RJH CONSULTANTS, INC.

GEOTECHNICAL AND
WATER RESOURCES ENGINEERING

GEOTECHNICAL DATA REPORT

THORNTON WATER TREATMENT PLANT

ADAMS COUNTY, COLORADO

Submitted to
City of Thornton
9500 Civic Center Drive
Thornton, Colorado 80229

Submitted by
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November 2016
Project 16104

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ROBERT J. HUZJAK
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11/18/16
PROFESSIONAL ENGINEER

Robert J. Huzjak, P.E.
Project Manager

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SECTION 1 - INTRODUCTION

1.1 Purpose and Objective

The City of Thornton (Thornton) retained RJH Consultants, Inc. (RJH) as part of the Owner's Advisor consultant team (Thornton Team) for geotechnical issues associated with the Thornton Water Treatment Plant Project (Project). Thornton is developing this Project using a progressive design-build approach.

The purpose of this draft Geotechnical Data Report (Report) is to present geotechnical data collected at the Project site (Site). The geotechnical data was collected to support development of a Project budget and a design-build proposal.

Evaluation and interpretation of the collected data are not included in this Report.

1.2 Site Background

The Site is located at 9500 Washington Street in Thornton, Colorado, which is southeast of the intersection of Washington Street and Thornton Parkway. The Site is generally bounded on the east by an existing water treatment plant and on the south by East 95th Avenue, Hoffman Way, and apartment buildings. The Site is approximately 12 acres and currently consists of undeveloped land that is covered with grass and weeds. A Site vicinity map is shown on Figure 1.1.

Asbestos-containing material (ACM) has previously been identified at the Site. In 1994, work was performed to remove ACM from the ground surface and the top 9 inches of soil. The ACM generally consisted of pieces of Transite pipe from former underground water lines. The work in 1994 appears to have not removed all ACM, and fragments of ACM remain at the Site.

Based on historic aerial imagery, site grading and placement of fill material occurred at the Site between 1999 and 2002. The timing of the fill placement corresponds to development of the area north of the Site. The fill was placed to level portions of the Site, and fill placement exceeded 20 feet thick at some locations. The fill placement covered a significant portion of the area, where asbestos removal activities were performed in 1994.

ERO Resources Corporation (ERO) was retained by Thornton as an environmental consultant on Thornton's Team to address issues associated with the onsite ACM. During a Site reconnaissance on March 28, 2016, RJH and ERO identified fragments of Transite pipe on the ground surface at several locations across the Site, including on top of filled areas. Since fill placement techniques were not documented and there did not appear to be a pattern to observed Transite pipe occurrences, the entire volume of fill material was considered by the Colorado Department of Public Health and Environment (CDPHE) to be regulated asbestos contaminated soil (RACS) at the time of RJH's Site investigation. ERO developed a Project Specific RACS Management Plan (RACS Plan) for RJH's work, which was submitted to and approved by the CDPHE. The RACS Plan is presented in Appendix A. Subsequent to the fieldwork by RJH, ERO has completed further evaluation of the asbestos contaminated soils. Information from subsequent evaluations by ERO provides more current data regarding asbestos at the Site.

1.3 Project Description

At the time of our Site investigation, the draft water treatment plant layout was mostly located in the northern portion of the Site and included drying beds, administration building, and various buildings to house treatment processes. It is our understanding that final grade is intended to be similar to the existing ground surface elevation, and structures are anticipated to be buried less than 20 feet deep.

1.4 Scope of Work

RJH performed the following services for the geotechnical investigation:

- Developed a Project-specific health and safety plan (HASP) and performed asbestos awareness training prior to fieldwork.
- Coordinated utility clearances with Colorado 811.
- Performed a reconnaissance-level Site visit and mapping of surficial features.
- Subcontracted a driller and drilled, sampled, and logged nine borings.
- Complied with the RACS Plan as directed by ERO, which included:
    - Accessed borings from a restricted access point located near the intersection of East 95th avenue and Hoffman Way.
    - Accessed boring location, following access corridors, and worked within regulated work areas.

  - Moistened dry to slightly moist cuttings with a sprayer.
  - Containerized drill cuttings.
  - Wrapped augers in plastic sheeting when transporting the drill rig between borings.
  - Placed plastic sheeting at locations where water (used for coring) exited the ground surface.
  - Stopped work during periods of elevated consistent wind speeds or frequent gusts.
  - Decontaminated equipment and tooling, and containerized cleaning water upon completion of the Project.
- Obtained monitoring well permits from the Colorado Office of the State Engineer (SEO).
- Installed and developed three, 2-inch diameter monitoring wells and installed datalogging instruments in the wells.
- Performed periodic Site visits to download data from the datalogging instruments, and to bail water from the wells.
- Backfilled borings not converted to monitoring wells with cement-bentonite grout and bentonite chips.
- Performed quality assurance review of collected samples and field logs by a senior geotechnical engineer.
- Performed laboratory tests on selected samples of soil and bedrock.
- Prepared final boring logs based on the field logs, quality assurance review, and laboratory test results.
- Prepared this Report.

1.5 Authorization

This work was performed in general accordance with the terms and conditions of the On-Call Agreement for Professional Consulting Service (Project 218-15) between Thornton and RJH, dated December 8, 2015, and Thornton Purchase Order Number 1600683 OP.

1.6 Project Personnel

The following personnel from RJH are responsible for the work contained in this Report:

Project Manager	Robert Huzjak, P.E.
Project Engineer	Adam Prochaska, Ph.D., P.E., P.G.[1]
Geotechnical Engineer	Micah Smidt, P.E.

Note: 1. Licensed in states other than Colorado.



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RJH CONSULTANTS, INC.

GEOTECHNICAL DATA REPORT THORNTON WTP	SITE VICINITY MAP
PROJECT NO. 16104	November 2016 **Figure 1.1**

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SECTION 2 - SITE INVESTIGATION

2.1 General

The Site investigation generally consisted of drilling, sampling, and logging borings, and installing monitoring wells with datalogging instruments. A Site reconnaissance and mobilization of the drill rig occurred on March 28, 2016; however, Site conditions were too wet to access the boring locations. Drilling activities occurred from June 20 to 30, 2016. RJH also was onsite on July 1, July 15, August 12, and September 13, 2016 to develop monitoring wells and download groundwater data from the datalogging instruments.

2.2 Surveying

Topographic data for the Project was provided to RJH by Thornton but was not set to a standard horizontal coordinate system. RJH set the topographic data to approximate horizontal coordinates by overlaying the topographic contours on aerial imagery that was georeferenced. The horizontal alignment of the topographic contours shown on the Report figures are considered to be accurate to within 5 horizontal feet, which in our opinion, is sufficiently accurate for evaluating the collected geotechnical data.

Borings at each drilling location were surveyed following the fieldwork by Bailey Professional Solutions of Englewood, Colorado under contract to RJH. Borings B-105A and B-102 were not surveyed. RJH estimated the locations of these explorations by measuring from nearby explorations B-105 and B-108(P), which were surveyed. The coordinates of B-105A and B-102 are considered to be accurate to within approximately 1 foot horizontally and 0.3 feet vertically.

The horizontal coordinate system is Colorado State Plane North Zone and the vertical datum is North American Vertical Datum 88 (NAVD 88).

2.3 Borings

2.3.1 General

Nine borings were drilled at seven locations. The borings were located to develop a generalized understanding of subsurface conditions across the Site, and not to collect information specific to any proposed facilities. The boring locations are shown on

Figure 2.1. Horizontal coordinates and ground surface elevations at each boring are provided in Table 2.1.

In B-105, an obstruction was encountered about 11 feet deep that resulted in auger refusal. This boring was abandoned, relocated approximately 10 feet west, and completed as B-105A.

In B-102, drill cuttings combined with groundwater to produce a clayey slurry that rendered installation of a monitoring well impractical. This boring was backfilled with grout and B-108(P) was drilled nearby to allow for installation of a monitoring well at this location.

TABLE 2.1
SUMMARY OF BORINGS

Boring	Northing[1] (ft)	Easting[1] (ft)	Ground Surface Elevation[2] (ft)	Depth[3] to Bottom of Fill (ft)	Depth[3] to Top of Bedrock (ft)	Depth[3] to Groundwater[4] (ft)	Total Depth[3] of Boring (ft)	Boring Completion
B-101(P)	1196040.4	3146739.3	5414.1	17.3	17.3	18.5	49.4	2" Monitoring Well
B-102[5]	1195929.5	3147097.3	5407.2	24.2	24.2	Not Measured	60.5	Grout[6]
B-103	1196072.1	3147457.3	5414.1	19.5	24.2	Not Measured	69.5	Grout
B-104(P)	1195902.1	3147471.1	5405.6	25.8	25.8	37.6	56.5	2” Monitoring Well
B-105	1195596.4	3147474.1	5361.1	Not Encountered	Not Encountered	Not Measured	12.0	Bentonite Chips
B-105A[7]	1195591.3	3147465.3	5360.8	13.5	13.5	Not Measured	49.1	Grout
B-106	1195898.1	3146773.7	5407.1	20.7	21.2	Not Measured	54.3	Grout
B-107	1196053.1	3147104.5	5408.6	21.8	21.8	Not Measured	55.0	Grout
B-108(P)	1195929.5	3147081.8	5407.2	25.0	25.0	32.3	50.0	2" Monitoring Well

Notes:
1. Horizontal coordinate system is Colorado State Plane North Zone.
2. Vertical datum is North American Vertical Datum 88 (NAVD 88).
3. Depth below the ground surface elevation at boring.
4. Measurement obtained from monitoring well. Additional information about water level measurements at the time of drilling is presented in Section 2.5.
5. B-102 was not surveyed. RJH estimated the boring location and elevation based on survey data from B-108(P).
6. Borings completed by grouting were topped off with bentonite chips after the grout cured.
7. B-105A was not surveyed. RJH estimated the boring location and elevation based on survey data from B-105.

2.3.2 Drilling

RJH retained Elite Drilling Services (Elite) of Denver, Colorado to provide drilling equipment and services. Borings were advanced using a buggy-mounted CME 550x drill rig with an automatic hammer.

Borings were advanced using 8-inch outside diameter (O.D.) (4.25-inch inside diameter (I.D.)) hollow-stem augers. Samples were generally obtained at about 2.5-foot or 5-foot intervals using the following methods:

- 1.375-inch I.D. (2.0-inch O.D.) standard split-spoon sampler (ASTM D1586, except that samplers were generally advanced 24 inches instead of the standard 18 inches). These samples are denoted with the prefix "S" on the boring logs.
- 2.0-inch I.D. (2.5-inch O.D.) ring-lined split barrel (California) sampler (ASTM D3550). These samples are denoted with the prefix "CA" on the boring logs.
- 2.5-inch I.D. (3.0-inch O.D.) ring-lined split barrel (Dames & Moore, or Modified California) sampler (ASTM D3550). These samples are denoted with the prefix "DM" on the boring logs.

A standard penetration test (SPT) was performed in general accordance with ASTM D1586 at the location of each split-spoon sample. At each SPT location, RJH obtained a "standard penetration resistance" or SPT N-value. The SPT N-value equals the number of blows that are required from a 140-pound hammer dropped 30 inches to drive a standard split-spoon sampler from 6 to 18 inches. SPT refusal was defined as 50 blows for less than 6 inches of penetration prior to advancing 18 inches; refusal can occur in any of the three 6 inch intervals of the test. The true SPT N-value cannot be obtained at sample locations that encounter refusal because the sampler is not driven the full 18 inches. Boring B-104 sample S-17 was advanced from 12 to 18 inches with 60 hammer blows because the sampler continued to steadily advance after each additional blow of the hammer. This sample was considered to have encountered refusal. The SPT N-values presented in this Report were not adjusted to account for overburden pressures, hammer energy, etc. Hammer blow counts or hydraulic pressure were also documented for each 6-inch interval of penetration while advancing California and Dames & Moore samplers. A summary of SPT N-Values is presented in Table 2.2.

TABLE 2.2
SPT N-VALUE SUMMARY

Geologic Unit	Number of Tests	Number of Tests that Encountered Refusal[1]	Minimum N-Value	Maximum N-value	Average N-Value
Fill	38	1	10	39	18
Bedrock	30	8	25	72	45
Multiple Units[2]	2	0	12	45	29
Total	**70**	**9**	**10**	**72**	**28**

Notes:
1. Samples that encountered refusal are not reported in maximum, minimum, or average.
2. Samples advanced through intervals containing fill and bedrock; and fill, colluvium/residuum, and bedrock.

In selected borings, drilling with hollow-stem augers stopped near the top of bedrock and borings were advanced through bedrock and sampled continuously using NQ3-size (1.75-inch core diameter, 2.98-inch hole diameter) wireline rock coring techniques in general accordance with ASTM D2113. Core runs ranged in length from about 0.8 to 5.1 feet and were mostly 5.0 feet long. Water was obtained from hydrants near the Site and used as drilling fluid during rock coring.

Bulk samples of auger cuttings were collected at selected drilling intervals. These samples are denoted with the prefix "Bu" on the boring logs.

Auger cuttings that were not sampled were containerized in 55-gallon drums for subsequent disposal by others. Borings B-101(P), B-104(P), and B-108(P) were completed as monitoring wells, as described in Section 2.6. Boring B-105 was backfilled with bentonite chips. The remaining borings were backfilled with cement-bentonite grout. Grout was mixed using water from the same source used for rock coring. If the grout settled during the cure process the void at the ground surface was backfilled with bentonite chips.

2.4 Logging Procedures

RJH observed drilling procedures, recorded relevant drilling information, photographed and visually classified the soil and rock samples, and prepared a field log of each boring. In the field, soil samples were classified in general accordance with ASTM D2488 (visual-manual method) and rock cores were classified in general accordance with to the U.S. Bureau of Reclamation (USBR), *Engineering Geology Field Manual* (USBR, 2001).

Collected soil and rock samples were packaged and transported in general conformance with ASTM D4220 and the requirements of the RACS Plan. Recovered split-spoon samples were placed in sealed plastic bags to help preserve the natural moisture content of the material. Samples recovered from California and Dames & Moore samplers were kept in brass liners that were capped and sealed with vinyl tape. Bulk samples were packaged in plastic buckets with sealing lids. Samples collected from the fill were labeled as "PACM" to denote that the material could potentially contain asbestos.

Bedrock core samples were photographed, logged, wrapped in plastic, and placed in wooden core boxes. Some core samples were wrapped in plastic to help preserve the natural moisture content and wrapped with tape to maintain the samples in compression for possible laboratory testing.

RJH prepared final boring logs based on field and laboratory classifications, quality assurance office review of samples, and indirect observations (i.e., drill chatter, drill resistance, etc.), as appropriate. Between recovered samples, the lithology presented on the boring logs is interpreted. Explanations of the soil and rock descriptors used on the boring logs are presented in Appendix B. Boring logs are presented in Appendix C. Photographs of recovered rock core in the core boxes are presented in Appendix D.

2.5 Water Level Measurements During Drilling

Water Levels within the borings were measured during drilling. Water level measurements were obtained using an electronic water level indicator, by measuring the depth at which the drill rods or samplers became wet, and by observing the depth of saturated cuttings on the flights of the hollow-stem augers. Water level measurements obtained during drilling are summarized in Table 2.3. These water-level measurements are considered to be less reliable than the water levels obtained from monitoring wells (Section 2.6), because these water levels may have been influenced by drilling activities. The water levels recorded during drilling may be higher or lower than the hydrostatic groundwater level.

TABLE 2.3
WATER LEVEL MEASUREMENTS OBTAINED DURING DRILLING

Boring	Date	Depth to Water Level[1] (ft)	Depth of Boring[1]	Notes
B-101(P)	6/28/2016 – Morning	5.5	36.9	Water level measured in boring after coring to 36.9 feet the previous day.[2]
B-102	6/23/2016	37.5	Near 37.5	Water level estimated from water observed on drill rods.
B-103	6/20/2016	29.0	Near 29.0	Water level estimated from water observed on drill rods.
	6/21/2016	65.6	69.5	Water level measured in boring after advancing boring to 69.5 feet the previous day.
B-104(P)	6/29/2016	43.5	56.5	Water level measured in boring after advancing boring to 56.5 feet the previous day.
B-105 and B-105A	6/30/2016	--[3]	20.4	Water level was not encountered prior to coring.
B-106	6/24/2016 - Evening	17.0	29.3	Water level measured in boring after coring to 29.3 feet.[2]
	6/27/2016 - Morning	24.3	29.3	
B-107	6/23/2016	--	24.5	Water level was not encountered prior to coring.
B-108(P)	6/29/2016	35.0	50.0	Saturated cuttings observed on hollow-stem auger flights.

Notes:
1. At time of measurement.
2. Water level measurement potentially influenced by water used for coring fluid.
3. Not encountered.

2.6 Monitoring Well Installations

Monitoring wells were installed by RJH at locations B-101(P), B-104(P), and B-108(P) as shown on Figure 2.1. The monitoring wells measure groundwater levels in bedrock.

Monitoring wells were constructed using solid and slotted 2-inch polyvinyl chloride (PVC) pipe, 10/20 Colorado washed silica sand, and bentonite. The surface completions consist of steel surface casings cast into a concrete pad that extends approximately 3 feet above the ground surface and 2 feet below the ground surface. The casing is secured with a combination lock. After installation, locations and elevations of the monitoring wells were surveyed by Bailey Professional Solutions. Monitoring well construction

information are shown on Figures 2.2 through 2.4. Monitoring well permit information is provided in Appendix E.

After installation, the monitoring wells were surged and bailed to develop the well and to remove drilling water from the well and sand pack. The surge block was 2 inches in diameter (nominal). The monitoring wells were bailed using a 1.7-inch diameter hand-bailer and a 1.8-inch diameter submersible pump.

On July 1, 2016, a datalogging instrument was installed in each well to monitor long-term groundwater trends. The instruments are Rugged TROLL 100 piezometers from In-Situ, Inc. of Fort Collins, Colorado. The datalogging instruments report the height of water above the instrument. The instruments were suspended from the piezometer J-plug cap using a wire cable to a location near the bottom of the wells. Installation depths are shown on Figures 2.2 through 2.4. A Rugged Baro TROLL barometer from In-Situ, Inc. was placed between the steel casing and the PVC pipe in B-104(P). Data from the barometer is used to correct the piezometer readings for changes in atmospheric pressure. Calibration certificates for the instruments are provided in Appendix F.

Following monitoring well construction and datalogger installation, water level measurements were obtained using readings downloaded from the dataloggers and corrected for variations in barometric pressure. Barometric corrections were performed using software provided by In-Situ, Inc. The piezometers and barometer were programmed to collect data every 6 to 12 hours. RJH also periodically obtained manual measurements within the monitoring wells using an electronic water level indicator. Groundwater measurements obtained following monitoring well construction are presented on Figure 2.5 and data are presented in Appendix F.

On July 1 and July 15, 2016, RJH removed water from the monitoring wells using a hand-bailer and a submersible pump, respectively. The water level rebounded to approximately the pre-bailing level within less than 1 day following each bailing effort. Bailing data are summarized in Table 2.4.

TABLE 2.4
MONITORING WELL BAILING DATA

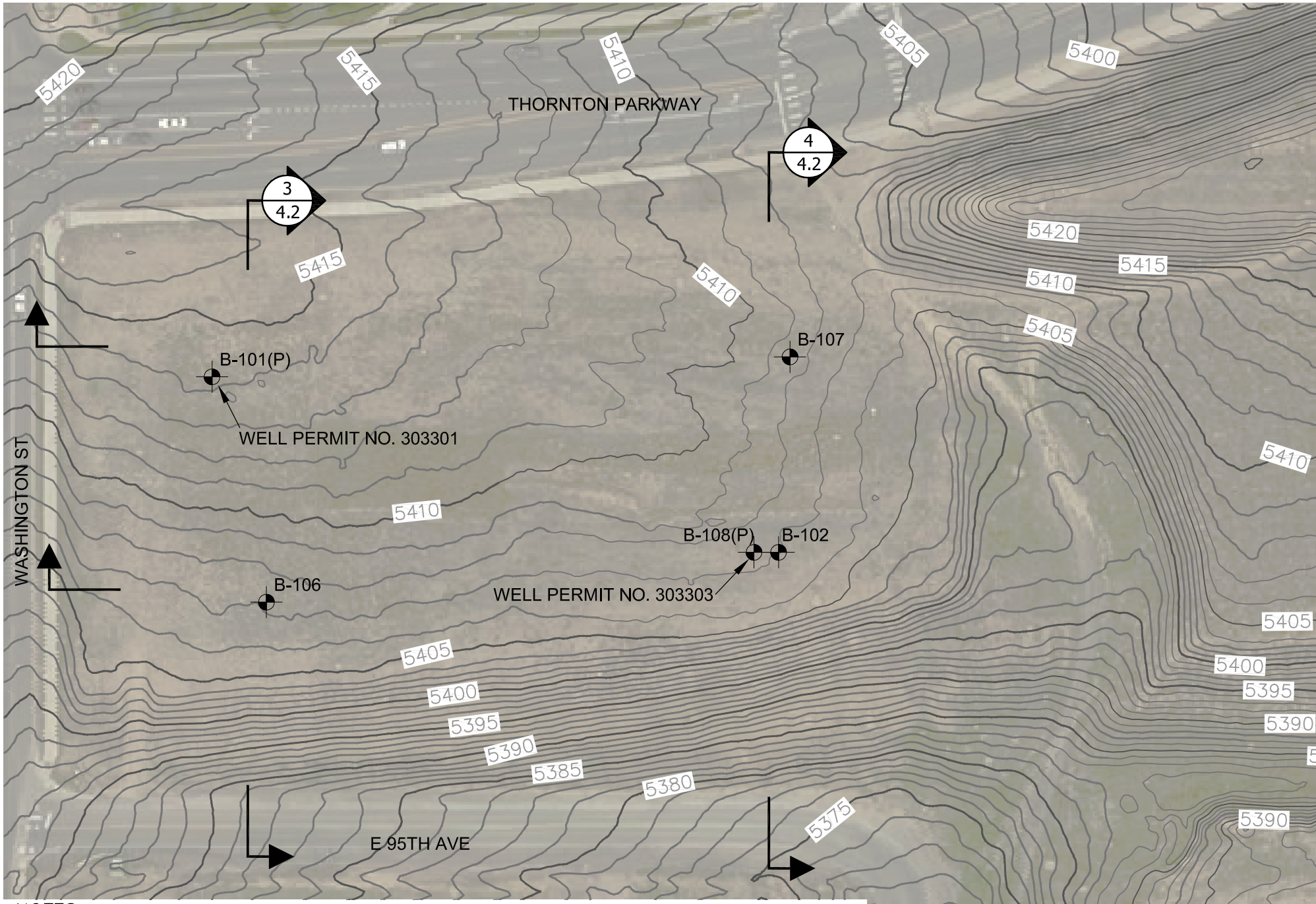
Monitoring Well	Date	Drawdown[1]	Drawdown[1] and Elapsed Time[2]	Drawdown[1] and Elapsed Time[2]
B-101(P)	7/1/2016	7.6	1.2 at 10 min	0.0 at 3 h 20 min
	7/15/2016	6.9	1.5 at 10 min	0.0 at 3 h
B-104(P)	7/1/2016	5.0	3.9 at 10 min	0.1 at 14 h 30 min
	7/15/2016	11.2	10.3 at 15 min	0.1 at 21 h 40 min
B-108(P)	7/1/2016	4.1	0.1 at 2 h 40 min	0.1 at 4 h 40 min
	7/15/2016	12.6	7.9 at 10 min	0.1 at 2 h 15 min

Notes:
1. Drawdown in feet of water level in monitoring well from initial starting depth.
2. Time elapsed following drawdown.

2.7 RACS Plan Compliance

ERO was onsite fulltime during drilling to manage implementation of and compliance with the RACS Plan. Specific activities performed by ERO included:

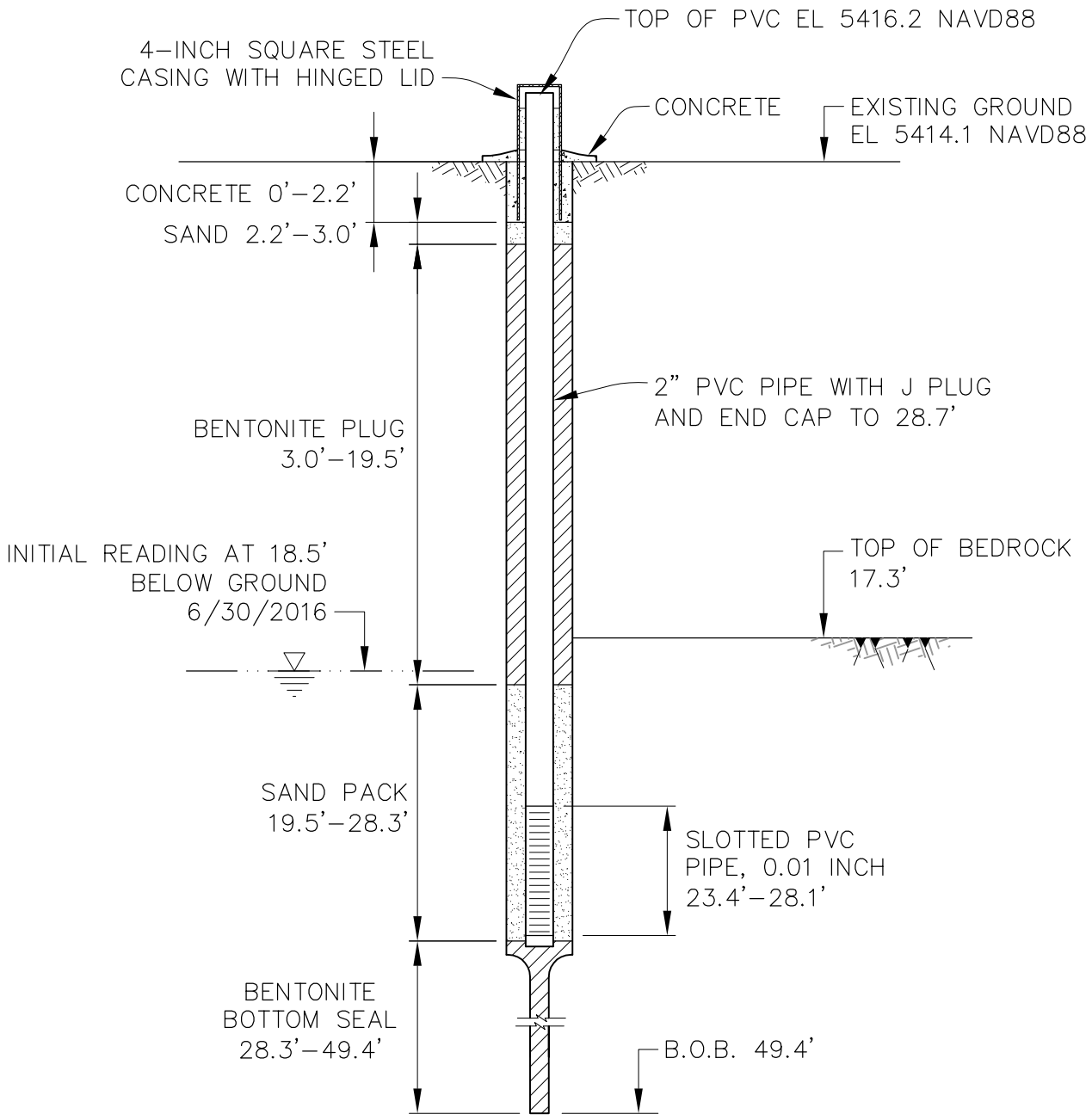
- Delineation of specific travel corridors and work areas within the Site.
- Visual clearance of ACM on the ground surface within travel corridors and work areas.
- Visual observation of collected samples for the presence of ACM. No ACM was identified within the recovered samples.
- Wind speed and air quality monitoring.
- Observation of drilling equipment decontamination upon completion of the work.
- Interpretation of the RACS Plan.



NOTES:

1. TOPOGRAPHY WAS PROVIDED BY THORNTON AND WAS APPROXIMATELY GEOREFERENCED BY RJH.

FIGURES\DATA REPORT\EXPLORATION PLAN AND SECTIONS.DWG 11/17/2016 11:51 AM



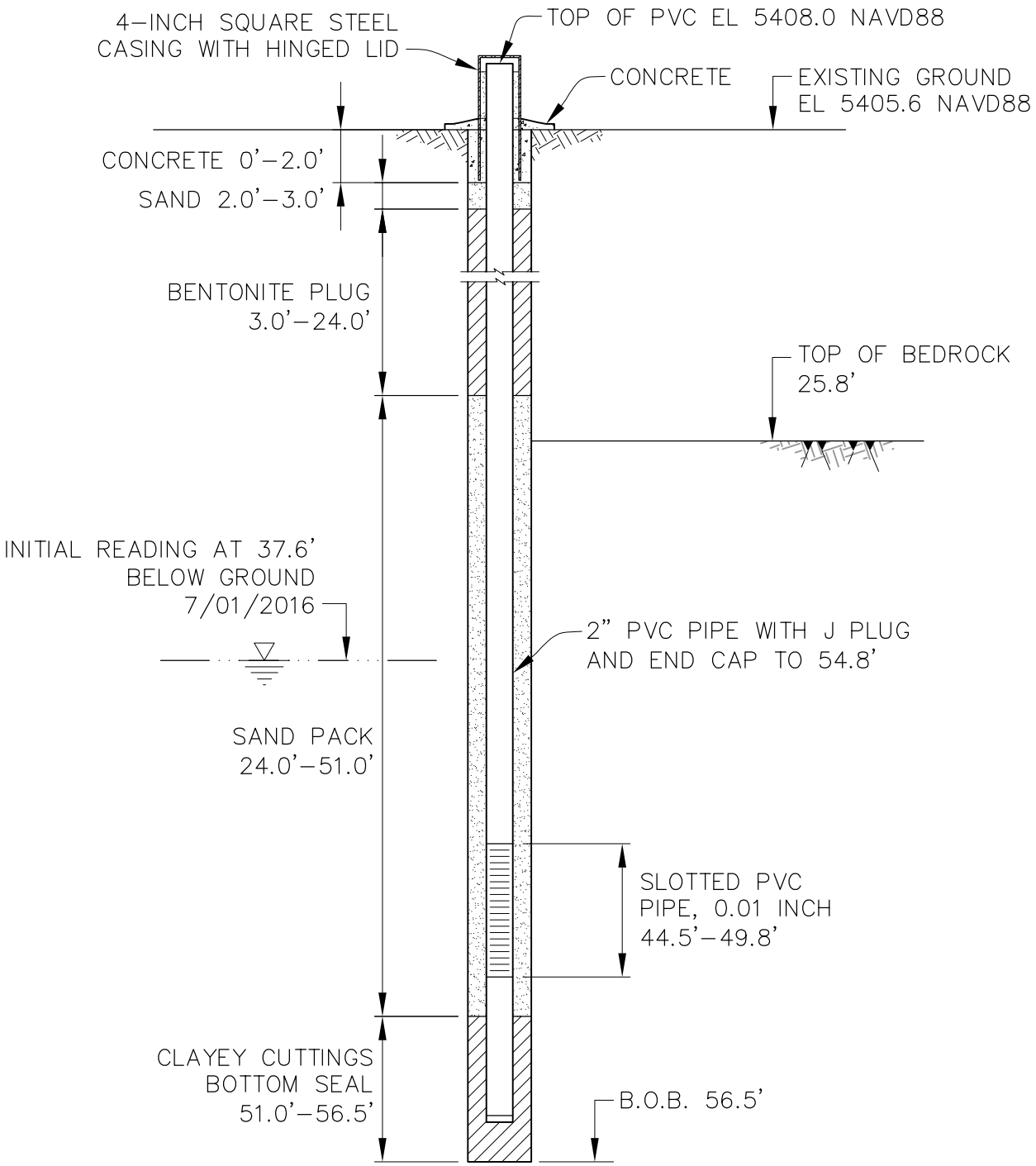
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NOTES:

1. MONITORING WELL INSTALLED 6/28/2016 WITH 8–INCH OD HOLLOW STEM AUGERS AND NQ3 SIZED (2.98–INCH OD) CORE STEEL.
2. STEEL CASING SECURED WITH LOCK.
3. LOCATION: N 1,196,040.4 FT; E 3,146,739.3 FT COLORADO STATE PLANE, NORTH ZONE.
4. SAND PACK CONSISTS OF 10/20 WASHED SILICA SAND.
5. MONITORING WELL EQUIPPED WITH RUGGED TROLL 100 DATA LOGGER (S/N 446235) SUSPENDED FROM THE J PLUG TO 29.9 FT BELOW TOP OF PVC.
6. WELL MONITORING NO. 303301.

City of Thornton	RJH CONSULTANTS, INC.	GEOTECHNICAL DATA REPORT THORNTON WTP	MONITORING WELL INSTALLATION B-101(P)
		PROJECT NO. 16104	November 2016 **Figure 2.2**

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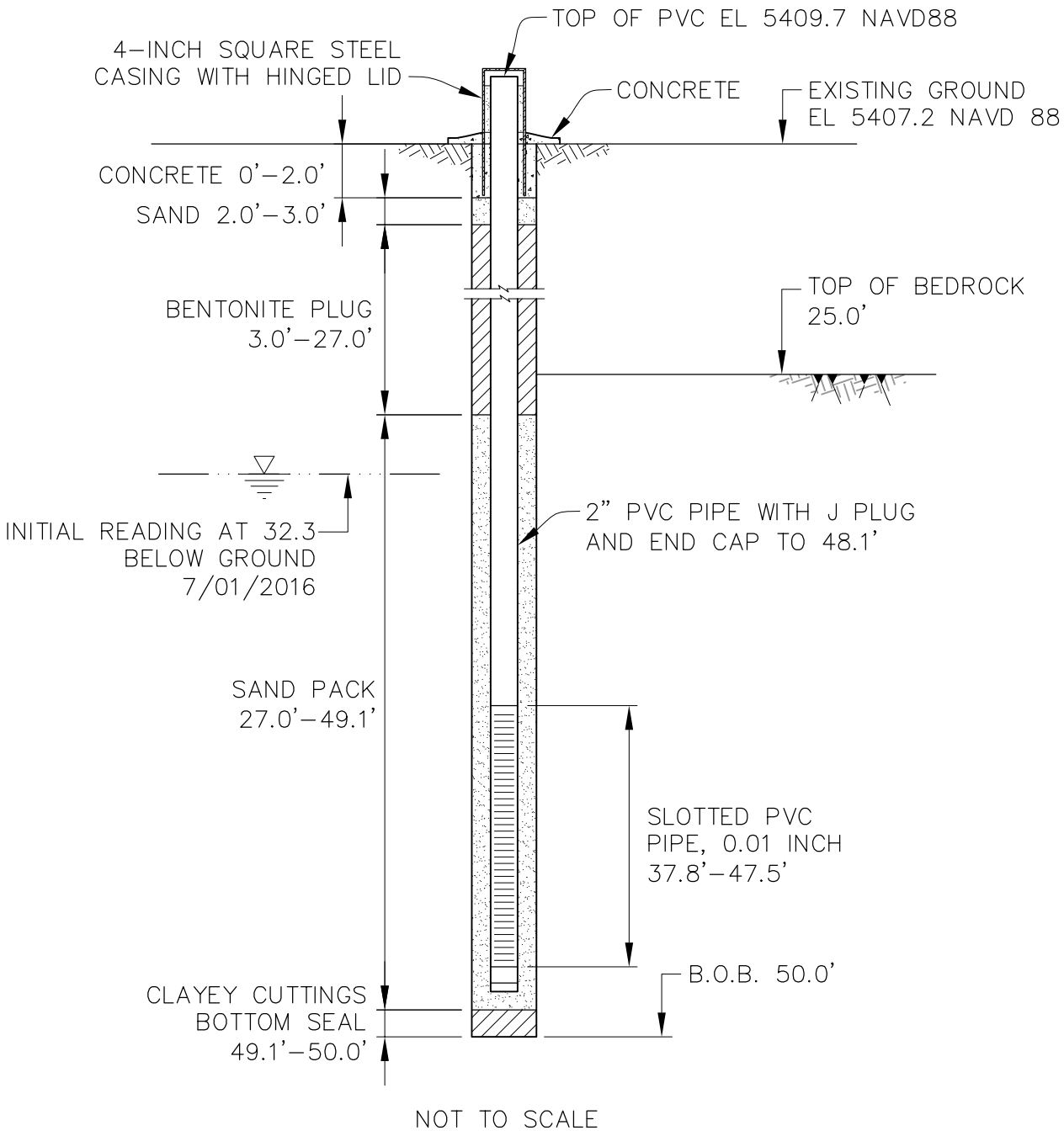
NOT TO SCALE

NOTES:

1. MONITORING WELL INSTALLED 6/29/2016 WITH 8–INCH OD HOLLOW STEM AUGERS.
2. STEEL CASING SECURED WITH LOCK.
3. LOCATION: N 1,195,902.1 FT; E 3,147,471.1 FT COLORADO STATE PLANE, NORTH ZONE.
4. SAND PACK CONSISTS OF 10/20 WASHED SILICA SAND.
5. MONITORING WELL EQUIPPED WITH RUGGED TROLL 100 DATA LOGGER (S/N 446258) SUSPENDED FROM THE J PLUG TO 52.8 FT BELOW TOP OF PVC.
6. RUGGED BAROTROLL BAROMETER (S/N 447557) PLACED INSIDE STEEL CASING (OUTSIDE OF PVC PIPE).
7. WELL PERMIT NO. 303302.

City of Thornton	RJH CONSULTANTS, INC.	GEOTECHNICAL DATA REPORT THORNTON WTP	MONITORING WELL INSTALLATION B-104(P)
		PROJECT NO. 16104	November 2016 **Figure 2.3**

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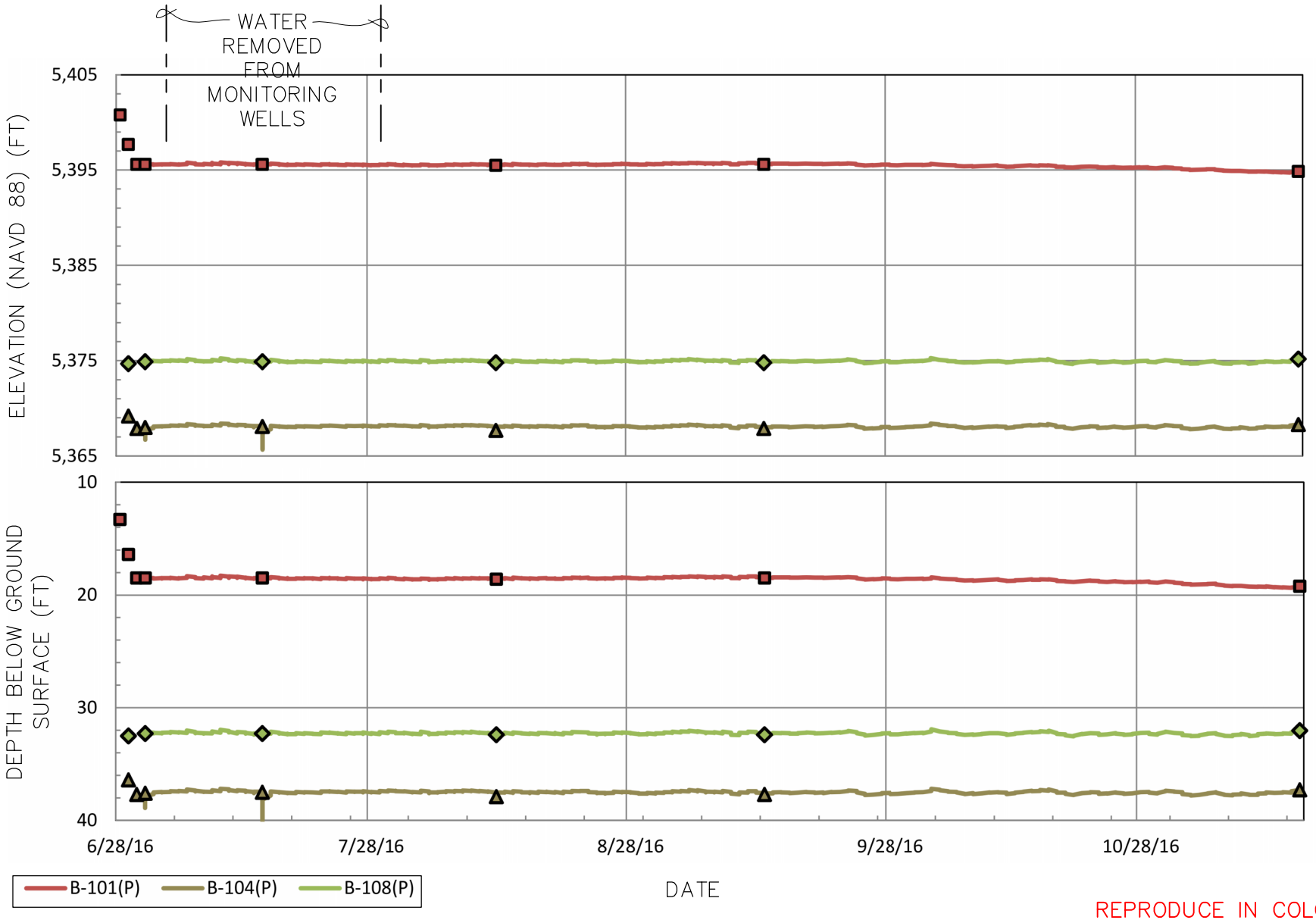


NOTES:

1. MONITORING WELL INSTALLED 6/29/2016 WITH 8–INCH OD HOLLOW STEM AUGERS.
2. STEEL CASING SECURED WITH LOCK.
3. LOCATION: N 1,195,929.5 FT; E 3,147,081.8 FT COLORADO STATE PLANE, NORTH ZONE.
4. SAND PACK CONSISTS OF 10/20 WASHED SILICA SAND.
5. MONITORING WELL EQUIPPED WITH RUGGED TROLL 100 DATA LOGGER (S/N 446260) SUSPENDED FROM THE J PLUG TO 49.7 FT BELOW TOP OF PVC.
6. WELL PERMIT NO. 303303.

City of Thornton	RJH CONSULTANTS, INC.	GEOTECHNICAL DATA REPORT THORNTON WTP	MONITORING WELL INSTALLATION B-108(P)
		PROJECT NO. 16104	November 2016 **Figure 2.4**

P:\16104 – THORNTON WTP\CAD\TASK 1001 FIGURES\DATA REPORT\MONITORINGWELLS.DWG 11/17/2016 12:04 PM



REPRODUCE IN COLOR

NOTE:

1. LINES REPRESENT ELECTRONIC (DATALOGGER) MEASUREMENTS. SYMBOLS ARE MANUAL MEASUREMENTS.

RJH CONSULTANTS, INC.

GEOTECHNICAL DATA REPORT
THORNTON WTP

MONITORING WELL DATA

PROJECT NO. 16104

November 2016

Figure 2.5

P:\16104 - THORNTON WTP\CAD\TASK 1001 FIGURES\DATA REPORT\GROUND WATER LEVEL.DWG 11/17/2016 12:16 PM

SECTION 3 - LABORATORY TESTING

Laboratory tests were performed on selected samples of soil and bedrock collected during the Site investigation. RJH engaged Advanced Terra Testing of Lakewood, Colorado to perform the laboratory tests. The tests consisted of:

- Index tests:
  - Forty-three natural moisture content tests (ASTM D2216)
  - Twenty-three density tests (ASTM D2937)
  - Six particle size analyses with hydrometer (ASTM D422)
  - Six particle size analyses (passing No. 200 sieve) (ASTM D1140)
  - Twenty-six Atterberg limits tests (ASTM D4318)
  - Two shrinkage limits tests (ASTM D4943)
  - One capillary moisture test (ASTM D6836)
  - Four specific gravity tests (ASTM D854)
- Deformation tests:
  - Two consolidation tests (ASTM D2435)
  - Five swell/consolidation tests (ASTM D4546 Method A)
  - Five remolded swell/consolidation tests (ASTM D4546 Method A)
  - Three swell/consolidation tests (Pre-2008 ASTM D4546 Method B)
- Strength tests:
  - Four unconfined compressive strength tests (ASTM D7012 Method C)
  - Five remolded unconfined compressive strength tests (ASTM D2166)
- Compaction tests:
  - Four Standard Proctor tests (ASTM D698)
- Soil corrosion tests:
  - Two pH tests (AASHTO T289-91)
  - Two electrical conductivity tests (ASA2 10-3.3)
  - Two resistivity tests (AASHTO T288-91)
  - Two water soluble chlorides tests (ASTM D4327)

- Two water soluble sulfate tests (ASTM D4327)
- Two sulfide tests (AWWA C105)
- Two redox tests (ASTM D1498)

Laboratory tests were performed on samples that approximately represent the existing conditions in the field (in-situ conditions) at the time of this investigation and on remolded samples. Laboratory test results for in-situ samples are presented in Table 3.1 through Table 3.5. Gradation data are presented on Figure 3.1, plasticity data are presented on Figure 3.2, Proctor data are presented on Figure 3.3, and swell /consolidation data are presented on Figure 3.4.

Laboratory tests were also performed on remolded samples to measure the swell potential and strength characteristics of recompacted fine-grained fill materials. Soil for remolded tests was obtained from B-102 and B-104(P) between 10 and 20 feet below ground (Composite 1) and was blended together and conditioned to produce five samples, each at a different moisture content and dry unit weight. One swell/consolidation test (with four inundation pressures) and one unconfined compressive strength test was performed on each sample. Index data for Composite 1 is presented in Table 3.1. Remolded test results are presented in Table 3.6. Remolded swell/consolidation test data are presented on Figure 3.4

Laboratory tests results are provided in Appendix G.

TABLE 3.1
INDEX, COMPACTION, UNCONFINED COMPRESSIVE STRENGTH, AND SWELL

Boring	Depth (ft)	Material Classification	Moisture Content (%)	Dry Unit Weight (pcf)	Liquid Limit, LL (%)	Plasticity Index, PI (%)	Shrinkage Limit (%)	Sand[1] (%)	Silt[2] (%)	Clay[3] (%)	Fines[4] (%)	Specific Gravity
Fill												
B-102	2.5 to 4.5	Fat Clay with Sand	20.1									
B-102	12.5 to 14.5	Lean Clay with Sand	16.6									
B-102	22.5 to 24.5	Fat Clay with Sand and Sandy Lean Clay[7]	17.1		47	33						
B-103	0 to 10.0	[8]			62	44					81	
B-103	5.0 to 7.0	Fat Clay	19.2									2.69
B-103	10.0 to 12.0	Fat Clay	21.3		56	37	11					
B-103	17.5 to 19.5	Lean Clay with Sand	17.4					19	39	42		
B-104(P)	5.0 to 7.0	Lean Clay with Sand	20.1									
B-104(P)	15.0 to 17.0	Sandy Lean Clay	17.9		48	34						2.73
B-105[11]	7.5 to 8.5	Lean Clay	14.1	101.0	45	31						
B-106[11]	5.0 to 6.0	Fat Clay	17.8	101.6	57	40		10	50	40		
Composite 1[9]	10.0 to 20.0	[8]			52	38		27	32	41		
Fine Grained Bedrock												
B-101(P)[10]	24.8 to 29.1	Claystone	24.1	100.1	51	35						
			16.5	115.9								
			14.3	119.7								
			10.9	123.4								
B-101(P)	44.9 to 45.6	Claystone	27.9	100.3	55	39						
B-102	25.0 to 26.0	Claystone	21.7	103.7	53	36						
B-102	30.0 to 32.0	Claystone	20.3		54	39						
B-102	37.5 to 39.5	Sandy Claystone	23.2									2.70
B-102	49.0 to 51.0	Claystone	27.0		55	33						
B-102	54.0 to 59.0	[8]			53	38					84	
B-103	24.2 to 25.5	Claystone	16.0									
B-103[11]	26.5 to 27.5	Claystone	17.5	111.5	52	37					99	

Boring	Depth (ft)	Material Classification	Moisture Content (%)	Dry Unit Weight (pcf)	Liquid Limit, LL (%)	Plasticity Index, PI (%)	Shrinkage Limit (%)	Sand[1] (%)	Silt[2] (%)	Clay[3] (%)	Fines[4] (%)	Specific Gravity
B-103	69.0 to 69.5	Claystone	16.2		57	39						
B-104(P)	27.5 to 29.5	Claystone	19.9		56	39						
B-104(P)	40.0 to 42.0	Claystone and Sandy Claystone[7]	18.5		47	31						
B-104(P)	55.0 to 56.5	Claystone	21.5		63	42						
B-106[10]	40.0 to 43.0	Claystone	20.4	108.4	51	38		7	61	32		
			20.9	105.8								
B-106[10]	48.0 to 50.0	Claystone	25.1	97.5	57	39		5	60	35		
			24.9	99.1								
B-107	26.5 to 27.0	Claystone	23.1	102.7	70	53					99	
B-107[10]	30.7 to 34.3	Claystone	22.1	104.8	63	47						
			26.2	97.9								
B-107[10]	44.3 to 45.6	Claystone	12.8	118.5	50	33					96	
			18.8	111.4								
			18.2	113.1								
			13.7	121.0								
B-108(P)	30.0 to 35.0	[8]			58	43		13	34	53		
Granular Bedrock												
B-106	31.1 to 31.6	Silty Sandstone	21.0	105.9								
B-107	39.1 to 39.7	Sandstone	18.4	110.8								

Notes:
1. Sand sized particles are finer than the #4 sieve and are larger than the #200 sieve.
2. Silt sized particles are finer than the #200 sieve and larger than 0.002 mm.
3. Clay sized particles are finer than 0.002 mm.
4. Fines include silt and clay and are finer than the #200 sieve.
5. Percent volume change (swell/consolidation) is computed as the change in sample height measured after inundation divided by the sample height prior to inundation. Positive va
6. Pressure required to reduce sample height to sample height measured prior to inundation. Pressure estimated by logarithmically interpolating test data.
7. Sample blended together for laboratory testing.
8. Sample collected from auger cuttings and could contain material from depths above sampled interval.
9. Composite 1 is a blend of B-102 10 to 20 feet and B-104(P) 10 to 20 feet.
10. ASTM D4546 Method A test result.
11. ASTM D4546 Method B test result.

TABLE 3.2
CONSOLIDATION[1] TEST RESULTS

Boring	Depth (ft)	Material Classification	Computed		
			Preconsolidation Pressure (psf)	Cc	Cr
Fine Grained Bedrock					
B-102	25.0 to 26.0	Claystone	8910	0.15	0.03
B-103	54.0 to 54.4	Claystone	5130	0.10	0.02

Note:
1. ASTM D2435 test result.

TABLE 3.3
UNCONFINED COMPRESSIVE STRENGTH TEST RESULTS

Boring	Depth (ft)	Unconfined Compressive Strength (psf)
Fine Grained Bedrock		
B-101(P)	44.9 to 45.6	12,960
B-107	26.5 to 27.0	18,720
Granular Bedrock		
B-106	31.1 to 31.6	23,040
B-107	39.1 to 39.7	47,520

TABLE 3.4
CAPILLARY MOISTURE TEST RESULT[1]

Applied Suction (bar)	Volumetric Water Content (Specimen 1)	Volumetric Water Content (Specimen 2)
0	49.4	48.4
0.3	42.1	45.6
0.7	40.3	44.3
2	38.7	42.4
5	35.8	39.5
15	35.8	39.4

Note:
1. Tested sample was claystone obtained from B-102, 30.0 to 32.0 feet.

TABLE 3.5
SOIL-CHEMICAL TEST RESULTS

Boring	Depth (ft)	pH	Electrical Conductivity (mmhos/cm)	Redox Potential (mv)	Resistivity (Ohm-cm)	Chloride – Water Soluble (%)	Sulfate – Water Soluble (%)	Sulfide (%)
Fill								
B-103	0 to 10.0	7.9	1.9	279	531	0.0037	0.052	(1)
Fine Grained Bedrock								
B-103	24.2 to 25.5	7.9	1.4	238	700	0.0047	0.019	(1)

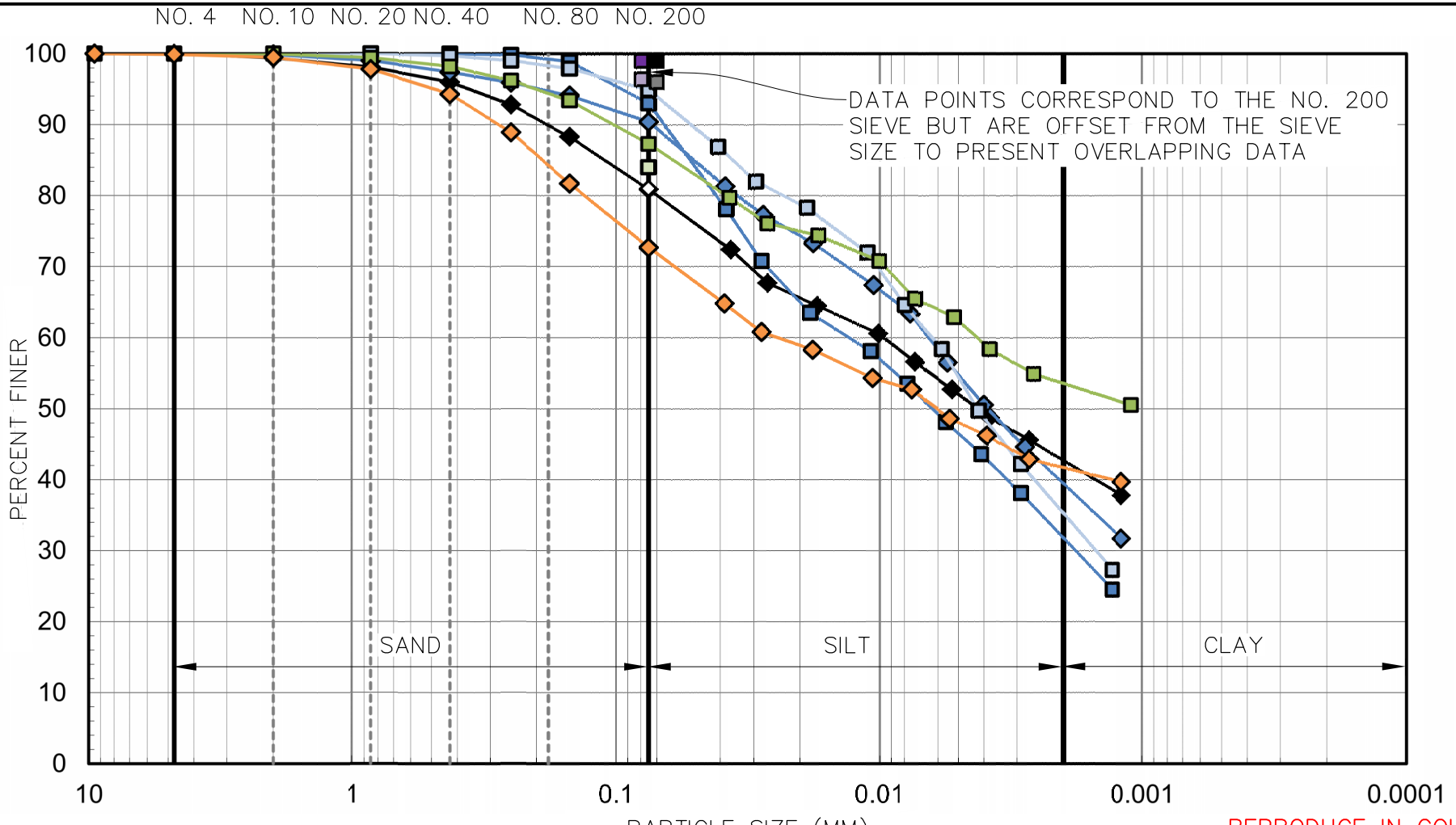
Note:
1. Below detection limit.

TABLE 3.6
REMOLDED TEST RESULTS

Moisture Content (%)	Dry Unit Weight (pcf)	Difference From Standard Proctor Optimum Moisture Content(1) (%)	Standard Proctor Relative Compaction(2) (%)	Nominal Inundation Pressure (psf)	Percent Volume Change(3) (swell/consolidation)	Unconfined Compressive Strength (psf)
Remolded Specimen 1(4)						
15.8	102.0	-2.8	97.7	20	12.3	
15.7	102.0	-2.9	97.7	1,500	2.4	
15.6	102.2	-3.0	97.9	4,000	-0.2	
15.6	102.1	-3.0	97.8	6,000	-1.0	
16.1	101.4	-2.5	97.1			4,720
Remolded Specimen 2(4)						
17.7	105.1	-0.9	100.7	20	8.4	
17.7	105.2	-1.0	100.8	1,500	2.0	
17.7	105.1	-0.9	100.7	4,000	0.4	
17.6	105.2	-1.0	100.8	6,000	-0.2	
18.4	104.0	-0.2	99.6			3,570
Remolded Specimen 3(4)						
18.1	101.9	-0.5	97.6	20	7.7	
18.2	101.7	-0.4	97.4	1,500	1.1	
18.1	101.8	-0.5	97.5	4,000	-0.7	
17.9	102.0	-0.7	97.7	6,000	-2.9	
18.5	101.1	-0.1	96.8			3,120
Remolded Specimen 4(4)						
19.4	104.0	0.8	99.6	20	6.8	
19.1	104.3	0.5	99.9	1,500	1.4	
19.5	103.9	0.9	99.5	4,000	0.1	
19.4	104.0	0.8	99.6	6,000	-0.2	
20.1	102.5	1.5	98.2			2,490

Moisture Content (%)	Dry Unit Weight (pcf)	Difference From Standard Proctor Optimum Moisture Content[1] (%)	Standard Proctor Relative Compaction[2] (%)	Nominal Inundation Pressure (psf)	Percent Volume Change[3] (swell/consolidation)	Unconfined Compressive Strength (psf)
Remolded Specimen 5[4]						
21.3	101.6	2.7	97.3	20	3.8	
20.8	102.0	2.2	97.7	1,500	0.3	
20.6	102.2	2.0	97.9	4,000	-0.4	
21.0	101.8	2.4	97.5	6,000	-0.9	
21.8	100.4	3.2	96.2			1,790

Notes:
1. Positive value indicates specimen moisture content is above the standard proctor optimum moisture content and a negative value indicates specimen moisture content is below the standard proctor optimum moisture content.
2. Relative compaction is the ratio of the specimen dry unit weight to the standard proctor maximum dry unit weight.
3. Refer to Table 3.1 note 5.
4. Tested sample corresponds to Composite 1. Refer to Table 3.1 for additional Composite 1 data and information.



NOTES:

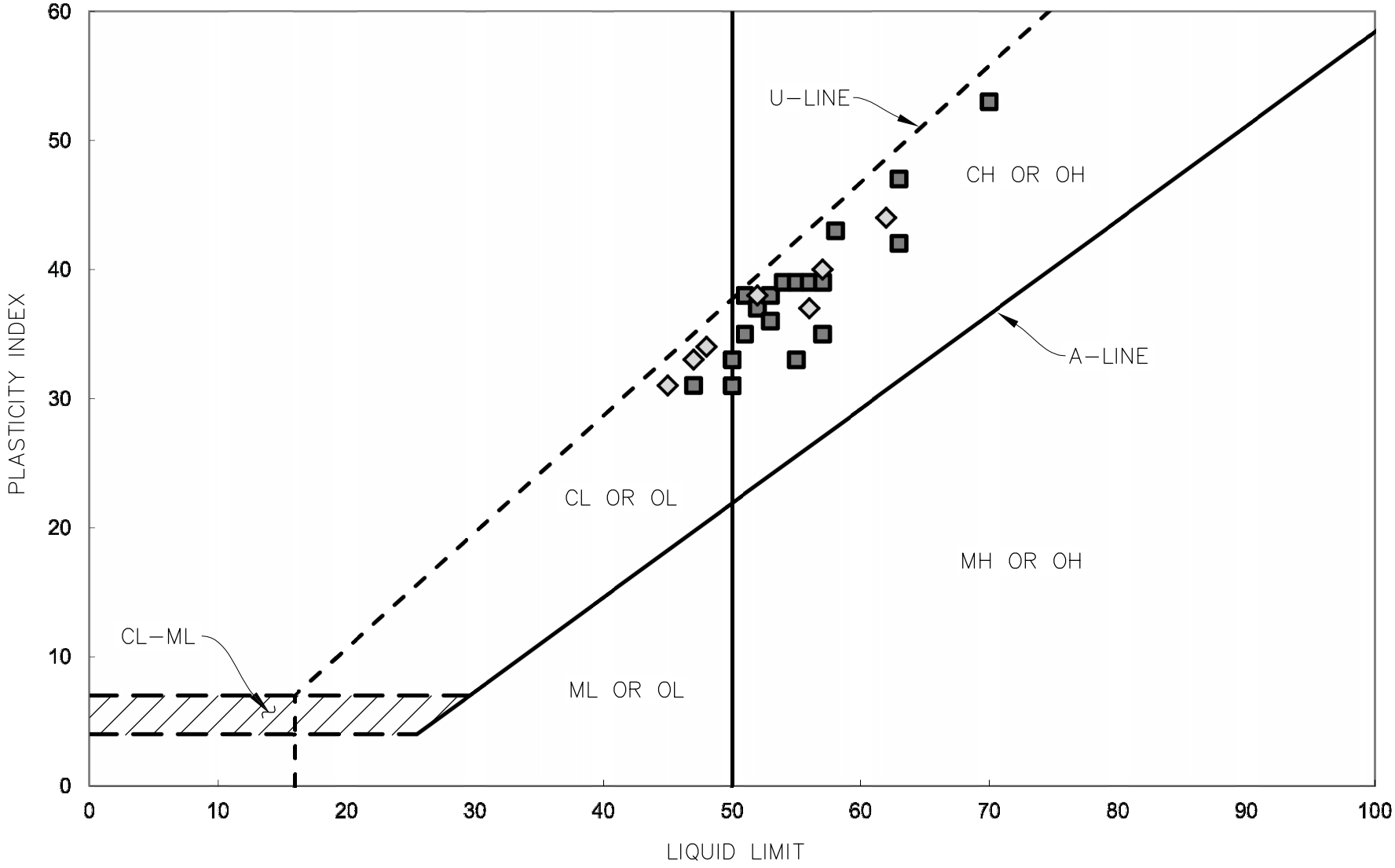
1. DATA POINTS CONNECTED BY LINES WERE OBTAINED FROM ASTM D422. DATA POINTS NOT CONNECTED BY LINES WERE OBTAINED FROM ASTM D1140 (NO. 200 WASH).

2. DIAMOND SYMBOLS ARE SOIL SAMPLES, SQUARE SYMBOLS ARE ROCK SAMPLES. COLORS REPRESENT DIFFERENT BORING LOCATIONS.

RJH CONSULTANTS, INC.

GEOTECHNICAL DATA REPORT THORNTON WTP	GRADATION DATA SUMMARY
PROJECT NO. 16104	November 2016 **Figure 3.1**

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REPRODUCE IN COLOR

NOTE:

1. DIAMOND SYMBOLS ARE SOIL SAMPLES, SQUARE SYMBOLS ARE ROCK SAMPLES.

RJH CONSULTANTS, INC.

GEOTECHNICAL DATA REPORT
THORNTON WTP

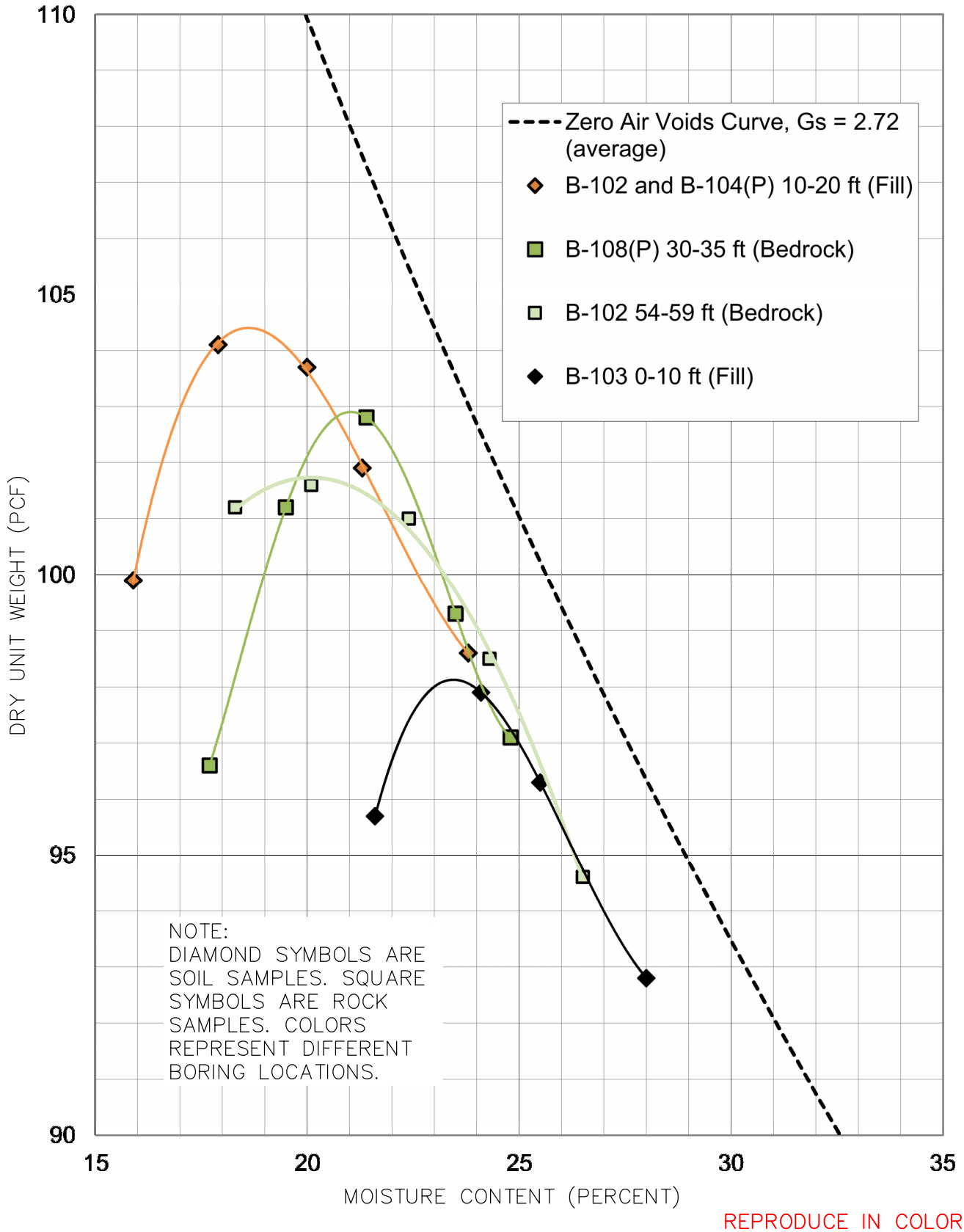
PLASTICITY DATA SUMMARY

PROJECT NO. 16104

November 2016

Figure 3.2

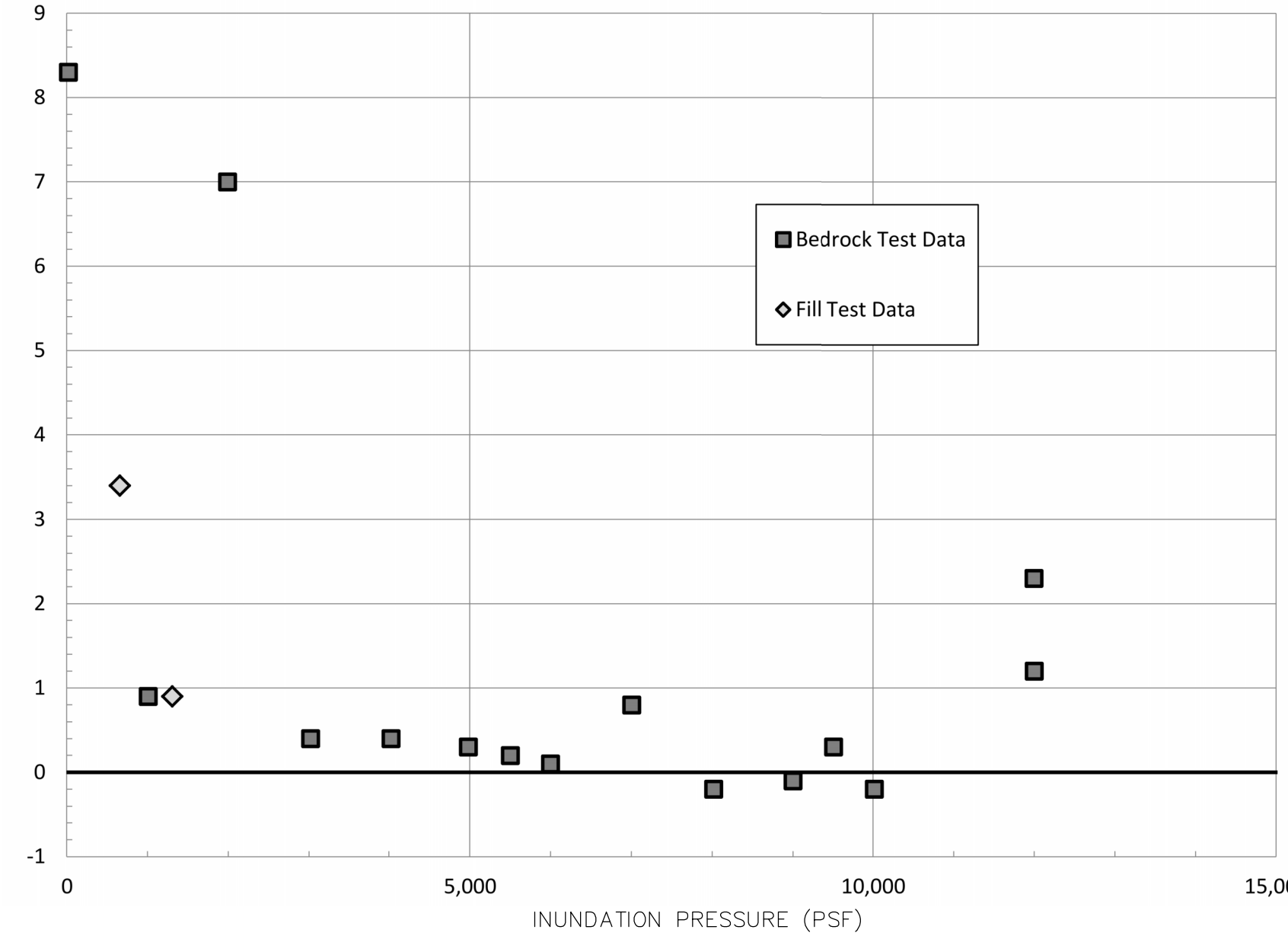
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REPRODUCE IN COLOR

RJH CONSULTANTS, INC.	GEOTECHNICAL DATA REPORT THORNTON WTP	STANDARD PROCTOR DATA SUMMARY
	PROJECT NO. 16104	November 2016 **Figure 3.3**

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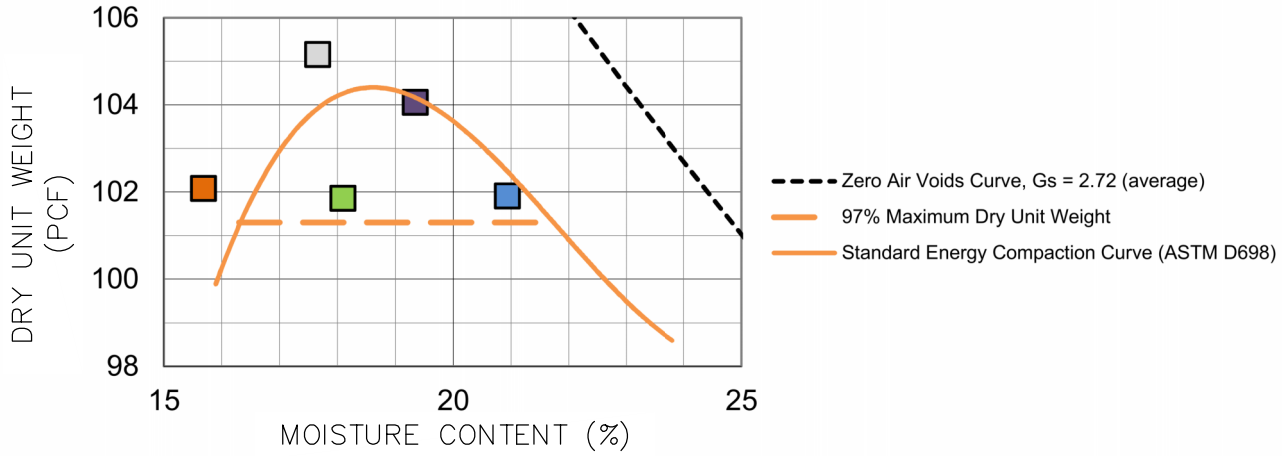
NOTE:

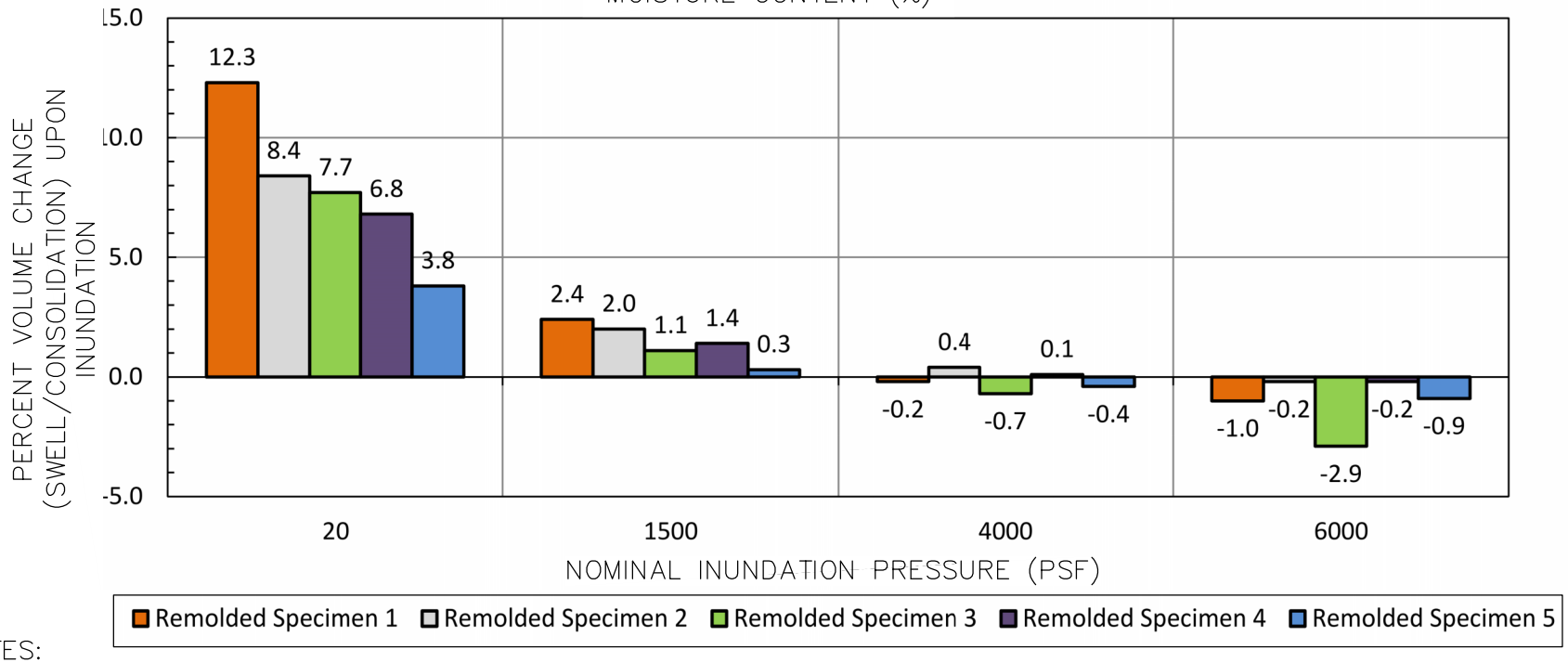
1. POSITIVE VOLUME CHANGE REPRESENTS SWELL, NEGATIVE VOLUME CHANGE REPRESENTS CONSOLIDATION.

RJH CONSULTANTS, INC.

GEOTECHNICAL DATA REPORT THORNTON WTP	SWELL/CONSOLIDATION TEST DATA SUMMARY
PROJECT NO. 16104	November 2016 **Figure 3.4**

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NOTES:

1. REFER TO FIGURE 3.4 NOTE 1.
2. REMOLDED SAMPLE WAS OBTAINED FROM B-102 AND B-104(P), 10 TO 20 FEET.
3. DATA POINTS ON PROCTOR CURVE ARE POSITIONED AT THE AVERAGE MOISTURE CONTENT AND DRY UNIT WEIGHT OF THE FOUR REMOLDED SWELL/CONSOLIDATION SPECIMENS.

REPRODUCE IN COLOR

RJH CONSULTANTS, INC.

GEOTECHNICAL DATA REPORT
THORNTON WTP

REMOLDED SWELL/CONSOLIDATION TEST DATA SUMMARY

PROJECT NO. 16104

November 2016

Figure 3.5

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SECTION 4 - SITE AND SUBSURFACE CONDITIONS

4.1 Site Geology

According to published geologic mapping (Lindvall, 1980), bedrock at the Site consists of the Paleocene to Upper Cretaceous aged (56 to 100 million years old) Denver and Arapahoe Formations. These formations generally consist of interbedded sandstone, claystone, siltstone, shale, and conglomerate and are over 700 feet thick. Bedrock at the Site reportedly has high to very high swell potential (Hart, 1974). Bedrock in the area north of the Site, which was being developed during the timeframe when fill was imported to the Site, is also mapped as Denver and Arapahoe Formations with high to very high swell potential.

The ridge in the northeast corner of the Site has been mapped as Pleistocene age (10,000 to 2.6 million years old) Rocky Flats Alluvium. This unit is commonly 10 to 20 feet thick and generally consists of poorly sorted coarse sand and gravel with lenses of clay and silt, cobbles, and scattered boulders.

4.2 Surface Conditions

No bedrock outcrops were observed during our Site reconnaissance. The ground surface generally consisted of medium to high plasticity clayey soil that was slick when wet. Prairie dog burrows were common throughout the Site. Pedestrian debris was also prevalent at the Site and mostly consisted of food and beverage containers. Multiple pieces of Transite pipe that were generally 1 to 4 inches in size were identified in the northeast portion of the Site. Occasional concrete debris was observed at the ground surface throughout the Site; the concrete debris was up to 18 inches in size in the southeast portion of the Site.

The ground surface in the area mapped as Rocky Flats Alluvium generally consisted of clayey sand with gravel. The material visible on the ground surface was visually estimated to be mostly fine to coarse-grained sand, 20 to 30 percent low to medium plasticity fines, and 10 to 20 percent fine to coarse-grained gravel. The maximum observed particle size was about 2 inches and the material was highly calcareous.

4.3 Subsurface Conditions

4.3.1 General Subsurface Profile

The subsurface profile encountered at the Site generally consisted of fill, overlying colluvium/residuum, overlying bedrock of the Denver and Arapahoe Formations. Colluvium/residuum was not identified in every boring. No subsurface explorations were performed within the Rocky Flats Alluvium.

Subsurface cross sections are shown on Figures 4.1 through Figure 4.2 and the cross section locations are shown on Figure 2.1. An explanation of the symbols used on the cross sections is provided on Figure 4.1. The sections are generalized from the boring logs and do not include all information. Additional information is provided on the boring logs in Appendix C.

4.3.2 Fill

Fill was encountered at the ground surface in each boring and extended 13.5 to 25.8 feet below the ground surface. The average thickness of the fill was 22 feet, excluding B-105 (boring located at the southeast corner), where the fill was approximately 13.5 feet thick. Fill included layers of granular and fine-grained soil, but was predominately fine-grained soil with occasional layers of sandy soil. Individual soil layers appeared to be randomly distributed throughout the Site. Fill was often blocky and consisted of a single bedrock fragment or contained fragments of bedrock within the sample and was brown, gray, or tan. There were occasional organics, woody debris, calcite was common, and the fill generally had a strong to weak reaction with hydrochloric acid. SPT N-values in fill ranged between 10 and 39 and averaged 18. Refusal was obtained for one SPT test. In B-105, asphaltic pavement was encountered and auger refusal occurred in the fill at 11 feet below the ground surface.

Granular fill consisted of both gravelly and sandy soil. Fourteen layers of granular fill were encountered, which ranged between 0.1 and about 5.0 feet thick. The average layer thickness was about 2 feet. Sandy fill classified as clayey sand, poorly graded sand with clay, poorly graded sand with silt, and poorly graded sand. Sandy fill contained mostly fine to coarse-grained sand generally with less than 25 percent low to medium plasticity fines and up to 10 percent fine to coarse-grained gravel. Sandy fill contained up to 40 percent nonplastic to high plasticity fines. Sandy fill was loose to dense but was predominately medium dense. Gravelly fill classified as clayey gravel with sand. Gravelly fill was encountered in B-105 and contained mostly fine to coarse-grained

gravel with 20 to 30 percent low to medium plasticity fines and 20 to 30 percent fine to medium-grained sand. No laboratory testing was performed on granular fill.

Eighteen layers of fine-grained fill were encountered, which ranged between about 1 and 21 feet thick. The average layer thickness was about 7 feet. Fine-grained fill classified as fat clay, lean clay, fat clay with sand, lean clay with sand, lean clay with gravel, and sandy lean clay. Fine-grained fill was mostly fines generally with less than 25 percent fine to medium-grained sand, and less than 5 percent fine to coarse-grained gravel. Fine-grained fill contained up to 50 percent fine to coarse-grained sand and up to 20 percent gravel. The sand content was between 10 and 27 percent, the silt content was between 32 and 50 percent, and the clay content was between 40 and 42 percent for two samples tested in the laboratory. The fines content (silt and clay) was between 73 and 90 percent for four samples tested in the laboratory. The fines ranged from low to high plasticity but were predominately medium to high plasticity. The liquid limit was between 45 and 62 and averaged 52, and the plasticity index was between 31 and 44 and averaged 37. The fill is considered highly plastic based on the Atterberg limits test results. Fine-grained fill was very soft to hard but was typically very stiff to hard. Pocket penetrometer test results were 4.5 tons per square foot (tsf) or higher. The natural moisture content ranged between 14 and 21 percent and averaged 18 percent. The in-situ dry unit weight was about 101 pcf for two tested samples. The maximum dry unit weight was between 98 and 104 pcf and the optimum moisture content was between 23 and 19 percent for two tested samples (standard compaction energy). The specific gravity was between 2.69 and 2.73 for two tested samples. Two tested samples of fill swelled between 0.9 and 3.4 percent, when inundated at 1,305 and 656 psf, respectively. The pressure required to restore the samples to the initial inundation height was between approximately 3,250 and 5,200 psf, respectively. The pH was 7.9, the resistivity was 531 Ohm-cm, the water soluble Chloride was less than 0.004 percent, the water soluble sulfate was less than 0.05 percent, and the sulfide content was below detectable limits for the tested sample.

Fine-grained fill was remolded to produce five specimens, each at a different moisture content and dry unit weight. The moisture content of the specimens was between -3.0 percent below and 2.7 percent above the optimum moisture content and between 97.3 and 100.8 percent of the maximum dry unit weight (based on standard Proctor compaction, ASTM D698). The free swell (inundated at 20 psf) of remolded fine-grained fill was between 3.8 and 12.3 percent. Remolded fine-grained fill swelled between 0.1 and 2.4 percent when inundated at 1,500 to 4,000 psf, respectively. Remolded fine-grained fill settled between -0.2 and -2.9 percent (consolidation), when inundated at 4,000 to 6,000 psf, respectively. The unconfined compressive strength of remolded fine-grained fill was between about 3,590 and 9,450 psf.

One layer of interbedded granular and fine-grained fill was encountered in B-107, which was about 2 feet thick. The soil consisted of interbedded lean clay with sand and poorly graded sand with silt, which were similar to the fine-grained fill and granular fill described above.

4.3.3 Colluvium/Residuum

Colluvium/residuum was identified beneath fill and above bedrock in B-103 and B-106. The top of colluvium/residuum was 19.5 to 20.7 feet below the ground surface and the unit was 0.5 to 4.7 feet thick. The colluvium/residuum occasionally contained bedrock fragments and the color was tan to dark brown, or brown. The colluvium/residuum had a strong reaction with hydrochloric acid.

Colluvium/residuum may have been present at other exploration locations, where it was not identified. In B-104(P), B-107, and B-108(P) there was lower drilling resistance 1.5 to 3.5 above the top of bedrock. These zones of softer drilling could correspond to a thin layer of colluvium/residuum beneath the fill. Also, colluvium/residuum and fill were both derived from bedrock and may have been difficult to differentiate in samples.

Both granular and fine-grained colluvium/residuum were encountered. Granular colluvium/residuum classified as clayey sand and was mostly fine to coarse-grained sand with 15 to 25 percent low-plasticity fines. Sandy colluvium/residuum was medium dense.

Fine-grained colluvium/residuum classified as sandy lean clay and was mostly medium to high plasticity fines with 30 to 40 percent fine to medium-grained sand. Fine-grained colluvium/residuum was stiff to very stiff.

No laboratory testing was performed on colluvium/residuum.

4.3.4 Bedrock

Bedrock was encountered in each boring beneath either fill or colluvium/residuum. The top of bedrock ranged from 13.5 to 25.8 feet below the ground surface and extended beyond the limits of exploration. The average depth to bedrock was 22.8 feet excluding B-105 (boring located at the southeast corner), where the top of bedrock was approximately 13.5 feet deep. Bedrock generally consisted of granular and fine-grained sedimentary rock. Individual rock layers ranged from about 0.1 to greater than 23.5 feet thick and appeared to be randomly distributed throughout the Site.

Bedrock was occasionally blocky and was typically very thinly bedded to laminated. The color was gray, brown and tan, and iron and manganese staining were common. Fractures were tight to open, and slickensided/polished to stepped, but were typically slightly to moderately open and slightly rough to smooth. Fractures were generally clean to very thinly infilled with iron and manganese staining. Occasional coal/organics, bentonite seams, and calcite were observed and the bedrock generally had a strong to weak reaction with hydrochloric acid. SPT N-values in bedrock ranged from 25 to 72 and averaged 45. Refusal was obtained for eight SPT tests.

Twenty-one layers of granular bedrock were encountered, which ranged between 0.1 and about 5 feet thick. The average layer thickness was about 2 feet. Granular bedrock classified as clayey sandstone, silty sandstone, and sandstone and was mostly fine to medium-grained sand, generally with 10 to 20 percent non-plastic to low plasticity fines. Granular bedrock contained up to 50 percent non-plastic to high plasticity fines. The unconfined compressive strength for granular bedrock was between 23,040 and 47,520 psf. Granular bedrock was unfractured to intensely fractured but was typically slightly to moderately fractured. The weathering of granular bedrock was fresh to decomposed but was typically moderately to intensely weathered. Fresh to moderately weathered layers ranged from less than 0.5 to about 3 feet thick and moderately weathered to decomposed granular bedrock layers ranged from less than 0.5 to about 5 feet.

Twenty-eight layers of fine-grained bedrock were encountered, which ranged between 0.1 and about 24 feet thick. The average layer thickness was about 8 feet. Fine-grained bedrock classified as claystone and sandy claystone and was mostly fines generally with less than 15 percent fine-grained sand. Fine-grained bedrock contained up to 30 percent fine to medium-grained sand. The sand content was between 5 and 13 percent, the silt content was between 34 and 61 percent, and the clay content was between 32 and 53 percent for three samples tested in the laboratory. The fines content (silt and clay) was between 84 and 99 percent for eight samples tested in the laboratory. Fines ranged from low to high plasticity fines but were predominately medium to high plasticity. The liquid limit was between 47 and 70 and averaged 55, and the plasticity index was between 31 and 53 and averaged 38. The bedrock is considered highly plastic based on the Atterberg limits test results. One pocket penetrometer test result exceeded the capacity of the instrument, which was 4.5 tsf. The natural moisture content was between 11 and 28 percent and averaged 20 percent. The in-situ dry unit weight was between 98 and 123 pcf and averaged 107 pcf. The maximum dry unit weight was between 102 and 103 pcf and the optimum moisture content was between 20 and 21 percent for two tested samples (standard compaction energy). The specific gravity was between 2.70 and 2.75 for two tested samples. The free swell (inundated at 20 psf) of one bedrock sample was about 8

percent. The pressure required to restore this sample to the initial inundation height was about 17,420 psf. Bedrock displaced between 7 percent and -0.2 percent (consolidation) at inundation pressures between about 1,000 and 12,000 psf. The unconfined compressive strength was between 12,960 and 18,720 psf. The pH of fine-grained bedrock was 7.9, the resistivity was 700 Ohm-cm, the water soluble chloride was less than 0.005 percent, the water soluble sulfate was less than 0.02 percent, and the sulfide content was below detectable limits for the tested sample.

Fine-grained bedrock was unfractured to intensely fractured but was typically slightly fractured. Fine-grained bedrock was fresh to very intensely weathered but was typically fresh to moderately weathered. Relatively weathered bedrock was typically encountered adjacent to weathered layers of granular bedrock. Fresh to moderately weathered layers ranged from less than 0.5 to about 18 feet thick, and moderately to very intensely weathered layers ranged from less than 0.5 to 16 feet thick.

One layer of interbedded granular and fine-grained bedrock was encountered in B-106. The layer was 5 feet thick and consisted of interbedded claystone and sandstone, which were similar to the fine-grained bedrock and the granular bedrock described above. Interbedded bedrock was intensely fractured and was fresh to slightly weathered.

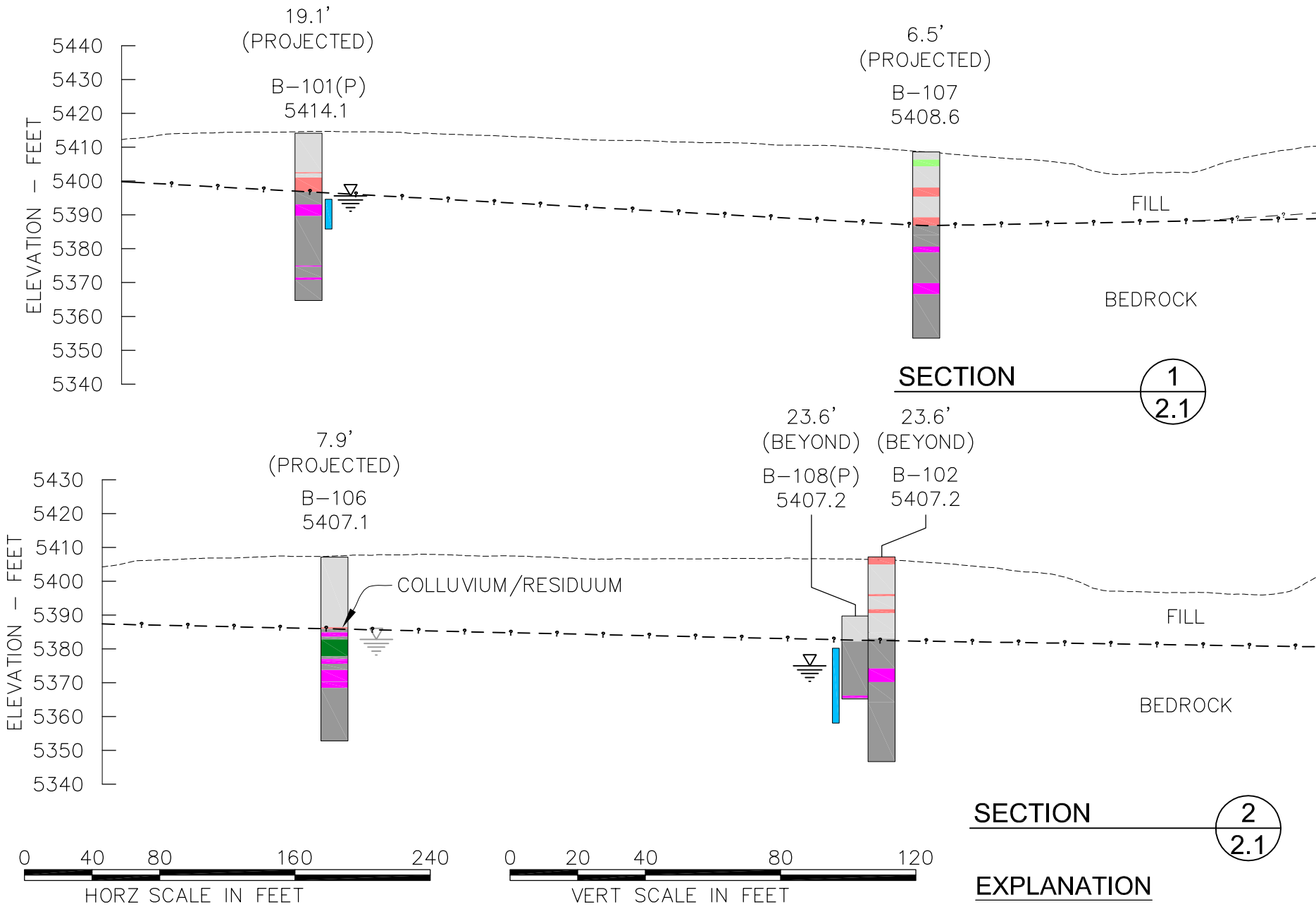
4.4 Groundwater Conditions

Groundwater measurements from monitoring wells are considered to be more reliable than water levels measured at the time of drilling. Groundwater levels in monitoring wells were encountered about 1 to 13.5 feet below the top of bedrock (between elevation (El.) 5368.0 and El. 5395.6) and, in general, appear to decrease in elevation to the south and east at the Site. Between about October 3, 2016 and November 16, 2016, the groundwater level in B-101(P) decreased about 1 foot and the groundwater level in B-104(P) and B-108(P) remained relatively constant. The measured groundwater levels could be perched groundwater or segregated groundwater pockets and may not be attributed to a continuous layer of saturated bedrock. Groundwater was not encountered in colluvium/residuum or fill.

Groundwater levels are presented on Figure 2.5.

The water level in the monitoring wells was removed on two occasions, as described in Section 2.6. After both occasions, the water level rebounded relatively quickly to near the initial reading prior to removing the water. These results suggested that the amount

of water available is relatively substantial and the hydraulic conductivity of water-bearing zones is relatively high.



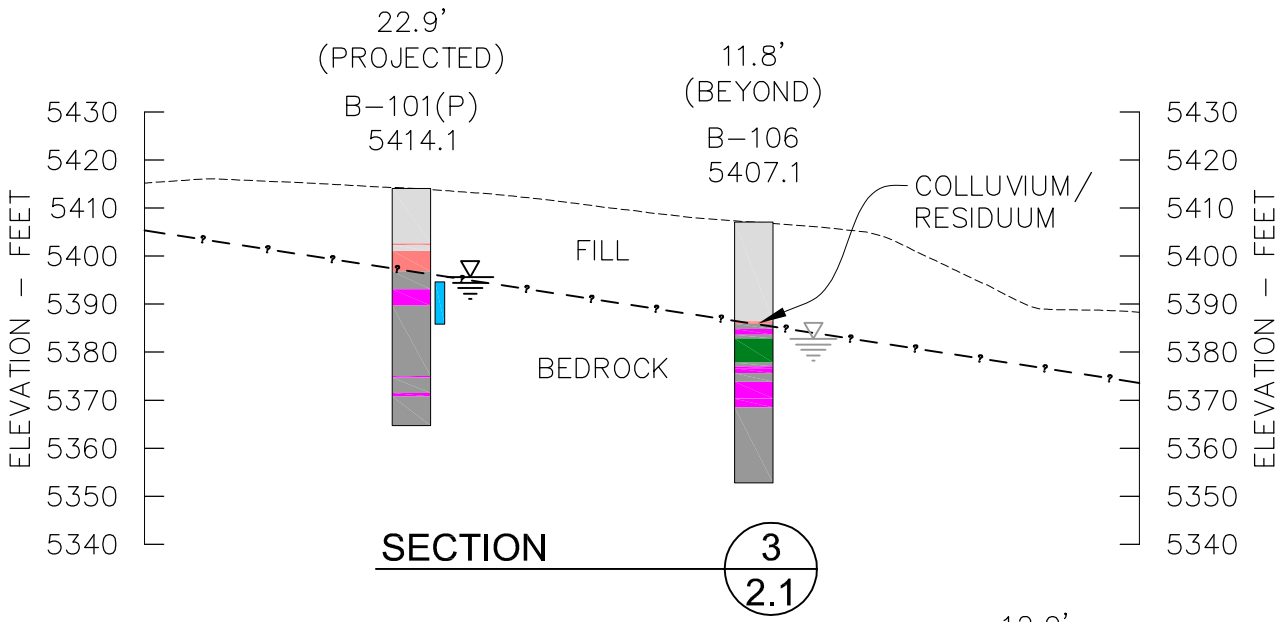
EXPLANATION

- FINE GRAINED SOIL
  > 50 PERCENT SILT AND CLAY
- GRANULAR SOIL
  < 50 PERCENT SILT AND CLAY
- INTERBEDDED FINE GRAINED

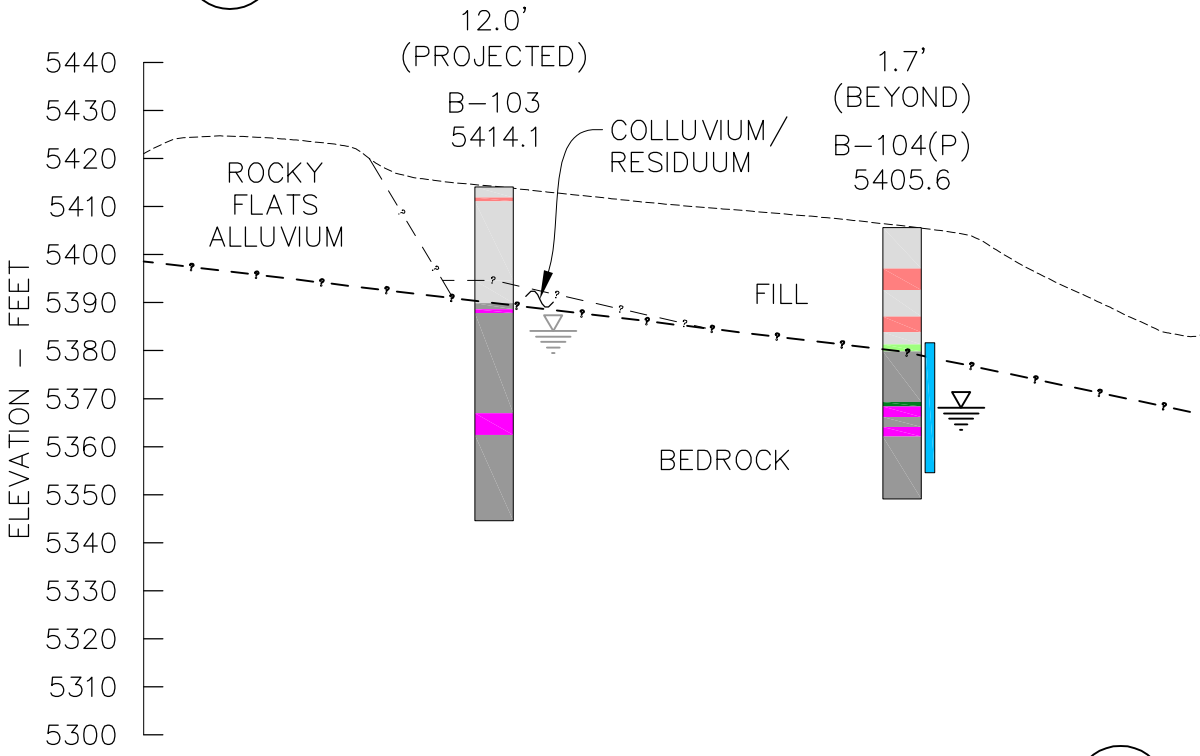
NOTES:

1. SUBSURFACE INFORMATION IS ONLY KNOWN AT THE BORING LOCATIONS; SUBSURFACE CONDITIONS BETWEEN BORINGS ARE INTERPOLATED.

01 FIGURES\DATA REPORT\EXPLORATION PLAN AND SECTIONS.DWG 11/17/2016 11:57 AM



SECTION 3 / 2.1



SECTION 5 / 2.1

01 FIGURES\DATA REPORT\EXPLORATION PLAN AND SECTIONS.DWG 11/17/2016 11:58 AM

SECTION 5 - LIMITATIONS

This Report has been prepared for the exclusive use of RJH and Thornton to support planning of a new water treatment plant at 9500 Washington Street. The purpose of the subsurface investigation was to collect preliminary geotechnical data and develop a generalized understanding of subsurface conditions across the Site. Design-build bidders are responsible for interpreting the collected data and evaluating its usefulness. RJH and Thornton are not responsible for technical interpretations of this data by others. It is expected that the successful design-build team will need to perform additional subsurface investigations to support specific aspects of their design and construction.

RJH has endeavored to conduct our professional services for this Project in a manner consistent with a level of care and skill ordinarily exercised by members of the engineering profession currently practicing in Colorado under similar conditions as this Project. RJH makes no other warranty, expressed or implied.

The methods used in this study indicate subsurface conditions only at the specific locations, where samples were obtained, only at the time they were obtained, and only to the depths penetrated. Samples cannot be relied on to accurately reflect variations in subsurface conditions that may exist between sampling locations.

The nature and extent of variations between borings may not become evident until construction. Timely and comprehensive observation and evaluation of actual subsurface conditions, supported by appropriate field and laboratory testing, will be critical during construction as variations from anticipated subsurface conditions may be encountered.

SECTION 6 - REFERENCES

Hart, S.S. (1974). *Potentially Swelling Soil and Rock in the Front Range Urban Corridor, Colorado*. Colorado Geologic Survey Map EG-07.

Lindvall, R.M. (1980). *Geologic Map of the Commerce City Quadrangle, Adams and Denver Counties, Colorado*. U.S. Geological Survey Map GQ-1541.

U.S. Bureau of Reclamation (USBR) (2001). *Engineering Geology Field Manual,* Second Edition.

APPENDIX A

PROJECT SPECIFIC RACS MANAGEMENT PLAN

Consultants in Natural Resources and the Environment

Denver • Durango • Hotchkiss • Idaho

PROJECT SPECIFIC RACS MANAGEMENT PLAN
9500 WASHINGTON STREET
THORNTON, COLORADO

Prepared for—
City of Thornton
9500 Civic Center Drive
Thornton, Colorado 80229

For submittal to—
Colorado Department of Public Health and Environment
4300 Cherry Creek Drive, South
Denver, CO 80246-1530

Prepared by—
ERO Resources Corporation
1842 Clarkson Street
Denver, Colorado 80218
(303) 830-1188

And

Clear Consulting, LLC
Certified Asbestos Consulting Firm No. ACF-14902
6875 Fire Opal Lane
Castle Rock, Colorado 80108

This PSRMP was prepared under the direct oversight and certified by:

H. Kim Thiel
CDPHE Building Inspector: H. Kim Thiel - Certification No. 668

April 14, 2016_rev. June 7, 2016

ERO Project #6242

ERO Resources Corp.
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Denver, CO 80218
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APPENDICES

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PROJECT SPECIFIC RACS MANAGEMENT PLAN

9500 WASHINGTON STREET
THORNTON, COLORADO

APRIL 14, 2016_REV. JUNE 7, 2016

A) Project Representative

Project Representative: Jerry Dye, City of Thornton, Director of Support Services
9500 Civic Center Drive, Thornton, CO 80229
(303) 538-7493

B) Property Location

Approximate Address: 9500 Washington Street
Southeast corner of Washington Street and Thornton Parkway

Adams County Tax Parcel No. 0171923200015

C) General Site Description

The project site is a 12.2-acre undeveloped vacant parcel vegetated with grasses and weeds that slopes to the south. Informal pedestrian access has occurred and access to the entire property is currently open. The northern portion of the site has fill material placed to permit a flat elevation to portions of the site. The southern portion of the site contains several buried water utilities within a City of Thornton and Denver Water easement. The project proponent (City of Thornton) is currently in negotiations with the property owner for purchase.

Visual inspections of the project site conducted in April 2016 identified non-friable pieces of Transite pipe containing up to 15% chrysotile located on the surface across the project site. The Transite pipe is assumed to be associated with historical water utility repairs to lines that cross the property. In 1994, the City of Thornton undertook the removal of asbestos-containing materials (ACM), primarily Transite pipe and debris from the utility easements across the property. The cleanup activity was conducted under Colorado's Air Quality Control Division Regulation 8. The removal activity consisted of the following: a visual inspection and removal of ACM; followed by a harrow pulled across portion of the project area to break up soil and unearth additional pieces of ACM; followed by a discing machine with 24-inch discs that was pulled across the easement area to unearth additional ACM. In each case, abatement contractors followed behind the machines, visually inspecting and retrieving ACM to package and dispose as ACM waste. The City of Thornton has had no subsequent involvement on the site since the 1994 cleanup activities (until now). Around 2002, a significant amount of fill material was brought onto the property from off-site developments, generally assumed to be from the north. This fill material was placed by contractors and methods that are not known to the current project proponent. The depth of the fill soils are estimated to be up to 20 feet. Aerial photographic review of historical soil disturbances on the site indicate that the fill material likely buried a significant portion of the site that was subject to the 1994 remediation activities.

Site inspections conducted by a CABI in April 2016 identified Transite pipe on the surface at several locations across the project site, including on top of filled areas. Because there was no discernable pattern to the locations of the Transite pipe occurrences, much of the project site is covered with imported fill, and no subsurface investigations have been conducted to date, the entire site and fill material is assumed to have the potential to have Transite pipe between the surface and the base of the imported fill material.

D) Description of Planned Soil Disturbing Activity

Soil disturbing activity will consist of two separate events – geotechnical soil investigation and direct-push environmental investigation – each conducted for the purposes of characterizing site conditions in anticipation of future construction. The total anticipated timeline of soil disturbing activities is expected to be up to 10 days for geotechnical drilling and up to 3 days for environmental drilling.

Geotechnical Drilling – Geotechnical drilling will consist of drilling up to seven (7) soil borings/monitoring wells on the property using a hollow stem auger drill rig. Equipment that will be on-site include a drill rig, drill equipment support truck, and geotechnical engineering support vehicle. Drilling will consist of driving a drill rig onto the project site and drilling subsurface soils to obtain geotechnical samples of the fill material and underlying bedrock. Any samples collected during geotechnical activities will either be inspected by a CABI prior to shipment for presence of visual Transite/ACM or be transported in leak-proof containers and submitted to a laboratory capable of managing soils containing asbestos. Documentation of all off-site laboratory shipments will be maintained within the project record. Anticipated length of the disturbing activity is up to 10 days.

Environmental Drilling – Environmental drilling will consist of mobilizing a track-rig direct-push drill rig onto the project site to install direct push soil borings in an attempt to identify fill thickness for volumetric calculations. Any samples collected during geotechnical activities will either be inspected by a CABI prior to shipment for presence of visual Transite/ACM or be transported in leak-proof containers and submitted to a laboratory capable of managing soils containing asbestos. Anticipated length of the disturbing activity is up to 3 days.

E) Training Requirements

Training requirements as outlined in Colorado Department of Public Health and Environment, Solid and Hazardous Waste Commission/Hazardous Materials and Waste Management Division 6 CCR 1007-2, Part 1 – Regulations Pertaining to Solid Waste Sites and Facilities, Section 5.5.3 Training will be followed in their entirety and are attached to this plan in Appendix B.

F) Description of Site Management, Emission Controls, and Work Practices.

Site management, emission controls, and work practices will generally conform to those outlined in Colorado Department of Public Health and Environment, Solid and Hazardous Waste Commission/Hazardous Materials and Waste Management Division 6 CCR 1007-2, Part 1 – Regulations Pertaining to Solid Waste Sites and Facilities, Section 5.5.7. Given the minimal soil disturbing activity associated with the drilling activities, specific portions of the standard procedures outlined in Section 5.5.7 have been clarified or modified for applicability to the project soil disturbing activities described above. For completeness, Section 5.5.7 and 5.5.8 are included as an appendix to this document.

The Area of Concern (AOC) for the project is the entire 12.2-acre parcel and is shown on Figure 1 (Appendix A). This determination is based on the visual inspection of the ground surface that identified numerous pieces of broken, non-friable Transite pipe. The vertical definition of RACS consists of surface areas that have not been cleared of RACS in accordance with protocols outlined in Section 5.5.7(F)(2) to the depth of native material, plus 2 feet, to account for any historical soil disturbance associated with original (1994) Transite pipe removal. In areas of surface management and clearance in accordance with Section 5.5.7(F)(2)(a-b), surfaces are no longer considered RACS for the purposes of soil disturbing activities, however subsurface soils remain RACS.

In general, the requirements of Section 5.5.7 Standard Requirements for the Disturbance of RACS will be followed as the default RACS management plan (attached as Appendix C). This section presents project-specific deviations, clarifications or modifications to the individual subsection of 5.5.7 as identified in *italics*.

5.5.7(A) Establishment and Control of a Regulated Work Area (RWA)

This section will be followed in its entirety with the following clarification:

> *The RWA will be established within the perimeter fencing denoting the AOC. The RWA will consists of an area measuring approximately 60 feet in diameter and will surround each soil disturbing/drilling area activity. It is anticipated that numerous RWAs will be located within the AOC, one for each soil boring location. Each RWA will be established and demarcated within the AOC by visible means such as caution tape that fully defines the extent of the RWA. Labeling and signage shall indicate the presence of asbestos, and that the area is off limits to unauthorized personnel. Access to non-project personnel will be limited to perimeter project construction fencing. Prior to soil disturbing equipment entering the RWA, the RWA will be visually inspected and any RACS managed and cleared in accordance with Section 5.5.7(F)(2).*
>
> *Access roads will be established between RWAs and the Project Access Point. Access roads will be visually inspected and cleared in accordance with the procedures outlined in Section 5.5.7(F)(2). The roads will be staked with flags and wood laths to denote areas of drivable access. No access to areas outside of the access roads will be permitted.*

5.5.7(B) Personal Protective Equipment (PPE) for the Purposes of Preventing Cross-Contamination

This section will be followed in its entirety.

5.5.7(C) Wetting

This section will be followed in its entirety with the following clarifications:

5.5.7(C)(1)(a):

Soil cuttings at the drill auger will be wetted using misting equipment/hand-held sprayer during drilling operations and placement of spoils into disposal containers. Misting/spraying of the augers and cuttings will be conducted at low pressure to minimize dust generation.

5.5.7(D) Wind Speed Monitoring

This section will be followed in its entirety with the following clarification:

5.5.7(D)(1)(a):

Because of the variability of location of the RWAs within the AOC, wind measurements will be collected from the RWA during soil disturbing activity.

5.5.7(E) Air Monitoring

This section will be followed in its entirety with the following clarification:

5.5.7(E)(2)(b):

Four samples will be collected from the perimeter of the RWA during geotechnical drilling activities with an RWA approximately 0.1 acre in area.

5.5.7(F) Work Practices to be Followed During RACS Disturbance

This section will be followed in its entirety with the following clarifications:

5.5.7(F)(1)(a)(ii):

Drill augers, cuttings, and cutting shoes will be continuously wetted during drilling. Drill cuttings and cores will be visually inspected by a CABI meeting training requirements of Section 5.5.3(D) for visual indications of ACM.

5.5.7(F)(1)(c):

All RACS will be containerized in accordance with Section 5.5.8(A). RACS will be containerized in either 6-mil plastic bags or in 55-gallon steel drums lined with 6-mil plastic liners. The disposal will be assumed to be RACS containing greater than 1% of friable ACM and will be packaged in leak tight containers and disposed of in accordance with Section 5.3 of CSWR. For this reason, stormwater is not anticipated to come into contact with RACS and no project-specific modifications aside from those required by the Water Quality Control Commission's stormwater regulations will be implemented.

5.5.7(F)(2)(b):

All designated access roads and RWAs within the AOC will be visually cleared by a CABI to confirm that the visible extent of ACM and

surrounding soil, or other material, has been removed. Should RACS be encountered within the clearance area, the RACS will be managed in accordance with Section 5.5.7(F)(2)(a) requiring the wet removal of the RACS and six (6) inches, in all directions, of surrounding soil or other material from the last occurrence of visible ACM, followed by inspection by the CABI. As there is no documented evidence of non-visible RACS at the site, a visual inspection and clearance shall be sufficient to determine the removal of RACS. After the removal of the additional six (6) inches, and in the absence of any debris, the QPM may make the determination that RACS has been removed.

5.5.7(F)(4):

All ground surface areas for which a visible clearance has been conducted and passed in accordance with Section 5.5.7(F)(2)(b) *will no longer be considered RACS and is no longer subject to applicable site management procedures for RACS outlined in Regulation 5.5. This applies to the ground surface only and not subsurface soils beneath the surficial layer of soil or surface.*

5.5.7(G) Loading and Placement of RACS

This section will be followed in its entirety with the following clarification:

5.5.7(G)(2)(a)

Soil cuttings generated during drilling activities will be containerized within leak proof containers prior to leaving the RWA for the on-site staging area within the AOC. All access roads between RWAs and the on-site staging area will be visually cleared in accordance with Section 5.5.7(F)(2)(b) prior to soil disturbing activities and therefore will not be considered RACS unless the surface is compromised, causing vehicle tires or equipment breaching the ground surface and therefore coming into contact with RACS.

5.5.7(H) Onsite Staging, Stockpiling, and Storage of RACS

This section will be followed in its entirety with the following clarification:

No staging, stockpiling, or storage of non-containerized RACS will occur. All RACS will be containerized within the RWA and mobilized to a waste storage area within the AOC for disposal in accordance with Section 5.5.8. RACS will be disposed in accordance with Section 5.5.8 within 10 calendar days of completion of soil disturbing activities.

5.5.7(I) Decontamination

This section will be followed in its entirety with the following clarification:

5.5.7(I)(1)(b):

RWAs will not be considered RACS upon initial entering by site equipment. Drilling activities are expected to encounter RACS within the fill material and two feet into the native material. All soils and drill cuttings will be wetted while containerizing and inspected by a CABI. The drill rig vehicle and support vehicles are not anticipated to come into contact with RACS, therefore these vehicles will not need to be decontaminated. Should the vehicles or equipment come into contact with RACS, the equipment will be driven onto a decontamination pad consisting of a 10-mil poly sheeting placed to capture wet decontamination of site equipment. All decontamination liquids and solids shall be contained, and run-on and run-off shall be prevented. Rinsate/runoff shall be collected and re-applied to RACS that will be managed under this PSRMPC. For breaches in the decontamination pad where RACS or water contaminated with asbestos may have impacted the material below the decontamination pad, provisions of Section 5.5.7(J) will be implemented. Decontamination pad sheeting will be managed as asbestos-contaminated waste.

Drill auger and drilling equipment that comes into contact with RACS will be wrapped/covered in 6-mil poly sheeting prior to movement to the subsequent RWA. After all boreholes are completed, drill auger and drilling equipment that comes into contact with RACS will be decontaminated using wet methods. Equipment will be placed on a decontamination pad consisting of a 10-mil poly sheeting placed to capture solids and liquids from wet decontamination. All decontamination liquids and solids shall be contained, and run-on and run-off shall be prevented. Rinsate/runoff shall be collected and re-applied to RACS that will be managed under this PSRMPC. For breaches in the decontamination pad or poly sheeting used to cover equipment moving between RWAs where RACS or water contaminated with asbestos may have impacted the material below the decontamination pad, provisions of Section 5.5.7(J) will be implemented. Decontamination pad sheeting will be managed as asbestos-contaminated waste.

5.5.7(J) RACS Spill Response

This section will be followed in its entirety.

5.5.7(K) Requirements for Exposed RACS Remaining in Place

This section will be followed in its entirety with the following clarification:

The anticipated soil disturbing activities may encounter RACS in the subsurface that will remain in place upon completion of soil disturbing activities. As the subsurface RACS will be inaccessible and the soil borings either grouted or completed as ground water monitoring wells, the

RACS would be stabilized in place and inaccessible, meeting the requirements of this Section.

5.5.7(L) Documentation

This section will be followed in its entirety.

G) RACS Management and Disposal

All RACS investigation derived wastes generated will be containerized in accordance with Section 5.5.8(A). RACS will be containerized in either 6-mil plastic bags or in 55-gallon steel drums lined with 6-mil plastic liners. The disposal will be assumed to be RACS containing greater than 1% friable ACM and will be packaged in leak tight containers and disposed of in accordance with Section 5.5.8.

H) Sample Collection Protocols and Analytical Methodologies

Project asbestos sample collection and analytical methodologies will follow those outlined in Appendix 5A of the Regulation with the following modifications for samples collected from RACS anticipated for geotechnical purposes:

Geotechnical samples collected from RACS (defined above as between the cleared surface and two feet into identified native subsurface materials) will be assumed to consist of RACS. These samples will fall into two categories:

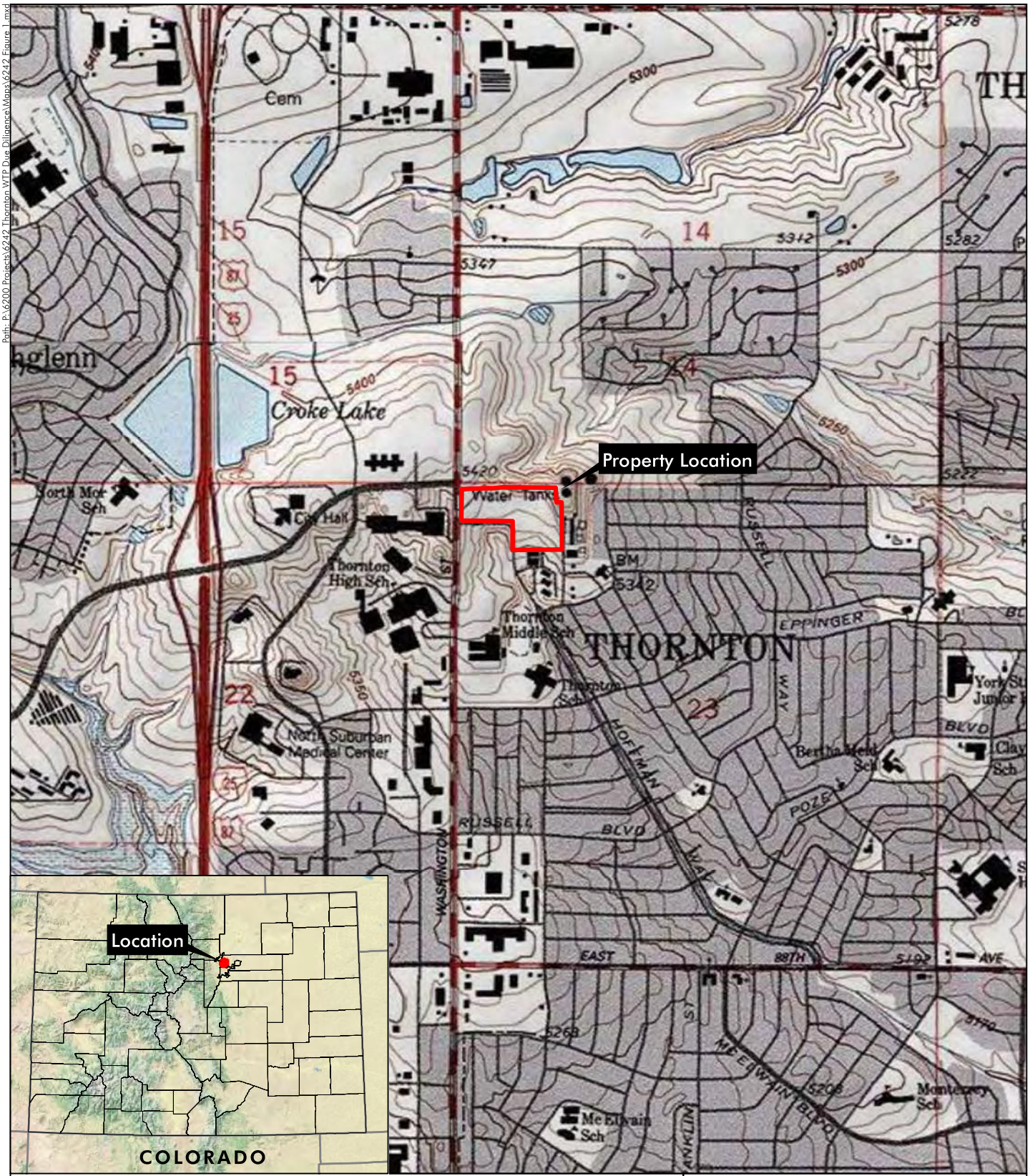
Bulk Samples – These samples will be collected and, because they are not required to remain intact, will be visually inspected by a CABI for Transite or ACM prior to packaging for analysis. Packaging will consist of placing the samples in leak proof containers for transport to the laboratory.

Intact Samples – Several sample types require intact samples of the soil column. In these cases, the CABI will attempt to inspect soils and soil cuttings stratigraphically above and below the sample interval for the visual indication of Transite or ACM. The samples ("California Sampler" is typical) will then be placed into double leak tight containers (double bagged) for shipment to the laboratory. The outside packaging will indicate Asbestos-Contaminated Soils as will all sample documentation. The laboratory has the ability to conduct the required geotechnical analysis within controlled environments that prevent the emission. Upon completion of sample evaluation, return of the sample portions will be requested from the laboratory so as to manage and dispose of the RACS in accordance with Section 5.5.8.

Samples from bedrock beneath fill material will not come into contact with RACS because they will be collected from samplers that are extended through the hollow stem auger flights. For this reason, Section 5.5 requirements do not apply to these samples.

APPENDIX A —

FIGURES



Sharma Property, 9500 Washington Street, Thornton, CO

Section 23, T2S, R68W; 6th PM

UTM NAD 83: Zone 13N; 502111mE, 4413308mN

Latitude, Longitude: 39.86981°N, 104.975318°W

USGS Commerce City, CO Quadrangle

Adams County, Colorado

Copyright:© 2013 National Geographic Society, i-cubed

Figure 1
Vicinity Map

Prepared for: City of Thornton

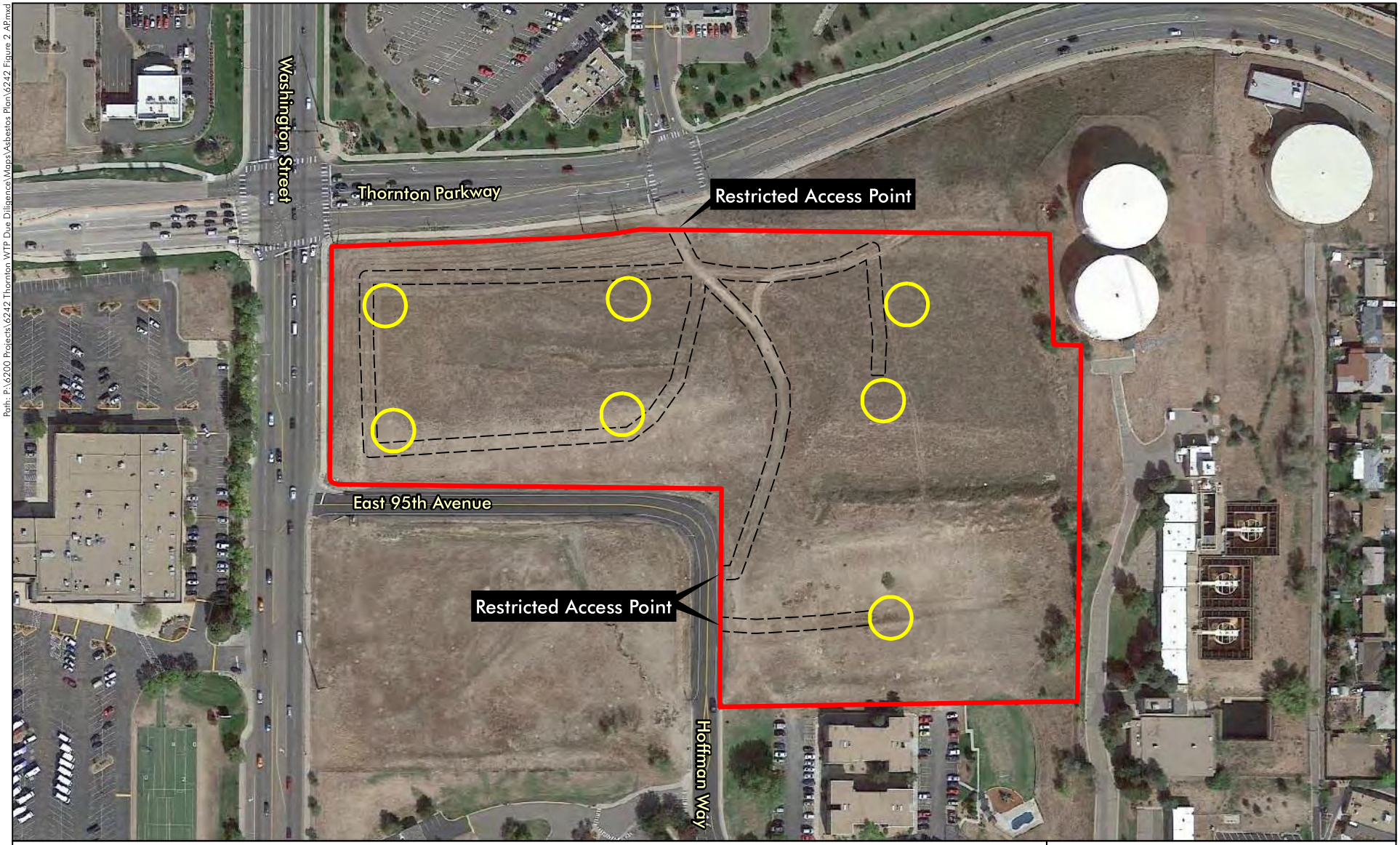
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July 14, 2015

ERO Resources Corp.

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Path: P:\6200 Projects\6242 Thornton WTP Due Diligence\Maps\Asbestos Plan\6242 Figure 2 AP.mxd



Sharma Property, 9500 Washington Street, Thornton, CO

Area of Concern (AOC) - Fenced

Regulated Work Areas (Approximatley 60' Diameter)

Access Corridor (20' Width)

0 100 200 feet

N

Figure 2
Site Plan

Prepared for: City of Thornton
File: 6242 Figure 2 AP.mxd [dlH]
April 6, 2016

ERO Resources Corp.

Aerial Image: © Copyright Google Earth Pro 10/9/2015

APPENDIX B —

6 CCR 100-2, PART 1, SECTION 5.5.3

PERSONNEL TRAINING REQUIREMENTS FOR THE DISTURBANCE OF RACS

(H) Soil disturbing activities involving debris that only contains metal, glass, plastic, wood, and/or bare concrete with no associated material suspected of being ACM (such as sealants, adhesives, mastics, coatings, adhered materials, or resins), as determined by a CABI, QMP, or generator knowledge, are not subject to the requirements of Section 5.5.

(I) Soil disturbing activities involving debris that only contains green waste or natural stone are not subject to the requirements of Section 5.5.

5.5.3 TRAINING

(A) All personnel inside the regulated work area (RWA) during the disturbance of RACS shall have annual awareness training. Except as provided in Section 5.5.3(F), this training requirement also applies to equipment operators and drivers of trucks carrying contaminated material for offsite disposal or reuse. This training shall cover information necessary to comply with Section 5.5 requirements and the approved project specific RACS management plan (PSMRP) or standard operating procedure (SOP) (if any) including:

1) General asbestos awareness; including health effects; and

2) Overview of the requirements of Section 5.5 and its implementation; and

3) Overview of suspect ACM that requires further evaluation by a CABI; and

4) Overview of RACS and Non-RACS; and

5) Worker protection, including respiratory protection. An overview of the levels of personal protective equipment (PPE) required for various activities and conditions; and

6) Decontamination requirements for equipment and personnel including the establishment of decontamination station(s); and

7) Engineering controls in order to prevent visible emissions from leaving the RWA or demonstrate that asbestos is not leaving the RWA above risk-based air thresholds; and

8) Overview of RACS handling procedures.

This training shall be conducted by a CABI who is familiar with the site specific plan and/or the Standard Requirements in Section 5.5.7. Records of this training shall be retained, by the owner/operator, and be available for inspection, for a minimum of one year from the date of the training.

(B) In addition to the annual asbestos awareness training required in 5.5.3(A), all personnel inside the RWA during the disturbance of RACS shall have per-project site-specific awareness training. Except as provided in Section 5.5.3(F), this training requirement also applies to equipment operators and drivers of trucks carrying contaminated material for offsite disposal or reuse. This training shall cover site-specific information necessary to comply with Section 5.5 and the selected management approach for the project (PSRMP, SOPs, or the standard requirements of Section 5.5.7), including:

1) An overview of the items from 5.5.3(A) as they pertain to site specific provisions and/or conditions that will affect work practices; and

2) Project chain-of-command and identification of authorized personnel with stop work authority, and identification of QPM(s); and

3) Hands on training specific to the soil disturbing activities the individual will be performing subject to this Regulation.

This training shall be provided by a CABI who meets the training requirements of 5.5.3(D). Records of this training shall be retained by the owner/operator, and be available for inspection, for the duration of the project for which the training was conducted.

(C) Qualified Project Monitors shall have, at a minimum:

1) Annual asbestos awareness training and site specific awareness training under Section 5.5.3(A) and (B); and

2) Training from a CABI on identifying debris, exempted materials under Section 5.5.1(A)(3), and the assumption of debris to be RACS as outlined in Section 5.5.1; and

3) Training from a CABI on how to implement the standard requirements under Section 5.5.7 and how to perform the duties that a QPM may perform in lieu of a CABI; and

4) Training from a CABI on how to implement the provisions of the chosen RACS management approach (PSRMP, SOPs, or standard requirements of Section 5.5.7) and how to perform the duties that a QPM may perform in lieu of a CABI; and

5) Forty (40) verifiable hours of direct experience implementing Section 5.5.

Records of this training shall be retained by the owner/operator, and be available for inspection for the duration of the project for which the training was conducted.

(D) Visual Inspection and identification of RACS shall be conducted by a CABI, with forty (40) verifiable hours of on the job asbestos in soils experience on a minimum of three (3) different asbestos in soils projects, conducted under either AQCC Regulation No. 8 or Section 5.5. The CABI shall be independent of the general contractor (GC) and/or abatement contractor unless the CABI and the GC or abatement contractor are both direct employees of the property owner. However, the GC or abatement contractor may hire a subcontractor CABI, but the CABI shall not be a direct employee of the GC or abatement contractor.

(E) Air monitoring conducted in accordance with this Section 5.5 shall be performed by an Air Monitoring Specialist (AMS).

(F) Truck drivers who do not complete the training in 5.5.3(A) and (B) are ancillary workers. Soil disturbing activities must cease if the truck driver is present within the RWA unless the driver remains in the cab of the truck, the truck's windows and doors remain closed, and the air handling system remains off while the truck is inside the RWA.

5.5.4 RESPONSE TO UNPLANNED RACS DISCOVERY

Soil disturbing activities that expose RACS without previously approved plans are subject to the following requirements:

(A) IMMEDIATE ACTIONS: Immediate actions shall be taken by the person conducting the soil disturbing activity, or representative of the owner or operator, to manage RACS in accordance with Section 5.5 and Section 1.2 definitions of these Regulations. These actions shall include, at a minimum, the following:

(1) Stopping all soil disturbing activities related to RACS, until the 24-hour notification requirements in Section 5.5.4(B), and the interim action requirements in Section 5.5.4(C), are met. In the event of an emergency in which a soil disturbing activity must continue or commence at once, notification shall be made as soon as possible, but within 24 hours of identifying or assuming the presence of RACS within the soil disturbing area. During the initial response to the immediate emergency, the standard requirements of Section 5.5.7 shall be implemented to the extent possible. Within 48 hours, any disturbed and/or exposed RACS shall be managed in accordance with the standard requirements of Section 5.5.7, an approved PSRMP, or an approved SOP.

(2) Establishing and taking measures in order to prevent access to the RWA by unauthorized persons. Instances of unauthorized access not under the control of the owner/operator shall be evaluated to determine if additional access controls are warranted. The unauthorized access, and the response actions taken, shall be documented and provided to the Department within 48 hours of the incident.

APPENDIX C —

6 CCR 100-2, PART 1, SECTION 5.5.7

STANDARD REQUIREMENTS FOR THE DISTURBANCE OF RACS

5.5.7 STANDARD REQUIREMENTS FOR THE DISTURBANCE OF RACS

The requirements of this section, if followed in their entirety, constitute a default RACS management plan, eliminating the need to submit a PSRMP or SOP.

(A) ESTABLISHMENT AND CONTROL OF A REGULATED WORK AREA (RWA)

(1) Requirements for establishment and control of a RWA applicable to all projects subject to this Regulation:

(a) Establish a RWA which is identifiable to all persons. Haul roads between RWAs, where RACS is not present, are considered to be outside the RWA(s); however, equipment decontamination [Section 5.5.7(I)] and spill response procedures [Section 5.5.7(J)] shall be followed; and
(b) Stop all soil disturbing activities in the RWA if ancillary workers or members of the public are present within the RWA. Truck drivers who do not complete the training under Sections 5.5.3(A) and (B) are ancillary workers. Soil disturbing activities must cease if the truck driver is present within the RWA unless the driver remains in the cab of the truck, the truck's windows remain closed, and the air handling system remains off while the truck is inside the RWA; and
(c) Post labeling and signage to demarcate RWA(s). The RWA shall be demarcated by visible means that fully defines the extent of the RWA. Labeling and signage shall indicate the presence of asbestos, and that the area is off limits to unauthorized personnel.

(2) **Additional Requirement for Projects Disturbing RACS Containing Friable ACM.** Establish a secured work site (e.g., fencing with locks/zip-ties/chains). Personnel, or staff assigned to this duty, may be used to secure the RWA in lieu of fencing. If the RWA is located within a larger secure facility, fencing of the RWA is not necessary as long as the RWA is secured.

(B) PERSONAL PROTECTIVE EQUIPMENT (PPE) FOR THE PURPOSES OF PREVENTING CROSS-CONTAMINATION

(1) Requirements applicable to all RWAs subject to this Regulation:

(a) Use of disposable booties or impermeable footwear that will be decontaminated per Section 5.5.7(I); and
(b) Use of disposable gloves or impermeable gloves that will be decontaminated per Section 5.5.7(I); and
(c) Replace or decontaminate (per Section 5.5.7(I)) all PPE in all instances where the integrity of the PPE is compromised, and when workers exit the RWA; and
(d) Decontaminate (per Section 5.5.7(I)) or dispose of all used PPE as asbestos contaminated waste.

(2) **Additional Requirement Applicable to Projects at RWAs Containing Friable ACM.** Use of disposable impermeable suits or equivalent coveralls, remove suits or coveralls upon exiting the RWA, and dispose of used suits or coveralls as asbestos contaminated waste.

(C) WETTING

(1) Wetting requirements applicable to all RACS disturbance:

(a) Adequately wet all RACS and soils, or other materials containing RACS, on the surface and in the sub-surface prior to and during RACS disturbance, except as provided in Section 5.5.7(F)(1)(b)(ii). Pre-wetting is not necessary if soils are already adequately wet. Apply water or amended water (as required in Section 5.5.7(C)(2)) at low pressure in order to minimize dust generation and splattering to prevent visible emissions from leaving the RWA, or demonstrate that asbestos is not leaving the RWA above risk-based thresholds.
(b) Mist RACS and soils, or other materials, containing RACS during placement as needed to maintain the material in an adequately wet condition using equipment mounted spray bars, or additional hose operator(s).
(c) Except as provided in (d) below, incidental occurrences of visible emissions leaving the RWA shall be managed by evaluating site conditions and engineering controls for each occurrence of visible emissions, and immediately implementing any identified engineering control revisions necessary in order to prevent future occurrences of visible emissions. All instances of visible emissions leaving the RWA shall be documented as required in Section 5.5.7(L) of this regulation.
(d) When utilizing the risk-based air monitoring threshold approach to evaluate the effectiveness of adequately wetting, visible emissions are allowed to leave the RWA as long as the risk-based air threshold is not exceeded.

(2) **Additional requirement for RACS that contains friable ACM.** Use amended water containing a wetting agent, such as a 50:50 mixture of polyoxyethylene ester and polyoxyethylene ether, or the equivalent, in a 0.16 percent solution (1 ounce to 5 gallons) of water, or as per manufacturer recommendations for the wetting of asbestos. This requirement may be waived by the Department for emergency situations where the work must occur immediately and wetting agents are not available.

(D) WIND SPEED MONITORING

(1) Requirements applicable to all projects involving mechanical disturbance of RACS, and hand disturbance of RACS containing friable ACM:

(a) Take wind measurements from within the RWA using a hand held anemometer. Alternatively, or in conjunction with hand held measurements, an onsite weather station may be used within a quarter mile of the RWA as long as the conditions measured by the weather station are representative of conditions in the RWA.

i. Collect wind speed measurements at a minimum of thirty (30) minute intervals and during wind gust(s). Average wind speed measurements shall be obtained manually by taking ten readings at one minute intervals and averaging the ten readings, or through the use of instrumentation that provides a ten minute average wind speed reading.
ii. If wind break barriers are used, wind speed measurements may be taken from within barriers; however, wind speed measurements shall also be taken outside the wind break barriers if any RACS disturbing activities, such as loading, are taking place outside or above the barriers. Wind speed shut-down criteria shall be based on measurements taken that are representative of the area of active RACS disturbance.

(b) Immediate stoppage of all RACS disturbance shall occur based on results of wind speed monitoring conducted in accordance with subsection (a) and exceedance of the following criteria:

i. Wind gust(s) in excess of 20 mph, or
ii. Sustained winds in excess of 12 mph, averaged over ten (10) minutes, or
iii. Winds are interfering with the ability of engineering controls to work as intended, or
iv. Winds are creating visible emissions that leave the RWA.

(c) RACS disturbance may resume when all of the following criteria are met:

i. No gust(s) in excess of 20 mph occur for twenty (20) minutes, and
ii. No sustained winds in excess of 12 mph occur for twenty (20) minutes, based on a ten (10) minute average wind speed measurement, and
iii. Winds are not interfering with the ability of engineering controls to function as intended, and
iv. Winds are not creating visible emissions that leave the RWA.

(E) AIR MONITORING

(1) If using the risk-based air threshold approach to monitor the effectiveness of adequately wetting:

(a) Air monitoring to determine asbestos content of visible emissions allowed to leave the RWA, for comparison to the risk-based air thresholds shall not be utilized for projects that are less than ten (10) days in duration.

(b) Air monitoring to determine asbestos content of visible emissions allowed to leave the RWA, for comparison to the risk-based air thresholds, shall begin on the first day of the project.
(c) A minimum of four (4) air samples per day shall be collected for TEM analysis.
(d) Sample collection, analysis, and data evaluation shall be conducted in accordance with Appendix 5A.

(2) If preventing visible emissions leaving the RWA as an indication of the effectiveness of work practices, not for risk evaluation, air monitoring is required during mechanical disturbance of RACS in RWAs with an adjacent receptor zone:

(a) No air monitoring is required for RACS disturbance that will not exceed a duration of two (2) days. However, the requirements for adequate wetting (Section 5.5.7(C)) and no visible emissions leaving the RWA (Section 5.5.7(F)) shall be adhered to on all RACS disturbance projects. Dividing projects into multiple two (2) day or shorter components shall not be used as a mechanism to avoid air monitoring requirements.

(b) Area monitoring shall consist of a minimum of four (4) samples collected on the perimeter of the RWA at appropriate intervals to provide representative information regarding potential releases of asbestos fibers to the adjacent receptor zone(s). Additional samples shall be collected for large perimeter RWAs (greater than one (1) acre). RWAs greater than one (1) acre shall require additional perimeter monitoring points be added at a rate of one (1) sample for every 200 linear feet (or approximately each additional ¼ acre). If representative information about potential releases to the adjacent receptor zone(s) can be collected using less than the minimum number of samples, the remaining sample locations shall be at the discretion of the AMS.

(c) Phase Contrast Microscopy (PCM) analysis is required on all samples collected (unless all samples will be analyzed by Transmission Electron Microscope (TEM) by default). The laboratory shall be requested to provide verbal results to the AMS or the QPM by the start of the next working day, or as soon as possible after the start of the next working day, with written results within 24 hours of the receipt of verbal results. A consultation with the Department is required If this timeframe cannot be met by the laboratory.

(d) Upon receipt of a laboratory report indicating a “cannot be read (CBR)”, or a “not analyzed (NA) or rejected” due to loose debris or uneven loading, analysis result:

i. The AMS shall evaluate the lab report and any field documentation to determine a possible cause for the CBR or “not analyzed (NA) or rejected” result; and

ii. If the CBR or “not analyzed (NA) or rejected” cannot be correlated to a specific field event that compromised the sample (e.g. the sample was blown over, the filter of the sample was sprayed with water) then the sample shall be prepared for indirect TEM presence/absence analysis to determine potential asbestos content in accordance with Appendix 5A; and
iii. If the CBR or “not analyzed (NA) or rejected”, analysis result can be correlated to a compromised sample, then preparation for indirect TEM presence/absence analysis is not required as long as adequate air monitoring data is available to evaluate the effectiveness of engineering controls. However, overloading of a sample with particulate matter does not constitute a compromised sample, and will require indirect preparation for TEM presence/absence analysis; and
iv. Field personnel shall evaluate why the sample was compromised and modify field procedures as necessary to avoid future samples from being compromised; and
v. The Department project manager shall be notified by phone or email of instances of CBR or “not analyzed (NA) or rejected” analysis results within 24 hours of receipt of verbal results.

(e) TEM presence/absence analysis is required (analysis providing fiber counts/concentrations is always optional) as described in paragraphs (i) through (iv) below. The laboratory shall be requested to provide verbal results by the start of the next working day, or as soon as possible after the start of the next working day, with written results within 24 hours of the receipt of verbal results.

i. All samples, required by this Section 5.5, with PCM results having fiber concentrations greater than 0.01f/cc shall be submitted for TEM analysis.
ii. During the first five (5) days of RACS disturbance – A minimum of 25% of the samples collected from each RWA, inclusive of the downwind floating samples as described in 5.5.7(E)(2), shall be submitted for TEM analysis. The sample(s) selected for TEM analysis shall have the highest PCM result(s) based on fiber concentration. If all PCM results are Below Detectable Limit (BDL) for fiber concentration, then the sample(s) selected for TEM analysis shall be determined by highest fiber count. If all samples have no fiber counts (i.e. zero (0) fibers counted, not a “below detection limit” fiber concentration) then no TEM analysis is required.
iii. After five (5) days of RACS disturbance with no asbestos detections by TEM analysis, the frequency of analysis by TEM, on the highest 25% of PCM results(s), may be reduced to once every five (5) days of RACS disturbance, or portions thereof, using the same selection criteria as in paragraphs (i) and (ii) above. The samples submitted for TEM analysis during the period of reduced frequency TEM analysis shall be either the first occurrence of: 1) high winds exceeding wind shut down criteria, or 2) visible emissions. In the absence of high wind events or visible emissions

the selected day for TEM analysis may be random, as determined by the AMS.

iv. If there are any asbestos detections during the random once every five (5) days of RACS disturbance analysis by TEM, then TEM analysis shall be conducted for the next three (3) consecutive days of RACS disturbance, or portions thereof, using the same procedures as in paragraph (i) and (ii) above. If there are no additional asbestos detections during the next three (3) consecutive days of RACS disturbance with samples submitted for TEM analysis, then the frequency of TEM analysis may return to random once every five (5) days of RACS disturbance.

v. If site conditions, friability of the materials being managed, or work practices change, then the initial five (5) days of TEM analysis shall restart using the provisions set forth in this Section 5.5.7(E)(1)(e).

(f) Detection or presence responses - For each detection of asbestos by TEM analysis, the following shall be conducted:

i. Notify the Department project manager by phone or email, on the same calendar day as receipt of verbal or written results (whichever comes first) from the laboratory.

ii. Evaluate site conditions and engineering controls for each detection, and immediately implement any identified engineering control revisions necessary with the goal of preventing future detections of asbestos fibers.

iii. Submit an Emission Control Plan (ECP) to the Department project manager for each detection (days with multiple detections can be addressed by a single ECP). The ECP shall be submitted within 48 hours from the asbestos detection event and shall contain:

1. The date of the detection.
2. A written description of sample details (sample ID, number of structures detected, type of asbestos detected, PCM analytical result) and any potential cause of the release. Include a description of site activity (engineering controls being employed, equipment being used, size of excavation/soil disturbing activity, types of materials identified, etc.) and CABI observations at the work area before and during the presumed time of release.
3. A diagram or write up of all air sample positions clearly indicating which sample received the TEM detection. Indicate, through illustration or description, prevailing wind direction and average wind speeds for the detection event; include any wind speed shutdowns for the date of detection. If applicable, indicate downwind floater air sample relocation times and new positions through illustration or description.
4. Laboratory reports confirming the type and amount of fibers detected by TEM analysis.

