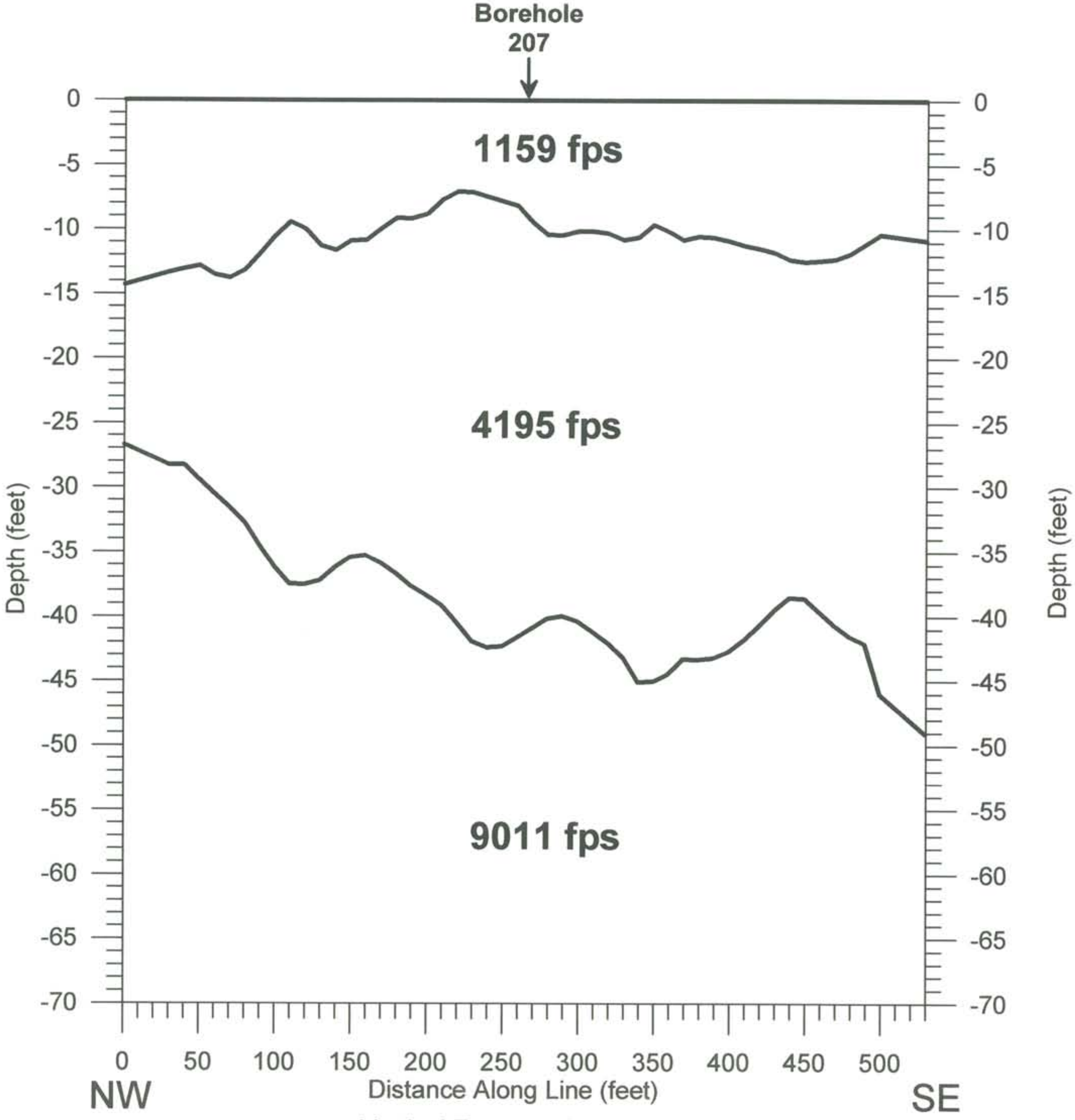
Vertical Exaggeration = 7.6

Velocities in feet per second (fps)

Hasbrouck Geophysics, Inc.

Borehole206EWDepth2D.grf

Seismic Rippability Investigation
Crescent Junction Disposal Site
Borehole 207 NW to SE Seismic Line
Depth Section



Vertical Exaggeration = 7.6

Velocities in feet per second (fps)

Hasbrouck Geophysics, Inc.

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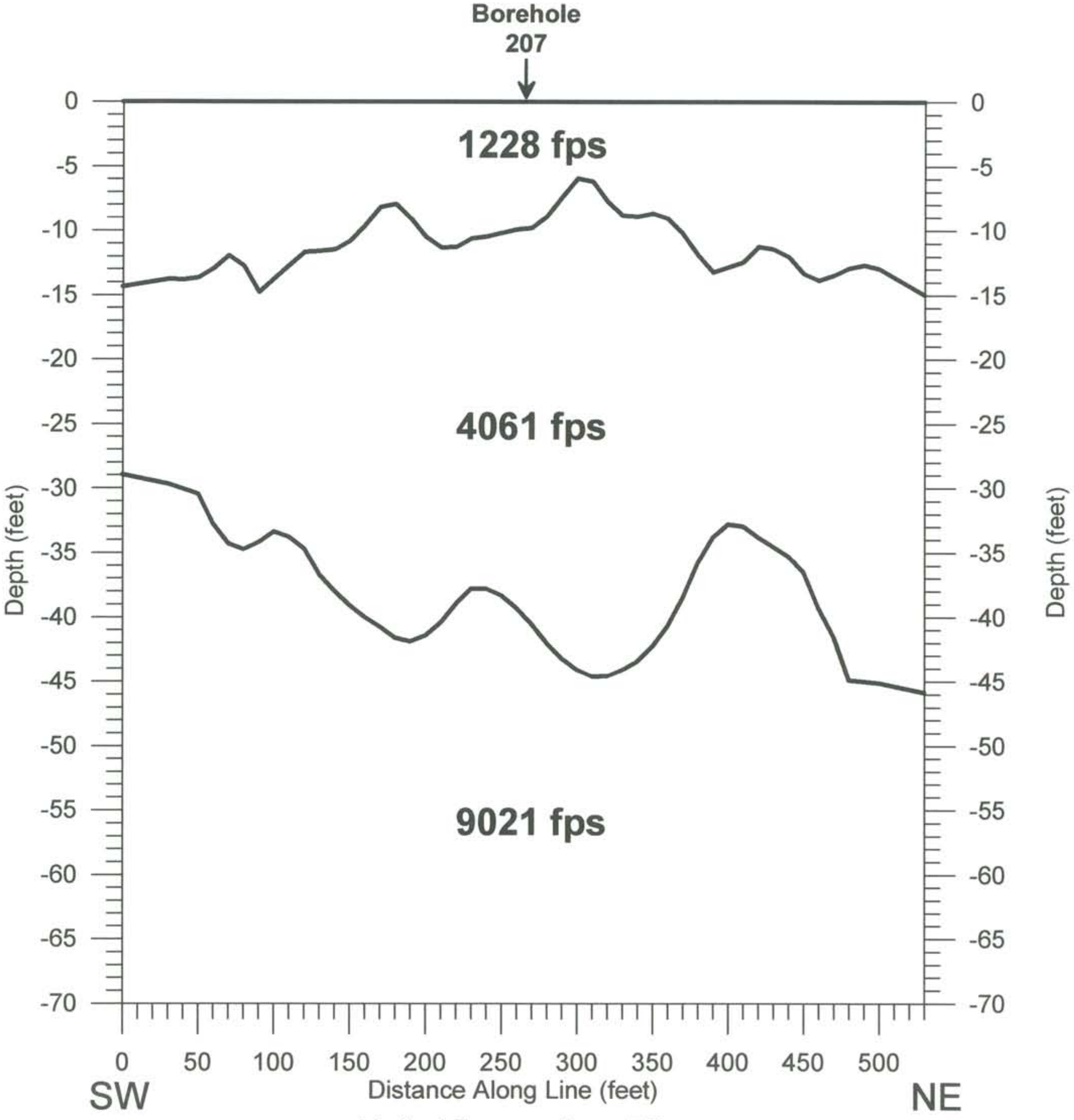
Seismic Rippability Investigation
Crescent Junction Disposal Site
Borehole 207 SW to NE Seismic Line
Depth Section



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Velocities in feet per second (fps)

Hasbrouck Geophysics, Inc.

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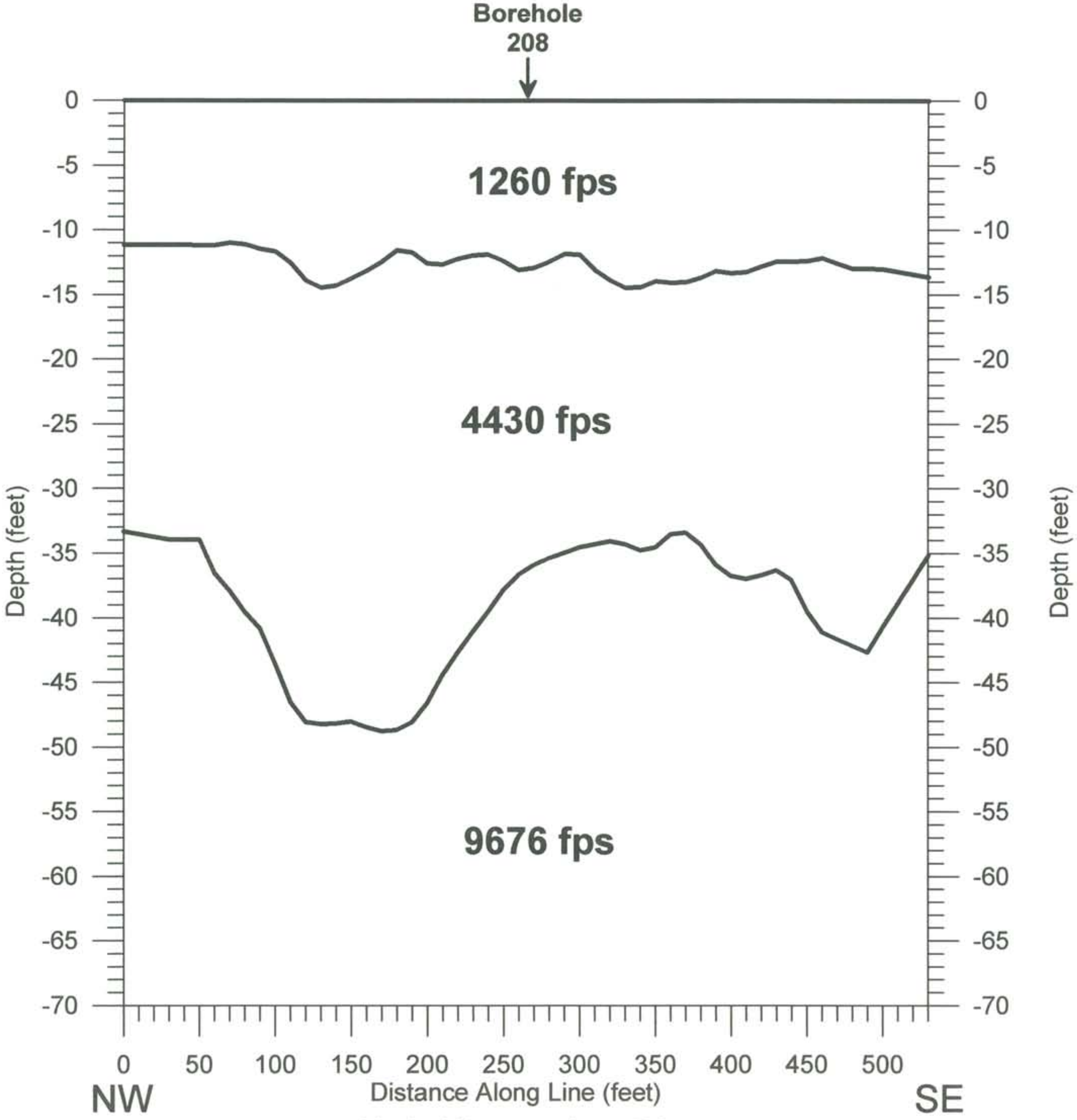
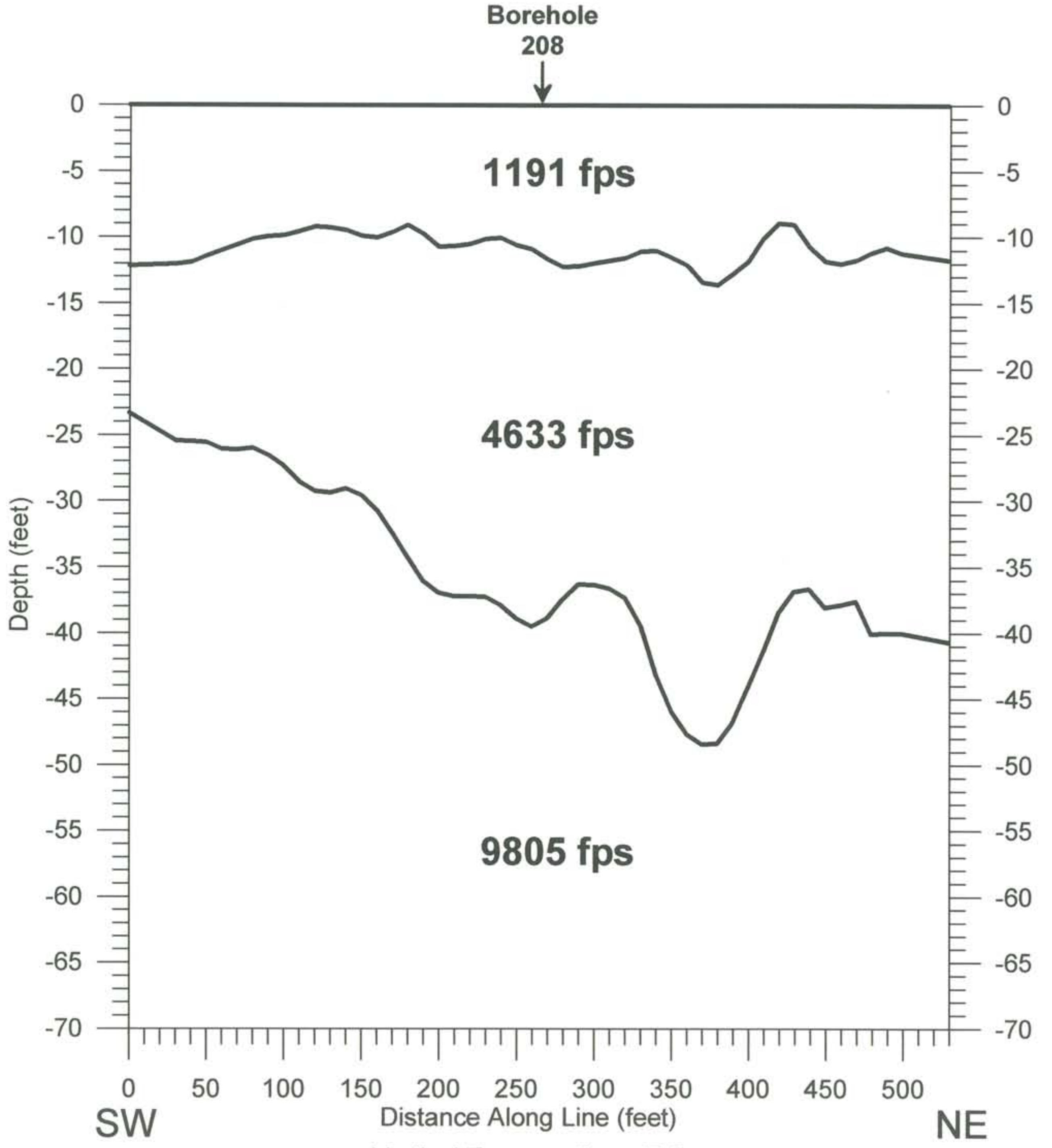
Seismic Rippability Investigation
Crescent Junction Disposal Site
Borehole 208 NW to SE Seismic Line
Depth Section



Vertical Exaggeration = 7.6

Velocities in feet per second (fps)

Seismic Rippability Investigation
Crescent Junction Disposal Site
Borehole 208 SW to NE Seismic Line
Depth Section



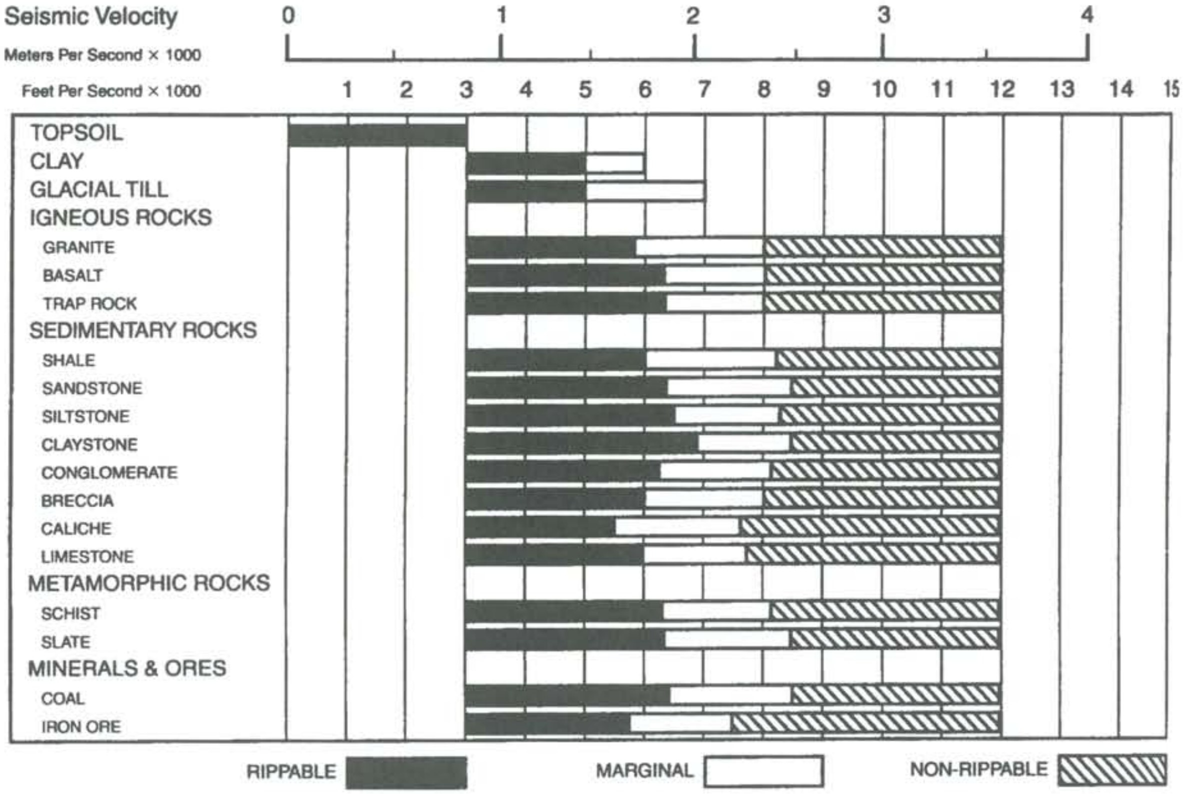
Vertical Exaggeration = 7.6

Velocities in feet per second (fps)

Caterpillar D8 Ripping Chart

D8R

- **Multi or Single Shank No. 8 Ripper**
- **Estimated by Seismic Wave Velocities**

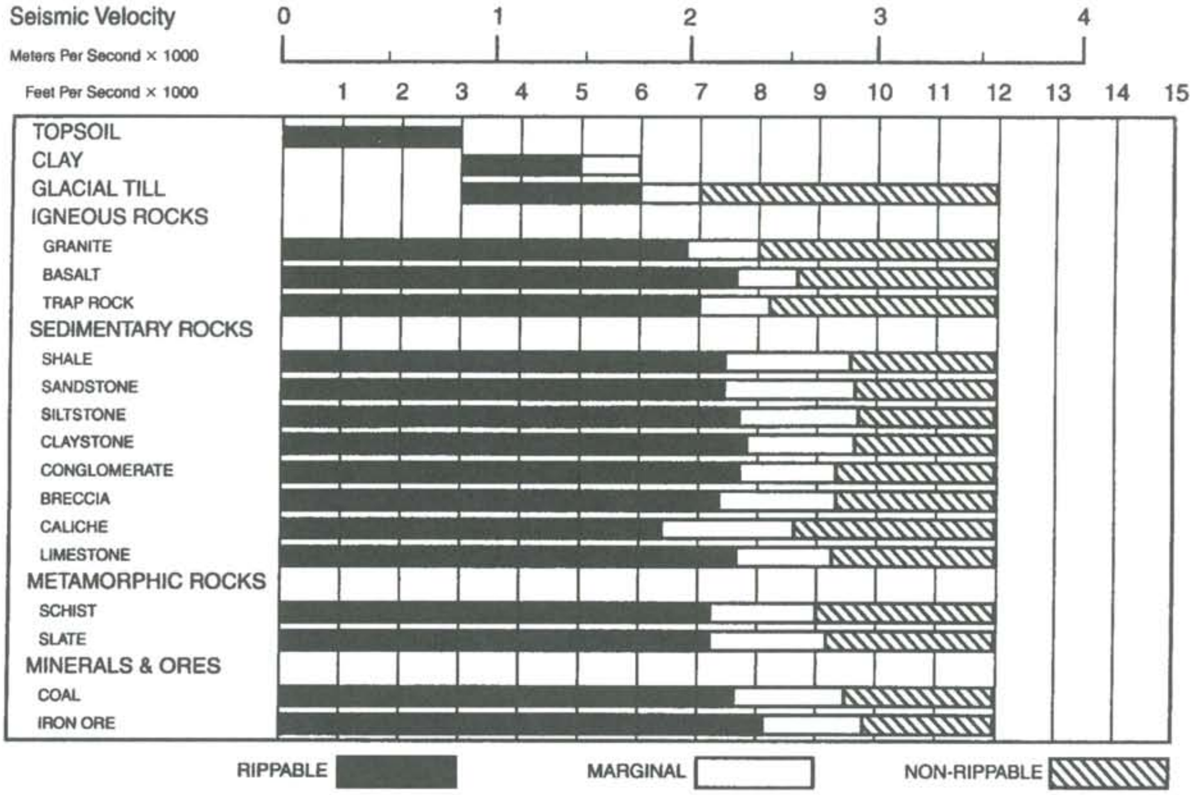


Hasbrouck Geophysics, Inc.

Caterpillar D9 Ripping Chart

D9R

- **Multi or Single Shank No. 9 Ripper**
- **Estimated by Seismic Wave Velocities**

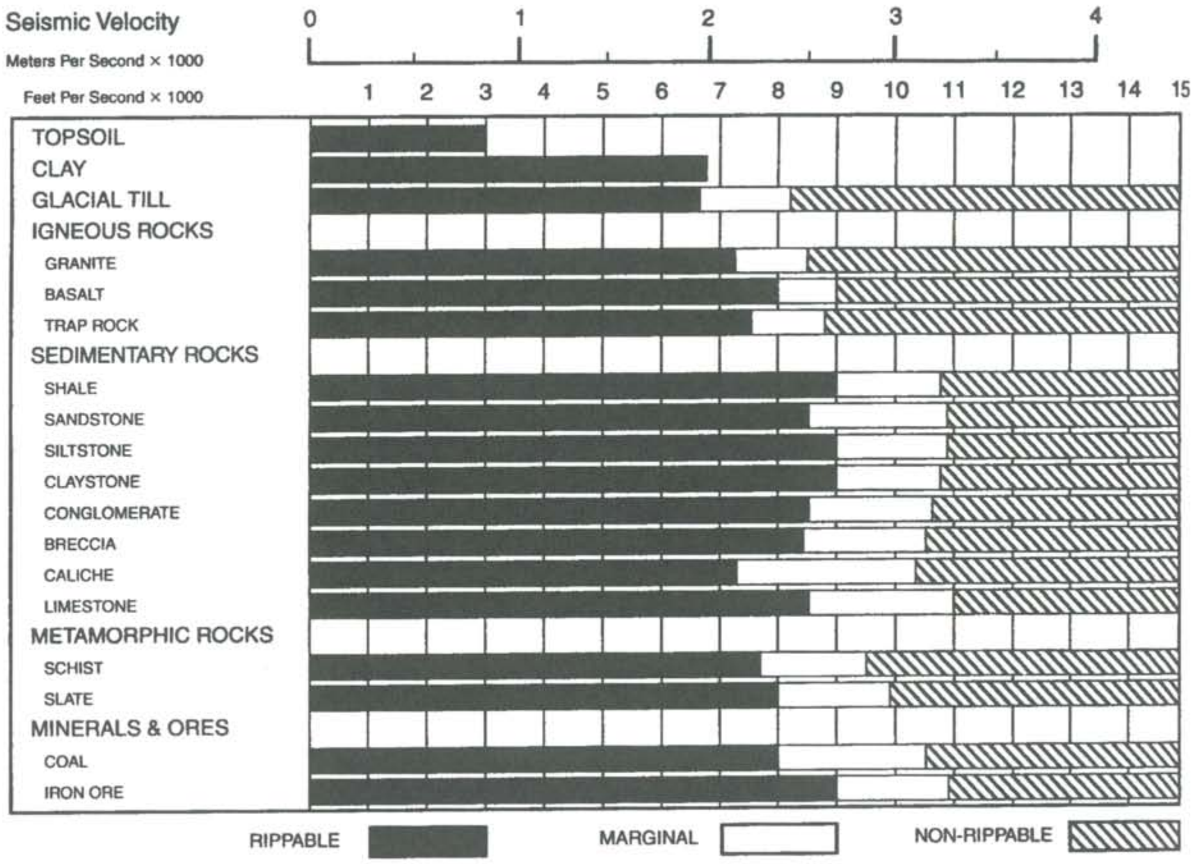


Hasbrouck Geophysics, Inc.

Caterpillar D10 Ripping Chart

D10R

- **Multi or Single Shank No. 10 Ripper**
- **Estimated by Seismic Wave Velocities**

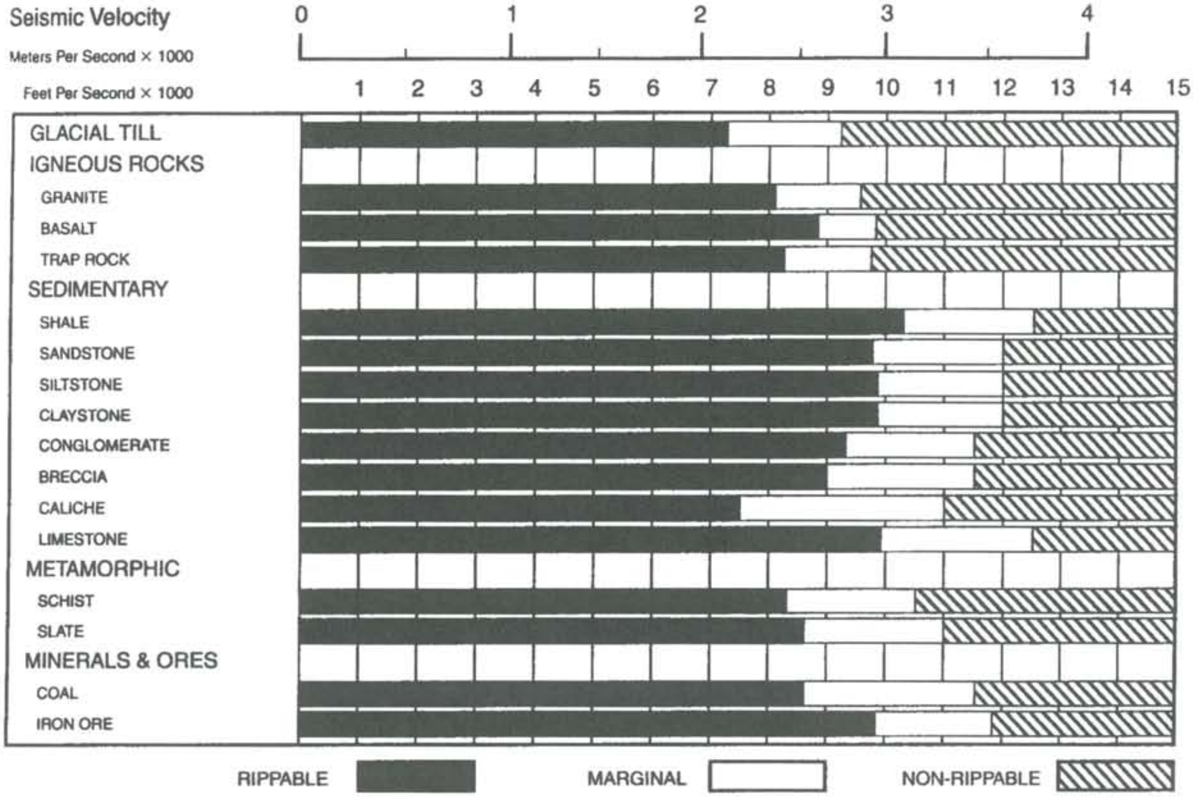


Hasbrouck Geophysics, Inc.

Caterpillar D11 Ripping Chart

D11R

- **Multi or Single Shank No. 11 Ripper**
- **Estimated by Seismic Wave Velocities**



Hasbrouck Geophysics, Inc.

Appendix B

Review of Seismic Report

The Word Works Inc., dba

H. David Mac Lean, P. Geoph

November 23, 2005

Mr. Mark Kautsky
S.M. Stoller Corp.
2597 B ¾ Road
Grand Junction CO 81503

Subject: Review of Report; *Seismic Rippability Investigations*
at the Crescent Junction Disposal Site,
for S.M. Stoller Corp. Grand Junction CO
by Hasbrouck Geophysics.

202 North Ave., PMB 252
Grand Junction Co 81501 Phone/fax : 970-242-1649

In its simplest form, the delay time method involves measurement of the time of arrival of a seismic wave at two geophone locations separated by a distance D. The description of the method and the procedures employed to accomplish the measurements as set forth in the above reference report are in accordance with standard industry practice. It is a limitation of the method that in order to measure the seismic velocity of successively deeper units, the seismic velocity must increase sequentially with depth, as stated in the report. This is usually the case in the most frequently encountered field situations, but low velocity, or reversal situations are encountered on occasion. Low velocity reversals do not appear to occur at the Crescent Junction site.

The lithologic section and the depth of investigation were specified by Stoller. The near surface section was determined by careful logging of core and cuttings from boreholes located throughout the planned repository. Selected boreholes formed the centers of the seismic refraction spreads as shown in the Borehole and Seismic Line Location Map included with the subject report. The refraction surveys were intended to extend the layer thickness information for approximately 250 ft in four orthogonal directions from the borehole.

Field Data Acquisition

The equipment referenced in the subject report was inspected during a visit to the field operations on October 29. The equipment was found to be as specified, and to be in good working order. Field conditions were less than optimal. Heavy rains had turned the area into a quagmire; nevertheless, the field crew was able to bring equipment into the area and proceeded with the survey with only minimal interruption caused by the adverse road and access conditions.

Field work for the survey was conducted October 29 and 30, 2005. It was observed that all field activities were conducted in a professional and workmanlike manner. Prior to commencement of operations, the field crew was briefed on health and safety issues by a Stoller representative, and a Health and Safety Plan was provided to the crew. The briefing was attended by this reviewer. Requirements of the plan, including clothing specifications were carefully observed by all field personnel.. In accordance with plan requirements, any soil that became even slightly contaminated in the course of the field activities was removed from the site and disposed of in accordance with applicable procedures and regulations.

This reviewer participated in one day of the field operations and noted that they were conducted as described in the report. Field work was conduct by a crew provided by Bird Geophysics in accordance with survey design specifications developed by Hasbrouck Geophysics. The crew was obviously well trained and performed all assigned tasks with competence and in a professional manner.

Upon locating the center of the refraction spreads referenced in an expanded version of the "Borehole and Seismic Line Location Map" included in the report, two orthogonal survey lines were extended in a NE-SW direction and a NW-SE direction. The lines were run by chain and compass; markers were placed at 10 foot intervals for a distance of 270 ft in the four directions from the center point. Every fourth marker from the center was identified so that its position could be surveyed later to the required accuracy. Since the terrain was open and unencumbered by vegetation, the entire line could be viewed from vantage points along the line. Lines were visually determined to be straight along the length of the chained interval.

Geophones were placed at each 10 foot marker. All geophones in a linear string were connected to the Bison 48 channel seismograph with Mark Products geophone cables.

Seismic signals were generated by the accelerated weight drop hammer mentioned in the report. A 200 lb metal bar is raised against compressing springs, and is thus accelerated downward to strike an aluminum plate placed on the ground at the shot point. The hammering operation started at one end of the line, and continued at various points along the spread as stated in the report. This is standard "shooting" procedure for seismic refraction surveys. The multiple shot points allow numerous depth and velocity determinations at various points along the spreads, and permit averaging and compensation for anisotropy and dip, since the seismic ray path can be observed in opposite directions. This procedure enables production of a much more detailed and representative velocity-depth section than would be possible if only a single shot point was employed.

Several (up to six) "shots" or hammer blows were taken at each shot point, allowing the seismic signals at each geophone location to be stacked. This procedure increases the signal to noise ratio. As pointed out in the report, seismic waves that arrive at a geophone at the same time following a hammer blow are additive to the signal; random noise or seismic signals for which the strike instant is incorrect are destructive and will not augment or enhance the initial seismic signal. On completion of the stacking activity, a seismogram was printed in the field for inspection and quality assurance purposes.

On the completion of the field survey day, digital data sets were forwarded to Hasbrouck Geophysics for processing and analysis. The data were processed by Hasbrouck Geophysics using the SIPwin software from Rimrock Geophysics. This processing software is state-of-the-technology for Refraction Seismic Data Processing. Given the software capabilities and the field procedures employed, Hasbrouck Geophysics was able to calculate seismic velocities over very short refractor distances. Velocities were calculated using both the regression and Hobson-Overton methods. This processing combination adequately deals with the effects anisotropy, and the distortions introduced by dipping layers. The resulting depth and velocity calculations were then employed to produce the very detailed velocity/depth sections included with the subject report.

Analysis

The velocities for the 3 layers discussed in the report, i.e., alluvium (layer 1) weathered Mancos Shale (layer 2) and Mancos Shale (layer 3) are well within the range expected for these materials. In unconsolidated material such as Layer 1, seismic velocities are often close to acoustic velocities in air (approximately 1100fps). Considerable variation in the measured velocity of Layer 2, (the weathered shale or regolith) can be expected depending on the amount of sand or silt inclusioning and the degree of consolidation within local areas. As pointed out in the report, weathering will not be complete through the entire geologic section and the lithologic material is not uniform. As expected, the seismic velocities increase as a function of depth.

The velocity function for all three layers underlying the planned repository is well illustrated by the time-distance (T-D) plot for one of the survey lines at borehole 204. A copy of the T-D plot is attached hereto. The figure provides a visual indication of the seismic velocity for the various layers. Generally, the flatter the curve on the T-D plot, the higher the velocity. A segment of the T-D plot that is continuous over a measurable interval indicates an identifiable layer. A simple estimate of the velocity associated with this interval can be made by dividing the distance interval D by the difference in arrival time (T) on the T-D plot. Of course the actual final determination of the depth associated with this interval involves a considerably more complex calculation, as has been discussed peripherally in the report.

Limitations

The purpose of measuring the seismic velocities of the layers underlying the proposed mill tailings repository was to estimate the rippability of the underlying lithologic units. Hasbrouck Geophysics has developed depth and velocity sections for all of the surveyed lines that show the lithologic layers to depths of 50 to 60 feet and the measured seismic velocities within these layers to the accuracy that is achievable with the equipment and methodology employed. However, the relationship of these measured seismic velocities to rippability of a particular unit is empirical, not an engineering certainty. Caterpillar Inc. and others involved with heavy equipment operations have observed an apparent relationship and have published charts and graphs showing the ripping capabilities of certain tractor models for various geologic material with a range of seismic velocities. However, there are many other factors that contribute to rippability, such as the degree and orientation of fracturing. Although the rippability charts published by Caterpillar Inc. represent that material with a seismic velocity in a certain range is usually within the ripping capability of certain tractor types, it is not an engineering certainty that this is the case.

Accordingly, any decision to employ a certain type of equipment based on the velocities provided in the subject report must be taken on the basis of the excavation contractor's own knowledge, and not on statements or implied statements in the report. The velocities and layer thicknesses provided in the report are valid within the accuracy of the seismic refraction method, and are reproducible by similar surveys. Nevertheless, the relationship of these in-situ measured velocities and the suitability of a specific tractor model for ripping a geologic unit with these velocities is strictly empirical and may vary from that presented in the rippability charts provided by Caterpillar Inc.

Conclusions

The subject report provides seismic velocities and the thickness of layers underlying the proposed tailings repository to a depth of about 60 ft or more. The sections showing these depths and velocities provided in the report were produced by means of a refraction seismic survey that was conducted in a professional and workmanlike manner, employing equipment that was suitable to the task. The measured interval velocities, unit thicknesses and variations to be expected are accurate to within the limitations of the current state of refraction seismic technology. The statement in the report that measured velocities are accurate to within 10 per cent is probably overly pessimistic; the accuracy of the measurements is probably much closer to 5% or less. General experience suggests that the unit thicknesses stated in the report are accurate to within 10% or better.

As stated in the report, the suitability of selecting equipment based on the reported velocities is based entirely on the experience of Caterpillar Inc. Nothing in the subject report should be construed as an endorsement of the suitability of a particular tractor model for ripping and excavating applications at the Crescent Junction repository. This decision must be taken on the basis of the excavator's own experience with ripping machinery in applications where seismic velocities are known.

Respectfully Submitted,

H. David Mac Lean, P. Geoph.

HDM/hdm

Enclosures:

Borehole 204 NW to SE Time-Distance plot

References:

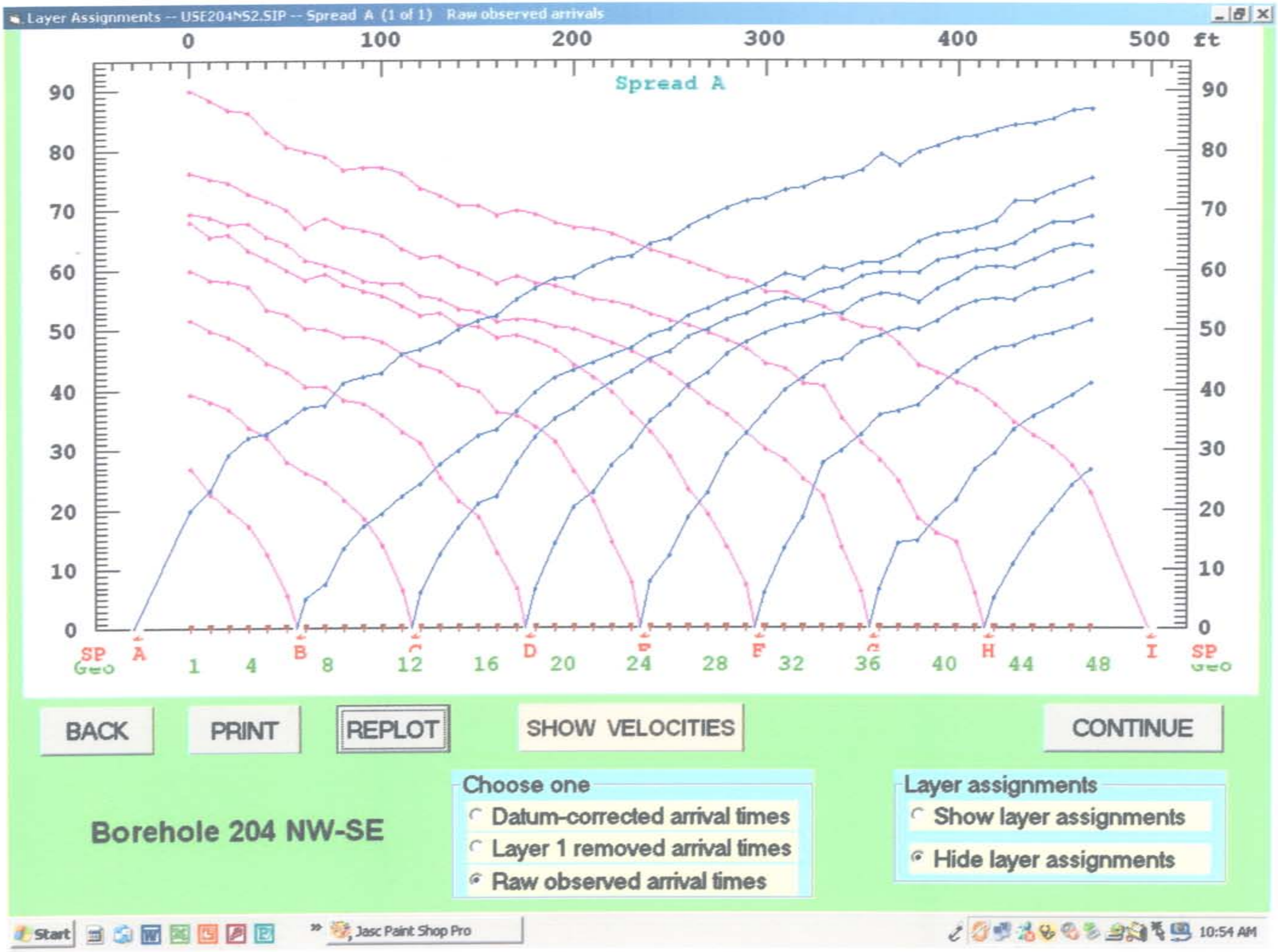
________________. Caterpillar Performance Handbook, Ed 30, October 1999, *Use of Seismic Velocity Charts* pp 1-71-1-78

Statement of Qualifications

H. David Mac Lean is a Registered Professional Geophysicist in the State of Californa, Registration No. 440 and in the Province of Alberta, Canada, Registration no.M15724. Mr. Mac Lean has been a practicing geophysicist for over 35 years.

Mr. Mac Lean has gained experience with the seismic refraction method while engaged in aggregate mapping activities in the Beaufort Sea, and in laying out seismic surveys for oil exploration in Alberta, Canada.

Mr. Mac Lean is an emeritus member of the Society of Exploration Geophysicists, the Canadian Exploration Geophysical Society, The Australian Society of Exploration Geophsicist, the Society for Mining and Metallurgy of the American Institute Mining Engineering and other technical and professional societies dedicated to the advancement of geophysics. Mr. MacLean is a frequent attendee at conventions, trade shows and seminars dedicated to geophysical technologies.



Borehole 204 NW-SE

Choose one
- ○ Datum-corrected arrival times
- ○ Layer 1 removed arrival times
- ● Raw observed arrival times

Layer assignments
- ○ Show layer assignments
- ● Hide layer assignments

U.S. Department of Energy—Grand Junction, Colorado

Calculation Cover Sheet

Calc. No.: MOA-02-03-2007-3-04-01
Doc. No.: X0156900
Discipline: Geochemical Properties
No. of Sheets: 8

Location: Attachment 5 Vol. I, Appendix H

Project: Moab UMTRA Project

Site: Crescent Junction, Utah

Feature: Background Ground Water Quality for the Crescent Junction Site

Sources of Data:

Chemistry results from the following Crescent Junction Disposal Site ground water sampling events. Results are available in Appendix B of this report and in the SEEPro database.

November 7, 2005
December 27, 2005
April 18, 2006
September 6–11, 2006

Remedial Action Plan (RAP) calculations as referenced in the text.

Purpose of Revision:

Revision is being issued to include results of April 2006 and September 2006 ground water sampling.

Sources of Formulae and References:

See "References" section

Preliminary Calc. ☐ **Final Calc.** ☒ **Supersedes Calc. No.** MOA-02-03-2006-3-04-00

Author: Name 5-31-07 Date

Approved by: Name 5/31/07 Date

Checked by:
Name 5/30/07 Date
Dave Peterson Name 5/31/07 Date
Name 31 May 07 Date
Name May 31, 07 Date

No text for this page

Problem Statement:

Preliminary site selection performed jointly by the U.S. Department of Energy (DOE) and the Contractor has identified a 2,300-acre withdrawal area in the Crescent Flat area just northeast of Crescent Junction, Utah, as a possible site for final disposal of the Moab uranium mill tailings. The proposed disposal cell would cover approximately 250 acres. Based on the preliminary site-selection process, the suitability of the Crescent Junction Disposal Site is being evaluated from several technical aspects including geomorphic, geologic, hydrologic, seismic, geochemical, and geotechnical. The objective of this calculation set is to evaluate background ground water quality data from the Crescent Junction Disposal Site.

Conclusions from these data will be incorporated into Attachment 3 (Ground Water Hydrology) and Attachment 4 (Water Resources Protection) of the Remedial Action Plan and Site Design for Stabilization of Moab Title I Uranium Mill Tailings at the Crescent Junction, Utah, Disposal Site (RAP) and summarized in the Remedial Action Selection (RAS) Report for the Moab Site.

Method of Solution:

Ten coreholes were advanced to depths of approximately 300 feet (ft) in the study area for the Crescent Junction Disposal Site (
Figure 1 and Appendix A). Ground water was observed immediately after completion of drilling in coreholes 0201, 0202, 0203, 0204, and 0208. Ground water seeped into coreholes 0205 and 0210 over the course of several weeks after completion of drilling. Coreholes 0206, 0207, and 0209 remained dry as of May 2006.

Background ground water samples were collected during four sampling events. The first sampling event (November 2005) included sampling of ground water from coreholes 0208 and 0210 to determine total dissolved solids (TDS) concentrations and major cations and anions. The second sampling event (December 2005) included collection of ground water from coreholes 0201, 0202, 0203, 0204, and 0208. A more comprehensive list of constituents was analyzed during the December 2005 sampling event. Coreholes 0205 and 0210 were not sampled during the second round because in comparison to the other coreholes they had much deeper water levels and longer water-level recovery rates; therefore, they were considered less significant. Results from these initial two sampling events were reported in the Preliminary Calculation Set of May 2006.

The two additional sampling events were carried out during April 2006 and September 2006 to evaluate if temporal changes had occurred since the coreholes were first advanced. Samples were collected from coreholes 0201, 0202, 0203, 0204, 0205, 0208, and 0210. A more comprehensive analyte list was developed to include potential contaminants of concern from the Moab Processing Site, constituents in Table 1 to Subpart A of Title 40 of the *Code of Federal Regulations* (40 CFR 192), and other diagnostic constituents for geochemical properties of the Mancos Shale at the disposal site. This final calculation set includes results of all background ground water quality data collected from the Crescent Junction Disposal Site.

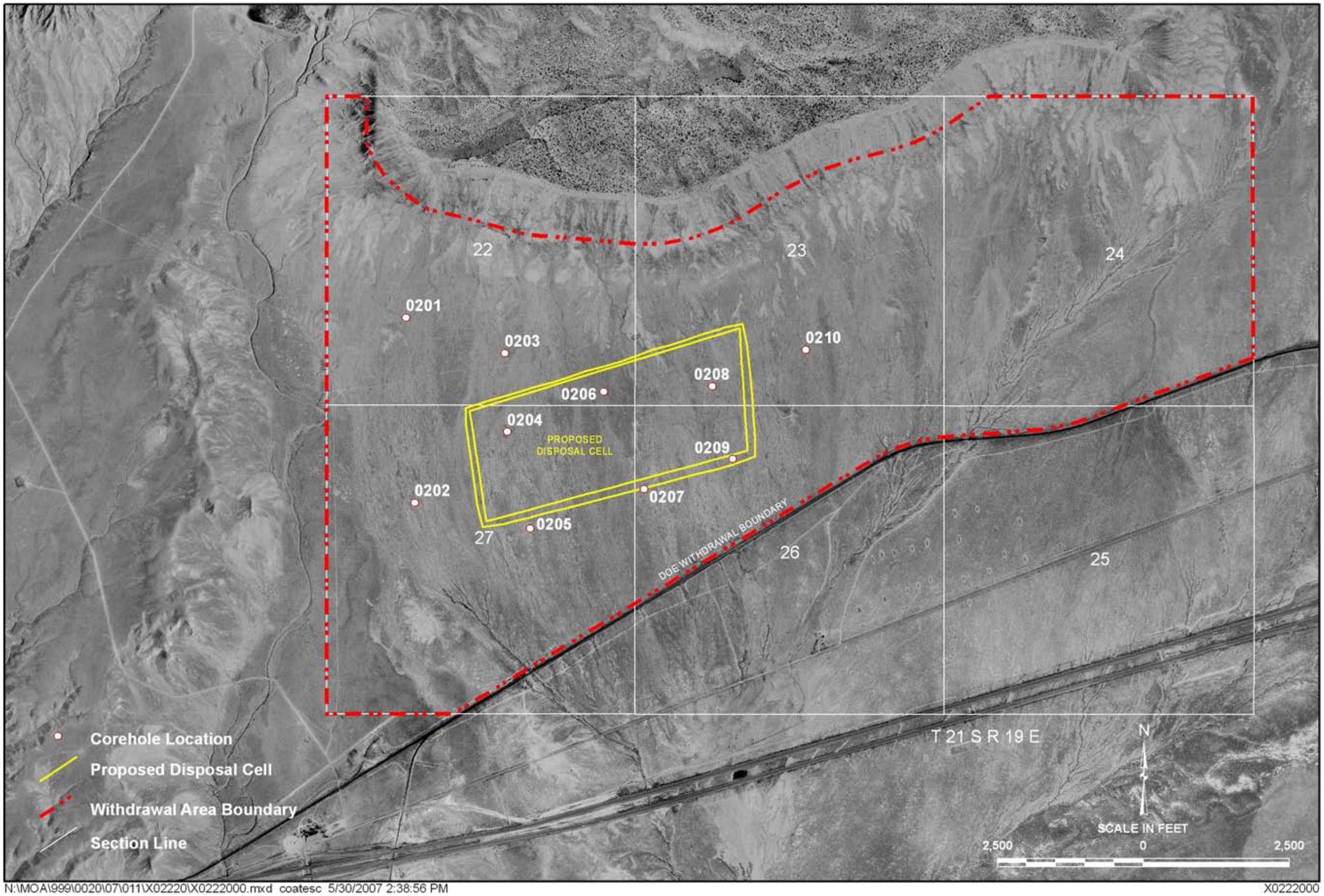
Ground water was sampled according to procedures and protocols in the Sampling and Analysis Plan (SAP) (DOE 2005). The Paragon Analytics laboratory, located in Fort Collins, Colorado, analyzed the ground water samples (analytical results are provided in Appendix B). Data were validated according to the SAP (see Laboratory Performance Assessments in Appendix C) and then loaded into the SEEPro database located at the DOE office in Grand Junction, Colorado.

Assumptions:

N/A

Calculation:

N/A



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X0222000

Figure 1. Corehole Locations at the Crescent Junction Site

Discussion:

Background ground water quality data from coreholes 0201, 0202, 0203, 0204, 0205, 0208, and 0210 are available in the SEEPro database and are presented in Appendix B (see Table 1 for summary of indicator constituents analyzed during the September 2006 sampling event). The ground water analyses indicated that TDS concentrations were significantly elevated, ranging from 20,000 to 44,000 milligrams per liter (mg/L). Uranium concentrations in ground water were typically very low (ranging from 0.0002 to 0.020 mg/L) and below the maximum concentration limit (MCL) of 0.044 mg/L (Table 1 to Subpart A of 40 CFR 192).

Levels of barium exceeded the MCL of 1 mg/L in coreholes 0202, 0204, and 0205 during the April 2006 and September 2006 sampling events. The concentration of nitrate slightly exceeded the MCL of 10 mg/L in corehole 0208 during December 2005; however, during April and September 2006 the nitrate concentration in corehole 0208 was at least two orders of magnitude below the MCL. Concentrations in ground water of other constituents with MCLs were consistently low and significantly below their respective MCLs.

Gross alpha activities in all coreholes sampled during the April 2006 and September 2006 sampling events were apparently above the MCL as a result of the analytical method used which yielded a high detection limit because of interference caused by the significantly elevated levels of TDS in ground water. Samples from the September 2006 sampling event were re-analyzed for gross alpha using an alternate analytical method (EPA method 900.1) to achieve lower detection limits. These analyses yielded lower detection values for gross alpha, but activities still exceeded the MCL of 15 picocuries per liter (pCi/L) in coreholes 0202 and 0204. These gross alpha activities, based on the alternate method, are related to the elevated uranium content, which naturally occurs in sediments of the Mancos Shale (Pliler and Adams 1962, Sprinkel 1987). Radium-226 and radium-228 activities were elevated above the MCL of 5 pCi/L in coreholes 0202 and 0204.

Table 1. Background Concentrations[1] of Indicator Constituents in Ground Water

Constituent	**0201**	**0202**	**0203**	**0204**	**0205**	**0208**	**0210**
Ammonia as N	8	16	13	18	12	19	7
Alkalinity, Bicarbonate (as $CaCO_3$)	1,000	410	1,500	550	440	560	1,700
Alkalinity, Total (as $CaCO_3$)	1,000	374	1,500	472	440	1,687	1,700
Calcium	160	200	160	300	370	250	70
Chloride	20,000	22,000	15,000	26,000	27,000	24,000	5,300
Magnesium	150	96	110	130	140	140	56
Molybdenum	0.0043	0.0043	0.0026	0.0037	0.0096	0.0120	0.0036
Nitrate	0.081	0.022	0.020	0.029	0.049	0.100	0.010
ORP[2]	1	42	11	-3	56	59	117
pH	7.08	7.15	6.93	6.85	7.24	6.94	7.08
Selenium	0.0089	0.0054	0.0014	0.0029	0.0016	0.0028	0.0007
Sodium	11,000	11,000	9,800	13,000	13,000	13,000	5,700
Sulfate	2,200	*100U**	5,500	*100U**	*100U**	750	6,100
TDS	38,000	37,000	34,000	44,000	44,000	42,000	20,000
Uranium	0.0027	0.0053	0.0002	0.0002	0.0008	0.0018	0.0200

[1] Concentrations in mg/L.
[2] ORP = oxidation—reduction potential.
*U** = Data qualifier signifying that the parameter was analyzed for but not detected.
Data from September 2006 sampling event.

Because the TDS concentration in the ground water is particularly high, an examination of the dominant chemical species contributing to the TDS is warranted. Table 2 presents the ratios of the foremost chemical constituents to the TDS based on data from the 2005 sampling events. Although some concentrations have varied in the 2006 sampling events, this assessment appears to be representative of natural conditions at the site. The ratios of sodium to TDS are consistently about 0.3 in each sample. Ratios of chloride to TDS are approximately 0.6 in ground water at coreholes 0201, 0202, 0204, and 0210; consequently, sodium and chloride alone account for 93 to 95 percent of the chemical mass of which the TDS is comprised. Accordingly, the ratios of sulfate and bicarbonate to TDS are correspondingly low in coreholes 0201, 0202, 0204, and 0210. However, because the ratio of chloride to TDS is much lower (approximately 0.3) at corehole 0208, the deficit is made up through relative enrichment of primarily sulfate and some bicarbonate. These results show that the briny ground water (TDS>35,000 mg/L) at the Crescent Junction Disposal Site is typified by a sodium-chloride-dominated composition. Ground water at corehole 0208, which was very saline (10,000 mg/L<TDS<35,000 mg/L), had an anion chemistry composed mostly of chloride and sulfate. Figure 2 shows the Piper diagram for these ground water samples.

Table 2. Ratios of Leading Chemical Concentrations in Ground Water to the TDS Concentrations

Corehole	Date	Na/TDS	Cl/TDS	SO_4/TDS	HCO_3/TDS	(Na+Cl+SO_4+HCO_3) /TDS
0201	12/27/2005	0.31	0.62	0.03	0.02	0.98
0202	12/27/2005	0.32	0.63	0.00	0.01	0.96
0203	12/27/2005	0.30	0.51	0.11	0.04	0.96
0204	12/27/2005	0.29	0.64	0.00	0.02	0.95
0208	12/27/2005	0.27	0.29	0.34	0.07	0.97
0210	11/7/2005	0.32	0.62	0.05	N/A	N/A

N/A indicates that the analysis of bicarbonate was not available for that sample date.

Conclusion and Recommendations:

Ground water encountered in the coreholes drilled into the shallow Mancos Shale was highly saline and often exceeded the minimum salinity levels characteristic of brine (TDS>35,000 mg/L) (Hem 1970, p. 219). Based on its occurrence and composition, the ground water intersected by these coreholes is likely to be connate water, or water that has been trapped in the pores of the rock since the rock was formed in a marine environment. This suggests that ground water in the shallowest zones of the Mancos Shale at the site does not necessarily occur in interconnected aquifers capable of producing significant amounts of water to wells. The variability of TDS levels in ground water in the coreholes infers lack of interconnected zones of saturation. These observations, along with other information collected during the field investigations and presented in other calculation sets, suggest that ground water found locally in the shallow Mancos Shale occurs in isolated pockets that are unaffected by, or disconnected from, a more regional, dynamic aquifer system.

Another aspect of the shallow ground water chemistry of the Mancos Shale is that there appears to be a modest enrichment of bicarbonate alkalinity accompanied by highly variable sulfate concentrations. The bicarbonate enrichment is noteworthy because it alone makes up the total alkalinity of the water. The pH grid in Hem (1970, p. 154−155) suggests that bicarbonate would make up about 80 percent of the total alkalinity (with the remaining 20 percent attributable to carbonate). In addition, there is significant variability in the sulfate concentrations, which range from below detection in coreholes 0202, 0204, and 0205 to 6,100 mg/L at corehole 0210.

The combination of enriched bicarbonate and depleted sulfate, in coexistence with depleted calcium and magnesium concentrations, was proposed by Van Voast (2003, p. 673) to be an indication of a ground water system associated with hydrocarbon-rich environments where sulfate is unstable. A comparison of the calcium and magnesium concentrations shown in Table 1 and Appendix B to the average chemical composition of seawater (Hem 1970, p. 11) would show that they too are modestly depleted with respect to modern seawater. Evidence of sulfate depletion in the ground water is found in the occurrence of framboidal pyrite in all the coreholes drilled into the Mancos Shale for this project (see "Corehole Logs" calculation, RAP Attachment 5, Vol. I, Appendix A). Perhaps the minor gas encountered in the Mancos Shale during drilling provides locally reducing conditions necessary to biochemically reduce sulfate, enrich bicarbonate, and precipitate calcium and magnesium.

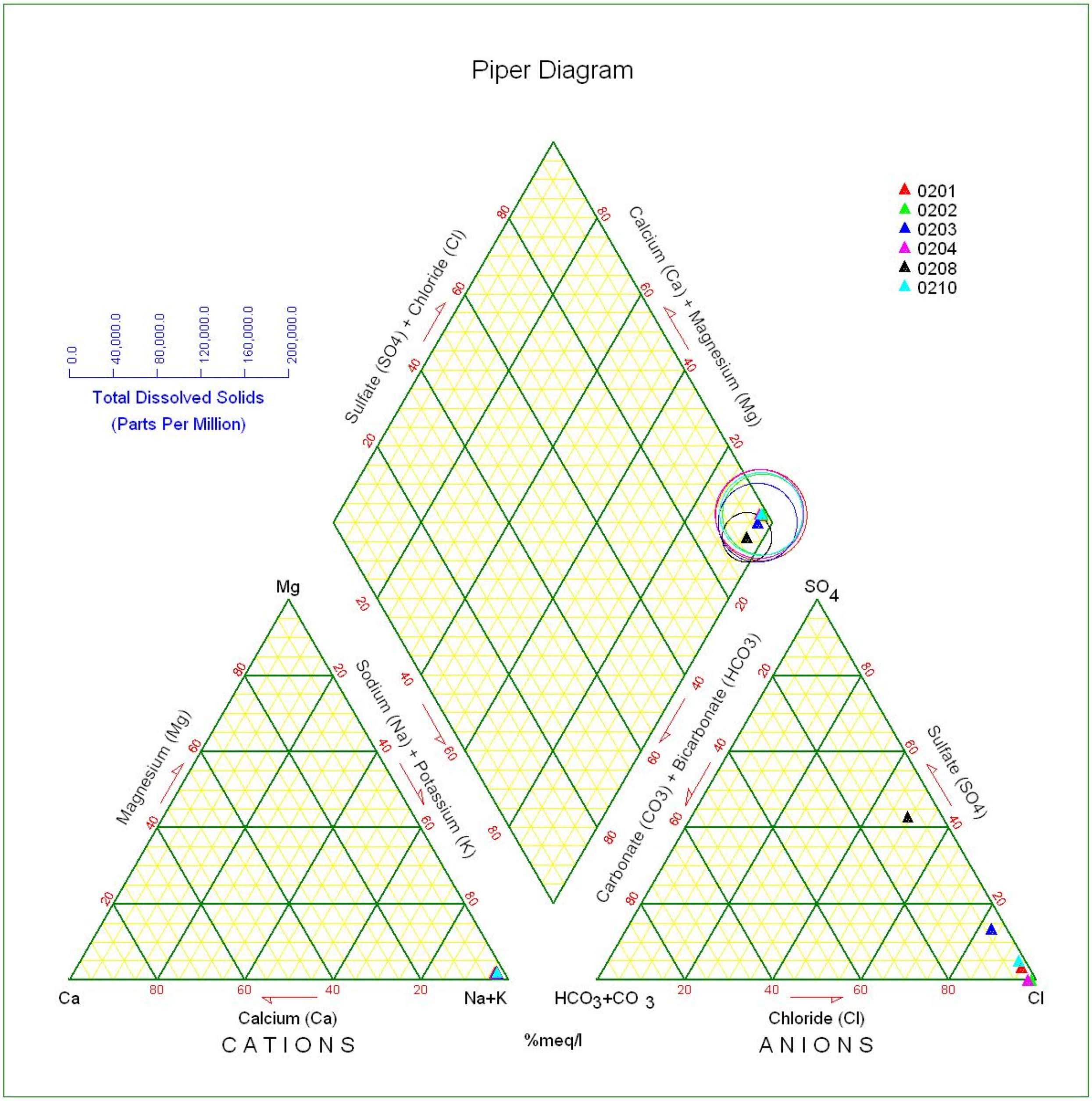


Figure 2. Piper Diagram for the Ground Water at the Crescent Junction Site

Computer Source:

N/A

References:

40 CFR 192. U.S. Environmental Protection Agency (EPA) Promulgated Standards for Remedial Actions at Inactive Uranium Processing Sites, *Code of Federal Regulations,* Title 40, Part 192.

DOE (U.S. Department of Energy), 2005. *Ground Water and Surface Water Sampling and Analysis Plan for U.S. Department of Energy Office of Legacy Management Sites*, Revision 7, DOE-LM/GJ863-2005, prepared by the U.S. Department of Energy, Grand Junction, Colorado, April.

Hem, J.D. 1970. "*Study and Interpretation of the Chemical Characteristics of Natural Water, Second Edition," U.S. Geological Survey Water-Supply Paper 1473*.

Pliler, R. and J.A.S. Adams, 1962. "The Distribution of Thorium, Uranium, and Potassium in the Mancos Shale," *Geochimica et Cosmochima*, v. 26, pp. 1115–1135.

Sprinkel, D.A., 1987. *Potential Radon Hazard Map*, Utah Geological Survey Open File Report 108.

Van Voast, W.A. 2003. "Geochemical Signature of Formation Waters Associated With Coalbed Methane," *American Association of Petroleum Geologists Bulletin*, 87(4), pp. 667–676.

Appendix A

Borehole Report (USEE310) for Site CRJ01
Crescent Junction Site

BOREHOLE REPORT (USEE310) FOR SITE CRJ01, Crescent Junction Site
REPORT DATE: 2/15/2007 6:41 pm

LOCATION CODE	NORTH COORD. (FT STATE-PLANE)	EAST COORD. (FT STATE-PLANE)	GROUND ELEV. (FT)	BORE HOLE DEPTH (FT BLS)	BORE HOLE DIA. (INCHES)	DATE ESTAB.	INSTALLED BY	LOCATION SUBTYPE	LOCATION COMMENTS
0201	6797583.56	2120851.13	5030.00	301.00	8.5	08/24/2005	Layne GeoConstruction		
0202	6794422.62	2120996.12	4960.00	300.00	8.5	08/25/2005	Layne GeoConstruction		
0203	6796977.60	2122543.47	5015.00	301.00	8.5	08/25/2005	Layne GeoConstruction		
0204	6795633.72	2122583.61	4983.00	300.00	8.5	08/26/2005	Layne GeoConstruction		
0205	6793981.28	2122975.63	4945.90	300.00	8.5	08/28/2005	Layne GeoConstruction		
0208	6796412.91	2126089.65	4986.10	301.00	8.5	09/09/2005	Layne GeoConstruction		
0210	6797035.78	2127690.41	4998.60	302.00	8.5	08/30/2005	Layne GeoConstruction		

RECORDS: SELECTED FROM USEE310 WHERE site_code='CRJ01' AND location_code in('0201','0202','0203','0204','0205','0208','0210')

LOCATION SUBTYPES:

Appendix B

Ground Water Quality Data by Location (USEE100) for Site CRJ01, Crescent Junction Site

GROUND WATER QUALITY DATA BY LOCATION (USEE100) FOR SITE CRJ01, Crescent Junction Site
LOCATION: 0201 <borehole>
REPORT DATE: 2/15/2007 7:56 pm

		SAMPLE:		DEPTH RANGE		QUALIFIERS:			DETECTION	UN-
PARAMETER	UNITS	DATE	ID	(FT BLS)	RESULT	LAB	DATA	QA		CERTAINTY
Alkalinity, Bicarbonate (As	mg/L	12/27/2005	0001	0.00 - 0.00	740		LQ	#	20	-
	mg/L	04/18/2006	0001	0.00 - 0.00	790			#	20	-
	mg/L	09/06/2006	0001	0.00 - 0.00	1000			#	50	-
Alkalinity, Carbonate (As	mg/L	12/27/2005	0001	0.00 - 0.00	20	U	LQ	#	20	-
	mg/L	04/18/2006	0001	0.00 - 0.00	20	U		#	20	-
	mg/L	09/06/2006	0001	0.00 - 0.00	50	U		#	50	-
Alkalinity, Total (As CaCO3)	mg/L	12/27/2005	0001	0.00 - 0.00	732		LQ	#	-	-
	mg/L	12/27/2005	0001	0.00 - 0.00	740		LQ	#	20	-
	mg/L	04/18/2006	0001	0.00 - 0.00	790			#	20	-
	mg/L	04/18/2006	0001	0.00 - 0.00	795			#	-	-
	mg/L	09/06/2006	0001	0.00 - 0.00	1000			#	50	-
	mg/L	09/06/2006	0001	0.00 - 0.00	994			#	-	-
Ammonia Total as N	mg/L	12/27/2005	0001	0.00 - 0.00	13		LQ	#	0.5	-
	mg/L	04/18/2006	0001	0.00 - 0.00	14			#	0.5	-
	mg/L	09/06/2006	0001	0.00 - 0.00	7 .6			#	0.5	-
Arsenic	mg/L	04/18/2006	0001	0.00 - 0.00	0 .00099			#	0.000038	-
	mg/L	09/06/2006	0001	0.00 - 0.00	0 .002	B	U	#	0.00014	-
Barium	mg/L	04/18/2006	0001	0.00 - 0.00	0 .200	B		#	0.0017	-
	mg/L	09/06/2006	0001	0.00 - 0.00	0 .220	B		#	0.002	-
Boron	mg/L	12/27/2005	0001	0.00 - 0.00	1 .300		LQ	#	0.0095	-
	mg/L	04/18/2006	0001	0.00 - 0.00	1 .500			#	0.012	-
	mg/L	09/06/2006	0001	0.00 - 0.00	1 .500			#	0.02	-
Bromide	mg/L	12/27/2005	0001	0.00 - 0.00	86		LQ	#	10	-
	mg/L	04/18/2006	0001	0.00 - 0.00	76			#	10	-

GROUND WATER QUALITY DATA BY LOCATION (USEE100) FOR SITE CRJ01, Crescent Junction Site
LOCATION: 0201 <borehole>
REPORT DATE: 2/15/2007 7:56 pm

PARAMETER	UNITS	SAMPLE: DATE	SAMPLE: ID	DEPTH RANGE (FT BLS)	RESULT	QUALIFIERS: LAB	QUALIFIERS: DATA	QUALIFIERS: QA	DETECTION	UN-CERTAINTY
Bromide	mg/L	09/06/2006	0001	0.00 - 0.00	73			#	40	-
Cadmium	mg/L	04/18/2006	0001	0.00 - 0.00	0 .0007	B	U	#	0.0001	-
	mg/L	09/06/2006	0001	0.00 - 0.00	0 .00094	B	U	#	0.000081	-
Calcium	mg/L	12/27/2005	0001	0.00 - 0.00	190 .000		LQ	#	0.035	-
	mg/L	04/18/2006	0001	0.00 - 0.00	190 .000			#	0.056	-
	mg/L	09/06/2006	0001	0.00 - 0.00	160 .000			#	0.15	-
Chloride	mg/L	12/27/2005	0001	0.00 - 0.00	26000		LQ	#	400	-
	mg/L	04/18/2006	0001	0.00 - 0.00	27000			#	400	-
	mg/L	09/06/2006	0001	0.00 - 0.00	20000			#	1000	-
Chromium	mg/L	04/18/2006	0001	0.00 - 0.00	0 .018	U		#	0.018	-
	mg/L	09/06/2006	0001	0.00 - 0.00	0 .014	U		#	0.014	-
Copper	mg/L	12/27/2005	0001	0.00 - 0.00	0 .024	B	ULQ	#	0.0061	-
	mg/L	04/18/2006	0001	0.00 - 0.00	0 .052	B	U	#	0.0067	-
	mg/L	09/06/2006	0001	0.00 - 0.00	0 .030	B		#	0.015	-
Fluoride	mg/L	12/27/2005	0001	0.00 - 0.00	5	U	LQ	#	5	-
	mg/L	04/18/2006	0001	0.00 - 0.00	5	U		#	5	-
	mg/L	09/06/2006	0001	0.00 - 0.00	20	U		#	20	-
Gross Alpha	pCi/L	04/18/2006	0001	0.00 - 0.00	83 .7	U		#	83.7	± 46.50
	pCi/L	09/06/2006	0001	0.00 - 0.00	111	U		#	111	± 63.90
	pCi/L	09/06/2006	0002	0.00 - 0.00	5 .93			#	2.48	± 2.07
Gross Beta	pCi/L	04/18/2006	0001	0.00 - 0.00	115	U		#	115	± 68.60
	pCi/L	09/06/2006	0001	0.00 - 0.00	218	U		#	218	± 136.00
Iron	mg/L	12/27/2005	0001	0.00 - 0.00	0 .170	B	ULQ	#	0.078	-
	mg/L	04/18/2006	0001	0.00 - 0.00	0 .340	B	U	#	0.14	-

GROUND WATER QUALITY DATA BY LOCATION (USEE100) FOR SITE CRJ01, Crescent Junction Site
LOCATION: 0201 <borehole>
REPORT DATE: 2/15/2007 7:56 pm

		SAMPLE:		DEPTH RANGE		QUALIFIERS:			DETECTION	UN-
PARAMETER	UNITS	DATE	ID	(FT BLS)	RESULT	LAB	DATA	QA		CERTAINTY
Iron	mg/L	09/06/2006	0001	0.00 - 0.00	0 .510	B	U	#	0.28	-
Lead	mg/L	04/18/2006	0001	0.00 - 0.00	0 .0017	B	U	#	0.00011	-
	mg/L	09/06/2006	0001	0.00 - 0.00	0 .0019	B	U	#	0.00016	-
Magnesium	mg/L	12/27/2005	0001	0.00 - 0.00	140 .000		LQ	#	0.072	-
	mg/L	04/18/2006	0001	0.00 - 0.00	140 .000			#	0.068	-
	mg/L	09/06/2006	0001	0.00 - 0.00	150 .000			#	0.11	-
Manganese	mg/L	12/27/2005	0001	0.00 - 0.00	0 .028	B	LQ	#	0.00096	-
	mg/L	04/18/2006	0001	0.00 - 0.00	0 .034	B		#	0.0023	-
	mg/L	09/06/2006	0001	0.00 - 0.00	0 .034	B		#	0.0019	-
Molybdenum	mg/L	12/27/2005	0001	0.00 - 0.00	0 .0018	B	ULQ	#	0.00014	-
	mg/L	04/18/2006	0001	0.00 - 0.00	0 .0016	B	U	#	0.001	-
	mg/L	09/06/2006	0001	0.00 - 0.00	0 .0043	B	U	#	0.0013	-
Nitrate + Nitrite as Nitrogen	mg/L	12/27/2005	0001	0.00 - 0.00	0 .027		LQ	#	0.01	-
	mg/L	04/18/2006	0001	0.00 - 0.00	0 .031			#	0.01	-
	mg/L	09/06/2006	0001	0.00 - 0.00	0 .081			#	0.01	-
Oxidation Reduction	mV	12/27/2005	N001	0.00 - 0.00	442		LQ	#	-	-
	mV	04/18/2006	N001	0.00 - 0.00	263			#	-	-
	mV	09/06/2006	N001	0.00 - 0.00	0 .98			#	-	-
pH	s.u.	12/27/2005	N001	0.00 - 0.00	6 .88		LQ	#	-	-
	s.u.	04/18/2006	N001	0.00 - 0.00	7 .02			#	-	-
	s.u.	09/06/2006	N001	0.00 - 0.00	7 .08			#	-	-
Potassium	mg/L	12/27/2005	0001	0.00 - 0.00	68 .000		LQ	#	0.68	-
	mg/L	04/18/2006	0001	0.00 - 0.00	65 .000			#	0.74	-
	mg/L	09/06/2006	0001	0.00 - 0.00	57 .000			#	1.1	-

GROUND WATER QUALITY DATA BY LOCATION (USEE100) FOR SITE CRJ01, Crescent Junction Site
LOCATION: 0201 <borehole>
REPORT DATE: 2/15/2007 7:56 pm

PARAMETER	UNITS	SAMPLE: DATE	ID	DEPTH RANGE (FT BLS)	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION	UN-CERTAINTY
Radium-226	pCi/L	04/18/2006	0001	0.00 - 0.00	0 .308	U		#	0.308	± 0.21
	pCi/L	09/06/2006	0001	0.00 - 0.00	0 .533	U		#	0.533	± 0.36
Radium-228	pCi/L	04/18/2006	0001	0.00 - 0.00	0 .665	U		#	0.665	± 0.36
	pCi/L	09/06/2006	0001	0.00 - 0.00	1 .14		J	#	0.65	± 0.49
Selenium	mg/L	12/27/2005	0001	0.00 - 0.00	0 .00048	B	ULQ	#	0.00011	-
	mg/L	04/18/2006	0001	0.00 - 0.00	0 .026		J	#	0.0001	-
	mg/L	09/06/2006	0001	0.00 - 0.00	0 .0089			#	0.00031	-
Sodium	mg/L	12/27/2005	0001	0.00 - 0.00	13000 .000		LQ	#	2.9	-
	mg/L	04/18/2006	0001	0.00 - 0.00	12000 .000			#	1.8	-
	mg/L	09/06/2006	0001	0.00 - 0.00	11000 .000			#	2	-
Specific Conductance	umhos/cm	12/27/2005	N001	0.00 - 0.00	62030		LQ	#	-	-
	umhos/cm	04/18/2006	N001	0.00 - 0.00	60225			#	-	-
	umhos/cm	09/06/2006	N001	0.00 - 0.00	54530			#	-	-
Sulfate	mg/L	12/27/2005	0001	0.00 - 0.00	1300		LQ	#	25	-
	mg/L	04/18/2006	0001	0.00 - 0.00	1600			#	25	-
	mg/L	09/06/2006	0001	0.00 - 0.00	2200			#	100	-
Sulfide	mg/L	12/27/2005	0001	0.00 - 0.00	2	U	LQ	#	2	-
	mg/L	04/18/2006	0001	0.00 - 0.00	2	U		#	2	-
	mg/L	09/06/2006	0001	0.00 - 0.00	2	U		#	2	-
Temperature	C	12/27/2005	N001	0.00 - 0.00	15 .8		LQ	#	-	-
	C	04/18/2006	N001	0.00 - 0.00	16 .3			#	-	-
	C	09/06/2006	N001	0.00 - 0.00	17 .58			#	-	-
Total Dissolved Solids	mg/L	12/27/2005	0001	0.00 - 0.00	42000		LQ	#	2000	-
	mg/L	04/18/2006	0001	0.00 - 0.00	38000			#	2000	-

GROUND WATER QUALITY DATA BY LOCATION (USEE100) FOR SITE CRJ01, Crescent Junction Site
LOCATION: 0201 <borehole>
REPORT DATE: 2/15/2007 7:56 pm

		SAMPLE:		DEPTH RANGE		QUALIFIERS:			DETECTION	UN-
PARAMETER	UNITS	DATE	ID	(FT BLS)	RESULT	LAB	DATA	QA		CERTAINTY
Total Dissolved Solids	mg/L	09/06/2006	0001	0.00 - 0.00	38000			#	4000	-
Turbidity	NTU	12/27/2005	N001	0.00 - 0.00	31 .6		LQ	#	-	-
	NTU	04/18/2006	N001	0.00 - 0.00	3 .18			#	-	-
	NTU	09/06/2006	N001	0.00 - 0.00	18 .5			#	-	-
Uranium	mg/L	12/27/2005	0001	0.00 - 0.00	0 .0023		LQ	#	0.0000095	-
	mg/L	04/18/2006	0001	0.00 - 0.00	0 .0018			#	0.000017	-
	mg/L	09/06/2006	0001	0.00 - 0.00	0 .0027			#	0.000016	-

GROUND WATER QUALITY DATA BY LOCATION (USEE100) FOR SITE CRJ01, Crescent Junction Site
LOCATION: 0201 <borehole>
REPORT DATE: 2/15/2007 7:56 pm

		SAMPLE:		DEPTH RANGE		QUALIFIERS:			DETECTION	UN-
PARAMETER	UNITS	DATE	ID	(FT BLS)	RESULT	LAB	DATA	QA		CERTAINTY

RECORDS: SELECTED FROM USEE100 WHERE site_code='CRJ01' AND location_code in('0201','0202','0203','0204','0205','0206','0207','0208','0209','0210') AND (data_validation_qualifiers IS NULL OR data_validation_qualifiers NOT LIKE '%N%' AND data_validation_qualifiers NOT LIKE '%R%' AND data_validation_qualifiers NOT LIKE '%X%') AND DATE_SAMPLED between #1/1/2005# and #1/1/2008#

SAMPLE ID CODES: 000X = Filtered sample (0.45 µm). N00X = Unfiltered sample. X = replicate number.

LAB QUALIFIERS:

*	Replicate analysis not within control limits.
+	Correlation coefficient for MSA < 0.995.
>	Result above upper detection limit.
A	TIC is a suspected aldol-condensation product.
B	Inorganic: Result is between the IDL and CRDL. Organic & Radiochemistry: Analyte also found in method blank.
C	Pesticide result confirmed by GC-MS.
D	Analyte determined in diluted sample.
E	Inorganic: Estimate value because of interference, see case narrative. Organic: Analyte exceeded calibration range of the GC-MS.
H	Holding time expired, value suspect.
I	Increased detection limit due to required dilution.
J	Estimated
M	GFAA duplicate injection precision not met.
N	Inorganic or radiochemical: Spike sample recovery not within control limits. Organic: Tentatively identified compund (TIC).
P	> 25% difference in detected pesticide or Arochlor concentrations between 2 columns.
S	Result determined by method of standard addition (MSA).
U	Analytical result below detection limit.
W	Post-digestion spike outside control limits while sample absorbance < 50% of analytical spike absorbance.
X	Laboratory defined (USEPA CLP organic) qualifier, see case narrative.
Y	Laboratory defined (USEPA CLP organic) qualifier, see case narrative.
Z	Laboratory defined (USEPA CLP organic) qualifier, see case narrative.

DATA QUALIFIERS:

F	Low flow sampling method used.
L	Less than 3 bore volumes purged prior to sampling.
R	Unusable result.
G	Possible grout contamination, pH > 9.
N	Presumptive evidence that analyte is present. The analyte is "tentatively identified".
U	Parameter analyzed for but was not detected.
J	Estimated value.
Q	Qualitative result due to sampling technique
X	Location is undefined.

QA QUALIFIER: # = validated according to Quality Assurance guidelines.

GROUND WATER QUALITY DATA BY LOCATION (USEE100) FOR SITE CRJ01, Crescent Junction Site
LOCATION: 0202 <borehole>
REPORT DATE: 2/15/2007 7:56 pm

PARAMETER	UNITS	SAMPLE: DATE	ID	DEPTH RANGE (FT BLS)	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION	UN- CERTAINTY
Alkalinity, Bicarbonate (As	mg/L	12/27/2005	0001	0.00 - 0.00	430		LQ	#	33	-
	mg/L	04/18/2006	0001	0.00 - 0.00	430			#	50	-
	mg/L	09/07/2006	0001	0.00 - 0.00	410			#	10	-
Alkalinity, Carbonate (As	mg/L	12/27/2005	0001	0.00 - 0.00	33	U	LQ	#	33	-
	mg/L	04/18/2006	0001	0.00 - 0.00	50	U		#	50	-
	mg/L	09/07/2006	0001	0.00 - 0.00	10	U		#	10	-
Alkalinity, Total (As CaCO3)	mg/L	12/27/2005	0001	0.00 - 0.00	415		LQ	#	-	-
	mg/L	12/27/2005	0001	0.00 - 0.00	430		LQ	#	33	-
	mg/L	04/18/2006	0001	0.00 - 0.00	805			#	-	-
	mg/L	04/18/2006	0001	0.00 - 0.00	430			#	50	-
	mg/L	09/07/2006	0001	0.00 - 0.00	374			#	-	-
	mg/L	09/07/2006	0001	0.00 - 0.00	410			#	10	-
Ammonia Total as N	mg/L	12/27/2005	0001	0.00 - 0.00	15		LQ	#	0.5	-
	mg/L	04/18/2006	0001	0.00 - 0.00	17			#	1	-
	mg/L	09/07/2006	0001	0.00 - 0.00	16			#	0.5	-
Arsenic	mg/L	04/18/2006	0001	0.00 - 0.00	0 .0019			#	0.000038	-
	mg/L	09/07/2006	0001	0.00 - 0.00	0 .0017	B	U	#	0.00014	-
Barium	mg/L	04/18/2006	0001	0.00 - 0.00	38 .000			#	0.0017	-
	mg/L	09/07/2006	0001	0.00 - 0.00	35 .000			#	0.002	-
Boron	mg/L	12/27/2005	0001	0.00 - 0.00	1 .100		LQ	#	0.0095	-
	mg/L	04/18/2006	0001	0.00 - 0.00	1 .100			#	0.012	-
	mg/L	09/07/2006	0001	0.00 - 0.00	1 .100			#	0.02	-
Bromide	mg/L	12/27/2005	0001	0.00 - 0.00	110		LQ	#	10	-
	mg/L	04/18/2006	0001	0.00 - 0.00	100			#	10	-

GROUND WATER QUALITY DATA BY LOCATION (USEE100) FOR SITE CRJ01, Crescent Junction Site
LOCATION: 0202 <borehole>
REPORT DATE: 2/15/2007 7:56 pm

PARAMETER	UNITS	SAMPLE: DATE	ID	DEPTH RANGE (FT BLS)	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION	UN-CERTAINTY
Bromide	mg/L	09/07/2006	0001	0.00 - 0.00	100			#	40	-
Cadmium	mg/L	04/18/2006	0001	0.00 - 0.00	0 .0008	B	U	#	0.0001	-
	mg/L	09/07/2006	0001	0.00 - 0.00	0 .00082	B	U	#	0.000081	-
Calcium	mg/L	12/27/2005	0001	0.00 - 0.00	200 .000		LQ	#	0.035	-
	mg/L	04/18/2006	0001	0.00 - 0.00	230 .000			#	0.056	-
	mg/L	09/07/2006	0001	0.00 - 0.00	200 .000			#	0.15	-
Chloride	mg/L	12/27/2005	0001	0.00 - 0.00	24000		LQ	#	400	-
	mg/L	04/18/2006	0001	0.00 - 0.00	28000			#	400	-
	mg/L	09/07/2006	0001	0.00 - 0.00	22000			#	1000	-
Chromium	mg/L	04/18/2006	0001	0.00 - 0.00	0 .018	U		#	0.018	-
	mg/L	09/07/2006	0001	0.00 - 0.00	0 .014	U		#	0.014	-
Copper	mg/L	12/27/2005	0001	0.00 - 0.00	0 .016	B	ULQ	#	0.0061	-
	mg/L	04/18/2006	0001	0.00 - 0.00	0 .022	B	U	#	0.0067	-
	mg/L	09/07/2006	0001	0.00 - 0.00	0 .051	B		#	0.015	-
Fluoride	mg/L	12/27/2005	0001	0.00 - 0.00	5	U	LQ	#	5	-
	mg/L	04/18/2006	0001	0.00 - 0.00	5	U		#	5	-
	mg/L	09/07/2006	0001	0.00 - 0.00	20	U		#	20	-
Gross Alpha	pCi/L	04/18/2006	0001	0.00 - 0.00	88 .8	U		#	88.8	± 53.40
	pCi/L	09/07/2006	0001	0.00 - 0.00	141	U		#	141	± 79.70
	pCi/L	09/07/2006	0002	0.00 - 0.00	118			#	3.3	± 19.90
Gross Beta	pCi/L	04/18/2006	0001	0.00 - 0.00	110	U		#	110	± 66.00
	pCi/L	09/07/2006	0001	0.00 - 0.00	222	U		#	222	± 135.00
Iron	mg/L	12/27/2005	0001	0.00 - 0.00	0 .078	U	LQ	#	0.078	-
	mg/L	04/18/2006	0001	0.00 - 0.00	0 .200	B	U	#	0.14	-

GROUND WATER QUALITY DATA BY LOCATION (USEE100) FOR SITE CRJ01, Crescent Junction Site
LOCATION: 0202 <borehole>
REPORT DATE: 2/15/2007 7:56 pm

		SAMPLE:		DEPTH RANGE		QUALIFIERS:			DETECTION	UN-
PARAMETER	UNITS	DATE	ID	(FT BLS)	RESULT	LAB	DATA	QA		CERTAINTY
Iron	mg/L	09/07/2006	0001	0.00 - 0.00	0 .620	B	U	#	0.28	-
Lead	mg/L	04/18/2006	0001	0.00 - 0.00	0 .0014	B	U	#	0.00011	-
	mg/L	09/07/2006	0001	0.00 - 0.00	0 .0013	B	U	#	0.00016	-
Magnesium	mg/L	12/27/2005	0001	0.00 - 0.00	94 .000		LQ	#	0.072	-
	mg/L	04/18/2006	0001	0.00 - 0.00	100 .000			#	0.068	-
	mg/L	09/07/2006	0001	0.00 - 0.00	96 .000			#	0.11	-
Manganese	mg/L	12/27/2005	0001	0.00 - 0.00	0 .057		LQ	#	0.00096	-
	mg/L	04/18/2006	0001	0.00 - 0.00	0 .017	B		#	0.0023	-
	mg/L	09/07/2006	0001	0.00 - 0.00	0 .054	B		#	0.0019	-
Molybdenum	mg/L	12/27/2005	0001	0.00 - 0.00	0 .0056		LQ	#	0.00014	-
	mg/L	04/18/2006	0001	0.00 - 0.00	0 .0043	B	U	#	0.001	-
	mg/L	09/07/2006	0001	0.00 - 0.00	0 .0043	B	U	#	0.0013	-
Nitrate + Nitrite as Nitrogen	mg/L	12/27/2005	0001	0.00 - 0.00	0 .022		LQ	#	0.01	-
	mg/L	04/18/2006	0001	0.00 - 0.00	0 .027			#	0.01	-
	mg/L	09/07/2006	0001	0.00 - 0.00	0 .022			#	0.01	-
Oxidation Reduction	mV	12/27/2005	N001	0.00 - 0.00	246		LQ	#	-	-
	mV	04/18/2006	N001	0.00 - 0.00	465			#	-	-
	mV	09/07/2006	N001	0.00 - 0.00	42			#	-	-
pH	s.u.	12/27/2005	N001	0.00 - 0.00	7 .26		LQ	#	-	-
	s.u.	04/18/2006	N001	0.00 - 0.00	7 .33			#	-	-
	s.u.	09/07/2006	N001	0.00 - 0.00	7 .15			#	-	-
Potassium	mg/L	12/27/2005	0001	0.00 - 0.00	61 .000		LQ	#	0.68	-
	mg/L	04/18/2006	0001	0.00 - 0.00	61 .000			#	0.74	-
	mg/L	09/07/2006	0001	0.00 - 0.00	54 .000			#	1.1	-

GROUND WATER QUALITY DATA BY LOCATION (USEE100) FOR SITE CRJ01, Crescent Junction Site
LOCATION: 0202 <borehole>
REPORT DATE: 2/15/2007 7:56 pm

		SAMPLE:		DEPTH RANGE		QUALIFIERS:			DETECTION	UN-
PARAMETER	UNITS	DATE	ID	(FT BLS)	RESULT	LAB	DATA	QA		CERTAINTY
Radium-226	pCi/L	04/18/2006	0001	0.00 - 0.00	38 .8			#	0.346	± 9.65
	pCi/L	09/07/2006	0001	0.00 - 0.00	25 .6			#	0.261	± 6.38
Radium-228	pCi/L	04/18/2006	0001	0.00 - 0.00	27 .9			#	0.668	± 8.35
	pCi/L	09/07/2006	0001	0.00 - 0.00	28 .5			#	0.665	± 8.52
Selenium	mg/L	12/27/2005	0001	0.00 - 0.00	0 .0079		JLQ	#	0.00011	-
	mg/L	04/18/2006	0001	0.00 - 0.00	0 .030		J	#	0.0001	-
	mg/L	09/07/2006	0001	0.00 - 0.00	0 .0054			#	0.00031	-
Sodium	mg/L	12/27/2005	0001	0.00 - 0.00	12000 .000		LQ	#	2.9	-
	mg/L	04/18/2006	0001	0.00 - 0.00	12000 .000			#	1.8	-
	mg/L	09/07/2006	0001	0.00 - 0.00	11000 .000			#	2	-
Specific Conductance	umhos/cm	12/27/2005	N001	0.00 - 0.00	58180		LQ	#	-	-
	umhos/cm	04/18/2006	N001	0.00 - 0.00	60607			#	-	-
	umhos/cm	09/07/2006	N001	0.00 - 0.00	54950			#	-	-
Sulfate	mg/L	12/27/2005	0001	0.00 - 0.00	25	U	LQ	#	25	-
	mg/L	04/18/2006	0001	0.00 - 0.00	25	U		#	25	-
	mg/L	09/07/2006	0001	0.00 - 0.00	100	U		#	100	-
Sulfide	mg/L	12/27/2005	0001	0.00 - 0.00	2	U	LQ	#	2	-
	mg/L	04/18/2006	0001	0.00 - 0.00	2	U		#	2	-
	mg/L	09/07/2006	0001	0.00 - 0.00	2	U		#	2	-
Temperature	C	12/27/2005	N001	0.00 - 0.00	15 .6		LQ	#	-	-
	C	04/18/2006	N001	0.00 - 0.00	16 .2			#	-	-
	C	09/07/2006	N001	0.00 - 0.00	19 .48			#	-	-
Total Dissolved Solids	mg/L	12/27/2005	0001	0.00 - 0.00	38000		LQ	#	1000	-
	mg/L	04/18/2006	0001	0.00 - 0.00	39000			#	2000	-

GROUND WATER QUALITY DATA BY LOCATION (USEE100) FOR SITE CRJ01, Crescent Junction Site
LOCATION: 0202 <borehole>
REPORT DATE: 2/15/2007 7:56 pm

		SAMPLE:		DEPTH RANGE		QUALIFIERS:			DETECTION	UN-
PARAMETER	UNITS	DATE	ID	(FT BLS)	RESULT	LAB	DATA	QA		CERTAINTY
Total Dissolved Solids	mg/L	09/07/2006	0001	0.00 - 0.00	37000			#	4000	-
Turbidity	NTU	12/27/2005	N001	0.00 - 0.00	12 .3		LQ	#	-	-
	NTU	04/18/2006	N001	0.00 - 0.00	3 .15			#	-	-
	NTU	09/07/2006	N001	0.00 - 0.00	41 .0			#	-	-
Uranium	mg/L	12/27/2005	0001	0.00 - 0.00	0 .00041		LQ	#	0.0000095	-
	mg/L	04/18/2006	0001	0.00 - 0.00	0 .0011		U	#	0.000017	-
	mg/L	09/07/2006	0001	0.00 - 0.00	0 .0053			#	0.000016	-

GROUND WATER QUALITY DATA BY LOCATION (USEE100) FOR SITE CRJ01, Crescent Junction Site
LOCATION: 0202 <borehole>
REPORT DATE: 2/15/2007 7:56 pm

		SAMPLE:				QUALIFIERS:				
PARAMETER	UNITS	DATE	ID	DEPTH RANGE (FT BLS)	RESULT	LAB	DATA	QA	DETECTION	UN-CERTAINTY

RECORDS: SELECTED FROM USEE100 WHERE site_code='CRJ01' AND location_code in('0201','0202','0203','0204','0205','0206','0207','0208','0209','0210') AND (data_validation_qualifiers IS NULL OR data_validation_qualifiers NOT LIKE '%N%' AND data_validation_qualifiers NOT LIKE '%R%' AND data_validation_qualifiers NOT LIKE '%X%') AND DATE_SAMPLED between #1/1/2005# and #1/1/2008#

SAMPLE ID CODES: 000X = Filtered sample (0.45 µm). N00X = Unfiltered sample. X = replicate number.

LAB QUALIFIERS:

*	Replicate analysis not within control limits.
+	Correlation coefficient for MSA < 0.995.
>	Result above upper detection limit.
A	TIC is a suspected aldol-condensation product.
B	Inorganic: Result is between the IDL and CRDL. Organic & Radiochemistry: Analyte also found in method blank.
C	Pesticide result confirmed by GC-MS.
D	Analyte determined in diluted sample.
E	Inorganic: Estimate value because of interference, see case narrative. Organic: Analyte exceeded calibration range of the GC-MS.
H	Holding time expired, value suspect.
I	Increased detection limit due to required dilution.
J	Estimated
M	GFAA duplicate injection precision not met.
N	Inorganic or radiochemical: Spike sample recovery not within control limits. Organic: Tentatively identified compund (TIC).
P	> 25% difference in detected pesticide or Arochlor concentrations between 2 columns.
S	Result determined by method of standard addition (MSA).
U	Analytical result below detection limit.
W	Post-digestion spike outside control limits while sample absorbance < 50% of analytical spike absorbance.
X	Laboratory defined (USEPA CLP organic) qualifier, see case narrative.
Y	Laboratory defined (USEPA CLP organic) qualifier, see case narrative.
Z	Laboratory defined (USEPA CLP organic) qualifier, see case narrative.

DATA QUALIFIERS:

F	Low flow sampling method used.	G	Possible grout contamination, pH > 9.	J	Estimated value.
L	Less than 3 bore volumes purged prior to sampling.	N	Presumptive evidence that analyte is present. The analyte is "tentatively identified".	Q	Qualitative result due to sampling technique
R	Unusable result.	U	Parameter analyzed for but was not detected.	X	Location is undefined.

QA QUALIFIER: # = validated according to Quality Assurance guidelines.

GROUND WATER QUALITY DATA BY LOCATION (USEE100) FOR SITE CRJ01, Crescent Junction Site
LOCATION: 0203 <borehole>
REPORT DATE: 2/15/2007 7:56 pm

		SAMPLE:		DEPTH RANGE		QUALIFIERS:			DETECTION	UN-
PARAMETER	UNITS	DATE	ID	(FT BLS)	RESULT	LAB	DATA	QA		CERTAINTY
Alkalinity, Bicarbonate (As	mg/L	12/27/2005	0001	0.00 - 0.00	1300		LQ	#	33	-
	mg/L	04/18/2006	0001	0.00 - 0.00	1400			#	50	-
	mg/L	09/07/2006	0001	0.00 - 0.00	1500			#	50	-
	mg/L	09/07/2006	0002	0.00 - 0.00	1500			#	50	-
Alkalinity, Carbonate (As	mg/L	12/27/2005	0001	0.00 - 0.00	33	U	LQ	#	33	-
	mg/L	04/18/2006	0001	0.00 - 0.00	50	U		#	50	-
	mg/L	09/07/2006	0001	0.00 - 0.00	50	U		#	50	-
	mg/L	09/07/2006	0002	0.00 - 0.00	50	U		#	50	-
Alkalinity, Total (As CaCO3)	mg/L	12/27/2005	0001	0.00 - 0.00	1300		LQ	#	33	-
	mg/L	12/27/2005	0001	0.00 - 0.00	1352		LQ	#	-	-
	mg/L	04/18/2006	0001	0.00 - 0.00	1400			#	50	-
	mg/L	04/18/2006	0001	0.00 - 0.00	1437			#	-	-
	mg/L	09/07/2006	0001	0.00 - 0.00	1435			#	-	-
	mg/L	09/07/2006	0001	0.00 - 0.00	1500			#	50	-
	mg/L	09/07/2006	0002	0.00 - 0.00	1500			#	50	-
Ammonia Total as N	mg/L	12/27/2005	0001	0.00 - 0.00	13		LQ	#	0.5	-
	mg/L	04/18/2006	0001	0.00 - 0.00	14			#	0.5	-
	mg/L	09/07/2006	0001	0.00 - 0.00	13			#	0.5	-
	mg/L	09/07/2006	0002	0.00 - 0.00	8 .1			#	0.5	-
Arsenic	mg/L	04/18/2006	0001	0.00 - 0.00	0 .0021			#	0.000038	-
	mg/L	09/07/2006	0001	0.00 - 0.00	0 .0043		U	#	0.00014	-
	mg/L	09/07/2006	0002	0.00 - 0.00	0 .0038		U	#	0.00014	-
Barium	mg/L	04/18/2006	0001	0.00 - 0.00	0 .049	B		#	0.0017	-
	mg/L	09/07/2006	0001	0.00 - 0.00	0 .120	B		#	0.002	-
	mg/L	09/07/2006	0002	0.00 - 0.00	0 .027	B		#	0.002	-

GROUND WATER QUALITY DATA BY LOCATION (USEE100) FOR SITE CRJ01, Crescent Junction Site
LOCATION: 0203 <borehole>
REPORT DATE: 2/15/2007 7:56 pm

		SAMPLE:		DEPTH RANGE		QUALIFIERS:			DETECTION	UN-
PARAMETER	UNITS	DATE	ID	(FT BLS)	RESULT	LAB	DATA	QA		CERTAINTY
Boron	mg/L	12/27/2005	0001	0.00 - 0.00	1 .600		LQ	#	0.0095	-
	mg/L	04/18/2006	0001	0.00 - 0.00	1 .700			#	0.012	-
	mg/L	09/07/2006	0001	0.00 - 0.00	1 .700			#	0.02	-
	mg/L	09/07/2006	0002	0.00 - 0.00	1 .600			#	0.02	-
Bromide	mg/L	12/27/2005	0001	0.00 - 0.00	59		LQ	#	10	-
	mg/L	04/18/2006	0001	0.00 - 0.00	58			#	10	-
	mg/L	09/07/2006	0001	0.00 - 0.00	56			#	40	-
	mg/L	09/07/2006	0002	0.00 - 0.00	58			#	40	-
Cadmium	mg/L	04/18/2006	0001	0.00 - 0.00	0 .00057	B	U	#	0.0001	-
	mg/L	09/07/2006	0001	0.00 - 0.00	0 .00068	B	U	#	0.000081	-
	mg/L	09/07/2006	0002	0.00 - 0.00	0 .00074	B	U	#	0.000081	-
Calcium	mg/L	12/27/2005	0001	0.00 - 0.00	160 .000		LQ	#	0.035	-
	mg/L	04/18/2006	0001	0.00 - 0.00	150 .000			#	0.056	-
	mg/L	09/07/2006	0001	0.00 - 0.00	160 .000			#	0.15	-
	mg/L	09/07/2006	0002	0.00 - 0.00	140 .000			#	0.15	-
Chloride	mg/L	12/27/2005	0001	0.00 - 0.00	19000		LQ	#	200	-
	mg/L	04/18/2006	0001	0.00 - 0.00	16000			#	200	-
	mg/L	09/07/2006	0001	0.00 - 0.00	15000			#	1000	-
	mg/L	09/07/2006	0002	0.00 - 0.00	15000			#	1000	-
Chromium	mg/L	04/18/2006	0001	0.00 - 0.00	0 .018	U		#	0.018	-
	mg/L	09/07/2006	0001	0.00 - 0.00	0 .014	U		#	0.014	-
	mg/L	09/07/2006	0002	0.00 - 0.00	0 .014	U		#	0.014	-
Copper	mg/L	12/27/2005	0001	0.00 - 0.00	0 .041	B	ULQ	#	0.0061	-
	mg/L	04/18/2006	0001	0.00 - 0.00	0 .0067	U		#	0.0067	-
	mg/L	09/07/2006	0001	0.00 - 0.00	0 .015	U		#	0.015	-

GROUND WATER QUALITY DATA BY LOCATION (USEE100) FOR SITE CRJ01, Crescent Junction Site
LOCATION: 0203 <borehole>
REPORT DATE: 2/15/2007 7:56 pm

		SAMPLE:		DEPTH RANGE		QUALIFIERS:			DETECTION	UN-
PARAMETER	UNITS	DATE	ID	(FT BLS)	RESULT	LAB	DATA	QA		CERTAINTY
Copper	mg/L	09/07/2006	0002	0.00 - 0.00	0 .015	U		#	0.015	-
Fluoride	mg/L	12/27/2005	0001	0.00 - 0.00	5	U	LQ	#	5	-
	mg/L	04/18/2006	0001	0.00 - 0.00	5	U		#	5	-
	mg/L	09/07/2006	0001	0.00 - 0.00	20	U		#	20	-
	mg/L	09/07/2006	0002	0.00 - 0.00	20	U		#	20	-
Gross Alpha	pCi/L	04/18/2006	0001	0.00 - 0.00	71 .6	U		#	71.6	± 39.00
	pCi/L	09/07/2006	0001	0.00 - 0.00	67 .1	U		#	67.1	± 37.10
	pCi/L	09/07/2006	0002	0.00 - 0.00	85 .9	U		#	85.9	± 46.40
	pCi/L	09/07/2006	0003	0.00 - 0.00	2 .49	U		#	2.49	± 1.50
	pCi/L	09/07/2006	0004	0.00 - 0.00	2 .79	U		#	2.79	± 1.50
Gross Beta	pCi/L	04/18/2006	0001	0.00 - 0.00	115	U		#	115	± 68.90
	pCi/L	09/07/2006	0001	0.00 - 0.00	112	U		#	112	± 67.10
	pCi/L	09/07/2006	0002	0.00 - 0.00	113	U		#	113	± 68.80
Iron	mg/L	12/27/2005	0001	0.00 - 0.00	0 .140	B	ULQ	#	0.078	-
	mg/L	04/18/2006	0001	0.00 - 0.00	0 .340	B	U	#	0.14	-
	mg/L	09/07/2006	0001	0.00 - 0.00	1 .500		U	#	0.28	-
	mg/L	09/07/2006	0002	0.00 - 0.00	1 .300		U	#	0.28	-
Lead	mg/L	04/18/2006	0001	0.00 - 0.00	0 .00086	B	U	#	0.00011	-
	mg/L	09/07/2006	0001	0.00 - 0.00	0 .0011	B	U	#	0.00016	-
	mg/L	09/07/2006	0002	0.00 - 0.00	0 .0011	B	U	#	0.00016	-
Magnesium	mg/L	12/27/2005	0001	0.00 - 0.00	110 .000		LQ	#	0.072	-
	mg/L	04/18/2006	0001	0.00 - 0.00	100 .000			#	0.068	-
	mg/L	09/07/2006	0001	0.00 - 0.00	110 .000			#	0.11	-
	mg/L	09/07/2006	0002	0.00 - 0.00	100 .000			#	0.11	-

GROUND WATER QUALITY DATA BY LOCATION (USEE100) FOR SITE CRJ01, Crescent Junction Site
LOCATION: 0203 <borehole>
REPORT DATE: 2/15/2007 7:56 pm

		SAMPLE:		DEPTH RANGE		QUALIFIERS:			DETECTION	UN-
PARAMETER	UNITS	DATE	ID	(FT BLS)	RESULT	LAB	DATA	QA		CERTAINTY
Manganese	mg/L	12/27/2005	0001	0.00 - 0.00	0 .033	B	LQ	#	0.00096	-
	mg/L	04/18/2006	0001	0.00 - 0.00	0 .021	B		#	0.0023	-
	mg/L	09/07/2006	0001	0.00 - 0.00	0 .022	B	U	#	0.0019	-
	mg/L	09/07/2006	0002	0.00 - 0.00	0 .018	B		#	0.0019	-
Molybdenum	mg/L	12/27/2005	0001	0.00 - 0.00	0 .0021		LQ	#	0.00014	-
	mg/L	04/18/2006	0001	0.00 - 0.00	0 .001	B	U	#	0.001	-
	mg/L	09/07/2006	0001	0.00 - 0.00	0 .0026	B	U	#	0.0013	-
	mg/L	09/07/2006	0002	0.00 - 0.00	0 .0028	B	U	#	0.0013	-
Nitrate + Nitrite as Nitrogen	mg/L	12/27/2005	0001	0.00 - 0.00	0 .026		LQ	#	0.01	-
	mg/L	04/18/2006	0001	0.00 - 0.00	0 .02			#	0.01	-
	mg/L	09/07/2006	0001	0.00 - 0.00	0 .02			#	0.01	-
	mg/L	09/07/2006	0002	0.00 - 0.00	0 .02			#	0.01	-
Oxidation Reduction	mV	12/27/2005	N001	0.00 - 0.00	234		LQ	#	-	-
	mV	04/18/2006	N001	0.00 - 0.00	-217			#	-	-
	mV	09/07/2006	N001	0.00 - 0.00	11			#	-	-
pH	s.u.	12/27/2005	N001	0.00 - 0.00	6 .93		LQ	#	-	-
	s.u.	04/18/2006	N001	0.00 - 0.00	7 .08			#	-	-
	s.u.	09/07/2006	N001	0.00 - 0.00	6 .93			#	-	-
Potassium	mg/L	12/27/2005	0001	0.00 - 0.00	59 .000		LQ	#	0.68	-
	mg/L	04/18/2006	0001	0.00 - 0.00	54 .000			#	0.74	-
	mg/L	09/07/2006	0001	0.00 - 0.00	53 .000			#	1.1	-
	mg/L	09/07/2006	0002	0.00 - 0.00	48 .000			#	1.1	-
Radium-226	pCi/L	04/18/2006	0001	0.00 - 0.00	0 .39	U		#	0.39	± 0.26
	pCi/L	09/07/2006	0001	0.00 - 0.00	0 .482		J	#	0.283	± 0.26
	pCi/L	09/07/2006	0002	0.00 - 0.00	0 .439	U		#	0.439	± 0.24

GROUND WATER QUALITY DATA BY LOCATION (USEE100) FOR SITE CRJ01, Crescent Junction Site
LOCATION: 0203 <borehole>
REPORT DATE: 2/15/2007 7:56 pm

PARAMETER	UNITS	SAMPLE: DATE	ID	DEPTH RANGE (FT BLS)	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION	UN-CERTAINTY
Radium-228	pCi/L	04/18/2006	0001	0.00 - 0.00	0 .956		J	#	0.71	± 0.47
	pCi/L	09/07/2006	0001	0.00 - 0.00	0 .831		J	#	0.635	± 0.42
	pCi/L	09/07/2006	0002	0.00 - 0.00	1 .39		J	#	0.848	± 0.62
Selenium	mg/L	12/27/2005	0001	0.00 - 0.00	0 .00076		ULQ	#	0.00011	-
	mg/L	04/18/2006	0001	0.00 - 0.00	0 .0082		J	#	0.0001	-
	mg/L	09/07/2006	0001	0.00 - 0.00	0 .0014	B	U	#	0.00031	-
	mg/L	09/07/2006	0002	0.00 - 0.00	0 .0013	B	U	#	0.00031	-
Sodium	mg/L	12/27/2005	0001	0.00 - 0.00	11000 .000		LQ	#	2.9	-
	mg/L	04/18/2006	0001	0.00 - 0.00	11000 .000			#	1.8	-
	mg/L	09/07/2006	0001	0.00 - 0.00	9800 .000			#	2	-
	mg/L	09/07/2006	0002	0.00 - 0.00	9400 .000			#	2	-
Specific Conductance	umhos/cm	12/27/2005	N001	0.00 - 0.00	52390		LQ	#	-	-
	umhos/cm	04/18/2006	N001	0.00 - 0.00	53160			#	-	-
	umhos/cm	09/07/2006	N001	0.00 - 0.00	47330			#	-	-
Sulfate	mg/L	12/27/2005	0001	0.00 - 0.00	4200		LQ	#	25	-
	mg/L	04/18/2006	0001	0.00 - 0.00	4500			#	25	-
	mg/L	09/07/2006	0001	0.00 - 0.00	5500			#	100	-
	mg/L	09/07/2006	0002	0.00 - 0.00	5500			#	100	-
Sulfide	mg/L	12/27/2005	0001	0.00 - 0.00	2	U	LQ	#	2	-
	mg/L	04/18/2006	0001	0.00 - 0.00	2	U		#	2	-
	mg/L	09/07/2006	0001	0.00 - 0.00	2	U		#	2	-
	mg/L	09/07/2006	0002	0.00 - 0.00	2	U		#	2	-
Temperature	C	12/27/2005	N001	0.00 - 0.00	15 .0		LQ	#	-	-
	C	04/18/2006	N001	0.00 - 0.00	16 .4			#	-	-

GROUND WATER QUALITY DATA BY LOCATION (USEE100) FOR SITE CRJ01, Crescent Junction Site
LOCATION: 0203 <borehole>
REPORT DATE: 2/15/2007 7:56 pm

		SAMPLE:		DEPTH RANGE		QUALIFIERS:			DETECTION	UN-
PARAMETER	UNITS	DATE	ID	(FT BLS)	RESULT	LAB	DATA	QA		CERTAINTY
Temperature	C	09/07/2006	N001	0.00 - 0.00	18 .73			#	-	-
Total Dissolved Solids	mg/L	12/27/2005	0001	0.00 - 0.00	37000		LQ	#	1000	-
	mg/L	04/18/2006	0001	0.00 - 0.00	37000			#	2000	-
	mg/L	09/07/2006	0001	0.00 - 0.00	34000			#	4000	-
	mg/L	09/07/2006	0002	0.00 - 0.00	35000			#	2000	-
Turbidity	NTU	12/27/2005	N001	0.00 - 0.00	13 .1		LQ	#	-	-
	NTU	04/18/2006	N001	0.00 - 0.00	2 .59			#	-	-
	NTU	09/07/2006	N001	0.00 - 0.00	7 .31			#	-	-
Uranium	mg/L	12/27/2005	0001	0.00 - 0.00	0 .00018	B	LQ	#	0.0000095	-
	mg/L	04/18/2006	0001	0.00 - 0.00	0 .00025	B	U	#	0.000017	-
	mg/L	09/07/2006	0001	0.00 - 0.00	0 .00024	B	U	#	0.000016	-
	mg/L	09/07/2006	0002	0.00 - 0.00	0 .00022	B	U	#	0.000016	-

GROUND WATER QUALITY DATA BY LOCATION (USEE100) FOR SITE CRJ01, Crescent Junction Site
LOCATION: 0203 <borehole>
REPORT DATE: 2/15/2007 7:56 pm

PARAMETER	UNITS	SAMPLE: DATE	SAMPLE: ID	DEPTH RANGE (FT BLS)	RESULT	QUALIFIERS: LAB	QUALIFIERS: DATA	QUALIFIERS: QA	DETECTION	UN-CERTAINTY

RECORDS: SELECTED FROM USEE100 WHERE site_code='CRJ01' AND location_code in('0201','0202','0203','0204','0205','0206','0207','0208','0209','0210') AND (data_validation_qualifiers IS NULL OR data_validation_qualifiers NOT LIKE '%N%' AND data_validation_qualifiers NOT LIKE '%R%' AND data_validation_qualifiers NOT LIKE '%X%') AND DATE_SAMPLED between #1/1/2005# and
#1/1/2008#

SAMPLE ID CODES: 000X = Filtered sample (0.45 μm). N00X = Unfiltered sample. X = replicate number.

LAB QUALIFIERS:

*	Replicate analysis not within control limits.
+	Correlation coefficient for MSA < 0.995.
>	Result above upper detection limit.
A	TIC is a suspected aldol-condensation product.
B	Inorganic: Result is between the IDL and CRDL. Organic & Radiochemistry: Analyte also found in method blank.
C	Pesticide result confirmed by GC-MS.
D	Analyte determined in diluted sample.
E	Inorganic: Estimate value because of interference, see case narrative. Organic: Analyte exceeded calibration range of the GC-MS.
H	Holding time expired, value suspect.
I	Increased detection limit due to required dilution.
J	Estimated
M	GFAA duplicate injection precision not met.
N	Inorganic or radiochemical: Spike sample recovery not within control limits. Organic: Tentatively identified compund (TIC).
P	> 25% difference in detected pesticide or Arochlor concentrations between 2 columns.
S	Result determined by method of standard addition (MSA).
U	Analytical result below detection limit.
W	Post-digestion spike outside control limits while sample absorbance < 50% of analytical spike absorbance.
X	Laboratory defined (USEPA CLP organic) qualifier, see case narrative.
Y	Laboratory defined (USEPA CLP organic) qualifier, see case narrative.
Z	Laboratory defined (USEPA CLP organic) qualifier, see case narrative.

DATA QUALIFIERS:

F	Low flow sampling method used.	G	Possible grout contamination, pH > 9.	J	Estimated value.
L	Less than 3 bore volumes purged prior to sampling.	N	Presumptive evidence that analyte is present. The analyte is "tentatively identified".	Q	Qualitative result due to sampling technique
R	Unusable result.	U	Parameter analyzed for but was not detected.	X	Location is undefined.

QA QUALIFIER: # = validated according to Quality Assurance guidelines.

GROUND WATER QUALITY DATA BY LOCATION (USEE100) FOR SITE CRJ01, Crescent Junction Site
LOCATION: 0204 <borehole>
REPORT DATE: 2/15/2007 7:56 pm

		SAMPLE:		DEPTH RANGE		QUALIFIERS:			DETECTION	UN-
PARAMETER	UNITS	DATE	ID	(FT BLS)	RESULT	LAB	DATA	QA		CERTAINTY
Alkalinity, Bicarbonate (As	mg/L	12/27/2005	0001	0.00 - 0.00	830		LQ	#	33	-
	mg/L	04/18/2006	0001	0.00 - 0.00	840			#	50	-
	mg/L	09/07/2006	0001	0.00 - 0.00	550			#	50	-
Alkalinity, Carbonate (As	mg/L	12/27/2005	0001	0.00 - 0.00	33	U	LQ	#	33	-
	mg/L	04/18/2006	0001	0.00 - 0.00	50	U		#	50	-
	mg/L	09/07/2006	0001	0.00 - 0.00	50	U		#	50	-
Alkalinity, Total (As CaCO3)	mg/L	12/27/2005	0001	0.00 - 0.00	812		LQ	#	-	-
	mg/L	12/27/2005	0001	0.00 - 0.00	830		LQ	#	33	-
	mg/L	04/18/2006	0001	0.00 - 0.00	840			#	50	-
	mg/L	04/18/2006	0001	0.00 - 0.00	1101			#	-	-
	mg/L	09/07/2006	0001	0.00 - 0.00	472			#	-	-
	mg/L	09/07/2006	0001	0.00 - 0.00	550			#	50	-
Ammonia Total as N	mg/L	12/27/2005	0001	0.00 - 0.00	15		LQ	#	0.5	-
	mg/L	04/18/2006	0001	0.00 - 0.00	17			#	1	-
	mg/L	09/07/2006	0001	0.00 - 0.00	18			#	0.5	-
Arsenic	mg/L	04/18/2006	0001	0.00 - 0.00	0 .0032			#	0.000038	-
	mg/L	09/07/2006	0001	0.00 - 0.00	0 .0019	B	U	#	0.00014	-
Barium	mg/L	04/18/2006	0001	0.00 - 0.00	9 .100			#	0.0017	-
	mg/L	09/07/2006	0001	0.00 - 0.00	16 .000			#	0.002	-
Boron	mg/L	12/27/2005	0001	0.00 - 0.00	1 .300		LQ	#	0.0095	-
	mg/L	04/18/2006	0001	0.00 - 0.00	1 .400			#	0.012	-
	mg/L	09/07/2006	0001	0.00 - 0.00	1 .200			#	0.02	-
Bromide	mg/L	12/27/2005	0001	0.00 - 0.00	100		LQ	#	10	-
	mg/L	04/18/2006	0001	0.00 - 0.00	99			#	10	-

GROUND WATER QUALITY DATA BY LOCATION (USEE100) FOR SITE CRJ01, Crescent Junction Site
LOCATION: 0204 <borehole>
REPORT DATE: 2/15/2007 7:56 pm

		SAMPLE:		DEPTH RANGE		QUALIFIERS:			DETECTION	UN-
PARAMETER	UNITS	DATE	ID	(FT BLS)	RESULT	LAB	DATA	QA		CERTAINTY
Bromide	mg/L	09/07/2006	0001	0.00 - 0.00	120			#	40	-
Cadmium	mg/L	04/18/2006	0001	0.00 - 0.00	0 .00072	B	U	#	0.0001	-
	mg/L	09/07/2006	0001	0.00 - 0.00	0 .00072	B	U	#	0.000081	-
Calcium	mg/L	12/27/2005	0001	0.00 - 0.00	240 .000		LQ	#	0.035	-
	mg/L	04/18/2006	0001	0.00 - 0.00	230 .000			#	0.056	-
	mg/L	09/07/2006	0001	0.00 - 0.00	300 .000			#	0.15	-
Chloride	mg/L	12/27/2005	0001	0.00 - 0.00	27000		LQ	#	400	-
	mg/L	04/18/2006	0001	0.00 - 0.00	28000			#	400	-
	mg/L	09/07/2006	0001	0.00 - 0.00	26000			#	1000	-
Chromium	mg/L	04/18/2006	0001	0.00 - 0.00	0 .018	U		#	0.018	-
	mg/L	09/07/2006	0001	0.00 - 0.00	0 .014	U		#	0.014	-
Copper	mg/L	12/27/2005	0001	0.00 - 0.00	0 .120		LQ	#	0.0061	-
	mg/L	04/18/2006	0001	0.00 - 0.00	0 .028	B	U	#	0.0067	-
	mg/L	09/07/2006	0001	0.00 - 0.00	0 .021	B		#	0.015	-
Fluoride	mg/L	12/27/2005	0001	0.00 - 0.00	5	U	LQ	#	5	-
	mg/L	04/18/2006	0001	0.00 - 0.00	5	U		#	5	-
	mg/L	09/07/2006	0001	0.00 - 0.00	20	U		#	20	-
Gross Alpha	pCi/L	04/18/2006	0001	0.00 - 0.00	77 .7	U		#	77.7	± 46.40
	pCi/L	09/07/2006	0001	0.00 - 0.00	109	U		#	109	± 71.00
	pCi/L	09/07/2006	0002	0.00 - 0.00	39 .8			#	3.11	± 7.48
Gross Beta	pCi/L	04/18/2006	0001	0.00 - 0.00	122	U		#	122	± 73.90
	pCi/L	09/07/2006	0001	0.00 - 0.00	224	U		#	224	± 141.00
Iron	mg/L	12/27/2005	0001	0.00 - 0.00	0 .078	U	LQ	#	0.078	-
	mg/L	04/18/2006	0001	0.00 - 0.00	0 .140	U		#	0.14	-

GROUND WATER QUALITY DATA BY LOCATION (USEE100) FOR SITE CRJ01, Crescent Junction Site
LOCATION: 0204 <borehole>
REPORT DATE: 2/15/2007 7:56 pm

PARAMETER	UNITS	SAMPLE: DATE	ID	DEPTH RANGE (FT BLS)	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION	UN-CERTAINTY
Iron	mg/L	09/07/2006	0001	0.00 - 0.00	1 .500		U	#	0.28	-
Lead	mg/L	04/18/2006	0001	0.00 - 0.00	0 .0014	B	U	#	0.00011	-
	mg/L	09/07/2006	0001	0.00 - 0.00	0 .0011	B	U	#	0.00016	-
Magnesium	mg/L	12/27/2005	0001	0.00 - 0.00	130 .000		LQ	#	0.072	-
	mg/L	04/18/2006	0001	0.00 - 0.00	120 .000			#	0.068	-
	mg/L	09/07/2006	0001	0.00 - 0.00	130 .000			#	0.11	-
Manganese	mg/L	12/27/2005	0001	0.00 - 0.00	0 .060		LQ	#	0.00096	-
	mg/L	04/18/2006	0001	0.00 - 0.00	0 .055			#	0.0023	-
	mg/L	09/07/2006	0001	0.00 - 0.00	0 .120			#	0.0019	-
Molybdenum	mg/L	12/27/2005	0001	0.00 - 0.00	0 .0077		LQ	#	0.00014	-
	mg/L	04/18/2006	0001	0.00 - 0.00	0 .0019	B	U	#	0.001	-
	mg/L	09/07/2006	0001	0.00 - 0.00	0 .0037	B	U	#	0.0013	-
Nitrate + Nitrite as Nitrogen	mg/L	12/27/2005	0001	0.00 - 0.00	0 .032		LQ	#	0.01	-
	mg/L	04/18/2006	0001	0.00 - 0.00	0 .025			#	0.01	-
	mg/L	09/07/2006	0001	0.00 - 0.00	0 .029			#	0.01	-
Oxidation Reduction	mV	12/27/2005	N001	0.00 - 0.00	248		LQ	#	-	-
	mV	04/18/2006	N001	0.00 - 0.00	202			#	-	-
	mV	09/07/2006	N001	0.00 - 0.00	-3			#	-	-
pH	s.u.	12/27/2005	N001	0.00 - 0.00	7 .22		LQ	#	-	-
	s.u.	04/18/2006	N001	0.00 - 0.00	7 .14			#	-	-
	s.u.	09/07/2006	N001	0.00 - 0.00	6 .85			#	-	-
Potassium	mg/L	12/27/2005	0001	0.00 - 0.00	71 .000		LQ	#	0.68	-
	mg/L	04/18/2006	0001	0.00 - 0.00	65 .000			#	0.74	-
	mg/L	09/07/2006	0001	0.00 - 0.00	64 .000			#	1.1	-

GROUND WATER QUALITY DATA BY LOCATION (USEE100) FOR SITE CRJ01, Crescent Junction Site
LOCATION: 0204 <borehole>
REPORT DATE: 2/15/2007 7:56 pm

PARAMETER	UNITS	SAMPLE: DATE	ID	DEPTH RANGE (FT BLS)	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION	UN- CERTAINTY
Radium-226	pCi/L	04/18/2006	0001	0.00 - 0.00	10 .5			#	0.315	± 2.70
	pCi/L	09/07/2006	0001	0.00 - 0.00	11 .6			#	0.232	± 2.97
Radium-228	pCi/L	04/18/2006	0001	0.00 - 0.00	8 .46			#	0.644	± 2.58
	pCi/L	09/07/2006	0001	0.00 - 0.00	13			#	0.66	± 3.91
Selenium	mg/L	12/27/2005	0001	0.00 - 0.00	0 .0076		JLQ	#	0.00011	-
	mg/L	04/18/2006	0001	0.00 - 0.00	0 .017		J	#	0.0001	-
	mg/L	09/07/2006	0001	0.00 - 0.00	0 .0029		U	#	0.00031	-
Sodium	mg/L	12/27/2005	0001	0.00 - 0.00	12000 .000		LQ	#	2.9	-
	mg/L	04/18/2006	0001	0.00 - 0.00	13000 .000			#	1.8	-
	mg/L	09/07/2006	0001	0.00 - 0.00	13000 .000			#	2	-
Specific Conductance	umhos/cm	12/27/2005	N001	0.00 - 0.00	62620		LQ	#	-	-
	umhos/cm	04/18/2006	N001	0.00 - 0.00	63396			#	-	-
	umhos/cm	09/07/2006	N001	0.00 - 0.00	64260			#	-	-
Sulfate	mg/L	12/27/2005	0001	0.00 - 0.00	25	U	LQ	#	25	-
	mg/L	04/18/2006	0001	0.00 - 0.00	41			#	25	-
	mg/L	09/07/2006	0001	0.00 - 0.00	100	U		#	100	-
Sulfide	mg/L	12/27/2005	0001	0.00 - 0.00	2	U	LQ	#	2	-
	mg/L	04/18/2006	0001	0.00 - 0.00	2	U		#	2	-
	mg/L	09/07/2006	0001	0.00 - 0.00	2	U		#	2	-
Temperature	C	12/27/2005	N001	0.00 - 0.00	15 .1		LQ	#	-	-
	C	04/18/2006	N001	0.00 - 0.00	16 .2			#	-	-
	C	09/07/2006	N001	0.00 - 0.00	17 .18			#	-	-
Total Dissolved Solids	mg/L	12/27/2005	0001	0.00 - 0.00	42000		LQ	#	2000	-
	mg/L	04/18/2006	0001	0.00 - 0.00	42000			#	2000	-

GROUND WATER QUALITY DATA BY LOCATION (USEE100) FOR SITE CRJ01, Crescent Junction Site
LOCATION: 0204 <borehole>
REPORT DATE: 2/15/2007 7:56 pm

		SAMPLE:		DEPTH RANGE		QUALIFIERS:			DETECTION	UN-
PARAMETER	UNITS	DATE	ID	(FT BLS)	RESULT	LAB	DATA	QA		CERTAINTY
Total Dissolved Solids	mg/L	09/07/2006	0001	0.00 - 0.00	44000			#	4000	-
Turbidity	NTU	12/27/2005	N001	0.00 - 0.00	16 .9		LQ	#	-	-
	NTU	04/18/2006	N001	0.00 - 0.00	4 .25			#	-	-
	NTU	09/07/2006	N001	0.00 - 0.00	2 .76			#	-	-
Uranium	mg/L	12/27/2005	0001	0.00 - 0.00	0 .00042		LQ	#	0.0000095	-
	mg/L	04/18/2006	0001	0.00 - 0.00	0 .00025	B	U	#	0.000017	-
	mg/L	09/07/2006	0001	0.00 - 0.00	0 .00023	B	U	#	0.000016	-

GROUND WATER QUALITY DATA BY LOCATION (USEE100) FOR SITE CRJ01, Crescent Junction Site
LOCATION: 0204 <borehole>
REPORT DATE: 2/15/2007 7:56 pm

PARAMETER	UNITS	SAMPLE: DATE	SAMPLE: ID	DEPTH RANGE (FT BLS)	RESULT	QUALIFIERS: LAB	QUALIFIERS: DATA	QUALIFIERS: QA	DETECTION	UN- CERTAINTY

RECORDS: SELECTED FROM USEE100 WHERE site_code='CRJ01' AND location_code in('0201','0202','0203','0204','0205','0206','0207','0208','0209','0210') AND (data_validation_qualifiers IS NULL OR data_validation_qualifiers NOT LIKE '%N%' AND data_validation_qualifiers NOT LIKE '%R%' AND data_validation_qualifiers NOT LIKE '%X%') AND DATE_SAMPLED between #1/1/2005# and #1/1/2008#

SAMPLE ID CODES: 000X = Filtered sample (0.45 µm). N00X = Unfiltered sample. X = replicate number.

LAB QUALIFIERS:

*	Replicate analysis not within control limits.
+	Correlation coefficient for MSA < 0.995.
>	Result above upper detection limit.
A	TIC is a suspected aldol-condensation product.
B	Inorganic: Result is between the IDL and CRDL. Organic & Radiochemistry: Analyte also found in method blank.
C	Pesticide result confirmed by GC-MS.
D	Analyte determined in diluted sample.
E	Inorganic: Estimate value because of interference, see case narrative. Organic: Analyte exceeded calibration range of the GC-MS.
H	Holding time expired, value suspect.
I	Increased detection limit due to required dilution.
J	Estimated
M	GFAA duplicate injection precision not met.
N	Inorganic or radiochemical: Spike sample recovery not within control limits. Organic: Tentatively identified compund (TIC).
P	> 25% difference in detected pesticide or Arochlor concentrations between 2 columns.
S	Result determined by method of standard addition (MSA).
U	Analytical result below detection limit.
W	Post-digestion spike outside control limits while sample absorbance < 50% of analytical spike absorbance.
X	Laboratory defined (USEPA CLP organic) qualifier, see case narrative.
Y	Laboratory defined (USEPA CLP organic) qualifier, see case narrative.
Z	Laboratory defined (USEPA CLP organic) qualifier, see case narrative.

DATA QUALIFIERS:

F	Low flow sampling method used.	G	Possible grout contamination, pH > 9.	J	Estimated value.
L	Less than 3 bore volumes purged prior to sampling.	N	Presumptive evidence that analyte is present. The analyte is "tentatively identified".	Q	Qualitative result due to sampling technique
R	Unusable result.	U	Parameter analyzed for but was not detected.	X	Location is undefined.

QA QUALIFIER: # = validated according to Quality Assurance guidelines.

GROUND WATER QUALITY DATA BY LOCATION (USEE100) FOR SITE CRJ01, Crescent Junction Site
LOCATION: 0205 <borehole>
REPORT DATE: 2/15/2007 7:56 pm

PARAMETER	UNITS	SAMPLE: DATE	ID	DEPTH RANGE (FT BLS)	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION	UN- CERTAINTY
Alkalinity, Bicarbonate (As	mg/L	04/18/2006	0001	0.00 - 0.00	380			#	50	-
	mg/L	09/07/2006	0001	0.00 - 0.00	440			#	50	-
Alkalinity, Carbonate (As	mg/L	04/18/2006	0001	0.00 - 0.00	50	U		#	50	-
	mg/L	09/07/2006	0001	0.00 - 0.00	50	U		#	50	-
Alkalinity, Total (As CaCO3)	mg/L	04/18/2006	0001	0.00 - 0.00	914			#	-	-
	mg/L	04/18/2006	0001	0.00 - 0.00	380			#	50	-
	mg/L	09/07/2006	0001	0.00 - 0.00	440			#	50	-
	mg/L	09/07/2006	0001	0.00 - 0.00	439			#	-	-
Ammonia Total as N	mg/L	04/18/2006	0001	0.00 - 0.00	19			#	1	-
	mg/L	09/07/2006	0001	0.00 - 0.00	12			#	0.5	-
Arsenic	mg/L	04/18/2006	0001	0.00 - 0.00	0 .0037			#	0.000038	-
	mg/L	09/07/2006	0001	0.00 - 0.00	0 .0019	B	U	#	0.00014	-
Barium	mg/L	04/18/2006	0001	0.00 - 0.00	1 .500			#	0.0017	-
	mg/L	09/07/2006	0001	0.00 - 0.00	3 .500			#	0.002	-
Boron	mg/L	04/18/2006	0001	0.00 - 0.00	1 .100			#	0.012	-
	mg/L	09/07/2006	0001	0.00 - 0.00	1 .100			#	0.02	-
Bromide	mg/L	04/18/2006	0001	0.00 - 0.00	130			#	10	-
	mg/L	09/07/2006	0001	0.00 - 0.00	130			#	40	-
Cadmium	mg/L	04/18/2006	0001	0.00 - 0.00	0 .00081	B	U	#	0.0001	-
	mg/L	09/07/2006	0001	0.00 - 0.00	0 .00081	B	U	#	0.000081	-
Calcium	mg/L	04/18/2006	0001	0.00 - 0.00	340 .000			#	0.056	-
	mg/L	09/07/2006	0001	0.00 - 0.00	370 .000			#	0.15	-
Chloride	mg/L	04/18/2006	0001	0.00 - 0.00	28000			#	400	-
	mg/L	09/07/2006	0001	0.00 - 0.00	27000			#	1000	-

GROUND WATER QUALITY DATA BY LOCATION (USEE100) FOR SITE CRJ01, Crescent Junction Site
LOCATION: 0205 <borehole>
REPORT DATE: 2/15/2007 7:56 pm

PARAMETER	UNITS	SAMPLE: DATE	ID	DEPTH RANGE (FT BLS)	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION	UN- CERTAINTY
Chromium	mg/L	04/18/2006	0001	0.00 - 0.00	0 .018	U		#	0.018	-
	mg/L	09/07/2006	0001	0.00 - 0.00	0 .014	U		#	0.014	-
Copper	mg/L	04/18/2006	0001	0.00 - 0.00	0 .0067	U		#	0.0067	-
	mg/L	09/07/2006	0001	0.00 - 0.00	0 .015	U		#	0.015	-
Fluoride	mg/L	04/18/2006	0001	0.00 - 0.00	5	U		#	5	-
	mg/L	09/07/2006	0001	0.00 - 0.00	20	U		#	20	-
Gross Alpha	pCi/L	04/18/2006	0001	0.00 - 0.00	85 .5	U		#	85.5	± 45.80
	pCi/L	09/07/2006	0001	0.00 - 0.00	137	U		#	137	± 75.00
	pCi/L	09/07/2006	0002	0.00 - 0.00	10 .7			#	3.07	± 2.96
Gross Beta	pCi/L	04/18/2006	0001	0.00 - 0.00	109	U		#	109	± 65.20
	pCi/L	09/07/2006	0001	0.00 - 0.00	219	U		#	219	± 133.00
Iron	mg/L	04/18/2006	0001	0.00 - 0.00	0 .930			#	0.14	-
	mg/L	09/07/2006	0001	0.00 - 0.00	0 .700	B	U	#	0.28	-
Lead	mg/L	04/18/2006	0001	0.00 - 0.00	0 .00087	B	U	#	0.00011	-
	mg/L	09/07/2006	0001	0.00 - 0.00	0 .0011	B	U	#	0.00016	-
Magnesium	mg/L	04/18/2006	0001	0.00 - 0.00	140 .000			#	0.068	-
	mg/L	09/07/2006	0001	0.00 - 0.00	140 .000			#	0.11	-
Manganese	mg/L	04/18/2006	0001	0.00 - 0.00	0 .360			#	0.0023	-
	mg/L	09/07/2006	0001	0.00 - 0.00	0 .370			#	0.0019	-
Molybdenum	mg/L	04/18/2006	0001	0.00 - 0.00	0 .024			#	0.001	-
	mg/L	09/07/2006	0001	0.00 - 0.00	0 .0096		U	#	0.0013	-
Nitrate + Nitrite as Nitrogen	mg/L	04/18/2006	0001	0.00 - 0.00	0 .026			#	0.01	-
	mg/L	09/07/2006	0001	0.00 - 0.00	0 .049			#	0.01	-

GROUND WATER QUALITY DATA BY LOCATION (USEE100) FOR SITE CRJ01, Crescent Junction Site
LOCATION: 0205 <borehole>
REPORT DATE: 2/15/2007 7:56 pm

PARAMETER	UNITS	SAMPLE: DATE	ID	DEPTH RANGE (FT BLS)	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION	UN-CERTAINTY
Oxidation Reduction	mV	04/18/2006	N001	0.00 - 0.00	64			#	-	-
	mV	09/07/2006	N001	0.00 - 0.00	56			#	-	-
pH	s.u.	04/18/2006	N001	0.00 - 0.00	7 .06			#	-	-
	s.u.	09/07/2006	N001	0.00 - 0.00	7 .24			#	-	-
Potassium	mg/L	04/18/2006	0001	0.00 - 0.00	68 .000			#	0.74	-
	mg/L	09/07/2006	0001	0.00 - 0.00	64 .000			#	1.1	-
Radium-226	pCi/L	04/18/2006	0001	0.00 - 0.00	1 .76			#	0.39	± 0.60
	pCi/L	09/07/2006	0001	0.00 - 0.00	2 .5			#	0.395	± 0.80
Radium-228	pCi/L	04/18/2006	0001	0.00 - 0.00	1 .37		J	#	0.665	± 0.55
	pCi/L	09/07/2006	0001	0.00 - 0.00	2 .32			#	0.729	± 0.81
Selenium	mg/L	04/18/2006	0001	0.00 - 0.00	0 .016		J	#	0.0001	-
	mg/L	09/07/2006	0001	0.00 - 0.00	0 .0016	B	U	#	0.00031	-
Sodium	mg/L	04/18/2006	0001	0.00 - 0.00	14000 .000			#	1.8	-
	mg/L	09/07/2006	0001	0.00 - 0.00	13000 .000			#	2	-
Specific Conductance	umhos/cm	04/18/2006	N001	0.00 - 0.00	65712			#	-	-
	umhos/cm	09/07/2006	N001	0.00 - 0.00	66120			#	-	-
Sulfate	mg/L	04/18/2006	0001	0.00 - 0.00	170			#	25	-
	mg/L	09/07/2006	0001	0.00 - 0.00	100	U		#	100	-
Sulfide	mg/L	04/18/2006	0001	0.00 - 0.00	2	U		#	2	-
	mg/L	09/07/2006	0001	0.00 - 0.00	2	U		#	2	-
Temperature	C	04/18/2006	N001	0.00 - 0.00	15 .0			#	-	-
	C	09/07/2006	N001	0.00 - 0.00	16 .95			#	-	-
Total Dissolved Solids	mg/L	04/18/2006	0001	0.00 - 0.00	45000			#	2000	-

GROUND WATER QUALITY DATA BY LOCATION (USEE100) FOR SITE CRJ01, Crescent Junction Site
LOCATION: 0205 <borehole>
REPORT DATE: 2/15/2007 7:56 pm

PARAMETER	UNITS	SAMPLE: DATE	ID	DEPTH RANGE (FT BLS)	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION	UN-CERTAINTY
Total Dissolved Solids	mg/L	09/07/2006	0001	0.00 - 0.00	44000			#	4000	-
Turbidity	NTU	04/18/2006	N001	0.00 - 0.00	60 .8			#	-	-
Uranium	mg/L	04/18/2006	0001	0.00 - 0.00	0 .0015		U	#	0.000017	-
	mg/L	09/07/2006	0001	0.00 - 0.00	0 .00077		U	#	0.000016	-

GROUND WATER QUALITY DATA BY LOCATION (USEE100) FOR SITE CRJ01, Crescent Junction Site
LOCATION: 0205 <borehole>
REPORT DATE: 2/15/2007 7:56 pm

PARAMETER	UNITS	SAMPLE: DATE	ID	DEPTH RANGE (FT BLS)	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION	UN-CERTAINTY

RECORDS: SELECTED FROM USEE100 WHERE site_code='CRJ01' AND location_code in('0201','0202','0203','0204','0205','0206','0207','0208','0209','0210') AND (data_validation_qualifiers IS NULL OR data_validation_qualifiers NOT LIKE '%N%' AND data_validation_qualifiers NOT LIKE '%R%' AND data_validation_qualifiers NOT LIKE '%X%') AND DATE_SAMPLED between #1/1/2005# and #1/1/2008#

SAMPLE ID CODES: 000X = Filtered sample (0.45 µm). N00X = Unfiltered sample. X = replicate number.

LAB QUALIFIERS:

*	Replicate analysis not within control limits.
+	Correlation coefficient for MSA < 0.995.
>	Result above upper detection limit.
A	TIC is a suspected aldol-condensation product.
B	Inorganic: Result is between the IDL and CRDL. Organic & Radiochemistry: Analyte also found in method blank.
C	Pesticide result confirmed by GC-MS.
D	Analyte determined in diluted sample.
E	Inorganic: Estimate value because of interference, see case narrative. Organic: Analyte exceeded calibration range of the GC-MS.
H	Holding time expired, value suspect.
I	Increased detection limit due to required dilution.
J	Estimated
M	GFAA duplicate injection precision not met.
N	Inorganic or radiochemical: Spike sample recovery not within control limits. Organic: Tentatively identified compund (TIC).
P	> 25% difference in detected pesticide or Arochlor concentrations between 2 columns.
S	Result determined by method of standard addition (MSA).
U	Analytical result below detection limit.
W	Post-digestion spike outside control limits while sample absorbance < 50% of analytical spike absorbance.
X	Laboratory defined (USEPA CLP organic) qualifier, see case narrative.
Y	Laboratory defined (USEPA CLP organic) qualifier, see case narrative.
Z	Laboratory defined (USEPA CLP organic) qualifier, see case narrative.

DATA QUALIFIERS:

F	Low flow sampling method used.
L	Less than 3 bore volumes purged prior to sampling.
R	Unusable result.
G	Possible grout contamination, pH > 9.
N	Presumptive evidence that analyte is present. The analyte is "tentatively identified".
U	Parameter analyzed for but was not detected.
J	Estimated value.
Q	Qualitative result due to sampling technique
X	Location is undefined.

QA QUALIFIER: # = validated according to Quality Assurance guidelines.

GROUND WATER QUALITY DATA BY LOCATION (USEE100) FOR SITE CRJ01, Crescent Junction Site
LOCATION: 0208 <borehole>
REPORT DATE: 2/15/2007 7:56 pm

		SAMPLE:		DEPTH RANGE		QUALIFIERS:			DETECTION	UN-
PARAMETER	UNITS	DATE	ID	(FT BLS)	RESULT	LAB	DATA	QA		CERTAINTY
Alkalinity, Bicarbonate (As	mg/L	12/27/2005	0001	0.00 - 0.00	1700		LQ	#	50	-
	mg/L	04/18/2006	0001	0.00 - 0.00	1700			#	50	-
	mg/L	04/18/2006	0002	0.00 - 0.00	1700			#	50	-
	mg/L	09/11/2006	0001	0.00 - 0.00	560			#	10	-
Alkalinity, Carbonate (As	mg/L	12/27/2005	0001	0.00 - 0.00	50	U	LQ	#	50	-
	mg/L	04/18/2006	0001	0.00 - 0.00	50	U		#	50	-
	mg/L	04/18/2006	0002	0.00 - 0.00	50	U		#	50	-
	mg/L	09/11/2006	0001	0.00 - 0.00	10	U		#	10	-
Alkalinity, Total (As CaCO3)	mg/L	11/07/2005	0001	0.00 - 0.00	1497		LQ	#	-	-
	mg/L	12/27/2005	0001	0.00 - 0.00	1700		LQ	#	50	-
	mg/L	12/27/2005	0001	0.00 - 0.00	1788		LQ	#	-	-
	mg/L	04/18/2006	0001	0.00 - 0.00	1845			#	-	-
	mg/L	04/18/2006	0001	0.00 - 0.00	1700			#	50	-
	mg/L	04/18/2006	0002	0.00 - 0.00	1700			#	50	-
	mg/L	09/11/2006	0001	0.00 - 0.00	1687			#	-	-
	mg/L	09/11/2006	0001	0.00 - 0.00	560			#	10	-
Ammonia Total as N	mg/L	12/27/2005	0001	0.00 - 0.00	4 .1		LQ	#	0.1	-
	mg/L	04/18/2006	0001	0.00 - 0.00	3 .2			#	0.1	-
	mg/L	04/18/2006	0002	0.00 - 0.00	3 .6			#	0.1	-
	mg/L	09/11/2006	0001	0.00 - 0.00	19			#	1	-
Arsenic	mg/L	04/18/2006	0001	0.00 - 0.00	0 .00095			#	0.000038	-
	mg/L	04/18/2006	0002	0.00 - 0.00	0 .00092			#	0.000038	-
	mg/L	09/11/2006	0001	0.00 - 0.00	0 .00076			#	0.000036	-
Barium	mg/L	04/18/2006	0001	0.00 - 0.00	0 .032	B		#	0.0017	-
	mg/L	04/18/2006	0002	0.00 - 0.00	0 .031	B		#	0.0017	-

GROUND WATER QUALITY DATA BY LOCATION (USEE100) FOR SITE CRJ01, Crescent Junction Site
LOCATION: 0208 <borehole>
REPORT DATE: 2/15/2007 7:56 pm

PARAMETER	UNITS	SAMPLE: DATE	ID	DEPTH RANGE (FT BLS)	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION	UN- CERTAINTY
Barium	mg/L	09/11/2006	0001	0.00 - 0.00	0 .410	B		#	0.002	-
Boron	mg/L	12/27/2005	0001	0.00 - 0.00	1 .500		LQ	#	0.0095	-
	mg/L	04/18/2006	0001	0.00 - 0.00	1 .600			#	0.012	-
	mg/L	04/18/2006	0002	0.00 - 0.00	1 .600			#	0.012	-
	mg/L	09/11/2006	0001	0.00 - 0.00	1 .300			#	0.02	-
Bromide	mg/L	11/07/2005	0001	0.00 - 0.00	31		LQ	#	10	-
	mg/L	12/27/2005	0001	0.00 - 0.00	22		LQ	#	10	-
	mg/L	04/18/2006	0001	0.00 - 0.00	23			#	10	-
	mg/L	04/18/2006	0002	0.00 - 0.00	22			#	10	-
	mg/L	09/11/2006	0001	0.00 - 0.00	100			#	20	-
Cadmium	mg/L	04/18/2006	0001	0.00 - 0.00	0 .00055	B	U	#	0.0001	-
	mg/L	04/18/2006	0002	0.00 - 0.00	0 .0005	B	U	#	0.0001	-
	mg/L	09/11/2006	0001	0.00 - 0.00	0 .00054	B	U	#	0.000032	-
Calcium	mg/L	11/07/2005	0001	0.00 - 0.00	89 .000		LQ	#	0.035	-
	mg/L	12/27/2005	0001	0.00 - 0.00	94 .000		LQ	#	0.035	-
	mg/L	04/18/2006	0001	0.00 - 0.00	88 .000			#	0.056	-
	mg/L	04/18/2006	0002	0.00 - 0.00	90 .000			#	0.056	-
	mg/L	09/11/2006	0001	0.00 - 0.00	250 .000			#	0.15	-
Chloride	mg/L	11/07/2005	0001	0.00 - 0.00	8000		LQ	#	100	-
	mg/L	12/27/2005	0001	0.00 - 0.00	6600		LQ	#	100	-
	mg/L	04/18/2006	0001	0.00 - 0.00	6400			#	200	-
	mg/L	04/18/2006	0002	0.00 - 0.00	6500			#	200	-
	mg/L	09/11/2006	0001	0.00 - 0.00	24000			#	1000	-
Chromium	mg/L	04/18/2006	0001	0.00 - 0.00	0 .018	U		#	0.018	-
	mg/L	04/18/2006	0002	0.00 - 0.00	0 .018	U		#	0.018	-

GROUND WATER QUALITY DATA BY LOCATION (USEE100) FOR SITE CRJ01, Crescent Junction Site
LOCATION: 0208 <borehole>
REPORT DATE: 2/15/2007 7:56 pm

PARAMETER	UNITS	SAMPLE: DATE	ID	DEPTH RANGE (FT BLS)	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION	UN-CERTAINTY
Chromium	mg/L	09/11/2006	0001	0.00 - 0.00	0 .014	U		#	0.014	-
Copper	mg/L	12/27/2005	0001	0.00 - 0.00	0 .042	B	ULQ	#	0.0061	-
	mg/L	04/18/2006	0001	0.00 - 0.00	0 .0067	U		#	0.0067	-
	mg/L	04/18/2006	0002	0.00 - 0.00	0 .0067	U		#	0.0067	-
	mg/L	09/11/2006	0001	0.00 - 0.00	0 .015	U		#	0.015	-
Dissolved Oxygen	mg/L	11/07/2005	N001	0.00 - 0.00	2 .41		LQ	#	-	-
Fluoride	mg/L	11/07/2005	0001	0.00 - 0.00	5	U	LQ	#	5	-
	mg/L	12/27/2005	0001	0.00 - 0.00	5	U	LQ	#	5	-
	mg/L	04/18/2006	0001	0.00 - 0.00	5	U		#	5	-
	mg/L	04/18/2006	0002	0.00 - 0.00	5	U		#	5	-
	mg/L	09/11/2006	0001	0.00 - 0.00	10	U		#	10	-
Gross Alpha	pCi/L	04/18/2006	0001	0.00 - 0.00	44	U		#	44	± 24.60
	pCi/L	04/18/2006	0002	0.00 - 0.00	36 .1	U		#	36.1	± 21.00
	pCi/L	09/11/2006	0001	0.00 - 0.00	114	U		#	114	± 66.20
	pCi/L	09/11/2006	0002	0.00 - 0.00	2 .82			#	2.6	± 1.67
Gross Beta	pCi/L	04/18/2006	0001	0.00 - 0.00	71 .9	U		#	71.9	± 43.80
	pCi/L	04/18/2006	0002	0.00 - 0.00	72 .1	U		#	72.1	± 44.10
	pCi/L	09/11/2006	0001	0.00 - 0.00	213	U		#	213	± 130.00
Iron	mg/L	12/27/2005	0001	0.00 - 0.00	0 .078	U	LQ	#	0.078	-
	mg/L	04/18/2006	0001	0.00 - 0.00	0 .330	B	U	#	0.14	-
	mg/L	04/18/2006	0002	0.00 - 0.00	0 .320	B	U	#	0.14	-
	mg/L	09/11/2006	0001	0.00 - 0.00	0 .280	U		#	0.28	-
Lead	mg/L	04/18/2006	0001	0.00 - 0.00	0 .004			#	0.00011	-
	mg/L	04/18/2006	0002	0.00 - 0.00	0 .0029			#	0.00011	-

GROUND WATER QUALITY DATA BY LOCATION (USEE100) FOR SITE CRJ01, Crescent Junction Site
LOCATION: 0208 <borehole>
REPORT DATE: 2/15/2007 7:56 pm

PARAMETER	UNITS	SAMPLE: DATE	ID	DEPTH RANGE (FT BLS)	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION	UN-CERTAINTY
Lead	mg/L	09/11/2006	0001	0.00 - 0.00	0 .00056	B	U	#	0.000063	-
Magnesium	mg/L	11/07/2005	0001	0.00 - 0.00	78 .000		LQ	#	0.072	-
	mg/L	12/27/2005	0001	0.00 - 0.00	77 .000		LQ	#	0.072	-
	mg/L	04/18/2006	0001	0.00 - 0.00	68 .000			#	0.068	-
	mg/L	04/18/2006	0002	0.00 - 0.00	68 .000			#	0.068	-
	mg/L	09/11/2006	0001	0.00 - 0.00	140 .000			#	0.11	-
Manganese	mg/L	12/27/2005	0001	0.00 - 0.00	0 .042	B	LQ	#	0.00096	-
	mg/L	04/18/2006	0001	0.00 - 0.00	0 .034	B		#	0.0023	-
	mg/L	04/18/2006	0002	0.00 - 0.00	0 .034	B		#	0.0023	-
	mg/L	09/11/2006	0001	0.00 - 0.00	0 .160			#	0.0019	-
Molybdenum	mg/L	12/27/2005	0001	0.00 - 0.00	0 .0068		LQ	#	0.00014	-
	mg/L	04/18/2006	0001	0.00 - 0.00	0 .0041	B	U	#	0.001	-
	mg/L	04/18/2006	0002	0.00 - 0.00	0 .0038	B	U	#	0.001	-
	mg/L	09/11/2006	0001	0.00 - 0.00	0 .012		U	#	0.00052	-
Nitrate + Nitrite as Nitrogen	mg/L	12/27/2005	0001	0.00 - 0.00	11		LQ	#	0.1	-
	mg/L	04/18/2006	0001	0.00 - 0.00	0 .01	U		#	0.01	-
	mg/L	04/18/2006	0002	0.00 - 0.00	0 .015			#	0.01	-
	mg/L	09/11/2006	0001	0.00 - 0.00	0 .1			#	0.01	-
Oxidation Reduction	mV	11/07/2005	N001	0.00 - 0.00	25		LQ	#	-	-
	mV	12/27/2005	N001	0.00 - 0.00	248		LQ	#	-	-
	mV	04/18/2006	N001	0.00 - 0.00	-42			#	-	-
	mV	09/11/2006	N001	0.00 - 0.00	59			#	-	-
pH	s.u.	11/07/2005	N001	0.00 - 0.00	7 .29		LQ	#	-	-
	s.u.	12/27/2005	N001	0.00 - 0.00	7 .02		LQ	#	-	-
	s.u.	04/18/2006	N001	0.00 - 0.00	7 .31			#	-	-

GROUND WATER QUALITY DATA BY LOCATION (USEE100) FOR SITE CRJ01, Crescent Junction Site
LOCATION: 0208 <borehole>
REPORT DATE: 2/15/2007 7:56 pm

PARAMETER	UNITS	SAMPLE: DATE	ID	DEPTH RANGE (FT BLS)	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION	UN- CERTAINTY
pH	s.u.	09/11/2006	N001	0.00 - 0.00	6 .94			#	-	-
Potassium	mg/L	11/07/2005	0001	0.00 - 0.00	39 .000	EN	JLQ	#	0.68	-
	mg/L	12/27/2005	0001	0.00 - 0.00	38 .000		LQ	#	0.68	-
	mg/L	04/18/2006	0001	0.00 - 0.00	33 .000			#	0.74	-
	mg/L	04/18/2006	0002	0.00 - 0.00	33 .000			#	0.74	-
	mg/L	09/11/2006	0001	0.00 - 0.00	59 .000			#	1.1	-
Radium-226	pCi/L	04/18/2006	0001	0.00 - 0.00	0 .28	U		#	0.28	± 0.13
	pCi/L	04/18/2006	0002	0.00 - 0.00	0 .646	U		#	0.646	± 0.35
	pCi/L	09/11/2006	0001	0.00 - 0.00	0 .562		J	#	0.324	± 0.31
Radium-228	pCi/L	04/18/2006	0001	0.00 - 0.00	0 .752	U		#	0.752	± 0.39
	pCi/L	04/18/2006	0002	0.00 - 0.00	0 .746	U		#	0.746	± 0.36
	pCi/L	09/11/2006	0001	0.00 - 0.00	0 .949		J	#	0.702	± 0.47
Selenium	mg/L	12/27/2005	0001	0.00 - 0.00	0 .0021		JLQ	#	0.00011	-
	mg/L	04/18/2006	0001	0.00 - 0.00	0 .00084		J	#	0.0001	-
	mg/L	04/18/2006	0002	0.00 - 0.00	0 .00073		J	#	0.0001	-
	mg/L	09/11/2006	0001	0.00 - 0.00	0 .0028			#	0.000078	-
Sodium	mg/L	11/07/2005	0001	0.00 - 0.00	7100 .000		LQ	#	2.9	-
	mg/L	12/27/2005	0001	0.00 - 0.00	6200 .000		LQ	#	0.58	-
	mg/L	04/18/2006	0001	0.00 - 0.00	6700 .000			#	1.8	-
	mg/L	04/18/2006	0002	0.00 - 0.00	6800 .000			#	1.8	-
	mg/L	09/11/2006	0001	0.00 - 0.00	13000 .000			#	2	-
Specific Conductance	umhos/cm	11/07/2005	N001	0.00 - 0.00	32280		LQ	#	-	-
	umhos/cm	12/27/2005	N001	0.00 - 0.00	29610		LQ	#	-	-
	umhos/cm	04/18/2006	N001	0.00 - 0.00	30225			#	-	-
	umhos/cm	09/11/2006	N001	0.00 - 0.00	25640			#	-	-

GROUND WATER QUALITY DATA BY LOCATION (USEE100) FOR SITE CRJ01, Crescent Junction Site
LOCATION: 0208 <borehole>
REPORT DATE: 2/15/2007 7:56 pm

PARAMETER	UNITS	SAMPLE: DATE	ID	DEPTH RANGE (FT BLS)	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION	UN-CERTAINTY
Sulfate	mg/L	11/07/2005	0001	0.00 - 0.00	7700		LQ	#	250	-
	mg/L	12/27/2005	0001	0.00 - 0.00	7800		LQ	#	250	-
	mg/L	04/18/2006	0001	0.00 - 0.00	5900			#	500	-
	mg/L	04/18/2006	0002	0.00 - 0.00	5900			#	500	-
	mg/L	09/11/2006	0001	0.00 - 0.00	750			#	50	-
Sulfide	mg/L	12/27/2005	0001	0.00 - 0.00	2	U	LQ	#	2	-
	mg/L	04/18/2006	0001	0.00 - 0.00	2	U		#	2	-
	mg/L	04/18/2006	0002	0.00 - 0.00	2	U		#	2	-
	mg/L	09/11/2006	0001	0.00 - 0.00	2	U		#	2	-
Temperature	C	11/07/2005	N001	0.00 - 0.00	15 .4		LQ	#	-	-
	C	12/27/2005	N001	0.00 - 0.00	15 .1		LQ	#	-	-
	C	04/18/2006	N001	0.00 - 0.00	16 .3			#	-	-
	C	09/11/2006	N001	0.00 - 0.00	17 .15			#	-	-
Total Dissolved Solids	mg/L	11/07/2005	0001	0.00 - 0.00	25000		LQ	#	1000	-
	mg/L	12/27/2005	0001	0.00 - 0.00	23000		LQ	#	1000	-
	mg/L	04/18/2006	0001	0.00 - 0.00	23000			#	2000	-
	mg/L	04/18/2006	0002	0.00 - 0.00	23000			#	2000	-
	mg/L	09/11/2006	0001	0.00 - 0.00	42000			#	2000	-
Turbidity	NTU	12/27/2005	N001	0.00 - 0.00	10 .6		LQ	#	-	-
	NTU	04/18/2006	N001	0.00 - 0.00	10 .6			#	-	-
	NTU	09/11/2006	N001	0.00 - 0.00	12 .4			#	-	-
Uranium	mg/L	12/27/2005	0001	0.00 - 0.00	0 .031		LQ	#	0.0000095	-
	mg/L	04/18/2006	0001	0.00 - 0.00	0 .016			#	0.000017	-
	mg/L	04/18/2006	0002	0.00 - 0.00	0 .017			#	0.000017	-
	mg/L	09/11/2006	0001	0.00 - 0.00	0 .0018			#	0.0000063	-

GROUND WATER QUALITY DATA BY LOCATION (USEE100) FOR SITE CRJ01, Crescent Junction Site
LOCATION: 0208 <borehole>
REPORT DATE: 2/15/2007 7:56 pm

PARAMETER	UNITS	SAMPLE: DATE	ID	DEPTH RANGE (FT BLS)	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION	UN-CERTAINTY

RECORDS: SELECTED FROM USEE100 WHERE site_code='CRJ01' AND location_code in('0201','0202','0203','0204','0205','0206','0207','0208','0209','0210') AND (data_validation_qualifiers IS NULL OR data_validation_qualifiers NOT LIKE '%N%' AND data_validation_qualifiers NOT LIKE '%R%' AND data_validation_qualifiers NOT LIKE '%X%') AND DATE_SAMPLED between #1/1/2005# and #1/1/2008#

SAMPLE ID CODES: 000X = Filtered sample (0.45 µm). N00X = Unfiltered sample. X = replicate number.

LAB QUALIFIERS:

*	Replicate analysis not within control limits.
+	Correlation coefficient for MSA < 0.995.
>	Result above upper detection limit.
A	TIC is a suspected aldol-condensation product.
B	Inorganic: Result is between the IDL and CRDL. Organic & Radiochemistry: Analyte also found in method blank.
C	Pesticide result confirmed by GC-MS.
D	Analyte determined in diluted sample.
E	Inorganic: Estimate value because of interference, see case narrative. Organic: Analyte exceeded calibration range of the GC-MS.
H	Holding time expired, value suspect.
I	Increased detection limit due to required dilution.
J	Estimated
M	GFAA duplicate injection precision not met.
N	Inorganic or radiochemical: Spike sample recovery not within control limits. Organic: Tentatively identified compund (TIC).
P	> 25% difference in detected pesticide or Arochlor concentrations between 2 columns.
S	Result determined by method of standard addition (MSA).
U	Analytical result below detection limit.
W	Post-digestion spike outside control limits while sample absorbance < 50% of analytical spike absorbance.
X	Laboratory defined (USEPA CLP organic) qualifier, see case narrative.
Y	Laboratory defined (USEPA CLP organic) qualifier, see case narrative.
Z	Laboratory defined (USEPA CLP organic) qualifier, see case narrative.

DATA QUALIFIERS:

F	Low flow sampling method used.	G	Possible grout contamination, pH > 9.	J	Estimated value.
L	Less than 3 bore volumes purged prior to sampling.	N	Presumptive evidence that analyte is present. The analyte is "tentatively identified".	Q	Qualitative result due to sampling technique
R	Unusable result.	U	Parameter analyzed for but was not detected.	X	Location is undefined.

QA QUALIFIER: # = validated according to Quality Assurance guidelines.

GROUND WATER QUALITY DATA BY LOCATION (USEE100) FOR SITE CRJ01, Crescent Junction Site
LOCATION: 0210 <borehole>
REPORT DATE: 2/15/2007 7:56 pm

		SAMPLE:		DEPTH RANGE		QUALIFIERS:			DETECTION	UN-
PARAMETER	UNITS	DATE	ID	(FT BLS)	RESULT	LAB	DATA	QA		CERTAINTY
Alkalinity, Bicarbonate (As	mg/L	04/18/2006	0001	0.00 - 0.00	640			#	50	-
	mg/L	09/11/2006	0001	0.00 - 0.00	1700			#	20	-
Alkalinity, Carbonate (As	mg/L	04/18/2006	0001	0.00 - 0.00	50	U		#	50	-
	mg/L	09/11/2006	0001	0.00 - 0.00	20	U		#	20	-
Alkalinity, Total (As CaCO3)	mg/L	11/07/2005	0001	0.00 - 0.00	634		LQ	#	-	-
	mg/L	04/18/2006	0001	0.00 - 0.00	640			#	50	-
	mg/L	04/18/2006	0001	0.00 - 0.00	649			#	-	-
	mg/L	09/11/2006	0001	0.00 - 0.00	1700			#	20	-
	mg/L	09/11/2006	0001	0.00 - 0.00	534			#	-	-
Ammonia Total as N	mg/L	04/18/2006	0001	0.00 - 0.00	17			#	1	-
	mg/L	09/11/2006	0001	0.00 - 0.00	6 .7			#	0.2	-
Arsenic	mg/L	04/18/2006	0001	0.00 - 0.00	0 .0029	E		#	0.000038	-
	mg/L	09/11/2006	0001	0.00 - 0.00	0 .00086		U	#	0.000036	-
Barium	mg/L	04/18/2006	0001	0.00 - 0.00	0 .270	B		#	0.0017	-
	mg/L	09/11/2006	0001	0.00 - 0.00	0 .027	B	U	#	0.001	-
Boron	mg/L	04/18/2006	0001	0.00 - 0.00	1 .400			#	0.012	-
	mg/L	09/11/2006	0001	0.00 - 0.00	1 .500			#	0.0098	-
Bromide	mg/L	11/07/2005	0001	0.00 - 0.00	60		LQ	#	10	-
	mg/L	04/18/2006	0001	0.00 - 0.00	88			#	10	-
	mg/L	09/11/2006	0001	0.00 - 0.00	19			#	10	-
Cadmium	mg/L	04/18/2006	0001	0.00 - 0.00	0 .0021			#	0.0001	-
	mg/L	09/11/2006	0001	0.00 - 0.00	0 .0003	B	U	#	0.000032	-
Calcium	mg/L	11/07/2005	0001	0.00 - 0.00	180 .000		LQ	#	0.035	-
	mg/L	04/18/2006	0001	0.00 - 0.00	230 .000			#	0.056	-

GROUND WATER QUALITY DATA BY LOCATION (USEE100) FOR SITE CRJ01, Crescent Junction Site
LOCATION: 0210 <borehole>
REPORT DATE: 2/15/2007 7:56 pm

PARAMETER	UNITS	SAMPLE: DATE	ID	DEPTH RANGE (FT BLS)	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION	UN-CERTAINTY
Calcium	mg/L	09/11/2006	0001	0.00 - 0.00	70 .000			#	0.073	-
Chloride	mg/L	11/07/2005	0001	0.00 - 0.00	23000		LQ	#	400	-
	mg/L	04/18/2006	0001	0.00 - 0.00	27000			#	400	-
	mg/L	09/11/2006	0001	0.00 - 0.00	5300			#	400	-
Chromium	mg/L	04/18/2006	0001	0.00 - 0.00	0 .018	U		#	0.018	-
	mg/L	09/11/2006	0001	0.00 - 0.00	0 .007	U		#	0.007	-
Copper	mg/L	04/18/2006	0001	0.00 - 0.00	0 .0067	U		#	0.0067	-
	mg/L	09/11/2006	0001	0.00 - 0.00	0 .0076	U		#	0.0076	-
Dissolved Oxygen	mg/L	11/07/2005	N001	0.00 - 0.00	2 .80		LQ	#	-	-
Fluoride	mg/L	11/07/2005	0001	0.00 - 0.00	5	U	LQ	#	5	-
	mg/L	04/18/2006	0001	0.00 - 0.00	5	U		#	5	-
	mg/L	09/11/2006	0001	0.00 - 0.00	5	U		#	5	-
Gross Alpha	pCi/L	04/18/2006	0001	0.00 - 0.00	65 .7	U		#	65.7	± 38.00
	pCi/L	09/11/2006	0001	0.00 - 0.00	45 .3		J	#	38.5	± 26.40
	pCi/L	09/11/2006	0002	0.00 - 0.00	15 .2			#	2.45	± 3.47
Gross Beta	pCi/L	04/18/2006	0001	0.00 - 0.00	109	U		#	109	± 66.40
	pCi/L	09/11/2006	0001	0.00 - 0.00	55 .1	U		#	55.1	± 33.30
Iron	mg/L	04/18/2006	0001	0.00 - 0.00	0 .240	B	U	#	0.14	-
	mg/L	09/11/2006	0001	0.00 - 0.00	0 .470	B		#	0.14	-
Lead	mg/L	04/18/2006	0001	0.00 - 0.00	0 .00087	B	U	#	0.00011	-
	mg/L	09/11/2006	0001	0.00 - 0.00	0 .00047	B	U	#	0.000063	-
Magnesium	mg/L	11/07/2005	0001	0.00 - 0.00	140 .000		LQ	#	0.072	-
	mg/L	04/18/2006	0001	0.00 - 0.00	130 .000			#	0.068	-
	mg/L	09/11/2006	0001	0.00 - 0.00	56 .000			#	0.055	-

GROUND WATER QUALITY DATA BY LOCATION (USEE100) FOR SITE CRJ01, Crescent Junction Site
LOCATION: 0210 <borehole>
REPORT DATE: 2/15/2007 7:56 pm

PARAMETER	UNITS	SAMPLE: DATE	ID	DEPTH RANGE (FT BLS)	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION	UN-CERTAINTY
Manganese	mg/L	04/18/2006	0001	0.00 - 0.00	0 .200			#	0.0023	-
	mg/L	09/11/2006	0001	0.00 - 0.00	0 .028	B		#	0.00095	-
Molybdenum	mg/L	04/18/2006	0001	0.00 - 0.00	0 .018			#	0.001	-
	mg/L	09/11/2006	0001	0.00 - 0.00	0 .0036		U	#	0.00052	-
Nitrate + Nitrite as Nitrogen	mg/L	04/18/2006	0001	0.00 - 0.00	0 .048			#	0.01	-
	mg/L	09/11/2006	0001	0.00 - 0.00	0 .01	U		#	0.01	-
Oxidation Reduction	mV	11/07/2005	N001	0.00 - 0.00	15		LQ	#	-	-
	mV	04/18/2006	N001	0.00 - 0.00	-5			#	-	-
	mV	09/11/2006	N001	0.00 - 0.00	117			#	-	-
pH	s.u.	11/07/2005	N001	0.00 - 0.00	7 .23		LQ	#	-	-
	s.u.	04/18/2006	N001	0.00 - 0.00	7 .16			#	-	-
	s.u.	09/11/2006	N001	0.00 - 0.00	7 .08			#	-	-
Potassium	mg/L	11/07/2005	0001	0.00 - 0.00	58 .000		JLQ	#	0.68	-
	mg/L	04/18/2006	0001	0.00 - 0.00	67 .000			#	0.74	-
	mg/L	09/11/2006	0001	0.00 - 0.00	27 .000			#	0.57	-
Radium-226	pCi/L	04/18/2006	0001	0.00 - 0.00	0 .706	U		#	0.706	± 0.36
	pCi/L	09/11/2006	0001	0.00 - 0.00	0 .291	U		#	0.291	± 0.16
Radium-228	pCi/L	04/18/2006	0001	0.00 - 0.00	0 .75	U		#	0.75	± 0.40
	pCi/L	09/11/2006	0001	0.00 - 0.00	0 .723	U		#	0.723	± 0.39
Selenium	mg/L	04/18/2006	0001	0.00 - 0.00	0 .003	N	J	#	0.0001	-
	mg/L	09/11/2006	0001	0.00 - 0.00	0 .00067		U	#	0.000078	-
Sodium	mg/L	11/07/2005	0001	0.00 - 0.00	12000 .000		LQ	#	2.9	-
	mg/L	04/18/2006	0001	0.00 - 0.00	13000 .000			#	1.8	-
	mg/L	09/11/2006	0001	0.00 - 0.00	5700 .000			#	1	-

GROUND WATER QUALITY DATA BY LOCATION (USEE100) FOR SITE CRJ01, Crescent Junction Site
LOCATION: 0210 <borehole>
REPORT DATE: 2/15/2007 7:56 pm

		SAMPLE:		DEPTH RANGE		QUALIFIERS:			DETECTION	UN-
PARAMETER	UNITS	DATE	ID	(FT BLS)	RESULT	LAB	DATA	QA		CERTAINTY
Specific Conductance	umhos/cm	11/07/2005	N001	0.00 - 0.00	56190		LQ	#	-	-
	umhos/cm	04/18/2006	N001	0.00 - 0.00	60860			#	-	-
	umhos/cm	09/11/2006	N001	0.00 - 0.00	62430			#	-	-
Sulfate	mg/L	11/07/2005	0001	0.00 - 0.00	1700		LQ	#	25	-
	mg/L	04/18/2006	0001	0.00 - 0.00	1100			#	25	-
	mg/L	09/11/2006	0001	0.00 - 0.00	6100			#	1000	-
Sulfide	mg/L	04/18/2006	0001	0.00 - 0.00	2	U		#	2	-
	mg/L	09/11/2006	0001	0.00 - 0.00	2	U		#	2	-
Temperature	C	11/07/2005	N001	0.00 - 0.00	15 .5		LQ	#	-	-
	C	04/18/2006	N001	0.00 - 0.00	15 .6			#	-	-
	C	09/11/2006	N001	0.00 - 0.00	17 .11			#	-	-
Total Dissolved Solids	mg/L	11/07/2005	0001	0.00 - 0.00	37000		LQ	#	1000	-
	mg/L	04/18/2006	0001	0.00 - 0.00	41000			#	2000	-
	mg/L	09/11/2006	0001	0.00 - 0.00	20000			#	1000	-
Turbidity	NTU	04/18/2006	N001	0.00 - 0.00	26 .3			#	-	-
Uranium	mg/L	04/18/2006	0001	0.00 - 0.00	0 .0023			#	0.000017	-
	mg/L	09/11/2006	0001	0.00 - 0.00	0 .020			#	0.0000063	-

GROUND WATER QUALITY DATA BY LOCATION (USEE100) FOR SITE CRJ01, Crescent Junction Site
LOCATION: 0210 <borehole>
REPORT DATE: 2/15/2007 7:56 pm

PARAMETER	UNITS	SAMPLE: DATE	SAMPLE: ID	DEPTH RANGE (FT BLS)	RESULT	QUALIFIERS: LAB	QUALIFIERS: DATA	QUALIFIERS: QA	DETECTION	UN- CERTAINTY

RECORDS: SELECTED FROM USEE100 WHERE site_code='CRJ01' AND location_code in('0201','0202','0203','0204','0205','0206','0207','0208','0209','0210') AND (data_validation_qualifiers IS NULL OR data_validation_qualifiers NOT LIKE '%N%' AND data_validation_qualifiers NOT LIKE '%R%' AND data_validation_qualifiers NOT LIKE '%X%') AND DATE_SAMPLED between #1/1/2005#
and
#1/1/2008#

SAMPLE ID CODES: 000X = Filtered sample (0.45 µm). N00X = Unfiltered sample. X = replicate number.

LAB QUALIFIERS:

*	Replicate analysis not within control limits.
+	Correlation coefficient for MSA < 0.995.
>	Result above upper detection limit.
A	TIC is a suspected aldol-condensation product.
B	Inorganic: Result is between the IDL and CRDL. Organic & Radiochemistry: Analyte also found in method blank.
C	Pesticide result confirmed by GC-MS.
D	Analyte determined in diluted sample.
E	Inorganic: Estimate value because of interference, see case narrative. Organic: Analyte exceeded calibration range of the GC-MS.
H	Holding time expired, value suspect.
I	Increased detection limit due to required dilution.
J	Estimated
M	GFAA duplicate injection precision not met.
N	Inorganic or radiochemical: Spike sample recovery not within control limits. Organic: Tentatively identified compund (TIC).
P	> 25% difference in detected pesticide or Arochlor concentrations between 2 columns.
S	Result determined by method of standard addition (MSA).
U	Analytical result below detection limit.
W	Post-digestion spike outside control limits while sample absorbance < 50% of analytical spike absorbance.
X	Laboratory defined (USEPA CLP organic) qualifier, see case narrative.
Y	Laboratory defined (USEPA CLP organic) qualifier, see case narrative.
Z	Laboratory defined (USEPA CLP organic) qualifier, see case narrative.

DATA QUALIFIERS:

F	Low flow sampling method used.	G	Possible grout contamination, pH > 9.	J	Estimated value.
L	Less than 3 bore volumes purged prior to sampling.	N	Presumptive evidence that analyte is present. The analyte is "tentatively identified".	Q	Qualitative result due to sampling technique
R	Unusable result.	U	Parameter analyzed for but was not detected.	X	Location is undefined.

QA QUALIFIER: # = validated according to Quality Assurance guidelines.

Appendix C

Laboratory Performance Assessment Reports for November 2005, December 2005, April 2006, and September 2006
Crescent Junction Site

U.S. Department of Energy at Grand Junction

2597 B 3/4 Road, Grand Junction, CO 81503 (970) 248-6000

Laboratory Performance Assessment

General Information

Requisition No.:	05110259
Sample Event:	November 7, 2005
Site(s):	Crescent Junction, Utah
Laboratory:	Paragon Analytics
Work Order No.:	0511094
Analysis:	Metals and Inorganics
Validator:	Steve Donivan
Review Date:	December 29, 2005

This validation was performed according to the *Environmental Procedures Catalog* (STO 6), "Standard Practice for Validation of Laboratory Data", GT-9(P). All analyses were successfully completed. The samples were prepared and analyzed using accepted procedures based on methods specified by line item code, which are listed in Table 1.

Table 1. Analytes and Methods

Analyte	*Line Item Code*	*Prep Method*	*Analytical Method*
Bromide, Br	MIS-A-038	SW-846 9056	SW-846 9056
Calcium, Ca	MET-A-020	SW-846 3005A	SW-846 6010B
Chloride, Cl	MIS-A-039	SW-846 9056	SW-846 9056
Magnesium, Mg	MET-A-020	SW-846 3005A	SW-846 6010B
Potassium, K	MET-A-020	SW-846 3005A	SW-846 6010B
Sodium, Na	MET-A-020	SW-846 3005A	SW-846 6010B
Sulfate, SO4	MIS-A-044	SW-846 9056	SW-846 9056
Total Dissolved Solids, TDS	WCH-A-033	MCAWW 160.1	MCAWW 160.1

Data Qualifier Summary

Analytical results were qualified as listed in Table 2. Refer to the attached validation worksheets and the sections below for an explanation of the data qualifiers applied.

Table 2. Data Qualifiers

Sample Number	**Location**	**Analyte**	*Flag*	*Reason*
0511094-1	0208	K	J	Matrix spike failure
0511094-2	0210	K	J	Matrix spike failure

Sample Shipping/Receiving

Paragon Analytics in Fort Collins, Colorado, received 2 samples on November 10, 2005, accompanied by a Chain of Custody (COC) form. The COC form was checked to confirm that all of the samples were listed on the form with sample collection dates and times, and that signatures and dates were present indicating sample relinquishment and receipt. The COC form had no errors or omissions.

Preservation and Holding Times

The sample shipment was received cool and intact with the temperature within the cooler 3.8 °C, which complies with requirements. All samples were received in the correct container types and had been preserved correctly for the requested analyses and all samples were analyzed within the applicable holding times.

Laboratory Instrument Calibration

Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for all analytes. Initial calibration demonstrates that the instrument is capable of acceptable performance in the beginning of the analytical run and of producing a linear curve. Compliance requirements for continuing calibration checks are established to ensure that the instrument continues to be capable of producing acceptable qualitative and quantitative data. All laboratory instrument calibrations were performed correctly in accordance with the cited methods.

Method SW-846 6010B

Calibrations for calcium, magnesium, potassium, and sodium were performed on December 5, 2005. The initial calibrations were performed using four calibration standards resulting in a calibration curve with a correlation coefficient (r^2) value greater than 0.995. The absolute value of the curve intercept was less than 3 times the MDL. Calibration and laboratory spike standards were prepared from independent sources. Initial and continuing calibration verification (CCV) checks were made at the required frequency resulting in eight CCVs. All calibration check results met the acceptance criteria. A reporting limit verification check was made at the required frequency to verify the linearity of the calibration curve near the practical quantitation limit. The check was within the acceptance criteria range.

Method SW-846 9056

The initial calibrations for bromide, chloride, fluoride, and sulfate were performed using five calibration standards each on November 11, 2005. The calibration curve r^2 values were greater than 0.995 and intercepts were less than 3 times the MDL. Initial calibration and calibration check standards were prepared from independent sources. Initial and continuing calibration checks were made at the required frequency resulting in seven CCVs. The calibration checks met the acceptance criteria.

Method MCAWW 160.1

There is no initial or continuing calibration requirement associated with the determination of TDS.

Method and Calibration Blanks

The calcium, magnesium, potassium, and sodium initial and continuing calibration blanks were below the practical quantitation limits but greater than the MDL. The bromide, chloride, fluoride, sulfate, and TDS method blanks, and initial and continuing calibration blanks were below the MDLs.

Inductively Coupled Plasma Interference Check Sample Analysis

Inductively coupled plasma interference check samples were analyzed at the required frequency to verify the instrumental interelement and background correction factors. All check sample results met the acceptance criteria.

Matrix Spike Analysis

Matrix spike and matrix spike duplicate pairs were analyzed for calcium, magnesium, potassium, sodium, bromide, chloride, fluoride, and sulfate as a measure of method performance in the sample matrix. The spike recoveries met the recovery and precision criteria for all analytes with the following exceptions. The chloride, sodium, and sulfate matrix spike data were not evaluated because the concentration of the unspiked sample was greater than four times the spike amount. The potassium matrix spike and matrix spike duplicate results were outside of the acceptance range. The potassium results are qualified with a "J" flag as estimated values.

Laboratory Replicate Analysis

The relative percent difference (RPD) values for the laboratory replicate sample and matrix spike duplicate sample results for all analytes were less than 20 percent, indicating acceptable laboratory precision.

Laboratory Control Sample

Laboratory control samples were analyzed at the correct frequency to provide information on the accuracy of the analytical method and the overall laboratory performance, including sample preparation. The results were acceptable for all analytes.

Metals Serial Dilution

Serial dilutions were performed during the calcium, magnesium, potassium, and sodium analysis to monitor physical or chemical interferences that may exist in the sample matrix. The results met the acceptance criteria with the exception of potassium indicating a matrix interference. The potassium results are qualified with a "J" flag as estimated values.

Detection Limits/Dilutions

Samples were diluted in a consistent and acceptable manner when required. The samples were diluted prior to analysis of uranium to reduce interferences. The required detection limits were achieved for all analytes.

Completeness

Results were reported in the correct units for all analytes requested using contract-required laboratory qualifiers.

Chromatography Peak Integration

The integration of analyte peaks was reviewed for all ion chromatography data. There were no manual integrations performed and all peak integrations were satisfactory.

Electronic Data Deliverable File

The electronic data deliverable file (EDD) file arrived on December 22, 2005. The Sample Management System EDD validation module was used to verify that the EDD file was complete and in compliance with requirements. The module compares the contents of the file to the requested analyses to ensure all and only the requested data are delivered. The contents of the EDD were manually examined to verify that the sample results accurately reflect the data contained in the sample data package.

Report Prepared By: ______________________________

Laboratory Coordinator

Page 1 of 1

General Data Validation Worksheet

RIN: 05110259 **Lab Code:** PAR **Validator:** Steve Donivan **Validation Date:** 12/29/2005

Site: MOAB MONITORING **Analysis Type:** ☑ Metals ☑ General Chem ☐ Rad ☐ Oraganics

# of Samples: 2 **Matrix:** WATER **Requested Analysis Completed:** Yes

Chain of Custody
Present: OK **Signed:** OK **Dated:** OK

Sample
Integrity: OK **Preservation:** OK **Temperature:** OK

Exceptions

Method	Analyte	Location	Ticket	Collection Date	Preparation Date	Analysis Date	Dilution Factor	Holding Time Met	Detection Limit Met

Comments: The reported detection limits are equal to or below contract requirements.
All samples were analyzed within the applicable holding times.

GRAND JUNCTION SITE

Metals Data Validation Worksheet

RIN: 05110259 **Lab Code:** PAR **Date Due:** 12/8/2005

Matrix: Water **Site Code:** MOA **Date Completed:** 12/23/2005

Analyte	Date Analyzed	CALIBRATION						Method	LCS %R	MS %R	MSD %R	MS/MSD	ICSAB %R	Serial Dil. %R	CRI %R
		Int.	R^2	ICV	CCV	ICB	CCB	Blank				RPD			
Calcium	12/05/2005	0.0000	1.0000	OK	OK	OK	OK	OK	102.0	109.0	114.0	2.0	103.0	6.0	95.3
Calcium	12/05/2005												108.0		99.9
Magnesium	12/05/2005	0.0000	1.0000	OK	OK	OK	OK	OK	100.0	108.0	114.0	2.0	106.0	10.0	98.3
Magnesium	12/05/2005												106.0		99.8
Potassium	12/05/2005	0.0000	1.0000	OK	OK	OK	OK	OK	88.0	172.0	173.0	1.0		73.0	87.6
Potassium	12/05/2005														87.4
Sodium	12/05/2005	0.0000	1.0000	OK	OK	OK	OK	OK	90.0	339.0	241.0	1.0		1.0	87.2
Sodium	12/05/2005														87.6

Comments: ______________________________

Page 1 of 1

GRAND JUNCTION SITE

Inorganics Data Validation Worksheet

RIN: 05110259
Lab Code: PAR
Date Due: 12/8/2005
Matrix: Water
Site Code: MOA
Date Completed: 12/23/2005

Analyte	Date Analyzed	CALIBRATION						Method	LCS %R	MS %R	MSD %R	DUP RPD	Serial Dil. %R
		Int.	R^2	ICV	CCV	ICB	CCB	Blank					
Bromide	11/14/2005	0.001	0.9999	OK	OK	OK	OK	OK	104.0	101.0	99.0	2.00	
Chloride	11/14/2005	0.053	0.9999	OK	OK	OK	OK	OK	102.0				
Fluoride	11/14/2005	0.006	1.0000	OK	OK	OK	OK	OK	104.0	99.0	97.0	2.00	
Sulfate	11/14/2005	0.100	1.0000	OK	OK	OK	OK	OK	107.0				
Total Dissolved Solids	11/15/2005							OK	97.0			3.00	

Comments: ____________________

U.S. Department of Energy at Grand Junction
2597 B 3/4 Road, Grand Junction, CO 81503 (970) 248-6000

Laboratory Performance Assessment

General Information

Requisition No.:	05120284
Sample Event:	December 27, 2005
Site(s):	Crescent Junction, Utah
Laboratory:	Paragon Analytics
Work Order No.:	0512193, 0601166
Analysis:	Metals and Inorganics
Validator:	Steve Donivan
Review Date:	February 16, 2006

This validation was performed according to the *Environmental Procedures Catalog* (STO 6), "Standard Practice for Validation of Laboratory Data," GT-9(P) (2004). See attached Data Validation Worksheets for supporting documentation on the data review and validation. All analyses were successfully completed. The samples were prepared and analyzed using accepted procedures based on methods specified by line item code, which are listed in Table 1.

Table 1. Analytes and Methods

Analyte	Line Item Code	Prep Method	Analytical Method
Alkalinity, Total as $CaCO_3$	WCH-A-002	MCAWW 310.1	MCAWW 310.1
Ammonia as N, NH_3-N	WCH-A-005	MCAWW 350.1	MCAWW 350.1
Boron, B	MET-A-020	SW-846 3005A	SW-846 6010B
Bromide, Br	MIS-A-038	SW-846 9056	SW-846 9056
Calcium, Ca	MET-A-020	SW-846 3005A	SW-846 6010B
Copper, Cu	MET-A-020	SW-846 3005A	SW-846 6010B
Chloride, Cl	MIS-A-039	SW-846 9056	SW-846 9056
Fluoride, F	MIS-A-040	SW-846 9056	SW-846 9056
Iron, Fe	GJO-016	SW-846 3005A	SW-846 6010B
Manganese, Mn	GJO-017	SW-846 3005A	SW-846 6010B
Magnesium, Mg	MET-A-020	SW-846 3005A	SW-846 6010B
Molybdenum, Mo	GJO-015	SW-846 3005A	SW-846 6020A
Nitrate as N, NO_3-N	WCH-A-022	MCAWW 353.2	MCAWW 353.2
Potassium, K	MET-A-020	SW-846 3005A	SW-846 6010B
Selenium, Se	GJO-014	SW-846 3005A	SW-846 6020A
Sodium, Na	MET-A-020	SW-846 3005A	SW-846 6010B
Sulfate, SO4	MIS-A-044	SW-846 9056	SW-846 9056
Sulfide, S	WCH-A-038	MCAWW 376.1	MCAWW 376.1
Total Dissolved Solids, TDS	WCH-A-033	MCAWW 160.1	MCAWW 160.1
Uranium, U	GJO-01	SW-846 3005A	SW-846 6020A

Data Qualifier Summary

Analytical results were qualified as listed in Table 2. Refer to the attached validation worksheets and the sections below for an explanation of the data qualifiers applied.

Table 2. Data Qualifiers

Sample Number	**Location**	**Analyte**	*Flag*	*Reason*
0512193-1	0201	Cu	U	Less than 5 times the calibration blank
0512193-1	0201	Fe	U	Less than 5 times the calibration blank
0512193-1	0201	Mo	U	Less than 5 times the calibration blank
0512193-1	0201	Se	U	Less than 5 times the calibration blank
0512193-2	0202	Cu	U	Less than 5 times the calibration blank
0512193-2	0202	Se	J	No matrix spike data
0512193-3	0203	Cu	U	Less than 5 times the calibration blank
0512193-3	0203	Se	U	Less than 5 times the calibration blank
0512193-3	0203	Fe	U	Less than 5 times the calibration blank
0512193-4	0204	Se	J	No matrix spike data
0512193-5	0208	Cu	U	Less than 5 times the calibration blank
0512193-5	0208	Se	J	No matrix spike data

Sample Shipping/Receiving

Paragon Analytics in Fort Collins, Colorado, received five samples on December 29, 2005, accompanied by Chain of Custody (COC) forms. The COC forms were checked to confirm that all of the samples were listed on the form with sample collection dates and times, and that signatures and dates were present indicating sample relinquishment and receipt. The sample submittal documents including the COC forms, the Sample Submittal Forms, and the sample tickets had no errors or omissions.

Preservation and Holding Times

The sample shipment was received cool and intact with the temperature within the cooler of 3.2 °C, which complies with requirements. All samples were received in the correct container types and had been preserved correctly for the requested analyses and all samples were analyzed within the applicable holding times.

Laboratory Instrument Calibration

Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for all analytes. Initial calibration demonstrates that the instrument is capable of acceptable performance in the beginning of the analytical run and of producing a linear curve. Compliance requirements for continuing calibration checks are established to ensure that the instrument continues to be capable of producing acceptable qualitative and quantitative data. All laboratory instrument calibrations were performed correctly in accordance with the cited methods.

Method SW-846 6010B

Calibrations for boron, calcium, copper, iron, magnesium, manganese, potassium, and sodium were performed on January 4, 2006. The initial calibrations were performed using four calibration standards resulting in calibration curves with a correlation coefficient (r^2) value greater than 0.995. The absolute values of the curves intercept were less than 3 times the MDL. Calibration and laboratory spike standards were prepared from independent sources. Initial and continuing calibration verification (CCV) checks were made at the required frequency resulting in 13 CCVs. All calibration check results met the acceptance criteria. A reporting limit verification check was made at the beginning and end of the analytical sequence to verify the linearity of the calibration curve near the practical quantitation limit. The checks were within the acceptance criteria range.

Method SW-846 6020A

Calibrations for molybdenum and uranium were performed on January 4, 2006 and for selenium on January 11, 2006. The initial calibrations were performed using six calibration standards resulting in calibration curves with a correlation coefficient (r^2) value greater than 0.995. The absolute values of the curve intercepts were less than 3 times the MDL. Calibration and laboratory spike standards were prepared from independent sources. Initial and continuing calibration verification (CCV) checks were made at the required frequency resulting in seven CCVs for molybdenum and uranium; and three CCVs for selenium. All calibration check results met the acceptance criteria. A reporting limit verification check was made at the required frequency to verify the linearity of the calibration curve near the practical quantitation limit. The check was within the acceptance criteria range. Mass calibration and resolution verifications were performed at the beginning of each analytical run in accordance with the analytical procedure. Internal standard recoveries were stable and within acceptable ranges.

Method SW-846 9056

The initial calibrations for bromide, chloride, fluoride, and sulfate were performed using five calibration standards each on January 10, 2006. The calibration curve r^2 values were greater than 0.995 and intercepts were less than 3 times the MDL. Initial calibration and calibration check standards were prepared from independent sources. Initial and continuing calibration checks were made at the required frequency resulting in three CCVs. The calibration checks met the acceptance criteria.

Method MCAWW 350.1

The initial calibrations for ammonia as N were performed using six calibration standards on January 9, 2005 resulting in calibration curves with r^2 values greater than 0.995 and intercepts less than 3 times the MDL. Initial and continuing calibration checks were made at the required frequency resulting in 11 CCVs. All calibration check results were within the acceptance criteria.

Method MCAWW 353.2

The initial calibrations for nitrate as N were performed using six calibration standards on January 10, 2005, resulting in a calibration curve with a r^2 value greater than 0.995 and an intercept less than 3 times the MDL. Initial and continuing calibration checks were made at the required frequency resulting in six CCVs. All calibration check results were within the acceptance criteria.

Methods MCAWW 160.1, 310.1, 376.1

There is no initial or continuing calibration requirement associated with the determination of TDS, alkalinity, or sulfide.

Method and Calibration Blanks

All initial and continuing calibration blank results were below the practical quantitation limits for method 6010B and 6020A analytes. In cases where blank concentration exceeded the instrument detection limit, the associated sample results are qualified with a "U" flag (not detected) when the sample result is greater than the MDL but less than five times the blank concentration.

The alkalinity, ammonia-N, bromide, chloride, fluoride, Nitrate-N, sulfate, and TDS method blanks and initial and continuing calibration blank results were below the method detection limits

Inductively Coupled Plasma Interference Check Sample Analysis

Inductively coupled plasma interference check samples were analyzed at the required frequency to verify the instrumental interelement and background correction factors. All check sample results met the acceptance criteria.

