ADDENDUM 3.1-A

FACILITIES ENGINEERING REPORT

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1.0 INTRODUCTION

This report provides designs and site geotechnical investigation for facilities within the proposed Central Processing Plant (CPP) area at the proposed Ross ISR Project. These investigations were conducted to better characterize the expected operating conditions, potential environmental impacts and potential public and occupational health effects for the proposed project.

2.0 FACILITIES LOCATION AND LAYOUT

The proposed location for the CPP is in the northeast quarter of the southeast quarter of Section 18, Township 53 North, Range 67 West, as described in Section 2.1 of the Technical Report (TR). The area is relatively flat and is located in the lower portion of a minor ephemeral tributary. The CPP and support facilities will be located on lands that have been previously cultivated for farming use. The site currently has three spreader dikes. Spreader dikes are used in the semi-arid west where water supplies are limited. Spreader dikes take the natural ephemeral flow from the drainages (typically snow melt or runoff from a precipitation event) and passively spread the flow. The proposed facilities in relation to the project area are depicted on TR Figure 2.1-3. The layout of the CPP area is depicted on TR Figure 3.1-16. The CPP location was chosen due to the following:

- The terrain is gentle and large enough to accommodate the CPP and related infrastructure,
- The location is central to the proposed wellfields,
- The site has low visual impact,
- The site lacks significant uranium mineralization,
- Access to the county road is convenient, and
- Acquisition of the surface is possible.

3.0 SITE AND MATERIAL CHARACTERIZATION

In May 2010 and August 2011, geotechnical and hydrological investigations were conducted at the proposed Ross ISR Project CPP area. The details of these investigations are included as Attachment A, Geotechnical and Hydrological Investigations and Water Management Infrastructure Report, of this addendum. These investigations were conducted in order to confirm the geologic, geotechnical, and hydrological properties of the area proposed for the location of the Ross ISR Project CPP and associated infrastructure.

As described in Attachment A (Geotechnical Report), the soils in the CPP area are a layer of recent unconsolidated valley fill deposits, which consist of an undifferentiated sequence of locally-derived sediments deposited by alluvial, colluvial, and eolian processes. The site and material characterization is discussed in detail in Section 4.0 of the Geotechnical Report.

4.0 RETENTION POND DESIGN

Permeate and brine resulting from operation and aquifer restoration activities the proposed Ross ISR Project will be stored in two lined retention ponds. Each pond will consist of three cells that have double liners and leak detection systems. Road surfacing will be placed on pond embankments to allow access to pond infrastructure and monitoring/inspection. A system will also be installed to deter avian wildlife from landing in the retention ponds. The pond layout and design details are depicted on TR Figure 4.2-1 (2 sheets) and discussed in TR Section 4.2.

4.1 Lined Retention Pond Capacity

The pond cell capacities are defined in terms of the operating capacity, the auxiliary capacity, and the freeboard capacity. Sufficient capacity will always be maintained between the cells such that the contents of an entire pond cell can be transferred into the other two cells within the same pond in the event of a leak. The water level at which this capacity is maintained is referred to as the normal water level (NWL). The capacity below the NWL is

termed the operating capacity. The capacity between the NWL and high water line (HWL) is termed the auxiliary capacity. Since there are three cells in each pond, the required auxiliary capacity of each cell is equal to one-third of the total available capacity. The ponds were designed with three cells in order to minimize the required auxiliary capacity. Table 4-1 and the area capacity tables on TR Figure 4.2-1 (sheet 2 of 2) provide a breakdown of the capacities of the ponds. The capacity above the HWL and below the crest of the ponds is the freeboard capacity. The ponds were designed with a minimum of three feet of freeboard capacity. As discussed in Section 4.3 of this report, the freeboard capacity will be sufficient to contain the probable maximum precipitation event as well as the resulting wave action from 80 mph winds. Ponds will never be operated above the HWL. Although both ponds will be capable of handling either permeate or brine, it is anticipated that Pond 1 will be used primarily for permeate storage and Pond 2 for brine storage.

The pond sizes and capacities reflect the need to store brine and excess permeate from ISR operations for varying lengths of time at the maximum design flow rates, as described in Section 4.2.3 of the TR. Excess permeate will only be present during two relatively brief operational periods: operation without concurrent aquifer restoration and groundwater sweep in the first wellfield module(s) undergoing aquifer restoration. During all other operational periods, no excess permeate will be produced due to high permeate demand in the injection streams for uranium production and aquifer restoration. The estimated flow of excess permeate during uranium production without concurrent aquifer restoration (resulting from RO treatment of the production bleed) will be 57 gpm. During this time, the demand for excess permeate for use as plant makeup water is expected to be approximately 25 gpm, making the excess permeate available for discharge to the ponds 32 gpm. At this flow rate, Pond 1 will have an operating capacity equivalent to 3.8 months of storage. The duration of uranium production without concurrent restoration will be approximately 2.5 years. Therefore, the total estimated volume of excess permeate during this operational period would be approximately 129 ac-ft.

Excess permeate generation during the time when groundwater sweep is occurring in the first wellfield modules will be approximately 184.5 gpm. The resulting flow rate of excess permeate from the restoration bleed will be 127.5 gpm after two phases of RO. In addition, it is estimated that an excess permeate flow rate of 57 gpm will also be produced from wellfields in operation. As in the operation only phase, approximately 25 gpm of excess permeate will be used for plant make up water. Therefore, the net flow rate available for surface discharge will be approximately 159.5 gpm. At this flow rate, Pond 1 will have an operating capacity equivalent to approximately 23 days of storage. The period where groundwater sweep is occurring in the first wellfield modules will be relatively short at approximately 2 months. A portion of the excess permeate produced during this phase may be stored in Pond 2 to handle the required surge capacity. The total volume of excess permeate produced during this phase will be approximately 42.3 ac-ft.

The maximum brine flow rate will occur during the concurrent operation and restoration phase, when up to 227 gpm of brine will be discharged into the ponds. At this flow rate, Pond 2 will have an operating capacity equivalent to 2.1 months of storage. Up to 1 month of excess brine storage capacity may also be reserved in Pond 2 during this phase to prepare for a possible upset condition where the deep disposal wells are inoperable. Liquid waste disposal options and capacities are discussed in Section 4.2 of the TR.

4.2 Lined Retention Pond Earthwork

Design drawings for the lined retention ponds are presented on TR Figure 4.2-1 (2 sheets). Pond cells will be trapezoidal, with maximum interior slopes of 3H:1V. Ponds will be approximately 17 feet deep and will be mostly incised to minimize embankment fill and the volume of water that could be released during an embankment failure. TR Figure 4.2-1 Sheet 2, shows cross sections of the Ponds. Pond embankment crest widths will be 25 feet with 3H:1V maximum exterior slopes. Attachment B provides the specifications for the

construction of the Ponds. Specifications for earthwork are discussed in Part 3 of Section 1.

4.2.1 Slope Stability Analysis

Two slope stability analyses were performed on the lined retention ponds. One evaluated the ponds interior slope in Pond 2 Cell 3, and the other evaluated the exterior slope at the maximum fill section which is located in Pond 2, Cell 1. The material properties for the slope stability analyses were obtained from drilling samples collected in August of 2011 and tested in September of 2011 (See Attachment A). The material testing results are presented in Table 4-2 and the laboratory data is provided as Attachment C. Table 4-2 also provides the source and justification for the soil strength parameters used in the evaluation.

The computer program GeoStudio 2007 Slope/W© module was used to generate the slope stability analyses. The program uses Morgenstern-Price general method of slices to determine minimum factors of safety (Morgenstern and Price 1965). Specific input requirements of the program include the material properties (Table 4-2), surface profiles and phreatic surface profiles. Analyses were performed for the interior slope of Pond 2 Cell 3 and the downstream maximum fill section in Pond 2 Cell 1. For the interior slope analysis it was assumed that the pond contained no water and the phreatic surface had been drawn down to a level below the floor of the pond. For the maximum dam section it was assumed that the pond was in an emergency situation and the water level was at the HWL. Since the ponds are lined no phreatic lines were developed through the embankment. A pseudo static analysis of the long-term stability condition was performed for the ponds using a seismic coefficient of 0.05 which is recommended for this seismic zone (Jansen 1988). Results of the analysis are shown in Table 4-3 and graphical outputs for the studies are provided in Attachment D. The results of the stability analysis indicate that the ponds will be stable considering a minimum factor of safety of 1.5 as recommended in Jansen (1988).

4.2.2 Settlement

The foundation of the ponds was found to be predominantly sand and silty clay as described in Section 4.1 of Attachment A. According to lab testing, the bearing strength of this material is approximately 15,000 lb/ft^2. The ponds are designed to have a maximum water depth of approximately 14 feet (HWL) which will result in approximately 873.6 lbs/ft^2 being applied to the pond foundation material. Considering the bearing strength of the foundation material, settlement of the pond is not anticipated.

4.2.3 Liquefaction Potential Analysis

Liquefaction occurs principally in uncompacted cohesionless saturated clean sands and silty sands (U.S. Bureau of Reclamation, 1987). The soils in this area have a relative density of 20%-30%. The materials are not clean sands or silty sands. As presented in Attachment A, the materials in the CPP area are predominantly CL (clean clays) and CH (fat clays). In addition, the phreatic surface elevation will be maintained at a minimum of one foot below the floor of the pond. Therefore, it is unlikely that liquefaction will occur due to the material types.

4.3 Freeboard Analysis

The freeboard analysis for the lined retention ponds considers the highest water level at which the ponds will be operated at, which is the HWL. NRC Regulatory Guide 3.11 (NRC 2008) states that if impoundments are designed to contain only direct precipitation, a single occurrence of the 6-hour PMP may be used in determining the storage capacity and freeboard requirements. The 6-hour PMP was calculated to be 22 inches (NOAA 1984) at the proposed project area. As stated in Section 4.1, the HWL is the maximum operating water level in the ponds and will provide a minimum of 3 feet of freeboard. Therefore, the HWL freeboard will be sufficient to contain the 6-hour PMP of 22 inches.

Under HWL conditions, the freeboard is also sufficient to contain the combined action from wind setup (Z_s), wave height (z_w), and wave run up (z_r). The calculations used to compute the wave action come from Water-Resources Engineering (Linsley and Franzini 1972). The following assumptions were made in these calculations:

- Wind Velocity, Vw = 80
- Fetch (length of water surface over which the wind blows), F = 0.11 mi (diagonal distance at the HWL in Pond 2 cells)
- Depth (average depth of pond), d = 14 ft (depth of water at the HWL)
- Embankment Slope = 3H:1V

Wind Setup:

$$Z_s = \frac{V_w^2 F}{1400d} = 0.04ft$$

Wave Height:

$$z_w = 0.034V_w^{1.06}F^{0.47} = 1.25ft$$

Wave Period:

$$t_w = 0.46V_w^{0.44}F^{0.28} = 1.70sec$$

Wavelength:

$$\lambda = 5.12t_w^2 = 14.8ft$$

Wave Run Up:

$^{z_r}/_{z_w} = 1.35$ (Interpolated from Figure 7-13 (Linsley and Franzini 1972))

$$z_r = 1.69ft$$

Wave Action:

$$Wave\ Action = Z_s + z_w + z_r = 2.98ft$$

It should be noted that under normal operating conditions, the ponds will be operated at the NWL, which will provide sufficient storage capacity in the event that brine or permeate from a leaking pond cell need to be transferred

into other cells within a pond. The normal water levels for Pond 1 and Pond 2 are listed in Table 4-1, and provide ample freeboard for containment of the 6-hour PMP and wave action combined. The ponds will rarely be operated at the HWL, and the probability of this occurring during the 6-hour PMP event combined with 80 mph winds is low.

4.4 Pond Liners

Each pond will be equipped with a primary and secondary geosynthetic liner. Primary liners will be high density polyethylene (HDPE) with a minimum thickness of 36 mils. Secondary liners also will be HDPE with a minimum thickness of 36 mils. Strata is also considering the use of a native clay liner instead of a secondary geosynthetic liner. Additional subsurface testing will be conducted to determine if the foundation materials are suitable. Criteria for the suitability of the foundation material are discussed in Section 4.2.2.1 of the TR. Non-woven geotextile fabric will be used to protect the secondary liner from the subgrade. Construction specifications for the liners are presented in Attachment B.

4.5 Leak Detection System

The leak detection system will consist of a permeable drainage layer and a collection piping system. The permeable drainage layer will be located directly under the primary liner. This layer will provide support for the overlying liner and will also transmit any leakage to collection pipes. The drainage layer will likely be constructed of a geosynthetic drainage material or Geonet. Collection pipes will convey leakage to riser pipes located on the corner of each pond cell. Pond bottoms will be contoured to slope to the corners in order help identify the quadrant of a leak if one were to occur. TR Figure 4.2-1 shows details of the leak detection system. See Attachment B for construction specifications.

4.6 Embankment Road Surfacing

Gravel road surfacing will be placed on pond embankments in order to allow access for operation and inspection. Road surfacing will be 15 feet wide

and approximately 12" thick. As indicated earlier, the embankment crest width is 25 feet wide. Non-woven geotextile will be used as separation fabric between the road base and pond embankments. See Attachment B for construction specifications for the embankment road surfacing.

4.7 Avian Control

An avian deterrent system will be required to deter waterfowl from landing on the brine pond surfaces. Three options are being considered for avian control, including netting, "bird balls" (hollow or water-filled balls), or a radar hazing system. Netting is more expensive to install, in part due to the difficulty in suspending the netting over the relatively large pond cells. Netting would also be expensive to maintain, since the fabric could be easily damaged by wind and freezing rain or snow. Bird balls would provide an effective barrier at a reduced cost compared to netting however, they may be inadequate during periods of high winds and severe weather. A radar hazing system appears to be the most effective solution. The system uses radar to detect incoming waterfowl and then uses hazing techniques (primarily noise) to deter the waterfowl. Conversations with industrial operators indicate that this technique has proven effective at deterring waterfowl from large pond surfaces. At this time the specific type of avian deterrent system has not been selected, but it appears that a radar/hazing system will be implemented.

4.8 Erosion Protection

The interior slopes of the ponds will be protected from wave action and other erosion methods by the primary pond liners, which will come to the top of the pond embankment. The outslope for the ponds will be protected from erosion by planting an approved seed mixture.

Table 4-1 Lined Retention Pond Capacities

Pond	Operating Capacity (ac-ft)	Normal Water Elevation (ft)	Auxiliary Capacity (ac-ft)	High Water Elevation (ft)	Total Capacity (ac-ft)	Embankment Crest (ft)
Pond #1	16.5	4131.7	8.0	4135.0	24.5	4138.0
Pond #2	63.4	4131.2	31.6	4135.0	95.0	4138.0

(Source: Table 4.2-1 of the TR)

Table 4-2 Material Properties

INTERIOR				
Pond 2 Cell 3 – Interior Slope **Long-Term Stability – with seismic coeff. C = 0.05g, interior slope Min. pseudostatic F.S. = 1.91**				
Soil Zone	Soil Parameters[1]			
	Density (pcf)	Cohesion (psf)	Phi Angle (Degrees)	Description
1	119.2	231	19.7	Effective stress parameters from removed C.U.T. on LRP-3[2]
2	122.8	200	22.2	Effective stress parameters from removed C.U.T. on LRP-7[2]
3	93.6	720	33.9	Assumed parameters for bedrock[3]
EMBANKMENT				
Pond 2 Cell 1 – Embankment **Long-Term Stability – with seismic coeff. C = 0.05g, embankment F.S. = 2.73**				
Soil Zone	Soil Parameters[1]			
	Density (pcf)	Cohesion (psf)	Phi Angle (Degrees)	Description
1	119.2	231	19.7	Effective stress parameters from removed C.U.T. on LRP-3[2]
2	122.8	200	22.2	Effective stress parameters from removed C.U.T. on LRP-7[2]
3	93.6	720	33.9	Assumed parameters for bedrock[3]

Notes: [1] Results of Laboratory Soil Testing – Attachment C
[2] C.U.T. = consolidated undrained triaxial
[3] U.S. Bureau of Reclamation (1987), Table 8

Table 4-3 Stability Analyses Results

Condition	Min. Factor of Safety[1]	Calculated Factor of Safety
Pond 2 Cell 1 – Embankment	1.50	1.91
Pond 2 Cell 3 – Interior Slope	1.50	2.73

Notes: [1] Jansen, 1988

5.0 FACILITIES FLOOD CONTROL DIVERSION DESIGN

The CPP area will be partially located in the channel of an ephemeral stream. Historically, the ephemeral channel bisected the area, but it has since been adjusted to the east in order to optimize irrigation efforts by the addition of a spreader dike system. Drainage basin B13, shown on TR Figure 2.7-3, represents the contributing drainage area to the CPP area. Section 2.7.1.3 of the TR discusses the surface water run-off estimates in detail. To provide flood control from the approximately 1.7 square mile drainage area above the CPP, surface runoff will be routed around the CPP using a flood control diversion structure. The structure will consist of a diversion berm, a reinforced concrete box culvert to convey runoff under the primary access road, and a trapezoidal channel to convey the runoff to a nearby tributary of the Little Missouri River. The design details for the system are presented on TR Figure 3.1-18 (2 sheets).

5.1 Design Description

The facilities flood control diversion will be capable of passing runoff from the 100-year, 24-hour storm event. The maximum flow rate during this storm event is estimated to be approximately 680 cubic feet per second (cfs) as presented in TR Table 2.7-5. Routing effects through the culvert were not accounted for in the channel and culvert design. The diversion channel will accommodate storm events up to the 10-year, 24-hour runoff event at non-erosive velocities (less than 5 fps). TR Figure 3.1-18 (2 sheets) provides the facilities flood control diversion layout and design information.

5.2 Facilities Flood Control Diversion Earthwork

The diversion berm will have a 15-foot top width and 3H:1V side slopes. It will be approximately 1,700 feet long. The diversion channel will be trapezoidal with a 15-foot bottom width, a 3H:1V left side slope and a 5H:1V right side slope. Attachment B, Section 2 provides the construction specifications for the diversion.

5.3 Reinforced Concrete Box Culvert

A concrete box culvert will convey runoff underneath the primary access road. The culvert will be approximately 6 feet high, 10 feet wide and 163 feet long. The culvert will be installed on a downward slope of about 2.6%. The culvert is designed to pass the peak discharge during the 100-year, 24-hour precipitation event. The hydraulic design information for the culvert is presented on TR Figure 3.1-18, sheet 2. As shown on the figure, the design allows for the passage of the 100-yr, 24-hr precipitation event while maintaining a minimum of one foot of freeboard.

5.4 Channel Erosion Protection

The diversion channel and diversion berm will be planted with a WDEQ/LQD approved seed mixture to provide erosion protection. The channel can accommodate a storm of up to the 10-year, 24-hour runoff event at non-erosive velocities (5 feet per second or less). The estimated velocity in the diversion channel at a flow rate of 311 cfs, or the peak flow rate calculated for the 10-year, 24-hour runoff event, is about 4.9 feet per second. Storm events generating peak flow rates greater than this amount may result in erosional damage to the diversion channel, but occasional channel repair will be less costly over the life of the project than providing armoring along the entire channel length.

Channel erosion protection will be provide around the inlet and outlet of the concrete box culvert to avoid damage to the culvert or primary access road embankment from runoff events up to the 100-year, 24-hour storm. Calculations show that the maximum culvert inlet velocity during the 100-year storm event will be about 10 feet per second, and the maximum outlet velocity will be about 14 feet per second. A cellular concrete mat erosion control system such as ArmorFlex® was selected to protect the channel at the culvert inlet and outlet. The mat will extend a minimum of 20 feet downstream from the culvert outlet and 40 feet upstream from the culvert inlet.

6.0 CONTAINMENT BARRIER WALL AND DEWATERING SYSTEM DESIGN AND CONSTRUCTION

The containment barrier wall (CBW) and dewatering infrastructure will be necessary to reduce the potential for hydrostatic uplift of the retention ponds liner system. As discussed in Attachment A, the location of the CPP resides in an area of shallow groundwater. The groundwater is believed to enter the CPP area within the valley fill. The valley fill is generally clay rich with low permeability although there are also discontinuous sandy intervals. The CBW is designed to cut off the "sand channel" conduits which contribute to thigh groundwater in the area.

6.1 Containment Barrier Wall

The CBW will consist of a highly impermeable in-situ mixture of soil and bentonite that forms a continuous barrier upgradient of the CPP area. The CBW will be approximately 2 feet wide and will extend from the ground surface through the soil and unconsolidated surficial material to a point at a minimum of 2 feet into bedrock or a maximum depth of approximately 35 feet. The soil-bentonite mixture will contain approximately 4% bentonite by dry weight.

Figure 6-1 provides the approximate alignment of the CBW. The depth will range from approximately 4 feet to approximately 35 feet. The depth and extents of the CBW were estimated from borehole data and from piezometers installed in May 2010 and August 2011. Cross Section A-A (Figure 2) of Attachment A provides a geological cross section along the CBW. Bedrock intercepts were interpreted from the logs and used as the basis for the variable CBW depth.

The proposed CBW alignment runs along the south edge of the CPP area as shown on Figure 6-1. The CBW is not currently planned around the entire CPP area because boreholes indicated that bedrock along the east and west sides of the site are generally shallow (within 3-5 feet of the existing ground).

The CBW will be tied into the shallow bedrock on the east and west sides, effectively creating a dam to shallow groundwater flowing into the site. The north end of the CPP site is hydraulically downgradient from the CPP and CBW and should therefore contribute little groundwater flow to the site. Although some infiltration of surface runoff can be expected from the facilities flood control diversion during storm events, it will be minimal and will easily be handled by the dewatering infrastructure proposed within the CPP area. In addition, operational groundwater monitoring described in Section 5.7.8.2 will allow Strata to detect inflow from the east, west, and north sides of the site.

6.2 Dewatering Infrastructure

Four French drains are planned to dewater and maintain a depressed groundwater level throughout the operational life of the project. One French drain will be located directly upgradient of the CBW and three will be located within the interior of the site. French drains will consist of approximately 1.5-foot wide drainage trenches constructed of clean sand or fine gravel surrounding 5" perforated HDPE pipe. The French drains will slope at a minimum of 0.5% toward collector wells. Figure 6-1 presents the approximate locations and lengths of the French drains. The French drains will be installed such that the bottoms of the drains are 5 to 7 feet below the bottom of the ponds. Collector wells will be constructed of 2-foot diameter corrugated steel pipe extending from the French drain to the ground surface. A submersible pump will be installed inside each collector well. The collector wells will be fitted with pressure transducers to monitor water level and to control submersible pumps. Pump discharge piping will be approximately 3" diameter HDPE piping. The buried pump discharge piping will provide flexibility to convey the groundwater to an outfall structure within the facilities flood control diversion (assuming the water meets effluent limits) or to the lined retention ponds (if contaminated).

As discussed in Attachment A (Section 6.5), the anticipated flow from bedrock sources is expected to be 28 gpd. This low flow will be easily handled by the dewatering system. The system will be operated such that the water level will be a minimum of one foot below the bottom of the ponds.

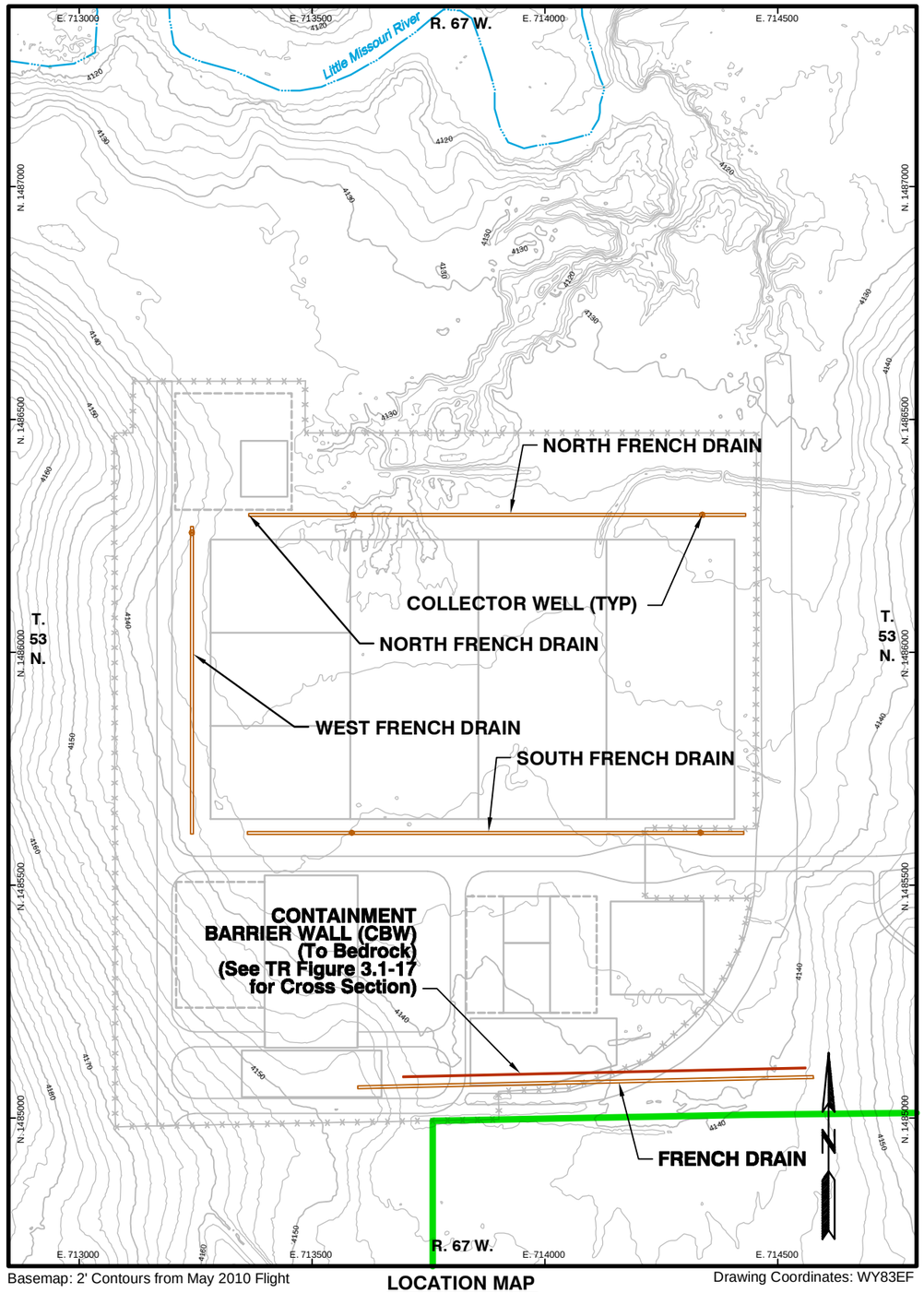
6.3 Containment Barrier Wall Contingency Plan

The CBW and French drains will be among the first things constructed at the CPP. Dewatering of the area will then be initiated to allow for construction of the remainder of the facilities. Strata will know by the initial dewatering efforts if the CBW/French drain system will be successful at the site. If it is observed that dewatering efforts are not working, additional options may be

evaluated. These may include the siting and construction of additional drain(s), installation of dewatering wells in the problem areas, and/or adjustments to the pond designs which may include underdrains and an increase in the pond bottom elevations to reduce the potential for floating the synthetic liners. Due to the timing of the wellfield operations, it may also be possible to delay the construction of Pond 2.

6.4 CBW Monitor Well Network

Approximately eight 2" diameter monitor wells will be installed to monitor water levels and water quality inside and outside of the CBW. Monitor wells will be fitted with data logging pressure transducers as stated in the TR Section 5.7.8.2.



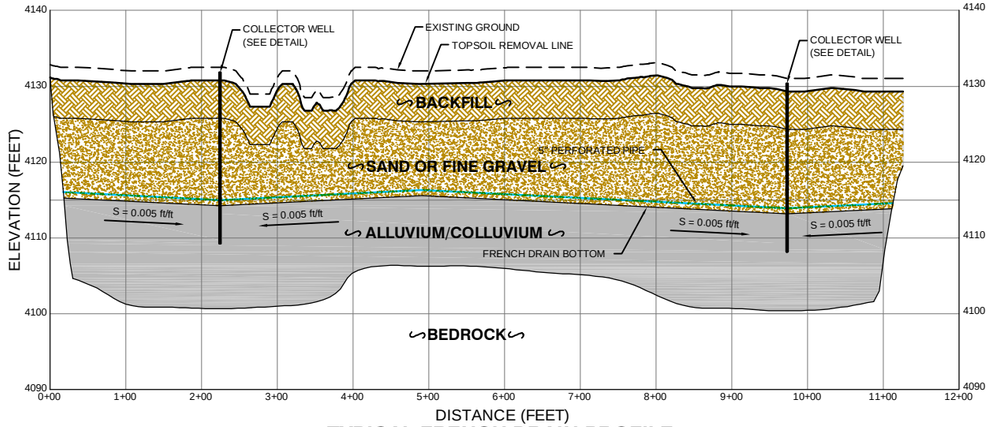
Basemap: 2' Contours from May 2010 Flight

Drawing Coordinates: WY83EF

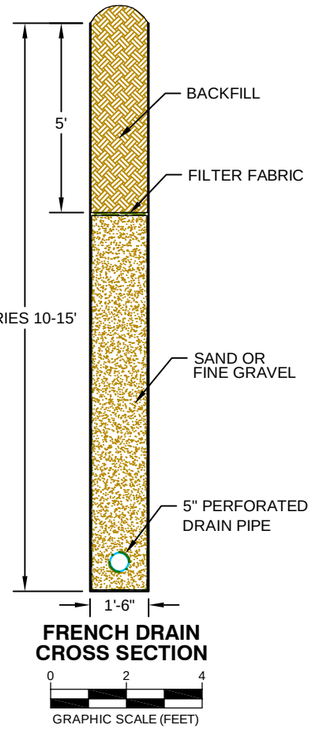
LOCATION MAP

0 150 300 450 600

GRAPHIC SCALE (FEET)



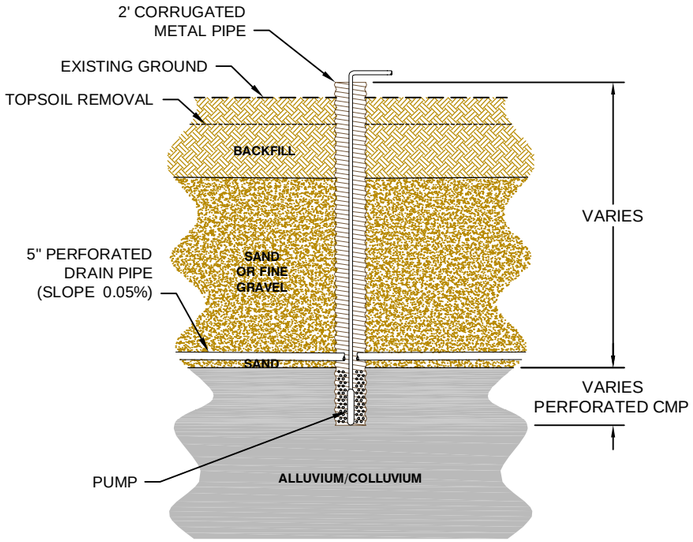
TYPICAL FRENCH DRAIN PROFILE



FRENCH DRAIN CROSS SECTION

0 2 4

GRAPHIC SCALE (FEET)



FRENCH DRAIN COLLECTOR WELL CROSS SECTION

0 5 10

GRAPHIC SCALE (FEET)

LEGEND

PROPOSED ROSS PERMIT BOUNDARY

CONTAINMENT BARRIER WALL (CBW)

Note: See Attachment A, Figure 2 for geologic cross section along CBW.

PENINSULA STRATA ENERGY

ROSS ISR PROJECT
CROOK COUNTY, WY

P.O. BOX 2318
GILLETTE, WY 82716

REVISIONS	
Date	Description
2/5/14	Edit CBW, French Drain

ADDENDUM 3.1-A
FIGURE 6-1

CBW AND FRENCH DRAIN DETAILS

Drawn By: MBM
Checked By: DEB
Date: 3/27/12

FILE: ROSS_RAI_CBW_FD_R1

WWC ENGINEERING www.wwcengineering.com

7.0 HYDROSTATIC UPLIFT ANALYSIS

The French drains and dewatering system will be operated to maintain the water level in the CPP area to an elevation of one foot below the elevation of the bottom of the ponds. This will prevent any uplift due to the groundwater conditions.

8.0 CONSTRUCTION SPECIFICATIONS

Construction specifications for the lined retention ponds, flood control diversion, containment barrier wall, and dewatering system are provided in Attachment B.

9.0 QUALITY CONTROL TESTING PROGRAM (METHODS AND FREQUENCIES)

Quality control procedures and material testing schedules are included in Part 3 of the construction specifications contained in Attachment B. Additionally, an engineer will be on-site to conduct construction inspection and materials testing during installation of the lined retention ponds, flood control diversion, and containment barrier wall.

10.0 OPERATIONAL INSPECTION PLANS

Operational inspection plans for the facilities are discussed in TR Sections 5.3.2 (Lined Retention Ponds), 5.3.4 (Flood Control Diversion), and 5.3.5 (Containment Barrier Wall). Inspection plans for the lined retention ponds include daily, monthly, quarterly, and annual inspections. The flood control diversion channel will be inspected monthly and after large storm events. Monitoring for the containment barrier wall will be accomplished by monitoring the hydraulic gradient across the wall through a network of wells as discussed in Section 6.4 of this Addendum.

11.0 CLOSURE PLANS

The primary surface disturbance area at the proposed project site is the CPP area. Surface disturbance associated with the CPP, including the lined retention ponds and facilities flood control diversion, will remain for the life of the project. Prior to final decommissioning and surface reclamation of any area, Strata will submit a detailed decommissioning and reclamation plan to the NRC at least 12 months prior to the commencement of the activities.

At the proposed Ross ISR project area, the reclaimed land will be capable of supporting livestock grazing, dry land farming and wildlife habitat. Structures and equipment will be decontaminated or deposited at an NRC approved waste facility site. Baseline soils, vegetation, and radiological data will be used to guide the reclamation activities.

Details regarding disposal of structures and equipment, and general procedures for surface reclamation are discussed in Section 6.2 and 6.3 of the TR. The restoration action plan (RAP) with financial assurance estimate is provided as TR Addendum 6.1-A.

12.0 REFERENCES

Jansen, R.B. ed., 1988. Advanced Dam Engineering for Design, Construction and Rehabilitation, Van Nostrand Reinhold, New York, NY.

Linsley, Ray K., and Joseph B. Franzini, 1972, Water Resources Engineering, Second Edition, McGraw Hill.

Morgenstern, N.R., and V.E. Price, 1965. The Analysis of the Stability of General Slip Surfaces. Geotechnique, Vol. 15, pp. 79-93.

NOAA, (U.S. Department of Commerce, National Oceanic and Atmospheric Administration), 1984, Probable Maximum Precipitation Estimates, - United States Between the Continental Divide and the 103rd Meridian, Hydro Meteorological Report No. 55.

NRC, (U.S. Nuclear Regulatory Commission), 2008, Regulatory Guide 3.11, Design, Construction, and Inspection of Embankment Retention Systems at Uranium Recovery Facilities, November 2008.

U.S. Bureau of Reclamation, Department of the Interior, 1987, Design of Small Dams, Revised Reprint.

ATTACHMENT A

GEOTECHNICAL AND HYDROLOGICAL INVESTIGATIONS AND WATER MANAGEMENT INFRASTRUCTURE

Ross ISR Project

Central Processing Plant Area

Geotechnical and Hydrological Investigations and Water Management Infrastucture

WWC ENGINEERING

April 2012

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1.0 INTRODUCTION

The investigations described in this report were conducted in order to confirm the geologic, geotechnical, and hydrological properties of the area proposed for the location of the Ross ISR Project Central Processing Plant (CPP) and associated infrastructure. The area investigated is on private lands located in the NESE of Section 18, T53N, R67W. These investigations included on-site drilling performed in May 2010 and August 2011. In May 2010, four shallow wells were installed and geotechnical testing on the borehole cuttings was performed to establish preliminary geotechnical conditions.

In August 2011, an additional 74 shallow geotechnical boreholes were drilled and four observation wells were installed within the proposed footprint of the CPP. In addition to generally increasing available geotechnical and hydrological knowledge within the CPP area, specific goals of the August 2011 drilling program included:

1) Further evaluation to determine whether or not a proposed containment barrier wall (CBW) is needed.
2) Further evaluate the depth of the valley fill deposits and underlying bedrock characteristics along the alignment of the proposed CBW in order to determine the depth that the CBW should be constructed.
3) Collect samples along the alignment of the proposed CBW that can be later used to develop the bentonite/in-situ soil mix for the CBW.
4) Evaluate the bedrock material in the northwestern and western portion of the CPP area in order to determine if the proposed CBW needs to be extended in these areas.
5) Evaluate the hydraulic properties of the Quaternary valley fill materials to determine how to best dewater the CPP area.
6) Evaluate the hydraulic properties of the bedrock material beneath the valley fill within the CPP area in order to determine how much groundwater may enter the CPP area through bedrock sources.
7) Evaluate the material located below the retention ponds in order to determine pond liner requirements.
8) Collect samples from within the retention ponds that can be tested in the laboratory and used to design the ponds as the project moves to final design stages.

9) Evaluate the lithology along the alignment of the proposed diversion structure in order to determine the extent and thickness of the valley fill.

10) Evaluate the lithology and soils along the proposed access road to determine the extent of the valley fill.

11) Evaluate the soils below the footprint of the proposed CPP, office, and warehouse for the purpose of designing a foundation for the facilities.

12) Evaluate groundwater levels and soils within the proposed domestic wastewater drain field.

The CPP facilities and the various borehole and observation well locations are depicted on Figure 1-1. Oversight for the May 2010 drilling and testing program was provided by WWC Engineering (WWC). Oversight for the August 2011 geotechnical drilling and testing program was provided by both WWC Engineering and Yeh and Associates, LLC. WWC oversaw all the drilling and analyses associated with the CBW, the retention ponds, the diversion structure, the access road, and the domestic wastewater drain field. All hydrological investigations were also conducted by WWC. Yeh and Associates provided oversight for all the drilling and analyses associated with the CPP area and warehouse building foundations.

Prior to initiating the August 2011 geotechnical drilling, Strata met with the Wyoming Department of Environmental Quality (WDEQ) and the U.S. Nuclear Regulatory Commission (NRC) in order to solicit their recommendations on the proposed drilling program. Their recommendations and focus areas were included in the August 2011 geotechnical drilling and testing investigation.

2.0 DRILLING

2.1 2010 Drilling Program

In May 2010, four boreholes were drilled and sampled with a CME 55 High Torque (HT) auger drilling rig contracted from Terracon in Rapid City, South Dakota. Due to land use constraints (landowner hay production), the

four boreholes were drilled on the periphery of the approximate 40-acre site. The four borehole logs and well construction summaries are included in Appendix A.

Borings were advanced to the first water bearing unit or sandstone bedrock expected to contain water. Four shallow, 2-inch diameter wells (SA 13-17-1, SA43-18-3, SA 43-18-1, and SA43-18-2) were installed for water quantity and quality testing. The northernmost well (SA43-18-3) was completed in valley fill consisting of alluvial, colluvial and eolian sediments. The remaining three wells were completed in shallow Lance silt/sandstone bedrock sediments. Soil samples were collected from each test hole to determine soil characteristics. Standard penetration test data were also collected for each boring. Fifteen of the soil samples were submitted to the lab for further testing and analysis.

Figure 1-1 depicts the location of each well. Well SA13-17-1 is approximately 800 feet due east of the center of the CPP site. Well SA43-18-3 is approximately 650 feet due north of the center of the site. Well SA43-18-1 is approximately 800 feet west-northwest of the center of the site. Well SA43-18-2 is located approximately 550 feet south-southwest of the center of the site. Table 2-1 summarizes the location and pertinent details regarding the wells constructed in May 2010, as well as the boreholes and wells constructed in August 2011.

2.2 2011 Drilling Program

The 2011 drilling program consisted of drilling and sampling 78 shallow boreholes with a CME 55 High Torque (HT) auger drilling rig contracted from Terracon in Rapid City, South Dakota. The 2011 drilling program was aimed at obtaining specific geotechnical and groundwater information at the locations of the various facilities and components associated with the CPP. Twenty-seven borings were located along the proposed alignment of the containment barrier wall (CBW-series), and were advanced through the surficial valley fill into the underlying Lance formation bedrock sediments around the perimeter of the

CPP area. Eight borings were located along the alignment of the diversion channel (DVC-series), which is in the eastern portion of the study area where a surface water conveyance structure is planned to divert runoff around the CPP facility. Eight borings were located in the northern half of the study area where the lined retention ponds are proposed (LRP-series). Twenty-five borings were located in the southern portion of the study area where the central processing plant chemical storage area, and administration and maintenance buildings are planned for construction (FD-series). One boring was located at the proposed site of the domestic wastewater drain field (DWD-1). Three borings were completed along the proposed access road alignment from the New Haven Road (RD-series). Six boring were specifically drilled in and around the CPP study area to assess groundwater conditions in the shallow groundwater aquifer (surficial aquifer (SA) unit) and four of those borings were completed as observation wells. Figure 1-1 depicts the locations of all geotechnical boreholes and observation wells, and Table 2-1 summarizes the location and pertinent details regarding all boreholes and observation wells. The boring logs for all the boreholes are contained in Appendix B. The observation well construction summaries are presented in Appendix C. All boreholes not completed as wells were plugged and abandoned with 3/8" bentonite chips within 48 hours of drilling.

Table 2-1. Details for the Boreholes and Observation Wells

Borehole ID	Northing	Easting	Land Surface Elevation (ft)	Total Depth (ft)	Groundwater Elevation (ft)	Bedrock Elevation (ft)
CBW-1	1486575.6	713167.4	4136.8	30.5	4125.6	4129.3
CBW-2	1486567.7	713380.2	4133.0	18.5	4122.2	4112.0
CBW-3	1486594.5	713934.7	4130.9	20.5	4119.4	4113.9
CBW-4	1486516.0	713478.6	4132.3	10.5	Dry	4124.3
CBW-5	1486355.3	713479.1	4132.2	12.0	Dry	4125.2
CBW-6	1486316.1	713543.9	4132.1	17.0	4124.1	4122.9
CBW-7	1486438.8	713646.1	4131.6	24.5	4121.8	4118.6
CBW-8	1486329.3	713730.6	4132.1	15.5	4122.9	4118.6
CBW-9	1486323.9	713850.0	4132.2	22.0	4121.7	4115.7
CBW-10	1486324.2	714001.1	4132.2	30.5	4120.5	4107.2
CBW-11	1486327.3	714143.7	4132.4	38.0	4120.2	4098.4
CBW-12	1486323.5	714304.8	4130.8	36.0	4120.0	4097.8
CBW-13	1486309.8	714451.0	4130.7	40.5	4120.5	4107.7
CBW-14	1486173.7	714451.3	4131.7	18.5	4124.2	4119.7
CBW-15	1486026.5	714452.7	4132.5	15.5	4125.0	4120.5
CBW-16	1485726.6	714451.1	4133.7	47.0	4128.9	4117.7
CBW-17	1485443.0	714434.8	4136.2	20.5	4131.7	4118.7
CBW-18	1485248.6	714340.3	4137.7	32.0	4133.1	4110.2
CBW-19	1485179.8	714270.7	4138.6	25.5	4133.9	4116.6
CBW-20	1485121.7	714188.8	4138.4	25.5	4134.5	4114.9
CBW-21	1485086.9	714096.0	4140.9	37.0	4135.2	4109.4
CBW-22	1485065.8	713998.1	4141.7	32.0	4136.2	4117.2
CBW-23	1485059.8	713900.7	4141.9	27.0	4136.6	4123.9
CBW-24	1485029.3	713781.9	4142.0	15.5	4139.4	4131.0
CBW-25	1485025.1	713393.7	4152.2	25.5	4138.8	4149.2
CBW-26	1485026.6	713121.1	4166.1	9.0	Dry	4162.1
CBW-27	1486066.6	713129.4	4138.9	5.5	Dry	4134.9
DVC-1	1486024.5	714526.2	4132.5	14.0	4127.5	4119.5
DVC-2	1486026.2	714605.1	4133.4	19.0	4125.7	4116.4
DVC-3	1485722.1	714524.6	4135.2	14.0	Dry	4128.2
DVC-4	1485722.5	714600.7	4136.8	14.0	Dry	4129.3
DVC-5	1485403.4	714505.0	4137.4	9.0	4131.8	4136.4
DVC-6	1485383.3	714575.8	4142.4	9.0	Dry	4141.4
DVC-7	1485151.7	714460.7	4139.3	15.0	4134.3	4128.3
DVC-8	1485062.2	714576.3	4142.8	10.0	Dry	4138.8
DWD-1	1485144.3	714056.1	4140.3	32.0	4135.3	4109.0
FD-1	1485521.6	713261.3	4140.8	40.5	4116.0	4132.0
FD-2	1485423.6	713261.7	4143.9	20.5	4131.0	4131.0
FD-3	1485333.0	713263.5	4146.8	20.5	4132.3	4143.0
FD-4	1485242.6	713262.8	4149.3	35.5	4132.7	4145.0
FD-5	1485148.0	713261.1	4153.5	25.5	4134.9	4150.0
FD-6	1485470.8	713359.0	4138.1	39.9	4125.4	4130.0

Table 2-1. Details for the Boreholes and Observation Wells (Continued)

Borehole ID	Northing	Easting	Land Surface Elevation (ft)	Total Depth (ft)	Groundwater Elevation (ft)	Bedrock Elevation (ft)
FD-7	1485383.1	713360.1	4141.4	35.5	Dry	4133.0
FD-8	1485287.8	713362.9	4143.7	34.5	Dry	4138.0
FD-9	1485194.8	713362.0	4146.8	40.5	4133.8	4142.0
FD-10	1485516.9	713463.5	4136.3	35.5	4122.6	4126.0
FD-11	1485424.2	713461.6	4137.7	35.5	4109.0	4129.0
FD-12	1485335.1	713459.3	4140.2	35.5	4130.3	4130.0
FD-13	1485238.8	713460.9	4143.6	40.5	4133.3	4136.0
FD-14	1485148.7	713465.7	4146.5	40.5	4134.5	4139.0
FD-15	1485077.8	713366.2	4151.5	45.5	4136.2	4144.0
FD-16	1485515.7	713600.9	4137.1	35.5	4126.6	4119.0
FD-17	1485387.9	713603.0	4137.9	35.5	4129.2	4121.0
FD-18	1485284.4	713601.8	4141.2	35.0	4127.4	4133.0
FD-19	1485150.5	713602.4	4147.8	39.9	4133.4	4144.0
FD-20	1485473.7	713912.2	4137.7	40.5	4130.2	4116.0
FD-21	1485351.6	713914.3	4139.6	30.5	4132.4	4115.0
FD-22	1485223.7	713915.3	4140.9	34.1	4131.7	4107.0
FD-23	1485479.9	714012.9	4138.4	45.5	4130.5	4103.0
FD-24	1485346.4	714016.5	4139.1	40.5	4132.4	4109.0
FD-25	1485223.0	714012.9	4139.8	40.5	4134.2	4111.0
LRP-1	1486166.3	713356.8	4132.6	45.5	4123.5	4124.6
LRP-2	1485708.5	713357.4	4135.0	21.5	4122.2	4119.9
LRP-3	1485937.6	713587.1	4134.1	26.5	4121.8	4113.1
LRP-4	1486170.5	713929.9	4133.4	26.5	4120.5	4109.9
LRP-5	1485940.0	714137.0	4134.1	30.5	4124.1	4103.8
LRP-6	1486167.6	714342.7	4132.0	26.5	4122.0	4110.0
LRP-7	1485706.6	714339.1	4135.2	23.0	4130.4	4117.2
LRP-8	1485365.5	714249.1	4137.4	31.5	4132.6	4109.9
RD-1	1485577.9	714899.0	4149.0	19.5	Dry	4148.0
RD-2	1485672.8	715167.6	4161.6	10.5	Dry	4159.6
RD-3	1485735.6	715648.7	4198.8	10.5	Dry	4196.8
SA13-17-1	1485559.5	714589.3	4138.7	13.0	Dry	4136.2
SA42-18-1	1486696.3	713257.7	4133.8	30.5	4122.3	4125.8
SA43-18- 5	1485750.4	714100.5	4134.8	31.0	4125.2	4109.1
SA43-18- 7	1485949.1	714184.4	4133.8	33.5	4124.4	4104.8
SA43-18- 8	1485724.5	713924.6	4136.1	19.5	4125.0	4122.6
SA43-18-1	1485568.3	713105.0	4146.8	15.5	4127.2	4140.7
SA43-18-2	1485026.2	713632.6	4149.3	20.5	4139.7	4145.0
SA43-18-3	1486276.9	713754.7	4132.9	27.0	4120.0	4106.6
SA43-18-4	1485144.3	713941.5	4141.4	26.5	4135.1	4117.4
SA43-18-6	1485145.7	713910.9	4141.3	29.5	4135.0	4114.3

NOTES: 1. *Coordinates are NAD 83 WY East State Plane.*
2. Units are US Survey Feet.
3. Groundwater levels measured late August 2011.

CERTIFICATE OF GEOLOGIST

I, Benjamin J. Schiffer, hereby certify that this drawing was prepared by myself or under my direct supervision and that it correctly represents the geologic conditions described in the accompanying application which is provided to meet the requirements of the Wyoming Environmental Quality Act and its accompanying regulations.

PROFESSIONAL GEOLOGIST
BENJAMIN J. SCHIFFER
PG-3446
WYOMING

LEGEND

- ROSS PERMIT BOUNDARY
- BEDROCK LITHOLOGY BOUNDARY
- SHALLOW BEDROCK AND ALLUVIAL GROUNDWATER ELEVATION CONTOUR (DASHED WHERE INFERRED) MEASURED LATE AUGUST 2011
- LRP-5 (G) GEOTECHNICAL BOREHOLE
- SA43-18-7 (W) OBSERVATION WELL
- C' GEOLOGIC CROSS SECTION LOCATION

0 100 200 300 400
GRAPHIC SCALE (FEET)

R. 67 W.

T. 53 N.

E. 713000 E. 713500 E. 714000 E. 714500 E. 715000 E. 715500

N. 1486500 N. 1486000 N. 1485500 N. 1485000

F' A' G' E E' D D' C C' B B' A G F

SA42-18-1 SA43-18-1 SA43-18-2 SA43-18-3 SA43-18-4 SA43-18-5 SA43-18-6 SA43-18-7 SA43-18-8 SA13-17-1

CBW-1 CBW-2 CBW-3 CBW-4 CBW-5 CBW-6 CBW-7 CBW-8 CBW-9 CBW-10 CBW-11 CBW-12 CBW-13 CBW-14 CBW-15 CBW-16 CBW-17 CBW-18 CBW-19 CBW-20 CBW-21 CBW-22 CBW-23 CBW-24 CBW-25 CBW-26 CBW-27

LRP-1 LRP-2 LRP-3 LRP-4 LRP-5 LRP-6 LRP-7 LRP-8

DVC-1 DVC-2 DVC-3 DVC-4 DVC-5 DVC-6 DVC-7 DVC-8

DWD-1

RD-1 RD-2 RD-3

FD-1 FD-2 FD-3 FD-4 FD-5 FD-6 FD-7 FD-8 FD-9 FD-10 FD-11 FD-12 FD-13 FD-14 FD-15 FD-16 FD-17 FD-18 FD-19 FD-20 FD-21 FD-22 FD-23 FD-24 FD-25

END CBW

BEGIN CBW

POND 1 CELL 1
POND 1 CELL 2
POND 1 CELL 3
POND 2 CELL 1
POND 2 CELL 2
POND 2 CELL 3
SEDIMENT POND

BEDROCK SANDSTONE CLAYSTONE

4120 4122 4124 4126 4128 4130 4132 4134 4136 4138 4140 4150 4160 4170 4180 4190 4200

Basemap: 2' Contours from May 2010 Flight

CENTRAL PROCESSING PLANT AREA

Drawing Coordinates: WY83EF

STRATA energy — PENINSULA ENERGY LTD

ROSS ISR PROJECT
CROOK COUNTY, WY
P.O. BOX 2318
GILLETTE, WY 82716

REVISIONS	
Date	Description

TR ADDENDUM 3.1-A
FIGURE 1-1

ROSS
CENTRAL PROCESSING PLANT AREA
SHALLOW GEOLOGIC
CROSS SECTION LOCATIONS
AND WATER TABLE MAP

Drawn By: MBM
Checked By: RBM
Date: 2/28/12

WWC ENGINEERING
www.wwcengineering.com

FILE: ROSS_RAI_PS_GEO_122711

K:\Peninsula_Minerals\09142\DWGS_RAI\ROSS_RAI_PS_GEO_122711.dwg 4/5/2012 9:22:26 AM mbmcg

3.0 LABORATORY SOIL TESTING

3.1 2010 Laboratory Summary

During the 2010 geotechnical investigations soil specimens were collected from each of the test holes using various means, including California tubes, split barrel standard penetration tests (SPT) (ASTM D-1586), and bulk samples. On 5-foot intervals, beginning 5 feet below the ground surface, either a SPT or a California tube was driven. In the majority of the boreholes both methods were used to collect samples. The SPT blow counts were recorded on the borehole logs.

Advanced Terra Testing (ATT), in Lakewood, Colorado, performed the laboratory soil testing. Laboratory tests on all the samples that were submitted to ATT included Atterberg Limits (ASTM D4318) and grain size analyses (ASTM D1140). One California tube sample collected from borehole SA43-18-3 at a depth of 10.5 feet was submitted to the lab for permeability testing. Two bulk samples from borehole SA43-18-1 and SA43-18-2 were submitted to the lab for standard proctor density testing (ASTM 698). Results of the 2010 soil testing are summarized in Table 3-1.

3.2 2011 Laboratory Summary

Similar to the 2010 geotechnical testing, soil specimens were collected during the 2011 geotechnical investigations from each of the test holes using various means, including California tube samplers, SPT split spoon samplers, Shelby tubes, a CME hollow stem continuous sampler, and bulk samples. On 5-foot intervals, beginning 5 feet below the ground surface, either an SPT or a California tube was driven. In some of the boreholes both a California tube and an SPT were driven on 5-foot intervals if additional data were needed. The SPT blow counts were recorded on the borehole logs.

As previously described, WWC and Yeh and Associates oversaw different parts of the 2011 drilling program. All the samples collected from the FD-series boreholes (associated with the building foundations) were collected by Yeh and Associates and they oversaw laboratory testing of the samples

selected for testing. Within the remaining boreholes the samples were collected by WWC. The samples that WWC selected for further testing were submitted to ATT for testing. For all the samples submitted for testing, Atterberg Limits and minus #200 sieve grain size tests were performed in order to classify the soils. Additional testing performed on selected samples included Standard Proctor density testing, permeability testing, and triaxial strength testing. The soil test results from the drilling that WWC Engineering supervised are included in Table 3-2.

A similar soil testing program was conducted by Yeh and Associates and their laboratory analyses included gradation testing, Atterberg limit tests, pH tests, water soluble sulfate tests, resistivity testing, chloride percent tests, swell and consolidation tests, and unconfined compressive strength tests for selected samples. A summary of the results from the 2011 testing conducted by Yeh and Associates is included in Table 3-3.

Table 3-1. Summary of Laboratory Testing Results Conducted in 2010 by ATT

Borehole ID	Sample Type	Sample Interval	GSA (-200%)	Atterberg (ASTM D4318)			Class	SPC (pcf @ % M.C.)	Perm (cm/s)
				LL	PL	PI			
SA13-17-1	CAL	10.5	52.0%	48	20	28	CL	-	-
SA43-18-1	Bulk	1-5	80.0%	51	48	33	CH	102.3@19.8	-
SA43-18-1	CAL	4-5.5	51.0%	50	16	34	CH	-	-
SA43-18-1	CAL	9	-	-	-	-	-	-	-
SA43-18-1	CAL	15.5	28.0%	NV	NP	NP	SM	-	-
SA43-18-2	CAL	15.5	71.0%	46	23	23	CL	-	-
SA43-18-2	Bulk	3-6	65.0%	49	21	28	CL	100.5@19.5	-
SA43-18-1	CAL	5	-	-	-	-	-	-	-
SA43-18-1	CAL	9	78.0%	37	15	22	CL	-	-
SA43-18-2	CAL	9	62.0%	42	20	22	CL	-	-
SA43-18-2	CAL	9	-	-	-	-	-	-	-
SA43-18-3	CAL	14	-	-	-	-	-	-	-
SA43-18-3	CAL	4-5.5	95.3%	42.9%	14.7%	28.2%	CL	-	2.80E-07
SA43-18-3	CAL	10.5	94.0%	62	18	44	CH	-	-
SA43-18-3	CAL	14	-	-	-	-	-	-	-

Abbreviations:

Sample Interval = the depth below ground level, in feet.
CAL=California Tube Sample.
GSA = Grain Size Analysis, percent fines, -200 sieve only, ASTM D 1140.
Class = USCS Classification of soil after GSA and ALT.
SPC = Standard Proctor Compaction test, ASTM D 698, Method A.
Perm = Back pressure permeability test, by flow pump, ASTM D 5084.

Table 3-2. Summary of Laboratory Testing Results Conducted in 2011 by ATT

Borehole ID	Sample Type	Sample Interval	GSA (-200%)	Atterberg (ASTM 4318)			Class	SPC (lb/cf)	Borelog Description	Triax CU		Perm (cm/s)
				LL	PL	PI				Phi	C (psf)	
LRP-1	CAL	12.4-12.7	51.6	61.7	15.8	46	CH					3.5E-06
LRP-1	SPT	13-14.5	69.6	63.2	12.9	50.4	CH		Siltstone			
LRP-1	SPT	16.5-18	32	58	12.1	45.8	SC		Sandy siltstone w/clay			
LRP-2	CAL	12.4-13	51.2	32.3	7.9	24.4	CL		Silt/sand	*	*	
LRP-2	SPT	13-14.5	42.2	33.7	8.5	25.1	CL		Sand silty			
LRP-2	SPT	20-21.5	84.3	87.9	15.7	72.1	CH		Silty sandstone/clay			
LRP-3	SPT	5-6.5	97.2	69.5	16.9	52.6	CH		Clay-silty			
LRP-3	SPT	14-15.5	72.9	59.5	11.5	48	CH		Clay-dark			
LRP-3	Bulk	6.5-12	94.4	61.8	15	46.7	CH	104.5	Clay-silty	19.7	231	1.2E-07
LRP-3	CAl	12.5-14	81.9	78.4	15.2	63.2	CH		Clay-firm cohesive			1.6E-07
LRP-3	CAl	20.9-21.5	99	66.3	14.4	51.9	CH		Siltstone clay-rich			2.1E-08
LRP-4	SPT	13-14.5	89.9	47.3	12.1	35.2	CL		Clay soft sticky			
LRP-4	SPT	16.5-18	95.7	42.8	10.5	32.2	CL		Sandy clay			
LRP-5	SPT	14-15.5	57	38.1	12.5	25.7	CL		Clayey sand			
LRP-5	CAL	14.0-15.5	56.7	39.7	8.3	31.4	CL		Sandy silty clay			8.1E-07
LRP-5	Bulk	6.5-12	90.3	47.3	11	36.4	CL	111.9	Silty clay			8.0E-08
LRP-6	SPT	12-13.5	84.5	48.8	12.5	36.3	CL		Silty-sandy clay			
LRP-6	CAL	14.5-16	89.6	54.3	8.4	45.9	CH		Sandy clay w/silt	23.9	105	
LRP-7	CAL	10.9-11.5	99.5	59.1	14.8	44.3	CH		Sandy silty clay	22.2	200	
LRP-7	CAL	13.8-14.1	91.7	50	13.8	36.2	CL					7.2E-08
LRP-7	CAL	19.6-19.9	54.1	51.3	16.1	35.3	CH		Siltstone-sandstone hard			4.1E-07
LRP-8	SPT	17-18.5	91.5	47.2	12	35.2	CL		Clayey sand/sandy clay			
DWD-1	Bulk	3-5.0	97.7	55.5	14.8	40.7	CH					
SA43-18-4	ST	18-20	66	39.2	12.3	26.9	CL					3.6E-07

Table 3-2. Summary of Laboratory Testing Results Conducted in 2011 by ATT (Continued)

Borehole ID	Sample Type	Sample Interval	GSA (-200%)	Atterberg (ASTM 4318)			Class	SPC (lb/cf)	Borelog Description	Triax CU		Perm (cm/s)
				LL	PL	PI				Phi	C (psf)	
SA43-18-6	Bulk	3.0-5	89	46.9	13.1	33.7	CL					
RD-2	SPT	4-5.5	49.6	36.8	12.5	24.2	CL		Sandstone/silty			
RD-1	SPT	4-5.5	95.5	57.7	9.7	47.9	CH		Silty claystone			
CBW-1	SPT	29-30.5	76	65.8	11.7	54.1	CH		Dark sandy siltstone			
CBW-2	SPT	9-10.5	59.6	66.2	14.4	51.9	CH		Sandy silt/clay			
CBW-2	CAL	16.2-16.6	41.9	52.8	17.9	64.9	SC		Silty sandstone			2.7E-06
CBW-6	SPT	9-10.5	37.6	35.3	16.5	18.9	SC		Silty sandstone			
CBW-6	SPT	15.5-17	40.9	53.6	11.9	41.7	SC		Silty sandstone			
CBW-8	SPT	10.5-13	44.7	60.6	15.8	44.8	SC		Sandy			
CBW-8	SPT	14-15.5	97	68.9	14.5	54.4	CH		Siltstone			
CBW-9	SPT	9-10.5	82.1	47.2	12.9	34.2	CL		Clay w/silt & sand			
CBW-9	CAL	19-20.5	34.9	45.8	18.6	27.2	SC		Silty sandstone			1.5E-06
CBW-11	SPT	14-15.5	66.9	35.5	12.1	23	CL		Silty clay w/ sand			
CBW-11	SPT	29-30.5	77	42.1	11.6	30.5	CL		Silty clay			
CBW-13	SPT	14-15.5	89.8	45.4	11.8	33.6	CL		Clay silty			
CBW-13	CAL	25-26	81.8	61.5	10.6	50.9	CH		Silty sandstone			4.3E-08
CBW-14	CAL	15.5-17	94.2	50.5	13.7	36.8	CH		Siltstone			6.7E-08
CBW-16	SPT	9-10.5	83.7	45.5	12.2	33.3	CL		Clay			
CBW-16	CAL	18.5-19.3	21.6	NP	NP	NP	SP		Sandstone fine friable			1.3E-03
CBW-16	SPT	20.5-22	18.5	47.1	9.3	37.8	SC		Sandstone			
CBW-16	CAL	44-45.5	94.2	78.8	16.6	62.2	CH		Claystone carbonaceous			1.8E-08
CBW-18	SPT	14-15.5	86	45.8	13	32.8	CL		Silty clay			
CBW-18	CAL	29-30.5	98.2	59.3	14.4	44.9	CH		Silty claystone			1.9E-08
CBW-22	SPT	9-10.5	91.9	59.7	14.7	45	CH		Silty clay			
CBW-22	SPT	24-25.5	88.7	55.7	15.4	40.2	CH		Sand clean			

Table 3-2. Summary of Laboratory Testing Results Conducted in 2011 by ATT (Continued)

Borehole ID	Sample Type	Sample Interval	GSA (-200%)	Atterberg (ASTM 4318)			Class	SPC (lb/cf)	Borelog Description	Triax CU		Perm (cm/s)
				LL	PL	PI				Phi	C (psf)	
CBW-25	SPT	10.5-12	45.3	39.3	10.3	29	SC		Sandstone/siltstone			
CBW-23	CAL	24.7-25.1	97.1	50.5	16	34.4	CH		Silty claystone			8.0E-8
CBW-25	SPT	19-20.5	25.4	37.8	24.1	13.7	SC		Sandstone			
CBW-25	SPT	24-25.5	97.6	128.1	18.5	109.6	CH		Silty claystone			

NOTE: * LRP-2, 12.4-13': Two samples were subjected to a Triaxial Shear, unconsolidated, undrained test, ASTM D 2850. The deviator stress at 10 percent strain were 3800 psf at a 1000 psf confining pressure and 2000 psf at a 5000 psf confining pressure.