5. Other pertinent information that will additionally describe the release and/or will assist in the prevention of future releases from the RWA.
6. A written description of actions taken and any other proposed actions with the goal of preventing future releases from the RWA.
7. If the owner/operator believes fibers are coming from offsite and are not under the control of the owner/operator, then, in addition to the information provided in the ECP, documentation shall be provided demonstrating additional sources of asbestos fibers.

(g) If there are three (3) TEM detections on consecutive analysis events or ten (10) detections for a single project, consultation with the Department is required to determine if the standard requirements of Section 5.5.7 are being implemented appropriately and whether:

i. Changes in the standard requirements of Section 5.5.7 are likely to prevent future releases; or
ii. Changes in the standard requirements of Section 5.5.7 are not likely to prevent future releases and a PSRMP is necessary per Section 5.5.5(A)(2); or
iii. If the owner/operator believes fibers are coming from offsite and are not under the control of the owner/operator, then, in addition to the information provided in the ECP, documentation shall be provided demonstrating additional sources of asbestos fibers. Air samples shall be collected and analyzed following the analytical procedures of Appendix 5A for the type of project being conducted; and
iv. Additional consultation with the Department is required to determine whether additional engineering controls for structures within the adjacent receptor zone are appropriate.

(3) **Additional requirement for projects disturbing RACS containing friable ACM.** Collect two (2) additional downwind floating samples for mechanical disturbance of RACS containing friable ACM. The samplers shall be moved based on prevailing wind direction and adjacent receptors. For example, if adjacent receptors are present on only one side of the RWA, one sample location should be maintained between the RWA and the adjacent receptor.

(F) WORK PRACTICES TO BE FOLLOWED DURING RACS DISTURBANCE

(1) Work practice requirements applicable to all management of RACS:

(a) Prevent visible emissions from leaving the RWA, or demonstrate that asbestos is not leaving the RWA above risk based thresholds by:

i. Excavating in lifts not to exceed the extent of wetting; or

ii. Conducting continuous wetting while mixing dry materials at the point of RACS disturbance to ensure all materials are adequately wet prior to removal from the excavation.
iii. Instances of visible emissions leaving the RWA shall be documented and addressed by changing or increasing controls (e.g. more effective wetting, reduced speed of excavation).

(b) RACS on exposed excavation faces that will be disturbed and/or managed during the project shall either be kept adequately wet (in accordance with Section 5.5.7(C)), or be stabilized using any of the following in order to prevent visible emissions from leaving the RWA, or demonstrate that asbestos is not leaving the RWA above risk based thresholds:

i. Polyethylene sheeting or geofabric with daily inspection, and inspection no later than twelve (12) hours following a storm event, and repair/replace sheeting as necessary to maintain stabilization; or
ii. Chemical stabilizer demonstrated to be effective in the stabilization of RACS (e.g. magnesium chloride) with weekly inspection, and inspection no later than one (1) calendar day following a storm event, and re-application of chemical stabilizer as necessary to maintain stabilization; or
iii. Minimum of three (3) inches of soil appropriate for unrestricted use.

(c) Stormwater shall be managed in accordance with the Water Quality Control Commission's stormwater regulations (5 CCR 1002-61), which include specific stormwater permitting and management requirements for construction sites. The Water Quality Control Division should be contacted to determine the specific requirements for each project. Stormwater shall be managed in a manner that minimizes run on and runoff from RACS. Stormwater that comes into contact with RACS shall be treated as asbestos contaminated water in accordance with Section 5.5.7(J)(4), and other material(s) impacted by asbestos contaminated stormwater shall be managed as RACS in accordance with Section 5.5.7(J)(3).

(2) Work Practice requirements applicable to the management of RACS using hand methods on surfaces or in the subsurface:

a. Wet and remove the RACS and six (6) inches, in all directions, of surrounding soil or other material from the last occurrence of visible ACM; and

b A CABI shall confirm that the visible extent of ACM and surrounding soil, or other material, has been removed (or extent of excavation has been reached). If RACS remains, it shall be managed for stabilization or future removal. If there is no documented evidence of non-visible RACS at the site, then a visual inspection and clearance shall be sufficient to determine the removal of RACS. If there is documented evidence of non-visible

RACS at the site, sampling is required to confirm the removal of RACS. After the removal of the additional six (6) inches, and in the absence of any debris, a QPM may make the determination that RACS has been removed; and

c. If RACS remains in the RWA, it shall be managed for stabilization, per Section 5.5.7(K), or future removal.

d. In lieu of stabilization or full removal, sampling may be performed per Section 2.2 of Appendix 5A to demonstrate that the material is not RACS.

e. Dispose of RACS in accordance with Section 5.5.8.

(3) Work practice requirements applicable to management of RACS using mechanical methods:

a. For surface occurrence of RACS - Wet and remove all RACS and a minimum of six (6) inches of soil, and/or other matrix material, in all directions from the last occurrence of visible ACM, with CABI confirmation that the visible extent of RACS has been removed.

b. For subsurface occurrence of RACS - Wet and remove all RACS and a minimum of three (3) linear feet of soil or other matrix material, in the direction(s) of planned excavation, with CABI confirmation that the visible extent of RACS has been removed. If there is no documented evidence of non-visible RACS at the site, then a visual inspection and clearance shall be sufficient to determine the removal of RACS. If there is documented evidence of non-visible RACS at the site, sampling is required to confirm the removal of RACS. After the removal of the additional three (3) linear feet, and in the absence of any debris, a QPM may make the determination that RACS has been removed.

c. If RACS remains in the RWA, it shall be managed for stabilization, per 5.5.7(K), or future removal.

d. In lieu of stabilization or full removal, sampling may be performed per Appendix 5A to demonstrate that the material is not RACS.

e. Package and dispose of RACS in accordance with Section 5.5.8.

(4) Soil or other matrix material that remains after removal of RACS in accordance with Section 5.5.7(F), Section 5.5.7(H)(1)(c)(i), or an approved plan, is not considered RACS, is not subject to Section 5.5, and may be appropriate for unrestricted use, onsite or offsite, as long as it does not contain any other regulated material.

(G)LOADING AND PLACEMENT OF RACS

(1) Requirements for the loading of RACS:

(a) Protect clean surfaces (including loading surface and truck or disposal container surfaces that may come in contact with RACS) by covering or decontamination of surfaces prior to transport or removal of the truck or disposal container from the RWA and/or loading zone.

(b) Spill prevention shall consist of:

i. Minimization of spillage by not overfilling the excavator or loader bucket and returning the bucket to a closed position prior to moving from the loading point; and
ii. Replacement of protective coverings when worn or damaged in order to prevent breaches; and
iii. Control of runoff in order to prevent cross contamination from water containing asbestos; and
iv. Mitigation of spills of RACS in accordance with Section 5.5.7(J).

(c) During the process of loading the container, the equipment operator shall lower the bucket as close as possible to the interior of the container before dumping, and dump the load slowly to allow adequate misting and in order to prevent visible emissions from leaving the RWA, or demonstrate that asbestos is not leaving the RWA above risk based thresholds.

(2) Requirements for the transportation of RACS:

(a) Onsite transportation of RACS between the RWA and an onsite area of staging, stockpiling, storage, disposal or reuse shall comply with the following:

i. The packaging requirements for RACS set forth in Section 5.5.8(A) of these regulations are not applicable; however, the decontamination requirements of Section 5.5.7(I) shall be followed at the end of disposal operations, or before disposal equipment is removed from the site; and
ii. Driving speeds shall not exceed 12 miles per hour or RACS shall be covered during transport; and
iii. For transportation between the RWA and a non-contiguous onsite staging, stockpiling, storage, disposal, or reuse area:

1. Transportation equipment tires shall not contact RACS; or
2. RACS that is driven upon is a RWA and shall be kept adequately wet in order to prevent visible emissions from leaving the RWA, or demonstrate that asbestos is not leaving the RWA above risk based thresholds, and all equipment surfaces that have come into contact

with RACS shall be decontaminated per Section 5.5.7(I) before leaving the RWA; or

3. The haul road shall be managed as RACS for stabilization, per Section 5.5.7(F)(1), and future removal of a minimum of three (3) inches of soil, or other matrix material. If the road is constructed of a durable surface such as concrete or asphalt, the surface shall be decontaminated in accordance with Section 5.5.7(I)(1)(b) using wet methods, followed by CABI inspection verifying that all soil and debris has been removed from the surface. Rinsate/runoff shall be collected and filtrated to less than 5 microns (or applicable local requirements) and discharged to a sanitary sewer or other Department-approved disposal facility or re-applied to RACS that will be managed under these regulations.

(H) ONSITE STAGING, STOCKPILING, AND STORAGE OF RACS

(1) Staging, as defined in Section 1.2 of these regulations, is the accumulation and temporary storage of RACS in the RWA for 12 hours or less. The following requirements shall apply to the staging of RACS:

(a) Staged RACS shall be kept adequately wet.

(b) Staging of RACS shall be on 6 mil, or greater, polyethylene sheeting or shall include removal, and management as RACS, of a minimum of three (3) inches of material, from below the staging pile/area prior to demobilization; with visual or measured confirmation of removal. If polyethylene sheeting is placed on top of a durable surface such as concrete or asphalt, the surface must be decontaminated using wet methods, followed by CABI inspection verifying that all soil and debris has been removed from the surface. Rinsate/runoff shall be collected and filtrated to less than 5 microns (or applicable local requirements) and discharged to a sanitary sewer or other Department-approved disposal facility or re-applied to RACS that will be managed under these regulations.

(c) Material determined to be clean during generation shall be inspected during placement for staging. Staging of clean material with incidental discovery of RACS shall be managed as follows:

i. If a CABI was continually inspecting the material during generation, remove the piece of ACM and one (1) foot of material in all directions, with CABI confirmation that the visible extent of RACS has been removed. If more than one (1) piece of ACM, or a pocket of ACM is discovered, remove the pocket of ACM plus one (1) foot of material in all directions, with CABI confirmation that the visible extent of RACS has been removed. Material that remains after removal of RACS, and CABI visible confirmation, is not considered RACS, is not subject to Section 5.5, and

may be appropriate for unrestricted reuse, onsite or offsite, as long as it does not contain any other regulated material.

ii. If a CABI was not continually inspecting the material during generation, an intrusive inspection of the pile shall be conducted to determine the extent of RACS contamination, followed by the removal of the visible extent of contamination plus removal of one (1) foot of material in all directions. Alternatively, the entire pile, plus three (3) inches of material below the pile, shall be removed and managed as RACS. If the pile was placed on top of a durable surface such as concrete or asphalt, the surface shall be decontaminated using wet methods, followed by CABI inspection verifying that all soil and debris has been removed from the surface. Rinsate/runoff shall be collected and filtrated to less than 5 microns (or applicable local requirements) and discharged to a sanitary sewer or other Department-approved disposal facility or re-applied to RACS that will be managed under these regulations.

(2) Stockpiling, as defined in Section 1.2 of these regulations, is the accumulation and storage of RACS that will exist for more than twelve (12) hours, up to and including ten (10) calendar days. The following requirements shall apply to stockpiled RACS:

(a) Stockpiled RACS shall be placed on a minimum of 6 mil polyethylene sheeting or shall include removal, and management as RACS, of a minimum of three (3) inches of soil, or other matrix material, from under the entire area of RACS stockpiling after stockpile removal. If the stockpile was placed on top of a durable surface such as concrete or asphalt, the surface must be decontaminated using wet methods, followed by CABI inspection verifying that all soil and debris has been removed from the surface. Rinsate/runoff shall be collected and filtrated to less than 5 microns (or applicable local requirements) and discharged to a sanitary sewer or other Department-approved disposal facility or re-applied to RACS that will be managed under these regulations.

(b) RACS shall be adequately wet during disturbance.

(c) Stockpiled RACS shall be controlled per Section 5.5.7(A).

(d) Stockpiled RACS shall be stabilized by:

i. Polyethylene sheeting or geotechnical fabric with daily inspection, and inspection no later than twelve (12) hours following storm events, and repair/replace sheeting as necessary to maintain stabilization; or

ii. Chemical stabilizer demonstrated to be effective in the stabilization of RACS (e.g. magnesium chloride) with weekly inspection, and inspection no later than one (1) calendar day after storm events, and re-application of chemical stabilizer as necessary to maintain stabilization; or

iii. Minimum of three (3) inches of soil appropriate for unrestricted use.

(e) For stockpile areas that are non-contiguous with the RWA, transportation of RACS shall be conducted in accordance with the following:

i. Transportation equipment tires shall not contact RACS; or
ii. The tires shall be decontaminated per Section 5.5.7(I) before leaving the RWA; or
iii. The haul road shall be managed as RACS for stabilization, per Section 5.5.7(H)(2)(d), and future removal of a minimum of three (3) inches of soil, or other matrix material. If the road is constructed of a durable surface such as concrete or asphalt, the surface shall be decontaminated using wet methods, followed by CABI inspection verifying that all soil and debris has been removed from the surface. Rinsate/runoff shall be collected and filtrated to less than 5 microns (or applicable local requirements) and discharged to a sanitary sewer or other Department-approved disposal facility or re-applied to RACS that will be managed under these regulations.

(f) For a stockpile that was previously thought to be free of RACS, but where RACS is subsequently identified, the procedure outlined in Section 5.5.7 (H)(1)(c) shall be followed.

(3) Storage of RACS exceeding ten calendar days shall require the submission of a RACS Storage Plan. Storage of RACS shall not commence prior to approval of the RACS Storage Plan by the Department's Hazardous Materials and Waste Management Division. The RACS Storage Plan shall include:

(a) Approval of storage with signature from the property owner; and

(b) Volume of RACS intended for storage; and

(c) Liner design or provisions for removal of a minimum of three (3) inches of underlying material; and

(d) Storm water design including protections for run-on and run-off; and

(e) Cover design or use of an equivalent durable stabilizer; and

(f) Access control and signage; and

(g) Storage timeframe (shall not exceed six (6) months unless an extended storage timeframe is approved by the Department and complies with local governing authority requirements); and

(h) Inspection and maintenance schedule; and

(i) Closure and removal requirements; and

(j) Documentation and reporting; and

(k) Certification of any designed elements by a Colorado registered Professional Engineer.

(4) Temporary sub-surface storage of RACS in areas of future planned RACS removal shall not exceed six (6) months and shall comply with the following:

(a) RACS may only be placed within the Area of Contamination (AOC) that it was originally removed from.

(b) Placement of RACS utilizing standard RACS management requirements in accordance with the standard requirements of Section 5.5.7, an approved PSRMP, or an approved SOP.

(c) Cover RACS in accordance with the requirements of Section 5.5.7(K).

(d) RACS not removed within six (6) months (unless an extended storage timeframe is approved by the Department), shall be considered disposal in accordance with Section 5.5.8(A), or reuse within an AOC and will require an environmental covenant in accordance with Section 5.5.8(B)(1).

(5) Offsite staging, stockpiling, and storage of RACS are allowed as long as they comply with the disposition requirements of Section 5.5.8.

(I) DECONTAMINATION

(1) Requirements applicable to all projects subject to Section 5.5:

(a) Personnel Decontamination:

i. Remove booties and/or gloves before exiting RWA and dispose as asbestos contaminated waste; or
ii. If not using disposable PPE, decontaminate boots in a boot wash station, remove gloves after exiting the boot wash station, and dispose of gloves as asbestos contaminated waste. Rinsate from the boot wash station shall be collected, filtrated to less than 5 microns (or applicable local requirements) and discharged to a sanitary sewer or other Department-approved disposal facility, or re-applied to RACS that will be managed under these regulations.

(b) Decontamination of Equipment or Surfaces that have come into Contact with RACS

i. For equipment that comes into contact with RACS:

1. Wet decontamination on a decontamination pad (minimum 10 mil poly or other durable non-permeable barrier) followed by CABI inspection and verification of equipment decontamination before it leaves the decontamination area. All decontamination liquids and solids shall be contained, and run-on and run-off shall be prevented. Rinsate/runoff shall be collected, filtrated to less than 5 microns (or applicable local requirements) and discharged to a sanitary sewer or other Department-approved disposal facility or re-applied to RACS that will be managed under these regulations. For breaches in the decontamination pad where RACS or water contaminated with asbestos may have impacted the material below the decontamination pad, implement the provisions of Section 5.5.7(J);

and/or

2. Decontamination using HEPA vacuums followed by CABI inspection and verification of equipment decontamination before it leaves the decontamination area.

(c) Protection of Clean Equipment and Surfaces:

i. Keep all equipment off of RACS; or
ii. Protect clean surfaces from coming in contact with RACS by covering equipment surfaces or RACS surfaces with polyethylene sheeting or equivalent durable impermeable covering. For onsite movement of excavation equipment between RWAs, where only the excavator bucket has come in contact with RACS, the bucket shall be wrapped in polyethylene sheeting (minimum 6 mil) prior to movement. Protective coverings shall be cleaned, repaired, or replaced as necessary. If protective coverings are breached and RACS or asbestos contaminated water comes into contact with underlying material, the provisions of Section 5.5.7(J) shall be followed. Coverings that have come in contact with RACS shall be disposed as asbestos contaminated waste.

(2) Additional Requirements for Projects Disturbing RACS Containing Friable ACM:

(a) Remove disposable impermeable suits or equivalent coveralls before exiting RWA and dispose as asbestos contaminated waste, or

(b) After removal of suits or coveralls, conduct full wet decontamination prior to exiting RWA with collection of rinsate and filtration to less than 5 microns and

discharge to a sanitary sewer or other Department-approved disposal facility. Re-application of decontamination shower water is prohibited.

(J) RACS SPILL RESPONSE

(1) Areas where RACS is spilled are RWAs until clean up is completed.

(2) Spilled material shall be cleaned up immediately and not allowed to dry out or accumulate on any surface. The Department's Hazardous Materials and Waste Management Division shall be notified, through the spill reporting hotline, in the event that spills of RACS cannot be cleaned up within 24 hours of spill identification.

(3) Where there are breaches in ground coverings that have the potential to allow RACS or water contaminated with asbestos to impact the material below the covering, a minimum of three (3) inches of soil, or other matrix material, shall be removed from beneath the breached ground coverings. Visual or measured (e.g. survey) confirmation that three (3) inches of soil and/or other matrix material from beneath the breached covering has been removed shall be conducted. If ground coverings are placed on top of a durable surface such as concrete or asphalt, the surface shall be decontaminated using wet methods, followed by CABI inspection that all soil and debris has been removed from the surface.

(4) Rinsate, runoff, or any other water that has come into contact with RACS shall be considered to be asbestos contaminated water and shall be collected and filtrated to less than 5 microns and discharged to a sanitary sewer or other Department-approved disposal facility or re-applied to RACS that will be managed under these regulations.

(5) Surfaces that are contacted by asbestos contaminated water shall be managed as RACS as per Section 5.5.7(J)(3) or permanently stabilized as per Section 5.5.7(K).

(6) If work practices in an RWA are causing an ongoing spill outside the RWA, the work practices shall cease or be modified to prevent additional releases.

(K) REQUIREMENTS FOR EXPOSED RACS REMAINING IN PLACE

(1) Any remaining RACS that has been exposed by the soil disturbing activity, but is not disturbed, such as an excavation side-wall or bottom shall be covered or stabilized using one of the following:

(a) Cover RACS with geofabric, followed by eighteen (18) inches of fill suitable for unrestricted use, and vegetation; or

(b) Cover RACS with geofabric, followed by six (6) inches of fill suitable for unrestricted use, and concrete or asphalt; or

(c) Cover RACS with geofabric, followed by fill suitable for unrestricted use to grade or six (6) inches, whichever is greater, for vertical excavation faces or trenches; or

(d) Alternate cover designs as approved by the Department.

(L) DOCUMENTATION

(1) The documents listed below shall be maintained during a project and available for Department review upon request. However, this documentation need not be submitted to the Department unless requested. CABI and AMS notes may be collected by one individual if they possess both certifications; however, if no AMS is onsite the CABI shall provide items listed in the AMS notes section (e.g. wind monitoring and shutdown events). CABI and AMS notes may be taken by another individual, but shall be reviewed, approved, and signed by the CABI or AMS for whom the notes are being taken. Other appropriate personnel may also provide the following documentation.

(a) CABI/QPM Notes shall include documentation of:

i. Site description including location; and
ii. Descriptions of site activities; and
iii. Descriptions of equipment in use; and
iv. Descriptions of hand removals (including locations); and
v. Descriptions of types of debris identified; and
vi. Descriptions of suspect material identified; and
vii. Friability of ACM identified (as determined by a CABI); and
viii. Sampling, if conducted (all sampling shall be conducted by a CABI); and
ix. Decontamination visual inspection and clearances; and
x. Excavation visual inspection and clearances; and
xi. Spill response activities; and
xii. Observations of visible emissions and responses; and
xiii. Observations of non-earthen material or the appearance of fill; and
xiv. Observations of other indicators of impact to soils.

(b) AMS notes shall include documentation of:

i. Wind speed measurements; and
ii. Prevailing wind direction(s); and
iii. Wind shut down event(s); and
iv. Initial air sample locations; and
v. Air sample relocation notes; and
vi. Observations of visible emissions and responses; and

vii. Notes pertaining to sample malfunctions (pump faults, overloading, etc.); and
viii. Instances of samples being compromised (samples knocked over, sample filters being sprayed with water, samples physically impacted by equipment, etc.); and
ix. Air sample data (flow rates, time of sampling, volumes, calibration method, etc.).

(c) General documentation shall include:

i. Disposal records; and
ii. Analytical reports including chain of custody forms; and
iii. Evaluations of any samples with a “cannot be read” analysis result and the notifications of these events to the Department; and
iv. Location of known remaining RACS; and
v. Creation and removal dates for, and locations of, staged, stockpiled, and/or stored RACS; and
vi. Stockpile and staging pile inspection logs and documentation of weather events requiring inspection; and
vii. Logs of all site personnel with access to the RWA; and
viii. Certification records for all CABIs and AMSs utilized on the project, and
ix. Records for training conducted in accordance Sections 5.5.3(A) and 5.5.3(B); and
x. Records demonstrating the QPM(s) meet the training and experience requirements set forth in Section 5.5.3(C); and
xi. ECP(s) generated during the project.

5.5.8 PACKAGING AND DISPOSITION OF REGULATED ASBESTOS CONTAMINATED SOIL (RACS)

(A) Disposal of RACS

(1) RACS containing one percent (1%) or greater of friable ACM (as determined in the field by a CABI) by volume per load or container, based on visual estimation through continuous visual inspection or other Department-approved quantifiable means of measurement, shall be packaged in a leak tight container and disposed as friable asbestos waste, in accordance with Section 5.3 of these regulations. Alternatively, a friable ACM determination by a CABI is not required if the disposal load is assumed to be RACS containing 1% or greater of friable ACM and is packaged and disposed of in accordance with Section 5.3 of these regulations. Documentation shall accompany each load of RACS removed from the site stating that soil originating from this site shall not be used as daily cover or reused offsite.

(2) For RACS containing:

(a) Less than one percent (1%) of friable ACM (as determined in the field by a CABI) by volume, per load or container, based on visual estimation through continuous visual inspection, or other Department-approved quantifiable means of measurement, shall be packaged in a leak tight container and disposed in a manner similar to non-friable asbestos waste, as described in Section 5.2 of these regulations. Documentation must accompany each load of RACS removed from the site stating that soil originating from this site shall not be used as daily cover or reused offsite.

(b) Except as provided by Section 5.5.8(A)(3), only visible non-friable ACM (as determined in the field by a CABI) that has not been rendered friable, or RACS that contains no visible ACM, shall be packaged in a leak tight container and disposed of as non-friable asbestos waste in accordance with Section 5.2 of this Part 5. Documentation shall accompany each load of RACS removed from the site stating that soil originating from this site shall not be used as daily cover or reused offsite.

(c) A total volume of debris that is less than 1% of the disposal load, based on visual estimation through continuous visual inspection, and the debris is all assumed to be RACS, then a CABI is not required to make a friable ACM determination.

(3) Owners/operators may utilize alternative packaging for RACS, that contains only non-friable ACM and/or asbestos fibers in soil, that ensures that there are no visible emissions during transport to or from the landfill. The alternative packaging must also be acceptable to the disposal facility accepting the waste. A written notice shall be submitted to the Department at least forty-eight (48) hours prior to the alternative packaging being used. If alternative packaging will be used for material that contains any amount of friable asbestos waste, the alternative packaging shall be in accordance with Section 5.3.5 of the Regulation.

(4) A Design and Operations (D&O) plan shall be submitted to, and approved by, the Department for onsite disposal of RACS outside of the AOC, in accordance with the Colorado Solid Wastes Disposal Sites and Facilities Act (C.R.S. 30-20, Part 1) and these regulations. The packaging requirements set forth above in Section 5.5.8(A)(1-2) are not required for onsite disposal, but the requirements of Section 5.5.5(A)(2)(e) are applicable. An environmental covenant, in accordance with 25-15-320, C.R.S., is required for onsite RACS disposal, and a Certificate of Designation shall be required, in accordance with Section 1.6 of these regulations, unless exempt under Section 1.4.

(B) Onsite reuse of RACS:

(1) A plan for reuse of RACS within the footprint of the AOC shall be submitted to the Department for review and approval prior to implementation and shall comply with Section 5.5.5(A)(2)(e), and the following cover requirements:

(a) Cover RACS with geofabric, followed by eighteen (18) inches of fill suitable for unrestricted use, and vegetation; or

(b) Cover RACS with geofabric, followed by six (6) inches of fill suitable for unrestricted use, and concrete or asphalt; or

(c) Cover RACS with geofabric, followed by fill suitable for unrestricted use to grade or six (6) inches, whichever is greater, for vertical excavation faces or trenches; and

(d) The final grades shall promote surface water run-off and minimize erosion, and shall have slopes no less than 5% (20:1) and no greater than 25% (4:1); or

(e) Alternate cover designs as approved by the Department; and

(f) An environmental covenant, in accordance with 25-15-320, C.R.S., may be required for onsite reuse of RACS.

(2) A plan for beneficial reuse of RACS outside the footprint of the AOC, in accordance with Section 8.6, shall be submitted to the Department for review and approval prior to its implementation. The plan shall include provisions for covering RACS and shall comply with the management requirements of Section 5.5.5(A)(2)(e). Additionally, the cover requirements outlined in Section 5.5.7(K) shall be adhered to. An environmental covenant, in accordance with 25-15-320 C.R.S. may be required for beneficial reuse of RACS.

(C) Demonstration of Non-RACS

(1) Soil or other matrix material initially determined to be RACS may be demonstrated not to be RACS based on visual inspection, removal of all ACM, and sampling and analysis of the remaining material showing no detectable asbestos. Sampling and analysis shall be conducted in accordance with Appendix 5A. If there is no detectable asbestos, this material is no longer subject to Section 5.5 and may be appropriate for unrestricted use, onsite or offsite, as long as it does not contain any other regulated material.

APPENDIX B

SOIL AND BEDROCK DESCRIPTORS

ABBREVIATIONS

ABBREVIATIONS

Abbreviation	Meaning
Bu	Bulk sample
CA	2.0-inch I.D. ring-lined split barrel California sample
DM	2.5-inch I.D. ring-lined split barrel Dames and Moore (modified California) sample
RQD	Rock Quality Designation
S	1.375-inch I.D. standard split-spoon sample (unlined)
PP	Pocket Penetrometer
U	Shelby Tube sample

SOIL CLASSIFICATION FLOWCHARTS AND DESCRIPTION CRITERIA

TABLE 1.1
CRITERIA FOR DESCRIBING SOIL STRUCTURE(1)

Description	Criteria
Stratified	Alternating layers of varying material or color with layers greater than or equal to 1/4 inch thick (6 mm)
Laminated	Alternating layers of varying material or color with layers less than 1/4 inch thick (6 mm)
Fissured	Breaks along definite plates of fracture with little resistance to fracturing
Slickensided	Fracture planes appear polished or glossy, sometimes striated
Blocky	Cohesive soil that can be broken down into small angular lumps which resist further breakdown
Lensed	Inclusion of small pockets of different soils, such as small lenses of sand scattered through a mass of clay
Homogeneous	Same color and appearance throughout

Note:
1. Modified from ASTM D 2488 *Description and Identification of Soils (Visual-Manual Procedure)* and differ from the U.S. Bureau of Reclamation *Engineering Geology Field Manual* (2001).

TABLE 1.2
RELATIVE DENSITY OF SANDS ACCORDING TO RESULTS OF STANDARD PENETRATION TEST(1)

Number of Blows N	Relative Density
0-4	Very Loose
5-10	Loose
11-30	Medium
31-50	Dense
Over 50	Very Dense

Note:
1. Modified from Terzaghi, Peck, and Mesri (1996).

TABLE 1.3
GUIDE FOR STIFFNESS OF FINE-GRAINED SOILS(1)

Description	Criteria	Estimated Unconfined Compressive Strength (TSF)
Very Soft	Extrudes between fingers when squeezed	<0.25
Soft	Molded by light finger pressure	0.25-0.50
Medium	Molded by strong finger pressure	0.50-1.00
Stiff	Readily indented by thumb or penetrated with great effort	1.00-2.00
Very Stiff	Readily indented by thumbnail	2.00-4.00
Hard	Indented with difficulty by thumbnail	>4.00

Note:
1. Reproduced from NAVFAC (1986).

TABLE 1.4
CRITERIA FOR DESCRIBING SOIL MOISTURE CONDITION[1]

Description	Criteria
Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, usually soil is below the water table

Note:
1. Reproduced from ASTM 2488 *Description and Identification of Soils (Visual-Manual Procedure)*.

TABLE 1.5
CRITERIA FOR DESCRIBING SOIL CEMENTATION[1][2]

Description	Criteria
Weak	Crumbles or breaks with handling or little finger pressure
Moderate	Crumbles or breaks with considerable finger pressure
Strong	Will not crumble or break with finger pressure

Notes:
1. Reproduced from ASTM 2488 *Description and Identification of Soils (Visual-Manual Procedure)*.
2. The absence of cementation was not recorded on boring logs.

TABLE 1.6
CRITERIA FOR DESCRIBING SOIL REACTION WITH HCL[1]

Description	Criteria
None[2]	No visible reaction
Weak	Some reaction, with bubbles forming slowly
Strong	Violent reaction, with bubbles forming immediately

Notes:
1. Reproduced from ASTM 2488 Description and Identification of Soils (Visual-Manual Procedure).
2. The absence of a reaction was not recorded on boring logs.

SEDIMENTARY ROCK CLASSIFICATION AND CRITERIA FOR DESCRIPTIONS

TABLE 2.1
GENERAL SEDIMENTARY ROCK TYPES

Rock Type	General Description
Conglomerate	Mostly gravel, cobbles, or boulders; grains are rounded to subrounded.
Breccia	Mostly gravel, cobbles, or boulders; grains are angular to subangular.
Sandstone	Mostly sand sized particles.
Siltstone	Mostly silt sized particles that are generally non to low plastic.
Claystone	Mostly clay sized particles that are generally low to high plastic fines.
Mudstone	Mostly clay sized particles that are generally low to high plastic fines. Generally less competent and more friable than claystone.
Shale	Mostly clay sized particles that are generally low to high plastic fines; more competent than claystone; fissile along bedding planes.

TABLE 2.2
BEDDING, FOLIATION, OR FLOW TEXTURE DESCRIPTIONS[(1)(2)]

Descriptor	Thickness/Spacing
Massive	Greater than 10 ft. (3 m)
Very Thickly (Bedded, Foliated, or Banded)	3 to 10 ft. (1 to 3 m)
Thickly	1 to 3 ft. (300 mm to 1 m)
Moderately	0.3 to 1 ft. (100 to 300 mm)
Thinly	0.1 to 0.3 ft. (30 to 100 mm)
Very Thinly	0.03 [3/8-in.] to 0.1 ft. (10 to 30 mm)
Laminated (Intensely Foliated or Banded)	Less than 0.03 ft. [3/8-in] (10 mm)

Notes:

1. The dip of the bedding noted on the logs is measured from horizontal for vertical boreholes and normal to the axis on angled boreholes.
2. Reproduced from U.S. Bureau of Reclamation, *Engineering Geology Field Manual* (2001).

TABLE 2.3
WEATHERING DESCRIPTORS

Weathering Descriptor	Diagnostic Features				
	Chemical Weathering – Discoloration and/or Oxidation		Mechanical Weathering (Grain boundary conditions-use with granitics and coarse grained sediments)	Texture	Solutioning
	Body of Rock	Fracture Surfaces[2]			
Fresh	No discoloration, not oxidized	No discoloration or oxidation	No separation, intact (tight)	No change	No Solutioning
Slightly weathered to fresh [1]					
Slightly weathered	Discoloration or oxidation is limited to surface or short distance from, fractures: some feldspar crystals are dull	Minor to complete discoloration or oxidation of most surfaces	No visible separation, intact (tight)	Preserved	Minor leaching of some soluble minerals may be noted
Moderately to slightly weathered [1]					
Moderately weathered	Discoloration or oxidation extends from fractures, usually throughout: Fe-Mg minerals are “rusty”, feldspar crystals are “cloudy”	All fracture surfaces are discolored or oxidized	Partial separation of boundaries visible	Generally Preserved	Soluble minerals may be mostly leached
Intensely to moderately weathered [1]					
Intensely weathered	Discoloration or oxidation throughout; all feldspars and Fe-Mg minerals are altered to clay to some extent; or chemical alteration produces in-situ disaggregation, see grain boundaries conditions	All fracture surfaces are discolored or oxidized, surfaces friable	Partial separation, rock is friable; in semi-arid conditions granitics are disaggregated	Texture altered by chemical disintegration (hydration, argillation)	Leaching of soluble minerals may be complete
Very intensely weathered [1]					
Decomposed	Discolored or oxidized throughout, but resistant minerals such as quartz may be unaltered; all feldspars and Fe-Mg minerals are completely altered to clay		Complete separation of grain boundaries (disaggregated)	Resembles a soil, partial, or complete remnant rock structure may be preserved; leaching of soluble minerals usually complete	

Notes:

This chart and its horizontal categories are most readily applied to rocks with feldspars and mafic minerals. Weathering in various sedimentary rocks, particularly limestones and poorly indurated sediments, will not always fit the categories established. This chart and weathering categories may have to be modified for particular site conditions or alteration such as hydrothermal effects; however, the basic framework and similar descriptors are to be used.

1. Combination descriptors are permissible where equal distribution of both weathering characteristics are present over significant intervals or where characteristics present are “in between” the diagnostic feature. However, dual descriptors should not be used where significant, identifiable zones can be delineated. When given as a range, only two adjacent terms may be combined (i.e., decomposed to slightly weathered or moderately weathered to fresh are not acceptable).
2. Does not include directional weathering along shears or faults and their associated features. For example, a shear zone that carried weathering to great depths into a fresh rock mass would not require the rock mass to be classified as weathered.
3. Reproduced from U.S. Bureau of Reclamation, *Engineering Geology Field Manual* (2001).

TABLE 2.4
FRACTURE DENSITY DESCRIPTORS[1]

Descriptor	Criteria (Excludes Mechanical Breaks)
Unfractured	No observed fractures.
Very Slightly Fractured	Core recovered mostly in lengths greater than 3 feet (1 m).
Slightly to Very Slightly Fractured [2]	
Slightly Fractured	Core recovered mostly in lengths from 1 to 3 feet (300 to 1,000 mm) with few scattered lengths less than 1 foot (300 mm) or greater than 3 feet (1,000 mm).
Moderately to Slightly Fractured [2]	
Moderately Fractured	Core recovered mostly in lengths from 0.33 to 1.0 foot (100 to 300 mm) lengths with most lengths about 0.67 foot (200 mm).
Intensely to Moderately Fractured [2]	
Intensely Fractured	Lengths average from 0.1 to 0.33 foot (30 to 100 mm) with scattered fragmented intervals. Core recovered mostly in lengths less than 0.33 foot (100 mm).
Very Intensely to Intensely Fractured [2]	
Very Intensely Fractured	Core recovered mostly as chips and fragments with a few scattered short core lengths.

Notes:
1. Reproduced from U.S. Bureau of Reclamation, *Engineering Geology Field Manual* (2001).
2. Combinations of fracture densities are permissible (e.g., very intensely to intensely fractured or moderately to slightly fractured) where equal distribution of both fracture density characteristics are present over a significant core interval or exposure, or where characteristics are “in between” the descriptor definitions.

TABLE 2.5
ROCK HARDNESS / STRENGTH DESCRIPTORS[1]

Alphanumeric Descriptor	Descriptor	Criteria
H1	Extremely Hard	Core, fragment, or exposure cannot be scratched with knife or sharp pick; can only be chipped with repeated heavy hammer blow.
H2	Very Hard	Cannot be scratched with knife or sharp pick. Core or fragment breaks with repeated heavy hammer blow.
H3	Hard	Can be scratched with knife or sharp pick with difficulty (heavy pressure). Heavy hammer blow required to break specimen.
H4	Moderately Hard	Can be scratched with knife or sharp pick with light or moderate pressure. Core or fragment breaks with moderate hammer blow.
H5	Moderately Soft	Can be grooved 1/16 inch (2 mm) deep by knife or sharp pick with moderate or heavy pressure. Core or fragment breaks with light hammer blow or heavy manual pressure.
H6	Soft	Can be grooved or gouged easily by knife or sharp pick with light pressure. Can be scratched with fingernail. Breaks with light to moderate manual pressure.
H7	Very Soft	Can be readily indented, grooved, or gouged with fingernail, or carved with a knife. Breaks with light manual pressure.

Note:
1. Reproduced from U.S. Bureau of Reclamation, *Engineering Geology Field Manual* (2001).

TABLE 2.6
FRACTURE OPENNESS DESCRIPTORS(1)

Alphanumeric Descriptor	Descriptor	Openness
O0	Tight	No visible separation
O1	Slightly Open	Less than 0.003 ft [1/32 in] (< 1 mm)
O2	Moderately Open	0.003 to 0.01 ft [1/32 to 1/8 in] (1 to 3 mm)
O3	Open	0.01 to 0.03 ft [1/8 to 3/8 in] (3 to 10 mm)
O4	Moderately Wide	0.03 to 0.1 ft [3/8 to 1.2 in] (10 to 30 mm)
O5	Wide	Greater than 0.1 ft [1.2 in] (> 30 mm)

Note:
1. Reproduced from U.S. Bureau of Reclamation, *Engineering Geology Field Manual* (2001).

TABLE 2.7
FRACTURE ROUGHNESS DESCRIPTORS(1)

Alphanumeric Descriptor	Roughness Descriptor	Criteria
R1	Stepped	Near-normal steps and ridges occur on the fracture surface.
R2	Rough	Large angular asperities can be seen.
R3	Moderately Rough	Asperities are clearly visible and fracture surface feels abrasive.
R4	Slightly Rough	Small asperities on the fracture surface are visible and can be felt.
R5	Smooth	No asperities, smooth to the touch.
R6	Polished/ Slickensided	Extremely smooth and shiny. A polished fault surface, often with a lineation parallel to the displacement direction.

Note:
1. Reproduced from U.S. Bureau of Reclamation, *Engineering Geology Field Manual* (2001).

TABLE 2.8
FRACTURE FILLING THICKNESS DESCRIPTORS(1)

Alphanumeric Descriptor	Fracture Filling Descriptor	Thickness
T0	Clean	No film or coating
T1	Very Thin	Less than 0.003 ft [1/32 in] (< 1 mm)
T2	Moderately Thin	0.003 to 0.01 ft [1/32 to 1/8 in] (1 to 3 mm)
T3	Thin	0.01 to 0.03 ft [1/8 to 3/8 in] (3 to 10 mm)
T4	Moderately Thick	0.03 [3/8 in] to 0.1 ft (10 to 30 mm)
T5	Thick	Greater than 0.1 ft (> 30 mm)

Note:
1. Reproduced from U.S. Bureau of Reclamation, *Engineering Geology Field Manual* (2001).

TABLE 2.9
REACTION WITH HCL[1]

Descriptor	Criteria
None[2]	No visible reaction
Weak	Some reaction, with bubbles forming slowly
Strong	Violent reaction, with bubbles forming immediately

Notes:
1. Reproduced from ASTM 2488 Description and Identification of Soils (Visual-Manual Procedure).
2. The absence of a reaction was not recorded on boring logs.

REFERENCES

ASTM D 2487 (2011). *Standard Classification of Soils for Engineering Purposes (USCS)*. June.

ASTM D 2488 (2009). *Standard Practice for Description and Identification of Soils (Visual-Manual Method*). July.

Bates, Robert C. and Jackson, Julia A. (1984). *Dictionary of Geologic Terms,* 3rd Edition.

Hunt, Roy E. (Hunt) (2005). *Geotechnical Investigation Handbook*.

Naval Facilities Engineering Command (NAVFAC) (1986). *Soil Mechanics Design Manual 7.01 (DM-7;01)*. September.

Terzaghi, Karl, Peck, Ralph B., and Mesri, Gholamreza. (Terzaghi, Peck, and Mesri). (1996). *Soil Mechanics in Engineering Practice*.

U.S. Bureau of Reclamation (USBR) (2001). *Engineering Geology Field Manual*.

APPENDIX C

BORING LOGS

LOG OF SOIL BORING

Project name: Thornton WTP
Project No: 16104
Boring Location: N 1196040.4, E 3146739.3 ft
Ground El: 5414.1 ft Total Depth: 49.4 ft
Groundwater El: 5395.6 ft On Date: 06-30-2016

Start Date: 06-27-2016 End Date: 06-28-2016
Driller: Elite - Marshall Logged By: MSS
Bedrock Depth: 17.3 ft Checked By: ABP

Drilling Rig: CME 550 Buggy Rig
Equipment: 4-1/4 inch ID 8 inch OD HSA

Borehole ID: **B-101(P)**
Sheet 1 of 6

Elevation	Depth (ft)	Type - No	Blows per 6 inch	Penetration (ft)	Recovery (ft)	Remarks	Graphic Lithology	Description and Classification of Materials
	1	S - 1	4/6/7/9	2.0	1.3	Bu-4 collected from 0.0 to 10.0 ft.		S-1: Lean Clay with Sand Mostly fines, low to medium plasticity; 20-30% sand, fine to coarse grained, subangular to subrounded; very stiff to hard; dry to slightly moist; brown with calcite throughout; occasional roots and bedrock fragments throughout; strong reaction with HCl; (CL); [Fill]
	2							
5411.8								S-2: Fat Clay Mostly fines, medium to high plasticity; 5-15% sand, fine to coarse grained, subangular to subrounded; very soft to soft; moist to wet; brown; trace roots and bedrock fragments; (CH); [Fill]
	3	S - 2	5/6/6/7	2.0	0.9			
5410.3								S-2: Lean Clay Blocky; mostly fines, medium to high plasticity; 5-15% sand, fine grained; very stiff to hard; slightly moist to moist; brown; occasional bedrock fragments and calcite throughout; strong reaction with HCl; (CL); [Fill]
	4							
5409.4								S-3: Lean Clay with Gravel Mostly fines, medium to high plasticity; 10-20% gravel, fine to coarse grained, subangular to subrounded; 5-15% sand, fine grained; maximum particle size = 1 inch; very stiff to hard; moist; brown; PP = >4.5 tsf; iron staining common, occasional bedrock fragments, calcite, and woody debris throughout; strong reaction with HCl; (CL); [Fill]
	5					Moisture content of cuttings increased below 5.0 ft. Water level was 5.5 ft deep on 6/28/2016 after coring to 36.9 ft.		
	6	S - 3	7/7/9/10	2.0	1.6			
	7							
5406.8								DM-5: Lean Clay Mostly fines, medium to high plasticity; 5-15% sand, fine grained; less than 5% gravel, coarse grained, angular to subangular; maximum particle size = 3 inches; very stiff to hard; moist; brown; iron staining common, occasional bedrock fragments, calcite, and woody debris throughout; strong reaction with HCl; (CL); [Fill]
	8	DM - 5	6/13	1.0	1.0			
	9							
5404.8								S-6: Lean Clay with Sand Mostly fines, medium to high plasticity; 15-25% sand, fine to coarse grained, subangular to subrounded; stiff to very stiff; moist; brown; occasional iron staining, occasional bedrock fragments and calcite throughout; (CL);
	10							

Continued on next sheet

Notes Lithology between recovered samples is interpreted; contacts are approximate. Boring completed as a monitoring well.

LOG OF SOIL BORING

Project name: Thornton WTP
Project No: 16104
Boring Location: N 1196040.4, E 3146739.3 ft
Ground El: 5414.1 ft Total Depth: 49.4 ft
Groundwater El: 5395.6 ft On Date: 06-30-2016

Start Date: 06-27-2016 End Date: 06-28-2016
Driller: Elite - Marshall Logged By: MSS
Bedrock Depth: 17.3 ft Checked By: ABP

Drilling Rig: CME 550 Buggy Rig
Equipment: 4-1/4 inch ID 8 inch OD HSA

Borehole ID: **B-101(P)**
Sheet 2 of 6

Elevation	Depth (ft)	Type - No	Blows per 6 inch	Penetration (ft)	Recovery (ft)	Remarks	Graphic Lithology	Description and Classification of Materials
	11	S - 6	5/8/11/10	2.0	1.4			[Fill]
5402.6								S-6: Poorly Graded Sand Mostly sand, fine to medium grained; less than 5% fines; medium dense; dry to slightly moist; tan; weakly cemented, bedrock fragment; (SP); [Fill]
5402.3	12							S-6, S-7: Lean Clay with Sand Mostly fines, medium to high plasticity; 15-25% sand, fine to coarse grained, subangular to subrounded; stiff to very stiff; moist; brown; occasional iron staining, occasional bedrock fragments and calcite throughout; (CL); [Fill]
5401.1	13	S - 7	5/14/19/24	2.0	2.0			*12.5 to 13.0 ft: Sand is fine grained; medium stiff to stiff;* S-7, DM-8: Clayey Sand Mostly sand, fine to medium grained; 15-25% fines, low to medium plasticity; dense; moist; tan; occasional calcite and bedrock fragments; weak reaction with HCl; (SC); [Fill]
	14							
	15	DM - 8	9/29	1.0	0.8			
	16							
	17							
5396.8						Driller reported increased resistance at 17.3 ft. Top of bedrock at 17.3 ft.		S-9, DM-10: Claystone Blocky, laminated to very thinly bedded; mostly fines, medium to high plasticity; less than 5% sand; slightly to moderately weathered; slightly moist to moist; light brown; H7; [TKda]
	18	S - 9	8/12/14/16	2.0	1.9	Ground water level was 18.5 ft deep on 6/30/2016. Measurement was obtained from monitoring well.		
	19							
	20							

Continued on next sheet

Notes Lithology between recovered samples is interpreted; contacts are approximate. Boring completed as a monitoring well.

LOG OF SOIL BORING

Project name: Thornton WTP
Project No: 16104
Boring Location: N 1196040.4, E 3146739.3 ft
Ground El: 5414.1 ft Total Depth: 49.4 ft
Groundwater El: 5395.6 ft On Date: 06-30-2016

Start Date: 06-27-2016 End Date: 06-28-2016
Driller: Elite - Marshall Logged By: MSS
Bedrock Depth: 17.3 ft Checked By: ABP

Drilling Rig: CME 550 Buggy Rig
Equipment: 4-1/4 inch ID 8 inch OD HSA

Borehole ID: **B-101(P)**

Elevation	Depth (ft)	Type - No	Blows per 6 inch	Penetration (ft)	Recovery (ft)	Remarks	Graphic Lithology	Description and Classification of Materials
5393.2	21	DM - 10	12/25	1.0	0.8	Switched to NQ3 wireline coring after sampling DM-10.		
5393.1								DM-10: Sandy Claystone Laminated to very thinly bedded; mostly fines, low to medium plasticity; 20-30% sand, fine grained; slightly to moderately weathered; slightly moist to moist; light brown; H7; [TKda] End of boring log at 21.00 ft
	22							
	23							
	24							
	25							
	26							
	27							
	28							
	29							
	30							

Notes Lithology between recovered samples is interpreted; contacts are approximate. Boring completed as a monitoring well.

LOG OF ROCK CORE

Project name: Thornton WTP
Project No: 16104
Boring Location: N 1196040.4, E 3146739.3 ft
Ground El: 5414.1 ft Total Depth: 49.4 ft
Groundwater El: 5395.6 ft On Date: 06-30-2016

Start Date: 06-27-2016 End Date: 06-28-2016
Driller: Elite - Marshall Logged By: MSS
Bedrock Depth: 17.3 ft Checked By: ABP
Plunge: 90.0 Bearing: Not Applicable

Borehole ID: **B-101(P)**
Sheet 4 of 6

Drilling Rig: CME 550 Buggy Rig
Equipment: NQ3-Sized core steel, 1.75 inch ID 2.98 inch OD

Elevation	Depth (ft)	Notes: Groundwater, Drilling, Conditions, Circulation etc	Interval (ft)	Penetration (ft)	Recovery ft, (%)	RQD, ft (%)	Coring Time (min)	No. of Pieces	Longest (ft)	Shortest (ft)	Hardness	In Situ Testing	Joint Description	Joint Symbol	Lithology	Description and Classification of Materials
	21	RQD may not be applicable. 20.7 to 21.0 ft advanced through a portion of DM-10 sample interval.											Core Loss			21.0 to 24.4 ft: Silty Sandstone Mostly sand, fine grained; 30-40% fines, low to medium plasticity; moderately weathered; unfractured to slightly fractured; moist; light brown; [TKda]
	22	Near 100-percent drilling-water circulation.	20.7 to 24.4	3.7	3.3 (89)	2.6 (70)	2	7	2.1	<0.1	H7					
	23												Mechanical Break			
	24												40 to 50 degrees, Tight to slightly open, slightly rough to smooth, clean			
5389.7	25	Drilling-water exited ground surface during coring. Drillers attempted to establish a better seal using bentonite chips on three occasions.											40 degrees, Tight to slightly open, slightly rough to smooth, clean to very thin iron infilling			24.4 to 39.1 ft: Claystone Mostly fines, medium to high plasticity; less than 5% sand, fine grained; fresh to slightly weathered; slightly to moderately fractured; moist; light brown to gray; [TKda]
	26												60 degrees, Tight to slightly open, moderately to slightly rough, clean to very thin iron infilling			
	27		24.4 to 29.4	5.0	5.0 (100)	4.5 (90)	8	7	1.4	0.2	H7		60 degrees, Tight to slightly open, slightly rough to smooth, clean to very thin iron infilling			
	28												Tight to slightly open, slightly rough to smooth, clean to very thin iron infilling			
	29												25 degrees, Tight to slightly open, slightly rough to smooth, clean to very thin iron infilling			*29.4 to 34.4 ft: less than 10% sand, fine grained; unfractured to slightly fractured;*
	30															

Continued on next sheet

Notes Lithology between recovered samples is interpreted; contacts are approximate. Boring completed as a monitoring well.

LOG OF ROCK CORE

Project name: Thornton WTP
Project No: 16104
Boring Location: N 1196040.4, E 3146739.3 ft
Ground El: 5414.1 ft Total Depth: 49.4 ft
Groundwater El: 5395.6 ft On Date: 06-30-2016

Start Date: 06-27-2016 End Date: 06-28-2016
Driller: Elite - Marshall Logged By: MSS
Bedrock Depth: 17.3 ft Checked By: ABP
Plunge: 90.0 Bearing: Not Applicable

Borehole ID: **B-101(P)**
Sheet 5 of 6

Drilling Rig: CME 550 Buggy Rig
Equipment: NQ3-Sized core steel, 1.75 inch ID 2.98 inch OD

Elevation	Depth (ft)	Notes: Groundwater, Drilling, Conditions, Circulation etc	Interval (ft)	Penetration (ft)	Recovery ft, (%)	RQD, ft (%)	Coring Time (min)	No. of Pieces	Longest (ft)	Shortest (ft)	Hardness	In Situ Testing	Joint Description	Joint Symbol	Lithology	Description and Classification of Materials
	31	RQD may not be applicable.														
	32	Greater than 100-percent recovery and RQD attributed to swell of the recovered core sample.	29.4 to 34.4	5.0	5.2 (104)	5.2 (104)	9	1	5.2	5.2	H7					
	33												70 degrees, Tight, slightly rough to smooth, very thin iron infilling			
	34															*34.4 to 35.1 ft: less than 10% sand, fine grained; moderately weathered; unfractured to slightly fractured;*
	35															*35.1 to 36.9 ft: less than 10% sand, fine grained; slightly weathered; unfractured to slightly fractured;*
	36	Greater than 100-percent recovery and RQD attributed to swell of the recovered core sample.	34.4 to 36.9	2.5	2.7 (108)	2.7 (108)	4	4	1.6	0.1	H7		60 degrees			
	37	Advanced augers to 28.8 ft after coring to 36.9 ft to improve bedrock seal. Near 100-percent drilling-water circulation.											Slightly to moderately open, slightly rough to smooth, clean to very thin iron infilling			*36.9 to 38.0 ft: less than 10% sand, fine grained; fresh to slightly weathered; unfractured to slightly fractured; occasional organics throughout;*
													Coal bedding plane			
	38		36.9 to 39.4	2.5	2.5 (100)	2.5 (100)	4	2	1.4	1.1	H7		Mechanical Break			*38.0 to 39.1 ft: less than 10% sand, fine grained; slightly to moderately weathered; unfractured to slightly fractured; occasional organics throughout;*
5375.0	39															39.1 to 39.4 ft: Clayey Sandstone Mostly sand, fine grained; 40-50% fines, medium to high plasticity; moderately to intensely weathered; unfractured; moist; light brown to gray; [TKda]
5374.7													Core Loss			39.4 to 42.6 ft: Claystone Mostly fines, medium to high plasticity; less than 5% sand,
	40															

Continued on next sheet

Notes Lithology between recovered samples is interpreted; contacts are approximate. Boring completed as a monitoring well.

LOG OF ROCK CORE

Project name: Thornton WTP
Project No: 16104
Boring Location: N 1196040.4, E 3146739.3 ft
Ground El: 5414.1 ft Total Depth: 49.4 ft
Groundwater El: 5395.6 ft On Date: 06-30-2016

Start Date: 06-27-2016 End Date: 06-28-2016
Driller: Elite - Marshall Logged By: MSS
Bedrock Depth: 17.3 ft Checked By: ABP
Plunge: 90.0 Bearing: Not Applicable

Borehole ID: **B-101(P)**
Sheet 6 of 6

Drilling Rig: CME 550 Buggy Rig
Equipment: NQ3-Sized core steel, 1.75 inch ID 2.98 inch OD

Elevation	Depth (ft)	Notes: Groundwater, Drilling, Conditions, Circulation etc	Interval (ft)	Penetration (ft)	Recovery ft, (%)	RQD, ft (%)	Coring Time (min)	No. of Pieces	Longest (ft)	Shortest (ft)	Hardness	In Situ Testing	Joint Description	Joint Symbol	Lithology	Description and Classification of Materials
	41	RQD may not be applicable.											Slightly to moderately open, moderately to slightly rough, clean Coal bedding plane Mechanical Break			fine grained; slightly to moderately weathered; moderately to intensely fractured; moist; light brown to gray; [TKda]
	42	Core barrel plugged twice during coring between 39.4 and 44.4 ft.	39.4 to 44.4	5.0	4.5 (90)	1.5 (30)	9	> 10	0.5	<0.1	H7		Slightly to moderately open, moderately to slightly rough, clean			
5371.5																42.6 to 43.3 ft: Clayey Sandstone Mostly sand, fine grained; 20-30% fines, low to medium plasticity; moderately to intensely weathered; moderately to intensely fractured; moist; tan; [TKda]
5370.8	43															43.3 to 49.4 ft: Claystone Mostly fines, medium to high plasticity; less than 5% sand, fine grained; slightly to moderately weathered; unfractured; moist; light brown to gray; [TKda]
	44															*44.4 to 47.4 ft: fresh to slightly weathered;*
	45															
	46															
	47		44.4 to 49.4	5.0	5.0 (100)	4.2 (84)	10	7	3.5	0.2	H7					*47.4 to 49.4 ft: fresh to slightly weathered; intensely fractured;*
	48												40 to 60 degrees, Tight to slightly open, slightly rough to smooth, clean to very thin iron and manganese infilling			
	49												Mechanical Break			
5364.7		Bottom of Boring at 49.4 ft.														End of rock core log at 49.40 ft
	50															

Notes Lithology between recovered samples is interpreted; contacts are approximate. Boring completed as a monitoring well.

RJH CONSULTANTS INC

LOG OF SOIL BORING

Project name: Thornton WTP
Project No: 16104
Boring Location: N 1195929.5, E 3147097.3 ft
Ground El: 5407.2 ft Total Depth: 60.5 ft
Groundwater El: Not Measured On Date: 06-24-2016

Start Date: 06-23-2016 End Date: 06-24-2016
Driller: Elite - Marshall Logged By: MSS
Bedrock Depth: 24.2 ft Checked By: ABP

Drilling Rig: CME 550 Buggy Rig
Equipment: 4-1/4 inch ID 8 inch OD HSA

Borehole ID: **B-102**
Sheet 1 of 7

Elevation	Depth (ft)	Type - No	Blows per 6 inch	Penetration (ft)	Recovery (ft)	Remarks	Graphic Lithology	Description and Classification of Materials
	1	S - 1	2/4/6/7	2.0	1.7			S-1: Clayey Sand Mostly sand, fine to coarse grained; 15-25% fines, low to medium plasticity; less than 10% gravel, fine grained, subangular to subrounded; maximum particle size = 0.5 inches; loose; slightly moist to moist; brown; roots and calcite throughout; strong reaction with HCl; (SC); [Fill]
	2							
5405.0								
	3	S - 2	5/7/9/11	2.0	1.6			S-2, S-3: Fat Clay with Sand Mostly fines, medium to high plasticity; 15-25% sand, fine to medium grained; stiff to very stiff; moist; brown ; PP = 2.75-4.5 tsf; occasional iron staining, bedrock fragments, and calcite; strong reaction with HCl; (CH); [Fill]
	4							
	5					Moisture content of cuttings increased below 5.0 ft.		*5.0 to 7.0 ft: very stiff to hard; brown to tan; calcite and subangular gravel sized piece at 6.8 ft, maximum particle size = 0.5 inches;*
	6	S - 3	9/10/12/13	2.0	1.2			
	7							
5400.0								S-4: Sandy Lean Clay Mostly fines, medium to high plasticity; 30-40% sand, fine to medium grained; stiff to very stiff; moist; brown; occasional coal; (CL); [Fill]
	8	S - 4	8/9/12/12	2.0	1.7			
	9							
5397.4								DM-5: Fat Clay with Sand
	10							

Continued on next sheet

Notes Lithology between recovered samples is interpreted; contacts are approximate. Boring backfilled with cement-bentonite grout topped off with bentonite chips.

RJH CONSULTANTS INC

LOG OF SOIL BORING

Project name: Thornton WTP
Project No: 16104
Boring Location: N 1195929.5, E 3147097.3 ft
Ground El: 5407.2 ft Total Depth: 60.5 ft
Groundwater El: Not Measured On Date: 06-24-2016

Start Date: 06-23-2016 End Date: 06-24-2016
Driller: Elite - Marshall Logged By: MSS
Bedrock Depth: 24.2 ft Checked By: ABP

Drilling Rig: CME 550 Buggy Rig
Equipment: 4-1/4 inch ID 8 inch OD HSA

Borehole ID: **B-102**
Sheet 2 of 7

Elevation	Depth (ft)	Type - No	Blows per 6 inch	Penetration (ft)	Recovery (ft)	Remarks	Graphic Lithology	Description and Classification of Materials
	11	DM - 5	1000 psi	1.0	0.8	Bu-6 collected from 10.0 to 20.0 ft.		Mostly fines, medium to high plasticity; 15-25% sand, fine to coarse grained; very stiff to hard; moist; brown to tan; PP = 4.5 tsf; occasional iron staining, bedrock fragments, and calcite; (CH); [Fill]
5396.2								DM-5: Poorly Graded Sand with Silt Mostly sand, fine to medium grained; 5-15% fines; dry to slightly moist; tan; bedrock fragments; (SP-SM); [Fill]
5395.5	12							S-7, CA-8: Lean Clay with Sand Mostly fines, medium to high plasticity; 15-25% sand, fine to medium grained; very stiff to hard; slightly moist to moist; brown to tan; PP = 4.5 tsf; occasional iron staining and bedrock fragments throughout; (CL); [Fill]
	13	S - 7	6/7/7/9	2.0	1.0			
	14							
	15							
		CA - 8	7/17	1.0	0.7			
5391.7								CA-8: Clayey Sand Mostly sand, fine grained; 30-40% fines, low to medium plasticity; dry to slightly moist; tan; (SC); [Fill]
5391.2	16							CA-8: Poorly Graded Sand with Silt Mostly sand, fine to medium grained, subangular to subrounded; 5-15% fines, nonplastic to low plasticity; dry to slightly moist; tan; weakly cemented; bedrock fragment; (SP-SM); [Fill]
5390.5	17							S-9, DM-10: Sandy Lean Clay Mostly fines, medium to high plasticity; 30-40% sand, fine to coarse grained, subangular to subrounded; very stiff to hard; slightly moist to moist; brown; PP = >4.5 tsf; occasional iron staining, bedrock fragments, and calcite throughout; strong reaction with HCl; (CL); [Fill]
	18	S - 9	3/3/8/9	2.0	1.2			
	19							
	20							

Continued on next sheet

Notes Lithology between recovered samples is interpreted; contacts are approximate. Boring backfilled with cement-bentonite grout topped off with bentonite chips.

LOG OF SOIL BORING

Project name: Thornton WTP
Project No: 16104
Boring Location: N 1195929.5, E 3147097.3 ft
Ground El: 5407.2 ft Total Depth: 60.5 ft
Groundwater El: Not Measured On Date: 06-24-2016

Start Date: 06-23-2016 End Date: 06-24-2016
Driller: Elite - Marshall Logged By: MSS
Bedrock Depth: 24.2 ft Checked By: ABP

Drilling Rig: CME 550 Buggy Rig
Equipment: 4-1/4 inch ID 8 inch OD HSA

Borehole ID: **B-102**

Elevation	Depth (ft)	Type - No	Blows per 6 inch	Penetration (ft)	Recovery (ft)	Remarks	Graphic Lithology	Description and Classification of Materials
	21	DM - 10	5/8/10/11	2.0	2.0	Sampler packed. Packaged in a resealable plastic bag.		
	22					Water poured into boring after sampling DM-10.		
5385.0								S-11: Fat Clay with Sand Mostly fines, medium to high plasticity; 15-25% sand, fine to medium grained, subangular to subrounded; very stiff to hard; moist; brown; (CH); [Fill]
5384.1	23	S - 11	5/12/16/22	2.0	1.5			S-11: Sandy Lean Clay Mostly fines, medium to high plasticity; 30-40% sand, fine grained; very stiff to hard; slightly moist to moist; brown and tan; iron staining throughout; occasional bedrock fragments; weak reaction with HCl; (CL); [Fill]
5383.0	24					Top of bedrock at 24.2 ft.		S-11, DM-12,S-13,S-14, DM-15: Claystone Blocky, laminated to very thinly bedded; mostly fines, medium to high plasticity; less than 5% sand; slightly to moderately weathered; slightly moist to moist; gray to green; trace iron staining, H7; [TKda]
	25	DM - 12	7/17	1.0	1.0			*25.0 to 26.8 ft: fresh to slightly weathered; PP = >4.5 tsf; occasional calcite veins throughout;*
	26							
	27							*26.8 to 31.8 ft: slightly to moderately weathered; occasional iron and manganese staining;*
	28	S - 13	12/22/29/41	2.0	2.0			
	29							
	30							

Continued on next sheet

Notes: Lithology between recovered samples is interpreted; contacts are approximate. Boring backfilled with cement-bentonite grout topped off with bentonite chips.

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LOG OF SOIL BORING

Project name: Thornton WTP
Project No: 16104
Boring Location: N 1195929.5, E 3147097.3 ft
Ground El: 5407.2 ft Total Depth: 60.5 ft
Groundwater El: Not Measured On Date: 06-24-2016

Start Date: 06-23-2016 End Date: 06-24-2016
Driller: Elite - Marshall Logged By: MSS
Bedrock Depth: 24.2 ft Checked By: ABP

Drilling Rig: CME 550 Buggy Rig
Equipment: 4-1/4 inch ID 8 inch OD HSA

Borehole ID: **B-102**

Elevation	Depth (ft)	Type - No	Blows per 6 inch	Penetration (ft)	Recovery (ft)	Remarks	Graphic Lithology	Description and Classification of Materials
	31	S - 14	12/22/30/36	2.0	2.0			*31.8 to 32.0 ft: fresh to slightly weathered; occasional iron and manganese staining;*
	32							
5374.2	33	DM - 15	21/50 for 5 inches	0.9	0.9			DM-15, S-16: Clayey Sandstone Mostly sand, fine to medium grained; 15-25% fines, low to medium plasticity; intensely weathered; slightly moist to moist; oxidized orange; H7; [TKda]
	34							
	35	S - 16	17/21/50	1.5	1.5			*35.0 to 36.0 ft: Sand is fine grained; Fines are nonplastic to low plasticity; moderately to intensely weathered; moist; brown; iron staining throughout;*
	36							*36.0 to 37.0 ft: 30-40% fines, low to medium plasticity; moderately to intensely weathered; moist; trace coal; H7;*
5370.2	37					Drill rod wet after advancing augers below about 37.5 ft.		S-17, S-18: Sandy Claystone Mostly fines, low to medium plasticity; 15-25% sand, fine grained; intensely to very intensely weathered; moist; gray; iron staining throughout, H7; [TKda]
	38	S - 17	7/12/20/30	2.0	2.0			
	39							
	40							

Continued on next sheet

Notes: Lithology between recovered samples is interpreted; contacts are approximate. Boring backfilled with cement-bentonite grout topped off with bentonite chips.

LOG OF SOIL BORING

Project name: Thornton WTP
Project No: 16104
Boring Location: N 1195929.5, E 3147097.3 ft
Ground El: 5407.2 ft Total Depth: 60.5 ft
Groundwater El: Not Measured On Date: 06-24-2016

Start Date: 06-23-2016 End Date: 06-24-2016
Driller: Elite - Marshall Logged By: MSS
Bedrock Depth: 24.2 ft Checked By: ABP

Drilling Rig: CME 550 Buggy Rig
Equipment: 4-1/4 inch ID 8 inch OD HSA

Borehole ID: **B-102**
Sheet 5 of 7

Elevation	Depth (ft)	Type - No	Blows per 6 inch	Penetration (ft)	Recovery (ft)	Remarks	Graphic Lithology	Description and Classification of Materials
	41	S - 18	11/19/30/40	2.0	2.0	Bu-19 collected from 40.0 to 44.0 ft.		*40.0 to 43.0 ft: Fines are medium to high plasticity; slightly to moderately weathered; iron and manganese staining on fractures and bedding planes;*
	42							
5364.2	43							CA-20, S-21, DM-22: Claystone Mostly fines, medium to high plasticity; less than 15% sand, fine grained; slightly to moderately weathered; moist; brown; iron staining on fractures, H7; [TKda]
	44	CA - 20	1400 psi for 5 inches/50 for 7 inches	1.0	1.0			
	45							
	46							
	47							
	48							
	49							*49.0 to 52.5 ft: fresh to slightly weathered; gray;*
	50							

Continued on next sheet

Notes Lithology between recovered samples is interpreted; contacts are approximate. Boring backfilled with cement-bentonite grout topped off with bentonite chips.

LOG OF SOIL BORING

Project name: Thornton WTP
Project No: 16104
Boring Location: N 1195929.5, E 3147097.3 ft
Ground El: 5407.2 ft Total Depth: 60.5 ft
Groundwater El: Not Measured On Date: 06-24-2016

Start Date: 06-23-2016 End Date: 06-24-2016
Driller: Elite - Marshall Logged By: MSS
Bedrock Depth: 24.2 ft Checked By: ABP

Drilling Rig: CME 550 Buggy Rig
Equipment: 4-1/4 inch ID 8 inch OD HSA

Borehole ID: **B-102**
Sheet 6 of 7

Elevation	Depth (ft)	Type - No	Blows per 6 inch	Penetration (ft)	Recovery (ft)	Remarks	Graphic Lithology	Description and Classification of Materials
	51	S - 21	16/17/24/40	2.0	2.0			
	52							*52.5 to 57.0 ft: moderately to intensely weathered;*
	53							
	54							
		DM - 22	16/26	1.0	1.0	Bu-23 collected from 54.0 to 59.0 ft.		
	55							
	56							
5350.2	57							S-24: Sandy Claystone Mostly fines, low to medium plasticity; 20-30% sand, fine grained; moderately to intensely weathered; moist to wet; gray; iron staining, H7; [TKda]
	58							
	59							
		S - 24	22/33/50	1.5	1.5			
	60							

Continued on next sheet

Notes Lithology between recovered samples is interpreted; contacts are approximate. Boring backfilled with cement-bentonite grout topped off with bentonite chips.

RJH CONSULTANTS INC

LOG OF SOIL BORING

Project name: Thornton WTP
Project No: 16104
Boring Location: N 1195929.5, E 3147097.3 ft
Ground El: 5407.2 ft Total Depth: 60.5 ft
Groundwater El: Not Measured On Date: 06-24-2016

Start Date: 06-23-2016 End Date: 06-24-2016
Driller: Elite - Marshall Logged By: MSS
Bedrock Depth: 24.2 ft Checked By: ABP

Drilling Rig: CME 550 Buggy Rig
Equipment: 4-1/4 inch ID 8 inch OD HSA

Borehole ID: **B-102**
Sheet 7 of 7

Elevation	Depth (ft)	Type - No	Blows per 6 inch	Penetration (ft)	Recovery (ft)	Remarks	Graphic Lithology	Description and Classification of Materials
5346.7						Bottom of Boring at 60.5 ft.		End of boring log at 60.50 ft
	61							
	62							
	63							
	64							
	65							
	66							
	67							
	68							
	69							
	70							

Notes Lithology between recovered samples is interpreted; contacts are approximate. Boring backfilled with cement-bentonite grout topped off with bentonite chips.

LOG OF SOIL BORING

Project name: Thornton WTP
Project No: 16104
Boring Location: N 1196072.1, E 3147457.3 ft
Ground El: 5414.1 ft Total Depth: 69.5 ft
Groundwater El: Not Measured On Date: 06-21-2016

Start Date: 06-20-2016 End Date: 06-21-2016
Driller: Elite - Marshall Logged By: MSS
Bedrock Depth: 24.2 ft Checked By: ABP

Drilling Rig: CME 550 Buggy Rig
Equipment: 4-1/4 inch ID 8 inch OD HSA

Borehole ID: **B-103**
Sheet 1 of 7

Elevation	Depth (ft)	Type - No	Blows per 6 inch	Penetration (ft)	Recovery (ft)	Remarks	Graphic Lithology	Description and Classification of Materials
	1	S - 1	8/6/8/11	2.0	2.0	Bu-2 collected from 0.0 to 10.0 ft.		S-1: Lean Clay with Sand Blocky; mostly fines, low to medium plasticity; 15-25% sand, fine to medium grained; medium stiff to stiff; dry to slightly moist; brown; trace calcite, roots, and organics; strong reaction with HCl; (CL); [Fill]
	2							
5411.8								S-3: Clayey Sand Mostly sand, fine to medium grained; 30-40% fines, nonplastic to low plasticity; medium dense; moist; tan; iron staining throughout; trace calcite; weak reaction with HCl; (SC); [Fill]
5411.1	3	S - 3	6/7/9/11	2.0	2.0			S-3: Lean Clay with Sand Blocky; mostly fines, low to medium plasticity; 15-25% sand, fine to medium grained; medium stiff to stiff; dry to slightly moist; brown; trace iron staining and calcite; strong reaction with HCl; (CL); [Fill]
	4							*4.1 to 4.5 ft: brown and tan;*
5409.4	5					Moisture content of cuttings increased below 5.0 ft.		S-4, S-5, S-6: Fat Clay Blocky; mostly fines, medium to high plasticity; 5-15% sand, fine to medium grained; less than 10% gravel, fine grained, subangular to subrounded; maximum particle size = 0.5 inches; stiff to very stiff; moist; brown and tan; trace calcite; strong reaction with HCl; (CH); [Fill]
	6	S - 4	4/7/10/12	2.0	1.5			*6.7 to 7.0 ft: less than 5% sand; dark brown;*
	7							
	8	S - 5	5/7/9/15	2.0	1.6			*7.5 to 9.5 ft: occasional weathered bedrock fragments, trace iron staining;*
	9							
	10							

Continued on next sheet

Notes Lithology between recovered samples is interpreted; contacts are approximate. Boring backfilled with cement-bentonite grout.

RJH CONSULTANTS INC

LOG OF SOIL BORING

Project name: Thornton WTP
Project No: 16104
Boring Location: N 1196072.1, E 3147457.3 ft
Ground El: 5414.1 ft Total Depth: 69.5 ft
Groundwater El: Not Measured On Date: 06-21-2016

Start Date: 06-20-2016 End Date: 06-21-2016
Driller: Elite - Marshall Logged By: MSS
Bedrock Depth: 24.2 ft Checked By: ABP

Drilling Rig: CME 550 Buggy Rig
Equipment: 4-1/4 inch ID 8 inch OD HSA

Borehole ID: **B-103**
Sheet 2 of 7

Elevation	Depth (ft)	Type - No	Blows per 6 inch	Penetration (ft)	Recovery (ft)	Remarks	Graphic Lithology	Description and Classification of Materials
	11	S - 6	3/6/8/11	2.0	2.0			*10.0 to 12.0 ft: less than 5% gravel, fine grained, subangular to subrounded; maximum particle size = 0.375 inches;*
5401.8	12							DM-7, S-8, S-9: Lean Clay with Sand Blocky; mostly fines, medium to high plasticity; 15-25% sand, fine to medium grained; stiff to very stiff; moist; dark brown and tan; trace calcite, occasional sandstone fragments; strong reaction with HCl; (CL); [Fill]
	13	DM - 7	1000 psi	1.1	1.1	Increased drilling resistance at 12.5 ft.		
	14							
	15							
	16	S - 8	3/7/10/12	2.0	2.0			
	17							*17.5 to 19.5 ft: Sand is fine to coarse grained; very stiff to hard; brown and tan; occasional bedrock fragments and organics;*
	18	S - 9	6/10/14/15	2.0	1.5			
	19							
5394.6	20					Adjusted Colluvium/Residuum Contact based on data provided by ERO.		S-10: Sandy Lean Clay Mostly fines, medium to high plasticity; 30-40% sand, fine to medium grained; stiff to very stiff; slightly moist to moist; tan

Continued on next sheet

Notes Lithology between recovered samples is interpreted; contacts are approximate. Boring backfilled with cement-bentonite grout.

RJH CONSULTANTS, INC.

LOG OF SOIL BORING

Project name: Thornton WTP
Project No: 16104
Boring Location: N 1196072.1, E 3147457.3 ft
Ground El: 5414.1 ft Total Depth: 69.5 ft
Groundwater El: Not Measured On Date: 06-21-2016

Start Date: 06-20-2016 End Date: 06-21-2016
Driller: Elite - Marshall Logged By: MSS
Bedrock Depth: 24.2 ft Checked By: ABP

Drilling Rig: CME 550 Buggy Rig
Equipment: 4-1/4 inch ID 8 inch OD HSA

Borehole ID: **B-103**

Elevation	Depth (ft)	Type - No	Blows per 6 inch	Penetration (ft)	Recovery (ft)	Remarks	Graphic Lithology	Description and Classification of Materials
	21							to dark brown; (CL); [Qcr]
	22							
	23							
	24							
5389.9						Top of bedrock at 24.2 ft.		S-10: Claystone Laminated to very thinly bedded; mostly fines, low to medium plasticity; less than 5% sand, fine grained; slightly to moderately weathered; dry to slightly moist; gray; iron staining and trace calcite on fracture surfaces, H7; strong reaction with HCl; [TKda]
	25	S - 10	6/15/19/30	2.0	2.0	Increased drilling resistance at 25.0 ft.		
5388.6								S-10: Sandstone Laminated to very thinly bedded; mostly sand, fine grained; less than 10% fines, nonplastic; very intensely weathered to decomposed; dry to moist; tan; iron staining throughout, H7; [TKda]
	26							
5387.8								DM-11, S-12, S-13, S-14, S-15: Claystone Laminated to very thinly bedded; mostly fines, medium to high plasticity; less than 5% sand, fine grained; slightly to moderately weathered; dry to slightly moist; gray; iron staining and trace calcite on fracture surfaces, H7; strong reaction with HCl; [TKda]
	27	DM - 11	10/38	1.0	0.6			
	28							
	29					Drill rod wet after advancing augers below about 29.0 ft.		*29.0 to 31.0 ft: Blocky; 5-15% sand, fine to medium grained; fresh to slightly weathered; slightly moist to moist; dark brown; H6 to H7;*
	30	S - 12	10/20/50	1.5	1.5			

Continued on next sheet

Notes Lithology between recovered samples is interpreted; contacts are approximate. Boring backfilled with cement-bentonite grout.

LOG OF SOIL BORING

Project name: Thornton WTP
Project No: 16104
Boring Location: N 1196072.1, E 3147457.3 ft
Ground El: 5414.1 ft Total Depth: 69.5 ft
Groundwater El: Not Measured On Date: 06-21-2016

Start Date: 06-20-2016 End Date: 06-21-2016
Driller: Elite - Marshall Logged By: MSS
Bedrock Depth: 24.2 ft Checked By: ABP

Drilling Rig: CME 550 Buggy Rig
Equipment: 4-1/4 inch ID 8 inch OD HSA

Borehole ID: **B-103**
Sheet 4 of 7

Elevation	Depth (ft)	Type - No	Blows per 6 inch	Penetration (ft)	Recovery (ft)	Remarks	Graphic Lithology	Description and Classification of Materials
	31							*31.0 to 42.5 ft: Blocky; 5-15% sand, fine to medium grained; moderately to intensely weathered; slightly moist to moist; dark brown; iron staining; trace calcite, H6 to H7; weak reaction with HCl;*
	32	S - 13	15/25/38/50 for 5 inches	1.9	1.9			
	33							
	34							
	35	S - 14	6/15/22/29	2.0	2.0			
	36							
	37							
	38							
	39					Water poured into boring after collecting samples from 39 to 60 ft.		
	40							

Continued on next sheet

Notes Lithology between recovered samples is interpreted; contacts are approximate. Boring backfilled with cement-bentonite grout.

RJH CONSULTANTS INC

LOG OF SOIL BORING

Project name: Thornton WTP
Project No: 16104
Boring Location: N 1196072.1, E 3147457.3 ft
Ground El: 5414.1 ft Total Depth: 69.5 ft
Groundwater El: Not Measured On Date: 06-21-2016

Start Date: 06-20-2016 End Date: 06-21-2016
Driller: Elite - Marshall Logged By: MSS
Bedrock Depth: 24.2 ft Checked By: ABP

Drilling Rig: CME 550 Buggy Rig
Equipment: 4-1/4 inch ID 8 inch OD HSA

Borehole ID: **B-103**
Sheet 5 of 7

Elevation	Depth (ft)	Type - No	Blows per 6 inch	Penetration (ft)	Recovery (ft)	Remarks	Graphic Lithology	Description and Classification of Materials
	41	S - 15	6/17/23/30	2.0	2.0			
	42							
5371.6	43							S-16: Sandy Claystone Blocky, laminated to very thinly bedded; mostly fines, low plasticity; 15-25% sand, fine to medium grained; moderately to intensely weathered; slightly moist to moist; dark brown; iron staining; trace calcite, H6 to H7; weak reaction with HCl; [TKda]
	44	S - 16	23/37/50 for 2 inches	1.2	1.2			
	45							
	46							
5367.0	47							S-17: Sandstone Mostly sand, fine to medium grained, subangular to subrounded; less than 10% fines, nonplastic; decomposed; moist; brown; H7; [TKda]
	48							
	49	S - 17	50 for 4 inches	0.3	0.3			
	50							

Continued on next sheet

Notes Lithology between recovered samples is interpreted; contacts are approximate. Boring backfilled with cement-bentonite grout.

RJH CONSULTANTS, INC.

LOG OF SOIL BORING

Project name: Thornton WTP
Project No: 16104
Boring Location: N 1196072.1, E 3147457.3 ft
Ground El: 5414.1 ft Total Depth: 69.5 ft
Groundwater El: Not Measured On Date: 06-21-2016

Start Date: 06-20-2016 End Date: 06-21-2016
Driller: Elite - Marshall Logged By: MSS
Bedrock Depth: 24.2 ft Checked By: ABP

Drilling Rig: CME 550 Buggy Rig
Equipment: 4-1/4 inch ID 8 inch OD HSA

Borehole ID: **B-103**
Sheet 6 of 7

Elevation	Depth (ft)	Type - No	Blows per 6 inch	Penetration (ft)	Recovery (ft)	Remarks	Graphic Lithology	Description and Classification of Materials
5362.4	51							DM-18, S-19, S-20, S-21: Claystone Blocky, laminated to very thinly bedded; mostly fines, medium to high plasticity; less than 5% sand, fine to medium grained; fresh to slightly weathered; dry to slightly moist; gray; H6 to H7, friable; [TKda]
	52							
	53							
	54	DM - 18	50 for 5 inches	0.4	0.4			
	55							
	56							
	57							
	58							
	59	S - 19	33/50 for 4 inches	0.8	0.8			
	60							

Continued on next sheet

Notes Lithology between recovered samples is interpreted; contacts are approximate. Boring backfilled with cement-bentonite grout.

LOG OF SOIL BORING

Project name: Thornton WTP
Project No: 16104
Boring Location: N 1196072.1, E 3147457.3 ft
Ground El: 5414.1 ft Total Depth: 69.5 ft
Groundwater El: Not Measured On Date: 06-21-2016

Start Date: 06-20-2016 End Date: 06-21-2016
Driller: Elite - Marshall Logged By: MSS
Bedrock Depth: 24.2 ft Checked By: ABP

Drilling Rig: CME 550 Buggy Rig
Equipment: 4-1/4 inch ID 8 inch OD HSA

Borehole ID: **B-103**
Sheet 7 of 7

Elevation	Depth (ft)	Type - No	Blows per 6 inch	Penetration (ft)	Recovery (ft)	Remarks	Graphic Lithology	Description and Classification of Materials
	61							
	62							
	63							
	64	S - 20	34/50 for 5 inches	0.9	0.9			
	65					Water level was 65.6 ft deep on 6/21/2016 after advancing boring to 69.5 ft.		
	66							
	67							
	68							
	69	S - 21	50 for 6 inches	0.5	0.5			
5344.6	70					Bottom of Boring at 69.5 ft.		End of boring log at 69.50 ft

Notes Lithology between recovered samples is interpreted; contacts are approximate. Boring backfilled with cement-bentonite grout.

RJH CONSULTANTS INC

LOG OF SOIL BORING

Project name: Thornton WTP
Project No: 16104
Boring Location: N 1195902.1, E 3147471.1 ft
Ground El: 5405.6 ft Total Depth: 56.5 ft
Groundwater El: 5368.0 ft On Date: 07-01-2016

Start Date: 06-28-2016 End Date: 06-29-2016
Driller: Elite - Marshall Logged By: MSS
Bedrock Depth: 25.8 ft Checked By: ABP

Drilling Rig: CME 550 Buggy Rig
Equipment: 4-1/4 inch ID 8 inch OD HSA

Borehole ID: **B-104(P)**
Sheet 1 of 6

Elevation	Depth (ft)	Type - No	Blows per 6 inch	Penetration (ft)	Recovery (ft)	Remarks	Graphic Lithology	Description and Classification of Materials
	1	S - 1	4/5/9/8	2.0	1.5			S-1, S-2: Lean Clay with Sand Blocky; mostly fines, low to medium plasticity; 15-25% sand, fine grained; medium stiff to stiff; dry to slightly moist; brown; occasional calcite, bedrock fragments, and organics; strong reaction with HCl; (CL); [Fill]
	2							
	3							
	4							
	5					Moisture content of cuttings increased below 5.0 ft.		*5.0 to 7.0 ft: Fines are medium to high plasticity; Sand is fine to medium grained; less than 5% gravel, fine grained, subangular to rounded; maximum particle size = 0.5 inches; slightly moist to moist;*
	6	S - 2	4/6/9/12	2.0	1.6			
	7							
	8							
5397.1								DM-4: Clayey Sand Laminated; mostly sand, fine grained; 30-40% fines, low to medium plasticity; dry to slightly moist; brown-tan; (SC); [Fill]
	9							
	10							

Continued on next sheet

Notes Lithology between recovered samples is interpreted; contacts are approximate. Boring completed as a monitoring well.

LOG OF SOIL BORING

Project name: Thornton WTP
Project No: 16104
Boring Location: N 1195902.1, E 3147471.1 ft
Ground El: 5405.6 ft Total Depth: 56.5 ft
Groundwater El: 5368.0 ft On Date: 07-01-2016

Start Date: 06-28-2016 End Date: 06-29-2016
Driller: Elite - Marshall Logged By: MSS
Bedrock Depth: 25.8 ft Checked By: ABP

Drilling Rig: CME 550 Buggy Rig
Equipment: 4-1/4 inch ID 8 inch OD HSA

Borehole ID: **B-104(P)**
Sheet 2 of 6

Elevation	Depth (ft)	Type - No	Blows per 6 inch	Penetration (ft)	Recovery (ft)	Remarks	Graphic Lithology	Description and Classification of Materials
	11	DM - 4	900 psi	1.0	1.0	Bu-3 collected from 10.0 to 20.0 ft.		
	12							
5392.6	13							S-5: Sandy Lean Clay Mostly fines, medium to high plasticity; 30-40% sand, fine to medium grained; medium stiff to stiff; dry to slightly moist; brown-tan; occasional bedrock fragments; weak reaction with HCl; (CL); [Fill]
	14							
	15							
	16	S - 5	6/10/12/14	2.0	1.8			
	17							
	18							
5387.1	19							DM-6: Poorly Graded sand with Clay Mostly sand, fine to medium grained; 5-15% fines, low to medium plasticity; slightly moist to moist; tan; (SP-SC); [Fill]
	20							

Continued on next sheet

Notes Lithology between recovered samples is interpreted; contacts are approximate. Boring completed as a monitoring well.

RJH Consultants, Inc.

LOG OF SOIL BORING

Project name: Thornton WTP
Project No: 16104
Boring Location: N 1195902.1, E 3147471.1 ft
Ground El: 5405.6 ft Total Depth: 56.5 ft
Groundwater El: 5368.0 ft On Date: 07-01-2016

Start Date: 06-28-2016 End Date: 06-29-2016
Driller: Elite - Marshall Logged By: MSS
Bedrock Depth: 25.8 ft Checked By: ABP

Drilling Rig: CME 550 Buggy Rig
Equipment: 4-1/4 inch ID 8 inch OD HSA

Borehole ID: **B-104(P)**

Elevation	Depth (ft)	Type - No	Blows per 6 inch	Penetration (ft)	Recovery (ft)	Remarks	Graphic Lithology	Description and Classification of Materials
		DM - 6	8/15	1.0	1.0			
	21							
5383.8								S-7: Lean Clay Blocky, laminated to very thinly bedded; mostly fines, medium to high plasticity; 5-15% sand, fine grained; medium stiff to stiff; moist; light brown to gray; sample driven through bedrock fragment; (CL); [Fill]
	22							
						Lower drilling resistance at 22.5 ft.		
	23	S - 7	4/6/6/7	2.0	1.5			
5381.7	24							S-7: Lean Clay with Sand Blocky, laminated to very thinly bedded; mostly fines, medium to high plasticity; 15-25% sand, fine grained; medium stiff to stiff; moist; dark brown; sample driven through bedrock fragment; (CL); [Fill]
5381.3 5381.2								S-7: Poorly Graded Sand with Clay Mostly sand, fine to medium grained; 5-15% fines, medium to high plasticity; moist; tan; sample driven through bedrock fragment; (SP-SC); [Fill]
	25	DM - 8	6/10	1.0	1.0			S-7, DM-8: Lean Clay Blocky, laminated to very thinly bedded; mostly fines, medium to high plasticity; 5-15% sand, fine grained; stiff to very stiff; moist; light brown to gray; sample driven through bedrock fragment; (CL); [Fill]
5379.9 5379.8						Top of bedrock at 25.8 ft.		
	26							DM-8: Poorly Graded Sand Mostly sand, fine to coarse grained, subangular to subrounded; moist; tan; sample driven through bedrock fragment; (SP); [Fill]
	27							DM-8, S-9, DM-10: Claystone Blocky, laminated to very thinly bedded; mostly fines, medium to high plasticity; less than 10% sand, fine grained; fresh to slightly weathered; moist; light brown to gray; H7; [TKda]
								27.5 to 29.5 ft: gray; occasional calcite and iron staining throughout;
	28	S - 9	9/14/24/29	2.0	2.0			
	29							
	30							

Continued on next sheet

Notes Lithology between recovered samples is interpreted; contacts are approximate. Boring completed as a monitoring well.

RJH CONSULTANTS, INC.

LOG OF SOIL BORING

Project name: Thornton WTP
Project No: 16104
Boring Location: N 1195902.1, E 3147471.1 ft
Ground El: 5405.6 ft Total Depth: 56.5 ft
Groundwater El: 5368.0 ft On Date: 07-01-2016

Start Date: 06-28-2016 End Date: 06-29-2016
Driller: Elite - Marshall Logged By: MSS
Bedrock Depth: 25.8 ft Checked By: ABP

Drilling Rig: CME 550 Buggy Rig
Equipment: 4-1/4 inch ID 8 inch OD HSA

Borehole ID: **B-104(P)**

Elevation	Depth (ft)	Type - No	Blows per 6 inch	Penetration (ft)	Recovery (ft)	Remarks	Graphic Lithology	Description and Classification of Materials
		DM - 10	21/47	1.0	1.0			*30.0 to 31.8 ft: slightly to moderately weathered; gray; occasional calcite and iron staining throughout;*
	31							
5373.8	32							S-11, S-12: Sandy Claystone Blocky, laminated to very thinly bedded; mostly fines, medium to high plasticity; 20-30% sand, fine grained; moderately to intensely weathered; moist; light brown to gray; iron staining throughout, H7; [TKda]
	33	S - 11	16/30/42	1.5	1.5			*33.5 to 36.3 ft: slightly to moderately weathered; occasional iron staining;*
	34							
	35							
	36	S - 12	12/25/37/50	2.0	2.0			
5369.3								S-12: Silty Sandstone Very thinly bedded; mostly sand, fine to medium grained; 20-30% fines, nonplastic to low plasticity; moderately weathered; slightly moist; tan; iron staining throughout, H7; [TKda]
5368.7	37							S-12: Sandy Claystone Blocky, laminated to very thinly bedded; mostly fines, medium to high plasticity; 20-30% sand, fine grained; slightly to moderately weathered; moist; light brown to gray; occasional iron staining throughout, H7; [TKda]
5368.4								
	38	S - 13	20/34/50 for 5 inches	1.4	1.4	Ground water level was 37.6 ft deep on 7/1/2016. Measurement was obtained from monitoring well.		S-13: Clayey Sandstone Mostly sand, fine grained; 20-30% fines, low to medium plasticity; intensely to very intensely weathered; slightly moist to moist; gray and light brown; iron staining throughout, H7; [TKda]
	39							
5366.2								S-14: Claystone Mostly fines, medium to high plasticity; 5-15% sand; fresh to slightly weathered; slightly moist to moist; gray; H7; [TKda]
	40							Continued on next sheet

Notes Lithology between recovered samples is interpreted; contacts are approximate. Boring completed as a monitoring well.

LOG OF SOIL BORING

Project name: Thornton WTP
Project No: 16104
Boring Location: N 1195902.1, E 3147471.1 ft
Ground El: 5405.6 ft Total Depth: 56.5 ft
Groundwater El: 5368.0 ft On Date: 07-01-2016

Start Date: 06-28-2016 End Date: 06-29-2016
Driller: Elite - Marshall Logged By: MSS
Bedrock Depth: 25.8 ft Checked By: ABP

Drilling Rig: CME 550 Buggy Rig
Equipment: 4-1/4 inch ID 8 inch OD HSA

Borehole ID: **B-104(P)**
Sheet 5 of 6

Elevation	Depth (ft)	Type - No	Blows per 6 inch	Penetration (ft)	Recovery (ft)	Remarks	Graphic Lithology	Description and Classification of Materials
	41	S - 14	10/22/33/38	2.0	2.0			
5364.1	42							S-14: Clayey Sandstone Mostly sand, fine grained; 20-30% fines, medium to high plasticity; moderately to intensely weathered; slightly moist to moist; gray to brown; iron staining throughout, H7; [TKda]
	43							
5362.1	44					Water level was 43.5 ft deep on 6/29/2016 after advancing boring to 56.5 ft.		S-15, DM-16, S-17: Claystone Mostly fines, medium to high plasticity; 5-15% sand; slightly weathered; moist; gray; H7; [TKda]
	45							
	46	S - 15	7/15/21/35	2.0	2.0			
	47							
	48							
	49							
	50							

Continued on next sheet

Notes Lithology between recovered samples is interpreted; contacts are approximate. Boring completed as a monitoring well.

RJH CONSULTANTS, INC.

LOG OF SOIL BORING

Project name: Thornton WTP
Project No: 16104
Boring Location: N 1195902.1, E 3147471.1 ft
Ground El: 5405.6 ft Total Depth: 56.5 ft
Groundwater El: 5368.0 ft On Date: 07-01-2016

Start Date: 06-28-2016 End Date: 06-29-2016
Driller: Elite - Marshall Logged By: MSS
Bedrock Depth: 25.8 ft Checked By: ABP

Drilling Rig: CME 550 Buggy Rig
Equipment: 4-1/4 inch ID 8 inch OD HSA

Borehole ID: **B-104(P)**
Sheet 6 of 6

Elevation	Depth (ft)	Type - No	Blows per 6 inch	Penetration (ft)	Recovery (ft)	Remarks	Graphic Lithology	Description and Classification of Materials
	50	DM - 16	34/50 for 4 inches	0.8	0.8			*50.0 to 50.8 ft: iron staining throughout;*
	51							
	52							
	53							
	54							
	55							*55.0 to 55.6 ft: Fines are high plasticity; moderately to intensely weathered;*
	56	S - 17	25/35/60	1.5	1.5			*55.6 to 56.5 ft: Fines are high plasticity; fresh to slightly weathered;*
5349.1						Bottom of Boring at 56.5 ft.		End of boring log at 56.50 ft
	57							
	58							
	59							
	60							

Notes Lithology between recovered samples is interpreted; contacts are approximate. Boring completed as a monitoring well.

RJH CONSULTANTS, INC.

LOG OF SOIL BORING

Project name: Thornton WTP
Project No: 16104
Boring Location: N 1195596.4, E 3147474.1 ft
Ground El: 5361.1 ft Total Depth: 12.0 ft
Groundwater El: Not Measured On Date: 06-29-2016

Start Date: 06-29-2016 End Date: 06-29-2016
Driller: Elite - Marshall Logged By: MSS
Bedrock Depth: Not encountered Checked By: ABP

Drilling Rig: CME 550 Buggy Rig
Equipment: 4-1/4 inch ID 8 inch OD HSA

Borehole ID: **B-105**
Sheet 1 of 2

Elevation	Depth (ft)	Type - No	Blows per 6 inch	Penetration (ft)	Recovery (ft)	Remarks	Graphic Lithology	Description and Classification of Materials
5361.0	0					Clay clod lodged in shoe.		S-1: Clayey Sand Mostly sand, fine to medium grained; 15-25% fines, low to medium plasticity; loose; dry; tan; occasional organics throughout; (SC); [Fill]
	1	S - 1	4/4/6/7	2.0	0.2			S-1: Lean Clay Mostly fines, medium to high plasticity; 5-15% sand, fine to medium grained, subangular to subrounded; very stiff to hard; slightly moist; dark brown; (CL); [Fill]
	2							
5358.8								S-2, S-3: Sandy Lean Clay Mostly fines, medium to high plasticity; 40-50% sand, fine to medium grained, subangular to subrounded; very stiff to hard; slightly moist to moist; brown; occasional bedrock fragments; strong reaction with HCl; (CL); [Fill]
	3	S - 2	5/6/6/6	2.0	1.1			
	4							
	5					Moisture content of cuttings increased below 5.0 ft.		*5.0 to 7.0 ft: Fines are low to medium plasticity; 30-40% sand; stiff to very stiff; dark brown; occasional calcite throughout; weak to strong reaction with HCl;*
	6	S - 3	8/6/9/9	2.0	0.7	Increased drilling resistance at 6.0 ft.		
	7					Asphalt debris at 6.9 ft.		
5353.8								DM-4: Lean Clay Mostly fines, medium to high plasticity; 5-15% sand, fine grained; very stiff to hard; moist; dark brown; weak to strong reaction with HCl; (CL); [Fill]
	8	DM - 4	8/15	1.0	0.8			
5352.6	9					Gravel in cuttings below 8.5 ft. Bu-5 collected from 8.5 to 10.0 ft.		S-6: Clayey Gravel with Sand Mostly gravel, fine to coarse grained, subangular to rounded; 20-30% fines, low to medium plasticity; 20-30% sand, fine to medium grained; maximum particle size = 1 inch; dense; moist; brown; (GC); [Fill]
	10							Continued on next sheet

Notes Lithology between recovered samples is interpreted; contacts are approximate. Boring backfilled with bentonite chips.

RJH CONSULTANTS INC

LOG OF SOIL BORING

Project name: Thornton WTP
Project No: 16104
Boring Location: N 1195596.4, E 3147474.1 ft
Ground El: 5361.1 ft Total Depth: 12.0 ft
Groundwater El: Not Measured On Date: 06-29-2016

Start Date: 06-29-2016 End Date: 06-29-2016
Driller: Elite - Marshall Logged By: MSS
Bedrock Depth: Not encountered Checked By: ABP

Drilling Rig: CME 550 Buggy Rig
Equipment: 4-1/4 inch ID 8 inch OD HSA

Borehole ID: **B-105**
Sheet 2 of 2

Elevation	Depth (ft)	Type - No	Blows per 6 inch	Penetration (ft)	Recovery (ft)	Remarks	Graphic Lithology	Description and Classification of Materials
5350.1	11	S - 6	14/16/23/31	2.0	2.0	Practical auger refusal at 11 ft. Auger teeth worn away by subsurface obstruction. The drill rig lifted vertically while attempting to advance the augers. Moved drill location 10 feet (west) and continued boring as B-105A. Bottom of Boring at 12.0 ft.		S-6: Lean Clay Blocky; mostly fines, medium to high plasticity; less than 5% sand, fine grained; stiff to very stiff; moist; calcite throughout; [Fill]
5349.1	12							End of boring log at 12.00 ft
	13							
	14							
	15							
	16							
	17							
	18							
	19							
	20							

Notes Lithology between recovered samples is interpreted; contacts are approximate. Boring backfilled with bentonite chips.

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LOG OF SOIL BORING

Project name: Thornton WTP
Project No: 16104
Boring Location: N 1195591.3, E 3147465.3 ft
Ground El: 5360.8 ft Total Depth: 49.1 ft
Groundwater El: Not Measured On Date: 06-30-2016

Start Date: 06-29-2016 End Date: 06-30-2016
Driller: Elite - Marshall Logged By: MSS
Bedrock Depth: 13.5 ft Checked By: ABP

Drilling Rig: CME 550 Buggy Rig
Equipment: 4-1/4 inch ID 8 inch OD HSA

Borehole ID: **B-105A**
Sheet 1 of 5

Elevation	Depth (ft)	Type - No	Blows per 6 inch	Penetration (ft)	Recovery (ft)	Remarks	Graphic Lithology	Description and Classification of Materials
	13	S - 1	5/12/33/50 for 4 inches	1.8	1.6	Augered to 12.5 ft prior to sampling. Refer to B-105 for log of this interval. Sample DM-2 driven through S-1 sample interval.		S-1: Lean Clay with Sand Mostly fines, medium to high plasticity; 15-25% sand, fine grained; 10-20% gravel, fine to coarse grained, angular to subangular; maximum particle size = 1 inch; medium stiff; moist; brown; strong reaction with HCl; (CL); [Fill]
5347.3						Top of bedrock at 13.5 ft.		S-1, DM-2: Sandstone Mostly sand, fine to medium grained; 5-15% fines, nonplastic to low plasticity; intensely to very intensely weathered; moist; tan; H7; weak reaction with HCl; [TKda]
	14					Top of DM-2.		
		DM - 2	25/50 for 4 inches	0.8	0.8	Bottom of S-1.		
	15							
	16							
5344.6								S-3: Claystone Mostly fines, medium to high plasticity; less than 5% sand, fine grained; slightly to moderately weathered; moist; light brown; occasional iron and manganese staining, H7; [TKda]
	17							
	18	S - 3	5/10/15/19	2.0	2.0	Sample DM-4 driven through S-3 sample interval.		
	19					Top of DM-4.		
5341.3						Bottom of S-3.		DM-4: Clayey Sandstone Mostly sand, fine grained; 20-30% fines, low to medium plasticity; moderately to intensely weathered; moist; brown; iron staining throughout, H7; [TKda]
		DM - 4	30/47/50 for 5 inches	1.4	1.4			
5340.7	20							DM-4: Claystone Mostly fines, medium to high plasticity; 5-15% sand, fine grained; slightly to moderately weathered; moist; gray; iron staining throughout, H7; [TKda]
5340.4						Ground water not encountered prior to coring. Switched to NQ3 wireline coring after sampling DM-4.		End of boring log at 20.40 ft
	21							
	22							

Notes: Lithology between recovered samples is interpreted; contacts are approximate. Refer to boring B-105A for a log of 0.0 to 12.5 feet. Boring backfilled with cement-bentonite grout topped off with bentonite chips.

RJH CONSULTANTS INC

LOG OF ROCK CORE

Project name: Thornton WTP
Project No: 16104
Boring Location: N 1195591.3, E 3147465.3 ft
Ground El: 5360.8 ft Total Depth: 49.1 ft
Groundwater El: Not Measured On Date: 06-30-2016

Start Date: 06-29-2016 End Date: 06-30-2016
Driller: Elite - Marshall Logged By: MSS
Bedrock Depth: 13.5 ft Checked By: ABP
Plunge: 90.0 Bearing: Not Applicable

Drilling Rig: CME 550 Buggy Rig
Equipment: NQ3-Sized core steel, 1.75 inch ID 2.98 inch OD

Borehole ID: **B-105A**

Elevation	Depth (ft)	Notes: Groundwater, Drilling, Conditions, Circulation etc	Interval (ft)	Penetration (ft)	Recovery ft, (%)	RQD, ft (%)	Coring Time (min)	No. of Pieces	Longest (ft)	Shortest (ft)	Hardness	In Situ Testing	Joint Description	Joint Symbol	Lithology	Description and Classification of Materials
	20	RQD may not be applicable. Cored through S-3 and DM-4 sample intervals. Near 100-percent drilling-water circulation.											Core Loss			20.4 to 21.5 ft: Claystone Mostly fines, medium to high plasticity; 5-15% sand; slightly to moderately weathered; unfractured; moist; light brown; [TKda]
	21												Mechanical Break			
5339.3			19.0 to 24.1	5.1	3.0 (59)	3.0 (59)	3	5	1.5	0.1	H7					21.5 to 23.5 ft: Silty Sandstone Mostly sand, fine to medium grained, subangular to subrounded; 15-25% fines, nonplastic to low plasticity; moderately to intensely weathered; unfractured; moist; tan; iron staining throughout; [TKda]
	22	Lower coring resistance from 22.5 to 24.1 ft.														
	23															
5337.3																23.5 to 24.1 ft: Sandstone Mostly sand, fine to medium grained, subangular to subrounded; 5-15% fines, nonplastic to low plasticity; moderately to intensely weathered; unfractured; moist; tan; iron staining throughout; [TKda]
5336.7	24															
													Core Loss			24.1 to 24.3 ft: Claystone Mostly fines, medium to high plasticity; 5-15% sand; slightly to moderately weathered; unfractured; moist; gray; iron staining throughout; [TKda]
5336.5																24.3 to 25.3 ft: Silty Sandstone Mostly sand, fine to medium grained, subangular to subrounded; 15-25% fines, nonplastic to low plasticity; moderately to intensely weathered; unfractured; moist; tan; iron staining throughout; [TKda]
	25															
5335.5													Mechanical Break			25.3 to 46.4 ft: Claystone Mostly fines, medium to high plasticity; 5-15% sand; slightly to moderately weathered; unfractured; moist; gray; iron staining throughout; [TKda]
	26															
		Drilling resistance in B-105A was generally lower than in other borings.	24.1 to 29.1	5.0	4.8 (96)	4.8 (96)	10	4	3.6	0.1	H7					
	27															
	28															
	29															

Continued on next sheet

Notes Lithology between recovered samples is interpreted; contacts are approximate. Refer to boring B-105A for a log of 0.0 to 12.5 feet. Boring backfilled with cement-bentonite grout topped off with bentonite chips.

RJH CONSULTANTS INC

LOG OF ROCK CORE

Project name: Thornton WTP
Project No: 16104
Boring Location: N 1195591.3, E 3147465.3 ft
Ground El: 5360.8 ft Total Depth: 49.1 ft
Groundwater El: Not Measured On Date: 06-30-2016

Start Date: 06-29-2016 End Date: 06-30-2016
Driller: Elite - Marshall Logged By: MSS
Bedrock Depth: 13.5 ft Checked By: ABP
Plunge: 90.0 Bearing: Not Applicable
Drilling Rig: CME 550 Buggy Rig
Equipment: NQ3-Sized core steel, 1.75 inch ID 2.98 inch OD

Borehole ID: **B-105A**

Elevation	Depth (ft)	Notes: Groundwater, Drilling, Conditions, Circulation etc	Interval (ft)	Penetration (ft)	Recovery ft, (%)	RQD, ft (%)	Coring Time (min)	No. of Pieces	Longest (ft)	Shortest (ft)	Hardness	In Situ Testing	Joint Description	Joint Symbol	Lithology	Description and Classification of Materials
	30	RQD may not be applicable.											70 degrees Tight to slightly open, slightly rough to smooth, clean to very thin iron infilling			*29.1 to 34.1 ft: slightly fractured;*
	31												50 degrees Tight to slightly open, slightly rough to smooth, clean to very thin iron infilling			
	32		29.1 to 34.1	5.0	5.0 (100)	4.3 (86)	16	8	1.6	<0.1	H7		60 degrees			
	33												50 to 70 degrees, Slightly to moderately open, slightly rough to smooth, clean to very thin iron infilling			
	34															*34.1 to 35.0 ft: unfractured to slightly fractured; light gray; occasional iron and manganese staining;*
	35															*35.0 to 39.1 ft: fresh to slightly weathered; slightly to moderately fractured; dark gray; occasional iron and manganese staining;*
	36												70 degrees, Slightly to moderately open, smooth to polished, clean			
	37		34.1 to 39.1	5.0	5.0 (100)	4.8 (96)	9	7	1.9	0.1	H7		Slightly to moderately open, stepped to rough, clean			
	38												20 to 30 degrees Coal bedding plane Slightly to moderately open, smooth to polished, clean			
	39															

Continued on next sheet

Notes: Lithology between recovered samples is interpreted; contacts are approximate. Refer to boring B-105A for a log of 0.0 to 12.5 feet. Boring backfilled with cement-bentonite grout topped off with bentonite chips.

RJH CONSULTANTS, INC.

LOG OF ROCK CORE

Project name: Thornton WTP
Project No: 16104
Boring Location: N 1195591.3, E 3147465.3 ft
Ground El: 5360.8 ft Total Depth: 49.1 ft
Groundwater El: Not Measured On Date: 06-30-2016

Start Date: 06-29-2016 End Date: 06-30-2016
Driller: Elite - Marshall Logged By: MSS
Bedrock Depth: 13.5 ft Checked By: ABP
Plunge: 90.0 Bearing: Not Applicable

Borehole ID: **B-105A**

Drilling Rig: CME 550 Buggy Rig
Equipment: NQ3-Sized core steel, 1.75 inch ID 2.98 inch OD

Elevation	Depth (ft)	Notes: Groundwater, Drilling, Conditions, Circulation etc	Interval (ft)	Penetration (ft)	Recovery ft, (%)	RQD, ft (%)	Coring Time (min)	No. of Pieces	Longest (ft)	Shortest (ft)	Hardness	In Situ Testing	Joint Description	Joint Symbol	Lithology	Description and Classification of Materials
	40												Slightly to moderately open, slightly rough to smooth, clean to very thin iron infilling 70 degrees			*39.1 to 41.1 ft: Fines are low to medium plasticity; slightly to moderately weathered; unfractured to slightly fractured; light gray;*
	41												60 degrees, slick			*41.1 to 44.1 ft: Fines are low to medium plasticity; slightly to moderately weathered; unfractured to slightly fractured; dark gray;*
			39.1 to 44.1	5.0	5.0 (100)	4.5 (90)	10	7	1.9	0.2	H7					
	42															
	43												Mechanical Break			
	44															
													40 degrees, Slightly to moderately open, rough to moderately rough, clean to very thin iron infilling			*44.1 to 46.4 ft: less than 5% sand; fresh to slightly weathered; unfractured to very slightly fractured; dark gray;*
	45															
	46															
5314.4		Lost some circulation from 44.1 to 49.1 ft.	44.1 to 49.1	5.0	5.0 (100)	4.6 (92)	9	6	2.0	0.1	H7		Slightly to moderately open, moderately to slightly rough, clean to very thin iron infilling			46.4 to 49.1 ft: Silty Sandstone Mostly sand, fine grained; 30-40% fines, nonplastic to low plasticity; slightly to moderately weathered; very slightly to slightly fractured; moist; light gray; [TKda]
	47												20 degrees			
	48															
	49															

Continued on next sheet

Notes: Lithology between recovered samples is interpreted; contacts are approximate. Refer to boring B-105A for a log of 0.0 to 12.5 feet. Boring backfilled with cement-bentonite grout topped off with bentonite chips.

LOG OF ROCK CORE

Project name: Thornton WTP
Project No: 16104
Boring Location: N 1195591.3, E 3147465.3 ft
Ground El: 5360.8 ft Total Depth: 49.1 ft
Groundwater El: Not Measured On Date: 06-30-2016

Start Date: 06-29-2016 End Date: 06-30-2016
Driller: Elite - Marshall Logged By: MSS
Bedrock Depth: 13.5 ft Checked By: ABP
Plunge: 90.0 Bearing: Not Applicable

Drilling Rig: CME 550 Buggy Rig
Equipment: NQ3-Sized core steel, 1.75 inch ID 2.98 inch OD

Borehole ID: **B-105A**

Elevation	Depth (ft)	Notes: Groundwater, Drilling, Conditions, Circulation etc	Interval (ft)	Penetration (ft)	Recovery ft, (%)	RQD, ft (%)	Coring Time (min)	No. of Pieces	Longest (ft)	Shortest (ft)	Hardness	In Situ Testing	Joint Description	Joint Symbol	Lithology	Description and Classification of Materials
5311.7		Bottom of Boring at 49.1 ft.														End of rock core log at 49.10 ft

Notes Lithology between recovered samples is interpreted; contacts are approximate. Refer to boring B-105A for a log of 0.0 to 12.5 feet. Boring backfilled with cement-bentonite grout topped off with bentonite chips.

LOG OF SOIL BORING

Project name: Thornton WTP
Project No: 16104
Boring Location: N 1195898.1, E 3146773.7 ft
Ground El: 5407.1 ft Total Depth: 54.3 ft
Groundwater El: Not Measured On Date: 06-27-2016

Start Date: 06-24-2016 End Date: 06-27-2016
Driller: Elite - Marshall Logged By: MSS
Bedrock Depth: 21.2 ft Checked By: ABP

Drilling Rig: CME 550 Buggy Rig
Equipment: 4-1/4 inch ID 8 inch OD HSA

Borehole ID: **B-106**
Sheet 1 of 7

Elevation	Depth (ft)	Type - No	Blows per 6 inch	Penetration (ft)	Recovery (ft)	Remarks	Graphic Lithology	Description and Classification of Materials
	1	S - 1	6/6/8/11	2.0	0.5	Bu-2 collected from 0.0 ft to 10.0 ft		S-1: Lean Clay with Sand Mostly fines, medium to high plasticity; 15-25% sand, fine grained; very stiff to hard; dry to moist; brown; calcite veins and organics throughout, occasional bedrock fragments; (CL); [Fill]
	2							
	3							
5403.6	4							DM-3: Fat Clay Mostly fines, medium to high plasticity, fines are mostly silt; 5-15% sand, fine grained; slightly moist; brown and gray; iron staining throughout, occasional bedrock fragments throughout; weak to strong reaction with HCl; (CH); [Fill]
	5	DM - 3	800 psi	1.0	1.0	Moisture content of cuttings increased below 5.0 ft.		
	6							
	7							
5399.1	8							S-4: Sandy Lean Clay Mostly fines, low to medium plasticity; 30-40% sand, fine to coarse grained, subangular to subrounded; less than 5% gravel, fine grained, angular to subangular; maximum particle size = 0.375 inches; very stiff to hard; slightly moist; brown; PP = >4.5 tsf; occasional calcite and bedrock fragments throughout; weak to strong reaction with HCl; (CL); [Fill]
	9							
	10							

Continued on next sheet

Notes Lithology between recovered samples is interpreted; contacts are approximate. Boring backfilled with cement-bentonite grout topped off with bentonite chips.

RJH CONSULTANTS INC

LOG OF SOIL BORING

Project name: Thornton WTP
Project No: 16104
Boring Location: N 1195898.1, E 3146773.7 ft
Ground El: 5407.1 ft Total Depth: 54.3 ft
Groundwater El: Not Measured On Date: 06-27-2016

Start Date: 06-24-2016 End Date: 06-27-2016
Driller: Elite - Marshall Logged By: MSS
Bedrock Depth: 21.2 ft Checked By: ABP

Drilling Rig: CME 550 Buggy Rig
Equipment: 4-1/4 inch ID 8 inch OD HSA

Borehole ID: **B-106**

Elevation	Depth (ft)	Type - No	Blows per 6 inch	Penetration (ft)	Recovery (ft)	Remarks	Graphic Lithology	Description and Classification of Materials
	11	S - 4	8/9/11/11	2.0	1.5			
	12							
	13							
5393.6	14							DM-5, S-6, S-7: Lean Clay with Sand Mostly fines, low to medium plasticity; 20-30% sand, fine to medium grained, subangular to subrounded; stiff to very stiff; slightly moist; dark brown; PP = >4.5 tsf; occasional calcite, bedrock, and roots throughout; strong reaction with HCl; (CL); [Fill]
	15	DM - 5	11/14	1.0	1.0			
	16							*less than 5% gravel, fine grained, subangular to subrounded; maximum particle size = 0.5 inches;*
	17							
	18	S - 6	5/7/10/9	2.0	1.4			*17.5 to 19.5 ft: Fines are medium to high plasticity; less than 5% gravel, fine grained; maximum particle size = 0.25 inches; medium stiff to stiff; brown; iron staining;*
	19							
	20							

Continued on next sheet

Notes: Lithology between recovered samples is interpreted; contacts are approximate. Boring backfilled with cement-bentonite grout topped off with bentonite chips.

RJH CONSULTANTS, INC

LOG OF SOIL BORING

Project name: Thornton WTP
Project No: 16104
Boring Location: N 1195898.1, E 3146773.7 ft
Ground El: 5407.1 ft Total Depth: 54.3 ft
Groundwater El: Not Measured On Date: 06-27-2016

Start Date: 06-24-2016 End Date: 06-27-2016
Driller: Elite - Marshall Logged By: MSS
Bedrock Depth: 21.2 ft Checked By: ABP

Drilling Rig: CME 550 Buggy Rig
Equipment: 4-1/4 inch ID 8 inch OD HSA

Borehole ID: **B-106**
Sheet 3 of 7

Elevation	Depth (ft)	Type - No	Blows per 6 inch	Penetration (ft)	Recovery (ft)	Remarks	Graphic Lithology	Description and Classification of Materials
								20.0 to 20.7 ft: Fines are medium to high plasticity; 15-25% sand, fine to coarse grained; soft to medium stiff; moist; brown and tan;
5386.4	21	S - 7	4/5/7/8	2.0	1.5	Top of bedrock at 21.2 ft.		S-7: Clayey Sand Mostly sand, fine to coarse grained, subangular to subrounded; 15-25% fines, low plasticity; medium dense; moist; brown; occasional bedrock fragments; strong reaction with HCl; (SC); [Qcr]
5385.9	22							S-7: Claystone Blocky, laminated to very thinly bedded; mostly fines, medium to high plasticity; 5-15% sand, fine grained; slightly to moderately weathered; moist; gray to brown; H7; [TKda]
5384.8	23	DM - 8	12/20	1.0	1.0			DM-8: Sandstone Mostly sand, fine to medium grained; 5-15% fines, low plasticity; slightly to moderately weathered; moist; gray brown; H7; weak reaction with HCl; [TKda]
5383.6	24					Switched to NQ3 wireline coring after sampling DM-8.		End of boring log at 23.50 ft
	25							
	26							
	27							
	28							
	29							
	30							

Notes Lithology between recovered samples is interpreted; contacts are approximate. Boring backfilled with cement-bentonite grout topped off with bentonite chips.

RJH CONSULTANTS, INC

LOG OF ROCK CORE

Project name: Thornton WTP
Project No: 16104
Boring Location: N 1195898.1, E 3146773.7 ft
Ground El: 5407.1 ft Total Depth: 54.3 ft
Groundwater El: Not Measured On Date: 06-27-2016

Start Date: 06-24-2016 End Date: 06-27-2016
Driller: Elite - Marshall Logged By: MSS
Bedrock Depth: 21.2 ft Checked By: ABP
Plunge: 90.0 Bearing: Not Applicable

Borehole ID: **B-106**

Drilling Rig: CME 550 Buggy Rig
Equipment: NQ3-Sized core steel, 1.75 inch ID 2.98 inch OD

Elevation	Depth (ft)	Notes: Groundwater, Drilling, Conditions, Circulation etc	Interval (ft)	Penetration (ft)	Recovery ft, (%)	RQD, ft (%)	Coring Time (min)	No. of Pieces	Longest (ft)	Shortest (ft)	Hardness	In Situ Testing	Joint Description	Joint Symbol	Lithology	Description and Classification of Materials
	24	RQD may not be applicable.	23.5 to 24.3	0.8	0.8 (100)	0.4 (50)	2	5	0.4	<0.1	H7		Slightly to moderately open, slightly rough to smooth, clean Mechanical Break			23.5 to 24.3 ft: Claystone Mostly fines, low to medium plasticity; 5-15% sand, fine grained; fresh to slightly weathered; slightly fractured; moist; gray; occasional iron staining; [TKda]
5382.8	25	Near 100-percent drilling-water circulation.											Core Loss			24.3 to 29.3 ft: Interbedded Claystone and Sandstone Claystone (approx 70 percent by volume): Mostly fines, low to medium plasticity; 5-15% sand, fine grained; fresh to slightly weathered; intensely fractured; moist; gray; occasional iron staining, claystone interbeds between 0.2 and 2.3 ft thick; Sandstone (approx 30 percent by volume): Mostly sand, fine to medium grained; less than 5% fines; slightly to moderately weathered; intensely fractured; moist; gray; sandstone interbeds between 0.2 and 0.7 ft thick; [TKda]
	26															
	27	Water level in boring dropped from 17 ft to 24.3 ft deep between 6:00 pm on 6/24/2016 and 7:00 am on 6/27/2016. The bottom of boring was at 29.3 ft during this time interval.	24.3 to 29.3	5.0	2.7 (54)	0.0 (0)	6	> 10	0.2	<0.1	H7		Tight to slightly open, slightly rough to smooth, clean to very thin iron infilling 70 degrees 40 degrees			*26.6 to 26.8 ft: Sandstone; moderately to intensely weathered;* *26.8 to 27.0 ft: Sandstone; 1/4 to 1/2 inch claystone clods in matrix of sandstone;* *27.0 to 27.2 ft: Sandstone; moderately to intensely weathered;*
	28												Mechanical Break			
	29												Tight to slightly open, slightly rough to smooth, clean to very thin iron infilling			
5377.8													Core Loss			29.3 to 30.1 ft: Claystone Mostly fines, low to medium plasticity; less than 5% sand, fine grained; moderately weathered; slightly fractured; moist; gray ; iron staining throughout, H7; [TKda]
	30												Mechanical Break			
5377.0																30.1 to 30.5 ft: Sandstone Mostly sand, fine to medium grained; less than 5% fines; fresh to slightly weathered; slightly fractured; moist; gray; H6; [TKda]
5376.6																30.5 to 31.5 ft: Silty Sandstone Mostly sand, fine to medium grained; 15-25% fines, nonplastic to low plasticity; moderately weathered; slightly fractured; moist; gray to brown; iron staining throughout, H7; [TKda]
	31												Slightly to moderately open, slightly rough to smooth, clean			
5375.6			29.3 to 34.3	5.0	4.7 (94)	4.4 (88)	11	9	1.0	0.2	H6 to H7					31.5 to 33.3 ft: Claystone Mostly fines, low to medium plasticity; less than 5% sand, fine grained; moderately weathered; slightly fractured; moist; gray ; iron staining throughout, H7; [TKda]
	32												20 degrees Mechanical Break			
	33												Slightly to moderately open, slightly rough to smooth, clean			
5373.8																33.3 to 36.1 ft: Silty Sandstone

Continued on next sheet

Notes: Lithology between recovered samples is interpreted; contacts are approximate. Boring backfilled with cement-bentonite grout topped off with bentonite chips.

RJH CONSULTANTS, INC

LOG OF ROCK CORE

Project name: Thornton WTP
Project No: 16104
Boring Location: N 1195898.1, E 3146773.7 ft
Ground El: 5407.1 ft Total Depth: 54.3 ft
Groundwater El: Not Measured On Date: 06-27-2016

Start Date: 06-24-2016 End Date: 06-27-2016
Driller: Elite - Marshall Logged By: MSS
Bedrock Depth: 21.2 ft Checked By: ABP
Plunge: 90.0 Bearing: Not Applicable

Drilling Rig: CME 550 Buggy Rig
Equipment: NQ3-Sized core steel, 1.75 inch ID 2.98 inch OD

Borehole ID: **B-106**

Elevation	Depth (ft)	Notes: Groundwater, Drilling, Conditions, Circulation etc	Interval (ft)	Penetration (ft)	Recovery ft, (%)	RQD, ft (%)	Coring Time (min)	No. of Pieces	Longest (ft)	Shortest (ft)	Hardness	In Situ Testing	Joint Description	Joint Symbol	Lithology	Description and Classification of Materials
	34	RQD may not be applicable.											Mechanical Break			Mostly sand, fine to medium grained; 15-25% fines, nonplastic to low plasticity; moderately weathered; slightly fractured; moist; gray to brown; iron staining throughout, H7; [TKda]
													Core Loss			
	35												Slightly to moderately open, slightly rough to smooth, clean to very thin manganese infilling			
5371.0	36												Mechanical Break			36.1 to 36.4 ft: Sandstone Mostly sand, fine to medium grained; less than 5% fines; fresh to slightly weathered; slightly fractured; moist; gray; H6; [TKda]
5370.7																
5370.4			34.3 to 39.3	5.0	4.9 (98)	4.9 (98)	8	10	1.5	0.2	H6 to H7					36.4 to 36.7 ft: Silty Sandstone Mostly sand, fine to medium grained; 15-25% fines, nonplastic to low plasticity; moderately weathered; slightly fractured; moist; gray to brown; iron staining throughout, H7; [TKda]
5370.3	37												70 degrees			36.7 to 36.8 ft: Claystone Mostly fines, low to medium plasticity; less than 5% sand, fine grained; moderately weathered; slightly fractured; moist; gray ; iron staining throughout, H7; [TKda]
													Slightly to moderately open, slightly rough to smooth, clean to very thin manganese infilling			36.8 to 38.1 ft: Sandstone Mostly sand, fine to medium grained; less than 5% fines; fresh to slightly weathered; slightly fractured; moist; gray; H6; [TKda]
5369.0	38															38.1 to 38.6 ft: Silty Sandstone Mostly sand, fine to medium grained; 15-25% fines, nonplastic to low plasticity; moderately weathered; slightly fractured; moist; gray to brown; iron staining throughout, H7; [TKda]
5368.5																38.6 to 46.5 ft: Claystone Mostly fines, medium to high plasticity; less than 5% sand, fine grained; slightly to moderately weathered; slightly fractured; moist; gray ; iron staining throughout; [TKda]
	39															*39.3 to 44.3 ft: Fines are mostly silt; 5-10% sand; brown to gray;*
	40															
	41		39.3 to 44.3	5.0	5.0 (100)	4.8 (96)	9	6	1.8	0.2	H7		Tight to slightly open, moderately to slightly rough, clean			
	42															
	43															

Continued on next sheet

Notes Lithology between recovered samples is interpreted; contacts are approximate. Boring backfilled with cement-bentonite grout topped off with bentonite chips.

RJH CONSULTANTS, INC.

LOG OF ROCK CORE

Project name: Thornton WTP
Project No: 16104
Boring Location: N 1195898.1, E 3146773.7 ft
Ground El: 5407.1 ft Total Depth: 54.3 ft
Groundwater El: Not Measured On Date: 06-27-2016

Start Date: 06-24-2016 End Date: 06-27-2016
Driller: Elite - Marshall Logged By: MSS
Bedrock Depth: 21.2 ft Checked By: ABP
Plunge: 90.0 Bearing: Not Applicable

Drilling Rig: CME 550 Buggy Rig
Equipment: NQ3-Sized core steel, 1.75 inch ID 2.98 inch OD

Borehole ID: **B-106**

Elevation	Depth (ft)	Notes: Groundwater, Drilling, Conditions, Circulation etc	Interval (ft)	Penetration (ft)	Recovery ft, (%)	RQD, ft (%)	Coring Time (min)	No. of Pieces	Longest (ft)	Shortest (ft)	Hardness	In Situ Testing	Joint Description	Joint Symbol	Lithology	Description and Classification of Materials
	44	RQD may not be applicable.														
	45															*44.3 to 46.5 ft: gray; iron staining throughout;*
	46															
5360.6																46.5 to 46.7 ft: Sandy Claystone Mostly fines, medium to high plasticity; 15-25% sand, fine grained; slightly to moderately weathered; slightly fractured; moist; brown to gray; [TKda]
5360.4	47		44.3 to 49.3	5.0	5.0 (100)	4.8 (96)	13	4	2.5	0.2	H7		Slightly to moderately open, slightly rough to smooth, clean to very thin iron and manganese infilling very thin bentonite infilling			46.7 to 54.3 ft: Claystone Mostly fines, medium to high plasticity, fines are mostly silt; less than 10% sand, fine grained; slightly weathered; slightly fractured; moist; gray ; iron staining throughout, H7; [TKda]
	48															
	49												Slightly to moderately open, slightly rough to smooth, clean to very thin iron and manganese infilling			
	50															
	51		49.3 to 54.3	5.0	5.0 (100)	5.0 (100)	11	5	2.9	0.2	H7		30 degrees, Tight to slightly open, moderately to slightly rough, clean to very thin iron and manganese infilling			
	52															
	53												30 degrees, Tight to slightly open, moderately to slightly rough, clean to very thin iron and manganese infilling			

Continued on next sheet

Notes: Lithology between recovered samples is interpreted; contacts are approximate. Boring backfilled with cement-bentonite grout topped off with bentonite chips.

LOG OF ROCK CORE

Project name: Thornton WTP
Project No: 16104
Boring Location: N 1195898.1, E 3146773.7 ft
Ground El: 5407.1 ft Total Depth: 54.3 ft
Groundwater El: Not Measured On Date: 06-27-2016

Start Date: 06-24-2016 End Date: 06-27-2016
Driller: Elite - Marshall Logged By: MSS
Bedrock Depth: 21.2 ft Checked By: ABP
Plunge: 90.0 Bearing: Not Applicable

Drilling Rig: CME 550 Buggy Rig
Equipment: NQ3-Sized core steel, 1.75 inch ID 2.98 inch OD

Borehole ID: **B-106**

Elevation	Depth (ft)	Notes: Groundwater, Drilling, Conditions, Circulation etc	Interval (ft)	Penetration (ft)	Recovery ft, (%)	RQD, ft (%)	Coring Time (min)	No. of Pieces	Longest (ft)	Shortest (ft)	Hardness	In Situ Testing	Joint Description	Joint Symbol	Lithology	Description and Classification of Materials
5352.8	54	Bottom of Boring at 54.3 ft.														End of rock core log at 54.30 ft
	55															
	56															
	57															
	58															
	59															
	60															
	61															
	62															
	63															

Notes Lithology between recovered samples is interpreted; contacts are approximate. Boring backfilled with cement-bentonite grout topped off with bentonite chips.

LOG OF SOIL BORING

Project name: Thornton WTP
Project No: 16104
Boring Location: N 1196053.1, E 3147104.5 ft
Ground El: 5408.6 ft Total Depth: 55.0 ft
Groundwater El: Not Measured On Date: 06-23-2016

Start Date: 06-21-2016 End Date: 06-23-2016
Driller: Elite - Marshall Logged By: MSS
Bedrock Depth: 21.8 ft Checked By: ABP

Drilling Rig: CME 550 Buggy Rig
Equipment: 4-1/4 inch ID 8 inch OD HSA

Borehole ID: **B-107**
Sheet 1 of 7

Elevation	Depth (ft)	Type - No	Blows per 6 inch	Penetration (ft)	Recovery (ft)	Remarks	Graphic Lithology	Description and Classification of Materials
	1	S - 1	3/3/7/7	2.0	1.7	Bu-2 collected from 0.0 ft to 10.0 ft		S-1: Lean Clay with Sand Mostly fines, low to medium plasticity; 20-30% sand, fine to medium grained, subangular to subrounded; medium stiff to stiff; dry to slightly moist; tan; occasional roots; strong reaction with HCl; (CL); [Fill]
	2							
5406.4								DM-3: Interbedded Lean Clay with Sand and Poorly Graded Sand with Silt Lean Clay with Sand (approx 50 percent by volume): Mostly fines, low to medium plasticity; 20-30% sand, fine to medium grained, subangular to subrounded; stiff to very stiff; slightly moist to moist; brown; trace calcite; strong reaction with HCl; (CL); Poorly Graded Sand with Silt (approx 50 percent by volume): Mostly sand, fine to medium grained; 5-15% fines, nonplastic; slightly moist to moist; tan; (SP-SM); [Fill]
	3	DM - 3	700 psi	1.0	1.0			
	4							
5404.4								S-4, S-5: Lean Clay Blocky; mostly fines, medium to high plasticity; less than 5% sand, fine to medium grained; very stiff to hard; moist; brown; trace calcite, occasional bedrock fragments; weak to strong reaction with HCl; (CL); [Fill]
	5					Moisture content of cuttings increased below 5.0 ft.		
	6	S - 4	6/7/10/14	2.0	1.3			
	7							
								7.5 to 9.5 ft: occasional sandier layers; 5-15% sand;
	8	S - 5	8/8/15/17	2.0	1.2			
	9							
5398.8								DM-6: Sandy Lean Clay
	10							

Continued on next sheet

Notes: Lithology between recovered samples is interpreted; contacts are approximate. Boring backfilled with cement-bentonite grout topped off with bentonite chips.

LOG OF SOIL BORING

Project name: Thornton WTP
Project No: 16104
Boring Location: N 1196053.1, E 3147104.5 ft
Ground El: 5408.6 ft Total Depth: 55.0 ft
Groundwater El: Not Measured On Date: 06-23-2016

Start Date: 06-21-2016 End Date: 06-23-2016
Driller: Elite - Marshall Logged By: MSS
Bedrock Depth: 21.8 ft Checked By: ABP

Drilling Rig: CME 550 Buggy Rig
Equipment: 4-1/4 inch ID 8 inch OD HSA

Borehole ID: **B-107**

Elevation	Depth (ft)	Type - No	Blows per 6 inch	Penetration (ft)	Recovery (ft)	Remarks	Graphic Lithology	Description and Classification of Materials
5398.1		DM - 6	7/16	1.0	1.0	Water poured into boring after collecting samples between 11 and 21 ft.		Mostly fines, medium to high plasticity; 30-40% sand, fine to medium grained; very stiff to hard; slightly moist; brown; trace calcite; occasional bedrock fragments; weak to strong reaction with HCl; (CL); [Fill]
	11							DM-6: Poorly Graded Sand Mostly sand, fine to medium grained; less than 5% fines, nonplastic; dry; tan; weakly cemented, possible sandstone fragment; (SP); [Fill]
5396.8	12							S-7: Clayey Sand Mostly sand, fine to medium grained; 20-30% fines, low to medium plasticity; medium dense; dry to slightly moist; tan; weak reaction with HCl; (SC); [Fill]
5395.4	13	S - 7	6/9/13/16	2.0	1.8			S-7, S-8, CA-9, S-10: Lean Clay with Sand Blocky; mostly fines, medium to high plasticity; 15-25% sand, fine grained; very stiff to hard; moist; brown; occasional calcite and bedrock fragments throughout; strong reaction with HCl; (CL); [Fill]
	14							
	15					Recovered small white debris. Not considered potentially asbestos contaminated material.		*15.0 to 17.0 ft: 20-30% sand, fine to medium grained; occasional organics;*
	16	S - 8	7/10/15/20	2.0	1.6			
	17	CA - 9	4/7	1.0	0.8	Rig shutdown due to radiator mechanical failure after sampling S-8. Rig demobilized from site. Resumed 6/23/16 with the same rig. Gravel lodged in shoe of CA-9.		*17.0 to 18.0 ft: Sand is fine to medium grained; pulverized angular to subangular cobble composed of igneous rock in shoe at 18.0 ft, maximum particle size = 2.0 inches;*
	18							*18.0 to 19.3 ft: Sand is fine to medium grained; medium stiff to stiff; weak to strong reaction with HCl;*
	19	S - 10	5/7/12/18	2.0	2.0			
5389.3								S-10, S-11: Poorly Graded Sand with Silt Mostly sand, fine to medium grained; 5-15% fines, nonplastic to low plasticity; medium dense; slightly moist to moist; tan; iron staining throughout, bedrock fragment; (SP-SM);
	20							

Continued on next sheet

Notes: Lithology between recovered samples is interpreted; contacts are approximate. Boring backfilled with cement-bentonite grout topped off with bentonite chips.

LOG OF SOIL BORING

Project name: Thornton WTP
Project No: 16104
Boring Location: N 1196053.1, E 3147104.5 ft
Ground El: 5408.6 ft Total Depth: 55.0 ft
Groundwater El: Not Measured On Date: 06-23-2016

Start Date: 06-21-2016 End Date: 06-23-2016
Driller: Elite - Marshall Logged By: MSS
Bedrock Depth: 21.8 ft Checked By: ABP

Drilling Rig: CME 550 Buggy Rig
Equipment: 4-1/4 inch ID 8 inch OD HSA

Borehole ID: **B-107**
Sheet 3 of 7

Elevation	Depth (ft)	Type - No	Blows per 6 inch	Penetration (ft)	Recovery (ft)	Remarks	Graphic Lithology	Description and Classification of Materials
		S - 11	20/50 for 5 inches	0.9	0.9	Lower drilling resistance at 20.0 ft.		[Fill] *20.0 to 20.9 ft: less than 10% gravel, coarse grained, subangular; maximum particle size = 1 inch; wet; weathered bedrock fragment present; weak reaction with HCl;*
	21							
5386.8						Top of bedrock at 21.8 ft.		S-12: Sandy Claystone Mostly fines, medium to high plasticity; 20-30% sand, fine grained; slightly to moderately weathered; moist; brown to dark gray; iron staining on fracture surfaces, H7; [TKda]
	22							
	23	S - 12	13/17/20/30	2.0	1.9			
5384.9								S-12: Claystone Mostly fines, medium to high plasticity; 5-15% sand, fine grained; slightly to moderately weathered; moist; brown to dark gray; iron staining on fracture surfaces, H7; [TKda]
	24					Switched to NQ3 wireline coring after sampling S-12.		
5384.1								End of boring log at 24.50 ft
	25							
	26							
	27							
	28							
	29							
	30							

Notes Lithology between recovered samples is interpreted; contacts are approximate. Boring backfilled with cement-bentonite grout topped off with bentonite chips.

RJH CONSULTANTS, INC.

LOG OF ROCK CORE

Project name: Thornton WTP
Project No: 16104
Boring Location: N 1196053.1, E 3147104.5 ft
Ground El: 5408.6 ft Total Depth: 55.0 ft
Groundwater El: Not Measured On Date: 06-23-2016

Start Date: 06-21-2016 End Date: 06-23-2016
Driller: Elite - Marshall Logged By: MSS
Bedrock Depth: 21.8 ft Checked By: ABP
Plunge: 90.0 Bearing: Not Applicable

Drilling Rig: CME 550 Buggy Rig
Equipment: NQ3-Sized core steel, 1.75 inch ID 2.98 inch OD

Borehole ID: **B-107**

Elevation	Depth (ft)	Notes: Groundwater, Drilling, Conditions, Circulation etc	Interval (ft)	Penetration (ft)	Recovery ft, (%)	RQD, ft (%)	Coring Time (min)	No. of Pieces	Longest (ft)	Shortest (ft)	Hardness	In Situ Testing	Joint Description	Joint Symbol	Lithology	Description and Classification of Materials
		Cored through S-12 sample interval.	24.0 to 25.0	1.0	0.6 (60)	0.6 (60)	2	4	0.5	<0.1	H7		Core Loss			
	25	RQD may not be applicable.											Mechanical Break			24.5 to 28.0 ft: Claystone Mostly fines, medium to high plasticity; less than 5% sand, fine grained; slightly to moderately weathered; unfractured to slightly fractured; moist; gray; iron staining throughout; [TKda]
	26	Near 100-percent drilling-water circulation.											Slightly to moderately open, moderately to slightly rough, clean to very thin iron and manganese infilling Mechanical Break			
	27															*27.3 to 28.0 ft: 5-15% sand; slightly weathered;*
5380.6	28		25.0 to 30.0	5.0	5.0 (100)	5.0 (100)	8	8	2.4	0.1	H7					28.0 to 29.7 ft: Sandstone Mostly sand, fine to medium grained; 5-15% fines, nonplastic; moderately weathered; unfractured; iron staining throughout; [TKda]
	29												Mechanical Break			
5378.9	30												Mechanical Break			29.7 to 38.8 ft: Claystone Mostly fines, medium to high plasticity; 5-15% sand, fine grained; moderately weathered; very slightly to slightly fractured; moist; gray; iron staining throughout; [TKda]
	31												Moderately open to open, moderately to slightly rough, clean to very thin iron infilling			
	32		30.0 to 35.0	5.0	5.0 (100)	4.7 (94)	10	9	2.0	<0.1	H7					
	33												Tight to slightly open, slightly rough to smooth, very thin manganese infilling			*33.0 to 35.0 ft: less than 5% sand; fresh to slightly weathered;*
	34												Mechanical Break			

Continued on next sheet

Notes: Lithology between recovered samples is interpreted; contacts are approximate. Boring backfilled with cement-bentonite grout topped off with bentonite chips.

RJH CONSULTANTS, INC.

LOG OF ROCK CORE

Project name: Thornton WTP
Project No: 16104
Boring Location: N 1196053.1, E 3147104.5 ft
Ground El: 5408.6 ft Total Depth: 55.0 ft
Groundwater El: Not Measured On Date: 06-23-2016

Start Date: 06-21-2016 End Date: 06-23-2016
Driller: Elite - Marshall Logged By: MSS
Bedrock Depth: 21.8 ft Checked By: ABP
Plunge: 90.0 Bearing: Not Applicable

Drilling Rig: CME 550 Buggy Rig
Equipment: NQ3-Sized core steel, 1.75 inch ID 2.98 inch OD

Borehole ID: **B-107**

Elevation	Depth (ft)	Notes: Groundwater, Drilling, Conditions, Circulation etc	Interval (ft)	Penetration (ft)	Recovery ft, (%)	RQD, ft (%)	Coring Time (min)	No. of Pieces	Longest (ft)	Shortest (ft)	Hardness	In Situ Testing	Joint Description	Joint Symbol	Lithology	Description and Classification of Materials
	35	RQD may not be applicable.											Mechanical Break			35.0 to 38.8 ft: fresh to slightly weathered; occasional organics;
	36												Slightly to moderately open, moderately to slightly rough, clean to very thin iron and manganese infilling			
	37		35.0 to 40.0	5.0	5.0 (100)	5.0 (100)	10	> 10	1.7	<0.1	H7		Slightly to moderately open, moderately to slightly rough, clean to very thin iron infilling			
	38															
5369.8	39												Slightly to moderately open, moderately to slightly rough, clean to very thin iron and manganese infilling			38.8 to 42.0 ft: Sandstone Laminated to very thinly bedded; mostly sand, fine to medium grained; less than 5% fines; moderately to intensely weathered; slightly to moderately fractured; tan; iron staining throughout; [TKda]
													Mechanical Break			
													Slightly to moderately open, stepped, clean			
	40												Mechanical Break			
													Core Loss			
	41												Mechanical Break			
5366.6	42		40.0 to 45.0	5.0	4.7 (94)	4.7 (94)	10	> 10	2.1	<0.1	H7					42.0 to 55.0 ft: Claystone Laminated to very thinly bedded; mostly fines, medium to high plasticity; less than 5% sand, fine grained; fresh to slightly weathered; slightly fractured; moist; gray; occasional iron and manganese staining, occasional organics; [TKda]
	43															
	44															

Continued on next sheet

Notes: Lithology between recovered samples is interpreted; contacts are approximate. Boring backfilled with cement-bentonite grout topped off with bentonite chips.

RJH CONSULTANTS, INC.

LOG OF ROCK CORE

Project name: Thornton WTP
Project No: 16104
Boring Location: N 1196053.1, E 3147104.5 ft
Ground El: 5408.6 ft Total Depth: 55.0 ft
Groundwater El: Not Measured On Date: 06-23-2016

Start Date: 06-21-2016 End Date: 06-23-2016
Driller: Elite - Marshall Logged By: MSS
Bedrock Depth: 21.8 ft Checked By: ABP
Plunge: 90.0 Bearing: Not Applicable

Drilling Rig: CME 550 Buggy Rig
Equipment: NQ3-Sized core steel, 1.75 inch ID 2.98 inch OD

Borehole ID: **B-107**

Elevation	Depth (ft)	Notes: Groundwater, Drilling, Conditions, Circulation etc	Interval (ft)	Penetration (ft)	Recovery ft, (%)	RQD, ft (%)	Coring Time (min)	No. of Pieces	Longest (ft)	Shortest (ft)	Hardness	In Situ Testing	Joint Description	Joint Symbol	Lithology	Description and Classification of Materials
	45	RQD may not be applicable.											Tight to slightly open, moderately to slightly rough, clean to very thin iron and manganese infilling			45.0 to 47.2 ft: slightly weathered; moderately to intensely fractured; occasional iron and manganese staining;
	46												35 degrees, Slightly to moderately open, moderately to slightly rough, clean to very thin iron infilling			
	47												Mechanical Break			47.2 to 55.0 ft: moderately to intensely fractured;
			45.0 to 50.0	5.0	5.0 (100)	3.9 (78)	15	> 10	0.9	<0.1	H7		35 degrees, Bentonite			
	48												Mechanical Break			
													35 degrees			
	49												Slightly to moderately open, moderately to slightly rough, clean			
													Slightly to moderately open, smooth to polished, clean			
	50												70 degrees, Slightly to moderately open, smooth to polished, clean			
	51												Bedding Plane			
													Mechanical Break			
	52		50.0 to 55.0	5.0	5.0 (100)	4.3 (86)	12	7	1.1	0.2	H7					
	53												65 degrees, Slightly to moderately open, smooth to polished, clean			
	54															

Continued on next sheet

Notes: Lithology between recovered samples is interpreted; contacts are approximate. Boring backfilled with cement-bentonite grout topped off with bentonite chips.

RJH CONSULTANTS, INC.