Matrix Spike Analysis

Matrix spike and matrix spike duplicate (MS/MSD) pairs were analyzed for all analytes as required as a measure of method performance in the sample matrix with the exception of selenium. The selenium results that are greater than the MDL are qualified with a "J" flag as estimated values. The chloride matrix spike data were not evaluated because the concentration of the unspiked sample was greater than four times the spike concentration. The spike recoveries met the recovery and precision criteria for all analytes.

Laboratory Replicate Analysis

The relative percent difference (RPD) values for the laboratory replicate sample and matrix spike duplicate sample results for all analytes were less than 20 percent, indicating acceptable laboratory precision.

Laboratory Control Sample

Laboratory control samples were analyzed at the correct frequency to provide information on the accuracy of the analytical method and the overall laboratory performance, including sample preparation. The results were acceptable for all analytes.

Metals Serial Dilution

Serial dilutions were performed during the uranium analysis to monitor physical or chemical interferences that may exist in the sample matrix. The results met the acceptance criteria.

U.S. Department of Energy at Grand Junction

2597 B 3/4 Road, Grand Junction, CO 81503 (970) 248-6000

Laboratory Performance Assessment

General Information

Requisition No.:	06040351
Sample Event:	April 18, 2006
Site(s):	Crescent Junction, Utah
Laboratory:	Paragon Analytics
Work Order No.:	0604159
Analysis:	Metals and Inorganics
Validator:	Steve Donivan
Review Date:	June 2, 2006

This validation was performed according to the *Environmental Procedures Catalog* (STO 6), "Standard Practice for Validation of Laboratory Data," GT-9(P) (2004). See attached Data Validation Worksheets for supporting documentation on the data review and validation. All analyses were successfully completed. The samples were prepared and analyzed using accepted procedures based on methods specified by line item code, which are listed in Table 1.

Table 1. Analytes and Methods

Analyte	Line Item Code	Prep Method	Analytical Method
Alkalinity, Total as $CaCO_3$	WCH-A-002	MCAWW 310.1	MCAWW 310.1
Alkalinity, Bicarbonate	WCH-A-003	MCAWW 310.1	MCAWW 310.1
Alkalinity, Carbonate	WCH-A-004	MCAWW 310.1	MCAWW 310.1
Ammonia as N, NH_3-N	WCH-A-005	MCAWW 350.1	MCAWW 350.1
Arsenic, As	GJO-13	SW-846 3005A	SW-846 6020A
Barium, Ba	MET-A-020	SW-846 3005A	SW-846 6010B
Boron, B	MET-A-020	SW-846 3005A	SW-846 6010B
Bromide, Br	MIS-A-038	SW-846 9056	SW-846 9056
Cadmium, Cd	MET-A-026	SW-846 3005A	SW-846 6020A
Calcium, Ca	MET-A-020	SW-846 3005A	SW-846 6010B
Chromium, Cr	MET-A-020	SW-846 3005A	SW-846 6010B
Copper, Cu	MET-A-020	SW-846 3005A	SW-846 6010B
Chloride, Cl	MIS-A-039	SW-846 9056	SW-846 9056
Fluoride, F	MIS-A-040	SW-846 9056	SW-846 9056
Gross Alpha/Beta	GPC-A-001	SOP702R17	SOP724R9
Iron, Fe	GJO-016	SW-846 3005A	SW-846 6010B
Lead, Pb	MET-A-026	SW-846 3005A	SW-846 6020A
Manganese, Mn	GJO-017	SW-846 3005A	SW-846 6010B
Magnesium, Mg	MET-A-020	SW-846 3005A	SW-846 6010B
Molybdenum, Mo	GJO-015	SW-846 3005A	SW-846 6020A
Nitrate as N, NO_3-N	WCH-A-022	MCAWW 353.2	MCAWW 353.2

Potassium, K	MET-A-020	SW-846 3005A	SW-846 6010B
Radium-226	ASP-A-016	SOP783R7	SOP783R7
Radium-228	GPC-A-020	SOP746R8	SOP746R8
Selenium, Se	GJO-014	SW-846 3005A	SW-846 6020A
Sodium, Na	MET-A-020	SW-846 3005A	SW-846 6010B
Sulfate, SO4	MIS-A-044	SW-846 9056	SW-846 9056
Sulfide, S	WCH-A-038	MCAWW 376.1	MCAWW 376.1
Total Dissolved Solids, TDS	WCH-A-033	MCAWW 160.1	MCAWW 160.1
Uranium, U	GJO-01	SW-846 3005A	SW-846 6020A

Data Qualifier Summary

Analytical results were qualified as listed in Table 2. Refer to the attached validation worksheets and the sections below for an explanation of the data qualifiers applied.

Table 2. Data Qualifiers

Sample Number	Location	Analyte	Flag	Reason
0604159-1	0201	Cd	U	Less than 5 times the calibration blank
0604159-1	0201	Cu	U	Less than 5 times the calibration blank
0604159-1	0201	Fe	U	Less than 5 times the calibration blank
0604159-1	0201	Pb	U	Less than 5 times the calibration blank
0604159-1	0201	Mo	U	Less than 5 times the calibration blank
0604159-1	0201	Se	J	Matrix spike failure
0604159-2	0202	Cd	U	Less than 5 times the calibration blank
0604159-2	0202	Cu	U	Less than 5 times the calibration blank
0604159-2	0202	Fe	U	Less than 5 times the calibration blank
0604159-2	0202	Pb	U	Less than 5 times the calibration blank
0604159-2	0202	Mo	U	Less than 5 times the calibration blank
0604159-2	0202	Se	J	Matrix spike failure
0604159-2	0202	U	U	Less than 5 times the calibration blank
0604159-3	0203	Cd	U	Less than 5 times the calibration blank
0604159-3	0203	Fe	U	Less than 5 times the calibration blank
0604159-3	0203	Pb	U	Less than 5 times the calibration blank
0604159-3	0203	Mo	U	Less than 5 times the calibration blank
0604159-3	0203	Ra-228	J	Less than 3 times the MDC
0604159-3	0203	Se	J	Matrix spike failure
0604159-3	0203	U	U	Less than 5 times the calibration blank
0604159-4	0204	Cd	U	Less than 5 times the calibration blank
0604159-4	0204	Cu	U	Less than 5 times the calibration blank
0604159-4	0204	Pb	U	Less than 5 times the calibration blank
0604159-4	0204	Mo	U	Less than 5 times the calibration blank
0604159-4	0204	Se	J	Matrix spike failure
0604159-4	0204	U	U	Less than 5 times the calibration blank
0604159-5	0205	Cd	U	Less than 5 times the calibration blank
0604159-5	0205	Pb	U	Less than 5 times the calibration blank
0604159-5	0205	Se	J	Matrix spike failure
0604159-5	0205	Ra-228	J	Less than 3 times the MDC
0604159-5	0205	U	U	Less than 5 times the calibration blank
0604159-6	0208	Cd	U	Less than 5 times the calibration blank

0604159-6	0208	Fe	U	Less than 5 times the calibration blank
0604159-6	0208	Mo	U	Less than 5 times the calibration blank
0604159-6	0208	Se	J	Matrix spike failure
0604159-7	0210	Fe	U	Less than 5 times the calibration blank
0604159-7	0210	Pb	U	Less than 5 times the calibration blank
0604159-7	0210	Se	J	Matrix spike failure
0604159-8	2318 (0208 Dup)	Cd	U	Less than 5 times the calibration blank
0604159-8	2318 (0208 Dup)	Fe	U	Less than 5 times the calibration blank
0604159-8	2318 (0208 Dup)	Mo	U	Less than 5 times the calibration blank
0604159-8	2318 (0208 Dup)	Se	J	Matrix spike failure

Sample Shipping/Receiving

Paragon Analytics in Fort Collins, Colorado, received eight samples on April 20, 2006, accompanied by Chain of Custody (COC) forms. The COC forms were checked to confirm that all of the samples were listed on the form with sample collection dates and times, and that signatures and dates were present indicating sample relinquishment and receipt. The sample submittal documents including the COC forms, the Sample Submittal Forms, and the sample tickets had no errors or omissions.

Preservation and Holding Times

The sample shipment was received cool and intact with the temperature within the chilled cooler of 0.2 °C, which complies with requirements. All samples were received in the correct container types and had been preserved correctly for the requested analyses and all samples were analyzed within the applicable holding times.

Laboratory Instrument Calibration

Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for all analytes. Initial calibration demonstrates that the instrument is capable of acceptable performance in the beginning of the analytical run and of producing a linear curve. Compliance requirements for continuing calibration checks are established to ensure that the instrument continues to be capable of producing acceptable qualitative and quantitative data. All laboratory instrument calibrations were performed correctly in accordance with the cited methods.

Method SW-846 6010B

Calibrations for barium, boron, calcium, chromium, copper, iron, magnesium, manganese, potassium, and sodium were performed on April 24, 2006. The initial calibrations were performed using four calibration standards resulting in calibration curves with a correlation coefficient (r^2) value greater than 0.995. The absolute values of the curves intercept were less than 3 times the MDL. Calibration and laboratory spike standards were prepared from independent sources. Initial and continuing calibration verification (CCV) checks were made at the required frequency resulting in 15 CCVs. All calibration check results met the acceptance criteria. A reporting limit verification check was made at the beginning and end of the analytical sequence to verify the linearity of the calibration curve near the practical quantitation limit. The checks were within the acceptance criteria range.

Method SW-846 6020A
Calibrations for cadmium, lead, molybdenum and uranium were performed on May 4, 2006 and for arsenic and selenium on May 5, 2006. The initial calibrations were performed using six calibration standards resulting in calibration curves with a correlation coefficient (r^2) value greater than 0.995. The absolute values of the curve intercepts were less than 3 times the MDL. Calibration and laboratory spike standards were prepared from independent sources. Initial and continuing calibration verification (CCV) checks were made at the required frequency resulting in six CCVs on May 4, 2006; and three CCVs on May 5, 2006. All calibration check results met the acceptance criteria with the exception of CCV1 for molybdenum. There were no sample results associated with this CCV. A reporting limit verification check was made at the required frequency to verify the linearity of the calibration curve near the practical quantitation limit. The check was within the acceptance criteria range. Mass calibration and resolution verifications were performed at the beginning of each analytical run in accordance with the analytical procedure. Internal standard recoveries were stable and within acceptable ranges.

Method SW-846 9056
The initial calibrations for bromide, chloride, fluoride, and sulfate were performed using five calibration standards each on April 18, 2006. The calibration curve r^2 values were greater than 0.995 and intercepts were less than 3 times the MDL. Initial calibration and calibration check standards were prepared from independent sources. Initial and continuing calibration checks were made at the required frequency resulting in seven CCVs. The calibration checks met the acceptance criteria.

Method MCAWW 350.1
The initial calibrations for ammonia as N were performed using six calibration standards on April 26, 2006 resulting in calibration curves with r^2 values greater than 0.995 and intercepts less than 3 times the MDL. Initial and continuing calibration checks were made at the required frequency resulting in three CCVs. All calibration check results were within the acceptance criteria.

Method MCAWW 353.2
The initial calibrations for nitrate as N were performed using six calibration standards on April 26, 2006, resulting in a calibration curve with a r^2 value greater than 0.995 and an intercept less than 3 times the MDL. Initial and continuing calibration checks were made at the required frequency resulting in four CCVs. All calibration check results were within the acceptance criteria.

Methods MCAWW 160.1, 310.1, 376.1
There is no initial or continuing calibration requirement associated with the determination of TDS, alkalinity, or sulfide.

Radiochemical Analysis

Radiochemical results are qualified with a “J” flag (estimated) when the result is greater than the minimum detectable concentration (MDC), but less than three times the MDC. Radiochemical results are qualified with a “U” flag (not detected) when the result is greater than the MDC, but less than the two sigma total propagated uncertainty (TPU).

Gross Alpha/Beta
Plateau calibrations were performed on January 23, 2006. Alpha and beta attenuation calibrations were performed on February 21, 2006, covering a range of 0 to 204 milligrams (mg). All standards were counted to a minimum of 10,000 counts. All calibration and background checks met acceptance criteria. The residual mass was between 30 mg and 100 mg for all samples.

Radium-226
Emanation cell plateau voltage determinations were performed on August 20, 2005, and cell efficiency calibrations were performed on August 26, 2005. Daily efficiency calibration and background checks were performed on May 9, 2006. All calibration data met the acceptance criteria. The chemical recoveries met the acceptance criteria of 40 to 110% for all samples

Radium-228
Plateau voltage determinations were performed on October 31, 2005, and detector efficiency calibrations were performed on November 4, 2005. Daily efficiency calibration and background checks were performed on May 5, 2006. All calibration data met the acceptance criteria. The chemical recoveries met the acceptance criteria of 40 to 110% for all samples.

Method and Calibration Blanks

All initial and continuing calibration blank results were below the practical quantitation limits for method 6010B and 6020A analytes with the exception of CCB1 and CCB2 for molybdenum. There were no sample results associated with these CCBs. In cases where blank concentration exceeded the instrument detection limit, the associated sample results are qualified with a "U" flag (not detected) when the sample result is greater than the MDL but less than five times the blank concentration.

The alkalinity, ammonia-N, bromide, chloride, fluoride, Nitrate-N, sulfate, sulfide, and TDS method blanks and initial and continuing calibration blank results were below the method detection limits

Inductively Coupled Plasma Interference Check Sample Analysis

Inductively coupled plasma interference check samples were analyzed at the required frequency to verify the instrumental interelement and background correction factors. All check sample results met the acceptance criteria.

Matrix Spike Analysis

Matrix spike and matrix spike duplicate (MS/MSD) pairs were analyzed for all analytes as required as a measure of method performance in the sample matrix. The sodium matrix spike data were not evaluated because the concentration of the unspiked sample was greater than four times the spike concentration. The spike recoveries met the recovery and precision criteria for all analytes with the exception of selenium. The selenium results that are greater than the MDL are qualified with a "J" flag as estimated values. .

Laboratory Replicate Analysis

The relative percent difference (RPD) values for the laboratory replicate sample and matrix spike duplicate sample results for all analytes were less than 20 percent, indicating acceptable laboratory precision. The radiochemical relative error ratio for all laboratory replicate samples was less than three.

Laboratory Control Sample

Laboratory control samples were analyzed at the correct frequency to provide information on the accuracy of the analytical method and the overall laboratory performance, including sample preparation. The results were acceptable for all analytes.

Metals Serial Dilution

Serial dilutions were performed during the metals analysis to monitor physical or chemical interferences that may exist in the sample matrix. The arsenic serial dilution data were not evaluated because the concentration of the undiluted sample was less than 100 times the method detection limit. The results for the analytes evaluated met the acceptance criteria.

Detection Limits/Dilutions

Samples were diluted in a consistent and acceptable manner when required. The samples were diluted prior to analysis of method 6020A analytes to reduce interferences. The required detection limits were met for all analytes with the following exceptions: the required detection limits were not met for gross alpha, gross beta, and alkalinity because of the elevated levels of dissolved solids in the samples.

Completeness

Results were reported in the correct units for all analytes requested using contract-required laboratory qualifiers.

Chromatography Peak Integration

The integration of analyte peaks was reviewed for all ion chromatography data. There were no manual integrations performed and all peak integrations were satisfactory.

Electronic Data Deliverable File

The electronic data deliverable file (EDD) file arrived on May 18, 2006. The Sample Management System EDD validation module was used to verify that the EDD files were complete and in compliance with requirements. The module compares the contents of the file to the requested analyses to ensure all and only the requested data are delivered. The contents of the EDD file was manually examined to verify that the sample results accurately reflect the data contained in the sample data package.

Report Prepared By: ______________________________

Laboratory Coordinator

SAMPLE MANAGEMENT SYSTEM

General Data Validation Worksheet

RIN: 06040351 **Lab Code:** PAR **Validator:** Steve Donivan **Validation Date:** 6/2/2006

Site: MOAB CRESCENT JUNCTION **Analysis Type:** ☑ Metals ☑ General Chem ☑ Rad ☐ Oraganics

# of Samples: 8 **Matrix:** WATER **Requested Analysis Completed:** Yes

Chain of Custody

Present: OK **Signed:** OK **Dated:** OK

Sample

Integrity: OK **Preservation:** OK **Temperature:** OK

Exceptions

Method	Analyte	Location	Ticket	Collection Date	Preparation Date	Analysis Date	Dilution Factor	Holding Time Met	Detection Limit Met
EPA 310.1	ARBONATE AS CaC	0201	NFA 326	04/18/2006	04/26/2006	04/26/2006	1	No	NA
EPA 310.1	ARBONATE AS CaC	0202	NFA 327	04/18/2006	04/26/2006	04/26/2006	1	No	NA
EPA 310.1	ARBONATE AS CaC	0203	NFA 328	04/18/2006	04/26/2006	04/26/2006	1	No	NA
EPA 310.1	ARBONATE AS CaC	0204	NFA 329	04/18/2006	04/26/2006	04/26/2006	1	No	NA
EPA 310.1	ARBONATE AS CaC	0205	NFA 330	04/18/2006	04/26/2006	04/26/2006	1	No	NA
EPA 310.1	ARBONATE AS CaC	0208	NFA 332	04/18/2006	04/26/2006	04/26/2006	1	No	NA
EPA 310.1	ARBONATE AS CaC	0210	NFA 331	04/18/2006	04/26/2006	04/26/2006	1	No	NA
EPA 310.1	ARBONATE AS CaC	2318	NFA 333	04/18/2006	04/26/2006	04/26/2006	1	No	NA
EPA 310.1	RBONATE AS CaC	0201	NFA 326	04/18/2006	04/26/2006	04/26/2006	1	Yes	No
EPA 310.1	RBONATE AS CaC	0202	NFA 327	04/18/2006	04/26/2006	04/26/2006	1	Yes	No
EPA 310.1	RBONATE AS CaC	0203	NFA 328	04/18/2006	04/26/2006	04/26/2006	1	Yes	No
EPA 310.1	RBONATE AS CaC	0204	NFA 329	04/18/2006	04/26/2006	04/26/2006	1	Yes	No
EPA 310.1	RBONATE AS CaC	0205	NFA 330	04/18/2006	04/26/2006	04/26/2006	1	Yes	No
EPA 310.1	RBONATE AS CaC	0208	NFA 332	04/18/2006	04/26/2006	04/26/2006	1	Yes	No
EPA 310.1	RBONATE AS CaC	0210	NFA 331	04/18/2006	04/26/2006	04/26/2006	1	Yes	No
EPA 310.1	RBONATE AS CaC	2318	NFA 333	04/18/2006	04/26/2006	04/26/2006	1	Yes	No
SOP724R8	GROSS ALPHA	0201	NFA 326	04/18/2006	04/28/2006	05/03/2006	1	Yes	No
SOP724R8	GROSS ALPHA	0202	NFA 327	04/18/2006	04/28/2006	05/03/2006	1	Yes	No
SOP724R8	GROSS ALPHA	0203	NFA 328	04/18/2006	04/28/2006	05/03/2006	1	Yes	No
SOP724R8	GROSS ALPHA	0204	NFA 329	04/18/2006	04/28/2006	05/04/2006	1	Yes	No
SOP724R8	GROSS ALPHA	0205	NFA 330	04/18/2006	04/28/2006	05/04/2006	1	Yes	No
SOP724R8	GROSS ALPHA	0208	NFA 332	04/18/2006	04/28/2006	05/04/2006	1	Yes	No
SOP724R8	GROSS ALPHA	0210	NFA 331	04/18/2006	04/28/2006	05/04/2006	1	Yes	No
SOP724R8	GROSS ALPHA	2318	NFA 333	04/18/2006	04/28/2006	05/04/2006	1	Yes	No
SOP724R8	GROSS BETA	0201	NFA 326	04/18/2006	04/28/2006	05/03/2006	1	Yes	No
SOP724R8	GROSS BETA	0202	NFA 327	04/18/2006	04/28/2006	05/03/2006	1	Yes	No
SOP724R8	GROSS BETA	0203	NFA 328	04/18/2006	04/28/2006	05/03/2006	1	Yes	No
SOP724R8	GROSS BETA	0204	NFA 329	04/18/2006	04/28/2006	05/04/2006	1	Yes	No
SOP724R8	GROSS BETA	0205	NFA 330	04/18/2006	04/28/2006	05/04/2006	1	Yes	No
SOP724R8	GROSS BETA	0208	NFA 332	04/18/2006	04/28/2006	05/04/2006	1	Yes	No
SOP724R8	GROSS BETA	0210	NFA 331	04/18/2006	04/28/2006	05/04/2006	1	Yes	No
SOP724R8	GROSS BETA	2318	NFA 333	04/18/2006	04/28/2006	05/04/2006	1	Yes	No

Comments:

SAMPLE MANAGEMENT SYSTEM

Metals Data Validation Worksheet

RIN: 06040351 **Lab Code:** PAR **Date Due:** 5/18/2006

Matrix: Water **Site Code:** MOA16 **Date Completed:** 5/19/2006

Analyte	Date Analyzed	CALIBRATION						Method	LCS %R	MS %R	MSD %R	Dup. RPD	ICSAB %R	Serial Dil. %R	CRI %R
		Int.	R^2	ICV	CCV	ICB	CCB	Blank							
Arsenic	05/05/2006	0.0000	1.0000	OK	OK	OK	OK	OK	100.0	92.0	95.0	2.0	120.0	19.0	87.8
Barium	04/24/2006	0.0000	1.0000	OK	OK	OK	OK			104.0	104.0	0.0	91.0		102.0
Boron	04/24/2006	0.0000	1.0000	OK	OK	OK	OK			103.0	104.0	0.0	102.0	1.0	103.0
Cadmium	05/05/2006	0.0000	1.0000	OK	OK	OK	OK						102.0		93.0
Calcium	04/24/2006	0.0000	1.0000	OK	OK	OK	OK			93.0	90.0	1.0	103.0	0.0	96.0
Chromium	04/24/2006	0.0000	1.0000	OK	OK	OK	OK			100.0	95.0	5.0	88.0		95.0
Copper	04/24/2006	0.0000	1.0000	OK	OK	OK	OK			103.0	102.0	1.0	109.0		105.0
Iron	04/24/2006	0.0000	1.0000	OK	OK	OK	OK			118.0	97.0	15.0	103.0		92.0
Lead	05/05/2006	0.0030	1.0000	OK	OK	OK	OK						102.0		95.0
Magnesium	04/24/2006	0.0000	1.0000	OK	OK	OK	OK			85.0	84.0	1.0	105.0	7.0	102.0
Manganese	04/24/2006	0.0000	1.0000	OK	OK	OK	OK			98.0	97.0	1.0	91.0		98.8
Molybdenum	05/05/2006	0.0000	1.0000	OK	OK	OK	OK						118.0		124.0
Potassium	04/24/2006	0.0000	1.0000	OK	OK	OK	OK			97.0	97.0	0.0			89.0
Selenium	05/05/2006	0.0000	1.0000	OK	OK	OK	OK	OK	102.0	60.0	63.0	4.0	123.0		107.0
Sodium	04/24/2006	0.0000	1.0000	OK	OK	OK	OK			-417.0	-156.0	2.0		7.0	90.1
Uranium	05/05/2006	0.0000	1.0000	OK	OK	OK	OK						108.0		97.9

Comments: ____________________

SAMPLE MANAGEMENT SYSTEM

Inorganics Data Validation Worksheet

RIN: 06040351 **Lab Code:** PAR **Date Due:** 5/18/2006

Matrix: Water **Site Code:** MOA16 **Date Completed:** 5/19/2006

Analyte	Date Analyzed	CALIBRATION						Method	LCS %R	MS %R	MSD %R	DUP RPD	Serial Dil. %R
		Int.	R^2	ICV	CCV	ICB	CCB	Blank					
ALKALINITY, Bicarbonate	04/26/2006							OK				1.00	
ALKALINITY, Carbonate	04/26/2006							OK					
ALKALINITY, Total as CaCO3	04/26/2006							OK	100.0			1.00	
Ammonia as N	04/26/2006	0	0.9997	OK	OK	OK	OK	OK	92.0				
Bromide	04/24/2006	0	1.0000	OK	OK	OK	OK	OK	96.0				
Chloride	04/24/2006	0	1.0000	OK	OK	OK	OK	OK	97.0				
Fluoride	04/24/2006	0.240	1.0000	OK	OK	OK	OK	OK	91.0				
Nitrate+Nitrite as N	04/26/2006	0	0.9999	OK	OK	OK	OK	OK	97.0				
Sulfate	04/24/2006	0.179	1.0000	OK	OK	OK	OK	OK	99.0				
Sulfide	04/25/2006							OK	102.0				
Total Dissolved Solids	04/25/2006							OK	97.0				

Comments: ______________________________

SAMPLE MANAGEMENT SYSTEM
Radiochemistry Data Validation Worksheet

RIN: 06040351 **Lab Code:** PAR **Date Due:** 5/18/2006

Matrix: Water **Site Code:** MOA16 **Date Completed:** 5/19/2006

Sample	Analyte	Date Analyzed	Result	Flag	Tracer %R	LCS %R	MS %R	Duplicate
0201	Radium-228	05/03/2006			65.9			
0201	Radium-226	05/09/2006			84.9			
0202	Radium-228	05/03/2006			67.3			
0202	Radium-226	05/09/2006			88.4			
0203	Radium-228	05/03/2006			62.8			
0203	Radium-226	05/09/2006			59.3			
0204	Radium-226	05/09/2006			80.9			
0204	Radium-228	05/09/2006			67.1			
0205	Radium-228	05/03/2006			67.7			
0205	Radium-226	05/09/2006			73.4			
0208	Radium-228	05/03/2006			61.9			
0208	Radium-226	05/09/2006			62.2			
0210	Radium-228	05/03/2006			62.7			
0210	Radium-226	05/09/2006			65.8			
2318	Radium-228	05/03/2006			61.3			
2318	Radium-226	05/09/2006			55.1			
LCS	Radium-228	05/03/2006			65.5	95.5		
LCS	Radium-226	05/09/2006			97.9	91.2		
LCS	Radium-228	05/09/2006			59.9	90.8		
LCSD	Radium-228	05/03/2006			63.2	96.9		0.07
LCSD	Radium-226	05/09/2006			94.8	104.0		0.76
LCSD	Radium-228	05/09/2006			60.0	95.7		0.25
Method Blank	Radium-228	05/03/2006	0.1140	U	60.7			
Method Blank	Radium-226	05/09/2006	0.2710	U	99.8			
Method Blank	Radium-228	05/09/2006	0.6730	U	64.2			
QC	Gross Alpha	04/28/2006	0.8330			95.2	106.0	0.94
QC	Gross Beta	04/28/2006	0.2030	U		99.7	93.8	0.42

Comments:

Stoller
Legacy Management Team

Stoller • Battelle • Source One

Data Review and Validation Report

General Information

Requisition No.:	06080471
Sample Event:	September 8-12, 2006
Site(s):	Crescent Junction, Utah
Laboratory:	Paragon Analytics
Work Order No.:	0609064
Analysis:	Metals and Inorganics
Validator:	Steve Donivan
Review Date:	November 16, 2006

This validation was performed according to the *Environmental Procedures Catalog* (STO 6), "Standard Practice for Validation of Laboratory Data," GT-9(P) rev1 (2006). The procedure was applied at Level 2, Data Deliverables Verification. See attached Data Validation Worksheets for supporting documentation on the data review and validation. All analyses were successfully completed. The samples were prepared and analyzed using accepted procedures based on methods specified by line item code, which are listed in Table 1. These samples were analyzed concurrently with samples from RIN 06080453 and are evaluated using common quality control samples.

Table 1. Analytes and Methods

Analyte	Line Item Code	Prep Method	Analytical Method
Alkalinity, Total as $CaCO_3$	WCH-A-002	MCAWW 310.1	MCAWW 310.1
Alkalinity, Bicarbonate	WCH-A-003	MCAWW 310.1	MCAWW 310.1
Alkalinity, Carbonate	WCH-A-004	MCAWW 310.1	MCAWW 310.1
Ammonia as N, NH_3-N	WCH-A-005	MCAWW 350.1	MCAWW 350.1
Arsenic, As	GJO-13	SW-846 3005A	SW-846 6020A
Barium, Ba	MET-A-020	SW-846 3005A	SW-846 6010B
Boron, B	MET-A-020	SW-846 3005A	SW-846 6010B
Bromide, Br	MIS-A-038	SW-846 9056	SW-846 9056
Cadmium, Cd	MET-A-026	SW-846 3005A	SW-846 6020A
Calcium, Ca	MET-A-020	SW-846 3005A	SW-846 6010B
Chromium, Cr	MET-A-020	SW-846 3005A	SW-846 6010B
Copper, Cu	MET-A-020	SW-846 3005A	SW-846 6010B
Chloride, Cl	MIS-A-039	SW-846 9056	SW-846 9056
Fluoride, F	MIS-A-040	SW-846 9056	SW-846 9056
Gross Alpha/Beta	GPC-A-001	SOP702R17	SOP724R9
Gross Alpha	LMR-01	EPA 900.1	EPA 900.1
Iron, Fe	GJO-016	SW-846 3005A	SW-846 6010B

Lead, Pb	MET-A-026	SW-846 3005A	SW-846 6020A
Manganese, Mn	GJO-017	SW-846 3005A	SW-846 6010B
Magnesium, Mg	MET-A-020	SW-846 3005A	SW-846 6010B
Molybdenum, Mo	GJO-015	SW-846 3005A	SW-846 6020A
Nitrate as N, NO_3-N	WCH-A-022	MCAWW 353.2	MCAWW 353.2
Potassium, K	MET-A-020	SW-846 3005A	SW-846 6010B
Radium-226	ASP-A-016	SOP783R7	SOP783R7
Radium-228	GPC-A-020	SOP746R8	SOP746R8
Selenium, Se	GJO-014	SW-846 3005A	SW-846 6020A
Sodium, Na	MET-A-020	SW-846 3005A	SW-846 6010B
Sulfate, SO4	MIS-A-044	SW-846 9056	SW-846 9056
Sulfide, S	WCH-A-038	MCAWW 376.1	MCAWW 376.1
Total Dissolved Solids, TDS	WCH-A-033	MCAWW 160.1	MCAWW 160.1
Uranium, U	GJO-01	SW-846 3005A	SW-846 6020A

Data Qualifier Summary

Analytical results were qualified as listed in Table 2. Refer to the attached validation worksheets and the sections below for an explanation of the data qualifiers applied.

Table 2. Data Qualifiers

Sample Number	**Location**	**Analyte**	*Flag*	*Reason*
All	All	Cd	U	Less than 5 times the calibration blank
All	All	Pb	U	Less than 5 times the calibration blank
All	All	Mo	U	Less than 5 times the calibration blank
0609064-1	0201	As	U	Less than 5 times the method blank
0609064-1	0201	Fe	U	Less than 5 times the calibration blank
0609064-1	0201	Ra-228	J	Less than 3 times the MDC
0609064-2	0202	As	U	Less than 5 times the method blank
0609064-2	0202	Fe	U	Less than 5 times the calibration blank
0609064-3	0203	As	U	Less than 5 times the method blank
0609064-3	0203	Fe	U	Less than 5 times the calibration blank
0609064-3	0203	Mn	U	Less than 5 times the calibration blank
0609064-3	0203	Ra-226	J	Less than 3 times the MDC
0609064-3	0203	Ra-228	J	Less than 3 times the MDC
0609064-3	0203	Se	U	Less than 5 times the method blank
0609064-3	0203	U	U	Less than 5 times the method blank
0609064-4	0204	As	U	Less than 5 times the method blank
0609064-4	0204	Fe	U	Less than 5 times the calibration blank
0609064-4	0204	Se	U	Less than 5 times the method blank
0609064-4	0204	U	U	Less than 5 times the method blank
0609064-5	0205	As	U	Less than 5 times the method blank
0609064-5	0205	Fe	U	Less than 5 times the calibration blank
0609064-5	0205	Se	U	Less than 5 times the method blank
0609064-5	0205	U	U	Less than 5 times the method blank
0609064-6	2318 (0203 Dup)	As	U	Less than 5 times the method blank
0609064-6	2318 (0203 Dup)	Fe	U	Less than 5 times the calibration blank
0609064-6	2318 (0203 Dup)	Mn	U	Less than 5 times the calibration blank
0609064-6	2318 (0203 Dup)	Ra-228	J	Less than 3 times the MDC

0609064-6	2318 (0203 Dup)	Se	U	Less than 5 times the method blank
0609064-6	2318 (0203 Dup)	U	U	Less than 5 times the method blank
0609064-7	0208	Fe	U	Less than 5 times the calibration blank
0609064-7	0208	Ra-226	J	Less than 3 times the MDC
0609064-7	0208	Ra-228	J	Less than 3 times the MDC
0609064-8	0210	As	U	Less than 5 times the method blank
0609064-8	0210	Ba	U	Less than 5 times the calibration blank
0609064-8	0210	Gross Alpha	J	Less than 3 times the MDC
0609064-8	0210	Se	U	Less than 5 times the method blank
06110707-1	0201	Gross Alpha	J	Less than 3 times the MDC
06110707-7	0208	Gross Alpha	J	Less than 3 times the MDC

Sample Shipping/Receiving

Paragon Analytics in Fort Collins, Colorado, received eight samples on between September 9, 2006 and September 13, 2006, accompanied by Chain of Custody (COC) forms. The COC forms were checked to confirm that all of the samples were listed on the form with sample collection dates and times, and that signatures and dates were present indicating sample relinquishment and receipt. The sample submittal documents including the COC forms, the Sample Submittal Forms, and the sample tickets had no errors or omissions.

Preservation and Holding Times

The sample shipment was received cool and intact with the temperature within the chilled coolers of 0.8 and 0.2 °C, which complies with requirements. All samples were received in the correct container types and had been preserved correctly for the requested analyses with the following exceptions. Twelve sample bottles received with incorrect pH values. These sample bottles were acidified upon receipt and allowed to equilibrate prior to analysis. The alkalinity results for sample 0208 indicated that the sample bottle had been incorrectly acidified. The analysis was repeated using a non-acidified sample aliquot. All samples were analyzed within the applicable holding times.

Laboratory Instrument Calibration

Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for all analytes. Initial calibration demonstrates that the instrument is capable of acceptable performance in the beginning of the analytical run and of producing a linear curve. Compliance requirements for continuing calibration checks are established to ensure that the instrument continues to be capable of producing acceptable qualitative and quantitative data. All laboratory instrument calibrations were performed correctly in accordance with the cited methods.

Method SW-846 6010B

Calibrations for barium, boron, calcium, chromium, copper, iron, magnesium, manganese, potassium, and sodium were performed on September 14, 2006 and September 19, 2006. The initial calibrations were performed using four calibration standards resulting in calibration curves with a correlation coefficient (r^2) value greater than 0.995. The absolute values of the curves intercept were less than 3 times the MDL. Calibration and laboratory spike standards were prepared from independent sources. Initial and continuing calibration verification (CCV) checks were made at the required frequency resulting in 26 CCVs. All calibration check results met the acceptance criteria with the exception of CCV13 for calcium. There were no reported sample results associated with this CCV. A reporting limit verification check was made at the beginning and end of the analytical sequence to verify the linearity of the calibration curve near the practical quantitation limit. The checks were within the acceptance criteria range.

Method SW-846 6020A
Calibrations for cadmium, lead, molybdenum and uranium were performed on September 25, 2006 and for arsenic and selenium on September 18, 2006. The initial calibrations were performed using six calibration standards resulting in calibration curves with a correlation coefficient (r^2) value greater than 0.995. The absolute values of the curve intercepts were less than 3 times the MDL. Calibration and laboratory spike standards were prepared from independent sources. Initial and continuing calibration verification (CCV) checks were made at the required frequency resulting in six CCVs on September 18, 2006; and five CCVs on September 25, 2006. All calibration check results met the acceptance criteria with the exception of CCV1 for molybdenum. There were no sample results associated with this CCV. A reporting limit verification check was made at the required frequency to verify the linearity of the calibration curve near the practical quantitation limit. The check was within the acceptance criteria range with the exception of molybdenum. All molybdenum results are qualified with a "U" flag as not detected. Mass calibration and resolution verifications were performed at the beginning of each analytical run in accordance with the analytical procedure. Internal standard recoveries were stable and within acceptable ranges.

Method SW-846 9056
The initial calibrations for bromide, chloride, fluoride, and sulfate were performed using five calibration standards each on August 21, 2006. The calibration curve r^2 values were greater than 0.995 and intercepts were less than 3 times the MDL. Initial calibration and calibration check standards were prepared from independent sources. Initial and continuing calibration checks were made at the required frequency resulting in 11 CCVs. The calibration checks met the acceptance criteria.

Method MCAWW 350.1
The initial calibrations for ammonia as N were performed using six calibration standards on September 14, 2006 and September 26, 2006 resulting in calibration curves with r^2 values greater than 0.995 and intercepts less than 3 times the MDL. Initial and continuing calibration checks were made at the required frequency resulting in 13 CCVs. All calibration check results were within the acceptance criteria.

Method MCAWW 353.2
The initial calibrations for nitrate as N were performed using six calibration standards on September 18, 2006, resulting in a calibration curve with a r^2 value greater than 0.995 and an intercept less than 3 times the MDL. Initial and continuing calibration checks were made at the required frequency resulting in seven CCVs. All calibration check results were within the acceptance criteria.

Methods MCAWW 160.1, 310.1, 376.1
There is no initial or continuing calibration requirement associated with the determination of TDS, alkalinity, or sulfide.

Radiochemical Analysis

Radiochemical results are qualified with a "J" flag (estimated) when the result is greater than the minimum detectable concentration (MDC), but less than three times the MDC. Radiochemical results are qualified with a "U" flag (not detected) when the result is greater than the MDC, but less than the two sigma total propagated uncertainty (TPU).

Gross Alpha/Beta
Plateau calibrations were performed on January 23, 2006. Alpha and beta attenuation calibrations were performed on February 21, 2006, covering a range of 0 to 204 milligrams (mg). All standards were counted to a minimum of 10,000 counts. All calibration and background checks met acceptance criteria. The residual mass was between 30 mg and 100 mg for all samples.

Gross Alpha, Method 900.1
Plateau calibrations were performed on November 6, 2006. Alpha attenuation calibrations were performed on November 28, 2006, covering a range of 0 to 102 milligrams (mg). All standards were counted to a minimum of 10,000 counts. All calibration and background checks met acceptance criteria. The residual mass was between 30 mg and 100 mg for all samples.

Radium-226
Emanation cell plateau voltage determinations were performed on August 20, 2005, and cell efficiency calibrations were performed on August 26, 2005. Daily efficiency calibration and background checks were performed on May 9, 2006. All calibration data met the acceptance criteria. The chemical recoveries met the acceptance criteria of 40 to 110% for all samples

Radium-228
Plateau voltage determinations were performed on September 19, 2006, and detector efficiency calibrations were performed on September 20, 2006. Daily efficiency calibration and background checks were performed on October 17, 2006. All calibration data met the acceptance criteria. The chemical recoveries met the acceptance criteria of 40 to 110% for all samples with the exception of samples 0202, 0204, and 0205. The results for these samples were adjusted to a recovery of 100%.

Method and Calibration Blanks

All initial and continuing calibration blank results were below the practical quantitation limits for method 6010B and 6020A analytes with the exception of CCB1 for molybdenum and CCB6 and CCB14 for iron. There were no sample results associated with these CCBs. In cases where blank concentration exceeded the instrument detection limit, the associated sample results are qualified with a "U" flag (not detected) when the sample result is greater than the MDL but less than five times the blank concentration.

The alkalinity, ammonia-N, bromide, chloride, fluoride, Nitrate-N, sulfate, sulfide, and TDS method blanks and initial and continuing calibration blank results were below the method detection limits

Inductively Coupled Plasma Interference Check Sample Analysis

Inductively coupled plasma interference check samples were analyzed at the required frequency to verify the instrumental interelement and background correction factors. All check sample results met the acceptance criteria.

Matrix Spike Analysis

Matrix spike and matrix spike duplicate (MS/MSD) pairs were analyzed for all analytes as required as a measure of method performance in the sample matrix. The sodium matrix spike data were not evaluated because the concentration of the unspiked sample was greater than four times the spike concentration. The spike recoveries met the recovery and precision criteria for all analytes.

Laboratory Replicate Analysis

The relative percent difference (RPD) values for the laboratory replicate sample and matrix spike duplicate sample results for all analytes were less than 20 percent, indicating acceptable laboratory precision. The radiochemical relative error ratio for all laboratory replicate samples was less than three.

Laboratory Control Sample

Laboratory control samples were analyzed at the correct frequency to provide information on the accuracy of the analytical method and the overall laboratory performance, including sample preparation. The results were acceptable for all analytes.

Metals Serial Dilution

Serial dilutions were performed during the metals analysis to monitor physical or chemical interferences that may exist in the sample matrix. The arsenic serial dilution data were not evaluated because the concentration of the undiluted sample was less than 100 times the method detection limit. The results for the analytes evaluated met the acceptance criteria.

Detection Limits/Dilutions

Samples were diluted in a consistent and acceptable manner when required. The samples were diluted prior to analysis of method 6020A analytes to reduce interferences. The required detection limits were met for all analytes with the following exceptions: the required detection limits were not met for gross alpha and gross beta because of the elevated levels of dissolved solids in the samples. Re-analysis for the samples for gross alpha using EPA method 900.1 to achieve lower detection limits was requested on November 9, 2006 with the results arriving on January 8, 2007.

Completeness

Results were reported in the correct units for all analytes requested using contract-required laboratory qualifiers.

Chromatography Peak Integration

The integration of analyte peaks was reviewed for all ion chromatography data. There were no manual integrations performed and all peak integrations were satisfactory.

Electronic Data Deliverable File

The electronic data deliverable file (EDD) file arrived on October 25, 2006. The Sample Management System EDD validation module was used to verify that the EDD files were complete and in compliance with requirements. The module compares the contents of the file to the requested analyses to ensure all and only the requested data are delivered. The contents of the EDD file was manually examined to verify that the sample results accurately reflect the data contained in the sample data package.

Report Prepared By: ____

Laboratory Coordinator

SAMPLE MANAGEMENT SYSTEM

Page 1 of 1

General Data Validation Worksheet

RIN: 6080471 **Lab Code:** PAR **Validator:** Steve Donivan **Validation Date:** 11/16/2006

Site: MOAB CRESCENT JUNCTION **Analysis Type:** ☑ Metals ☑ General Chem ☑ Rad ☐ Oraganics

# of Samples: 8 **Matrix:** WATER **Requested Analysis Completed:** Yes

Chain of Custody

Present: OK **Signed:** OK **Dated:** OK

Sample

Integrity: OK **Preservation:** OK **Temperature:** OK

Exceptions

Method	Analyte	Location	Ticket	Collection Date	Preparation Date	Analysis Date	Dilution Factor	Holding Time Met	Detection Limit Met
SOP724R9	GROSS BETA	201	NFA 262	9/6/2006	10/2/2006	10/10/2006	1	Yes	No
SOP724R9	GROSS ALPHA	201	NFA 262	9/6/2006	10/2/2006	10/10/2006	1	Yes	No
SOP724R9	GROSS BETA	202	NFA 263	9/7/2006	10/2/2006	10/10/2006	1	Yes	No
SOP724R9	GROSS ALPHA	202	NFA 263	9/7/2006	10/2/2006	10/10/2006	1	Yes	No
SOP724R9	GROSS BETA	203	NFA 264	9/7/2006	10/2/2006	10/10/2006	1	Yes	No
SOP724R9	GROSS ALPHA	203	NFA 264	9/7/2006	10/2/2006	10/10/2006	1	Yes	No
SOP724R9	GROSS BETA	204	NFA 266	9/7/2006	10/2/2006	10/10/2006	1	Yes	No
SOP724R9	GROSS ALPHA	204	NFA 266	9/7/2006	10/2/2006	10/10/2006	1	Yes	No
SOP724R9	GROSS BETA	205	NFA 267	9/7/2006	10/2/2006	10/10/2006	1	Yes	No
SOP724R9	GROSS ALPHA	205	NFA 267	9/7/2006	10/2/2006	10/10/2006	1	Yes	No
SOP724R9	GROSS BETA	2318	NFA 265	9/7/2006	10/2/2006	10/10/2006	1	Yes	No
SOP724R9	GROSS ALPHA	2318	NFA 265	9/7/2006	10/2/2006	10/10/2006	1	Yes	No
SOP724R9	GROSS BETA	208	NFA 268	9/11/2006	10/2/2006	10/12/2006	1	Yes	No
SOP724R9	GROSS ALPHA	208	NFA 268	9/11/2006	10/2/2006	10/12/2006	1	Yes	No
SOP724R9	GROSS BETA	210	NFA 269	9/11/2006	10/2/2006	10/12/2006	1	Yes	No
SOP724R9	GROSS ALPHA	210	NFA 269	9/11/2006	10/2/2006	10/12/2006	1	Yes	No

Comments:

All samples were analyzed within the applicable holding times.

SAMPLE MANAGEMENT SYSTEM

Metals Data Validation Worksheet

RIN: 06080471 **Lab Code:** PAR **Date Due:** 10/11/2006

Matrix: Water **Site Code:** MOA16 **Date Completed:** 10/26/2006

Analyte	Date Analyzed	CALIBRATION						Method Blank	LCS %R	MS %R	MSD %R	Dup. RPD	ICSAB %R	Serial Dil. %R	CRI %R
		Int.	R^2	ICV	CCV	ICB	CCB								
Arsenic	09/18/2006	0.0000	1.0000	OK	OK	OK	OK	OK	103.0				94.0		86.8
Barium	09/14/2006	0.0000	1.0000	OK	OK	OK	OK						92.0		105.0
Barium	09/14/2006												92.0		103.0
Barium	09/19/2006	0.0000	1.0000	OK	OK	OK	OK						93.0		104.0
Barium	09/19/2006												89.0		
Boron	09/14/2006	0.0000	1.0000	OK	OK	OK	OK						96.0		102.0
Boron	09/14/2006												96.0		103.0
Boron	09/19/2006	0.0000	1.0000	OK	OK	OK	OK						101.0		108.0
Boron	09/19/2006												97.0		
Cadmium	09/25/2006	0.0000	1.0000	OK	OK	OK	OK						97.0		106.0
Calcium	09/14/2006	0.0000	1.0000	OK	OK	OK	OK						101.0		93.0
Calcium	09/14/2006												100.0		102.0
Calcium	09/19/2006	0.0000	1.0000	OK	OK	OK	OK						104.0		98.2
Calcium	09/19/2006												99.0		
Chromium	09/14/2006	0.0000	1.0000	OK	OK	OK	OK						86.0		102.0
Chromium	09/14/2006												85.0		104.0
Chromium	09/19/2006	0.0000	1.0000	OK	OK	OK	OK						88.0		
Chromium	09/19/2006												85.0		100.0

Comments: ____________________

SAMPLE MANAGEMENT SYSTEM
Metals Data Validation Worksheet

RIN: 06080471 **Lab Code:** PAR **Date Due:** 10/11/2006

Matrix: Water **Site Code:** MOA16 **Date Completed:** 10/26/2006

Analyte	Date Analyzed	CALIBRATION						Method Blank	LCS %R	MS %R	MSD %R	Dup. RPD	ICSAB %R	Serial Dil. %R	CRI %R
		Int.	R^2	ICV	CCV	ICB	CCB								
Copper	09/14/2006	0.0000	1.0000	OK	OK	OK	OK						102.0		100.0
Copper	09/14/2006												101.0		96.0
Copper	09/19/2006	0.0000	1.0000	OK	OK	OK	OK						104.0		103.0
Copper	09/19/2006												101.0		
Iron	09/14/2006	0.0000	1.0000	OK	OK	OK	OK						102.0		89.0
Iron	09/14/2006												100.0		91.0
Iron	09/19/2006	0.0000	1.0000	OK	OK	OK	OK						104.0		99.0
Iron	09/19/2006												99.0		
Lead	09/25/2006	0.0000	0.9999	OK	OK	OK	OK						104.0		94.0
Magnesium	09/14/2006	0.0000	1.0000	OK	OK	OK	OK						103.0		94.4
Magnesium	09/14/2006												102.0		98.2
Magnesium	09/19/2006	0.0000	1.0000	OK	OK	OK	OK						104.0		98.5
Magnesium	09/19/2006												101.0		
Manganese	09/14/2006	0.0000	1.0000	OK	OK	OK	OK						87.0		102.0
Manganese	09/14/2006												86.0		106.0
Manganese	09/19/2006	0.0000	1.0000	OK	OK	OK	OK						92.0		106.0
Manganese	09/19/2006												89.0		
Molybdenum	09/25/2006	0.0000	1.0000	OK	OK	OK	OK						110.0		167.0

Comments:

SAMPLE MANAGEMENT SYSTEM

Metals Data Validation Worksheet

RIN: 06080471 **Lab Code:** PAR **Date Due:** 10/11/2006

Matrix: Water **Site Code:** MOA16 **Date Completed:** 10/26/2006

Analyte	Date Analyzed	CALIBRATION						Method Blank	LCS %R	MS %R	MSD %R	Dup. RPD	ICSAB %R	Serial Dil. %R	CRI %R
		Int.	R^2	ICV	CCV	ICB	CCB								
Potassium	09/14/2006	0.0000	1.0000	OK	OK	OK	OK								86.5
Potassium	09/19/2006	0.0000	1.0000	OK	OK	OK	OK								89.1
Selenium	09/18/2006	0.0000	0.9998	OK	OK	OK	OK	OK	102.0				98.0		104.0
Sodium	09/14/2006	0.0000	1.0000	OK	OK	OK	OK								86.6
Sodium	09/19/2006	0.0000	1.0000	OK	OK	OK	OK								87.6
Uranium	09/25/2006	0.0000	1.0000	OK	OK	OK	OK						108.0		

Comments: ____________________

SAMPLE MANAGEMENT SYSTEM

Inorganics Data Validation Worksheet

RIN: 06080471 **Lab Code:** PAR **Date Due:** 10/11/2006

Matrix: Water **Site Code:** MOA16 **Date Completed:** 10/26/2006

Analyte	Date Analyzed	CALIBRATION						Method	LCS %R	MS %R	MSD %R	DUP RPD	Serial Dil. %R
		Int.	R^2	ICV	CCV	ICB	CCB	Blank					
ALKALINITY, Bicarbonate	09/12/2006							OK					
ALKALINITY, Bicarbonate	09/20/2006							OK					
ALKALINITY, Carbonate	09/12/2006							OK					
ALKALINITY, Carbonate	09/20/2006							OK					
ALKALINITY, Total as CaCO3	09/12/2006							OK	100.0				
ALKALINITY, Total as CaCO3	09/20/2006							OK	100.0				
Ammonia as N	09/14/2006	-0.044	0.9997	OK	OK	OK	OK	OK	102.0				
Ammonia as N	09/26/2006	-0.044	0.9998	OK	OK	OK	OK	OK	99.0				
Bromide	09/12/2006	0	1.0000	OK	OK	OK	OK	OK	95.0				
Bromide	09/15/2006				OK		OK	OK	91.0				
Chloride	09/12/2006	0	0.9999	OK	OK	OK	OK	OK	94.0				
Chloride	09/15/2006				OK		OK	OK	91.0				
Fluoride	09/12/2006	0	0.9999	OK	OK	OK	OK	OK	99.0				
Fluoride	09/15/2006				OK		OK	OK	98.0				
Nitrate+Nitrite as N	09/18/2006	-0.006	0.9998	OK	OK	OK	OK	OK	95.0				
Sulfate	09/12/2006	0	0.9999	OK	OK	OK	OK	OK	99.0				
Sulfate	09/15/2006				OK		OK	OK	96.0				

Comments: ______________________________

SAMPLE MANAGEMENT SYSTEM

Inorganics Data Validation Worksheet

RIN: 06080471 **Lab Code:** PAR **Date Due:** 10/11/2006

Matrix: Water **Site Code:** MOA16 **Date Completed:** 10/26/2006

Analyte	Date Analyzed	CALIBRATION						Method	LCS %R	MS %R	MSD %R	DUP RPD	Serial Dil. %R
		Int.	R^2	ICV	CCV	ICB	CCB	Blank					
Sulfide	09/13/2006							OK	101.0				
Total Dissolved Solids	09/13/2006							OK	101.0			2.00	
Total Dissolved Solids	09/18/2006							OK	98.0			0	

Comments: ______

Page 1 of 1

SAMPLE MANAGEMENT SYSTEM
Radiochemistry Data Validation Worksheet

RIN: 06080471 **Lab Code:** PAR **Date Due:** 10/11/2006

Matrix: Water **Site Code:** MOA16 **Date Completed:** 10/26/2006

Sample	Analyte	Date Analyzed	Result	Flag	Tracer %R	LCS %R	MS %R	Duplicate
0201	Radium-228	10/05/2006			68.9			
0201	Radium-226	10/17/2006			106			
0202	Radium-228	10/05/2006			64.4			
0202	Radium-226	10/17/2006			122			
0203	Radium-228	10/05/2006			66.4			
0203	Radium-226	10/17/2006			110			
0204	Radium-228	10/05/2006			66.7			
0204	Radium-226	10/17/2006			114			
0205	Radium-228	10/05/2006			61.8			
0205	Radium-226	10/17/2006			111			
0208	Radium-228	10/05/2006			62.6			
0208	Radium-226	10/17/2006			104			
0208Dup	Radium-226	10/17/2006			108			1.11
0210	Radium-228	10/05/2006			61			
0210	Radium-226	10/17/2006			91.9			
2318	Radium-228	10/05/2006			49.2			
2318	Radium-226	10/17/2006			109			
Duplicate	Gross Alpha	10/12/2006						2.04
Duplicate	Gross Beta	10/12/2006						1.02
LCS	Radium-228	10/05/2006			69.5	95.7		
LCS	Gross Alpha	10/12/2006				99.3		
LCS	Gross Beta	10/12/2006				104		
LCS	Radium-226	10/17/2006			103	91.4		
LCS	Gross Alpha	12/28/2006			109.0			
LCSD	Radium-228	10/05/2006			62.1	111		0.7
Method Blank	Radium-228	10/05/2006	0.322	U	66.8			
Method Blank	Gross Alpha	10/12/2006	-0.134	U				
Method Blank	Gross Beta	10/12/2006	-0.31	U				
Method Blank	Radium-226	10/17/2006	0.0658	U	102			
Method Blank	Gross Alpha	12/28/2006	-0.0239	U				
MS	Gross Alpha	12/28/2006			77.3			0.50

Comments: ______________________________

U.S. Department of Energy—Grand Junction, Colorado

Calculation Cover Sheet

Calc. No.: MOA-01-07-2006-4-08-00 **Discipline:** Geotechnical Properties **No. of Sheets:** 4
Doc. No.: X0186900

Location: Attachment 5 Vol. I, Appendix I

Project: Moab UMTRA Project

Site: Moab Processing Site

Feature: Boring and Test Pit Logs for the Moab Processing Site

Sources of Data:

Boring and Test Pit Logs from the 2005 Geotechnical Investigation at the Moab Processing Site

Sources of Formulae and References:

See "References" section.

Preliminary Calc. ☐ **Final Calc.** ☒ **Supersedes Calc. No.**

Author: Name 5-31-07 Date

Approved by: Name 5/31/07 Date

Checked by:
Name 5/30/07 Date
Name 31 May 07 Date
Craig Goodknight Name 31 May 07 Date
Name May 31, 07 Date

No text for this page

Problem Statement:

Preliminary site selection performed jointly by the U.S. Department of Energy (DOE) and the Contractor has identified a 2,300-acre withdrawal area in the Crescent Flat area just northeast of Crescent Junction, Utah, as a possible site for final disposal of the Moab uranium mill tailings. The proposed disposal cell would cover approximately 250 acres. Based on the preliminary site-selection process, the suitability of the Crescent Junction Disposal Site is being evaluated from several technical aspects, including geomorphic, geologic, hydrologic, seismic, geochemical, and geotechnical. The objective of this calculation set is to present boring and test pit logs from the Moab tailings investigation.

These data will be incorporated into Attachment 5 of the Remedial Action Plan and Site Design for Stabilization of Moab Title I Uranium Mill Tailings at Crescent Junction, Utah, Site (RAP) and summarized in the Remedial Action Selection (RAS) report for the Moab Site.

Method of Solution:

Locations and descriptions of test holes and test pits advanced during this investigation were described in Golder Associates (2006). The geotechnical investigation during 2005 included drilling 24 boreholes through the Moab uranium mill tailings pile along with 12 test pits on the pile (Figure 1). The boreholes ranged in depth from 37 to 97 feet (ft) and were drilled, using a hollow-stem auger rig, through the tailings into the underlying alluvium. These holes were identified as 0700 through 0723. The test pits were dug to 13 ft with a backhoe during August 2005 (initial two test pits) and to a depth of 20 ft for the remainder during December 2005. Golder Associates originally identified the test pits as GATP-01 through GATP-12; later, Stoller Corp renamed the test pits as 0621 through 0632. Logs of the borings and test pits are attached to this calculation set in Appendixes A and B, respectively. Samples were collected from the borings and test pits and sent in for analysis of various geotechnical parameters (see the “Geotechnical Laboratory Testing Results for the Moab Processing Site” calculation in RAP Attachment 5, Vol. I, Appendix J).

Assumptions:

N/A

Calculation:

N/A

Discussion:

Results and evaluation of the boring and test pits at the Moab processing site are discussed in detail in relevant sections of the RAS.

Conclusion and Recommendations:

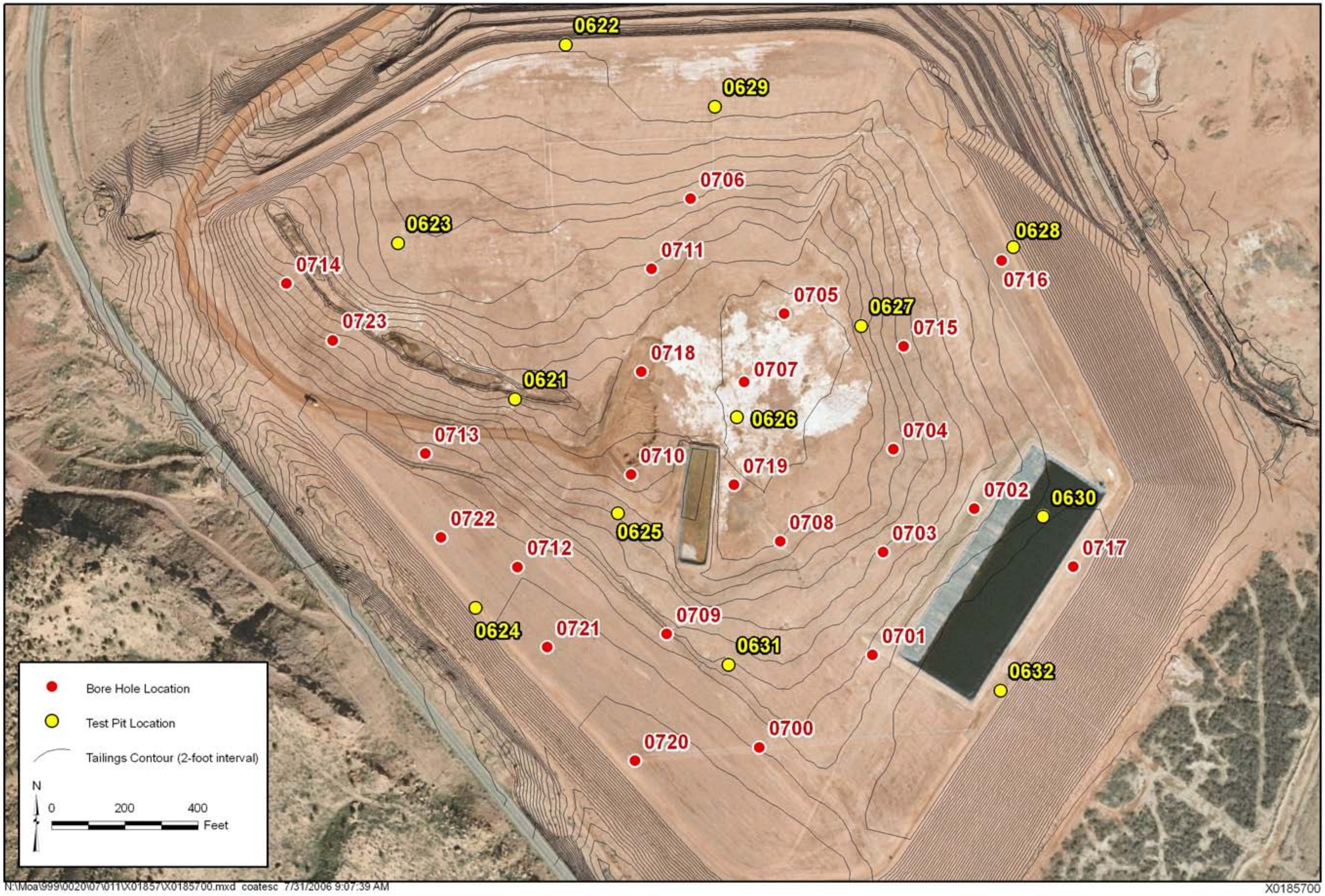
N/A

Computer Source:

N/A

References:

Golder Associates, 2006. *Sample Selection and Test Request Summary, Proposed Geotechnical Laboratory Test Program, Moab Project, Grand County, Utah,* Letter to Mark Kautsky, Hydrologist, S.M. Stoller Corporation, Golder Associates Reference Number 053-2269, January.



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X0185700

Figure 1. Borehole and Test Pit Locations, Moab Tailings Site, Utah

Appendix A

Boring Logs

RECORD OF BOREHOLE 0700

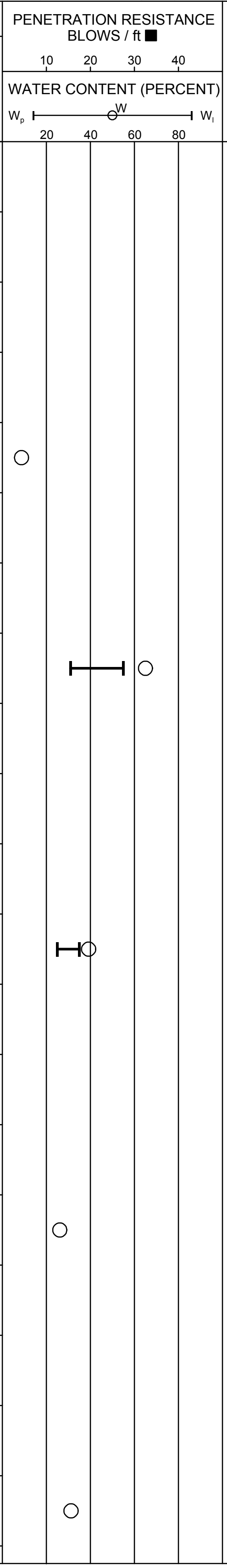
SHEET 1 of 3

PROJECT: Moab Tailings Impoundment
PROJECT NUMBER: 053-2269
LOCATION: Moab, UT

DRILLING METHOD: 3.25" ID HSA
DRILLING DATE: 11/5/2005
DRILL RIG: CME 75

DATUM: ft. amsl
AZIMUTH: N/A
COORDINATES: N: 6,664,019.00 E: 2,184,461.00

ELEVATION: 4055
INCLINATION: -90



DEPTH (feet)	BORING METHOD	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	SAMPLES NUMBER	TYPE	BLOWS per 6 in (140 lb hammer 30 inch drop)	N	REC / ATT	REMARKS
0	3.25" ID HSA / STANDARD SPLIT SPOON	0.0 - 4.0 Silty SAND with GRAVEL (SM), well graded, subrounded gravel, loose, non plastic, dry, reddish brown, (COVER FILL)	SM		4053.0 2.0	1	SH			1/2	WATER LEVEL @ 40 FT BGS
		color change to dark yellowish brown to dark reddish brown, moist			4051.0 4.0	2	SH			2/2	
5		4.0 - 12.0 Silty SAND, poorly graded, fine grained, loose, non plastic, moist, dark yellowish brown (SM) (TRANSITIONAL TAILINGS)	SM			3	SH			1.3/2	
											@ 6.0-8.0 ft, Area Skipped by drillers
						4	SH			2/2	
10					4043.0 12.0	5	SH			1.6/2	
		12.0 - 17.0 Sandy elastic SILT, some thinly bedded clays, thinly stratified, medium dense, high plasticity, moist, yellowish brown (MH) (SLIMES)	MH			6	SH			2/2	Drilling stopped 11/5/05 @ 1620 Drilling resumed 11/6/05 @ 0715
15					4039.0 16.0	7	SH			2/2	
		increasing amounts of interbedded clays 17.0 - 26.5 Sandy SILT with clay, fine grained, poorly graded sand, stiff, non plastic, moist, dark brown and gray (ML) (TRANSITIONAL TAILINGS)	ML		4038.0 17.0	8	SH			2/2	>0.28 kg/cm2 penetrometer test
						9	SH			2/2	
20					4033.0 22.0	10	SH			2/2	
		Transition zones of high plasticity, SILT with sand and clay, low plasticity			4031.0 24.0	11	SH			2/2	>0.28 kg/cm2 penetrometer test, Unconfined Test, UU Test
25		Contains very fine grained sands				12	SH			2/2	
		26.5 - 31.0 Transition to material with more fines (ML) (SLIMES)	ML		4028.5 26.5	13	SH			1.6/2	>0.28 kg/cm2 penetrometer test
						14	SH			1.5/2	>0.28 kg/cm2 penetrometer test
30		31.0 - 41.0 SILT, trace fine grained sand, trace clays, poorly graded, thinly to thickly interbedded layers, stiff, non plastic, moist, light gray (ML) (SLIMES)	ML		4024.0 31.0	15	SH			2/2	
						16	SH			1.5/2	>0.28 kg/cm2 penetrometer test
35						17	SH			1.5/2	
					4017.0 38.0	18	SH			0.2/2	Majority of sample sloughed off into borehole.
		Contains fine grained sands.				19	SH			2/2	>0.28 kg/cm2 penetrometer test
40											

Log continued on next page

SCALE: 1 in = 5 ft
DRILLING CONTRACTOR: Boart Longyear
DRILLER:

LOGGED: RD
CHECKED: DLG
DATE: 5/10/2006

RECORD OF BOREHOLE 0700

SHEET 2 of 3

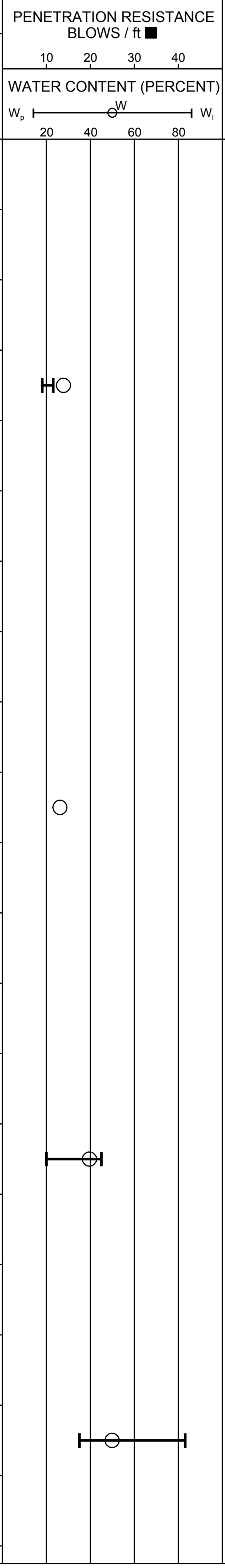
PROJECT: Moab Tailings Impoundment
PROJECT NUMBER: 053-2269
LOCATION: Moab, UT

DRILLING METHOD: 3.25" ID HSA
DRILLING DATE: 11/5/2005
DRILL RIG: CME 75

DATUM: ft. amsl
AZIMUTH: N/A
COORDINATES: N: 6,664,019.00 E: 2,184,461.00

ELEVATION: 4055
INCLINATION: -90

DEPTH (feet)	BORING METHOD	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	SAMPLES: NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC / ATT	REMARKS
40	3.25" ID HSA / STANDARD SPLIT SPOON		ML		4014.0 41.0	20	SH			1/2	
		41.0 - 46.4 Silty SAND with clay, poorly graded, uniform, medium dense, non plastic, moist to wet, dark brown (SM) (TRANSITIONAL TAILINGS)	SM			21	SH			2/2	
45						22	SH			2/2	
		46.4 - 58.0 Silty sandy CLAY, firm, non plastic, saturated, gray to dark gray (CL-ML) (SLIMES)	CL-ML		4008.6 46.4	23	SH			2/2	
						24	SH			2/2	
50						25	SH			0/2	
		Wet to saturated fine sands			4002.0 53.0	26	SH			1/2	
55						27	SH			0/2	
		Continued wet, fine sands, changing colors to dark gray, brown			3998.0 57.0	28	SH			0.5/2	
		58.0 - 64.0 Clayey SILT with little sand, non plastic, moist, brown and dark gray (ML) (SLIMES)	ML		3997.0 58.0	29	SH			2/2	Unconfined Test, UU Test
60						30	SH			2/2	<0.03 kg/cm2 penetrometer test
						31	SH			2/2	
65		64.0 - 68.0 Silty CLAY, little sand, mottled, medium stiff, low to medium plasticity, moist, dark gray and reddish brown (CL) (SLIMES)	CL		3991.0 64.0	32	SH			2/2	
						33	SH			0/2	>0.28 kg/cm2 penetrometer test
		68.0 - 70.3 Silty CLAY, low to medium plasticity, moist, dark gray (CL) (SLIMES)	CL		3987.0 68.0	34	SH			2/2	0.16 kg/cm2 penetrometer test
70		70.3 - 72.0 Sandy CLAY, uniform, medium stiff, low to medium plasticity, moist, dark brown (CL) (SLIMES)	CL		3984.7 70.3	35	SH			2/2	>0.28 kg/cm2 penetrometer test
		72.0 - 76.0 Sandy SILT with clay, poorly graded, medium dense, low plasticity, moist, light gray (ML) (SLIMES)	ML		3983.0 72.0	36	SH			2/2	
75						37	SH			2/2	>0.28 kg/cm2 penetrometer test
		76.0 - 82.0 Silty CLAY, medium stiff, high plasticity, moist, dark brown and gray (CH) (SLIMES)	CH		3979.0 76.0	38	SH			2/2	Unconfined Test, UU Test
						39	SH			1.5/2	>0.28 kg/cm2 penetrometer test
80		Log continued on next page									



SCALE: 1 in = 5 ft
DRILLING CONTRACTOR: Boart Longyear
DRILLER:

LOGGED: RD
CHECKED: DLG
DATE: 5/10/2006

Golder Associates

RECORD OF BOREHOLE 0700

SHEET 3 of 3

PROJECT: Moab Tailings Impoundment
PROJECT NUMBER: 053-2269
LOCATION: Moab, UT
DRILLING METHOD: 3.25" ID HSA
DRILLING DATE: 11/5/2005
DRILL RIG: CME 75
DATUM: ft. amsl
AZIMUTH: N/A
COORDINATES: N: 6,664,019.00 E: 2,184,461.00
ELEVATION: 4055
INCLINATION: -90

DEPTH (feet)	BORING METHOD	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV. DEPTH (ft)	SAMPLES: NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC / ATT	PENETRATION RESISTANCE BLOWS / ft ■ 10 20 30 40; WATER CONTENT (PERCENT) Wp W Wl 20 40 60 80	REMARKS
80		76.0 - 82.0 Silty CLAY, medium stiff, high plasticity, moist, dark brown and gray (CH) (SLIMES) *(Continued)*	CH	▨	3973.0	40	SH			1.5 2		
		82.0 - 82.5 Silty SAND, trace organics, medium dense to dense, non plastic, moist, dark reddish brown (SM) (ALLUVIUM) Boring completed at 82.5 ft.	SM	⁘	82.0	41	SH			0.5 0.5		Auger TD @ 82.0', Shelby TD @ 82.5', finish @16:05 on 11/06/2005
85												
90												
95												
100												
105												
110												
115												
120												

SCALE: 1 in = 5 ft
DRILLING CONTRACTOR: Boart Longyear
DRILLER:

LOGGED: RD
CHECKED: DLG
DATE: 5/10/2006

Golder Associates

RECORD OF BOREHOLE 0701

SHEET 1 of 3

PROJECT: Moab Tailings Impoundment
PROJECT NUMBER: 053-2269
LOCATION: Moab, UT

DRILLING METHOD: 3.25" ID HSA
DRILLING DATE: 11/7/2005
DRILL RIG: CME75

DATUM: ft. amsl
AZIMUTH: N/A
COORDINATES: N: 6,664,272.00 E: 2,184,771.00

ELEVATION: 4053
INCLINATION: -90

BORING METHOD	SOIL PROFILE DESCRIPTION	USCS	ELEV. / DEPTH (ft)	SAMPLES NUMBER	TYPE	BLOWS per 6 in (140 lb hammer 30 inch drop)	N	REC / ATT	REMARKS
3.25" ID HSA / STANDARD SPLIT SPOON	0.0 - 6.8 Silty SAND with gravel, well graded, subrounded, medium dense, non plastic, dry at surface, moist below surface, reddish brown (SM) (COVER FILL)	SM		1	SS	9-9-17	26	1.3/1.5	
	Color changes to buff tan		4050.0 3.0	2	SH			1.3/2	
	6.8 - 15.0 Sandy SILT with clay, poorly graded, interbedded clays, loose, non plastic, moist, tan and gray (ML) (TRANSITIONAL TAILINGS)	ML	4046.2 6.8	3	SS	7-4-4	8	1.5/1.5	
				4	SH			2/2	
									>0.28 kg/cm2 penetrometer test
	Becomes more silty.		4041.5 11.5	5	SS	4-4-5	9	1.5/1.5	
				6	SH			1.5/2	
	15.0 - 21.0 Clayey SILT, uniform to thinly laminated, very soft, low to medium plasticity, moist, dark brown (ML) (SLIMES)	ML	4038.0 15.0	7	SS	1-1-1	2	1.5/1.5	
				8	SH			2/2	
									>0.28 kg/cm2 penetrometer test
	21.0 - 27.5 Silty SAND, poorly graded, very loose, non plastic, moist, dark yellowish brown (SM) (SAND TAILINGS)	SM	4032.0 21.0	9	SS	1-1-1	2	1.5/1.5	
				10	SH			1.5/2	
									0.22 kg/cm2 penetrometer test
	27.5 - 31.0 Sandy SILT, poorly graded, thinly laminated and bedded, soft, non plastic, moist, olive gray (ML) (SLIMES)	ML	4025.5 27.5	11	SS	9-2-1	3	1.5/1.5	
				12	SH			2/2	
	31.0 - 37.0 Sandy SILT with clay, fine grained sands, stiff, non plastic, moist, dark yellowish brown (ML) (TRANSITION TAILINGS)	ML	4022.0 31.0	13	SS	4-4-5	9	1.5/1.5	
				14	SH			1.6/2	
									>0.28 kg/cm2 penetrometer test
	37.0 - 48.0 Silty CLAY, uniform, mottled, soft, high plasticity, moist, dark reddish brown (CH) (SLIMES)	CH	4016.0 37.0	15	SS	1-1-3	4	1.5/1.5	
				16	SH			0/2	

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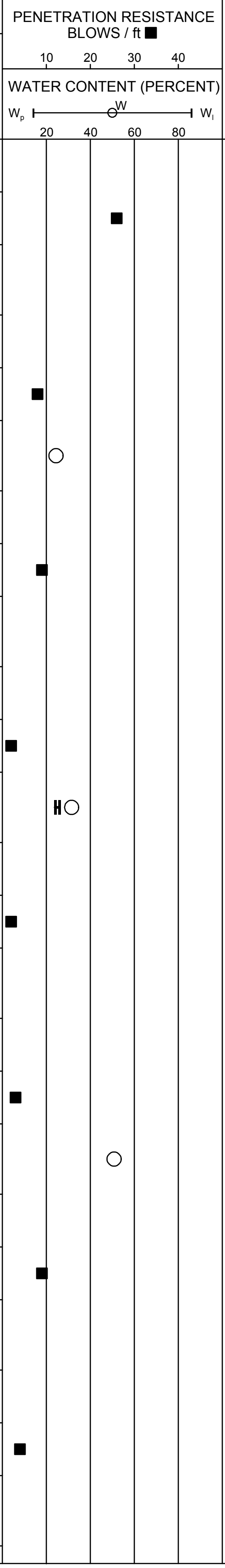


SCALE: 1 in = 5 ft
DRILLING CONTRACTOR: Boart Longyear
DRILLER:

LOGGED: RD
CHECKED: DLG
DATE: 5/10/2006

Golder Associates

RECORD OF BOREHOLE 0701

SHEET 2 of 3

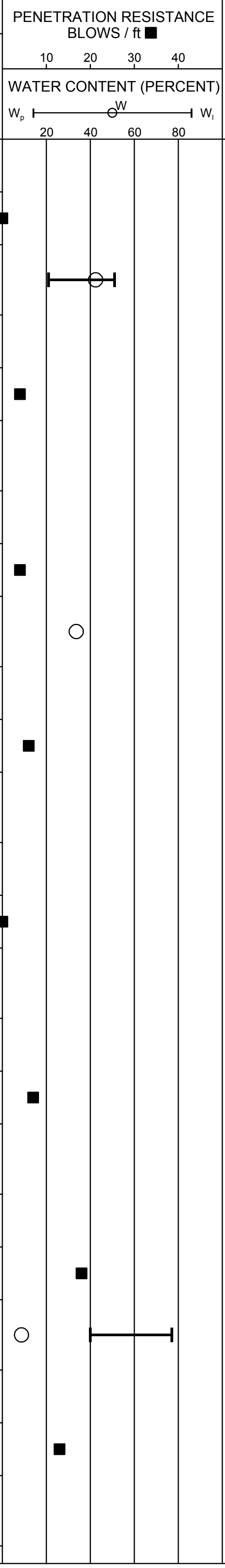
PROJECT: Moab Tailings Impoundment
PROJECT NUMBER: 053-2269
LOCATION: Moab, UT

DRILLING METHOD: 3.25" ID HSA
DRILLING DATE: 11/7/2005
DRILL RIG: CME75

DATUM: ft. amsl
AZIMUTH: N/A
COORDINATES: N: 6,664,272.00 E: 2,184,771.00

ELEVATION: 4053
INCLINATION: -90

DEPTH (feet)	BORING METHOD	SOIL PROFILE DESCRIPTION	USCS	ELEV. DEPTH (ft)	SAMPLES NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC / ATT	REMARKS
40	3.25" ID HSA / STANDARD SPLIT SPOON	37.0 - 48.0 Silty CLAY, uniform, mottled, soft, high plasticity, moist, dark reddish brown (CH) (SLIMES) *(Continued)*	CH							
					17	SS	1-0-0	0	1.5/1.5	
					18	SH			2/2	
45										>0.28 kg/cm2 penetrometer test
					19	SS	1-2-2	4	1.5/1.5	
		48.0 - 54.0 Olive gray and brown mottled CLAY, high plasticity (CH) (SLIMES)	CH	4005.0 48.0	20	SH			2/2	
50										>0.28 kg/cm2 penetrometer test
					21	SS	1-2-2	4	1.5/1.5	
		54.0 - 68.4 SILT with trace to little sand and little clay, firm, non plastic, moist, light to dark gray (ML) (SLIMES)	ML	3999.0 54.0	22	SH			2/2	
55										>0.28 kg/cm2 penetrometer test
					23	SS	1-3-3	6	1.5/1.5	
					24	SH			2/2	
60										>0.28 kg/cm2 penetrometer test
		Becomes very soft, moist to wet		3991.5 61.5	25	SS	1-0-0	0	1.5/1.5	
					26	SH			2/2	
65										0.25 kg/cm2 penetrometer test
		Becomes firm.		3986.0 67.0	27	SS	2-3-4	7	1.5/1.5	
		68.4 - 76.2 Clayey elastic SILT, uniform, stiff, high plasticity, moist, reddish gray, dark gray (MH) (SLIMES)	MH	3984.6 68.4	28	SH			2/2	
70										>0.28 kg/cm2 penetrometer test
					29	SS	8-9-9	18	1.5/1.5	
					30	SH			2/2	
75										>0.28 kg/cm2 penetrometer test
		76.2 - 80.0 Clayey elastic SILT, thinly laminated, stiff, medium plasticity, moist, gray, brown, olive (MH) (SLIMES)	MH	3976.8 76.2	31	SS	4-6-7	13	1.5/1.5	
					32	SH			2/2	
80				3973.0						



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SCALE: 1 in = 5 ft
DRILLING CONTRACTOR: Boart Longyear
DRILLER:

LOGGED: RD
CHECKED: DLG
DATE: 5/10/2006

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RECORD OF BOREHOLE 0701

SHEET 3 of 3

PROJECT: Moab Tailings Impoundment
PROJECT NUMBER: 053-2269
LOCATION: Moab, UT

DRILLING METHOD: 3.25" ID HSA
DRILLING DATE: 11/7/2005
DRILL RIG: CME75

DATUM: ft. amsl
AZIMUTH: N/A
COORDINATES: N: 6,664,272.00 E: 2,184,771.00

ELEVATION: 4053
INCLINATION: -90

DEPTH (feet)	BORING METHOD	SOIL PROFILE				SAMPLES					PENETRATION RESISTANCE BLOWS / ft ■	REMARKS
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV. DEPTH (ft)	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC / ATT	10 20 30 40 WATER CONTENT (PERCENT) Wp ⊢—○W—⊣ Wl 20 40 60 80	
80		80.0 - 81.5 Silty SAND, fine grained, trace organics, poorly graded, medium dense, non plastic, little moisture, dark reddish brown (SM) (ALLUVIUM) Boring completed at 81.5 ft.	SM		80.0	33	SS	9-8-9	17	1.5/1.5	○ ■	Auger TD @ 80.0', Split Spoon TD @ 81.5', finish @10:15 on 11/08/2005
85												
90												
95												
100												
105												
110												
115												
120												

SCALE: 1 in = 5 ft
DRILLING CONTRACTOR: Boart Longyear
DRILLER:

LOGGED: RD
CHECKED: DLG
DATE: 5/10/2006

Golder Associates

RECORD OF BOREHOLE 0702

SHEET 1 of 2

PROJECT: Moab Tailings Impoundment
PROJECT NUMBER: 053-2269
LOCATION: Moab, UT
DRILLING METHOD: 3.25" ID HSA
DRILLING DATE: 11/9/2005
DRILL RIG: CME 75
DATUM: ft. amsl
AZIMUTH: N/A
COORDINATES: N: 6,664,595.00 E: 2,184,965.00
ELEVATION: 4050
INCLINATION: -90

BORING METHOD: 3.25" ID HSA / STANDARD SPLIT SPOON

SOIL PROFILE DESCRIPTION	USCS	ELEV. / DEPTH (ft)	SAMPLES NUMBER	TYPE	BLOWS per 6 in (140 lb hammer 30 inch drop)	N	REC / ATT	REMARKS
0.0 - 7.5 Silty SAND with gravel, well graded, subrounded gravels, medium dense, non plastic, dry at surface, moist at depth, reddish brown (SM) (COVER FILL)	SM	4042.5 7.5	1	SS	7-7-7	14	1.5/1.5	
			2	SH			1/2	
			3	SS	7-4-4	8	1.5/1.5	
7.5 - 9.6 Sandy SILT, poorly graded, firm, non plastic, little moisture, yellowish brown (ML) (SLIMES)	ML	4040.4 9.6	4	SH			2/2	
9.6 - 18.4 Sandy elastic SILT with clay, slightly stratified, very soft, moist, yellowish brown, contains geogrid debris (MH) (SLIMES)	MH	4031.6 18.4						> 0.28 kg/cm2 penetrometer test
			5	SS	2-0-0	0	1.5/1.5	
			6	SH			2/2	
								> 0.28 kg/cm2 penetrometer test
			7	SS	2-1-1	2	0.5/1.5	
18.4 - 26.2 Silty SAND, poorly graded, slightly stratified, loose, non plastic, moist, light yellowish tan (SM) (TRANSITIONAL TAILINGS)	SM	4023.8 26.2	8	SH			2/2	
			9	SS	4-3-4	7	1/1.5	
			10	SH			1.5/2	
26.2 - 39.6 SILT with trace to little sand, very soft to soft, non plastic, wet, dark yellowish brown (ML) (SLIMES)	ML	4010.4 39.6	11	SS	2-2-2	4	1.5/1.5	
			12	SH			0/2	
			13	SS	1-0-0	0	1.5/1.5	
			14	SH			2/2	
								0.22 kg/cm2 penetrometer test
			15	SS	2-2-2	4	1.5/1.5	
			16	SH			2/2	
	CL-ML							

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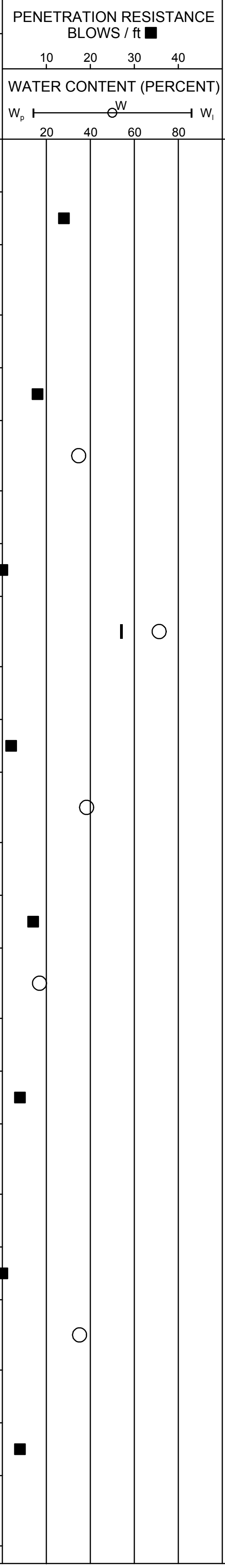


SCALE: 1 in = 5 ft
DRILLING CONTRACTOR: Boart Longyear
DRILLER:

LOGGED: RD
CHECKED: DLG
DATE: 5/10/2006

RECORD OF BOREHOLE 0702

SHEET 2 of 2

PROJECT: Moab Tailings Impoundment
PROJECT NUMBER: 053-2269
LOCATION: Moab, UT

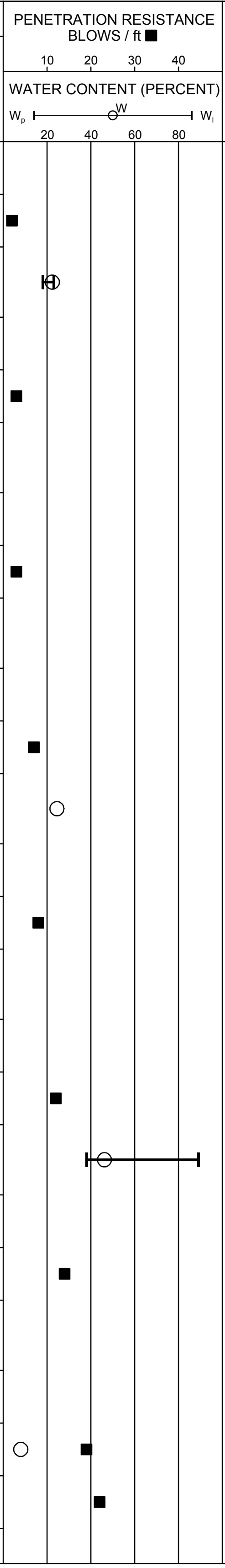
DRILLING METHOD: 3.25" ID HSA
DRILLING DATE: 11/9/2005
DRILL RIG: CME 75

DATUM: ft. amsl
AZIMUTH: N/A
COORDINATES: N: 6,664,595.00 E: 2,184,965.00

ELEVATION: 4050
INCLINATION: -90

BORING METHOD: 3.25" ID HSA / STANDARD SPLIT SPOON

DEPTH (feet)	SOIL PROFILE: DESCRIPTION	USCS	ELEV. / DEPTH (ft)	SAMPLES: NUMBER	TYPE	BLOWS per 6 in (140 lb hammer 30 inch drop)	N	REC / ATT	REMARKS
40	39.6 - 46.5 Sandy silty CLAY, soft, low plasticity, very moist, dark yellowish brown (CL-ML) (TRANSITIONAL TAILINGS)*(Continued)*	CL-ML		17	SS	2-1-1	2	1.5/1.5	
				18	SH			2/2	
45			4003.5 46.5						
	46.5 - 48.4 Sandy SILT with clay, poorly graded, soft, non plastic, moist, dark yellowish brown (ML) (SLIMES)	ML	4001.6 48.4	19	SS	1-1-2	3	1.5/1.5	
	48.4 - 63.0 Silty SAND with clay, poorly graded, very loose to loose, non plastic, wet, medium yellowish brown (SM) (TRANSITIONAL TAILINGS)	SM		20	SH			2/2	
50				21	SS	1-1-2	3	1.5/1.5	
				22	SH			0/2	
55			3993.5 56.5						
	Thickly bedded silty fines interbedded with silty SAND			23	SS	3-3-4	7	1/1.5	
				24	SH			2/2	
60			3987.0 63.0	25	SS	4-4-4	8	1.5/1.5	
	63.0 - 66.5 Silty SAND with clay, poorly graded, interbedded clays, loose, non plastic, moist, olive gray, gray (SM) (TRANSITIONAL TAILINGS)	SM	3983.5 66.5	26	SH			2/2	
65	66.5 - 76.5 CLAY with silt, thinly laminated, thinly bedded, stiff, high plasticity, moist, gray, light reddish brown, olive (CH) (SLIMES)	CH		27	SS	4-5-7	12	1.5/1.5	
				28	SH			2/2	
70									> 0.28 kg/cm2 penetrometer test
				29	SS	5-7-7	14	1.5/1.5	
				30	SH			2/2	
75			3973.5 76.5						> 0.28 kg/cm2 penetrometer test
	76.5 - 79.5 Silty SAND with gravel, medium to fine grained, poorly graded, trace organics, medium dense, non plastic, moist, dark reddish brown (SM) (ALLUVIUM)	SM		31	SS	8-9-10	19	1/1.5	
				32	SS	7-10-12	22	1/1.5	Auger TD @ 78.0', Split Spoon TD @ 79.5', finish
80	Boring completed at 79.5 ft.								



SCALE: 1 in = 5 ft
DRILLING CONTRACTOR: Boart Longyear
DRILLER:

LOGGED: RD
CHECKED: DLG
DATE: 5/10/2006

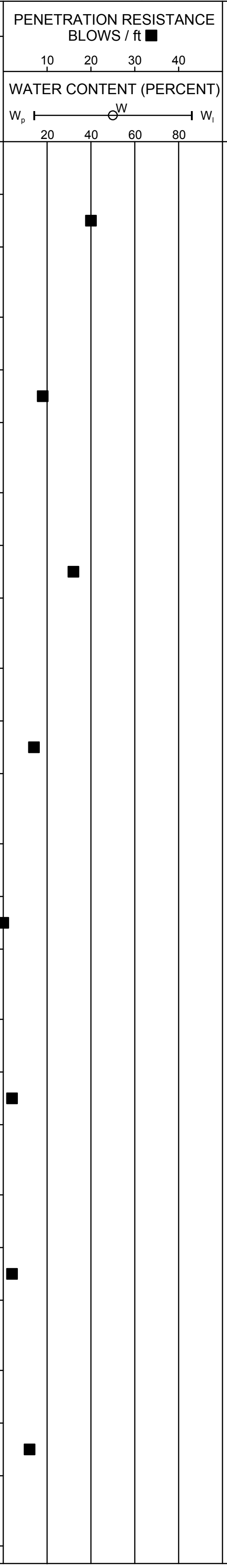
Golder Associates

RECORD OF BOREHOLE 0703

SHEET 1 of 2

PROJECT: Moab Tailings Impoundment
PROJECT NUMBER: 053-2269
LOCATION: Moab, UT
DRILLING METHOD: 3.25" ID HSA
DRILLING DATE: 11/8/2005
DRILL RIG: CME 75
DATUM: ft. amsl
AZIMUTH: N/A
COORDINATES: N: 6,664,553.00 E: 2,184,799.00
ELEVATION: 4046
INCLINATION: -90

DEPTH (feet)	BORING METHOD	SOIL PROFILE DESCRIPTION	USCS	ELEV. / DEPTH (ft)	SAMPLES NUMBER	TYPE	BLOWS per 6 in (140 lb hammer 30 inch drop)	N	REC / ATT	REMARKS
0	3.25" ID HSA / STANDARD SPLIT SPOON	0.0 - 3.0 Silty SAND with gravel, well graded, subrounded gravels, loose to medium dense, non plastic, dry to moist, reddish brown, dark yellowish brown (SM) (COVER FILL)	SM							
				4043.0	1	SS	7-10-10	20	1.5/1.5	
		3.0 - 18.6 Silty SAND, poorly graded, loose to medium dense, non plastic, little moisture to moist, dark yellowish brown, dark reddish brown (SM) (SAND TAILINGS)	SM	3.0	2	SH			2/2	
5										> 0.28 kg/cm2 penetrometer test
					3	SS	4-3-6	9	1/1.5	
					4	SH			2/2	
10										> 0.31 kg/cm2 penetrometer test
					5	SS	5-7-9	16	1.5/1.5	
					6	SH			1.6/2	
15										
				4027.4	7	SS	2-3-4	7	1.5/1.5	
		18.6 - 22.0 Sandy SILT with clay, soft, non plastic, moist, gray, olive gray (ML) (TRANSITIONAL TAILINGS)	ML	18.6	8	SH			2/2	
20										> 0.28 kg/cm2 penetrometer test
		22.0 - 27.6 Silty CLAY, very soft, low to medium plasticity, moist, dark yellowish brown (CL) (SLIMES)	CL	4024.0 22.0	9	SS	2-0-0	0	1.5/1.5	
					10	SH			2/2	
25										> 0.28 kg/cm2 penetrometer test
				4018.4	11	SS	1-1-1	2	1.5/1.5	
		27.6 - 33.0 Silty CLAY, thickly stratified to uniform, very soft, low to medium plasticity, moist, black, dark reddish brown (CL) (SLIMES)	CL	27.6	12	SH			2/2	
30										> 0.28 kg/cm2 penetrometer test
				4013.0	13	SS	1-1-1	2	1.5/1.5	
		33.0 - 46.0 Silty SAND with clay, interbedded thick silty clays, very loose, non plastic, wet, olive gray to yellowish brown (SM) (TRANSITIONAL TAILINGS)	SM	33.0	14	SH			2/2	
35										0.09 kg/cm2 penetrometer test
					15	SS	2-3-3	6	1.5/1.5	
					16	SH			1/2	
40		Log continued on next page								



SCALE: 1 in = 5 ft
DRILLING CONTRACTOR: Boart Longyear
DRILLER:

LOGGED: RD
CHECKED: DLG
DATE: 5/10/2006

Golder Associates

RECORD OF BOREHOLE 0703

SHEET 2 of 2

PROJECT: Moab Tailings Impoundment
PROJECT NUMBER: 053-2269
LOCATION: Moab, UT

DRILLING METHOD: 3.25" ID HSA
DRILLING DATE: 11/8/2005
DRILL RIG: CME 75

DATUM: ft. amsl
AZIMUTH: N/A
COORDINATES: N: 6,664,553.00 E: 2,184,799.00

ELEVATION: 4046
INCLINATION: -90

DEPTH (feet)	BORING METHOD	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. DEPTH (ft)	SAMPLES NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC / ATT	PENETRATION RESISTANCE BLOWS / ft ■ (10 20 30 40) WATER CONTENT (PERCENT) W_p ⊢ W ⊣ W_l (20 40 60 80)	REMARKS
40	3.25" ID HSA / STANDARD SPLIT SPOON	33.0 - 46.0 Silty SAND with clay, interbedded thick silty clays, very loose, non plastic, wet, olive gray to yellowish brown (SM) (TRANSITIONAL TAILINGS) *(Continued)*	SM									
						17	SS	1-1-1	2	1.5/1.5	■	
						18	SH			1/2		
45												
		46.0 - 53.4 Silty CLAY, uniform, very soft, low to medium plasticity, moist, dark yellowish brown (CL) (SLIMES)	CL		4000.0 46.0	19	SS	1-1-1	2	1.5/1.5	■	
						20	SH			1/2		
50												0.12 kg/cm2 penetrometer test
						21	SS	1-0-0	0	1.5/1.5	■	
		53.4 - 58.0 Silty CLAY, very soft, low to medium plasticity, moist, olive gray (CL) (SLIMES)	CL		3992.6 53.4	22	SH			2/2		
55												0.25 kg/cm2 penetrometer test
						23	SS	1-0-1	1	1.5/1.5	■	
		58.0 - 73.0 Silty SAND with clay, very loose, non plastic, moist, olive gray to gray (SM) (TRANSITIONAL TAILINGS)	SM		3988.0 58.0	24	SH			2/2		
60												0.22 kg/cm2 penetrometer test
						25	SS	1-0-0	0	1.5/1.5	■	
						26	SH			2/2		
65												Drilling stopped @ 1620 Drilling resumed on 11/9/05 @ 0730
		Becomes medium dense			3979.5 66.5	27	SS	4-7-7	14	1.5/1.5	■	> 0.28 kg/cm2 penetrometer test
						28	SH			2/2		
70												> 0.28 kg/cm2 penetrometer test
						29	SS	7-7-10	17	1.5/1.5	■	
		73.0 - 74.5 Silty SAND, medium to fine grained, poorly graded, medium dense, non plastic, little moisture, dark reddish brown (SM) (ALLUVIUM) Boring completed at 74.5 ft.	SM		3973.0 73.0	30	SS	9-9-11	20	0.5/1.5	■	Auger TD @ 73.0', Split Spoon TD @ 74.5', finish @08:40 on 11/09/2005
75												
80												

SCALE: 1 in = 5 ft
DRILLING CONTRACTOR: Boart Longyear
DRILLER:

LOGGED: RD
CHECKED: DLG
DATE: 5/10/2006

Golder Associates

BOREHOLE (WITH OR WITHOUT WELL) GAGEO 053-2269.GPJ GLDR_CO.GDT 5/12/06

RECORD OF BOREHOLE 0704

SHEET 1 of 2

PROJECT: Moab Tailings Impoundment
PROJECT NUMBER: 053-2269
LOCATION: Moab, UT
DRILLING METHOD: 3.25" ID HSA
DRILLING DATE: 11/10/2005
DRILL RIG: CME 75
DATUM: ft. amsl
AZIMUTH: N/A
COORDINATES: N: 6,664,834.00 E: 2,184,828.00
ELEVATION: 4040
INCLINATION: -90

DEPTH (feet)	BORING METHOD	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	SAMPLES: NUMBER	TYPE	BLOWS per 6 in (140 lb hammer 30 inch drop)	N	REC / ATT	REMARKS
0	3.25" ID HSA / STANDARD SPLIT SPOON	0.0 - 3.5 Silty SAND with gravel, subrounded gravels, well graded, loose, non plastic, dry to moist, dark reddish brown (SM) (COVER FILL)	SM	▩		1	SS	4-5-5	10	1.5/1.5	
		3.5 - 11.5 Silty SAND, well graded, loose to very dense, non plastic, little moisture, medium yellowish brown, dark reddish brown (SM) (SAND TAILINGS)	SM		4036.5 3.5	2	SH			1.5/2	
5						3	SS	50	50	0.4/1.5	Loose. Refusal due to large debris or rock.
						4	SH			1/2	
10		11.5 - 21.5 SILT with clay, slightly stratified, very soft, low to medium plasticity, moist, dark yellowish brown (ML) (SLIMES)	ML		4028.5 11.5	5	SS	2-1-1	2	1/1.5	
						6	SH			2/2	
15						7	SS	1-0-0	0	1/1.5	
						8	SH			2/2	
20											> 0.16 kg/cm2 penetrometer test
		21.5 - 38.4 CLAY with silt, trace sand, thinly stratified, very soft, low to medium plasticity, moist, dark reddish brown to dark yellowish brown, gray (CL) (SLIMES)	CL	▨	4018.5 21.5	9	SS	1-0-0	0	1.5/1.5	
						10	SH			2/2	
25											0.22 kg/cm2 penetrometer test
						11	SS	1-0-0	0	1.5/1.5	
						12	SH			2/2	
30											0.22 kg/cm2 penetrometer test
						13	SS	1-0-0	0	1.5/1.5	
						14	SH			2/2	
35											0.25 kg/cm2 penetrometer test
		Becomes very soft			4003.5 36.5	15	SS	1-1-2	3	1.5/1.5	
			ML		4001.6 38.4	16	SH			2/2	
40											

PENETRATION RESISTANCE BLOWS / ft ■ 10 20 30 40
WATER CONTENT (PERCENT) W_p W W_l 20 40 60 80

Log continued on next page

SCALE: 1 in = 5 ft
DRILLING CONTRACTOR: Boart Longyear
DRILLER:

LOGGED: RD
CHECKED: DLG
DATE: 5/10/2006

Golder Associates

RECORD OF BOREHOLE 0704

SHEET 2 of 2

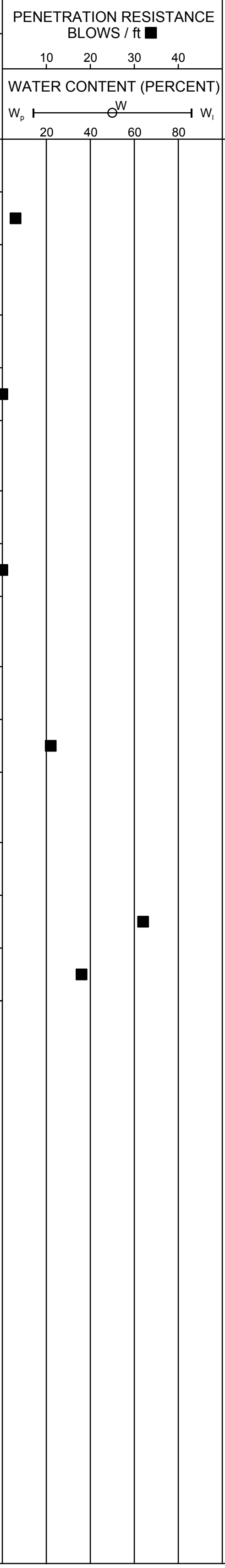
PROJECT: Moab Tailings Impoundment
PROJECT NUMBER: 053-2269
LOCATION: Moab, UT

DRILLING METHOD: 3.25" ID HSA
DRILLING DATE: 11/10/2005
DRILL RIG: CME 75

DATUM: ft. amsl
AZIMUTH: N/A
COORDINATES: N: 6,664,834.00 E: 2,184,828.00

ELEVATION: 4040
INCLINATION: -90

DEPTH (feet)	BORING METHOD	SOIL PROFILE DESCRIPTION	USCS	ELEV. / DEPTH (ft)	SAMPLES NUMBER	TYPE	BLOWS per 6 in (140 lb hammer 30 inch drop)	N	REC / ATT	REMARKS
40	3.25" ID HSA / STANDARD SPLIT SPOON	38.4 - 43.0 Sandy SILT with clay, fine grained sand, soft, low to medium plasticity, moist, dark reddish brown (ML) (SLIMES)*(Continued)*	ML							0.22 kg/cm2 penetrometer test
				3997.0 43.0	17	SS	1-1-2	3	1.5/1.5	
		43.0 - 49.0 CLAY with silt, uniform, very soft, low to medium plasticity, moist, olive brown to reddish brown (CL) (SLIMES)	CL		18	SH			2/2	
45										> 0.28 kg/cm2 penetrometer test
					19	SS	1-0-0	0	1.5/1.5	
				3991.0 49.0	20	SH			2/2	
50		49.0 - 51.5 SILT with clay, soft, low to medium plasticity, moist, olive gray to brown (ML) (SLIMES)	ML	3988.5 51.5						0.22 kg/cm2 penetrometer test
		51.5 - 54.0 Silty CLAY, very soft, low to medium plasticity, moist, dark yellowish brown (CL) (SLIMES)	CL	3986.0 54.0	21	SS	1-0-0	0	1.5/1.5	
					22	SH			2/2	
55		54.0 - 58.0 SILT with clay, thinly stratified, loose to medium stiff, medium plasticity, moist, olive gray to yellowish brown (ML) (SLIMES)	ML							> 0.28 kg/cm2 penetrometer test
				3982.0 58.0	23	SS	5-5-6	11	1.5/1.5	
		58.0 - 62.6 Silty CLAY, stiff to very stiff, low to medium plasticity, moist, light gray to medium brown (CL) (SLIMES)	CL		24	SH			2/2	
60										> 0.28 kg/cm2 penetrometer test
				3977.4 62.6	25	SS	8-13-19	32	1.5/1.5	
		62.6 - 64.5 Silty SAND, micaceous, medium to fine grained, well graded, medium dense, non plastic, moist, dark reddish brown (SM) (ALLUVIUM)	SM		26	SS	9-9-9	18	1.5/1.5	
65		Boring completed at 64.5 ft.								Auger TD @ 63.0', Split Spoon TD @ 64.5', finish @11:00 on 11/10/2005
70										
75										
80										



SCALE: 1 in = 5 ft
DRILLING CONTRACTOR: Boart Longyear
DRILLER:

LOGGED: RD
CHECKED: DLG
DATE: 5/10/2006

Golder Associates

RECORD OF BOREHOLE 0705

SHEET 1 of 2

PROJECT: Moab Tailings Impoundment
PROJECT NUMBER: 053-2269
LOCATION: Moab, UT

DRILLING METHOD: 3.25" ID HSA
DRILLING DATE: 12/1/2005
DRILL RIG: CME 75

DATUM: ft. amsl
AZIMUTH: N/A
COORDINATES: N: 6,665,205.00 E: 2,184,529.00

ELEVATION: 4034
INCLINATION: -90

DEPTH (feet)	BORING METHOD	SOIL PROFILE DESCRIPTION	USCS	ELEV. DEPTH (ft)	SAMPLES NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC / ATT	PENETRATION RESISTANCE BLOWS / ft ■ 10 20 30 40 WATER CONTENT (PERCENT) W_p W W_l 20 40 60 80	REMARKS
0	3.25" ID HSA / STANDARD SPLIT SPOON	0.0 - 7.6 Silty SAND with gravel, well gradeded, subrounded gravel, loose, non plastic, dry to moist, dark reddish brown (SM) (COVER SOILS) Increased moisture with depth	SM								
				4032.0 2.0	1	SS	1-1-1	2	1.5/1.5	■	
5					2	SH			2.0/2		
				4026.4 7.6	3	SS	1-1-2	3	1.5/1.5	■	
		7.6 - 15.0 Silty SAND with clay, poorly graded, very loose, non plastic, moist to wet, dark reddish brown to light olive gray (SM) (TRANSITIONAL TAILINGS)	SM		4	SH			2.0/2		
10											> 0.28 kg/cm2 penetrometer test
		Becomes wet to saturated		4022.0 12.0	5	SS	1-0-0	0	0.2/1.5	■	
				4019.0 15.0	6	SH			2/2		
15		15.0 - 21.0 Silty SAND with clay, fine grained sand, poorly graded, some coarse crystalline salt present, medium dense, non plastic, wet to saturated, light olive gray (SM) (TRANSITIONAL TAILINGS)	SM								
					7	SS	3-7-8	15	1.5/1.5	■	
20					8	SH			1.5/2		
				4013.0 21.0							
		21.0 - 23.4 Silty CLAY with little sand, very soft, low to medium plasticity, wet, dark yellowish brown (CL) (SLIMES)	CL	4010.6 23.4	9	SS	1-0-0	0	1.5/1.5	■	
25		23.4 - 26.2 Silty SAND with clay, medium to coarse grained sand, poorly graded, very loose to loose, non plastic, dark reddish brown (SM) (TRANSITIONAL TAILINGS)	SM	4007.8 26.2	10	SH			1.3/2		
		26.2 - 37.0 Silty CLAY with sand, very soft, low to medium plasticity, saturated, dark yellowish brown (CL) (SLIMES)	CL		11	SS	1-0-0	0	1.5/1.5	■	
					12	SH			0/2		
30											
					13	SS	1-0-0	0	1.5/1.5	■	
					14	SH			0/2		
35				3997.0 37.0							
		37.0 - 50.5 Silty CLAY, trace very fine grained sand, very soft, low to medium plasticity, saturated, dark yellowish brown to dark olive (CL) (SLIMES)	CL		15	SS	1-0-0	0	1.5/1.5	■	
					16	SH			0/2		
40											

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SCALE: 1 in = 5 ft
DRILLING CONTRACTOR: Boart Longyear
DRILLER:

LOGGED: RD
CHECKED: DLG
DATE: 5/10/2006

Golder Associates

RECORD OF BOREHOLE 0705

SHEET 2 of 2

PROJECT: Moab Tailings Impoundment
PROJECT NUMBER: 053-2269
LOCATION: Moab, UT

DRILLING METHOD: 3.25" ID HSA
DRILLING DATE: 12/1/2005
DRILL RIG: CME 75

DATUM: ft. amsl
AZIMUTH: N/A
COORDINATES: N: 6,665,205.00 E: 2,184,529.00

ELEVATION: 4034
INCLINATION: -90

BORING METHOD: 3.25" ID HSA / STANDARD SPLIT SPOON

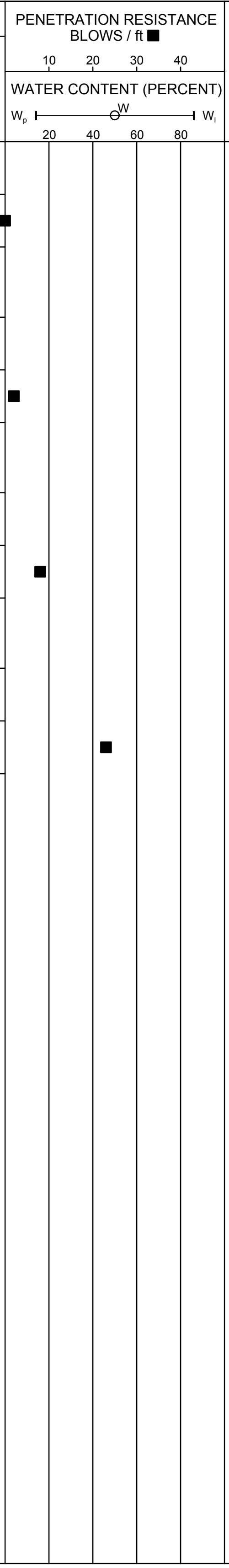
SOIL PROFILE

DEPTH (feet)	DESCRIPTION	USCS	ELEV. / DEPTH (ft)
40	37.0 - 50.5 Silty CLAY, trace very fine grained sand, very soft, low to medium plasticity, saturated, dark yellowish brown to dark olive (CL) (SLIMES) *(Continued)*	CL	3983.5 50.5
50	50.5 - 57.6 Silty CLAY, thinly stratified, medium stiff, low to medium plasticity, moist, light gray to light yellowish brown (CL-ML) (SLIMES)	CL-ML	3976.4 57.6
	57.6 - 58.0 Silty SAND, fine grained, well graded, medium dense, non plastic, moist, dark reddish brown (SM) (ALLUVIUM)	SM	

Boring completed at 58.5 ft.

SAMPLES

NUMBER	TYPE	BLOWS per 6 in (140 lb hammer 30 inch drop)	N	REC / ATT
17	SS	1-0-0	0	1.5/1.5
18	SH			1.5/2
19	SS	1-0-2	2	1.5/1.5
20	SH			2/2
21	SS	3-4-4	8	1.5/1.5
22	SH			2/2
23	SS	7-9-14	23	1.5/1.5



REMARKS

0.22 kg/cm2 penetrometer test (50 ft)

> 0.28 kg/cm2 penetrometer test (55 ft)

SCALE: 1 in = 5 ft
DRILLING CONTRACTOR: Boart Longyear
DRILLER:

LOGGED: RD
CHECKED: DLG
DATE: 5/10/2006

RECORD OF BOREHOLE 0706

SHEET 1 of 2

PROJECT: Moab Tailings Impoundment
PROJECT NUMBER: 053-2269
LOCATION: Moab, UT
DRILLING METHOD: 3.25" ID HSA
DRILLING DATE: 12/6/2005
DRILL RIG: CME 75
DATUM: ft. amsl
AZIMUTH: N/A
COORDINATES: N: 6,665,519.00 E: 2,184,273.00
ELEVATION: 4046
INCLINATION: -90

DEPTH (feet)	BORING METHOD	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	SAMPLES: NUMBER	TYPE	BLOWS per 6 in (140 lb hammer 30 inch drop)	N	REC / ATT	REMARKS
0	3.25" ID HSA / STANDARD SPLIT SPOON	0.0 - 16.7 Silty SAND with gravel, poorly graded, subrounded gravels, loose, non plastic, dry to moist, dark reddish brown (SM) (COVER SOILS/SAND TAILINGS)	SM								
						1	SS	3-3-3	6	1.5/1.5	
						2	SH			1.0/2	
5											
						3	SS	5-5-7	12	1.5/1.5	
						4	SH			1.0/2	
10											> 0.28 kg/cm2 penetrometer test
						5	SS	3-3-4	7	0.2/1.5	
						6	SH			1.0/2	
15											> 0.28 kg/cm2 penetrometer test
		16.7 - 18.4 Clayey elastic SILT, very soft, highly plastic, moist, dark yellowish brown (MH) (SLIMES)	MH		4029.3 16.7	7	SS	1-0-1	1	1.5/1.5	
		18.4 - 23.8 Clayey elastic SILT with fine grained, poorly graded sand, very soft, moist to wet, olive gray to yellowish brown (MH) (SLIMES)	MH		4027.6 18.4	8	SH			2.0/2	
20											> 0.28 kg/cm2 penetrometer test
						9	SS	1-0-1	1	1.5/1.5	
		23.8 - 33.4 Silty CLAY, uniform, very soft, highly plastic, moist, dark yellowish brown to dark reddish brown (CH) (SLIMES)	CH		4022.2 23.8	10	SH			2.0/2	
25											0.25 kg/cm2 penetrometer test
						11	SS	1-1-1	2	1.5/1.5	
						12	SH			2.0/2	
30											0.22 kg/cm2 penetrometer test
						13	SS	1-0-0	0	1.5/1.5	
		33.4 - 36.8 Clayey SILT with sand, soft, low to medium plasticity, moist, dark olive, dark yellowish brown (ML) (SLIMES)	ML		4012.6 33.4	14	SH			2.0/2	
35											> 0.28 kg/cm2 penetrometer test
		36.8 - 46.5 Clayey SILT with sand, organic odors, poorly graded, soft, non plastic, wet to saturated, olive gray to black (ML) (SLIMES)	ML		4009.2 36.8	15	SS	2-1-1	2	1.5/1.5	
						16	SH			2.0/2	
40											

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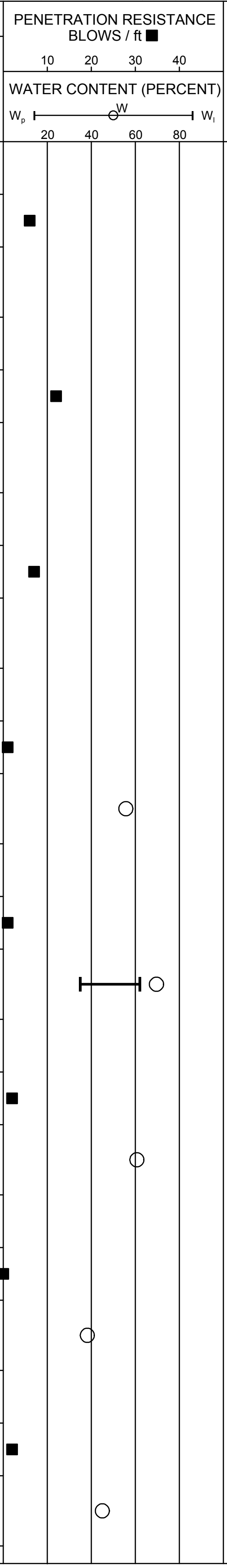


SCALE: 1 in = 5 ft
DRILLING CONTRACTOR: Boart Longyear
DRILLER:

LOGGED: RD
CHECKED: DLG
DATE: 5/10/2006

Golder Associates

BOREHOLE (WITH OR WITHOUT WELL) GAGEO 053-2269.GPJ GLDR_CO.GDT 5/12/06

RECORD OF BOREHOLE 0706

SHEET 2 of 2

PROJECT: Moab Tailings Impoundment
PROJECT NUMBER: 053-2269
LOCATION: Moab, UT

DRILLING METHOD: 3.25" ID HSA
DRILLING DATE: 12/6/2005
DRILL RIG: CME 75

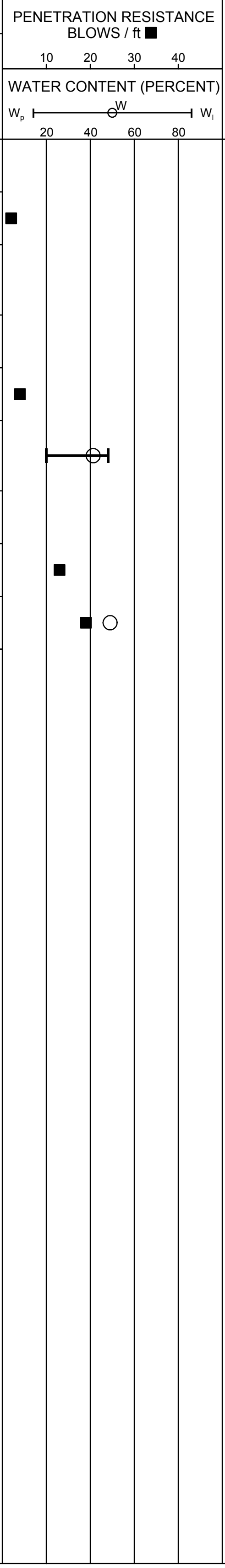
DATUM: ft. amsl
AZIMUTH: N/A
COORDINATES: N: 6,665,519.00 E: 2,184,273.00

ELEVATION: 4046
INCLINATION: -90

BORING METHOD (40 – 53 ft): 3.25" ID HSA / STANDARD SPLIT SPOON

DEPTH (feet)	SOIL PROFILE: DESCRIPTION	USCS	ELEV. / DEPTH (ft)
40	36.8 - 46.5 Clayey SILT with sand, organic odors, poorly graded, soft, non plastic, wet to saturated, olive gray to black (ML) (SLIMES) *(Continued)*	ML	3999.5 46.5
46.5	46.5 - 54.2 Silty CLAY, trace sand, thinly to thickly stratified, soft, low to medium plasticity, moist, olive gray, tan, light yellowish brown (CL) (SLIMES)	CL	3996.0 50.0
50	Becomes moderately stratified.		3991.8 54.2
54.2	54.2 - 54.5 Silty SAND, fine grained, organics, well graded, medium dense, non plastic, moist, dark reddish brown (SM) (ALLUVIUM)	SM	
	Boring completed at 54.5 ft.		

NUMBER	TYPE	BLOWS per 6 in (140 lb hammer 30 inch drop)	N	REC / ATT	REMARKS
17	SS	1-1-1	2	1.5/1.5	
18	SH			2.0/2	
					< 0.03 kg/cm2 penetrometer test
19	SS	1-2-2	4	1.5/1.5	
20	SH			2.0/2	
					> 0.28 kg/cm2 penetrometer test
21	SS	3-4-9	13	1.5/1.5	
22	SS	4-7-12	19	1.5/1.5	



SCALE: 1 in = 5 ft
DRILLING CONTRACTOR: Boart Longyear
DRILLER:

LOGGED: RD
CHECKED: DLG
DATE: 5/10/2006

Golder Associates

RECORD OF BOREHOLE 0707

SHEET 1 of 2

PROJECT: Moab Tailings Impoundment
PROJECT NUMBER: 053-2269
LOCATION: Moab, UT
DRILLING METHOD: 3.25" ID HSA
DRILLING DATE: 11/30/2005
DRILL RIG: CME 75
DATUM: ft. amsl
AZIMUTH: N/A
COORDINATES: N: 6,665,018.00 E: 2,184,420.00
ELEVATION: 4035
INCLINATION: -90

BORING METHOD: 3.25" ID HSA / STANDARD SPLIT SPOON

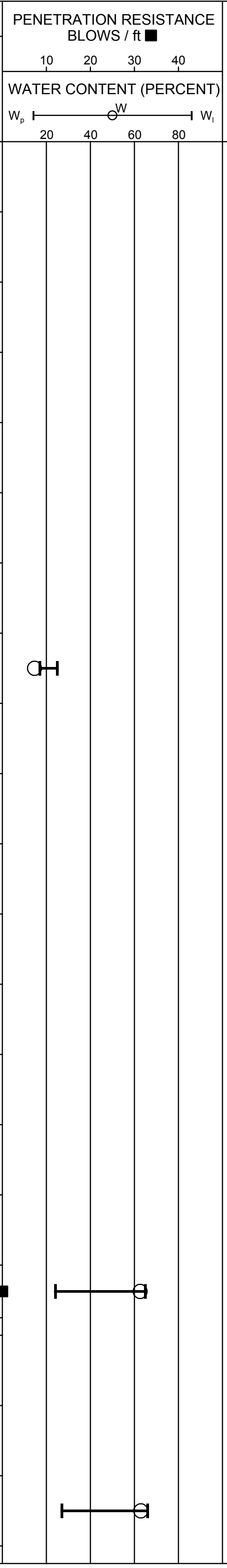
SOIL PROFILE

DESCRIPTION	USCS	ELEV. / DEPTH (ft)
0.0 - 7.0 Silty SAND with gravel, coarse to fine, well graded, subrounded gravels, loose to medium dense, non plastic, dry to moist, dark reddish brown (SM) (COVER SOILS) Increased moisture with depth	SM	4031.0 4.0 4028.0 7.0
7.0 - 11.0 Silty SAND, medium to fine grained, poorly graded sand, loose, non plastic, moist to wet, Fe staining, olive gray (SM) (SAND TAILINGS) Water present at approximately 10.0 feet below ground surface	SM	4025.0 10.0 4024.0 11.0
11.0 - 13.0 Silty SAND, small amount of clay present, fine grained, poorly graded sand, loose, non plastic, wet, olive, dark yellowish brown (SM) (SAND TAILINGS)	SM	4022.0 13.0
13.0 - 15.7 Clayey SAND with silt and gravel, fine grained, poorly graded sand, loose,low plasticity, wet, dark yellowish brown (SC) (TRANSITIONAL TAILINGS)	SC	4019.3 15.7
15.7 - 22.0 Silty SAND and GRAVEL, well graded, dense, non plastic, wet to saturated, organic odors, black (SM) (SAND TAILINGS)	SM	4013.0 22.0
22.0 - 38.0 Silty CLAY with trace to little fine grained, poorly graded sand, very soft, medium to high plasticity, moist to saturated, dark reddish brown (CH) (SLIMES) Saturated zone, thinly stratified very fine sands and silts in interval	CH	4000.0 35.0 3997.0 38.0
	CH	

Log continued on next page

SAMPLES

NUMBER	TYPE	BLOWS per 6 in (140 lb hammer 30 inch drop)	N	REC / ATT
1	SH			1.5/2
2	SH			1.5/2
3	SH			2/2
4	SH			2/2
5	SH			2/2
6	SH			1/2
7	SH			1/2
8	SH			2/2
9	SH			0/2
10	SH			0.5/2
11	SH			1/2
12	SH			0/2
13	SH			0/2
14	SH			0/2
15	SH			0/2
16	SH			0/2
17	SS	1-0-0	0	1.5/1.5
18	SH			0.5/2
19	SH			0/2
20	SH			2/2



REMARKS

DEPTH (feet): 0 5 10 15 20 25 30 35 40

SCALE: 1 in = 5 ft
DRILLING CONTRACTOR: Boart Longyear
DRILLER:

LOGGED: RD
CHECKED: DLG
DATE: 5/10/2006

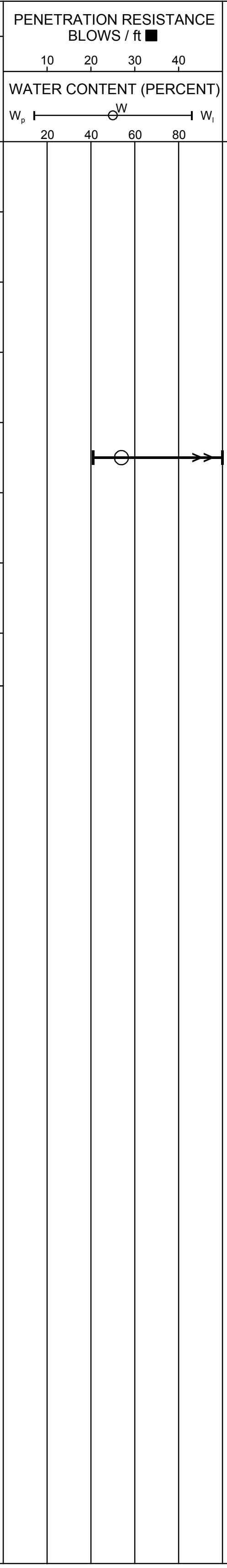
Golder Associates

RECORD OF BOREHOLE 0707

SHEET 2 of 2

PROJECT: Moab Tailings Impoundment
PROJECT NUMBER: 053-2269
LOCATION: Moab, UT
DRILLING METHOD: 3.25" ID HSA
DRILLING DATE: 11/30/2005
DRILL RIG: CME 75
DATUM: ft. amsl
AZIMUTH: N/A
COORDINATES: N: 6,665,018.00 E: 2,184,420.00
ELEVATION: 4035
INCLINATION: -90

DEPTH (feet)	BORING METHOD	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	SAMPLES: NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC / ATT	REMARKS
40	3.25" ID HSA / STANDARD SPLIT SPOON	38.0 - 46.0 Silty CLAY with little sand, fine grained sands, very soft, high plasticity, moist to wet, dark reddish brown, black (CH) (SLIMES) *(Continued)*	CH			21	SH			0/2	0.06 kg/cm2 penetrometer test
						22	SH			0/2	
45					3989.0 46.0	23	SH			0/2	
		46.0 - 48.4 Clayey SILT, soft, low to medium plasticity, moist, olive gray (ML) (SLIMES)	ML		3986.6 48.4	24	SH			2/2	
		48.4 - 53.0 Silty CLAY, thinly stratified, stiff, high plasticity, moist, reddish brown, olive gray (CH) (SLIMES)	CH			25	SH			2/2	
50						26	SH			2/2	> 0.28 kg/cm2 penetrometer test
					3982.0 53.0	27	SH			1/2	
55		53.0 - 55.5 Silty SAND, fine grained, poorly graded sand, medium to very dense, non plastic, moist, dark reddish brown (SM) (ALLUVIUM)	SM			28	SS	27-50	50	0.9/1.5	Auger TD @ 54.0', Split Spoon TD @ 55.5', finish @10:00 on 12/01/2005
		Boring completed at 55.5 ft.									
60											
65											
70											
75											
80											



SCALE: 1 in = 5 ft
DRILLING CONTRACTOR: Boart Longyear
DRILLER:

LOGGED: RD
CHECKED: DLG
DATE: 5/10/2006

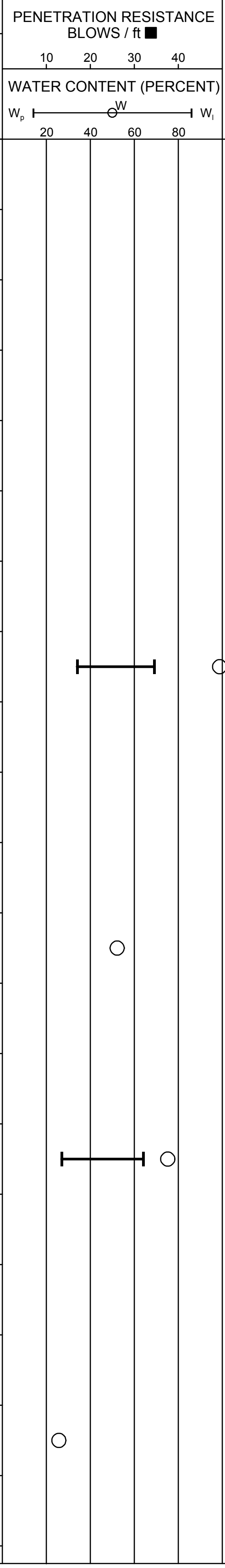
Golder Associates

RECORD OF BOREHOLE 0708

SHEET 1 of 2

PROJECT: Moab Tailings Impoundment
PROJECT NUMBER: 053-2269
LOCATION: Moab, UT
DRILLING METHOD: 3.25" ID HSA
DRILLING DATE: 11/30/2005
DRILL RIG: CME 75
DATUM: ft. amsl
AZIMUTH: N/A
COORDINATES: N: 6,664,581.00 E: 2,184,518.00
ELEVATION: 4037
INCLINATION: -90

DEPTH (feet)	BORING METHOD	SOIL PROFILE DESCRIPTION	USCS	ELEV. DEPTH (ft)	SAMPLES NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC / ATT	REMARKS
0	3.25" ID HSA / STANDARD SPLIT SPOON	0.0 - 12.0 Silty SAND with gravel, medium to fine grained sand, fine to coarse gravel, well graded, loose, non plastic, dry to moist, dark reddish brown (SM) (COVER SOILS/SAND TAILINGS)	SM		1	SH			2.0/2	No water encountered.
					2	SH			1.5/2	
5					3	SH			2.0/2	
		Decreasing gravel with depth		4031.0 6.0	4	SH			1.5/2	> 0.28 kg/cm2 penetrometer test
		becomes wet to saturated		4028.0 9.0	5	SH			2.0/2	
10					6	SH			0.0/2	> 0.28 kg/cm2 penetrometer test
		12.0 - 18.0 Clayey elastic SILT with trace to little sand, uniform, soft, high plasticity, moist, olive gray (MH) (SLIMES)	MH	4025.0 12.0	7	SH			1.0/2	0.09 kg/cm2 penetrometer test
15					8	SH			2.0/2	Unconfined Test, UU Test
					9	SH			2.0/2	
		18.0 - 26.2 Silty CLAY, moderately stratified, very soft, high plasticity, moist to wet, olive gray to dark reddish brown (CH) (SLIMES)	CH	4019.0 18.0	10	SH			2.0/2	
20					11	SH			2.0/2	
					12	SH			2.0/2	
25		Becomes primarily dark reddish brown.		4012.0 25.0	13	SH			2.0/2	0.09 kg/cm2 penetrometer test
		26.2 - 32.0 Silty CLAY, moderately stratified, very soft, high plasticity, moist, dark olive gray to black (CH) (SLIMES)	CH	4010.8 26.2	14	SH			2.0/2	
					15	SH			2.0/2	Unconfined Test, UU Test
30					16	SH			2.0/2	
		32.0 - 35.0 Silty CLAY, uniform, very soft, high plasticity, moist to wet, olive gray to dark olive gray (CH) (SLIMES)	CH	4005.0 32.0	17	SS			2.0/2	
35		35.0 - 38.0 Clayey SILT with sand, uniform, very soft, low to medium plasticity, moist to wet, yellowish brown (ML) (SLIMES)	ML	4002.0 35.0	18	SH			2.0/2	0.06 kg/cm2 penetrometer test
					19	SH			2.0/2	
			CL	3999.0 38.0	20	SH			2.0/2	
40		Log continued on next page								



SCALE: 1 in = 5 ft
DRILLING CONTRACTOR: Boart Longyear
DRILLER:
LOGGED: RD
CHECKED: DLG
DATE: 5/10/2006

Golder Associates

RECORD OF BOREHOLE 0708

SHEET 2 of 2

PROJECT: Moab Tailings Impoundment
PROJECT NUMBER: 053-2269
LOCATION: Moab, UT

DRILLING METHOD: 3.25" ID HSA
DRILLING DATE: 11/30/2005
DRILL RIG: CME 75

DATUM: ft. amsl
AZIMUTH: N/A
COORDINATES: N: 6,664,581.00 E: 2,184,518.00

ELEVATION: 4037
INCLINATION: -90

BORING METHOD: 3.25" ID HSA / STANDARD SPLIT SPOON

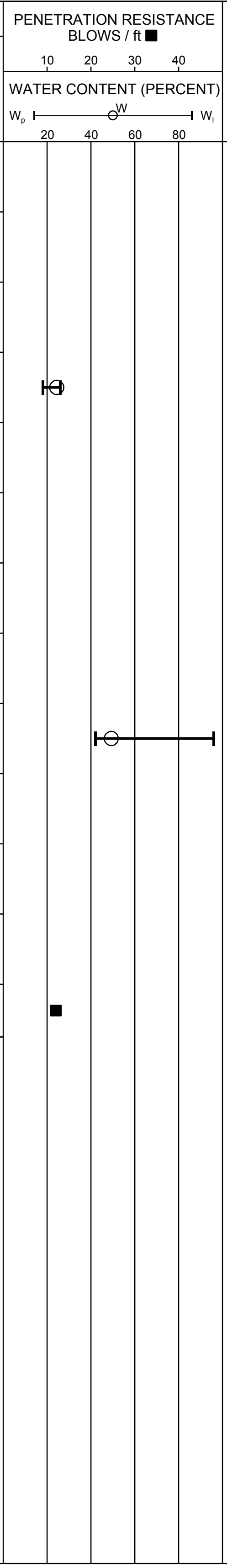
SOIL PROFILE

DESCRIPTION	USCS	ELEV. / DEPTH (ft)
38.0 - 47.0 Silty CLAY with sand, very fine grained sands, very soft to soft, low to medium plasticity, wet, dark yellowish brown (CL) (SLIMES) *(Continued)*	CL	3990.0 47.0
47.0 - 49.0 Silty CLAY, trace fine grained interbedded sands and silts, very soft, low to medium plasticity, moist, dark yellowish brown (CL) (SLIMES)	CL	3988.0 49.0
49.0 - 52.0 Silty CLAY, very soft, low to medium plasticity, moist, olive (CL-ML) (SLIMES)	CL-ML	3985.0 52.0
52.0 - 54.0 Clayey SILT, slightly stratified, very soft, low to medium plasticity, moist, olive gray to light yellowish brown (ML) (SLIMES)	ML	3983.0 54.0
54.0 - 63.6 Clayey elastic SILT, moderately stratified, stiff to very stiff, high plasticity, moist, light yellowish brown (MH) (SLIMES)	MH	3973.4 63.6
63.6 - 65.5 Silty SAND, fine grained, trace organics, poorly graded, medium dense, non plastic, moist, dark reddish brown (SM) (ALLUVIUM)	SM	

Boring completed at 65.5 ft.

SAMPLES

NUMBER	TYPE	BLOWS per 6 in (140 lb hammer 30 inch drop)	N	REC / ATT	REMARKS
21	SH			2.0/2	
22	SH			2.0/2	
23	SH			2.0/2	
24	SH			2.0/2	Unconfined Test, UU Test
25	SH			2.0/2	0.12 kg/cm2 penetrometer test
26	SH			2.0/2	0.16 kg/cm2 penetrometer test
27	SH			2.0/2	
28	SH			2.0/2	
29	SH			2.0/2	
30	SH			2.0/2	> 0.28 kg/cm2 penetrometer test
31	SH			1.5/2	
32	SH			2.0/2	
33	SS	4-5-7	12	1.0/1.5	Auger TD @ 64.0', Split Spoon TD @ 65.5', finish @14:00 on 11/30/2005



SCALE: 1 in = 5 ft
DRILLING CONTRACTOR: Boart Longyear
DRILLER:

LOGGED: RD
CHECKED: DLG
DATE: 5/10/2006

RECORD OF BOREHOLE 0709

SHEET 1 of 2

PROJECT: Moab Tailings Impoundment
PROJECT NUMBER: 053-2269
LOCATION: Moab, UT

DRILLING METHOD: 3.25" ID HSA
DRILLING DATE: 11/7/2005
DRILL RIG: CME 75

DATUM: ft. amsl
AZIMUTH: N/A
COORDINATES: N: 6,664,329.00 E: 2,184,208.00

ELEVATION: 4052
INCLINATION: -90

DEPTH (feet)	BORING METHOD	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	SAMPLES: NUMBER	TYPE	BLOWS per 6 in (140 lb hammer 30 inch drop)	N	REC / ATT	PENETRATION RESISTANCE BLOWS / ft ■ (10 20 30 40) / WATER CONTENT (PERCENT) Wp —O W— Wl (20 40 60 80)	REMARKS
0	3.25" ID HSA / STANDARD SPLIT SPOON	0.0 - 1.0 Silty SAND with gravel, well graded sands, well graded subrounded gravels, loose, non plastic, dry, reddish brown (SM) (COVER SOILS)	SM									WATER LEVEL @ 36.5 FT BGS
		1.0 - 11.2 Silty SAND, medium to fine grained sands, trace gravels, loose to medium dense, non plastic, little moisture, dark yellowish brown (SM) (SAND TAILINGS)	SM		4051.0 1.0	1	SS	4-6-6	12	1.5/1.5		
						2	SH			1/2		
5												
						3	SS	8-12-14	26	1.5/1.5		
						4	SH			1/2		
10												
		11.2 - 14.0 Silty SAND, medium to fine grained sands, trace gravels, loose, non plastic, little moisture, tan to buff (SM) (SAND TAILINGS)	SM		4040.8 11.2	5	SS	3-3-4	7	1.5/1.5		
		14.0 - 16.8 Sandy SILT with clay, medium dense, non plastic, moist, dark yellowish brown (ML) (TRANSITIONAL TAILINGS)	ML		4038.0 14.0	6	SH			2/2		
15												> 0.28 kg/cm2 penetrometer test
		16.8 - 18.8 Sandy SILT with clay, fine sand, very soft, non plastic, moist, dark yellowish brown (ML) (TRANSITIONAL TAILINGS)	ML		4035.2 16.8	7	SS	2-1-1	2	1.5/1.5		
		18.8 - 21.2 Silty SAND, fine grained, poorly graded, loose, non plastic, moist, light yellowish brown (SM) (SAND TAILINGS)	SM		4033.2 18.8	8	SH			2/2		
20												
		21.2 - 26.0 Sandy SILT with clay, fine grained sands, very soft, non plastic, moist, dark yellowish brown (ML) (TRANSITIONAL TAILINGS)	ML		4030.8 21.2	9	SS	2-1-1	2	1.5/1.5		
						10	SH			2/2		
25												> 0.28 kg/cm2 penetrometer test
		26.0 - 31.0 Sandy CLAY, little silt, fine grained sands, soft, low to medium plasticity, moist, dark yellowish brown (CL) (TRANSITIONAL TAILINGS)	CL		4026.0 26.0	11	SS	2-2-2	4	1.5/1.5		
						12	SH			2/2		
30												0.24 kg/cm2 penetrometer test
		31.0 - 36.5 Silty SAND with clay, fine grained, moderately stratified, poorly graded, loose, non plastic, moist, dark yellowish brown, (SM) (TRANSITIONAL TAILINGS)	SM		4021.0 31.0	13	SS	3-2-4	6	1.5/1.5		
						14	SH			2/2		
35												> 0.28 kg/cm2 penetrometer test
		36.5 - 46.0 Sandy SILT with clay, very fine grained sands, very soft, non plastic, wet to saturated, dark yellowish brown (ML) (TRANSITIONAL TAILINGS)	ML		4015.5 36.5	15	SS	1-0-0	0	1.5/1.5		
						16	SH			2/2		
40		Log continued on next page										

SCALE: 1 in = 5 ft
DRILLING CONTRACTOR: Boart Longyear
DRILLER:

LOGGED: RD
CHECKED: DLG
DATE: 5/10/2006

Golder Associates

RECORD OF BOREHOLE 0709

SHEET 2 of 2

PROJECT: Moab Tailings Impoundment
PROJECT NUMBER: 053-2269
LOCATION: Moab, UT
DRILLING METHOD: 3.25" ID HSA
DRILLING DATE: 11/7/2005
DRILL RIG: CME 75
DATUM: ft. amsl
AZIMUTH: N/A
COORDINATES: N: 6,664,329.00 E: 2,184,208.00
ELEVATION: 4052
INCLINATION: -90

DEPTH (feet)	BORING METHOD	SOIL PROFILE: DESCRIPTION	USCS	ELEV. / DEPTH (ft)	SAMPLES: NUMBER	TYPE	BLOWS per 6 in (140 lb hammer 30 inch drop)	N	REC / ATT	PENETRATION RESISTANCE BLOWS / ft ■ (10 20 30 40); WATER CONTENT (PERCENT) Wp W Wl (20 40 60 80)	REMARKS
40	3.25" ID HSA / STANDARD SPLIT SPOON	36.5 - 46.0 Sandy SILT with clay, very fine grained sands, very soft, non plastic, wet to saturated, dark yellowish brown (ML) (TRANSITIONAL TAILINGS) *(Continued)*	ML	4010.5 41.5							0.06 kg/cm2 penetrometer test
					17	SS	1-1-1	2	1.5/1.5	■	
		Becomes dark brown.			18	SH			2/2		
45				4006.0							0.06 kg/cm2 penetrometer test
		46.0 - 49.0 Silty SAND with little clay, unstratified, uniform, fine grained, poorly graded, very loose, non plastic, moist, olive gray (SM) (TRANSITIONAL TAILINGS)	SM	46.0	19	SS	2-0-0	0	1.5/1.5	■	
		49.0 - 58.5 Silty CLAY with sand, uniform, very fine sands, soft, low to medium plasticity, moist, light to dark olive gray, black (CL-ML) (TRANSITIONAL TAILINGS)	CL-ML	4003.0 49.0	20	SH			2/2		
50											> 0.28 kg/cm2 penetrometer test
		Becomes light olive gray.		4000.5 51.5	21	SS	2-2-2	4	1.5/1.5	■	
					22	SH			2/2		
55											> 0.28 kg/cm2 penetrometer test
					23	SS	2-2-3	5	1.5/1.5	■	
		58.5 - 61.5 Sandy SILT, some clay, very fine grained sands, soft, non plastic, moist, olive gray (ML) (TRANSITIONAL TAILINGS)	ML	3993.5 58.5	24	SH			2/2		
60											
		61.5 - 64.0 Silty CLAY, little fine grained sand, moderately stratified, soft, low to medium plasticity, gray to reddish brown (CL-ML) (TRANSITIONAL TAILINGS)	CL-ML	3990.5 61.5	25	SS	2-2-2	4	1.5/1.5	■	
		64.0 - 65.8 Silty SAND, weathered sandstone, poorly graded, very dense, non plastic, little moisture, dark reddish brown (SM) (ALLUVIUM)	SM	3988.0 64.0	26	SH			1/2		
65					27	SS	50-0-0	0	0.75/0.75	■	Auger TD @ 65.0', Split Spoon TD @ 65.75', finish @13:25 on 11/07/2005
		Boring completed at 65.75 ft.									
70											
75											
80											

SCALE: 1 in = 5 ft
DRILLING CONTRACTOR: Boart Longyear
DRILLER:

LOGGED: RD
CHECKED: DLG
DATE: 5/10/2006

RECORD OF BOREHOLE 0710

SHEET 1 of 2

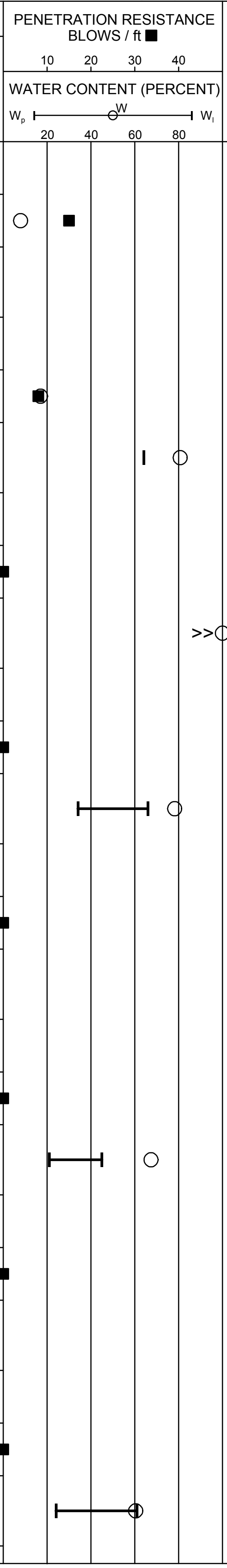
PROJECT: Moab Tailings Impoundment
PROJECT NUMBER: 053-2269
LOCATION: Moab, UT
DRILLING METHOD: 3.25" ID HSA
DRILLING DATE: 12/1/2005
DRILL RIG: CME 75
DATUM: ft. amsl
AZIMUTH: N/A
COORDINATES: N: 6,664,765.00 E: 2,184,110.00
ELEVATION: 4039
INCLINATION: -90

BORING METHOD: 3.25" ID HSA / STANDARD SPLIT SPOON

SOIL PROFILE			
DESCRIPTION	USCS	GRAPHIC LOG	ELEV. DEPTH (ft)
0.0 - 4.0 Silty SAND with gravel, fine grained sands, medium to fine grained subrounded gravels, loose to medium dense, non plastic, dry to moist, dark reddish brown (SM) (COVER SOILS)	SM		4035.0 4.0
4.0 - 7.9 Silty SAND with clay, interbedded plastic clay lenses, fine grained sand, poorly graded, loose, non plastic, moist, dark reddish brown (SP-SC) (TRANSITIONAL TAILINGS)	SP-SC		4031.1 7.9
7.9 - 13.2 Clayey elastic SILT with sand, very soft, moist, dark yellowish brown (MH) (SLIMES)	MH		4025.8 13.2
13.2 - 21.0 Clayey elastic SILT, trace to some fine sands, uniform, very soft, high plasticity, moist to saturated, dark yellowish brown (MH) (SLIMES)	MH		4018.0 21.0
21.0 - 38.0 Silty CLAY, uniform, very soft, low to medium plasticity, wet, dark yellowish brown to black (CL) (SLIMES)	CL		4001.0 38.0
38.0 - 42.6 Silty CLAY, uniform, very soft, high plasticity, wet, dark yellowish brown to black (CH) (SLIMES)	CH		

Log continued on next page

SAMPLES					
NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC / ATT	REMARKS
1	SS	4-5-10	15	1.5/1.5	
2	SH			2.0/2	
3	SS	4-6-2	8	1.5/1.5	
4	SH			2/2	
					0.16 kg/cm2 penetrometer test
5	SS	1-0-0	0	0.5/1.5	
6	SH			2/2	
7	SS	1-0-0	0	1.5/1.5	
8	SH			2/2	
9	SS	1-0-0	0	1.5/1.5	
10	SH			2/2	
					< 0.06 kg/cm2 penetrometer test
11	SS	1-0-0	0	1.5/1.5	
12	SH			2/2	
					0.12 kg/cm2 penetrometer test
13	SS	1-0-0	0	1.5/1.5	
14	SH			2/2	
					0.22 kg/cm2 penetrometer test
15	SS	1-0-0	0	1.5/1.5	
16	SH			2/2	



DEPTH (feet): 0, 5, 10, 15, 20, 25, 30, 35, 40

SCALE: 1 in = 5 ft
DRILLING CONTRACTOR: Boart Longyear
DRILLER:

LOGGED: RD
CHECKED: DLG
DATE: 5/10/2006

Golder Associates

RECORD OF BOREHOLE 0710

SHEET 2 of 2

PROJECT: Moab Tailings Impoundment
PROJECT NUMBER: 053-2269
LOCATION: Moab, UT

DRILLING METHOD: 3.25" ID HSA
DRILLING DATE: 12/1/2005
DRILL RIG: CME 75

DATUM: ft. amsl
AZIMUTH: N/A
COORDINATES: N: 6,664,765.00 E: 2,184,110.00

ELEVATION: 4039
INCLINATION: -90

DEPTH (feet)	BORING METHOD	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	SAMPLES: NUMBER	TYPE	BLOWS per 6 in (140 lb hammer 30 inch drop)	N	REC / ATT	PENETRATION RESISTANCE BLOWS / ft ■ (10 20 30 40) / WATER CONTENT (PERCENT) W	REMARKS
40		38.0 - 42.6 Silty CLAY, uniform, very soft, high plasticity, wet, dark yellowish brown to black (CH) (SLIMES) *(Continued)*	CH		3996.4 42.6	17	SS	1-0-0	0	1.5/1.5	■	0.22 kg/cm2 penetrometer test
		42.6 - 45.0 Silty CLAY, soft to stiff, low to medium plasticity, moist, medium gray (CL-ML) (SLIMES)	CL-ML		3994.0 45.0	18	SH			2/2		
45		45.0 - 46.5 Silty SAND, fine grained, poorly graded, medium dense, non plastic, moist, organics, dark reddish brown (SM) (ALLUVIUM)	SM			19	SS	6-7-11	18	1.5/1.5	○ ■	> 0.28 kg/cm2 penetrometer test Auger TD @ 45.0', Split Spoon TD @ 46.5', finish @08:30 on 12/05/2005
		Boring completed at 46.5 ft.										
50												
55												
60												
65												
70												
75												
80												

Water content scale: W_p ⊢—○W—⊣ W_l; 20 40 60 80

SCALE: 1 in = 5 ft
DRILLING CONTRACTOR: Boart Longyear
DRILLER:

LOGGED: RD
CHECKED: DLG
DATE: 5/10/2006

Golder Associates

RECORD OF BOREHOLE 0711

SHEET 1 of 2

PROJECT: Moab Tailings Impoundment
PROJECT NUMBER: 053-2269
LOCATION: Moab, UT

DRILLING METHOD: 3.25" ID HSA
DRILLING DATE: 12/5/2005
DRILL RIG: CME 75

DATUM: ft. amsl
AZIMUTH: N/A
COORDINATES: N: 665,328.00 E: 2,184,167.00

ELEVATION: 4043
INCLINATION: -90

		SOIL PROFILE				SAMPLES					PENETRATION RESISTANCE BLOWS / ft ■	
DEPTH (feet)	BORING METHOD	DESCRIPTION	USCS	GRAPHIC LOG	ELEV. DEPTH (ft)	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC / ATT	10 20 30 40 WATER CONTENT (PERCENT) W_p W W_l 20 40 60 80	REMARKS
0	3.25" ID HSA / STANDARD SPLIT SPOON	0.0 - 8.0 Silty SAND with gravel, fine grained sand, fine to medium grained subrounded gravels, well graded, very loose to loose, non plastic, dry to moist, dark reddish brown (SM) (COVER SOILS)	SM									
						1	SS	3-2-1	3	1.5/1.5	■	
						2	SH			2.0/2		
5												> 0.28 kg/cm2 penetrometer test
						3	SS	2-2-2	4	1.5/1.5	■	
		8.0 - 13.0 SAND with silt, little gravel, trace clays, fine grained, poorly graded, very loose to loose, non plastic, moist to wet, dark reddish brown (SP-SM) (SAND TAILINGS)	SP-SM		4035.0 8.0	4	SH			2.0/2		
10												> 0.28 kg/cm2 penetrometer test
						5	SS	4-4-4	8	1.5/1.5	■	
		13.0 - 16.4 SAND with silt and clay, fine grained, poorly graded, loose, non plastic, wet, dark yellowish brown (SP-SM) (SAND TAILINGS)	SP-SM		4030.0 13.0	6	SH			2.0/2		
15												> 0.28 kg/cm2 penetrometer test
		16.4 - 22.6 Clayey SILT with little sand, fine grained sand, very soft, low to medium plasticity, wet, yellowish brown (ML) (SLIMES)	ML		4026.6 16.4	7	SS	1-0-0	0	1.5/1.5	■	
						8	SH			2.0/2		
20												> 0.28 kg/cm2 penetrometer test
						9	SS	1-0-0	0	1.5/1.5	■	
		22.6 - 36.5 Silty CLAY, trace sand, uniform, very soft, high plasticity, moist, dark yellowish brown (CH) (SLIMES)	CH		4020.4 22.6	10	SH			2.0/2		
25												0.22 kg/cm2 penetrometer test
						11	SS	1-0-0	0	1.5/1.5	■	
						12	SH			2.0/2		
30												0.22 kg/cm2 penetrometer test
		Becomes dark olive gray to dark yellowish brown			4011.0 32.0	13	SS	1-0-0	0	1.5/1.5	■	
						14	SH			2.0/2		
35												0.22 kg/cm2 penetrometer test
		36.5 - 49.0 Silty CLAY, trace fine sand lenses, with thicker clayey sand lenses with depth, uniform, very soft, high plasticity, moist to very moist with increasing depth, olive gray (CH) (SLIMES)	CH		4006.5 36.5	15	SS	1-1-1	2	1.5/1.5	■	
						16	SH			2.0/2		
40		Log continued on next page										

SCALE: 1 in = 5 ft
DRILLING CONTRACTOR: Boart Longyear
DRILLER:

LOGGED: RD
CHECKED: DLG
DATE: 5/10/2006

Golder Associates

RECORD OF BOREHOLE 0711

SHEET 2 of 2

PROJECT: Moab Tailings Impoundment
PROJECT NUMBER: 053-2269
LOCATION: Moab, UT
DRILLING METHOD: 3.25" ID HSA
DRILLING DATE: 12/5/2005
DRILL RIG: CME 75
DATUM: ft. amsl
AZIMUTH: N/A
COORDINATES: N: 665,328.00 E: 2,184,167.00
ELEVATION: 4043
INCLINATION: -90

DEPTH (feet)	BORING METHOD	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	SAMPLES: NUMBER	TYPE	BLOWS per 6 in (140 lb hammer 30 inch drop)	N	REC / ATT	PENETRATION RESISTANCE BLOWS / ft ■ (10 20 30 40) / WATER CONTENT (PERCENT) Wp —○W— Wl (20 40 60 80)	REMARKS
40	3.25" ID HSA / STANDARD SPLIT SPOON	36.5 - 49.0 Silty CLAY, trace fine sand lenses, with thicker clayey sand lenses with depth, uniform, very soft, high plasticity, moist to very moist with increasing depth, olive gray (CH) (SLIMES) *(Continued)*	CH	▨								0.22 kg/cm2 penetrometer test
						17	SS	1-1-1	2	1.5/1.5	■	
						18	SH			2.0/2		
45												> 0.28 kg/cm2 penetrometer test
						19	SS	1-2-2	4	1.5/1.5	■	
		49.0 - 51.5 Clayey SILT, thinly stratified, medium stiff to stiff, low to medium plasticity, moist, olive gray, yellowish brown (ML) (SLIMES)	ML		3994.0 49.0	20	SH			1.0/2		
50												> 0.28 kg/cm2 penetrometer test
		51.5 - 53.0 Silty SAND with gravel, fine grain sands and gravel fragments, medium dense, non plastic, moist, organics, dark reddish brown (SM) (ALLUVIUM)	SM		3991.5 51.5	21	SS	13-8-8	16	1.0/1.5	■	Auger TD @ 51.5', Split Spoon TD @ 53.0', finish @14:25 on 12/05/2005
		Boring completed at 53 ft.										
55												
60												
65												
70												
75												
80												

SCALE: 1 in = 5 ft
DRILLING CONTRACTOR: Boart Longyear
DRILLER:

LOGGED: RD
CHECKED: DLG
DATE: 5/10/2006

Golder Associates

RECORD OF BOREHOLE 0712

SHEET 1 of 2

PROJECT: Moab Tailings Impoundment
PROJECT NUMBER: 053-2269
LOCATION: Moab, UT
DRILLING METHOD: 3.25" ID HSA
DRILLING DATE: 11/4/2005
DRILL RIG: CME75
DATUM: ft. amsl
AZIMUTH: N/A
COORDINATES: N: 6,664,512.00 E: 2,183,800.00
ELEVATION: 4055
INCLINATION: -90

BORING METHOD: 3.25" ID HSA / STANDARD SPLIT SPOON

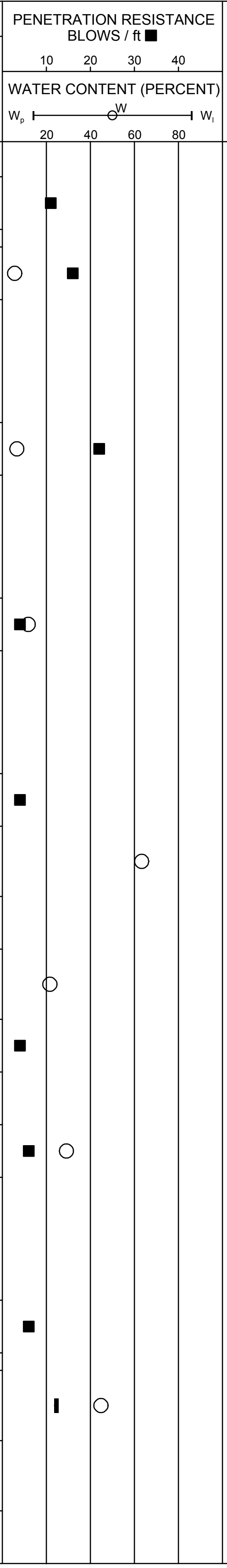
SOIL PROFILE

DESCRIPTION	USCS	ELEV. / DEPTH (ft)
0.0 - 0.5 Gravelly SAND with silt, fine to medium grained sands and gravels, subrounded gravels, well graded, loose, non plastic, dry, reddish brown (SW-SM) (COVER SOILS)	SW-SM	4054.5 0.5
0.5 - 7.0 Silty SAND, fine grained, poorly graded, medium dense, non plastic, little moisture, reddish brown (SM) (SAND TAILINGS)	SM	4048.0 7.0
7.0 - 18.0 Silty SAND, fine grained, poorly graded, medium dense, non plastic, little moisture, buff, tan (SM) (SAND TAILINGS)	SM	4042.0 13.0
Becomes very loose.		4037.0 18.0
18.0 - 22.0 Sandy SILT with interbedded clays, fine grained, poorly graded, very loose to loose, non plastic, little moisture, medium tan (ML) (SLIMES)	ML	4033.0 22.0
22.0 - 28.0 Silty clayey SAND, fine grained, poorly graded, very loose to loose, low plasticity, moist, tan, light brown (SC) (SAND TAILINGS)	SC	4030.0 25.0
Interbedded lenses of clay.		4027.0 28.0
28.0 - 32.8 Silty clayey SAND, fine grained, poorly graded, very loose to loose, non plastic, moist, tan, light brown (SC) (TRANSITIONAL TAILINGS)	SC	4022.2 32.8
32.8 - 47.0 Silty CLAY with sand, very soft to medium stiff, low plasticity, moist, dark yellowish brown (ML) (TRANSITIONAL TAILINGS)	ML	4016.0 39.0
Interbedded fine grained sands.		

Log continued on next page

SAMPLES

NUMBER	TYPE	BLOWS per 6 in (140 lb hammer 30 inch drop)	N	REC / ATT	REMARKS
1	SS	5-5-6	11	1.5/1.5	
2	SS	6-8-8	16	1.5/1.5	
3	SS	8-11-11	22	1.2/1.5	
4	SS	2-2-2	4	1.5/1.5	
5	SS	1-2-2	4	1.5/1.5	
6	SH			2/2	> 0.19 kg/cm2 penetrometer test
7	SH			2/2	
8	SS	3-2-2	4	1.5/1.5	
9	SS	3-3-3	6	1.5/1.5	
10	SS	1-3-3	6	1.5/1.5	
11	SH			2/2	> 0.22 kg/cm2 penetrometer test
12	SH			2/2	



SCALE: 1 in = 5 ft
DRILLING CONTRACTOR: Boart Longyear
DRILLER:
LOGGED: RD
CHECKED: DLG
DATE: 5/10/2006

Golder Associates

RECORD OF BOREHOLE 0712

SHEET 2 of 2

PROJECT: Moab Tailings Impoundment
PROJECT NUMBER: 053-2269
LOCATION: Moab, UT

DRILLING METHOD: 3.25" ID HSA
DRILLING DATE: 11/4/2005
DRILL RIG: CME75

DATUM: ft. amsl
AZIMUTH: N/A
COORDINATES: N: 6,664,512.00 E: 2,183,800.00

ELEVATION: 4055
INCLINATION: -90

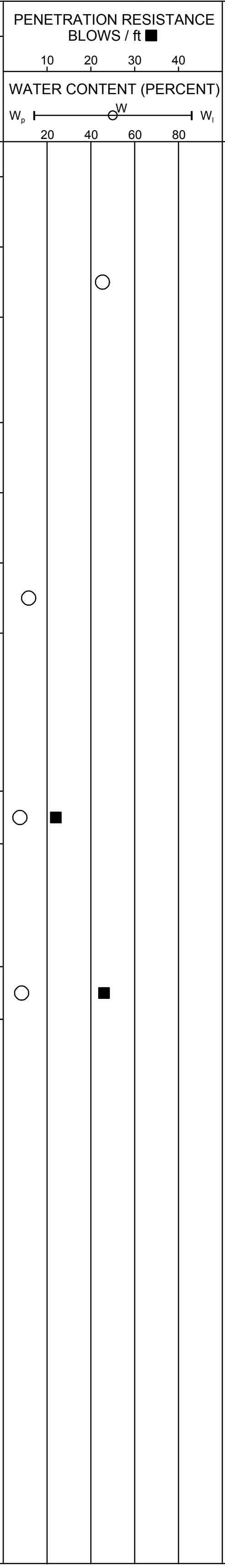
BORING METHOD: 3.25" ID HSA / STANDARD SPLIT SPOON

SOIL PROFILE

DEPTH (feet)	DESCRIPTION	USCS	ELEV. / DEPTH (ft)
40	32.8 - 47.0 Silty CLAY with sand, very soft to medium stiff, low plasticity, moist, dark yellowish brown (ML) (TRANSITIONAL TAILINGS) *(Continued)* Interbedded fine grained sands.	ML	4012.0 43.0 4008.0 47.0
	47.0 - 52.0 Silty CLAY, uniform, medium stiff to stiff, low to medium plasticity, moist, light to medium gray (CL-ML) (SLIMES)	CL-ML	4003.0 52.0
	52.0 - 65.0 Silty SAND with trace to little gravel, fine grained, poorly graded, loose to medium dense, non plastic, little moisture, deep reddish brown, (SM) (ALLUVIUM) Increased sandstone and mudstone fragments with depth, medium dense, little moisture	SM	3991.5 63.5
65	Boring completed at 65 ft.		

SAMPLES

NUMBER	TYPE	BLOWS per 6 in (140 lb hammer 30 inch drop)	N	REC / ATT	REMARKS
12	SH			2/2	> 0.28 kg/cm2 penetrometer test
13	SH			2/2	> 0.28 kg/cm2 penetrometer test
14	SH			2/2	0.28 kg/cm2 penetrometer test
15	SH			1.3/2	
16	SS	5-6-6	12	1.5/1.5	
17	SS	12-13-10	23	1.5/1.5	Auger TD @ 63.5', Split Spoon TD @ 65.0', finish @15:40 on 11/04/2005



SCALE: 1 in = 5 ft
DRILLING CONTRACTOR: Boart Longyear
DRILLER:

LOGGED: RD
CHECKED: DLG
DATE: 5/10/2006

Golder Associates

RECORD OF BOREHOLE 0713

SHEET 1 of 1

PROJECT: Moab Tailings Impoundment
PROJECT NUMBER: 053-2269
LOCATION: Moab, UT
DRILLING METHOD: 3.25" ID HSA
DRILLING DATE: 11/3/2005
DRILL RIG: CME 75
DATUM: ft. amsl
AZIMUTH: N/A
COORDINATES: N: 6,664,822.00 E: 2,183,547.00
ELEVATION: 4049
INCLINATION: -90

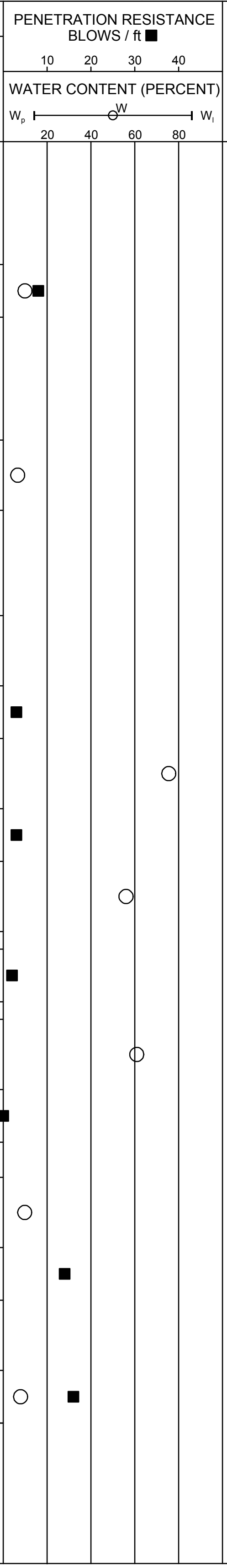
BORING METHOD: 3.25" ID HSA / STANDARD SPLIT SPOON

SOIL PROFILE

DESCRIPTION	USCS	ELEV. DEPTH (ft)
0.0 - 0.5 Silty SAND and gravel, fine to medium grained sand, subrounded gravel, well graded, loose, non plastic, dry, reddish brown (SM) (COVER SOILS)	SM	4048.5 0.5
0.5 - 13.0 Silty SAND with intermittent clays, fine to medium grained, poorly graded, loose, non plastic, moist, yellowish brown to light reddish brown (SM) (SAND TAILINGS)	SM	4042.0 7.0
Interbedded clays		4036.0 13.0
13.0 - 27.0 Sandy SILT, very soft, non plastic, moist, tan to black (ML) (SLIMES)	ML	4028.5 20.5
Increased fines and fine grained sands with depth		4022.0 27.0
27.0 - 31.5 Silty SAND with clay and trace gravel, very soft, non plastic, moist, dark reddish brown (SM) (TRANSITIONAL TAILINGS)	SM	4017.5 31.5
31.5 - 36.5 Silty SAND with little gravel, fine grained, poorly graded, medium dense, non plastic, little moisture, organics, dark reddish brown (SM) (ALLUVIUM)	SM	
Boring completed at 36.5 ft.		

SAMPLES

NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC / ATT	REMARKS
1	SS	3-4-4	8	1.5/1.5	
2	SH			2/2	
3	SH			1/2	0.16 kg/cm2 penetrometer test
4	SS	1-2-1	3	1.5/1.5	> 0.15 kg/cm2 penetrometer test
5	SH			2/2	
6	SS	1-2-1	3	1.5/1.5	
7	SH			2/2	
8	SS	1-1-1	2	1.5/1.5	
9	SH			2/2	
10	SS	1-0-0	0	1.5/1.5	
11	SH			2/2	
12	SS	7-7-7	14	1/1.5	0.15 kg/cm2 penetrometer test
13	SS	7-8-8	16	1.3/1.5	Auger TD @ 35.0', Split Spoon TD @ 36.5', finish @09:15 on 11/04/2005



SCALE: 1 in = 5 ft
DRILLING CONTRACTOR: Boart Longyear
DRILLER:
LOGGED: RD
CHECKED: DLG
DATE: 5/10/2006

Golder Associates

RECORD OF BOREHOLE 0714

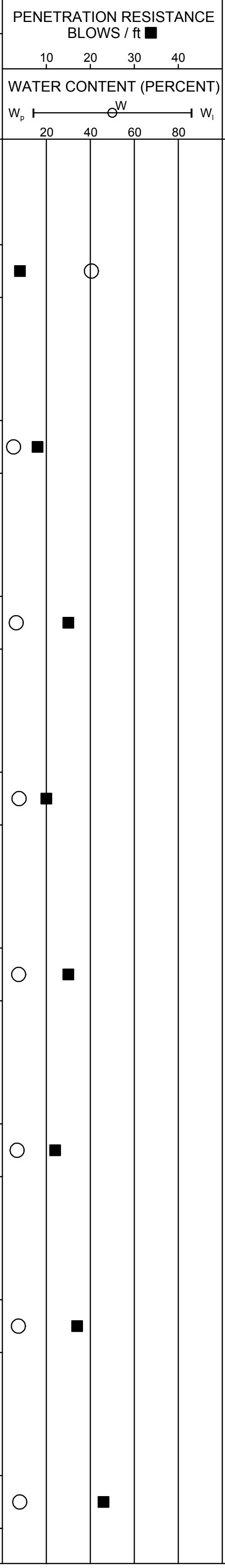
SHEET 1 of 1

PROJECT: Moab Tailings Impoundment
PROJECT NUMBER: 053-2269
LOCATION: Moab, UT
DRILLING METHOD: 3.25" ID HSA
DRILLING DATE: 11/3/2005
DRILL RIG: CME 75
DATUM: ft. amsl
AZIMUTH: N/A
COORDINATES: N: 6,665,287.00 E: 2,183,168.00
ELEVATION: 4039
INCLINATION: -90

BORING METHOD: 3.25" ID HSA / STANDARD SPLIT SPOON

DEPTH (feet)	DESCRIPTION	USCS	ELEV. / DEPTH (ft)	NUMBER	TYPE	BLOWS per 6 in (140 lb hammer 30 inch drop)	N	REC / ATT	REMARKS
0.0 - 0.5	Silty SAND with gravel, fine to coarse grained sands and gravels, well graded, subrounded to angular, loose, non plastic, dry, dark reddish brown (SM) (COVER SOILS)	SM							
0.5 - 7.0	Sandy SILT, fine grained sand, trace gravels, little interbedded clays, soft, non plastic, moist, dark reddish brown (ML) (TRANSITIONAL TAILINGS)	ML	4038.5 0.5	1	SS	2-1-3	4	1.5/1.5	
7.0 - 13.0	Silty SAND, medium to fine grained, small amount of gravel, loose, non plastic, little moisture to moist, reddish brown to dark reddish brown (SM) (SAND TAILINGS)	SM	4032.0 7.0	2	SS	6-4-4	8	1/1.5	
13.0 - 23.0	Increasing silts and moisture with depth (TRANSITIONAL TAILINGS)	SM	4026.0 13.0	3	SS	4-5-10	15	1.2/1.5	
				4	SS	6-5-5	10	1.5/1.5	
23.0 - 28.0	Sandy SILT with fine sandstone fragments, fine to medium grained, well graded, stiff, non plastic, little moisture, dark reddish brown (ML) (ALLUVIUM)	ML	4016.0 23.0	5	SS	6-7-8	15	1.2/1.5	
28.0 - 33.0	Silty SAND with fine sandstone fragments, fine to medium grained, well graded, medium dense, non plastic, little moisture, dark reddish brown (SM) (ALLUVIUM)	SM	4011.0 28.0	6	SS	8-6-6	12	1.2/1.5	
33.0 - 38.0	Sandy SILT with fine sandstone fragments, fine to medium grained, well graded, stiff, non plastic, little moisture, dark reddish brown (ML) (ALLUVIUM)	ML	4006.0 33.0	7	SS	6-8-9	17	1.2/1.5	
38.0 - 39.5	Silty SAND, medium to coarse grained, poorly graded, medium dense, non plastic, moist, reddish brown (SM) (ALLUVIUM)	SM	4001.0 38.0	8	SS	8-9-14	23	1/1.5	Auger TD @ 38.0', Split Spoon TD @ 39.5', finish

Boring completed at 39.5 ft.



SCALE: 1 in = 5 ft
DRILLING CONTRACTOR: Boart Longyear
DRILLER:

LOGGED: RD
CHECKED: DLG
DATE: 5/10/2006

Golder Associates

RECORD OF BOREHOLE 0715

SHEET 1 of 2

PROJECT: Moab Tailings Impoundment
PROJECT NUMBER: 053-2269
LOCATION: Moab, UT
DRILLING METHOD: 3.25" ID HSA
DRILLING DATE: 11/10/2005
DRILL RIG: CME 75
DATUM: ft. amsl
AZIMUTH: N/A
COORDINATES: N: 6,665,116.00 E: 2,184,856.00
ELEVATION: 4046
INCLINATION: -90

BORING METHOD: 3.25" ID HSA / STANDARD SPLIT SPOON

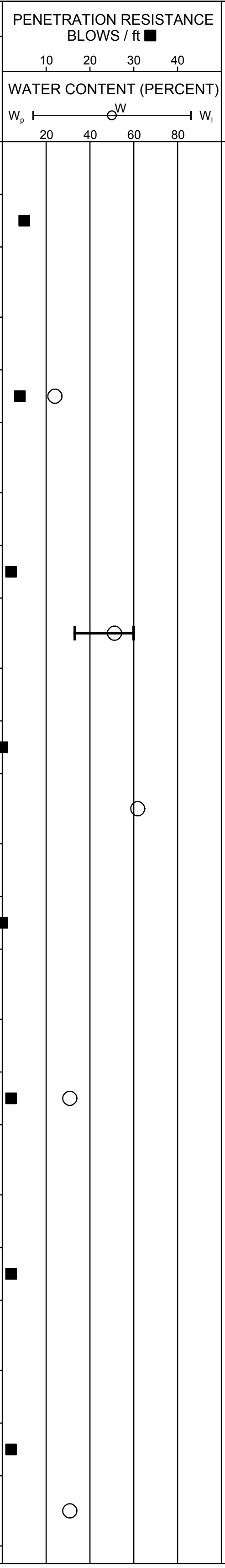
SOIL PROFILE

DESCRIPTION	USCS	ELEV. / DEPTH (ft)
0.0 - 3.2 Silty SAND with gravel, coarse sand, medium to coarse gravel, well graded, subround gravels, loose, non plastic, dry to moist, reddish brown (SM) (COVER SOILS)	SM	4042.8 3.2
3.2 - 8.0 Silty SAND with trace gravel, fine grained sand, poorly graded, very loose to loose, non plastic, moist, light yellowish brown to brown (SM) (TRANSITIONAL TAILINGS)	SM	4039.0 7.0
Little clay present.		4038.0 8.0
8.0 - 11.0 Silty SAND, fine grained, poorly graded, small amount of interbedded fines, loose, non plastic, moist, dark reddish brown, dark yellowish brown (SM) (SAND TAILINGS)	SM	4035.0 11.0
11.0 - 18.0 Sandy elastic SILT with clay, very soft, plastic, moist, yellowish brown (MH) (SLIMES)	MH	4028.0 18.0
18.0 - 23.0 Decreasing fines (TRANSITIONAL TAILINGS)	MH	4023.0 23.0
23.0 - 37.8 Silty SAND with clay, predominantly fine grained sands, poorly graded, loose, non plastic, moist to wet, olive gray, dark yellowish brown (SM) (TRANSITIONAL TAILINGS)	SM	4018.0 28.0
Becoms very wet, very loose		4008.2 37.8
37.8 - 43.0 Silty CLAY with little to some fine grained sand, soft, low to medium plasticity, moist, dark yellowish brown (CL-ML) (SLIMES)	CL-ML	

Log continued on next page

SAMPLES

NUMBER	TYPE	BLOWS per 6 in (140 lb hammer 30 inch drop)	N	REC / ATT	REMARKS
1	SS	1-3-2	5	1.5/1.5	
2	SH			1.3/2	
3	SS	1-2-2	4	1.5/1.5	
4	SH			2/2	
5	SS	1-1-1	2	1.5/1.5	
6	SH			2/2	Unconfined Test, UU Test > 0.28 kg/cm2 penetrometer test
7	SS	1-0-0	0	1.5/1.5	
8	SH			2/2	> 0.28 kg/cm2 penetrometer test
9	SS	1-0-0	0	1.5/1.5	
10	SH			1/2	
11	SS	1-1-1	2	0.5/1.5	
12	SH			0.5/2	
13	SS	1-1-1	2	1.5/1.5	
14	SH			2/2	
15	SS	1-1-1	2	1.5/1.5	
16	SH			2/2	Unconfined Test, UU Test



SCALE: 1 in = 5 ft
DRILLING CONTRACTOR: Boart Longyear
DRILLER:
LOGGED: RD
CHECKED: DLG
DATE: 5/10/2006

Golder Associates

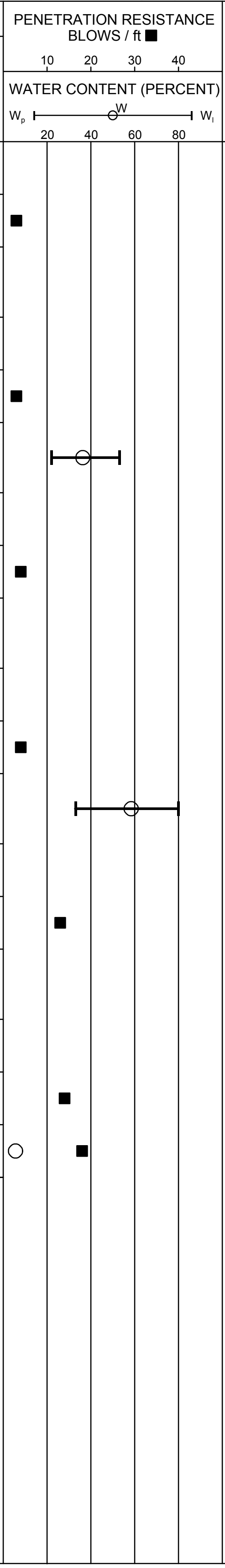
RECORD OF BOREHOLE 0715

SHEET 2 of 2

PROJECT: Moab Tailings Impoundment	DRILLING METHOD: 3.25" ID HSA	DATUM: ft. amsl	ELEVATION: 4046
PROJECT NUMBER: 053-2269	DRILLING DATE: 11/10/2005	AZIMUTH: N/A	INCLINATION: -90
LOCATION: Moab, UT	DRILL RIG: CME 75	COORDINATES: N: 6,665,116.00 E: 2,184,856.00	

BORING METHOD: 3.25" ID HSA / STANDARD SPLIT SPOON

DEPTH (feet)	SOIL PROFILE DESCRIPTION	USCS	ELEV. DEPTH (ft)	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC / ATT	REMARKS
40	37.8 - 43.0 Silty CLAY with little to some fine grained sand, soft, low to medium plasticity, moist, dark yellowish brown (CL-ML) (SLIMES) *(Continued)*	CL-ML							0.25 kg/cm2 penetrometer test
				17	SS	1-2-1	3	1.5/1.5	
	43.0 - 47.6 Silty SAND with clay, fine grained, poorly graded, very loose, non plastic, wet, olive gray (SP-SM) (TRANSITIONAL TAILINGS)	SP-SM	4003.0 43.0	18	SH			2/2	
45									
				19	SS	1-2-1	3	1.5/1.5	
	47.6 - 53.4 Silty CLAY, uniform, soft, high plasticity, moist, medium yellowish brown (CH) (SLIMES)	CH	3998.4 47.6	20	SH			2/2	
50									> 0.28 kg/cm2 penetrometer test
				21	SS	1-2-2	4	1.5/1.5	
	53.4 - 56.2 SILT with clay, trace fine grained sands, very soft, non plastic, moist, dark olive gray (ML) (SLIMES)	ML	3992.6 53.4	22	SH			2/2	
55									> 0.28 kg/cm2 penetrometer test
	56.2 - 58.4 Silty CLAY with trace sand, uniform, soft, low to medium plasticity, moist, dark yellowish brown (CL-ML) (SLIMES)	CL-ML	3989.8 56.2	23	SS	1-2-2	4	1.5/1.5	
	58.4 - 63.0 CLAY with silt, medium stiff to stiff, high plasticity, moist, light olive gray (CH) (SLIMES)	CH	3987.6 58.4	24	SH			2/2	Unconfined Test, UU Test
60									0.22 kg/cm2 penetrometer test
				25	SS	2-6-7	13	1.5/1.5	
	63.0 - 67.0 Sandy SILT with little clay, very fine grained sands, stiff, non plastic, moist, medium gray (ML) (TRANSITIONAL TAILINGS)	ML	3983.0 63.0	26	SH			2/2	
65									
	67.0 - 69.5 Silty SAND with trace gravel, mostly medium to fine grained well graded sands, organics, medium dense, non plastic, dark reddish brown (SM) (ALLUVIUM)	SM	3979.0 67.0	27	SS	7-7-7	14	1.5/1.5	
				28	SS	10-7-11	18	1.5/1.5	Auger TD @ 68.0', Split Spoon TD @ 69.5', finish @16:25 on 11/10/2005
70	Boring completed at 69.5 ft.								
75									
80									



SCALE: 1 in = 5 ft
DRILLING CONTRACTOR: Boart Longyear
DRILLER:

LOGGED: RD
CHECKED: DLG
DATE: 5/10/2006

Golder Associates

RECORD OF BOREHOLE 0716

SHEET 1 of 2

PROJECT: Moab Tailings Impoundment	DRILLING METHOD: 3.25" ID HSA	DATUM: ft. amsl	ELEVATION: 4056
PROJECT NUMBER: 053-2269	DRILLING DATE: 11/11/2005	AZIMUTH: N/A	INCLINATION: -90
LOCATION: Moab, UT	DRILL RIG: CME 75	COORDINATES: N: 6,665,369.00 E: 2,185,166.00	

DEPTH (feet)	BORING METHOD	SOIL PROFILE DESCRIPTION	USCS	ELEV. / DEPTH (ft)	SAMPLES NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC / ATT	REMARKS
0	3.25" ID HSA / Standard Split Spoon	0.0 - 2.0 Silty SAND, some gravel, loose, non-plastic, dry, reddish brown (SM) (COVER FILL)	SM	4054.0 2.0						Start @8:00 am 11/11/2005
5		2.0 - 8.0 Silty SAND, very loose to loose, non-plastic, dry, olive gray with some light tan (SM) (SAND TAILINGS)	SM	4048.0 8.0	1	SS	2-2-3	5	1.5/1.5	
10		8.0 - 23.0 SAND with little to some silt, slightly stratified, loose, non-plastic, dry to moist, buff to tan (SM) (SAND TAILINGS)	SM		2	SS	3-3-5	8	1/1.5	
15					3	SS	4-5-5	10	1.5/1.5	
20		Becomes medium dense.		4037.5 18.5	4	SS	4-8-13	21	1.5/1.5	
				4033.0 23.0						
25		23.0 - 39.8 Silty SAND, little clay, fine grained, slightly stratified, medium dense, dry to moist, buff to light yellowish brown (SM) (SAND TAILINGS)	SM		5	SS	0-15-30	45	1/1	Split Spoon driven only 12 inches into the ground.
30		Becomes loose.		4027.5 28.5	6	SS	3-4-6	10	1.5/1.5	
35		Becomes medium dense.		4022.5 33.5	7	SS	6-8-9	17	1.5/1.5	
40		Becomes loose.		4017.5 38.5	8	SS	2-2-3	5	1.5/1.5	
				4016.2						

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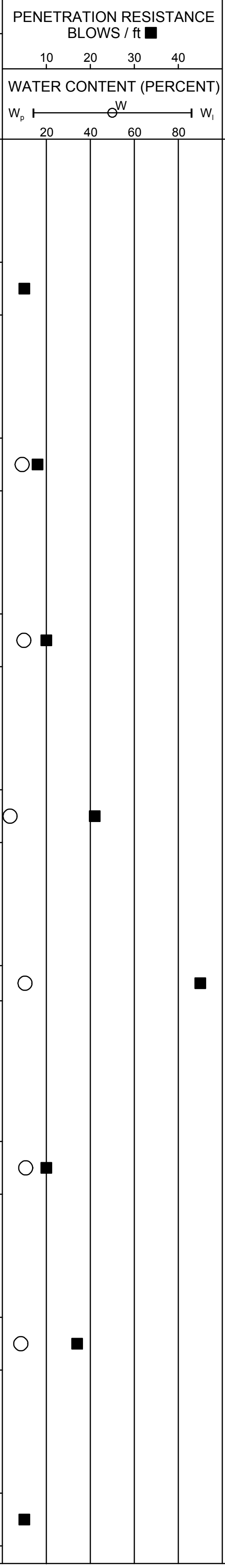


SCALE: 1 in = 5 ft	LOGGED: RD
DRILLING CONTRACTOR: Boart Longyear	CHECKED: DLG
DRILLER:	DATE: 5/10/2006

Golder Associates

RECORD OF BOREHOLE 0716

SHEET 2 of 2

PROJECT: Moab Tailings Impoundment	DRILLING METHOD: 3.25" ID HSA	DATUM: ft. amsl	ELEVATION: 4056
PROJECT NUMBER: 053-2269	DRILLING DATE: 11/11/2005	AZIMUTH: N/A	INCLINATION: -90
LOCATION: Moab, UT	DRILL RIG: CME 75	COORDINATES: N: 6,665,369.00 E: 2,185,166.00	

BORING METHOD: 3.25" ID HSA / Standard Split Spoon

SOIL PROFILE

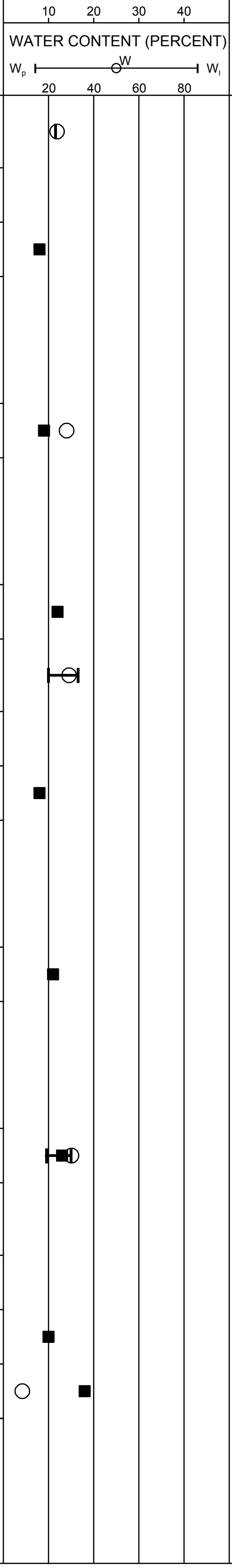
DESCRIPTION	USCS	ELEV. / DEPTH (ft)
39.8 - 41.0 Sandy SILT, some clay, soft, moist, non plastic, light tan to brown (ML) (TRANSITIONAL TAILINGS) *(Continued)*	ML	39.8
41.0 - 49.6 Sandy SILT, slightly stratified, loose, moist, non-plastic, light tan (ML) (SLIMES)	ML ML	4015.0 41.0
49.6 - 64.0 Silty CLAY, interbedded clay approximately 3" thick, loose, moist, low plasticity, olive gray to medium yellowish brown (CL) (SLIMES)	CL	4006.4 49.6
Becomes medium dense.		4002.5 53.5
Becomes loose, wet		3997.0 59.0
64.0 - 68.0 Silty SAND, little clay, loose to medium dense, non-plastic, olive gray to medium brown (SM) (SAND TAILINGS)	SM	3992.0 64.0
68.0 - 71.5 CLAY with some fine grained sand, slightly stratified, stiff, moist, low plasticity, medium olive gray to light yellowish brown (CL) (SLIMES)	CL	3988.0 68.0
71.5 - 74.0 Silty SAND, some clay, slightly stratified, loose, moist, non-plastic, yellowish brown (SM) (SAND TAILINGS)	SM	3984.5 71.5
74.0 - 75.0 CLAY, some silt,stiff, low plasticity, moist, light olive brown (CL) (SLIMES)	CL	3982.0 74.0
75.0 - 76.5 Silty SAND with trace gravel, fine to medium grained, medium dense, moist, non-plastic, dark reddish brown (SM) (ALLUVIUM)	SM	3981.0 75.0

Boring completed at 76.5 ft.

SAMPLES

NUMBER	TYPE	BLOWS per 6 in (140 lb hammer 30 inch drop)	N	REC / ATT
9	SH			1.7/2
10	SS	3-4-4	8	1.5/1.5
11	SS	5-5-4	9	1.5/1.5
12	SS	3-4-8	12	1.5/1.5
13	SH			2/2
14	SS	3-3-5	8	1.5/1.5
15	SS	5-5-6	11	1.5/1.5
16	SS	6-6-7	13	1.5/1.5
17	SH			1.5/2
18	SS	4-5-5	10	1.5/1.5
19	SS	7-8-10	18	1/1.5

PENETRATION RESISTANCE BLOWS / ft ■ — WATER CONTENT (PERCENT)



REMARKS

Auger TD @75', Split Spoon TD @76.5' Finish @3:25 pm on 11/11/2005

Hole back filled with cuttings.