Abbreviations:

CAL = California Tube Sample.
DBS = Disturbed Bulk Sample.
ST = Shelby Tube Sample.
SPT = Split Spoon test sample.
Sample Interval = depth below ground level, in feet.
Class = USCS Classification of soil after GSA and ALT.
SPC = Standard Proctor Compaction test, ASTM D 698, Method A.
GSA = Grain Size Analysis, percent fines, -200 sieve only, ASTM D 1140.
Triax CU = Triaxial Shear, Consolidated, Undrained, with pore pressure measurements, 3-point test, ASTM D 4767.
Perm = Back pressure permeability test, by flow pump, ASTM D 5084.

Table 3-3. Summary of Laboratory Testing Results Conducted in 2011 by Yeh & Associates

Borehole ID	Sample Interval	Sample Type	GSA (-200%)	ALT			pH	Water Soluble Sulfate (%)	Resistivity (ohm/cm)	Chloride (%)	% Swell (+) or Consolidation (-)	Unconfined Comp. Strength (psf)	Class
				LL	PL	PI							
FD-01	4	CAL	92	55	22	33	-	-	-	-	-	1694	CH
FD-02	4	CAL	47	42	18	24	-	-	-	-	-	-	SC
FD-03	4	CAL	84	48	21	27	-	-	-	-	2.7	-	CL
FD-03	9	CAL	-	-	-	-	-	-	-	-	-	-	-
FD-03	14	CAL	-	-	-	-	-	-	-	-	-	-	-
FD-04	4	CAL	77	34	21	13	-	-	-	-	-	-	CL
FD-04	9	CAL	-	-	-	-	-	-	-	-	3.5	-	-
FD-05	9	CAL	-	-	-	-	8.4	0.09	457	0.003	-	-	-
FD-05	14	CAL	-	-	-	-	-	-	-	-	-	-	-
FD-06	10.5	CAL	74	35	17	18	-	-	-	-	-	495	CL
FD-06	19	CAL	-	-	-	-	-	-	-	-	-	-	-
FD-07	8	CAL	-	-	-	-	-	-	-	-	-	-	-
FD-07	24	SPT	-	-	-	-	-	-	-	-	-	-	-
FD-08	8	CAL		-	-	-	-	-	-	-	1	-	-
FD-08	28	SPT	87	77	25	52	-	-	-	-	-	-	CH
FD-09	4	CAL	70	53	20	33	8.3	1.594	185	0.0345	0	2793	CH
FD-09	14	SPT	25	NV	NP	NP	-	-	-	-	-	-	SM
FD-10	4	CAL	-	-	-	-	8.2	0.333	301	0.0124	-	4639	-
FD-10	14	CAL	52	39	16	23	-	-	-	-	-	-	CL
FD-10	24	CAL	-	-	-	-	-	-	-	-	-	-	-
FD-11	4	CAL	89	64	23	41	-	-	-	-	1.2	-	CH
FD-11	9	CAL	-	-	-	-	-	-	-	-	-	-	-
FD-11	14	CAL	-	-	-	-	-	-	-	-	1	-	-
FD-12	4	CAL	76	63	24	39	-	-	-	-	-0.8	-	CH
FD-12	14	CAL	-	-	-	-	-	-	-	-	-	1010	-
FD-13	4	CAL	-	-	-	-	-	-	-	-	-	3009	-
FD-13	29	SPT	87	67	25	39	-	-	-	-	-	-	CH
FD-14	4	CAL	-	-	-	-	8.5	0.821	166	0.0169	0.5	-	-
FD-14	9	CAL	37	37	17	20	-	-	-	-	-	-	CL
FD-15	4	CAL	54	42	19	23	8.6	0.298	235	0.0064	-0.3	-	CL

Table 3-3. Summary of Laboratory Testing Results Conducted in 2011 by Yeh & Associates (Continued)

Borehole ID	Sample Interval	Sample Type	GSA (-200%)	ALT			pH	Water Soluble Sulfate (%)	Resistivity (ohm/cm)	Chloride (%)	% Swell (+) or Consolidation (-)	Unconfined Comp. Strength (psf)	Class
				LL	PL	PI							
FD-15	9	CAL	-	-	-	-	-	-	-	-	-	770	-
FD-15	14	CAL	28	NV	NP	NP	-	-	-	-	-	-	SM
FD-16	4	CAL	-	-	-	-	-	-	-	-	-2.6	-	-
FD-16	11	CAL	42	NV	NP	NP	-	-	-	-	-	-	SM
FD-16	19	CAL	-	-	-	-	-	-	-	-	-	-	-
FD-17	9	SH	-	-	-	-	-	-	-	-	-	-	-
FD-18	4	CAL	-	-	-	-	-	-	-	-	-	-	-
FD-18	9.5	CAL	94	94	24	38	-	-	-	-	-	1282	CH
FD-19	0-4	BULK	-	-	-	-	8.1	1.07	341	0.0006	-	-	-
FD-19	14	SPT	88	88	22	48	-	-	-	-	0	-	CH
FD-20	4	CAL	-	-	-	-	-	-	-	-	-0.2	-	-
FD-20	9	CAL	65	65	18	19	-	-	-	-	-	-	CL
FD-21	0-4	BULK	-	-	-	-	8.3	0.003	-	-	-	-	-
FD-21	11	CAL	-	-	-	-	-	-	-	-	-0.4	-	-
FD-21	14	CAL	75	75	17	22	-	-	-	-	-	2838	CL
FD-22	19	CAL	80	80	23	32	-	-	-	-	-0.6	-	CH
FD-23	4	CAL	-	-	-	-	-	-	-	-	-1.2	-	-
FD-23	14	CAL	-	-	-	-	-	-	-	-	-	3862	-
FD-23	24	CAL	62	31	15	15	-	-	-	-	-	-	CL
FD-24	19	CAL	-	-		-	-	-	-	-	-	3801	-
FD-24	24	CAL	67	32	15	17	-	-	-	-	-	-	CL
FD-25	0-4	BULK	-	-	-	-	8.4	1.335	176	0.0009	-	-	-
FD-25	9	CAL	-	-	-	-	-	-	-	-	-	3555	-
FD-25	24	CAL	67	32	15	17	-	-	-	-	-	-	CL

Abbreviations:

CAL = California Tube Sample.
DBS = Disturbed Bulk Sample.
ST = Shelby Tube Sample.
SPT = Split Spoon Test Sample.
GSA = Grain Size Analysis, percent fines, -200 sieve only, ASTM D 1140.
ALT = Atterberg Limits Test, ASTM D 4318.
Class = USCS Classification of soil after GSA and ALT.

4.0 DESCRIPTION OF GENERAL LITHOLOGY

4.1 Valley Fill Materials

The surficial, unconsolidated, Quaternary-age deposits consist of a sequence of very fine-grained, locally-derived sediments deposited by alluvial, colluvial, and eolian processes. These deposits, collectively referred to herein as *valley fill*, are generally soft, brown and often mottled, predominantly sandy and silty clay with occasional thin to very thin lenticular layers of poorly- to moderately well-sorted, fine- to coarse-grained sands and secondary pebbly, clay-rich sands. The soft, cohesive clays near the ground surface often display visible salt crystals, which is indicative of upward transport and precipitation of dissolved saline minerals from shallow groundwater. In the CPP area, the valley fill deposits range from just a few feet to over 30 feet thick.

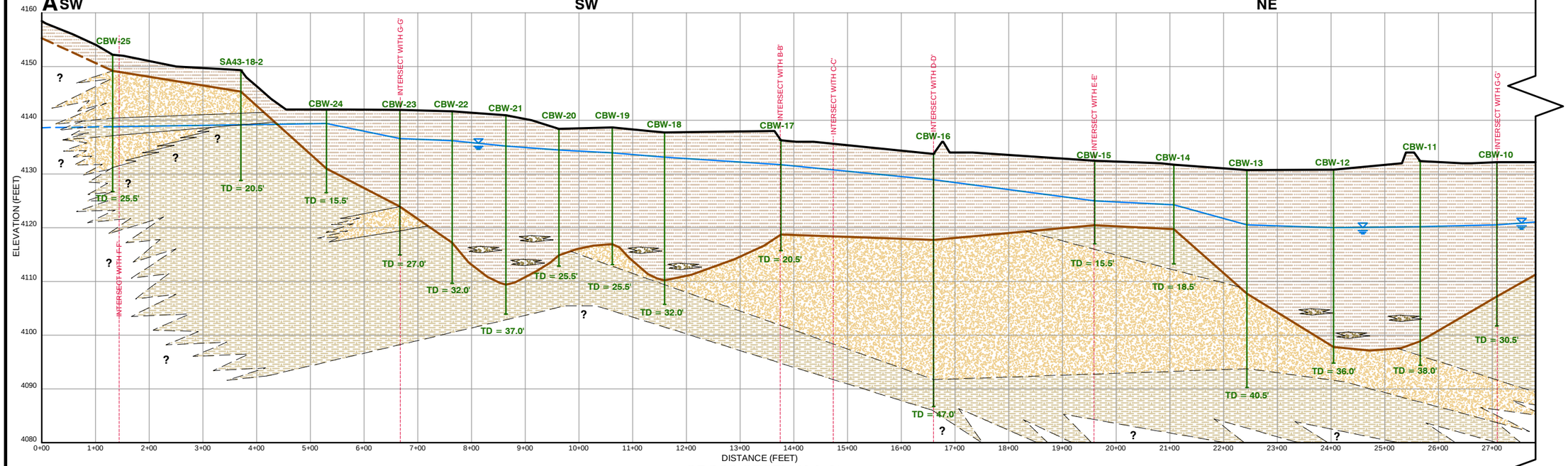
4.2 Bedrock Materials

Bedrock materials underlying the valley fill are of the Upper Cretaceous-age Lance Formation sedimentary sequence. The Lance Formation consists of very fine-grained terrestrial sandstone, siltstone, mudstone, claystone, and occasional thin lenses of carbonaceous mudstone and coal, of fluvial, lacustrine, and paludal origins. The bedrock sediments are consolidated and firm, but generally poorly indurated and moderately friable with occasional well-cemented ledges and concretions that are very hard due to calcium carbonate cementation. Sandstones of the Lance Formation are extremely fine-grained, silty, and typically have low plasticity. The Lance Formation is frequently weathered immediately below the erosional contact, resulting in a very soft boundary. In some cases the rocks are deeply weathered and the soft, residual soils may extend a considerable depth below the erosion surface.

Based on all the available borehole logs, seven geologic cross sections depicting the valley fill and shallow bedrock in the CPP area were developed and are presented as Figures 4-1 through 4-7. As shown on the cross sections, bedrock depths vary from around 1 foot to approximately 35 feet below land surface (bls). The overlying valley fill deposits are thinnest in the eastern and

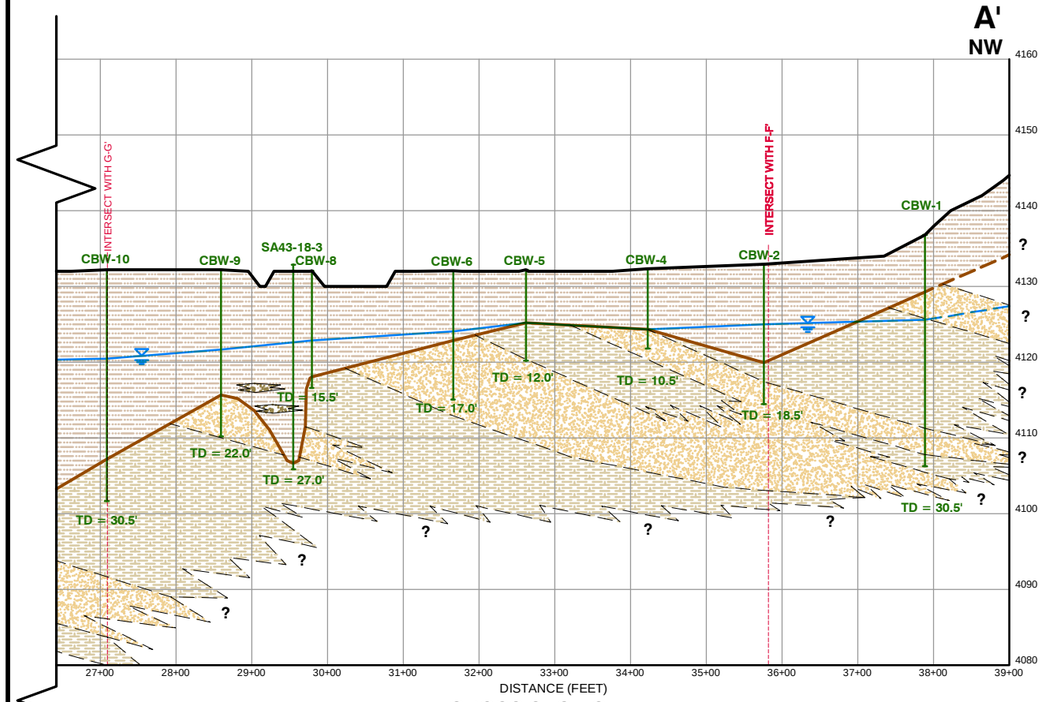
western portions of the project area. The depth to bedrock is greatest along a line that trends roughly north-south and just east of cross section G-G'. The top-of-bedrock elevation at each borehole is detailed in Table 2-1.

In addition to the geologic cross sections, borehole logs were used to develop boundaries between the bedrock lithologies. As described above, in addition to fine-grained sandstones, the Lance bedrock sediments are comprised of claystones and siltstones. Based on the lithologic descriptions in the borehole logs and subsequent laboratory testing of the samples, the bedrock type at the contact between the valley fill and the bedrock was mapped. Figure 1 depicts the lithologic boundaries where the bedrock sediments beneath the valley fill change from claystone to sandstone. Generally along the western portion of the CPP area the bedrock immediately below the valley fill is sandstone. The predominant bedrock type beneath most of the facility is claystone/siltstone with minor areas of sandstone located in the northeastern and the southeastern portions of the CPP area.



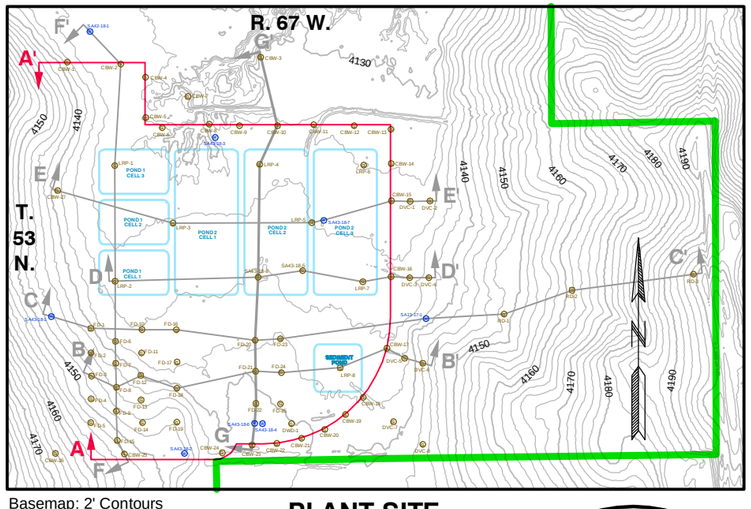
CROSS SECTION A-A'

10:1 VERTICAL EXAGGERATION



CROSS SECTION A-A'

10:1 VERTICAL EXAGGERATION



Basemap: 2' Contours from May 2010 Flight

PLANT SITE

0 300 600

GRAPHIC SCALE (FEET)

LEGEND

Approximate groundwater level in late August 2011, recorded in morning on day after drilling. Dashed where inferred. (Typically very slow infiltration into borehole)

Quaternary Alluvial & Colluvial fill

Sandy Clay and Silty Clay; brown, very cohesive when moist, contains sparse very thin, very fine sandy lenses, stiff to very soft. Occasional thin zones of fine pebble gravels.

Pebbly Sand and Clay; brown, poorly sorted, may contain sparse thin clean sand. Lenticular and laterally discontinuous.

Unconformity

"Contact" Dashed where inferred.

Upper Cretaceous Lance Formation "Bedrock"

Claystone and Siltstone; brown, dark brown, and gray, very firm mudstone and finely laminated shale.

Sandstone; light brown to gray, extremely fine grained silty and clay rich poorly to moderately consolidated sandstone. Occasionally very hard and well cemented with $CaCO_3$ cement.

Note: Bedrock may be weathered and soft to very soft below contact. Erosion surface may exhibit more complex topography than limited drilling is able to reveal.

CERTIFICATE OF GEOLOGIST

I, Benjamin J. Schiffer, hereby certify that this drawing was prepared by myself or under my direct supervision and that it correctly represents the geologic conditions described in the accompanying application which is provided to meet the requirements of the Wyoming Environmental Quality Act and its accompanying regulations.

PROFESSIONAL GEOLOGIST
BENJAMIN J. SCHIFFER
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ROSS ISR PROJECT
CROOK COUNTY, WY
P.O. BOX 2318
GILLETTE, WY 82716

REVISIONS

Date	Description

TR ADDENDUM 3.1-A
FIGURE 4-1
ROSS
CENTRAL PROCESSING PLANT AREA
SHALLOW GEOLOGIC
CROSS SECTION A-A'

Drawn By: MBM
Checked By: RBM
Date: 1/19/12

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FILE: ROSS_RAI_PS_GEO_122711
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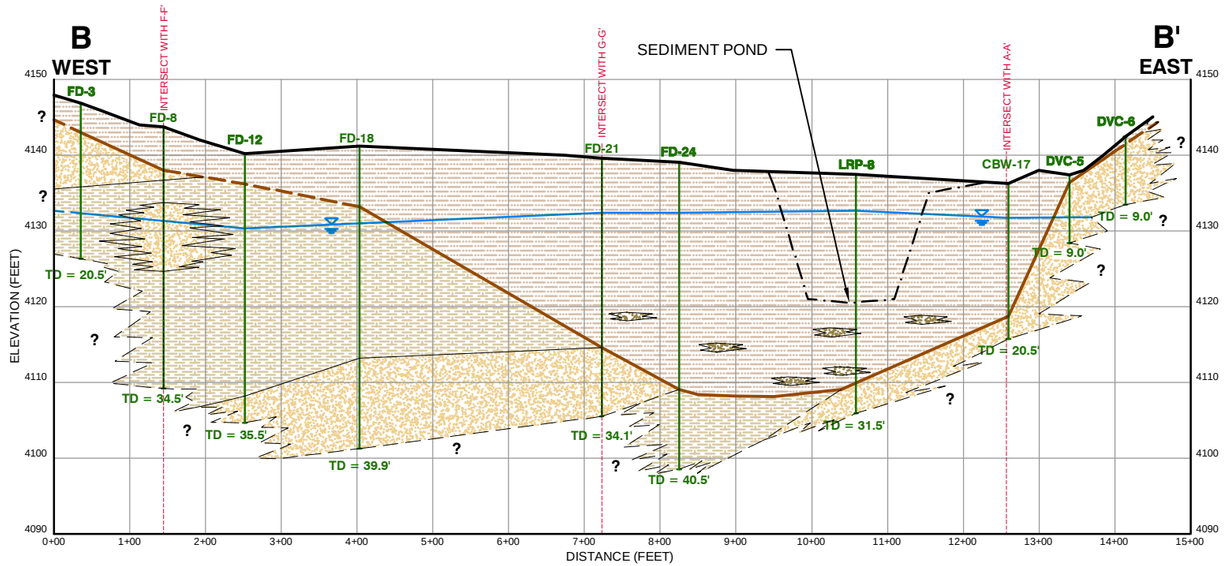
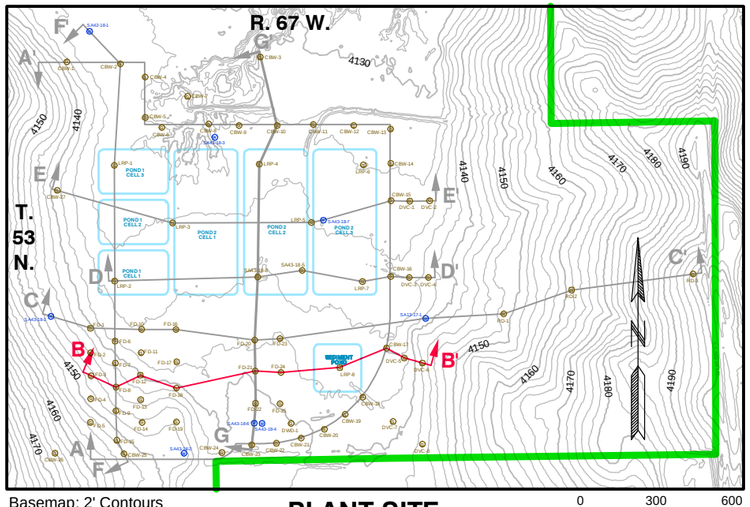


CROSS SECTION B-B'

10:1 VERTICAL EXAGGERATION



Basemap: 2' Contours
from May 2010 Flight

PLANT SITE

0 300 600

GRAPHIC SCALE (FEET)

LEGEND

Approximate groundwater level in late August 2011, recorded in morning on day after drilling. Dashed where inferred. (Typically very slow infiltration into borehole)

Quaternary Alluvial & Colluvial fill

Sandy Clay and Silty Clay; brown, very cohesive when moist, contains sparse very thin, very fine sandy lenses, stiff to very soft. Occasional thin zones of fine pebble gravels.

Pebbly Sand and Clay; brown, poorly sorted, may contain sparse thin clean sand. Lenticular and laterally discontinuous.

Unconformity — "Contact" Dashed where inferred.

Upper Cretaceous Lance Formation "Bedrock"

Claystone and Siltstone; brown, dark brown, and gray, very firm mudstone and finely laminated shale.

Sandstone; light brown to gray, extremely fine grained silty and clay rich poorly to moderately consolidated sandstone. Occasionally very hard and well cemented with $CaCO_3$ cement.

Note: Bedrock may be weathered and soft to very soft below contact. Erosion surface may exhibit more complex topography than limited drilling is able to reveal.

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WYOMING

STRATA energy

ROSS ISR PROJECT
CROOK COUNTY, WY

P.O. BOX 2318
GILLETTE, WY 82716

REVISIONS

Date	Description

TR ADDENDUM 3.1-A

FIGURE 4-2

ROSS
CENTRAL PROCESSING PLANT AREA
SHALLOW GEOLOGIC
CROSS SECTION B-B'

Drawn By: MBM
Checked By: RBM
Date: 1/19/12

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FILE: ROSS_RAI_PS_GEO_122711

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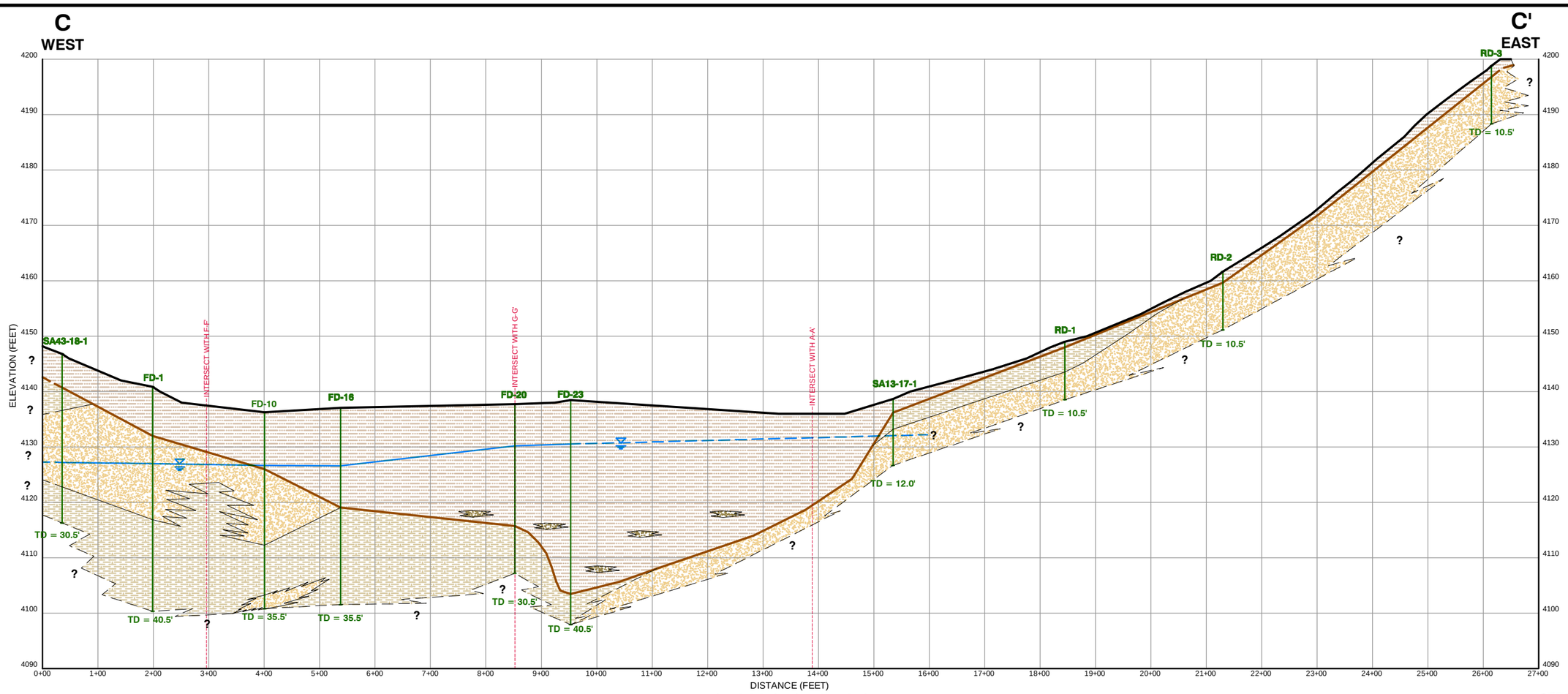
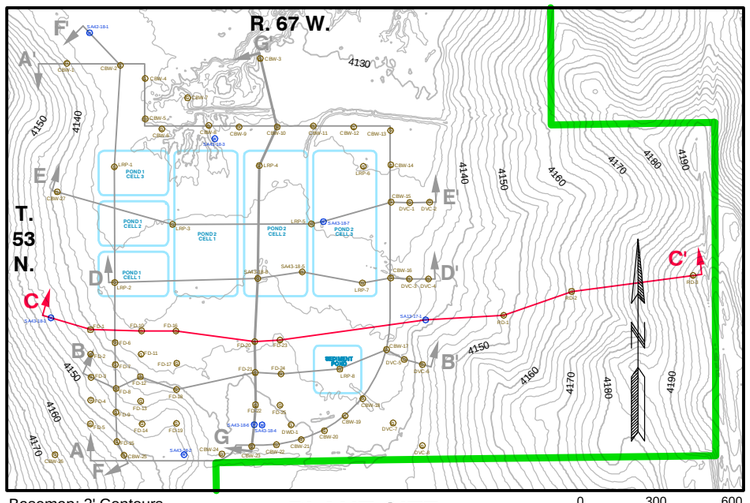


CROSS SECTION C-C'

10:1 VERTICAL EXAGGERATION



Basemap: 2' Contours from May 2010 Flight

PLANT SITE

LEGEND

- Approximate groundwater level in late August 2011, recorded in morning on day after drilling. Dashed where inferred. (Typically very slow infiltration into borehole)
- Quaternary Alluvial & Colluvial fill
  - Sandy Clay and Silty Clay; brown, very cohesive when moist, contains sparse very thin, very fine sandy lenses, stiff to very soft. Occasional thin zones of fine pebble gravels.
  - Pebbly Sand and Clay; brown, poorly sorted, may contain sparse thin clean sand. Lenticular and laterally discontinuous.
- Unconformity — "Contact" Dashed where inferred.
- Upper Cretaceous Lance Formation "Bedrock"
  - Claystone and Siltstone; brown, dark brown, and gray, very firm mudstone and finely laminated shale.
  - Sandstone; light brown to gray, extremely fine grained silty and clay rich poorly to moderately consolidated sandstone. Occasionally very hard and well cemented with $CaCO_3$ cement.

Note: Bedrock may be weathered and soft to very soft below contact. Erosion surface may exhibit more complex topography than limited drilling is able to reveal.

CERTIFICATE OF GEOLOGIST

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ROSS ISR PROJECT
CROOK COUNTY, WY
P.O. BOX 2318
GILLETTE, WY 82716

REVISIONS

Date	Description

TR ADDENDUM 3.1-A
FIGURE 4-3
ROSS
CENTRAL PROCESSING PLANT AREA
SHALLOW GEOLOGIC
CROSS SECTION C-C'

Drawn By: MBM
Checked By: RBM
Date: 1/19/12

WWC ENGINEERING
www.wwcengineering.com

FILE: ROSS_RAI_PS_GEO_122711
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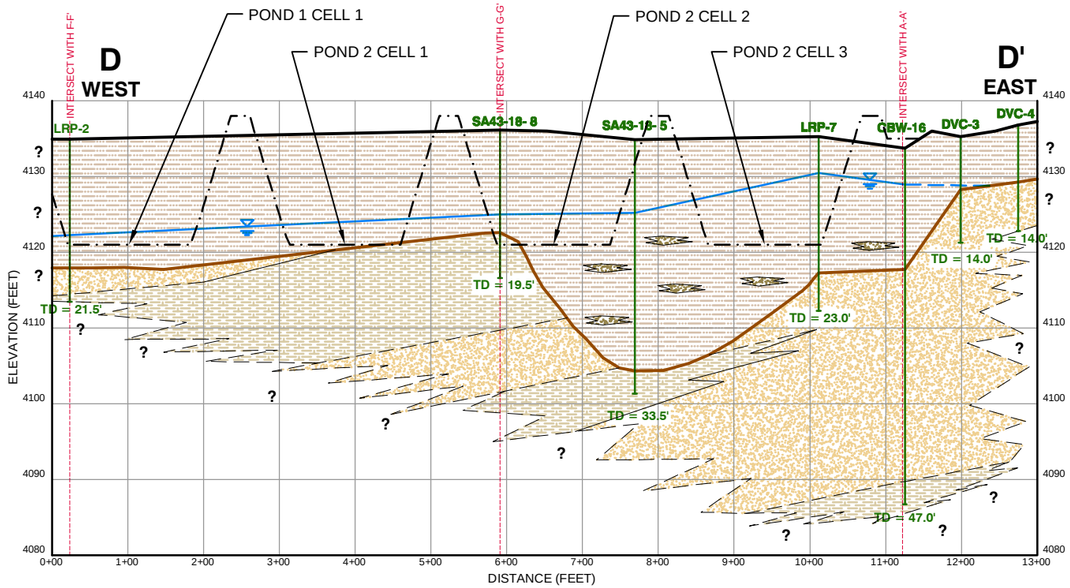
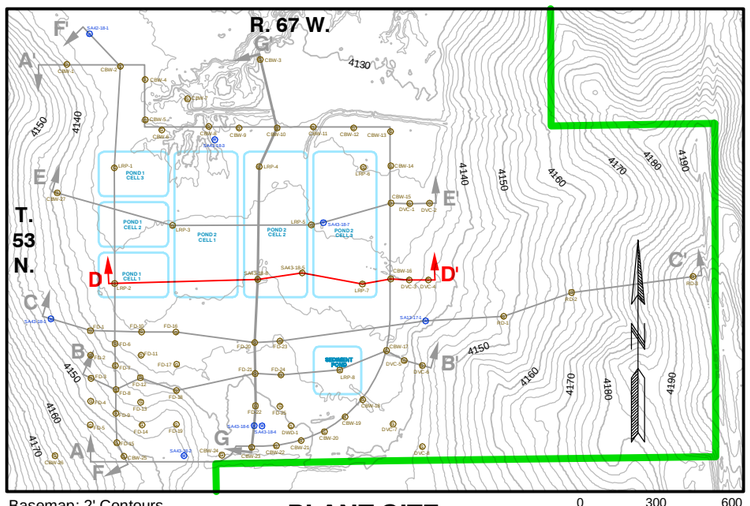


CROSS SECTION D-D'

10:1 VERTICAL EXAGGERATION



Basemap: 2' Contours
from May 2010 Flight

PLANT SITE

LEGEND

Approximate groundwater level in late August 2011, recorded in morning on day after drilling. Dashed where inferred. (Typically very slow infiltration into borehole)

Quaternary Alluvial & Colluvial fill

Sandy Clay and Silty Clay; brown, very cohesive when moist, contains sparse very thin, very fine sandy lenses, stiff to very soft. Occasional thin zones of fine pebble gravels.

Pebbly Sand and Clay; brown, poorly sorted, may contain sparse thin clean sand. Lenticular and laterally discontinuous.

Unconformity

"Contact" Dashed where inferred.

Upper Cretaceous Lance Formation "Bedrock"

Claystone and Siltstone; brown, dark brown, and gray, very firm mudstone and finely laminated shale.

Sandstone; light brown to gray, extremely fine grained silty and clay rich poorly to moderately consolidated sandstone. Occasionally very hard and well cemented with $CaCO_3$ cement.

Note: Bedrock may be weathered and soft to very soft below contact. Erosion surface may exhibit more complex topography than limited drilling is able to reveal.

CERTIFICATE OF GEOLOGIST

I, Benjamin J. Schiffer, hereby certify that this drawing was prepared by myself or under my direct supervision and that it correctly represents the geologic conditions described in the accompanying application which is provided to meet the requirements of the Wyoming Environmental Quality Act and its accompanying regulations.

PROFESSIONAL GEOLOGIST
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ROSS ISR PROJECT
CROOK COUNTY, WY
P.O. BOX 2318
GILLETTE, WY 82716

REVISIONS	
Date	Description

TR ADDENDUM 3.1-A
FIGURE 4-4
ROSS
CENTRAL PROCESSING PLANT AREA
SHALLOW GEOLOGIC
CROSS SECTION D-D'

Drawn By: MBM
Checked By: RBM
Date: 1/19/12

WWC ENGINEERING
www.wwcengineering.com

FILE: ROSS_RAI_PS_GEO_122711
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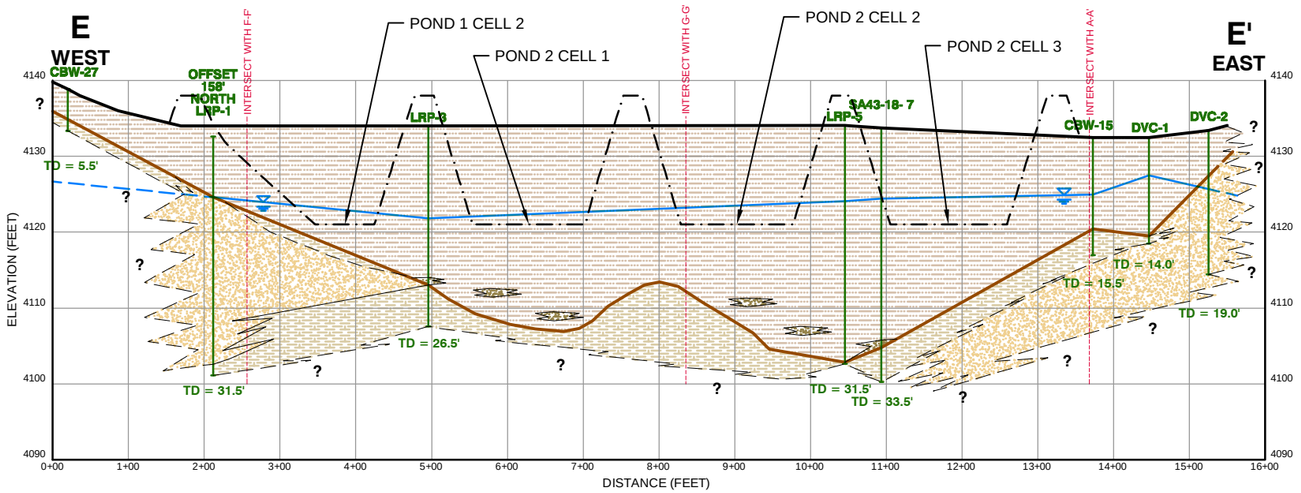
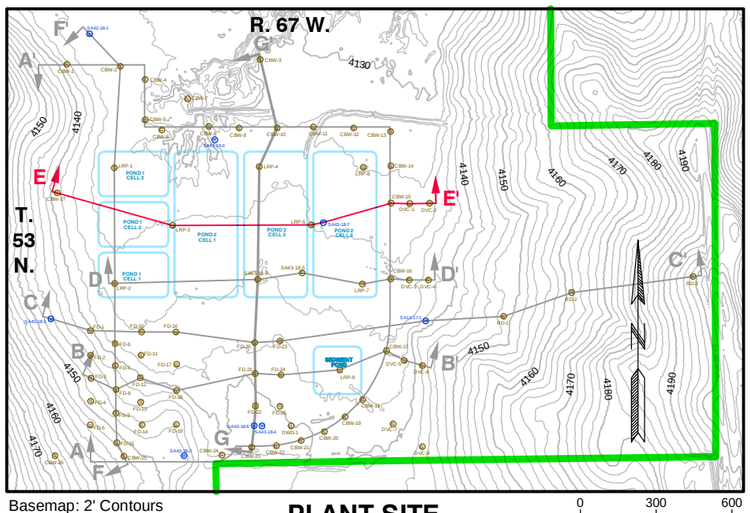


CROSS SECTION E-E'

10:1 VERTICAL EXAGGERATION



Basemap: 2' Contours from May 2010 Flight

PLANT SITE

LEGEND

Approximate groundwater level in late August 2011, recorded in morning on day after drilling. Dashed where inferred. (Typically very slow infiltration into borehole)

Quaternary Alluvial & Colluvial fill

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GILLETTE, WY 82716

REVISIONS

Date	Description

TR ADDENDUM 3.1-A
FIGURE 4-5
ROSS CENTRAL PROCESSING PLANT AREA SHALLOW GEOLOGIC CROSS SECTION E-E'

Drawn By: MBM
Checked By: RBM
Date: 1/19/12

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FILE: ROSS_RAI_PS_GEO_122711

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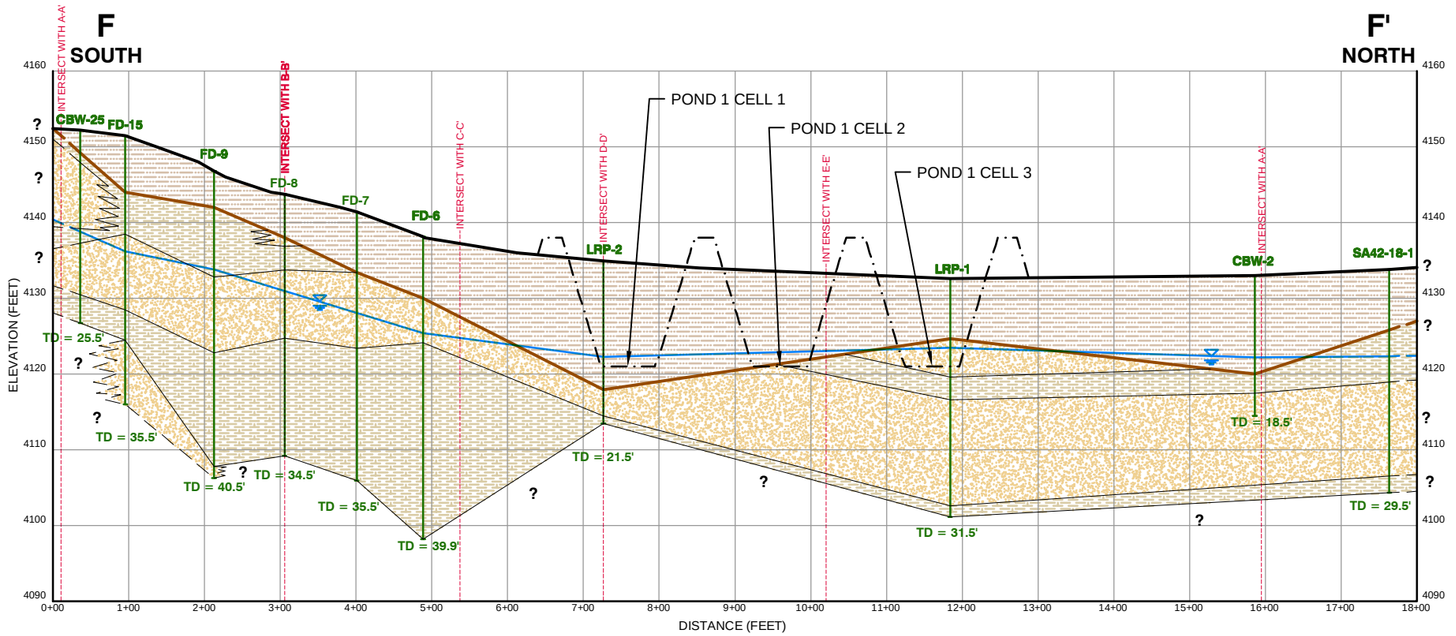
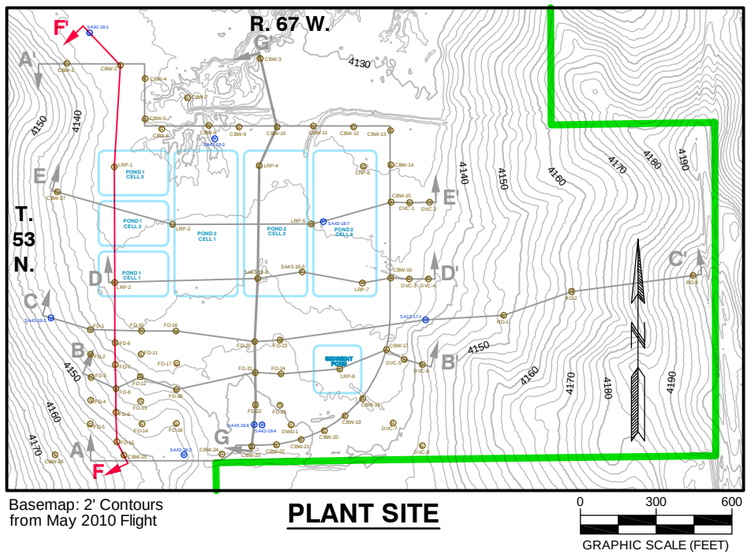


CROSS SECTION F-F'

10:1 VERTICAL EXAGGERATION



Basemap: 2' Contours
from May 2010 Flight

PLANT SITE

0 300 600

GRAPHIC SCALE (FEET)

LEGEND

Approximate groundwater level in late August 2011, recorded in morning on day after drilling. Dashed where inferred. (Typically very slow infiltration into borehole)

Quaternary Alluvial & Colluvial fill

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CROOK COUNTY, WY

P.O. BOX 2318
GILLETTE, WY 82716

REVISIONS	
Date	Description

TR ADDENDUM 3.1-A

FIGURE 4-6

ROSS
CENTRAL PROCESSING PLANT AREA
SHALLOW GEOLOGIC
CROSS SECTION F-F'

Drawn By: MBM
Checked By: RBM
Date: 1/19/12

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FILE: ROSS_RAI_PS_GEO_122711

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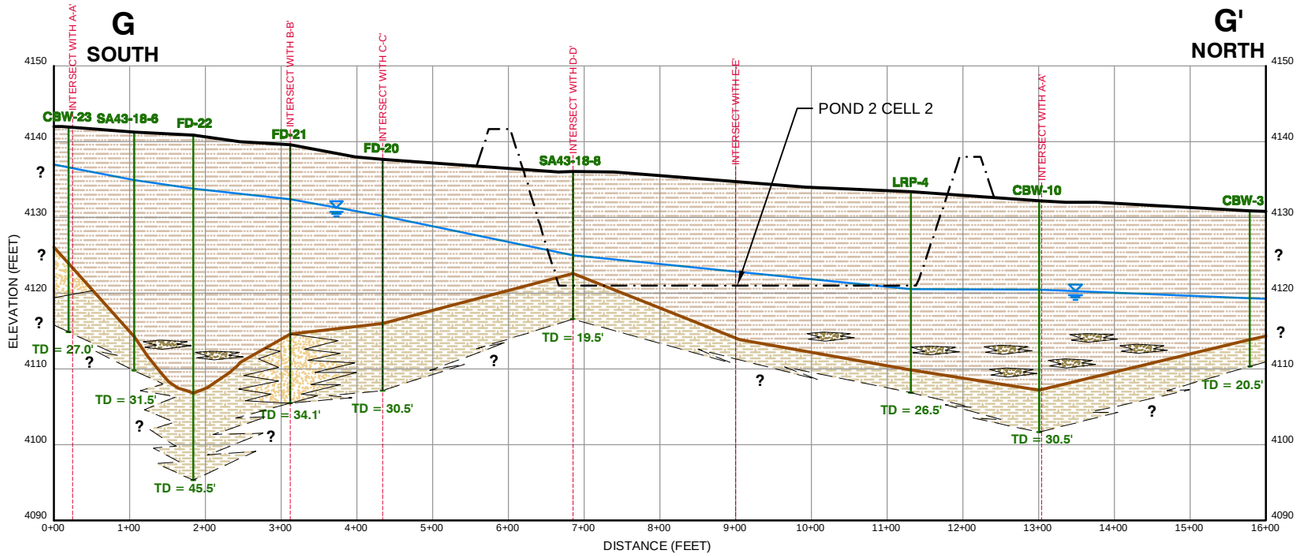
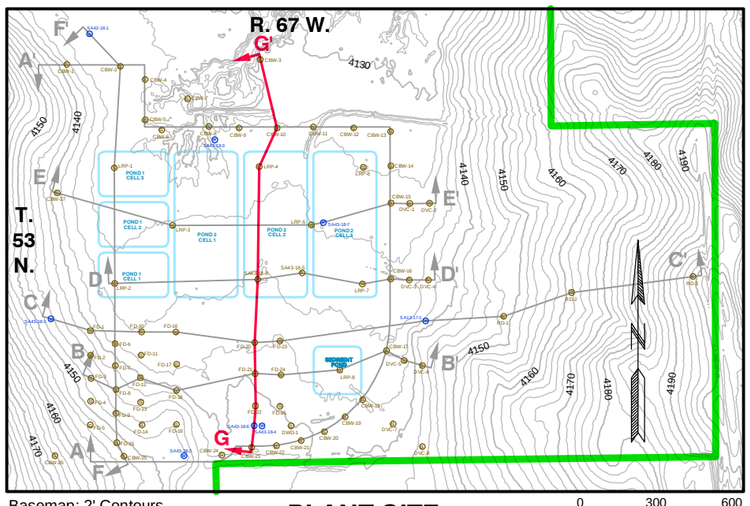


CROSS SECTION G-G'

10:1 VERTICAL EXAGGERATION



Basemap: 2' Contours from May 2010 Flight

PLANT SITE

LEGEND

Approximate groundwater level in late August 2011, recorded in morning on day after drilling. Dashed where inferred. (Typically very slow infiltration into borehole)

Quaternary Alluvial & Colluvial fill

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WYOMING

STRATA energy — PENINSULA ENERGY LTD.

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CROOK COUNTY, WY
P.O. BOX 2318
GILLETTE, WY 82716

REVISIONS

Date	Description

TR ADDENDUM 3.1-A
FIGURE 4-7
ROSS
CENTRAL PROCESSING PLANT AREA
SHALLOW GEOLOGIC
CROSS SECTION G-G'

Drawn By: MBM
Checked By: RBM
Date: 1/19/12

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FILE: ROSS_RAI_PS_GEO_122711
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5.0 HYDROLOGIC CONDITIONS

Extensive analyses of the regional and local hydrologic conditions in the proposed Ross ISR Project area have been conducted and are ongoing by Strata Energy for mine planning and state and federal permitting purposes. Strata's groundwater monitoring and testing efforts in the project area began with the installation of six regional baseline monitoring well clusters in the fourth quarter of 2009. Aquifer units identified and studied in the area are, in ascending order: the DM (deep monitoring) unit, the OZ (ore zone) unit; the SM (shallow monitoring) unit, and the SA (surficial aquifer) unit. The term *aquifer unit* is used to describe saturated bodies of rock or sediment that yield economic quantities of water to wells or springs, and are therefore hydrologically important.

The SA unit in the proposed Ross Project area is considered to be any of the many uppermost sandy bedrock strata of the Cretaceous age Lance Formation that are relatively permeable and saturated. Groundwater in the SA unit occurs under water table conditions and the aquifer is identified as unconfined. The uppermost Lance Formation in the project area is a sequence of thinly interbedded floodplain deposits of mudstones, claystones, siltstones, and very fine-grained fluvial channel sandstones. The sandier horizons, with adequate recharge and permeability, are locally saturated. Groundwater therefore occurs within some of the fluvial sandstone bodies, which are typically discontinuous and bound by the relatively impermeable floodplain mudstones, claystones and siltstones. Recharge to the SA unit in the project area occurs by direct infiltration of precipitation on outcrop areas and leakage from streamflow. Provided the overlying unconsolidated Quaternary age materials, which are inclusive of the alluvial deposits associated with the larger drainages in the area and the widespread slope wash (colluvial) and wind-blown (eolian) deposits, are water-bearing, they are included in the SA unit. Saturated alluvium is typically localized (having a relatively small areal extent) and in hydraulic communication with surface water features (e.g., streams and reservoirs). Due to the areal variability of the Lance Formation stratigraphy,

saturated Quaternary deposits may or may not be in hydraulic communication with underlying saturated bedrock sediments. Discharge from the SA unit in the project area occurs mainly as evapotranspiration, alluvial underflow, and seepage to streams.

5.1 Monitoring/Testing Program

Shallow wells were installed in the SA unit as part of the geotechnical/hydrological investigations that were conducted in the CPP area in 2010 and 2011. The intent of the hydrologic monitoring/testing program was to evaluate the occurrence of shallow groundwater and identify the hydraulic characteristics of the undifferentiated alluvial/colluvial/eolian materials (collectively referred to herein as valley fill deposits) and the uppermost Lance Formation bedrock sediments underlying the valley fill deposits. The relative components of groundwater recharge to valley fill materials in the CPP area from precipitation infiltration, nearby surface water features (i.e., Oshoto Reservoir, Little Missouri River, and small reservoirs and spreader dikes associated with agricultural land uses), and any contiguous saturated bedrock sediments were effectively identified. Ultimately, the hydrologic conditions determined by the monitoring/testing program will be used to design the shallow groundwater control system for the CPP area.

5.1.1 Well Construction Details

Preliminary investigations began in May 2010 when four shallow boreholes were drilled using a hollow-stemmed auger along the periphery of the existing hayfield that covers the roughly 40-acre CPP area. One borehole (SA43-18-3) was advanced through only the valley fill deposits, while the other three boreholes (SA43-18-1, SA43-18-2, and SA13-17-1) were drilled into only the bedrock sediments near the depositional limit of the valley fill deposits. The bedrock borings were advanced through the first shallow sandstone strata expected to be water-bearing. Soil specimens were collected from each of the four boreholes to determine soil characteristics, and standard penetration tests were conducted for each hole. A detailed discussion on the 2010 drilling

program and laboratory soil testing results are included in Sections 2 and 3 of this report. Wells were completed in these four 8-inch diameter boreholes by placing 2-inch diameter PVC well casing from ground level down to the top of the saturation level, and the intake interval, consisting of 0.010-inch slot V-wire PVC well screen, was placed below the saturation level. A 10-20 silica sand filter pack was emplaced evenly to fill the annular space between the well screen and borehole wall and the annular space above the sand pack was filled with hydrated bentonite chips. The top 1 foot of annular space was then filled and sealed at the ground surface with concrete. Development of the screened interval consisted of bailing and/or pumping the well dry several times. The borehole lithologic logs and well construction summaries are included in Appendix A. Upon construction completion, these four SA unit wells were incorporated into the proposed Ross ISR Project groundwater monitoring network.

The geotechnical/hydrological investigation program was intensified in August 2011 with the drilling of 78 shallow boreholes strategically located to obtain subsurface information throughout the area, paying particular attention to where the various components of the CPP are planned. Most of the borings were typically advanced through the valley fill materials and into the first few feet of the underlying bedrock sediments. However, some of the boreholes were located outside the depositional limits of the valley fill materials and thus penetrated only the first shallow Lance sandstone strata expected to be water-bearing. Core samples were routinely collected over the entire borehole depth for laboratory testing to determine properties such as permeability, gradation, and soil strength. A detailed discussion on the 2011 drilling program and laboratory soil testing results are included in Sections 2 and 3 of this report. Observation wells were completed in four of these geotechnical boreholes. Three of the wells, SA42-18-1, SA43-18-6 and SA43-18-7, were completed in 8.25-inch diameter boreholes by placing 2-inch diameter PVC well casing from ground level down to the top of the saturation level, and the intake interval, consisting of 0.020-inch slot V-wire PVC well screen, was placed below the

saturation level. The fourth well, SA43-18-4, was completed in a 10.25-inch diameter borehole by placing 4-inch diameter PVC well casing from ground level down to the top of the saturation level, and the intake interval, consisting of 0.020-inch slot V-wire PVC well screen, was placed below the saturation level. A 10-20 silica sand filter pack was emplaced evenly to fill the annular space between the screen and borehole wall and the annular space above the sand pack was filled with hydrated bentonite chips. The top 1 foot of annular space was then filled and sealed at the ground surface with concrete. Development of the screened interval consisted of bailing and/or pumping the well dry several times. The lithologic logs of the boreholes drilled in 2011 are included in Appendix B and the observation well construction summaries are included in Appendix C.

Borehole depths for the eight shallow SA unit wells in the CPP area range from 13.0 to 34.5 feet below ground level (bgl), and well completion depths range from 8.7 to 28.8 feet bgl. Four wells (SA43-18-3, SA43-18-4, SA43-18-6 and SA43-18-7) were installed in the valley fill materials, and four wells (SA13-17-1, SA42-18-1, SA43-18-1 and SA43-18-2) were installed in the underlying bedrock. Well completion details are summarized in Table 5-1, and the well locations are depicted on Figure 1-1.

The locations, ground surface and measuring point elevations of all boreholes and observation wells were surveyed by Bearlodge Engineering of Sundance, Wyoming.

5.1.2 Past Hydrologic Studies

Regional hydrologic analyses for the proposed Ross ISR Project began with the installation of six baseline monitoring well clusters in the fourth quarter of 2009. The six regional SA unit baseline monitoring wells are completed in the first relatively sandier bedrock strata encountered during drilling. Total well depths range from about 22 to 97 feet bgl. Water level data collection began with the installation of these six regional monitoring wells in the fourth quarter of 2009 and is ongoing. Two of these monitoring wells have

always been dry, and depths to water in the other four wells range from approximately 11 to 52 feet bgl. Groundwater level hydrographs developed for these baseline monitoring wells are included in the Ross ISR Project's state (Wyoming Department of Environmental Quality-Land Quality Division) Mine Permit Application and the Technical Report portion of the federal (U.S. Nuclear Regulatory Commission) Application for a Source Materials License.

Groundwater quality sample collection from the regional SA unit monitoring wells commenced in the first quarter of 2010 and has been ongoing on a quarterly basis. The groundwater quality analyses for the regional network wells indicate that each aquifer unit (DM, OZ, SM, and SA) has distinct water quality. Detailed summaries of the water quality within each aquifer unit are included in the proposed Ross ISR Project's state mine permit application and Section 2.7.3 of the Technical Report portion of the Source Materials License application.

In May 2010, a site-specific hydrologic investigation of the shallow groundwater system within the CPP area commenced upon installation of four shallow SA unit wells (Section 5.1.1 above). Water level data collection began with the installation of these four wells and has been ongoing. In August 2010, a pressure transducer was installed in well SA43-18-3 and the water level monitoring frequency at this site was increased from monthly to continuous. One of these four wells (SA13-17-1) has always been dry, and the water levels in the other three wells are around 20 feet bgl at well SA43-18-1, 12 feet bgl at well SA43-18-2, and between 7.5 to 17.0 feet bgl at well SA43-18-3. Groundwater level hydrographs developed for these three CPP area wells are included in the proposed Ross ISR Project's state mine permit application and the Section 2.7.3 of Technical Report portion of the Source Materials License application.

Groundwater quality sample collection from the CPP area monitoring wells began in the second quarter of 2010 and has been ongoing on a quarterly basis. The laboratory analyses of the samples collected in 2010 from these wells are included in the proposed Ross ISR Project's state mine permit

application and Section 2.7.3 of the Technical Report portion of the federal Application for a Source Materials License.

The stage (pool elevation) of the nearby Oshoto Reservoir and the streamflow and water quality of the Little Missouri River just downstream of the reservoir were also regularly monitored in 2010 and 2011.

5.1.3 Recent Hydrologic Studies

As discussed in Section 2.2, seventy-eight shallow boreholes were drilled in the CPP area in August 2011 to obtain necessary geotechnical and hydrogeological information. Observation wells were completed in four of these geotechnical boreholes (Section 5.1.1 above). In addition to laboratory testing of the valley fill and underlying bedrock core samples acquired during the 2011 drilling program, the hydraulic parameters of transmissivity (T), hydraulic conductivity (K), and storativity (S) of these materials were measured in situ by conducting aquifer slug tests and pumping tests on the shallow CPP area observation wells.

In August 2011, slug-out tests were conducted on bedrock wells SA43-18-1 and SA43-18-2. An aquifer pumping test was conducted on bedrock well SA42-18-1 in September 2011. Aquifer pumping tests were conducted at valley fill wells SA43-18-3, SA43-18-4, SA43-18-6, and SA43-18-7 in September 2011. The results of these aquifer tests are discussed below.

After each borehole was drilled in the CPP area (excluding those completed as observation wells), it was left open for at least 24 hours to allow for groundwater (if present) to seep into the open hole and reach a static equilibrium level. The depth to water from ground level was then measured prior to abandonment of the borehole. As discussed below, these open-hole water level measurements were used in conjunction with water level measurements from the wells to develop a water table map of the SA unit in the CPP area.

5.2 Hydrologic Conditions Associated with SA Unit - Shallow Bedrock

Section 4 of this report includes a detailed lithologic description of the shallow bedrock that underlies the unconsolidated valley fill materials in the CPP area. In general, these Lance Formation sediments are a heterogeneous sequence of very fine-grained sandstones, siltstones, mudstones, and claystones. The Lance Formation is frequently weathered immediately below the contact with the valley fill deposits, resulting in a very soft boundary. With adequate recharge and permeability, groundwater occurs within some of the sandier units. Only the water-bearing sandy strata, which are typically not areally continuous or widespread, are considered to be part of the SA unit.

Not only does the stratigraphy of the Lance Formation greatly influence the occurrence and movement of shallow groundwater in the proposed Ross ISR Project area, but the structural geology also has a significant influence. The project area borders the western flank of the Black Hills uplift; therefore, the gently-dipping (1-2 degree westward) bedrock sediments are folded abruptly upward to a near-vertical dip, coincident with the uplift monocline axis that runs north-south near the eastern project area boundary. Consequently, Lance Formation sediments have been removed by erosion and do not exist east of the proposed Ross ISR Project area. A detailed discussion on the regional structural geology is included in the proposed Ross ISR Project's state mine permit application and Section 2.6.1 of the Technical Report portion of the federal Application for a Source Materials License.

Wells SA43-18-1, SA43-18-2, SA42-18-1, and SA13-17-1 were completed in the SA unit bedrock sediments in the CPP area. The lithologic logs and completion schedules for these four wells are included in Appendices A, B and C and well locations are depicted on Figure 1-1. As stated above, well SA13-17-1 located near the eastern edge of the CPP area has always been dry.

5.2.1 Groundwater Levels

Figure 5-1 is a map of the regional SA unit potentiometric surface contours over the proposed Ross ISR Project area. This map was developed

using water levels measured in late August 2011 at the six regional baseline monitoring wells and the eight wells located in the CPP area. As shown by the water table contours, the groundwater flow direction in the SA unit generally follows the topography, moving from the highlands to the lowlands and converging in the Little Missouri River valley. The groundwater flow direction is northeasterly at a gradient of approximately 35 feet per mile (0.01 ft/ft).

Water levels in the sandier bedrock strata, as recorded by the regional SA unit baseline monitoring wells, fluctuate seasonally in response to recharge from surface infiltration of snowmelt and spring precipitation events. The magnitude of recharge and the resulting rise in the water table is therefore dependent on weather conditions; however, in general, water level elevations tend to increase during the spring months and then gradually decrease during the remainder of the year. For example, water level measurements in 2010 and 2011 at monitoring well 12-18SA show an increase of approximately 5 feet from January to June, then gradually decrease during the remainder of the year. The groundwater level hydrograph for monitoring well 14-18SA shows the water level rose roughly 1 foot from January to June 2010, and then declined by a similar magnitude over the remainder of the year. From April to June 2011 the water level rose by approximately 2 feet at well 14-18SA, with a decline of similar magnitude over the remainder of the year. The water table elevation at monitoring well 21-19SA varied by less than 2 feet during all of 2010, but from February 2011 to June 2011 the water elevation increased by roughly 5 feet, with a decline of similar magnitude from June to December 2011. Similarly, the water table elevation at well 34-7SA remained relatively stable throughout 2010, although in 2011 the water table rose approximately 3 feet from February to June and then decreased over the remainder of the year. The other two regional SA unit cluster wells (34-18SA and 42-19SA) have remained dry since they were constructed.

In the CPP area, water levels in bedrock wells SA43-18-1 and SA43-18-2 have been monitored since mid-2010 and show similar seasonal fluctuations, albeit of lesser magnitude. At well SA43-18-1, the water table elevation

remained essentially stable from June 2010 through February 2011, it then increased about 0.3 foot from February to June, and it then rose another foot by August 2011. At well SA43-18-2, the water table elevation decreased by nearly 2 feet from June 2010 to February 2011, it then increased about 0.5 foot from February to June, and it then rose another 0.7 foot by August 2011. Bedrock well SA13-17-1 has remained dry since it was installed.

5.2.2 Hydraulic Properties

The near-well hydraulic properties (transmissivity and hydraulic conductivity) of the SA unit shallow bedrock sediments were determined at three observation well sites by conducting aquifer tests. In August 2011, slug tests were conducted at bedrock wells SA43-18-1 and SA43-18-2 and in September 2011 a pumping test was conducted at observation well SA42-18-1.

A slug test is in contrast to a standard aquifer pumping test, which involves pumping a well at a constant flow rate and monitoring the response of the aquifer. A slug test is conducted by causing an instantaneous change (rise or fall) of the water level in a well from equilibrium and the subsequent rate of water-level response (decline or recovery) is recorded. A slug test is often the preferred method of aquifer testing if the transmissivity of the material the well is completed in is too low to allow for the well to be properly pump tested.

Test procedures for both slug tests were consistent and conducted by lowering a solid slug (a 5-foot length of 1.25-inch diameter PVC pipe filled with sand and sealed) having a displacement volume of 0.63 gallon into the well until it was completely submerged below water level. Time was given to allow the displaced water level to recover back to static equilibrium. The solid slug was then rapidly removed from the well and the water level recovery was recorded using a pressure transducer and data logger programmed to record at one minute intervals. The recovery data, along with the initial drawdown value and the well completion information were input into the Aquifer^{Win32} software program (ESI 2003) for analysis.

The lithologic log and screen development information for well SA42-18-1 indicated that the well could be pumped at a sustained low flow rate. Therefore, an aquifer pumping test rather than a slug test was conducted at this site. The well was pumped using a Grundfos Redi-Flo 2-inch variable speed submersible pump powered by a portable generator. The Redi-Flo pump is designed to be used in 2 inch-diameter wells and to pump at constant, low flow rates. The test was conducted by pumping at an optimum discharge rate that adequately stressed the aquifer for the purpose of analysis. The drawdown and recovery data, along with the pumping rate and well completion information, were input into the Aquifer^{Win32} software program for analysis.

The field data sheets, time-drawdown plots, and analyses for all aquifer tests are included in Appendix D. Tables 5-2 and 5-3 summarize the results of the slug-out and pumping tests conducted on the surficial aquifer in the CPP area.

Well SA43-18-1

The slug test recovery plot for well SA43-18-1 is presented in Appendix D. The initial water level displaced after removal of the slug was 0.82 foot. The recovery data was revised to account for the surficial aquifer's natural water level trend in the vicinity at the time the test was conducted. The groundwater level hydrograph recorded at nearby well SA43-18-3 for the 2-week period prior to the slug test date is also included in Appendix D. The hydrograph illustrates that the shallow water table in the CPP area was declining at approximately 0.2 ft/day at the time. The recovery data were analyzed using the Bouwer and Rice method (Bouwer and Rice 1976), and the analysis plot is presented in Appendix D. The transmissivity (T) was determined to be 0.035 ft^2/day. Based on an estimated 5 feet of saturated "sandy" bedrock sediments at this site, the hydraulic conductivity (K) was determined to be 0.007 ft/day.