LOG OF ROCK CORE

Project name: Thornton WTP
Project No: 16104
Boring Location: N 1196053.1, E 3147104.5 ft
Ground El: 5408.6 ft Total Depth: 55.0 ft
Groundwater El: Not Measured On Date: 06-23-2016

Start Date: 06-21-2016 End Date: 06-23-2016
Driller: Elite - Marshall Logged By: MSS
Bedrock Depth: 21.8 ft Checked By: ABP
Plunge: 90.0 Bearing: Not Applicable

Borehole ID: **B-107**
Sheet 7 of 7

Drilling Rig: CME 550 Buggy Rig
Equipment: NQ3-Sized core steel, 1.75 inch ID 2.98 inch OD

Elevation	Depth (ft)	Notes: Groundwater, Drilling, Conditions, Circulation etc	Interval (ft)	Penetration (ft)	Recovery ft, (%)	RQD, ft (%)	Coring Time (min)	No. of Pieces	Longest (ft)	Shortest (ft)	Hardness	In Situ Testing	Joint Description	Joint Symbol	Lithology	Description and Classification of Materials
5353.6	55	Bottom of Boring at 55.0 ft.											50 degrees, Slightly to moderately open, smooth to polished, clean Slightly to moderately open, slightly rough to smooth, clean			End of rock core log at 55.00 ft
	56															
	57															
	58															
	59															
	60															
	61															
	62															
	63															
	64															

Notes: Lithology between recovered samples is interpreted; contacts are approximate. Boring backfilled with cement-bentonite grout topped off with bentonite chips.

RJH CONSULTANTS, INC.

LOG OF SOIL BORING

Project name: Thornton WTP
Project No: 16104
Boring Location: N 1195929.5, E 3147081.8 ft
Ground El: 5407.2 ft Total Depth: 50.0 ft
Groundwater El: 5374.9 ft On Date: 07-01-2016

Start Date: 06-29-2016 End Date: 06-29-2016
Driller: Elite - Marshall Logged By: MSS
Bedrock Depth: 25.0 ft Checked By: ABP

Drilling Rig: CME 550 Buggy Rig
Equipment: 4-1/4 inch ID 8 inch OD HSA

Borehole ID: **B-108(P)**
Sheet 1 of 4

Elevation	Depth (ft)	Type - No	Blows per 6 inch	Penetration (ft)	Recovery (ft)	Remarks	Graphic Lithology	Description and Classification of Materials
	18	DM - 1	13/18	1.0	0.7	0.0 to 17.5 feet were not sampled. Refer to B-102 for a log of this interval.		DM-1, S-2: Lean Clay with Sand Mostly fines, medium to high plasticity; 20-30% sand, fine grained; medium stiff to stiff; dry to slightly moist; tan and brown; occasional bedrock and calcite throughout; strong reaction with HCl; (CL); [Fill]
	19							
	20							
	21							
	22							
	23	S - 2	6/8/12/16	2.0	1.2	Driller reports lower drilling resistance from 23.5 to 25.0 ft.		
	24							
5382.2	25					Top of bedrock at 25.0 ft.		S-3: Sandy Claystone Mostly fines, medium to high plasticity; 15-25% sand, fine grained; slightly to moderately weathered; moist; dark brown-gray; H7; [TKda]
	26	S - 3	8/12/17/19	2.0	1.0			
	27							

Continued on next sheet

Notes Lithology between recovered samples is interpreted; contacts are approximate. Boring completed as a monitoring well.

LOG OF SOIL BORING

Project name: Thornton WTP
Project No: 16104
Boring Location: N 1195929.5, E 3147081.8 ft
Ground El: 5407.2 ft Total Depth: 50.0 ft
Groundwater El: 5374.9 ft On Date: 07-01-2016

Start Date: 06-29-2016 End Date: 06-29-2016
Driller: Elite - Marshall Logged By: MSS
Bedrock Depth: 25.0 ft Checked By: ABP

Drilling Rig: CME 550 Buggy Rig
Equipment: 4-1/4 inch ID 8 inch OD HSA

Borehole ID: **B-108(P)**

Elevation	Depth (ft)	Type - No	Blows per 6 inch	Penetration (ft)	Recovery (ft)	Remarks	Graphic Lithology	Description and Classification of Materials
	28							
5378.7	29							S-4: Claystone Mostly fines, medium to high plasticity; 5-15% sand, fine to medium grained; fresh to slightly weathered; moist; light brown; H7; weak reaction with HCl; [TKda]
	30					Bu-5 collected from 30.0 ft to 35.0 ft.		
	31	S - 4	8/12/18/20	2.0	2.0			
	32					Ground water level was 32.3 ft deep on 7/1/2016. Measurement was obtained from monitoring well.		
	33							
	34							
	35					Saturated soil observed on augers at 35-feet deep.		
5371.2	36							S-6: Sandy Claystone Mostly fines, low to medium plasticity; 15-25% sand, fine grained; moderately to intensely weathered; moist; gray and tan; iron staining throughout, H7; [TKda]
	37							

Continued on next sheet

Notes Lithology between recovered samples is interpreted; contacts are approximate. Boring completed as a monitoring well.

RJH CONSULTANTS, INC.

LOG OF SOIL BORING

Project name: Thornton WTP
Project No: 16104
Boring Location: N 1195929.5, E 3147081.8 ft
Ground El: 5407.2 ft Total Depth: 50.0 ft
Groundwater El: 5374.9 ft On Date: 07-01-2016

Start Date: 06-29-2016 End Date: 06-29-2016
Driller: Elite - Marshall Logged By: MSS
Bedrock Depth: 25.0 ft Checked By: ABP

Drilling Rig: CME 550 Buggy Rig
Equipment: 4-1/4 inch ID 8 inch OD HSA

Borehole ID: **B-108(P)**

Elevation	Depth (ft)	Type - No	Blows per 6 inch	Penetration (ft)	Recovery (ft)	Remarks	Graphic Lithology	Description and Classification of Materials
	38							
	39							
	40							
5366.2	41	S - 6	10/16/22/29	2.0	2.0			S-6: Clayey Sandstone Mostly sand, fine to medium grained; 15-25% fines, low to medium plasticity; moderately to intensely weathered; moist; tan; iron staining throughout, H7; [TKda]
5365.5								S-6: Claystone Mostly fines, medium to high plasticity; 5-15% sand, fine grained; slightly to moderately weathered; moist; gray and tan; iron staining throughout, H7; [TKda]
5365.2	42							
	43					Advanced augers to 50 feet and constructed monitoring well. 42 to 50 feet were not sampled. Refer to B-102 for a log of this interval.		
	44							
	45							
	46							
	47							

Continued on next sheet

Notes Lithology between recovered samples is interpreted; contacts are approximate. Boring completed as a monitoring well.

RJH CONSULTANTS, INC.

LOG OF SOIL BORING

Project name: Thornton WTP
Project No: 16104
Boring Location: N 1195929.5, E 3147081.8 ft
Ground El: 5407.2 ft Total Depth: 50.0 ft
Groundwater El: 5374.9 ft On Date: 07-01-2016

Start Date: 06-29-2016 End Date: 06-29-2016
Driller: Elite - Marshall Logged By: MSS
Bedrock Depth: 25.0 ft Checked By: ABP

Drilling Rig: CME 550 Buggy Rig
Equipment: 4-1/4 inch ID 8 inch OD HSA

Borehole ID: **B-108(P)**

Elevation	Depth (ft)	Type - No	Blows per 6 inch	Penetration (ft)	Recovery (ft)	Remarks	Graphic Lithology	Description and Classification of Materials
	48							
	49							
	50					Bottom of Boring at 50.0 ft.		End of boring log at 50.00 ft
	51							
	52							
	53							
	54							
	55							
	56							
	57							

Notes Lithology between recovered samples is interpreted; contacts are approximate. Boring completed as a monitoring well.

APPENDIX D

PHOTOGRAPHS



Photograph 1: Northern site extents (looking west).



Photograph 2: Central site extents (looking east along the north side of east 95th Ave).



Photograph 3: Southern site extents (looking east near the intersection of East 95th avenue and Hoffman Way).



Photograph 4: Regulated work area and drill rig.



Photograph 5: Typical air monitoring device set-up around perimeter of the regulated work area.



Photograph 6: Disposal of Transite pipe collected from the ground surface and containerized cuttings.



Photograph 7: Augers wrapped in plastic sheeting.



Photograph 8: Decontamination of equipment and tooling.



Photograph 9: Saturated soil on augers at B-108(P).



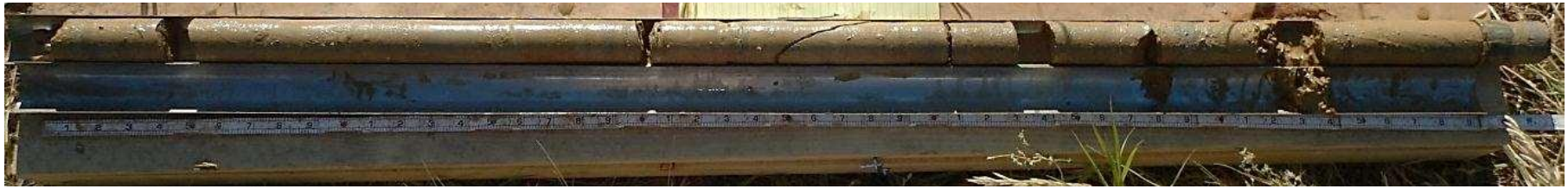
Photograph 10: B-101(P), S-6; 10 to 12 feet: Poorly graded sand interbed within lean clay with sand layer [Fill].



Photograph 11: B-103, S-9; 17.5 to 19.5 feet: Occasional bedrock fragments identified within fill material [Fill].



Photograph 12: B-107; 35 to 40 feet: Fresh to slightly weathered claystone over moderately to intensely weathered sandstone [TKda].



Photograph 13: B-106; 34.3 to 39.3 feet: Fresh to moderately weathered sandstone and silty sandstone (predominately) [Tkda].



Photograph 14: B-102, S-12; 37.5 to 39.5 feet: Intensely to very intensely weathered sandy claystone [TKda].



Photograph 15: B-105A, S-1; 12.5 to 14.3 feet: Lean clay with sand over intensely to very intensely weathered sandstone.



20.7 to 24.4 feet



24.4 to 29.4 feet



29.4 to 34.4 feet



34.4 to 36.9 feet



36.9 to 39.4 feet



39.4 to 44.4 feet



44.4 to 49.4 feet

Photograph 16: B-101 recovered rock core, 20.7 to 49.4 feet.



19.0 to 24.1 feet



24.1 to 29.1 feet



29.1 to 34.1 feet



34.1 to 39.1 feet



39.1 to 44.1 feet



44.1 to 49.1 feet

Photograph 17: B-105A recovered rock core, 19.0 to 49.1 feet.



23.5 to 24.3 feet



24.3 to 29.3 feet



29.3 to 34.3 feet



34.3 to 39.3 feet



39.3 to 44.3 feet



44.3 to 49.3 feet



49.3 to 54.3 feet

Photograph 18: B-106 recovered rock core, 23.5 to 54.3 feet.



24.0 to 25.0 feet



25.0 to 30.0 feet



30.0 to 35.0 feet



35.0 to 40.0 feet



40.0 to 45.0 feet



45.0 to 50.0 feet



50.0 to 55.0 feet

Photograph 19: B-107 recovered rock core, 24.0 to 55.0 feet.

APPENDIX E

MONITORING WELL PERMITS

Notice of Intent to Construct Monitoring Hole(s) Form GWS-51

RECEIVED

JUN 09 2016

WATER RESOURCES
STATE ENGINEER COLO

GWS-61
3/2013

NOTICE OF INTENT TO CONSTRUCT MONITORING HOLE(S)

Please type or print legibly in black or blue ink or file online @ dwrpermitsonline@state.co.us
COLORADO DIVISION OF WATER RESOURCES-1313 SHERMAN ST-STE 821-DENVER-CO-80203
PHONE: 303-866-3581---FAX: 303-866-3589 WEB: www.water.state.co.us

Well Owner Name(s): City of Thornton Attn: Eduardo Moreno
Address : 12450 Washington St, Thornton, CO 80241
Phone (area code & no.): 720-977-6272
Landowner's Name: City of Thornton

Please check one and complete as indicated including contact info:

☐ Water Well Driller Licensed in Colorado – Lic. No. _____

☐ Professional Engineer Registered in Colorado – Reg. No. _____

☐ Professional Geologist per CRS 34-1-201(3)

☒ Other -anyone directly employed by or under the supervision of a licensed driller, registered professional engineer or professional geologist

Contact / Company Micah Smidt, RJH Consultants, Inc.
Address 9800 Mt. Pyramid Ct. Ste. 330
City, State & Zip Englewood, CO 80112
Phone 303-225-4611 Fax 303-225-4615

Print Name: Micah S. Smidt
Sign or enter full name here: Micah Smidt

Location: NW ¼ NW ¼, Section 23
Township 2 ☐N ☒S, Range 68 ☐E ☒W, 6 PM
County Adams
Subdivision: _____
Lot: _____ Block: _____ Filing Unit: _____
Site/Property Address Thornton, CO
Parcel Number 0171923200015

GPS Location in UTM format (optional):
Set GPS unit to true north, datum NAD83, and use meters for the distance units, ☐ Zone 12 or ☐ Zone 13.
Easting _____ Northing _____

# of Monitoring Hole(s) to be constructed: 3
Estimated Depth 70 **Ft., Aquifer** N/A
Purpose of Monitoring Hole(s) Monitor Ground Water Level (Phreatic Surface)

Anticipated Date of Construction (mm/dd/yyyy) 06/15/2016

Date Notice Submitted (mm/dd/yyyy): 06/09/2016
(Must be at least 3 days prior to construction)

ACKNOWLEDGEMENT FROM STATE ENGINEER'S OFFICE
FOR OFFICE USE ONLY

055511 - MH **PROCESSED BY** Debbie Fitzgerald

DIV. 1 WD 2 BAS _____ MD _____ **DATE ACKNOWLEDGED** 6/13/16

CONDITIONS OF MONITORING HOLE ACKNOWLEDGEMENT

A COPY OF THE WRITTEN NOTICE OR ACKNOWLEDGEMENT SHALL BE AVAILABLE AT THE DRILLING SITE.

1) **Notice was provided to the State Engineer at least 3 days prior to construction of monitoring & observation hole(s).**
2) **Construction of the hole(s) must be completed within 90 days of the date notice was given to the State Engineer.** Testing and/or pumping shall not exceed a total of 200 hours unless prior written approval is obtained from the State Engineer. Water diverted during testing shall not be used for beneficial purposes. The owner of the hole(s) is responsible for obtaining permit(s) and complying with all rules and regulations pertaining to the discharge of fluids produced during testing.
3) **All work must comply with the Water Well Construction Rules, 2 CCR 402-2.** Minimum construction standards must be met or a variance obtained. Standard permit application and work report forms, including online filing instructions, are found on the DWR website at http://www.water.state.co.us. **Well Construction and Test Reports (GWS-31)** must be completed for each hole drilled. The licensed contractor or authorized individual must submit the completed forms to this office within 60 days of monitoring hole completion.
4) **Unless a well permit is obtained, or variance approved, the hole(s) must be plugged and sealed within one (1) year after construction. An Abandonment Report (form GWS-9) must be submitted within 60 days of plugging & sealing.** The above MH acknowledgement number, owner's structure name, and owner's name and address must be provided on all well permit application(s), well construction and abandonment reports.
5) **The owner of the hole(s) shall maintain records of water quality testing and submit this data to the State Engineer upon request.**
6) **A MONITORING HOLE CANNOT BE CONVERTED TO A PRODUCTION WATER WELL, except for purposes of remediation (recovery) or as a permanent dewatering system, if constructed in accordance with the Water Well Construction Rules and policies of the State Engineer.**
7) IF HOLES WILL NOT BE CONSTRUCTED UNDER THIS NOTICE WITHIN 90 DAYS, PLEASE WRITE, "NO HOLES CONSTRUCTED" ON A COPY OF THE ACKNOWLEDGED NOTICE WITH THE FILE NUMBER AND FAX THE COPY TO THE DIVISION OF WATER RESOURCES.

THIS ACKNOWLEDGEMENT OF NOTICE DOES NOT INDICATE THAT WELL PERMIT(S) CAN BE APPROVED.

(Use above space for labels or additional conditions as needed)

Well Construction and Test Report
Form GWS-31

FORM NO. GWS-31 4/2012

WELL CONSTRUCTION AND TEST REPORT

STATE OF COLORADO, OFFICE OF THE STATE ENGINEER
1313 Sherman St., Ste 821, Denver, CO 80203
Main (303) 866-3581 Fax (303) 866-3589 www.water.state.co.us

For Office Use Only

1. WELL PERMIT NUMBER: 055511-MH

2. WELL OWNER INFORMATION

NAME OF WELL OWNER: City of Thornton Attn: Eduardo Moreno

MAILING ADDRESS: 12450 Washington St

CITY: Thornton STATE: CO ZIP CODE: 80241

TELEPHONE NUMBER w/area code: 720-977-6272

3. WELL LOCATION AS DRILLED: NW 1/4, NW 1/4, Sec., 23 Twp. 2 ☐ N or S, ☒ Range 68 ☐ E or W ☒

DISTANCES FROM SEC. LINES: 150 ft. from ☒ N or ☐ S section line and 170 ft. from ☐ E or ☒ W section line.

SUBDIVISION: _____, LOT____, BLOCK____, FILING (UNIT) ____

Optional GPS Location: GPS Unit must use the following settings: Format must be **UTM**, Units must be **meters**, Datum must be **NAD83**, Unit must be set to **true N**, ☐ Zone 12 or ☐ Zone 13

Owner's Well Designation: B-101(P)

Easting: _____

STREET ADDRESS AT WELL LOCATION: Parcel # 0171923200015

Northing: _____

4. GROUND SURFACE ELEVATION +/- 5414 feet DRILLING METHOD 8" auger and NQ rock core

DATE COMPLETED 06/28/2016 TOTAL DEPTH 49.4 feet DEPTH COMPLETED 28.7 feet

5. GEOLOGIC LOG:

Depth	Type	Grain Size	Color	Water Loc.
0 to 17.3	fill	clay	brown	
17.3 to 20.7	claystone	clay	brown	18.5
20.7 to 24.4	silty sandstone	sand	brown	
24.4 to 49.4	claystone	clay	brown	

6. HOLE DIAM (in.)

HOLE DIAM (in.)	From (ft)	To (ft)
8"	0	28.8
3"	28.8	49.4

7. PLAIN CASING:

OD (in)	Kind	Wall Size (in)	From (ft)	To (ft)
2"	PVC	Sch 40	0	23.4
2"	PVC	Sch 40	28.1	28.7

PERFORATED CASING: Screen Slot Size (in): 0.01"

OD (in)	Kind	Wall Size (in)	From (ft)	To (ft)
2"	PVC	Sch 40	23.4	28.1

8. FILTER PACK:

Material: Sand
Size: 10/20
Interval: 19.5-28.3

9. PACKER PLACEMENT:

Type: _____
Depth: _____

10. GROUTING RECORD

Material	Amount	Density	Interval	Placement
bentonite	2buckets	pellets	28.3-49.4	downhole
bentonite	8 bags	chips	3.0-19.5	downhole

Remarks: _____

11. DISINFECTION: Type _____ Amt. Used _____

12. WELL TEST DATA: ☐ Check box if Test Data is submitted on Form Number GWS 39 Supplemental Well Test.

TESTING METHOD _____

Static Level 18.5 ft. Date/Time measured: 6/30/16 2:15 p.m., Production Rate _____ gpm.

Pumping Level _____ ft. Date/Time measured _____, Test Length (hrs) _____.

Remarks:

13. I have read the statements made herein and know the contents thereof, and they are true to my knowledge. This document is signed (or name entered if filing online) and certified in accordance with Rule 17.4 of the Water Well Construction Rules, 2 CCR 402-2. The filing of a document that contains false statements is a violation of section 37-91-108(1)(e), C.R.S., and is punishable by fines up to $5000 and/or revocation of the contracting license. If filing online the State Engineer considers entering of licensed contractor name to be compliance with Rule 17.4

Company Name:	Phone w/area code:	License Number:
RJH Consultants, Inc.	303-225-4611	

Mailing Address: 9800 Mt. Pyramid Ct. Suite 330, Englewood, CO 80112

Sign (or enter name if filing online)	Print Name and Title	Date
Micah Smidt	Micah S. Smidt, Engineer	8-16-16

FORM NO. GWS-31 4/2012

WELL CONSTRUCTION AND TEST REPORT

STATE OF COLORADO, OFFICE OF THE STATE ENGINEER
1313 Sherman St., Ste 821, Denver, CO 80203
Main (303) 866-3581 Fax (303) 866-3589 www.water.state.co.us

For Office Use Only

1. WELL PERMIT NUMBER: 055511-MH

2. WELL OWNER INFORMATION

NAME OF WELL OWNER: City of Thornton Attn: Eduardo Moreno

MAILING ADDRESS: 12450 Washington St

CITY: Thornton STATE: CO ZIP CODE: 80241

TELEPHONE NUMBER w/area code: 720-977-6272

3. WELL LOCATION AS DRILLED: NW 1/4, NW 1/4, Sec., 23 Twp 2 ☐ N or S, ☒ Range 68 ☐ E or W ☒

DISTANCES FROM SEC. LINES: 300 ft. from ☒ N or ☐ S section line and 910 ft. from ☐ E or ☒ W section line.

SUBDIVISION: _____, LOT____, BLOCK____, FILING (UNIT) ____

Optional GPS Location: GPS Unit must use the following settings: Format must be **UTM**, Units must be **meters**, Datum must be **NAD83**, Unit must be set to **true N**, ☐ Zone 12 or ☐ Zone 13

Owner's Well Designation: B-104(P)

Easting: _____

STREET ADDRESS AT WELL LOCATION: Parcel # 0171923200015

Northing: _____

4. GROUND SURFACE ELEVATION +/- 5405 feet DRILLING METHOD 8" auger

DATE COMPLETED 06/29/2016 TOTAL DEPTH 56.5 feet DEPTH COMPLETED 54.8 feet

5. GEOLOGIC LOG:

Depth	Type	Grain Size	Color	Water Loc.
0 to 25.8	fill	clay	brown	
25.8 to 36	claystone	clay	gray-brown	
36 to 43.5	clayey sandstone	sand	brown	37.5
43.5 to 56.5	claystone	clay	gray	

6. HOLE DIAM (in.)

	From (ft)	To (ft)
8"	0	56.5

7. PLAIN CASING:

OD (in)	Kind	Wall Size (in)	From (ft)	To (ft)
2"	PVC	Sch 40	0	44.5
2"	PVC	Sch 40	49.8	54.8

PERFORATED CASING: Screen Slot Size (in): 0.01"

2"	PVC	Sch 40	44.5	49.8

8. FILTER PACK:

Material: Sand
Size: 10/20
Interval: 24.0-51.0

9. PACKER PLACEMENT:

Type: _____
Depth: _____

10. GROUTING RECORD

Material	Amount	Density	Interval	Placement
cuttings			51 to 56.5	auger
bentonite	11 bags	chips	3 to 24	downhole

Remarks: _____

11. DISINFECTION: Type _____ Amt. Used _____

12. WELL TEST DATA: ☐ Check box if Test Data is submitted on Form Number GWS 39 Supplemental Well Test.

TESTING METHOD _____

Static Level 37.5 ft. Date/Time measured: 7/1/16 9:00 a.m., Production Rate _____ gpm.

Pumping Level _____ ft. Date/Time measured _____, Test Length (hrs) _____.

Remarks:

13. I have read the statements made herein and know the contents thereof, and they are true to my knowledge. This document is signed (or name entered if filing online) and certified in accordance with Rule 17.4 of the Water Well Construction Rules, 2 CCR 402-2. The filing of a document that contains false statements is a violation of section 37-91-108(1)(e), C.R.S., and is punishable by fines up to $5000 and/or revocation of the contracting license. If filing online the State Engineer considers entering of licensed contractor name to be compliance with Rule 17.4

Company Name:	Phone w/area code:	License Number:
RJH Consultants, Inc.	303-225-4611	

Mailing Address: 9800 Mt. Pyramid Ct. Suite 330, Englewood, CO 80112

Sign (or enter name if filing online)	Print Name and Title	Date
Micah Smidt	Micah S. Smidt, Engineer	8-16-16

FORM NO. GWS-31 4/2012

WELL CONSTRUCTION AND TEST REPORT

STATE OF COLORADO, OFFICE OF THE STATE ENGINEER
1313 Sherman St., Ste 821, Denver, CO 80203
Main (303) 866-3581 Fax (303) 866-3589 www.water.state.co.us

For Office Use Only

1. WELL PERMIT NUMBER: 055511-MH

2. WELL OWNER INFORMATION

NAME OF WELL OWNER: City of Thornton Attn: Eduardo Moreno

MAILING ADDRESS: 12450 Washington St

CITY: Thornton STATE: CO ZIP CODE: 80241

TELEPHONE NUMBER w/area code: 720-977-6272

3. WELL LOCATION AS DRILLED: NW 1/4, NW 1/4, Sec., 23 Twp 2 ☐ N or S, ☒ Range 68 ☐ E or W ☒

DISTANCES FROM SEC. LINES: 260 ft. from ☒ N or ☐ S section line and 540 ft. from ☐ E or ☒ W section line.

SUBDIVISION: _____, LOT____, BLOCK____, FILING (UNIT) ____

Optional GPS Location: GPS Unit must use the following settings: Format must be **UTM**, Units must be **meters**, Datum must be **NAD83**, Unit must be set to **true N**, ☐ Zone 12 or ☐ Zone 13

Owner's Well Designation: B-108(P)

Easting: _____

STREET ADDRESS AT WELL LOCATION: Parcel # 0171923200015

Northing: _____

4. GROUND SURFACE ELEVATION +/- 5407 feet DRILLING METHOD 8" auger

DATE COMPLETED 06/29/2016 TOTAL DEPTH 50 feet DEPTH COMPLETED 49.1 feet

5. GEOLOGIC LOG:

Depth	Type	Grain Size	Color	Water Loc.
0 to 25	fill	clay	brown	
25 to 41	claystone	clay	brown	32.2
41 to 42	clayey sandstone	sand	brown	
42 to 50	claystone	clay	brown	

6. HOLE DIAM (in.)

	From (ft)	To (ft)
8"	0	50

7. PLAIN CASING:

OD (in)	Kind	Wall Size (in)	From (ft)	To (ft)
2"	PVC	Sch 40	0	37.8
2"	PVC	Sch 40	47.5	48.1

PERFORATED CASING: Screen Slot Size (in): 0.01"

2"	PVC	Sch 40	37.8	47.5

8. FILTER PACK:

Material Sand
Size 10/20
Interval 27-49.1

9. PACKER PLACEMENT:

Type _____
Depth _____

10. GROUTING RECORD

Material	Amount	Density	Interval	Placement
cuttings			49.1-50	auger
bentonite	11 bags	chips	3-27	downhole

Remarks: _____

11. DISINFECTION: Type _____ Amt. Used _____

12. WELL TEST DATA: ☐ Check box if Test Data is submitted on Form Number GWS 39 Supplemental Well Test.

TESTING METHOD _____

Static Level 32.2 ft. Date/Time measured: 7/1/16 6:00 a.m., Production Rate _____ gpm.

Pumping Level _____ ft. Date/Time measured _____, Test Length (hrs) _____.

Remarks:

13. I have read the statements made herein and know the contents thereof, and they are true to my knowledge. This document is signed (or name entered if filing online) and certified in accordance with Rule 17.4 of the Water Well Construction Rules, 2 CCR 402-2. The filing of a document that contains false statements is a violation of section 37-91-108(1)(e), C.R.S., and is punishable by fines up to $5000 and/or revocation of the contracting license. If filing online the State Engineer considers entering of licensed contractor name to be compliance with Rule 17.4

Company Name:	Phone w/area code:	License Number:
RJH Consultants, Inc.	303-225-4611	

Mailing Address: 9800 Mt. Pyramid Ct. Suite 330, Englewood, CO 80112

Sign (or enter name if filing online)	Print Name and Title	Date
Micah Smidt	Micah S. Smidt, Engineer	8.16.16

Monitoring/Observation Water Well
Permit Application
Form GWS-46

COLORADO DIVISION OF WATER RESOURCES
DEPARTMENT OF NATURAL RESOURCES
1313 SHERMAN ST., Ste 821, DENVER CO 80203
Phone: (303) 866-3581 dwrpermitsonline@state.co.us

Office Use Only

Form GWS-46 (11/2011)

MONITORING/OBSERVATION Water Well Permit Application

Review instructions on reverse side prior to completing form.
The form must be typed, completed online or in black or blue ink.

1. Well Owner Information

Name of well owner: City of Thornton Attn: Eduardo Moreno

Mailing address: 12450 Washington St

City	State	Zip code
Thornton	CO	80241

Telephone #	E-Mail (If filing online it is required)
720-977-6272	Eduardo.Moreno@cityofthornton.net

2. Type Of Application (check applicable boxes)

- ☒ Use existing well
- ☐ Construct new well
- ☐ Other:
- ☐ Replacement for existing monitoring well: Permit no.:

3. Refer To (if applicable)

Monitoring hole acknowledgment	Well name or #
MH- 055511	B-101(P)

4. Location Of Proposed Well (Important! See Instructions)

County: Adams

NW 1/4 of the NW 1/4

Section	Township	N or S	Range	E or W	Principal Meridian
23	2	☐ ☒	68	☐ ☒	Sixth

Distance of well from section lines (section lines are typically not property lines)

150 Ft. from ☒ N ☐ S 170 Ft. from ☐ E ☒ W

For replacement wells only – distance and direction from old well to new well

feet direction

Well location address (Include City, State, Zip) ☐ Check if well address is same as Item 1.

9500 Washington St. Thornton, Colorado 80229

Optional: GPS well location information in UTM format
You must check GPS unit for required settings as follows:

Format must be UTM
☐ Zone 12 or ☐ Zone 13
Units must be Meters
Datum must be NAD83
Unit must be set to true north
Was GPS unit checked for above? ☐ YES

Easting _____
Northing _____
Remember to set Datum to NAD83

5. Property Owner Information

Name of property owner: City of Thornton Attn: Eduardo Moreno

Mailing address: 12450 Washington St

City	State	Zip Code
Thornton	CO	80241

Telephone #: 720-977-6272

6. Use Of Well

Use of this well is limited to monitoring water levels and/or water quality sampling

7. Well Data (proposed)

Total depth	Aquifer
49.4 feet	Not Applicable

8. Consultant Information (if applicable)

Name of contact person: Micah Smidt

Company name: RJH Consultants, Inc.

Mailing address: 9800 Mt. Pyramid Ct. Ste 330

City	State	Zip Code
Englewood	CO	80112

Telephone #: 303-225-4611

9. Proposed Well Driller License #(optional):

10. Name of Well Owner or Authorized Agent

The making of false statements herein constitutes perjury in the second degree, which is punishable as a class 1 misdemeanor pursuant to C.R.S. 24-4-104 (13)(a). I have read the statements herein, know the contents thereof and state that they are true to my knowledge.

Sign or enter full name here	Date (mm/dd/yyyy)
Micah Smidt	09-06-2016

If signing print name. Print title if other than land owner.

Micah Smidt, Engineer

Office Use Only

USGS map name	DWR map no.	Surface elev.

Receipt area only

DIV ____ WD ____ BA ____ MD ____

COLORADO DIVISION OF WATER RESOURCES
DEPARTMENT OF NATURAL RESOURCES
1313 SHERMAN ST., Ste 821, DENVER CO 80203
Phone: (303) 866-3581 dwrpermitsonline@state.co.us

Office Use Only

Form GWS-46 (11/2011)

MONITORING/OBSERVATION Water Well Permit Application

Review instructions on reverse side prior to completing form.
The form must be typed, completed online or in black or blue ink.

1. Well Owner Information

Name of well owner: City of Thornton Attn: Eduardo Moreno

Mailing address: 12450 Washington St

City	State	Zip code
Thornton	CO	80241

Telephone #	E-Mail (If filing online it is required)
720-977-6272	Eduardo.Moreno@cityofthornton.net

2. Type Of Application (check applicable boxes)

- [x] Use existing well
- [ ] Construct new well
- [ ] Other:
- [ ] Replacement for existing monitoring well: Permit no.:

3. Refer To (if applicable)

Monitoring hole acknowledgment	Well name or #
MH- 055511	B-104(P)

4. Location Of Proposed Well (Important! See Instructions)

County: Adams

NW 1/4 of the NW 1/4

Section	Township	N or S	Range	E or W	Principal Meridian
23	2	[ ] [x]	68	[ ] [x]	Sixth

Distance of well from section lines (section lines are typically not property lines)

300 Ft. from [x] N [ ] S 910 Ft. from [ ] E [x] W

For replacement wells only – distance and direction from old well to new well

feet direction

Well location address (Include City, State, Zip) [ ] Check if well address is same as Item 1.

9500 Washington St. Thornton, Colorado 80229

Optional: GPS well location information in UTM format
You must check GPS unit for required settings as follows:

Format must be UTM
[ ] Zone 12 or [ ] Zone 13
Units must be Meters
Datum must be NAD83
Unit must be set to true north
Was GPS unit checked for above? [ ] YES

Easting _____
Northing _____
Remember to set Datum to NAD83

5. Property Owner Information

Name of property owner: City of Thornton Attn: Eduardo Moreno

Mailing address: 12450 Washington St

City	State	Zip Code
Thornton	CO	80241

Telephone #: 720-977-6272

6. Use Of Well

Use of this well is limited to monitoring water levels and/or water quality sampling

7. Well Data (proposed)

Total depth	Aquifer
56.5 feet	Not Applicable

8. Consultant Information (if applicable)

Name of contact person: Micah Smidt

Company name: RJH Consultants, Inc.

Mailing address: 9800 Mt. Pyramid Ct. Ste 330

City	State	Zip Code
Englewood	CO	80112

Telephone #: 303-225-4611

9. Proposed Well Driller License #(optional):

10. Name of Well Owner or Authorized Agent

The making of false statements herein constitutes perjury in the second degree, which is punishable as a class 1 misdemeanor pursuant to C.R.S. 24-4-104 (13)(a). I have read the statements herein, know the contents thereof and state that they are true to my knowledge.

Sign or enter full name here	Date (mm/dd/yyyy)
Micah Smidt	09-06-2016

If signing print name. Print title if other than land owner.

Micah Smidt, Engineer

Office Use Only

USGS map name	DWR map no.	Surface elev.

Receipt area only

DIV ____ WD ____ BA ____ MD ____

COLORADO DIVISION OF WATER RESOURCES
DEPARTMENT OF NATURAL RESOURCES
1313 SHERMAN ST., Ste 821, DENVER CO 80203
Phone: (303) 866-3581 dwrpermitsonline@state.co.us

Office Use Only

Form GWS-46 (11/2011)

MONITORING/OBSERVATION Water Well Permit Application

Review instructions on reverse side prior to completing form.
The form must be typed, completed online or in black or blue ink.

1. Well Owner Information

Name of well owner: City of Thornton Attn: Eduardo Moreno

Mailing address: 12450 Washington St

City	State	Zip code
Thornton	CO	80241

Telephone #	E-Mail (If filing online it is required)
720-977-6272	Eduardo.Moreno@cityofthornton.net

2. Type Of Application (check applicable boxes)

- [■] Use existing well
- [ ] Construct new well
- [ ] Other:
- [ ] Replacement for existing monitoring well: Permit no.:

3. Refer To (if applicable)

Monitoring hole acknowledgment	Well name or #
MH- 055511	B-108(P)

4. Location Of Proposed Well (Important! See Instructions)

County: Adams

NW 1/4 of the NW 1/4

Section	Township	N or S	Range	E or W	Principal Meridian
23	2	[ ] [X]	68	[ ] [X]	Sixth

Distance of well from section lines (section lines are typically not property lines)

260 Ft. from [X] N [ ] S 540 Ft. from [ ] E [X] W

For replacement wells only – distance and direction from old well to new well

feet direction

Well location address (Include City, State, Zip) [ ] Check if well address is same as Item 1.

9500 Washington St. Thornton, Colorado 80229

Optional: GPS well location information in UTM format
You must check GPS unit for required settings as follows:

Format must be UTM
[ ] Zone 12 or [ ] Zone 13
Units must be Meters
Datum must be NAD83
Unit must be set to true north
Was GPS unit checked for above? [ ] YES

Easting _____
Northing _____
Remember to set Datum to NAD83

5. Property Owner Information

Name of property owner: City of Thornton Attn: Eduardo Moreno

Mailing address: 12450 Washington St

City	State	Zip Code
Thornton	CO	80241

Telephone #: 720-977-6272

6. Use Of Well

Use of this well is limited to monitoring water levels and/or water quality sampling

7. Well Data (proposed)

Total depth	Aquifer
50 feet	Not Applicable

8. Consultant Information (if applicable)

Name of contact person: Micah Smidt

Company name: RJH Consultants, Inc.

Mailing address: 9800 Mt. Pyramid Ct. Ste 330

City	State	Zip Code
Englewood	CO	80112

Telephone #: 303-225-4611

9. Proposed Well Driller License #(optional):

10. Name of Well Owner or Authorized Agent

The making of false statements herein constitutes perjury in the second degree, which is punishable as a class 1 misdemeanor pursuant to C.R.S. 24-4-104 (13)(a). I have read the statements herein, know the contents thereof and state that they are true to my knowledge.

Sign or enter full name here	Date (mm/dd/yyyy)
Micah Smidt	09-06-2016

If signing print name. Print title if other than land owner.

Micah Smidt, Engineer

Office Use Only

USGS map name	DWR map no.	Surface elev.

Receipt area only

DIV ____ WD ____ BA ____ MD ____

Permit to Use Existing Well
Form No. GWS-25

Form No.
GWS-25

OFFICE OF THE STATE ENGINEER
COLORADO DIVISION OF WATER RESOURCES

818 Centennial Bldg., 1313 Sherman St., Denver, Colorado 80203
(303) 866-3581

B-101(P)

EXST

WELL PERMIT NUMBER 303301 - -
DIV. 1 WD 5 DES. BASIN MD

APPLICANT

CITY OF THORNTON
C/O EDUARDO MORENO
12450 WASHINGTON ST
THORNTON, CO 80241-

(720) 977-6272

APPROVED WELL LOCATION
ADAMS COUNTY
NW 1/4 NW 1/4 Section 23
Township 2 S Range 68 W Sixth P.M.

DISTANCES FROM SECTION LINES
150 Ft. from North Section Line
170 Ft. from West Section Line

UTM COORDINATES (Meters,Zone:13,NAD83)
Easting: Northing:

PERMIT TO USE AN EXISTING WELL

ISSUANCE OF THIS PERMIT DOES NOT CONFER A WATER RIGHT

CONDITIONS OF APPROVAL

1) This well shall be used in such a way as to cause no material injury to existing water rights. The issuance of this permit does not ensure that no injury will occur to another vested water right or preclude another owner of a vested water right from seeking relief in a civil court action.
2) The construction of this well shall be in compliance with the Water Well Construction Rules 2 CCR 402-2, unless approval of a variance has been granted by the State Board of Examiners of Water Well Construction and Pump Installation Contractors in accordance with Rule 18.
3) Approved pursuant to CRS 37-92-602(3)(b)(I) for uses as described in CRS 37-92-602(1)(f). Use of this well is limited to monitoring water levels and/or water quality sampling.
4) Approved for the use of an existing well acknowledged for construction under monitoring hole notice MH-55511, and known as B-101(P).
5) This well must be equipped with a locking cap or seal to prevent well contamination or possible hazards as an open well. The well must be kept capped and locked at all times except during sampling or measuring.
6) Records of water level measurements and water quality analyses shall be maintained by the well owner and submitted to the Division of Water Resources upon request.
7) Upon conclusion of the monitoring program the well owner shall plug this well in accordance with Rule 16 of the Water Well Construction Rules. A Well Abandonment Report must be completed and submitted to the Division of Water Resources within 60 days of plugging.
8) The owner shall mark the well in a conspicuous place with the well permit number and name of aquifer as appropriate, and shall take necessary means and precautions to preserve these markings.
9) This well must have been constructed by or under the supervision of a licensed well driller or other authorized individual according to the Water Well Construction Rules.
10) This well must be located not more than 200 feet from the location specified on this permit.

NOTE: Issuance of this permit does not guarantee that this well can be converted to a production well under a future permit. Additionally, pursuant to Rule 14.2 of the Water Well Construction Rules (2 CCR 402-2), monitoring holes constructed pursuant to a monitoring hole notice shall not be converted to a production well. (Upon obtaining a permit from the State Engineer, a monitoring hole may be converted to a monitoring well, recovery well for remediation of the aquifer, or a dewatering system for dewatering the aquifer.)

APPROVED
DG2

Dick Wolfe by
State Engineer

Debbie Gonzales
By

Receipt No. 3676322A DATE ISSUED 10-21-2016 EXPIRATION DATE N/A

Form No.
GWS-25

OFFICE OF THE STATE ENGINEER
COLORADO DIVISION OF WATER RESOURCES

818 Centennial Bldg., 1313 Sherman St., Denver, Colorado 80203
(303) 866-3581

B-104(P)

EXST

WELL PERMIT NUMBER 303302 - - -
DIV. 1 WD 5 DES. BASIN MD

APPLICANT

CITY OF THORNTON
C/O EDUARDO MORENO
12450 WASHINGTON ST
THORNTON, CO 80241-

(720) 977-6272

APPROVED WELL LOCATION
ADAMS COUNTY
NW 1/4 NW 1/4 Section 23
Township 2 S Range 68 W Sixth P.M.

DISTANCES FROM SECTION LINES
300 Ft. from North Section Line
910 Ft. from West Section Line

UTM COORDINATES (Meters,Zone:13,NAD83)
Easting: Northing:

PERMIT TO USE AN EXISTING WELL

ISSUANCE OF THIS PERMIT DOES NOT CONFER A WATER RIGHT

CONDITIONS OF APPROVAL

1) This well shall be used in such a way as to cause no material injury to existing water rights. The issuance of this permit does not ensure that no injury will occur to another vested water right or preclude another owner of a vested water right from seeking relief in a civil court action.
2) The construction of this well shall be in compliance with the Water Well Construction Rules 2 CCR 402-2, unless approval of a variance has been granted by the State Board of Examiners of Water Well Construction and Pump Installation Contractors in accordance with Rule 18.
3) Approved pursuant to CRS 37-92-602(3)(b)(I) for uses as described in CRS 37-92-602(1)(f). Use of this well is limited to monitoring water levels and/or water quality sampling.
4) Approved for the use of an existing well acknowledged for construction under monitoring hole notice MH-55511, and known as B-104(P).
5) This well must be equipped with a locking cap or seal to prevent well contamination or possible hazards as an open well. The well must be kept capped and locked at all times except during sampling or measuring.
6) Records of water level measurements and water quality analyses shall be maintained by the well owner and submitted to the Division of Water Resources upon request.
7) Upon conclusion of the monitoring program the well owner shall plug this well in accordance with Rule 16 of the Water Well Construction Rules. A Well Abandonment Report must be completed and submitted to the Division of Water Resources within 60 days of plugging.
8) The owner shall mark the well in a conspicuous place with the well permit number and name of aquifer as appropriate, and shall take necessary means and precautions to preserve these markings.
9) This well must have been constructed by or under the supervision of a licensed well driller or other authorized individual according to the Water Well Construction Rules.
10) This well must be located not more than 200 feet from the location specified on this permit.

NOTE: Issuance of this permit does not guarantee that this well can be converted to a production well under a future permit. Additionally, pursuant to Rule 14.2 of the Water Well Construction Rules (2 CCR 402-2), monitoring holes constructed pursuant to a monitoring hole notice shall not be converted to a production well. (Upon obtaining a permit from the State Engineer, a monitoring hole may be converted to a monitoring well, recovery well for remediation of the aquifer, or a dewatering system for dewatering the aquifer.)

APPROVED
DG2

Dick Wolfe by
State Engineer

Debbie Gonzales
By

Receipt No. 3676322B DATE ISSUED 10-21-2016 EXPIRATION DATE N/A

Form No. GWS-25

OFFICE OF THE STATE ENGINEER
COLORADO DIVISION OF WATER RESOURCES

818 Centennial Bldg., 1313 Sherman St., Denver, Colorado 80203
(303) 866-3581

B-108(P)

EXST

WELL PERMIT NUMBER 303303 -_____-____
DIV. 1 WD 5 DES. BASIN MD

APPLICANT

CITY OF THORNTON
C/O EDUARDO MORENO
12450 WASHINGTON ST
THORNTON, CO 80241-

(720) 977-6272

APPROVED WELL LOCATION
ADAMS COUNTY
NW 1/4 NW 1/4 Section 23
Township 2 S Range 68 W Sixth P.M.

DISTANCES FROM SECTION LINES
260 Ft. from North Section Line
540 Ft. from West Section Line

UTM COORDINATES (Meters,Zone:13,NAD83)
Easting: Northing:

PERMIT TO USE AN EXISTING WELL

ISSUANCE OF THIS PERMIT DOES NOT CONFER A WATER RIGHT

CONDITIONS OF APPROVAL

1) This well shall be used in such a way as to cause no material injury to existing water rights. The issuance of this permit does not ensure that no injury will occur to another vested water right or preclude another owner of a vested water right from seeking relief in a civil court action.
2) The construction of this well shall be in compliance with the Water Well Construction Rules 2 CCR 402-2, unless approval of a variance has been granted by the State Board of Examiners of Water Well Construction and Pump Installation Contractors in accordance with Rule 18.
3) Approved pursuant to CRS 37-92-602(3)(b)(I) for uses as described in CRS 37-92-602(1)(f). Use of this well is limited to monitoring water levels and/or water quality sampling.
4) Approved for the use of an existing well acknowledged for construction under monitoring hole notice MH-55511, and known as B-108(P).
5) This well must be equipped with a locking cap or seal to prevent well contamination or possible hazards as an open well. The well must be kept capped and locked at all times except during sampling or measuring.
6) Records of water level measurements and water quality analyses shall be maintained by the well owner and submitted to the Division of Water Resources upon request.
7) Upon conclusion of the monitoring program the well owner shall plug this well in accordance with Rule 16 of the Water Well Construction Rules. A Well Abandonment Report must be completed and submitted to the Division of Water Resources within 60 days of plugging.
8) The owner shall mark the well in a conspicuous place with the well permit number and name of aquifer as appropriate, and shall take necessary means and precautions to preserve these markings.
9) This well must have been constructed by or under the supervision of a licensed well driller or other authorized individual according to the Water Well Construction Rules.
10) This well must be located not more than 200 feet from the location specified on this permit.

NOTE: Issuance of this permit does not guarantee that this well can be converted to a production well under a future permit. Additionally, pursuant to Rule 14.2 of the Water Well Construction Rules (2 CCR 402-2), monitoring holes constructed pursuant to a monitoring hole notice shall not be converted to a production well. (Upon obtaining a permit from the State Engineer, a monitoring hole may be converted to a monitoring well, recovery well for remediation of the aquifer, or a dewatering system for dewatering the aquifer.)

APPROVED
DG2

Dick Wolfe by
State Engineer

Debbie Gonzales
By

Receipt No. 3676322C DATE ISSUED 10-21-2016 EXPIRATION DATE N/A

APPENDIX F

GROUNDWATER MEASUREMENT DATA AND DATALOGGER INFORMATION

B-101(P)

Piezometer B-101(P)	Electronic Data			Manual Data		
Instrument Serial Number	S/N 446235					
Cable Length[(1)]	29.9					
Ground Surface Elevation (NAVD 88)	5414.1			5414.1		
Piezometer Stick-up[(2)]	2.1			2.1		
Date and Time	Water Height Above Instrument (ft)	Water Depth Below Ground Surface (ft)	Water Surface Elevation (Ft)	Depth Below Top Of PVC	Water Depth Below Ground Surface (ft)	Water Surface Elevation (Ft)
6/28/2016 12:00				15.4	13.3	5400.8
6/29/2016 12:00				18.5	16.4	5397.7
6/30/2016 12:00				20.6	18.5	5395.6
7/1/2016 12:00	9.2	18.6	5395.5	20.6	18.5	5395.6
7/1/2016 18:00	9.3	18.5	5395.6			
7/2/2016 0:00	9.3	18.5	5395.6			
7/2/2016 6:00	9.3	18.5	5395.6			
7/2/2016 12:00	9.3	18.5	5395.6			
7/2/2016 18:00	9.3	18.5	5395.6			
7/3/2016 0:00	9.3	18.5	5395.6			
7/3/2016 6:00	9.3	18.5	5395.6			
7/3/2016 12:00	9.3	18.5	5395.6			
7/3/2016 18:00	9.3	18.5	5395.6			
7/4/2016 0:00	9.3	18.5	5395.6			
7/4/2016 6:00	9.3	18.5	5395.6			
7/4/2016 12:00	9.3	18.5	5395.6			
7/4/2016 18:00	9.3	18.5	5395.6			
7/5/2016 0:00	9.3	18.5	5395.6			
7/5/2016 6:00	9.3	18.5	5395.6			
7/5/2016 12:00	9.3	18.5	5395.6			
7/5/2016 18:00	9.3	18.5	5395.6			
7/6/2016 0:00	9.3	18.5	5395.6			
7/6/2016 6:00	9.4	18.4	5395.7			
7/6/2016 12:00	9.5	18.3	5395.8			
7/6/2016 18:00	9.5	18.3	5395.8			
7/7/2016 0:00	9.4	18.4	5395.7			
7/7/2016 6:00	9.4	18.4	5395.7			
7/7/2016 12:00	9.4	18.4	5395.7			
7/7/2016 18:00	9.3	18.5	5395.6			
7/8/2016 0:00	9.3	18.5	5395.6			
7/8/2016 6:00	9.3	18.5	5395.6			
7/8/2016 12:00	9.3	18.5	5395.6			
7/8/2016 18:00	9.4	18.4	5395.7			
7/9/2016 0:00	9.3	18.5	5395.6			
7/9/2016 6:00	9.3	18.5	5395.6			
7/9/2016 12:00	9.4	18.4	5395.7			
7/9/2016 18:00	9.4	18.4	5395.7			
7/10/2016 0:00	9.3	18.5	5395.6			
7/10/2016 6:00	9.3	18.5	5395.6			
7/10/2016 12:00	9.4	18.4	5395.7			
7/10/2016 18:00	9.5	18.3	5395.8			
7/11/2016 0:00	9.4	18.4	5395.7			
7/11/2016 6:00	9.3	18.5	5395.6			
7/11/2016 12:00	9.4	18.4	5395.7			
7/11/2016 18:00	9.5	18.3	5395.8			
7/12/2016 0:00	9.4	18.4	5395.7			
7/12/2016 6:00	9.3	18.5	5395.6			
7/12/2016 12:00	9.4	18.4	5395.7			
7/12/2016 18:00	9.4	18.4	5395.7			

Piezometer B-101(P)	Electronic Data			Manual Data		
Instrument Serial Number	S/N 446235					
Cable Length[(1)]	29.9					
Ground Surface Elevation (NAVD 88)	5414.1			5414.1		
Piezometer Stick-up[(2)]	2.1			2.1		
7/13/2016 0:00	9.3	18.5	5395.6			
7/13/2016 6:00	9.3	18.5	5395.6			
7/13/2016 12:00	9.3	18.5	5395.6			
7/13/2016 18:00	9.3	18.5	5395.6			
7/14/2016 0:00	9.3	18.5	5395.6			
7/14/2016 6:00	9.2	18.6	5395.5			
7/14/2016 12:00	9.3	18.5	5395.6			
7/14/2016 18:00	9.3	18.5	5395.6			
7/15/2016 0:00	9.3	18.5	5395.6			
7/15/2016 6:00	9.3	18.5	5395.6	20.6	18.5	5395.6
7/15/2016 12:00	9.3	18.5	5395.6			
7/15/2016 18:00	9.3	18.5	5395.6			
7/16/2016 0:00	9.3	18.5	5395.6			
7/16/2016 6:00	9.3	18.5	5395.6			
7/16/2016 12:00	9.3	18.5	5395.6			
7/16/2016 18:00	9.4	18.4	5395.7			
7/17/2016 0:00	9.3	18.5	5395.6			
7/17/2016 6:00	9.3	18.5	5395.6			
7/17/2016 12:00	9.2	18.6	5395.5			
7/17/2016 18:00	9.3	18.5	5395.6			
7/18/2016 0:00	9.2	18.6	5395.5			
7/18/2016 6:00	9.2	18.6	5395.5			
7/18/2016 12:00	9.3	18.5	5395.6			
7/18/2016 18:00	9.2	18.6	5395.5			
7/19/2016 0:00	9.2	18.6	5395.5			
7/19/2016 6:00	9.3	18.5	5395.6			
7/19/2016 12:00	9.3	18.5	5395.6			
7/19/2016 18:00	9.3	18.5	5395.6			
7/20/2016 0:00	9.3	18.5	5395.6			
7/20/2016 6:00	9.3	18.5	5395.6			
7/20/2016 12:00	9.3	18.5	5395.6			
7/20/2016 18:00	9.3	18.5	5395.6			
7/21/2016 0:00	9.3	18.5	5395.6			
7/21/2016 6:00	9.2	18.6	5395.5			
7/21/2016 12:00	9.3	18.5	5395.6			
7/21/2016 18:00	9.3	18.5	5395.6			
7/22/2016 0:00	9.2	18.6	5395.5			
7/22/2016 6:00	9.3	18.5	5395.6			
7/22/2016 12:00	9.3	18.6	5395.6			
7/22/2016 18:00	9.3	18.5	5395.6			
7/23/2016 0:00	9.3	18.5	5395.6			
7/23/2016 6:00	9.3	18.5	5395.6			
7/23/2016 12:00	9.3	18.5	5395.6			
7/23/2016 18:00	9.3	18.5	5395.6			
7/24/2016 0:00	9.3	18.5	5395.6			
7/24/2016 6:00	9.2	18.6	5395.5			
7/24/2016 12:00	9.3	18.5	5395.6			
7/24/2016 18:00	9.2	18.6	5395.5			
7/25/2016 0:00	9.2	18.6	5395.5			
7/25/2016 6:00	9.2	18.6	5395.5			
7/25/2016 12:00	9.2	18.6	5395.5			

Piezometer B-101(P)	Electronic Data			Manual Data		
Instrument Serial Number	S/N 446235					
Cable Length[(1)]	29.9					
Ground Surface Elevation (NAVD 88)	5414.1			5414.1		
Piezometer Stick-up[(2)]	2.1			2.1		
7/25/2016 18:00	9.3	18.5	5395.6			
7/26/2016 0:00	9.2	18.6	5395.5			
7/26/2016 6:00	9.3	18.5	5395.6			
7/26/2016 12:00	9.2	18.6	5395.5			
7/26/2016 18:00	9.3	18.5	5395.6			
7/27/2016 0:00	9.3	18.6	5395.6			
7/27/2016 6:00	9.2	18.6	5395.5			
7/27/2016 12:00	9.2	18.6	5395.5			
7/27/2016 18:00	9.3	18.5	5395.6			
7/28/2016 0:00	9.2	18.6	5395.5			
7/28/2016 6:00	9.2	18.6	5395.5			
7/28/2016 12:00	9.2	18.6	5395.5			
7/28/2016 18:00	9.2	18.6	5395.5			
7/29/2016 0:00	9.2	18.6	5395.5			
7/29/2016 6:00	9.2	18.6	5395.5			
7/29/2016 12:00	9.2	18.6	5395.5			
7/29/2016 18:00	9.3	18.5	5395.6			
7/30/2016 0:00	9.2	18.6	5395.5			
7/30/2016 6:00	9.3	18.5	5395.6			
7/30/2016 12:00	9.3	18.5	5395.6			
7/30/2016 18:00	9.3	18.5	5395.6			
7/31/2016 0:00	9.3	18.5	5395.6			
7/31/2016 6:00	9.2	18.6	5395.5			
7/31/2016 12:00	9.3	18.5	5395.6			
7/31/2016 18:00	9.2	18.6	5395.5			
8/1/2016 0:00	9.2	18.6	5395.5			
8/1/2016 6:00	9.3	18.5	5395.6			
8/1/2016 12:00	9.2	18.6	5395.5			
8/1/2016 18:00	9.3	18.5	5395.6			
8/2/2016 0:00	9.2	18.6	5395.5			
8/2/2016 6:00	9.2	18.6	5395.5			
8/2/2016 12:00	9.2	18.6	5395.5			
8/2/2016 18:00	9.2	18.6	5395.5			
8/3/2016 0:00	9.2	18.6	5395.5			
8/3/2016 6:00	9.2	18.6	5395.5			
8/3/2016 12:00	9.2	18.6	5395.5			
8/3/2016 18:00	9.3	18.5	5395.6			
8/4/2016 0:00	9.2	18.6	5395.5			
8/4/2016 6:00	9.2	18.6	5395.5			
8/4/2016 12:00	9.2	18.6	5395.5			
8/4/2016 18:00	9.2	18.6	5395.5			
8/5/2016 0:00	9.2	18.6	5395.5			
8/5/2016 6:00	9.2	18.6	5395.5			
8/5/2016 12:00	9.2	18.6	5395.5			
8/5/2016 18:00	9.2	18.6	5395.5			
8/6/2016 0:00	9.2	18.6	5395.5			
8/6/2016 6:00	9.2	18.6	5395.5			
8/6/2016 12:00	9.2	18.6	5395.5			
8/6/2016 18:00	9.3	18.5	5395.6			
8/7/2016 0:00	9.2	18.6	5395.5			
8/7/2016 6:00	9.2	18.6	5395.5			

Piezometer B-101(P)	Electronic Data			Manual Data		
Instrument Serial Number	S/N 446235					
Cable Length[(1)]	29.9					
Ground Surface Elevation (NAVD 88)	5414.1			5414.1		
Piezometer Stick-up[(2)]	2.1			2.1		
8/7/2016 12:00	9.2	18.6	5395.5			
8/7/2016 18:00	9.3	18.5	5395.6			
8/8/2016 0:00	9.2	18.6	5395.5			
8/8/2016 6:00	9.2	18.6	5395.5			
8/8/2016 12:00	9.2	18.6	5395.5			
8/8/2016 18:00	9.3	18.5	5395.6			
8/9/2016 0:00	9.3	18.5	5395.6			
8/9/2016 6:00	9.3	18.5	5395.6			
8/9/2016 12:00	9.3	18.5	5395.6			
8/9/2016 18:00	9.3	18.5	5395.6			
8/10/2016 0:00	9.3	18.5	5395.6			
8/10/2016 6:00	9.3	18.5	5395.6			
8/10/2016 12:00	9.3	18.5	5395.6			
8/10/2016 18:00	9.3	18.5	5395.6			
8/11/2016 0:00	9.3	18.5	5395.6			
8/11/2016 6:00	9.2	18.6	5395.5			
8/11/2016 12:00	9.2	18.6	5395.5			
8/11/2016 18:00	9.3	18.5	5395.6			
8/12/2016 0:00	9.2	18.6	5395.5			
8/12/2016 6:00	9.2	18.6	5395.5	20.7	18.6	5395.5
8/12/2016 12:00	9.2	18.6	5395.5			
8/12/2016 18:00	9.3	18.5	5395.6			
8/13/2016 0:00	9.2	18.6	5395.5			
8/13/2016 6:00	9.3	18.5	5395.6			
8/13/2016 12:00	9.2	18.6	5395.5			
8/13/2016 18:00	9.3	18.5	5395.6			
8/14/2016 0:00	9.2	18.6	5395.5			
8/14/2016 6:00	9.3	18.5	5395.6			
8/14/2016 12:00	9.2	18.6	5395.5			
8/14/2016 18:00	9.3	18.5	5395.6			
8/15/2016 0:00	9.3	18.5	5395.6			
8/15/2016 6:00	9.3	18.5	5395.6			
8/15/2016 12:00	9.3	18.5	5395.6			
8/15/2016 18:00	9.3	18.5	5395.6			
8/16/2016 0:00	9.3	18.5	5395.6			
8/16/2016 6:00	9.2	18.6	5395.5			
8/16/2016 12:00	9.2	18.6	5395.5			
8/16/2016 18:00	9.3	18.5	5395.6			
8/17/2016 0:00	9.2	18.6	5395.5			
8/17/2016 6:00	9.3	18.5	5395.6			
8/17/2016 12:00	9.3	18.5	5395.6			
8/17/2016 18:00	9.3	18.5	5395.6			
8/18/2016 0:00	9.3	18.5	5395.6			
8/18/2016 6:00	9.3	18.5	5395.6			
8/18/2016 12:00	9.3	18.5	5395.6			
8/18/2016 18:00	9.3	18.5	5395.6			
8/19/2016 0:00	9.2	18.6	5395.5			
8/19/2016 6:00	9.3	18.5	5395.6			
8/19/2016 12:00	9.3	18.5	5395.6			
8/19/2016 18:00	9.2	18.6	5395.5			
8/20/2016 0:00	9.2	18.6	5395.5			

Piezometer B-101(P)	Electronic Data			Manual Data		
Instrument Serial Number	S/N 446235					
Cable Length[(1)]	29.9					
Ground Surface Elevation (NAVD 88)	5414.1			5414.1		
Piezometer Stick-up[(2)]	2.1			2.1		
8/20/2016 6:00	9.2	18.6	5395.5			
8/20/2016 12:00	9.3	18.5	5395.6			
8/20/2016 18:00	9.3	18.5	5395.6			
8/21/2016 0:00	9.3	18.5	5395.6			
8/21/2016 6:00	9.3	18.5	5395.6			
8/21/2016 12:00	9.3	18.5	5395.6			
8/21/2016 18:00	9.3	18.5	5395.6			
8/22/2016 0:00	9.3	18.5	5395.6			
8/22/2016 6:00	9.3	18.5	5395.6			
8/22/2016 12:00	9.3	18.5	5395.6			
8/22/2016 18:00	9.3	18.5	5395.6			
8/23/2016 0:00	9.3	18.5	5395.6			
8/23/2016 6:00	9.3	18.5	5395.6			
8/23/2016 12:00	9.3	18.5	5395.6			
8/23/2016 18:00	9.3	18.5	5395.6			
8/24/2016 0:00	9.2	18.6	5395.5			
8/24/2016 6:00	9.3	18.5	5395.6			
8/24/2016 12:00	9.2	18.6	5395.5			
8/24/2016 18:00	9.2	18.6	5395.5			
8/25/2016 0:00	9.3	18.5	5395.6			
8/25/2016 6:00	9.2	18.6	5395.5			
8/25/2016 12:00	9.2	18.6	5395.5			
8/25/2016 18:00	9.3	18.5	5395.6			
8/26/2016 0:00	9.3	18.5	5395.6			
8/26/2016 6:00	9.3	18.5	5395.6			
8/26/2016 12:00	9.3	18.5	5395.6			
8/26/2016 18:00	9.3	18.5	5395.6			
8/27/2016 0:00	9.3	18.5	5395.6			
8/27/2016 6:00	9.3	18.5	5395.6			
8/27/2016 12:00	9.4	18.4	5395.7			
8/27/2016 18:00	9.3	18.5	5395.6			
8/28/2016 0:00	9.3	18.5	5395.6			
8/28/2016 6:00	9.3	18.5	5395.6			
8/28/2016 12:00	9.3	18.5	5395.6			
8/28/2016 18:00	9.3	18.5	5395.6			
8/29/2016 0:00	9.3	18.5	5395.6			
8/29/2016 6:00	9.3	18.5	5395.6			
8/29/2016 12:00	9.3	18.5	5395.6			
8/29/2016 18:00	9.3	18.5	5395.6			
8/30/2016 0:00	9.3	18.5	5395.6			
8/30/2016 6:00	9.3	18.5	5395.6			
8/30/2016 12:00	9.3	18.5	5395.6			
8/30/2016 18:00	9.3	18.5	5395.6			
8/31/2016 0:00	9.3	18.5	5395.6			
8/31/2016 6:00	9.3	18.5	5395.6			
8/31/2016 12:00	9.3	18.5	5395.6			
8/31/2016 18:00	9.3	18.5	5395.6			
9/1/2016 0:00	9.3	18.5	5395.6			
9/1/2016 6:00	9.3	18.5	5395.6			
9/1/2016 12:00	9.3	18.5	5395.6			
9/1/2016 18:00	9.4	18.4	5395.7			

Piezometer B-101(P)	Electronic Data			Manual Data		
Instrument Serial Number	S/N 446235					
Cable Length[(1)]	29.9					
Ground Surface Elevation (NAVD 88)	5414.1			5414.1		
Piezometer Stick-up[(2)]	2.1			2.1		
9/2/2016 0:00	9.4	18.4	5395.7			
9/2/2016 6:00	9.4	18.4	5395.7			
9/2/2016 12:00	9.4	18.5	5395.7			
9/2/2016 18:00	9.4	18.4	5395.7			
9/3/2016 0:00	9.4	18.4	5395.7			
9/3/2016 6:00	9.4	18.4	5395.7			
9/3/2016 12:00	9.4	18.4	5395.7			
9/3/2016 18:00	9.4	18.4	5395.7			
9/4/2016 0:00	9.4	18.4	5395.7			
9/4/2016 6:00	9.4	18.4	5395.7			
9/4/2016 12:00	9.4	18.4	5395.7			
9/4/2016 18:00	9.5	18.3	5395.8			
9/5/2016 0:00	9.4	18.4	5395.7			
9/5/2016 6:00	9.4	18.4	5395.7			
9/5/2016 12:00	9.4	18.4	5395.7			
9/5/2016 18:00	9.4	18.4	5395.7			
9/6/2016 0:00	9.4	18.4	5395.7			
9/6/2016 6:00	9.3	18.5	5395.6			
9/6/2016 12:00	9.3	18.5	5395.6			
9/6/2016 18:00	9.4	18.4	5395.7			
9/7/2016 0:00	9.4	18.4	5395.7			
9/7/2016 6:00	9.4	18.4	5395.7			
9/7/2016 12:00	9.3	18.5	5395.6			
9/7/2016 18:00	9.4	18.4	5395.7			
9/8/2016 0:00	9.4	18.4	5395.7			
9/8/2016 6:00	9.4	18.4	5395.7			
9/8/2016 12:00	9.4	18.4	5395.7			
9/8/2016 18:00	9.4	18.4	5395.7			
9/9/2016 0:00	9.4	18.4	5395.7			
9/9/2016 6:00	9.4	18.4	5395.7			
9/9/2016 12:00	9.3	18.5	5395.6			
9/9/2016 18:00	9.3	18.5	5395.6			
9/10/2016 0:00	9.3	18.5	5395.6			
9/10/2016 6:00	9.3	18.5	5395.6			
9/10/2016 12:00	9.3	18.5	5395.6			
9/10/2016 18:00	9.4	18.4	5395.7			
9/11/2016 0:00	9.4	18.4	5395.7			
9/11/2016 6:00	9.4	18.4	5395.7			
9/11/2016 12:00	9.4	18.4	5395.7			
9/11/2016 18:00	9.5	18.3	5395.8			
9/12/2016 0:00	9.4	18.4	5395.7			
9/12/2016 6:00	9.4	18.4	5395.7			
9/12/2016 12:00	9.4	18.4	5395.7			
9/12/2016 18:00	9.4	18.4	5395.7			
9/13/2016 0:00	9.3	18.5	5395.6			
9/13/2016 6:00	9.3	18.5	5395.6	20.6	18.5	5395.6
9/13/2016 12:00	9.3	18.5	5395.6			
9/14/2016 0:00	9.3	18.5	5395.6			
9/14/2016 12:00	9.4	18.4	5395.7			
9/15/2016 0:00	9.4	18.4	5395.7			
9/15/2016 12:00	9.4	18.4	5395.7			

Piezometer B-101(P)	Electronic Data			Manual Data		
Instrument Serial Number	S/N 446235					
Cable Length[(1)]	29.9					
Ground Surface Elevation (NAVD 88)	5414.1			5414.1		
Piezometer Stick-up[(2)]	2.1			2.1		
9/16/2016 0:00	9.4	18.4	5395.7			
9/16/2016 12:00	9.3	18.5	5395.6			
9/17/2016 0:00	9.3	18.5	5395.6			
9/17/2016 12:00	9.3	18.5	5395.6			
9/18/2016 0:00	9.4	18.4	5395.7			
9/18/2016 12:00	9.4	18.4	5395.7			
9/19/2016 0:00	9.3	18.5	5395.6			
9/19/2016 12:00	9.3	18.5	5395.6			
9/20/2016 0:00	9.3	18.5	5395.6			
9/20/2016 12:00	9.3	18.5	5395.6			
9/21/2016 0:00	9.3	18.5	5395.6			
9/21/2016 12:00	9.3	18.5	5395.6			
9/22/2016 0:00	9.4	18.4	5395.7			
9/22/2016 12:00	9.3	18.5	5395.6			
9/23/2016 0:00	9.4	18.4	5395.7			
9/23/2016 12:00	9.4	18.4	5395.7			
9/24/2016 0:00	9.3	18.5	5395.6			
9/24/2016 12:00	9.3	18.5	5395.6			
9/25/2016 0:00	9.2	18.6	5395.5			
9/25/2016 12:00	9.2	18.6	5395.5			
9/26/2016 0:00	9.2	18.6	5395.5			
9/26/2016 12:00	9.2	18.6	5395.5			
9/27/2016 0:00	9.2	18.6	5395.5			
9/27/2016 12:00	9.3	18.5	5395.6			
9/28/2016 0:00	9.3	18.5	5395.6			
9/28/2016 12:00	9.2	18.6	5395.5			
9/29/2016 0:00	9.2	18.6	5395.5			
9/29/2016 12:00	9.2	18.6	5395.5			
9/30/2016 0:00	9.2	18.6	5395.5			
9/30/2016 12:00	9.2	18.6	5395.5			
10/1/2016 0:00	9.2	18.6	5395.5			
10/1/2016 12:00	9.2	18.6	5395.5			
10/2/2016 0:00	9.2	18.6	5395.5			
10/2/2016 12:00	9.2	18.6	5395.5			
10/3/2016 0:00	9.3	18.5	5395.6			
10/3/2016 12:00	9.4	18.4	5395.7			
10/4/2016 0:00	9.3	18.5	5395.6			
10/4/2016 12:00	9.3	18.5	5395.6			
10/5/2016 0:00	9.2	18.6	5395.5			
10/5/2016 12:00	9.2	18.6	5395.5			
10/6/2016 0:00	9.2	18.6	5395.5			
10/6/2016 12:00	9.1	18.7	5395.4			
10/7/2016 0:00	9.1	18.7	5395.4			
10/7/2016 12:00	9.1	18.7	5395.4			
10/8/2016 0:00	9.1	18.7	5395.4			
10/8/2016 12:00	9.1	18.7	5395.4			
10/9/2016 0:00	9.1	18.7	5395.4			
10/9/2016 12:00	9.1	18.7	5395.4			
10/10/2016 0:00	9.1	18.7	5395.4			
10/10/2016 12:00	9.1	18.7	5395.4			
10/11/2016 0:00	9.2	18.6	5395.5			

Piezometer B-101(P)	Electronic Data			Manual Data		
Instrument Serial Number	S/N 446235					
Cable Length[(1)]	29.9					
Ground Surface Elevation (NAVD 88)	5414.1			5414.1		
Piezometer Stick-up[(2)]	2.1			2.1		
10/11/2016 12:00	9.1	18.7	5395.4			
10/12/2016 0:00	9.1	18.7	5395.4			
10/12/2016 12:00	9.0	18.8	5395.3			
10/13/2016 0:00	9.1	18.7	5395.4			
10/13/2016 12:00	9.1	18.7	5395.4			
10/14/2016 0:00	9.1	18.7	5395.4			
10/14/2016 12:00	9.1	18.7	5395.4			
10/15/2016 0:00	9.2	18.6	5395.5			
10/15/2016 12:00	9.2	18.6	5395.5			
10/16/2016 0:00	9.1	18.7	5395.4			
10/16/2016 12:00	9.2	18.6	5395.5			
10/17/2016 0:00	9.2	18.6	5395.5			
10/17/2016 12:00	9.2	18.6	5395.5			
10/18/2016 0:00	9.1	18.7	5395.4			
10/18/2016 12:00	9.0	18.8	5395.3			
10/19/2016 0:00	9.0	18.8	5395.3			
10/19/2016 12:00	9.0	18.8	5395.3			
10/20/2016 0:00	8.9	18.9	5395.2			
10/20/2016 12:00	9.0	18.8	5395.3			
10/21/2016 0:00	9.0	18.8	5395.3			
10/21/2016 12:00	9.0	18.8	5395.3			
10/22/2016 0:00	9.1	18.7	5395.4			
10/22/2016 12:00	9.1	18.7	5395.4			
10/23/2016 0:00	9.0	18.8	5395.3			
10/23/2016 12:00	9.0	18.8	5395.3			
10/24/2016 0:00	9.0	18.8	5395.3			
10/24/2016 12:00	9.0	18.8	5395.3			
10/25/2016 0:00	9.0	18.8	5395.3			
10/25/2016 12:00	9.0	18.8	5395.3			
10/26/2016 0:00	8.9	18.9	5395.2			
10/26/2016 12:00	8.9	18.9	5395.2			
10/27/2016 0:00	8.9	18.9	5395.2			
10/27/2016 12:00	8.9	18.9	5395.2			
10/28/2016 0:00	9.0	18.8	5395.3			
10/28/2016 12:00	9.0	18.8	5395.3			
10/29/2016 0:00	9.0	18.8	5395.3			
10/29/2016 12:00	8.9	18.9	5395.2			
10/30/2016 0:00	8.9	18.9	5395.2			
10/30/2016 12:00	8.9	18.9	5395.2			
10/31/2016 0:00	9.0	18.8	5395.3			
10/31/2016 12:00	9.0	18.8	5395.3			
11/1/2016 0:00	8.9	18.9	5395.2			
11/1/2016 12:00	8.9	18.9	5395.2			
11/2/2016 0:00	8.8	19.0	5395.1			
11/2/2016 12:00	8.8	19.0	5395.1			
11/3/2016 0:00	8.8	19.0	5395.1			
11/3/2016 12:00	8.7	19.1	5395.0			
11/4/2016 0:00	8.7	19.1	5395.0			
11/4/2016 12:00	8.7	19.1	5395.0			
11/5/2016 0:00	8.8	19.0	5395.1			
11/5/2016 12:00	8.8	19.0	5395.1			

Piezometer B-101(P)	Electronic Data			Manual Data		
Instrument Serial Number	S/N 446235					
Cable Length[(1)]	29.9					
Ground Surface Elevation (NAVD 88)	5414.1			5414.1		
Piezometer Stick-up[(2)]	2.1			2.1		
11/6/2016 0:00	8.8	19.0	5395.1			
11/6/2016 11:00	8.8	19.0	5395.1			
11/6/2016 23:00	8.7	19.1	5395.0			
11/7/2016 11:00	8.7	19.1	5395.0			
11/7/2016 23:00	8.6	19.2	5394.9			
11/8/2016 11:00	8.6	19.2	5394.9			
11/8/2016 23:00	8.6	19.2	5394.9			
11/9/2016 11:00	8.6	19.2	5394.9			
11/9/2016 23:00	8.6	19.2	5394.9			
11/10/2016 11:00	8.5	19.3	5394.8			
11/10/2016 23:00	8.5	19.3	5394.8			
11/11/2016 11:00	8.5	19.3	5394.8			
11/11/2016 23:00	8.5	19.3	5394.8			
11/12/2016 11:00	8.5	19.3	5394.8			
11/12/2016 23:00	8.6	19.2	5394.9			
11/13/2016 11:00	8.5	19.3	5394.8			
11/13/2016 23:00	8.5	19.3	5394.8			
11/14/2016 11:00	8.5	19.3	5394.8			
11/14/2016 23:00	8.5	19.3	5394.8			
11/15/2016 11:00	8.4	19.4	5394.7			
11/15/2016 23:00	8.5	19.3	5394.8			
11/16/2016 11:00	8.5	19.3	5394.8	21.3	19.2	5394.9

Notes:

1) Depth from top of PVC casing to instrument installation location.

2) Vertical distance from ground surface elevation to top of PVC casing.

3) Collected data was rounded to the nearest 0.1 foot for presentation purposes. Some rounding error may be present.

Calibration Report

In-Situ Inc.
221 East Lincoln Avenue, Fort Collins, CO 80524 USA
1-970-498-1500, 1-800-446-7488, FAX: 1-970-498-1598
Visit us at www.in-situ.com

Report Number: **20160218028 39-446235**

Instrument Details:

Instrument Model:	**Rugged TROLL 100** B-101(P)
Full Scale Depth Range:	**0- 100 Ft (0- 30 m)**
Serial Number:	**446235**
Hardware Version:	0
Firmware Version:	1.02

Calibration Details:

Calibration Result:	**PASS**
Calibration Date:	2016-02-18 02:08:39 (UTC)
Nominal Range of Applied Temperature:	0 C to +50 C
Temperature Accuracy Specification:	+/- 0.3 C From 0 C to +50 C
Nominal Range of Applied Pressure:	7 PSI - 58 PSI Absolute
Pressure Accuracy Specification:	Typical +/-0.1% FS, Maximum +/-0.3% FS

Post-Calibration Check:

Parameter	Applied	Reported	Deviation	Unit
Depth	100.3340	100.3305	-0.0035	FT
Depth	61.1176	61.1152	-0.0024	FT
Depth	21.9039	21.9244	0.0205	FT
Temperature	19.9800	19.9856	0.0056	C

Calibration Procedures and Equipment Used:

Manu MENSOR Model 600 SerialNo 621384
Manu Agilent Model 53131A-010 SerialNo MY40012869
Manu Instrulab Model 406X-0031-01 SerialNo 31098-2
Manu Instrulab Model 3312A-14-15-24 SerialNo 31139

Notes:

1. Standards used in this calibration are traceable to the National Institute of Standards and Technology.
2. This calibration report shall not be reproduced, except in full, without the written approval of In-Situ, Inc.
3. Pressure calibration is conducted in units of PSI Absolute.
4. The total range of applied pressure includes pressure due to both the water column and 1 bar of atmosphere.
5. The pressure accuracy specification is in terms of the full-scale capability of the pressure sensor (i.e. maximum water depth + 1 bar atmosphere).
6. The Post-Calibration data is expressed, for convenience, in terms of water depth. An ambient barometric pressure of 1 bar is assumed.
7. Conversion factors: 2.30666 FT/PSI, 14.50377 PSI/bar.

Performed By: WR

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B-104(P)

Piezometer B-104(P)	Electronic Data			Manual Data		
Instrument Serial Number	S/N 446258					
Cable Length[(1)]	52.8					
Ground Surface Elevation (NAVD 88)	5405.6			5405.6		
Piezometer Stick-up[(2)]	2.4			2.4		
Date and Time	Water Height Above Instrument (ft)	Water Depth Below Ground Surface (ft)	Water Surface Elevation (Ft)	Depth Below Top Of PVC	Water Depth Below Ground Surface (ft)	Water Surface Elevation (Ft)
6/28/2016 12:00						
6/29/2016 12:00				38.8	36.4	5369.2
6/30/2016 12:00				40.1	37.7	5367.9
7/1/2016 12:00	11.5	38.9	5366.7	40.0	37.6	5368.0
7/1/2016 18:00	12.6	37.8	5367.8			
7/2/2016 0:00	12.7	37.7	5367.9			
7/2/2016 6:00	12.8	37.6	5368.0			
7/2/2016 12:00	12.8	37.6	5368.0			
7/2/2016 18:00	12.9	37.5	5368.1			
7/3/2016 0:00	12.9	37.5	5368.1			
7/3/2016 6:00	12.9	37.5	5368.1			
7/3/2016 12:00	12.9	37.5	5368.1			
7/3/2016 18:00	12.9	37.5	5368.1			
7/4/2016 0:00	12.9	37.5	5368.1			
7/4/2016 6:00	12.9	37.5	5368.1			
7/4/2016 12:00	12.9	37.5	5368.1			
7/4/2016 18:00	13.0	37.4	5368.2			
7/5/2016 0:00	13.0	37.4	5368.2			
7/5/2016 6:00	13.0	37.4	5368.2			
7/5/2016 12:00	13.0	37.4	5368.2			
7/5/2016 18:00	13.0	37.4	5368.2			
7/6/2016 0:00	13.0	37.4	5368.2			
7/6/2016 6:00	13.0	37.4	5368.2			
7/6/2016 12:00	13.0	37.4	5368.2			
7/6/2016 18:00	13.2	37.2	5368.4			
7/7/2016 0:00	13.1	37.3	5368.3			
7/7/2016 6:00	13.0	37.4	5368.2			
7/7/2016 12:00	13.0	37.4	5368.2			
7/7/2016 18:00	13.0	37.4	5368.2			
7/8/2016 0:00	13.0	37.4	5368.2			
7/8/2016 6:00	12.9	37.5	5368.1			
7/8/2016 12:00	12.9	37.5	5368.1			
7/8/2016 18:00	12.9	37.5	5368.1			
7/9/2016 0:00	12.9	37.5	5368.1			
7/9/2016 6:00	12.9	37.5	5368.1			
7/9/2016 12:00	13.0	37.4	5368.2			
7/9/2016 18:00	13.1	37.3	5368.3			
7/10/2016 0:00	13.0	37.4	5368.2			
7/10/2016 6:00	13.1	37.3	5368.3			
7/10/2016 12:00	13.1	37.3	5368.3			
7/10/2016 18:00	13.2	37.2	5368.4			
7/11/2016 0:00	13.2	37.2	5368.4			
7/11/2016 6:00	13.1	37.3	5368.3			
7/11/2016 12:00	13.0	37.4	5368.2			
7/11/2016 18:00	13.1	37.3	5368.3			
7/12/2016 0:00	13.0	37.4	5368.2			
7/12/2016 6:00	13.0	37.4	5368.2			
7/12/2016 12:00	13.0	37.4	5368.2			
7/12/2016 18:00	13.1	37.3	5368.3			

Piezometer B-104(P)	Electronic Data			Manual Data		
Instrument Serial Number	S/N 446258					
Cable Length[(1)]	52.8					
Ground Surface Elevation (NAVD 88)	5405.6			5405.6		
Piezometer Stick-up[(2)]	2.4			2.4		
7/13/2016 0:00	13.0	37.4	5368.2			
7/13/2016 6:00	13.0	37.4	5368.2			
7/13/2016 12:00	12.9	37.5	5368.1			
7/13/2016 18:00	13.0	37.4	5368.2			
7/14/2016 0:00	12.9	37.5	5368.1			
7/14/2016 6:00	12.9	37.5	5368.1			
7/14/2016 12:00	12.8	37.6	5368.0			
7/14/2016 18:00	12.9	37.5	5368.1			
7/15/2016 0:00	12.9	37.5	5368.1			
7/15/2016 6:00	12.9	37.5	5368.1	39.9	37.5	5368.1
7/15/2016 12:00	10.5	39.9	5365.7			
7/15/2016 18:00	12.2	38.2	5367.4			
7/16/2016 0:00	12.6	37.8	5367.8			
7/16/2016 6:00	12.8	37.6	5368.0			
7/16/2016 12:00	12.9	37.5	5368.1			
7/16/2016 18:00	13.0	37.4	5368.2			
7/17/2016 0:00	12.9	37.5	5368.1			
7/17/2016 6:00	12.9	37.5	5368.1			
7/17/2016 12:00	12.9	37.5	5368.1			
7/17/2016 18:00	12.9	37.5	5368.1			
7/18/2016 0:00	12.8	37.6	5368.0			
7/18/2016 6:00	12.8	37.6	5368.0			
7/18/2016 12:00	12.8	37.6	5368.0			
7/18/2016 18:00	12.9	37.5	5368.1			
7/19/2016 0:00	12.8	37.6	5368.0			
7/19/2016 6:00	12.9	37.5	5368.1			
7/19/2016 12:00	12.9	37.5	5368.1			
7/19/2016 18:00	12.9	37.5	5368.1			
7/20/2016 0:00	12.9	37.5	5368.1			
7/20/2016 6:00	12.9	37.5	5368.1			
7/20/2016 12:00	12.9	37.5	5368.1			
7/20/2016 18:00	12.9	37.5	5368.1			
7/21/2016 0:00	12.9	37.5	5368.1			
7/21/2016 6:00	12.9	37.5	5368.1			
7/21/2016 12:00	12.9	37.5	5368.1			
7/21/2016 18:00	12.9	37.5	5368.1			
7/22/2016 0:00	12.9	37.5	5368.1			
7/22/2016 6:00	12.9	37.5	5368.1			
7/22/2016 12:00	12.9	37.5	5368.1			
7/22/2016 18:00	13.0	37.4	5368.2			
7/23/2016 0:00	13.0	37.4	5368.2			
7/23/2016 6:00	13.0	37.4	5368.2			
7/23/2016 12:00	13.0	37.4	5368.2			
7/23/2016 18:00	13.0	37.4	5368.2			
7/24/2016 0:00	12.9	37.5	5368.1			
7/24/2016 6:00	12.9	37.5	5368.1			
7/24/2016 12:00	12.9	37.5	5368.1			
7/24/2016 18:00	13.0	37.5	5368.2			
7/25/2016 0:00	12.9	37.5	5368.1			
7/25/2016 6:00	12.9	37.5	5368.1			
7/25/2016 12:00	12.9	37.5	5368.1			

Piezometer B-104(P)	Electronic Data			Manual Data		
Instrument Serial Number	S/N 446258					
Cable Length[(1)]	52.8					
Ground Surface Elevation (NAVD 88)	5405.6			5405.6		
Piezometer Stick-up[(2)]	2.4			2.4		
7/25/2016 18:00	13.0	37.4	5368.2			
7/26/2016 0:00	12.9	37.5	5368.1			
7/26/2016 6:00	12.9	37.5	5368.1			
7/26/2016 12:00	12.9	37.5	5368.1			
7/26/2016 18:00	12.9	37.5	5368.1			
7/27/2016 0:00	13.0	37.4	5368.2			
7/27/2016 6:00	12.9	37.5	5368.1			
7/27/2016 12:00	12.9	37.5	5368.1			
7/27/2016 18:00	13.0	37.4	5368.2			
7/28/2016 0:00	12.9	37.5	5368.1			
7/28/2016 6:00	12.9	37.5	5368.1			
7/28/2016 12:00	12.9	37.5	5368.1			
7/28/2016 18:00	12.9	37.5	5368.1			
7/29/2016 0:00	12.9	37.5	5368.1			
7/29/2016 6:00	12.9	37.5	5368.1			
7/29/2016 12:00	12.9	37.5	5368.1			
7/29/2016 18:00	13.0	37.4	5368.2			
7/30/2016 0:00	13.0	37.4	5368.2			
7/30/2016 6:00	13.0	37.4	5368.2			
7/30/2016 12:00	13.0	37.4	5368.2			
7/30/2016 18:00	13.0	37.4	5368.2			
7/31/2016 0:00	13.0	37.4	5368.2			
7/31/2016 6:00	13.0	37.4	5368.2			
7/31/2016 12:00	13.0	37.4	5368.2			
7/31/2016 18:00	13.0	37.4	5368.2			
8/1/2016 0:00	13.0	37.4	5368.2			
8/1/2016 6:00	13.0	37.4	5368.2			
8/1/2016 12:00	13.0	37.4	5368.2			
8/1/2016 18:00	13.0	37.4	5368.2			
8/2/2016 0:00	12.9	37.5	5368.1			
8/2/2016 6:00	12.9	37.5	5368.1			
8/2/2016 12:00	12.9	37.5	5368.1			
8/2/2016 18:00	12.9	37.5	5368.1			
8/3/2016 0:00	12.9	37.5	5368.1			
8/3/2016 6:00	12.9	37.5	5368.1			
8/3/2016 12:00	13.0	37.4	5368.2			
8/3/2016 18:00	13.0	37.4	5368.2			
8/4/2016 0:00	13.0	37.4	5368.2			
8/4/2016 6:00	13.0	37.4	5368.2			
8/4/2016 12:00	12.8	37.6	5368.0			
8/4/2016 18:00	12.9	37.5	5368.1			
8/5/2016 0:00	12.9	37.5	5368.1			
8/5/2016 6:00	12.9	37.5	5368.1			
8/5/2016 12:00	12.9	37.5	5368.1			
8/5/2016 18:00	12.9	37.5	5368.1			
8/6/2016 0:00	12.9	37.5	5368.1			
8/6/2016 6:00	13.0	37.4	5368.2			
8/6/2016 12:00	12.9	37.5	5368.1			
8/6/2016 18:00	13.0	37.4	5368.2			
8/7/2016 0:00	13.0	37.4	5368.2			
8/7/2016 6:00	13.0	37.4	5368.2			

Piezometer B-104(P)	Electronic Data			Manual Data		
Instrument Serial Number	S/N 446258					
Cable Length[(1)]	52.8					
Ground Surface Elevation (NAVD 88)	5405.6			5405.6		
Piezometer Stick-up[(2)]	2.4			2.4		
8/7/2016 12:00	12.9	37.5	5368.1			
8/7/2016 18:00	13.0	37.4	5368.2			
8/8/2016 0:00	13.0	37.4	5368.2			
8/8/2016 6:00	13.0	37.4	5368.2			
8/8/2016 12:00	13.0	37.4	5368.2			
8/8/2016 18:00	13.0	37.4	5368.2			
8/9/2016 0:00	13.0	37.4	5368.2			
8/9/2016 6:00	13.0	37.4	5368.2			
8/9/2016 12:00	13.0	37.4	5368.2			
8/9/2016 18:00	13.0	37.4	5368.2			
8/10/2016 0:00	13.0	37.4	5368.2			
8/10/2016 6:00	13.0	37.4	5368.2			
8/10/2016 12:00	13.0	37.4	5368.2			
8/10/2016 18:00	13.0	37.4	5368.2			
8/11/2016 0:00	13.0	37.4	5368.2			
8/11/2016 6:00	13.0	37.4	5368.2			
8/11/2016 12:00	12.9	37.5	5368.1			
8/11/2016 18:00	13.0	37.4	5368.2			
8/12/2016 0:00	12.9	37.5	5368.1			
8/12/2016 6:00	12.9	37.5	5368.1	40.3	37.9	5367.7
8/12/2016 12:00	12.8	37.6	5368.0			
8/12/2016 18:00	12.9	37.5	5368.1			
8/13/2016 0:00	12.9	37.5	5368.1			
8/13/2016 6:00	12.9	37.5	5368.1			
8/13/2016 12:00	12.9	37.5	5368.1			
8/13/2016 18:00	12.9	37.5	5368.1			
8/14/2016 0:00	12.9	37.5	5368.1			
8/14/2016 6:00	12.9	37.5	5368.1			
8/14/2016 12:00	12.9	37.5	5368.1			
8/14/2016 18:00	13.0	37.4	5368.2			
8/15/2016 0:00	12.9	37.5	5368.1			
8/15/2016 6:00	12.9	37.5	5368.1			
8/15/2016 12:00	12.9	37.5	5368.1			
8/15/2016 18:00	12.9	37.5	5368.1			
8/16/2016 0:00	12.9	37.5	5368.1			
8/16/2016 6:00	12.8	37.6	5368.0			
8/16/2016 12:00	12.8	37.6	5368.0			
8/16/2016 18:00	12.9	37.5	5368.1			
8/17/2016 0:00	12.9	37.5	5368.1			
8/17/2016 6:00	12.9	37.5	5368.1			
8/17/2016 12:00	12.9	37.5	5368.1			
8/17/2016 18:00	13.0	37.5	5368.2			
8/18/2016 0:00	12.9	37.5	5368.1			
8/18/2016 6:00	13.0	37.4	5368.2			
8/18/2016 12:00	12.9	37.5	5368.1			
8/18/2016 18:00	12.9	37.5	5368.1			
8/19/2016 0:00	12.9	37.5	5368.1			
8/19/2016 6:00	12.9	37.5	5368.1			
8/19/2016 12:00	12.9	37.5	5368.1			
8/19/2016 18:00	12.9	37.5	5368.1			
8/20/2016 0:00	12.8	37.6	5368.0			

Piezometer B-104(P)	Electronic Data			Manual Data		
Instrument Serial Number	S/N 446258					
Cable Length[(1)]	52.8					
Ground Surface Elevation (NAVD 88)	5405.6			5405.6		
Piezometer Stick-up[(2)]	2.4			2.4		
8/20/2016 6:00	12.8	37.6	5368.0			
8/20/2016 12:00	12.9	37.5	5368.1			
8/20/2016 18:00	12.9	37.5	5368.1			
8/21/2016 0:00	12.9	37.5	5368.1			
8/21/2016 6:00	12.9	37.5	5368.1			
8/21/2016 12:00	12.9	37.5	5368.1			
8/21/2016 18:00	13.0	37.4	5368.2			
8/22/2016 0:00	13.0	37.4	5368.2			
8/22/2016 6:00	13.0	37.4	5368.2			
8/22/2016 12:00	13.0	37.4	5368.2			
8/22/2016 18:00	13.0	37.4	5368.2			
8/23/2016 0:00	13.0	37.4	5368.2			
8/23/2016 6:00	13.0	37.4	5368.2			
8/23/2016 12:00	13.0	37.4	5368.2			
8/23/2016 18:00	12.9	37.5	5368.1			
8/24/2016 0:00	12.9	37.5	5368.1			
8/24/2016 6:00	12.9	37.5	5368.1			
8/24/2016 12:00	12.8	37.6	5368.0			
8/24/2016 18:00	12.8	37.6	5368.0			
8/25/2016 0:00	12.8	37.6	5368.0			
8/25/2016 6:00	12.8	37.6	5368.0			
8/25/2016 12:00	12.8	37.6	5368.0			
8/25/2016 18:00	12.8	37.6	5368.0			
8/26/2016 0:00	12.8	37.6	5368.0			
8/26/2016 6:00	12.9	37.5	5368.1			
8/26/2016 12:00	12.9	37.5	5368.1			
8/26/2016 18:00	12.9	37.5	5368.1			
8/27/2016 0:00	12.9	37.5	5368.1			
8/27/2016 6:00	12.9	37.5	5368.1			
8/27/2016 12:00	12.9	37.5	5368.1			
8/27/2016 18:00	12.9	37.5	5368.1			
8/28/2016 0:00	12.9	37.5	5368.1			
8/28/2016 6:00	12.9	37.5	5368.1			
8/28/2016 12:00	12.9	37.5	5368.1			
8/28/2016 18:00	12.9	37.5	5368.1			
8/29/2016 0:00	12.8	37.6	5368.0			
8/29/2016 6:00	12.8	37.6	5368.0			
8/29/2016 12:00	12.8	37.6	5368.0			
8/29/2016 18:00	12.8	37.6	5368.0			
8/30/2016 0:00	12.8	37.6	5368.0			
8/30/2016 6:00	12.8	37.6	5368.0			
8/30/2016 12:00	12.8	37.6	5368.0			
8/30/2016 18:00	12.8	37.6	5368.0			
8/31/2016 0:00	12.8	37.6	5368.0			
8/31/2016 6:00	12.8	37.6	5368.0			
8/31/2016 12:00	12.8	37.6	5368.0			
8/31/2016 18:00	12.9	37.5	5368.1			
9/1/2016 0:00	12.8	37.6	5368.0			
9/1/2016 6:00	12.9	37.5	5368.1			
9/1/2016 12:00	12.8	37.6	5368.0			
9/1/2016 18:00	12.9	37.5	5368.1			

Piezometer B-104(P)	Electronic Data			Manual Data		
Instrument Serial Number	S/N 446258					
Cable Length[(1)]	52.8					
Ground Surface Elevation (NAVD 88)	5405.6			5405.6		
Piezometer Stick-up[(2)]	2.4			2.4		
9/2/2016 0:00	12.9	37.5	5368.1			
9/2/2016 6:00	12.9	37.5	5368.1			
9/2/2016 12:00	12.9	37.5	5368.1			
9/2/2016 18:00	13.0	37.4	5368.2			
9/3/2016 0:00	12.9	37.5	5368.1			
9/3/2016 6:00	13.0	37.4	5368.2			
9/3/2016 12:00	13.0	37.4	5368.2			
9/3/2016 18:00	13.0	37.4	5368.2			
9/4/2016 0:00	13.0	37.4	5368.2			
9/4/2016 6:00	13.0	37.4	5368.2			
9/4/2016 12:00	13.0	37.4	5368.2			
9/4/2016 18:00	13.1	37.3	5368.3			
9/5/2016 0:00	13.0	37.4	5368.2			
9/5/2016 6:00	13.0	37.4	5368.2			
9/5/2016 12:00	13.0	37.4	5368.2			
9/5/2016 18:00	13.1	37.3	5368.3			
9/6/2016 0:00	13.0	37.4	5368.2			
9/6/2016 6:00	12.9	37.5	5368.1			
9/6/2016 12:00	12.9	37.5	5368.1			
9/6/2016 18:00	12.9	37.5	5368.1			
9/7/2016 0:00	12.9	37.5	5368.1			
9/7/2016 6:00	12.9	37.5	5368.1			
9/7/2016 12:00	12.9	37.5	5368.1			
9/7/2016 18:00	13.0	37.4	5368.2			
9/8/2016 0:00	12.9	37.5	5368.1			
9/8/2016 6:00	12.9	37.5	5368.1			
9/8/2016 12:00	12.9	37.5	5368.1			
9/8/2016 18:00	13.0	37.4	5368.2			
9/9/2016 0:00	12.9	37.5	5368.1			
9/9/2016 6:00	12.9	37.5	5368.1			
9/9/2016 12:00	12.8	37.6	5368.0			
9/9/2016 18:00	12.8	37.6	5368.0			
9/10/2016 0:00	12.7	37.7	5367.9			
9/10/2016 6:00	12.7	37.7	5367.9			
9/10/2016 12:00	12.8	37.6	5368.0			
9/10/2016 18:00	12.9	37.5	5368.1			
9/11/2016 0:00	12.9	37.5	5368.1			
9/11/2016 6:00	12.9	37.5	5368.1			
9/11/2016 12:00	12.9	37.5	5368.1			
9/11/2016 18:00	13.0	37.4	5368.2			
9/12/2016 0:00	13.0	37.4	5368.2			
9/12/2016 6:00	13.0	37.4	5368.2			
9/12/2016 12:00	12.9	37.5	5368.1			
9/12/2016 18:00	12.9	37.5	5368.1			
9/13/2016 0:00	12.8	37.6	5368.0			
9/13/2016 6:00	12.8	37.6	5368.0	40.1	37.7	5367.9
9/13/2016 12:00	12.8	37.6	5368.0			
9/14/2016 0:00	12.8	37.6	5368.0			
9/14/2016 12:00	12.9	37.5	5368.1			
9/15/2016 0:00	12.9	37.5	5368.1			
9/15/2016 12:00	12.9	37.5	5368.1			

Piezometer B-104(P)	Electronic Data			Manual Data		
Instrument Serial Number	S/N 446258					
Cable Length[(1)]	52.8					
Ground Surface Elevation (NAVD 88)	5405.6			5405.6		
Piezometer Stick-up[(2)]	2.4			2.4		
9/16/2016 0:00	12.9	37.5	5368.1			
9/16/2016 12:00	12.8	37.6	5368.0			
9/17/2016 0:00	12.9	37.5	5368.1			
9/17/2016 12:00	12.9	37.5	5368.1			
9/18/2016 0:00	12.9	37.5	5368.1			
9/18/2016 12:00	12.9	37.5	5368.1			
9/19/2016 0:00	12.9	37.5	5368.1			
9/19/2016 12:00	12.8	37.6	5368.0			
9/20/2016 0:00	12.9	37.5	5368.1			
9/20/2016 12:00	12.8	37.6	5368.0			
9/21/2016 0:00	12.9	37.5	5368.1			
9/21/2016 12:00	12.9	37.5	5368.1			
9/22/2016 0:00	12.9	37.5	5368.1			
9/22/2016 12:00	12.9	37.5	5368.1			
9/23/2016 0:00	13.0	37.4	5368.2			
9/23/2016 12:00	13.1	37.3	5368.3			
9/24/2016 0:00	13.0	37.4	5368.2			
9/24/2016 12:00	12.9	37.5	5368.1			
9/25/2016 0:00	12.8	37.6	5368.0			
9/25/2016 12:00	12.7	37.7	5367.9			
9/26/2016 0:00	12.7	37.7	5367.9			
9/26/2016 12:00	12.7	37.7	5367.9			
9/27/2016 0:00	12.7	37.7	5367.9			
9/27/2016 12:00	12.8	37.6	5368.0			
9/28/2016 0:00	12.8	37.6	5368.0			
9/28/2016 12:00	12.7	37.7	5367.9			
9/29/2016 0:00	12.8	37.6	5368.0			
9/29/2016 12:00	12.8	37.6	5368.0			
9/30/2016 0:00	12.8	37.6	5368.0			
9/30/2016 12:00	12.8	37.6	5368.0			
10/1/2016 0:00	12.9	37.5	5368.1			
10/1/2016 12:00	12.9	37.5	5368.1			
10/2/2016 0:00	12.9	37.5	5368.1			
10/2/2016 12:00	12.9	37.5	5368.1			
10/3/2016 0:00	13.0	37.4	5368.2			
10/3/2016 12:00	13.2	37.2	5368.4			
10/4/2016 0:00	13.1	37.3	5368.3			
10/4/2016 12:00	13.1	37.3	5368.3			
10/5/2016 0:00	13.0	37.4	5368.2			
10/5/2016 12:00	12.9	37.5	5368.1			
10/6/2016 0:00	12.9	37.5	5368.1			
10/6/2016 12:00	12.9	37.5	5368.1			
10/7/2016 0:00	12.8	37.6	5368.0			
10/7/2016 12:00	12.7	37.7	5367.9			
10/8/2016 0:00	12.8	37.6	5368.0			
10/8/2016 12:00	12.7	37.7	5367.9			
10/9/2016 0:00	12.8	37.6	5368.0			
10/9/2016 12:00	12.8	37.6	5368.0			
10/10/2016 0:00	12.9	37.5	5368.1			
10/10/2016 12:00	12.9	37.5	5368.1			
10/11/2016 0:00	12.9	37.5	5368.1			

Piezometer B-104(P)	Electronic Data			Manual Data		
Instrument Serial Number	S/N 446258					
Cable Length[(1)]	52.8					
Ground Surface Elevation (NAVD 88)	5405.6			5405.6		
Piezometer Stick-up[(2)]	2.4			2.4		
10/11/2016 12:00	12.9	37.5	5368.1			
10/12/2016 0:00	12.9	37.5	5368.1			
10/12/2016 12:00	12.7	37.7	5367.9			
10/13/2016 0:00	12.8	37.6	5368.0			
10/13/2016 12:00	12.9	37.5	5368.1			
10/14/2016 0:00	12.9	37.5	5368.1			
10/14/2016 12:00	13.0	37.4	5368.2			
10/15/2016 0:00	13.0	37.4	5368.2			
10/15/2016 12:00	13.0	37.4	5368.2			
10/16/2016 0:00	13.0	37.4	5368.2			
10/16/2016 12:00	13.1	37.3	5368.3			
10/17/2016 0:00	13.0	37.4	5368.2			
10/17/2016 12:00	13.2	37.2	5368.4			
10/18/2016 0:00	13.0	37.4	5368.2			
10/18/2016 12:00	12.9	37.5	5368.1			
10/19/2016 0:00	12.9	37.5	5368.1			
10/19/2016 12:00	12.8	37.6	5368.0			
10/20/2016 0:00	12.7	37.7	5367.9			
10/20/2016 12:00	12.7	37.7	5367.9			
10/21/2016 0:00	12.8	37.6	5368.0			
10/21/2016 12:00	12.8	37.6	5368.0			
10/22/2016 0:00	12.9	37.5	5368.1			
10/22/2016 12:00	12.9	37.5	5368.1			
10/23/2016 0:00	12.9	37.5	5368.1			
10/23/2016 12:00	12.7	37.7	5367.9			
10/24/2016 0:00	12.8	37.6	5368.0			
10/24/2016 12:00	12.8	37.6	5368.0			
10/25/2016 0:00	12.9	37.5	5368.1			
10/25/2016 12:00	12.9	37.5	5368.1			
10/26/2016 0:00	12.8	37.6	5368.0			
10/26/2016 12:00	12.8	37.6	5368.0			
10/27/2016 0:00	12.8	37.6	5368.0			
10/27/2016 12:00	12.8	37.6	5368.0			
10/28/2016 0:00	12.9	37.5	5368.1			
10/28/2016 12:00	12.9	37.5	5368.1			
10/29/2016 0:00	12.9	37.5	5368.1			
10/29/2016 12:00	12.9	37.5	5368.1			
10/30/2016 0:00	12.8	37.6	5368.0			
10/30/2016 12:00	12.8	37.6	5368.0			
10/31/2016 0:00	13.0	37.4	5368.2			
10/31/2016 12:00	13.0	37.4	5368.2			
11/1/2016 0:00	13.0	37.4	5368.2			
11/1/2016 12:00	12.9	37.5	5368.1			
11/2/2016 0:00	12.9	37.5	5368.1			
11/2/2016 12:00	12.7	37.7	5367.9			
11/3/2016 0:00	12.7	37.7	5367.9			
11/3/2016 12:00	12.6	37.8	5367.8			
11/4/2016 0:00	12.7	37.7	5367.9			
11/4/2016 12:00	12.7	37.7	5367.9			
11/5/2016 0:00	12.8	37.6	5368.0			
11/5/2016 12:00	12.8	37.6	5368.0			

Piezometer B-104(P)	Electronic Data			Manual Data		
Instrument Serial Number	S/N 446258					
Cable Length[(1)]	52.8					
Ground Surface Elevation (NAVD 88)	5405.6			5405.6		
Piezometer Stick-up[(2)]	2.4			2.4		
11/6/2016 0:00	12.9	37.5	5368.1			
11/6/2016 11:00	12.9	37.5	5368.1			
11/6/2016 23:00	12.9	37.5	5368.1			
11/7/2016 11:00	12.7	37.7	5367.9			
11/7/2016 23:00	12.7	37.7	5367.9			
11/8/2016 11:00	12.6	37.8	5367.8			
11/8/2016 23:00	12.7	37.7	5367.9			
11/9/2016 11:00	12.7	37.7	5367.9			
11/9/2016 23:00	12.8	37.6	5368.0			
11/10/2016 11:00	12.7	37.7	5367.9			
11/10/2016 23:00	12.7	37.7	5367.9			
11/11/2016 11:00	12.7	37.7	5367.9			
11/11/2016 23:00	12.8	37.6	5368.0			
11/12/2016 11:00	12.8	37.6	5368.0			
11/12/2016 23:00	12.9	37.5	5368.1			
11/13/2016 11:00	12.8	37.6	5368.0			
11/13/2016 23:00	12.8	37.6	5368.0			
11/14/2016 11:00	12.9	37.5	5368.1			
11/14/2016 23:00	12.9	37.5	5368.1			
11/15/2016 11:00	12.9	37.5	5368.1			
11/15/2016 23:00	13.0	37.4	5368.2			
11/16/2016 11:00	13.1	37.3	5368.3	39.7	37.3	5368.3

Notes:

1) Depth from top of PVC casing to instrument installation location.

2) Vertical distance from ground surface elevation to top of PVC casing.

3) Collected data was rounded to the nearest 0.1 foot for presentation purposes. Some rounding error may be present.

In-Situ Inc.

Calibration Report

Report Number: 20160218115210-446258

221 East Lincoln Avenue, Fort Collins, CO 80524 USA
1-970-498-1500, 1-800-446-7488, FAX: 1-970-498-1598
Visit us at www.in-situ.com

Instrument Details:

Instrument Model:	**Rugged TROLL 100** B-104(P)
Full Scale Depth Range:	**0- 100 Ft (0- 30 m)**
Serial Number:	**446258**
Hardware Version:	0
Firmware Version:	1.02

Calibration Details:

Calibration Result:	**PASS**
Calibration Date:	2016-02-18 11:52:10 (UTC)
Nominal Range of Applied Temperature:	0 C to +50 C
Temperature Accuracy Specification:	+/- 0.3 C From 0 C to +50 C
Nominal Range of Applied Pressure:	7 PSI - 58 PSI Absolute
Pressure Accuracy Specification:	Typical +/-0.1% FS, Maximum +/-0.3% FS

Post-Calibration Check:

Parameter	Applied	Reported	Deviation	Unit
Depth	100.3331	100.3183	-0.0148	FT
Depth	61.1162	61.1260	0.0099	FT
Depth	21.9032	21.9049	0.0017	FT
Temperature	18.8500	18.8934	0.0434	C

Calibration Procedures and Equipment Used:

Manu MENSOR Model 600 SerialNo 622741
Manu Agilent Model 53131A-010 SerialNo MY40016413
Manu Instrulab Model 406X-0031-01 SerialNo 31099-2
Manu Instrulab Model 3312A-14-15-24 SerialNo 31140

Notes:

1. Standards used in this calibration are traceable to the National Institute of Standards and Technology.
2. This calibration report shall not be reproduced, except in full, without the written approval of In-Situ, Inc.
3. Pressure calibration is conducted in units of PSI Absolute.
4. The total range of applied pressure includes pressure due to both the water column and 1 bar of atmosphere.
5. The pressure accuracy specification is in terms of the full-scale capability of the pressure sensor (i.e. maximum water depth + 1 bar atmosphere).
6. The Post-Calibration data is expressed, for convenience, in terms of water depth. An ambient barometric pressure of 1 bar is assumed.
7. Conversion factors: 2.30666 FT/PSI, 14.50377 PSI/bar.

Performed By: NJH

Report generated: 2016-02-18 15:16:25 UTC

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B-108(P)

Piezometer B-108(P)	Electronic Data			Manual Data		
Instrument Serial Number	S/N 446260					
Cable Length[(1)]	49.7					
Ground Surface Elevation (NAVD 88)	5407.2			5407.2		
Piezometer Stick-up[(2)]	2.5			2.5		
Date and Time	Water Height Above Instrument (ft)	Water Depth Below Ground Surface (ft)	Water Surface Elevation (Ft)	Depth Below Top Of PVC	Water Depth Below Ground Surface (ft)	Water Surface Elevation (Ft)
6/28/2016 12:00						
6/29/2016 12:00				35.0	32.5	5374.7
6/30/2016 12:00						
7/1/2016 12:00	14.9	32.3	5374.9	34.8	32.3	5374.9
7/1/2016 18:00	15.0	32.2	5375.0			
7/2/2016 0:00	15.0	32.2	5375.0			
7/2/2016 6:00	15.0	32.2	5375.0			
7/2/2016 12:00	14.9	32.3	5374.9			
7/2/2016 18:00	15.0	32.2	5375.0			
7/3/2016 0:00	14.9	32.3	5374.9			
7/3/2016 6:00	15.0	32.2	5375.0			
7/3/2016 12:00	14.9	32.3	5374.9			
7/3/2016 18:00	15.0	32.2	5375.0			
7/4/2016 0:00	15.0	32.2	5375.0			
7/4/2016 6:00	15.0	32.2	5375.0			
7/4/2016 12:00	15.0	32.2	5375.0			
7/4/2016 18:00	15.0	32.2	5375.0			
7/5/2016 0:00	15.0	32.2	5375.0			
7/5/2016 6:00	15.0	32.2	5375.0			
7/5/2016 12:00	15.0	32.2	5375.0			
7/5/2016 18:00	15.0	32.2	5375.0			
7/6/2016 0:00	15.0	32.2	5375.0			
7/6/2016 6:00	15.0	32.2	5375.0			
7/6/2016 12:00	15.1	32.1	5375.1			
7/6/2016 18:00	15.2	32.0	5375.2			
7/7/2016 0:00	15.1	32.1	5375.1			
7/7/2016 6:00	15.0	32.2	5375.0			
7/7/2016 12:00	14.9	32.3	5374.9			
7/7/2016 18:00	15.0	32.2	5375.0			
7/8/2016 0:00	14.9	32.3	5374.9			
7/8/2016 6:00	14.9	32.3	5374.9			
7/8/2016 12:00	14.9	32.3	5374.9			
7/8/2016 18:00	14.9	32.3	5374.9			
7/9/2016 0:00	14.9	32.3	5374.9			
7/9/2016 6:00	14.9	32.3	5374.9			
7/9/2016 12:00	15.0	32.2	5375.0			
7/9/2016 18:00	15.1	32.1	5375.1			
7/10/2016 0:00	15.0	32.2	5375.0			
7/10/2016 6:00	15.0	32.2	5375.0			
7/10/2016 12:00	15.1	32.1	5375.1			
7/10/2016 18:00	15.2	32.0	5375.2			
7/11/2016 0:00	15.1	32.1	5375.1			
7/11/2016 6:00	15.0	32.2	5375.0			
7/11/2016 12:00	15.0	32.2	5375.0			
7/11/2016 18:00	15.1	32.1	5375.1			
7/12/2016 0:00	14.9	32.3	5374.9			
7/12/2016 6:00	15.0	32.2	5375.0			
7/12/2016 12:00	15.0	32.2	5375.0			
7/12/2016 18:00	15.1	32.1	5375.1			

Piezometer B-108(P)	Electronic Data			Manual Data		
Instrument Serial Number	S/N 446260					
Cable Length[(1)]	49.7					
Ground Surface Elevation (NAVD 88)	5407.2			5407.2		
Piezometer Stick-up[(2)]	2.5			2.5		
7/13/2016 0:00	15.0	32.2	5375.0			
7/13/2016 6:00	14.9	32.3	5374.9			
7/13/2016 12:00	14.9	32.3	5374.9			
7/13/2016 18:00	15.0	32.2	5375.0			
7/14/2016 0:00	14.9	32.3	5374.9			
7/14/2016 6:00	14.8	32.4	5374.8			
7/14/2016 12:00	14.8	32.4	5374.8			
7/14/2016 18:00	14.9	32.3	5374.9			
7/15/2016 0:00	14.9	32.3	5374.9			
7/15/2016 6:00	14.9	32.3	5374.9	34.8	32.3	5374.9
7/15/2016 12:00	14.8	32.4	5374.8			
7/15/2016 18:00	14.9	32.4	5374.9			
7/16/2016 0:00	14.9	32.3	5374.9			
7/16/2016 6:00	15.0	32.2	5375.0			
7/16/2016 12:00	15.0	32.2	5375.0			
7/16/2016 18:00	15.1	32.1	5375.1			
7/17/2016 0:00	15.0	32.2	5375.0			
7/17/2016 6:00	14.9	32.3	5374.9			
7/17/2016 12:00	14.9	32.3	5374.9			
7/17/2016 18:00	14.9	32.3	5374.9			
7/18/2016 0:00	14.9	32.3	5374.9			
7/18/2016 6:00	14.8	32.4	5374.8			
7/18/2016 12:00	14.9	32.3	5374.9			
7/18/2016 18:00	14.9	32.3	5374.9			
7/19/2016 0:00	14.9	32.3	5374.9			
7/19/2016 6:00	14.9	32.3	5374.9			
7/19/2016 12:00	14.9	32.3	5374.9			
7/19/2016 18:00	14.9	32.3	5374.9			
7/20/2016 0:00	14.9	32.3	5374.9			
7/20/2016 6:00	14.9	32.3	5374.9			
7/20/2016 12:00	14.9	32.3	5374.9			
7/20/2016 18:00	14.9	32.3	5374.9			
7/21/2016 0:00	14.9	32.3	5374.9			
7/21/2016 6:00	14.9	32.3	5374.9			
7/21/2016 12:00	14.9	32.3	5374.9			
7/21/2016 18:00	14.9	32.3	5374.9			
7/22/2016 0:00	14.9	32.3	5374.9			
7/22/2016 6:00	14.9	32.3	5374.9			
7/22/2016 12:00	14.9	32.3	5374.9			
7/22/2016 18:00	15.0	32.2	5375.0			
7/23/2016 0:00	15.0	32.2	5375.0			
7/23/2016 6:00	15.0	32.2	5375.0			
7/23/2016 12:00	15.0	32.2	5375.0			
7/23/2016 18:00	15.0	32.2	5375.0			
7/24/2016 0:00	14.9	32.3	5374.9			
7/24/2016 6:00	14.9	32.3	5374.9			
7/24/2016 12:00	14.9	32.3	5374.9			
7/24/2016 18:00	14.9	32.3	5374.9			
7/25/2016 0:00	14.8	32.4	5374.8			
7/25/2016 6:00	14.9	32.3	5374.9			
7/25/2016 12:00	14.9	32.3	5374.9			

Piezometer B-108(P)	Electronic Data			Manual Data		
Instrument Serial Number	S/N 446260					
Cable Length[(1)]	49.7					
Ground Surface Elevation (NAVD 88)	5407.2			5407.2		
Piezometer Stick-up[(2)]	2.5			2.5		
7/25/2016 18:00	15.0	32.2	5375.0			
7/26/2016 0:00	14.9	32.3	5374.9			
7/26/2016 6:00	14.9	32.3	5374.9			
7/26/2016 12:00	14.9	32.3	5374.9			
7/26/2016 18:00	14.9	32.3	5374.9			
7/27/2016 0:00	14.9	32.3	5374.9			
7/27/2016 6:00	14.9	32.3	5374.9			
7/27/2016 12:00	14.9	32.3	5374.9			
7/27/2016 18:00	15.0	32.2	5375.0			
7/28/2016 0:00	14.9	32.3	5374.9			
7/28/2016 6:00	14.9	32.3	5374.9			
7/28/2016 12:00	14.9	32.3	5374.9			
7/28/2016 18:00	14.9	32.3	5374.9			
7/29/2016 0:00	14.9	32.3	5374.9			
7/29/2016 6:00	14.9	32.3	5374.9			
7/29/2016 12:00	14.9	32.3	5374.9			
7/29/2016 18:00	15.0	32.2	5375.0			
7/30/2016 0:00	14.9	32.3	5374.9			
7/30/2016 6:00	15.0	32.2	5375.0			
7/30/2016 12:00	15.0	32.2	5375.0			
7/30/2016 18:00	15.1	32.1	5375.1			
7/31/2016 0:00	15.0	32.2	5375.0			
7/31/2016 6:00	15.0	32.2	5375.0			
7/31/2016 12:00	15.0	32.2	5375.0			
7/31/2016 18:00	14.9	32.3	5374.9			
8/1/2016 0:00	14.9	32.3	5374.9			
8/1/2016 6:00	15.0	32.2	5375.0			
8/1/2016 12:00	14.9	32.3	5374.9			
8/1/2016 18:00	15.0	32.2	5375.0			
8/2/2016 0:00	14.9	32.3	5374.9			
8/2/2016 6:00	14.9	32.3	5374.9			
8/2/2016 12:00	14.8	32.4	5374.8			
8/2/2016 18:00	14.9	32.3	5374.9			
8/3/2016 0:00	14.9	32.3	5374.9			
8/3/2016 6:00	15.0	32.2	5375.0			
8/3/2016 12:00	15.0	32.2	5375.0			
8/3/2016 18:00	15.1	32.1	5375.1			
8/4/2016 0:00	15.0	32.2	5375.0			
8/4/2016 6:00	15.0	32.2	5375.0			
8/4/2016 12:00	14.8	32.4	5374.8			
8/4/2016 18:00	14.9	32.3	5374.9			
8/5/2016 0:00	14.9	32.3	5374.9			
8/5/2016 6:00	14.9	32.3	5374.9			
8/5/2016 12:00	14.9	32.3	5374.9			
8/5/2016 18:00	14.9	32.3	5374.9			
8/6/2016 0:00	14.9	32.3	5374.9			
8/6/2016 6:00	15.0	32.3	5375.0			
8/6/2016 12:00	14.9	32.3	5374.9			
8/6/2016 18:00	15.0	32.2	5375.0			
8/7/2016 0:00	15.0	32.2	5375.0			
8/7/2016 6:00	15.0	32.2	5375.0			

Piezometer B-108(P)	Electronic Data			Manual Data		
Instrument Serial Number	S/N 446260					
Cable Length[1]	49.7					
Ground Surface Elevation (NAVD 88)	5407.2			5407.2		
Piezometer Stick-up[2]	2.5			2.5		
8/7/2016 12:00	14.9	32.3	5374.9			
8/7/2016 18:00	15.0	32.2	5375.0			
8/8/2016 0:00	15.0	32.2	5375.0			
8/8/2016 6:00	15.0	32.2	5375.0			
8/8/2016 12:00	14.9	32.3	5374.9			
8/8/2016 18:00	15.1	32.1	5375.1			
8/9/2016 0:00	15.0	32.2	5375.0			
8/9/2016 6:00	15.0	32.2	5375.0			
8/9/2016 12:00	15.0	32.2	5375.0			
8/9/2016 18:00	15.1	32.1	5375.1			
8/10/2016 0:00	15.0	32.2	5375.0			
8/10/2016 6:00	15.0	32.2	5375.0			
8/10/2016 12:00	15.0	32.2	5375.0			
8/10/2016 18:00	15.0	32.2	5375.0			
8/11/2016 0:00	14.9	32.3	5374.9			
8/11/2016 6:00	15.0	32.2	5375.0			
8/11/2016 12:00	14.9	32.3	5374.9			
8/11/2016 18:00	15.0	32.2	5375.0			
8/12/2016 0:00	14.9	32.3	5374.9			
8/12/2016 6:00	14.9	32.3	5374.9	34.9	32.4	5374.8
8/12/2016 12:00	14.8	32.4	5374.8			
8/12/2016 18:00	14.9	32.3	5374.9			
8/13/2016 0:00	14.9	32.3	5374.9			
8/13/2016 6:00	14.9	32.3	5374.9			
8/13/2016 12:00	14.9	32.3	5374.9			
8/13/2016 18:00	15.0	32.2	5375.0			
8/14/2016 0:00	14.9	32.3	5374.9			
8/14/2016 6:00	14.9	32.3	5374.9			
8/14/2016 12:00	14.9	32.3	5374.9			
8/14/2016 18:00	15.0	32.2	5375.0			
8/15/2016 0:00	14.9	32.3	5374.9			
8/15/2016 6:00	14.9	32.3	5374.9			
8/15/2016 12:00	14.9	32.3	5374.9			
8/15/2016 18:00	14.9	32.3	5374.9			
8/16/2016 0:00	14.9	32.3	5374.9			
8/16/2016 6:00	14.9	32.3	5374.9			
8/16/2016 12:00	14.9	32.3	5374.9			
8/16/2016 18:00	14.9	32.3	5374.9			
8/17/2016 0:00	14.9	32.3	5374.9			
8/17/2016 6:00	14.9	32.3	5374.9			
8/17/2016 12:00	14.9	32.3	5374.9			
8/17/2016 18:00	15.0	32.2	5375.0			
8/18/2016 0:00	14.9	32.3	5374.9			
8/18/2016 6:00	15.0	32.2	5375.0			
8/18/2016 12:00	15.0	32.2	5375.0			
8/18/2016 18:00	14.9	32.3	5374.9			
8/19/2016 0:00	14.9	32.3	5374.9			
8/19/2016 6:00	14.9	32.3	5374.9			
8/19/2016 12:00	15.0	32.2	5375.0			
8/19/2016 18:00	14.9	32.3	5374.9			
8/20/2016 0:00	14.8	32.4	5374.8			

Piezometer B-108(P)	Electronic Data			Manual Data		
Instrument Serial Number	S/N 446260					
Cable Length[(1)]	49.7					
Ground Surface Elevation (NAVD 88)	5407.2			5407.2		
Piezometer Stick-up[(2)]	2.5			2.5		
8/20/2016 6:00	14.9	32.3	5374.9			
8/20/2016 12:00	14.9	32.3	5374.9			
8/20/2016 18:00	15.0	32.2	5375.0			
8/21/2016 0:00	14.9	32.3	5374.9			
8/21/2016 6:00	15.0	32.2	5375.0			
8/21/2016 12:00	15.0	32.2	5375.0			
8/21/2016 18:00	15.0	32.2	5375.0			
8/22/2016 0:00	15.0	32.2	5375.0			
8/22/2016 6:00	15.0	32.2	5375.0			
8/22/2016 12:00	15.0	32.2	5375.0			
8/22/2016 18:00	15.0	32.2	5375.0			
8/23/2016 0:00	15.0	32.2	5375.0			
8/23/2016 6:00	15.0	32.2	5375.0			
8/23/2016 12:00	15.0	32.2	5375.0			
8/23/2016 18:00	14.9	32.3	5374.9			
8/24/2016 0:00	14.9	32.3	5374.9			
8/24/2016 6:00	14.9	32.3	5374.9			
8/24/2016 12:00	14.8	32.4	5374.8			
8/24/2016 18:00	14.9	32.3	5374.9			
8/25/2016 0:00	14.9	32.3	5374.9			
8/25/2016 6:00	14.9	32.3	5374.9			
8/25/2016 12:00	14.8	32.4	5374.8			
8/25/2016 18:00	14.9	32.3	5374.9			
8/26/2016 0:00	14.9	32.3	5374.9			
8/26/2016 6:00	15.0	32.2	5375.0			
8/26/2016 12:00	14.9	32.3	5374.9			
8/26/2016 18:00	15.0	32.2	5375.0			
8/27/2016 0:00	15.0	32.2	5375.0			
8/27/2016 6:00	15.0	32.2	5375.0			
8/27/2016 12:00	14.9	32.3	5374.9			
8/27/2016 18:00	15.0	32.2	5375.0			
8/28/2016 0:00	15.0	32.2	5375.0			
8/28/2016 6:00	14.9	32.3	5374.9			
8/28/2016 12:00	14.9	32.3	5374.9			
8/28/2016 18:00	14.9	32.3	5374.9			
8/29/2016 0:00	14.9	32.3	5374.9			
8/29/2016 6:00	14.9	32.3	5374.9			
8/29/2016 12:00	14.8	32.4	5374.8			
8/29/2016 18:00	14.8	32.4	5374.8			
8/30/2016 0:00	14.9	32.3	5374.9			
8/30/2016 6:00	14.8	32.4	5374.8			
8/30/2016 12:00	14.8	32.4	5374.8			
8/30/2016 18:00	14.9	32.3	5374.9			
8/31/2016 0:00	14.9	32.3	5374.9			
8/31/2016 6:00	14.9	32.3	5374.9			
8/31/2016 12:00	14.9	32.3	5374.9			
8/31/2016 18:00	14.9	32.3	5374.9			
9/1/2016 0:00	14.9	32.3	5374.9			
9/1/2016 6:00	14.9	32.3	5374.9			
9/1/2016 12:00	14.9	32.3	5374.9			
9/1/2016 18:00	15.0	32.2	5375.0			

Piezometer B-108(P)	Electronic Data			Manual Data		
Instrument Serial Number	S/N 446260					
Cable Length[(1)]	49.7					
Ground Surface Elevation (NAVD 88)	5407.2			5407.2		
Piezometer Stick-up[(2)]	2.5			2.5		
9/2/2016 0:00	15.0	32.2	5375.0			
9/2/2016 6:00	15.0	32.2	5375.0			
9/2/2016 12:00	15.0	32.2	5375.0			
9/2/2016 18:00	15.1	32.1	5375.1			
9/3/2016 0:00	15.0	32.2	5375.0			
9/3/2016 6:00	15.0	32.2	5375.0			
9/3/2016 12:00	15.0	32.2	5375.0			
9/3/2016 18:00	15.1	32.1	5375.1			
9/4/2016 0:00	15.1	32.1	5375.1			
9/4/2016 6:00	15.1	32.1	5375.1			
9/4/2016 12:00	15.1	32.1	5375.1			
9/4/2016 18:00	15.2	32.0	5375.2			
9/5/2016 0:00	15.1	32.1	5375.1			
9/5/2016 6:00	15.1	32.1	5375.1			
9/5/2016 12:00	15.0	32.2	5375.0			
9/5/2016 18:00	15.1	32.1	5375.1			
9/6/2016 0:00	15.0	32.2	5375.0			
9/6/2016 6:00	14.9	32.3	5374.9			
9/6/2016 12:00	14.9	32.3	5374.9			
9/6/2016 18:00	15.0	32.2	5375.0			
9/7/2016 0:00	15.0	32.2	5375.0			
9/7/2016 6:00	15.0	32.2	5375.0			
9/7/2016 12:00	15.0	32.2	5375.0			
9/7/2016 18:00	15.0	32.2	5375.0			
9/8/2016 0:00	14.9	32.3	5374.9			
9/8/2016 6:00	14.9	32.3	5374.9			
9/8/2016 12:00	15.0	32.2	5375.0			
9/8/2016 18:00	15.1	32.1	5375.1			
9/9/2016 0:00	15.0	32.2	5375.0			
9/9/2016 6:00	15.0	32.2	5375.0			
9/9/2016 12:00	14.9	32.3	5374.9			
9/9/2016 18:00	14.8	32.4	5374.8			
9/10/2016 0:00	14.8	32.4	5374.8			
9/10/2016 6:00	14.8	32.4	5374.8			
9/10/2016 12:00	14.9	32.3	5374.9			
9/10/2016 18:00	15.0	32.2	5375.0			
9/11/2016 0:00	15.0	32.2	5375.0			
9/11/2016 6:00	15.0	32.2	5375.0			
9/11/2016 12:00	15.0	32.2	5375.0			
9/11/2016 18:00	15.1	32.1	5375.1			
9/12/2016 0:00	15.0	32.2	5375.0			
9/12/2016 6:00	15.0	32.2	5375.0			
9/12/2016 12:00	15.0	32.2	5375.0			
9/12/2016 18:00	15.0	32.2	5375.0			
9/13/2016 0:00	14.9	32.3	5374.9			
9/13/2016 6:00	14.9	32.3	5374.9	34.9	32.4	5374.8
9/13/2016 12:00	14.9	32.3	5374.9			
9/14/2016 0:00	14.9	32.3	5374.9			
9/14/2016 12:00	15.0	32.2	5375.0			
9/15/2016 0:00	14.9	32.3	5374.9			
9/15/2016 12:00	15.0	32.2	5375.0			

Piezometer B-108(P)	Electronic Data			Manual Data		
Instrument Serial Number	S/N 446260					
Cable Length[(1)]	49.7					
Ground Surface Elevation (NAVD 88)	5407.2			5407.2		
Piezometer Stick-up[(2)]	2.5			2.5		
9/16/2016 0:00	14.9	32.3	5374.9			
9/16/2016 12:00	14.9	32.3	5374.9			
9/17/2016 0:00	14.9	32.3	5374.9			
9/17/2016 12:00	14.9	32.3	5374.9			
9/18/2016 0:00	15.0	32.2	5375.0			
9/18/2016 12:00	15.0	32.2	5375.0			
9/19/2016 0:00	15.0	32.2	5375.0			
9/19/2016 12:00	14.9	32.3	5374.9			
9/20/2016 0:00	14.9	32.3	5374.9			
9/20/2016 12:00	14.9	32.3	5374.9			
9/21/2016 0:00	15.0	32.2	5375.0			
9/21/2016 12:00	15.0	32.2	5375.0			
9/22/2016 0:00	15.0	32.2	5375.0			
9/22/2016 12:00	15.0	32.2	5375.0			
9/23/2016 0:00	15.1	32.1	5375.1			
9/23/2016 12:00	15.1	32.1	5375.1			
9/24/2016 0:00	15.0	32.2	5375.0			
9/24/2016 12:00	14.9	32.3	5374.9			
9/25/2016 0:00	14.8	32.4	5374.8			
9/25/2016 12:00	14.7	32.5	5374.7			
9/26/2016 0:00	14.8	32.4	5374.8			
9/26/2016 12:00	14.8	32.4	5374.8			
9/27/2016 0:00	14.9	32.3	5374.9			
9/27/2016 12:00	14.9	32.3	5374.9			
9/28/2016 0:00	14.9	32.3	5374.9			
9/28/2016 12:00	14.8	32.4	5374.8			
9/29/2016 0:00	14.8	32.4	5374.8			
9/29/2016 12:00	14.8	32.4	5374.8			
9/30/2016 0:00	14.9	32.3	5374.9			
9/30/2016 12:00	14.9	32.3	5374.9			
10/1/2016 0:00	15.0	32.2	5375.0			
10/1/2016 12:00	14.9	32.3	5374.9			
10/2/2016 0:00	15.0	32.2	5375.0			
10/2/2016 12:00	14.9	32.3	5374.9			
10/3/2016 0:00	15.1	32.1	5375.1			
10/3/2016 12:00	15.3	31.9	5375.3			
10/4/2016 0:00	15.1	32.1	5375.1			
10/4/2016 12:00	15.1	32.1	5375.1			
10/5/2016 0:00	15.0	32.2	5375.0			
10/5/2016 12:00	15.0	32.2	5375.0			
10/6/2016 0:00	14.9	32.3	5374.9			
10/6/2016 12:00	14.9	32.3	5374.9			
10/7/2016 0:00	14.8	32.4	5374.8			
10/7/2016 12:00	14.8	32.4	5374.8			
10/8/2016 0:00	14.8	32.4	5374.8			
10/8/2016 12:00	14.8	32.4	5374.8			
10/9/2016 0:00	14.8	32.4	5374.8			
10/9/2016 12:00	14.9	32.3	5374.9			
10/10/2016 0:00	14.9	32.3	5374.9			
10/10/2016 12:00	14.9	32.3	5374.9			
10/11/2016 0:00	14.9	32.3	5374.9			

Piezometer B-108(P)	Electronic Data			Manual Data		
Instrument Serial Number	S/N 446260					
Cable Length[(1)]	49.7					
Ground Surface Elevation (NAVD 88)	5407.2			5407.2		
Piezometer Stick-up[(2)]	2.5			2.5		
10/11/2016 12:00	14.9	32.3	5374.9			
10/12/2016 0:00	14.9	32.3	5374.9			
10/12/2016 12:00	14.8	32.4	5374.8			
10/13/2016 0:00	14.9	32.3	5374.9			
10/13/2016 12:00	14.9	32.3	5374.9			
10/14/2016 0:00	15.0	32.2	5375.0			
10/14/2016 12:00	15.0	32.2	5375.0			
10/15/2016 0:00	15.0	32.2	5375.0			
10/15/2016 12:00	15.0	32.2	5375.0			
10/16/2016 0:00	15.0	32.2	5375.0			
10/16/2016 12:00	15.1	32.1	5375.1			
10/17/2016 0:00	15.1	32.1	5375.1			
10/17/2016 12:00	15.2	32.0	5375.2			
10/18/2016 0:00	14.9	32.3	5374.9			
10/18/2016 12:00	14.9	32.3	5374.9			
10/19/2016 0:00	14.8	32.4	5374.8			
10/19/2016 12:00	14.8	32.4	5374.8			
10/20/2016 0:00	14.7	32.5	5374.7			
10/20/2016 12:00	14.7	32.5	5374.7			
10/21/2016 0:00	14.9	32.3	5374.9			
10/21/2016 12:00	14.9	32.3	5374.9			
10/22/2016 0:00	14.9	32.3	5374.9			
10/22/2016 12:00	14.9	32.3	5374.9			
10/23/2016 0:00	14.9	32.3	5374.9			
10/23/2016 12:00	14.8	32.4	5374.8			
10/24/2016 0:00	14.8	32.4	5374.8			
10/24/2016 12:00	14.8	32.4	5374.8			
10/25/2016 0:00	14.9	32.3	5374.9			
10/25/2016 12:00	14.9	32.3	5374.9			
10/26/2016 0:00	14.8	32.4	5374.8			
10/26/2016 12:00	14.8	32.4	5374.8			
10/27/2016 0:00	14.8	32.4	5374.8			
10/27/2016 12:00	14.9	32.3	5374.9			
10/28/2016 0:00	15.0	32.2	5375.0			
10/28/2016 12:00	15.0	32.2	5375.0			
10/29/2016 0:00	15.0	32.2	5375.0			
10/29/2016 12:00	14.9	32.3	5374.9			
10/30/2016 0:00	14.8	32.4	5374.8			
10/30/2016 12:00	14.9	32.3	5374.9			
10/31/2016 0:00	15.0	32.2	5375.0			
10/31/2016 12:00	15.1	32.1	5375.1			
11/1/2016 0:00	15.0	32.2	5375.0			
11/1/2016 12:00	15.0	32.2	5375.0			
11/2/2016 0:00	14.9	32.3	5374.9			
11/2/2016 12:00	14.8	32.4	5374.8			
11/3/2016 0:00	14.7	32.5	5374.7			
11/3/2016 12:00	14.7	32.5	5374.7			
11/4/2016 0:00	14.7	32.5	5374.7			
11/4/2016 12:00	14.8	32.4	5374.8			
11/5/2016 0:00	14.9	32.3	5374.9			
11/5/2016 12:00	14.9	32.3	5374.9			

Piezometer B-108(P)	Electronic Data			Manual Data		
Instrument Serial Number	S/N 446260					
Cable Length[(1)]	49.7					
Ground Surface Elevation (NAVD 88)	5407.2			5407.2		
Piezometer Stick-up[(2)]	2.5			2.5		
11/6/2016 0:00	15.0	32.3	5375.0			
11/6/2016 11:00	14.9	32.3	5374.9			
11/6/2016 23:00	14.9	32.3	5374.9			
11/7/2016 11:00	14.7	32.5	5374.7			
11/7/2016 23:00	14.7	32.5	5374.7			
11/8/2016 11:00	14.7	32.5	5374.7			
11/8/2016 23:00	14.8	32.4	5374.8			
11/9/2016 11:00	14.8	32.4	5374.8			
11/9/2016 23:00	14.9	32.3	5374.9			
11/10/2016 11:00	14.8	32.4	5374.8			
11/10/2016 23:00	14.7	32.5	5374.7			
11/11/2016 11:00	14.7	32.5	5374.7			
11/11/2016 23:00	14.9	32.4	5374.9			
11/12/2016 11:00	14.9	32.3	5374.9			
11/12/2016 23:00	14.9	32.3	5374.9			
11/13/2016 11:00	14.9	32.3	5374.9			
11/13/2016 23:00	14.9	32.3	5374.9			
11/14/2016 11:00	14.9	32.3	5374.9			
11/14/2016 23:00	14.9	32.3	5374.9			
11/15/2016 11:00	14.9	32.3	5374.9			
11/15/2016 23:00	15.0	32.2	5375.0			
11/16/2016 11:00	15.2	32.0	5375.2	34.5	32.0	5375.2

Notes:

1) Depth from top of PVC casing to instrument installation location.

2) Vertical distance from ground surface elevation to top of PVC casing.

3) Collected data was rounded to the nearest 0.1 foot for presentation purposes. Some rounding error may be present.

In-Situ Inc.

Calibration Report

Report Number: 20160218115321-446260

221 East Lincoln Avenue, Fort Collins, CO 80524 USA
1-970-498-1500, 1-800-446-7488, FAX: 1-970-498-1598
Visit us at www.in-situ.com

Instrument Details:

Instrument Model:	**Rugged TROLL 100** B-108(P)
Full Scale Depth Range:	**0- 100 Ft (0- 30 m)**
Serial Number:	**446260**
Hardware Version:	0
Firmware Version:	1.02

Calibration Details:

Calibration Result:	**PASS**
Calibration Date:	2016-02-18 11:53:21 (UTC)
Nominal Range of Applied Temperature:	0 C to +50 C
Temperature Accuracy Specification:	+/- 0.3 C From 0 C to +50 C
Nominal Range of Applied Pressure:	7 PSI - 58 PSI Absolute
Pressure Accuracy Specification:	Typical +/-0.1% FS, Maximum +/-0.3% FS

Post-Calibration Check:

Parameter	Applied	Reported	Deviation	Unit
Depth	100.3335	100.3182	-0.0153	FT
Depth	61.1159	61.1174	0.0014	FT
Depth	21.9039	21.9151	0.0112	FT
Temperature	19.9790	19.9368	-0.0422	C

Calibration Procedures and Equipment Used:

Manu MENSOR Model 600 SerialNo 621384
Manu Agilent Model 53131A-010 SerialNo MY40012869
Manu Instrulab Model 406X-0031-01 SerialNo 31098-2
Manu Instrulab Model 3312A-14-15-24 SerialNo 31139

Notes:

1. Standards used in this calibration are traceable to the National Institute of Standards and Technology.
2. This calibration report shall not be reproduced, except in full, without the written approval of In-Situ, Inc.
3. Pressure calibration is conducted in units of PSI Absolute.
4. The total range of applied pressure includes pressure due to both the water column and 1 bar of atmosphere.
5. The pressure accuracy specification is in terms of the full-scale capability of the pressure sensor (i.e. maximum water depth + 1 bar atmosphere).
6. The Post-Calibration data is expressed, for convenience, in terms of water depth. An ambient barometric pressure of 1 bar is assumed.
7. Conversion factors: 2.30666 FT/PSI, 14.50377 PSI/bar.