DEPTH (feet): 40, 45, 50, 55, 60, 65, 70, 75, 80

SCALE: 1 in = 5 ft
DRILLING CONTRACTOR: Boart Longyear
DRILLER:

LOGGED: RD
CHECKED: DLG
DATE: 5/10/2006

Golder Associates

RECORD OF BOREHOLE 0717

SHEET 1 of 3

PROJECT: Moab Tailings Impoundment
PROJECT NUMBER: 053-2269
LOCATION: Moab, UT

DRILLING METHOD: 3.25" ID HSA
DRILLING DATE: 11/29/2005
DRILL RIG: CME 75

DATUM: ft. amsl
AZIMUTH: N/A
COORDINATES: N: 6,664,496.00 E: 2,185,362.00

ELEVATION: 4055
INCLINATION: -90

BORING METHOD	DESCRIPTION	USCS	ELEV. DEPTH (ft)	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC / ATT	REMARKS
3.25" ID HSA / Standard Split Spoon	0.0 - 2.0 Silty SAND, some gravel, loose, non-plastic, dry, reddish brown (SM) (COVER FILL)	SM							Start @7:25 am 11/29/2005
	2.0 - 13.5 Silty SAND, trace clay, loose, non-plastic, dry, olive gray, brown (SM) (SAND TAILINGS)	SM	4053.0 2.0	1	SS	4-4-4	8	1.5/1.5	
	Becomes moist.		4045.5 9.5	2	SS	2-4-4	8	1.5/1.5	
	13.5 - 17.0 SILT with some sand and trace clay, firm, non-plastic, dry, olive gray, brown (ML) (TRANSITIONAL TAILINGS)	ML	4041.5 13.5	3	SS	3-4-4	8	1.33/1.5	
	17.0 - 22.0 Silty SAND, little clay, slightly stratified, fine grained, medium dense, non-plastic, moist, dark yellowish brown (SM) (TRANSITIONAL TAILINGS)	SM	4038.0 17.0	4	SS	5-4-8	12	1.5/1.5	
	22.0 - 43.0 Silty SAND, dense, fine grained, non-plastic, moist, yellowish brown (SM) (TRANSITIONAL TAILINGS)	SM	4033.0 22.0	5	SS	7-19-25	44	1.5/1.5	
	Becomes medium dense.		4026.5 28.5	6	SS	5-6-6	12	1.5/1.5	
				7	SS	5-7-5	12	1.5/1.5	
				8	SS	4-5-6	11	1.5/1.5	

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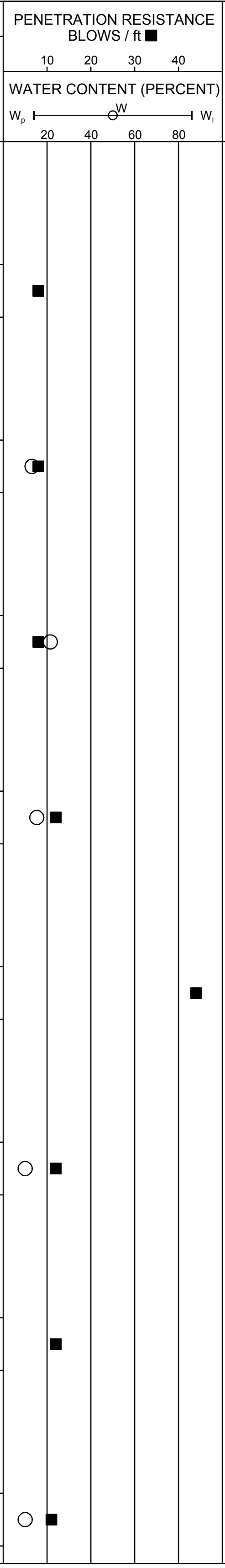

SCALE: 1 in = 5 ft
DRILLING CONTRACTOR: Boart Longyear
DRILLER:

LOGGED: RD
CHECKED: DLG
DATE: 5/10/2006

RECORD OF BOREHOLE 0717

SHEET 2 of 3

PROJECT: Moab Tailings Impoundment
PROJECT NUMBER: 053-2269
LOCATION: Moab, UT

DRILLING METHOD: 3.25" ID HSA
DRILLING DATE: 11/29/2005
DRILL RIG: CME 75

DATUM: ft. amsl
AZIMUTH: N/A
COORDINATES: N: 6,664,496.00 E: 2,185,362.00

ELEVATION: 4055
INCLINATION: -90

BORING METHOD: 3.25" ID HSA / Standard Split Spoon

SOIL PROFILE

DEPTH (feet)	DESCRIPTION	USCS	ELEV. / DEPTH (ft)
40	22.0 - 43.0 Silty SAND, dense, fine grained, non-plastic, moist, yellowish brown (SM) (TRANSITIONAL TAILINGS)*(Continued)*	SM	4012.0 43.0
45	43.0 - 53.0 Silty SAND, little clay, fine-grained, interbedded clay lenses, loose to medium dense, non-plastic, moist (SM) (TRANSITIONAL TAILINGS)	SM	4002.0 53.0
55	53.0 - 68.5 Sandy SILT, some clay, fine grained, slightly stratified, stiff, non-plastic, wet (ML) (SLIMES)	ML	3996.5 58.5
60	Becomes loose	ML	3986.5 68.5
70	68.5 - 77.0 Silty SAND, some clay, fine grained, slightly stratified, medium dense, non-plastic, wet (SM) (TRANSITIONAL TAILINGS)	SM	3978.0 77.0
80	77.0 - 83.0 Sandy SILT, little clay, loose, non-plastic, wet, grayish brown (ML) (TRANSITIONAL TAILINGS)	ML	

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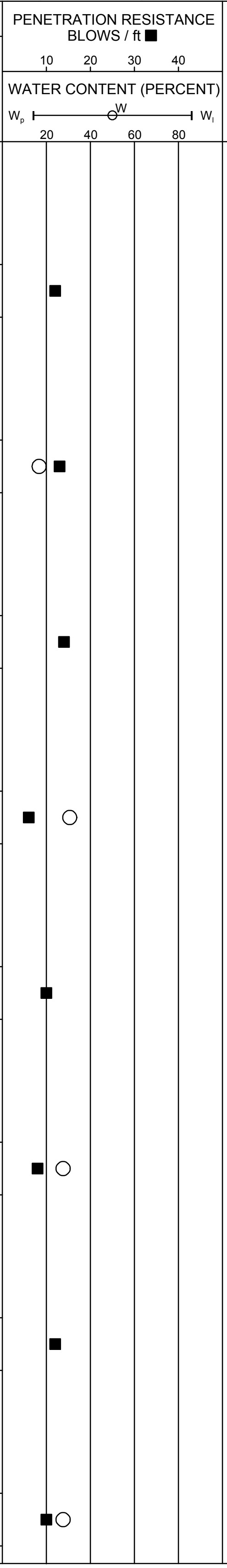
SAMPLES

NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC / ATT
9	SS	6-6-6	12	1.5/1.5
10	SS	3-5-8	13	1.5/1.5
11	SS	6-7-7	14	1.5/1.5
12	SS	2-3-3	6	0.83/1.5
13	SS	3-5-5	10	1.5/1.5
14	SS	4-4-4	8	1.5/1.5
15	SS	4-6-6	12	1.5/1.5
16	SS	4-5-5	10	1.5/1.5



REMARKS

SCALE: 1 in = 5 ft
DRILLING CONTRACTOR: Boart Longyear
DRILLER:

LOGGED: RD
CHECKED: DLG
DATE: 5/10/2006

Golder Associates

RECORD OF BOREHOLE 0717

SHEET 3 of 3

PROJECT: Moab Tailings Impoundment
PROJECT NUMBER: 053-2269
LOCATION: Moab, UT
DRILLING METHOD: 3.25" ID HSA
DRILLING DATE: 11/29/2005
DRILL RIG: CME 75
DATUM: ft. amsl
AZIMUTH: N/A
COORDINATES: N: 6,664,496.00 E: 2,185,362.00
ELEVATION: 4055
INCLINATION: -90

DEPTH (feet)	BORING METHOD	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV. DEPTH (ft)	SAMPLES: NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC / ATT	PENETRATION RESISTANCE BLOWS / ft ■ (10 20 30 40) WATER CONTENT (PERCENT) W_p ├─○W─┤ W_l (20 40 60 80)	REMARKS
80	3.25" ID HSA / Standard Split Spoon	77.0 - 83.0 Sandy SILT, little clay, loose, non-plastic, wet, grayish brown (ML) (TRANSITIONAL TAILINGS) *(Continued)*	ML		3972.0 83.0							
85		83.0 - 91.0 SILT, some clay, trace to some fine grained sand, slightly stratified, stiff, medium plasticity, moist, olive gray (ML) (SLIMES)	ML		3964.0 91.0	17	SS	4-8-10	18	1.5/1.5	■	
90						18	SS	12-12-11	23	1.5/1.5	■◐	
		91.0 - 95.0 Sandy SILT, some clay, slightly stratified, hard, plastic, moist, gray (ML) (TRANSITIONAL TAILINGS)	ML		3960.0 95.0	19	SH			1.5/2		
						20	SS	12-15-16	31	1.5/1.5	■	
95		95.0 - 96.5 Silty SAND, trace gravel, very dense, fine to medium grained, non-plastic, moist (SM) (ALLUVIUM)	SM			21	SS	13-26-28	>50	0.83/1.5	○ >>■	Auger TD @95', Split Spoon TD @96.5' Finish @11:25 am on 11/29/2005 Hole back filled with cuttings.
		Boring completed at 96.5 ft.										
100												
105												
110												
115												
120												

SCALE: 1 in = 5 ft
DRILLING CONTRACTOR: Boart Longyear
DRILLER:

LOGGED: RD
CHECKED: DLG
DATE: 5/10/2006

Golder Associates

RECORD OF BOREHOLE 0718

SHEET 1 of 2

PROJECT: Moab Tailings Impoundment
PROJECT NUMBER: 053-2269
LOCATION: Moab, UT
DRILLING METHOD: 3.25" ID HSA
DRILLING DATE: 12/5/2005
DRILL RIG: CME 75
DATUM: ft. amsl
AZIMUTH: N/A
COORDINATES: N: 6,665,046.00 E: 2,184,138.00
ELEVATION: 4036
INCLINATION: -90

BORING METHOD: 3.25" ID HSA / Standard Split Spoon

SOIL PROFILE

DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)
0.0 - 9.0 Silty SAND, some gravel, fine to medium grained, loose, non-plastic, dry, dark reddish brown (SM) (COVER FILL)	SM	▩	4027.0 9.0
9.0 - 19.0 Elastic SILT, trace to little sand, some clay, very soft, moist, dark yellowish gray (MH) (SLIMES)	MH	▥	4017.0 19.0
19.0 - 33.4 Silty CLAY, very soft, low to medium plasticity, moist, reddish brown to dark yellowish brown (CL) (SLIMES)	CL	▨	4002.6 33.4
33.4 - 38.4 CLAY, trace silt, moderate stratification, very soft, high plasticity, moist, olive gray (CH) (SLIMES)	CH	▨	3997.6 38.4
	MH	▥	

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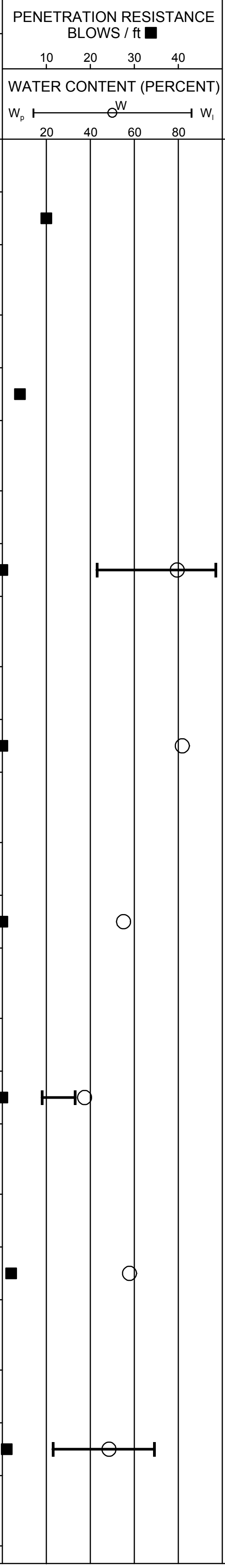
SAMPLES

NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC / ATT	REMARKS
					Start @9:25 am 12/5/2005
1	SS	3-4-6	10	1/1.5	
2	SH			2/2	
3	SS	3-2-2	4	1.5/1.5	
4	SH			2/2	
5	SS	0-0-0	0	1.5/1.5	Weight of hammer for 1.5 feet.
6	SH			2/2	
7	SS	0-0-0	0	1.5/1.5	Weight of hammer for 1.5 feet.
8	SH			2/2	
9	SS	0-0-0	0	1.5/1.5	Weight of hammer for 1.5 feet.
10	SH			2/2	
11	SS	0-0-0	0	1.5/1.5	Weight of hammer for 1.5 feet.
12	SH			2/2	
13	SS	0-0-2	2	1.5/1.5	
14	SH			2/2	
15	SS	0-0-1	1	1.5/1.5	
16	SH			2/2	



DEPTH (feet): 0, 5, 10, 15, 20, 25, 30, 35, 40

SCALE: 1 in = 5 ft
DRILLING CONTRACTOR: Boart Longyear
DRILLER:

LOGGED: RD
CHECKED: DLG
DATE: 5/10/2006

Golder Associates

RECORD OF BOREHOLE 0718

SHEET 2 of 2

PROJECT: Moab Tailings Impoundment
PROJECT NUMBER: 053-2269
LOCATION: Moab, UT

DRILLING METHOD: 3.25" ID HSA
DRILLING DATE: 12/5/2005
DRILL RIG: CME 75

DATUM: ft. amsl
AZIMUTH: N/A
COORDINATES: N: 6,665,046.00 E: 2,184,138.00

ELEVATION: 4036
INCLINATION: -90

DEPTH (feet)	BORING METHOD	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	SAMPLES: NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC / ATT	PENETRATION RESISTANCE BLOWS / ft ■ (10 20 30 40) WATER CONTENT (PERCENT) W_p ⊢—○W—⊣ W_l (20 40 60 80)	REMARKS
40		38.4 - 41.5 Clayey SILT, very soft, high plasticity, moist, light olive gray to olive brown (MH) (SLIMES) *(Continued)*	MH		3994.5 41.5							
		41.5 - 43.0 Silty SAND, some organics, medium dense, moist (SM) (ALLUVIUM)	SM			17	SS	8-10-10	20	1.5 1.5	○ ■	Auger TD @41.5', Split Spoon TD @43' Finish @11:00 am on 12/5/2005 Hole back filled with cuttings.
		Boring completed at 43 ft.										
45												
50												
55												
60												
65												
70												
75												
80												

SCALE: 1 in = 5 ft
DRILLING CONTRACTOR: Boart Longyear
DRILLER:

LOGGED: RD
CHECKED: DLG
DATE: 5/10/2006

Golder Associates

RECORD OF BOREHOLE 0719

SHEET 1 of 2

PROJECT: Moab Tailings Impoundment
PROJECT NUMBER: 053-2269
LOCATION: Moab, UT

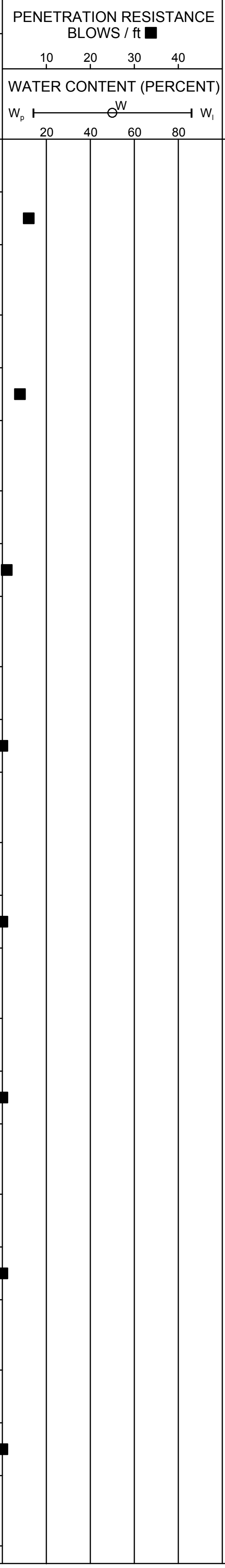
DRILLING METHOD: 3.25" ID HSA
DRILLING DATE: 11/29/2005
DRILL RIG: CME 75

DATUM: ft. amsl
AZIMUTH: N/A
COORDINATES: N: 6,664,736.00 E: 2,184,391.00

ELEVATION: 4035
INCLINATION: -90

BORING METHOD: 3.25" ID HSA / Standard Split Spoon

SOIL PROFILE				SAMPLES					
DEPTH (feet)	DESCRIPTION	USCS	ELEV. / DEPTH (ft)	NUMBER	TYPE	BLOWS per 6 in (140 lb hammer 30 inch drop)	N	REC / ATT	REMARKS
0	0.0 - 4.0 Silty SAND, some gravel, loose, non-plastic, dry, dark reddish brown (SM) (COVER FILL)	SM							Start @1:50 pm 11/29/2005
				1	SS	3-3-3	6	1.5/1.5	
			4031.0 4.0	2	SH			2/2	
5	4.0 - 16.5 Silty SAND, little clay, loose, non-plastic, moist, dark reddish brown (SM) (SAND TAILINGS)	SM							
				3	SS	1-2-2	4	1.5/1.5	
				4	SH			1/2	
10									
				5	SS	0-0-1	1	0.5/1.5	
				6	SH			0.5/2	
15			4018.5 16.5						
	16.5 - 39.0 Silty CLAY, trace sand, very soft, low plasticity, moist, dark yellowish brown, gray to black (CL) (SLIMES)	CL		7	SS	0-0-0	0	1.5/1.5	Weight of hammer for 1.5 feet.
				8	SH			0/2	
20									
				9	SS	0-0-0	0	1.5/1.5	Weight of hammer for 1.5 feet.
				10	SH			0.5/2	
25									
				11	SS	0-0-0	0	1.5/1.5	Weight of hammer for 1.5 feet.
				12	SH			0/2	
30									
				13	SS	0-0-0	0	1.5/1.5	Weight of hammer for 1.5 feet.
				14	SH			0/2	
35									
				15	SS	0-0-0	0	1.5/1.5	Weight of hammer for 1.5 feet.
			3996.0 39.0	16	SH			1/2	
40	Log continued on next page	CL							



SCALE: 1 in = 5 ft
DRILLING CONTRACTOR: Boart Longyear
DRILLER:

LOGGED: RD
CHECKED: DLG
DATE: 5/10/2006

Golder Associates

RECORD OF BOREHOLE 0719

SHEET 2 of 2

PROJECT: Moab Tailings Impoundment
PROJECT NUMBER: 053-2269
LOCATION: Moab, UT

DRILLING METHOD: 3.25" ID HSA
DRILLING DATE: 11/29/2005
DRILL RIG: CME 75

DATUM: ft. amsl
AZIMUTH: N/A
COORDINATES: N: 6,664,736.00 E: 2,184,391.00

ELEVATION: 4035
INCLINATION: -90

DEPTH (feet)	BORING METHOD	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	SAMPLES: NUMBER	TYPE	BLOWS per 6 in (140 lb hammer 30 inch drop)	N	REC / ATT	PENETRATION RESISTANCE BLOWS / ft ■ (10 20 30 40) / WATER CONTENT (PERCENT) Wp —○W— Wl (20 40 60 80)	REMARKS
40	3.25" ID HSA / Standard Split Spoon	39.0 - 47.0 Silty CLAY, very soft, low plasticity, wet, olive gray (CL) (SLIMES)*(Continued)*	CL									
						17	SS	0-0-0	0	1.5/1.5		Weight of hammer for 1.5 feet.
						18	SH			2/2		
45												
		47.0 - 49.0 Clayey SILT, slightly stratified, very soft, low plasticity, moist, olive gray (ML) (SLIMES)	ML		3988.0 47.0	19	SS	1-1-1	2	1.5/1.5		
						20	SH			2/2		
		49.0 - 51.5 Silty SAND, fine grained, some organics, medium dense (SM) (ALLUVIUM)	SM		3986.0 49.0							
50						21	SS	8-10-15	25	0.7/1.5		Auger TD @50', Split Spoon TD @51.5' Finish @4:40 pm on 11/29/2005 Hole back filled with cuttings.
		Boring completed at 51.5 ft.										
55												
60												
65												
70												
75												
80												

SCALE: 1 in = 5 ft
DRILLING CONTRACTOR: Boart Longyear
DRILLER:

LOGGED: RD
CHECKED: DLG
DATE: 5/10/2006

Golder Associates

RECORD OF BOREHOLE 0720

SHEET 1 of 2

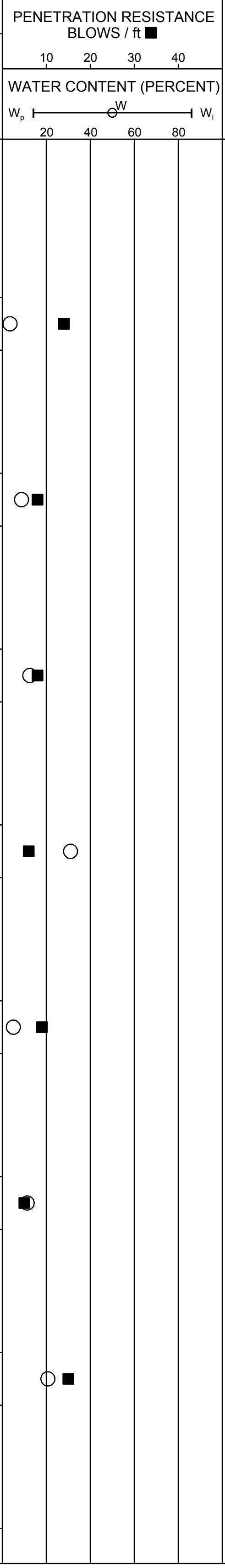
PROJECT: Moab Tailings Impoundment
PROJECT NUMBER: 053-2269
LOCATION: Moab, UT

DRILLING METHOD: 3.25" ID HSA
DRILLING DATE: 11/5/2005
DRILL RIG: CME 75

DATUM: ft. amsl
AZIMUTH: N/A
COORDINATES: N: 6,663,921.00 E: 2,184,024.00

ELEVATION: 4059.5
INCLINATION: -90

DEPTH (feet)	BORING METHOD	SOIL PROFILE: DESCRIPTION	USCS	ELEV. / DEPTH (ft)	SAMPLES: NUMBER	TYPE	BLOWS per 6 in (140 lb hammer 30 inch drop)	N	REC / ATT	REMARKS
0	3.25" ID HSA / Standard Split Spoon	0.0 - 0.6 Silty SAND, some gravel, subrounded gravel, loose, non-plastic, dry, medium reddish brown (SM) (COVER FILL)	SM	4058.9 0.6						Start @12:20 pm 11/5/2005
		0.6 - 18.0 Silty SAND, fine grained, slightly stratified, loose to medium dense, non-plastic, dry, yellowish brown to buff (SM) (SAND TAILINGS)	SM							
5					1	SS	7-7-7	14	1/1.5	
10					2	SS	3-4-4	8	1/1.5	
15					3	SS	4-4-4	8	0.8/1.5	
		18.0 - 24.0 Silty SAND with interbedded clay, loose, non-plastic, poorly graded, moist, yellowish brown (SM) (TRANSITIONAL TAILINGS)	SM	4041.5 18.0						
20					4	SS	2-2-4	6	1.5/1.5	
		24.0 - 29.0 Decreasing fines (SAND TAILINGS)	SM	4035.5 24.0						
25					5	SS	4-4-5	9	0.7/1.5	
		29.0 - 34.0 Increasing fines (TRANSITIONAL TAILINGS)	SM	4030.5 29.0						
30					6	SS	2-2-3	5	1.5/1.5	
		34.0 - 38.0 Sandy SILT, some clay, poorly graded, medium dense, non-plastic, moist, dark yellowish brown (ML) (TRANSITIONAL TAILINGS)	ML	4025.5 34.0						
35					7	SS	7-7-8	15	0.7/1.5	
		38.0 - 42.0 SILT with trace sand, stiff, non-plastic, moist, dark yellowish brown (ML) (SLIMES)	ML	4021.5 38.0						
40		Log continued on next page			8	SS	6-6-8	14		



SCALE: 1 in = 5 ft
DRILLING CONTRACTOR: Boart Longyear
DRILLER:

LOGGED: RD
CHECKED: DLG
DATE: 5/10/2006

Golder Associates

RECORD OF BOREHOLE 0720

SHEET 2 of 2

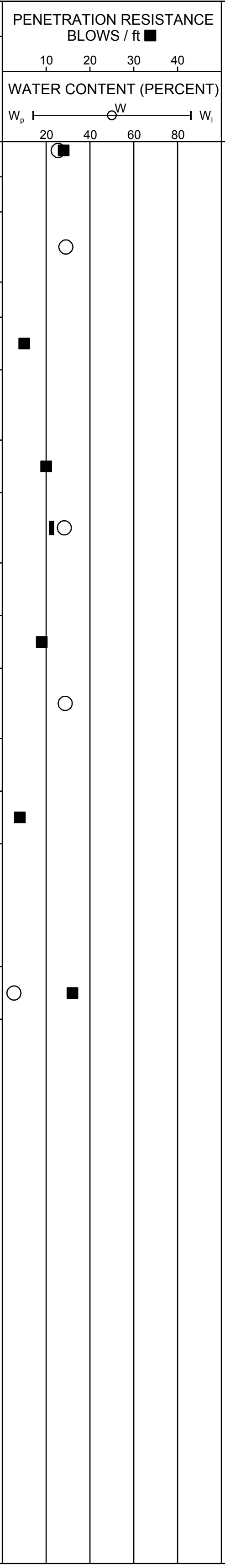
PROJECT: Moab Tailings Impoundment
PROJECT NUMBER: 053-2269
LOCATION: Moab, UT

DRILLING METHOD: 3.25" ID HSA
DRILLING DATE: 11/5/2005
DRILL RIG: CME 75

DATUM: ft. amsl
AZIMUTH: N/A
COORDINATES: N: 6,663,921.00 E: 2,184,024.00

ELEVATION: 4059.5
INCLINATION: -90

DEPTH (feet)	BORING METHOD	SOIL PROFILE DESCRIPTION	USCS	ELEV. DEPTH (ft)	SAMPLES NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC / ATT	REMARKS
40	3.25" ID HSA / Standard Split Spoon	38.0 - 42.0 SILT with trace sand, stiff, non-plastic, moist, dark yellowish brown (ML) (SLIMES) *(Continued)*	ML	4017.5 42.0	8	SS	6-6-8	14	1.5/1.5	
		42.0 - 48.0 Silty SAND, poorly graded, loose, non-plastic, wet, dark gray (SM) (SAND TAILINGS)	SM	4011.5 48.0	9	SH			2/2	
45					10	SS	1-3-2	5	1/1.5	
		48.0 - 50.0 Silty CLAY, stiff, medium plasticity, reddish brown to dark gray (CL) (TRANSITIONAL TAILINGAS)	CL	4009.5 50.0	11	SS	3-5-5	10	1.5/1.5	
50		50.0 - 57.8 SILT with trace to little fine grained sand, loose, non-plastic, moist to wet, gray to dark gray (ML) (SLIMES)	ML	4001.7 57.8	12	SH			2/2	
					13	SS	5-4-5	9	1.5/1.5	
55					14	SH			2.5/2	
		57.8 - 63.5 Silty SAND, some clay, poorly graded, non-plastic, loose, moist, gray (SM) (SAND TAILINGS)	SM	3996.0 63.5	15	SS	3-2-2	4	1.5/1.5	
60										
65		63.5 - 65.0 Silty SAND, trace gravel, fine grained, poorly graded, root fragments, medium dense, non-plastic, moist, dark reddish brown (SM) (ALLUVIUM) Boring completed at 65 ft.	SM		16	SS	7-7-9	16	0.7/1.5	Auger TD @63.5', Split Spoon TD @65' Finish @2:35 pm on 11/5/2005 Hole back filled with cuttings.
70										
75										
80										



SCALE: 1 in = 5 ft
DRILLING CONTRACTOR: Boart Longyear
DRILLER:

LOGGED: RD
CHECKED: DLG
DATE: 5/10/2006

Golder Associates

RECORD OF BOREHOLE 0721

SHEET 1 of 2

PROJECT: Moab Tailings Impoundment
PROJECT NUMBER: 053-2269
LOCATION: Moab, UT
DRILLING METHOD: 3.25" ID HSA
DRILLING DATE: 11/5/2005
DRILL RIG: CME 75
DATUM: ft. amsl
AZIMUTH: N/A
COORDINATES: N: 6,664,231.00 E: 2,183,771.00
ELEVATION: 4057.5
INCLINATION: -90

BORING METHOD: 3.25" ID HSA / Standard Split Spoon

SOIL PROFILE

DESCRIPTION	USCS	ELEV. / DEPTH (ft)
0.0 - 0.6 Silty SAND, some gravel, subrounded, loose, non-plastic, dry, reddish brown to light red (SM) (COVER FILL)	SM	4056.9 0.6
0.6 - 8.0 Silty SAND, little gravel, fine to medium grained, medium dense, non-plastic, dry to moist, reddish brown (SM) (SAND TAILINGS)	SM	4049.5 8.0
8.0 - 29.5 Silty SAND, medium dense, non-plastic, dry to moist, dark yellowish brown (SM) (SAND TAILINGS)	SM	4044.0 13.5
Becomes loose, slight stratification.		4028.0 29.5
29.5 - 34.5 Silty CLAY, trace sand, very soft, low plasticity, moist, medium gray to reddish brown (CL) (SLIMES)	CL	4023.0 34.5
34.5 - 37.5 Silty SAND, trace clay, very loose, non-plastic, moist, medium gray to reddish brown (SM) (SAND TAILINGS)	SM	4020.0 37.5
37.5 - 54.0 Silty CLAY, little sand, very soft, low plasticity, moist, medium gray to reddish brown (CL) (SLIMES)	CL	

Log continued on next page

SAMPLES

NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC / ATT
1	SS	9-11-11	22	1.5/1.5
2	SS	12-12-11	23	1.3/1.5
3	SS	4-4-4	8	1/1.5
4	SS	3-4-4	8	1.5/1.5
5	SS	2-3-4	7	1.5/1.5
6	SS	1-2-2	4	1.5/1.5
7	SH			2/2
8	SS	1-0-0	0	1.5/1.5
9	SH			2/2
10	SS	1-1-1	2	1.5/1.5

PENETRATION RESISTANCE BLOWS / ft ■ (10, 20, 30, 40)
WATER CONTENT (PERCENT) W_p —O^W— W_l (20, 40, 60, 80)

REMARKS: Start @7:35 am 11/5/2005

DEPTH (feet): 0, 5, 10, 15, 20, 25, 30, 35, 40

SCALE: 1 in = 5 ft
DRILLING CONTRACTOR: Boart Longyear
DRILLER:
LOGGED: RD
CHECKED: DLG
DATE: 5/10/2006

Golder Associates

RECORD OF BOREHOLE 0721

SHEET 2 of 2

PROJECT: Moab Tailings Impoundment
PROJECT NUMBER: 053-2269
LOCATION: Moab, UT

DRILLING METHOD: 3.25" ID HSA
DRILLING DATE: 11/5/2005
DRILL RIG: CME 75

DATUM: ft. amsl
AZIMUTH: N/A
COORDINATES: N: 6,664,231.00 E: 2,183,771.00

ELEVATION: 4057.5
INCLINATION: -90

DEPTH (feet)	BORING METHOD	SOIL PROFILE DESCRIPTION	USCS	ELEV. DEPTH (ft)	SAMPLES NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC / ATT	REMARKS
40	3.25" ID HSA / Standard Split Spoon	37.5 - 54.0 Silty CLAY, little sand, very soft, low plasticity, moist, medium gray to reddish brown (CL) (SLIMES) *(Continued)*	CL		11	SH			2/2	
		Becomes soft.		4014.0 43.5	12	SS	2-2-2	4	1.5/1.5	
45					13	SH			2/2	
					14	SS	2-2-2	4	1.5/1.5	
50					15	SH			2/2	
		54.0 - 55.0 Silty SAND, some organics, fine grained, medium dense, non-plastic, moist, reddish brown (SM) (ALLUVIUM)	SM	4003.5 54.0	16	SS	5-6-7	13	1.5/1.5	Auger TD @53.5', Split Spoon TD @55' Finish @10:20 am on 11/5/2005 Hole back filled with cuttings.
55		Boring completed at 55 ft.								
60										
65										
70										
75										
80										

PENETRATION RESISTANCE BLOWS / ft ■ (10, 20, 30, 40)
WATER CONTENT (PERCENT) W_p —○W— W_l (20, 40, 60, 80)

SCALE: 1 in = 5 ft
DRILLING CONTRACTOR: Boart Longyear
DRILLER:

LOGGED: RD
CHECKED: DLG
DATE: 5/10/2006

RECORD OF BOREHOLE 0722

SHEET 1 of 2

PROJECT: Moab Tailings Impoundment
PROJECT NUMBER: 053-2269
LOCATION: Moab, UT

DRILLING METHOD: 3.25" ID HSA
DRILLING DATE: 11/4/2005
DRILL RIG: CME 75

DATUM: ft. amsl
AZIMUTH: N/A
COORDINATES: N: 6,664,541.00 E: 2,183,519.00

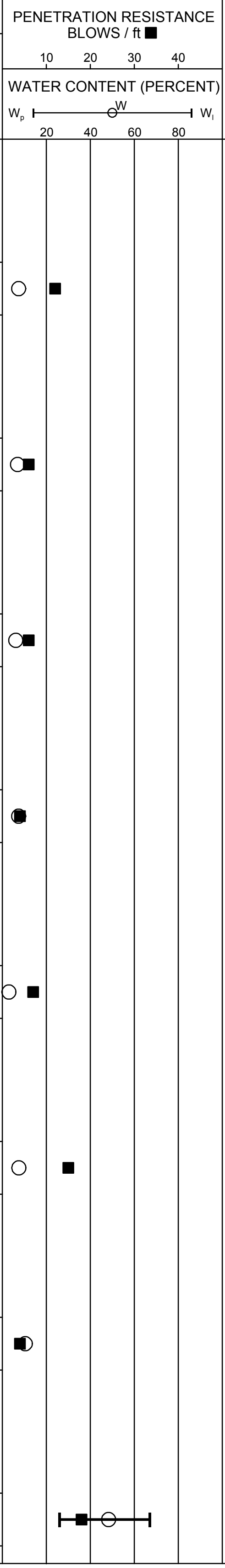
ELEVATION: 4055.5
INCLINATION: -90

BORING METHOD: 3.25" ID HSA / Standard Split Spoon

DEPTH (feet)	DESCRIPTION	USCS	ELEV. / DEPTH (ft)
0	0.0 - 0.4 Silty SAND, some gravel, well graded, subrounded, loose, non-plastic, dry, reddish brown (SM) (COVER FILL)	SM	4055.1 0.4
	0.4 - 15.0 Silty SAND, poorly graded, medium dense to loose, non-plastic, moist, light buff tan to medium brown (SM) (SAND TAILINGS)	SM	4040.5 15.0
15	15.0 - 22.0 SAND, some clay, fine grained, very loose, non-plastic, moist, light buff to medium brown (SM) (SAND TAILINGS)	SP	4033.5 22.0
	22.0 - 27.5 SAND, little clay, poorly graded, loose, non-plastic, moist, light to medium gray (SP) (SAND TAILINGS)	SP	4028.0 27.5
	27.5 - 38.0 Silty SAND with gravel, some clay, medium dense, dark reddish brown (SM) (SAND TAILINGS)	SM	4022.0 33.5
	Becomes very loose, increasing fines (TRANSITIONAL TAILINGS)		4017.5 38.0
	38.0 - 40.0 Silty CLAY, trace sand, very stiff, high plasticity, moist, medium reddish brown (CH) (SLIMES)	CH	4015.5
40	Log continued on next page		

SAMPLES (BLOWS per 6 in, 140 lb hammer, 30 inch drop)

NUMBER	TYPE	BLOWS per 6 in	N	REC / ATT
1	SS	7-6-6	12	1.5/1.5
2	SS	3-3-3	6	0.7/1.5
3	SS	2-3-3	6	0.7/1.5
4	SS	2-2-2	4	1.5/1.5
5	SS	4-3-4	7	1.5/1.5
6	SS	15-9-6	15	1/1.5
7	SS	3-2-2	4	0.7/1.5
8	SS	8-9-9	18	1.5/1.5



REMARKS

Start @9:40 am
11/4/2005

Auger TD @38.5', Split

SCALE: 1 in = 5 ft
DRILLING CONTRACTOR: Boart Longyear
DRILLER:

LOGGED: RD
CHECKED: DLG
DATE: 5/10/2006

Golder Associates

RECORD OF BOREHOLE 0722

SHEET 2 of 2

PROJECT: Moab Tailings Impoundment
PROJECT NUMBER: 053-2269
LOCATION: Moab, UT

DRILLING METHOD: 3.25" ID HSA
DRILLING DATE: 11/4/2005
DRILL RIG: CME 75

DATUM: ft. amsl
AZIMUTH: N/A
COORDINATES: N: 6,664,541.00 E: 2,183,519.00

ELEVATION: 4055.5
INCLINATION: -90

DEPTH (feet)	BORING METHOD	SOIL PROFILE: DESCRIPTION	SOIL PROFILE: USCS	SOIL PROFILE: GRAPHIC LOG	SOIL PROFILE: ELEV. / DEPTH (ft)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS per 6 in 140 lb hammer 30 inch drop	SAMPLES: N	SAMPLES: REC / ATT	PENETRATION RESISTANCE BLOWS / ft ■ 10 20 30 40 WATER CONTENT (PERCENT) W_p ⊢—O^W—⊣ W_l 20 40 60 80	REMARKS
40		40.0 - 41.0 Silty SAND, some organics, dense, non-plastic, moist, brown (SM) (ALLUVIUM) Boring completed at 41 ft.	SM		40.0	9	SH			1/1		Spoon TD @40' Finish @11:07 am on 11/4/2005 Hole back filled with cuttings.
45												
50												
55												
60												
65												
70												
75												
80												

SCALE: 1 in = 5 ft
DRILLING CONTRACTOR: Boart Longyear
DRILLER:

LOGGED: RD
CHECKED: DLG
DATE: 5/10/2006

Golder Associates

RECORD OF BOREHOLE 0723

SHEET 1 of 1

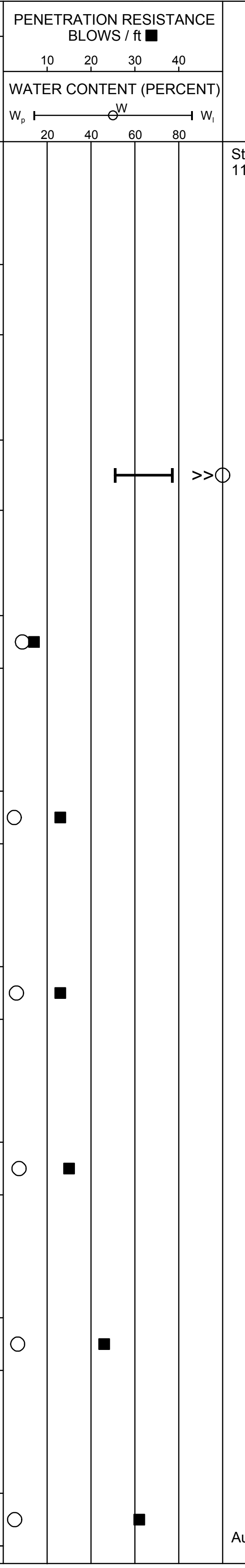
PROJECT: Moab Tailings Impoundment
PROJECT NUMBER: 053-2269
LOCATION: Moab, UT

DRILLING METHOD: 3.25" ID HSA
DRILLING DATE: 11/3/2005
DRILL RIG: CME 75

DATUM: ft. amsl
AZIMUTH: N/A
COORDINATES: N: 6,665,132.00 E: 2,183,294.00

ELEVATION: 4041
INCLINATION: -90

DEPTH (feet)	BORING METHOD	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	SAMPLES: NUMBER	TYPE	BLOWS per 6 in (140 lb hammer 30 inch drop)	N	REC / ATT	REMARKS
0	3.25" ID HSA / Standard Split Spoon	0.0 - 0.7 Silty SAND, some gravel, well graded, subrounded to angular, loose, non-plastic, dry, dark reddish brown (SM) (COVER FILL)	SM		4040.3 0.7						Start @2:10 pm 11/3/2005
		0.7 - 12.0 Silty SAND, some clay, fine grained, soft, high plasticity, moist, dark tan (SM) (TRANSITIONAL TAILINGS)	SM		4029.0 12.0	1	SH			1/2	
5											
						2	SH			2/2	
10											
		12.0 - 23.5 Silty SAND, little gravel, loose, non-plastic, moist, reddish brown (SM) (TRANSITIONAL TAILINGS)	SM		4017.5 23.5	3	SS	3-4-3	7	1/1.5	
15											
						4	SS	5-5-8	13	1/1.5	
20											
		23.5 - 33.0 Silty SAND, little to some gravel, interbedded sand, loose, moist, reddish brown (SM) (TRANSITIONAL TAILINGS)	SM		4008.0 33.0	5	SS	4-6-7	13	1/1.5	
25											
						6	SS	6-6-9	15	1/1.5	
30											
		33.0 - 40.0 Silty SAND with gravel, some weathered rock fragments (nearly equal portions of gravel, sand, and fines), medium dense, non-plastic, dry to moist, reddish brown (SM) (ALLUVIUM)	SM			7	SS	8-11-12	23	1.3/1.5	
35											
						8	SS	14-15-16	31	1.3/1.5	Auger TD @38.5', Split
40		Boring completed at 40 ft.									



SCALE: 1 in = 5 ft
DRILLING CONTRACTOR: Boart Longyear
DRILLER:

LOGGED: RD
CHECKED: DLG
DATE: 5/10/2006

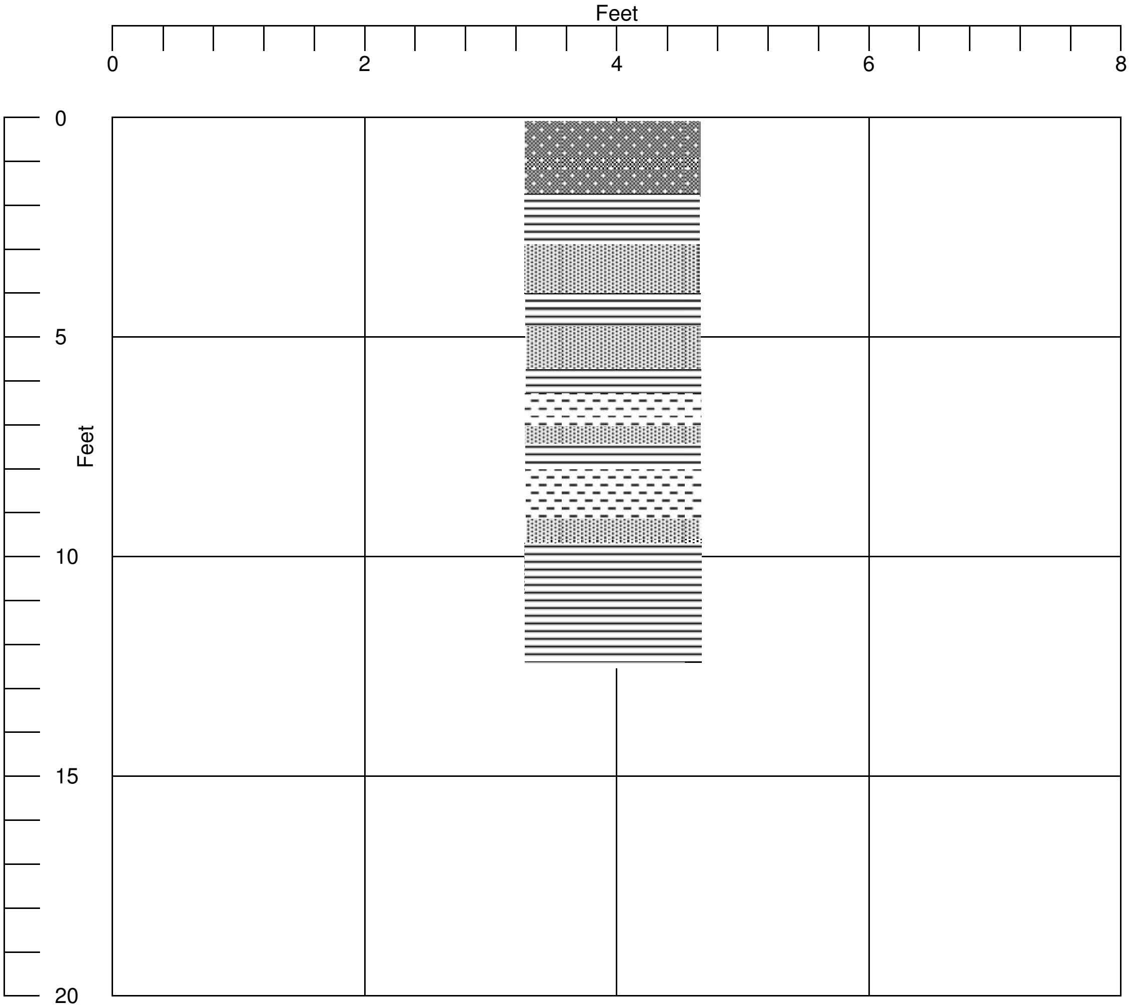
Golder Associates

Appendix B

Test Pit Logs

FIELD TEST PIT LOG

Temp: 85 F Weather: Partly Cloudy Engineer: J. Obermeyer Operator: Randy Test Pit: 0621 (GATP-01)
Equipment: Caterpillar 416 with a 2' bucket Contractor S.M. Stoller Date 8/24/2005
Location Moab, Utah Elevation -- Datum Ground Surface Job No. 053-2269



Samples	
No	Depth
1	Composite
2	Composite
3	Composite.
4	Composite.
5	Composite

Sample Descriptions and Excavation Notes
(0-2.0) Silty SAND with gravel (SM), loose, reddish brown. (COVER FILL) (2.0-7.0) Silty SAND and Silty CLAY (SM, CL) , tan, dark yellowish brown, olive, loose, moist, medium to fine grained sand (Interbedded SAND and TRANSITIONAL TAILINGS). (7.0-13.0) Intermittent Silty SAND, mostly clayey SILT, and silty CLAY (SM, MH, CL), dark yellowish brown, olive, gray, fine grained sands, moist, loose (Interbedded TRANSITIONAL TAILINGS and SLIMES).

Sample	Sample Type	Sample site
1	Bulk	Track-hoe bucket
2	Bulk	Track-hoe bucket
3	Bulk	Track-hoe bucket
4	Bulk	Track-hoe bucket
5	Bulk	Track-hoe bucket

Special Notes:

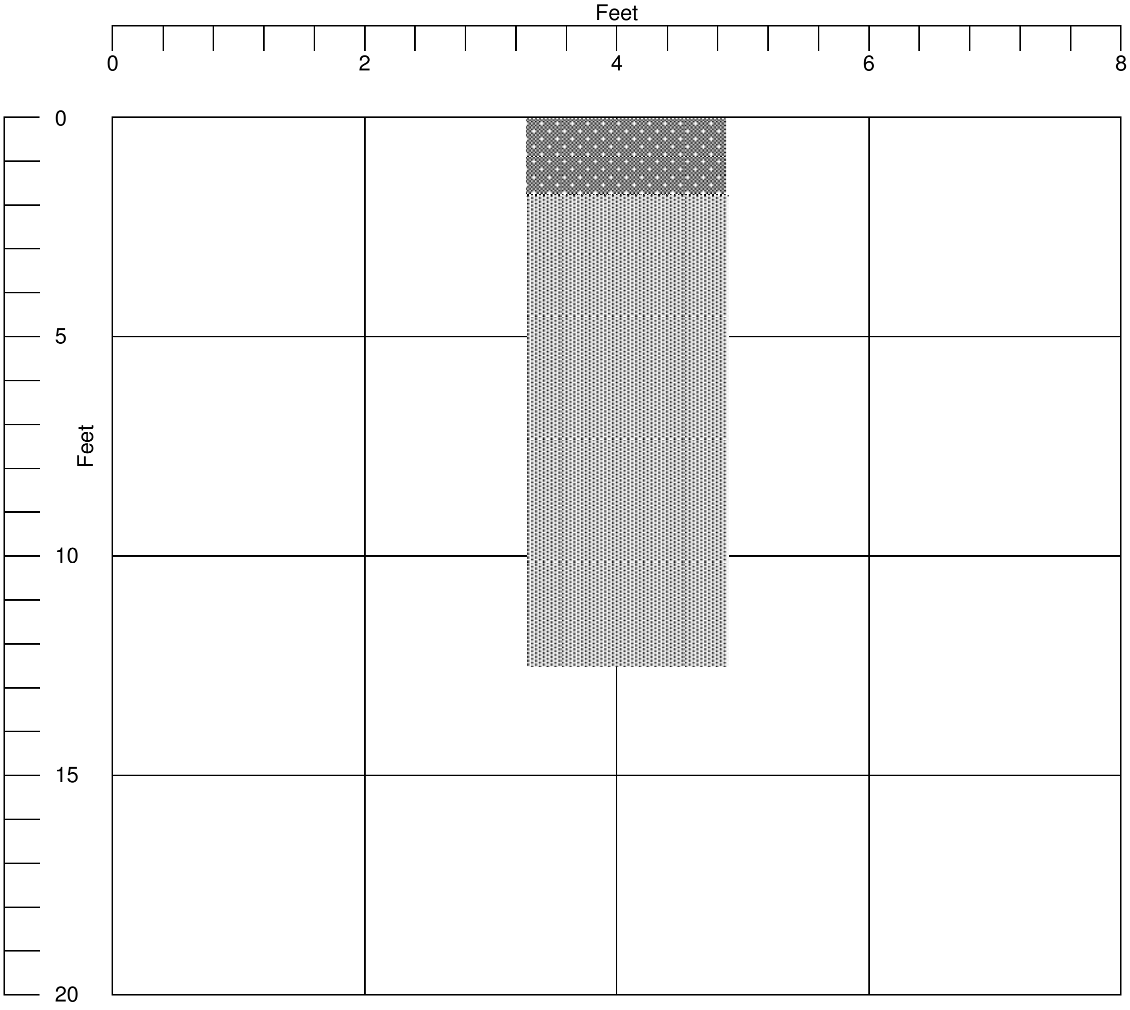
Samples collected represent materials from the test pit necessary for index testing.

GATP-01 Test Pit Picture

1. Photo of GATP-01 from ground surface.

FIELD TEST PIT LOG

Temp: 85 F Weather: Partly Cloudy Engineer: J. Obermeyer Operator: Randy Test Pit: 0622 (GATP-02)
Equipment: Caterpillar 416 with a 2' bucket Contractor S.M. Stoller Date 8/24/2005
Location Moab, Utah Elevation -- Datum Ground Surface Job No. 053-2269



Samples	
No	Depth
1	Composite
2	Composite
3	Composite.
4	Composite.
5	Composite

Sample Descriptions and Excavation Notes	Sample	Sample Type	Sample site
(0-2.0) Silty SAND with gravel (SM), loose, reddish brown. (COVER FILL) (2.0-13.0) Silty SAND and minor Clayey SILT (SM, MH) , tan, yellowish brown, olive, loose to medium dense, dry to lightly moist, medium to fine grained. Sands and Silts consolidated with increased depth. Some intermittent, interbedded cohesive silty clay lenses (SAND TAILINGS).	1	Bulk	Track-hoe bucket
	2	Bulk	Track-hoe bucket
	3	Bulk	Track-hoe bucket
	4	Bulk	Track-hoe bucket
	5	Bulk	Track-hoe bucket

Special Notes:

Samples collected represent materials from the test pit necessary for index testing.

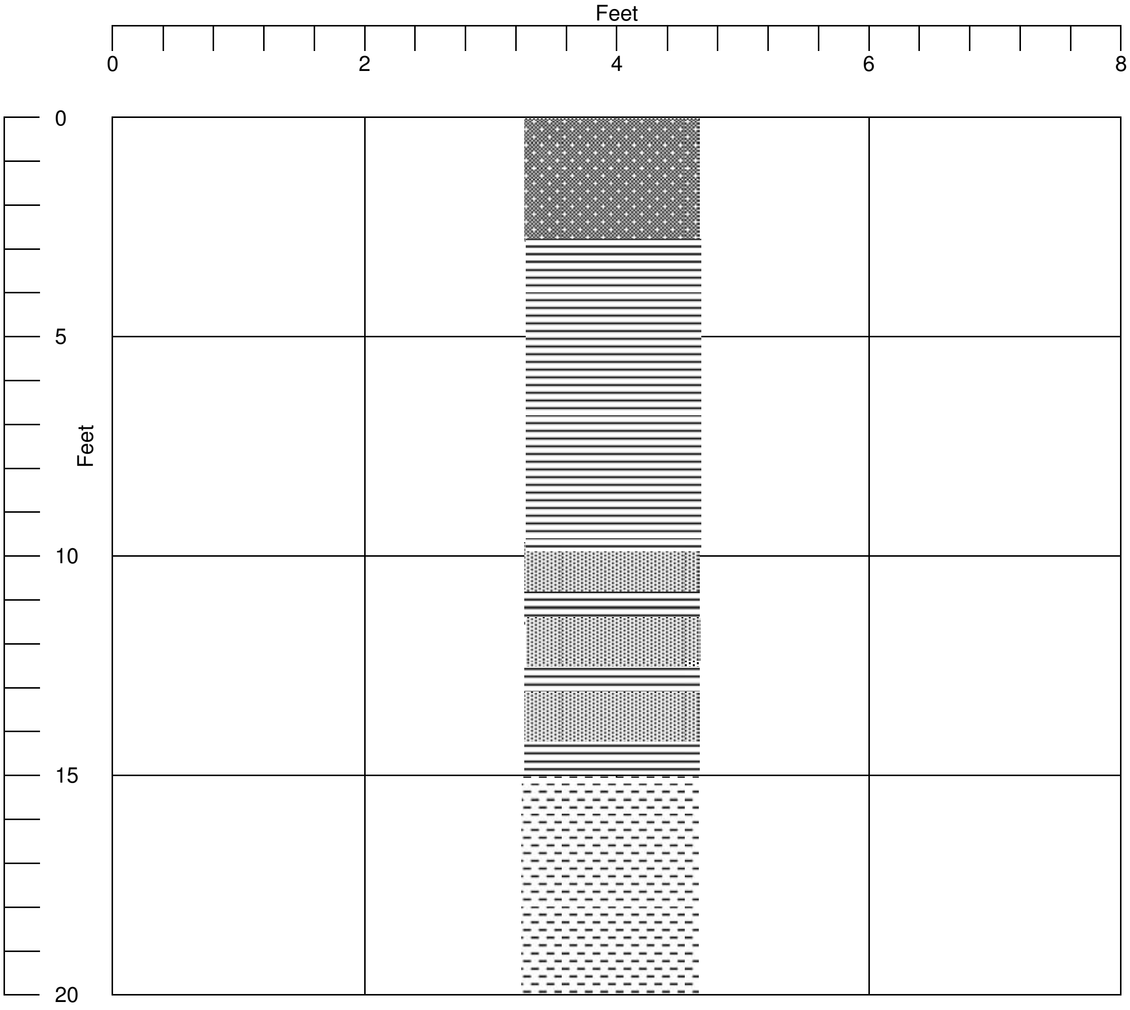
GATP-02 Test Pit Pictures

1. Photo of GATP-02 from ground surface.

2. Photo of GATP-02 cuttings on the ground surface.

FIELD TEST PIT LOG

Temp: 22 F Weather: Partly Cloudy Engineer: R. Di Donato Operator: Chris Test Pit: 0623 (GATP-03)
Equipment: Caterpillar 320BL with a 2' bucket Contractor K-Sue Construction Date 12/08/2005
Location Moab, Utah Elevation 4043 ft Datum N 6665394, E 2183378 Job No. 053-2269



Samples	
No	Depth
1	0.0-5.0 ft.
2	5.0-10.0 ft.
3	10.0-15.0 ft.
4	15.0-20.0 ft.
5	Composite

Sample Descriptions and Excavation Notes
(0-3.0) Silty SAND with gravel (SM), loose, reddish brown. (COVER FILL) (3.0-10.0) Silty sandy CLAY (CH), tan, dark yellowish brown, olive, firm, high plasticity. (SLIMES) (10.0-15.0) Silty SAND and Silty CLAY (SM, CL) , tan, dark yellowish brown, olive, loose, moist, medium to fine grained sand. (TRANSITIONAL TAILINGS) (15.0-20.0) Sandy SILT (ML), dark yellowish brown, fine grained, moist, firm. (TRANSITIONAL TAILINGS)

Sample	Sample Type	Sample site
1	Bulk	Track-hoe bucket
2	Bulk	Track-hoe bucket
3	Bulk	Track-hoe bucket
4	Bulk	Track-hoe bucket
5	Bulk	Track-hoe bucket

Special Notes:

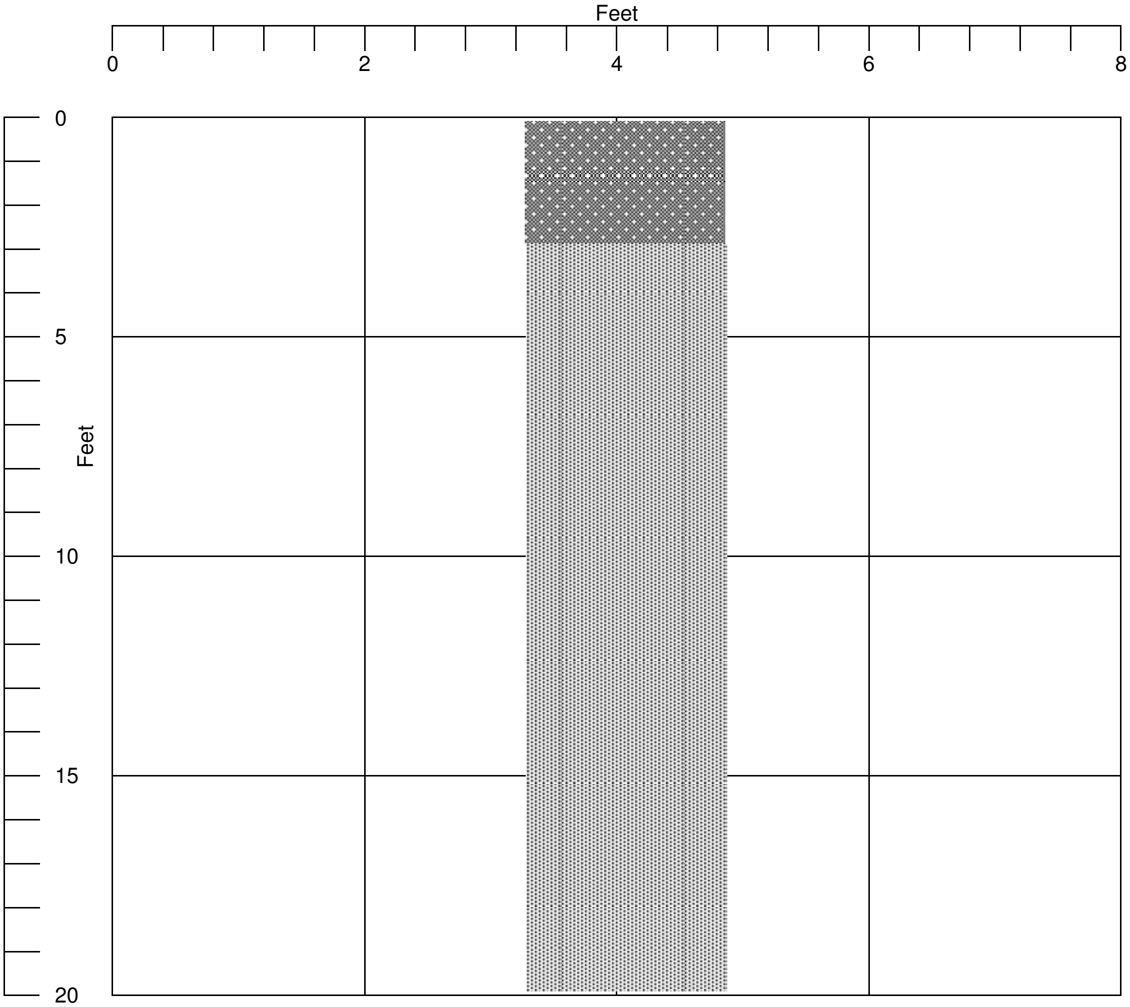
Sample Number 5 excludes cover fill material and is comprised of primarily tailings.

GATP-03 Test Pit Picture

1. Photo of GATP-03 from ground surface, approximately 10 feet bgs into excavation.

FIELD TEST PIT LOG

Temp: 21 F Weather: Partly Cloudy Engineer: R. Di Donato Operator: Chris Test Pit: 0624 (GATP-04)
Equipment: Caterpillar 320BL with a 2' bucket Contractor K-Sue Construction Date 12/08/2005
Location Moab, Utah Elevation 4056 ft Datum N 6664450, E 2183650 Job No. 053-2269



Samples	
No	Depth
1	0.0-5.0 ft.
2	5.0-10.0 ft.
3	10.0-15.0 ft.
4	15.0-20.0 ft.
5	Composite

Sample Descriptions and Excavation Notes	Sample	Sample Type	Sample site
(0-3.0) Silty SAND with gravel (SM), loose, reddish brown. (COVER FILL) (3.0-20.0) Silty SAND and minor Clayey SILT (SM, MH), tan, yellowish brown, olive, loose, dry to moist, medium to fine grained. (SAND TAILINGS)	1	Bulk	Track-hoe bucket
	2	Bulk	Track-hoe bucket
	3	Bulk	Track-hoe bucket
	4	Bulk	Track-hoe bucket
	5	Bulk	Track-hoe bucket

Special Notes:

Sample Number 5 excludes cover fill material and is comprised of primarily tailings.

GATP-04 Test Pit Picture

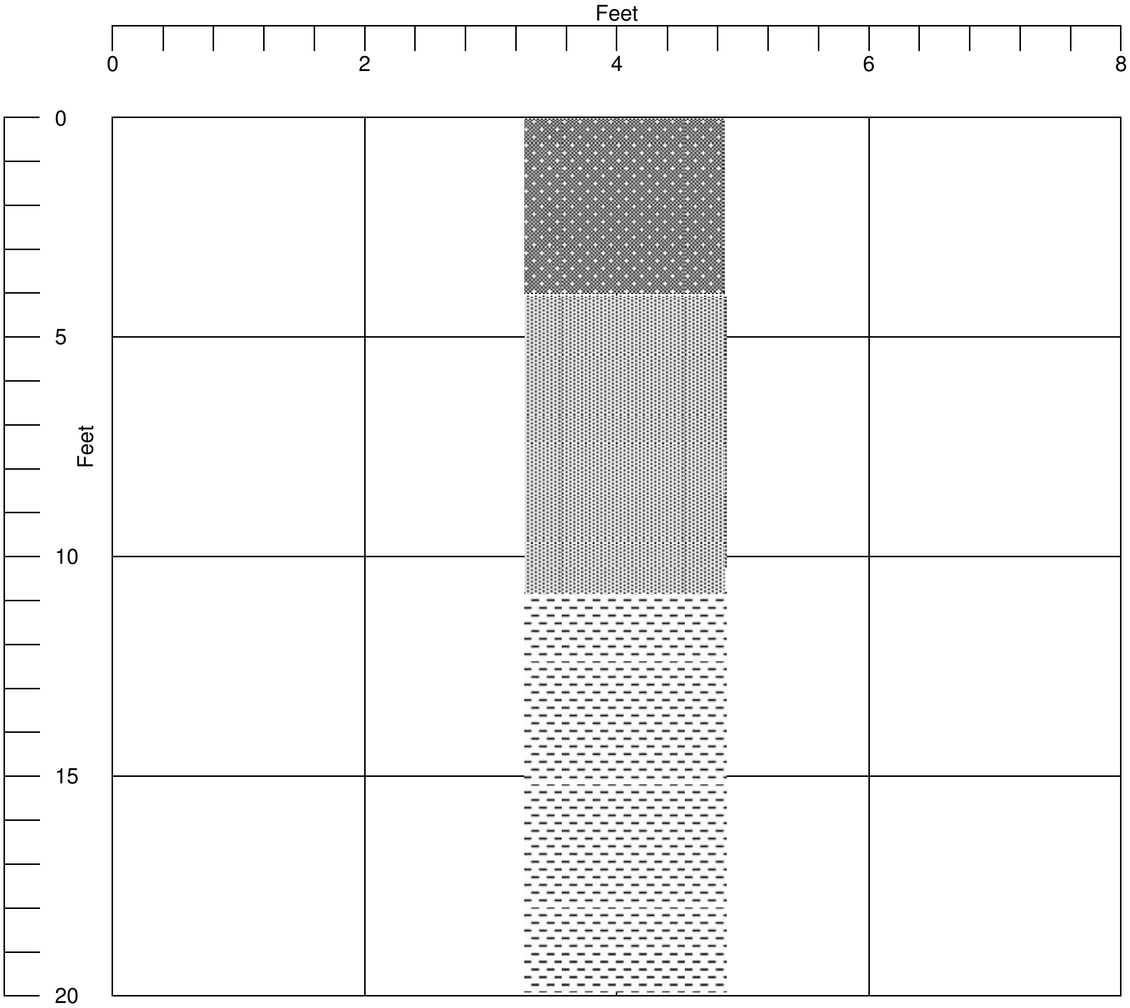
1. Photo of GATP-04 from ground surface.

FIELD TEST PIT LOG

Temp: 21 F Weather: Partly Cloudy Engineer: R. Di Donato Operator: Chris Test Pit: 0625 (GATP-05)

Equipment: Caterpillar 320BL with a 2' bucket Contractor K-Sue Construction Date 12/08/2005

Location Moab, Utah Elevation 4042 ft Datum N 6664650, E 2184100 Job No. 053-2269



Samples	
No	Depth
1	0.0-5.0 ft.
2	5.0-10.0 ft.
3	10.0-15.0 ft.
4	15.0-20.0 ft.
5	Composite

Sample Descriptions and Excavation Notes

(0-4.0) Silty SAND with gravel (SM), loose, reddish brown. (COVER FILL)

(4.0-11.0) SAND with little clay and silt (SM), gray, olive, dark yellowish brown, loose, moist, fine grained. (SAND TAILINGS)

(11.0-20.0) Clayey elastic SILT with some fine grained sand (MH), olive, plastic fines, moist. (SLIMES)

Sample	Sample Type	Sample site
1	Bulk	Track-hoe bucket
2	Bulk	Track-hoe bucket
3	Bulk	Track-hoe bucket
4	Bulk	Track-hoe bucket
5	Bulk	Track-hoe bucket

Special Notes:

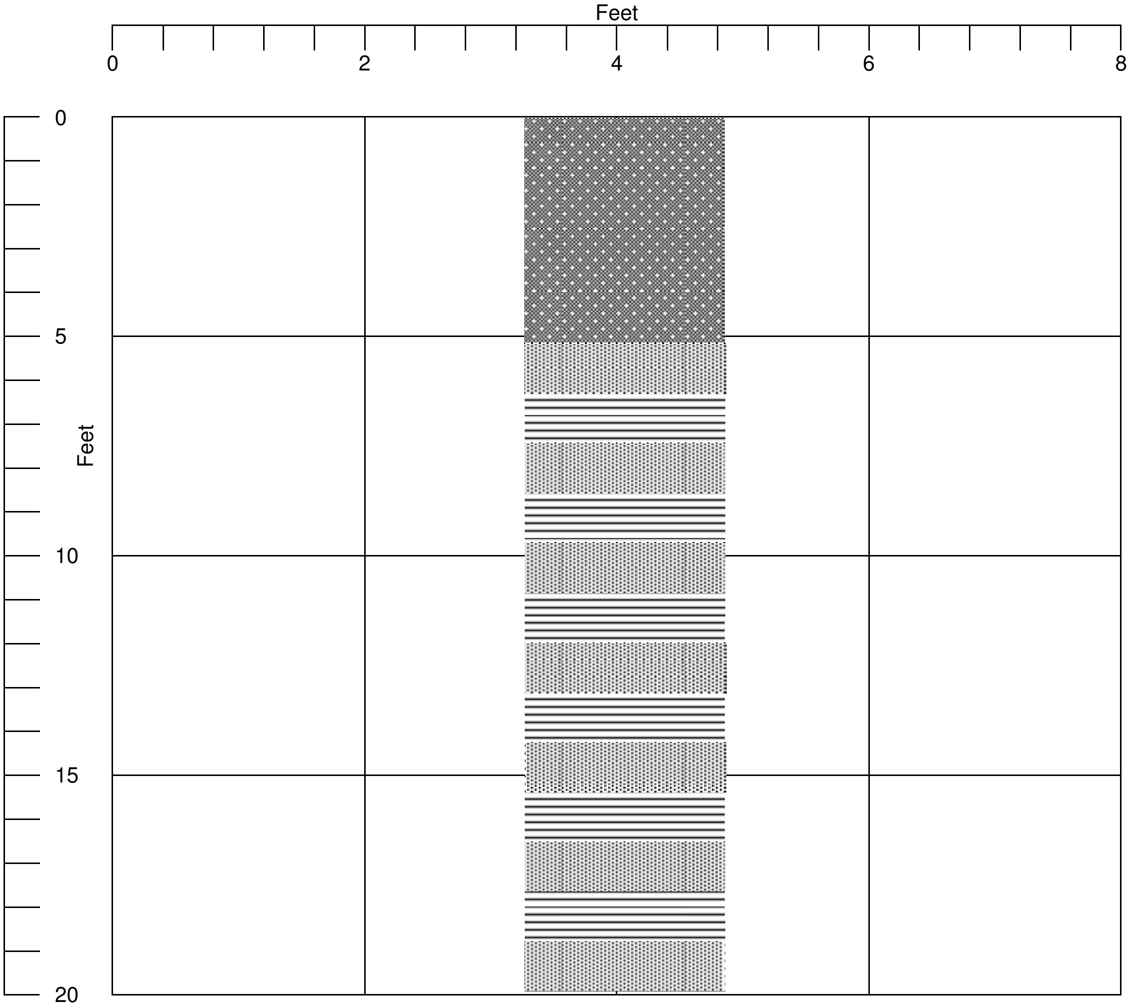
Sample Number 5 excludes cover fill material and is comprised of primarily tailings.

GATP-05 Test Pit Picture

1. Photo of GATP-05 from ground surface.

FIELD TEST PIT LOG

Temp: 20 F
Weather: Partly Cloudy
Engineer: R. Di Donato
Operator: Chris
Test Pit: 0626 (GATP-06)
Equipment: Caterpillar 320BL with a 2' bucket
Contractor: K-Sue Construction
Date: 12/08/2005
Location: Moab, Utah
Elevation: 4034 ft
Datum: N 6664900, E 2184400
Job No.: 053-2269



Samples	
No	Depth
1	0.0-5.0 ft.
2	5.0-10.0 ft.
3	10.0-15.0 ft.
4	15.0-20.0 ft.
5	Composite

Sample Descriptions and Excavation Notes

(0-5.0) Silty SAND with gravel (SM), loose, reddish brown. (COVER FILL)

(5.0-20.0) Silty SAND, Clayey SAND and Silty SAND with clay (SC, SM), some interbedded silty clay layers also present, gray, olive, reddish brown, loose, moist, fine grained. Intermixed transitional material. (TRANSITIONAL TAILINGS)

Sample	Sample Type	Sample site
1	Bulk	Track-hoe bucket
2	Bulk	Track-hoe bucket
3	Bulk	Track-hoe bucket
4	Bulk	Track-hoe bucket
5	Bulk	Track-hoe bucket

Special Notes:

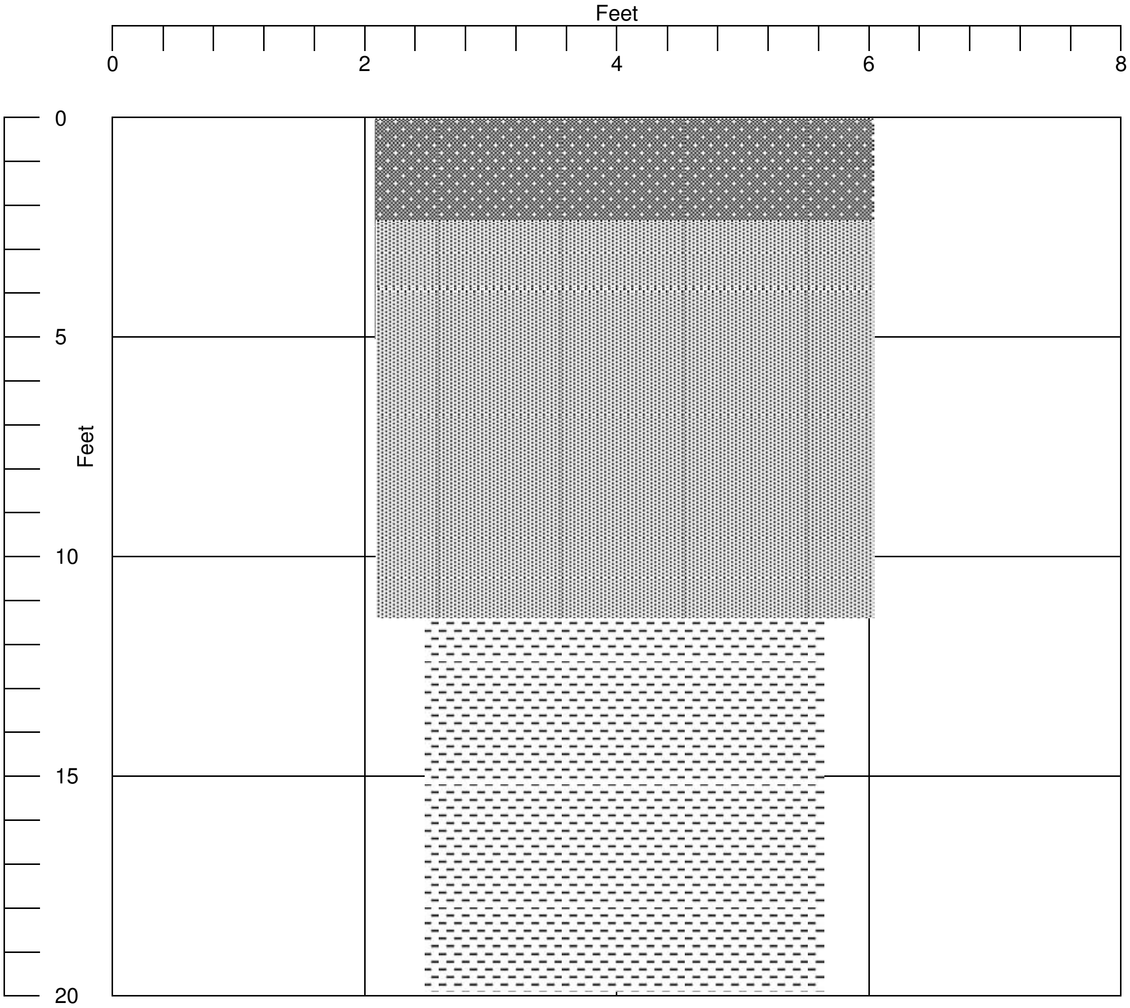
Sample Number 5 excludes cover fill material and is comprised of primarily tailings.

GATP-06 Test Pit Picture

1. Photo of GATP-06 cuttings from ground surface. Excavation and Track-hoe to the left of the photo.

FIELD TEST PIT LOG

Temp: 26 F Weather: Partly Cloudy Engineer: R. Di Donato Operator: Chris Test Pit: 0627 (GATP-07)
Equipment: Caterpillar 320BL with a 2' bucket Contractor K-Sue Construction Date 12/07/2005
Location Moab, Utah Elevation 4040 ft Datum N 6665150, E 2184750 Job No. 053-2269



Samples	
No	Depth
1	0.0-5.0 ft.
2	5.0-10.0 ft.
3	10.0-15.0 ft.
4	15.0-20.0 ft.
5	Composite

Sample Descriptions and Excavation Notes

(0-2.5) Silty SAND with gravel (SM), loose, reddish brown. Geogrid layer present. (COVER FILL)

(2.5-11.5) Silty clayey SAND (SC-SM), olive to yellowish brown, saturated and wet. Geogrid layer present. Free water present and entering test pit at approximately 12 feet. (TRANSITIONAL TAILINGS)

(11.5-20.0) Clayey elastic SILT with little sand, olive green to dark brown and black. (SLIMES)

Sample	Sample Type	Sample site
1	Bulk	Track-hoe bucket
2	Bulk	Track-hoe bucket
3	Bulk	Track-hoe bucket
4	Bulk	Track-hoe bucket
5	Bulk	Track-hoe bucket

Special Notes:

Distinctive ammonia odor present

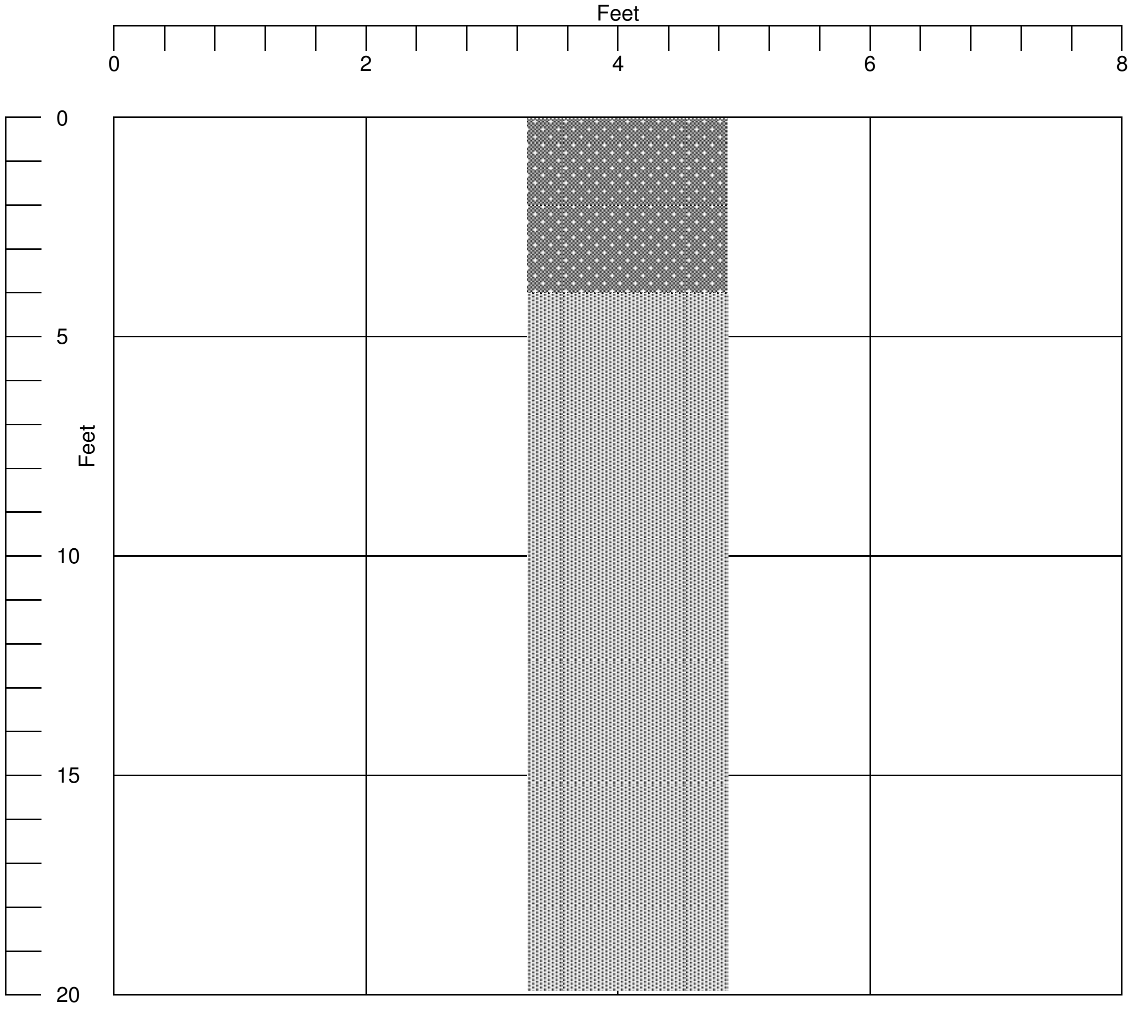
Sample Number 5 excludes cover fill material and is comprised of primarily tailings.

GATP-01 Test Pit Picture

1. Photo of GATP-07 from ground surface. Note Geogrid at approximately 2 feet and 9 feet below ground surface.

FIELD TEST PIT LOG

Temp: 23 F
Weather: Partly Cloudy
Engineer: R. Di Donato
Operator: Chris
Test Pit: 0628 (GATP-08)
Equipment: Caterpillar 320BL with a 2' bucket
Contractor K-Sue Construction
Date 12/08/2005
Location Moab, Utah
Elevation 4056 ft
Datum N 6665400, E 2185150
Job No. 053-2269



Samples	
No	Depth
1	0.0-5.0 ft.
2	5.0-10.0 ft.
3	10.0-15.0 ft.
4	15.0-20.0 ft.
5	Composite

Sample Descriptions and Excavation Notes

(0-4.0) Silty SAND with gravel (SM), loose, reddish brown. (COVER FILL)

(4.0-20.0) Silty SAND (SM), very few clayey silt lenses tan, yellowish brown, loose, mostly dry, medium to fine grained sand. (SANDS TAILINGS)

Sample	Sample Type	Sample site
1	Bulk	Track-hoe bucket
2	Bulk	Track-hoe bucket
3	Bulk	Track-hoe bucket
4	Bulk	Track-hoe bucket
5	Bulk	Track-hoe bucket

Special Notes:

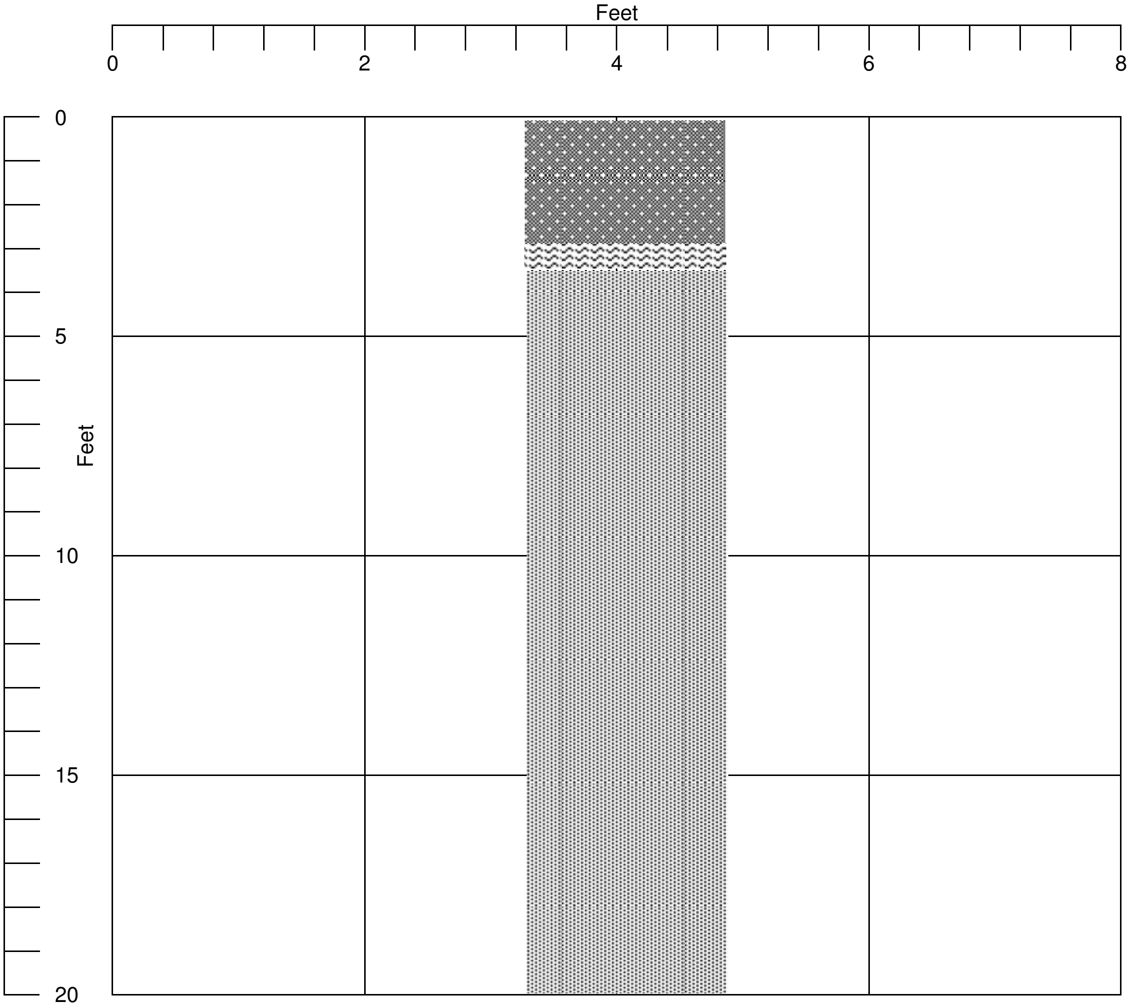
Sample Number 5 excludes cover fill material and is comprised of primarily tailings.

GATP-08 Test Pit Picture

1. Photo of GATP-08 from ground surface.

FIELD TEST PIT LOG

Temp: 21 F Weather: Partly Cloudy Engineer: R. Di Donato Operator: Chris Test Pit: 0629 (GATP-09)
Equipment: Caterpillar 320BL with a 2' bucket Contractor K-Sue Construction Date 12/08/2005
Location Moab, Utah Elevation 4056 ft Datum N 6665849, E 2184347 Job No. 053-2269



Samples	
No	Depth
1	0.0-5.0 ft.
2	5.0-10.0 ft.
3	10.0-15.0 ft.
4	15.0-20.0 ft.
5	Composite

Sample Descriptions and Excavation Notes

(0-3.0) Silty SAND with gravel (SM), loose, reddish brown. (COVER FILL)

(3.0-3.5) SALT lens, Very Hard

(3.5-20.0) Silty SAND (SM), tan, yellowish brown, olive, loose to medium dense, moist, medium to fine grained. Sands and silts cemented with increased depth. Very little intermittent, interbedded silty clay lenses. (TRANSITIONAL TAILINGS)

Sample	Sample Type	Sample site
1	Bulk	Track-hoe bucket
2	Bulk	Track-hoe bucket
3	Bulk	Track-hoe bucket
4	Bulk	Track-hoe bucket
5	Bulk	Track-hoe bucket

Special Notes:

Distinctive ammonia odors emanating from the test pit.

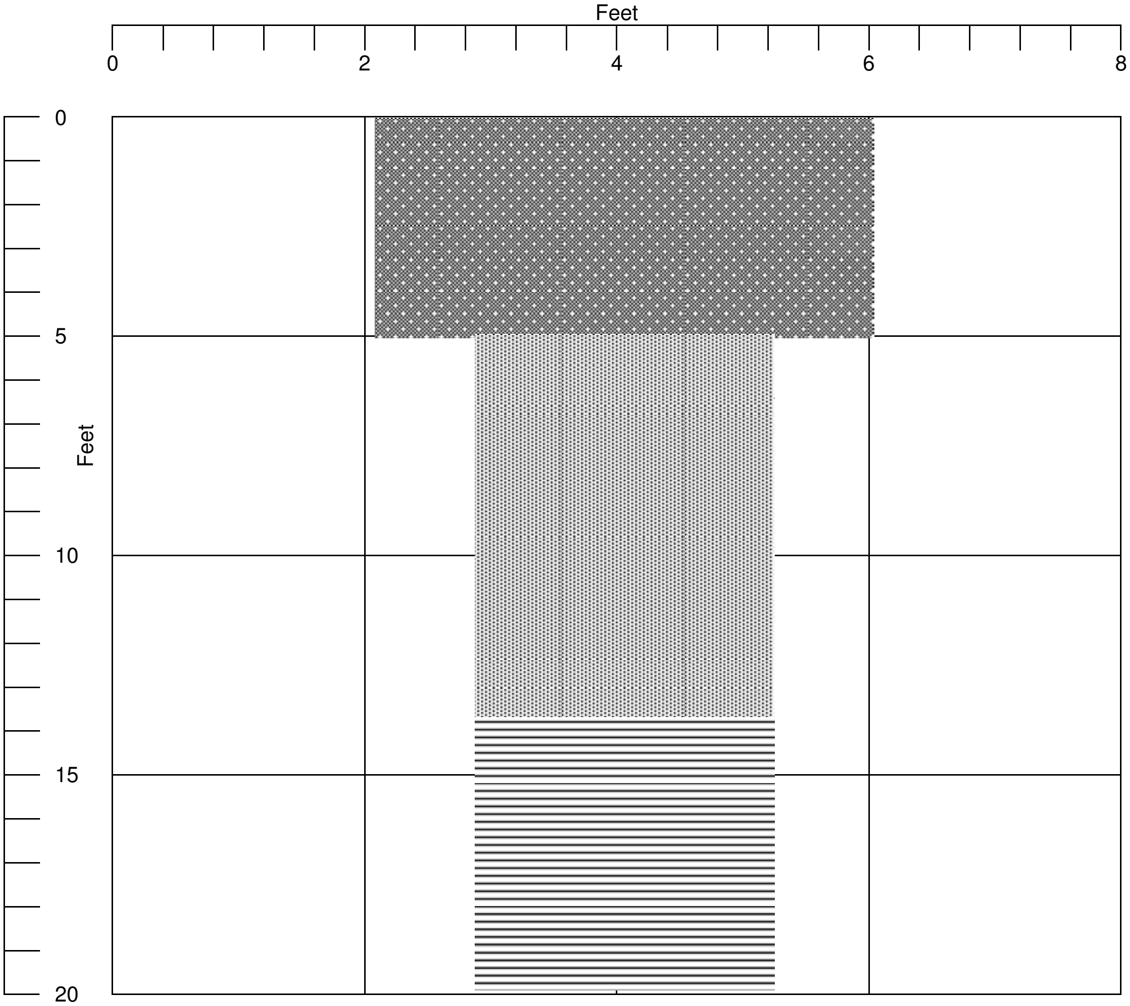
Sample Number 5 excludes cover fill material and is comprised of primarily tailings.

GATP-09 Test Pit Picture

1. Photo of GATP-09 from ground surface. Note the salt lens approximately 3 feet bgs.

FIELD TEST PIT LOG

Temp: 27 F Weather: Partly Cloudy Engineer: R. Di Donato Operator: Chris Test Pit: 0630 (GATP-10)
Equipment: Caterpillar 320BL with a 2' bucket Contractor K-Sue Construction Date 12/07/2005
Location Moab, Utah Elevation 4049 ft Datum N 6664650, E 2184971 Job No. 053-2269



Samples	
No	Depth
1	0.0-5.0 ft.
2	5.0-10.0 ft.
3	10.0-15.0 ft.
4	15.0-20.0 ft.
5	Composite

Sample Descriptions and Excavation Notes

(0-5.0) Silty SAND with little gravel (SM), loose, reddish brown. (COVER FILL)

(5.0-13.5) Silty SAND with gravel (SM), tan to dark yellowish brown. (SAND TAILINGS)

(13.5-20.0) Clayey elastic SILT (MH) and Silty fat CLAY (CH), some sand, olive green to dark yellowish brown. (SLIMES)

Sample	Sample Type	Sample site
1	Bulk	Track-hoe bucket
2	Bulk	Track-hoe bucket
3	Bulk	Track-hoe bucket
4	Bulk	Track-hoe bucket
5	Bulk	Track-hoe bucket

Special Notes:

Sample Number 5 excludes cover fill material and is comprised of primarily tailings.

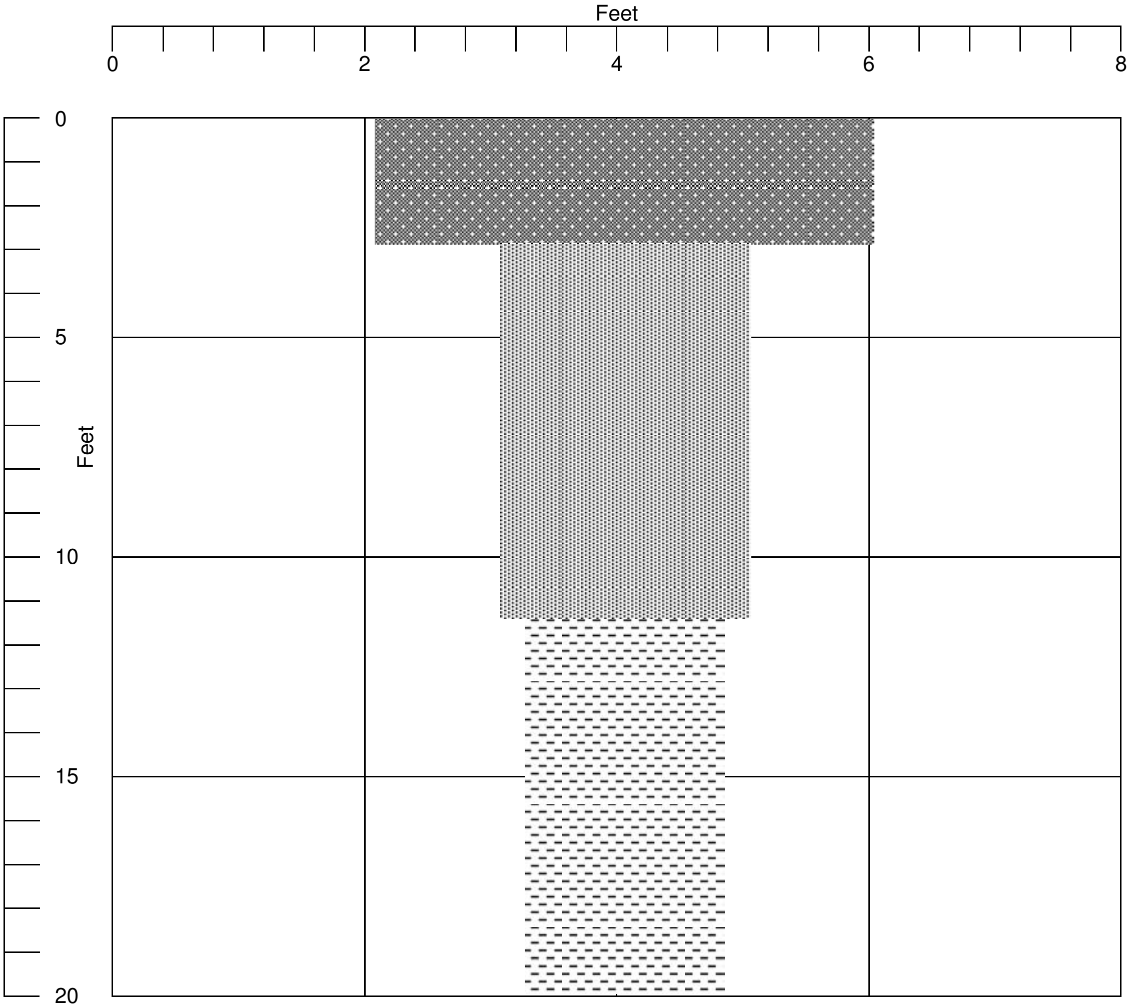
GATP-10 Test Pit Picture

1. Photo of GATP-10 from ground surface.

FIELD TEST PIT LOG

Temp:	25 F	Weather:	Partly Cloudy	Engineer:	R. Di Donato	Operator:	Chris
Equipment:	Caterpillar 320BL with a 2' bucket			Contractor	K-Sue Construction		
Location	Moab, Utah			Elevation	4048 ft	Datum	N 6664317, E 2184353

Test Pit:	0631 (GATP-11)
Date	12/07/2005
Job No.	053-2269



Samples	
No	Depth
1	0.0-5.0 ft.
2	5.0-10.0 ft.
3	10.0-15.0 ft.
4	15.0-20.0 ft.
5	Composite

Sample Descriptions and Excavation Notes
(0-3.0) Silty SAND with gravel (SM), loose, reddish brown. (COVER FILL)
(3.0-4.5) Silty SAND (SM) , tan, loose, moist. (SAND TAILINGS)
(4.5-11.5) Silty SAND (SM), little gravel, few interbedded silty clays and clayey silts, olive gray, tan, yellowish brown, wet. Sidewall tension cracking in this zone. (TRANSITIONAL TAILINGS)
(11.5-18.0) Clayey elastic SILT (MH), little sand, olive, brown. (SLIMES)
(18.0-20.0) Clayey elastic SILT (MH), olive brown, moist to wet. (SLIMES)

Sample	Sample Type	Sample site
1	Bulk	Track-hoe bucket
2	Bulk	Track-hoe bucket
3	Bulk	Track-hoe bucket
4	Bulk	Track-hoe bucket
5	Bulk	Track-hoe bucket

Special Notes:

Sample Number 5 excludes cover fill material and is comprised of primarily tailings.

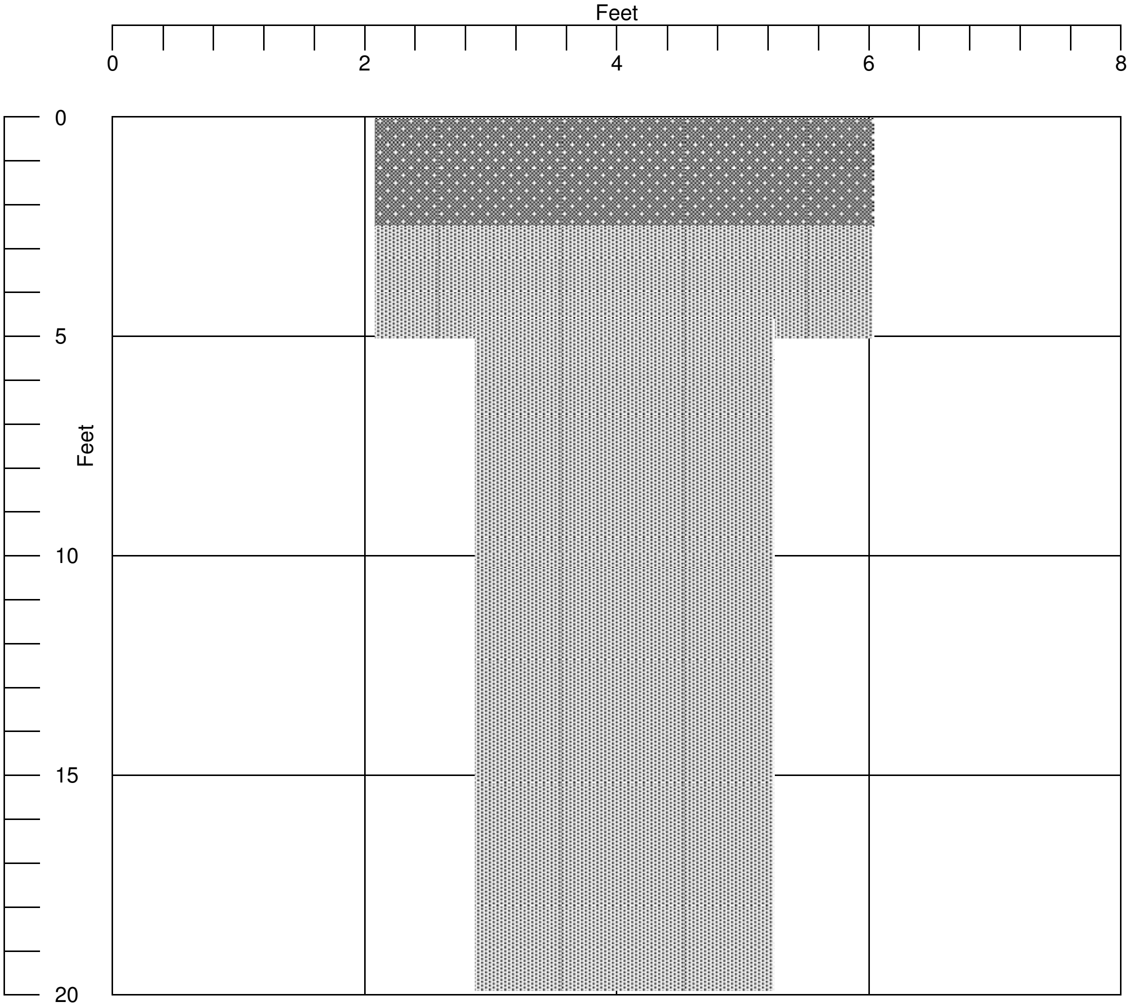
GATP-11 Test Pit Picture

1. Photo of GATP-11 from ground surface.

FIELD TEST PIT LOG

Temp:	25 F	Weather:	Partly Cloudy	Engineer:	R. Di Donato	Operator:	Chris
Equipment:	Caterpillar 320BL with a 2' bucket	Contractor	K-Sue Construction				
Location	Moab, Utah	Elevation	4058 ft	Datum	N 6664094, E 2184981		

Test Pit: 0632 (GATP-12)
Date 12/07/2005
Job No. 053-2269



Samples	
No	Depth
1	0.0-5.0 ft.
2	5.0-10.0 ft.
3	10.0-15.0 ft.
4	15.0-20.0 ft.
5	Composite

Sample Descriptions and Excavation Notes	Sample	Sample Type	Sample site
(0-2.5) Silty SAND with gravel (SM), loose, reddish brown. (COVER FILL) (2.5-20.0) Silty SAND (SM), little gravel, loose to medium dense, brown to buff. Salt crystals present. (SAND TAILINGS)	1	Bulk	Track-hoe bucket
	2	Bulk	Track-hoe bucket
	3	Bulk	Track-hoe bucket
	4	Bulk	Track-hoe bucket
	5	Bulk	Track-hoe bucket

Special Notes:
Sample Number 5 excludes cover fill material and is comprised of primarily tailings.

GATP-12 Test Pit Picture

1. Photo of GATP-12 from ground surface.

U.S. Department of Energy—Grand Junction, Colorado

Calculation Cover Sheet

Calc. No.: MOA-01-08-2006-4-09-01 **Discipline:** Geotechnical Properties **No. of Sheets:** 4

Doc. No.: X0188100

Location: Attachment 5 Vol. I, Appendix J

Project: Moab UMTRA Project

Site: Moab Processing Site

Feature: Geotechnical Laboratory Testing Results for the Moab Processing Site

Sources of Data:

Geotechnical Testing Data from the Moab Processing Site (referenced below)

Remedial Action Plan (RAP) calculations as referenced in the text.

Reason for Revision:

Internal Quality Assurance reviews detected inconsistencies in the data as originally reported. The extent of the inconsistencies is documented in Appendix C, and page changes are provided in Appendix B.

Sources of Formulae and References:

Shaw E&I, 2006. *Certificate of Analysis*, prepared for 37 soil samples received February 15, 2006, Shaw Project Number 109855.01310000, April 6.

Shaw E&I, 2006. *Certificate of Analysis*, prepared for 122 soil samples received February 1, 2006, Shaw Project Number 109855.01210000, May 3.

Preliminary Calc. ☐ **Final Calc.** ☒ **Supersedes Calc. No. MOA-01-07-2006-4-09-00**

Author: Name 5-31-07 Date

Approved by: Name 5/31/07 Date

Checked by:
Name 5/30/07 Date
Name 31 May 07 Date
Name Date
Name May 31, 07 Date

No text for this page

Problem Statement:

Preliminary site selection performed jointly by the U.S. Department of Energy (DOE) and the Contractor identified a 2,300-acre withdrawal area in the Crescent Flat area just northeast of Crescent Junction, Utah, as a possible site for final disposal of the Moab uranium mill tailings. The proposed disposal cell would cover approximately 250 acres.

Based on the preliminary site-selection process, the suitability of the Crescent Junction Disposal Site is being evaluated from several technical aspects, including geomorphic, geologic, hydrologic, seismic, geochemical, and geotechnical. The objective of this calculation set is to present the geotechnical testing activities that were used to characterize the tailings at the Moab Processing Site.

These data will be incorporated into Attachment 5 of the Remedial Action Plan and Site Design for Stabilization of Moab Title I Uranium Mill Tailings at Crescent Junction, Utah, Site (RAP) and summarized in the Remedial Action Selection (RAS) report for the Moab Site.

Method of Solution:

Samples were collected from the tailings pile at the Moab processing site during the 2005 geotechnical investigation. Samples were analyzed from the 700-series boreholes and from the 600-series (also known as the GATP series) test pits. Figure 1 shows the location where the tailings samples were collected. Analyses performed included percent moisture, liquid limit, plasticity index, USCS soil classification, specific gravity, bulk density, dry density, and grain size analysis. Data are presented in Appendix A and Appendix B at the conclusion of this calculation. Correspondence generated during the laboratory data review is presented in Appendix C.

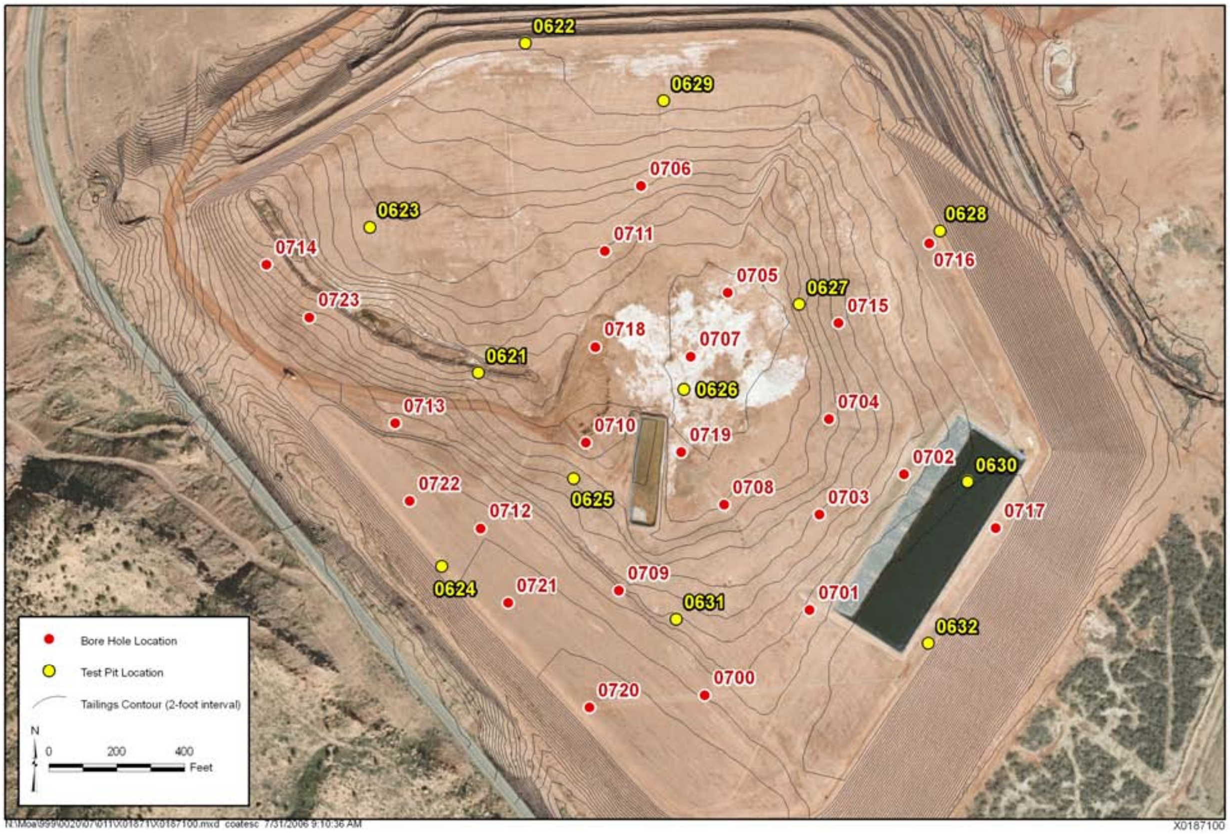


Figure 1. Location of Tailings Samples

Assumptions:

Not applicable.

Calculation:

Not applicable.

Discussion:

Soil and tailings samples from this sampling effort were sent to Shaw E& I, Inc. Geotechnical Laboratory (hereafter referred to as the laboratory) in two separate batches. The first batch was received at the laboratory on February 1, 2006, and the second batch was received at the laboratory on February 15, 2006.

The laboratory issued to Stoller Corporation a *Certificate of Analysis* for the first batch of samples on March 13, 2006. Golder Associates, who furnished engineering-design support to Stoller Corporation for the tailings excavation, reviewed the testing results from the first batch of samples and prepared three sets of written comments in regard to the testing results. The three sets of comments from Golder Associates were dated March 20, March 22, and March 23, 2006.

On April 13, 2006, the laboratory issued a response letter to the March 20 and March 22, 2006, comments provided by Golder Associates. Subsequently, Golder Associates, in a letter dated April 20, 2006, stated that the laboratory had substantively addressed the comments contained in the letters dated March 20 and March 22, 2006, but noted that the comments in the March 23, 2006, letter had not been addressed.

On May 3, 2006, the laboratory issued a revised *Certificate of Analysis* containing the corrected and amended results. This *Certificate of Analysis* superseded the original report and contained a notification in the cover letter stating that the “original report should not be used.”

On August 16, 2006, the laboratory responded to the comments in Golder Associates’ March 23, 2006, letter. In conjunction with their response, the laboratory issued page changes to the May 3, 2006, *Certificate of Analysis*. These page changes were inserted into both the electronic version of the May 3, 2006, data set and the paper copies of that data set.

During QA verification of the final data set, S.M. Stoller discovered one remaining error in the May 3, 2006, *Certificate of Analysis*. In a letter dated February 21, 2007, the laboratory responded and sent one additional page change to the May 3, 2006, data set. With the inserted page changes, the data contained in the May 3, 2006, *Certificate of Analysis* is now deemed to be complete and validated. No additional action is required. Appendix C contains, in chronologic order, each of the letters that were generated during the data review process. Page changes issued by the laboratory are included in the May 3, 2006, *Certificate of Analysis*, which is contained in Appendix B of this calculation.

Conclusion and Recommendations:

Not applicable.

Computer Source:

Not applicable.

References:

See “Sources of Formulae and References” located on the cover sheet.

Appendix A

Certificate of Analysis
April 6, 2006

Shaw™
Shaw E & I, Inc.

Geotechnical Laboratory
PO Box 4339
1570 Bear Creek Road
Oak Ridge TN 37830
(865) 482-6497

CERTIFICATE OF ANALYSIS

Erin Stanley
General Engineering Laboratories
2040 Savage Road
Charleston SC 29407

April 6, 2006

This is the Certificate of Analysis for the following samples:

Shaw Project ID:	**GEL – Moab**
Shaw Project Number:	**109855.01310000**
Date Received by Lab:	February 15, 2006
Number of Samples:	Thirty-seven (37)
Sample Type:	Soil

I. Introduction/Case Narrative

Thirty-seven soil samples were received by the Shaw Geotechnical Laboratory on February 15, 2006. Samples were submitted for determination of moisture content, specific gravity, bulk density, Atterberg limits, percent finer than #200, sieve analysis, and particle-size distribution.

These samples were the fulfillment of a partial sample shipment received on February 1, 2006.

Please see Appendix A, Sample Number Cross Reference List; Appendix B, Analysis Results; and Appendix C, Chain-of-Custody/Sample Receipt Records.

Reviewed and Approved:

Ralph Cole
Laboratory Manager, Geotechnical Services

II. Analytical Results/Methodology

REFERENCES: United Nations, *Recommendations on the Transport of Dangerous Goods, Manual of Tests and Criteria*, third ed. New York, 1999. United States Army Corps of Engineers (USACE), Engineer Manual 1110-2-1906, *Laboratory Soils Testing*, appendix II, 1970; United States Environmental Protection Agency, SW846, *Test Methods for Examining Solid Waste, Physical/Chemical Methods*, 3rd ed., Nov 1986 (EPA SW-846). Annual Book of ASTM Standards, Section 4, Construction, Volume 04.08, *Soil and Rock (I)*, and Volume 04.09, *Soil and Rock (II)*, 2006. Shaw Environmental and infrastructure, Standard Operating Procedures.

Particle-Size Distribution of Soils	**ASTM D 422**
Specific Gravity of Soils	**ASTM D 854**
Amount of Material Finer Than the #200 Sieve	**ASTM D 1140**
Moisture Content of Soil and Rock	**ASTM D 2216**
Atterberg Limits: Liquid Limit, Plastic Limit, Plasticity Index	**ASTM D 4318**
Bulk Density	**USACE**

III. Quality Control

Quality control checks such as duplicates and spikes (QC samples), are not normally applicable to geotechnical testing. This is due largely to the inability of obtaining samples with known characteristics, the heterogenous nature of the samples, and quality control procedures built-in to the analytical method.

QC measures to ensure accuracy and precision of test results include the following:

- 100% verification of all numerical results - raw data entries, transcriptions and calculations entered by lab technicians are checked, recalculated and verified. Most data calculations are performed by computer programs.

- Data validation through test reasonableness - summaries of all test results for individual reports are reviewed to determine the overall reasonableness of data and to determine the presence of any data that may be considered outliers.

- Quality control procedures are built into most standardized geotechnical procedures. For example, liquid limit and plastic limit analyses call for re-analyses and specify acceptance criteria.

- Routine instrument calibration - instruments, gauges and equipment used in testing are calibrated on a routine basis. All instrument calibration follows ASTM or manufacturer guidelines.

- Maintenance of all past calibration records - calibration records and certification documents of all instruments, gauges and equipment are updated routinely and maintained in the Quality Control Coordinators Quality/Operations files.

- Certified and trained personnel - all technicians are trained in the application of standard laboratory procedures for geotechnical analyses as well as the quality assurance measures implemented by Shaw.

- Quantitative analyses frequently used in geotechnical/physical testing programs do not use QC tools common to wet chemistry or radiochemistry laboratories. Measures not employed in the analysis of samples reported in this report include: laboratory control samples (LCS), blanks, matrix spikes (MS), duplicate analyses, dilutions, digestions, correction factors, surrogate sample analyses, detection limit determinations, control charts, and/or tentatively identified compounds (TICs).

IV. Data Qualification

Several samples appeared to contain a large amount of soluble salts. Some grainsize results for the silt/clay range may be skewed high due to this, and specific gravity (particle density) tests may have been affected.

Appendix A
Sample Cross-Reference List

SAMPLE NUMBER CROSS-REFERENCE LIST (Cont'd)

LAB SAMPLE NO.	CLIENT SAMPLE NO.	MATRIX
BC0874	701-R26	Soil
BC0875	706-R20	Soil
BC0876	706-R22	Soil
BC0877	707-R17	Soil
BC0878	707-R28	Soil
BC0879	710-R1	Soil
BC0880	710-R19	Soil
BC0881	710-R3	Soil
BC0882	713-R1	Soil
BC0883	713-R13	Soil
BC0884	715-R3	Soil
BC0885	718-R11	Soil
BC0886	718-R13	Soil
BC0887	718-R15	Soil
BC0888	718-R17	Soil
BC0889	718-R5	Soil
BC0890	718-R7	Soil
BC0891	718-R9	Soil
BC0892	722-R1	Soil
BC0893	722-R2	Soil
BC0894	722-R3	Soil
BC0895	722-R5	Soil
BC0896	GATP-10-4	Soil
BC0897	GATP-11-2	Soil
BC0898	GATP-11-4	Soil
BC0899	GATP-12-5	Soil

SAMPLE NUMBER CROSS-REFERENCE LIST (Cont'd)

LAB SAMPLE NO.	CLIENT SAMPLE NO.	MATRIX
BC0900	GATP-3-2	Soil
BC0901	GATP-3-4	Soil
BC0902	GATP-4-5	Soil
BC0903	GATP-5-2	Soil
BC0904	GATP-5-4	Soil
BC0905	GATP-6-1	Soil
BC0906	GATP-6-5	Soil
BC0907	GATP-7-2	Soil
BC0908	GATP-7-4	Soil
BC0909	GATP-8-5	Soil
BC0910	GATP-9-5	Soil

Appendix B
Data Results

MOISTURE CONTENT

PROJECT NAME
GEL - Moab

PROJECT NUMBER
109855.01310000

LAB SAMPLE NO.	CLIENT SAMPLE NO.	MOISTURE, % ASTM D 2216	MOISTURE , % SW846	SOLIDS, % SW846
BC0874	701-R26	33.9	25.3	74.7
BC0875	706-R20	41.3	29.2	70.8
BC0876	706-R22	49.0	32.9	67.1
BC0877	707-R17	62.6	38.5	61.5
BC0878	707-R28	13.6	12.0	88.0
BC0879	710-R1	7.9	7.3	92.7
BC0880	710-R19	9.7	8.9	91.1
BC0881	710-R3	17.0	14.5	85.5
BC0882	713-R1	9.9	9.0	91.0
BC0883	713-R13	7.9	7.3	92.7
BC0884	715-R3	24.0	19.4	80.6
BC0885	718-R11	37.4	27.2	72.8
BC0886	718-R13	57.8	36.6	63.4
BC0887	718-R15	48.5	32.7	67.3
BC0888	718-R17	10.5	9.5	90.5
BC0889	718-R5	79.5	44.3	55.7
BC0890	718-R7	81.8	45.0	55.0
BC0891	718-R9	55.1	35.5	64.5
BC0892	722-R1	7.4	6.9	93.1
BC0893	722-R2	6.9	6.5	93.5

ASTM D 2216 results are based on dry sample weight.
SW846 results are based on wet sample weight.
Solids content is determined by subtracting the SW846 moisture (%) from 100.

April 6, 2006
Erin Stanley
General Engineering Laboratories
Shaw Project Name: GEL – Moab
Shaw Project No. 109855.01310000

MOISTURE CONTENT

PROJECT NAME
GEL - Moab

PROJECT NUMBER
109855.01310000

LAB SAMPLE NO.	CLIENT SAMPLE NO.	MOISTURE, % ASTM D 2216	MOISTURE , % SW846	SOLIDS, % SW846
BC0894	722-R3	6.1	5.8	94.2
BC0895	722-R5	3.0	2.9	97.1
BC0896	GATP-10-4	59.0	37.1	62.9
BC0897	GATP-11-2	5.8	5.5	94.5
BC0898	GATP-11-4	54.4	35.2	64.8
BC0899	GATP-12-5	7.3	6.8	93.2
BC0900	GATP-3-2	56.8	36.2	63.8
BC0901	GATP-3-4	23.3	18.9	81.1
BC0902	GATP-4-5	10.0	9.1	90.9
BC0903	GATP-5-2	7.8	7.2	92.8
BC0904	GATP-5-4	83.0	45.4	54.6
BC0905	GATP-6-1	10.4	9.4	90.6
BC0906	GATP-6-5	30.5	23.4	76.6
BC0907	GATP-7-2	29.8	22.9	77.1
BC0908	GATP-7-4	82.4	45.2	54.8
BC0909	GATP-8-5	113.3	53.1	46.9
BC0910	GATP-9-5	10.6	9.6	90.4

ASTM D 2216 results are based on dry sample weight.
SW846 results are based on wet sample weight.
Solids content is determined by subtracting the SW846 moisture (%) from 100.

SPECIFIC GRAVITY
ASTM D 854

PROJECT NAME:
GEL - Moab

PROJECT NUMBER:
109855.01310000

LAB SAMPLE NO.	CLIENT SAMPLE NO.	SPECIFIC GRAVITY
BC0875	706-R20	2.7419
BC0877	707-R17	2.8075
BC0887	718-R15	2.7297
BC0889	718-R5	2.9083
BC0891	718-R9	2.7129
BC0896	GATP-10-4	2.8315
BC0898	GATP-11-4	2.8423
BC0900	GATP-3-2	2.7394
BC0902	GATP-4-5	2.6142
BC0905	GATP-6-1	2.6935
BC0906	GATP-6-5	2.7158
BC0908	GATP-7-4	2.8222
BC0909	GATP-8-5	2.6871

BULK DENSITY/DRY DENSITY
ASTM D 2937, USACE EM 1110-2-1906, app. II

PROJECT NAME:
GEL - Moab

PROJECT NUMBER:
109855.01310000

LAB SAMPLE NUMBER	CLIENT SAMPLE NUMBER	AVERAGE LENGTH, inches	AVERAGE DIAMETER, inches*	WET WEIGHT, grams	MOISTURE CONTENT, %	BULK DENSITY, pcf	DRY DENSITY, pcf
BC0874	701-R26	5.4765	2.8098	1069.48	33.9	120.0	89.6
BC0875	706-R20	5.5932	2.7847	1033.52	41.3	115.6	81.8

Moisture content calculated by ASTM D 2216 based on sample dry weight.

Bulk density is the weight of wet sample divided by the volume of the wet sample (as-received).

Dry density is the weight of the dry sample solids divided by the volume of the original sample.

ATTERBERG LIMITS
ASTM D 4318

PROJECT NAME:
GEL-Moab

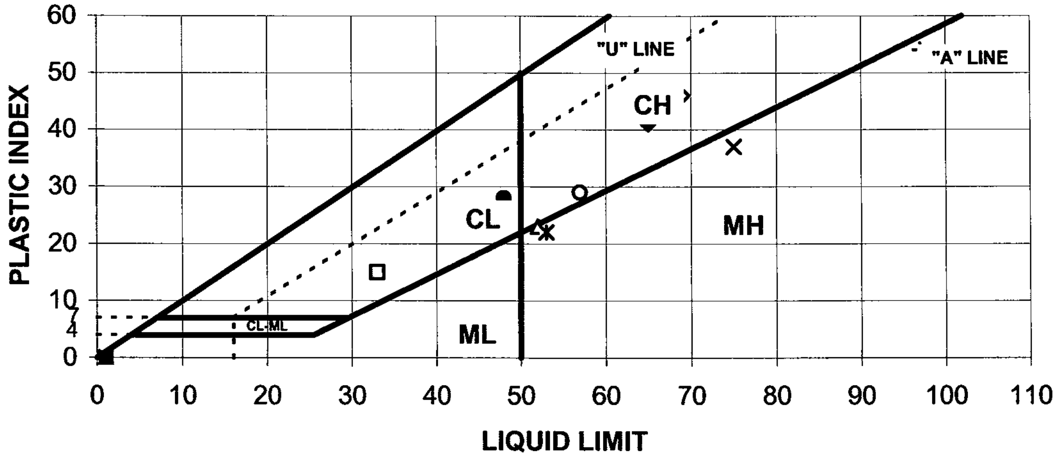
PROJECT NO.
109855.01310000

ATTERBERG LIMITS RESULTS

LAB SAMPLE NO.	FIELD SAMPLE NO.	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	USCS SYMBOL
BC0875 ●	706-R20	48	20	28	CL
BC0877 ◆	707-R17	65	24	41	CH
BC0885 □	718-R11	33	18	15	CL
BC0887 ◇	718-R15	69	23	46	CH
BC0889 +	718-R5	97	43	54	MH
BC0896 ○	GATP-10-4	57	28	29	CH
BC0897 ■	GATP-11-2	NP	NP	NP	NP
BC0898 x	GATP-11-4	75	38	37	MH
BC0900 △	GATP-3-2	52	29	23	CH
BC0904 *	GATP-5-4	53	31	22	MH

*NP=Nonplastic

PLASTICITY CHART



ATTERBERG LIMITS
ASTM D 4318

PROJECT NAME:
GEL-Moab

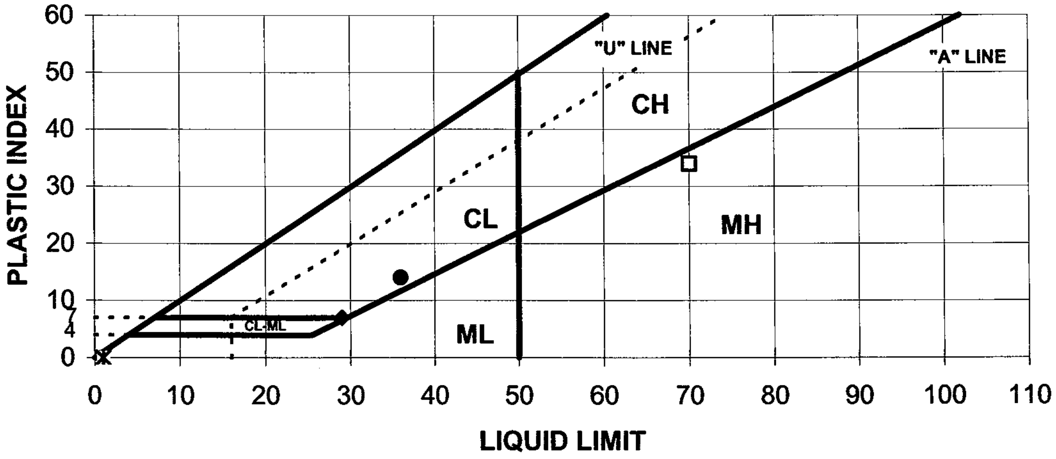
PROJECT NO.
109855.01310000

ATTERBERG LIMITS RESULTS

LAB SAMPLE NO.	FIELD SAMPLE NO.	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	USCS SYMBOL
BC0906 ●	GATP-6-5	36	22	14	CL
BC0907 ◆	GATP-7-2	29	22	7	CL-ML
BC0908 □	GATP-7-4	70	36	34	MH
◇					
+					
○					
■					
X					
△					
*					

*NP=Nonplastic

PLASTICITY CHART



AMT FINER THAN #200 SIEVE
ASTM D 1140

PROJECT NAME
GEL - Moab

PROJECT NUMBER
109855.01310000

SHAW LAB SAMPLE NO.	CLIENT SAMPLE NO.	% LOSS (% FINER THAN #200)
BC0881	710-R3	36.8
BC0882	713-R1	17.1
BC0885	718-R11	99.8
BC0886	718-R13	99.7
BC0890	718-R7	99.6
BC0892	722-R1	21.7
BC0894	722-R3	13.8
BC0895	722-R5	7.3
BC0901	GATP-3-4	60.6
BC0903	GATP-5-2	7.1
BC0910	GATP-9-5	22.4

The number 200 sieve has openings equivalent to 75 microns (0.075mm).

PARTICLE-SIZE DISTRIBUTION
ASTM D 422

Project Name	GEL - Moab	Field Sample No.	701-R26
Project No.	109855.01310000	Lab Sample No.	BC0874

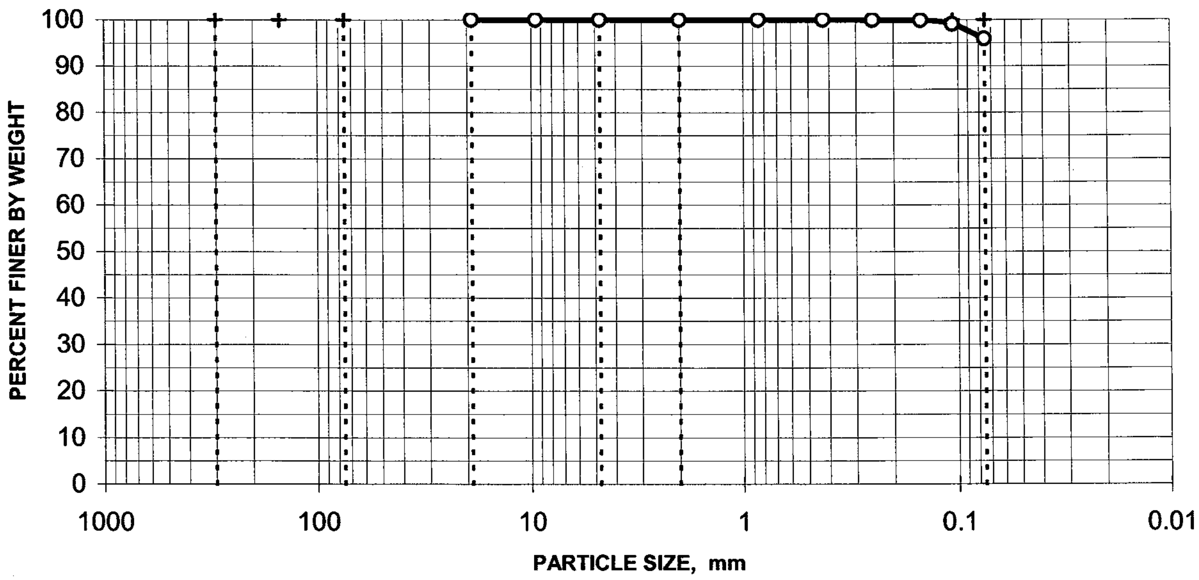
Moisture Content = 33.9%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	100.0%
	#4	4.750	100.0%
	#10	2.000	100.0%

	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	100.0%
	#40	0.425	100.0%
	#60	0.250	100.0%
	#100	0.149	99.9%
	#140	0.106	99.0%
	#200	0.075	95.9%

DISTRIBUTION CURVE



0.0% Gravel 4.1% Sand 95.9% Silt/Clay

PARTICLE-SIZE ANALYSIS
ASTM D 422

Project Name
GEL - Moab
Project No.
109855.01310000

Client Sample No.
706-R20
Lab Sample No.
BC0875

Specific Gravity = 2.7419

Moisture Content = 41.3%
based on dry sample weight

SIEVE ANALYSIS

COARSE	Sieve No.	Diameter mm	Percent Finer
	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	100.0%
	#4	4.750	100.0%
	#10	2.000	100.0%

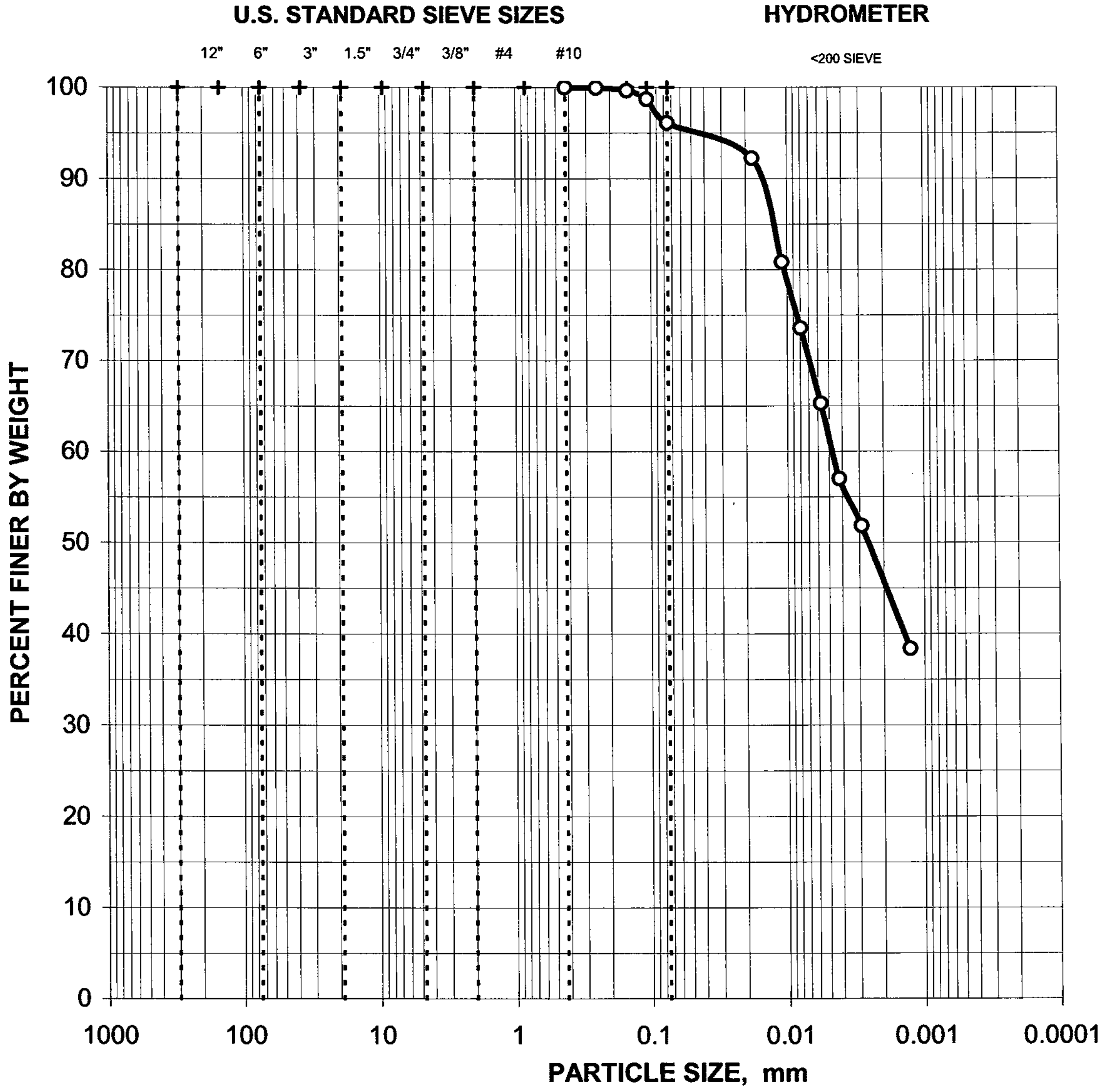
FINE	Sieve No.	Diameter mm	Percent Finer
	#20	0.850	100.0%
	#40	0.425	100.0%
	#60	0.250	99.9%
	#100	0.149	99.6%
	#140	0.106	98.7%
	#200	0.075	96.1%

HYDROMETER ANALYSIS

HYDROMETER	Diameter mm	Percent Finer
	0.01789	92.2%
	0.01089	80.8%
	0.00796	73.6%
	0.00569	65.3%
	0.00419	57.0%
	0.00288	51.8%
	0.00127	38.3%

0.0% Gravel 3.9% Sand 96.1% Silt/Clay

GEL - Moab



CLIENT SAMPLE NO.: 706-R20

LAB SAMPLE NO.: BC0875

BOULDERS	COBBLES	GRAVEL		SAND			Silt/Clay
		COARSE	FINE	COARSE	MEDIUM	FINE	

PARTICLE-SIZE DISTRIBUTION
ASTM D 422

Project Name GEL - Moab

Project No. 109855.01310000

Field Sample No. 706-R22

Lab Sample No. BC0876

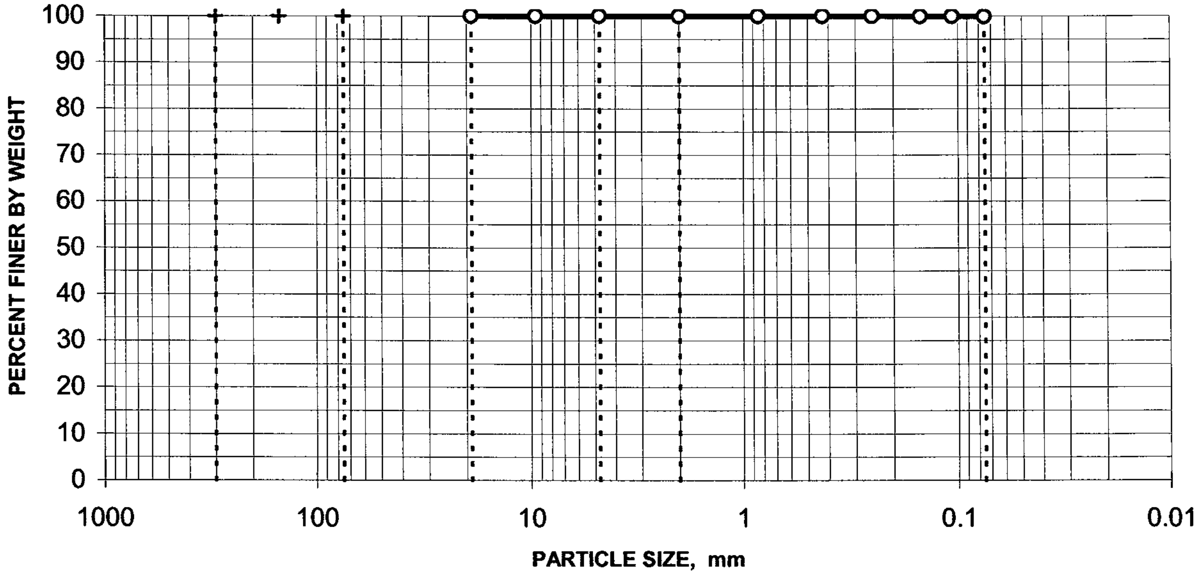
Moisture Content = 49.0%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	100.0%
	#4	4.750	100.0%
	#10	2.000	100.0%

	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	100.0%
	#40	0.425	100.0%
	#60	0.250	100.0%
	#100	0.149	100.0%
	#140	0.106	99.9%
	#200	0.075	99.8%

DISTRIBUTION CURVE



0.0% Gravel 0.2% Sand 99.8% Silt/Clay

PARTICLE-SIZE ANALYSIS
ASTM D 422

Project Name
GEL - Moab
Project No.
109855.01310000

Client Sample No.
707-R17
Lab Sample No.
BC0877

Specific Gravity = 2.8075

Moisture Content = 62.6%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	100.0%
	#4	4.750	100.0%
	#10	2.000	100.0%

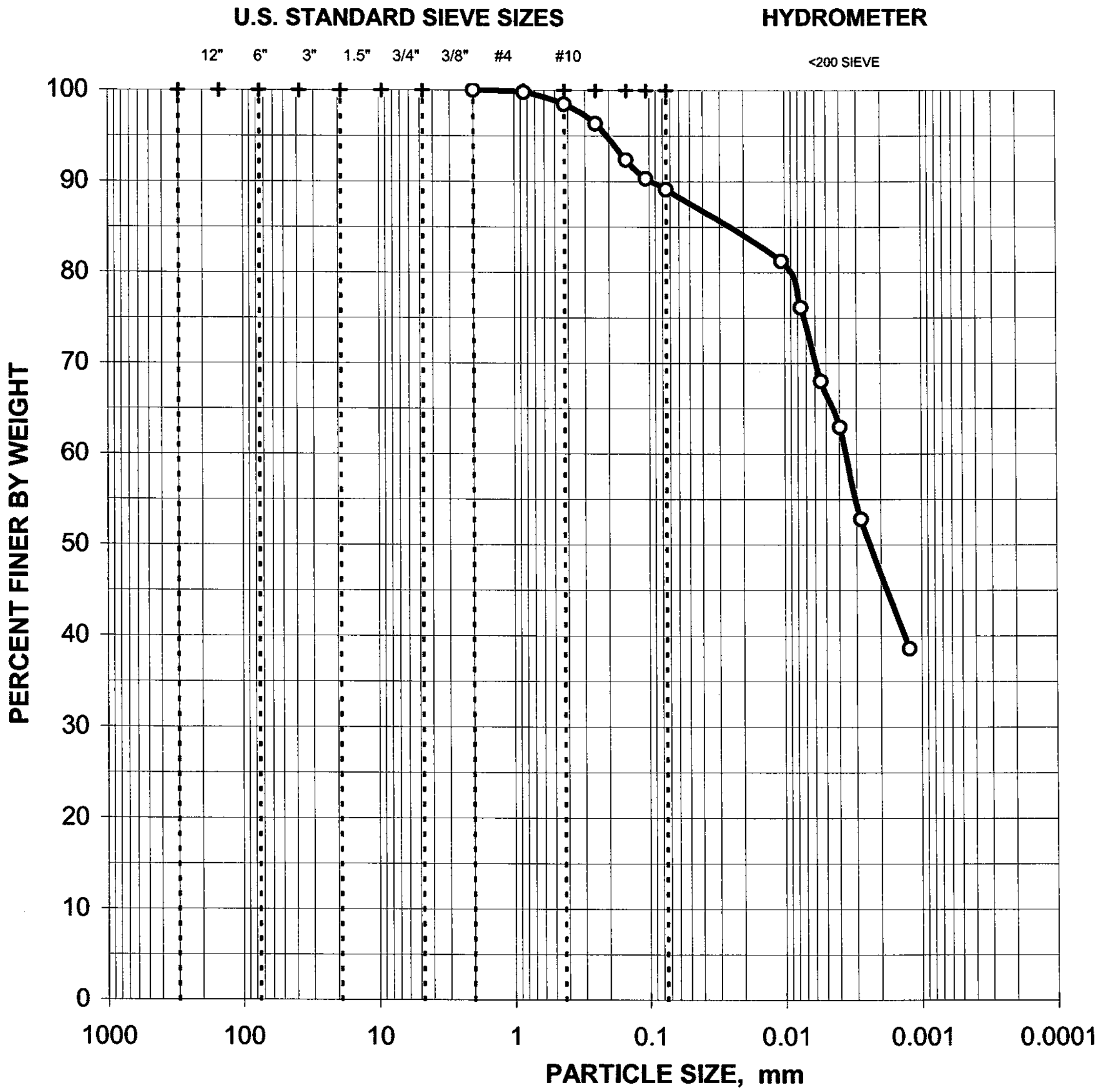
	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	99.7%
	#40	0.425	98.5%
	#60	0.250	96.3%
	#100	0.149	92.4%
	#140	0.106	90.3%
	#200	0.075	89.1%

HYDROMETER ANALYSIS

	Diameter mm	Percent Finer
HYDROMETER		
	0.01052	81.2%
	0.00759	76.1%
	0.00544	68.0%
	0.00395	62.9%
	0.00279	52.8%
	0.00123	38.6%

0.0% Gravel 10.9% Sand 89.1% Silt/Clay

GEL - Moab



CLIENT SAMPLE NO.: 707-R17

LAB SAMPLE NO.: BC0877

BOULDERS	COBBLES	GRAVEL		SAND			Silt/Clay
		COARSE	FINE	COARSE	MEDIUM	FINE	

PARTICLE-SIZE DISTRIBUTION
ASTM D 422

Project Name GEL - Moab

Project No. 109855.01310000

Field Sample No. 707-R28

Lab Sample No. BC0878

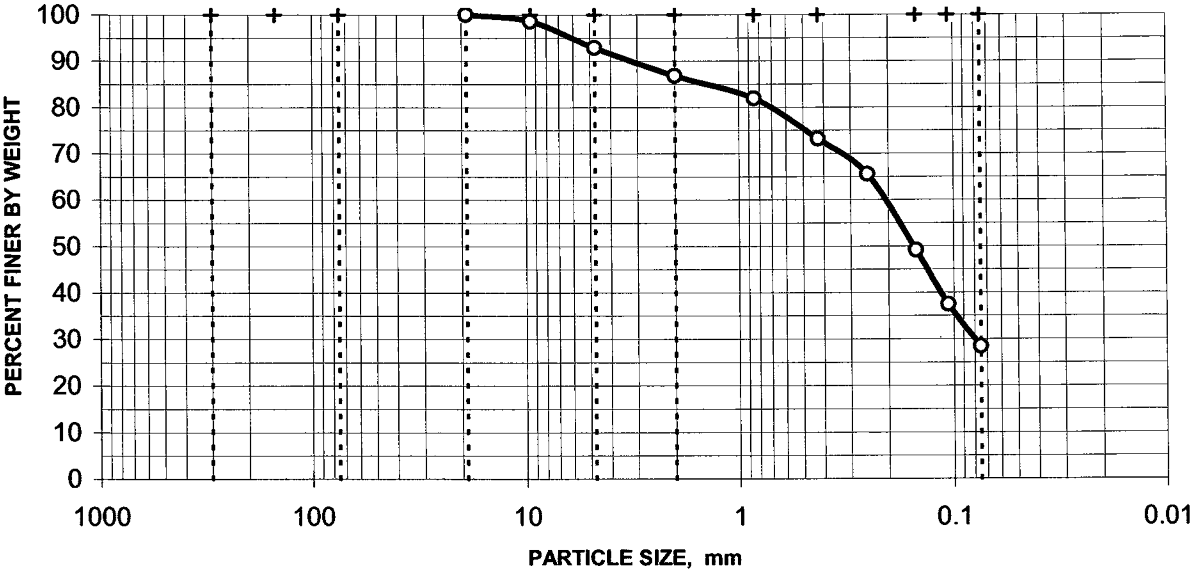
Moisture Content = 13.6%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	98.5%
	#4	4.750	92.8%
	#10	2.000	86.8%

	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	81.9%
	#40	0.425	73.2%
	#60	0.250	65.5%
	#100	0.149	49.1%
	#140	0.106	37.5%
	#200	0.075	28.5%

DISTRIBUTION CURVE



7.2% Gravel 64.4% Sand 28.5% Silt/Clay

PARTICLE-SIZE DISTRIBUTION
ASTM D 422

Project Name GEL - Moab

Field Sample No. 710-R1

Project No. 109855.01310000

Lab Sample No. BC0879

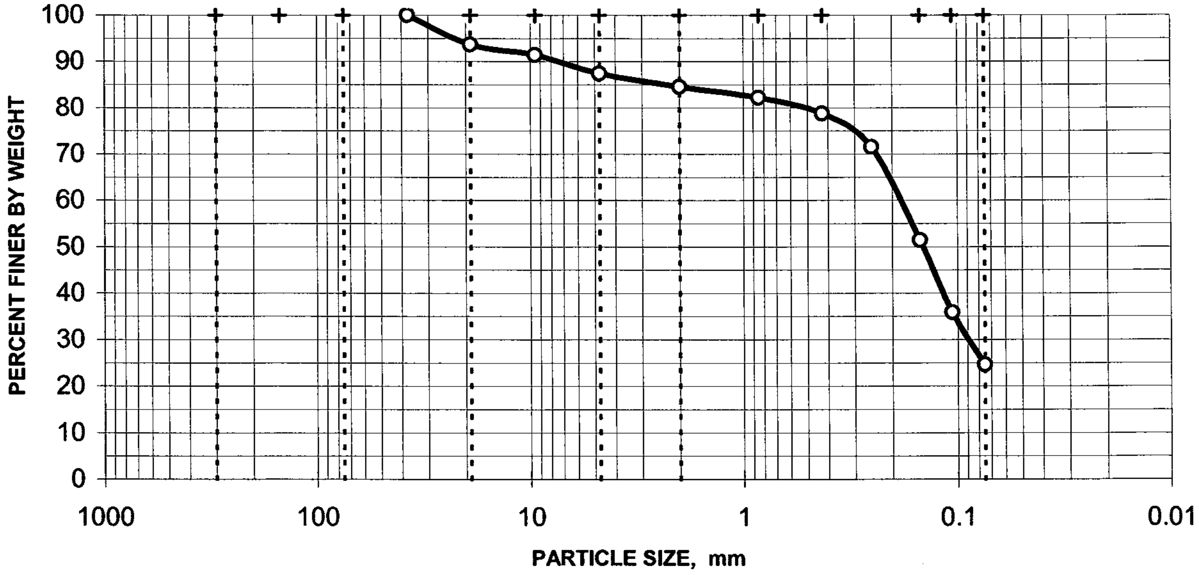
Moisture Content = 7.9%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
C O A R S E	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	93.7%
	0.375"	9.500	91.4%
	#4	4.750	87.4%
	#10	2.000	84.5%

	Sieve No.	Diameter mm	Percent Finer
F I N E	#20	0.850	82.2%
	#40	0.425	78.8%
	#60	0.250	71.5%
	#100	0.149	51.4%
	#140	0.106	35.8%
	#200	0.075	24.6%

DISTRIBUTION CURVE



12.6% Gravel 62.8% Sand 24.6% Silt/Clay

PARTICLE-SIZE DISTRIBUTION
ASTM D 422

Project Name GEL - Moab

Project No. 109855.01310000

Field Sample No. 710-R19

Lab Sample No. BC0880

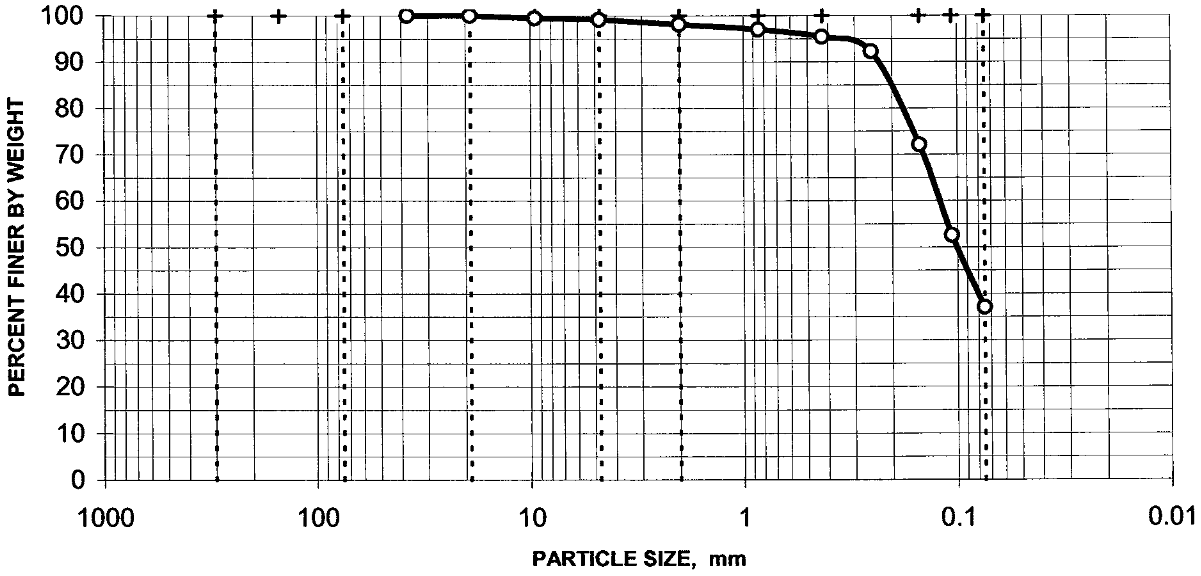
Moisture Content = 9.7%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	99.4%
	#4	4.750	99.1%
	#10	2.000	98.1%

	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	97.0%
	#40	0.425	95.4%
	#60	0.250	92.2%
	#100	0.149	72.0%
	#140	0.106	52.5%
	#200	0.075	37.0%

DISTRIBUTION CURVE



0.9% Gravel 62.1% Sand 37.0% Silt/Clay

PARTICLE-SIZE DISTRIBUTION
ASTM D 422

Project Name GEL - Moab

Project No. 109855.01310000

Field Sample No. 713-R13

Lab Sample No. BC0883

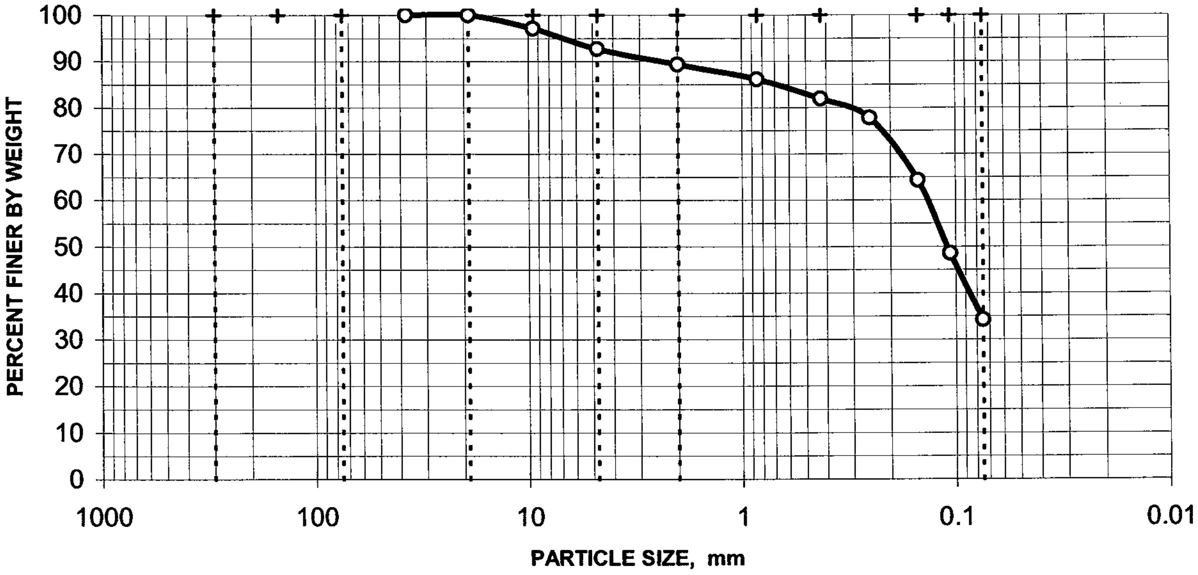
Moisture Content = 7.9%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	97.1%
	#4	4.750	92.7%
	#10	2.000	89.3%

	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	86.1%
	#40	0.425	81.9%
	#60	0.250	77.8%
	#100	0.149	64.3%
	#140	0.106	48.5%
	#200	0.075	34.2%

DISTRIBUTION CURVE



7.3% Gravel 58.5% Sand 34.2% Silt/Clay

PARTICLE-SIZE DISTRIBUTION
ASTM D 422

Project Name GEL - Moab

Project No. 109855.01310000

Field Sample No. 715-R3

Lab Sample No. BC0884

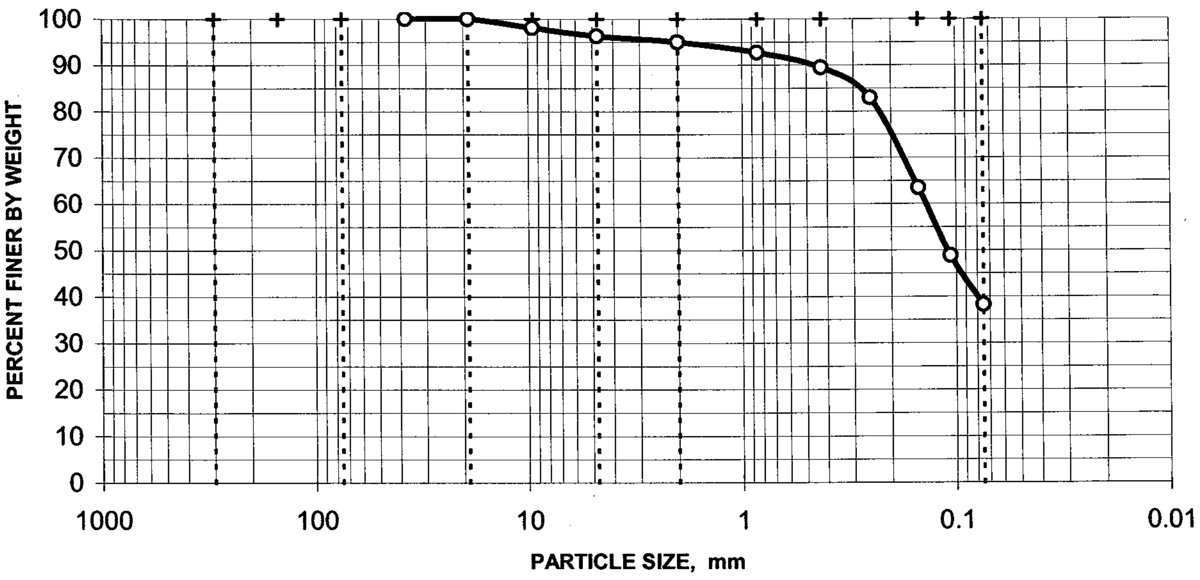
Moisture Content = 24.0%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	98.1%
	#4	4.750	96.3%
	#10	2.000	95.0%

	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	92.7%
	#40	0.425	89.4%
	#60	0.250	82.9%
	#100	0.149	63.5%
	#140	0.106	48.8%
	#200	0.075	38.2%

DISTRIBUTION CURVE



3.7% Gravel 58.1% Sand 38.2% Silt/Clay

PARTICLE-SIZE ANALYSIS
ASTM D 422

Project Name	Client Sample No.
GEL - Moab	718-R15
Project No.	Lab Sample No.
109855.01310000	BC0887

Specific Gravity = 2.7297

Moisture Content = 48.5%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	100.0%
	#4	4.750	100.0%
	#10	2.000	100.0%

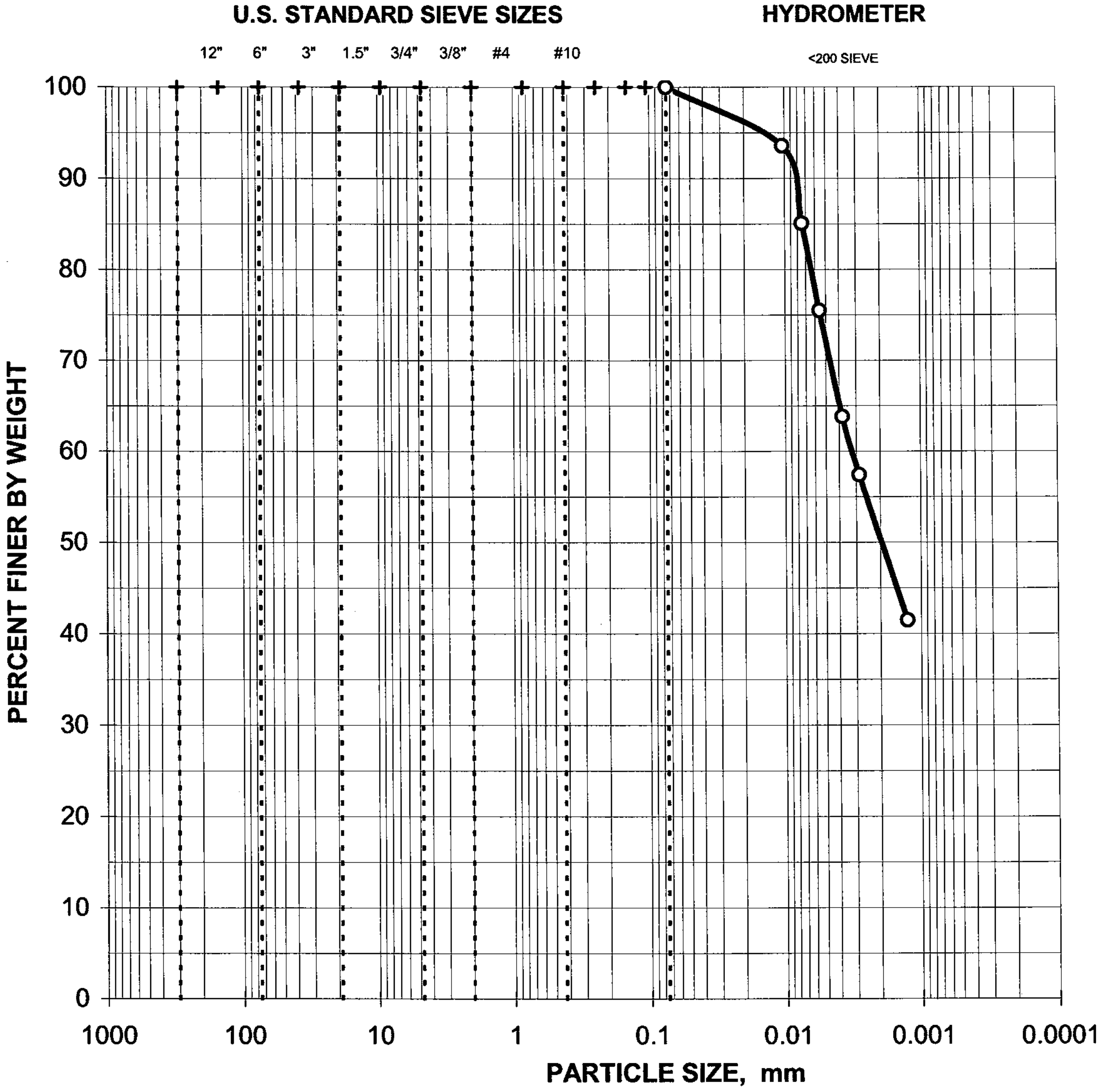
	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	100.0%
	#40	0.425	100.0%
	#60	0.250	100.0%
	#100	0.149	100.0%
	#140	0.106	100.0%
	#200	0.075	100.0%

HYDROMETER ANALYSIS

	Diameter mm	Percent Finer
HYDROMETER		
	0.01039	93.6%
	0.00744	85.1%
	0.00555	75.5%
	0.00378	63.8%
	0.00284	57.4%
	0.00126	41.5%

0.0% Gravel 0.0% Sand 100.0% Silt/Clay

GEL - Moab



CLIENT SAMPLE NO.: 718-R15 **LAB SAMPLE NO.:** BC0887

BOULDERS	COBBLES	GRAVEL		SAND			Silt/Clay
		COARSE	FINE	COARSE	MEDIUM	FINE	

PARTICLE-SIZE DISTRIBUTION
ASTM D 422

Project Name GEL - Moab

Project No. 109855.01310000

Field Sample No. 718-R17

Lab Sample No. BC0888

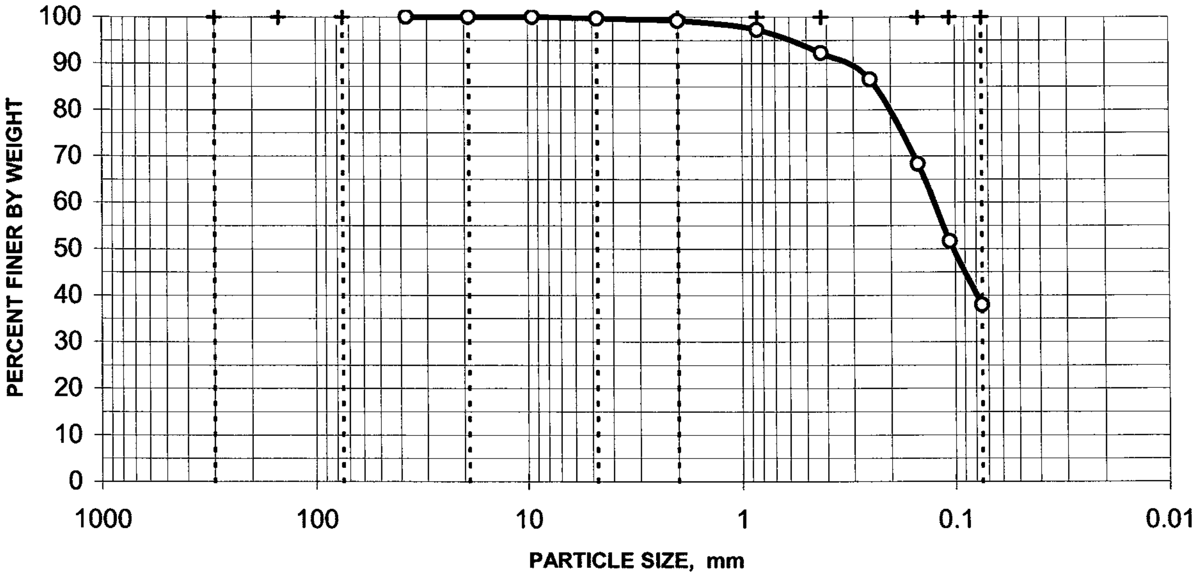
Moisture Content = 10.5%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	100.0%
	#4	4.750	99.7%
	#10	2.000	99.2%

	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	97.2%
	#40	0.425	92.2%
	#60	0.250	86.5%
	#100	0.149	68.2%
	#140	0.106	51.6%
	#200	0.075	37.9%

DISTRIBUTION CURVE



0.3% Gravel   61.8% Sand   37.9% Silt/Clay

PARTICLE-SIZE ANALYSIS
ASTM D 422

Project Name	Client Sample No.
GEL - Moab	718-R5
Project No.	Lab Sample No.
109855.01310000	BC0889

Specific Gravity = 2.9083

Moisture Content = 79.5%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	100.0%
	#4	4.750	100.0%
	#10	2.000	100.0%

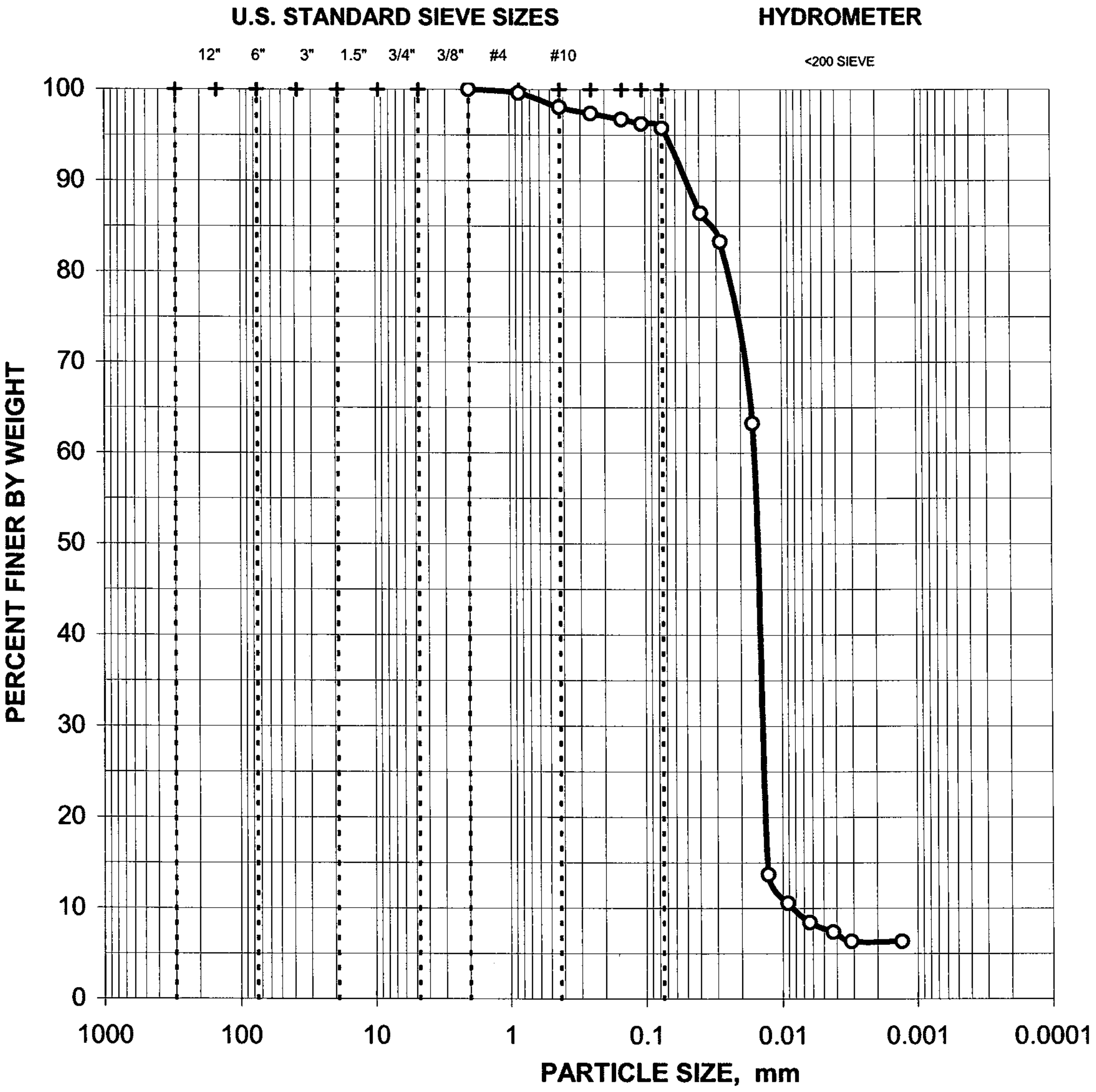
	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	99.6%
	#40	0.425	98.0%
	#60	0.250	97.4%
	#100	0.149	96.7%
	#140	0.106	96.2%
	#200	0.075	95.7%

HYDROMETER ANALYSIS

	Diameter mm	Percent Finer
HYDROMETER		
	0.03912	86.4%
	0.02806	83.3%
	0.01626	63.2%
	0.01272	13.7%
	0.00912	10.5%
	0.00634	8.4%
	0.00424	7.4%
	0.00311	6.3%
	0.00131	6.3%

0.0% Gravel   4.3% Sand   95.7% Silt/Clay

GEL - Moab



CLIENT SAMPLE NO.: 718-R5

LAB SAMPLE NO.: BC0889

BOULDERS	COBBLES	GRAVEL		SAND			Silt/Clay
		COARSE	FINE	COARSE	MEDIUM	FINE	

PARTICLE-SIZE ANALYSIS
ASTM D 422

Project Name
GEL - Moab
Project No.
109855.01310000

Client Sample No.
718-R9
Lab Sample No.
BC0891

Specific Gravity = 2.7129

Moisture Content = 55.1%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	100.0%
	#4	4.750	100.0%
	#10	2.000	100.0%

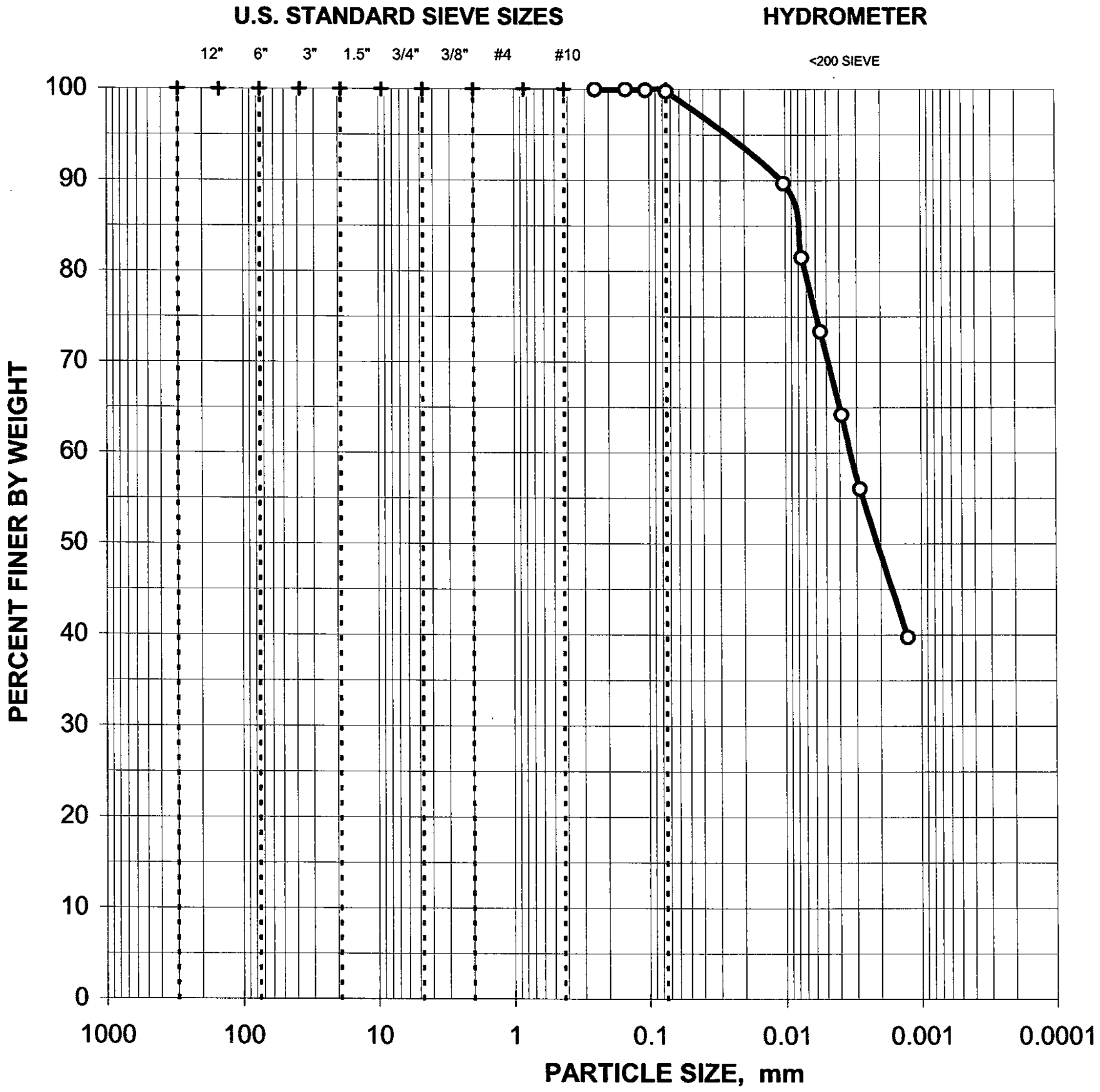
	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	100.0%
	#40	0.425	100.0%
	#60	0.250	99.9%
	#100	0.149	99.9%
	#140	0.106	99.9%
	#200	0.075	99.7%

HYDROMETER ANALYSIS

	Diameter mm	Percent Finer
HYDROMETER		
	0.01026	89.7%
	0.00756	81.5%
	0.00553	73.4%
	0.00385	64.2%
	0.00283	56.0%
	0.00126	39.7%

0.0% Gravel 0.3% Sand 99.7% Silt/Clay

GEL - Moab



CLIENT SAMPLE NO.: 718-R9

LAB SAMPLE NO.: BC0891

BOULDERS	COBBLES	GRAVEL		SAND			Silt/Clay
		COARSE	FINE	COARSE	MEDIUM	FINE	

PARTICLE-SIZE DISTRIBUTION
ASTM D 422

Project Name GEL - Moab

Project No. 109855.01310000

Field Sample No. 722-R2

Lab Sample No. BC0893

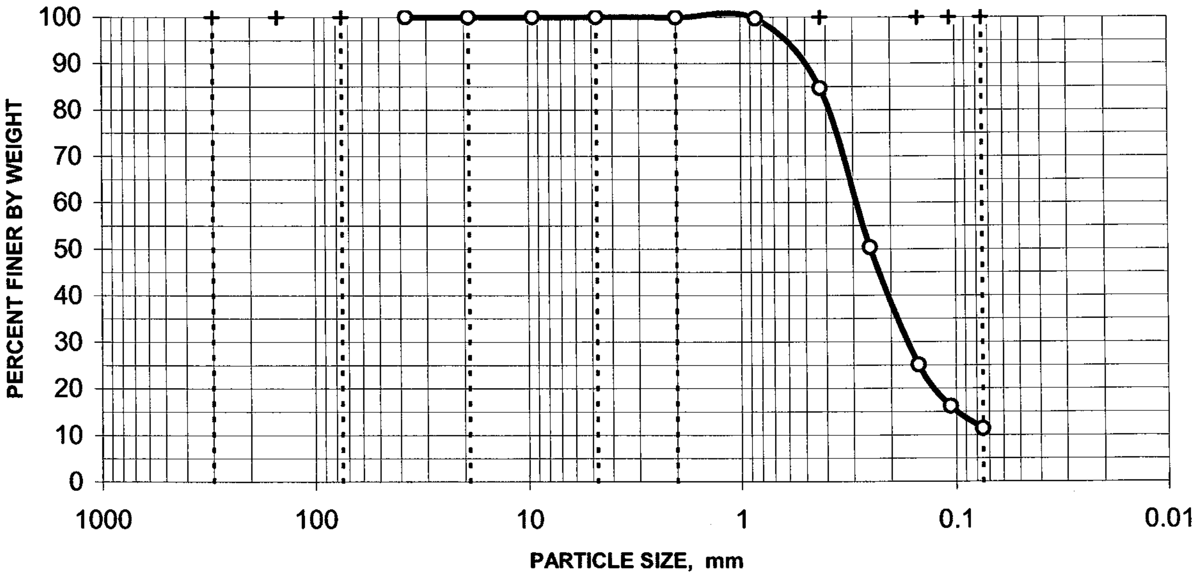
Moisture Content = 6.9%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	100.0%
	#4	4.750	100.0%
	#10	2.000	100.0%

	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	99.6%
	#40	0.425	84.7%
	#60	0.250	50.3%
	#100	0.149	25.0%
	#140	0.106	16.2%
	#200	0.075	11.3%

DISTRIBUTION CURVE



0.0% Gravel 88.7% Sand 11.3% Silt/Clay

PARTICLE-SIZE ANALYSIS
ASTM D 422

Project Name
GEL - Moab
Project No.
109855.01310000

Client Sample No.
GATP-10-4
Lab Sample No.
BC0896

Specific Gravity = 2.8315

Moisture Content = 59.0%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	100.0%
	#4	4.750	100.0%
	#10	2.000	100.0%

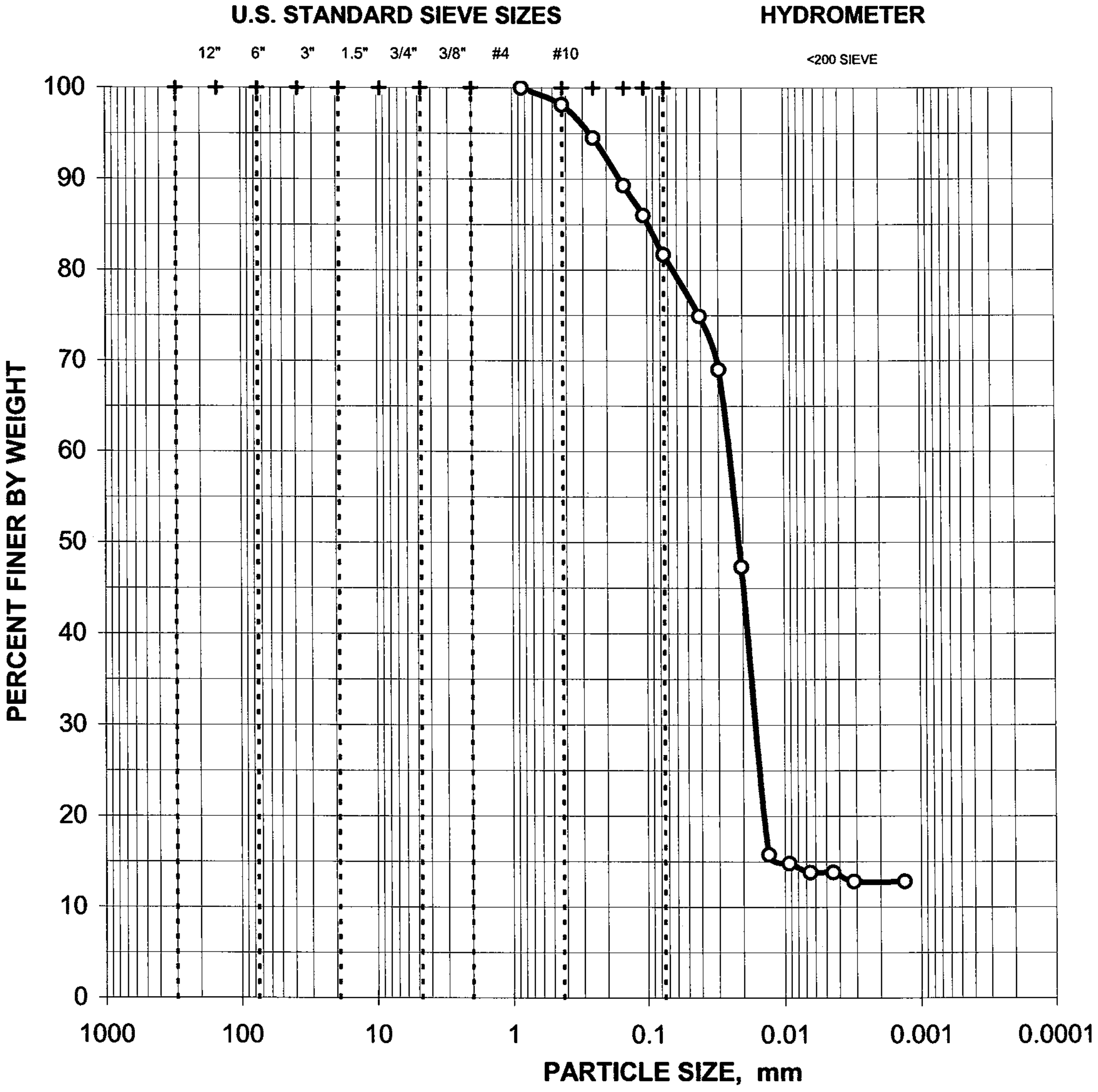
	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	100.0%
	#40	0.425	98.1%
	#60	0.250	94.5%
	#100	0.149	89.3%
	#140	0.106	86.0%
	#200	0.075	81.7%

HYDROMETER ANALYSIS

	Diameter mm	Percent Finer
HYDROMETER	0.05624	80.8%
	0.04091	74.9%
	0.02971	69.0%
	0.02048	47.3%
	0.01310	15.8%
	0.00930	14.8%
	0.00651	13.8%
	0.00444	13.8%
	0.00314	12.8%
	0.00132	12.8%

0.0% Gravel   18.3% Sand   81.7% Silt/Clay

GEL - Moab



CLIENT SAMPLE NO.: GATP-10-4

LAB SAMPLE NO.: BC0896

BOULDERS	COBBLES	GRAVEL		SAND			Silt/Clay
		COARSE	FINE	COARSE	MEDIUM	FINE	

PARTICLE-SIZE DISTRIBUTION
ASTM D 422

Project Name GEL - Moab

Project No. 109855

Field Sample No. GATP-11-2

Lab Sample No. BC0897

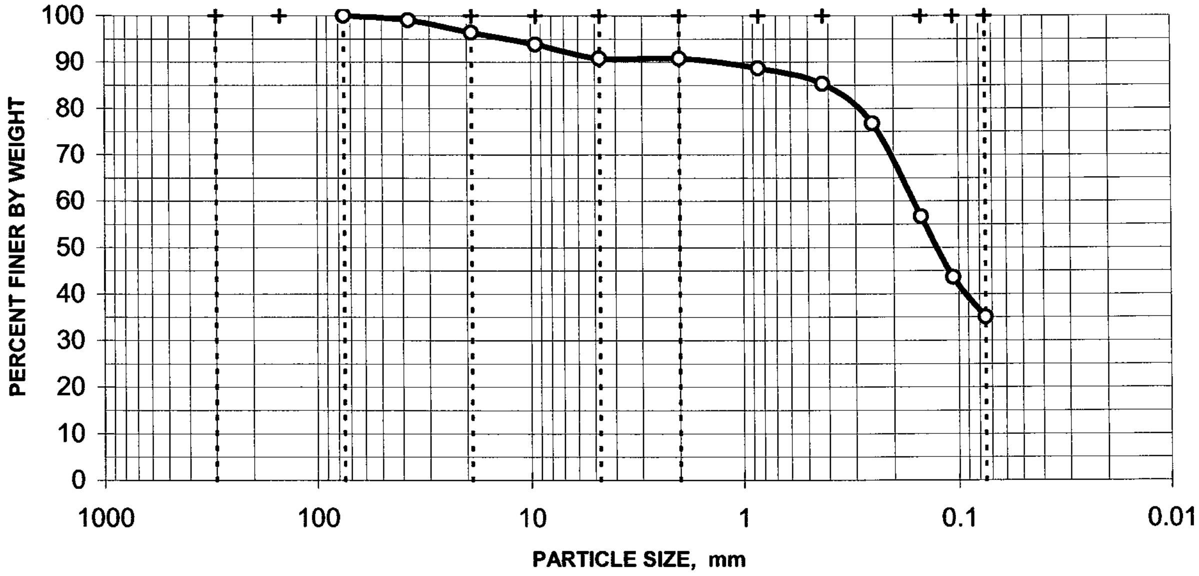
Moisture Content = 5.8%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	99.0%
	0.75"	19.000	96.4%
	0.375"	9.500	93.8%
	#4	4.750	90.8%
	#10	2.000	90.8%

	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	88.6%
	#40	0.425	85.3%
	#60	0.250	76.8%
	#100	0.149	56.6%
	#140	0.106	43.6%
	#200	0.075	35.0%

DISTRIBUTION CURVE



9.2% Gravel 55.8% Sand 35.0% Silt/Clay

PARTICLE-SIZE ANALYSIS
ASTM D 422

Project Name GEL - Moab	Client Sample No. GATP-11-4
Project No. 109855.01310000	Lab Sample No. BC0898

Specific Gravity = 2.8423

Moisture Content = 54.4%
based on dry sample weight

SIEVE ANALYSIS

COARSE	Sieve No.	Diameter mm	Percent Finer
	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	100.0%
	#4	4.750	100.0%
	#10	2.000	100.0%

FINE	Sieve No.	Diameter mm	Percent Finer
	#20	0.850	100.0%
	#40	0.425	100.0%
	#60	0.250	99.7%
	#100	0.149	98.1%
	#140	0.106	95.5%
	#200	0.075	91.8%

HYDROMETER ANALYSIS

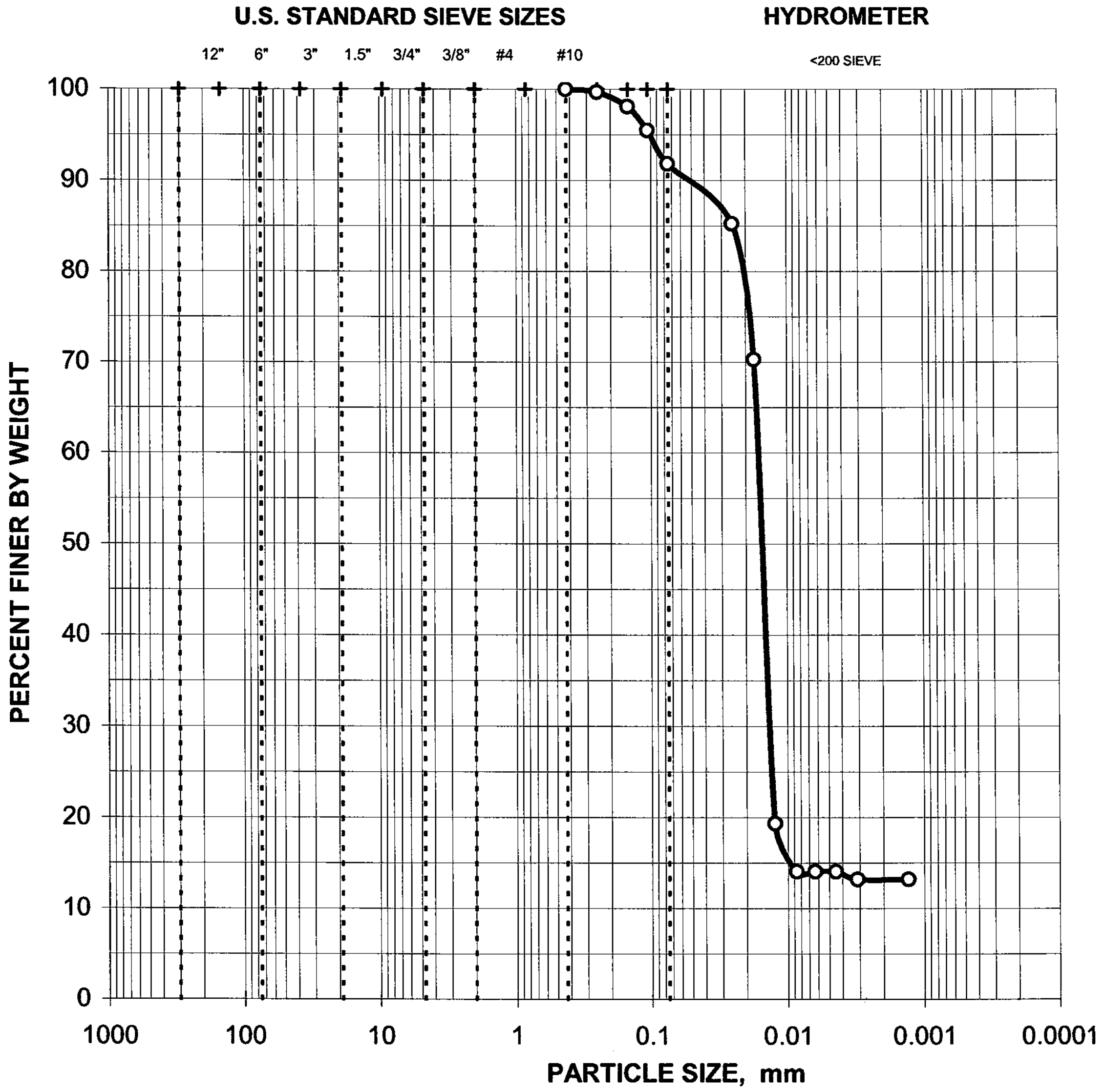
HYDROMETER	Diameter mm	Percent Finer
	0.02506	85.2%
	0.01734	70.3%
	0.01240	19.3%
	0.00864	14.1%
	0.00631	14.1%
	0.00446	14.1%
	0.00310	13.2%
	0.00131	13.2%

0.0% Gravel 8.2% Sand 91.8% Silt/Clay

April 6, 2006
Erin Stanley
General Engineering Laboratories
Shaw Project Name: GEL – Moab
Shaw Project No. 109855.01310000

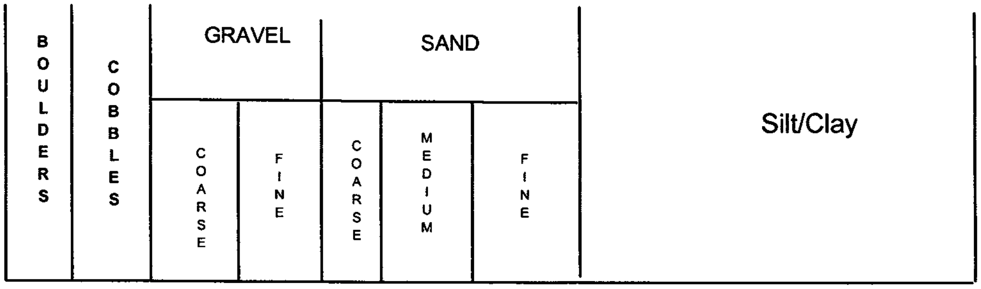
Shaw Geotechnical Laboratory
Oak Ridge TN
(865) 482-6497

GEL - Moab



CLIENT SAMPLE NO.: GATP-11-4

LAB SAMPLE NO.: BC0898



PARTICLE-SIZE DISTRIBUTION
ASTM D 422

Project Name GEL - Moab

Project No. 109855

Field Sample No. GATP-12-5

Lab Sample No. BC0899

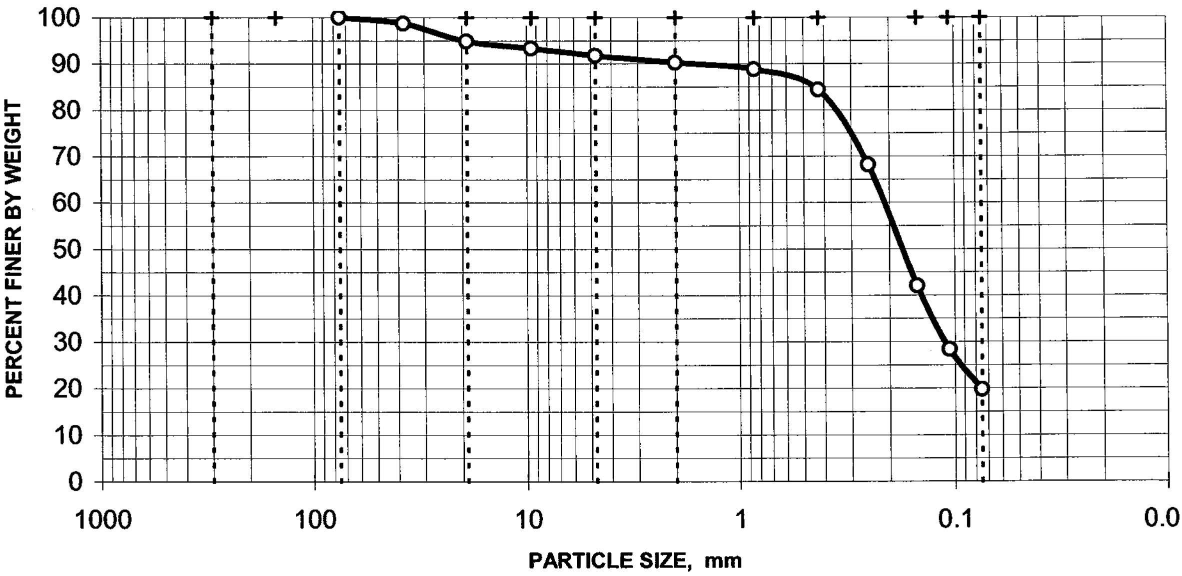
Moisture Content = 7.3%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	98.7%
	0.75"	19.000	94.8%
	0.375"	9.500	93.3%
	#4	4.750	91.8%
	#10	2.000	90.2%

	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	88.8%
	#40	0.425	84.3%
	#60	0.250	68.1%
	#100	0.149	42.1%
	#140	0.106	28.3%
	#200	0.075	19.8%

DISTRIBUTION CURVE



8.2% Gravel 72.0% Sand 19.8% Silt/Clay

PARTICLE-SIZE ANALYSIS
ASTM D 422

Project Name
GEL - Moab
Project No.
109855.01310000

Client Sample No.
GATP-3-2
Lab Sample No.
BC0900

Specific Gravity = 2.7394

Moisture Content = 56.8%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	100.0%
	#4	4.750	100.0%
	#10	2.000	100.0%

	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	98.2%
	#40	0.425	95.4%
	#60	0.250	93.8%
	#100	0.149	88.1%
	#140	0.106	81.4%
	#200	0.075	74.7%

HYDROMETER ANALYSIS

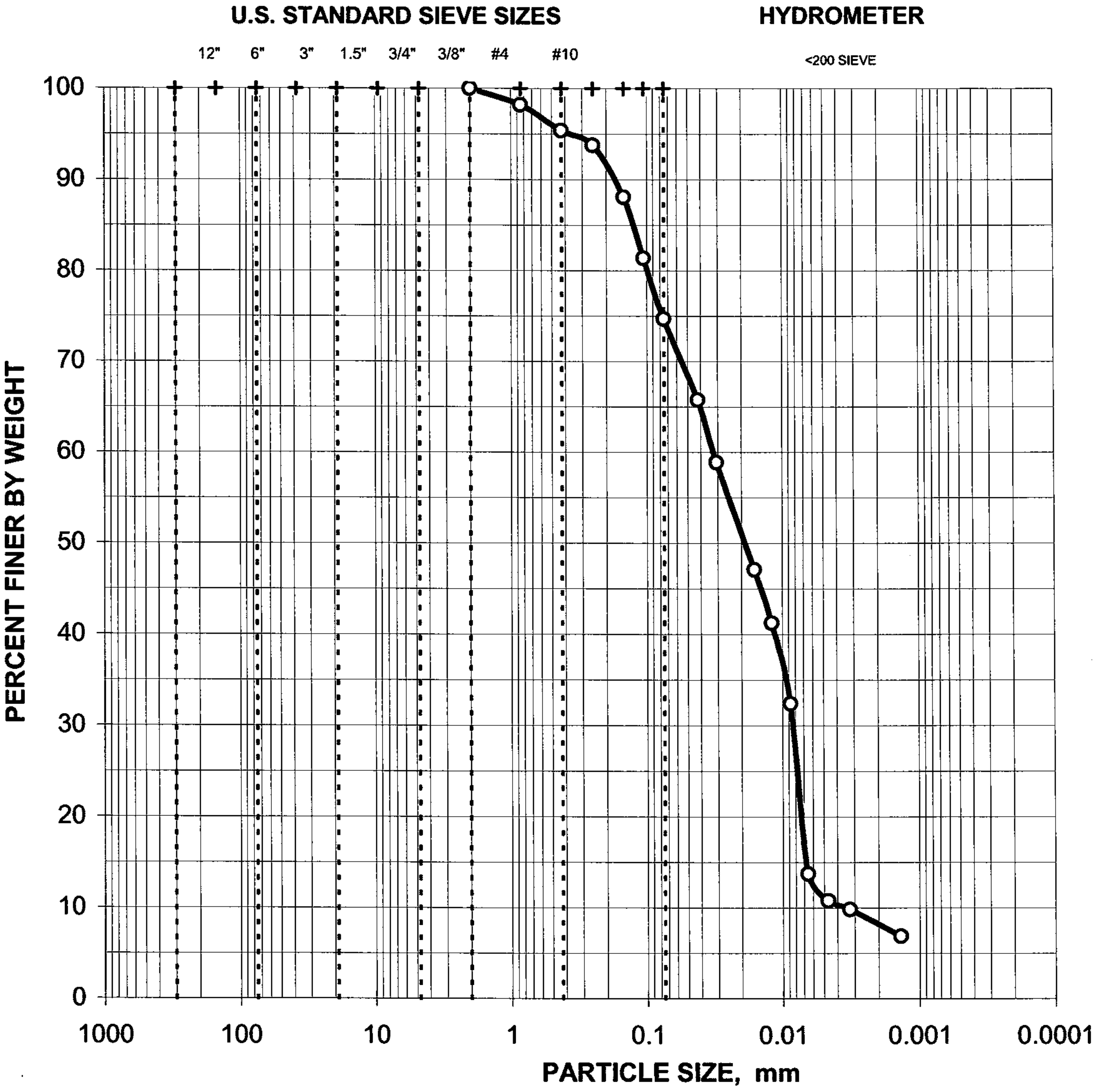
	Diameter mm	Percent Finer
HYDROMETER		
	0.04207	65.8%
	0.03065	58.9%
	0.01604	47.1%
	0.01197	41.2%
	0.00871	32.4%
	0.00654	13.7%
	0.00466	10.8%
	0.00324	9.8%
	0.00138	6.9%