Well SA43-18-2

The slug test recovery plot for well SA43-18-2 is presented in Appendix D. Upon submerging the slug, the water level was displaced in the well 0.73 foot. Fifty-two minutes after the slug was submerged the water level had not made any recovery back to the initial static equilibrium level. At which time the slug was then withdrawn from the well and the water level recovered almost instantly back to static equilibrium. These data indicate that there was essentially no movement of water into or out of the well screen when the slug was introduced and then removed. The recovery data does not lend itself to a slug test analysis; therefore, it can be concluded that the hydraulic conductivity of the bedrock sediments at this site are too low to be accurately determined via an in situ aquifer test.

Well SA42-18-1

The duration of pumping was 362 minutes at a constant discharge rate of 0.37 gallons per minute (gpm). The drawdown and recovery plot is presented in Appendix D. Total drawdown was 11.05 feet, which occurred during the first 60 minutes of the test. After approximately 300 more minutes of pumping no additional drawdown occurred. After the first hour of pumping, the cone of depression, or area of influence of the well, encountered a source of recharge. The rate of recharge within the area of influence was sufficient to equal the rate of pumping, which resulted in a stabilized water level throughout the area of influence. The rapidly stabilized cone of depression at this well site, which is located approximately 600 feet from the Oshoto Reservoir and Little Missouri River, strongly suggests that these major surface water features provide a constant-head source of recharge to permeable bedrock sediments that subcrop beneath them. Therefore, the recharge boundary effects on the aquifer at this site invalidate the Cooper-Jacob straight line drawdown method of analysis (Cooper and Jacob 1946) for this test. The recovery data were analyzed using the Theis recovery method of analysis (Theis 1935), and the analysis plot is presented in Appendix D. The transmissivity (T) was determined to be 45.4 ft^2/day. Based on an estimated 15.5 feet of saturated “siltstone and

sandstone" bedrock sediments at this site, the hydraulic conductivity (K) was determined to be 2.93 ft/day.

The range of K values determined by these three tests is indicative of the variable lithology of the Lance bedrock sediments that comprise the SA unit aquifer. The materials representative of the two lower K values (essentially zero and 0.007 ft/day) are very fine-grained sands, silts, and clays, whereas the aquifer material representative of the higher K value (2.93 ft/day) is predominantly a fine-grained sandstone. In addition, the drawdown data from test well SA42-18-1 demonstrate that the sandstone present at that location is in hydraulic communication with a nearby constant head recharge boundary (the Oshoto Reservoir and Little Missouri River).

5.3 Hydrologic Conditions Associated with SA Unit - Valley Fill Deposits

Section 4 of this report includes a detailed description of the lithology of the Quaternary-age valley fill deposits in the CPP area. These unconsolidated sediments consist of an interbedded sequence of very fine-grained, locally-derived alluvial, colluvial, and eolian deposits. In general, these surficial deposits in the CPP area are comprised of sandy and silty clays with occasional thin to very thin lenticular (limited in areal extent) layers of poorly to moderately well sorted, fine- to coarse-grained sands and pebbly, clay-rich sands.

The CPP area is located within a shallow valley that was formed by an unnamed ephemeral tributary of the Little Missouri River. This valley, which is named Larson Flats, extends south-southeast of the CPP area. As such, the Quaternary-age valley fill deposits associated with this drainage are continuous to the south of the CPP area, as well as to the north where they are in contact with the Little Missouri River alluvium. As depicted on the geologic cross sections (Figures 4-1 through 4-7), the thickness of the unconsolidated Quaternary fill deposits in the CPP area generally range from less than 10 feet to just over 30 feet. The valley fill deposits are thinnest at the eastern and

western edges of the Larson Flats valley where the surface topography begins to increase in elevation.

Valley fill deposits in the CPP area are typically saturated due to groundwater recharge from various sources, including local surface water features (e.g., impoundments and spreader dikes associated with agricultural land uses), underlying saturated bedrock, precipitation infiltration, and contiguous saturated valley fill deposits to the south that are associated with the Larson Flats drainage. The relative contribution of recharge from precipitation infiltration is presumed to be less than from the other sources due to clay-rich soils and surface compaction from current land uses.

Observation wells SA43-18-3, SA43-18-4, SA43-18-6, and SA43-18-7 were completed in the valley fill materials in the CPP area. The lithologic logs and completion schedules for these four wells are included in Appendices A, B and C and well locations are depicted on Figure 1-1.

5.3.1 Groundwater Levels

As described in Section 5.1.3, open-hole water level measurements were used in conjunction with water level measurements from the observation wells to develop a water table map (Figure 1-1) of the SA unit in the CPP area. A description of the regional SA unit water table and groundwater flow direction is included in Section 5.2.1. The water table contours depicted in Figures 1-1 and 5-1 illustrate that shallow groundwater moves from the highland areas west and south of the CPP area via saturated Lance Formation bedrock strata and discharges to the overlying valley fill deposits. Shallow groundwater also flows down gradient in a northerly direction within the Larson Flats valley fill deposits and ultimately discharges to the Little Missouri River alluvium.

Of the four valley-fill wells in the CPP area, groundwater levels have been monitored on a continuous basis at only well SA43-18-3. The frequency and degree of groundwater level fluctuations recorded at this site, from September 27, 2010 to September 27, 2011, are depicted in Figure 5-2. This hydrograph illustrates the localized recharge effect to the valley fill deposits that is largely

attributed to a small surface water impoundment located very close to well SA43-18-3. The groundwater level at this particular location gradually and steadily declined about 1 foot from the end of September until about the third week of March, at which time the water level suddenly increased from a base elevation of approximately 4,117.5 feet to a peak of about 4,127.5 feet by around the third week of May. The 10-foot rise in water level corresponds to the seasonal filling of the small impoundment.

This impoundment, which is entrenched into the valley fill deposits, fills seasonally depending on the surface runoff available during the spring months in response to snowmelt and thunderstorm events. As shown on Figure 1-1, the topographic contours near well SA43-18-3 depict the surface depression that is formed by this north-trending gulley and the east-west-trending embankment that acts as a dam across the gully. Water that is held within the impoundment is a localized source of groundwater recharge for the valley fill materials. As the water level in the impoundment recedes due to evaporation and seepage during the remainder of the year, the saturation level in the valley fill materials near the impoundment likewise declines, as illustrated by Figure 5-2.

The ephemeral streamflow of Larson Flats drainage is diverted onto the hayfield covered by the CPP area by a series of spreader dikes. Sometime in the past, water that was diverted from the main drainage channel eventually dissected into the soft valley fill deposits at the southern edge of the Little Missouri River valley, creating a deeply entrenched gully. The small impoundment next to well SA43-18-3 was created by the land owner by emplacing of an earthen embankment across this gully to store water for irrigation, although it no longer appears to be used for that purpose. The spreader dikes do however continue to divert the ephemeral streamflows onto the hayfield and thus act to increase the amount of surface infiltration recharge to the valley fill materials over a large area.

The Oshoto Reservoir is located approximately 1,300 feet northwest of well SA43-18-3. Figure 10 depicts an annual hydrograph for both the reservoir

stage and the groundwater level at well SA43-18-3. Both hydrographs appear similar with respect to increasing water levels during the spring months and then decreasing water levels over the remainder of the year, which is typical of increased streamflows and groundwater levels in response to snow melt and thunderstorm events. However, because the reservoir's stage increased by only about 3.5 feet while the groundwater level increased by roughly 10 feet, and the difference in elevations ranged from approximately 14 feet to 6 feet during the year, it can be concluded that there is little if any hydraulic communication between the valley fill materials and the Oshoto Reservoir via the Lance Formation bedrock materials that separate them.

5.3.2 Hydraulic Properties

The near-well hydraulic properties (transmissivity and hydraulic conductivity) of the SA unit valley fill deposits were determined at three well sites by conducting aquifer tests. In September 2011, pumping tests were conducted at valley fill wells SA43-18-4 and SA43-18-6, well SA43-18-3, and well SA43-18-7. The lithologic logs and screen development information for these wells indicated that they could be pumped at a sustained low flow rate. Therefore, aquifer pumping tests were conducted rather than slug tests. The wells were pumped using a Grundfos Redi-Flo 2-inch variable speed submersible pump powered by a portable generator. The Redi-Flo pump is designed to be used in 2 inch-diameter wells and to pump at constant, low flow rates. The tests were conducted by pumping at an optimum discharge rate that adequately stressed the aquifer for the purpose of analysis. The drawdown and recovery data, along with the pumping rate and well completion information, were input into the Aquifer^{Win32} software program (ESI 2003) for analysis.

The field data sheets, time-drawdown plots, and analyses for these three aquifer pumping tests are included in Appendix D, and Tables 5-2 and 5-3 summarize the results.

Wells SA43-18-4 and SA43-18-6

This aquifer test was performed by pumping well SA43-18-4 and observing water level responses in both the pumped well and an observation well, SA43-18-6, located 30.67 feet to the west of well SA43-18-4 (Figure 1-1). Both wells fully penetrate the surficial valley fill deposits.

The duration of pumping was 1,382 minutes at a constant discharge rate of 0.50 gpm. After 300 minutes of pumping, approximately 12.0 feet of drawdown had occurred in pumped well SA43-18-4, and the total drawdown was 13.10 feet. The Cooper-Jacob straight line drawdown method of analysis (Cooper and Jacob 1946) was considered valid for this test, and the time-recovery data were analyzed using the Theis recovery method of analysis (Theis 1935). For the pumped well, the transmissivity (T) was determined to be 6.90 ft^2/day using the drawdown data, while a T value of 37.10 ft^2/day was determined using the recovery data. The Theis recovery method results are believed to be more representative of actual aquifer conditions. The exact cause of the discrepancy between the T values measured by the Cooper-Jacob and the Theis methods is likely related to low well efficiency, which results in excess drawdown. The factors contributing to low well efficiency are either design- or construction-related. The time-recovery data and Theis recovery analysis for a pumping well is considered more accurate than the time-drawdown data and Cooper-Jacob drawdown analysis because well efficiency is not a factor. The efficiency of the pumped well was not determined. Based on an estimated 18.3 feet of saturated valley fill deposits at this site, the hydraulic conductivity (K) was determined to be 2.03 ft/day.

Drawdown response in observation well SA43-18-6 began immediately upon initiation of pumping, with a total of 0.32 feet of total drawdown. The T values estimated for the observation well using the time-drawdown data are 100.60 ft^2/day using the Cooper-Jacob method and 4.43 ft^2/day using the Theis drawdown method. These T values are dissimilar and incomparable to the T value determined for the pumped well. In addition, because of the total drawdown was only 0.32 feet, analysis of the time-drawdown plots are very

subjective and do not provide for a clear analysis. Analysis of the time-drawdown data is therefore not to be considered valid for this test. The time-recovery data were analyzed using the Theis recovery method of analysis and the T was determined to be 58.70 ft^2/day. Because this T value is comparable to the T determined for the pumped well, it should be considered representative. Based on an estimated 20.70 feet of saturated valley fill deposits at this site, the K was determined to be 2.83 ft/day.

The storativity value (S) determined by the Theis analysis using time-drawdown data from the observation well is 3.1 x 10^{-6}, appropriate for a confined aquifer. However, this value is questionable for the same reason stated above. The SA unit, by definition, is an unconfined, water table aquifer.

Well SA43-18-3

This well, which fully penetrates the valley fill deposits, was pumped for 346 minutes at a constant discharge rate of 1.55 gpm and the total drawdown was 3.58 feet. The Cooper-Jacob straight line drawdown method of analysis was considered valid for this test, and the time-recovery data were analyzed using the Theis recovery method of analysis. The T was determined to be 48.60 ft^2/day using the drawdown data, while the T was determined to be 30.50 ft^2/day using the recovery data. The Theis recovery method results are believed to be more representative of actual aquifer conditions. Based on an estimated 13.4 feet of saturated valley fill deposits at this site, the K value was determined to be 2.28 ft/day.

Well SA43-18-7

Attempts to conduct a pumping test using this well were unsuccessful. At a pumping rate of less than 0.25 gpm the water level drew down to the pump within 40 minutes. Therefore, the K value at this location is too low to be determined by an aquifer pumping test.

The range of K values determined by these aquifer tests is indicative of the variable lithology of the valley fill deposits that comprise the SA unit aquifer. The materials representative of the test result at observation well

SA43-18-7 are very fine-grained silts and clays of very low permeability (too low to be measured by pumping the well). The materials representative of the K values measured at observation wells SA43-18-3, SA43-18-4 and SA43-18-6 (roughly between 2.0 and 3.0 ft/day) are a very fine-grained sand. In addition, the multiple-well test at wells SA43-18-4 and SA43-18-6 suggests that the permeable zones in the valley fill are limited in areal extent.

5.4 Groundwater Quality

The groundwater sampling results of all the regional baseline monitoring wells demonstrated that the greatest variability in major ion chemistry occurs in the SA unit. Each of the four regional baseline wells sampled has somewhat distinct water chemistry. However, in general, sodium is the predominant cation and bicarbonate is the predominant anion in the water from all four wells. Variable concentrations of calcium, magnesium and sulfate are also present. The total dissolved solids (TDS) concentrations range from around 500 milligrams per liter (mg/L) at well 12-18SA to 1,200 mg/L at well 14-18SA. Few radiological constituents above detection limits have been measured in the SA unit.

The three shallow SA unit observation wells in the CPP area that have been sampled (SA43-18-1, SA43-18-2 and SA43-18-3) indicate significant water quality variability between those completed in the Lance bedrock strata verses the overlying valley fill deposits. For example, groundwater quality at the valley fill observation well (SA43-18-3) is similar to that observed at the regional baseline monitoring cluster wells in that the TDS concentrations range from 420 to 510 mg/L and the predominant ions are sodium and bicarbonate. However, the water quality at bedrock wells SA43-18-1 and SA43-18-2 varies significantly from the water quality that is typical at all other SA unit wells. For example, the TDS concentrations are considerably higher; ranging from 6,400 mg/L at SA43-18-1 to 7,280 mg/L at SA43-18-2. Sodium and sulfate are the predominant ions in the groundwater at both of these bedrock wells, and high concentrations of selenium, uranium and gross alpha are also present.

The difference in water quality observed at the wells in the CPP area is primarily attributed to the contributing surficial aquifer's lithology and well location with respect to areas of active groundwater movement/circulation. It is apparent that the valley fill groundwater quality is influenced by a relatively greater degree of groundwater movement and flushing with bicarbonate as the predominant anion. The considerably higher concentration of dissolved constituents and radionuclides in the groundwater at wells SA43-18-1 and SA43-18-2 is likely attributable to relatively slow groundwater movement and more stagnant conditions in the SA unit bedrock sediments in the CPP area.

Table 5-1. Ross ISR Central Processing Plant Site, Shallow Well Construction Summary

Well ID	Surficial Aquifer Type	Location Coordinates (NAD 83)		Ground Surface Elevation (ft amsl)	Top of Casing Elevation (ft amsl)	Bedrock Elevation (ft amsl)	Hole Diameter	PVC Well Casing Diameter/ Depth Interval	PVC Well Screen Diameter/ Depth Interval	Aquifer Thickness*	Completion Date
SA13-17-1	Bedrock	1485559.5	714589.3	4138.7	4140.0	4136.2	8.0"	2" / 0' – 3.7'	2" / 3.7' – 8.7'	Dry	5/17/10
SA42-18-1	Bedrock	1486696.3	713257.7	4133.8	4135.9	4125.8	8.25"	2" / 0' – 8.0'	2" / 8.0' – 28.0'	15.5'	8/27/11
SA43-18-1	Bedrock	1485568.3	713105.0	4146.8	4148.0	4140.7	8.0"	2" / 0' – 8.8'	2" / 8.8' – 28.8'	5.0'	5/18/10
SA43-18-2	Bedrock	1485026.2	713632.6	4149.3	4150.7	4145.0	8.0"	2" / 0' – 8.6'	2" / 8.6' – 18.6'	nil	5/18/10
SA43-18-3	Valley Fill	1486276.9	713754.7	4132.9	4134.8	4106.6	8.0"	2" / 0' – 13.1'	2" / 13.1' – 23.1'	13.4'	5/18/10
SA43-18-4	Valley Fill	1485144.3	713941.5	4141.4	4143.3	4117.4	10.25"	4" / 0' – 6.0'	4" / 6.0' – 26.0'	18.3'	8/28/11
SA43-18-6	Valley Fill	1485145.6	713910.9	4141.3	4143.4	4114.3	8.25"	2" / 0' – 7.9'	2" / 7.9' – 27.9'	20.7'	8/26/11
SA43-18-7	Valley Fill	1485949.1	714184.4	4133.7	4135.7	4104.8	8.25"	2" / 10' – 8.0'	2" / 10.0' – 30.0'	nil	8/28/11

NOTE: * Aquifer thickness is approximate, based on the lithology and saturated thickness when the aquifer test was conducted

Table 5-2. Ross ISR Central Processing Plant Site, Aquifer Test Well Response Summary

Well ID	Well Type	Test Date	Initial Depth to Water (ft)	Water Level Elevation (ft amsl)	Constant Discharge Rate (gpm)	Slug Volume Removed (gal)	Duration of Pumping (min)	Maximum Drawdown (ft)	Specific Capacity (gpm/ft)
SA43-18-3	Pumping	9/29/11	12.80	4120.10	1.55	n/a	346	3.58	0.43
SA43-18-4	Pumping	9/27/11	6.66	4134.71	0.50	n/a	1382	13.1	0.04
SA43-18-6	Observation	9/27/11	6.77	4134.53	n/a	n/a	n/a	0.342	n/a
SA42-18-1	Pumping	9/28/11	11.81	4121.99	0.37	n/a	362	11.05	0.03
SA43-18-7	Pumping	9/28/11	11.46	4122.30	<0.25	n/a	40	Unable to pump.	
SA43-18-1	Slug-out	8/16/11	17.97	4128.83	n/a	0.63	n/a	0.82	n/a
SA43-18-2	Slug-out	8/17/11	10.13	4139.17	n/a	0.63	n/a	0.00	n/a

Table 5-3. Ross ISR Central Processing Plant Site, Aquifer Test Summary of Hydraulic Characteristics

Well ID	Material Tested	Test Well Type	Interpretation Method	Transmissivity (ft^2/day)	Aquifer Thickness (ft)	Hydraulic Conductivity (ft/day)	Storativity (unitless)
SA43-18-3	Valley Fill	Pumping	Cooper Jacob Straight Line	48.60	13.40	3.63	n/a
			Theis Recovery	30.50	13.40	2.28	n/a
SA43-18-4	Valley Fill	Pumping	Cooper Jacob Straight Line	6.90	18.30	0.37	n/a
			Theis Recovery	37.10	18.30	2.03	n/a
SA43-18-6	Valley Fill	Obs.	Cooper Jacob Straight Line	100.60	20.70	4.86	n/a
			Theis Drawdown	4.43	20.70	0.21	3.1E-06
			Theis Recovery	58.70	20.70	2.83	n/a
SA42-18-1	Bedrock	Pumping	Theis Recovery	45.40	15.50	2.93	n/a
SA43-18-7	Valley Fill	Pumping	Pumped dry in 40 minutes @ <0.25 gpm. Hydraulic conductivity too low to conduct pumping				
SA43-18-1	Bedrock	Slug-out	Bouwer and Rice (unconfined)	0.035	5.00	0.007	n/a
SA43-18-2	Bedrock	Slug-out	No recovery after slug is introduced and removed, suggesting essentially no hydraulic				

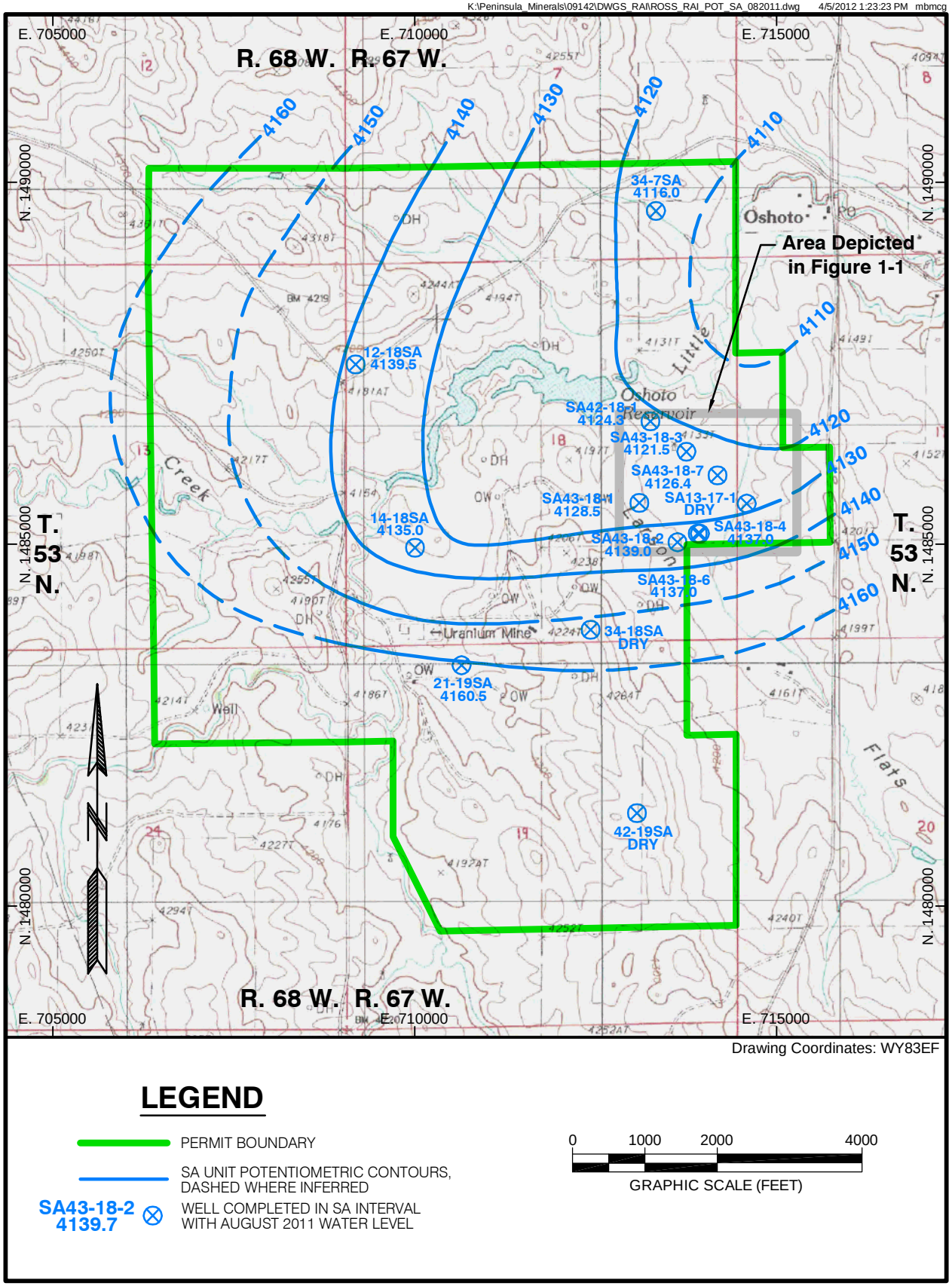


Figure 5-1. Regional SA Unit Potentiometric Surface Contours

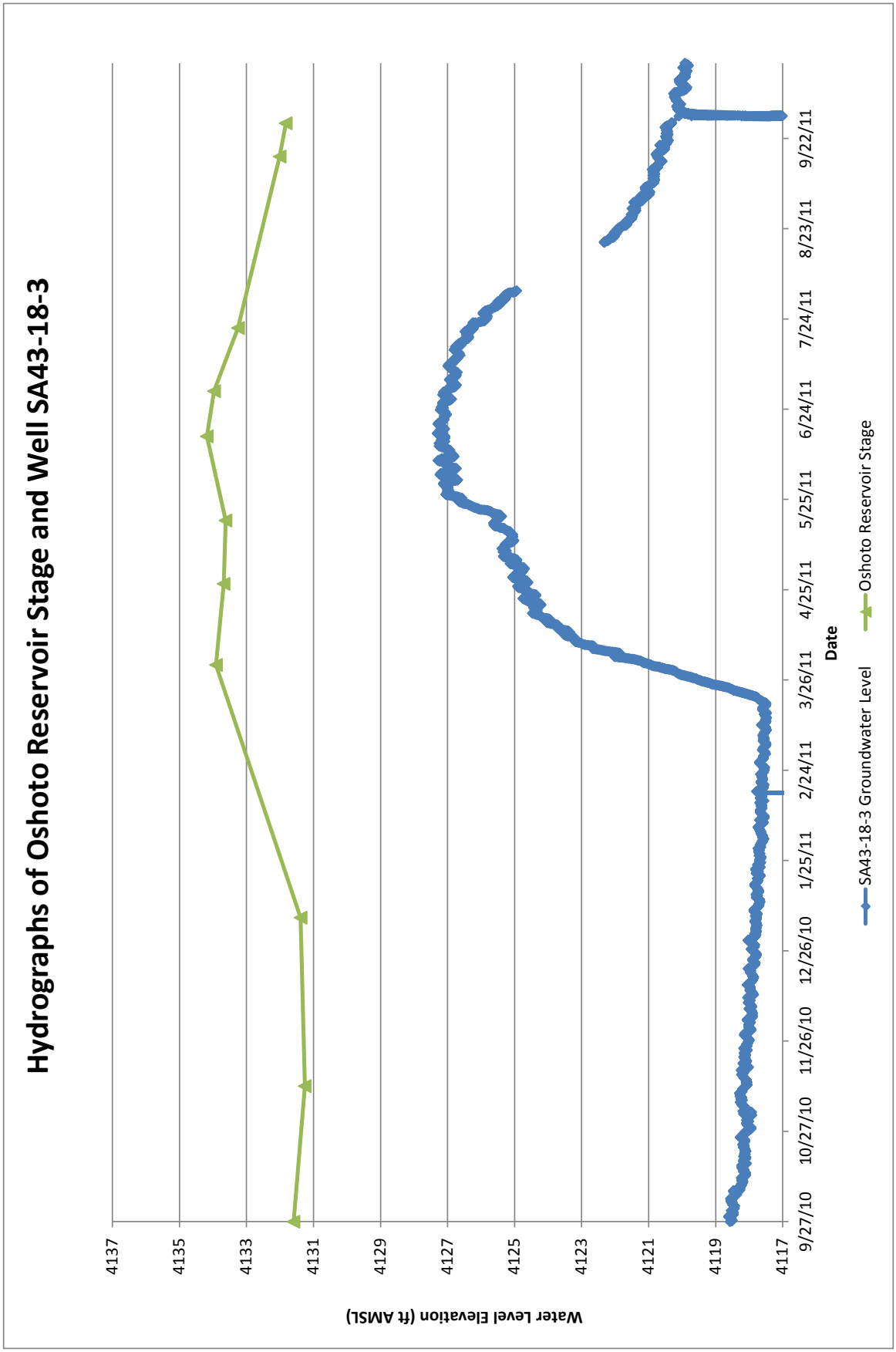


Figure 5-2. Hydrographs of Oshoto Reservoir Stage and Well SA43-18-3

6.0 HYDROLOGIC IMPLICATIONS TO FACILITIES

As described in Section 1, the goals of these investigations were to evaluate the existing subsurface conditions within the proposed CPP area and to determine the resulting hydrologic implications to the facilities planned for construction in this area. This section describes how the results of these investigations impact: 1) the need for a containment barrier wall (CBW), 2) the depth of the CBW, 3) the length of the CBW, 4) how to dewater the CPP area for construction as well as continued dewatering for long term operations of the CPP and related facilities, 5) the potential for groundwater inflow from the underlying bedrock into the CPP area, 6) the design details for the proposed containment ponds, and 7) the design of the proposed domestic wastewater drain field.

Based on the results of all the drilling within the CPP area, the valley fill is generally comprised of fine- to very fine-grained, clay-rich materials with low permeability. Throughout the project area there are locations where the lower portions of the valley fill have sandier zones with higher permeability. However, these zones of higher permeability were found to be relatively thin and areally discontinuous. After evaluating the drilling logs, no pattern could be established that explains the location or the extent of the more permeable zones within the valley fill.

One of the goals accomplished during the 2011 geotechnical drilling program was to further define the bedrock lying beneath the alluvial fill within the CPP area. In general, the western portion of the CPP area is underlain by fine-grained, clay-rich sandstone. The central portion of the CPP area is underlain by relatively impermeable bedrock that is primarily claystone intermixed with some siltstone. The eastern portion of the CPP area is predominately underlain by fine-grained, clay-rich sandstone similar to the sandstone bedrock in the western portion of the CPP area. Figure 1-1 includes an approximate trace of the sandstone/claystone bedrock boundary throughout the CPP area. Figures 4-1 through 4-7 depict geologic cross sections located throughout the CPP area.

Strata has used the information gathered from the 2010 and 2011 geotechnical drilling programs and the subsequent aquifer test analyses to further evaluate the specific goals of the investigations described above. The following sections summarize the findings of these investigations in relation to each individual goal.

6.1 Valley Fill Evaluation

Based on the geotechnical investigations an estimate was made concerning the composition and groundwater flow potential of the valley fill. The valley fill is primarily comprised of clay with low permeability, and randomly dispersed sandy intervals throughout the proposed project area.

Darcy's equation (flux calculation) was used to evaluate the existing potential groundwater flow through the valley fill within the proposed project area. Using cross sections A-A', C-C', D-D' and E-E' shown on Figures 4-1, 4-3, 4-4, and 4-5 respectively, the flow area was calculated. Cross section A-A′ was broken into North and South components in order to obtain flow areas approximately perpendicular to the natural hydraulic gradient. Cross section G-G', shown on Figure 4-7, was used to calculate the hydraulic gradient at the intersections of the above flow areas. The resulting flow areas are presented in Table 6-1 while the hydraulic gradient values are presented in Table 6-2.

Two values for hydraulic conductivity were estimated for the flow calculations through the valley fill. The first value is for the clay material which was estimated from permeability testing of borehole samples. The second value is for the sand intervals located throughout the project area. This was estimated using the pump test data from wells SA43-18-3, SA43-18-4, and SA43-18-6. The resulting hydraulic conductivity for the clay material was determined to be 0.001 ft/day, while the hydraulic conductivity used for the sandy intervals was calculated at 2.38 ft/day.

In order to account for the varying hydraulic conductivities of the valley fill material, a percentage of each cross sectional area was assigned one of the hydraulic conductivities discussed above. These values were estimated by

comparing borehole logs. Material classified as gravels or sands were determined to have a hydraulic conductivity of 2.38 ft/day. Material classified as silts and clays were determined to have a hydraulic conductivity of 0.001 ft/day. A percentage of flow area was then determined for both the clay and sand portions of the valley fill.

The flux calculation was performed for each material then summed to calculate the total flow through each cross section. The results are presented in Table 6-3.

As is seen from the results in Table 6-3, the estimated flow through the valley fill in the project area varies significantly. This is most likely due to the discontinuity of the sandy layers throughout the project area. Based on the results, a conservative estimate of groundwater flow would be up to 800 gal/day. This flow rate could be difficult to handle with only a conventional dewatering system especially over an extended period of time.

6.2 CBW Design and Operational Considerations

Based on the geotechnical investigations performed thus far and the flux calculations above, the CBW will be necessary, primarily to ensure that the synthetic liner systems are not compromised due to hydrostatic uplift. Most of the shallow groundwater is believed to enter the proposed CPP area within the valley fill. As discussed above, the valley fill is generally clay rich with low permeability. However, within the lower/basal portion of the valley fill deposits, thin, discontinuous sandy intervals were encountered in many of the boreholes. Since the sandy intervals are randomly dispersed throughout the project area, it will be necessary to construct the CBW continuously around most of the CPP area in order to ensure that all the potential "sand channel" conduits are cut off hydraulically from the valley fill outside of the CPP and associated facilities area. The alignment of the CBW follows geologic cross section A-A', and is illustrated on Figure 1-1.

6.2.1 Anticipated CBW Depth and Length

Geologic cross section A-A' (Figure 4-1) presents the lithological interpretations from 25 boreholes drilled either on or immediately adjacent to the proposed alignment of the CBW. At a minimum, the CBW will need to be constructed from the land surface through the entire thickness of valley fill down to the bedrock contact. Along the alignment of the CBW the valley fill thickness varies from approximately 10 feet to 35 feet.

As depicted on Figures 1-1 and 4-1, the bedrock material beneath the valley fill is predominately sandstone along portions of the CBW's length. With the exception of two test results, laboratory permeability tests and in-situ aquifer tests performed on the bedrock sandstone indicate that the hydraulic conductivity of this fine- to very fine-grained sandstone is generally very low. As such, potential underflow seepage from the bedrock sandstone is expected to be minimal. However, there is a possibility that the permeability of the sandstone could be variable and higher than the measured values within localized zones. To address this issue, it is recommended that the CBW be constructed, if possible, to the base of the bedrock sandstone layers in those areas along the CBW's alignment where sandstone is in contact with the overlying valley fill and where significant recharge is possible (northwest corner of the site). Final depths of the CBW will be determined during construction. If, due to high consolidation or cementation of the bedrock sandstone, it is not possible to construct the CBW through the entire thickness, only minimal seepage is anticipated as discussed in Section 6.2.2 below.

Based on previously submitted preliminary designs for the proposed Ross ISR Project, the CBW was projected to fully surround the CPP area. As described in the following paragraphs, along the west side of the project area the bedrock is very shallow (in some places only 2 feet below the valley fill) and the permeability is very low. As a result of the investigations described herein it was determined that it was not necessary to construct the CBW along the western side of the CPP area and along the southwest corner of the CPP where the valley fill is shallow. The only area that could be problematic is the far

northwestern corner which is believed to be close to the Little Missouri River alluvium and could potentially result in increased bedrock inflows.

6.2.2 Estimated Seepage Into CPP Area Following CBW Construction

In order to determine if seepage into the CPP area through the sandstone bedrock in the northwest area would be significant, two samples of the bedrock material were submitted to the laboratory for permeability testing. A sandstone bedrock sample was collected from borehole CBW-2 and the measured permeability was 0.0077 ft/day. The other sandstone bedrock sample was collected from borehole CBW-9 and the measured permeability was 0.0043 ft/day. In addition to the laboratory permeability tests, an aquifer pumping test was performed at observation well SA42-18-1, and a slug test was performed at observation well SA43-18-1 to determine the in-situ hydraulic conductivity of the bedrock sandstone. Well SA42-18-1 is located approximately 120 feet north of the proposed CBW in the northwest corner and well SA43-18-1 is located approximately 1,000 feet south of CBW-1 which lies along the northernmost portion of the wall (Figure 1-1). Based on the aquifer pumping test at well SA42-18-1, the calculated hydraulic conductivity was approximately 3.0 ft/day. Based on the slug test at well SA43-18-1, the calculated hydraulic conductivity was approximately 0.007 ft/day.

Using the measured hydraulic conductivities, Strata performed a seepage analyses using Seep/W© software (GEO-SLOPE 2007) to evaluate the potential inflow into the CPP area through the bedrock sandstone. The first analysis was based on a hydraulic conductivity of 0.007 ft/day, which best represents the values measured in situ. Geologic cross section E-E' (Figure 4-5) was used as a basis for the seepage analysis. No borehole data exists in the area immediately west of borehole CBW-27; therefore, the subsurface geology was extrapolated for a distance of approximately 830 feet between borehole CBW-27 and the Oshoto Reservoir, and is illustrated by Figure 6-1. This interpretation is intended to represent a worst-case scenario, which is a continuous sandstone layer that acts as a direct hydrologic conduit connecting the Oshoto Reservoir to the CPP area. Oshoto Reservoir was modeled as a constant-head recharge

source having an elevation of 4,134 ft (which is the reservoir's spillway elevation). The water elevation within the CPP area was modeled at an elevation of 4,120, which is expected to be the long-term, steady-state groundwater level within the CPP area.

Results of the seepage modeling indicate that, at a hydraulic conductivity of 0.007 ft/day, the expected bedrock inflow to the west side of the CPP (through the flux section depicted on Figure 6-1) would be 0.00235 ft^3/day/ft. Assuming that the extrapolated geology shown on Figure 6-1 is representative of the entire west side of CPP area (which is approximately 1,500 feet long), the total inflow into the CPP area through the sandstone bedrock is estimated to be 3.5 ft^3/day (26 gallons per day (gpd)).

Based on the permeability testing performed thus far, if there is any sandstone layer that has a hydraulic conductivity of 3.0 ft/day it is most likely to be in the vicinity of well SA42-18-1. Conservatively assuming that the higher permeability sandstone extends south 200 feet from well SA42-18-1 (roughly twice the distance from well SA42-18-1 to borehole CBW-2), a seepage rate of 200 ft^3/day (1,496 gpd) is estimated through the higher permeability sandstone. In order to eliminate any potential seepage near the northwest corner of the CPP area it is recommended that the CBW be extended approximately 100 feet to the west to borehole CBW-1 and then south for approximately 300 feet as shown on Figure 6-1 to effectively cut off this potential seepage pathway. The ultimate configuration of the CBW in this area will be determined by field conditions during installation.

In addition to the laboratory permeability tests of sandstone bedrock samples from boreholes CBW-2 and CBW-9, the permeability of sandstone samples collected from boreholes CBW-13 and CBW-16 were also measured in the laboratory to be 0.0001 ft/day, and 3.69 ft/day, respectively. A slug test performed at well SA43-18-2 concluded that the hydraulic conductivity of the bedrock sandstone at that site is too low to be accurately determined via an in situ aquifer test. With the exception of the hydraulic conductivity calculated at well SA42-18-1 (approximately 3.0 ft/day) and the permeability measured at

borehole CBW-16 (approximately 3.7 ft/day), the measured hydraulic conductivity within the bedrock sandstones range from 0.0077 ft/day to 0.0001 ft/day.

The greater hydraulic conductivity calculated from the pumping test performed at observation well SA42-18-1 is not believed to be representative of the hydraulic conductivity of the sandstone beneath the greater CPP area. The relatively higher K value for the bedrock sandstone at this site is likely due to localized lithologic variations and the sandstone's hydraulic communication with the nearby Oshoto Reservoir and Little Missouri River, which provide a constant head recharge source. As described above, if the CBW at the northwestern corner of the CPP area extends west to borehole CBW-1 and then turns south for a distance of 300 feet, the risk of groundwater moving into valley fill within the CPP area from the west through the bedrock sandstone would be greatly minimized.

The relatively high permeability measured at borehole CBW-16 was of the coarsest sandstone sample collected during the drilling program. This sample was collected just below the valley fill/bedrock contact. The grain size analyses performed on bedrock sandstone samples collected during the drilling program indicated that at all other locations the bedrock was generally finer grained than at this location. As such, the higher permeability bedrock sandstone in proximity of borehole CBW-16 is believed to be localized to the immediate area. As Figures 4-1 and 4-4 illustrate, it would be possible to construct the CBW completely through the sandstone layer in this area, which would minimize any potential groundwater inflow to the overlying valley fill within the CPP area through this coarser sandstone.

6.2.3 Expected Water from Bedrock Sources

Assuming that the CBW is keyed into the underlying bedrock, it will effectively cut off all groundwater flowing into and within the valley fill from the north, south, and east directions. As a result, the only avenue for water to

enter into the CPP area will be either from the west or beneath the CPP area via bedrock sources.

Figure 1-1 depicts the approximate boundaries between the various bedrock types beneath the valley fill deposits within the CPP area. Bedrock at the valley fill contact in the western, eastern, and northeastern portions of the CPP area is dominated by fine-grained sandstone. Within the central portion of the CPP area, the underlying bedrock is dominated by finer grained siltstones and claystones. Tests performed on the siltstone/claystone bedrock material indicate that the hydraulic conductivity varies from 0.00005 ft/day to 0.0002 ft/day. As described in Section 5.2.2, the sandstone bedrock has a higher hydraulic conductivity (0.007 ft/day). Based on the seepage modeling described in Section 6.1.2, the estimated inflow into the CPP area from the west through shallow bedrock sandstone is 26 gpd.

As depicted on Figure 6-1, the post-construction groundwater level within the valley fill in the CPP area will be maintained at a maximum elevation of 4,120 feet. At the northern extent of the CPP area, the natural groundwater elevation in the SA unit aquifer is at or below an elevation of 4,120 feet for most of the year (Figures 1-1 and 5-1). As such, estimated groundwater seepage from the north is expected to be minimal primarily because the groundwater gradient across the north and south sides of the CBW in this area will be very low under normal operating conditions. In addition, the CBW is generally bounded at its base by claystone bedrock along most of the northern boundary. Since the hydraulic conductivity of the claystone is so low, potential seepage through the north side of the CPP area is further limited.

The CBW along the east side of the CPP area is bounded at its base by both sandstone and claystone bedrock materials (Figure 1-1). The northern portion of the CBW along the east side is primarily underlain by claystone bedrock, and the groundwater gradient across the east and west sides of the CBW is minimal; therefore, any potential seepage is expected to be minimal in this area. The southern portion of the CBW along the east side is primarily underlain by sandstone bedrock. Depending on actual conditions encountered

during construction, the depth of the CBW may be extended in this area to penetrate entirely through the sandstone layer down to the underlying claystone, thus eliminating any potential seepage through the sandstone. However, in the event that it is not possible to construct the CBW entirely through the sandstone layer, the seepage potential is expected to be minimal in this area because recharge to the SA unit-shallow bedrock is limited to the east (Section 5.2). It is therefore likely that any seepage of groundwater from the eastern direction through the sandstone in this area, which has a relatively low permeability, would be minimal. Conservatively, assuming similar seepage rates as those calculated in Section 6.2.2 on the west side of the CPP area, the approximately 600 feet of sand/CBW interface on the east side would likely transmit less than 2 gpd.

The CBW along the southern side of the CPP area will be keyed into a claystone-rich bedrock material; therefore, seepage from the south is expected to be minimal.

In summary, the CBW will block all seepage into the CPP area from the unconsolidated surficial valley fill materials. The total seepage into the CPP area from underlying bedrock sources is expected to be in the range of 28 gpd (26 gpd from the east side and 2 gpd from the east side). The potential volume of bedrock inflow is limited for the following reasons: 1) The head difference between the average alluvial water table elevation at the northern edge of the CPP area and the post-construction water table elevation inside the CPP area is minimal. 2) The majority of the bedrock sediments beneath the valley fill in CPP area is siltstone/claystone having a very low hydraulic conductivity, which minimizes seepage. 3) The permeability of the sandier bedrock materials is relatively low, which minimizes seepage where the CBW cannot penetrate entirely through the sandstone layers. 4) Recharge to the thin bedrock sandstone layers, which are typically limited in areal extent, is minimal so the volume of water available from the bedrock is likewise minimal.

6.3 Proposed Dewatering Method

As the test results presented in Tables 3-1 and 3-2 indicate, the Quaternary-age valley fill deposits within the CPP area are generally fine- to very fine-grained, clay-rich, with low permeability. Drilling data throughout the CPP area indicate that there are locations where the lower portion of the valley fill has sandier zones with relatively higher permeability. However, these zones of higher permeability materials are relatively thin and discontinuous. As such, a dewatering system with many individual well points may be effective in some localized areas, although in other areas dewatering wells may not make enough water to be pumped continuously. Alternatively, dewatering by gravity drainage into French drains combined with collector wells would allow the sandier layers/zones of higher permeability, as well as the finer-grained layers/zones of lower permeability to dewater into a common trench that can be pumped continuously. Due to the heterogeneity encountered within the valley fill, French drains in combination with collector wells are recommended.

French drains are currently planned on the north, south and west sides of the retention ponds to dewater and maintain a depressed groundwater level throughout the operational life of the project. French drains will consist of approximately 1.5-foot wide drainage trenches constructed of clean sand or gravel surrounding perforated HDPE pipe. The French drains will slope at a minimum of 0.5% toward the collector wells. The north and south French drains will be approximately 1,100 feet long. The French drains will be installed such that the bottom of the drains are approximately 5 to 7 feet below the bottom of the ponds. Collector wells will be constructed by 2-foot diameter corrugated steel pipe extending from the French drain to the ground surface. A submersible pump will be installed inside each collector well. The collector wells will likely be fitted with pressure transducers to monitor water level and to control the submersible pumps. Pump discharge piping will be approximately 3-inch diameter HDPE piping.

6.4 Proposed Lined Retention Ponds

WDEQ Regulations require that the lined retention ponds have a double liner beneath them. If the material beneath the ponds is naturally a low permeability material it may be possible to use the native in-situ material as a secondary liner. Chapter 20, Section 35 of the WDEQ regulations require that the secondary liner have a permeability of $1x10^{-6}$ cm/sec (0.0028 ft/day) or less. Several permeability tests were performed on the in situ material beneath the proposed lined retention ponds. Permeability tests on the in situ material immediately below the base of the lined retention ponds indicate that the permeability of the alluvial material varies from $1.6x10^{-7}$ cm/sec (0.000454 ft/ day) for a sample collected at borehole LRP-3 to $3.5x10^{-6}$ cm/sec (0.0099 ft/day) for a sample collected at borehole LRP-1. Two permeability tests were also performed on bulk samples remolded to 95 percent of the Standard Proctor (ASTM 698). The measured permeabilities of remolded bulk samples collected at borehole LRP-3 and LRP-5 were $1.2x10^{-7}$ cm/sec (0.00034 ft/day) and $8x10^{-8}$ cm/sec (0.00023 ft/day), respectively. Based on initial testing results it is believed that if the material immediately below the ponds is compacted to 95 percent of Standard Proctor it will likely meet WDEQ requirements for a secondary pond liner. In the event that the soils below the lined retention ponds vary significantly from the soils sampled during the drilling programs, and additional compaction does not sufficiently decrease the hydraulic conductivity of the material, it may be possible to add soil amendments such as bentonite or excavate and replace the suspect soils with low permeability soil borrowed from onsite sources. Either way, the on-site soils are believed to be suitable to meet WDEQ's secondary liner requirements.

Several undisturbed samples were submitted to the laboratory for triaxial strength testing. The results of this testing indicate the material that will be used to construct the ponds has strength characteristics typical of fine-grained, clay-rich soils.

6.5 Design of the Proposed Domestic Wastewater Drain Field

One borehole (DWD-1) and 2 observation wells (SA43-18-4 and SA43-18-6) were constructed within the footprint of the proposed domestic wastewater drain field. The primary purposes of the investigations within the domestic wastewater drain field were to verify the groundwater elevations and to evaluate the textural properties of the soil within the proposed drain field. Grain size (ASTM D1140) and Atterberg Limit (ASTM D4318) analyses performed on samples collected from borehole DWD-1 indicate that the soils are very fine-grained and the permeability is expected to be low. The initial feasibility level designs for the domestic wastewater drain field were developed based on the assumption that the permeability of the drain field would be very low, so the results of the testing are not expected to change the size of the drain field.

Initial water levels collected during the geotechnical drilling indicated that the groundwater elevation is between 5 and 7 feet below the ground surface. The permit level design was based on the assumption that the groundwater elevation would be approximately 7 feet below the ground surface. Since seasonal groundwater levels may be higher than initially anticipated, it may be necessary to construct a partially raised or a raised bed drain field. WWC will continue to monitor water levels within the observation wells completed in the domestic wastewater drain field to establish seasonal groundwater levels. Once the seasonally high groundwater levels have been established, it will be possible to further assess the final configuration of the drain field.

Table 6-1. Flow Areas

Cross-Section	Location	Area (ft^2)
A-A' (South)	CBW-24 to CBW-17	15,440
C-C'	FD-10 to SA13-17-1	15,947
D-D'	LRP-2 to DVC-3	10,951
E-E'	LRP-1 to DVC-2	14,283
A-A' (North)	CBW-5 to CBW-13	12,209

Note: Determined from cross sections (Figures 4-1, and 4-3 through 4-5)

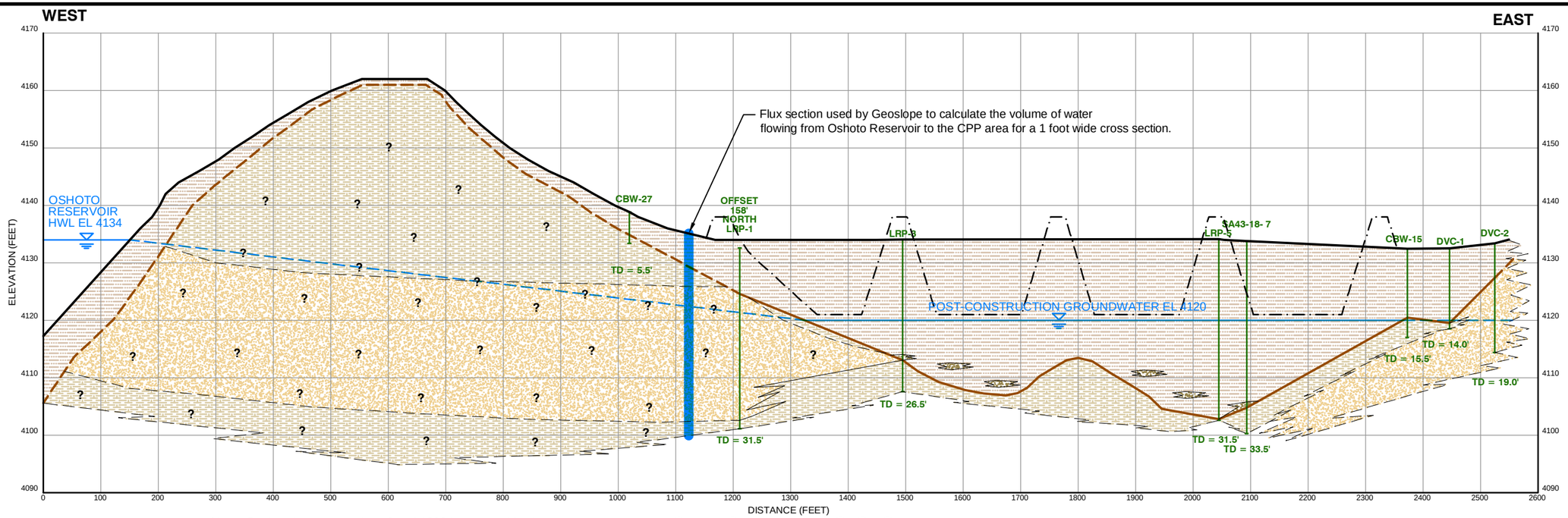
Table 6-2. Hydraulic Gradient

Location	i (ft/ft)
SA43-18-6 to CBW-23	0.0193
FD-20 to FD-21	0.0180
SA43-18-8 to FD-20	0.0207
Intersect with E-E' to SA43-18-8	0.0100
CBW-10 to LRP-4	0.0002

Note: Determined from cross section (Figure 4-7)

Table 6-3. Groundwater Flow Calculations, Composite Flux Value

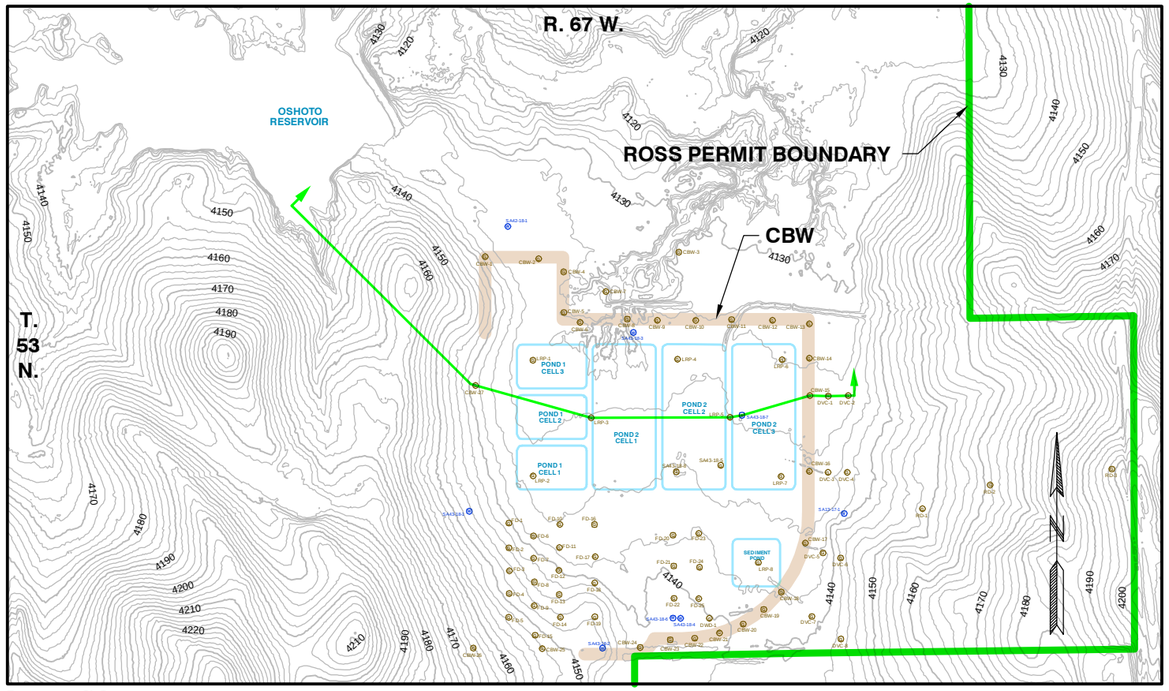
Location	K (ft/day)	i (ft/ft)	Material %	A (ft^2)	Q (ft^3/day)	Q (gal/day)	Q (gal/min)
A-A' (South)	2.38	0.0193	0.0%	0	0.3	2.5	0.0
	0.001		100%	15,440			
C-C'	2.38	0.0180	15.1%	2,411	103.5	774.6	0.5
	0.001		84.9%	13,536			
D-D'	2.38	0.0207	16.5%	1,803	89.0	666.0	0.5
	0.001		83.5%	9,148			
E-E'	2.38	0.0100	6.7%	960	23.0	172.0	0.1
	0.001		93.3%	13,323			
A-A' (North)	2.38	0.0002	4.6%	558	0.3	2.0	0.0
	0.001		95.4%	11,651			



Note: Geology between stations 0 and 1200 is assumed for the purpose of estimating worst case scenario seepage. No actual drilling data is available to confirm actual conditions.

SEEPAGE ANALYSIS SECTION (BASED ON CROSS SECTION E-E')

10:1 VERTICAL EXAGGERATION



Basemap: 2' Contours from May 2010 Flight

LEGEND

- Approximate post-construction groundwater level. Dashed where inferred.
- Quaternary Alluvial & Colluvial fill
  - Sandy Clay and Silty Clay; brown, very cohesive when moist, contains sparse very thin, very fine sandy lenses, stiff to very soft. Occasional thin zones of fine pebble gravels.
  - Pebbly Sand and Clay; brown, poorly sorted, may contain sparse thin clean sand. Lenticular and laterally discontinuous.
- Unconformity
  - "Contact" Dashed where inferred.
- Upper Cretaceous Lance Formation "Bedrock"
  - Claystone and Siltstone; brown, dark brown, and gray, very firm mudstone and finely laminated shale.
  - Sandstone; light brown to gray, extremely fine grained silty and clay rich poorly to moderately consolidated sandstone. Occasionally very hard and well cemented with $CaCO_3$ cement.

Note: Bedrock may be weathered and soft to very soft below contact. Erosion surface may exhibit more complex topography than limited drilling is able to reveal.

CERTIFICATE OF GEOLOGIST

I, Benjamin J. Schiffer, hereby certify that this drawing was prepared by myself or under my direct supervision and that it correctly represents the geologic conditions described in the accompanying application which is provided to meet the requirements of the Wyoming Environmental Quality Act and its accompanying regulations.

PROFESSIONAL GEOLOGIST — BENJAMIN J. SCHIFFER — PG-3446 — WYOMING

STRATA energy

ROSS ISR PROJECT
CROOK COUNTY, WY
P.O. BOX 2318
GILLETTE, WY 82716

REVISIONS	
Date	Description

TR ADDENDUM 3.1-A
FIGURE 6-1

CROSS SECTION USED TO ESTIMATE POTENTIAL BEDROCK SEEPAGE INTO CPP AREA

Drawn By: MBM
Checked By: RBM
Date: 2/28/12

FILE: ROSS_RAI_OSHOTO_RES_XSEC

WWC ENGINEERING www.wwcengineering.com

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7.0 SUMMARY AND CONCLUSIONS

As a result of the 2010 and 2011 geotechnical and hydrological investigations within the CPP area, a number of details regarding the soil and the shallow geological and hydrological conditions have been revealed. The area proposed for the construction of the CPP and associated infrastructure is located within the valley of a minor ephemeral tributary to the Little Missouri River. The proposed location is adjacent to the confluence of the minor ephemeral tributary and the Little Missouri River, but outside the depositional limits of the alluvium associated with the river. The investigations described in this report were performed in order to determine whether or not it would be feasible to construct the CPP and associated facilities at this location.

Beneath the CPP area is a layer of recent unconsolidated valley fill deposits, which consist of an undifferentiated sequence of locally-derived sediments deposited by alluvial, colluvial, and eolian processes. The Quaternary-age valley fill varies in thickness from approximately 2 feet on the east and the west sides of the CPP area to approximately 35 feet thick in middle of the CPP area. The valley fill materials are generally fine- to very fine-grained, clay-rich, and of low permeability. Throughout the CPP area there are zones in the valley fill, particularly the lowest level, comprised of sandier materials with higher permeability; however, these zones were found to be relatively thin and discontinuous. Aquifer testing of observation wells constructed into the valley fill deposits further verified that the more permeable, water-producing sand lenses are randomly dispersed throughout the valley fill.

Lying beneath the valley fill is Lance Formation bedrock. As shown on Figure 1-1, the bedrock type varies throughout the CPP area. On the far western side of the CPP area the bedrock material is primarily sandstone. Within the middle of the CPP area the bedrock consists primarily of claystone and siltstone. Along the far eastern side of the CPP area both sandstone and claystone bedrock underlies the valley fill. Permeability testing indicates that the hydraulic conductivity of the claystone bedrock is in the range of

0.00005 ft/day to 0.0002 ft/day, whereas the measured hydraulic conductivity of the sandstone bedrock is approximately 0.007 ft/day. In general, the hydraulic conductivity of the claystone bedrock is low enough that it essentially acts as a barrier to groundwater movement. A seepage analysis indicates that the potential rate of inflow into the CPP area from the bedrock sandstones would be considerably less than 100 gpd.

In general, the results of these investigations indicate that it would be possible to construct the CPP and facilities at the proposed location. Since the geotechnical drilling verified the occurrence of shallow groundwater in the area, a CBW will be a necessary component of the overall design. The CBW will allow for the dewatering of the valley fill inside the confines of the CBW as well as prevent shallow groundwater associated with the valley fill from entering the CPP area. Since seepage from the underlying bedrock is estimated to be minimal, the CBW is expected to be quite effective. As a result of the geotechnical investigations described herein, several recommendations regarding the various CPP design elements can be made and are included in Table 7-1.

Table 7-1. Recommendations Regarding CPP Facilities Resulting from the Geotechnical and Hydrological Investigations

Design Element	Recommendations
CBW	A CBW will be necessary. At a minimum, the CBW should be keyed into the bedrock. Where the bedrock is composed of sandstone it is recommended that the CBW be constructed to the base of the sandstone if possible. It is recommended to extend the CBW at the northwestern corner of the CPP area approximately 100 feet to the west (to borehole CBW-1) and then 300 feet to the south.
CPP Area Dewatering	Dewatering trenches are the recommended method.
Lined Retention Ponds	The material beneath the ponds is suitable to serve as a secondary liner.
Roads	The foundation material beneath the proposed access roads is acceptable. There are no changes to the road design.
Diversion	There are no changes to the diversion design.
Plant, Office, and Warehouse Foundations	A conventional mat foundation for CPP and chemical storage areas while office/warehouse will utilize spread footing with a slab-on-grade floor.
Domestic Waste Water	The domestic waste water system will likely need to be either a partially or fully raised bed system.

8.0 REFERENCES

Bouwer, H. and R.C. Rice, 1976, A slug test for determining hydraulic conductivity of unconfined aquifers with completely or partially penetrating wells, Water Resources Research, v. 12, p. 423-428.

Cooper, H.H. and C.E. Jacob, 1946, A generalized graphical method for evaluating formation constants and summarizing well field history, Am Geophys. Union Trans., Vol. 27, pp. 526-534.

ESI, (Environmental Simulation Inc.), 2003, AquiferWin32 Version 3, (aquifer test analysis software). Available online at: http://www.groundwatermodels.com/ESI_Software.php

GEO-SLOPE, 2007, Seep/W computer program for groundwater seepage analysis. GEO-SLOPE International Ltd., Calgary, Alberta, Canada, 2007.

Theis, C.V., 1935, The relation between the lowering of the piezometric surface and the rate and duration of discharge of a well using groundwater storage, Trans. Amer. Geophys. Union, Vol. 16, pp. 519-524.