Performed By: NJH

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Barometer

Barometer	Data
Instrument Serial Number	S/N 447557

Date and Time	Barometric Pressure (psi)
6/28/2016 12:00	
6/29/2016 12:00	
6/30/2016 12:00	
7/1/2016 12:00	12.13
7/1/2016 18:00	12.09
7/2/2016 0:00	12.11
7/2/2016 6:00	12.10
7/2/2016 12:00	12.12
7/2/2016 18:00	12.10
7/3/2016 0:00	12.10
7/3/2016 6:00	12.10
7/3/2016 12:00	12.11
7/3/2016 18:00	12.09
7/4/2016 0:00	12.10
7/4/2016 6:00	12.10
7/4/2016 12:00	12.10
7/4/2016 18:00	12.06
7/5/2016 0:00	12.08
7/5/2016 6:00	12.09
7/5/2016 12:00	12.07
7/5/2016 18:00	12.05
7/6/2016 0:00	12.09
7/6/2016 6:00	12.07
7/6/2016 12:00	12.04
7/6/2016 18:00	11.98
7/7/2016 0:00	12.03
7/7/2016 6:00	12.06
7/7/2016 12:00	12.10
7/7/2016 18:00	12.07
7/8/2016 0:00	12.11
7/8/2016 6:00	12.12
7/8/2016 12:00	12.11
7/8/2016 18:00	12.10
7/9/2016 0:00	12.12
7/9/2016 6:00	12.12
7/9/2016 12:00	12.10
7/9/2016 18:00	12.03
7/10/2016 0:00	12.08
7/10/2016 6:00	12.05
7/10/2016 12:00	12.01
7/10/2016 18:00	11.92
7/11/2016 0:00	11.96
7/11/2016 6:00	12.01
7/11/2016 12:00	12.04
7/11/2016 18:00	12.01
7/12/2016 0:00	12.08
7/12/2016 6:00	12.08
7/12/2016 12:00	12.07
7/12/2016 18:00	12.02

Barometer	Data
Instrument Serial Number	S/N 447557
7/13/2016 0:00	12.06
7/13/2016 6:00	12.10
7/13/2016 12:00	12.12
7/13/2016 18:00	12.09
7/14/2016 0:00	12.13
7/14/2016 6:00	12.17
7/14/2016 12:00	12.18
7/14/2016 18:00	12.12
7/15/2016 0:00	12.13
7/15/2016 6:00	12.13
7/15/2016 12:00	12.12
7/15/2016 18:00	12.13
7/16/2016 0:00	12.12
7/16/2016 6:00	12.08
7/16/2016 12:00	12.06
7/16/2016 18:00	12.02
7/17/2016 0:00	12.08
7/17/2016 6:00	12.10
7/17/2016 12:00	12.13
7/17/2016 18:00	12.10
7/18/2016 0:00	12.17
7/18/2016 6:00	12.17
7/18/2016 12:00	12.15
7/18/2016 18:00	12.17
7/19/2016 0:00	12.18
7/19/2016 6:00	12.16
7/19/2016 12:00	12.16
7/19/2016 18:00	12.13
7/20/2016 0:00	12.16
7/20/2016 6:00	12.15
7/20/2016 12:00	12.14
7/20/2016 18:00	12.14
7/21/2016 0:00	12.16
7/21/2016 6:00	12.15
7/21/2016 12:00	12.16
7/21/2016 18:00	12.17
7/22/2016 0:00	12.17
7/22/2016 6:00	12.16
7/22/2016 12:00	12.15
7/22/2016 18:00	12.10
7/23/2016 0:00	12.12
7/23/2016 6:00	12.11
7/23/2016 12:00	12.09
7/23/2016 18:00	12.10
7/24/2016 0:00	12.13
7/24/2016 6:00	12.14
7/24/2016 12:00	12.12
7/24/2016 18:00	12.13
7/25/2016 0:00	12.18
7/25/2016 6:00	12.15
7/25/2016 12:00	12.14

Barometer	Data
Instrument Serial Number	S/N 447557
7/25/2016 18:00	12.11
7/26/2016 0:00	12.13
7/26/2016 6:00	12.13
7/26/2016 12:00	12.13
7/26/2016 18:00	12.11
7/27/2016 0:00	12.13
7/27/2016 6:00	12.14
7/27/2016 12:00	12.16
7/27/2016 18:00	12.09
7/28/2016 0:00	12.16
7/28/2016 6:00	12.13
7/28/2016 12:00	12.15
7/28/2016 18:00	12.13
7/29/2016 0:00	12.17
7/29/2016 6:00	12.15
7/29/2016 12:00	12.15
7/29/2016 18:00	12.07
7/30/2016 0:00	12.12
7/30/2016 6:00	12.09
7/30/2016 12:00	12.09
7/30/2016 18:00	12.05
7/31/2016 0:00	12.07
7/31/2016 6:00	12.06
7/31/2016 12:00	12.06
7/31/2016 18:00	12.10
8/1/2016 0:00	12.10
8/1/2016 6:00	12.08
8/1/2016 12:00	12.10
8/1/2016 18:00	12.09
8/2/2016 0:00	12.14
8/2/2016 6:00	12.15
8/2/2016 12:00	12.16
8/2/2016 18:00	12.15
8/3/2016 0:00	12.17
8/3/2016 6:00	12.12
8/3/2016 12:00	12.11
8/3/2016 18:00	12.05
8/4/2016 0:00	12.09
8/4/2016 6:00	12.11
8/4/2016 12:00	12.19
8/4/2016 18:00	12.17
8/5/2016 0:00	12.16
8/5/2016 6:00	12.15
8/5/2016 12:00	12.17
8/5/2016 18:00	12.14
8/6/2016 0:00	12.14
8/6/2016 6:00	12.12
8/6/2016 12:00	12.13
8/6/2016 18:00	12.09
8/7/2016 0:00	12.11
8/7/2016 6:00	12.11

Barometer	Data
Instrument Serial Number	S/N 447557
8/7/2016 12:00	12.13
8/7/2016 18:00	12.06
8/8/2016 0:00	12.08
8/8/2016 6:00	12.09
8/8/2016 12:00	12.11
8/8/2016 18:00	12.05
8/9/2016 0:00	12.08
8/9/2016 6:00	12.08
8/9/2016 12:00	12.07
8/9/2016 18:00	12.04
8/10/2016 0:00	12.08
8/10/2016 6:00	12.07
8/10/2016 12:00	12.07
8/10/2016 18:00	12.07
8/11/2016 0:00	12.10
8/11/2016 6:00	12.10
8/11/2016 12:00	12.12
8/11/2016 18:00	12.09
8/12/2016 0:00	12.16
8/12/2016 6:00	12.17
8/12/2016 12:00	12.18
8/12/2016 18:00	12.14
8/13/2016 0:00	12.17
8/13/2016 6:00	12.16
8/13/2016 12:00	12.15
8/13/2016 18:00	12.11
8/14/2016 0:00	12.17
8/14/2016 6:00	12.16
8/14/2016 12:00	12.15
8/14/2016 18:00	12.09
8/15/2016 0:00	12.12
8/15/2016 6:00	12.12
8/15/2016 12:00	12.13
8/15/2016 18:00	12.14
8/16/2016 0:00	12.16
8/16/2016 6:00	12.17
8/16/2016 12:00	12.17
8/16/2016 18:00	12.13
8/17/2016 0:00	12.17
8/17/2016 6:00	12.16
8/17/2016 12:00	12.15
8/17/2016 18:00	12.11
8/18/2016 0:00	12.12
8/18/2016 6:00	12.11
8/18/2016 12:00	12.11
8/18/2016 18:00	12.12
8/19/2016 0:00	12.15
8/19/2016 6:00	12.13
8/19/2016 12:00	12.12
8/19/2016 18:00	12.15
8/20/2016 0:00	12.19

Barometer	Data
Instrument Serial Number	S/N 447557
8/20/2016 6:00	12.15
8/20/2016 12:00	12.13
8/20/2016 18:00	12.11
8/21/2016 0:00	12.13
8/21/2016 6:00	12.12
8/21/2016 12:00	12.11
8/21/2016 18:00	12.06
8/22/2016 0:00	12.07
8/22/2016 6:00	12.06
8/22/2016 12:00	12.05
8/22/2016 18:00	12.06
8/23/2016 0:00	12.05
8/23/2016 6:00	12.07
8/23/2016 12:00	12.09
8/23/2016 18:00	12.12
8/24/2016 0:00	12.14
8/24/2016 6:00	12.14
8/24/2016 12:00	12.19
8/24/2016 18:00	12.16
8/25/2016 0:00	12.16
8/25/2016 6:00	12.17
8/25/2016 12:00	12.20
8/25/2016 18:00	12.17
8/26/2016 0:00	12.17
8/26/2016 6:00	12.13
8/26/2016 12:00	12.14
8/26/2016 18:00	12.10
8/27/2016 0:00	12.12
8/27/2016 6:00	12.12
8/27/2016 12:00	12.13
8/27/2016 18:00	12.09
8/28/2016 0:00	12.12
8/28/2016 6:00	12.13
8/28/2016 12:00	12.15
8/28/2016 18:00	12.13
8/29/2016 0:00	12.19
8/29/2016 6:00	12.17
8/29/2016 12:00	12.20
8/29/2016 18:00	12.21
8/30/2016 0:00	12.21
8/30/2016 6:00	12.21
8/30/2016 12:00	12.21
8/30/2016 18:00	12.17
8/31/2016 0:00	12.20
8/31/2016 6:00	12.19
8/31/2016 12:00	12.20
8/31/2016 18:00	12.16
9/1/2016 0:00	12.18
9/1/2016 6:00	12.16
9/1/2016 12:00	12.16
9/1/2016 18:00	12.11

Barometer	Data
Instrument Serial Number	S/N 447557
9/2/2016 0:00	12.12
9/2/2016 6:00	12.09
9/2/2016 12:00	12.12
9/2/2016 18:00	12.06
9/3/2016 0:00	12.09
9/3/2016 6:00	12.07
9/3/2016 12:00	12.06
9/3/2016 18:00	12.03
9/4/2016 0:00	12.05
9/4/2016 6:00	12.04
9/4/2016 12:00	12.03
9/4/2016 18:00	11.97
9/5/2016 0:00	12.03
9/5/2016 6:00	12.03
9/5/2016 12:00	12.04
9/5/2016 18:00	11.99
9/6/2016 0:00	12.05
9/6/2016 6:00	12.10
9/6/2016 12:00	12.11
9/6/2016 18:00	12.06
9/7/2016 0:00	12.09
9/7/2016 6:00	12.09
9/7/2016 12:00	12.11
9/7/2016 18:00	12.07
9/8/2016 0:00	12.12
9/8/2016 6:00	12.12
9/8/2016 12:00	12.10
9/8/2016 18:00	12.03
9/9/2016 0:00	12.08
9/9/2016 6:00	12.11
9/9/2016 12:00	12.15
9/9/2016 18:00	12.22
9/10/2016 0:00	12.24
9/10/2016 6:00	12.24
9/10/2016 12:00	12.20
9/10/2016 18:00	12.12
9/11/2016 0:00	12.13
9/11/2016 6:00	12.13
9/11/2016 12:00	12.11
9/11/2016 18:00	12.05
9/12/2016 0:00	12.06
9/12/2016 6:00	12.06
9/12/2016 12:00	12.11
9/12/2016 18:00	12.11
9/13/2016 0:00	12.16
9/13/2016 6:00	12.17
9/13/2016 12:00	12.17
9/14/2016 0:00	12.18
9/14/2016 12:00	12.13
9/15/2016 0:00	12.13
9/15/2016 12:00	12.12

Barometer	Data
Instrument Serial Number	S/N 447557
9/16/2016 0:00	12.15
9/16/2016 12:00	12.16
9/17/2016 0:00	12.16
9/17/2016 12:00	12.14
9/18/2016 0:00	12.11
9/18/2016 12:00	12.11
9/19/2016 0:00	12.12
9/19/2016 12:00	12.16
9/20/2016 0:00	12.14
9/20/2016 12:00	12.15
9/21/2016 0:00	12.11
9/21/2016 12:00	12.11
9/22/2016 0:00	12.09
9/22/2016 12:00	12.10
9/23/2016 0:00	12.03
9/23/2016 12:00	11.98
9/24/2016 0:00	12.04
9/24/2016 12:00	12.09
9/25/2016 0:00	12.20
9/25/2016 12:00	12.27
9/26/2016 0:00	12.26
9/26/2016 12:00	12.24
9/27/2016 0:00	12.20
9/27/2016 12:00	12.17
9/28/2016 0:00	12.16
9/28/2016 12:00	12.22
9/29/2016 0:00	12.22
9/29/2016 12:00	12.21
9/30/2016 0:00	12.17
9/30/2016 12:00	12.18
10/1/2016 0:00	12.14
10/1/2016 12:00	12.13
10/2/2016 0:00	12.11
10/2/2016 12:00	12.12
10/3/2016 0:00	12.02
10/3/2016 12:00	11.89
10/4/2016 0:00	11.96
10/4/2016 12:00	11.98
10/5/2016 0:00	12.03
10/5/2016 12:00	12.05
10/6/2016 0:00	12.07
10/6/2016 12:00	12.13
10/7/2016 0:00	12.19
10/7/2016 12:00	12.21
10/8/2016 0:00	12.18
10/8/2016 12:00	12.21
10/9/2016 0:00	12.18
10/9/2016 12:00	12.16
10/10/2016 0:00	12.12
10/10/2016 12:00	12.12
10/11/2016 0:00	12.10

Barometer	Data
Instrument Serial Number	S/N 447557
10/11/2016 12:00	12.10
10/12/2016 0:00	12.15
10/12/2016 12:00	12.20
10/13/2016 0:00	12.16
10/13/2016 12:00	12.12
10/14/2016 0:00	12.09
10/14/2016 12:00	12.05
10/15/2016 0:00	12.02
10/15/2016 12:00	12.04
10/16/2016 0:00	12.02
10/16/2016 12:00	11.96
10/17/2016 0:00	11.98
10/17/2016 12:00	11.91
10/18/2016 0:00	12.04
10/18/2016 12:00	12.09
10/19/2016 0:00	12.12
10/19/2016 12:00	12.19
10/20/2016 0:00	12.27
10/20/2016 12:00	12.25
10/21/2016 0:00	12.16
10/21/2016 12:00	12.15
10/22/2016 0:00	12.11
10/22/2016 12:00	12.08
10/23/2016 0:00	12.12
10/23/2016 12:00	12.19
10/24/2016 0:00	12.18
10/24/2016 12:00	12.19
10/25/2016 0:00	12.12
10/25/2016 12:00	12.13
10/26/2016 0:00	12.17
10/26/2016 12:00	12.22
10/27/2016 0:00	12.18
10/27/2016 12:00	12.17
10/28/2016 0:00	12.09
10/28/2016 12:00	12.10
10/29/2016 0:00	12.08
10/29/2016 12:00	12.13
10/30/2016 0:00	12.19
10/30/2016 12:00	12.15
10/31/2016 0:00	12.03
10/31/2016 12:00	12.00
11/1/2016 0:00	12.05
11/1/2016 12:00	12.05
11/2/2016 0:00	12.09
11/2/2016 12:00	12.22
11/3/2016 0:00	12.25
11/3/2016 12:00	12.29
11/4/2016 0:00	12.28
11/4/2016 12:00	12.26
11/5/2016 0:00	12.19
11/5/2016 12:00	12.17

Barometer	Data
Instrument Serial Number	S/N 447557
11/6/2016 0:00	12.11
11/6/2016 11:00	12.10
11/6/2016 23:00	12.13
11/7/2016 11:00	12.24
11/7/2016 23:00	12.27
11/8/2016 11:00	12.29
11/8/2016 23:00	12.26
11/9/2016 11:00	12.22
11/9/2016 23:00	12.19
11/10/2016 11:00	12.24
11/10/2016 23:00	12.28
11/11/2016 11:00	12.27
11/11/2016 23:00	12.21
11/12/2016 11:00	12.16
11/12/2016 23:00	12.13
11/13/2016 11:00	12.16
11/13/2016 23:00	12.16
11/14/2016 11:00	12.14
11/14/2016 23:00	12.13
11/15/2016 11:00	12.13
11/15/2016 23:00	12.05
11/16/2016 11:00	11.94

Note:
1) Collected data was rounded to the nearest 0.01 psi for presentation purposes. Some rounding error may be present.

In-Situ Inc.

Calibration Report

Report Number: 20160301202117-447557

221 East Lincoln Avenue, Fort Collins, CO 80524 USA
1-970-498-1500, 1-800-446-7488, FAX: 1-970-498-1598
Visit us at www.in-situ.com

Instrument Details:

Instrument Model:	**Rugged BaroTROLL** Barometer
Full Scale Depth Range:	**0- 15 Ft (0- 1 m)**
Serial Number:	**447557**
Hardware Version:	0
Firmware Version:	1.01

Calibration Details:

Calibration Result:	**PASS**
Calibration Date:	2016-03-01 20:21:17 (UTC)
Nominal Range of Applied Temperature:	0 C to +50 C
Temperature Accuracy Specification:	+/- 0.3 C From 0 C to +50 C
Nominal Range of Applied Pressure:	7 PSI - 30 PSI Absolute
Pressure Accuracy Specification:	Typical +/-0.1% FS, Maximum +/-0.3% FS

Post-Calibration Check:

Parameter	Applied	Reported	Deviation	Unit
Depth	35.7452	35.7355	-0.0097	FT
Depth	9.2179	9.2141	-0.0038	FT
Depth	-17.3089	-17.3097	-0.0008	FT
Temperature	18.8495	18.8850	0.0355	C

Calibration Procedures and Equipment Used:

Manu MENSOR Model 600 SerialNo 622741
Manu Agilent Model 53131A-010 SerialNo MY40016413
Manu Instrulab Model 406X-0031-01 SerialNo 31099-2
Manu Instrulab Model 3312A-14-15-24 SerialNo 31140

Notes:

1. Standards used in this calibration are traceable to the National Institute of Standards and Technology.
2. This calibration report shall not be reproduced, except in full, without the written approval of In-Situ, Inc.
3. Pressure calibration is conducted in units of PSI Absolute.
4. The total range of applied pressure includes pressure due to both the water column and 1 bar of atmosphere.
5. The pressure accuracy specification is in terms of the full-scale capability of the pressure sensor (i.e. maximum water depth + 1 bar atmosphere).
6. The Post-Calibration data is expressed, for convenience, in terms of water depth. An ambient barometric pressure of 1 bar is assumed.
7. Conversion factors: 2.30666 FT/PSI, 14.50377 PSI/bar.

Performed By: RG

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APPENDIX G

LABORATORY TEST RESULTS

ATT
ADVANCED TERRA TESTING
833 Parfet Street, Unit A • Lakewood, Colorado 80215 • (303) 232-8308 • Fax: (303) 232-1579

MOISTURE CONTENT ANALYSIS
ASTM D 2216

Moisture Content Determinations

ASTM D 2216

CLIENT:	RJH Consultants	JOB NO.	2679-96
PROJECT	Thornton Water Treatment Plant	LOCATION	--
PROJECT NO.	16104		

BORING NO.	B-103	B-104(P)	B-104(P)	B-103
DEPTH	69-69.5'	55-56.5'	27.5-29.5'	34-36'
SAMPLE NO.	S-21	S-17	S-9	S-14
DATE SAMPLED	6/20/2016	6/29/2016	6/28/2016	6/20/2016
DATE TESTED	7/21/2016 CKP	7/21/2016 CKP	7/21/2016 CKP	7/21/2016 CKP
SOIL DESCRIPTION	Claystone	Claystone	Claystone	Claystone
MOISTURE DETERMINATIONS				
Wt. of Wet Soil & Dish (gms)	184.55	434.52	583.61	537.85
Wt. of Dry Soil & Dish (gms)	160.80	360.29	489.11	448.35
Net Loss of Moisture (gms)	23.75	74.23	94.50	89.50
Wt. of Dish (gms)	14.20	14.23	14.27	14.23
Wt. of Dry Soil (gms)	146.60	346.06	474.84	434.12
Moisture Content (%)	16.2	21.5	19.9	20.6

BORING NO.	B-102	B-102	B-104(P)	B-103
DEPTH	49-51'	37.5-39.5'	40-42'	24.2-25.5'
SAMPLE NO.	S-21	S-17	S-14	S-10
DATE SAMPLED	6/24/2016	6/24/2016	6/28/2016	6/20/2016
DATE TESTED	7/21/2016 CKP	7/21/2016 CKP	7/21/2016 CKP	7/21/2016 CKP
SOIL DESCRIPTION	Claystone	Sandy Claystone	Claystone	Claystone
MOISTURE DETERMINATIONS				
Wt. of Wet Soil & Dish (gms)	662.00	582.63	612.68	399.20
Wt. of Dry Soil & Dish (gms)	524.38	475.66	519.46	346.02
Net Loss of Moisture (gms)	137.62	106.97	93.22	53.18
Wt. of Dish (gms)	14.21	14.26	14.47	14.22
Wt. of Dry Soil (gms)	510.17	461.40	504.99	331.80
Moisture Content (%)	27.0	23.2	18.5	16.0

Data entry by: NN Date: 7/22/2016

Checked by: CKP Date: 7/22/16

Moisture Content Determinations

ASTM D 2216

CLIENT:	RJH Consultants	JOB NO.	2679-96
PROJECT	Thornton Water Treatment Plant	LOCATION	--
PROJECT NO.	16104		

BORING NO.	B-104(P)	B-102	B-102	B-103
DEPTH	5-7'	2.5-4.5'	12.5-14.5'	59-59.8'
SAMPLE NO.	S-2	S-2	S-7	S-19
DATE SAMPLED	6/28/2016	6/23/2016	6/23/2016	6/20/2016
DATE TESTED	7/20/2016 CKP	7/20/2016 CKP	7/20/2016 CKP	7/20/2016 CKP
SOIL DESCRIPTION	Fill Lean Clay w/ sand	Fill Lean Clay w/ sand	Fill Lean Clay w/ sand	Claystone
MOISTURE DETERMINATIONS				
Wt. of Wet Soil & Dish (gms)	944.82	904.49	609.00	833.67
Wt. of Dry Soil & Dish (gms)	789.58	755.75	524.37	715.88
Net Loss of Moisture (gms)	155.24	148.74	84.63	117.79
Wt. of Dish (gms)	15.52	15.54	15.60	14.27
Wt. of Dry Soil (gms)	774.06	740.21	508.77	701.61
Moisture Content (%)	20.1	20.1	16.6	16.8

BORING NO.	B-103	B-103
DEPTH	29-30.5'	44-45.2'
SAMPLE NO.	S-12	S-16
DATE SAMPLED	6/20/2016	6/20/2016
DATE TESTED	7/20/2016 CKP	7/20/2016 CKP
SOIL DESCRIPTION	Claystone	Sandy Claystone
MOISTURE DETERMINATIONS		
Wt. of Wet Soil & Dish (gms)	929.30	634.50
Wt. of Dry Soil & Dish (gms)	797.45	537.51
Net Loss of Moisture (gms)	131.85	96.99
Wt. of Dish (gms)	14.38	15.59
Wt. of Dry Soil (gms)	783.07	521.92
Moisture Content (%)	16.8	18.6

Data entry by: NN Date: 7/21/2016

Checked by: CKP Date: 7/21/16

ATT
ADVANCED TERRA TESTING

Moisture Content Determinations

ASTM D 2216

CLIENT:	RJH Consultants	JOB NO.	2679-96
PROJECT	Thornton Water Treatment Plant	LOCATION	--
PROJECT NO.	16104		

BORING NO.	B-102	B-103	B-104(P)	B-103
DEPTH	22.5-24.5'	5-7'	15-17'	10-12'
SAMPLE NO.	S-11	S-4	S-5	S-6
DATE SAMPLED	06/23/2016	06/20/2016	06/28/2016	06/20/2016
DATE TESTED	07/28/2016 CKP	07/28/2016 CKP	07/28/2016 CKP	07/28/2016 CKP
SOIL DESCRIPTION	Fill, Fat Clay W/Sand	Fill, Lean Clay	Fill, Sandy Clay	Fill, Lean Clay
MOISTURE DETERMINATIONS				
Wt. of Wet Soil & Dish (gms)	340.92	445.61	459.11	483.32
Wt. of Dry Soil & Dish (gms)	293.18	376.17	391.44	400.95
Net Loss of Moisture (gms)	47.74	69.44	67.67	82.37
Wt. of Dish (gms)	14.18	14.22	14.30	13.80
Wt. of Dry Soil (gms)	279.00	361.95	377.14	387.15
Moisture Content (%)	17.1	19.2	17.9	21.3

BORING NO.	B-103
DEPTH	17.5-19.5'
SAMPLE NO.	S-9
DATE SAMPLED	06/20/2016
DATE TESTED	07/28/2016 CKP
SOIL DESCRIPTION	Fill, Lean Clay W/Sand
MOISTURE DETERMINATIONS	
Wt. of Wet Soil & Dish (gms)	236.47
Wt. of Dry Soil & Dish (gms)	203.81
Net Loss of Moisture (gms)	32.66
Wt. of Dish (gms)	15.68
Wt. of Dry Soil (gms)	188.13
Moisture Content (%)	17.4

Data entry by: CKP Date: 8/3/2016
Checked by: KR Date: 8/4/16

Moisture Content Determinations

ASTM D 2216

CLIENT:	RJH Consultants	JOB NO.	2679-96
PROJECT	Thornton Water Treatment Plant	LOCATION	--
PROJECT NO.	16104		

BORING NO.	B-102
DEPTH	30-32'
SAMPLE NO.	S-14
DATE SAMPLED	06/23/2016
DATE TESTED	07/29/2016 CKP
SOIL DESCRIPTION	Claystone

MOISTURE DETERMINATIONS	
Wt. of Wet Soil & Dish (gms)	391.95
Wt. of Dry Soil & Dish (gms)	328.14
Net Loss of Moisture (gms)	63.81
Wt. of Dish (gms)	14.20
Wt. of Dry Soil (gms)	313.94
Moisture Content (%)	20.3

Data entry by: CKP Date: 8/3/2016

Checked by: KR Date: 8/4/16

Moisture & Density

ASTM D 2216 & 2937

ATT
ADVANCED TESTING

Moisture & Density Determinations

ASTM D 2216 & D 2937

CLIENT:	RJH Consultants	JOB NO.	2679-96
PROJECT	Thornton Water Treatment Plant	LOCATION	--
PROJECT NO.	16104		

BORING NO.	B-101 (P)	B-106	B-107	B-107
DEPTH	44.9-45.6'	31.1-31.6'	26.5-27'	39.1-39.7'
SAMPLE NO.	--	--	--	--
DATE SAMPLED	--	--	--	--
DATE TESTED	7/12/2016	7/12/2016	7/12/2016	7/12/2016
SOIL DESCRIPTION	Claystone	Silty Sandstone	Claystone	Sandstone
DENSITY DETERMINATIONS				
Sample Height (in)	4.020	3.981	4.037	3.848
Sample Diameter (in)	1.793	1.817	1.769	1.758
Wt of Wet Soil & Rings (gms)	341.900	347.100	329.300	321.800
Wt of Rings (gms)	0.000	0.000	0.000	0.000
Wt of Wet Soil (gms)	341.90	347.10	329.30	321.80
Sample Volume (cu ft)	0.00587	0.00597	0.00574	0.00541
WET DENSITY (pcf)	128.3	128.1	126.4	131.2
DRY DENSITY (pcf)	100.3	105.9	102.7	110.8
MOISTURE DETERMINATIONS				
Wt. of Wet Soil & Dish (gms)	101.12	150.37	106.67	146.95
Wt. of Dry Soil & Dish (gms)	80.53	125.48	88.25	125.14
Net Loss of Moisture (gms)	20.59	24.89	18.42	21.81
Wt. of Dish (gms)	6.77	6.99	8.46	6.69
Wt. of Dry Soil (gms)	73.76	118.49	79.79	118.45
Moisture Content (%)	27.9	21.0	23.1	18.4

Data entry by: NN Date: 7/13/2016

Checked by: BKL Date: 7/13/16

Specific Gravity Test

ASTM D854

Specific Gravity
ASTM D 854 - Method B

CLIENT:	RJH	JOB NO.	2679-96
PROJECT		LOCATION	Thornton Water Treatment Plant
PROJECT NO.			

BORING NO.	B-102	B-103
DEPTH	37.5-39.5'	34-36'
SAMPLE NO.	S-17	S-14
DATE SAMPLED	--	--
DATE TESTED	7/27/2016 BDF	7/28/2016 BDF
Pycnometer #	Big 7	Big 13
Weight of oven dry soil (g) (Wo)	73.31	75.80
Weight of flask, soil, and water. (g) (Wb)	719.19	719.72
Temperature (deg. C) (Tx)	25.4	25.0
Weight of water & flask at Tx (from cal. curve)(Wa)	673.01	671.46
Specific Gravity*	2.70	2.75

*Specific Gravity = Wo/[Wo+(Wa-Wb)]

Data entry by: NN Date: 7/28/2016
Checked by: KR Date: 8/4/16
File name: 2679_96_SpecificGravity-ASTM-854-R1_0.xls

ATT
ADVANCED TERRA TESTING

Specific Gravity
ASTM D 854 - Method B

CLIENT:	RJH Consultants	JOB NO.	2679-96
PROJECT	Thornton Water Treatment Plant	LOCATION	--
PROJECT NO.	16104		

BORING NO.	B-103
DEPTH	5'-7'
SAMPLE NO.	S-4
DATE SAMPLED	--
DATE TESTED	8-9-16 CAL

Pycnometer #	Big 10
Weight of oven dry soil (g) (Wo)	69.58
Weight of flask, soil, and water. (g) (Wb)	715.61
Temperature (deg. C) (Tx)	25.1
Weight of water & flask at Tx (from cal. curve)(Wa)	671.85
Specific Gravity*	2.69

*Specific Gravity = Wo/[Wo+(Wa-Wb)]

Data entry by: CL Date: 8/9/2016
Checked by: Cal Date: 8/9/16
File name: 2679_96_SpecificGravity-ASTM-D854-R1_1.xls

ATT
ADVANCED TERRA TESTING

Specific Gravity
ASTM D 854 - Method B

CLIENT:	RJH Consultants	JOB NO.	2679-96
PROJECT	Thornton Water Treatment Plant	LOCATION	--
PROJECT NO.	16104		

BORING NO.	B-104(P)
DEPTH	15-17'
SAMPLE NO.	S-5
DATE SAMPLED	--
DATE TESTED	8/18/16 DPM

Pycnometer #	Big 12
Weight of oven dry soil (g) (Wo)	127.03
Weight of flask, soil, and water. (g) (Wb)	752.98
Temperature (deg. C) (Tx)	25.1
Weight of water & flask at Tx (from cal. curve)(Wa)	672.47
Specific Gravity*	2.73

*Specific Gravity = Wo/[Wo+(Wa-Wb)]

Data entry by: DPM Date: 8/19/2016
Checked by: CKP Date: 8/19/16
File name: 2679_96_SpecificGravity-ASTM-854-R1_2.xls

ATT
ADVANCED TERRA TESTING

SHRINKAGE LIMITS
ASTM D 4943

SHRINKAGE FACTORS OF SOILS by the WAX METHOD
(SHRINKAGE LIMIT)
ASTM D 4943

CLIENT: RJH Consultants JOB NO.: 2679-96
LOCATION: Thornton Water Treatment Plant - 16104

BORING	B-103	B-103	B-103	B-103
SAMPLE DEPTH	10-12'	10-12'	34-36'	34-36'
SAMPLE NO.	S-6	S-6-R	S-14	S-14-R
DATE SAMPLED	--	--	--	--
DATE TESTED	8/24/16 DPM	8/24/16 DPM	8/24/16 DPM	8/24/16 DPM
SOIL DESCRIPTION	Fill Lean Clay	Fill Lean Clay	Claystone	Claystone
Dish Name	2	3	4	5
Mass of dry soil pat & dish (g)	35.64	35.54	35.22	35.21
Mass of greased dish (g)	25.05	24.93	24.74	24.79
Mass of dry soil pat (g)	10.59	10.62	10.48	10.41
Mass of wet soil & dish (g)	42.19	42.09	41.87	41.84
Moisture content %	61.9	61.7	63.5	63.7
Mass of dry soil pat & wax in air (g)	11.62	11.32	11.27	11.35
Mass of dry soil pat & wax in water (g)	5.31	5.48	5.44	5.34
Density of water (g/cc)	1.00	1.00	1.00	1.00
Volume of dry soil pat & wax (g/cc)	6.31	5.84	5.84	6.01
Mass of wax	1.03	0.71	0.79	0.93
Density of wax (g/cc)	0.93	0.93	0.93	0.93
Volume of wax (g/cc)	1.11	0.76	0.85	1.00
Volume of dry soil pat (g/cc)	5.20	5.08	4.99	5.01
Volume of dish (g/cc)	10.61	10.61	10.63	10.62
Shrinkage Limit	11	10	10	10

Data entered by: DPM Date: 08/24/2016
Data checked by: BDF Date: 8/24/16
FileName: RJSLB103

ADVANCED TERRA TESTING, INC. ATT

ATTERBERG LIMITS
ASTM D 4318

Atterberg Limits Test
ASTM D 4318

Client: RJH Consultants
Job Number: 2679-96
Project: Thornton Water Treatment Plant
Location: --
Project Number: 16104

Boring Number: B-101 (P)
Depth: 24.8-25.5' & 28.6-29.1'
Sample Number: NQ-2
Test Date: 8/16/2016
Technician: BDF
Sampled Date: 6/27/2016
Sampled By: --
Method: Method A

Test Configuration

Liquid Limits Device: 0966
Material Size of Fines: -#40

Plastic Limits

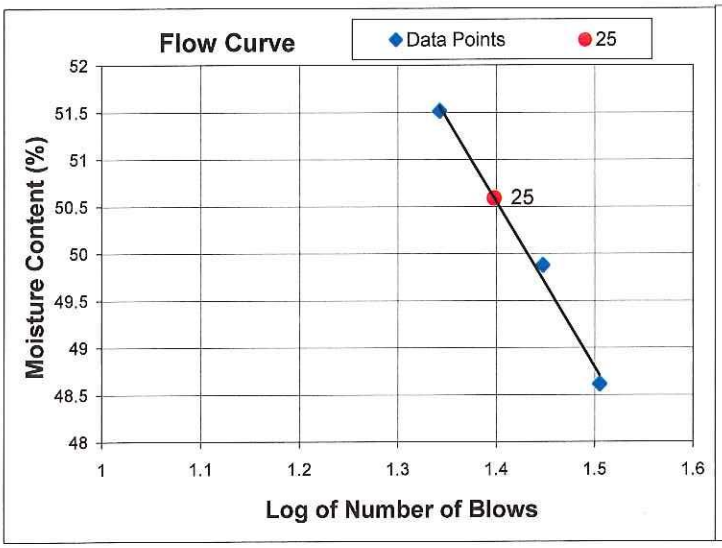
	Sample 1	Sample 2	Sample 3
Weight of Wet Soil & Pan (g):	6.132	6.184	5.780
Weight of Dry Soil & Pan (g):	5.439	5.491	5.130
Weight of Water (g):	0.693	0.693	0.650
Weight of Pan (g):	1.149	1.140	1.070
Moisture Content (%):	16.2	15.9	16.0

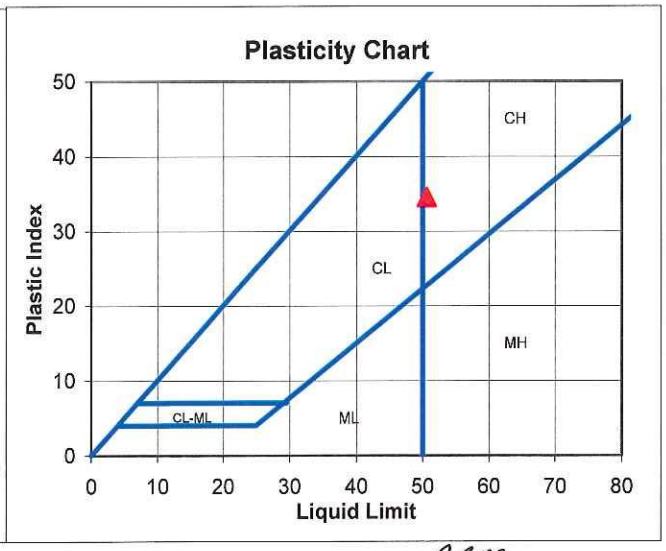
Average: 16.0%
Standard Deviation: 0.1%

Liquid Limits

	Sample 1	Sample 2	Sample 3
Number of Blows:	32	28	22
Weight of Wet Soil & Pan (g):	12.898	12.910	13.264
Weight of Dry Soil & Pan (g):	9.044	8.996	9.138
Weight of Water (g):	3.854	3.914	4.126
Weight of Pan (g):	1.116	1.148	1.128
Moisture Content (%):	48.6	49.9	51.5

Plastic Limit: 16
Liquid Limit: 51
Plastic Index: 35
Atterberg Classification CH





Data Entered By: KR
Date: 8/17/2016
File Name: 2679_96_atterberg-ASTMD-4318-R8_23.xls

Data Checked By: DBM
Date: 8/19/16

ATT
ADVANCED TERRA TESTING

Atterberg Limits Test
ASTM D 4318

Client: RJH Consultants
Job Number: 2679-96
Project: Thornton Water Treatment Plant
Location: --
Project Number: 16104

Boring Number: B-101 (P)
Depth: 44.9-45.6'
Sample Number: NQ-7
Test Date: 7/26/2016
Technician: BDF
Sampled Date: --
Sampled By: --
Method: Method A

Test Configuration

Liquid Limits Device: 1075
Material Size of Fines: -#40

Plastic Limits

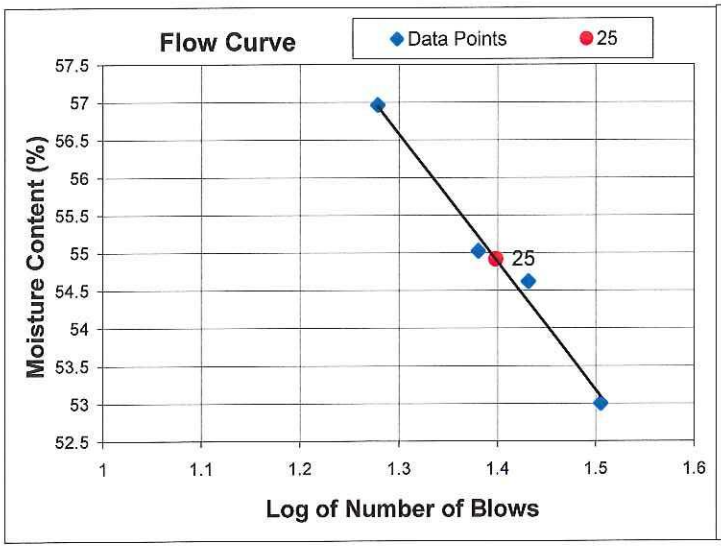
	Sample 1	Sample 2	Sample 3
Weight of Wet Soil & Pan (g):	5.470	5.495	5.383
Weight of Dry Soil & Pan (g):	4.877	4.893	4.813
Weight of Water (g):	0.593	0.602	0.570
Weight of Pan (g):	1.151	1.060	1.147
Moisture Content (%):	15.9	15.7	15.5

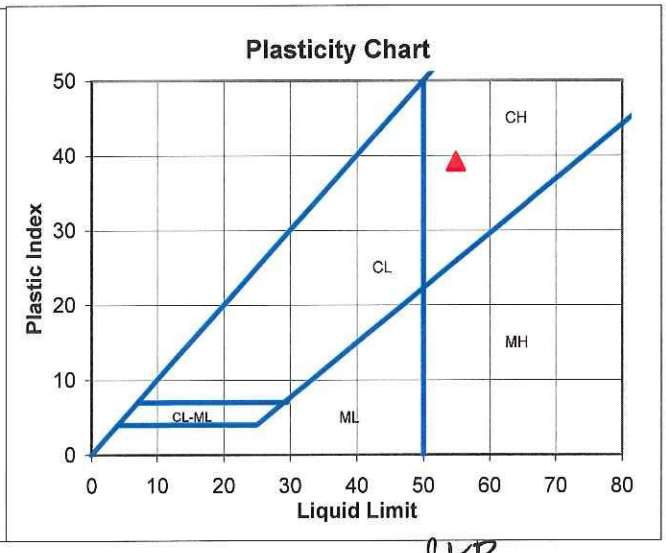
Average: 15.7%
Standard Deviation: 0.2%

Liquid Limits

	Sample 1	Sample 2	Sample 3	Sample 4
Number of Blows:	24	32	27	19
Weight of Wet Soil & Pan (g):	8.653	11.474	9.688	9.546
Weight of Dry Soil & Pan (g):	5.968	7.897	6.666	6.498
Weight of Water (g):	2.685	3.577	3.022	3.048
Weight of Pan (g):	1.088	1.148	1.133	1.147
Moisture Content (%):	55.0	53.0	54.6	57.0

Plastic Limit: 16
Liquid Limit: 55
Plastic Index: 39
Atterberg Classification CH





Data Entered By: NN Date: 7/27/2016
File Name: 2679_96_atterberg-ASTMD-4318-R8_1.xls

Data Checked By: CKP
Date: 7/28/16

ATT
ADVANCED TERRA TESTING

Atterberg Limits Test
ASTM D 4318

Client: RJH Consultants
Job Number: 2679-96
Project: Thornton Water Treatment Plant
Location: --
Project Number: 16104

Boring Number: B-102
Depth: 22.5-24.5'
Sample Number: S-11
Test Date: 8/8/2016
Technician: BDF
Sampled Date: --
Sampled By: --
Method: Method A

Test Configuration

Liquid Limits Device: 1075
Material Size of Fines: -#40

Plastic Limits

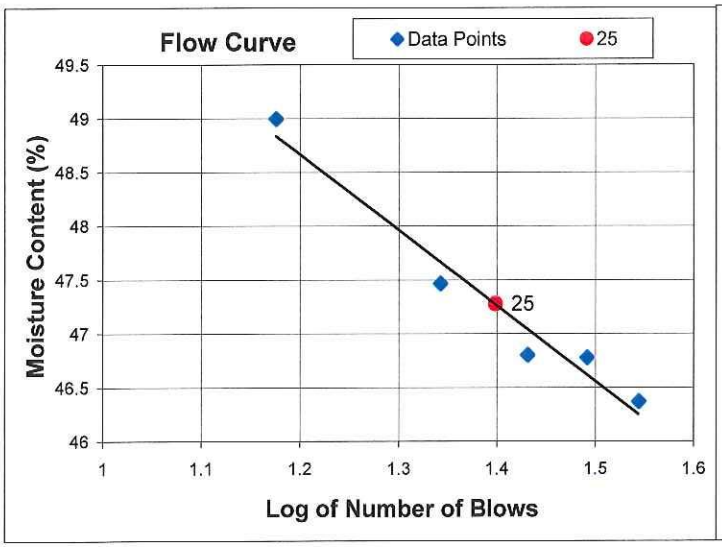
	Sample 1	Sample 2	Sample 3
Weight of Wet Soil & Pan (g):	5.725	5.884	5.870
Weight of Dry Soil & Pan (g):	5.172	5.298	5.269
Weight of Water (g):	0.553	0.586	0.601
Weight of Pan (g):	1.133	1.147	1.098
Moisture Content (%):	13.7	14.1	14.4

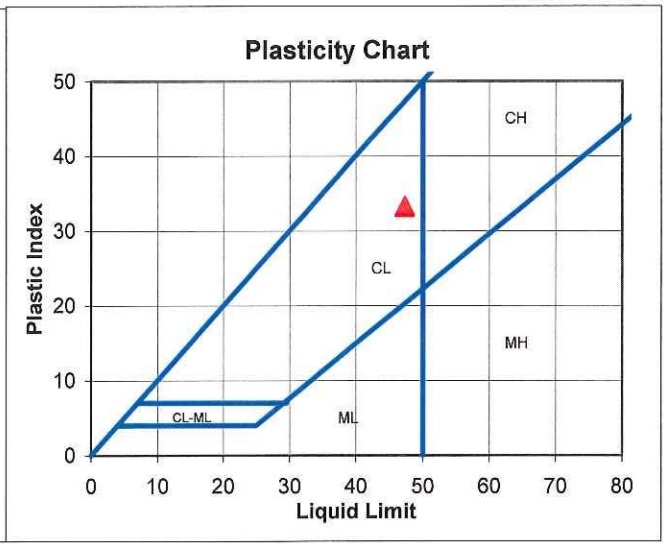
Average: 14.1%
Standard Deviation: 0.4%

Liquid Limits

	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
Number of Blows:	35	22	27	15	31
Weight of Wet Soil & Pan (g):	12.140	11.554	12.114	10.909	15.560
Weight of Dry Soil & Pan (g):	8.668	8.192	8.617	7.667	10.962
Weight of Water (g):	3.472	3.362	3.497	3.242	4.598
Weight of Pan (g):	1.180	1.109	1.145	1.050	1.132
Moisture Content (%):	46.4	47.5	46.8	49.0	46.8

Plastic Limit: 14
Liquid Limit: 47
Plastic Index: 33
Atterberg Classification CL





Data Entered By: KR Date: 8/9/2016
File Name: 2679_96_atterberg-ASTMD-4318-R8_14.xls

Data Checked By: CH
Date: 8/9/16

ATT
ADVANCED TERRA TESTING

Atterberg Limits Test
ASTM D 4318

Client: RJH Consultants
Job Number: 2679-96
Project: Thornton Water Treatment Plant
Location: --
Project Number: 16104

Boring Number: B-102
Depth: 25-26'
Sample Number: DM-12
Test Date: 7/26/2016
Technician: BDF
Sampled Date: 6/23/2016
Sampled By: --
Method: Method A

Test Configuration

Liquid Limits Device: 1075
Material Size of Fines: -#40

Plastic Limits

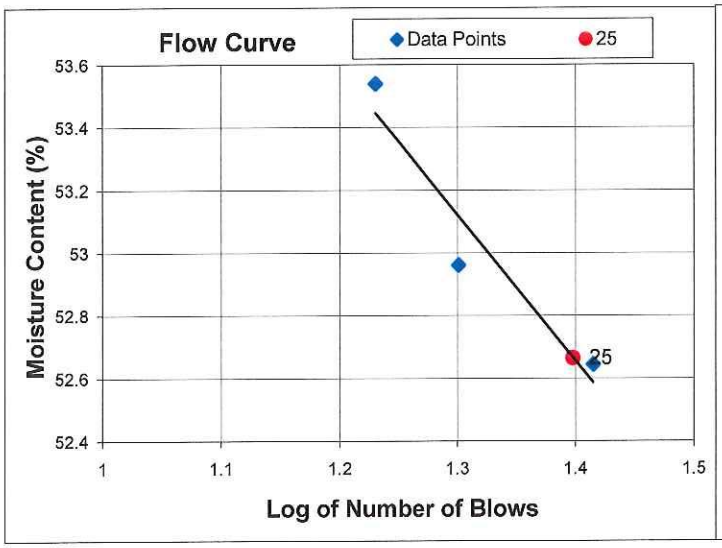
	Sample 1	Sample 2	Sample 3
Weight of Wet Soil & Pan (g):	5.273	5.198	5.775
Weight of Dry Soil & Pan (g):	4.686	4.608	5.105
Weight of Water (g):	0.587	0.590	0.670
Weight of Pan (g):	1.147	1.086	1.101
Moisture Content (%):	16.6	16.8	16.7

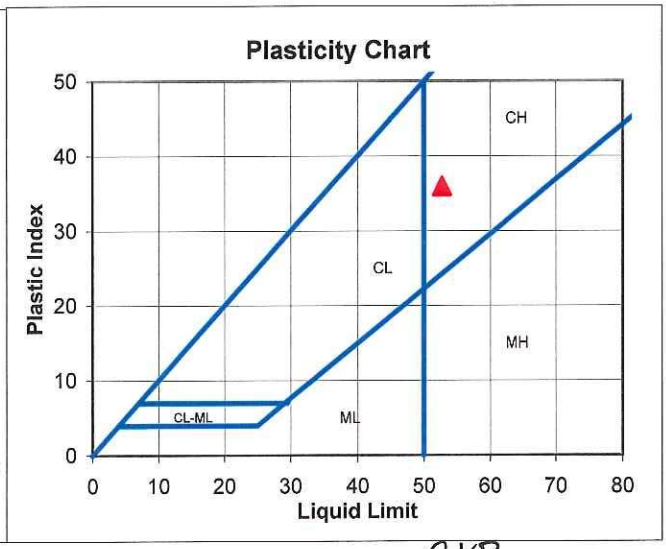
Average: 16.7%
Standard Deviation: 0.1%

Liquid Limits

	Sample 1	Sample 2	Sample 3
Number of Blows:	17	26	20
Weight of Wet Soil & Pan (g):	9.729	10.407	9.375
Weight of Dry Soil & Pan (g):	6.719	7.212	6.513
Weight of Water (g):	3.010	3.195	2.862
Weight of Pan (g):	1.097	1.143	1.109
Moisture Content (%):	53.5	52.6	53.0

Plastic Limit: 17
Liquid Limit: 53
Plastic Index: 36
Atterberg Classification CH





Data Entered By: NN Date: 7/27/2016
File Name: 2679_96_atterberg-ASTMD-4318-R8_0.xls

Data Checked By: RKP
Date: 7/27/16

ATT
ADVANCED TERRA TESTING

Atterberg Limits Test
ASTM D 4318

Client: RJH Consultants
Job Number: 2679-96
Project: Thornton Water Treatment Plant
Location: --
Project Number: 16104

Boring Number: B-102
Depth: 30-32'
Sample Number: S-14
Test Date: 8/8/2016
Technician: BDF
Sampled Date: 6/23/2016
Sampled By: --
Method: Method A

Test Configuration

Liquid Limits Device: 1075
Material Size of Fines: -#40

Plastic Limits

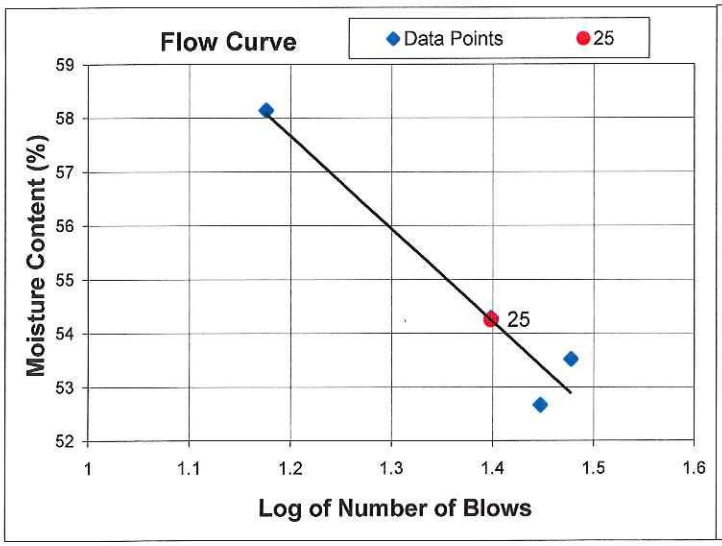
	Sample 1	Sample 2	Sample 3
Weight of Wet Soil & Pan (g):	5.554	5.716	5.646
Weight of Dry Soil & Pan (g):	4.957	5.108	5.037
Weight of Water (g):	0.597	0.608	0.609
Weight of Pan (g):	1.144	1.120	1.069
Moisture Content (%):	15.7	15.2	15.3

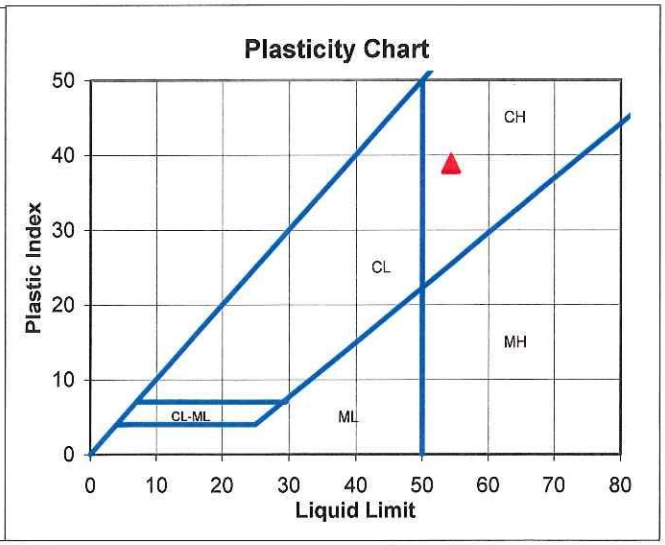
Average: 15.4%
Standard Deviation: 0.2%

Liquid Limits

	Sample 1	Sample 2	Sample 3	Sample 4
Number of Blows:	30	28	25	15
Weight of Wet Soil & Pan (g):	8.839	12.963	10.250	12.365
Weight of Dry Soil & Pan (g):	6.132	8.887	7.024	8.237
Weight of Water (g):	2.707	4.076	3.226	4.128
Weight of Pan (g):	1.074	1.147	1.081	1.137
Moisture Content (%):	53.5	52.7	54.3	58.1

Plastic Limit: 15
Liquid Limit: 54
Plastic Index: 39
Atterberg Classification CH





Data Entered By: KR
Date: 8/9/2016
File Name: 2679_96_atterberg-ASTMD-4318-R8_13.xls

Data Checked By: CAL
Date: 8/9/16

ATT
ADVANCED TERRA TESTING

Atterberg Limits Test
ASTM D 4318

Client: RJH Consultants
Job Number: 2679-96
Project: Thornton Water Treatment Plant
Location: --
Project Number: 16104

Boring Number: B-102
Depth: 49-51'
Sample Number: S-21
Test Date: 08/02/2016
Technician: DPM
Sampled Date: --
Sampled By: --
Method: Method A

Test Configuration

Liquid Limits Device: 1075
Material Size of Fines: -#40

Plastic Limits

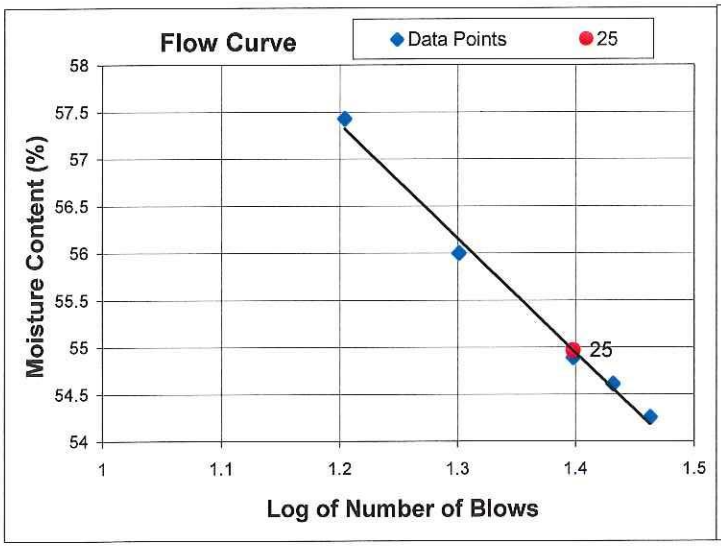
	Sample 1	Sample 2	Sample 3
Weight of Wet Soil & Pan (g):	6.797	6.809	6.831
Weight of Dry Soil & Pan (g):	5.793	5.779	5.785
Weight of Water (g):	1.004	1.030	1.046
Weight of Pan (g):	1.086	1.146	1.099
Moisture Content (%):	21.3	22.2	22.3

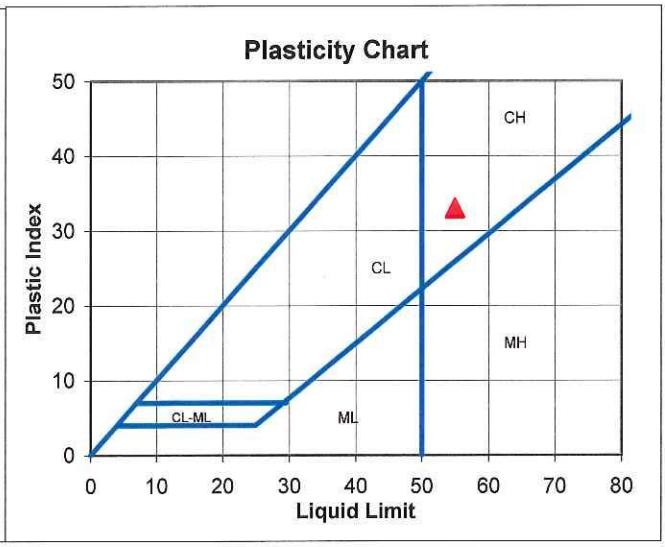
Average: 22.0%
Standard Deviation: 0.5%

Liquid Limits

	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
Number of Blows:	27	29	25	20	16
Weight of Wet Soil & Pan (g):	15.040	14.648	15.440	15.596	12.689
Weight of Dry Soil & Pan (g):	10.120	9.891	10.371	10.408	8.459
Weight of Water (g):	4.920	4.757	5.069	5.188	4.230
Weight of Pan (g):	1.110	1.122	1.136	1.143	1.093
Moisture Content (%):	54.6	54.2	54.9	56.0	57.4

Plastic Limit: 22
Liquid Limit: 55
Plastic Index: 33
Atterberg Classification CH





Data Entered By: CKP Date: 8/3/2016
File Name: 2679_96_atterberg-ASTMD-4318-R8_7.xls

Data Checked By: KR
Date: 8/4/16

ATT
ADVANCED TERRA TESTING

Atterberg Limits Test
ASTM D 4318

Client: RJH Consultants
Job Number: 2679-96
Project: Thornton Water Treatment Plant
Location: --
Project Number: 16104

Boring Number: B-102
Depth: 54-59'
Sample Number: Bu-23
Test Date: 08/15/2016
Technician: DPM
Sampled Date: --
Sampled By: --
Method: Method A

Test Configuration

Liquid Limits Device: 1075
Material Size of Fines: -#40

Plastic Limits

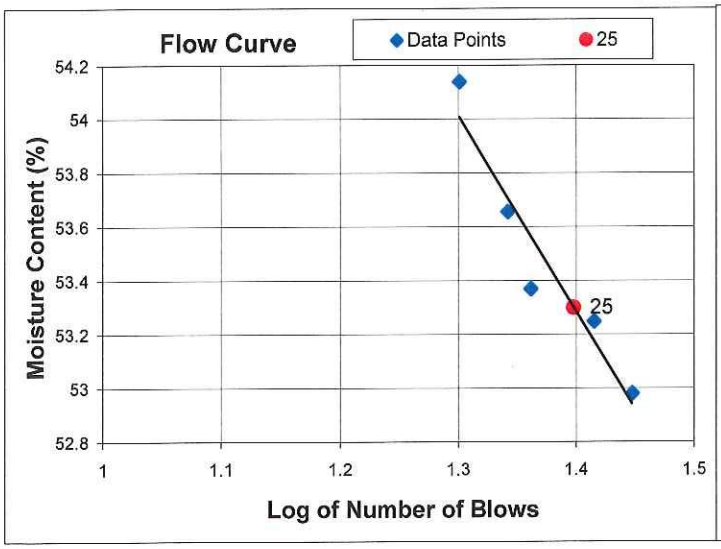
	Sample 1	Sample 2	Sample 3
Weight of Wet Soil & Pan (g):	6.703	6.361	6.588
Weight of Dry Soil & Pan (g):	5.980	5.670	5.880
Weight of Water (g):	0.723	0.691	0.708
Weight of Pan (g):	1.126	1.041	1.113
Moisture Content (%):	14.9	14.9	14.9

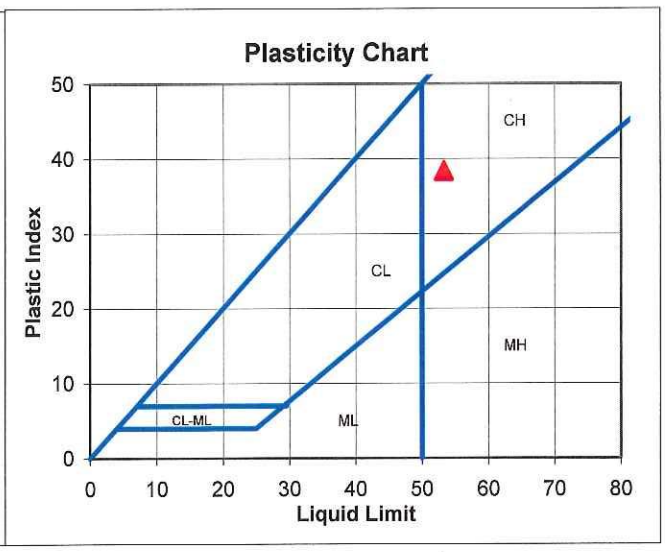
Average: 14.9%
Standard Deviation: 0.0%

Liquid Limits

	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
Number of Blows:	28	26	22	23	20
Weight of Wet Soil & Pan (g):	15.454	14.750	17.044	14.760	14.774
Weight of Dry Soil & Pan (g):	10.483	10.020	11.474	10.007	9.990
Weight of Water (g):	4.971	4.730	5.570	4.753	4.784
Weight of Pan (g):	1.100	1.137	1.093	1.101	1.153
Moisture Content (%):	53.0	53.2	53.7	53.4	54.1

Plastic Limit: 15
Liquid Limit: 53
Plastic Index: 38
Atterberg Classification CH





Data Entered By: CKP Date: 8/16/2016
File Name: 2679_96_atterberg-ASTMD-4318-R8_21.xls

Data Checked By: BKL
Date: 8/17/16

ATT
ADVANCED TERRA TESTING

Atterberg Limits Test
ASTM D 4318

Client: RJH Consultants
Job Number: 2679-96
Project: Thornton Water Treatment Plant
Location: --
Project Number: 16104

Boring Number: B-103
Depth: 0-10'
Sample Number: Bu-2
Test Date: 08/15/2016
Technician: DPM
Sampled Date: --
Sampled By: --
Method: Method A

Test Configuration

Liquid Limits Device: 1075
Material Size of Fines: -#40

Plastic Limits

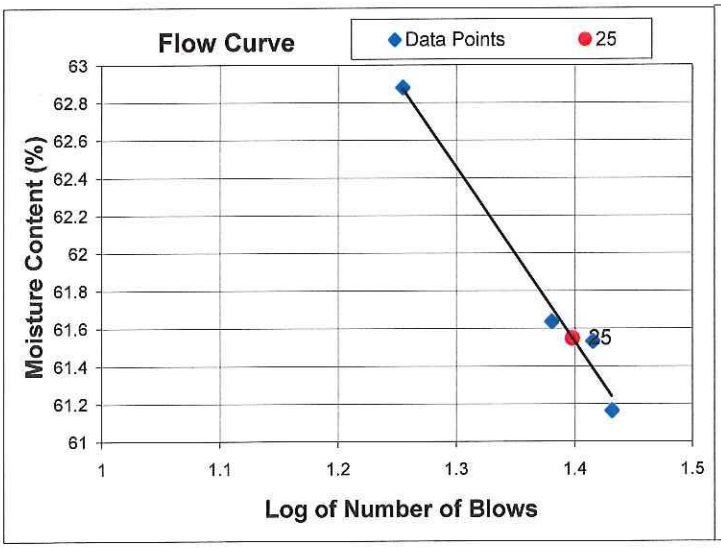
	Sample 1	Sample 2	Sample 3
Weight of Wet Soil & Pan (g):	5.757	6.006	5.950
Weight of Dry Soil & Pan (g):	5.057	5.282	5.209
Weight of Water (g):	0.700	0.724	0.741
Weight of Pan (g):	1.051	1.086	1.101
Moisture Content (%):	17.5	17.3	18.0

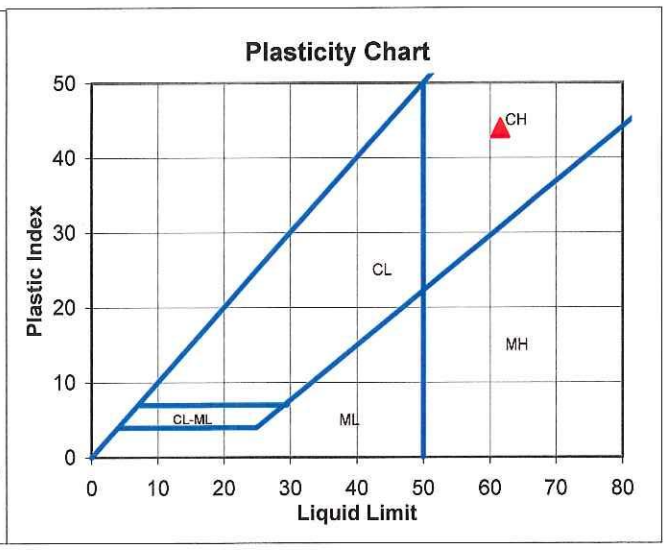
Average: 17.6%
Standard Deviation: 0.4%

Liquid Limits

	Sample 1	Sample 2	Sample 3	Sample 4
Number of Blows:	26	27	24	18
Weight of Wet Soil & Pan (g):	14.592	15.615	14.495	15.402
Weight of Dry Soil & Pan (g):	9.438	10.117	9.402	9.893
Weight of Water (g):	5.154	5.498	5.093	5.509
Weight of Pan (g):	1.062	1.128	1.139	1.132
Moisture Content (%):	61.5	61.2	61.6	62.9

Plastic Limit: 18
Liquid Limit: 62
Plastic Index: 44
Atterberg Classification CH





Data Entered By: CKP Date: 8/16/2016
File Name: 2679_96_atterberg-ASTMD-4318-R8_22.xls

Data Checked By: BKL
Date: 8/17/16

ATT
ADVANCED TERRA TESTING

Atterberg Limits Test
ASTM D 4318

Client: RJH Consultants
Job Number: 2679-96
Project: Thornton Water Treatment Plant
Location: --
Project Number: 16104

Boring Number: B-103
Depth: 10-12'
Sample Number: S-6
Test Date: 8/11/2016
Technician: DPM
Sampled Date: --
Sampled By: --
Method: Method A

Test Configuration

Liquid Limits Device: 1075
Material Size of Fines: -#40

Plastic Limits

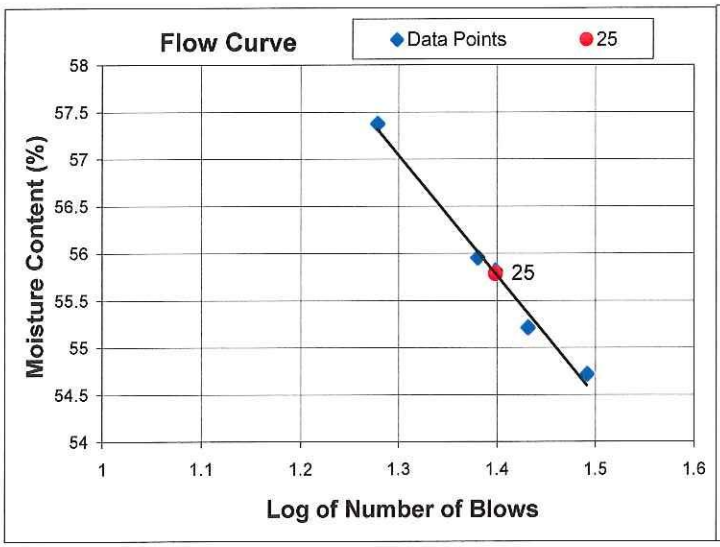
	Sample 1	Sample 2
Weight of Wet Soil & Pan (g):	6.829	6.791
Weight of Dry Soil & Pan (g):	5.913	5.899
Weight of Water (g):	0.916	0.892
Weight of Pan (g):	1.138	1.140
Moisture Content (%):	19.2	18.7

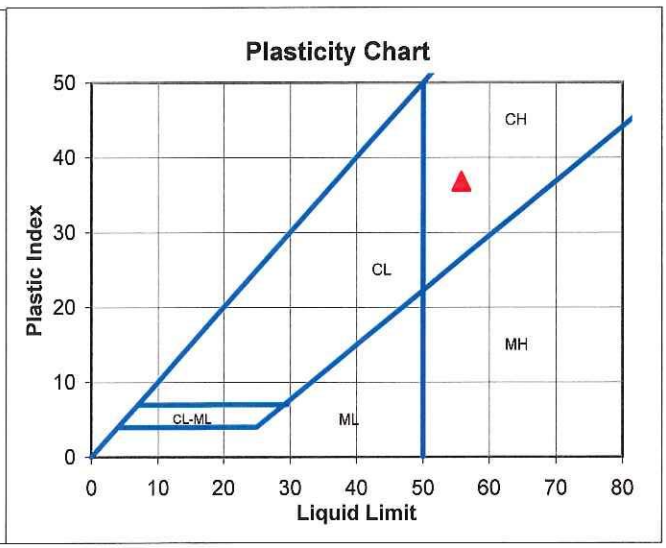
Average: 19.0%
Standard Deviation: 0.3%

Liquid Limits

	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
Number of Blows:	25	27	31	24	19
Weight of Wet Soil & Pan (g):	14.168	14.872	14.430	18.610	14.980
Weight of Dry Soil & Pan (g):	9.493	9.977	9.713	12.318	9.916
Weight of Water (g):	4.675	4.895	4.717	6.292	5.064
Weight of Pan (g):	1.117	1.111	1.092	1.073	1.090
Moisture Content (%):	55.8	55.2	54.7	56.0	57.4

Plastic Limit: 19
Liquid Limit: 56
Plastic Index: 37
Atterberg Classification CH





Data Entered By: KR
Date: 8/15/2016
File Name: 2679_96_atterberg-ASTMD-4318-R8_18.xls

Data Checked By: CM
Date: 8-15-16

ATT
ADVANCED TERRA TESTING

Atterberg Limits Test
ASTM D 4318

Client: RJH Consultants
Job Number: 2679-96
Project: Thornton Water Treatment Plant
Location: --
Project Number: 16104

Boring Number: B-103
Depth: 26.5-27.5'
Sample Number: DM-11
Test Date: 07/29/2016
Technician: BDF
Sampled Date: 6/20/2016
Sampled By: --
Method: Method A

Test Configuration

Liquid Limits Device: 1075
Material Size of Fines: -#40

Plastic Limits

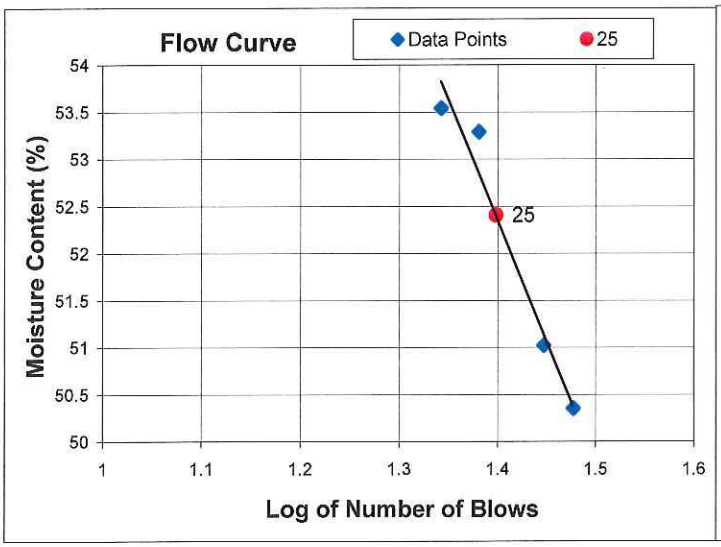
	Sample 1	Sample 2	Sample 3
Weight of Wet Soil & Pan (g):	5.614	5.953	5.839
Weight of Dry Soil & Pan (g):	5.043	5.331	5.234
Weight of Water (g):	0.571	0.622	0.605
Weight of Pan (g):	1.133	1.139	1.135
Moisture Content (%):	14.6	14.8	14.8

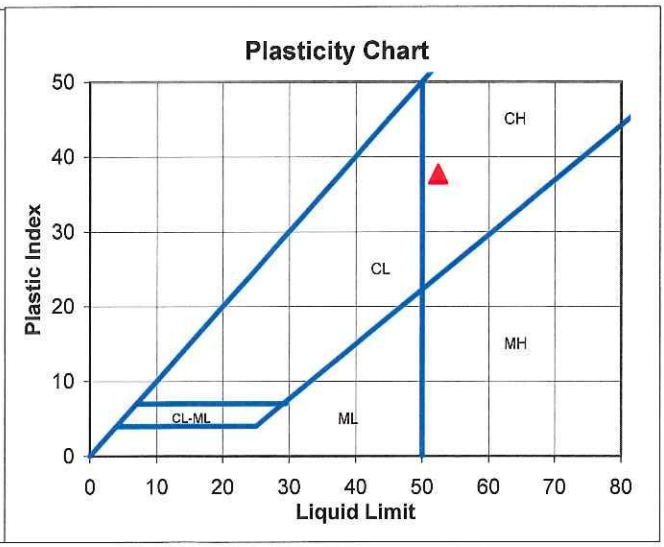
Average: 14.7%
Standard Deviation: 0.1%

Liquid Limits

	Sample 1	Sample 2	Sample 3	Sample 4
Number of Blows:	30	28	22	24
Weight of Wet Soil & Pan (g):	9.048	8.909	8.656	8.255
Weight of Dry Soil & Pan (g):	6.400	6.280	6.023	5.767
Weight of Water (g):	2.648	2.629	2.633	2.488
Weight of Pan (g):	1.141	1.127	1.105	1.098
Moisture Content (%):	50.4	51.0	53.5	53.3

Plastic Limit: 15
Liquid Limit: 52
Plastic Index: 37
Atterberg Classification CH





Data Entered By: CKP Date: 8/3/2016
File Name: 2679_96_atterberg-ASTMD-4318-R8_5.xls

Data Checked By: KR
Date: 8/4/16

ATT
ADVANCED TERRA TESTING

Atterberg Limits Test
ASTM D 4318

Client: RJH Consultants
Job Number: 2679-96
Project: Thornton Water Treatment Plant
Location: --
Project Number: 16104

Boring Number: B-103
Depth: 34-36'
Sample Number: S-14
Test Date: 8/5/2016
Technician: DPM
Sampled Date: --
Sampled By: --
Method: Method A

Test Configuration

Liquid Limits Device: 1075
Material Size of Fines: -#40

Plastic Limits

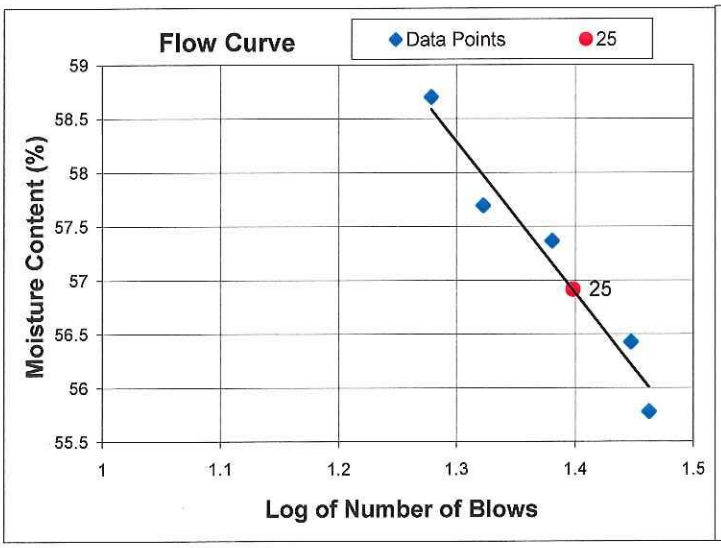
	Sample 1	Sample 2
Weight of Wet Soil & Pan (g):	7.143	6.017
Weight of Dry Soil & Pan (g):	6.067	5.165
Weight of Water (g):	1.076	0.852
Weight of Pan (g):	1.151	1.163
Moisture Content (%):	21.9	21.3

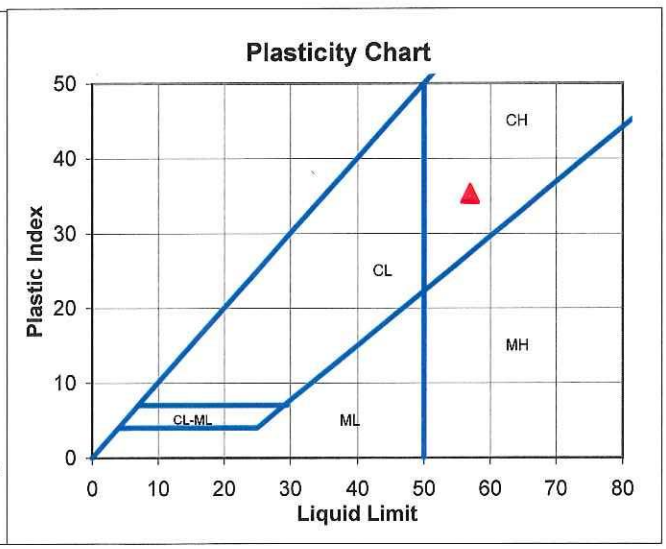
Average: 21.6%
Standard Deviation: 0.4%

Liquid Limits

	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
Number of Blows:	29	28	21	24	19
Weight of Wet Soil & Pan (g):	13.591	15.279	14.510	13.938	14.528
Weight of Dry Soil & Pan (g):	9.148	10.179	9.619	9.275	9.549
Weight of Water (g):	4.443	5.100	4.891	4.663	4.979
Weight of Pan (g):	1.182	1.140	1.141	1.146	1.067
Moisture Content (%):	55.8	56.4	57.7	57.4	58.7

Plastic Limit: 22
Liquid Limit: 57
Plastic Index: 35
Atterberg Classification CH





Data Entered By: KR Date: 8/8/2016
File Name: 2679_96_atterberg-ASTMD-4318-R8_12.xls

Data Checked By: cm
Date: 8/09/16

ATT
ADVANCED TERRA TESTING

Atterberg Limits Test
ASTM D 4318

Client: RJH Consultants
Job Number: 2679-96
Project: Thornton Water Treatment Plant
Location: --
Project Number: 16104

Boring Number: B-103
Depth: 54-54.4'
Sample Number: DM-18
Test Date: 8/3/2016
Technician: DPM
Sampled Date: 6/20/2016
Sampled By: --
Method: Method A

Test Configuration

Liquid Limits Device: 1075
Material Size of Fines: -#40

Plastic Limits

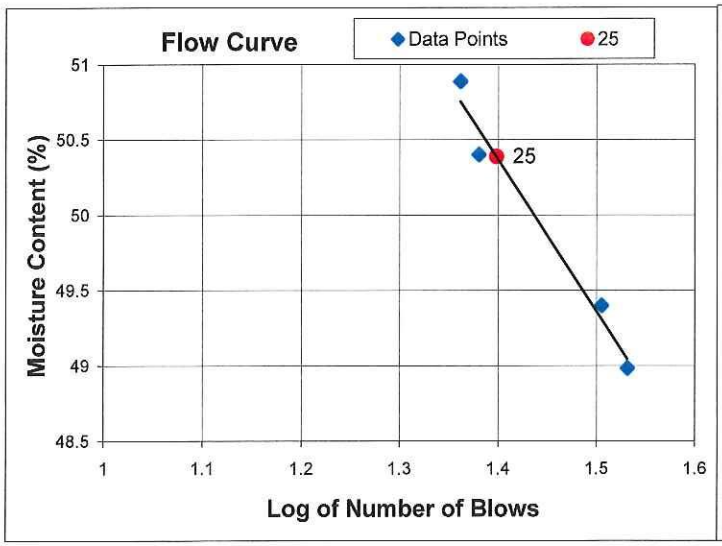
	Sample 1	Sample 2	Sample 3
Weight of Wet Soil & Pan (g):	7.039	6.769	6.711
Weight of Dry Soil & Pan (g):	6.110	5.863	5.854
Weight of Water (g):	0.929	0.906	0.857
Weight of Pan (g):	1.100	1.151	1.075
Moisture Content (%):	18.5	19.2	17.9

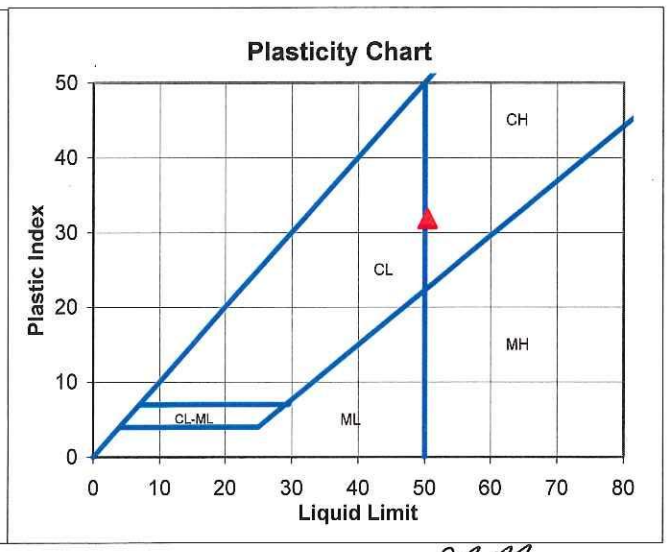
Average: 18.6%
Standard Deviation: 0.6%

Liquid Limits

	Sample 1	Sample 2	Sample 3	Sample 4
Number of Blows:	34	32	24	23
Weight of Wet Soil & Pan (g):	16.171	15.521	15.804	15.258
Weight of Dry Soil & Pan (g):	11.213	10.762	10.906	10.492
Weight of Water (g):	4.958	4.759	4.898	4.766
Weight of Pan (g):	1.091	1.128	1.188	1.126
Moisture Content (%):	49.0	49.4	50.4	50.9

Plastic Limit: 19
Liquid Limit: 50
Plastic Index: 31
Atterberg Classification CH





Data Entered By: KR Date: 8/5/2016
File Name: 2679_96_atterberg-ASTMD-4318-R8_11.xls

Data Checked By: DPM
Date: 8/5/16

ATT
ADVANCED TERRA TESTING

Atterberg Limits Test
ASTM D 4318

Client: RJH Consultants
Job Number: 2679-96
Project: Thornton Water Treatment Plant
Location: --
Project Number: 16104

Boring Number: B-103
Depth: 69-69.5'
Sample Number: S-21
Test Date: 08/01/2016
Technician: BDF
Sampled Date: --
Sampled By: --
Method: Method A

Test Configuration

Liquid Limits Device: 1075
Material Size of Fines: -#40

Plastic Limits

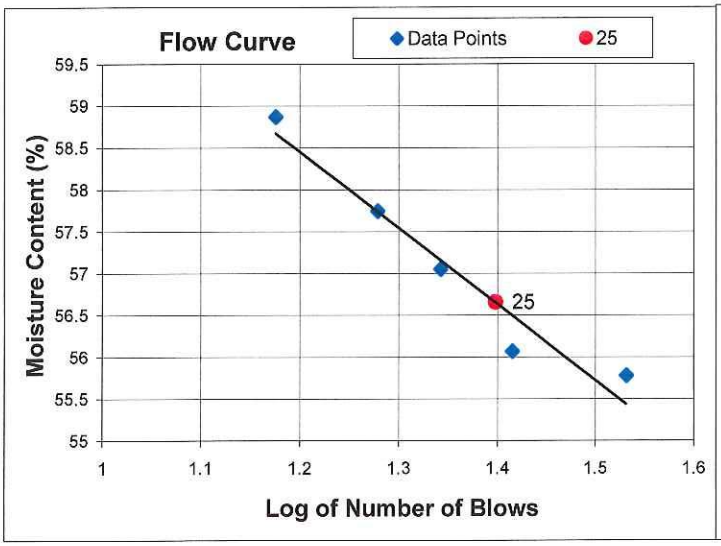
	Sample 1	Sample 2	Sample 3
Weight of Wet Soil & Pan (g):	5.359	5.631	5.563
Weight of Dry Soil & Pan (g):	4.734	4.946	4.882
Weight of Water (g):	0.625	0.685	0.681
Weight of Pan (g):	1.104	1.138	1.120
Moisture Content (%):	17.2	18.0	18.1

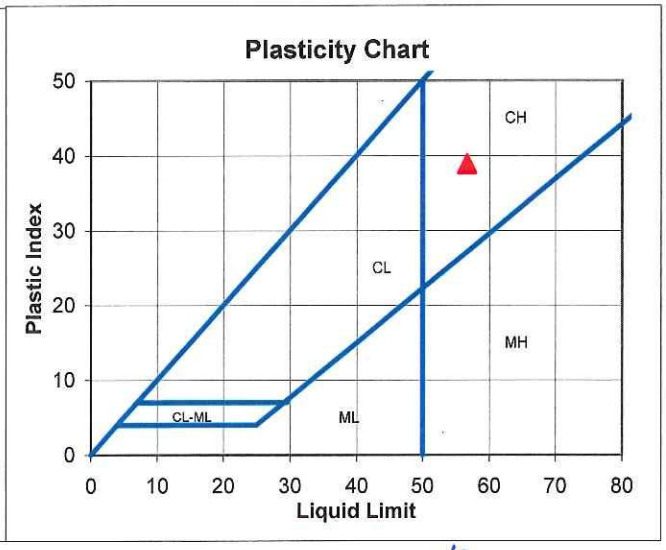
Average: 17.8%
Standard Deviation: 0.5%

Liquid Limits

	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
Number of Blows:	15	19	22	26	34
Weight of Wet Soil & Pan (g):	7.743	8.462	8.379	9.023	8.959
Weight of Dry Soil & Pan (g):	5.296	5.773	5.745	6.189	6.158
Weight of Water (g):	2.447	2.689	2.634	2.834	2.801
Weight of Pan (g):	1.139	1.116	1.128	1.134	1.136
Moisture Content (%):	58.9	57.7	57.1	56.1	55.8

Plastic Limit: 18
Liquid Limit: 57
Plastic Index: 39
Atterberg Classification CH





Data Entered By: CKP Date: 8/3/2016
File Name: 2679_96_atterberg-ASTMD-4318-R8_4.xls

Data Checked By: KR
Date: 8/4/16

ATT
ADVANCED TERRA TESTING

Atterberg Limits Test
ASTM D 4318

Client: RJH Consultants
Job Number: 2679-96
Project: Thornton Water Treatment Plant
Location: --
Project Number: 16104

Boring Number: B-104(P)
Depth: 15-17'
Sample Number: S-5
Test Date: 8/18/2016
Technician: BDF
Sampled Date: --
Sampled By: --
Method: Method A

Test Configuration

Liquid Limits Device: 1080
Material Size of Fines: -#40

Plastic Limits

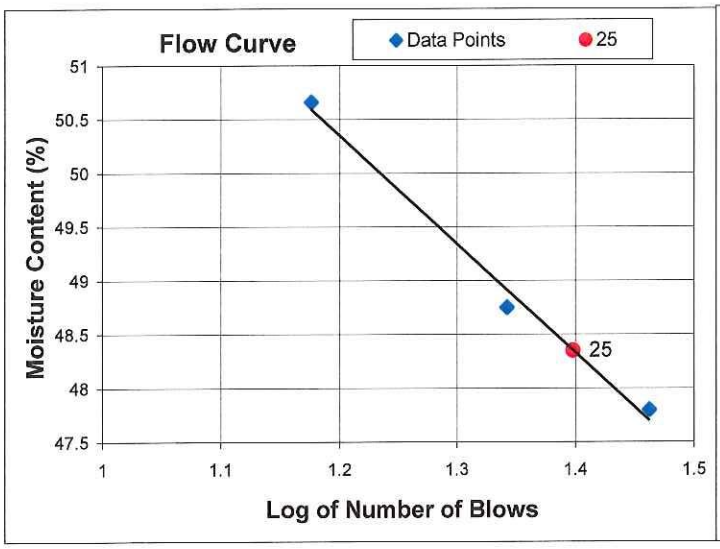
	Sample 1	Sample 2
Weight of Wet Soil & Pan (g):	5.602	5.782
Weight of Dry Soil & Pan (g):	5.037	5.203
Weight of Water (g):	0.565	0.579
Weight of Pan (g):	1.129	1.138
Moisture Content (%):	14.5	14.2

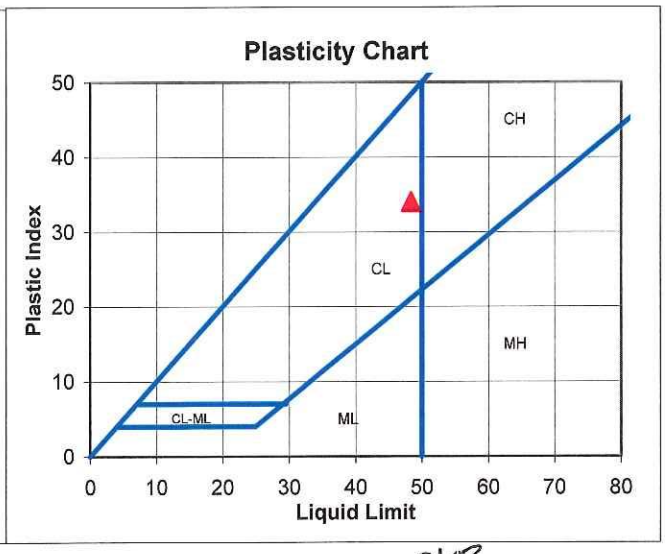
Average: 14.4%
Standard Deviation: 0.2%

Liquid Limits

	Sample 1	Sample 2	Sample 3
Number of Blows:	29	22	15
Weight of Wet Soil & Pan (g):	12.611	12.887	11.138
Weight of Dry Soil & Pan (g):	8.903	9.035	7.763
Weight of Water (g):	3.708	3.852	3.375
Weight of Pan (g):	1.145	1.133	1.101
Moisture Content (%):	47.8	48.7	50.7

Plastic Limit: 14
Liquid Limit: 48
Plastic Index: 34
Atterberg Classification CL





Data Entered By: DPM Date: 8/19/2016
File Name: 2679_96_atterberg-ASTMD-4318-R8_25.xls

Data Checked By: CKP
Date: 8/19/16

ATT
ADVANCED TERRA TESTING

Atterberg Limits Test
ASTM D 4318

Client: RJH Consultants
Job Number: 2679-96
Project: Thornton Water Treatment Plant
Location: --
Project Number: 16104

Boring Number: B-104(P)
Depth: 27.5-29.5'
Sample Number: S-9
Test Date: 08/02/2016
Technician: BDF
Sampled Date: --
Sampled By: --
Method: Method A

Test Configuration

Liquid Limits Device: 1075
Material Size of Fines: -#40

Plastic Limits

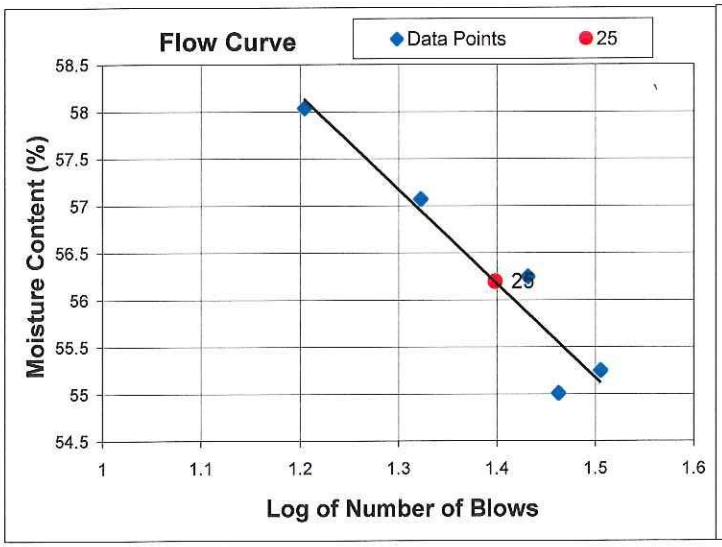
	Sample 1	Sample 2	Sample 3
Weight of Wet Soil & Pan (g):	5.317	5.533	5.116
Weight of Dry Soil & Pan (g):	4.682	4.877	4.543
Weight of Water (g):	0.635	0.656	0.573
Weight of Pan (g):	1.134	1.099	1.132
Moisture Content (%):	17.9	17.4	16.8

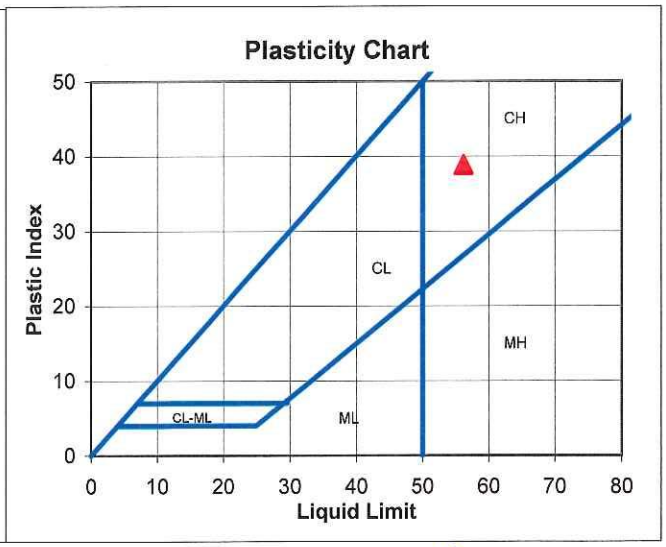
Average: 17.4%
Standard Deviation: 0.5%

Liquid Limits

	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
Number of Blows:	16	29	32	21	27
Weight of Wet Soil & Pan (g):	9.597	10.449	8.471	9.298	9.567
Weight of Dry Soil & Pan (g):	6.491	7.131	5.844	6.336	6.532
Weight of Water (g):	3.106	3.318	2.627	2.962	3.035
Weight of Pan (g):	1.139	1.099	1.089	1.146	1.136
Moisture Content (%):	58.0	55.0	55.2	57.1	56.2

Plastic Limit: 17
Liquid Limit: 56
Plastic Index: 39
Atterberg Classification CH





Data Entered By: CKP Date: 8/3/2016
File Name: 2679_96_atterberg-ASTMD-4318-R8_6.xls

Data Checked By: KR
Date: 8/4/16

ATT
ADVANCED TERRA TESTING

Atterberg Limits Test
ASTM D 4318

Client: RJH Consultants
Job Number: 2679-96
Project: Thornton Water Treatment Plant
Location: --
Project Number: 16104

Boring Number: B-104 (P)
Depth: 40-42'
Sample Number: S-14
Test Date: 8/3/2016
Technician: DPM
Sampled Date: --
Sampled By: --
Method: Method A

Test Configuration

Liquid Limits Device: 1075
Material Size of Fines: -#40

Plastic Limits

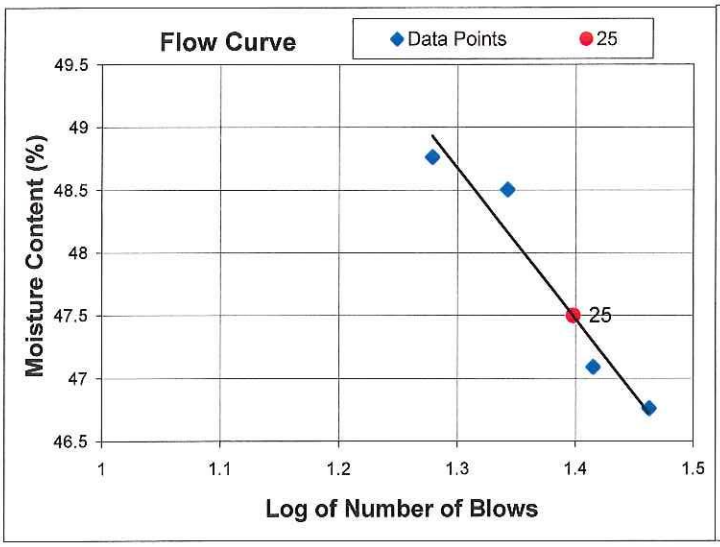
	Sample 1	Sample 2	Sample 3
Weight of Wet Soil & Pan (g):	6.562	7.102	7.442
Weight of Dry Soil & Pan (g):	5.831	6.262	6.563
Weight of Water (g):	0.731	0.840	0.879
Weight of Pan (g):	1.122	1.105	1.135
Moisture Content (%):	15.5	16.3	16.2

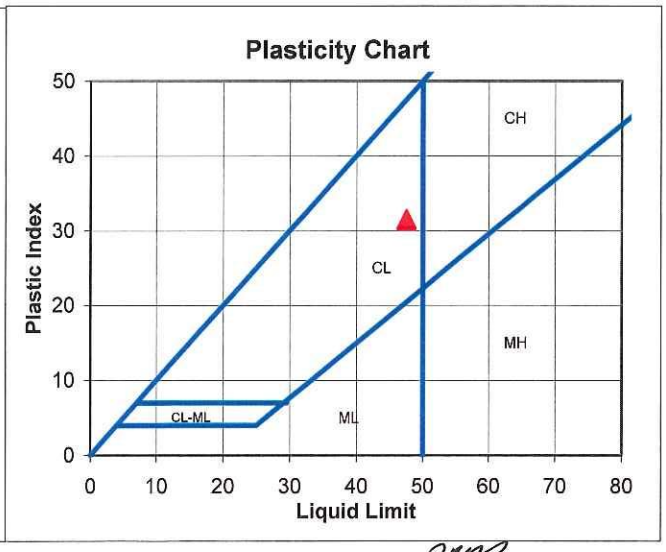
Average: 16.0%
Standard Deviation: 0.4%

Liquid Limits

	Sample 1	Sample 2	Sample 3	Sample 4
Number of Blows:	29	26	19	22
Weight of Wet Soil & Pan (g):	13.361	13.710	14.316	14.824
Weight of Dry Soil & Pan (g):	9.466	9.683	10.000	10.354
Weight of Water (g):	3.895	4.027	4.316	4.470
Weight of Pan (g):	1.136	1.131	1.149	1.138
Moisture Content (%):	46.8	47.1	48.8	48.5

Plastic Limit: 16
Liquid Limit: 47
Plastic Index: 31
Atterberg Classification CL





Data Entered By: KR
Date: 8/5/2016
File Name: 2679_96_atterberg-ASTMD-4318-R8_8.xls

Data Checked By: DPM
Date: 8/5/16

ATT
ADVANCED TERRA TESTING

Atterberg Limits Test
ASTM D 4318

Client: RJH Consultants
Job Number: 2679-96
Project: Thornton Water Treatment Plant
Location: --
Project Number: 16104

Boring Number: B-104(P)
Depth: 55-56.5'
Sample Number: S-17
Test Date: 08/01/2016
Technician: DPM
Sampled Date: --
Sampled By: --
Method: Method A

Test Configuration

Liquid Limits Device: 1075
Material Size of Fines: -#40

Plastic Limits

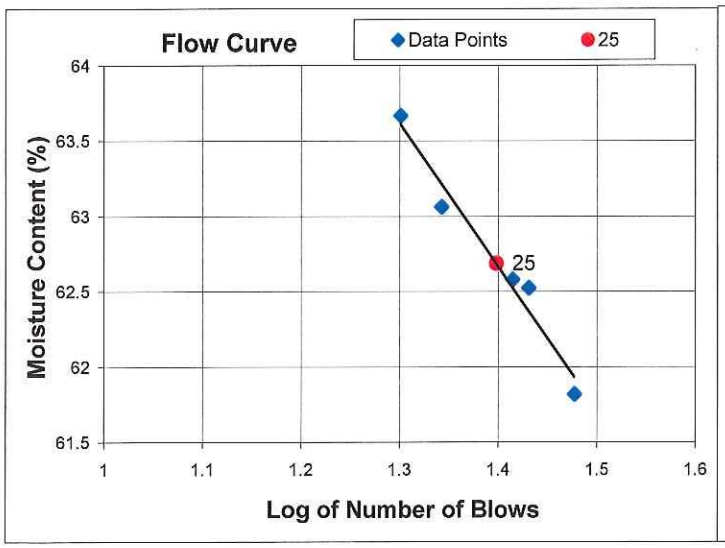
	Sample 1	Sample 2	Sample 3
Weight of Wet Soil & Pan (g):	6.542	6.179	6.263
Weight of Dry Soil & Pan (g):	5.580	5.310	5.361
Weight of Water (g):	0.962	0.869	0.902
Weight of Pan (g):	1.136	1.166	1.047
Moisture Content (%):	21.6	21.0	20.9

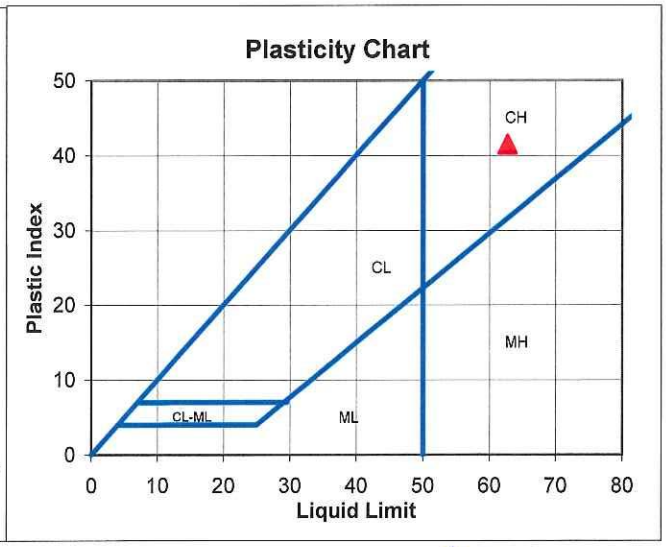
Average: 21.2%
Standard Deviation: 0.4%

Liquid Limits

	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
Number of Blows:	26	30	27	22	20
Weight of Wet Soil & Pan (g):	12.833	16.213	14.745	14.193	14.971
Weight of Dry Soil & Pan (g):	8.308	10.428	9.497	9.148	9.572
Weight of Water (g):	4.525	5.785	5.248	5.045	5.399
Weight of Pan (g):	1.077	1.070	1.103	1.148	1.092
Moisture Content (%):	62.6	61.8	62.5	63.1	63.7

Plastic Limit: 21
Liquid Limit: 63
Plastic Index: 42
Atterberg Classification CH





Data Entered By: CKP Date: 8/3/2016
File Name: 2679_96_atterberg-ASTMD-4318-R8_3.xls

Data Checked By: KP
Date: 8/4/16

ATT
ADVANCED TERRA TESTING

Atterberg Limits Test
ASTM D 4318

Client:	RJH Consultants	Boring Number:	B-105
Job Number:	2679-96	Depth:	7.5-8.5' (8.0-8.5')
Project:	Thornton Water Treatment Plant	Sample Number:	DM-4
Location:	--	Test Date:	8/3/2016
Project Number:	16104	Technician:	DPM
		Sampled Date:	6/29/2016
		Sampled By:	--
		Method:	Method A

Test Configuration

Liquid Limits Device: 1075
Material Size of Fines: -#40

Plastic Limits

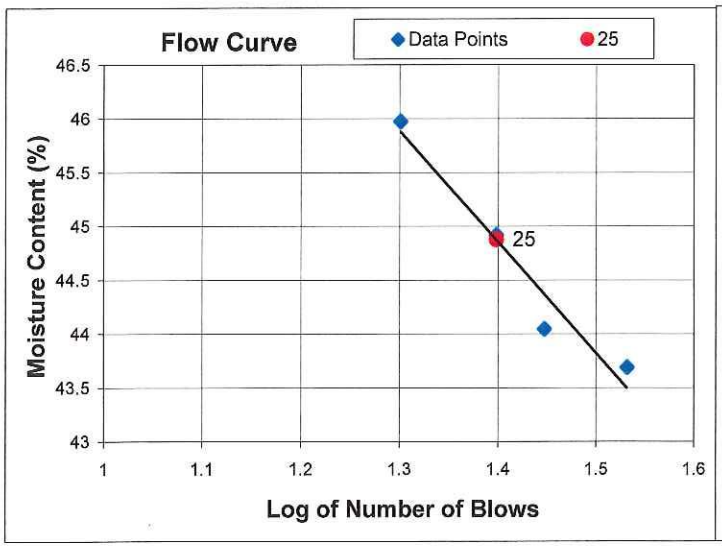
	Sample 1	Sample 2	Sample 3
Weight of Wet Soil & Pan (g):	6.768	6.600	6.553
Weight of Dry Soil & Pan (g):	6.069	5.908	5.904
Weight of Water (g):	0.699	0.692	0.649
Weight of Pan (g):	1.152	1.093	1.143
Moisture Content (%):	14.2	14.4	13.6

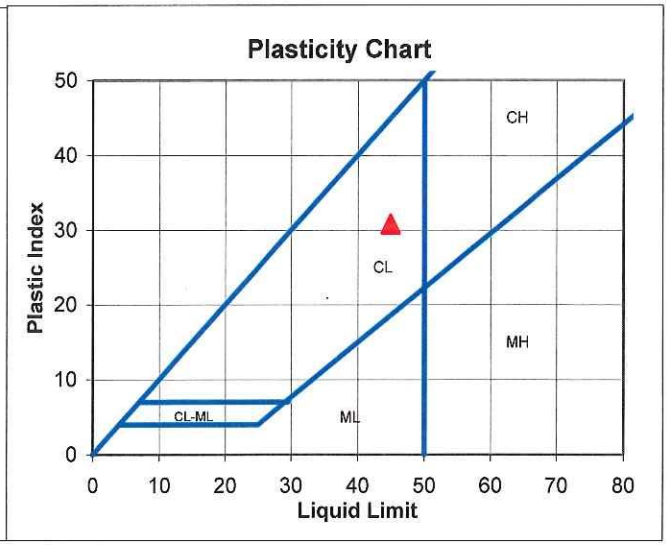
Average: 14.1%
Standard Deviation: 0.4%

Liquid Limits

	Sample 1	Sample 2	Sample 3	Sample 4
Number of Blows:	28	34	25	20
Weight of Wet Soil & Pan (g):	13.870	14.579	15.878	15.503
Weight of Dry Soil & Pan (g):	9.981	10.497	11.295	10.976
Weight of Water (g):	3.889	4.082	4.583	4.527
Weight of Pan (g):	1.151	1.153	1.092	1.129
Moisture Content (%):	44.0	43.7	44.9	46.0

Plastic Limit: 14
Liquid Limit: 45
Plastic Index: 31
Atterberg Classification CL





Data Entered By: KR Date: 8/5/2016
File Name: 2679_96_atterberg-ASTMD-4318-R8_9.xls

Data Checked By: DPM
Date: 8/5/16

ATT
ADVANCED TERRA TESTING

Atterberg Limits Test
ASTM D 4318

Client: RJH Consultants
Job Number: 2679-96
Project: Thornton Water Treatment Plant
Location: --
Project Number: 16104

Boring Number: B-106
Depth: 5-6' (5.5-6.0')
Sample Number: DM-3
Test Date: 8/4/2016
Technician: DPM
Sampled Date: 6/24/2016
Sampled By: --
Method: Method A

Test Configuration

Liquid Limits Device: 1075
Material Size of Fines: -#40

Plastic Limits

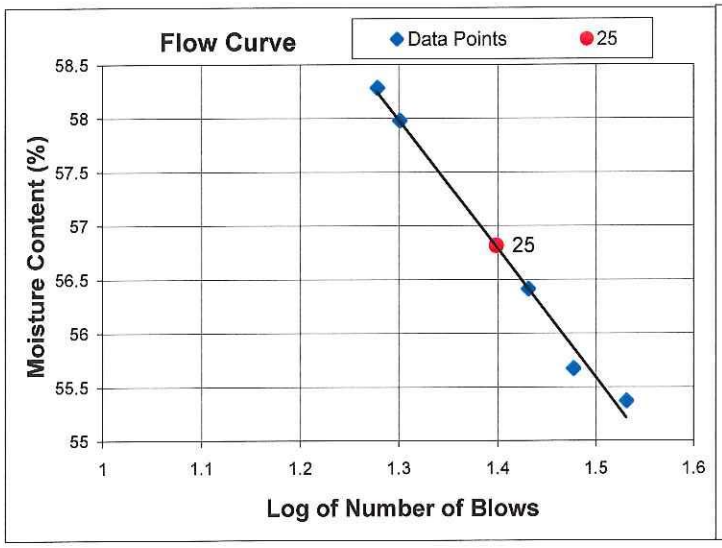
	Sample 1	Sample 2
Weight of Wet Soil & Pan (g):	6.726	6.655
Weight of Dry Soil & Pan (g):	5.930	5.858
Weight of Water (g):	0.796	0.797
Weight of Pan (g):	1.155	1.138
Moisture Content (%):	16.7	16.9

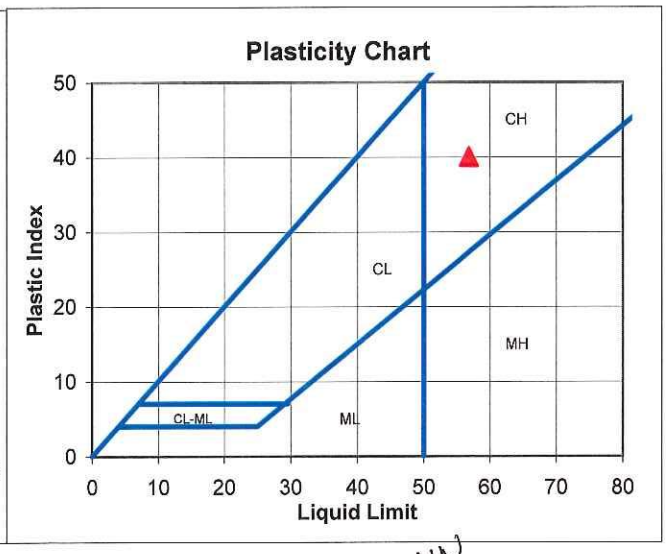
Average: 16.8%
Standard Deviation: 0.2%

Liquid Limits

	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
Number of Blows:	34	30	27	19	20
Weight of Wet Soil & Pan (g):	13.418	14.868	14.753	12.747	11.981
Weight of Dry Soil & Pan (g):	9.034	9.964	9.846	8.472	7.991
Weight of Water (g):	4.384	4.904	4.907	4.275	3.990
Weight of Pan (g):	1.116	1.155	1.147	1.137	1.109
Moisture Content (%):	55.4	55.7	56.4	58.3	58.0

Plastic Limit: 17
Liquid Limit: 57
Plastic Index: 40
Atterberg Classification CH





Data Entered By: KR Date: 8/5/2016
File Name: 2679_96_atterberg-ASTMD-4318-R8_10.xls

Data Checked By: NN
Date: 8/8/16

ATT
ADVANCED TERRA TESTING

Atterberg Limits Test
ASTM D 4318

Client: RJH Consultants
Job Number: 2679-96
Project: Thornton Water Treatment Plant
Location: --
Project Number: 16104

Boring Number: B-106
Depth: 40.0-40.7'
Sample Number: --
Test Date: 08/12/2016
Technician: BDF
Sampled Date: 06/27/2016
Sampled By: --
Method: Method A

Test Configuration

Liquid Limits Device: 1075
Material Size of Fines: -#40

Plastic Limits

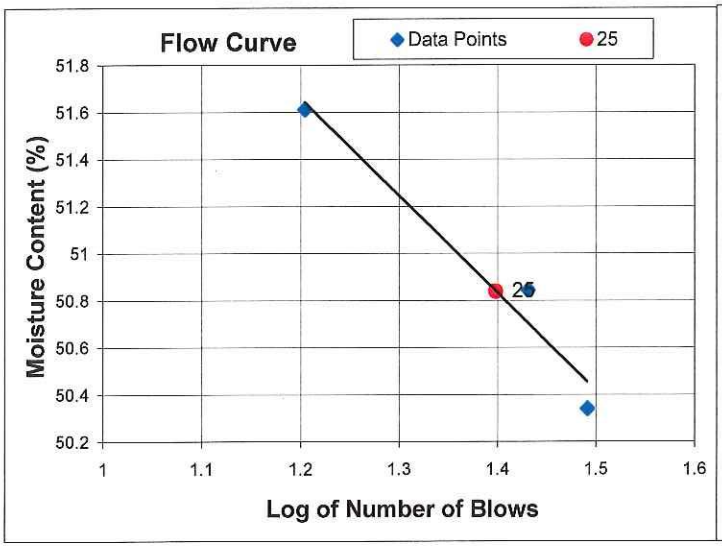
	Sample 1	Sample 2	Sample 3
Weight of Wet Soil & Pan (g):	5.810	6.060	5.975
Weight of Dry Soil & Pan (g):	5.254	5.476	5.396
Weight of Water (g):	0.556	0.584	0.579
Weight of Pan (g):	1.103	1.143	1.094
Moisture Content (%):	13.4	13.5	13.5

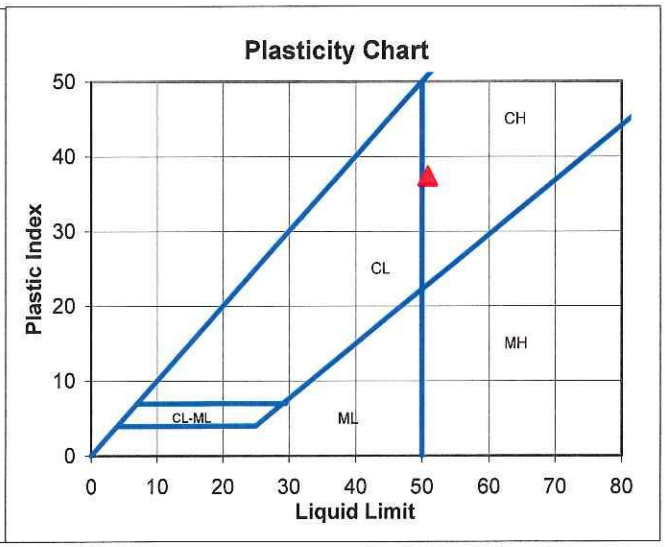
Average: 13.4%
Standard Deviation: 0.0%

Liquid Limits

	Sample 1	Sample 2	Sample 3
Number of Blows:	27	16	31
Weight of Wet Soil & Pan (g):	13.040	13.378	13.211
Weight of Dry Soil & Pan (g):	9.007	9.198	9.146
Weight of Water (g):	4.033	4.180	4.065
Weight of Pan (g):	1.075	1.099	1.071
Moisture Content (%):	50.8	51.6	50.3

Plastic Limit: 13
Liquid Limit: 51
Plastic Index: 38
Atterberg Classification CH





Data Entered By: CKP Date: 8/16/2016
File Name: 2679_96_atterberg-ASTMD-4318-R8_19.xls

Data Checked By: BKL
Date: 8/17/16

ATT
ADVANCED TERRA TESTING

Atterberg Limits Test
ASTM D 4318

Client: RJH Consultants
Job Number: 2679-96
Project: Thornton Water Treatment Plant
Location: --
Project Number: 16104

Boring Number: B-106
Depth: 49.4-50.0'
Sample Number: NQ-6 & NQ-7
Test Date: 8/16/2016
Technician: BDF
Sampled Date: 6/24/2016
Sampled By: --
Method: Method A

Test Configuration

Liquid Limits Device: 1075
Material Size of Fines: -#40

Plastic Limits

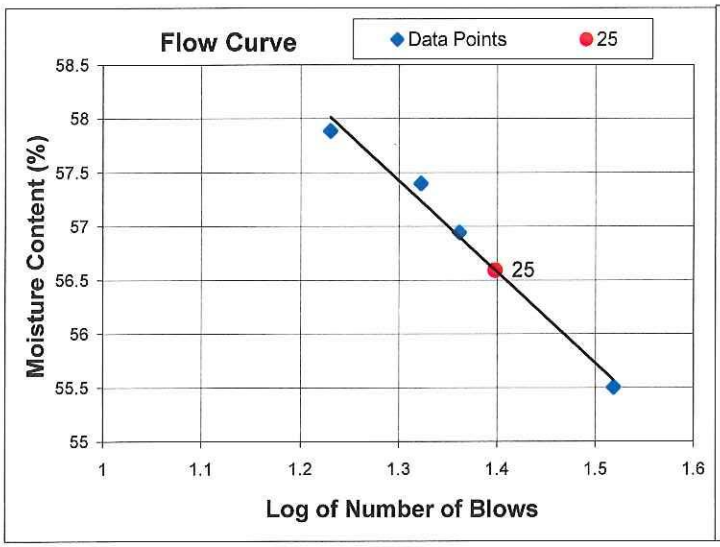
	Sample 1	Sample 2	Sample 3
Weight of Wet Soil & Pan (g):	5.553	5.500	5.595
Weight of Dry Soil & Pan (g):	4.876	4.859	4.918
Weight of Water (g):	0.677	0.641	0.677
Weight of Pan (g):	1.146	1.152	1.145
Moisture Content (%):	18.2	17.3	17.9

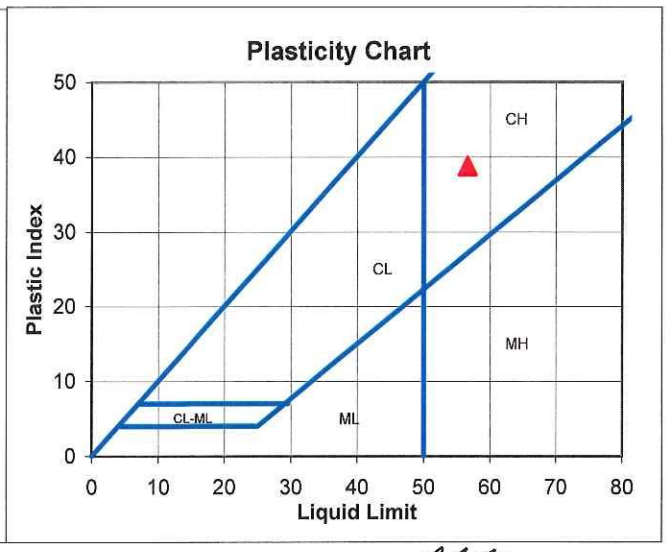
Average: 17.8%
Standard Deviation: 0.4%

Liquid Limits

	Sample 1	Sample 2	Sample 3	Sample 4
Number of Blows:	33	21	17	23
Weight of Wet Soil & Pan (g):	14.774	11.630	13.661	13.362
Weight of Dry Soil & Pan (g):	9.906	7.800	9.073	8.926
Weight of Water (g):	4.868	3.830	4.588	4.436
Weight of Pan (g):	1.135	1.127	1.147	1.135
Moisture Content (%):	55.5	57.4	57.9	56.9

Plastic Limit: 18
Liquid Limit: 57
Plastic Index: 39
Atterberg Classification CH





Data Entered By: KR
Date: 8/17/2016
File Name: 2679_96_atterberg-ASTMD-4318-R8_24.xls

Data Checked By: DM
Date: 8/19/16

ATT
ADVANCED TERRA TESTING

Atterberg Limits Test
ASTM D 4318

Client: RJH Consultants
Job Number: 2679-96
Project: Thornton Water Treatment Plant
Location: --
Project Number: 16104

Boring Number: B-107
Depth: 26-27'
Sample Number: NQ-2
Test Date: 7/26/2016
Technician: BDF
Sampled Date: --
Sampled By: --
Method: Method A

Test Configuration

Liquid Limits Device: 1075
Material Size of Fines: -#40

Plastic Limits

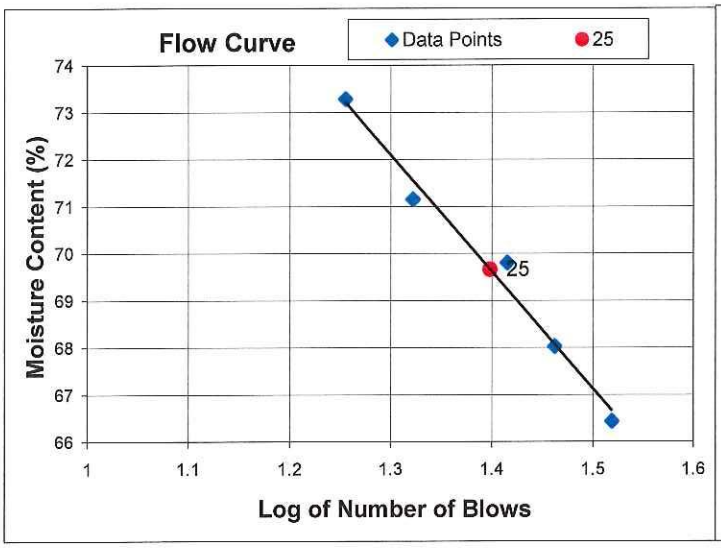
	Sample 1	Sample 2	Sample 3
Weight of Wet Soil & Pan (g):	5.378	5.160	5.195
Weight of Dry Soil & Pan (g):	4.767	4.577	4.598
Weight of Water (g):	0.611	0.583	0.597
Weight of Pan (g):	1.091	1.093	1.075
Moisture Content (%):	16.6	16.7	16.9

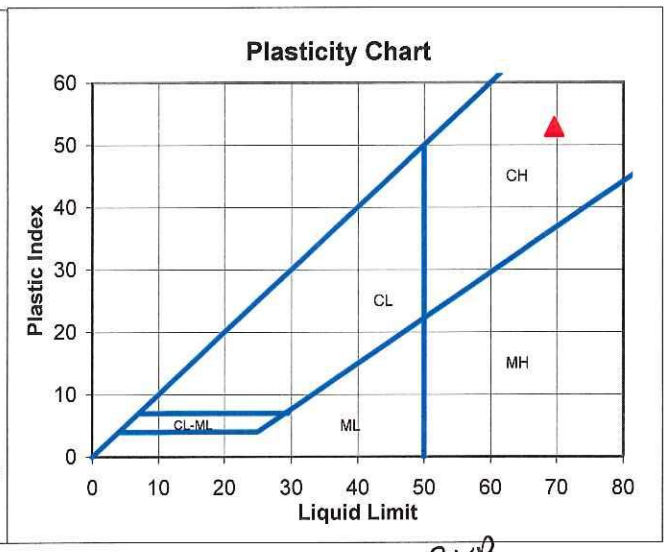
Average: 16.8%
Standard Deviation: 0.2%

Liquid Limits

	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
Number of Blows:	33	26	21	18	29
Weight of Wet Soil & Pan (g):	9.034	8.428	8.266	8.423	9.727
Weight of Dry Soil & Pan (g):	5.863	5.432	5.301	5.332	6.231
Weight of Water (g):	3.171	2.996	2.965	3.091	3.496
Weight of Pan (g):	1.090	1.140	1.134	1.114	1.092
Moisture Content (%):	66.4	69.8	71.2	73.3	68.0

Plastic Limit: 17
Liquid Limit: 70
Plastic Index: 53
Atterberg Classification CH





Data Entered By: NN
Date: 7/27/2016
File Name: 2679_96_atterberg-ASTMD-4318-R8_2.xls

Data Checked By: CKP
Date: 7/27/16

ATT
ADVANCED TERRA TESTING

Atterberg Limits Test
ASTM D 4318

Client: RJH Consultants
Job Number: 2679-96
Project: Thornton Water Treatment Plant
Location: --
Project Number: 16104

Boring Number: B-107
Depth: 33.7-34.3'
Sample Number: NQ-3
Test Date: 08/15/2016
Technician: BDF
Sampled Date: 06/27/2016
Sampled By: --
Method: Method A

Test Configuration

Liquid Limits Device: 0966
Material Size of Fines: -#40

Plastic Limits

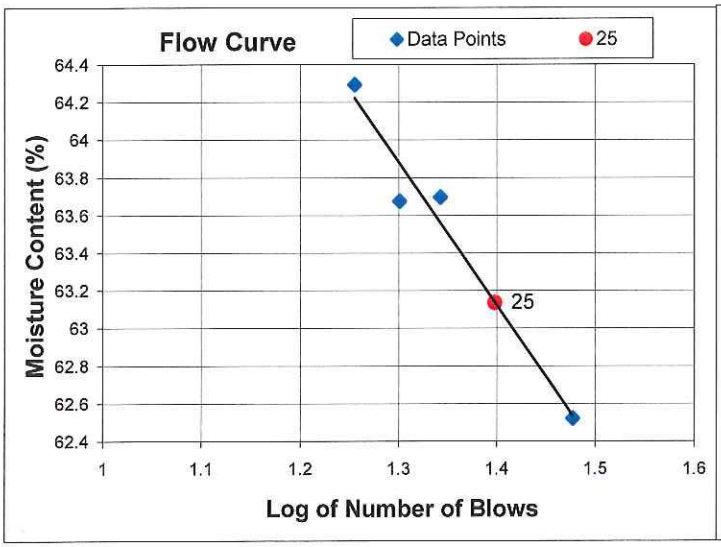
	Sample 1	Sample 2	Sample 3
Weight of Wet Soil & Pan (g):	5.126	5.366	5.931
Weight of Dry Soil & Pan (g):	4.570	4.771	5.258
Weight of Water (g):	0.556	0.595	0.673
Weight of Pan (g):	1.153	1.142	1.160
Moisture Content (%):	16.3	16.4	16.4

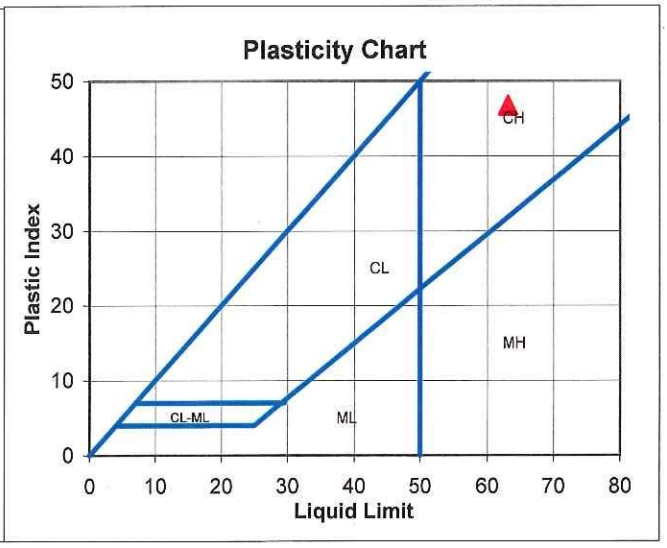
Average: 16.4%
Standard Deviation: 0.1%

Liquid Limits

	Sample 1	Sample 2	Sample 3	Sample 4
Number of Blows:	20	18	30	22
Weight of Wet Soil & Pan (g):	11.048	10.310	11.347	12.015
Weight of Dry Soil & Pan (g):	7.193	6.723	7.425	7.783
Weight of Water (g):	3.855	3.587	3.922	4.232
Weight of Pan (g):	1.139	1.144	1.152	1.139
Moisture Content (%):	63.7	64.3	62.5	63.7

Plastic Limit: 16
Liquid Limit: 63
Plastic Index: 47
Atterberg Classification CH





Data Entered By: CKP Date: 8/16/2016
File Name: 2679_96_atterberg-ASTMD-4318-R8_20.xls

Data Checked By: BKL
Date: 8/17/16

ATT
ADVANCED TERRA TESTING

Atterberg Limits Test
ASTM D 4318

Client: RJH Consultants
Job Number: 2679-96
Project: Thornton Water Treatment Plant
Location: --
Project Number: 16104

Boring Number: B-107
Depth: 44.3-45.0'
Sample Number: NQ-5
Test Date: 8/12/2016
Technician: BDF
Sampled Date: 6/23/2016
Sampled By: --
Method: Method A

Test Configuration

Liquid Limits Device: 1075
Material Size of Fines: -#40

Plastic Limits

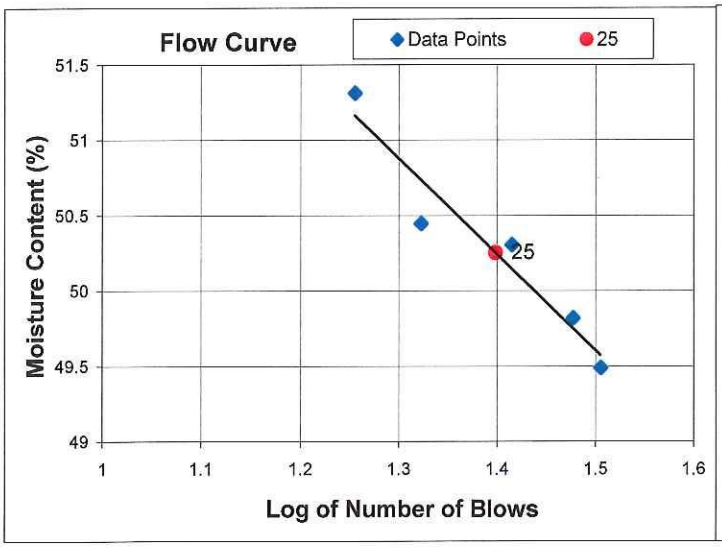
	Sample 1	Sample 2	Sample 3
Weight of Wet Soil & Pan (g):	5.981	5.908	6.027
Weight of Dry Soil & Pan (g):	5.282	5.223	5.298
Weight of Water (g):	0.699	0.685	0.729
Weight of Pan (g):	1.185	1.137	1.136
Moisture Content (%):	17.1	16.8	17.5

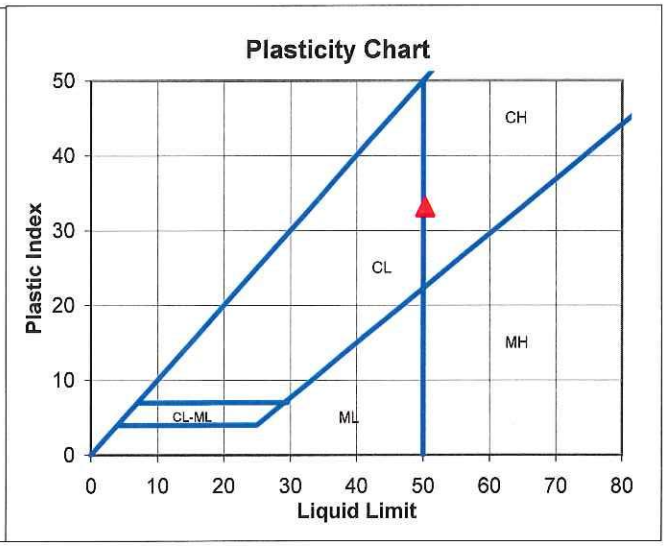
Average: 17.1%
Standard Deviation: 0.4%

Liquid Limits

	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
Number of Blows:	18	26	21	30	32
Weight of Wet Soil & Pan (g):	8.396	10.204	12.232	8.521	9.901
Weight of Dry Soil & Pan (g):	5.932	7.149	8.499	6.045	7.004
Weight of Water (g):	2.464	3.055	3.733	2.476	2.897
Weight of Pan (g):	1.130	1.076	1.099	1.075	1.150
Moisture Content (%):	51.3	50.3	50.4	49.8	49.5

Plastic Limit: 17
Liquid Limit: 50
Plastic Index: 33
Atterberg Classification CH





Data Entered By: KR Date: 8/15/2016
File Name: 2679_96_atterberg-ASTMD-4318-R8_16.xls

Data Checked By: CAL
Date: 8-15-16

ATT
ADVANCED TERRA TESTING

Atterberg Limits Test
ASTM D 4318

Client: RJH Consultants
Job Number: 2679-96
Project: Thornton Water Treatment Plant
Location: --
Project Number: 16104

Boring Number: B-108 (P)
Depth: 30-35'
Sample Number: Bu-5
Test Date: 8/10/2016
Technician: DPM
Sampled Date: --
Sampled By: --
Method: Method A

Test Configuration

Liquid Limits Device: 1075
Material Size of Fines: -#40

Plastic Limits

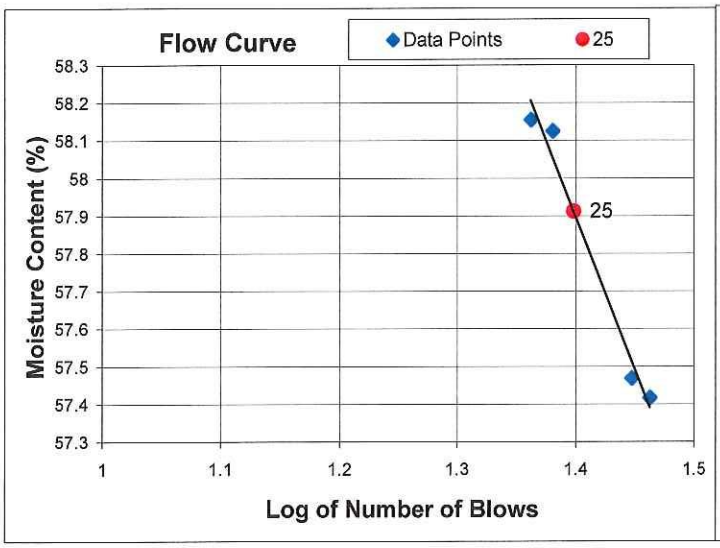
	Sample 1	Sample 2	Sample 3
Weight of Wet Soil & Pan (g):	5.961	5.879	5.899
Weight of Dry Soil & Pan (g):	5.327	5.292	5.287
Weight of Water (g):	0.634	0.587	0.612
Weight of Pan (g):	1.117	1.142	1.150
Moisture Content (%):	15.1	14.1	14.8

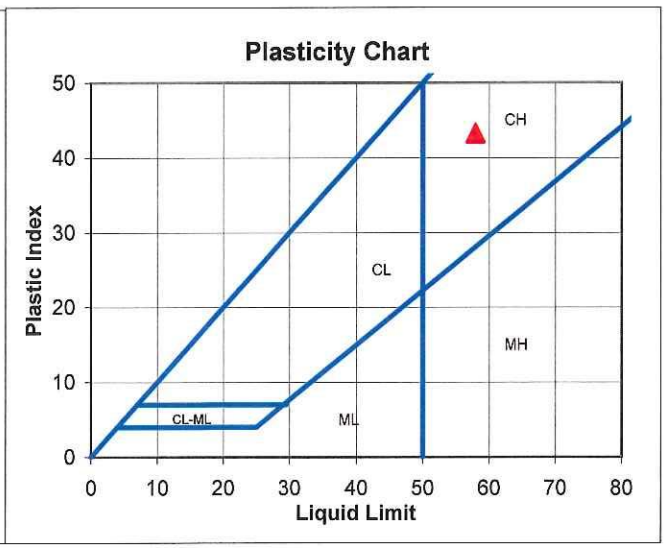
Average: 14.7%
Standard Deviation: 0.5%

Liquid Limits

	Sample 1	Sample 2	Sample 3	Sample 4
Number of Blows:	28	23	29	24
Weight of Wet Soil & Pan (g):	14.438	15.328	16.761	14.474
Weight of Dry Soil & Pan (g):	9.567	10.115	11.063	9.563
Weight of Water (g):	4.871	5.213	5.698	4.911
Weight of Pan (g):	1.091	1.151	1.139	1.114
Moisture Content (%):	57.5	58.2	57.4	58.1

Plastic Limit: 15
Liquid Limit: 58
Plastic Index: 43
Atterberg Classification CH





Data Entered By: KR
Date: 8/15/2016
File Name: 2679_96_atterberg-ASTMD-4318-R8_17.xls

Data Checked By: CMC
Date: 8-15-16

ATT
ADVANCED TERRA TESTING

Atterberg Limits Test
ASTM D 4318

Client: RJH Consultants
Job Number: 2679-96
Project: Thornton Water Treatment Plant
Location: --
Project Number: 16104

Boring Number: B-102 & B-104 (P)
Depth: 10-20'
Sample Number: Bu-6 & Bu-3
Test Date: 8/9/2016
Technician: DPM
Sampled Date: --
Sampled By: --
Method: Method A

Test Configuration

Liquid Limits Device: 1075
Material Size of Fines: -#40

Plastic Limits

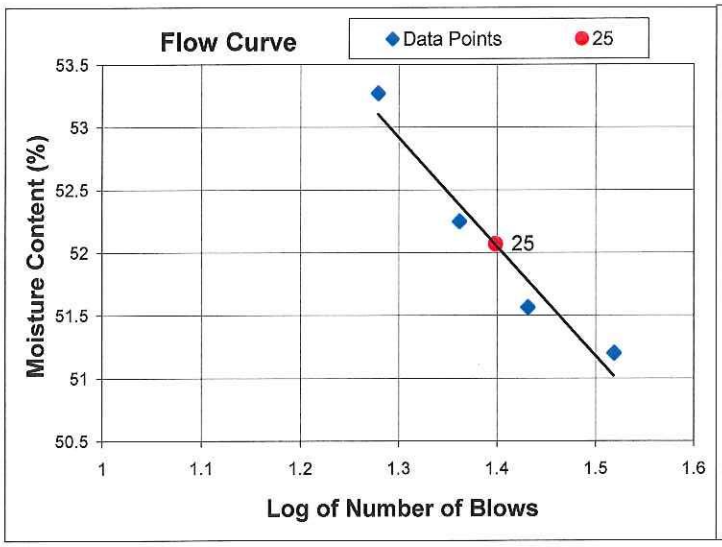
	Sample 1	Sample 2	Sample 3
Weight of Wet Soil & Pan (g):	6.585	6.462	6.561
Weight of Dry Soil & Pan (g):	5.905	5.820	5.893
Weight of Water (g):	0.680	0.642	0.668
Weight of Pan (g):	1.151	1.142	1.089
Moisture Content (%):	14.3	13.7	13.9

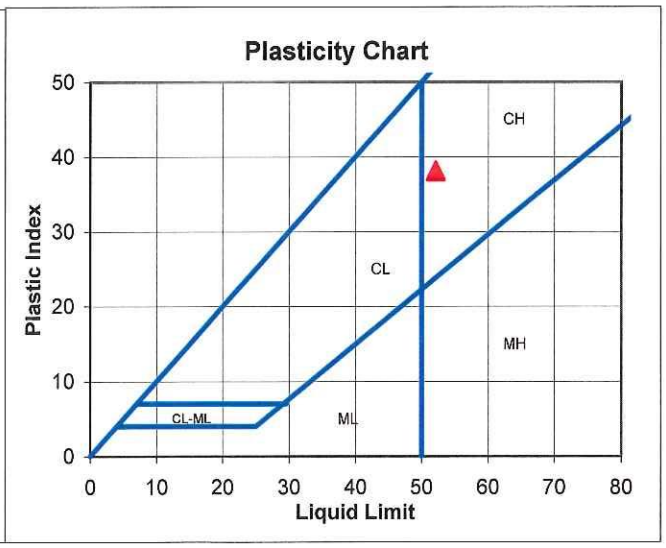
Average: 14.0%
Standard Deviation: 0.3%

Liquid Limits

	Sample 1	Sample 2	Sample 3	Sample 4
Number of Blows:	33	27	23	19
Weight of Wet Soil & Pan (g):	15.212	14.291	14.331	13.559
Weight of Dry Soil & Pan (g):	10.446	9.821	9.793	9.216
Weight of Water (g):	4.766	4.470	4.538	4.343
Weight of Pan (g):	1.137	1.152	1.107	1.063
Moisture Content (%):	51.2	51.6	52.2	53.3

Plastic Limit: 14
Liquid Limit: 52
Plastic Index: 38
Atterberg Classification CH





Data Entered By: KR
Date: 8/10/2016
File Name: 2679_96_atterberg-ASTMD-4318-R8_15.xls

Data Checked By: BDF
Date: 8/10/16

ATT
ADVANCED TERRA TESTING

Grain Size Analysis

Percent Fines, -200 Sieve Only

ASTM D1140

Amount of Material in Soils Finer than #200
ASTM D 1140

Client: RJH Consultants
Job Number: 2679-96
Project: Thornton Water Treatment Plant
Location: --
Project Number: 16104

Boring Number: B-102
Depth: 54-59'
Sample Number: Bu-23
Sampled Date: --
(+) Wash Date: --
(-) Wash Date: 8/5/16

Sampled By: --
Technician: --
Technician: BDF

Grain Size Data

Hygroscopic Moisture of Fines

Weight of Wet Soil & Pan (g): 89.83
Weight of Dry Soil & Pan (g): 86.02
Weight of Water (g): 3.81
Weight of Pan (g): 3.10
Weight of Dry Soil (g): 82.92
Moisture (%): 4.6

Total Wet Weight of Sample (g): 205.69
Total Dry Weight of Sample (g): 196.65
Calculated Weight Plus #200 (g): 31.39
Moisture of Total Sample (%): 4.6
Percent Retained #200 Sieve (%): 16.0

Plus Split Data

Original Weight of +#4 (g): 0.00
Calculated Weight of +#4 (g): 0.00

Minus Split Data

Original Weight of -#4 (g): 205.69
Calculated Dry Weight of -#4 (g): 196.65

Sieve Number	Sieve Size (mm)	Weight of Retained Soil & Pan (g)	Weight of Pan (g)	Weight of Retained Soil (g)	Calculated Weight of Retained Soil (g)	Percent Passing by Weight (%)
#4	**4.750**	0.00	0.00	0.00	0.00	100.0
205.69g split out of -#4 material.						
#200	**0.075**	842.43	811.04	31.39	31.39	84.0

Data Entered By: KR
Date: 1/0/1900
File Name: 2679_96_grainSize-ASTM-C33-D1140-D6319-D2487-R6_4.xls

Checked By: NN
Date: 8/8/16

ATT
ADVANCED TERRA TESTING

Amount of Material in Soils Finer than #200
ASTM D 1140

Client: RJH Consultants
Job Number: 2679-96
Project: Thornton Water Treatment Plant
Location: --
Project Number: 16104

Boring Number: B-103
Depth: 0-10'
Sample Number: Bu-2
Sampled Date: --
(+) Wash Date: 07/28/2016
(-) Wash Date: 08/02/2016

Sampled By: --
Technician: CKP
Technician: DPM

Grain Size Data

Hygroscopic Moisture of Fines

Weight of Wet Soil & Pan (g): 1085.03
Weight of Dry Soil & Pan (g): 1048.53
Weight of Water (g): 36.50
Weight of Pan (g): 843.26
Weight of Dry Soil (g): 205.27
Moisture (%): 17.8

Total Wet Weight of Sample (g): 16,376.93
Total Dry Weight of Sample (g): 13,918.16
Calculated Weight Plus #200 (g): 2,669.81
Moisture of Total Sample (%): 17.7
Percent Retained #200 Sieve (%): 19.2

Plus Split Data

Original Weight of +3/8" (g): 97.58
Calculated Weight of +3/8" (g): 90.46

Minus Split Data

Original Weight of -3/8" (g): 16,279.35
Calculated Dry Weight of -3/8" (g): 13,827.70

Sieve Number	Sieve Size (mm)	Weight of Retained Soil & Pan (g)	Weight of Pan (g)	Weight of Retained Soil (g)	Calculated Weight of Retained Soil (g)	Percent Passing by Weight (%)
3/8"	**9.525**	90.46	0.00	90.46	90.46	99.4
241.77g split out of -3/8" material.						
#200	**0.075**	881.55	843.26	38.29	2579.35	80.8

Data Entered By: CKP
Date: 8/3/2016
File Name: 2679_96_grainSize-ASTM-C33-D1140-D6319-D2487-R6_1.xls

Checked By: KR
Date: 8/4/16

ATT
ADVANCED TERRA TESTING

Amount of Material in Soils Finer than #200
ASTM D 1140

Client: RJH Consultants
Job Number: 2679-96
Project: Thornton Water Treatment Plant
Location: --
Project Number: 16104

Boring Number: B-103
Depth: 26.5-27.5' (27-27.5')
Sample Number: DM-11
Sampled Date: 06/20/2016
(+) Wash Date: --
(-) Wash Date: 07/28/2016

Sampled By: --
Technician: --
Technician: CKP

Grain Size Data

Sieve Number	Sieve Size (mm)	Weight of Retained Soil & Pan (g)	Weight of Pan (g)	Weight of Retained Soil (g)	Calculated Weight of Retained Soil (g)	Percent Passing by Weight (%)
#200	**0.075**	844.07	843.18	0.89	0.89	99.5

Hygroscopic Moisture of Fines

Weight of Wet Soil & Pan (g): 1031.54
Weight of Dry Soil & Pan (g): 1016.21
Weight of Water (g): 15.33
Weight of Pan (g): 843.18
Weight of Dry Soil (g): 173.03
Moisture (%): 8.9

Total Wet Weight of Sample (g): 188.36
Total Dry Weight of Sample (g): 173.03
Calculated Weight Plus #200 (g): 0.89
Moisture of Total Sample (%): 8.9
Percent Retained #200 Sieve (%): 0.5

Wet Weight of Soil (g): 188.36
Dry Weight of Soil (g): 173.03

Data Entered By: CKP
Date: 8/3/2016
File Name: 2679_96_grainSize-ASTM-C33-D1140-D6319-D2487-R6_2.xls

Checked By: KR
Date: 8/4/16

ATT
ADVANCED TERRA TESTING

Amount of Material in Soils Finer than #200
ASTM D 1140

Client: RJH Consultants
Job Number: 2679-96
Project: Thornton Water Treatment Plant
Location: --
Project Number: 16104

Boring Number: B-103
Depth: 54-54.4'
Sample Number: DM-18
Sampled Date: 06/20/2016
(+) Wash Date: --
(-) Wash Date: 07/28/2016

Sampled By: --
Technician: --
Technician: BDF

Grain Size Data

Sieve Number	Sieve Size (mm)	Weight of Retained Soil & Pan (g)	Weight of Pan (g)	Weight of Retained Soil (g)	Calculated Weight of Retained Soil (g)	Percent Passing by Weight (%)
#200	**0.075**	820.20	813.13	7.07	7.07	95.5

Hygroscopic Moisture of Fines

Weight of Wet Soil & Pan (g): 981.18
Weight of Dry Soil & Pan (g): 971.67
Weight of Water (g): 9.51
Weight of Pan (g): 813.13
Weight of Dry Soil (g): 158.54
Moisture (%): 6.0

Total Wet Weight of Sample (g): 168.05
Total Dry Weight of Sample (g): 158.54
Calculated Weight Plus #200 (g): 7.07
Moisture of Total Sample (%): 6.0
Percent Retained #200 Sieve (%): 4.5

Wet Weight of Soil (g): 168.05
Dry Weight of Soil (g): 158.54

Data Entered By: CKP
Date: 8/3/2016
File Name: 2679_96_grainSize-ASTM-C33-D1140-D6319-D2487-R6_3.xls

Checked By: KR
Date: 8/4/16

ATT
ADVANCED TERRA TESTING

Amount of Material in Soils Finer than #200
ASTM D 1140

Client: RJH Consultants
Job Number: 2679-96
Project: Thornton Water Treatment Plant
Location: --
Project Number: 16104

Boring Number: B-107
Depth: 26-27'
Sample Number: NQ-2
Sampled Date: --
(+) Wash Date: --
(-) Wash Date: 7/22/16

Sampled By: --
Technician: --
Technician: BDF

Grain Size Data

Sieve Number	Sieve Size (mm)	Weight of Retained Soil & Pan (g)	Weight of Pan (g)	Weight of Retained Soil (g)	Calculated Weight of Retained Soil (g)	Percent Passing by Weight (%)
#200	**0.075**	841.16	840.16	1.00	1.00	99.1

Hygroscopic Moisture of Fines

Weight of Wet Soil & Pan (g): 960.97
Weight of Dry Soil & Pan (g): 954.64
Weight of Water (g): 6.33
Weight of Pan (g): 840.16
Weight of Dry Soil (g): 114.48
Moisture (%): 5.5

Total Wet Weight of Sample (g): 120.81
Total Dry Weight of Sample (g): 114.48
Calculated Weight Plus #200 (g): 1.00
Moisture of Total Sample (%): 5.5
Percent Retained #200 Sieve (%): 0.9

Wet Weight of Soil (g): 120.81
Dry Weight of Soil (g): 114.48

Data Entered By: NN
Date: 7/25/2016
File Name: 2679_96_grainSize-ASTM-C33-D1140-D6319-D2487-R6_0.xls

Checked By: CKP
Date: 7/25/16

ATT
ADVANCED TERRA TESTING

Amount of Material in Soils Finer than #200
ASTM D 1140

Client: RJH Consultants
Job Number: 2679-96
Project: Thornton Water Treatment Plant
Location: --
Project Number: 16104

Boring Number: B-107
Depth: 44.3-45.0
Sample Number: NQ-5
Sampled Date: 6/23/16
(+) Wash Date: --
(-) Wash Date: 8/12/16

Sampled By: --
Technician: --
Technician: CKP

Grain Size Data

Sieve Number	Sieve Size (mm)	Weight of Retained Soil & Pan (g)	Weight of Pan (g)	Weight of Retained Soil (g)	Calculated Weight of Retained Soil (g)	Percent Passing by Weight (%)
#200	**0.075**	834.49	828.86	5.63	5.63	96.4

Hygroscopic Moisture of Fines

Weight of Wet Soil & Pan (g): 995.44
Weight of Dry Soil & Pan (g): 984.52
Weight of Water (g): 10.92
Weight of Pan (g): 828.86
Weight of Dry Soil (g): 155.66
Moisture (%): 7.0

Total Wet Weight of Sample (g): 166.58
Total Dry Weight of Sample (g): 155.66
Calculated Weight Plus #200 (g): 5.63
Moisture of Total Sample (%): 7.0
Percent Retained #200 Sieve (%): 3.6

Wet Weight of Soil (g): 166.58
Dry Weight of Soil (g): 155.66

Data Entered By: KR
Date: 8/15/2016
File Name: 2679_96_grainSize-ASTM-C33-D1140-D6319-D2487-R6_5.xls