0.0% Gravel 25.3% Sand 74.7% Silt/Clay

April 6, 2006
Erin Stanley
General Engineering Laboratories
Shaw Project Name: GEL – Moab
Shaw Project No. 109855.01310000

Shaw Geotechnical Laboratory
Oak Ridge TN
(865) 482-6497

GEL - Moab



CLIENT SAMPLE NO.: GATP-3-2

LAB SAMPLE NO.: BC0900

BOULDERS	COBBLES	GRAVEL		SAND			Silt/Clay
		COARSE	FINE	COARSE	MEDIUM	FINE	

PARTICLE-SIZE DISTRIBUTION
ASTM D 422

Project Name	GEL - Moab	Field Sample No.	GATP-4-5
Project No.	109855	Lab Sample No.	BC0902
		Moisture Content =	10.0%

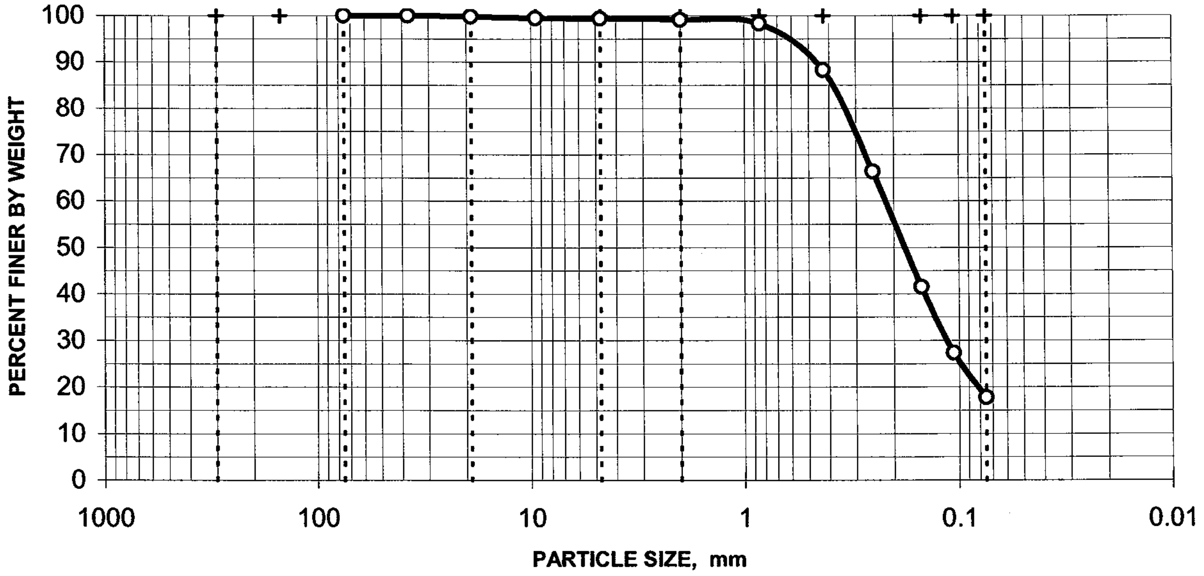
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	99.8%
	0.375"	9.500	99.5%
	#4	4.750	99.4%
	#10	2.000	99.1%

	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	98.3%
	#40	0.425	88.3%
	#60	0.250	66.4%
	#100	0.149	41.5%
	#140	0.106	27.3%
	#200	0.075	17.7%

DISTRIBUTION CURVE



0.6% Gravel   81.6% Sand   17.7% Silt/Clay

PARTICLE-SIZE DISTRIBUTION
ASTM D 422

Project Name GEL - Moab

Project No. 109855.01310000

Field Sample No. GATP-5-4

Lab Sample No. BC0904

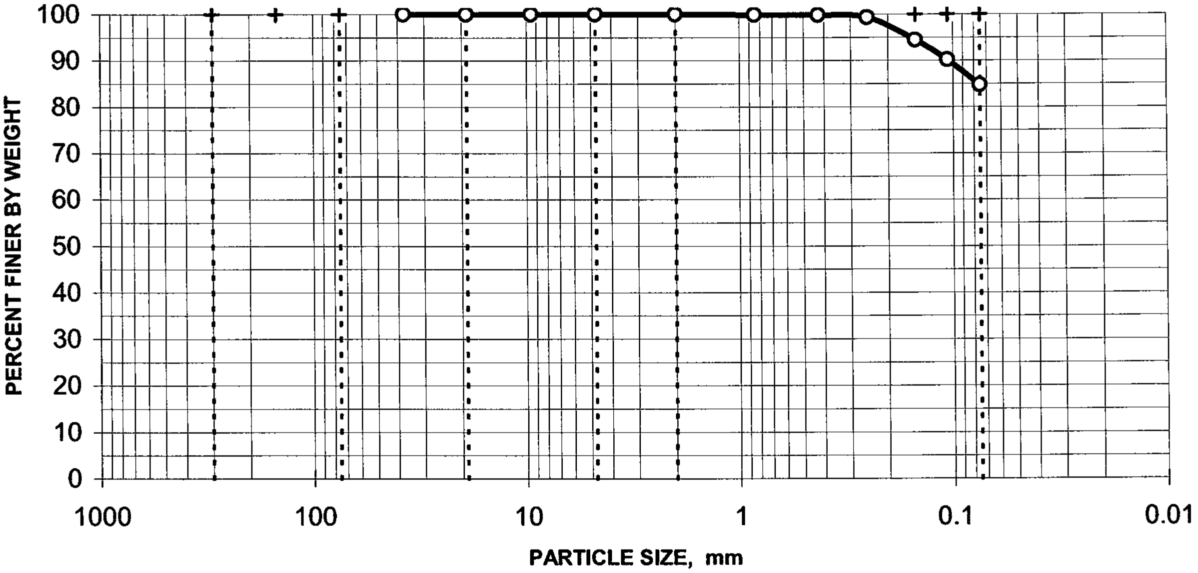
Moisture Content = 83.0%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	100.0%
	#4	4.750	100.0%
	#10	2.000	100.0%

	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	99.9%
	#40	0.425	99.8%
	#60	0.250	99.3%
	#100	0.149	94.5%
	#140	0.106	90.2%
	#200	0.075	84.7%

DISTRIBUTION CURVE



0.0% Gravel 15.3% Sand 84.7% Silt/Clay

PARTICLE-SIZE ANALYSIS
ASTM D 422

Project Name
GEL - Moab
Project No.
109855.01310000

Client Sample No.
GATP-6-1
Lab Sample No.
BC0905

Specific Gravity = 2.6935

Moisture Content = 10.4%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	96.5%
	0.375"	9.500	91.4%
	#4	4.750	87.4%
	#10	2.000	82.9%

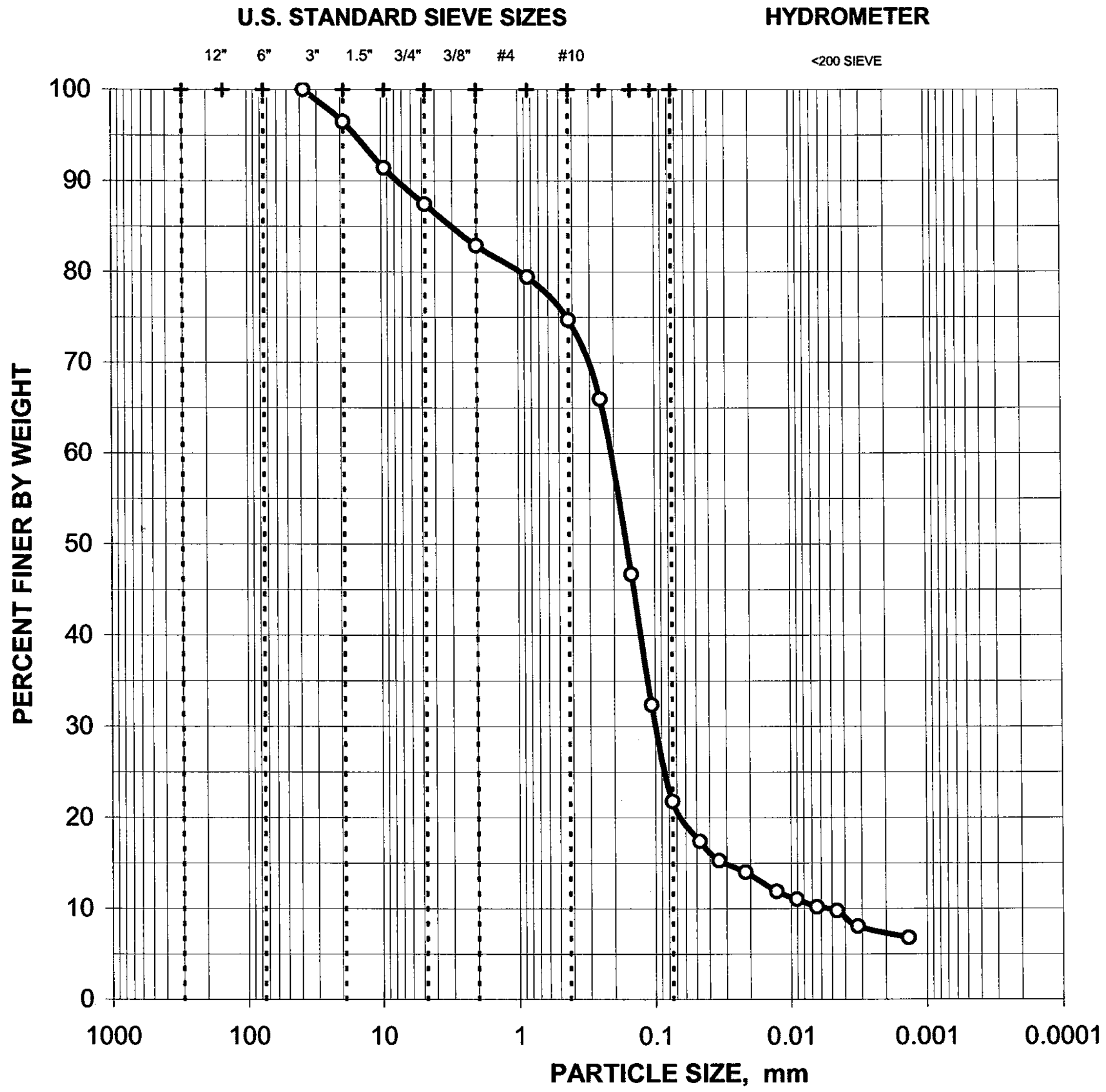
	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	79.4%
	#40	0.425	74.7%
	#60	0.250	66.0%
	#100	0.149	46.7%
	#140	0.106	32.4%
	#200	0.075	21.8%

HYDROMETER ANALYSIS

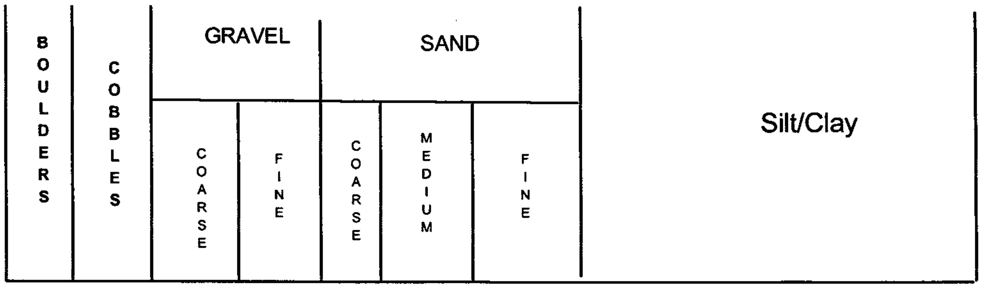
	Diameter mm	Percent Finer
HYDROMETER		
	0.04719	17.4%
	0.03399	15.3%
	0.02167	14.0%
	0.01271	11.9%
	0.00905	11.0%
	0.00643	10.2%
	0.00456	9.8%
	0.00320	8.1%
	0.00136	6.8%

12.6% Gravel　　65.6% Sand　　21.8% Silt/Clay

GEL - Moab



CLIENT SAMPLE NO.: GATP-6-1 **LAB SAMPLE NO.:** BC0905



PARTICLE-SIZE ANALYSIS
ASTM D 422

Project Name
GEL - Moab
Project No.
109855.01310000

Client Sample No.
GATP-6-5
Lab Sample No.
BC0906

Specific Gravity = 2.7158

Moisture Content = 30.5%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	99.2%
	0.375"	9.500	98.6%
	#4	4.750	97.0%
	#10	2.000	95.8%

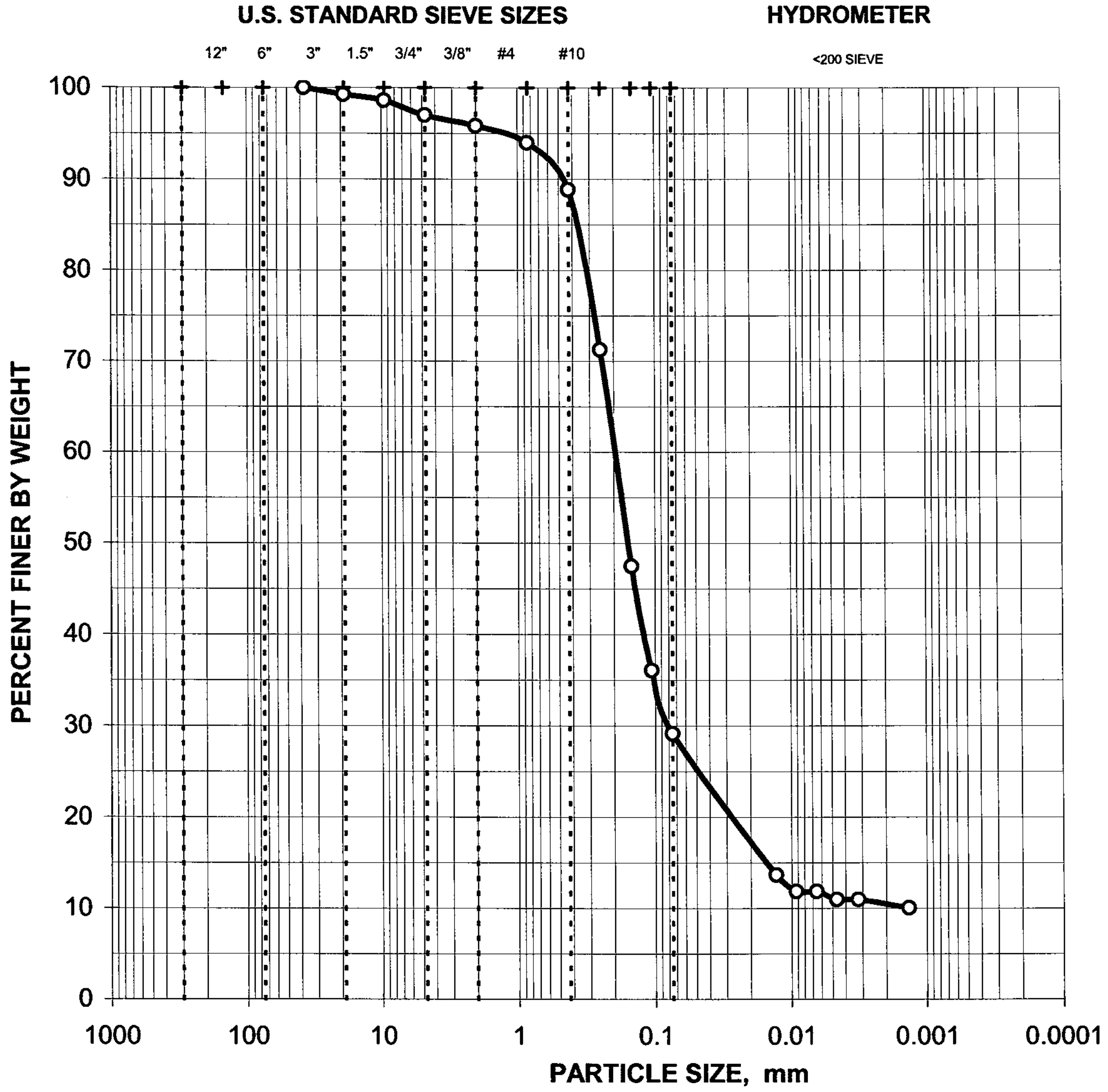
	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	94.0%
	#40	0.425	88.8%
	#60	0.250	71.3%
	#100	0.149	47.5%
	#140	0.106	36.1%
	#200	0.075	29.1%

HYDROMETER ANALYSIS

	Diameter mm	Percent Finer
HYDROMETER		
	0.01303	13.7%
	0.00921	11.9%
	0.00652	11.9%
	0.00464	10.9%
	0.00321	10.9%
	0.00136	10.0%

3.0% Gravel	67.9% Sand	29.1% Silt/Clay

GEL - Moab



CLIENT SAMPLE NO.: GATP-6-5 **LAB SAMPLE NO.:** BC0906

BOULDERS	COBBLES	GRAVEL		SAND			Silt/Clay
		COARSE	FINE	COARSE	MEDIUM	FINE	

PARTICLE-SIZE DISTRIBUTION
ASTM D 422

Project Name	GEL - Moab	Field Sample No.	GATP-7-2
Project No.	109855	Lab Sample No.	BC0907

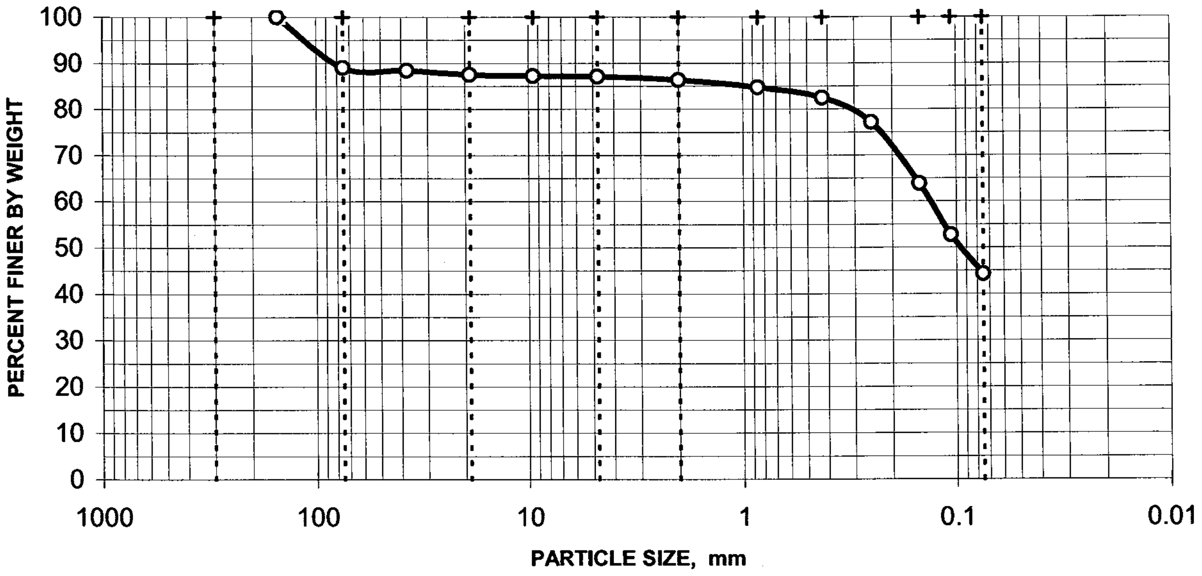
Moisture Content = 29.8%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	89.0%
	1.5"	37.500	88.4%
	0.75"	19.000	87.5%
	0.375"	9.500	87.2%
	#4	4.750	87.1%
	#10	2.000	86.3%

	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	84.7%
	#40	0.425	82.5%
	#60	0.250	77.1%
	#100	0.149	63.8%
	#140	0.106	52.7%
	#200	0.075	44.3%

DISTRIBUTION CURVE



12.9% Gravel 42.8% Sand 44.3% Silt/Clay

PARTICLE-SIZE ANALYSIS
ASTM D 422

Project Name
GEL - Moab
Project No.
109855.01310000

Client Sample No.
GATP-7-4
Lab Sample No.
BC0908

Specific Gravity = 2.8222

Moisture Content = 82.4%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	100.0%
	#4	4.750	100.0%
	#10	2.000	100.0%

	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	98.4%
	#40	0.425	95.6%
	#60	0.250	94.1%
	#100	0.149	92.6%
	#140	0.106	91.3%
	#200	0.075	89.2%

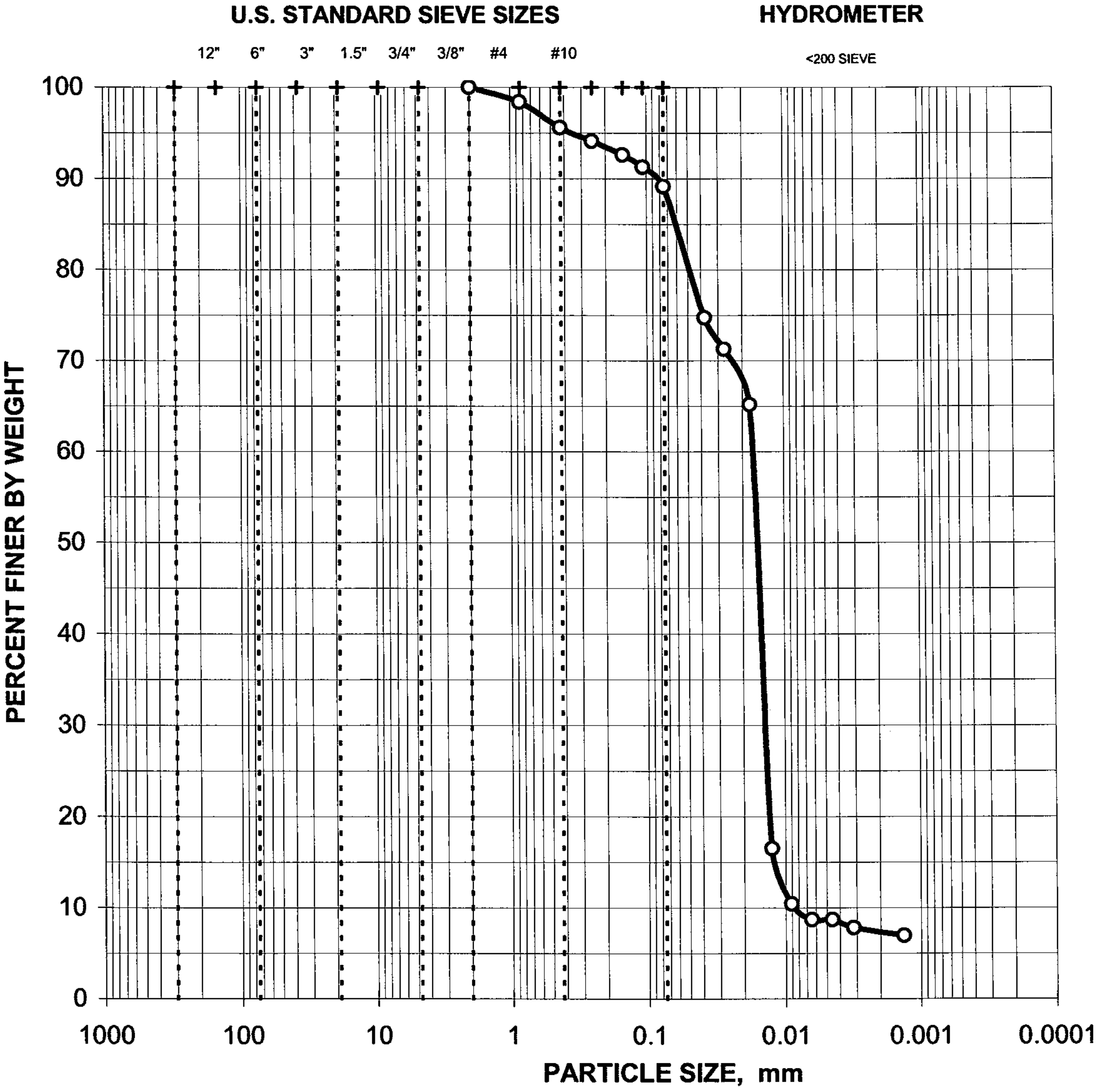
HYDROMETER ANALYSIS

	Diameter mm	Percent Finer
HYDROMETER		
	0.03765	74.7%
	0.02710	71.3%
	0.01768	65.2%
	0.01251	16.5%
	0.00902	10.4%
	0.00643	8.7%
	0.00454	8.7%
	0.00316	7.8%
	0.00134	7.0%

0.0% Gravel 10.8% Sand 89.2% Silt/Clay

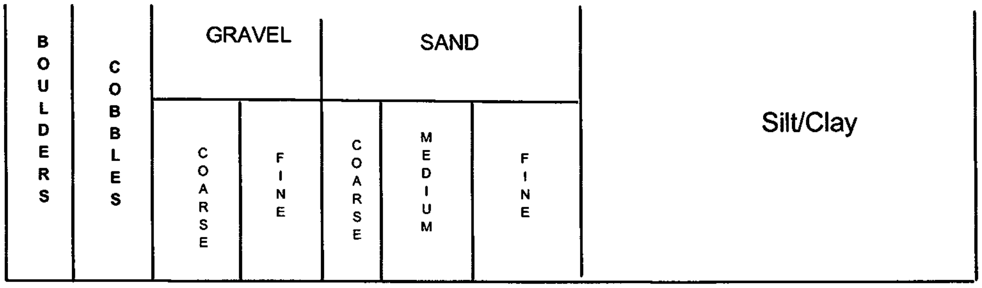
April 6, 2006
Erin Stanley
General Engineering Laboratories
Shaw Project Name: GEL – Moab
Shaw Project No. 109855.01310000

GEL - Moab



CLIENT SAMPLE NO.: GATP-7-4

LAB SAMPLE NO.: BC0908



PARTICLE-SIZE DISTRIBUTION
ASTM D 422

Project Name GEL - Moab

Project No. 109855

Field Sample No. GATP-8-5

Lab Sample No. BC0909

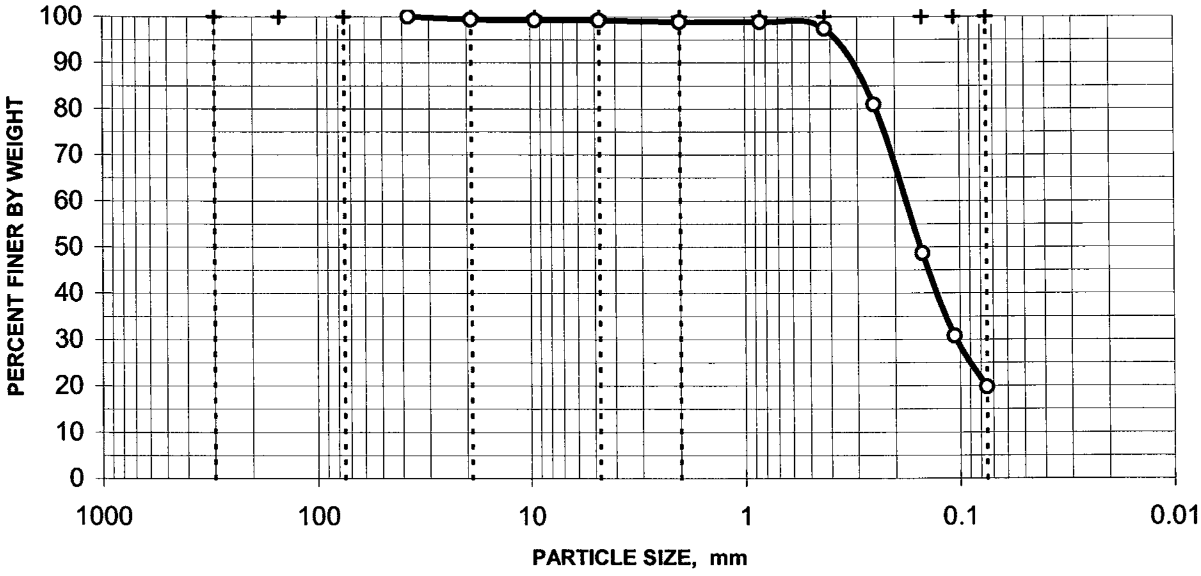
Moisture Content = 113.3%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	99.4%
	0.375"	9.500	99.2%
	#4	4.750	99.2%
	#10	2.000	98.8%

	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	98.8%
	#40	0.425	97.4%
	#60	0.250	80.9%
	#100	0.149	48.6%
	#140	0.106	30.8%
	#200	0.075	19.8%

DISTRIBUTION CURVE



0.8% Gravel 79.4% Sand 19.8% Silt/Clay

Appendix C
Chain of Custody Records

U.S. Department of Energy at Grand Junction

2597 B 3/4 Road, Grand Junction, CO 81503 (970) 248-6000

CHAIN OF CUSTODY

RIN: 06010294
COC: 06010294.2.1
Sampler(s):

Page 1 of 3

Site Name: MOAB CHARACTERIZATION
Site Code: MOA01
Cost Number: 06-203-4-01-5-2-01
Purchase Order: 24316
Sample Matrix: Soil

Process history demonstrates that the activity concentrations (or activity limit) of these samples are below the values listed in 49 CFR 173.436 allowing shipment as an exempt consignment.

Ticket No.	Location	Sample Date	Time	HDPE 125 mL	HDPE 250 mL	HDPE 500 mL	HDPE 1 L	Glass 40 mL	Glass 1 L	Other	Analysis
	701-R26	11/07/2005	0:00	0	0	0	0	0	0	1	
	706R20	12/06/2005	0:00	0	0	0	0	0	0	1	
	706-R22	12/06/2005	0:00	0	0	0	0	0	0	1	
	707-R17	12/01/2005	0:00	0	0	0	0	0	0	1	
	707-R28	12/01/2005	0:00	0	0	0	0	0	0	1	
	710-R1	12/01/2005	0:00	0	0	0	0	0	0	1	
	710-R19	12/05/2005	0:00	0	0	0	0	0	0	1	
	710-R3	12/01/2005	0:00	0	0	0	0	0	0	1	
	713-R1	11/03/2005	0:00	0	0	0	0	0	0	1	
	713-R13	11/04/2005	0:00	0	0	0	0	0	0	1	
	715-R3	11/10/2005	0:00	0	0	0	0	0	0	1	
	718-R11	12/05/2005	0:00	0	0	0	0	0	0	1	
	718-R13	12/05/2005	0:00	0	0	0	0	0	0	1	
	718-R15	12/05/2005	0:00	0	0	0	0	0	0	1	
	718-R17	12/05/2005	0:00	0	0	0	0	0	0	1	
	718-R5	12/05/2005	0:00	0	0	0	0	0	0	1	
			Sum							16	

Reliquished by (signature)	Date 2-14-06	Time 10:40
Received by (signature)	Date 2/15/06	Time 1030

Reliquished by (signature)	Date	Time
Received by (signature)	Date	Time

U.S. Department of Energy at Grand Junction

2597 B 3/4 Road, Grand Junction, CO 81503 (970) 248-6000

CHAIN OF CUSTODY

RIN: 06010294
COC: 06010294.2.2
Sampler(s):

Page 2 of 3

Site Name: MOAB CHARACTERIZATION
Site Code: MOA01
Cost Number: 06-203-4-01-5-2-01
Purchase Order: 24316
Sample Matrix: Soil

Process history demonstrates that the activity concentrations (or activity limit) of these samples are below the values listed in 49 CFR 173.436 allowing shipment as an exempt consignment.

Ticket No.	Location	Sample Date	Time	*HDPE 125 mL*	*HDPE 250 mL*	*HDPE 500 mL*	*HDPE 1 L*	*Glass 40 mL*	*Glass 1 L*	*Other*	Analysis
	718-R7	12/05/2005	0:00	0	0	0	0	0	0	1	
	718-R9	12/05/2005	0:00	0	0	0	0	0	0	1	
	722-R1	11/04/2005	0:00	0	0	0	0	0	0	1	
	722-R2	11/04/2005	0:00	0	0	0	0	0	0	1	
	722-R3	11/04/2005	0:00	0	0	0	0	0	0	1	
	722-R5	11/04/2005	0:00	0	0	0	0	0	0	1	
	GATP-10-4	12/07/2005	0:00	0	0	0	0	0	0	1	
	GATP-11-2	12/07/2005	0:00	0	0	0	0	0	0	1	
	GATP-11-4	12/07/2005	0:00	0	0	0	0	0	0	1	
	GATP-12-5	12/07/2005	0:00	0	0	0	0	0	0	1	
	GATP-3-2	12/08/2005	0:00	0	0	0	0	0	0	1	
	GATP-3-4	12/08/2005	0:00	0	0	0	0	0	0	1	
	GATP-4-5	12/08/2005	0:00	0	0	0	0	0	0	1	
	GATP-5-2	12/08/2005	0:00	0	0	0	0	0	0	1	
	GATP-5-4	12/08/2005	0:00	0	0	0	0	0	0	1	
	GATP-6-1	12/08/2005	0:00	0	0	0	0	0	0	1	
			Sum							16	

Reliquished by (signature)	Date	Time
	2-14-06	10:40
Received by (signature)	**Date**	**Time**
	2-15-06	1030

Reliquished by (signature)	Date	Time
Received by (signature)	Date	Time

U.S. Department of Energy at Grand Junction

2597 B 3/4 Road, Grand Junction, CO 81503 (970) 248-6000

CHAIN OF CUSTODY

RIN: 06010294
COC: 06010294.2.3
Sampler(s):

Page 3 of 3

Site Name: MOAB CHARACTERIZATION
Site Code: MOA01
Cost Number: 06-203-4-01-5-2-01
Purchase Order: 24316
Sample Matrix: Soil

Process history demonstrates that the activity concentrations (or activity limit) of these samples are below the values listed in 49 CFR 173.436 allowing shipment as an exempt consignment.

Ticket No.	Location	Sample Date	Time	HDPE 125 mL	HDPE 250 mL	HDPE 500 mL	HDPE 1 L	Glass 40 mL	Glass 1 L	Other	Analysis
	GATP-6-5	12/08/2005	0:00	0	0	0	0	0	0	1	
	GATP-7-2	12/07/2005	0:00	0	0	0	0	0	0	1	
	GATP-7-4	12/07/2005	0:00	0	0	0	0	0	0	1	
	GATP-8-5	12/08/2005	0:00	0	0	0	0	0	0	1	
	GATP-9-5	12/08/2005	0:00	0	0	0	0	0	0	1	
			Sum							5	

Reliquished by (signature)	Date 2-14-06	Time 10:40
Received by (signature)	Date 2-15-06	Time 1030

Reliquished by (signature)	Date	Time
Received by (signature)	Date	Time

Appendix B

Certificate of Analysis
May 3, 2006

Shaw™
Shaw E & I, Inc.

Geotechnical Laboratory
PO Box 4339
1570 Bear Creek Road
Oak Ridge TN 37830
(865) 482-6497

CERTIFICATE OF ANALYSIS

Erin Stanley
General Engineering Laboratories
2040 Savage Road
Charleston SC 29407

May 3, 2006

This is the Certificate of Analysis for the following samples:

Shaw Project ID:	**GEL – Moab**
Shaw Project Number:	**109855.01210000**
Date Received by Lab:	February 1, 2006
Number of Samples:	One hundred twenty-two (122)
Sample Type:	Soil

I. Introduction/Case Narrative

One hundred twenty-two soil samples were received by the Shaw Geotechnical Laboratory on February 1, 2006. Samples were submitted for moisture content, specific gravity, bulk density, Atterberg limits, percent finer than #200, sieve analysis, particle-size distribution, unconfined compressive strength, and one-point UU triaxial testing.

Not all samples listed on the chain-of-custody were received on February 1, 2006. Another shipment of samples was received on February 15, 2006. Results for the later shipment will be submitted under separate cover.

The original report for this work was issued March 13, 2006. This report contains corrections and amendments to the original report. The original report should not be used.

Please see Appendix A, Sample Number Cross Reference List; Appendix B, Analysis Results; Appendix C, Chain-of-Custody/Sample Receipt Records; and Appendix D, Nonconformance/Variance Reports.

Reviewed and Approved:

Ralph Cole
Laboratory Manager, Geotechnical Services

II. Analytical Results/Methodology

REFERENCES: United Nations, *Recommendations on the Transport of Dangerous Goods, Manual of Tests and Criteria*, third ed. New York, 1999. United States Army Corps of Engineers (USACE), Engineer Manual 1110-2-1906, *Laboratory Soils Testing*, appendix II, 1970; United States Environmental Protection Agency, SW846, *Test Methods for Examining Solid Waste, Physical/Chemical Methods*, 3rd ed., Nov 1986 (EPA SW-846). Annual Book of ASTM Standards, Section 4, Construction, Volume 04.08, *Soil and Rock (I)*, and Volume 04.09, *Soil and Rock (II)*, 2006. Shaw Environmental and infrastructure, Standard Operating Procedures.

Particle-Size Distribution of Soils	**ASTM D 422**
Specific Gravity of Soils	**ASTM D 854**
Amount of Material Finer Than the #200 Sieve	**ASTM D 1140**
Unconfined Compressive Strength	**ASTM D 2166**
Moisture Content of Soil and Rock	**ASTM D 2216**
Unconsolidated Undrained Triaxial Shear Strength	**ASTM D 2850**
Atterberg Limits: Liquid Limit, Plastic Limit, Plasticity Index	**ASTM D 4318**
Bulk Density	**USACE**

III. Quality Control

Quality control checks such as duplicates and spikes (QC samples), are not normally applicable to geotechnical testing. This is due largely to the inability of obtaining samples with known characteristics, the heterogenous nature of the samples, and quality control procedures built-in to the analytical method.

QC measures to ensure accuracy and precision of test results include the following:

- 100% verification of all numerical results - raw data entries, transcriptions and calculations entered by lab technicians are checked, recalculated and verified. Most data calculations are performed by computer programs.

- Data validation through test reasonableness - summaries of all test results for individual reports are reviewed to determine the overall reasonableness of data and to determine the presence of any data that may be considered outliers.

- Quality control procedures are built into most standardized geotechnical procedures. For example, liquid limit and plastic limit analyses call for re-analyses and specify acceptance criteria.

- Routine instrument calibration - instruments, gauges and equipment used in testing are calibrated on a routine basis. All instrument calibration follows ASTM or manufacturer guidelines.

- Maintenance of all past calibration records - calibration records and certification documents of all instruments, gauges and equipment are updated routinely and maintained in the Quality Control Coordinators Quality/Operations files.

- Certified and trained personnel - all technicians are trained in the application of standard laboratory procedures for geotechnical analyses as well as the quality assurance measures implemented by Shaw.

- Quantitative analyses frequently used in geotechnical/physical testing programs do not use QC tools common to wet chemistry or radiochemistry laboratories. Measures not employed in the analysis of samples reported in this report include: laboratory control samples (LCS), blanks, matrix spikes (MS), duplicate analyses, dilutions, digestions, correction factors, surrogate sample analyses, detection limit determinations, control charts, and/or tentatively identified compounds (TICs).

IV. Data Qualification

Several samples appeared to contain a large amount of soluble salts. Some grainsize results for the silt/clay range may be skewed high due to this, and specific gravity (particle density) tests may have been affected. Observations: hydrometer readings at the end of the 24-hr reading were unusually high given that the soil/water column was transparent (e.g. sample 710-R12, 722-R8). We would expect hydrometer readings to indicate zero grams soil per liter under these conditions, but the readings indicated 10-16 grams per liter still in suspension. Several samples were re-run due to the high solubles pushing the instrument out of range.

Unconsolidated undrained triaxial tests were performed on one test specimen at confining pressures supplied by a client agency.

Several Atterberg limits tests were re-run after the original report was issued. The new results are included in this report.

Density results for sample number BC0757 (700-R8) are unusually high for a naturally occurring soil. Shaw rechecked the data and found it to be entered and calculated correctly. The sample length dimension could possibly have been written on the bench sheet incorrectly by the technician during analysis. If this were the case, the most likely results would have been 129.5 pcf wet density, 78.5 pcf dry density. Unfortunately, there was no way to verify this.

In some cases, moisture content results are reported on report pages for different analyses. The laboratory frequently determines the moisture content of specimen aliquots. Therefore, moisture content values may vary for the same sample among different test specimens.

Appendix A
Sample Cross-Reference List

SAMPLE NUMBER CROSS-REFERENCE LIST

LAB SAMPLE NO.	CLIENT SAMPLE NO.	MATRIX
BC0749	700-R12	Soil
BC0750	700-R16	Soil
BC0751	700-R20	Soil
BC0752	700-R24	Soil
BC0753	700-R30	Soil
BC0754	700-R35	Soil
BC0755	700-R39	Soil
BC0756	700-R5	Soil
BC0757	700-R8	Soil
BC0758	701-R12	Soil
BC0759	701-R18	Soil
BC0760	701-R22	Soil
BC0761	701-R30	Soil
BC0762	701-R33	Soil
BC0763	701-R4	Soil
BC0764	701-R8	Soil
BC0765	702-R10	Soil
BC0766	702-R14	Soil
BC0767	702-R18	Soil
BC0768	702-R24	Soil
BC0769	702-R28	Soil
BC0770	702-R31	Soil
BC0771	702-R4	Soil
BC0772	702-R6	Soil
BC0773	702-R8	Soil

SAMPLE NUMBER CROSS-REFERENCE LIST (Cont'd)

LAB SAMPLE NO.	CLIENT SAMPLE NO.	MATRIX
BC0774	706-R10	Soil
BC0775	706-R12	Soil
BC0776	706-R14	Soil
BC0777	706-R16	Soil
BC0778	706-R8	Soil
BC0779	707-R20	Soil
BC0780	707-R25	Soil
BC0781	707-R8	Soil
BC0782	708-R12	Soil
BC0783	708-R15	Soil
BC0784	708-R19	Soil
BC0785	708-R24	Soil
BC0786	708-R29	Soil
BC0787	708-R8	Soil
BC0788	710-R12	Soil
BC0789	710-R16	Soil
BC0790	710-R4	Soil
BC0791	710-R6	Soil
BC0792	710-R8	Soil
BC0793	712-R11	Soil
BC0794	712-R13	Soil
BC0795	712-R15	Soil
BC0796	712-R16	Soil
BC0797	712-R17	Soil
BC0798	712-R2	Soil
BC0799	712-R3	Soil

SAMPLE NUMBER CROSS-REFERENCE LIST (Cont'd)

LAB SAMPLE NO.	CLIENT SAMPLE NO.	MATRIX
BC0800	712-R4	Soil
BC0801	712-R6	Soil
BC0802	712-R7	Soil
BC0803	712-R9	Soil
BC0804	713-R2	Soil
BC0805	713-R5	Soil
BC0806	713-R7	Soil
BC0807	713-R9	Soil
BC0808	714-R1	Soil
BC0809	714-R2	Soil
BC0810	714-R3	Soil
BC0811	714-R4	Soil
BC0812	714-R5	Soil
BC0813	714-R6	Soil
BC0814	714-R7	Soil
BC0815	714-R8	Soil
BC0816	715-R11	Soil
BC0817	715-R16	Soil
BC0818	715-R20	Soil
BC0819	715-R24	Soil
BC0820	715-R28	Soil
BC0821	715-R6	Soil
BC0822	715-R8	Soil
BC0823	716-R11	Soil
BC0824	716-R13	Soil
BC0825	716-R16	Soil

SAMPLE NUMBER CROSS-REFERENCE LIST (Cont'd)

LAB SAMPLE NO.	CLIENT SAMPLE NO.	MATRIX
BC0826	716-R19	Soil
BC0827	716-R2	Soil
BC0828	716-R3	Soil
BC0829	716-R4	Soil
BC0830	716-R5	Soil
BC0831	716-R6	Soil
BC0832	716-R7	Soil
BC0833	716-R9	Soil
BC0834	717-R10	Soil
BC0835	717-R12	Soil
BC0836	717-R14	Soil
BC0837	717-R16	Soil
BC0838	717-R18	Soil
BC0839	717-R2	Soil
BC0840	717-R21	Soil
BC0841	717-R3	Soil
BC0842	717-R4	Soil
BC0843	717-R6	Soil
BC0844	717-R8	Soil
BC0845	720-R1	Soil
BC0846	720-R12	Soil
BC0847	720-R14	Soil
BC0848	720-R16	Soil
BC0849	720-R2	Soil
BC0850	720-R3	Soil
BC0851	720-R4	Soil

SAMPLE NUMBER CROSS-REFERENCE LIST (Cont'd)

LAB SAMPLE NO.	CLIENT SAMPLE NO.	MATRIX
BC0852	720-R5	Soil
BC0853	720-R6	Soil
BC0854	720-R7	Soil
BC0855	720-R8	Soil
BC0856	720-R9	Soil
BC0857	722-R4	Soil
BC0858	722-R6	Soil
BC0859	722-R7	Soil
BC0860	722-R8	Soil
BC0861	723-R2	Soil
BC0862	723-R3	Soil
BC0863	723-R4	Soil
BC0864	723-R5	Soil
BC0865	723-R6	Soil
BC0866	723-R7	Soil
BC0867	723-R8	Soil
BC0868	GATP-10-1	Soil
BC0869	GATP-10-2	Soil
BC0870	713-R11	Soil

Appendix B
Data Results

MOISTURE CONTENT

PROJECT NAME	PROJECT NUMBER
GEL - Moab	**109855.01210000**

LAB SAMPLE NO.	CLIENT SAMPLE NO.	MOISTURE, % ASTM D 2216	MOISTURE , % SW846	SOLIDS, % SW846
BC0749	700-R12	39.2	28.2	71.8
BC0750	700-R16	26.1	20.7	79.3
BC0751	700-R20	31.2	23.8	76.2
BC0752	700-R24	27.8	21.8	78.2
BC0753	700-R30	26.2	20.8	79.2
BC0754	700-R35	39.6	28.4	71.6
BC0755	700-R39	49.9	33.3	66.7
BC0756	700-R5	8.7	8.0	92.0
BC0757	700-R8	65.0	39.4	60.6
BC0758	701-R12	50.8	33.7	66.3
BC0759	701-R18	42.4	29.8	70.2
BC0760	701-R22	33.6	25.2	74.8
BC0761	701-R30	8.7	8.0	92.0
BC0762	701-R33	6.7	6.3	93.7
BC0763	701-R4	24.4	19.6	80.4
BC0764	701-R8	31.5	24.0	76.0
BC0765	702-R10	16.9	14.4	85.6
BC0766	702-R14	35.1	26.0	74.0
BC0767	702-R18	22.4	18.3	81.7
BC0768	702-R24	24.5	19.7	80.3

ASTM D 2216 results are based on dry sample weight.
SW846 results are based on wet sample weight.
Solids content is determined by subtracting the SW846 moisture (%) from 100.

MOISTURE CONTENT

PROJECT NAME
GEL - Moab

PROJECT NUMBER
109855.01210000

LAB SAMPLE NO.	CLIENT SAMPLE NO.	MOISTURE, % ASTM D 2216	MOISTURE , % SW846	SOLIDS, % SW846
BC0769	702-R28	46.2	31.6	68.4
BC0770	702-R31	8.0	7.4	92.6
BC0771	702-R4	34.7	25.7	74.3
BC0772	702-R6	71.3	41.6	58.4
BC0773	702-R8	38.3	27.7	72.3
BC0774	706-R10	69.6	41.0	59.0
BC0775	706-R12	60.7	37.8	62.2
BC0776	706-R14	38.2	27.7	72.3
BC0777	706-R16	45.0	31.0	69.0
BC0778	706-R8	55.7	35.8	64.2
BC0779	707-R20	62.9	38.6	61.4
BC0780	707-R25	53.9	35.0	65.0
BC0781	707-R8	14.6	12.7	87.3
BC0782	708-R12	52.2	34.3	65.7
BC0783	708-R15	75.2	42.9	57.1
BC0784	708-R19	25.7	20.5	79.5
BC0785	708-R24	24.4	19.6	80.4
BC0786	708-R29	49.3	33.0	67.0
BC0787	708-R8	98.8	49.7	50.3
BC0788	710-R12	67.4	40.3	59.7

ASTM D 2216 results are based on dry sample weight.
SW846 results are based on wet sample weight.
Solids content is determined by subtracting the SW846 moisture (%) from 100.

MOISTURE CONTENT

PROJECT NAME
GEL - Moab

PROJECT NUMBER
109855.01210000

LAB SAMPLE NO.	CLIENT SAMPLE NO.	MOISTURE, % ASTM D 2216	MOISTURE , % SW846	SOLIDS, % SW846
BC0789	710-R16	60.4	37.6	62.4
BC0790	710-R4	80.7	44.7	55.3
BC0791	710-R6	116.8	53.9	46.1
BC0792	710-R8	78.2	43.9	56.1
BC0793	712-R11	44.8	31.0	69.0
BC0794	712-R13	45.3	31.2	68.8
BC0795	712-R15	11.6	10.4	89.6
BC0796	712-R16	7.6	7.1	92.9
BC0797	712-R17	8.4	7.8	92.2
BC0798	712-R2	5.6	5.3	94.7
BC0799	712-R3	6.6	6.2	93.8
BC0800	712-R4	11.8	10.5	89.5
BC0801	712-R6	63.3	38.8	61.2
BC0802	712-R7	21.6	17.8	82.2
BC0803	712-R9	29.1	22.6	77.4
BC0804	713-R2	6.6	6.2	93.8
BC0805	713-R5	75.5	43.0	57.0
BC0806	713-R7	56.0	35.9	64.1
BC0807	713-R9	60.9	37.8	62.2
BC0808	714-R1	40.5	28.8	71.2

ASTM D 2216 results are based on dry sample weight.
SW846 results are based on wet sample weight.
Solids content is determined by subtracting the SW846 moisture (%) from 100.

MOISTURE CONTENT

PROJECT NAME
GEL - Moab

PROJECT NUMBER
109855.01210000

LAB SAMPLE NO.	CLIENT SAMPLE NO.	MOISTURE, % ASTM D 2216	MOISTURE , % SW846	SOLIDS, % SW846
BC0809	714-R2	5.1	4.9	95.1
BC0810	714-R3	6.3	6.0	94.0
BC0811	714-R4	7.6	7.0	93.0
BC0812	714-R5	7.4	6.9	93.1
BC0813	714-R6	6.7	6.3	93.7
BC0814	714-R7	7.3	6.8	93.2
BC0815	714-R8	7.9	7.3	92.7
BC0816	715-R11	30.8	23.5	76.5
BC0817	715-R16	30.8	23.6	76.4
BC0818	715-R20	36.3	26.7	73.3
BC0819	715-R24	58.4	36.9	63.1
BC0820	715-R28	5.6	5.3	94.7
BC0821	715-R6	51.2	33.8	66.2
BC0822	715-R8	61.8	38.2	61.8
BC0823	716-R11	28.0	21.9	78.1
BC0824	716-R13	29.1	22.5	77.5
BC0825	716-R16	30.2	23.2	76.8
BC0826	716R-19	8.4	7.8	92.2
BC0827	716-R2	9.0	8.3	91.7
BC0828	716-R3	9.8	8.9	91.1

ASTM D 2216 results are based on dry sample weight.
SW846 results are based on wet sample weight.
Solids content is determined by subtracting the SW846 moisture (%) from 100.

MOISTURE CONTENT

PROJECT NAME
GEL - Moab

PROJECT NUMBER
109855.01210000

LAB SAMPLE NO.	CLIENT SAMPLE NO.	MOISTURE, % ASTM D 2216	MOISTURE , % SW846	SOLIDS, % SW846
BC0829	716-R4	3.5	3.4	96.6
BC0830	716-R5	10.3	9.3	90.7
BC0831	716-R6	10.6	9.6	90.4
BC0832	716-R7	8.4	7.7	92.3
BC0833	716-R9	23.8	19.2	80.8
BC0834	717-R10	16.7	14.3	85.7
BC0835	717-R12	30.6	23.4	76.6
BC0836	717-R14	27.6	21.6	78.4
BC0837	717-R16	27.6	21.6	78.4
BC0838	717-R18	48.3	32.6	67.4
BC0839	717-R2	13.1	11.5	88.5
BC0840	717-R21	8.0	7.4	92.6
BC0841	717-R3	21.5	17.7	82.3
BC0842	717-R4	15.3	13.3	86.7
BC0843	717-R6	10.0	9.1	90.9
BC0844	717-R8	10.0	9.1	90.9
BC0845	720-R1	3.5	3.4	96.6
BC0846	720-R12	28.3	22.0	78.0
BC0847	720-R14	28.7	22.3	77.7
BC0848	720-R16	5.3	5.0	95.0

ASTM D 2216 results are based on dry sample weight.
SW846 results are based on wet sample weight.
Solids content is determined by subtracting the SW846 moisture (%) from 100.

MOISTURE CONTENT

PROJECT NAME
GEL - Moab

PROJECT NUMBER
109855.01210000

LAB SAMPLE NO.	CLIENT SAMPLE NO.	MOISTURE, % ASTM D 2216	MOISTURE , % SW846	SOLIDS, % SW846
BC0849	720-R2	8.7	8.0	92.0
BC0850	720-R3	12.5	11.1	88.9
BC0851	720-R4	31.0	23.7	76.3
BC0852	720-R5	5.0	4.8	95.2
BC0853	720-R6	11.3	10.2	89.8
BC0854	720-R7	20.7	17.1	82.9
BC0855	720-R8	25.5	20.3	79.7
BC0856	720-R9	29.0	22.5	77.5
BC0857	722-R4	7.4	6.9	93.1
BC0858	722-R6	7.5	7.0	93.0
BC0859	722-R7	10.4	9.4	90.6
BC0860	722-R8	48.3	32.6	67.4
BC0861	723-R2	100.6	50.2	49.8
BC0862	723-R3	8.7	8.0	92.0
BC0863	723-R4	5.0	4.8	95.2
BC0864	723-R5	6.0	5.7	94.3
BC0865	723-R6	7.2	6.7	93.3
BC0866	723-R7	6.6	6.2	93.8
BC0867	723-R8	5.2	4.9	95.1
BC0868	GATP-10-1	5.9	5.6	94.4

ASTM D 2216 results are based on dry sample weight.
SW846 results are based on wet sample weight.
Solids content is determined by subtracting the SW846 moisture (%) from 100.

MOISTURE CONTENT

PROJECT NAME
GEL - Moab

PROJECT NUMBER
109855.01210000

LAB SAMPLE NO.	CLIENT SAMPLE NO.	MOISTURE, % ASTM D 2216	MOISTURE , % SW846	SOLIDS, % SW846
BC0869	GATP-10-2	9.6	8.7	91.3
BC0870	713-R11	9.8	8.9	91.1

ASTM D 2216 results are based on dry sample weight.
SW846 results are based on wet sample weight.
Solids content is determined by subtracting the SW846 moisture (%) from 100.

ATTERBERG LIMITS
ASTM D 4318

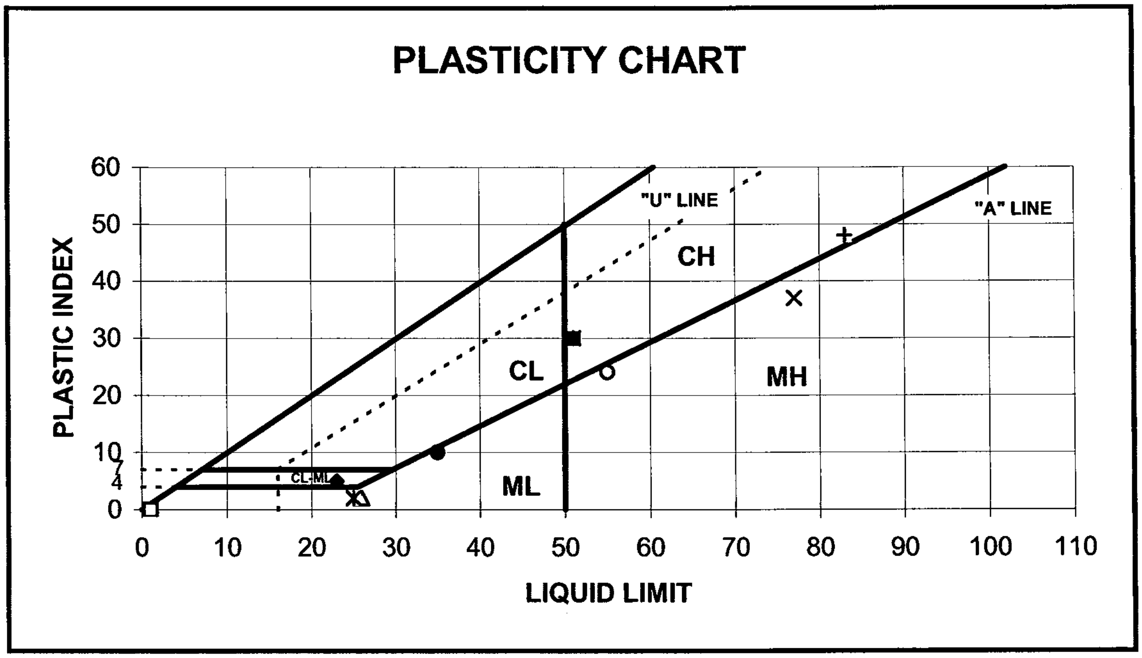
PROJECT NAME:
GEL-Moab

PROJECT NO.
109855.01210000

ATTERBERG LIMITS RESULTS

LAB SAMPLE NO.	FIELD SAMPLE NO.	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	USCS SYMBOL
BC0749 ●	700-R12	35	25	10	ML
BC0752 ◆	700-R24	23	18	5	CL-ML
BC0753 □	700-R30	NP	NP	NP	NP
BC0754 ◇	700-R35	45	20	25	CL
BC0755 +	700-R39	83	35	48	CH
BC0757 ○	700-R8	55	31	24	MH
BC0759 ■	701-R18	51	21	30	CH
BC0761 x	701-R30	77	40	37	MH
BC0764 △	701-R8	26	24	2	ML
BC0764 dup *	701-R8 dup	25	23	2	ML

*NP=Nonplastic



ATTERBERG LIMITS
ASTM D 4318

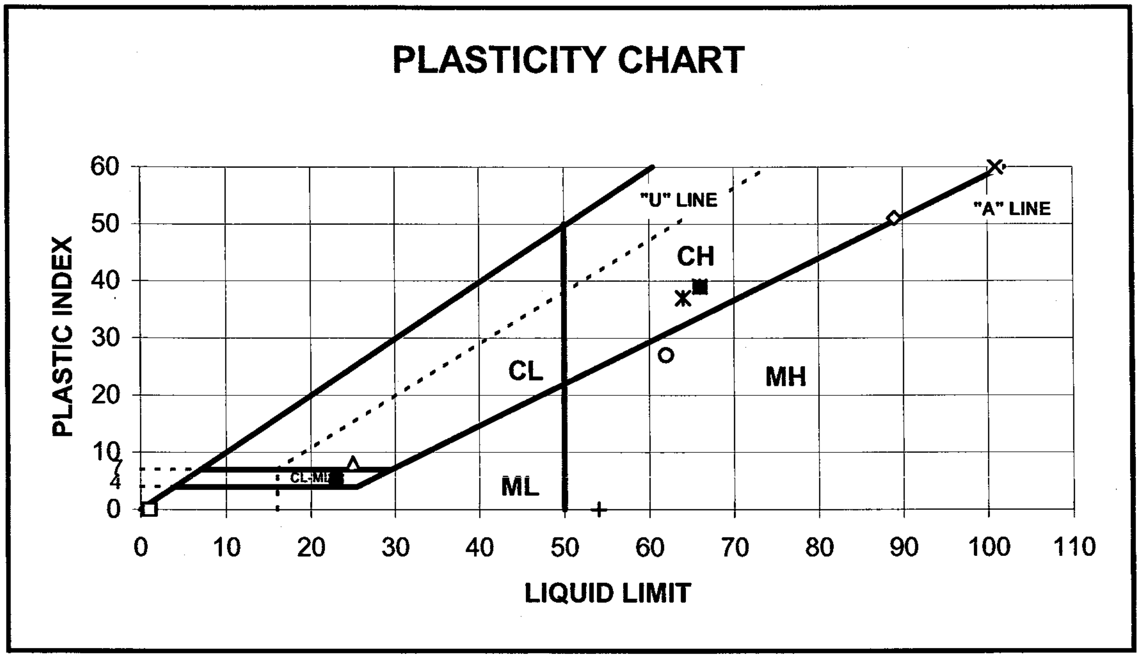
PROJECT NAME:
GEL-Moab

PROJECT NO.
109855.01210000

ATTERBERG LIMITS RESULTS

LAB SAMPLE NO.		FIELD SAMPLE NO.	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	USCS SYMBOL
BC0767	●	702-R18	23	18	5	CL-ML
BC0767 dup	◆	702-R18 dup	23	17	6	CL-ML
BC0768	□	702-R24	NP	NP	NP	NP
BC0769	◇	702-R28	89	38	51	CH
BC0772	+	702-R6	54	NP	NP	NP
BC0774	○	706-R10	62	35	27	MH
BC0779	■	707-R20	66	27	39	CH
BC0780	X	707-R25	101	41	60	CH
BC0781	△	707-R8	25	17	8	CL
BC0783	*	708-R15	64	27	37	CH

*NP=Nonplastic



ATTERBERG LIMITS
ASTM D 4318

PROJECT NAME: GEL-Moab

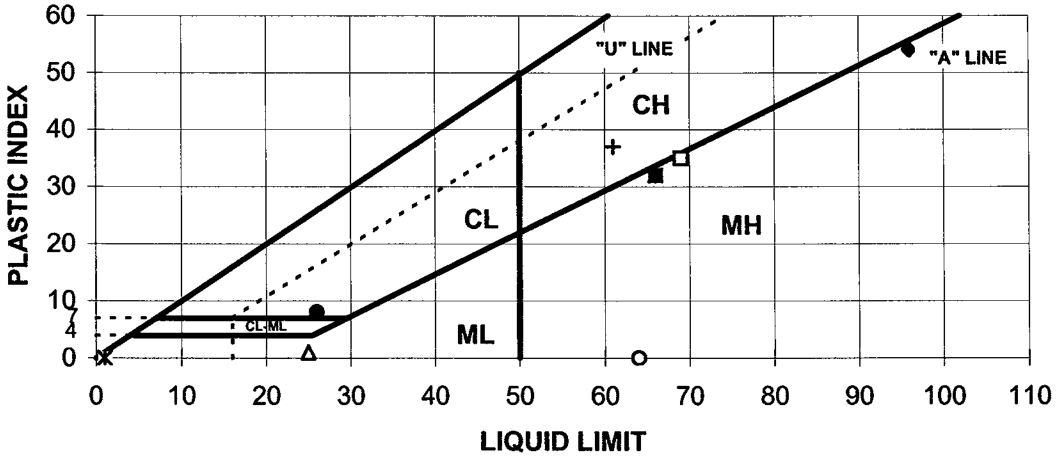
PROJECT NO. 109855.01210000

ATTERBERG LIMITS RESULTS

LAB SAMPLE NO.	FIELD SAMPLE NO.	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	USCS SYMBOL
BC0785 ●	708-R24	26	18	8	CL
BC0786 ◆	708-R29	96	42	54	MH
BC0787 □	708-R8	69	34	35	MH
BC0788 ◇	710-R12	45	21	24	CL
BC0789 +	710-R16	61	24	37	CH
BC0790 ○	710-R4	64	NP	NP	NP
BC0792 ■	710-R8	66	34	32	MH
BC0793 X	712-R11	25	27	-2	NP
BC0793 dup △	712-R11 dup	25	24	1	ML
BC0816 *	715-R11	NP	NP	NP	NP

*NP=Nonplastic

PLASTICITY CHART



ATTERBERG LIMITS
ASTM D 4318

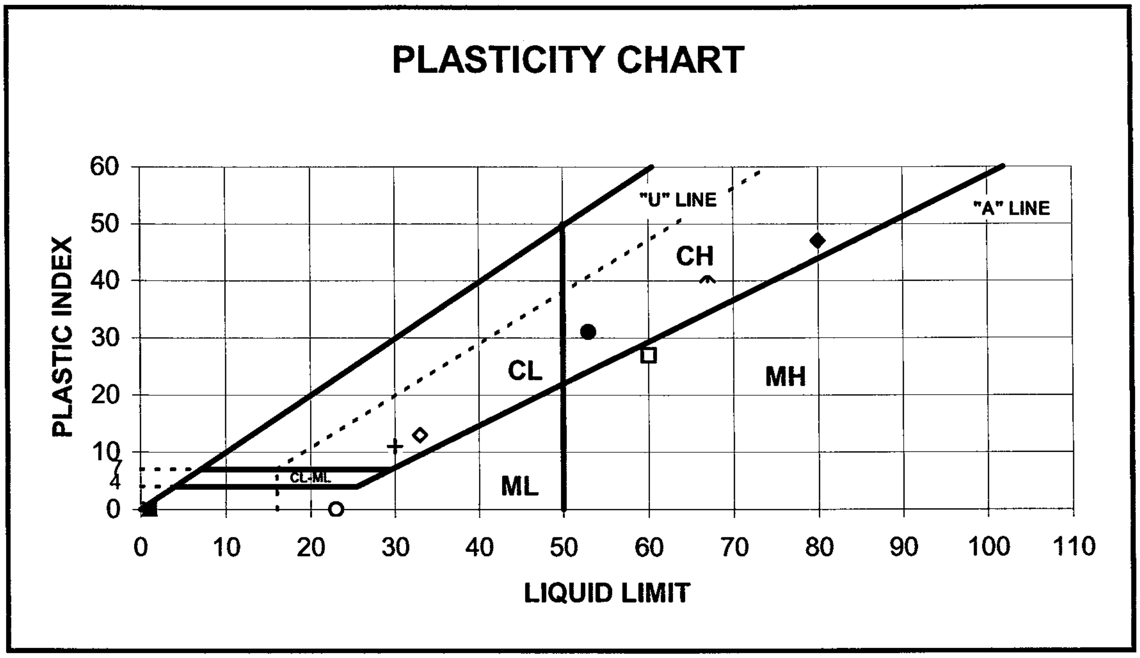
PROJECT NAME:
GEL-Moab

PROJECT NO.
109855.01210000

ATTERBERG LIMITS RESULTS

LAB SAMPLE NO.	FIELD SAMPLE NO.	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	USCS SYMBOL
BC0818 ●	715-R20	53	22	31	CH
BC0819 ◆	715-R24	80	33	47	CH
BC0821 □	715-R6	60	33	27	MH
BC0824 ◇	716-R13	33	20	13	CL
BC0825 +	716-R16	30	19	11	CL
BC0833 ○	716-R9	23	NP	NP	NP
BC0834 ■	717-R10	NP	NP	NP	NP
BC0846 x	720-R12	22	23	-1	NP
BC0846 dup △	720-R12 dup	22	23	-1	NP
BC0860 *	722-R8	67	26	41	CH

*NP=Nonplastic



ATTERBERG LIMITS
ASTM D 4318

PROJECT NAME:
GEL-Moab

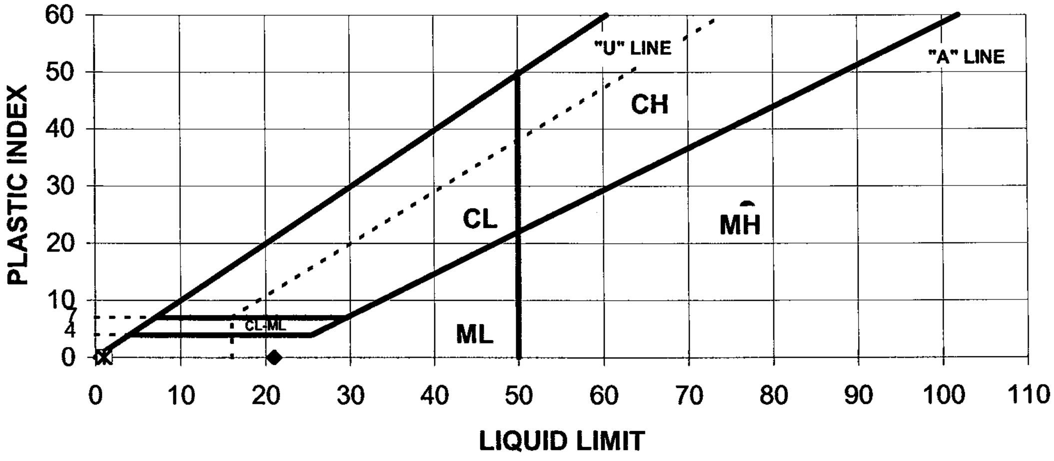
PROJECT NO.
109855.01210000

ATTERBERG LIMITS RESULTS

LAB SAMPLE NO.		FIELD SAMPLE NO.	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	USCS SYMBOL
BC0861	●	723-R2	77	51	26	MH
BC0869	◆	GATP-10-2	21	NP	NP	NP
BC0870	□	713-R11	NP	NP	NP	NP
	◇					
	+					
	○					
	■					
	x					
	△					
	*					

*NP=Nonplastic

PLASTICITY CHART



SPECIFIC GRAVITY
ASTM D 854

PROJECT NAME:
GEL - Moab

PROJECT NUMBER:
109855.01210000

LAB SAMPLE NO.	CLIENT SAMPLE NO.	SPECIFIC GRAVITY
BC0753	700-R30	2.6676
BC0755	700-R39	2.9813
BC0756	700-R5	2.7212
BC0757	700-R8	2.9198
BC0759	701-R18	2.7108
BC0761	701-R30	2.9971
BC0764	701-R8	2.7783
BC0767	702-R18	2.6814
BC0769	702-R28	2.9660
BC0771	702-R4	2.8149
BC0772	702-R6	2.8105
BC0774	706-R10	2.7899
BC0779	707-R20	2.8050
BC0786	708-R29	3.0827
BC0787	708-R8	2.8742
BC0788	710-R12	2.7828
BC0790	710-R4	2.9369
BC0801	712-R6	2.8674
BC0804	713-R2	2.6825
BC0806	713-R7	2.8013

SPECIFIC GRAVITY
ASTM D 854

PROJECT NAME:
GEL - Moab

PROJECT NUMBER:
109855.01210000

LAB SAMPLE NO.	CLIENT SAMPLE NO.	SPECIFIC GRAVITY
BC0810	714-R3	2.7385
BC0818	715-R20	2.7335
BC0819	715-R24	3.0120
BC0821	715-R6	2.8716
BC0824	716-R13	2.7237
BC0860	722-R8	2.7517
BC0861	723-R2	2.8811
BC0868	GATP-10-1	2.7023
BC0869	GATP-10-2	2.7257
BC0870	713-R11	2.7078

BULK DENSITY/DRY DENSITY
ASTM D 2937, USACE EM 1110-2-1906, app. II

PROJECT NAME:
GEL - Moab

PROJECT NUMBER:
109855.01210000

LAB SAMPLE NUMBER	CLIENT SAMPLE NUMBER	AVERAGE LENGTH, inches	AVERAGE DIAMETER, inches*	WET WEIGHT, grams	MOISTURE CONTENT, %	BULK DENSITY, pcf	DRY DENSITY, pcf
BC0749	700-R12	4.5922	2.8075	791.32	39.2	106.1	76.2
BC0750	700-R16	4.6368	2.8347	899.12	26.1	117.1	92.8
BC0751	700-R20	3.4549	2.7467	649.49	31.2	120.9	92.2
BC0752	700-R24	5.0343	2.8185	1007.55	27.8	122.2	95.6
BC0753	700-R30	5.5703	2.8327	1136.25	26.2	123.3	97.7
BC0754	700-R35	4.4848	2.8363	912.28	39.6	122.7	87.8
BC0755	700-R39	5.4885	2.8637	1040.72	49.9	112.2	74.8
BC0756	700-R5	4.5243	2.8603	979.20	8.7	128.3	118.0
BC0757	700-R8	**4.8627**	2.7750	794.21	65.0	102.9	62.4
BC0758	701-R12	5.6170	2.7770	978.51	50.6	109.6	72.8
BC0759	701-R18	5.6170	2.7770	1058.79	42.4	118.6	83.3
BC0760	701-R22	5.5743	2.8142	1141.87	33.6	125.5	93.9
BC0761	701-R30	3.2002	2.8675	629.98	45.0	116.1	80.1
BC0763	701-R4	6.6267	2.8675	1117.14	24.4	99.5	79.9
BC0764	701-R8	4.9127	2.8063	964.87	31.5	121.0	92.0
BC0765	702-R10	4.1993	2.8108	772.43	16.9	112.9	96.6
BC0766	702-R14	5.6027	2.7443	1099.18	35.1	126.4	93.5
BC0767	702-R18	5.5797	2.8180	1162.12	22.4	127.2	104.0
BC0768	702-R24	3.3355	2.8128	707.27	24.5	130.0	104.4
BC0769	702-R28	5.6195	2.8327	1075.39	46.2	115.7	79.1

Moisture content calculated by ASTM D 2216 based on sample dry weight.

Bulk density is the weight of wet sample divided by the volume of the wet sample (as-received).

Dry density is the weight of the dry sample solids divided by the volume of the original sample.

Sample 700-R8 sample length is assumed.

BULK DENSITY/DRY DENSITY
ASTM D 2937, USACE EM 1110-2-1906, app. II

PROJECT NAME: **GEL - Moab**

PROJECT NUMBER: **109855.01210000**

LAB SAMPLE NUMBER	CLIENT SAMPLE NUMBER	AVERAGE LENGTH, inches	AVERAGE DIAMETER, inches*	WET WEIGHT, grams	MOISTURE CONTENT, %	BULK DENSITY, pcf	DRY DENSITY, pcf
BC0771	702-R4	4.5757	2.7712	827.52	34.7	114.3	84.8
BC0772	702-R6	3.0869	1.9560	241.01	71.3	99.0	57.8
BC0773	702-R8	4.6657	2.8399	829.59	38.3	107.0	77.3
BC0774	706-R10	5.6073	2.7972	931.23	69.6	103.0	60.7
BC0775	706-R12	5.5778	2.8158	1006.83	60.7	110.4	68.7
BC0776	706-R14	3.7167	2.8172	671.05	38.2	110.4	79.8
BC0777	706-R16	4.9500	2.7753	889.78	45.0	113.2	78.1
BC0778	706-R8	4.4765	2.8218	738.29	55.7	100.5	64.5
BC0779	707-R20	4.7293	2.7728	772.43	62.9	103.1	63.3
BC0780	707-R25	5.0627	2.8302	915.02	53.9	109.5	71.1
BC0781	707-R8	3.8083	2.8755	891.79	14.6	137.4	119.9
BC0782	708-R12	3.8993	2.7485	678.59	52.2	111.8	73.5
BC0783	708-R15	5.5435	2.7700	915.25	75.2	104.4	59.6
BC0784	708-R19	4.0344	2.8068	829.33	25.7	126.6	100.7
BC0785	708-R24	5.5385	2.8477	1210.67	29.9	130.8	100.7
BC0786	708-R29	4.1570	2.8530	790.95	49.3	113.4	76.0
BC0787	708-R8	4.9507	2.7590	750.22	98.5	96.6	48.7
BC0788	710-R12	3.8776	2.7743	659.88	67.4	107.3	64.1
BC0789	710-R16	4.0665	2.7717	690.85	60.4	107.3	66.9
BC0790	710-R4	3.2562	1.9815	255.53	80.7	97.0	53.7

Moisture content calculated by ASTM D 2216 based on sample dry weight.

Bulk density is the weight of wet sample divided by the volume of the wet sample (as-received).

Dry density is the weight of the dry sample solids divided by the volume of the original sample.

BULK DENSITY/DRY DENSITY
ASTM D 2937, USACE EM 1110-2-1906, app. II

PROJECT NAME:
GEL - Moab

PROJECT NUMBER:
109855.01210000

LAB SAMPLE NUMBER	CLIENT SAMPLE NUMBER	AVERAGE LENGTH, inches	AVERAGE DIAMETER, inches*	WET WEIGHT, grams	MOISTURE CONTENT, %	BULK DENSITY, pcf	DRY DENSITY, pcf
BC0791	710-R6	2.7238	2.8423	403.62	116.8	89.0	41.0
BC0792	710-R8	4.2805	2.7945	697.52	78.2	101.2	56.8
BC0793	712-R11	5.6077	2.8488	1004.04	44.8	107.0	73.9
BC0794	712-R13	4.9320	2.7250	876.14	45.3	116.1	79.9
BC0795	712-R15	5.1618	2.7383	879.82	11.6	110.3	98.8
BC0801	712-R6	4.3985	2.8137	748.74	63.3	104.3	63.9
BC0802	712-R7	4.7237	2.7458	799.65	21.6	108.9	89.6
BC0804	713-R2	4.1560	2.8317	666.54	6.6	97.0	91.0
BC0805	713-R5	2.8483	1.9755	222.91	75.5	97.3	55.4
BC0806	713-R7	2.7352	2.9622	495.26	56.0	100.1	64.2
BC0807	713-R9	4.8845	2.7735	799.19	60.9	103.2	64.1
BC0817	715-R16	5.6118	2.7677	1046.50	30.8	118.1	90.3
BC0818	715-R20	5.0393	2.8130	984.37	36.3	119.8	87.8
BC0819	715-R24	5.3728	2.8225	979.99	52.1	111.1	73.0
BC0821	715-R6	3.9292	2.0388	351.93	39.5	104.5	74.9
BC0822	715-R8	5.3812	2.8467	922.24	61.8	102.6	63.4
BC0824	716-R13	2.4353	2.7780	488.53	29.1	126.1	97.7
BC0833	716-R9	4.2315	2.9278	803.16	23.8	107.4	86.7
BC0846	720-R12	2.0832	2.8542	432.97	28.3	123.8	96.5
BC0847	720-R14	4.5505	2.7732	898.17	28.7	124.5	96.8

Moisture content calculated by ASTM D 2216 based on sample dry weight.

Bulk density is the weight of wet sample divided by the volume of the wet sample (as-received).

Dry density is the weight of the dry sample solids divided by the volume of the original sample.

BULK DENSITY/DRY DENSITY
ASTM D 2937, USACE EM 1110-2-1906, app. II

PROJECT NAME: **GEL - Moab**

PROJECT NUMBER: **109855.01210000**

LAB SAMPLE NUMBER	CLIENT SAMPLE NUMBER	AVERAGE LENGTH, inches	AVERAGE DIAMETER, inches*	WET WEIGHT, grams	MOISTURE CONTENT, %	BULK DENSITY, pcf	DRY DENSITY, pcf
BC0856	720-R9	4.3155	2.7975	842.36	29.0	121.0	93.8
BC0861	723-R2	3.3600	2.8033	496.84	100.6	91.3	45.5
BC0870	713-R11	3.5582	2.7935	648.92	9.8	113.4	103.3

Moisture content calculated by ASTM D 2216 based on sample dry weight.

Bulk density is the weight of wet sample divided by the volume of the wet sample (as-received).

Dry density is the weight of the dry sample solids divided by the volume of the original sample.

AMT FINER THAN #200 SIEVE
ASTM D 1140

PROJECT NAME
GEL - Moab

PROJECT NUMBER
109855.01210000

SHAW LAB SAMPLE NO.	CLIENT SAMPLE NO.	% LOSS (% FINER THAN #200)
BC0750	700-R16	98.3
BC0751	700-R20	99.4
BC0752	700-R24	63.4
BC0754	700-R35	93.9
BC0765	702-R10	43.3
BC0766	702-R14	95.6
BC0771	702-R4	76.9
BC0775	706-R12	99.6
BC0777	706-R16	70.7
BC0782	708-R12	99.6
BC0784	708-R19	76.4
BC0789	710-R16	99.6
BC0792	710-R8	75.8
BC0794	712-R13	65.2
BC0796	712-R16	29.1
BC0798	712-R2	25.5
BC0800	712-R4	21.3
BC0802	712-R7	19.0
BC0803	712-R9	36.4
BC0805	713-R5	83.2

The number 200 sieve has openings equivalent to 75 microns (0.075mm).

AMT FINER THAN #200 SIEVE
ASTM D 1140

PROJECT NAME
GEL - Moab

PROJECT NUMBER
109855.01210000

SHAW LAB SAMPLE NO.	CLIENT SAMPLE NO.	% LOSS (% FINER THAN #200)
BC0807	713-R9	100.0
BC0808	714-R1	54.6
BC0810	714-R3	32.9
BC0812	714-R5	57.9
BC0814	714-R7	55.0
BC0817	715-R16	87.9
BC0822	715-R8	55.8
BC0823	716-R11	86.6
BC0828	716-R3	26.3
BC0829	716-R4	7.3
BC0830	716-R5	18.9
BC0831	716-R6	30.0
BC0832	716-R7	21.0
BC0835	717-R12	74.3
BC0836	717-R14	47.7
BC0837	717-R16	51.3
BC0838	717-R18	96.9
BC0841	717-R3	54.7
BC0842	717-R4	33.8
BC0844	717-R8	38.7

The number 200 sieve has openings equivalent to 75 microns (0.075mm).

AMT FINER THAN #200 SIEVE
ASTM D 1140

PROJECT NAME
GEL - Moab

PROJECT NUMBER
109855.01210000

SHAW LAB SAMPLE NO.	CLIENT SAMPLE NO.	% LOSS (% FINER THAN #200)
BC0846	720-R12	83.3
BC0847	720-R14	97.0
BC0849	720-R2	26.5
BC0850	720-R3	24.0
BC0852	720-R5	17.6
BC0853	720-R6	44.1
BC0854	720-R7	61.7
BC0856	720-R9	40.9
BC0857	722-R4	21.3
BC0859	722-R7	35.5
BC0862	723-R3	37.1
BC0864	723-R5	33.3
BC0866	723-R7	38.4

The number 200 sieve has openings equivalent to 75 microns (0.075mm).

PARTICLE-SIZE DISTRIBUTION
ASTM D 422

Project Name GEL - Moab

Project No. 109855.01210000

Field Sample No. 700-R12

Lab Sample No. BC0749

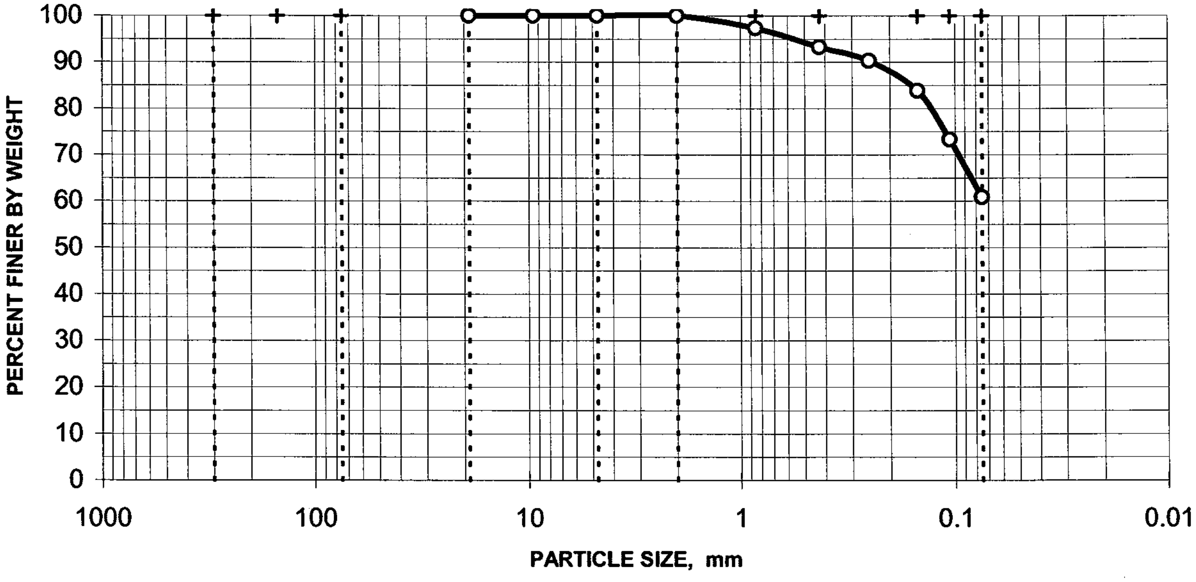
Moisture Content = 39.2%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	100.0%
	#4	4.750	100.0%
	#10	2.000	100.0%

	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	97.3%
	#40	0.425	93.2%
	#60	0.250	90.3%
	#100	0.149	83.8%
	#140	0.106	73.3%
	#200	0.075	60.9%

DISTRIBUTION CURVE



0.0% Gravel 39.1% Sand 60.9% Silt/Clay

PARTICLE-SIZE DISTRIBUTION
ASTM D 422

Project Name GEL - Moab

Project No. 109855.01210000

Field Sample No. 700-R30

Lab Sample No. BC0753

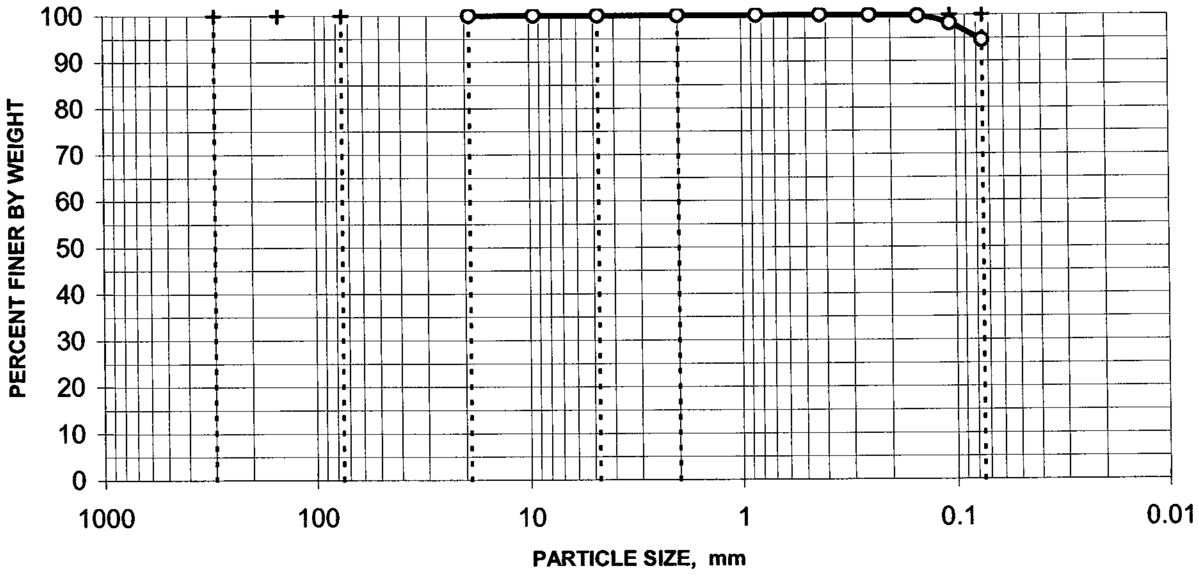
Moisture Content = 26.2%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	100.0%
	#4	4.750	100.0%
	#10	2.000	100.0%

	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	100.0%
	#40	0.425	100.0%
	#60	0.250	100.0%
	#100	0.149	99.7%
	#140	0.106	98.2%
	#200	0.075	94.5%

DISTRIBUTION CURVE



0.0% Gravel 5.5% Sand 94.5% Silt/Clay

PARTICLE-SIZE ANALYSIS
ASTM D 422

Project Name
GEL - Moab
Project No.
109855.01210000

Client Sample No.
700-R39
Lab Sample No.
BC0755

Specific Gravity = 2.9813

Moisture Content = 49.9%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	100.0%
	#4	4.750	100.0%
	#10	2.000	100.0%

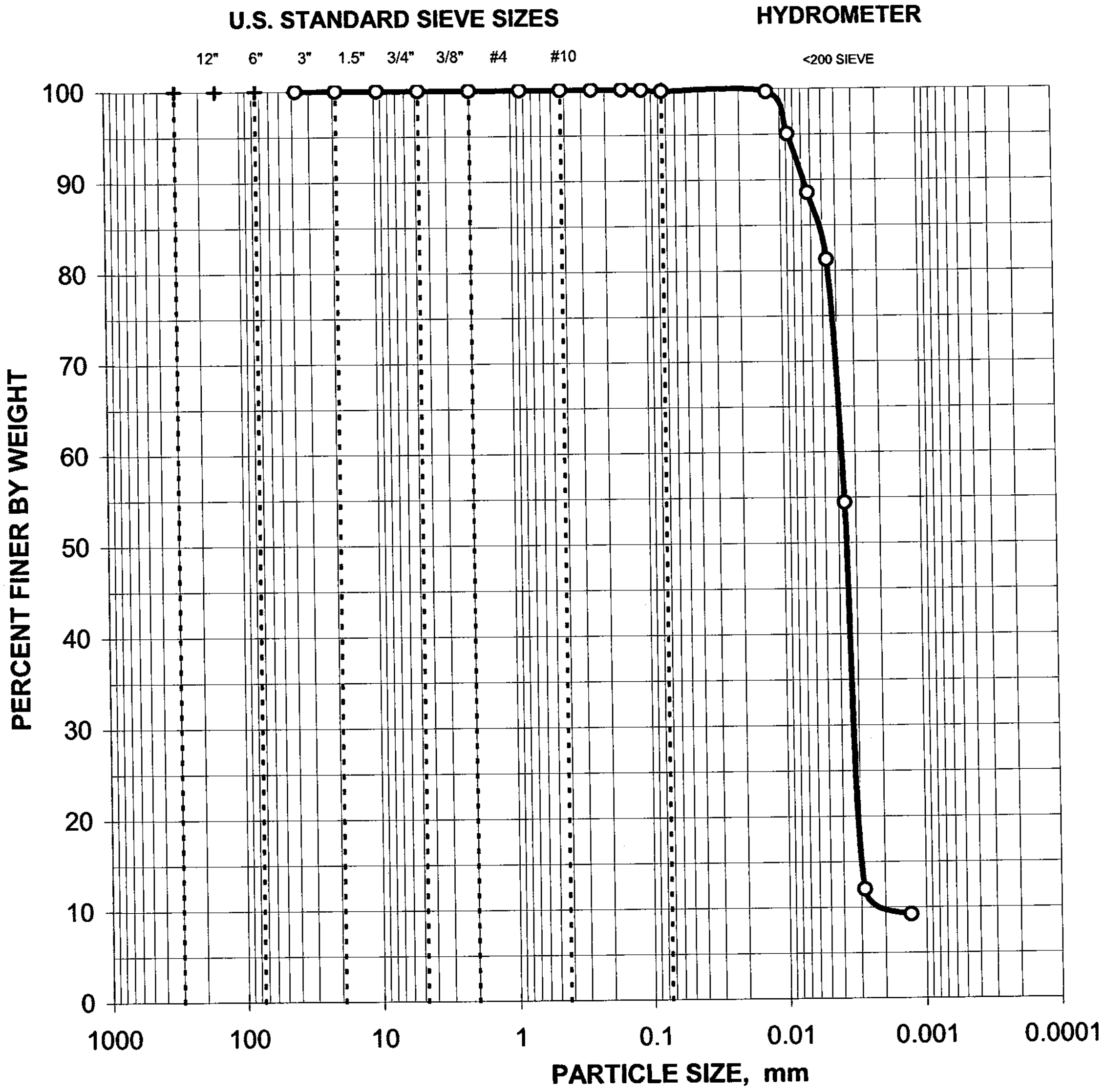
	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	100.0%
	#40	0.425	100.0%
	#60	0.250	100.0%
	#100	0.149	100.0%
	#140	0.106	99.9%
	#200	0.075	99.8%

HYDROMETER ANALYSIS

	Diameter mm	Percent Finer
HYDROMETER		
	0.01244	99.6%
	0.00875	95.0%
	0.00631	88.6%
	0.00463	81.2%
	0.00359	54.4%
	0.00281	12.0%
	0.00129	9.2%

0.0% Gravel 0.2% Sand 99.8% Silt/Clay

GEL - Moab



CLIENT SAMPLE NO.: 700-R39

LAB SAMPLE NO.: BC0755

BOULDERS	COBBLES	GRAVEL		SAND			Silt/Clay
		COARSE	FINE	COARSE	MEDIUM	FINE	

PARTICLE-SIZE DISTRIBUTION
ASTM D 422

Project Name GEL - Moab

Project No. 109855.01210000

Field Sample No. 700-R5

Lab Sample No. BC0756

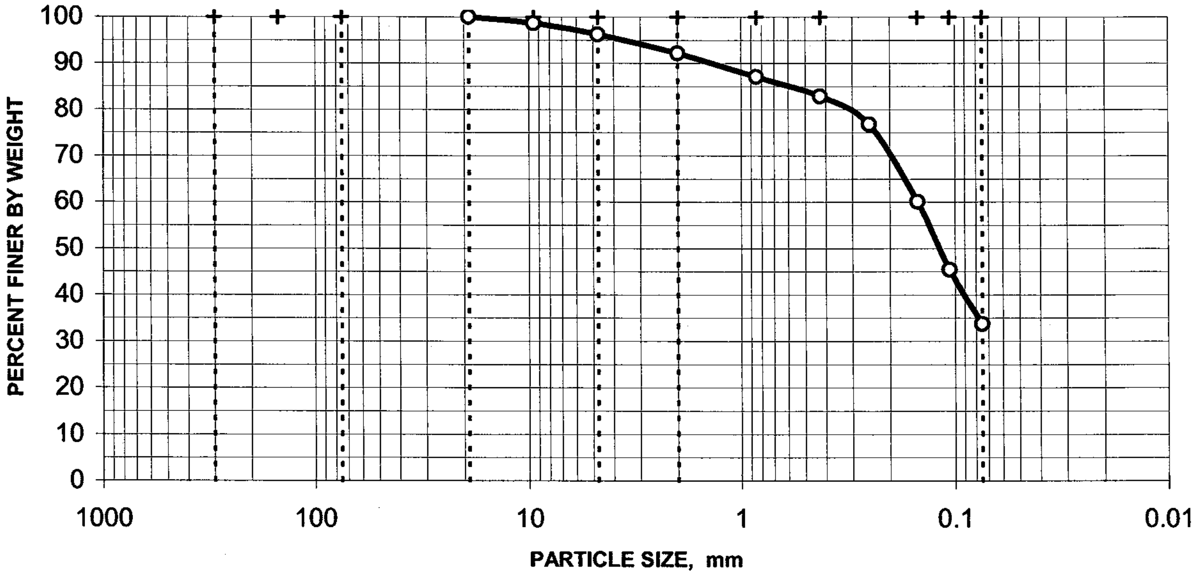
Moisture Content = 8.7%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	98.6%
	#4	4.750	96.2%
	#10	2.000	92.1%

	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	87.0%
	#40	0.425	82.9%
	#60	0.250	76.8%
	#100	0.149	60.1%
	#140	0.106	45.4%
	#200	0.075	33.7%

DISTRIBUTION CURVE



3.8% Gravel 62.5% Sand 33.7% Silt/Clay

PARTICLE-SIZE ANALYSIS
ASTM D 422

Project Name
GEL - Moab
Project No.
109855.01210000

Client Sample No.
700-R8
Lab Sample No.
BC0757

Specific Gravity = 2.9198

Moisture Content = 65.0%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	100.0%
	#4	4.750	100.0%
	#10	2.000	100.0%

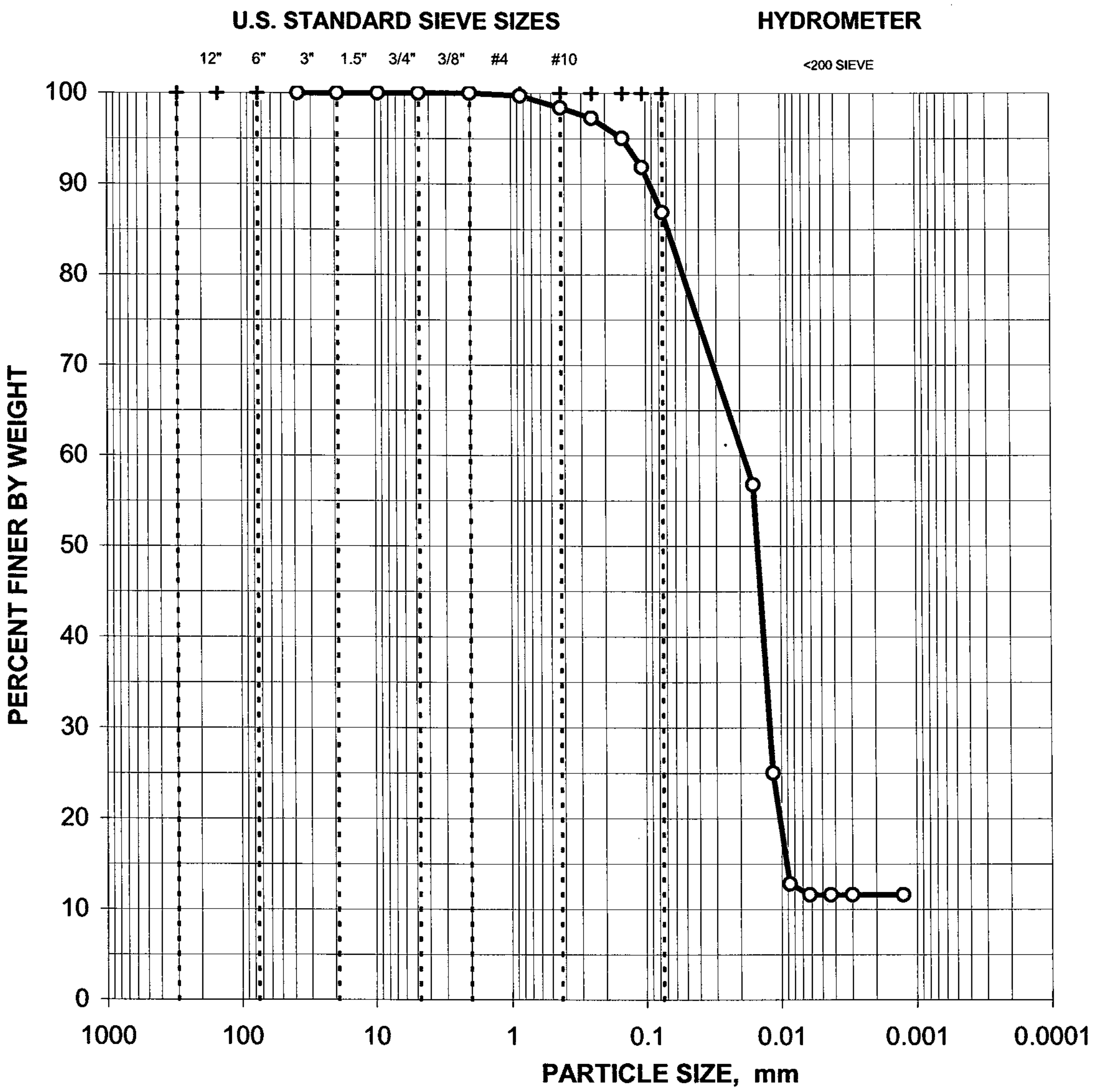
	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	99.7%
	#40	0.425	98.4%
	#60	0.250	97.2%
	#100	0.149	95.1%
	#140	0.106	91.8%
	#200	0.075	86.9%

HYDROMETER ANALYSIS

	Diameter mm	Percent Finer
HYDROMETER		
	0.01597	56.8%
	0.01154	25.0%
	0.00869	12.8%
	0.00619	11.6%
	0.00432	11.6%
	0.00300	11.6%
	0.00126	11.6%

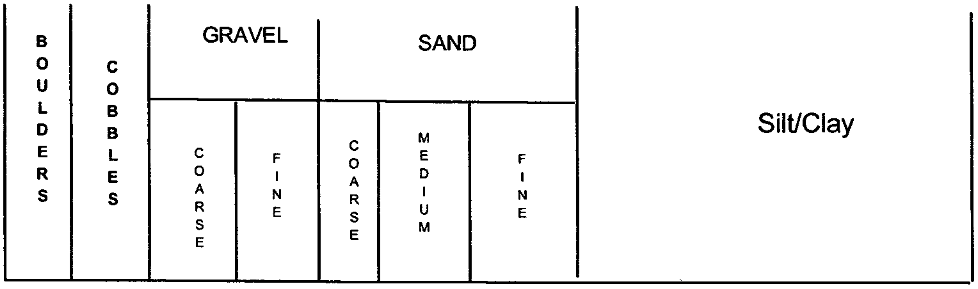
0.0% Gravel	13.1% Sand	86.9% Silt/Clay

GEL - Moab



CLIENT SAMPLE NO.: 700-R8

LAB SAMPLE NO.: BC0757



PARTICLE-SIZE DISTRIBUTION
ASTM D 422

Project Name GEL - Moab

Project No. 109855.01210000

Field Sample No. 701-R12

Lab Sample No. BC0758

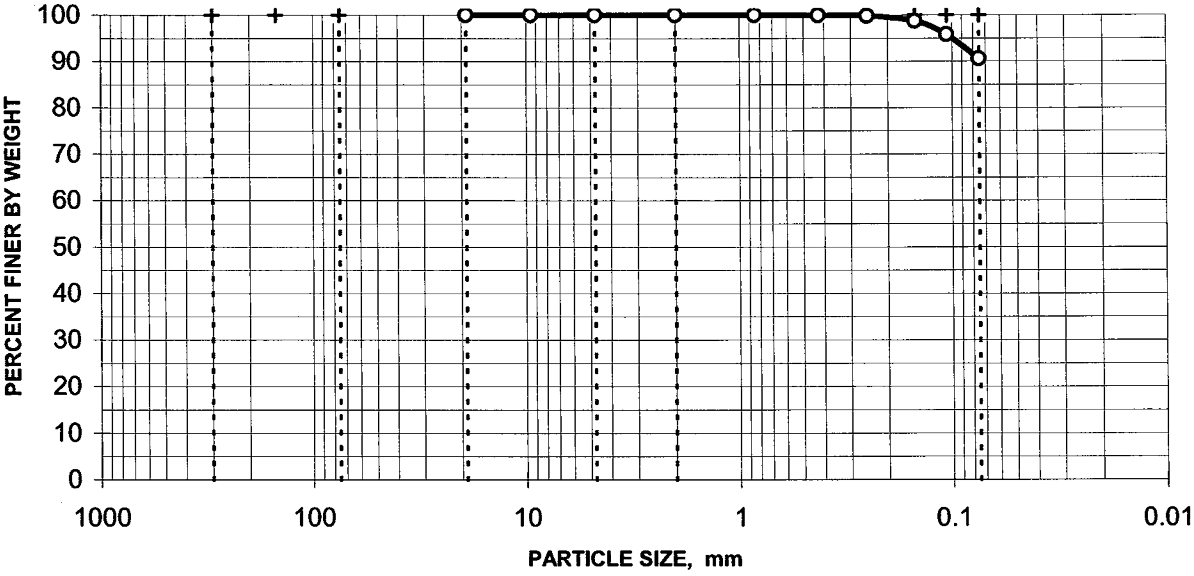
Moisture Content = 50.8%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	100.0%
	#4	4.750	100.0%
	#10	2.000	100.0%

	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	100.0%
	#40	0.425	99.9%
	#60	0.250	99.8%
	#100	0.149	98.7%
	#140	0.106	95.8%
	#200	0.075	90.5%

DISTRIBUTION CURVE



0.0% Gravel 9.5% Sand 90.5% Silt/Clay

PARTICLE-SIZE ANALYSIS
ASTM D 422

Project Name
GEL - Moab
Project No.
109855.01210000

Client Sample No.
701-R18
Lab Sample No.
BC0759

Specific Gravity = 2.7108

Moisture Content = 42.4%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	100.0%
	#4	4.750	100.0%
	#10	2.000	100.0%

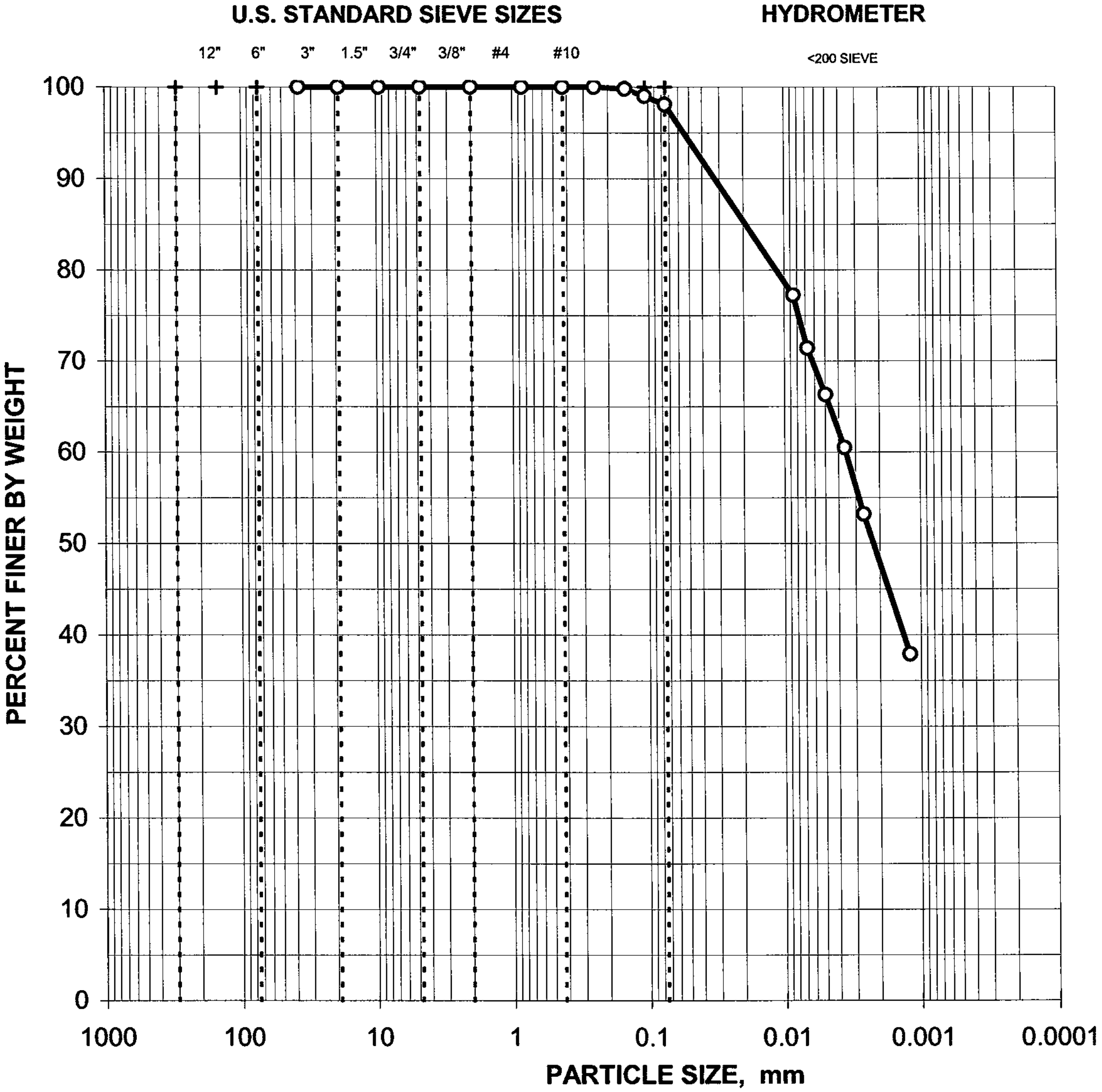
	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	100.0%
	#40	0.425	100.0%
	#60	0.250	100.0%
	#100	0.149	99.8%
	#140	0.106	99.0%
	#200	0.075	98.1%

HYDROMETER ANALYSIS

	Diameter mm	Percent Finer
HYDROMETER		
	0.00855	77.2%
	0.00675	71.4%
	0.00497	66.3%
	0.00360	60.5%
	0.00261	53.2%
	0.00120	37.9%

0.0% Gravel 1.9% Sand 98.1% Silt/Clay

GEL - Moab



CLIENT SAMPLE NO.: 701-R18 **LAB SAMPLE NO.:** BC0759

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<tr><td>COARSE</td><td>FINE</td><td>COARSE</td><td>MEDIUM</td><td>FINE</td></tr>
</table>

PARTICLE-SIZE DISTRIBUTION
ASTM D 422

Project Name GEL - Moab

Project No. 109855.01210000

Field Sample No. 701-R22

Lab Sample No. BC0760

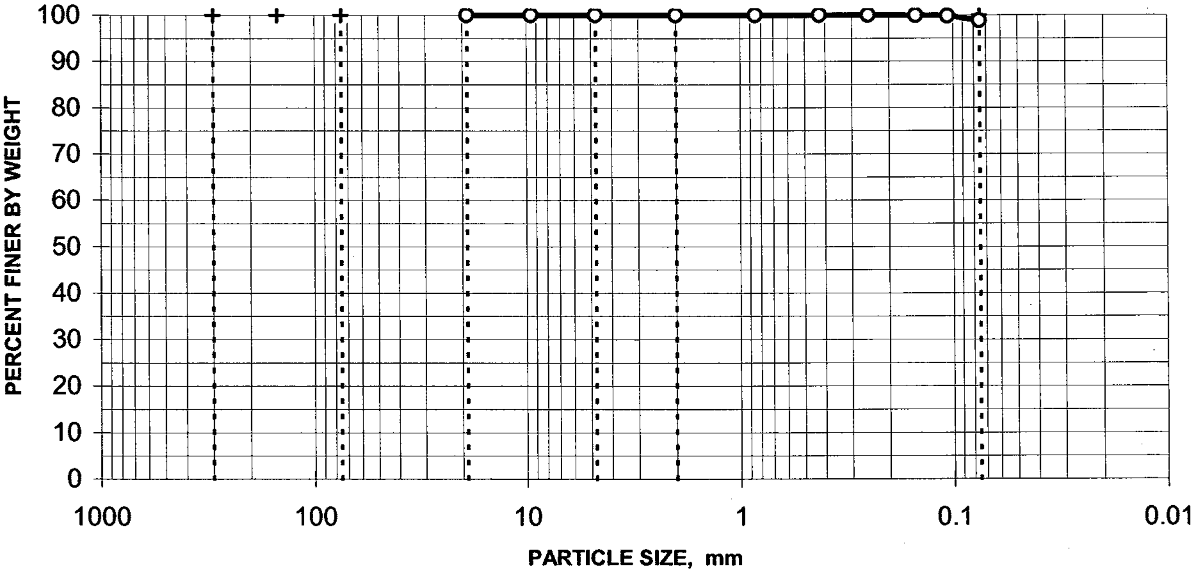
Moisture Content = 33.6%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	100.0%
	#4	4.750	100.0%
	#10	2.000	100.0%

	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	100.0%
	#40	0.425	100.0%
	#60	0.250	100.0%
	#100	0.149	100.0%
	#140	0.106	99.8%
	#200	0.075	98.8%

DISTRIBUTION CURVE



0.0% Gravel 1.2% Sand 98.8% Silt/Clay

PARTICLE-SIZE ANALYSIS
ASTM D 422

Project Name
GEL - Moab
Project No.
109855.01210000

Client Sample No.
701-R30
Lab Sample No.
BC0761

Specific Gravity = 2.9971

Moisture Content = 8.7%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	100.0%
	#4	4.750	100.0%
	#10	2.000	100.0%

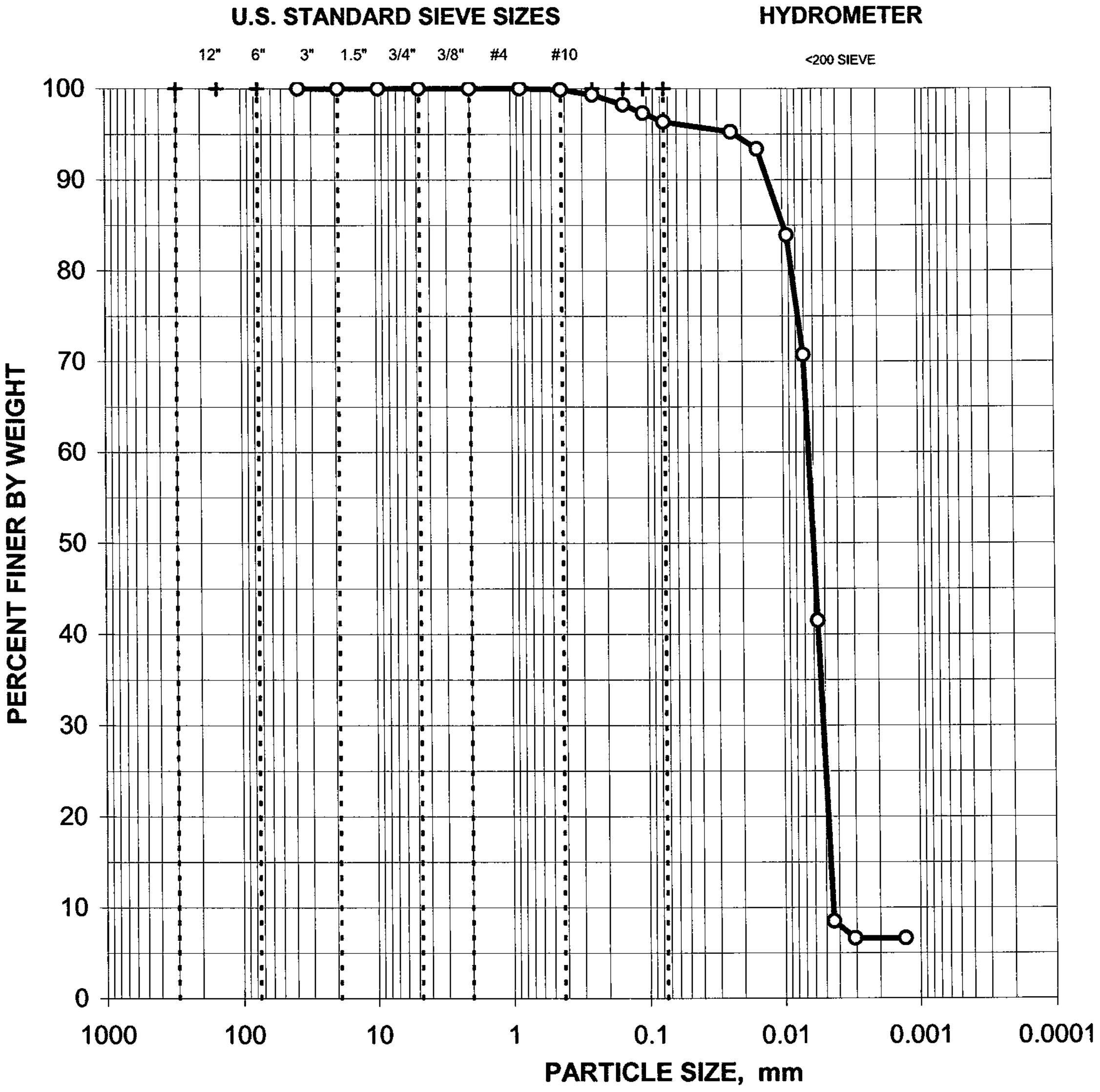
	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	100.0%
	#40	0.425	99.9%
	#60	0.250	99.3%
	#100	0.149	98.2%
	#140	0.106	97.3%
	#200	0.075	96.3%

HYDROMETER ANALYSIS

	Diameter mm	Percent Finer
HYDROMETER		
	0.02384	95.2%
	0.01519	93.3%
	0.00925	83.9%
	0.00702	70.7%
	0.00560	41.5%
	0.00438	8.5%
	0.00305	6.6%
	0.00129	6.6%

0.0% Gravel 3.7% Sand 96.3% Silt/Clay

GEL - Moab



CLIENT SAMPLE NO.: 701-R30

LAB SAMPLE NO.: BC0761

BOULDERS	COBBLES	GRAVEL		SAND			Silt/Clay
		COARSE	FINE	COARSE	MEDIUM	FINE	

PARTICLE-SIZE DISTRIBUTION
ASTM D 422

Project Name GEL - Moab

Project No. 109855.01210000

Field Sample No. 701-R33

Lab Sample No. BC0762

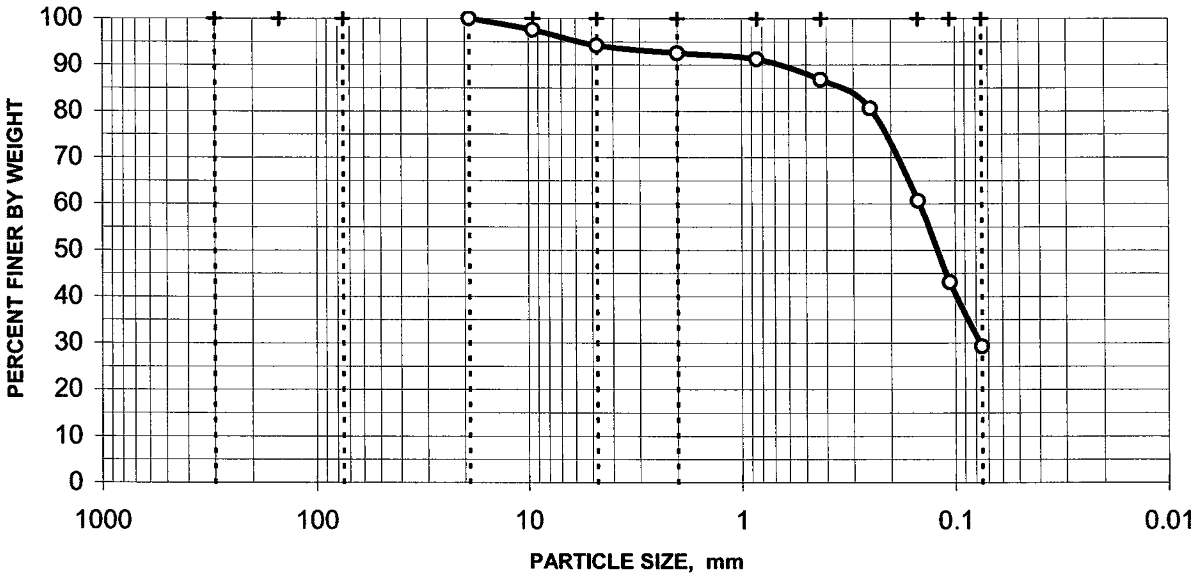
Moisture Content = 6.7%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	97.5%
	#4	4.750	94.2%
	#10	2.000	92.5%

	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	91.2%
	#40	0.425	86.8%
	#60	0.250	80.6%
	#100	0.149	60.6%
	#140	0.106	43.1%
	#200	0.075	29.3%

DISTRIBUTION CURVE



5.8% Gravel 64.9% Sand 29.3% Silt/Clay

PARTICLE-SIZE DISTRIBUTION
ASTM D 422

Project Name GEL - Moab

Project No. 109855.01210000

Field Sample No. 701-R4

Lab Sample No. BC0763

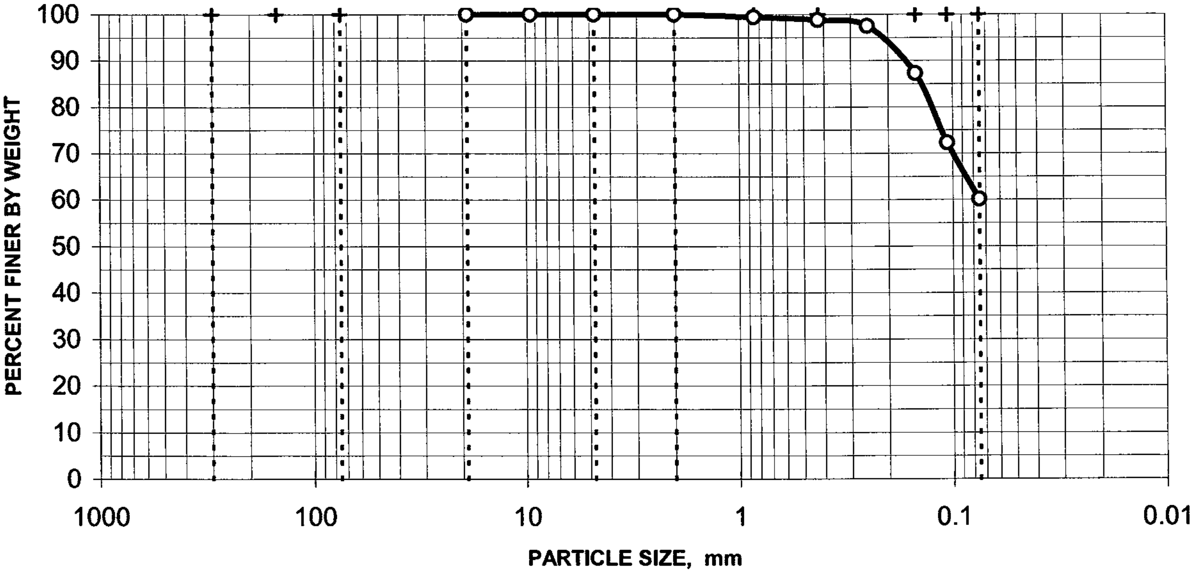
Moisture Content = 24.4%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	100.0%
	#4	4.750	100.0%
	#10	2.000	100.0%

	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	99.4%
	#40	0.425	98.8%
	#60	0.250	97.5%
	#100	0.149	87.2%
	#140	0.106	72.3%
	#200	0.075	60.1%

DISTRIBUTION CURVE



0.0% Gravel 39.9% Sand 60.1% Silt/Clay

PARTICLE-SIZE ANALYSIS
ASTM D 422

Project Name
GEL - Moab
Project No.
109855.01210000

Client Sample No.
701-R8
Lab Sample No.
BC0764

Specific Gravity = 2.7783

Moisture Content = 31.5%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	100.0%
	#4	4.750	100.0%
	#10	2.000	100.0%

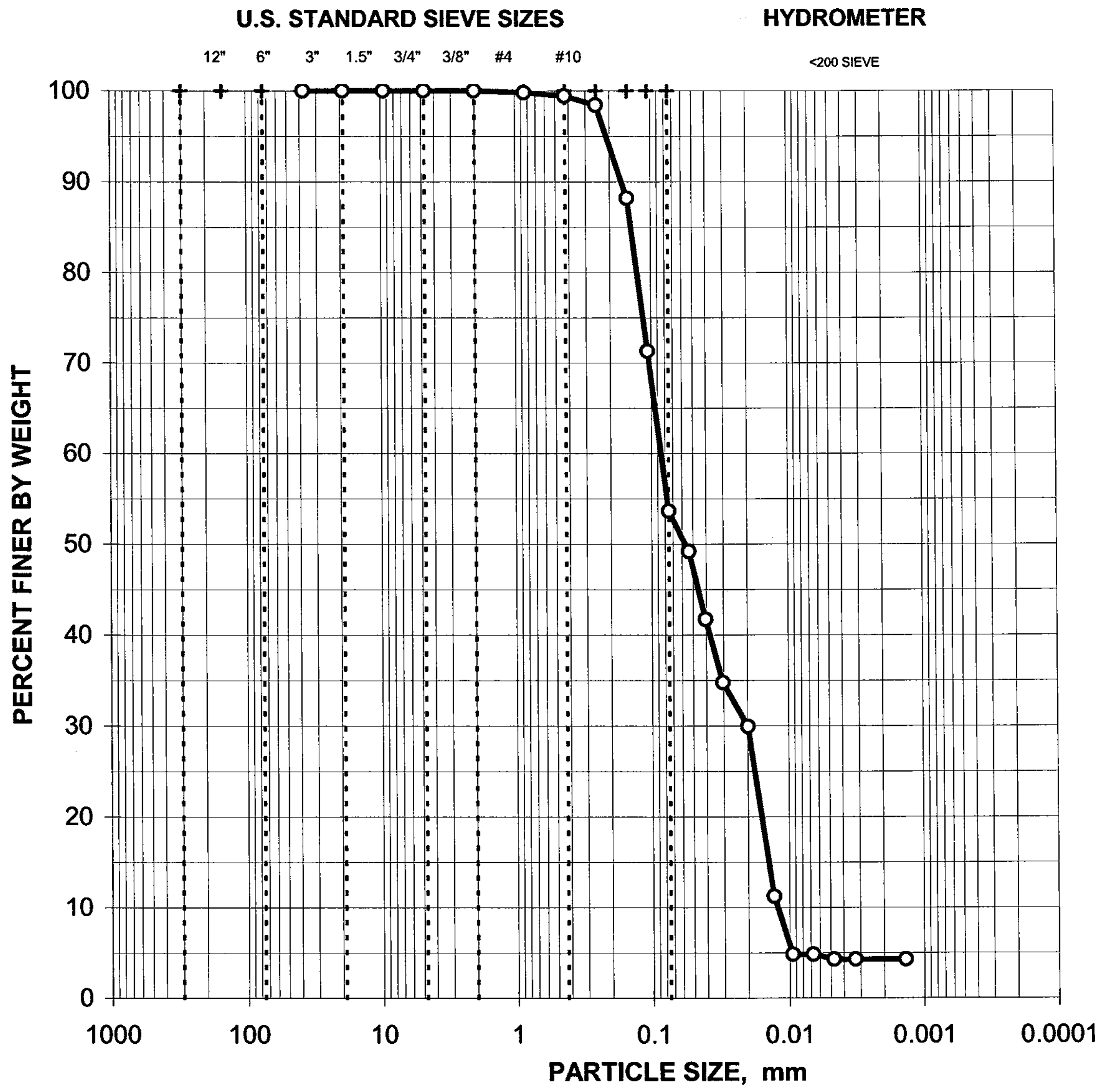
	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	99.8%
	#40	0.425	99.4%
	#60	0.250	98.4%
	#100	0.149	88.2%
	#140	0.106	71.3%
	#200	0.075	53.6%

HYDROMETER ANALYSIS

	Diameter mm	Percent Finer
HYDROMETER	0.05368	49.2%
	0.04054	41.7%
	0.03039	34.8%
	0.01988	29.9%
	0.01294	11.2%
	0.00948	4.8%
	0.00670	4.8%
	0.00470	4.3%
	0.00325	4.3%
	0.00137	4.3%

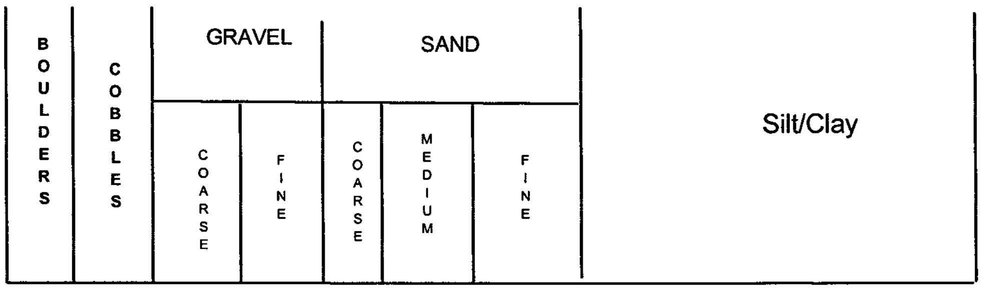
0.0% Gravel	46.4% Sand	53.6% Silt/Clay

GEL - Moab



CLIENT SAMPLE NO.: 701-R8

LAB SAMPLE NO.: BC0764



PARTICLE-SIZE ANALYSIS
ASTM D 422

Project Name
GEL - Moab
Project No.
109855.01210000

Client Sample No.
702-R18
Lab Sample No.
BC0767

Specific Gravity = 2.6814

Moisture Content = 22.4%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	100.0%
	#4	4.750	100.0%
	#10	2.000	100.0%

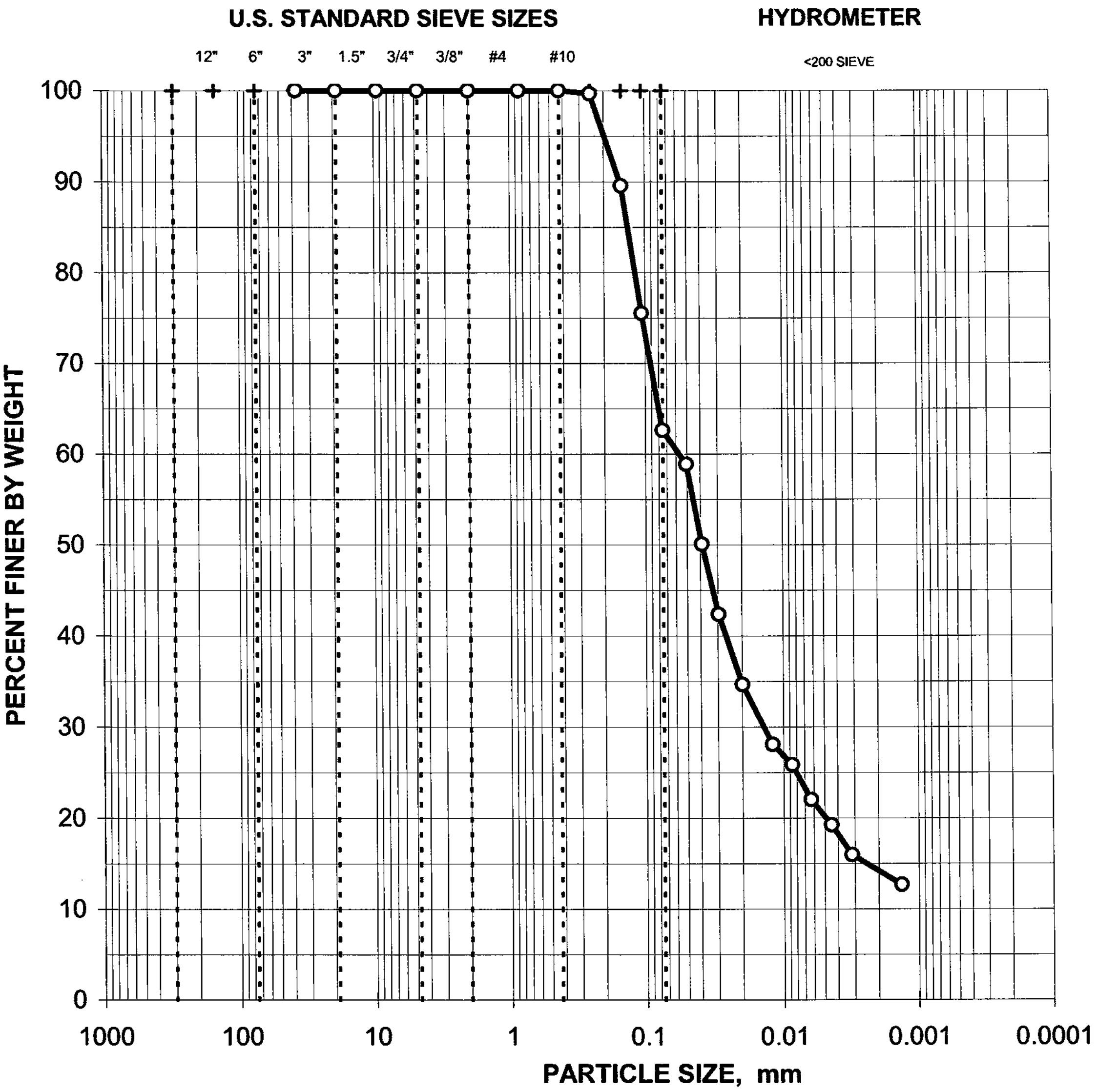
	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	100.0%
	#40	0.425	100.0%
	#60	0.250	99.7%
	#100	0.149	89.5%
	#140	0.106	75.5%
	#200	0.075	62.6%

HYDROMETER ANALYSIS

	Diameter mm	Percent Finer
HYDROMETER	0.05044	58.9%
	0.03907	50.1%
	0.02951	42.4%
	0.01988	34.7%
	0.01203	28.1%
	0.00862	25.9%
	0.00624	22.0%
	0.00444	19.3%
	0.00314	16.0%
	0.00134	12.7%

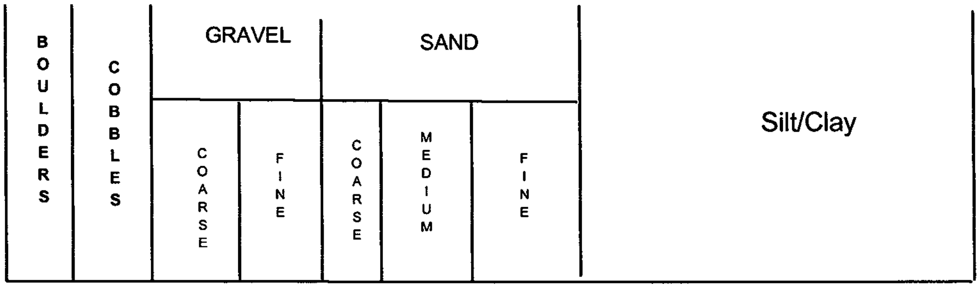
0.0% Gravel 37.4% Sand 62.6% Silt/Clay

GEL - Moab



CLIENT SAMPLE NO.: 702-R18

LAB SAMPLE NO.: BC0767



PARTICLE-SIZE DISTRIBUTION
ASTM D 422

Project Name	GEL - Moab	Field Sample No.	702-R24
Project No.	109855.01210000	Lab Sample No.	BC0768

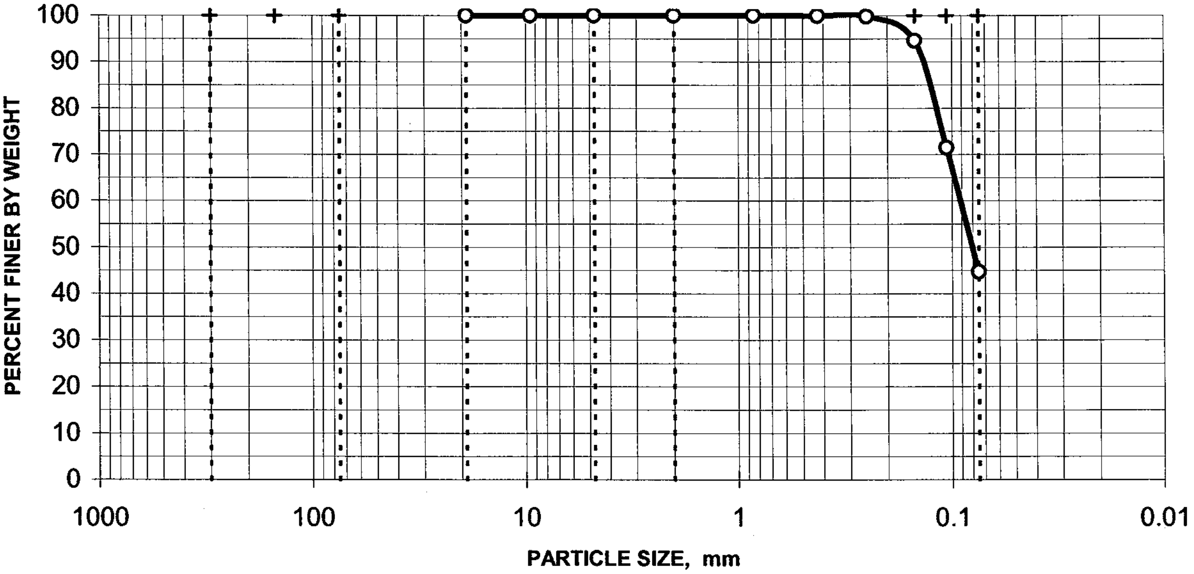
Moisture Content = 24.5%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	100.0%
	#4	4.750	100.0%
	#10	2.000	100.0%

	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	100.0%
	#40	0.425	99.9%
	#60	0.250	99.8%
	#100	0.149	94.6%
	#140	0.106	71.4%
	#200	0.075	44.7%

DISTRIBUTION CURVE



0.0% Gravel 55.3% Sand 44.7% Silt/Clay

PARTICLE-SIZE ANALYSIS
ASTM D 422

Project Name GEL - Moab	Client Sample No. 702-R28
Project No. 109855.01210000	Lab Sample No. BC0769

Specific Gravity = 2.9660

Moisture Content = 46.2%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	100.0%
	#4	4.750	100.0%
	#10	2.000	100.0%

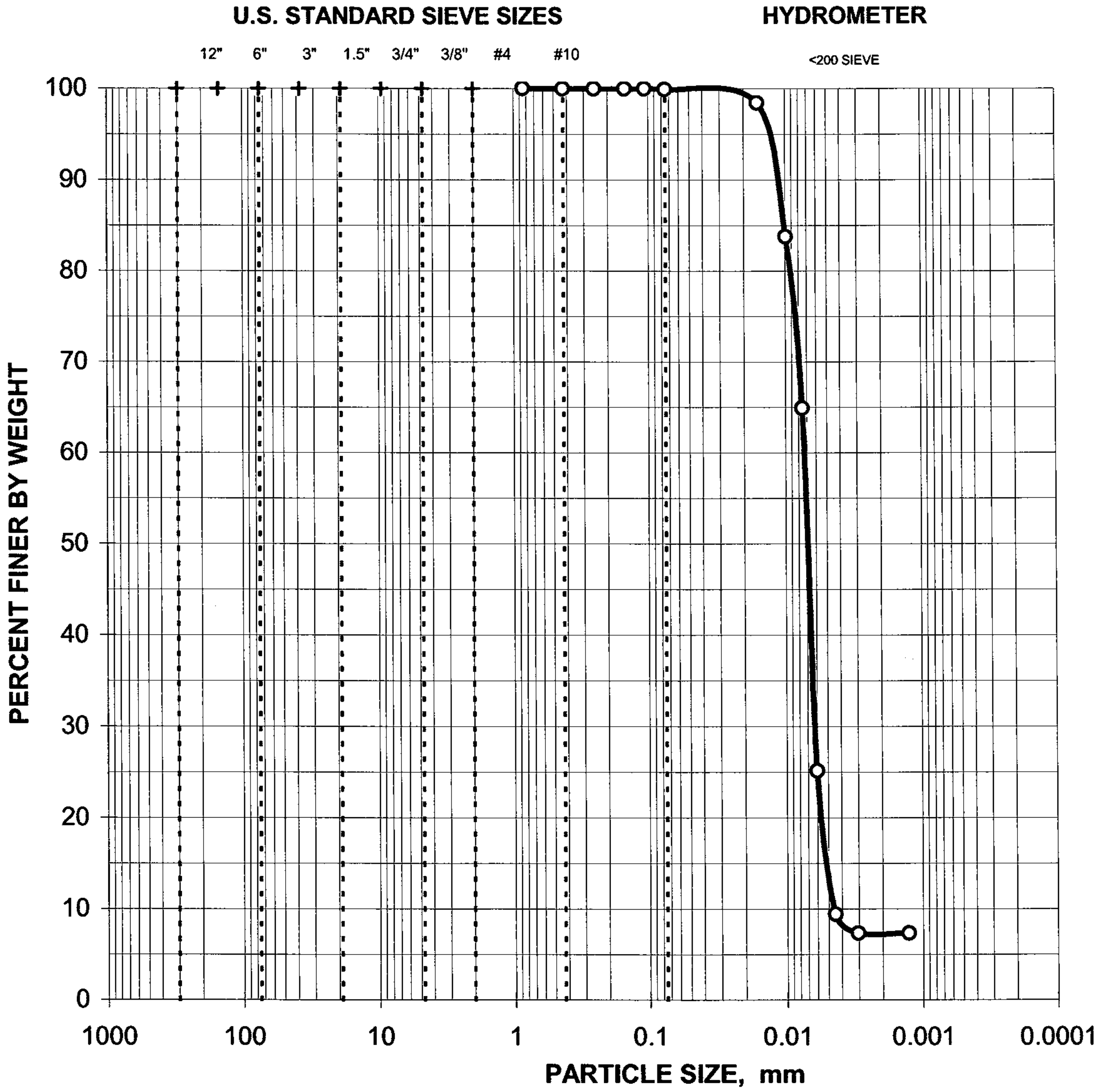
	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	100.0%
	#40	0.425	100.0%
	#60	0.250	100.0%
	#100	0.149	100.0%
	#140	0.106	100.0%
	#200	0.075	99.9%

HYDROMETER ANALYSIS

	Diameter mm	Percent Finer
HYDROMETER		
	0.01591	98.4%
	0.00988	83.8%
	0.00752	64.9%
	0.00600	25.1%
	0.00444	9.4%
	0.00302	7.3%
	0.00127	7.3%

0.0% Gravel 0.1% Sand 99.9% Silt/Clay

GEL - Moab



CLIENT SAMPLE NO.: 702-R28 **LAB SAMPLE NO.:** BC0769

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<tr><td>COARSE</td><td>FINE</td><td>COARSE</td><td>MEDIUM</td><td>FINE</td></tr>
</table>

Shaw Geotechnical Laboratory
Oak Ridge TN
(865) 482-6497

PARTICLE-SIZE DISTRIBUTION
ASTM D 422

Project Name GEL - Moab

Project No. 109855.01210000

Field Sample No. 702-R31

Lab Sample No. BC0770

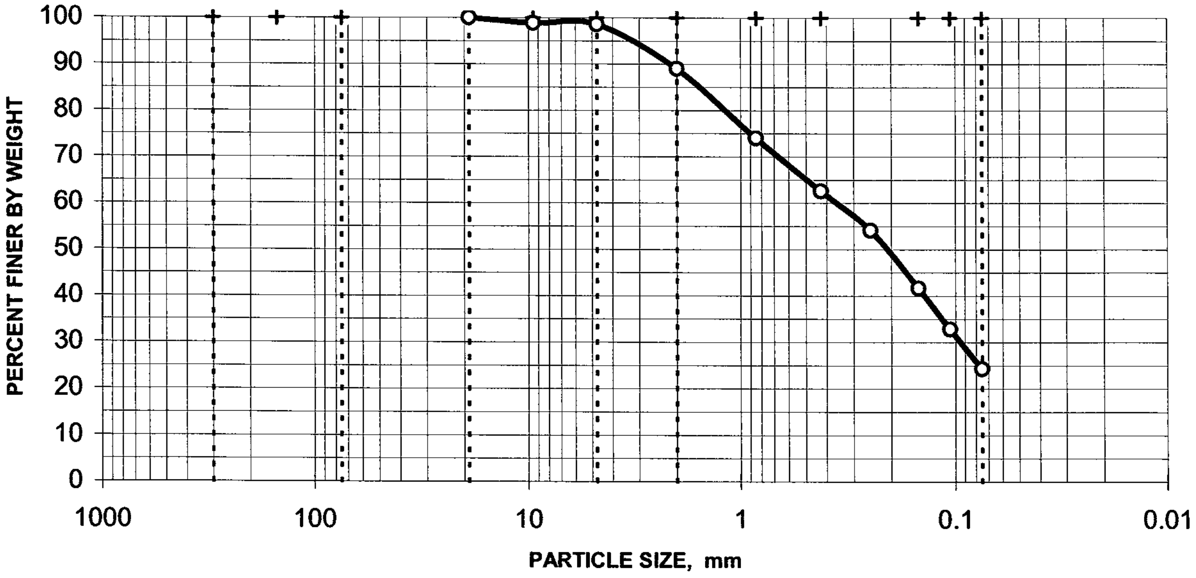
Moisture Content = 8.0%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	98.9%
	#4	4.750	98.5%
	#10	2.000	89.0%

	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	74.0%
	#40	0.425	62.6%
	#60	0.250	54.1%
	#100	0.149	41.6%
	#140	0.106	32.8%
	#200	0.075	24.3%

DISTRIBUTION CURVE



1.5% Gravel 74.2% Sand 24.3% Silt/Clay

PARTICLE-SIZE ANALYSIS
ASTM D 422

Project Name
GEL - Moab
Project No.
109855.01210000

Client Sample No.
702-R6
Lab Sample No.
BC0772

Specific Gravity = 2.7383

Moisture Content = 71.3%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	100.0%
	#4	4.750	100.0%
	#10	2.000	100.0%

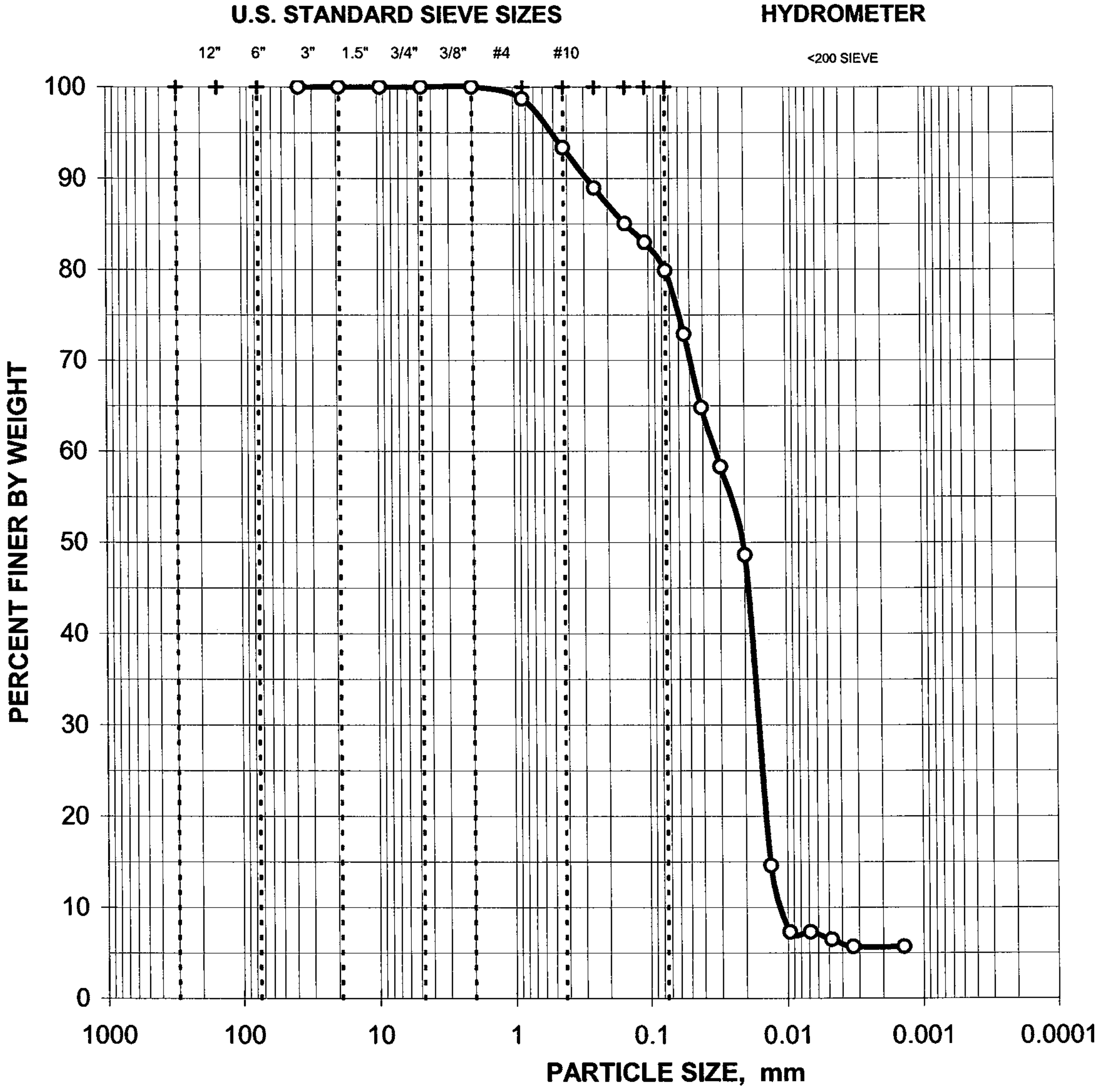
	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	98.7%
	#40	0.425	93.4%
	#60	0.250	88.9%
	#100	0.149	85.0%
	#140	0.106	83.0%
	#200	0.075	79.8%

HYDROMETER ANALYSIS

	Diameter mm	Percent Finer
HYDROMETER	0.05477	72.9%
	0.04088	64.8%
	0.02987	58.3%
	0.01987	48.6%
	0.01322	14.6%
	0.00961	7.3%
	0.00680	7.3%
	0.00476	6.5%
	0.00331	5.7%
	0.00139	5.7%

0.0% Gravel 20.2% Sand 79.8% Silt/Clay

GEL - Moab



CLIENT SAMPLE NO.: 702-R6

LAB SAMPLE NO.: BC0772

BOULDERS	COBBLES	GRAVEL		SAND			Silt/Clay
		COARSE	FINE	COARSE	MEDIUM	FINE	

PARTICLE-SIZE DISTRIBUTION
ASTM D 422

Project Name GEL - Moab

Project No. 109855.01210000

Field Sample No. 702-R8

Lab Sample No. BC0773

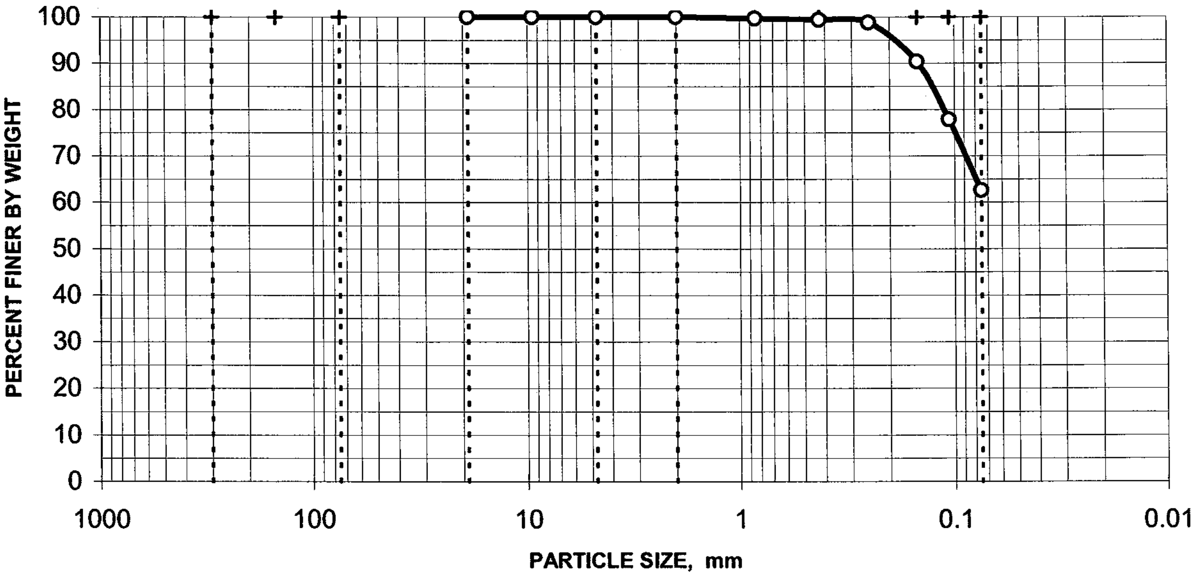
Moisture Content = 38.3%
based on dry sample weight

SIEVE ANALYSIS

COARSE	Sieve No.	Diameter mm	Percent Finer
	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	100.0%
	#4	4.750	100.0%
	#10	2.000	100.0%

FINE	Sieve No.	Diameter mm	Percent Finer
	#20	0.850	99.7%
	#40	0.425	99.4%
	#60	0.250	98.8%
	#100	0.149	90.4%
	#140	0.106	77.8%
	#200	0.075	62.6%

DISTRIBUTION CURVE



0.0% Gravel 37.4% Sand 62.6% Silt/Clay

PARTICLE-SIZE ANALYSIS
ASTM D 422

Project Name
GEL - Moab
Project No.
109855.01210000

Client Sample No.
706-R10
Lab Sample No.
BC0774

Specific Gravity = 2.7899

Moisture Content = 69.6%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	100.0%
	#4	4.750	100.0%
	#10	2.000	99.8%

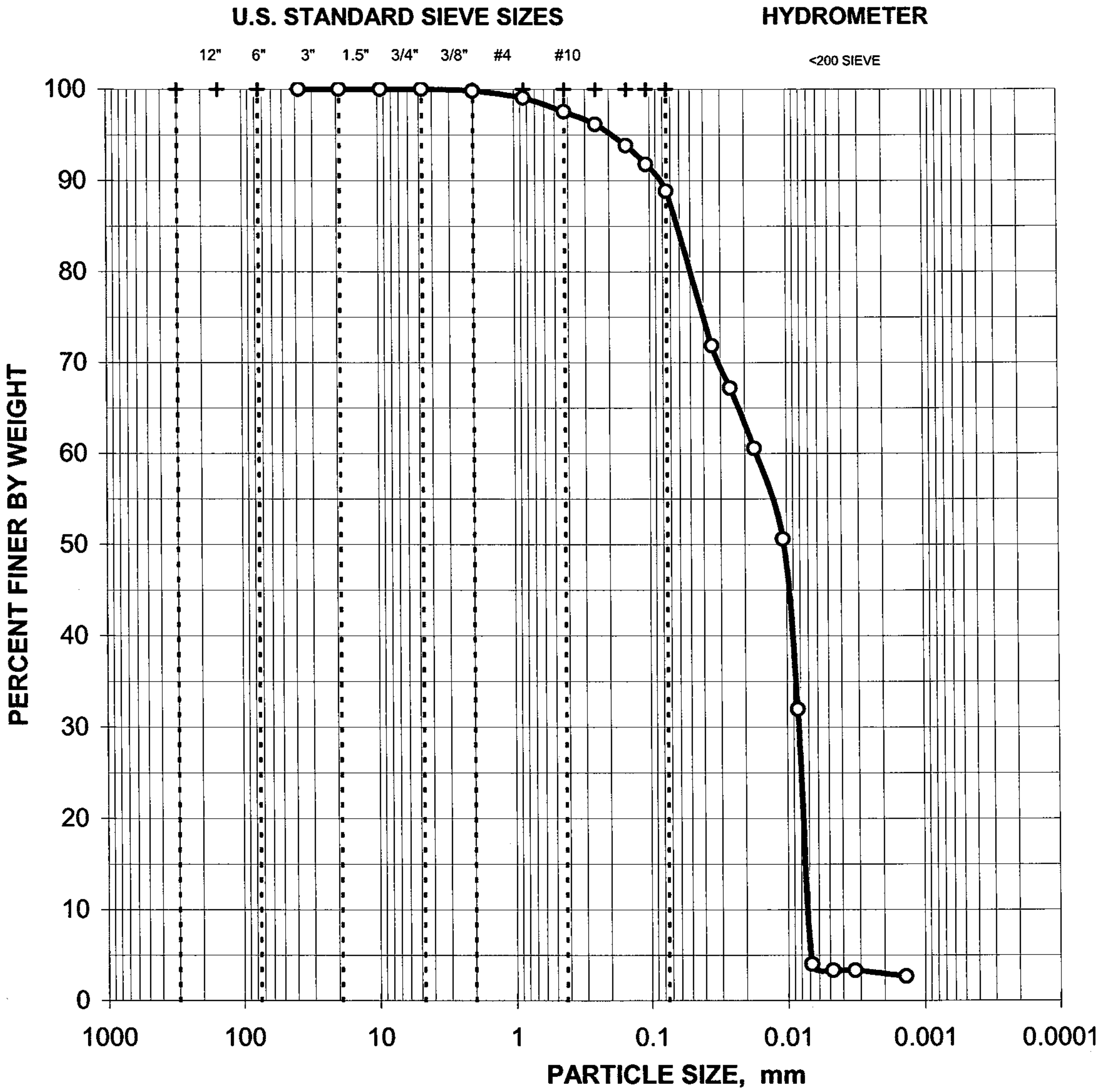
	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	99.1%
	#40	0.425	97.5%
	#60	0.250	96.2%
	#100	0.149	93.8%
	#140	0.106	91.8%
	#200	0.075	88.8%

HYDROMETER ANALYSIS

	Diameter mm	Percent Finer
HYDROMETER		
	0.03465	71.9%
	0.02552	67.2%
	0.01703	60.5%
	0.01059	50.6%
	0.00838	31.9%
	0.00675	4.0%
	0.00473	3.3%
	0.00328	3.3%
	0.00139	2.7%

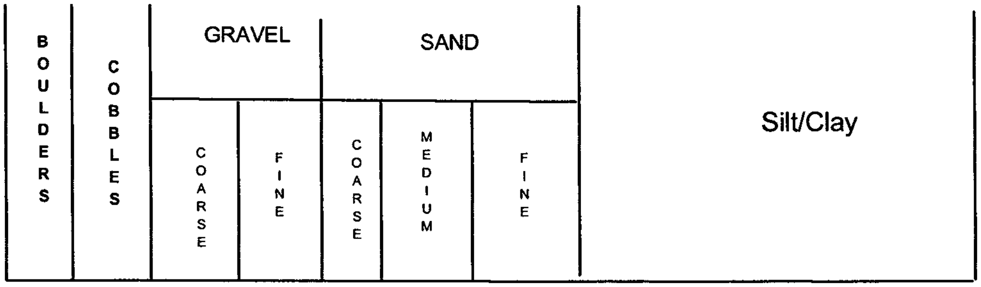
0.0% Gravel 11.2% Sand 88.8% Silt/Clay

GEL - Moab



CLIENT SAMPLE NO.: 706-R10

LAB SAMPLE NO.: BC0774



PARTICLE-SIZE DISTRIBUTION
ASTM D 422

Project Name GEL - Moab

Project No. 109855.01210000

Field Sample No. 706-R14

Lab Sample No. BC0776

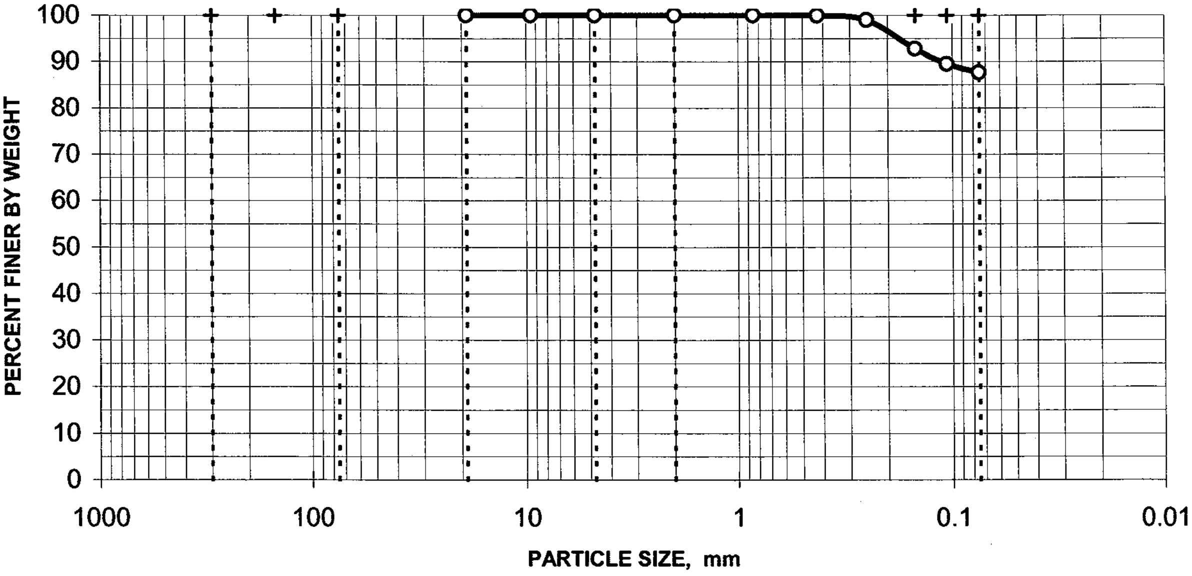
Moisture Content = 38.2%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	100.0%
	#4	4.750	100.0%
	#10	2.000	100.0%

	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	100.0%
	#40	0.425	99.9%
	#60	0.250	98.9%
	#100	0.149	92.8%
	#140	0.106	89.5%
	#200	0.075	87.6%

DISTRIBUTION CURVE



0.0% Gravel 12.4% Sand 87.6% Silt/Clay

PARTICLE-SIZE DISTRIBUTION
ASTM D 422

Project Name GEL - Moab

Project No. 109855.01210000

Field Sample No. 706-R8

Lab Sample No. BC0778

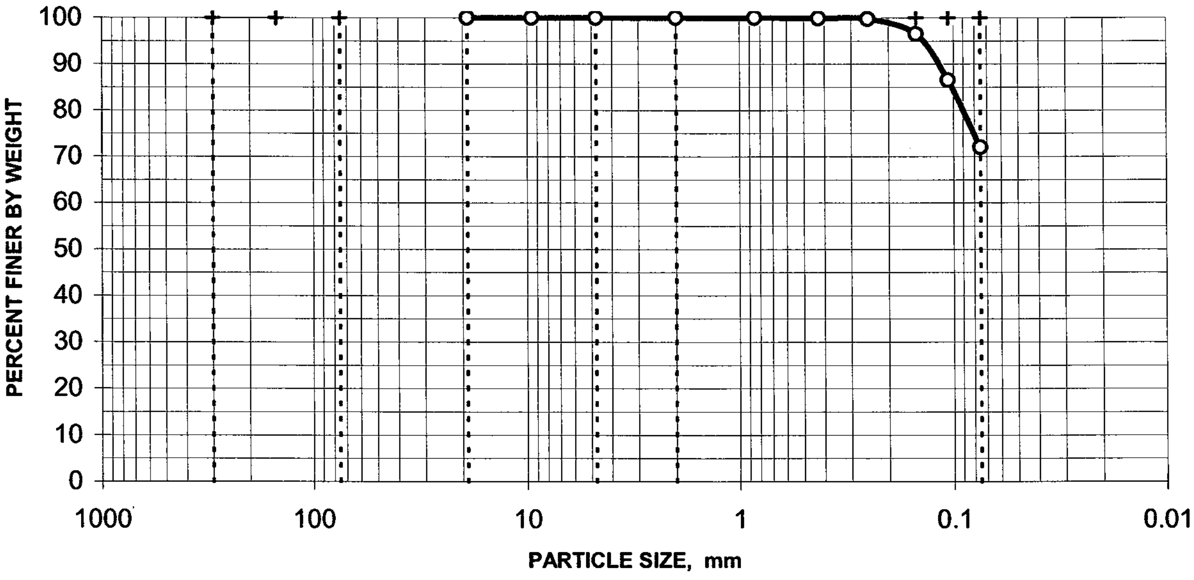
Moisture Content = 55.7%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	100.0%
	#4	4.750	100.0%
	#10	2.000	100.0%

	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	100.0%
	#40	0.425	99.9%
	#60	0.250	99.7%
	#100	0.149	96.5%
	#140	0.106	86.5%
	#200	0.075	72.0%

DISTRIBUTION CURVE



0.0% Gravel 28.0% Sand 72.0% Silt/Clay

PARTICLE-SIZE ANALYSIS
ASTM D 422

Project Name
GEL - Moab
Project No.
109855.01210000

Client Sample No.
707-R20
Lab Sample No.
BC0779

Specific Gravity = 2.8050

Moisture Content = 62.9%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	100.0%
	#4	4.750	100.0%
	#10	2.000	100.0%

	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	99.8%
	#40	0.425	99.4%
	#60	0.250	98.8%
	#100	0.149	97.8%
	#140	0.106	97.1%
	#200	0.075	96.5%

HYDROMETER ANALYSIS

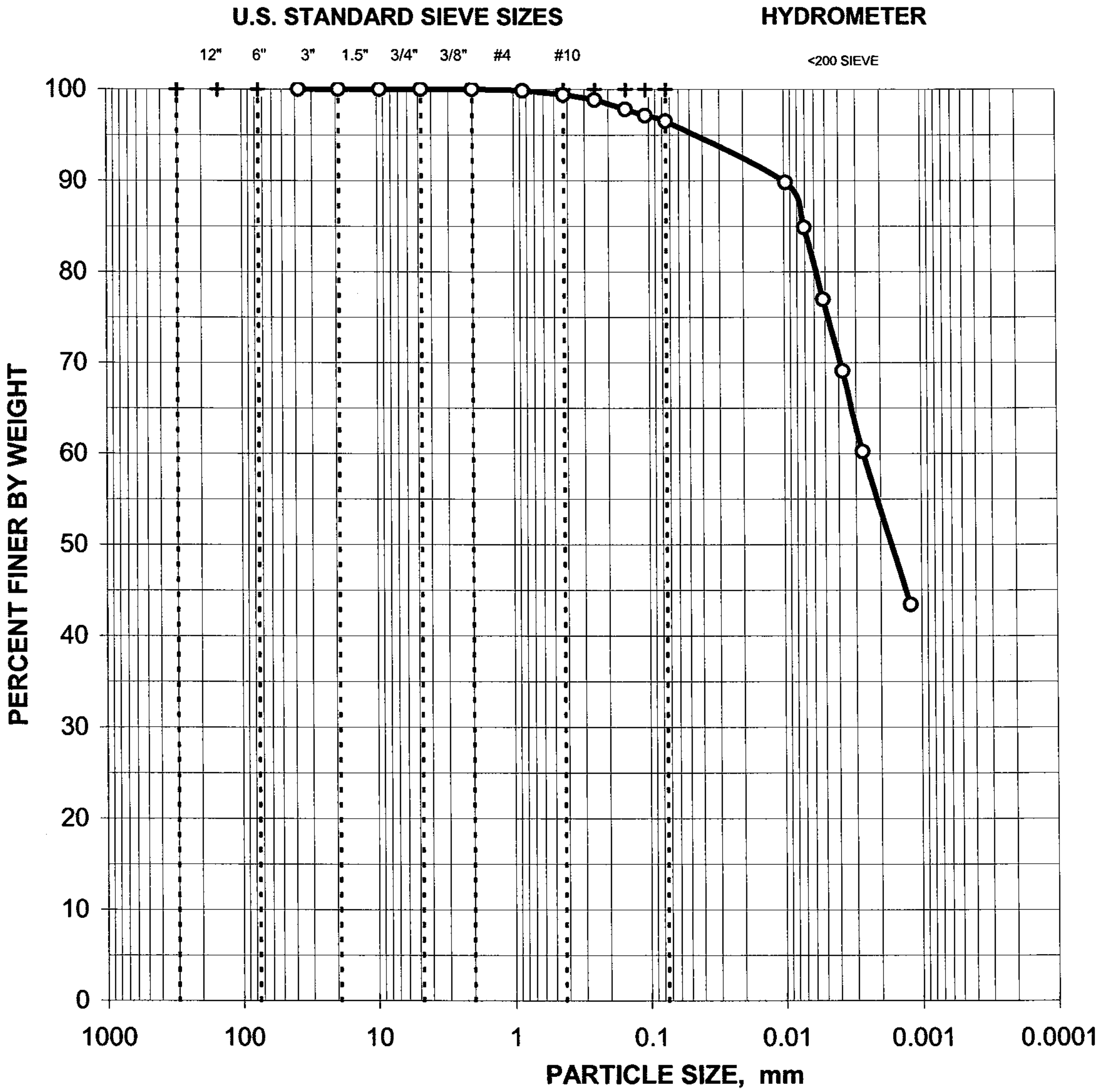
	Diameter mm	Percent Finer
HYDROMETER		
	0.00969	89.8%
	0.00704	84.9%
	0.00516	77.0%
	0.00374	69.1%
	0.00269	60.2%
	0.00121	43.4%

0.0% Gravel 3.5% Sand 96.5% Silt/Clay

May 3, 2006
Erin Stanley
General Engineering Laboratories
Shaw Project Name: GEL – Moab
Shaw Project No. 109855.01210000

Shaw Geotechnical Laboratory
Oak Ridge TN
(865) 482-6497

GEL - Moab



CLIENT SAMPLE NO.: 707-R20

LAB SAMPLE NO.: BC0779

BOULDERS	COBBLES	GRAVEL		SAND			Silt/Clay
		COARSE	FINE	COARSE	MEDIUM	FINE	

PARTICLE-SIZE DISTRIBUTION
ASTM D 422

Project Name GEL - Moab

Project No. 109855.01210000

Field Sample No. 707-R25

Lab Sample No. BC0780

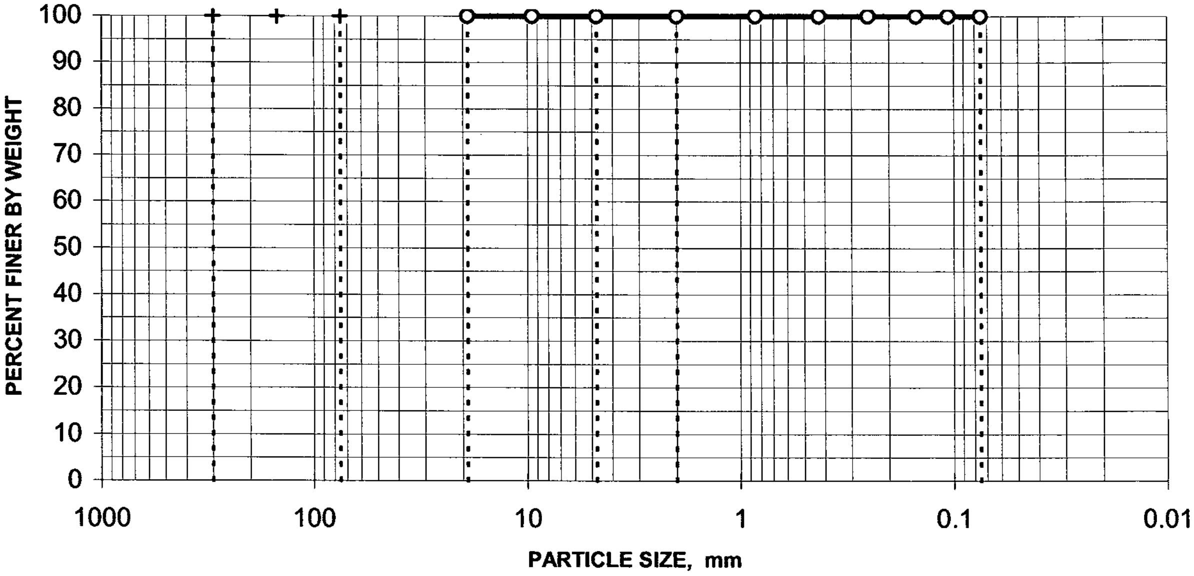
Moisture Content = 53.9%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	100.0%
	#4	4.750	100.0%
	#10	2.000	100.0%

	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	100.0%
	#40	0.425	100.0%
	#60	0.250	100.0%
	#100	0.149	100.0%
	#140	0.106	100.0%
	#200	0.075	100.0%

DISTRIBUTION CURVE



0.0% Gravel 0.0% Sand 100.0% Silt/Clay

PARTICLE-SIZE DISTRIBUTION
ASTM D 422

Project Name GEL - Moab

Project No. 109855.01210000

Field Sample No. 707-R8

Lab Sample No. BC0781

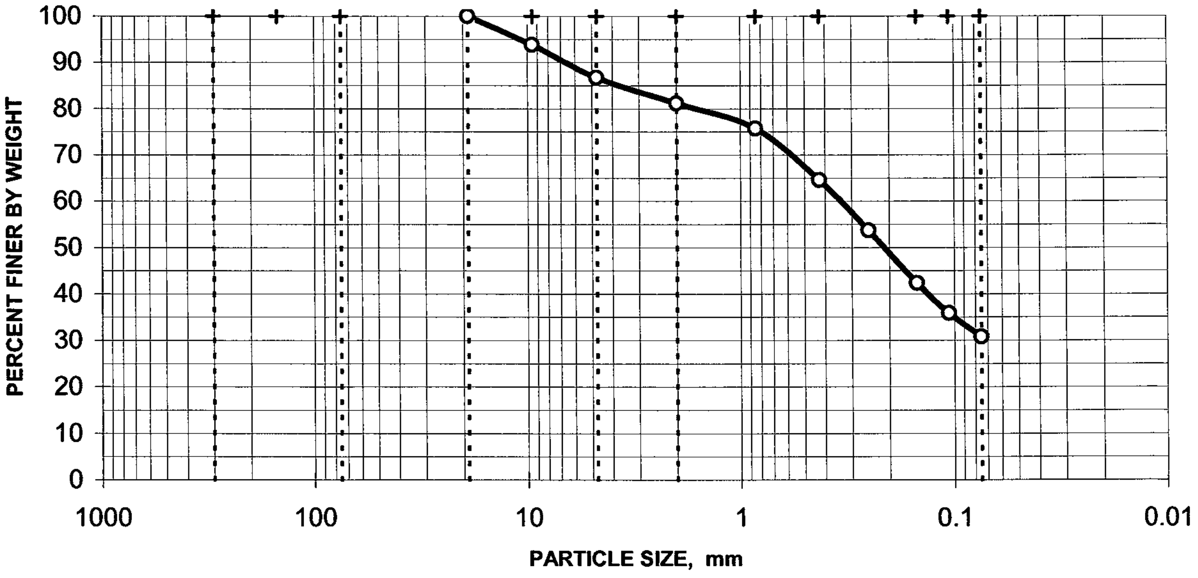
Moisture Content = 14.6%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	93.8%
	#4	4.750	86.7%
	#10	2.000	81.2%

	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	75.7%
	#40	0.425	64.6%
	#60	0.250	53.7%
	#100	0.149	42.3%
	#140	0.106	35.9%
	#200	0.075	30.7%

DISTRIBUTION CURVE



13.3% Gravel 56.0% Sand 30.7% Silt/Clay

PARTICLE-SIZE DISTRIBUTION
ASTM D 422

Project Name GEL - Moab

Project No. 109855.01210000

Field Sample No. 708-R15

Lab Sample No. BC0783

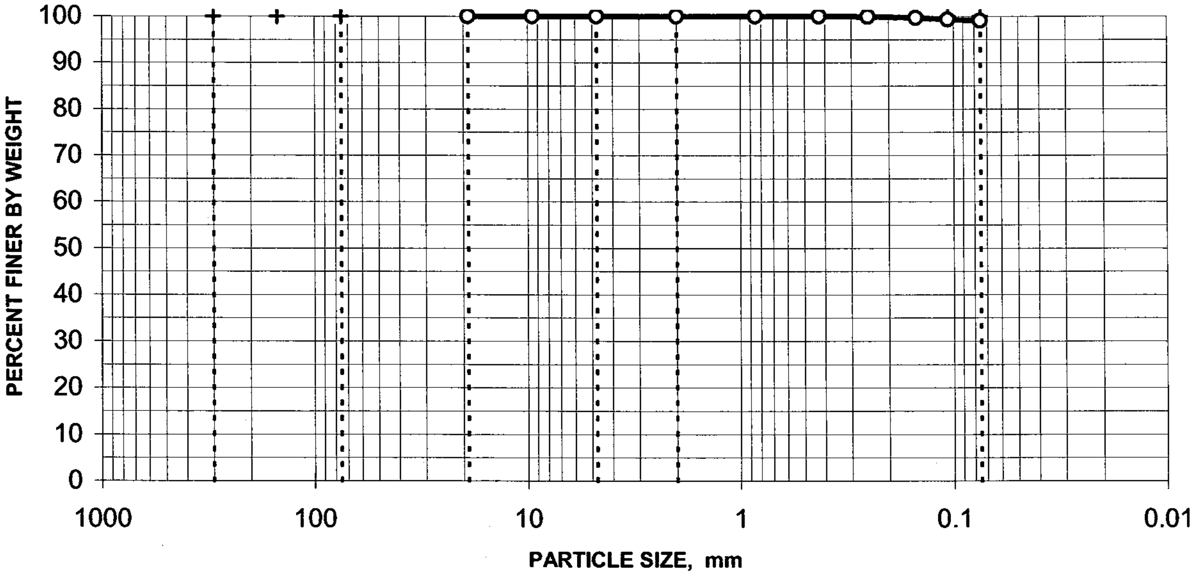
Moisture Content = 75.2%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	100.0%
	#4	4.750	100.0%
	#10	2.000	100.0%

	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	100.0%
	#40	0.425	100.0%
	#60	0.250	99.9%
	#100	0.149	99.6%
	#140	0.106	99.3%
	#200	0.075	99.1%

DISTRIBUTION CURVE



0.0% Gravel 0.9% Sand 99.1% Silt/Clay

PARTICLE-SIZE DISTRIBUTION
ASTM D 422

Project Name GEL - Moab

Field Sample No. 708-R24

Project No. 109855.01210000

Lab Sample No. BC0785

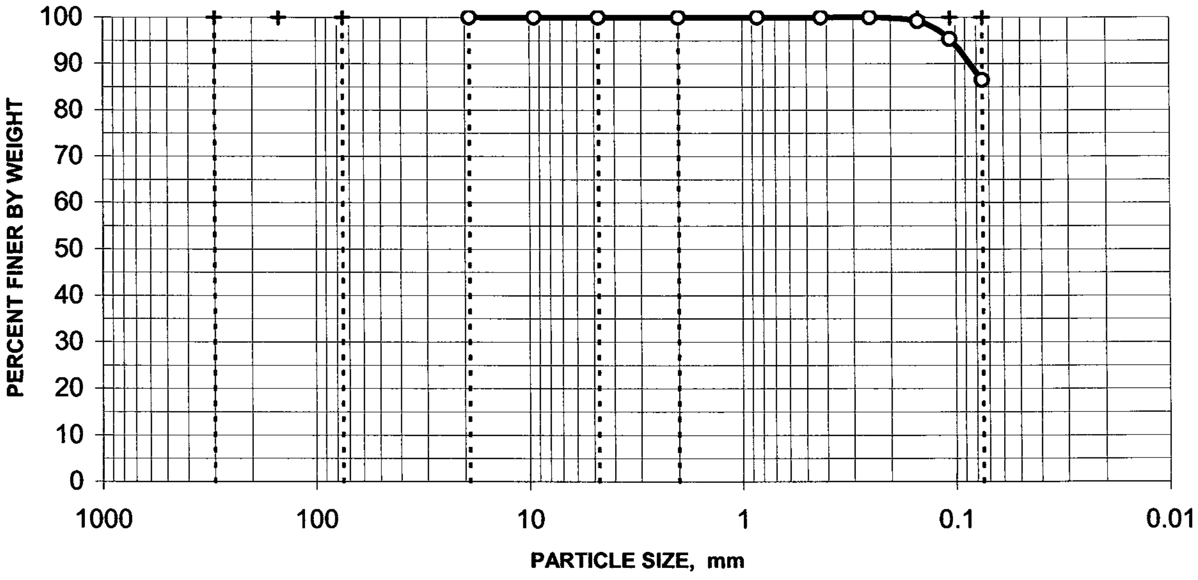
Moisture Content = 24.4%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	100.0%
	#4	4.750	100.0%
	#10	2.000	100.0%

	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	100.0%
	#40	0.425	100.0%
	#60	0.250	100.0%
	#100	0.149	99.2%
	#140	0.106	95.3%
	#200	0.075	86.4%

DISTRIBUTION CURVE



0.0% Gravel 13.6% Sand 86.4% Silt/Clay

PARTICLE-SIZE ANALYSIS
ASTM D 422

Project Name
GEL - Moab
Project No.
109855.01210000

Client Sample No.
708-R29
Lab Sample No.
BC0786

Specific Gravity = 3.0827

Moisture Content = 49.3%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	100.0%
	#4	4.750	100.0%
	#10	2.000	100.0%

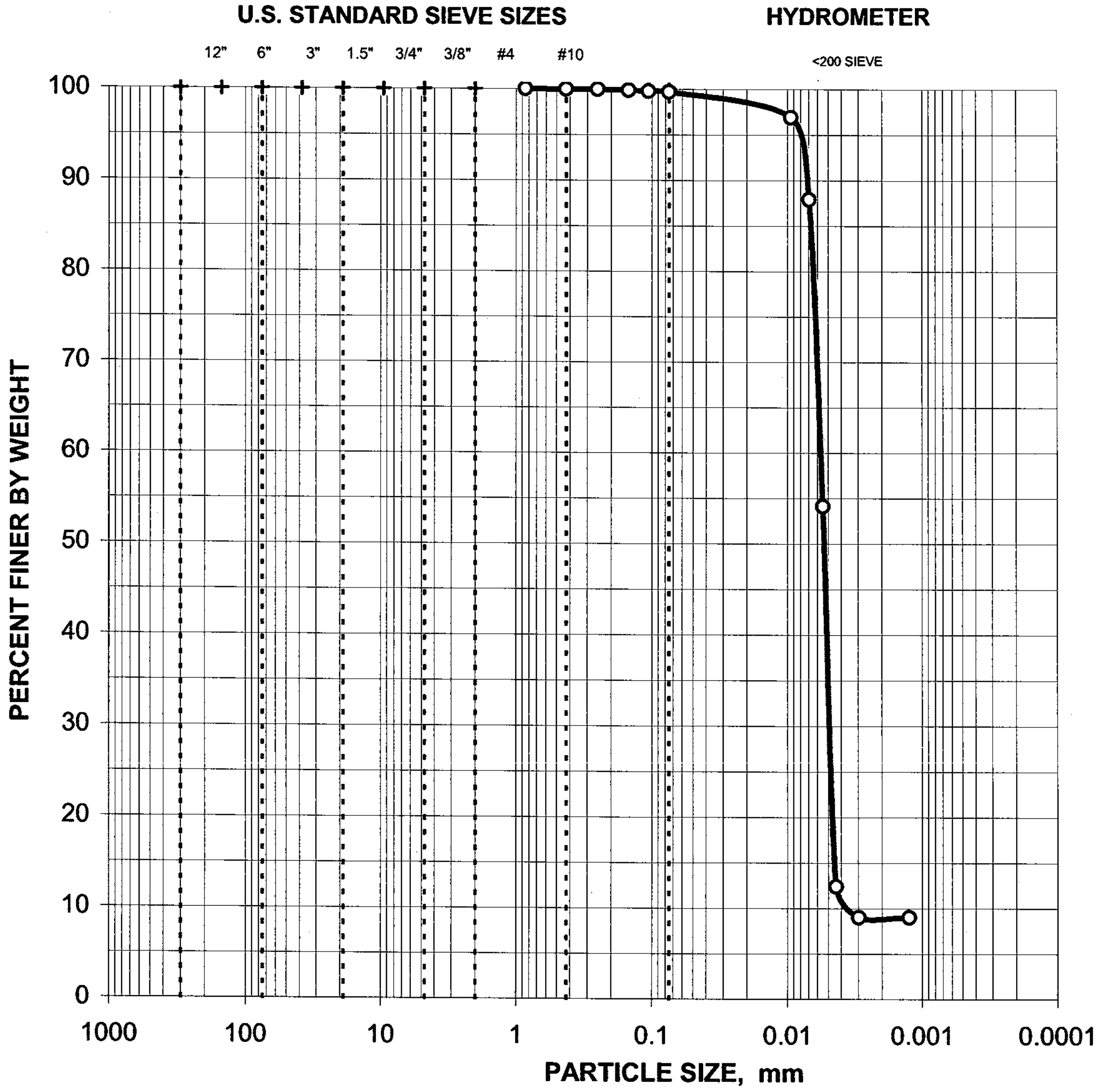
	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	100.0%
	#40	0.425	100.0%
	#60	0.250	100.0%
	#100	0.149	99.9%
	#140	0.106	99.8%
	#200	0.075	99.7%

HYDROMETER ANALYSIS

	Diameter mm	Percent Finer
HYDROMETER		
	0.00944	96.9%
	0.00691	87.9%
	0.00546	54.1%
	0.00434	12.4%
	0.00296	9.0%
	0.00125	9.0%

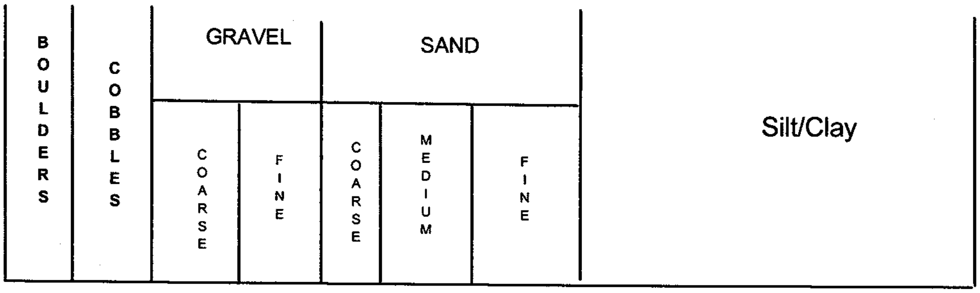
0.0% Gravel 0.3% Sand 99.7% Silt/Clay

GEL - Moab



CLIENT SAMPLE NO.: 708-R29

LAB SAMPLE NO.: BC0786



PARTICLE-SIZE ANALYSIS
ASTM D 422

Project Name
GEL - Moab
Project No.
109855.01210000

Client Sample No.
708-R8
Lab Sample No.
BC0787

Specific Gravity = 2.8742

Moisture Content = 98.8%
based on dry sample weight

SIEVE ANALYSIS

COARSE	Sieve No.	Diameter mm	Percent Finer
	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	100.0%
	#4	4.750	100.0%
	#10	2.000	100.0%

FINE	Sieve No.	Diameter mm	Percent Finer
	#20	0.850	99.6%
	#40	0.425	99.1%
	#60	0.250	98.9%
	#100	0.149	98.3%
	#140	0.106	95.7%
	#200	0.075	90.1%

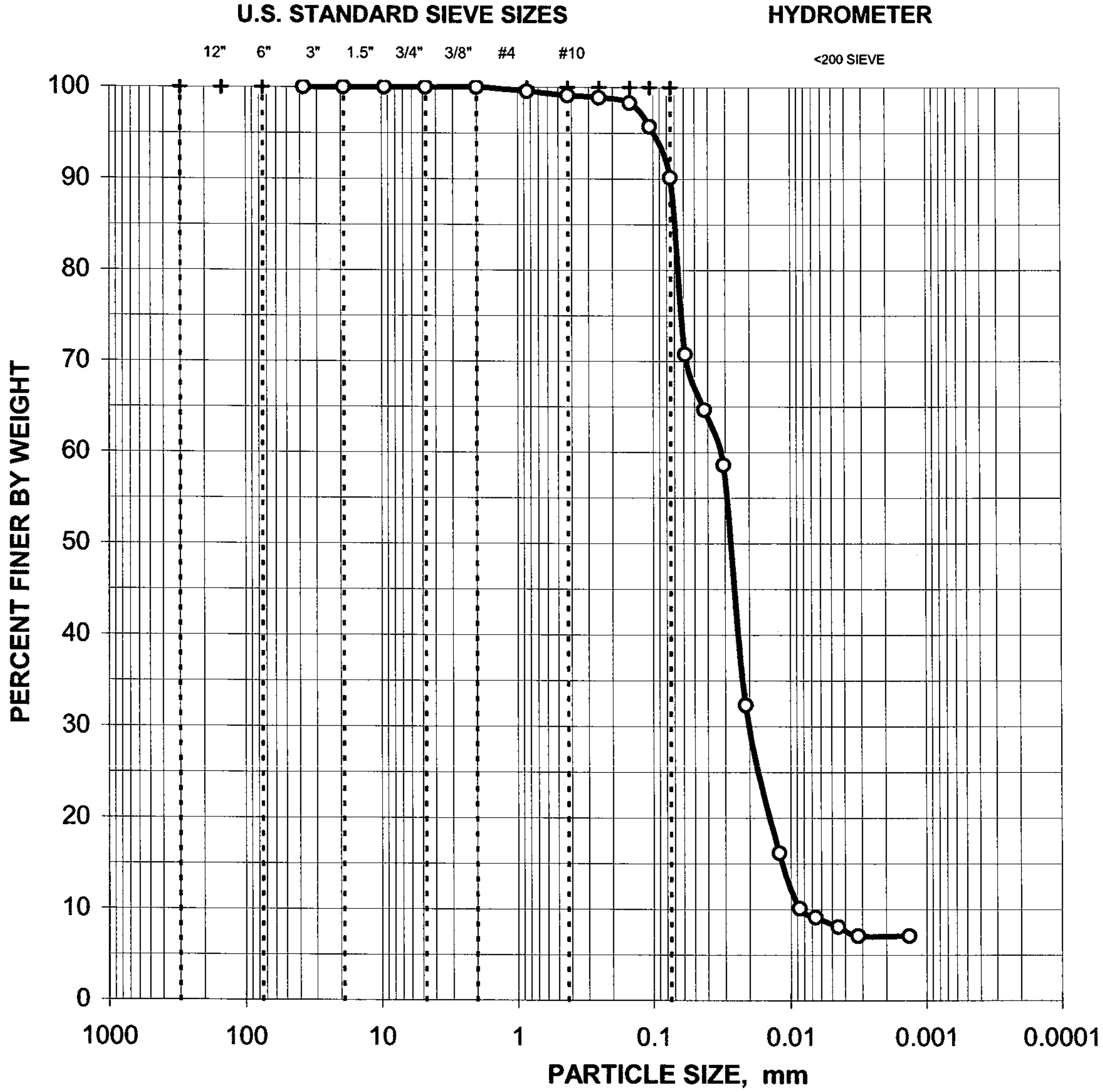
HYDROMETER ANALYSIS

HYDROMETER	Diameter mm	Percent Finer
	0.05863	70.7%
	0.04252	64.7%
	0.03080	58.6%
	0.02132	32.3%
	0.01214	16.2%
	0.00861	10.1%
	0.00660	9.1%
	0.00449	8.1%
	0.00321	7.1%
	0.00135	7.1%

0.0% Gravel 9.9% Sand 90.1% Silt/Clay

May 3, 2006
Erin Stanley
General Engineering Laboratories
Shaw Project Name: GEL – Moab
Shaw Project No. 109855.01210000

GEL - Moab



CLIENT SAMPLE NO.: 708-R8

LAB SAMPLE NO.: BC0787

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<tr><td>COARSE</td><td>FINE</td><td>COARSE</td><td>MEDIUM</td><td>FINE</td></tr>
</table>

PARTICLE-SIZE ANALYSIS
ASTM D 422

Project Name
GEL - Moab
Project No.
109855.01210000

Client Sample No.
710-R12
Lab Sample No.
BC0788

Specific Gravity = 2.7828

Moisture Content = 67.4%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	100.0%
	#4	4.750	100.0%
	#10	2.000	100.0%