APPENDIX A

Borehole Logs and Well Construction Summaries for Observation Wells Installed in 2010

LOG OF BOREHOLE	BOREHOLE # SA 13-17-1	Page 1 of 1
PROJECT: Proposed Plant Site Geotech (Berger)	**DRILLER:** Bill Cameron Terracon	**DATE:** 5-17-10
CLIENT/LOCATION: Strata Energy NWSW Section 17, T53N, R67W	**RIG:** CME-55 High Torque	**START:** 14:15
GROUND ELEVATION: 4138.7	**BIT(S):** Hollow-Stem Auger	**FINISH:** 15:30
COORDINATES:		
N: 4,935,667 **E:** 504,618 UTM Zone 13 NAD 27	**FLUID:** None	**TOTAL DEPTH:** 13.0'
SURVEYED: Yes GPS	**LOG BY:** M. Wolf – WYPG #614	**HOLE DIAMETER:** 8" OD, 4" ID

DEPTH From	DEPTH To	DESCRIPTION OF MATERIALS (ASTM D2488)	ASTM D2487 SYMBOL	BPF ASTM D1586	SWL	TEST, SAMPLES, OR NOTES
0	1	Silty clay; dark brown, moist, cohesive	CL			
1	2.5	SPT (1/2/8) recovered 1.4'		10		
		Silty clay; grey, brown-salts	CL			
2.5	4	Firm; grey, moist	CL			"Bedrock"
4	5.5	CAL (8/9/8) 3 liners, top poor		17		
		Siltstone; buff, abundant salts	ML			
5.5	7.0	SPT (3/3/5) recovered 1.5'		8		
		Very fine sand; grey, uniform, clean, no clay, non-cohesive	SM			
9	10.5	CAL (7/14/20) 4 rings – top poor		34		3 bottom OK
		Sandstone; buff grey, clay, very coarse, friable. Looks like mechanical fracture on bedding	SM			
10.5	13.0	SPT (10/14/20) recovered 1.8'		24		
		Sandstone; very, very fine grained, light grey, clay rich, uniform, Lance-Fox Hills	SM/SC			
		Rings – 4.5-4.84, 4.84-5.17, 5.17-5.5, 9.17-9.5, 9.5-9.84, 9.87-10.17, 10.17-10.5				

ABBREVIATIONS

SWL – Static Water Level
ST – Shelby Tube Sample
GS – Geochemical Sample
O - Petroleum Odor

DBS – Disturbed Bulk Sample
REF – Refusal
SPT – Standard Penetration Test with Split Barrel Sample (ASTM D-1586)

CAL – California Tube Sample
ZP – Ziplock Bag Sample
LA – Laboratory Analysis
PID – Instrument Response

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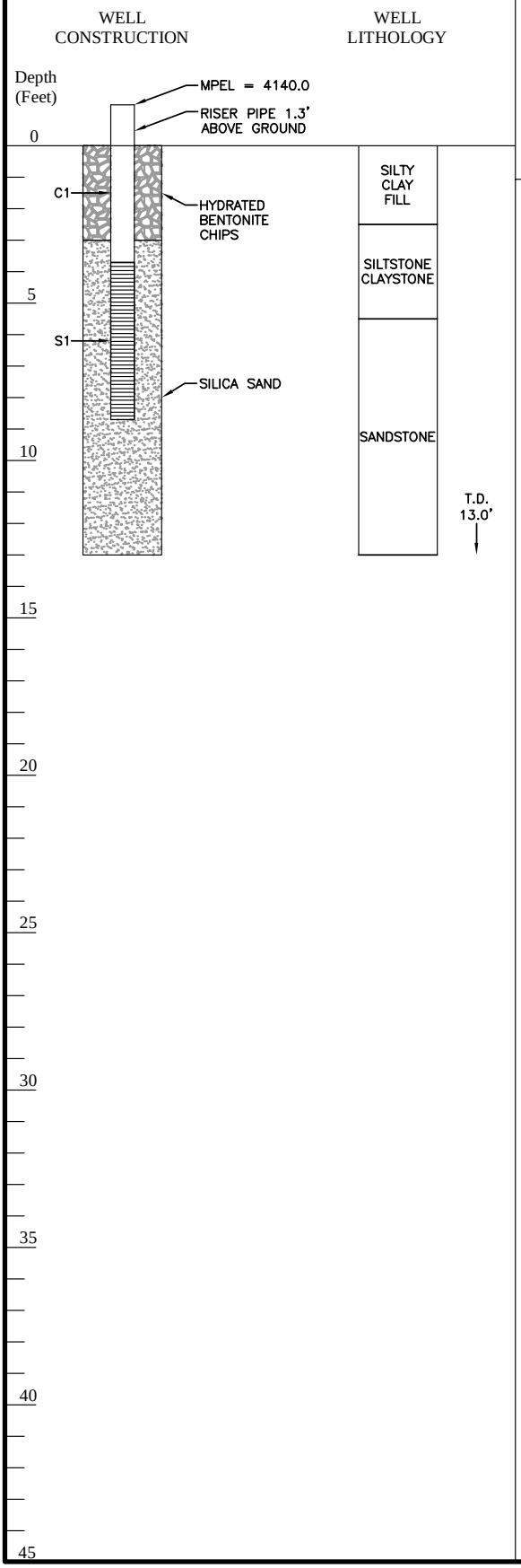
Well Construction Summary

Client: STRATA ENERGY
Project: PROPOSED PLANT SITE GROUNDWATER Well: SA13-17-1
Location: N 4,935,667 E 504,618 GRD EL 4138.7
Projection UTM ZONE 13 NAD 27
NE /4, SE /4, Section 18 T. 53 N. R. 67 W.
Geologist: MIKE WOLF WY PG #614



Drilling Summary

Total Depth: 13.0
Hole Dia.: 8"
Driller: BILL CAMERON
TERRACON
Rig: CME55 HIGH TORQUE
Bit(s): HOLLOW STEM AUGER
4 1/2 INCH I.D.
Fluid: NONE
Casing: FLUSH THREAD 2" PVC

Well Data

Casing: C=Casing S=Screen

C1 -+1.3- 3.7 | S1 - 3.7 -8.7

Monument or Surface Casing:
NONE

Centralizer:
NONE

Casing C1:
2" SCH 40 PVC – FLUSH THREAD

Screen S1:
2" FACTORY SLOTTED 0.010" SLOT

Filter Pack:
10/20 COLORADO SILICA SAND
Depth: 3.0 - 8.7

Bentonite:
3/8" HYR. BENT. CHIPS
Depth: 0 - 3.0

Cement:
NONE
Depth: ____ - ____

Other:

Construction Time Log

Drilling:	Start	End
5-17-10	14:15	15:00

Casing:	Start	End
5-17-10	15:00	15:30

Well Development

DRY AFTER COMPLETION

Remarks

Abandoned

Date:
Method:

WWC ENGINEERING

LOG OF BOREHOLE	BOREHOLE # SA 43-18-1	Page 1 of 1
PROJECT: Proposed Plant Site Geotech (Berger)	**DRILLER:** Bill Cameron Terracon	**DATE:** 5-18-10
CLIENT/LOCATION: Strata Energy NESE Section 18, T53N, R67W	**RIG:** CME-55 High Torque	**START:** 09:25
GROUND ELEVATION: 4146.8	**BIT(S):** Hollow-Stem Auger	**FINISH:** 11:45
COORDINATES:		
N: 4,935,671 **E:** 504,165.7 UTM Zone 13 NAD 27	**FLUID:** None	**TOTAL DEPTH:** 30.5'
SURVEYED: Yes GPS	**LOG BY:** M. Wolf – WYPG #614	**HOLE DIAMETER:** 8"

DEPTH From	DEPTH To	DESCRIPTION OF MATERIALS (ASTM D2488)	ASTM D2487 SYMBOL	BPF ASTM D1586	SWL	TEST, SAMPLES, OR NOTES
0	1	Silty clay; dark brown, little sandy	CL-ML			
1	2.5	SPT (2/3/5) recovered 1.5'		8		
1	1.7	Clayey silt; dark brown	ML-CL			
1.7	2.5	Sandy/silt/silty sand; light buff-grey	SM			
4	5.5	CAL (3/7/9) recovered 1.4'		16		2 good/1 poor
		Silty clay; very dark, very abundant salts, very cohesive	CL			
5.5	7.0	SPT (3/5/8) recovered 1.5'		13		
5.5	6.0	Clay; very dark black/brown, silty, salts	CL			
6	7	Siltstone; brown, sandy, abundant salts	ML			"Bedrock"
9	10.5	CAL (4/6/7) recovered 1.5'. 3 good rings		13		3 good rings
9	10.2	Siltstone; clay rich, very dark, salts, moderately cohesive	ML-CL			
10.2	10.5	Sandstone; light buff, very fine grained, very friable				
10.5	13	SPT (3/10/12) recovered 1.8'		22		
		Sandstone; very light buff, very, very fine grained, very, very friable, no clay, very clean	SP			
14	15.5	CAL (18/52) refusal at 1.0'		52+		
		Sandstone; buff, very fine grained, friable	SP			2 good top poor
15.5	17.0	SPT (25/50 for 5) recovered 1.0'		50+		
		Sandstone; buff-yellow, very, very, fine grained, very friable, moist	SP			
19	20.5	SPT (10/22/27) recovered 2.0'		49		
		Sandstone; light buff-grey, very fine grained, very friable	SP			
24	25.5	SPT (7/12/20) recovered 1.8'		32		
		Claystone; grey-dark grey, silty, fissile	CL			
29	30.5	SPT (12/23/32) recovered 1.8'		55		
		Siltstone; grey, moist, friable	ML			

ABBREVIATIONS

SWL – Static Water Level
ST – Shelby Tube Sample
GS – Geochemical Sample
O - Petroleum Odor

DBS – Disturbed Bulk Sample
REF – Refusal
SPT – Standard Penetration Test with Split Barrel Sample (ASTM D-1586)

CAL – California Tube Sample
ZP – Ziplock Bag Sample
LA – Laboratory Analysis
PID – Instrument Response

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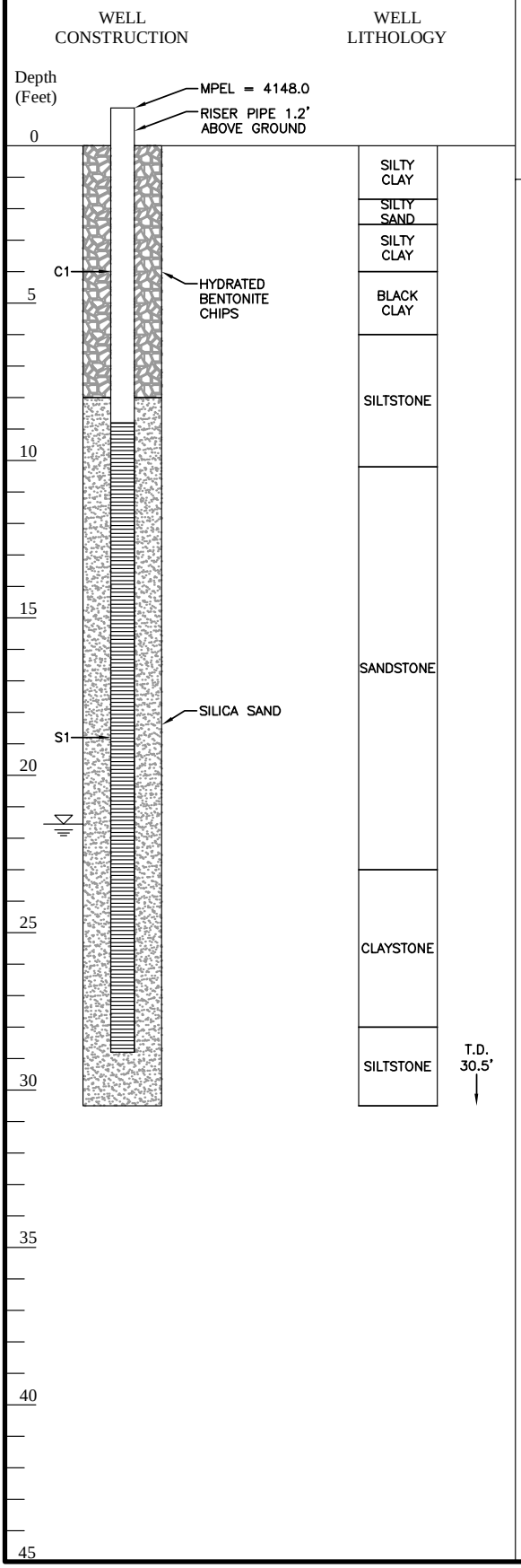
Well Construction Summary

Client: STRATA ENERGY
Project: PROPOSED PLANT SITE GROUNDWATER Well: SA43-18-1
Location: N 4,935,671 E 504,165.7 GRD EL 4146.8
Projection UTM ZONE 13 NAD 27
NE /4, SE /4, Section 18 T. 53 N. R. 67 W.
Geologist: MIKE WOLF WY PG #614



Drilling Summary

Total Depth: 30.5
Hole Dia.: 8"
Driller: BILL CAMERON
TERRACON
Rig: CME55 HIGH TORQUE
Bit(s): HOLLOW STEM AUGER
4 1/2 INCH I.D.
Fluid: NONE
Casing: FLUSH THREAD 2" PVC

Well Data

Casing: C=Casing S=Screen

C1 -+1.2- 8.8 | S1 - 8.8 -28.8

Monument or Surface Casing:
NONE

Centralizer:
NONE

Casing C1:
2" SCH 40 PVC – FLUSH THREAD

Screen S1:
2" FACTORY SLOTTED 0.010" SLOT

Filter Pack:
10/20 COLORADO SILICA SAND
Depth: 8.0 - 30.5

Bentonite:
3/8" HYR. BENT. CHIPS
Depth: 0 - 8.0

Cement:
NONE
Depth: ____ - ____

Other:

Construction Time Log

Drilling:	Start	End
5-18-10	9:25	11:00

Casing:	Start	End
5-18-10	11:00	11:45

Well Development

NONE, DRY FOLLOWING DEVELOPMENT
5-19-10
DTW AT 9:45 = 22.75 BTOC

Remarks

Abandoned

Date:
Method:

WWC ENGINEERING

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LOG OF BOREHOLE	**BOREHOLE # SA 43-18-2**	**Page 1 of 1**
PROJECT: Proposed Plant Site Geotech (Berger)	**DRILLER:** Bill Cameron Terracon	**DATE:** 5-18-10
CLIENT/LOCATION: Strata Energy NESE Section 18, T53N, R67W	**RIG:** CME-55 High Torque	**START:** 07:48
GROUND ELEVATION: 4149.3	**BIT(S):** Hollow-Stem Auger	**FINISH:** 09:15
COORDINATES:		
N: 4,935,505 **E:** 504,326.1 UTM Zone 13 NAD 27	**FLUID:** None	**TOTAL DEPTH:** 20.5'
SURVEYED: Yes GPS	**LOG BY:** M. Wolf – WYPG #614	**HOLE DIAMETER:** 8"

DEPTH		**DESCRIPTION OF MATERIALS (ASTM D2488)**	**ASTM D2487 SYMBOL**	**BPF ASTM D1586**	**SWL**	**TEST, SAMPLES, OR NOTES**
From	**To**					
0	1	Silty clay; brown, moist moderately cohesive	CL-ML			
1	2.5	SPT (2/4/6) recovered 1.5'		10		
		Silt; buff-brown, slight clay, sandy, very fine grained. May be bedrock	ML			
4	5.5	CAL (8/14/14) recovered 1.4' iron oxide in shoe		28		"Bedrock"
		Sandstone; yellow-buff, very fine grained, friable, silty	SM			3 good rings
5.5	7.0	SPT (5/5/9) recovered		14		
9	10.5	CAL (6/10/15) recovered 1.5'		25		4 good rings
9	10.2	Siltstone; buff, little sandy, friable	ML			
10.2	10.5	Claystone; grey, very firm to hard, silty	CL			
10.5	12.0	SPT (7/9/10) recovered 1.5'		19		
		Claystone-siltstone; grey, very cohesive	CL			
14	15.5	CAL (5/9/10) recovered 1.8'		19		4 good rings
		Claystone; grey, very silty, very moist	CL			
15.5	17	SPT (5/9/13) recovered 1.8'		22		
		Claystone; grey, very silty as above, very firm, very cohesive	CL-ML			
19	20.5	SPT (8/17/24) recovered 2.0'		41		
		Siltstone; grey, friable, moderate claystone	ML			

ABBREVIATIONS

SWL – Static Water Level
ST – Shelby Tube Sample
GS – Geochemical Sample
O - Petroleum Odor

DBS – Disturbed Bulk Sample
REF – Refusal
SPT – Standard Penetration Test with Split Barrel Sample (ASTM D-1586)

CAL – California Tube Sample
ZP – Ziplock Bag Sample
LA – Laboratory Analysis
PID – Instrument Response

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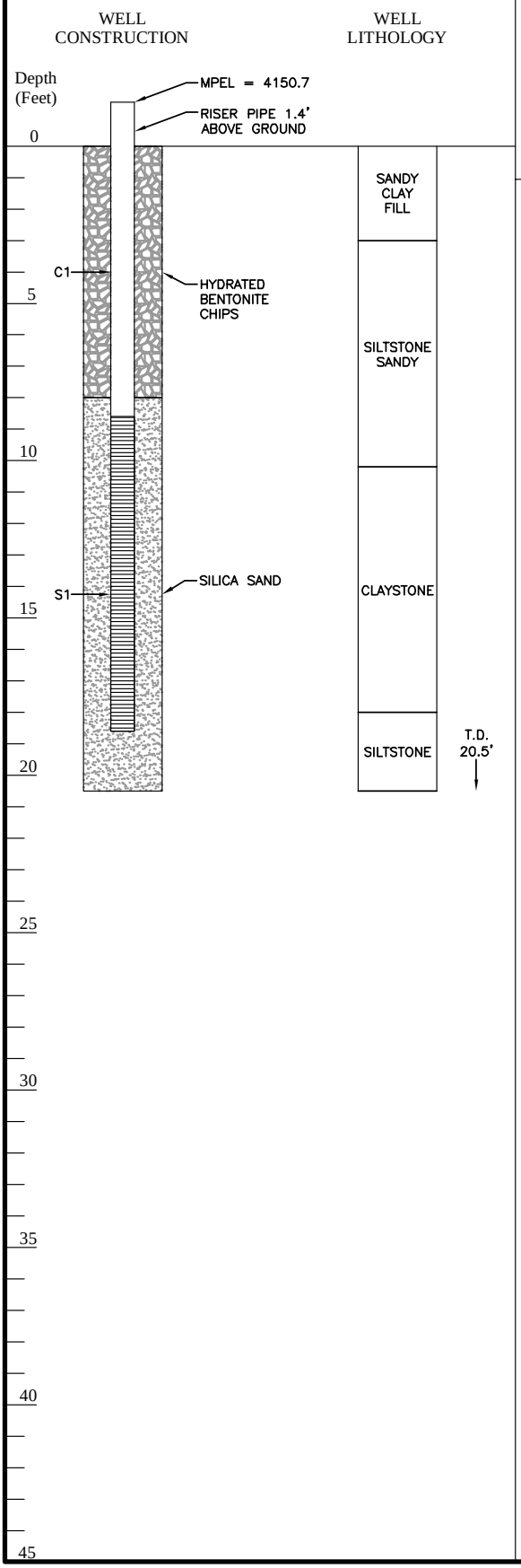
Well Construction Summary

Client: STRATA ENERGY
Project: PROPOSED PLANT SITE GROUNDWATER Well: SA43-18-2
Location: N 4,935,505 E 504,326.1 GRD EL 4149.3
Projection UTM ZONE 13 NAD 27
NE /4, SE /4, Section 18 T. 53 N. R. 67 W.
Geologist: MIKE WOLF WY PG #614



Drilling Summary

Total Depth: 20.5
Hole Dia.: 8"
Driller: BILL CAMERON
TERRACON
Rig: CME55 HIGH TORQUE
Bit(s): HOLLOW STEM AUGER
4 1/2 INCH I.D.
Fluid: NONE
Casing: FLUSH THREAD 2" PVC

Well Data

Casing: C=Casing S=Screen

C1 - +1.4 - 8.6 | S1 - 8.6 - 18.6

Monument or Surface Casing:
NONE

Centralizer:
NONE

Casing C1:
2" SCH 40 PVC – FLUSH THREAD

Screen S1:
2" FACTORY SLOTTED 0.010" SLOT

Filter Pack:
10/20 COLORADO SILICA SAND
Depth: 8.0 - 18.6

Bentonite:
3/8" HYR. BENT. CHIPS
Depth: 0 - 8.0

Cement:
NONE
Depth: ____ - ____

Other:

Construction Time Log

Drilling:	Start	End
5-18-10	7:48	8:30

Casing:	Start	End
5-18-10	8:30	9:15

Well Development

DRY AFTER COMPLETION

Remarks

Abandoned

Date:
Method:

WWC ENGINEERING

LOG OF BOREHOLE	BOREHOLE # SA 43-18-3	Page 1 of 2
PROJECT: Proposed Plant Site Geotech (Berger)	**DRILLER:** Bill Cameron Terracon	**DATE:** 5-18-10
CLIENT/LOCATION: Strata Energy NESE Section 18, T53N, R67W	**RIG:** CME-55 High Torque	**START:** 12:10
GROUND ELEVATION: 4132.9	**BIT(S):** Hollow-Stem Auger	**FINISH:** 14:45
COORDINATES:		
N: 4,935,886 **E:** 504,364.1 UTM Zone 13 NAD 27	**FLUID:** None	**TOTAL DEPTH:** 27.0'
SURVEYED: Yes GPS	**LOG BY:** M. Wolf – WYPG #614	**HOLE DIAMETER:** 8"

DEPTH From	DEPTH To	DESCRIPTION OF MATERIALS (ASTM D2488)	ASTM D2487 SYMBOL	BPF ASTM D1586	SWL	TEST, SAMPLES, OR NOTES
0	1	Silty clay; dark brown, very cohesive, roots	CL			
1	2.5	SPT (1/3/8) recovered 2.0'		11		
		Clay; brown-grey, silty, very cohesive	CL			
4	5.5	CAL (3/5/6) recovered 3 good rings		11		
		Silty sand; yellow-brown, laminated, soft	SM			
9	10.5	CAL (2/5/9) 4 good rings		14		
		Clay; olive brown, silty, very cohesive	CL			
10.5	13	SPT (3/4/8) recovered 1.8'		12		
		Clays; olive brown, moist, very cohesive	CL			
14	15.5	CAL (3/15/9) recovered		13		
14	15	Clay; dark brown-olive	CL			
15	15.5	Sand with few rock fragments, wet	SP			
15.5	17.0	SPT (3/4/5) recovered 2.0'		9		
		Sandy clay with rock fragments, wet	SC			
19	20.5	CAL (3/4/6) recovered 3 rings		10		
		Clayey sand; brown, small rock fragments	SC			
20.5	23	SPT (3/5/6) recovered 1.5'		11		
		Clayey sand; very soft, few pebbles	SC			
24	25.5	CAL (1/5/10) no good rings. Put 2 poor rings in bag!		15		Bag with rings
		Interbedded heaving sand and pebble gravels, loose	SP/SW			
25.5	27.0	SPT (5/10/17)		27		
25.5	26.2	Sand; brown, very fine grained, salt and pepper, few small rock fragments, wet, very soft	SP			Loose
26.2	27.0	Claystone; brown, very cohesive, very firm	CL			Firm- "Bedrock"

ABBREVIATIONS

SWL – Static Water Level
ST – Shelby Tube Sample
GS – Geochemical Sample
O - Petroleum Odor

DBS – Disturbed Bulk Sample
REF – Refusal
SPT – Standard Penetration Test with Split Barrel Sample (ASTM D-1586)

CAL – California Tube Sample
ZP – Ziplock Bag Sample
LA – Laboratory Analysis
PID – Instrument Response

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LOG OF BOREHOLE	BOREHOLE # SA 43-18-3	Page 1 of 2
PROJECT: Proposed Plant Site Geotech (Berger)	**DRILLER:** Bill Cameron Terracon	**DATE:** 5-18-10
CLIENT/LOCATION: Strata Energy NESE Section 18, T53N, R67W	**RIG:** CME-55 High Torque	**START:** 12:10
GROUND ELEVATION: 4132.9	**BIT(S):** Hollow-Stem Auger	**FINISH:** 14:45
COORDINATES:		
N: 4,935,886 **E:** 504,364.1 UTM Zone 13 NAD 27	**FLUID:** None	**TOTAL DEPTH:** 27.0'
SURVEYED: Yes GPS	**LOG BY:** M. Wolf – WYPG #614	**HOLE DIAMETER:** 8"

DEPTH		DESCRIPTION OF MATERIALS (ASTM D2488)	ASTM D2487 SYMBOL	BPF ASTM D1586	SWL	TEST, SAMPLES, OR NOTES
From	To					

ABBREVIATIONS

SWL – Static Water Level
ST – Shelby Tube Sample
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CAL – California Tube Sample
ZP – Ziplock Bag Sample
LA – Laboratory Analysis
PID – Instrument Response

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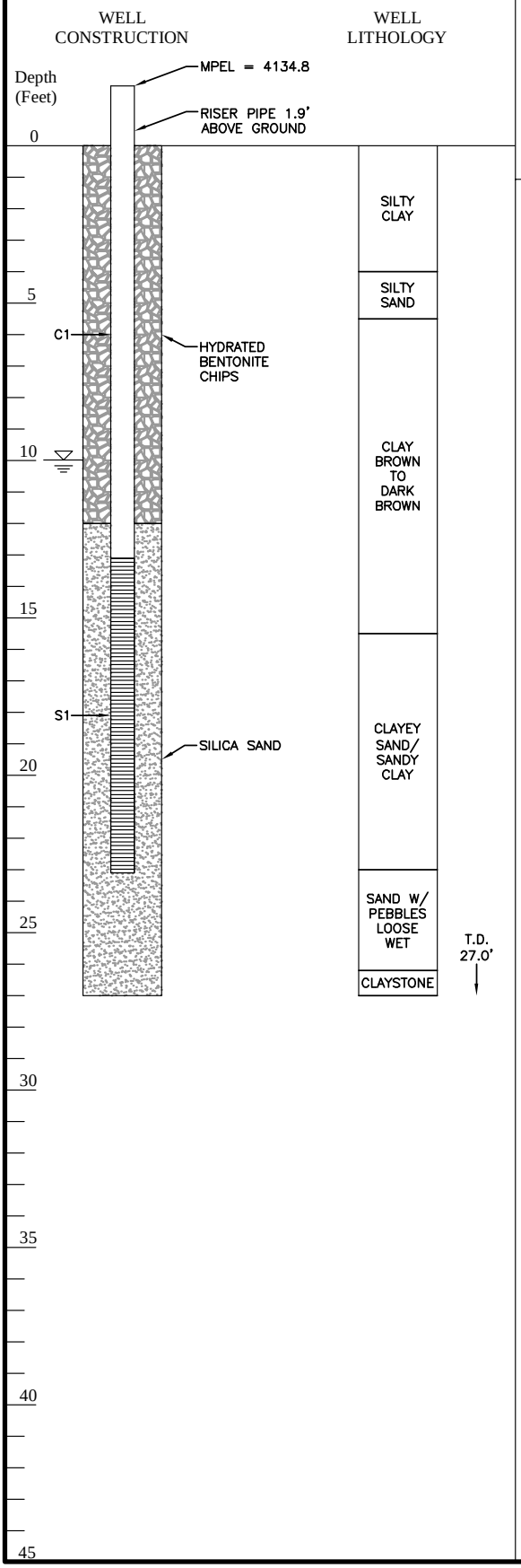
Well Construction Summary

Client: STRATA ENERGY
Project: PROPOSED PLANT SITE GROUNDWATER Well: SA43-18-3
Location: N 4,935,886 E 504,364.1 GRD EL 4132.9
Projection UTM ZONE 13 NAD 27
NE /4, SE /4, Section 18 T. 53 N. R. 67 W.
Geologist: MIKE WOLF WY PG #614



Drilling Summary

Total Depth: 27.0
Hole Dia.: 8"
Driller: BILL CAMERON
TERRACON
Rig: CME55 HIGH TORQUE
Bit(s): HOLLOW STEM AUGER
4 1/2 INCH I.D.
Fluid: NONE
Casing: FLUSH THREAD 2" PVC

Well Data

Casing: C=Casing S=Screen

C1 -+1.9- 13.1 | S1 - 13.1 -23.1

Monument or Surface Casing:
NONE

Centralizer:
NONE

Casing C1:
2" SCH 40 PVC – FLUSH THREAD

Screen S1:
2" FACTORY SLOTTED 0.010" SLOT

Filter Pack:
10/20 COLORADO SILICA SAND
Depth: 12.0 - 23.1

Bentonite:
3/8" HYR. BENT. CHIPS
Depth: 0 - 12.0

Cement:
NONE
Depth: ____ - ____

Other:

Construction Time Log

Drilling:	Start	End
5-18-10	12:10	13:15

Casing:	Start	End
5-18-10	13:15	14:45

Well Development

DTW AFTER DRILLING
5-18-10 @ 14:30 = 11.85 BTOC
5-19-10 @ 9:45 = 11.89 BTOC

Remarks

Abandoned

Date:
Method:

WWC ENGINEERING

APPENDIX B

Borehole Logs for 2011 Boreholes Drilled Under WWC and Yeh and Associates Supervision

ENGINEERING HYDROLOGY AND HYDROGEOLOGY

LOG OF BOREHOLE	BOREHOLE # CBW-1	Page 1 of 1
PROJECT: Ross ISR Plant Site Geotech	**DRILLER:** Bill Cameron Terracon S&E – Rapid City, SD	**DATE:** 8-15-11
CLIENT/LOCATION: Strata Energy/Oshoto, WY	**RIG:** CME 55-HT	**START:** 10:30
GROUND ELEVATION: 4136.80′	**BIT(S):** 4” Solid Stem Auger	**FINISH:** 11:35
COORDINATES: **N:** 1486576 **E:** 713167	**FLUID:** None	**TOTAL DEPTH:** 30.5′
SURVEYED: YES NAD 83 WY East S.P.	**LOG BY:** M. Wolf, WY PG #614	**HOLE DIAMETER:** 4” solid

DEPTH From	DEPTH To	DESCRIPTION OF MATERIALS (ASTM D2488)	ASTM D2487 SYMBOL	BPF ASTM D1586	SWL	TEST, SAMPLES, OR NOTES
0	4	Silty clay; 10YR/Rt/2-6/3, dry at surface, fill/colluvium	CL			0′-2′ ZIP
4	5.5	SPT (2/2/3) very moist, very cohesive, recovered 1.5′	CL	5		
5.5	7.5	Same 10YR 5/1-5/2 gray-brown	CL			
7.5	9	Firm				
9	10.5	SPT (17/24/37) recovered 1.5′		61		
		Silty sandstone; greenish 5Y 5/2, very firm, moist bedrock	SM		11.2′	
14	15.5	SPT (20/21/27) recovered 1.5′		48		
		Sandy siltstone 10YR 5/3-6/3 brown, very firm, moderate clay content, little friable	ML/SM			
19	20.5	SPT (6/15/20) recovered 1.5′		35		
		Clayey siltstone; 5Y 5/2, greenish grey, some Fe (iron) oxides on fractures, very firm	ML		Moist	
24	25.5	SPT (15/25/30) recovered 1.5′		55		
		Sandy siltstone; gray 10YR 5/1-6/1 friable, firm, becoming sandy at shoe, very, very fine grained	ML/SM			
29	30.5	SPT (19/19/38) recovered 1.5′		57		Little water!
29	29.3	Sandstone; very, very fine, very dark, 10YR 4/1, very, very soft	SM			
29.3	30.5	Sandy siltstone; dark, 10YR 5/1-6/1, very firm, little water in bottom of hole – leave open for static water level!	ML/SM			
		DTW on 8-16-11 @ 6:54=11.2′				
		Plug and abandon boring on 8-16-11 with 2-50lb. bags of bentonite chips and fill remaining hole to surface with cuttings				
		Color designations from Munsell Soil Color Charts, U.S. Department Agriculture Handbook 18-Soil Survey Manual, Revised 2000.				

ABBREVIATIONS

DTW – Depth to Water
SWL – Static Water Level
ST – Shelby Tube Sample
GS – Geochemical Sample
O - Petroleum Odor

DBS – Disturbed Bulk Sample
REF – Refusal
SPT – Standard Penetration Test with Split Barrel Sample (ASTM D-1586)

CAL – California Tube Sample*
ZP – Ziplock Bag Sample
LA – Laboratory Analysis
PID – Instrument Response

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ENGINEERING HYDROLOGY AND HYDROGEOLOGY

LOG OF BOREHOLE	BOREHOLE # CBW-2	Page 1 of 1
PROJECT: Ross ISR Plant Site Geotech	**DRILLER:** Bill Cameron Terracon S&E – Rapid City, SD	**DATE:** 8-15-11
CLIENT/LOCATION: Strata Energy/Oshoto, WY	**RIG:** CME 55-HT	**START:** 11:40
GROUND ELEVATION: 4132.95′ **COORDINATES:**	**BIT(S):** Hollow Stem Auger	**FINISH:** 12:30
N: 1486568 **E:** 713380	**FLUID:** None	**TOTAL DEPTH:** 18.5′
SURVEYED: YES NAD 83 WY East S.P.	**LOG BY:** M. Wolf, WY PG #614	**HOLE DIAMETER:** 7”

DEPTH From	DEPTH To	DESCRIPTION OF MATERIALS (ASTM D2488)	ASTM D2487 SYMBOL	BPF ASTM D1586	SWL	TEST, SAMPLES, OR NOTES
0	4	Silty clay; brown, 10YR 4/3-5/3 slightly moist, very cohesive when wet	CL-ML			
4	5.5	SPT (2/3/4) recovered 1.4′, Soft clay; silty, 10YR 4/2-4/3, very cohesive, very soft, moderately fat clay	CL	7		Very moist 5.5-9′ bulk
9	10.5	SPT (2/3/3)recovered 0.8′		6		
9	9.4	Clay; as above	CL			
9.4	9.8	Sandy silt; soft, loose, moderately wet	SM			
9.8	10.5	Lost – slid out	?			
10.5	13	Sandy clay; 10YR 5/2-6/2 very soft, very moist	SC		10.8′	Very Soft! 10.5-14′ bulk
13	14	Firm? Driller says more firm				
14	15.5	SPT (3/7/9) recovered 1.4′	ML	16		
		Siltstone; 10YR 5/2-5/3, moderately soft, weathered, stains on fracture, then sandy interbedded				
15.5	17.0	CAL (15/20/26) 3 good rings		46*		
		Silty sandstone; 10YR 5/3-5/4, friable, little cohesive	SM			
17.0	18.5	SPT (7/12/15) recovered 1.5′		27		
		Silty sandstone; 10YR 5/3, friable, very, very, fine grained	SM			
		DTW on 8-16-11 @ 6:57=10.8′				
		Plug and abandon boring on 8-16-11 with 3-50lb. bags of bentonite chips and fill remaining hole to surface with cuttings				
		Color designations from Munsell Soil Color Charts, U.S. Department Agriculture Handbook 18-Soil Survey Manual, Revised 2000.				

ABBREVIATIONS

DTW – Depth to Water
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DBS – Disturbed Bulk Sample
REF – Refusal
SPT – Standard Penetration Test with Split Barrel Sample (ASTM D-1586)

CAL – California Tube Sample*
ZP – Ziplock Bag Sample
LA – Laboratory Analysis
PID – Instrument Response

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ENGINEERING HYDROLOGY AND HYDROGEOLOGY

LOG OF BOREHOLE	BOREHOLE # CBW-3	Page 1 of 1
PROJECT: Ross ISR Plant Site Geotech	**DRILLER:** Bill Cameron Terracon S&E – Rapid City, SD	**DATE:** 8-16-11
CLIENT/LOCATION: Strata Energy/Oshoto, WY	**RIG:** CME 55-HT	**START:** 09:20
GROUND ELEVATION: 4130.87′ **COORDINATES:**	**BIT(S):** Hollow Stem Auger	**FINISH:** 10:00
N: 1486594 **E:** 713935	**FLUID:** None	**TOTAL DEPTH:** 20.5′
SURVEYED: YES NAD 83 WY East S.P.	**LOG BY:** M. Wolf, WY PG #614	**HOLE DIAMETER:** 7”

DEPTH From	DEPTH To	DESCRIPTION OF MATERIALS (ASTM D2488)	ASTM D2487 SYMBOL	BPF ASTM D1586	SWL	TEST, SAMPLES, OR NOTES
0	4	Silty clay; 10Y, 5/1-5/2, little sandy, dry, hard	CL			
4	5.5	SPT (6/8/8) recovered 1.5′		16		
		Silty sand; 10YR 6/2-7/2 dry, very friable, little clay, notable stratification	SM			
5.5	9.0	Sandy to 7′ then more clay-rich	SM			
9.0	10.5	SPT (7/12/17) recovered 1.2′		29	11.5′	
		Sandy clay; 6/2-5/2, poorly sorted, very silty	SC/SM			
14.0	15.5	SPT (3/4/5) recovered 1.5′		9		
		Sandy-clayey pebble gravels; angular rock fragments	GW			
15.5	17.0	Feels gravelly! Bedrock at 17′ “Slight Rig Chatter”				
19	20.5	SPT (4/6/9) recovered 1.5′		15		
		Siltstone; 10YR 6/2, soft, friable, clay-rich	ML			
		DTW on 8-17-11 @ 7:12 = 11.5′				
		Plug and abandon boring on 8-16-11 with 3-50lb. bags of bentonite chips and fill remaining hole to surface with cuttings				
		Color designations from Munsell Soil Color Charts, U.S. Department Agriculture Handbook 18-Soil Survey Manual, Revised 2000.				

ABBREVIATIONS

DTW – Depth to Water
SWL – Static Water Level
ST – Shelby Tube Sample
GS – Geochemical Sample
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DBS – Disturbed Bulk Sample
REF – Refusal
SPT – Standard Penetration Test with Split Barrel Sample (ASTM D-1586)

CAL – California Tube Sample*
ZP – Ziplock Bag Sample
LA – Laboratory Analysis
PID – Instrument Response

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ENGINEERING HYDROLOGY AND HYDROGEOLOGY

LOG OF BOREHOLE	BOREHOLE # CBW-4	Page 1 of 1
PROJECT: Ross ISR Plant Site Geotech	**DRILLER:** Bill Cameron Terracon S&E – Rapid City, SD	**DATE:** 8-15-11
CLIENT/LOCATION: Strata Energy/Oshoto, WY	**RIG:** CME 55-HT	**START:** 12:35
GROUND ELEVATION: 4132.32′ **COORDINATES:**	**BIT(S):** Hollow Stem Auger	**FINISH:** 12:53
N: 1486516 **E:** 713479	**FLUID:** None	**TOTAL DEPTH:** 10.5′
SURVEYED: YES NAD 83 WY East S.P.	**LOG BY:** M. Wolf, WY PG #614	**HOLE DIAMETER:** 7”

DEPTH From	DEPTH To	DESCRIPTION OF MATERIALS (ASTM D2488)	ASTM D2487 SYMBOL	BPF ASTM D1586	SWL	TEST, SAMPLES, OR NOTES
0	4	Silty clay; 10YR 4/1-5/2 cohesive	CL			
4	5.5	SPT (3/8/7) recovered 0.9′		15		
		Silty clay; 10YR 5/2-5/3	CL-ML			
5.5	9.0	Same; bulk sample, silty clay	CL-ML		8.3′	Bulk 5-9′
	8.0	Bedrock!	SM/SP			
9.0	10.5	SPT (5/10/25) recovered 1.3′ very hard, lost 0.2′		35		
9.0	10.3	Silty sandstone; friable, 10YR 6/3, very, very fine	SM			
10.3	10.5	Sandstone; very, very fine, light gray, moderate cement, very hard	SM/SP			
		DTW on 8-16-11 @ 6:58= Dry at 8.3′ “Cave In”				
		Plug and abandon boring on 8-16-11 with drill cuttings to surface				
		Color designations from Munsell Soil Color Charts, U.S. Department Agriculture Handbook 18-Soil Survey Manual, Revised 2000.				

ABBREVIATIONS

DTW – Depth to Water
SWL – Static Water Level
ST – Shelby Tube Sample
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O - Petroleum Odor

DBS – Disturbed Bulk Sample
REF – Refusal
SPT – Standard Penetration Test with Split Barrel Sample (ASTM D-1586)

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ZP – Ziplock Bag Sample
LA – Laboratory Analysis
PID – Instrument Response

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ENGINEERING HYDROLOGY AND HYDROGEOLOGY

LOG OF BOREHOLE	BOREHOLE # CBW-5	Page 1 of 1
PROJECT: Ross ISR Plant Site Geotech	**DRILLER:** Bill Cameron Terracon S&E – Rapid City, SD	**DATE:** 8-15-11
CLIENT/LOCATION: Strata Energy/Oshoto, WY	**RIG:** CME 55-HT	**START:** 12:55
GROUND ELEVATION: 4132.20′ **COORDINATES:**	**BIT(S):** Hollow Stem Auger	**FINISH:** 13:20
N: 1486355 **E:** 713479	**FLUID:** None	**TOTAL DEPTH:** 12.0′
SURVEYED: YES NAD 83 WY East S.P.	**LOG BY:** M. Wolf, WY PG #614	**HOLE DIAMETER:** 7”

DEPTH From	DEPTH To	DESCRIPTION OF MATERIALS (ASTM D2488)	ASTM D2487 SYMBOL	BPF ASTM D1586	SWL	TEST, SAMPLES, OR NOTES
0	4	Silty clay; gray-brown, 10YR 5/2-6/2, dry to 1.5′ feet then moist and cohesive	CL-ML			
4.0	5.5	SPT (3/4/5) recovered 1.4′		9		
4.0	5.5	Silty sand; 10YR 5/3, soft, loose, little or no clay, non-cohesive	SP/SM			
5.5	7.0	Same	SP/SM			Bulk 5-9′
7.0	9.0	Firm, “Bedrock”			8.3′	Very firm
9.0	10.5	CAL (5/11/17) recovered 3 good rings		28		
		9.1′-9.5′, 9.5′-9.9′, 9.9′-10.3′, Siltstone; 10YR 4/2-5/3	ML			
10.5	12	SPT (13/16/20) recovered 1.5′		36		
		Sandy siltstone; 10YR 5/2-5/3, firm, moderately cohesive	ML			Bulk 7.5-11′
		DTW on 8-16-11 @ 6:59 = dry at 8.3′				
		Plug and abandon boring on 8-16-11 with drill cuttings to surface				
		Color designations from Munsell Soil Color Charts, U.S. Department Agriculture Handbook 18-Soil Survey Manual, Revised 2000.				

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ENGINEERING HYDROLOGY AND HYDROGEOLOGY

LOG OF BOREHOLE	BOREHOLE # CBW-6	Page 1 of 1
PROJECT: Ross ISR Plant Site Geotech	**DRILLER:** Bill Cameron Terracon S&E – Rapid City, SD	**DATE:** 8-15-11
CLIENT/LOCATION: Strata Energy/Oshoto, WY	**RIG:** CME 55-HT	**START:** 13:20
GROUND ELEVATION: 4132.10′ **COORDINATES:**	**BIT(S):** Hollow Stem Auger	**FINISH:** 13:52
N: 1486316 **E:** 713544	**FLUID:** None	**TOTAL DEPTH:** 17.0’
SURVEYED: YES NAD 83 WY East S.P.	**LOG BY:** M. Wolf, WY PG #614	**HOLE DIAMETER:** 7”

DEPTH From	DEPTH To	DESCRIPTION OF MATERIALS (ASTM D2488)	ASTM D2487 SYMBOL	BPF ASTM D1586	SWL	TEST, SAMPLES, OR NOTES
0	4	Silty clay; 10YR 5/1-5/2, very cohesive	CL			
4	5.5	SPT (3/8/7) recovered 0.9′		6		
		Silty clay; very cohesive 10YR 5/2-5/3, more sandy in shoe, thin lens	CL-ML			
5.5	9.0	Silty clay; with thin interbedded sandy lenses	CL-ML		8.0′	Bulk 5-10′
9.0	10.5	SPT (3/3/5) recovered 1.5′		8		
9.0	9.2	Clayey sand; valley fill	SC			
9.2	10.5	Silty sandstone; 10YR 5/3, weathered bedrock, friable, little firm	SM			Bulk 10-14′
10.5	14.0	Auger ahead – Bulk sample	SC/CL			
14.0	15.5	CAL (9/16/21) recovered 4 good rings		37*		
		14′-14.4′, 14.4′-14.8′, 14.8′-15.2′, 15.2′-15.6′ silty sandstone, 10 YR 5/2-6/3, friable	SM/SP			
15.5	17.0	SPT (7/13/16) recovered 1.5′	SP/SM	29		
		Silty sandstone – sandy siltstone, 10YR 6/3, friable, little cohesive				
		DTW on 8-16-11 @ 7:00 = 8.0′				
		Plug and abandon boring on 8-16-11 with 3-50lb. bags of bentonite chips and fill remaining hole to surface with cuttings				
		Color designations from Munsell Soil Color Charts, U.S. Department Agriculture Handbook 18-Soil Survey Manual, Revised 2000.				

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ENGINEERING HYDROLOGY AND HYDROGEOLOGY

LOG OF BOREHOLE	BOREHOLE # CBW-7	Page 1 of 1
PROJECT: Ross ISR Plant Site Geotech	**DRILLER:** Bill Cameron Terracon S&E – Rapid City, SD	**DATE:** 8-15-11
CLIENT/LOCATION: Strata Energy/Oshoto, WY	**RIG:** CME 55-HT	**START:** 13:55
GROUND ELEVATION: 4131.62′ **COORDINATES:**	**BIT(S):** Hollow Stem Auger	**FINISH:** 14:50
N: 1486439 **E:** 713646	**FLUID:** None	**TOTAL DEPTH:** 24.5′
SURVEYED: YES NAD 83 WY East S.P.	**LOG BY:** M. Wolf, WY PG #614	**HOLE DIAMETER:** 7”

DEPTH From	DEPTH To	DESCRIPTION OF MATERIALS (ASTM D2488)	ASTM D2487 SYMBOL	BPF ASTM D1586	SWL	TEST, SAMPLES, OR NOTES
		Move hole 3-4′ NW of lath, rig high on jacks				
0	1	Sandy silt; light brown	SM			
1	3	Clayey sand	SC			
3	4.5	SPT (1/2/3) recovered 1.4′		5		
		Clayey silt, 10YR 5/2-5/3, friable, soft, little cohesive, sandy	ML/SM			
4.5	8	Sandy silt	SM			
8	9.5	SPT (1/2/2) recovered 0.6′		4		
		Slid out bottom				
8	8.6	Sandy silt; 10YR 5/3, soft	SM			
8.6	9.5	Slid out				
9.5	13.0	Clayey sand – sandy clay cuttings, very cohesive	SC		9.8′	
13.0	14.5	SPT (2/3/5) recovered 1.5′	ML	8		
		Siltstone; mottled, clay-rich, moderately soft, brown, 10YR 5/2-6/2, salts in fractures				
14.5	18.0	Assume as above				
18.0	19.5	SPT (4/9/10) recovered 1.5′		19		
		Silty claystone; 10YR 5/3-6/3, little detrital coal, little soft, friable	CL			
19.5	23.0					
23.0	24.5	SPT (10/14/18) recovered 1.5′		32		
		Siltstone; dark, 10YR 4/1-5/2, very clay-rich, firm	ML			
		DTW on 8-16-11 @ 7:01=9.8′				
		Plug and abandon boring on 8-16-11 with 5-50lb. bags of bentonite chips and fill remaining hole to surface with cuttings				
		Color designations from Munsell Soil Color Charts, U.S. Department Agriculture Handbook 18-Soil Survey Manual, Revised 2000.				

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ENGINEERING HYDROLOGY AND HYDROGEOLOGY

LOG OF BOREHOLE	BOREHOLE # CBW-8	Page 1 of 1
PROJECT: Ross ISR Plant Site Geotech	**DRILLER:** Bill Cameron Terracon S&E – Rapid City, SD	**DATE:** 8-15-11
CLIENT/LOCATION: Strata Energy/Oshoto, WY	**RIG:** CME 55-HT	**START:** 15:30
GROUND ELEVATION: 4132.10′	**BIT(S):** Hollow Stem Auger	**FINISH:** 16:10
COORDINATES: **N:** 1486329 **E:** 713731	**FLUID:** None	**TOTAL DEPTH:** 15.5′
SURVEYED: YES NAD 83 WY East S.P.	**LOG BY:** M. Wolf, WY PG #614	**HOLE DIAMETER:** 7”

DEPTH From	DEPTH To	DESCRIPTION OF MATERIALS (ASTM D2488)	ASTM D2487 SYMBOL	BPF ASTM D1586	SWL	TEST, SAMPLES, OR NOTES
0	4	Silty clay; 10YR 5/1-6/2, dry to ~ 2′ then moist	CL			
4	5.5	SPT (2/3/5) recovered 1.3′		8		
		Sandy silt; 10YR 5/3, little clay, moist	ML			
5.5	7	Soft easy drilling				Bulk 5-9′
7.0	9.0	Firm “Bedrock”				
9.0	10.5	CAL (8/14/15 recovered 3 good rings			9.2′	
		Silty sandstone; friable, 9.1′-9.5′, 9.5′-9.9′, 9.9′-10.3′	ML	29*		
10.5	13.0	SPT (13/16/21)		34		
		Sandy; not well sorted, medium grained, “Make driller go deeper!” Contact ~ 14′	SP			
14.0	15.5	SPT (4/9/10) recovered 1.5′		19		
		Siltstone; 10YR 5/2-5/3, very firm, Fe oxides on fractures	ML			
		DTW on 8-16-11 @ 7:08 = 9.2′				
		Plug and abandon boring on 8-16-11 with 3-50lb. bags of bentonite chips and fill remaining hole to surface with cuttings				
		Color designations from Munsell Soil Color Charts, U.S. Department Agriculture Handbook 18-Soil Survey Manual, Revised 2000.				

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ENGINEERING HYDROLOGY AND HYDROGEOLOGY

LOG OF BOREHOLE	BOREHOLE # CBW-9	Page 1 of 1
PROJECT: Ross ISR Plant Site Geotech	**DRILLER:** Bill Cameron Terracon S&E – Rapid City, SD	**DATE:** 8-15-11
CLIENT/LOCATION: Strata Energy/Oshoto, WY	**RIG:** CME 55-HT	**START:** 14:55
GROUND ELEVATION: 4132.20′ **COORDINATES:**	**BIT(S):** Hollow Stem Auger	**FINISH:** 15:30
N: 1486324 **E:** 713850	**FLUID:** None	**TOTAL DEPTH:** 22.0’
SURVEYED: YES NAD 83 WY East S.P.	**LOG BY:** M. Wolf, WY PG #614	**HOLE DIAMETER:** 7” HSA

DEPTH From	DEPTH To	DESCRIPTION OF MATERIALS (ASTM D2488)	ASTM D2487 SYMBOL	BPF ASTM D1586	SWL	TEST, SAMPLES, OR NOTES
		Silty clay; wet from 2-4 feet (very moist)	CL			
4	5.5	SPT (2/2/3) recovered 1.4′		5		
		Silty clay; brown, 10YR 5/2-5/3, moist, very cohesive, soft	CL			
5.5	9.0	Silty clay; as above, wet and soft				Bulk 5-9′
9.0	10.5	SPT (1/1/1) recovered 1.5′	CL	2		
		Clay; silty-sandy, very soft				
10.5	14.0	Soft sandy clay; wet	CL		10.5′	
14.0	15.5	SPT (2/4/4) recovered 1.8′		8		Bulk 11-14′
		Silty clay; mottled olive brown, soft	CL			
15.5	16.5	Soft				
16.5	19	Firm – ‘Bedrock’; very hard, 18-18.5′ well cemented!				
19.0	20.5	CAL (7/14/18) recovered 3 good rings	SM	32*		
		19.1′-19.5′, 19.5′-19.9′, 19.9′-20.3′, Silty sand				
20.5	22.0	SPT (7/14/15) recovered 1.5′	SM	29		
		Silty sandstone; 10YR 5/3-5/4, friable				
		DTW on 8-16-11 @ 7:09 = 10.5′				
		Plug and abandon boring on 8-16-11 with 4-50lb. bags of bentonite chips and fill remaining hole to surface with cuttings				
		Color designations from Munsell Soil Color Charts, U.S. Department Agriculture Handbook 18-Soil Survey Manual, Revised 2000.				

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ENGINEERING HYDROLOGY AND HYDROGEOLOGY

LOG OF BOREHOLE	BOREHOLE # CBW-10	Page 1 of 1
PROJECT: Ross ISR Plant Site Geotech	**DRILLER:** Bill Cameron Terracon S&E – Rapid City, SD	**DATE:** 8-15-11
CLIENT/LOCATION: Strata Energy/Oshoto, WY	**RIG:** CME 55-HT	**START:** 16:15
GROUND ELEVATION: 4132.20′	**BIT(S):** 7” HSA	**FINISH:** 17:00
COORDINATES: **N:** 1486324 **E:** 714001	**FLUID:** None	**TOTAL DEPTH:** 30.5’
SURVEYED: YES NAD 83 WY East S.P.	**LOG BY:** M. Wolf, WY PG #614	**HOLE DIAMETER:** 7”

DEPTH From	DEPTH To	DESCRIPTION OF MATERIALS (ASTM D2488)	ASTM D2487 SYMBOL	BPF ASTM D1586	SWL	TEST, SAMPLES, OR NOTES
	2	Silty clay; dry	CL			
2	5	Silty clay; moist, cohesive	CL			
5	9	Clay; light brown, 10YR 5/2, silty	CL			Bulk 5-10′, 10-15′
9	10.5	SPT (1/2/3) recovered 1.5, very soft		5		
		Clayey silt, 10YR 5/1-5/2, very cohesive, very moist	CL			
10.5	24	Clay; very soft			11.67′	Bulk 15-20′
24	25.5	SPT (2/3/4) recovered 1.8′		7		
		Clay; silty, moderately soft, mottled, very cohesive	CL			
25	29	Claystone; light brown 10YR 5/3	CL			
29	30.5	SPT (3/7/9) recovered 1.5′	CL/OH	16		
		Claystone; dark, 10YR 4/2, carbonaceous, firm, dense				
		DTW on 8-16-11 @ 7:11 = 11.67′ BGL				
		Plug and abandon boring on 8-16-11 with 5-50lb. bags of bentonite chips and fill remaining hole to surface with cuttings				
		Color designations from Munsell Soil Color Charts, U.S. Department Agriculture Handbook 18-Soil Survey Manual, Revised 2000.				

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ENGINEERING HYDROLOGY AND HYDROGEOLOGY

LOG OF BOREHOLE	BOREHOLE # CBW-11	Page 1 of 1
PROJECT: Ross ISR Plant Site Geotech	**DRILLER:** Bill Cameron Terracon S&E – Rapid City, SD	**DATE:** 8-16-11
CLIENT/LOCATION: Strata Energy/Oshoto, WY	**RIG:** CME55-HT	**START:** 08:00
GROUND ELEVATION: 4132.40′ **COORDINATES:**	**BIT(S):** 7” HSA	**FINISH:** 09:20
N: 1486327 **E:** 714144	**FLUID:** None	**TOTAL DEPTH:** 38.0’
SURVEYED: YES NAD 83 WY East S.P.	**LOG BY:** M. Wolf, WY PG #614	**HOLE DIAMETER:** 7”

DEPTH From	DEPTH To	DESCRIPTION OF MATERIALS (ASTM D2488)	ASTM D2487 SYMBOL	BPF ASTM D1586	SWL	TEST, SAMPLES, OR NOTES
	4	Silty clay; 10YR 5/3, dry to ~2, then moist	CL			
4	5.5	SPT (7/10/12) recovered 1.2′	CL	22		
		Silty clay; 10YR 6/2, gypsum salts, dry				
5.5	9.0	Silty clay; light brown, slightly moist	CL			Bulk 6-10′
9.0	10.5	SPT (3/5/5) recovered 1.3′	CL	10		
		Silty – sandy clay; little displacive salts				
10.5	14	As above			12.2′	Bulk 11-15′
14	15.5	SPT (1/2/3) recovered 1.5′		5		
		Silty clay; very moist, very soft, sandy	CL/ML			
15.5	19.0	As above; little apparent stratification				
19.0	20.5	SPT (1/4/4) recovered 1.8′		8		
		Silty clay; light brown 10YR 5/3, very moist, very cohesive	CL/ML			
20.5	24.0	Clay	CL			
24.0	25.5	SPT (2/3/4) recovered 1.8′		7		
		Clay; gray-brown, mottled, soft, silt bands	CL			
25.5	29.0	As above	CL			
29.0	30.5	SPT (0/2/3) recovered 1.7′		5		
		Silty clay; few medium angular rock fragments	CL			
34	34.5	SPT (8/-/-) recovered 0.5′ (only drove 0.5 feet) “refusal”, well cemented!		V. FIRM		“Bedrock”
35.0	36.5	CAL (23/75 for 8”) recovered 3 ok rings		100+*		
		Siltstone; 10YR 6/2-6/3	ML			
36.5	38.0	SPT (29/34/50) recovered 1.5′		84		
36.5	36.9	Sandstone; very, very fine grained				
36.9	37.6	Claystone; finely laminated	SP			
36.6	38.0	Sandstone; brown, very, very fine	CL			
		DTW 8-17-11 @ 7:05 = 12.2′	SP			
		Plug and abandon boring on 8-17-11 with 4-50lb. bags of bentonite chips and fill remaining hole to surface with cuttings				
		Color designations from Munsell Soil Color Charts, U.S. Department Agriculture Handbook 18-Soil Survey Manual, Revised 2000.				

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ENGINEERING HYDROLOGY AND HYDROGEOLOGY

LOG OF BOREHOLE	BOREHOLE # CBW-12	Page 1 of 1
PROJECT: Ross ISR Plant Site Geotech	**DRILLER:** Bill Cameron Terracon S&E – Rapid City, SD	**DATE:** 8-16-11
CLIENT/LOCATION: Strata Energy/Oshoto, WY	**RIG:** CME 55-HT	**START:** 10:00
GROUND ELEVATION: 4130.77′ **COORDINATES:**	**BIT(S):** Hollow Stem Auger	**FINISH:** 10:50
N: 1486324 **E:** 714305	**FLUID:** None	**TOTAL DEPTH:** 36.0’
SURVEYED: YES NAD 83 WY East S.P.	**LOG BY:** M. Wolf, WY PG #614	**HOLE DIAMETER:** 7”

DEPTH From	DEPTH To	DESCRIPTION OF MATERIALS (ASTM D2488)	ASTM D2487 SYMBOL	BPF ASTM D1586	SWL	TEST, SAMPLES, OR NOTES
0	5	Silty clay; 10YR 5/2, dry at surface then moist	CL			
5	10	As above – cohesive silty clay balls	CL			
10	15	As above – cohesive silty clay balls, very soft	CL		10.8′	
15	19	As above – cohesive silty clay balls, very soft	CL			
19	20.5	SPT (2/3/4) recovered 1.5′		7		
		Silty clay; light brown, 10YR 5/3-6/3, very moist, very cohesive, uniform, no laminations	CL			
20.5	25.0	As above; very soft				
25.0	29.0	Same; very soft, wet!	CL			
29.0	30.5	SPT (1/0/3) recovered 1.8′		3		
		Sand; medium grained (mgr), and sandy clay interbedded, wet. Sands are well sorted, loose, fluvial!				
30.5	33.0	Soft Fill; easy drilling, unconsolidated				
33.0	34.5	Firm bedrock; rig indicates stiff material	SP			
34.5	36	SPT (7/17/30) recovered 2.0′		47		
		Sandstone; 10YR 6/2-6/3 very, very fine, uniform, approx.98+% quartz, “Lance Sandstone”	SP			
		DTW on 8-17-11 @ 7:15 = 10.8′				
		Plug and abandon boring on 8-17-11 with 4-50lb. bags of bentonite chips and fill remaining hole to surface with cuttings				
		Color designations from Munsell Soil Color Charts, U.S. Department Agriculture Handbook 18-Soil Survey Manual, Revised 2000.				

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ENGINEERING HYDROLOGY AND HYDROGEOLOGY

LOG OF BOREHOLE	BOREHOLE # CBW-13	Page 1 of 2
PROJECT: Ross ISR Plant Site Geotech	**DRILLER:** Bill Cameron Terracon S&E – Rapid City, SD	**DATE:** 8-16-11
CLIENT/LOCATION: Strata Energy/Oshoto, WY	**RIG:** CME 55-HT	**START:** 10:57
GROUND ELEVATION: 4130.74′ **COORDINATES:**	**BIT(S):** Hollow Stem Auger	**FINISH:** 13:55
N: 1486310 **E:** 714451	**FLUID:** None	**TOTAL DEPTH:** 40.5′
SURVEYED: YES NAD 83 WY East S.P.	**LOG BY:** M. Wolf, WY PG #614	**HOLE DIAMETER:** 7”

DEPTH From	DEPTH To	DESCRIPTION OF MATERIALS (ASTM D2488)	ASTM D2487 SYMBOL	BPF ASTM D1586	SWL	TEST, SAMPLES, OR NOTES
0	4	Silty clay; 10YR 5/1-5/3, dry	CL			
4	5.5	SPT (2/3/3) recovered 1.4′ Clay silty; 10YR 5/1-5/2, notable salts (gypsum?);	CL	6		
6	9	Clay; as above	CL			Bulk 5-9′
9	10.5	SPT (1/1/3) recovered 1.6′		4		
		Clay; silty, tan, 10YR 5/3-6/3, very cohesive, one band of dark organics, cattails?	CL			
10.5	14	Silty clay; as above, wet, cohesive	CL		10.2′	Bulk 10-14′
14	15.5	SPT (1/3/3) recovered 1.7′; Clay; silty as above, less salts	CL	6		
19.0	20.5	SPT (1/2/2) recovered 1.7′; Clay; mottled, sandy and silty, very sandy at drive shoe	CL	4		Very soft!
20.5	24	Driller thinks little gravelly to 23′ then “Bedrock”				
24.0	24.5	SPT (25 for 6”) recovered 0.5′	SP/ROCK	50+		Very hard!
		Sandstone; gray and brown, very hard, auger ahead, to drive CAL				
25	26.0	CAL (22/55 for 6”) recovered 0.8′; 2 good rings #1 and 2, 25.2′-25.6′; 25.6′-26′	SP	100+*		
26	27.5	SPT (25/42/50 for 4”) recovered 1.5′		100+		
26	26.7	Silty sandstone; 10YR 5/2-6/2 very, very fine, friable	ML/SM			
26.7	26.9	Claystone; gray, very firm				
26.9	27.5	Sandstone; very, very fine, very soft, moderately clean	SP			
29.0	30.5	SPT (13/19/30) recovered 1.8′		49		
		Sandstone; 10YR 6/3-7/3 very, very fine, very firm, moderately cohesive, some zones soft and very friable	SP			
34.0	35.5	SPT (14/24/32) recovered 1.6′		56		
		Sandstone; silty, 10YR 7/1-7/2, very, very fine, firm but friable, very hard at 36-37′, well cemented	SP/SM			
39.0	40.5	SPT (30/34/44) recovered 1.6′		78		
		Claystone; dark gray, 10YR 4/1-4/2, very firm, carbonaceous, extreme low permeability	CL/OH			
		Assume claystone starts at 37′ just below hard sandstone lenses				

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ZP – Ziplock Bag Sample
LA – Laboratory Analysis
PID – Instrument Response

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ENGINEERING HYDROLOGY AND HYDROGEOLOGY

LOG OF BOREHOLE	BOREHOLE # CBW-13	Page 2 of 2
PROJECT: Ross ISR Plant Site Geotech	**DRILLER:** Bill Cameron Terracon S&E – Rapid City, SD	**DATE:** 8-16-11
CLIENT/LOCATION: Strata Energy/Oshoto, WY	**RIG:** CME 55-HT	**START:** 10:57
GROUND ELEVATION: 4130.74′ **COORDINATES:**	**BIT(S):** Hollow Stem Auger	**FINISH:** 13:55
N: 1486310 **E:** 714451	**FLUID:** None	**TOTAL DEPTH:** 40.5′
SURVEYED: YES NAD 83 WY East S.P.	**LOG BY:** M. Wolf, WY PG #614	**HOLE DIAMETER:** 7”

DEPTH From	DEPTH To	DESCRIPTION OF MATERIALS (ASTM D2488)	ASTM D2487 SYMBOL	BPF ASTM D1586	SWL	TEST, SAMPLES, OR NOTES
		DTW on 8-17-11 @ 7:18 = 10.2′				
		Plug and abandon boring on 8-17-11 with 4-50lb. bags of bentonite chips and fill remaining hole to surface with cuttings				
		Color designations from Munsell Soil Color Charts, U.S. Department Agriculture Handbook 18-Soil Survey Manual, Revised 2000.				

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ENGINEERING HYDROLOGY AND HYDROGEOLOGY

LOG OF BOREHOLE	BOREHOLE # CBW-14	Page 1 of 1
PROJECT: Ross ISR Plant Site Geotech	**DRILLER:** Bill Cameron Terracon S&E – Rapid City, SD	**DATE:** 8-16-11
CLIENT/LOCATION: Strata Energy/Oshoto, WY	**RIG:** CME 55-HT	**START:** 12:15
GROUND ELEVATION: 4131.73′ **COORDINATES:**	**BIT(S):** Hollow Stem Auger	**FINISH:** 12:55
N: 1486174 **E:** 714451	**FLUID:** None	**TOTAL DEPTH:** 18.5′
SURVEYED: YES NAD 83 WY East S.P.	**LOG BY:** M. Wolf, WY PG #614	**HOLE DIAMETER:** 7”

DEPTH From	DEPTH To	DESCRIPTION OF MATERIALS (ASTM D2488)	ASTM D2487 SYMBOL	BPF ASTM D1586	SWL	TEST, SAMPLES, OR NOTES
0	4	Silty clay	CL			
4	5.5	SPT (2/2/2) recovered 1.0′		4		
		Clay; firm, silty, 10YR 5/3, moderately cohesive	CL			
5.5	9.0	Clay; as above	CL		7.5′	Bulk 6-10′
9.0	10.5	SPT (1/2/3) recovered 1.3′, very soft		5		
		Clay; sandy, silty, 10YR 5/3, very cohesive!	CL			
10.5	14.0	Clay; as above, bedrock at ~12′	CL			Bulk 10-14′
14.0	15.5	SPT (4/6/13) recovered 1.4′		19		
		Siltstone; 10YR 6/2-7/2, very firm, fine laminations	ML			
		Auger to 15.5′ to drive CAL				
15.5	17.0	CAL (9/17/23) recovered 3 good rings	CL-ML	40		
		Silty claystone; with fractures, 15.8′-16.2′, 16.2′-16.6′, 16.6′-17.0′	CL			
17.0	18.5	SPT (6/11/21) recovered 1.5′		32		
		Siltstone; gray-brown, very firm	ML			
		DTW on 8-17-11 @ 7:20 = 7.5′				
		Plug and abandon boring on 8-17-11 with 2-50lb. bags of bentonite chips and fill remaining hole to surface with cuttings				
		Color designations from Munsell Soil Color Charts, U.S. Department Agriculture Handbook 18-Soil Survey Manual, Revised 2000.				