Checked By: CK
Date: 8-15-16

ATT
ADVANCED TERRA TESTING

MECHANICAL ANALYSIS
WITH HYDROMETER
ASTM D 422

Particle Size Analysis of Soils
ASTM D 422

Client:	RJH Consultants	Boring Number:	B-103		
Job Number:	2679-96	Depth:	17.5-19.5'		
Project:	Thornton Water Treatment Plant	Sample Number:	S-9		
Location:	--	Sampled Date:	--	Sampled By:	--
Project Number:	16104	Wash Date:	8/4/2016	Wash Technician:	BDF

Grain Size Data

Hygroscopic Moisture of Fines

Weight of Wet Soil & Pan (g):	74.43
Weight of Dry Soil & Pan (g):	70.04
Weight of Water (g):	4.39
Weight of Pan (g):	6.59
Weight of Dry Soil (g):	63.45
Moisture (%):	6.9

General Sample Data

Total Wet Weight of Sample (g):	535.12
Total Dry Weight of Sample (g):	500.69
Calculated Weight Plus #200 (g):	95.81
Moisture of Total Sample (%):	6.9
Percent Retained #200 Sieve (%):	19.1

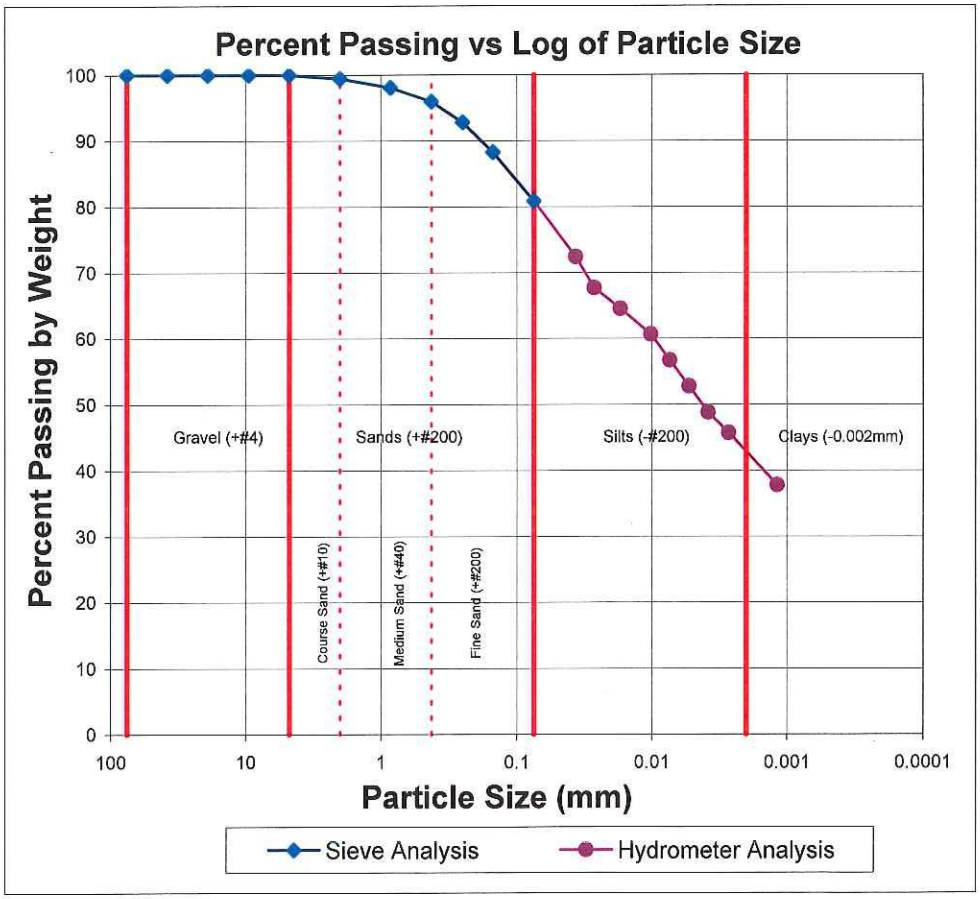
Sieve Number	Sieve Size (mm)	Weight of Retained Soil & Pan (g)	Weight of Pan (g)	Weight of Retained Soil (g)	Calculated Weight of Retained Soil (g)	Percent Passing by Weight (%)
3"	**76.2**	0.00	0.00	0.00	0.00	100.0
1.5"	**38.10**	0.00	0.00	0.00	0.00	100.0
3/4"	**19.05**	0.00	0.00	0.00	0.00	100.0
3/8"	**9.525**	0.00	0.00	0.00	0.00	100.0
#4	**4.750**	0.00	0.00	0.00	0.00	100.0
#10	**2.000**	2.98	0.00	2.98	2.98	99.4
67.64g split out of -#10 material.						
#20	**0.850**	4.07	3.22	0.85	6.71	98.1
#40	**0.425**	4.53	3.20	1.33	10.47	96.0
#60	**0.250**	5.12	3.10	2.02	15.90	92.8
#100	**0.150**	6.01	3.14	2.87	22.60	88.3
#200	**0.075**	7.83	3.11	4.72	37.14	80.9

Plus Split Data

Original Weight of +#10 (g): 6.18
Calculated Weight of +#10 (g): 2.98

Minus Split Data

Original Weight of -#10 (g): 528.94
Calculated Dry Weight of -#10 (g): 497.71



Data Entered By:	KR	Checked By:	CAL
Date:	8/5/2016	Date:	8/9/16
File Name:	2679_96_hydrometer-ASTM-D422-R3_3.xls		

ATT
ADVANCED TERRA TESTING

Particle Size Analysis of Soils
ASTM D 422

Client:	RJH Consultants	Boring Number:	B-103		
Job Number:	2679-96	Depth:	17.5-19.5'		
Project:	Thornton Water Treatment Plant	Sample Number:	S-9		
Location:	--	Sampled Date:	--	Sampled By:	--
Project Number:	16104	Test Date:	8/3/2016	Technician:	BDF

Hydrometer Data

Test Configuration

Hydrometer Type:	152H	Total Wet Weight of Sample (g):	535.12
Specific Gravity:	2.65	Total Dry Weight of Sample (g):	500.69
Deflocculant:	Sodium Hexametaphosphate	Wet Weight of Sub-Sample (g):	67.640
Deflocculant Correction:	4.0	Dry Weight of Sub-Sample (g):	63.263
Specific Gravity Correction Factor	1.00	Corrected Dry Weight of Sub-Sample - W(g):	63.645

Elapsed Time (min)	Hydrometer Reading	Corrected Hydrometer Reading	Temperature (°C)	Temperature Coefficient (K)	Effective Depth (L)	Grain Diameter (mm)	Percent in Suspension (%)	Calculated Weight of Retained Soil (g)	Percent Passing by Weight (%)
0	-	-	-	-	-	-	-	-	-
1	50.0	46.0	25.2	0.0129	8.09	0.0366	72.4	362.37	72.4
2	47.0	43.0	25.2	0.0129	8.59	0.0266	67.7	338.74	67.7
5	45.0	41.0	25.2	0.0129	8.91	0.0172	64.5	322.98	64.5
15	42.5	38.5	25.2	0.0129	9.32	0.0101	60.6	303.29	60.6
30	40.0	36.0	25.2	0.0129	9.73	0.0073	56.6	283.59	56.6
60	37.5	33.5	25.3	0.0129	10.14	0.0053	52.7	263.90	52.7
120	35.0	31.0	25.4	0.0129	10.55	0.0038	48.8	244.21	48.8
250	33.0	29.0	25.3	0.0129	10.88	0.0027	45.6	228.45	45.6
1440	28.0	24.0	24.8	0.0130	11.70	0.0012	37.8	189.06	37.8

Data Entered By:	KR		
Date:	8/5/2016	Checked By:	CHC
File Name:	2679_96_hydrometer-ASTM-D422-R3_3.xls	Date:	8/9/16

ATT
ADVANCED TESTING

Particle Size Analysis of Soils
ASTM D 422

Client:	RJH Consultants	Boring Number:	B-106		
Job Number:	2679-96	Depth:	5-6' (5.5-6.0')		
Project:	Thornton Water Treatment Plant	Sample Number:	DM-3		
Location:	--	Sampled Date:	--	Sampled By:	--
Project Number:	16104	Wash Date:	8/4/2016	Wash Technician:	BDF

Grain Size Data

Hygroscopic Moisture of Fines

Weight of Wet Soil & Pan (g):	75.58
Weight of Dry Soil & Pan (g):	67.51
Weight of Water (g):	8.07
Weight of Pan (g):	6.61
Weight of Dry Soil (g):	60.90
Moisture (%):	13.3

General Sample Data

Total Wet Weight of Sample (g):	676.60
Total Dry Weight of Sample (g):	597.54
Calculated Weight Plus #200 (g):	57.15
Moisture of Total Sample (%):	13.2
Percent Retained #200 Sieve (%):	9.6

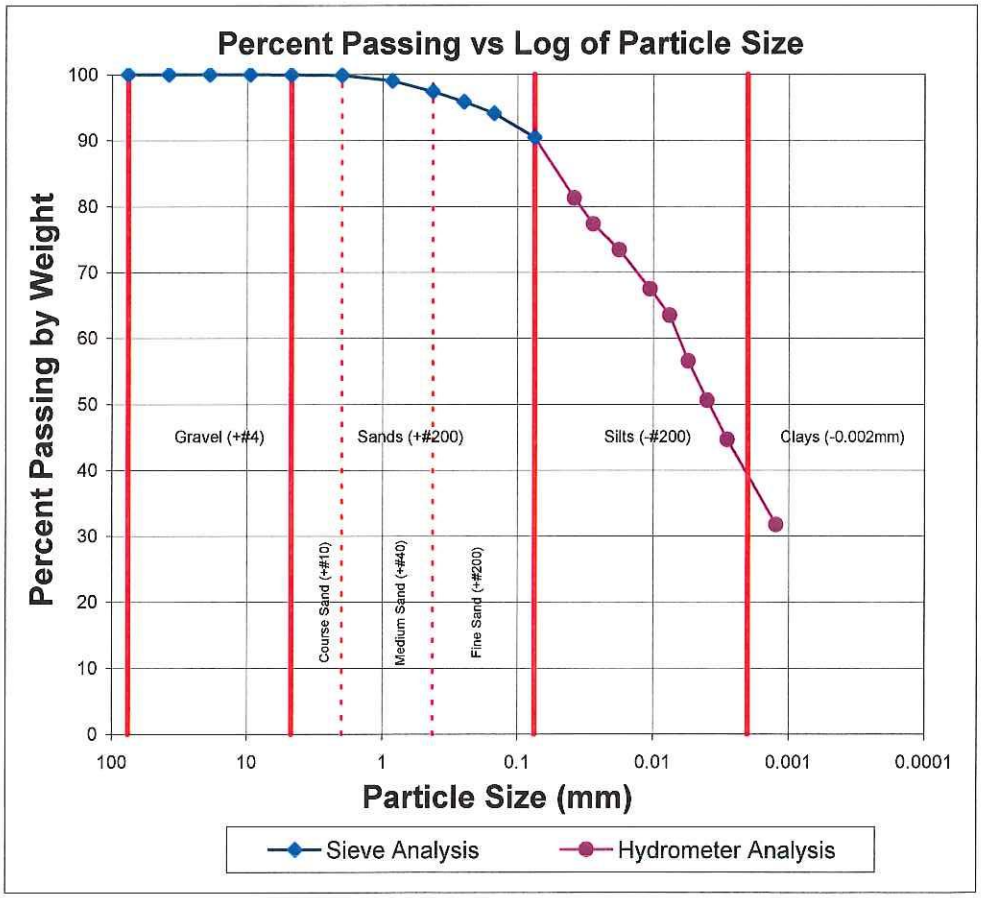
Sieve Number	Sieve Size (mm)	Weight of Retained Soil & Pan (g)	Weight of Pan (g)	Weight of Retained Soil (g)	Calculated Weight of Retained Soil (g)	Percent Passing by Weight (%)
3"	**76.2**	0.00	0.00	0.00	0.00	100.0
1.5"	**38.10**	0.00	0.00	0.00	0.00	100.0
3/4"	**19.05**	0.00	0.00	0.00	0.00	100.0
3/8"	**9.525**	0.00	0.00	0.00	0.00	100.0
#4	**4.750**	0.30	0.00	0.30	0.30	99.9
#10	**2.000**	0.59	0.00	0.59	0.59	99.9
57.159g split out of -#10 material.						
#20	**0.850**	3.55	3.13	0.43	5.06	99.0
#40	**0.425**	3.96	3.15	0.81	9.56	97.4
#60	**0.250**	4.01	3.23	0.78	9.21	95.9
#100	**0.150**	4.00	3.10	0.90	10.58	94.1
#200	**0.075**	5.06	3.21	1.85	21.85	90.4

Plus Split Data

Original Weight of +#10 (g): 41.59
Calculated Weight of +#10 (g): 0.89

Minus Split Data

Original Weight of -#10 (g): 635.01
Calculated Dry Weight of -#10 (g): 596.65



Data Entered By: KR
Date: 8/5/2016
File Name: 2679_96_hydrometer-ASTM-D422-R3_2.xls

Checked By: CM
Date: 8/09/16

ATT
ADVANCED TERRA TESTING

Particle Size Analysis of Soils
ASTM D 422

Client:	RJH Consultants	Boring Number:	B-106		
Job Number:	2679-96	Depth:	5-6' (5.5-6.0')		
Project:	Thornton Water Treatment Plant	Sample Number:	DM-3		
Location:	--	Sampled Date:	--	Sampled By:	--
Project Number:	16104	Test Date:	8/3/2016	Technician:	BDF

Hydrometer Data

Test Configuration

Hydrometer Type:	152H	Total Wet Weight of Sample (g):	676.60
Specific Gravity:	2.65	Total Dry Weight of Sample (g):	597.54
Deflocculant:	Sodium Hexametaphosphate	Wet Weight of Sub-Sample (g):	57.159
Deflocculant Correction:	4.0	Dry Weight of Sub-Sample (g):	50.471
Specific Gravity Correction Factor	1.00	Corrected Dry Weight of Sub-Sample - W(g):	50.521

Elapsed Time (min)	Hydrometer Reading	Corrected Hydrometer Reading	Temperature (°C)	Temperature Coefficient (K)	Effective Depth (L)	Grain Diameter (mm)	Percent in Suspension (%)	Calculated Weight of Retained Soil (g)	Percent Passing by Weight (%)
0	-	-	-	-	-	-	-	-	-
1	45.0	41.0	25.3	0.0129	8.91	0.0384	81.3	485.58	81.3
2	43.0	39.0	25.3	0.0129	9.24	0.0276	77.3	461.90	77.3
5	41.0	37.0	25.3	0.0129	9.57	0.0178	73.3	438.21	73.3
15	38.0	34.0	25.3	0.0129	10.06	0.0105	67.4	402.68	67.4
30	36.0	32.0	25.4	0.0129	10.39	0.0076	63.4	378.99	63.4
60	32.5	28.5	25.4	0.0129	10.96	0.0055	56.5	337.54	56.5
120	29.5	25.5	25.4	0.0129	11.46	0.0040	50.5	302.01	50.5
250	26.5	22.5	25.4	0.0129	11.95	0.0028	44.6	266.48	44.6
1440	20.0	16.0	24.8	0.0130	13.01	0.0012	31.7	189.50	31.7

Data Entered By:	KR		
Date:	8/5/2016	Checked By:	CMC
File Name:	2679_96_hydrometer-ASTM-D422-R3_2.xls	Date:	8/09/16

ATT
ADVANCED TERRA TESTING

Particle Size Analysis of Soils
ASTM D 422

Client:	RJH Consultants	Boring Number:	B-106		
Job Number:	2679-96	Depth:	40-40.7'		
Project:	Thornton Water Treatment Plant	Sample Number:	--		
Location:	--	Sampled Date:	6/27/2016	Sampled By:	--
Project Number:	16104	Wash Date:	8/11/2016	Wash Technician:	BDF

Grain Size Data

Hygroscopic Moisture of Fines

Weight of Wet Soil & Pan (g):	140.09
Weight of Dry Soil & Pan (g):	133.51
Weight of Water (g):	6.57
Weight of Pan (g):	6.66
Weight of Dry Soil (g):	126.86
Moisture (%):	5.2

General Sample Data

Total Wet Weight of Sample (g):	421.77
Total Dry Weight of Sample (g):	400.99
Calculated Weight Plus #200 (g):	27.88
Moisture of Total Sample (%):	5.2
Percent Retained #200 Sieve (%):	7.0

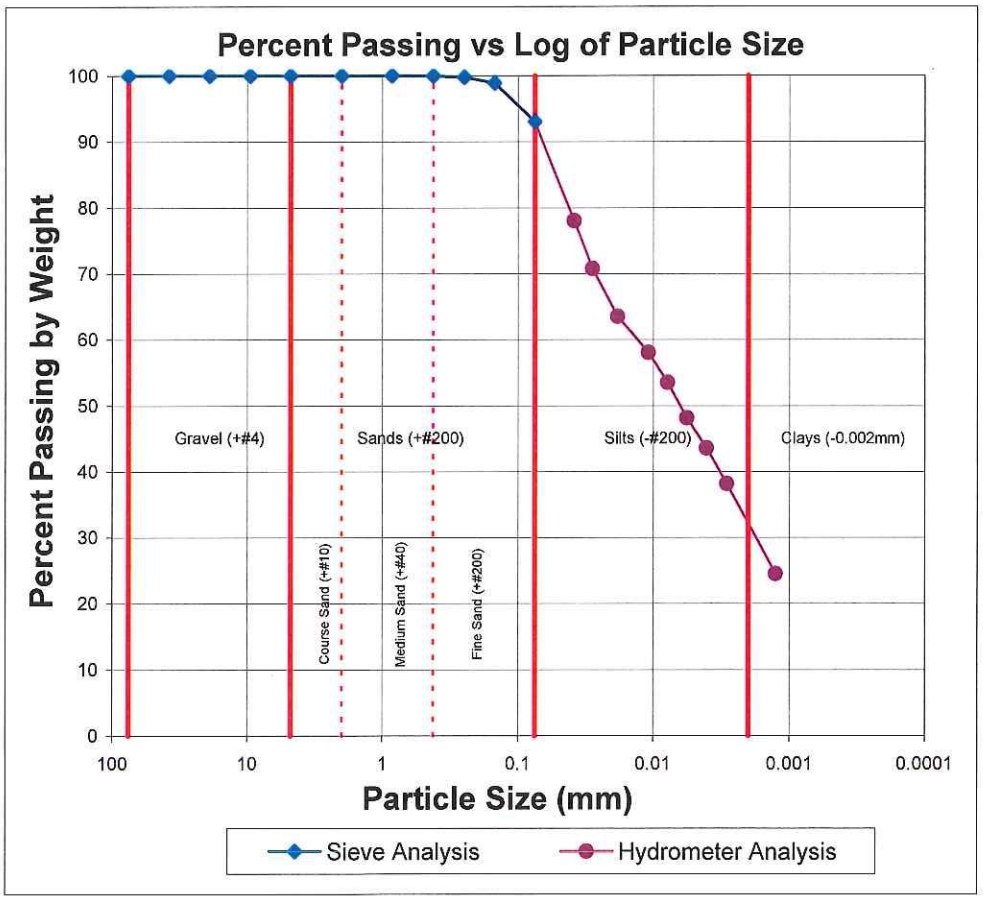
Sieve Number	Sieve Size (mm)	Weight of Retained Soil & Pan (g)	Weight of Pan (g)	Weight of Retained Soil (g)	Calculated Weight of Retained Soil (g)	Percent Passing by Weight (%)
3"	**76.2**	0.00	0.00	0.00	0.00	100.0
1.5"	**38.10**	0.00	0.00	0.00	0.00	100.0
3/4"	**19.05**	0.00	0.00	0.00	0.00	100.0
3/8"	**9.525**	0.00	0.00	0.00	0.00	100.0
#4	**4.750**	0.00	0.00	0.00	0.00	100.0
#10	**2.000**	0.00	0.00	0.00	0.00	100.0
58.025g split out of -#10 material.						
#20	**0.850**	3.09	3.09	0.00	0.00	100.0
#40	**0.425**	3.15	3.13	0.02	0.14	100.0
#60	**0.250**	3.18	3.07	0.11	0.81	99.8
#100	**0.150**	3.57	3.09	0.48	3.50	98.9
#200	**0.075**	6.28	3.06	3.22	23.43	93.0

Plus Split Data

Original Weight of +#10 (g): 0.00
Calculated Weight of +#10 (g): 0.00

Minus Split Data

Original Weight of -#10 (g): 421.77
Calculated Dry Weight of -#10 (g): 400.99



Data Entered By: KR
Date: 8/15/2016
File Name: 2679_96_hydrometer-ASTM-D422-R3_5.xls

Checked By: CAL
Date: 8-15-16

ATT
ADVANCED TERRA TESTING

Particle Size Analysis of Soils
ASTM D 422

Client:	RJH Consultants	Boring Number:	B-106		
Job Number:	2679-96	Depth:	40-40.7'		
Project:	Thornton Water Treatment Plant	Sample Number:	--		
Location:	--	Sampled Date:	6/27/2016	Sampled By:	--
Project Number:	16104	Test Date:	8/10/2016	Technician:	BDF

Hydrometer Data

Test Configuration

Hydrometer Type:	152H	Total Wet Weight of Sample (g):	421.77
Specific Gravity:	2.65	Total Dry Weight of Sample (g):	400.99
Deflocculant:	Sodium Hexametaphosphate	Wet Weight of Sub-Sample (g):	58.025
Deflocculant Correction:	4.0	Dry Weight of Sub-Sample (g):	55.166
Specific Gravity Correction Factor	1.00	Corrected Dry Weight of Sub-Sample - W(g):	55.166

Elapsed Time (min)	Hydrometer Reading	Corrected Hydrometer Reading	Temperature (°C)	Temperature Coefficient (K)	Effective Depth (L)	Grain Diameter (mm)	Percent in Suspension (%)	Calculated Weight of Retained Soil (g)	Percent Passing by Weight (%)
0	-	-	-	-	-	-	-	-	-
1	47.0	43.0	24.2	0.0130	8.59	0.0381	78.1	312.98	78.1
2	43.0	39.0	24.2	0.0130	9.24	0.0280	70.8	283.87	70.8
5	39.0	35.0	24.2	0.0130	9.90	0.0183	63.5	254.75	63.5
15	36.0	32.0	24.1	0.0130	10.39	0.0108	58.1	232.92	58.1
30	33.5	29.5	24.3	0.0130	10.80	0.0078	53.5	214.72	53.5
60	30.5	26.5	24.4	0.0130	11.29	0.0056	48.1	192.88	48.1
120	28.0	24.0	24.5	0.0130	11.70	0.0041	43.6	174.69	43.6
250	25.0	21.0	24.6	0.0130	12.19	0.0029	38.1	152.85	38.1
1440	17.5	13.5	24.2	0.0130	13.42	0.0013	24.5	98.26	24.5

Data Entered By:	KR		
Date:	8/15/2016	Checked By:	CH
File Name:	2679_96_hydrometer-ASTM-D422-R3_5.xls	Date:	8-15-16

ATT
ADVANCED

Particle Size Analysis of Soils
ASTM D 422

Client:	RJH Consultants	Boring Number:	B-106		
Job Number:	2679-96	Depth:	49.4-50.0'		
Project:	Thornton Water Treatment Plant	Sample Number:	NQ-6 & NQ-7		
Location:	--	Sampled Date:	6/24/2016	Sampled By:	--
Project Number:	16104	Wash Date:	8/11/2016	Wash Technician:	BDF

Grain Size Data

Hygroscopic Moisture of Fines

Weight of Wet Soil & Pan (g):	43.29
Weight of Dry Soil & Pan (g):	40.90
Weight of Water (g):	2.40
Weight of Pan (g):	6.64
Weight of Dry Soil (g):	34.26
Moisture (%):	7.0

General Sample Data

Total Wet Weight of Sample (g):	325.67
Total Dry Weight of Sample (g):	304.39
Calculated Weight Plus #200 (g):	15.58
Moisture of Total Sample (%):	7.0
Percent Retained #200 Sieve (%):	5.1

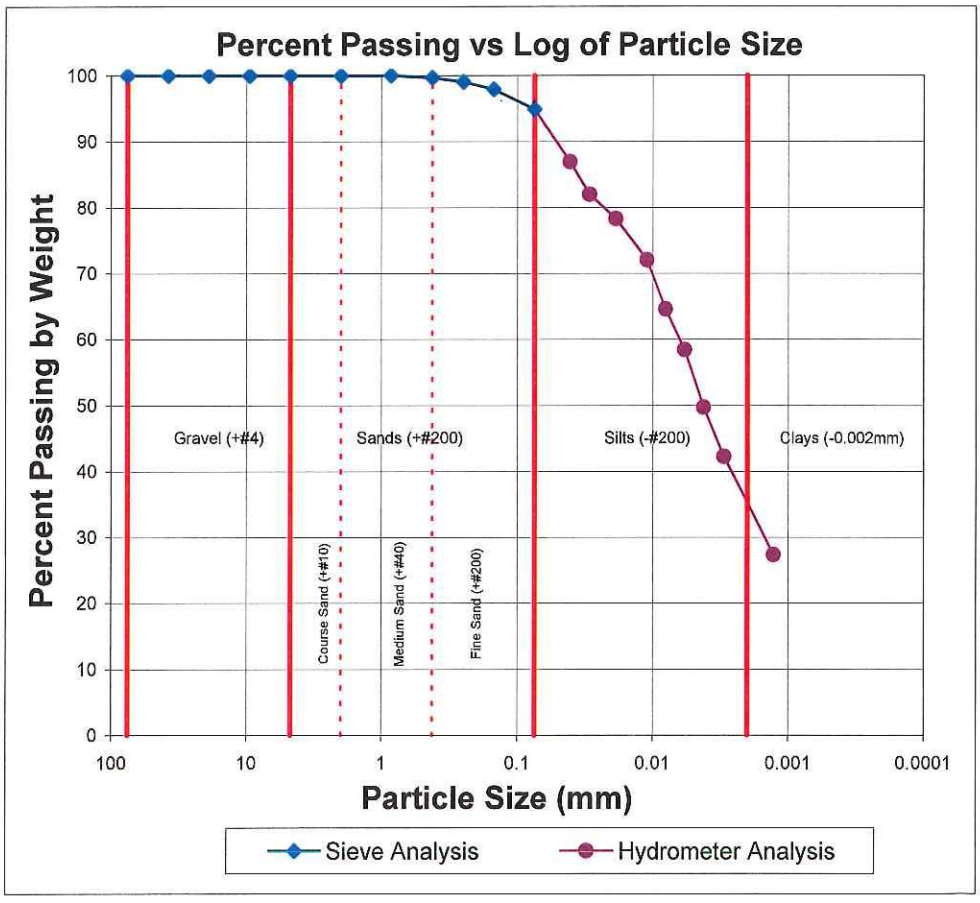
Sieve Number	Sieve Size (mm)	Weight of Retained Soil & Pan (g)	Weight of Pan (g)	Weight of Retained Soil (g)	Calculated Weight of Retained Soil (g)	Percent Passing by Weight (%)
3"	**76.2**	0.00	0.00	0.00	0.00	100.0
1.5"	**38.10**	0.00	0.00	0.00	0.00	100.0
3/4"	**19.05**	0.00	0.00	0.00	0.00	100.0
3/8"	**9.525**	0.00	0.00	0.00	0.00	100.0
#4	**4.750**	0.00	0.00	0.00	0.00	100.0
#10	**2.000**	0.00	0.00	0.00	0.00	100.0
43.128g split out of -#10 material.						
#20	**0.850**	3.09	3.09	0.01	0.06	100.0
#40	**0.425**	3.20	3.08	0.12	0.94	99.7
#60	**0.250**	3.38	3.12	0.27	2.01	99.0
#100	**0.150**	3.55	3.10	0.45	3.37	97.9
#200	**0.075**	4.33	3.12	1.22	9.20	94.9

Plus Split Data

Original Weight of +#10 (g): 0.00
Calculated Weight of +#10 (g): 0.00

Minus Split Data

Original Weight of -#10 (g): 325.67
Calculated Dry Weight of -#10 (g): 304.39



Data Entered By: KR
Date: 8/15/2016
File Name: 2679_96_hydrometer-ASTM-D422-R3_4.xls

Checked By: CAC
Date: 8-15-16

ATT
ADVANCED TERRA TESTING

Particle Size Analysis of Soils
ASTM D 422

Client:	RJH Consultants	Boring Number:	B-106		
Job Number:	2679-96	Depth:	49.4-50.0'		
Project:	Thornton Water Treatment Plant	Sample Number:	NQ-6 & NQ-7		
Location:	--	Sampled Date:	6/24/2016	Sampled By:	--
Project Number:	16104	Test Date:	8/10/2016	Technician:	BDF

Hydrometer Data

Test Configuration

Hydrometer Type:	152H	Total Wet Weight of Sample (g):	325.67
Specific Gravity:	2.65	Total Dry Weight of Sample (g):	304.39
Deflocculant:	Sodium Hexametaphosphate	Wet Weight of Sub-Sample (g):	43.128
Deflocculant Correction:	4.0	Dry Weight of Sub-Sample (g):	40.310
Specific Gravity Correction Factor	1.00	Corrected Dry Weight of Sub-Sample - W(g):	40.310

Elapsed Time (min)	Hydrometer Reading	Corrected Hydrometer Reading	Temperature (°C)	Temperature Coefficient (K)	Effective Depth (L)	Grain Diameter (mm)	Percent in Suspension (%)	Calculated Weight of Retained Soil (g)	Percent Passing by Weight (%)
0	-	-	-	-	-	-	-	-	-
1	39.0	35.0	24.5	0.0130	9.90	0.0409	86.9	264.65	86.9
2	37.0	33.0	24.5	0.0130	10.23	0.0294	82.0	249.53	82.0
5	35.5	31.5	24.5	0.0130	10.47	0.0188	78.3	238.19	78.3
15	33.0	29.0	24.4	0.0130	10.88	0.0111	72.0	219.28	72.0
30	30.0	26.0	24.5	0.0130	11.37	0.0080	64.6	196.60	64.6
60	27.5	23.5	24.5	0.0130	11.78	0.0058	58.4	177.70	58.4
120	24.0	20.0	24.6	0.0130	12.36	0.0042	49.7	151.23	49.7
250	21.0	17.0	24.6	0.0130	12.85	0.0029	42.2	128.55	42.2
1440	15.0	11.0	24.2	0.0130	13.83	0.0013	27.3	83.18	27.3

Data Entered By:	KR		
Date:	8/15/2016	Checked By:	CM
File Name:	2679_96_hydrometer-ASTM-D422-R3_4.xls	Date:	8-15-16

ATT
ADVANCED

Particle Size Analysis of Soils
ASTM D 422

Client:	RJH Consultants	Boring Number:	B-108 (P)		
Job Number:	2679-96	Depth:	30-35'		
Project:	Thornton Water Treatment Plant	Sample Number:	Bu-5		
Location:	--	Sampled Date:	--	Sampled By:	--
Project Number:	16104	Wash Date:	8/4/2016	Wash Technician:	BDF

Grain Size Data

Hygroscopic Moisture of Fines

Weight of Wet Soil & Pan (g):	65.58
Weight of Dry Soil & Pan (g):	62.43
Weight of Water (g):	3.15
Weight of Pan (g):	6.98
Weight of Dry Soil (g):	55.45
Moisture (%):	5.7

General Sample Data

Total Wet Weight of Sample (g):	1,143.35
Total Dry Weight of Sample (g):	1,081.93
Calculated Weight Plus #200 (g):	137.68
Moisture of Total Sample (%):	5.7
Percent Retained #200 Sieve (%):	12.7

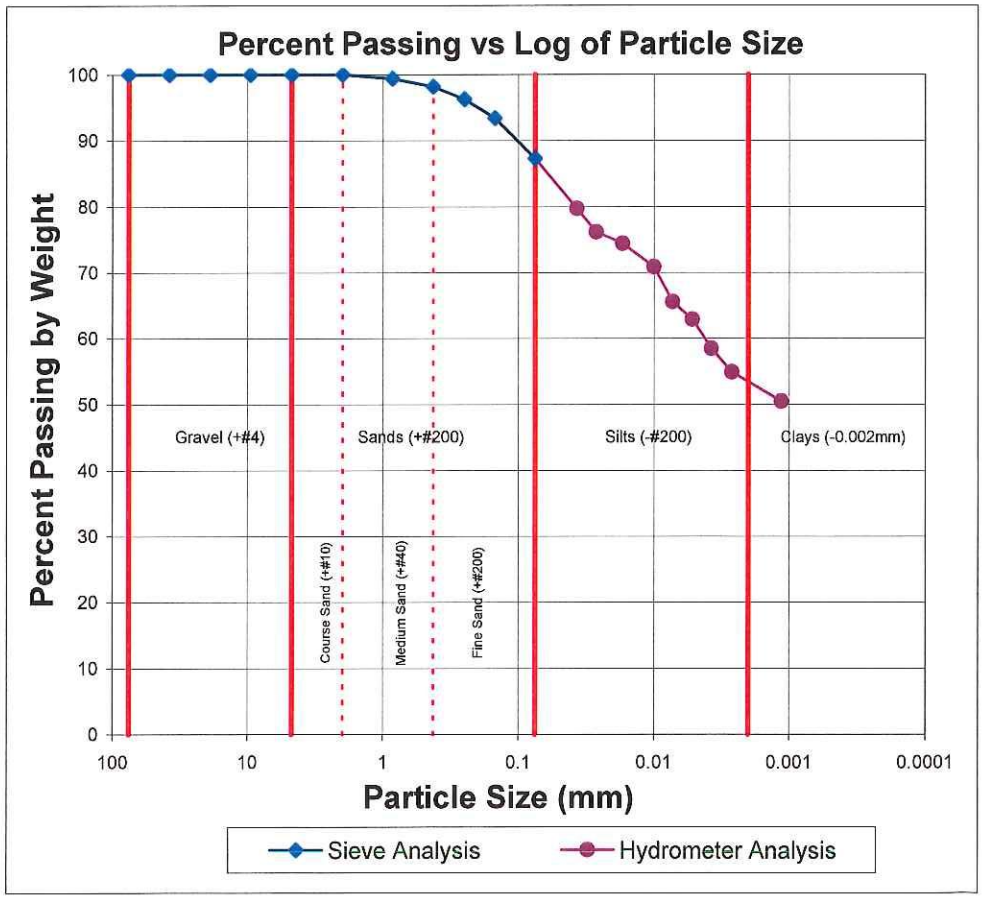
Sieve Number	Sieve Size (mm)	Weight of Retained Soil & Pan (g)	Weight of Pan (g)	Weight of Retained Soil (g)	Calculated Weight of Retained Soil (g)	Percent Passing by Weight (%)
3"	**76.2**	0.00	0.00	0.00	0.00	100.0
1.5"	**38.10**	0.00	0.00	0.00	0.00	100.0
3/4"	**19.05**	0.00	0.00	0.00	0.00	100.0
3/8"	**9.525**	0.00	0.00	0.00	0.00	100.0
#4	**4.750**	0.00	0.00	0.00	0.00	100.0
#10	**2.000**	0.00	0.00	0.00	0.00	100.0
59.767g split out of -#10 material.						
#20	**0.850**	3.57	3.21	0.36	6.85	99.4
#40	**0.425**	3.80	3.11	0.68	13.07	98.2
#60	**0.250**	4.18	3.09	1.08	20.72	96.2
#100	**0.150**	4.82	3.20	1.62	30.97	93.4
#200	**0.075**	6.60	3.14	3.45	66.08	87.3

Plus Split Data

Original Weight of +#10 (g): 0.00
Calculated Weight of +#10 (g): 0.00

Minus Split Data

Original Weight of -#10 (g): 1,143.35
Calculated Dry Weight of -#10 (g): 1,081.93



Data Entered By: KR
Date: 8/5/2016
File Name: 2679_96_hydrometer-ASTM-D422-R3_1.xls

Checked By: CR
Date: 8/9/16

ATT
ADVANCED TERRA TESTING

Particle Size Analysis of Soils
ASTM D 422

Client:	RJH Consultants	Boring Number:	B-108 (P)		
Job Number:	2679-96	Depth:	30-35'		
Project:	Thornton Water Treatment Plant	Sample Number:	Bu-5		
Location:	--	Sampled Date:	--	Sampled By:	--
Project Number:	16104	Test Date:	8/3/2016	Technician:	BDF

Hydrometer Data

Test Configuration

Hydrometer Type:	152H	Total Wet Weight of Sample (g):	1,143.35
Specific Gravity:	2.65	Total Dry Weight of Sample (g):	1,081.93
Deflocculant:	Sodium Hexametaphosphate	Wet Weight of Sub-Sample (g):	59.767
Deflocculant Correction:	4.0	Dry Weight of Sub-Sample (g):	56.556
Specific Gravity Correction Factor	1.00	Corrected Dry Weight of Sub-Sample - W(g):	56.556

Elapsed Time (min)	Hydrometer Reading	Corrected Hydrometer Reading	Temperature (°C)	Temperature Coefficient (K)	Effective Depth (L)	Grain Diameter (mm)	Percent in Suspension (%)	Calculated Weight of Retained Soil (g)	Percent Passing by Weight (%)
0	-	-	-	-	-	-	-	-	-
1	49.0	45.0	25.0	0.0129	8.26	0.0370	79.7	862.03	79.7
2	47.0	43.0	25.0	0.0129	8.59	0.0266	76.1	823.72	76.1
5	46.0	42.0	25.0	0.0129	8.75	0.0170	74.4	804.56	74.4
15	44.0	40.0	25.0	0.0129	9.08	0.0100	70.8	766.25	70.8
30	41.0	37.0	25.1	0.0129	9.57	0.0073	65.5	708.78	65.5
60	39.5	35.5	25.3	0.0129	9.82	0.0052	62.9	680.05	62.9
120	37.0	33.0	25.4	0.0129	10.23	0.0038	58.4	632.15	58.4
250	35.0	31.0	25.4	0.0129	10.55	0.0026	54.9	593.84	54.9
1440	32.5	28.5	24.9	0.0130	10.96	0.0011	50.5	545.95	50.5

Data Entered By:	KR		
Date:	8/5/2016	Checked By:	_____
File Name:	2679_96_hydrometer-ASTM-D422-R3_1.xls	Date:	_____

ATT
ADVANCED

Particle Size Analysis of Soils
ASTM D 422

Client:	RJH Consultants	Boring Number:	B-102 & B-104 (P)		
Job Number:	2679-96	Depth:	10-20'		
Project:	Thornton Water Treatment Plant	Sample Number:	Bu-6 & Bu-3		
Location:	--	Sampled Date:	--	Sampled By:	--
Project Number:	16104	Wash Date:	8/4/2016	Wash Technician:	BDF

Grain Size Data

Hygroscopic Moisture of Fines

Weight of Wet Soil & Pan (g):	74.05
Weight of Dry Soil & Pan (g):	69.55
Weight of Water (g):	4.50
Weight of Pan (g):	6.67
Weight of Dry Soil (g):	62.88
Moisture (%):	7.1

General Sample Data

Total Wet Weight of Sample (g):	1,886.18
Total Dry Weight of Sample (g):	1,760.91
Calculated Weight Plus #200 (g):	480.74
Moisture of Total Sample (%):	7.1
Percent Retained #200 Sieve (%):	27.3

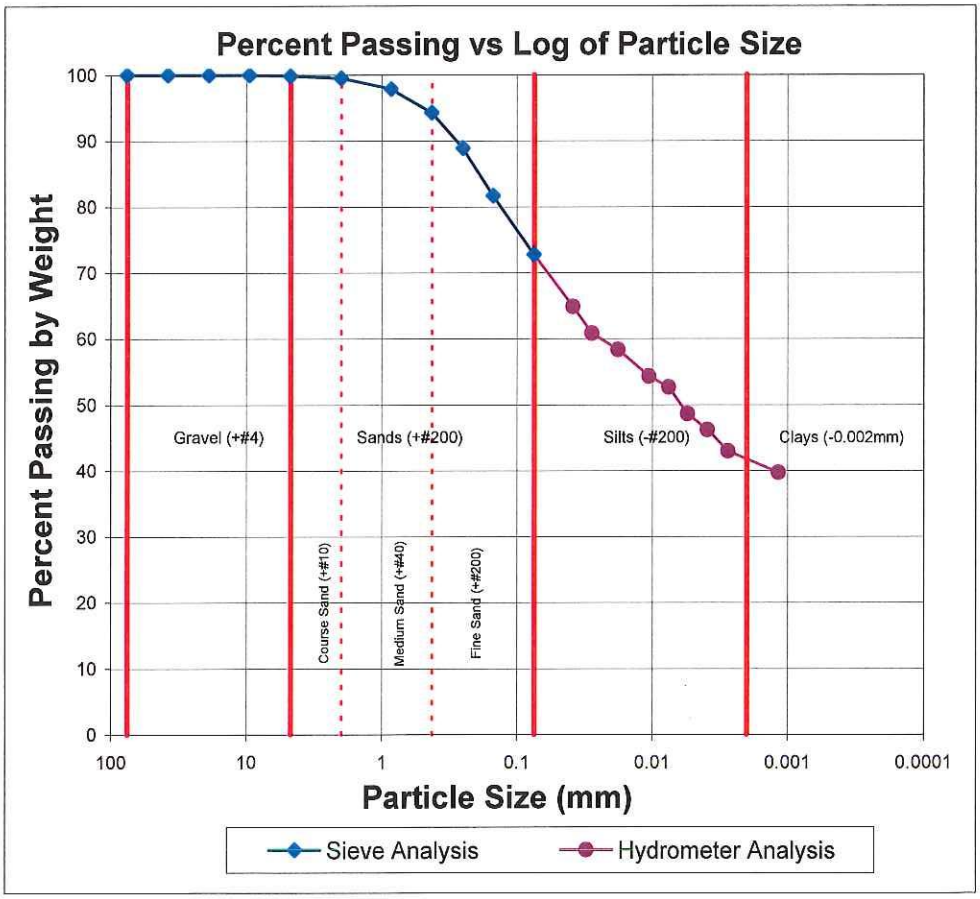
Sieve Number	Sieve Size (mm)	Weight of Retained Soil & Pan (g)	Weight of Pan (g)	Weight of Retained Soil (g)	Calculated Weight of Retained Soil (g)	Percent Passing by Weight (%)
3"	**76.2**	0.00	0.00	0.00	0.00	100.0
1.5"	**38.10**	0.00	0.00	0.00	0.00	100.0
3/4"	**19.05**	0.00	0.00	0.00	0.00	100.0
3/8"	**9.525**	0.00	0.00	0.00	0.00	100.0
#4	**4.750**	2.24	0.00	2.24	2.24	99.9
#10	**2.000**	6.37	0.00	6.37	6.37	99.5
65.88g split out of -#10 material.						
#20	**0.850**	4.17	3.14	1.04	29.55	97.8
#40	**0.425**	5.36	3.15	2.21	63.01	94.3
#60	**0.250**	6.46	3.13	3.34	95.05	88.9
#100	**0.150**	7.68	3.23	4.45	126.74	81.7
#200	**0.075**	8.78	3.24	5.54	157.77	72.7

Plus Split Data

Original Weight of +#10 (g): 20.28
Calculated Weight of +#10 (g): 8.61

Minus Split Data

Original Weight of -#10 (g): 1,865.90
Calculated Dry Weight of -#10 (g): 1,752.30



Data Entered By: KR
Date: 8/5/2016
File Name: 2679_96_hydrometer-ASTM-D422-R3_0.xls

Checked By: BDF
Date: 8/9/16

ATT
ADVANCED TERRA TESTING

Particle Size Analysis of Soils
ASTM D 422

Client:	RJH Consultants	Boring Number:	B-102 & B-104 (P)		
Job Number:	2679-96	Depth:	10-20'		
Project:	Thornton Water Treatment Plant	Sample Number:	Bu-6 & Bu-3		
Location:	--	Sampled Date:	--	Sampled By:	--
Project Number:	16104	Test Date:	8/3/2016	Technician:	BDF

Hydrometer Data

Test Configuration

Hydrometer Type:	152H	Total Wet Weight of Sample (g):	1,886.18
Specific Gravity:	2.65	Total Dry Weight of Sample (g):	1,760.91
Deflocculant:	Sodium Hexametaphosphate	Wet Weight of Sub-Sample (g):	65.880
Deflocculant Correction:	4.0	Dry Weight of Sub-Sample (g):	61.485
Specific Gravity Correction Factor	1.00	Corrected Dry Weight of Sub-Sample - W(g):	61.794

Elapsed Time (min)	Hydrometer Reading	Corrected Hydrometer Reading	Temperature (°C)	Temperature Coefficient (K)	Effective Depth (L)	Grain Diameter (mm)	Percent in Suspension (%)	Calculated Weight of Retained Soil (g)	Percent Passing by Weight (%)
0	-	-	-	-	-	-	-	-	-
1	44.0	40.0	25.3	0.0129	9.08	0.0387	64.8	1141.42	64.8
2	41.5	37.5	25.3	0.0129	9.49	0.0280	60.8	1070.08	60.8
5	40.0	36.0	25.3	0.0129	9.73	0.0179	58.3	1027.28	58.3
15	37.5	33.5	25.3	0.0129	10.14	0.0106	54.3	955.94	54.3
30	36.5	32.5	25.4	0.0129	10.31	0.0075	52.7	927.40	52.7
60	34.0	30.0	25.4	0.0129	10.72	0.0054	48.6	856.06	48.6
120	32.5	28.5	25.4	0.0129	10.96	0.0039	46.2	813.26	46.2
250	30.5	26.5	25.3	0.0129	11.29	0.0027	42.9	756.19	42.9
1440	28.5	24.5	24.8	0.0130	11.62	0.0012	39.7	699.12	39.7

Data Entered By:	KR		
Date:	8/5/2016	Checked By:	BDF
File Name:	2679_96_hydrometer-ASTM-D422-R3_0.xls	Date:	8/9/16

ATT
ADVANCED

STANDARD PROCTOR COMPACTION

Method A, B or C
ASTM D 698

ADVANCED TERRA TESTING

Compaction Test
ASTM D 698 - B

Client:	RJH Consultants	Job number:	2679-96
Project Number:	16104		
Project:	Thornton Water Treatment Plant	Boring:	B-102
Sampled by:	--	Depth:	54-59'
Tested by:	BDF	Sample Id:	Bu-23
Location:	--	Test date:	8/5/2016

Initial conditions

Wet Wt. Pan and Soil (g):	313.43	Pf (% fines)	100.00%
Dry Wt. Pan and Soil (g):	299.98	Pc (% course)	0.00%
Wt. Water (g):	13.45	Use Correction?	No
Dish Weight:	6.99	Layers	5
Wet Wt. of Total Fines (lb):	37.00	Blows/Layer	25
Dry Wt. of total fines (lb):	35.38		
Mdc (mass dry coarse) (lb):	0		

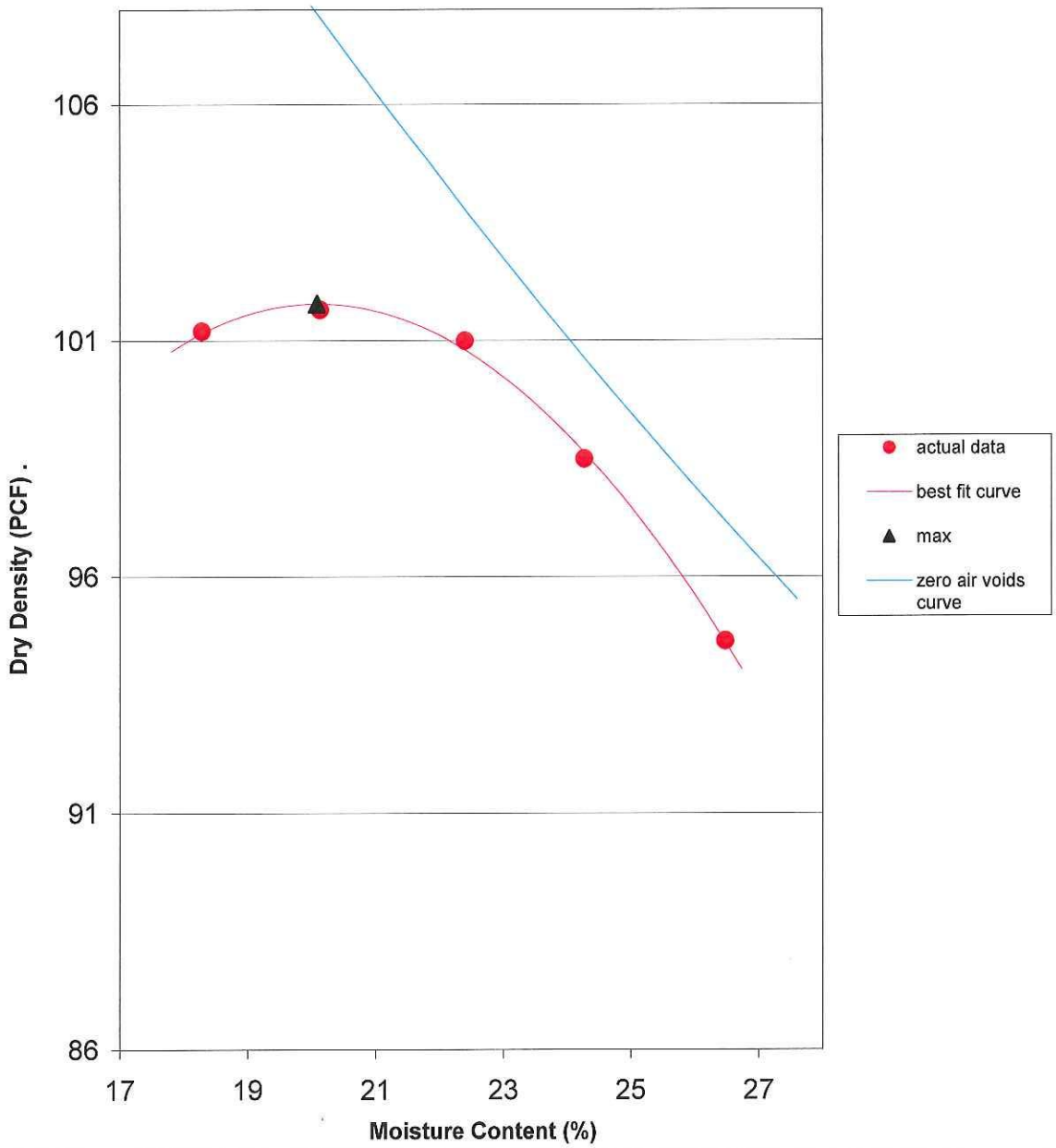
Wt of Moisture added (ml)	320	360	400	440	480
Wt. of soil & dish (g)	254.86	250.44	273.03	227.85	307.82
Dry wt. soil & dish (g)	216.48	209.64	224.28	184.65	244.83
Net loss of moisture (g)	38.38	40.80	48.75	43.20	62.99
Wt. of dish (g)	6.61	6.90	6.58	6.66	6.93
Net wt. of dry soil (g)	209.87	202.74	217.70	177.99	237.90
Moisture Content	18.3%	20.1%	22.4%	24.3%	26.5%
Corrected Moisture Content					
Wt of soil & mold (lb)	13.76	13.84	13.89	13.85	13.76
Wt. of mold (lb)	9.77	9.77	9.77	9.77	9.77
Net wt. of wet soil (lb)	3.99	4.07	4.12	4.08	3.99
Net wt of dry soil (lb)	3.37	3.39	3.37	3.28	3.15
Dry Density, (pcf)	101.2	101.6	101.0	98.5	94.6
Corrected Dry Density (pcf)					

Data entry by:	KR	Date:	08/08/16
Data checked by:		Date:	
Filename	2679_96_Proctor_ASTMD1557_ASTMD698_R2_3.xls		

Proctor Compaction Test

ASTM D 698 - B

Client:	RJH Consultants	Job number:	2679-96
Project Number:	16104		
Project:	Thornton Water Treatment Plant	Boring:	B-102
Sampled by:	--	Depth:	54-59'
Tested by:	BDF	Sample Id:	Bu-23
Location:	--	Test date:	8/5/2016



Optimum Moisture content: 20.1 Maximum dry density: 101.8	Zero air voids curve @ SG = 2.65

Data entry by:	KR	Date:	08/08/16
Data checked by:	CM	Date:	08/09/16
Filename	2679_96_Proctor_ASTMD1557_ASTMD698_R2_3.xls		

ADVANCED TERRA TESTING

Compaction Test
ASTM D 698 - B

Client:	RJH Consultants	Job number:	2679-96
Project Number:	16104		
Project:	Thornton Water Treatment Plant	Boring:	B-103
Sampled by:	--	Depth:	0-10'
Tested by:	BDF	Sample Id:	Bu-2
Location:	--	Test date:	8/1/2016

Initial conditions

Wet Wt. Pan and Soil (g):	289.75	Pf (% fines)	99.29%
Dry Wt. Pan and Soil (g):	248.26	Pc (% course)	0.71%
Wt. Water (g):	41.49	Use Correction?	No
Dish Weight:	6.97	Layers	3
Wet Wt. of Total Fines (lb):	35.89	Blows/Layer	25
Dry Wt. of total fines (lb):	30.62		
Mdc (mass dry coarse) (lb):	0.218		

Wt of Moisture added (ml)	80	120	160	200		
Wt. of soil & dish (g)	244.99	281.59	264.04	314.78		
Dry wt. soil & dish (g)	202.73	228.26	211.83	247.42		
Net loss of moisture (g)	42.26	53.33	52.21	67.36		
Wt. of dish (g)	6.94	6.60	7.03	6.92		
Net wt. of dry soil (g)	195.79	221.66	204.80	240.50		
Moisture Content	21.6%	24.1%	25.5%	28.0%		
Corrected Moisture Content						
Wt of soil & mold (lb)	13.65	13.82	13.80	13.73		
Wt. of mold (lb)	9.77	9.77	9.77	9.77		
Net wt. of wet soil (lb)	3.88	4.05	4.03	3.96		
Net wt of dry soil (lb)	3.19	3.26	3.21	3.09		
Dry Density, (pcf)	95.7	97.9	96.3	92.8		
Corrected Dry Density (pcf)						

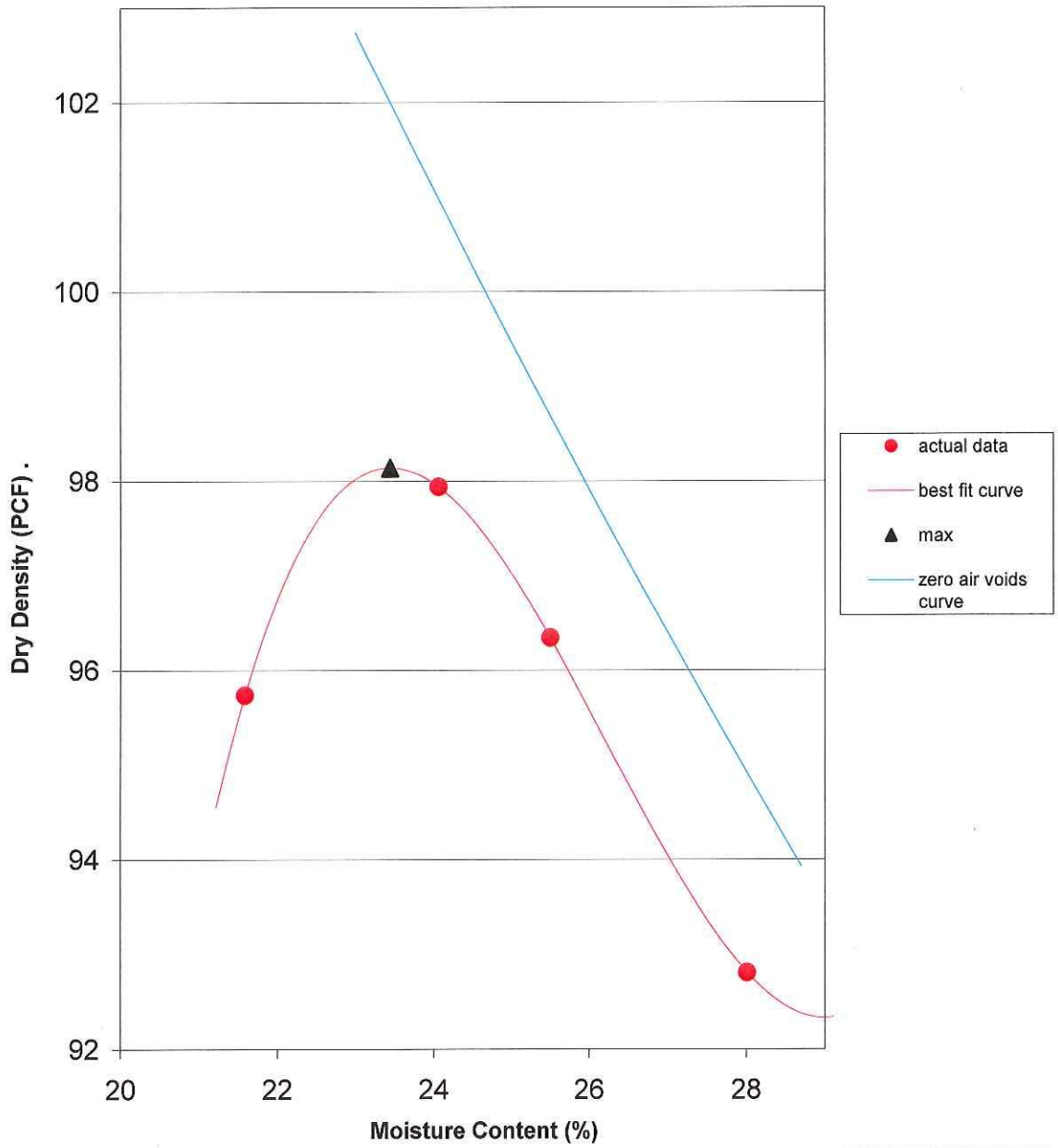
Data entry by:	KR	Date:	08/05/16		
Data checked by:		Date:			

Filename 2679_96_Proctor_ASTMD1557_ASTMD698_R2_1.xls

Proctor Compaction Test

ASTM D 698 - B

Client:	RJH Consultants	Job number:	2679-96
Project Number:	16104		
Project:	Thornton Water Treatment Plant	Boring:	B-103
Sampled by:	--	Depth:	0-10'
Tested by:	BDF	Sample Id:	Bu-2
Location:	--	Test date:	8/1/2016



Optimum Moisture content: 23.4 Maximum dry density: 98.1

Zero air voids curve @ SG = 2.65

Data entry by:	KR	Date:	08/05/16
Data checked by:	CH	Date:	08/09/16
Filename	2679_96_Proctor_ASTMD1557_ASTMD698_R2_1.xls		

ADVANCED TERRA TESTING

Compaction Test
ASTM D 698 - B

Client:	RJH Consultants	Job number:	2679-96
Project Number:	16104		
Project:	Thornton Water Treatment Plant	Boring:	B-108 (P)
Sampled by:	--	Depth:	30-35'
Tested by:	BDF	Sample Id:	Bu-5
Location:	--	Test date:	8/1/2016

Initial conditions

Wet Wt. Pan and Soil (g):	366.48	Pf (% fines)	99.92%
Dry Wt. Pan and Soil (g):	327.77	Pc (% course)	0.08%
Wt. Water (g):	38.71	Use Correction?	No
Dish Weight:	6.97	Layers	3
Wet Wt. of Total Fines (lb):	36.66	Blows/Layer	25
Dry Wt. of total fines (lb):	32.71		
Mdc (mass dry coarse) (lb):	0.026		

Wt of Moisture added (ml)	120	160	200	240	280	
Wt. of soil & dish (g)	229.71	295.99	268.59	348.51	270.62	
Dry wt. soil & dish (g)	196.17	248.80	222.53	283.45	218.13	
Net loss of moisture (g)	33.54	47.19	46.06	65.06	52.49	
Wt. of dish (g)	6.98	7.01	6.98	6.95	6.62	
Net wt. of dry soil (g)	189.19	241.79	215.55	276.50	211.51	
Moisture Content	17.7%	19.5%	21.4%	23.5%	24.8%	
Corrected Moisture Content						
Wt of soil & mold (lb)	13.56	13.80	13.93	13.86	13.81	
Wt. of mold (lb)	9.77	9.77	9.77	9.77	9.77	
Net wt. of wet soil (lb)	3.79	4.03	4.16	4.09	4.04	
Net wt of dry soil (lb)	3.22	3.37	3.43	3.31	3.24	
Dry Density, (pcf)	96.6	101.2	102.8	99.3	97.1	
Corrected Dry Density (pcf)						

Data entry by:	KR	Date:	08/05/16
Data checked by:		Date:	

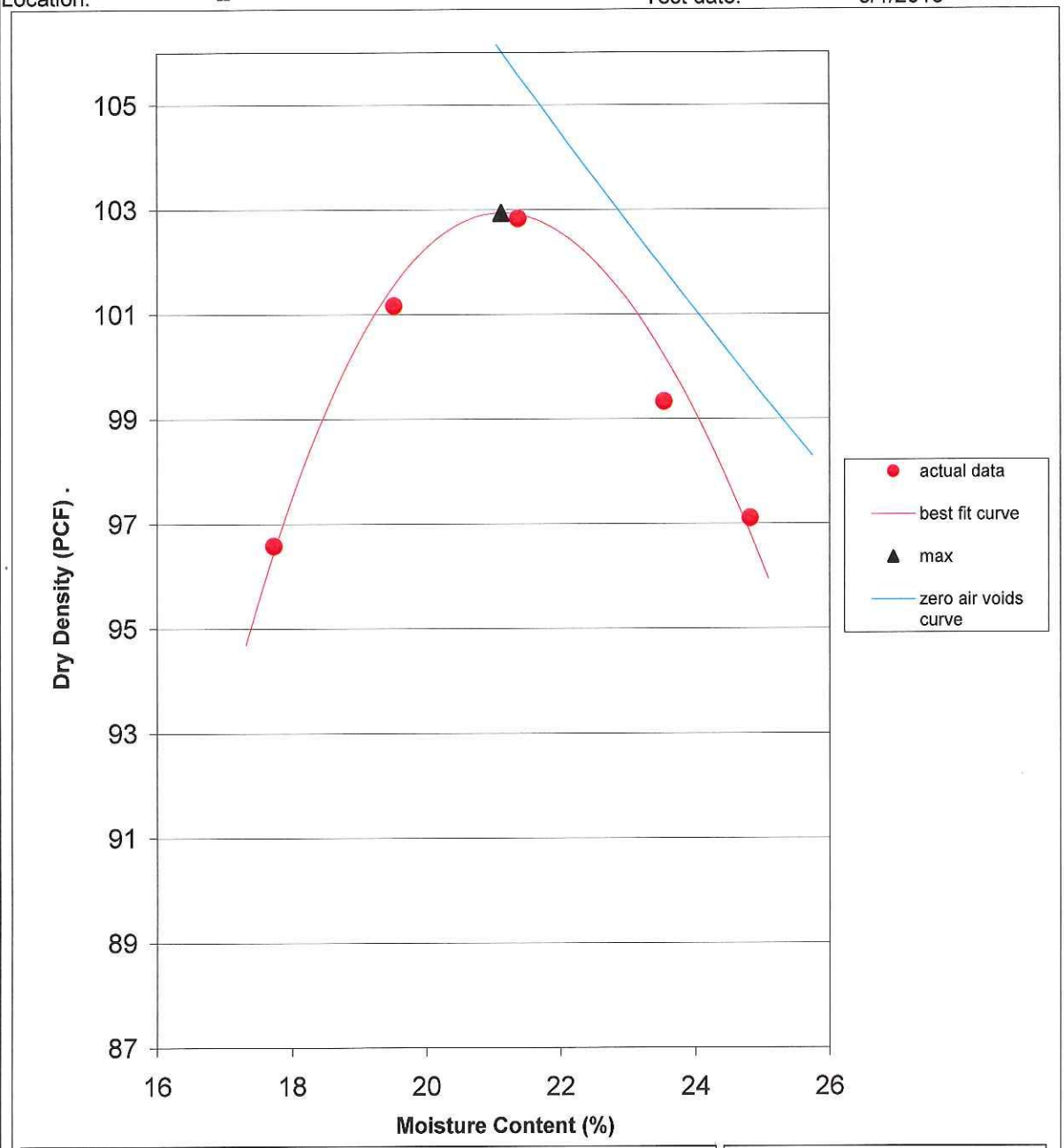
Filename 2679_96_Proctor_ASTMD1557_ASTMD698_R2_2.xls

Proctor Compaction Test

ASTM D 698 - B

ADVANCED TERRA TESTING

Client:	RJH Consultants	Job number:	2679-96
Project Number:	16104		
Project:	Thornton Water Treatment Plant	Boring:	B-108 (P)
Sampled by:	--	Depth:	30-35'
Tested by:	BDF	Sample Id:	Bu-5
Location:	--	Test date:	8/1/2016



Optimum Moisture content: 21.1 Maximum dry density: 102.9

Zero air voids curve @ SG = 2.65

Data entry by:	KR	Date:	08/05/16
Data checked by:	CAL	Date:	08/09/16
Filename	2679_96_Proctor_ASTMD1557_ASTMD698_R2_2.xls		

ATT
ADVANCED TERRA TESTING

Compaction Test
ASTM D 698 - B

Client:	RJH Consultants	Job number:	2679-96
Project Number:	16104		
Project:	Thornton Water Treatment Plant	Boring:	B-102 & B-104(P)
Sampled by:	--	Depth:	10-20'
Tested by:	BDF	Sample Id:	Bu-6 & Bu-3
Location:	--	Test date:	8/2/2016

Initial conditions

Wet Wt. Pan and Soil (g):	371.55	Pf (% fines)	99.93%
Dry Wt. Pan and Soil (g):	337.32	Pc (% course)	0.07%
Wt. Water (g):	34.23	Use Correction?	No
Dish Weight:	6.9	Layers	3
Wet Wt. of Total Fines (lb):	63.61	Blows/Layer	25
Dry Wt. of total fines (lb):	57.64		
Mdc (mass dry coarse) (lb):	0.039		

Wt of Moisture added (ml)	120	160	200	240	280
Wt. of soil & dish (g)	284.23	217.25	342.54	308.50	280.28
Dry wt. soil & dish (g)	246.19	185.31	286.50	255.55	227.67
Net loss of moisture (g)	38.04	31.94	56.04	52.95	52.61
Wt. of dish (g)	6.93	6.59	6.55	7.02	6.69
Net wt. of dry soil (g)	239.26	178.72	279.95	248.53	220.98
Moisture Content	15.9%	17.9%	20.0%	21.3%	23.8%
Corrected Moisture Content					
Wt of soil & mold (lb)	13.63	13.86	13.92	13.89	13.84
Wt. of mold (lb)	9.77	9.77	9.77	9.77	9.77
Net wt. of wet soil (lb)	3.86	4.09	4.15	4.12	4.07
Net wt of dry soil (lb)	3.33	3.47	3.46	3.40	3.29
Dry Density, (pcf)	99.9	104.1	103.7	101.9	98.6
Corrected Dry Density (pcf)					

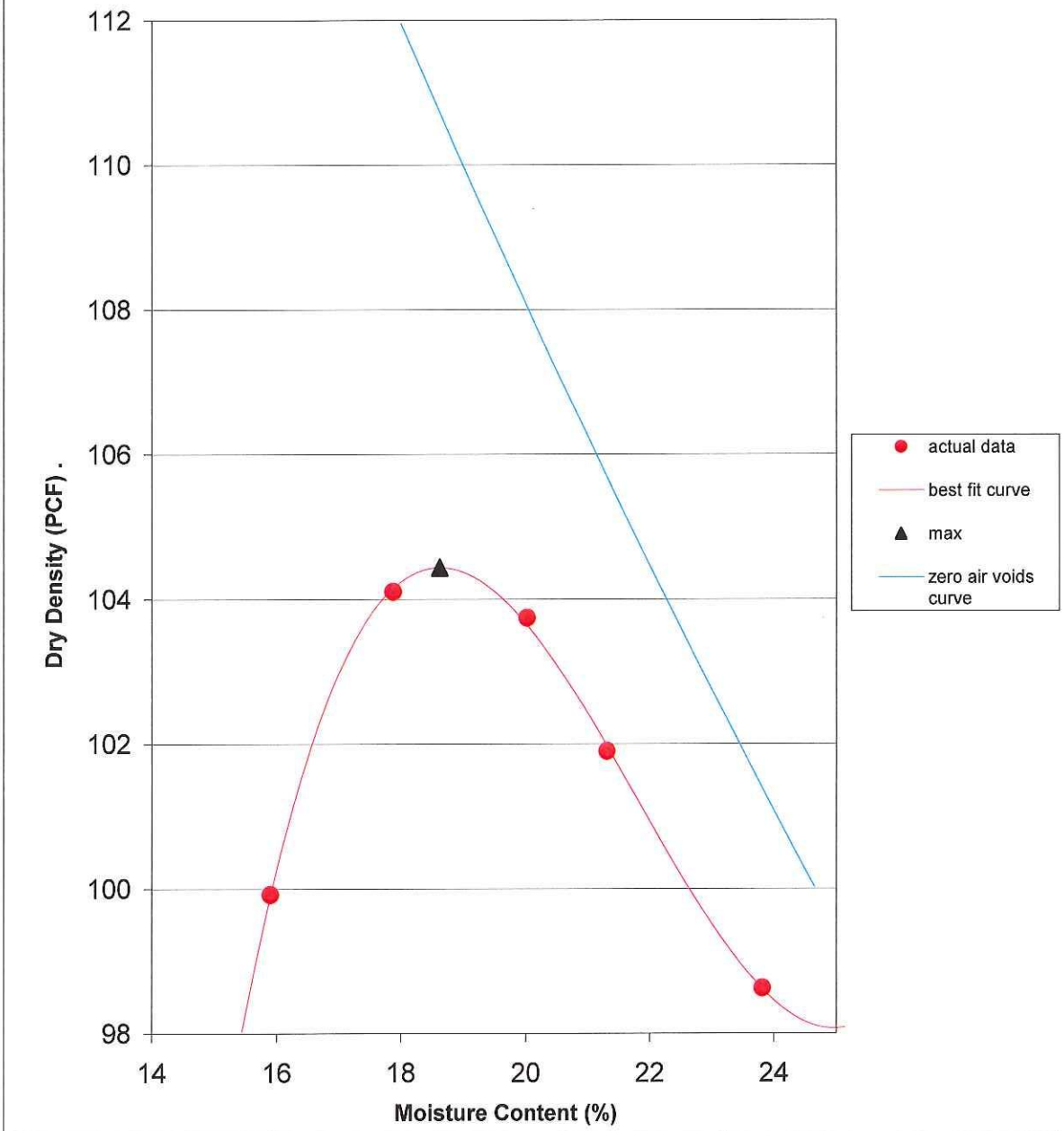
Data entry by:	CKP	Date:	08/03/16
Data checked by:		Date:	
Filename	2679_96_Proctor_ASTMD1557_ASTMD698_R2_0.xls		

Proctor Compaction Test

ASTM D 698 - B

ADVANCED TERRA TESTING

Client:	RJH Consultants	Job number:	2679-96
Project Number:	16104		
Project:	Thornton Water Treatment Plant	Boring:	B-102 & B-104(P)
Sampled by:	--	Depth:	10-20'
Tested by:	BDF	Sample Id:	Bu-6 & Bu-3
Location:	--	Test date:	08/02/2016



Optimum Moisture content: 18.6 Maximum dry density: 104.4

Zero air voids curve @ SG = 2.65

Data entry by:	CKP	Date:	08/03/16
Data checked by:	KR	Date:	8/4/16
Filename	2679_96_Proctor_ASTMD1557_ASTMD698_R2_0.xls		

CAPILLARY MOISTURE RETENTION TEST
ASTM D 6836

CAPILLARY MOISTURE RETENTION TEST
ASTM D 6836

CLIENT	RJH	JOB NO.	2679-96
SAMPLE DATE	--	TEST STARTED	7/28/16 DPM
SOIL DESCR.	Claystone	TEST FINISHED	8/25/16 DPM
LOCATION	Thornton WTP - 16104		

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		0.208	0.697	0.594	0.414	0.333	0.321	0.320			
B-102, 30-32', S-14	7.484	28.517	30.993	30.147	29.784	29.536	29.230	29.228		26.759	1.315
B-102, 30-32', S-14R	7.585	28.716	30.738	30.355	30.038	29.764	29.448	29.446		26.597	1.306

Data Entered By: KR Date: 08/26/2016
Data Checked By: DPM Date: 8/26/16
Filename: capreten.wk4

CAPILLARY MOISTURE RETENTION TEST
ASTM D 6836

CLIENT	RJH	JOB NO.	2679-96
SAMPLE DATE	–	TEST STARTED	7/28/16 DPM
SOIL DESCR.	Claystone	TEST FINISHED	8/25/16 DPM
LOCATION	Thornton WTP - 16104		

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.
B-102, 30-32', S-14	17.752	1.732	22.812	5.060	28.50	49.36	4.317	24.32	42.11	4.134	23.29	40.32
B-102, 30-32', S-14R	17.498	1.707	22.456	4.958	28.33	48.36	4.678	26.73	45.63	4.541	25.95	44.29

Data Entered By: KR Date: 08/26/2016
Data Checked By: DPM Date: 8/26/16
Filename: capreten.wk4

CAPILLARY MOISTURE RETENTION TEST
ASTM D 6836

CLIENT RJH

JOB NO. 2679-96

SAMPLE DATE --
SOIL DESCR. Claystone
LOCATION Thornton WTP - 16104

TEST STARTED 7/28/16 DPM
TEST FINISHED 8/25/16 DPM

Moisture Content Data: % D.M. = Moisture Content By Dry Mass; % Vol. = Moisture Content By Volume

Sample Description	2 Bar			5 Bar			15 Bar			0.0 Bar		
	Retained H2O	% DM	% Vol.	Retained H2O	% DM	% Vol.	Retained H2O	% DM	% Vol.	Retained H2O	% DM	% Vol.
B-102, 30-32', S-1	3.967	22.35	38.69	3.673	20.69	35.83	3.672	20.68	35.82	-25.236	-142.16	-246.16
B-102, 30-32', S-1	4.348	24.85	42.41	4.044	23.11	39.45	4.043	23.11	39.44	-25.083	-143.35	-244.66

Data Entered By: KR Date: 08/26/2016
Data Checked By: DPM Date: 8/26/16
Filename: capreten.wk4

CAPILLARY MOISTURE RETENTION TEST
ASTM D 6836

CLIENT RJH

JOB NO. 2679-96

SAMPLE DATE --
SOIL DESCR. Claystone
LOCATION Thornton WTP - 16104

TEST STARTED 7/28/16 DPM
TEST FINISHED 8/25/16 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
B-102, 30-32', S-14	49.36	42.11	40.32	38.69	35.83	35.82
B-102, 30-32', S-14R	48.36	45.63	44.29	42.41	39.45	39.44

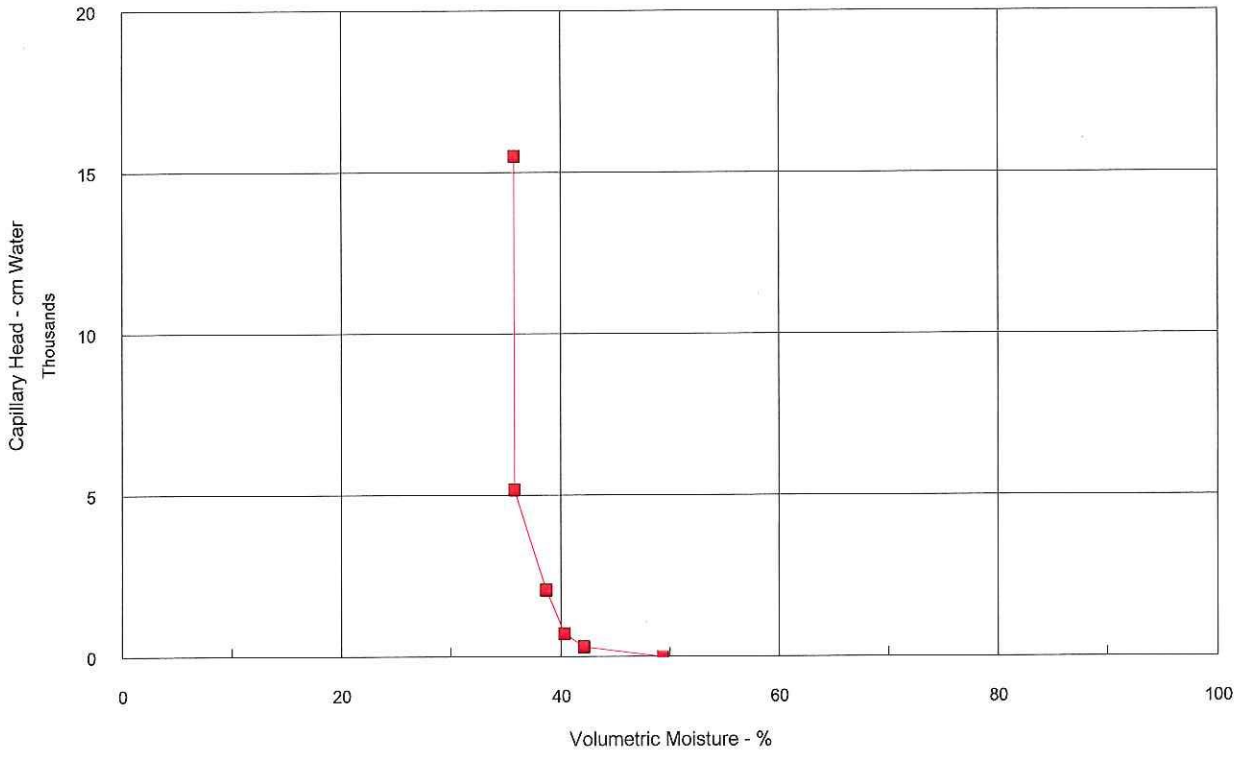
	% Saturation					
	Sat.	0.3 Bar	0.7 Bar	2 Bar	5 Bar	15 Bar
B-102, 30-32', S-14	100.00	85.32	81.70	78.40	72.59	72.57
B-102, 30-32', S-14R	100.00	94.35	91.59	87.70	81.57	81.54

Data Entered By: KR Date: 08/26/2016
Data Checked By: DPM Date: 8/26/16
Filename: capreten.wk4

ADVANCED TERRA TESTING, INC. ATT

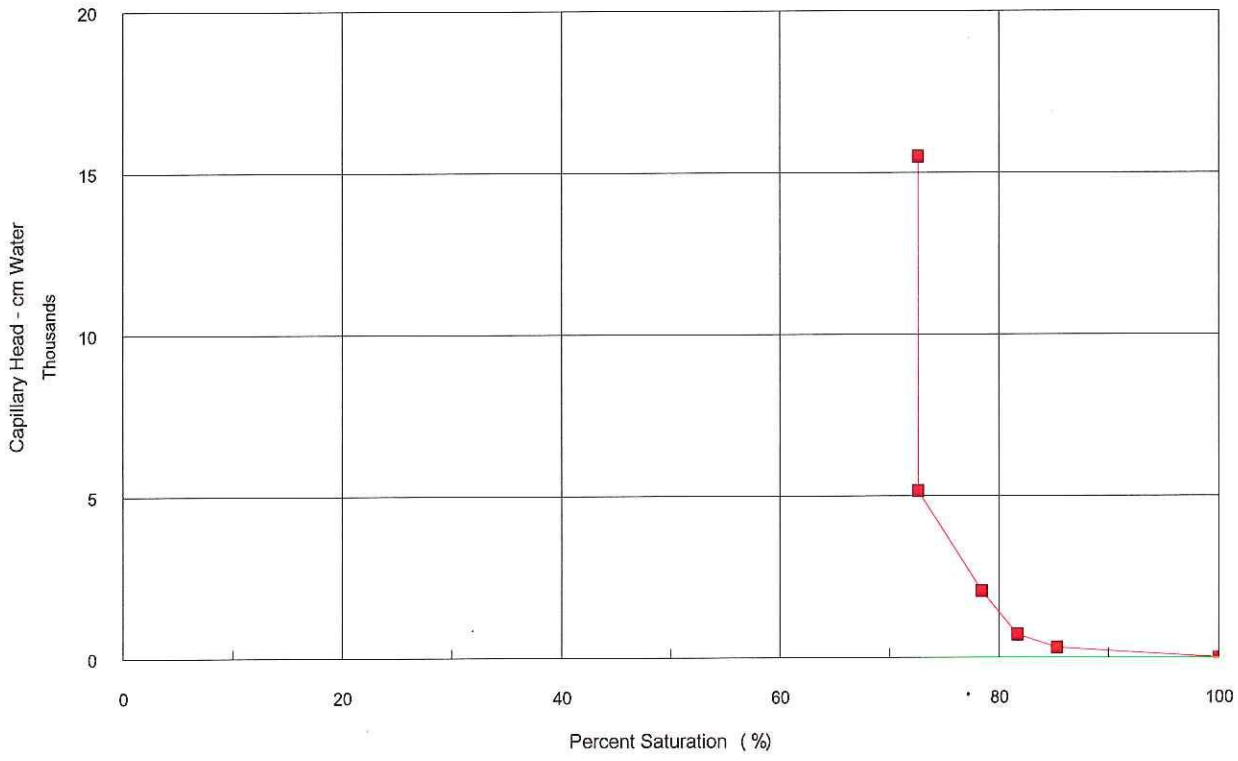
CAPILLARY MOISTURE CHARACTERISTIC CURVE

B-102, 30-32', S-14



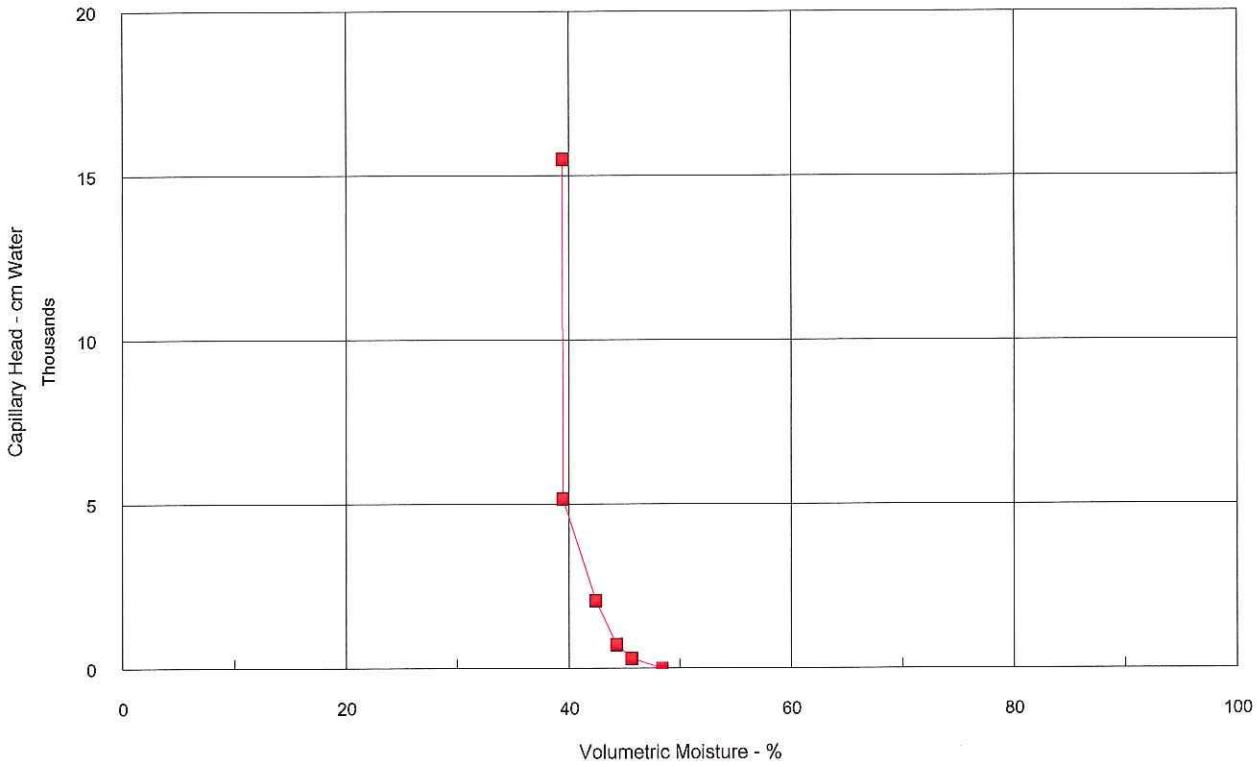
CAPILLARY MOISTURE CHARACTERISTIC CURVE

B-102, 30-32', S-14



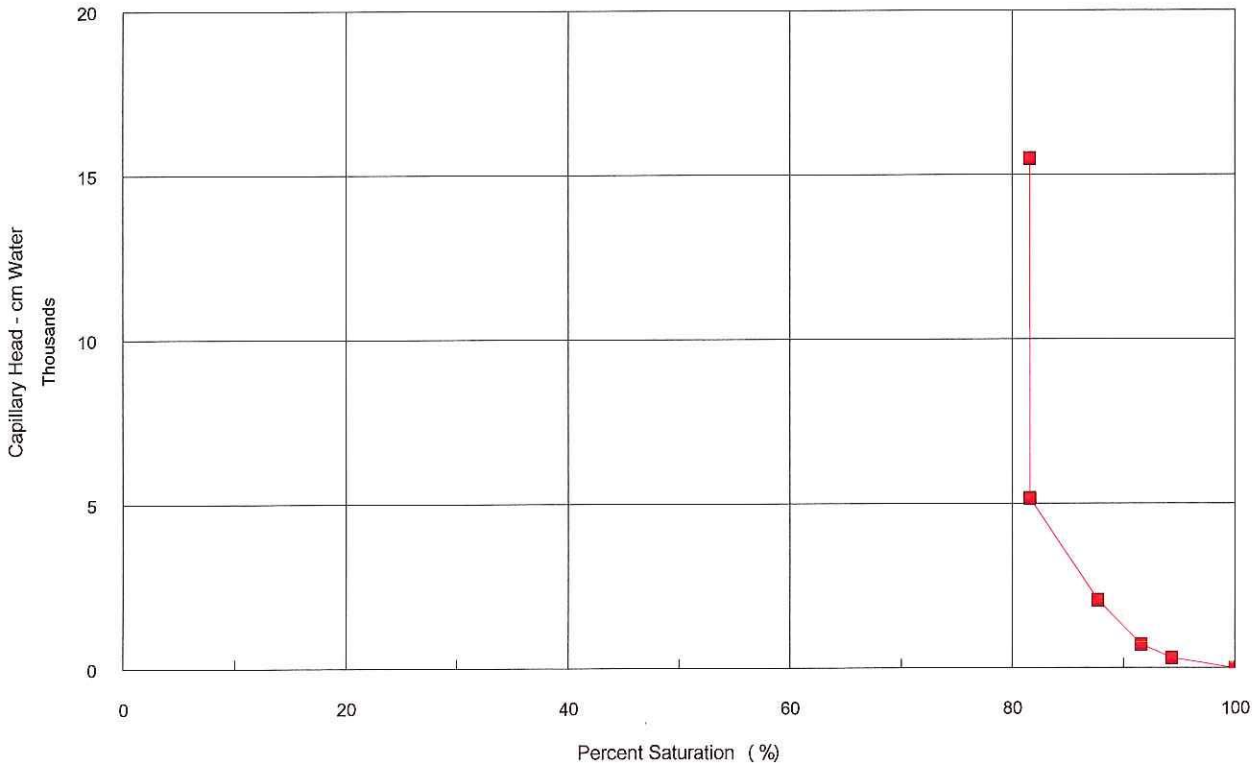
CAPILLARY MOISTURE CHARACTERISTIC CURVE

B-102, 30-32', S-14R



CAPILLARY MOISTURE CHARACTERISTIC CURVE

B-102, 30-32', S-14R



Consolidation/Swell Test

ASTM D 4546

SWELL/COLLAPSE TEST

ASTM D4546 Method B (modified)

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	SAMPLED	06/20/2016 --
PROJECT NO.	16104	TEST STARTED	07/13/2016 DPM
LOCATION	--	TEST FINISHED	07/17/2016 DPM
BORING NO.	B-103	CONSOLIDOMETER	ATT-17
DEPTH	26.5-27.5' (27-27.5')	SAMPLE DESCR.	Claystone
SAMPLE NO.	DM-11		
SAMPLE DIA.(in)	2.410	INITIAL HT.(in)	0.795
SPECIFIC GRAVITY	2.65	FINAL HT.(in)	0.787

MOISTURE/DENSITY DATA

	BEFORE TEST	AFTER TEST		BEFORE TEST	AFTER TEST
Wt. Soil & Ring(s) (g)	171.01	174.17	Wt. Wet Soil & Pan (g)	127.82	130.97
Wt. Ring(s) (g)	46.34	46.34	Wt. Dry Soil & Pan (g)	109.28	109.28
Wt. Soil (g)	124.67	127.82	Wt. Lost Moisture (g)	18.54	21.69
Wet Density (pcf)	131.0	135.6	Wt. of Pan Only (g)	3.15	3.15
Moisture Content (%)	17.47	20.44	Wt. of Dry Soil (g)	106.13	106.13
Dry Density (pcf)	111.5	112.6	Saturation (%)	96.19	116.10

	LOAD (psf)	CONSOL. (IN)	LOG p	CONSOL. (IN/IN)	DEFL. (IN/IN)	STRAIN (%)
	20	0.0000	1.292	0.0000	0.0000	0.0
Inundate	20	-0.0659	1.292	-0.0829	0.0829	8.3
	100	-0.0645	2.000	-0.0811	0.0811	8.1
	200	-0.0602	2.301	-0.0757	0.0757	7.6
	400	-0.0540	2.602	-0.0679	0.0679	6.8
	800	-0.0462	2.903	-0.0581	0.0581	5.8
	1600	-0.0370	3.204	-0.0465	0.0465	4.7
	3200	-0.0281	3.505	-0.0353	0.0353	3.5
	6400	-0.0169	3.806	-0.0213	0.0213	2.1
	12800	-0.0062	4.107	-0.0078	0.0078	0.8
	25600	0.0079	4.408	0.0099	-0.0099	-1.0

Data entry by: NN Date: 7/18/2016

Data checked by: DPM Date: 7/29/16

File Name: 2679_96_Swell-Consol_ASTMD4546_R0_2.xls

SWELL/COLLAPSE TEST

ASTM D4546 Method B (modified)

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	SAMPLED	06/20/2016 --
PROJECT NO.	16104	TEST STARTED	07/13/2016 DPM
LOCATION	--	TEST FINISHED	07/17/2016 DPM
BORING NO.	B-103	CONSOLIDOMETER	ATT-17
DEPTH	26.5-27.5' (27-27.5')	SAMPLE DESCR.	Claystone
SAMPLE NO.	DM-11		

Timed Reading Data

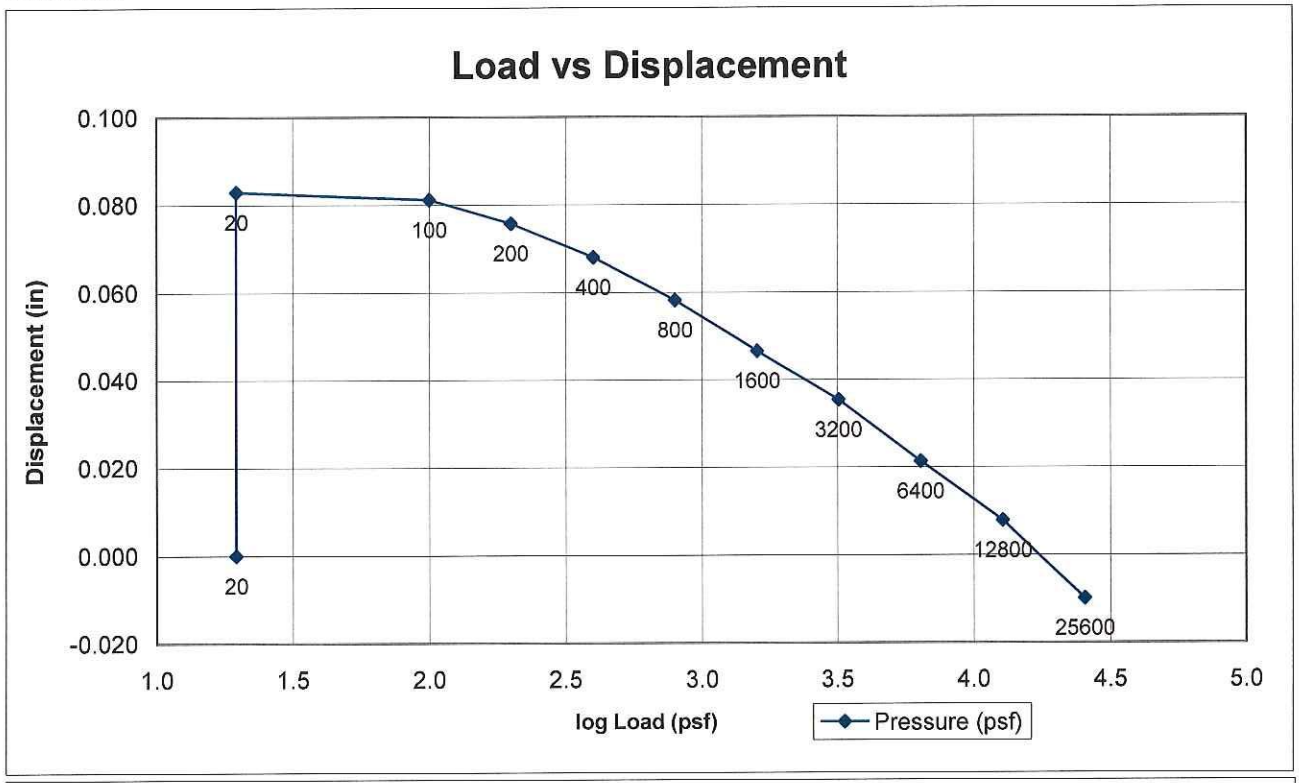
19.6 psf Inundation Load

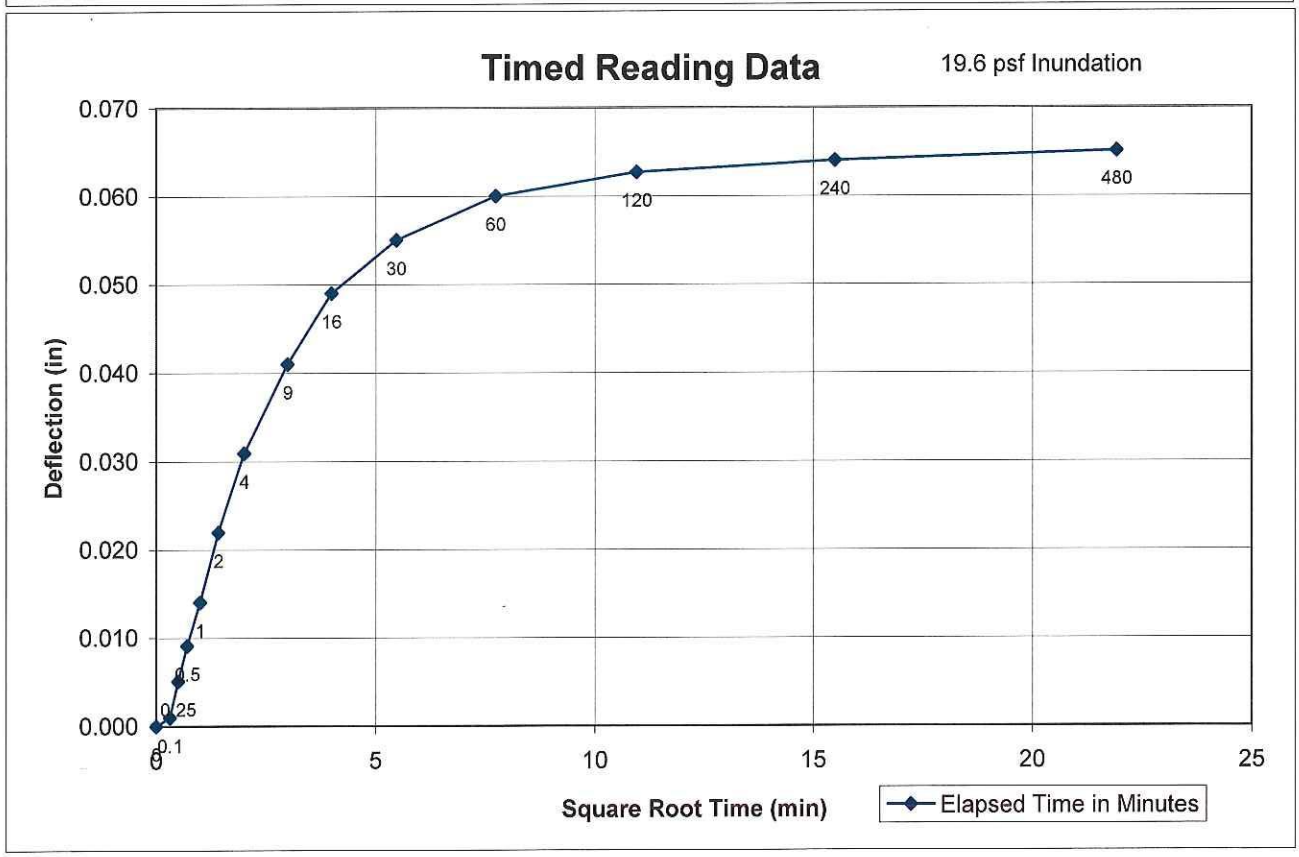
Elapsed Time (min)	SQRT Time (min)	Dial Reading (in)	Defl. (in)
0	0.00	0.4414	0.0000
0.1	0.32	0.4404	0.0010
0.25	0.50	0.4363	0.0051
0.5	0.71	0.4323	0.0091
1	1.00	0.4274	0.0140
2	1.41	0.4195	0.0219
4	2.00	0.4105	0.0309
9	3.00	0.4004	0.0410
16	4.00	0.3924	0.0490
30	5.48	0.3864	0.0550
60	7.75	0.3814	0.0600
120	10.95	0.3787	0.0627
240	15.49	0.3774	0.0640
480	21.91	0.3763	0.0651

SWELL/COLLAPSE TEST

ASTM D4546 Method B (modified)

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	BORING NO.	B-103
PROJECT NO.	16104	DEPTH	26.5-27.5' (27-27.5')
LOCATION	--	SAMPLE NO.	DM-11





SWELL/COLLAPSE TEST

ASTM D4546 Method B (modified)

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	SAMPLED	-- --
PROJECT NO.	16104	TEST STARTED	07/13/2016 DPM
LOCATION	--	TEST FINISHED	07/15/2016 DPM
BORING NO.	B-105	CONSOLIDOMETER	ATT-02
DEPTH	7.5-8.5'	SAMPLE DESCR.	Lean Clay
SAMPLE NO.	DM-4		
SAMPLE DIA.(in)	2.410	INITIAL HT.(in)	0.896
SPECIFIC GRAVITY	2.65	FINAL HT.(in)	0.857

MOISTURE/DENSITY DATA

	BEFORE TEST	AFTER TEST		BEFORE TEST	AFTER TEST
Wt. Soil & Ring(s) (g)	169.75	177.38	Wt. Wet Soil & Pan (g)	126.79	134.42
Wt. Ring(s) (g)	46.10	46.10	Wt. Dry Soil & Pan (g)	111.52	111.52
Wt. Soil (g)	123.65	131.29	Wt. Lost Moisture (g)	15.27	22.90
Wet Density (pcf)	115.3	127.9	Wt. of Pan Only (g)	3.13	3.13
Moisture Content (%)	14.09	21.13	Wt. of Dry Soil (g)	108.39	108.39
Dry Density (pcf)	101.0	105.6	Saturation (%)	58.81	99.24

	LOAD (psf)	CONSOL. (IN)	LOG p	CONSOL. (IN/IN)	DEFL. (IN/IN)	STRAIN (%)
	106	0.00000	2.024	0.00000	0.00000	0.0
	1305	0.00850	3.116	0.00949	-0.00949	-0.9
Inundate	1305	0.00020	3.116	0.00022	-0.00022	0.0
	1488	0.00010	3.173	0.00011	-0.00011	0.0
	3126	0.00675	3.495	0.00753	-0.00753	-0.8
	6367	0.03865	3.804	0.04314	-0.04314	-4.3

Data entry by: NN Date: 7/18/2016

Data checked by: DPM Date: 7/29/16

File Name: 2679_96_Swell-Consol_ASTMD4546_R0_1.xls

SWELL/COLLAPSE TEST

ASTM D4546 Method B (modified)

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	SAMPLED	-- --
PROJECT NO.	16104	TEST STARTED	07/13/2016 DPM
LOCATION	--	TEST FINISHED	07/15/2016 DPM
BORING NO.	B-105	CONSOLIDOMETER	ATT-02
DEPTH	7.5-8.5'	SAMPLE DESCR.	Lean Clay
SAMPLE NO.	DM-4		

Timed Reading Data

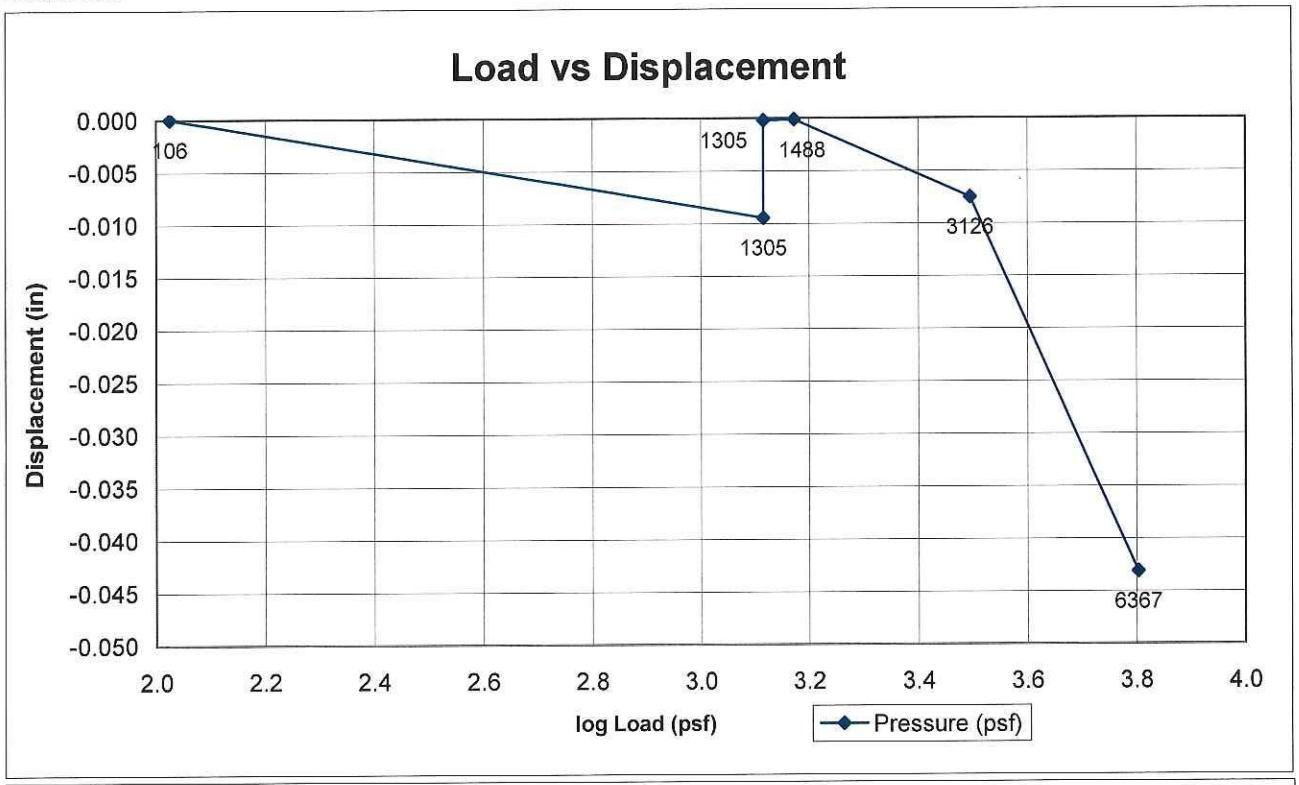
1305 psf Inundation Load

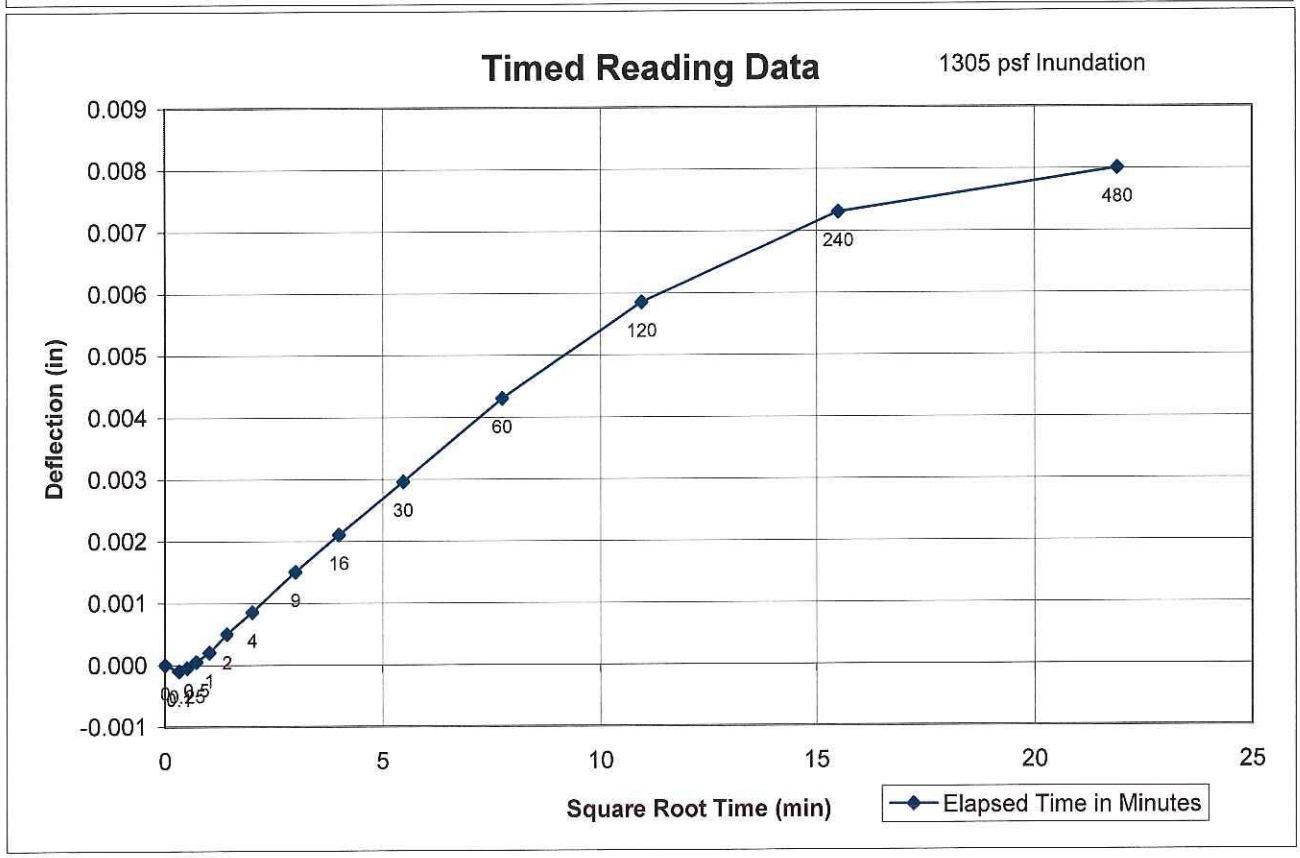
Elapsed Time (min)	SQRT Time (min)	Dial Reading (in)	Defl. (in)
0	0.00	0.01300	0.00000
0.1	0.32	0.01310	-0.00010
0.25	0.50	0.01305	-0.00005
0.5	0.71	0.01295	0.00005
1	1.00	0.01280	0.00020
2	1.41	0.01250	0.00050
4	2.00	0.01215	0.00085
9	3.00	0.01150	0.00150
16	4.00	0.01090	0.00210
30	5.48	0.01005	0.00295
60	7.75	0.00870	0.00430
120	10.95	0.00715	0.00585
240	15.49	0.00570	0.00730
480	21.91	0.00500	0.00800

SWELL/COLLAPSE TEST

ASTM D4546 Method B (modified)

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	BORING NO.	B-105
PROJECT NO.	16104	DEPTH	7.5-8.5'
LOCATION	--	SAMPLE NO.	DM-4





SWELL/COLLAPSE TEST

ASTM D4546 Method B (modified)

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	SAMPLED	-- --
PROJECT NO.	16104	TEST STARTED	07/13/2016 DPM
LOCATION	--	TEST FINISHED	07/15/2016 DPM
BORING NO.	B-106	CONSOLIDOMETER	ATT-5
DEPTH	5-6'(5.5-6')	SAMPLE DESCR.	Fill, Lean Clay
SAMPLE NO.	DM-3		
SAMPLE DIA.(in)	2.410	INITIAL HT.(in)	0.896
SPECIFIC GRAVITY	2.65	FINAL HT.(in)	0.888

MOISTURE/DENSITY DATA

	BEFORE TEST	AFTER TEST		BEFORE TEST	AFTER TEST
Wt. Soil & Ring(s) (g)	174.61	181.14	Wt. Wet Soil & Pan (g)	131.46	137.99
Wt. Ring(s) (g)	46.25	46.25	Wt. Dry Soil & Pan (g)	112.06	112.06
Wt. Soil (g)	128.36	134.89	Wt. Lost Moisture (g)	19.39	25.93
Wet Density (pcf)	119.6	126.8	Wt. of Pan Only (g)	3.10	3.10
Moisture Content (%)	17.80	23.80	Wt. of Dry Soil (g)	108.96	108.96
Dry Density (pcf)	101.6	102.4	Saturation (%)	75.34	102.99

	LOAD (psf)	CONSOL. (IN)	LOG p	CONSOL. (IN/IN)	DEFL. (IN/IN)	STRAIN (%)
	97	0.0000	1.988	0.0000	0.0000	0.0
	656	0.0010	2.817	0.0011	-0.0011	-0.1
Inundate	656	-0.0290	2.817	-0.0324	0.0324	3.2
	808	-0.0290	2.907	-0.0324	0.0324	3.2
	1637	-0.0250	3.214	-0.0278	0.0278	2.8
	3231	-0.0134	3.509	-0.0150	0.0150	1.5
	6471	0.0076	3.811	0.0085	-0.0085	-0.8

Data entry by: NN Date: 7/18/2016

Data checked by: DPM Date: 7/29/16

File Name: 2679_96_Swell-Consol_ASTMD4546_R0_0.xls

SWELL/COLLAPSE TEST

ASTM D4546 Method B (modified)

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	SAMPLED	-- --
PROJECT NO.	16104	TEST STARTED	07/13/2016 DPM
LOCATION	--	TEST FINISHED	07/15/2016 DPM
BORING NO.	B-106	CONSOLIDOMETER	ATT-5
DEPTH	5-6'(5.5-6')	SAMPLE DESCR.	Fill, Lean Clay
SAMPLE NO.	DM-3		

Timed Reading Data

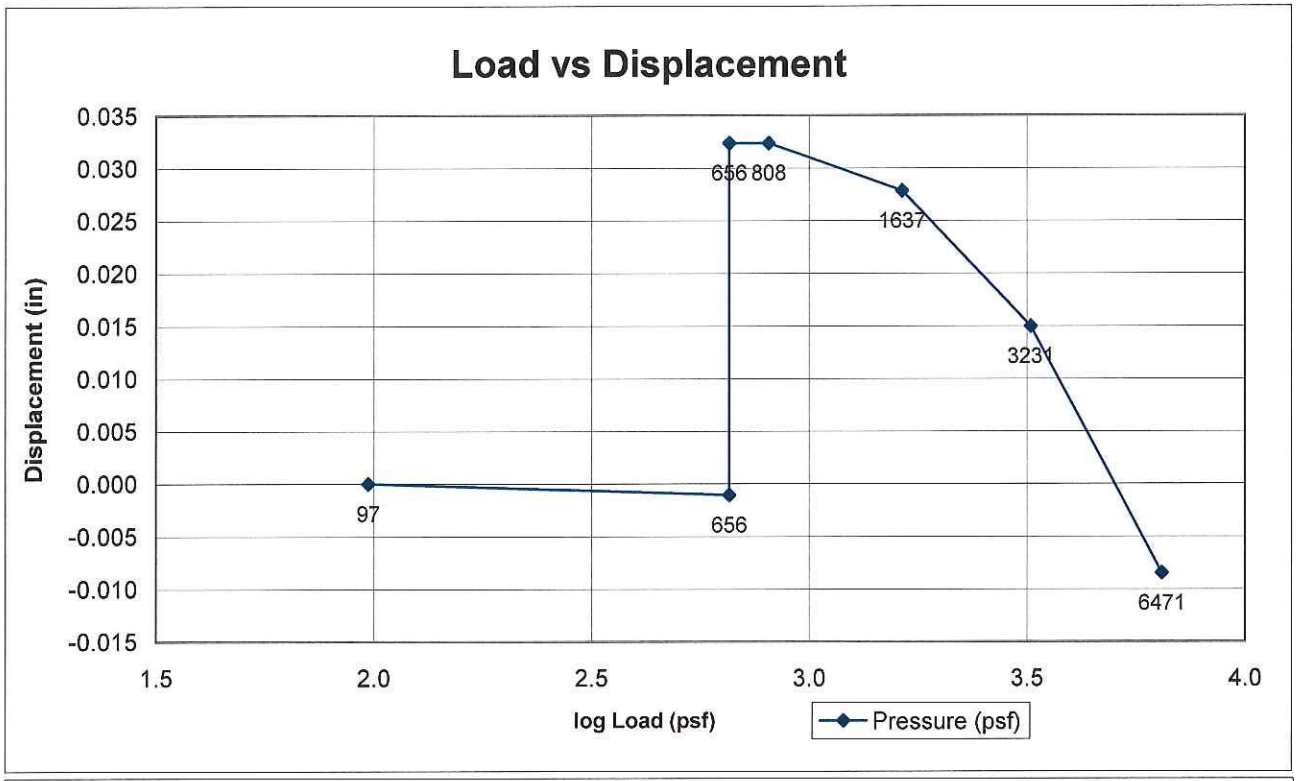
656 psf Inundation Load

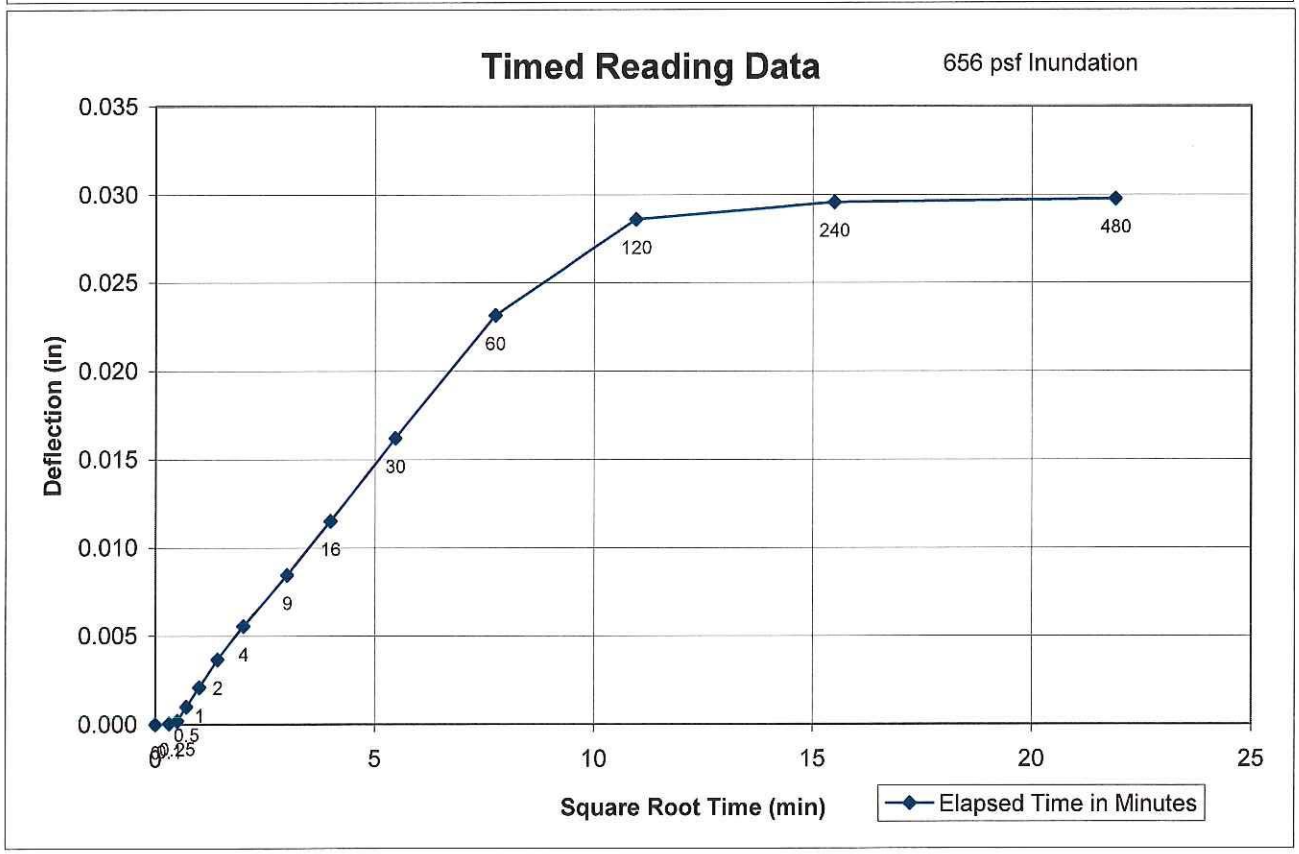
Elapsed Time (min)	SQRT Time (min)	Dial Reading (in)	Defl. (in)
0	0.00	0.0045	0.0000
0.1	0.32	0.0044	0.0000
0.25	0.50	0.0043	0.0002
0.5	0.71	0.0035	0.0010
1	1.00	0.0024	0.0021
2	1.41	0.0008	0.0037
4	2.00	-0.0011	0.0056
9	3.00	-0.0040	0.0085
16	4.00	-0.0071	0.0115
30	5.48	-0.0118	0.0162
60	7.75	-0.0187	0.0232
120	10.95	-0.0242	0.0286
240	15.49	-0.0251	0.0296
480	21.91	-0.0253	0.0298

SWELL/COLLAPSE TEST

ASTM D4546 Method B (modified)

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	BORING NO.	B-106
PROJECT NO.	16104	DEPTH	5-6'(5.5-6')
LOCATION	--	SAMPLE NO.	DM-3





SWELL TEST

ASTM D 4546

Method A

SWELL/COLLAPSE TEST

ASTM D4546 Method ~~C (modified)~~ Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	SAMPLED	06/27/2016 --
PROJECT NO.	16104	TEST STARTED	08/08/2016 DPM
LOCATION	--	TEST FINISHED	08/09/2016 DPM
BORING NO.	B-101(P)	CONSOLIDOMETER	ATT-16
DEPTH	24.8-25.5' & 28.6-29.1'	SAMPLE DESCR.	Claystone
SAMPLE NO.	NQ-2 1000psf		
SAMPLE DIA.(in)	1.782	INITIAL HT.(in)	0.941
SPECIFIC GRAVITY	2.65	FINAL HT.(in)	0.946

MOISTURE/DENSITY DATA

	BEFORE TEST	AFTER TEST		BEFORE TEST	AFTER TEST
Wt. Soil & Ring(s) (g)	76.48	77.77	Wt. Wet Soil & Pan (g)	79.55	80.84
Wt. Ring(s) (g)	0.00	0.00	Wt. Dry Soil & Pan (g)	64.72	64.72
Wt. Soil (g)	76.48	77.77	Wt. Lost Moisture (g)	14.83	16.12
Wet Density (pcf)	124.1	125.6	Wt. of Pan Only (g)	3.07	3.07
Moisture Content (%)	24.06	26.16	Wt. of Dry Soil (g)	61.64	61.64
Dry Density (pcf)	100.1	99.6	Saturation (%)	98.04	105.21

	LOAD (psf)	CONSOL. (IN)	LOG p	CONSOL. (IN/IN)	DEFL. (IN/IN)	STRAIN (%)
	183	0.0000	2.262	0.0000	0.0000	0.0
	1006	0.0036	3.003	0.0038	-0.0038	-0.4
Inundate	1006	-0.0048	3.003	-0.0051	0.0051	0.5

This sample came from the 24.8-25.5' section of the sample.
It appeared to be softer than the 28.6-29.1' portion of the sample.

Data entry by: KR Date: 8/10/2016
Data checked by: Date: 8/11/16
File Name: 2679_96_Swell-Consol_ASTMD4546_R0_13.xls

SWELL/COLLAPSE TEST

ASTM D4546 Method ~~C (modified)~~ Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	SAMPLED	06/27/2016 --
PROJECT NO.	16104	TEST STARTED	08/08/2016 DPM
LOCATION	--	TEST FINISHED	08/09/2016 DPM
BORING NO.	B-101(P)	CONSOLIDOMETER	ATT-16
DEPTH	24.8-25.5' & 28.6-29.1'	SAMPLE DESCR.	Claystone
SAMPLE NO.	NQ-2 1000psf		

Timed Reading Data

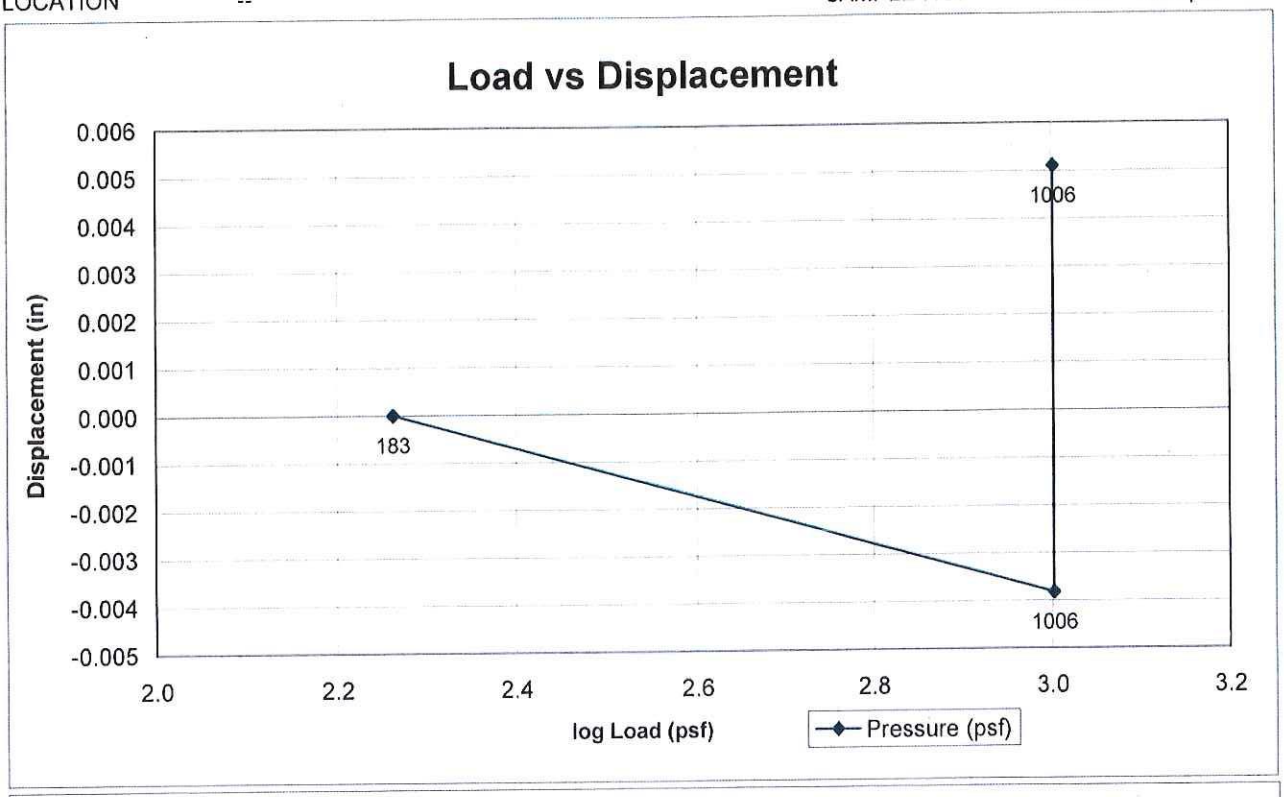
1006 psf Inundation Load

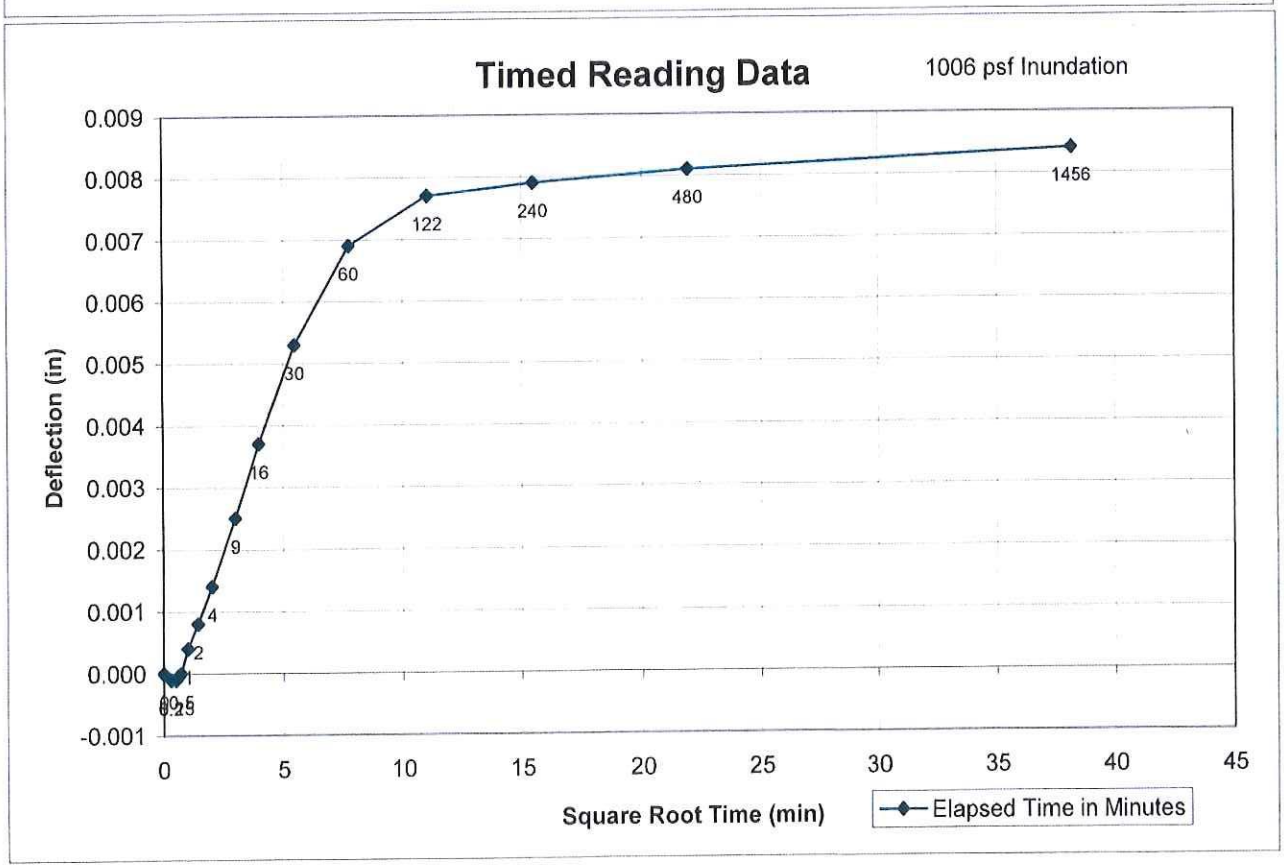
Elapsed Time (min)	SQRT Time (min)	Dial Reading (in)	Defl. (in)
0	0.00	0.0046	0.0000
0.1	0.32	0.0047	-0.0001
0.25	0.50	0.0047	-0.0001
0.5	0.71	0.0046	0.0000
1	1.00	0.0042	0.0004
2	1.41	0.0038	0.0008
4	2.00	0.0032	0.0014
9	3.00	0.0021	0.0025
16	4.00	0.0009	0.0037
30	5.48	-0.0007	0.0053
60	7.75	-0.0023	0.0069
122	11.05	-0.0031	0.0077
240	15.49	-0.0033	0.0079
480	21.91	-0.0035	0.0081
1456	38.16	-0.0038	0.0084

SWELL/COLLAPSE TEST

ASTM D4546 Method ~~C (modified)~~ Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	BORING NO.	B-101(P)
PROJECT NO.	16104	DEPTH	24.8-25.5' & 28.6-29.1
LOCATION	--	SAMPLE NO.	NQ-2 1000psf





SWELL/COLLAPSE TEST

ASTM D4546 Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	SAMPLED	06/27/2016 --
PROJECT NO.	16104	TEST STARTED	07/20/2016 BDF
LOCATION	--	TEST FINISHED	07/21/2016 DPM
BORING NO.	B-101 (P)	CONSOLIDOMETER	ATT-05
DEPTH	24.8-25.5' + 28.6-29.1'	SAMPLE DESCR.	Claystone
SAMPLE NO.	NQ-2 3000psf		
SAMPLE DIA.(in)	1.779	INITIAL HT.(in)	0.934
SPECIFIC GRAVITY	2.65	FINAL HT.(in)	0.930

MOISTURE/DENSITY DATA

	BEFORE TEST	AFTER TEST		BEFORE TEST	AFTER TEST
Wt. Soil & Ring(s) (g)	82.29	82.64	Wt. Wet Soil & Pan (g)	85.44	85.79
Wt. Ring(s) (g)	0.00	0.00	Wt. Dry Soil & Pan (g)	73.78	73.78
Wt. Soil (g)	82.29	82.64	Wt. Lost Moisture (g)	11.67	12.02
Wet Density (pcf)	135.1	136.2	Wt. of Pan Only (g)	3.15	3.15
Moisture Content (%)	16.52	17.01	Wt. of Dry Soil (g)	70.63	70.63
Dry Density (pcf)	115.9	116.4	Saturation (%)	103.07	107.53

	LOAD (psf)	CONSOL. (IN)	LOG p	CONSOL. (IN/IN)	DEFL. (IN/IN)	STRAIN (%)
	178	0.00000	2.250	0.00000	0.00000	0.0
	3017	0.00695	3.480	0.00744	-0.00744	-0.7
Inundate	3017	0.00355	3.480	0.00380	-0.00380	-0.4

Data entry by: NN Date: 7/26/2016

Data checked by: DPM Date: 7/28/16

File Name: 2679_96_Swell-Consol_ASTMD4546_R0_11.xls

SWELL/COLLAPSE TEST

ASTM D4546 Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	SAMPLED	06/27/2016 --
PROJECT NO.	16104	TEST STARTED	07/20/2016 BDF
LOCATION	--	TEST FINISHED	07/21/2016 DPM
BORING NO.	B-101 (P)	CONSOLIDOMETER	ATT-05
DEPTH	24.8-25.5' + 28.6-29.1'	SAMPLE DESCR.	Claystone
SAMPLE NO.	NQ-2 3000psf		

Timed Reading Data

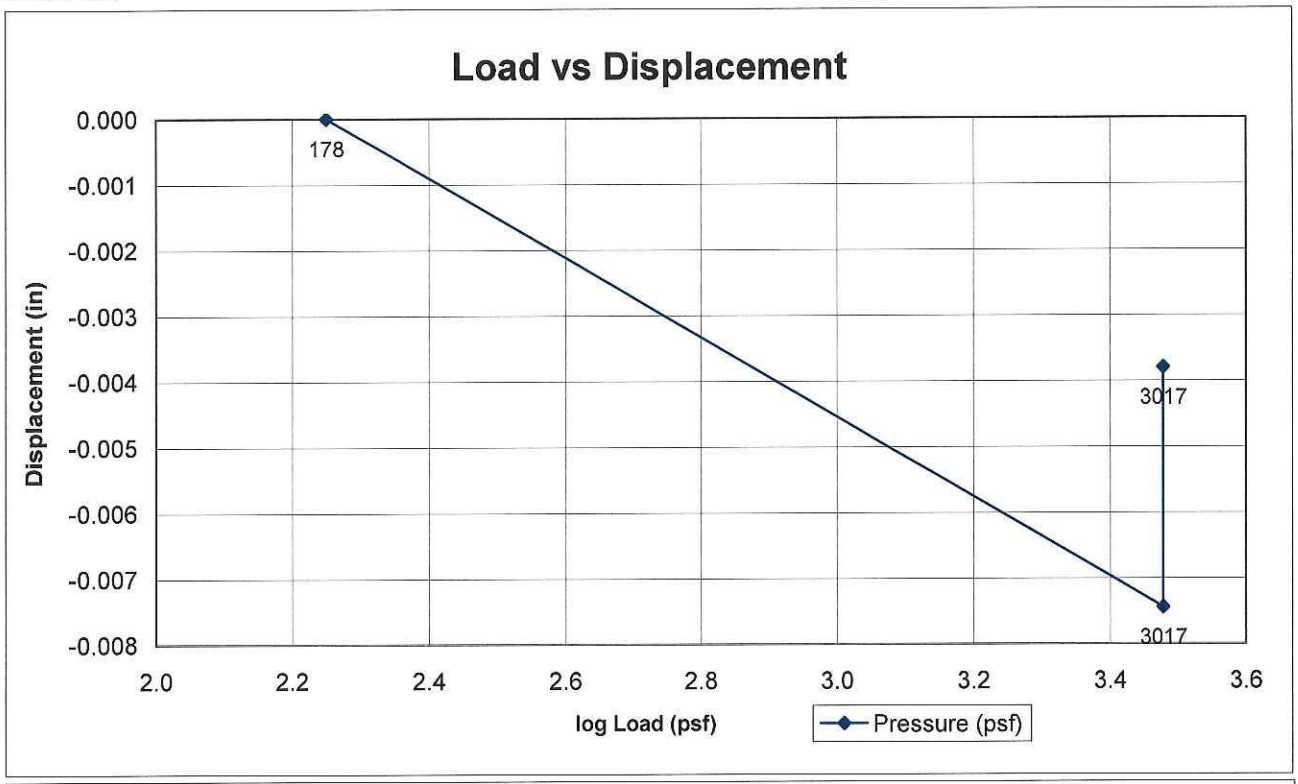
3017 psf Inundation Load

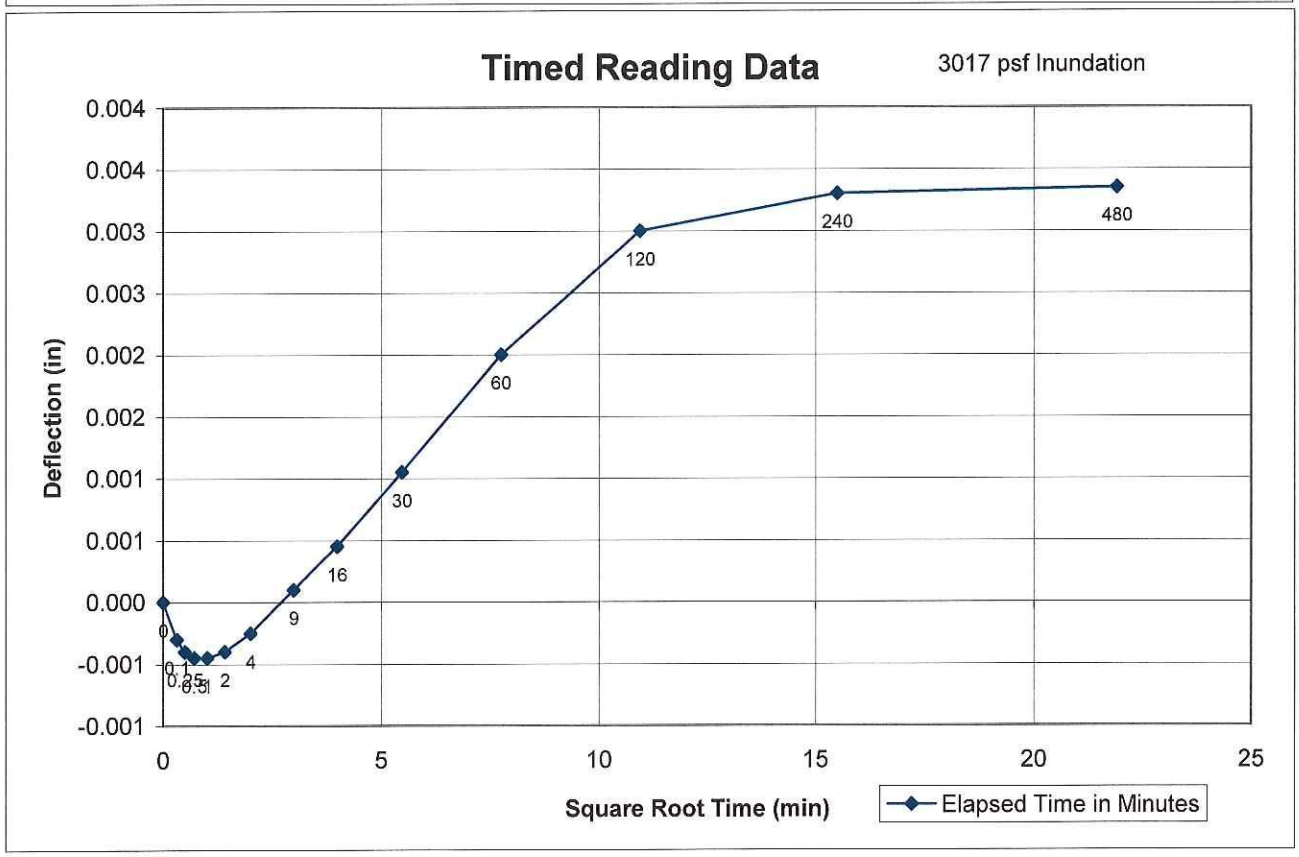
Elapsed Time (min)	SQRT Time (min)	Dial Reading (in)	Defl. (in)
0	0.00	0.01705	0.00000
0.1	0.32	0.01735	-0.00030
0.25	0.50	0.01745	-0.00040
0.5	0.71	0.01750	-0.00045
1	1.00	0.01750	-0.00045
2	1.41	0.01745	-0.00040
4	2.00	0.01730	-0.00025
9	3.00	0.01695	0.00010
16	4.00	0.01660	0.00045
30	5.48	0.01600	0.00105
60	7.75	0.01505	0.00200
120	10.95	0.01405	0.00300
240	15.49	0.01375	0.00330
480	21.91	0.01370	0.00335

SWELL/COLLAPSE TEST

ASTM D4546 Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	BORING NO.	B-101 (P)
PROJECT NO.	16104	DEPTH	24.8-25.5' + 28.6-29.1'
LOCATION	--	SAMPLE NO.	NQ-2 3000psf





SWELL/COLLAPSE TEST

ASTM D4546 Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	SAMPLED	06/27/2016 --
PROJECT NO.	16104	TEST STARTED	07/22/2016 DPM
LOCATION	--	TEST FINISHED	07/25/2016 DPM
BORING NO.	B-101 (P)	CONSOLIDOMETER	ATT-04
DEPTH	24.8-25.5' + 28.6-29.1'	SAMPLE DESCR.	Claystone
SAMPLE NO.	NQ-2 7000psf		
SAMPLE DIA.(in)	1.763	INITIAL HT.(in)	0.946
SPECIFIC GRAVITY	2.65	FINAL HT.(in)	0.948

MOISTURE/DENSITY DATA

	BEFORE TEST	AFTER TEST		BEFORE TEST	AFTER TEST
Wt. Soil & Ring(s) (g)	82.91	83.66	Wt. Wet Soil & Pan (g)	86.08	86.84
Wt. Ring(s) (g)	0.00	0.00	Wt. Dry Soil & Pan (g)	75.71	75.71
Wt. Soil (g)	82.91	83.66	Wt. Lost Moisture (g)	10.37	11.13
Wet Density (pcf)	136.8	137.8	Wt. of Pan Only (g)	3.18	3.18
Moisture Content (%)	14.30	15.34	Wt. of Dry Soil (g)	72.53	72.53
Dry Density (pcf)	119.7	119.5	Saturation (%)	99.68	106.31

	LOAD (psf)	CONSOL. (IN)	LOG p	CONSOL. (IN/IN)	DEFL. (IN/IN)	STRAIN (%)
	188	0.00000	2.275	0.00000	0.00000	0.0
	7004	0.00565	3.845	0.00597	-0.00597	-0.6
Inundate	7004	-0.00160	3.845	-0.00169	0.00169	0.2

Data entry by: NN Date: 7/26/2016

Data checked by: DPM Date: 7/27/16

File Name: 2679_96_Swell-Consol_ASTMD4546_R0_9.xls

SWELL/COLLAPSE TEST

ASTM D4546 Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	SAMPLED	06/27/2016 --
PROJECT NO.	16104	TEST STARTED	07/22/2016 DPM
LOCATION	--	TEST FINISHED	07/25/2016 DPM
BORING NO.	B-101 (P)	CONSOLIDOMETER	ATT-04
DEPTH	24.8-25.5' + 28.6-29.1'	SAMPLE DESCR.	Claystone
SAMPLE NO.	NQ-2 7000psf		