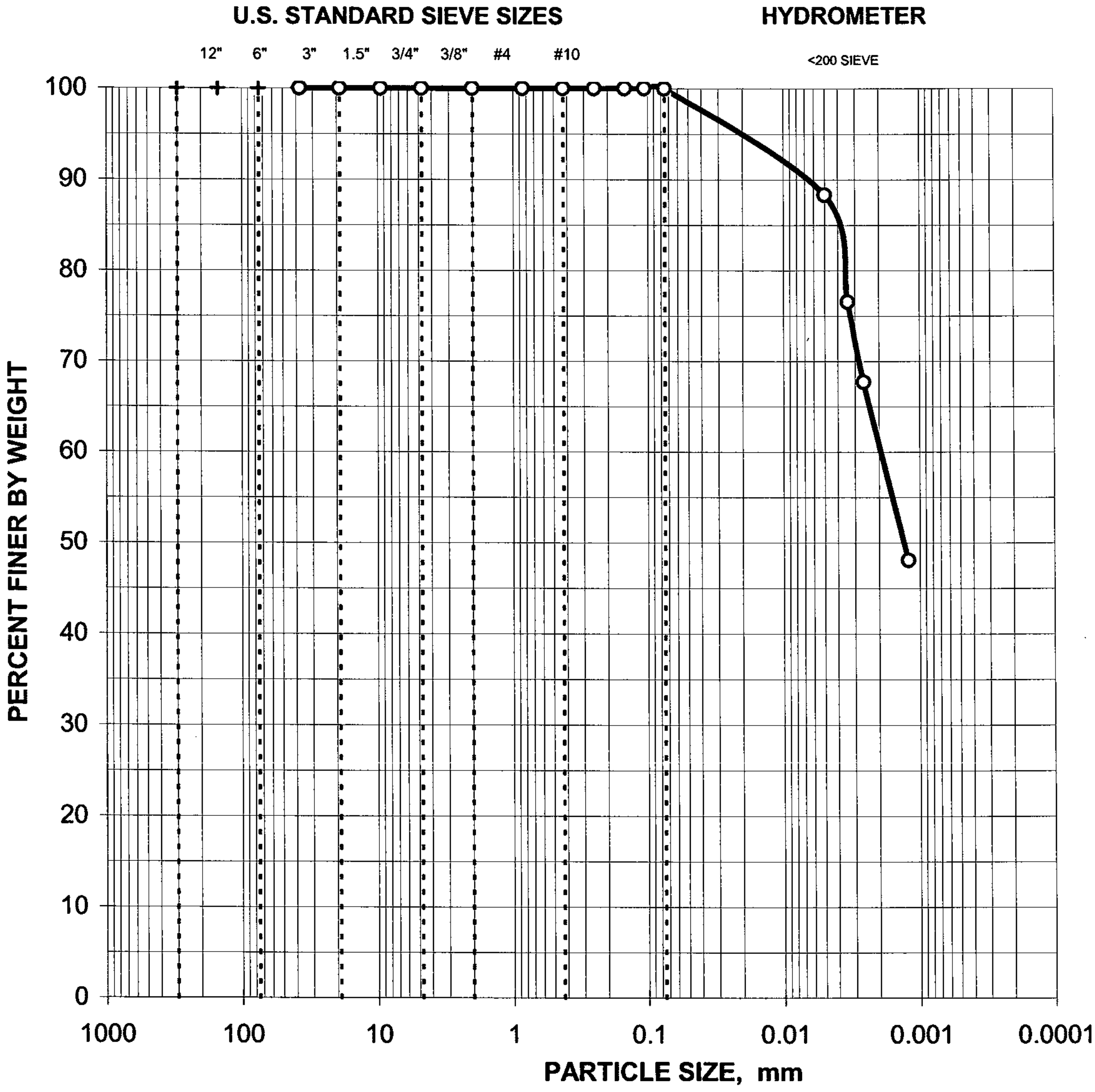
	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	100.0%
	#40	0.425	100.0%
	#60	0.250	100.0%
	#100	0.149	100.0%
	#140	0.106	100.0%
	#200	0.075	100.0%

HYDROMETER ANALYSIS

	Diameter mm	Percent Finer
HYDROMETER		
	0.00499	88.3%
	0.00338	76.5%
	0.00259	67.7%
	0.00122	48.1%

0.0% Gravel 0.0% Sand 100.0% Silt/Clay

GEL - Moab



CLIENT SAMPLE NO.: 710-R12 **LAB SAMPLE NO.:** BC0788

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<tr><td>COARSE</td><td>FINE</td><td>COARSE</td><td>MEDIUM</td><td>FINE</td></tr>
</table>

PARTICLE-SIZE ANALYSIS
ASTM D 422

Project Name
GEL - Moab
Project No.
109855.01210000

Client Sample No.
710-R4
Lab Sample No.
BC0790

Specific Gravity = 2.9369

Moisture Content = 80.7%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	100.0%
	#4	4.750	100.0%
	#10	2.000	100.0%

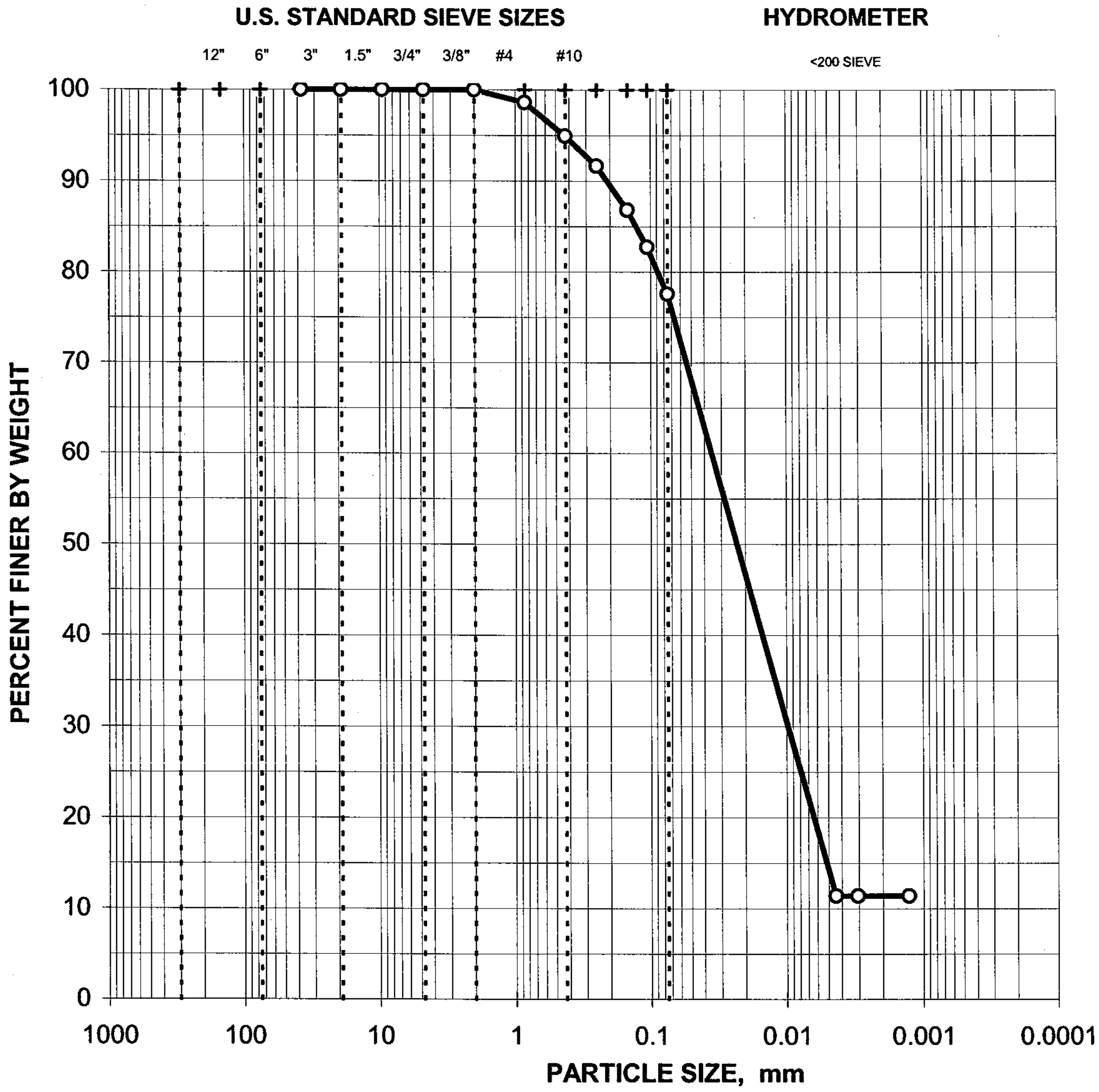
	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	98.6%
	#40	0.425	94.9%
	#60	0.250	91.6%
	#100	0.149	86.8%
	#140	0.106	82.7%
	#200	0.075	77.6%

HYDROMETER ANALYSIS

	Diameter mm	Percent Finer
HYDROMETER		
	0.00439	11.4%
	0.00304	11.4%
	0.00128	11.4%

0.0% Gravel 22.4% Sand 77.6% Silt/Clay

GEL - Moab



CLIENT SAMPLE NO.: 710-R4

LAB SAMPLE NO.: BC0790

BOULDERS	COBBLES	GRAVEL		SAND			Silt/Clay
		COARSE	FINE	COARSE	MEDIUM	FINE	

PARTICLE-SIZE DISTRIBUTION
ASTM D 422

Project Name GEL - Moab

Project No. 109855.01210000

Field Sample No. 710-R6

Lab Sample No. BC0791

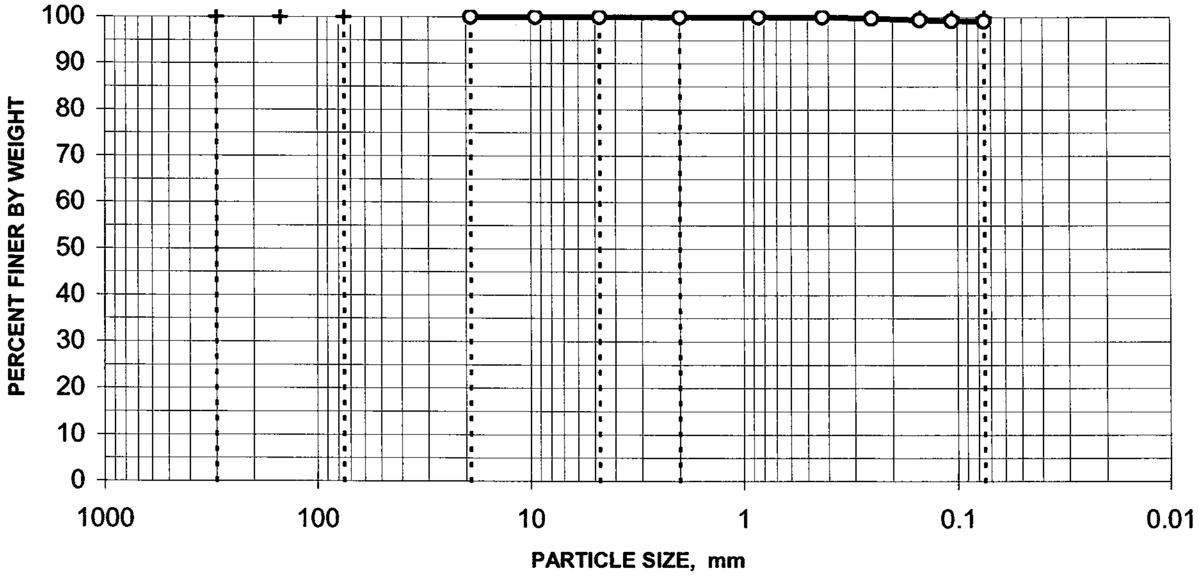
Moisture Content = 116.8%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	100.0%
	#4	4.750	100.0%
	#10	2.000	100.0%

	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	100.0%
	#40	0.425	100.0%
	#60	0.250	99.7%
	#100	0.149	99.4%
	#140	0.106	99.2%
	#200	0.075	99.1%

DISTRIBUTION CURVE



0.0% Gravel 0.9% Sand 99.1% Silt/Clay

PARTICLE-SIZE DISTRIBUTION
ASTM D 422

Project Name GEL - Moab

Project No. 109855.01210000

Field Sample No. 712-R11

Lab Sample No. BC0793

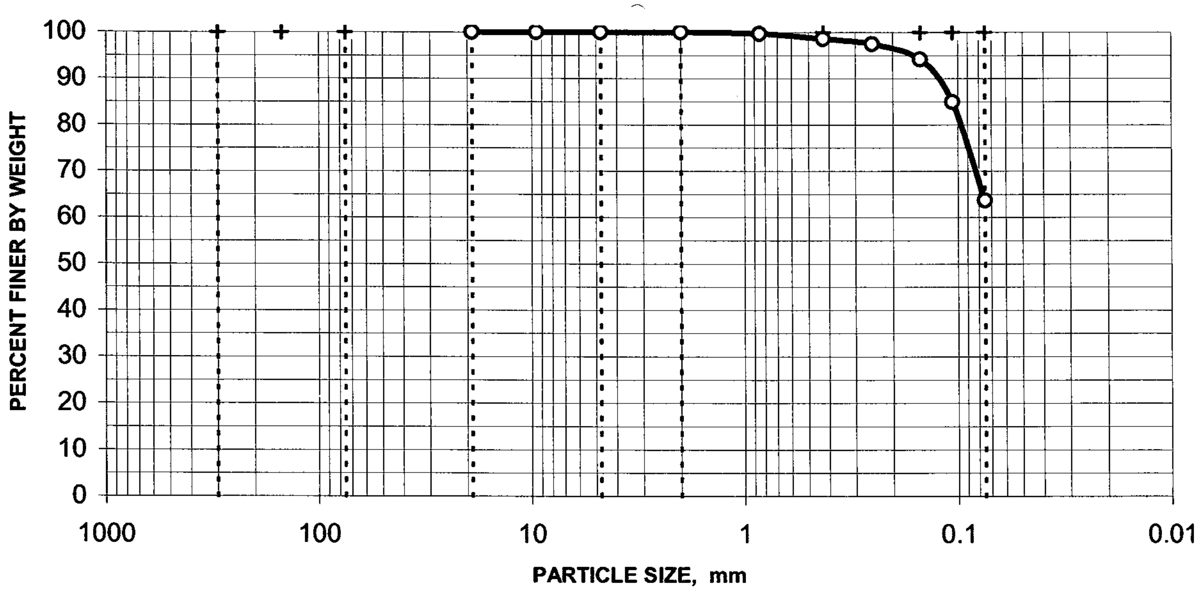
Moisture Content = 44.8%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	100.0%
	#4	4.750	100.0%
	#10	2.000	100.0%

	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	99.7%
	#40	0.425	98.5%
	#60	0.250	97.5%
	#100	0.149	94.1%
	#140	0.106	84.9%
	#200	0.075	63.6%

DISTRIBUTION CURVE



0.0% Gravel 36.4% Sand 63.6% Silt/Clay

PARTICLE-SIZE DISTRIBUTION
ASTM D 422

Project Name	GEL - Moab	Field Sample No.	712-R15
Project No.	109855.01210000	Lab Sample No.	BC0795

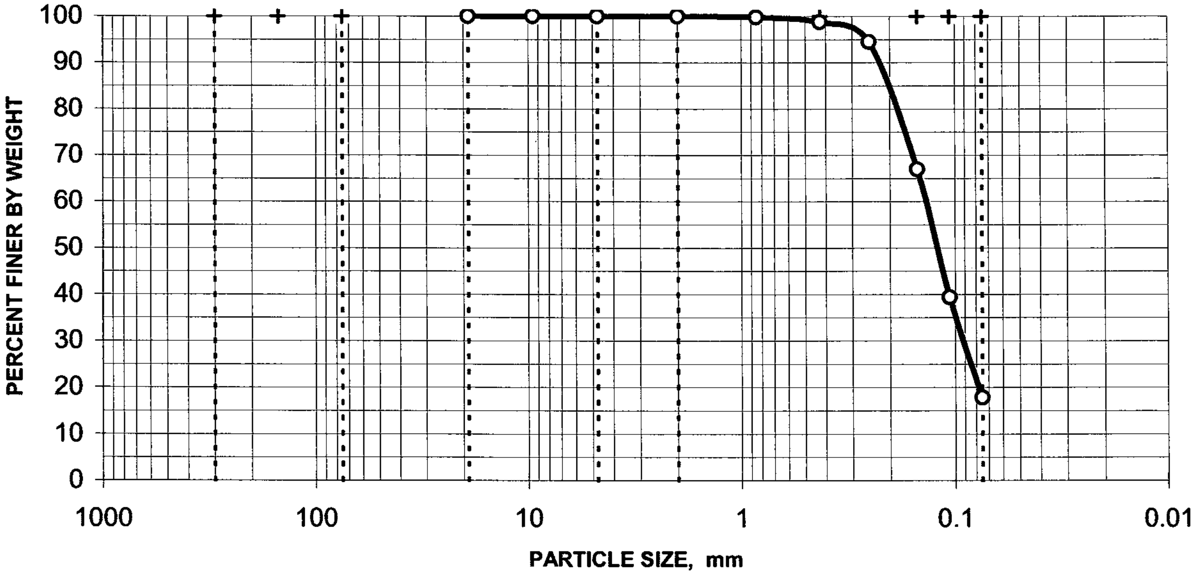
Moisture Content = 11.6%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	100.0%
	#4	4.750	100.0%
	#10	2.000	100.0%

	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	99.8%
	#40	0.425	98.8%
	#60	0.250	94.5%
	#100	0.149	67.0%
	#140	0.106	39.4%
	#200	0.075	17.8%

DISTRIBUTION CURVE



0.0% Gravel	82.2% Sand	17.8% Silt/Clay

PARTICLE-SIZE DISTRIBUTION
ASTM D 422

Project Name	GEL - Moab	Field Sample No.	712-R17
Project No.	109855.01210000	Lab Sample No.	BC0797

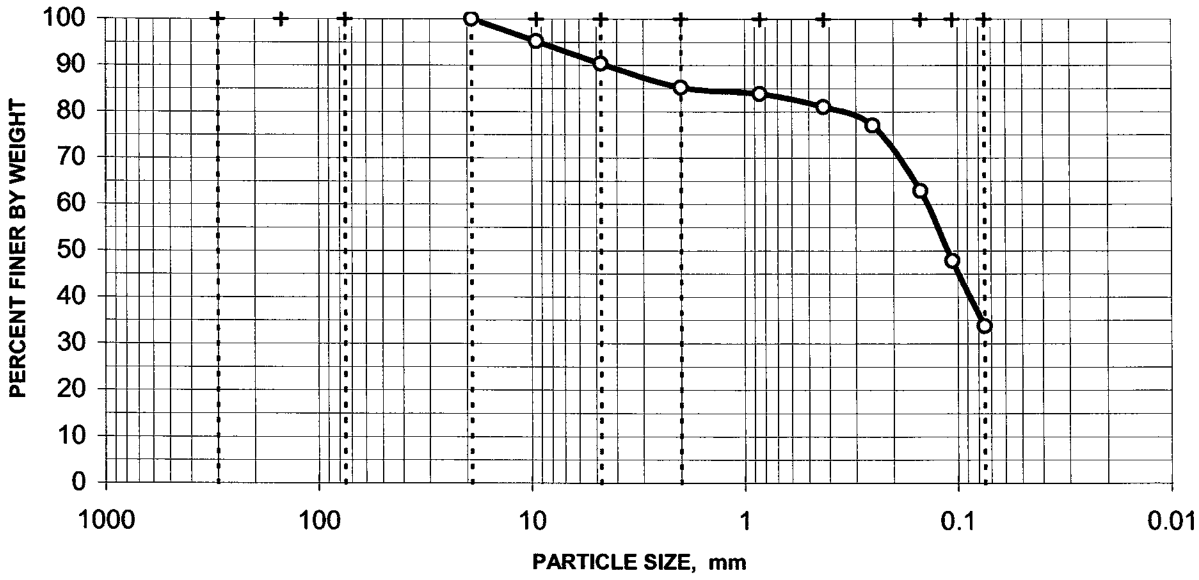
Moisture Content = 8.4%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	95.2%
	#4	4.750	90.3%
	#10	2.000	85.2%

	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	83.8%
	#40	0.425	81.0%
	#60	0.250	77.0%
	#100	0.149	62.9%
	#140	0.106	47.8%
	#200	0.075	33.8%

DISTRIBUTION CURVE



9.7% Gravel 56.5% Sand 33.8% Silt/Clay

May 3, 2006
Erin Stanley
General Engineering Laboratories
Shaw Project Name: GEL – Moab
Shaw Project No. 109855.01210000

Shaw Geotechnical
Laboratory
Oak Ridge TN
(865) 482-6497

PARTICLE-SIZE DISTRIBUTION
ASTM D 422

Project Name	GEL - Moab	Field Sample No.	712-R3
Project No.	109855.01210000	Lab Sample No.	BC0799

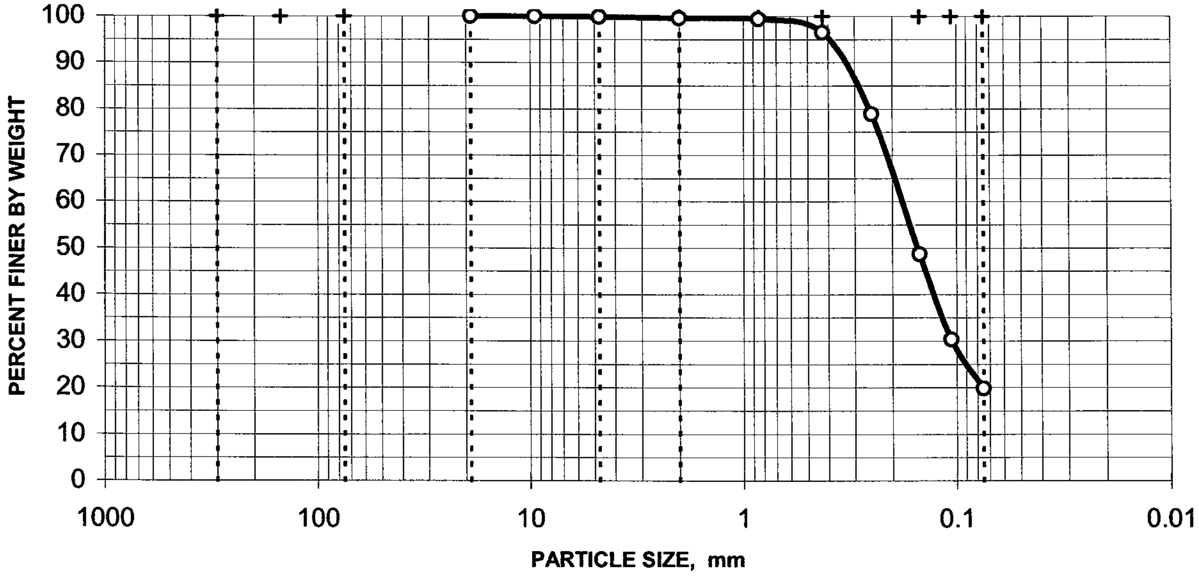
Moisture Content = 6.6%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	100.0%
	#4	4.750	99.9%
	#10	2.000	99.6%

	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	99.4%
	#40	0.425	96.5%
	#60	0.250	78.9%
	#100	0.149	48.7%
	#140	0.106	30.4%
	#200	0.075	19.8%

DISTRIBUTION CURVE



0.1% Gravel 80.1% Sand 19.8% Silt/Clay

PARTICLE-SIZE ANALYSIS
ASTM D 422

Project Name
GEL - Moab
Project No.
109855.01210000

Client Sample No.
712-R6
Lab Sample No.
BC0801

Specific Gravity = 2.8730

Moisture Content = 63.3%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	100.0%
	#4	4.750	100.0%
	#10	2.000	99.9%

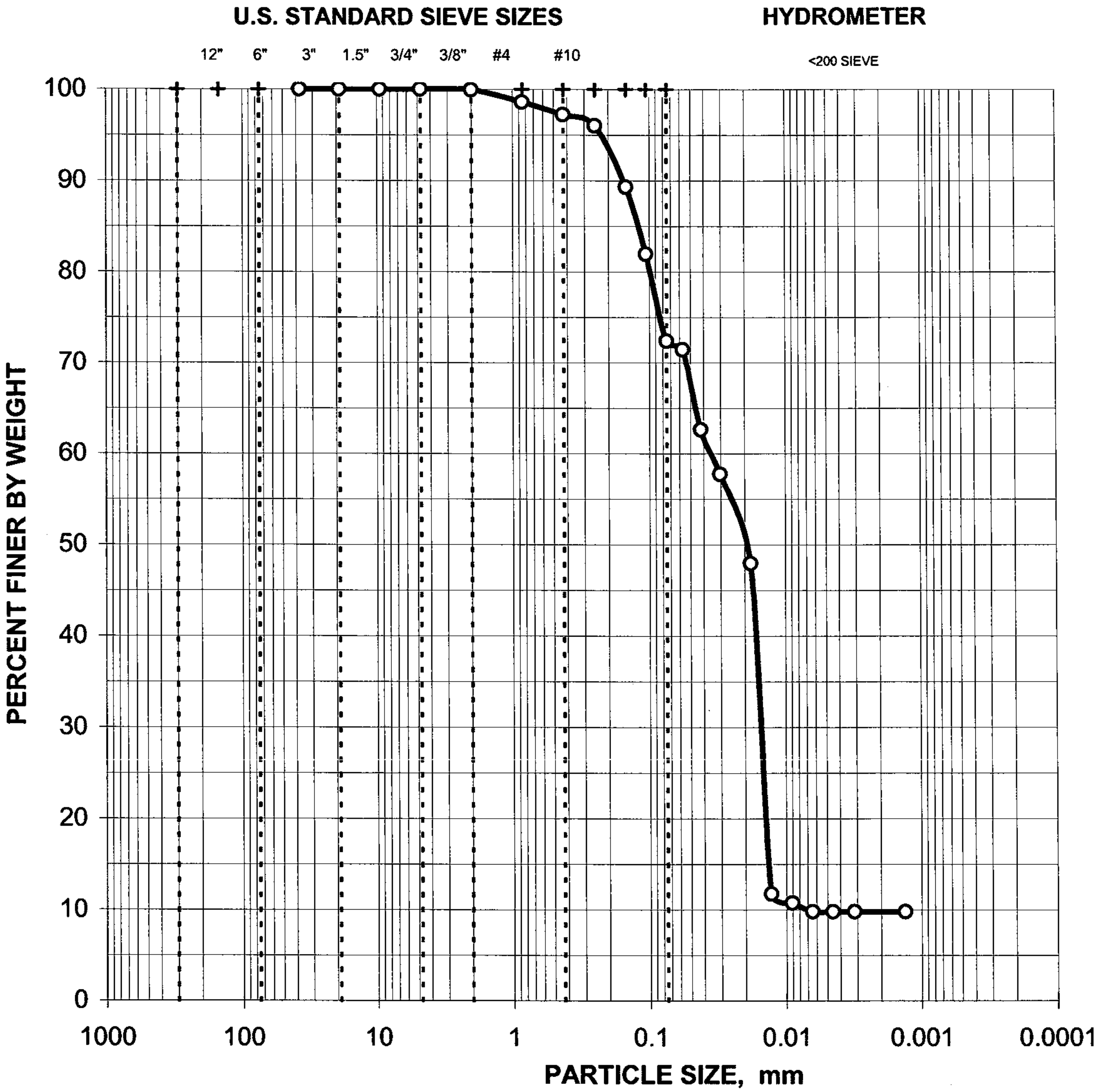
	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	98.6%
	#40	0.425	97.2%
	#60	0.250	96.0%
	#100	0.149	89.3%
	#140	0.106	81.9%
	#200	0.075	72.4%

HYDROMETER ANALYSIS

	Diameter mm	Percent Finer
HYDROMETER	0.05697	71.4%
	0.04198	62.6%
	0.03027	57.7%
	0.01813	47.9%
	0.01290	11.7%
	0.00904	10.8%
	0.00642	9.8%
	0.00454	9.8%
	0.00314	9.8%
	0.00133	9.8%

0.0% Gravel 27.6% Sand 72.4% Silt/Clay

GEL - Moab



CLIENT SAMPLE NO.: 712-R6 **LAB SAMPLE NO.:** BC0801

BOULDERS	COBBLES	GRAVEL		SAND			Silt/Clay
		COARSE	FINE	COARSE	MEDIUM	FINE	

PARTICLE-SIZE DISTRIBUTION
ASTM D 422

Project Name	GEL - Moab	Field Sample No.	713-R2
Project No.	109855.01210000	Lab Sample No.	BC0804

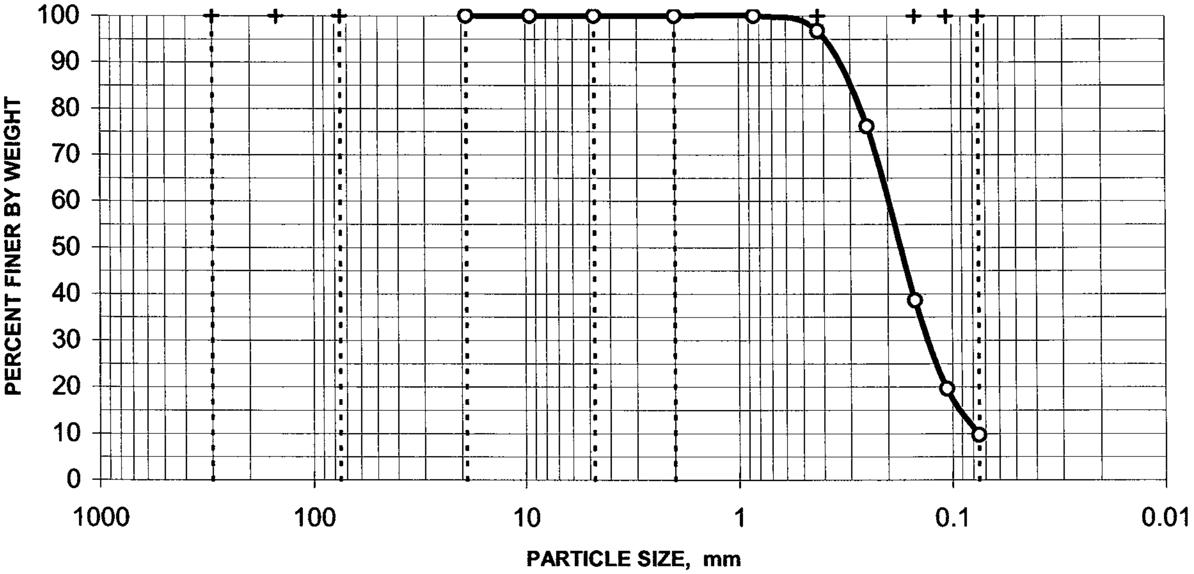
Moisture Content = 6.6%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	100.0%
	#4	4.750	100.0%
	#10	2.000	100.0%

	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	100.0%
	#40	0.425	96.8%
	#60	0.250	76.1%
	#100	0.149	38.6%
	#140	0.106	19.6%
	#200	0.075	9.7%

DISTRIBUTION CURVE



0.0% Gravel 90.3% Sand 9.7% Silt/Clay

PARTICLE-SIZE DISTRIBUTION
ASTM D 422

Project Name GEL - Moab

Project No. 109855.01210000

Field Sample No. 713-R7

Lab Sample No. BC0806

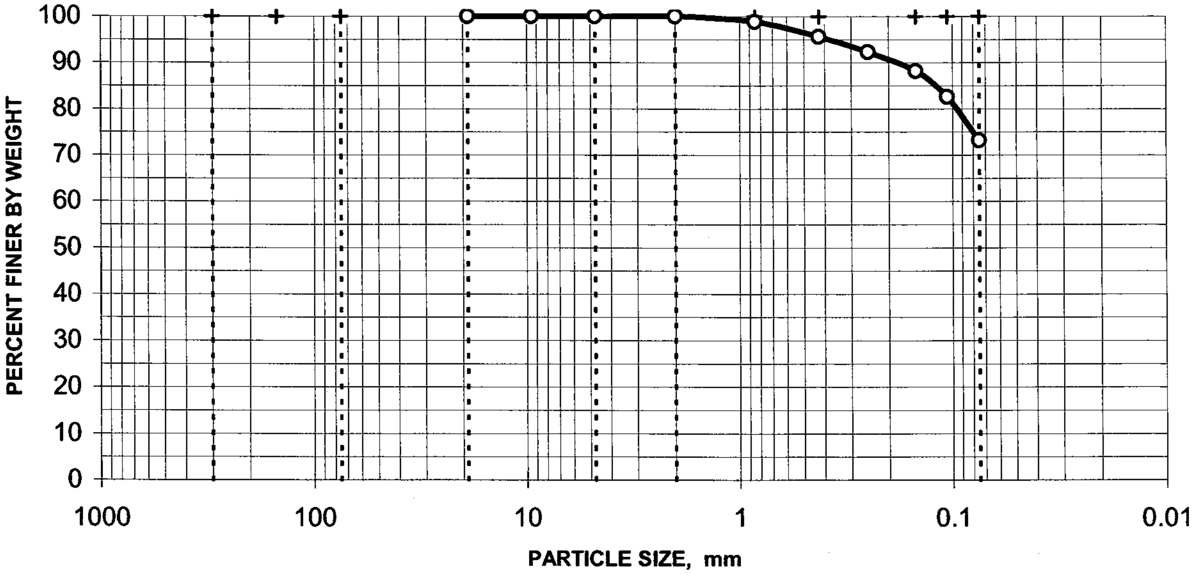
Moisture Content = 56.0%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	100.0%
	#4	4.750	100.0%
	#10	2.000	100.0%

	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	98.9%
	#40	0.425	95.6%
	#60	0.250	92.3%
	#100	0.149	88.2%
	#140	0.106	82.6%
	#200	0.075	73.2%

DISTRIBUTION CURVE



0.0% Gravel 26.8% Sand 73.2% Silt/Clay

PARTICLE-SIZE DISTRIBUTION
ASTM D 422

Project Name GEL - Moab

Project No. 109855.01210000

Field Sample No. 714-R2

Lab Sample No. BC0809

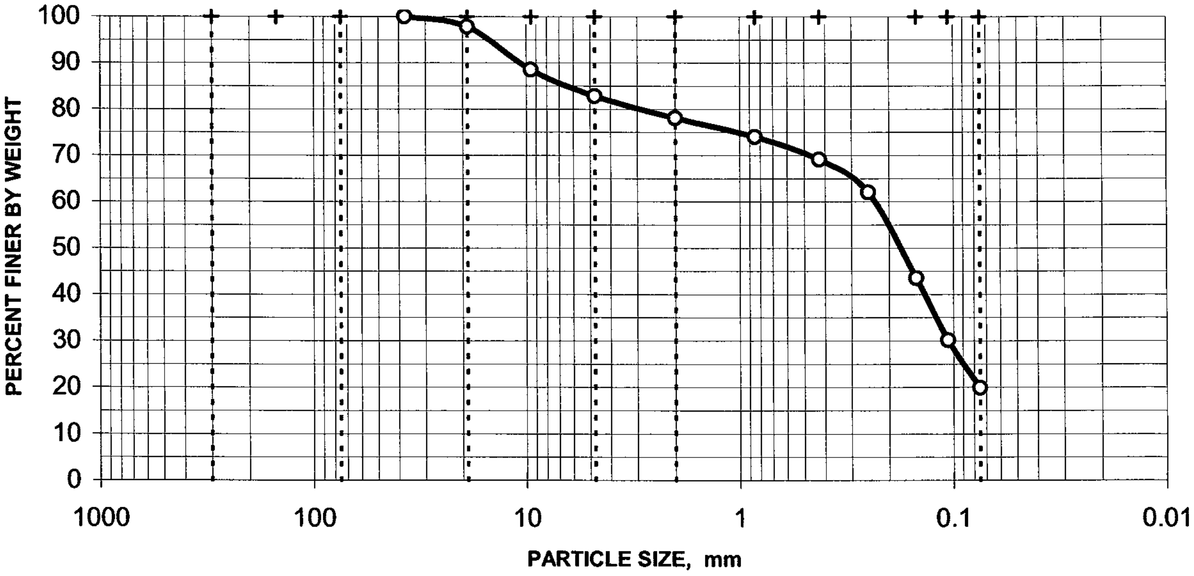
Moisture Content = 5.1%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	97.8%
	0.375"	9.500	88.5%
	#4	4.750	82.8%
	#10	2.000	78.1%

	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	74.0%
	#40	0.425	69.1%
	#60	0.250	62.0%
	#100	0.149	43.5%
	#140	0.106	30.2%
	#200	0.075	19.9%

DISTRIBUTION CURVE



17.2% Gravel 62.9% Sand 19.9% Silt/Clay

PARTICLE-SIZE DISTRIBUTION
ASTM D 422

Project Name GEL - Moab

Project No. 109855.01210000

Field Sample No. 714-R4

Lab Sample No. BC0811

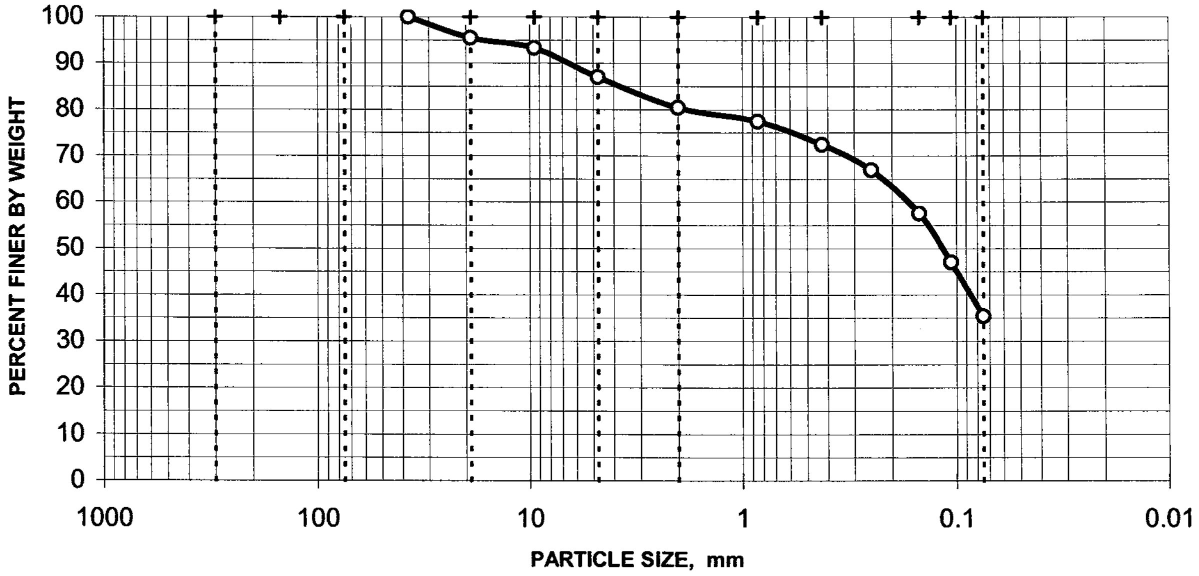
Moisture Content = 7.6%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
C O A R S E	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	95.5%
	0.375"	9.500	93.2%
	#4	4.750	87.0%
	#10	2.000	80.4%

	Sieve No.	Diameter mm	Percent Finer
F I N E	#20	0.850	77.5%
	#40	0.425	72.4%
	#60	0.250	66.9%
	#100	0.149	57.6%
	#140	0.106	47.0%
	#200	0.075	35.4%

DISTRIBUTION CURVE



13.0% Gravel 51.6% Sand 35.4% Silt/Clay

PARTICLE-SIZE DISTRIBUTION
ASTM D 422

Project Name GEL - Moab

Project No. 109855.01210000

Field Sample No. 714-R6

Lab Sample No. BC0813

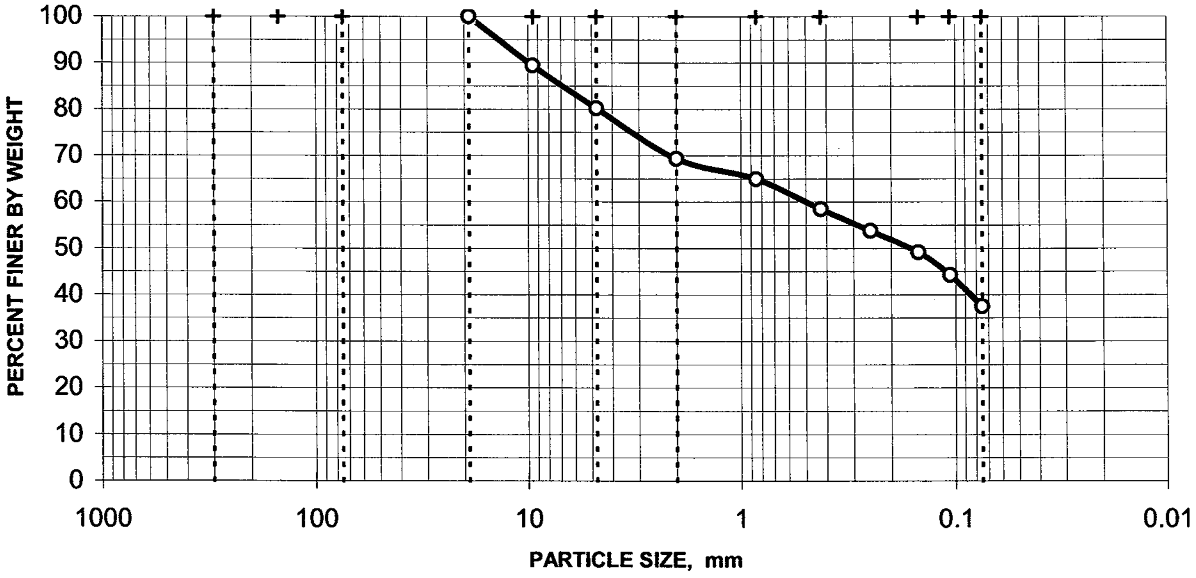
Moisture Content = 6.7%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	89.4%
	#4	4.750	80.2%
	#10	2.000	69.3%

	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	64.9%
	#40	0.425	58.4%
	#60	0.250	53.8%
	#100	0.149	49.1%
	#140	0.106	44.2%
	#200	0.075	37.5%

DISTRIBUTION CURVE



19.8% Gravel 42.7% Sand 37.5% Silt/Clay

PARTICLE-SIZE DISTRIBUTION
ASTM D 422

Project Name GEL - Moab

Project No. 109855.01210000

Field Sample No. 714-R8

Lab Sample No. BC0815

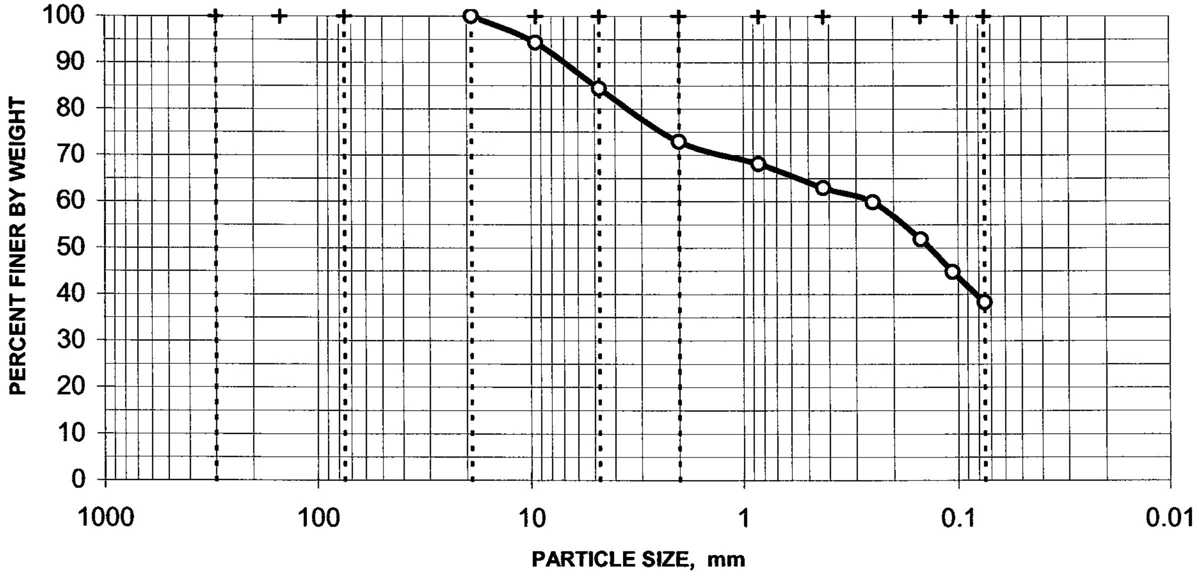
Moisture Content = 7.9%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	94.3%
	#4	4.750	84.4%
	#10	2.000	72.9%

	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	68.1%
	#40	0.425	62.9%
	#60	0.250	59.8%
	#100	0.149	51.8%
	#140	0.106	44.8%
	#200	0.075	38.3%

DISTRIBUTION CURVE



15.6% Gravel 46.1% Sand 38.3% Silt/Clay

PARTICLE-SIZE DISTRIBUTION
ASTM D 422

Project Name GEL - Moab

Project No. 109855.01210000

Field Sample No. 715-R11

Lab Sample No. BC0816

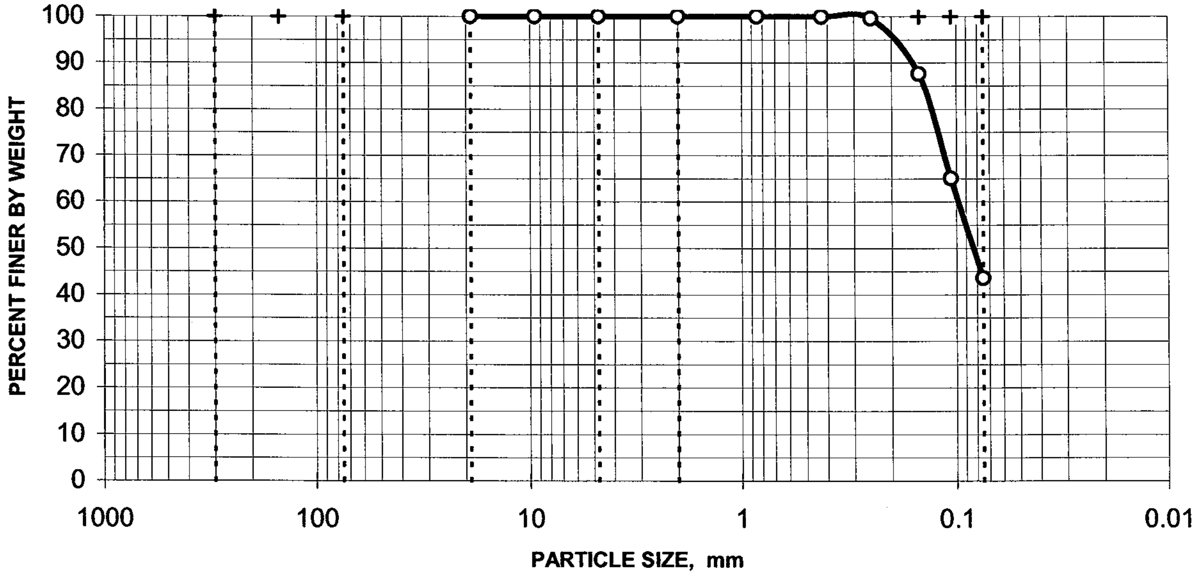
Moisture Content = 30.8%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	100.0%
	#4	4.750	100.0%
	#10	2.000	100.0%

	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	100.0%
	#40	0.425	100.0%
	#60	0.250	99.6%
	#100	0.149	87.6%
	#140	0.106	65.1%
	#200	0.075	43.6%

DISTRIBUTION CURVE



0.0% Gravel 56.4% Sand 43.6% Silt/Clay

PARTICLE-SIZE ANALYSIS
ASTM D 422

Project Name
GEL - Moab
Project No.
109855.01210000

Client Sample No.
715-R20
Lab Sample No.
BC0818

Specific Gravity = 2.7335

Moisture Content = 36.3%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	100.0%
	#4	4.750	100.0%
	#10	2.000	100.0%

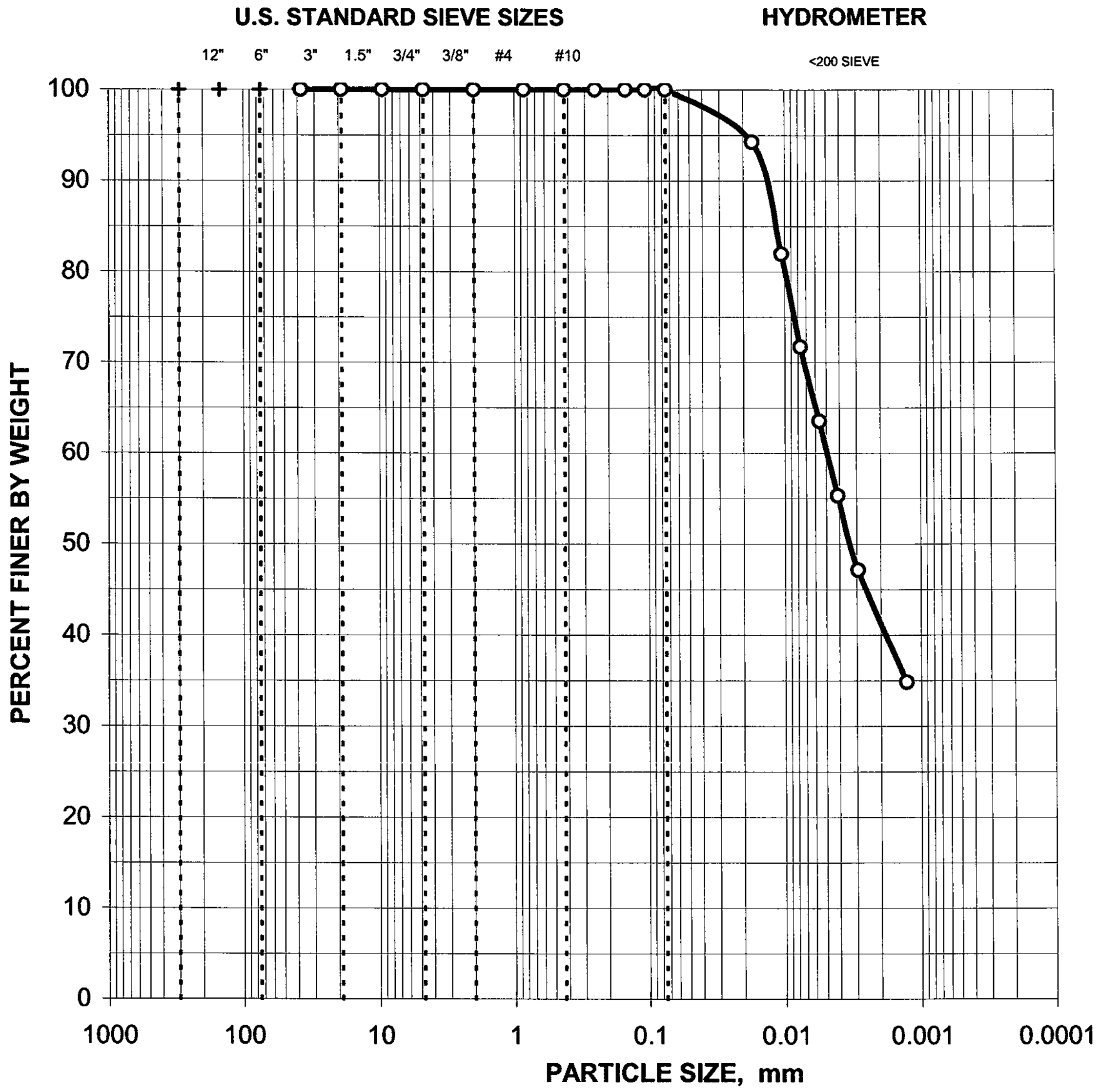
	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	100.0%
	#40	0.425	100.0%
	#60	0.250	100.0%
	#100	0.149	100.0%
	#140	0.106	100.0%
	#200	0.075	100.0%

HYDROMETER ANALYSIS

	Diameter mm	Percent Finer
HYDROMETER		
	0.01721	94.2%
	0.01055	82.0%
	0.00770	71.7%
	0.00561	63.5%
	0.00410	55.3%
	0.00292	47.1%
	0.00128	34.8%

0.0% Gravel 0.0% Sand 100.0% Silt/Clay

GEL - Moab



CLIENT SAMPLE NO.: 715-R20

LAB SAMPLE NO.: BC0818

BOULDERS	COBBLES	GRAVEL		SAND			Silt/Clay
		COARSE	FINE	COARSE	MEDIUM	FINE	

PARTICLE-SIZE ANALYSIS
ASTM D 422

Project Name
GEL - Moab
Project No.
109855.01210000

Client Sample No.
715-R24
Lab Sample No.
BC0819

Specific Gravity = 3.0120

Moisture Content = 58.4%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	100.0%
	#4	4.750	100.0%
	#10	2.000	100.0%

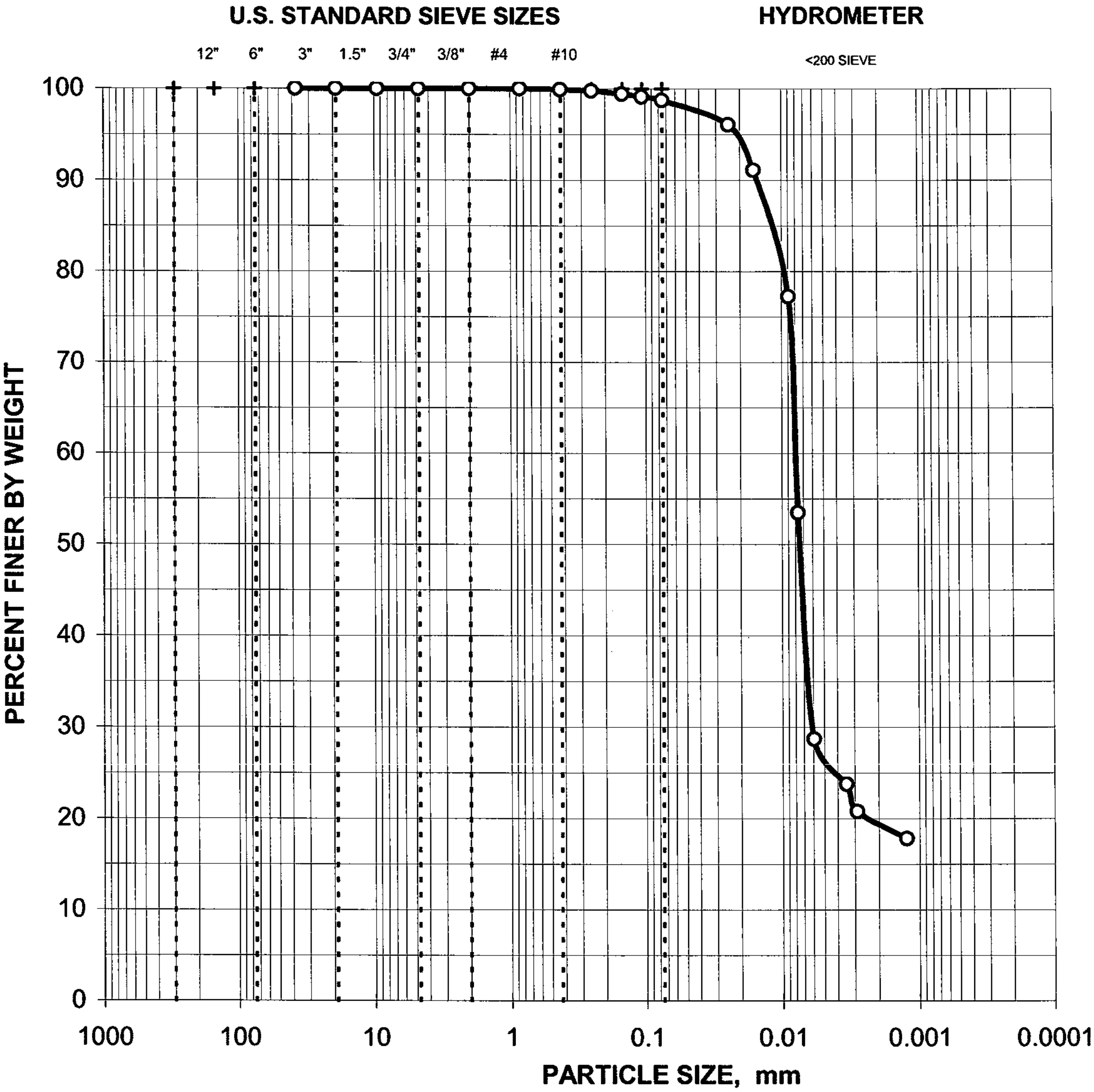
	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	100.0%
	#40	0.425	99.9%
	#60	0.250	99.7%
	#100	0.149	99.4%
	#140	0.106	99.1%
	#200	0.075	98.7%

HYDROMETER ANALYSIS

	Diameter mm	Percent Finer
HYDROMETER		
	0.02433	96.0%
	0.01585	91.1%
	0.00892	77.2%
	0.00765	53.5%
	0.00590	28.7%
	0.00343	23.8%
	0.00287	20.8%
	0.00124	17.8%

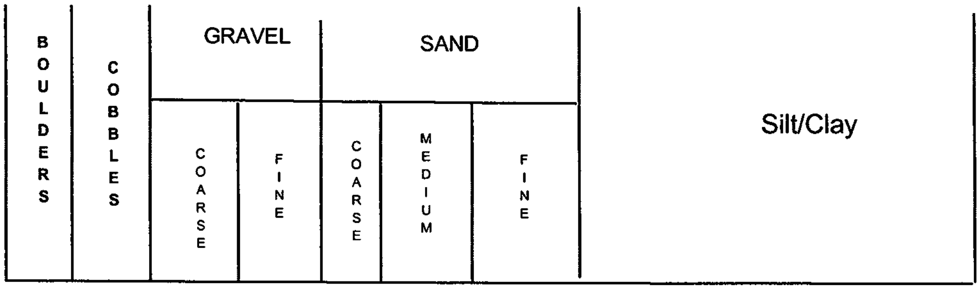
0.0% Gravel 1.3% Sand 98.7% Silt/Clay

GEL - Moab



CLIENT SAMPLE NO.: 715-R24

LAB SAMPLE NO.: BC0819



PARTICLE-SIZE DISTRIBUTION
ASTM D 422

Project Name GEL - Moab

Project No. 109855.01210000

Field Sample No. 715-R28

Lab Sample No. BC0820

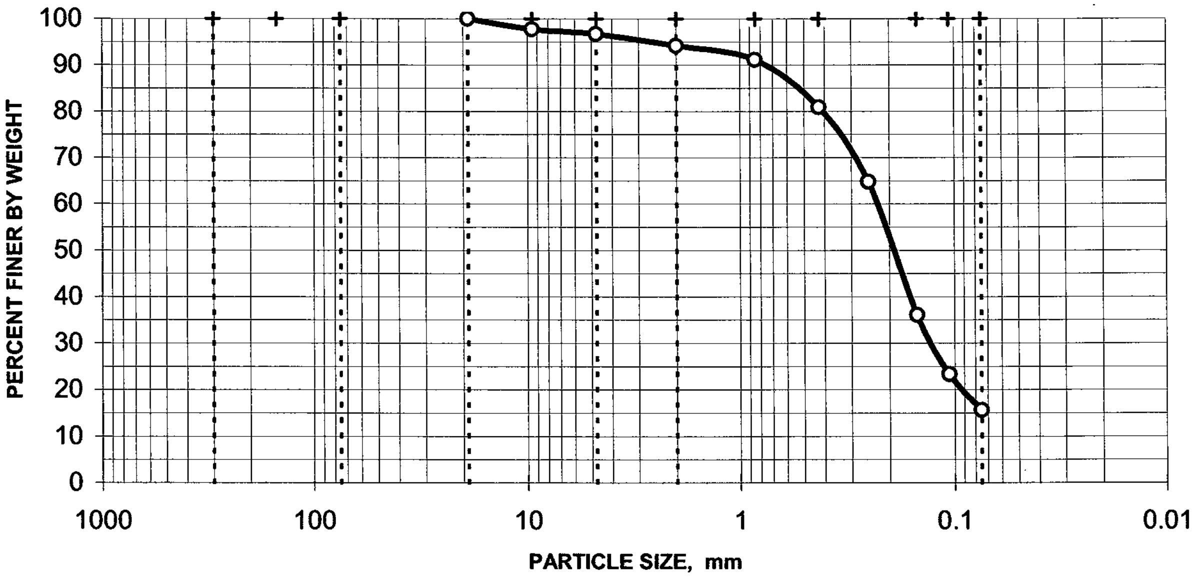
Moisture Content = 5.6%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	97.7%
	#4	4.750	96.7%
	#10	2.000	94.1%

	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	91.1%
	#40	0.425	80.9%
	#60	0.250	64.7%
	#100	0.149	36.1%
	#140	0.106	23.3%
	#200	0.075	15.6%

DISTRIBUTION CURVE



3.3% Gravel 81.1% Sand 15.6% Silt/Clay

PARTICLE-SIZE ANALYSIS
ASTM D 422

Project Name
GEL - Moab
Project No.
109855.01210000

Client Sample No.
715-R6
Lab Sample No.
BC0821

Specific Gravity = 2.8716

Moisture Content = 51.2%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	100.0%
	#4	4.750	100.0%
	#10	2.000	100.0%

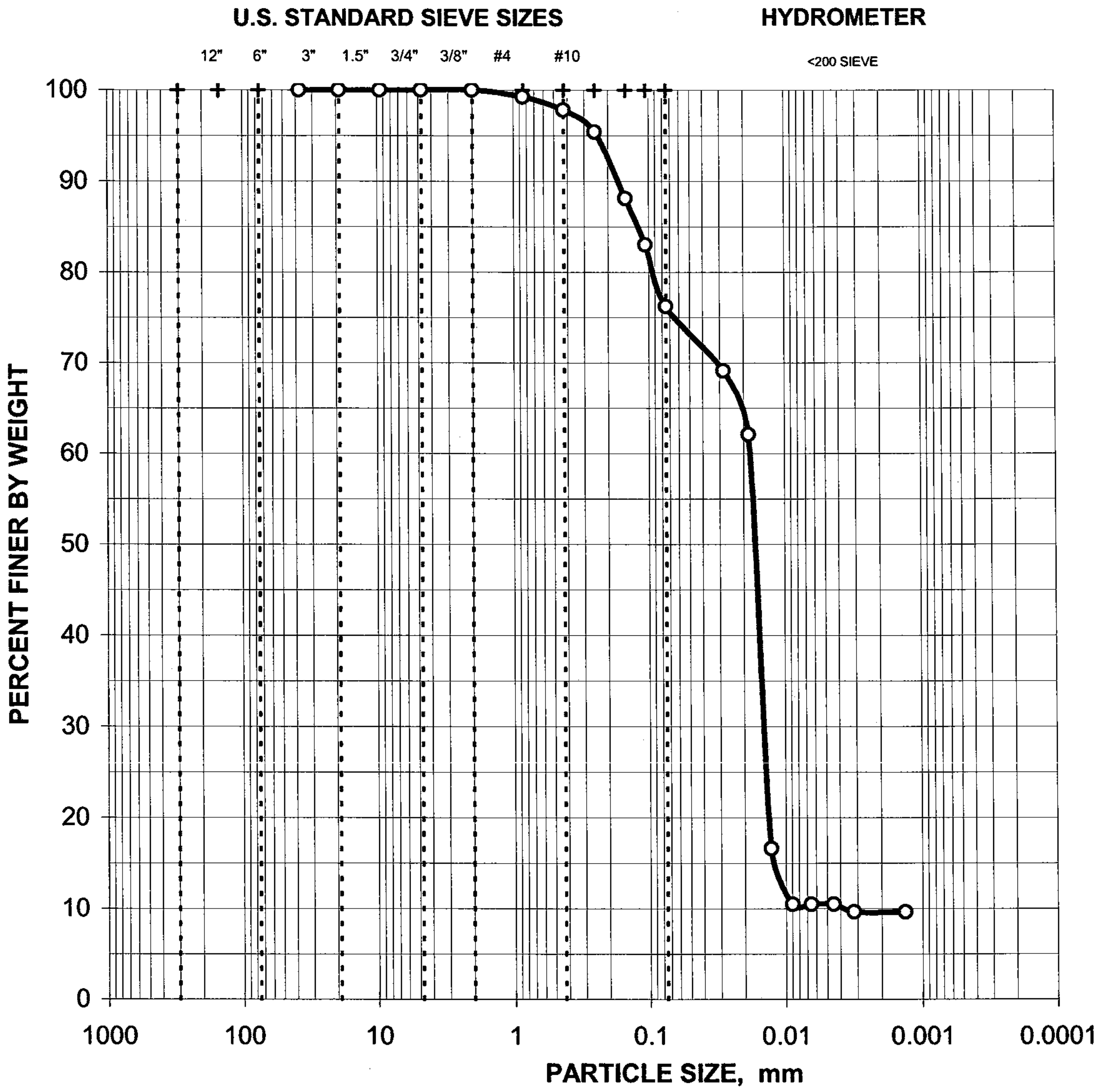
	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	99.3%
	#40	0.425	97.8%
	#60	0.250	95.4%
	#100	0.149	88.1%
	#140	0.106	83.0%
	#200	0.075	76.2%

HYDROMETER ANALYSIS

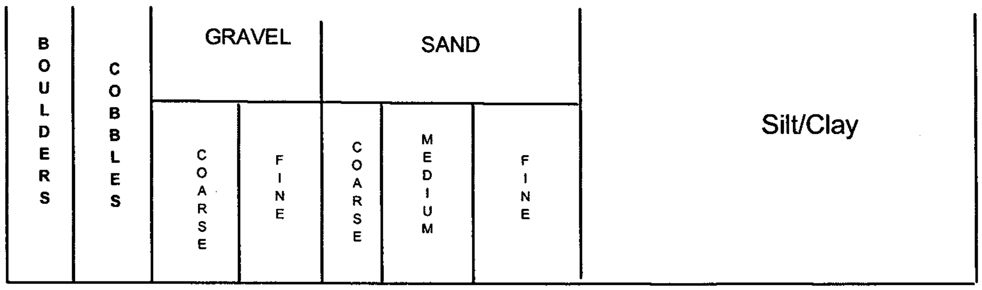
	Diameter mm	Percent Finer
HYDROMETER		
	0.03878	73.5%
	0.02815	69.1%
	0.01844	62.1%
	0.01281	16.6%
	0.00894	10.5%
	0.00653	10.5%
	0.00447	10.5%
	0.00317	9.6%
	0.00134	9.6%

0.0% Gravel 23.8% Sand 76.2% Silt/Clay

GEL - Moab



CLIENT SAMPLE NO.: 715-R6 **LAB SAMPLE NO.:** BC0821



PARTICLE-SIZE ANALYSIS
ASTM D 422

Project Name GEL - Moab	Client Sample No. 716-R13
Project No. 109855.01210000	Lab Sample No. BC0824

Specific Gravity = 2.7237

Moisture Content = 28.0%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	100.0%
	#4	4.750	100.0%
	#10	2.000	100.0%

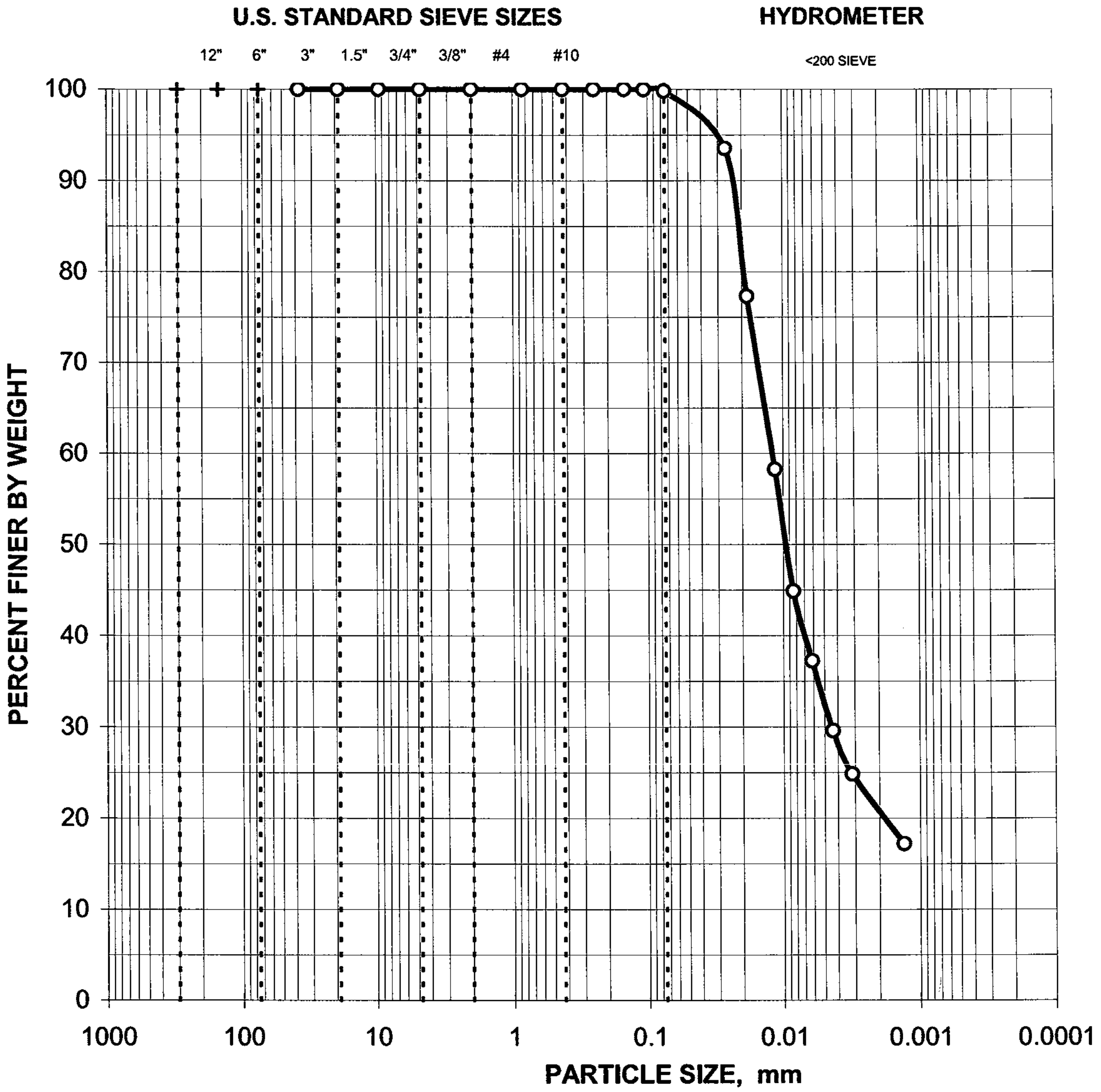
	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	100.0%
	#40	0.425	100.0%
	#60	0.250	100.0%
	#100	0.149	100.0%
	#140	0.106	100.0%
	#200	0.075	99.8%

HYDROMETER ANALYSIS

	Diameter mm	Percent Finer
HYDROMETER		
	0.02642	93.5%
	0.01828	77.3%
	0.01147	58.2%
	0.00839	44.9%
	0.00614	37.2%
	0.00432	29.6%
	0.00313	24.8%
	0.00132	17.2%

0.0% Gravel   0.2% Sand   99.8% Silt/Clay

GEL - Moab



CLIENT SAMPLE NO.: 716-R13

LAB SAMPLE NO.: BC0824

BOULDERS	COBBLES	GRAVEL		SAND			Silt/Clay
		COARSE	FINE	COARSE	MEDIUM	FINE	

PARTICLE-SIZE DISTRIBUTION
ASTM D 422

Project Name GEL - Moab

Project No. 109855.01210000

Field Sample No. 716-R16

Lab Sample No. BC0825

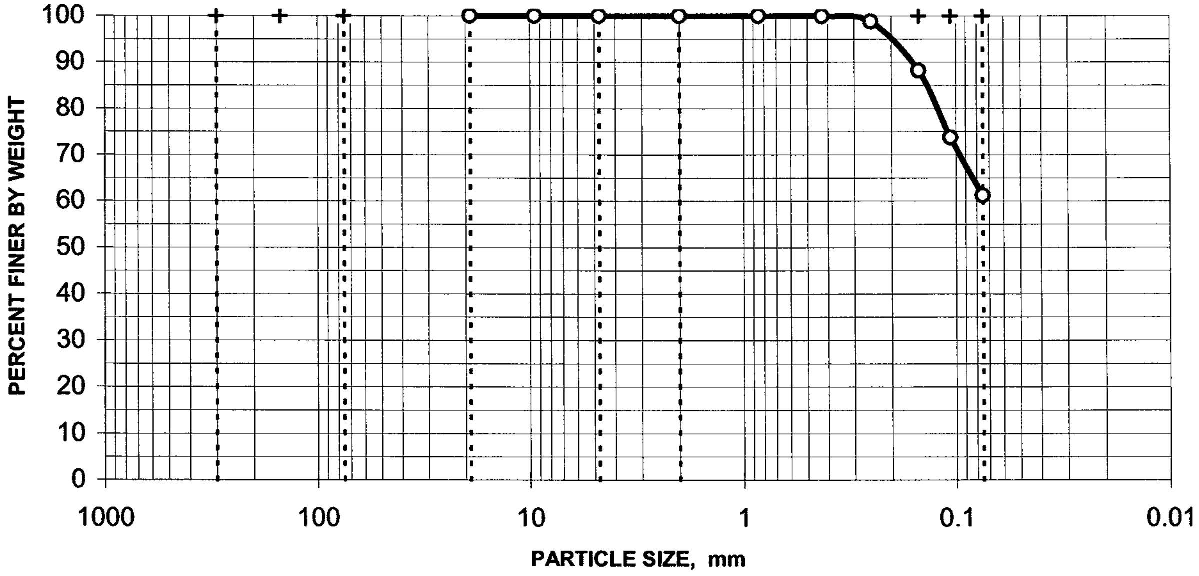
Moisture Content = 30.2%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	100.0%
	#4	4.750	100.0%
	#10	2.000	100.0%

	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	100.0%
	#40	0.425	99.9%
	#60	0.250	98.7%
	#100	0.149	88.2%
	#140	0.106	73.7%
	#200	0.075	61.2%

DISTRIBUTION CURVE



0.0% Gravel 38.8% Sand 61.2% Silt/Clay

PARTICLE-SIZE DISTRIBUTION
ASTM D 422

Project Name GEL - Moab

Project No. 109855.01210000

Field Sample No. 716-R19

Lab Sample No. BC0826

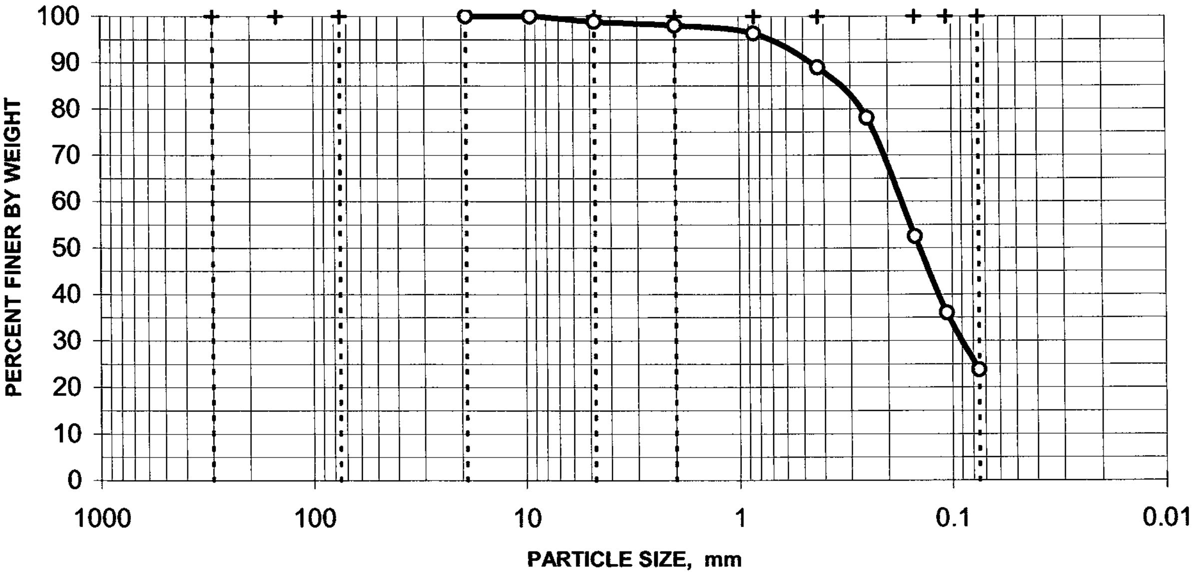
Moisture Content = 8.4%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	100.0%
	#4	4.750	98.8%
	#10	2.000	98.0%

	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	96.3%
	#40	0.425	88.9%
	#60	0.250	78.0%
	#100	0.149	52.4%
	#140	0.106	36.0%
	#200	0.075	23.7%

DISTRIBUTION CURVE



1.2% Gravel 75.1% Sand 23.7% Silt/Clay

**Shaw Geotechnical
Laboratory
Oak Ridge TN
(865) 482-6497**

PARTICLE-SIZE DISTRIBUTION
ASTM D 422

Project Name GEL - Moab

Project No. 109855.01210000

Field Sample No. 716-R2

Lab Sample No. BC0827

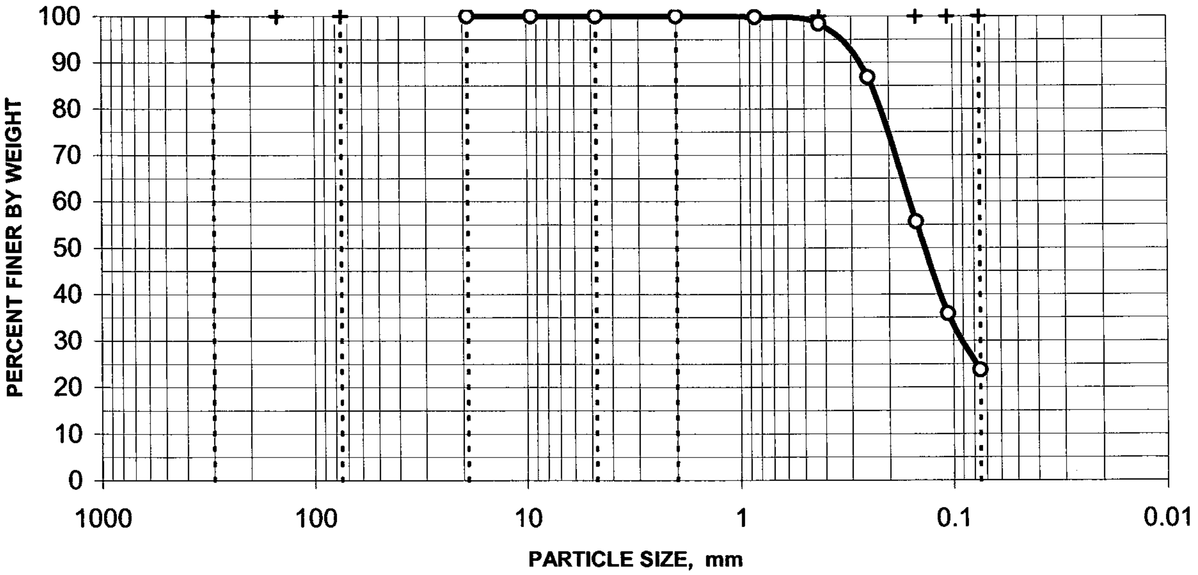
Moisture Content = 9.0%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	100.0%
	#4	4.750	100.0%
	#10	2.000	100.0%

	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	99.8%
	#40	0.425	98.4%
	#60	0.250	86.8%
	#100	0.149	55.6%
	#140	0.106	35.8%
	#200	0.075	23.7%

DISTRIBUTION CURVE



0.0% Gravel 76.3% Sand 23.7% Silt/Clay

PARTICLE-SIZE DISTRIBUTION
ASTM D 422

Project Name GEL - Moab

Project No. 109855.01210000

Field Sample No. 716-R9

Lab Sample No. BC0833

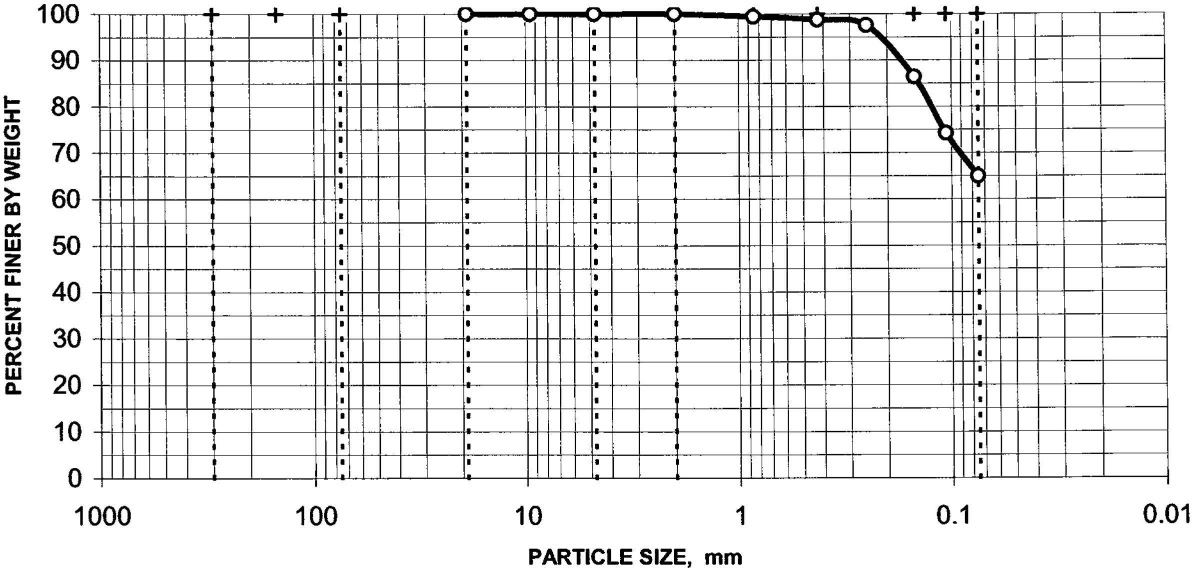
Moisture Content = 23.8%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	100.0%
	#4	4.750	100.0%
	#10	2.000	100.0%

	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	99.4%
	#40	0.425	98.7%
	#60	0.250	97.5%
	#100	0.149	86.4%
	#140	0.106	74.2%
	#200	0.075	64.9%

DISTRIBUTION CURVE



0.0% Gravel 35.1% Sand 64.9% Silt/Clay

PARTICLE-SIZE DISTRIBUTION
ASTM D 422

Project Name GEL - Moab

Project No. 109855.01210000

Field Sample No. 717-R10

Lab Sample No. BC0834

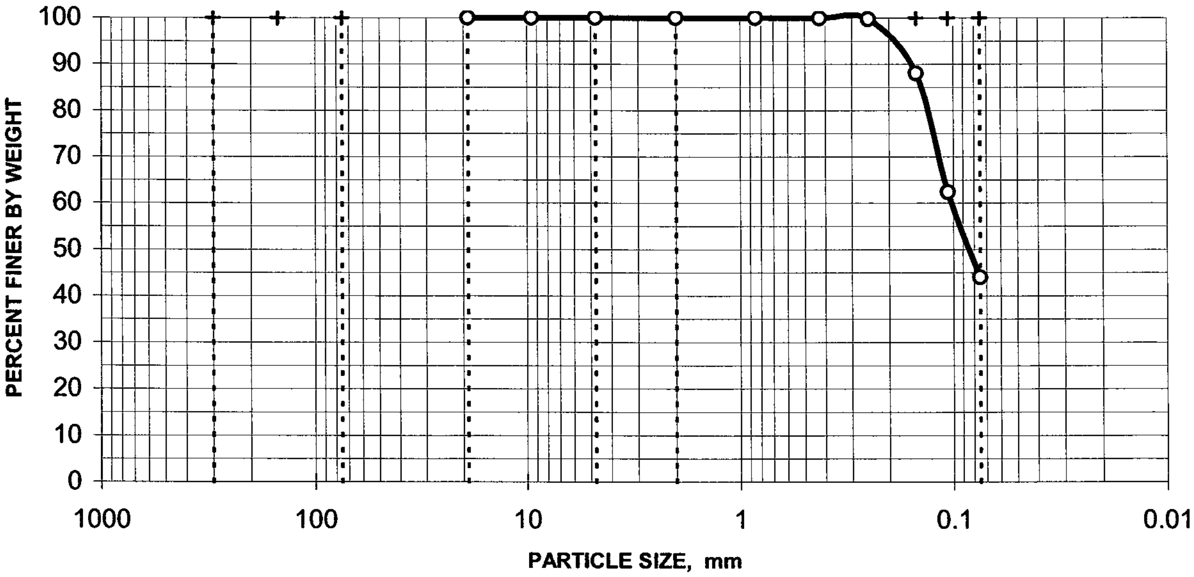
Moisture Content = 16.7%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	100.0%
	#4	4.750	100.0%
	#10	2.000	100.0%

	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	100.0%
	#40	0.425	100.0%
	#60	0.250	99.7%
	#100	0.149	88.0%
	#140	0.106	62.3%
	#200	0.075	44.0%

DISTRIBUTION CURVE



0.0% Gravel 56.0% Sand 44.0% Silt/Clay

PARTICLE-SIZE DISTRIBUTION
ASTM D 422

Project Name GEL - Moab

Project No. 109855.01210000

Field Sample No. 717-R2

Lab Sample No. BC0839

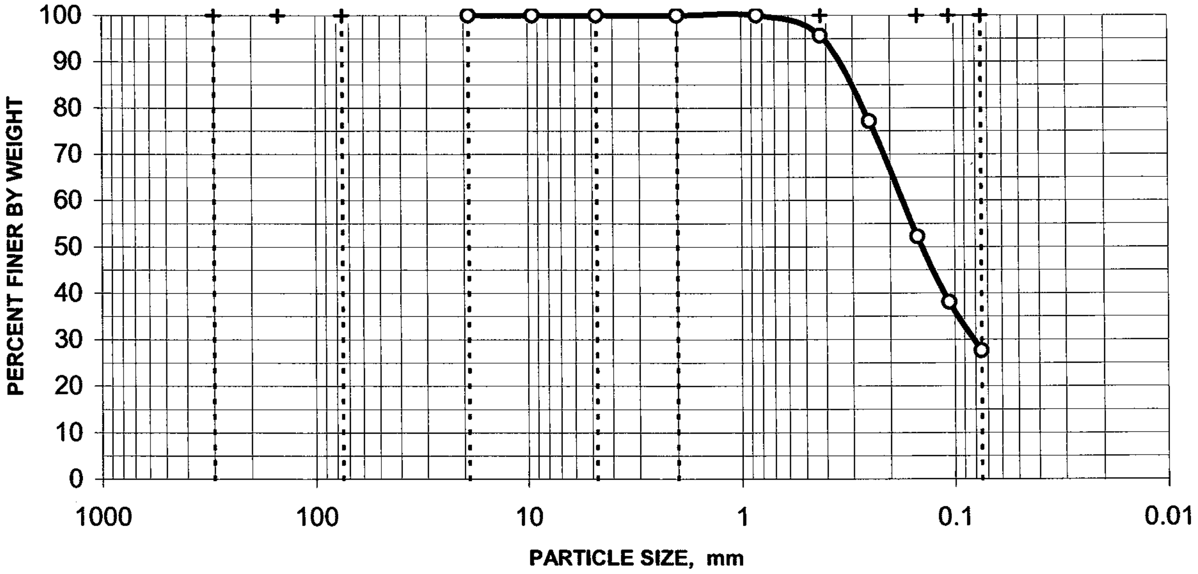
Moisture Content = 13.1%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	100.0%
	#4	4.750	100.0%
	#10	2.000	100.0%

	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	100.0%
	#40	0.425	95.6%
	#60	0.250	77.1%
	#100	0.149	52.2%
	#140	0.106	38.0%
	#200	0.075	27.6%

DISTRIBUTION CURVE



0.0% Gravel 72.4% Sand 27.6% Silt/Clay

PARTICLE-SIZE DISTRIBUTION
ASTM D 422

Project Name GEL - Moab

Project No. 109855.01210000

Field Sample No. 717-R21

Lab Sample No. BC0840

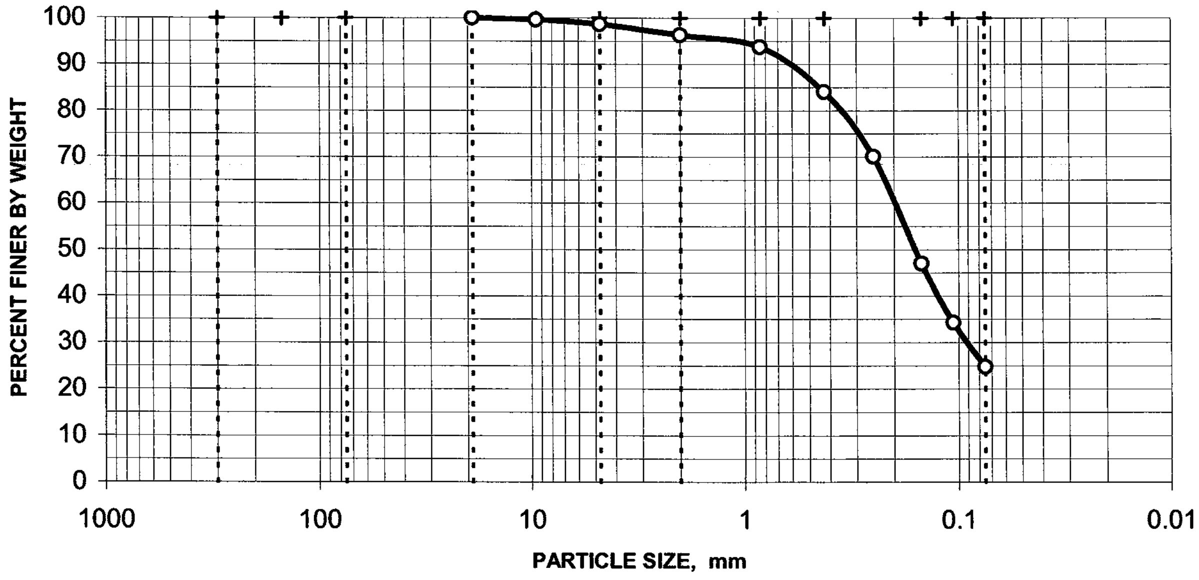
Moisture Content = 8.0%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	99.6%
	#4	4.750	98.6%
	#10	2.000	96.3%

	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	93.7%
	#40	0.425	84.0%
	#60	0.250	70.1%
	#100	0.149	47.0%
	#140	0.106	34.2%
	#200	0.075	24.8%

DISTRIBUTION CURVE



1.4% Gravel 73.8% Sand 24.8% Silt/Clay

PARTICLE-SIZE DISTRIBUTION
ASTM D 422

Project Name GEL - Moab

Project No. 109855.01210000

Field Sample No. 717-R6

Lab Sample No. BC0843

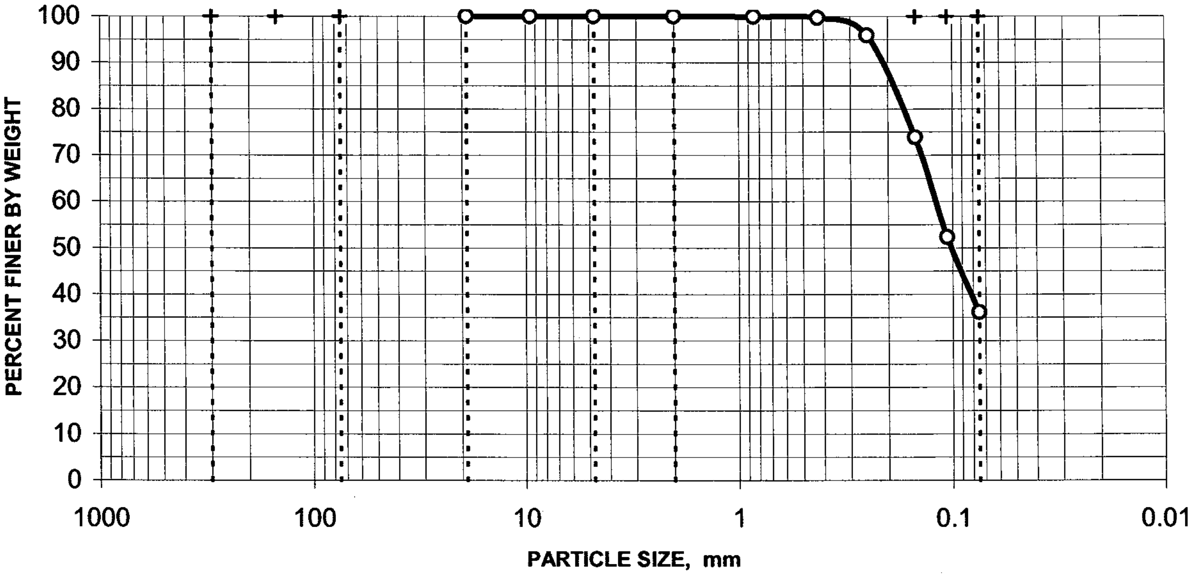
Moisture Content = 10.0%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	100.0%
	#4	4.750	100.0%
	#10	2.000	100.0%

	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	99.9%
	#40	0.425	99.7%
	#60	0.250	95.9%
	#100	0.149	73.9%
	#140	0.106	52.3%
	#200	0.075	36.1%

DISTRIBUTION CURVE



0.0% Gravel 63.9% Sand 36.1% Silt/Clay

PARTICLE-SIZE DISTRIBUTION
ASTM D 422

Project Name GEL - Moab

Project No. 109855.01210000

Field Sample No. 720-R1

Lab Sample No. BC0845

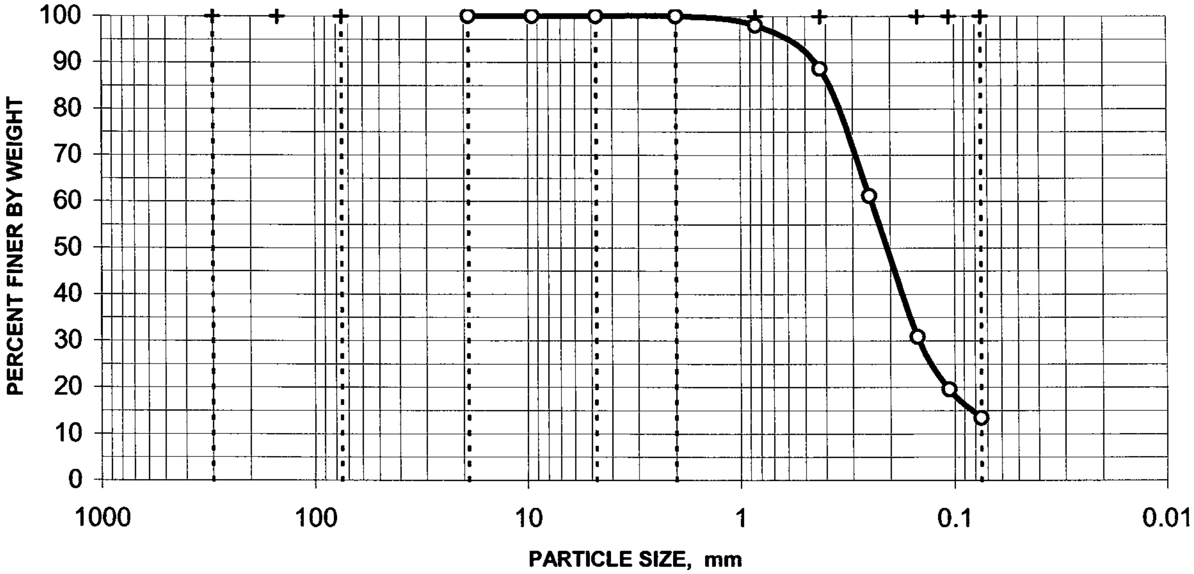
Moisture Content = 3.5%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	100.0%
	#4	4.750	100.0%
	#10	2.000	100.0%

	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	98.0%
	#40	0.425	88.7%
	#60	0.250	61.2%
	#100	0.149	30.9%
	#140	0.106	19.6%
	#200	0.075	13.4%

DISTRIBUTION CURVE



0.0% Gravel 86.6% Sand 13.4% Silt/Clay

PARTICLE-SIZE DISTRIBUTION
ASTM D 422

Project Name GEL - Moab

Project No. 109855.01210000

Field Sample No. 720-R16

Lab Sample No. BC0848

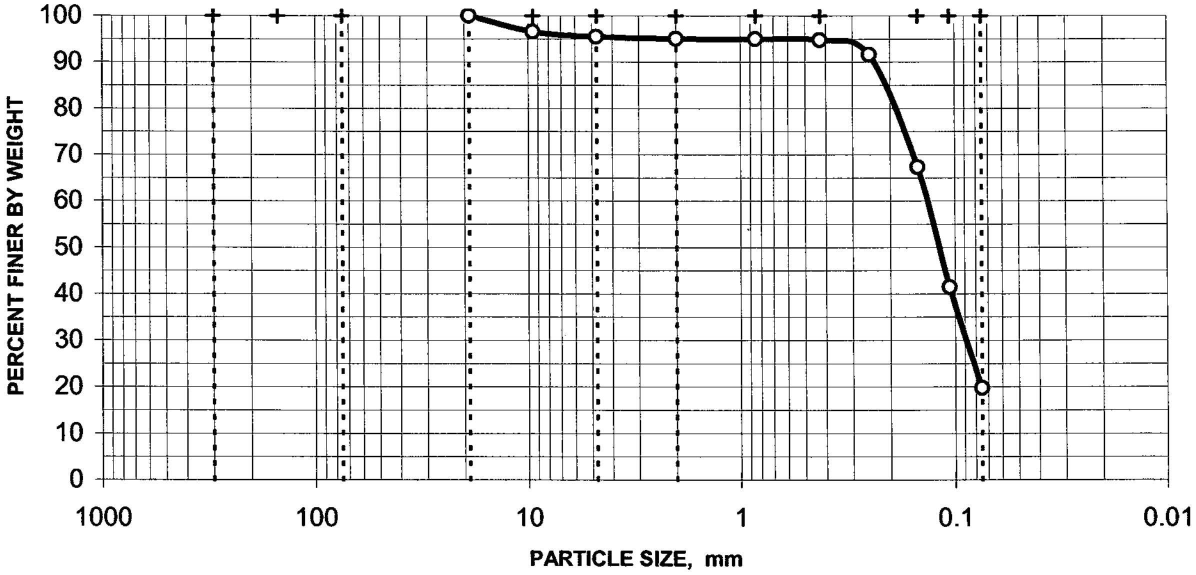
Moisture Content = 5.3%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	96.6%
	#4	4.750	95.4%
	#10	2.000	95.1%

	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	95.0%
	#40	0.425	94.8%
	#60	0.250	91.6%
	#100	0.149	67.3%
	#140	0.106	41.4%
	#200	0.075	19.7%

DISTRIBUTION CURVE



4.6% Gravel 75.7% Sand 19.7% Silt/Clay

PARTICLE-SIZE DISTRIBUTION
ASTM D 422

Project Name GEL - Moab

Project No. 109855.01210000

Field Sample No. 720-R4

Lab Sample No. BC0851

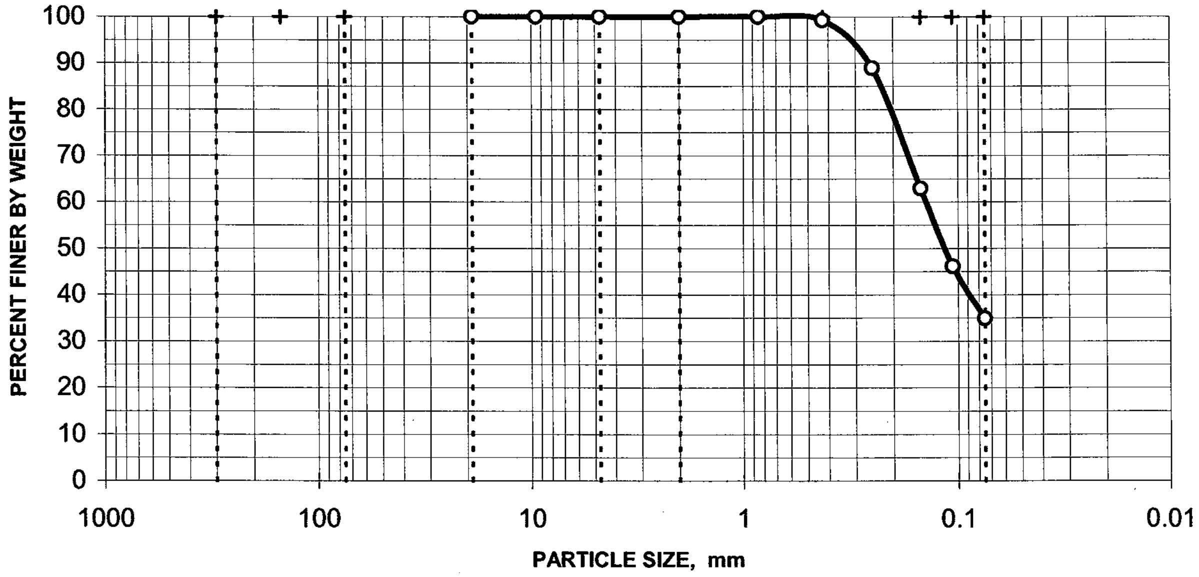
Moisture Content = 31.0%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	100.0%
	#4	4.750	100.0%
	#10	2.000	100.0%

	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	100.0%
	#40	0.425	99.2%
	#60	0.250	88.9%
	#100	0.149	62.9%
	#140	0.106	46.1%
	#200	0.075	34.9%

DISTRIBUTION CURVE



0.0% Gravel 65.1% Sand 34.9% Silt/Clay

PARTICLE-SIZE DISTRIBUTION
ASTM D 422

Project Name GEL - Moab

Project No. 109855.01210000

Field Sample No. 720-R8

Lab Sample No. BC0855

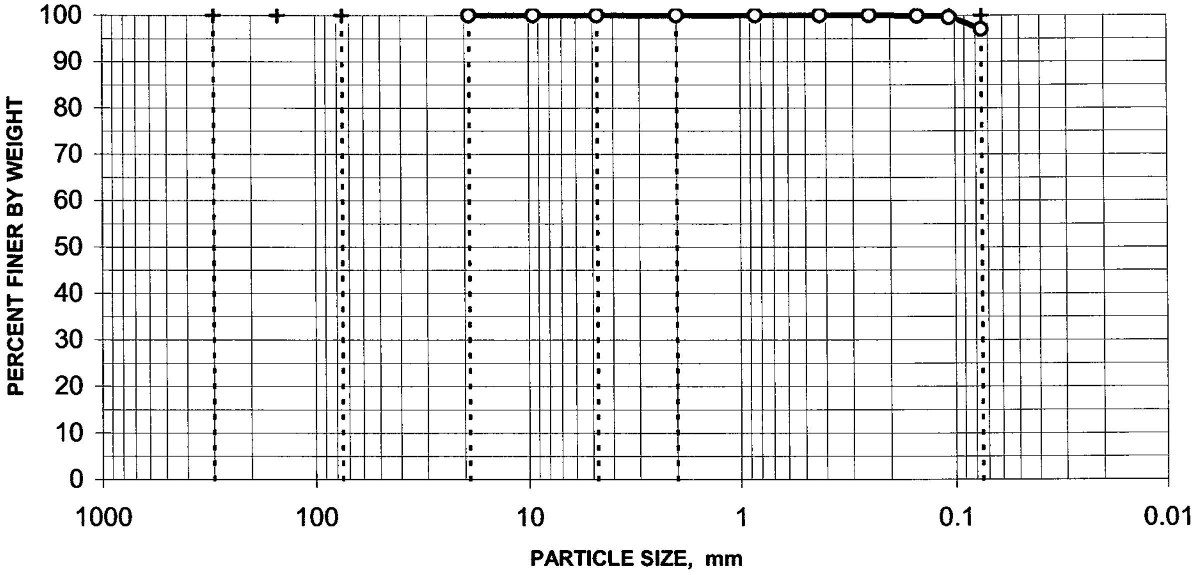
Moisture Content = 25.5%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	100.0%
	#4	4.750	100.0%
	#10	2.000	100.0%

	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	100.0%
	#40	0.425	100.0%
	#60	0.250	100.0%
	#100	0.149	99.9%
	#140	0.106	99.5%
	#200	0.075	97.0%

DISTRIBUTION CURVE



0.0% Gravel 3.0% Sand 97.0% Silt/Clay

PARTICLE-SIZE DISTRIBUTION
ASTM D 422

Project Name GEL - Moab

Project No. 109855.01210000

Field Sample No. 722-R6

Lab Sample No. BC0858

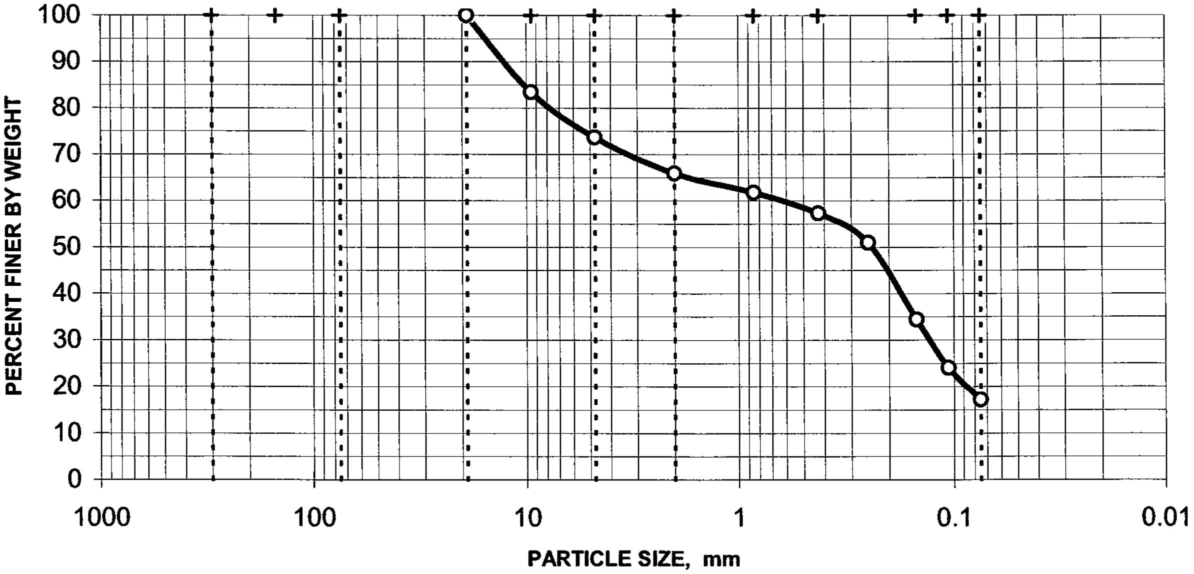
Moisture Content = 7.5%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	83.4%
	#4	4.750	73.6%
	#10	2.000	65.8%

	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	61.8%
	#40	0.425	57.3%
	#60	0.250	50.9%
	#100	0.149	34.4%
	#140	0.106	24.0%
	#200	0.075	17.2%

DISTRIBUTION CURVE



26.4% Gravel 56.4% Sand 17.2% Silt/Clay

PARTICLE-SIZE ANALYSIS
ASTM D 422

Project Name	Client Sample No.
GEL - Moab	722-R8
Project No.	Lab Sample No.
109855.01210000	BC0860
Specific Gravity = 2.7517	Moisture Content = 48.3% based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	100.0%
	#4	4.750	100.0%
	#10	2.000	100.0%

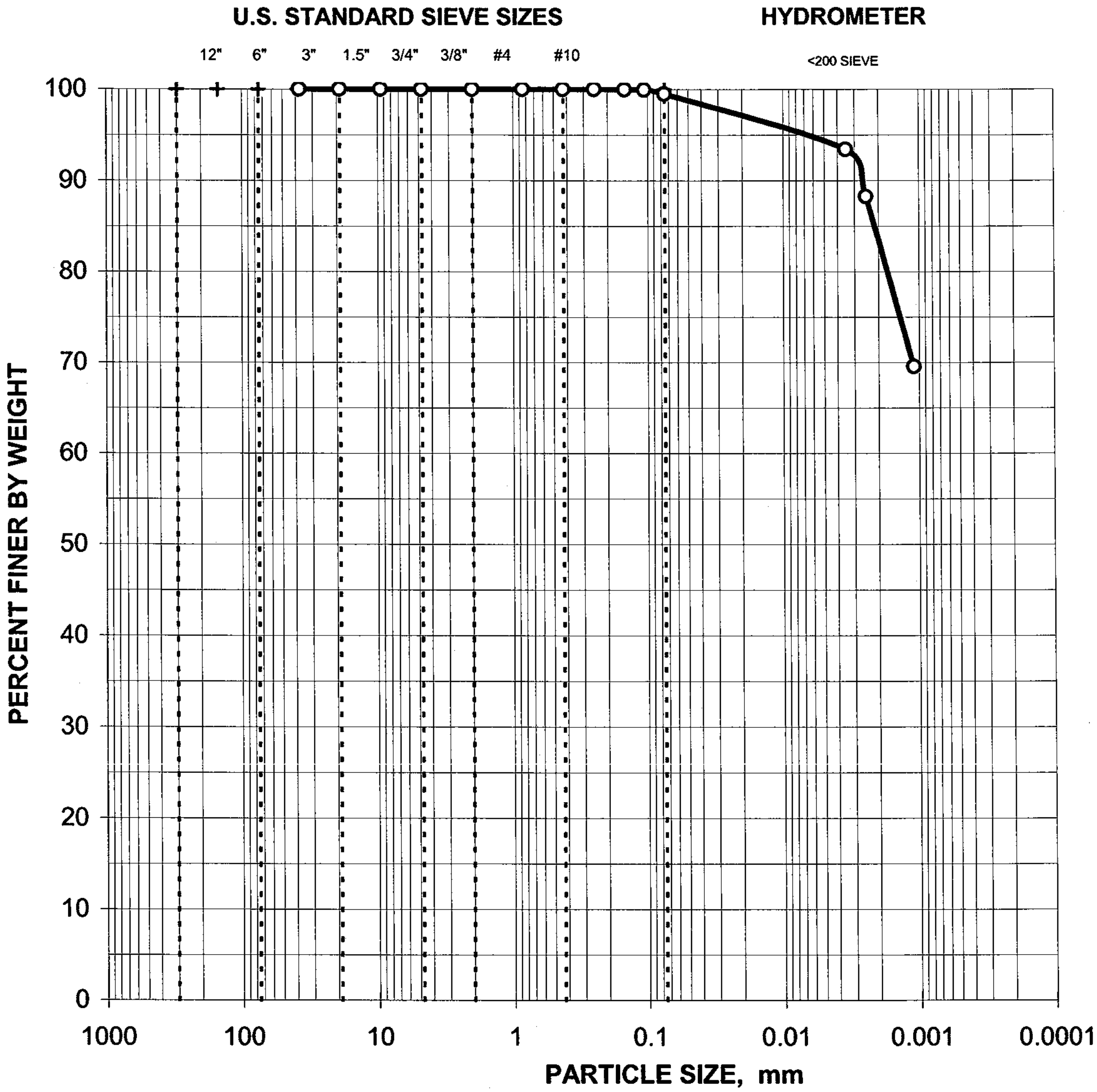
	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	100.0%
	#40	0.425	100.0%
	#60	0.250	100.0%
	#100	0.149	100.0%
	#140	0.106	99.9%
	#200	0.075	99.5%

HYDROMETER ANALYSIS

	Diameter mm	Percent Finer
HYDROMETER		
	0.00347	93.4%
	0.00246	88.2%
	0.00110	69.6%

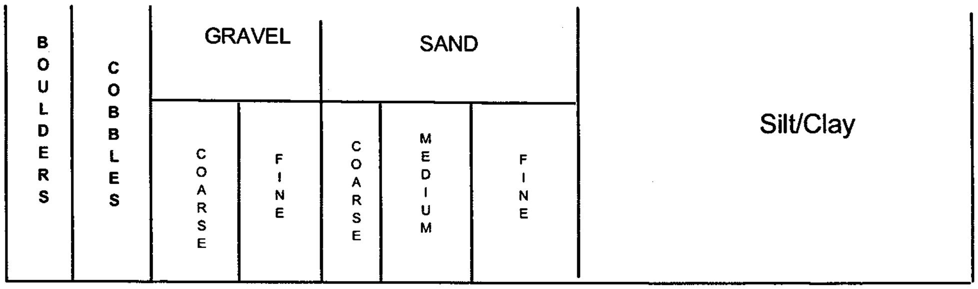
0.0% Gravel 0.5% Sand 99.5% Silt/Clay

GEL - Moab



CLIENT SAMPLE NO.: 722-R8

LAB SAMPLE NO.: BC0860



PARTICLE-SIZE ANALYSIS
ASTM D 422

Project Name
GEL - Moab
Project No.
109855.01210000

Client Sample No.
723-R2
Lab Sample No.
BC0861

Specific Gravity = 2.8811

Moisture Content = 100.6%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	100.0%
	#4	4.750	100.0%
	#10	2.000	100.0%

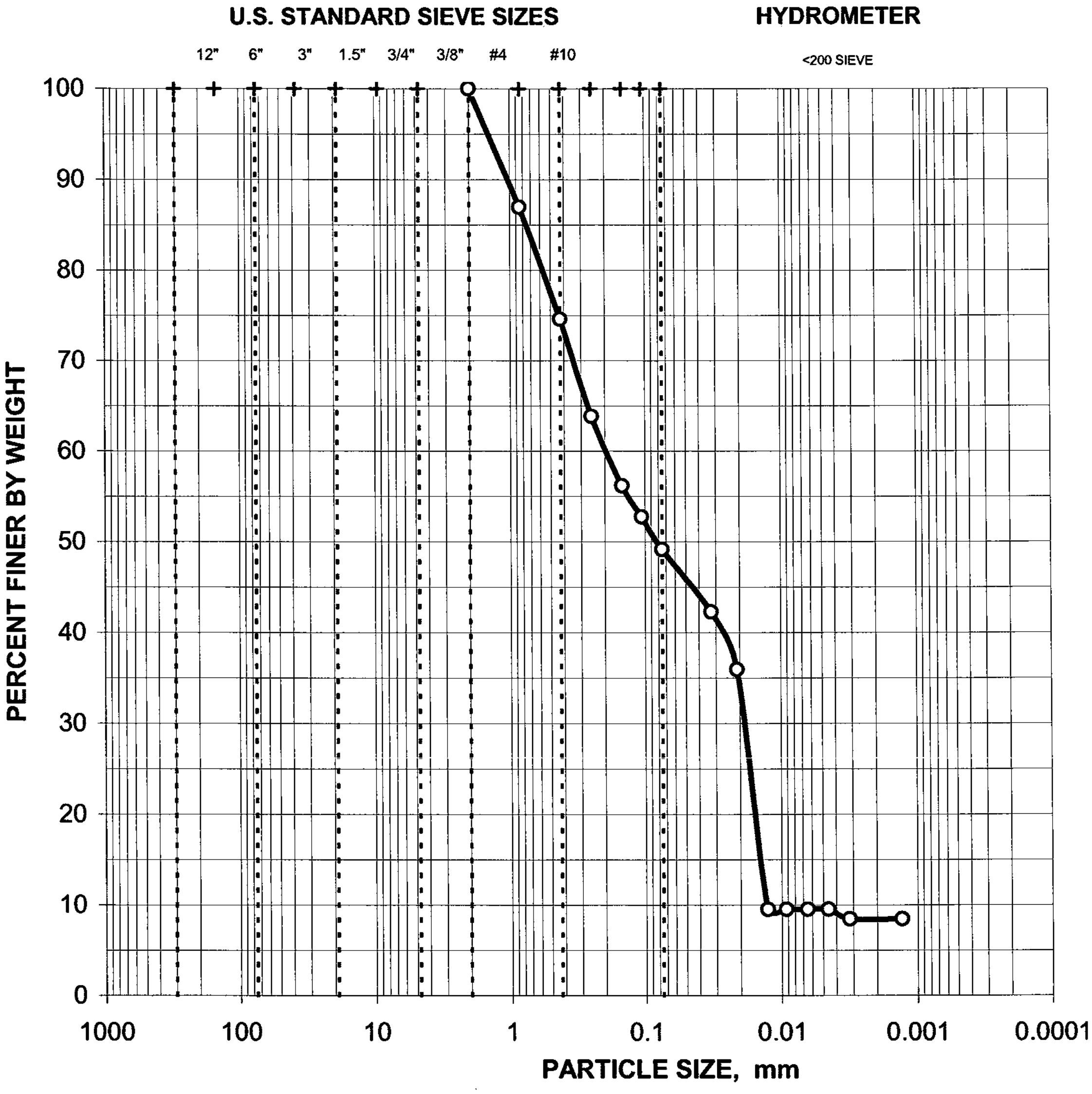
	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	87.0%
	#40	0.425	74.6%
	#60	0.250	63.8%
	#100	0.149	56.2%
	#140	0.106	52.7%
	#200	0.075	49.1%

HYDROMETER ANALYSIS

	Diameter mm	Percent Finer
HYDROMETER		
	0.03249	42.3%
	0.02097	35.9%
	0.01266	9.5%
	0.00925	9.5%
	0.00646	9.5%
	0.00457	9.5%
	0.00317	8.5%
	0.00130	8.5%

0.0% Gravel 50.9% Sand 49.1% Silt/Clay

GEL - Moab



CLIENT SAMPLE NO.: 723-R2

LAB SAMPLE NO.: BC0861

BOULDERS	COBBLES	GRAVEL		SAND			Silt/Clay
		COARSE	FINE	COARSE	MEDIUM	FINE	

PARTICLE-SIZE DISTRIBUTION
ASTM D 422

Project Name GEL - Moab

Project No. 109855.01210000

Field Sample No. 723-R4

Lab Sample No. BC0863

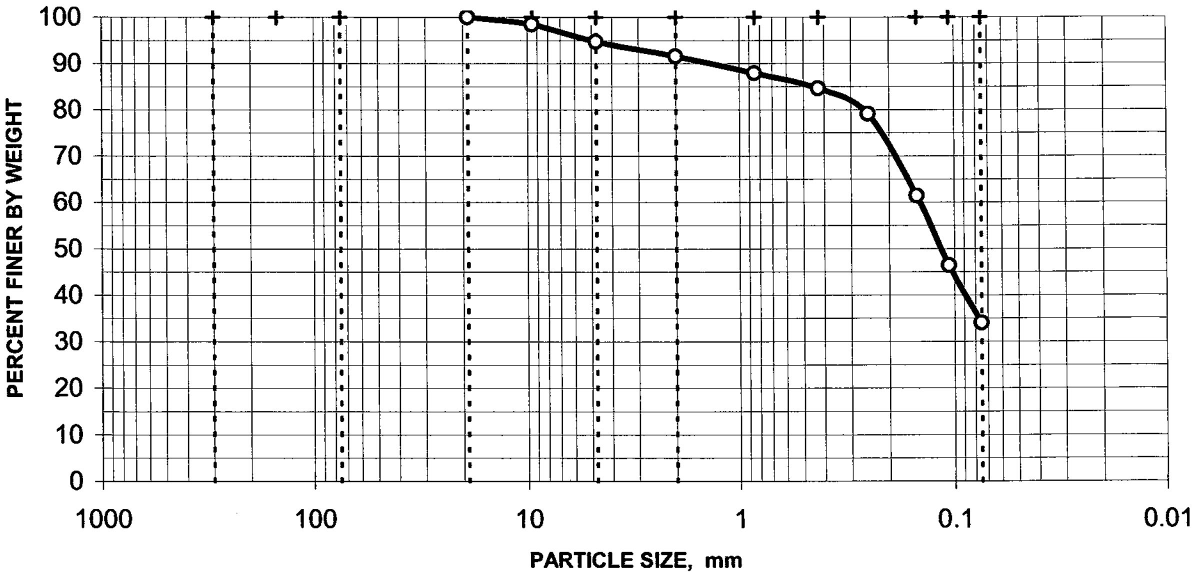
Moisture Content = 5.0%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	98.4%
	#4	4.750	94.7%
	#10	2.000	91.6%

	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	87.9%
	#40	0.425	84.6%
	#60	0.250	79.1%
	#100	0.149	61.4%
	#140	0.106	46.4%
	#200	0.075	34.0%

DISTRIBUTION CURVE



5.3% Gravel 60.7% Sand 34.0% Silt/Clay

PARTICLE-SIZE DISTRIBUTION
ASTM D 422

Project Name	GEL - Moab	Field Sample No.	723-R6
Project No.	109855.01210000	Lab Sample No.	BC0865

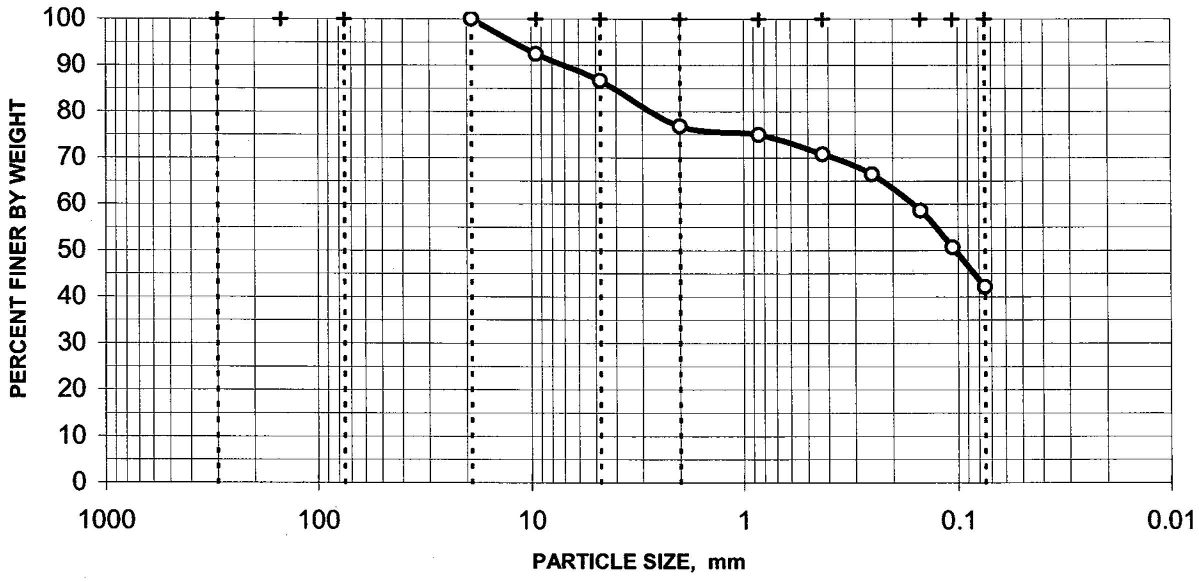
Moisture Content = 7.2%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	92.4%
	#4	4.750	86.7%
	#10	2.000	76.8%

	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	74.9%
	#40	0.425	70.8%
	#60	0.250	66.4%
	#100	0.149	58.6%
	#140	0.106	50.6%
	#200	0.075	42.1%

DISTRIBUTION CURVE



13.3% Gravel 44.5% Sand 42.1% Silt/Clay

PARTICLE-SIZE DISTRIBUTION
ASTM D 422

Project Name GEL - Moab

Project No. 109855.01210000

Field Sample No. 723-R8

Lab Sample No. BC0867

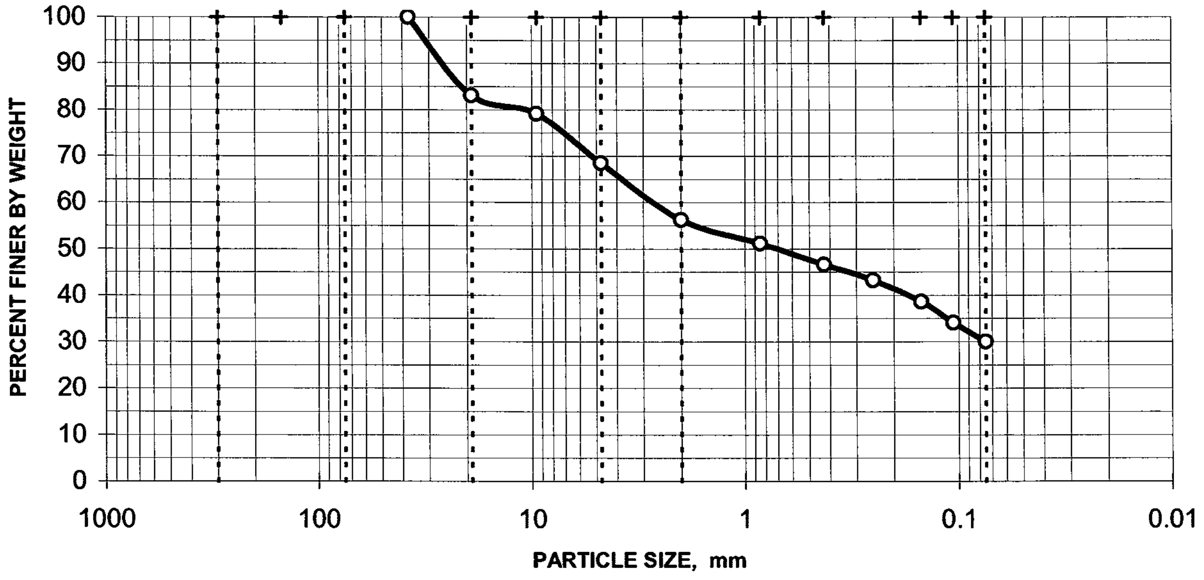
Moisture Content = 5.2%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	83.1%
	0.375"	9.500	79.1%
	#4	4.750	68.5%
	#10	2.000	56.2%

	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	51.2%
	#40	0.425	46.6%
	#60	0.250	43.2%
	#100	0.149	38.6%
	#140	0.106	34.1%
	#200	0.075	30.0%

DISTRIBUTION CURVE



31.5% Gravel 38.5% Sand 30.0% Silt/Clay

PARTICLE-SIZE ANALYSIS
ASTM D 422

Project Name
GEL - Moab
Project No.
109855.01210000

Client Sample No.
GATP-10-1
Lab Sample No.
BC0868

Specific Gravity = 2.7023

Moisture Content = 5.9%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	99.5%
	0.375"	9.500	96.6%
	#4	4.750	94.1%
	#10	2.000	91.3%

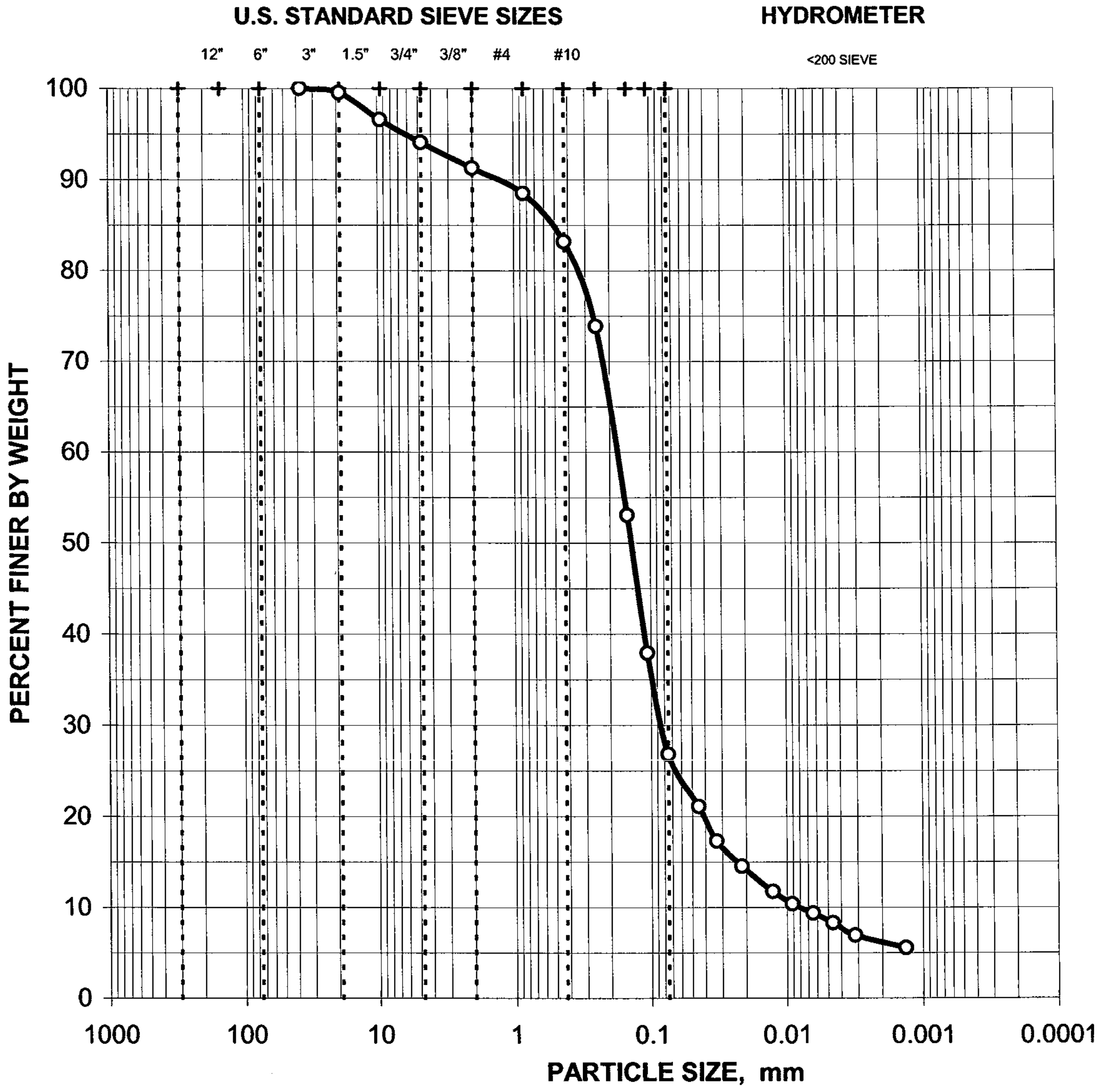
	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	88.5%
	#40	0.425	83.2%
	#60	0.250	73.9%
	#100	0.149	53.0%
	#140	0.106	37.9%
	#200	0.075	26.8%

HYDROMETER ANALYSIS

	Diameter mm	Percent Finer
HYDROMETER	0.05956	26.3%
	0.04480	21.1%
	0.03304	17.3%
	0.02154	14.5%
	0.01274	11.8%
	0.00915	10.4%
	0.00644	9.3%
	0.00459	8.3%
	0.00315	6.9%
	0.00134	5.5%

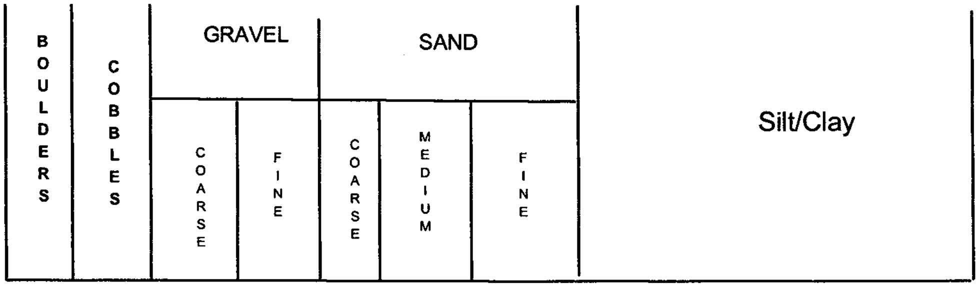
5.9% Gravel 67.3% Sand 26.8% Silt/Clay

GEL - Moab



CLIENT SAMPLE NO.: GATP-10-1

LAB SAMPLE NO.: BC0868



PARTICLE-SIZE ANALYSIS
ASTM D 422

Project Name
GEL - Moab
Project No.
109855.01210000

Client Sample No.
GATP-10-2
Lab Sample No.
BC0869

Specific Gravity = 2.7257

Moisture Content = 9.6%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	92.9%
	0.75"	19.000	90.6%
	0.375"	9.500	88.7%
	#4	4.750	87.0%
	#10	2.000	85.3%

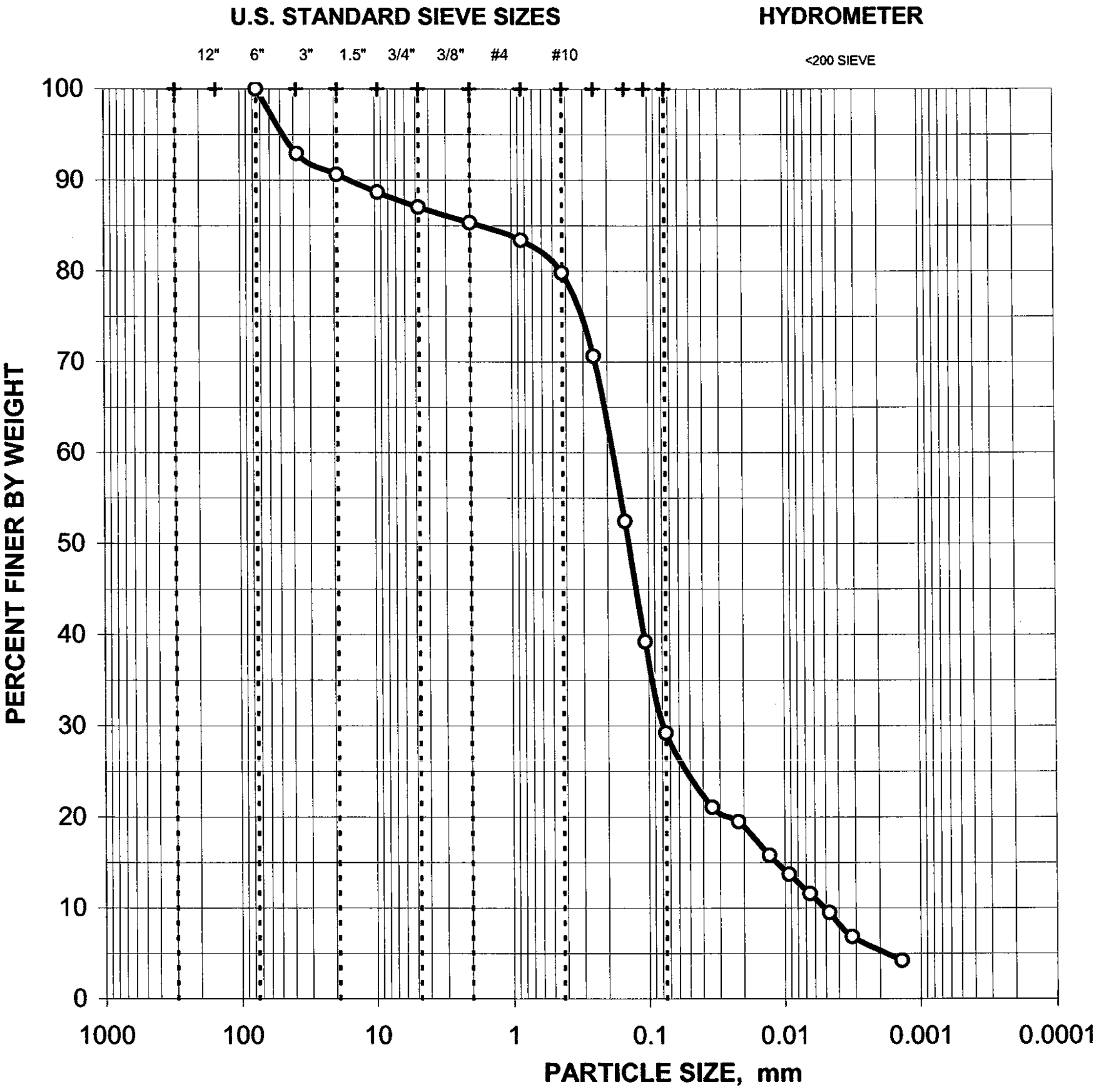
	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	83.4%
	#40	0.425	79.8%
	#60	0.250	70.6%
	#100	0.149	52.4%
	#140	0.106	39.2%
	#200	0.075	29.2%

HYDROMETER ANALYSIS

	Diameter mm	Percent Finer
HYDROMETER		
	0.04693	25.8%
	0.03419	21.1%
	0.02190	19.5%
	0.01295	15.8%
	0.00926	13.7%
	0.00654	11.6%
	0.00467	9.5%
	0.00319	6.8%
	0.00138	4.2%

13.0% Gravel	57.8% Sand	29.2% Silt/Clay

GEL - Moab



CLIENT SAMPLE NO.: GATP-10-2

LAB SAMPLE NO.: BC0869

BOULDERS	COBBLES	GRAVEL		SAND			Silt/Clay
		COARSE	FINE	COARSE	MEDIUM	FINE	

PARTICLE-SIZE ANALYSIS
ASTM D 422

Project Name
GEL - Moab
Project No.
109855.01210000

Client Sample No.
713-R11
Lab Sample No.
BC0870

Specific Gravity = 2.7078

Moisture Content = 9.8%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	99.4%
	#4	4.750	97.4%
	#10	2.000	96.7%

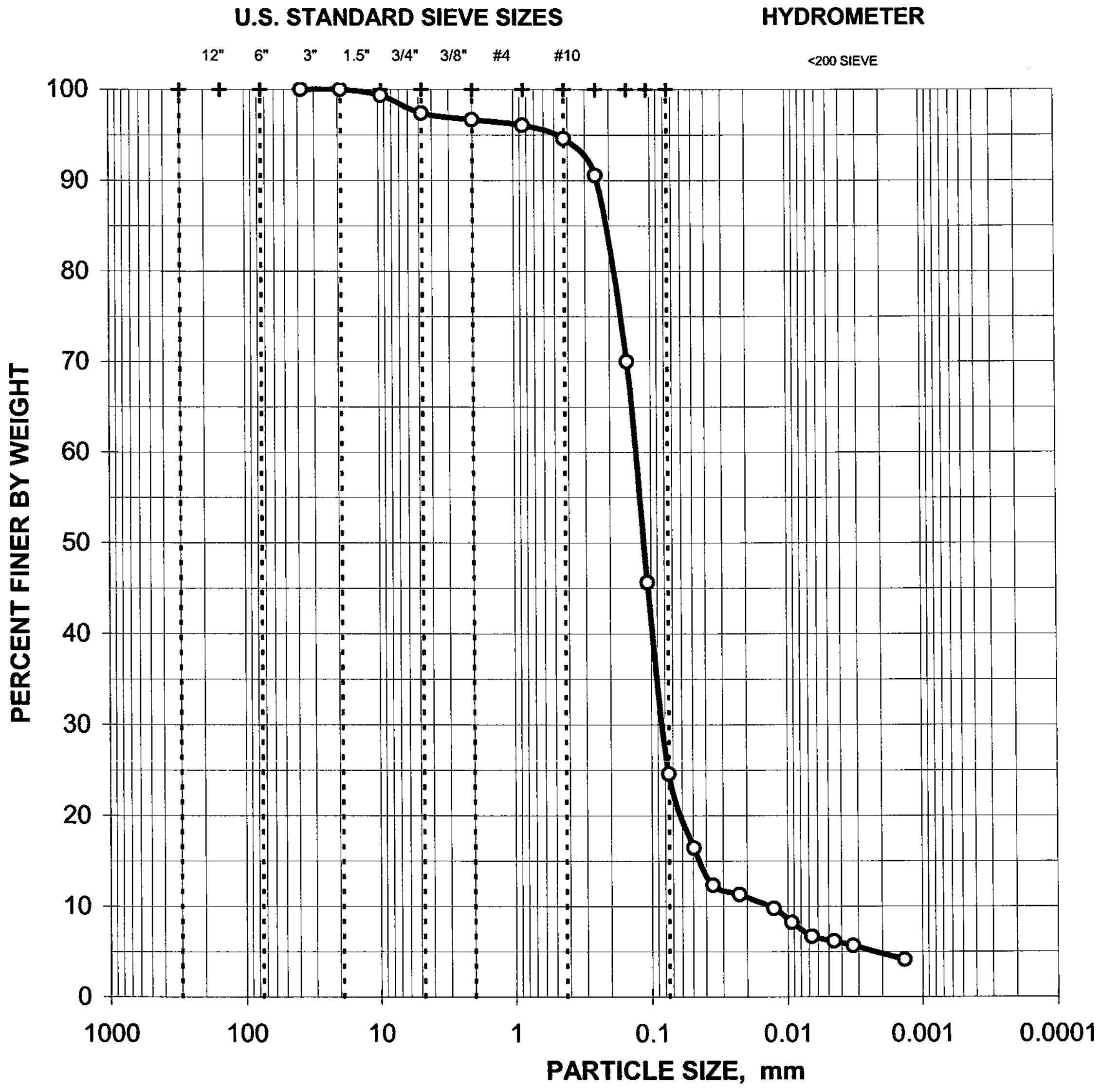
	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	96.1%
	#40	0.425	94.6%
	#60	0.250	90.5%
	#100	0.149	70.0%
	#140	0.106	45.6%
	#200	0.075	24.6%

HYDROMETER ANALYSIS

	Diameter mm	Percent Finer
HYDROMETER		
	0.04930	16.4%
	0.03567	12.3%
	0.02273	11.3%
	0.01264	9.8%
	0.00933	8.2%
	0.00664	6.7%
	0.00453	6.2%
	0.00328	5.7%
	0.00136	4.1%

2.6% Gravel 72.8% Sand 24.6% Silt/Clay

GEL - Moab



CLIENT SAMPLE NO.: 713-R11

LAB SAMPLE NO.: BC0870

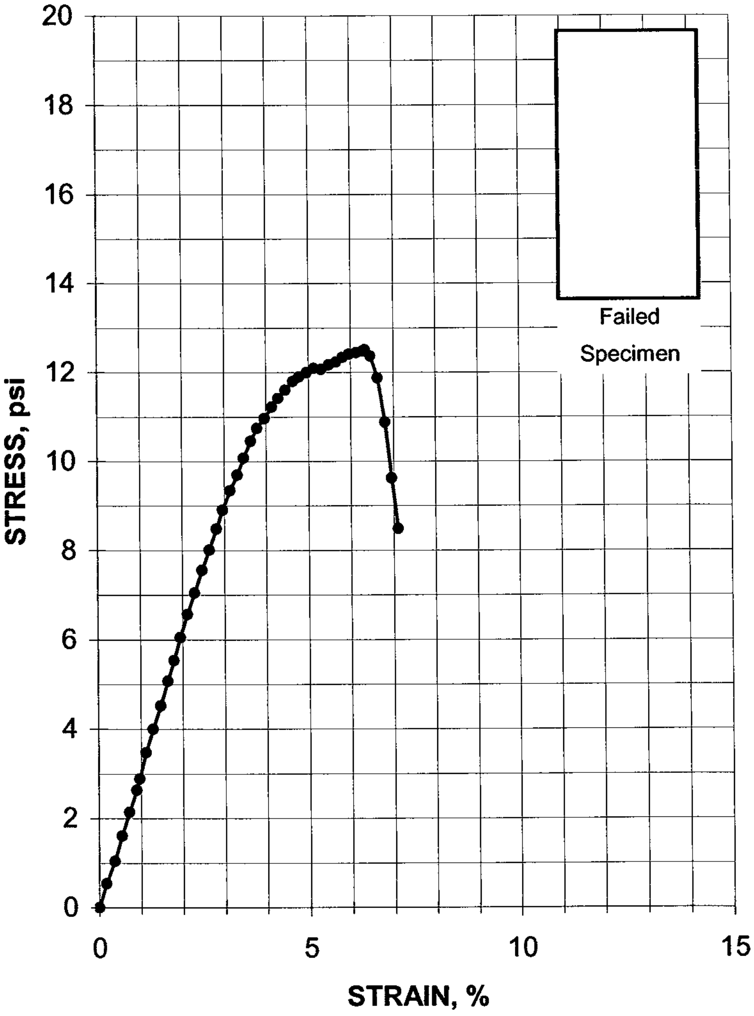
BOULDERS	COBBLES	GRAVEL		SAND			Silt/Clay
		COARSE	FINE	COARSE	MEDIUM	FINE	

UNCONFINED COMPRESSIVE STRENGTH
ASTM D 2166

Project Name	GEL - Moab	Client Sample No.	700-R12
Project No.	109855.01210000	Lab Specimen No.	BC0749

Specimen Collection Date	11/6/2005	Specimen Height, in.	4.0092
Specimen Test Date	3/2/2006	Specimen Diameter, in.	2.0065
		Specimen Weight, g.	374.34
STRESS AT FAILURE, psi	**12.5**	Moisture Content, %	44.6
STRAIN AT FAILURE, %	**6.3**	Wet Unit Weight, pcf.	112.5
		Dry Unit Weight, pcf.	77.8
		Rate of Strain, in./min.	0.0250

AXIAL STRAIN, %	DEVIATOR STRESS, psi
0.00	0.0
0.17	0.5
0.55	1.6
0.90	2.6
1.12	3.5
1.47	4.5
1.80	5.5
2.12	6.6
2.47	7.6
2.82	8.5
3.14	9.3
3.47	10.1
3.79	10.7
4.14	11.2
4.46	11.6
4.79	11.9
5.14	12.1
5.49	12.2
5.81	12.3
6.14	12.4
6.34	12.5
6.63	11.9
6.96	9.6



UNCONFINED COMPRESSIVE STRENGTH
ASTM D 2166

Project Name GEL - Moab
Project No. 109855.01210000

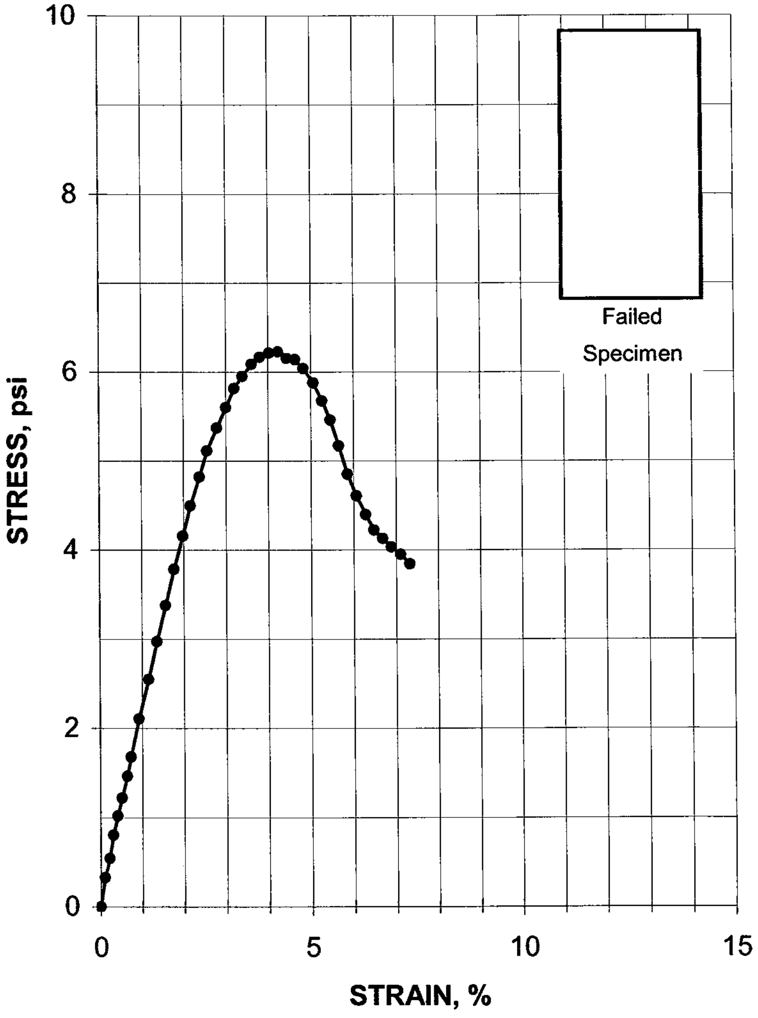
Client Sample No. 700-R30
Lab Specimen No. BC0753

Specimen Collection Date 11/30/2005
Specimen Test Date 3/1/2006

STRESS AT FAILURE, psi 6.2
STRAIN AT FAILURE, % 4.2

Specimen Height, in. 5.5865
Specimen Diameter, in. 2.8643
Specimen Weight, g. 1126.06
Moisture Content, % 31.7
Wet Unit Weight, pcf. 119.2
Dry Unit Weight, pcf. 90.5
Rate of Strain, in./min. 0.0380

AXIAL STRAIN, %	DEVIATOR STRESS, psi
0.00	0.0
0.11	0.3
0.30	0.8
0.52	1.2
0.73	1.7
1.16	2.5
1.58	3.4
1.99	4.2
2.38	4.8
2.79	5.4
3.20	5.8
3.62	6.1
4.03	6.2
4.44	6.2
4.83	6.0
5.26	5.7
5.66	5.2
6.07	4.6
6.48	4.2
6.89	4.0
7.32	3.8



UNCONFINED COMPRESSIVE STRENGTH
ASTM D 2166

Project Name GEL - Moab
Project No. 109855.01210000

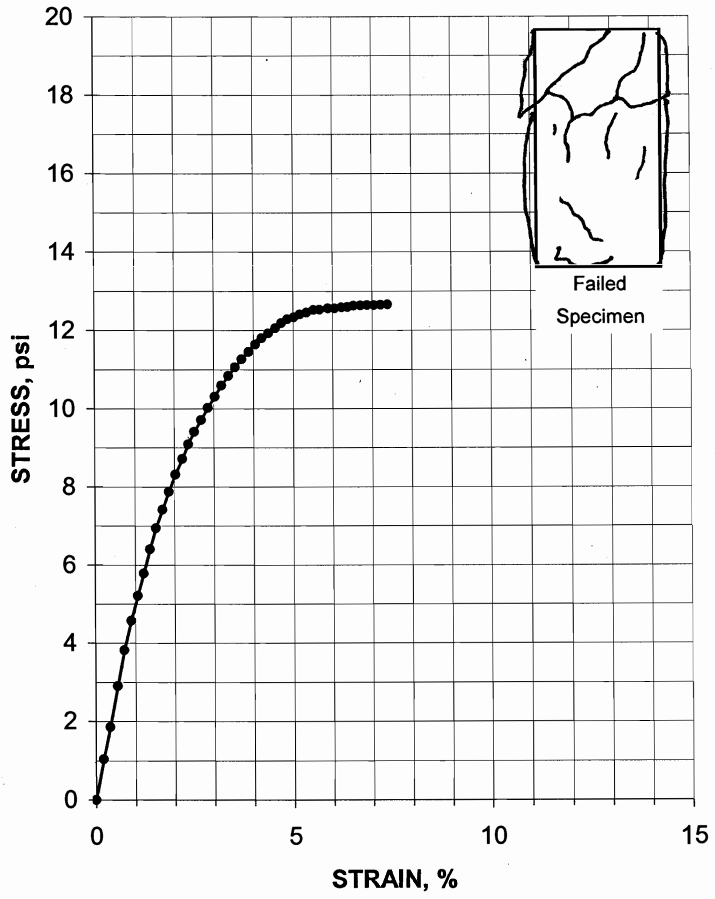
Client Sample No. 700-R39
Lab Specimen No. BC0755

Specimen Collection Date 11/6/2005
Specimen Test Date 3/1/2006

STRESS AT FAILURE, psi **12.7**
STRAIN AT FAILURE, % **7.6**

Specimen Height, in. 5.8132
Specimen Diameter, in. 2.8652
Specimen Weight, g. 1141.91
Moisture Content, % 36.0
Wet Unit Weight, pcf. 116.1
Dry Unit Weight, pcf. 85.3
Rate of Strain. in./min. 0.0580

AXIAL STRAIN, %	DEVIATOR STRESS, psi
0.00	0.0
0.19	1.0
0.55	2.9
0.89	4.6
1.22	5.8
1.53	6.9
1.86	7.9
2.20	8.7
2.51	9.4
2.86	10.0
3.20	10.6
3.54	11.1
3.89	11.4
4.21	11.8
4.56	12.0
4.87	12.3
5.18	12.4
5.52	12.5
5.88	12.6
6.23	12.6
6.54	12.6
6.88	12.6
7.22	12.6
7.57	12.7
7.90	12.6
8.22	12.6
8.55	12.6
8.91	12.4
9.07	11.9

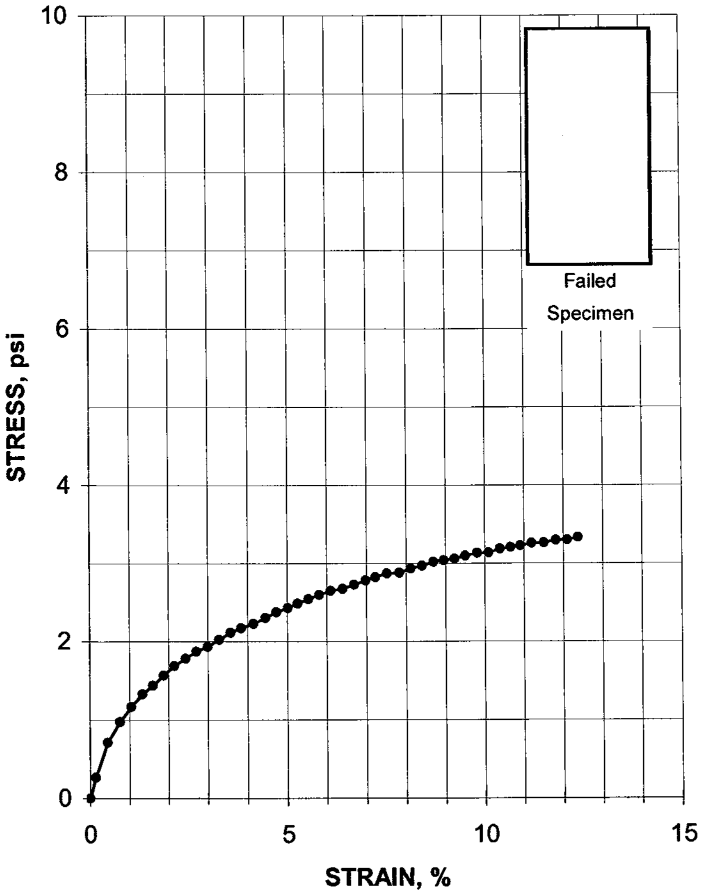


UNCONFINED COMPRESSIVE STRENGTH
ASTM D 2166

Project Name	GEL - Moab
Project No.	109855.01210000
Specimen Collection Date	11/30/2005
Specimen Test Date	3/1/2006
STRESS AT FAILURE, psi	**3.5**
STRAIN AT FAILURE, %	**15.2**

Client Sample No.	708-R15
Lab Specimen No.	BC0783
Specimen Height, in.	5.5435
Specimen Diameter, in.	2.7700
Specimen Weight, g.	915.25
Moisture Content, %	75.2
Wet Unit Weight, pcf.	104.4
Dry Unit Weight, pcf.	59.6
Rate of Strain. in./min.	0.0520

AXIAL STRAIN, %	DEVIATOR STRESS, psi
0.00	0.0
0.14	0.3
0.76	1.0
1.33	1.3
1.88	1.6
2.44	1.8
2.99	1.9
3.57	2.1
4.15	2.2
4.73	2.4
5.27	2.5
5.81	2.6
6.40	2.7
6.98	2.8
7.52	2.9
8.12	2.9
8.69	3.0
9.24	3.1
9.81	3.1
10.39	3.2
10.91	3.2
11.51	3.3
12.10	3.3
12.63	3.3
13.19	3.4
13.76	3.4
14.40	3.4
14.88	3.4
15.19	3.5

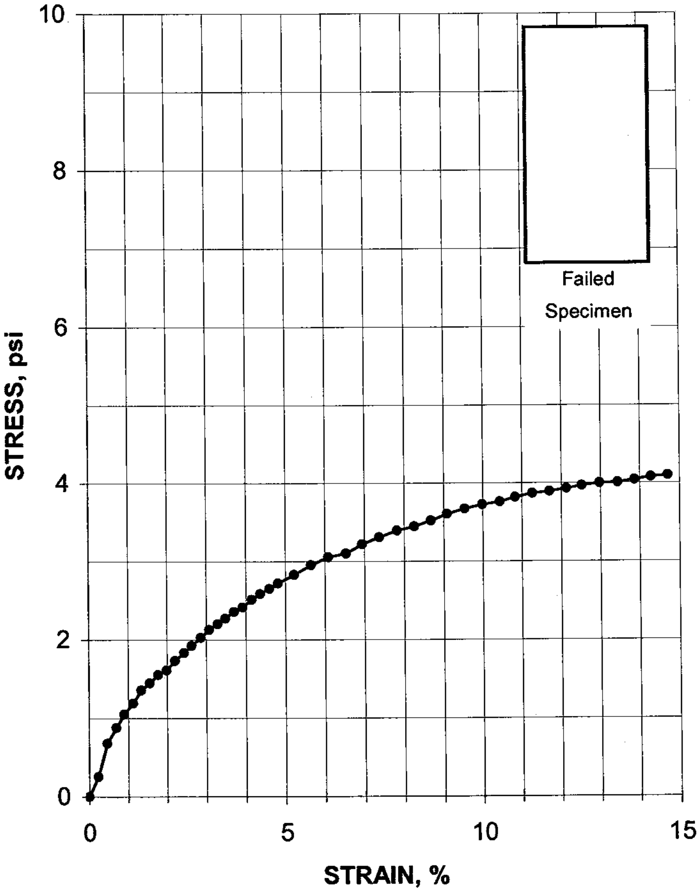


UNCONFINED COMPRESSIVE STRENGTH
ASTM D 2166

Project Name	GEL - Moab	Client Sample No.	708-R24
Project No.	109855.01210000	Lab Specimen No.	BC0785

Specimen Collection Date	11/30/2005	Specimen Height, in.	5.5872
Specimen Test Date	3/1/2006	Specimen Diameter, in.	2.8393
		Specimen Weight, g.	1067.42
STRESS AT FAILURE, psi	**4.1**	Moisture Content, %	41.0
STRAIN AT FAILURE, %	**14.7**	Wet Unit Weight, pcf.	115.0
		Dry Unit Weight, pcf.	81.6
		Rate of Strain. in./min.	0.048

AXIAL STRAIN, %	DEVIATOR STRESS, psi
0.00	0.0
0.23	0.3
0.70	0.9
1.13	1.2
1.56	1.4
1.99	1.6
2.43	1.8
2.86	2.0
3.29	2.2
3.70	2.4
4.15	2.5
4.60	2.7
5.23	2.8
6.09	3.1
6.94	3.2
7.82	3.4
8.68	3.5
9.54	3.7
10.43	3.8
11.28	3.9
12.13	3.9
12.98	4.0
13.87	4.0
14.71	4.1

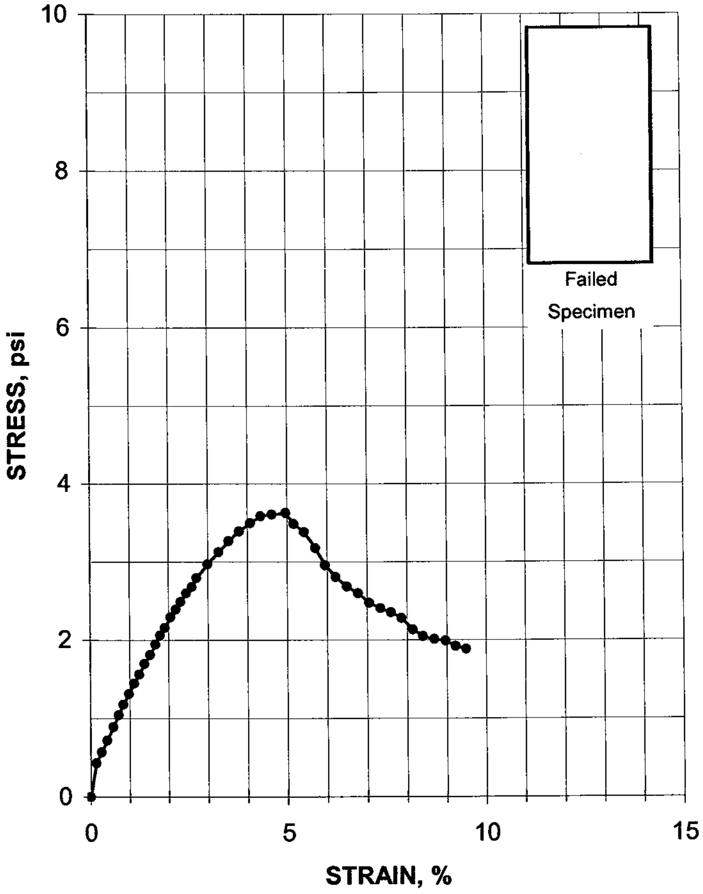


UNCONFINED COMPRESSIVE STRENGTH
ASTM D 2166

Project Name	GEL - Moab	Client Sample No.	708-R8
Project No.	109855.01210000	Lab Specimen No.	BC0787

Specimen Collection Date	11/30/2005	Specimen Height, in.	4.9730
Specimen Test Date	3/2/2006	Specimen Diameter, in.	2.7218
		Specimen Weight, g.	745.04
STRESS AT FAILURE, psi	**3.6**	Moisture Content, %	98.8
STRAIN AT FAILURE, %	**5.0**	Wet Unit Weight, pcf.	98.1
		Dry Unit Weight, pcf.	49.4
		Rate of Strain, in./min.	0.050

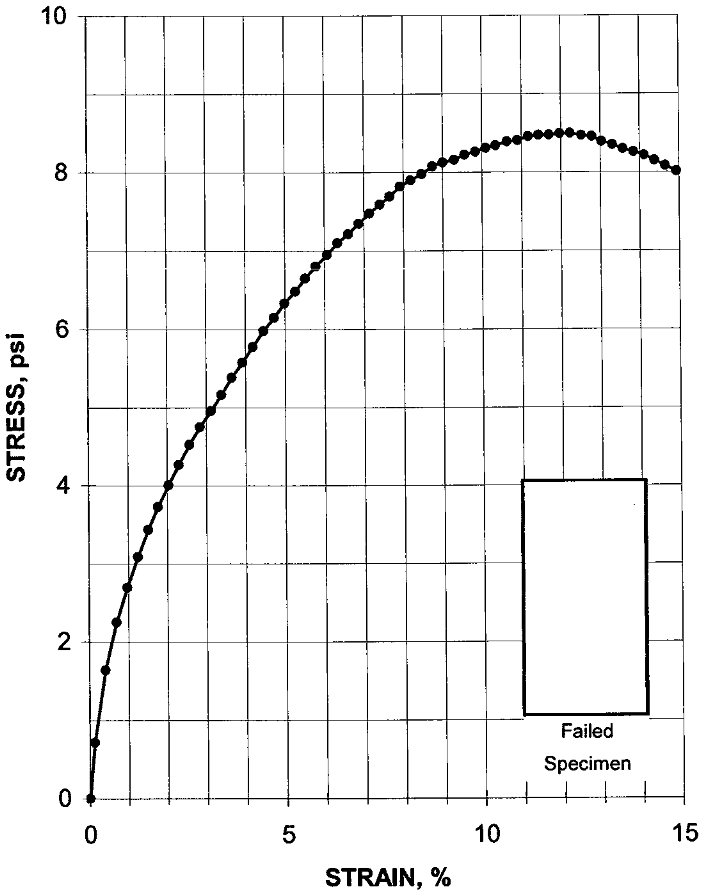
AXIAL STRAIN, %	DEVIATOR STRESS, psi
0.00	0.0
0.14	0.4
0.42	0.7
0.72	1.0
0.99	1.3
1.25	1.6
1.53	1.8
1.79	2.1
2.05	2.3
2.31	2.5
2.59	2.7
3.00	3.0
3.54	3.3
4.08	3.5
4.62	3.6
5.17	3.5
5.71	3.2
6.21	2.8
6.78	2.6
7.34	2.4
7.86	2.3
8.41	2.0
8.97	2.0
9.49	1.9
10.03	1.8
10.56	1.7
11.10	1.6



UNCONFINED COMPRESSIVE STRENGTH
ASTM D 2166

Project Name	GEL - Moab	Client Sample No.	715-R16
Project No.	109855.01210000	Lab Specimen No.	BC0817
Specimen Collection Date	11/10/2006	Specimen Height, in.	5.6028
Specimen Test Date	3/2/2006	Specimen Diameter, in.	2.7957
		Specimen Weight, g.	1043.48
STRESS AT FAILURE, psi	**8.5**	Moisture Content, %	30.8
STRAIN AT FAILURE, %	**12.2**	Wet Unit Weight, pcf.	115.6
		Dry Unit Weight, pcf.	88.4
		Rate of Strain, in./min.	0.056

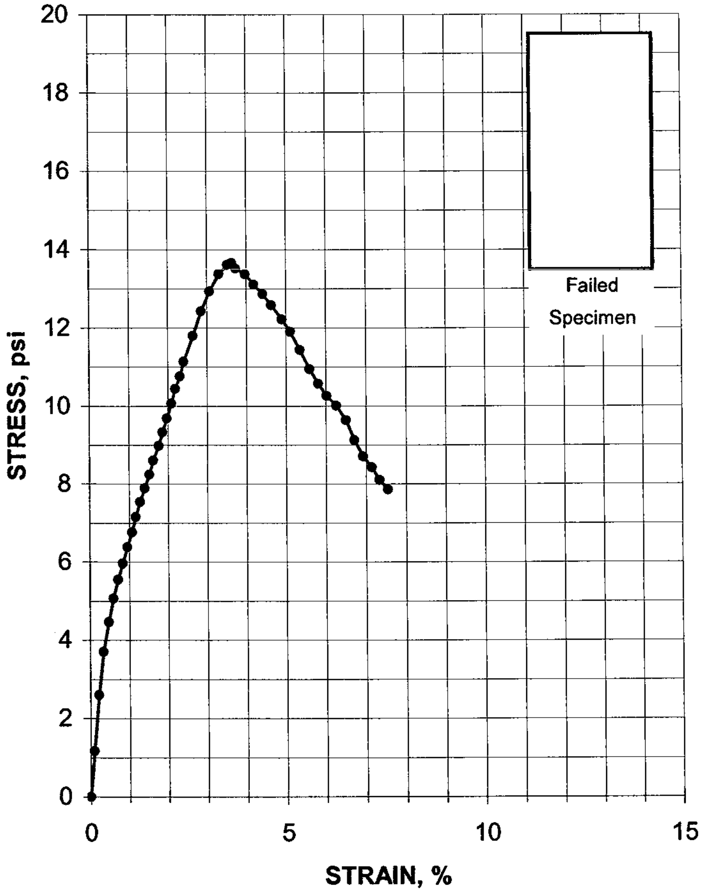
AXIAL STRAIN, %	DEVIATOR STRESS, psi
0.00	0.0
0.12	0.7
0.70	2.2
1.25	3.1
1.77	3.7
2.30	4.3
2.84	4.7
3.39	5.2
3.93	5.6
4.46	6.0
5.00	6.3
5.52	6.6
6.07	6.9
6.60	7.2
7.14	7.5
7.66	7.7
8.19	7.9
8.75	8.1
9.30	8.2
9.83	8.3
10.35	8.3
10.91	8.4
11.44	8.5
11.98	8.5
12.53	8.5
13.05	8.4
13.58	8.3
14.12	8.2
14.39	8.1



UNCONFINED COMPRESSIVE STRENGTH
ASTM D 2166

Project Name	GEL - Moab	Client Sample No.	715-R24
Project No.	109855.01210000	Lab Specimen No.	BC0819
Specimen Collection Date	11/10/2006	Specimen Height, in.	4.2003
Specimen Test Date	3/2/2006	Specimen Diameter, in.	2.0377
		Specimen Weight, g.	379.18
STRESS AT FAILURE, psi	**13.7**	Moisture Content, %	58.4
STRAIN AT FAILURE, %	**3.6**	Wet Unit Weight, pcf.	105.5
		Dry Unit Weight, pcf.	66.6
		Rate of Strain. in./min.	0.028

AXIAL STRAIN, %	DEVIATOR STRESS, psi
0.00	0.0
0.10	1.2
0.33	3.7
0.60	5.1
0.83	6.0
1.07	6.8
1.29	7.5
1.52	8.2
1.76	9.0
1.98	9.7
2.19	10.4
2.40	11.1
2.86	12.4
3.31	13.4
3.64	13.7
3.98	13.4
4.43	12.9
4.90	12.2
5.36	11.4
5.81	10.6
6.26	10.0
6.71	9.1
7.14	8.4
7.55	7.9



UNCONFINED COMPRESSIVE STRENGTH
ASTM D 2166

Project Name GEL - Moab
Project No. 109855.01210000

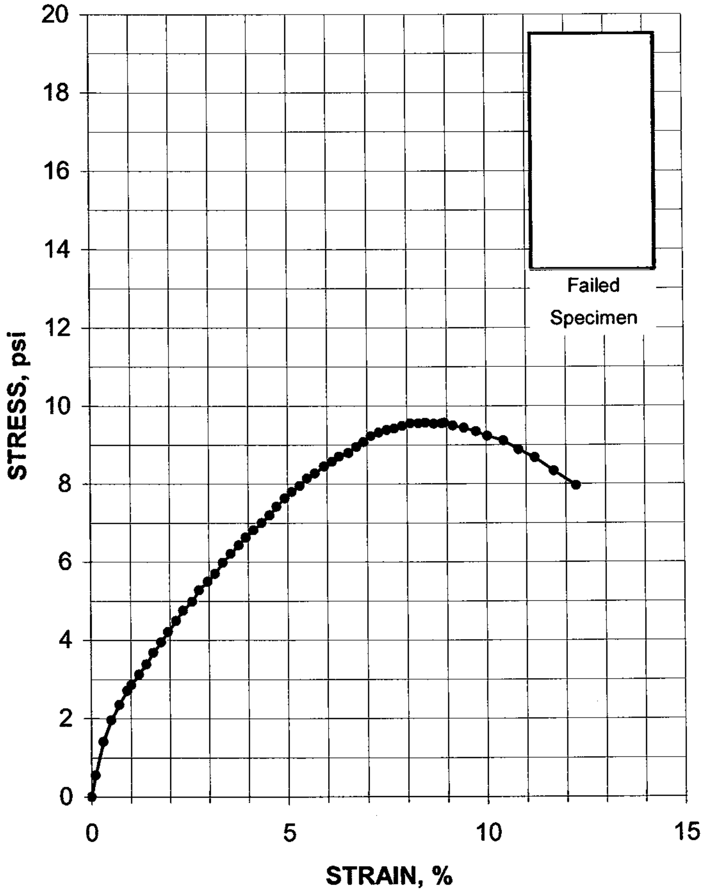
Client Sample No. 715-R6
Lab Specimen No. BC0821

Specimen Collection Date 11/10/2006
Specimen Test Date 3/2/2006

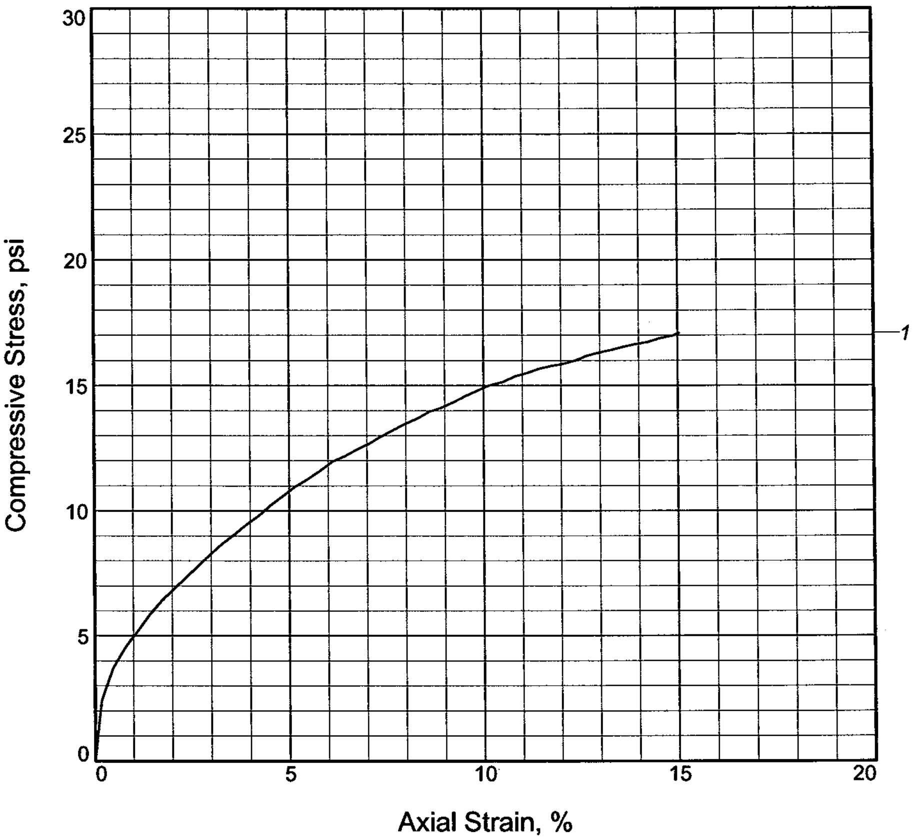
STRESS AT FAILURE, psi **9.6**
STRAIN AT FAILURE, % **9.0**

Specimen Height, in. 3.9292
Specimen Diameter, in. 2.0388
Specimen Weight, g. 351.93
Moisture Content, % 51.2
Wet Unit Weight, pcf. 104.5
Dry Unit Weight, pcf. 69.2
Rate of Strain. in./min. 0.023

AXIAL STRAIN, %	DEVIATOR STRESS, psi
0.00	0.0
0.10	0.6
0.51	2.0
0.92	2.7
1.22	3.1
1.58	3.7
1.96	4.2
2.34	4.8
2.75	5.3
3.16	5.7
3.56	6.2
3.94	6.6
4.35	7.0
4.73	7.4
5.12	7.8
5.50	8.1
5.93	8.4
6.31	8.7
6.74	8.9
7.10	9.2
7.51	9.4
7.89	9.5
8.30	9.6
8.68	9.5
8.96	9.6
9.44	9.4
10.03	9.2
10.82	8.9
11.22	8.7



UNCONSOLIDATED UNDRAINED TEST



Sample No.	1			
Fail. Stress, psi	17.09			
Ult. Stress, psi				
Cell pressure, psi	12.30			
Strain rate, in./min.	0.03			
Water content, %	39.2			
Wet density, pcf	111.0			
Dry density, pcf	79.8			
Saturation, %	95.1			
Void ratio	1.1133			
Specimen diameter, in.	2.02			
Specimen height, in.	4.01			
Height/diameter ratio	1.98			

Description:

LL = 35	**PL =** 25	**PI =** 10	**Assumed GS=** 2.7	**Type:** Undisturbed

Project No.: 109855.01210000

Date: 11/6/2005

Remarks:

Figure BC0749

Client: General Engineering Laboratories

Project: GEL Moab

Location: 700-R12

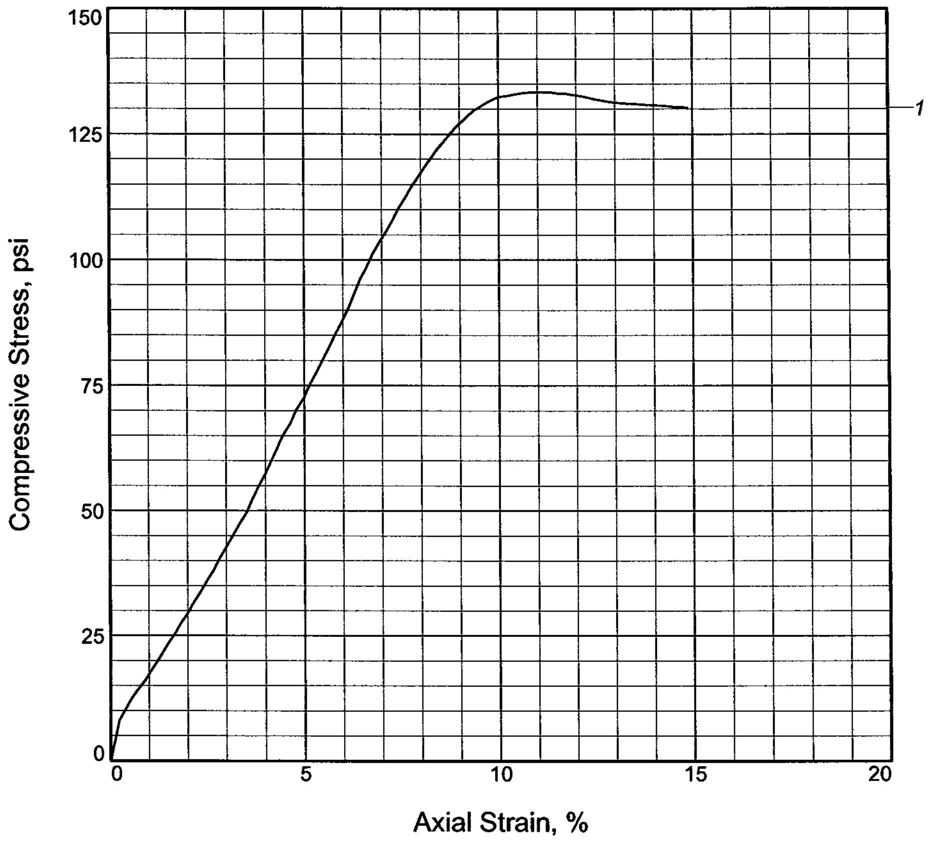
Sample Number: BC0749 **Depth:** 22'-24'

UNCONSOLIDATED UNDRAINED TEST

Shaw E&I

Tested By: D. Huskey **Checked By:** R. Cole

UNCONSOLIDATED UNDRAINED TEST



Sample No.	1			
Fail. Stress, psi	133.37			
Ult. Stress, psi				
Cell pressure, psi	31.60			
Strain rate, in./min.	0.02			
Water content, %	26.2			
Wet density, pcf	122.6			
Dry density, pcf	97.1			
Saturation, %	97.8			
Void ratio	0.7146			
Specimen diameter, in.	2.02			
Specimen height, in.	4.01			
Height/diameter ratio	1.98			

Description:

LL = NP	**PL =**	**PI =** NP	**GS=** 2.6676	**Type:** Undisturbed

Project No.: 109855.01210000

Date: 11/6/2005

Remarks:

Figure BC0753

Client: General Engineering Laboratories

Project: GEL Moab

Location: 700-R30

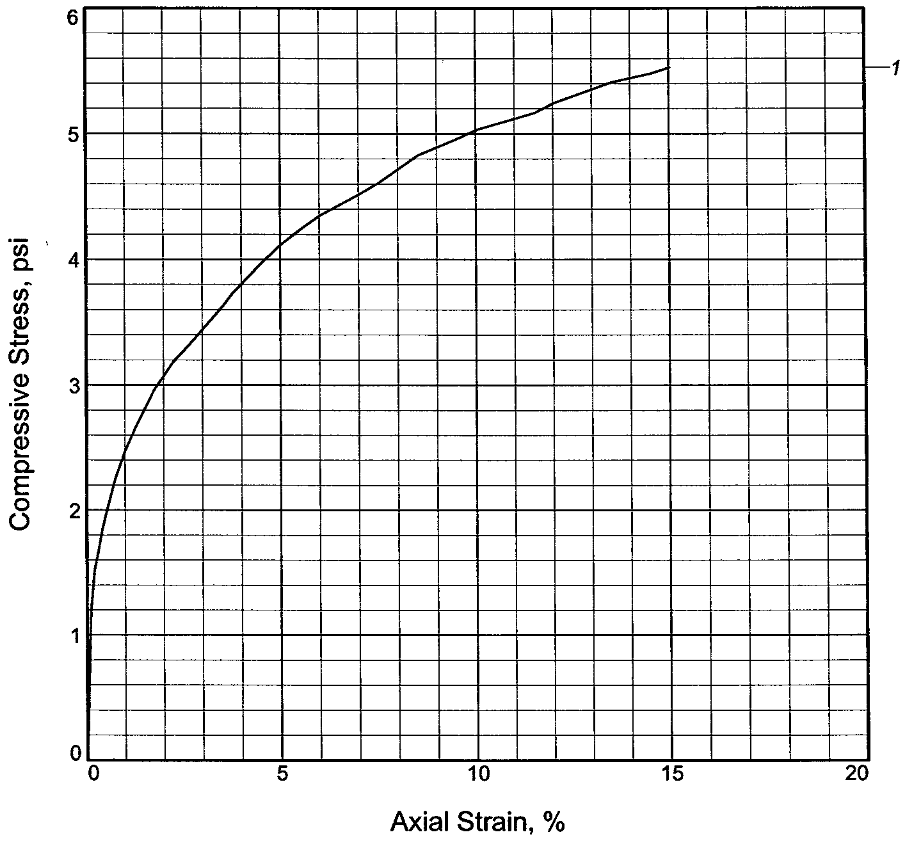
Sample Number: BC0753 **Depth:** 58'-60'

UNCONSOLIDATED UNDRAINED TEST

Shaw E&I

Tested By: D. Huskey **Checked By:** R. Cole

UNCONSOLIDATED UNDRAINED TEST



Sample No.	1			
Fail. Stress, psi	5.53			
Ult. Stress, psi				
Cell pressure, psi	41.20			
Strain rate, in./min.	0.03			
Water content, %	49.9			
Wet density, pcf	112.2			
Dry density, pcf	74.8			
Saturation, %	100.0			
Void ratio	1.4871			
Specimen diameter, in.	2.86			
Specimen height, in.	5.49			
Height/diameter ratio	1.92			

Description:

LL = 83	**PL =** 35	**PI =** 48	**GS=** 2.9813	**Type:** Undisturbed

Project No.: 109855.01210000

Date: 11/6/2005

Remarks:

Figure BC0755

Client: General Engineering Laboratories

Project: GEL Moab

Location: 700-R39

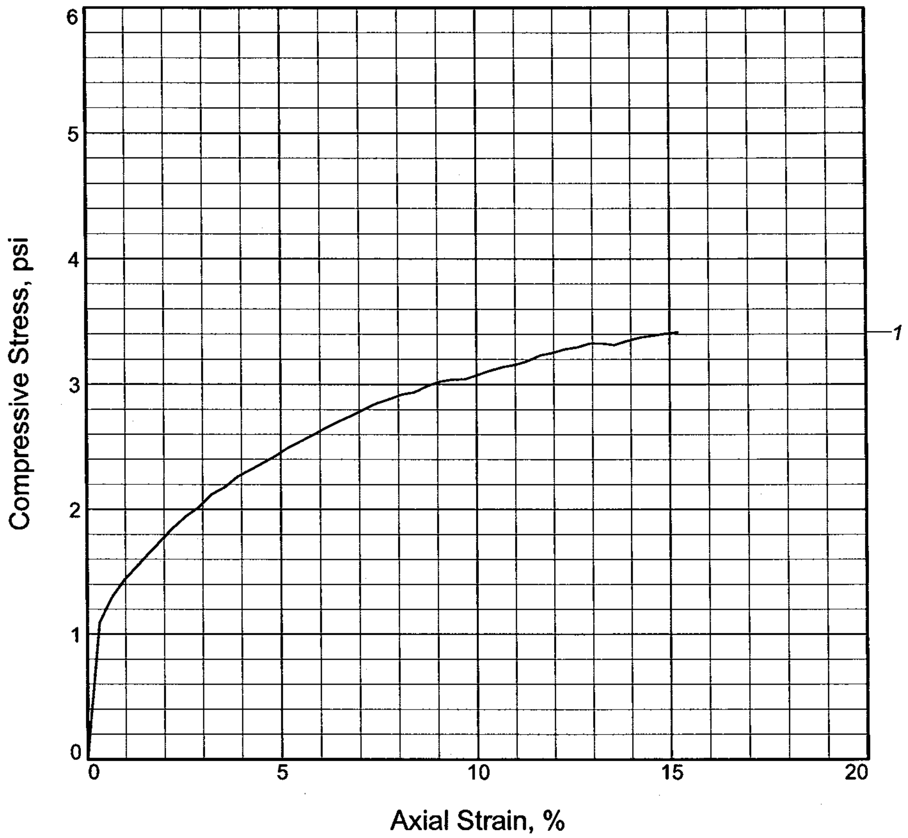
Sample Number: BC0755 **Depth:** 76'-78'

UNCONSOLIDATED UNDRAINED TEST

Shaw E&I

Tested By: D. Huskey **Checked By:** R. Cole

UNCONSOLIDATED UNDRAINED TEST



Sample No.	1			
Fail. Stress, psi	3.42			
Ult. Stress, psi				
Cell pressure, psi	15.50			
Strain rate, in./min.	0.07			
Water content, %	62.1			
Wet density, pcf	105.1			
Dry density, pcf	64.9			
Saturation, %	107.4			
Void ratio	1.5026			
Specimen diameter, in.	2.81			
Specimen height, in.	5.55			
Height/diameter ratio	1.98			

Description:

LL = 64	**PL =** 27	**PI =** 37	**Assumed GS=** 2.6	**Type:** Undisturbed

Project No.: 109855.01210000

Date: 11/30/2005

Remarks:

Figure BC0783

Client: General Engineering Laboratories

Project: GEL Moab

Location: 708-R15

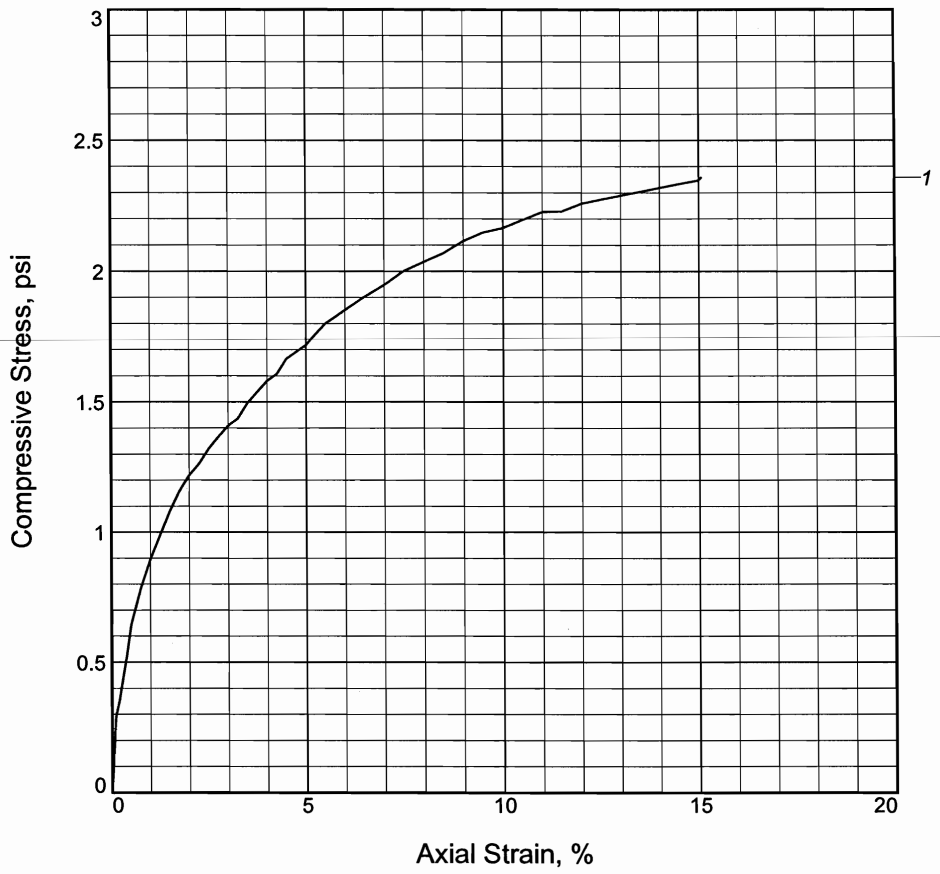
Sample Number: BC0783 **Depth:** 28'-30'

UNCONSOLIDATED UNDRAINED TEST

Shaw E&I

Tested By: D. Huskey **Checked By:** R. Cole

UNCONSOLIDATED UNDRAINED TEST



Sample No.	1			
Fail. Stress, psi	2.36			
Ult. Stress, psi				
Cell pressure, psi	8.00			
Strain rate, in./min.	0.05			
Water content, %	98.8			
Wet density, pcf	93.1			
Dry density, pcf	46.9			
Saturation, %	100.3			
Void ratio	2.8299			
Specimen diameter, in.	2.81			
Specimen height, in.	5.60			
Height/diameter ratio	2.00			

Description:

LL =	**PL =**	**PI =**	**GS=** 2.8742	**Type:** Undisturbed

Project No.: 109855.01210000

Date: 11/30/2005

Remarks:

Figure BC0787

Client: General Engineering Laboratories

Project: GEL Moab

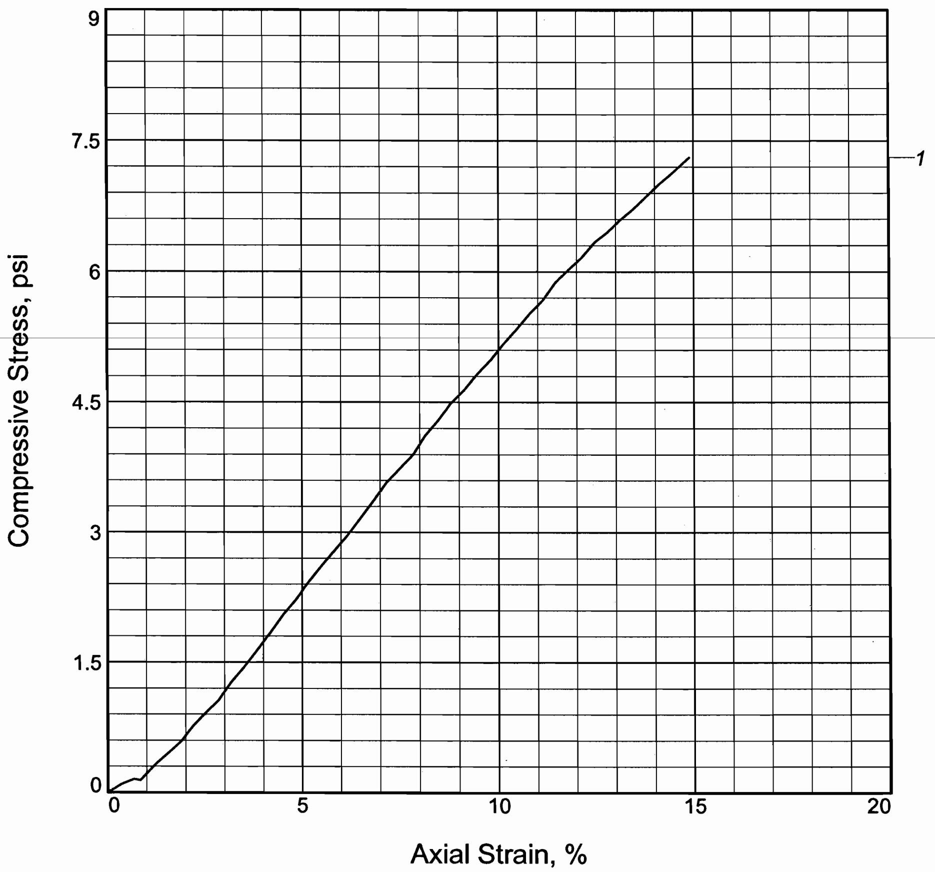
Location: 708-R8

Sample Number: BC0787 **Depth:** 14'-16'

UNCONSOLIDATED UNDRAINED TEST

Shaw E&I

UNCONSOLIDATED UNDRAINED TEST



Sample No.	1			
Fail. Stress, psi	7.31			
Ult. Stress, psi				
Cell pressure, psi	25.10			
Strain rate, in./min.	0.06			
Water content, %	24.4			
Wet density, pcf	130.5			
Dry density, pcf	104.9			
Saturation, %	115.9			
Void ratio	0.5479			
Specimen diameter, in.	2.85			
Specimen height, in.	5.54			
Height/diameter ratio	1.94			

Description:

LL = 26	**PL =** 18	**PI =** 8	**Assumed GS=** 2.6	**Type:** Undisturbed

Project No.: 109855.01210000

Date: 11/30/2005

Remarks:

Figure BC0785

Client: General Engineering Laboratories

Project: GEL Moab

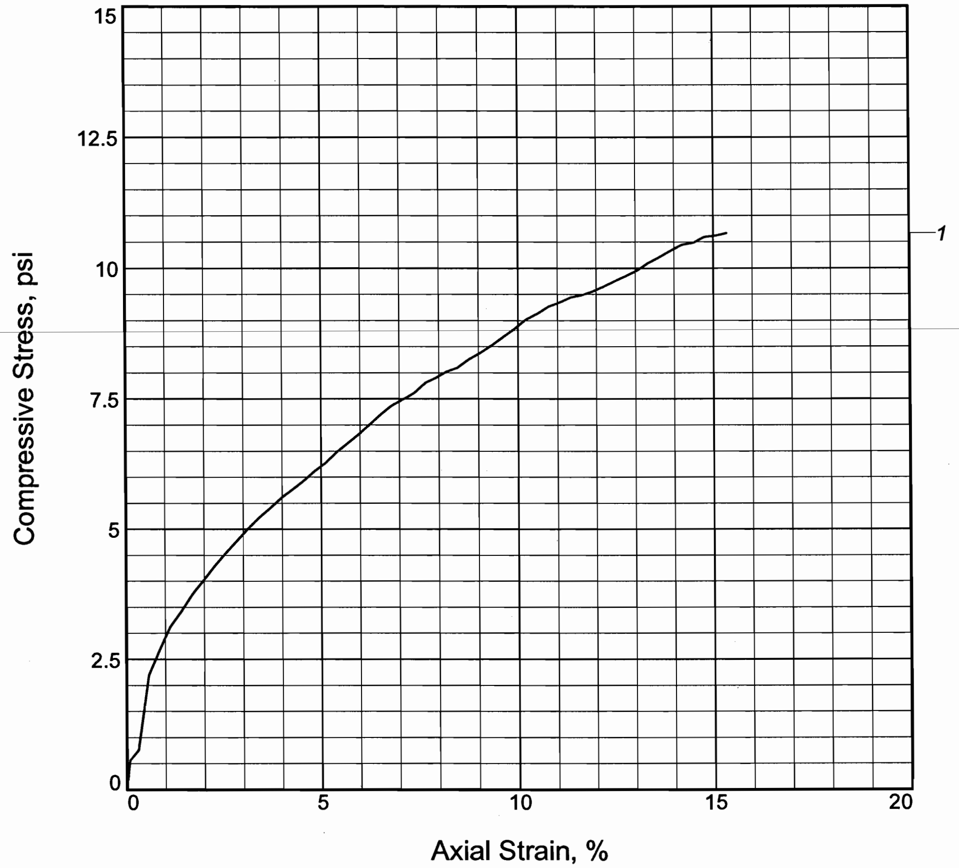
Location: 708-R24

Sample Number: BC0785 **Depth:** 46'-48'

UNCONSOLIDATED UNDRAINED TEST

Shaw E&I

UNCONSOLIDATED UNDRAINED TEST



Sample No.	1			
Fail. Stress, psi	10.66			
Ult. Stress, psi				
Cell pressure, psi	20.90			
Strain rate, in./min.	0.05			
Water content, %	30.8			
Wet density, pcf	119.3			
Dry density, pcf	91.2			
Saturation, %	98.1			
Void ratio	0.8483			
Specimen diameter, in.	2.74			
Specimen height, in.	5.62			
Height/diameter ratio	2.05			

Description:

LL =	**PL =**	**PI =**	**Assumed GS=** 2.7	**Type:** Undisturbed

Project No.: 109855.01210000

Date: 11/10/2005

Remarks:

Figure BC0817

Client: General Engineering Laboratories

Project: GEL Moab

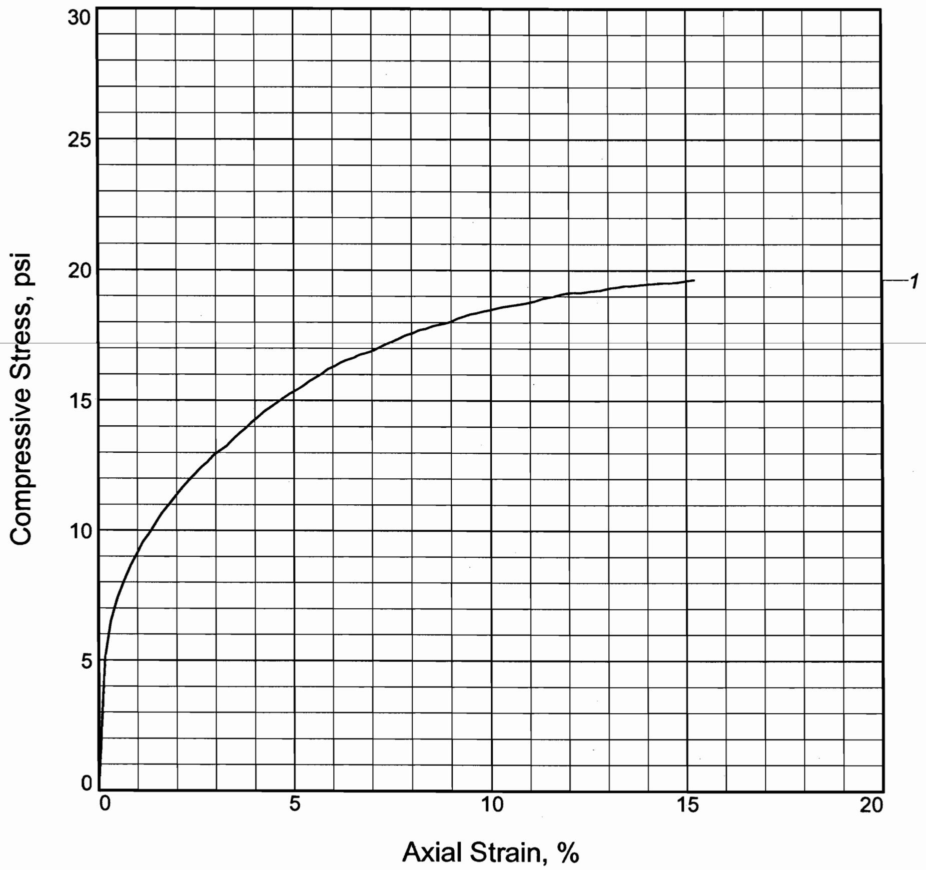
Location: 715-R16

Sample Number: BC0817 **Depth:** 38'-40'

UNCONSOLIDATED UNDRAINED TEST

Shaw E&I

UNCONSOLIDATED UNDRAINED TEST



Sample No.	1			
Fail. Stress, psi	19.64			
Ult. Stress, psi				
Cell pressure, psi	31.60			
Strain rate, in./min.	0.05			
Water content, %	58.4			
Wet density, pcf	111.1			
Dry density, pcf	70.1			
Saturation, %	104.6			
Void ratio	1.6821			
Specimen diameter, in.	2.82			
Specimen height, in.	5.37			
Height/diameter ratio	1.90			

Description:

LL = 80	**PL =** 33	**PI =** 47	**GS=** 3.012	**Type:** Undisturbed

Project No.: 109855.01210000

Date: 11/10/2005

Remarks:

Figure BC0819

Client: General Engineering Laboratories

Project: GEL Moab

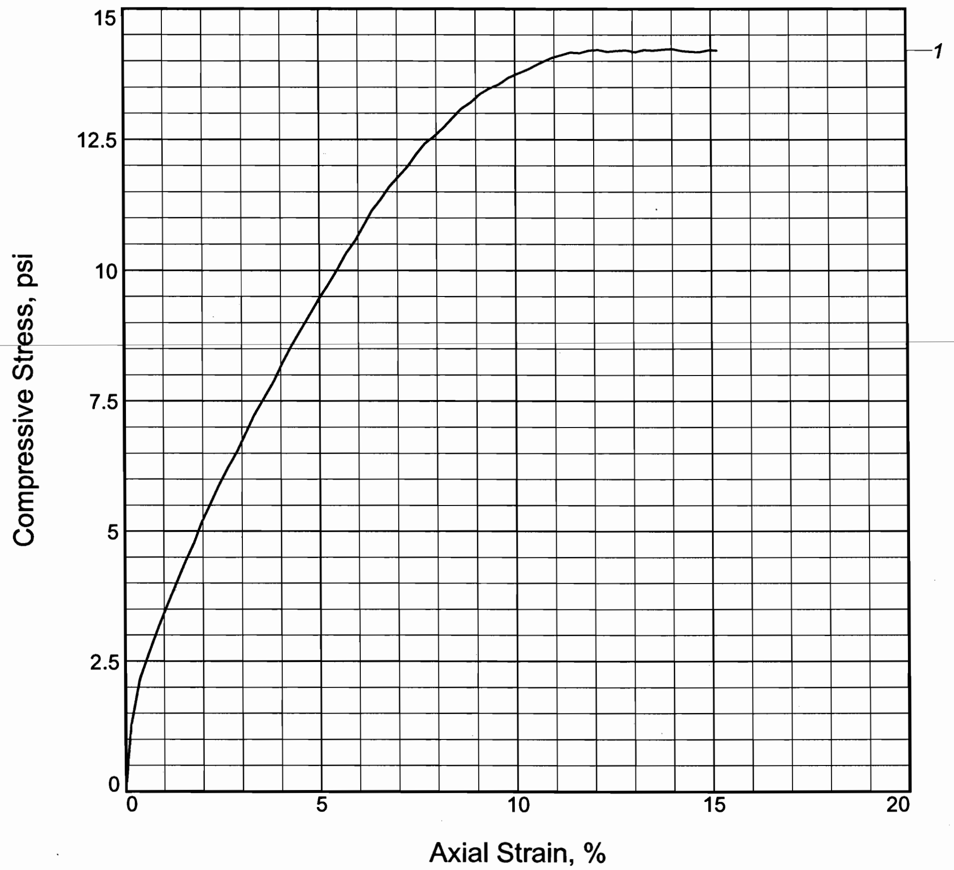
Location: 715-R24

Sample Number: BC0819 **Depth:** 58'-60'

UNCONSOLIDATED UNDRAINED TEST

Shaw E&I

UNCONSOLIDATED UNDRAINED TEST



Sample No.	1			
Fail. Stress, psi	14.23			
Ult. Stress, psi				
Cell pressure, psi	7.50			
Strain rate, in./min.	0.04			
Water content, %	51.2			
Wet density, pcf	110.0			
Dry density, pcf	72.8			
Saturation, %	100.4			
Void ratio	1.4633			
Specimen diameter, in.	2.02			
Specimen height, in.	4.55			
Height/diameter ratio	2.26			

Description:

LL = 60	**PL** = 33	**PI** = 27	**GS=** 2.8716	**Type:** Undisturbed

Project No.: 109855.01210000

Date: 11/10/2005

Remarks:

Figure BC821

Client: General Engineering Laboratories

Project: GEL Moab

Location: 715-R6

Sample Number: BC0821 **Depth:** 13'-15'

UNCONSOLIDATED UNDRAINED TEST

Shaw E&I

CAPILLARY-MOISTURE RELATIONS by POTENTIOMETER

PROJECT NAME
GEL Moab

LAB SAMPLE NUMBER
BC0914

PROJECT NUMBER
109855.01410000

CLIENT SAMPLE NUMBER
GABT-04

TEST NUMBER	MOISTURE, % ASTM D 2216	MOISTURE , % SW846	SOLIDS, % SW846	VAPOR TENSION, Mpa
1	3.1	3.0	97.0	-4.1
2	3.8	3.7	96.3	-3.3
3	4.8	4.6	95.4	-1.4
4	5.5	5.2	94.8	-1.4
5	6.6	6.2	93.8	-1.0
6	7.2	6.7	93.3	-0.6
7	8.7	8.0	92.0	-0.4
8	11.4	10.2	89.8	-0.3
9	12.0	10.7	89.3	-0.3
10	13.8	12.2	87.8	-0.3
11	16.7	14.3	85.7	-0.2
12	17.3	14.8	85.2	-0.2
13	21.8	17.9	82.1	-0.1
14	27.8	21.8	78.2	-0.1
15	29.8	22.9	77.1	-0.1
16	32.1	24.3	75.7	0.0
17				
18				
19				
20				
21				
22				
23				
24				
25				

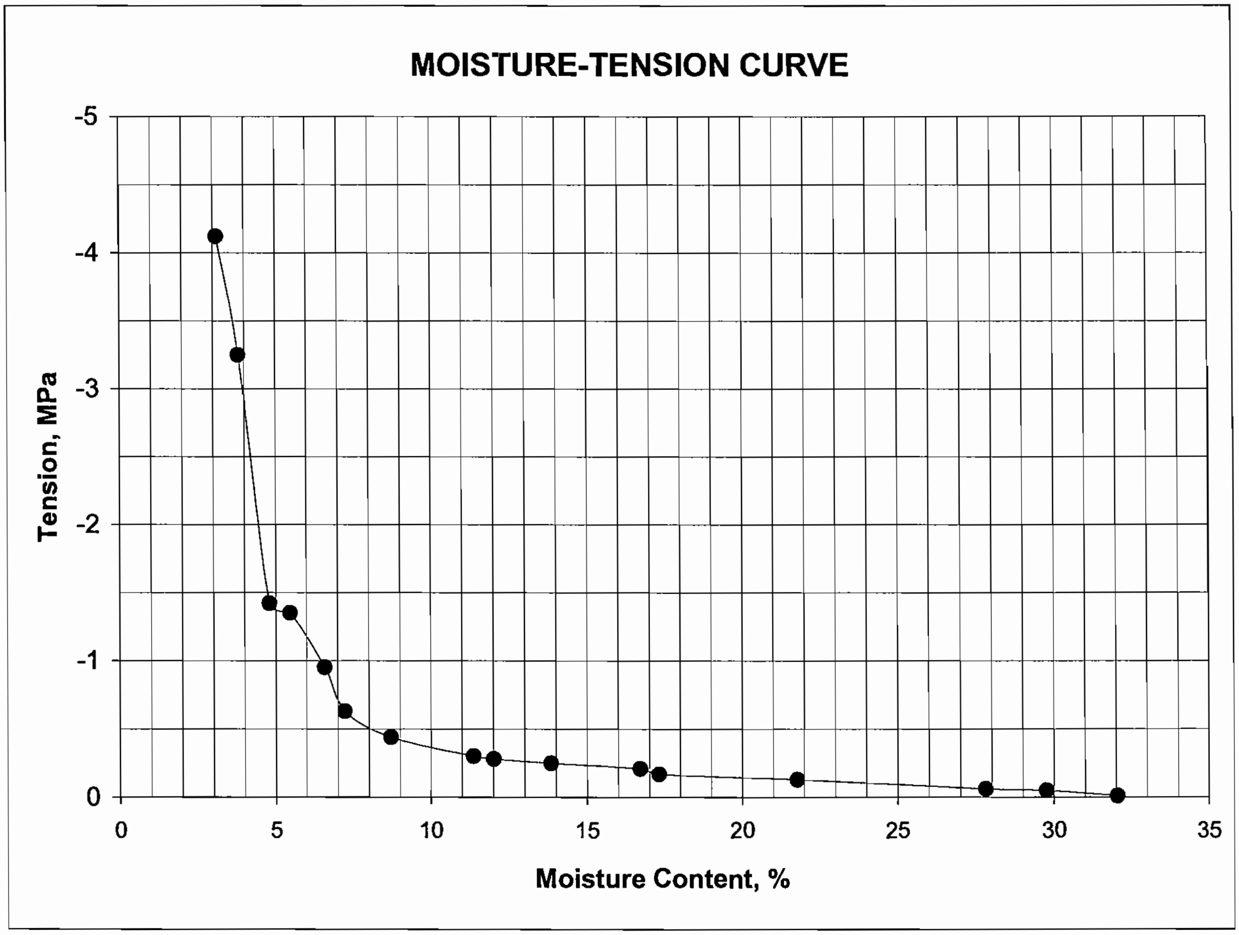
ASTM D 2216 results are based on dry sample weight.
SW846 results are based on wet sample weight.
Solids content is determined by subtracting the SW846 moisture (%) from 100.