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ENGINEERING HYDROLOGY AND HYDROGEOLOGY

LOG OF BOREHOLE	BOREHOLE # CBW-15	Page 1 of 1
PROJECT: Plant Site Geotech	**DRILLER:** Bill Cameron, Terracon S&E – Rapid City, SD	**DATE:** 8-16-11
CLIENT/LOCATION: Strata Energy/Oshoto, WY	**RIG:** CME 55-HT	**START:** 14:00
GROUND ELEVATION: 4132.46′	**BIT(S):** Hollow Stem Auger	**FINISH:** 14:35
COORDINATES: **N:** 1486027 **E:** 714453	**FLUID:** None	**TOTAL DEPTH:** 15.5′
SURVEYED: YES NAD 83 WY East S.P.	**LOG BY:** M. Wolf, WY PG #614	**HOLE DIAMETER:** 7”

DEPTH From	DEPTH To	DESCRIPTION OF MATERIALS (ASTM D2488)	ASTM D2487 SYMBOL	BPF ASTM D1586	SWL	TEST, SAMPLES, OR NOTES
0	4	Silty clay; 10YR 4/3-5/3, very cohesive	CL			
4	5.5	SPT (2/2/3) recovered 1.4′		5		
		Clay; 10YR 4/2-5/2, silty, very cohesive, moist	CL			Bulk 5-9′
5.5	9.0	As above	CL		7.5′	
9.0	10.5	SPT (1/3/4) recovered 1.5′		7		
		Clay; silty, one pebble ~1/2” in diameter	CL			
10.5	14.0	As above; firm at ~12′				Bulk 10-14′
14.0	15.5	SPT (4/7/11) recovered 1.5′	ML	18		
		Siltstone; 10YR 5/3-6/2, firm, fine laminations, “Bedrock”, weathered, displacive salts in drive shoe				
		Bedrock at ~12.0′				
		DTW on 8-17-11 @ 7:21 = 7.5′				
		Plug and abandon boring on 8-17-11 with 2-50lb. bags of bentonite chips and fill remaining hole to surface with cuttings				
		Color designations from Munsell Soil Color Charts, U.S. Department Agriculture Handbook 18-Soil Survey Manual, Revised 2000.				

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ENGINEERING HYDROLOGY AND HYDROGEOLOGY

LOG OF BOREHOLE	BOREHOLE # CBW-16	Page 1 of 2
PROJECT: Ross ISR Plant Site Geotech	**DRILLER:** Bill Cameron Terracon S&E – Rapid City, SD	**DATE:** 8-16-11
CLIENT/LOCATION: Strata Energy/Oshoto, WY	**RIG:** CME 55-HT	**START:** 14:35
GROUND ELEVATION: 4133.73′ **COORDINATES:**	**BIT(S):** Hollow Stem Auger	**FINISH:** 16:40
N: 1485727 **E:** 714451	**FLUID:** None	**TOTAL DEPTH:** 47.0′
SURVEYED: YES NAD 83 WY East S.P.	**LOG BY:** M. Wolf, WY PG #614	**HOLE DIAMETER:** 7”

DEPTH From	DEPTH To	DESCRIPTION OF MATERIALS (ASTM D2488)	ASTM D2487 SYMBOL	BPF ASTM D1586	SWL	TEST, SAMPLES, OR NOTES
0	4	Silty clay; dark 10YR 5/2-5/3, cohesive	CL			
4	5.5	SPT (2/3/4) recovered 1.4′		7	4.8′	
		Clay; silty, 10YR 5/2, very cohesive	CL			
5.5	9.0	Clay; soft as above	CL			Bulk 6-9′
9	10.5	SPT (2/2/3) recovered 1.6′	CL	5		
		Clay; 10YR 5/3, very soft, very sticky	CL			
10.5	14	As above	CL			Bulk 11-14′
14	15.5	SPT (2/3/3) recovered 1.7′	CL	6		
		Clay; silty, and thin sandy interbeds, brown 10YR 5/3, very soft	CL			
15.5	16.0	Same	CL			
16.0	19.0	Firm “Bedrock”	SP			
19.0	20.5	CAL (17/34/50) recovered 5 good rings		34*		5 liners
		19.0′-19.4′, 19.4′-19.7′, 19.7′-20.1′, 20.1′-20.5′, Sandstone; very , very fine, friable	SP			
20.5	22.0	SPT (23/32/45) recovered 1.5′		77		
		Sandstone; 10YR 6/3-7/2, very, very fine, friable, little cohesive	SP			
24	25.5	SPT (10/15/16) recovered 1.5′		31		
		Sandstone; very, very fine, silty, very firm	SP			
29.0	30.5	SPT (13/17/26) recovered 1.8′	SP	43		
		Sandstone; very, very fine, massive, 10YR 6/2-7/3	SP			
34.0	34.5	Drive spoon and hit very, very hard rock at 34.5; pull spoon and empty. Sandstone; well cemented in drive shoe. Auger ahead to bottom of hard ledge and drive CAL. Very hard ~.5′	SP			
37.0	38.5	CAL (15/40/50 for 5”) recovered 0.4′, “slid out”		90+*		No rings, ZIP
39.0	40.5	SPT (16/34/50 for 3”) recovered 0.0′, “slid out” – think sandstone	SP			
44.0	45.5	CAL (24/45/50) recovered 4 good rings		95		
		Claystone; very dark, 10YR 4/1-4/2, moderately carbonaceous, very firm, 42.9′-43.3′, 44.3′-44.7′, 44.7′-45.1′, 45.1′-45.5′	CL/OH			
45.5	47.0	SPT (15/35/50) recovered 1.3′		85		
		Claystone; very dark 10YR 4/1, very fine and firm	CL/OH			

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ENGINEERING HYDROLOGY AND HYDROGEOLOGY

LOG OF BOREHOLE	BOREHOLE # CBW-16	Page 2 of 2
PROJECT: Ross ISR Plant Site Geotech	**DRILLER:** Bill Cameron Terracon S&E – Rapid City, SD	**DATE:** 8-16-11
CLIENT/LOCATION: Strata Energy/Oshoto, WY	**RIG:** CME 55-HT	**START:** 14:35
GROUND ELEVATION: 4133.73′	**BIT(S):** Hollow Stem Auger	**FINISH:** 16:40
COORDINATES: **N:** 1485727 **E:** 714451	**FLUID:** None	**TOTAL DEPTH:** 47.0′
SURVEYED: YES NAD 83 WY East S.P.	**LOG BY:** M. Wolf, WY PG #614	**HOLE DIAMETER:** 7”

DEPTH From	DEPTH To	DESCRIPTION OF MATERIALS (ASTM D2488)	ASTM D2487 SYMBOL	BPF ASTM D1586	SWL	TEST, SAMPLES, OR NOTES
		Carbonaceous, very cohesive, little coaly fragments				
		DTW on 8-17-11 @ 7:24 = 4.8′				
		Plug and abandon boring on 8-17-11 with 4-50lb. bags of bentonite chips and fill remaining hole to surface with cuttings				
		Color designations from Munsell Soil Color Charts, U.S. Department Agriculture Handbook 18-Soil Survey Manual, Revised 2000.				

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ENGINEERING HYDROLOGY AND HYDROGEOLOGY

LOG OF BOREHOLE	BOREHOLE # CBW-17	Page 1 of 1
PROJECT: Ross ISR Plant Site Geotech	**DRILLER:** Bill Cameron Terracon S&E – Rapid City, SD	**DATE:** 8-17-11
CLIENT/LOCATION: Strata Energy/Oshoto, WY	**RIG:** CME 55-HT	**START:** 07:50
GROUND ELEVATION: 4136.24′ **COORDINATES:**	**BIT(S):** Hollow Stem Auger	**FINISH:** 08:20
N: 1485443 **E:** 714435	**FLUID:** None	**TOTAL DEPTH:** 20.5′
SURVEYED: YES NAD 83 WY East S.P.	**LOG BY:** M. Wolf, WY PG #614	**HOLE DIAMETER:** 7”

DEPTH From	DEPTH To	DESCRIPTION OF MATERIALS (ASTM D2488)	ASTM D2487 SYMBOL	BPF ASTM D1586	SWL	TEST, SAMPLES, OR NOTES
0	4	Sitly clay; brown	CL			
4	5.5	SPT (2/1/2) recovered 1.2′		3	4.5′	
		Silty clay; 10YR 6/2,very, very soft, sticky	CL			
5.5	9.0	Silty clay; as above, very little sand	CL			Bulk 6-9′
9.0	10.5	SPT (1/2/2) recovered 1.4′		4		
9.0	10.5	Silty clay	CL			
10.5	14.0	As above	CL			Bulk 11-14′
14.0	15.5	SPT (3/4/5) recovered 1.7′		9		
		Silty clay; as above, little salts	CL			
15.5	19.0	As above; Clay, wet, sticky	CL			
		Bedrock at 17.5′, rig indicates firm boundary!				
19.0	20.5	SPT (9/29/30) recovered 1.8′	SM	59		
		Silty sandstone – sandy siltstone; very, very fine, firm, 10YR 6/2-7/3, very fine laminations				
		DTW on 8-18-11 @ 7:17 = 4.5′				
		Plug and abandon boring on 8-18-11 with 4-50lb. bags of bentonite chips and fill remaining hole to surface with cuttings				
		Color designations from Munsell Soil Color Charts, U.S. Department Agriculture Handbook 18-Soil Survey Manual, Revised 2000.				

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ENGINEERING HYDROLOGY AND HYDROGEOLOGY

LOG OF BOREHOLE	BOREHOLE # CBW-18	Page 1 of 1
PROJECT: Ross ISR Plant Site Geotech	**DRILLER:** Bill Cameron Terracon S&E – Rapid City, SD	**DATE:** 8-17-11
CLIENT/LOCATION: Strata Energy/Oshoto, WY	**RIG:** CME 55-HT	**START:** 08:22
GROUND ELEVATION: 4137.70′ **COORDINATES:**	**BIT(S):** Hollow Stem Auger	**FINISH:** 09:25
N: 1485249 **E:** 714340	**FLUID:** None	**TOTAL DEPTH:** 32.0′
SURVEYED: YES NAD 83 WY East S.P.	**LOG BY:** M. Wolf, WY PG #614	**HOLE DIAMETER:** 7”

DEPTH From	DEPTH To	DESCRIPTION OF MATERIALS (ASTM D2488)	ASTM D2487 SYMBOL	BPF ASTM D1586	SWL	TEST, SAMPLES, OR NOTES
0	4	Silty clay; light brown, 10YR 5/2 – 5/3	CL			
4	5.5	SPT (2/2/2) recovered 1.2′		4	4.6′	
5.5	9.0	Silty clay; very soft	CL			
5.5	9.0	Same as above	CL			Bulk 4-9′
9.0	10.5	SPT (1/1/2) recovered 1.8′		3		
		Silty clay; little more sandy in shoe	CL			
10.5	14.0	Same as above	CL			Bulk 11-14′
14.0	15.5	SPT (2/3/4) recovered 1.7′		7		
		Silty clay; more firm, little salts	CL			
15.5	19.0	Silty clay; very, very soft, wet	CL			
19.0	20.5	SPT (2/3/3) recovered 1.8′		6		
		Clay; mottled, little fine gravelly clay	CL			
20.5	24	Same; soft clay, little fine, clayey, ground free water!	CL			
24	25.5	SPT (2/3/3) recovered		6		
		Clay and gravelly clay; fine gravels, very poorly sorted, wet	CL/GC			
25.5	27.5	Soft – as above	CL/GC			
27.5	29.0	Firm – “Bedrock”				
29.0	30.5	CAL (12/16/22) recovered 3 good rings		38*		
		Silty claystone; 10YR 5/3-6/2, very firm	CL			
30.5	32.0	SPT (14/27/47) recovered 1.5′	CL	74		
		Silty claystone; 10YR 5/1-5/2, very firm				
		Caving hole at bottom fill! Lots of water!				
		DTW on 8-18-11 @ 7:19 = 4.6′				
		Plug and abandon boring on 8-18-11 with 5-50lb. bags of bentonite chips and fill remaining hole to surface with cuttings				
		Color designations from Munsell Soil Color Charts, U.S. Department Agriculture Handbook 18-Soil Survey Manual, Revised 2000.				

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ENGINEERING HYDROLOGY AND HYDROGEOLOGY

LOG OF BOREHOLE	BOREHOLE # CBW-19	Page 1 of 1
PROJECT: Ross ISR Plant Site Geotech	**DRILLER:** Bill Cameron Terracon S&E – Rapid City, SD	**DATE:** 8-17-11
CLIENT/LOCATION: Strata Energy/Oshoto, WY	**RIG:** CME 55-HT	**START:** 09:27
GROUND ELEVATION: 4138.63′	**BIT(S):** Hollow Stem Auger	**FINISH:** 09:50
COORDINATES: **N:** 1485180 **E:** 714271	**FLUID:** None	**TOTAL DEPTH:** 25.5′
SURVEYED: YES NAD 83 WY East S.P.	**LOG BY:** M. Wolf, WY PG #614	**HOLE DIAMETER:** 7”

DEPTH From	DEPTH To	DESCRIPTION OF MATERIALS (ASTM D2488)	ASTM D2487 SYMBOL	BPF ASTM D1586	SWL	TEST, SAMPLES, OR NOTES
0	4	Silty clay; dry to ~2′	CL			
4	10	Same	CL		4.7′	
10	15	Same; sparse small angular rock fragments and pebbles	CL			
15	20	Same; still soft	CL			
20	22	Soft; very few small rock fragments, little sandy	CL			
22	24	Firm; “Bedrock” – Lance! Silty sandstone	SM			
24	25.5	SPT (6/12/20) recovered 1.4′		32		
24	25	Silty sandstone; 10YR 6/4-6/5 firm	SM			
25	25.5	Siltstone; 10YR 5/3, firm, slight very, very fine sand content	ML			
		DTW on 8-18-11 @ 7:21 = 4.7′				
		Plug and abandon boring on 8-18-11 with 4-50lb. bags of bentonite chips and fill remaining hole to surface with cuttings				
		Color designations from Munsell Soil Color Charts, U.S. Department Agriculture Handbook 18-Soil Survey Manual, Revised 2000.				

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ENGINEERING HYDROLOGY AND HYDROGEOLOGY

LOG OF BOREHOLE	BOREHOLE # CBW-20	Page 1 of 1
PROJECT: Ross ISR Plant Site Geotech	**DRILLER:** Bill Cameron Terracon S&E – Rapid City, SD	**DATE:** 8-17-11
CLIENT/LOCATION: Strata Energy/Oshoto, WY	**RIG:** CME 55-HT	**START:** 09:52
GROUND ELEVATION: 4138.36′ **COORDINATES:**	**BIT(S):** Hollow Stem Auger	**FINISH:** 10:35
N: 1485122 **E:** 714189	**FLUID:** None	**TOTAL DEPTH:** 25.5′
SURVEYED: YES NAD 83 WY East S.P.	**LOG BY:** M. Wolf, WY PG #614	**HOLE DIAMETER:** 7”

DEPTH From	DEPTH To	DESCRIPTION OF MATERIALS (ASTM D2488)	ASTM D2487 SYMBOL	BPF ASTM D1586	SWL	TEST, SAMPLES, OR NOTES
0	4	Silty clay; 10YR 5/1-5/2, moist	CL			
4	5.5	SPT (2/3/5) recovered 1.3′		8	3.9′	
		Clay; silty, 10YR 5/2-6/2, firm, cohesive	CL			
5.5	9.0	Clay; silty, soft, as above, cohesive	CL			Bulk 6-9′
9.0	10.5	SPT (1/1/2) recovered 1.3′		3		
10.5	14.0	As above; very sticky	CL			Bulk 11-14′
14.0	15.5	SPT (1/3/3) recovered 1.8′		6		
		Clay as above; 0.1’ band of sandy clay at 14.8′	CL			
15.5	19.0	Same; very soft, very sticky, wet, no apparent gravel!	CL			
19.0	19.7	Clay; sandy clay	CL			
19.7	19.8	Gravelly clay; red angular pebbles	GC			
19.8	20.5	Clay; firm, silty	CL			
20.5	24.0	Bedrock ~23.5′	CL			Bedrock @ 23.5′
24.0	25.3	SPT (3/6/10) recovered 1.4′		16		
		Silty claystone; mottled 10YR 6/1 and 6/4	CL/ML			
25.3	25.5	More siltstone in shoe 25.3′ – 25.5′	ML			
		DTW on 8-18-11 @ =3.9′				
		Plug and abandon boring on 8-18-11 with 4-50lb. bags of bentonite chips and fill remaining hole to surface with cuttings				
		Color designations from Munsell Soil Color Charts, U.S. Department Agriculture Handbook 18-Soil Survey Manual, Revised 2000.				

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PID – Instrument Response

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ENGINEERING HYDROLOGY AND HYDROGEOLOGY

LOG OF BOREHOLE	BOREHOLE # CBW-21	Page 1 of 1
PROJECT: Ross ISR Plant Site Geotech	**DRILLER:** Bill Cameron Terracon S&E – Rapid City, SD	**DATE:** 8-17-11
CLIENT/LOCATION: Strata Energy/Oshoto, WY	**RIG:** CME 55-HT	**START:** 10:38
GROUND ELEVATION: 4140.92′ **COORDINATES:**	**BIT(S):** Hollow Stem Auger	**FINISH:** 11:45
N: 1485087 **E:** 714096	**FLUID:** None	**TOTAL DEPTH:** 37.0′
SURVEYED: YES NAD 83 WY East S.P.	**LOG BY:** M. Wolf, WY PG #614	**HOLE DIAMETER:** 7”

DEPTH From	DEPTH To	DESCRIPTION OF MATERIALS (ASTM D2488)	ASTM D2487 SYMBOL	BPF ASTM D1586	SWL	TEST, SAMPLES, OR NOTES
		Auger down to find firm bedrock!				
0	2	Clay; silty, dry	CL			
2	15	Clay; silty, 10YR 5/2, moist, very cohesive	CL			
15	25	Still soft clay!	CL			
25	31.5	Soft!	CL			
31.5	34	Firm – Assume Bedrock!	ML			Bedrock @ 31.5′
34.5	35.5	CAL (8/12/14) recovered 4 good rings		26*		
		Siltstone; 10YR 5/1-6/2, clay-rich, few rock fragments, clay-rich, very firm	ML			
		33.9′-34.3′, 34.3′-34.7′, 34.7′-35.1′, 35.1′-35.5′				
35.5	37.0	SPT (7/10/13) recovered 1.5′	ML	23		
		Siltstone; 10YR 5/1-5/3, clay-rich, very firm, thin, lighter, more silty laminations, low permeability				
		DTW on 8-18-11 @ 7:26=5.7′				
		Plug and abandon boring on 8-18-11 with 6-50lb. bags of bentonite chips and fill remaining hole to surface with cuttings				
		Color designations from Munsell Soil Color Charts, U.S. Department Agriculture Handbook 18-Soil Survey Manual, Revised 2000.				

ABBREVIATIONS

DTW – Depth to Water
SWL – Static Water Level
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DBS – Disturbed Bulk Sample
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ENGINEERING HYDROLOGY AND HYDROGEOLOGY

LOG OF BOREHOLE	BOREHOLE # CBW-22	Page 1 of 1
PROJECT: Ross ISR Plant Site Geotech	**DRILLER:** Bill Cameron Terracon S&E – Rapid City, SD	**DATE:** 8-17-11
CLIENT/LOCATION: Strata Energy/Oshoto, WY	**RIG:** CME 55-HT	**START:** 12:10
GROUND ELEVATION: 4141.68′ **COORDINATES:**	**BIT(S):** Hollow Stem Auger	**FINISH:** 13:00
N: 1485066 **E:** 713998	**FLUID:** None	**TOTAL DEPTH:** 32.0′
SURVEYED: YES NAD 83 WY East S.P.	**LOG BY:** M. Wolf, WY PG #614	**HOLE DIAMETER:** 7”

DEPTH From	DEPTH To	DESCRIPTION OF MATERIALS (ASTM D2488)	ASTM D2487 SYMBOL	BPF ASTM D1586	SWL	TEST, SAMPLES, OR NOTES
0	4	Silty clay; dry to 2′, then moist	CL			
4	5.5	SPT (2/4/5) recovered 1.2′		9	5.5	
		Silty clay; 10YR 5/2, moist, firm, cohesive	CL			
5.5	9.0	Same as above	CL			Bulk 4-9′
9.0	10.5	SPT (2/2/4) recovered 1.4′		6		
		Silty clay; 10YR 5/2, soft, sticky, moderate salts	CL			
10.5	14.0	Same as above	CL			Bulk 11-14′
14.0	15.5	SPT (2/3/4) recovered 1.5′		7		
		Clay; silty, as above	CL			
15.5	19.0	Same; still soft	CL			Free water!
19.0	20.5	SPT (2/3/3) recovered 1.8′		6		
		Clay; as above	CL			
20.5	24	Still soft	CL			
24	25.5	SPT (2/3/3) recovered 1.8′		6		
		Sand; medium grained, clean, very permeable	SP			Very wet
24.5	25.5	Sandy siltstone; mottled, weathered, “bedrock”	ML/SM			
25.5	27.0	Siltstone bedrock; soft	ML			
29.0	30.5	CAL (4/7/12) recovered 4 good rings	ML	19*		
		Siltstone; with very thin sandy silt laminations	ML			
30.5	32.0	SPT (7/10/12) recovered 1.4′		22		
		Siltstone; with sandy silt laminations	ML			
		DTW on 8-18-11 @ 7:28 = 5.5′				
		Plug and abandon boring on 8-18-11 with 6-50lb. bags of bentonite chips and fill remaining hole to surface with cuttings				
		Color designations from Munsell Soil Color Charts, U.S. Department Agriculture Handbook 18-Soil Survey Manual, Revised 2000.				

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ENGINEERING HYDROLOGY AND HYDROGEOLOGY

LOG OF BOREHOLE	BOREHOLE # CBW-23	Page 1 of 1
PROJECT: Ross ISR Plant Site Geotech	**DRILLER:** Bill Cameron Terracon S&E – Rapid City, SD	**DATE:** 8-17-11
CLIENT/LOCATION: Strata Energy/Oshoto, WY	**RIG:** CME 55-HT	**START:** 13:00
GROUND ELEVATION: 4141.92′ **COORDINATES:**	**BIT(S):** Hollow Stem Auger	**FINISH:** 13:45
N: 1485060 **E:** 713901	**FLUID:** None	**TOTAL DEPTH:** 27.0′
SURVEYED: YES NAD 83 WY East S.P.	**LOG BY:** M. Wolf, WY PG #614	**HOLE DIAMETER:** 7”

DEPTH From	DEPTH To	DESCRIPTION OF MATERIALS (ASTM D2488)	ASTM D2487 SYMBOL	BPF ASTM D1586	SWL	TEST, SAMPLES, OR NOTES
0	4	Silty clay; 10YR 4/2-5/2, moist at 3′	CL			
4	5.5	SPT (2/3/4) recovered 1.3′		7	5.3′	
		Clay; silty, moist, cohesive	CL			
5.5	9.0	As above	CL			Bulk 6-10′
9.0	10.5	SPT (2/3/3) recovered 1.5′		6		
		Clay; silty, little darker 10YR 4/2-5/2	CL			
10.5	14.0	As above	CL			Bulk 10-15′
14.0	15.5	SPT (4/5/6) recovered 1.8′		10		
		Clay; silty, more firm, very cohesive, little faint organic splotches	CL			
15.5	19.0	Still soft drilling – clay?	CL			
19.0	20.5	SPT (1/2/4) recovered 1.4′		6		
19.0	20.3	Silty sandstone	SM			“Bedrock”
20.3	20.5	Sandstone; uniform, mostly quartz, firm at 22.5′	SP			
24	25.5	CAL (4/8/10) recovered 3 good rings		18*		
		Silty claystone	CL/ML			
25.5	27.0	SPT (3/6/10) recovered 1.5′		16		
		Silty claystone; orange from 25.5′ – 28′, more silty then gray-orange alternating	ML/CL			
		DTW on 8-18-11 @ 7:30 = 5.3′				
		Plug and abandon boring on 8-18-11 with 5-50lb. bags of bentonite chips and fill remaining hole to surface with cuttings				
		Color designations from Munsell Soil Color Charts, U.S. Department Agriculture Handbook 18-Soil Survey Manual, Revised 2000.				

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ENGINEERING HYDROLOGY AND HYDROGEOLOGY

LOG OF BOREHOLE	BOREHOLE # CBW-24	Page 1 of 1
PROJECT: Ross ISR Plant Site Geotech	**DRILLER:** Bill Cameron Terracon S&E – Rapid City, SD	**DATE:** 8-17-11
CLIENT/LOCATION: Strata Energy/Oshoto, WY	**RIG:** CME 55-HT	**START:** 13:47
GROUND ELEVATION: 4142.00′ **COORDINATES:**	**BIT(S):** Hollow Stem Auger	**FINISH:** 14:08
N: 1485029 **E:** 713782	**FLUID:** None	**TOTAL DEPTH:** 15.5′
SURVEYED: YES NAD 83 WY East S.P.	**LOG BY:** M. Wolf, WY PG #614	**HOLE DIAMETER:** 7”

DEPTH From	DEPTH To	DESCRIPTION OF MATERIALS (ASTM D2488)	ASTM D2487 SYMBOL	BPF ASTM D1586	SWL	TEST, SAMPLES, OR NOTES
0	3	Silty clay; dry, firm	CL			
3	4	Silty clay; moist, cohesive	CL			
4	11	Silty clay; 10YR 5/2 – 6/2, very soft, very cohesive	CL			Bulk 5-10′
11	14	Gets very firm, “assume bedrock”	ML?			Bulk 10-11′
14	15.5	SPT (6/10/16) recovered 1.5′		26		
14	14.4	Siltstone; 5Y 5/1, very firm	ML			
14.4	15.5	Claystone; silty 10YR 4/2 – 4/3, very firm	CL			
		DTW on 8/18/11 @ 7:32 = 2.6′				
		Plug and abandon boring on 8-18-11 with 4-50lb. bags of bentonite chips and fill remaining hole to surface with cuttings				
		Color designations from Munsell Soil Color Charts, U.S. Department Agriculture Handbook 18-Soil Survey Manual, Revised 2000.				

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ENGINEERING HYDROLOGY AND HYDROGEOLOGY

LOG OF BOREHOLE	BOREHOLE # CBW-25	Page 1 of 1
PROJECT: Ross ISR Plant Site Geotech	**DRILLER:** Bill Cameron Terracon S&E – Rapid City, SD	**DATE:** 8-17-11
CLIENT/LOCATION: Strata Energy/Oshoto, WY	**RIG:** CME 55-HT	**START:** 14:10
GROUND ELEVATION: 4152.20′ **COORDINATES:**	**BIT(S):** Hollow Stem Auger	**FINISH:** 15:05
N: 1485025 **E:** 713394	**FLUID:** None	**TOTAL DEPTH:** 25.5′
SURVEYED: YES NAD 83 WY East S.P.	**LOG BY:** M. Wolf, WY PG #614	**HOLE DIAMETER:** 7”

DEPTH From	DEPTH To	DESCRIPTION OF MATERIALS (ASTM D2488)	ASTM D2487 SYMBOL	BPF ASTM D1586	SWL	TEST, SAMPLES, OR NOTES
0	2	Silty sand; light brown, salty 1-2′	SM			Bulk 0-2′
2	4	Clay; silty	CL			
4	5.5	SPT (2/5/6) recovered 1.5′, Silty sandstone; 10YR 6/2, uniform, very, very firm, mostly quartz “bedrock”	SM	11		Bulk 5-10′
9	10.5	CAL (5/12/25) recovered 3 good rings, 3 strings claystone dark weathered, #2 siltstone #3 sandy, very, very, very fine		37*		3 – all different lithologies
10.5	12.0	SPT (11/16/21) recovered 1.4′		37		
10.5	11.5	Sandstone; very light, 10YR 7/2, very, very, very fine, uniform	SP			
11.5	11.7	Siltstone; little darker	ML			
11.7	11.8	Sandstone; as above	SP/SM			
11.8	12.0	Siltstone; 10YR 6/1, very firm, little sandy	ML			
12	14	Sandy siltstone; firm				
14	14.7	SPT (15/50 for 3”) recovered 0.3′				
		Siltstone; very fine, little sandy, well cemented at 14.6′ calcite cement 14.6′ – 15.1′, very hard, auger to see how thick cemented ledge is	ML SM/ROCK			Very hard!
19	20.5	SPT (8/17/20) recovered 1.8′				
		Sandstone; very light, 10YR 6/2 – 7/1, soft, friable, silty but predominantly quartz, very, very fine, dark clay at ~21′	SP/SM	37		
24	25.5	CAL (6/10/14) recovered 3 rings				
		Silty claystone/clayey siltstone; 10YR 6/2, rings poor - fractures! Coal specks	ML			Fractures
		DTW on 8/18/11 @ 7:34 = 13.4′				
		Plug and abandon boring on 8-18-11 with 4-50lb. bags of bentonite chips and fill remaining hole to surface with cuttings				
		Color designations from Munsell Soil Color Charts, U.S. Department Agriculture Handbook 18-Soil Survey Manual, Revised 2000.				

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ENGINEERING HYDROLOGY AND HYDROGEOLOGY

LOG OF BOREHOLE	BOREHOLE # CBW-26	Page 1 of 1
PROJECT: Ross ISR Plant Site Geotech	**DRILLER:** Bill Cameron Terracon S&E – Rapid City, SD	**DATE:** 8-17-11
CLIENT/LOCATION: Strata Energy/Oshoto, WY	**RIG:** CME55-HT	**START:** 15:10
GROUND ELEVATION: 4166.11′ **COORDINATES:**	**BIT(S):** 4” Solid Stem Auger	**FINISH:** 15:30
N: 1485027 **E:** 713121	**FLUID:** None	**TOTAL DEPTH:** 9.0′
SURVEYED: YES NAD 83 WY East S.P.	**LOG BY:** M. Wolf, WY PG #614	**HOLE DIAMETER:** 4”

DEPTH From	DEPTH To	DESCRIPTION OF MATERIALS (ASTM D2488)	ASTM D2487 SYMBOL	BPF ASTM D1586	SWL	TEST, SAMPLES, OR NOTES
0	2	Sand; very fine, silty	SP/SM			
2	4	Clayey sand; brown, little cohesion	SC			
4	5.5	SPT (3/4/5) recovered 1.5′		9		
		Clayey sand; yellow-brown, weathered bedrock!	SC			
5.5	9	Clayey sandstone; soft, weathered	SC/SM			
		No water encountered				
		Plug and abandon boring on 8-18-11 with drill cuttings to ground surface				
		Color designations from Munsell Soil Color Charts, U.S. Department Agriculture Handbook 18-Soil Survey Manual, Revised 2000.				

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ENGINEERING HYDROLOGY AND HYDROGEOLOGY

LOG OF BOREHOLE	BOREHOLE # CBW-27	Page 1 of 1
PROJECT: Ross ISR Plant Site Geotech	**DRILLER:** Bill Cameron Terracon S&E – Rapid City, SD	**DATE:** 8-17-11
CLIENT/LOCATION: Strata Energy/Oshoto, WY	**RIG:** CME 55-HT	**START:** 15:40
GROUND ELEVATION: 4138.87′ **COORDINATES:**	**BIT(S):** 4” Solid Stem Auger	**FINISH:** 15:55
N: 1486067 **E:** 713129	**FLUID:** None	**TOTAL DEPTH:** 5.5′
SURVEYED: YES NAD 83 WY East S.P.	**LOG BY:** M. Wolf, WY PG #614	**HOLE DIAMETER:** 4”

DEPTH From	DEPTH To	DESCRIPTION OF MATERIALS (ASTM D2488)	ASTM D2487 SYMBOL	BPF ASTM D1586	SWL	TEST, SAMPLES, OR NOTES
0	1.5	Sand; loose, light brown, silty	SM			
1.5	4	Clayey sand; dark brown, clay-rich	SC			
4	5.5	SPT (8/9/11) recovered 1.5′		20		
		Siltstone; dark brown, 10YR 4/2, very firm, salts, moderate fractures	ML			
		Dry. No water encountered				
		Plug and abandon boring on 8-18-11 with drill cuttings to ground surface				
		Color designations from Munsell Soil Color Charts, U.S. Department Agriculture Handbook 18-Soil Survey Manual, Revised 2000.				

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ENGINEERING HYDROLOGY AND HYDROGEOLOGY

LOG OF BOREHOLE	BOREHOLE # DVC-1	Page 1 of 1
PROJECT: Ross ISR Plant Site Geotech	**DRILLER:** Bill Cameron Terracon S&E – Rapid City, SD	**DATE:** 8-19-11
CLIENT/LOCATION: Strata Energy/Oshoto, WY	**RIG:** CME 55-HT	**START:** 13:50
GROUND ELEVATION: 4132.52′ **COORDINATES:**	**BIT(S):** 4" Solid Stem Auger	**FINISH:** 14:10
N: 1486024 **E:** 714526	**FLUID:** None	**TOTAL DEPTH:** 14.0'
SURVEYED: YES NAD 83 WY East S.P.	**LOG BY:** M. Wolf, WY PG #614	**HOLE DIAMETER:** 4"

DEPTH From	DEPTH To	DESCRIPTION OF MATERIALS (ASTM D2488)	ASTM D2487 SYMBOL	BPF ASTM D1586	SWL	TEST, SAMPLES, OR NOTES
0	4	Silty-sandy clay; brown, 10YR 5/2, very soft, very cohesive	CL			
4	9	Sandy clay; very soft, very cohesive	SC		5.0′	Bulk 4-14′
9	13	Sandy clay; very soft, very cohesive	SC			
13	14	Clayey siltstone or silty claystone; 10YR 4/2, very firm, some limonite streaks on fractures or bedding	CL			ZP
		DTW on 8/22/11 at 8:51 = 5.0'				
		Plug and abandon boring on 8-22-11 with 1-50lb. bags of bentonite chips and fill remaining hole to surface with cuttings				
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ENGINEERING HYDROLOGY AND HYDROGEOLOGY

LOG OF BOREHOLE	BOREHOLE # DVC-2	Page 1 of 1
PROJECT: Ross ISR Plant Site Geotech	**DRILLER:** Bill Cameron Terracon S&E – Rapid City, SD	**DATE:** 8-19-11
CLIENT/LOCATION: Strata Energy/Oshoto, WY	**RIG:** CME 55-HT	**START:** 13:31
GROUND ELEVATION: 4133.41′ **COORDINATES:**	**BIT(S):** 4" Solid Stem Auger	**FINISH:** 13:47
N: 1486026 **E:** 714605	**FLUID:** None	**TOTAL DEPTH:** 19.0'
SURVEYED: YES NAD 83 WY East S.P.	**LOG BY:** M. Wolf, WY PG #614	**HOLE DIAMETER:** 4"

DEPTH From	DEPTH To	DESCRIPTION OF MATERIALS (ASTM D2488)	ASTM D2487 SYMBOL	BPF ASTM D1586	SWL	TEST, SAMPLES, OR NOTES
0	2	Clayey sand; dry	CL-SC			
2	4	Sandy clay; very firm, very dry	CL-SC			
4	6	Still fairly dry, as above	CL-SC			
6	14	Clayey sandstone; brown, moist, cohesive, gets wet and sticky at ~12', very soft	SC		7.7′	Wet Bulk 4-14′
14	17	Still very soft, clayey sand; sticky	SC			
17	19	Sandstone; very firm, silty, white $CaCO_3$ cement	SM			
		DTW on 8/22/11 at 8:50 = 7.7'				
		Plug and abandon boring on 8-22-11 with 1-50lb. bags of bentonite chips and fill remaining hole to surface with cuttings				
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ENGINEERING HYDROLOGY AND HYDROGEOLOGY

LOG OF BOREHOLE	BOREHOLE # DVC-3	Page 1 of 1
PROJECT: Ross ISR Plant Site Geotech	**DRILLER:** Bill Cameron Terracon S&E – Rapid City, SD	**DATE:** 8-19-11
CLIENT/LOCATION: Strata Energy/Oshoto, WY	**RIG:** CME 55-HT	**START:** 13:11
GROUND ELEVATION: 4135.23′ **COORDINATES:**	**BIT(S):** 4" Solid Stem Auger	**FINISH:** 13:22
N: 1485722 **E:** 714525	**FLUID:** None	**TOTAL DEPTH:** 14.0'
SURVEYED: YES NAD 83 WY East S.P.	**LOG BY:** M. Wolf, WY PG #614	**HOLE DIAMETER:** 4"

DEPTH From	DEPTH To	DESCRIPTION OF MATERIALS (ASTM D2488)	ASTM D2487 SYMBOL	BPF ASTM D1586	SWL	TEST, SAMPLES, OR NOTES
0	2	Silty clay; light brown	CL/SM			
2	4	Clayey sand; 10YR 5/2, moist cohesive	SC/CL			
4	7	Silty clay; dark brown, 10YR 4/2, very moist, very sticky, little sand	CL			
7	14	Firm clayey sandstone; soft, 10YR 6/3, yellow-brown	SC		~7′	
		"Will make water"!				
		Leave open overnight for water level				
		DTW on 8/22/11 at 8:52 = dry at 6.4'				
		Caved in over weekend! Assume cave-in to water level!				
		Plug and abandon boring on 8-22-11 with 1-50lb. bags of bentonite chips and fill remaining hole to surface with cuttings				
		Color designations from Munsell Soil Color Charts, U.S. Department Agriculture Handbook 18-Soil Survey Manual, Revised 2000.				

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ENGINEERING HYDROLOGY AND HYDROGEOLOGY

LOG OF BOREHOLE	BOREHOLE # DVC-4	Page 1 of 1
PROJECT: Ross ISR Plant Site Geotech	**DRILLER:** Bill Cameron Terracon S&E – Rapid City, SD	**DATE:** 8-19-11
CLIENT/LOCATION: Strata Energy/Oshoto, WY	**RIG:** CME 55-HT	**START:** 12:59
GROUND ELEVATION: 4136.79′ **COORDINATES:**	**BIT(S):** 4" Solid Stem Auger	**FINISH:** 13:11
N: 1485723 **E:** 714601	**FLUID:** None	**TOTAL DEPTH:** 14.0'
SURVEYED: YES NAD 83 WY East S.P.	**LOG BY:** M. Wolf, WY PG #614	**HOLE DIAMETER:** 4"

DEPTH From	DEPTH To	DESCRIPTION OF MATERIALS (ASTM D2488)	ASTM D2487 SYMBOL	BPF ASTM D1586	SWL	TEST, SAMPLES, OR NOTES
0	1	Sandy silt; dry	ML			
1	4	Clayey sand; few angular rock fragments	SC			
4	7.5	Clayey sand; few angular rock fragments	SC			
7.5	7.5	Silty sandstone; More Firm!	SM			
7.5	14	Clayey sandstone; 10YR 5/1, cohesive, moist	SC			
		Leave open over weekend				
		DTW on 8/22/11 at 8:55 = dry at 13.5'				
		Plug and abandon boring on 8-22-11 with drill cuttings to ground surface				
		Color designations from Munsell Soil Color Charts, U.S. Department Agriculture Handbook 18-Soil Survey Manual, Revised 2000.				

ABBREVIATIONS

DTW – Depth to Water
SWL – Static Water Level
ST – Shelby Tube Sample
GS – Geochemical Sample
O - Petroleum Odor

DBS – Disturbed Bulk Sample
REF – Refusal
SPT – Standard Penetration Test with Split Barrel Sample (ASTM D-1586)

CAL – California Tube Sample*
ZP – Ziplock Bag Sample
LA – Laboratory Analysis
PID – Instrument Response

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ENGINEERING HYDROLOGY AND HYDROGEOLOGY

LOG OF BOREHOLE	BOREHOLE # DVC-5	Page 1 of 1
PROJECT: Ross ISR Plant Site Geotech	**DRILLER:** Bill Cameron Terracon S&E – Rapid City, SD	**DATE:** 8-19-11
CLIENT/LOCATION: Strata Energy/Oshoto, WY	**RIG:** CME 55-HT	**START:** 12:49
GROUND ELEVATION: 4137.40′ **COORDINATES:**	**BIT(S):** 4" Solid Stem Auger	**FINISH:** 12:57
N: 1485403 **E:** 714505	**FLUID:** None	**TOTAL DEPTH:** 9.0'
SURVEYED: YES NAD 83 WY East S.P.	**LOG BY:** M. Wolf, WY PG #614	**HOLE DIAMETER:** 4"

DEPTH From	DEPTH To	DESCRIPTION OF MATERIALS (ASTM D2488)	ASTM D2487 SYMBOL	BPF ASTM D1586	SWL	TEST, SAMPLES, OR NOTES
0	1	Sandy topsoil; silty loose	SM			
1	7	Sandstone; 10YR 6/2 – 7/2, silty, little cohesive	SM		5.6′	
7	9	Sandy claystone – clayey sandstone; very cohesive, moist	SC			Bulk 1-9′
		Leave open over weekend				
		DTW on 8/22/11 at 8:58 = 5.6'				
		Plug and abandon boring on 8-22-11 with 1-50lb. bags of bentonite chips and fill remaining hole to surface with cuttings				
		Color designations from Munsell Soil Color Charts, U.S. Department Agriculture Handbook 18-Soil Survey Manual, Revised 2000.				

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ENGINEERING HYDROLOGY AND HYDROGEOLOGY

LOG OF BOREHOLE	BOREHOLE # DVC-6	Page 1 of 1
PROJECT: Ross ISR Plant Site Geotech	**DRILLER:** Bill Cameron Terracon S&E – Rapid City, SD	**DATE:** 8-19-11
CLIENT/LOCATION: Strata Energy/Oshoto, WY	**RIG:** CME 55-HT	**START:** 12:40
GROUND ELEVATION: 4142.44′ **COORDINATES:**	**BIT(S):** 4" Solid Stem Auger	**FINISH:** 12:48
N: 1485383 **E:** 714576	**FLUID:** None	**TOTAL DEPTH:** 9.0'
SURVEYED: YES NAD 83 WY East S.P.	**LOG BY:** M. Wolf, WY PG #614	**HOLE DIAMETER:** 4"

DEPTH From	DEPTH To	DESCRIPTION OF MATERIALS (ASTM D2488)	ASTM D2487 SYMBOL	BPF ASTM D1586	SWL	TEST, SAMPLES, OR NOTES
0	1	Sand; silty, 10YR 7/2, dry	SM			
1	4	Sandstone; silty and clay-rich 10YR 6/2	SM/SC			Bulk 1-4′
4	9	Silty sandstone; soft, little carbonaceous at ~7.5-8′	SM			Bulk 4-9′
		No apparent water following boring completion!				
		Left open for water check!				
		DTW on 8/22/11 at 8:59 = dry at 9.0'				
		Plug and abandon boring on 8-22-11 with drill cuttings to ground surface				
		Color designations from Munsell Soil Color Charts, U.S. Department Agriculture Handbook 18-Soil Survey Manual, Revised 2000.				

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ENGINEERING HYDROLOGY AND HYDROGEOLOGY

LOG OF BOREHOLE	BOREHOLE # DVC-7	Page 1 of 1
PROJECT: Ross ISR Plant Site Geotech	**DRILLER:** Bill Cameron Terracon S&E – Rapid City, SD	**DATE:** 8-19-11
CLIENT/LOCATION: Strata Energy/Oshoto, WY	**RIG:** CME 55-HT	**START:** 12:05
GROUND ELEVATION: 4139.34′ **COORDINATES:**	**BIT(S):** 4" Solid Stem Auger	**FINISH:** 12:35
N: 1485152 **E:** 714461	**FLUID:** None	**TOTAL DEPTH:** 15.0'
SURVEYED: YES NAD 83 WY East S.P.	**LOG BY:** M. Wolf, WY PG #614	**HOLE DIAMETER:** 4"

DEPTH From	DEPTH To	DESCRIPTION OF MATERIALS (ASTM D2488)	ASTM D2487 SYMBOL	BPF ASTM D1586	SWL	TEST, SAMPLES, OR NOTES
0	1	Clay; silty, dry	CL			
1	4	Clay; silty, 10YR 5/2 – 4/2, moist, cohesive	CL			Bulk 0-4′
4	11	Clay; silty, 10YR 5/2 – 4/2, moist, cohesive, firm at 11.0'	CL			
11	15	Claystone; silty, little sandy	CL/SC			
		Probably will make water!				
		Bedrock at 11.0'				
		Left open over weekend				
		DTW on 8/22/11 at 9:00 – caved to 5.0′				
		Estimated SWL = 5.0′ Assume cave-in to water level!				
		Plug and abandon boring on 8-22-11 with 1-50lb. bags of bentonite chips and fill remaining hole to surface with cuttings				
		Color designations from Munsell Soil Color Charts, U.S. Department Agriculture Handbook 18-Soil Survey Manual, Revised 2000.				

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ENGINEERING HYDROLOGY AND HYDROGEOLOGY

LOG OF BOREHOLE	BOREHOLE # DVC-8	Page 1 of 1
PROJECT: Ross ISR Plant Site Geotech	**DRILLER:** Bill Cameron Terracon S&E – Rapid City, SD	**DATE:** 8-19-11
CLIENT/LOCATION: Strata Energy/Oshoto, WY	**RIG:** CME55-HT	**START:** 12:05
GROUND ELEVATION: 4142.80′ **COORDINATES:**	**BIT(S):** 4" Solid Stem Auger	**FINISH:** 12:20
N: 1485062 **E:** 714576	**FLUID:** None	**TOTAL DEPTH:** 10.0'
SURVEYED: YES NAD 83 WY East S.P.	**LOG BY:** M. Wolf, WY PG #614	**HOLE DIAMETER:** 4"

DEPTH From	DEPTH To	DESCRIPTION OF MATERIALS (ASTM D2488)	ASTM D2487 SYMBOL	BPF ASTM D1586	SWL	TEST, SAMPLES, OR NOTES
0	1	Sand; silty, light buff, topsoil	SM			
1	4	Fill; sandy clay	SC			Bulk 0-4′
4	10	Sandstone; red, oxidized, very fine grained sandstone, very well cemented at 7 – 7.3' then sandy siltstone, less firm	SP			Bulk 4-10′
		Bedrock at 4.0'				
		DTW on 8/22/11 at 9:02 = dry at 9.0'				
		Plug and abandon boring on 8-22-11 with drill cuttings to ground surface				
		Color designations from Munsell Soil Color Charts, U.S. Department Agriculture Handbook 18-Soil Survey Manual, Revised 2000.				

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ENGINEERING HYDROLOGY AND HYDROGEOLOGY

LOG OF BOREHOLE	BOREHOLE # DWD-1	Page 1 of 1
PROJECT: Ross ISR Plant Site Geotech	**DRILLER:** Bill Cameron Terracon S&E – Rapid City, SD	**DATE:** 8-19-11
CLIENT/LOCATION: Strata Energy/Oshoto, WY	**RIG:** CME 55-HT	**START:** 9:20
GROUND ELEVATION: 4140.33′	**BIT(S):** 4" Solid Stem Auger	**FINISH:** 10:40
COORDINATES: **N:** 1485144 **E:** 714056	**FLUID:** None	**TOTAL DEPTH:** 32.0'
SURVEYED: YES NAD 83 WY East S.P.	**LOG BY:** M. Wolf, WY PG #614	**HOLE DIAMETER:** 7"

DEPTH From	DEPTH To	DESCRIPTION OF MATERIALS (ASTM D2488)	ASTM D2487 SYMBOL	BPF ASTM D1586	SWL	TEST, SAMPLES, OR NOTES
0	3	Silty clay; dry	CL			
3	5	Silty clay; dark, very moist & cohesive	CL			Bulk 3-5′
5	6.5	SPT (2/2/3) recovered 1.3′, Silty clay; little sandy	CL	5	5.0′	
6.5	10.0	Silty clay; soft, very cohesive, 10YR 4/2 – 5/2	CL			Bulk 5-7′
10	11.5	CAL (2/5/5) recovered 3 good rings, Silty & Sandy clay; firm, 10YR 4/2 – 5/2	CL	10*		
11.5	13.0	SPT (2/3/5) recovered 1.5′, Silty clay; little very fine grained sand, stiff	CL	8		
14	15.5	SPT (2/3/4) recovered 1.5′, Sandy clay; as above, very thin, sandy, hard ~0.05' thick, wet	CL	7		
19	20.5	SPT (1/1/2) recovered 1.7′, Sandy clay; very soft, very cohesive, very wet, very sticky, sands are very fine	CL/SC	3		
24	25.5	SPT (2/1/2) recovered 1.9′, Clayey sand; very, very fined grained, very, very soft, some flowing sand, very wet, fairly uniform, soupy cuttings with water	SC/SM	3		
29	30.5	SPT (4/2/4) recovered 1.5′		6		
29	29.8	Clayey sand	SC			
29.8	30.2	Sand; fine to coarse	SP			
30.2	30.4	Pebble gravel & coarse sand	GW			
30.4	30.4	Clay; grey, firm, sticky, advance auger 5' & drive again	CL			“Bedrock” at 31.3′
30.5	32.0	SPT (2/18/15) recovered 1.4′		33		
30.5	30.9	Sand; fine	SP			
30.9	31.3	Gravelly clay	GC			
31.3	32	Sandy siltstone; 10YR 6/2	ML			
		Plug and abandon boring on 8-22-11 with 6-50lb. bags of bentonite chips and fill remaining hole to surface with cuttings				
		Color designations from Munsell Soil Color Charts, U.S. Department Agriculture Handbook 18-Soil Survey Manual, Revised 2000.				

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ENGINEERING HYDROLOGY AND HYDROGEOLOGY

LOG OF BOREHOLE	BOREHOLE # LRP-1	Page 1 of 1
PROJECT: Ross ISR Plant Site Geotech	**DRILLER:** Bill Cameron Terracon S&E – Rapid City, SD	**DATE:** 8-18-11
CLIENT/LOCATION: Strata Energy/Oshoto, WY	**RIG:** CME 55-HT	**START:** 09:30
GROUND ELEVATION: 4132.61′	**BIT(S):** 4” Solid Stem Auger	**FINISH:** 10:38
COORDINATES: **N:** 1486166 **E:** 713357	**FLUID:** None	**TOTAL DEPTH:** 31.5′
SURVEYED: YES NAD 83 WY East S.P.	**LOG BY:** M. Wolf, WY PG #614	**HOLE DIAMETER:** 7”

DEPTH From	DEPTH To	DESCRIPTION OF MATERIALS (ASTM D2488)	ASTM D2487 SYMBOL	BPF ASTM D1586	SWL	TEST, SAMPLES, OR NOTES
0	5	Silty clay; mostly dry, firm, 10YR 5/2-5/2	CL			
5	6.5	SPT (4/5/4) recovered 1.0′		9		
5	5.2	Silty clay	CL/ML			Bulk 6.5-11.5′
5.2	5.7	Sand; silty, 10YR 6/3, dry	SM			
5.7	6.0	Silt; clay rich sandy, abundant salts, probably gypsum!	SM			
6.0	6.5	No core				
6.5	11.5	Little more firm at ~8.0′ “Bedrock”			9.15′	
11.5	13.0	CAL (11/16/19) recovered 3 good rings		35*		
		Silty sandstone; 3 good rings	SM			“Bedrock” Bulk 13-15′
13.0	14.5	SPT (6/10/16) recovered 1.5′				
		Siltstone; 10YR 6/3-7/2	ML	26		
15.0	16.5	CAL (11/14/17) recovered 3 ok rings				
		Sandy silt-silty sand; crumbly, 10YR 5/2-5/3, friable	SM	31*		Bedrock
16.5	18	SPT (8/12/16) recovered 1.6′	SM	28		
		Silty sandstone/sandy siltstone; cohesive, little clay				
18	24	Silty sandstone; little clay, 10YR 6/2-6/3	SM			
25	26.5	SPT (15/25/35) recovered 1.9′		60		
		Silty sandstone; 10YR 6/3-6/4, very, very fine, moist	SM			
30	31.5	SPT (13/22/26) recovered 1.5′		48		Little coal @ 29′
		Silty claystone; 10YR 4/1-5/1, very firm, very low permeability				
		Claystone at ~28′				
		DTW @ 7:14 on 8/19/11 = 9.15′ BGL				
		Plug and abandon boring on 8-19-11 with 6-50lb. bags of bentonite chips and fill remaining hole to surface with cuttings				
		Color designations from Munsell Soil Color Charts, U.S. Department Agriculture Handbook 18-Soil Survey Manual, Revised 2000.				

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ENGINEERING HYDROLOGY AND HYDROGEOLOGY

LOG OF BOREHOLE	BOREHOLE # LRP-2	Page 1 of 1
PROJECT: Ross ISR Plant Site Geotech	**DRILLER:** Bill Cameron Terracon S&E – Rapid City, SD	**DATE:** 8-18-11
CLIENT/LOCATION: Strata Energy/Oshoto, WY	**RIG:** CME 55-HT	**START:** 10:45
GROUND ELEVATION: 4134.94′	**BIT(S):** 4” Solid Stem Auger	**FINISH:** 11:30
COORDINATES: **N:** 1485708 **E:** 713357	**FLUID:** None	**TOTAL DEPTH:** 21.5′
SURVEYED: YES NAD 83 WY East S.P.	**LOG BY:** M. Wolf, WY PG #614	**HOLE DIAMETER:** 7”

DEPTH From	DEPTH To	DESCRIPTION OF MATERIALS (ASTM D2488)	ASTM D2487 SYMBOL	BPF ASTM D1586	SWL	TEST, SAMPLES, OR NOTES
0	3	Clay; dark, 10YR 4/2, silty	CL			
3	5	Silty sand	SM	9		
5	6.5	SPT (5/10/10) recovered 1.4′		20		
		Silty sand; poor sorting, fine to medium grained	SM			
6.5	9.0	As above				
9.0	11.5	Sandy clay; 10YR 5/3, moist, moderately cohesive	SC			Bulk 6.5-11.5′
11.5	13.0	CAL (4/8/6) recovered only 2 rings		14*		
		Silt at top and sand loose in bottom	SM			
13.0	14.5	SPT (3/4/4) recovered 1.6′		8	~13′	Bulk 13-14.5′
		Sand; brown, 10YR 3/2, silty, very soft	SP/SM			
14.5	16.0	CAL (3/3/5) recovered 3 good rings		8*		
		Top ring, clay, bottom ring, gravelly clay, fine gravel in shoe	GC			3-ok “Gravelly”
16	17.5	SPT (5/7/4) recovered 1.5′		11		
16	17.0	Gravelly sand and clay; little water	GM/GC			
17.0	17.5	Silty sandstone; 10YR 6/3, firm	SM			
20	21.5	SPT (4/4/5) recovered 1.4′		9		
20	20.5	Silty sandstone; 10YR 6/4, friable	ML			
20.5	21.5	Silty claystone; 10YR 4/3-5/2	CL			
		Very firm, fine laminations				
		DTW! Mud at 12.7′ @ 7:16 on 8/19/11				
		Plug and abandon boring on 8-19-11 with 3-50lb. bags of bentonite chips and fill remaining hole to surface with cuttings				
		Color designations from Munsell Soil Color Charts, U.S. Department Agriculture Handbook 18-Soil Survey Manual, Revised 2000.				

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ENGINEERING HYDROLOGY AND HYDROGEOLOGY

LOG OF BOREHOLE	BOREHOLE # LRP-3	Page 1 of 1
PROJECT: Ross ISR Plant Site Geotech	**DRILLER:** Bill Cameron Terracon S&E – Rapid City, SD	**DATE:** 8-18-11
CLIENT/LOCATION: Strata Energy/Oshoto, WY	**RIG:** CME 55-HT	**START:** 11:35
GROUND ELEVATION: 4134.10′	**BIT(S):** 4” Solid Stem Auger	**FINISH:** 12:25
COORDINATES: **N:** 1485938 **E:** 713587	**FLUID:** None	**TOTAL DEPTH:** 26.5′
SURVEYED: YES NAD 83 WY East S.P.	**LOG BY:** M. Wolf, WY PG #614	**HOLE DIAMETER:** 7”

DEPTH From	DEPTH To	DESCRIPTION OF MATERIALS (ASTM D2488)	ASTM D2487 SYMBOL	BPF ASTM D1586	SWL	TEST, SAMPLES, OR NOTES
0	2	Clay; silty, dark, dry, 10YR 5/1	CL			
2	5	Silty sand; 10YR 6/3, slightly moist	SM			
5	6.5	SPT (7/10/12) recovered 1.5′		22		
		Clay; silty 10YR 6/1, abundant salts, very firm	CL			
6.5	12.5	As above	CL			Bulk 6.5-12.0′
12.5	14.0	CAL (3/6/6) recovered 4 good rings		12*	12.25′	
		Clay; 10YR 5/2, very firm, very cohesive, silty	CL			
14.0	15.5	SPT (2/3/4) recovered 1.5′		7		
		Clay; dark, 10YR 4/2, very cohesive	CL			Bulk 15.5-18.0′
15.5	18	Clay; dark, firm	CL			Bulk 18-20′
18	20	Sandy clay; soft, sticky	SC			
20	21.5	CAL (5/8/11) recovered 4 good rings		19*		
		Think contact is in #1 or #2 liner				
20	21.0	Pebbley, sandy clay;	GC/SC			
21	21.5	Siltstone; 10YR 5/3, moderately firm	ML	22		
21.5	23.0	SPT (6/10/12) recovered 1.5′				
		Siltstone; 10YR 6/2-6/3, clay rich, very cohesive	ML/CL			
25	26.5	SPT (4/5/6) recovered 1.5′		11		
25	25.9	Siltstone; as above	ML			
25.9	26.5	Claystone; 10YR 5/2, silty, very firm				
		DTW @ 7:18 on 8/19/11 = 12.25′ BGL				
		Plug and abandon boring on 8-19-11 with 4-50lb. bags of bentonite chips and fill remaining hole to surface with cuttings				
		Color designations from Munsell Soil Color Charts, U.S. Department Agriculture Handbook 18-Soil Survey Manual, Revised 2000.				

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*CAL Blow Count

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ENGINEERING HYDROLOGY AND HYDROGEOLOGY

LOG OF BOREHOLE	BOREHOLE # LRP-4	Page 1 of 1
PROJECT: Ross ISR Plant Site Geotech	**DRILLER:** Bill Cameron Terracon S&E – Rapid City, SD	**DATE:** 8-18-11
CLIENT/LOCATION: Strata Energy/Oshoto, WY	**RIG:** CME 55-HT	**START:** 12:25
GROUND ELEVATION: 4133.41′	**BIT(S):** 4” Solid Stem Auger	**FINISH:** 13:15
COORDINATES: **N:** 1486171 **E:** 713930	**FLUID:** None	**TOTAL DEPTH:** 26.5′
SURVEYED: YES NAD 83 WY East S.P.	**LOG BY:** M. Wolf, WY PG #614	**HOLE DIAMETER:** 7”

DEPTH From	DEPTH To	DESCRIPTION OF MATERIALS (ASTM D2488)	ASTM D2487 SYMBOL	BPF ASTM D1586	SWL	TEST, SAMPLES, OR NOTES
0	4	Silty clay; dry	CL/ML			
4	5	Firm, stiff				
5	6.5	SPT (4/9/12) recovered 1.5′		21		
		Clay; dark, very firm, little salts	CL			
6.5	11.5	Clay; silty	CL			
						Bulk 6.5-11.5′
11.5	13.0	CAL (3/5/6) recovered 3 good rings		11*	11.88′	
		Clay; dark, silty and sandy	CL			
13.0	14.5	SPT (3/4/4) recovered 1.6′		8		
		Clay; silty, very soft, sticky, moderate sand content in shoe	CL			
15.0	16. 5	CAL (3/4/5) recovered 3 good rings		9*		
		Sandy clay; soft, wet, sticky	SC			
16.5	18.0	SPT (2/3/5) recovered 1.7′	CL/SC	8		
		Sandy clay; very soft and sticky				
20	21.5	SPT (2/3/4) recovered 1.9′ (soft)		7		
		Sandy clay; olive brown, 10YR 5/3, very soft, very cohesive, firm @ 23.5′	CL/SC			
25	26.5	SPT (3/6/6) recovered 1.2′		12		
25	25.9	Claystone; olive brown, firm	CL			
25.9	26.2	Sandy siltstone; soft, friable, little clay	SM			
		DTW @ 7:20 on 8-19-11 = 11.88′ BGL				
		Plug and abandon boring on 8-19-11 with 5-50lb. bags of bentonite chips and fill remaining hole to surface with cuttings				
		Color designations from Munsell Soil Color Charts, U.S. Department Agriculture Handbook 18-Soil Survey Manual, Revised 2000.				

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ENGINEERING HYDROLOGY AND HYDROGEOLOGY

LOG OF BOREHOLE	BOREHOLE # LRP-5	Page 1 of 1
PROJECT: Ross ISR Plant Site Geotech	**DRILLER:** Bill Cameron Terracon S&E – Rapid City, SD	**DATE:** 8-18-11
CLIENT/LOCATION: Strata Energy/Oshoto, WY	**RIG:** CME 55-HT	**START:** 13:20
GROUND ELEVATION: 4134.11′	**BIT(S):** 4” Solid Stem Auger	**FINISH:** 14:00
COORDINATES: **N:** 1485940 **E:** 714137	**FLUID:** None	**TOTAL DEPTH:** 30.5′
SURVEYED: YES NAD 83 WY East S.P.	**LOG BY:** M. Wolf, WY PG #614	**HOLE DIAMETER:** 7”

DEPTH From	DEPTH To	DESCRIPTION OF MATERIALS (ASTM D2488)	ASTM D2487 SYMBOL	BPF ASTM D1586	SWL	TEST, SAMPLES, OR NOTES
0	5	Silty clay; brown, stiff, dry to 3′ then moist	CL			
5	6.5	SPT (4/5/6) recovered 1.1′		11		
		Silty clay; brown, 10YR 5/2, firm, very cohesive	CL			
6.5	12.5	Silty clay; as above, little sandy	CL		10.0′	Bulk 6.5-12.5′
12.5	14.0	CAL (1/3/2) recovered 3 good rings		5*		
		Sandy silty clay; 10YR 5/2, soft, sticky	CL			
14	15.5	SPT (0/2/2) recovered 1.8′		4		Bulk 13-15′
		Clayey sand; with sparse small pebbles, very soft, very wet, very cohesive	SC			
20	21.5	CAL (3/5/8) recovered 4 good rings		13*		
		Sandy clay; olive brown, 10YR 4/2, very cohesive	CL/SC			
21.5	23	SPT (4/5/6) recovered 1.6′		11		
		Clay; dark, 10YR 4/2, very cohesive, sandy	CL			
25	26.5	SPT (3/4/3) recovered 2.0′		7		
		Clay; sandy, brown-gray, mottling, few small angular rock fragments	CL			
30	31.5	SPT (2/2/4) recovered 1.5′		6		
30	30.2	Coarse sand; clayey	SP			
30.2	30.5	Silty clay; gray	CL/ML			
30.5	31.3	Gravelly sand; fine pebbles, wet, poor sorting	GP			
31.3	31.5	Claystone; gray, coal fragments “Bedrock”	CL			
		DTW @ 7:22 on 8-19-11 = 10.0′ BGL				
		Plug and abandon boring on 8-19-11 with 5-50lb. bags of bentonite chips and fill remaining hole to surface with cuttings				
		Color designations from Munsell Soil Color Charts, U.S. Department Agriculture Handbook 18-Soil Survey Manual, Revised 2000.				

ABBREVIATIONS

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ENGINEERING HYDROLOGY AND HYDROGEOLOGY

LOG OF BOREHOLE	BOREHOLE # LRP-6	Page 1 of 1
PROJECT: Ross ISR Plant Site Geotech	**DRILLER:** Bill Cameron Terracon S&E – Rapid City, SD	**DATE:** 8-18-11
CLIENT/LOCATION: Strata Energy/Oshoto, WY	**RIG:** CME 55-HT	**START:** 14:05
GROUND ELEVATION: 4132.01′	**BIT(S):** 4” Solid Stem Auger	**FINISH:** 14:55
COORDINATES: **N:** 1486168 **E:** 714343	**FLUID:** None	**TOTAL DEPTH:** 26.5′
SURVEYED: YES NAD 83 WY East S.P.	**LOG BY:** M. Wolf, WY PG #614	**HOLE DIAMETER:** 7”

DEPTH From	DEPTH To	DESCRIPTION OF MATERIALS (ASTM D2488)	ASTM D2487 SYMBOL	BPF ASTM D1586	SWL	TEST, SAMPLES, OR NOTES
0	5	Silty clay; dry, 10YR 5/2-5/3, firm	CL			
5	6.5	SPT (3/8/7) recovered 1.3′		15		
		Siltstone; brown, 10YR 6/2, firm, little salts	ML			
6.5	10.5	Clayey silt; brown, moist, moderately cohesive	ML		10.0′	Bulk 6.5-10.5′
10.5	12.0	CAL (4/6/6) recovered 3 good rings		12*		
		Clayey sand; 10YR 6/2-6/3, soft, sticky in drive shoe, top rings-silty, bottom ring-sandy, drive shoe is clayey sand	SC			Bulk 13.0 14.5′
12	13.5	SPT (2/3/4) recovered 1.8′		7		
		Silty-sandy clay; very cohesive, very moist	CL			
14.5	16.0	CAL (3/4/4) recovered 4 good rings		8*		
		Sandy clay; brown, abundant silt, very cohesive	CL/SC			
16.0	17.5	SPT (2/4/4) recovered 1.8′		8		
		Silty-sandy clay; brown, thin sandy lams	CL			
20	21.5	SPT (2/3/4) recovered 1.9′		7		
		Sandy silt; “may be weathered bedrock?”	ML/SM			
25	26.5	SPT (2/2/4) recovered 1.7′		6		
		Silty sandstone-sandy siltstone; 10YR 6/2-7/2	SM			
		soft, very friable, very wet, little cohesive				
		DTW @ 7:24 on 8-19-11 = 10.0′ BGL				
		Plug and abandon boring on 8-19-11 with 6-50lb. bags of bentonite chips and fill remaining hole to surface with cuttings				
		Color designations from Munsell Soil Color Charts, U.S. Department Agriculture Handbook 18-Soil Survey Manual, Revised 2000.				