Timed Reading Data

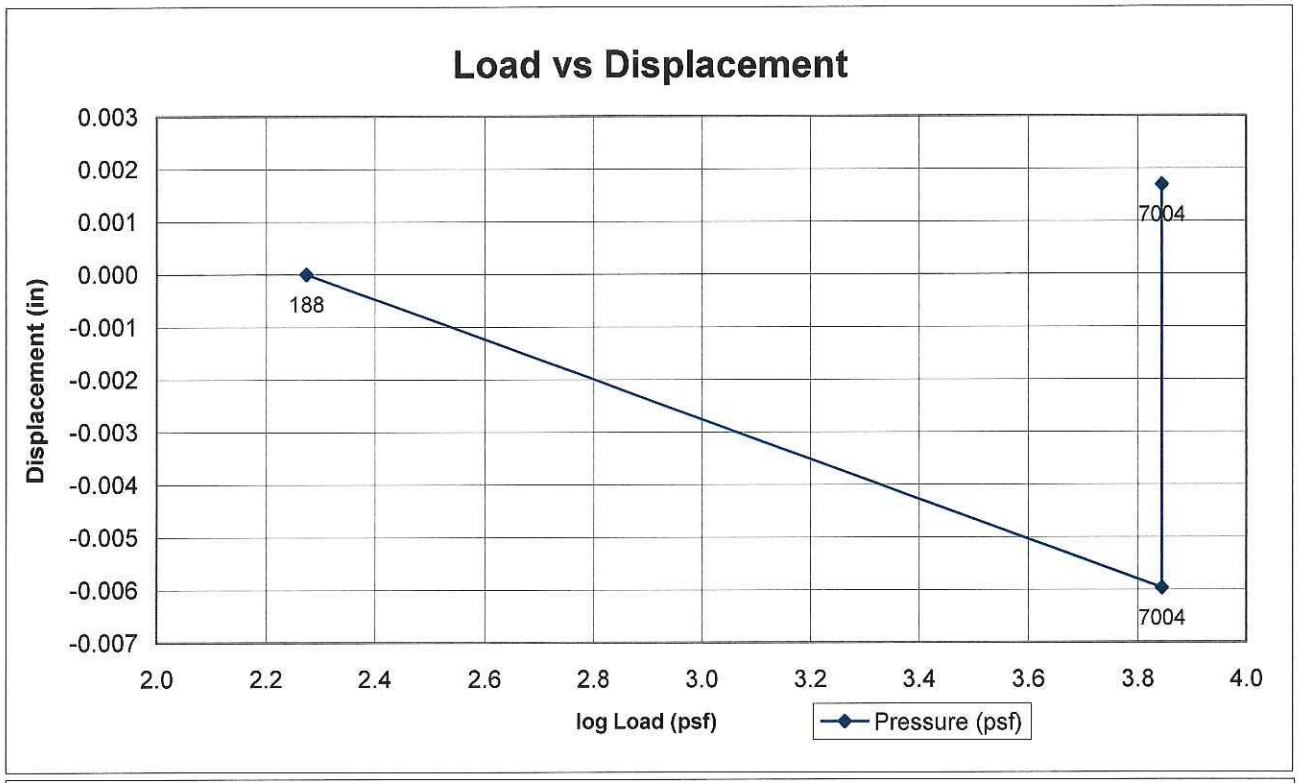
7004 psf Inundation Load

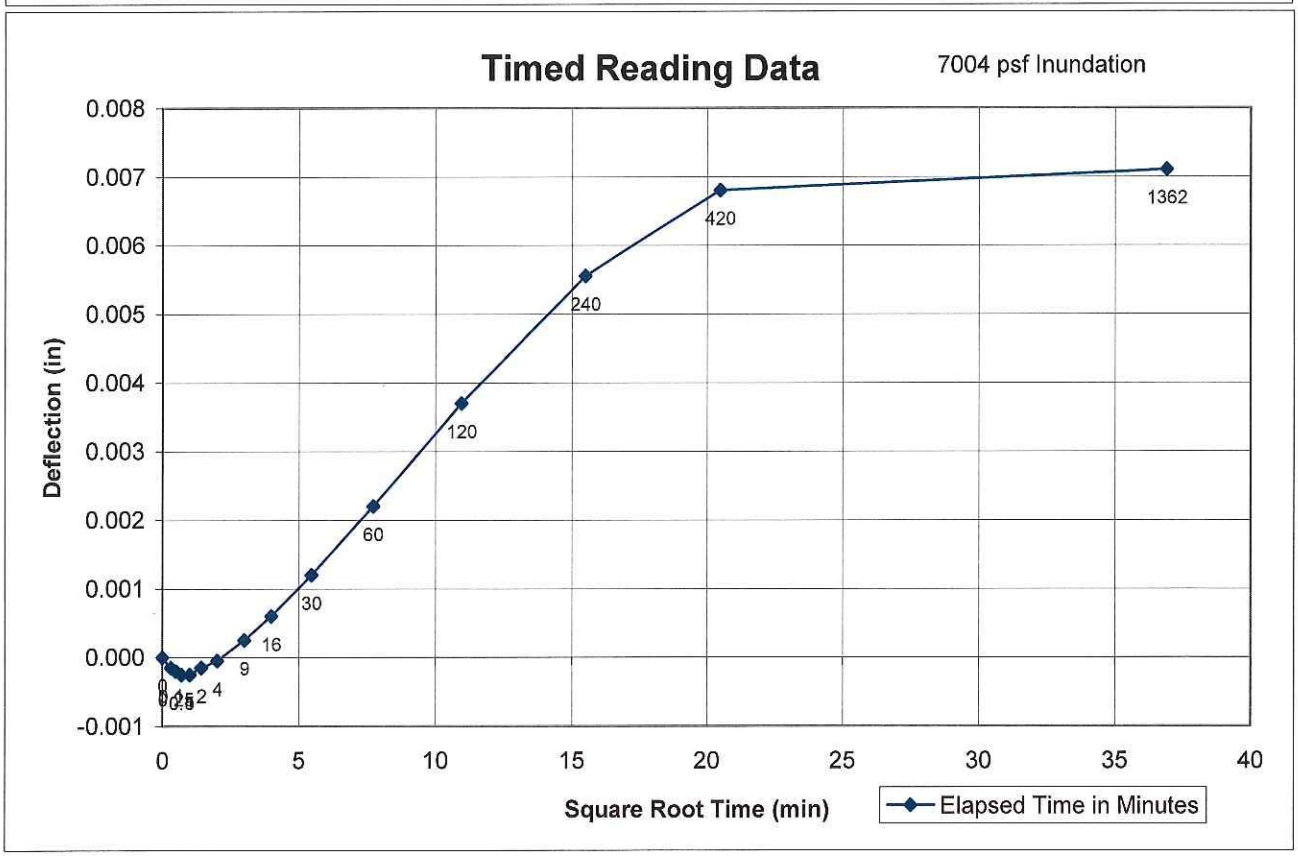
Elapsed Time (min)	SQRT Time (min)	Dial Reading (in)	Defl. (in)
0	0.00	0.01385	0.00000
0.1	0.32	0.01400	-0.00015
0.25	0.50	0.01405	-0.00020
0.5	0.71	0.01410	-0.00025
1	1.00	0.01410	-0.00025
2	1.41	0.01400	-0.00015
4	2.00	0.01390	-0.00005
9	3.00	0.01360	0.00025
16	4.00	0.01325	0.00060
30	5.48	0.01265	0.00120
60	7.75	0.01165	0.00220
120	10.95	0.01015	0.00370
240	15.49	0.00830	0.00555
420	20.49	0.00705	0.00680
1362	36.91	0.00675	0.00710

SWELL/COLLAPSE TEST

ASTM D4546 Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	BORING NO.	B-101 (P)
PROJECT NO.	16104	DEPTH	24.8-25.5' + 28.6-29.1'
LOCATION	--	SAMPLE NO.	NQ-2 7000psf





SWELL/COLLAPSE TEST

ASTM D4546 Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	SAMPLED	06/27/2016 --
PROJECT NO.	16104	TEST STARTED	08/08/2016 DPM
LOCATION	--	TEST FINISHED	08/10/2016 DPM
BORING NO.	B-101 (P)	CONSOLIDOMETER	Att-05
DEPTH	24.8-25.5' & 28.6-29.1'	SAMPLE DESCR.	Claystone
SAMPLE NO.	NQ-2 12000psf		
SAMPLE DIA.(in)	1.758	INITIAL HT.(in)	0.770
SPECIFIC GRAVITY	2.65	FINAL HT.(in)	0.774

MOISTURE/DENSITY DATA

	BEFORE TEST	AFTER TEST		BEFORE TEST	AFTER TEST
Wt. Soil & Ring(s) (g)	67.18	69.23	Wt. Wet Soil & Pan (g)	70.29	72.35
Wt. Ring(s) (g)	0.00	0.00	Wt. Dry Soil & Pan (g)	63.68	63.68
Wt. Soil (g)	67.18	69.23	Wt. Lost Moisture (g)	6.61	8.67
Wet Density (pcf)	136.9	140.4	Wt. of Pan Only (g)	3.11	3.11
Moisture Content (%)	10.92	14.32	Wt. of Dry Soil (g)	60.56	60.56
Dry Density (pcf)	123.4	122.8	Saturation (%)	85.65	110.12

	LOAD (psf)	CONSOL. (IN)	LOG p	CONSOL. (IN/IN)	DEFL. (IN/IN)	STRAIN (%)
	183	0.00000	2.262	0.00000	0.00000	0.0
	12022	0.00545	4.080	0.00708	-0.00708	-0.7
Inundate	12022	-0.00385	4.080	-0.00500	0.00500	0.5

Data entry by: DPM Date: 8/11/2016

Data checked by: CAE Date: 8/12/16

File Name: 2679_96_Swell-Consol_ASTMD4546_R0_16.xls

SWELL/COLLAPSE TEST

ASTM D4546 Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	SAMPLED	06/27/2016 --
PROJECT NO.	16104	TEST STARTED	08/08/2016 DPM
LOCATION	--	TEST FINISHED	08/10/2016 DPM
BORING NO.	B-101 (P)	CONSOLIDOMETER	Att-05
DEPTH	24.8-25.5' & 28.6-29.1'	SAMPLE DESCR.	Claystone
SAMPLE NO.	NQ-2 12000psf		

Timed Reading Data

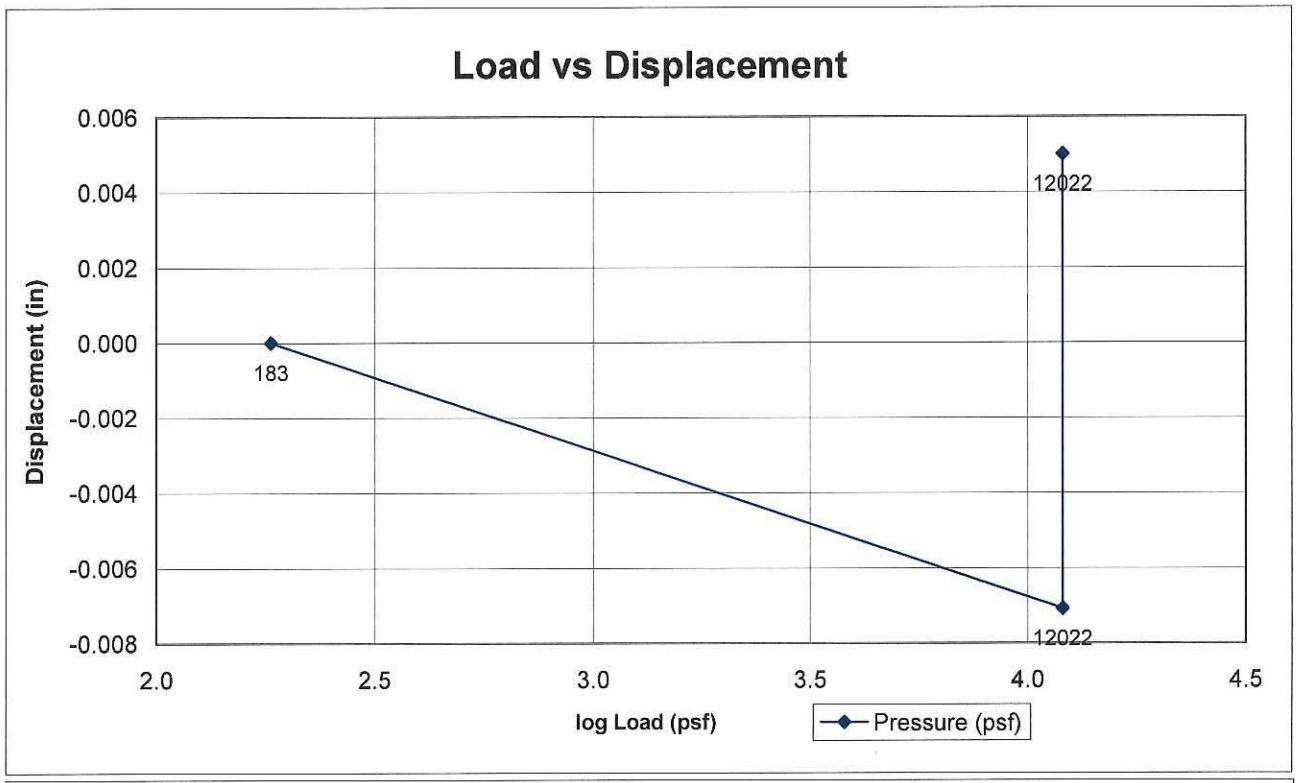
12022 psf Inundation Load

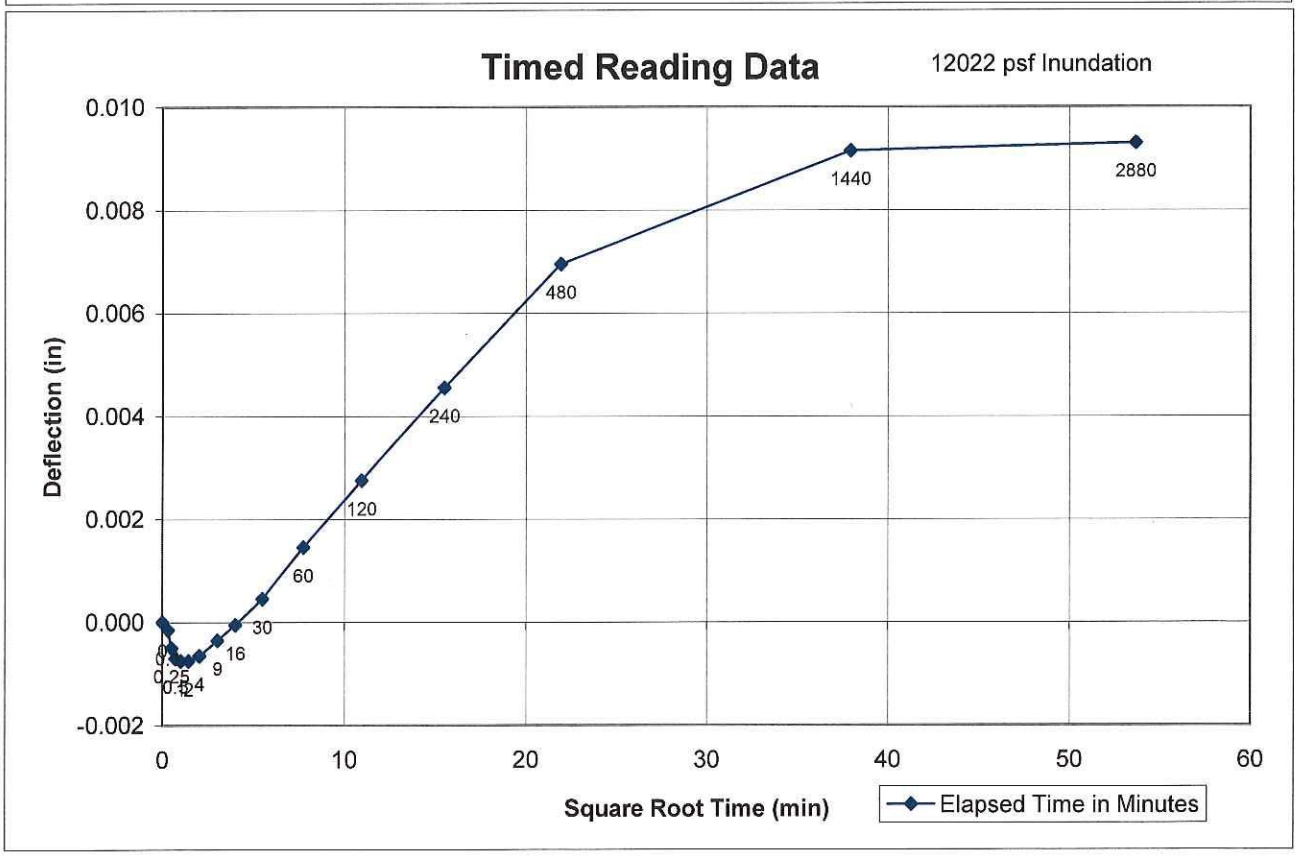
Elapsed Time (min)	SQRT Time (min)	Dial Reading (in)	Defl. (in)
0	0.00	0.01445	0.00000
0.1	0.32	0.01460	-0.00015
0.25	0.50	0.01495	-0.00050
0.5	0.71	0.01515	-0.00070
1	1.00	0.01520	-0.00075
2	1.41	0.01520	-0.00075
4	2.00	0.01510	-0.00065
9	3.00	0.01480	-0.00035
16	4.00	0.01450	-0.00005
30	5.48	0.01400	0.00045
60	7.75	0.01300	0.00145
120	10.95	0.01170	0.00275
240	15.49	0.00990	0.00455
480	21.91	0.00750	0.00695
1440	37.95	0.00530	0.00915
2880	53.67	0.00515	0.00930

SWELL/COLLAPSE TEST

ASTM D4546 Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	BORING NO.	B-101 (P)
PROJECT NO.	16104	DEPTH	24.8-25.5' & 28.6-29.1
LOCATION	--	SAMPLE NO.	NQ-2 12000psf





SWELL/COLLAPSE TEST

ASTM D4546 Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	SAMPLED	06/27/2016 --
PROJECT NO.	16104	TEST STARTED	07/19/2016 DPM
LOCATION	--	TEST FINISHED	07/20/2016 BDF
BORING NO.	B-106	CONSOLIDOMETER	ATT-04
DEPTH	40-40.7' + 42.5-43'	SAMPLE DESCR.	Sandy Claystone
SAMPLE NO.	NQ-4 5000 psf		
SAMPLE DIA.(in)	1.791	INITIAL HT.(in)	0.9255
SPECIFIC GRAVITY	2.65	FINAL HT.(in)	0.922

MOISTURE/DENSITY DATA

	BEFORE TEST	AFTER TEST		BEFORE TEST	AFTER TEST
Wt. Soil & Ring(s) (g)	79.90	80.38	Wt. Wet Soil & Pan (g)	83.12	83.60
Wt. Ring(s) (g)	0.00	0.00	Wt. Dry Soil & Pan (g)	69.57	69.57
Wt. Soil (g)	79.90	80.38	Wt. Lost Moisture (g)	13.55	14.02
Wet Density (pcf)	130.5	131.8	Wt. of Pan Only (g)	3.22	3.22
Moisture Content (%)	20.41	21.13	Wt. of Dry Soil (g)	66.35	66.35
Dry Density (pcf)	108.4	108.8	Saturation (%)	103.38	108.25

	LOAD (psf)	CONSOL. (IN)	LOG p	CONSOL. (IN/IN)	DEFL. (IN/IN)	STRAIN (%)
	182	0.00000	2.261	0.00000	0.00000	0.0
	4981	0.00650	3.697	0.00702	-0.00702	-0.7
Inundate	4981	0.00360	3.697	0.00389	-0.00389	-0.4

Data entry by: NN Date: 7/21/2016

Data checked by: DPM Date: 7/28/16

File Name: 2679_96_Swell-Consol_ASTMD4546_R0_7.xls

SWELL/COLLAPSE TEST

ASTM D4546 Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	SAMPLED	06/27/2016 --
PROJECT NO.	16104	TEST STARTED	07/19/2016 DPM
LOCATION	--	TEST FINISHED	07/20/2016 BDF
BORING NO.	B-106	CONSOLIDOMETER	ATT-04
DEPTH	40-40.7' + 42.5-43'	SAMPLE DESCR.	Sandy Claystone
SAMPLE NO.	NQ-4 5000 psf		

Timed Reading Data

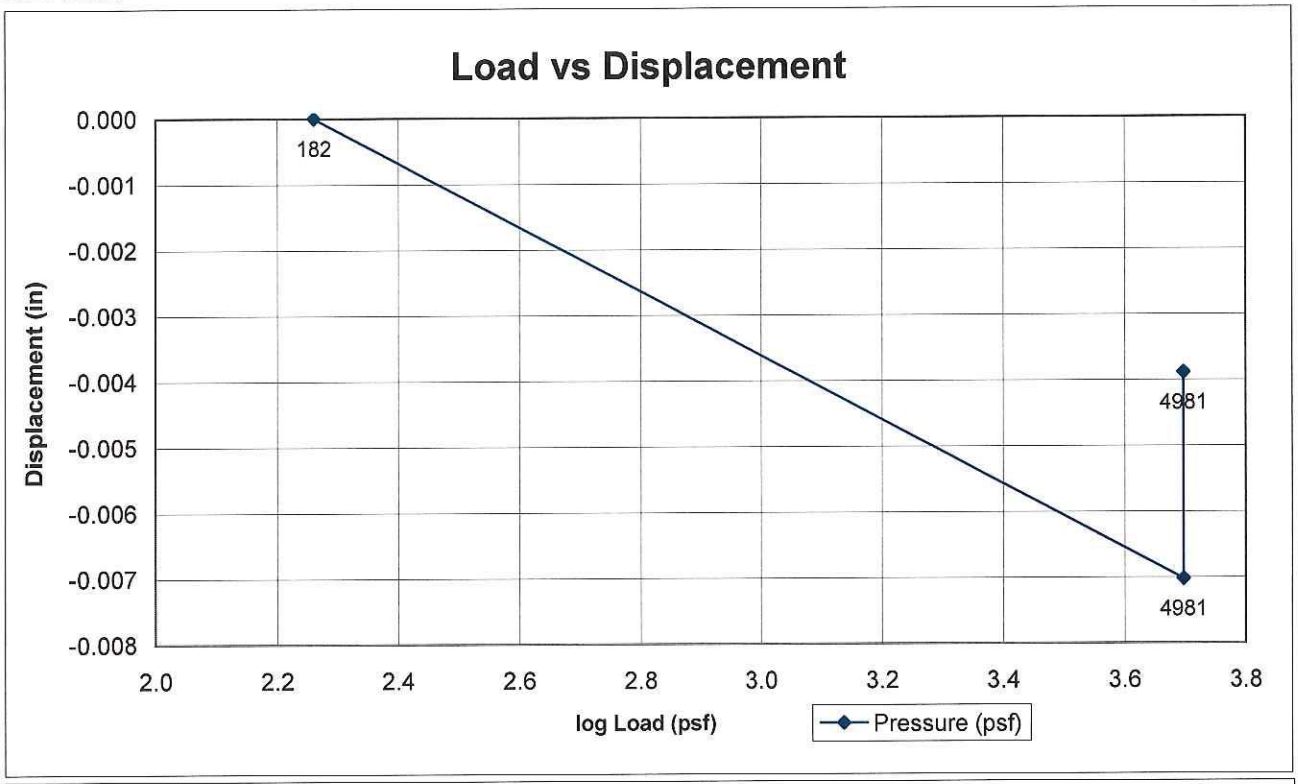
4981 psf Inundation Load

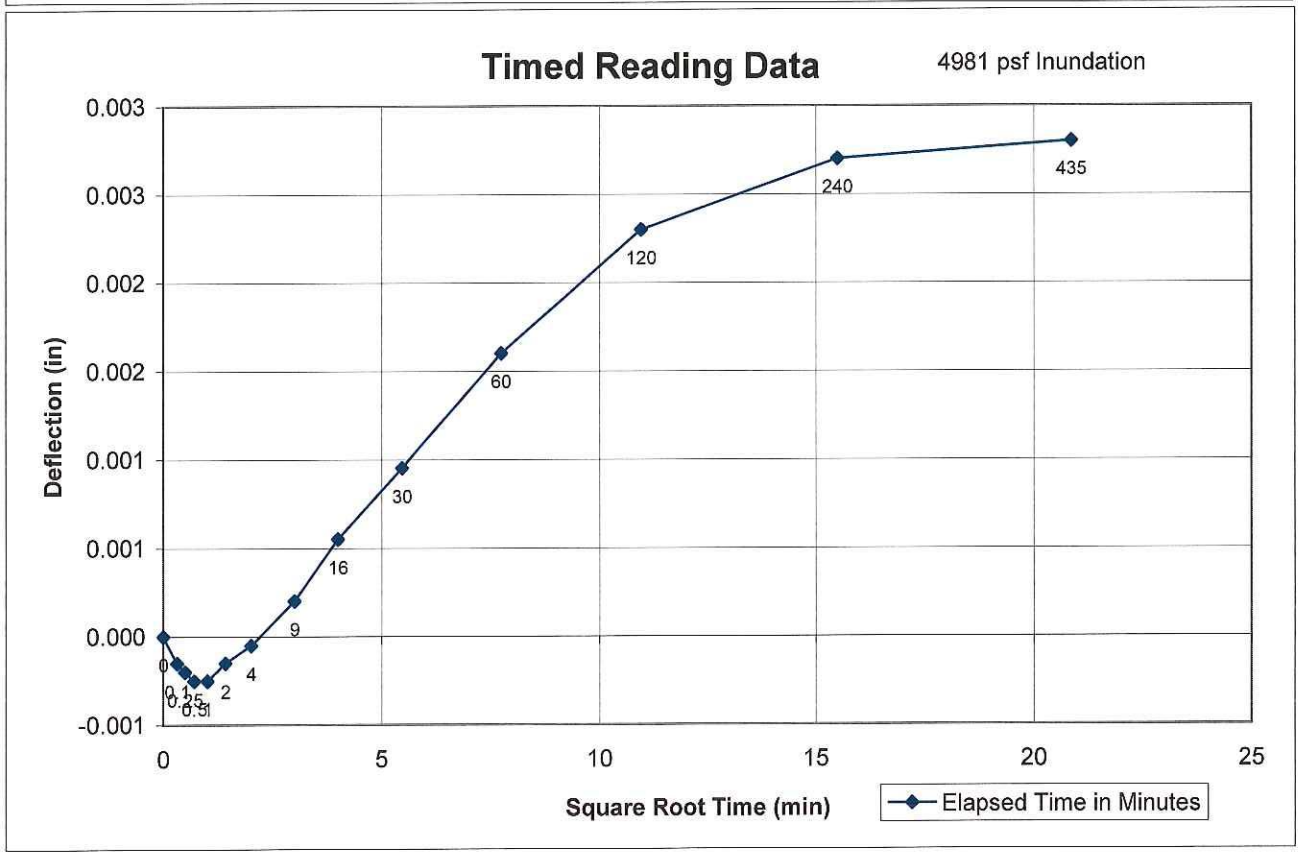
Elapsed Time (min)	SQRT Time (min)	Dial Reading (in)	Defl. (in)
0	0.00	0.01400	0.00000
0.1	0.32	0.01415	-0.00015
0.25	0.50	0.01420	-0.00020
0.5	0.71	0.01425	-0.00025
1	1.00	0.01425	-0.00025
2	1.41	0.01415	-0.00015
4	2.00	0.01405	-0.00005
9	3.00	0.01380	0.00020
16	4.00	0.01345	0.00055
30	5.48	0.01305	0.00095
60	7.75	0.01240	0.00160
120	10.95	0.01170	0.00230
240	15.49	0.01130	0.00270
435	20.86	0.01120	0.00280

SWELL/COLLAPSE TEST

ASTM D4546 Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	BORING NO.	B-106
PROJECT NO.	16104	DEPTH	40-40.7' + 42.5-43'
LOCATION	--	SAMPLE NO.	NQ-4 5000 psf





SWELL/COLLAPSE TEST

ASTM D4546 Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	SAMPLED	06/27/2016 --
PROJECT NO.	16104	TEST STARTED	07/19/2016 DPM
LOCATION	--	TEST FINISHED	07/20/2016 BDF
BORING NO.	B-106	CONSOLIDOMETER	ATT-2
DEPTH	40-40.7' + 42.5-43'	SAMPLE DESCR.	Sandy Claystone
SAMPLE NO.	NQ-4 9000 psf		
SAMPLE DIA.(in)	1.807	INITIAL HT.(in)	0.925
SPECIFIC GRAVITY	2.65	FINAL HT.(in)	0.907

MOISTURE/DENSITY DATA

	BEFORE TEST	AFTER TEST		BEFORE TEST	AFTER TEST
Wt. Soil & Ring(s) (g)	79.66	80.03	Wt. Wet Soil & Pan (g)	82.75	83.11
Wt. Ring(s) (g)	0.00	0.00	Wt. Dry Soil & Pan (g)	68.98	68.98
Wt. Soil (g)	79.66	80.03	Wt. Lost Moisture (g)	13.77	14.13
Wet Density (pcf)	127.9	131.1	Wt. of Pan Only (g)	3.08	3.08
Moisture Content (%)	20.89	21.44	Wt. of Dry Soil (g)	65.90	65.90
Dry Density (pcf)	105.8	108.0	Saturation (%)	98.77	107.36

	LOAD (psf)	CONSOL. (IN)	LOG p	CONSOL. (IN/IN)	DEFL. (IN/IN)	STRAIN (%)
	188	0.00000	2.274	0.00000	0.00000	0.0
	9000	0.01800	3.954	0.01946	-0.01946	-1.9
Inundate	9000	0.01850	3.954	0.02000	-0.02000	-2.0

Data entry by: NN Date: 7/21/2016

Data checked by: DPM Date: 7/28/16

File Name: 2679_96_Swell-Consol_ASTMD4546_R0_8.xls

SWELL/COLLAPSE TEST

ASTM D4546 Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	SAMPLED	06/27/2016 --
PROJECT NO.	16104	TEST STARTED	07/19/2016 DPM
LOCATION	--	TEST FINISHED	07/20/2016 BDF
BORING NO.	B-106	CONSOLIDOMETER	ATT-2
DEPTH	40-40.7' + 42.5-43'	SAMPLE DESCR.	Sandy Claystone
SAMPLE NO.	NQ-4 9000 psf		

Timed Reading Data

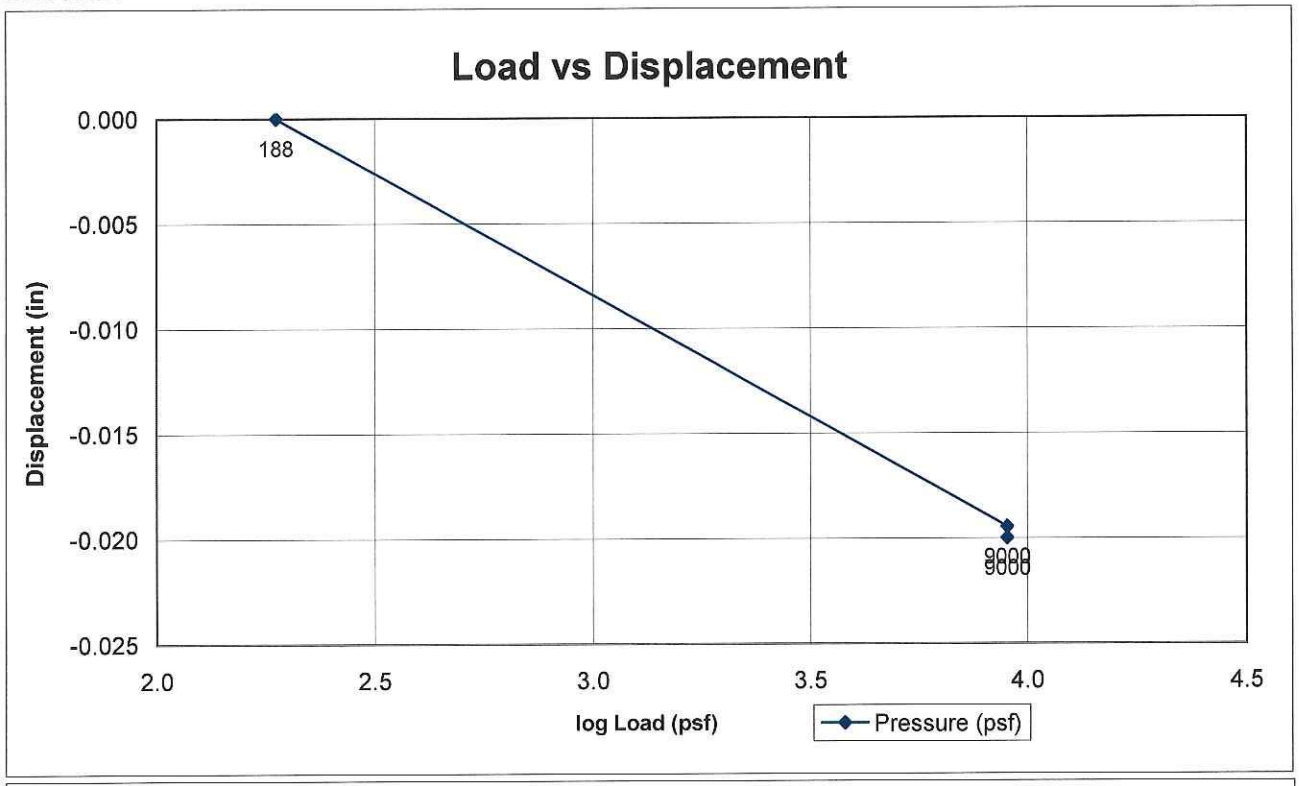
9000 psf Inundation Load

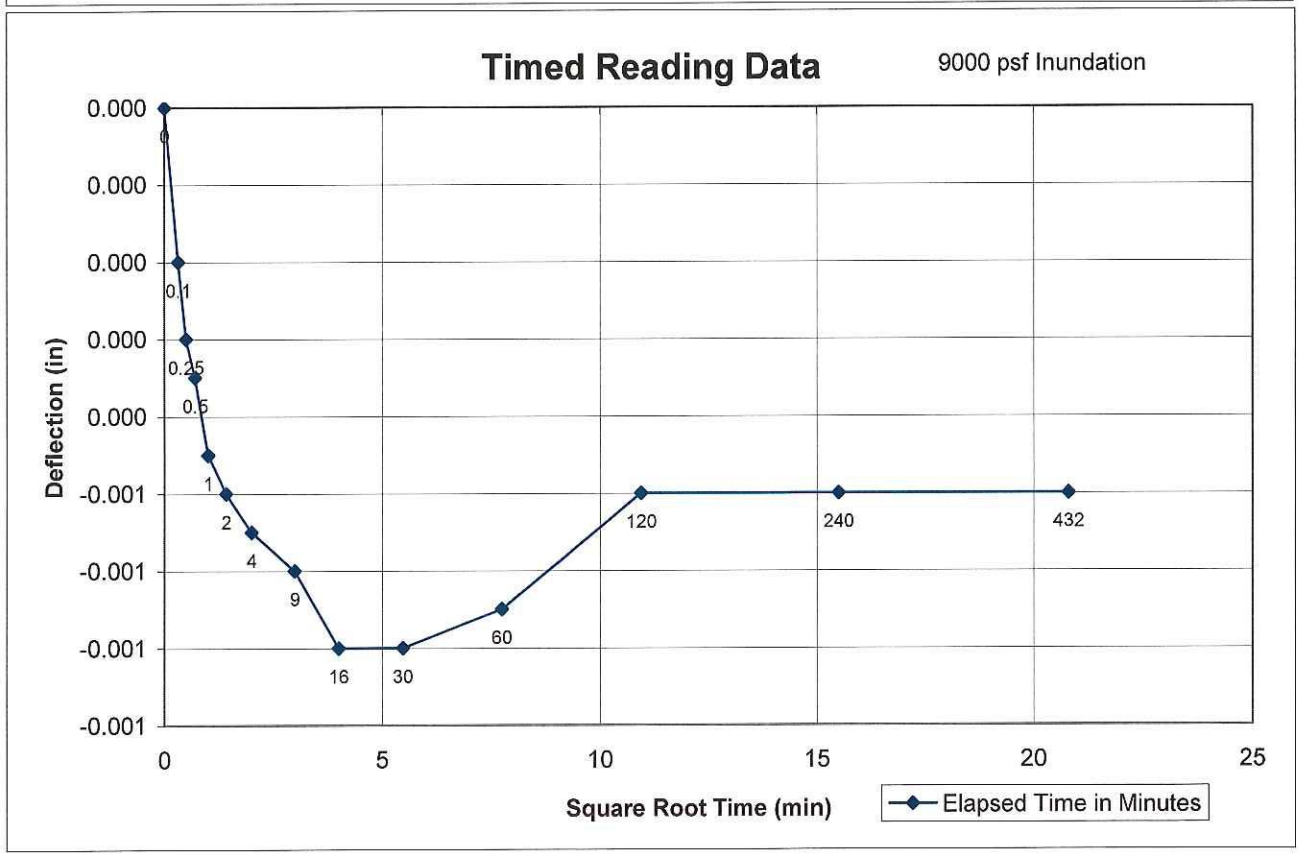
Elapsed Time (min)	SQRT Time (min)	Dial Reading (in)	Defl. (in)
0	0.00	0.02550	0.00000
0.1	0.32	0.02570	-0.00020
0.25	0.50	0.02580	-0.00030
0.5	0.71	0.02585	-0.00035
1	1.00	0.02595	-0.00045
2	1.41	0.02600	-0.00050
4	2.00	0.02605	-0.00055
9	3.00	0.02610	-0.00060
16	4.00	0.02620	-0.00070
30	5.48	0.02620	-0.00070
60	7.75	0.02615	-0.00065
120	10.95	0.02600	-0.00050
240	15.49	0.02600	-0.00050
432	20.78	0.02600	-0.00050

SWELL/COLLAPSE TEST

ASTM D4546 Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	BORING NO.	B-106
PROJECT NO.	16104	DEPTH	40-40.7' + 42.5-43'
LOCATION	--	SAMPLE NO.	NQ-4 9000 psf





SWELL/COLLAPSE TEST

ASTM D4546 Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	SAMPLED	-- --
PROJECT NO.	16104	TEST STARTED	07/17/2016 DPM
LOCATION	--	TEST FINISHED	07/18/2016 DPM
BORING NO.	B-106	CONSOLIDOMETER	ATT-04
DEPTH	48-48.5 + 49.4-50'	SAMPLE DESCR.	Claystone
SAMPLE NO.	NQ-7 6000 psf		
SAMPLE DIA.(in)	1.809	INITIAL HT.(in)	0.937
SPECIFIC GRAVITY	2.65	FINAL HT.(in)	0.920

MOISTURE/DENSITY DATA

	BEFORE TEST	AFTER TEST		BEFORE TEST	AFTER TEST
Wt. Soil & Ring(s) (g)	77.08	77.93	Wt. Wet Soil & Pan (g)	80.30	81.15
Wt. Ring(s) (g)	0.00	0.00	Wt. Dry Soil & Pan (g)	64.82	64.82
Wt. Soil (g)	77.08	77.93	Wt. Lost Moisture (g)	15.48	16.33
Wet Density (pcf)	122.0	125.6	Wt. of Pan Only (g)	3.22	3.22
Moisture Content (%)	25.12	26.51	Wt. of Dry Soil (g)	61.60	61.60
Dry Density (pcf)	97.5	99.3	Saturation (%)	95.96	105.99

	LOAD (psf)	CONSOL. (IN)	LOG p	CONSOL. (IN/IN)	DEFL. (IN/IN)	STRAIN (%)
	179	0.00000	2.253	0.00000	0.00000	0.0
	5998	0.01815	3.778	0.01937	-0.01937	-1.9
Inundate	5998	0.01710	3.778	0.01825	-0.01825	-1.8

Data entry by: NN Date: 7/20/2016

Data checked by: Date: 7/26/16

File Name: 2679_96_Swell-Consol_ASTMD4546_R0_3.xls

SWELL/COLLAPSE TEST

ASTM D4546 Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	SAMPLED	-- --
PROJECT NO.	16104	TEST STARTED	07/17/2016 DPM
LOCATION	--	TEST FINISHED	07/18/2016 DPM
BORING NO.	B-106	CONSOLIDOMETER	ATT-04
DEPTH	48-48.5 + 49.4-50'	SAMPLE DESCR.	Claystone
SAMPLE NO.	NQ-7 6000 psf		

Timed Reading Data

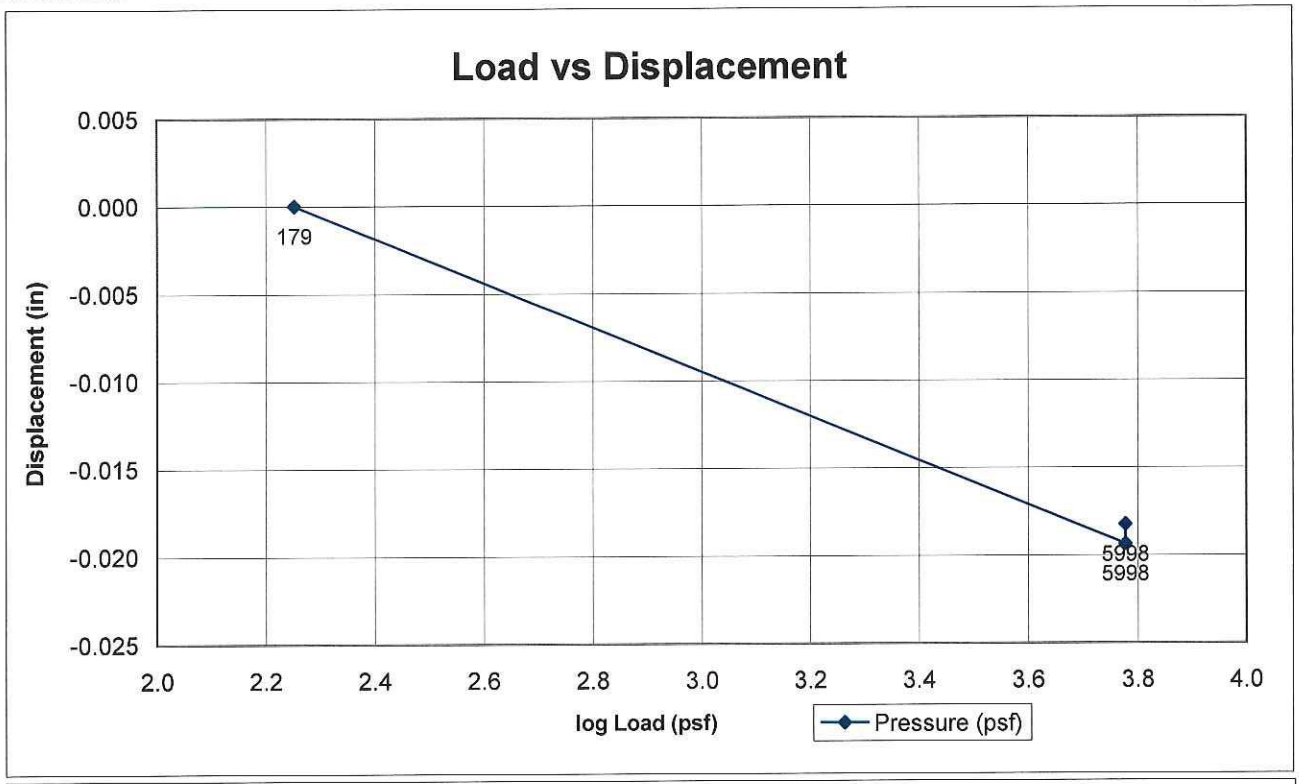
5998 psf Inundation Load

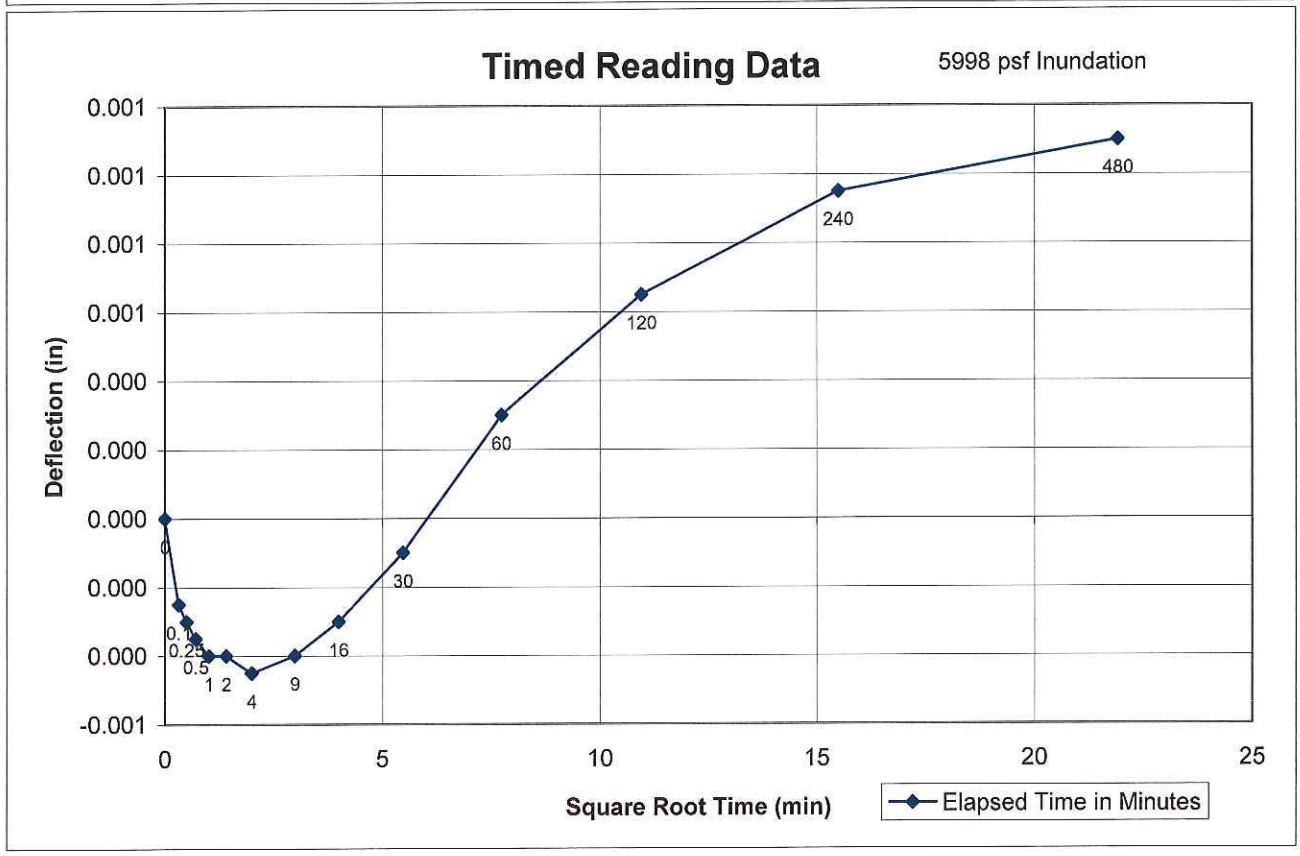
Elapsed Time (min)	SQRT Time (min)	Dial Reading (in)	Defl. (in)
0	0.00	0.02745	0.00000
0.1	0.32	0.02770	-0.00025
0.25	0.50	0.02775	-0.00030
0.5	0.71	0.02780	-0.00035
1	1.00	0.02785	-0.00040
2	1.41	0.02785	-0.00040
4	2.00	0.02790	-0.00045
9	3.00	0.02785	-0.00040
16	4.00	0.02775	-0.00030
30	5.48	0.02755	-0.00010
60	7.75	0.02715	0.00030
120	10.95	0.02680	0.00065
240	15.49	0.02650	0.00095
480	21.91	0.02635	0.00110

SWELL/COLLAPSE TEST

ASTM D4546 Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	BORING NO.	B-106
PROJECT NO.	16104	DEPTH	48-48.5 + 49.4-50'
LOCATION	--	SAMPLE NO.	NQ-7 6000 psf





SWELL/COLLAPSE TEST

ASTM D4546 Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	SAMPLED	-- --
PROJECT NO.	16104	TEST STARTED	07/17/2016 DPM
LOCATION	--	TEST FINISHED	07/18/2016 DPM
BORING NO.	B-106	CONSOLIDOMETER	ATT-02
DEPTH	48-48.5' + 49.4-50'	SAMPLE DESCR.	Claystone
SAMPLE NO.	NQ-7 10000 psf		
SAMPLE DIA.(in)	1.803	INITIAL HT.(in)	0.940
SPECIFIC GRAVITY	2.65	FINAL HT.(in)	0.924

MOISTURE/DENSITY DATA

	BEFORE TEST	AFTER TEST		BEFORE TEST	AFTER TEST
Wt. Soil & Ring(s) (g)	77.96	78.38	Wt. Wet Soil & Pan (g)	81.13	81.56
Wt. Ring(s) (g)	0.00	0.00	Wt. Dry Soil & Pan (g)	65.59	65.59
Wt. Soil (g)	77.96	78.38	Wt. Lost Moisture (g)	15.55	15.97
Wet Density (pcf)	123.7	126.6	Wt. of Pan Only (g)	3.17	3.17
Moisture Content (%)	24.91	25.59	Wt. of Dry Soil (g)	62.41	62.41
Dry Density (pcf)	99.1	100.8	Saturation (%)	98.98	106.22

	LOAD (psf)	CONSOL. (IN)	LOG p	CONSOL. (IN/IN)	DEFL. (IN/IN)	STRAIN (%)
	182	0.00000	2.260	0.00000	0.00000	0.0
	10018	0.01470	4.001	0.01564	-0.01564	-1.6
Inundate	10018	0.01605	4.001	0.01707	-0.01707	-1.7

Data entry by: NN Date: 7/20/2016

Data checked by: DPM Date: 7/28/16

File Name: 2679_96_Swell-Consol_ASTMD4546_R0_4.xls

SWELL/COLLAPSE TEST

ASTM D4546 Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	SAMPLED	-- --
PROJECT NO.	16104	TEST STARTED	07/17/2016 DPM
LOCATION	--	TEST FINISHED	07/18/2016 DPM
BORING NO.	B-106	CONSOLIDOMETER	ATT-02
DEPTH	48-48.5' + 49.4-50'	SAMPLE DESCR.	Claystone
SAMPLE NO.	NQ-7 10000 psf		

Timed Reading Data

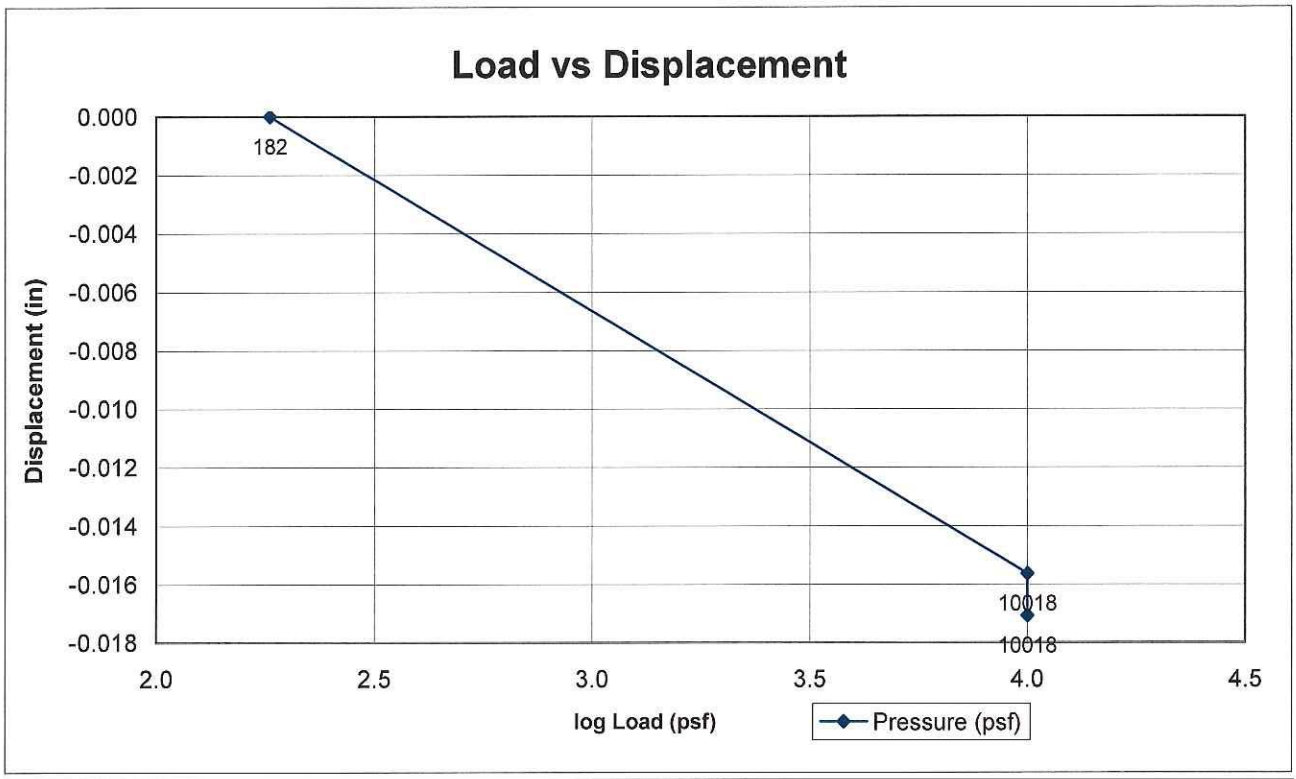
10018 psf Inundation Load

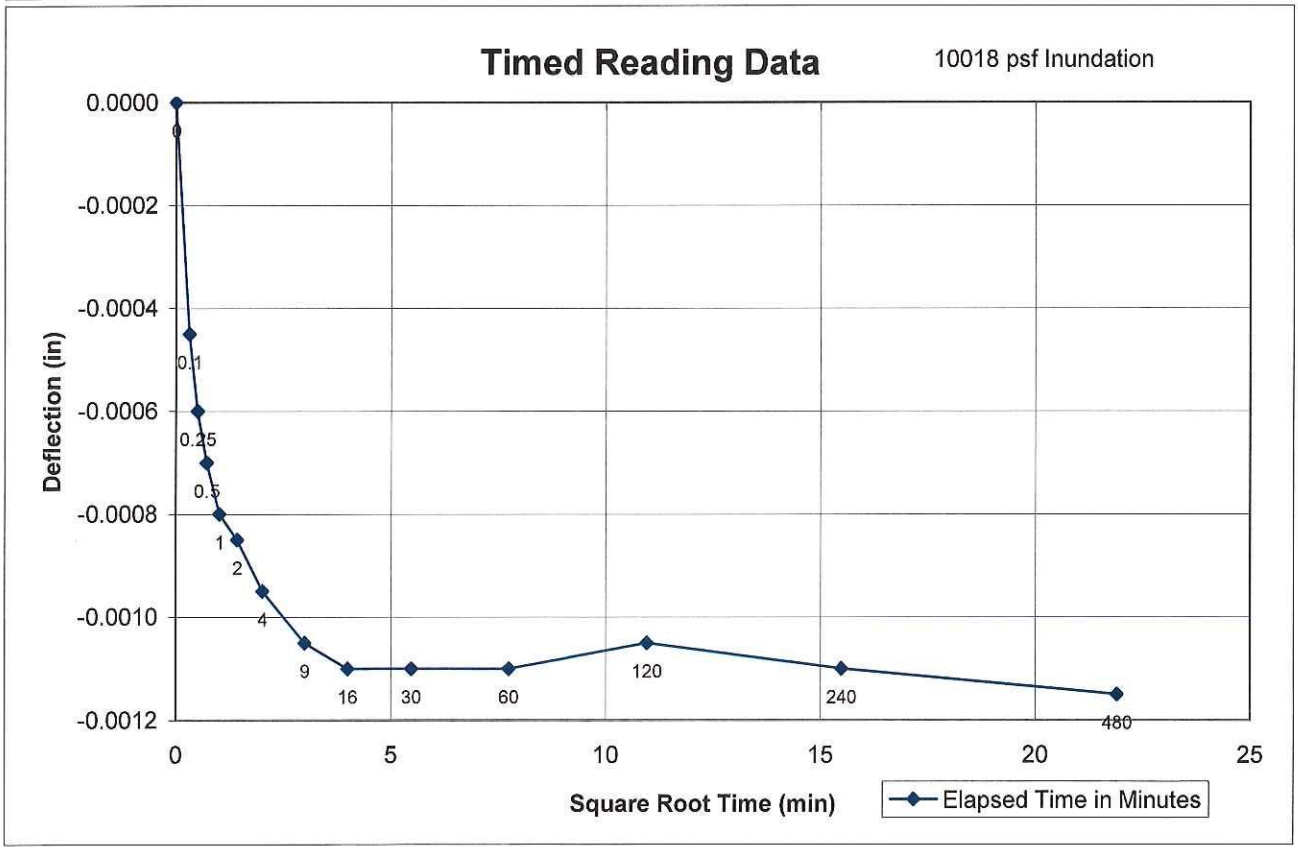
Elapsed Time (min)	SQRT Time (min)	Dial Reading (in)	Defl. (in)
0	0.00	0.02250	0.00000
0.1	0.32	0.02295	-0.00045
0.25	0.50	0.02310	-0.00060
0.5	0.71	0.02320	-0.00070
1	1.00	0.02330	-0.00080
2	1.41	0.02335	-0.00085
4	2.00	0.02345	-0.00095
9	3.00	0.02355	-0.00105
16	4.00	0.02360	-0.00110
30	5.48	0.02360	-0.00110
60	7.75	0.02360	-0.00110
120	10.95	0.02355	-0.00105
240	15.49	0.02360	-0.00110
480	21.91	0.02365	-0.00115

SWELL/COLLAPSE TEST

ASTM D4546 Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	BORING NO.	B-106
PROJECT NO.	16104	DEPTH	48-48.5' + 49.4-50'
LOCATION	--	SAMPLE NO.	NQ-7 10000 psf





SWELL/COLLAPSE TEST

ASTM D4546 Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	SAMPLED	06/27/2016 --
PROJECT NO.	16104	TEST STARTED	07/22/2016 DPM/CP
LOCATION	--	TEST FINISHED	07/25/2016 DPM
BORING NO.	B-107	CONSOLIDOMETER	ATT-05
DEPTH	30.7-31.2' + 33.7-34.3'	SAMPLE DESCR.	Claystone
SAMPLE NO.	NQ-3 4000psf		
SAMPLE DIA.(in)	1.762	INITIAL HT.(in)	0.936
SPECIFIC GRAVITY	2.65	FINAL HT.(in)	0.936

MOISTURE/DENSITY DATA

	BEFORE TEST	AFTER TEST		BEFORE TEST	AFTER TEST
Wt. Soil & Ring(s) (g)	76.71	76.97	Wt. Wet Soil & Pan (g)	79.80	80.06
Wt. Ring(s) (g)	0.00	0.00	Wt. Dry Soil & Pan (g)	65.90	65.90
Wt. Soil (g)	76.71	76.97	Wt. Lost Moisture (g)	13.91	14.17
Wet Density (pcf)	128.0	128.4	Wt. of Pan Only (g)	3.10	3.10
Moisture Content (%)	22.14	22.56	Wt. of Dry Soil (g)	62.80	62.80
Dry Density (pcf)	104.8	104.8	Saturation (%)	101.97	103.79

	LOAD (psf)	CONSOL. (IN)	LOG p	CONSOL. (IN/IN)	DEFL. (IN/IN)	STRAIN (%)
	182	0.00000	2.260	0.00000	0.00000	0.0
	4024	0.00305	3.605	0.00326	-0.00326	-0.3
Inundate	4024	-0.00030	3.605	-0.00032	0.00032	0.0

Data entry by: NN Date: 7/26/2016

Data checked by: DPM Date: 7/28/16

File Name: 2679_96_Swell-Consol_ASTMD4546_R0_10.xls

SWELL/COLLAPSE TEST

ASTM D4546 Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	SAMPLED	06/27/2016 --
PROJECT NO.	16104	TEST STARTED	07/22/2016 DPM/CP
LOCATION	--	TEST FINISHED	07/25/2016 DPM
BORING NO.	B-107	CONSOLIDOMETER	ATT-05
DEPTH	30.7-31.2' + 33.7-34.3'	SAMPLE DESCR.	Claystone
SAMPLE NO.	NQ-3 4000psf		

Timed Reading Data

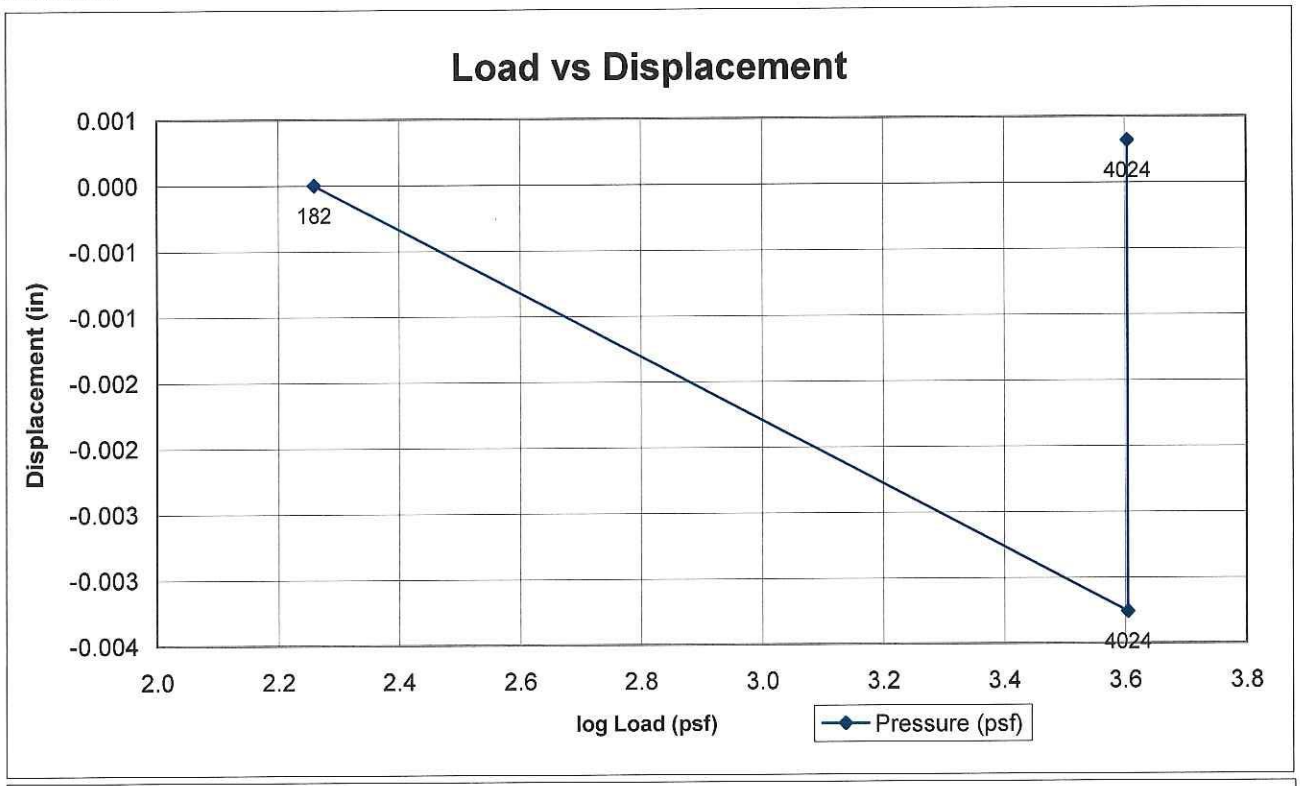
4024 psf Inundation Load

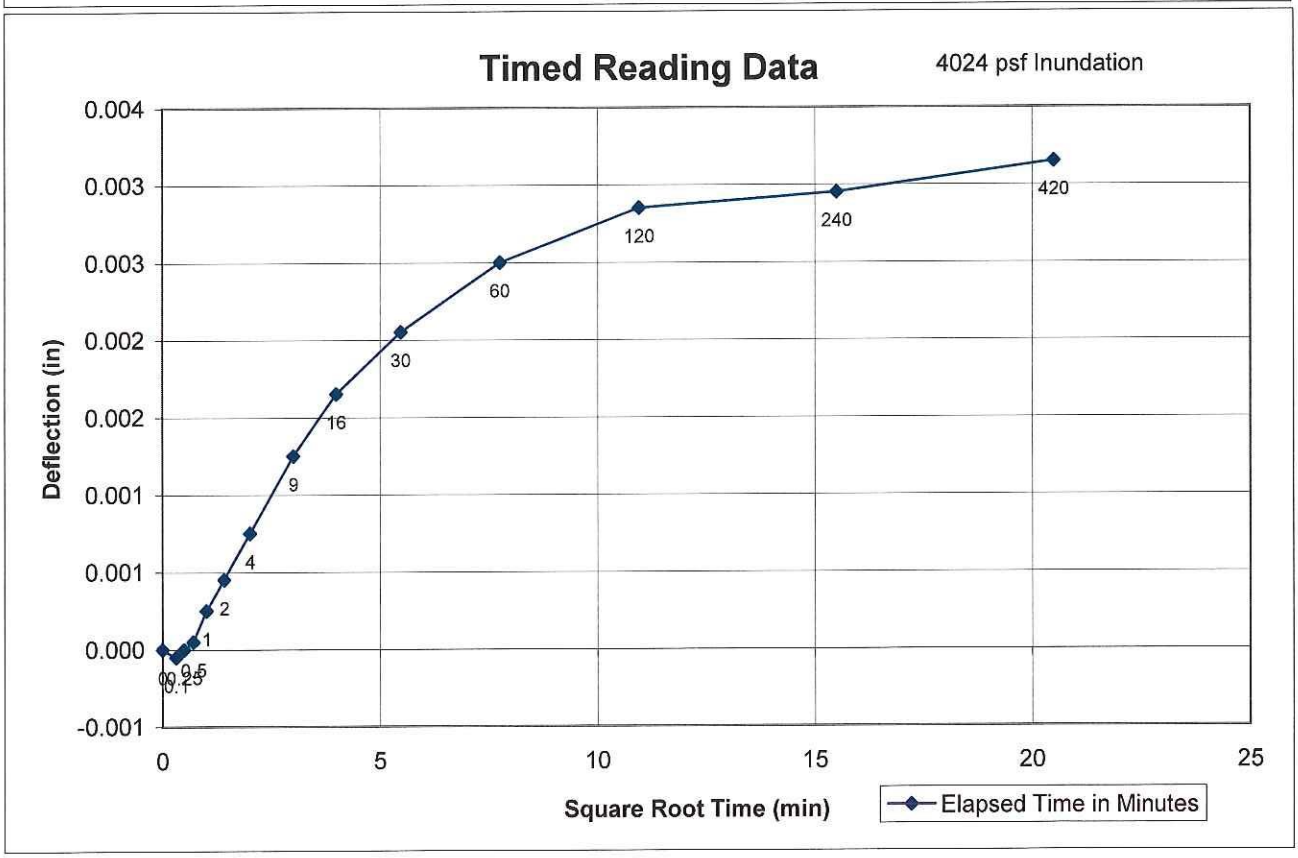
Elapsed Time (min)	SQRT Time (min)	Dial Reading (in)	Defl. (in)
0	0.00	0.00905	0.00000
0.1	0.32	0.00910	-0.00005
0.25	0.50	0.00905	0.00000
0.5	0.71	0.00900	0.00005
1	1.00	0.00880	0.00025
2	1.41	0.00860	0.00045
4	2.00	0.00830	0.00075
9	3.00	0.00780	0.00125
16	4.00	0.00740	0.00165
30	5.48	0.00700	0.00205
60	7.75	0.00655	0.00250
120	10.95	0.00620	0.00285
240	15.49	0.00610	0.00295
420	20.49	0.00590	0.00315

SWELL/COLLAPSE TEST

ASTM D4546 Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	BORING NO.	B-107
PROJECT NO.	16104	DEPTH	30.7-31.2' + 33.7-34.3'
LOCATION	--	SAMPLE NO.	NQ-3 4000psf





SWELL/COLLAPSE TEST

ASTM D4546 Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	SAMPLED	06/27/2016 --
PROJECT NO.	16104	TEST STARTED	07/25/2016 DPM
LOCATION	--	TEST FINISHED	07/26/2016 DPM
BORING NO.	B-107	CONSOLIDOMETER	ATT-02
DEPTH	30.7-31.2' + 33.7-34.3'	SAMPLE DESCR.	Claystone
SAMPLE NO.	NQ-3 8000psf		
SAMPLE DIA.(in)	1.724	INITIAL HT.(in)	0.937
SPECIFIC GRAVITY	2.65	FINAL HT.(in)	0.917

MOISTURE/DENSITY DATA

	BEFORE TEST	AFTER TEST		BEFORE TEST	AFTER TEST
Wt. Soil & Ring(s) (g)	70.88	71.09	Wt. Wet Soil & Pan (g)	74.09	74.30
Wt. Ring(s) (g)	0.00	0.00	Wt. Dry Soil & Pan (g)	59.40	59.40
Wt. Soil (g)	70.88	71.09	Wt. Lost Moisture (g)	14.69	14.90
Wet Density (pcf)	123.5	126.5	Wt. of Pan Only (g)	3.21	3.21
Moisture Content (%)	26.15	26.51	Wt. of Dry Soil (g)	56.19	56.19
Dry Density (pcf)	97.9	100.0	Saturation (%)	100.81	107.80

	LOAD (psf)	CONSOL. (IN)	LOG p	CONSOL. (IN/IN)	DEFL. (IN/IN)	STRAIN (%)
	207	0.00000	2.315	0.00000	0.00000	0.0
	8018	0.01805	3.904	0.01926	-0.01926	-1.9
Inundate	8018	0.01985	3.904	0.02118	-0.02118	-2.1

Data entry by: NN Date: 7/27/2016

Data checked by: DPM Date: 7/29/16

File Name: 2679_96_Swell-Consol_ASTMD4546_R0_12.xls

SWELL/COLLAPSE TEST

ASTM D4546 Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	SAMPLED	06/27/2016 --
PROJECT NO.	16104	TEST STARTED	07/25/2016 DPM
LOCATION	--	TEST FINISHED	07/26/2016 DPM
BORING NO.	B-107	CONSOLIDOMETER	ATT-02
DEPTH	30.7-31.2' + 33.7-34.3'	SAMPLE DESCR.	Claystone
SAMPLE NO.	NQ-3 8000psf		

Timed Reading Data

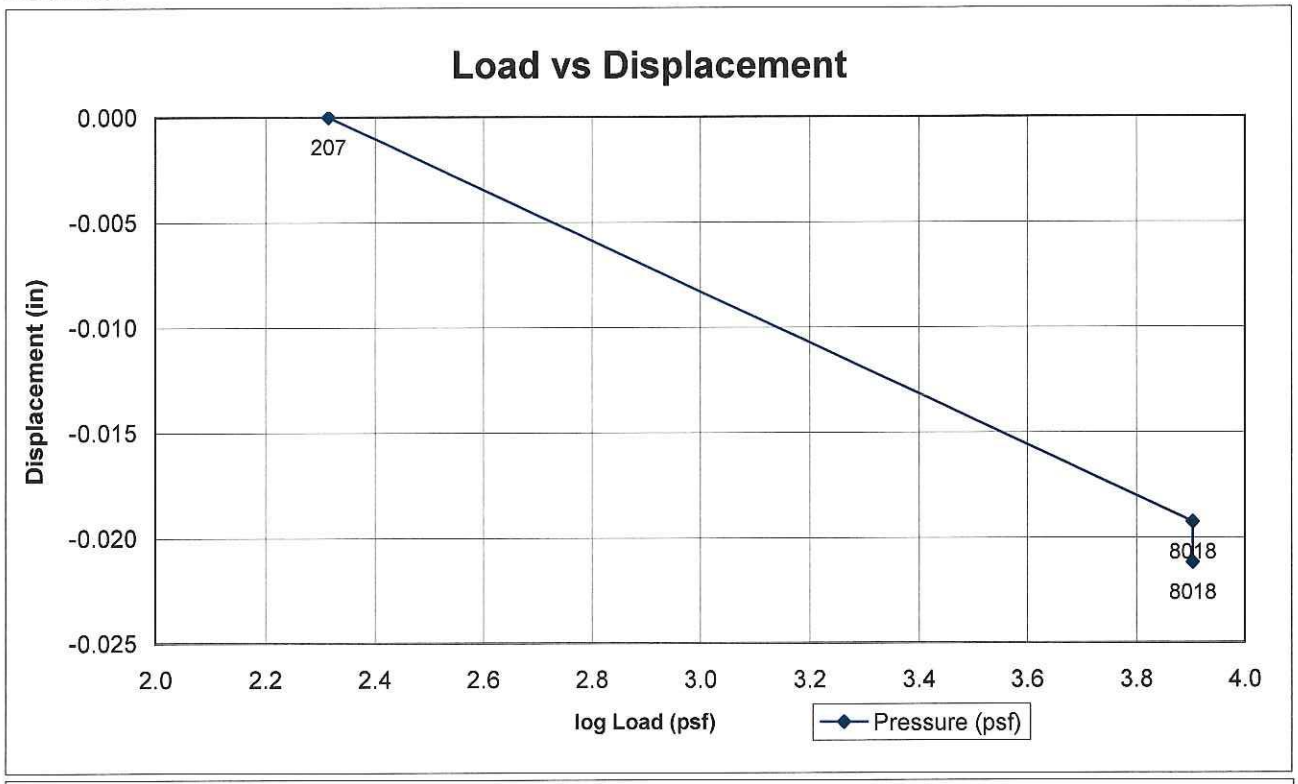
8018 psf Inundation Load

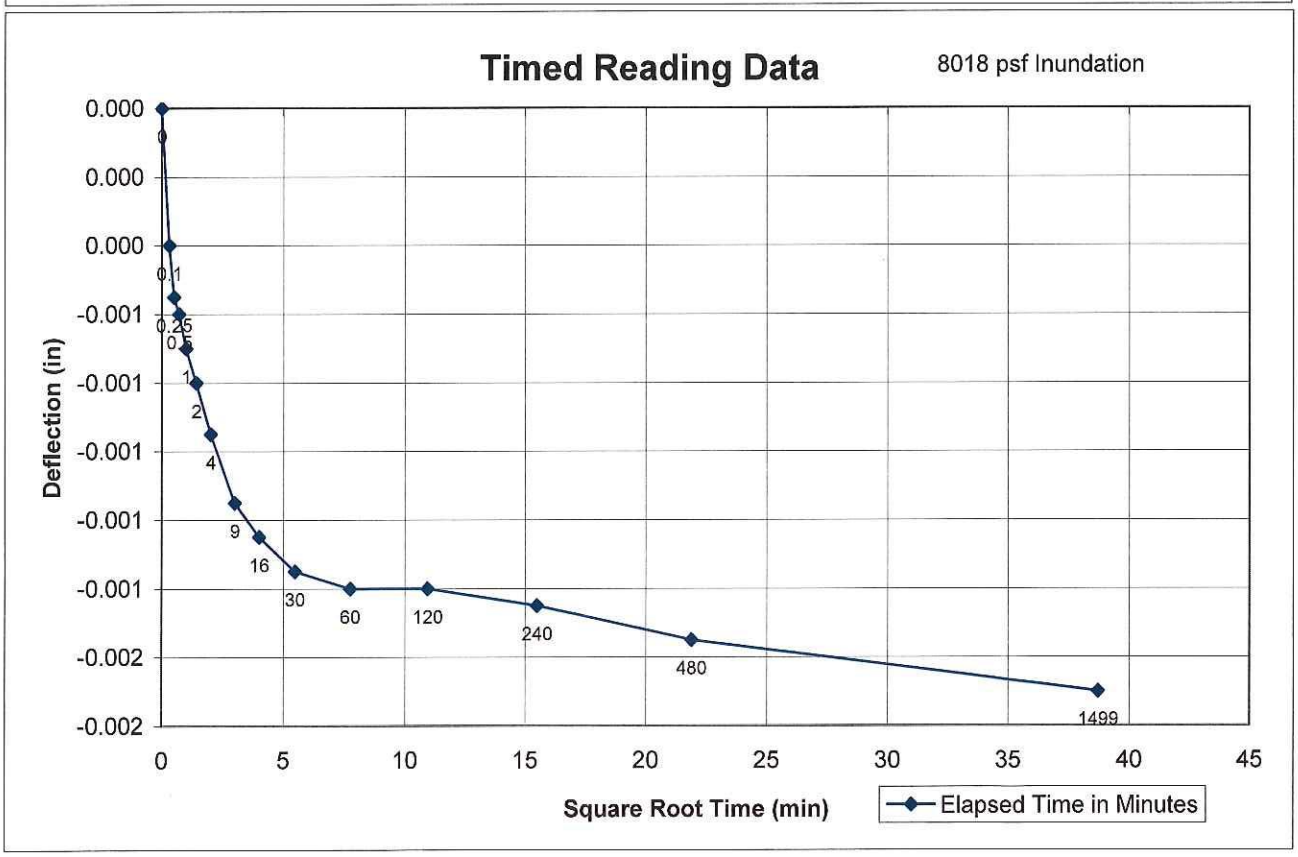
Elapsed Time (min)	SQRT Time (min)	Dial Reading (in)	Defl. (in)
0	0.00	0.02515	0.00000
0.1	0.32	0.02555	-0.00040
0.25	0.50	0.02570	-0.00055
0.5	0.71	0.02575	-0.00060
1	1.00	0.02585	-0.00070
2	1.41	0.02595	-0.00080
4	2.00	0.02610	-0.00095
9	3.00	0.02630	-0.00115
16	4.00	0.02640	-0.00125
30	5.48	0.02650	-0.00135
60	7.75	0.02655	-0.00140
120	10.95	0.02655	-0.00140
240	15.49	0.02660	-0.00145
480	21.91	0.02670	-0.00155
1499	38.72	0.02685	-0.00170

SWELL/COLLAPSE TEST

ASTM D4546 Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	BORING NO.	B-107
PROJECT NO.	16104	DEPTH	30.7-31.2' + 33.7-34.3'
LOCATION	--	SAMPLE NO.	NQ-3 8000psf





SWELL/COLLAPSE TEST

ASTM D4546 Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	SAMPLED	06/23/2016 --
PROJECT NO.	16104	TEST STARTED	08/08/2016 DPM
LOCATION	--	TEST FINISHED	08/10/2016 DPM
BORING NO.	B-107	CONSOLIDOMETER	Att-17
DEPTH	44.3-45.0' & 45.1-45.6'	SAMPLE DESCR.	Claystone
SAMPLE NO.	NQ-5 & NQ-6 2000psf		
SAMPLE DIA.(in)	1.750	INITIAL HT.(in)	0.951
SPECIFIC GRAVITY	2.65	FINAL HT.(in)	1.013

MOISTURE/DENSITY DATA

	BEFORE TEST	AFTER TEST		BEFORE TEST	AFTER TEST
Wt. Soil & Ring(s) (g)	80.22	85.23	Wt. Wet Soil & Pan (g)	83.29	88.29
Wt. Ring(s) (g)	0.00	0.00	Wt. Dry Soil & Pan (g)	74.19	74.19
Wt. Soil (g)	80.22	85.23	Wt. Lost Moisture (g)	9.09	14.10
Wet Density (pcf)	133.6	133.2	Wt. of Pan Only (g)	3.06	3.06
Moisture Content (%)	12.78	19.82	Wt. of Dry Soil (g)	71.13	71.13
Dry Density (pcf)	118.5	111.2	Saturation (%)	85.96	108.22

	LOAD (psf)	CONSOL. (IN)	LOG p	CONSOL. (IN/IN)	DEFL. (IN/IN)	STRAIN (%)
	190	0.0000	2.279	0.0000	0.0000	0.0
	1991	0.0048	3.299	0.0050	-0.0050	-0.5
Inundate	1991	-0.0622	3.299	-0.0654	0.0654	6.5

Data entry by: DPM Date: 8/11/2016

Data checked by: CM Date: 8/12/16

File Name: 2679_96_Swell-Consol_ASTMD4546_R0_14.xls

SWELL/COLLAPSE TEST

ASTM D4546 Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	SAMPLED	06/23/2016 --
PROJECT NO.	16104	TEST STARTED	08/08/2016 DPM
LOCATION	--	TEST FINISHED	08/10/2016 DPM
BORING NO.	B-107	CONSOLIDOMETER	Att-17
DEPTH	44.3-45.0' & 45.1-45.6'	SAMPLE DESCR.	Claystone
SAMPLE NO.	NQ-5 & NQ-6 2000psf		

Timed Reading Data

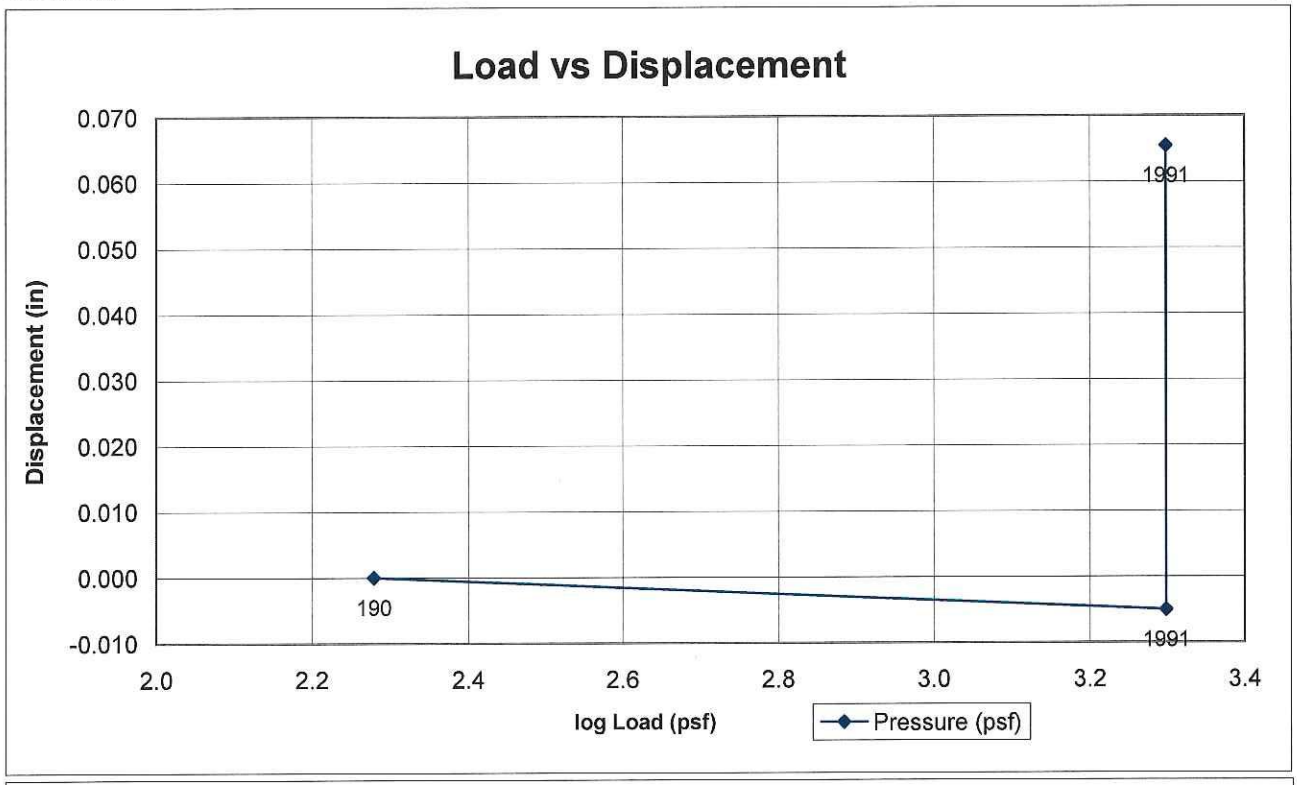
1991 psf Inundation Load

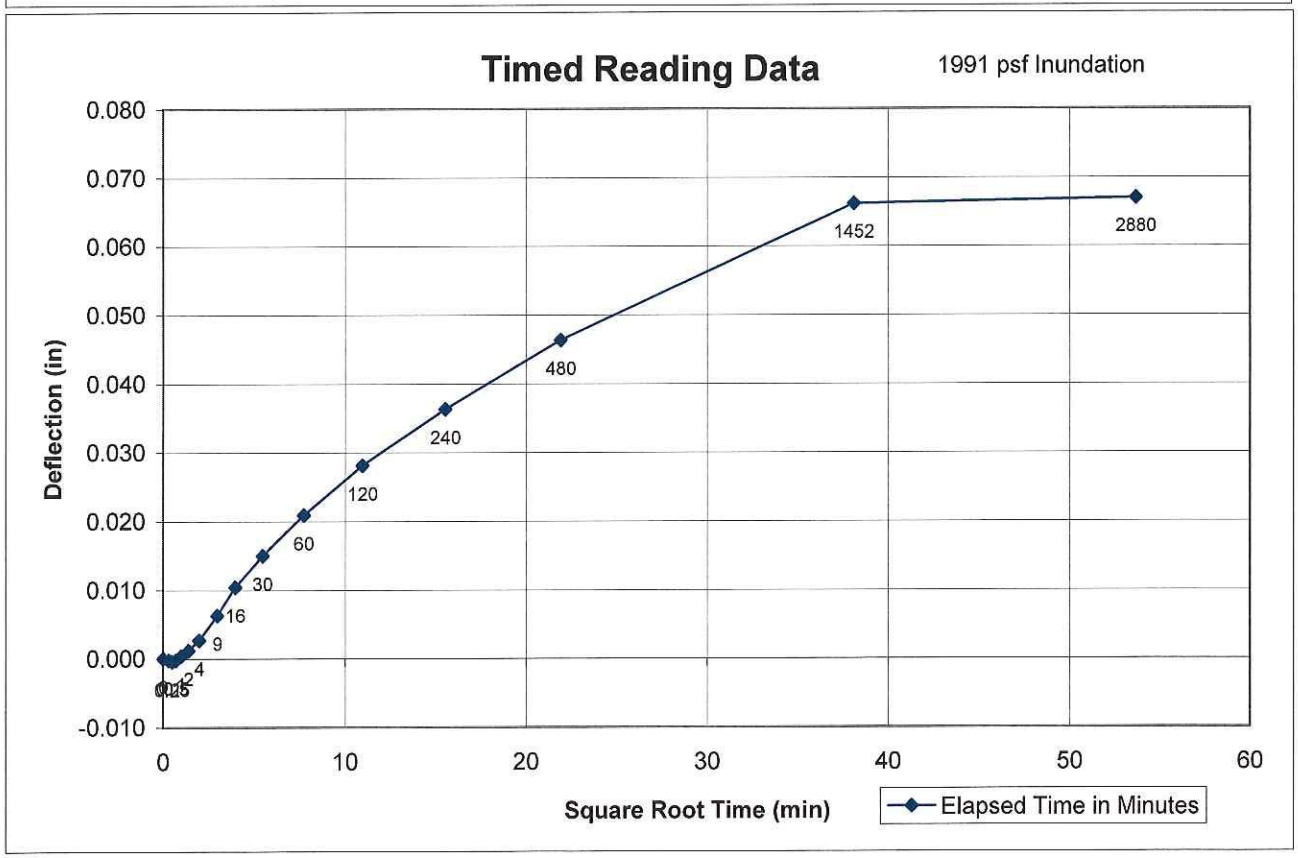
Elapsed Time (min)	SQRT Time (min)	Dial Reading (in)	Defl. (in)
0	0.00	0.0068	0.0000
0.1	0.32	0.0070	-0.0002
0.25	0.50	0.0072	-0.0004
0.5	0.71	0.0070	-0.0002
1	1.00	0.0064	0.0004
2	1.41	0.0056	0.0012
4	2.00	0.0041	0.0027
9	3.00	0.0005	0.0063
16	4.00	-0.0036	0.0104
30	5.48	-0.0082	0.0150
60	7.75	-0.0141	0.0209
120	10.95	-0.0213	0.0281
240	15.49	-0.0295	0.0363
480	21.91	-0.0395	0.0463
1452	38.11	-0.0594	0.0662
2880	53.67	-0.0602	0.0670

SWELL/COLLAPSE TEST

ASTM D4546 Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	BORING NO.	B-107
PROJECT NO.	16104	DEPTH	44.3-45.0' & 45.1-45.6'
LOCATION	--	SAMPLE NO.	NQ-5 & NQ-6 2000psf





SWELL/COLLAPSE TEST

ASTM D4546 Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	SAMPLED	06/23/2016 --
PROJECT NO.	16104	TEST STARTED	07/18/2016 DPM
LOCATION	--	TEST FINISHED	07/19/2016 DPM
BORING NO.	B-107	CONSOLIDOMETER	ATT-17
DEPTH	44.3-45' + 45.1-45.6'	SAMPLE DESCR.	Claystone
SAMPLE NO.	NQ-5 5500 psf		
SAMPLE DIA.(in)	1.765	INITIAL HT.(in)	0.929
SPECIFIC GRAVITY	2.65	FINAL HT.(in)	0.923

MOISTURE/DENSITY DATA

	BEFORE TEST	AFTER TEST		BEFORE TEST	AFTER TEST
Wt. Soil & Ring(s) (g)	78.92	79.43	Wt. Wet Soil & Pan (g)	82.03	82.53
Wt. Ring(s) (g)	0.00	0.00	Wt. Dry Soil & Pan (g)	69.57	69.57
Wt. Soil (g)	78.92	79.43	Wt. Lost Moisture (g)	12.46	12.96
Wet Density (pcf)	132.3	133.9	Wt. of Pan Only (g)	3.10	3.10
Moisture Content (%)	18.75	19.50	Wt. of Dry Soil (g)	66.46	66.46
Dry Density (pcf)	111.4	112.1	Saturation (%)	102.96	109.18

	LOAD (psf)	CONSOL. (IN)	LOG p	CONSOL. (IN/IN)	DEFL. (IN/IN)	STRAIN (%)
	186	0.0000	2.270	0.0000	0.0000	0.0
	5500	0.0075	3.740	0.0081	-0.0081	-0.8
Inundate	5500	0.0057	3.740	0.0061	-0.0061	-0.6

Data entry by: NN Date: 7/20/2016

Data checked by: DPM Date: 7/27/16

File Name: 2679_96_Swell-Consol_ASTMD4546_R0_5.xls

SWELL/COLLAPSE TEST

ASTM D4546 Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	SAMPLED	06/23/2016 --
PROJECT NO.	16104	TEST STARTED	07/18/2016 DPM
LOCATION	--	TEST FINISHED	07/19/2016 DPM
BORING NO.	B-107	CONSOLIDOMETER	ATT-17
DEPTH	44.3-45' + 45.1-45.6'	SAMPLE DESCR.	Claystone
SAMPLE NO.	NQ-5 5500 psf		

Timed Reading Data

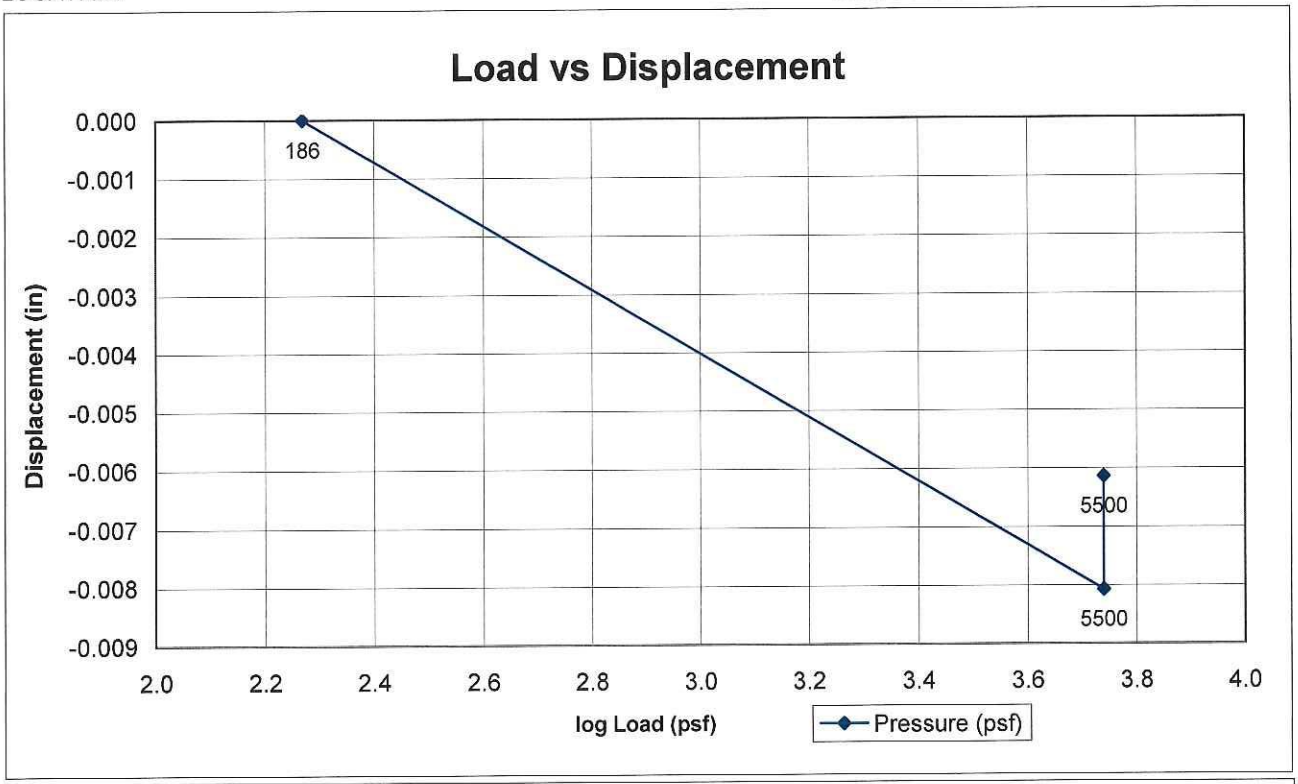
5500 psf Inundation Load

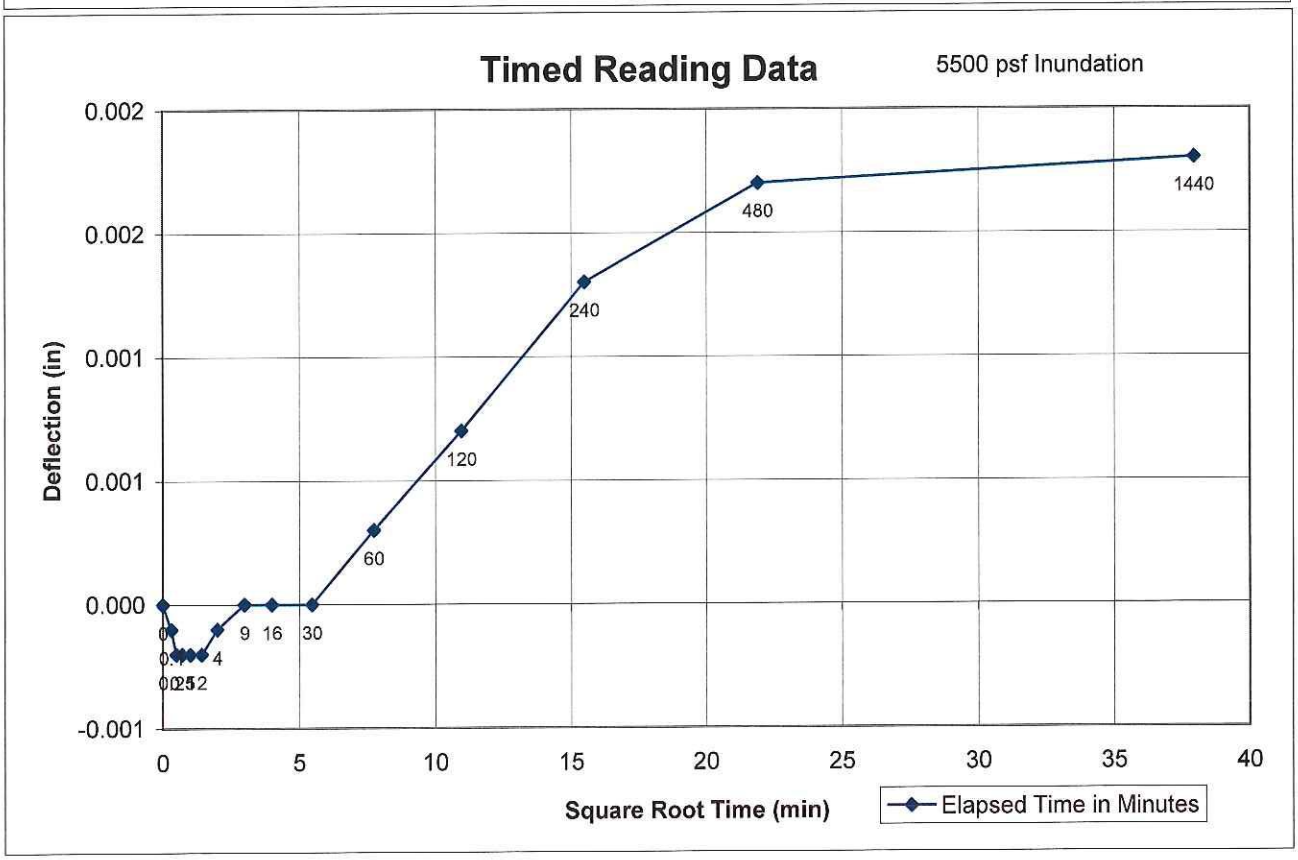
Elapsed Time (min)	SQRT Time (min)	Dial Reading (in)	Defl. (in)
0	0.00	0.0116	0.0000
0.1	0.32	0.0117	-0.0001
0.25	0.50	0.0118	-0.0002
0.5	0.71	0.0118	-0.0002
1	1.00	0.0118	-0.0002
2	1.41	0.0118	-0.0002
4	2.00	0.0117	-0.0001
9	3.00	0.0116	0.0000
16	4.00	0.0116	0.0000
30	5.48	0.0116	0.0000
60	7.75	0.0113	0.0003
120	10.95	0.0109	0.0007
240	15.49	0.0103	0.0013
480	21.91	0.0099	0.0017
1440	37.95	0.0098	0.0018

SWELL/COLLAPSE TEST

ASTM D4546 Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	BORING NO.	B-107
PROJECT NO.	16104	DEPTH	44.3-45' + 45.1-45.6'
LOCATION	--	SAMPLE NO.	NQ-5 5500 psf





SWELL/COLLAPSE TEST

ASTM D4546 Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	SAMPLED	06/23/2016 --
PROJECT NO.	16104	TEST STARTED	07/18/2016 DPM
LOCATION	--	TEST FINISHED	07/19/2016 DPM
BORING NO.	B-107	CONSOLIDOMETER	ATT-5
DEPTH	44.3-45' + 45.1-45.6'	SAMPLE DESCR.	Claystone
SAMPLE NO.	NQ-5 9500 psf		
SAMPLE DIA.(in)	1.758	INITIAL HT.(in)	0.928
SPECIFIC GRAVITY	2.65	FINAL HT.(in)	0.925

MOISTURE/DENSITY DATA

	BEFORE TEST	AFTER TEST		BEFORE TEST	AFTER TEST
Wt. Soil & Ring(s) (g)	78.98	79.23	Wt. Wet Soil & Pan (g)	82.12	82.36
Wt. Ring(s) (g)	0.00	0.00	Wt. Dry Soil & Pan (g)	69.95	69.95
Wt. Soil (g)	78.98	79.23	Wt. Lost Moisture (g)	12.17	12.41
Wet Density (pcf)	133.6	134.4	Wt. of Pan Only (g)	3.13	3.13
Moisture Content (%)	18.21	18.57	Wt. of Dry Soil (g)	66.82	66.82
Dry Density (pcf)	113.1	113.4	Saturation (%)	104.74	107.74

	LOAD (psf)	CONSOL. (IN)	LOG p	CONSOL. (IN/IN)	DEFL. (IN/IN)	STRAIN (%)
	183	0.00000	2.262	0.00000	0.00000	0.0
	9510	0.00470	3.978	0.00507	-0.00507	-0.5
Inundate	9510	0.00240	3.978	0.00259	-0.00259	-0.3

Data entry by: NN Date: 7/20/2016

Data checked by: DPM Date: 7/27/16

File Name: 2679_96_Swell-Consol_ASTMD4546_R0_6.xls

SWELL/COLLAPSE TEST

ASTM D4546 Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	SAMPLED	06/23/2016 --
PROJECT NO.	16104	TEST STARTED	07/18/2016 DPM
LOCATION	--	TEST FINISHED	07/19/2016 DPM
BORING NO.	B-107	CONSOLIDOMETER	ATT-5
DEPTH	44.3-45' + 45.1-45.6'	SAMPLE DESCR.	Claystone
SAMPLE NO.	NQ-5 9500 psf		

Timed Reading Data

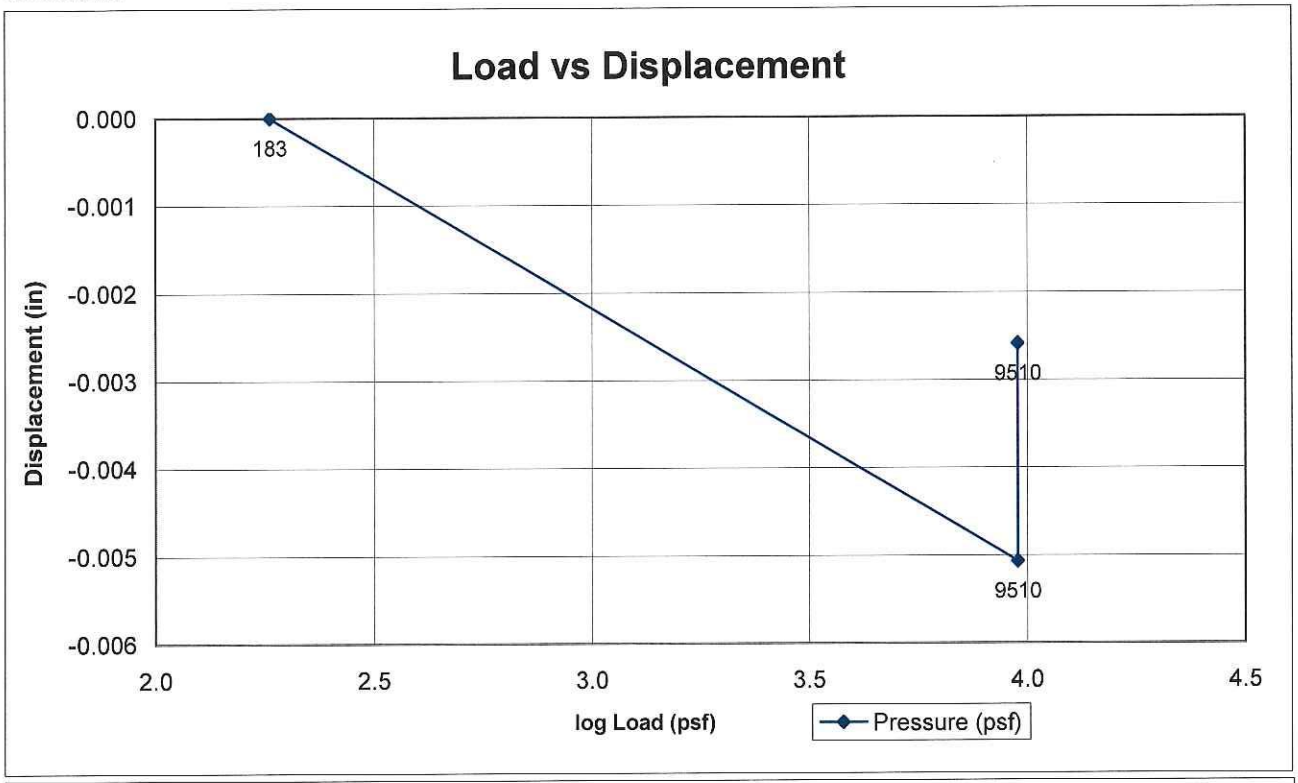
9510 psf Inundation Load

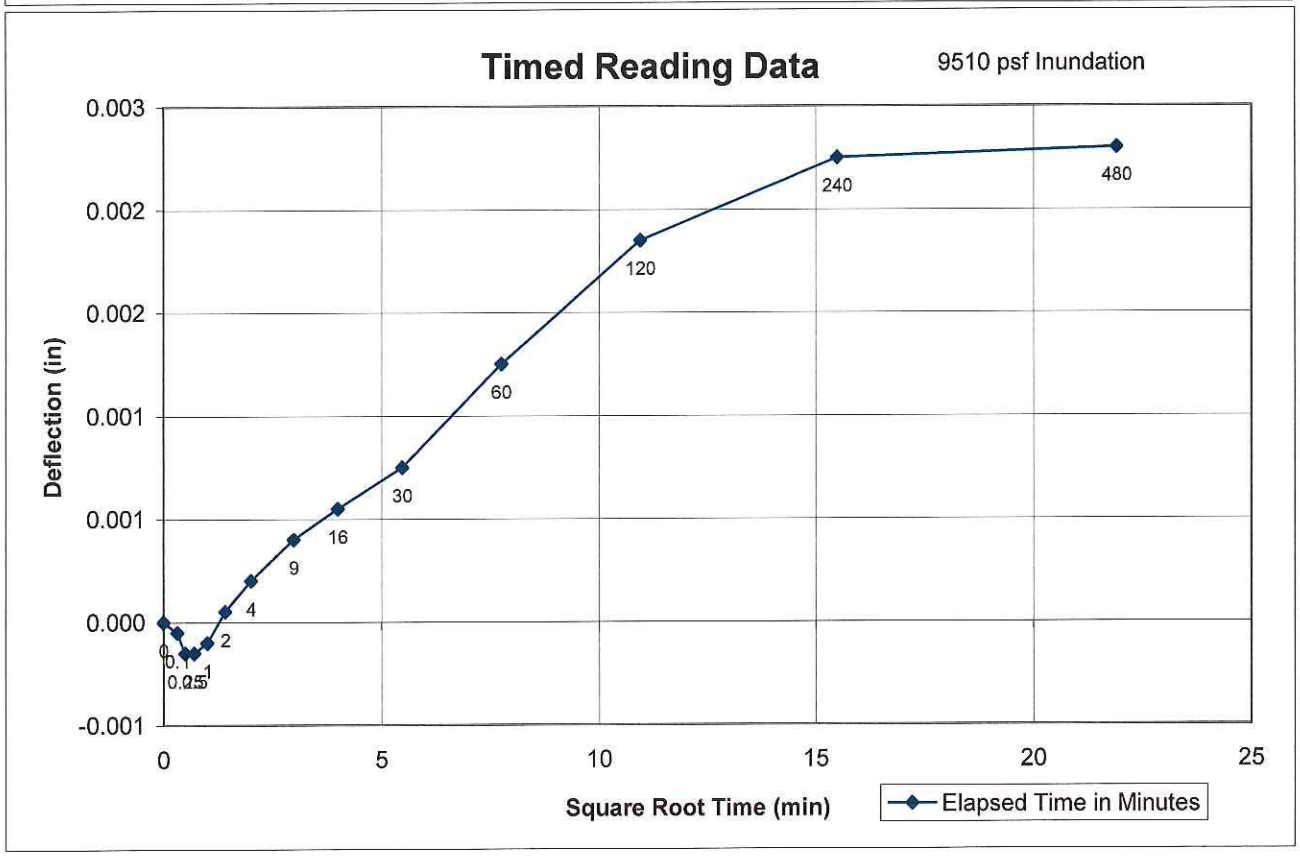
Elapsed Time (min)	SQRT Time (min)	Dial Reading (in)	Defl. (in)
0	0.00	0.01300	0.00000
0.1	0.32	0.01305	-0.00005
0.25	0.50	0.01315	-0.00015
0.5	0.71	0.01315	-0.00015
1	1.00	0.01310	-0.00010
2	1.41	0.01295	0.00005
4	2.00	0.01280	0.00020
9	3.00	0.01260	0.00040
16	4.00	0.01245	0.00055
30	5.48	0.01225	0.00075
60	7.75	0.01175	0.00125
120	10.95	0.01115	0.00185
240	15.49	0.01075	0.00225
480	21.91	0.01070	0.00230

SWELL/COLLAPSE TEST

ASTM D4546 Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	BORING NO.	B-107
PROJECT NO.	16104	DEPTH	44.3-45' + 45.1-45.6'
LOCATION	--	SAMPLE NO.	NQ-5 9500 psf





SWELL/COLLAPSE TEST

ASTM D4546 Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	SAMPLED	06/23/2016 --
PROJECT NO.	16104	TEST STARTED	08/08/2016 DPM
LOCATION	--	TEST FINISHED	08/10/2016 DPM
BORING NO.	B-107	CONSOLIDOMETER	Att-04
DEPTH	44.3-45.0' & 45.1-45.6'	SAMPLE DESCR.	Claystone
SAMPLE NO.	NQ-5 & NQ-6 12000psf		
SAMPLE DIA.(in)	1.729	INITIAL HT.(in)	0.937
SPECIFIC GRAVITY	2.65	FINAL HT.(in)	0.953

MOISTURE/DENSITY DATA

	BEFORE TEST	AFTER TEST		BEFORE TEST	AFTER TEST
Wt. Soil & Ring(s) (g)	79.47	81.89	Wt. Wet Soil & Pan (g)	82.55	84.98
Wt. Ring(s) (g)	0.00	0.00	Wt. Dry Soil & Pan (g)	72.95	72.95
Wt. Soil (g)	79.47	81.89	Wt. Lost Moisture (g)	9.60	12.03
Wet Density (pcf)	137.6	139.4	Wt. of Pan Only (g)	3.09	3.09
Moisture Content (%)	13.74	17.22	Wt. of Dry Soil (g)	69.86	69.86
Dry Density (pcf)	121.0	118.9	Saturation (%)	99.77	117.44

	LOAD (psf)	CONSOL. (IN)	LOG p	CONSOL. (IN/IN)	DEFL. (IN/IN)	STRAIN (%)
	196	0.00000	2.291	0.00000	0.00000	0.0
	11995	0.00550	4.079	0.00587	-0.00587	-0.6
Inundate	11995	-0.01605	4.079	-0.01713	0.01713	1.7

Data entry by: DPM Date: 8/11/2016

Data checked by: Cw Date: 08/12/16

File Name: 2679_96_Swell-Consol_ASTMD4546_R0_15.xls

SWELL/COLLAPSE TEST

ASTM D4546 Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	SAMPLED	06/23/2016 --
PROJECT NO.	16104	TEST STARTED	08/08/2016 DPM
LOCATION	--	TEST FINISHED	08/10/2016 DPM
BORING NO.	B-107	CONSOLIDOMETER	Att-04
DEPTH	44.3-45.0' & 45.1-45.6'	SAMPLE DESCR.	Claystone
SAMPLE NO.	NQ-5 & NQ-6 12000psf		

Timed Reading Data

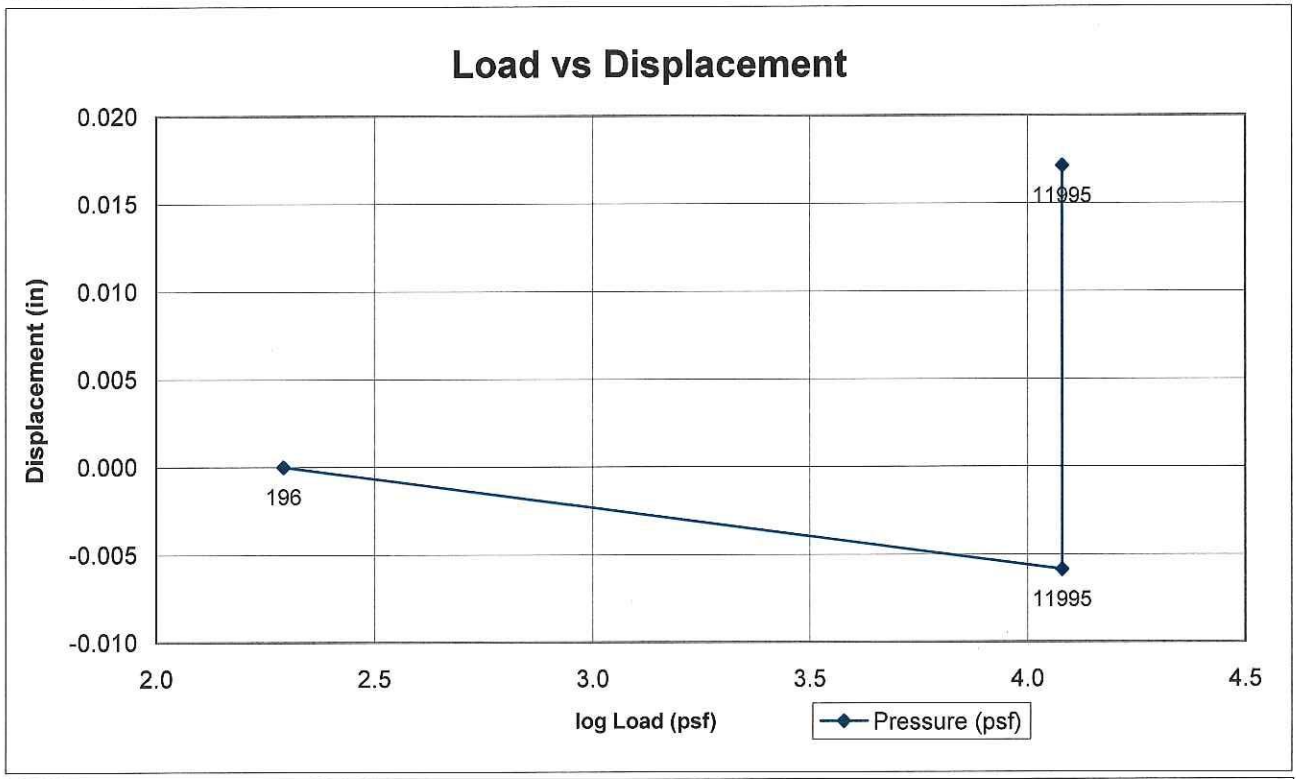
11995 psf Inundation Load

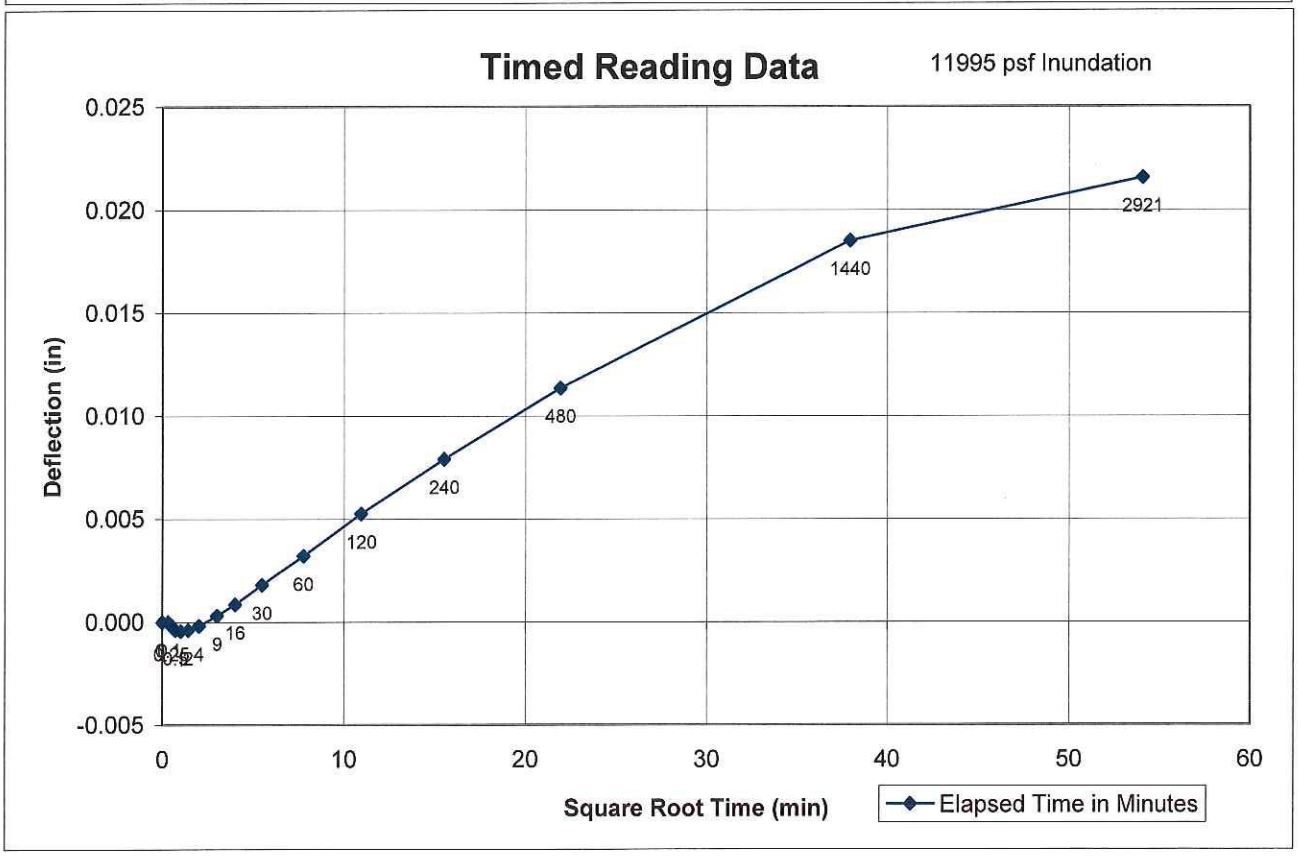
Elapsed Time (min)	SQRT Time (min)	Dial Reading (in)	Defl. (in)
0	0.00	0.01490	0.00000
0.1	0.32	0.01490	0.00000
0.25	0.50	0.01510	-0.00020
0.5	0.71	0.01530	-0.00040
1	1.00	0.01535	-0.00045
2	1.41	0.01530	-0.00040
4	2.00	0.01510	-0.00020
9	3.00	0.01460	0.00030
16	4.00	0.01405	0.00085
30	5.48	0.01310	0.00180
60	7.75	0.01170	0.00320
120	10.95	0.00965	0.00525
240	15.49	0.00700	0.00790
480	21.91	0.00355	0.01135
1440	37.95	-0.00360	0.01850
2921	54.05	-0.00665	0.02155

SWELL/COLLAPSE TEST

ASTM D4546 Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	BORING NO.	B-107
PROJECT NO.	16104	DEPTH	44.3-45.0' & 45.1-45.6'
LOCATION	--	SAMPLE NO.	NQ-5 & NQ-6 12000psf





REMOLDED SWELL TEST

ASTM D4546

Method A

SWELL/COLLAPSE TEST

ASTM D4546 Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	SAMPLED	-- --
PROJECT NO.	16104	TEST STARTED	09/23/2016 DPM
LOCATION	--	TEST FINISHED	09/26/2016 DPM
BORING NO.	B-102, Bu-6 & B-104, Bu-3	CONSOLIDOMETER	ATT-06
DEPTH	Composite 10-20'	SAMPLE DESCR.	20 psf
SAMPLE NO.	#1 101.5 pcf @ 16.4% mc		
SAMPLE DIA.(in)	2.410	INITIAL HT.(in)	1.000
SPECIFIC GRAVITY	2.65	FINAL HT.(in)	1.123

MOISTURE/DENSITY DATA

	BEFORE TEST	AFTER TEST		BEFORE TEST	AFTER TEST
Wt. Soil & Ring(s) (g)	183.85	199.91	Wt. Wet Soil & Pan (g)	144.58	160.64
Wt. Ring(s) (g)	42.44	42.44	Wt. Dry Soil & Pan (g)	125.28	125.28
Wt. Soil (g)	141.42	157.48	Wt. Lost Moisture (g)	19.30	35.36
Wet Density (pcf)	118.1	117.1	Wt. of Pan Only (g)	3.17	3.17
Moisture Content (%)	15.81	28.96	Wt. of Dry Soil (g)	122.11	122.11
Dry Density (pcf)	102.0	90.8	Saturation (%)	67.64	93.77

	LOAD (psf)	CONSOL. (IN)	LOG p	CONSOL. (IN/IN)	DEFL. (IN/IN)	STRAIN (%)
	20	0.0000	1.301	0.0000	0.0000	0.0
	20	0.0000	1.301	0.0000	0.0000	0.0
Inundate	20	-0.1229	1.301	-0.1229	0.1229	12.3

Data entry by: KR Date: 9/27/2016

Data checked by: CM Date: 9/27/16

File Name: 2679_96_Swell-Consol_ASTMD4546_R0_35.xls

SWELL/COLLAPSE TEST

ASTM D4546 Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	SAMPLED	-- --
PROJECT NO.	16104	TEST STARTED	09/23/2016 DPM
LOCATION	--	TEST FINISHED	09/26/2016 DPM
BORING NO.	B-102, Bu-6 & B-104, Bu-3	CONSOLIDOMETER	ATT-06
DEPTH	Composite 10-20'	SAMPLE DESCR.	20 psf
SAMPLE NO.	#1 101.5 pcf @ 16.4% mc		

Timed Reading Data

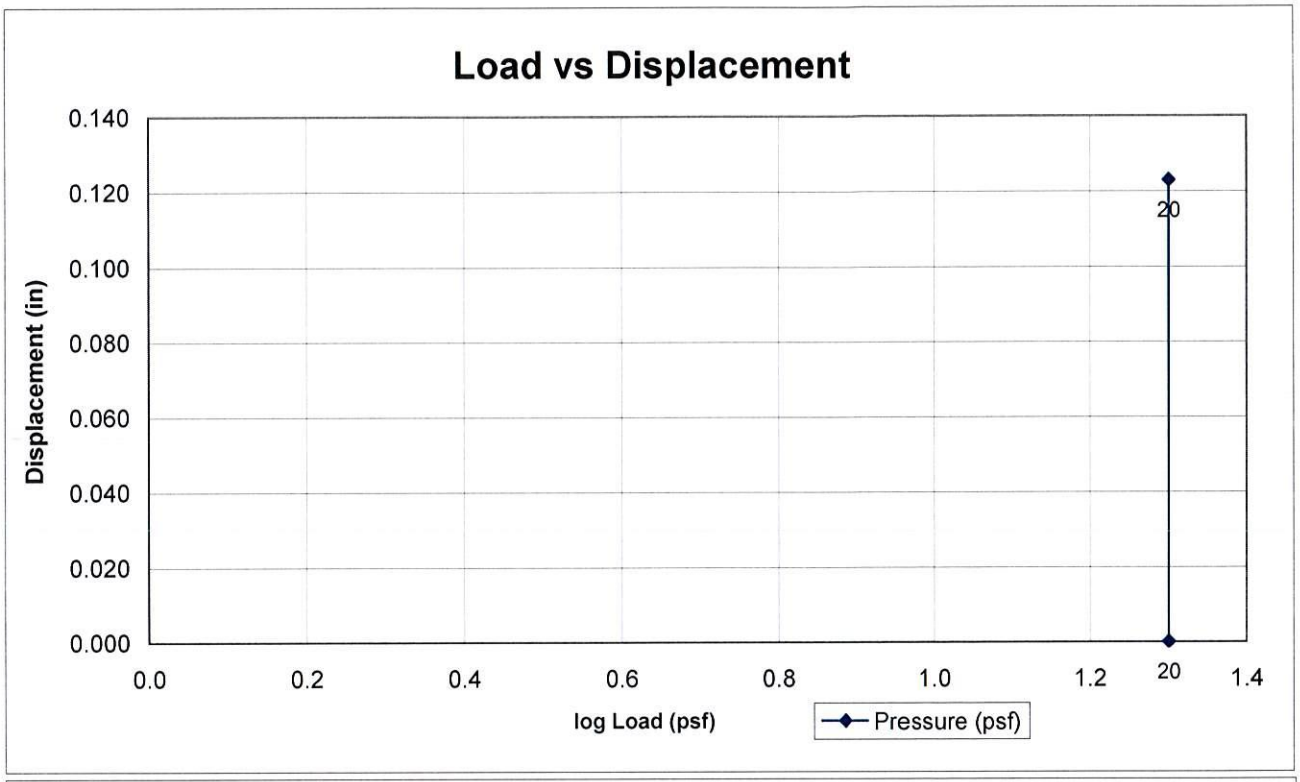
20 psf Inundation Load

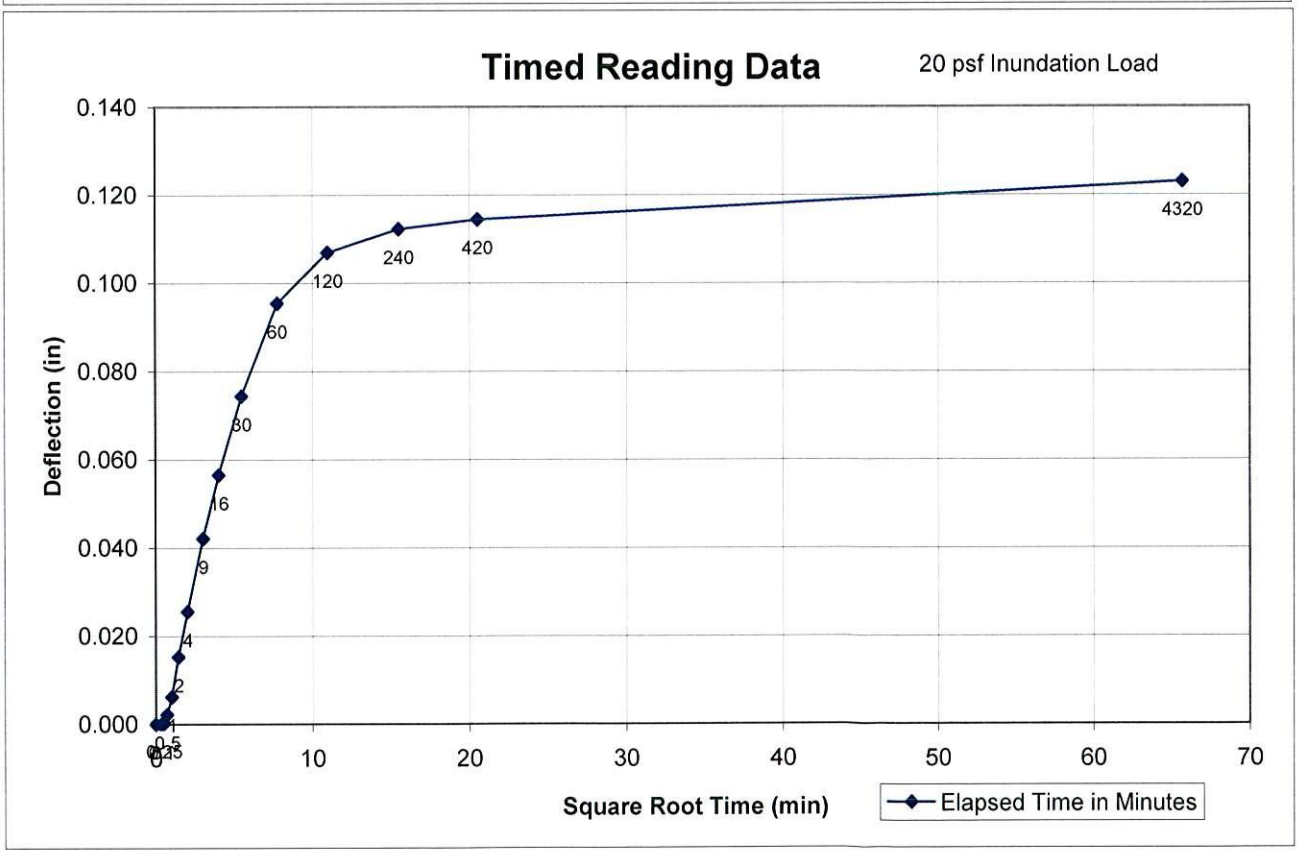
Elapsed Time (min)	SQRT Time (min)	Dial Reading (in)	Defl. (in)
0	0.00	0.3056	0.0000
0.1	0.32	0.3056	0.0000
0.25	0.50	0.3054	0.0002
0.5	0.71	0.3034	0.0022
1	1.00	0.2994	0.0062
2	1.41	0.2904	0.0152
4	2.00	0.2801	0.0255
9	3.00	0.2636	0.0420
16	4.00	0.2492	0.0564
30	5.48	0.2313	0.0743
60	7.75	0.2102	0.0954
120	10.95	0.1987	0.1069
240	15.49	0.1934	0.1122
420	20.49	0.1912	0.1144
4320	65.73	0.1827	0.1229

SWELL/COLLAPSE TEST

ASTM D4546 Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	BORING NO.	B-102, Bu-6 & B-104, Bu-3
PROJECT NO.	16104	DEPTH	Composite 10-20'
LOCATION	--	SAMPLE NO.	#1 101.5 pcf @ 16.4% mc





SWELL/COLLAPSE TEST

ASTM D4546 Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	SAMPLED	-- --
PROJECT NO.	16104	TEST STARTED	09/20/2016 DPM
LOCATION	--	TEST FINISHED	09/21/2016 DPM
BORING NO.	B-102, Bu-6 & B-104, Bu-3	CONSOLIDOMETER	ATT-03
DEPTH	Composite 10-20'	SAMPLE DESCR.	--
SAMPLE NO.	#1 101.5 pcf @ 16.4% mc		
SAMPLE DIA.(in)	2.410	INITIAL HT.(in)	1.000
SPECIFIC GRAVITY	2.65	FINAL HT.(in)	1.023

MOISTURE/DENSITY DATA

	BEFORE TEST	AFTER TEST		BEFORE TEST	AFTER TEST
Wt. Soil & Ring(s) (g)	182.85	191.78	Wt. Wet Soil & Pan (g)	144.47	153.40
Wt. Ring(s) (g)	41.47	41.47	Wt. Dry Soil & Pan (g)	125.25	125.25
Wt. Soil (g)	141.38	150.31	Wt. Lost Moisture (g)	19.22	28.15
Wet Density (pcf)	118.1	122.7	Wt. of Pan Only (g)	3.09	3.09
Moisture Content (%)	15.74	23.05	Wt. of Dry Soil (g)	122.16	122.16
Dry Density (pcf)	102.0	99.7	Saturation (%)	67.39	93.06

	LOAD (psf)	CONSOL. (IN)	LOG p	CONSOL. (IN/IN)	DEFL. (IN/IN)	STRAIN (%)
	101	0.00000	2.006	0.00000	0.00000	0.0
	1497	0.00115	3.175	0.00115	-0.00115	-0.1
Inundate	1497	-0.02315	3.175	-0.02315	0.02315	2.3

Data entry by: KR Date: 9/22/2016

Data checked by: CM Date: 9/23/16

File Name: 2679_96_Swell-Consol_ASTMD4546_R0_30.xls

SWELL/COLLAPSE TEST

ASTM D4546 Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	SAMPLED	-- --
PROJECT NO.	16104	TEST STARTED	09/20/2016 DPM
LOCATION	--	TEST FINISHED	09/21/2016 DPM
BORING NO.	B-102, Bu-6 & B-104, Bu-3	CONSOLIDOMETER	ATT-03
DEPTH	Composite 10-20'	SAMPLE DESCR.	--
SAMPLE NO.	#1 101.5 pcf @ 16.4% mc		

Timed Reading Data

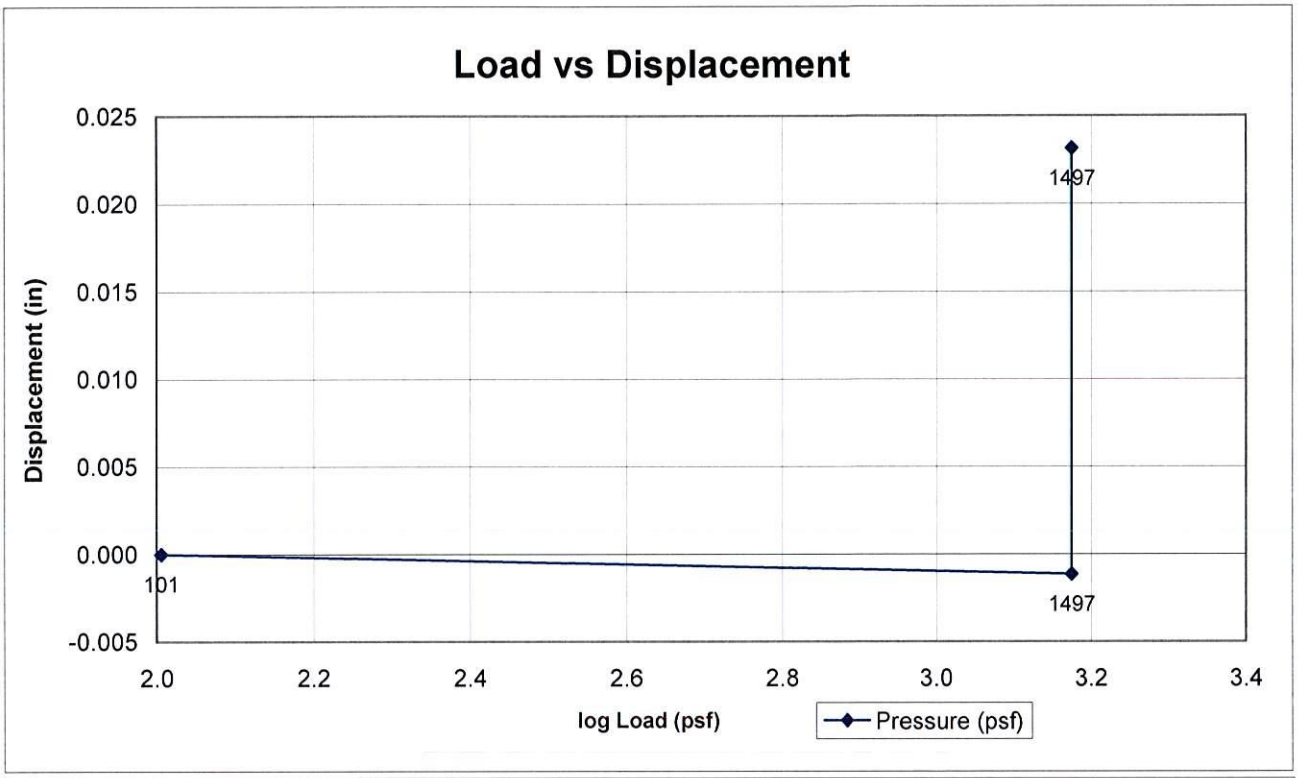
1497 psf Inundation Load

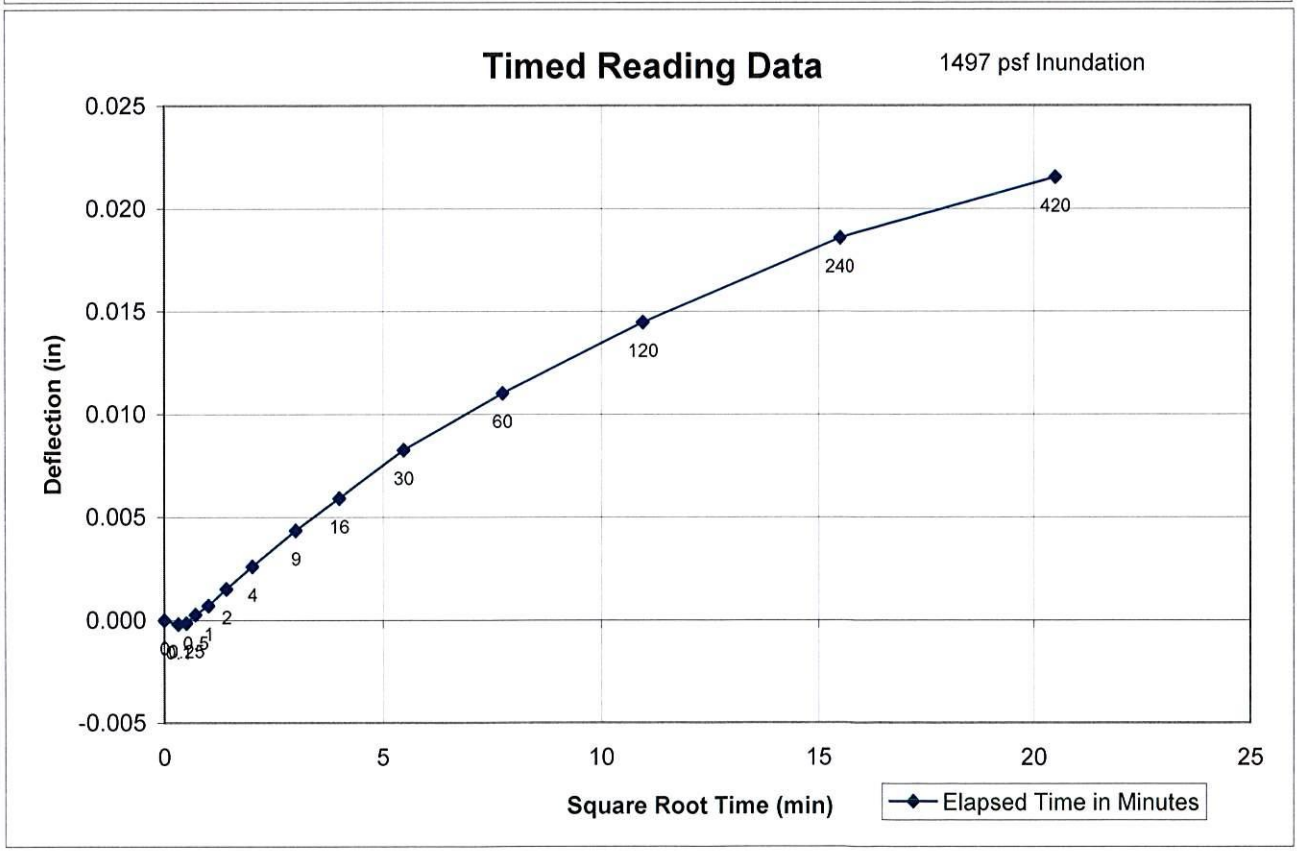
Elapsed Time (min)	SQRT Time (min)	Dial Reading (in)	Defl. (in)
0	0.00	0.00815	0.00000
0.1	0.32	0.00835	-0.00020
0.25	0.50	0.00830	-0.00015
0.5	0.71	0.00790	0.00025
1	1.00	0.00745	0.00070
2	1.41	0.00665	0.00150
4	2.00	0.00555	0.00260
9	3.00	0.00380	0.00435
16	4.00	0.00225	0.00590
30	5.48	-0.00010	0.00825
60	7.75	-0.00285	0.01100
120	10.95	-0.00630	0.01445
240	15.49	-0.01040	0.01855
420	20.49	-0.01335	0.02150

SWELL/COLLAPSE TEST

ASTM D4546 Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	BORING NO.	B-102, Bu-6 & B-104, Bu-3
PROJECT NO.	16104	DEPTH	Composite 10-20'
LOCATION	--	SAMPLE NO.	#1 101.5 pcf @ 16.4% mc





SWELL/COLLAPSE TEST

ASTM D4546 Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	SAMPLED	-- --
PROJECT NO.	16104	TEST STARTED	09/20/2016 DPM
LOCATION	--	TEST FINISHED	09/21/2016 DPM
BORING NO.	B-102, Bu-6 & B-104, Bu-3	CONSOLIDOMETER	ATT-04
DEPTH	Composite 10-20'	SAMPLE DESCR.	--
SAMPLE NO.	#1 101.5 pcf @ 16.4% mc		
SAMPLE DIA.(in)	2.410	INITIAL HT.(in)	1.000
SPECIFIC GRAVITY	2.65	FINAL HT.(in)	0.992

MOISTURE/DENSITY DATA

	BEFORE TEST	AFTER TEST		BEFORE TEST	AFTER TEST
Wt. Soil & Ring(s) (g)	183.29	191.30	Wt. Wet Soil & Pan (g)	144.51	152.52
Wt. Ring(s) (g)	41.84	41.84	Wt. Dry Soil & Pan (g)	125.41	125.41
Wt. Soil (g)	141.45	149.46	Wt. Lost Moisture (g)	19.10	27.11
Wet Density (pcf)	118.1	125.8	Wt. of Pan Only (g)	3.06	3.06
Moisture Content (%)	15.61	22.16	Wt. of Dry Soil (g)	122.35	122.35
Dry Density (pcf)	102.2	103.0	Saturation (%)	67.14	97.30

	LOAD (psf)	CONSOL. (IN)	LOG p	CONSOL. (IN/IN)	DEFL. (IN/IN)	STRAIN (%)
	101	0.00000	2.003	0.00000	0.00000	0.0
	3998	0.00600	3.602	0.00600	-0.00600	-0.6
Inundate	3998	0.00790	3.602	0.00790	-0.00790	-0.8

Data entry by: KR Date: 9/22/2016

Data checked by: cal Date: 9/23/16

File Name: 2679_96_Swell-Consol_ASTMD4546_R0_29.xls

SWELL/COLLAPSE TEST

ASTM D4546 Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	SAMPLED	-- --
PROJECT NO.	16104	TEST STARTED	09/20/2016 DPM
LOCATION	--	TEST FINISHED	09/21/2016 DPM
BORING NO.	B-102, Bu-6 & B-104, Bu-3	CONSOLIDOMETER	ATT-04
DEPTH	Composite 10-20'	SAMPLE DESCR.	--
SAMPLE NO.	#1 101.5 pcf @ 16.4% mc		

Timed Reading Data

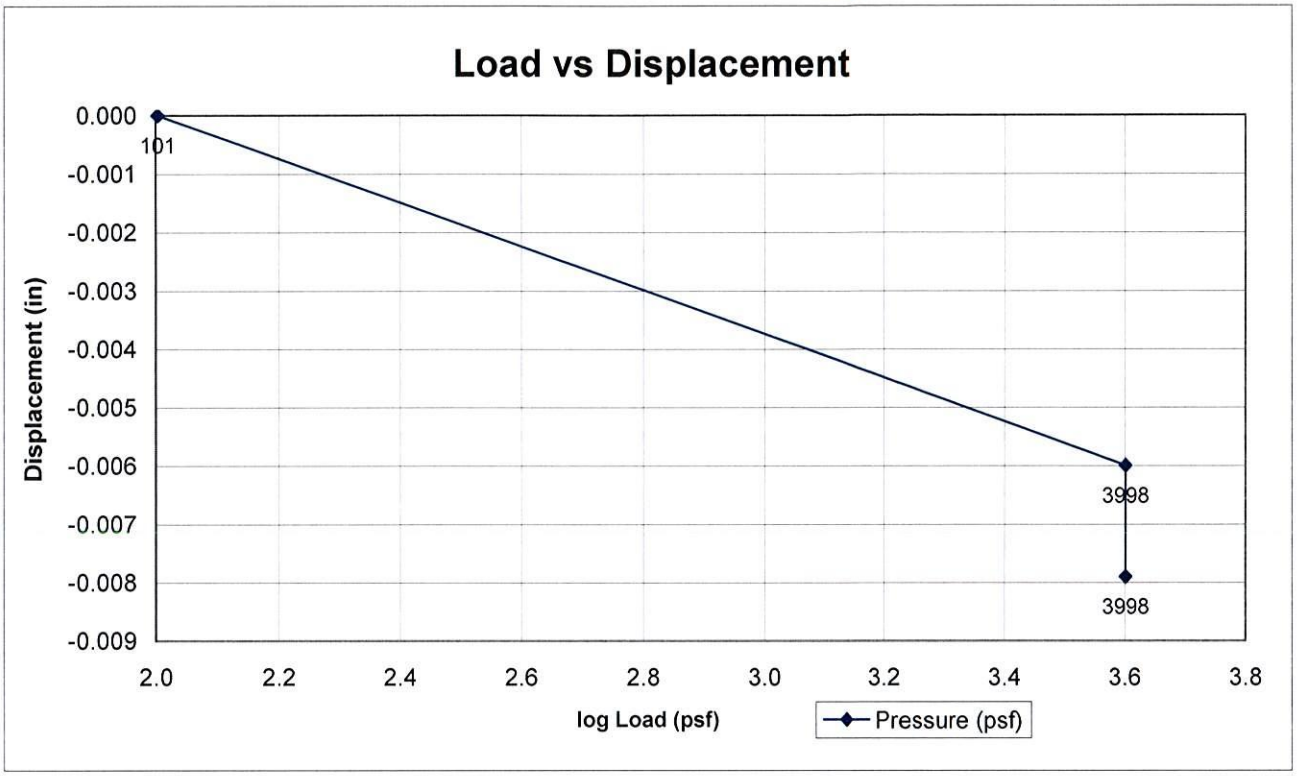
3998 psf Inundation Load

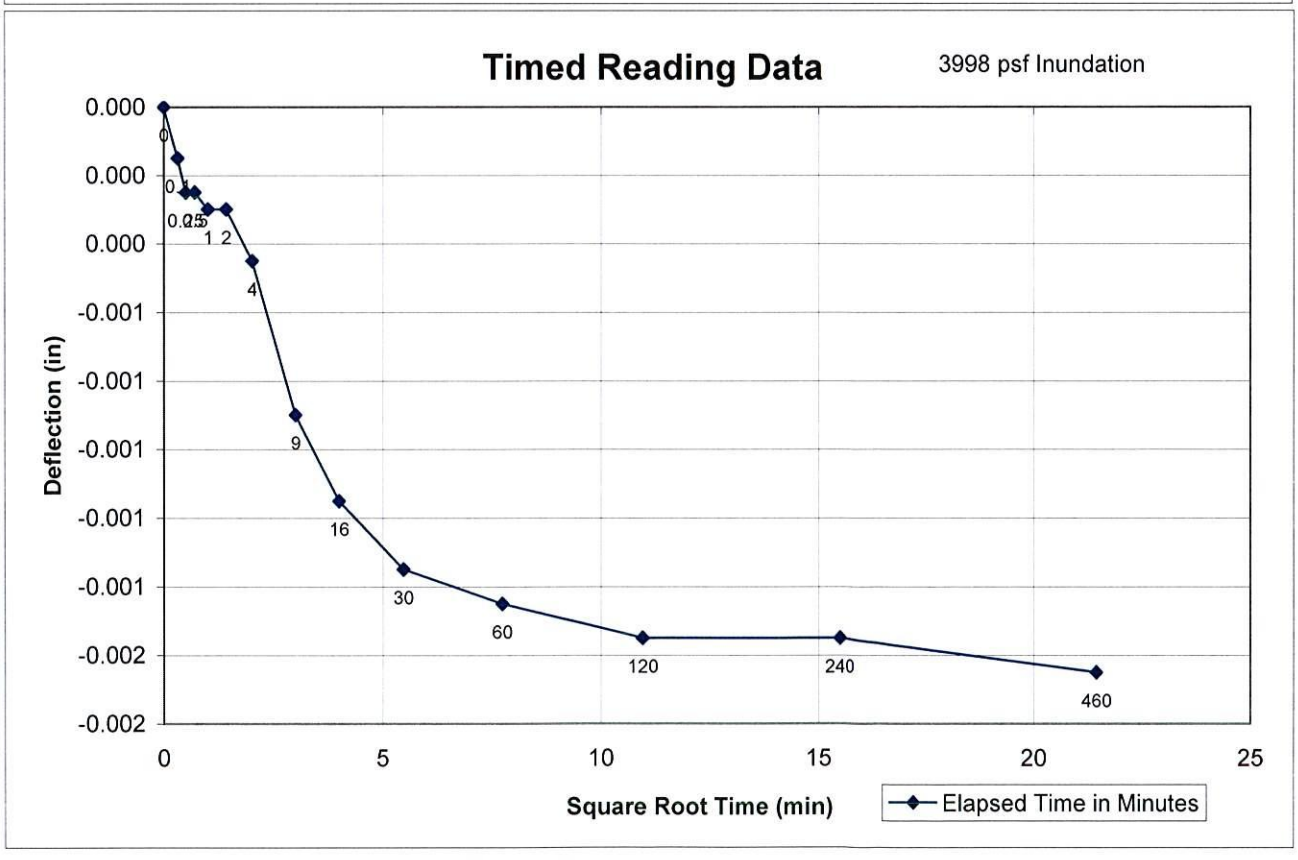
Elapsed Time (min)	SQRT Time (min)	Dial Reading (in)	Defl. (in)
0	0.00	0.01440	0.00000
0.1	0.32	0.01455	-0.00015
0.25	0.50	0.01465	-0.00025
0.5	0.71	0.01465	-0.00025
1	1.00	0.01470	-0.00030
2	1.41	0.01470	-0.00030
4	2.00	0.01485	-0.00045
9	3.00	0.01530	-0.00090
16	4.00	0.01555	-0.00115
30	5.48	0.01575	-0.00135
60	7.75	0.01585	-0.00145
120	10.95	0.01595	-0.00155
240	15.49	0.01595	-0.00155
460	21.45	0.01605	-0.00165