CAPILLARY-MOISTURE RELATIONS by POTENTIOMETER

PROJECT NAME:	**GEL Moab**	CLIENT SAMPLE NO.	**GABT-04**
PROJECT NO.:	**109855.01410000**	SHAW LAB SAMPLE	**BC0914**

UNDISTURBED SPECIMEN DATA

Water content, %
Wet unit weight, pcf
Dry unit weight, pcf
Specific gravity of solids
Effective porosity, %
Estimated degree of saturation, %



CAPILLARY-MOISTURE RELATIONS by POTENTIOMETER

PROJECT NAME
GEL Moab

LAB SAMPLE NUMBER
BC0916

PROJECT NUMBER
109855.01410000

CLIENT SAMPLE NUMBER
GABT-06

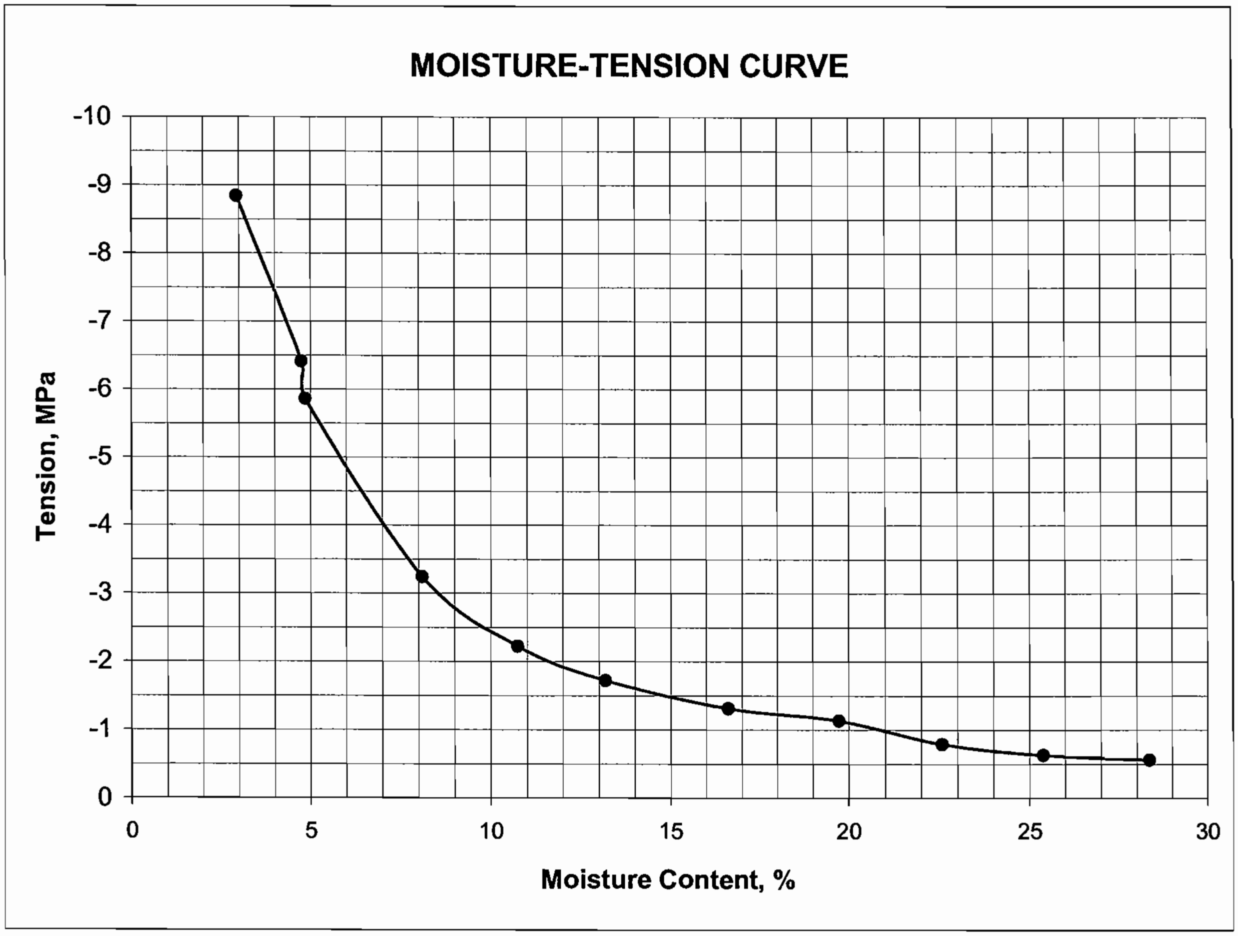
TEST NUMBER	MOISTURE, % ASTM D 2216	MOISTURE , % SW846	SOLIDS, % SW846	VAPOR TENSION, Mpa
1	2.9	2.9	97.1	-8.8
2	4.8	4.5	95.5	-6.4
3	4.9	4.6	95.4	-5.9
4	8.1	7.5	92.5	-3.2
5	10.7	9.7	90.3	-2.2
6	13.2	11.6	88.4	-1.7
7	16.6	14.3	85.7	-1.3
8	19.7	16.5	83.5	-1.1
9	22.6	18.4	81.6	-0.8
10	25.4	20.3	79.7	-0.6
11	28.4	22.1	77.9	-0.6
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				

ASTM D 2216 results are based on dry sample weight.
SW846 results are based on wet sample weight.
Solids content is determined by subtracting the SW846 moisture (%) from 100.

CAPILLARY-MOISTURE RELATIONS by POTENTIOMETER

PROJECT NAME: **GEL Moab**
PROJECT NO.: **109855.01410000**
CLIENT SAMPLE NO. **GABT-06**
SHAW LAB SAMPLE **BC0916**

UNDISTURBED SPECIMEN DATA
Water content, %
Wet unit weight, pcf
Dry unit weight, pcf
Specific gravity of solids
Effective porosity, %
Estimated degree of saturation, %



CAPILLARY-MOISTURE
RELATIONS by POTENTIOMETER

PROJECT NAME
GEL Moab

LAB SAMPLE NUMBER
BC0919

PROJECT NUMBER
109855.01410000

CLIENT SAMPLE NUMBER
GABT-09

TEST NUMBER	MOISTURE, % ASTM D 2216	MOISTURE , % SW846	SOLIDS, % SW846	VAPOR TENSION, Mpa
1	4.3	4.1	95.9	-12.1
2	6.7	6.3	93.7	-6.4
3	8.5	7.8	92.2	-4.1
4	11.0	9.9	90.1	-3.1
5	12.5	11.1	88.9	-2.3
6	14.6	12.7	87.3	-1.7
7	18.5	15.6	84.4	-1.4
8	22.4	18.3	81.7	-1.3
9	26.9	21.2	78.8	-1.2
10	29.7	22.9	77.1	-0.9
11	31.6	24.0	76.0	-0.8
12	34.7	25.8	74.2	-0.7
13	37.6	27.3	72.7	-0.7
14	38.1	27.6	72.4	-0.7
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				

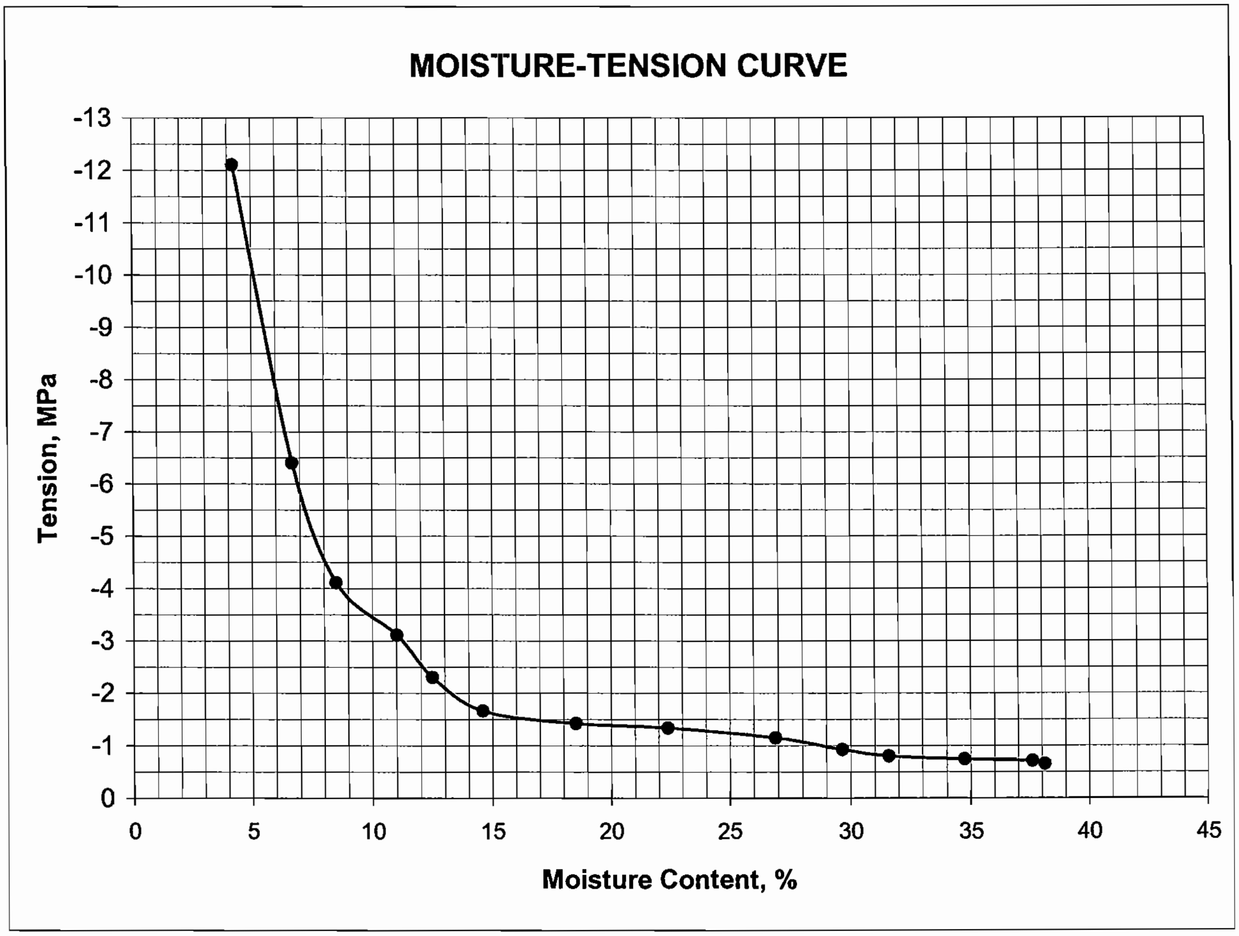
ASTM D 2216 results are based on dry sample weight.
SW846 results are based on wet sample weight.
Solids content is determined by subtracting the SW846 moisture (%) from 100.

CAPILLARY-MOISTURE RELATIONS by POTENTIOMETER

PROJECT NAME:	**GEL Moab**	CLIENT SAMPLE NO.	**GABT-09**
PROJECT NO.:	**109855.01410000**	SHAW LAB SAMPLE	**BC0919**

UNDISTURBED SPECIMEN DATA

Water content, %
Wet unit weight, pcf
Dry unit weight, pcf
Specific gravity of solids
Effective porosity, %
Estimated degree of saturation, %



CAPILLARY-MOISTURE RELATIONS by POTENTIOMETER

PROJECT NAME
GEL Moab

LAB SAMPLE NUMBER
BC0920

PROJECT NUMBER
109855.01410000

CLIENT SAMPLE NUMBER
GABT-10

TEST NUMBER	MOISTURE, % ASTM D 2216	MOISTURE , % SW846	SOLIDS, % SW846	VAPOR TENSION, Mpa
1	5.8	5.4	94.6	-25.6
2	7.9	7.3	92.7	-24.6
3	10.3	9.3	90.7	-18.3
4	12.4	11.0	89.0	-16.0
5	13.8	12.2	87.8	-13.6
6	16.3	14.0	86.0	-12.0
7	20.7	17.1	82.9	-9.4
8	22.4	18.3	81.7	-8.1
9	23.7	19.2	80.8	-7.5
10	25.4	20.2	79.8	-6.7
11	28.5	22.2	77.8	-5.8
12	30.8	23.6	76.4	-5.5
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				

ASTM D 2216 results are based on dry sample weight.
SW846 results are based on wet sample weight.
Solids content is determined by subtracting the SW846 moisture (%) from 100.

CAPILLARY-MOISTURE RELATIONS by POTENTIOMETER

PROJECT NAME:	**GEL Moab**	CLIENT SAMPLE NO.	**GABT-10**
PROJECT NO.:	**109855.01410000**	SHAW LAB SAMPLE	**BC0920**

UNDISTURBED SPECIMEN DATA

Water content, %

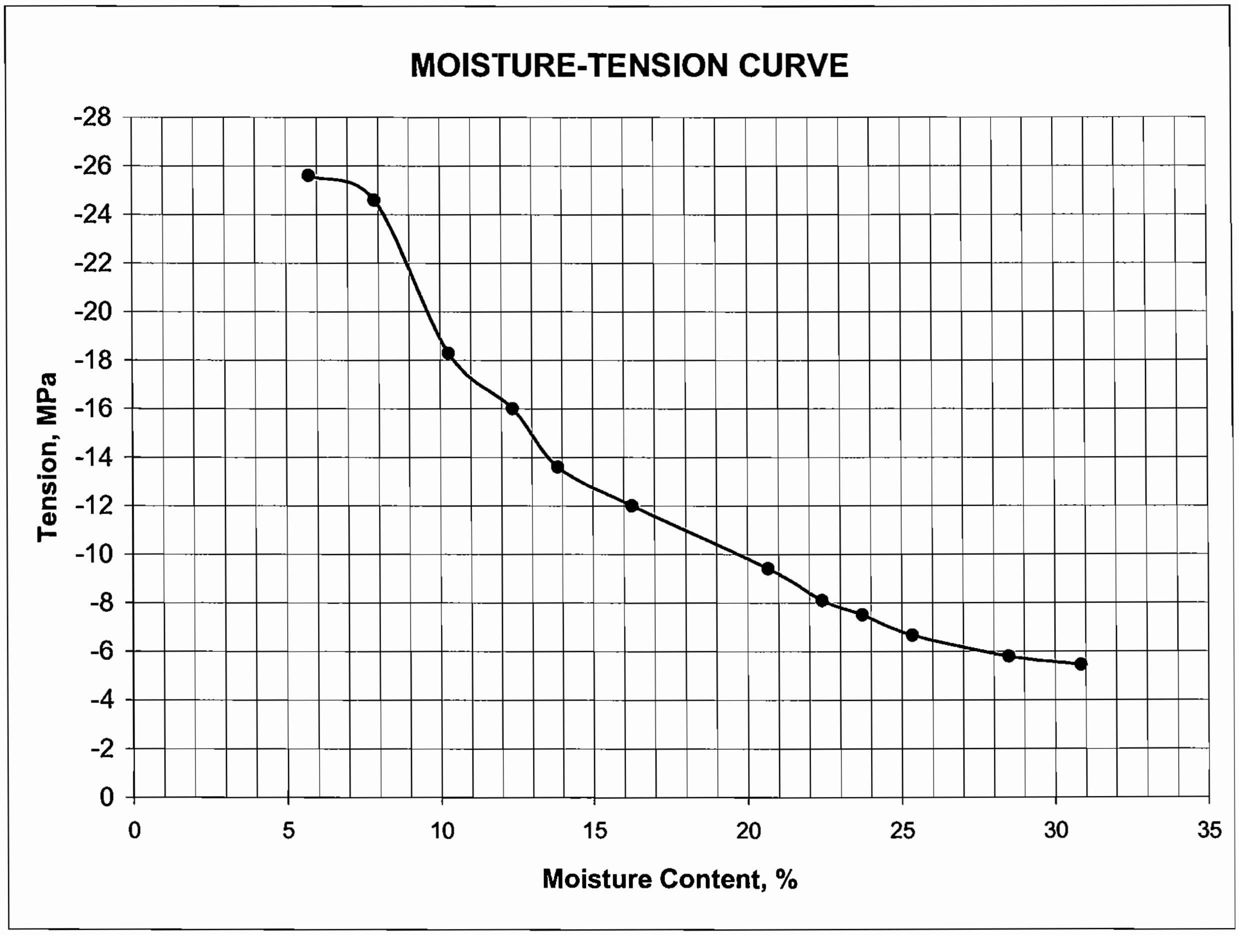
Wet unit weight, pcf

Dry unit weight, pcf

Specific gravity of solids

Effective porosity, %

Estimated degree of saturation, %



CAPILLARY-MOISTURE RELATIONS by POTENTIOMETER

PROJECT NAME
GEL Moab

LAB SAMPLE NUMBER
BC0921

PROJECT NUMBER
109855.01410000

CLIENT SAMPLE NUMBER
GABT-11

TEST NUMBER	MOISTURE, % ASTM D 2216	MOISTURE , % SW846	SOLIDS, % SW846	VAPOR TENSION, Mpa
1	10.9	9.9	90.1	-10.9
2	13.1	11.6	88.4	-5.5
3	17.5	14.9	85.1	-2.7
4	21.1	17.4	82.6	-1.8
5	22.4	18.3	81.7	-1.5
6	26.4	20.9	79.1	-1.1
7	33.6	25.2	74.8	-0.9
8	37.5	27.3	72.7	-0.7
9	40.1	28.6	71.4	-0.6
10	45.2	31.1	68.9	-0.5
11	56.9	36.3	63.7	-0.5
12	60.4	37.6	62.4	-0.4
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				

ASTM D 2216 results are based on dry sample weight.
SW846 results are based on wet sample weight.
Solids content is determined by subtracting the SW846 moisture (%) from 100.

CAPILLARY-MOISTURE RELATIONS by POTENTIOMETER

PROJECT NAME:	**GEL Moab**	CLIENT SAMPLE NO.	**GABT-11**
PROJECT NO.:	**109855.01410000**	SHAW LAB SAMPLE	**BC0921**

UNDISTURBED SPECIMEN DATA

Water content, %

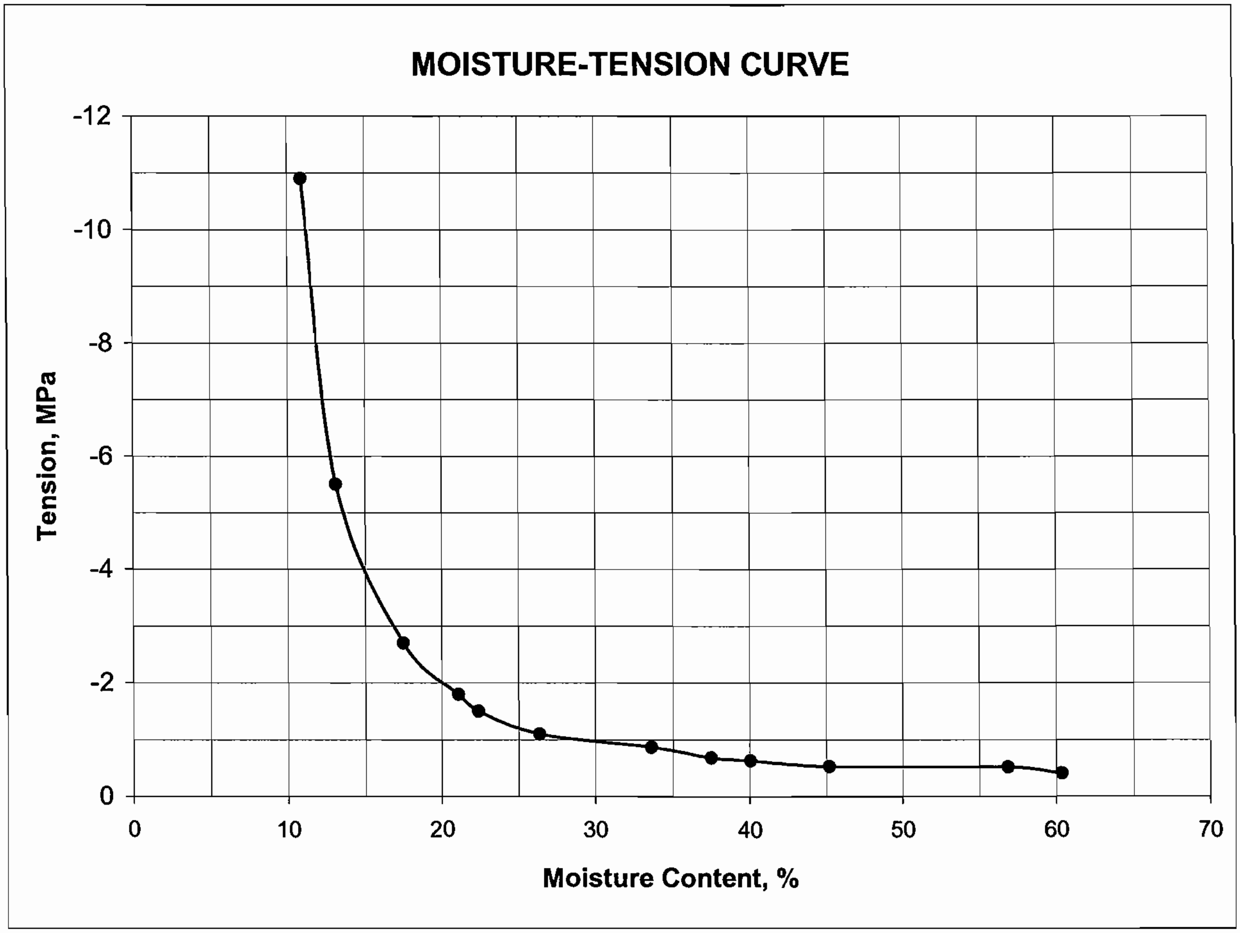
Wet unit weight, pcf

Dry unit weight, pcf

Specific gravity of solids

Effective porosity, %

Estimated degree of saturation, %



CAPILLARY-MOISTURE RELATIONS by POTENTIOMETER

PROJECT NAME
GEL Moab

LAB SAMPLE NUMBER
BC0923

PROJECT NUMBER
109855.01410000

CLIENT SAMPLE NUMBER
GABT-13

TEST NUMBER	MOISTURE, % ASTM D 2216	MOISTURE , % SW846	SOLIDS, % SW846	VAPOR TENSION, Mpa
1	11.7	10.4	89.6	-6.0
2	15.4	13.4	86.6	-2.8
3	16.1	13.8	86.2	-2.5
4	16.8	14.4	85.6	-2.1
5	17.9	15.2	84.8	-1.9
6	20.8	17.2	82.8	-1.3
7	23.1	18.8	81.2	-1.0
8	28.1	21.9	78.1	-0.7
9	33.2	24.9	75.1	-0.5
10	39.4	28.3	71.7	-0.5
11	43.9	30.5	69.5	-0.4
12	51.2	33.9	66.1	-0.4
13	56.1	35.9	64.1	-0.3
14	60.5	37.7	62.3	-0.3
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				

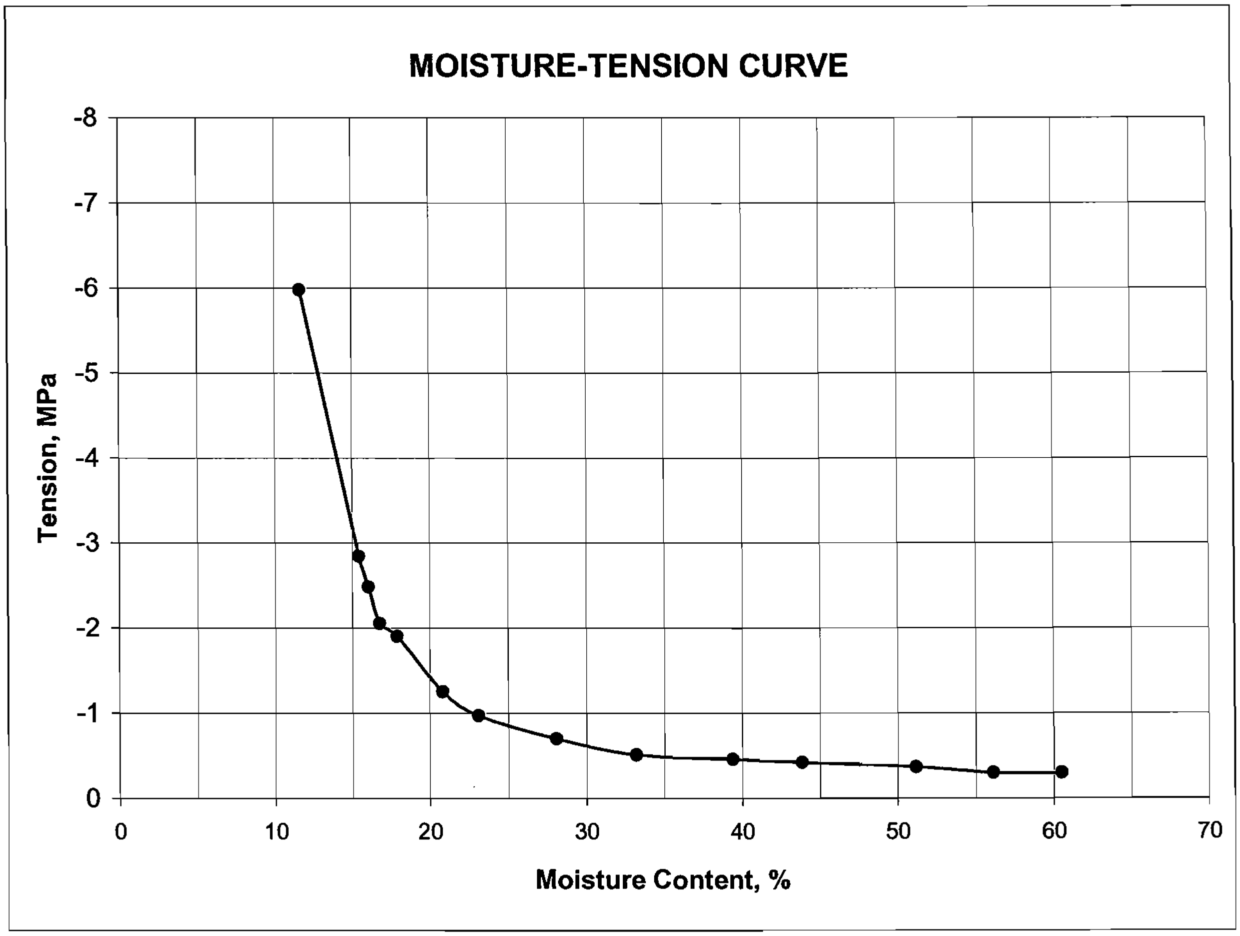
ASTM D 2216 results are based on dry sample weight.
SW846 results are based on wet sample weight.
Solids content is determined by subtracting the SW846 moisture (%) from 100.

CAPILLARY-MOISTURE RELATIONS by POTENTIOMETER

PROJECT NAME:	**GEL Moab**	CLIENT SAMPLE NO.	**GABT-13**
PROJECT NO.:	**109855.01410000**	SHAW LAB SAMPLE	**BC0923**

UNDISTURBED SPECIMEN DATA

Water content, %
Wet unit weight, pcf
Dry unit weight, pcf
Specific gravity of solids
Effective porosity, %
Estimated degree of saturation, %



Appendix C
Chain of Custody Records

U.S. Department of Energy at Grand Junction

2597 B 3/4 Road, Grand Junction, CO 81503 (970) 248-6000

CHAIN OF CUSTODY

RIN: 06010294
COC: 06010294.1.1
Sampler(s):

Page 1 of 10

Site Name: MOAB MONITORING
Site Code: MOA01
Cost Number: 06-203-2-01-3-1-01
Purchase Order: 24316
Sample Matrix: Soil

Ticket No.	Location	Sample Date	Time	HDPE 125 mL	HDPE 250 mL	HDPE 500 mL	HDPE 1 L	Glass 40 mL	Glass 1 L	Other	Analysis
	700-R12	11/06/2005	0:00	0	0	0	0	0	0	1	
	700-R16	11/06/2005	0:00	0	0	0	0	0	0	1	
	700-R20	11/06/2005	0:00	0	0	0	0	0	0	1	
	700-R24	11/06/2005	0:00	0	0	0	0	0	0	1	
	700-R30	11/06/2005	0:00	0	0	0	0	0	0	1	
	700-R35	11/06/2005	0:00	0	0	0	0	0	0	1	
	700-R39	11/06/2005	0:00	0	0	0	0	0	0	1	
	700-R5	11/05/2005	0:00	0	0	0	0	0	0	1	
	700-R8	11/06/2005	0:00	0	0	0	0	0	0	1	
	701-R12	11/07/2005	0:00	0	0	0	0	0	0	1	
*	701-R26	11/07/2005	0:00	0	0	0	0	0	0	1	
	701-R18	11/07/2005	0:00	0	0	0	0	0	0	1	
	701-R22	11/08/2005	0:00	0	0	0	0	0	0	1	
	701-R30	11/08/2005	0:00	0	0	0	0	0	0	1	
	701-R33	11/08/2005	0:00	0	0	0	0	0	0	1	
	701-R4	11/07/2005	0:00	0	0	0	0	0	0	1	
			Sum							16	

Reliquished by (signature)	Date	Time
	1-23-06	13:00
Received by (signature)	**Date**	**Time**
	02/01/06	0800

*did not receive

Reliquished by (signature)	Date	Time
Received by (signature)	Date	Time

U.S. Department of Energy at Grand Junction

2597 B 3/4 Road, Grand Junction, CO 81503 (970) 248-6000

CHAIN OF CUSTODY

RIN: 06010294
COC: 06010294.1.2
Sampler(s):

Page 2 of 10

Site Name: MOAB MONITORING
Site Code: MOA01
Cost Number: 06-203-2-01-3-1-01
Purchase Order: 24316
Sample Matrix: Soil

Ticket No.	Location	Sample Date	Time	*HDPE 125 mL*	*HDPE 250 mL*	*HDPE 500 mL*	*HDPE 1 L*	*Glass 40 mL*	*Glass 1 L*	*Other*	Analysis
	701-R8	11/07/2005	0:00	0	0	0	0	0	0	1	
	702-R10	11/07/2005	0:00	0	0	0	0	0	0	1	
	702-R14	11/07/2005	0:00	0	0	0	0	0	0	1	
	702-R18	11/07/2005	0:00	0	0	0	0	0	0	1	
	702-R24	11/08/2005	0:00	0	0	0	0	0	0	1	
	702-R28	11/08/2005	0:00	0	0	0	0	0	0	1	
	702-R31	11/08/2005	0:00	0	0	0	0	0	0	1	
	702-R4	11/09/2005	0:00	0	0	0	0	0	0	1	
	702-R6	11/09/2005	0:00	0	0	0	0	0	0	1	
	702-R8	11/09/2005	0:00	0	0	0	0	0	0	1	
	706-R10	12/06/2005	0:00	0	0	0	0	0	0	1	
	706-R12	12/06/2005	0:00	0	0	0	0	0	0	1	
	706-R14	12/06/2005	0:00	0	0	0	0	0	0	1	
	706-R16	12/06/2005	0:00	0	0	0	0	0	0	1	
*	706R20	12/06/2005	0:00	0	0	0	0	0	0	1	did not receive
*	706-R22	12/06/2005	0:00	0	0	0	0	0	0	1	did not receive
			Sum							16	

	Date	Time
Reliquished by (signature)	1-23-06	13:00
Received by (signature)	02/02/06	0800

	Date	Time
Reliquished by (signature)		
Received by (signature)		

* did not receive

U.S. Department of Energy at Grand Junction

2597 B 3/4 Road, Grand Junction, CO 81503 (970) 248-6000

CHAIN OF CUSTODY

RIN: 06010294
COC: 06010294.1.3
Sampler(s):

Page 3 of 10

Site Name: MOAB MONITORING
Site Code: MOA01
Cost Number: 06-203-2-01-3-1-01
Purchase Order: 24316
Sample Matrix: Soil

Ticket No.	Location	Sample Date	Time	HDPE 125 mL	HDPE 250 mL	HDPE 500 mL	HDPE 1 L	Glass 40 mL	Glass 1 L	Other	Analysis
	706-R8	12/06/2005	0:00	0	0	0	0	0	0	1	
*	707-R17	12/01/2005	0:00	0	0	0	0	0	0	1	did not receive
	707-R20	12/01/2005	0:00	0	0	0	0	0	0	1	
	707-R25	12/01/2005	0:00	0	0	0	0	0	0	1	
*	707-R28	12/01/2005	0:00	0	0	0	0	0	0	1	did not receive
	707-R8	11/30/2005	0:00	0	0	0	0	0	0	1	
	708-R12	11/30/2005	0:00	0	0	0	0	0	0	1	
	708-R15	11/30/2005	0:00	0	0	0	0	0	0	1	
	708-R19	11/30/2005	0:00	0	0	0	0	0	0	1	
	708-R24	11/30/2005	0:00	0	0	0	0	0	0	1	
	708-R29	11/30/2005	0:00	0	0	0	0	0	0	1	
	708-R8	11/30/2005	0:00	0	0	0	0	0	0	1	
*	710-R1	12/01/2005	0:00	0	0	0	0	0	0	1	did not receive
	710-R12	12/05/2005	0:00	0	0	0	0	0	0	1	
	710-R16	12/05/2005	0:00	0	0	0	0	0	0	1	
*	710-R19	12/05/2005	0:00	0	0	0	0	0	0	1	did not receive
			Sum							16	

Reliquished by (signature)	Date	Time
Steve	1-23-06	13:00
Received by (signature)	**Date**	**Time**
	02/01/06	0800

Reliquished by (signature)	Date	Time
Received by (signature)	Date	Time

* did not receive

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CHAIN OF CUSTODY

RIN: 06010294
COC: 06010294.1.4
Sampler(s):

Page 4 of 10

Site Name: MOAB MONITORING
Site Code: MOA01
Cost Number: 06-203-2-01-3-1-01
Purchase Order: 24316
Sample Matrix: Soil

Ticket No.	Location	Sample Date	Time	HDPE 125 mL	HDPE 250 mL	HDPE 500 mL	HDPE 1 L	Glass 40 mL	Glass 1 L	Other	Analysis
*	710-R3	12/01/2005	0:00	0	0	0	0	0	0	1	did not receive
	710-R4	12/01/2005	0:00	0	0	0	0	0	0	1	
	710-R6	12/01/2005	0:00	0	0	0	0	0	0	1	
	710-R8	12/01/2005	0:00	0	0	0	0	0	0	1	
	712-R11	11/04/2005	0:00	0	0	0	0	0	0	1	
	712-R13	11/04/2005	0:00	0	0	0	0	0	0	1	
	712-R15	11/04/2005	0:00	0	0	0	0	0	0	1	
	712-R16	11/04/2005	0:00	0	0	0	0	0	0	1	
	712-R17	11/04/2005	0:00	0	0	0	0	0	0	1	
	712-R2	11/04/2005	0:00	0	0	0	0	0	0	1	
	712-R3	11/04/2005	0:00	0	0	0	0	0	0	1	
	712-R4	11/04/2005	0:00	0	0	0	0	0	0	1	
	712-R6	11/04/2005	0:00	0	0	0	0	0	0	1	
	712-R7	11/04/2005	0:00	0	0	0	0	0	0	1	
	712-R9	11/04/2005	0:00	0	0	0	0	0	0	1	
*	713-R1	11/03/2005	0:00	0	0	0	0	0	0	1	did not receive
			Sum							16	

Reliquished by (signature)	Date	Time
	1-23-06	13:00
Received by (signature)	**Date**	**Time**
	02/01/06	0800

Reliquished by (signature)	Date	Time
Received by (signature)	**Date**	**Time**

* did not receive

U.S. Department of Energy at Grand Junction

2597 B 3/4 Road, Grand Junction, CO 81503 (970) 248-6000

CHAIN OF CUSTODY

RIN: 06010294
COC: 06010294.1.5
Sampler(s):

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Site Name: MOAB MONITORING
Site Code: MOA01
Cost Number: 06-203-2-01-3-1-01
Purchase Order: 24316
Sample Matrix: Soil

Ticket No.	Location	Sample Date	Time	HDPE 125 mL	HDPE 250 mL	HDPE 500 mL	HDPE 1 L	Glass 40 mL	Glass 1 L	Other	Analysis
	713-R11	11/04/2005	0:00	0	0	0	0	0	0	1	
*	713-R13	11/04/2005	0:00	0	0	0	0	0	0	1	did not receive
	713-R2	11/03/2005	0:00	0	0	0	0	0	0	1	
	713-R5	11/04/2005	0:00	0	0	0	0	0	0	1	
	713-R7	11/04/2005	0:00	0	0	0	0	0	0	1	
	713-R9	11/04/2005	0:00	0	0	0	0	0	0	1	
	714-R1	11/03/2005	0:00	0	0	0	0	0	0	1	
	714-R2	11/03/2005	0:00	0	0	0	0	0	0	1	
	714-R3	11/03/2005	0:00	0	0	0	0	0	0	1	
	714-R4	11/03/2005	0:00	0	0	0	0	0	0	1	
	714-R5	11/03/2005	0:00	0	0	0	0	0	0	1	
	714-R6	11/03/2005	0:00	0	0	0	0	0	0	1	
	714-R7	11/03/2005	0:00	0	0	0	0	0	0	1	
	714-R8	11/03/2005	0:00	0	0	0	0	0	0	1	
	715-R11	11/10/2005	0:00	0	0	0	0	0	0	1	
	715-R16	11/10/2005	0:00	0	0	0	0	0	0	1	
			Sum							16	

Reliquished by (signature)	Date	Time
	1-23-06	13:00
Received by (signature)	**Date**	**Time**
	02/01/06	0800

Reliquished by (signature)	Date	Time
Received by (signature)	Date	Time

* did not receive

U.S. Department of Energy at Grand Junction
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CHAIN OF CUSTODY

RIN: 06010294
COC: 06010294.1.6
Sampler(s):

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Site Name: MOAB MONITORING
Site Code: MOA01
Cost Number: 06-203-2-01-3-1-01
Purchase Order: 24316
Sample Matrix: Soil

Ticket No.	Location	Sample Date	Time	HDPE 125 mL	HDPE 250 mL	HDPE 500 mL	HDPE 1 L	Glass 40 mL	Glass 1 L	Other	Analysis
	715-R20	11/10/2005	0:00	0	0	0	0	0	0	1	
	715-R24	11/10/2005	0:00	0	0	0	0	0	0	1	
	715-R28	11/10/2005	0:00	0	0	0	0	0	0	1	
*	715-R3	11/10/2005	0:00	0	0	0	0	0	0	1	did not receive
	715-R6	11/10/2005	0:00	0	0	0	0	0	0	1	
	715-R8	11/10/2005	0:00	0	0	0	0	0	0	1	
	716-R11	11/11/2005	0:00	0	0	0	0	0	0	1	
	716-R13	11/11/2005	0:00	0	0	0	0	0	0	1	
	716-R16	11/11/2005	0:00	0	0	0	0	0	0	1	
	716-R19	11/11/2005	0:00	0	0	0	0	0	0	1	
	716-R2	11/11/2005	0:00	0	0	0	0	0	0	1	
	716-R3	11/11/2005	0:00	0	0	0	0	0	0	1	
	716-R4	11/11/2005	0:00	0	0	0	0	0	0	1	
	716-R5	11/11/2005	0:00	0	0	0	0	0	0	1	
	716-R6	11/11/2005	0:00	0	0	0	0	0	0	1	
	716-R7	11/11/2005	0:00	0	0	0	0	0	0	1	
			Sum							16	

Reliquished by (signature)	Date	Time
	1-23-06	13:00
Received by (signature)	**Date**	**Time**
	02/01/06	0800

Reliquished by (signature)	Date	Time
Received by (signature)	Date	Time

* did not receive

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CHAIN OF CUSTODY

RIN: 06010294
COC: 06010294.1.7
Sampler(s):

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Site Name: MOAB MONITORING
Site Code: MOA01
Cost Number: 06-203-2-01-3-1-01
Purchase Order: 24316
Sample Matrix: Soil

Ticket No.	Location	Sample Date	Time	*HDPE 125 mL*	*HDPE 250 mL*	*HDPE 500 mL*	*HDPE 1 L*	*Glass 40 mL*	*Glass 1 L*	*Other*	Analysis
	716-R9	11/11/2005	0:00	0	0	0	0	0	0	1	
	717-R10	11/29/2005	0:00	0	0	0	0	0	0	1	
	717-R12	11/29/2005	0:00	0	0	0	0	0	0	1	
	717-R14	11/29/2005	0:00	0	0	0	0	0	0	1	
	717-R16	11/29/2005	0:00	0	0	0	0	0	0	1	
	717-R18	11/29/2005	0:00	0	0	0	0	0	0	1	
	717-R2	11/29/2005	0:00	0	0	0	0	0	0	1	
	717-R21	11/29/2005	0:00	0	0	0	0	0	0	1	
	717-R3	11/29/2005	0:00	0	0	0	0	0	0	1	
	717-R4	11/29/2005	0:00	0	0	0	0	0	0	1	
	717-R6	11/29/2005	0:00	0	0	0	0	0	0	1	
	717-R8	11/29/2005	0:00	0	0	0	0	0	0	1	
*	718-R11	12/05/2005	0:00	0	0	0	0	0	0	1	did not receive
*	718-R13	12/05/2005	0:00	0	0	0	0	0	0	1	" " "
*	718-R15	12/05/2005	0:00	0	0	0	0	0	0	1	" " "
*	718-R17	12/05/2005	0:00	0	0	0	0	0	0	1	" " "
			Sum							16	

Relinquished by (signature)	Date	Time
	1-23-06	13:00
Received by (signature)	**Date**	**Time**
	02/01/06	0800

Relinquished by (signature)	Date	Time
Received by (signature)	**Date**	**Time**

* did not receive

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CHAIN OF CUSTODY

RIN: 06010294
COC: 06010294.1.8
Sampler(s):

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Site Name: MOAB MONITORING
Site Code: MOA01
Cost Number: 06-203-2-01-3-1-01
Purchase Order: 24316
Sample Matrix: Soil

Ticket No.	Location	Sample Date	Time	HDPE 125 mL	HDPE 250 mL	HDPE 500 mL	HDPE 1 L	Glass 40 mL	Glass 1 L	Other	Analysis
*	718-R5	12/05/2005	0:00	0	0	0	0	0	0	1	did not receive
*	718-R7	12/05/2005	0:00	0	0	0	0	0	0	1	" " "
*	718-R9	12/05/2005	0:00	0	0	0	0	0	0	1	" " "
	720-R1	11/05/2005	0:00	0	0	0	0	0	0	1	
	720-R12	11/05/2005	0:00	0	0	0	0	0	0	1	
	720-R14	11/05/2005	0:00	0	0	0	0	0	0	1	
	720-R16	11/05/2005	0:00	0	0	0	0	0	0	1	
	720-R2	11/05/2005	0:00	0	0	0	0	0	0	1	
	720-R3	11/05/2005	0:00	0	0	0	0	0	0	1	
	720-R4	11/05/2005	0:00	0	0	0	0	0	0	1	
	720-R5	11/05/2005	0:00	0	0	0	0	0	0	1	
	720-R6	11/05/2005	0:00	0	0	0	0	0	0	1	
	720-R7	11/05/2005	0:00	0	0	0	0	0	0	1	
	720-R8	11/05/2005	0:00	0	0	0	0	0	0	1	
	720-R9	11/05/2005	0:00	0	0	0	0	0	0	1	
*	722-R1	11/04/2005	0:00	0	0	0	0	0	0	1	did not receive
			Sum							16	

Reliquished by (signature)	Date	Time
	1-23-06	13:00
Received by (signature)	**Date**	**Time**
	02/01/06	0800

Reliquished by (signature)	Date	Time
Received by (signature)	**Date**	**Time**

* did not receive

CHAIN OF CUSTODY

RIN: 06010294
COC: 06010294.1.9
Sampler(s):

Site Name: MOAB MONITORING
Site Code: MOA01
Cost Number: 06-203-2-01-3-1-01
Purchase Order: 24316
Sample Matrix: Soil

Ticket No.	Location	Sample Date	Time	HDPE 125 mL	HDPE 250 mL	HDPE 500 mL	HDPE 1 L	Glass 40 mL	Glass 1 L	Other	Analysis
*	722-R2	11/04/2005	0:00	0	0	0	0	0	0	1	did not receive
*	722-R3	11/04/2005	0:00	0	0	0	0	0	0	1	did not receive
	722-R4	11/04/2005	0:00	0	0	0	0	0	0	1	
*	722-R5	11/04/2005	0:00	0	0	0	0	0	0	1	did not receive
	722-R6	11/04/2005	0:00	0	0	0	0	0	0	1	
	722-R7	11/04/2005	0:00	0	0	0	0	0	0	1	
	722-R8	11/04/2005	0:00	0	0	0	0	0	0	1	
	723-R2	11/03/2005	0:00	0	0	0	0	0	0	1	
	723-R3	11/03/2005	0:00	0	0	0	0	0	0	1	
	723-R4	11/03/2005	0:00	0	0	0	0	0	0	1	
	723-R5	11/03/2005	0:00	0	0	0	0	0	0	1	
	723-R6	11/03/2005	0:00	0	0	0	0	0	0	1	
	723-R7	11/03/2005	0:00	0	0	0	0	0	0	1	
	723-R8	11/03/2005	0:00	0	0	0	0	0	0	1	
	GATP-10-1	12/07/2005	0:00	0	0	0	0	0	0	1	
	GATP-10-2	12/07/2005	0:00	0	0	0	0	0	0	1	
			Sum							16	

Relinquished by (signature)	Date	Time
	1-23-06	13:00
Received by (signature)	**Date**	**Time**
	02/01/06	0800

Relinquished by (signature)	Date	Time
Received by (signature)	**Date**	**Time**

* did not receive

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CHAIN OF CUSTODY

RIN: 06010294
COC: 06010294.1.10
Sampler(s):

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Site Name: MOAB MONITORING
Site Code: MOA01
Cost Number: 06-203-2-01-3-1-01
Purchase Order: 24316
Sample Matrix: Soil

Ticket No.	Location	Sample Date	Time	HDPE 125 mL	HDPE 250 mL	HDPE 500 mL	HDPE 1 L	Glass 40 mL	Glass 1 L	Other	Analysis
*	GATP-10-4	12/07/2005	0:00	0	0	0	0	0	0	1	did not receive
	GATP-11-2	12/07/2005	0:00	0	0	0	0	0	0	1	
	GATP-11-4	12/07/2005	0:00	0	0	0	0	0	0	1	
	GATP-12-5	12/07/2005	0:00	0	0	0	0	0	0	1	
	GATP-3-2	12/08/2005	0:00	0	0	0	0	0	0	1	
	GATP-3-4	12/08/2005	0:00	0	0	0	0	0	0	1	
	GATP-4-5	12/08/2005	0:00	0	0	0	0	0	0	1	
	GATP-5-2	12/08/2005	0:00	0	0	0	0	0	0	1	
	GATP-5-4	12/08/2005	0:00	0	0	0	0	0	0	1	
	GATP-6-1	12/08/2005	0:00	0	0	0	0	0	0	1	
	GATP-6-5	12/08/2005	0:00	0	0	0	0	0	0	1	
	GATP-7-2	12/07/2005	0:00	0	0	0	0	0	0	1	
	GATP-7-4	12/07/2005	0:00	0	0	0	0	0	0	1	
	GATP-8-5	12/08/2005	0:00	0	0	0	0	0	0	1	
*	GATP-9-5	12/08/2005	0:00	0	0	0	0	0	0	1	
			Sum							15	

Relinquished by (signature)	Date	Time
	1-27-06	13:00
Received by (signature)	**Date**	**Time**
	02/01/06	0800

Reliquished by (signature)	Date	Time
Received by (signature)	Date	Time

TABLE 1 - BOREHOLE SOIL SAMPLE LOG AND TEST REQUEST

Golder Associates

Project: *Moab Tailings Impoundment Geotechnical Investigation*
Project No.: *053-2269*
Project Location: *Moab, Utah*

Borehole No.	Sample No.	Sample Date	Sampled by	Sample Type	Sample Location (Northing, Easting)	Sample Interval (ft. bgs)	Description Based On Field Logs	Laboratory Test Request (see key below)	Laboratory Test Specific Instructions (UU Triax. Cell Pressure in psf)
714	R1	11/3/2005	RPD	Split Spoon, Bag	SEE MAP	3.0-4.5	Sandy Silt	1c,4b	
714	R2	11/3/2005	RPD	Split Spoon, Bag	SEE MAP	8.0-9.5	Silty Sand with Clay	1b,4b	
714	R3	11/3/2005	RPD	Split Spoon, Bag	SEE MAP	13.0-14.5	Silty Sand	1c,3,4b	
714	R4	11/3/2005	RPD	Split Spoon, Bag	SEE MAP	18.0-19.5	Silty Sand	1b,4b	
714	R5	11/3/2005	RPD	Split Spoon, Bag	SEE MAP	23.0-24.5	Silty Sand	1c,4b	
714	R6	11/3/2005	RPD	Split Spoon, Bag	SEE MAP	28.0-29.5	Silty Sand	1b,4b	
714	R7	11/3/2005	RPD	Split Spoon, Bag	SEE MAP	33.0-34.5	Silty Sand	1c,4b	
714	R8	11/3/2005	RPD	Split Spoon, Bag	SEE MAP	38.0-39.5	Silty Sand, native	1b,4b	
723	R1	11/3/2005	RPD	Shelby Tube	SEE MAP	3.5-5.5	Silty Clay with Sand		
723	R2	11/3/2005	RPD	Shelby Tube	SEE MAP	8.5-10.5	Silty Clay with Sand	1a,2,4a,	
723	R3	11/3/2005	RPD	Split Spoon, Bag	SEE MAP	13.5-15.0	Silty Sand	1c,4b	
723	R4	11/3/2005	RPD	Split Spoon, Bag	SEE MAP	18.5-20.0	Silty Sand	1b,4b	
723	R5	11/3/2005	RPD	Split Spoon, Bag	SEE MAP	23.5-25.0	Silty Sand	1c,4b	
723	R6	11/3/2005	RPD	Split Spoon, Bag	SEE MAP	28.5-30.0	Silty Sand	1b,4b	
723	R7	11/3/2005	RPD	Split Spoon, Bag	SEE MAP	33.5-35.0	Silty Sand	1c,4b	
723	R8	11/3/2005	RPD	Split Spoon, Bag	SEE MAP	38.5-40.0	Silty Sand, native	1b,4b	
713	R1	11/3/2005	RPD	Split Spoon, Bag	SEE MAP	3.5-5.0	Silty Sand	1c,4b	
713	R2	11/3/2005	RPD	Shelby Tube	SEE MAP	8.5-10.5	Silty Sand with intermintent clay lenses	1b,3,4a	
713	R3	11/4/2005	RPD	Shelby Tube	SEE MAP	13.5-15.5	Sandy Silt		
713	R4	11/4/2005	RPD	Split Spoon, Bag	SEE MAP	15.5-17.0	Sandy Silt		
713	R5	11/4/2005	RPD	Shelby Tube	SEE MAP	17.0-19.0	Sandy Silt	1c,4a	
713	R6	11/4/2005	RPD	Split Spoon, Bag	SEE MAP	19.0-20.5	Sandy Silt		
713	R7	11/4/2005	RPD	Shelby Tube	SEE MAP	20.5-22.5	Sandy Silt	1b,3,4a	
713	R8	11/4/2005	RPD	Split Spoon, Bag	SEE MAP	23.0-24.5	Sandy Silt		
713	R9	11/4/2005	RPD	Shelby Tube	SEE MAP	25.0-27.0	Sandy Silt	1c,4a	
713	R10	11/4/2005	RPD	Split Spoon, Bag	SEE MAP	27.0-28.5	Sandy Silt with Clay		
713	R11	11/4/2005	RPD	Shelby Tube	SEE MAP	29.5-31.5	Sandy Silt with Clay	1a,2,4a,	
713	R12	11/4/2005	RPD	Split Spoon, Bag	SEE MAP	31.5-33.0	Silty Sand		
713	R13	11/4/2005	RPD	Split Spoon, Bag	SEE MAP	35.0-36.5	Silty Sand, native	1b,4b	
722	R1	11/4/2005	RPD	Split Spoon, Bag	SEE MAP	3.5-5.0	Silty Sand	1c,4b	
722	R2	11/4/2005	RPD	Split Spoon, Bag	SEE MAP	8.5-10.0	Silty Sand	1b,4b	
722	R3	11/4/2005	RPD	Split Spoon, Bag	SEE MAP	13.5-15.0	Silty Sand	1c,4b	
722	R4	11/4/2005	RPD	Split Spoon, Bag	SEE MAP	18.5-20.0	Silty Sand	1c,4b	
722	R5	11/4/2005	RPD	Split Spoon, Bag	SEE MAP	23.5-25.0	Silty Sand	1c,4b	
722	R6	11/4/2005	RPD	Split Spoon, Bag	SEE MAP	28.5-30.0	Silty Sand with Clay	1b,4b	
722	R7	11/4/2005	RPD	Split Spoon, Bag	SEE MAP	33.5-35.0	Silty Sand with Clay	1c,4b	
722	R8	11/4/2005	RPD	Split Spoon, Bag	SEE MAP	38.5-40.0	Silty Clay with Sand	1a,2	
722	R9	11/4/2005	RPD	Shelby Tube	SEE MAP	40.0-41.0	Silty Sand		
712	R1	11/4/2005	RPD	Split Spoon, Bag	SEE MAP	1.0-2.5	Silty Sand		
712	R2	11/4/2005	RPD	Split Spoon, Bag	SEE MAP	3.0-4.5	Silty Sand	1c,4b	
712	R3	11/4/2005	RPD	Split Spoon, Bag	SEE MAP	8.0-9.5	Silty Sand	1b,4b	
712	R4	11/4/2005	RPD	Split Spoon, Bag	SEE MAP	13.0-14.5	Silty Sand	1c,4b	
712	R5	11/4/2005	RPD	Split Spoon, Bag	SEE MAP	18.0-19.5	Silty Sand with Clay		
712	R6	11/4/2005	RPD	Shelby Tube	SEE MAP	19.5-21.5	Silty Sand with Clay	1a,4a	
712	R7	11/4/2005	RPD	Shelby Tube	SEE MAP	23.0-25.0	Silty Clay	1c,4a	
712	R8	11/4/2005	RPD	Split Spoon, Bag	SEE MAP	25.0-26.5	Silty Clay		

TABLE 1 - BOREHOLE SOIL SAMPLE LOG AND TEST REQUEST

Golder Associates

Project: *Moab Tailings Impoundment Geotechnical Investigation*
Project No.: *053-2269*
Project Location: *Moab, Utah*

Borehole No.	Sample No.	Sample Date	Sampled by	Sample Type	Sample Location (Northing, Easting)	Sample Interval (ft, bgs)	Description Based On Field Logs	Laboratory Test Request (see key below)	Laboratory Test Specific Instructions (UU Triax, Cell Pressure in psf)
712	R9	11/4/2005	RPD	Split Spoon, Bag	SEE MAP	28.0-29.5	Silty Clay	1c,4b	
712	R10	11/4/2005	RPD	Split Spoon, Bag	SEE MAP	33.0-34.5	Sandy Silty Clay		
712	R11	11/4/2005	RPD	Shelby Tube	SEE MAP	35.0-37.0	Sandy Silty Clay	1b,2,4a	
712	R12	11/4/2005	RPD	Shelby Tube	SEE MAP	39.0-41.0	Sandy Silty Clay		
712	R13	11/4/2005	RPD	Shelby Tube	SEE MAP	43.0-45.0	Sandy Silty Clay	1c,4a	
712	R14	11/4/2005	RPD	Shelby Tube	SEE MAP	48.0-50.0	Silty Clay		
712	R15	11/4/2005	RPD	Shelby Tube	SEE MAP	52.0-54.0	Silty Sand	1b,4a	
712	R16	11/4/2005	RPD	Split Spoon, Bag	SEE MAP	58.5-60.0	Silty Sand	1c,4b	
712	R17	11/4/2005	RPD	Split Spoon, Bag	SEE MAP	63.5-65.0	Silty Sand, native	1b,4b	
721	R1	11/5/2005	RPD	Split Spoon, Bag	SEE MAP	3.5-5.0	Silty Sand		
721	R2	11/5/2005	RPD	Split Spoon, Bag	SEE MAP	8.5-10.0	Silty Sand		
721	R3	11/5/2005	RPD	Split Spoon, Bag	SEE MAP	13.5-15.0	Silty Sand		
721	R4	11/5/2005	RPD	Split Spoon, Bag	SEE MAP	18.5-20.0	Silty Sand		
721	R5	11/5/2005	RPD	Split Spoon, Bag	SEE MAP	23.5-25.0	Silty Sand		
721	R6	11/5/2005	RPD	Split Spoon, Bag	SEE MAP	28.5-30.0	Silty Clay		
721	R7	11/5/2005	RPD	Shelby Tube	SEE MAP	30.0-32.0	Silty Clay		
721	R8	11/5/2005	RPD	Split Spoon, Bag	SEE MAP	33.5-35.0	Silty Sand with Clay		
721	R9	11/5/2005	RPD	Shelby Tube	SEE MAP	35.0-37.0	Silty Sand with Clay		
721	R10	11/5/2005	RPD	Split Spoon, Bag	SEE MAP	38.5-40.0	Silty Clay, high fines content		
721	R11	11/5/2005	RPD	Shelby Tube	SEE MAP	40.0-42.0	Silty Clay, high fines content		
721	R12	11/5/2005	RPD	Split Spoon, Bag	SEE MAP	43.5-45.0	Silty Clay, high fines content		
721	R13	11/5/2005	RPD	Shelby Tube	SEE MAP	45.0-47.0	Silty Clay, high fines content		
721	R14	11/5/2005	RPD	Split Spoon, Bag	SEE MAP	48.5-50.0	Silty Clay, high fines content		
721	R15	11/5/2005	RPD	Shelby Tube	SEE MAP	50.0-52.0	Silty Clay, high fines content		
721	R16	11/5/2005	RPD	Split Spoon, Bag	SEE MAP	53.5-55.0	Silty Sand, native		
720	R1	11/5/2005	RPD	Split Spoon, Bag	SEE MAP	4.5-6.0	Silty Sand	1b,4b	
720	R2	11/5/2005	RPD	Split Spoon, Bag	SEE MAP	9.5-11.0	Silty Sand	1c,4b	
720	R3	11/5/2005	RPD	Split Spoon, Bag	SEE MAP	14.5-16.0	Silty Sand	1c,4b	
720	R4	11/5/2005	RPD	Split Spoon, Bag	SEE MAP	19.5-21.0	Silty Sand with Clay	1b,4b	
720	R5	11/5/2005	RPD	Split Spoon, Bag	SEE MAP	24.5-26.0	Silty Sand with Clay	1c,4b	
720	R6	11/5/2005	RPD	Split Spoon, Bag	SEE MAP	29.5-31.0	Silty Sand with Clay	1c,4b	
720	R7	11/5/2005	RPD	Split Spoon, Bag	SEE MAP	34.5-36.0	Silty Sand with Clay	1c,4b	
720	R8	11/5/2005	RPD	Split Spoon, Bag	SEE MAP	39.5-41.0	Sandy Silt	1b,4b	
720	R9	11/5/2005	RPD	Shelby Tube	SEE MAP	42.0-44.0	Sandy Silt	1c,4a	
720	R10	11/5/2005	RPD	Split Spoon, Bag	SEE MAP	45.0-46.5	Silty Sand		
720	R11	11/5/2005	RPD	Split Spoon, Bag	SEE MAP	48.5-50.0	Silty Clay		
720	R12	11/5/2005	RPD	Shelby Tube	SEE MAP	50.0-52.0	Silty Sand, little Clay	1c,2,4a	
720	R13	11/5/2005	RPD	Split Spoon, Bag	SEE MAP	53.5-55.0	Silty Sand, little Clay		
720	R14	11/5/2005	RPD	Shelby Tube	SEE MAP	55.0-57.0	Silty Sand, little Clay	1c,4a	
720	R15	11/5/2005	RPD	Split Spoon, Bag	SEE MAP	58.5-60.0	Silty Sand with Clay		
720	R16	11/5/2005	RPD	Split Spoon, Bag	SEE MAP	63.5-65.0	Silty Sand, native	1b,4b	
700	R1	11/5/2005	RPD	Shelby Tube	SEE MAP	0.0-2.0	Silty Sand		
700	R2	11/5/2005	RPD	Shelby Tube	SEE MAP	2.0-4.0	Silty Sand		
700	R3	11/5/2005	RPD	Shelby Tube	SEE MAP	4.0-6.0	Silty Sand		
700	R4	11/5/2005	RPD	Shelby Tube	SEE MAP	6.0-8.0	No Recovery		
700	R5	11/5/2005	RPD	Shelby Tube	SEE MAP	8.0-10.0	Silty Sand	1b,3,4a	

TABLE 1 - BOREHOLE SOIL SAMPLE LOG AND TEST REQUEST

Golder Associates

Project: *Moab Tailings Impoundment Geotechnical Investigation*
Project No.: *053-2269*
Project Location: *Moab, Utah*

Borehole No.	Sample No.	Sample Date	Sampled by	Sample Type	Sample Location (Northing, Easting)	Sample Interval (ft, bgs)	Description Based On Field Logs	Laboratory Test Request (see key below)	Laboratory Test Specific Instructions (UU Triax. Cell Pressure in psf)
700	R6	11/6/2005	RPD	Shelby Tube	SEE MAP	10.0-12.0	Silty Sand		
700	R7	11/6/2005	RPD	Shelby Tube	SEE MAP	12.0-14.0	Silty Sand with Clay		
700	R8	11/6/2005	RPD	Shelby Tube	SEE MAP	14.0-16.0	Silty Sand with Clay	1a,2,4a,	
700	R9	11/6/2005	RPD	Shelby Tube	SEE MAP	16.0-18.0	Silty Sand with Clay		
700	R10	11/6/2005	RPD	Shelby Tube	SEE MAP	18.0-20.0	Silty Sand with Clay		
700	R11	11/6/2005	RPD	Shelby Tube	SEE MAP	20.0-22.0	Silty Sand with Clay		
700	R12	11/6/2005	RPD	Shelby Tube	SEE MAP	22.0-24.0	Silty Sand with Clay	1b,2,4a,5a,5b	1772
700	R13	11/6/2005	RPD	Shelby Tube	SEE MAP	24.0-26.0	Silty Sand with Clay		
700	R14	11/6/2005	RPD	Shelby Tube	SEE MAP	26.0-28.0	Silty Sand with Clay		
700	R15	11/6/2005	RPD	Shelby Tube	SEE MAP	28.0-30.0	Silty Sand with Clay		
700	R16	11/6/2005	RPD	Shelby Tube	SEE MAP	30.0-32.0	Silty Sand with Clay	1c,4a	
700	R17	11/6/2005	RPD	Shelby Tube	SEE MAP	32.0-34.0	Silty Sand		
700	R18	11/6/2005	RPD	Shelby Tube	SEE MAP	34.0-36.0	Silty Sand		
700	R19	11/6/2005	RPD	Shelby Tube	SEE MAP	36.0-38.0	Silty Sand		
700	R20	11/6/2005	RPD	Shelby Tube	SEE MAP	38.0-40.0	Silty Sand	1c,4a	
700	R21	11/6/2005	RPD	Shelby Tube	SEE MAP	40.0-42.0	Silty Sand with Clay		
700	R22	11/6/2005	RPD	Shelby Tube	SEE MAP	42.0-44.0	Silty Sand with Clay		
700	R23	11/6/2005	RPD	Shelby Tube	SEE MAP	44.0-46.0	Silty Sand with Clay		
700	R24	11/6/2005	RPD	Shelby Tube	SEE MAP	46.0-48.0	Silty Sand with little Clay	1c,2,4a	
700	R25	11/6/2005	RPD	Shelby Tube	SEE MAP	48.0-50.0	Silty Sand with little Clay		
700	R26	11/6/2005	RPD	Shelby Tube	SEE MAP	50.0-52.0	No Recovery		
700	R27	11/6/2005	RPD	Shelby Tube	SEE MAP	52.0-54.0	Saturated fine Sand		
700	R28	11/6/2005	RPD	Shelby Tube	SEE MAP	54.0-56.0	No Recovery		
700	R29	11/6/2005	RPD	Shelby Tube	SEE MAP	56.0-58.0	Silty Sand with Clay		
700	R30	11/6/2005	RPD	Shelby Tube	SEE MAP	58.0-60.0	Silty Sand with Clay	1b,2,3,4a,5a,5b	4546
700	R31	11/6/2005	RPD	Shelby Tube	SEE MAP	60.0-62.0	Silty Sand with Clay		
700	R32	11/6/2005	RPD	Shelby Tube	SEE MAP	62.0-64.0	Silty Sand with Clay		
700	R33	11/6/2005	RPD	Shelby Tube	SEE MAP	64.0-66.0	Silty Clay		
700	R34	11/6/2005	RPD	Shelby Tube	SEE MAP	66.0-68.0	No Recovery		
700	R35	11/6/2005	RPD	Shelby Tube	SEE MAP	68.0-70.0	Silty Sand with Clay	1c,2,4a	
700	R36	11/6/2005	RPD	Shelby Tube	SEE MAP	70.0-72.0	Silty Sandy Clay		
700	R37	11/6/2005	RPD	Shelby Tube	SEE MAP	72.0-74.0	Sandy Silt with Clay		
700	R38	11/6/2005	RPD	Shelby Tube	SEE MAP	74.0-76.0	Sandy Silt with Clay		
700	R39	11/6/2005	RPD	Shelby Tube	SEE MAP	76.0-78.0	Silty Sandy Clay	1a,2,4a,5a,5b	5933
700	R40	11/6/2005	RPD	Shelby Tube	SEE MAP	78.0-80.0	Silty Sandy Clay		
700	R41	11/6/2005	RPD	Shelby Tube	SEE MAP	80.0-82.0	Silty Sandy Clay		
700	R42	11/6/2005	RPD	Shelby Tube	SEE MAP	82.0-82.5	Silty Sand, native		
709	R1	11/7/2005	RPD	Split Spoon, Bag	SEE MAP	1.5-3.0	Silty Sand		
709	R2	11/7/2005	RPD	Shelby Tube	SEE MAP	3.0-5.0	Silty Sand		
709	R3	11/7/2005	RPD	Split Spoon, Bag	SEE MAP	6.5-8.0	Silty Sand		
709	R4	11/7/2005	RPD	Shelby Tube	SEE MAP	8.0-10.0	Silty Sand		
709	R5	11/7/2005	RPD	Split Spoon, Bag	SEE MAP	11.5-13.0	Silty Sand		
709	R6	11/7/2005	RPD	Shelby Tube	SEE MAP	13.0-15.0	Sandy Silt		
709	R7	11/7/2005	RPD	Split Spoon, Bag	SEE MAP	16.5-18.0	Sandy Silt		
709	R8	11/7/2005	RPD	Shelby Tube	SEE MAP	18.0-20.0	Silty Sand		
709	R9	11/7/2005	RPD	Split Spoon, Bag	SEE MAP	21.5-23.0	Sandy Silt		

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Golder Associates

Project: *Moab Tailings Impoundment Geotechnical Investigation*
Project No.: *053-2269*
Project Location: *Moab, Utah*

Borehole No.	Sample No.	Sample Date	Sampled by	Sample Type	Sample Location (Northing, Easting)	Sample Interval (ft, bgs)	Description Based On Field Logs	Laboratory Test Request (see key below)	Laboratory Test Specific Instructions (UU Triax. Cell Pressure in psf)
709	R10	11/7/2005	RPD	Shelby Tube	SEE MAP	23.0-25.0	Sandy Silt		
709	R11	11/7/2005	RPD	Split Spoon, Bag	SEE MAP	26.5-28.0	Sandy Clay, little Silt		
709	R12	11/7/2005	RPD	Shelby Tube	SEE MAP	28.0-30.0	Sandy Clay, little Silt		
709	R13	11/7/2005	RPD	Split Spoon, Bag	SEE MAP	31.5-33.0	Silty Sand with Clay		
709	R14	11/7/2005	RPD	Shelby Tube	SEE MAP	33.0-35.0	Silty Sand with Clay		
709	R15	11/7/2005	RPD	Split Spoon, Bag	SEE MAP	36.5-38.0	Sandy Silt with Clay		
709	R16	11/7/2005	RPD	Shelby Tube	SEE MAP	38.0-40.0	Sandy Silt with Clay		
709	R17	11/7/2005	RPD	Split Spoon, Bag	SEE MAP	41.5-43.0	Sandy Silt with Clay		
709	R18	11/7/2005	RPD	Shelby Tube	SEE MAP	43.0-45.0	Sandy Silt with Clay		
709	R19	11/7/2005	RPD	Split Spoon, Bag	SEE MAP	46.5-48.0	Silty Sand with Clay		
709	R20	11/7/2005	RPD	Shelby Tube	SEE MAP	48.0-50.0	Silty Sand with Clay		
709	R21	11/7/2005	RPD	Split Spoon, Bag	SEE MAP	51.5-53.0	Silty Clay with Sand		
709	R22	11/7/2005	RPD	Shelby Tube	SEE MAP	53.0-55.0	Silty Clay with Sand		
709	R23	11/7/2005	RPD	Split Spoon, Bag	SEE MAP	56.5-58.0	Silty Clay with Sand		
709	R24	11/7/2005	RPD	Shelby Tube	SEE MAP	58.0-60.0	Sandy Silt		
709	R25	11/7/2005	RPD	Split Spoon, Bag	SEE MAP	61.5-63.0	Silty Clay		
709	R26	11/7/2005	RPD	Shelby Tube	SEE MAP	63.0-65.0	Silty Clay		
709	R27	11/7/2005	RPD	Split Spoon, Bag	SEE MAP	65.0-65.75	Silty Sand, native		
701	R1	11/7/2005	RPD	Split Spoon, Bag	SEE MAP	1.5-3.0	Silty Sand		
701	R2	11/7/2005	RPD	Shelby Tube	SEE MAP	3.0-5.0	Silty Sand		
701	R3	11/7/2005	RPD	Split Spoon, Bag	SEE MAP	6.5-8.0	Silty Sand with Clay		
701	R4	11/7/2005	RPD	Shelby Tube	SEE MAP	8.0-10.0	Silty Sand with Clay	1b,4a	
701	R5	11/7/2005	RPD	Split Spoon, Bag	SEE MAP	11.5-13.0	Silty Sand with Clay		
701	R6	11/7/2005	RPD	Shelby Tube	SEE MAP	13.0-15.0	Silty Sand with Clay		
701	R7	11/7/2005	RPD	Split Spoon, Bag	SEE MAP	16.5-18.0	Silty Clay		
701	R8	11/7/2005	RPD	Shelby Tube	SEE MAP	18.0-20.0	Silty Clay	1a,2,4a,	
701	R9	11/7/2005	RPD	Split Spoon, Bag	SEE MAP	21.5-23.0	Silty Sand, some Clay		
701	R10	11/7/2005	RPD	Shelby Tube	SEE MAP	23.0-25.0	Silty Sand, some Clay		
701	R11	11/7/2005	RPD	Split Spoon, Bag	SEE MAP	26.5-28.0	Silty Sand		
701	R12	11/7/2005	RPD	Shelby Tube	SEE MAP	28.0-30.0	Silty Sand	1b,4a	
701	R13	11/7/2005	RPD	Split Spoon, Bag	SEE MAP	31.5-33.0	Sandy Silt with Clay		
701	R14	11/7/2005	RPD	Shelby Tube	SEE MAP	33.0-35.0	Sandy Silt with Clay		
701	R15	11/7/2005	RPD	Split Spoon, Bag	SEE MAP	36.5-38.0	Silty Clay		
701	R16	11/7/2005	RPD	Shelby Tube	SEE MAP	38.0-40.0	No Recovery		
701	R17	11/7/2005	RPD	Split Spoon, Bag	SEE MAP	41.5-43.0	Silty Clay		
701	R18	11/7/2005	RPD	Shelby Tube	SEE MAP	43.0-45.0	Silty Clay	1a,2,4a,	
701	R19	11/8/2005	RPD	Split Spoon, Bag	SEE MAP	46.5-48.0	Silty Clay		
701	R20	11/8/2005	RPD	Shelby Tube	SEE MAP	48.0-50.0	Silty Clay		
701	R21	11/8/2005	RPD	Split Spoon, Bag	SEE MAP	51.5-53.0	Silty Clay		
701	R22	11/8/2005	RPD	Shelby Tube	SEE MAP	53.0-55.0	Silty Clay, Silty Sand with Clay	1b,4a	
701	R23	11/8/2005	RPD	Split Spoon, Bag	SEE MAP	56.5-58.0	Silty Sand with Clay		
701	R24	11/8/2005	RPD	Shelby Tube	SEE MAP	58.0-60.0	Silty Sand with Clay		
701	R25	11/8/2005	RPD	Split Spoon, Bag	SEE MAP	61.5-63.0	Silty Sand with Clay		
701	R26	11/8/2005	RPD	Shelby Tube	SEE MAP	63.0-65.0	Silty Sand with Clay	1b,4a	
701	R27	11/8/2005	RPD	Split Spoon, Bag	SEE MAP	66.5-68.0	Silty Sand with Clay		
701	R28	11/8/2005	RPD	Shelby Tube	SEE MAP	68.0-70.0	Silty Clay		

TABLE 1 - BOREHOLE SOIL SAMPLE LOG AND TEST REQUEST

Golder Associates

Project: Moab Tailings Impoundment Geotechnical Investigation
Project No.: 053-2269
Project Location: Moab, Utah

Borehole No.	Sample No.	Sample Date	Sampled by	Sample Type	Sample Location (Northing, Easting)	Sample Interval (ft. bgs)	Description Based On Field Logs	Laboratory Test Request (see key below)	Laboratory Test Specific Instructions (UU Triax, Cell Pressure in psf)
701	R29	11/8/2005	RPD	Split Spoon, Bag	SEE MAP	71.5-73.0	Silty Clay		
701	R30	11/8/2005	RPD	Shelby Tube	SEE MAP	73.0-75.0	Silty Clay	1a,2,4a,	
701	R31	11/8/2005	RPD	Split Spoon, Bag	SEE MAP	76.5-78.0	Clayey Silt		
701	R32	11/8/2005	RPD	Shelby Tube	SEE MAP	78.0-80.0	Clayey Silt		
701	R33	11/8/2005	RPD	Split Spoon, Bag	SEE MAP	80.0-81.5	Silty Sand, native	1b,4b	
703	R1	11/8/2005	RPD	Split Spoon, Bag	SEE MAP	1.5-3.0	Silty Sand with Gravel		
703	R2	11/8/2005	RPD	Shelby Tube	SEE MAP	3.0-5.0	Silty Sand		
703	R3	11/8/2005	RPD	Split Spoon, Bag	SEE MAP	6.5-8.0	Silty Sand		
703	R4	11/8/2005	RPD	Shelby Tube	SEE MAP	8.0-10.0	Silty Sand		
703	R5	11/8/2005	RPD	Split Spoon, Bag	SEE MAP	11.5-13.0	Silty Sand		
703	R6	11/8/2005	RPD	Shelby Tube	SEE MAP	13.0-15.0	Silty Sand		
703	R7	11/8/2005	RPD	Split Spoon, Bag	SEE MAP	16.5-18.0	Silty Sand		
703	R8	11/8/2005	RPD	Shelby Tube	SEE MAP	18.0-20.0	Sandy Silt with Clay		
703	R9	11/8/2005	RPD	Split Spoon, Bag	SEE MAP	21.5-23.0	Silty Clay		
703	R10	11/8/2005	RPD	Shelby Tube	SEE MAP	23.0-25.0	Silty Clay		
703	R11	11/8/2005	RPD	Split Spoon, Bag	SEE MAP	26.5-28.0	Silty Clay		
703	R12	11/8/2005	RPD	Shelby Tube	SEE MAP	28.0-30.0	Silty Clay		
703	R13	11/8/2005	RPD	Split Spoon, Bag	SEE MAP	31.5-33.0	Silty Clay		
703	R14	11/8/2005	RPD	Shelby Tube	SEE MAP	33.0-35.0	Silty Sand with Clay		
703	R15	11/8/2005	RPD	Split Spoon, Bag	SEE MAP	36.5-38.0	Silty Sand with Clay		
703	R16	11/8/2005	RPD	Shelby Tube	SEE MAP	38.0-40.0	Silty Sand with Clay		
703	R17	11/8/2005	RPD	Split Spoon, Bag	SEE MAP	41.5-43.0	Silty Sand with Clay		
703	R18	11/8/2005	RPD	Shelby Tube	SEE MAP	43.0-45.0	Silty Sand with Clay		
703	R19	11/8/2005	RPD	Split Spoon, Bag	SEE MAP	46.5-48.0	Silty Clay		
703	R20	11/8/2005	RPD	Shelby Tube	SEE MAP	48.0-50.0	Silty Clay		
703	R21	11/8/2005	RPD	Split Spoon, Bag	SEE MAP	51.5-53.0	Silty Clay		
703	R22	11/8/2005	RPD	Shelby Tube	SEE MAP	53.0-55.0	Silty Clay		
703	R23	11/8/2005	RPD	Split Spoon, Bag	SEE MAP	56.5-58.0	Silty Clay		
703	R24	11/8/2005	RPD	Shelby Tube	SEE MAP	58.0-60.0	Silty Sand with Clay		
703	R25	11/8/2005	RPD	Split Spoon, Bag	SEE MAP	61.5-63.0	Silt with Clay		
703	R26	11/8/2005	RPD	Shelby Tube	SEE MAP	63.0-65.0	Silt with Clay		
703	R27	11/9/2005	RPD	Split Spoon, Bag	SEE MAP	66.5-68.0	Silt with Clay		
703	R28	11/9/2005	RPD	Shelby Tube	SEE MAP	68.0-70.0	Silt with Clay		
703	R29	11/9/2005	RPD	Split Spoon, Bag	SEE MAP	71.5-73.0	Silt with Clay		
703	R30	11/9/2005	RPD	Split Spoon, Bag	SEE MAP	73.0-74.5	Silty Sand, native		
702	R1	11/9/2005	RPD	Split Spoon, Bag	SEE MAP	1.5-3.0	Silty Sand with Gravel		
702	R2	11/9/2005	RPD	Shelby Tube	SEE MAP	3.0-5.0	Silty Sand with Gravel		
702	R3	11/9/2005	RPD	Split Spoon, Bag	SEE MAP	6.5-8.0	Silty Sand		
702	R4	11/9/2005	RPD	Shelby Tube	SEE MAP	8.0-10.0	Silty Sand	1c,3,4a	
702	R5	11/9/2005	RPD	Split Spoon, Bag	SEE MAP	11.5-13.0	Sandy Silt with Clay		
702	R6	11/9/2005	RPD	Shelby Tube	SEE MAP	13.0-15.0	Sandy Silt with Clay	1a,2,4a,	
702	R7	11/9/2005	RPD	Split Spoon, Bag	SEE MAP	16.5-18.0	Sandy Silt with Clay		
702	R8	11/9/2005	RPD	Shelby Tube	SEE MAP	18.0-20.0	Silty Sand, little Clay	1b,4a	
702	R9	11/9/2005	RPD	Split Spoon, Bag	SEE MAP	21.5-23.0	Silty Sand, little Clay		
702	R10	11/9/2005	RPD	Shelby Tube	SEE MAP	23.0-25.0	Silty Sand, little Clay	1c,4a	
702	R11	11/9/2005	RPD	Split Spoon, Bag	SEE MAP	26.5-28.0	Silty Sand, little Clay		

TABLE 1 - BOREHOLE SOIL SAMPLE LOG AND TEST REQUEST

Project: *Moab Tailings Impoundment Geotechnical Investigation*
Project No.: *053-2269*
Project Location: *Moab, Utah*

Borehole No.	Sample No.	Sample Date	Sampled by	Sample Type	Sample Location (Northing, Easting)	Sample Interval (ft, bgs)	Description Based On Field Logs	Laboratory Test Request (see key below)	Laboratory Test Specific Instructions (UU Triax. Cell Pressure in psf)
702	R12	11/9/2005	RPD	Shelby Tube	SEE MAP	28.0-30.0	No Recovery		
702	R13	11/9/2005	RPD	Split Spoon, Bag	SEE MAP	31.5-33.0	Sandy Silt with Clay		
702	R14	11/9/2005	RPD	Shelby Tube	SEE MAP	33.0-35.0	Sandy Silt with Clay	1c,4a	
702	R15	11/9/2005	RPD	Split Spoon, Bag	SEE MAP	36.5-38.0	Sandy Silt with Clay		
702	R16	11/9/2005	RPD	Shelby Tube	SEE MAP	38.0-40.0	Sandy Silt with Clay		
702	R17	11/9/2005	RPD	Split Spoon, Bag	SEE MAP	41.5-43.0	Silty Sand with Clay		
702	R18	11/9/2005	RPD	Shelby Tube	SEE MAP	43.0-45.0	Silty Sand with Clay	1a,2,4a,	
702	R19	11/9/2005	RPD	Split Spoon, Bag	SEE MAP	46.5-48.0	Sandy Silt with Clay		
702	R20	11/9/2005	RPD	Shelby Tube	SEE MAP	48.0-50.0	Silty Sand with Clay		
702	R21	11/9/2005	RPD	Split Spoon, Bag	SEE MAP	51.5-53.0	Silty Sand with Clay		
702	R22	11/9/2005	RPD	Shelby Tube	SEE MAP	53.0-55.0	No Recovery		
702	R23	11/9/2005	RPD	Split Spoon, Bag	SEE MAP	56.5-58.0	Silty Sand with Clay		
702	R24	11/9/2005	RPD	Shelby Tube	SEE MAP	58.0-60.0	Silty Sand with Clay	1b,2,4a	
702	R25	11/9/2005	RPD	Split Spoon, Bag	SEE MAP	61.5-63.0	Silty Sand with Clay		
702	R26	11/9/2005	RPD	Shelby Tube	SEE MAP	63.0-65.0	Silty Sand with Clay		
702	R27	11/9/2005	RPD	Split Spoon, Bag	SEE MAP	66.5-68.0	Silt with Clay		
702	R28	11/9/2005	RPD	Shelby Tube	SEE MAP	68.0-70.0	Silt with Clay	1a,2,4a,	
702	R29	11/9/2005	RPD	Split Spoon, Bag	SEE MAP	71.5-73.0	Silt with Clay		
702	R30	11/9/2005	RPD	Shelby Tube	SEE MAP	73.0-75.0	Silt with Clay		
702	R31	11/9/2005	RPD	Split Spoon, Bag	SEE MAP	76.5-78.0	Silty Sand, native	1b,4b	
702	R32	11/9/2005	RPD	Split Spoon, Bag	SEE MAP	78.0-79.5	Silty Sand, native		
704	R1	11/10/2005	RPD	Split Spoon, Bag	SEE MAP	1.5-3.0	Silty Sand with Gravel		
704	R2	11/10/2005	RPD	Shelby Tube	SEE MAP	3.0-5.0	Silty Sand		
704	R3	11/10/2005	RPD	Split Spoon, Bag	SEE MAP	6.5-8.0	Silty Sand		
704	R4	11/10/2005	RPD	Shelby Tube	SEE MAP	8.0-10.0	Silty Sand		
704	R5	11/10/2005	RPD	Split Spoon, Bag	SEE MAP	11.5-13.0	Silt with Clay		
704	R6	11/10/2005	RPD	Shelby Tube	SEE MAP	13.0-15.0	Silt with Clay		
704	R7	11/10/2005	RPD	Split Spoon, Bag	SEE MAP	16.5-18.0	Silt with Clay		
704	R8	11/10/2005	RPD	Shelby Tube	SEE MAP	18.0-20.0	Silt with Clay		
704	R9	11/10/2005	RPD	Split Spoon, Bag	SEE MAP	21.5-23.0	Clay with Silt		
704	R10	11/10/2005	RPD	Shelby Tube	SEE MAP	23.0-25.0	Clay with Silt		
704	R11	11/10/2005	RPD	Split Spoon, Bag	SEE MAP	26.5-28.0	Clay with Silt		
704	R12	11/10/2005	RPD	Shelby Tube	SEE MAP	28.0-30.0	Clay with Silt		
704	R13	11/10/2005	RPD	Split Spoon, Bag	SEE MAP	31.5-33.0	Clay with Silt		
704	R14	11/10/2005	RPD	Shelby Tube	SEE MAP	33.0-35.0	Clay with Silt		
704	R15	11/10/2005	RPD	Split Spoon, Bag	SEE MAP	36.5-38.0	Clay with Silt		
704	R16	11/10/2005	RPD	Shelby Tube	SEE MAP	38.0-40.0	Sandy Silt with Clay		
704	R17	11/10/2005	RPD	Split Spoon, Bag	SEE MAP	41.5-43.0	Sandy Silt with Clay		
704	R18	11/10/2005	RPD	Shelby Tube	SEE MAP	43.0-45.0	Clay with Silt		
704	R19	11/10/2005	RPD	Split Spoon, Bag	SEE MAP	46.5-48.0	Clay with Silt		
704	R20	11/10/2005	RPD	Shelby Tube	SEE MAP	48.0-50.0	Silt with Clay		
704	R21	11/10/2005	RPD	Split Spoon, Bag	SEE MAP	51.5-53.0	Silty Clay		
704	R22	11/10/2005	RPD	Shelby Tube	SEE MAP	53.0-55.0	Silt with Clay		
704	R23	11/10/2005	RPD	Split Spoon, Bag	SEE MAP	56.5-58.0	Silt with Clay		
704	R24	11/10/2005	RPD	Shelby Tube	SEE MAP	58.0-60.0	Silty Clay		
704	R25	11/10/2005	RPD	Split Spoon, Bag	SEE MAP	61.5-63.0	Silty Clay		

TABLE 1 - BOREHOLE SOIL SAMPLE LOG AND TEST REQUEST

Golder Associates

Project: *Moab Tailings Impoundment Geotechnical Investigation*
Project No.: *053-2269*
Project Location: *Moab, Utah*

Borehole No.	Sample No.	Sample Date	Sampled by	Sample Type	Sample Location (Northing, Easting)	Sample Interval (ft, bgs)	Description Based On Field Logs	Laboratory Test Request (see key below)	Laboratory Test Specific Instructions (UU Triax. Cell Pressure in psf)
704	R26	11/10/2005	RPD	Split Spoon, Bag	SEE MAP	63.0-64.5	Silty Sand, native		
715	R1	11/10/2005	RPD	Split Spoon, Bag	SEE MAP	1.5-3.0	Silty Sand with Gravel		
715	R2	11/10/2005	RPD	Shelby Tube	SEE MAP	3.0-5.0	Silty Sand		
715	R3	11/10/2005	RPD	Split Spoon, Bag	SEE MAP	6.5-8.0	Silty Sand	1b,4b	
715	R4	11/10/2005	RPD	Shelby Tube	SEE MAP	8.0-10.0	Silty Sand		
715	R5	11/10/2005	RPD	Split Spoon, Bag	SEE MAP	11.5-13.0	Sandy Silt with Clay		
715	R6	11/10/2005	RPD	Shelby Tube	SEE MAP	13.0-15.0	Sandy Silt with Clay	1a,2,4a,5a,5b	1079
715	R7	11/10/2005	RPD	Split Spoon, Bag	SEE MAP	16.5-18.0	Sandy Silt with Clay		
715	R8	11/10/2005	RPD	Shelby Tube	SEE MAP	18.0-20.0	Sandy Silt with Clay	1c,4a	
715	R9	11/10/2005	RPD	Split Spoon, Bag	SEE MAP	21.5-23.0	Sandy Silt with Clay		
715	R10	11/10/2005	RPD	Shelby Tube	SEE MAP	23.0-25.0	Silty Sand with Clay		
715	R11	11/10/2005	RPD	Split Spoon, Bag	SEE MAP	26.5-28.0	Silty Sand with Clay	1b,2	
715	R12	11/10/2005	RPD	Shelby Tube	SEE MAP	28.0-30.0	Silty Sand with Clay		
715	R13	11/10/2005	RPD	Split Spoon, Bag	SEE MAP	31.5-33.0	Silty Sand with Clay		
715	R14	11/10/2005	RPD	Shelby Tube	SEE MAP	33.0-35.0	Silty Sand with Clay		
715	R15	11/10/2005	RPD	Split Spoon, Bag	SEE MAP	36.5-38.0	Silty Sand with Clay		
715	R16	11/10/2005	RPD	Shelby Tube	SEE MAP	38.0-40.0	Silty Clay with Sand	1c,4a,5a,5b	3005
715	R17	11/10/2005	RPD	Split Spoon, Bag	SEE MAP	41.5-43.0	Silty Clay with Sand		
715	R18	11/10/2005	RPD	Shelby Tube	SEE MAP	43.0-45.0	Silty Sand with Clay		
715	R19	11/10/2005	RPD	Split Spoon, Bag	SEE MAP	46.5-48.0	Silty Sand with Clay		
715	R20	11/10/2005	RPD	Shelby Tube	SEE MAP	48.0-50.0	Silty Clay	1a,2,4a,	
715	R21	11/10/2005	RPD	Split Spoon, Bag	SEE MAP	51.5-53.0	Silty Clay		
715	R22	11/10/2005	RPD	Shelby Tube	SEE MAP	53.0-55.0	Silt with Clay		
715	R23	11/10/2005	RPD	Split Spoon, Bag	SEE MAP	56.5-58.0	Silty Clay		
715	R24	11/10/2005	RPD	Shelby Tube	SEE MAP	58.0-60.0	Silt with Clay	1a,2,4a,5a,5b	4546
715	R25	11/10/2005	RPD	Split Spoon, Bag	SEE MAP	61.5-63.0	Silt with Clay		
715	R26	11/10/2005	RPD	Shelby Tube	SEE MAP	63.0-65.0	Sandy Silt		
715	R27	11/10/2005	RPD	Split Spoon, Bag	SEE MAP	66.5-68.0	Silty Sand, native		
715	R28	11/10/2005	RPD	Split Spoon, Bag	SEE MAP	68.0-69.5	Silty Sand, native	1b,4b	
716	R1	11/11/2005	RPD	Split Spoon, Bag	SEE MAP	3.5-5.0	Silty Sand with Gravel		
716	R2	11/11/2005	RPD	Split Spoon, Bag	SEE MAP	8.5-10.0	Silty Sand	1b,4b	
716	R3	11/11/2005	RPD	Split Spoon, Bag	SEE MAP	13.5-15.0	Silty Sand	1c,4b	
716	R4	11/11/2005	RPD	Split Spoon, Bag	SEE MAP	18.5-20.0	Silty Sand	1c,4b	
716	R5	11/11/2005	RPD	Split Spoon, Bag	SEE MAP	23.5-25.0	Silty Sand	1c,4b	
716	R6	11/11/2005	RPD	Split Spoon, Bag	SEE MAP	28.5-30.0	Silty Sand	1c,4b	
716	R7	11/11/2005	RPD	Split Spoon, Bag	SEE MAP	33.5-35.0	Silty Sand	1c,4b	
716	R8	11/11/2005	RPD	Split Spoon, Bag	SEE MAP	38.5-40.0	Silty Sand		
716	R9	11/11/2005	RPD	Shelby Tube	SEE MAP	40.0-42.0	Sandy Silt with Clay	1b,2,4a	
716	R10	11/11/2005	RPD	Split Spoon, Bag	SEE MAP	43.5-45.0	Silty Sand		
716	R11	11/11/2005	RPD	Split Spoon, Bag	SEE MAP	48.5-50.0	Silty Sand	1c,4b	
716	R12	11/11/2005	RPD	Split Spoon, Bag	SEE MAP	53.5-55.0	Silty Sand with Clay		
716	R13	11/11/2005	RPD	Shelby Tube	SEE MAP	55.0-57.0	Silty Sand with Clay	1a,2,4a,	
716	R14	11/11/2005	RPD	Split Spoon, Bag	SEE MAP	58.5-60.0	Silty Sand with Clay		
716	R15	11/11/2005	RPD	Split Spoon, Bag	SEE MAP	63.5-65.0	Silty Sand		
716	R16	11/11/2005	RPD	Split Spoon, Bag	SEE MAP	68.5-70.0	Sandy Silt with Clay	1b,2,4b	
716	R17	11/11/2005	RPD	Shelby Tube	SEE MAP	70.0-72.0	Sandy Silt with Clay		

TABLE 1 - BOREHOLE SOIL SAMPLE LOG AND TEST REQUEST

Golder Associates

Project: *Moab Tailings Impoundment Geotechnical Investigation*
Project No.: *053-2269*
Project Location: *Moab, Utah*

Borehole No.	Sample No.	Sample Date	Sampled by	Sample Type	Sample Location (Northing, Easting)	Sample Interval (ft, bgs)	Description Based On Field Logs	Laboratory Test Request (see key below)	Laboratory Test Specific Instructions (UU Triax. Cell Pressure in psi)
716	R18	11/11/2005	RPD	Split Spoon, Bag	SEE MAP	73.5-75.0	Clay with Silt		
716	R19	11/11/2005	RPD	Split Spoon, Bag	SEE MAP	75.0-76.5	Silty Sand	1b,4b	
717	R1	11/29/2005	RPD	Split Spoon, Bag	SEE MAP	3.5-5.0	Silty Sand with Gravel		
717	R2	11/29/2005	RPD	Split Spoon, Bag	SEE MAP	8.5-10.0	Silty Sand	1b,4b	
717	R3	11/29/2005	RPD	Split Spoon, Bag	SEE MAP	13.5-15.0	Silty Sand	1c,4b	
717	R4	11/29/2005	RPD	Split Spoon, Bag	SEE MAP	18.5-20.0	Silty Sand, little Clay	1c,4b	
717	R5	11/29/2005	RPD	Split Spoon, Bag	SEE MAP	23.5-25.0	Silty Sand		
717	R6	11/29/2005	RPD	Split Spoon, Bag	SEE MAP	28.5-30.0	Silty Sand	1b,4b	
717	R7	11/29/2005	RPD	Split Spoon, Bag	SEE MAP	33.5-35.0	Silty Sand		
717	R8	11/29/2005	RPD	Split Spoon, Bag	SEE MAP	38.5-40.0	Silty Sand	1c,4b	
717	R9	11/29/2005	RPD	Split Spoon, Bag	SEE MAP	43.5-45.0	Silty Sand, little Clay		
717	R10	11/29/2005	RPD	Split Spoon, Bag	SEE MAP	48.5-50.0	Silty Sand, little Clay	1b,2,4b	
717	R11	11/29/2005	RPD	Split Spoon, Bag	SEE MAP	53.5-55.0	Silty Sand with Clay		
717	R12	11/29/2005	RPD	Split Spoon, Bag	SEE MAP	58.5-60.0	Silty Sand with Clay	1c,4b	
717	R13	11/29/2005	RPD	Split Spoon, Bag	SEE MAP	63.5-65.0	Silty Sand, little Clay		
717	R14	11/29/2005	RPD	Split Spoon, Bag	SEE MAP	68.5-70.0	Silty Sand, little Clay	1c,4b	
717	R15	11/29/2005	RPD	Split Spoon, Bag	SEE MAP	73.5-75.0	Silty Sand, little Clay		
717	R16	11/29/2005	RPD	Split Spoon, Bag	SEE MAP	78.5-80.0	Silty Sand, little Clay	1c,4b	
717	R17	11/29/2005	RPD	Split Spoon, Bag	SEE MAP	83.5-85.0	Sandy Silt with Clay		
717	R18	11/29/2005	RPD	Split Spoon, Bag	SEE MAP	88.5-90.0	Sandy Silt with Clay	1c,4b	
717	R19	11/29/2005	RPD	Shelby Tube	SEE MAP	90.0-92.0	Sandy Silt with Clay		
717	R20	11/29/2005	RPD	Split Spoon, Bag	SEE MAP	93.5-95.0	Sandy Silt with Clay		
717	R21	11/29/2005	RPD	Split Spoon, Bag	SEE MAP	95.0-96.5	Silty Sand, native	1b,4b	
719	R1	11/29/2005	RPD	Split Spoon, Bag	SEE MAP	1.5-3.0	Silty Sand with Gravel		
719	R2	11/29/2005	RPD	Shelby Tube	SEE MAP	3.0-5.0	Silty Sand, little Clay		
719	R3	11/29/2005	RPD	Split Spoon, Bag	SEE MAP	6.5-8.0	Silty Sand, little Clay		
719	R4	11/29/2005	RPD	Shelby Tube	SEE MAP	8.0-10.0	Silty Sand, little Clay		
719	R5	11/29/2005	RPD	Split Spoon, Bag	SEE MAP	11.5-13.0	Silty Sand, little Clay		
719	R6	11/29/2005	RPD	Shelby Tube	SEE MAP	13.0-15.0	No Recovery		
719	R7	11/29/2005	RPD	Split Spoon, Bag	SEE MAP	16.5-18.0	Silty Clay with Sand		
719	R8	11/29/2005	RPD	Shelby Tube	SEE MAP	18.0-20.0	No Recovery		
719	R9	11/29/2005	RPD	Split Spoon, Bag	SEE MAP	21.5-23.0	Silty Clay with Sand		
719	R10	11/29/2005	RPD	Shelby Tube	SEE MAP	23.0-25.0	Silty Clay with Sand		
719	R11	11/29/2005	RPD	Split Spoon, Bag	SEE MAP	26.5-28.0	Silty Clay with Sand		
719	R12	11/29/2005	RPD	Shelby Tube	SEE MAP	28.0-30.0	No Recovery		
719	R13	11/29/2005	RPD	Split Spoon, Bag	SEE MAP	31.5-33.0	Silty Clay with Sand		
719	R14	11/29/2005	RPD	Shelby Tube	SEE MAP	33.0-35.0	No Recovery		
719	R15	11/29/2005	RPD	Split Spoon, Bag	SEE MAP	36.5-38.0	Silty Clay with Sand		
719	R16	11/29/2005	RPD	Shelby Tube	SEE MAP	38.0-40.0	Silty Clay		
719	R17	11/29/2005	RPD	Split Spoon, Bag	SEE MAP	41.5-43.0	Silty Clay		
719	R18	11/29/2005	RPD	Shelby Tube	SEE MAP	43.0-45.0	Silty Clay		
719	R19	11/29/2005	RPD	Split Spoon, Bag	SEE MAP	46.5-48.0	Silty Clay, Clayey Silt		
719	R20	11/29/2005	RPD	Shelby Tube	SEE MAP	48.0-50.0	Clayey Silt, Silty Sand		
719	R21	11/29/2005	RPD	Split Spoon, Bag	SEE MAP	50.0-51.5	Silty Sand, native		
708	R1	11/30/2005	RPD	Shelby Tube	SEE MAP	0.0-2.0	Silty Sand with Gravel		
708	R2	11/30/2005	RPD	Shelby Tube	SEE MAP	2.0-4.0	Silty Sand with Gravel		

TABLE 1 - BOREHOLE SOIL SAMPLE LOG AND TEST REQUEST

Golder Associates

Project: Moab Tailings Impoundment Geotechnical Investigation
Project No.: 053-2269
Project Location: Moab, Utah

Borehole No.	Sample No.	Sample Date	Sampled by	Sample Type	Sample Location (Northing, Easting)	Sample Interval (ft, bgs)	Description Based On Field Logs	Laboratory Test Request (see key below)	Laboratory Test Specific Instructions (UU Triax. Cell Pressure in psf)
708	R3	11/30/2005	RPD	Shelby Tube	SEE MAP	4.0-6.0	Silty Sand with Gravel		
708	R4	11/30/2005	RPD	Shelby Tube	SEE MAP	6.0-8.0	Silty Sand with Gravel		
708	R5	11/30/2005	RPD	Shelby Tube	SEE MAP	8.0-10.0	Silty Sand with Gravel		
708	R6	11/30/2005	RPD	Shelby Tube	SEE MAP	10.0-12.0	No Recovery		
708	R7	11/30/2005	RPD	Shelby Tube	SEE MAP	12.0-14.0	Silty Clay		
708	R8	11/30/2005	RPD	Shelby Tube	SEE MAP	14.0-16.0	Silty Clay	1a,2,4a,5a,5b	1156
708	R9	11/30/2005	RPD	Shelby Tube	SEE MAP	16.0-18.0	Silty Clay		
708	R10	11/30/2005	RPD	Shelby Tube	SEE MAP	18.0-20.0	Silty Clay		
708	R11	11/30/2005	RPD	Shelby Tube	SEE MAP	20.0-22.0	Silty Clay		
708	R12	11/30/2005	RPD	Shelby Tube	SEE MAP	22.0-24.0	Silty Clay	1c,4a	
708	R13	11/30/2005	RPD	Shelby Tube	SEE MAP	24.0-26.0	Silty Clay		
708	R14	11/30/2005	RPD	Shelby Tube	SEE MAP	26.0-28.0	Clayey Silt		
708	R15	11/30/2005	RPD	Shelby Tube	SEE MAP	28.0-30.0	Clayey Silt	1b,2,4a,5a,5b	2234
708	R16	11/30/2005	RPD	Shelby Tube	SEE MAP	30.0-32.0	Clayey Silt		
708	R17	11/30/2005	RPD	Shelby Tube	SEE MAP	32.0-34.0	Silty Clay		
708	R18	11/30/2005	RPD	Shelby Tube	SEE MAP	34.0-36.0	Silty Clay		
708	R19	11/30/2005	RPD	Shelby Tube	SEE MAP	36.0-38.0	Clayey Silt	1c,4a	
708	R20	11/30/2005	RPD	Shelby Tube	SEE MAP	38.0-40.0	Clayey Silt		
708	R21	11/30/2005	RPD	Shelby Tube	SEE MAP	40.0-42.0	Clayey Silt		
708	R22	11/30/2005	RPD	Shelby Tube	SEE MAP	42.0-44.0	Clayey Silt		
708	R23	11/30/2005	RPD	Shelby Tube	SEE MAP	44.0-46.0	Clayey Silt		
708	R24	11/30/2005	RPD	Shelby Tube	SEE MAP	46.0-48.0	Clayey Silt	1b,2,4a,5a,5b	3621
708	R25	11/30/2005	RPD	Shelby Tube	SEE MAP	48.0-50.0	Silty Clay		
708	R26	11/30/2005	RPD	Shelby Tube	SEE MAP	50.0-52.0	Silty Clay		
708	R27	11/30/2005	RPD	Shelby Tube	SEE MAP	52.0-54.0	Clayey Silt		
708	R28	11/30/2005	RPD	Shelby Tube	SEE MAP	54.0-56.0	Silty Clay		
708	R29	11/30/2005	RPD	Shelby Tube	SEE MAP	56.0-58.0	Silty Clay	1a,2,4a,	
708	R30	11/30/2005	RPD	Shelby Tube	SEE MAP	58.0-60.0	Silty Clay		
708	R31	11/30/2005	RPD	Shelby Tube	SEE MAP	60.0-62.0	Silty Clay		
708	R32	11/30/2005	RPD	Shelby Tube	SEE MAP	62.0-64.0	Silty Clay		
708	R33	11/30/2005	RPD	Split Spoon, Bag	SEE MAP	64.0-65.5	Silty Sand, native		
707	R1	11/30/2005	RPD	Shelby Tube	SEE MAP	0.0-2.0	Silty Sand with Gravel		
707	R2	11/30/2005	RPD	Shelby Tube	SEE MAP	2.0-4.0	Silty Sand with Gravel		
707	R3	11/30/2005	RPD	Shelby Tube	SEE MAP	4.0-6.0	Silty Sand with Gravel		
707	R4	11/30/2005	RPD	Shelby Tube	SEE MAP	6.0-8.0	Silty Sand		
707	R5	11/30/2005	RPD	Shelby Tube	SEE MAP	8.0-10.0	Silty Sand		
707	R6	11/30/2005	RPD	Shelby Tube	SEE MAP	10.0-12.0	Silty Sand		
707	R7	11/30/2005	RPD	Shelby Tube	SEE MAP	12.0-14.0	Silty Sand with Clay		
707	R8	11/30/2005	RPD	Shelby Tube	SEE MAP	14.0-16.0	Silty Sand with Clay	1b,2,4a	
707	R9	11/30/2005	RPD	Shelby Tube	SEE MAP	16.0-18.0	No Recovery		
707	R10	11/30/2005	RPD	Shelby Tube	SEE MAP	18.0-20.0	Silty Sand with Gravel(sluff)		
707	R11	11/30/2005	RPD	Shelby Tube	SEE MAP	20.0-22.0	Silty Sand with Gravel		
707	R12	11/30/2005	RPD	Shelby Tube	SEE MAP	22.0-24.0	No Recovery		
707	R13	11/30/2005	RPD	Shelby Tube	SEE MAP	24.0-26.0	No Recovery		
707	R14	12/1/2005	RPD	Shelby Tube	SEE MAP	26.0-28.0	No Recovery		
707	R15	12/1/2005	RPD	Shelby Tube	SEE MAP	28.0-30.0	No Recovery		

TABLE 1 - BOREHOLE SOIL SAMPLE LOG AND TEST REQUEST

Golder Associates

Project: *Moab Tailings Impoundment Geotechnical Investigation*
Project No.: *053-2269*
Project Location: *Moab, Utah*

Borehole No.	Sample No.	Sample Date	Sampled by	Sample Type	Sample Location (Northing, Easting)	Sample Interval (ft, bgs)	Description Based On Field Logs	Laboratory Test Request (see key below)	Laboratory Test Specific Instructions (UU Triax, Cell Pressure in psf)
707	R16	12/1/2005	RPD	Shelby Tube	SEE MAP	30.0-32.0	No Recovery		
707	R17	12/1/2005	RPD	Split Spoon, Bag	SEE MAP	32.0-33.5	Sandy Silty Clay	1a,2,4b	
707	R18	12/1/2005	RPD	Shelby Tube	SEE MAP	34.0-36.0	Sandy Silty Clay		
707	R19	12/1/2005	RPD	Shelby Tube	SEE MAP	36.0-38.0	No Recovery		
707	R20	12/1/2005	RPD	Shelby Tube	SEE MAP	38.0-40.0	Silty Clay, little Sand	1a,2,4a,	
707	R21	12/1/2005	RPD	Shelby Tube	SEE MAP	40.0-42.0	No Recovery		
707	R22	12/1/2005	RPD	Shelby Tube	SEE MAP	42.0-44.0	No Recovery		
707	R23	12/1/2005	RPD	Shelby Tube	SEE MAP	44.0-46.0	No Recovery		
707	R24	12/1/2005	RPD	Shelby Tube	SEE MAP	46.0-48.0	Clayey Silt		
707	R25	12/1/2005	RPD	Shelby Tube	SEE MAP	48.0-50.0	Silty Clay	1b,2,4a	
707	R26	12/1/2005	RPD	Shelby Tube	SEE MAP	50.0-52.0	Silty Clay		
707	R27	12/1/2005	RPD	Shelby Tube	SEE MAP	52.0-54.0	Silty Clay, Silty Sand, native		
707	R28	12/1/2005	RPD	Split Spoon, Bag	SEE MAP	54.0-55.5	Silty Sand, native	1b,4b	
705	R1	12/1/2005	RPD	Split Spoon, Bag	SEE MAP	1.5-3.0	Silty Sand with Gravel		
705	R2	12/1/2005	RPD	Shelby Tube	SEE MAP	3.0-5.0	Silty Sand with Gravel		
705	R3	12/1/2005	RPD	Split Spoon, Bag	SEE MAP	6.5-8.0	Silty Sand with Gravel		
705	R4	12/1/2005	RPD	Shelby Tube	SEE MAP	8.0-10.0	Silty Sand with Clay		
705	R5	12/1/2005	RPD	Split Spoon, Bag	SEE MAP	11.5-13.0	Silty Sand with Clay		
705	R6	12/1/2005	RPD	Shelby Tube	SEE MAP	13.0-15.0	Silty Sand with Clay		
705	R7	12/1/2005	RPD	Split Spoon, Bag	SEE MAP	16.5-18.0	Silty Sand with Clay		
705	R8	12/1/2005	RPD	Shelby Tube	SEE MAP	18.0-20.0	Silty Sand with Clay		
705	R9	12/1/2005	RPD	Split Spoon, Bag	SEE MAP	21.5-23.0	Silty Clay, little Sand		
705	R10	12/1/2005	RPD	Shelby Tube	SEE MAP	23.0-25.0	Silty Sand with Clay		
705	R11	12/1/2005	RPD	Split Spoon, Bag	SEE MAP	26.5-28.0	Silty Clay with Sand		
705	R12	12/1/2005	RPD	Shelby Tube	SEE MAP	28.0-30.0	No Recovery		
705	R13	12/1/2005	RPD	Split Spoon, Bag	SEE MAP	31.5-33.0	Silty Clay with Sand		
705	R14	12/1/2005	RPD	Shelby Tube	SEE MAP	33.0-35.0	No Recovery		
705	R15	12/1/2005	RPD	Split Spoon, Bag	SEE MAP	36.5-38.0	Silty Clay		
705	R16	12/1/2005	RPD	Shelby Tube	SEE MAP	38.0-40.0	No Recovery		
705	R17	12/1/2005	RPD	Split Spoon, Bag	SEE MAP	41.5-43.0	Silty Clay		
705	R18	12/1/2005	RPD	Shelby Tube	SEE MAP	43.0-45.0	Silty Clay		
705	R19	12/1/2005	RPD	Split Spoon, Bag	SEE MAP	46.5-48.0	Silty Clay		
705	R20	12/1/2005	RPD	Shelby Tube	SEE MAP	48.0-50.0	Silty Clay		
705	R21	12/1/2005	RPD	Split Spoon, Bag	SEE MAP	51.5-53.0	Silty Clay		
705	R22	12/1/2005	RPD	Shelby Tube	SEE MAP	53.0-55.0	Silty Clay		
705	R23	12/1/2005	RPD	Split Spoon, Bag	SEE MAP	56.5-58.0	Silty Clay, Silty Sand, native		
710	R1	12/1/2005	RPD	Split Spoon, Bag	SEE MAP	1.5-3.0	Silty Sand with Gravel	1b,4b	
710	R2	12/1/2005	RPD	Shelby Tube	SEE MAP	3.0-5.0	Silty Sand with Gravel and Clay		
710	R3	12/1/2005	RPD	Split Spoon, Bag	SEE MAP	6.5-8.0	Silty Sand with Clay	1c,4b	
710	R4	12/1/2005	RPD	Shelby Tube	SEE MAP	8.0-10.0	Silty Clay	1a,2,4a,	
710	R5	12/1/2005	RPD	Split Spoon, Bag	SEE MAP	11.5-13.0	Silty Clay		
710	R6	12/1/2005	RPD	Shelby Tube	SEE MAP	13.0-15.0	Silty Clay	1b,4a	
710	R7	12/1/2005	RPD	Split Spoon, Bag	SEE MAP	16.5-18.0	Silty Clay		
710	R8	12/1/2005	RPD	Shelby Tube	SEE MAP	18.0-20.0	Silty Clay	1c,2,4a	
710	R9	12/5/2005	RPD	Split Spoon, Bag	SEE MAP	21.5-23.0	Silty Clay		
710	R10	12/5/2005	RPD	Shelby Tube	SEE MAP	23.0-25.0	Silty Clay		

TABLE 1 - BOREHOLE SOIL SAMPLE LOG AND TEST REQUEST

Golder Associates

Project: *Moab Tailings Impoundment Geotechnical Investigation*
Project No.: *053-2269*
Project Location: *Moab, Utah*

Borehole No.	Sample No.	Sample Date	Sampled by	Sample Type	Sample Location (Northing, Easting)	Sample Interval (ft, bgs)	Description Based On Field Logs	Laboratory Test Request (see key below)	Laboratory Test Specific Instructions (UU Triax. Cell Pressure in psf)
710	R11	12/5/2005	RPD	Split Spoon, Bag	SEE MAP	26.5-28.0	Silty Clay		
710	R12	12/5/2005	RPD	Shelby Tube	SEE MAP	28.0-30.0	Silty Clay	1a,2,4a,	
710	R13	12/5/2005	RPD	Split Spoon, Bag	SEE MAP	31.5-33.0	Silty Clay		
710	R14	12/5/2005	RPD	Shelby Tube	SEE MAP	33.0-35.0	Silty Clay		
710	R15	12/5/2005	RPD	Split Spoon, Bag	SEE MAP	36.5-38.0	Silty Clay		
710	R16	12/5/2005	RPD	Shelby Tube	SEE MAP	38.0-40.0	Silty Clay	1c,2,4a	
710	R17	12/5/2005	RPD	Split Spoon, Bag	SEE MAP	41.5-43.0	Silty Clay		
710	R18	12/5/2005	RPD	Shelby Tube	SEE MAP	43.0-45.0	Silty Clay		
710	R19	12/5/2005	RPD	Split Spoon, Bag	SEE MAP	45.0-46.5	Silty Sand, native	1b,4b	
718	R1	12/5/2005	RPD	Split Spoon, Bag	SEE MAP	1.5-3.0	Silty Sand with Gravel		
718	R2	12/5/2005	RPD	Shelby Tube	SEE MAP	3.0-5.0	Silty Sand with Gravel		
718	R3	12/5/2005	RPD	Split Spoon, Bag	SEE MAP	6.5-8.0	Silty Sand with Gravel		
718	R4	12/5/2005	RPD	Shelby Tube	SEE MAP	8.0-10.0	Sandy Silty Clay		
718	R5	12/5/2005	RPD	Split Spoon, Bag	SEE MAP	11.5-13.0	Sandy Silty Clay	1a,2,4b	
718	R6	12/5/2005	RPD	Shelby Tube	SEE MAP	13.0-15.0	Sandy Silty Clay		
718	R7	12/5/2005	RPD	Split Spoon, Bag	SEE MAP	16.5-18.0	Sandy Silty Clay	1c,4b	
718	R8	12/5/2005	RPD	Shelby Tube	SEE MAP	18.0-20.0	Sandy Silty Clay, Silty Clay		
718	R9	12/5/2005	RPD	Split Spoon, Bag	SEE MAP	21.5-23.0	Silty Clay	1a,4b	
718	R10	12/5/2005	RPD	Shelby Tube	SEE MAP	23.0-25.0	Silty Clay		
718	R11	12/5/2005	RPD	Split Spoon, Bag	SEE MAP	26.5-28.0	Silty Clay	1c,2,4b	
718	R12	12/5/2005	RPD	Shelby Tube	SEE MAP	28.0-30.0	Silty Clay		
718	R13	12/5/2005	RPD	Split Spoon, Bag	SEE MAP	31.5-33.0	Silty Clay	1c,4b	
718	R14	12/5/2005	RPD	Shelby Tube	SEE MAP	33.0-35.0	Clay		
718	R15	12/5/2005	RPD	Split Spoon, Bag	SEE MAP	36.5-38.0	Clay	1a,2,4b	
718	R16	12/5/2005	RPD	Shelby Tube	SEE MAP	38.0-40.0	Clayey Silt		
718	R17	12/5/2005	RPD	Split Spoon, Bag	SEE MAP	41.5-43.0	Silty Sand, native	1b,4b	
711	R1	12/5/2005	RPD	Split Spoon, Bag	SEE MAP	1.5-3.0	Silty Sand with Gravel		
711	R2	12/5/2005	RPD	Shelby Tube	SEE MAP	3.0-5.0	Silty Sand with Gravel		
711	R3	12/5/2005	RPD	Split Spoon, Bag	SEE MAP	6.5-8.0	Silty Sand with Gravel		
711	R4	12/5/2005	RPD	Shelby Tube	SEE MAP	8.0-10.0	Silty Sand		
711	R5	12/5/2005	RPD	Split Spoon, Bag	SEE MAP	11.5-13.0	Silty Sand		
711	R6	12/5/2005	RPD	Shelby Tube	SEE MAP	13.0-15.0	Silty Sand with Clay		
711	R7	12/5/2005	RPD	Split Spoon, Bag	SEE MAP	16.5-18.0	Clayey Silt		
711	R8	12/5/2005	RPD	Shelby Tube	SEE MAP	18.0-20.0	Clayey Silt		
711	R9	12/5/2005	RPD	Split Spoon, Bag	SEE MAP	21.5-23.0	Clayey Silt		
711	R10	12/5/2005	RPD	Shelby Tube	SEE MAP	23.0-25.0	Silty Clay		
711	R11	12/5/2005	RPD	Split Spoon, Bag	SEE MAP	26.5-28.0	Silty Clay		
711	R12	12/5/2005	RPD	Shelby Tube	SEE MAP	28.0-30.0	Silty Clay		
711	R13	12/5/2005	RPD	Split Spoon, Bag	SEE MAP	31.5-33.0	Silty Clay		
711	R14	12/5/2005	RPD	Shelby Tube	SEE MAP	33.0-35.0	Silty Clay		
711	R15	12/5/2005	RPD	Split Spoon, Bag	SEE MAP	36.5-38.0	Silty Clay		
711	R16	12/5/2005	RPD	Shelby Tube	SEE MAP	38.0-40.0	Silty Clay		
711	R17	12/5/2005	RPD	Split Spoon, Bag	SEE MAP	41.5-43.0	Silty Clay		
711	R18	12/5/2005	RPD	Shelby Tube	SEE MAP	43.0-45.0	Silty Clay		
711	R19	12/5/2005	RPD	Split Spoon, Bag	SEE MAP	46.5-48.0	Silty Clay		
711	R20	12/5/2005	RPD	Shelby Tube	SEE MAP	48.0-50.0	Silty Clay, Clayey Silt		

TABLE 1 - BOREHOLE SOIL SAMPLE LOG AND TEST REQUEST

Golder Associates

Project: *Moab Tailings Impoundment Geotechnical Investigation*
Project No.: *053-2269*
Project Location: *Moab, Utah*

Borehole No.	Sample No.	Sample Date	Sampled by	Sample Type	Sample Location (Northing, Easting)	Sample Interval (ft, bgs)	Description Based On Field Logs	Laboratory Test Request (see key below)	Laboratory Test Specific Instructions (UU Triax. Cell Pressure in psf)
711	R21	12/5/2005	RPD	Split Spoon, Bag	SEE MAP	51.5-53.0	Silty Sand with Gravel, native		
706	R1	12/6/2005	RPD	Split Spoon, Bag	SEE MAP	1.5-3.0	Silty Sand with Gravel		
706	R2	12/6/2005	RPD	Shelby Tube	SEE MAP	3.0-5.0	Silty Sand with Gravel		
706	R3	12/6/2005	RPD	Split Spoon, Bag	SEE MAP	6.5-8.0	Silty Sand with Gravel		
706	R4	12/6/2005	RPD	Shelby Tube	SEE MAP	8.0-10.0	Silty Sand with Gravel		
706	R5	12/6/2005	RPD	Split Spoon, Bag	SEE MAP	11.5-13.0	Silty Sand with Gravel		
706	R6	12/6/2005	RPD	Shelby Tube	SEE MAP	13.0-15.0	Silty Sand with Gravel		
706	R7	12/6/2005	RPD	Split Spoon, Bag	SEE MAP	16.5-18.0	Clayey Silt		
706	R8	12/6/2005	RPD	Shelby Tube	SEE MAP	18.0-20.0	Clayey Silt and Sand	1b,4a	
706	R9	12/6/2005	RPD	Split Spoon, Bag	SEE MAP	21.5-23.0	Clayey Silt and Sand		
706	R10	12/6/2005	RPD	Shelby Tube	SEE MAP	23.0-25.0	Silty Clay	1a,2,4a.	
706	R11	12/6/2005	RPD	Split Spoon, Bag	SEE MAP	26.5-28.0	Silty Clay		
706	R12	12/6/2005	RPD	Shelby Tube	SEE MAP	28.0-30.0	Silty Clay	1c,4a	
706	R13	12/6/2005	RPD	Split Spoon, Bag	SEE MAP	31.5-33.0	Silty Clay		
706	R14	12/6/2005	RPD	Shelby Tube	SEE MAP	33.0-35.0	Clayey Silt	1b,4a	
706	R15	12/6/2005	RPD	Split Spoon, Bag	SEE MAP	36.5-38.0	Clayey Silt and Sand		
706	R16	12/6/2005	RPD	Shelby Tube	SEE MAP	38.0-40.0	Clayey Silt and Sand	1c,4a	
706	R17	12/6/2005	RPD	Split Spoon, Bag	SEE MAP	41.5-43.0	Clayey Silt and Sand		
706	R18	12/6/2005	RPD	Shelby Tube	SEE MAP	43.0-45.0	Clayey Silt and Sand		
706	R19	12/6/2005	RPD	Split Spoon, Bag	SEE MAP	46.5-48.0	Silty Clay		
706	R20	12/6/2005	RPD	Shelby Tube	SEE MAP	48.0-50.0	Silty Clay	1a,2,4a.	
706	R21	12/6/2005	RPD	Split Spoon, Bag	SEE MAP	51.5-53.0	Silty Clay		
706	R22	12/6/2005	RPD	Split Spoon, Bag	SEE MAP	53.0-54.5	Silty Clay, Silty Sand, native	1b,4b	

Test Request Key

1 - Particle Size Analysis
  1a - Hydrometer/Sieve/Specific Gravity
  1b - Sieve
  1c - Percent Fines (-#200 sieve)
2 - Atterberg Limits
3 - Specific Gravity
4 - Moisture/Density
  4a - Moisture Content And Dry Density (from tube sample)
  4b - Moisture Content
5- Strength
  5a - Unconfined Compression
  5b - Unconsolidated-Undrained Triaxial Compression

TABLE 2 - TEST PIT SOIL SAMPLE LOG AND TEST REQUEST

Golder Associates

Project: *Moab Tailings Impoundment Geotechnical Investigation*
Project No.: *053-2269*
Project Location: *Moab, Utah*

Test Pit	Sample No.	Sample Date	Sampled by	Sample Type (see key below)	Sample Location (Northing, Easting)	Sample Depth (ft, bgs)	Description	Laboratory Testing (see key below)
GATP-1	1	8/24/2005	JO	Bulk	SEE MAP	Composite	Silty sand , Silty clay and clayey silt with medium to fine grained sand	
GATP-1	2	8/24/2005	JO	Bulk	SEE MAP	Composite		
GATP-1	3	8/24/2005	JO	Bulk	SEE MAP	Composite		
GATP-1	4	8/24/2005	JO	Bulk	SEE MAP	Composite		
GATP-1	5	8/24/2005	JO	Bulk	SEE MAP	Composite		
GATP-2	1	8/24/2005	JO	Bulk	SEE MAP	Composite	Silty sand and silty clay	
GATP-2	2	8/24/2005	JO	Bulk	SEE MAP	Composite		
GATP-2	3	8/24/2005	JO	Bulk	SEE MAP	Composite		
GATP-2	4	8/24/2005	JO	Bulk	SEE MAP	Composite		
GATP-2	5	8/24/2005	JO	Bulk	SEE MAP	Composite		
GATP-3	1	12/8/2005	RPD	Bulk	SEE MAP	0-5	Silty Sand	
GATP-3	2	12/8/2005	RPD	Bulk	SEE MAP	5-10	Silty Sand, Silty Clay	1a,2
GATP-3	3	12/8/2005	RPD	Bulk	SEE MAP	10-15	Silty Sand, Silty Clay	
GATP-3	4	12/8/2005	RPD	Bulk	SEE MAP	15-20	Silty Sand	1c
GATP-3	5	12/8/2005	RPD	Bulk	SEE MAP	Composite		
GATP-4	1	12/8/2005	RPD	Bulk	SEE MAP	0-5	Silty Sand	
GATP-4	2	12/8/2005	RPD	Bulk	SEE MAP	5-10	Silty Sand, Clayey Silt	
GATP-4	3	12/8/2005	RPD	Bulk	SEE MAP	10-15	Silty Sand, Clayey Silt	
GATP-4	4	12/8/2005	RPD	Bulk	SEE MAP	15-20	Silty Sand, Clayey Silt	
GATP-4	5	12/8/2005	RPD	Bulk	SEE MAP	Composite		1b,3
GATP-5	1	12/8/2005	RPD	Bulk	SEE MAP	0-5	Silty Sand	
GATP-5	2	12/8/2005	RPD	Bulk	SEE MAP	5-10	Silty Sand, Clayey Silt	1c
GATP-5	3	12/8/2005	RPD	Bulk	SEE MAP	10-15	Silty Sand, Clayey Silt	
GATP-5	4	12/8/2005	RPD	Bulk	SEE MAP	15-20	Silty Clay, Clayey Silt	1b,2
GATP-5	5	12/8/2005	RPD	Bulk	SEE MAP	Composite		
GATP-6	1	12/8/2005	RPD	Bulk	SEE MAP	0-5	Silty Sand	1a
GATP-6	2	12/8/2005	RPD	Bulk	SEE MAP	5-10	Silty Sand, Clayey Sand	
GATP-6	3	12/8/2005	RPD	Bulk	SEE MAP	10-15	Silty Sand, Clayey Sand	
GATP-6	4	12/8/2005	RPD	Bulk	SEE MAP	15-20	Silty Sand, Clayey Sand	
GATP-6	5	12/8/2005	RPD	Bulk	SEE MAP	Composite		1a,2
GATP-7	1	12/7/2005	RPD	Bulk	SEE MAP	0-5	Silty Sand	
GATP-7	2	12/7/2005	RPD	Bulk	SEE MAP	5-10	Clayey Silt, Silty Sand	1b,2
GATP-7	3	12/7/2005	RPD	Bulk	SEE MAP	10-15	Clayey Silt, Silty Sand	
GATP-7	4	12/7/2005	RPD	Bulk	SEE MAP	15-20	Silty Clay, Sandy Clay	1a,2
GATP-7	5	12/7/2005	RPD	Bulk	SEE MAP	Composite		
GATP-8	1	12/8/2005	RPD	Bulk	SEE MAP	0-5	Silty Sand	
GATP-8	2	12/8/2005	RPD	Bulk	SEE MAP	5-10	Silty Sand, interlayered clayey silt	
GATP-8	3	12/8/2005	RPD	Bulk	SEE MAP	10-15	Silty Sand, interlayered clayey silt	
GATP-8	4	12/8/2005	RPD	Bulk	SEE MAP	15-20	Silty Sand, interlayered clayey silt	
GATP-8	5	12/8/2005	RPD	Bulk	SEE MAP	Composite		1b,3

TABLE 2 - TEST PIT SOIL SAMPLE LOG AND TEST REQUEST

Golder Associates

Project: *Moab Tailings Impoundment Geotechnical Investigation*
Project No.: *053-2269*
Project Location: *Moab, Utah*

Test Pit	Sample No.	Sample Date	Sampled by	Sample Type (see key below)	Sample Location (Northing, Easting)	Sample Depth (ft, bgs)	Description	Laboratory Testing (see key below)
GATP-9	1	12/8/2005	RPD	Bulk	SEE MAP	0-5	Silty Sand	
GATP-9	2	12/8/2005	RPD	Bulk	SEE MAP	5-10	Silty Sand	
GATP-9	3	12/8/2005	RPD	Bulk	SEE MAP	10-15	Silty Sand	
GATP-9	4	12/8/2005	RPD	Bulk	SEE MAP	15-20	Silty Sand	
GATP-9	5	12/8/2005	RPD	Bulk	SEE MAP	Composite		1c
GATP-10	1	12/7/2005	RPD	Bulk	SEE MAP	0-5	Silty sand	1a
GATP-10	2	12/7/2005	RPD	Bulk	SEE MAP	5-10	Clayey Silt, Silty Clay	1a,2
GATP-10	3	12/7/2005	RPD	Bulk	SEE MAP	10-15	Clayey Silt, Silty Clay	
GATP-10	4	12/7/2005	RPD	Bulk	SEE MAP	15-20	Clayey Silt, Silty Clay	1a,2
GATP-10	5	12/7/2005	RPD	Bulk	SEE MAP	Composite		
GATP-11	1	12/7/2005	RPD	Bulk	SEE MAP	0-5	Silty Sand	
GATP-11	2	12/7/2005	RPD	Bulk	SEE MAP	5-10	Clayey silt, Silty Cay	1b,2
GATP-11	3	12/7/2005	RPD	Bulk	SEE MAP	10-15	Clayey silt, Silty Clay	
GATP-11	4	12/7/2005	RPD	Bulk	SEE MAP	15-20	Silty Clay	1a,2
GATP-11	5	12/7/2005	RPD	Bulk	SEE MAP	Composite		
GATP-12	1	12/7/2005	RPD	Bulk	SEE MAP	0-5	Silty Sand	
GATP-12	2	12/7/2005	RPD	Bulk	SEE MAP	5-10	Silty Sand	
GATP-12	3	12/7/2005	RPD	Bulk	SEE MAP	10-15	Silty Sand	
GATP-12	4	12/7/2005	RPD	Bulk	SEE MAP	15-20	Silty Sand	
GATP-12	5	12/7/2005	RPD	Bulk	SEE MAP	Composite		1b

NOTES:

1. **Sample type: Bulk sample = 5-gallon bucket (bag sample split taken for lab testing)**
2. **Test Request Key**
   - 1 - Particle Size Analysis
     - 1a - Hydrometer/Sieve/Specific Gravity
     - 1b - Sieve
     - 1c - Percent Fines (-#200 sieve)
   - 2 - Atterberg Limits
   - 3 - Specific Gravity
   - 4 - Moisture/Density
     - 4a - Moisture Content And Dry Density (from tube sample)
     - 4b - Moisture Content
   - 5- Strength
     - 5a - Unconfined Compression
     - 5b - Unconsolidated-Undrained Triaxial Compression

Appendix D
Nonconformance/Variance Reports

NONCONFORMANCE/VARIANCE REPORT

NONCONFORMANCE -or- [✓ VARIANCE] (circle one)

Project Name GEL - MOAB

Project No. 109855.01210000

Date 2-3-06

Page 1 of 1

Report No. ETDC-143-06V

Nonconformance/Variance Description (include requirement violated

NOT ALL SAMPLES LISTED ON CHAIN-OF-CUSTODY WERE RECEIVED IN SAMPLE SHIPMENT OF FEB. 1, 2006

SAMPLE NUMBERS AFFECTED:

GATP-6-1
GATP-6-5
GATP-7-2
GATP-7-4
GATP-8-5
GATP-9-5

701-R26
706-R20
706-R22
707-R17
707-R28
710-R1
710-R19

710-R3
713-R1
713-R13
715-R3
718-R1
718-R13
718-R15
718-R17

718-R5
718-R7
718-R9
722-R1
722-R2
722-R3
722-R5

GATP-10-4
GATP-10-2
GATP-11-4
GATP-12-5
GATP-3-2
GATP-3-4
GATP-4-5
GATP-5-2
GATP-5-4

Identified by

Root Cause

N/A

Corrective Action (include expected completion date)

N/A

To be completed by

Expected Completion Date

Action taken to preclude recurrence

N/A

To be performed by

Expected Completion Date

Client notified (include client name, how notified, and response)

NOTIFIED ERIN STANLEY @ GEL ON 2/3/06 VIA EMAIL W/ ATTACHED LIST

MISSING SAMPLES RECEIVED IN SHIPMENT OF 2/13/06

Notified by

Date 2/3/06

Corrective action completed by N/A

Date

Corrective action approved by

Laboratory Supervisor

Date 2/13/06

Project Manager

Date

QA Comments

QAO Approval

Date 2/13/06

Use back of page for additional space. Attach additional pages if necessary.

Appendix C

Correspondence

Shaw™
Shaw E & I, Inc.

Geotechnical Laboratory
PO Box 4339
1570 Bear Creek Road
Oak Ridge TN 37830
(865) 482-6497

February 21, 2007

Erin Stanley
General Engineering Laboratories
2040 Savage Road
Charleston SC 29407

Ms. Stanley,

Mr. Mark Kautsky of S.M. Stoller Corp. has recently posed questions regarding data produced by Shaw's geotechnical laboratory last year for GEL's Moab project. I will address his questions in this letter. Below is the text of his message dated today:

> Please take a look at the attached file, which is the May 3, 2006 data package you sent us (and renamed after you sent it to us). Notwithstanding your May 3 revisions, I inspected the data sheets and found some unusually high values for some parameters. I inserted electronic comments on pages 23, 25, 26, 68, 74, 125, 133, 136, 137, 138, 139, 140 to flag suspect data values, which include unreasonable moisture contents and dry density values. Please take a look at these and let me know if you agree these are strange results. Ws there some sort of transcription error? I want to flag these results as unuseable.

Most of the issues Mr. Kautsky raises have been addressed previously. I have attached copies of earlier documents where applicable. Also attached is a copy of the document containing questions posed by Mr. Kautsky. The four attachments are:

Att. 1 X01881_Appx_B(2).pdf ………………………… Mark Kautsky, S.M. Stoller, 2/21/07
Questions posed by Mr. Kautsky.

Att. 2 GEL-Moab, response to letter #3.pdf ………….. Ralph Cole, Shaw, 8/16/06
Answer to data validation process performed by Golder Associates.

Att. 3 GEL Moab corr pp 8-16-06.pdf ……………..….. Ralph Cole, Shaw, 8/17/06
Followup to above, amended data pages to replace those in report of 5/3/06.

Att. 4 GEL Moab corr p 23.pdf ……………..….. Ralph Cole, Shaw, 2/21/07
Followup to above, amended data page to replace page 23 in report of 5/3/06.

RESPONSES TO S.M. STOLLER QUESTIONS

Page 23 Sample 700-R8, bulk density determination, reported result 174.8 pcf.
The reported result was calculated and reported accurately. However, the result is very high. I believe the technician performing the analysis inadvertently recorded incorrect sample length measurements, average of three measurements being 2.8627 inches. The actual measurement was probably 3.8627 inches or 4.8627 inches. Using the former length, the wet density is 129.5

pcf and the dry density is 78.5 pcf. Using the latter length, the wet density is 102.9 pcf and the dry density is 62.4 pcf. I speculate that the last result is closest to the actual sample density based on the soil moisture and comparison with other soils in the data series. Attachment 4 of this letter offers an amended result.

Page 25 & 74 Sample 710-R6, bulk density determination, moisture content result questioned.
The reported result was calculated and reported accurately. The moisture test specimen was not obtained from the bulk density test specimen.

Page 26 Sample 723-R2, bulk density determination, moisture content result questioned.
The reported result was calculated and reported accurately. I have no reason to believe that a data recording error took place, but if it did, the most probable result would have been 30.3%.

Page 68 Sample 708-R8, grainsize test, moisture content result questioned.
The reported result was calculated and reported accurately. I have no reason to believe that a data recording error took place, but if it did, the most probable result would have been 31.3%.

Page 125 Sample 700-R39, UCS test, moisture content result questioned.
Please see Attachment 2, bullet #3 and Attachment 3, page 1.

Page 133 Sample 700-R30, UU triaxial test, failure stress questioned.
Please see Attachment 2, bullet #2.

Page 136 Sample 708-R24, UU triaxial test, moisture content result questioned.
Please see Attachment 2, bullet #1 and Attachment 3, page 2.

Page 137 Sample 708-R8, UU triaxial test, moisture content result questioned.
Please see Attachment 2, bullet #1 and Attachment 3, page 3.

Page 138 Sample 715-R16, UU triaxial test, moisture content result questioned.
Please see Attachment 2, bullet #1 and Attachment 3, page 4.

Page 139 Sample 715-R24, UU triaxial test, moisture content result questioned.
Please see Attachment 2, bullet #1 and Attachment 3, page 5.

Page 140 Sample 715-R6, UU triaxial test, moisture content result questioned.
Please see Attachment 2, bullet #1 and Attachment 3, page 6.

I will be happy to answer any more questions or provide additional information if needed.

Sincerely,

Ralph Cole
Laboratory Manager, Geotechnical Services

Shaw™
Shaw E & I, Inc.

Geotechnical Laboratory
PO Box 4339
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Oak Ridge TN 37830
(865) 482-6497

August 16, 2006

Erin Stanley
General Engineering Laboratories
2040 Savage Road
Charleston SC 29407

RE: Moab data report comments, 109855.01210000

Dear Ms. Stanley,

This correspondence responds to questions and comments contained in Golder Associates Letter #3, dated March 23, 2006 and received August 1, 2006. Letter #3 contains the results of a review by Golder of Shaw's data report originally issued on March 13, 2006. An amended report was issued by Shaw on May 3, 2006. Some of the concerns addressed in Letter #3 were closed in the amended report.

General comments on Golder's observations:
Many of the comments contained in the review focus on moisture content results, and/or dry density results (which are related). Moisture content tests were performed for three reasons: 1) GEL requested certain samples be analyzed for moisture content (primary moisture tests); 2) other requested test procedures specify moisture content information be provided as supporting information (ancillary moisture tests); and 3) Shaw attempted to report moisture content results even where not requested or required, if the information was available, for the sake of completeness.

Most of the individual samples were analyzed for moisture content several times. Moisture content results were obtained from discrete moisture content test aliquots, other test specimens, soil trimmings obtained during specimen preparation, and other sample aliquots. In some cases, the same moisture content result was reported to support different sample test results if the result was judged to be representative.

Moisture aliquot sizes varied from a few grams to several hundred grams depending on the source of the material. Larger aliquot sizes generally yield more representative results than small aliquot sizes. Moisture content results can vary depending on the specimen size, the specimen location in the sample, and the heterogeneity of the soil. Sample cores were up to 30 inches long, so test aliquots may have been obtained from opposite ends of the sample, or from different material layers depending on the intended use of the data. Core samples can contain widely varying moisture levels, particularly cores obtained near surface or near refusal. Collection procedures, sample storage and shipping procedures, and sample preparation procedures all affect the soil moisture contents.

The laboratory makes every effort to select test specimens from similar core material, but sample limitations frequently dictate that undisturbed specimens be obtained from different zones of the soil core. Soil samples cannot be homogenized before testing for physical properties.

Bullet #1: Initial moisture content data reported for UU triaxial specimens does not correlate with moisture contents reported elsewhere for the same sample ID's.

Response: (Applies to samples 708-R24, 708-R8, 715-R16, 715-R24, 715-R6.)
Due to a calculation setting in the Geosystem® SHEAR module software, the program calculated initial moisture content results indirectly. The indirect references were not necessarily correct for the intended application. The resulting ancillary moisture data should be disregarded. Initial moisture contents for these samples was assumed to be equal to the final moisture content of the specimens (except 715-R16, see below). Amended data sheets will be issued containing restated initial moisture content data.

715-R16: A final dry weight of solids was not recorded for the UU triaxial moisture sample for 715-R16. The moisture content from the corresponding UCS sample will be used instead. The UCS and UU triaxial specimens for this sample were judged to be relatively homogenous due to the proximity of the specimens obtained from the soil core. An amended data sheet will be issued containing a different initial moisture content result.

708-R15: The moisture contents for 708-R15 have been verified and are correct.

Bullet #2: UU triaxial failure stress of sample 700-R30 is higher than other samples, does not correlate well with same sample UCS results.

Response: UU triaxial results and UCS results for sample 700-R30 were recorded and reported accurately. The test readings from calibrated load cells and calibrated linear displacement transducers were recorded automatically by the test instruments. These numbers were transcribed to paper tables and 100% checked to the data entry spreadsheets for accuracy.

Shaw agrees that the triaxial results for this sample are significantly different than all other strength test results in this data batch. Testing was observed by the laboratory manager, and the data records contain no indication that the reported values are due to anything other than the properties of the soil. Any other explanation is speculative at this point.

Bullet #3: Ancillary moisture content results reported with UCS samples 700-R39, 708-R15, and 708-R24 do not appear to agree with moisture content results reported for these samples elsewhere.

The moisture content for 700-R39 was incorrectly stated as 120%. The correct result is 36.0%. The incorrect result was due to a data entry error caused by misreading technician's bench sheets. Subsequent QC checks also failed to identify the error.

The ancillary moisture content results for 708-R15 were self-identified by Shaw in March and corrections issued in the amended report dated May 3, 2006.

The ancillary moisture content results reported for sample 708-R24 have been verified and are correct.

Regarding the comment that soil samples may have been allowed to desiccate before testing, this did not occur. Shaw's staff applies sufficient protocols to ensure that the physical integrity of samples is maintained through testing. Desiccated soils would probably exhibit brittle failure in strength tests. In fact, UCS and UU triaxial tests of 708-R15 and 708-R24 indicate plastic deformation up to test termination at 15% strain, indicating that the specimens had not been allowed to dry.

Bullet #4: Questions about differences in reported dry densities across differing tests.

Response: It could be anticipated that all index properties, not just dry density, would be similar for aliquots within a single soil mass. Golder's questions can be answered by correcting moisture contents previously discussed, and by normal soil heterogeneity. Specific comments are listed below.

Dry density is determined by dividing the wet density by 1 + the moisture content. Samples of identical wet densities will have differing dry densities if their moisture contents differ. It is apparent that if moisture contents vary widely, the resulting dry densities will vary widely, also.

Item #1 – As noted above, the ancillary moisture content reported with UCS sample 700-R39 contained a previously undiscovered data entry error. Since the correct moisture content for this specimen was 36% instead of 120%, the dry density will be reported as 85.3 pcf in the amended data sheet to be issued as a result of this review.

Item #2 - As noted in the response above to Bullet #1, five ancillary moisture contents reported with UU triaxial results were not accurately calculated. One of these five samples was 708-R8. Since the ancillary moisture content of this specimen was noted, the corresponding dry density will be reported accurately as 46.9 pcf in the amended data sheet to be issued as a result of this review. Please note that "dry density" reflects the mass/volume of the entire soil mass, including voids and included gases (but not water), and is not the same as particle density.

Item #3 – Dry densities were amended for sample 708-R15 based on corrected moisture data in the re-issued report dated May 3, 2006.

Item #4 – As stated, the dry density of the UCS sample is 19% lower than the dry density of the insitu density of the same sample. These data have been verified. Note that the wet densities differ by 16 pcf, and the moisture contents differ by 11%. See the explanation in the first paragraph of this section above. Nineteen percent variation in dry density is not an unreasonable amount for an earth material.

Item #5 – The dry densities reported as ancillary data to the UU triaxial tests for 708-R24, 715-R6, 714-R16, and 715-R24 were affected by the miscalculation of moisture contents, as noted in #1 above. These changes will be noted in the amended data sheet to be issued as a result of this review.

We will issue corrected data pages where necessary based on the comments above. Please let me know should you have additional questions or need additional information.

Sincerely,

Ralph Cole
Manager, Geotechnical Laboratory

Golder Associates Inc.

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Fax (303) 985-2080

Golder Associates

April 20, 2006 Our Ref: 053-2269

S.M. Stoller
990 South Public Road
Suite A
Lafayette, Colorado 80026

Attention: Mr. Greg Lord, Senior Engineer

RE: SHAW E & I, INC. RESPONSE TO GOLDER COMMENTS, GEOTECHNICAL LABORATORY TEST PROGRAM, MOAB PROJECT, GRAND COUNTY, UTAH

Dear Mr. Lord:

Golder Associates Inc. (Golder) has received and reviewed Shaw E & I, Inc.'s (Shaw's) April 13, 2006 letter responding to the first two of three Golder comment letters (March 20 and 22, 2006) on the first round of laboratory test results for the Moab Project. This letter summarizes our response to Shaw's letter. To date we have received no response to our third letter dated March 23, 2006.

Regarding Shaw's responses to our March 20, 2006 review letter (Golder, 2006a), we have the following comments:

- Bullet #1 – Ok, agreed.
- Bullet #2 – Ok, agreed.
- Bullet #3 – It appears that our comment on the Atterberg limits test results for samples 701-R8 and 702-R18 may have been misinterpreted. Our comment was based on the fact that the summary table provided USCS symbols for the two tests as NP (non-plastic), while the actual test results indicated measurable plasticity. Shaw's retest results are encouraging as they indicate reproducibility based on similar liquid limit and plastic limit values. In addition, Shaw has now classified the samples as ML and CL-ML, respectively, so our comment has been addressed.
- Bullet #4 – By definition, a soil is in a plastic state at a moisture content "lower" than its liquid limit (Prakash, 1995). The liquid limit (LL) is the moisture content at which a soil suspension exhibits infinitesimal strength, and the soil is saturated at its liquid limit. The plastic limit (PL) occurs when a soil passes from a plastic state to a semi-solid state. Therefore, the test results provided by Shaw which indicate a negative plasticity index are probably an indication that the sample is actually non-plastic and the test methods are not applicable. We would agree to a non-plastic classification for these materials.

Regarding Shaw's response to Letter #2 (Golder, 2006b), we have the following comments:

- Bullet #1 – Ok, agreed.

- Bullet #2 – Ok, agreed.
- Bullet #3, second paragraph – Shaw provided corrected density results for sample 708-R15 as 104.4 pcf and 59.6 pcf for the wet and dry densities, respectively. However, Shaw also states that the unconfined compressive test results are correct, with reported wet and dry densities of 119.2 pcf and 90.5 pcf, respectively. This spread might be possible, but is unlikely for two samples taken from the same Shelby tube. For now, Golder will proceed with our work using these test results, but with some continued concern about their accuracy.
- Bullet #3, third paragraph – Sample 700-R8 with a calculated saturation of 263 percent is claimed by Shaw to be accurate based on a check of their data entry. They concur that the reported wet density of 174.8 pcf is high, but are confident of their test results. We believe that this result is likely in error, but note that it might be possible if the sample contains a substantial amount of a weakly bonded, hydrated mineral such as gypsum. If material is still available for this sample, we request that the test be re-evaluated. If similar results are obtained, the mineralogy of the sample should be evaluated.
- Bullet #3, fourth paragraph – Ok, agreed.
- Bullet #3, table – Ok, agreed, except that we believe the sample labeled as 708-R13 is actually referring to 708-R15.
- Bullet #4 – Shaw states that moisture content can vary by plus or minus 20 percent or more for long cores. When comparing the results for sample 708-R15 from pages 10, 23, and 125, moisture contents of 75.2, 62.1, and 31.7 percent are reported. Other samples undergoing a similar series of testing exhibited identical moisture contents for all test specimens. Therefore, we are still concerned about the results for 708-R15 because the measured moisture content range is considerably broader than 20 percent variation suggested as reasonable by Shaw and much broader than the range obtained for other samples tested. For now, Golder will proceed with our work using these test results, but with some continued concern about their accuracy.
- Bullet #5 – Ok, agreed except that the test results are for minus #200 results, not specific gravity as stated in Shaw's letter. The second to last sentence states that the results for 720-R3, 700-R4, and 700-R5 are reported on page 28. We assume that Shaw actually is referring to samples 720-R3, 720-R4, and 720-R5. However, minus #200 test results for sample 720-R4 were not requested, nor are they reported on page 28. Therefore, some clarification is still required.

Golder appreciates the opportunity to work with Stoller on this project. Please contact the undersigned at (303)980-0540 if you have any questions.

Sincerely,

GOLDER ASSOCIATES INC.

Kimberly Finke Morrison

James M. Johnson, P.E.
Principal

Kimberly Finke Morrison, P.E., R.G.
Senior Project Engineer

References:

Golder Associates Inc. (Golder) 2006a. "*Review of Partial Data Set, Shaw E & I, Inc. Geotechnical Laboratory Test Program, Moab Project, Grand County, Utah*." Prepared for S.M. Stoller, Project No. 053-2269, 20 March 2006. (Letter #1)

Golder Associates Inc. (Golder) 2006b. "*Additional Review of Partial Data Set, Shaw E & I, Inc. Geotechnical Laboratory Test Program, Moab Project, Grand County, Utah*." Prepared for S.M. Stoller, Project No. 053-2269, 22 March 2006. (Letter #2)

Golder Associates Inc. (Golder) 2006c. "*Further Review Comments (Letter #3) for Partial Data Set, Shaw E & I, Inc. Geotechnical Laboratory Test Program, Moab Project, Grand County, Utah*." Prepared for S.M. Stoller, Project No. 053-2269, 23 March 2006. (Letter #3)

Prakash, S. 1995. *Fundamentals of Soil Mechanics*. Rolla, Missouri: Shamsher Prakash Foundation. 467 pp.

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Golder Associates

August 21, 2006 Our Ref: 053-2269

S.M. Stoller
105 Technology Drive, Suite 190
Broomfield, CO 80021

Attention: Mr. Greg Lord, Senior Engineer

RE: REVIEW OF SHAW'S RESPONSE TO LETTER #3 COMMENTS REGARDING PARTIAL DATA SET, SHAW E & I, INC. GEOTECHNICAL LABORATORY TEST PROGRAM, MOAB PROJECT, GRAND COUNTY, UTAH

Dear Mr. Lord:

In March 2006, Golder Associates Inc. (Golder) received geotechnical laboratory test results from Shaw E & I, Inc. (Shaw) for the Moab Project in Grand County, Utah. After a thorough review of the laboratory test data, Golder issued several letters to Shaw (via S.M. Stoller) requesting clarification on data discrepancies.

Golder provided a letter on 20 March 2006 (Letter #1) providing initial comments resulting from a first review of Shaw's laboratory data to assess the reasonableness and completeness of the results. A second letter was issued on 22 March 2006 (Letter #2) providing additional comments resulting from a more detailed review of the lab testing results. A third letter was issued on 23 March 2006 (Letter #3) that presented additional comments resulting from an in-depth review of the unconsolidated undrained (UU) triaxial test results and the unconfined compressive strength test results. In previous correspondence, Shaw provided response to Letters #1 and #2.

On 17 August 2006, Golder received a partial response to the issues brought up on Letter #3 in the form of six replacement sheets for the lab testing report. Data in this submittal included one unconfined compressive strength test result and five UU triaxial test results. All six of the replacement sheets appear to have been changed to address Golder's comments in Letter #3; however, comments pertaining to other sheets in the report were not addressed. The following comments reference unaddressed bullet items in Letter #3:

- The moisture content comment pertaining to UU triaxial test sample 708-R15 was not addressed. Moisture contents of 62.1 and 75.2 percent were reported for this sample in two different places in Shaw's report. We believe that the moisture content was measured for material extruded from two discrete depths within the Shelby tube, and this variation in moisture content can be expected if this is indeed the case.
- The second bullet item from Letter #3 was not addressed. This item referred to the large variation in results between unconfined compressive strength (i.e., 6.2 psi) and undrained strength from the UU triaxial test (i.e., 133.4 psi) for sample 700-R30.

- The reported moisture contents for samples 708-R15 and 708-R24 discussed in the third bullet item from Letter #3 were not addressed.
- In the fourth bullet item from Letter #3, the dry density discrepancies noted for samples 708-R15 and 708-R24 were not addressed.

Golder does not intend to pursue the remaining subset of data discrepancies any further as we are not using the questionable data in our current modeling efforts and the addition of this data would likely have little to no impact on the modeling results. Of course, we will continue to assist Stoller as needed if additional followup is requested.

Golder appreciates the opportunity to work with Stoller on this project. Please contact the undersigned at (303)980-0540 if you have any questions.

Sincerely,

GOLDER ASSOCIATES INC.

James M. Johnson, P.E.
Principal

Golder Associates Inc.

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March 20, 2006 Our Ref: 053-2269

S.M. Stoller
990 South Public Road, Suite A
Lafayette, Colorado 80026

Attention: Mr. Greg Lord, Senior Engineer

RE: REVIEW OF PARTIAL DATA SET, SHAW E & I, INC. GEOTECHNICAL LABORATORY TEST PROGRAM, MOAB PROJECT, GRAND COUNTY, UTAH

Dear Mr. Lord:

Golder Associates Inc. (Golder) received on March 13, 2006 the first of an expected two rounds of geotechnical laboratory test results from Shaw E & I, Inc. (Shaw). We have performed an initial review to assess the reasonableness and completeness of the results. Shaw indicates that the first round of testing includes test results for the first shipment of samples received from the Moab Project in Grand County, Utah. This batch of 121 soil samples was received at their facility on February 1, 2006.

Golder has the following observations and comments on the test results received to date (Round 1):

- Missing minus #200 sieve tests for samples 700-R16, 700-R20, and 700-R24. We request that Shaw complete these tests and add the test results to the report.
- Sieve analysis was missing for sample 717-R10. It is possible that the data was mis-labeled 716-R10, which was an unassigned sample. We request that Shaw determine the correct sample designation, correct the report if necessary, and complete the sieve analysis on 717-R10 if the wrong sample was tested.
- Samples 701-R8 and 702-R18 were classified as NP (non-plastic), though the samples exhibited plasticity. We request that Shaw visually evaluate these samples and reassess the test results to make sure the results match the observed material types.
- Samples 712-R11 and 720-R12 were reported to have a higher plastic limit than liquid limit, therefore producing a negative plasticity index. We request that the Atterberg limits testing on these two samples be re-evaluated.

Shaw indicates that the second round of testing will be conducted on the subsequent sample shipment received at their facility on February 15, 2006. Golder will perform a similar review of these results when available. The second round of testing is expected to include:

- Test pit samples, with the exception of GATP-10 samples 1 and 2;
- Shelby tube samples: 701-R26 and 706-R20; and

- Split spoon samples: 706-R22, 707-R17, 707-R28, 710-R1, 710-R3, 710-R19, 713-R1, 713-R13, 715-R3, 718-R5, 718-R7, 718-R9, 718-R11, 718-R13, 718-R15, 718-R17, 722-R1, 722-R2, 722-R3, and 722-R5.

Golder appreciates the opportunity to work with Stoller on this project. Please contact the undersigned at (303)980-0540 if you have any questions.

Sincerely,

GOLDER ASSOCIATES INC.

James M. Johnson, P.E.
Principal

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March 22, 2006 Our Ref: 053-2269

S.M. Stoller
990 South Public Road
Suite A
Lafayette, Colorado 80026

Attention: Mr. Greg Lord, Senior Engineer

RE: ADDITIONAL REVIEW OF PARTIAL DATA SET, SHAW E & I, INC. GEOTECHNICAL LABORATORY TEST PROGRAM, MOAB PROJECT, GRAND COUNTY, UTAH

Dear Mr. Lord:

Golder Associates Inc. (Golder) received on March 13, 2006 the first of an expected two rounds of geotechnical laboratory test results from Shaw E & I, Inc. (Shaw). We provided a letter on 20 March 2006 providing initial comments resulting from a first review of the data to assess the reasonableness and completeness of the results. This letter presents additional comments resulting from a more detailed review of the lab testing results.

Shaw indicates that the first round of testing includes test results for the first shipment of samples received from the Moab Project in Grand County, Utah. This batch of 121 soil samples was received at their facility on February 1, 2006.

Golder provides the following additional observations and comments regarding the test results received to date (Round 1):

- In the sample number cross-reference list, sample number 713-R11 (BC0870) is not listed. We request that Shaw add the sample to the list, as data for the sample was included in the report.

- On pages 9 and 10 of 162, lab samples BC0762, BC0768, and BC0779 appear to be mis-labeled as samples 700-R33, 701-R24, and 704-R20, respectively. Based on the sample number cross-reference list, samples BC0762, BC0768, and BC0779 correspond to samples 701-R33, 702-R24, and 707-R20, respectively. On page 12 of 162, lab sample BC0823 is mis-labeled as sample 7126-R11. We believe that this sample corresponds to 716-R11. We request that Shaw provide confirmation and correct the data, accordingly.

- Several of the measured bulk and dry density values presented in the tables on pages 22 through 25 appear suspect due to either very high or very low measured density. Sample 700-R8 with a reported bulk density of 174.8 pcf, sample 708-R15 with a reported dry density of 32.2 pcf and sample 713-R5 with a dry density of 31.0 pcf are especially questionable. Sample 708-R15 is likely in error due to a data entry mistake whereby the sample diameter was entered as about 5.54 inches, though no sampler used for the program was larger than about 2.9 inches in diameter. Golder conducted a more thorough quality control check of the density data by calculating the sample saturation (*S*) and void ratio (*e*) based on the reported or assumed specific gravity (*SG*), reported water content (*w*), and reported dry density (γ_d). Samples with large void ratios (in excess of 3.8) are considered suspect, which includes samples 708-R15 and 713-R5. With the exception of near-surface samples or alluvial samples that are likely not saturated, samples with calculated saturations much less or much greater than 100 percent are also considered questionable, which includes samples 700-R8 (*S*=263%), 701-R30 (*S*=20%), 702-R10 (*S*=61%), 708-R15 (*S*=48%), 710-R16 (*S*=143%), 712-R7 (*S*=66%), 713-R5 (*S*=46%), and 716-R9 (*S*=68%). Additional samples of concern include 700-R12 (*S*=119%), 700-R35 (*S*=116%), 701-R18 (*S*=112%), 701-R22 (*S*=109%), 702-R24 (*S*=108%), 706-R12 (*S*=110%), 710-R12 (*S*=110%), 712-R13 (*S*=110%), 715-R24 (*S*=112%), and 716-R13 (*S*=107%). We request that Shaw double-check their data entry in these tables as the bulk and dry density values appear to be calculated based on the values entered for average length, average diameter, wet weight, and moisture content.

- On page 10, the moisture content reported for sample 708-R15 was 75.2 percent, while on page 23, the moisture content reported for the same sample was 62.1 percent. We request that Shaw determine the correct moisture content and correct the report where necessary.

- On page 26, the first three Shaw sample numbers (BC0750, BC0751, and BC0752) are reported as client sample numbers 720-R3, 720-R4, and 720-R5. The sample number cross reference list indicates that these sample numbers correspond to client sample numbers 700-R16, 700-R20, and 700-R24. We request that Shaw determine the correct sample numbers and correct the report accordingly.

- We have compared the reported percent fines on pages 26 through 28 to the boring log descriptions. Samples which differed considerably based on fines content from the field descriptions include the following:

Sample Number	Reported Fines Content	Field Description
702-R14	95.6	Silty sand (SM)
713-R9	100.0	Sandy silt (ML)
716-R11	86.6	Silty sand (SM)
716-R4	7.3	Silty sand (SM)
717-R18	96.9	Sandy silt (ML)
720-R12	83.3	Silty sand (SM)
720-R14	97.0	Silty sand (SM)
720-R4	0.0	Silty sand (SM)

We understand that discrepancies are expected between field classifications and laboratory test results particularly due to limitations associated with the field methods. However, for completeness, we request that Shaw double-check the data entry for the above-mentioned results.

- On page 100, the field sample number is listed as 716-R10. We believe that this is actually sample number 717-R10, based on the sample number cross reference list. We request that Shaw confirm the sample number and correct the report if necessary.

In our 20 March 2006 letter, we provided initial observations and comments on the test results received to date (Round 1). These observations and comments are presented below for easy reference and completeness:

- Missing minus #200 sieve tests for samples 700-R16, 700-R20, and 700-R24. We request that Shaw complete these tests and add the test results to the report.
- Sieve analysis was missing for sample 717-R10. It is possible that the data was mis-labeled 716-R10, which was an unassigned sample. We request that Shaw determine the correct sample designation, correct the report if necessary, and complete the sieve analysis on 717-R10 if the wrong sample was tested.
- Samples 701-R8 and 702-R18 were classified as NP (non-plastic), though the samples exhibited plasticity. We request that Shaw visually evaluate these samples and reassess the test results to make sure the results match the observed material types.
- Samples 712-R11 and 720-R12 were reported to have a higher plastic limit than liquid limit, therefore producing a negative plasticity index. We request that the Atterberg limits testing on these two samples be re-evaluated.

Shaw indicates that the second round of testing will be conducted on the subsequent sample shipment received at their facility on February 15, 2006. Golder will perform a similar review of these results when available. The second round of testing is expected to include:

- Test pit samples, with the exception of GATP-10 samples 1 and 2;
- Shelby tube samples: 701-R26 and 706-R20; and
- Split spoon samples: 706-R22, 707-R17, 707-R28, 710-R1, 710-R3, 710-R19, 713-R1, 713-R13, 715-R3, 718-R5, 718-R7, 718-R9, 718-R11, 718-R13, 718-R15, 718-R17, 722-R1, 722-R2, 722-R3, and 722-R5.

Golder appreciates the opportunity to work with Stoller on this project. Please contact the undersigned at (303)980-0540 if you have any questions.

Sincerely,

GOLDER ASSOCIATES INC.

James M. Johnson, P.E.
Principal

Golder Associates Inc.

44 Union Boulevard, Suite 300
Lakewood, CO USA 80228
Telephone (303) 980-0540
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March 23, 2006 Our Ref: 053-2269

S.M. Stoller
990 South Public Road
Suite A
Lafayette, Colorado 80026

Attention: Mr. Greg Lord, Senior Engineer

RE: FURTHER REVIEW COMMENTS (LETTER #3) FOR PARTIAL DATA SET, SHAW E & I, INC. GEOTECHNICAL LABORATORY TEST PROGRAM, MOAB PROJECT, GRAND COUNTY, UTAH

Dear Mr. Lord:

Golder Associates Inc. (Golder) received on March 13, 2006 the first of an expected two rounds of geotechnical laboratory test results from Shaw E & I, Inc. (Shaw). Shaw indicates that the first round of testing includes test results for the first shipment of samples received from the Moab Project in Grand County, Utah. This batch of 121 soil samples was received at their facility on February 1, 2006.

We provided a letter on 20 March 2006 providing initial comments resulting from a first review of Shaw's laboratory data to assess the reasonableness and completeness of the results. A second letter was issued on 22 March 2006 providing additional comments resulting from a more detailed review of the lab testing results. This third letter presents additional comments resulting from an in-depth review of the unconsolidated undrained (UU) triaxial test results and the unconfined compressive strength test results.

Based on a review of the UU triaxial test results and the unconfined compressive strength test results, we provide the following comments:

- Five of the UU test samples were reported to have unreasonably high moisture contents, as follows: 708-R8 (BC0787) – 578%; 708-R24 (BC0785) – 347%; 715-R6 (BC0821) – 217%; 715-R16 (BC0817) – 346%; and 715-R24 (BC0819) – 272%. These moisture contents differ significantly from the in-situ moisture contents reported for the same samples on pages 10 and 12 of the report, which range from 24 to 99 percent. The moisture content reported for UU test sample 708-R15 (62.1%) differs from that indicated on page 10 (75.2%), but is the same as the moisture content reported on page 23. The moisture contents reported on the UU test sheets for the remaining samples (700-R12, 700-R30, and 700-R39) matched the moisture contents reported on pages 9 through 15 of the report. We request that Shaw confirm the sample moisture contents and correct the report accordingly.

- With a stress at failure of 133.4 pounds per square inch (psi), UU test sample 700-R30 (BC0753) was reported to have a stress at failure that is an order of magnitude higher than that for any of the other test samples. An unconfined compressive strength of the same sample produced a failure stress of only 6.2 psi. Golder requests that Shaw confirm the test data and correct the report as needed..

- The reported moisture contents for three of the unconfined compressive strength tests differed significantly from the in-situ moisture contents reported on pages 9 through 15 of the report, as follows: 700-R39 (BC0755) – 120% compared to 50%; 708-R15 (BC0783) – 32% compared to 75% (on page 10) or 62% (on page 23); and 708-R24 (BC0785) – 41% compared to 24%. If the unconfined compressive strength tests were conducted after the samples were allowed to dry out to lower moisture contents, the strength results would likely be skewed unconservatively. In the case of the unconfined compressive strength test sample with a reported moisture content considerably higher than the in-situ result, no explanation other than data entry error can be inferred. We request that Shaw confirm the sample moisture contents and correct the report accordingly.

- The in-situ densities reported on pages 22 through 25 of the report should be similar to the in-situ densities reported for the same sample numbers on the unconfined compressive strength and UU triaxial test results. When doing a comparison of the reported dry densities, the following differences were noted: (1) unconfined compressive strength test sample 700-R39 was reported to have a dry density 29% lower than both the in-situ density and the UU test density; (2) UU test sample 708-R8 was reported to have a dry density 72% lower than the in-situ density, which was similar to the unconfined compressive strength test sample density; (3) sample 708-R15 was reported to have three very different dry densities (by as much as 200% different), with values of 32, 65, and 91 pounds per cubic foot (pcf) for the in-situ, UU triaxial test, and unconfined compressive strength test, respectively; (4) unconfined compressive strength test sample 708-R24 was reported to have a dry density 19% lower than the in-situ density; and (5) UU test samples 708-R24, 715-R6, 715-R16, and 715-R24 had reported dry densities 54 to 71% lower than the reported in-situ dry density, likely due to the aforementioned water content errors. Golder requests that Shaw confirm the data with regard to density and moisture content, and correct the report accordingly.

In our 20 March 2006 letter, we provided initial observations and comments on the test results received to date (Round 1). These observations and comments are presented below for easy reference and completeness:

- Missing minus #200 sieve tests for samples 700-R16, 700-R20, and 700-R24. We request that Shaw complete these tests and add the test results to the report.

- Sieve analysis was missing for sample 717-R10. It is possible that the data was mis-labeled 716-R10, which was an unassigned sample. We request that Shaw determine the correct sample designation, correct the report if necessary, and complete the sieve analysis on 717-R10 if the wrong sample was tested.

- Samples 701-R8 and 702-R18 were classified as NP (non-plastic), though the samples exhibited plasticity. We request that Shaw visually evaluate these samples and reassess the test results to make sure the results match the observed material types.

- Samples 712-R11 and 720-R12 were reported to have a higher plastic limit than liquid limit, therefore producing a negative plasticity index. We request that the Atterberg limits testing on these two samples be re-evaluated.

In our 22 March 2006 letter, we provided additional observations and comments on the test results received to date (Round 1). These observations and comments are presented below for easy reference and completeness:

- In the sample number cross-reference list, sample number 713-R11 (BC0870) is not listed. We request that Shaw add the sample to the list, as data for the sample was included in the report.

- On pages 9 and 10 of 162, lab samples BC0762, BC0768, and BC0779 appear to be mis-labeled as samples 700-R33, 701-R24, and 704-R20, respectively. Based on the sample number cross-reference list, samples BC0762, BC0768, and BC0779 correspond to samples 701-R33, 702-R24, and 707-R20, respectively. On page 12 of 162, lab sample BC0823 is mis-labeled as sample 7126-R11. We believe that this sample corresponds to 716-R11. We request that Shaw provide confirmation and correct the data, accordingly.

- Several of the measured bulk and dry density values presented in the tables on pages 22 through 25 appear suspect due to either very high or very low measured density. Sample 700-R8 with a reported bulk density of 174.8 pcf, sample 708-R15 with a reported dry density of 32.2 pcf and sample 713-R5 with a dry density of 31.0 pcf are especially questionable. Sample 708-R15 is likely in error due to a data entry mistake whereby the sample diameter was entered as about 5.54 inches, though no sampler used for the program was larger than about 2.9 inches in diameter. Golder conducted a more thorough quality control check of the density data by calculating the sample saturation (S) and void ratio (e) based on the reported or assumed specific gravity (SG), reported water content (w), and reported dry density (γ_d). Samples with large void ratios (in excess of 3.8) are considered suspect, which includes samples 708-R15 and 713-R5. With the exception of near-surface samples or alluvial samples that are likely not saturated, samples with calculated saturations much less or much greater than 100 percent are also considered questionable, which includes samples 700-R8 (S=263%), 701-R30 (S=20%), 702-R10 (S=61%), 708-R15 (S=48%), 710-R16 (S=143%), 712-R7 (S=66%), 713-R5 (S=46%), and 716-R9 (S=68%). Additional samples of concern include 700-R12 (S=119%), 700-R35 (S=116%), 701-R18 (S=112%), 701-R22 (S=109%), 702-R24 (S=108%), 706-R12 (S=110%), 710-R12 (S=110%), 712-R13 (S=110%), 715-R24 (S=112%), and 716-R13 (S=107%). We request that Shaw double-check their data entry in these tables as the bulk and dry density values appear to be calculated based on the values entered for average length, average diameter, wet weight, and moisture content.

- On page 10, the moisture content reported for sample 708-R15 was 75.2 percent, while on page 23, the moisture content reported for the same sample was 62.1 percent. We request that Shaw determine the correct moisture content and correct the report where necessary.

- On page 26, the first three Shaw sample numbers (BC0750, BC0751, and BC0752) are reported as client sample numbers 720-R3, 720-R4, and 720-R5. The sample number cross reference list indicates that these sample numbers correspond to client sample numbers 700-R16, 700-R20, and 700-R24. We request that Shaw determine the correct sample numbers and correct the report accordingly.

- We have compared the reported percent fines on pages 26 through 28 to the boring log descriptions. Samples which differed considerably based on fines content from the field descriptions include the following:

Sample Number	Reported Fines Content	Field Description
702-R14	95.6	Silty sand (SM)
713-R9	100.0	Sandy silt (ML)
716-R11	86.6	Silty sand (SM)
716-R4	7.3	Silty sand (SM)
717-R18	96.9	Sandy silt (ML)
720-R12	83.3	Silty sand (SM)
720-R14	97.0	Silty sand (SM)
720-R4	0.0	Silty sand (SM)

We understand that discrepancies are expected between field classifications and laboratory test results particularly due to limitations associated with the field methods. However, for completeness, we request that Shaw double-check the data entry for the above-mentioned results.

- On page 100, the field sample number is listed as 716-R10. We believe that this is actually sample number 717-R10, based on the sample number cross reference list. We request that Shaw confirm the sample number and correct the report if necessary.

Shaw indicates that the second round of testing will be conducted on the subsequent sample shipment received at their facility on February 15, 2006. Golder will perform a similar review of these results when available. The second round of testing is expected to include:

- Test pit samples, with the exception of GATP-10 samples 1 and 2;

- Shelby tube samples: 701-R26 and 706-R20; and

- Split spoon samples: 706-R22, 707-R17, 707-R28, 710-R1, 710-R3, 710-R19, 713-R1, 713-R13, 715-R3, 718-R5, 718-R7, 718-R9, 718-R11, 718-R13, 718-R15, 718-R17, 722-R1, 722-R2, 722-R3, and 722-R5.

Golder appreciates the opportunity to work with Stoller on this project. Please contact the undersigned at (303)980-0540 if you have any questions.

Sincerely,

GOLDER ASSOCIATES INC.

James M. Johnson, P.E.
Principal

Shaw™
Shaw E & I, Inc.

Geotechnical Laboratory
PO Box 4339
1570 Bear Creek Road
Oak Ridge TN 37830
(865) 482-6497

April 13, 2006

Erin Stanley
General Engineering Laboratories
2040 Savage Road
Charleston SC 29407

RE: Moab data report comments, 109855.01210000

Dear Ms. Stanley,

Shaw reported test results on March 13, 2006 for 122 geotechnical samples received February 1, 2006. Golder reviewed the data package and commented to Stoller on March 20 and March 22, 2006. This correspondence responds to questions and comments contained in Golder's letters to Stoller. Shaw also identified several discrepancies in the original report and will re-issue the report with corrections/clarifications.

Golder's review dated March 20, 2006

Bullet #1, missing minus #200 sieve tests for samples 700-R16, 700-R20, and 700-R24.
Response – page 26 lists data for Shaw sample numbers BC0750, BC0751, and BC0752. These sample numbers correspond to field sample numbers 700-R16, 700-R20, and 700-R24, respectively, and not the field numbers listed on the data page.

Bullet #2, sieve analysis data missing for 717-R10.
Response – Data results labeled 716-R10 are actually for 717-R10.

Bullet #3, Nonplastic Atterberg limits test results questioned for samples 701-R8 and 702-R12.
Response – Shaw elected to re-analyze these samples at our expense. The second tests yielded LL=25, PI=2, USCS=ML for the former; and LL=23, PI=6, USCS=CL-ML for the latter. The same technician performed the second tests as performed the original analyses. The Atterberg tests are somewhat subjective and the second results may have been influenced by Golder's request. In any case, the samples exhibited very low plasticity.

Bullet #4, Plastic limit results questioned for samples 712-R11 and 720-R12.
Response - Shaw elected to re-analyze these samples at our expense. The second tests yielded LL=25, PI=1, USCS=ML for the former; and LL=22, PI=(-1), USCS=NP for the latter. The same technician performed the second tests as performed the original analyses. The Atterberg tests are somewhat subjective and the second results may have been influenced by Golder's request. In any case, the samples exhibited extremely low plasticity. Second round results are consistent with original results.

Golder's review dated March 22, 2006
Bullet #1, sample number 713-R11 not included in sample cross-reference list.
Response - We concur and will include this sample in the report re-issue.

Bullet #2, incorrectly typed field sample ID's, pp. 9, 10, 12.
Response – We concur with Golder's assumptions and these entries will be amended in the re-issued report.

Bullet #3, certain density values questioned.
Response – Data are calculated from physical specimen measurements. Three specimen lengths are averaged, and three diameter measurements are averaged to determine gross volume. In some cases, one or two of the three measurements was entered incorrectly and was not identified during transcription checks.

Field sample number 708-R15: density values were reported incorrectly on the density data sheet (p. 23) but are reported correctly on the unconfined compressive strength report sheet (p. 125). The correct results for 708-R15 are 104.4 pcf wet density, 59.6 pcf dry density.

The bench data was entered correctly for sample 700-R8. We agree that the reported wet density appears very high. The sample also has a high specific gravity value.

The bench data was not entered correctly for sample 713-R5. The correct results are 97.3 pcf wet density, 55.4 pcf dry density. These data will be amended in the report re-issue.

We re-performed the transcription checks for all density data reported. Changes needed are included in the table below:

Field sample ID	Original wet density, pcf	Original dry density, pcf	New wet density, pcf	New dry density, pcf
700-R12	124.1	89.1	106.1	76.2
700-R5	128.4	118.1	128.3	118.0
702-R14	120.9	89.4	126.4	93.5
707-R8	137.6	120.1	137.4	119.9
708-R13	52.2	32.2	104.4	59.6
710-R16	128.3	80.0	107.3	66.9
713-R5	54.4	31.0	97.3	55.4
720-R14	116.0	90.2	124.5	96.8

Bullet #4, discrepancy between reported moisture result, sample 708-R15.
Response – both results are correct. The laboratory routinely gathers moisture content data on sample aliquots when multiple analyses are requested on the same sample. The moisture content of large samples, especially long soil cores, can vary +/-20% or more depending on where the aliquot is obtained in the core. The moisture content reported on a particle-size distribution report sheet may not match the moisture content reported on a UCS report sheet, for example, depending on where the test material was obtained in the core length.

Bullet #5, sample ID correlation, specific gravity results.
Response – The sample number cross-reference list is correct. The field numbers reported on page 26 for BC0750, BC0751, and BC0752 should be 700-R16, 700-R20, and 700-R24, respectively. Results for 720-R3, 700-R4, and 700-R5 are reported on page 28. Page 26 will be amended on the report re-issue.

Bullet #6, questions about ASTM D 1140 results versus boring log visual descriptions.
Response – We re-performed the transcription check for –200 analyses. The result for 722-R4 was found to be 21.3% passing the #200 sieve, instead of zero. All other numerical entries are correct.