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ENGINEERING HYDROLOGY AND HYDROGEOLOGY

LOG OF BOREHOLE	BOREHOLE # LRP-7	Page 1 of 1
PROJECT: Ross ISR Plant Site Geotech	**DRILLER:** Bill Cameron Terracon S&E – Rapid City, SD	**DATE:** 8-18-11
CLIENT/LOCATION: Strata Energy/Oshoto, WY	**RIG:** CME 55-HT	**START:** 15:00
GROUND ELEVATION: 4135.23′ **COORDINATES:**	**BIT(S):** 4” Solid Stem Auger	**FINISH:** 15:30
N: 1485707 **E:** 714339	**FLUID:** None	**TOTAL DEPTH:** 23.0′
SURVEYED: YES NAD 83 WY East S.P.	**LOG BY:** M. Wolf, WY PG #614	**HOLE DIAMETER:** 7”

DEPTH From	DEPTH To	DESCRIPTION OF MATERIALS (ASTM D2488)	ASTM D2487 SYMBOL	BPF ASTM D1586	SWL	TEST, SAMPLES, OR NOTES
0	5	Silty clay; little sandy	CL			
5	6.5	SPT (2/2/2) recovered 1.3′		4	4.8′	
		Sandy clay; very soft, very sticky	CL/SC			Bulk 6.5-10′
10	11.5	CAL (4/5/6) recovered 3 good rings		11*		
		Sandy silty clay; 10YR 5/2, very cohesive	CL/SC			
11.5	13.0	SPT (2/3/4) recovered 1.5′		7		
		Sandy clay; very soft, very sticky	CL			
13.5	15.0	CAL (2/3/3) recovered 4 good brass rings		6*		
		Sandy clay; 10YR 4/3-5/2, very cohesive	CL			Bulk 15-18′
15	18	Soft sandy clay	CL-SC			
18		Very firm – think bedrock ~18-18.5′				
20	21.5	CAL (11/16/17) recovered 4 good rings		33*		
		Siltstone – sandstone; very firm, very hard	ML/SM			
21.5	23.0	SPT (8/12/28) recovered 1.7′		40		
		Silty sandstone; 10YR 6/1-7/1, very, very fine, very firm, sparse coal fragments	SM			
		DTW @ 7:26 on 8-19-11 = 4.8′ BGL				
		Plug and abandon boring on 8-19-11 with 4-50lb. bags of bentonite chips and fill remaining hole to surface with cuttings				
		Color designations from Munsell Soil Color Charts, U.S. Department Agriculture Handbook 18-Soil Survey Manual, Revised 2000.				

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ENGINEERING HYDROLOGY AND HYDROGEOLOGY

LOG OF BOREHOLE	BOREHOLE # LRP-8	Page 1 of 1
PROJECT: Ross ISR Plant Site Geotech	**DRILLER:** Bill Cameron Terracon S&E – Rapid City, SD	**DATE:** 8-18-11
CLIENT/LOCATION: Strata Energy/Oshoto, WY	**RIG:** CME 55-HT	**START:** 15:35
GROUND ELEVATION: 4137.42′	**BIT(S):** 4” Solid Stem Auger	**FINISH:** 15:40
COORDINATES: **N:** 1485365 **E:** 714249	**FLUID:** None	**TOTAL DEPTH:** 31.5′
SURVEYED: YES NAD 83 WY East S.P.	**LOG BY:** M. Wolf, WY PG #614	**HOLE DIAMETER:** 7”

DEPTH From	DEPTH To	DESCRIPTION OF MATERIALS (ASTM D2488)	ASTM D2487 SYMBOL	BPF ASTM D1586	SWL	TEST, SAMPLES, OR NOTES
0	5	Sandy silty clay	CL			
5	6.5	SPT (1/2/3) recovered 1.7′		5	4.8′	
		Silty clay; 10YR 5/2-5/3, very soft, little sand, very sticky	CL			
10	11.5	CAL (1/2/3) recovered 2 good rings		5*		
		Sandy clay-clayey sand; bottom slid	CL/SC			Zip of bottom
11.5	13.0	SPT (1/1/2) recovered 1.8′				
		Clayey sand; 10YR 5/3-6/3, very, very soft	SC	3		
15.5	17.0	CAL (3/4/5) recovered 3 good rings “bottom slid out”		9*		
		Sandy clay-clayey sand; very soft	CL-SC			
17	18.5	SPT (1/2/3) recovered 1.7′		5		
		Clayey sand-sandy clay; very soft	SC/CL			
20	21.5	SPT (1/1/2) recovered 2.0′		3		
		Clayey sand; very, very soft, very sticky, very, very cohesive	SC			
25	26.5	SPT (0/1/2) recovered 1.4′		4		
		Clayey sand; very, very, very soft, very sparse small pebbles	SC			
26.5	27.5	Soft	SC			
27.5	30.0	Firm, probably bedrock?				
30.0	31.5	SPT (4/6/10) recovered 1.2′		16		
		Sandy siltstone-silty sandstone; 10YR 6/2-7/2, firm but friable, laminated	SC			
		DTW @ 7:28 on 8-19-11 = 4.8′ BGL				
		Plug and abandon boring on 8-19-11 with 5-50lb. bags of bentonite chips and fill remaining hole to surface with cuttings				
		Color designations from Munsell Soil Color Charts, U.S. Department Agriculture Handbook 18-Soil Survey Manual, Revised 2000.				

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ENGINEERING HYDROLOGY AND HYDROGEOLOGY

LOG OF BOREHOLE	BOREHOLE # RD-1	Page 1 of 1
PROJECT: Ross ISR Plant Site Geotech	**DRILLER:** Bill Cameron Terracon S&E – Rapid City, SD	**DATE:** 8-19-11
CLIENT/LOCATION: Strata Energy/Oshoto, WY	**RIG:** CME 55-HT	**START:** 11:42
GROUND ELEVATION: 4149.00′ **COORDINATES:**	**BIT(S):** 4" Solid Stem Auger	**FINISH:** 12:00
N: 1485578 **E:** 714899	**FLUID:** None	**TOTAL DEPTH:** 10.5'
SURVEYED: YES NAD 83 WY East S.P.	**LOG BY:** M. Wolf, WY PG #614	**HOLE DIAMETER:** 4"

DEPTH From	DEPTH To	DESCRIPTION OF MATERIALS (ASTM D2488)	ASTM D2487 SYMBOL	BPF ASTM D1586	SWL	TEST, SAMPLES, OR NOTES
0	1	Soil; sandy silt	ML			
1	4	Silty claystone; little detrital coal, 10YR 5/3 – 6/2	CL/ML			
4	5.5	SPT (7/14/15) recovered 1.5′, Silty claystone; 10YR 6/1 – 6/2	CL	29		
5.5	9	Firm – Bedrock !				
9	10.5	SPT (19/44/50 for 4") recovered 1.6′		100+		
9	9.4	Silty sandstone; 10YR 6/3, friable	SM			
9.4	10.5	Sandstone; 10YR 7/2, very, very fine, clean, dry	SP			
		Dry – backfill hole				
		Plug and abandon boring on 8-19-11 with drill cuttings to ground surface				
		Color designations from Munsell Soil Color Charts, U.S. Department Agriculture Handbook 18-Soil Survey Manual, Revised 2000.				

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ENGINEERING HYDROLOGY AND HYDROGEOLOGY

LOG OF BOREHOLE	BOREHOLE # RD-2	Page 1 of 1
PROJECT: Ross ISR Plant Site Geotech	**DRILLER:** Bill Cameron Terracon S&E – Rapid City, SD	**DATE:** 8-19-11
CLIENT/LOCATION: Strata Energy/Oshoto, WY	**RIG:** CME 55-HT	**START:** 11:15
GROUND ELEVATION: 4161.62′	**BIT(S):** 4" Solid Stem Auger	**FINISH:** 11:41
COORDINATES: **N:** 1485673 **E:** 715168	**FLUID:** None	**TOTAL DEPTH:** 10.5'
SURVEYED: YES NAD 83 WY East S.P.	**LOG BY:** M. Wolf, WY PG #614	**HOLE DIAMETER:** 4"

DEPTH From	DEPTH To	DESCRIPTION OF MATERIALS (ASTM D2488)	ASTM D2487 SYMBOL	BPF ASTM D1586	SWL	TEST, SAMPLES, OR NOTES
0	2	Soil; silty sand	SM			
2	4	Silty sandstone; 10YR 6/2 – 7/2, very fine, dry	SM			
4	5.5	SPT (10/16/50 for 3") recovered 1.4′		100+		
4	4.9	Sandstone; silty, 10YR 7/2, friable	SM			
4.9	5.3	Sandstone; 10YR 8/1, very, very hard, well cemented	SM/ROCK			
9	10.5	SPT (22/48/50 for 5") recovered 1.8, Sandstone; 10YR 7/2 – 7/3, silty, moderate cement, silty, friable, breaks on bedding	SM/SP	100+		
		"No water" - backfill				
		Plug and abandon boring on 8-19-11 with drill cuttings to ground surface				
		Color designations from Munsell Soil Color Charts, U.S. Department Agriculture Handbook 18-Soil Survey Manual, Revised 2000.				

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ENGINEERING HYDROLOGY AND HYDROGEOLOGY

LOG OF BOREHOLE	BOREHOLE # RD-3	Page 1 of 1
PROJECT: Ross ISR Plant Site Geotech	**DRILLER:** Bill Cameron Terracon S&E – Rapid City, SD	**DATE:** 8-19-11
CLIENT/LOCATION: Strata Energy/Oshoto, WY	**RIG:** CME 55-HT	**START:** 10:47
GROUND ELEVATION: 4198.80′ **COORDINATES:**	**BIT(S):** 4" Solid Stem Auger	**FINISH:** 11:10
N: 1485736 **E:** 715649	**FLUID:** None	**TOTAL DEPTH:** 10.5'
SURVEYED: YES NAD 83 WY East S.P.	**LOG BY:** M. Wolf, WY PG #614	**HOLE DIAMETER:** 4"

DEPTH From	DEPTH To	DESCRIPTION OF MATERIALS (ASTM D2488)	ASTM D2487 SYMBOL	BPF ASTM D1586	SWL	TEST, SAMPLES, OR NOTES
0	2	Soil; silty sand	SM			
2	4	Silty sandstone; soft friable	SM			
4	5.5	SPT (9/15/16) recovered 1.6′, Silty sandstone; 10YR 6/3 – 7/2, very, very fine grained, friable	SM	31		
5.5	9.0	SPT (9/15/16) recovered 1.6′, Silty sandstone; 10YR 6/3 – 7/2, very, very fine grained, friable	SM			
9	10.5	SPT (13/17/25) recovered 1.6′, Sandstone; 10YR 6/3, very fine grained, moderately clean, very friable	SP	42		
		No water - backfill				
		Plug and abandon boring on 8-19-11 with drill cuttings to ground surface				
		Color designations from Munsell Soil Color Charts, U.S. Department Agriculture Handbook 18-Soil Survey Manual, Revised 2000.				

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ENGINEERING HYDROLOGY AND HYDROGEOLOGY

LOG OF BOREHOLE	BOREHOLE # SA42-18-1	Page 1 of 1
PROJECT: Ross ISR Plant Site Groundwater Wells	**DRILLER:** Bill Cameron Terracon S&E – Rapid City, SD	**DATE:** 8-27-11
CLIENT/LOCATION: Strata Energy/Oshoto, WY	**RIG:** CME 55-HT	**START:** 10:24
GROUND ELEVATION: 4133.78′	**BIT(S):** 8 ¼ HSA Continuous Core	**FINISH:** 12:45
COORDINATES: **N:** 1486697 **E:** 713257	**FLUID:** None	**TOTAL DEPTH:** 29.5'
SURVEYED: YES NAD 83 WY East S.P.	**LOG BY:** M. Wolf, WY PG #614	**HOLE DIAMETER:** 8 ¼ "

DEPTH From	DEPTH To	DESCRIPTION OF MATERIALS (ASTM D2488)	ASTM D2487 SYMBOL	BPF ASTM D1586	SWL	TEST, SAMPLES, OR NOTES
0	1	Silty clay; dry, hard, abundant roots, notable displacive salts	CL			0-1′; 1-3′ core
1	3	Same, less roots, notable displacive salts	CL			
3	5	ST. Only got 1.7′, very hard, crush shelby tube, very hard. ST=3-4.7′	CL			
5	6.5	SPT (6/8/9) recovered 1.4′		17		ZP
5	5.9	Clay; silty, hard	CL			
5.9	6.5	Sand; very fine, clay and silt-rich core. 6-8″ in tube, sandy	SM			
8	9.5	SPT (5/7/12) recovered 1.4′		19		ZP
		Sands; very, very fine, may be bedrock	SP/SM			
8	13	Clayey sandstone	SC			
						11-13′ core
13	14.5	SPT (15/17/23) recovered 1.5′		40		
		Siltstone; very firm, friable	ML			ZP
14.5	18	Clayey sandstone	SC			16-18′ core
18	19.5	SPT (13/24/25) recovered 1.8′	SM	49		
		Silty sandstone; very, very fine, moist				
19.5	23	Same; sandstone, silty, firm	SM			21-23′ core
23	24.5	SPT (8/14/17) recovered 1.8′		31		
		As above, sandstone, very fine and silty	SM			
24.5	27.3	Sandstone; silty				
27.3	28	Claystone; very dark, gradational contact	CL			
27.5	28	Claystone; As above	CL			
28	29.5	CAL (8/16/21) recovered 3 ok rings		37*		
		Claystone; dark, very hard, fractures? Silty, moderately organic	CL			
		8/31/11 DTW @ 14:35 = 13.58′ BTOC				
		pH = 8.18; Temp. °C = 12.1; EC = 1720 µs				
		Color designations from Munsell Soil Color Charts, U.S. Department Agriculture Handbook 18-Soil Survey Manual, Revised 2000.				

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ENGINEERING HYDROLOGY AND HYDROGEOLOGY

LOG OF BOREHOLE	BOREHOLE # SA43-18-4	Page 1 of 1
PROJECT: Ross ISR Plant Site Groundwater Wells	**DRILLER:** Bill Cameron Terracon S&E – Rapid City, SD	**DATE:** 8-28-11
CLIENT/LOCATION: Strata Energy/Oshoto, WY	**RIG:** CME 55-HT	**START:** 10:05
GROUND ELEVATION: 4141.40′	**BIT(S):** 10 HSA Continuous Core	**FINISH:** 11:30
COORDINATES: **N:** 1485144 **E:** 713942	**FLUID:** None	**TOTAL DEPTH:** 26.5'
SURVEYED: YES NAD 83 WY East S.P.	**LOG BY:** M. Wolf, WY PG #614	**HOLE DIAMETER:** 10 ¼ "

DEPTH From	DEPTH To	DESCRIPTION OF MATERIALS (ASTM D2488)	ASTM D2487 SYMBOL	BPF ASTM D1586	SWL	TEST, SAMPLES, OR NOTES
0	3	Clay; silty, hard, dry, roots to 0.6′	CL			
3	5	ST only recovered sample from 3′-4′. Pulled out bottom; clay, moist	CL		~5.0′	
5	6.5	SPT (2/3/5) recovered 1.4′		8		
		Clay; brown, 10YR 4/2-5/2, silty, moist, very cohesive	CL			
6.5	8	Core #2 recovered 5.0′, Clay, silty, salts	CL			
8	10	ST recovered 1.7′, Clay; silty, moist, cohesive	CL			
10	11.5	SPT (2/3/4) recovered 1.4′		7		
		Sand; light buff, very, very fine, moderate clay, wet, moderately cohesive	SM/SP			May be bedrock
11.5	13	Core #3				
13	15	ST recovered 1.9′, Clay; sandy, silty, dark brown	CL			
15	16.5	SPT (3/4/6) recovered 1.7′		10		
		Clay; silty and sandy, gray-brown, very firm, cohesive	CL			Core 15-16.4′
16.5	18	Core #4 recovered 5.0′, Clay; dark, silty and sandy	CL			Core 17-18′
18	20	ST recovered 2.0′, Clay; sandy and silty	CL			
20	21.5	SPT (2/3/3) recovered 1.5′		6		
		Sand and clayey sand; very, very fine, brown, moderately cohesive, wet	SC/SP			
21.5	23	Core #5 recovered 4.0′				
21	22.5	Sandy ~ clayey sand; very wet, “best sand”				Core 21-22.5′
23	25	ST recovered 2.0′, may end in weathered bedrock?				
		Claystone-siltstone				
25	26.5	SPT (2/5/7) recovered 1.4′		12		
		Claystone; gray tan, mottled with limonite, oxidized, very firm, bedrock				
		Build well 5-25′ =4” screen				
		8/31/11 DTW @ 11:55 = 8.19′ BTOC				
		Pump another 50 gallons for additional development!				
		pH = 7.75; Temp. °C = 9.1; EC = 1130 µs				
		Color designations from Munsell Soil Color Charts, U.S. Department Agriculture Handbook 18-Soil Survey Manual, Revised 2000.				

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ENGINEERING HYDROLOGY AND HYDROGEOLOGY

LOG OF BOREHOLE	BOREHOLE # SA43-18-5	Page 1 of 1
PROJECT: Ross ISR Plant Site Groundwater Wells	**DRILLER:** Bill Cameron Terracon S&E – Rapid City, SD	**DATE:** 8-27-11
CLIENT/LOCATION: Strata Energy/Oshoto, WY	**RIG:** CME 55-HT	**START:** 13:00
GROUND ELEVATION: 4134.83′ **COORDINATES:**	**BIT(S):** Continuous Core Tool	**FINISH:** 14:30
N: 1485750 **E:** 714101	**FLUID:** None	**TOTAL DEPTH:** 31.0'
SURVEYED: YES NAD 83 WY East S.P.	**LOG BY:** M. Wolf, WY PG #614	**HOLE DIAMETER:** 8 ¼ "

DEPTH From	DEPTH To	DESCRIPTION OF MATERIALS (ASTM D2488)	ASTM D2487 SYMBOL	BPF ASTM D1586	SWL	TEST, SAMPLES, OR NOTES
0	3	Core #1 recovered 3.0 feet				Core 0-1
0	1.0	Silty clay; brown, dry, very hard, roots	CL			
1.0	3.0	As above; still dry and hard	CL			
3.0	8.0	Core #2 recovered 5.0′				
3.0	8.0	Clay; silty, very soft, very stick, very moist, salts	CL		~9.6′	
13	18	Core #3, Clay; very sticky, very cohesive	CL			
18	23	Core #4 recovered 2.0′, bottom slid out				
18	20	As above; very soft	CL			
20	23	Slid out of sampler – “Lost”				
23	28	Core #5 recovered 5.0′				
23	25.7	Clay; silty, mottled, firm, very cohesive	CL			No gravel
25.7	28	Siltstone; dark brown, sandy, “bedrock”	ML			Weathered, fractures
28	29.5	CAL (8/13/16) recovered 3 ok rings		29*		
		Siltstone; gray-brown, fractures, very firm	ML			
29.5	31.0	SPT (6/11/16) recovered 1.6′		27		
		Siltstone – claystone; dark brown, very firm	ML-CL			
		“Poor location for aquifer test”				
		Plug and abandon boring on 8-19-11 with 5-50lb. bags of bentonite chips and fill remaining hole to surface with cuttings				
		Color designations from Munsell Soil Color Charts, U.S. Department Agriculture Handbook 18-Soil Survey Manual, Revised 2000.				

ABBREVIATIONS

DTW – Depth to Water
SWL – Static Water Level
ST – Shelby Tube Sample
GS – Geochemical Sample
O - Petroleum Odor

DBS – Disturbed Bulk Sample
REF – Refusal
SPT – Standard Penetration Test with Split Barrel Sample (ASTM D-1586)

CAL – California Tube Sample*
ZP – Ziplock Bag Sample
LA – Laboratory Analysis
PID – Instrument Response

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ENGINEERING HYDROLOGY AND HYDROGEOLOGY

LOG OF BOREHOLE	BOREHOLE # SA43-18-6	Page 1 of 1
PROJECT: Ross ISR Plant Site Groundwater Wells	**DRILLER:** Bill Cameron Terracon S&E – Rapid City, SD	**DATE:** 8-26-11
CLIENT/LOCATION: Strata Energy/Oshoto, WY	**RIG:** CME 55-HT	**START:** 10:24
GROUND ELEVATION: 4141.30′	**BIT(S):** 8 ¼ HSA Continuous Core	**FINISH:** 12:45
COORDINATES: **N:** 1485146 **E:** 713910	**FLUID:** None	**TOTAL DEPTH:** 29.5'
SURVEYED: YES NAD 83 WY East S.P.	**LOG BY:** M. Wolf, WY PG #614	**HOLE DIAMETER:** 8 ¼ "

DEPTH From	DEPTH To	DESCRIPTION OF MATERIALS (ASTM D2488)	ASTM D2487 SYMBOL	BPF ASTM D1586	SWL	TEST, SAMPLES, OR NOTES
0	1	Topsoil; roots	CL			
1	3	Silty clay	CL			
3	5	Silty clay	CL	31		Bulk 3-5′
5	6.5	SPT (2/3/5) recovered 1.5′		8	~5.0	Bulk 5-7′
		Silty clay; 10YR 4/1, very moist, very cohesive	CL			
		Core 3-8′, sandy at bottom				
8	10	ST. Sandy at base	SC			
10	11.5	CAL (3/5/7) recovered 3 good rings		12*		
		Clay; with interbedded sandy bands	CLAY			
13	15	ST. Sandy clay at base	CL/SC	12*		
15	16.5	CAL (3/5/7) recovered 2 OK ring				Omit 13-17′
		Top is loose sand fill, bottom 2 rings, clay rich				
16.5	18	Clay; and thin sandy lenses	CL/SP	lenses		Core 17-18′
18	20	ST. Shelby tube. Clay but sandy near bottom	CL			
20	21.5	CAL (2/3/4) recovered 3 good rings		7*		
		Sand; clay-rich, very fine, very soft, ziplock of sandy lenses	SM/SP			ZP
21.5	23	Clayey sand; soft, no core, very fine grained	SC			Wet
23	25	ST				
25	26.5	CAL (4/6/8) recovered 2 OK rings		14*		
		Clayey sand; top loose, flowing!	SC			ZIP
26.5	27.5	Sand clayey; medium to coarse, rock fragments, may be near weathered bedrock				Bedrock 27-27.5′; 27-28′
27.5	28	Weathered claystone; siltstone	CL/ML			
28	30	ST. Weathered siltstone bedrock	ML			
30	31.5	CAL (9/13/17) recovered 3 good lines				
		Claystone; silty, wood/coal fragments, bedrock	CL	30		
		8/31/11 DTW @ 11:58 = 8.50′ BTOC				
		Pump an additional 50 gallons for development!				
		pH = 7.65; Temp.°C = 9.0; EC = 1318 µs				
		Color designations from Munsell Soil Color Charts, U.S. Department Agriculture Handbook 18-Soil Survey Manual, Revised 2000.				

ABBREVIATIONS

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ZP – Ziplock Bag Sample
LA – Laboratory Analysis
PID – Instrument Response

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ENGINEERING HYDROLOGY AND HYDROGEOLOGY

LOG OF BOREHOLE	BOREHOLE # SA43-18-7	Page 1 of 1
PROJECT: Ross ISR Plant Site Groundwater Wells	**DRILLER:** Bill Cameron Terracon S&E – Rapid City, SD	**DATE:** 8-27-11
CLIENT/LOCATION: Strata Energy/Oshoto, WY	**RIG:** CME 55-HT	**START:** 14:50
GROUND ELEVATION: 4133.76′ **COORDINATES:**	**BIT(S):** Continuous Core Tool	**FINISH:** 16:30
N: 1485950 **E:** 714185	**FLUID:** None	**TOTAL DEPTH:** 33.5'
SURVEYED: YES NAD 83 WY East S.P.	**LOG BY:** M. Wolf, WY PG #614	**HOLE DIAMETER:** 8 ¼ "

DEPTH From	DEPTH To	DESCRIPTION OF MATERIALS (ASTM D2488)	ASTM D2487 SYMBOL	BPF ASTM D1586	SWL	TEST, SAMPLES, OR NOTES
		Test well 50′ East of LRP-5				
0	3	Core #1 recovered 3.0′				
		Clay; silty, brown, dry, roots abundant at surface	CL			
3	8	Core #2 recovered 5.0′				
		Clay; silty, brown, moist, salts, cohesive	CL			
8	13	Core #3 recovered 5.0′			10.3′	
8	11.5	Clay; brown and sandy clay, soft	CL			
11.5	13	Sandy clay; very soft, very wet, very sticky	SC			
13	18	Core #4 recovered 5.0′				
		Clay; as above, however, thin sandy interbeds 14.4′-14.9′ and 16.2′-16.5′	CL & SC			
18	23	Core #5. Clay; with sand 19.2′-19.5′	CL/SP			
23	28	Core #6. All slid out. Go back into boring with catcher				
		Clay; silty and sandy, keep 24-26′ and 26-28′	CL			
28	33	Core #7 recovered 5.0′				
28	29	Gravelly, sandy clay	GC			Photo
29	30.5	Siltstone; light brown, firm, friable	ML			
30.5	33.0	Claystone; dark, silty	CL			
33	34.5	SPT (9/19/29) recovered 1.7′		48		
		Claystone-siltstone; dark, very, very firm, 10YR 4/2	CL-ML			
		8/31/11 DTW @ 11:52 = 11.37′ BTOC				
		Pump 15 gallons for additional development!				
		pH = 8.1; Temp. °C = 11.1; EC = 6.11 mS or 6110 µs				
		Color designations from Munsell Soil Color Charts, U.S. Department Agriculture Handbook 18-Soil Survey Manual, Revised 2000				

ABBREVIATIONS

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CAL – California Tube Sample*
ZP – Ziplock Bag Sample
LA – Laboratory Analysis
PID – Instrument Response

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ENGINEERING HYDROLOGY AND HYDROGEOLOGY

LOG OF BOREHOLE	BOREHOLE # SA43-18-8	Page 1 of 1
PROJECT: Ross ISR Plant Site Groundwater Wells	**DRILLER:** Bill Cameron Terracon S&E – Rapid City, SD	**DATE:** 8-28-11
CLIENT/LOCATION: Strata Energy/Oshoto, WY	**RIG:** CME 55-HT	**START:** 08:20
GROUND ELEVATION: 4136.11′ **COORDINATES:**	**BIT(S):** Continuous Core Tool	**FINISH:** 09:25
N: 1485725 **E:** 713925	**FLUID:** None	**TOTAL DEPTH:** 19.5'
SURVEYED: YES NAD 83 WY East S.P.	**LOG BY:** M. Wolf, WY PG #614	**HOLE DIAMETER:** 8 ¼ "

DEPTH From	DEPTH To	DESCRIPTION OF MATERIALS (ASTM D2488)	ASTM D2487 SYMBOL	BPF ASTM D1586	SWL	TEST, SAMPLES, OR NOTES
0	3	Core #1 recovered 3.0′				
		Clay; silty, dry, hard, abundant roots to 0.5′	CL			"Save" core 2-3′
3	8	Core #2 recovered 5.0′ as above				Core 7-8′
		Clay; silty, moist, very cohesive, displacive salts	CL			
8	13	Core #3 recovered 4.0′, lost bottom				
8	10	Clay; As above	CL			
10	12	Gravelly clay; sandy, poor sorting, "save"	GC			Core 10-12′
12	13	Lost – slid out of core barrel, "soft"?				
13	18	Core #4 recovered 5.0′				
13	13.5	Gravel; clay-rich, coarse sand and fine pebbles	GC			Core 13-13.5′
13.5	16.3	Clayey siltstone; buff, weathered , soft	ML			
16.3	18.0	Claystone; gray, brown, silty, very firm	CL			
18.0	19.5	CAL (9/14/17) recovered 3 ok rings		31*		
		Claystone; gray, very silty, fractured by CAL drive!	ML/CL			
		Bedrock at 13.5′! Poor location for aquifer test!				
		Plug and abandon boring on 8-19-11 with 3-50lb. bags of bentonite chips and fill remaining hole to surface with cuttings				
		Color designations from Munsell Soil Color Charts, U.S. Department Agriculture Handbook 18-Soil Survey Manual, Revised 2000				

ABBREVIATIONS

DTW – Depth to Water
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Legend for Symbols Used on Borehole Logs

Sample Types


Auger Cuttings

Standard Penetration Test


Grab Sample

Undisturbed Sample


Modified California Sampler

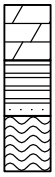

Shelby Tube

Soil and Bedrock Lithology


USCS Low Plasticity Clay

Sandstone

USCS Silty Sand

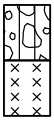

CLAYSTONE

Interbedded Sandstone and Claystone

Weathered Bedrock


USCS Low Plasticity Sandy Clay

USCS Clayey Sand


USCS Silty Gravel

Siltstone

Lab Test Abbreviations

MC-Moisture Content
DD-Dry Density
#200-Percent Passing #200 Sieve
LL-Liquid Limit
PL-Plastic Limit
PI-Plastic Index
S-Sulphate Content
S/C-Swell/Consolidation
UCCS-Unconfined Compressive Strength
Re-Resistivity
PtL-Point Load Test
AASHTO-AASHTO Classification
USCS-USCS Classification
Cl- Chloride Content
Cc-Compression Index
Cr- Recompression Index

YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: Ross Process and Admin Bldgs
Project Number: 211-147 Date: 10/6/11

Boring: **FD-01**
Sheet 1 of 2

Boring Began: 8/22/2011
Drilling Method: Hollow-Stem Auger
Drill: CME 55
Driller: Terracon
Logged By: B. Bunker
Final By: I. Chen
Inclination: Vertical

Completed: 8/22/2011
Drill Bit:
Casing:
Weather:

Total Depth: 40.0 ft
Ground Elevation: 4140.8 ft
Location:
Coordinates: N: 1,485,521.2 E: 713,261.3

Ground Water Notes:

Depth	▽ 25.0 ft	-	-	-
Date	8/23/11	-	-	-
Time	-	-	-	-

Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples: Blows per 6 in	Soil Samples: N	Lithology	Material Description	Field Notes and Lab Tests
4140								**0.0 - 4.0 ft. sandy CLAY**, brown, moist, medium dense.	
					4/6/10	16		**4.0 - 9.0 ft. CLAY**, brown, moist, stiff.	MC= 21.1 % DD= 111.8 pcf #200= 92 % LL= 55 PL= 22 PI= 33 UCCS= 1694 psf AASHTO: A-7-6 (33) USCS: CH
	10				6/11/17	28		**9.0 - 24.0 ft. silty SAND** (Completely Weathered Sandstone), tan, damp, medium dense.	
4130					4/6/9	15			
	20				7/10/12	22			
4120									
					4/8/13	21		**24.0 - 40.0 ft. SILTSTONE**, dark gray, damp, firm to medium hard.	
	30				9/14/17	31			
4110									
					15/20/28	48			

BORING LOG 211-147 BORING LOGS.GPJ YEH ASSOCIATES.GDT 12/22/11

YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: Ross Process and Admin Bldgs
Project Number: 211-147 Date: 10/6/11

Boring: **FD-01**
Sheet 2 of 2

Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples Blows per 6 in	Soil Samples N	Lithology	Material Description	Field Notes and Lab Tests
					27/50:6"	50:6"			
	40							Bottom of Hole at 40.0 ft.	
4100									
	50								
4090									
	60								
4080									
	70								
4070									

BORING LOG 211-147 BORING LOGS.GPJ YEH ASSOCIATES.GDT 12/22/11

YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: Ross Process and Admin Bldgs
Project Number: 211-147 Date: 10/6/11

Boring: **FD-02**
Sheet 1 of 1

Boring Began: 8/24/2011
Drilling Method: Hollow-Stem Auger
Drill: CME 55
Driller: Terracon
Logged By: B. Bunker
Final By: I. Chen
Inclination: Vertical

Completed: 8/24/2011
Drill Bit:
Casing:
Weather:

Total Depth: 20.5 ft
Ground Elevation: 4143.9 ft
Location:
Coordinates: N: 1,485,423.6 E: 713,261.7

Ground Water Notes:

Depth	▽ 13.0 ft	-	-	-
Date	8/24/11	-	-	-
Time	-	-	-	-

Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples: Blows per 6 in	Soil Samples: N	Lithology	Material Description	Field Notes and Lab Tests
4140								**0.0 - 9.0 ft. clayey SAND**, brown, moist, loose.	
					2/4/6	10			MC= 18.6 % DD= 104.4 pcf #200= 47 % LL= 42 PL= 18 PI= 24 AASHTO: A-7-6 (7) USCS: SC Cc= 0.19
	10				3/3/5	8		**9.0 - 12.0 ft. silty SAND**, tan-brown, damp, loose.	
4130		▽						**12.0 - 13.0 ft. sandy GRAVEL** silty, tan, damp to wet, loose.	
					13/32/45	77		**13.0 - 20.5 ft. SANDSTONE**, tan, damp, hard.	
	20				15/25/34	59			
								Bottom of Hole at 20.5 ft.	
4120									
	30								
4110									

BORING LOG 211-147 BORING LOGS.GPJ YEH ASSOCIATES.GDT 12/22/11

YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: Ross Process and Admin Bldgs
Project Number: 211-147 Date: 10/6/11

Boring: **FD-03**
Sheet 1 of 1

Boring Began: 8/21/2011
Drilling Method: Hollow-Stem Auger
Drill: CME 55
Driller: Terracon
Logged By: B. Bunker
Final By: I. Chen
Inclination: Vertical

Completed: 8/24/2011
Drill Bit:
Casing:
Weather:

Total Depth: 20.5 ft
Ground Elevation: 4146.8 ft
Location:
Coordinates: N: 1,485,333.0 E: 713,263.5

Ground Water Notes:

Depth	▽ 14.7 ft	-	-	-
Date	8/25/11	-	-	-
Time	-	-	-	-

Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples: Blows per 6 in	Soil Samples: N	Lithology	Material Description	Field Notes and Lab Tests
								0.0 - 4.0 ft. sandy CLAY, brown, moist, stiff.	
					7/15/16	31		**4.0 - 11.0 ft. sandy CLAY** (Completely Weathered Sandy Claystone), brown, very stiff to hard.	MC= 17.7 % DD= 101.2 pcf #200= 84 % LL= 48 PL= 21 PI= 27 S/C= 2.7 % AASHTO: A-7-6 (23) USCS: CL
4140									
	10				6/15/22	37			MC= 18 % DD= 101.5 pcf
								11.0 - 20.5 ft. CLAYSTONE, dark gray, damp, medium hard to hard.	
					7/17/22	39			MC= 14.4 % DD= 115.6 pcf
4130									
	20				11/29/42	71			
								Bottom of Hole at 20.5 ft.	
4120									
	30								

BORING LOG 211-147 BORING LOGS.GPJ YEH ASSOCIATES.GDT 12/22/11

YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: Ross Process and Admin Bldgs
Project Number: 211-147 Date: 10/6/11

Boring: **FD-04**
Sheet 1 of 1

Boring Began: 8/24/2011
Drilling Method: Hollow-Stem Auger
Drill: CME 55
Driller: Terracon
Logged By: B. Bunker
Final By: I. Chen
Inclination: Vertical

Completed: 8/24/2011
Drill Bit:
Casing:
Weather:

Total Depth: 35.5 ft
Ground Elevation: 4149.2 ft
Location:
Coordinates: N: 1,485,242.6 E: 713,262.8

Ground Water Notes:

Depth	▽ 16.3 ft	-	-	-
Date	8/25/11	-	-	-
Time	-	-	-	-

Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples Blows per 6 in	Soil Samples N	Lithology	Material Description	Field Notes and Lab Tests
								0.0 - 5.0 ft. sandy CLAY, brown, moist, very stiff.	
					6/15/21	36			MC= 19.9 % DD= 96.2 pcf #200= 77 % LL= 34 PL= 21 PI= 13 AASHTO: A - 6 (9) USCS: CL
								5.0 - 9.0 ft. silty SAND (Completely Weathered Silty Sandstone), tan to brown, damp, dense.	
4140									
	10				7/17/27	44		**9.0 - 15.0 ft. CLAYSTONE**, dark gray, damp, hard, medium hard to hard.	MC= 19.5 % DD= 105.5 pcf S/C= 3.5 %
					12/28/35	63			
								15.0 - 35.5 ft. SANDSTONE with SILTSTONE layers, brown to dark gray, damp, medium hard to hard, fine grained.	
4130									
	20				12/22/30	52			
					9/9/9	18		At 24 to 26 ft., grades to gravelly, residuum.	
4120									
	30				8/16/27	43			
					16/32/34	66			

Bottom of Hole at 35.5 ft.

BORING LOG 211-147 BORING LOGS.GPJ YEH ASSOCIATES.GDT 12/22/11

YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: Ross Process and Admin Bldgs
Project Number: 211-147 Date: 10/6/11

Boring: **FD-05**
Sheet 1 of 1

Boring Began: 8/24/2011
Drilling Method: Hollow-Stem Auger
Drill: CME 55
Driller: Terracon
Logged By: B. Bunker
Final By: I. Chen
Inclination: Vertical

Completed: 8/24/2011
Drill Bit:
Casing:
Weather:

Total Depth: 25.5 ft
Ground Elevation: 4153.4 ft
Location:
Coordinates: N: 1,485,148.0 E: 713,261.1

Ground Water Notes:

Depth	▽ 18.1 ft	-	-	-
Date	8/25/11	-	-	-
Time	-	-	-	-

Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples: Blows per 6 in	Soil Samples: N	Lithology	Material Description	Field Notes and Lab Tests
								0.0 - 4.0 ft. sandy CLAY, brown, moist, medium stiff.	
4150									
					4/4/3	7		**4.0 - 9.0 ft. silty SAND**, tan, damp, loose.	
	10				4/8/11	19		**9.0 - 14.0 ft. silty SAND** (Completely Weathered Silty Sandstone), tan, damp, medium dense.	pH= 8.4 S= 0.090 % Re= 457 ohms-cm Cl= 0.003 %
4140									
					6/14/18	32		**14.0 - 18.0 ft. WEATHERED CLAYSTONE**, gray, damp, medium hard.	MC= 20.9 % DD= 101.9 pcf
								18.0 - 25.5 ft. SANDSTONE, tan to brown, damp, hard.	
	20				17/29/42	71			
4130									
					16/30/38	68			
								Bottom of Hole at 25.5 ft.	
	30								
4120									

BORING LOG 211-147 BORING LOGS.GPJ YEH ASSOCIATES.GDT 12/22/11

YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: Ross Process and Admin Bldgs
Project Number: 211-147 Date: 10/6/11

Boring: **FD-06**
Sheet 1 of 2

Boring Began: 8/24/2011
Drilling Method: Hollow-Stem Auger
Drill: CME 55
Driller: Terracon
Logged By: B. Bunker
Final By: I. Chen
Inclination: Vertical

Completed: 8/24/2011
Drill Bit:
Casing:
Weather:

Total Depth: 39.9 ft
Ground Elevation: 4138.1 ft
Location:
Coordinates: N: 1,485,470.8 E: 713,359.0

Ground Water Notes:

Depth	▽ 12.6 ft	-	-	-
Date	8/25/11	-	-	-
Time	-	-	-	-

Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples: Blows per 6 in	Soil Samples: N	Lithology	Material Description	Field Notes and Lab Tests
								0.0 - 22.0 ft. sandy CLAY, brown, damp to moist, stiff.	
4130									
	10				4/6/6	12			MC= 22.2 % DD= 100.8 pcf #200= 74 % LL= 35 PL= 17 PI= 18 UCCS= 495 psf AASHTO: A - 6 (12) USCS: CL Cc= 0.35 Cr= 0.056
4120									
	20				3/4/6	10			MC= 36.3 % DD= 85.5 pcf Cc= 0.31
								22.0 - 31.0 ft. WEATHERED CLAYSTONE, gray and brown, damp, residuum to firm.	
					7/14/13	27			
4110									
	30				5/8/11	19			
								31.0 - 39.9 ft. CLAYSTONE, dark gray, damp, medium to very hard.	
					10/22/26	48			

BORING LOG 211-147 BORING LOGS.GPJ YEH ASSOCIATES.GDT 12/22/11

YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: Ross Process and Admin Bldgs
Project Number: 211-147 Date: 10/6/11

Boring: **FD-06**
Sheet 2 of 2

Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples Blows per 6 in	Soil Samples N	Lithology	Material Description	Field Notes and Lab Tests
4100									
	40				28/50:5"	50:5"		Bottom of Hole at 39.9 ft.	
4090	50								
4080	60								
4070	70								
4060									

BORING LOG 211-147 BORING LOGS.GPJ YEH ASSOCIATES.GDT 12/22/11

YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: Ross Process and Admin Bldgs
Project Number: 211-147 Date: 10/6/11

Boring: **FD-07**
Sheet 1 of 1

Boring Began: 8/26/2011
Drilling Method: Hollow-Stem Auger
Drill: CME 55
Driller: Terracon
Logged By: B. Bunker
Final By: I. Chen
Inclination: Vertical

Completed: 8/26/2011
Drill Bit:
Casing:
Weather:

Total Depth: 35.5 ft
Ground Elevation: 4141.4 ft
Location:
Coordinates: N: 1,485,383.1 E: 713,360.1

Ground Water Notes:

Depth	-	-	-	-
Date	-	-	-	-
Time	-	-	-	-

Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples Blows per 6 in	Soil Samples N	Lithology	Material Description	Field Notes and Lab Tests
4140								**0.0 - 3.0 ft. sandy CLAY**, brown, moist, medium stiff.	
								3.0 - 5.0 ft. silty SAND, tan, damp, medium dense.	
								5.0 - 8.0 ft. sandy CLAY, brown, damp, medium stiff.	
								8.0 - 18.0 ft. silty SAND (Completely Weathered Silty Sandstone), tan, damp, dense.	MC= 20.4 % DD= 102.3 pcf
	10				5/7/10	17			
4130									
					15/17/25	42			
								18.0 - 28.0 ft. WEATHERED CLAYSTONE, gray, damp, residuum.	
	20				6/8/11	19			
4120									
					6/7/12	19			MC= 30.5 % DD= 84.9 pcf
								28.0 - 35.5 ft. CLAYSTONE, gray, damp, medium hard.	
	30				17/25/25	50			
4110									
					13/20/29	49			

Bottom of Hole at 35.5 ft.

BORING LOG 211-147 BORING LOGS.GPJ YEH ASSOCIATES.GDT 12/22/11

YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: Ross Process and Admin Bldgs
Project Number: 211-147 Date: 10/6/11

Boring: **FD-08**
Sheet 1 of 1

Boring Began: 8/26/2011
Drilling Method: Hollow-Stem Auger
Drill: CME 55
Driller: Terracon
Logged By: B. Bunker
Final By: I. Chen
Inclination: Vertical

Completed: 8/26/2011
Drill Bit:
Casing:
Weather:

Total Depth: 34.5 ft
Ground Elevation: 4143.7 ft
Location:
Coordinates: N: 1,485,287.8 E: 713,362.9

Ground Water Notes:

Depth	-	-	-	-
Date	-	-	-	-
Time	-	-	-	-

Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples Blows per 6 in	Soil Samples N	Lithology	Material Description	Field Notes and Lab Tests
								0.0 - 6.0 ft. sandy CLAY, brown, moist, medium stiff.	
4140								**6.0 - 7.0 ft. silty SAND** (Completely Weathered Silty Sandstone), tan, damp, medium dense.	
								7.0 - 10.0 ft. sandy CLAY (Completely Weathered Sandy Claystone), brown, damp, very stiff.	
					8/11/13	24			MC= 21.3 % DD= 96.2 pcf S/C= 1 %
	10							**10.0 - 19.0 ft. SANDSTONE**, tan, damp to wet, hard to very hard.	
4130					15/22/34	56			
					37:3"	37:3"			
	20							**19.0 - 34.5 ft. CLAYSTONE**, dark gray, damp, medium hard to hard.	
4120					23/19/24	43			
					9/14/17	31			MC= 28.6 % DD= 92.1 pcf #200= 87 % LL= 77 PL= 25 PI= 52 AASHTO: A-7-6 (50) USCS: CH
	30								
4110					24/32/32	64			
								Bottom of Hole at 34.5 ft.	

BORING LOG 211-147 BORING LOGS.GPJ YEH ASSOCIATES.GDT 12/22/11

YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: Ross Process and Admin Bldgs
Project Number: 211-147 Date: 10/6/11

Boring: **FD-09**
Sheet 1 of 2

Boring Began: 8/23/2011
Drilling Method: Hollow-Stem Auger
Drill: CME 55
Driller: Terracon
Logged By: B. Bunker
Final By: I. Chen
Inclination: Vertical

Completed: 8/23/2011
Drill Bit:
Casing:
Weather:

Total Depth: 40.5 ft
Ground Elevation: 4146.8 ft
Location:
Coordinates: N: 1,485,194.8 E: 713,362.0

Ground Water Notes:

Depth	▽ 13.2 ft	-	-	-
Date	8/24/11	-	-	-
Time	-	-	-	-

Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples: Blows per 6 in	Soil Samples: N	Lithology	Material Description	Field Notes and Lab Tests
								0.0 - 10.0 ft. sandy CLAY, brown, moist, stiff.	
					4/6/9	15			MC= 21.8 % DD= 97.3 pcf #200= 70 % LL= 53 PL= 20 PI= 33 pH= 8.3 S= 1.594 % S/C= 0 % UCCS= 2793 psf Re= 185 ohms-cm AASHTO: A-7-6 (22) USCS: CH Cl= 0.0345 %
4140									
	10				9/15/20	35		**10.0 - 14.0 ft. sandy CLAY** (Completely Weathered Sandy Claystone), brown, moist, very stiff.	
					7/22/31	53		**14.0 - 24.0 ft. WEATHERED SILTY SANDSTONE**, tan and brown, damp, medium hard to hard.	MC= 19.8 % #200= 25 % LL= NV PL= NP PI= NP AASHTO: A-2-4 (0) USCS: SM Cc= 0.36 Cr= 0.049
4130									
	20				9/17/22	39			
					5/9/11	20		**24.0 - 29.0 ft. WEATHERED SANDY CLAYSTONE**, gray tan black, damp, firm.	
4120									
	30				9/12/14	26		**29.0 - 39.0 ft. CLAYSTONE**, dark brown, damp to wet, firm.	
					10/13/15	28			

BORING LOG 211-147 BORING LOGS.GPJ YEH ASSOCIATES.GDT 12/22/11

YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: Ross Process and Admin Bldgs
Project Number: 211-147 Date: 10/6/11

Boring: **FD-09**
Sheet 2 of 2

Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples Blows per 6 in	Soil Samples N	Lithology	Material Description	Field Notes and Lab Tests
4110									
	40				17/24/31	55		**39.0 - 40.5 ft. SANDSTONE**, dark gray, damp to wet, hard, fine grained.	
								Bottom of Hole at 40.5 ft.	
4100	50								
4090	60								
4080	70								
4070									

BORING LOG 211-147 BORING LOGS.GPJ YEH ASSOCIATES.GDT 12/22/11

YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: Ross Process and Admin Bldgs
Project Number: 211-147 Date: 10/6/11

Boring: **FD-10**
Sheet 1 of 1

Boring Began: 8/23/2011
Drilling Method: Hollow-Stem Auger
Drill: CME 55
Driller: Terracon
Logged By: B. Bunker
Final By: I. Chen
Inclination: Vertical

Completed: 8/23/2011
Drill Bit:
Casing:
Weather:

Total Depth: 35.5 ft
Ground Elevation: 4136.3 ft
Location:
Coordinates: N: 1,485,516.9 E: 713,463.5

Ground Water Notes:

Depth	▽ 13.4 ft	-	-	-
Date	8/24/11	-	-	-
Time	-	-	-	-

Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples Blows per 6 in	N	Lithology	Material Description	Field Notes and Lab Tests
								0.0 - 19.0 ft. sandy CLAY, brown, damp to moist, stiff.	
					4/8/6	14			MC= 16.2 % DD= 110.4 pcf pH= 8.2 S= 0.333 % UCCS= 4639 psf Re= 301 ohms-cm Cl= 0.0124 %
4130									
	10				5/6/7	13			
					3/5/6	11			MC= 21.6 % DD= 104.3 pcf #200= 52 % LL= 39 PL= 16 PI= 23 AASHTO: A - 6 (8) USCS: CL
4120									
	20				6/12/25	37		**19.0 - 24.0 ft. silty SAND** (Completely Weathered Silty Sandstone), brown, damp, dense.	
					6/8/10	18		**24.0 - 29.0 ft. sandy CLAY** (Completely Weathered Sandy Claystone), gray - brown, damp, very stiff.	MC= 25.5 % DD= 93.8 pcf
4110									
	30				8/15/24	39		**29.0 - 33.0 ft. CLAYSTONE**, gray, damp, medium hard.	
								33.0 - 35.5 ft. INTERBEDDED SANDSTONE and CLAYSTONE, gray and brown, damp, very hard, fine grained.	
					20/42/50	92			

Bottom of Hole at 35.5 ft.

BORING LOG 211-147 BORING LOGS.GPJ YEH ASSOCIATES.GDT 12/22/11

YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: Ross Process and Admin Bldgs
Project Number: 211-147 Date: 10/6/11

Boring: **FD-11**
Sheet 1 of 1

Boring Began: 8/23/2011
Drilling Method: Hollow-Stem Auger
Drill: CME 55
Driller: Terracon
Logged By: B. Bunker
Final By: I. Chen
Inclination: Vertical

Completed: 8/23/2011
Drill Bit:
Casing:
Weather:

Total Depth: 35.5 ft
Ground Elevation: 4137.7 ft
Location:
Coordinates: N: 1,485,424.2 E: 713,461.6

Ground Water Notes:

Depth	▽ 29.0 ft	-	-	-
Date	8/24/11	-	-	-
Time	-	-	-	-

Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples Blows per 6 in	N	Lithology	Material Description	Field Notes and Lab Tests
								0.0 - 10.0 ft. sandy CLAY, brown, damp to moist, stiff.	
					3/6/8	14			MC= 23.2 % DD= 95.7 pcf #200= 89 % LL= 64 PL= 23 PI= 41 S/C= 1.2 % AASHTO: A-7-6 (40) USCS: CH
4130									
	10				8/13/8	21			MC= 24.4 % DD= 91.2 pcf
								10.0 - 24.0 ft. sandy CLAY (Completely Weathered Sandy Claystone), brown, damp to moist, very stiff.	
					4/8/11	19			MC= 30.8 % DD= 89.3 pcf S/C= 1 %
4120									
	20				6/10/12	22			
					9/13/15	28		**24.0 - 33.0 ft. CLAYSTONE**, gray, damp, firm.	
4110		▽							
	30				7/10/12	22			
					12/26/37	63		**33.0 - 35.5 ft. SANDSTONE**, dark brown, damp, hard, fine grained.	

Bottom of Hole at 35.5 ft.

BORING LOG 211-147 BORING LOGS.GPJ YEH ASSOCIATES.GDT 12/22/11

YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: Ross Process and Admin Bldgs
Project Number: 211-147 Date: 10/6/11

Boring: **FD-12**
Sheet 1 of 1

Boring Began: 8/23/2011
Drilling Method: Hollow-Stem Auger
Drill: CME 55
Driller: Terracon
Logged By: B. Bunker
Final By: I. Chen
Inclination: Vertical

Completed: 8/23/2011
Drill Bit:
Casing:
Weather:

Total Depth: 35.5 ft
Ground Elevation: 4140.2 ft
Location:
Coordinates: N: 1,485,335.1 E: 713,459.3

Ground Water Notes:

Depth	▽ 9.7 ft	-	-	-
Date	8/24/11	-	-	-
Time	-	-	-	-

Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples Blows per 6 in	Soil Samples N	Lithology	Material Description	Field Notes and Lab Tests
								0.0 - 4.0 ft. silty SAND, brown, moist, medium dense.	
					3/5/7	12		**4.0 - 14.0 ft. sandy CLAY** (Completely Weathered Sandy Claystone), dark brown, damp, stiff.	MC= 28.4 % DD= 88.8 pcf #200= 76 % LL= 63 PL= 24 PI= 39 S/C= -0.8 % AASHTO: A-7-6 (31) USCS: CH
4130	10				5/6/7	13			
					9/8/11	19		**14.0 - 32.0 ft. WEATHERED CLAYSTONE**, gray - brown, damp, residuum to firm.	MC= 29.3 % DD= 86.4 pcf UCCS= 1010 psf Cc=0.24
4120	20				5/7/9	16			
					7/10/12	22			
4110	30				6/7/13	20			
					17/20/30	50		**32.0 - 35.5 ft. INBERBEDDED SANDSTONE and CLAYSTONE**, dark gray, damp, medium hard.	

Bottom of Hole at 35.5 ft.

BORING LOG 211-147 BORING LOGS.GPJ YEH ASSOCIATES.GDT 12/22/11

YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: Ross Process and Admin Bldgs
Project Number: 211-147 Date: 10/6/11

Boring: **FD-13**
Sheet 1 of 2

Boring Began: 8/23/2011
Drilling Method: Hollow-Stem Auger
Drill: CME 55
Driller: Terracon
Logged By: B. Bunker
Final By: I. Chen
Inclination: Vertical

Completed: 8/23/2011
Drill Bit:
Casing:
Weather:

Total Depth: 40.3 ft
Ground Elevation: 4143.6 ft
Location:
Coordinates: N: 1,485,238.8 E: 713,460.9

Ground Water Notes:

Depth	▽ 9.7 ft	-	-	-
Date	8/24/11	-	-	-
Time	-	-	-	-

Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples: Blows per 6 in	Soil Samples: N	Lithology	Material Description	Field Notes and Lab Tests
4140								**0.0 - 14.0 ft. sandy CLAY**, brown, moist, stiff.	
					4/6/6	12			MC= 32.9 % DD= 89.0 pcf UCCS= 3009 psf
	10 ▽				3/4/6	10			
4130					13/24/42	66		**14.0 - 19.0 ft. silty SAND** (Completely Weathered Silty Sandstone), tan-brown, damp, very dense.	
	20				4/7/9	16		**19.0 - 29.0 ft. sandy CLAY** (Completely Weathered Sandy Claystone), brown, damp, stiff.	
4120					5/7/9	16			
	30				16/26/20	46		**29.0 - 40.3 ft. CLAYSTONE**, gray - brown, moist, hard, medium hard to very hard, fine grained.	MC= 21.1 % #200= 87 % LL= 64 PL= 25 PI= 39 AASHTO: A-7-6 (38) USCS: CH
4110					9/15/26	41			

BORING LOG 211-147 BORING LOGS.GPJ YEH ASSOCIATES.GDT 12/22/11

YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: Ross Process and Admin Bldgs
Project Number: 211-147 Date: 10/6/11

Boring: **FD-13**
Sheet 2 of 2

Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples Blows per 6 in	Soil Samples N	Lithology	Material Description	Field Notes and Lab Tests
	40				20/45/32:3"	32:3"		Bottom of Hole at 40.3 ft.	
4100									
	50								
4090									
	60								
4080									
	70								
4070									

BORING LOG 211-147 BORING LOGS.GPJ YEH ASSOCIATES.GDT 12/22/11

YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: Ross Process and Admin Bldgs
Project Number: 211-147 Date: 10/6/11

Boring: **FD-14**
Sheet 1 of 2

Boring Began: 8/22/2011
Drilling Method: Hollow-Stem Auger
Drill: CME 55
Driller: Terracon
Logged By: B. Bunker
Final By: I. Chen
Inclination: Vertical

Completed: 8/22/2011
Drill Bit:
Casing:
Weather:

Total Depth: 40.5 ft
Ground Elevation: 4146.5 ft
Location:
Coordinates: N: 1,485,148.7 E: 713,465.7

Ground Water Notes:

Depth	▽ 11.5 ft	-	-	-
Date	8/23/11	-	-	-
Time	-	-	-	-

Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples: Blows per 6 in	Soil Samples: N	Lithology	Material Description	Field Notes and Lab Tests
								0.0 - 13.0 ft. sandy CLAY, brown, moist, medium stiff to stiff.	
					4/6/8	14			MC= 22.6 % DD= 98.8 pcf pH= 8.5 S= 0.821 % S/C= 0.5 % Re= 166 ohms-cm Cl= 0.0169 %
4140									
	10				3/3/4	7			MC= 22.8 % DD= 93.2 pcf #200= 67 % LL= 37 PL= 17 PI= 20 AASHTO: A - 6 (11) USCS: CL
	▽								
					8/14/24	38		**13.0 - 19.0 ft. silty SAND** (Completely Weathered Silty Sandstone), brown to tan, wet, dense.	
4130									
	20				15/16/12	28		**19.0 - 35.0 ft. SILTSTONE**, gray - brown, damp, firm to medium hard.	
					9/13/16	29			
4120									
	30				12/15/19	34			
					4/13/14	27		**35.0 - 40.5 ft. CLAYSTONE**, dark gray, damp,	

BORING LOG 211-147 BORING LOGS.GPJ YEH ASSOCIATES.GDT 12/22/11

YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: Ross Process and Admin Bldgs
Project Number: 211-147 Date: 10/6/11

Boring: **FD-14**
Sheet 2 of 2

Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples Blows per 6 in	Soil Samples N	Lithology	Material Description	Field Notes and Lab Tests
4110								hard.	
	40				28/30/50	80			
								Bottom of Hole at 40.5 ft.	
4100									
	50								
4090									
	60								
4080									
	70								
4070									

BORING LOG 211-147 BORING LOGS.GPJ YEH ASSOCIATES.GDT 12/22/11

YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: Ross Process and Admin Bldgs
Project Number: 211-147 Date: 10/6/11

Boring: **FD-15**
Sheet 1 of 1

Boring Began: 8/23/2011
Drilling Method: Hollow-Stem Auger
Drill: CME 55
Driller: Terracon
Logged By: B. Bunker
Final By: I. Chen
Inclination: Vertical

Completed: 8/23/2011
Drill Bit:
Casing:
Weather:

Total Depth: 35.5 ft
Ground Elevation: 4151.5 ft
Location:
Coordinates: N: 1,485,077.8 E: 713,366.2

Ground Water Notes:

Depth	▽ 15.8 ft	-	-	-
Date	8/24/11	-	-	-
Time	-	-	-	-

Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples Blows per 6 in	Soil Samples N	Lithology	Material Description	Field Notes and Lab Tests
4150								**0.0 - 13.0 ft. sandy CLAY**, brown, damp to moist, medium stiff to stiff.	
					3/4/6	10			MC= 19 % DD= 104.2 pcf #200= 54 % LL= 42 PL= 19 PI= 23 pH= 8.6 S= 0.298 % S/C= -0.3 % Re= 235 ohms-cm AASHTO: A-7-6 (9) USCS: CL Cl= 0.0064 % MC= 24.7 % DD= 95.2 pcf UCCS= 770 psf Cc=0.18
	10				2/1/3	4			
4140								**13.0 - 23.0 ft. silty SAND** (Completely Weathered Silty Sandstone), brown to gray, damp, medium dense to dense.	
					6/10/14	24			MC= 19.8 % DD= 108.7 pcf #200= 28 % LL= NV PL= NP PI= NP AASHTO: A-2-4 (0) USCS: SM
	20				9/13/21	34			
4130								**23.0 - 27.0 ft. sandy CLAY** (Completely Weathered Sandy Claystone), brown-gray, damp, very stiff.	
					4/7/9	16			
								27.0 - 35.5 ft. SANDSTONE, brown to gray, damp, medium hard to hard, fine grained.	
	30				12/23/26	49			
4120									
					12/23/29	52			

Bottom of Hole at 35.5 ft.

BORING LOG 211-147 BORING LOGS.GPJ YEH ASSOCIATES.GDT 12/22/11

YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: Ross Process and Admin Bldgs
Project Number: 211-147 Date: 10/6/11

Boring: **FD-16**
Sheet 1 of 1

Boring Began: 8/25/2011
Drilling Method: Hollow-Stem Auger
Drill: CME 55
Driller: Terracon
Logged By: B. Bunker
Final By: I. Chen
Inclination: Vertical

Completed: 8/25/2011
Drill Bit:
Casing:
Weather:

Total Depth: 35.5 ft
Ground Elevation: 4137.1 ft
Location:
Coordinates: N: 1,485,515.7 E: 713,600.9

Ground Water Notes:

Depth	▽ 10.4 ft	-	-	-
Date	8/26/11	-	-	-
Time	-	-	-	-

Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples Blows per 6 in	Soil Samples N	Lithology	Material Description	Field Notes and Lab Tests
								0.0 - 9.0 ft. sandy CLAY, brown, moist, hard.	
					6/15/22	37			MC= 12.7 % DD= 90.0 pcf S/C= -2.6 %
4130									
	▽ 10							**9.0 - 18.0 ft. silty SAND**, light brown, damp to wet, loose.	
					2/4/5	9			MC= 26.4 % DD= 97.6 pcf #200= 42 % LL= NV PL= NP PI= NP AASHTO: A - 4 (0) USCS: SM
					4/5/6	11			
4120									
								18.0 - 35.5 ft. CLAYSTONE, dark brown, damp, firm to hard.	
	20				5/9/11	20			MC= 29.9 % DD= 90.4 pcf
					8/15/17	32			
4110									
	30				9/13/18	31			
					12/23/31	54			

Bottom of Hole at 35.5 ft.

BORING LOG 211-147 BORING LOGS.GPJ YEH ASSOCIATES.GDT 12/22/11

YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: Ross Process and Admin Bldgs
Project Number: 211-147 Date: 10/6/11

Boring: **FD-17**
Sheet 1 of 1

Boring Began: 8/25/2011
Drilling Method: Hollow-Stem Auger
Drill: CME 55
Driller: Terracon
Logged By: B. Bunker
Final By: I. Chen
Inclination: Vertical

Completed: 8/25/2011
Drill Bit:
Casing:
Weather:

Total Depth: 35.0 ft
Ground Elevation: 4137.9 ft
Location:
Coordinates: N: 1,485,387.9 E: 713,603.0

Ground Water Notes:

Depth	▽ 8.8 ft	-	-	-
Date	8/26/11	-	-	-
Time	-	-	-	-

Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples: Blows per 6 in	Soil Samples: N	Lithology	Material Description	Field Notes and Lab Tests
								0.0 - 4.0 ft. sandy CLAY, brown, damp, medium stiff.	
								4.0 - 17.0 ft. silty SAND, brown, damp to wet, loose to medium dense.	
4130									
	10				2/4/5	9			MC= 22.5 % DD= 109.1 pcf
					3/5/7	12			
4120								**17.0 - 33.0 ft. CLAYSTONE**, brown, damp, firm.	
	20				9/14/16	30			
					5/8/10	18			
4110									
	30				10/13/14	27			
					24/50:6"	50:6"		**33.0 - 35.0 ft. INTERBEDDED SANDSTONE and CLAYSTONE**, dark gray, damp, very hard.	
								Bottom of Hole at 35.0 ft.	