SWELL/COLLAPSE TEST

ASTM D4546 Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	BORING NO.	B-102, Bu-6 & B-104, Bu-3
PROJECT NO.	16104	DEPTH	Composite 10-20'
LOCATION	--	SAMPLE NO.	#1 101.5 pcf @ 16.4% mc





SWELL/COLLAPSE TEST

ASTM D4546 Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	SAMPLED	-- --
PROJECT NO.	16104	TEST STARTED	09/20/2016 DPM
LOCATION	--	TEST FINISHED	09/21/2016 DPM
BORING NO.	B-102, Bu-6 & B-104, Bu-3	CONSOLIDOMETER	ATT-06
DEPTH	Composite 10-20'	SAMPLE DESCR.	--
SAMPLE NO.	#1 101.5 pcf @ 16.4% mc		
SAMPLE DIA.(in)	2.410	INITIAL HT.(in)	1.000
SPECIFIC GRAVITY	2.65	FINAL HT.(in)	0.982

MOISTURE/DENSITY DATA

	BEFORE TEST	AFTER TEST		BEFORE TEST	AFTER TEST
Wt. Soil & Ring(s) (g)	182.67	189.82	Wt. Wet Soil & Pan (g)	144.48	151.64
Wt. Ring(s) (g)	41.28	41.28	Wt. Dry Soil & Pan (g)	125.39	125.39
Wt. Soil (g)	141.38	148.54	Wt. Lost Moisture (g)	19.09	26.25
Wet Density (pcf)	118.1	126.3	Wt. of Pan Only (g)	3.10	3.10
Moisture Content (%)	15.61	21.46	Wt. of Dry Soil (g)	122.29	122.29
Dry Density (pcf)	102.1	104.0	Saturation (%)	67.05	96.67

	LOAD (psf)	CONSOL. (IN)	LOG p	CONSOL. (IN/IN)	DEFL. (IN/IN)	STRAIN (%)
	103	0.00000	2.011	0.00000	0.00000	0.0
	6000	0.00790	3.778	0.00790	-0.00790	-0.8
Inundate	6000	0.01770	3.778	0.01770	-0.01770	-1.8

Data entry by: KR Date: 9/22/2016

Data checked by: CM Date: 9/23/16

File Name: 2679_96_Swell-Consol_ASTMD4546_R0_28.xls

SWELL/COLLAPSE TEST

ASTM D4546 Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	SAMPLED	-- --
PROJECT NO.	16104	TEST STARTED	09/20/2016 DPM
LOCATION	--	TEST FINISHED	09/21/2016 DPM
BORING NO.	B-102, Bu-6 & B-104, Bu-3	CONSOLIDOMETER	ATT-06
DEPTH	Composite 10-20'	SAMPLE DESCR.	--
SAMPLE NO.	#1 101.5 pcf @ 16.4% mc		

Timed Reading Data

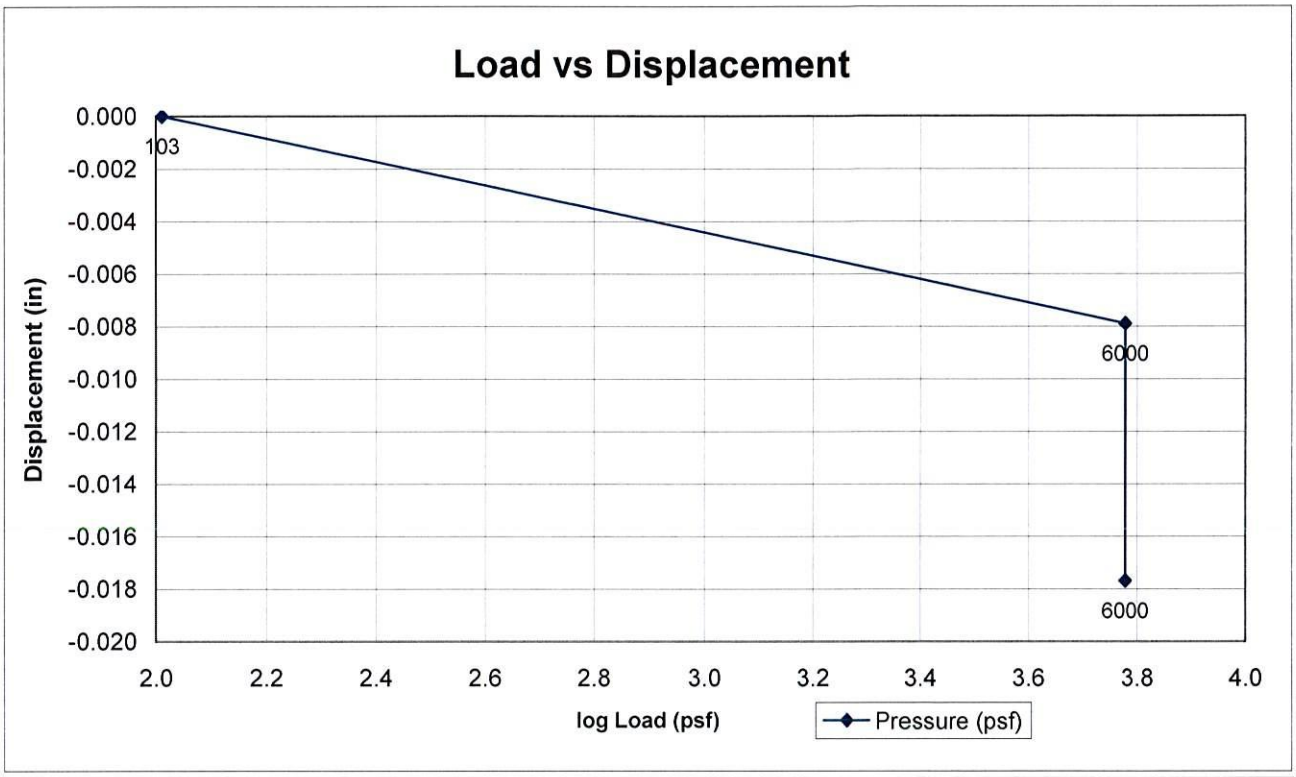
6000 psf Inundation Load

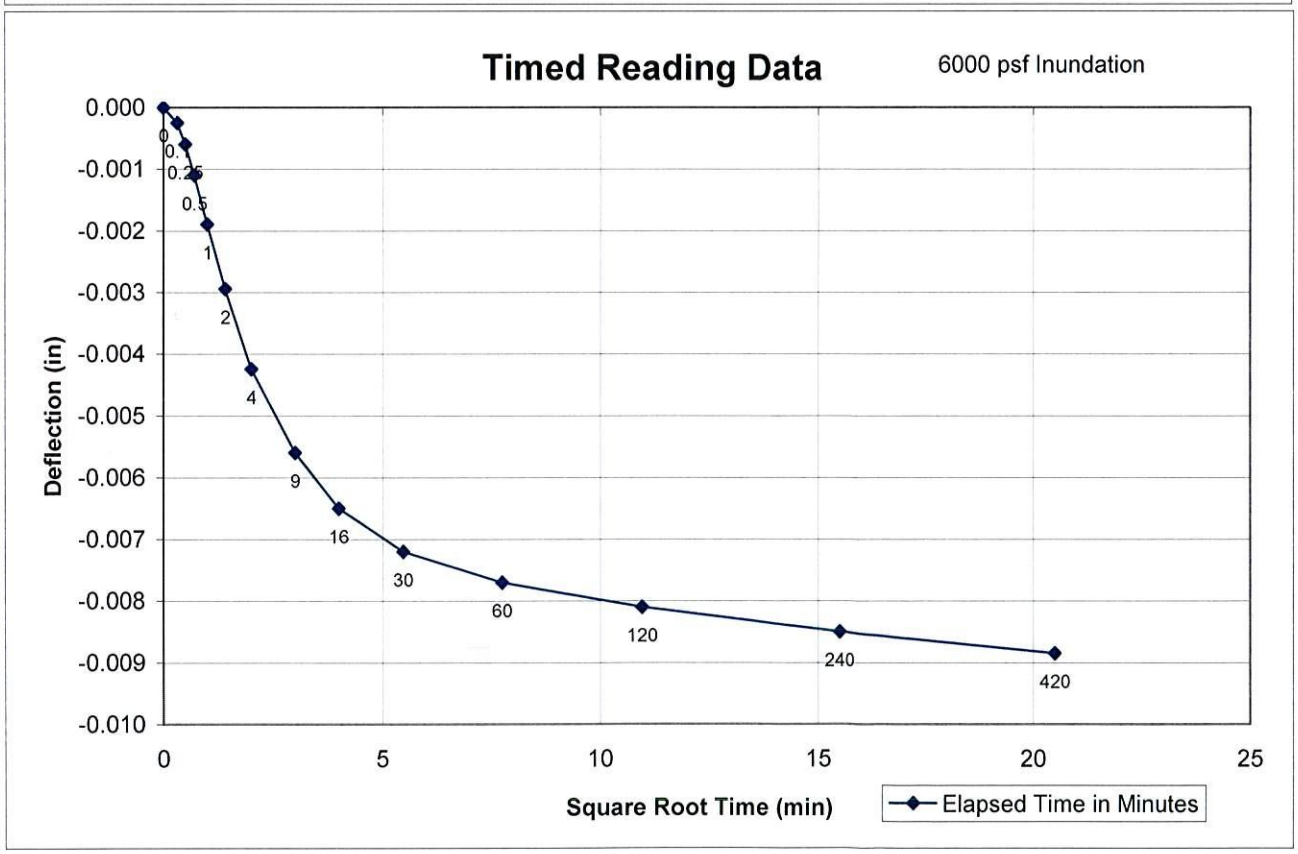
Elapsed Time (min)	SQRT Time (min)	Dial Reading (in)	Defl. (in)
0	0.00	0.01450	0.00000
0.1	0.32	0.01475	-0.00025
0.25	0.50	0.01510	-0.00060
0.5	0.71	0.01560	-0.00110
1	1.00	0.01640	-0.00190
2	1.41	0.01745	-0.00295
4	2.00	0.01875	-0.00425
9	3.00	0.02010	-0.00560
16	4.00	0.02100	-0.00650
30	5.48	0.02170	-0.00720
60	7.75	0.02220	-0.00770
120	10.95	0.02260	-0.00810
240	15.49	0.02300	-0.00850
420	20.49	0.02335	-0.00885

SWELL/COLLAPSE TEST

ASTM D4546 Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	BORING NO.	B-102, Bu-6 & B-104, Bu-3
PROJECT NO.	16104	DEPTH	Composite 10-20'
LOCATION	--	SAMPLE NO.	#1 101.5 pcf @ 16.4% mc





SWELL/COLLAPSE TEST

ASTM D4546 Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	SAMPLED	-- --
PROJECT NO.	16104	TEST STARTED	09/23/2016 DPM
LOCATION	--	TEST FINISHED	09/26/2016 DPM
BORING NO.	B-102, Bu-6 & B-104, Bu-3	CONSOLIDOMETER	ATT-01
DEPTH	Composite 10-20'	SAMPLE DESCR.	20 PSF
SAMPLE NO.	#2 104.4pcf, 18.6mc		
SAMPLE DIA.(in)	2.410	INITIAL HT.(in)	1.000
SPECIFIC GRAVITY	2.65	FINAL HT.(in)	1.084

MOISTURE/DENSITY DATA

	BEFORE TEST	AFTER TEST		BEFORE TEST	AFTER TEST
Wt. Soil & Ring(s) (g)	188.86	198.56	Wt. Wet Soil & Pan (g)	151.17	160.88
Wt. Ring(s) (g)	40.76	40.76	Wt. Dry Soil & Pan (g)	128.86	128.86
Wt. Soil (g)	148.10	157.80	Wt. Lost Moisture (g)	22.31	32.01
Wet Density (pcf)	123.7	121.6	Wt. of Pan Only (g)	3.07	3.07
Moisture Content (%)	17.74	25.45	Wt. of Dry Soil (g)	125.79	125.79
Dry Density (pcf)	105.1	96.9	Saturation (%)	82.18	95.75

	LOAD (psf)	CONSOL. (IN)	LOG p	CONSOL. (IN/IN)	DEFL. (IN/IN)	STRAIN (%)
	20	0.0000	1.301	0.0000	0.0000	0.0
	20	0.0000	1.301	0.0000	0.0000	0.0
Inundate	20	-0.0842	1.301	-0.0842	0.0842	8.4

Data entry by: DPM/KR Date: 9/26/2016

Data checked by: cpc Date: 9/27/16

File Name: 2679_96_Swell-Consol_ASTMD4546_R0_34.xls

SWELL/COLLAPSE TEST

ASTM D4546 Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	SAMPLED	-- --
PROJECT NO.	16104	TEST STARTED	09/23/2016 DPM
LOCATION	--	TEST FINISHED	09/26/2016 DPM
BORING NO.	B-102, Bu-6 & B-104, Bu-3	CONSOLIDOMETER	ATT-01
DEPTH	Composite 10-20'	SAMPLE DESCR.	20 PSF
SAMPLE NO.	#2 104.4pcf, 18.6mc		

Timed Reading Data

20 psf Inundation Load

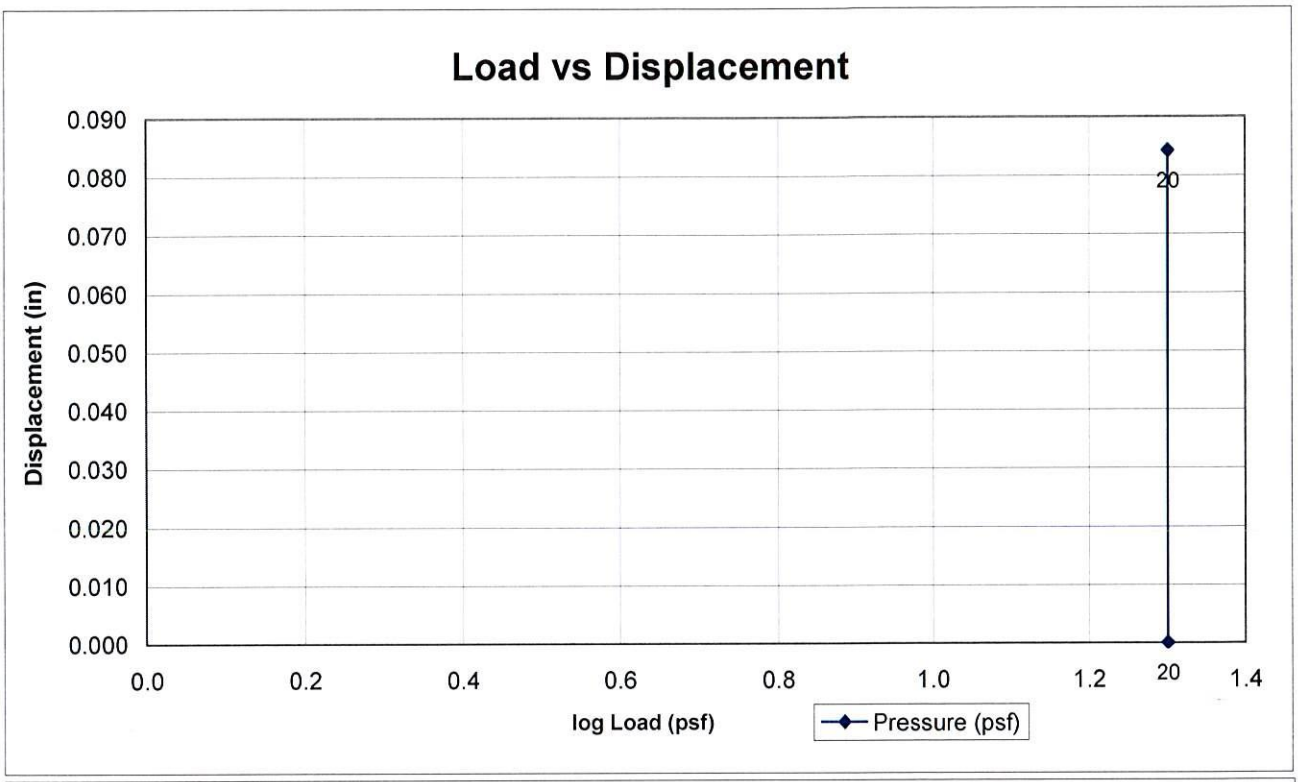
Elapsed Time (min)	SQRT Time (min)	Dial Reading (in)	Defl. (in)
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0.1	0.32	0.2885	0.0001
0.25	0.50	0.2884	0.0002
0.5	0.71	0.2881	0.0005
1	1.00	0.2861	0.0025
2	1.41	0.2841	0.0045
4	2.00	0.2801	0.0085
9	3.00	0.2746	0.0140
16	4.00	0.2700	0.0186
30	5.48	0.2646	0.0240
60	7.75	0.2562	0.0324
120	10.95	0.2461	0.0425
240	15.49	0.2331	0.0555
420	20.49	0.2201	0.0685

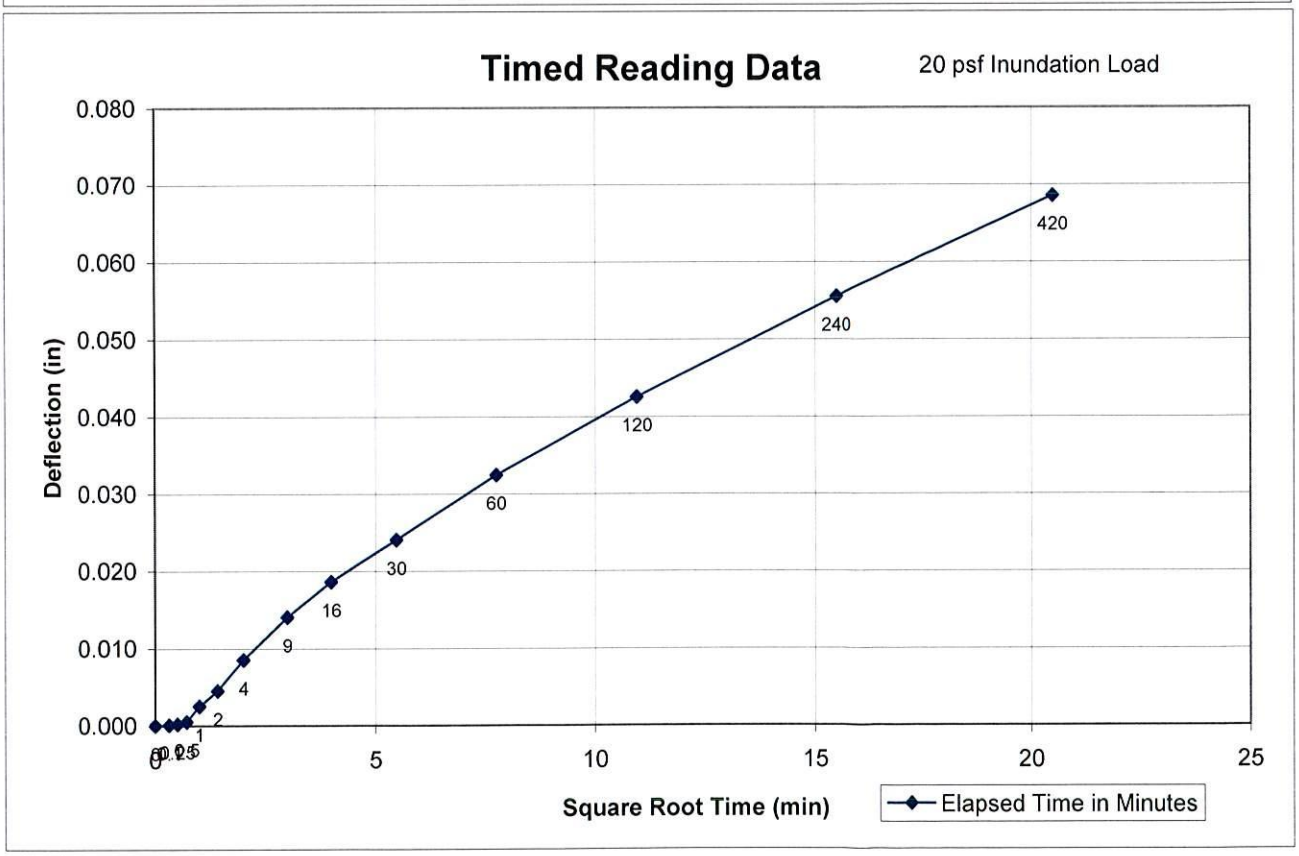
File Name: 2679_96_Swell-Consol_ASTMD4546_R0_34.xls

SWELL/COLLAPSE TEST

ASTM D4546 Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	BORING NO.	B-102, Bu-6 & B-104, Bu-3
PROJECT NO.	16104	DEPTH	Composite 10-20'
LOCATION	--	SAMPLE NO.	#2 104.4pcf, 18.6mc





SWELL/COLLAPSE TEST

ASTM D4546 Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	SAMPLED	-- --
PROJECT NO.	16104	TEST STARTED	09/21/2016 DPM
LOCATION	--	TEST FINISHED	09/22/2016 DPM
BORING NO.	B-102, Bu-6 & B-104, Bu-3	CONSOLIDOMETER	ATT-03
DEPTH	Composite 10-20'	SAMPLE DESCR.	1500PSF
SAMPLE NO.	#2 104.4 pcf @ 18.6% mc		
SAMPLE DIA.(in)	2.410	INITIAL HT.(in)	1.000
SPECIFIC GRAVITY	2.65	FINAL HT.(in)	1.017

MOISTURE/DENSITY DATA

	BEFORE TEST	AFTER TEST		BEFORE TEST	AFTER TEST
Wt. Soil & Ring(s) (g)	190.79	195.56	Wt. Wet Soil & Pan (g)	151.24	156.02
Wt. Ring(s) (g)	42.63	42.63	Wt. Dry Soil & Pan (g)	129.01	129.01
Wt. Soil (g)	148.15	152.93	Wt. Lost Moisture (g)	22.23	27.01
Wet Density (pcf)	123.7	125.6	Wt. of Pan Only (g)	3.09	3.09
Moisture Content (%)	17.65	21.45	Wt. of Dry Soil (g)	125.93	125.93
Dry Density (pcf)	105.2	103.4	Saturation (%)	82.02	95.19

	LOAD (psf)	CONSOL. (IN)	LOG p	CONSOL. (IN/IN)	DEFL. (IN/IN)	STRAIN (%)
	101	0.00000	2.006	0.00000	0.00000	0.0
	1497	0.00250	3.175	0.00250	-0.00250	-0.3
Inundate	1497	-0.01700	3.175	-0.01700	0.01700	1.7

Data entry by: DPM Date: 9/26/2016

Data checked by: ak Date: 9/26/16

File Name: 2679_96_Swell-Consol_ASTMD4546_R0_32.xls

SWELL/COLLAPSE TEST

ASTM D4546 Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	SAMPLED	-- --
PROJECT NO.	16104	TEST STARTED	09/21/2016 DPM
LOCATION	--	TEST FINISHED	09/22/2016 DPM
BORING NO.	B-102, Bu-6 & B-104, Bu-3	CONSOLIDOMETER	ATT-03
DEPTH	Composite 10-20'	SAMPLE DESCR.	1500PSF
SAMPLE NO.	#2 104.4 pcf @ 18.6% mc		

Timed Reading Data

1500 psf Inundation Load

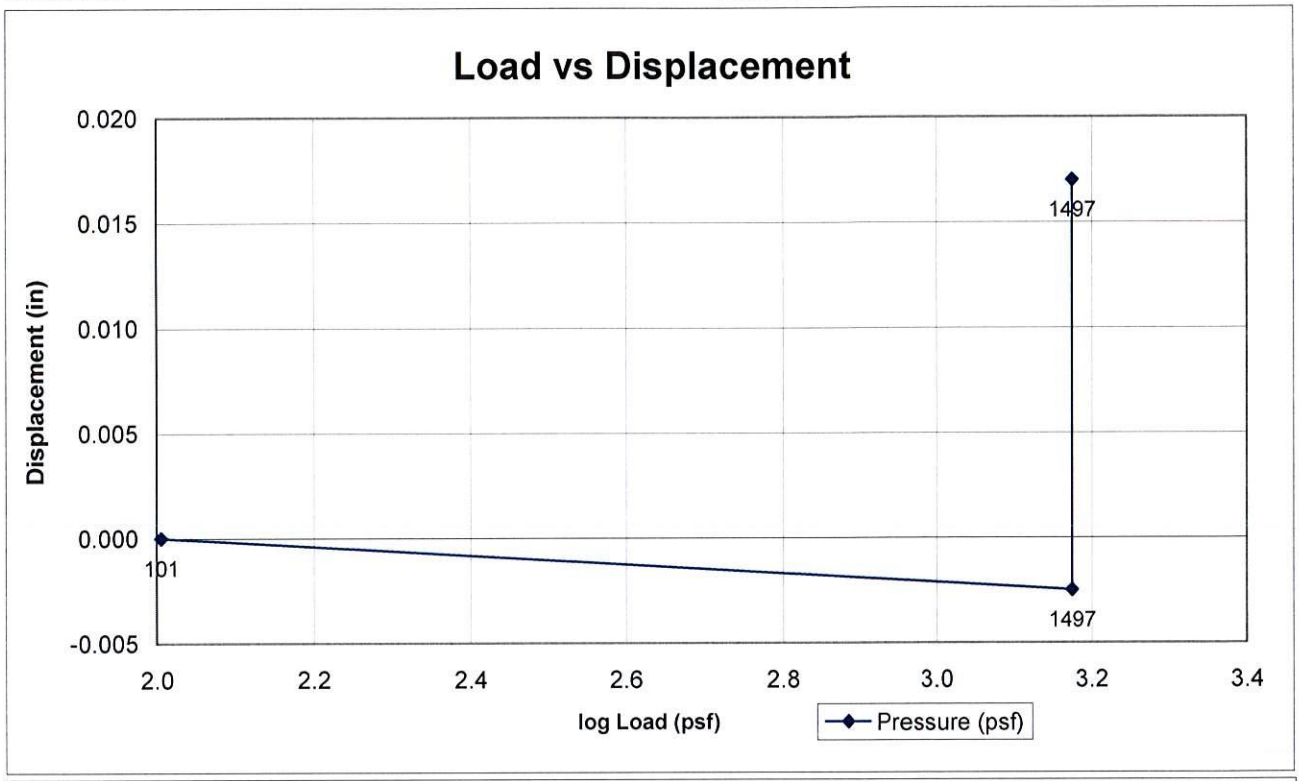
Elapsed Time (min)	SQRT Time (min)	Dial Reading (in)	Defl. (in)
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0.1	0.32	0.00915	-0.00005
0.25	0.50	0.00900	0.00010
0.5	0.71	0.00880	0.00030
1	1.00	0.00840	0.00070
2	1.41	0.00795	0.00115
4	2.00	0.00725	0.00185
9	3.00	0.00630	0.00280
16	4.00	0.00540	0.00370
30	5.48	0.00415	0.00495
60	7.75	0.00235	0.00675
120	10.95	0.00020	0.00890
240	15.49	-0.00280	0.01190
420	20.49	-0.00540	0.01450
1144	33.82	-0.00970	0.01880
1444	38.00	-0.01040	0.01950

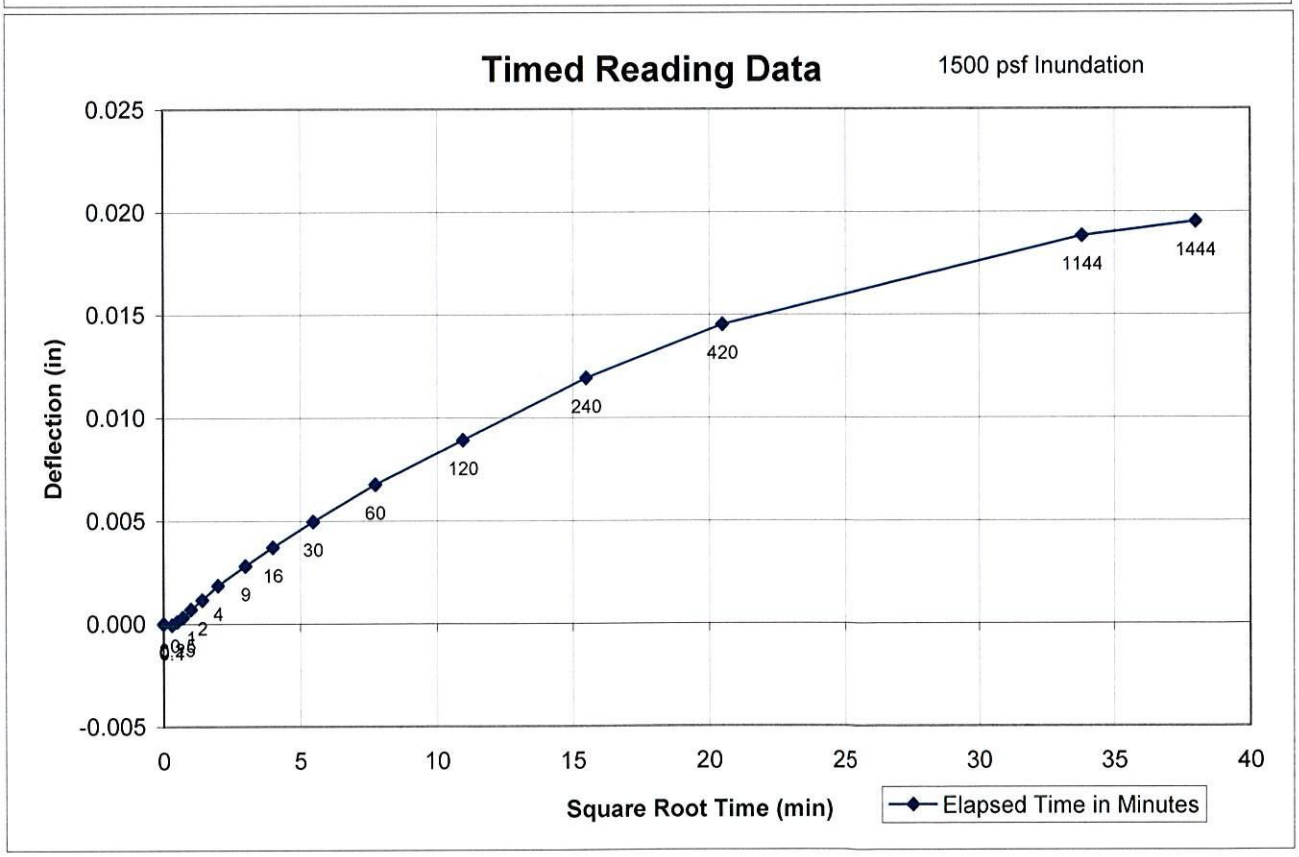
File Name: 2679_96_Swell-Consol_ASTMD4546_R0_32.xls

SWELL/COLLAPSE TEST

ASTM D4546 Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	BORING NO.	B-102, Bu-6 & B-104, Bu-3
PROJECT NO.	16104	DEPTH	Composite 10-20'
LOCATION	--	SAMPLE NO.	#2 104.4 pcf @ 18.6% mc





SWELL/COLLAPSE TEST

ASTM D4546 Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	SAMPLED	-- --
PROJECT NO.	16104	TEST STARTED	09/21/2016 DPM
LOCATION	--	TEST FINISHED	09/22/2016 DPM
BORING NO.	B-102, Bu-6 & B-104, Bu-3	CONSOLIDOMETER	ATT-04
DEPTH	Composite 10-20'	SAMPLE DESCR.	4000PSF
SAMPLE NO.	#2 104.4 pcf @ 18.6% mc		
SAMPLE DIA.(in)	2.410	INITIAL HT.(in)	1.000
SPECIFIC GRAVITY	2.65	FINAL HT.(in)	0.997

MOISTURE/DENSITY DATA

	BEFORE TEST	AFTER TEST		BEFORE TEST	AFTER TEST
Wt. Soil & Ring(s) (g)	189.14	193.09	Wt. Wet Soil & Pan (g)	151.24	155.19
Wt. Ring(s) (g)	40.97	40.97	Wt. Dry Soil & Pan (g)	128.97	128.97
Wt. Soil (g)	148.17	152.12	Wt. Lost Moisture (g)	22.27	26.22
Wet Density (pcf)	123.7	127.4	Wt. of Pan Only (g)	3.07	3.07
Moisture Content (%)	17.69	20.82	Wt. of Dry Soil (g)	125.90	125.90
Dry Density (pcf)	105.1	105.5	Saturation (%)	82.15	97.52

	LOAD (psf)	CONSOL. (IN)	LOG p	CONSOL. (IN/IN)	DEFL. (IN/IN)	STRAIN (%)
	101	0.00000	2.003	0.00000	0.00000	0.0
	3998	0.00715	3.602	0.00715	-0.00715	-0.7
Inundate	3998	0.00305	3.602	0.00305	-0.00305	-0.3

Data entry by: DPM Date: 9/26/2016

Data checked by: DPM Date: 9/26/16

File Name: 2679_96_Swell-Consol_ASTMD4546_R0_33.xls

SWELL/COLLAPSE TEST

ASTM D4546 Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	SAMPLED	-- --
PROJECT NO.	16104	TEST STARTED	09/21/2016 DPM
LOCATION	--	TEST FINISHED	09/22/2016 DPM
BORING NO.	B-102, Bu-6 & B-104, Bu-3	CONSOLIDOMETER	ATT-04
DEPTH	Composite 10-20'	SAMPLE DESCR.	4000PSF
SAMPLE NO.	#2 104.4 pcf @ 18.6% mc		

Timed Reading Data

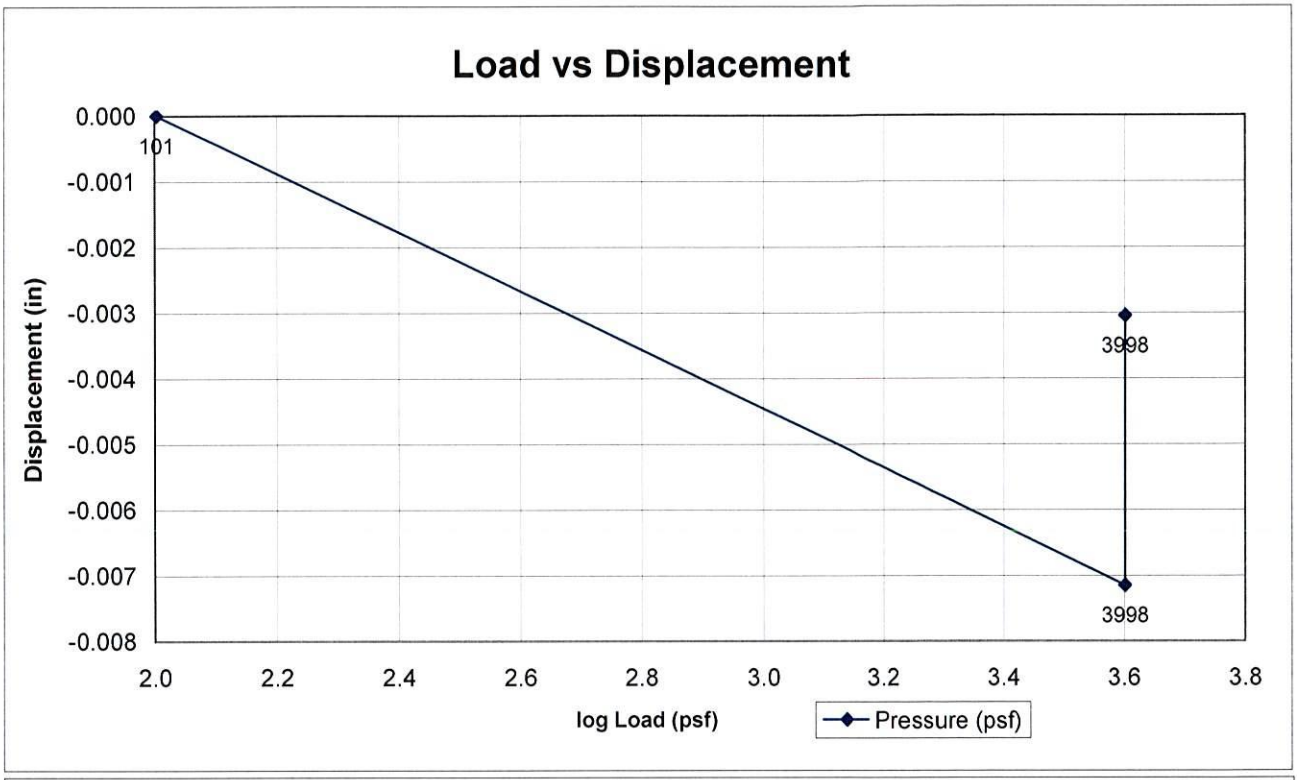
3998 psf Inundation Load

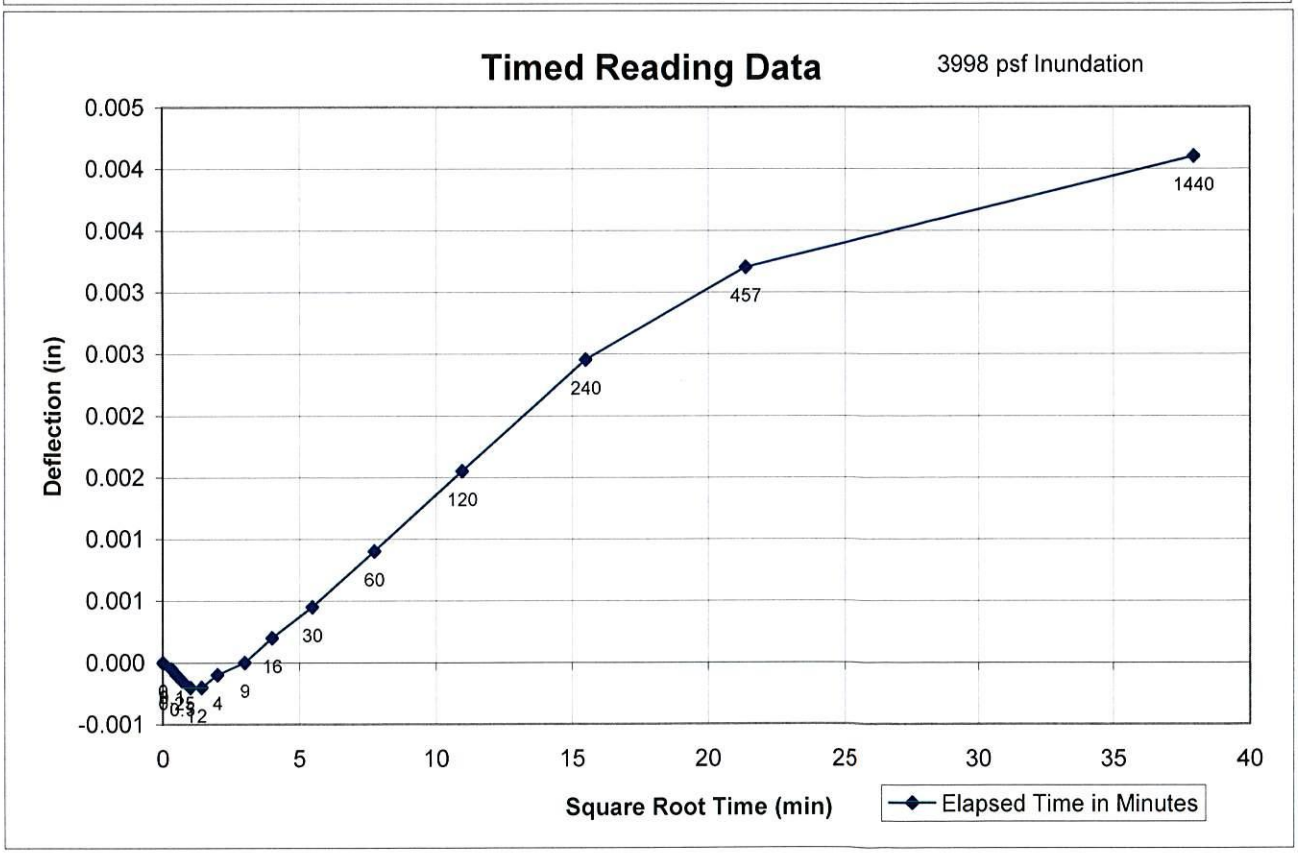
Elapsed Time (min)	SQRT Time (min)	Dial Reading (in)	Defl. (in)
0	0.00	0.01555	0.00000
0.1	0.32	0.01560	-0.00005
0.25	0.50	0.01565	-0.00010
0.5	0.71	0.01570	-0.00015
1	1.00	0.01575	-0.00020
2	1.41	0.01575	-0.00020
4	2.00	0.01565	-0.00010
9	3.00	0.01555	0.00000
16	4.00	0.01535	0.00020
30	5.48	0.01510	0.00045
60	7.75	0.01465	0.00090
120	10.95	0.01400	0.00155
240	15.49	0.01310	0.00245
457	21.38	0.01235	0.00320
1440	37.95	0.01145	0.00410

SWELL/COLLAPSE TEST

ASTM D4546 Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	BORING NO.	B-102, Bu-6 & B-104, Bu-3
PROJECT NO.	16104	DEPTH	Composite 10-20'
LOCATION	--	SAMPLE NO.	#2 104.4 pcf @ 18.6% mc





SWELL/COLLAPSE TEST

ASTM D4546 Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	SAMPLED	-- --
PROJECT NO.	16104	TEST STARTED	09/21/2016 DPM
LOCATION	--	TEST FINISHED	09/22/2016 DPM
BORING NO.	B-102, Bu-6 & B-104, Bu-3	CONSOLIDOMETER	ATT-06
DEPTH	Composite 10-20'	SAMPLE DESCR.	6000PSF
SAMPLE NO.	#2 104.4 pcf @ 18.6% mc		
SAMPLE DIA.(in)	2.410	INITIAL HT.(in)	1.000
SPECIFIC GRAVITY	2.65	FINAL HT.(in)	0.990

MOISTURE/DENSITY DATA

	BEFORE TEST	AFTER TEST		BEFORE TEST	AFTER TEST
Wt. Soil & Ring(s) (g)	190.81	194.34	Wt. Wet Soil & Pan (g)	151.23	154.77
Wt. Ring(s) (g)	42.68	42.68	Wt. Dry Soil & Pan (g)	129.09	129.09
Wt. Soil (g)	148.13	151.67	Wt. Lost Moisture (g)	22.14	25.68
Wet Density (pcf)	123.7	127.9	Wt. of Pan Only (g)	3.10	3.10
Moisture Content (%)	17.57	20.38	Wt. of Dry Soil (g)	125.99	125.99
Dry Density (pcf)	105.2	106.3	Saturation (%)	81.76	97.47

	LOAD (psf)	CONSOL. (IN)	LOG p	CONSOL. (IN/IN)	DEFL. (IN/IN)	STRAIN (%)
	103	0.00000	2.011	0.00000	0.00000	0.0
	6000	0.00780	3.778	0.00780	-0.00780	-0.8
Inundate	6000	0.00985	3.778	0.00985	-0.00985	-1.0

Data entry by: DPM Date: 9/26/2016

Data checked by: CH Date: 9/26/16

File Name: 2679_96_Swell-Consol_ASTMD4546_R0_31.xls

SWELL/COLLAPSE TEST

ASTM D4546 Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	SAMPLED	-- --
PROJECT NO.	16104	TEST STARTED	09/21/2016 DPM
LOCATION	--	TEST FINISHED	09/22/2016 DPM
BORING NO.	B-102, Bu-6 & B-104, Bu-3	CONSOLIDOMETER	ATT-06
DEPTH	Composite 10-20'	SAMPLE DESCR.	6000PSF
SAMPLE NO.	#2 104.4 pcf @ 18.6% mc		

Timed Reading Data

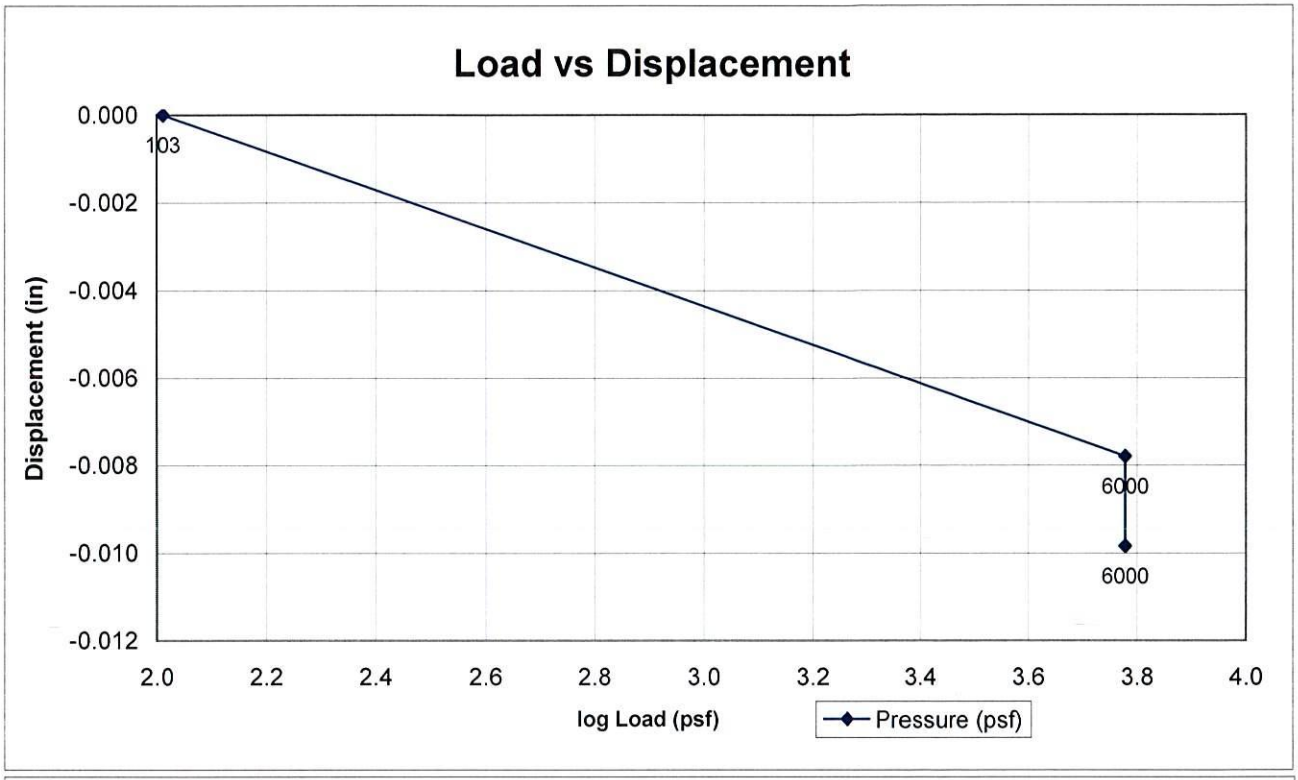
6000 psf Inundation Load

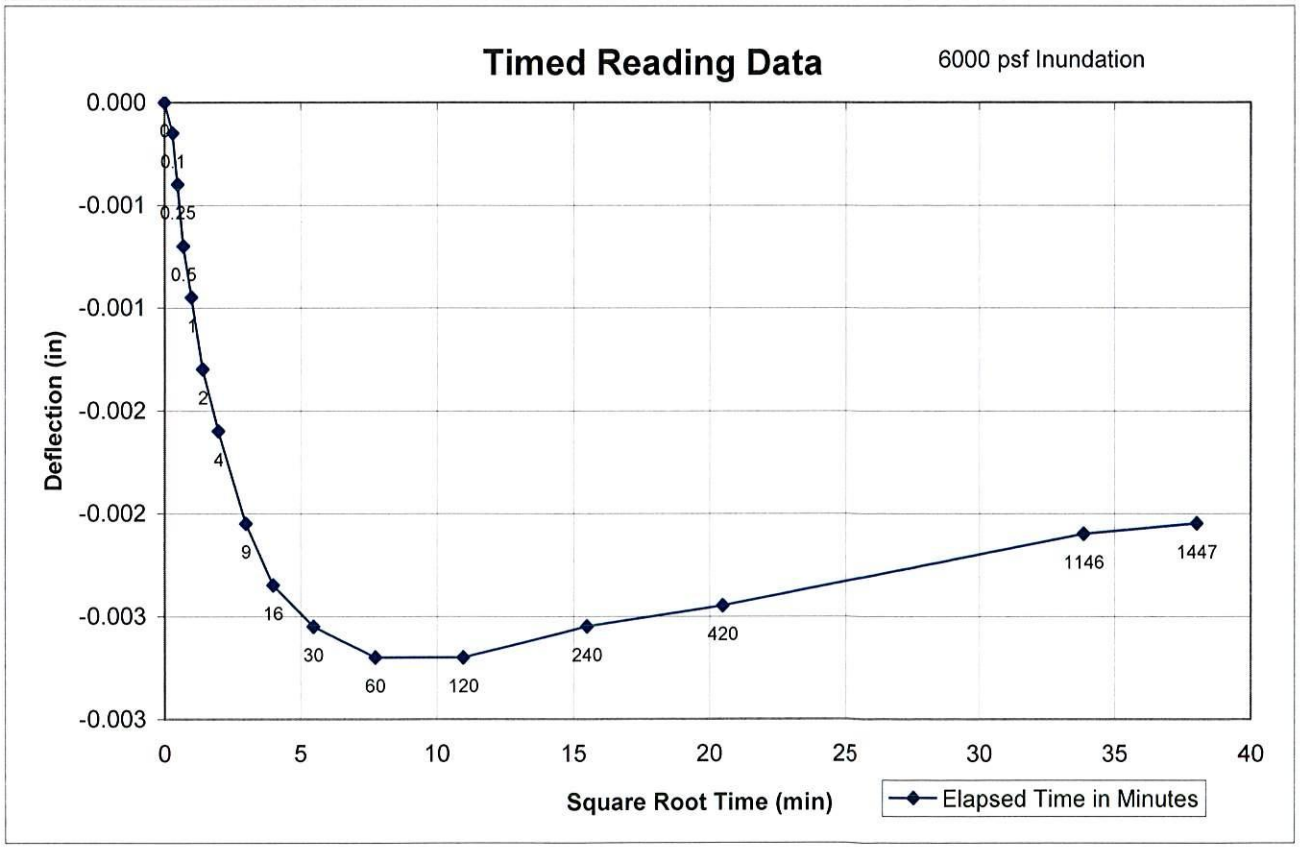
Elapsed Time (min)	SQRT Time (min)	Dial Reading (in)	Defl. (in)
0	0.00	0.01440	0.00000
0.1	0.32	0.01455	-0.00015
0.25	0.50	0.01480	-0.00040
0.5	0.71	0.01510	-0.00070
1	1.00	0.01535	-0.00095
2	1.41	0.01570	-0.00130
4	2.00	0.01600	-0.00160
9	3.00	0.01645	-0.00205
16	4.00	0.01675	-0.00235
30	5.48	0.01695	-0.00255
60	7.75	0.01710	-0.00270
120	10.95	0.01710	-0.00270
240	15.49	0.01695	-0.00255
420	20.49	0.01685	-0.00245
1146	33.85	0.01650	-0.00210
1447	38.04	0.01645	-0.00205

SWELL/COLLAPSE TEST

ASTM D4546 Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	BORING NO.	B-102, Bu-6 & B-104, Bu-3
PROJECT NO.	16104	DEPTH	Composite 10-20'
LOCATION	--	SAMPLE NO.	#2 104.4 pcf @ 18.6% mc





SWELL/COLLAPSE TEST

ASTM D4546 Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	SAMPLED	-- --
PROJECT NO.	16104	TEST STARTED	09/20/2016 DPM
LOCATION	--	TEST FINISHED	09/21/2016 DPM
BORING NO.	B-102 Bu-6, & B-104, Bu-3	CONSOLIDOMETER	ATT-1
DEPTH	Composite 10-20'	SAMPLE DESCR.	--
SAMPLE NO.	#3 101.5 pcf @18.6% mc		
SAMPLE DIA.(in)	2.410	INITIAL HT.(in)	1.000
SPECIFIC GRAVITY	2.65	FINAL HT.(in)	1.077

MOISTURE/DENSITY DATA

	BEFORE TEST	AFTER TEST		BEFORE TEST	AFTER TEST
Wt. Soil & Ring(s) (g)	185.97	195.54	Wt. Wet Soil & Pan (g)	147.13	156.70
Wt. Ring(s) (g)	41.93	41.93	Wt. Dry Soil & Pan (g)	125.06	125.06
Wt. Soil (g)	144.04	153.61	Wt. Lost Moisture (g)	22.08	31.64
Wet Density (pcf)	120.3	119.1	Wt. of Pan Only (g)	3.09	3.09
Moisture Content (%)	18.10	25.94	Wt. of Dry Soil (g)	121.96	121.96
Dry Density (pcf)	101.9	94.6	Saturation (%)	77.19	92.12

	LOAD (psf)	CONSOL. (IN)	LOG p	CONSOL. (IN/IN)	DEFL. (IN/IN)	STRAIN (%)
	20	0.0000	1.301	0.0000	0.0000	0.0
	20	-0.0006	1.301	-0.0006	0.0006	0.1
Inundate	20	-0.0771	1.301	-0.0771	0.0771	7.7

Data entry by: KR Date: 9/22/2016

Data checked by: CM Date: 9/23/16

File Name: 2679_96_Swell-Consol_ASTMD4546_R0_27.xls

SWELL/COLLAPSE TEST

ASTM D4546 Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	SAMPLED	-- --
PROJECT NO.	16104	TEST STARTED	09/20/2016 DPM
LOCATION	--	TEST FINISHED	09/21/2016 DPM
BORING NO.	B-102 Bu-6, & B-104, Bu-3	CONSOLIDOMETER	ATT-1
DEPTH	Composite 10-20'	SAMPLE DESCR.	--
SAMPLE NO.	#3 101.5 pcf @18.6% mc		

Timed Reading Data

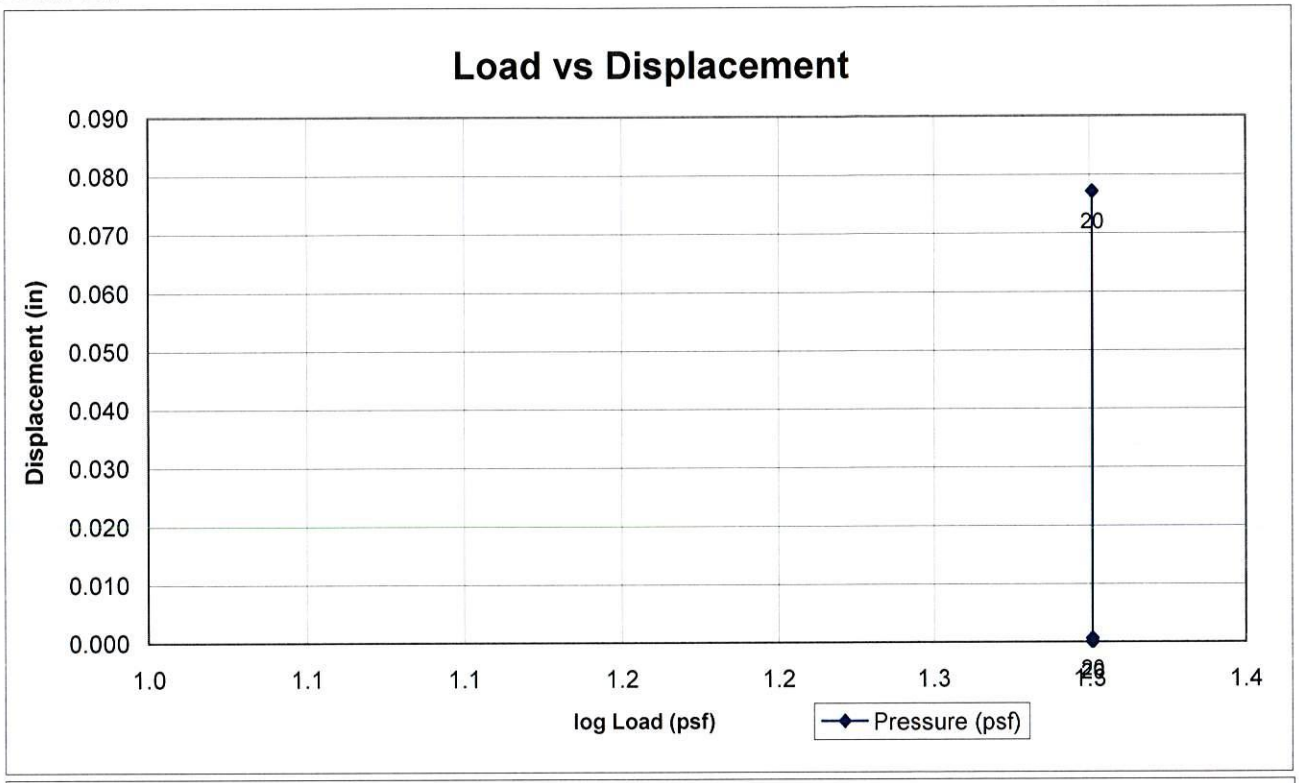
20 psf Inundation Load

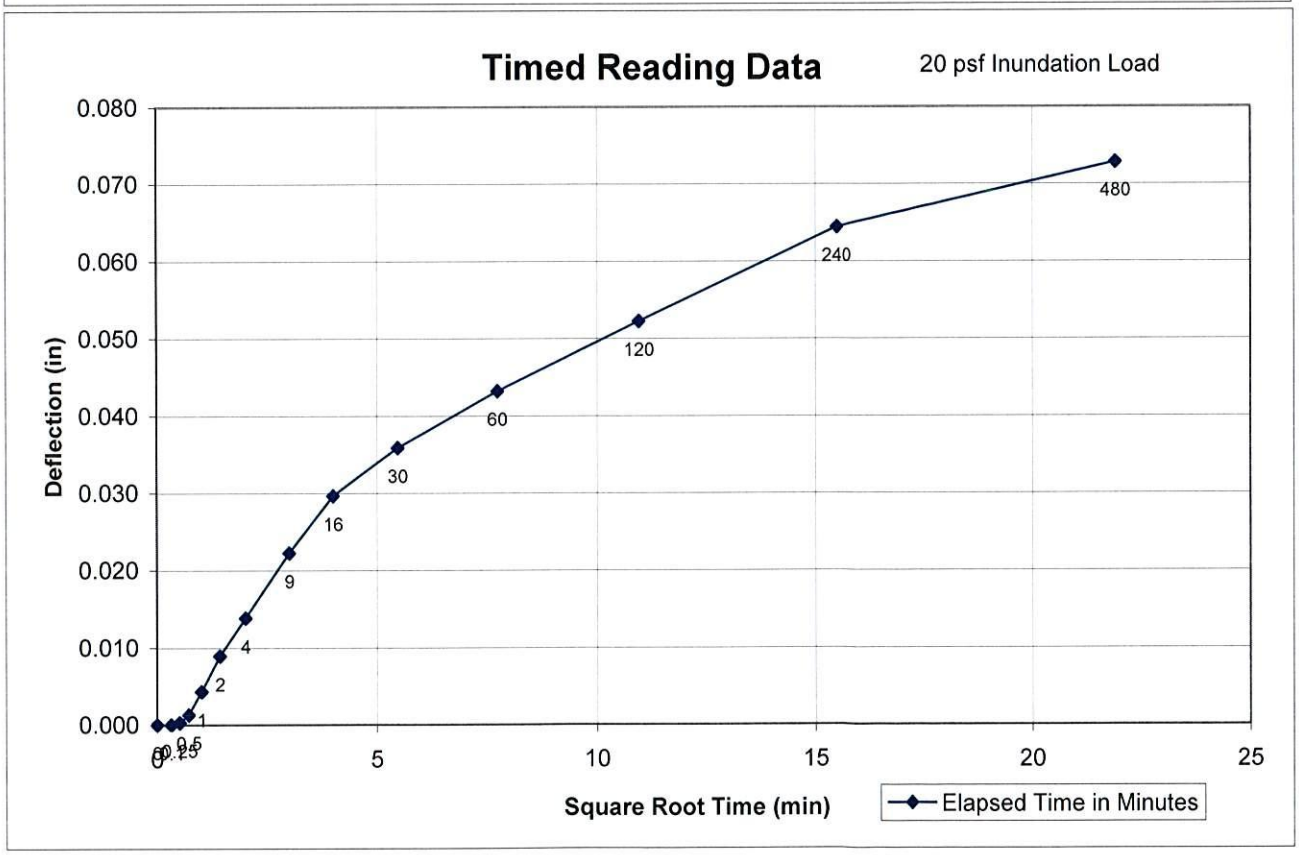
Elapsed Time (min)	SQRT Time (min)	Dial Reading (in)	Defl. (in)
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0.1	0.32	0.2165	0.0000
0.25	0.50	0.2162	0.0003
0.5	0.71	0.2152	0.0013
1	1.00	0.2122	0.0043
2	1.41	0.2076	0.0089
4	2.00	0.2027	0.0138
9	3.00	0.1943	0.0222
16	4.00	0.1869	0.0296
30	5.48	0.1807	0.0358
60	7.75	0.1733	0.0432
120	10.95	0.1643	0.0522
240	15.49	0.1521	0.0644
480	21.91	0.1437	0.0728

SWELL/COLLAPSE TEST

ASTM D4546 Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	BORING NO.	B-102 Bu-6, & B-104, Bu-3
PROJECT NO.	16104	DEPTH	Composite 10-20'
LOCATION	--	SAMPLE NO.	#3 101.5 pcf @18.6% mc





SWELL/COLLAPSE TEST

ASTM D4546 ~~Method C (modified)~~ Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	SAMPLED	-- --
PROJECT NO.	16104	TEST STARTED	09/14/2016 DPM
LOCATION	--	TEST FINISHED	09/15/2016 DPM
BORING NO.	B-102, Bu-6 & B-104, Bu-3	CONSOLIDOMETER	ATT-03
DEPTH	Composite 10-20'	SAMPLE DESCR.	--
SAMPLE NO.	#3 101.5 pcf @ 18.6% mc		
SAMPLE DIA.(in)	2.410	INITIAL HT.(in)	1.000
SPECIFIC GRAVITY	2.65	FINAL HT.(in)	1.008

MOISTURE/DENSITY DATA

	BEFORE TEST	AFTER TEST		BEFORE TEST	AFTER TEST
Wt. Soil & Ring(s) (g)	186.19	191.83	Wt. Wet Soil & Pan (g)	147.12	152.76
Wt. Ring(s) (g)	42.16	42.16	Wt. Dry Soil & Pan (g)	124.90	124.90
Wt. Soil (g)	144.03	149.66	Wt. Lost Moisture (g)	22.22	27.86
Wet Density (pcf)	120.3	123.9	Wt. of Pan Only (g)	3.10	3.10
Moisture Content (%)	18.24	22.87	Wt. of Dry Soil (g)	121.81	121.81
Dry Density (pcf)	101.7	100.9	Saturation (%)	77.54	95.13

	LOAD (psf)	CONSOL. (IN)	LOG p	CONSOL. (IN/IN)	DEFL. (IN/IN)	STRAIN (%)
	101	0.00000	2.006	0.00000	0.00000	0.0
	1497	0.00270	3.175	0.00270	-0.00270	-0.3
Inundate	1497	-0.00840	3.175	-0.00840	0.00840	0.8

Data entry by: KR Date: 9/22/2016

Data checked by: CM Date: 9/23/16

File Name: 2679_96_Swell-Consol_ASTMD4546_R0_25.xls

SWELL/COLLAPSE TEST

ASTM D4546 ~~Method C (modified)~~ Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	SAMPLED	-- --
PROJECT NO.	16104	TEST STARTED	09/14/2016 DPM
LOCATION	--	TEST FINISHED	09/15/2016 DPM
BORING NO.	B-102, Bu-6 & B-104, Bu-3	CONSOLIDOMETER	ATT-03
DEPTH	Composite 10-20'	SAMPLE DESCR.	--
SAMPLE NO.	#3 101.5 pcf @ 18.6% mc		

Timed Reading Data

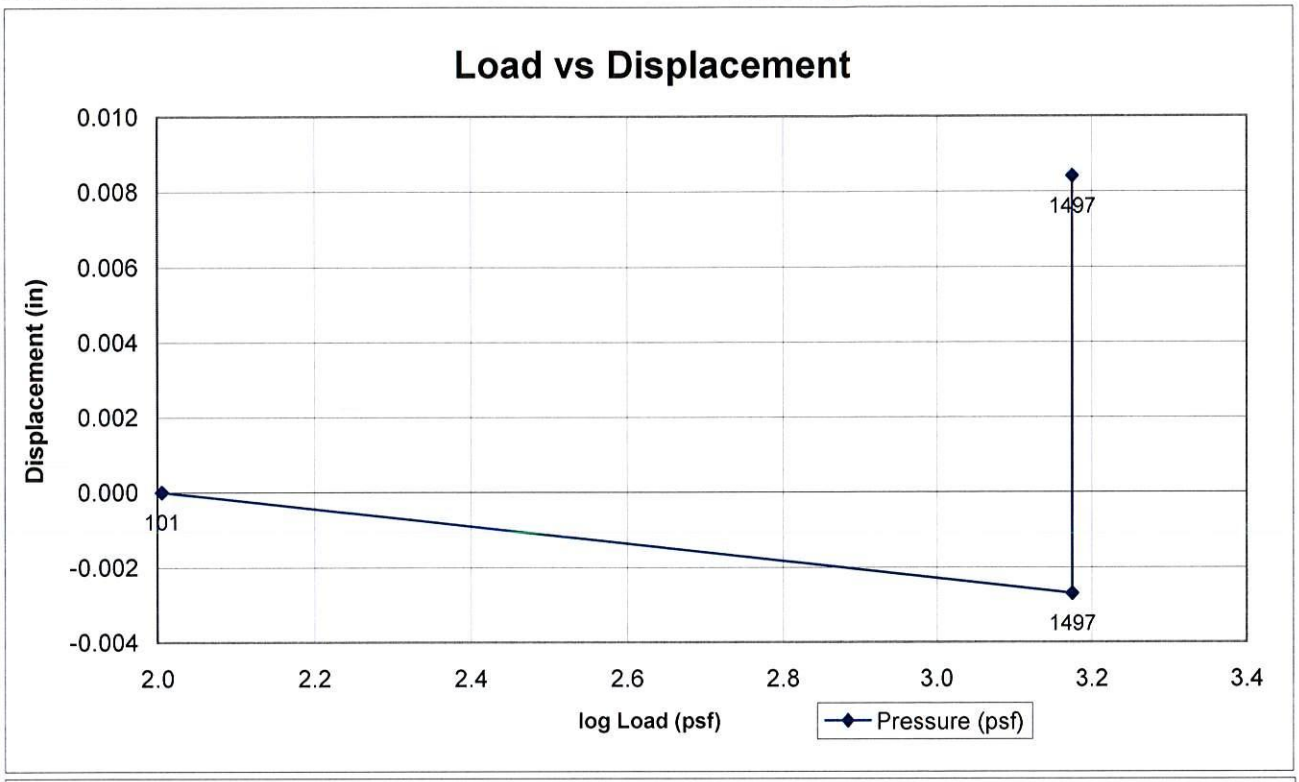
1497 psf Inundation Load

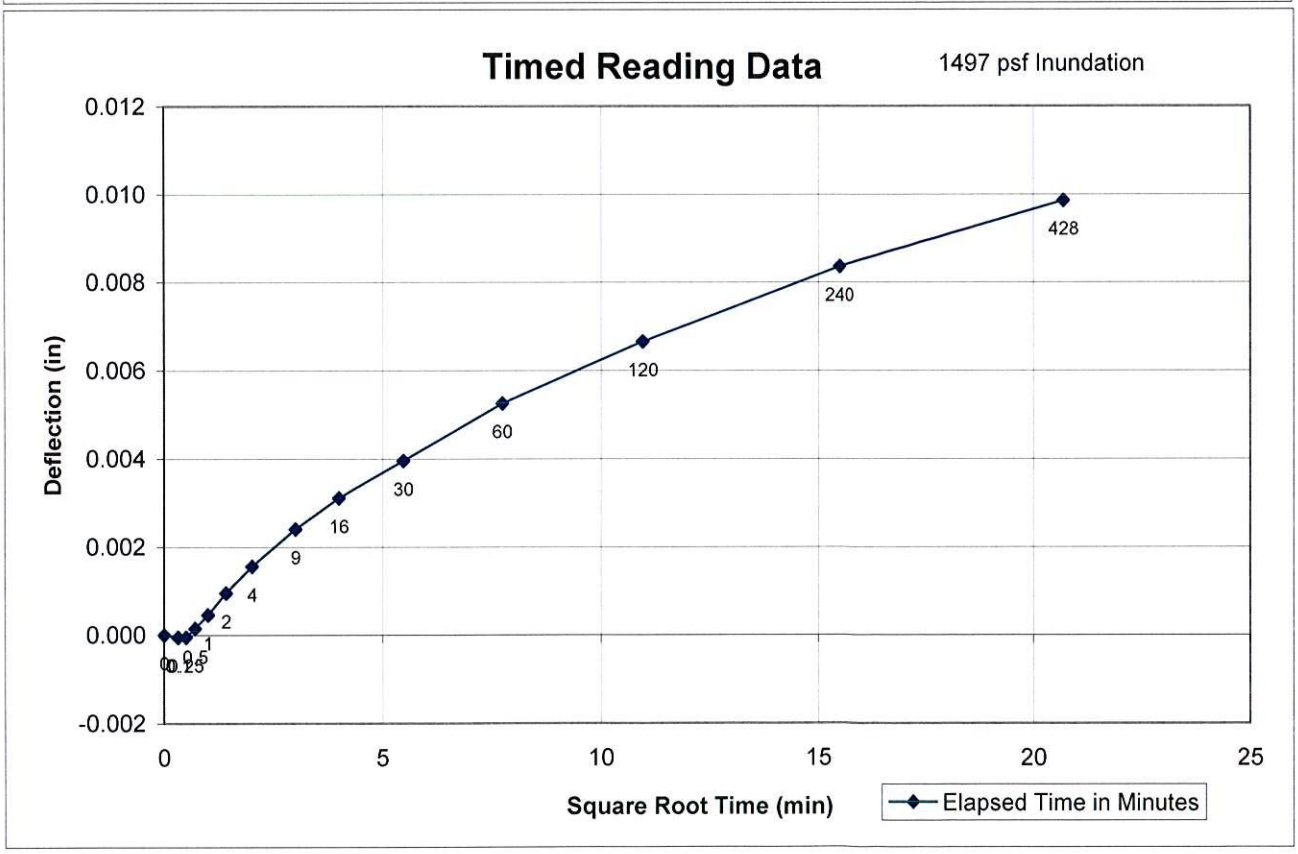
Elapsed Time (min)	SQRT Time (min)	Dial Reading (in)	Defl. (in)
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0.1	0.32	0.00935	-0.00005
0.25	0.50	0.00935	-0.00005
0.5	0.71	0.00915	0.00015
1	1.00	0.00885	0.00045
2	1.41	0.00835	0.00095
4	2.00	0.00775	0.00155
9	3.00	0.00690	0.00240
16	4.00	0.00620	0.00310
30	5.48	0.00535	0.00395
60	7.75	0.00405	0.00525
120	10.95	0.00265	0.00665
240	15.49	0.00095	0.00835
428	20.69	-0.00055	0.00985

SWELL/COLLAPSE TEST

ASTM D4546 ~~Method C (modified)~~ Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	BORING NO.	B-102, Bu-6 & B-104, Bu-3
PROJECT NO.	16104	DEPTH	Composite 10-20'
LOCATION	--	SAMPLE NO.	#3 101.5 pcf @ 18.6% mc





SWELL/COLLAPSE TEST

ASTM D4546 ~~Method C (modified)~~ Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	SAMPLED	-- --
PROJECT NO.	16104	TEST STARTED	09/14/2016 DPM
LOCATION	--	TEST FINISHED	09/15/2016 DPM
BORING NO.	B-102, Bu-6 & B-104, Bu-3	CONSOLIDOMETER	ATT-4
DEPTH	Composite 10-20'	SAMPLE DESCR.	--
SAMPLE NO.	#3 101.5 pcf @ 18.6% mc		
SAMPLE DIA.(in)	2.410	INITIAL HT.(in)	1.000
SPECIFIC GRAVITY	2.65	FINAL HT.(in)	0.982

MOISTURE/DENSITY DATA

	BEFORE TEST	AFTER TEST		BEFORE TEST	AFTER TEST
Wt. Soil & Ring(s) (g)	185.86	190.26	Wt. Wet Soil & Pan (g)	147.03	151.44
Wt. Ring(s) (g)	41.93	41.93	Wt. Dry Soil & Pan (g)	124.94	124.94
Wt. Soil (g)	143.93	148.33	Wt. Lost Moisture (g)	22.09	26.49
Wet Density (pcf)	120.2	126.2	Wt. of Pan Only (g)	3.11	3.11
Moisture Content (%)	18.13	21.74	Wt. of Dry Soil (g)	121.84	121.84
Dry Density (pcf)	101.8	103.6	Saturation (%)	77.11	97.06

	LOAD (psf)	CONSOL. (IN)	LOG p	CONSOL. (IN/IN)	DEFL. (IN/IN)	STRAIN (%)
	101	0.00000	2.003	0.00000	0.00000	0.0
	3998	0.01115	3.602	0.01115	-0.01115	-1.1
Inundate	3998	0.01810	3.602	0.01810	-0.01810	-1.8

Data entry by: KR Date: 9/22/2016

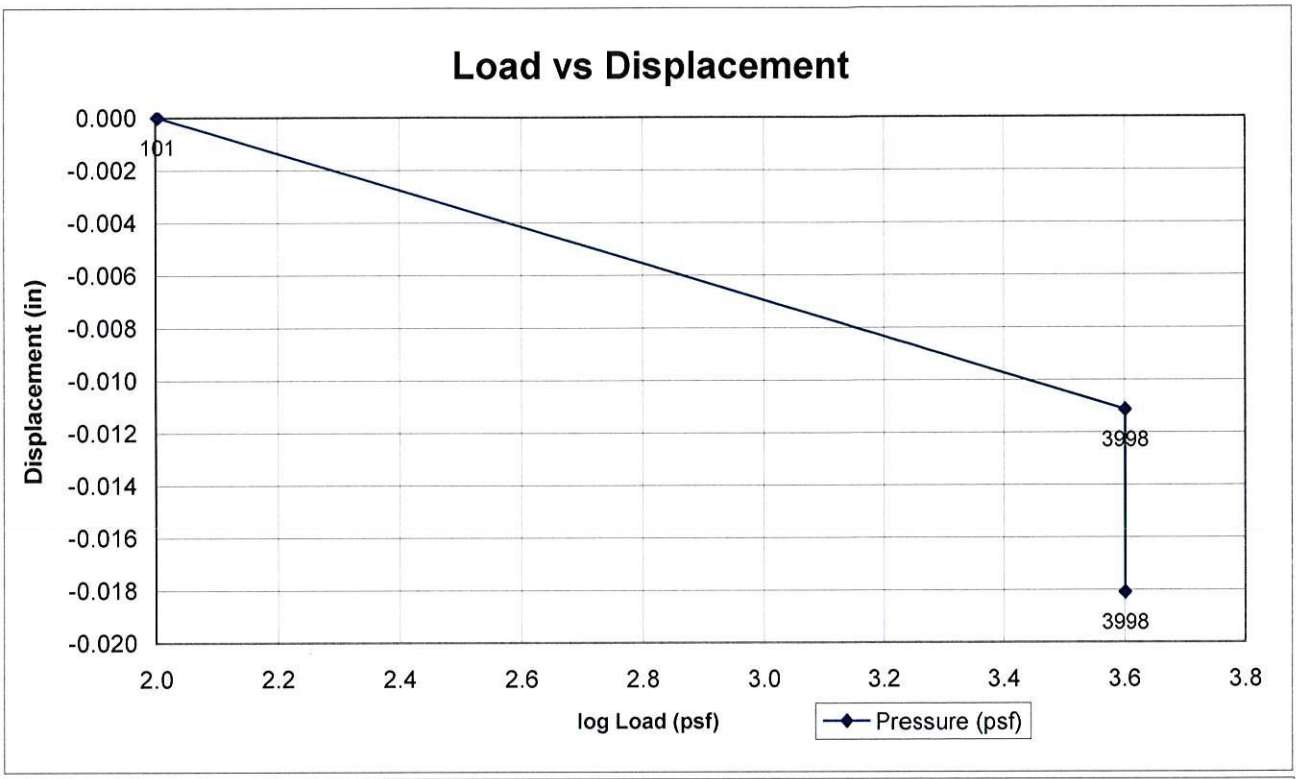
Data checked by: CM Date: 9/23/16

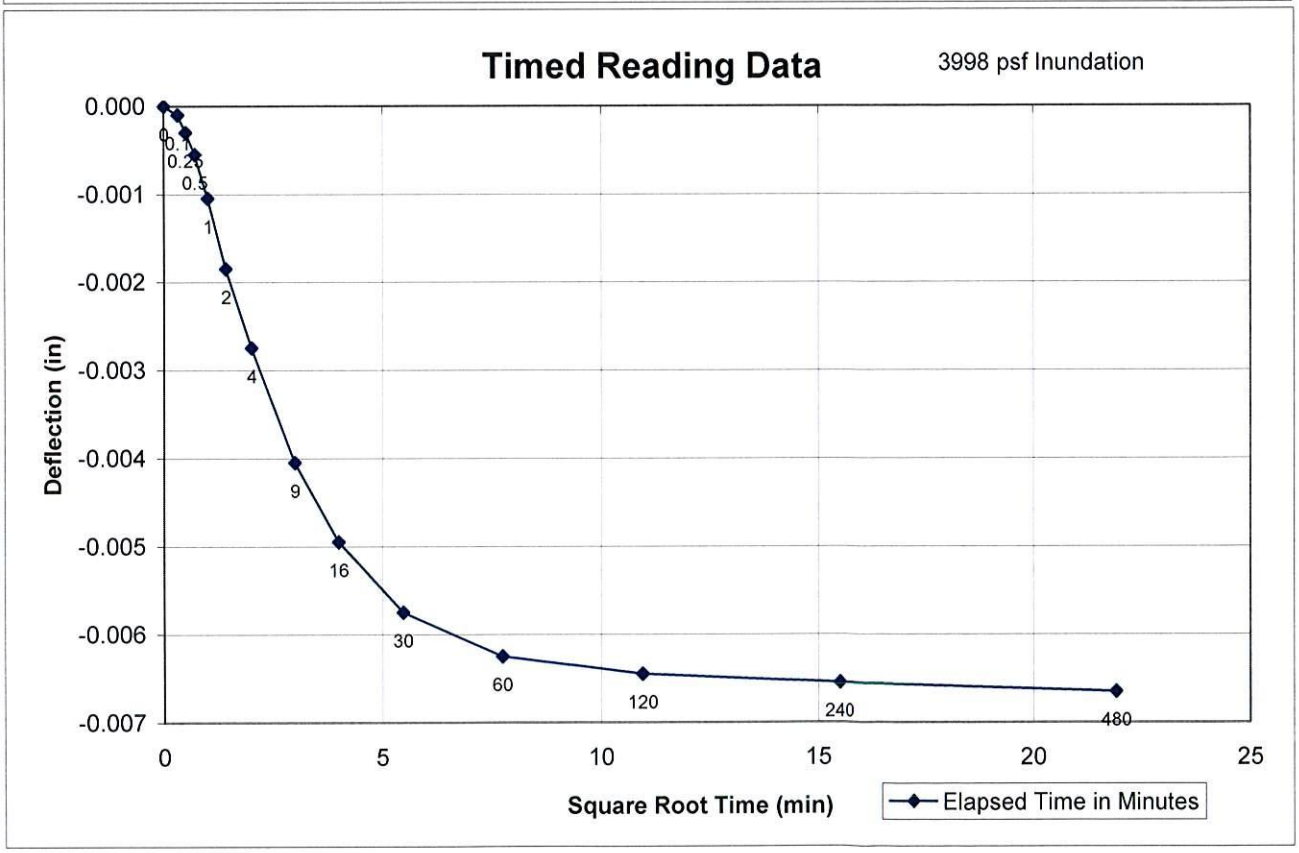
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SWELL/COLLAPSE TEST

ASTM D4546 ~~Method C (modified)~~ Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	BORING NO.	B-102, Bu-6 & B-104, Bu-3
PROJECT NO.	16104	DEPTH	Composite 10-20'
LOCATION	--	SAMPLE NO.	#3 101.5 pcf @ 18.6% mc





SWELL/COLLAPSE TEST

ASTM D4546 ~~Method C (modified)~~ Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	SAMPLED	-- --
PROJECT NO.	16104	TEST STARTED	09/14/2016 DPM
LOCATION	--	TEST FINISHED	09/15/2016 DPM
BORING NO.	B-102, Bu-6 & B-104, Bu-3	CONSOLIDOMETER	ATT-06
DEPTH	Composite 10-20'	SAMPLE DESCR.	--
SAMPLE NO.	#3 101.5 pcf @ 18.6% mc		
SAMPLE DIA.(in)	2.410	INITIAL HT.(in)	1.000
SPECIFIC GRAVITY	2.65	FINAL HT.(in)	0.958

MOISTURE/DENSITY DATA

	BEFORE TEST	AFTER TEST		BEFORE TEST	AFTER TEST
Wt. Soil & Ring(s) (g)	186.90	190.84	Wt. Wet Soil & Pan (g)	147.08	151.03
Wt. Ring(s) (g)	42.91	42.91	Wt. Dry Soil & Pan (g)	125.19	125.19
Wt. Soil (g)	143.99	147.93	Wt. Lost Moisture (g)	21.89	25.83
Wet Density (pcf)	120.3	129.0	Wt. of Pan Only (g)	3.09	3.09
Moisture Content (%)	17.93	21.16	Wt. of Dry Soil (g)	122.10	122.10
Dry Density (pcf)	102.0	106.4	Saturation (%)	76.69	101.66

	LOAD (psf)	CONSOL. (IN)	LOG p	CONSOL. (IN/IN)	DEFL. (IN/IN)	STRAIN (%)
	103	0.00000	2.011	0.00000	0.00000	0.0
	6000	0.01275	3.778	0.01275	-0.01275	-1.3
Inundate	6000	0.04200	3.778	0.04200	-0.04200	-4.2

Data entry by: KR Date: 9/22/2016

Data checked by: cm Date: 9/23/16

File Name: 2679_96_Swell-Consol_ASTMD4546_R0_26.xls

SWELL/COLLAPSE TEST

ASTM D4546 ~~Method C (modified)~~ Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	SAMPLED	-- --
PROJECT NO.	16104	TEST STARTED	09/14/2016 DPM
LOCATION	--	TEST FINISHED	09/15/2016 DPM
BORING NO.	B-102, Bu-6 & B-104, Bu-3	CONSOLIDOMETER	ATT-06
DEPTH	Composite 10-20'	SAMPLE DESCR.	--
SAMPLE NO.	#3 101.5 pcf @ 18.6% mc		

Timed Reading Data

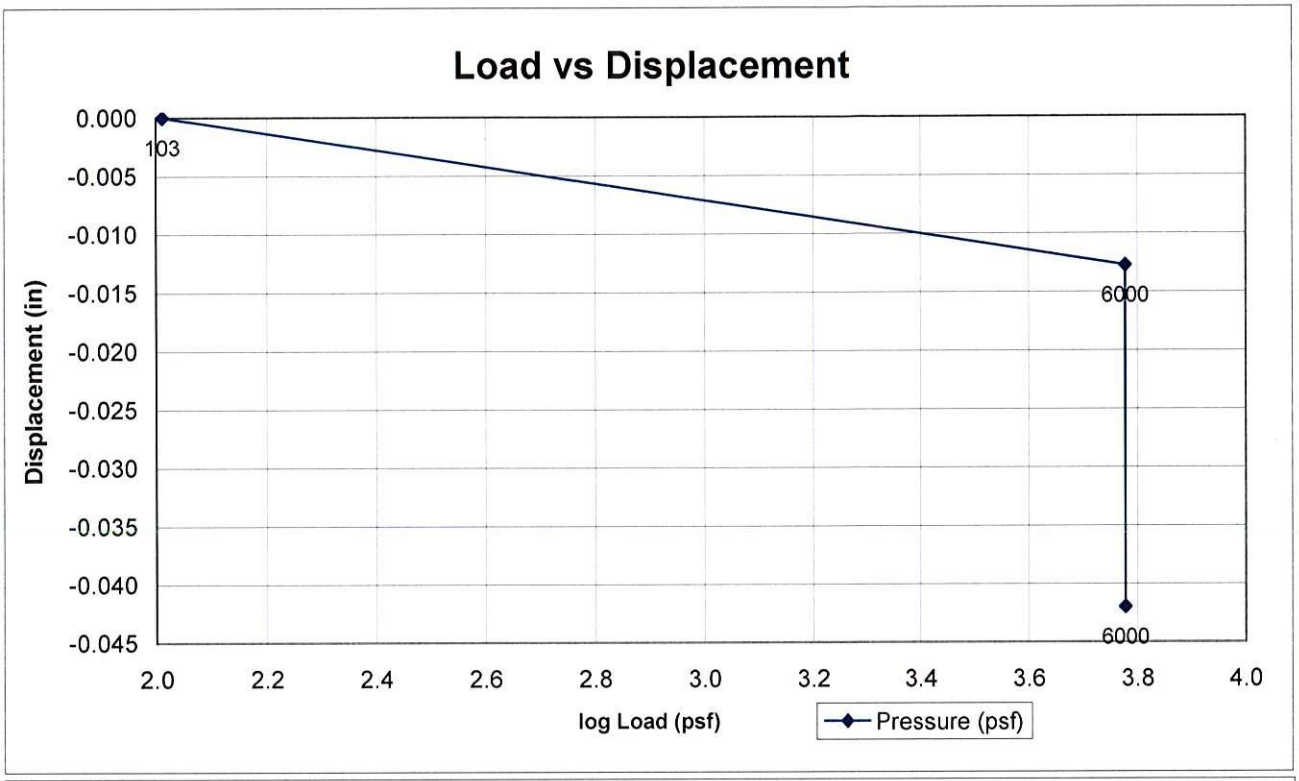
6000 psf Inundation Load

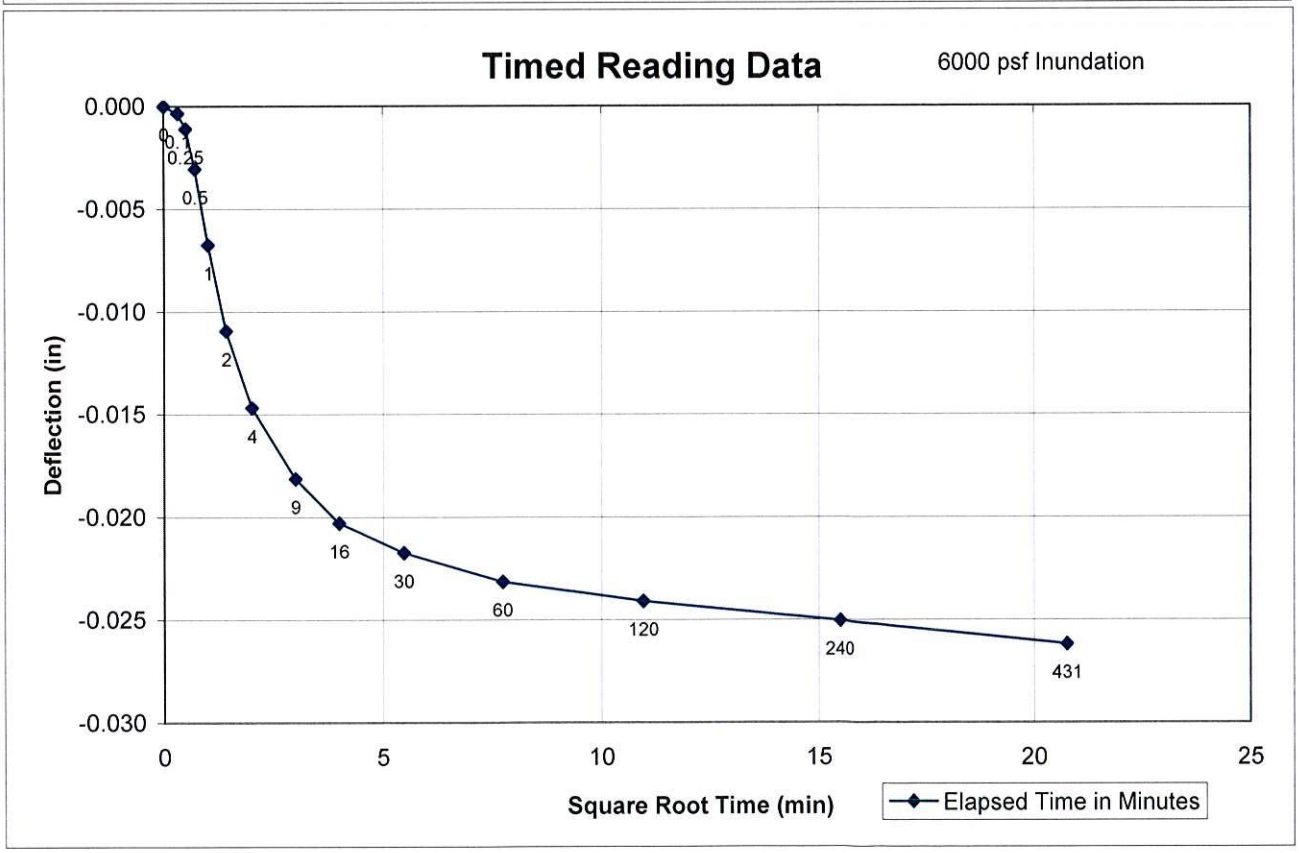
Elapsed Time (min)	SQRT Time (min)	Dial Reading (in)	Defl. (in)
0	0.00	0.01935	0.00000
0.1	0.32	0.01970	-0.00035
0.25	0.50	0.02045	-0.00110
0.5	0.71	0.02240	-0.00305
1	1.00	0.02610	-0.00675
2	1.41	0.03030	-0.01095
4	2.00	0.03405	-0.01470
9	3.00	0.03750	-0.01815
16	4.00	0.03965	-0.02030
30	5.48	0.04110	-0.02175
60	7.75	0.04250	-0.02315
120	10.95	0.04345	-0.02410
240	15.49	0.04440	-0.02505
431	20.76	0.04555	-0.02620

SWELL/COLLAPSE TEST

ASTM D4546 ~~Method C (modified)~~ Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	BORING NO.	B-102, Bu-6 & B-104, Bu-3
PROJECT NO.	16104	DEPTH	Composite 10-20'
LOCATION	--	SAMPLE NO.	#3 101.5 pcf @ 18.6% mc





SWELL/COLLAPSE TEST

ASTM D4546 Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	SAMPLED	-- --
PROJECT NO.	16104	TEST STARTED	09/21/2016 DPM
LOCATION	--	TEST FINISHED	09/23/2016 DPM
BORING NO.	B-102, Bu-6 & B-104, Bu-3	CONSOLIDOMETER	ATT-01
DEPTH	Composite 10-20'	SAMPLE DESCR.	20 psf
SAMPLE NO.	#4 103.5 pcf @ 20.1% mc		
SAMPLE DIA.(in)	2.410	INITIAL HT.(in)	1.000
SPECIFIC GRAVITY	2.65	FINAL HT.(in)	1.068

MOISTURE/DENSITY DATA

	BEFORE TEST	AFTER TEST		BEFORE TEST	AFTER TEST
Wt. Soil & Ring(s) (g)	190.66	198.46	Wt. Wet Soil & Pan (g)	151.78	159.58
Wt. Ring(s) (g)	41.99	41.99	Wt. Dry Soil & Pan (g)	127.67	127.67
Wt. Soil (g)	148.67	156.47	Wt. Lost Moisture (g)	24.11	31.91
Wet Density (pcf)	124.2	122.4	Wt. of Pan Only (g)	3.11	3.11
Moisture Content (%)	19.36	25.62	Wt. of Dry Soil (g)	124.56	124.56
Dry Density (pcf)	104.0	97.4	Saturation (%)	87.30	97.68

	LOAD (psf)	CONSOL. (IN)	LOG p	CONSOL. (IN/IN)	DEFL. (IN/IN)	STRAIN (%)
	20	0.0000	1.301	0.0000	0.0000	0.0
	20	0.0000	1.301	0.0000	0.0000	0.0
Inundate	20	-0.0677	1.301	-0.0677	0.0677	6.8

Data entry by: KR Date: 9/27/2016

Data checked by: cm Date: 9/27/16

File Name: 2679_96_Swell-Consol_ASTMD4546_R0_36.xls

SWELL/COLLAPSE TEST

ASTM D4546 Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	SAMPLED	-- --
PROJECT NO.	16104	TEST STARTED	09/21/2016 DPM
LOCATION	--	TEST FINISHED	09/23/2016 DPM
BORING NO.	B-102, Bu-6 & B-104, Bu-3	CONSOLIDOMETER	ATT-01
DEPTH	Composite 10-20'	SAMPLE DESCR.	20 psf
SAMPLE NO.	#4 103.5 pcf @ 20.1% mc		

Timed Reading Data

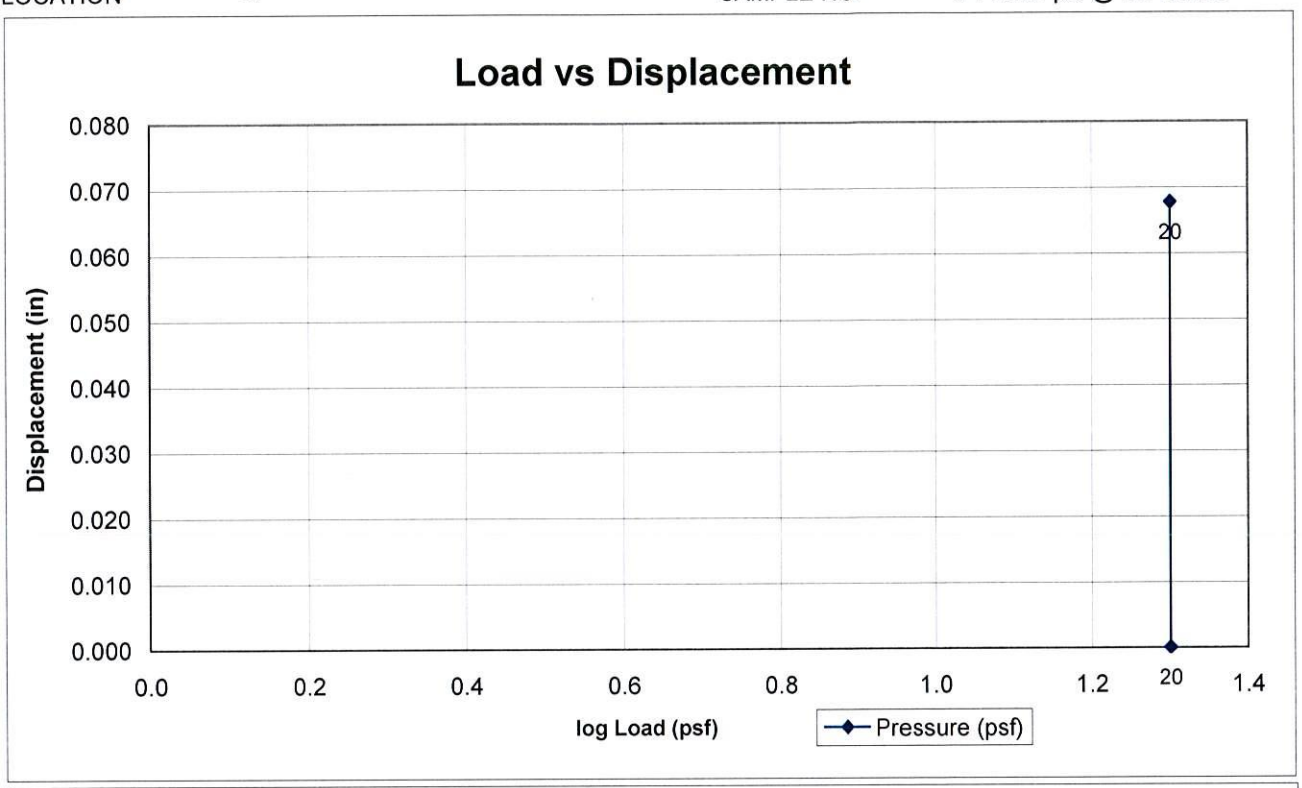
20 psf Inundation Load

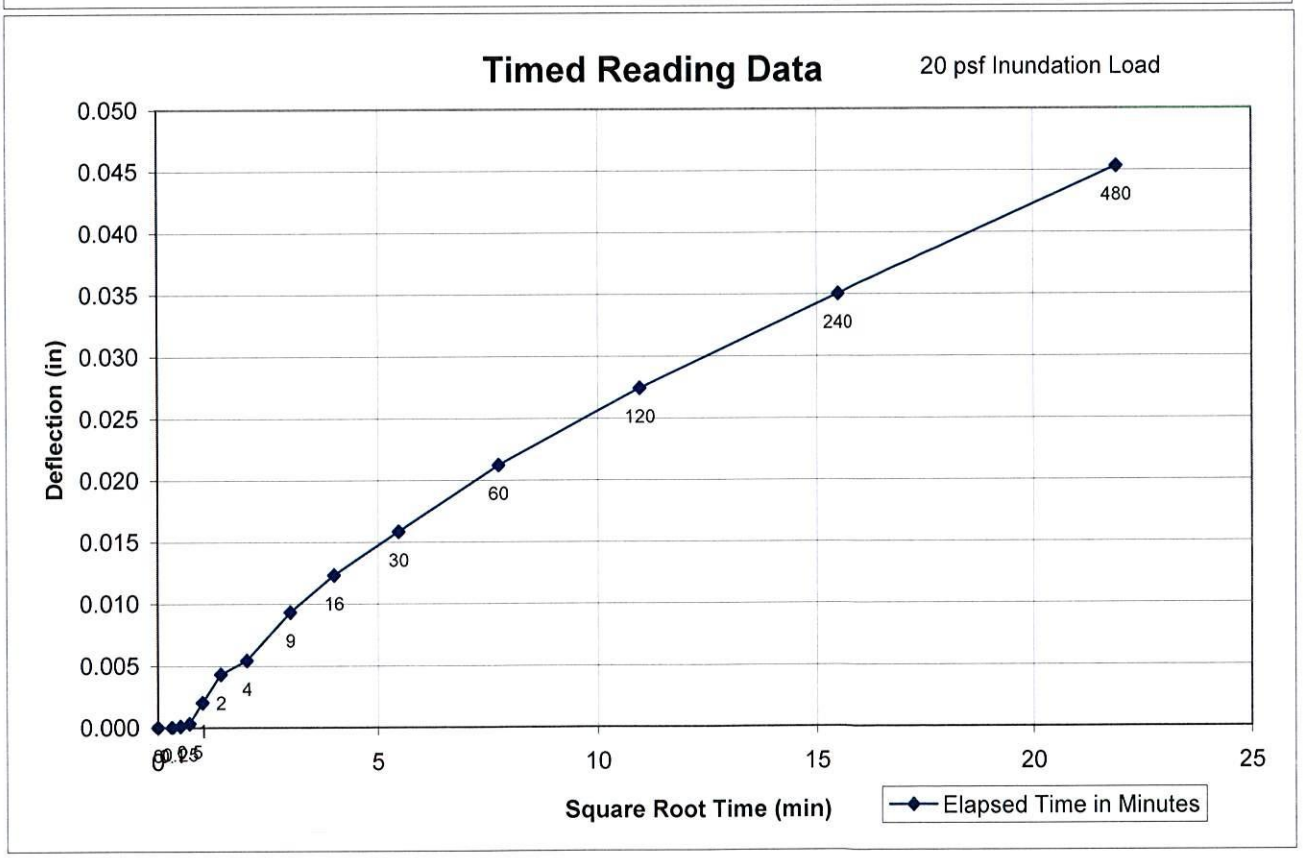
Elapsed Time (min)	SQRT Time (min)	Dial Reading (in)	Defl. (in)
0	0.00	0.2144	0.0000
0.1	0.32	0.2144	0.0000
0.25	0.50	0.2143	0.0001
0.5	0.71	0.2141	0.0003
1	1.00	0.2124	0.0020
2	1.41	0.2101	0.0043
4	2.00	0.2090	0.0054
9	3.00	0.2051	0.0093
16	4.00	0.2021	0.0123
30	5.48	0.1986	0.0158
60	7.75	0.1932	0.0212
120	10.95	0.1870	0.0274
240	15.49	0.1794	0.0350
480	21.91	0.1691	0.0453

SWELL/COLLAPSE TEST

ASTM D4546 Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	BORING NO.	B-102, Bu-6 & B-104, Bu-3
PROJECT NO.	16104	DEPTH	Composite 10-20'
LOCATION	--	SAMPLE NO.	#4 103.5 pcf @ 20.1% mc





SWELL/COLLAPSE TEST

ASTM D4546 ~~Method C (modified)~~ Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	SAMPLED	-- --
PROJECT NO.	16104	TEST STARTED	09/16/2016 DPM
LOCATION	--	TEST FINISHED	09/19/2016 DPM
BORING NO.	B-102, Bu-6 & B-104, Bu-3	CONSOLIDOMETER	ATT-03
DEPTH	Composite 10-20'	SAMPLE DESCR.	--
SAMPLE NO.	#4 103.5 pcf @ 20.1% mc		
SAMPLE DIA.(in)	2.410	INITIAL HT.(in)	1.000
SPECIFIC GRAVITY	2.65	FINAL HT.(in)	1.012

MOISTURE/DENSITY DATA

	BEFORE TEST	AFTER TEST		BEFORE TEST	AFTER TEST
Wt. Soil & Ring(s) (g)	195.33	198.71	Wt. Wet Soil & Pan (g)	151.82	155.20
Wt. Ring(s) (g)	46.60	46.60	Wt. Dry Soil & Pan (g)	127.93	127.93
Wt. Soil (g)	148.73	152.11	Wt. Lost Moisture (g)	23.89	27.28
Wet Density (pcf)	124.2	125.6	Wt. of Pan Only (g)	3.09	3.09
Moisture Content (%)	19.14	21.85	Wt. of Dry Soil (g)	124.84	124.84
Dry Density (pcf)	104.3	103.1	Saturation (%)	86.84	96.14

	LOAD (psf)	CONSOL. (IN)	LOG p	CONSOL. (IN/IN)	DEFL. (IN/IN)	STRAIN (%)
	101	0.00000	2.006	0.00000	0.00000	0.0
	1497	0.00270	3.175	0.00270	-0.00270	-0.3
Inundate	1497	-0.01150	3.175	-0.01150	0.01150	1.2

Data entry by: KR Date: 9/20/2016

Data checked by: CH Date: 9/21/16

File Name: 2679_96_Swell-Consol_ASTMD4546_R0_21.xls

SWELL/COLLAPSE TEST

ASTM D4546 ~~Method C (modified)~~ Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	SAMPLED	-- --
PROJECT NO.	16104	TEST STARTED	09/16/2016 DPM
LOCATION	--	TEST FINISHED	09/19/2016 DPM
BORING NO.	B-102, Bu-6 & B-104, Bu-3	CONSOLIDOMETER	ATT-03
DEPTH	Composite 10-20'	SAMPLE DESCR.	--
SAMPLE NO.	#4 103.5 pcf @ 20.1% mc		

Timed Reading Data

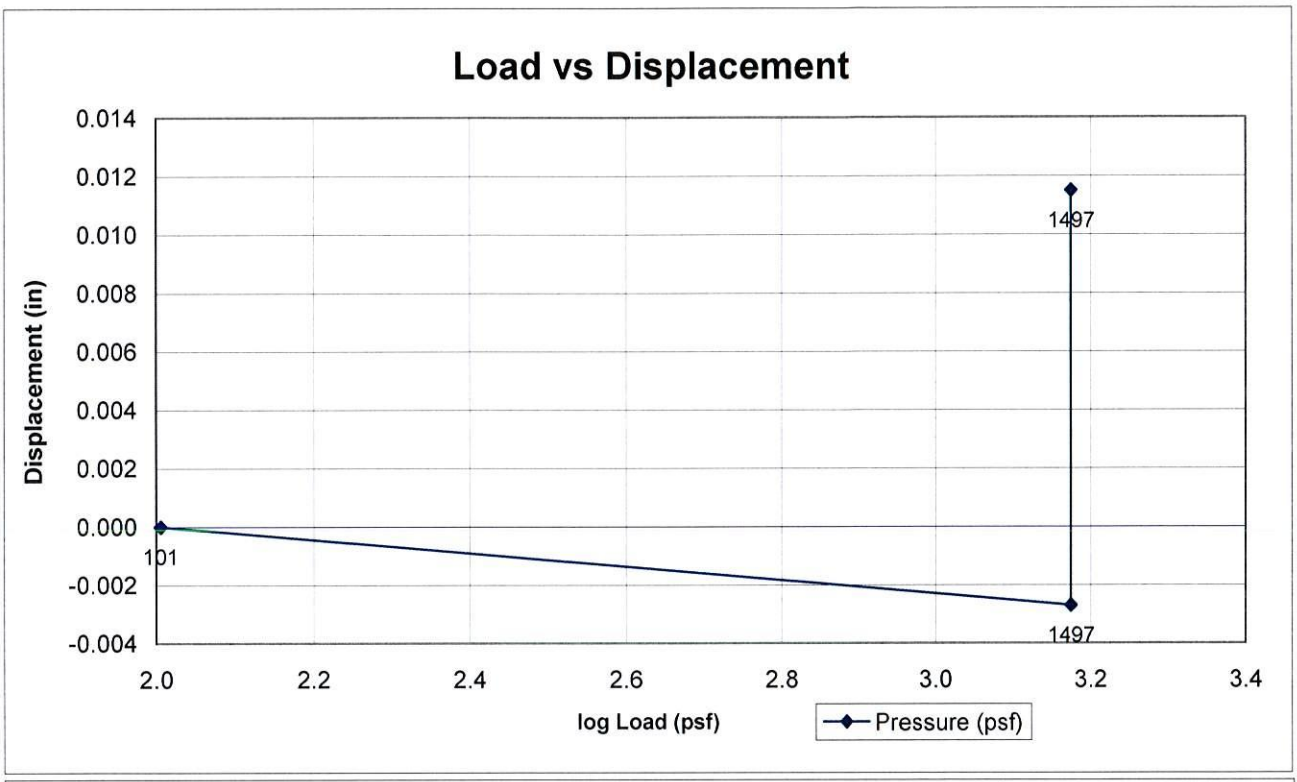
1497 psf Inundation Load

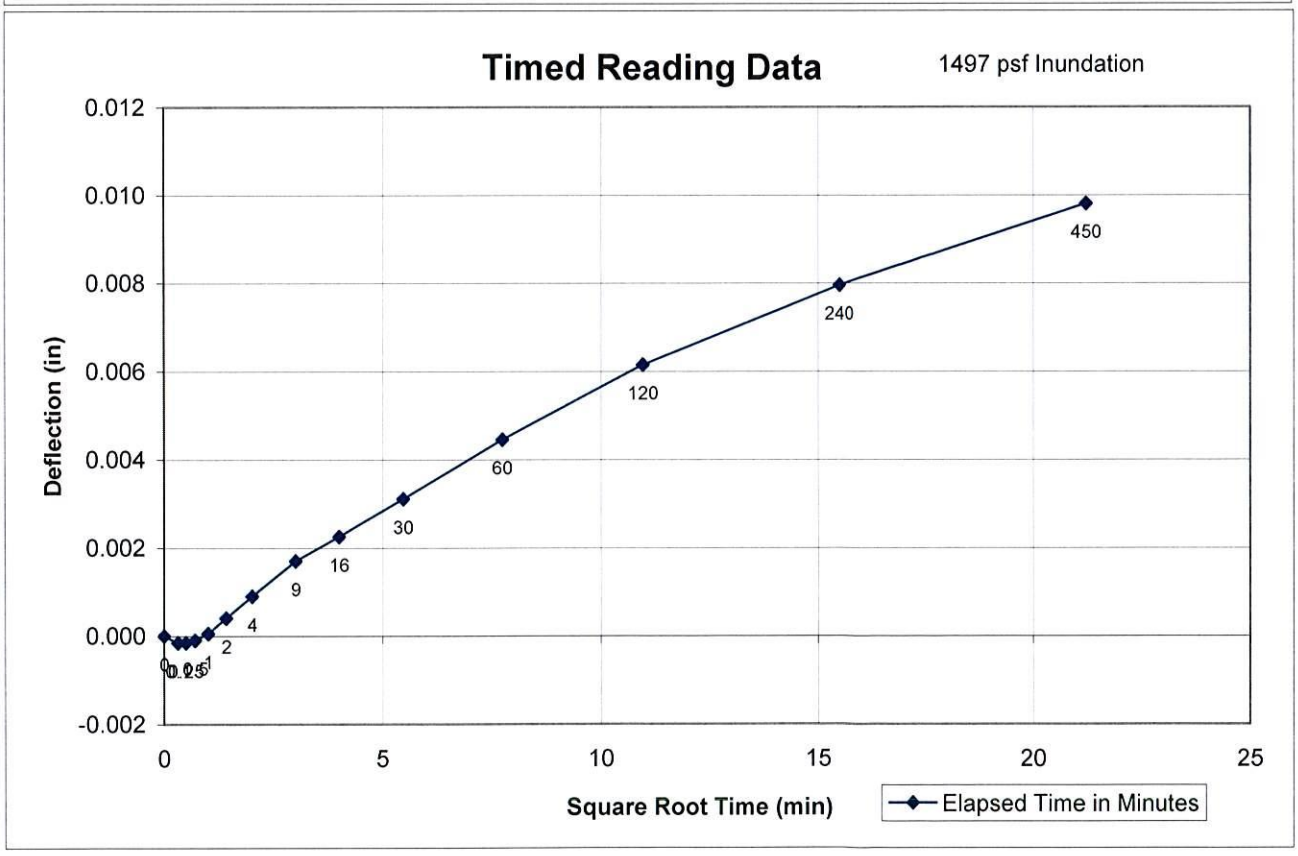
Elapsed Time (min)	SQRT Time (min)	Dial Reading (in)	Defl. (in)
0	0.00	0.00930	0.00000
0.1	0.32	0.00945	-0.00015
0.25	0.50	0.00945	-0.00015
0.5	0.71	0.00940	-0.00010
1	1.00	0.00925	0.00005
2	1.41	0.00890	0.00040
4	2.00	0.00840	0.00090
9	3.00	0.00760	0.00170
16	4.00	0.00705	0.00225
30	5.48	0.00620	0.00310
60	7.75	0.00485	0.00445
120	10.95	0.00315	0.00615
240	15.49	0.00135	0.00795
450	21.21	-0.00050	0.00980

SWELL/COLLAPSE TEST

ASTM D4546 ~~Method C (modified)~~ Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	BORING NO.	B-102, Bu-6 & B-104, Bu-3
PROJECT NO.	16104	DEPTH	Composite 10-20'
LOCATION	--	SAMPLE NO.	#4 103.5 pcf @ 20.1% mc





SWELL/COLLAPSE TEST

ASTM D4546 ~~Method C (modified)~~ Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	SAMPLED	-- --
PROJECT NO.	16104	TEST STARTED	09/16/2016 DPM
LOCATION	--	TEST FINISHED	09/16/2016 BDF
BORING NO.	B-102, Bu-6 & B-104, Bu-3	CONSOLIDOMETER	ATT-4
DEPTH	Composite 10-20'	SAMPLE DESCR.	--
SAMPLE NO.	#4 103.5 pcf @ 20.1 mc		
SAMPLE DIA.(in)	2.410	INITIAL HT.(in)	1.000
SPECIFIC GRAVITY	2.65	FINAL HT.(in)	0.990

MOISTURE/DENSITY DATA

	BEFORE TEST	AFTER TEST		BEFORE TEST	AFTER TEST
Wt. Soil & Ring(s) (g)	191.60	194.35	Wt. Wet Soil & Pan (g)	151.76	154.51
Wt. Ring(s) (g)	42.91	42.91	Wt. Dry Soil & Pan (g)	127.47	127.47
Wt. Soil (g)	148.69	151.44	Wt. Lost Moisture (g)	24.30	27.05
Wet Density (pcf)	124.2	127.7	Wt. of Pan Only (g)	3.08	3.08
Moisture Content (%)	19.53	21.74	Wt. of Dry Soil (g)	124.39	124.39
Dry Density (pcf)	103.9	104.9	Saturation (%)	87.77	100.36

	LOAD (psf)	CONSOL. (IN)	LOG p	CONSOL. (IN/IN)	DEFL. (IN/IN)	STRAIN (%)
	101	0.00000	2.003	0.00000	0.00000	0.0
	4000	0.01085	3.602	0.01085	-0.01085	-1.1
Inundate	4000	0.00980	3.602	0.00980	-0.00980	-1.0

Data entry by: KR Date: 9/20/2016

Data checked by: CAC Date: 9/21/16

File Name: 2679_96_Swell-Consol_ASTMD4546_R0_23.xls

SWELL/COLLAPSE TEST

ASTM D4546 ~~Method C (modified)~~ Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	SAMPLED	-- --
PROJECT NO.	16104	TEST STARTED	09/16/2016 DPM
LOCATION	--	TEST FINISHED	09/16/2016 BDF
BORING NO.	B-102, Bu-6 & B-104, Bu-3	CONSOLIDOMETER	ATT-4
DEPTH	Composite 10-20'	SAMPLE DESCR.	--
SAMPLE NO.	#4 103.5 pcf @ 20.1 mc		

Timed Reading Data

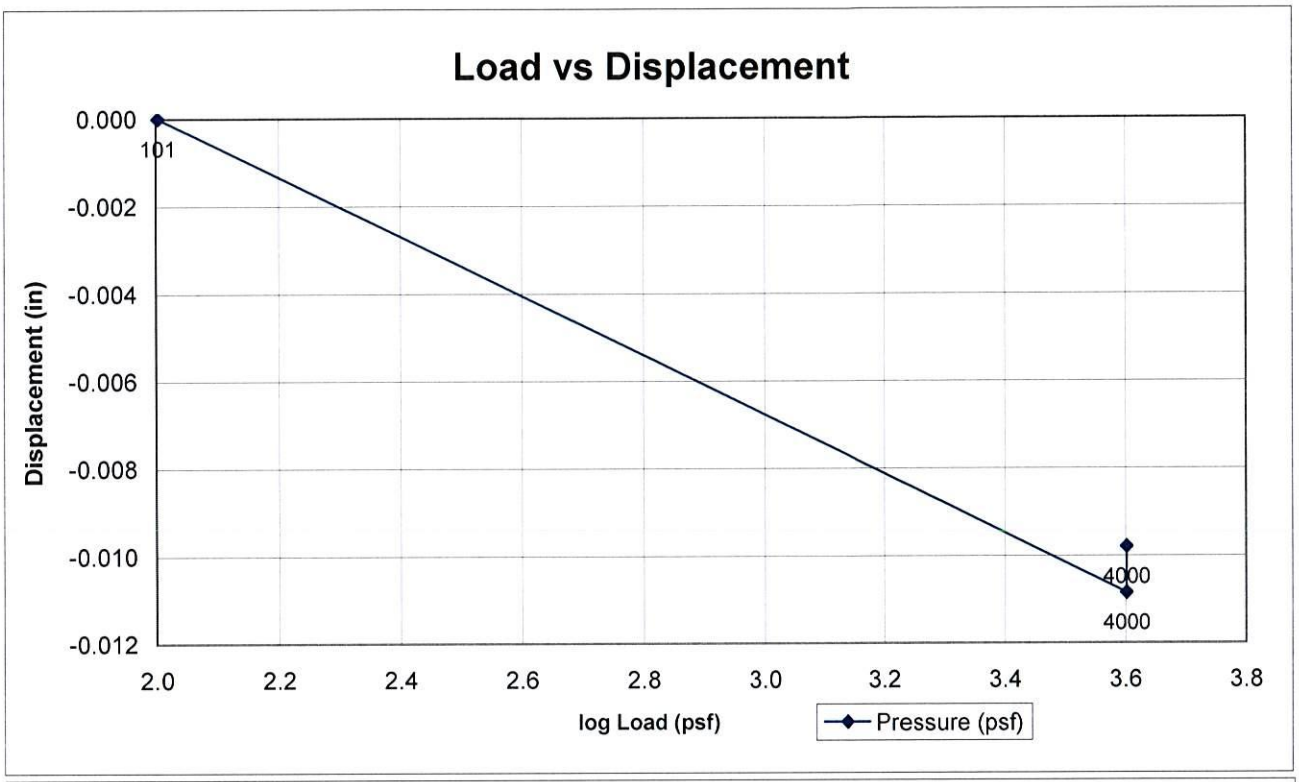
4000 psf Inundation Load

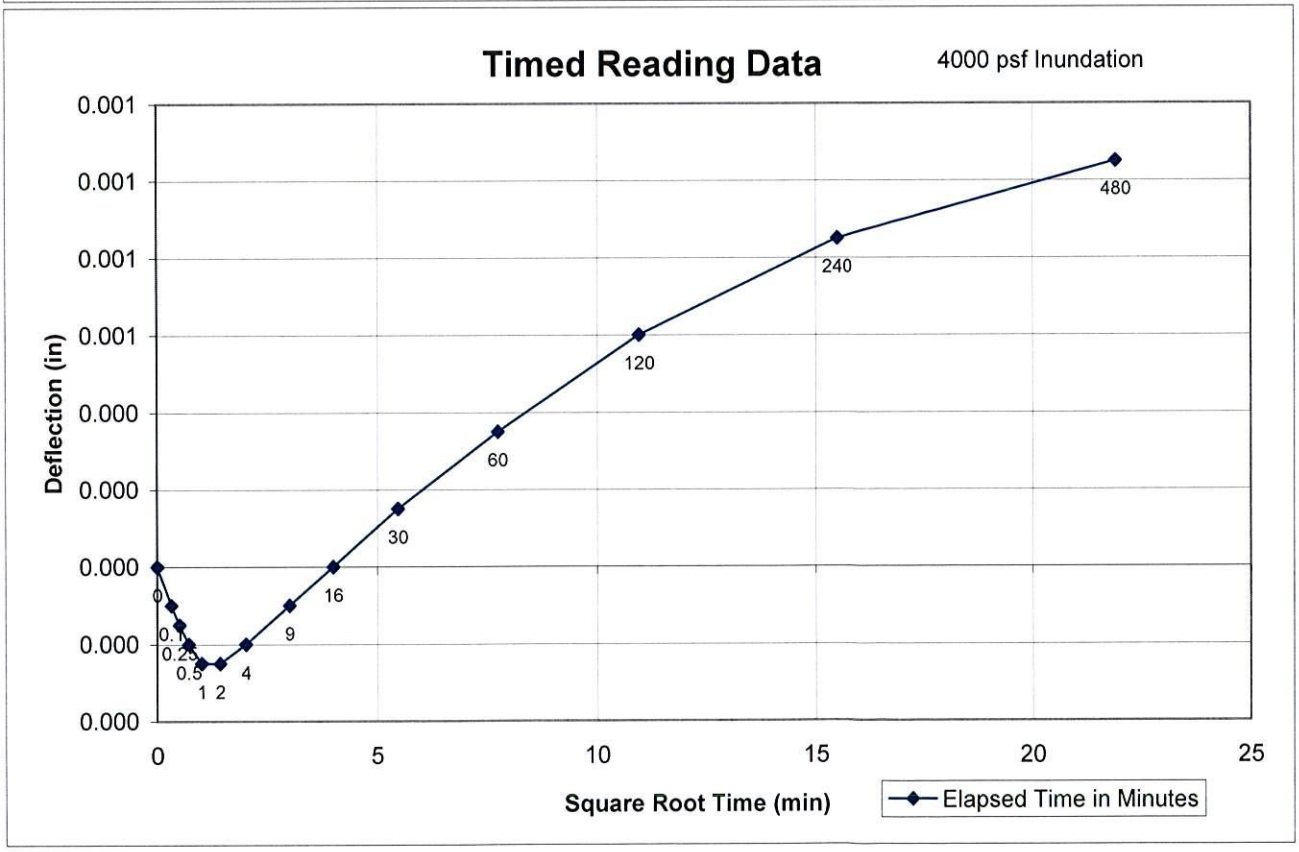
Elapsed Time (min)	SQRT Time (min)	Dial Reading (in)	Defl. (in)
0	0.00	0.01925	0.00000
0.1	0.32	0.01935	-0.00010
0.25	0.50	0.01940	-0.00015
0.5	0.71	0.01945	-0.00020
1	1.00	0.01950	-0.00025
2	1.41	0.01950	-0.00025
4	2.00	0.01945	-0.00020
9	3.00	0.01935	-0.00010
16	4.00	0.01925	0.00000
30	5.48	0.01910	0.00015
60	7.75	0.01890	0.00035
120	10.95	0.01865	0.00060
240	15.49	0.01840	0.00085
480	21.91	0.01820	0.00105

SWELL/COLLAPSE TEST

ASTM D4546 ~~Method C (modified)~~ Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	BORING NO.	B-102, Bu-6 & B-104, Bu-3
PROJECT NO.	16104	DEPTH	Composite 10-20'
LOCATION	--	SAMPLE NO.	#4 103.5 pcf @ 20.1 mc





SWELL/COLLAPSE TEST

ASTM D4546 ~~Method C (modified)~~ Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	SAMPLED	-- --
PROJECT NO.	16104	TEST STARTED	09/16/2016 DPM
LOCATION	--	TEST FINISHED	09/16/2016 BDF
BORING NO.	B-102, Bu-6 & B-104 Bu-3	CONSOLIDOMETER	ATT-06
DEPTH	Composite 10-20'	SAMPLE DESCR.	--
SAMPLE NO.	#4 103.5 pcf @ 20.1% mc		
SAMPLE DIA.(in)	2.410	INITIAL HT.(in)	1.000
SPECIFIC GRAVITY	2.65	FINAL HT.(in)	0.987

MOISTURE/DENSITY DATA

	BEFORE TEST	AFTER TEST		BEFORE TEST	AFTER TEST
Wt. Soil & Ring(s) (g)	190.30	192.63	Wt. Wet Soil & Pan (g)	151.78	154.12
Wt. Ring(s) (g)	41.61	41.61	Wt. Dry Soil & Pan (g)	127.64	127.64
Wt. Soil (g)	148.69	151.03	Wt. Lost Moisture (g)	24.14	26.47
Wet Density (pcf)	124.2	127.8	Wt. of Pan Only (g)	3.09	3.09
Moisture Content (%)	19.38	21.25	Wt. of Dry Soil (g)	124.55	124.55
Dry Density (pcf)	104.0	105.4	Saturation (%)	87.41	99.37

	LOAD (psf)	CONSOL. (IN)	LOG p	CONSOL. (IN/IN)	DEFL. (IN/IN)	STRAIN (%)
	103	0.00000	2.011	0.00000	0.00000	0.0
	6000	0.01095	3.778	0.01095	-0.01095	-1.1
Inundate	6000	0.01310	3.778	0.01310	-0.01310	-1.3

Data entry by: KR Date: 9/20/2016

Data checked by: CH Date: 9/21/16

File Name: 2679_96_Swell-Consol_ASTMD4546_R0_22.xls

SWELL/COLLAPSE TEST

ASTM D4546 ~~Method C (modified)~~ Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	SAMPLED	-- --
PROJECT NO.	16104	TEST STARTED	09/16/2016 DPM
LOCATION	--	TEST FINISHED	09/16/2016 BDF
BORING NO.	B-102, Bu-6 & B-104 Bu-3	CONSOLIDOMETER	ATT-06
DEPTH	Composite 10-20'	SAMPLE DESCR.	--
SAMPLE NO.	#4 103.5 pcf @ 20.1% mc		

Timed Reading Data

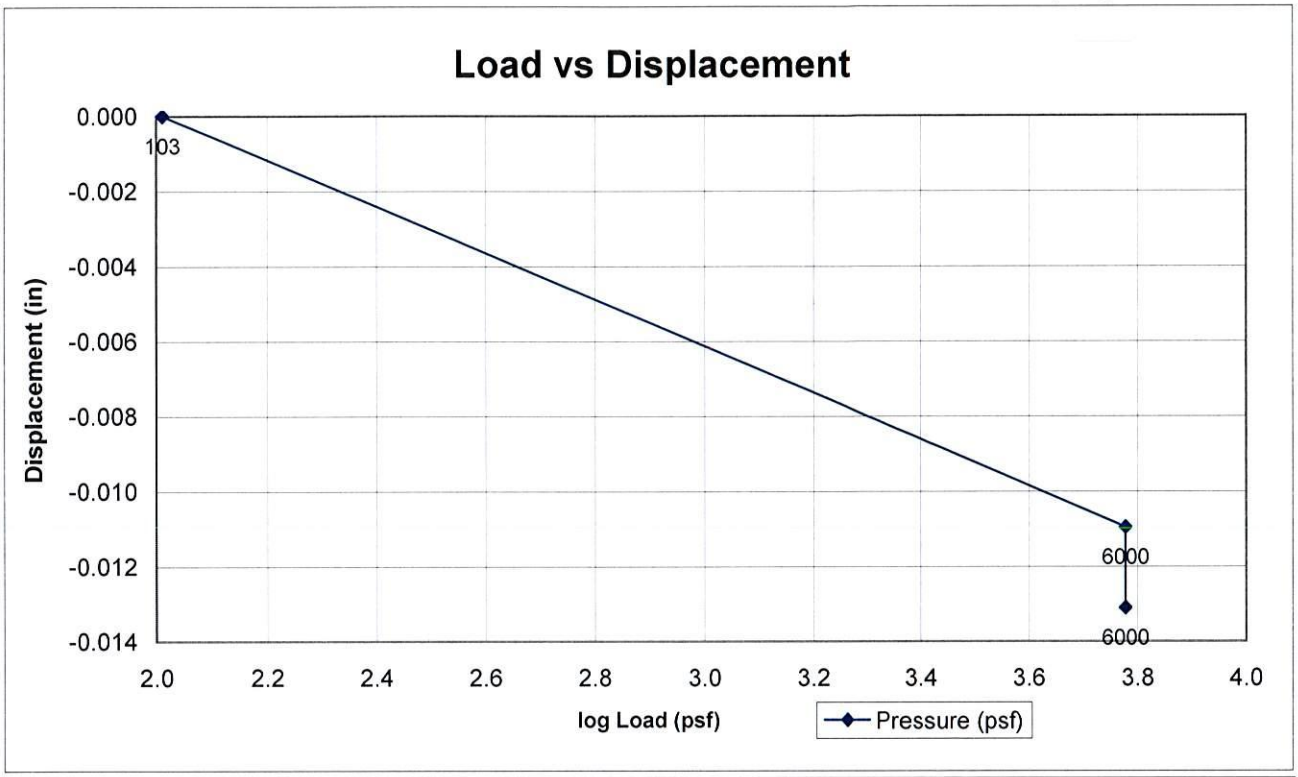
6000 psf Inundation Load

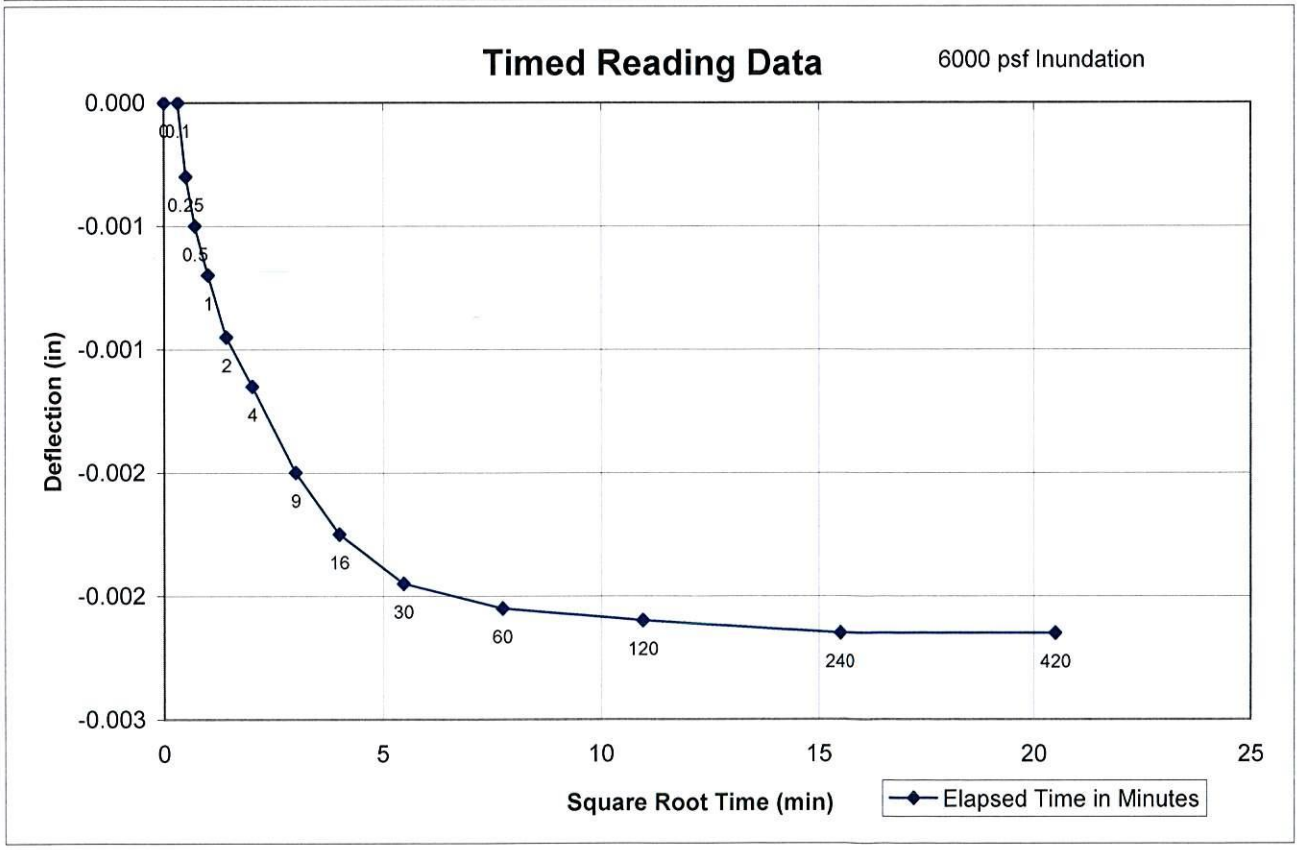
Elapsed Time (min)	SQRT Time (min)	Dial Reading (in)	Defl. (in)
0	0.00	0.01755	0.00000
0.1	0.32	0.01755	0.00000
0.25	0.50	0.01785	-0.00030
0.5	0.71	0.01805	-0.00050
1	1.00	0.01825	-0.00070
2	1.41	0.01850	-0.00095
4	2.00	0.01870	-0.00115
9	3.00	0.01905	-0.00150
16	4.00	0.01930	-0.00175
30	5.48	0.01950	-0.00195
60	7.75	0.01960	-0.00205
120	10.95	0.01965	-0.00210
240	15.49	0.01970	-0.00215
420	20.49	0.01970	-0.00215

SWELL/COLLAPSE TEST

ASTM D4546 ~~Method C (modified)~~ Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	BORING NO.	B-102, Bu-6 & B-104 Bu-3
PROJECT NO.	16104	DEPTH	Composite 10-20'
LOCATION	--	SAMPLE NO.	#4 103.5 pcf @ 20.1% mc





SWELL/COLLAPSE TEST

ASTM D4546 Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	SAMPLED	-- --
PROJECT NO.	16104	TEST STARTED	09/16/2016 DPM
LOCATION	--	TEST FINISHED	09/19/2016 DPM
BORING NO.	B-102, Bu-6 & B-104, Bu-3	CONSOLIDOMETER	ATT-01
DEPTH	Composite 10-20'	SAMPLE DESCR.	--
SAMPLE NO.	#5 101.5 pcf @ 21.6% mc		
SAMPLE DIA.(in)	2.410	INITIAL HT.(in)	1.000
SPECIFIC GRAVITY	2.65	FINAL HT.(in)	1.038

MOISTURE/DENSITY DATA

	BEFORE TEST	AFTER TEST		BEFORE TEST	AFTER TEST
Wt. Soil & Ring(s) (g)	193.94	198.27	Wt. Wet Soil & Pan (g)	150.69	155.02
Wt. Ring(s) (g)	46.36	46.36	Wt. Dry Soil & Pan (g)	124.78	124.78
Wt. Soil (g)	147.59	151.92	Wt. Lost Moisture (g)	25.92	30.24
Wet Density (pcf)	123.3	122.2	Wt. of Pan Only (g)	3.11	3.11
Moisture Content (%)	21.30	24.86	Wt. of Dry Soil (g)	121.67	121.67
Dry Density (pcf)	101.6	97.9	Saturation (%)	90.28	95.86

	LOAD (psf)	CONSOL. (IN)	LOG p	CONSOL. (IN/IN)	DEFL. (IN/IN)	STRAIN (%)
	20	0.0000	1.301	0.0000	0.0000	0.0
	20	0.0000	1.301	0.0000	0.0000	0.0
Inundate	20	-0.0381	1.301	-0.0381	0.0381	3.8

Data entry by: KR/CAL Date: 9/20/2016

Data checked by: cac Date: 9/21/16

File Name: 2679_96_Swell-Consol_ASTMD4546_R0_20.xls

SWELL/COLLAPSE TEST

ASTM D4546 Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	SAMPLED	-- --
PROJECT NO.	16104	TEST STARTED	09/16/2016 DPM
LOCATION	--	TEST FINISHED	09/19/2016 DPM
BORING NO.	B-102, Bu-6 & B-104, Bu-3	CONSOLIDOMETER	ATT-01
DEPTH	Composite 10-20'	SAMPLE DESCR.	--
SAMPLE NO.	#5 101.5 pcf @ 21.6% mc		

Timed Reading Data

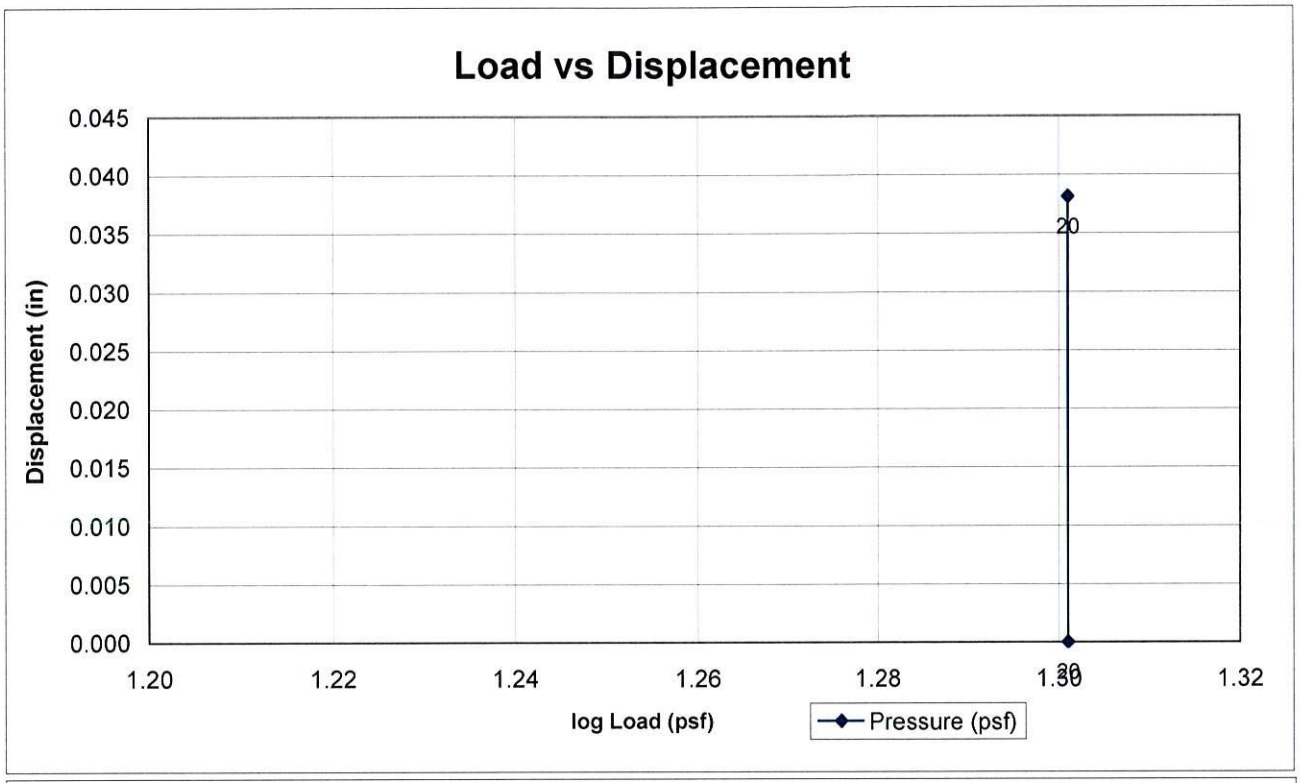
20 psf Inundation Load

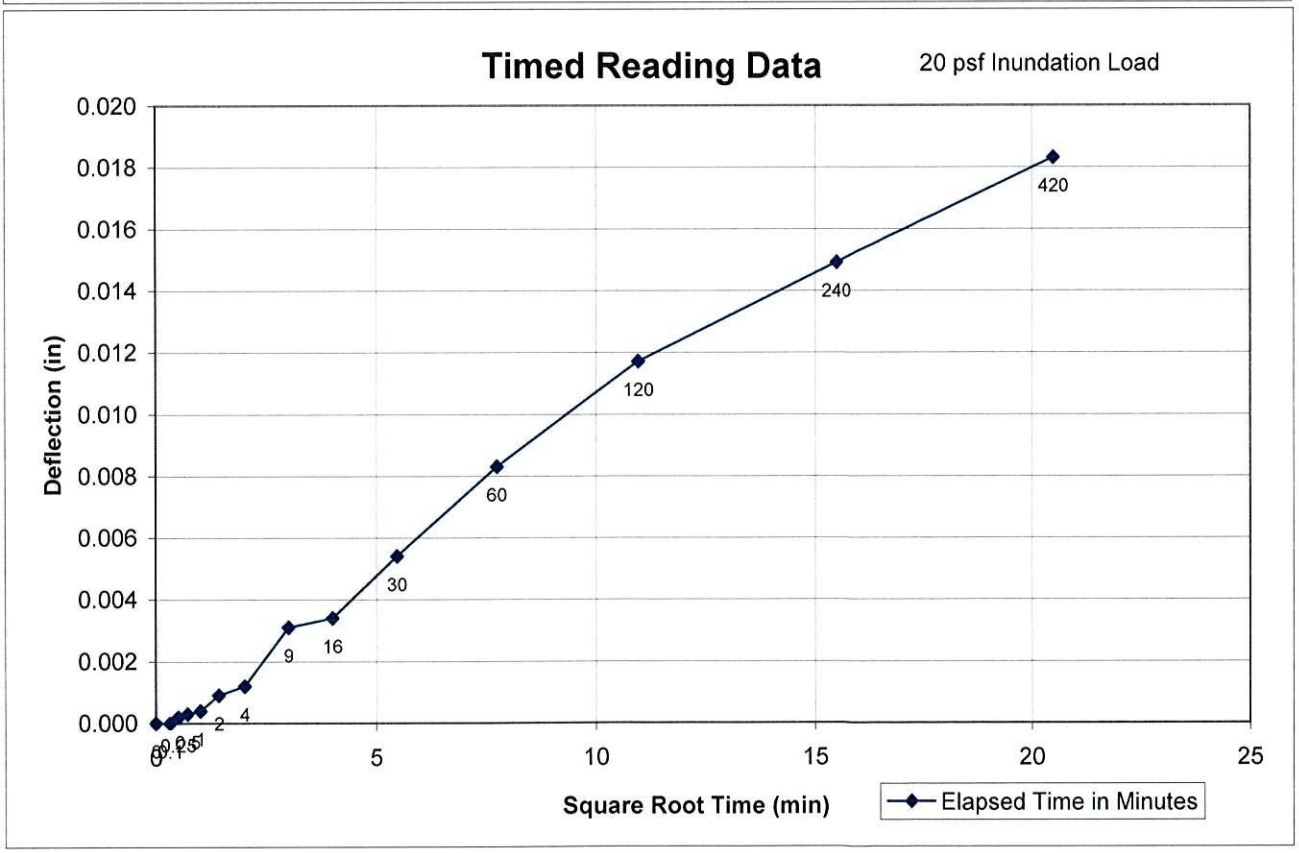
Elapsed Time (min)	SQRT Time (min)	Dial Reading (in)	Defl. (in)
0	0.00	0.2254	0.0000
0.1	0.32	0.2254	0.0000
0.25	0.50	0.2252	0.0002
0.5	0.71	0.2251	0.0003
1	1.00	0.2250	0.0004
2	1.41	0.2245	0.0009
4	2.00	0.2242	0.0012
9	3.00	0.2223	0.0031
16	4.00	0.2220	0.0034
30	5.48	0.2200	0.0054
60	7.75	0.2171	0.0083
120	10.95	0.2137	0.0117
240	15.49	0.2105	0.0149
420	20.49	0.2071	0.0183

SWELL/COLLAPSE TEST

ASTM D4546 Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	BORING NO.	B-102, Bu-6 & B-104, Bu-3
PROJECT NO.	16104	DEPTH	Composite 10-20'
LOCATION	--	SAMPLE NO.	#5 101.5 pcf @ 21.6% mc





SWELL/COLLAPSE TEST

ASTM D4546 Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	SAMPLED	-- --
PROJECT NO.	16104	TEST STARTED	09/02/2016 DPM
LOCATION	--	TEST FINISHED	09/13/2016 DPM
BORING NO.	B-102, Bu-6 & B-104, Bu-3	CONSOLIDOMETER	ATT-05
DEPTH	Composite 10-20'	SAMPLE DESCR.	1500 psf
SAMPLE NO.	#5 101.5 psf @ 21.6%		
SAMPLE DIA.(in)	2.410	INITIAL HT.(in)	1.000
SPECIFIC GRAVITY	2.65	FINAL HT.(in)	0.999

MOISTURE/DENSITY DATA

	BEFORE TEST	AFTER TEST		BEFORE TEST	AFTER TEST
Wt. Soil & Ring(s) (g)	190.11	193.26	Wt. Wet Soil & Pan (g)	150.81	153.97
Wt. Ring(s) (g)	42.52	42.52	Wt. Dry Soil & Pan (g)	125.38	125.38
Wt. Soil (g)	147.58	150.74	Wt. Lost Moisture (g)	25.43	28.59
Wet Density (pcf)	123.3	126.0	Wt. of Pan Only (g)	3.23	3.23
Moisture Content (%)	20.82	23.40	Wt. of Dry Soil (g)	122.15	122.15
Dry Density (pcf)	102.0	102.1	Saturation (%)	89.16	100.50

	LOAD (psf)	CONSOL. (IN)	LOG p	CONSOL. (IN/IN)	DEFL. (IN/IN)	STRAIN (%)
	97	0.00000	1.988	0.00000	0.00000	0.0
	1511	0.00420	3.179	0.00420	-0.00420	-0.4
Inundate	1511	0.00110	3.179	0.00110	-0.00110	-0.1

Data entry by: KR Date: 9/15/2016

Data checked by: CH Date: 9/20/16

File Name: 2679_96_Swell-Consol_ASTMD4546_R0_17.xls

SWELL/COLLAPSE TEST

ASTM D4546 Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	SAMPLED	-- --
PROJECT NO.	16104	TEST STARTED	09/02/2016 DPM
LOCATION	--	TEST FINISHED	09/13/2016 DPM
BORING NO.	B-102, Bu-6 & B-104, Bu-3	CONSOLIDOMETER	ATT-05
DEPTH	Composite 10-20'	SAMPLE DESCR.	1500 psf
SAMPLE NO.	#5 101.5 psf @ 21.6%		