We elected to re-analyze the samples highlighted by Golder. The new results are given below:

Field Sample ID	Original result, % passing	New result, % passing
702-R14	95.6	95.5
713-R9	100.0	87.3
716-R11	86.6	71.8
716-R4	7.3	8.4
717-R18	96.9	99.3
720-R12	83.3	96.4
720-R14	97.0	96.2

These new data correlate well with original results and are within the expected degree of heterogeneity of 24-in. soil cores.

Bullet #7, sample ID question, p.100.
Response – The correct sample ID for BC0834 is 717-R10. The field sample ID will be amended on page 100 for the report re-issue.

We will re-issue the data report for this first set of samples shortly. Please do not hesitate to contact us if additional information is needed. Shaw regrets the inconvenience that the original data report may have caused the receiving parties.

Best regards,

Ralph Cole
Manager, Geotechnical Laboratory

U.S. Department of Energy—Grand Junction, Colorado

Calculation Cover Sheet

Calc. No.: MOA-02-04-2007-4-03-01
Doc. No.: X0187000

Discipline: Geotechnical Properties

No. of Sheets: 6

Location: Attachment 5 Vol. I, Appendix K

Project: Moab UMTRA Project

Site: Crescent Junction Site

Feature: Supplemental Geotechnical Properties of Native Materials

Sources of Data:

Laboratory Test Results from Geotechnical Engineering Group, Inc: Letter Reports listed in Appendixes A through D of this revised calculation.

Test Pit Logs from the 2005 Geological Investigation (see "Test Pit Logs" calculation in Attachment 5, Appendix D).

Purpose of Revision:

Revision is being issued to include the testing results from two revised data packages that were obtained from Geotechnical Engineering Group on August 14, and September 20, 2006.

Sources of Formulae and References:

See "References" section

Preliminary Calc. ☐ **Final Calc.** ☒ **Supersedes Calc. No. MOA-02-07-2006-4-03-00**

Author: Name 5-31-07 Date

Checked by: Clint Strachan Name 29 May 2007 Date

Name 5/30/07 Date

Name 31 May 07 Date

Name May 31, 07 Date

Approved by: Name 5/31/07 Date

No text for this page

Problem Statement:

Preliminary site selection performed jointly by the U.S. Department of Energy (DOE) and the Contractor has identified a 2,300-acre withdrawal area in the Crescent Flat area just northeast of Crescent Junction, Utah, as a possible site for final disposal of the Moab uranium mill tailings. The proposed disposal cell would cover approximately 250 acres. Based on the preliminary site-selection process, the suitability of the Crescent Junction Disposal Site is being evaluated from several technical aspects, including geomorphic, geologic, hydrologic, seismic, geochemical, and geotechnical. The objective of this calculation set is to present supplemental geotechnical properties of native materials for the Crescent Junction Disposal Site.

These data will be incorporated into Attachment 5 of the Remedial Action Plan and Site Design for Stabilization of Moab Title I Uranium Mill Tailings at Crescent Junction, Utah, Site (RAP) and summarized in appropriate sections of the Remedial Action Selection (RAS) report for the Moab Site.

Method of Solution:

Samples described herein were collected from the Crescent Junction Disposal Site during the 2005 geological and geotechnical investigation. The samples were collected from the 0150 series test pits, whose locations appear in Figure 1. Lithologic descriptions of soils encountered in the test pits are summarized in Attachment 5, Volume 1, Appendix D of this Remedial Action Plan. Analyses performed included hydraulic conductivity (ASTM Test Method D5084), triaxial compressive strength (ASTM Test Method D4767), pinhole tests (ASTM Test Method D4647), and laboratory moisture retention tests (ASTM Method D3152). Laboratory results that appeared in the original version of this calculation are presented in Appendixes A and B of this revised calculation.

Data quality checks of the original laboratory data revealed that retests would be needed for the triaxial compressive strength and hydraulic conductivity analyses of sample number 154 at 20 ft. Laboratory results of this retest are presented in Appendix C of this revised calculation.

In addition, data-quality checks also indicated that retests of hydraulic conductivity would be required for sample numbers 152 at 23 ft, 154 at 12 ft, and 156 at 12 ft. Laboratory results of these retests are contained in Appendix D of this revised calculation. With the completion of the triaxial and hydraulic conductivity retests, which are documented in Appendixes C and D of this revised calculation, all data quality deficiencies associated with the original calculation were resolved.

Assumptions:

Not applicable.

Calculation:

Laboratory results from the testing are contained in Appendixes A through D of this revised calculation. A summary of the index properties of the natural materials from this data set are contained in Table 1.

Discussion:

N/A

Conclusion and Recommendations:

N/A

Computer Source:

N/A

Table 1. Summary of Supplemental Geotechnical Properties for Native Soil Materials at the Crescent Junction Site

Sample No.	**Depth (ft)**	**Field Description**	**Atterberg Limits (LL/PL/PI)**	**Passing No. 200 (%)**	**Specific Gravity**	**□$_{max}$ (Modified Proctor) (pcf)**	**w_{opt} (Modified Proctor) (%)**	**Volumetric Water Content at 15-bar**		**Hydraulic Conductivity (cm/s)**	**CU Triax.Shear**	
								At 112 pcf Dry Density	**At 104 pcf Dry Density**		**Cohesion (psf)**	**Effective Friction Angle, Degrees**
TP-151	4.5	sheet wash	24/19/5	66		118.5	13					
TP-152	7.5	sheet wash	26/17/9	74	2.64	120.5	13	18	16.3	8.7E-07	0	28.7
	15	fluvial/eolian	21/18/3	84	2.63	127.5	10	16	14.7	6.1E-06		
	23	weathered shale	33/21/12	97		121	12	24.6	22.1	1.7E-06	330	24.2
TP-153	3.5	sheet wash	23/18/5	72	2.68	120.5	12.5	18.9	17.2		0	37.9
	8.5	fluvial/eolian	NP	67	2.65	118	11	11.7	10.4	1.4E-04	0	28.8
TP-154	4	sheet wash	22/18/4	83		123	12					
	12	fluvial/eolian	20/17/3	63	2.65	122	12			1.9E-06		
	20	weathered shale	38/18/20	95	2.73	120.5	13	21.6	19.9	8.0E-07	160	23.1
TP-156	5	sheet wash	24/17/7	69	2.82	120	11.5	16.7	14.2			
TP-156	12	eolian	19/17/2	64	2.64	124.5	11			3.0E-06	0	30.7
TP-156	22	weathered shale	25/18/7	84	2.56	127.5	11	20.9	16.3	5.9E-09	96	31.1

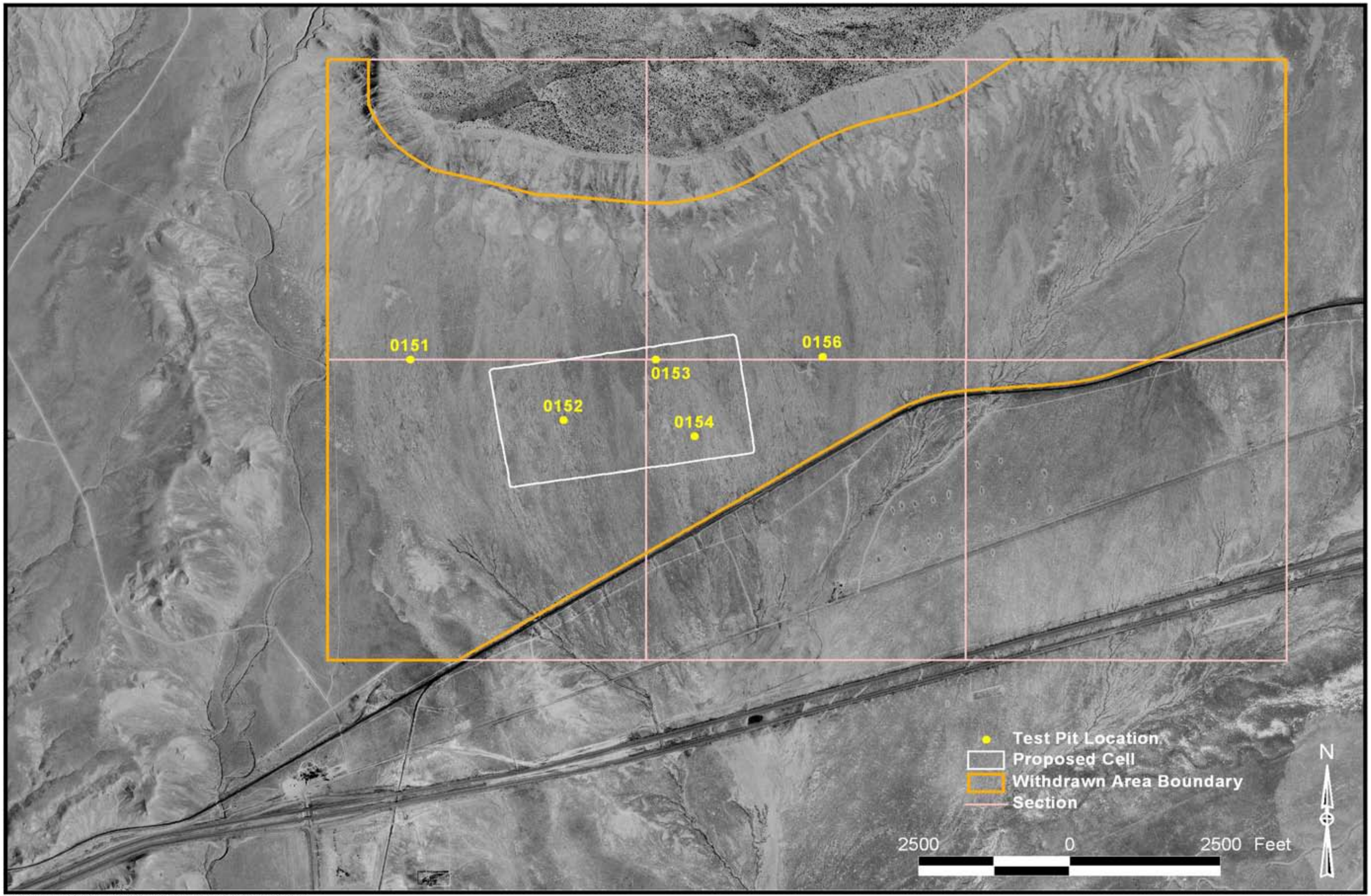


Figure 1. Location of Test Pits at the Crescent Junction, Utah, Disposal Site

References:

Geotechnical Engineering Group, Inc. (GEG), 2006a. “Geotechnical Testing Services – Crescent Junction, Utah Disposal Site”, Letter Report, GEG Job No. 2,165, May 19.

Geotechnical Engineering Group, Inc. (GEG), 2006b. “Geotechnical Testing Services – Crescent Junction, Utah, Disposal Site”, Letter Report, GEG Job No. 2,165, June 15.

Geotechnical Engineering Group, Inc. (GEG), 2006c. “Geotechnical Testing Services – Crescent Junction, Utah, Disposal Site”, Letter Report, GEG Job No. 2,165, August 14.

Geotechnical Engineering Group, Inc. (GEG), 2006d. “Geotechnical Testing Services – Crescent Junction, Utah, Disposal Site”, Letter Report, GEG Job No. 2,165, September 20.

Appendix A

Geotechnical Testing Results

May 19, 2006

Geotechnical Engineering Group, Inc.

May 19, 2006

S.M Stoller Corporation
2597 B ¾ Road
Grand Junction, CO 81503

Attention: Mr. Rex Sellers
Senior Contract Adviser

Subject: Geotechnical Testing Services
Cresent Junction
Utah Disposal Site
GEG Job No. 2,165

Dear Mr. Sellers,

As requested, Geotechnical Engineering Group, Inc. (GEG) has performed laboratory testing services for the subject project. The laboratory tests were performed on samples obtained by others. Laboratory tests performed were determined by S.M Stoller Corporation. Tests performed include hydraulic conductivity and phased triaxial, these are presented on Table I and Figs. 1 through 4. Pinhole tests were performed by H.C Nutting Company and are presented in Tables II through VII. Laboratory moisture retention tests were performed by Advanced Terra Testing, Inc. and are presented in Appendix 1.

Hydraulic Conductivity

Hydraulic conductivity was performed in general accordance with ASTM Test Method D5084. Cell, pore pressures and gradient for pore pressures were determined by S.M. Stoller.

Triaxial Compressive Strength

Triaxial compressive strength tests were conducted in general accordance with ASTM Test Method D4767. Phased triaxial pressures were determined by S.M. Stoller.

We believe the laboratory study was performed and this letter was prepared in a manner consistent with that level of care and skill ordinarily used by geotechnical engineers practicing in this area at this time. No other warranty, either express or implied, is made. When we may be of further service or answer any questions from a geotechnical or construction materials point of view, please call.

Sincerely,
GEOTECHNICAL ENGINEERING GROUP, INC.

Robert W. Anderson
Project Geologist

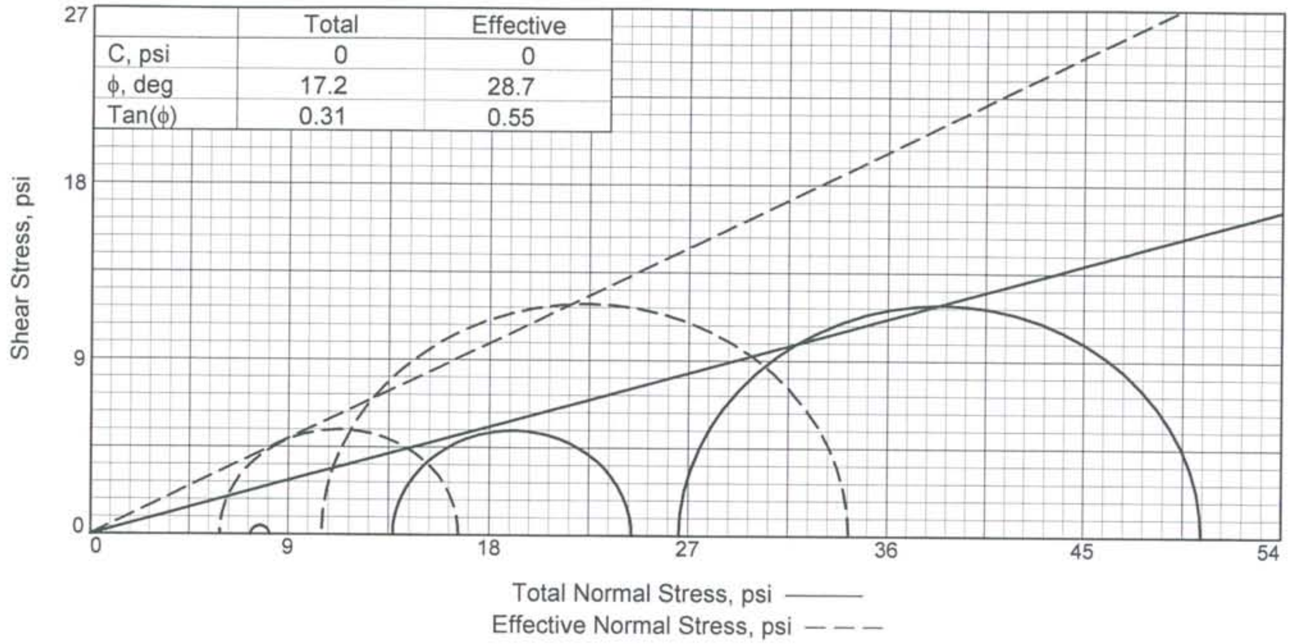
RWA:lc
(3 copies sent)

Geotechnical Engineering Group, Inc.

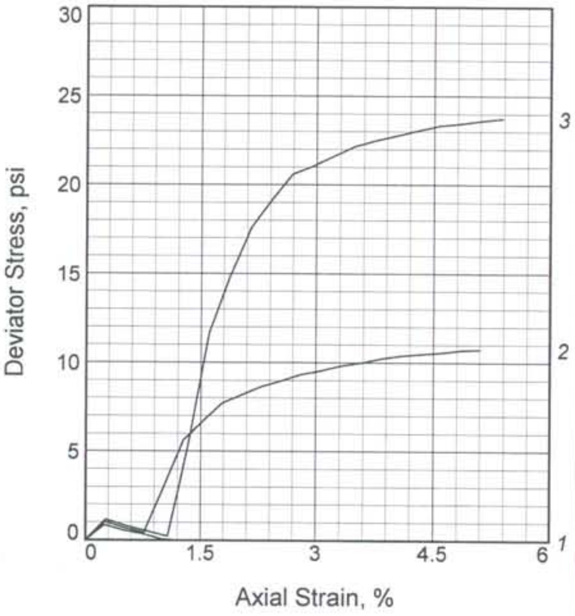
Job No. 2,165

TABLE I
SUMMARY OF LABORATORY TEST RESULTS

HOLE	DEPTH (feet)	Hydraulic Conductivity		ø (deg) effective	C (psi) effective
		B = %	Permeability cm / sec		
152	7.5	96	$8.7x10^{-7}$	0	28.7
152	15	96	$6.1x10^{-6}$		
153	8.5	100	$1.4x10^{-4}$	0	28.8
154	12	95	$1.9x10^{-6}$		
154	20	96	$8.0x10^{-7}$	1.74	1.6
156	20	100	$5.9x10^{-9}$	.67	31.1



	Total	Effective
C, psi	0	0
ϕ, deg	17.2	28.7
Tan(ϕ)	0.31	0.55



Sample No.		1	2	3
Initial	Water Content, %	12.0	12.0	12.0
	Dry Density, pcf	102.3	102.3	102.3
	Saturation, %	51.9	51.9	51.9
	Void Ratio	0.6110	0.6110	0.6110
	Diameter, in.	1.94	1.94	1.94
	Height, in.	4.00	4.00	4.00
At Test	Water Content, %	23.1	23.1	23.1
	Dry Density, pcf	102.3	102.3	102.3
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.6110	0.6110	0.6110
	Diameter, in.	1.94	1.96	2.01
	Height, in.	4.00	3.92	3.72
Strain rate, in./min.		0.03	0.03	0.03
Back Pressure, psi		29.1	28.8	30.0
Cell Pressure, psi		36.4	42.5	56.6
Fail. Stress, psi		0.9	10.8	23.8
Total Pore Pr., psi		29.1	36.6	46.1
Ult. Stress, psi				
Total Pore Pr., psi				
$\bar{\sigma}_1$ Failure, psi		8.2	16.7	34.3
$\bar{\sigma}_3$ Failure, psi		7.3	5.9	10.5

Type of Test:
CU with Pore Pressures

Sample Type: Remolded at 85% of ASTM D1557

Description: Clay, silty, sandy

LL= 26 **PL=** 17 **PI=** 9

Assumed Specific Gravity= 2.64

Remarks: B= 96%, Hydraulic Conductivity 8.7x10^-7

Figure 1

Client: S.M. Stoller

Project: Crescent Junction

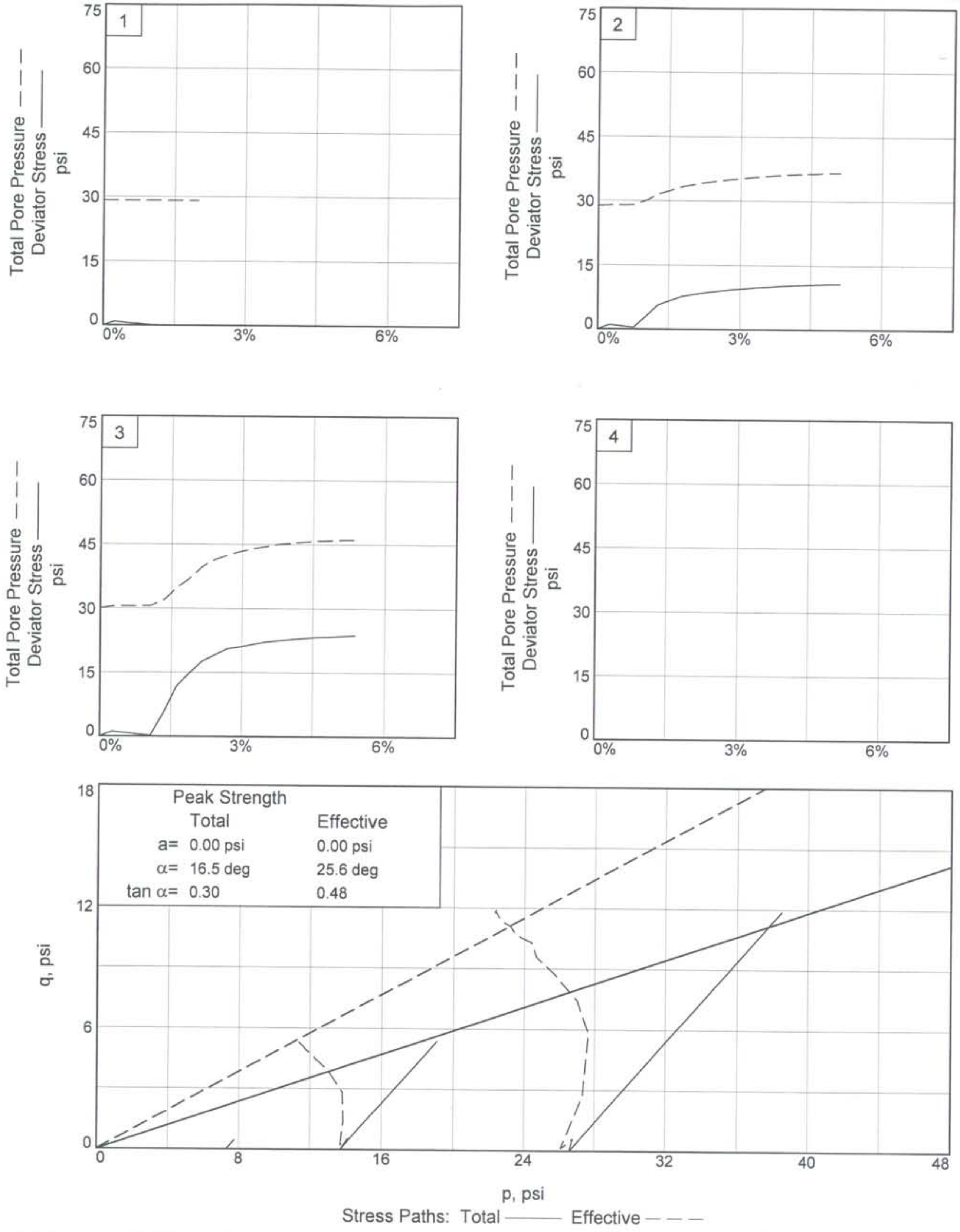
Location: Crescent Junction

Sample Number: 152 **Depth:** 7.5

Proj. No.: 2,165 **Date Sampled:**

Geotechnical
Engineering
Group, Inc.

Tested By: RWA



Peak Strength

	Total	Effective
a=	0.00 psi	0.00 psi
α=	16.5 deg	25.6 deg
tan α=	0.30	0.48

Client: S.M. Stoller

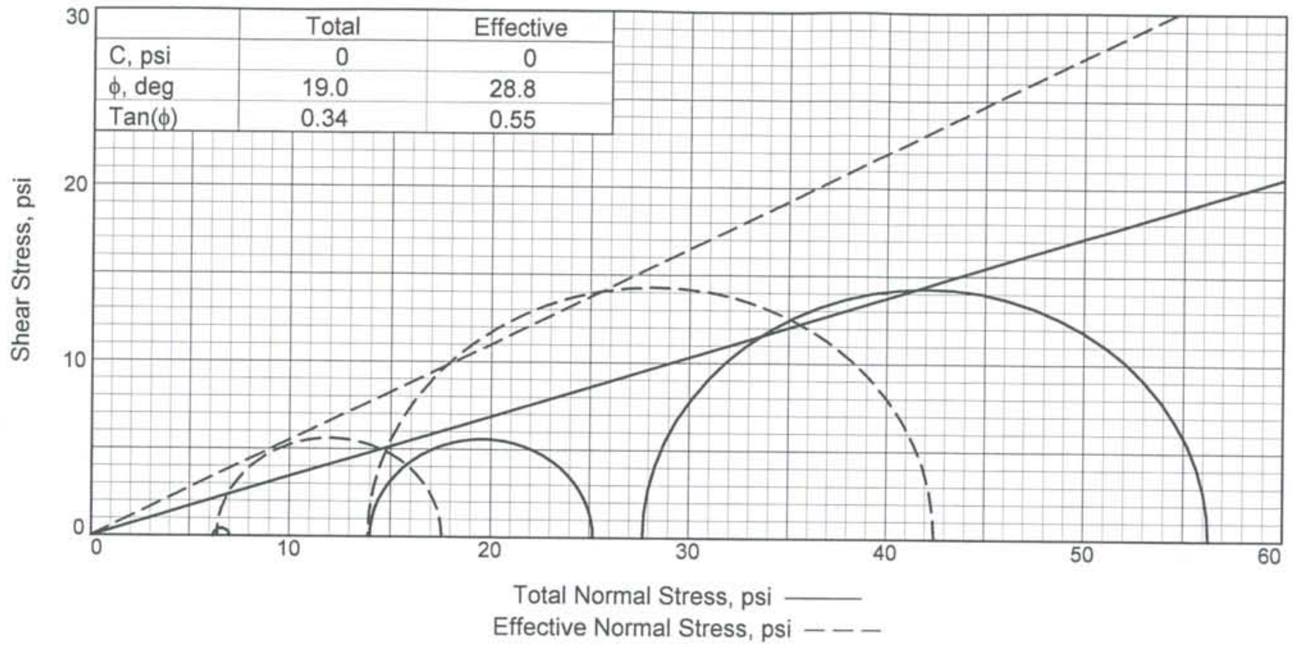
Project: Crescent Junction

Location: Crescent Junction **Depth:** 7.5 **Sample Number:** 152

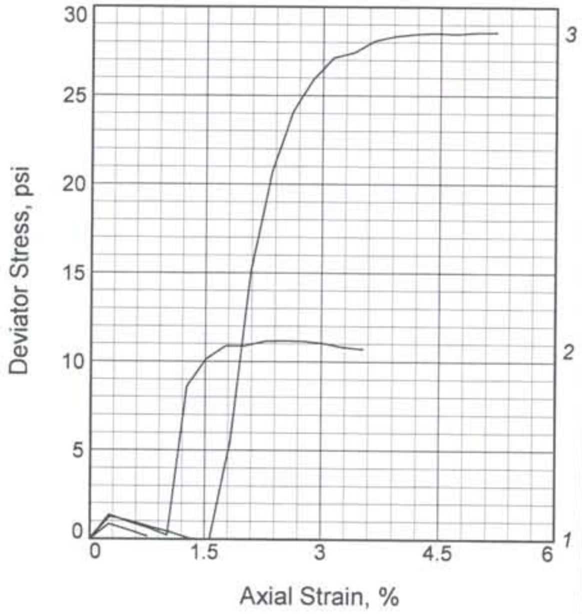
Project No.: 2,165 **Figure** 1A

Geotechnical Engereering Group, Inc.

Tested By: RWA



	Total	Effective
C, psi	0	0
ϕ, deg	19.0	28.8
Tan(ϕ)	0.34	0.55



	Sample No.	1	2	3
Initial	Water Content, %	11.4	11.4	11.4
	Dry Density, pcf	100.6	100.6	100.6
	Saturation, %	47.1	47.1	47.1
	Void Ratio	0.6442	0.6442	0.6442
	Diameter, in.	1.94	1.94	1.94
	Height, in.	4.00	4.00	4.00
At Test	Water Content, %	24.3	24.3	24.3
	Dry Density, pcf	100.6	100.6	100.6
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.6442	0.6442	0.6442
	Diameter, in.	1.94	1.95	1.98
	Height, in.	4.00	3.97	3.83
	Strain rate, in./min.	0.03	0.03	0.03
	Back Pressure, psi	28.4	28.1	28.6
	Cell Pressure, psi	34.6	42.1	56.3
	Fail. Stress, psi	0.8	11.2	28.6
	Total Pore Pr., psi	28.4	35.7	42.4
	Ult. Stress, psi			
	Total Pore Pr., psi			
	$\bar{\sigma}_1$ Failure, psi	7.0	17.6	42.5
	$\bar{\sigma}_3$ Failure, psi	6.2	6.4	13.9

Type of Test:
CU with Pore Pressures

Sample Type: Remold at 85% of ASTM D1557

Description: Clay, silty, sandy

LL= N/A **PI=** N/A

Specific Gravity= 2.65

Remarks: B= 100%, Hydraulic Conductivity 1.4x10^-5cm/sec

Figure 2

Client: S.M. Stoller

Project: Crescent Junction

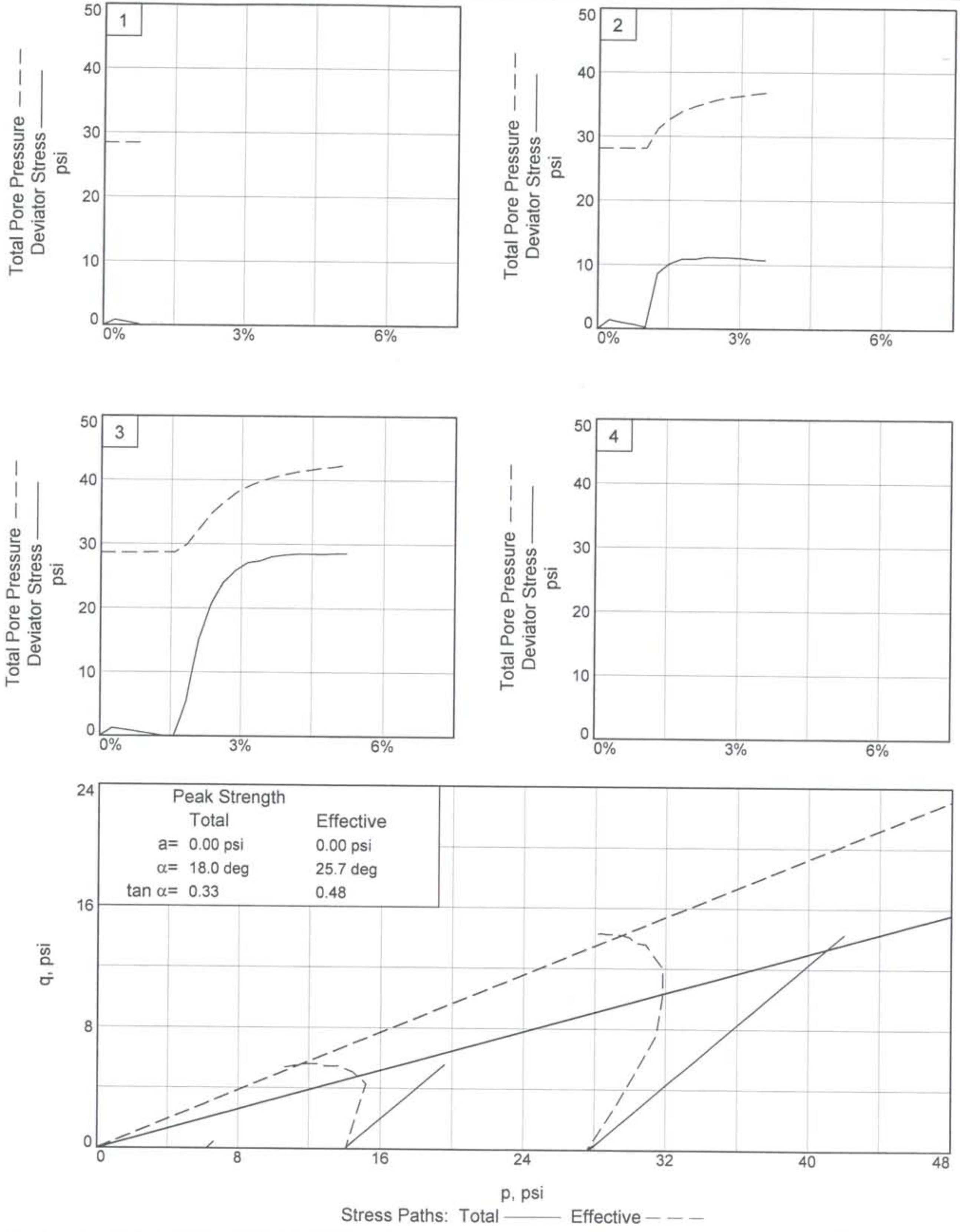
Location: Crescent Junction

Sample Number: 153 **Depth:** 8.5

Proj. No.: 2,165 **Date Sampled:**

Geotechnical
Engineering
Group, Inc.

Tested By: RWA



Peak Strength

	Total	Effective
a=	0.00 psi	0.00 psi
α=	18.0 deg	25.7 deg
tan α=	0.33	0.48

Client: S.M. Stoller

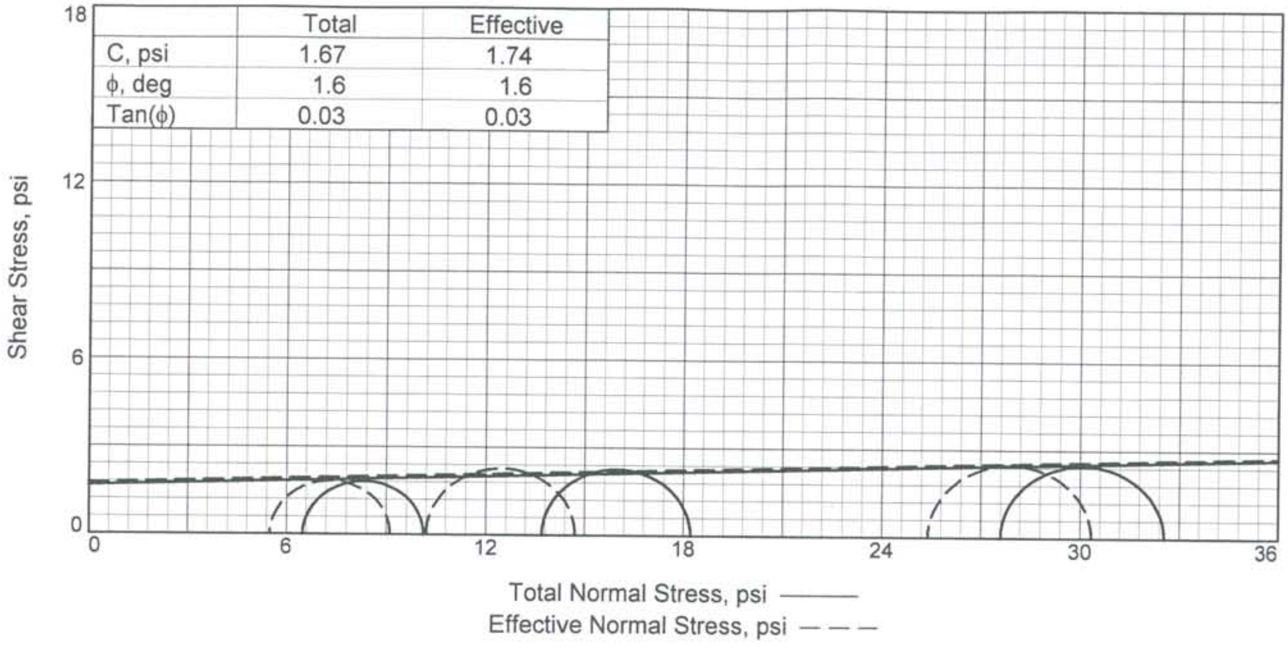
Project: Crescent Junction

Location: Crescent Junction **Depth:** 8.5 **Sample Number:** 153

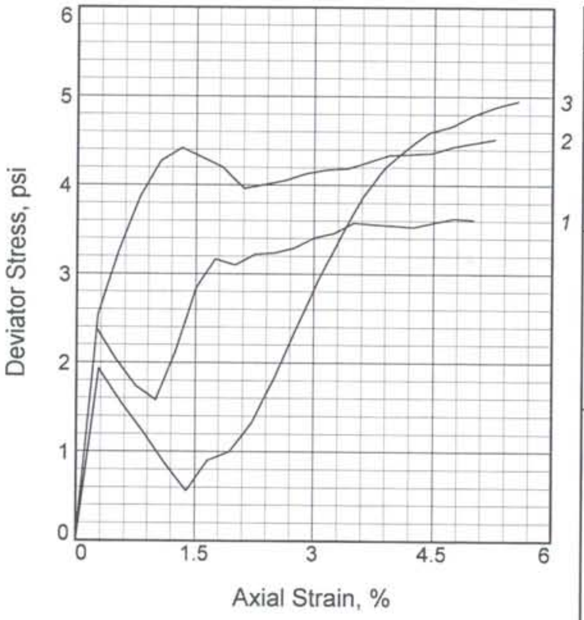
Project No.: 2,165 **Figure** 2A

Geotechnical Engereering Group, Inc.

Tested By: RWA



	Total	Effective
C, psi	1.67	1.74
ϕ, deg	1.6	1.6
Tan(ϕ)	0.03	0.03



Sample No.		1	2	3
Initial	Water Content, %	13.0	13.0	13.0
	Dry Density, pcf	110.6	110.6	110.6
	Saturation, %	65.8	65.8	65.8
	Void Ratio	0.5403	0.5403	0.5403
	Diameter, in.	1.94	1.94	1.94
	Height, in.	4.00	4.00	4.00
At Test	Water Content, %	19.8	19.8	19.8
	Dry Density, pcf	110.6	110.6	110.6
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.5403	0.5403	0.5403
	Diameter, in.	1.94	1.99	2.04
	Height, in.	4.00	3.80	3.60
Strain rate, in./min.		0.03	0.03	0.03
Back Pressure, psi		29.2	29.2	29.5
Cell Pressure, psi		35.7	42.9	57.1
Fail. Stress, psi		3.6	4.5	5.0
Total Pore Pr., psi		30.2	32.7	31.7
Ult. Stress, psi				
Total Pore Pr., psi				
$\bar{\sigma}_1$ Failure, psi		9.1	14.7	30.4
$\bar{\sigma}_3$ Failure, psi		5.5	10.2	25.4

Type of Test:
CU with Pore Pressures

Sample Type: Remolded at 92% of ASTM D1557

Description: Weathered shale

LL= 38 **PL=** 18 **PI=** 20

Specific Gravity= 2.73

Remarks: B= 96%, Hydraulic Conductivity 8.0x10^7cm/sec

Figure 3

Client: S.M. Stoller

Project: Crescent Junction

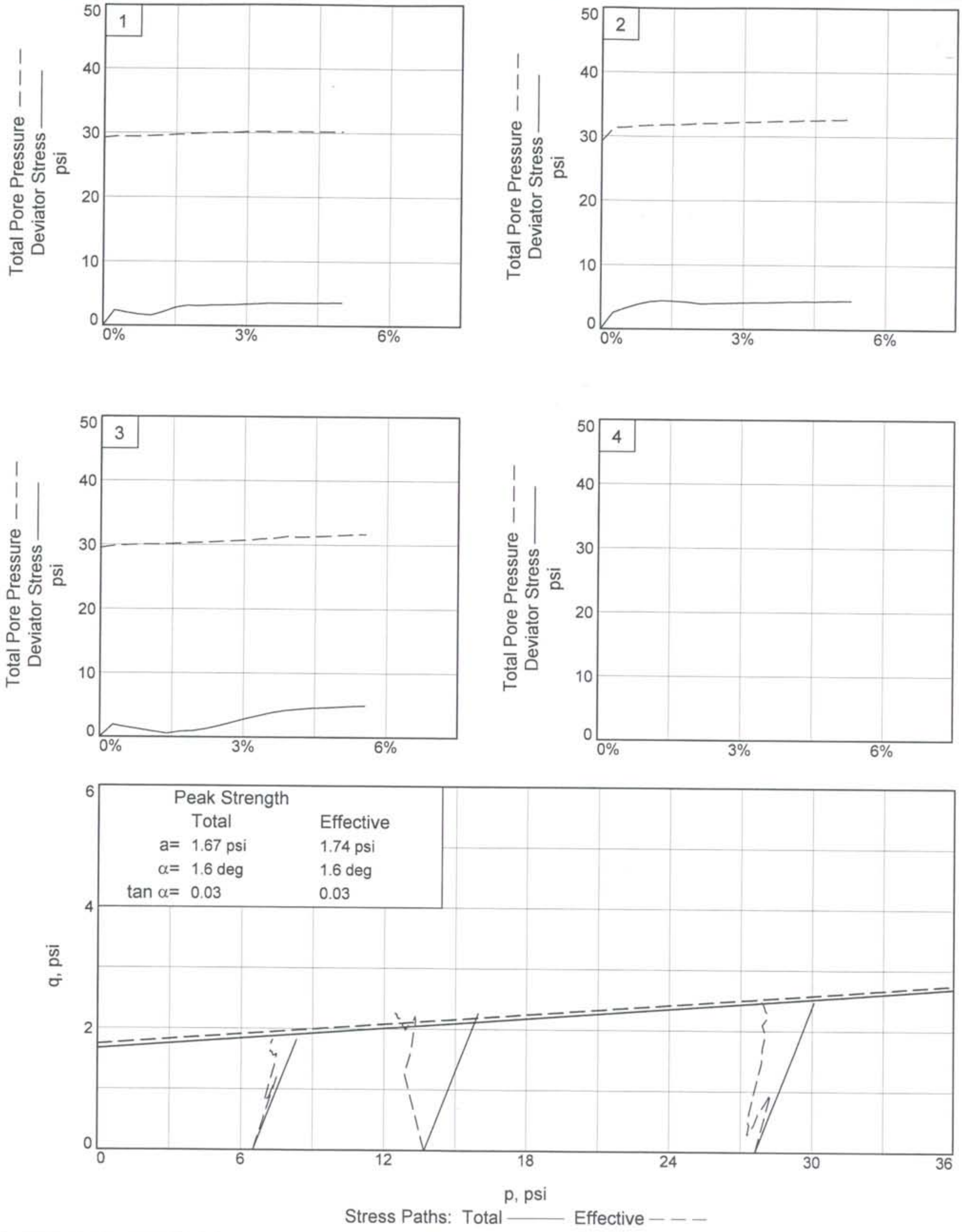
Location: Crescent Junction

Sample Number: 154 **Depth:** 20

Proj. No.: 2,165 **Date Sampled:**

Geotechnical
Engineering
Group, Inc.

Tested By: RWA



Peak Strength

	Total	Effective
a=	1.67 psi	1.74 psi
α=	1.6 deg	1.6 deg
tan α=	0.03	0.03

Client: S.M. Stoller

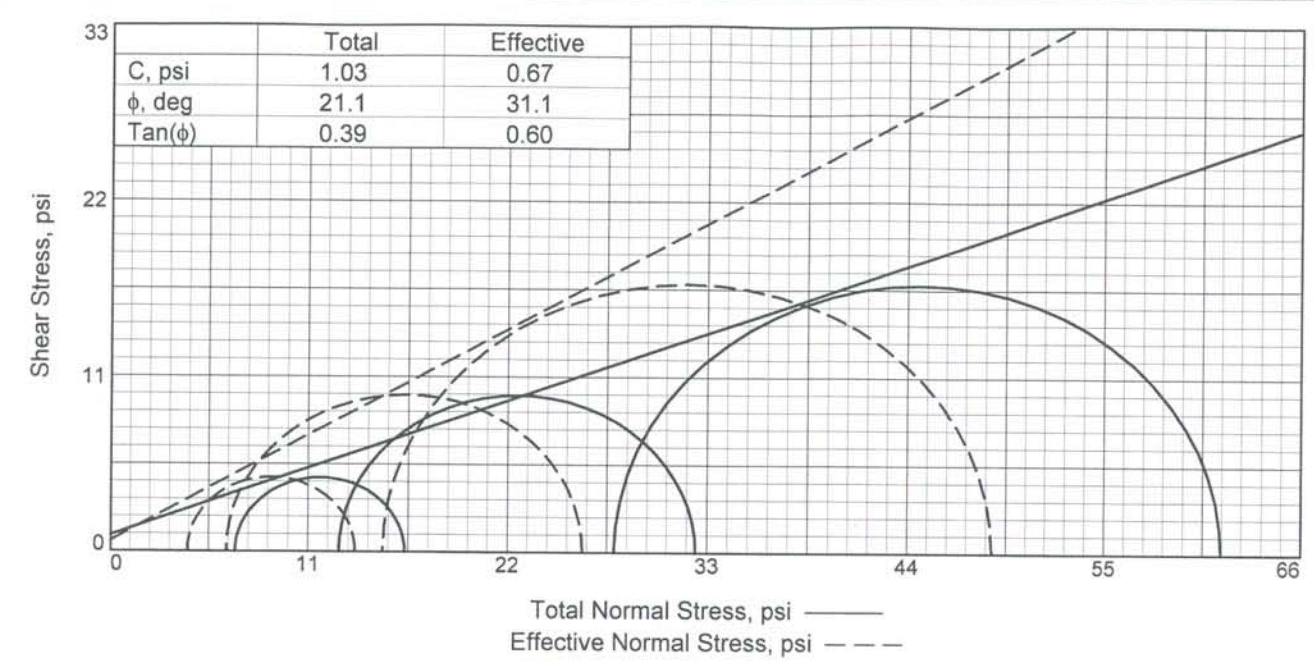
Project: Crescent Junction

Location: Crescent Junction **Depth:** 20 **Sample Number:** 154

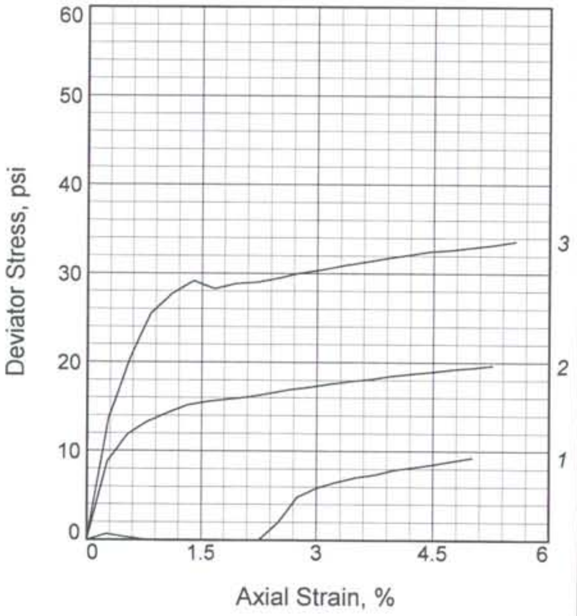
Project No.: 2,165 **Figure** 3A

Geotechnical Engeereing Group, Inc.

Tested By: RWA



	Total	Effective
C, psi	1.03	0.67
ϕ, deg	21.1	31.1
Tan(ϕ)	0.39	0.60



Sample No.		1	2	3
Initial	Water Content, %	12.0	12.0	12.0
	Dry Density, pcf	117.1	117.1	117.1
	Saturation, %	84.2	84.2	84.2
	Void Ratio	0.3649	0.3649	0.3649
	Diameter, in.	1.94	1.94	1.94
	Height, in.	4.00	4.00	4.00
At Test	Water Content, %	14.3	14.3	14.3
	Dry Density, pcf	117.1	117.1	117.1
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.3649	0.3649	0.3649
	Diameter, in.	1.94	1.99	2.04
	Height, in.	4.00	3.80	3.60
Strain rate, in./min.		0.03	0.03	0.03
Back Pressure, psi		27.5	29.1	27.8
Cell Pressure, psi		34.5	41.8	55.7
Fail. Stress, psi		9.3	19.7	33.6
Total Pore Pr., psi		30.2	35.3	40.6
Ult. Stress, psi				
Total Pore Pr., psi				
$\bar{\sigma}_1$ Failure, psi		13.6	26.2	48.7
$\bar{\sigma}_3$ Failure, psi		4.3	6.5	15.1

Type of Test:
CU with Pore Pressures

Sample Type: Remolded at 92% of ASTM D1557

Description: Weathered Shale

LL= 25 **PL=** 18 **PI=** 7

Specific Gravity= 2.56

Remarks: B= 100%, Hydraulic Conductivity 5.9x10^-9cm/sec

Figure 4

Client: S.M. Stoller

Project: Crescent Junction

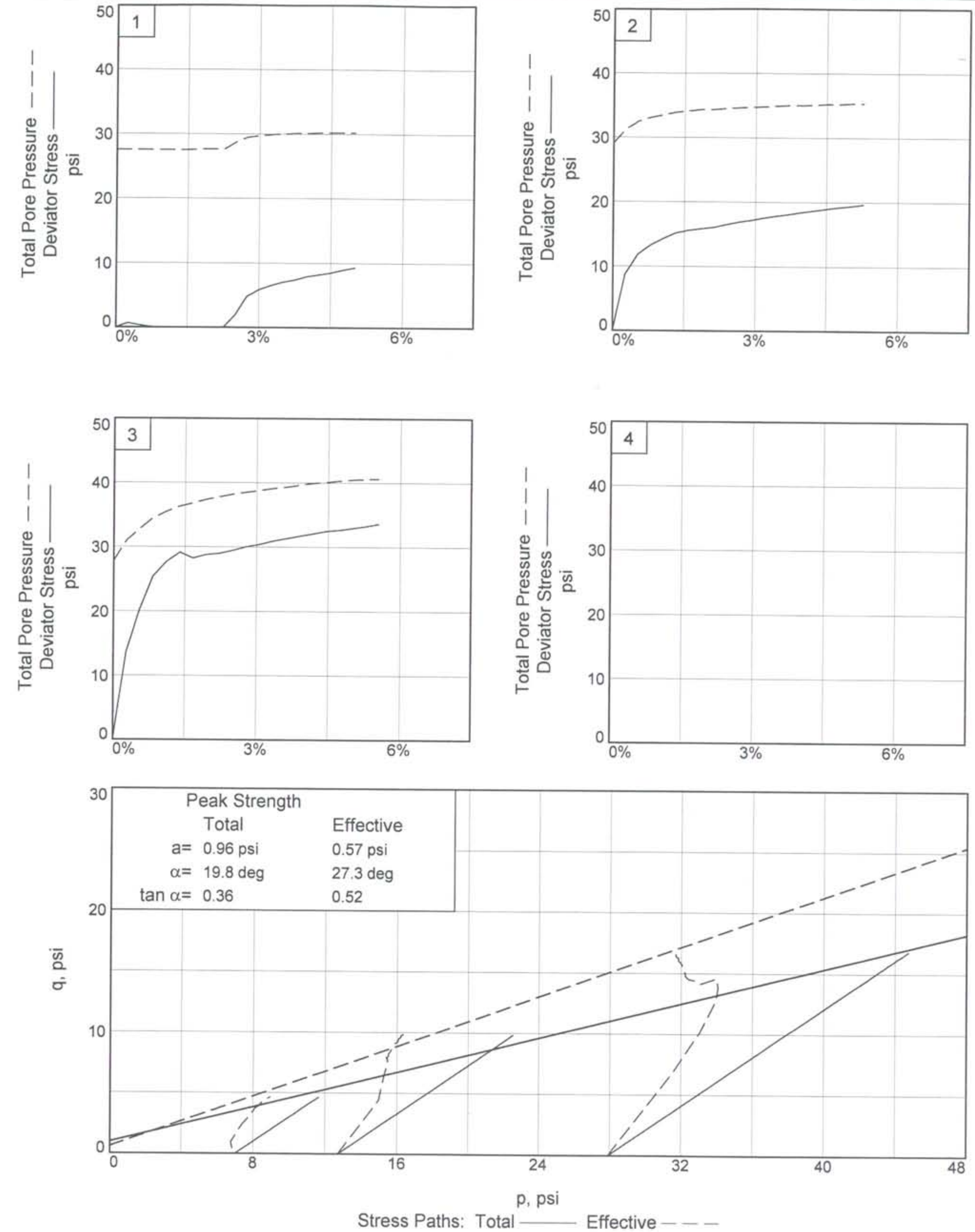
Location: Crescent Junction

Sample Number: 156 **Depth:** 20

Proj. No.: 2,165 **Date Sampled:**

Geotechnical
Engineering
Group, Inc.

Tested By: RWA



Peak Strength

	Total	Effective
a=	0.96 psi	0.57 psi
α=	19.8 deg	27.3 deg
tan α=	0.36	0.52

Client: S.M. Stoller
Project: Crescent Junction
Location: Crescent Junction **Depth:** 20 **Sample Number:** 156
Project No.: 2,165

Figure 4A

Geotechnical Engereering Group, Inc.

Tested By: RWA

**Geotechnical
Engineering
Group, Inc.**

PINHOLE TEST DATA
D 4647

Project: Crescent Junction

Job #: 2,165

Boring: TP- 152

Depth: 7.5 ft

Water Content: 13.2

Compaction Characteristics: Good

Distilled Water Added: No X Yes

Table II

Clock Time	Head (mm)	Flow		Flow Rate (ml/s)	Turbidity From Side						Remarks
		ml	Sec.		Very Dark	Dark	Moderately Dark	Slight Dark	Barely Visible	Completely Clear	
3:00	50	10	13	.76					X		
3:01		10	12	.83						X	
3:03		25	29	.86						X	
3:08		No Measurable flow									Hole collapsed during test

Geotechnical Engineering Group, Inc.

PINHOLE TEST DATA
D 4647

Project: Crescent Junction

Job #: 2165

Boring: TP- 152

Depth: 23.0 ft

Water Content: 12.6

Compaction Characteristics: Good
Yes

Distilled Water Added: X **No** ______

Table III

Clock Time	Head (mm)	Flow		Flow Rate (ml/s)	Turbidity From Side						Remarks
		ml	Sec.		Very Dark	Dark	Moderately Dark	Slight Dark	Barely Visible	Completely Clear	
3:40	50	10	26	.38					X		
3:41		10	27	.37						X	
3:43		25	58	.43						X	
3:48		25	51	.49						X	At 180 seconds to clog
3:50	180	10	240	.04						X	Open valve
3:58	380	25	101	.25				X			
4:01		25	47	.53						X	
4:03		25	49	.51						X	
4:08		25	58	.43						X	Start clog
4:10	1020	25	46	.54				X			
4:12		25	86	.29						X	
4:15		25	115	.22						X	
4:18		25	143	.17						X	
4:21		25	183	.14						X	Partial clogging

**Geotechnical
Engineering
Group, Inc.**

PINHOLE TEST DATA
D 4647

Project: Crescent Junction

Job #: 2165

Boring: TP- 153

Depth: 3.5 ft

Water Content: 12.6

Compaction Characteristics: Good
Yes

Distilled Water Added: X **No** ______

Table IV

Clock Time	Head (mm)	Flow		Flow Rate (ml/s)	Turbidity From Side						Remarks
		ml	Sec.		Very Dark	Dark	Moderately Dark	Slight Dark	Barely Visible	Completely Clear	
2:50	50	10	11	.90						X	
2:53		10	11	.90						X	
2:55		25	27	.90						X	
3:00		25	33	.76						X	
3:03		25	33	.76					X		
3:04	180	25	11	2.3						X	
3:05		25	10	2.5						X	
3:10		25	9	2.8						X	
3:13		50	19	2.6						X	

Geotechnical Engineering Group, Inc.

PINHOLE TEST DATA
D 4647

Project: Crescent Junction

Job #: 2165

Boring: TP- 154

Depth: 20.0 ft

Water Content: 13.0

Compaction Characteristics: Good

Distilled Water Added: X No ____ Yes

Table V

Clock Time	Head (mm)	Flow		Flow Rate (ml/s)	Turbidity From Side						Remarks
		ml	Sec.		Very Dark	Dark	Moderately Dark	Slight Dark	Barely Visible	Completely Clear	
3:48	50	10	30	.33					X		
3:51		10	29	.34						X	
3:53		25	62	.43						X	
3:57		25	63	.40						X	
4:00	180	25	24	1.04					X		
4:02		25	30	.83						X	
4:04		25	29	.86						X	
4:10		25	29	.86						X	
4:12	380	50	33	1.51				X			Hole clogged up
4:14		50	104	.48					X		
4:19		50	278	.18					X		

**Geotechnical
Engineering
Group, Inc.**

PINHOLE TEST DATA
D 4647

Project: Crescent Junction

Job #: 2165

Boring: TP- 155

Depth: 5.0 ft

Water Content: 12.2

Compaction Characteristics: Good

Distilled Water Added: X No ____ Yes

Table VI

Clock Time	Head (mm)	Flow		Flow Rate (ml/s)	Turbidity From Side						Remarks
		ml	Sec.		Very Dark	Dark	Moderately Dark	Slight Dark	Barely Visible	Completely Clear	
8:35	50	10	30	.33					X		
8:37		10	27	.37						X	
8:38		25	43	.58						X	
8:43		25	40	.62						X	
8:45	180	25	11	2.27					X		
8:47		25	11	2.27					X		
8:55		25	10	2.50						X	

**Geotechnical
Engineering
Group, Inc.**

PINHOLE TEST DATA
D 4647

Project: Crescent Junction

Job #: 2165

Boring: TP- 156

Depth: 20.0 ft

Water Content: 12.3

Compaction Characteristics: Good

Distilled Water Added: X **No** ______ **Yes**

Table VII

Clock Time	Head (mm)	Flow		Flow Rate (ml/s)	Turbidity From Side						Remarks
		ml	Sec.		Very Dark	Dark	Moderately Dark	Slight Dark	Barely Visible	Completely Clear	
12:38	50	10	25	.40					X		
12:40		10	25	.40						X	
12:42		25	60	.42						X	
12:47		25	59	.42						X	
12:49	180	25	13	1.92					X		
12:49		25	13	1.92						X	
12:50		25	13	1.92						X	
12:55		25	12	2.08						X	

APPENDIX 1

CAPILLARY MOISTURE RETENTION TEST
ASTM D 3152

CLIENT	Geotechnical Engineering Group	JOB NO.	2669-01
SAMPLE DATE		TEST STARTED	02-24-06 DPM
SOIL DESCR.		TEST FINISHED	04-07-06 DPM
LOCATION			

MASS DATA										
Sample Description	Ring Mass g	As Rec. Mass g	Sat. Mass g	0.3 Bar Mass g	0.7 Bar Mass g	2 Bar Mass g	5 Bar Mass g	15 Bar Mass g	Dry Mass Filter, Ring, & Dish (g)	Dish Wt. g
Filter Mass g		0.204	0.728	0.405	0.345	0.328	0.314	0.301		
TP-153, 3.5, A	10.537	48.235	52.193	49.837	49.253	48.723	48.232	47.653	46.303	2.353
TP-153, 3.5, A-R	10.621	48.260	52.251	49.879	49.327	48.592	48.193	47.664	46.410	2.365
TP-153, 3.5, B	10.431	45.263	50.264	47.018	46.331	45.656	45.217	44.724	43.748	2.349
TP-153, 3.5, B-R	10.622	45.453	50.202	47.152	46.578	46.045	45.539	44.958	43.912	2.292
TP-153, 8.5, A	10.791	47.652	50.918	47.905	47.630	47.113	46.734	45.934	46.025	2.389
TP-153, 8.5, A-R	10.415	47.281	50.692	47.804	47.233	46.694	46.219	45.467	45.505	2.333
TP-153, 8.5, B	10.620	44.705	49.079	44.742	44.433	43.963	43.646	43.025	43.302	2.350
TP-153, 8.5, B-R	10.476	44.541	49.174	44.780	44.311	43.788	43.414	42.777	43.092	2.346
TP-154, 20, A	10.713	48.375	53.316	50.855	50.284	49.677	49.074	48.365	46.610	2.375
TP-154, 20, A-R	10.693	48.350	53.287	50.903	50.300	49.624	49.084	48.433	46.549	2.324
TP-154, 20, B	10.658	45.448	51.281	47.947	47.360	46.756	46.180	45.561	44.072	2.369
TP-154, 20, B-R	10.374	45.005	50.791	47.534	46.999	46.422	45.849	45.202	43.709	2.363

Data Entered By: SR Date: 04/13/2006
Data Checked By: DPM Date: 04/13/06
Filename: GEKO1553

ADVANCED TERRA TESTING, INC.

CAPILLARY MOISTURE RETENTION TEST
ASTM D 3152

CLIENT Geotechnical Engineering Group

JOB NO. 2669-01

SAMPLE DATE
SOIL DESCR.
LOCATION

TEST STARTED 02-24-06 DPM
TEST FINISHED 04-07-06 DPM

Moisture Content Data: % D.M. = Moisture Content By Dry Mass; % Vol. = Moisture Content By Volume

Sample Description	**Sample Conditions**						**0.3 Bar**			**0.7 Bar**		
	Dry Mass (g)	Unit Wt. (g/cc)	Sat. Mass (g)	Total H2O (g)	Sat. M.C. % D.M.	Sat. M.C. % Vol.	Retained H2O	% DM	% Vol.	Retained H2O	% DM	% Vol.
TP-153, 3.5, A	33.209	1.762	40.928	7.719	23.24	40.95	5.686	17.12	30.16	5.162	15.54	27.38
TP-153, 3.5, A-R	33.220	1.762	40.902	7.682	23.12	40.75	5.633	16.96	29.88	5.141	15.48	27.27
TP-153, 3.5, B	30.764	1.632	39.105	8.341	27.11	44.24	5.418	17.61	28.74	4.791	15.57	25.41
TP-153, 3.5, B-R	30.794	1.633	38.852	8.058	26.17	42.74	5.331	17.31	28.28	4.817	15.64	25.55
TP-153, 8.5, A	32.641	1.731	39.399	6.758	20.70	35.85	4.068	12.46	21.58	3.853	11.80	20.44
TP-153, 8.5, A-R	32.553	1.727	39.549	6.996	21.49	37.11	4.431	13.61	23.50	3.920	12.04	20.79
TP-153, 8.5, B	30.128	1.598	37.731	7.603	25.24	40.33	3.589	11.91	19.04	3.340	11.09	17.72
TP-153, 8.5, B-R	30.066	1.595	37.970	7.904	26.29	41.93	3.833	12.75	20.33	3.424	11.39	18.16
TP-154, 20, A	33.318	1.767	41.875	8.557	25.68	45.39	6.419	19.27	34.05	5.908	17.73	31.34
TP-154, 20, A-R	33.328	1.768	41.866	8.538	25.62	45.29	6.477	19.43	34.36	5.934	17.80	31.48
TP-154, 20, B	30.841	1.636	39.895	9.054	29.36	48.03	6.043	19.59	32.05	5.516	17.89	29.26
TP-154, 20, B-R	30.768	1.632	39.689	8.921	28.99	47.32	5.987	19.46	31.76	5.512	17.91	29.24

Data Entered By: SR Date: 04/13/2006
Data Checked By: DPM Date: 04/13/06
Filename: GEKO1553

ADVANCED TERRA TESTING, INC.

CAPILLARY MOISTURE RETENTION TEST
ASTM D 3152

CLIENT	Geotechnical Engineering Group	JOB NO.	2669-01
SAMPLE DATE		TEST STARTED	02-24-06 DPM
SOIL DESCR.		TEST FINISHED	04-07-06 DPM
LOCATION			

Moisture Content Data: % D.M. = Moisture Content By Dry Mass; % Vol. = Moisture Content By Volume

Sample Description	2 Bar			5 Bar			15 Bar		
	Retained H2O	% DM	% Vol.	Retained H2O	% DM	% Vol.	Retained H2O	% DM	% Vol.
TP-153, 3.5, A	4.649	14.00	24.66	4.172	12.56	22.13	3.606	10.86	19.13
TP-153, 3.5, A-R	4.423	13.31	23.46	4.038	12.16	21.42	3.522	10.60	18.68
TP-153, 3.5, B	4.133	13.43	21.92	3.708	12.05	19.67	3.228	10.49	17.12
TP-153, 3.5, B-R	4.301	13.97	22.81	3.809	12.37	20.20	3.241	10.52	17.19
TP-153, 8.5, A	3.353	10.27	17.79	2.988	9.15	15.85	2.201	6.74	11.68
TP-153, 8.5, A-R	3.398	10.44	18.02	2.937	9.02	15.58	2.198	6.75	11.66
TP-153, 8.5, B	2.887	9.58	15.31	2.584	8.58	13.71	1.976	6.56	10.48
TP-153, 8.5, B-R	2.918	9.71	15.48	2.558	8.51	13.57	1.934	6.43	10.26
TP-154, 20, A	5.318	15.96	28.21	4.729	14.19	25.08	4.033	12.10	21.39
TP-154, 20, A-R	5.275	15.83	27.98	4.749	14.25	25.19	4.111	12.33	21.81
TP-154, 20, B	4.929	15.98	26.15	4.367	14.16	23.16	3.761	12.19	19.95
TP-154, 20, B-R	4.952	16.09	26.27	4.393	14.28	23.30	3.759	12.22	19.94

Data Entered By: SR Date: 04/13/2006
Data Checked By: DPM Date: 04/13/06
Filename: GEKO1553

CAPILLARY MOISTURE RETENTION TEST
ASTM D 3152

CLIENT Geotechnical Engineering Group

JOB NO. 2669-01

SAMPLE DATE
SOIL DESCR.
LOCATION

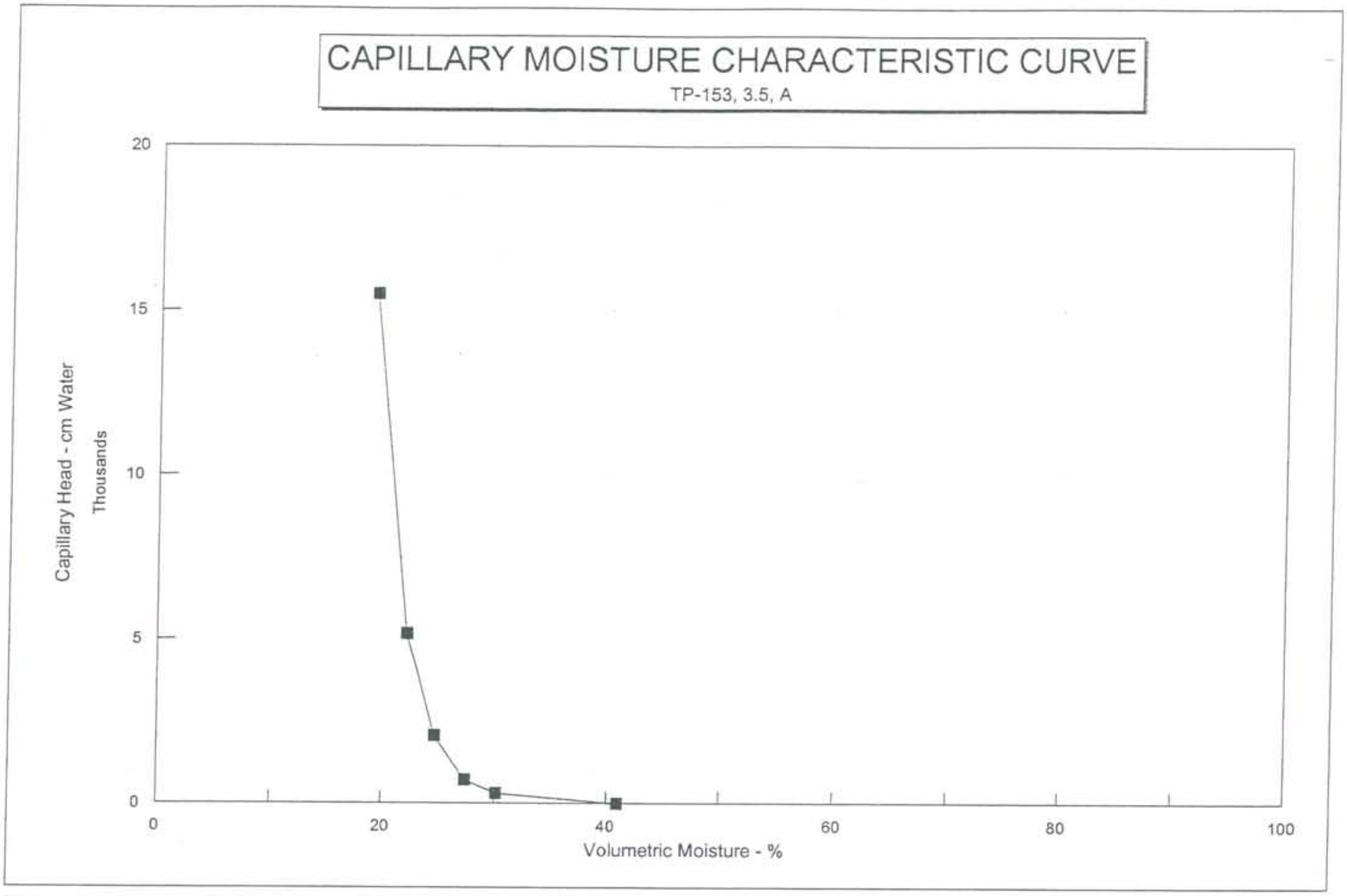
TEST STARTED 02-24-06 DPM
TEST FINISHED 04-07-06 DPM

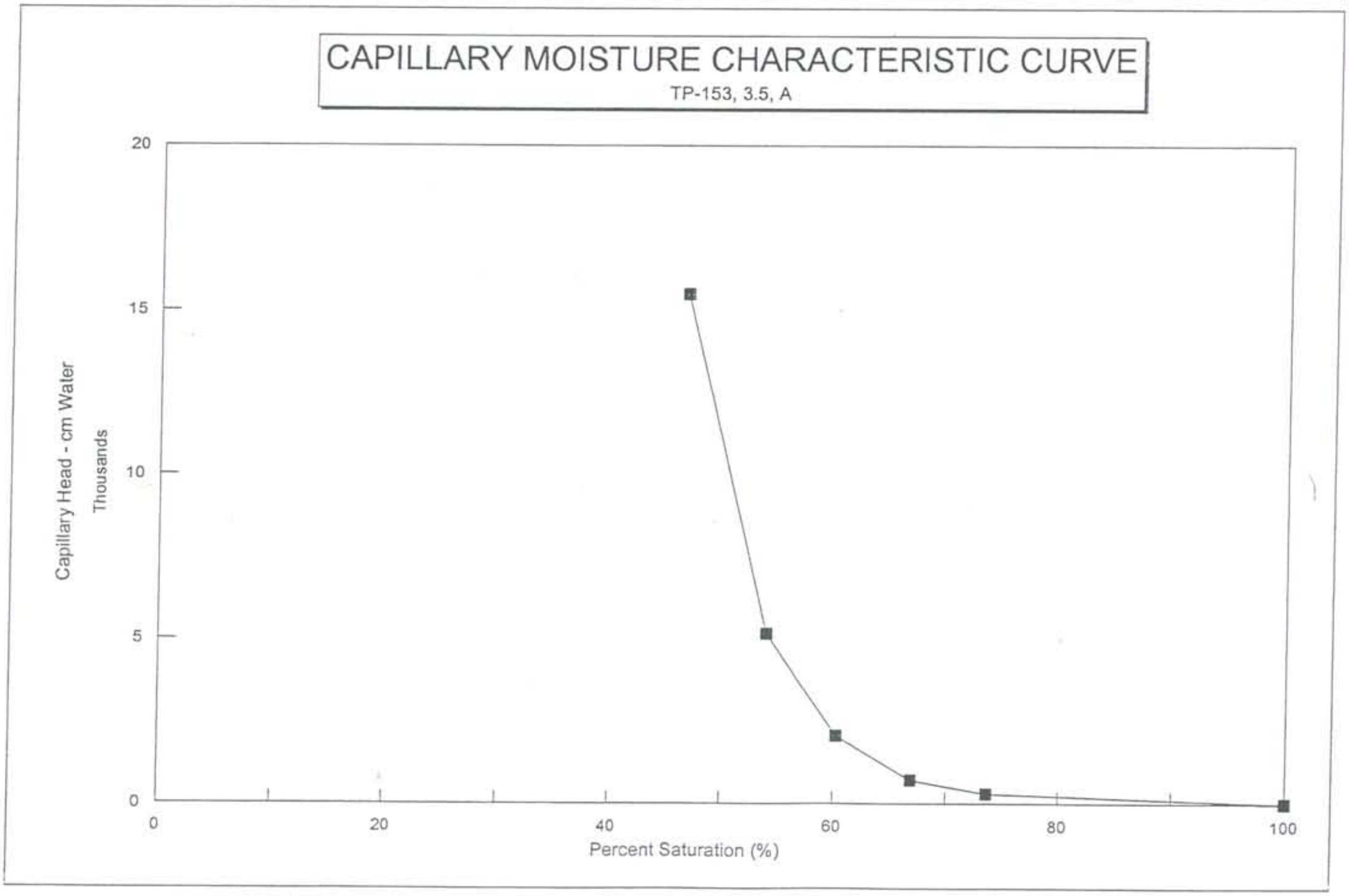
	Vol. MC % Sat.	Vol. MC % 0.3 Bar	Vol. MC % 0.7 Bar	Vol. MC % 2 Bar	Vol. MC % 5 Bar	Vol. MC % 15 Bar
TP-153, 3.5, A	40.95	30.16	27.38	24.66	22.13	19.13
TP-153, 3.5, A-R	40.75	29.88	27.27	23.46	21.42	18.68
TP-153, 3.5, B	44.24	28.74	25.41	21.92	19.67	17.12
TP-153, 3.5, B-R	42.74	28.28	25.55	22.81	20.20	17.19
TP-153, 8.5, A	35.85	21.58	20.44	17.79	15.85	11.68
TP-153, 8.5, A-R	37.11	23.50	20.79	18.02	15.58	11.66
TP-153, 8.5, B	40.33	19.04	17.72	15.31	13.71	10.48
TP-153, 8.5, B-R	41.93	20.33	18.16	15.48	13.57	10.26
TP-154, 20, A	45.39	34.05	31.34	28.21	25.08	21.39
TP-154, 20, A-R	45.29	34.36	31.48	27.98	25.19	21.81
TP-154, 20, B	48.03	32.05	29.26	26.15	23.16	19.95
TP-154, 20, B-R	47.32	31.76	29.24	26.27	23.30	19.94

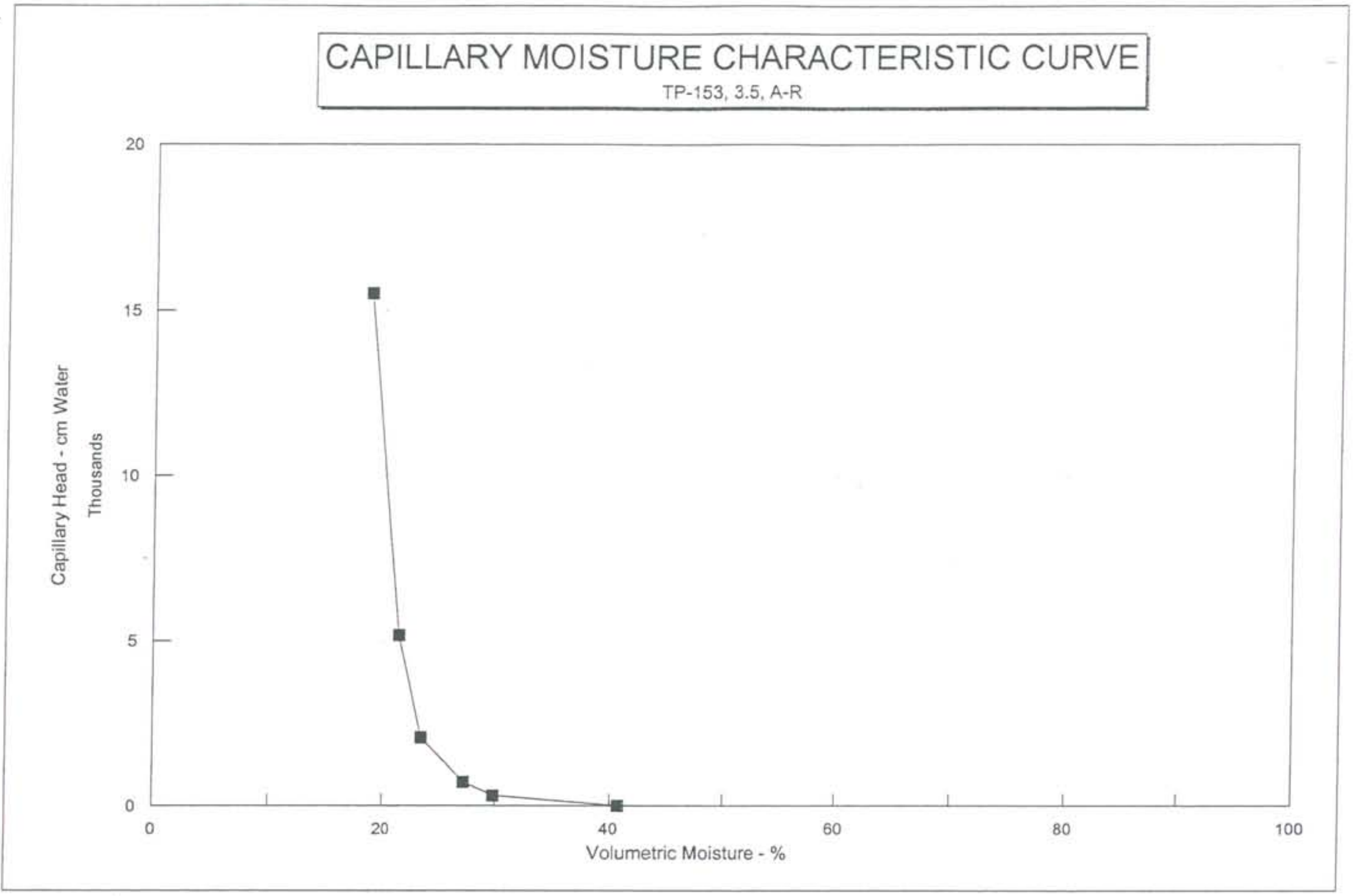
				% Saturation		
	Sat.	0.3 Bar	0.7 Bar	2 Bar	5 Bar	15 Bar
TP-153, 3.5, A	100.00	73.66	66.87	60.23	54.05	46.72
TP-153, 3.5, A-R	100.00	73.33	66.92	57.58	52.56	45.85
TP-153, 3.5, B	100.00	64.96	57.44	49.55	44.46	38.70
TP-153, 3.5, B-R	100.00	66.16	59.78	53.38	47.27	40.22
TP-153, 8.5, A	100.00	60.20	57.01	49.62	44.21	32.57
TP-153, 8.5, A-R	100.00	63.34	56.03	48.57	41.98	31.42
TP-153, 8.5, B	100.00	47.21	43.93	37.97	33.99	25.99
TP-153, 8.5, B-R	100.00	48.49	43.32	36.92	32.36	24.47
TP-154, 20, A	100.00	75.01	69.04	62.15	55.26	47.13
TP-154, 20, A-R	100.00	75.86	69.50	61.78	55.62	48.15
TP-154, 20, B	100.00	66.74	60.92	54.44	48.23	41.54
TP-154, 20, B-R	100.00	67.11	61.79	55.51	49.24	42.14

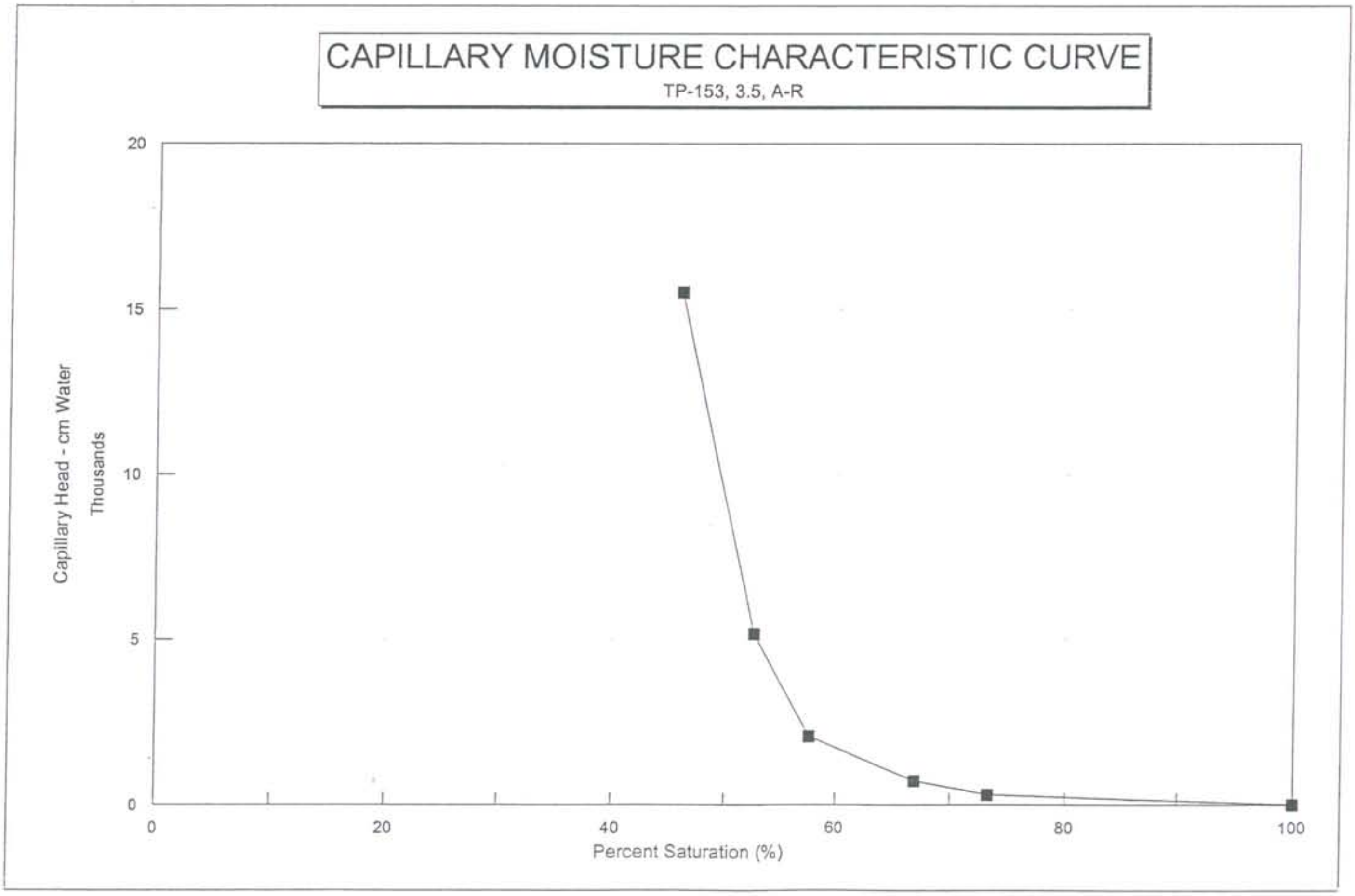
Data Entered By: SR Date: 04/13/2006
Data Checked By: OPM Date: 04/13/06
Filename: GEKO1553

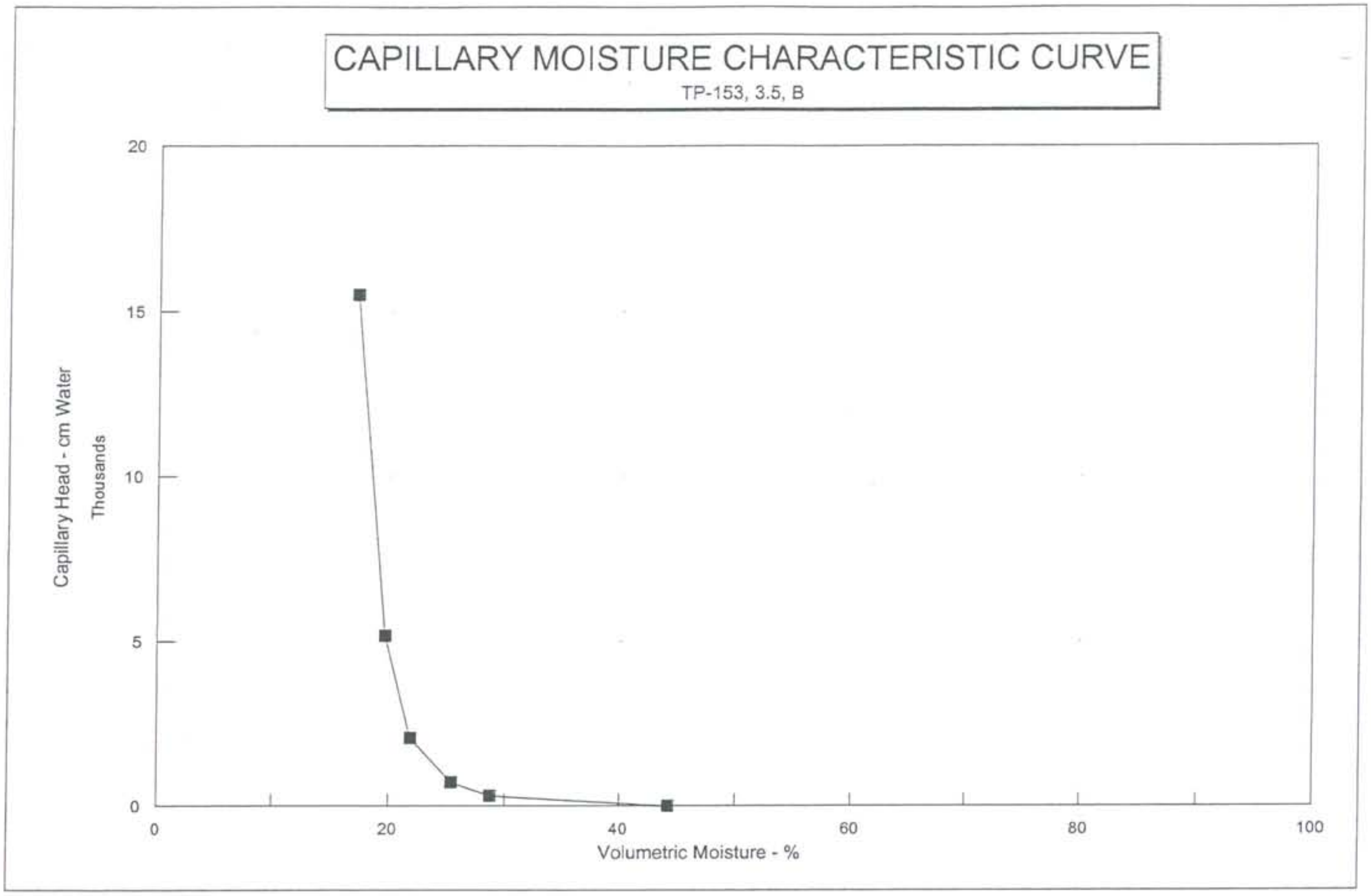
ADVANCED TERRA TESTING, INC.


CAPILLARY MOISTURE CHARACTERISTIC CURVE
TP-153, 3.5, A
Capillary Head - cm Water
Thousands
20
15
10
5
0
0
20
40
60
80
100
Volumetric Moisture - %


CAPILLARY MOISTURE CHARACTERISTIC CURVE
TP-153, 3.5, A
Capillary Head - cm Water
Thousands
20
15
10
5
0
0
20
40
60
80
100
Percent Saturation (%)

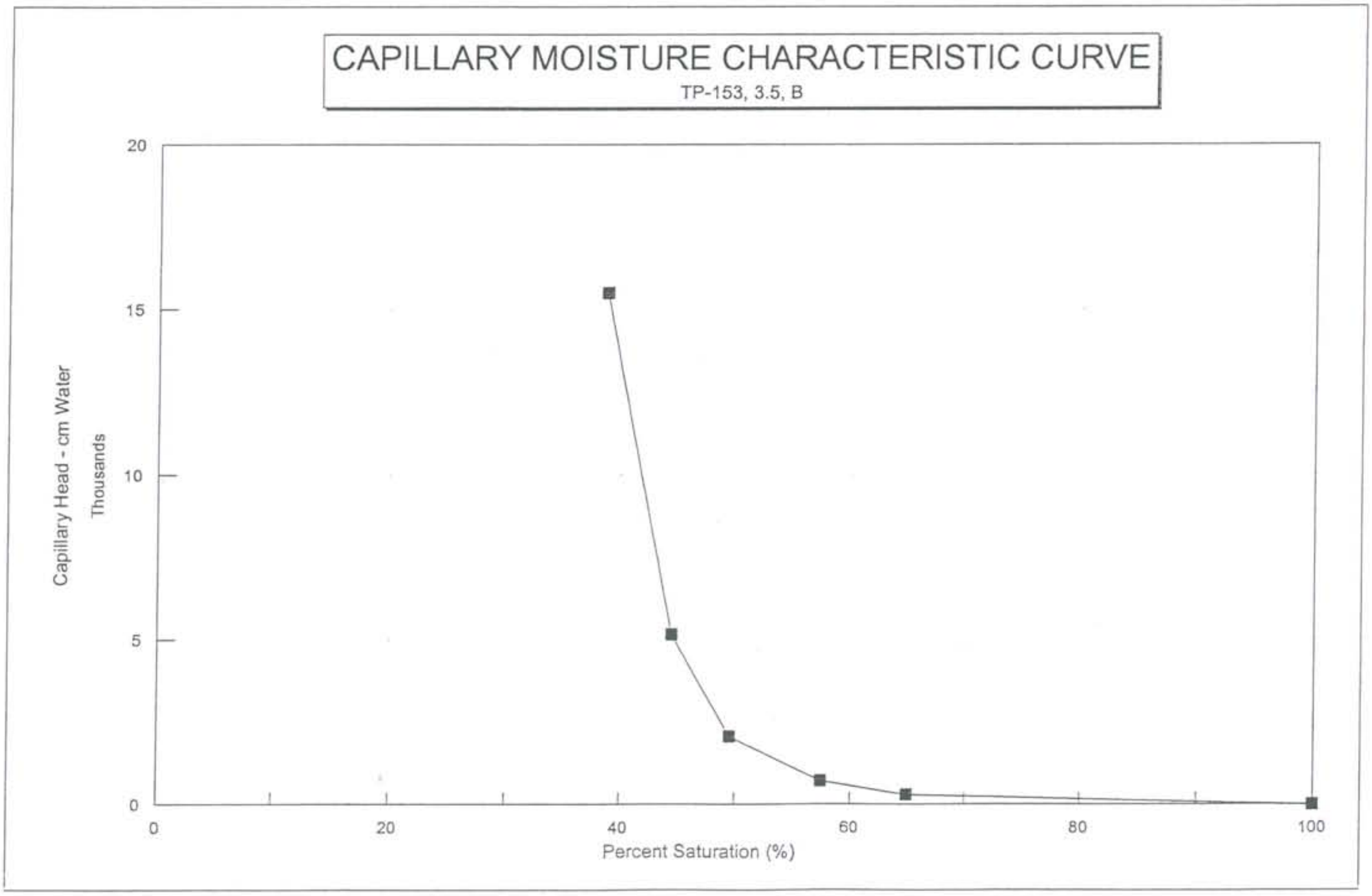

CAPILLARY MOISTURE CHARACTERISTIC CURVE
TP-153, 3.5, A-R
Capillary Head - cm Water
Thousands
20
15
10
5
0
0
20
40
60
80
100
Volumetric Moisture - %


CAPILLARY MOISTURE CHARACTERISTIC CURVE
TP-153, 3.5, A-R
Capillary Head - cm Water
Thousands
20
15
10
5
0
0
20
40
60
80
100
Percent Saturation (%)



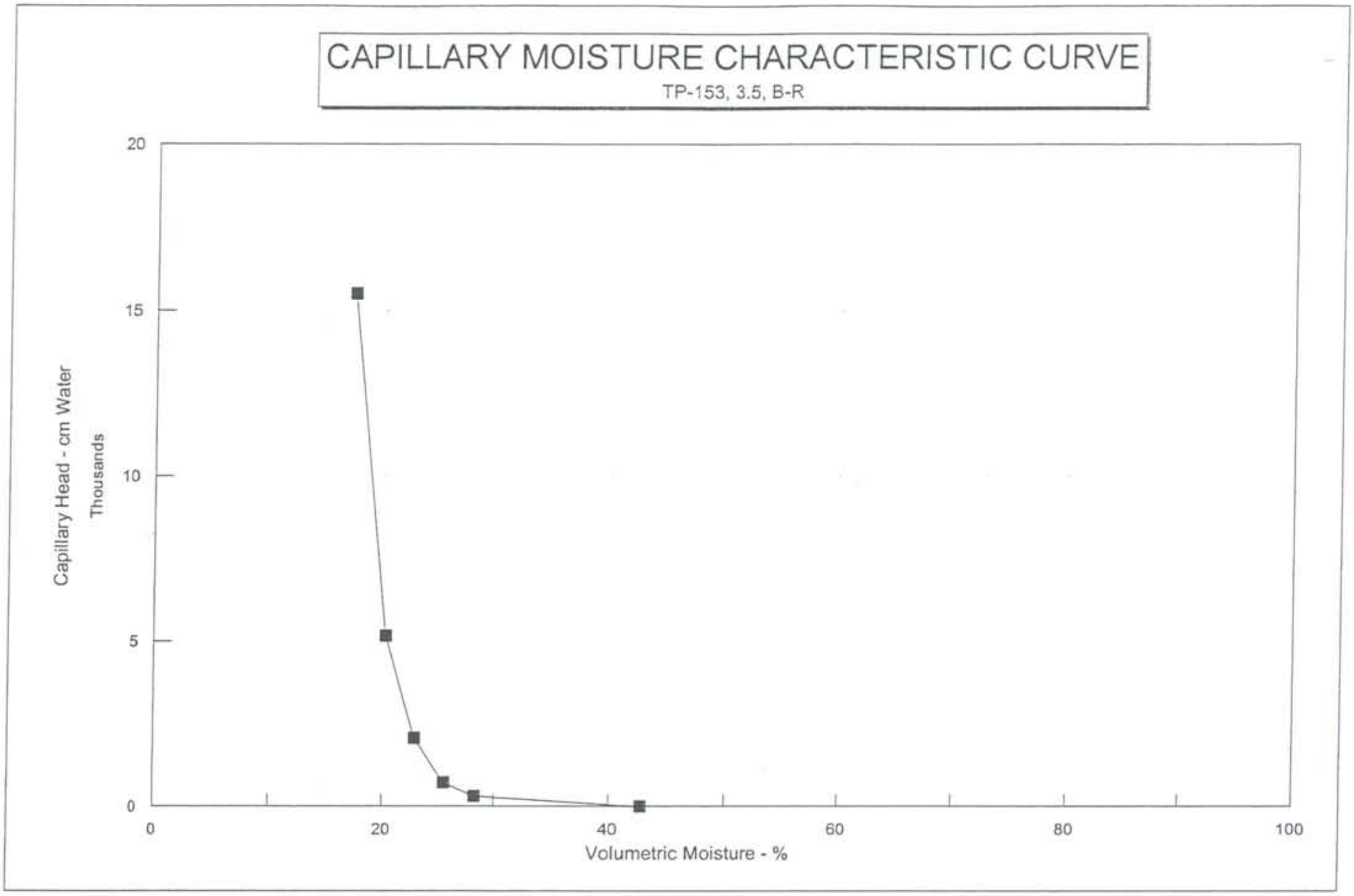
CAPILLARY MOISTURE CHARACTERISTIC CURVE

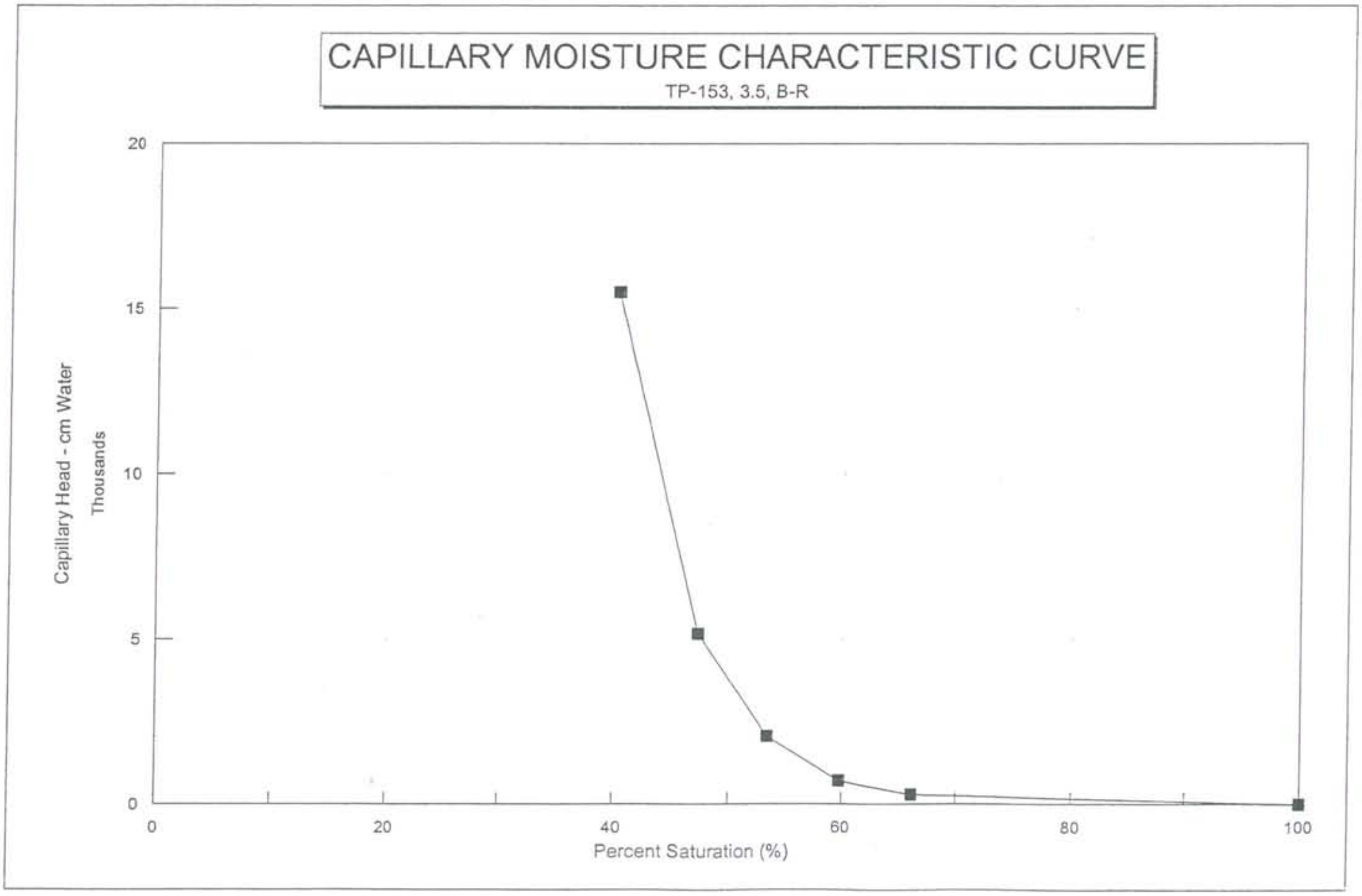
TP-153, 3.5, B

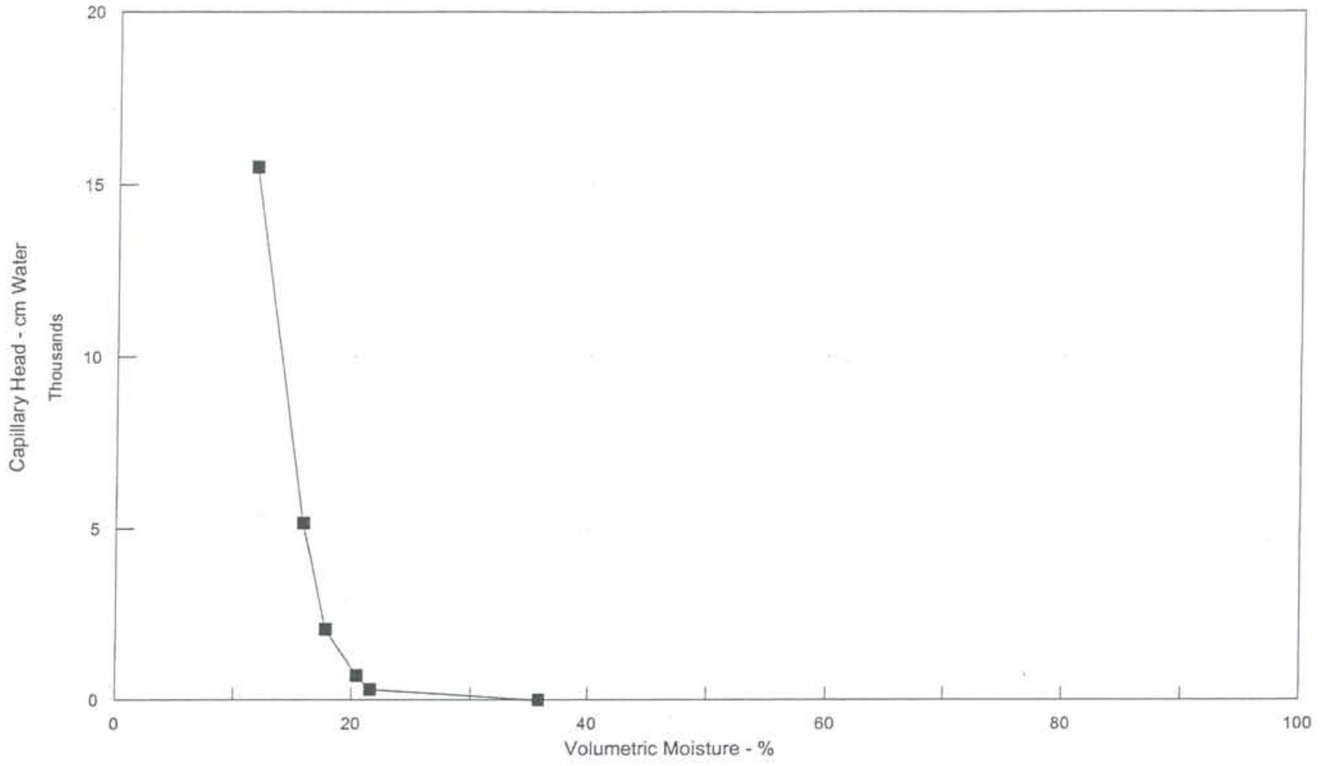


CAPILLARY MOISTURE CHARACTERISTIC CURVE

TP-153, 3.5, B

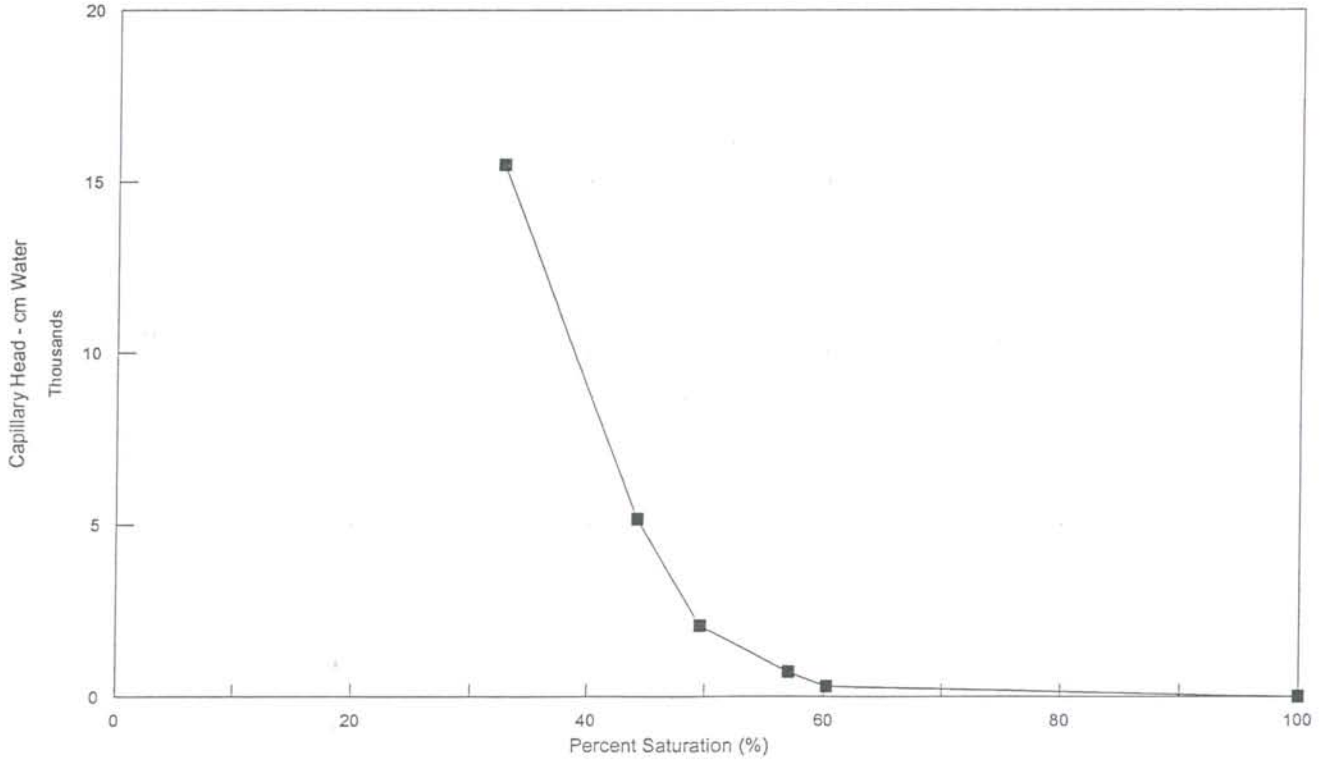

CAPILLARY MOISTURE CHARACTERISTIC CURVE
TP-153, 3.5, B-R


CAPILLARY MOISTURE CHARACTERISTIC CURVE
TP-153, 3.5, B-R



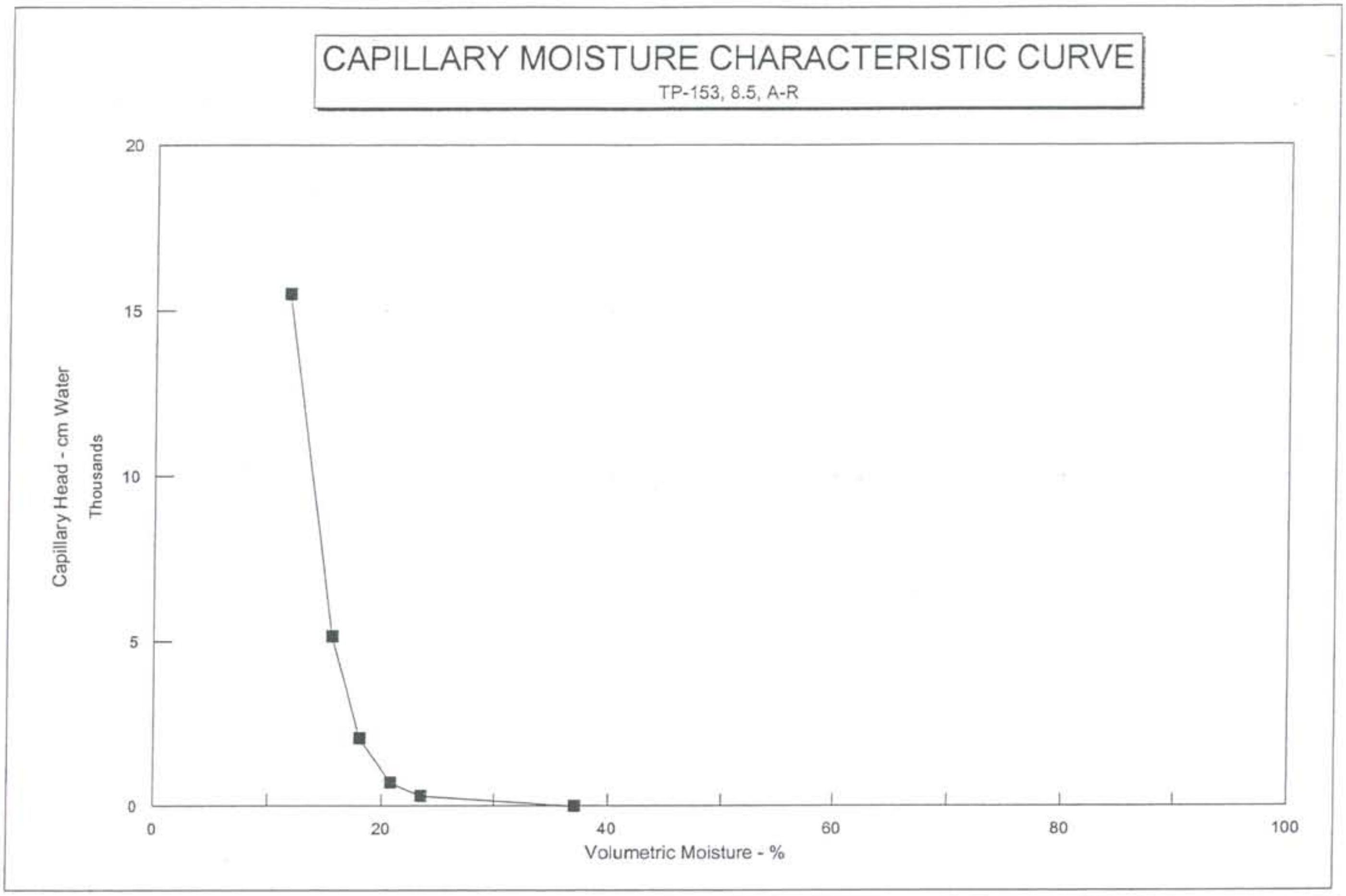
CAPILLARY MOISTURE CHARACTERISTIC CURVE

TP-153, 8.5, A



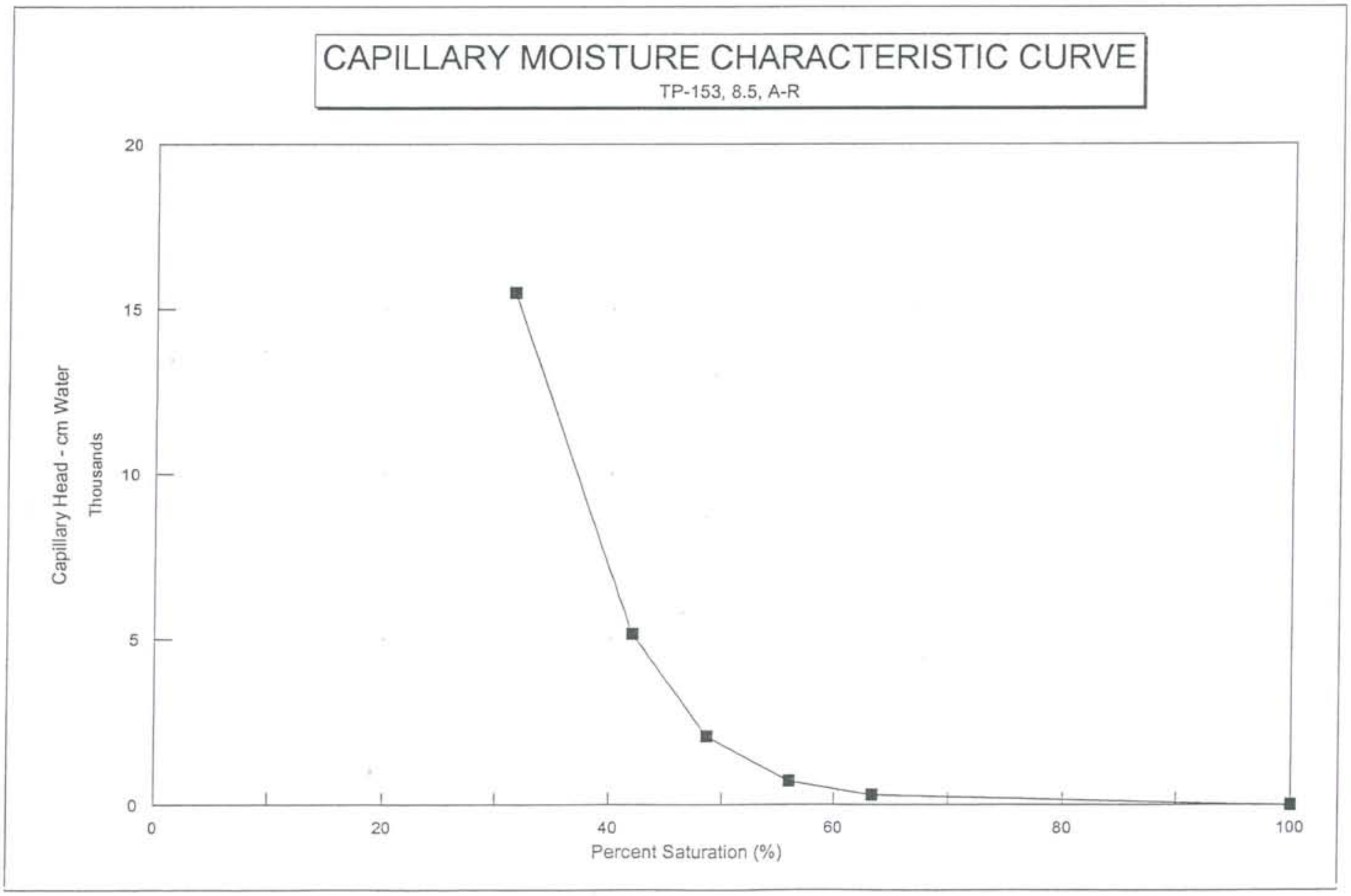
CAPILLARY MOISTURE CHARACTERISTIC CURVE

TP-153, 8.5, A



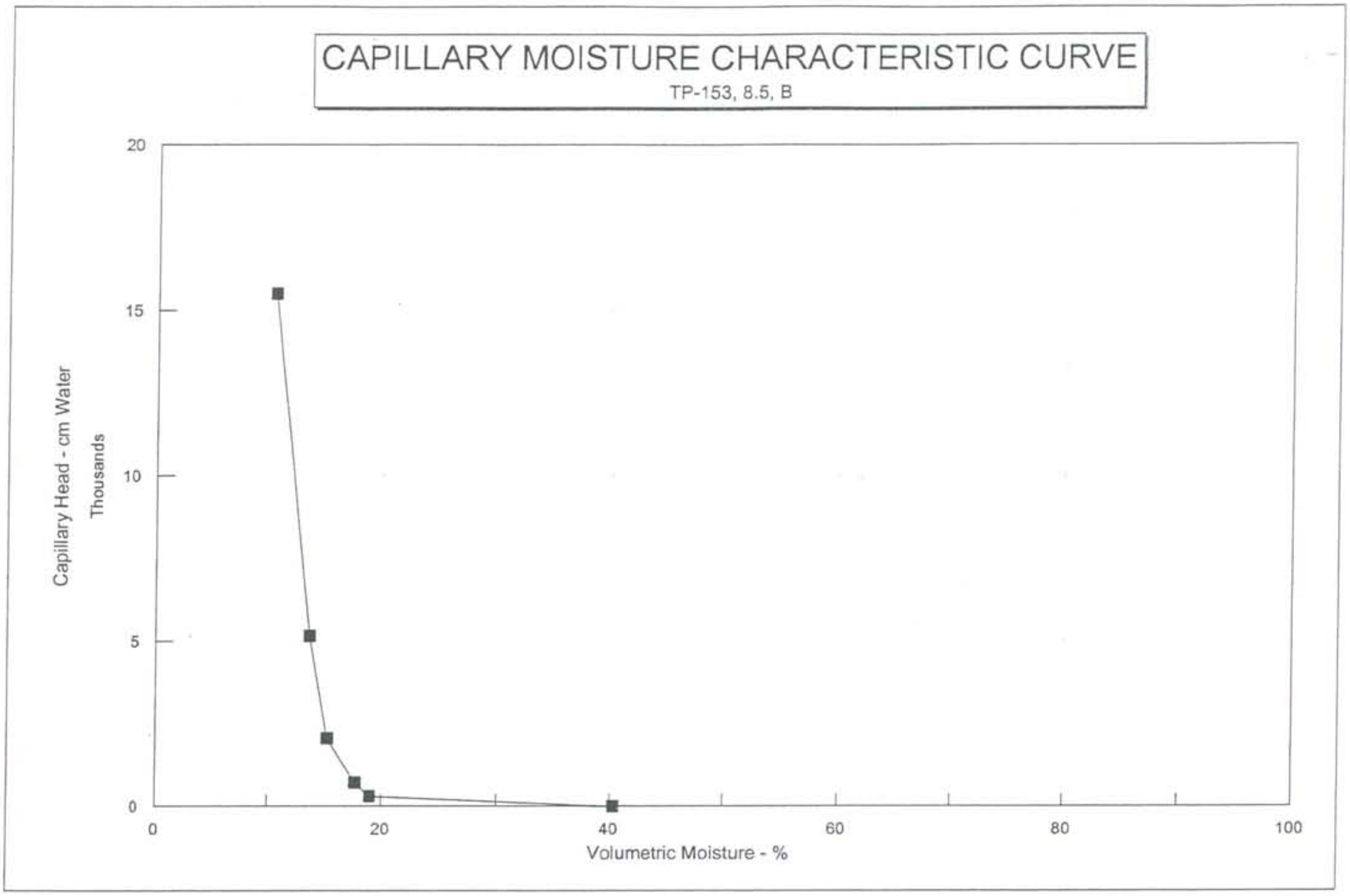
CAPILLARY MOISTURE CHARACTERISTIC CURVE

TP-153, 8.5, A-R



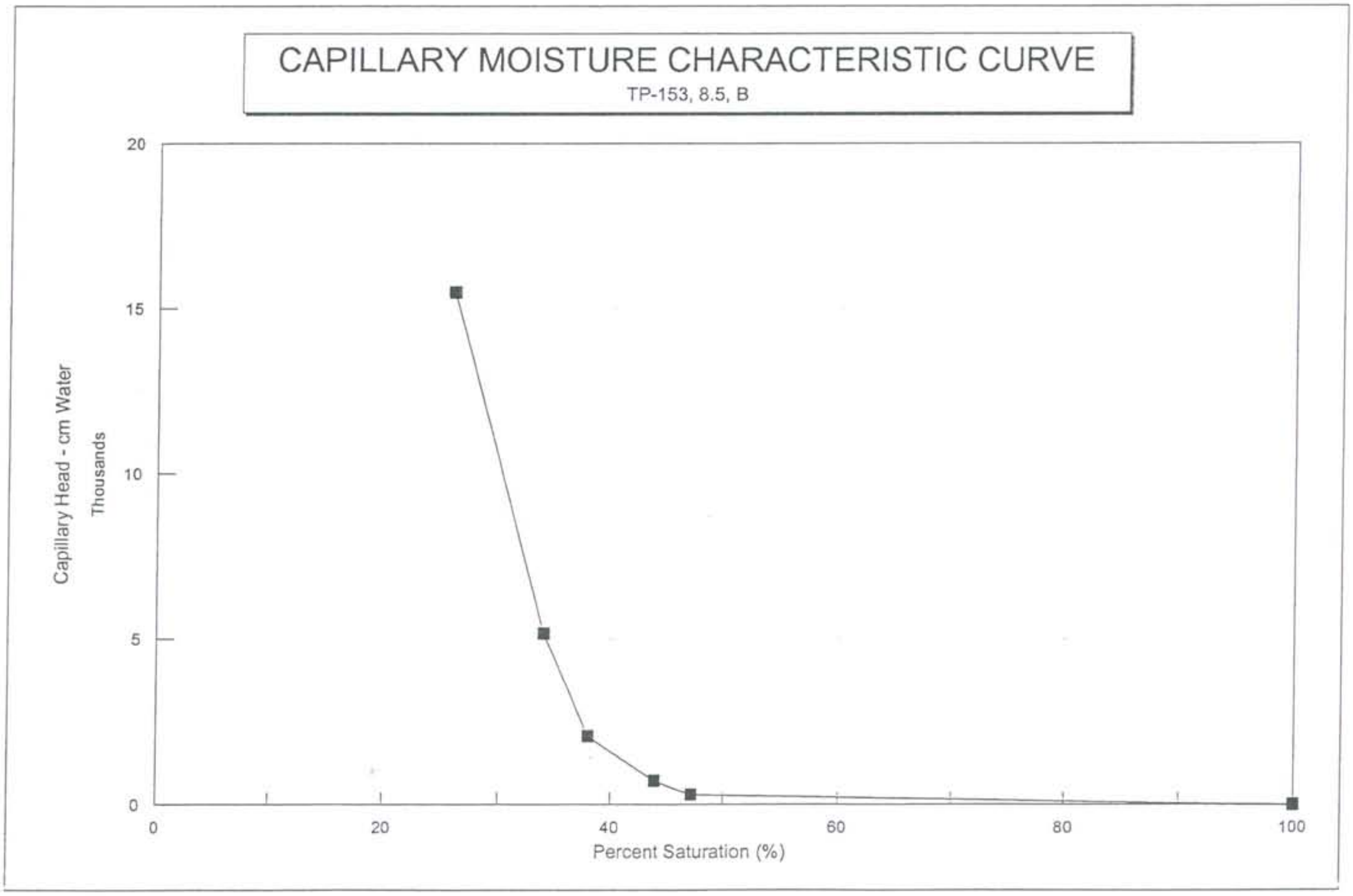
CAPILLARY MOISTURE CHARACTERISTIC CURVE

TP-153, 8.5, A-R



CAPILLARY MOISTURE CHARACTERISTIC CURVE

TP-153, 8.5, B

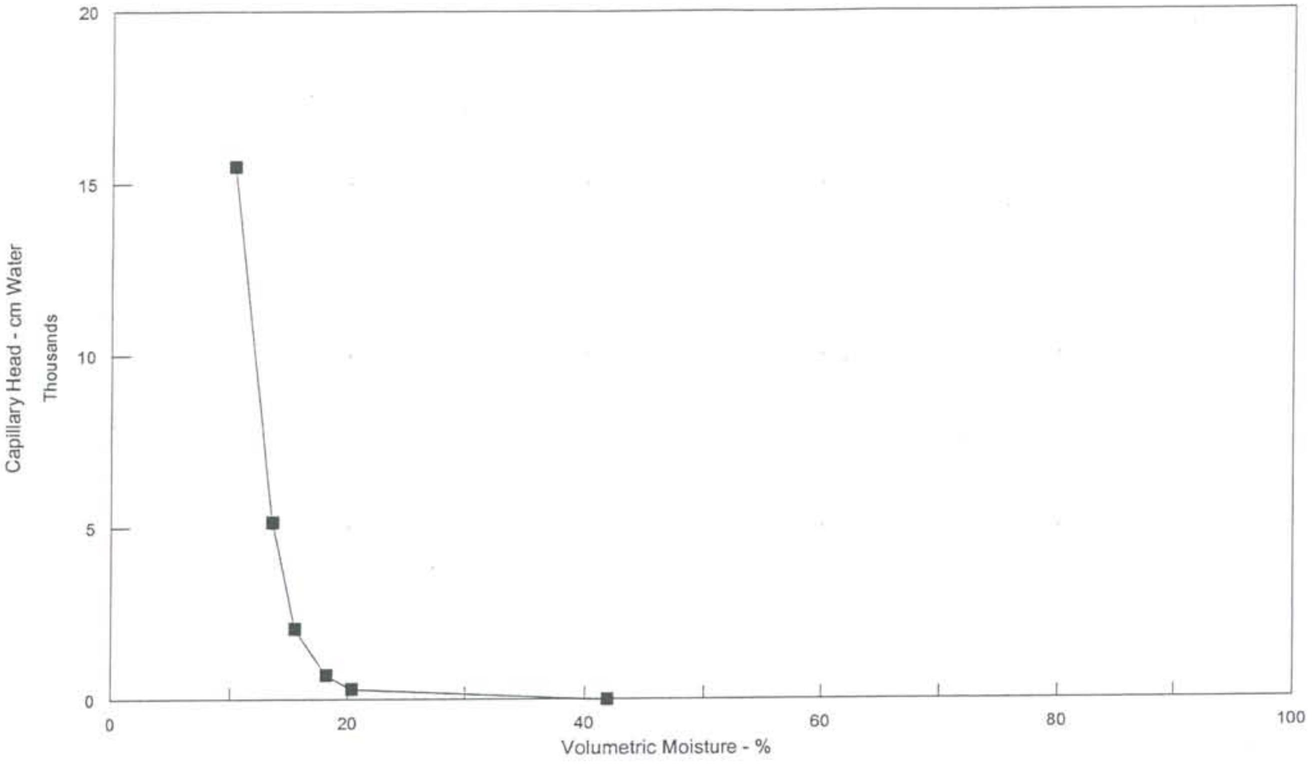


CAPILLARY MOISTURE CHARACTERISTIC CURVE

TP-153, 8.5, B

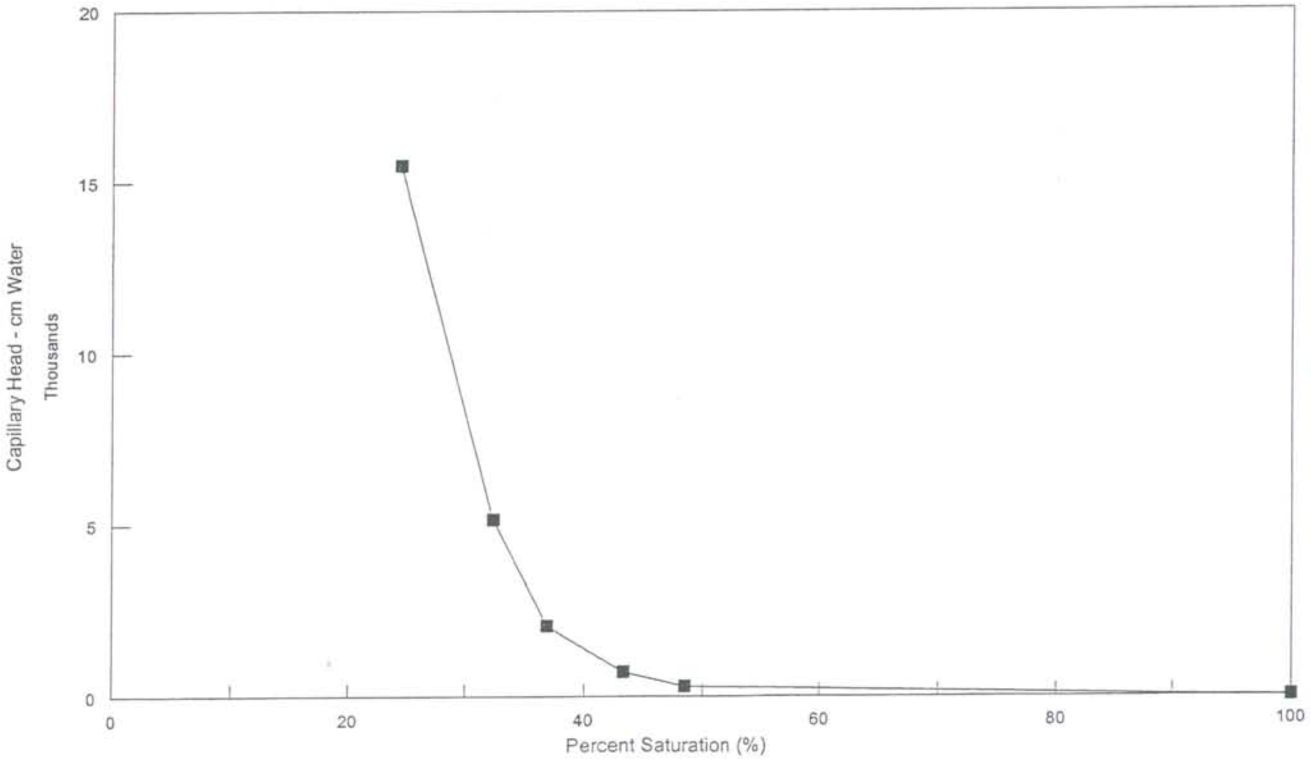
CAPILLARY MOISTURE CHARACTERISTIC CURVE

TP-153, 8.5, B-R



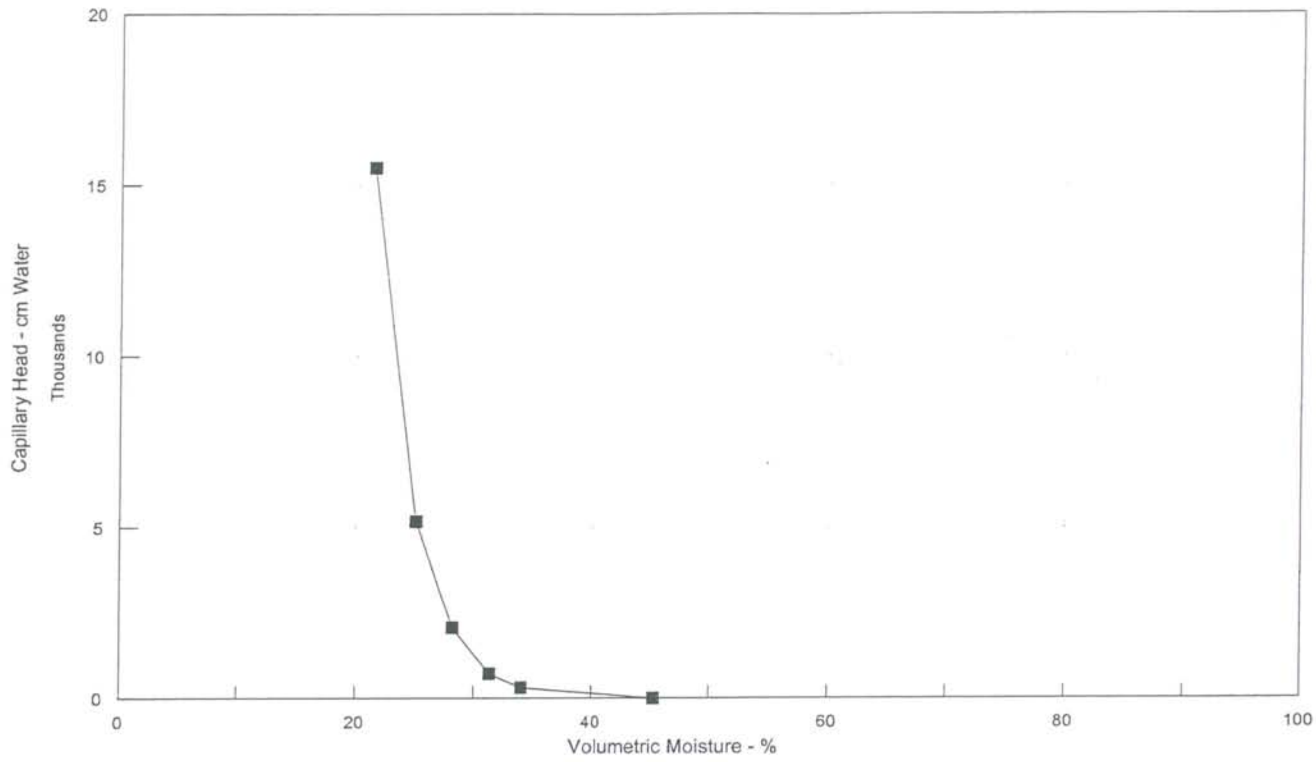
CAPILLARY MOISTURE CHARACTERISTIC CURVE

TP-153, 8.5, B-R



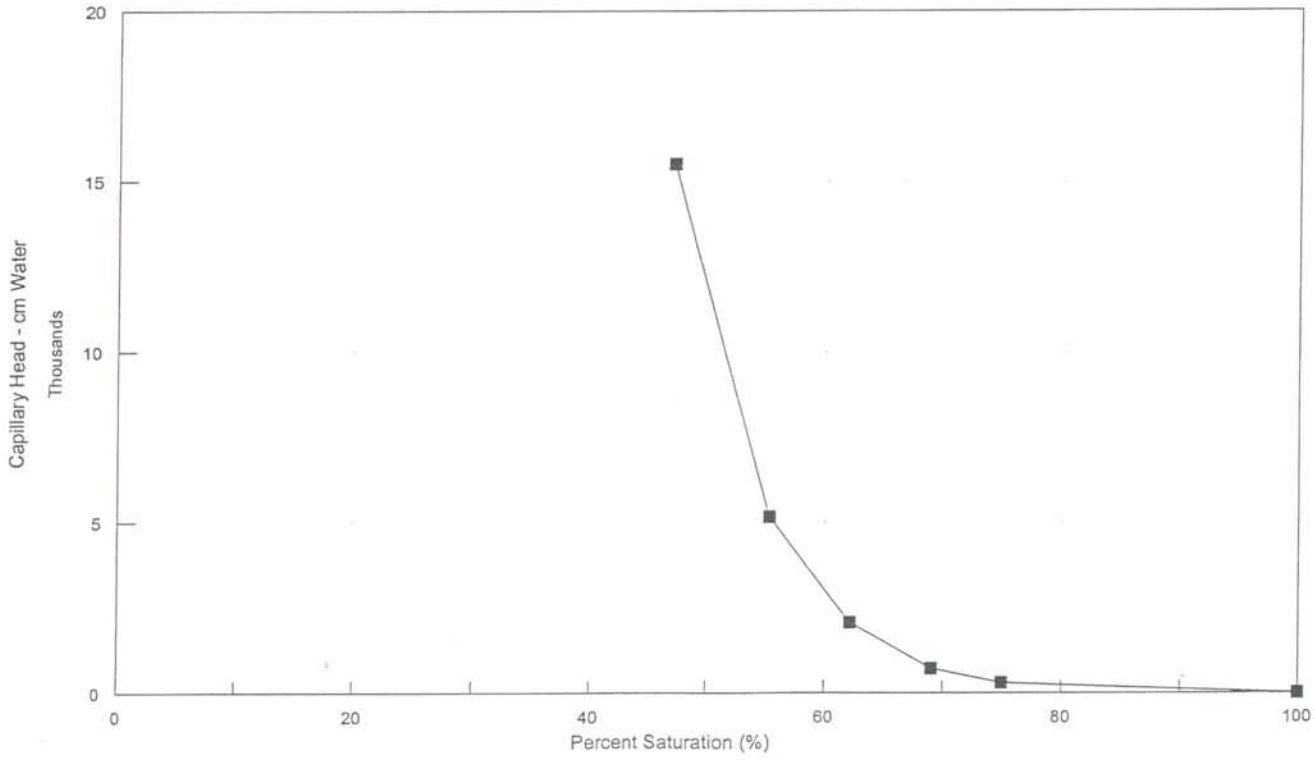
CAPILLARY MOISTURE CHARACTERISTIC CURVE

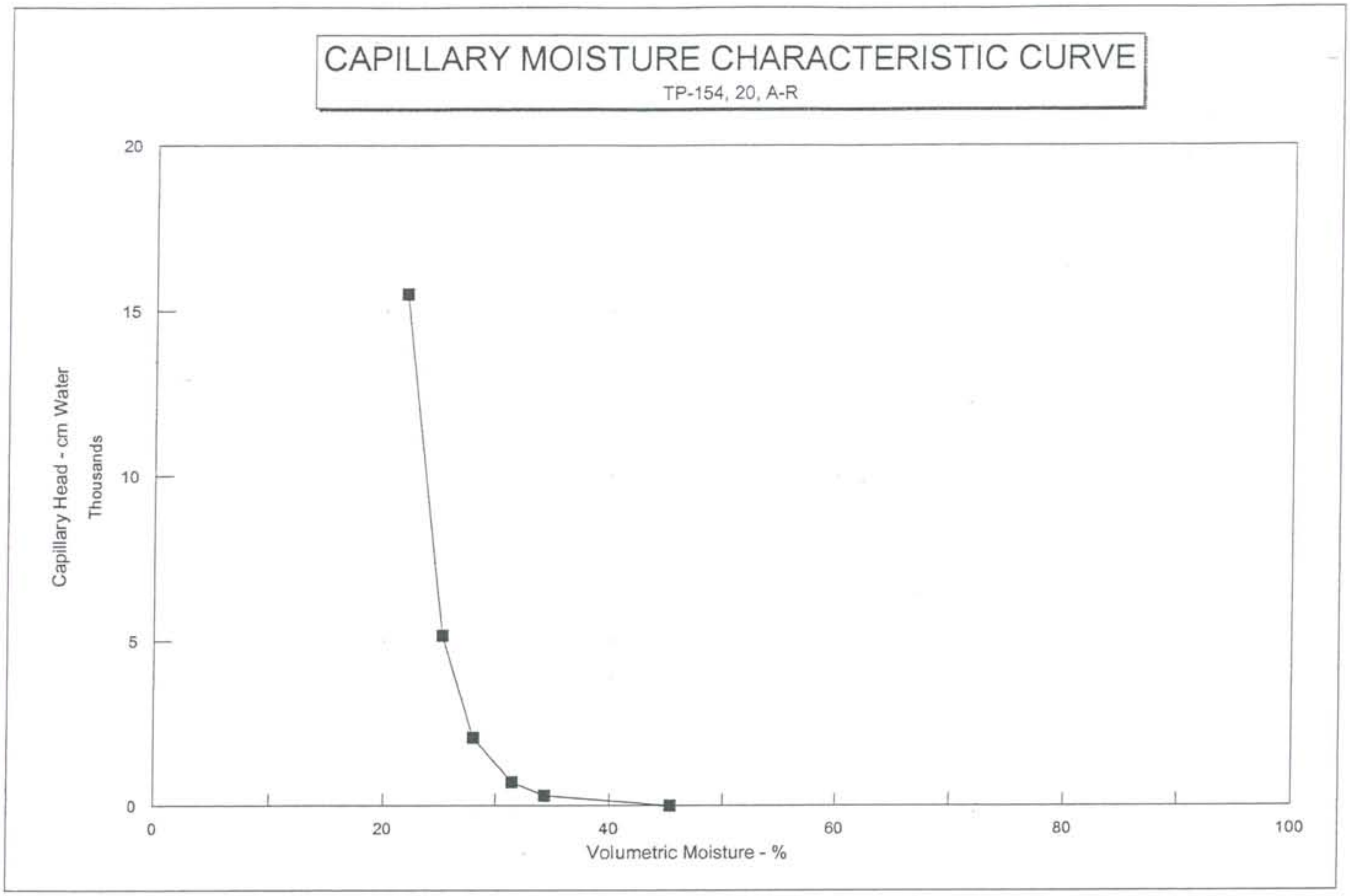
TP-154, 20, A



CAPILLARY MOISTURE CHARACTERISTIC CURVE

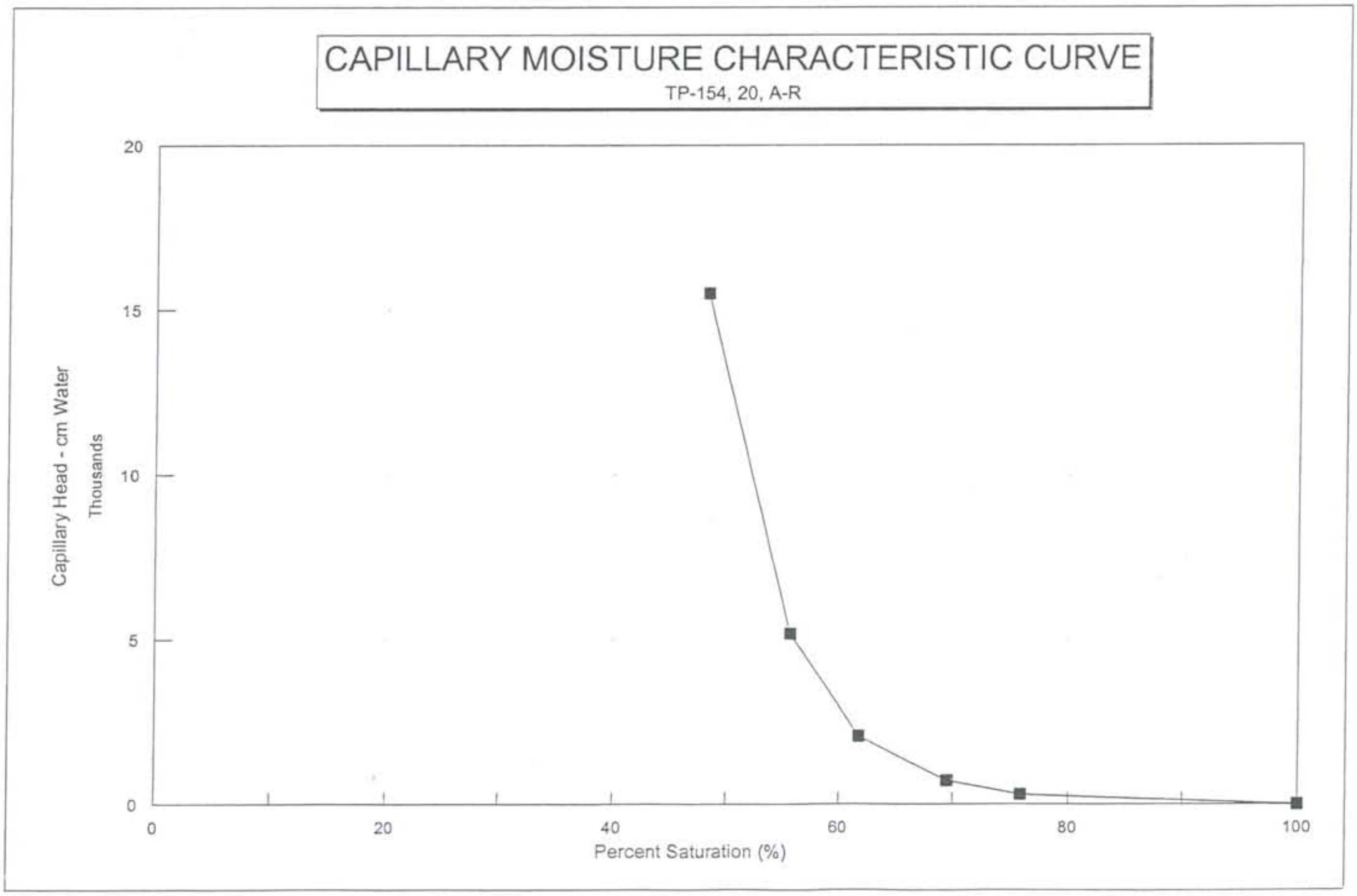
TP-154, 20, A





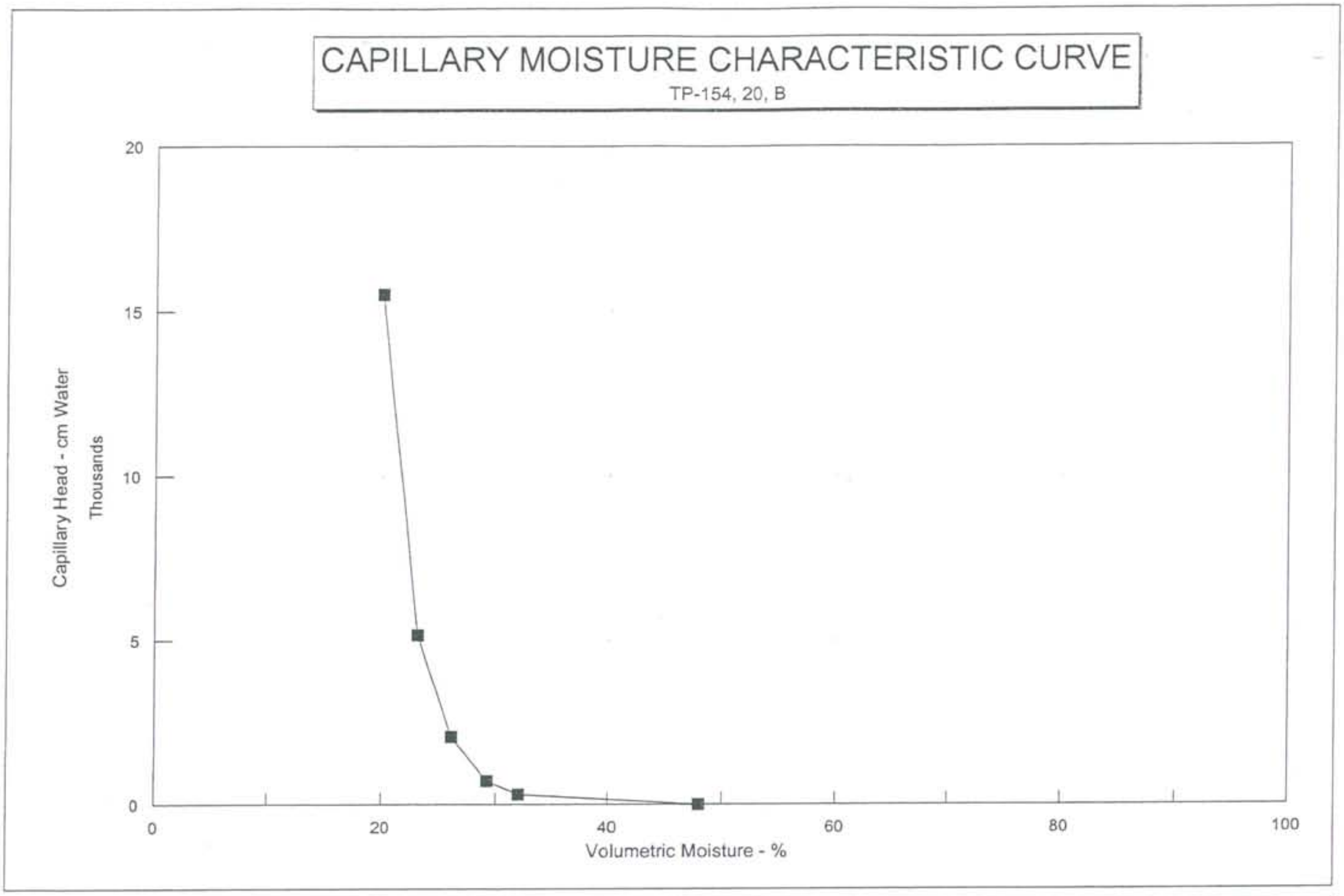
CAPILLARY MOISTURE CHARACTERISTIC CURVE

TP-154, 20, A-R

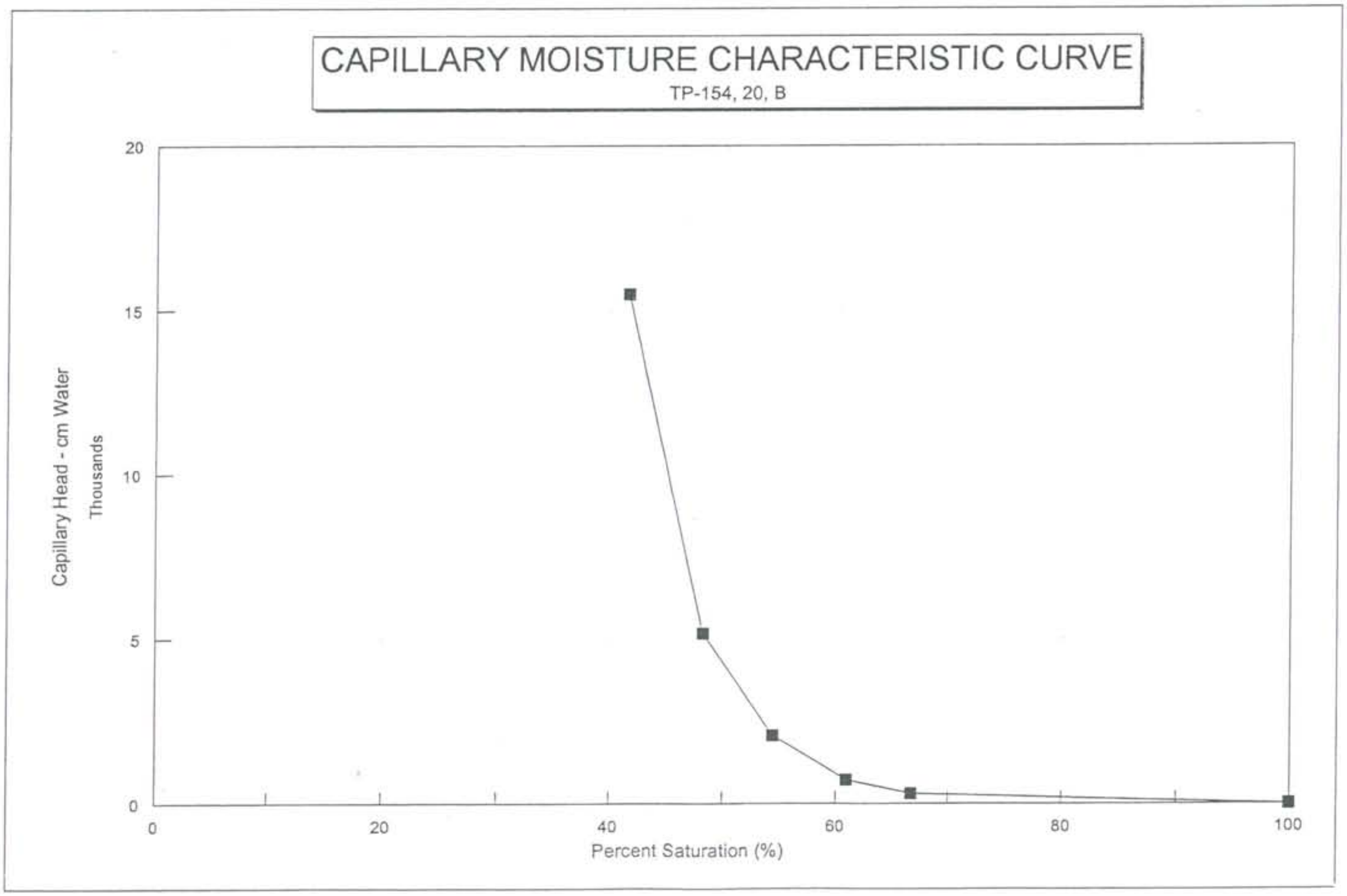


CAPILLARY MOISTURE CHARACTERISTIC CURVE

TP-154, 20, A-R


CAPILLARY MOISTURE CHARACTERISTIC CURVE

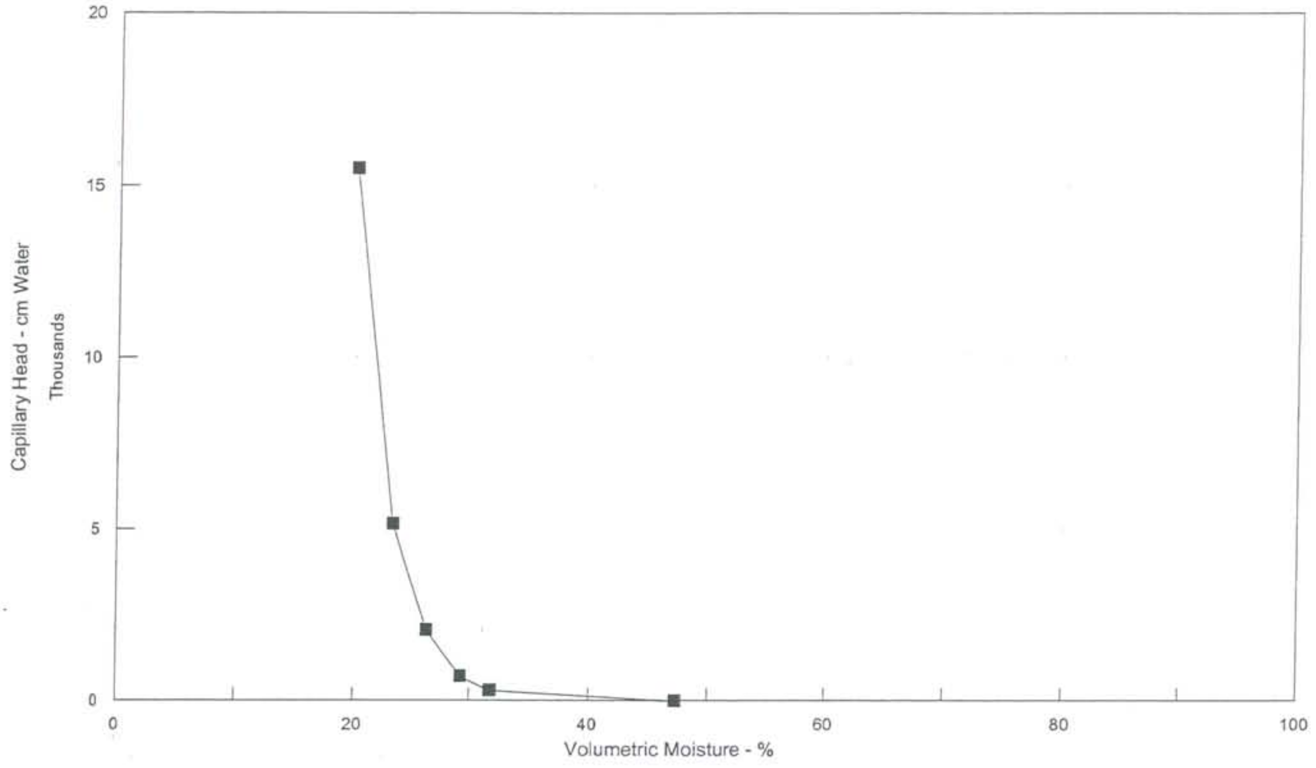
TP-154, 20, B


CAPILLARY MOISTURE CHARACTERISTIC CURVE

TP-154, 20, B

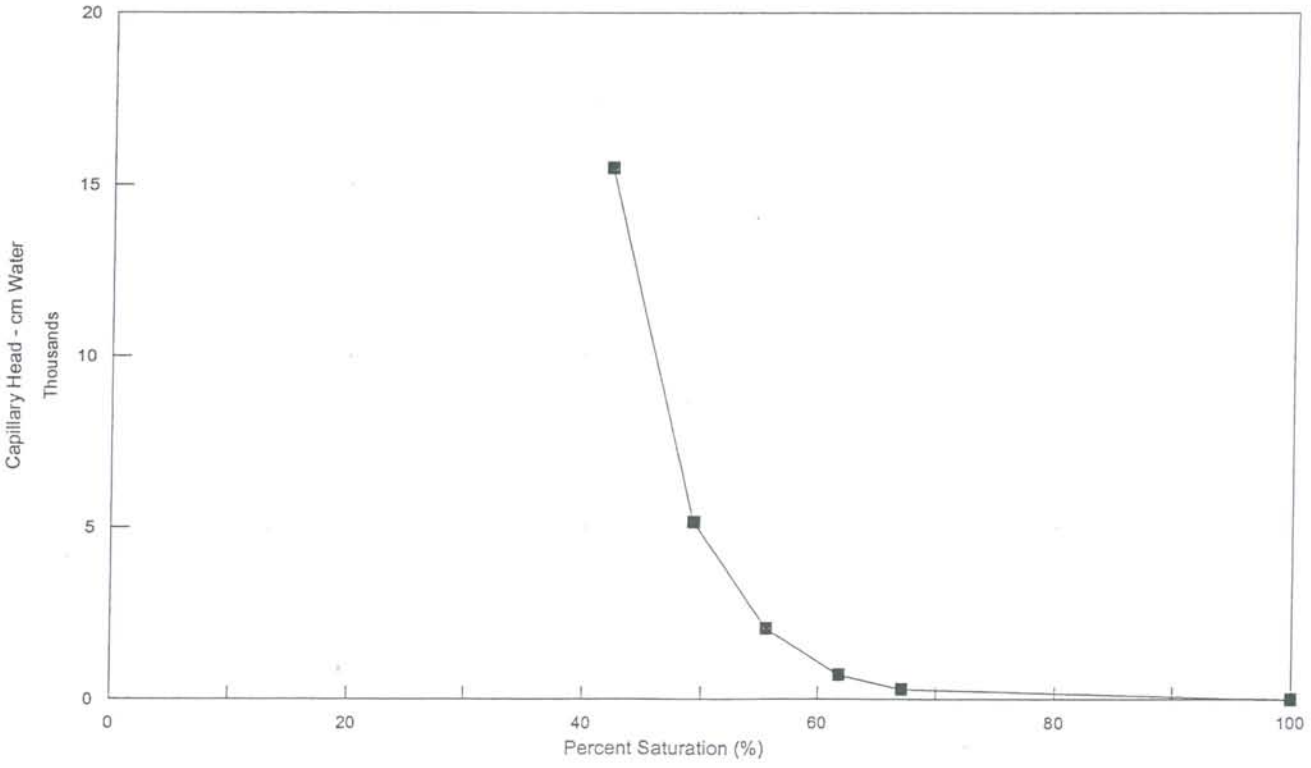
CAPILLARY MOISTURE CHARACTERISTIC CURVE

TP-154, 20, B-R



CAPILLARY MOISTURE CHARACTERISTIC CURVE

TP-154, 20, B-R



CAPILLARY MOISTURE RETENTION TEST
ASTM D 3152

CLIENT Geotechnical Engineering Group

JOB NO. 2669-01

SAMPLE DATE
SOIL DESCR.
LOCATION

TEST STARTED 02-24-06 DPM
TEST FINISHED 04-07-06 DPM

MASS DATA										
Sample Description	Ring Mass g	As Rec. Mass g	Sat. Mass g	0.3 Bar Mass g	0.7 Bar Mass g	2 Bar Mass g	5 Bar Mass g	15 Bar Mass g	Dry Mass Filter, Ring, & Dish (g)	Dish Wt. g
Filter Mass g		0.204	0.728	0.405	0.345	0.328	0.314	0.301		
TP-152, 7.5, A	10.549	48.275	53.524	49.899	49.354	48.666	48.165	47.586	46.461	2.337
TP-152, 7.5, A-R	10.627	48.283	53.371	49.975	49.707	48.715	48.208	47.720	46.584	2.364
TP-152, 7.5, B	10.635	45.433	51.134	47.225	46.738	45.903	45.382	44.771	43.866	2.265
TP-152, 7.5, B-R	10.598	45.413	50.957	47.104	46.608	45.812	45.340	44.773	43.950	2.363
TP-152, 15, A	10.737	50.584	54.045	51.108	50.915	50.381	50.053	49.376	48.623	2.357
TP-152, 15, A-R	10.757	50.585	54.471	51.182	50.900	50.435	50.102	49.454	48.644	2.300
TP-152, 15, B	10.707	47.516	52.224	48.035	47.751	47.294	46.935	46.330	45.794	2.360
TP-152, 15, B-R	10.705	46.540	51.262	47.217	46.911	46.416	46.034	45.459	44.985	2.356
TP-152, 23, A	10.703	48.501	55.429	52.120	51.677	50.651	49.957	49.073	46.621	2.318
TP-152, 23, A-R	10.707	48.444	55.655	52.046	51.654	50.713	49.942	48.966	46.638	2.350
TP-152, 23, B	10.691	45.625	52.303	49.309	48.714	47.704	46.979	46.052	44.154	2.360
TP-152, 23, B-R	10.356	45.290	52.191	48.887	48.284	47.295	46.597	45.703	43.694	2.274

Data Entered By: SR Date: 04/13/2006
Data Checked By: DPM Date: 04/13/06
Filename: GEKOTP15

CAPILLARY MOISTURE RETENTION TEST
ASTM D 3152

CLIENT	Geotechnical Engineering Group	JOB NO.	2669-01
SAMPLE DATE		TEST STARTED	02-24-06 DPM
SOIL DESCR.		TEST FINISHED	04-07-06 DPM
LOCATION			

Moisture Content Data: % D.M. = Moisture Content By Dry Mass; % Vol. = Moisture Content By Volume

Sample Description	**Sample Conditions**						**0.3 Bar**			**0.7 Bar**		
	Dry Mass (g)	Unit Wt. (g/cc)	Sat. Mass (g)	Total H2O (g)	Sat. M.C. % D.M.	Sat. M.C. % Vol.	Retained H2O	% DM	% Vol.	Retained H2O	% DM	% Vol.
TP-152, 7.5, A	33.371	1.770	42.247	8.876	26.60	47.08	5.574	16.70	29.57	5.089	15.25	26.99
TP-152, 7.5, A-R	33.389	1.771	42.016	8.627	25.84	45.76	5.554	16.63	29.46	5.346	16.01	28.36
TP-152, 7.5, B	30.762	1.632	39.771	9.009	29.29	47.79	5.423	17.63	28.77	4.996	16.24	26.50
TP-152, 7.5, B-R	30.785	1.633	39.631	8.846	28.73	46.92	5.316	17.27	28.20	4.880	15.85	25.89
TP-152, 15, A	35.325	1.874	42.580	7.255	20.54	38.48	4.641	13.14	24.62	4.508	12.76	23.91
TP-152, 15, A-R	35.383	1.877	42.986	7.603	21.49	40.33	4.637	13.11	24.60	4.415	12.48	23.42
TP-152, 15, B	32.523	1.725	40.789	8.266	25.42	43.85	4.400	13.53	23.34	4.176	12.84	22.15
TP-152, 15, B-R	31.720	1.683	39.829	8.109	25.56	43.01	4.387	13.83	23.27	4.141	13.05	21.97
TP-152, 23, A	33.396	1.771	43.998	10.602	31.75	56.24	7.616	22.81	40.40	7.233	21.66	38.37
TP-152, 23, A-R	33.377	1.770	44.220	10.843	32.49	57.52	7.557	22.64	40.09	7.225	21.65	38.32
TP-152, 23, B	30.899	1.639	40.884	9.985	32.31	52.97	7.314	23.67	38.80	6.779	21.94	35.96
TP-152, 23, B-R	30.860	1.637	41.107	10.247	33.20	54.35	7.266	23.55	38.54	6.723	21.79	35.66

Data Entered By: SR Date: 04/13/2006
Data Checked By: DPM Date: 04/13/06
Filename: GEKOTP15

CAPILLARY MOISTURE RETENTION TEST
ASTM D 3152

CLIENT	Geotechnical Engineering Group	JOB NO.	2669-01
SAMPLE DATE		TEST STARTED	02-24-06 DPM
SOIL DESCR.		TEST FINISHED	04-07-06 DPM
LOCATION			

Moisture Content Data: % D.M. = Moisture Content By Dry Mass; % Vol. = Moisture Content By Volume

Sample Description	2 Bar			5 Bar			15 Bar		
	Retained H2O	% DM	% Vol.	Retained H2O	% DM	% Vol.	Retained H2O	% DM	% Vol.
TP-152, 7.5, A	4.418	13.24	23.44	3.931	11.78	20.85	3.365	10.08	17.85
TP-152, 7.5, A-R	4.371	13.09	23.19	3.878	11.61	20.57	3.403	10.19	18.05
TP-152, 7.5, B	4.178	13.58	22.16	3.671	11.93	19.47	3.073	9.99	16.30
TP-152, 7.5, B-R	4.101	13.32	21.75	3.643	11.83	19.32	3.089	10.03	16.39
TP-152, 15, A	3.991	11.30	21.17	3.677	10.41	19.50	3.013	8.53	15.98
TP-152, 15, A-R	3.967	11.21	21.04	3.648	10.31	19.35	3.013	8.52	15.98
TP-152, 15, B	3.736	11.49	19.82	3.391	10.43	17.99	2.799	8.61	14.85
TP-152, 15, B-R	3.663	11.55	19.43	3.295	10.39	17.48	2.733	8.62	14.50
TP-152, 23, A	6.224	18.64	33.02	5.544	16.60	29.41	4.673	13.99	24.79
TP-152, 23, A-R	6.301	18.88	33.42	5.544	16.61	29.41	4.581	13.73	24.30
TP-152, 23, B	5.786	18.73	30.69	5.075	16.42	26.92	4.161	13.47	22.07
TP-152, 23, B-R	5.751	18.64	30.51	5.067	16.42	26.88	4.186	13.56	22.20

Data Entered By: SR Date: 04/13/2006
Data Checked By: DPM Date: 04/13/06
Filename: GEKOTP15

CAPILLARY MOISTURE RETENTION TEST
ASTM D 3152

CLIENT Geotechnical Engineering Group

JOB NO. 2669-01

SAMPLE DATE
SOIL DESCR.
LOCATION

TEST STARTED 02-24-06 DPM
TEST FINISHED 04-07-06 DPM

	Vol. MC % Sat.	**Vol. MC % 0.3 Bar**	**Vol. MC % 0.7 Bar**	**Vol. MC % 2 Bar**	**Vol. MC % 5 Bar**	**Vol. MC % 15 Bar**
TP-152, 7.5, A	47.08	29.57	26.99	23.44	20.85	17.85
TP-152, 7.5, A-R	45.76	29.46	28.36	23.19	20.57	18.05
TP-152, 7.5, B	47.79	28.77	26.50	22.16	19.47	16.30
TP-152, 7.5, B-R	46.92	28.20	25.89	21.75	19.32	16.39
TP-152, 15, A	38.48	24.62	23.91	21.17	19.50	15.98
TP-152, 15, A-R	40.33	24.60	23.42	21.04	19.35	15.98
TP-152, 15, B	43.85	23.34	22.15	19.82	17.99	14.85
TP-152, 15, B-R	43.01	23.27	21.97	19.43	17.48	14.50
TP-152, 23, A	56.24	40.40	38.37	33.02	29.41	24.79
TP-152, 23, A-R	57.52	40.09	38.32	33.42	29.41	24.30
TP-152, 23, B	52.97	38.80	35.96	30.69	26.92	22.07
TP-152, 23, B-R	54.35	38.54	35.66	30.51	26.88	22.20

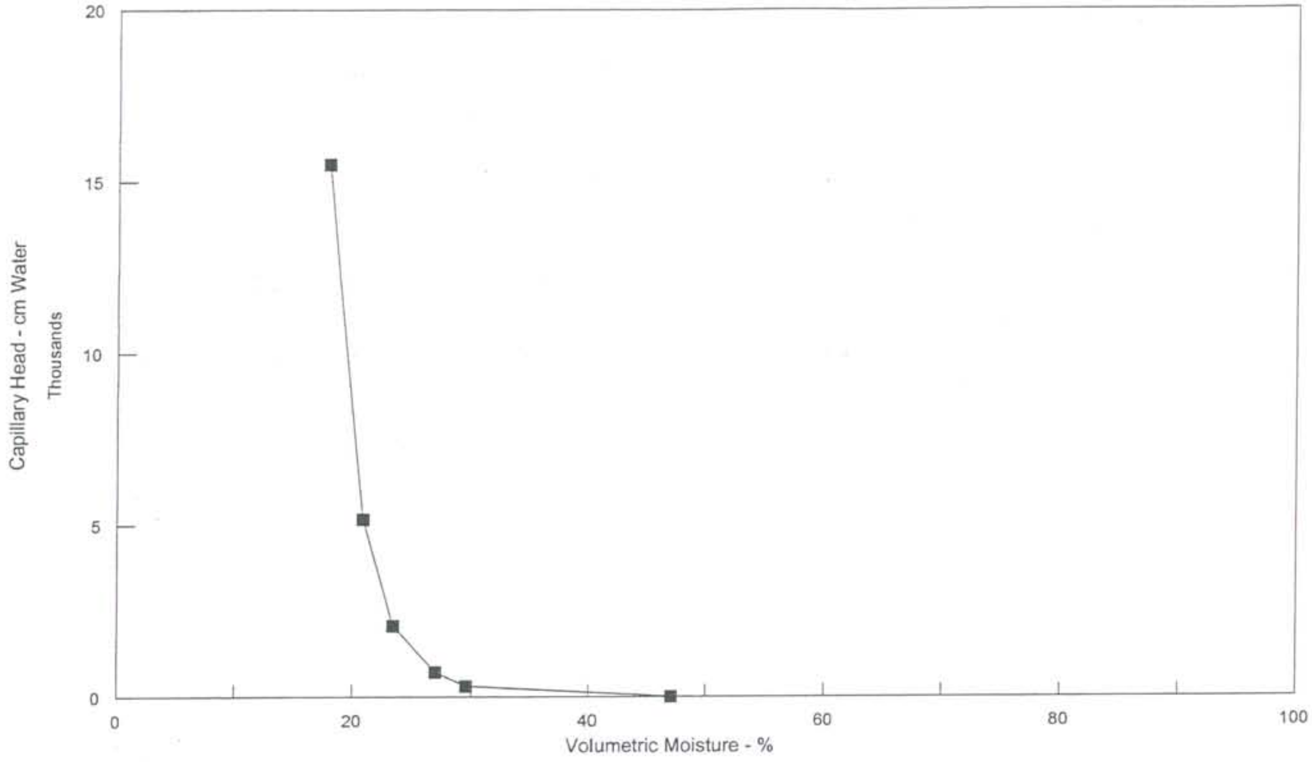
				% Saturation		
	Sat.	**0.3 Bar**	**0.7 Bar**	**2 Bar**	**5 Bar**	**15 Bar**
TP-152, 7.5, A	100.00	62.80	57.33	49.77	44.29	37.91
TP-152, 7.5, A-R	100.00	64.38	61.97	50.67	44.95	39.45
TP-152, 7.5, B	100.00	60.20	55.46	46.38	40.75	34.11
TP-152, 7.5, B-R	100.00	60.09	55.17	46.36	41.18	34.92
TP-152, 15, A	100.00	63.97	62.14	55.01	50.68	41.53
TP-152, 15, A-R	100.00	60.99	58.07	52.18	47.98	39.63
TP-152, 15, B	100.00	53.23	50.52	45.20	41.02	33.86
TP-152, 15, B-R	100.00	54.10	51.07	45.17	40.63	33.70
TP-152, 23, A	100.00	71.84	68.22	58.71	52.29	44.08
TP-152, 23, A-R	100.00	69.69	66.63	58.11	51.13	42.25
TP-152, 23, B	100.00	73.25	67.89	57.95	50.83	41.67
TP-152, 23, B-R	100.00	70.91	65.61	56.12	49.45	40.85

Data Entered By: SR Date: 04/13/2006
Data Checked By: DPM Date: 04/13/06
Filename: GEKOTP15

ADVANCED TERRA TESTING, INC.