BORING LOG 211-147 BORING LOGS.GPJ YEH ASSOCIATES.GDT 12/22/11

YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: Ross Process and Admin Bldgs
Project Number: 211-147 Date: 10/6/11

Boring: **FD-18**
Sheet 1 of 2

Boring Began: 8/24/2011
Drilling Method: Hollow-Stem Auger
Drill: CME 55
Driller: Terracon
Logged By: B. Bunker
Final By: I. Chen
Inclination: Vertical

Completed: 8/24/2011
Drill Bit:
Casing:
Weather:

Total Depth: 39.9 ft
Ground Elevation: 4141.2 ft
Location:
Coordinates: N: 1,485,284.4 E: 713,601.8

Ground Water Notes:

Depth	▽ 13.6 ft	-	-	-
Date	8/25/11	-	-	-
Time	-	-	-	-

Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples: Blows per 6 in	Soil Samples: N	Lithology	Material Description	Field Notes and Lab Tests
4140								**0.0 - 4.0 ft. sandy CLAY**, tan-brown, damp, soft to medium stiff.	
					2/4/4	8		**4.0 - 8.0 ft. silty SAND**, tan, damp, loose.	MC= 23 % DD= 90.6 pcf
								8.0 - 28.0 ft. CLAY (Completely Weathered Claystone), brown, damp, stiff to very stiff.	
	10				5/8/10	18			MC= 28.1 % DD= 87.2 pcf #200= 94 % LL= 72 PL= 34 PI= 38 UCCS= 1282 psf AASHTO: A-7-5 (43) USCS: CH Cc= 0.23
4130									
					4/7/9	16			
	20				12/14/14	28			
4120									
					6/9/11	20			
	30				11/16/18	34		**28.0 - 39.9 ft. SANDSTONE**, brown and gray, damp, firm to very hard, fine grained.	
4110									
					10/12/16	28			

BORING LOG 211-147 BORING LOGS.GPJ YEH ASSOCIATES.GDT 12/22/11

YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: Ross Process and Admin Bldgs
Project Number: 211-147 Date: 10/6/11

Boring: **FD-18**
Sheet 2 of 2

Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples Blows per 6 in	Soil Samples N	Lithology	Material Description	Field Notes and Lab Tests
					24/45:5"	45:5"			
	40							Bottom of Hole at 39.9 ft.	
4100									
	50								
4090									
	60								
4080									
	70								
4070									

BORING LOG 211-147 BORING LOGS.GPJ YEH ASSOCIATES.GDT 12/22/11

YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: Ross Process and Admin Bldgs
Project Number: 211-147 Date: 10/6/11

Boring: **FD-19**
Sheet 1 of 2

Boring Began: 8/24/2011
Drilling Method: Hollow-Stem Auger
Drill: CME 55
Driller: Terracon
Logged By: B. Bunker
Final By: I. Chen
Inclination: Vertical

Completed: 8/24/2011
Drill Bit:
Casing:
Weather:

Total Depth: 40.5 ft
Ground Elevation: 4147.8 ft
Location:
Coordinates: N: 1,485,150.5 E: 713,602.3

Ground Water Notes:

Depth	▽ 13.6 ft	-	-	-
Date	8/25/11	-	-	-
Time	-	-	-	-

Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples: Blows per 6 in	Soil Samples: N	Lithology	Material Description	Field Notes and Lab Tests
								0.0 - 4.0 ft. sandy CLAY, tan-brown, dry to moist, stiff.	pH= 8.1 S= 1.070 % Re= 341 ohms-cm Cl= 0.0006 %
					6/15/22	37		**4.0 - 9.0 ft. silty SAND** (Completely Weathered Silty Sandstone), tan, damp, dense.	
4140									
	10				8/14/18	32		**9.0 - 19.0 ft. sandy CLAY** (Completely Weathered Sandy Claystone), gray and brown, damp, stiff to very stiff.	
					3/6/8	14			MC= 30.8 % DD= 89.6 pcf #200= 88 % LL= 81 PL= 33 PI= 48 AASHTO: A-7-5 (49) USCS: CH
4130									
	20				8/14/16	30		**19.0 - 40.5 ft. SANDSTONE**, dark brown to gray, damp, firm to hard.	
					10/13/15	28			
4120									
	30				9/14/19	33			
					10/16/20	36			

BORING LOG 211-147 BORING LOGS.GPJ YEH ASSOCIATES.GDT 12/22/11

YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: Ross Process and Admin Bldgs
Project Number: 211-147 Date: 10/6/11

Boring: **FD-19**
Sheet 2 of 2

Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples Blows per 6 in	Soil Samples N	Lithology	Material Description	Field Notes and Lab Tests
4110									
	40				19/29/45	74			
								Bottom of Hole at 40.5 ft.	
4100	50								
4090	60								
4080	70								
4070									

BORING LOG 211-147 BORING LOGS.GPJ YEH ASSOCIATES.GDT 12/22/11

YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: Ross Process and Admin Bldgs
Project Number: 211-147 Date: 10/6/11

Boring: **FD-20**
Sheet 1 of 1

Boring Began: 8/25/2011
Drilling Method: Hollow-Stem Auger
Drill: CME 55
Driller: Terracon
Logged By: B. Bunker
Final By: I. Chen
Inclination: Vertical

Completed: 8/25/2011
Drill Bit:
Casing:
Weather:

Total Depth: 30.5 ft
Ground Elevation: 4137.7 ft
Location:
Coordinates: N: 1,485,473.7 E: 713,912.2

Ground Water Notes:

Depth	▽ 7.8 ft	-	-	-
Date	8/26/11	-	-	-
Time	-	-	-	-

Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples Blows per 6 in	Soil Samples N	Lithology	Material Description	Field Notes and Lab Tests
								0.0 - 22.0 ft. sandy CLAY, brown, damp, medium stiff to very stiff.	
					5/9/13	22			MC= 14.3 % DD= 108.6 pcf S/C= -0.2 %
4130 ▽									
	10				3/3/3	6			MC= 25.3 % DD= 82.5 pcf #200= 65 % LL= 37 PL= 18 PI= 19 AASHTO: A - 6 (10) USCS: CL
					3/8/11	19			
4120									
	20				4/9/10	19			
								22.0 - 30.5 ft. CLAYSTONE, dark brown, damp to wet, firm to hard.	
					8/13/15	28			
4110									
	30				12/22/29	51			
								Bottom of Hole at 30.5 ft.	

BORING LOG 211-147 BORING LOGS.GPJ YEH ASSOCIATES.GDT 12/22/11

YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: Ross Process and Admin Bldgs
Project Number: 211-147 Date: 10/6/11

Boring: **FD-21**
Sheet 1 of 1

Boring Began: 8/25/2011
Drilling Method: Hollow-Stem Auger
Drill: CME 55
Driller: Terracon
Logged By: B. Bunker
Final By: I. Chen
Inclination: Vertical

Completed: 8/25/2011
Drill Bit:
Casing:
Weather:

Total Depth: 34.1 ft
Ground Elevation: 4139.6 ft
Location:
Coordinates: N: 1,485,351.6 E: 713,914.3

Ground Water Notes:

Depth	▽ 7.6 ft	-	-	-
Date	8/26/11	-	-	-
Time	-	-	-	-

Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples Blows per 6 in	N	Lithology	Material Description	Field Notes and Lab Tests
								0.0 - 25.0 ft. sandy CLAY, brown, dry to wet, stiff to very stiff.	pH= 8.3 S= 0.003 % Re= 1267 ohms-cm Cl= 0.0004 %
					5/9/8	17			
4130	10								Cc= 0.21
					3/5/6	11			MC= 27 % DD= 95.7 pcf S/C= -0.4 %
					3/4/5	9			MC= 22.5 % DD= 102.8 pcf #200= 75 % LL= 39 PL= 17 PI= 22 UCCS= 2838 psf AASHTO: A - 6 (15) USCS: CL
4120	20				2/3/3	6			
					3/5/5	10		**25.0 - 27.0 ft. silty SAND**, tan-brown, wet, loose.	
								27.0 - 34.0 ft. SANDSTONE, tan, damp, firm to very hard, fine grained.	
4110	30				7/11/15	26			
					27:1"	27:1"		Bottom of Hole at 34.1 ft.	

BORING LOG 211-147 BORING LOGS.GPJ YEH ASSOCIATES.GDT 12/22/11

YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: Ross Process and Admin Bldgs
Project Number: 211-147 Date: 10/6/11

Boring: **FD-22**
Sheet 1 of 2

Boring Began: 8/22/2011
Drilling Method: Hollow-Stem Auger
Drill: CME 55
Driller: Terracon
Logged By: B. Bunker
Final By: I. Chen
Inclination: Vertical

Completed: 8/22/2011
Drill Bit:
Casing:
Weather:

Total Depth: 45.5 ft
Ground Elevation: 4140.9 ft
Location:
Coordinates: N: 1,485,223.7 E: 713,915.3

Ground Water Notes:

Depth	▽ 8.3 ft	-	-	-
Date	8/23/11	-	-	-
Time	-	-	-	-

Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples: Blows per 6 in	Soil Samples: N	Lithology	Material Description	Field Notes and Lab Tests
4140								**0.0 - 34.0 ft. sandy CLAY**, brown-gray, damp to wet, medium stiff to very stiff.	
					6/7/8	15			
	10				2/3/4	7			
4130									
					2/4/6	10			
	20				2/3/5	8			MC= 28.9 % DD= 93.0 pcf #200= 80 % LL= 55 PL= 23 PI= 32 S/C= -0.6 % AASHTO: A-7-6 (27) USCS: CH
4120									
					3/6/8	14			
	30				5/7/8	15			
4110									
					10/13/19	32		**34.0 - 45.5 ft. CLAYSTONE**, gray - brown, damp, firm to very hard.	

BORING LOG 211-147 BORING LOGS.GPJ YEH ASSOCIATES.GDT 12/22/11

YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: Ross Process and Admin Bldgs
Project Number: 211-147 Date: 10/6/11

Boring: **FD-22**
Sheet 2 of 2

Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples Blows per 6 in	Soil Samples N	Lithology	Material Description	Field Notes and Lab Tests
	40				8/15/25	40			
4100									
					14/26/36	62			
								Bottom of Hole at 45.5 ft.	
	50								
4090									
	60								
4080									
	70								
4070									

BORING LOG 211-147 BORING LOGS.GPJ YEH ASSOCIATES.GDT 12/22/11

YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: Ross Process and Admin Bldgs
Project Number: 211-147 Date: 10/6/11

Boring: **FD-23**
Sheet 1 of 2

Boring Began: 8/22/2011
Drilling Method: Hollow-Stem Auger
Drill: CME 55
Driller: Terracon
Logged By: B. Bunker
Final By: I. Chen
Inclination: Vertical

Completed: 8/22/2011
Drill Bit:
Casing:
Weather:

Total Depth: 40.5 ft
Ground Elevation: 4138.4 ft
Location:
Coordinates: N: 1,485,479.9 E: 714,012.9

Ground Water Notes:

Depth	▽ 7.5 ft	-	-	-
Date	8/23/11	-	-	-
Time	-	-	-	-

Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples: Blows per 6 in	Soil Samples: N	Lithology	Material Description	Field Notes and Lab Tests
								0.0 - 19.0 ft. sandy CLAY, gray, moist, stiff to very stiff.	
					5/10/12	22			MC= 10.5 % DD= 104.9 pcf S/C= -2.6 %
4130									
	10				3/5/7	12			
					2/5/6	11			MC= 21.2 % DD= 103.0 pcf UCCS= 3862 psf
4120									
	20				1/3/3	6		**19.0 - 24.0 ft. silty SAND**, brown, wet, loose.	
					0/0/1	1		**24.0 - 35.0 ft. sandy CLAY** with some gravel, tan, wet, very soft to very stiff.	MC= 25.5 % DD= 101.3 pcf #200= 62 % LL= 31 PL= 16 PI= 15 AASHTO: A - 6 (7) USCS: CL
4110									
	30				4/6/9	15			
					4/9/17	26		**35.0 - 40.5 ft. CLAYSTONE**, dark gray, medium	

BORING LOG 211-147 BORING LOGS.GPJ YEH ASSOCIATES.GDT 12/22/11

YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: Ross Process and Admin Bldgs
Project Number: 211-147 Date: 10/6/11

Boring: **FD-23**
Sheet 2 of 2

Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples Blows per 6 in	Soil Samples N	Lithology	Material Description	Field Notes and Lab Tests
4100								hard.	
	40				15/23/26	49			
								Bottom of Hole at 40.5 ft.	
4090	50								
4080	60								
4070	70								
4060									

BORING LOG 211-147 BORING LOGS.GPJ YEH ASSOCIATES.GDT 12/22/11

YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: Ross Process and Admin Bldgs
Project Number: 211-147 Date: 10/6/11

Boring: **FD-24**
Sheet 1 of 2

Boring Began: 8/25/2011
Drilling Method: Hollow-Stem Auger
Drill: CME 55
Driller: Terracon
Logged By: B. Bunker
Final By: I. Chen
Inclination: Vertical

Completed: 8/25/2011
Drill Bit:
Casing:
Weather:

Total Depth: 40.5 ft
Ground Elevation: 4139.1 ft
Location:
Coordinates: N: 1,485,346.3 E: 714,016.5

Ground Water Notes:

Depth	▽ 6.6 ft	-	-	-
Date	8/26/11	-	-	-
Time	-	-	-	-

Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples Blows per 6 in	Soil Samples N	Lithology	Material Description	Field Notes and Lab Tests
								0.0 - 30.0 ft. sandy CLAY, brown, moist to wet, stiff to very stiff.	
4130	10				3/4/5	9			Cc= 0.2
					3/4/5	9			
4120	20				2/4/5	9			MC= 27 % DD= 93.5 pcf UCCS= 3801 psf
					2/3/4	7			MC= 23.7 % DD= 101.9 pcf #200= 67 % LL= 32 PL= 15 PI= 17 AASHTO: A - 6 (9) USCS: CL
4110	30				8/12/15	27			
					8/13/19	32		**30.0 - 40.5 ft. CLAYSTONE**, brown, damp, medium hard to hard.	

BORING LOG 211-147 BORING LOGS.GPJ YEH ASSOCIATES.GDT 12/22/11

YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: Ross Process and Admin Bldgs
Project Number: 211-147 Date: 10/6/11

Boring: **FD-24**
Sheet 2 of 2

Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples Blows per 6 in	Soil Samples N	Lithology	Material Description	Field Notes and Lab Tests
4100	40				15/23/30	53		Bottom of Hole at 40.5 ft.	
4090	50								
4080	60								
4070	70								
4060									

BORING LOG 211-147 BORING LOGS.GPJ YEH ASSOCIATES.GDT 12/22/11

YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: Ross Process and Admin Bldgs
Project Number: 211-147 Date: 10/6/11

Boring: **FD-25**
Sheet 1 of 2

Boring Began: 8/25/2011
Drilling Method: Hollow-Stem Auger
Drill: CME 55
Driller: Terracon
Logged By: B. Bunker
Final By: I. Chen
Inclination: Vertical

Completed: 8/25/2011
Drill Bit:
Casing:
Weather:

Total Depth: 45.5 ft
Ground Elevation: 4139.8 ft
Location:
Coordinates: N: 1,485,223.0 E: 714,012.9

Ground Water Notes:

Depth	▽ 5.8 ft	-	-	-
Date	8/26/11	-	-	-
Time	-	-	-	-

Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples: Blows per 6 in	Soil Samples: N	Lithology	Material Description	Field Notes and Lab Tests
								0.0 - 29.0 ft. sandy CLAY, brown, moist, medium stiff to stiff.	pH= 8.4 S= 1.335 % Re= 176 ohms-cm Cl= 0.0009 %
					3/4/4	8			
4130	10				2/3/4	7			MC= 24.2 % DD= 99.6 pcf UCCS= 3555 psf
					3/5/5	10			
4120	20				2/3/3	6			
					1/2/2	4			MC= 26.8 % DD= 97.3 pcf #200= 67 % LL= 32 PL= 15 PI= 17 AASHTO: A - 6 (9) USCS: CL
4110	30				3/5/6	11		**29.0 - 34.0 ft. silty SAND**, tan, wet, medium dense.	
					10:2"	10:2"		**34.0 - 45.5 ft. INTERBEDDED SANDSTONE and CLAYSTONE**, brown and gray, damp to wet, medium hard to very hard.	

BORING LOG 211-147 BORING LOGS.GPJ YEH ASSOCIATES.GDT 12/22/11

YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: Ross Process and Admin Bldgs
Project Number: 211-147 Date: 10/6/11

Boring: **FD-25**
Sheet 2 of 2

Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples Blows per 6 in	Soil Samples N	Lithology	Material Description	Field Notes and Lab Tests
4100	40				10/15/23	38			
					21/28/34	62			
								Bottom of Hole at 45.5 ft.	
4090	50								
4080	60								
4070	70								

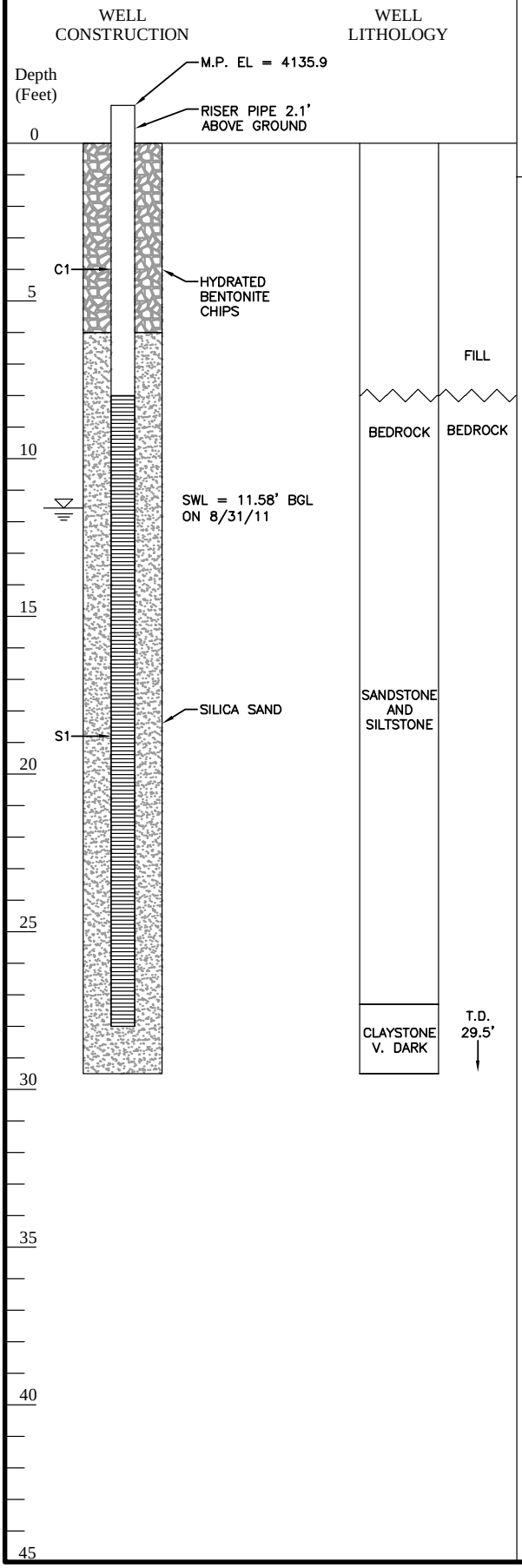
BORING LOG 211-147 BORING LOGS.GPJ YEH ASSOCIATES.GDT 12/22/11

APPENDIX C

Well Construction Summaries for Observation Wells Installed in 2011

Well Construction Summary

Client: STRATA ENERGY – ROSS ISR
Project: PLANT SITE GROUNDWATER WELLS Well: SA42–18–1
Location: N 1,486,696 E 713,257.7 GRD EL 4133.8
Projection WYOMING STATE PLANE NAD 83 EAST FEET
SE /4, NE /4, Section 18 T. 53 N. R. 67 W.
Geologist: MIKE WOLF WY PG #614



Drilling Summary

Total Depth: 29.5'
Hole Dia.: 8 1/4"
Driller: BILL CAMERON, TERRACON RAPID CITY, SD
Rig: CME55 HIGH TORQUE
Bit(s): HOLLOW STEM AUGER
Fluid: NONE
Casing: FLUSH THREAD SCH–40 PVC

Well Data

2" Casing: C=Casing S=Screen

C1: +2' - 18' | S1: 8' - 28'

Monument or Surface Casing:
4" X 5' LOCKING STEEL PROTECTOR

Centralizer:
NONE

Casing C1:
2" SCH 40 PVC – FLUSH THREAD

Screen S1:
FACTORY SLOTTED 0.020" SLOT

Filter Pack:
10/20 COLORADO SILICA SAND
13 BAGS Depth: 6.0' - 29.5'

Bentonite:
3/8" HYR. BENT. CHIPS
Depth: 1' - 6.0'

Cement:
REDI–MIX CONCRETE
2 BAGS Depth: +2.0' - 1.0'

Other:

Construction Time Log

Drilling:	Start	End
8–27–11	10:24	11:45

Casing:	Start	End
8–27–11	11:50	12:45

Well Development

8–28–11
BAIL 10 GALLONS WITH 3' PVC BAILER.
STILL FAIRLY SANDY.
CAN'T QUITE BAIL DRY

8–31–11
ADDITIONAL WELL DEVELOPMENT
DTWAT 14:35 = 13.58' BTOC
∴ DTW = 11.58' BGL

PUMP 15 GALLONS WITH CENTRIFUGAL PUMP FOR ADDITIONAL WELL DEVELOPMENT
FIELD PARAMETERS:
pH = 8.18
TEMP °C = 12.1
EC = 1720 µS

Remarks

BTOC = BELOW TOP OF CASING

BGL = BELOW GROUND LEVEL

M.P. EL = MEASURING POINT ELEVATION

Abandoned

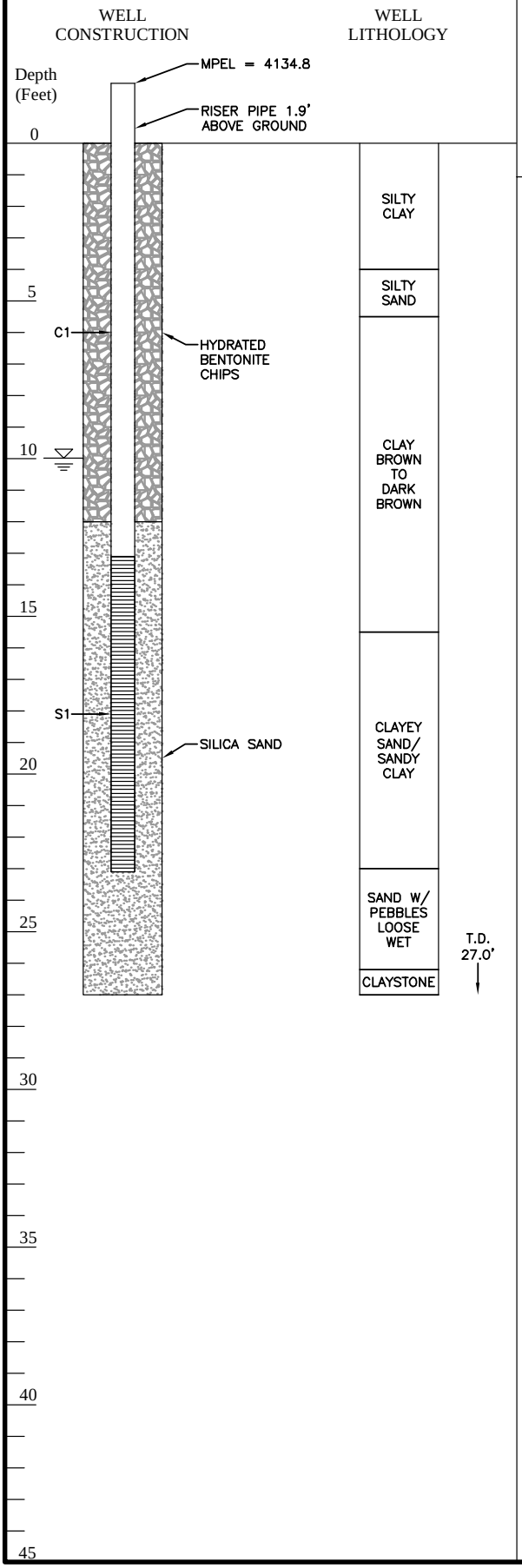
Date:
Method:

WWC ENGINEERING

Well Construction Summary

Client: STRATA ENERGY
Project: PLANT SITE GROUNDWATER WELLS Well: SA43-18-3

Location: N 4,935,886 E 504,364.1 GRD EL 4132.9
Projection UTM ZONE 13 NAD 27
NE /4, SE /4, Section 18 T. 53 N. R. 67 W.
Geologist: MIKE WOLF WY PG #614



Drilling Summary

Total Depth: 27.0
Hole Dia.: 8"
Driller: BILL CAMERON
TERRACON
Rig: CME55 HIGH TORQUE
Bit(s): HOLLOW STEM AUGER
4 1/2 INCH I.D.
Fluid: NONE
Casing: FLUSH THREAD 2" PVC

Well Data

Casing: C=Casing S=Screen

C1 - +1.9 - 13.1 | S1 - 13.1 - 23.1

Monument or Surface Casing:
NONE

Centralizer:
NONE

Casing C1:
2" SCH 40 PVC – FLUSH THREAD

Screen S1:
2" FACTORY SLOTTED 0.010" SLOT

Filter Pack:
10/20 COLORADO SILICA SAND
Depth: 12.0 - 23.1

Bentonite:
3/8" HYR. BENT. CHIPS
Depth: 0 - 12.0

Cement:
NONE
Depth: ____ - ____

Other:

Construction Time Log

Drilling:	Start	End
5-18-10	12:10	13:15

Casing:	Start	End
5-18-10	13:15	14:45

Well Development

DTW AFTER DRILLING
5-18-10 @ 14:30 = 11.85 BTOC
5-19-10 @ 9:45 = 11.89 BTOC

8-31-11 @ 15:55 = 13.58 BTOC

Remarks

BTOC = BELOW TOP OF CASING

BGL = BELOW GROUND LEVEL

Abandoned

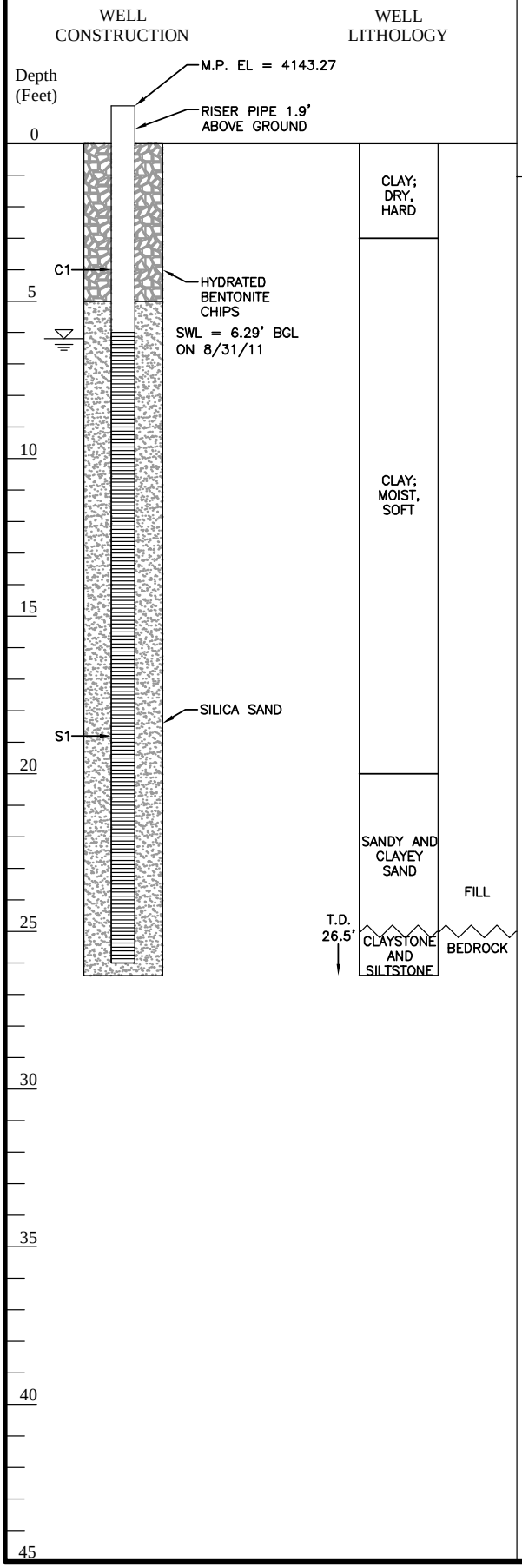
Date: ____
Method: ____

WWC ENGINEERING

Well Construction Summary

Client: STRATA ENERGY – ROSS ISR
Project: PLANT SITE GROUNDWATER WELLS Well: SA43–18–4

Location: N 1,485,144 E 713,941.5 GRD EL 4141.4
Projection WYOMING STATE PLANE NAD 83 EAST FEET
NE /4, SE /4, Section 18 T. 53 N. R. 67 W.
Geologist: MIKE WOLF WY PG #614



Drilling Summary

Total Depth: 26.5'
Hole Dia.: 10 1/4"
Driller: BILL CAMERON, TERRACON RAPID CITY, SD
Rig: CME55 HIGH TORQUE
Bit(s): CONTINUOUS CORE TOOL 10 1/4" O.D. 6 1/4" I.D. HSA
Fluid: NONE
Casing: FLUSH THREAD SCH–40 PVC

Well Data

Casing: C=Casing S=Screen
C1: +2.0' - 6.0' | S1: 6.0' -26.0'
Monument or Surface Casing: 6" X 5' LOCKING STEEL
Centralizer: NONE
Casing C1: 4" SCH 40 PVC – FLUSH THREAD
Screen S1: 0.020" V–WIRE SCREEN
Filter Pack: 10/20 COLORADO SILICA SAND
18 BAGS Depth: 5.0' - 26.0'
Bentonite: 3/8" HYR. BENT. CHIPS
2 BAGS Depth: 1.0' - 5.0'
Cement: REDI–MIX CONCRETE
2 – BAGS Depth: +0.3' - 1.0'
Other:

Construction Time Log

Drilling:	Start	End
8–28–11	10:05	11:30

Casing:	Start	End
8–28–11	11:30	14:30

Well Development

8–28–11
BAIL USING RIG AND 3" X 3' PVC BAILER.

BAIL 7 – 5 GALLON BUCKETS
35 GALLONS
NOT A LOT OF SAND COMING THROUGH SCREEN NEED OVERPUMP WITH 2" CENTRIFUGAL PUMP.

8–31–11
ADDITIONAL WELL DEVELOPMENT PUMP DRY SEVERAL TIMES TO IMPROVE DEVELOPMENT. REMOVE 50 GALLONS

FIELD PARAMETERS:
pH = 7.75
TEMP °C = 9.1
EC = 1130 µS

DTW AT 11:55 = 8.19' BTOC

30.5 OF CASING CUT OFF 2.6'
30' CASING +1/2 FOOT BOTTOM PLUG
∴ BOTTOM SCREEN AT 26'

Remarks

BTOC = BELOW TOP OF CASING

BGL = BELOW GROUND LEVEL

M.P. EL = MEASURING POINT ELEVATION

Abandoned

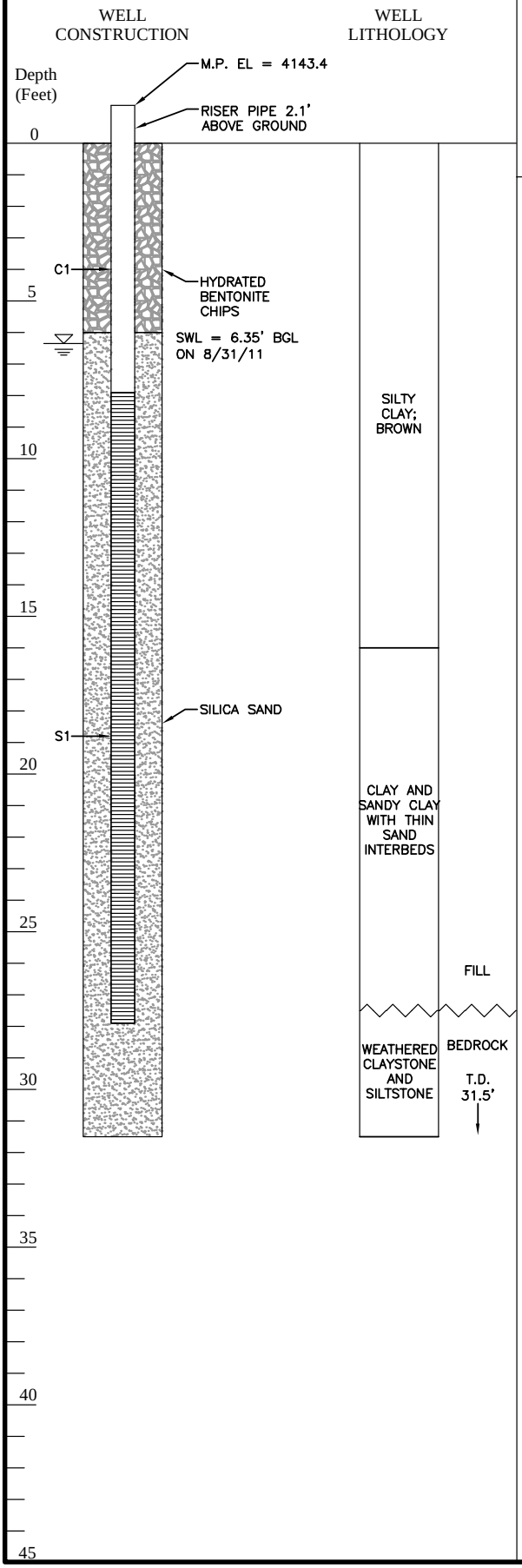
Date:
Method:

WWC ENGINEERING

Well Construction Summary

Client: STRATA ENERGY – ROSS ISR
Project: PLANT SITE GROUNDWATER WELLS Well: SA43–18–6

Location: N 1,485,146 E 713,910.9 GRD EL 4141.3
Projection WYOMING STATE PLANE NAD 83 EAST FEET
NE /4, SE /4, Section 18 T. 53 N. R. 67 W.
Geologist: MIKE WOLF WY PG #614



Drilling Summary

Total Depth: 31.5'
Hole Dia.: 8 1/4"
Driller: BILL CAMERON, TERRACON RAPID CITY, SD
Rig: CME55 HIGH TORQUE
Bit(s): CONTINUOUS CORE TOOL 8 1/4" HSA
Fluid: NONE
Casing: FLUSH THREAD SCH–40 PVC

Well Data

Casing: C=Casing S=Screen

C1: +2.15'- 7.9' | S1: 7.9' -27.9'

Monument or Surface Casing: 4" X 5' LOCKING STEEL

Centralizer: NONE

Casing C1: 2" SCH 40 PVC – FLUSH THREAD

Screen S1: FACTORY SLOTTED 0.020" SLOT

Filter Pack: 10/20 COLORADO SILICA SAND
12 BAGS Depth: 6.0' - 31.5'

Bentonite: 3/8" HYR. BENT. CHIPS
Depth: 1' - 6.0'

Cement: REDI–MIX CONCRETE
2 SACKS Depth: +0.3' - 1.0'

Other:

Construction Time Log

Drilling:	Start	End
8–26–11	15:00	17:30
8–27–11	7:45	8:30

Casing:	Start	End
8–21–11	8:30	10:20

Well Development

8–28–11
BAIL 40 GALLONS WITH STAINLESS STEEL BAILER.
STILL FAIRLY SANDY.

8–31–11
ADDITIONAL WELL DEVELOPMENT PUMP SEVERAL TIMES WITH CENTRIFUGAL PUMP.
REMOVE ANOTHER 50 GALLONS.
STILL SANDY

FIELD PARAMETERS:
pH = 7.65
TEMP °C = 9.0
EC = 1318 µS

DTW AT 11:58 = 8.50' BTOC

Remarks

BTOC = BELOW TOP OF CASING

BGL = BELOW GROUND LEVEL

M.P. EL = MEASURING POINT ELEVATION

Abandoned

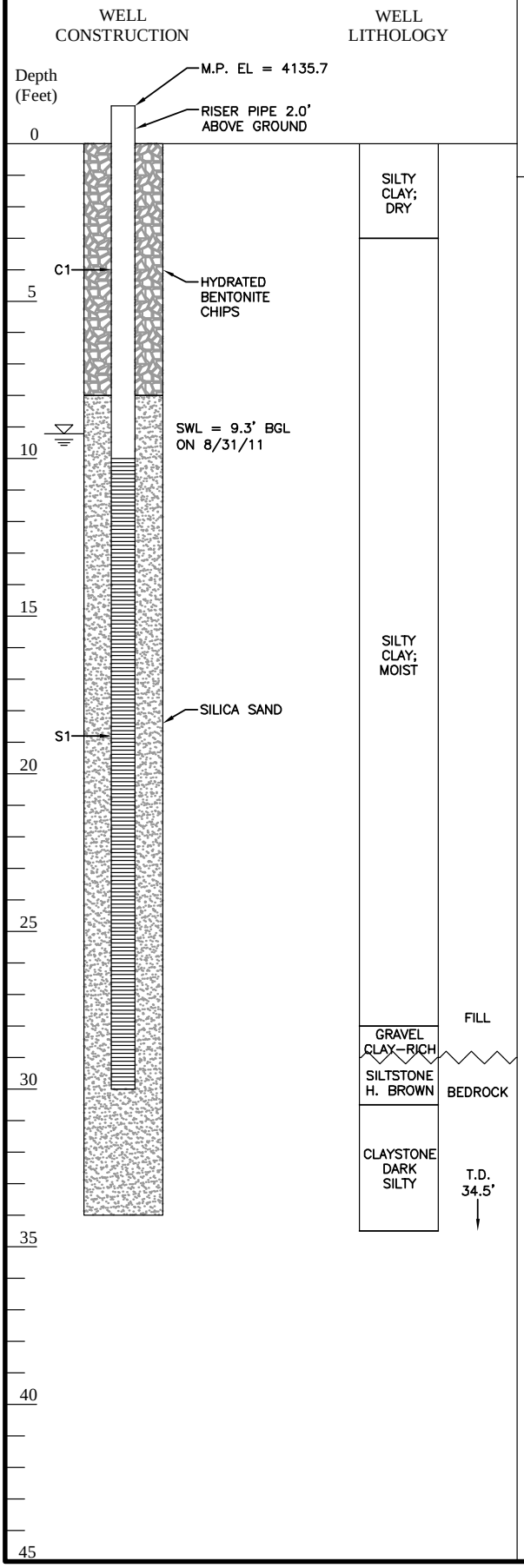
Date:
Method:

WWC ENGINEERING

Well Construction Summary

Client: STRATA ENERGY – ROSS ISR
Project: PLANT SITE GROUNDWATER WELLS Well: SA43–18–7

Location: N 1,485,949 E 714,184.4 GRD EL 4133.7
Projection WYOMING STATE PLANE NAD 83 EAST FEET
NE /4, SE /4, Section 18 T. 53 N. R. 67 W.
Geologist: MIKE WOLF WY PG #614



Drilling Summary

Total Depth: 34.5'
Hole Dia.: 8 1/4"
Driller: BILL CAMERON, TERRACON
RAPID CITY, SD
Rig: CME55 HIGH TORQUE
Bit(s): CONTONUOUS CORE TOOL
Fluid: NONE
Casing: FLUSH THREAD SCH–40 PVC

Well Data

Casing: C=Casing S=Screen

C1: +2.0' - 10' | S1: 10' -30'

Monument or Surface Casing:
4" X 5' LOCKING STEEL

Centralizer:
NONE

Casing C1:
2" SCH 40 PVC – FLUSH THREAD

Screen S1:
FACTORY SLOTTED 0.020" SLOT

Filter Pack:
10/20 COLORADO SILICA SAND
11 BAGS Depth: 8.0' - 30.0'

Bentonite:
3/8" HYR. BENT. CHIPS
2 BAGS Depth: 1.0' - 8.0'

Cement:
REDI–MIX CONCRETE
2 BAGS Depth: +0.2' - 1.0'

Other:

Construction Time Log

Drilling:	Start	End

Casing:	Start	End
8–28–11	9:25	10:00

Well Development

8–28–11
BAIL 10 GALLONS WITH STAINLESS STEEL BAILER.
STILL MODERATELY SILTY.

8–31–11
ADDITIONAL WELL DEVELOPMENT PUMP 15 GALLONS WITH CENTRIFUGAL PUMP.
DTW AT 11:52 = 11.37' BTOC
∴ DTW AT 9.37' BGL

FIELD PARAMETERS:
pH = 8.1
TEMP °C = 11.1
EC = 6110 µS

Remarks

BTOC = BELOW TOP OF CASING

BGL = BELOW GROUND LEVEL

M.P. EL = MEASURING POINT ELEVATION

Abandoned

Date:
Method:

WWC ENGINEERING

APPENDIX D

Field Data Sheets, Time Drawdown Plots, and Analyses for Aquifer Tests

WWC ENGINEERING

AQUIFER TEST FIELD DATA

Project/Client Ross/Strata/Plant Site Well Slug Test

Tested Well No. SA43-18-1 Observation Well No. None

Type of Pump Test: ☐ Constant Discharge ☐ Step-Drawdown

Tested Well Casing ID 2.0 inches

Distance Between Pumped and Observation Wells N/A feet

Water Level Measurements by: ☐ electric tape ☒ pressure transducer

Discharge Measurements by: ☐ bucket/stopwatch ☐ flow meter ☐ flume/weir

Screen/Perforation Interval(s) (below land surface) 8.8 – 28.8

Depth of Pump Intake (below land surface) N/A feet

Depth of Static Water Level (from measurement point) 19.17 feet

Height of Measurement Point (above land surface) 1.2 feet

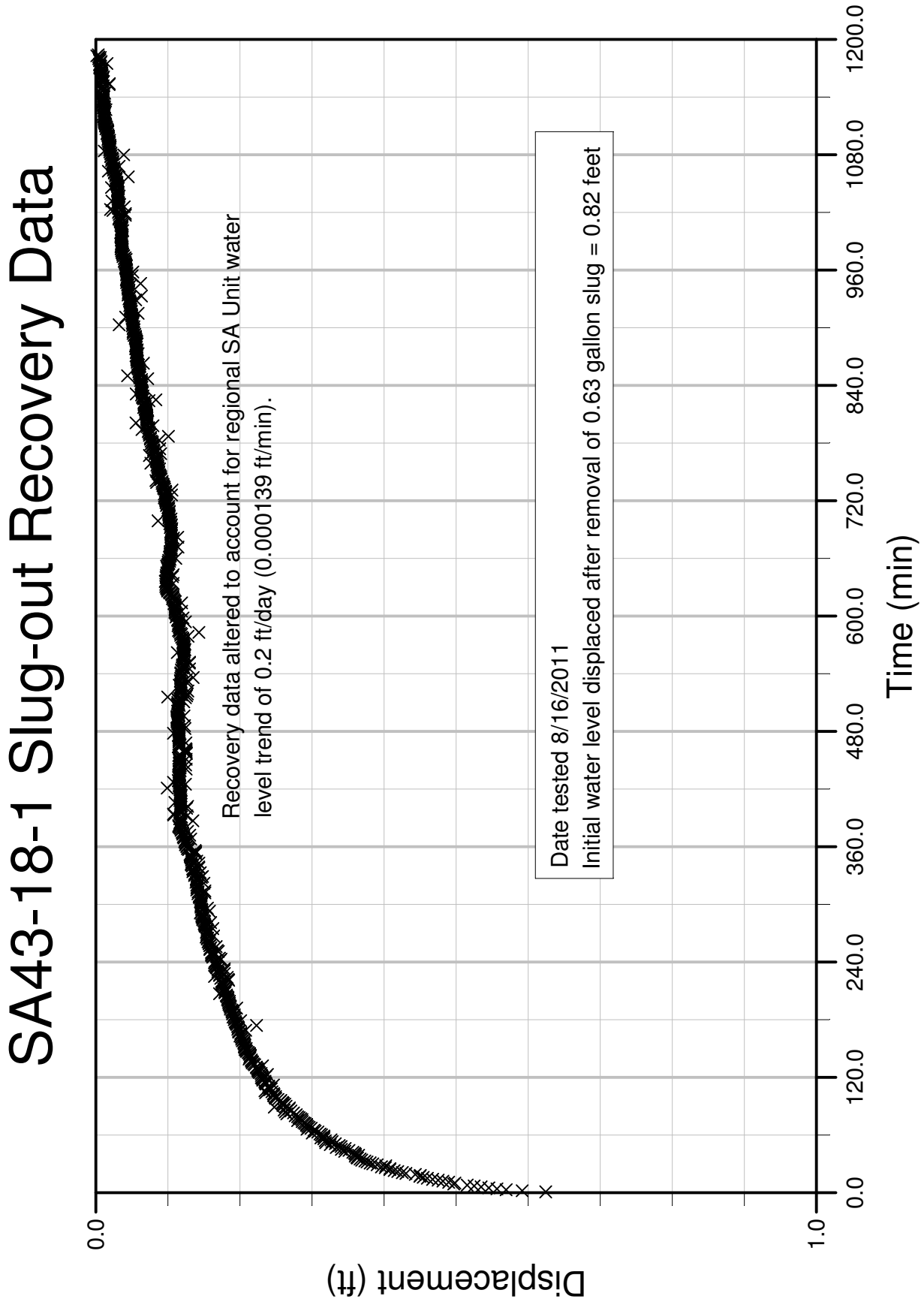
Elevation of Measurement Point 4,148.0 feet a.m.s.l.

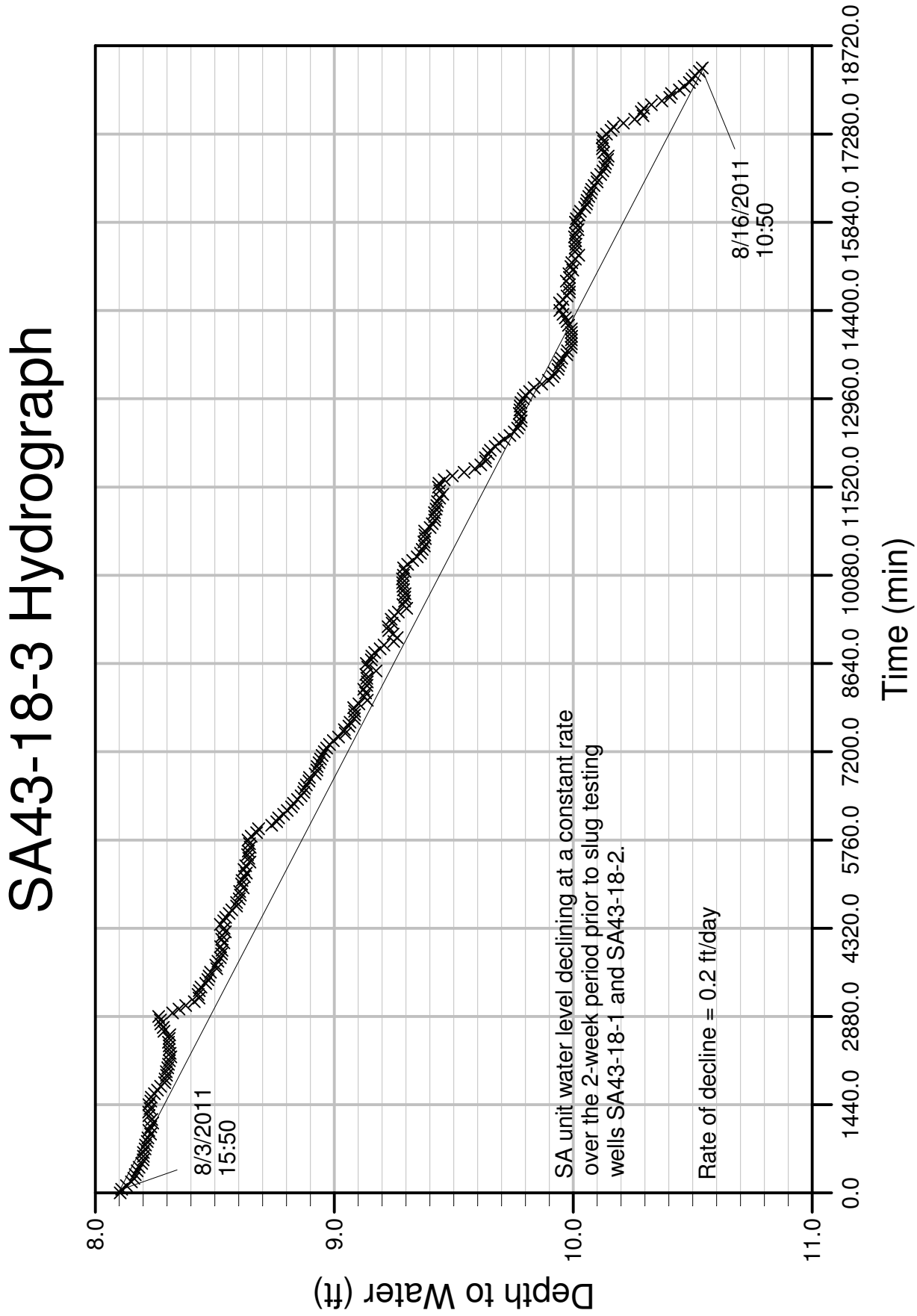
Slug Out Date 08 / 16 / 2011 Time 1230 AM/(PM)

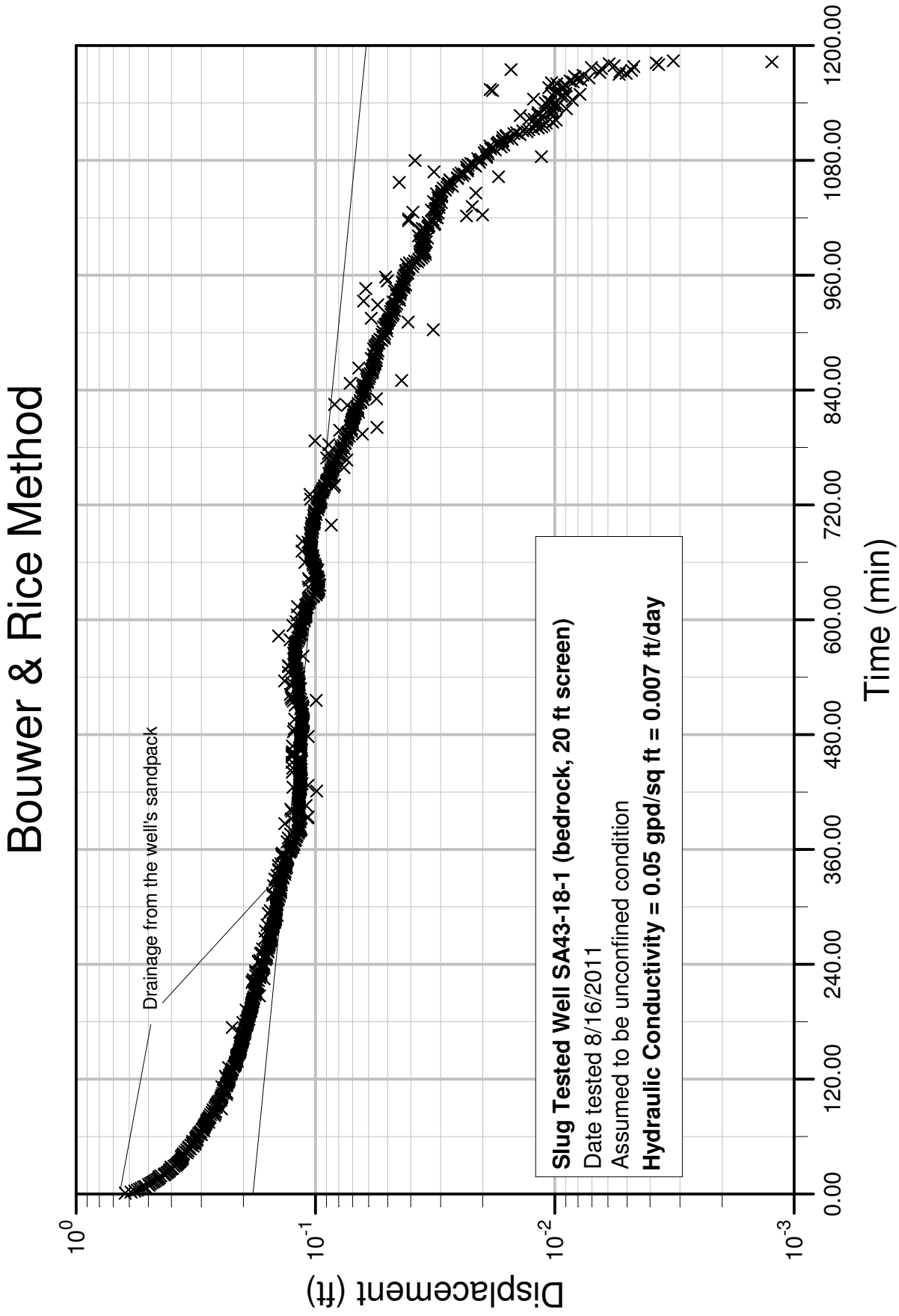
Pump Off Date / / Time AM/PM

Weather Conditions

Test Performed by Slug out test done by J. Rogers


SA43-18-1 Slug-out Recovery Data
Displacement (ft)
0.0
1.0
Time (min)
0.0
120.0
240.0
360.0
480.0
600.0
720.0
840.0
960.0
1080.0
1200.0
Recovery data altered to account for regional SA Unit water level trend of 0.2 ft/day (0.000139 ft/min).
Date tested 8/16/2011
Initial water level displaced after removal of 0.63 gallon slug = 0.82 feet


SA43-18-3 Hydrograph
Depth to Water (ft)
8.0
9.0
10.0
11.0
Time (min)
0.0
1440.0
2880.0
4320.0
5760.0
7200.0
8640.0
10080.0
11520.0
12960.0
14400.0
15840.0
17280.0
18720.0
8/3/2011
15:50
8/16/2011
10:50
SA unit water level declining at a constant rate
over the 2-week period prior to slug testing
wells SA43-18-1 and SA43-18-2.
Rate of decline = 0.2 ft/day


Bouwer & Rice Method
Drainage from the well's sandpack
Slug Tested Well SA43-18-1 (bedrock, 20 ft screen)
Date tested 8/16/2011
Assumed to be unconfined condition
Hydraulic Conductivity = 0.05 gpd/sq ft = 0.007 ft/day
Displacement (ft)
Time (min)
10^0
10^-1
10^-2
10^-3
0.00
120.00
240.00
360.00
480.00
600.00
720.00
840.00
960.00
1080.00
1200.00

WWC ENGINEERING

AQUIFER TEST FIELD DATA

Project/Client Ross/Strata/Plant Site Well Slug Test

Tested Well No. SA43-18-2 Observation Well No. None

Type of Pump Test: ☐ Constant Discharge ☐ Step-Drawdown

Tested Well Casing ID 2.0 inches

Distance Between Pumped and Observation Wells N/A feet

Water Level Measurements by: ☐ electric tape ☒ pressure transducer

Discharge Measurements by: ☐ bucket/stopwatch ☐ flow meter ☐ flume/weir

Screen/Perforation Interval(s) (below land surface) 8.6 – 18.6

Depth of Pump Intake (below land surface) N/A feet

Depth of Static Water Level (from measurement point) 11.53 feet

Height of Measurement Point (above land surface) 1.4 feet

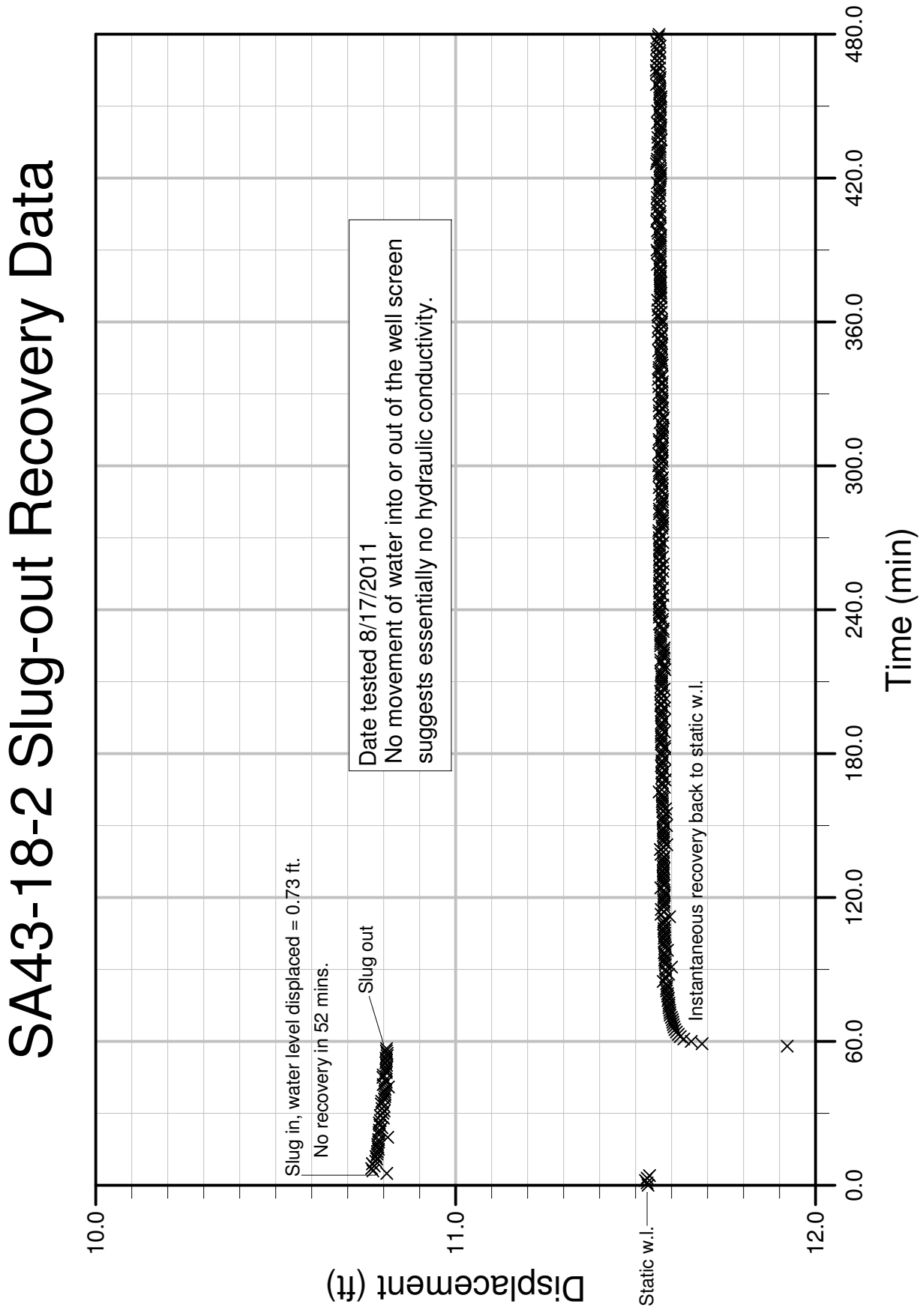
Elevation of Measurement Point 4,150.7 feet a.m.s.l.

Slug Out Date 08 / 17 / 2011 Time 0835 (AM)/PM

Pump Off Date / / Time AM/PM

Weather Conditions

Test Performed by Slug out test done by J. Rogers


SA43-18-2 Slug-out Recovery Data
Displacement (ft)
Time (min)
10.0
11.0
12.0
0.0
60.0
120.0
180.0
240.0
300.0
360.0
420.0
480.0
Static w.l.
Slug in, water level displaced = 0.73 ft.
No recovery in 52 mins.
Slug out
Instantaneous recovery back to static w.l.
Date tested 8/17/2011
No movement of water into or out of the well screen
suggests essentially no hydraulic conductivity.

WWC ENGINEERING

AQUIFER TEST FIELD DATA

Project/Client Ross/Strata/Plant Site Well Test

Pumped Well No. SA42-18-1 Observation Well No. None

Type of Pump Test: ☒ Constant Discharge ☐ Step-Drawdown

Pumped Well Casing ID 2.0 inches

Distance Between Pumped and Observation Wells N/A feet

Water Level Measurements by: ☒ electric tape ☒ pressure transducer

Discharge Measurements by: ☒ bucket/stopwatch ☐ flow meter ☐ flume/weir

Screen/Perforation Interval(s) (below land surface) 8.0 – 28.0

Depth of Pump Intake (below land surface) 27.0 feet

Depth of Static Water Level (from measurement point) 13.96 feet

Height of Measurement Point (above land surface) 2.1 feet

Elevation of Measurement Point 4,135.9 feet a.m.s.l.