Timed Reading Data

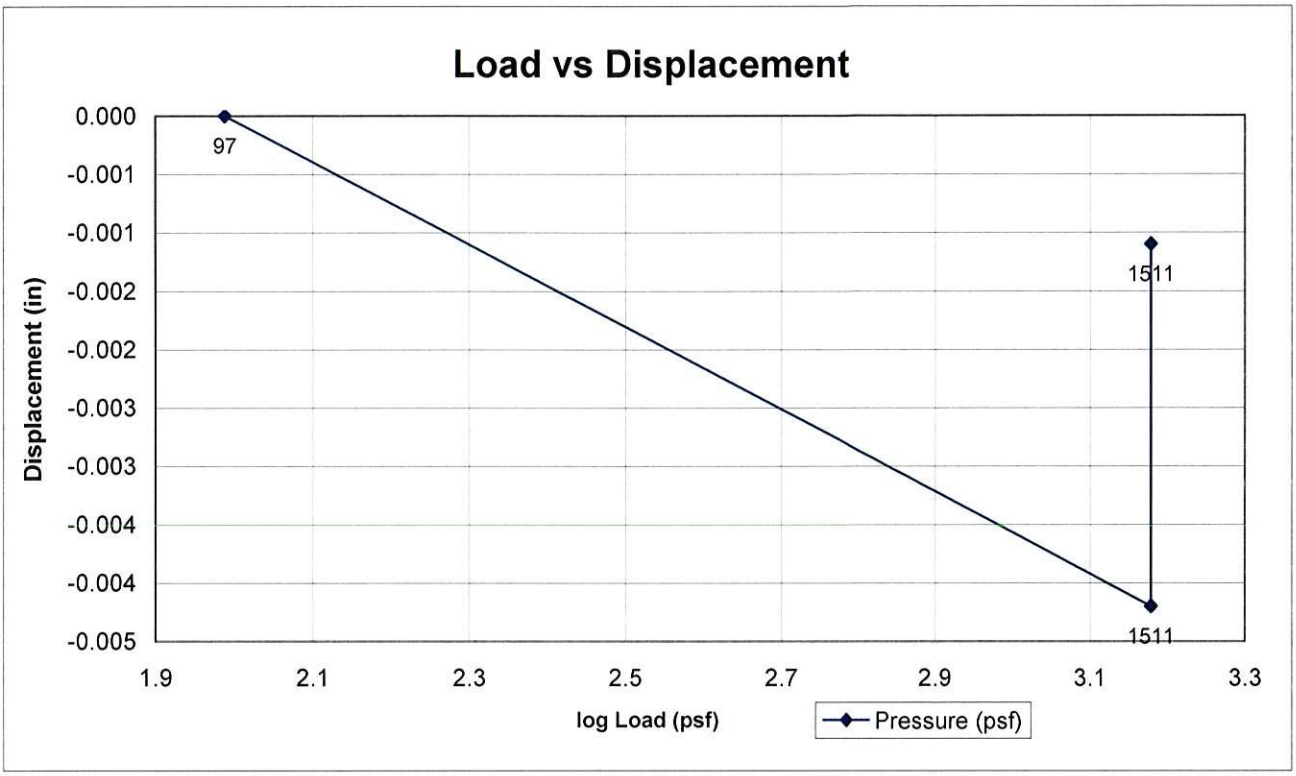
1511 psf Inundation Load

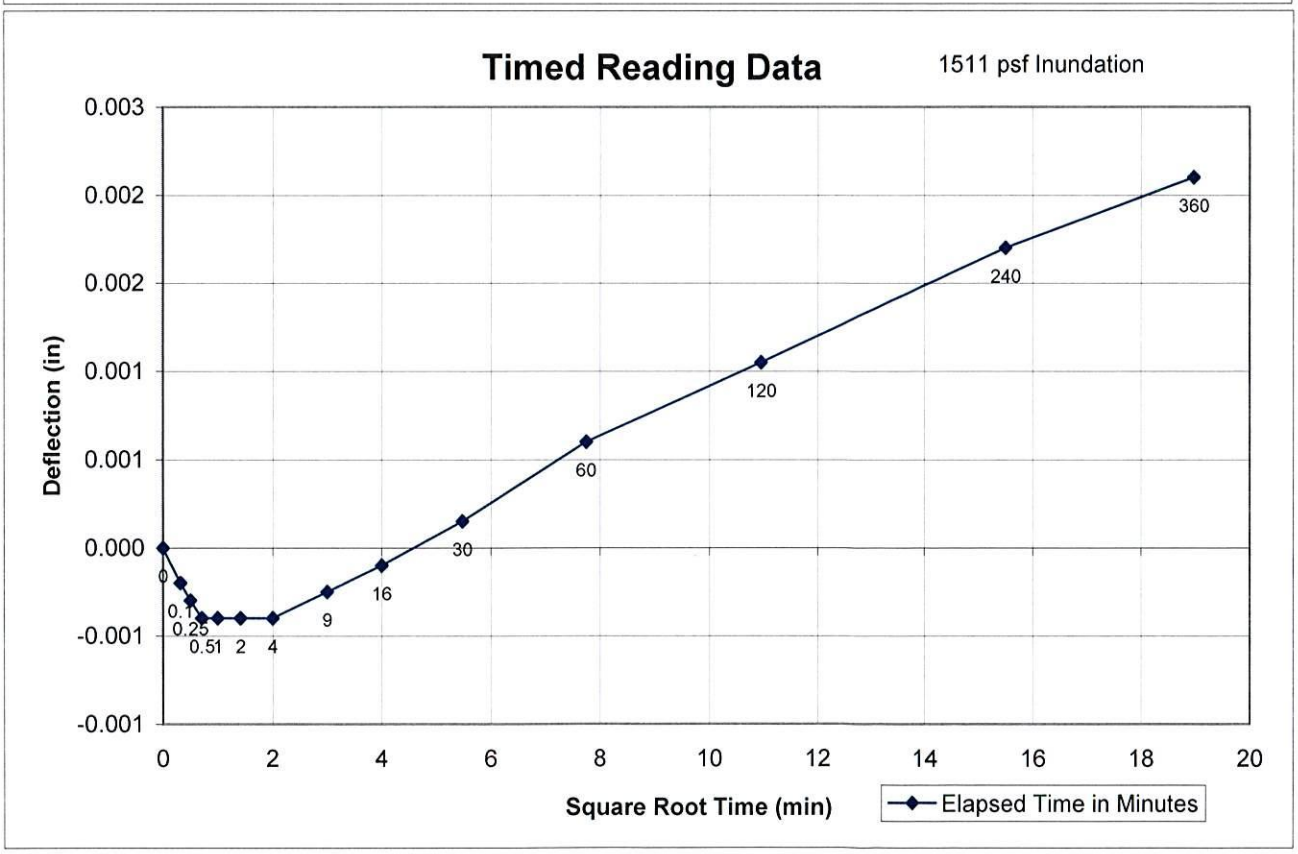
Elapsed Time (min)	SQRT Time (min)	Dial Reading (in)	Defl. (in)
0	0.00	0.00940	0.00000
0.1	0.32	0.00960	-0.00020
0.25	0.50	0.00970	-0.00030
0.5	0.71	0.00980	-0.00040
1	1.00	0.00980	-0.00040
2	1.41	0.00980	-0.00040
4	2.00	0.00980	-0.00040
9	3.00	0.00965	-0.00025
16	4.00	0.00950	-0.00010
30	5.48	0.00925	0.00015
60	7.75	0.00880	0.00060
120	10.95	0.00835	0.00105
240	15.49	0.00770	0.00170
360	18.97	0.00730	0.00210

SWELL/COLLAPSE TEST

ASTM D4546 Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	BORING NO.	B-102, Bu-6 & B-104, Bu-3
PROJECT NO.	16104	DEPTH	Composite 10-20'
LOCATION	--	SAMPLE NO.	#5 101.5 psf @ 21.6%





SWELL/COLLAPSE TEST

ASTM D4546 Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	SAMPLED	-- --
PROJECT NO.	16104	TEST STARTED	09/12/2016 DPM
LOCATION	--	TEST FINISHED	09/13/2016 DPM
BORING NO.	B-102, Bu-6 & B-104, Bu-3	CONSOLIDOMETER	ATT-2
DEPTH	Composite 10-20'	SAMPLE DESCR.	4000 psf
SAMPLE NO.	#5 101.5 pcf @ 21.6%		
SAMPLE DIA.(in)	2.410	INITIAL HT.(in)	1.000
SPECIFIC GRAVITY	2.65	FINAL HT.(in)	0.984

MOISTURE/DENSITY DATA

	BEFORE TEST	AFTER TEST		BEFORE TEST	AFTER TEST
Wt. Soil & Ring(s) (g)	194.44	196.36	Wt. Wet Soil & Pan (g)	150.96	152.88
Wt. Ring(s) (g)	46.76	46.76	Wt. Dry Soil & Pan (g)	125.71	125.71
Wt. Soil (g)	147.69	149.61	Wt. Lost Moisture (g)	25.25	27.17
Wet Density (pcf)	123.3	127.0	Wt. of Pan Only (g)	3.28	3.28
Moisture Content (%)	20.63	22.19	Wt. of Dry Soil (g)	122.43	122.43
Dry Density (pcf)	102.2	103.9	Saturation (%)	88.85	99.89

	LOAD (psf)	CONSOL. (IN)	LOG p	CONSOL. (IN/IN)	DEFL. (IN/IN)	STRAIN (%)
	106	0.00000	2.024	0.00000	0.00000	0.0
	4001	0.01260	3.602	0.01260	-0.01260	-1.3
Inundate	4001	0.01630	3.602	0.01630	-0.01630	-1.6

Data entry by: KR Date: 9/15/2016

Data checked by: CAL Date: 9/20/16

File Name: 2679_96_Swell-Consol_ASTMD4546_R0_19.xls

SWELL/COLLAPSE TEST

ASTM D4546 Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	SAMPLED	-- --
PROJECT NO.	16104	TEST STARTED	09/12/2016 DPM
LOCATION	--	TEST FINISHED	09/13/2016 DPM
BORING NO.	B-102, Bu-6 & B-104, Bu-3	CONSOLIDOMETER	ATT-2
DEPTH	Composite 10-20'	SAMPLE DESCR.	4000 psf
SAMPLE NO.	#5 101.5 pcf @ 21.6%		

Timed Reading Data

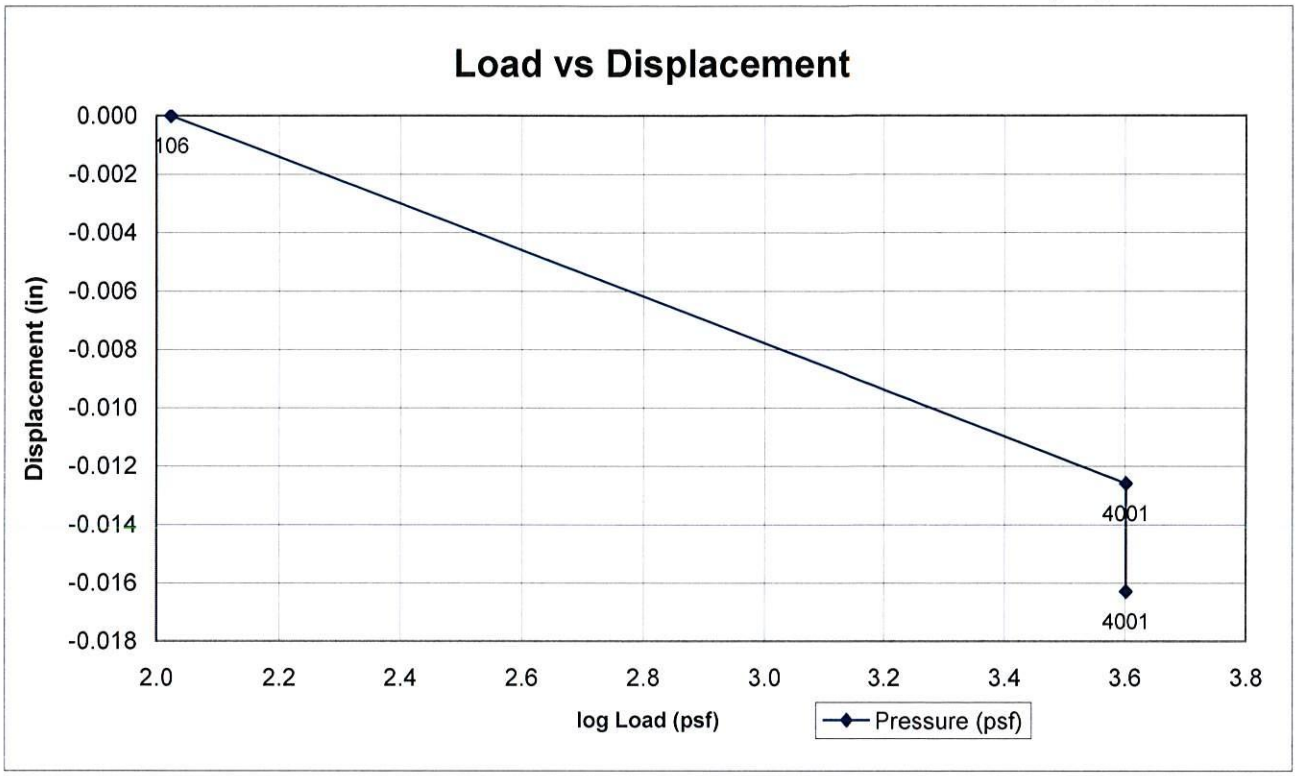
4001 psf Inundation Load

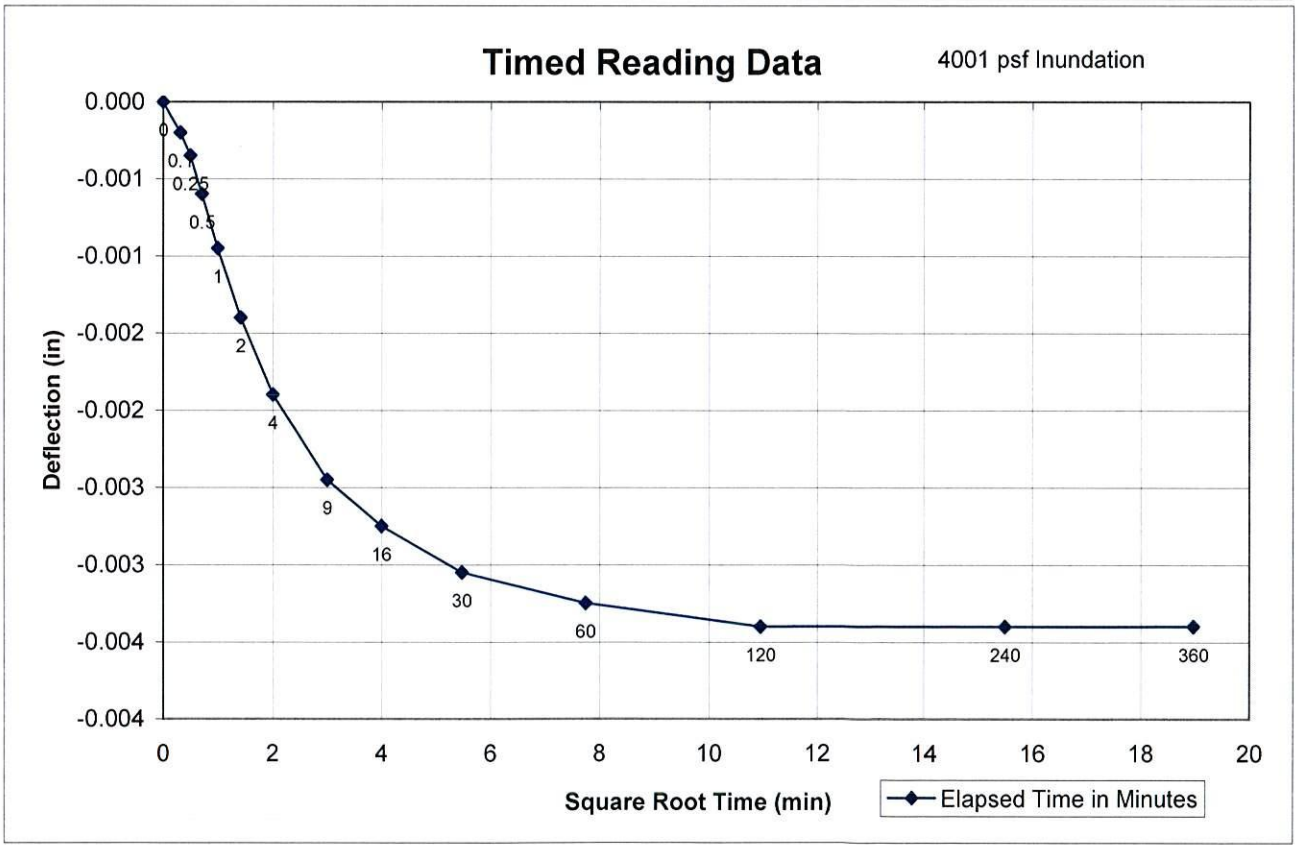
Elapsed Time (min)	SQRT Time (min)	Dial Reading (in)	Defl. (in)
0	0.00	0.01960	0.00000
0.1	0.32	0.01980	-0.00020
0.25	0.50	0.01995	-0.00035
0.5	0.71	0.02020	-0.00060
1	1.00	0.02055	-0.00095
2	1.41	0.02100	-0.00140
4	2.00	0.02150	-0.00190
9	3.00	0.02205	-0.00245
16	4.00	0.02235	-0.00275
30	5.48	0.02265	-0.00305
60	7.75	0.02285	-0.00325
120	10.95	0.02300	-0.00340
240	15.49	0.02300	-0.00340
360	18.97	0.02300	-0.00340

SWELL/COLLAPSE TEST

ASTM D4546 Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	BORING NO.	B-102, Bu-6 & B-104, Bu-3
PROJECT NO.	16104	DEPTH	Composite 10-20'
LOCATION	--	SAMPLE NO.	#5 101.5 pcf @ 21.6%





SWELL/COLLAPSE TEST

ASTM D4546 Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	SAMPLED	-- --
PROJECT NO.	16104	TEST STARTED	09/12/2016 DPM
LOCATION	--	TEST FINISHED	09/13/2016 DPM
BORING NO.	B-102, Bu-6 & B-104, Bu-3	CONSOLIDOMETER	ATT-06
DEPTH	Composite 10-20'	SAMPLE DESCR.	--
SAMPLE NO.	#5 101.5 pcf @ 21.6%		
SAMPLE DIA.(in)	2.410	INITIAL HT.(in)	1.000
SPECIFIC GRAVITY	2.65	FINAL HT.(in)	0.972

MOISTURE/DENSITY DATA

	BEFORE TEST	AFTER TEST		BEFORE TEST	AFTER TEST
Wt. Soil & Ring(s) (g)	190.36	191.25	Wt. Wet Soil & Pan (g)	150.74	151.63
Wt. Ring(s) (g)	42.79	42.79	Wt. Dry Soil & Pan (g)	125.13	125.13
Wt. Soil (g)	147.56	148.45	Wt. Lost Moisture (g)	25.62	26.51
Wet Density (pcf)	123.2	127.6	Wt. of Pan Only (g)	3.18	3.18
Moisture Content (%)	21.01	21.74	Wt. of Dry Soil (g)	121.94	121.94
Dry Density (pcf)	101.8	104.8	Saturation (%)	89.56	100.00

	LOAD (psf)	CONSOL. (IN)	LOG p	CONSOL. (IN/IN)	DEFL. (IN/IN)	STRAIN (%)
	103	0.00000	2.011	0.00000	0.00000	0.0
	6000	0.01885	3.778	0.01885	-0.01885	-1.9
Inundate	6000	0.02810	3.778	0.02810	-0.02810	-2.8

Data entry by: KR Date: 9/15/2016

Data checked by: CH Date: 9/20/16

File Name: 2679_96_Swell-Consol_ASTMD4546_R0_18.xls

SWELL/COLLAPSE TEST

ASTM D4546 Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	SAMPLED	-- --
PROJECT NO.	16104	TEST STARTED	09/12/2016 DPM
LOCATION	--	TEST FINISHED	09/13/2016 DPM
BORING NO.	B-102, Bu-6 & B-104, Bu-3	CONSOLIDOMETER	ATT-06
DEPTH	Composite 10-20'	SAMPLE DESCR.	--
SAMPLE NO.	#5 101.5 pcf @ 21.6%		

Timed Reading Data

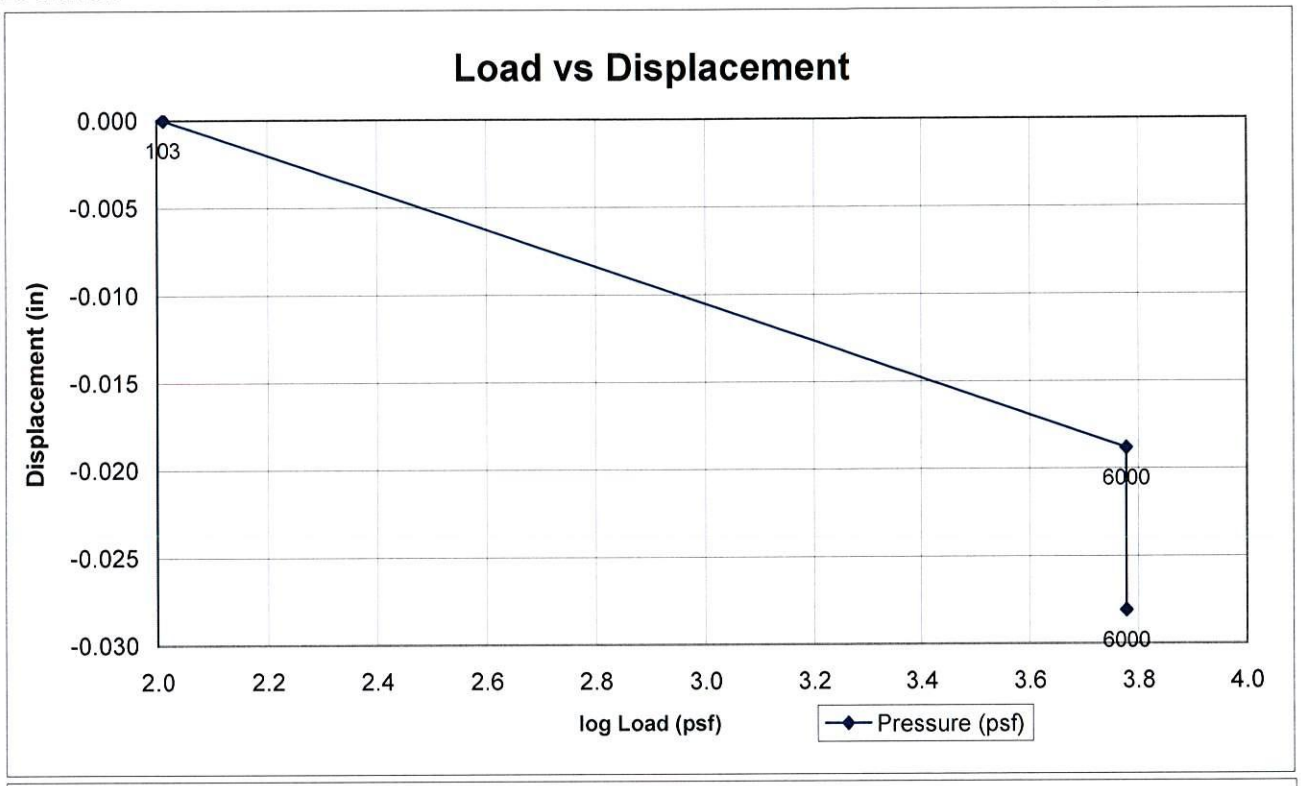
6000 psf Inundation Load

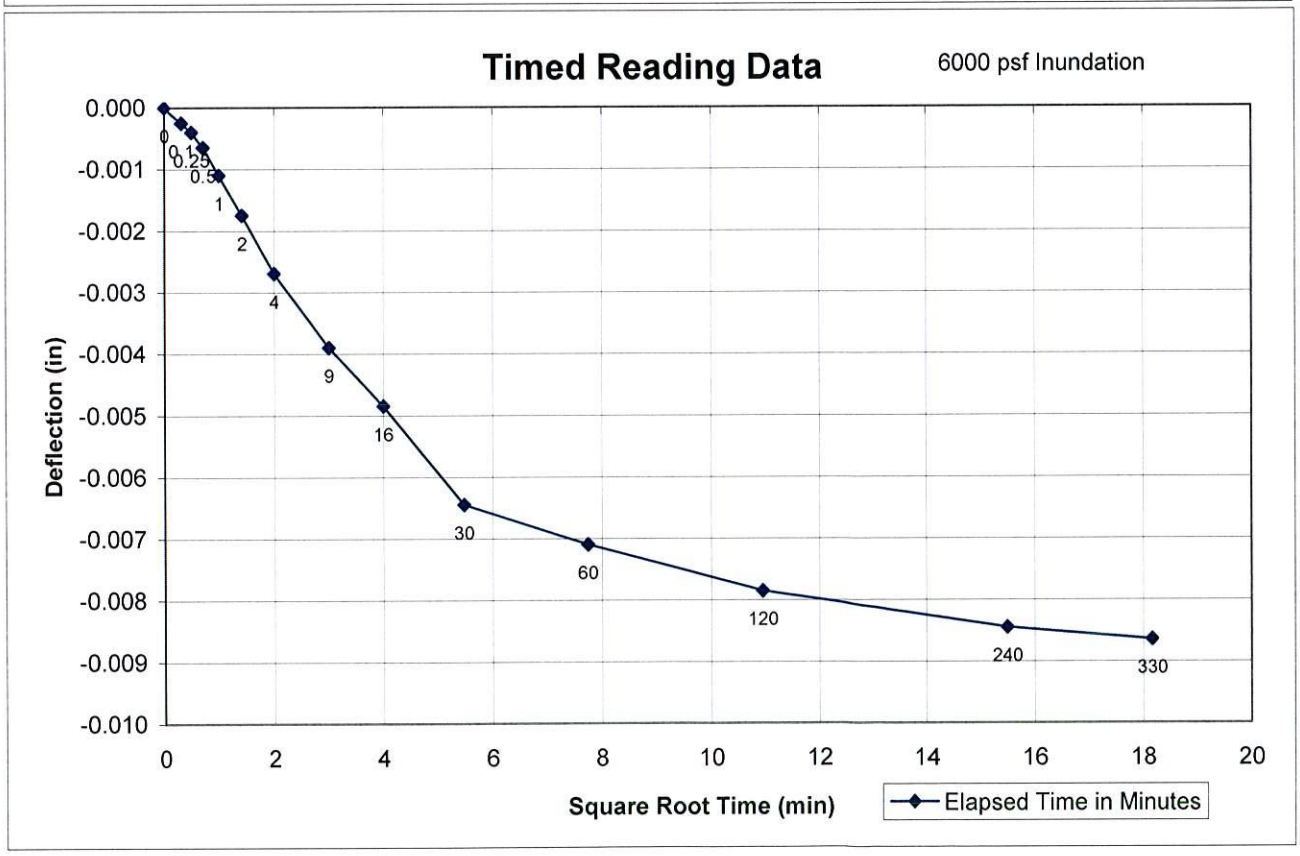
Elapsed Time (min)	SQRT Time (min)	Dial Reading (in)	Defl. (in)
0	0.00	0.02545	0.00000
0.1	0.32	0.02570	-0.00025
0.25	0.50	0.02585	-0.00040
0.5	0.71	0.02610	-0.00065
1	1.00	0.02655	-0.00110
2	1.41	0.02720	-0.00175
4	2.00	0.02815	-0.00270
9	3.00	0.02935	-0.00390
16	4.00	0.03030	-0.00485
30	5.48	0.03190	-0.00645
60	7.75	0.03255	-0.00710
120	10.95	0.03330	-0.00785
240	15.49	0.03390	-0.00845
330	18.17	0.03410	-0.00865

SWELL/COLLAPSE TEST

ASTM D4546 Method A

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT NAME	Thornton Water Treatment Plant	BORING NO.	B-102, Bu-6 & B-104, Bu-3
PROJECT NO.	16104	DEPTH	Composite 10-20'
LOCATION	--	SAMPLE NO.	#5 101.5 pcf @ 21.6%





Consolidation Test

ASTM D2435

CONSOLIDATION TEST

ASTM D2435

CLIENT RJH Consultants

JOB NO. 2679-96

PROJECT NAME	Thornton Water Treatment Plant	SAMPLED	06/23/2016 --
PROJECT NO.	16104	TEST STARTED	07/14/2016 DPM
LOCATION	--	TEST FINISHED	07/22/2016 DPM
BORING NO.	B-102	CONSOLIDOMETER	ATT-15
DEPTH	25-26' (25.5-26')	SAMPLE DESCR.	Claystone
SAMPLE NO.	DM-12		
		INITIAL HT.(in)	1.000
SAMPLE DIA.(in)	2.410	FINAL HT.(in)	0.916

MOISTURE/DENSITY DATA

	BEFORE TEST	AFTER TEST		BEFORE TEST	AFTER TEST
Wt. Soil & Ring(s) (g)	196.75	194.16	Wt. Wet Soil & Pan (g)	154.39	151.80
Wt. Ring(s) (g)	45.60	45.60	Wt. Dry Soil & Pan (g)	127.41	127.41
Wt. Soil (g)	151.15	148.56	Wt. Lost Moisture (g)	26.98	24.39
Wet Density (pcf)	126.2	135.4	Wt. of Pan Only (g)	3.24	3.24
Moisture Content (%)	21.7	19.6	Wt. of Dry Soil (g)	124.17	124.17
Dry Density (pcf)	103.7	113.2	Saturation (%)	96.7	112.7

		LOAD (psf)	CONSOL. (IN)	LOG p	CONSOL. (IN/IN)	DEFL. (IN/IN)	VOID RATIO (e)
		100	0.0000	2.000	0.0000	0.0000	0.595
		200	0.0006	2.301	0.0006	-0.0006	0.595
Inundate	*	200	-0.0006	2.301	-0.0006	0.0006	0.596
	*	400	-0.0005	2.602	-0.0005	0.0005	0.596
	*	800	-0.0006	2.903	-0.0006	0.0006	0.596
	*	1600	-0.0007	3.204	-0.0007	0.0007	0.597
		3200	0.0020	3.505	0.0020	-0.0020	0.592
		6400	0.0085	3.806	0.0085	-0.0085	0.582
		12800	0.0255	4.107	0.0255	-0.0255	0.555
		6400	0.0214	3.806	0.0214	-0.0214	0.561
		3200	0.0166	3.505	0.0166	-0.0166	0.569
		6400	0.0183	3.806	0.0183	-0.0183	0.566
		12800	0.0266	4.107	0.0266	-0.0266	0.553
		25600	0.0518	4.408	0.0518	-0.0518	0.513
		51200	0.0838	4.709	0.0838	-0.0838	0.462

Note: After the 100 psf seating load, a 200 psf seating load was applied for 5 minutes before the sample was inundated.

The sample started to leaf out between the pore stone and the ring at the 51200 psf load.

* Indicates Swelling. In compliance with ASTM D2435 the sample was loaded to the next load to prevent swelling.

Init. Ht. Solids (cm)	1.592	Sp. Gr. (g/cc)	2.650
Init. Ht. Voids (cm)	0.948		
Init. Void Ratio	0.595		

Data entry by: NN Date: 07/26/2016

Data checked by: DPM Date: 7/29/16

FileName: 2679_96_Consolidation-ASTMD2435-R0_1.xls

CONSOLIDATION TEST

ASTM D2435

CLIENT RJH Consultants

JOB NO. 2679-96

PROJECT NAME	Thornton Water Treatment Plant	SAMPLED	06/23/2016 --
PROJECT NO.	16104	TEST STARTED	07/14/2016 DPM
LOCATION	--	TEST FINISHED	07/22/2016 DPM
BORING NO.	B-102	CONSOLIDOMETER	ATT-15
DEPTH	25-26' (25.5-26')	SAMPLE DESCR.	Claystone
SAMPLE NO.	DM-12		

TIME READING DATA

6400 psf Load

Elapsed Time (min)	SQRT Time (min)	Dial Reading (in)	Defl. (in)
0.0	0.00	0.0057	0.0000
0.1	0.32	0.0089	-0.0032
0.3	0.50	0.0095	-0.0038
0.5	0.71	0.0099	-0.0042
1.0	1.00	0.0103	-0.0046
2.0	1.41	0.0106	-0.0049
4.0	2.00	0.0110	-0.0053
9.0	3.00	0.0113	-0.0056
16.0	4.00	0.0117	-0.0060
30.0	5.48	0.0119	-0.0062
60.0	7.75	0.0123	-0.0066
120.0	10.95	0.0126	-0.0069
240.0	15.49	0.0129	-0.0072
480.0	21.91	0.0131	-0.0074

12800 psf Load

Elapsed Time (min)	SQRT Time (min)	Dial Reading (in)	Defl. (in)
0.0	0.00	0.0134	0.0000
0.1	0.32	0.0216	-0.0082
0.3	0.50	0.0228	-0.0094
0.5	0.71	0.0235	-0.0101
1.0	1.00	0.0243	-0.0109
2.0	1.41	0.0251	-0.0117
4.0	2.00	0.0259	-0.0125
9.0	3.00	0.0268	-0.0134
16.0	4.00	0.0275	-0.0141
30.0	5.48	0.0283	-0.0149
60.0	7.75	0.0293	-0.0159
120.0	10.95	0.0303	-0.0169
240.0	15.49	0.0313	-0.0179
480.0	21.91	0.0321	-0.0187

25600 psf Load

Elapsed Time (min)	SQRT Time (min)	Dial Reading (in)	Defl. (in)
0.0	0.00	0.0337	0.0000
0.1	0.32	0.0432	-0.0095
0.3	0.50	0.0443	-0.0106
0.5	0.71	0.0451	-0.0114
1.0	1.00	0.0459	-0.0122
2.0	1.41	0.0468	-0.0131
4.0	2.00	0.0478	-0.0141
9.0	3.00	0.0489	-0.0152
16.0	4.00	0.0501	-0.0164
30.0	5.48	0.0515	-0.0178
60.0	7.75	0.0534	-0.0197
120.0	10.95	0.0555	-0.0218
240.0	15.49	0.0577	-0.0240
480.0	21.91	0.0595	-0.0258

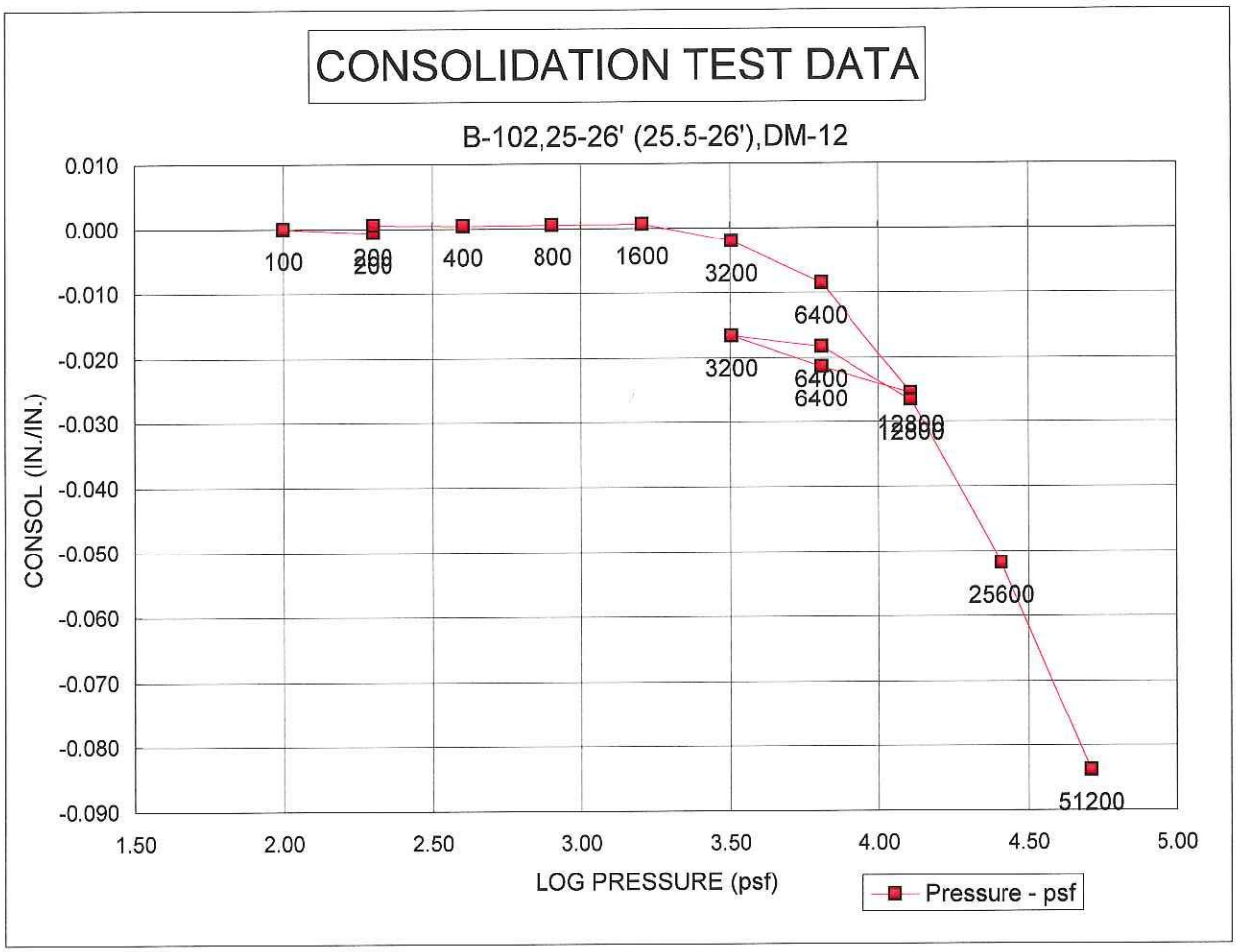
51200 psf Load

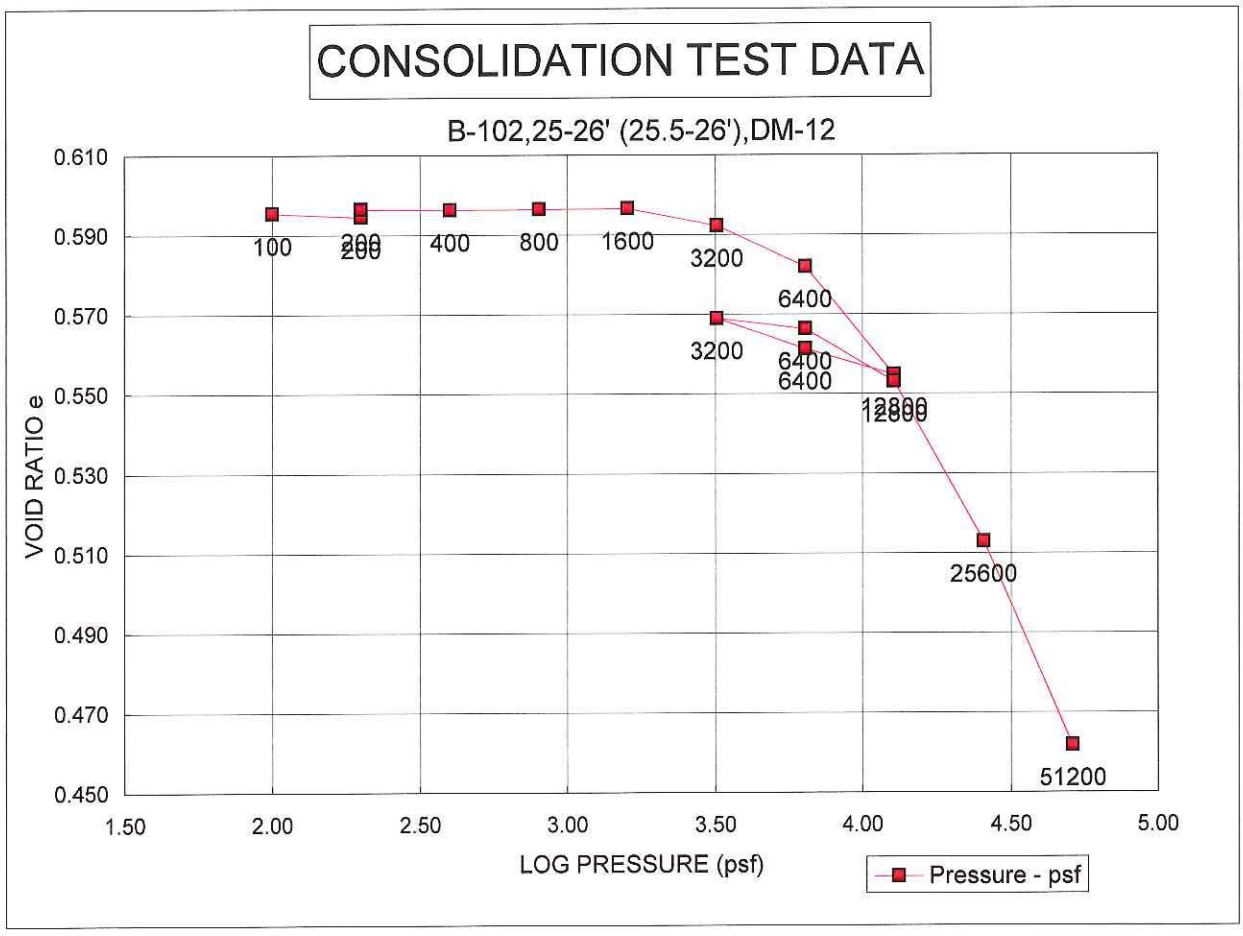
Elapsed Time (min)	SQRT Time (min)	Dial Reading (in)	Defl. (in)
0.0	0.00	0.0614	0.0000
0.1	0.32	0.0700	-0.0086
0.3	0.50	0.0706	-0.0092
0.5	0.71	0.0711	-0.0097
1.0	1.00	0.0718	-0.0104
2.0	1.41	0.0726	-0.0112
4.0	2.00	0.0734	-0.0120
9.0	3.00	0.0750	-0.0136
16.0	4.00	0.0763	-0.0149
30.0	5.48	0.0782	-0.0168
60.0	7.75	0.0812	-0.0198
120.0	10.95	0.0849	-0.0235
246.0	15.68	0.0894	-0.0280
480.0	21.91	0.0931	-0.0317
1750.0	41.83	0.0967	-0.0353

Data entry by: NN Date: 07/26/2016

Data checked by: QRM Date: 7/29/16

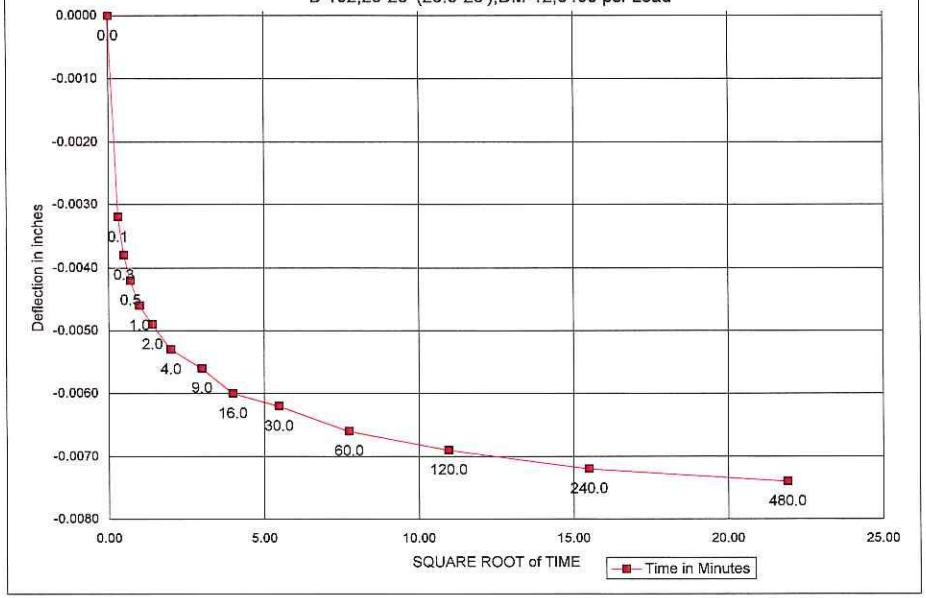
FileName: 2679_96_Consolidation-ASTMD2435-R0_1.xls


CONSOLIDATION TEST DATA
B-102,25-26' (25.5-26'),DM-12
CONSOL (IN./IN.)
0.010
0.000
-0.010
-0.020
-0.030
-0.040
-0.050
-0.060
-0.070
-0.080
-0.090
100
200
400
800
1600
3200
6400
3200
6400
6400
12800
25600
51200
1.50
2.00
2.50
3.00
3.50
4.00
4.50
5.00
LOG PRESSURE (psf)
Pressure - psf


CONSOLIDATION TEST DATA
B-102,25-26' (25.5-26'),DM-12
VOID RATIO e
0.610
0.590
0.570
0.550
0.530
0.510
0.490
0.470
0.450
100
200
400
800
1600
3200
6400
3200
6400
6400
12800
25600
51200
1.50
2.00
2.50
3.00
3.50
4.00
4.50
5.00
LOG PRESSURE (psf)
Pressure - psf

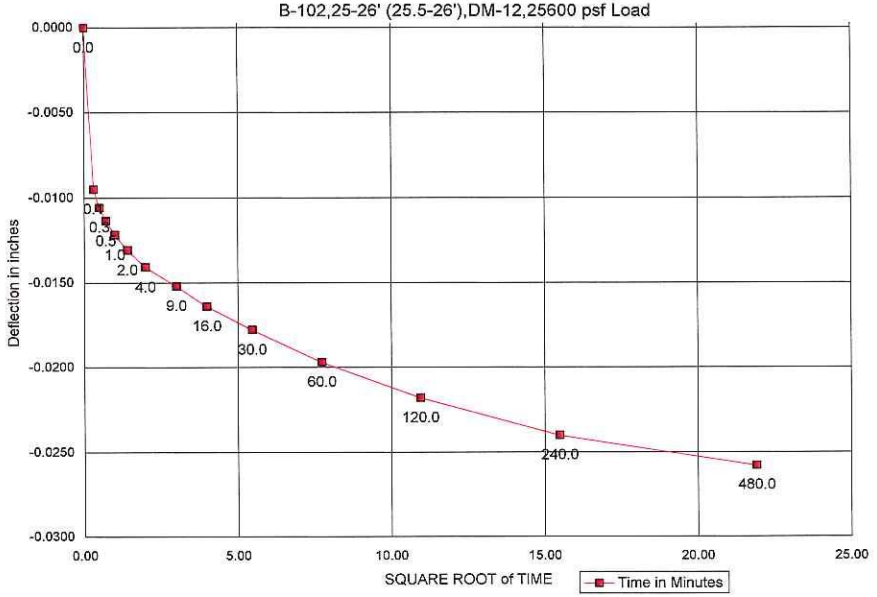
TIME READING DATA

B-102,25-26' (25.5-26'),DM-12,6400 psf Load



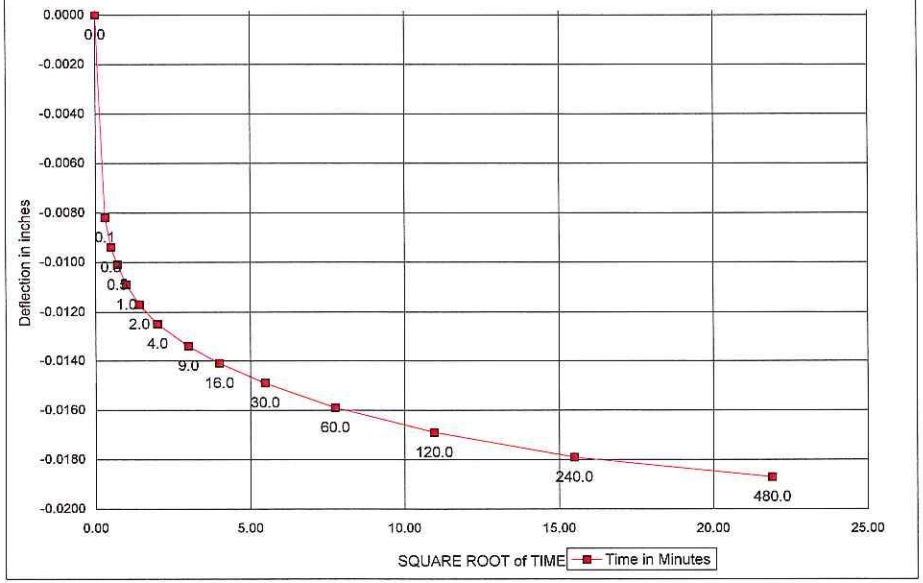
TIME READING DATA

B-102,25-26' (25.5-26'),DM-12,25600 psf Load



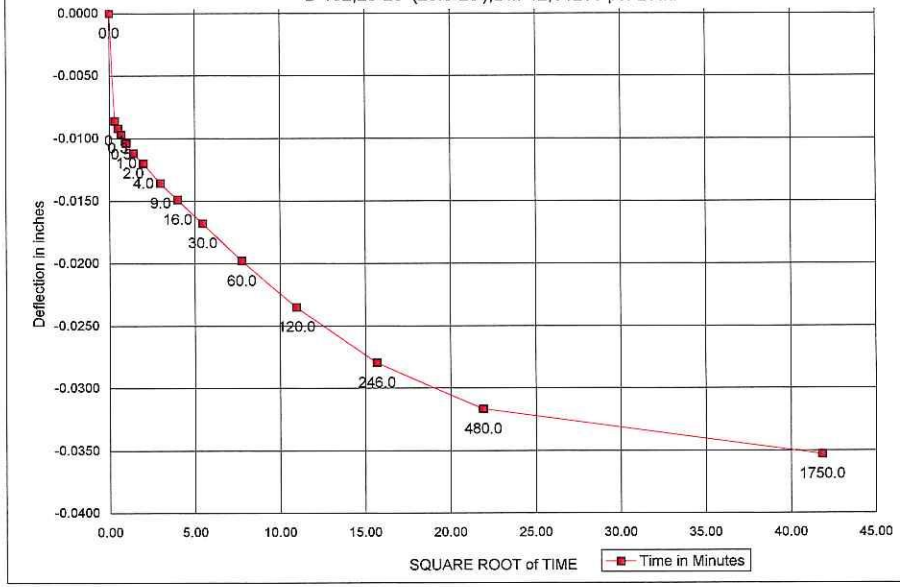
TIME READING DATA

B-102,25-26' (25.5-26'),DM-12,12800 psf Load



TIME READING DATA

B-102,25-26' (25.5-26'),DM-12,51200 psf Load



CONSOLIDATION TEST

ASTM D2435

CLIENT RJH Consultants

JOB NO. 2679-96

PROJECT NAME	Thornton Water Treatment Plant	SAMPLED	06/20/2016 --
PROJECT NO.	16104	TEST STARTED	07/14/2016 DPM
LOCATION	--	TEST FINISHED	07/22/2016 DPM
BORING NO.	B-103	CONSOLIDOMETER	ATT-16
DEPTH	54-54.4'	SAMPLE DESCR.	Claystone
SAMPLE NO.	DM-18		
		INITIAL HT.(in)	1.000
SAMPLE DIA.(in)	2.410	FINAL HT.(in)	0.927

MOISTURE/DENSITY DATA

	BEFORE TEST	AFTER TEST		BEFORE TEST	AFTER TEST
Wt. Soil & Ring(s) (g)	194.86	197.37	Wt. Wet Soil & Pan (g)	152.01	154.52
Wt. Ring(s) (g)	45.99	45.99	Wt. Dry Soil & Pan (g)	129.79	129.79
Wt. Soil (g)	148.87	151.38	Wt. Lost Moisture (g)	22.22	24.73
Wet Density (pcf)	124.3	136.3	Wt. of Pan Only (g)	3.15	3.15
Moisture Content (%)	17.5	19.5	Wt. of Dry Soil (g)	126.65	126.65
Dry Density (pcf)	105.8	114.1	Saturation (%)	82.4	114.9

		LOAD (psf)	CONSOL. (IN)	LOG p	CONSOL. (IN/IN)	DEFL. (IN/IN)	VOID RATIO (e)
		100	0.0000	2.000	0.0000	0.0000	0.564
		200	0.0008	2.301	0.0008	-0.0008	0.563
Inundate	*	200	-0.0007	2.301	-0.0007	0.0007	0.565
	*	400	-0.0010	2.602	-0.0010	0.0010	0.566
	*	800	-0.0006	2.903	-0.0006	0.0006	0.565
	*	1600	-0.0005	3.204	-0.0005	0.0005	0.565
		3200	0.0031	3.505	0.0031	-0.0031	0.559
		6400	0.0119	3.806	0.0119	-0.0119	0.546
		12800	0.0295	4.107	0.0295	-0.0295	0.518
		6400	0.0267	3.806	0.0267	-0.0267	0.522
		3200	0.0241	3.505	0.0241	-0.0241	0.527
		6400	0.0259	3.806	0.0259	-0.0259	0.524
		12800	0.0305	4.107	0.0305	-0.0305	0.517
		25600	0.0509	4.408	0.0509	-0.0509	0.485

Note: After the 100 psf seating load, a 200psf seating load was applied for 5 minutes before the sample was inundated.

*Indicates swelling. In compliance with ASTM D2435, the sample was loaded to the next load to prevent swelling.

Init. Ht. Solids (cm)	1.624	Sp. Gr. (g/cc)	2.650
Init. Ht. Voids (cm)	0.916		
Init. Void Ratio	0.564		

Data entry by: NN Date: 07/26/2016

Data checked by: DMM Date: 7/29/16

FileName: 2679_96_Consolidation-ASTMD2435-R0_0.xls

CONSOLIDATION TEST

ASTM D2435

CLIENT RJH Consultants

JOB NO. 2679-96

PROJECT NAME	Thornton Water Treatment Plant	SAMPLED	06/20/2016 --
PROJECT NO.	16104	TEST STARTED	07/14/2016 DPM
LOCATION	--	TEST FINISHED	07/22/2016 DPM
BORING NO.	B-103	CONSOLIDOMETER	ATT-16
DEPTH	54-54.4'	SAMPLE DESCR.	Claystone
SAMPLE NO.	DM-18		

TIME READING DATA

3200 psf Load

Elapsed Time (min)	SQRT Time (min)	Dial Reading (in)	Defl. (in)
0.0	0.00	0.0012	0.0000
0.1	0.32	0.0043	-0.0031
0.3	0.50	0.0046	-0.0034
0.5	0.71	0.0049	-0.0037
1.0	1.00	0.0051	-0.0039
2.0	1.41	0.0052	-0.0040
4.0	2.00	0.0053	-0.0041
10.0	3.16	0.0056	-0.0044
16.0	4.00	0.0057	-0.0045
30.0	5.48	0.0058	-0.0046
60.0	7.75	0.0058	-0.0046
120.0	10.95	0.0059	-0.0047
240.0	15.49	0.0059	-0.0047
516.0	22.72	0.0059	-0.0047

6400 psf Load

Elapsed Time (min)	SQRT Time (min)	Dial Reading (in)	Defl. (in)
0.0	0.00	0.0059	0.0000
0.1	0.32	0.0101	-0.0042
0.3	0.50	0.0108	-0.0049
0.5	0.71	0.0115	-0.0056
1.0	1.00	0.0120	-0.0061
2.0	1.41	0.0125	-0.0066
4.0	2.00	0.0131	-0.0072
9.0	3.00	0.0137	-0.0078
16.0	4.00	0.0141	-0.0082
30.0	5.48	0.0146	-0.0087
60.0	7.75	0.0151	-0.0092
120.0	10.95	0.0155	-0.0096
240.0	15.49	0.0156	-0.0097
480.0	21.91	0.0157	-0.0098

12800 psf Load

Elapsed Time (min)	SQRT Time (min)	Dial Reading (in)	Defl. (in)
0.0	0.00	0.0162	0.0000
0.1	0.32	0.0275	-0.0113
0.3	0.50	0.0294	-0.0132
0.5	0.71	0.0305	-0.0143
1.0	1.00	0.0314	-0.0152
2.0	1.41	0.0322	-0.0160
4.0	2.00	0.0328	-0.0166
9.0	3.00	0.0334	-0.0172
16.0	4.00	0.0338	-0.0176
30.0	5.48	0.0344	-0.0182
60.0	7.75	0.0347	-0.0185
120.0	10.95	0.0351	-0.0189
240.0	15.49	0.0355	-0.0193
480.0	21.91	0.0356	-0.0194

25600 psf Load

Elapsed Time (min)	SQRT Time (min)	Dial Reading (in)	Defl. (in)
0.0	0.00	0.0367	0.0000
0.1	0.32	0.0498	-0.0131
0.3	0.50	0.0515	-0.0148
0.5	0.71	0.0529	-0.0162
1.0	1.00	0.0539	-0.0172
2.0	1.41	0.0550	-0.0183
4.0	2.00	0.0560	-0.0193
9.0	3.00	0.0568	-0.0201
16.0	4.00	0.0572	-0.0205
30.0	5.48	0.0577	-0.0210
60.0	7.75	0.0580	-0.0213
120.0	10.95	0.0584	-0.0217
240.0	15.49	0.0586	-0.0219
480.0	21.91	0.0589	-0.0222

Data entry by: NN Date: 07/26/2016

Data checked by: DPM Date: 7/27/16

FileName: 2679_96_Consolidation-ASTMD2435-R0_0.xls

CONSOLIDATION TEST

ASTM D2435

CLIENT RJH Consultants

JOB NO. 2679-96

PROJECT NAME	Thornton Water Treatment Plant	SAMPLED	06/20/2016 --
PROJECT NO.	16104	TEST STARTED	07/14/2016 DPM
LOCATION	--	TEST FINISHED	07/22/2016 DPM
BORING NO.	B-103	CONSOLIDOMETER	ATT-16
DEPTH	54-54.4'	SAMPLE DESCR.	Claystone
SAMPLE NO.	DM-18		

TIME READING DATA

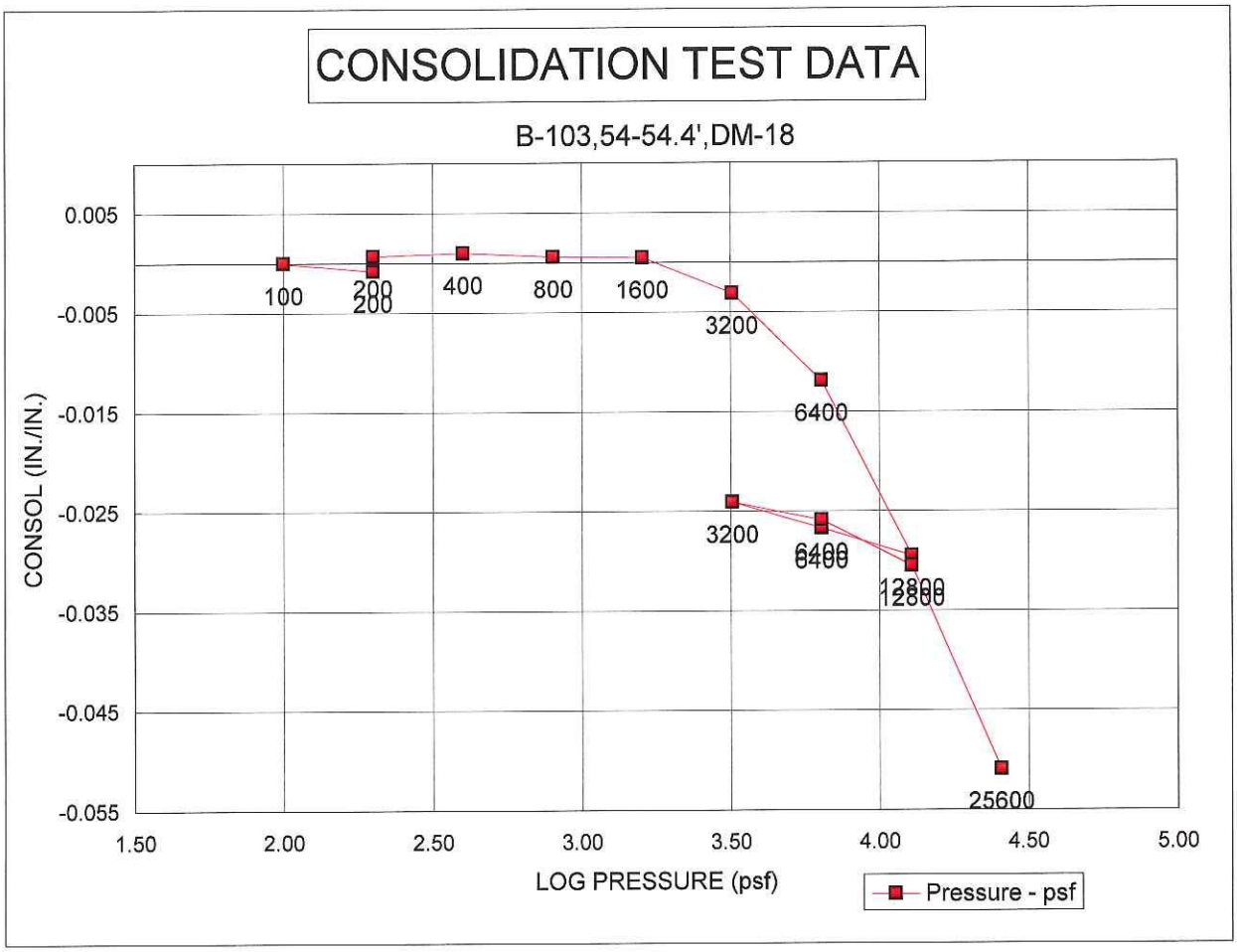
51200 psf Load

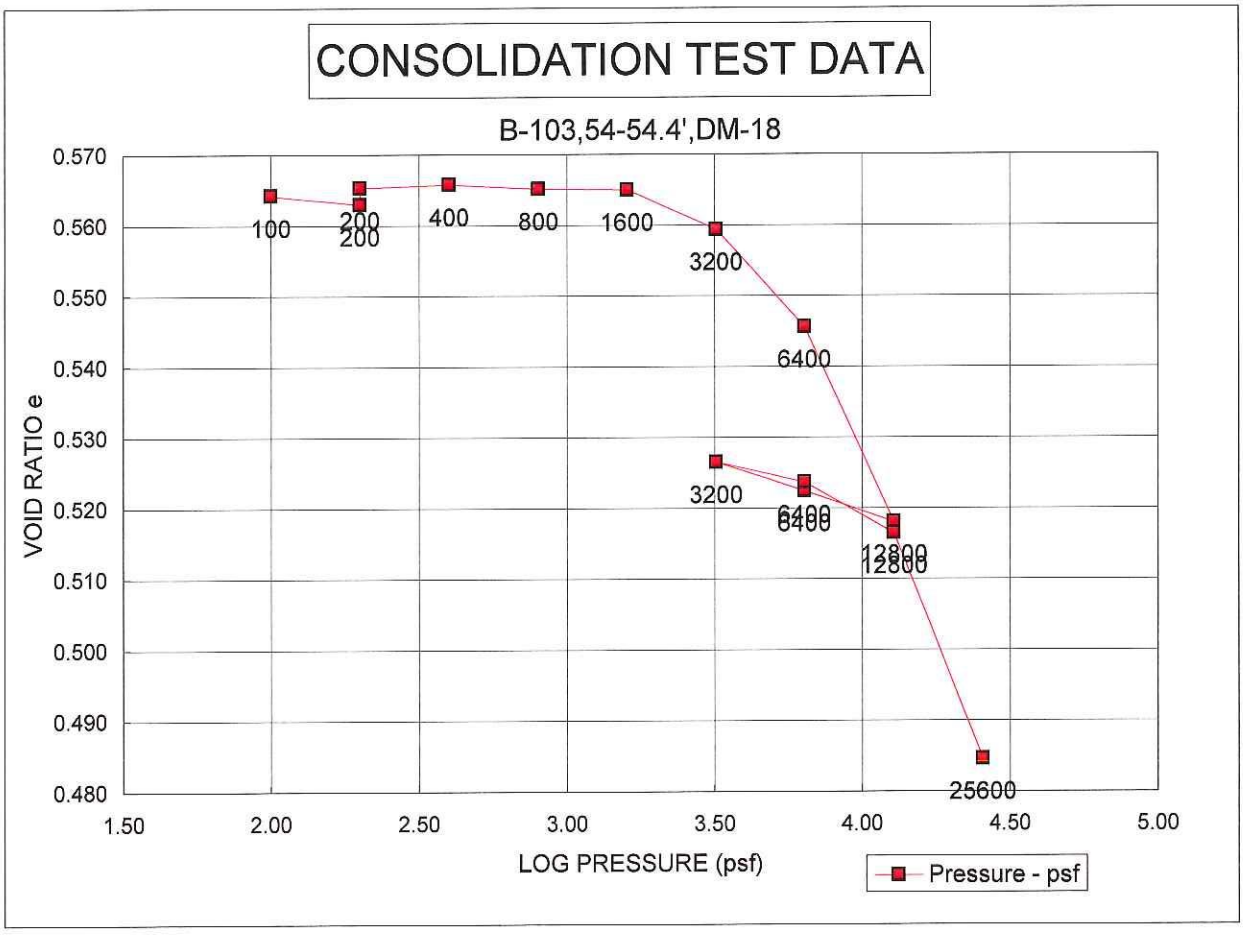
Elapsed Time (min)	SQRT Time (min)	Dial Reading (in)	Defl. (in)
0.0	0.00	0.0595	0.0000
0.1	0.32	0.0728	-0.0133
0.3	0.50	0.0745	-0.0150
0.5	0.71	0.0758	-0.0163
1.0	1.00	0.0773	-0.0178
2.0	1.41	0.0787	-0.0192
4.0	2.00	0.0801	-0.0206
9.0	3.00	0.0812	-0.0217
16.0	4.00	0.0820	-0.0225
30.0	5.48	0.0827	-0.0232
60.0	7.75	0.0833	-0.0238
120.0	10.95	0.0836	-0.0241
245.0	15.65	0.0840	-0.0245
480.0	21.91	0.0842	-0.0247

Data entry by: NN Date: 07/26/2016

Data checked by: DPM Date: 7/29/16

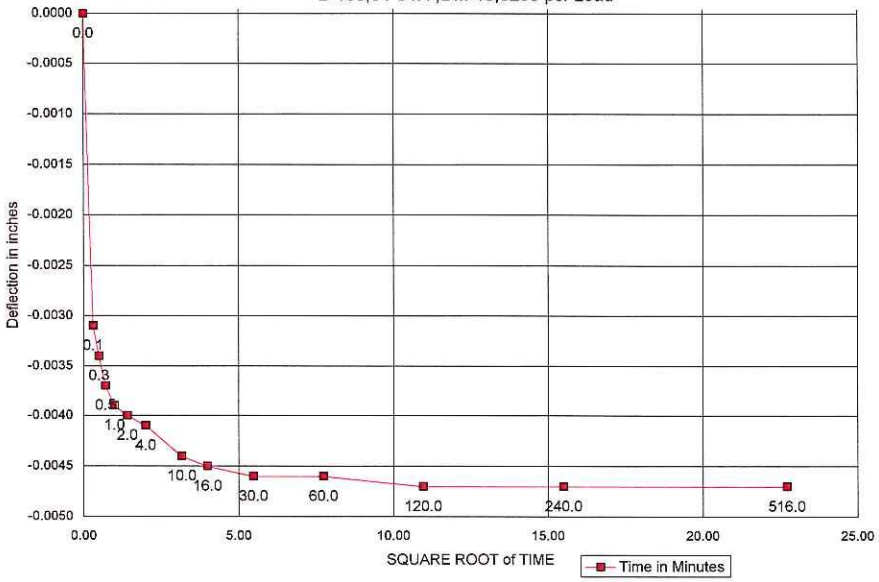
FileName: 2679_96_Consolidation-ASTMD2435-R0_0.xls


CONSOLIDATION TEST DATA
B-103,54-54.4',DM-18
CONSOL (IN./IN.)
0.005
-0.005
-0.015
-0.025
-0.035
-0.045
-0.055
100
200
200
400
800
1600
3200
6400
3200
6400
6400
12800
12800
25600
1.50
2.00
2.50
3.00
3.50
4.00
4.50
5.00
LOG PRESSURE (psf)
Pressure - psf


CONSOLIDATION TEST DATA
B-103,54-54.4',DM-18
VOID RATIO e
0.570
0.560
0.550
0.540
0.530
0.520
0.510
0.500
0.490
0.480
100
200
200
400
800
1600
3200
6400
3200
6400
6400
12800
12800
25600
1.50
2.00
2.50
3.00
3.50
4.00
4.50
5.00
LOG PRESSURE (psf)
Pressure - psf

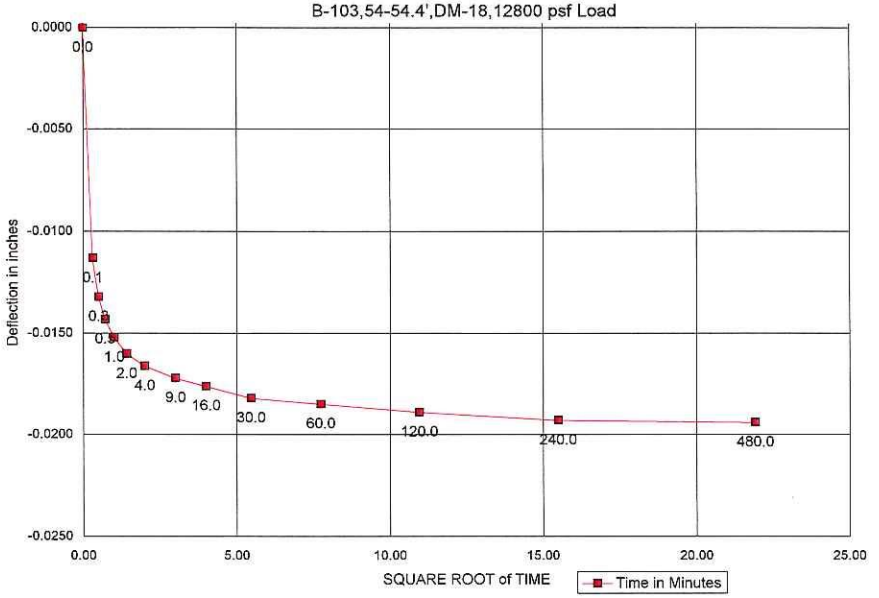
TIME READING DATA

B-103,54-54.4',DM-18,3200 psf Load



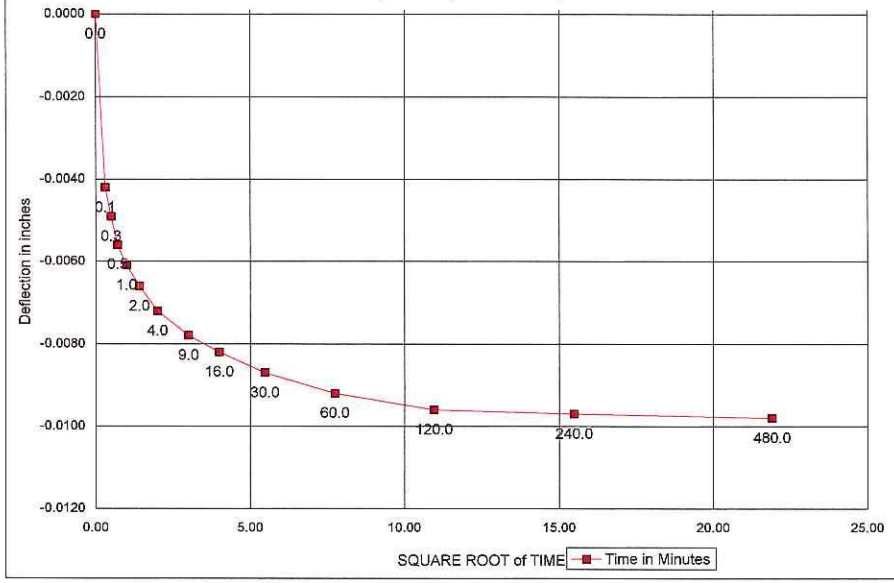
TIME READING DATA

B-103,54-54.4',DM-18,12800 psf Load



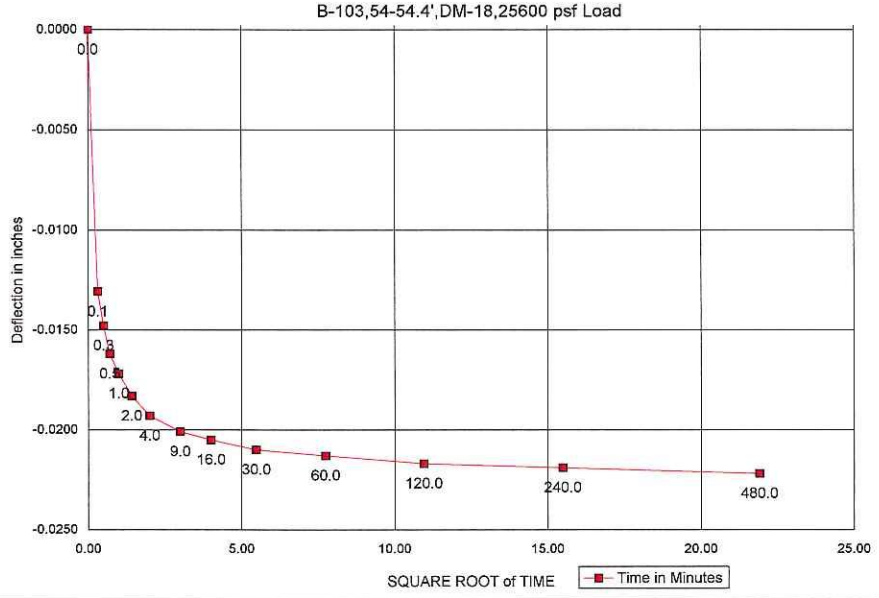
TIME READING DATA

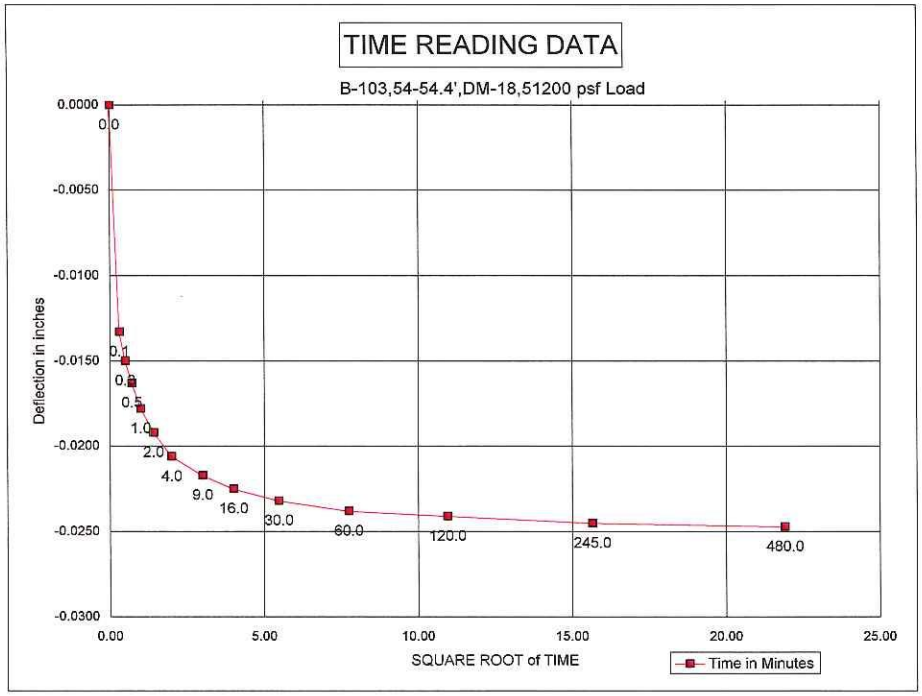
B-103,54-54.4',DM-18,6400 psf Load



TIME READING DATA

B-103,54-54.4',DM-18,25600 psf Load




TIME READING DATA
B-103,54-54.4',DM-18,51200 psf Load
Deflection in inches
0.0000
-0.0050
-0.0100
-0.0150
-0.0200
-0.0250
-0.0300
0.00
5.00
10.00
15.00
20.00
25.00
SQUARE ROOT of TIME
0.0
0.1
0.25
0.5
1.0
2.0
4.0
9.0
16.0
30.0
60.0
120.0
245.0
480.0
Time in Minutes

16104 Thornton WTP
Calculation of consolidation parameters
By ABP 8/1/16
Checked MSS 8/16/2016

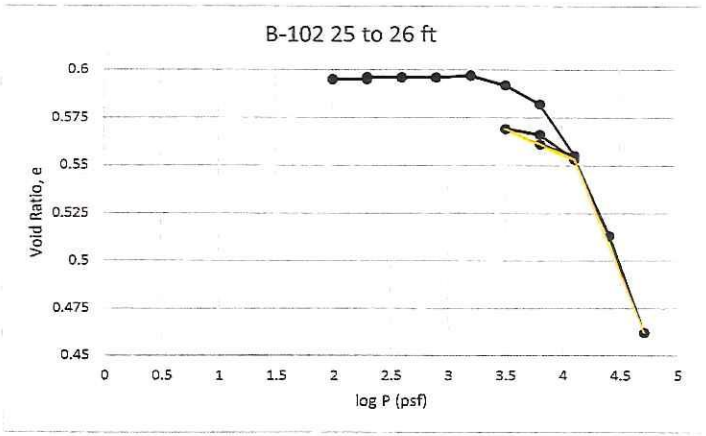
		B-102 25 to 26 ft	B-103 54 to 54.4 ft
Cc	e1	0.553	0.546
	e2	0.462	0.485
	log p1	4.107	3.806
	log p2	4.709	4.408
	Cc	0.15	0.10
Cr	e1	0.569	0.527
	e2	0.553	0.517
	log p1	3.505	3.505
	log p2	4.107	4.107
	Cr	0.03	0.02

NOTE B-103 LL=50 PI=31

B-102 LL=53 PI=36

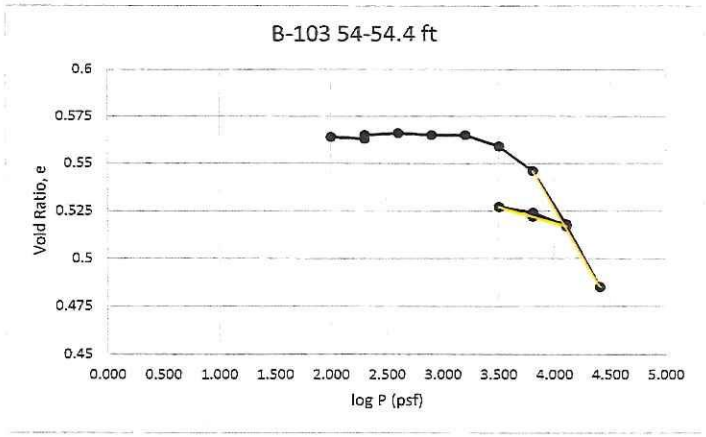
Consolidation Tests
B-102 25 to 26 feet

e	log P
0.595	2
0.595	2.301
0.596	2.301
0.596	2.602
0.596	2.903
0.597	3.204
0.592	3.505
0.582	3.806
0.555	4.107
0.561	3.806
0.569	3.505
0.566	3.806
0.553	4.107
0.513	4.408
0.462	4.709



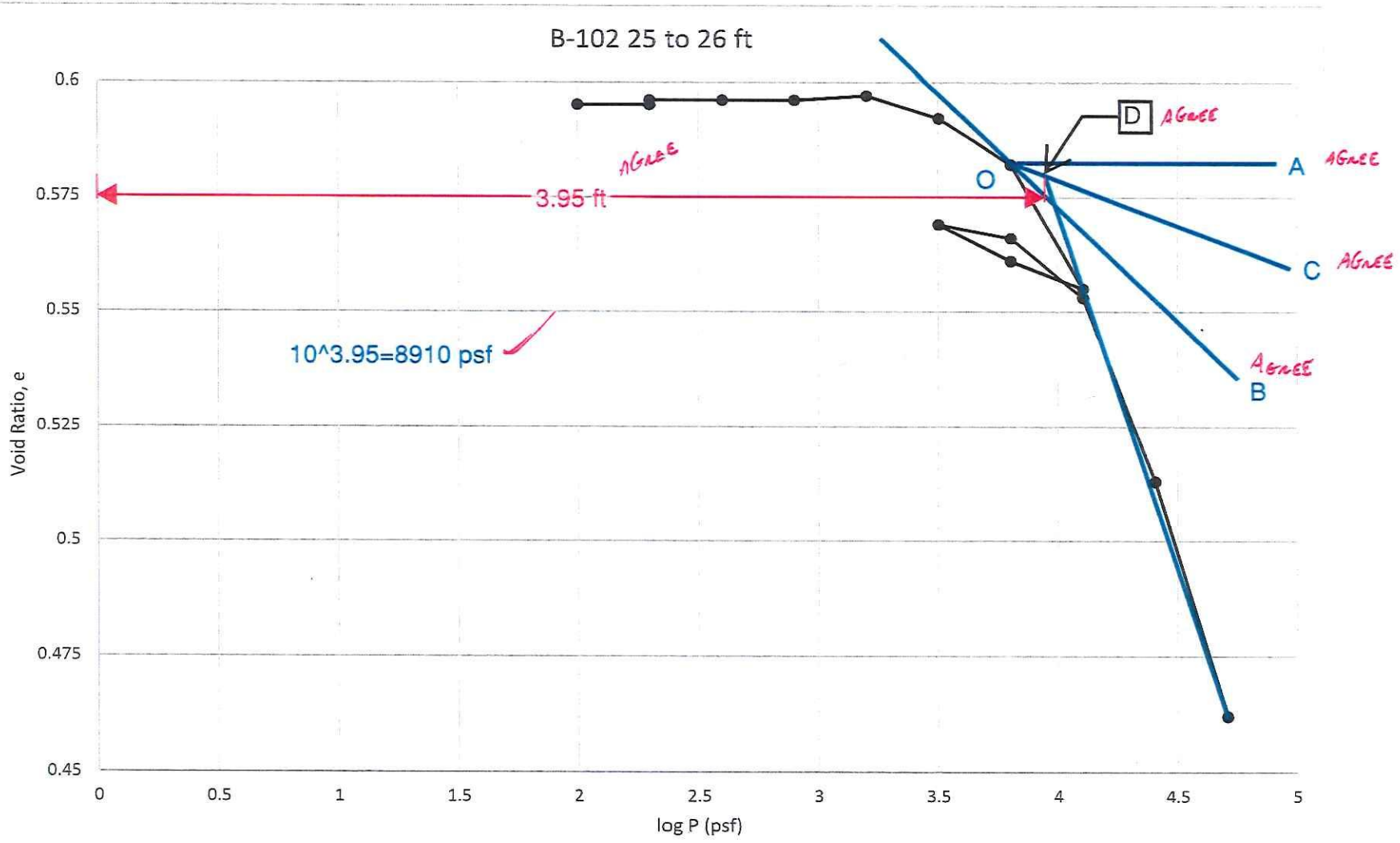
B-103 54-54.4 ft

e	log P
0.564	2.000
0.563	2.301
0.565	2.301
0.566	2.602
0.565	2.903
0.565	3.204
0.559	3.505
0.546	3.806
0.518	4.107
0.522	3.806
0.527	3.505
0.524	3.806
0.517	4.107
0.485	4.408

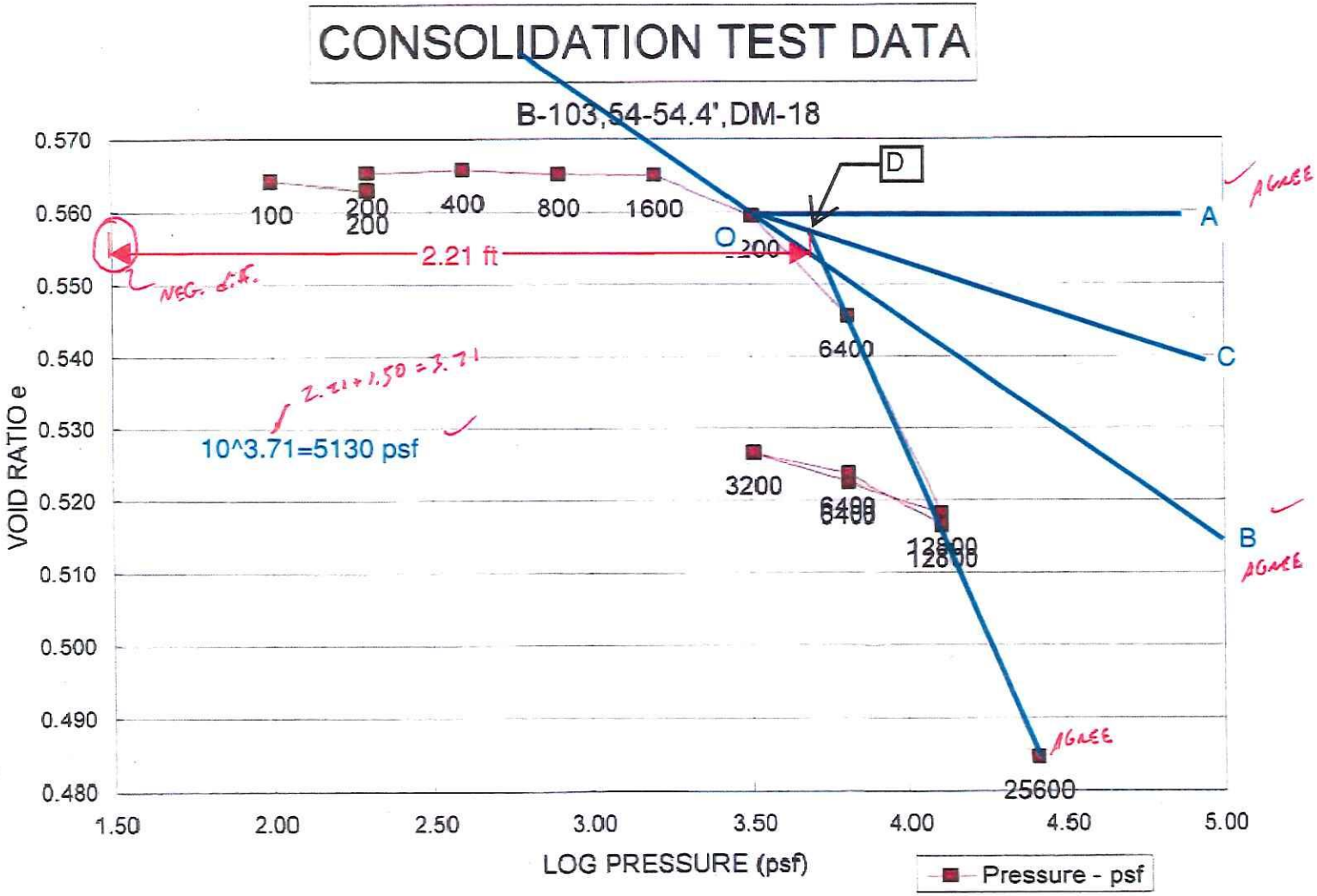


12

9.16-16 mss


B-102 25 to 26 ft
Void Ratio, e
log P (psf)
0.6
0.575
0.55
0.525
0.5
0.475
0.45
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
3.95 ft
10^3.95=8910 psf
O
D
AGREE
A
AGREE
C
AGREE
B
AGREE
AGREE

8-16-16 MSS


CONSOLIDATION TEST DATA
B-103,54-54.4',DM-18
VOID RATIO e
LOG PRESSURE (psf)
0.570
0.560
0.550
0.540
0.530
0.520
0.510
0.500
0.490
0.480
1.50
2.00
2.50
3.00
3.50
4.00
4.50
5.00
100
200
200
400
800
1600
200
6400
3200
6400
6400
12800
12800
25600
D
A
C
B
2.21 ft
NEG. d.f.
2.21+1.50=3.71
10^3.71=5130 psf
AGREE
AGREE
AGREE
Pressure - psf

REMOLDED UNCONFINED COMPRESSIVE STRENGTH TEST DATA

ASTM D2166

ADVANCED TERRA TESTING

UNCONFINED COMPRESSIVE STRENGTH TEST DATA

ASTM D 2166

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT	Thornton Water Treatment Plant	SAMPLED	--
PROJECT NO.	16104	SATURATED TEST	No
BORING NO.	Blend B-102 Bu-6 & B-104(P) Bu-3	AT FIELD MOIST.	Yes
DEPTH	10-20'		
SAMPLE NO.	1 (101.5@16.4%)		
SOIL DESCR.	Remolded -3/8"		
LOCATION	--		

MOISTURE/DENSITY DATA	BEFORE TEST
Wt. Soil + Moisture (g)	707.34
Wt. Wet Soil & Pan (g)	721.50
Wt. Dry Soil & Pan (g)	623.17
Wt. Lost Moisture (g)	98.33
Wt. of Pan Only (g)	14.16
Wt. of Dry Soil (g)	609.01
Moisture Content %	16.1
Wet Density PCF	117.7
Dry Density PCF	101.4
Init. Diameter (in)	2.410
Init. Area (sq in)	4.562
Init. Height (in)	5.018
Height to Diameter Ratio	2.082
Volume cu Ft.	0.01325

Notes & Comments:

Data entered by: CAL Date: 09/12/2016

Data checked by: DRM Date: 9/14/16

Q:\Client Data File\2679\96\2679_96_UCS-ASTMD-2166-R1_1.xls

ADVANCED TERRA TESTING

UNCONFINED COMPRESSIVE STRENGTH TEST DATA

ASTM D 2166

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT	Thornton Water Treatment Plant	SAMPLED	--
PROJECT NO.	16104	DATE TESTED	9/9/2016
BORING NO.	Blend B-102 Bu-6 & B-104(P) Bu-3	SATURATED TEST	No
DEPTH	10-20'	AT FIELD MOIST.	Yes
SAMPLE NO.	1 (101.5@16.4%)		
SOIL DESCR.	Remolded -3/8"	TEST TYPE	UCS
LOCATION	--		
Init. Ht. (in)	5.018	Init. Area (sq in)	4.562
		Strain Rate (in/min)	0.050

Axial Load Lbs.	Uncorrected Axial Stress PSF	Delta Ht. In.	Axial % Strain	Area Final Sq In.	Dev. Stress PSF	Dev. Stress PSI
0	0	0.000	0.0000	4.562	0	0.0
36	1136	0.005	0.0996	4.566	1135	7.9
84	2652	0.011	0.2192	4.572	2646	18.4
120	3788	0.016	0.3189	4.576	3776	26.2
153	4830	0.021	0.4185	4.581	4810	33.4
183	5777	0.026	0.5181	4.585	5747	39.9
207	6534	0.032	0.6377	4.591	6493	45.1
225	7103	0.037	0.7373	4.596	7050	49.0
240	7576	0.042	0.8370	4.600	7513	52.2
252	7955	0.047	0.9366	4.605	7880	54.7
264	8334	0.052	1.0363	4.609	8247	57.3
291	9186	0.078	1.5544	4.634	9043	62.8
300	9470	0.099	1.9729	4.653	9283	64.5
306	9660	0.125	2.4910	4.678	9419	65.4
309	9754	0.157	3.1287	4.709	9449	65.6
306	9660	0.199	3.9657	4.750	9277	64.4
282	8902	0.251	5.0020	4.802	8457	58.7
210	6629	0.299	5.9585	4.851	6234	43.3
135	4262	0.351	6.9948	4.905	3964	27.5
105	3315	0.404	8.0510	4.961	3048	21.2
96	3030	0.451	8.9876	5.012	2758	19.2
96	3030	0.488	9.7250	5.053	2736	19.0

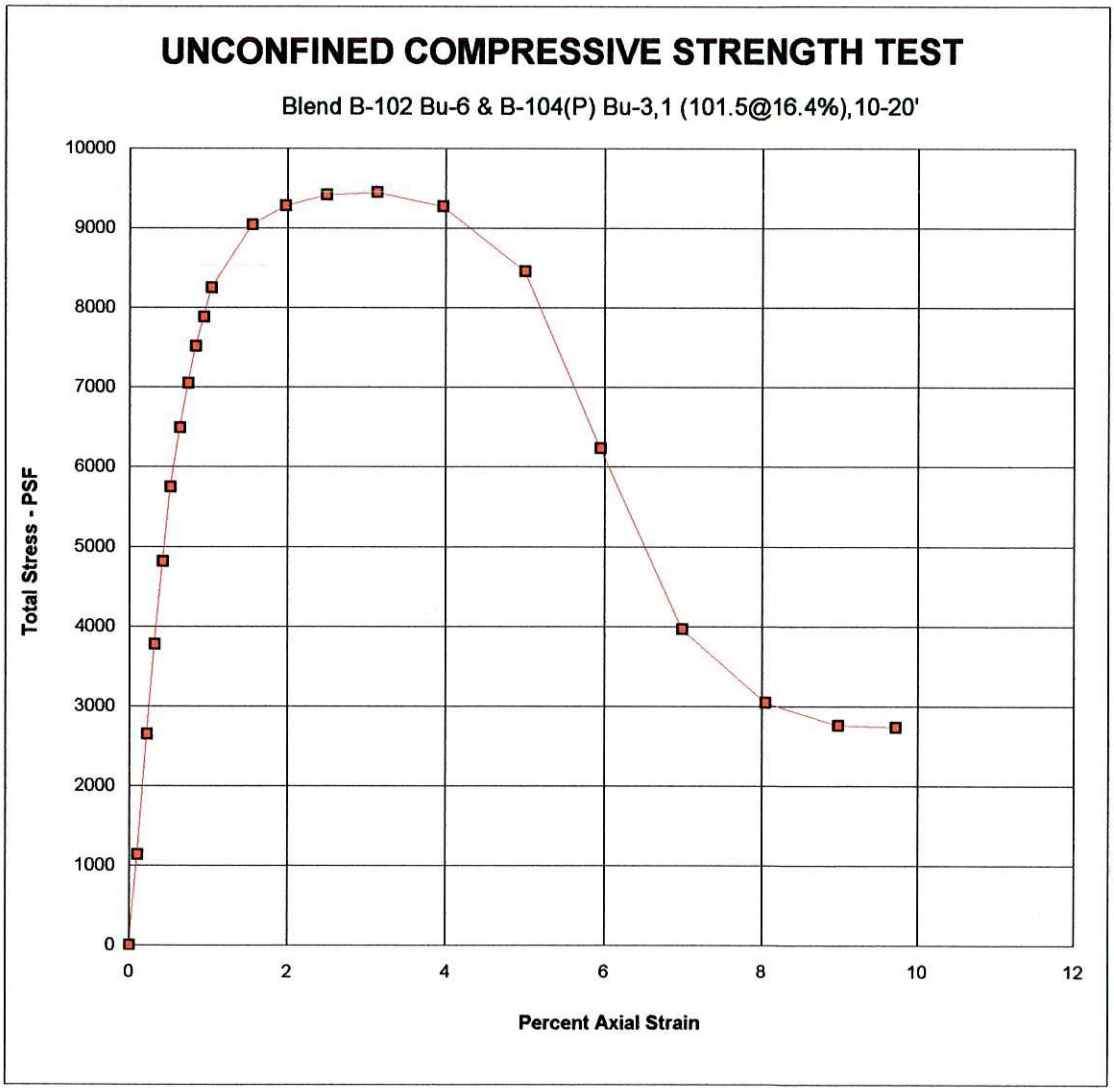
Peak Deviator Stress (psi) **65.6**

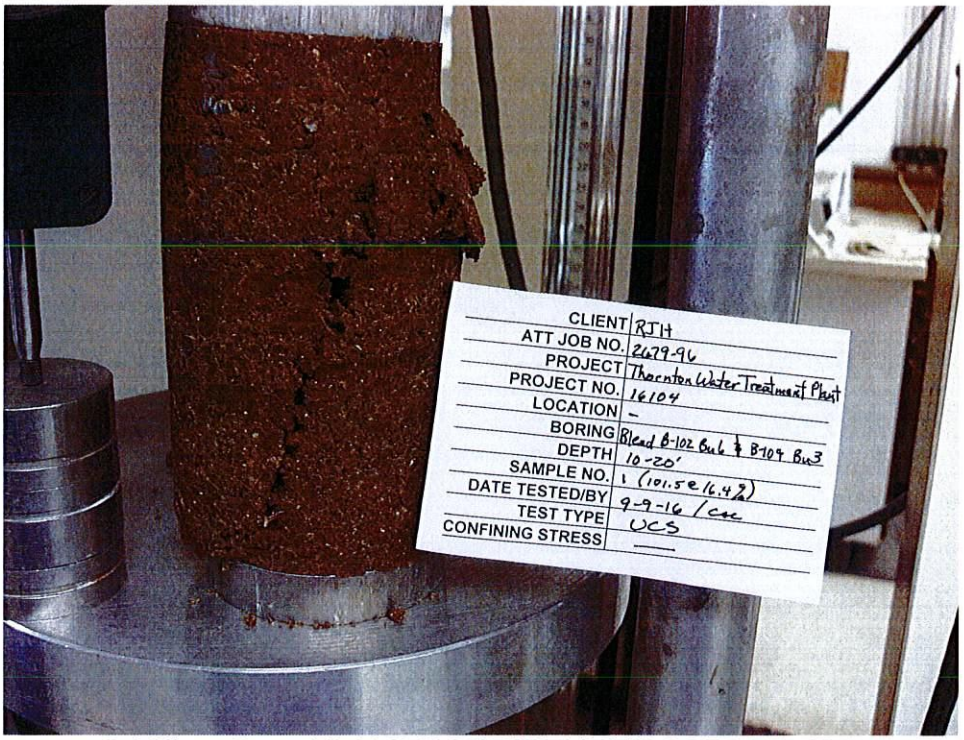
ADVANCED TERRA TESTING

UNCONFINED COMPRESSIVE STRENGTH TEST DATA

ASTM D 2166

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT	Thornton Water Treatment Plant	SAMPLED	--
PROJECT NO.	16104	SATURATED TEST	No
BORING NO.	Blend B-102 Bu-6 & B-104(P) Bu-3	AT FIELD MOIST.	Yes
DEPTH	10-20'		
SAMPLE NO.	1 (101.5@16.4%)		
SOIL DESCR.	Remolded -3/8"		
LOCATION	--		





Q:\Client Data File\2679\96\PICTURE\DSCF6353.JPG

ADVANCED TERRA TESTING

UNCONFINED COMPRESSIVE STRENGTH TEST DATA

ASTM D 2166

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT	Thornton Water Treatment Plant	SAMPLED	--
PROJECT NO.	16104	SATURATED TEST	No
BORING NO.	Blend B-102 Bu-6 & B-104(P) Bu-3	AT FIELD MOIST.	Yes
DEPTH	10-20'		
SAMPLE NO.	2 (104.4@18.6%)		
SOIL DESCR.	Remolded -3/8"		
LOCATION	--		

MOISTURE/DENSITY DATA	BEFORE TEST
Wt. Soil + Moisture (g)	741.54
Wt. Wet Soil & Pan (g)	755.74
Wt. Dry Soil & Pan (g)	640.50
Wt. Lost Moisture (g)	115.24
Wt. of Pan Only (g)	14.20
Wt. of Dry Soil (g)	626.30
Moisture Content %	18.4
Wet Density PCF	123.1
Dry Density PCF	104.0
Init. Diameter (in)	2.409
Init. Area (sq in)	4.558
Init. Height (in)	5.033
Height to Diameter Ratio	2.089
Volume cu Ft.	0.01328

Notes & Comments:

Data entered by: CAL Date: 09/12/2016

Data checked by: DLM Date: 9/14/16

Q:\Client Data File\2679\96\2679_96_UCS-ASTMD-2166-R1_2.xls

ADVANCED TERRA TESTING

UNCONFINED COMPRESSIVE STRENGTH TEST DATA

ASTM D 2166

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT	Thornton Water Treatment Plant	SAMPLED	--
PROJECT NO.	16104	DATE TESTED	9/9/2016
BORING NO.	Blend B-102 Bu-6 & B-104(P) Bu-3	SATURATED TEST	No
DEPTH	10-20'	AT FIELD MOIST.	Yes
SAMPLE NO.	2 (104.4@18.6%)		
SOIL DESCR.	Remolded -3/8"	TEST TYPE	UCS
LOCATION	--		
Init. Ht. (in)	5.033	Init. Area (sq in)	4.558
		Strain Rate (in/min)	0.050

Axial Load Lbs.	Uncorrected Axial Stress PSF	Delta Ht. In.	Axial % Strain	Area Final Sq In.	Dev. Stress PSF	Dev. Stress PSI
0.0	0	0.000	0.0000	4.558	0	0.0
30	948	0.005	0.0993	4.562	947	6.6
57	1801	0.011	0.2186	4.568	1797	12.5
81	2559	0.016	0.3179	4.572	2551	17.7
105	3317	0.021	0.4172	4.577	3303	22.9
126	3981	0.026	0.5166	4.582	3960	27.5
144	4549	0.031	0.6159	4.586	4521	31.4
159	5023	0.036	0.7153	4.591	4987	34.6
168	5308	0.041	0.8146	4.595	5264	36.6
180	5687	0.046	0.9140	4.600	5635	39.1
186	5876	0.052	1.0332	4.605	5816	40.4
210	6635	0.078	1.5498	4.630	6532	45.4
219	6919	0.099	1.9670	4.649	6783	47.1
225	7109	0.125	2.4836	4.674	6932	48.1
228	7203	0.151	3.0002	4.699	6987	48.5
234	7393	0.178	3.5367	4.725	7131	49.5
234	7393	0.199	3.9539	4.746	7101	49.3
234	7393	0.226	4.4904	4.772	7061	49.0
237	7488	0.231	4.5897	4.777	7144	49.6
237	7488	0.252	5.0070	4.798	7113	49.4
237	7488	0.300	5.9607	4.847	7041	48.9
237	7488	0.353	7.0137	4.902	6963	48.4
234	7393	0.401	7.9674	4.952	6804	47.2
228	7203	0.453	9.0006	5.009	6555	45.5
216	6824	0.504	10.0139	5.065	6141	42.6
201	6350	0.552	10.9676	5.119	5654	39.3
171	5403	0.605	12.0207	5.181	4753	33.0
159	5023	0.632	12.5571	5.212	4393	30.5

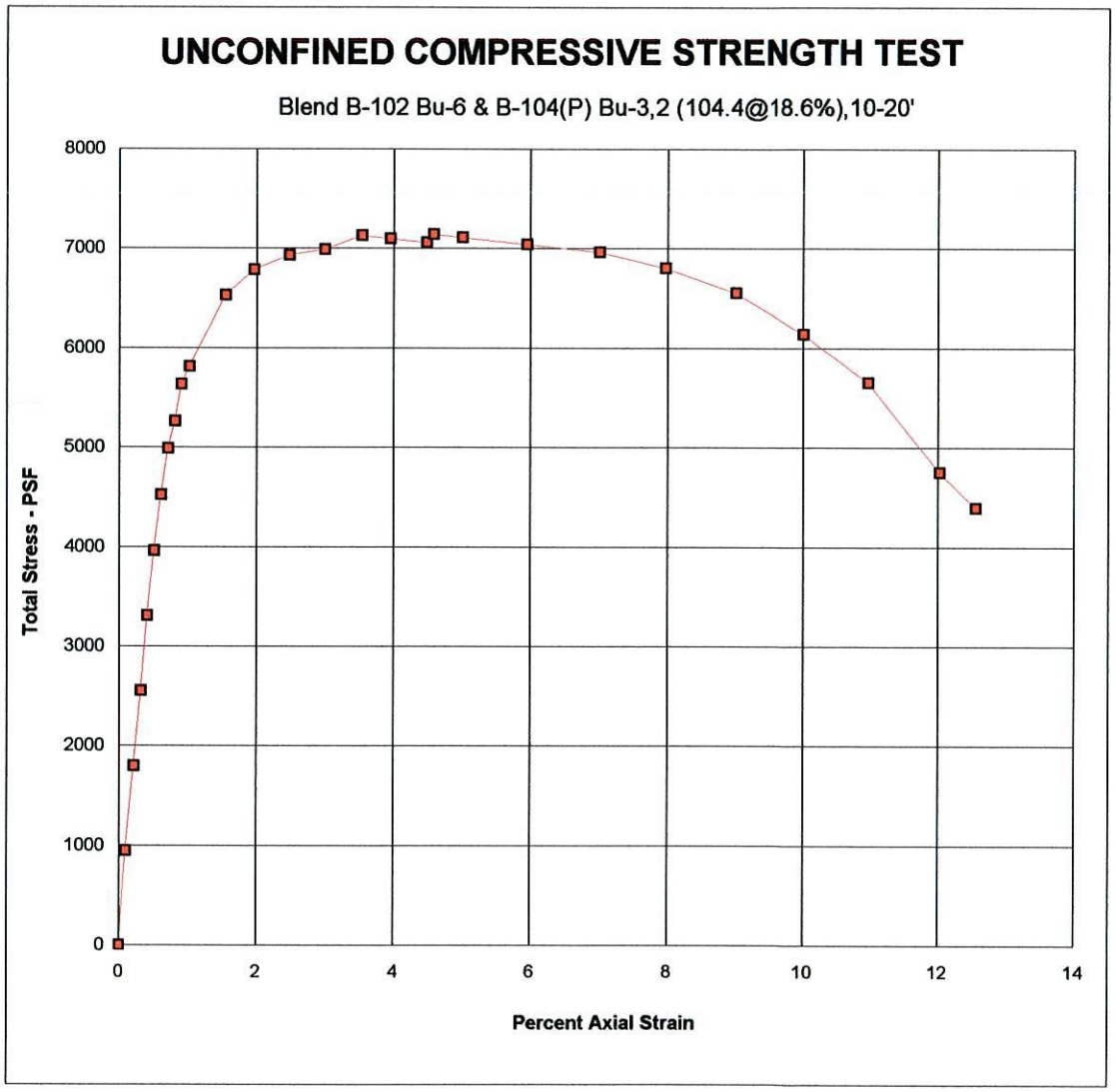
Peak Deviator Stress (psi) **49.6**

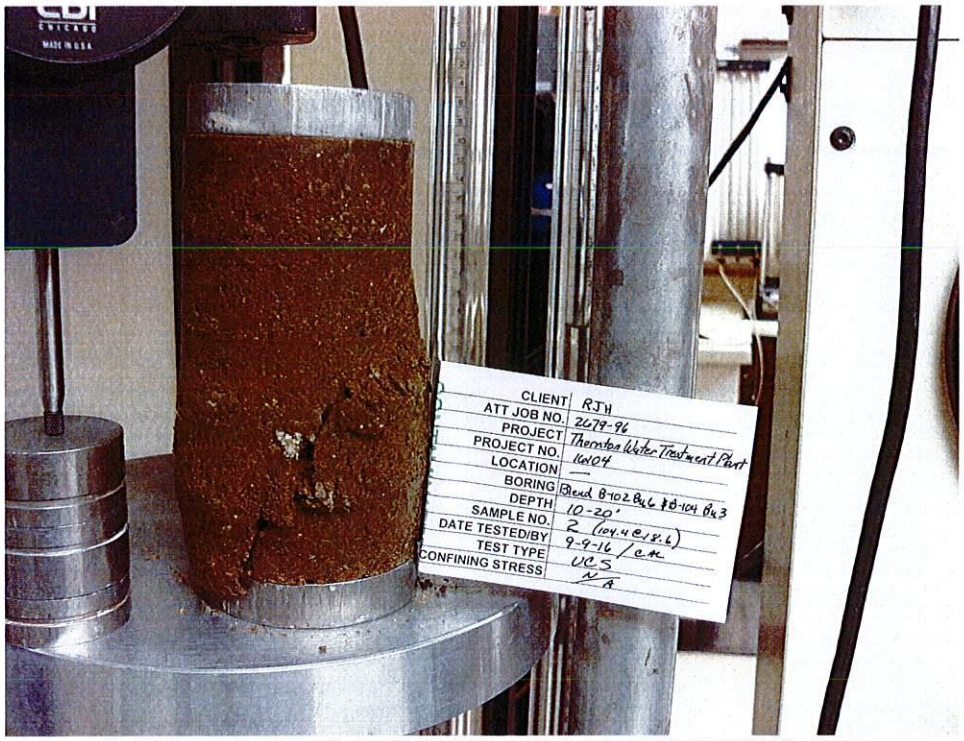
ADVANCED TERRA TESTING

UNCONFINED COMPRESSIVE STRENGTH TEST DATA

ASTM D 2166

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT	Thornton Water Treatment Plant	SAMPLED	--
PROJECT NO.	16104	SATURATED TEST	No
BORING NO.	Blend B-102 Bu-6 & B-104(P) Bu-3	AT FIELD MOIST.	Yes
DEPTH	10-20'		
SAMPLE NO.	2 (104.4@18.6%)		
SOIL DESCR.	Remolded -3/8"		
LOCATION	--		





Q:\Client Data File\2679\96\PICTURE\DSCF6356.JPG

ADVANCED TERRA TESTING

UNCONFINED COMPRESSIVE STRENGTH TEST DATA

ASTM D 2166

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT	Thornton Water Treatment Plant	SAMPLED	--
PROJECT NO.	16104	SATURATED TEST	No
BORING NO.	Blend B-102 Bu-6 & B-104(P) Bu-3	AT FIELD MOIST.	Yes
DEPTH	10-20'		
SAMPLE NO.	3 (101.5@18.6%)		
SOIL DESCR.	Remolded -3/8"		
LOCATION	--		

MOISTURE/DENSITY DATA	BEFORE TEST
Wt. Soil + Moisture (g)	720.68
Wt. Wet Soil & Pan (g)	735.04
Wt. Dry Soil & Pan (g)	622.70
Wt. Lost Moisture (g)	112.34
Wt. of Pan Only (g)	14.36
Wt. of Dry Soil (g)	608.34
Moisture Content %	18.5
Wet Density PCF	119.8
Dry Density PCF	101.1
Init. Diameter (in)	2.408
Init. Area (sq in)	4.554
Init. Height (in)	5.031
Height to Diameter Ratio	2.089
Volume cu Ft.	0.01326

Notes & Comments:

Data entered by: CAL Date: 09/12/2016

Data checked by: DJM Date: 9/14/16

ADVANCED TERRA TESTING

UNCONFINED COMPRESSIVE STRENGTH TEST DATA

ASTM D 2166

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT	Thornton Water Treatment Plant	SAMPLED	--
PROJECT NO.	16104	DATE TESTED	9/9/2016
BORING NO.	Blend B-102 Bu-6 & B-104(P) Bu-3	SATURATED TEST	No
DEPTH	10-20'	AT FIELD MOIST.	Yes
SAMPLE NO.	3 (101.5@18.6%)		
SOIL DESCR.	Remolded -3/8"	TEST TYPE	UCS
LOCATION	--		
Init. Ht. (in)	5.031	Init. Area (sq in)	4.554
		Strain Rate (in/min)	0.050

Axial Load Lbs.	Uncorrected Axial Stress PSF	Delta Ht. In.	Axial % Strain	Area Final Sq In.	Dev. Stress PSF	Dev. Stress PSI
0.0	0	0.000	0.0000	4.554	0	0.0
18	569	0.005	0.0994	4.559	569	3.9
45	1423	0.011	0.2186	4.564	1420	9.9
72	2277	0.016	0.3180	4.569	2269	15.8
96	3036	0.021	0.4174	4.573	3023	21.0
111	3510	0.026	0.5168	4.578	3492	24.2
126	3984	0.032	0.6361	4.583	3959	27.5
138	4364	0.037	0.7354	4.588	4331	30.1
150	4743	0.042	0.8348	4.592	4703	32.7
156	4933	0.047	0.9342	4.597	4887	33.9
165	5217	0.052	1.0336	4.602	5163	35.9
183	5786	0.073	1.4510	4.621	5702	39.6
195	6166	0.099	1.9678	4.646	6045	42.0
198	6261	0.125	2.4846	4.670	6105	42.4
201	6356	0.152	3.0213	4.696	6164	42.8
204	6450	0.157	3.1207	4.701	6249	43.4
204	6450	0.204	4.0549	4.747	6189	43.0
204	6450	0.251	4.9891	4.793	6129	42.6
198	6261	0.302	6.0028	4.845	5885	40.9
192	6071	0.350	6.9569	4.895	5649	39.2
174	5502	0.402	7.9905	4.950	5062	35.2
153	4838	0.453	9.0042	5.005	4402	30.6
132	4174	0.503	9.9980	5.060	3757	26.1
120	3794	0.550	10.9322	5.113	3380	23.5

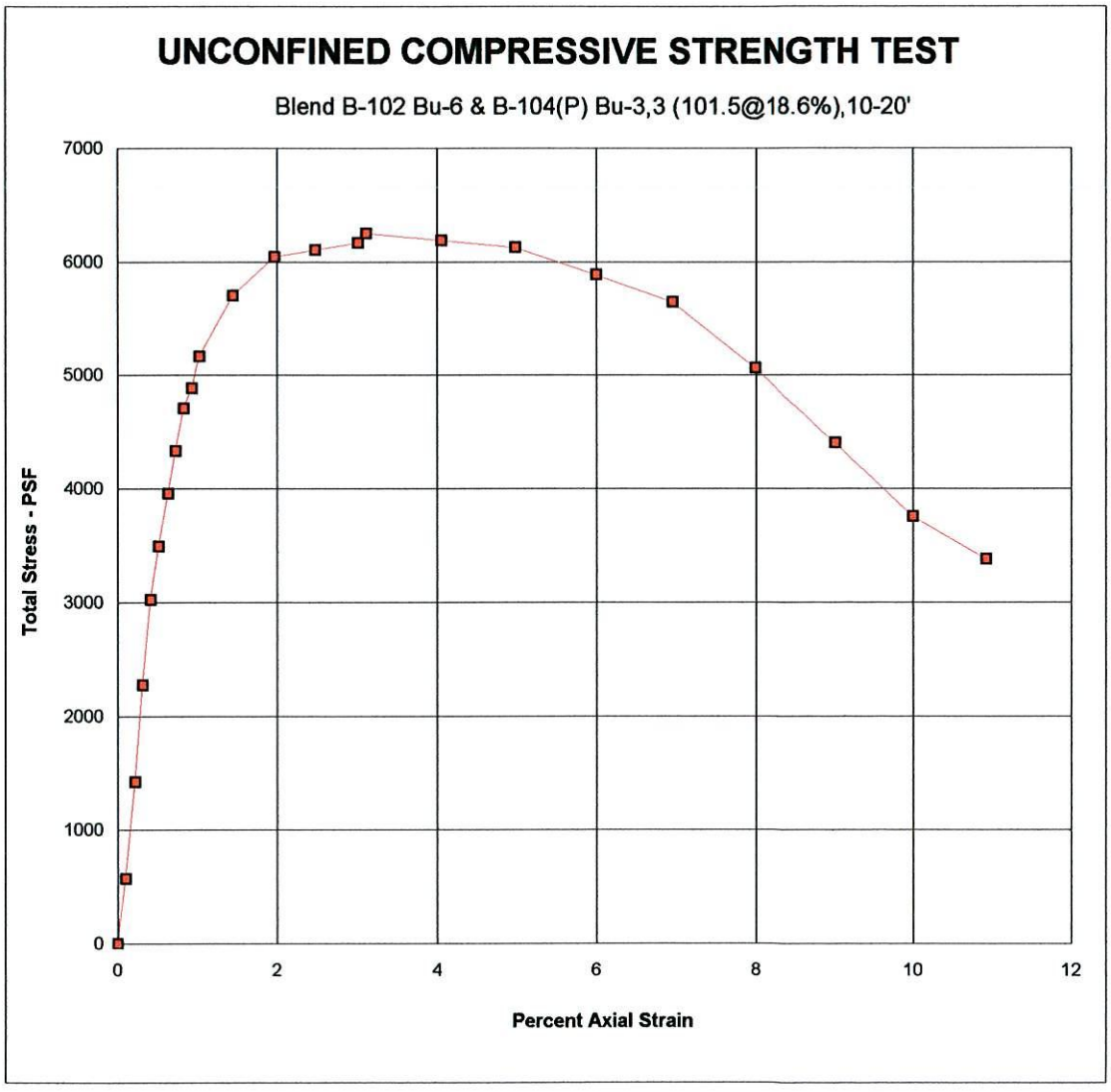
Peak Deviator Stress (psi) **43.4**

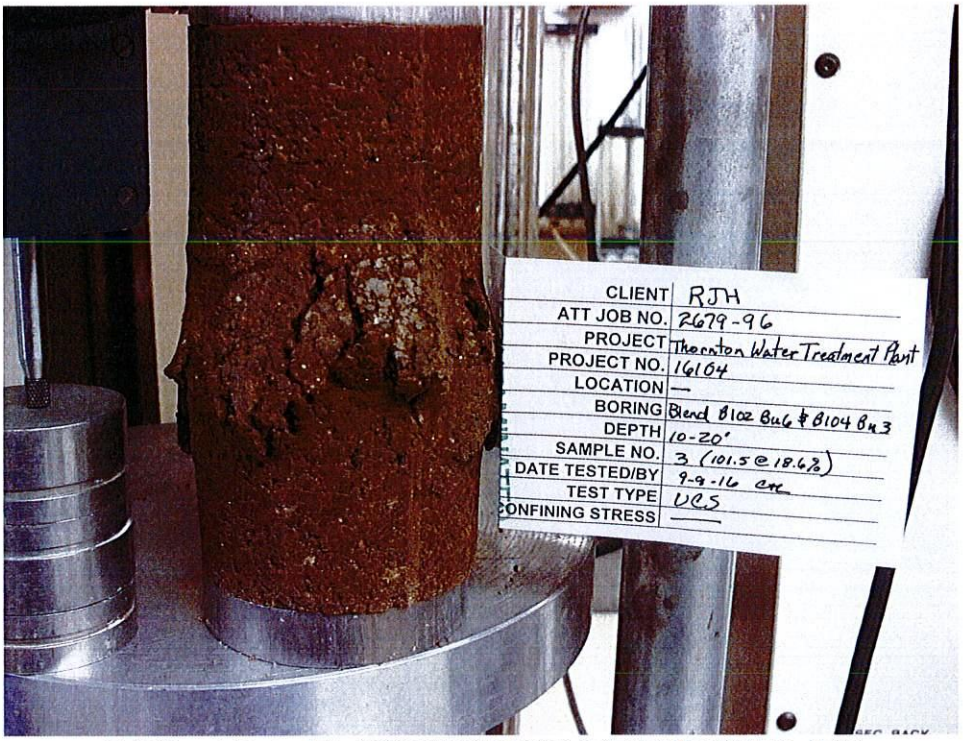
ADVANCED TERRA TESTING

UNCONFINED COMPRESSIVE STRENGTH TEST DATA

ASTM D 2166

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT	Thornton Water Treatment Plant	SAMPLED	--
PROJECT NO.	16104	SATURATED TEST	No
BORING NO.	Blend B-102 Bu-6 & B-104(P) Bu-3	AT FIELD MOIST.	Yes
DEPTH	10-20'		
SAMPLE NO.	3 (101.5@18.6%)		
SOIL DESCR.	Remolded -3/8"		
LOCATION	--		





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ADVANCED TERRA TESTING

UNCONFINED COMPRESSIVE STRENGTH TEST DATA

ASTM D 2166

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT	Thornton Water Treatment Plant	SAMPLED	--
PROJECT NO.	16104	SATURATED TEST	No
BORING NO.	Blend B-102 Bu-6 & B-104(P) Bu-3	AT FIELD MOIST.	Yes
DEPTH	10-20'		
SAMPLE NO.	4 (103.5@21.1%)		
SOIL DESCR.	Remolded -3/8"		
LOCATION	--		

MOISTURE/DENSITY DATA	BEFORE TEST
Wt. Soil + Moisture (g)	744.28
Wt. Wet Soil & Pan (g)	758.63
Wt. Dry Soil & Pan (g)	634.10
Wt. Lost Moisture (g)	124.53
Wt. of Pan Only (g)	14.35
Wt. of Dry Soil (g)	619.75
Moisture Content %	20.1
Wet Density PCF	123.0
Dry Density PCF	102.5

Init. Diameter (in)	2.413
Init. Area (sq in)	4.573
Init. Height (in)	5.039
Height to Diameter Ratio	2.088
Volume cu Ft.	0.01334

Notes & Comments:

Data entered by: CAL Date: 09/12/2016

Data checked by: DPM Date: 9/14/16

ADVANCED TERRA TESTING

UNCONFINED COMPRESSIVE STRENGTH TEST DATA

ASTM D 2166

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT	Thornton Water Treatment Plant	SAMPLED	--
PROJECT NO.	16104	DATE TESTED	9/9/2016
BORING NO.	Blend B-102 Bu-6 & B-104(P) Bu-3	SATURATED TEST	No
DEPTH	10-20'	AT FIELD MOIST.	Yes
SAMPLE NO.	4 (103.5@21.1%)		
SOIL DESCR.	Remolded -3/8"	TEST TYPE	UCS
LOCATION	--		
Init. Ht. (in)	5.039	Init. Area (sq in)	4.573
		Strain Rate (in/min)	0.050

Axial Load Lbs.	Uncorrected Axial Stress PSF	Delta Ht. In.	Axial % Strain	Area Final Sq In.	Dev. Stress PSF	Dev. Stress PSI
0.0	0	0.000	0.0000	4.573	0	0.0
15	472	0.005	0.0992	4.578	472	3.3
27	850	0.011	0.2183	4.583	848	5.9
45	1417	0.016	0.3175	4.588	1413	9.8
63	1984	0.021	0.4167	4.592	1976	13.7
81	2551	0.026	0.5160	4.597	2537	17.6
96	3023	0.032	0.6350	4.602	3004	20.9
105	3306	0.037	0.7343	4.607	3282	22.8
114	3590	0.042	0.8335	4.611	3560	24.7
120	3779	0.047	0.9327	4.616	3743	26.0
129	4062	0.053	1.0518	4.622	4019	27.9
144	4534	0.073	1.4487	4.640	4469	31.0
156	4912	0.100	1.9845	4.666	4815	33.4
159	5007	0.126	2.5005	4.690	4882	33.9
162	5101	0.152	3.0165	4.715	4947	34.4
165	5196	0.203	4.0286	4.765	4986	34.6
165	5196	0.250	4.9613	4.812	4938	34.3
162	5101	0.302	5.9933	4.865	4795	33.3
159	5007	0.354	7.0252	4.919	4655	32.3
153	4818	0.402	7.9778	4.969	4433	30.8
135	4251	0.453	8.9899	5.025	3869	26.9
108	3401	0.506	10.0417	5.084	3059	21.2
96	3023	0.550	10.9149	5.133	2693	18.7

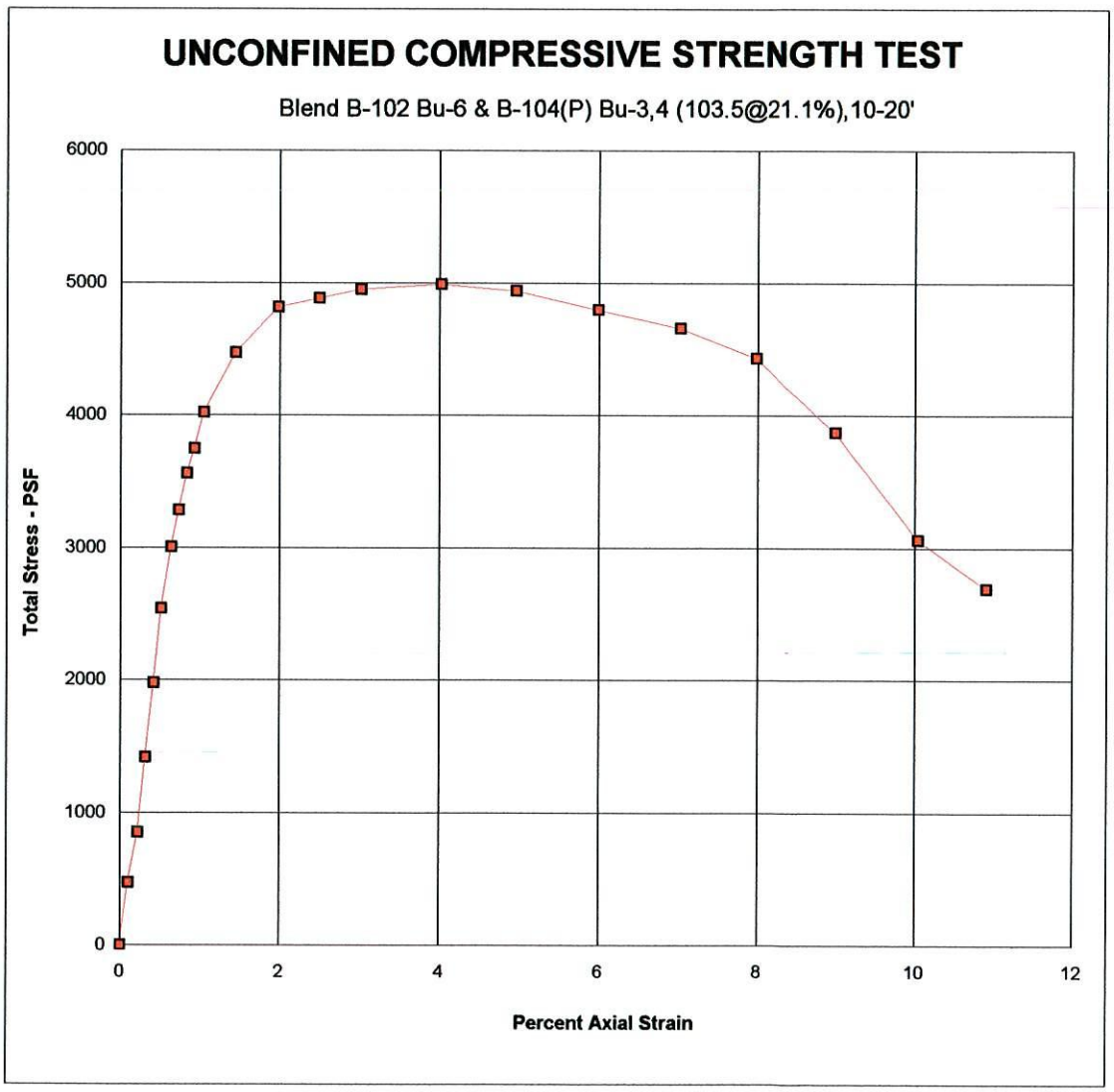
Peak Deviator Stress (psi) **34.6**

ADVANCED TERRA TESTING

UNCONFINED COMPRESSIVE STRENGTH TEST DATA

ASTM D 2166

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT	Thornton Water Treatment Plant	SAMPLED	--
PROJECT NO.	16104	SATURATED TEST	No
BORING NO.	Blend B-102 Bu-6 & B-104(P) Bu-3	AT FIELD MOIST.	Yes
DEPTH	10-20'		
SAMPLE NO.	4 (103.5@21.1%)		
SOIL DESCR.	Remolded -3/8"		
LOCATION	--		





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ADVANCED TERRA TESTING

UNCONFINED COMPRESSIVE STRENGTH TEST DATA

ASTM D 2166

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT	Thornton Water Treatment Plant	SAMPLED	--
PROJECT NO.	16104	SATURATED TEST	No
BORING NO.	Blend B-102 Bu-6 & B-104(P) Bu-3	AT FIELD MOIST.	Yes
DEPTH	10-20'		
SAMPLE NO.	5 (101.5@21.6%)		
SOIL DESCR.	Remolded -3/8"		
LOCATION	--		

MOISTURE/DENSITY DATA	BEFORE TEST
Wt. Soil + Moisture (g)	739.11
Wt. Wet Soil & Pan (g)	753.33
Wt. Dry Soil & Pan (g)	621.25
Wt. Lost Moisture (g)	132.08
Wt. of Pan Only (g)	14.22
Wt. of Dry Soil (g)	607.03
Moisture Content %	21.8
Wet Density PCF	122.3
Dry Density PCF	100.4

Init. Diameter (in)	2.414
Init. Area (sq in)	4.577
Init. Height (in)	5.030
Height to Diameter Ratio	2.084
Volume cu Ft.	0.01332

Notes & Comments:

Data entered by: CAL Date: 09/12/2016

Data checked by: DM Date: 9/15/16

ADVANCED TERRA TESTING

UNCONFINED COMPRESSIVE STRENGTH TEST DATA

ASTM D 2166

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT	Thornton Water Treatment Plant	SAMPLED	--
PROJECT NO.	16104	DATE TESTED	9/9/2016
BORING NO.	Blend B-102 Bu-6 & B-104(P) Bu-3	SATURATED TEST	No
DEPTH	10-20'	AT FIELD MOIST.	Yes
SAMPLE NO.	5 (101.5@21.6%)		
SOIL DESCR.	Remolded -3/8"	TEST TYPE	UCS
LOCATION	--		
Init. Ht. (in)	5.030	Init. Area (sq in)	4.577
		Strain Rate (in/min)	0.050

Axial Load Lbs.	Uncorrected Axial Stress PSF	Delta Ht. In.	Axial % Strain	Area Final Sq In.	Dev. Stress PSF	Dev. Stress PSI
0	0	0.000	0.0000	4.577	0	0.0
30	944	0.005	0.0994	4.581	943	6.5
42	1321	0.010	0.1988	4.586	1319	9.2
57	1793	0.016	0.3181	4.591	1788	12.4
66	2077	0.021	0.4175	4.596	2068	14.4
72	2265	0.026	0.5169	4.601	2254	15.7
78	2454	0.031	0.6163	4.605	2439	16.9
84	2643	0.036	0.7157	4.610	2624	18.2
90	2832	0.042	0.8350	4.615	2808	19.5
93	2926	0.047	0.9344	4.620	2899	20.1
96	3020	0.052	1.0338	4.625	2989	20.8
105	3304	0.077	1.5308	4.648	3253	22.6
111	3492	0.103	2.0477	4.673	3421	23.8
114	3587	0.123	2.4453	4.692	3499	24.3
114	3587	0.150	2.9821	4.718	3480	24.2
117	3681	0.202	4.0159	4.768	3533	24.5
120	3776	0.254	5.0497	4.820	3585	24.9
120	3776	0.300	5.9642	4.867	3550	24.7
117	3681	0.353	7.0179	4.922	3423	23.8
114	3587	0.405	8.0517	4.978	3298	22.9
111	3492	0.452	8.9861	5.029	3179	22.1
102	3209	0.503	10.0000	5.085	2888	20.1
96	3020	0.551	10.9543	5.140	2690	18.7
90	2832	0.604	12.0080	5.201	2492	17.3
81	2548	0.655	13.0219	5.262	2217	15.4
78	2454	0.707	14.0557	5.325	2109	14.6
75	2360	0.760	15.1093	5.391	2003	13.9

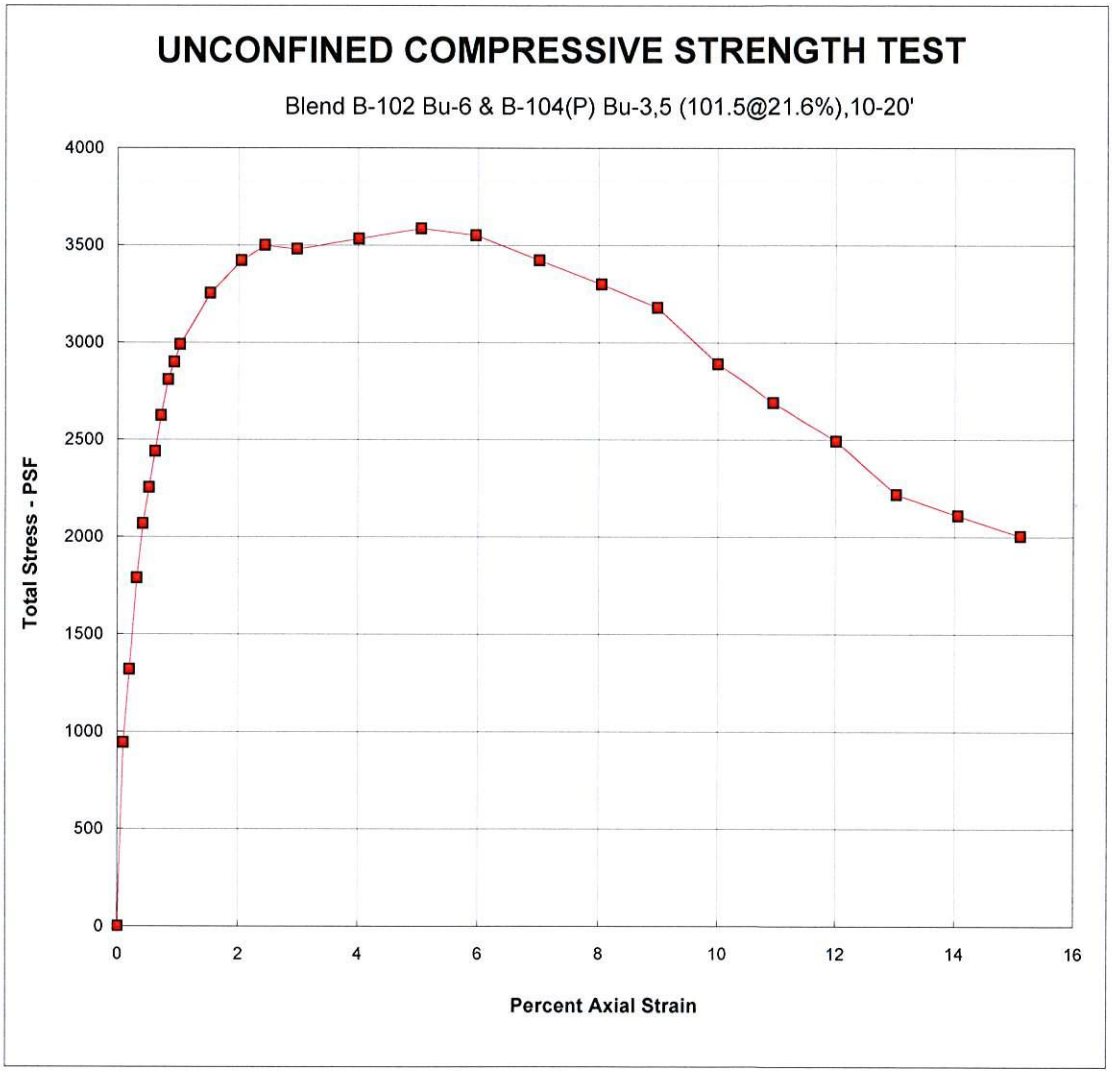
Peak Deviator Stress (psi) **24.9**

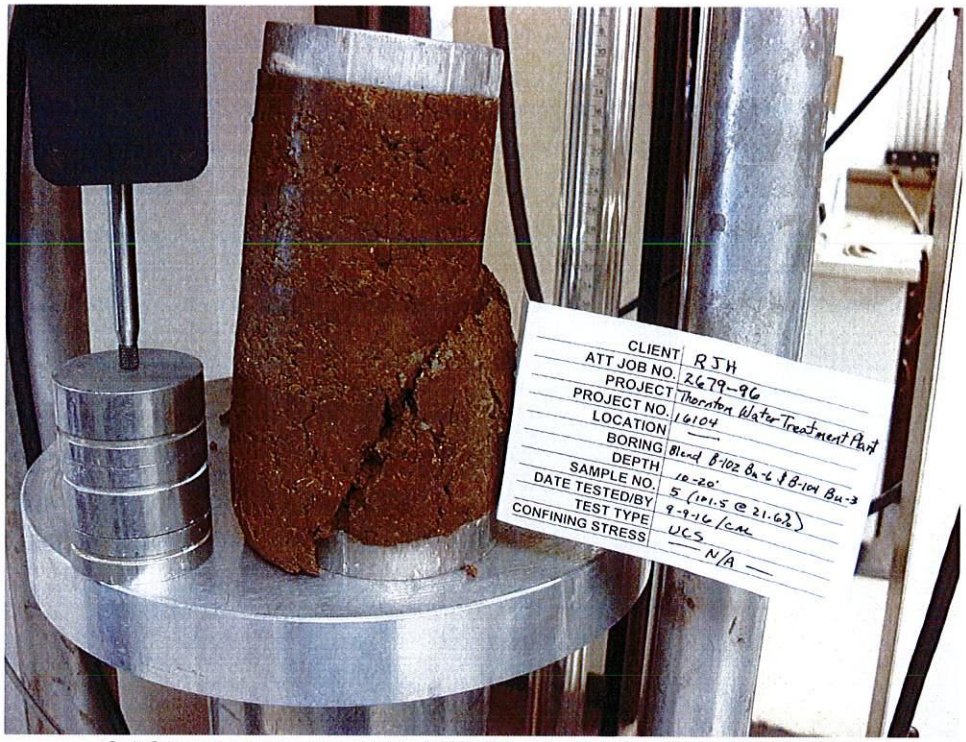
ADVANCED TERRA TESTING

UNCONFINED COMPRESSIVE STRENGTH TEST DATA

ASTM D 2166

CLIENT	RJH Consultants	JOB NO.	2679-96
PROJECT	Thornton Water Treatment Plant	SAMPLED	--
PROJECT NO.	16104	SATURATED TEST	No
BORING NO.	Blend B-102 Bu-6 & B-104(P) Bu-3	AT FIELD MOIST.	Yes
DEPTH	10-20'		
SAMPLE NO.	5 (101.5@21.6%)		
SOIL DESCR.	Remolded -3/8"		
LOCATION	--		





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Unconfined Compressive Strength

ASTM D7012 Method C

UNCONFINED COMPRESSIVE STRENGTH
ASTM D 7012; Method C (Previously ASTM D 2938)

CLIENT: RJH Consultants, Inc.

JOB NO.: 2679-96

LOCATION:

DATE TESTED: 7/12/16 HN/BL

PROJECT: Thornton Water Treatment Plant

Specimen ID Boring, Depth (ft.) , Rock type	Diameter (in.)	Length (in.)	Mass (gms)	Wet Density (pcf)	Failure Load (lb)	Failure Types *	Compressive Strength (psi)
B-101 (P) , 44.9-45.6, Claystone	1.793	4.020	341.9	128.3	215	F	90
B-106, 31.1-31.6, Silty Sandstone	1.817	3.981	347.1	128.1	428	F/S	160
B-107, 26.5-27.0, Claystone	1.769	4.037	329.3	126.4	309	F	130
B-107, 39.1-39.7, Sandstone	1.758	3.848	321.8	131.3	796	F/S	330

Notes and Comments:

* Failure types S: Shear Failure, M: Matrix Failure, F: Failure due to Fracture/Bedding, V: Void Failure, C: Combination

Data Entered By: BKL Date: 07/12/2016
Data Checked By: HN Date: 07/12/2016
Filename: RJUC96AA

ADVANCED TERRA TESTING



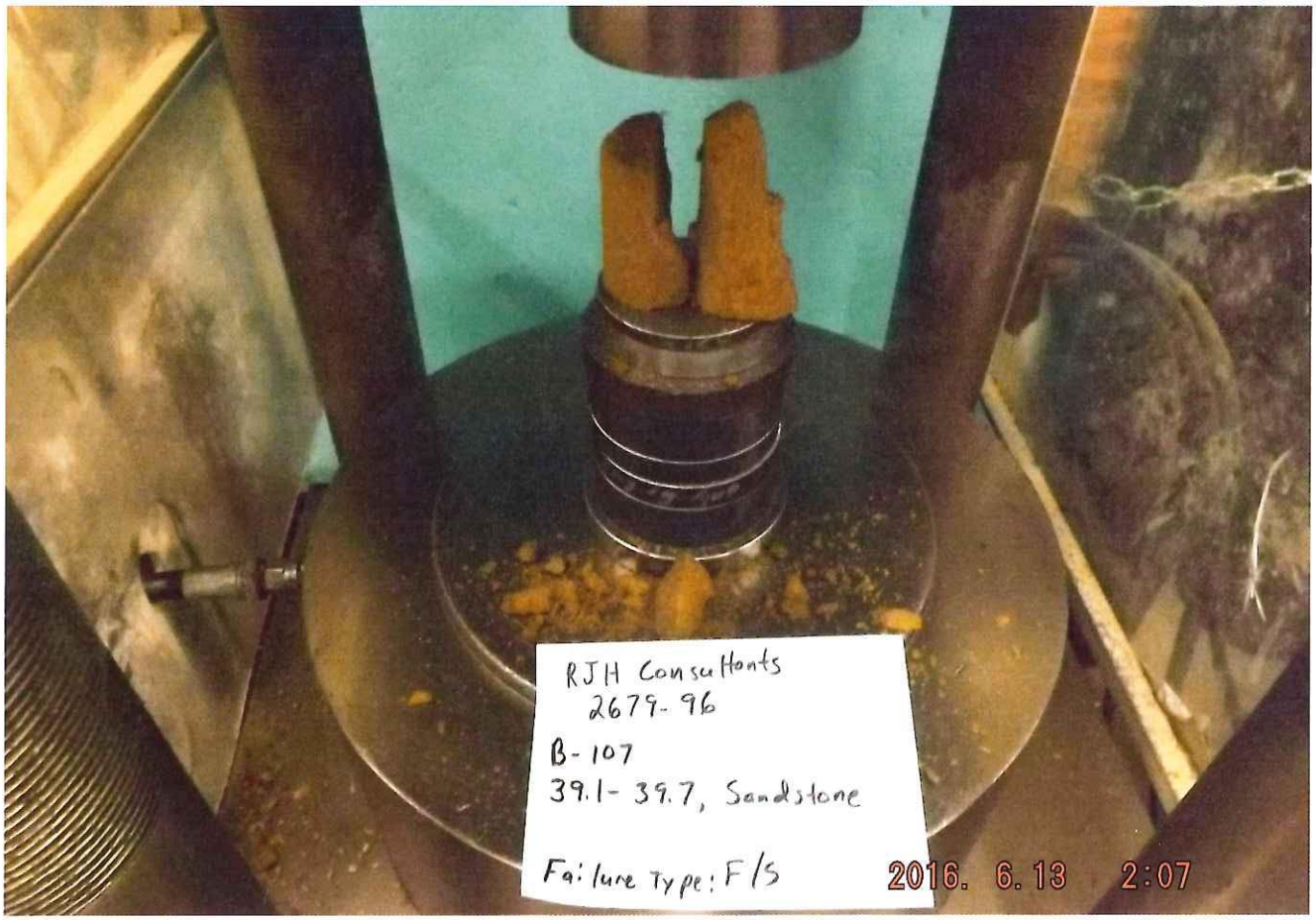
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Q:\Client Data File\2679\96\PICTURE\B107270CLAYSTONEAT



Q:\Client Data File\2679\96\PICTURE\B107397SANDSTONEAT

Soil-Chemical Test Results

Colorado Analytical LABORATORIES, INC.

Analytical Results

TASK NO: 160913067

Report To: Kerry Repola
Company: Advanced Terra Testing
833 Parfet Street
Unit A
Lakewood CO 80215

Bill To: Kerry Repola
Company: Advanced Terra Testing
833 Parfet Street
Unit A
Lakewood CO 80215

Task No.: 160913067
Client PO: 2679-96
Client Project: Thornton WTP 2679-96

Date Received: 9/13/16
Date Reported: 9/20/16
Matrix: Soil - Geotech

Customer Sample ID B-103 BU-2 @ 0-10 Ft.
Lab Number: 160913067-01

Test	Result	Method
Chloride - Water Soluble	**0.0037 %**	AASHTO T291-91/ ASTM D4327
Electrical Conductivity	**1.9 mmhos/cm**	ASA2 10-3.3
pH	**7.9 units**	AASHTO T289-91
Redox Potential	**279 mv**	ASTM D1498
Resistivity	**531 ohm.cm**	AASHTO T288-91
Sulfate - Water Soluble	**0.052 %**	AASHTO T290-91/ ASTM D4327
Sulfide	**Negative**	AWWA C105

Customer Sample ID B-103 S-10 @ 24.2 - 25.5 Ft.
Lab Number: 160913067-02

Test	Result	Method
Chloride - Water Soluble	**0.0047 %**	AASHTO T291-91/ ASTM D4327
Electrical Conductivity	**1.4 mmhos/cm**	ASA2 10-3.3
pH	**7.9 units**	AASHTO T289-91
Redox Potential	**238 mv**	ASTM D1498
Resistivity	**700 ohm.cm**	AASHTO T288-91
Sulfate - Water Soluble	**0.019 %**	AASHTO T290-91/ ASTM D4327
Sulfide	**Negaive**	AWWA C105

Abbreviations/ References:

AASHTO - American Association of State Highway and Transportation Officials.
ASTM - American Society for Testing and Materials.
ASA - American Society of Agronomy.
DIPRA - Ductile Iron Pipe Research Association Handbook of Ductile Iron Pipe.

DATA APPROVED FOR RELEASE BY