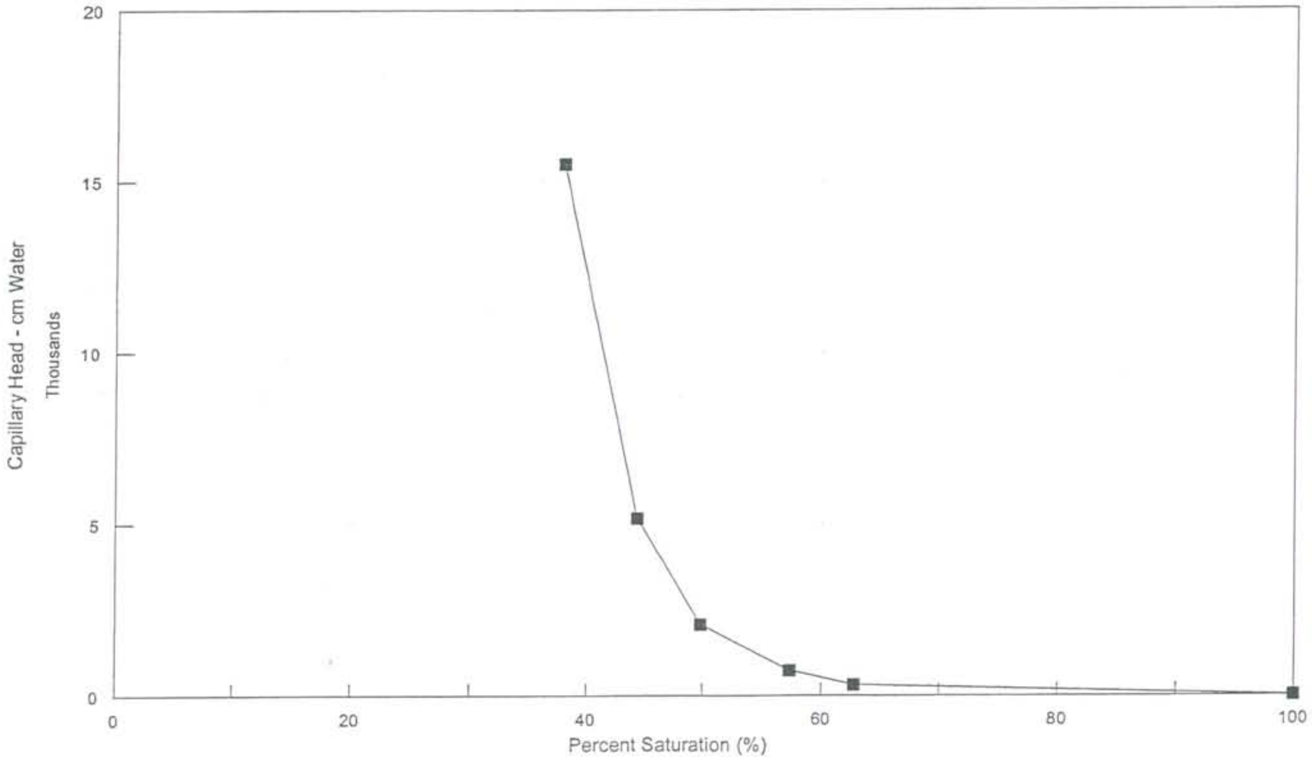
CAPILLARY MOISTURE CHARACTERISTIC CURVE

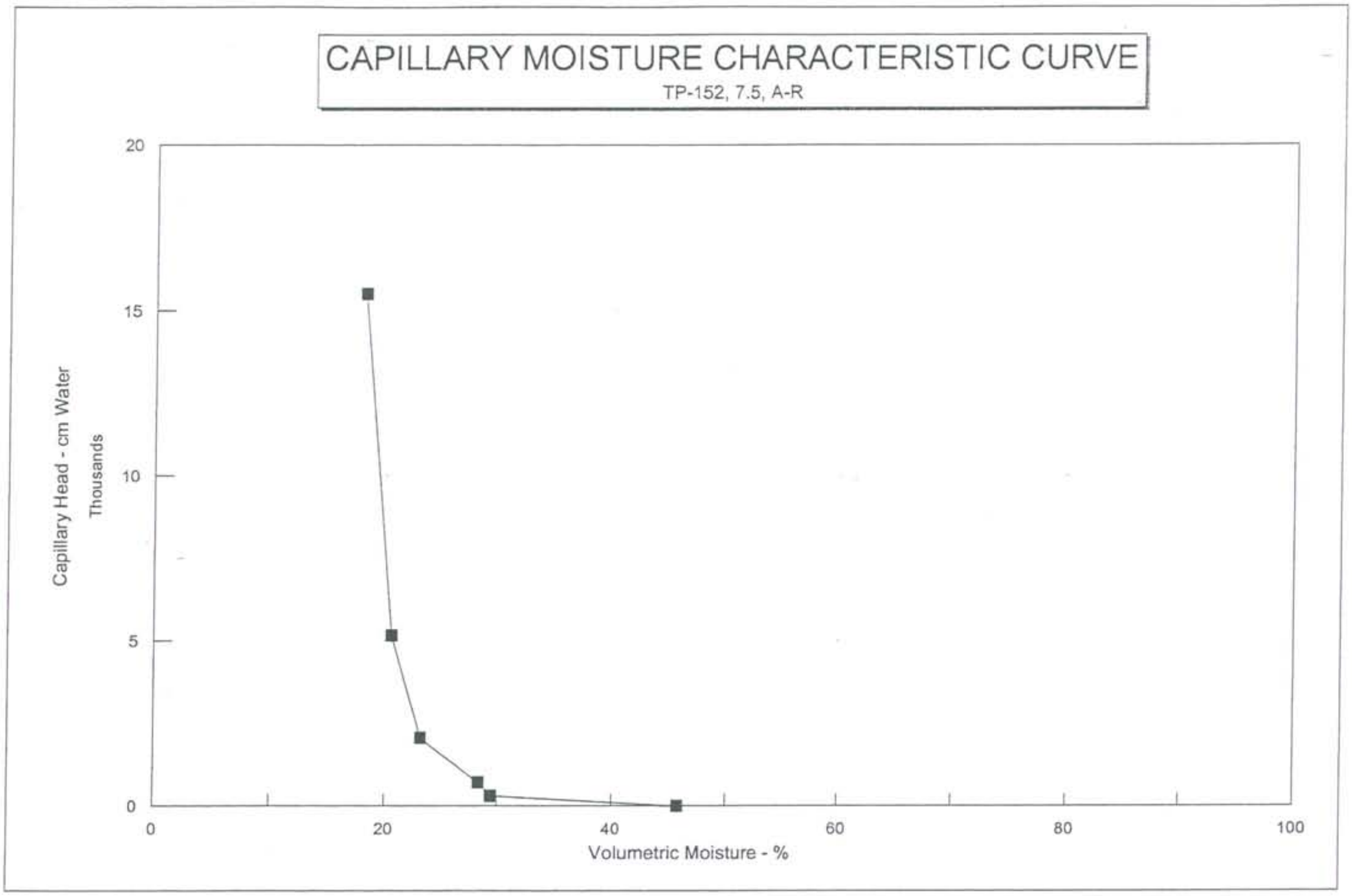
TP-152, 7.5, A



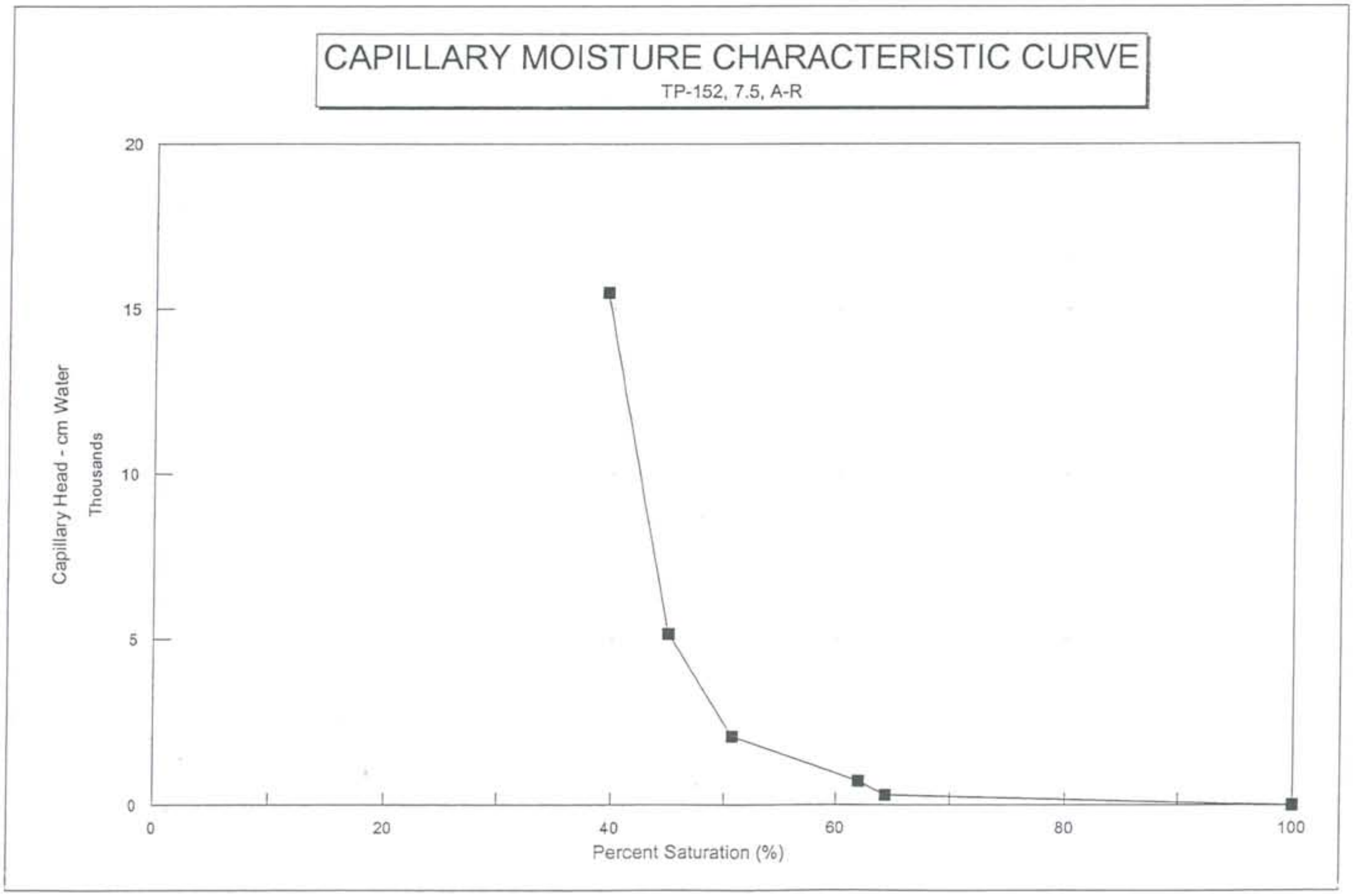
CAPILLARY MOISTURE CHARACTERISTIC CURVE

TP-152, 7.5, A




CAPILLARY MOISTURE CHARACTERISTIC CURVE

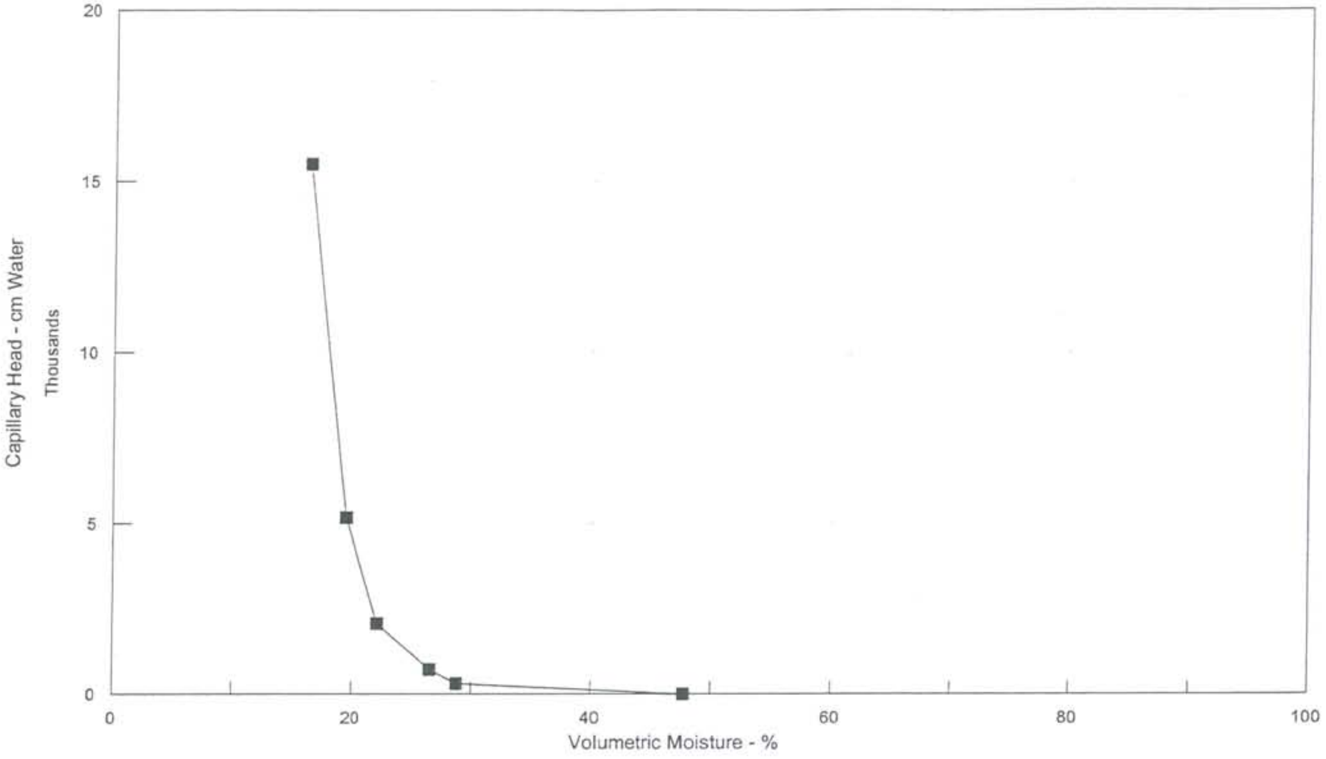
TP-152, 7.5, A-R


CAPILLARY MOISTURE CHARACTERISTIC CURVE

TP-152, 7.5, A-R

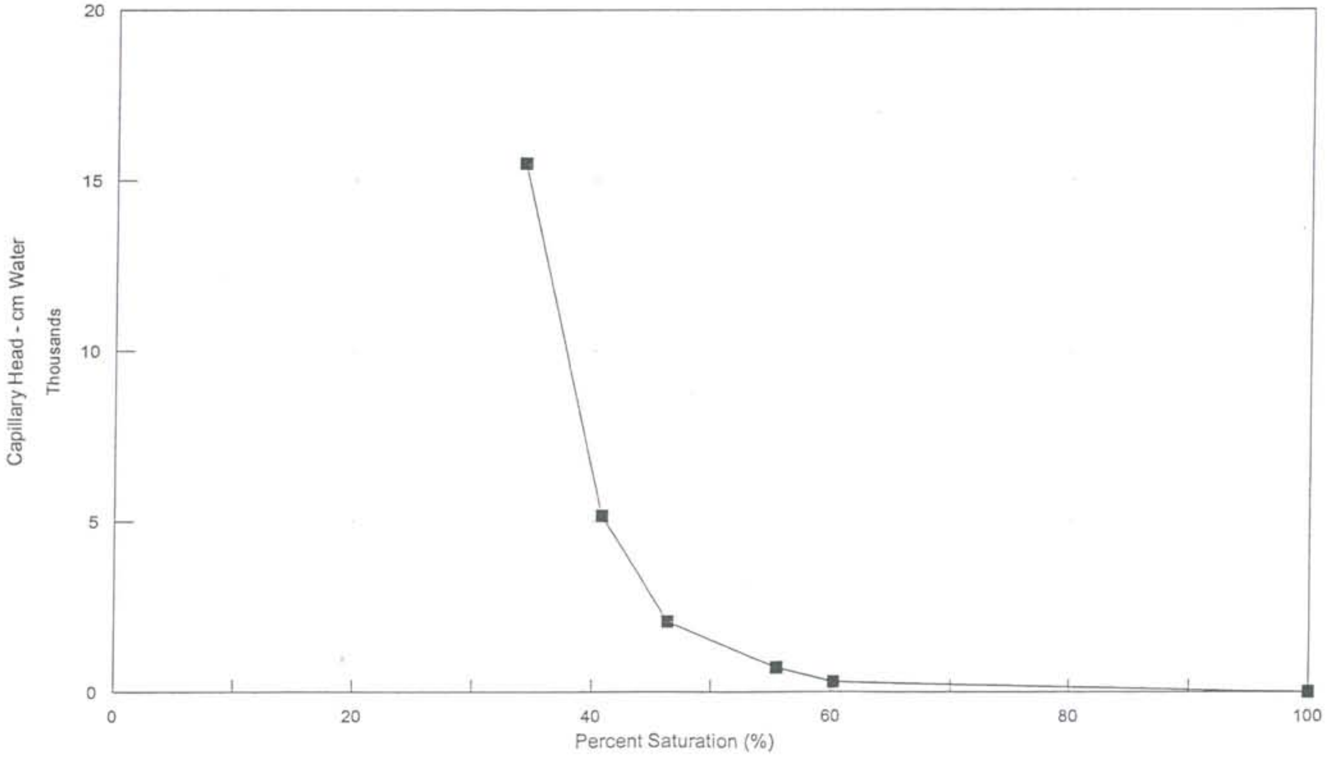
CAPILLARY MOISTURE CHARACTERISTIC CURVE

TP-152, 7.5, B



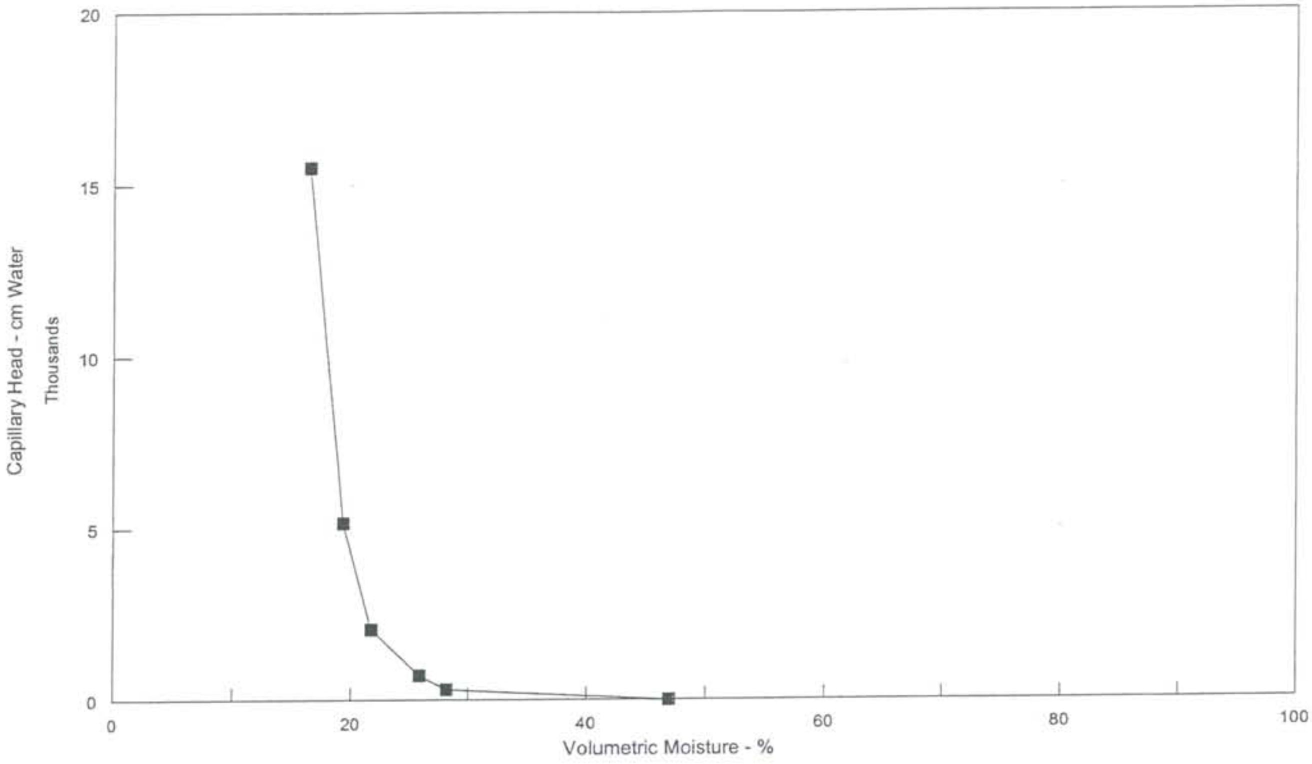
CAPILLARY MOISTURE CHARACTERISTIC CURVE

TP-152, 7.5, B



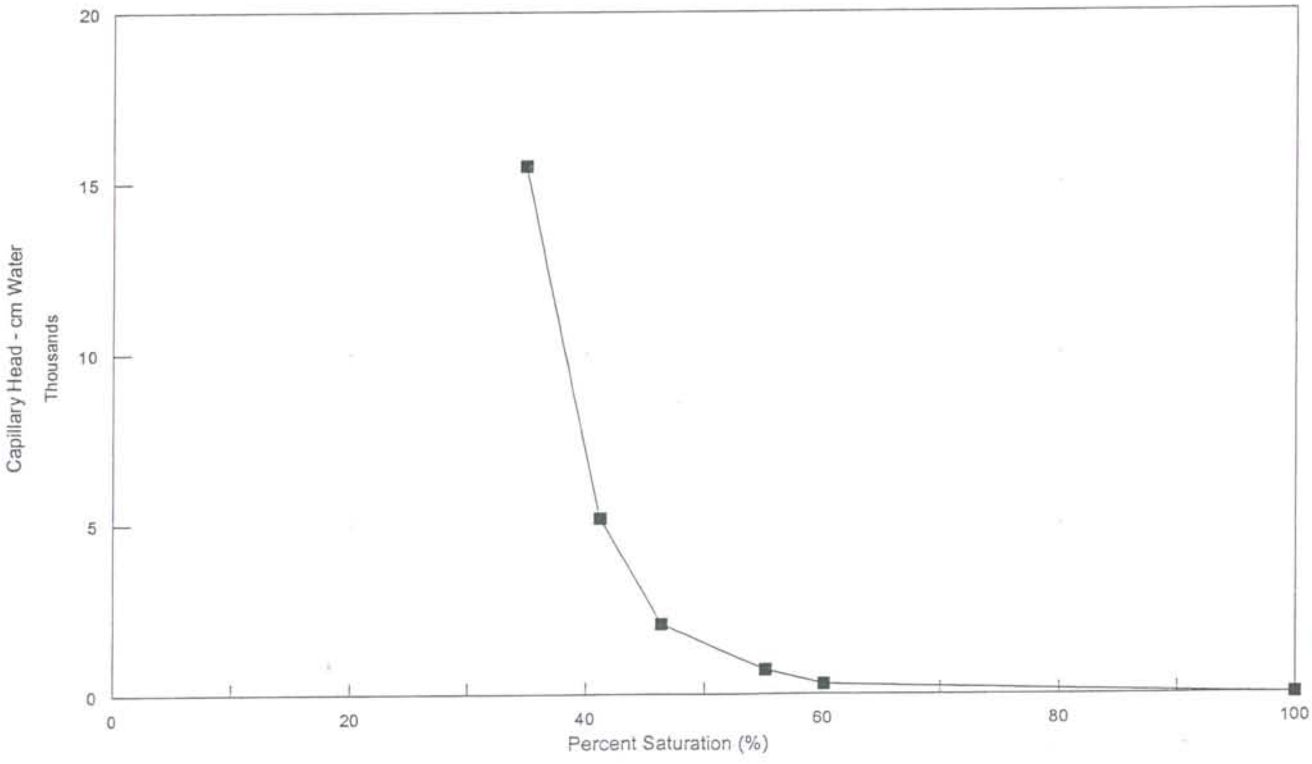
CAPILLARY MOISTURE CHARACTERISTIC CURVE

TP-152, 7.5, B-R



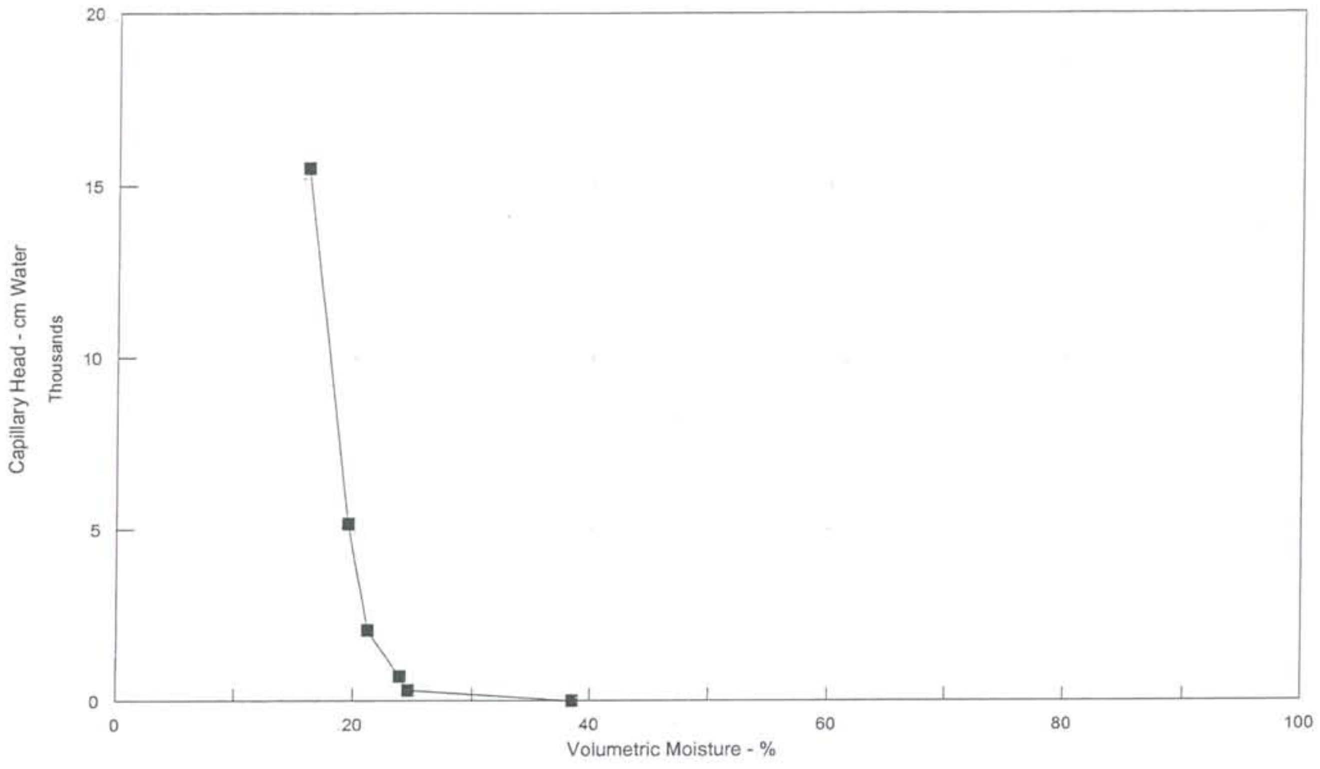
CAPILLARY MOISTURE CHARACTERISTIC CURVE

TP-152, 7.5, B-R



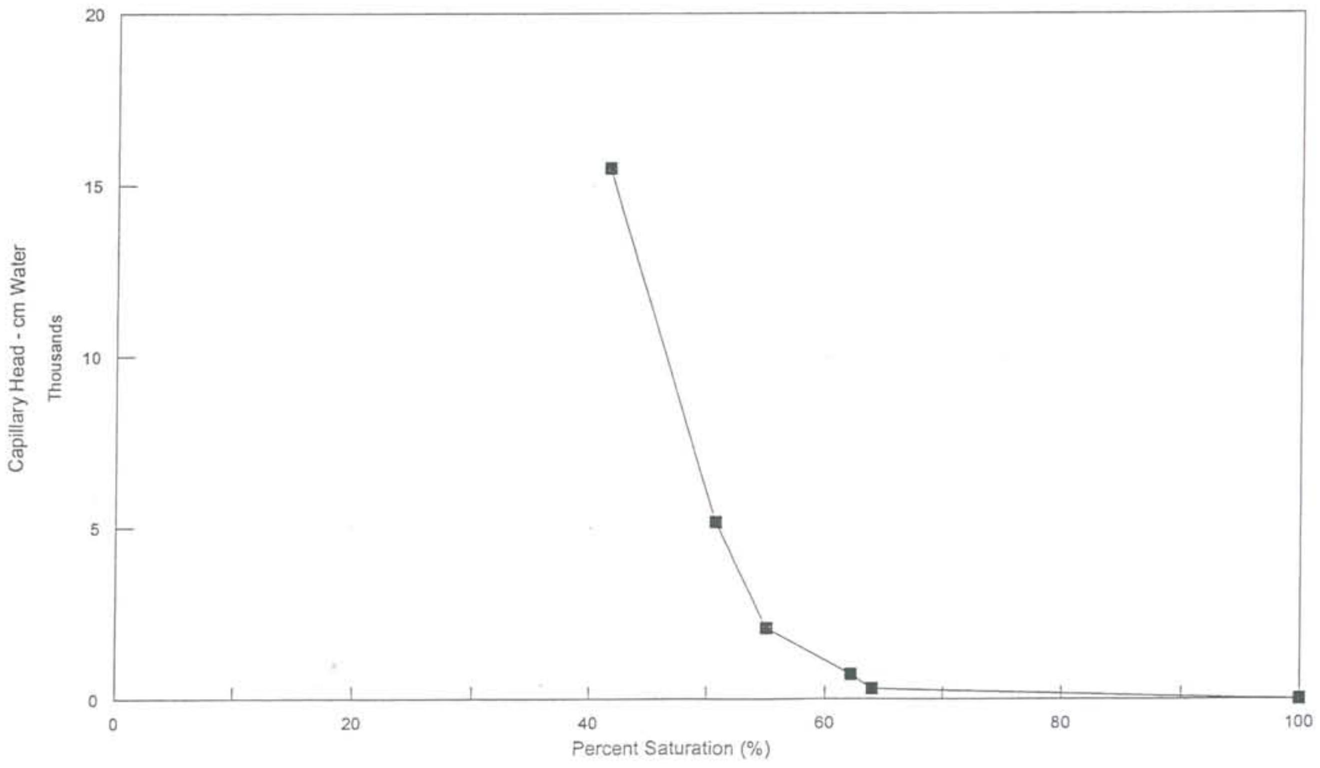
CAPILLARY MOISTURE CHARACTERISTIC CURVE

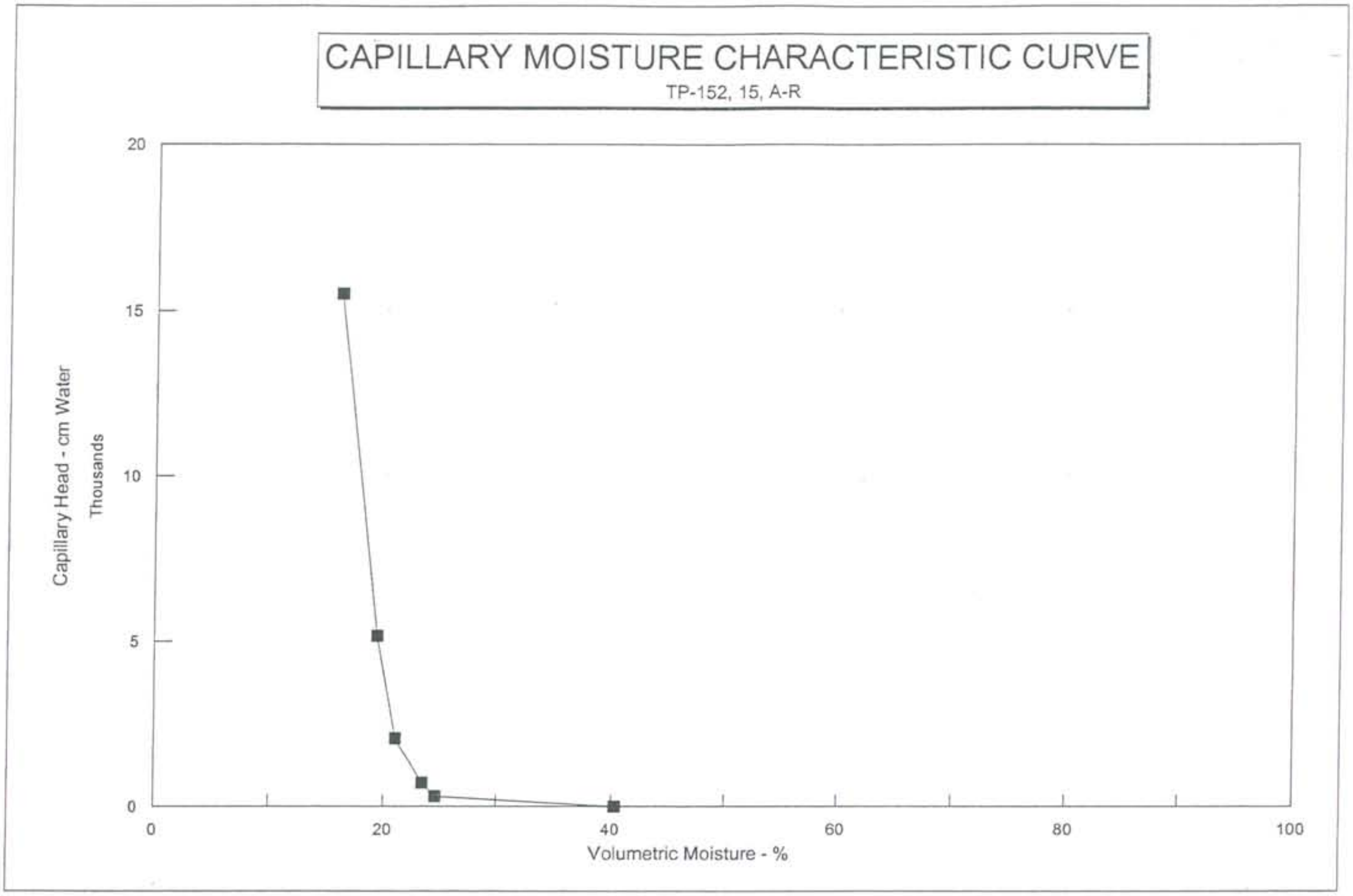
TP-152, 15, A



CAPILLARY MOISTURE CHARACTERISTIC CURVE

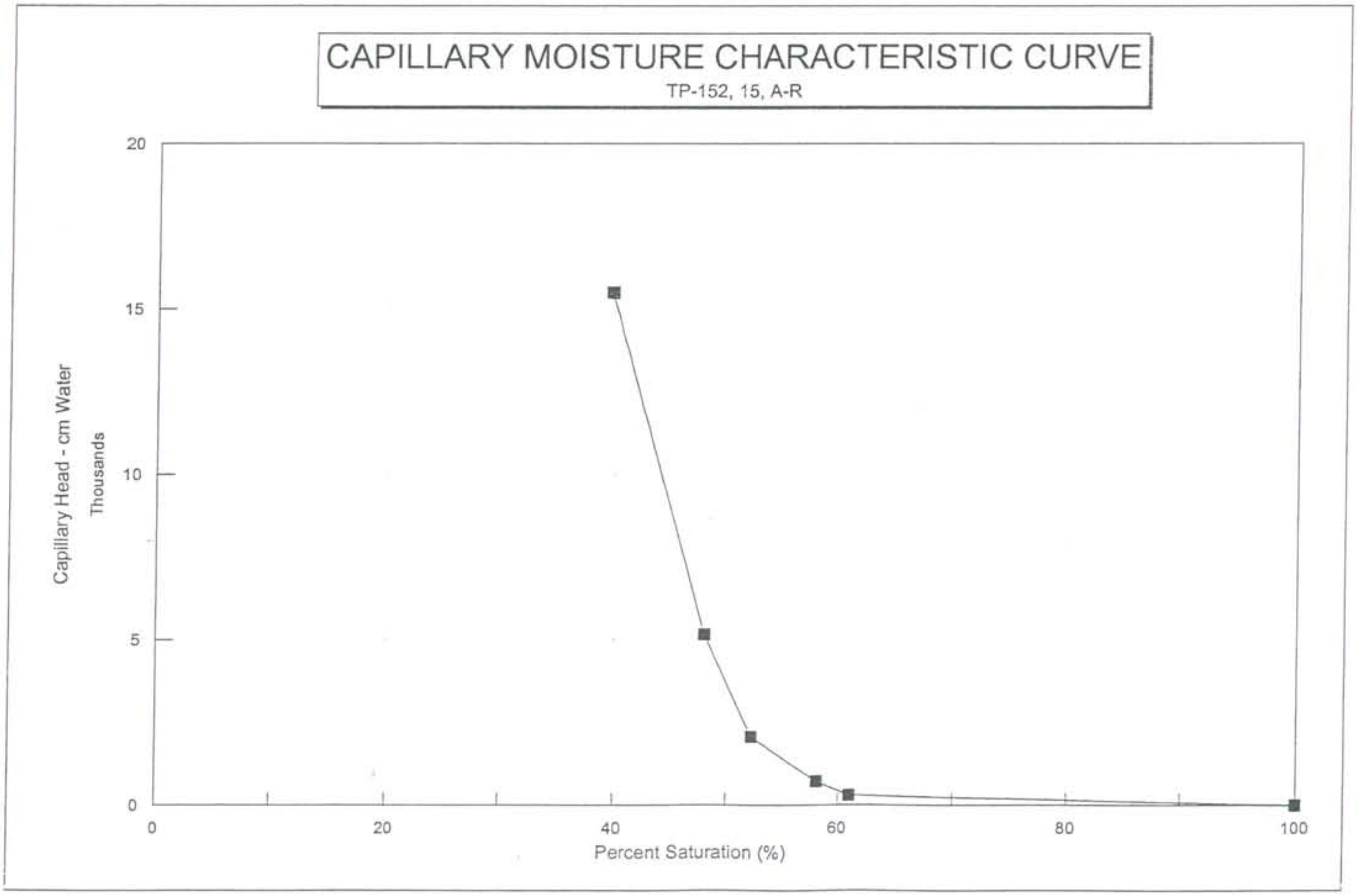
TP-152, 15, A





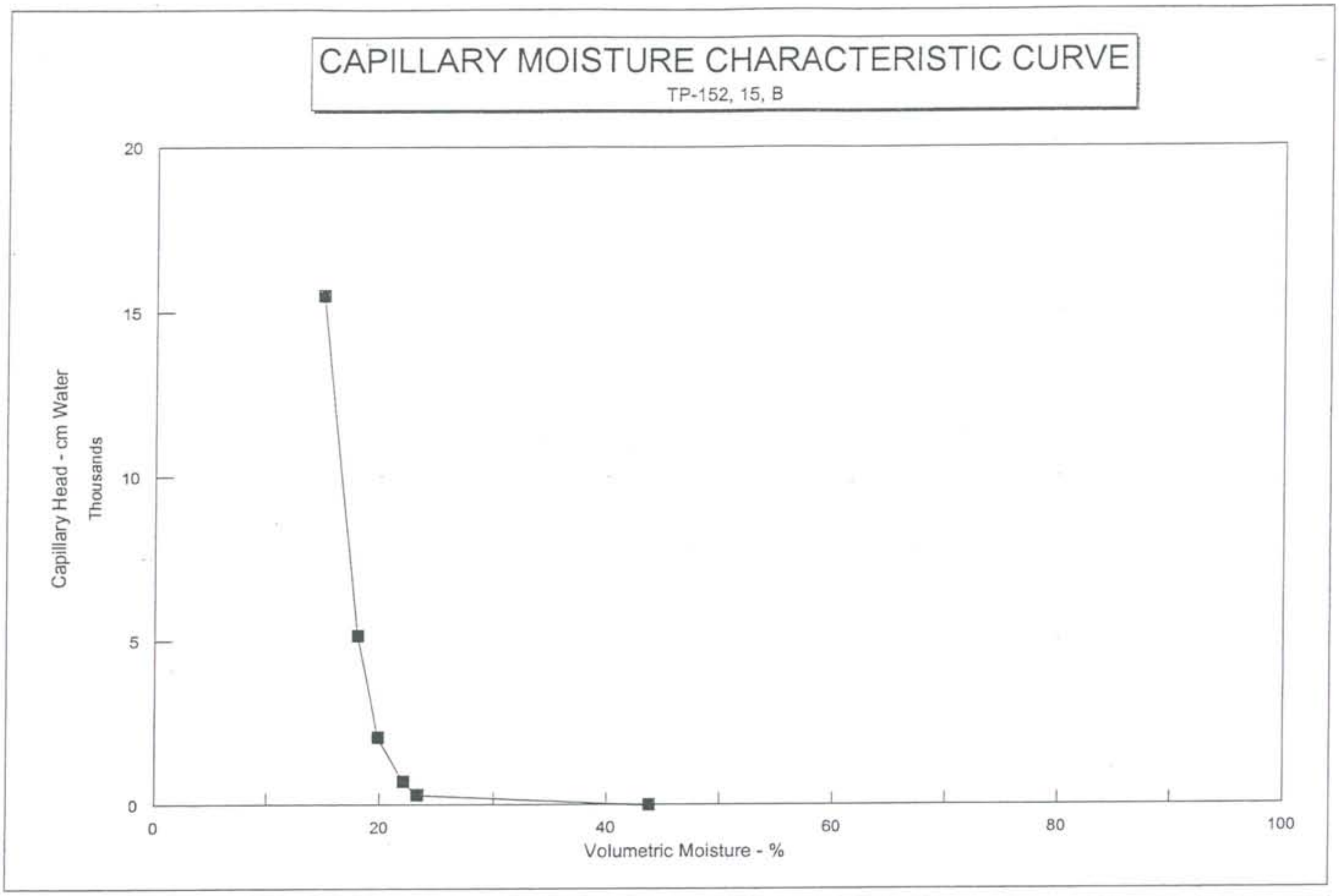
CAPILLARY MOISTURE CHARACTERISTIC CURVE

TP-152, 15, A-R



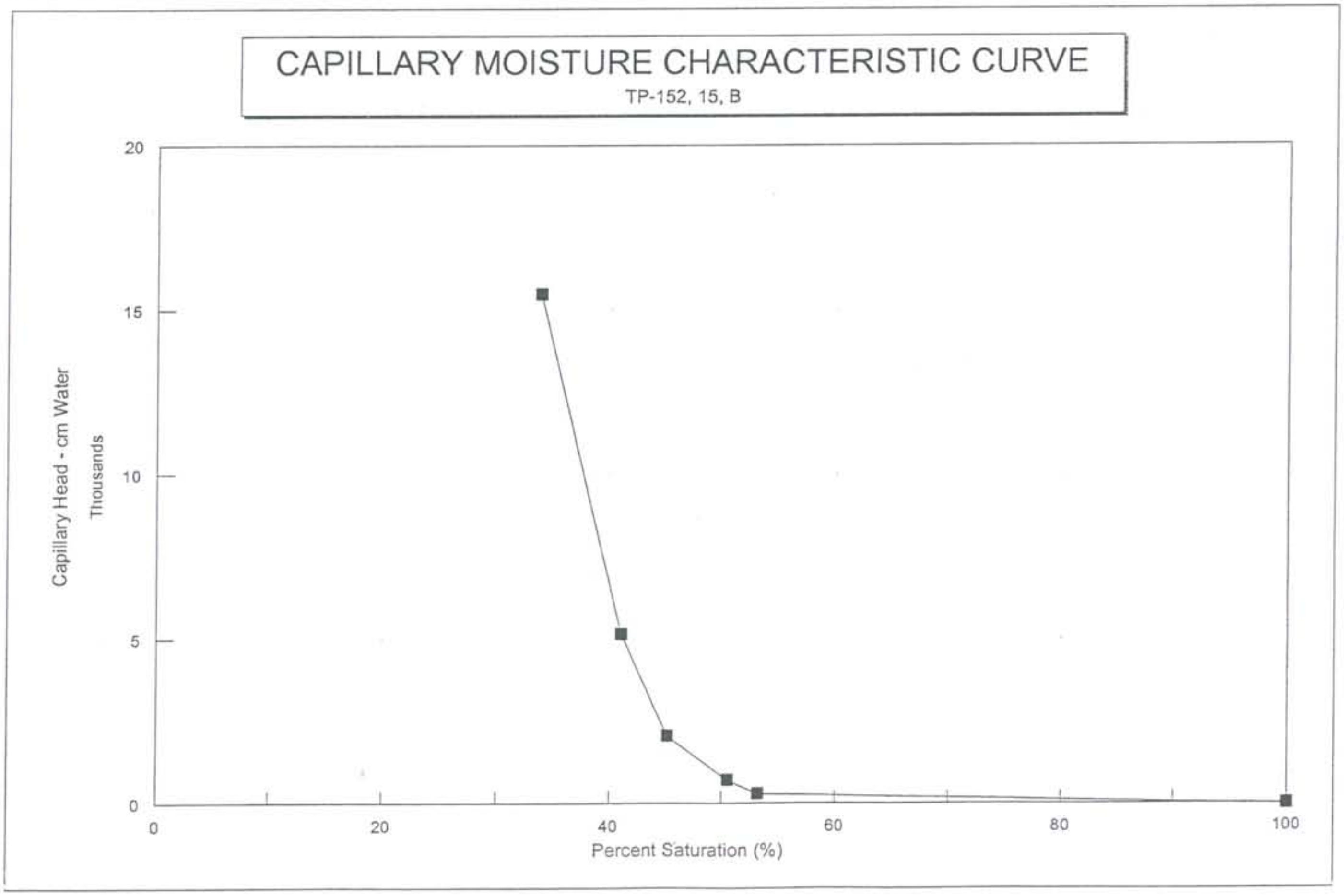
CAPILLARY MOISTURE CHARACTERISTIC CURVE

TP-152, 15, A-R



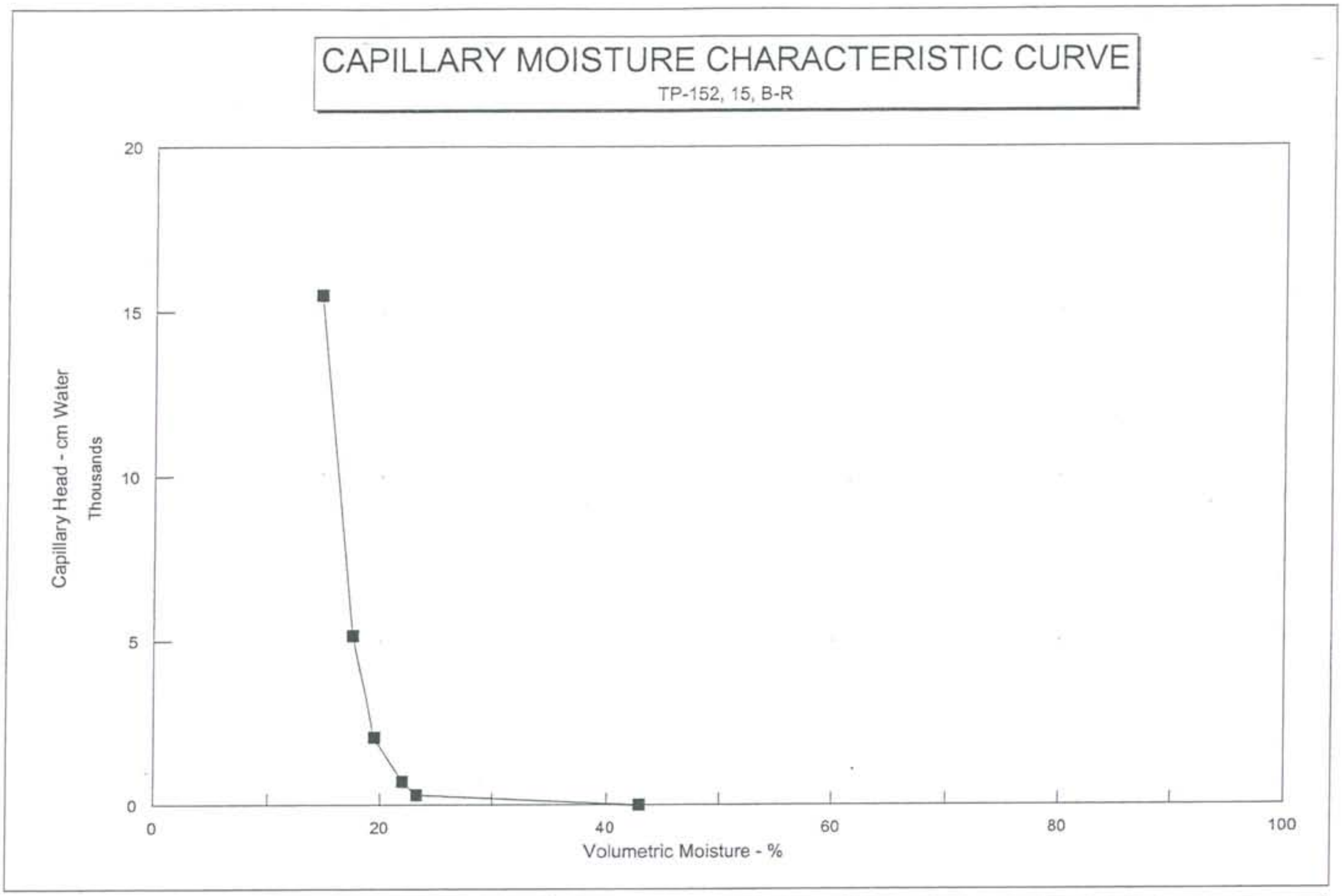
CAPILLARY MOISTURE CHARACTERISTIC CURVE

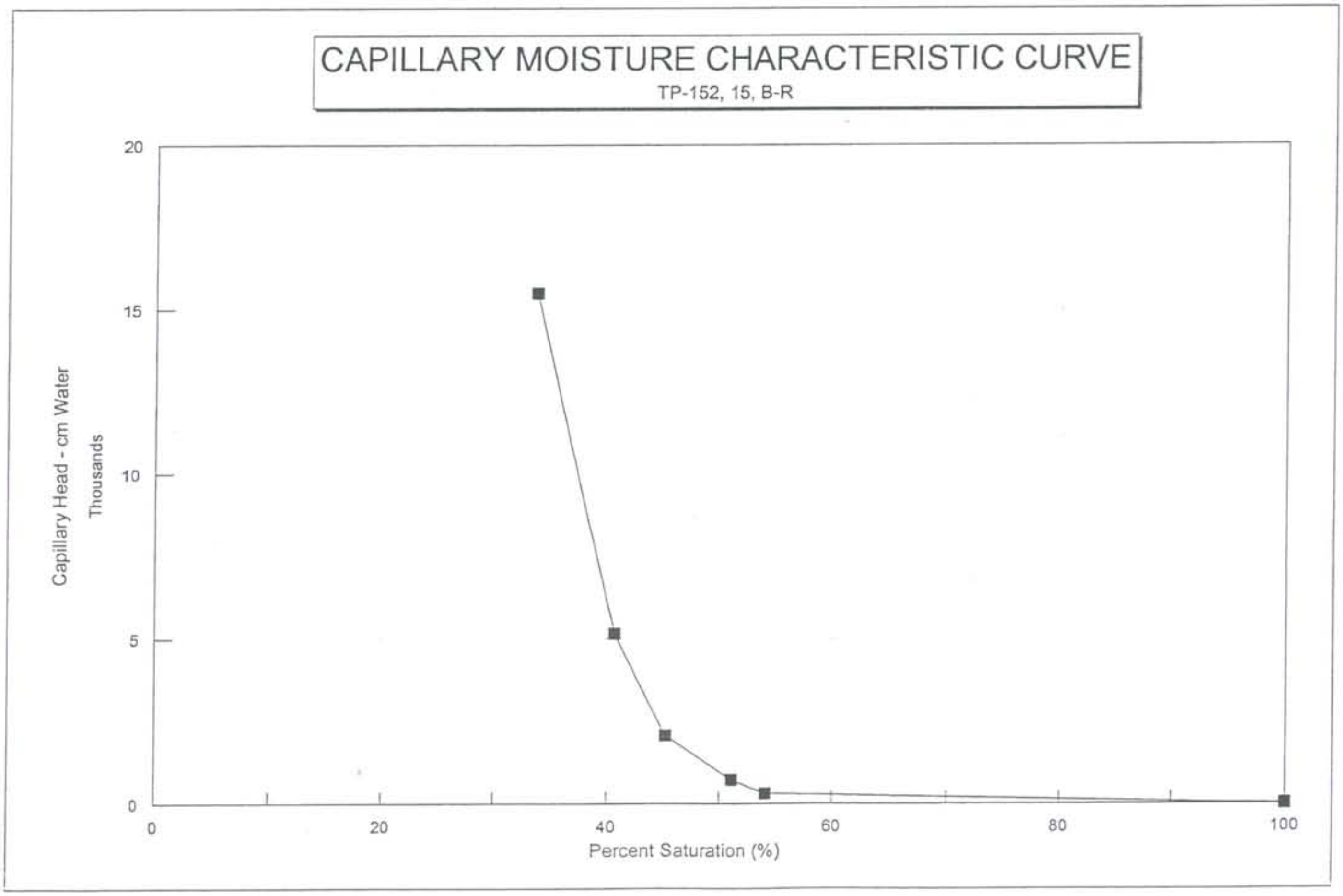
TP-152, 15, B

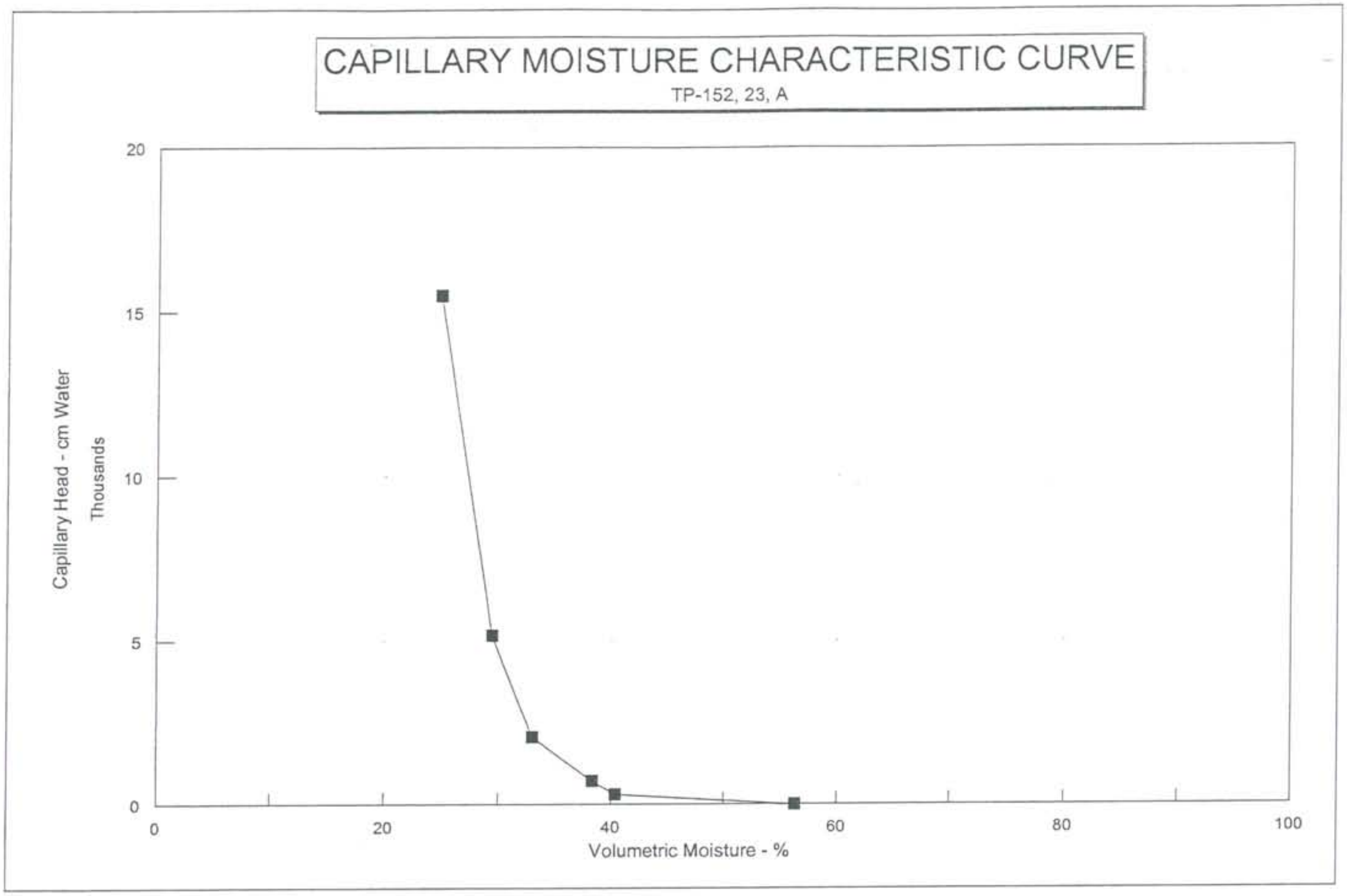


CAPILLARY MOISTURE CHARACTERISTIC CURVE

TP-152, 15, B

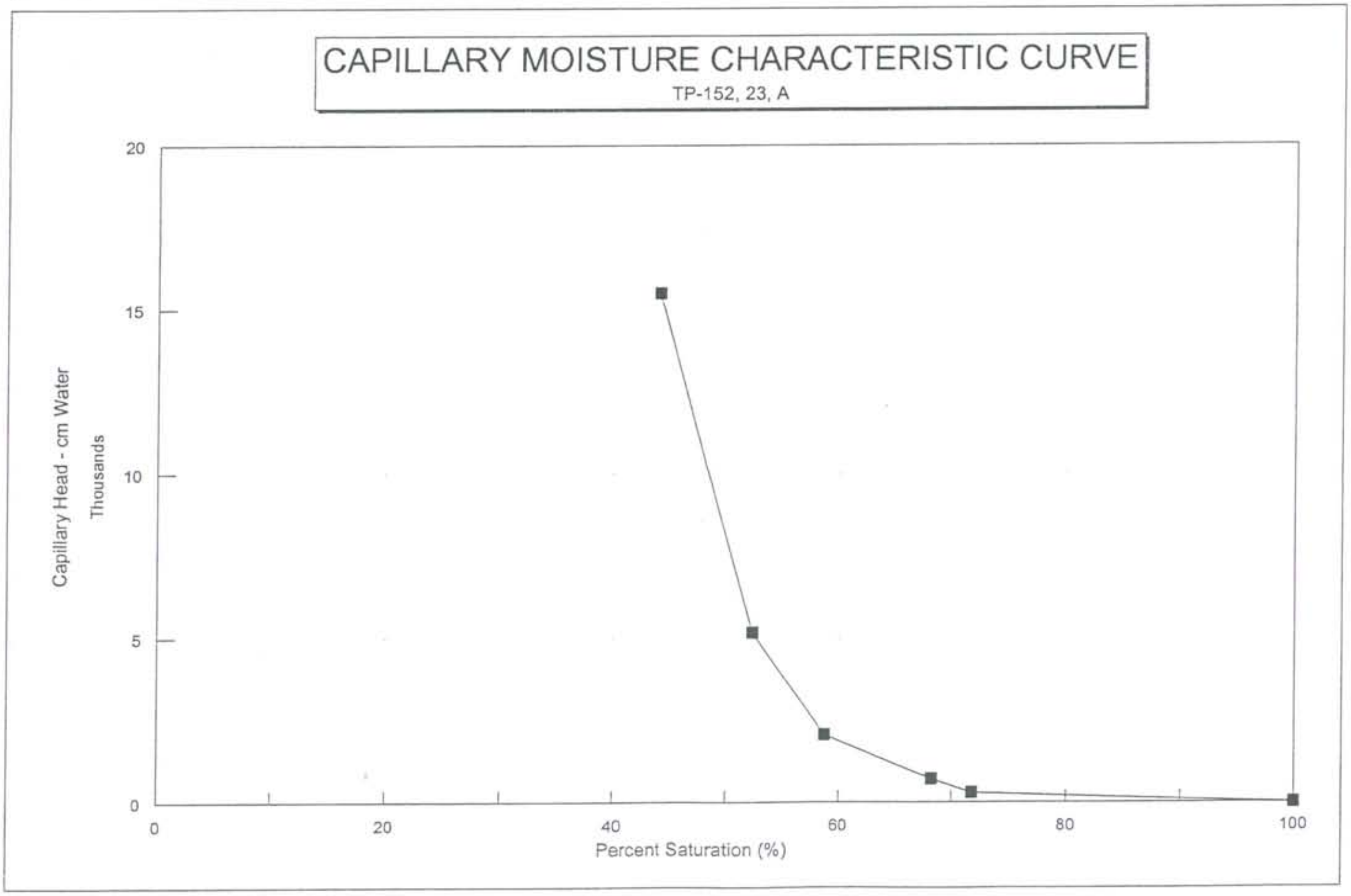

CAPILLARY MOISTURE CHARACTERISTIC CURVE
TP-152, 15, B-R
Capillary Head - cm Water
Thousands
20
15
10
5
0
0
20
40
60
80
100
Volumetric Moisture - %


CAPILLARY MOISTURE CHARACTERISTIC CURVE
TP-152, 15, B-R
Capillary Head - cm Water
Thousands
20
15
10
5
0
0
20
40
60
80
100
Percent Saturation (%)



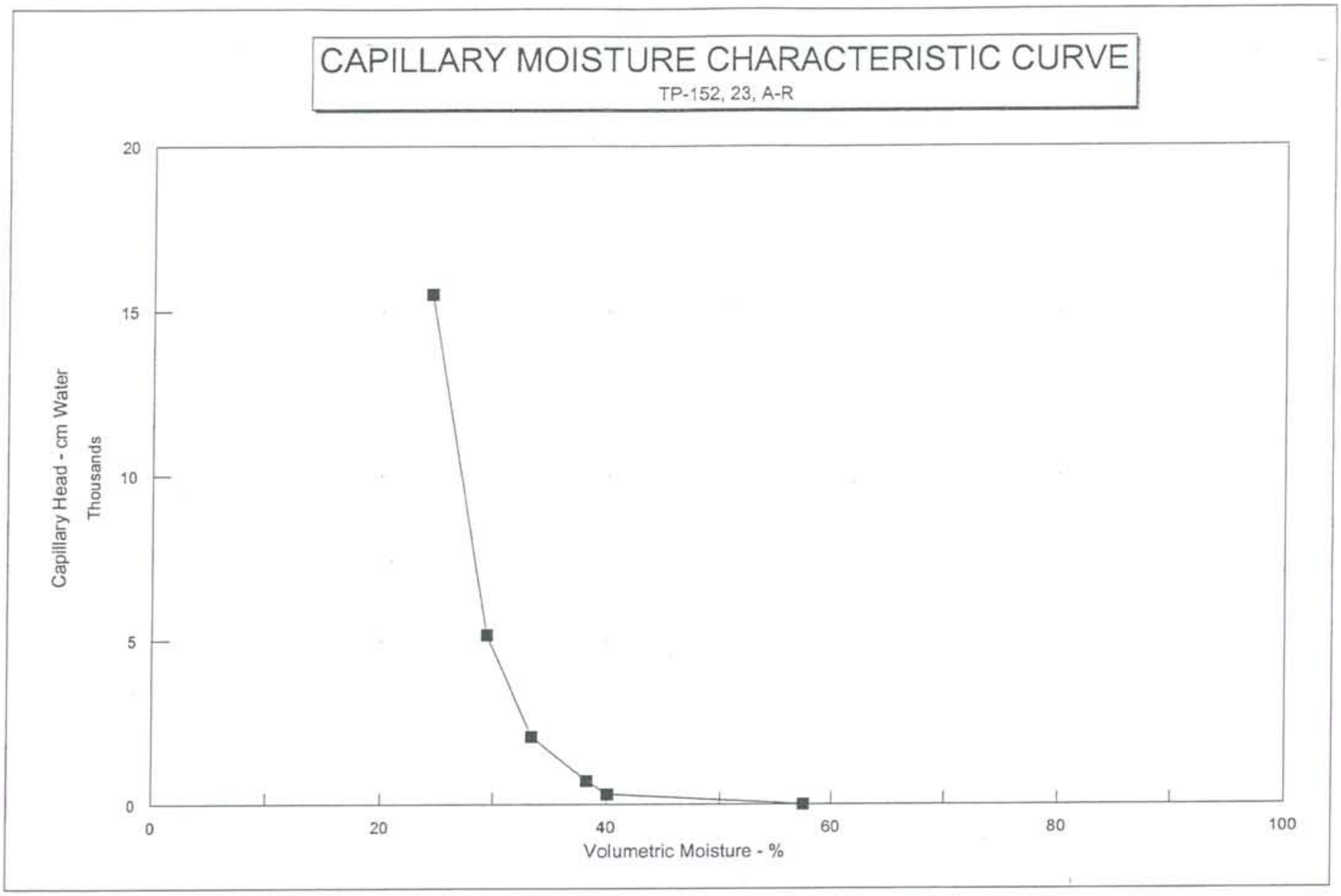
CAPILLARY MOISTURE CHARACTERISTIC CURVE

TP-152, 23, A

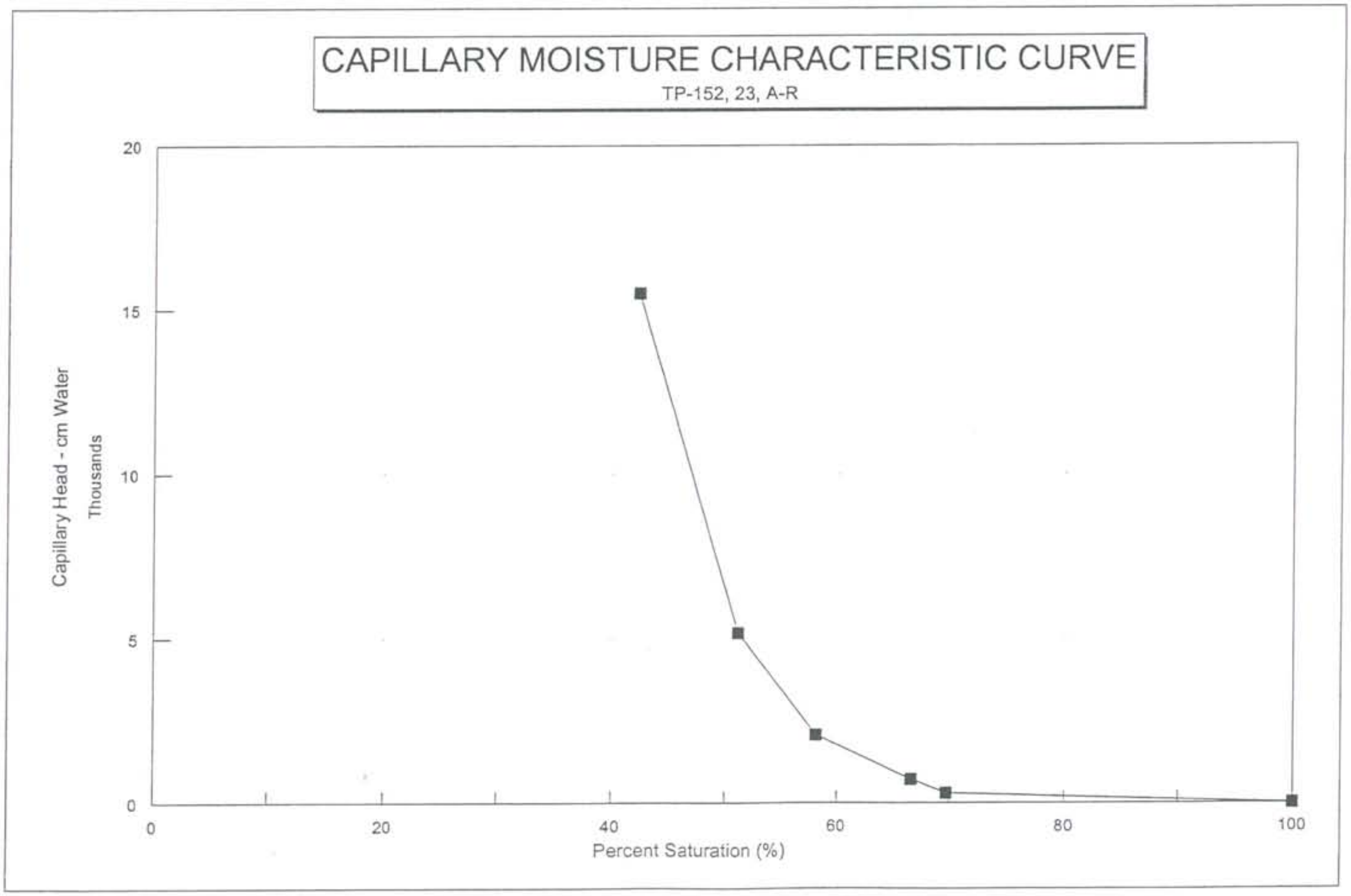


CAPILLARY MOISTURE CHARACTERISTIC CURVE

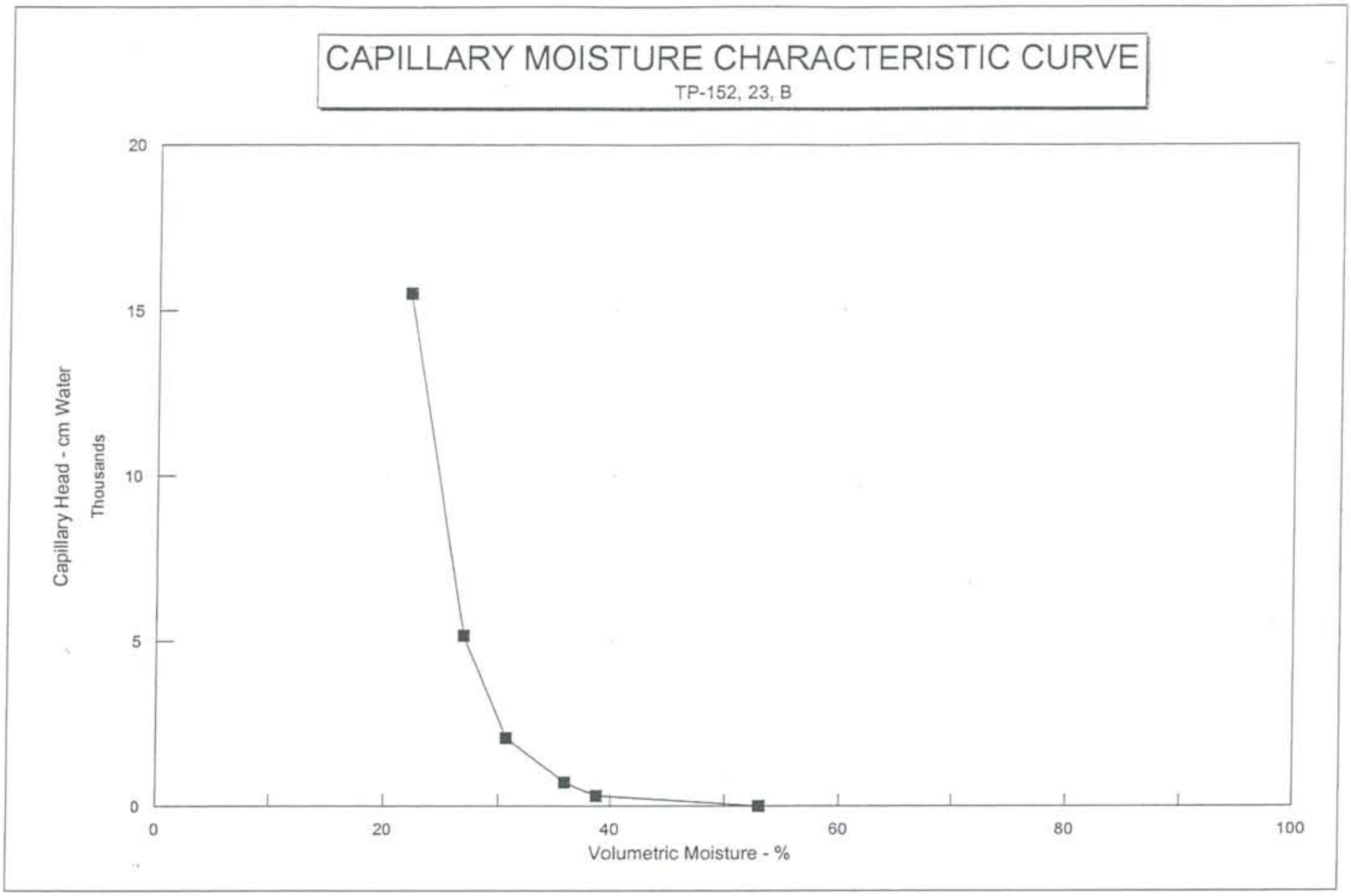
TP-152, 23, A


CAPILLARY MOISTURE CHARACTERISTIC CURVE

TP-152, 23, A-R

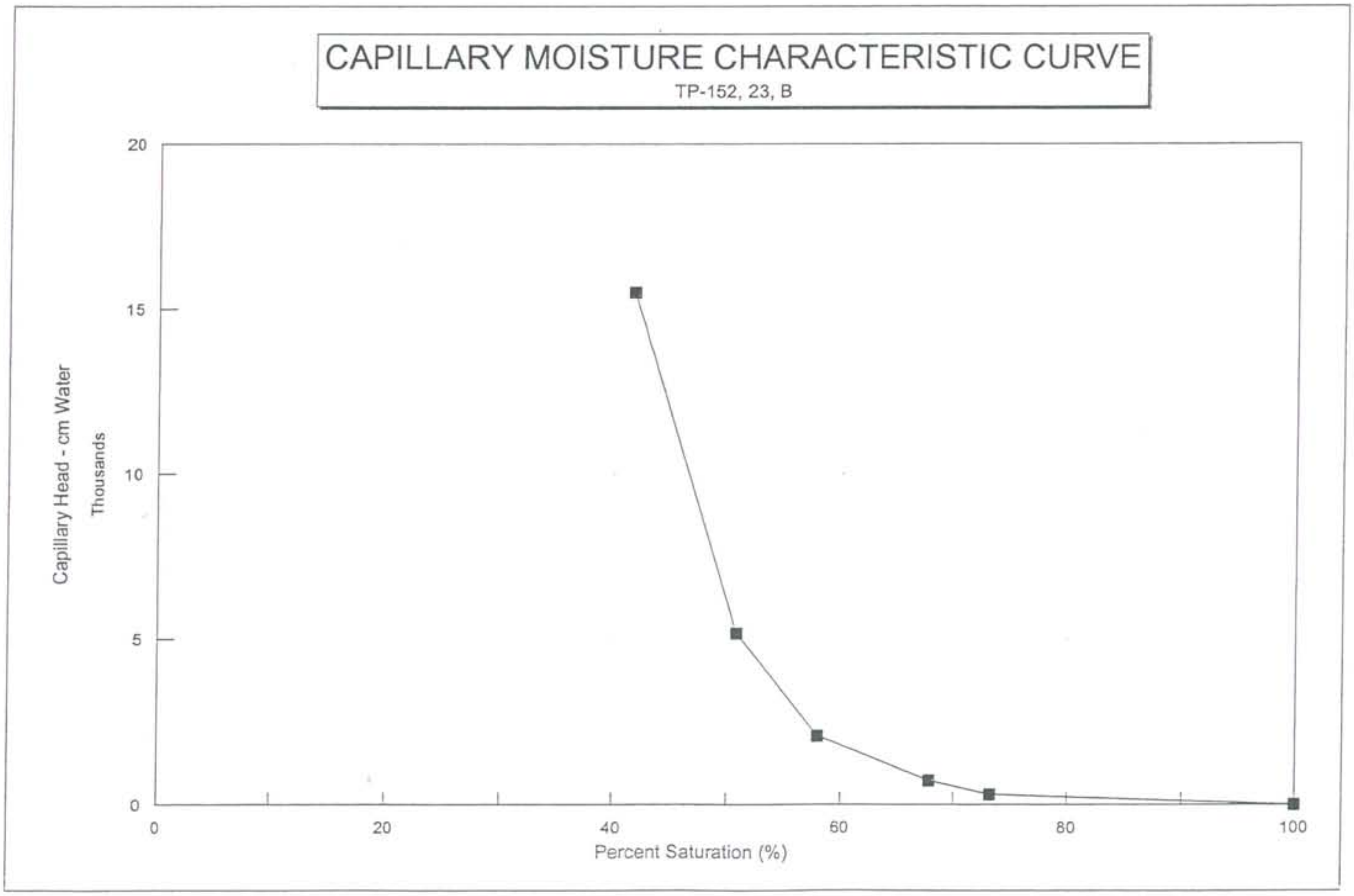

CAPILLARY MOISTURE CHARACTERISTIC CURVE

TP-152, 23, A-R



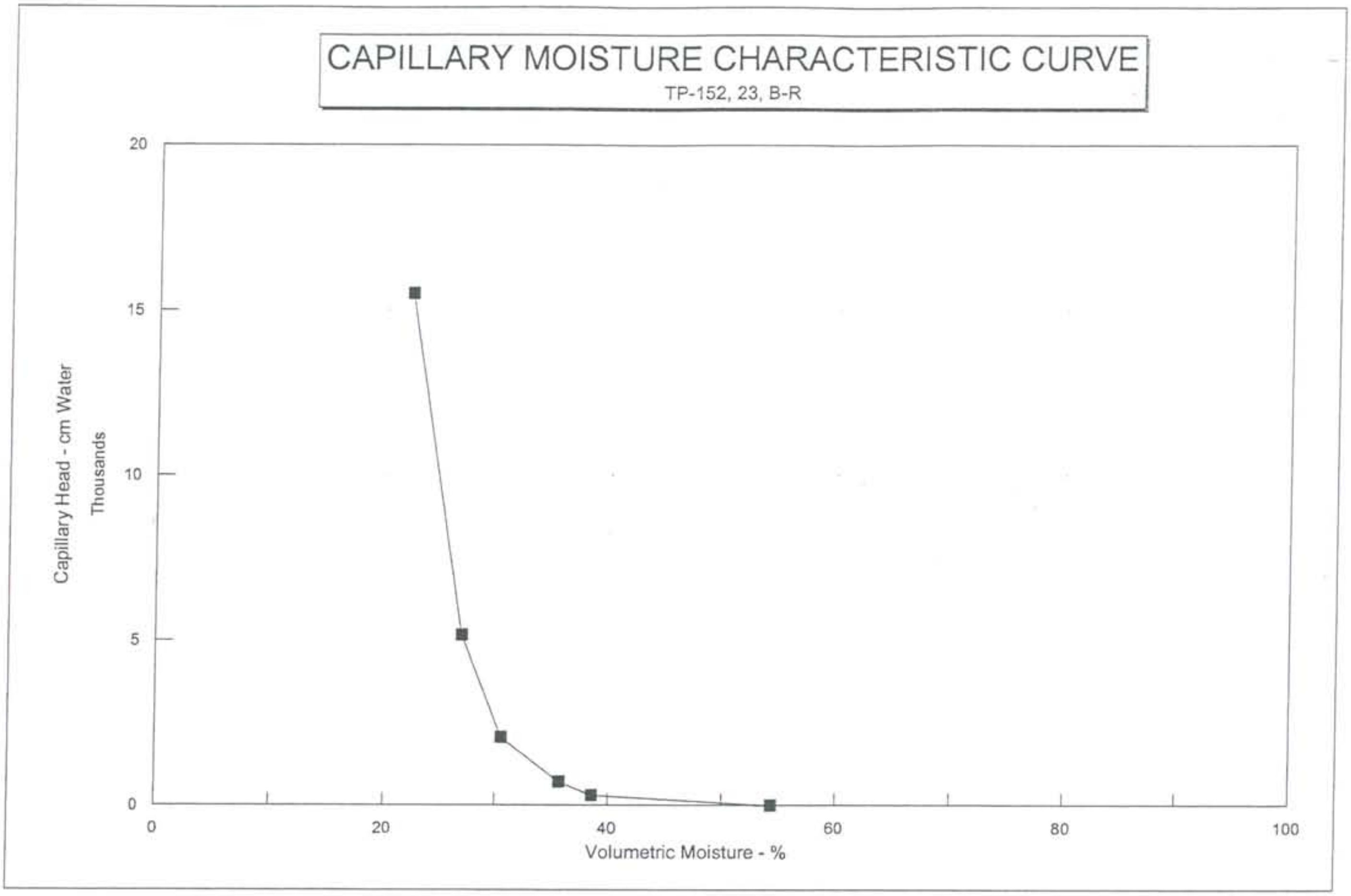
CAPILLARY MOISTURE CHARACTERISTIC CURVE

TP-152, 23, B

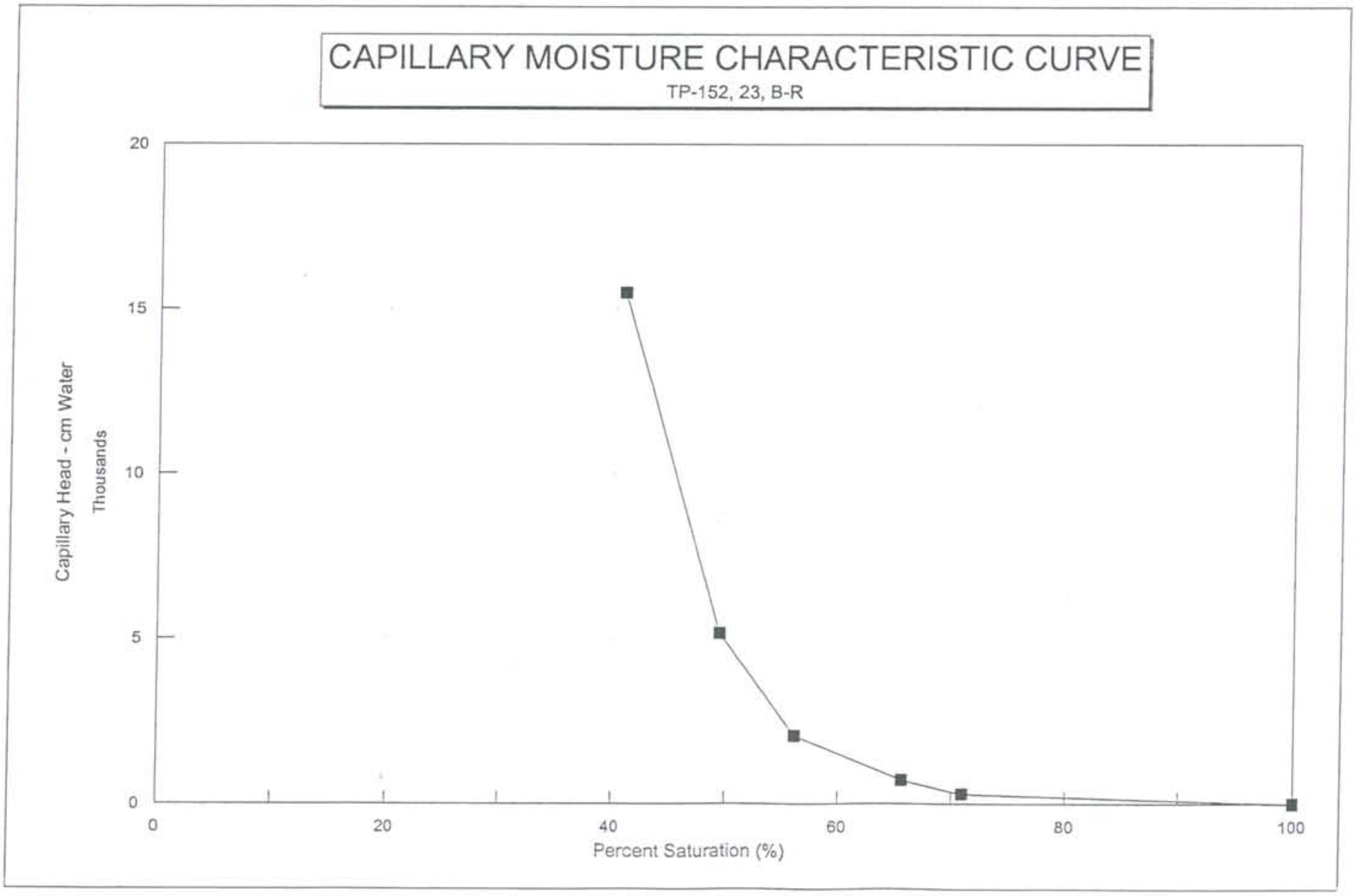


CAPILLARY MOISTURE CHARACTERISTIC CURVE

TP-152, 23, B



CAPILLARY MOISTURE CHARACTERISTIC CURVE
TP-152, 23, B-R



CAPILLARY MOISTURE CHARACTERISTIC CURVE
TP-152, 23, B-R

CAPILLARY MOISTURE RETENTION TEST
ASTM D 3152

CLIENT Geotechnical Engineering Group

JOB NO. 2669-01

SAMPLE DATE
SOIL DESCR.
LOCATION

TEST STARTED 02-24-06 DPM
TEST FINISHED 04-07-06 DPM

MASS DATA										
Sample Description	Ring Mass g	As Rec. Mass g	Sat. Mass g	0.3 Bar Mass g	0.7 Bar Mass g	2 Bar Mass g	5 Bar Mass g	15 Bar Mass g	Dry Mass Filter, Ring, & Dish (g)	Dish Wt. g
Filter Mass g		0.204	0.728	0.405	0.345	0.328	0.314	0.301		
TP-155, 5, A	10.642	48.100	51.977	49.974	48.982	48.390	48.009	47.520	46.601	2.370
TP-155, 5, A-R	10.397	47.866	52.400	50.023	49.169	48.191	47.802	47.253	46.361	2.310
TP-155, 5, B	10.649	45.292	49.569	46.177	45.578	45.142	44.804	44.324	43.904	2.362
TP-155, 5, B-R	10.652	45.317	49.469	46.237	45.617	45.176	44.816	44.335	43.906	2.345
TP-156, 22, A	10.581	50.411	54.493	52.361	51.833	51.368	50.796	50.111	48.438	2.363
TP-156, 22, A-R	10.598	50.395	54.680	52.345	51.880	51.351	50.755	50.070	48.411	2.370
TP-156, 22, B	10.723	47.537	51.905	48.892	48.422	47.895	47.390	46.693	45.926	2.359
TP-156, 22, B-R	10.625	47.451	52.044	48.781	48.309	47.809	47.284	46.562	45.732	2.364

Data Entered By: SR Date: 04/13/2006
Data Checked By: DPM Date: 04/13/06
Filename: GEKO1555

CAPILLARY MOISTURE RETENTION TEST
ASTM D 3152

CLIENT Geotechnical Engineering Group

JOB NO. 2669-01

SAMPLE DATE
SOIL DESCR.
LOCATION

TEST STARTED 02-24-06 DPM
TEST FINISHED 04-07-06 DPM

Moisture Content Data: % D.M. = Moisture Content By Dry Mass; % Vol. = Moisture Content By Volume

Sample Description	Sample Conditions						0.3 Bar			0.7 Bar		
	Dry Mass (g)	Unit Wt. (g/cc)	Sat. Mass (g)	Total H2O (g)	Sat. M.C. % D.M.	Sat. M.C. % Vol.	Retained H2O	% DM	% Vol.	Retained H2O	% DM	% Vol.
TP-155, 5, A	33.385	1.771	40.607	7.222	21.63	38.31	5.542	16.60	29.40	4.610	13.81	24.45
TP-155, 5, A-R	33.450	1.774	41.275	7.825	23.39	41.51	5.771	17.25	30.61	4.977	14.88	26.40
TP-155, 5, B	30.689	1.628	38.192	7.503	24.45	39.80	4.434	14.45	23.52	3.895	12.69	20.66
TP-155, 5, B-R	30.705	1.629	38.089	7.384	24.05	39.17	4.475	14.57	23.74	3.915	12.75	20.77
TP-156, 22, A	35.290	1.872	43.184	7.894	22.37	41.87	6.085	17.24	32.28	5.617	15.92	29.80
TP-156, 22, A-R	35.239	1.869	43.354	8.115	23.03	43.05	6.103	17.32	32.37	5.698	16.17	30.22
TP-156, 22, B	32.640	1.731	40.454	7.814	23.94	41.45	5.124	15.70	27.18	4.714	14.44	25.01
TP-156, 22, B-R	32.539	1.726	40.691	8.152	25.05	43.24	5.212	16.02	27.65	4.800	14.75	25.46

Data Entered By: SR Date: 04/13/2006
Data Checked By: DPM Date: 04/18/06
Filename: GEKO1555

ADVANCED TERRA TESTING, INC.

CAPILLARY MOISTURE RETENTION TEST
ASTM D 3152

CLIENT Geotechnical Engineering Group

JOB NO. 2669-01

SAMPLE DATE
SOIL DESCR.
LOCATION

TEST STARTED 02-24-06 DPM
TEST FINISHED 04-07-06 DPM

Moisture Content Data: % D.M. = Moisture Content By Dry Mass; % Vol. = Moisture Content By Volume

Sample Description	**2 Bar**			**5 Bar**			**15 Bar**		
	Retained H2O	% DM	% Vol.	Retained H2O	% DM	% Vol.	Retained H2O	% DM	% Vol.
TP-155, 5, A	4.035	12.09	21.40	3.668	10.99	19.46	3.192	9.56	16.93
TP-155, 5, A-R	4.016	12.01	21.30	3.641	10.88	19.31	3.105	9.28	16.47
TP-155, 5, B	3.476	11.33	18.44	3.152	10.27	16.72	2.685	8.75	14.24
TP-155, 5, B-R	3.491	11.37	18.52	3.145	10.24	16.68	2.677	8.72	14.20
TP-156, 22, A	5.169	14.65	27.42	4.611	13.07	24.46	3.939	11.16	20.89
TP-156, 22, A-R	5.186	14.72	27.51	4.604	13.07	24.42	3.932	11.16	20.86
TP-156, 22, B	4.204	12.88	22.30	3.713	11.38	19.70	3.029	9.28	16.07
TP-156, 22, B-R	4.317	13.27	22.90	3.806	11.70	20.19	3.097	9.52	16.43

Data Entered By: SR Date: 04/13/2006
Data Checked By: DPM Date: 04/13/06
Filename: GEKO1555

CAPILLARY MOISTURE RETENTION TEST
ASTM D 3152

CLIENT Geotechnical Engineering Group

JOB NO. 2669-01

SAMPLE DATE
SOIL DESCR.
LOCATION

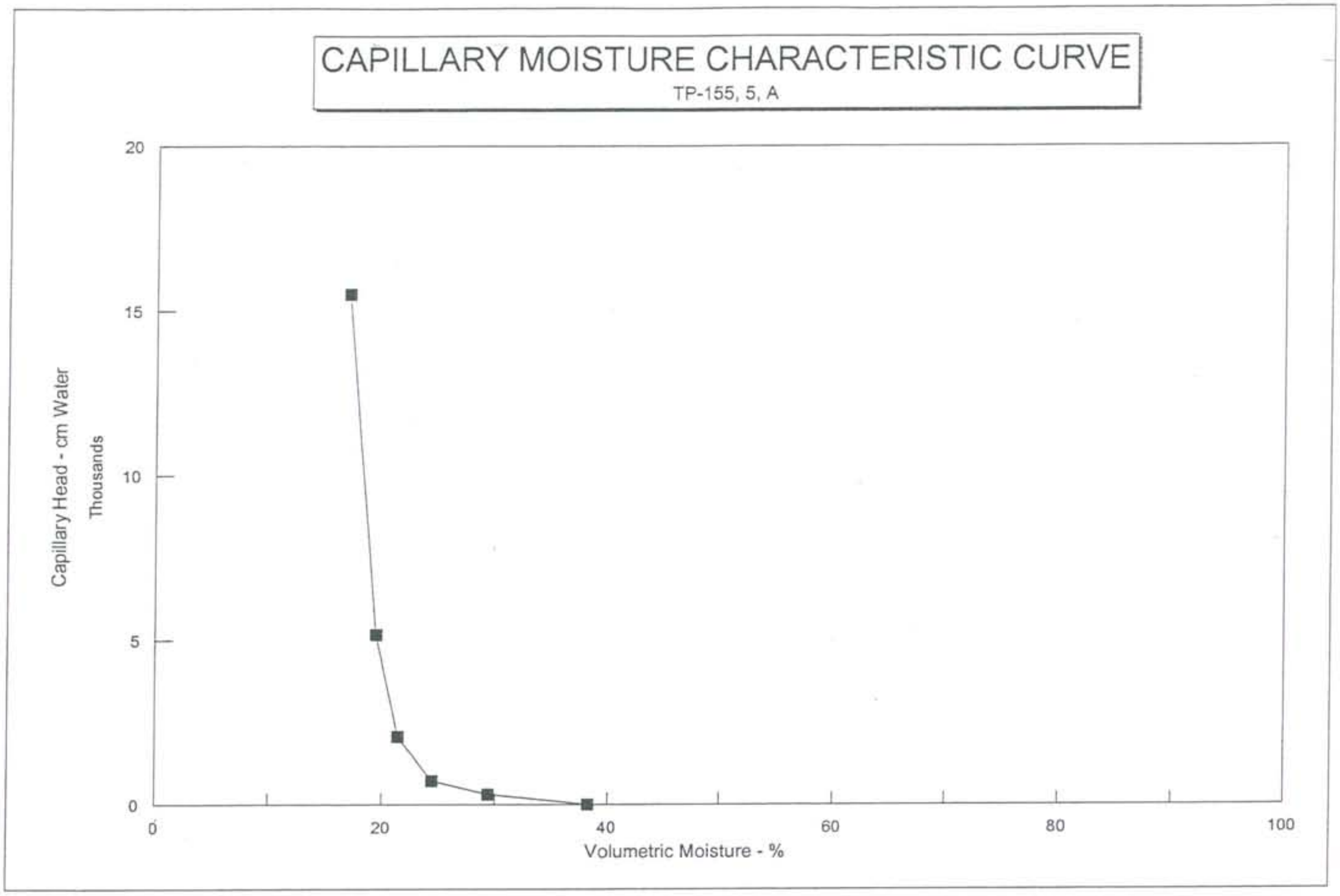
TEST STARTED 02-24-06 DPM
TEST FINISHED 04-07-06 DPM

	Vol. MC % Sat.	Vol. MC % 0.3 Bar	Vol. MC % 0.7 Bar	Vol. MC % 2 Bar	Vol. MC % 5 Bar	Vol. MC % 15 Bar
TP-155, 5, A	38.31	29.40	24.45	21.40	19.46	16.93
TP-155, 5, A-R	41.51	30.61	26.40	21.30	19.31	16.47
TP-155, 5, B	39.80	23.52	20.66	18.44	16.72	14.24
TP-155, 5, B-R	39.17	23.74	20.77	18.52	16.68	14.20
TP-156, 22, A	41.87	32.28	29.80	27.42	24.46	20.89
TP-156, 22, A-R	43.05	32.37	30.22	27.51	24.42	20.86
TP-156, 22, B	41.45	27.18	25.01	22.30	19.70	16.07
TP-156, 22, B-R	43.24	27.65	25.46	22.90	20.19	16.43

				% Saturation		
	Sat.	0.3 Bar	0.7 Bar	2 Bar	5 Bar	15 Bar
TP-155, 5, A	100.00	76.74	63.83	55.87	50.79	44.20
TP-155, 5, A-R	100.00	73.75	63.60	51.32	46.53	39.68
TP-155, 5, B	100.00	59.10	51.91	46.33	42.01	35.79
TP-155, 5, B-R	100.00	60.60	53.02	47.28	42.59	36.25
TP-156, 22, A	100.00	77.08	71.16	65.48	58.41	49.90
TP-156, 22, A-R	100.00	75.21	70.22	63.91	56.73	48.45
TP-156, 22, B	100.00	65.57	60.33	53.80	47.52	38.76
TP-156, 22, B-R	100.00	63.94	58.88	52.96	46.69	37.99

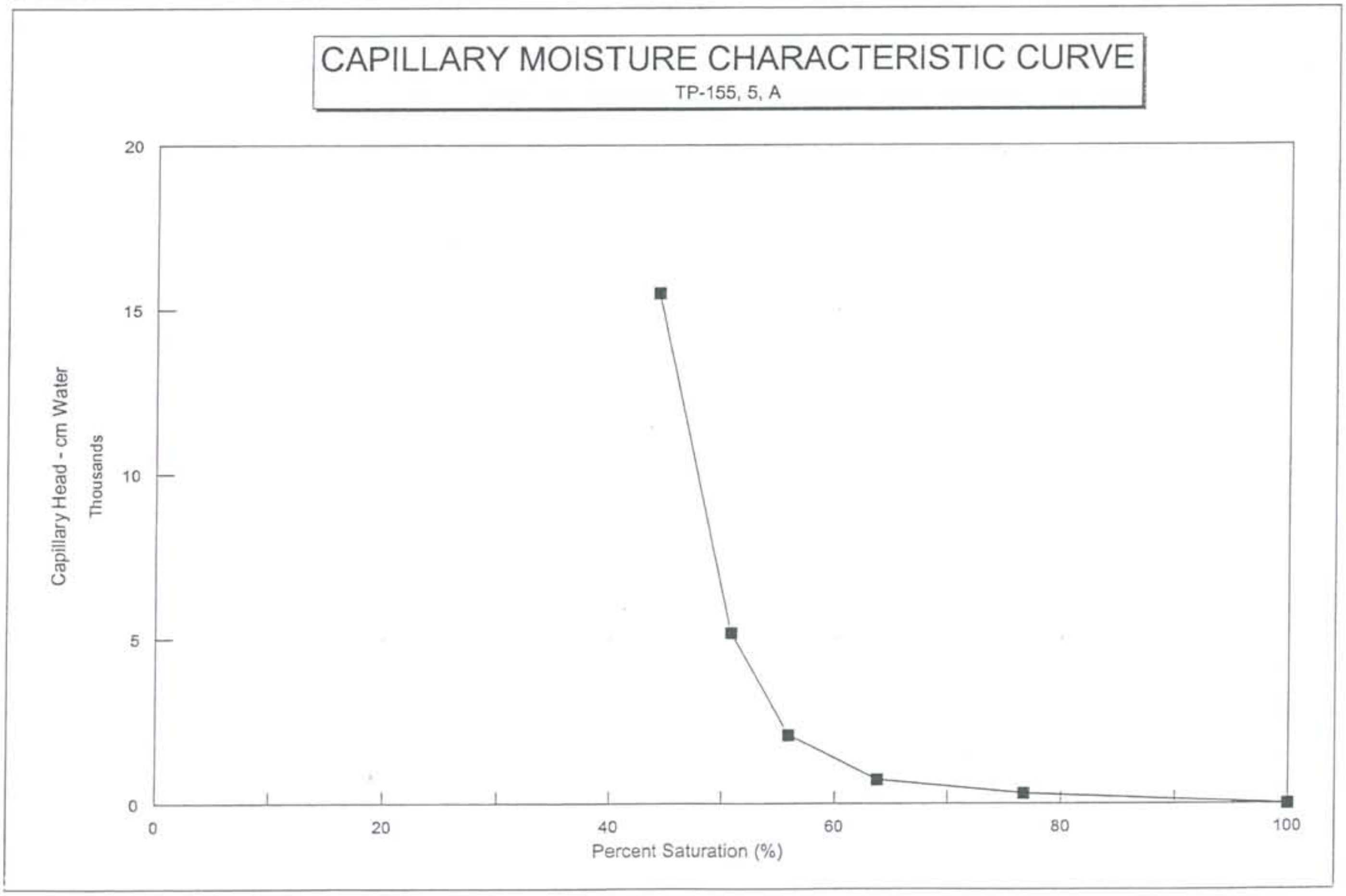
Data Entered By: SR Date: 04/13/2006
Data Checked By: DPM Date: 04/13/06
Filename: GEKO1555

ADVANCED TERRA TESTING, INC.



CAPILLARY MOISTURE CHARACTERISTIC CURVE

TP-155, 5, A

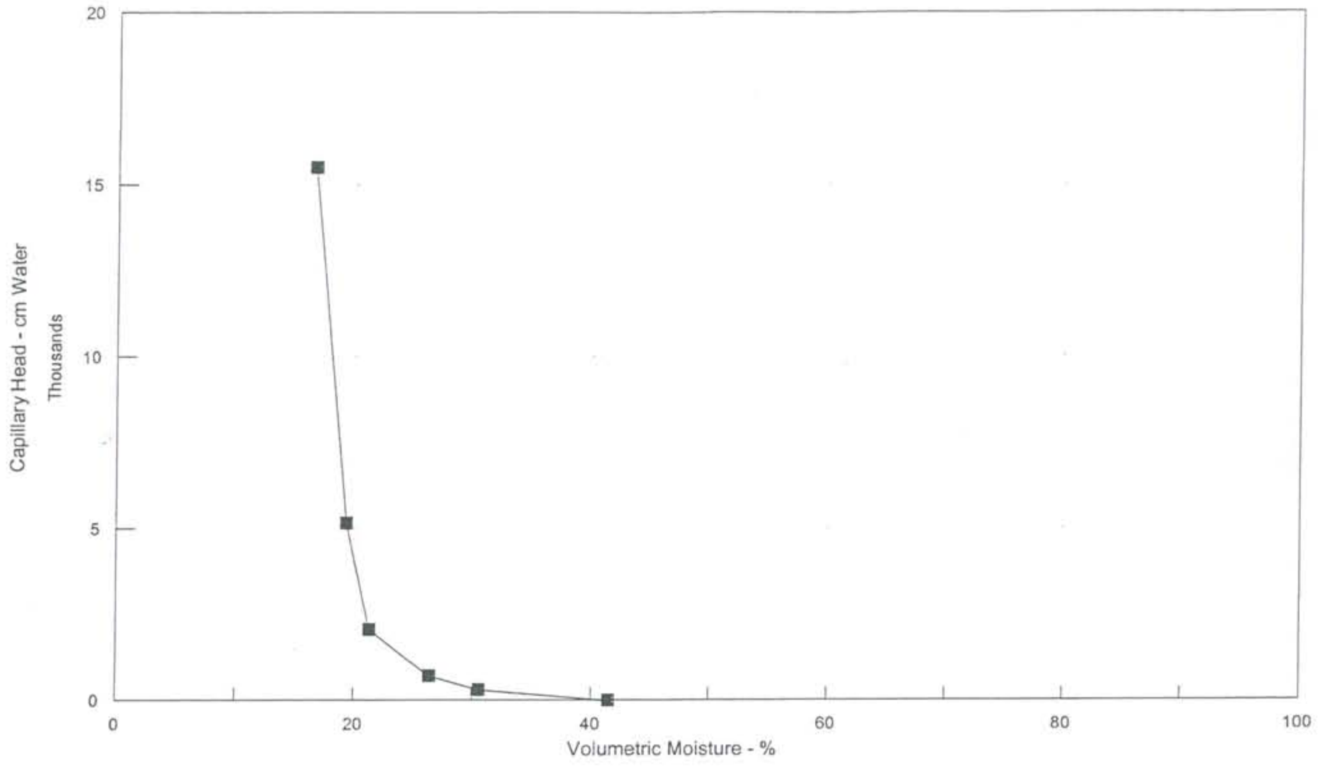


CAPILLARY MOISTURE CHARACTERISTIC CURVE

TP-155, 5, A

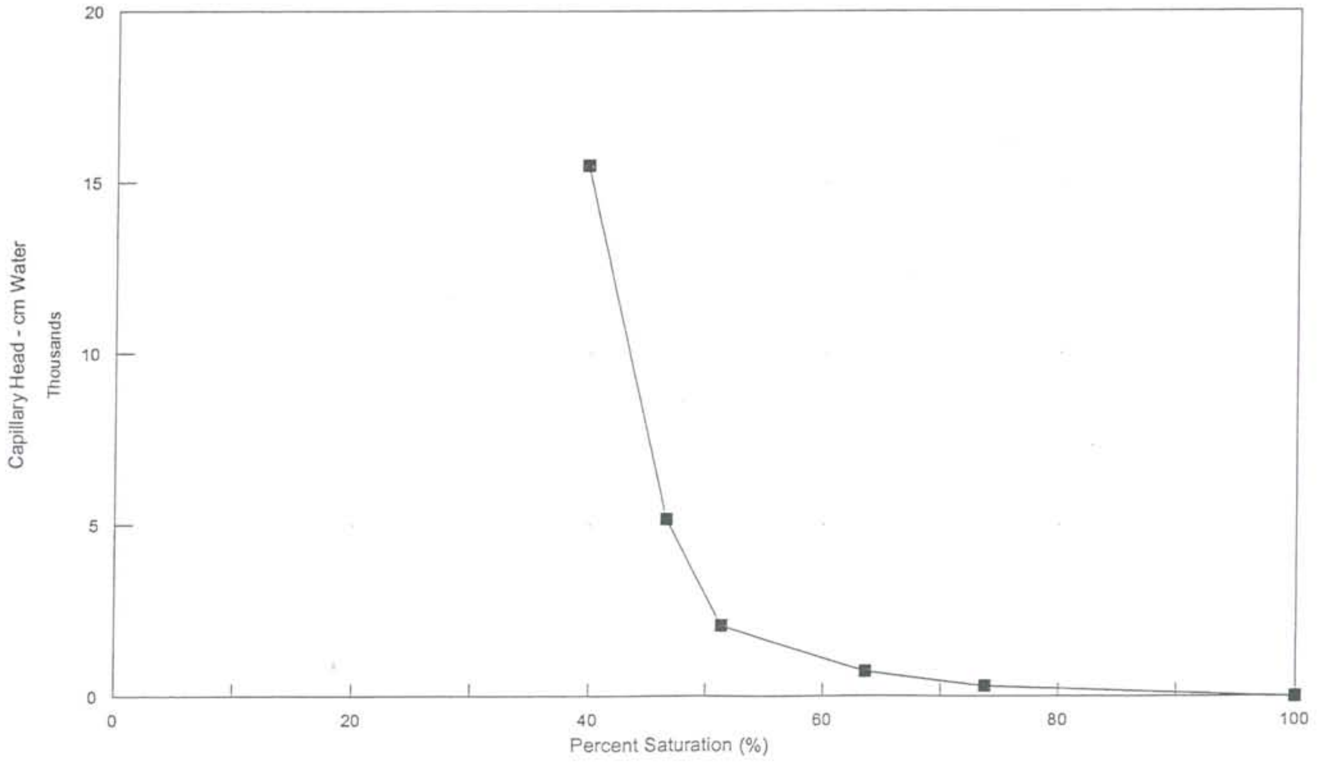
CAPILLARY MOISTURE CHARACTERISTIC CURVE

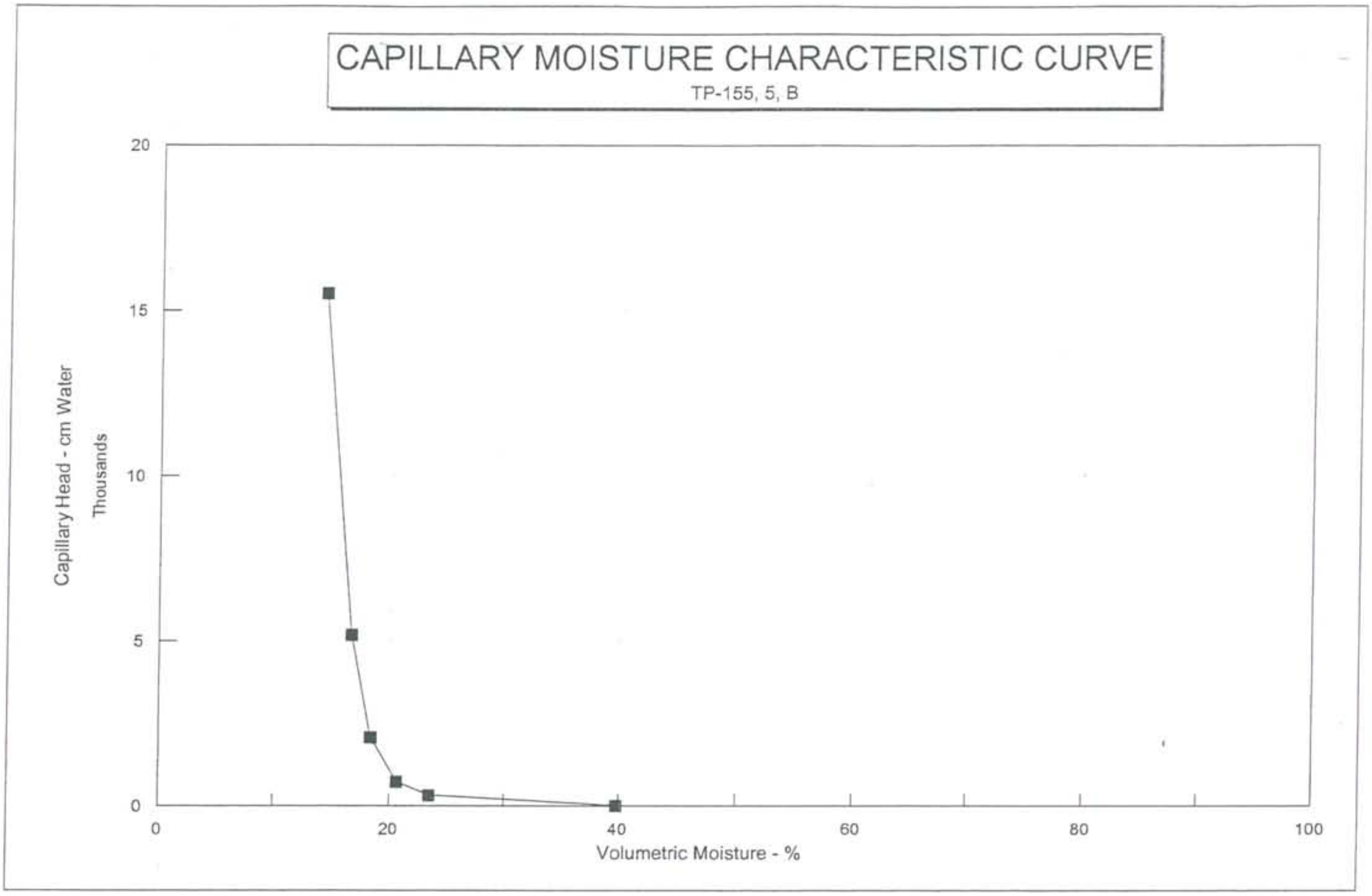
TP-155, 5, A-R

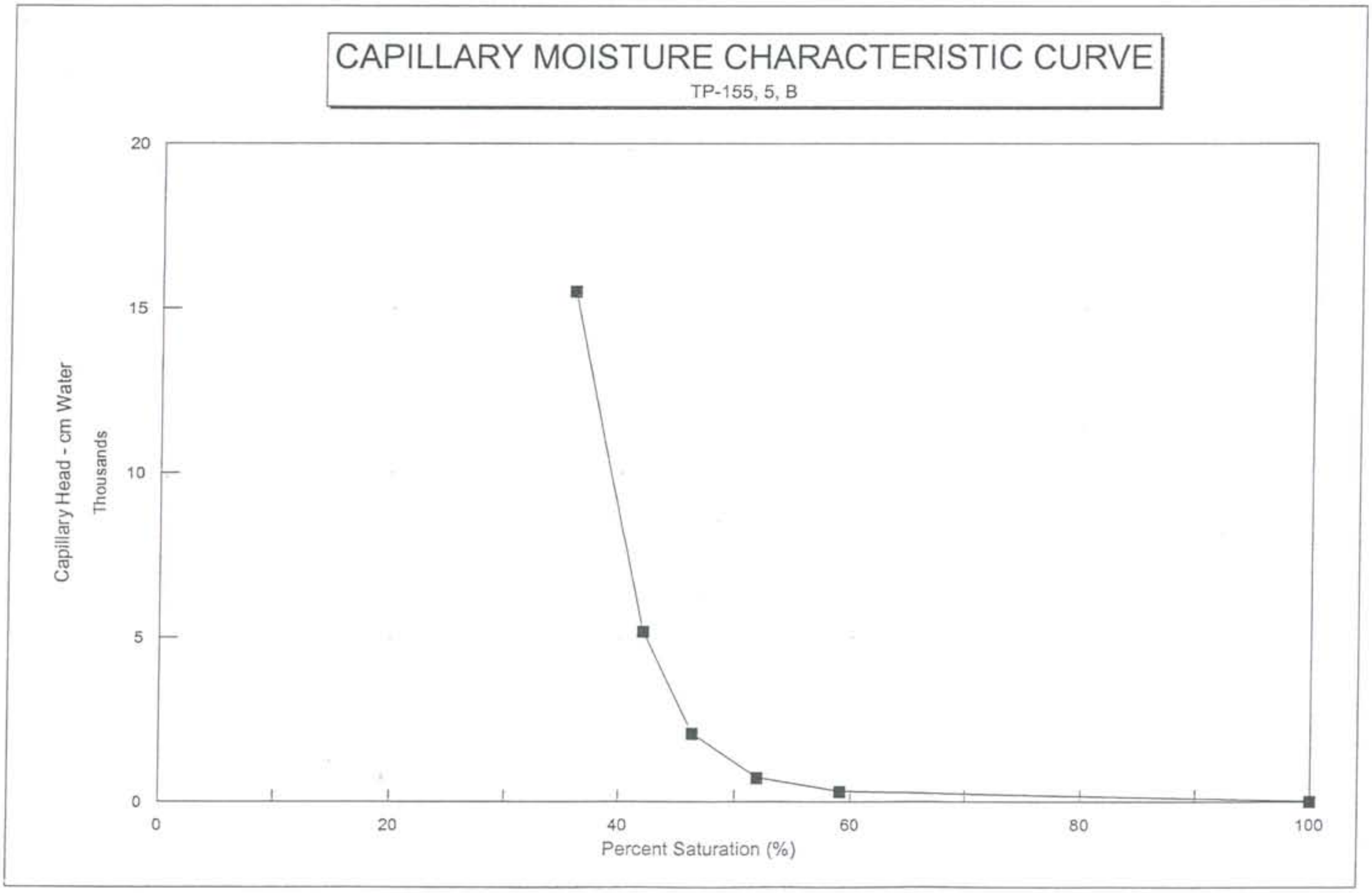


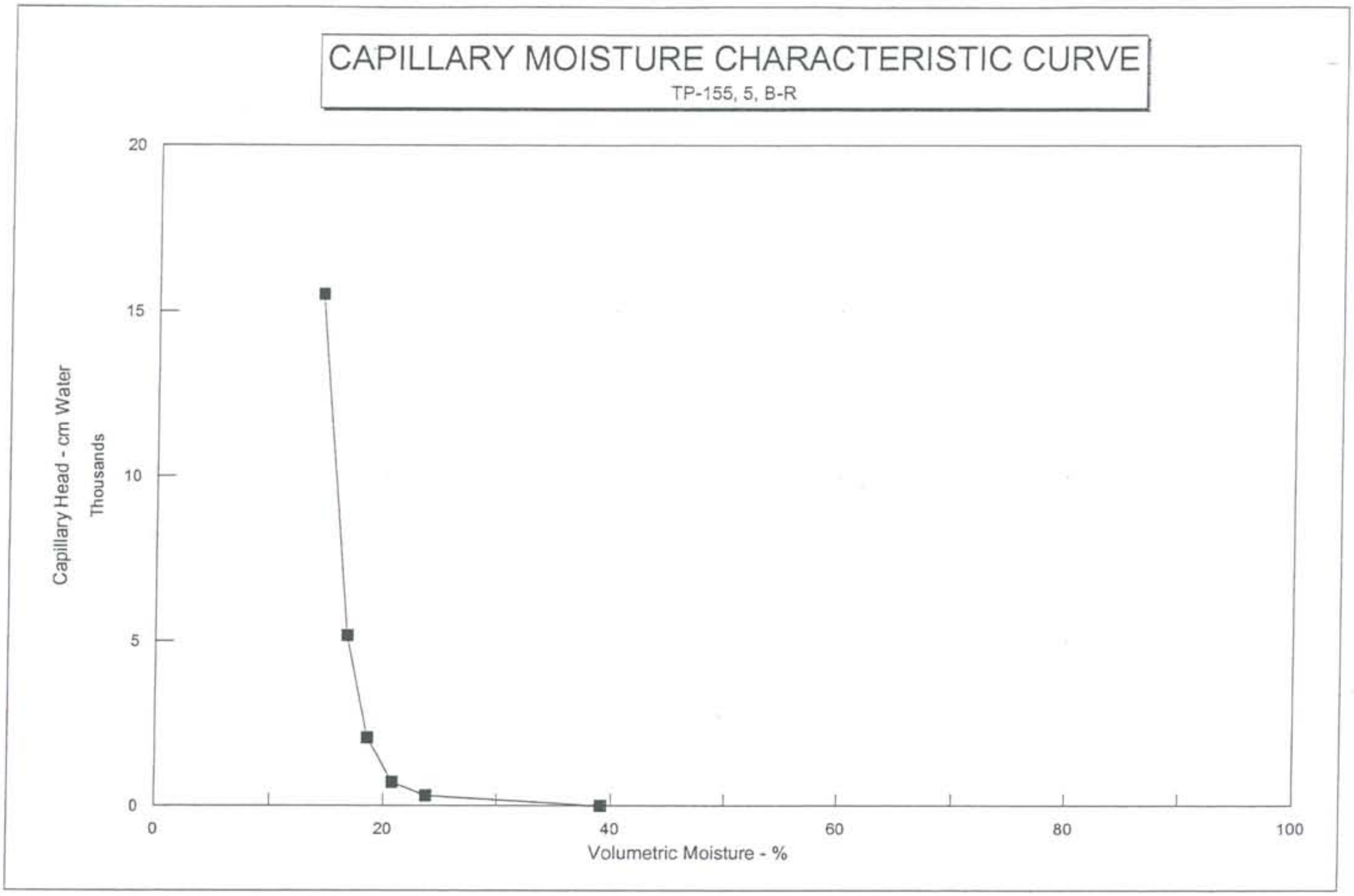
CAPILLARY MOISTURE CHARACTERISTIC CURVE

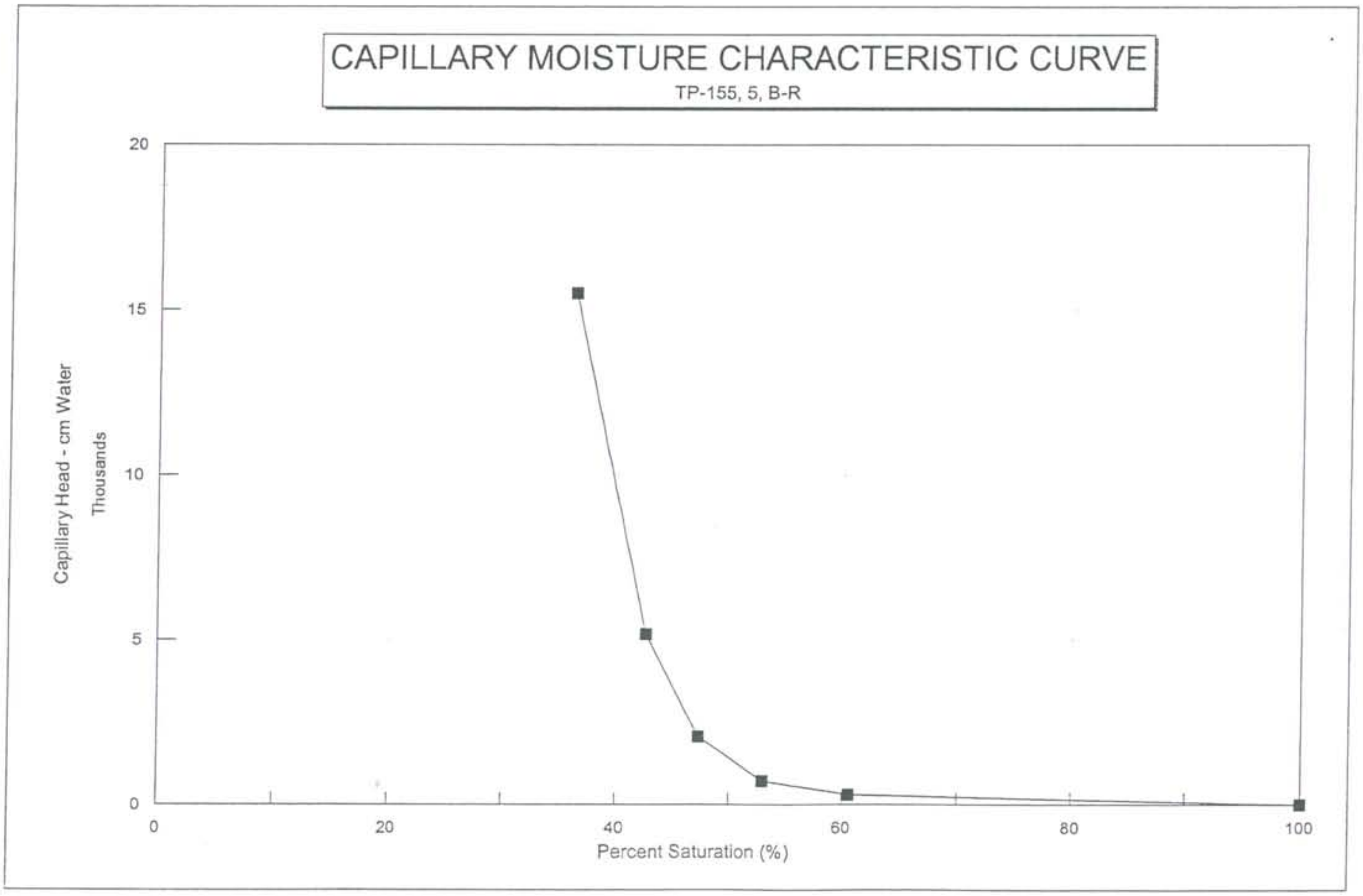
TP-155, 5, A-R

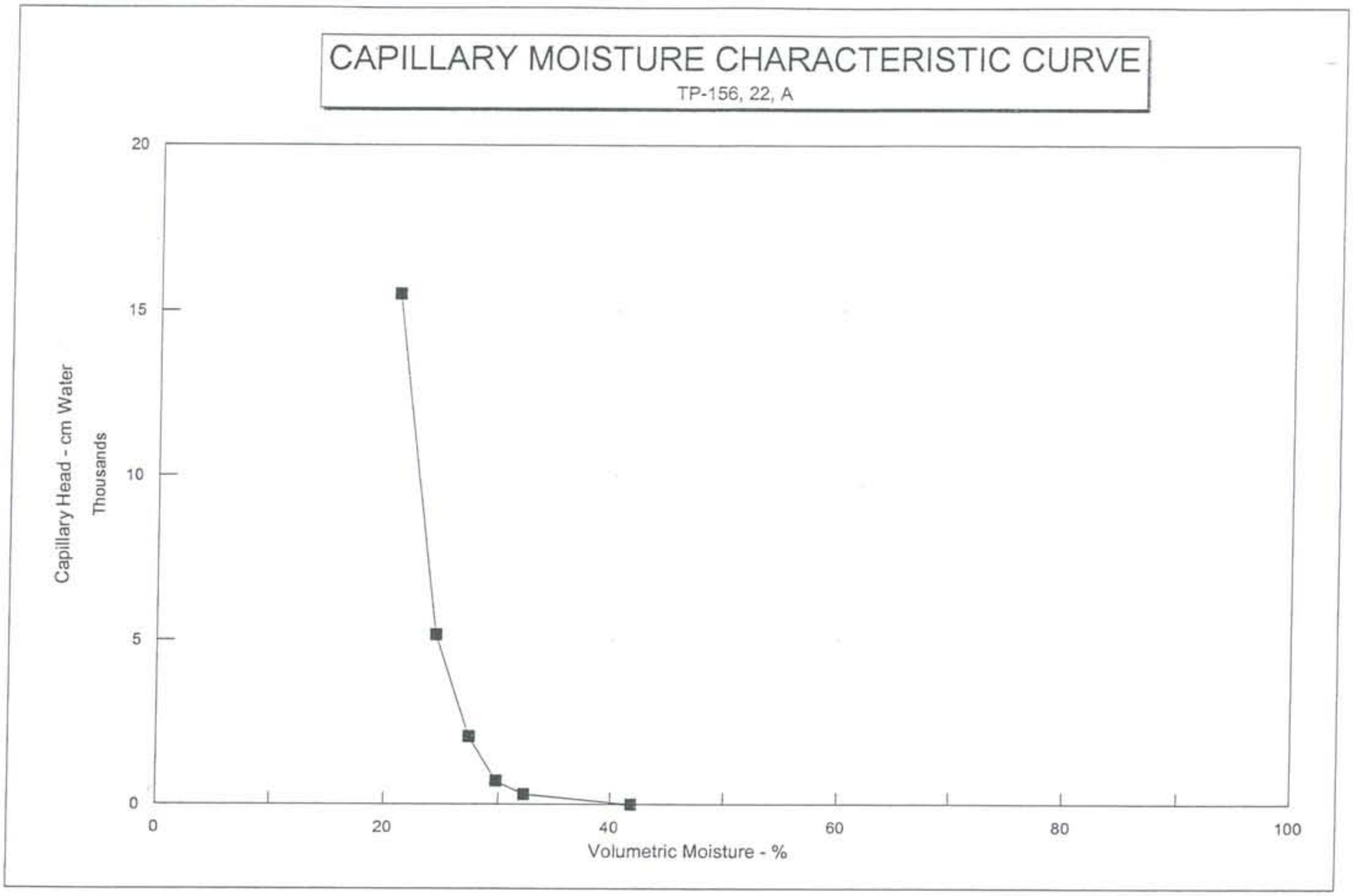



CAPILLARY MOISTURE CHARACTERISTIC CURVE
TP-155, 5, B
Capillary Head - cm Water
Thousands
20
15
10
5
0
0
20
40
60
80
100
Volumetric Moisture - %


CAPILLARY MOISTURE CHARACTERISTIC CURVE
TP-155, 5, B
Capillary Head - cm Water
Thousands
20
15
10
5
0
0
20
40
60
80
100
Percent Saturation (%)

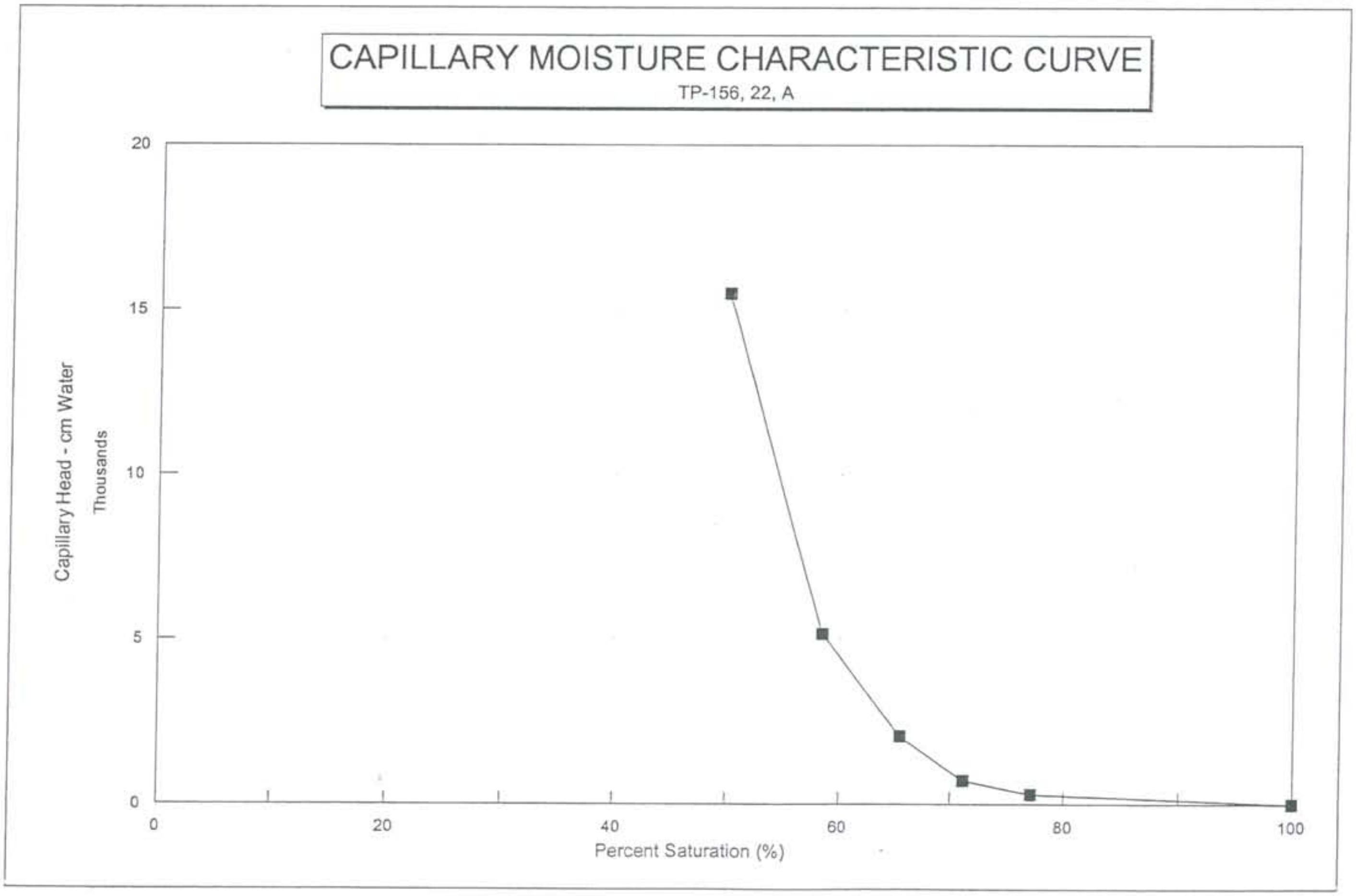

CAPILLARY MOISTURE CHARACTERISTIC CURVE
TP-155, 5, B-R
Capillary Head - cm Water
Thousands
20
15
10
5
0
0
20
40
60
80
100
Volumetric Moisture - %


CAPILLARY MOISTURE CHARACTERISTIC CURVE
TP-155, 5, B-R
Capillary Head - cm Water
Thousands
20
15
10
5
0
0
20
40
60
80
100
Percent Saturation (%)



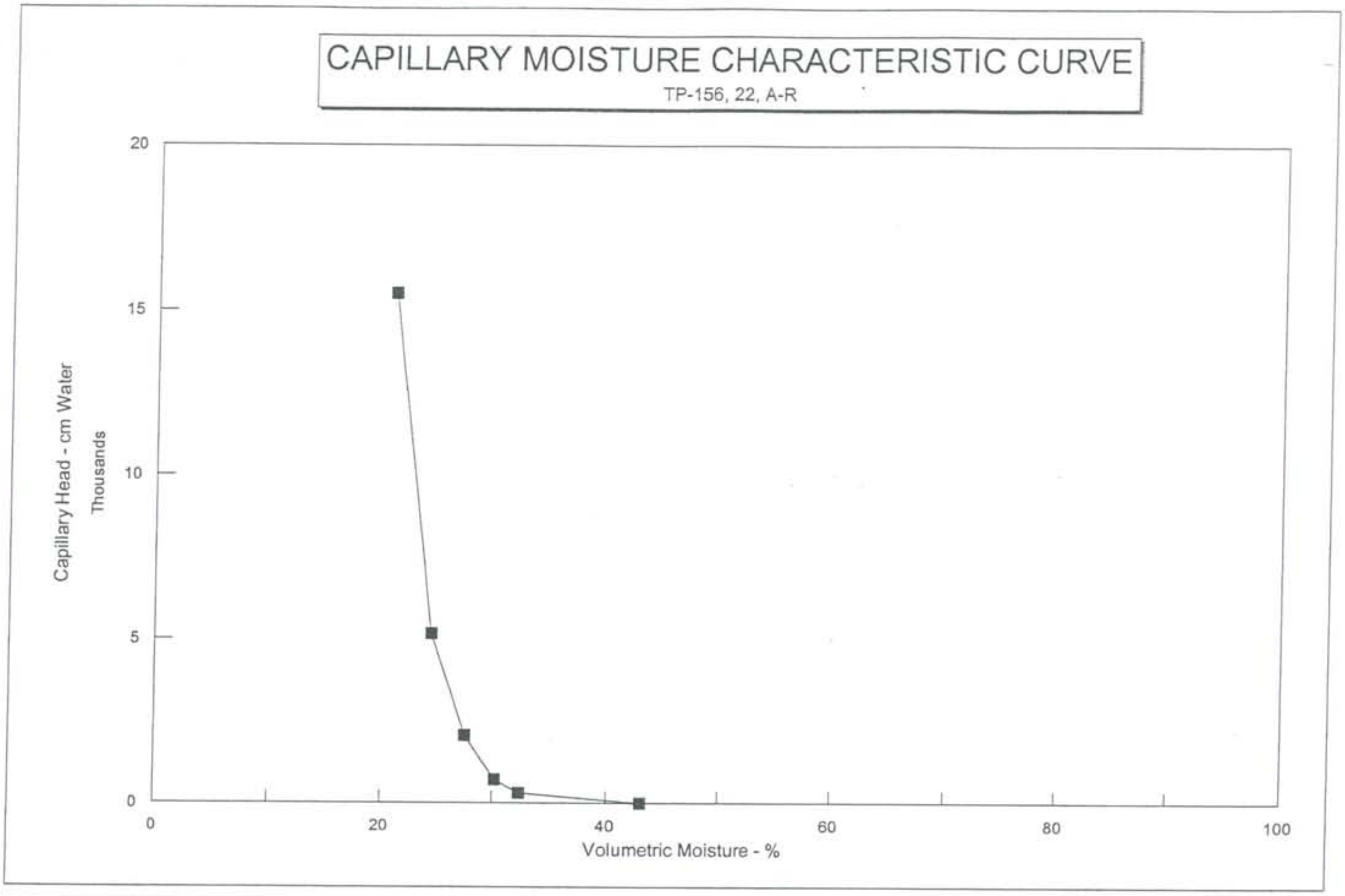
CAPILLARY MOISTURE CHARACTERISTIC CURVE

TP-156, 22, A



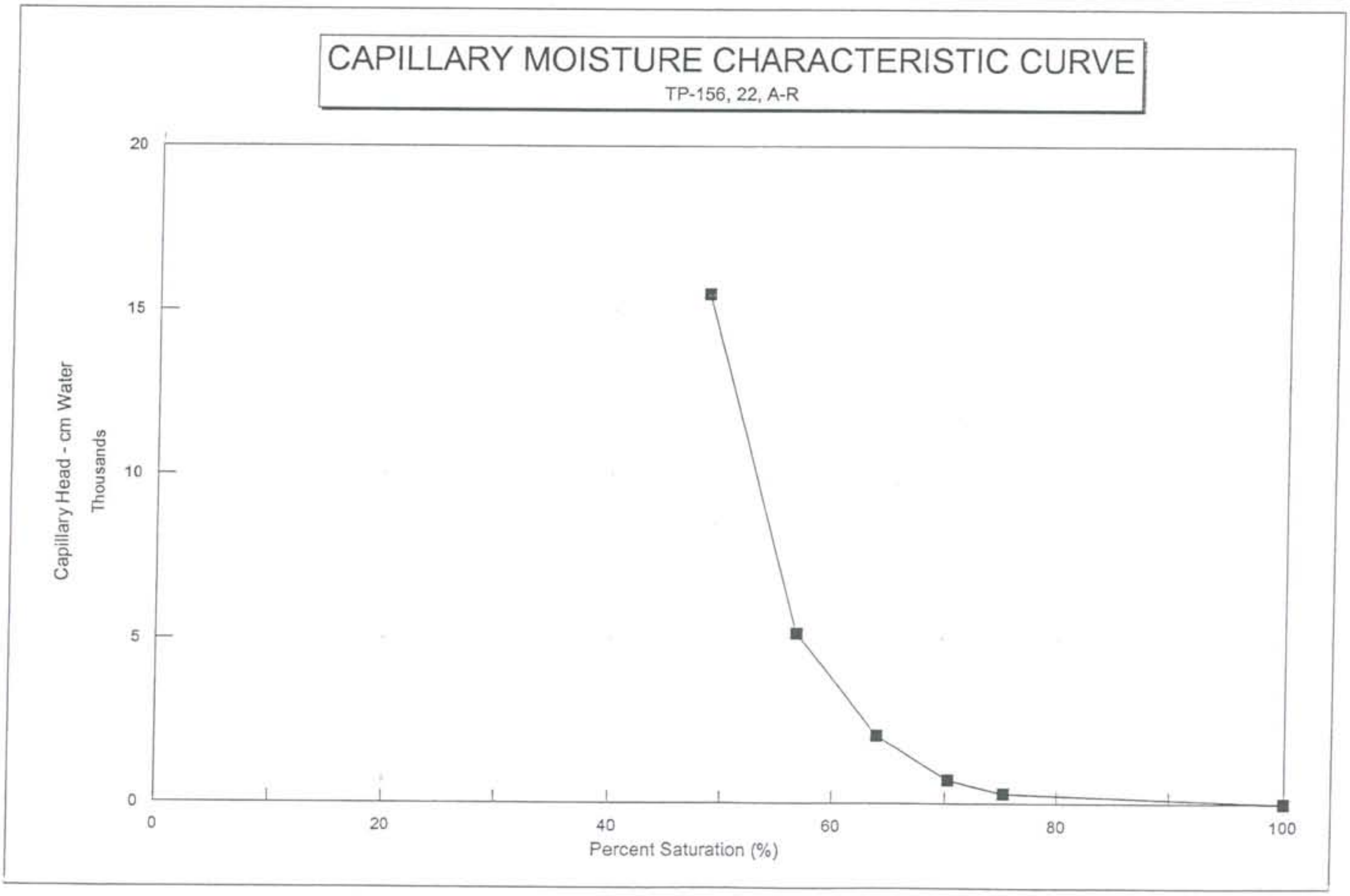
CAPILLARY MOISTURE CHARACTERISTIC CURVE

TP-156, 22, A



CAPILLARY MOISTURE CHARACTERISTIC CURVE

TP-156, 22, A-R

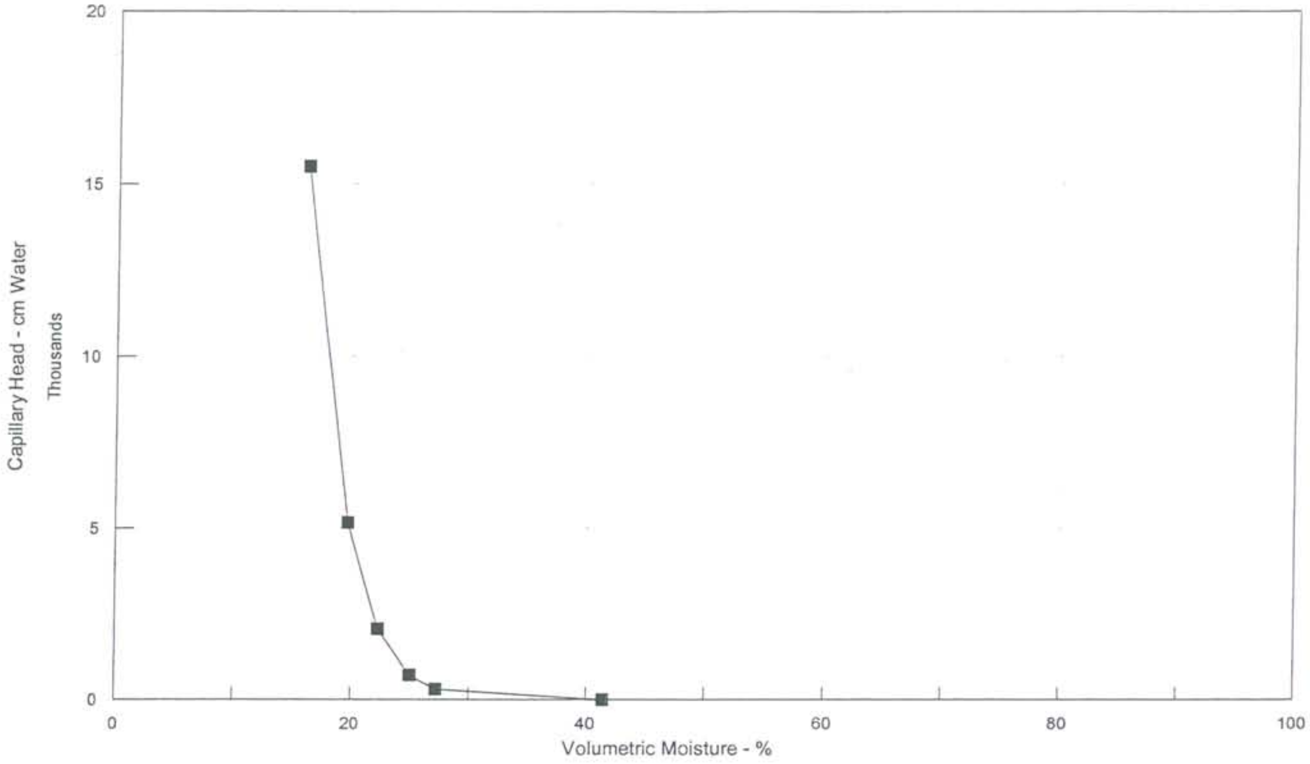


CAPILLARY MOISTURE CHARACTERISTIC CURVE

TP-156, 22, A-R

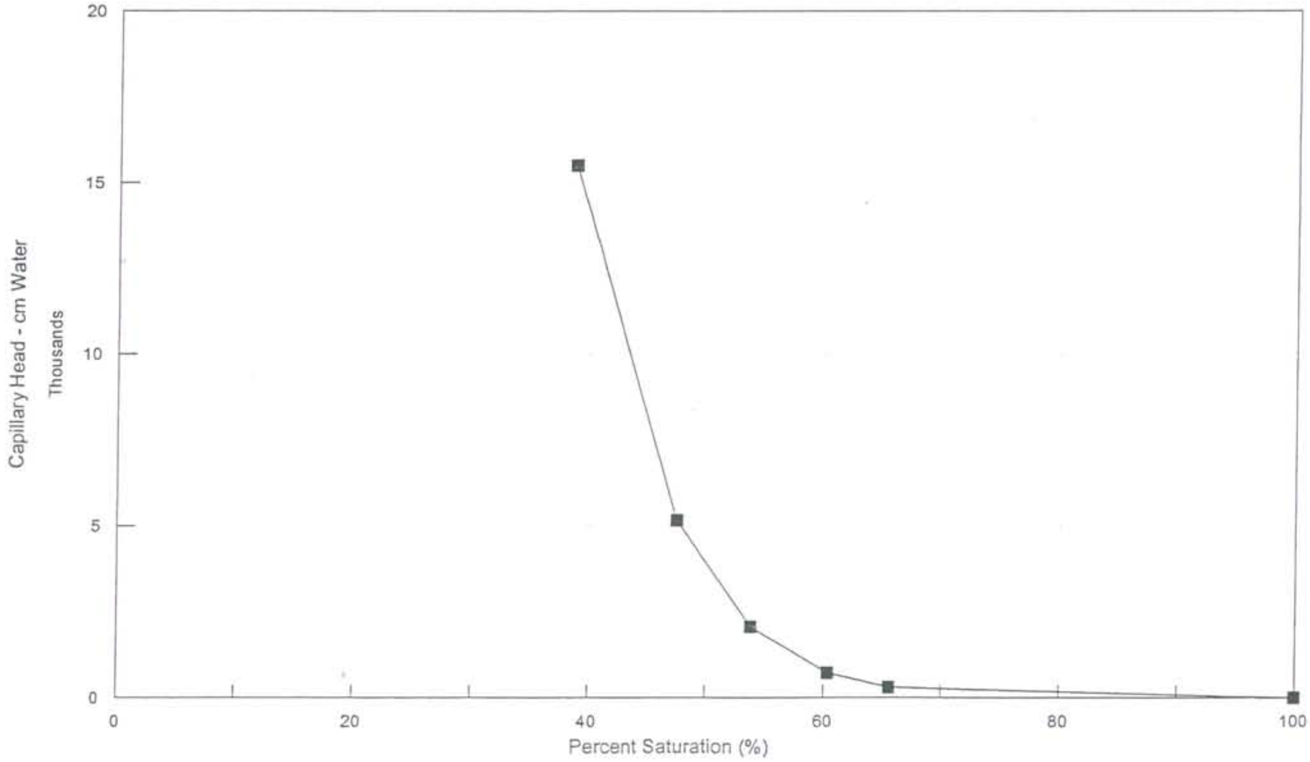
CAPILLARY MOISTURE CHARACTERISTIC CURVE

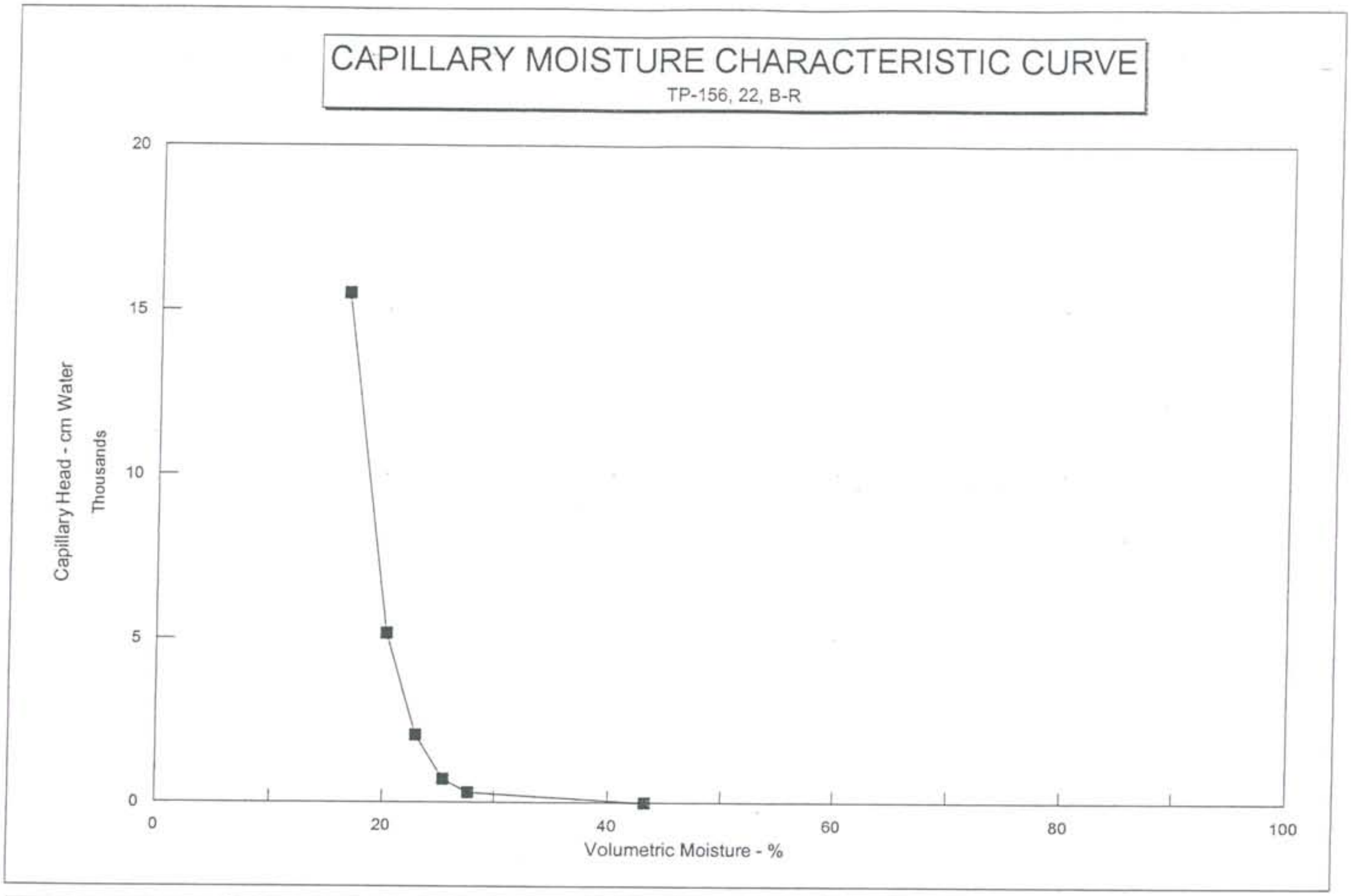
TP-156, 22, B

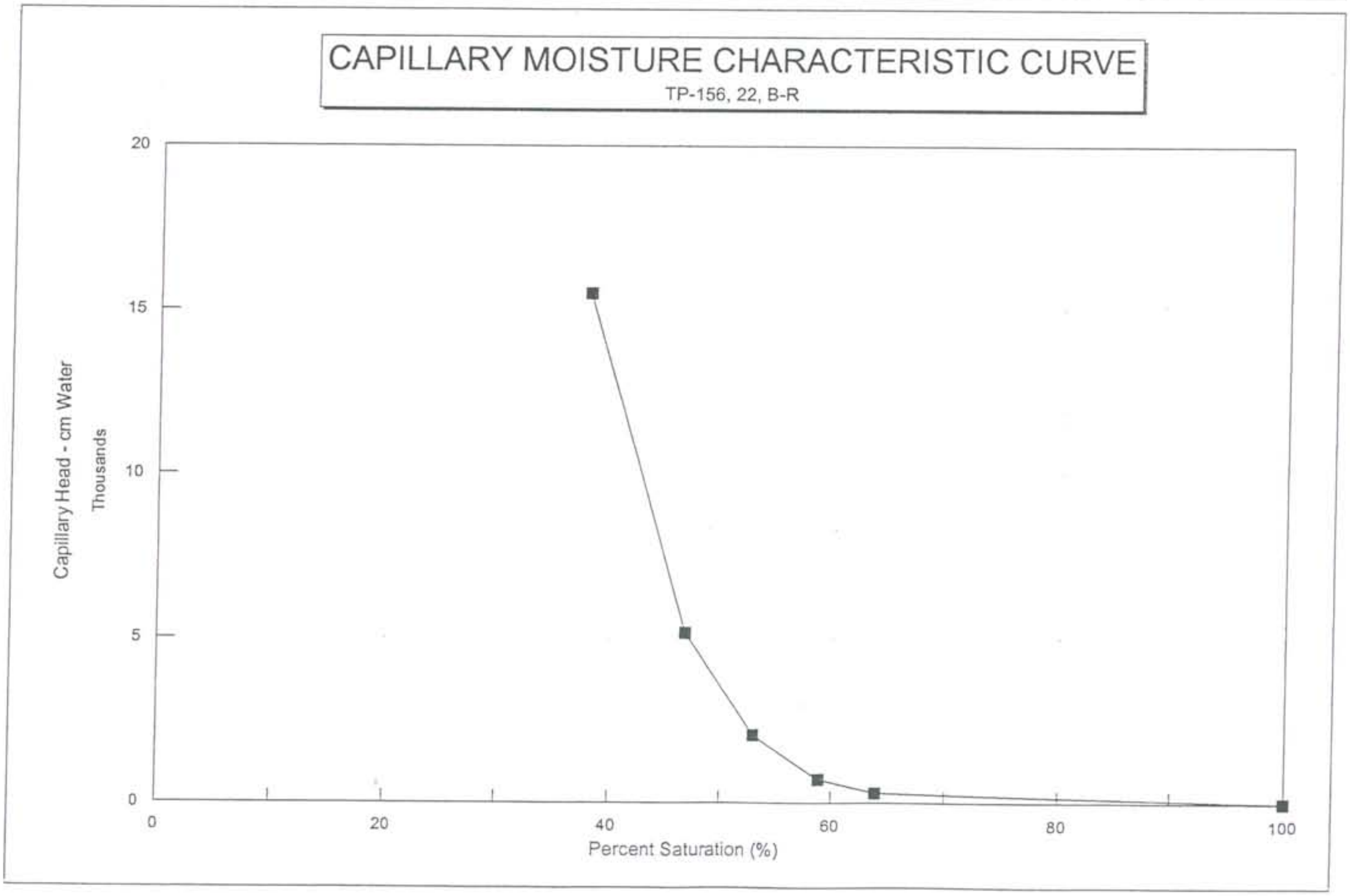


CAPILLARY MOISTURE CHARACTERISTIC CURVE

TP-156, 22, B




CAPILLARY MOISTURE CHARACTERISTIC CURVE
TP-156, 22, B-R
Capillary Head - cm Water
Thousands
20
15
10
5
0
0
20
40
60
80
100
Volumetric Moisture - %


CAPILLARY MOISTURE CHARACTERISTIC CURVE
TP-156, 22, B-R
Capillary Head - cm Water
Thousands
20
15
10
5
0
0
20
40
60
80
100
Percent Saturation (%)

Appendix B

Geotechnical Testing Results

June 15, 2006

**Geotechnical
Engineering
Group, Inc.**

JUN 6

June 15, 2006

**S.M Stoller Corporation
2597 B ¾ Road
Grand Junction, CO 81503**

**Attention: Mr. Rex Sellers
Senior Contract Adviser**

**Subject: Geotechnical Testing Services
Cresent Junction
Utah Disposal Site
GEG Job No. 2,165**

Dear Mr. Sellers,

As requested, Geotechnical Engineering Group, Inc. (GEG) has performed laboratory testing services for the subject project. The laboratory tests were performed on samples obtained by others. Laboratory tests performed were determined by S.M Stoller Corporation. Tests performed include hydraulic conductivity and phased triaxial, these are presented on Table I and Figs. 5 through 7.

Hydraulic Conductivity

Hydraulic conductivity was performed in general accordance with ASTM Test Method D5084. Cell, pore pressures and gradient for pore pressures were determined by S.M. Stoller.

Triaxial Compressive Strength

Triaxial compressive strength tests were conducted in general accordance with ASTM Test Method D4767. Phased triaxial pressures were determined by S.M. Stoller.

We believe the laboratory study was performed and this letter was prepared in a manner consistent with that level of care and skill ordinarily used by geotechnical engineers practicing in this area at this time. No other warranty, either express or implied, is made. When we may be of further service or answer any questions from a geotechnical or construction materials point of view, please call.

Sincerely,
GEOTECHNICAL ENGINEERING GROUP, INC.

Robert W. Anderson
Project Geologist

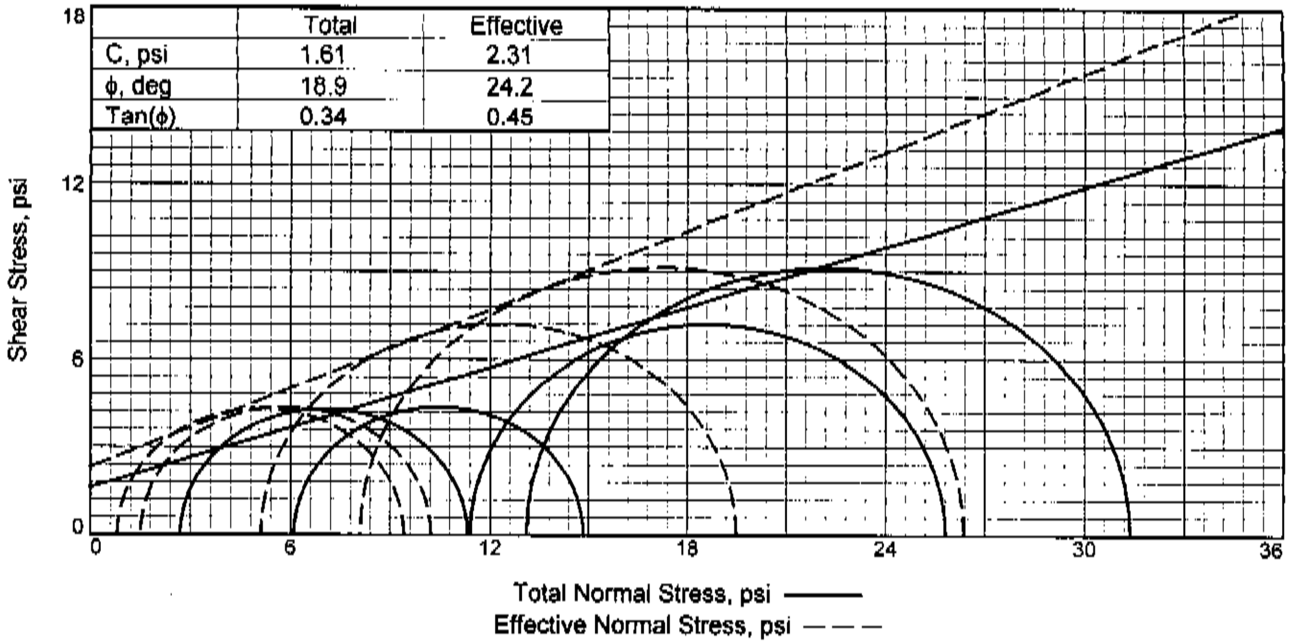
RWA:lc
(3 copies sent)

Geotechnical
Engineering
Group, Inc.

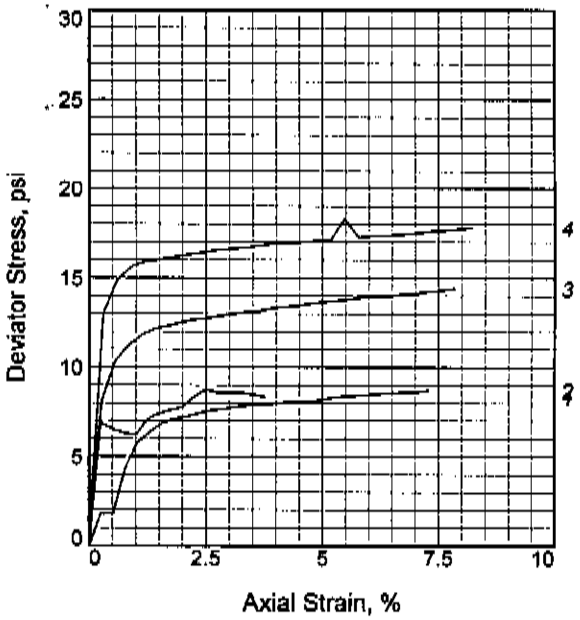
Job No. 2,165

TABLE I
SUMMARY OF LABORATORY TEST RESULTS

HOLE	DEPTH (feet)	Hydraulic Conductivity		ø (deg) effective	C (psi) effective
		B = %	Permeability cm / sec		
152	23	95	$1.4x10^{-12}$	2.31	24.2
153	3.5	96	$9.31x10^{-10}$	0	37.9
156	12	100	$1.32x10^{-8}$	0	30.7



	Total	Effective
C, psi	1.61	2.31
ϕ, deg	18.9	24.2
Tan(ϕ)	0.34	0.45



Sample No.		1	2	3	4
Initial	Water Content, %	13.1	13.1	13.1	13.1
	Dry Density, pcf	112.2	112.2	112.2	112.2
	Saturation, %	72.9	72.9	72.9	72.9
	Void Ratio	0.4746	0.4746	0.4746	0.4746
	Diameter, in.	1.92	1.92	1.92	1.92
	Height, in.	4.00	4.00	4.00	4.00
At Test	Water Content, %	17.9	17.9	17.9	17.9
	Dry Density, pcf	112.2	112.2	112.2	112.2
	Saturation, %	100.0	100.0	100.0	100.0
	Void Ratio	0.4746	0.4746	0.4746	0.4746
	Diameter, in.	1.92	1.96	2.03	2.12
	Height, in.	4.00	3.85	3.57	3.29
Strain rate, in./min.		0.03	0.03	0.03	0.03
Back Pressure, psi		28.4	29.0	31.2	36.1
Cell Pressure, psi		31.1	35.1	42.6	49.2
Fail. Stress, psi		8.6	8.7	14.4	18.3
Total Pore Pr., psi		30.3	33.6	37.5	41.1
Ult. Stress, psi					
Total Pore Pr., psi					
$\bar{\sigma}_1$ Failure, psi		9.4	10.2	19.5	26.4
$\bar{\sigma}_3$ Failure, psi		0.8	1.5	5.1	8.1

Type of Test:
CU with Pore Pressures

Sample Type: Remolded at 92% of ASTM D1557

Description: Weathered Shale

LL= 33 **PL=** 21 **PI=** 12

Assumed Specific Gravity= 2.65

Remarks: B= 95%, Hydraulic Conductivity 1.4x10^-12

Fig. 5

Client: S.M. Stoller

Project: Crescent Junction

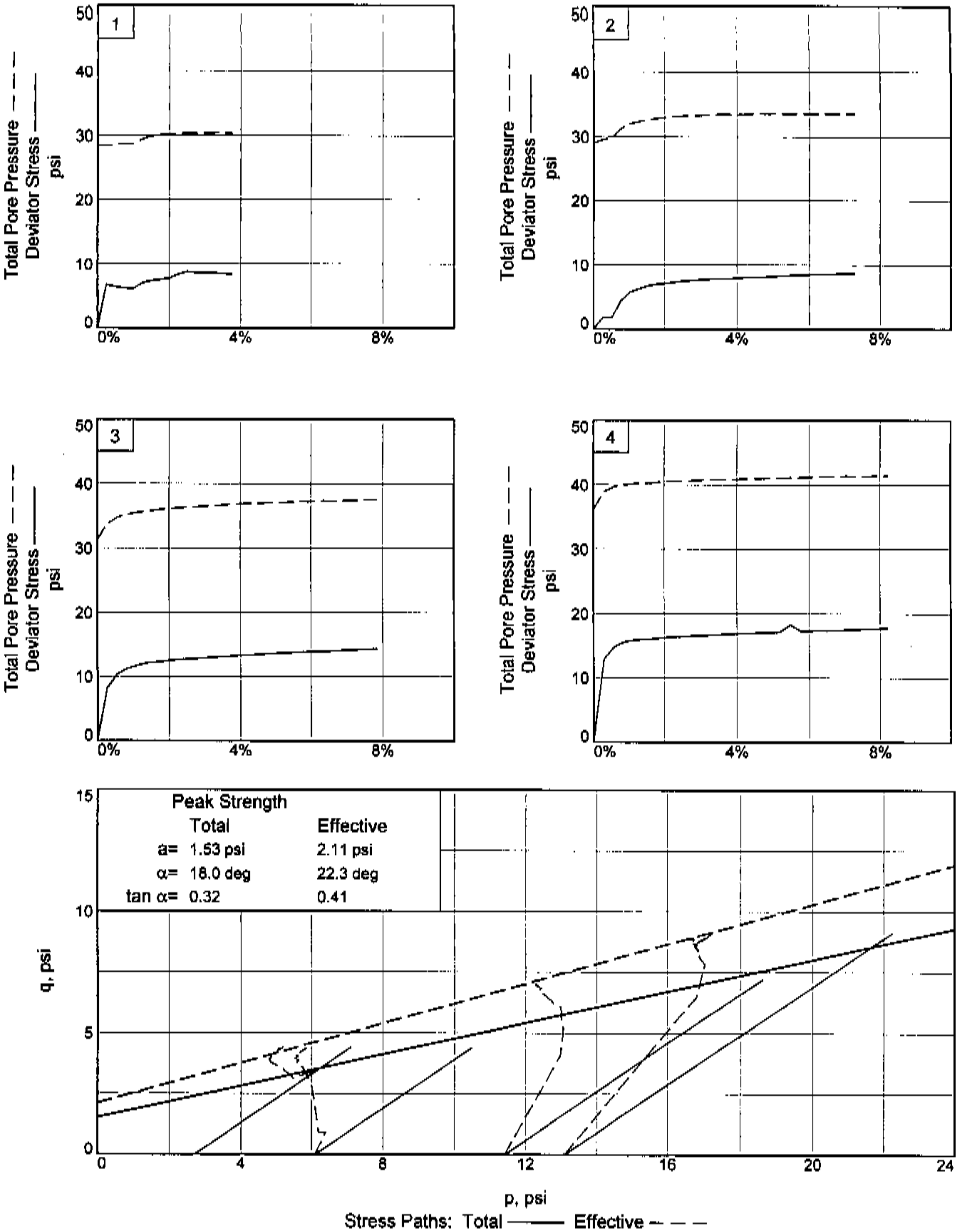
Location: Crescent Junction

Sample Number: 152 **Depth:** 23

Proj. No.: 2,165 **Date Sampled:**

Geotechnical
Engineering
Group, Inc.

Tested By: RWA



Peak Strength

	Total	Effective
a=	1.53 psi	2.11 psi
α=	18.0 deg	22.3 deg
tan α=	0.32	0.41

Client: S.M. Stoller

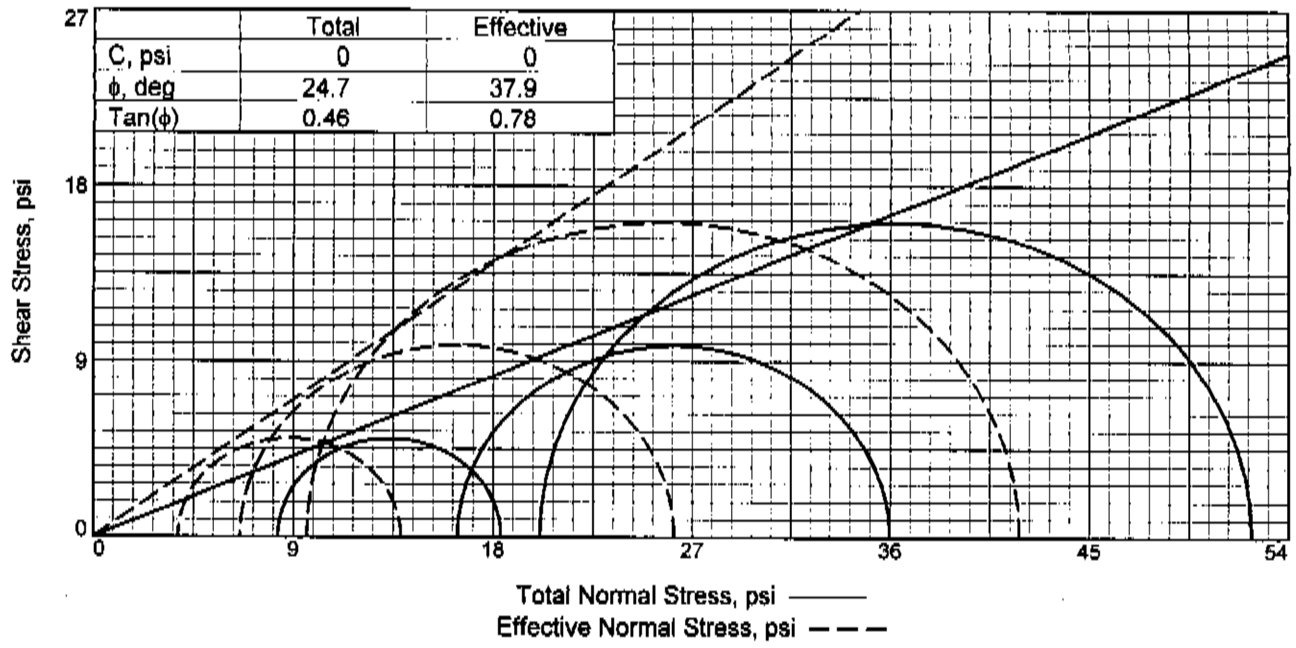
Project: Crescent Junction

Location: Crescent Junction **Depth:** 23 **Sample Number:** 152

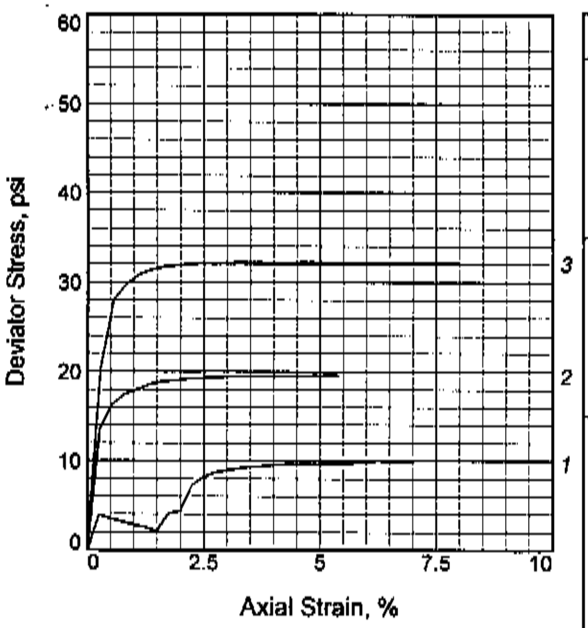
Project No.: 2,165 **Fig.** 5A

Geotechnical Engereering Group, Inc.

Tested By: RWA



	Total	Effective
C, psi	0	0
ϕ, deg	24.7	37.9
Tan(ϕ)	0.46	0.78



	Sample No.	1	2	3
Initial	Water Content, %	12.5	12.5	12.5
	Dry Density, pcf	102.4	102.4	102.4
	Saturation, %	52.7	52.7	52.7
	Void Ratio	0.6342	0.6342	0.6342
	Diameter, in.	1.94	1.94	1.94
	Height, in.	4.00	4.00	4.00
At Test	Water Content, %	23.7	23.7	23.7
	Dry Density, pcf	102.4	102.4	102.4
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.6342	0.6342	0.6342
	Diameter, in.	1.94	2.01	2.07
	Height, in.	4.00	3.72	3.52
	Strain rate, in./min.	0.03	0.03	0.03
	Back Pressure, psi	27.2	26.1	29.3
	Cell Pressure, psi	35.5	42.5	49.4
	Fail. Stress, psi	10.1	19.6	32.3
	Total Pore Pr., psi	31.7	35.9	39.8
	Ult. Stress, psi			
	Total Pore Pr., psi			
	$\overline{\sigma}_1$ Failure, psi	13.9	26.2	41.9
	$\overline{\sigma}_3$ Failure, psi	3.8	6.6	9.6

Type of Test:
CU with Pore Pressures

Sample Type: Remolded at 85% of ASTM D1557

Description: Sheet Wash

LL= 23 **PL=** 18 **PI=** 5

Assumed Specific Gravity= 2.68

Remarks: B= 96%, Hydraulic Conductivity 9.31x10^-10

Fig. 6

Client: S.M. Stoller

Project: Crescent Junction

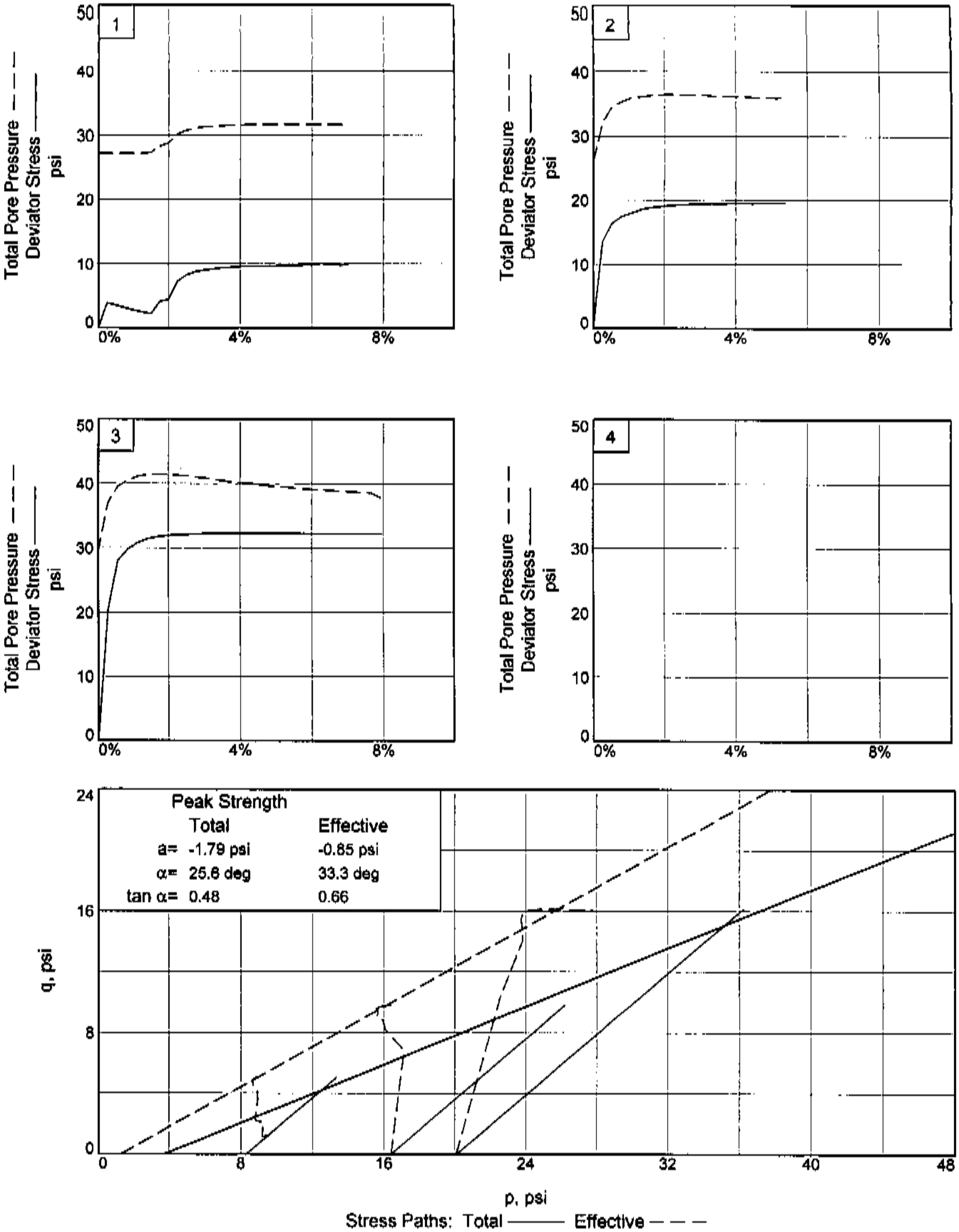
Location: Crescent Junction

Sample Number: 153 **Depth:** 3.5

Proj. No.: 2,165 **Date Sampled:**

Geotechnical Engineering Group, Inc.

Tested By: RWA

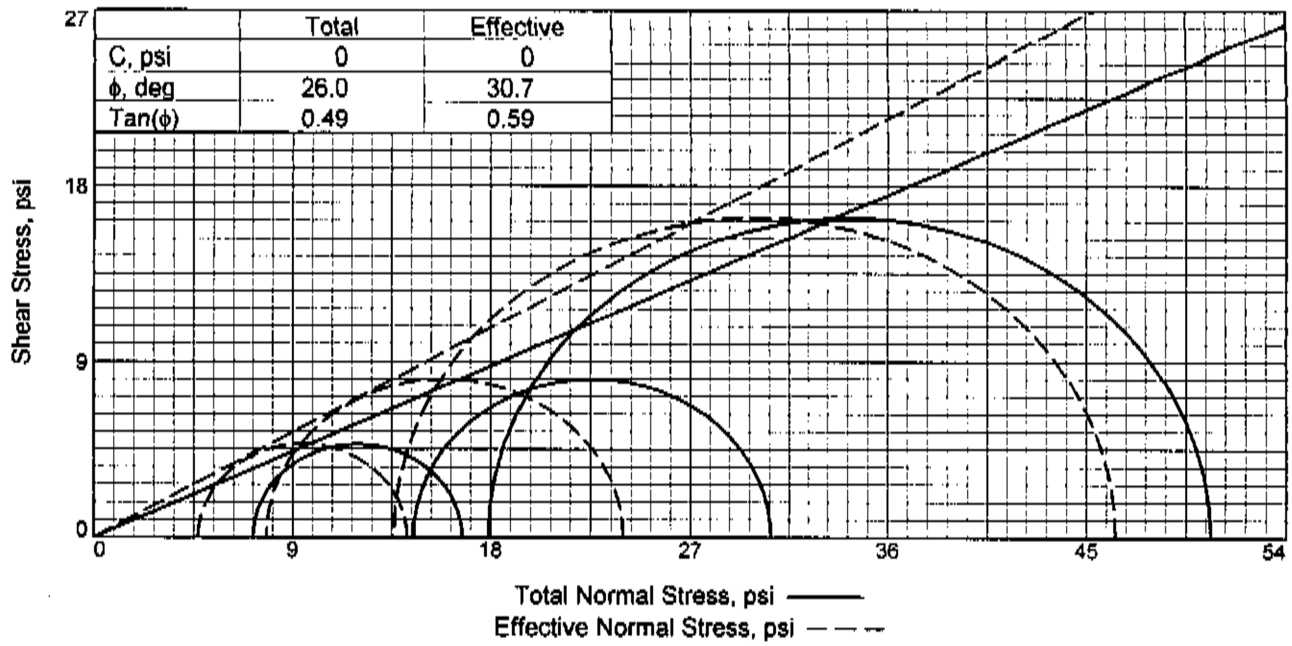


Peak Strength

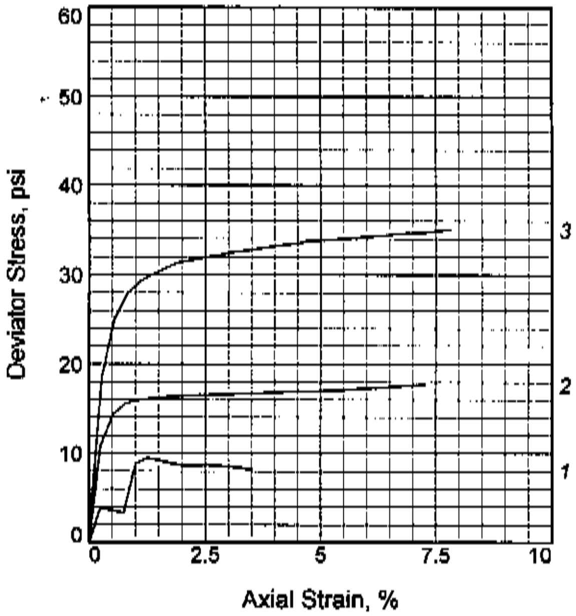
	Total	Effective
a=	-1.79 psi	-0.85 psi
α=	25.6 deg	33.3 deg
tan α=	0.48	0.66

Client: S.M. Stoller
Project: Crescent Junction
Location: Crescent Junction **Depth:** 3.5 **Sample Number:** 153
Project No.: 2,165 **Fig.** 6A **Geotechnical Engereering Group, Inc.**

Tested By: RWA



	Total	Effective
C, psi	0	0
ϕ, deg	26.0	30.7
Tan(ϕ)	0.49	0.59



Sample No.		1	2	3
Initial	Water Content, %	11.2	11.2	11.2
	Dry Density, pcf	111.0	111.0	111.0
	Saturation, %	60.9	60.9	60.9
	Void Ratio	0.4851	0.4851	0.4851
	Diameter, in.	1.94	1.94	1.94
	Height, in.	4.00	4.00	4.00
At Test	Water Content, %	18.4	18.4	18.4
	Dry Density, pcf	111.0	111.0	111.0
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.4851	0.4851	0.4851
	Diameter, in.	1.94	1.97	2.05
	Height, in.	4.00	3.86	3.58
Strain rate, in./min.		0.03	0.03	0.03
Back Pressure, psi		28.2	27.8	31.5
Cell Pressure, psi		35.4	42.3	49.4
Fail. Stress, psi		9.5	16.2	32.7
Total Pore Pr., psi		30.7	34.5	35.8
Ult. Stress, psi				
Total Pore Pr., psi				
$\overline{\sigma}_1$ Failure, psi		14.2	24.0	46.3
$\overline{\sigma}_3$ Failure, psi		4.7	7.8	13.6

Type of Test:
CU with Pore Pressures
Sample Type: Remolded at 85% of ASTM D1557
Description: Eolian

LL= 19 **PL=** 17 **PI=** 2
Assumed Specific Gravity= 2.64
Remarks: B= 100%, Hydraulic Conductivity 1.32x10^-8

Fig. 7

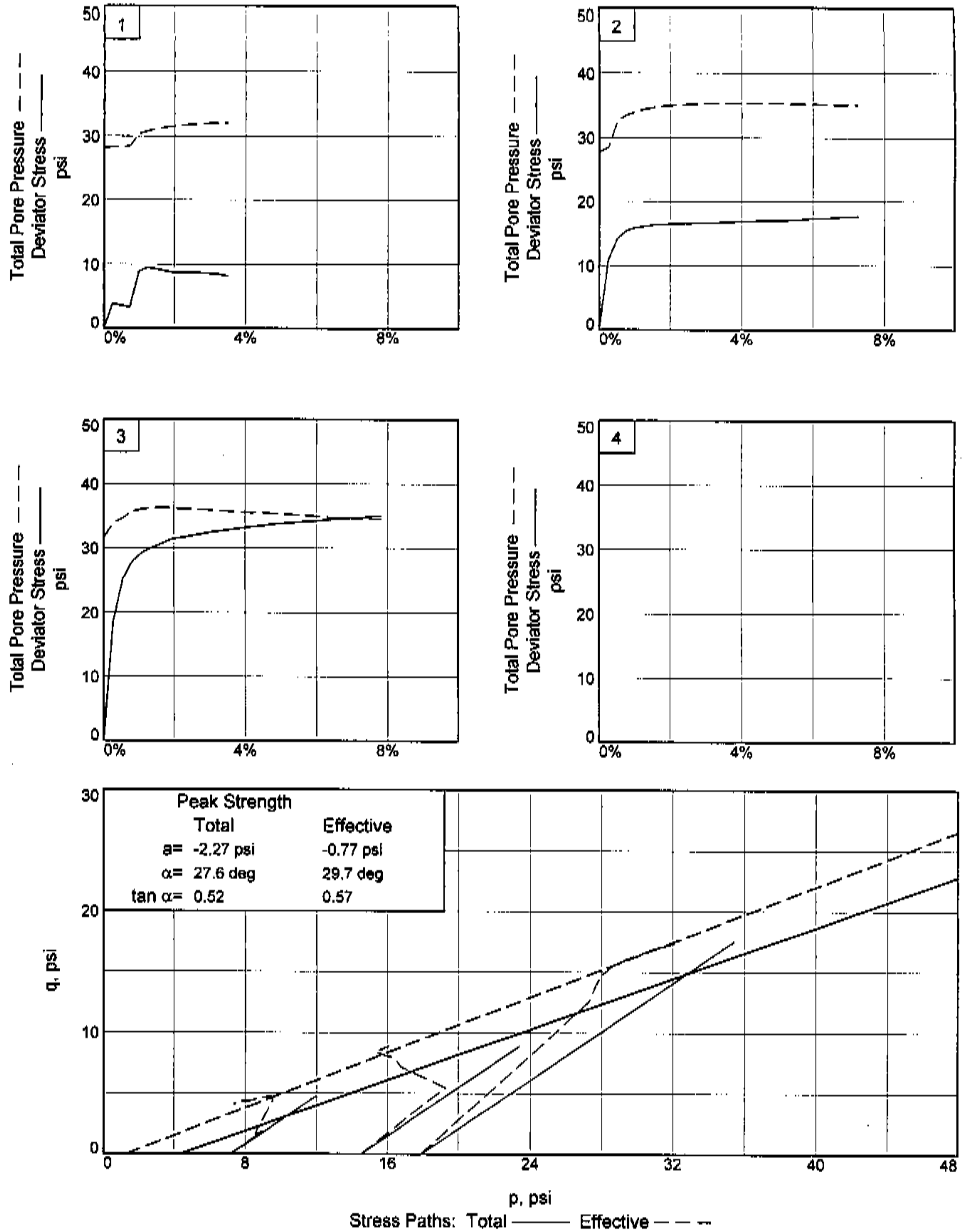
Client: S.M. Stoller

Project: Crescent Junction

Location: Crescent Junction
Sample Number: 156 **Depth:** 12
Proj. No.: 2,165 **Date Sampled:**

Geotechnical
Engineering
Group, Inc.

Tested By: RWA



Peak Strength	Total	Effective
a=	-2.27 psi	-0.77 psi
α=	27.6 deg	29.7 deg
tan α=	0.52	0.57

Client: S.M. Stoller
Project: Crescent Junction
Location: Crescent Junction **Depth:** 12 **Sample Number:** 156
Project No.: 2,165 **Fig.** 7A

Geotechnical Engereering Group, Inc.

Tested By: RWA

Appendix C

Geotechnical Testing Results

August 14, 2006

Geotechnical
Engineering
Group, Inc.

August 14, 2006

S.M Stoller Corporation
2597 B ¾ Road
Grand Junction, CO 81503

Attention: **Mr. Rex Sellers**
Senior Contract Adviser

Subject: **Geotechnical Testing Services**
Crescent Junction
Utah Disposal Site
GEG Job No. 2,165

Dear Mr. Sellers,

As requested, Geotechnical Engineering Group, Inc. (GEG) has performed laboratory testing services for the subject project. The laboratory tests were performed on a sample obtained by others. Laboratory tests performed were determined by S.M Stoller Corporation. Tests performed include retesting of sample TH-154 at 20 feet for hydraulic conductivity and phased triaxial, these tests are presented on Table I and Fig. 3.

Hydraulic Conductivity

Hydraulic conductivity was performed in general accordance with ASTM Test Method D5084. Cell, pore pressures and gradient for pore pressures were determined by S.M. Stoller.

Triaxial Compressive Strength

Geotechnical, Environmental and Materials Testing Consultants
Grand Junction - Montrose - Moab - Crested Butte
(970) 245-4078 • fax (970) 245-7115 • geotechnicalgroup.com
2308 Interstate Avenue, Grand Junction, Colorado 81505

Triaxial compressive strength tests were conducted in general accordance with ASTM Test Method D4767. Phased triaxial pressures were determined by S.M. Stoller.

We believe the laboratory study was performed and this letter was prepared in a manner consistent with that level of care and skill ordinarily used by geotechnical engineers practicing in this area at this time. No other warranty, either express or implied, is made. When we may be of further service or answer any questions from a geotechnical or construction materials point of view, please call.

Sincerely,
GEOTECHNICAL ENGINEERING GROUP, INC.

Reviewed by:

Robert W. Anderson
Project Geologist

Norman W. Johnston P.E
Project Geologist

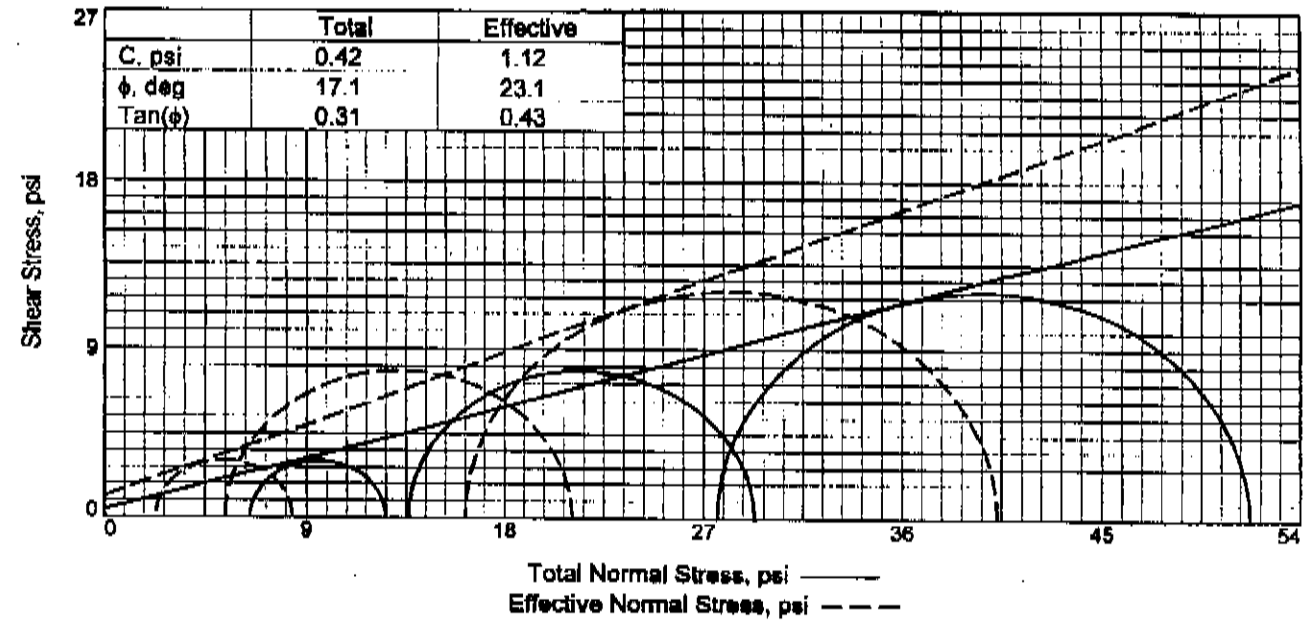
RWA:lc
(3 copies sent)

Geotechnical Engineering Group, Inc.

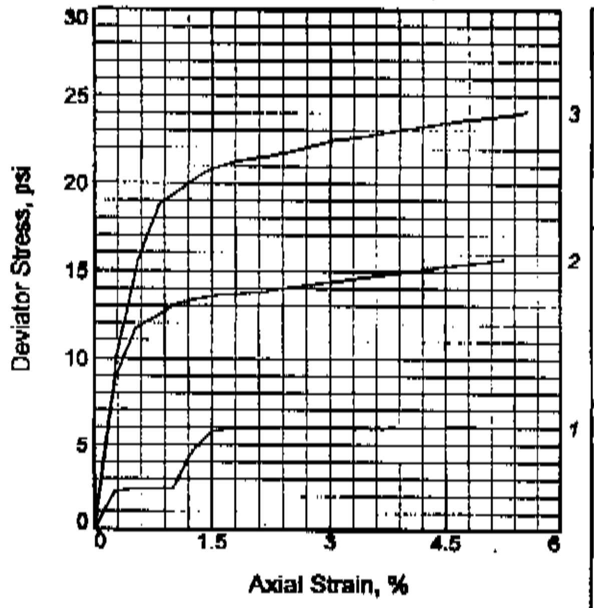
Job No. 2,165

TABLE I
SUMMARY OF LABORATORY TEST RESULTS

HOLE	DEPTH (feet)	Hydraulic Conductivity		ø (deg) effective	C (psi) effective
		B = %	Permeability cm / sec		
154	20	95	$1.34x10^{-[illegible]}$	23.1	1.12



	Total	Effective
C, psi	0.42	1.12
ϕ, deg	17.1	23.1
Tan(ϕ)	0.31	0.43



Sample No.		1	2	3
Initial	Water Content, %	13.1	13.1	13.1
	Dry Density, pcf	110.6	110.6	110.6
	Saturation, %	66.0	66.0	66.0
	Void Ratio	0.5415	0.5415	0.5415
	Diameter, in.	1.94	1.94	1.94
	Height, in.	4.00	4.00	4.00
At Test	Water Content, %	19.8	19.8	19.8
	Dry Density, pcf	110.6	110.6	110.6
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.5415	0.5415	0.5415
	Diameter, in.	1.94	1.99	2.04
	Height, in.	4.00	3.80	3.60
Strain rate, in./min.		0.03	0.03	0.03
Back Pressure, psi		29.2	29.1	29.5
Cell Pressure, psi		35.7	42.7	57.1
Fail. Stress, psi		6.1	15.7	24.1
Total Pore Pr., psi		33.4	37.3	40.9
Ult. Stress, psi				
Total Pore Pr., psi				
$\overline{\sigma}_1$ Failure, psi		8.4	21.1	40.3
$\overline{\sigma}_3$ Failure, psi		2.3	5.4	16.2

Type of Test:
CU with Pore Pressures

Sample Type: Remolded at 92% of ASTM D1557

Description: Weahthered Shale

LL= 38 **PL=** 18 **PI=** 20

Specific Gravity= 2.73

Remarks: B=95%, Hydraulic conductivity 1.34 X 10^-9 cm/sec

Fig. 3

Client: S.M. Stoller

Project: Crescent Junction

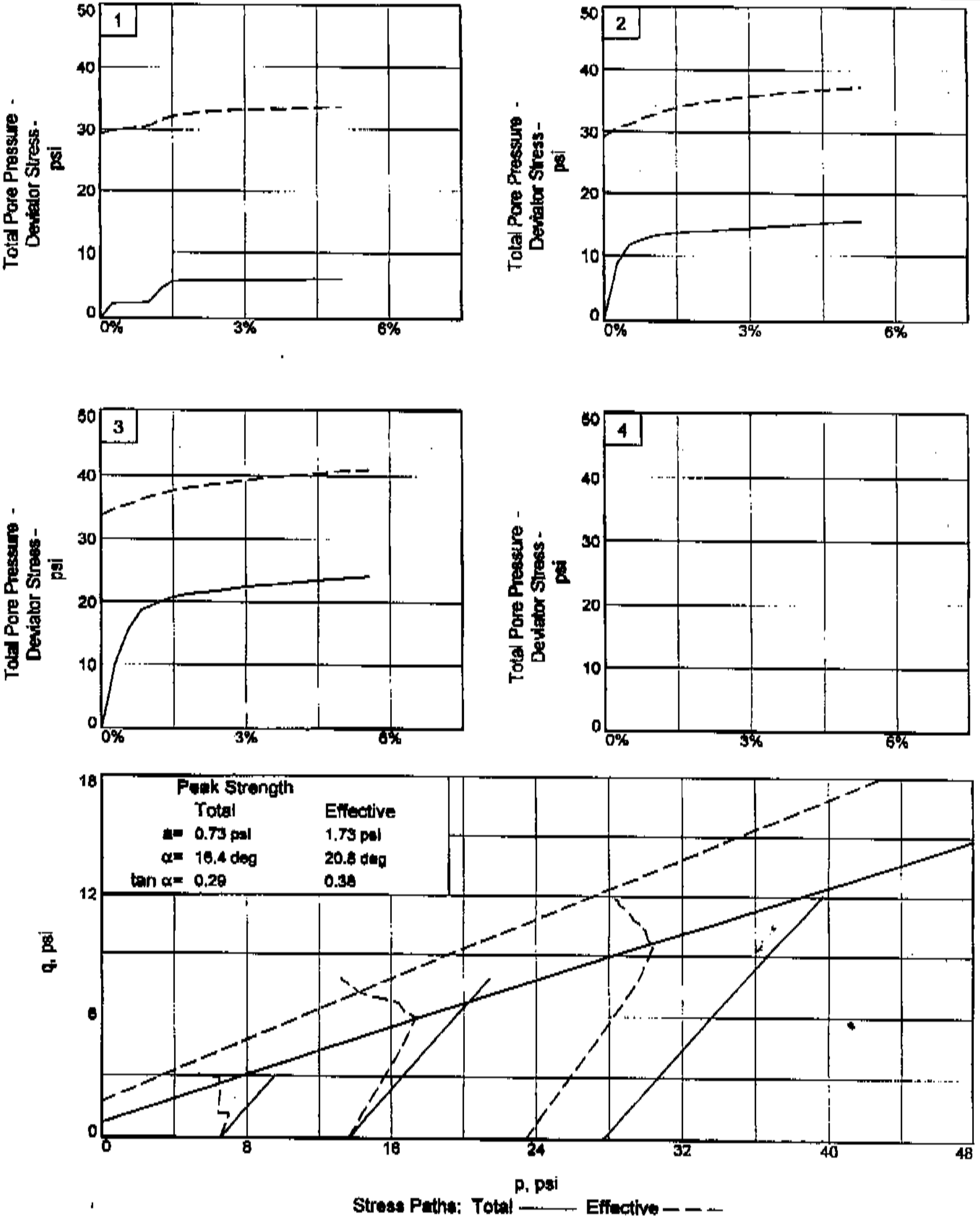
Location: Crescent Junction

Sample Number: Retest 154 **Depth:** 20

Proj. No.: 2,165 **Date Sampled:**

Geotechnical
Engineering
Group, Inc.

Tested By: RWA **Checked By:** NWJ



Client: S.M. Stoller

Project: Crescent Junction

Location: Crescent Junction **Depth:** 20 **Sample Number:** Retest 154

Project No.: 2,165 **Fig.** 3A

Geotechnical Engereering Group, Inc.

Tested By: RWA **Checked By:** NWJ

Geotechnical Engineering Group, Inc.

Geotechnical, Environmental and Materials Testing Consultants

2308 Interstate Avenue
Grand Junction, CO 81505

(970) 245-4078 • fax (970) 245-7115

FAX TRANSMITTAL SHEET

Date: 8/14/06

From: Robert Anderson

To: Mark K.

Company: Stoller Corp

Fax Number: 248-7628

Pages: 6 (including cover)

Project:

Re:

Comments:

Hard copy to follow? ☐ No ☐ U.S. Mail ☐ Federal Express

Copies to:

If you do not receive all of the described material, please telephone (970) 245-4078

CONFIDENTIALITY NOTICE:

Geotechnical
Engineering
Group, Inc.

Hydraulic Conductivity A M D5084

Job Name: Crescent Jet
Job No.: 2165
Technician: Rua
Date: 6-13
Sample Location: 15'1
Depth: 20
Descrition: Shale Tiger
Lab Number:

MDD (pcf): 120.5
OMC (%): 13
DD (pcf): 110.9
MC (%): 13
% Comp: 92
Compaction Method: Remold @92
Test Method: C (Falling Head/Rising Tail)

Sample Height, intial/final (in)		
#1	4	
#2	4	
#3	4	
#4		
Average	4"	

Sample Diameter, initial/final (in)		
Top		
Middle		
Bottom		
Average		

Initial Wet Mass (g):

Moisture	Initial	Final
Tare#	/	
Tare Mass (g)		
Tare and Wet (g)		
Tare and Dry (g)		

B-Coefficient

	Cell Volume (cc)	Initial Cell Pressure (psi)	Final Cell Pressure (psi)	Initial Pore Pressure (psi)	Final Pore Pressure (psi)	Base Volume (cc)	Top Volume (cc)	B
16		~~31.0~~	~~40.8~~	~~30.3~~	~~35.1~~			~~98~~
		30.1	40.2	26.4	37.9			96
7/6		31.1	41.1	28.4	37.9			95

Hydraulic Conductivity

	Elapsed Time (sec)	Cell Pressure (psi)	Base Pressure (psi)	Top Pressure (psi)	Base Volume (cc)	Top Volume (cc)	Head Loss, h_1 (m)	Head Loss, h_2 (m)	Conductivity, k (m/s)	Hydraulic Gradient
7/12	15:10	30.1	26.8	28.1	7.0	3.54				
7/15	6:50	31.5	29	28.9	6.36	4.66				
7/17	6:35	30.1	27.0	28.9	6.36	4.66				
8/4	6:37	30.0	26.0	29.0	5.51	5.26				
8/8	4:40	30.1	26.1	25.2	5.11	5.26				
8/9	7:25	30.2	29.1	25.2	5.80	5.36				
8/10	6:45	30.0	26.1	25.2	5.78	5.58				
8/11	13:10	30	25.0	25.2	5.74	5.49				

Lowered Tail PSI by 1 PSI

*Average for duration of test. **Average for last four readings.

Temp (C) =
a_{in} (m^2) = 1.97E-05
a_{out} (m^2) = 1.97E-05
L (m) =
A (m^2) =
R_T =
k** (m/s) =
k_{20} (m/s) =
Void Ratio:
Pore Volume (cc):
Volume Flowed (cc):
Pore Volumes Flowed:
Back Pressure* (psi):
Confining Pressure* (psi):
Max. Stress (psi):
Min. Stess (psi):

Remarks: Pore Volume estimated from final moisture content.

SM Fig. 16

Appendix D

Geotechnical Testing Results

September 20, 2006

Geotechnical Engineering Group, Inc.

September 20, 2006

S.M Stoller Corporation
2597 B ¾ Road
Grand Junction, CO 81503

Attention: **Mr. Rex Sellers**
Senior Contract Adviser

Subject: **Geotechnical Testing Services**
Crescent Junction
Utah Disposal Site
GEG Job No. 2,165

Dear Mr. Sellers,

As requested, Geotechnical Engineering Group, Inc. (GEG) has performed laboratory testing services for the subject project. The laboratory tests were performed on a sample obtained by others. Laboratory tests performed were determined by S.M Stoller Corporation. Tests performed include of samples TH-152B at 23 feet, TH-154B at 12 feet and TH-156B at 12 feet for hydraulic conductivity. These tests results are presented on Table I.

Hydraulic Conductivity

Hydraulic conductivity was performed in general accordance with ASTM Test Method D5084. Cell, pore pressures and gradient for pore pressures were determined by S.M. Stoller.

We believe these laboratory tests were conducted in a manner consistent with that level of care and skill ordinarily used by geotechnical engineers practicing in this area at this time. No other warranty, express or implied, is made. If we can be of further service in discussing the contents of this report or the analysis, please call.

Sincerely,
GEOTECHNICAL ENGINEERING GROUP, INC.

Reviewed by:

Robert W. Anderson
Project Geologist

Norman W. Johnston P.E.
Project Geologist

20 Sept 06

RWA:NWJ:mh
(3 copies sent)

Geotechnical Engineering Group, Inc.

Job No. 2,165

TABLE I
SUMMARY OF LABORATORY TEST RESULTS

HOLE	DEPTH (feet)	Hydraulic Conductivity	
		B = %	Permeability cm / sec
152B	23	100	$1.7x10^{-6}$
154B	12	97	$1.1x10^{-7}$
156B	12	96	$3.0x10^{-6}$

Geotechnical
Engineering
Group, inc.

Hydraulic Conductivity ASTM D5084

Job Name: Crescent Jct
Job No.: 2165
Technician: Zub
Date: 9/11
Sample Location: 1522B
Depth: 23
Lab Number:
Descrition:

MDD (pcf):
OMC (%): 12
DD (pcf):
MC (%): 12
% Comp: 92
Compaction Method: Tamped
Test Method: C (Falling Head/Rising Tail)

Sample Height, intial/final (in)		
#1		
#2		
#3		
#4		
Average		

Sample Diameter, initial/final (in)		
Top		
Middle		
Bottom		
Average		

Initial Wet Mass (g):

Moisture		
	Initial	Final
Tare#		
Tare Mass (g)		
Tare and Wet (g)		
Tare and Dry (g)		

B-Coefficient

	Cell Volume (cc)	Initial Cell Pressure (psi)	Final Cell Pressure (psi)	Initial Pore Pressure (psi)	Final Pore Pressure (psi)	Base Volume (cc)	Top Volume (cc)	B
/11		30.0	40	29.0	38.2			92
/13		30.1	40.1	29.1	39.1			100

Hydraulic Conductivity

	Elapsed Time (sec)	Cell Pressure (psi)	Base Pressure (psi)	Top Pressure (psi)	Base Volume (cc)	Top Volume (cc)	Head Loss, h_1 (m)	Head Loss, h_2 (m)	Conductivity, k (m/s)	Hydraulic Gradiendt
9/11	9:56	30.1	28.7	29.1	9.28	0.54				
	12:40	30.2	29.2	29.0	7.0	2.70				
	14:53	29.8	28.1	28.9	4.69	4.84				
	15:59	30.0	28.1	28.8	3.46	6.09				
9/12	957	30.0	28.3	29.0	5.12	4.64				
	10:54	30.0	28.4	29.0	4.20	5.52				
	11:00	30.0	28.4	28.9	3.64	6.04				
	13:00	29.9	28.5	28.8	1.90	7.69				
	13:30	29.9	28.5	29.7	1.52	8.02				
	14:33	30.1	28.5	28.7	1.04	8.49				
	15:26	29.9	27.8	29.3	0.62	8.86				
9/13	7:20	30.1	27.9	28.8	9.02	1.22				
	8:14	30.0	28	28.7	6.78	2.46				
	10:13	30.1	28.1	29.5	4.26	5.04				

*Average for duration of test. **Average for last four readings.

#5

1.69^{-4}

Temp (C) =
a_{in} (m^2) = 1.97E-05
a_{out} (m^2) = 1.97E-05
L (m) =
A (m^2) =
R_T =
k** (m/s) =
k_{20} (m/s) =
Void Ratio:
Pore Volume (cc):
Volume Flowed (cc):
Pore Volumes Flowed:
Back Pressure* (psi):
Confining Pressure* (psi):
Max. Stress (psi):
Min. Stess (psi):

Remarks: Pore Volume estimated from final moisture content.

SM Fig. 16

Geotechnical Engineering Group, Inc.

Hydraulic Conductivity ASTM D5084

Job Name: Cresent Jct Job No.: 2165 Technician: Date: 8/4

Sample Location: 154B Depth: 12 Lab Number:

Descrition:

MDD (pcf): OMC (%): 12 DD (pcf): MC (%): 12 % Comp: 90

Compaction Method: Remold Test Method: C (Falling Head/Rising Tail)

Sample Height, intial/final (in)		
#1		
#2		
#3		
#4		
Average		

Sample Diameter, initial/final (in)		
Top		
Middle		
Bottom		
Average		

Initial Wet Mass (g):

Moisture		
	Initial	Final
Tare#		
Tare Mass (g)		
Tare and Wet (g)		
Tare and Dry (g)		

B-Coefficient

	Cell Volume (cc)	Initial Cell Pressure (psi)	Final Cell Pressure (psi)	Initial Pore Pressure (psi)	Final Pore Pressure (psi)	Base Volume (cc)	Top Volume (cc)	B
		30	40.0	29	37.9			86
9/8		30.0	40	29.1	30.0			69
9/11		31.0	41	28.5	38.2			97

Temp (C) =

a_{in} (m^2) = 1.97E-05

a_{out} (m^2) = 1.97E-05

L (m) =

A (m^2) =

R_T =

k** (m/s) =

k_{20} (m/s) =

Void Ratio:

Pore Volume (cc):

Volume Flowed (cc):

Pore Volumes Flowed:

Back Pressure* (psi):

Confining Pressure* (psi):

Max. Stress (psi): Min. Stess (psi):

#6

Lower Tail by 1psi 9/15

Turned off Pores .7

1.05

Hydraulic Conductivity

	Elapsed Time (sec)	Cell Pressure (psi)	Base Pressure (psi)	Top Pressure (psi)	Base Volume (cc)	Top Volume (cc)	Head Loss, h_1 (m)	Head Loss, h_2 (m)	Conductivity, k (m/s)	Hydraulic Gradiend!	
9/11	9:57	30.7	27.9	29	9.34	3.64					
	12:42	30.3	27.1	28.7	6.79	5.30					
	1454	30.0	27.1	29.1	5.34	6.78					
	16:00	30.3	27.2	28.5	4.60	7.44					
9/12	956	29.8	26.9	29.2	7.38	2.66					
	10:35	29.8	27	28.0	6.88	3.22					
	11:01	29.8	27	28.7	6.48	3.60					
	13:01	29.9	27.1	28.6	6.16	3.98					
	13:37	29.8	27.1	29.5	5.62	4.34					
	14:29	30.3	27.6	28.5	5.28	4.66					
	15:27	29.7	27.0	28.2	4.78	5.32					
9/13	7:29	30.0	27.2	29.0	8.5	0.98					R
	8:15	30.0	27	29.0	7.9	1.14					
	10:44	30.0	26.9	28.8	5.92	3.20					
	14:15	30.4	27.6	29.7	4.06	5.14					
	14:44	30.1	27.6	29.7	3.76	5.40					
	15:39	30.1	27.6	29.6	3.48	5.74					
	16:07	30.1	27.6	29.4	3.30	5.90					
	7:20	30.0	27.6	29	8.04	1.62					R
	7:40	30.0	27.6	29	7.92	1.72					
	7:59	30.0	27.6	29	7.84	1.90					
	8:04	30.1	27.6	29	7.78	1.86					
	8:24	30.1	27.6	29	7.66	1.98					

*Average for duration of test. **Average for last four readings.

Remarks: Pore Volume estimated from final moisture content.

SM Fig. 16

Geotechnical Engineering Group, Inc.

Hydraulic Conductivity ASTM D5084

Job Name: Crescent Jct. Job No.: 2165 Technician: ZLA Date: 8/1

Sample Location: 156BG Depth: 12 Lab Number:

Descrition:

MDD (pcf): 104 OMC (%): 12 DD (pcf): MC (%): 12 % Comp: 92

Compaction Method: Test Method: C (Falling Head/Rising Tail)

#1

Sample Height, intial/final (in)		
#1	4	
#2	|	
#3	↓	
#4		
Average		

Sample Diameter, initial/final (in)		
Top		
Middle		
Bottom		
Average		

Initial Wet Mass (g):

Moisture		
	Initial	Final
Tare#		
Tare Mass (g)		
Tare and Wet (g)		
Tare and Dry (g)		

B-Coefficient

Cell Volume (cc)	Initial Cell Pressure (psi)	Final Cell Pressure (psi)	Initial Pore Pressure (psi)	Final Pore Pressure (psi)	Base Volume (cc)	Top Volume (cc)	B
	30.7	40.7	29.0	38.6			96

Hydraulic Conductivity

	Elapsed Time (sec)	Cell Pressure (psi)	Base Pressure (psi)	Top Pressure (psi)	Base Volume (cc)	Top Volume (cc)	Head Loss, h_1 (m)	Head Loss, h_2 (m)	Conductivity, k (m/s)	Hydraulic Gradiendt	
9/11	9:49	[illegible].2	28.5	29.2	9.24	0.74					
10min	9:59	30.1	29.4	29.6	8.44	1.34					
19min	10:20	30.1	28.3	29.6	7.28	2.52					
23min	10:43	30.1	29.4	29.6	6.02	3.74					
19min	11:02	30.1	29.5	29.4	5.10	4.62					
9/11	12:37	30.0	28.6	29.3	4.26	5.46					
	12:55	30.0	28.6	29.0	3.68	6.02					
	13:15	30.0	28.6	29.0	2.10	6.62					
	14:27	20.0	28.6	29.0	1.32	8.24					
	14:56	29.9	28.2	28.9	9.16	0.66					R
	15:54	29.9	28.2	28.3	7.94	1.58					
9/12	9:56	30.1	27.9	29.0	6.74	3.3					
	10:33	30.1	28	28.8	4.30	5.28					
	10:59	30.1	28.1	28.7	2.98	7.1					
	12:59	30.0	28.1	28.4	1.60	8.52					
	13:35	29.9	28.2	28.7	0.36	9.76					
9/13	7:27	30.0	28.1	29.1	5.74	4.68					R
	7:38	30.0	28.1	29.1	4.68	5.76					
	7:49	30.0	28.2	29.0	3.88	6.50					
	7:59	30.0	28.2	28.9	3.24	7.16					
	14:14	29.9	28	29.2	6.22	3.42					R
	14:44	29.9	28.2	29.1	3.69	5.99					
	15:37	29.9	28.3	28.9	1.16	8.54					
	16:06	29.9	28.4	28.9	0.24	9.42					

*Average for duration of test. **Average for last four readings.

Temp (C) =

a_{in} (m^2) = 1.97E-05

a_{out} (m^2) = 1.97E-05

L (m) =

A (m^2) =

R_T =

k** (m/s) =

k_{20} (m/s) =

Void Ratio:

Pore Volume (cc):

Volume Flowed (cc):

Pore Volumes Flowed:

Back Pressure* (psi):

Confining Pressure* (psi):

Max. Stress (psi): Min. Stess (psi):

Remarks: Pore Volume estimated from final moisture content.

Pg. 1 of 2

SM Fig. 16

Geotechnical
Engineering
Group, Inc.

Hydraulic Conductivity ASTM D5084

Job Name: ______ Job No.: ______ Technician: ______ Date: ______
Sample Location: 156 R Depth: 12 Lab Number: ______
Descrition: ______

MDD (pcf): ______ OMC (%): ______ DD (pcf): ______ MC (%): ______ % Comp: ______
Compaction Method: ______ Test Method: C (Falling Head/Rising Tail)

Sample Height, intial/final (in)		
#1		
#2		
#3		
#4		
Average		

ample Diameter, Initial/final (i		
Top		
Middle		
Bottom		
Average		

Initial Wet Mass (g): ______

Moisture		
	Initial	Final
Tare#		
Tare Mass (g)		
Tare and Wet (g)		
Tare and Dry (g)		

B-Coefficient

Cell Volume (cc)	Initial Cell Pressure (psi)	Final Cell Pressure (psi)	Initial Pore Pressure (psi)	Final Pore Pressure (psi)	Base Volume (cc)	Top Volume (cc)	B

Hydraulic Conductivity

4/1

Elapsed Time (sec)	Cell Pressure (psi)	Base Pressure (psi)	Top Pressure (psi)	Base Volume (cc)	Top Volume (cc)	Head Loss, h_1 (m)	Head Loss, h_2 (m)	Conductivity, k (m/s)	Hydraulic Gradiendt
7:18	30.0	28.1	29.3	6.12	3.56				
7:39	30.0	29.2	29.2	4.57	5.18				
7:53	30.0	29.2	29.2	3.66	6.04				
8:03	30.0	26.2	29.2	3.12	6.58				
8:23	30.0	29.2	29.2	2.02	7.68				

12

R

*Average for duration of test **Average for last four readings.

Temp (C) = ______
a_{in} (m^2) = 1.97E-05 3.03^{-6}
a_{out} (m^2) = 1.97E-05
L (m) = ______
A (m^2) = ______
R_T = ______
k** (m/s) = ______
k_{20} (m/s) = ______
Void Ratio: ______
Pore Volume (cc): ______
Volume Flowed (cc): ______
Pore Volumes Flowed: ______
Back Pressure* (psi): ______
onfining Pressure* (psi): ______
Max. Stress (psi): ______ Min. Stess (psi): ______

Remarks: Pore Volume estimated from final moisture content.

Pg 2 of 2

SM Fig. 16