Pump On Date 09 / 28 / 2011 Time 1030 (AM)/PM

Pump Off Date 09 / 28 / 2011 Time 1632 AM/(PM)

Weather Conditions Clear, dry, mild

Test Performed by Collier and Rogers

WWC ENGINEERING

AQUIFER TEST FIELD DATA

Project/Client Ross/Strata/Plant Site Well Test Well No. SA42-18-1 Single Well

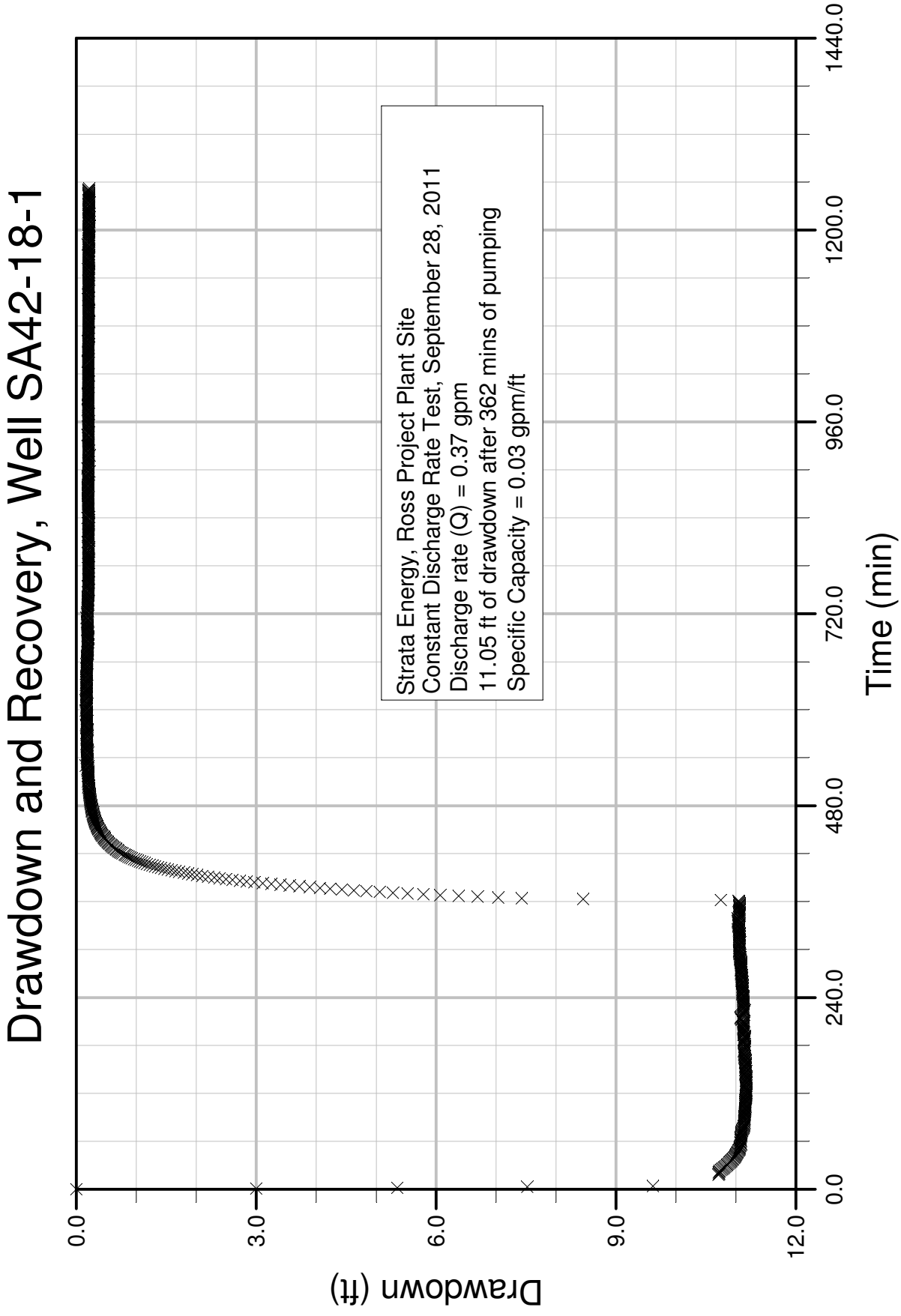
TIME			WATER LEVEL DATA			
Date	Clock Time	(**t**) Elapsed Time Since Pump ON or OFF (min)	Depth to Water Below M.P. (ft)	(**s**) Drawdown/ Recovery (ft)	(**Q**) Discharge (gpm)	COMMENTS
9-28-11		S.W.L. = 13.91' below M.P. Set Redi-Flow submersible pump and In-Situ transducer to record drawdown and recovery data.				
On 1030		0	13.91	0	0	
	1031	1	17.41	3.50	1.5	1.5 gpm too much - w.l. dropping too fast so adjusted Redi-Flow to 0.75 gpm
1032		2	19.95	6.04	0.75	
	1034	4	24.10	10.19	0.50	Discharge reduced more
	1037	7	25.65	11.74	0.37	163 sec/gal = 0.37 gpm
1040		10	25.45	11.54	0.37	
1045		15	24.75	10.84	0.37	
1050		20	24.65	10.74	0.37	
1100		30	24.81	10.90	0.37	
1115		45	24.97	11.06	0.37	
1130		60	25.02	11.11	0.37	
1205		95	25.11	11.20	0.37	
	1230	120	25.13	11.22	0.37	
	1300	150	25.10	11.19	0.37	161 sec/gal = 0.37 gpm
1400		210	25.10	11.19	0.37	
1500		270	25.05	11.14	0.37	

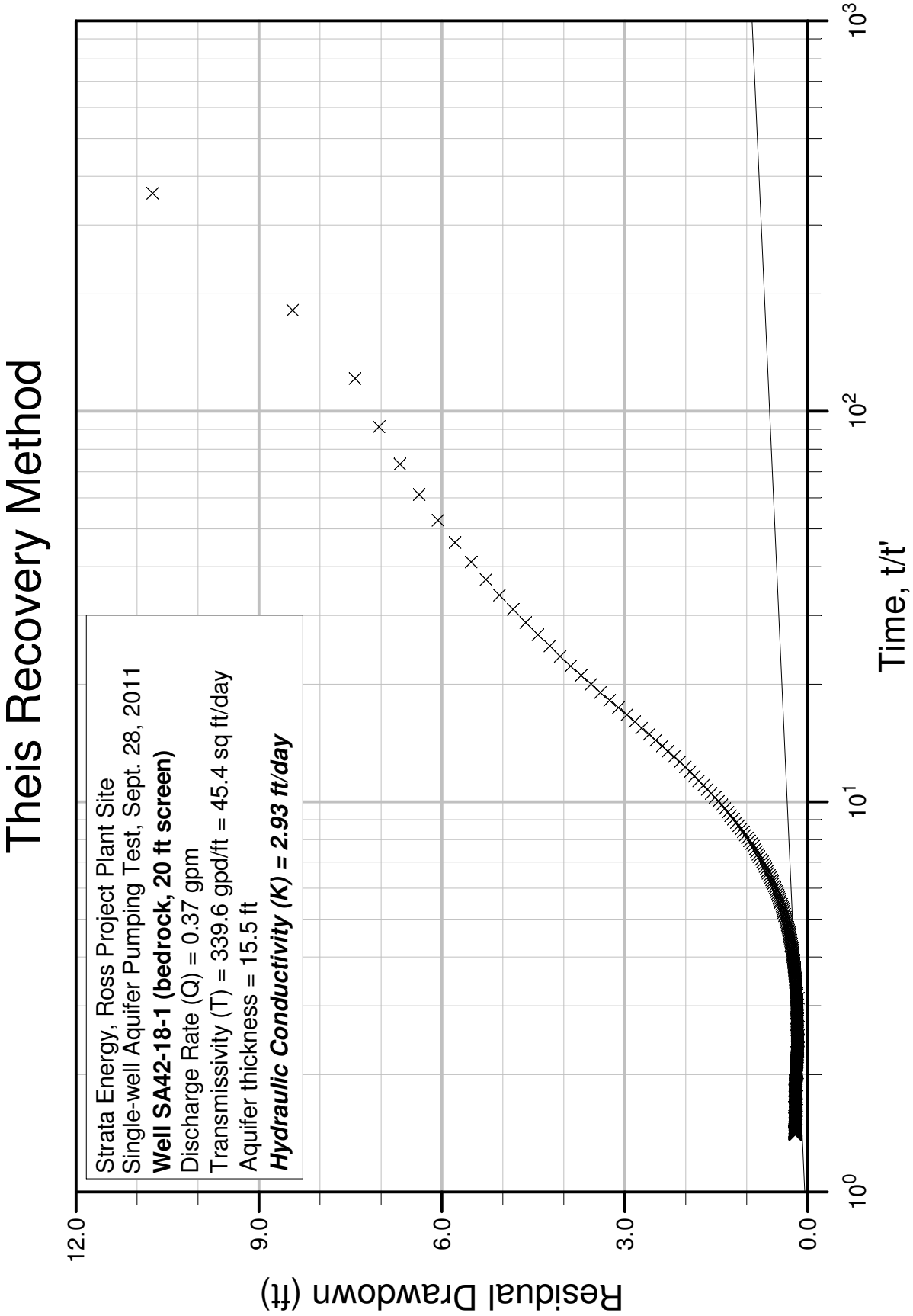
WWC ENGINEERING

AQUIFER TEST FIELD DATA

Project/Client Ross/Strata/Plant Site Well Test Well No. SA42-18-1 Single Well

TIME			WATER LEVEL DATA			
Date	Clock Time	(**t**) Elapsed Time Since Pump ON or OFF (min)	Depth to Water Below M.P. (ft)	(**s**) Drawdown/ Recovery (ft)	(**Q**) Discharge (gpm) COMME	NTS
9-28-11	1630	360	25.02	11.11	0.37	
Off	1632	362/0	25.02	11.11	0	
1633		363/1	21.75	7.84		
	1635	365/3	20.90	6.99		
	1640	370/8	19.40	5.49		
	1645	375/13	18.33	4.42		
1650		380/18	17.45	3.54		
1655		385/23	16.70	2.79		
1700		390/28	16.23	2.32		
9-29-11	0723	1253/891	14.12	0.21		


Drawdown and Recovery, Well SA42-18-1
Strata Energy, Ross Project Plant Site
Constant Discharge Rate Test, September 28, 2011
Discharge rate (Q) = 0.37 gpm
11.05 ft of drawdown after 362 mins of pumping
Specific Capacity = 0.03 gpm/ft
Drawdown (ft)
0.0
3.0
6.0
9.0
12.0
Time (min)
0.0
240.0
480.0
720.0
960.0
1200.0
1440.0


Theis Recovery Method
Strata Energy, Ross Project Plant Site
Single-well Aquifer Pumping Test, Sept. 28, 2011
Well SA42-18-1 (bedrock, 20 ft screen)
Discharge Rate (Q) = 0.37 gpm
Transmissivity (T) = 339.6 gpd/ft = 45.4 sq ft/day
Aquifer thickness = 15.5 ft
Hydraulic Conductivity (K) = 2.93 ft/day
Residual Drawdown (ft)
12.0
9.0
6.0
3.0
0.0
Time, t/t'
10^0
10^1
10^2
10^3

WWC ENGINEERING

AQUIFER TEST FIELD DATA

Project/Client Ross/Strata/Plant Site Well Test

Pumped Well No. SA43-18-4 Observation Well No. SA43-18-6

Type of Pump Test: ☒ Constant Discharge ☐ Step-Drawdown

Pumped Well Casing ID 4.0 inches

Distance Between Pumped and Observation Wells 30.67 feet

Water Level Measurements by: ☒ electric tape ☒ pressure transducer

Discharge Measurements by: ☒ bucket/stopwatch ☐ flow meter ☐ flume/weir
(0.5 gpm Dole valve used)

Screen/Perforation Interval(s) (below land surface) 6.0 – 26.0

Depth of Pump Intake (below land surface) 25.0 feet

Depth of Static Water Level (from measurement point) 8.56 feet

Height of Measurement Point (above land surface) 1.90 feet

Elevation of Measurement Point 4,143.27 feet a.m.s.l.

Pump On Date 09 / 27 / 2011 Time 0828 (AM)/PM

Pump Off Date 09 / 28 / 2011 Time 0730 (AM)/PM

Weather Conditions Clear, cool mornings, hot afternoons, dry

Test Performed by Collier and Rogers

AQUIFER TEST FIELD DATA

Project/Client Ross/Strata/Plant Site Well Test Well No. SA43-18-4 4" Pump Well

TIME			WATER LEVEL DATA			
Date	Clock Time	(t) Elapsed Time Since Pump ON or OFF (min)	Depth to Water Below M.P. (ft)	(s) Drawdown/ Recovery (ft)	(Q) Discharge (gpm)	COMMENTS
9-27-11		Hermit started recording @ 8:12 am. S.W.L. = 8.56' from M.P. All drawdown and recovery data recorded using In-Situ transducer and Hermit data logger.				
On	0828	0	8.56	0	0	½ gallon Dole valve. Q measured with bucket and stopwatch
0829		1	9.30	0.74	0.5	
0830		2	9.60	1.04	0.5	
0831		3	9.76	1.20	0.5	
0832		4	9.98	1.42	0.5	
0833		5	10.17	1.61	0.5	
0839		11	11.31	2.75	0.5	
0846		18	12.43	3.87	0.5	
0850		22	12.94	4.38	0.5	
0904		36	14.45	5.89	0.5	
0924		56	16.10	7.54	0.5	
0947		79	17.47	8.91	0.5	
1003		95	18.15	9.59	0.5	
1030		112	19.00	10.44	0.5	
1100		142	19.44	10.88	0.5	
1130		172	19.80	11.24	0.5	

WWC ENGINEERING

AQUIFER TEST FIELD DATA

Project/Client Ross/Strata/Plant Site Well Test Well No. SA43-18-4 4" Pump Well

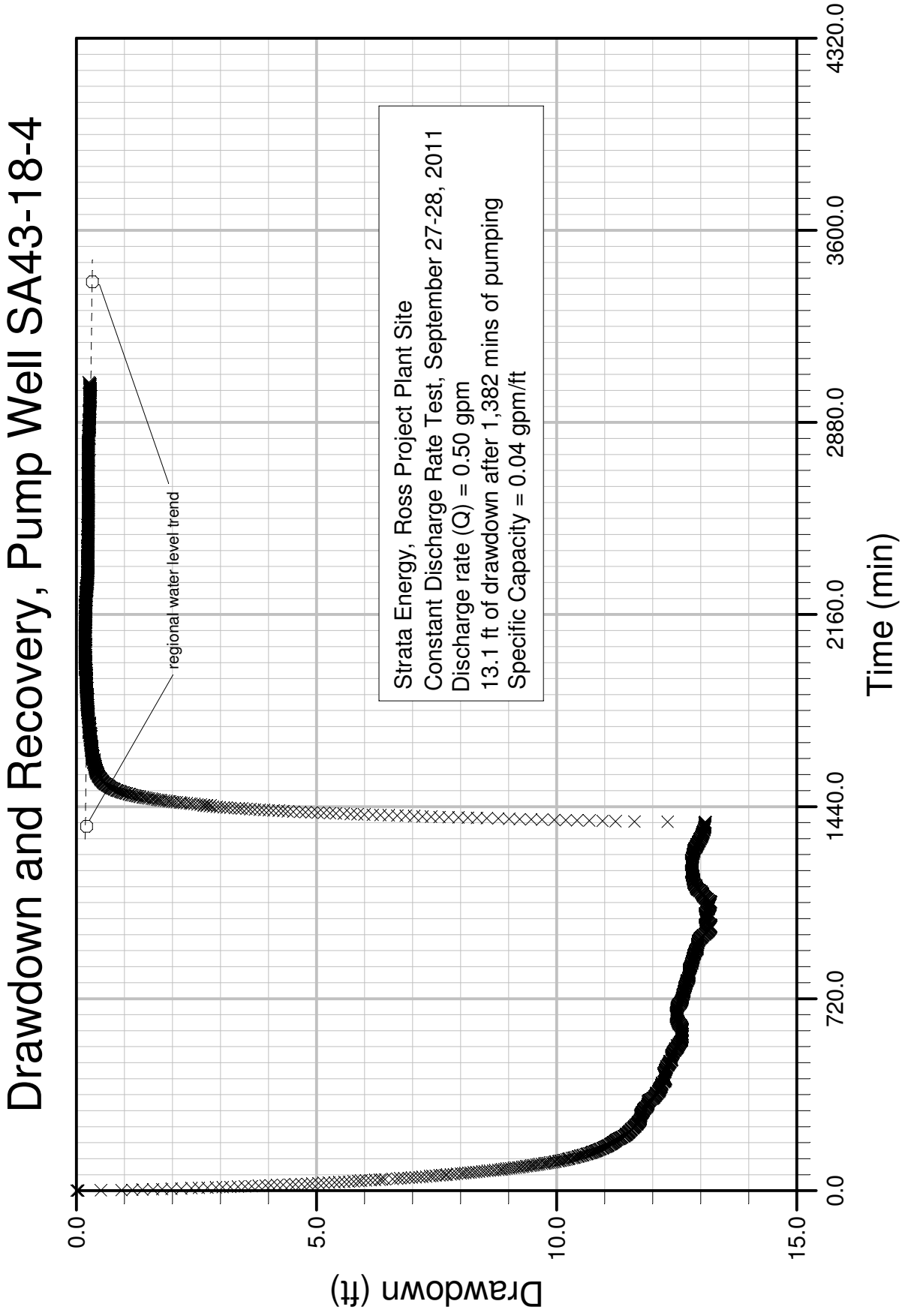
1200		202	20.06	11.50	0.5	
	1230	232	20.24	11.68	0.5	
1300		262	20.36	11.80	0.5	
	1330	292	20.42	11.86	0.5	Maybe just under 0.5 gpm
1430		352	20.67	12.11	0.5	
1530		412	20.89	12.33	0.5	
1630		472	20.97	12.41	0.5	W.Q. sample collected
1730		532	21.13	12.57	0.5	Hermit reads 12.51'
9-28-11 0725		1367	21.75	13.19	0.5	
Off 0730		1372/0	21.75	13.19	0	
0732		1374/2	20.15	11.59		
0734		1376/4	19.53	10.97		
0739		1381/9	18.30	9.74		
0745		1387/15	16.82	8.26		
0805		1407/35	13.50	4.94		
0815		1417/45	12.41	3.85		
	0830	1432/60	11.35	2.79		Pulled pump from well

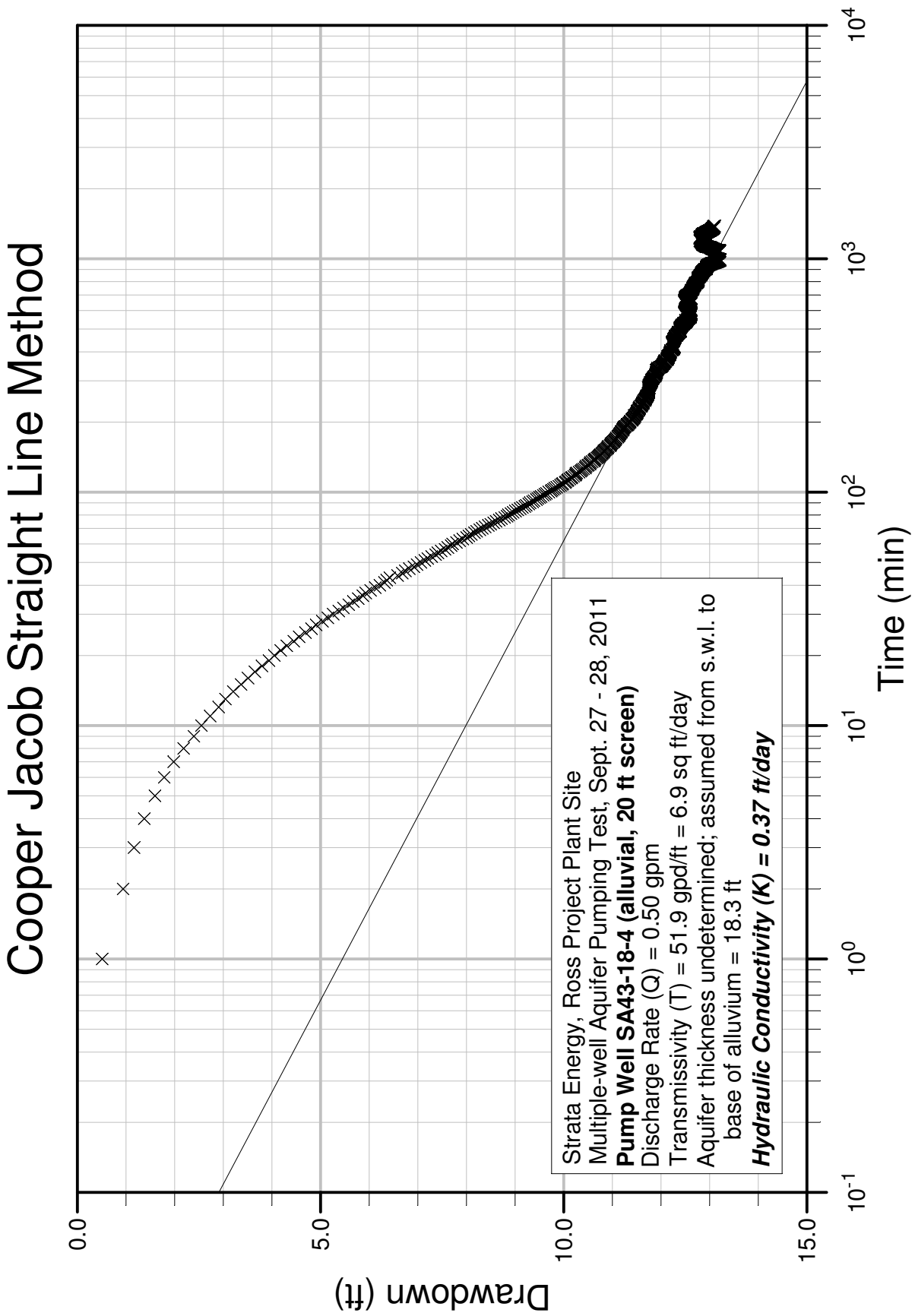
WWC ENGINEERING

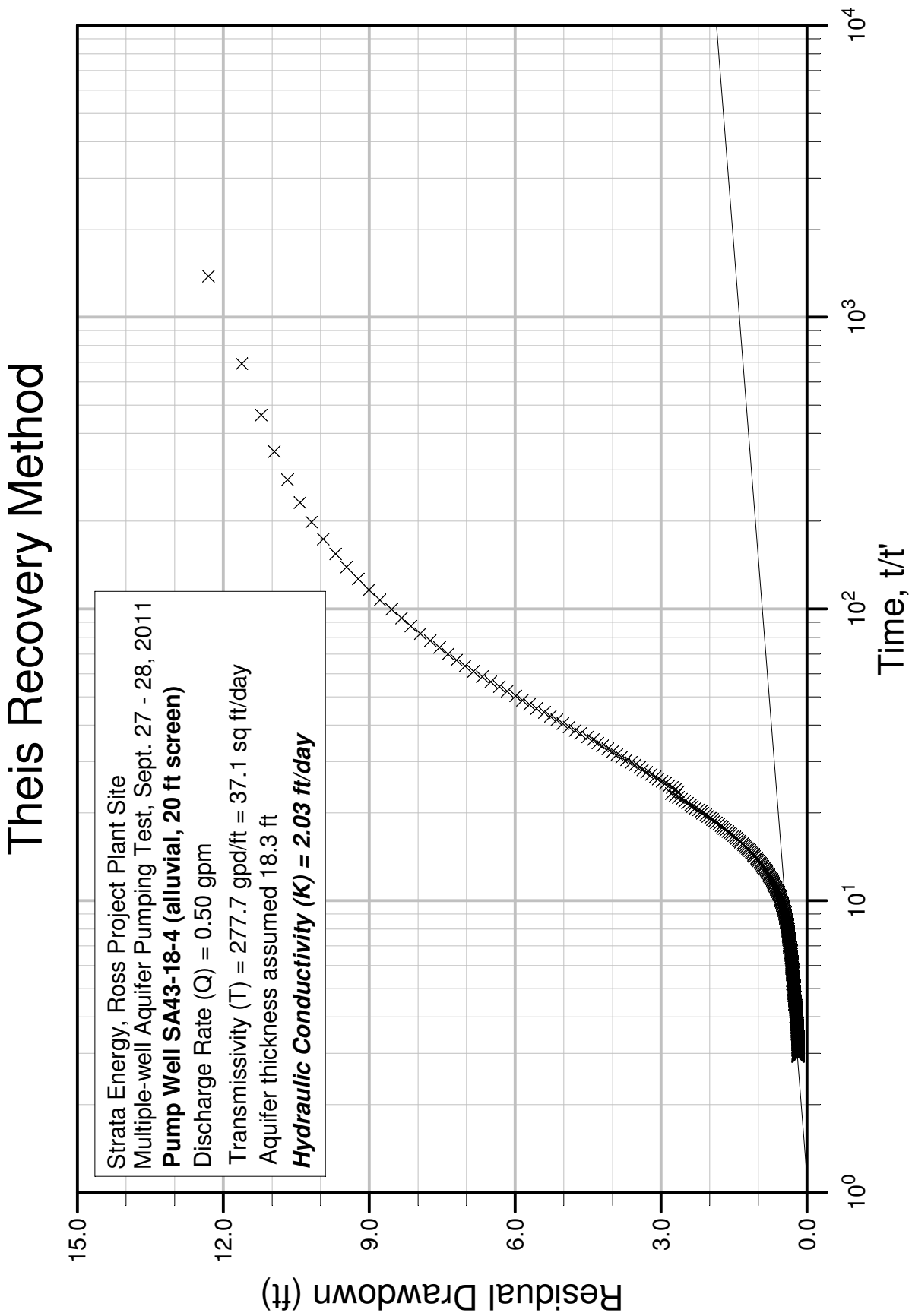
AQUIFER TEST FIELD DATA

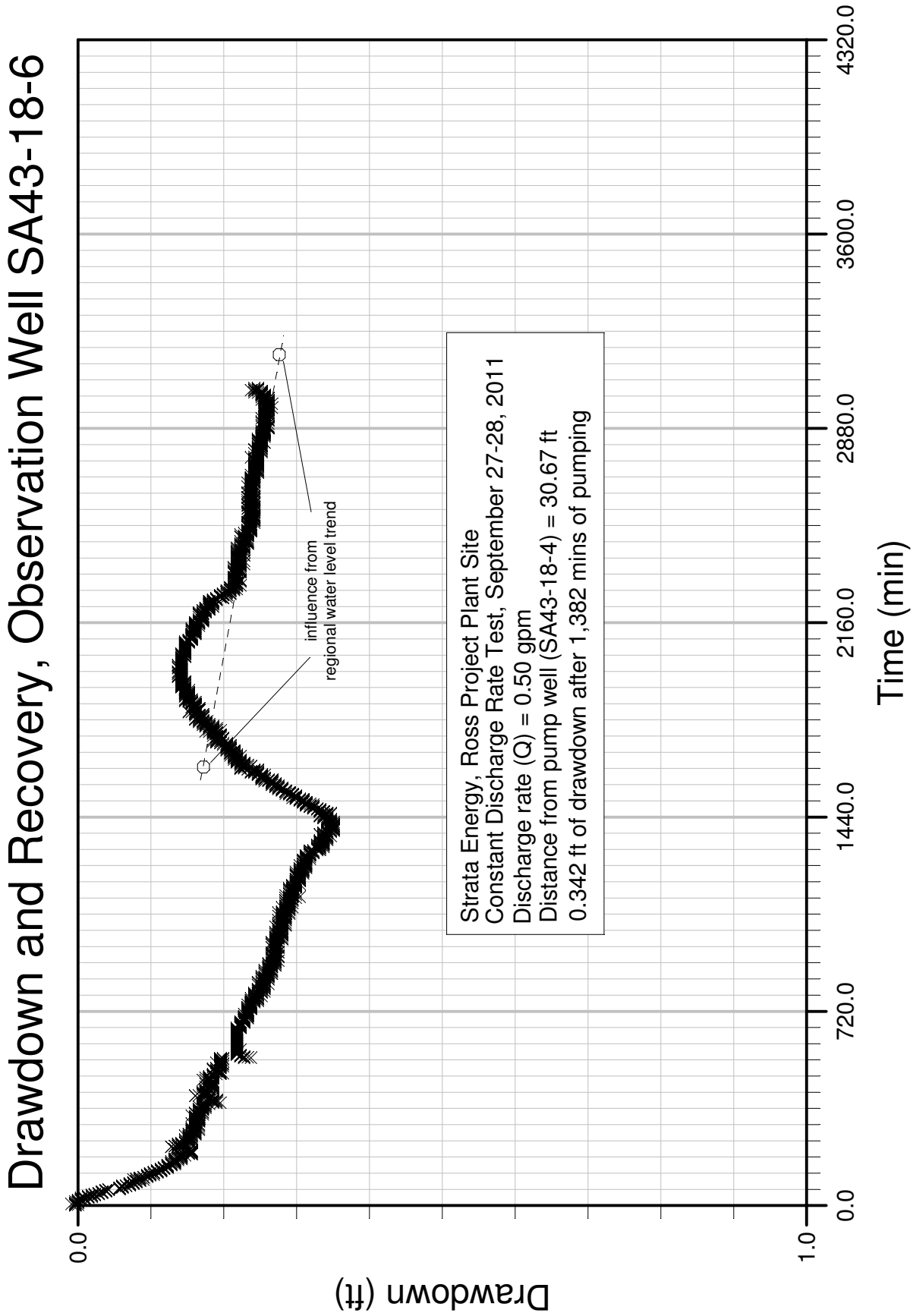
Project/Client Ross/Strata/Plant Site Well Test Well No. SA43-18-6 2" Obs. Well

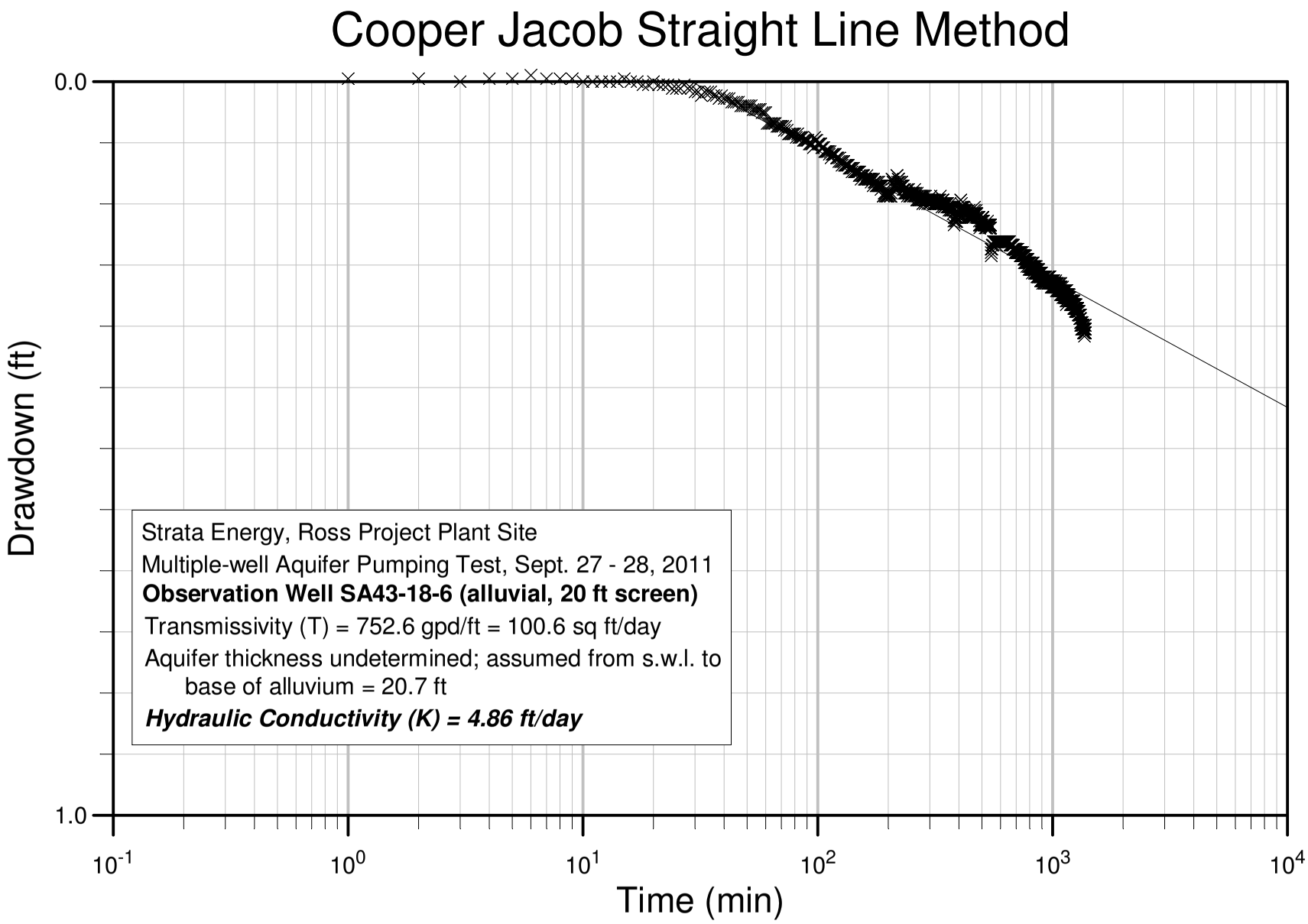
		Observation well 30.67 feet away from Pump Well SA-43-18-6				
9-27-11		Started Hermits @ 8:12am W.L. = 8.87' from M.P. Pump on @ 8:28 am				
		All drawdown and recovery data recorded using In-Situ transducer and Hermit data logger				

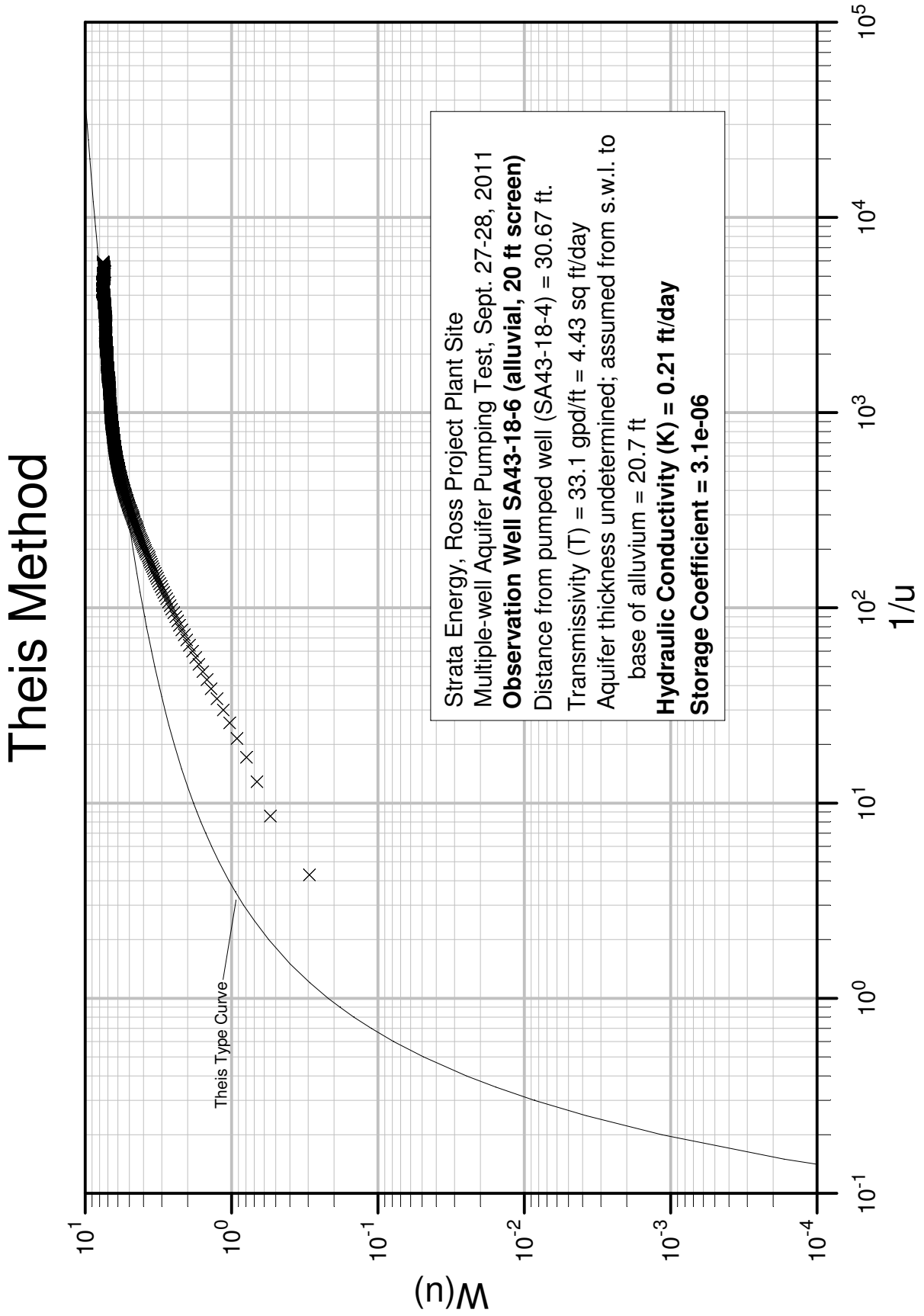

Drawdown and Recovery, Pump Well SA43-18-4
Strata Energy, Ross Project Plant Site
Constant Discharge Rate Test, September 27-28, 2011
Discharge rate (Q) = 0.50 gpm
13.1 ft of drawdown after 1,382 mins of pumping
Specific Capacity = 0.04 gpm/ft
regional water level trend
Drawdown (ft)
0.0
5.0
10.0
15.0
Time (min)
0.0
720.0
1440.0
2160.0
2880.0
3600.0
4320.0

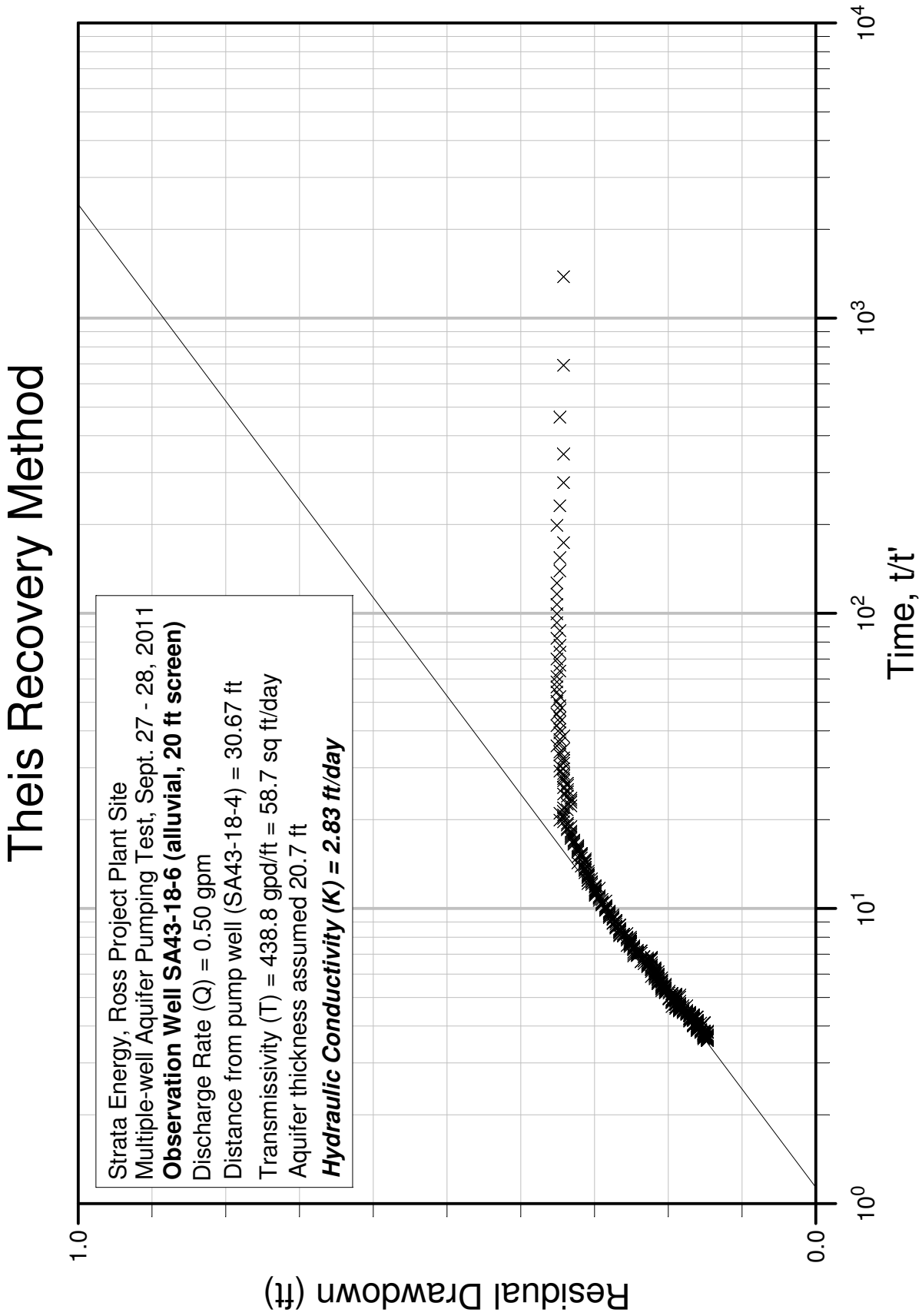

Cooper Jacob Straight Line Method
Drawdown (ft)
0.0
5.0
10.0
15.0
Time (min)
10^{-1}
10^{0}
10^{1}
10^{2}
10^{3}
10^{4}
Strata Energy, Ross Project Plant Site
Multiple-well Aquifer Pumping Test, Sept. 27 - 28, 2011
Pump Well SA43-18-4 (alluvial, 20 ft screen)
Discharge Rate (Q) = 0.50 gpm
Transmissivity (T) = 51.9 gpd/ft = 6.9 sq ft/day
Aquifer thickness undetermined; assumed from s.w.l. to base of alluvium = 18.3 ft
Hydraulic Conductivity (K) = 0.37 ft/day


Theis Recovery Method
Strata Energy, Ross Project Plant Site
Multiple-well Aquifer Pumping Test, Sept. 27 - 28, 2011
Pump Well SA43-18-4 (alluvial, 20 ft screen)
Discharge Rate (Q) = 0.50 gpm
Transmissivity (T) = 277.7 gpd/ft = 37.1 sq ft/day
Aquifer thickness assumed 18.3 ft
Hydraulic Conductivity (K) = 2.03 ft/day
Residual Drawdown (ft)
15.0
12.0
9.0
6.0
3.0
0.0
Time, t/t'
10^0
10^1
10^2
10^3
10^4


Drawdown and Recovery, Observation Well SA43-18-6
Strata Energy, Ross Project Plant Site
Constant Discharge Rate Test, September 27-28, 2011
Discharge rate (Q) = 0.50 gpm
Distance from pump well (SA43-18-4) = 30.67 ft
0.342 ft of drawdown after 1,382 mins of pumping
influence from
regional water level trend
Drawdown (ft)
0.0
1.0
Time (min)
0.0
720.0
1440.0
2160.0
2880.0
3600.0
4320.0


Cooper Jacob Straight Line Method
Drawdown (ft)
0.0
1.0
10^{-1}
10^{0}
10^{1}
10^{2}
10^{3}
10^{4}
Time (min)
Strata Energy, Ross Project Plant Site
Multiple-well Aquifer Pumping Test, Sept. 27 - 28, 2011
Observation Well SA43-18-6 (alluvial, 20 ft screen)
Transmissivity (T) = 752.6 gpd/ft = 100.6 sq ft/day
Aquifer thickness undetermined; assumed from s.w.l. to base of alluvium = 20.7 ft
Hydraulic Conductivity (K) = 4.86 ft/day


Theis Method
Strata Energy, Ross Project Plant Site
Multiple-well Aquifer Pumping Test, Sept. 27-28, 2011
Observation Well SA43-18-6 (alluvial, 20 ft screen)
Distance from pumped well (SA43-18-4) = 30.67 ft.
Transmissivity (T) = 33.1 gpd/ft = 4.43 sq ft/day
Aquifer thickness undetermined; assumed from s.w.l. to base of alluvium = 20.7 ft
Hydraulic Conductivity (K) = 0.21 ft/day
Storage Coefficient = 3.1e-06
Theis Type Curve
W(u)
1/u
10^{1}
10^{0}
10^{-1}
10^{-2}
10^{-3}
10^{-4}
10^{-1}
10^{0}
10^{1}
10^{2}
10^{3}
10^{4}
10^{5}


Theis Recovery Method
Strata Energy, Ross Project Plant Site
Multiple-well Aquifer Pumping Test, Sept. 27 - 28, 2011
Observation Well SA43-18-6 (alluvial, 20 ft screen)
Discharge Rate (Q) = 0.50 gpm
Distance from pump well (SA43-18-4) = 30.67 ft
Transmissivity (T) = 438.8 gpd/ft = 58.7 sq ft/day
Aquifer thickness assumed 20.7 ft
Hydraulic Conductivity (K) = 2.83 ft/day
Residual Drawdown (ft)
1.0
0.0
10^0
10^1
10^2
10^3
10^4
Time, t/t'

WWC ENGINEERING

AQUIFER TEST FIELD DATA

Project/Client Ross/Strata/Plant Site Well Test

Pumped Well No. SA43-18-3 Observation Well No. None

Type of Pump Test: ☒ Constant Discharge ☐ Step-Drawdown

Pumped Well Casing ID 2.0 inches

Distance Between Pumped and Observation Wells N/A feet

Water Level Measurements by: ☒ electric tape ☒ pressure transducer

Discharge Measurements by: ☒ bucket/stopwatch ☐ flow meter ☐ flume/weir

Screen/Perforation Interval(s) (below land surface) 13.10 – 23.10

Depth of Pump Intake (below land surface) 22.0 feet

Depth of Static Water Level (from measurement point) 14.70 feet

Height of Measurement Point (above land surface) 1.90 feet

Elevation of Measurement Point 4,134.8 feet a.m.s.l.

Pump On Date 09 / 29 / 2011 Time 0945 (AM)/PM

Pump Off Date 09 / 29 / 2011 Time 1530 AM/(PM)

Weather Conditions Clear, dry, mild

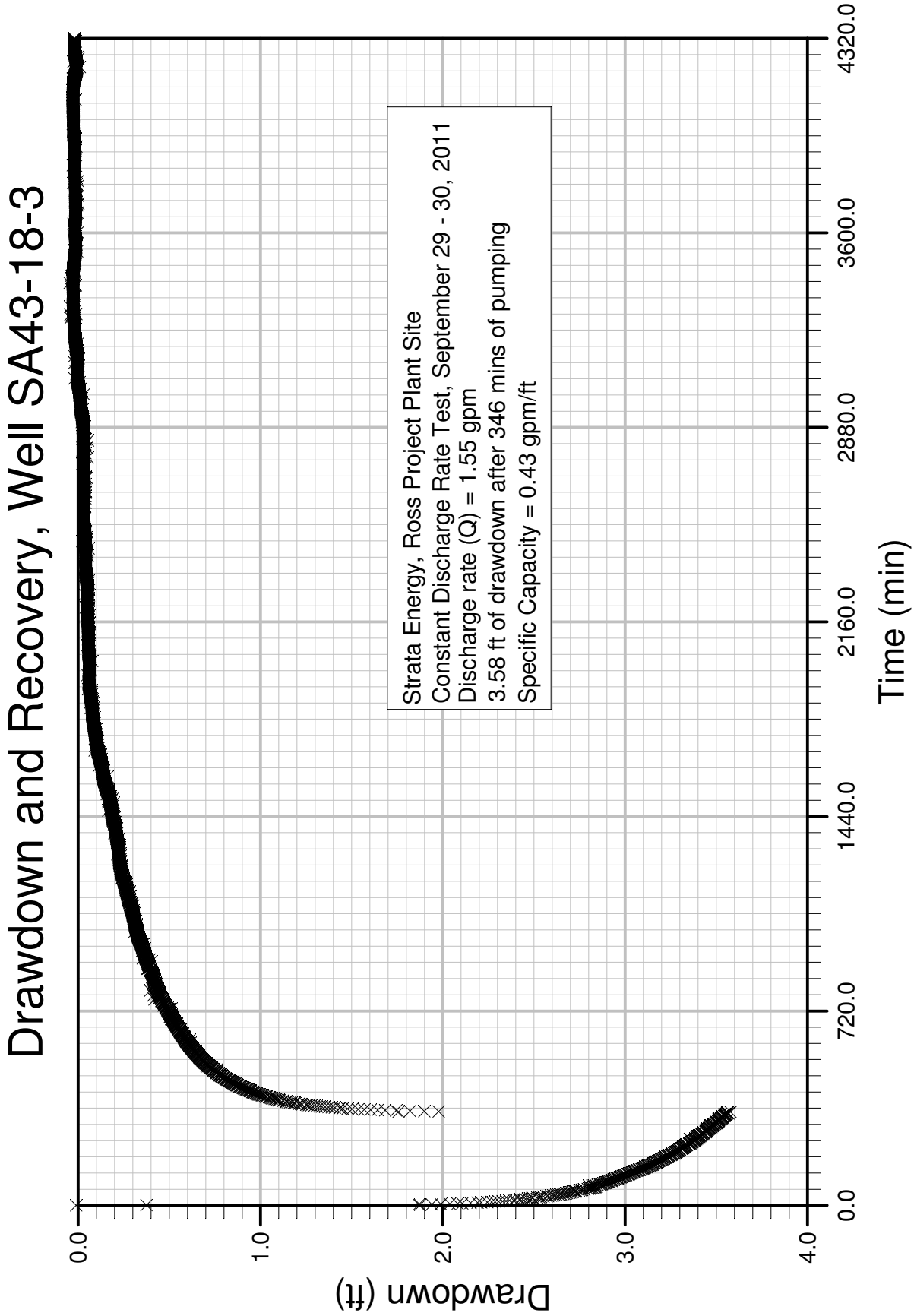
Test Performed by Collier and Rogers

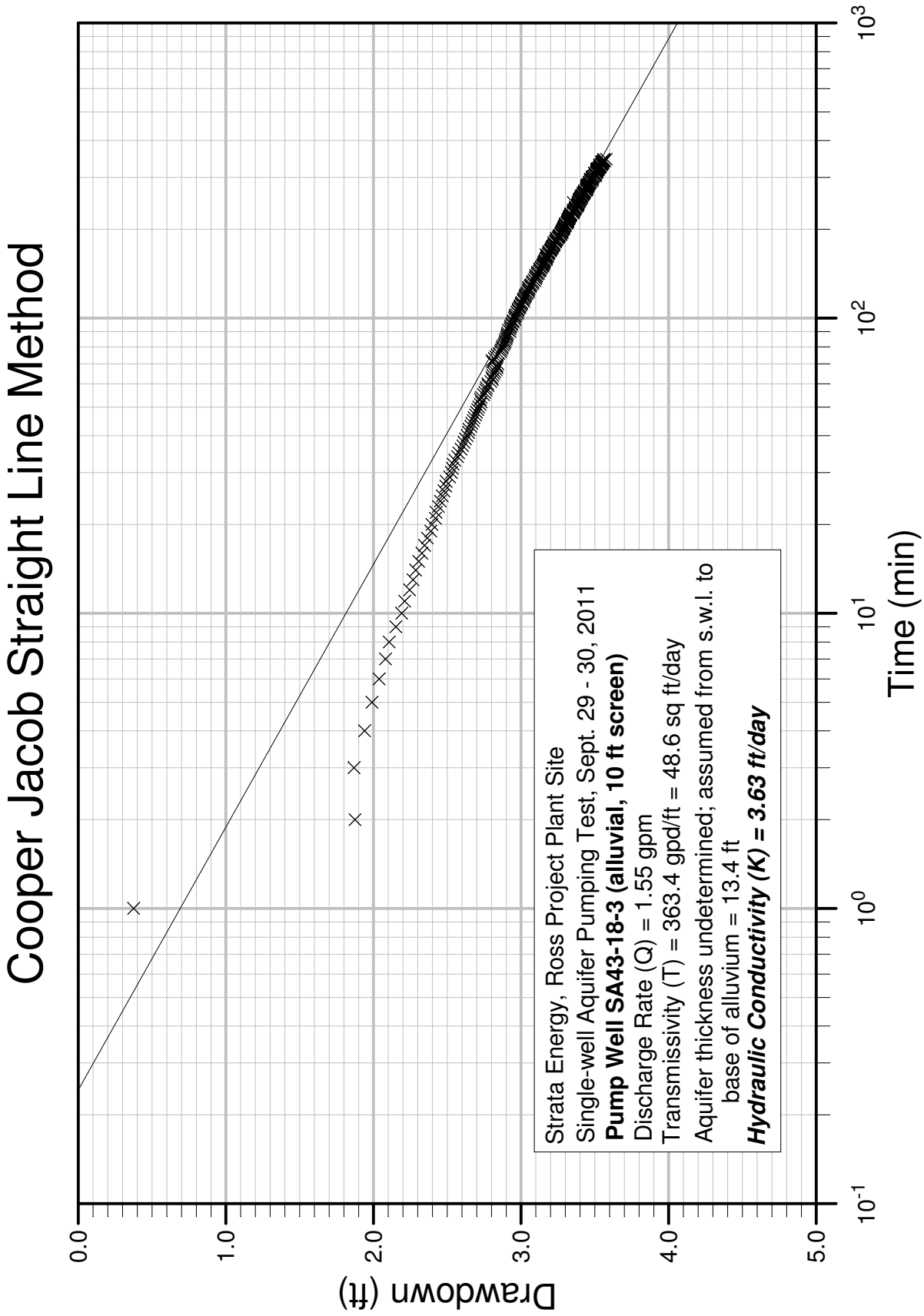
WWC ENGINEERING

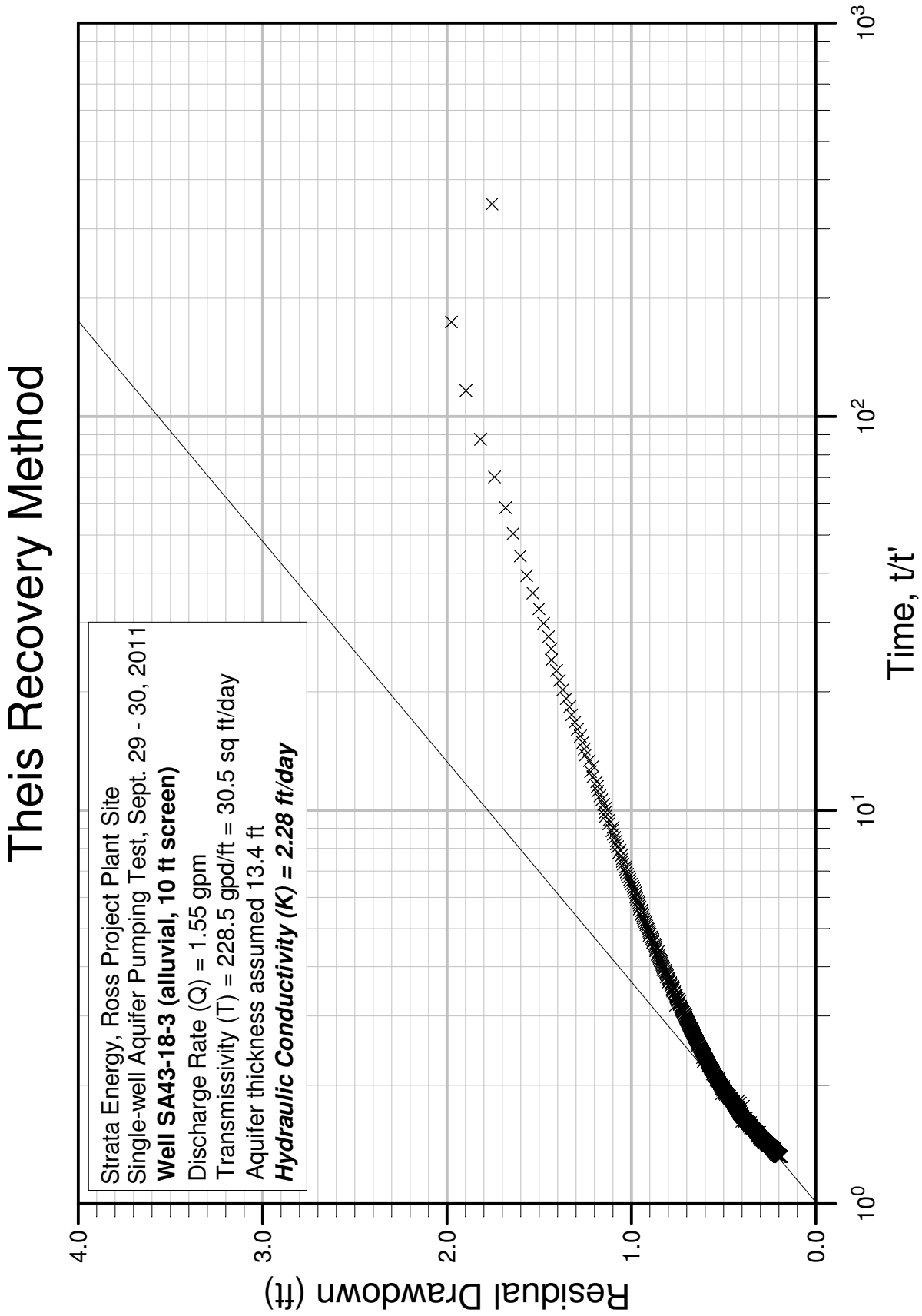
AQUIFER TEST FIELD DATA

Project/Client Ross/Strata/Plant Site Well Test Well No. SA43-18-3

TIME			WATER LEVEL DATA			
Date	Clock Time	(**t**) Elapsed Time Since Pump ON or OFF (min)	Depth to Water Below M.P. (ft)	(**s**) Drawdown/ Recovery (ft)	(**Q**) Discharge (gpm)	COMMENTS
9-29-11		S.W.L. = 14.70' below M.P. Set Redi-Flow submersible pump and In-Situ transducer with Hermit data logger for drawdown and recovery record. 2 gpm Dole valve used.				
On 0945		0	14.69	0	0	
0946		1	16.55	1.86	1.6	W.L. Dropping too fast so reduced discharge to 75 sec/2 gal
0948		3	16.63	1.94		
	0950	5	16.73	2.04	1.56	77 sec/2 gal
1001		16	17.05	2.36		
	1036	51	17.43	2.74	1.58	76 sec/2 gal
1124		99	17.65	2.96		
1205		140	17.82	3.13		
1248		183	17.95	3.26		
	1328	223	18.03	3.34	1.54	78 sec/2 gal
1420		275	18.15	3.46		
1500		315	18.22	3.53		
Off	1530	345	18.28	3.59	0	All recovery recorded by Hermit data logger


Drawdown and Recovery, Well SA43-18-3
Strata Energy, Ross Project Plant Site
Constant Discharge Rate Test, September 29 - 30, 2011
Discharge rate (Q) = 1.55 gpm
3.58 ft of drawdown after 346 mins of pumping
Specific Capacity = 0.43 gpm/ft
Drawdown (ft)
0.0
1.0
2.0
3.0
4.0
Time (min)
0.0
720.0
1440.0
2160.0
2880.0
3600.0
4320.0


Cooper Jacob Straight Line Method
Drawdown (ft)
Time (min)
0.0
1.0
2.0
3.0
4.0
5.0
10^{-1}
10^{0}
10^{1}
10^{2}
10^{3}
Strata Energy, Ross Project Plant Site
Single-well Aquifer Pumping Test, Sept. 29 - 30, 2011
Pump Well SA43-18-3 (alluvial, 10 ft screen)
Discharge Rate (Q) = 1.55 gpm
Transmissivity (T) = 363.4 gpd/ft = 48.6 sq ft/day
Aquifer thickness undetermined; assumed from s.w.l. to base of alluvium = 13.4 ft
Hydraulic Conductivity (K) = 3.63 ft/day


Theis Recovery Method
Strata Energy, Ross Project Plant Site
Single-well Aquifer Pumping Test, Sept. 29 - 30, 2011
Well SA43-18-3 (alluvial, 10 ft screen)
Discharge Rate (Q) = 1.55 gpm
Transmissivity (T) = 228.5 gpd/ft = 30.5 sq ft/day
Aquifer thickness assumed 13.4 ft
Hydraulic Conductivity (K) = 2.28 ft/day
Residual Drawdown (ft)
4.0
3.0
2.0
1.0
0.0
Time, t/t'
10^0
10^1
10^2
10^3

WWC ENGINEERING

AQUIFER TEST FIELD DATA

Project/Client Ross/Strata/Plant Site Well Test

Pumped Well No. SA43-18-7 Observation Well No. None

Type of Pump Test: ☒ Constant Discharge ☐ Step-Drawdown

Pumped Well Casing ID 2.0 inches

Distance Between Pumped and Observation Wells N/A feet

Water Level Measurements by: ☒ electric tape ☒ pressure transducer

Discharge Measurements by: ☒ bucket/stopwatch ☐ flow meter ☐ flume/weir
(0.5 gpm Dole valve used)

Screen/Perforation Interval(s) (below land surface) 10.0 – 30.0

Depth of Pump Intake (below land surface) 29.0 feet

Depth of Static Water Level (from measurement point) 11.46 feet

Height of Measurement Point (above land surface) 2.0 feet

Elevation of Measurement Point 4,135.7 feet a.m.s.l.

Pump On Date 09 / 29 / 2011 Time 0755 (AM)/PM

Pump Off Date 09 / 29 / 2011 Time 0835 (AM)/PM

Weather Conditions Clear, dry, mild

Test Performed by Collier and Rogers

WWC ENGINEERING

AQUIFER TEST FIELD DATA

Project/Client Ross/Strata/Plant Site Well Test Well No. SA43-18-7 Single Well

TIME			WATER LEVEL DATA			
Date	Clock Time	(**t**) Elapsed Time Since Pump ON or OFF (min)	Depth to Water Below M.P. (ft)	(**s**) Drawdown/ Recovery (ft)	(**Q**) Discharge (gpm)	COMMENTS
9-29-11	0735	Static W.L. = 11.46' from M.P. Set Redi-Flow sub-pump and In-Situ transducer/data logger to record drawdown and recovery				
On	0755	0	11.45			½ gpm Dole valve. Q measured with bucket and stopwatch
	0756	1	13.10			
	0757	2	13.50			
	0758	3	14.00		0.5	118 sec/gal
	0759	4	14.50			
	0800	5	14.90		0.25	Dropping too fast so reduced discharge to 0.25 gpm
	0805	10	17.23			
	0810	15	19.45			
	0820	25	25.00		<0.25	Cutting Q down more…
	0824	29	25.05			No discharge
	0825	30	25.81			Jammed pump impellers with solids
						Determined well cannot be pumped
Off	0835	Unable to pump at less than 0.25 gpm				Abandoned prospects of conducting pumping test

ATTACHMENT B

CONSTRUCTION SPECIFICATIONS

TABLE OF CONTENTS

SECTION 1
LINED RETENTION PONDS

PART 1 - GENERAL

1-1 SCOPE OF WORK: The intent of this specification is to define the material requirements, construction specifications, and testing methods for construction of the lined retention ponds.

1-2 WORK INCLUDED: Excavation, compacted earth berm, liner installation, leak detection system installation, piping/plumbing network installation, avian control system installation, road surfacing, and revegetation.

PART 2 - PRODUCTS

2-1 COMPACTED FILL

A. Material used to construct the earthen fill shall consist of suitable material available from excavation of the site pad, lined retention ponds or other nearby borrow sources.

B. Suitable material shall be free from any organics or bituminous material and should not contain excessive gravels or sands. Cobbles and/or rock fragments having maximum dimensions of more than six (6) inches shall not be placed in the compacted earth fill.

2-2 NON-WOVEN GEOTEXTILE FABRIC

A. Provide 8 oz. GSE non-woven geotextile filter fabric or approved equivalent.

2-3 GEOCOMPOSITE FABRIC

A. Provide 6 oz. GSE double-sided FabriNet Geocomposite or approved equivalent.

2-4 GEOSYNTHETIC LINER

A. Provide HDPE geomembrane or approved equivalent.

2-5 LEAK DETECTION PIPE

A. Provide 4-inch diameter schedule 40 PVC pipe and all associated fittings as shown on Drawings.

2-6 LEAK DETECTION SLOTTED PVC PIPE

A. Provide 4-inch diameter, 0.020 in. slotted schedule 40 PVC pipe, wrapped in an ADS non-woven geosynthetic sock as shown on Drawings.

2-7 ROAD BASE

A. Material used for road base will include crushed aggregate conforming to Wyoming Department of Transportation (WYDOT) Gradation W.

WYDOT Gradation W requirements

Sieve	% Passing
2 in	
1 1/2 in	100
1 in	90 to 100
3/4 in	
1/2 in	60 to 85
3/8 in	
No. 4	45 to 65
No. 8	33 to 53
No. 30	10 to 30
No. 200	3 to 12

PART 3 – EXECUTION

3-1 EXCAVATION

A. Excavate material from cut areas to the grades, lines, and elevations shown on the Drawings.

B. Direct-haul suitable cut material from cut area(s) to compacted fill area(s).

C. Direct-haul unsuitable cut material from cut area(s) to spoil stockpile area(s).

3-2 COMPACTED FILL

A. PREPARING FOUNDATIONS FOR COMPACTED FILL

1. Prepare the earth foundation prior to placing compacted earth fill.
2. Remove all vegetation and topsoil and other unsuitable materials.
3. Grade the foundation surface to remove surface irregularities.
4. Scarify the foundation surface to a minimum depth of eight inches (8").

a. Recompact scarified subgrade material before placing overlying compacted fill.

b. Recompact scarified subgrade material to the same standards as those to be applied to overlying compacted fill.

5. Modify moisture content of scarified native material to the same standard as to those to be applied to overlying compacted earth fill.

6. Ensure that the foundation and/or excavated area(s) are free of standing water and/or overly saturated material prior to and during placement of compacted earth fill.

7. Place and compact earth fill on the scarified, moisture conditioned foundation material before the foundation material dries.

B. PLACING COMPACTED EARTH FILL

1. Provide compacted earth fill as shown on the Drawings and as specified herein.

2. Place compacted fill in horizontal lifts not exceeding eight inches (8") before compaction or six inches (6") in thickness after compaction.

3. Place material that is to be compacted in continuous horizontal lifts between compacted fill boundaries.

4. Do not place compacted earth fill on top of any frozen material.

5. Do not place earth fill that is frozen or partially frozen.

6. Establish uniform moisture content of compacted fill material that is to be compacted to within plus three percent (+3%) and minus two percent (-2%) of optimum moisture content for the material as determined by ASTM D698.

7. Compact fill to a density equal to or greater than ninety-five percent (95%) of the Standard Proctor Maximum Dry Density as determined by ASTM D698.

8. Field moisture-density testing will be conducted by the ENGINEER during placement of the compacted fill.

3-3 GEOSYNTHETIC FABRICS

A. Storing Geosynthetic Fabrics

1. Store all geomembrane fabrics in strict accordance with the manufacturer/installer's instructions.

2. Do not expose stored geomembrane fabrics to the sun for more than seven (7) calendar days.

B. Installing Geosynthetic Fabrics

1. Will be installed by the manufacturer or manufacture certified installation representative.

2. Seam test Geomembrane Fabrics in accordance with manufacturer's instructions.

3-4 LEAK DETECTION PVC PIPE INSTALLATION

A. Trench bottom:

1. Provide trench bottom that is relatively smooth, dry, and free of projecting or loose rocks.

B. Pipe laying

1. Minimize lifting and moving of assembled pipe and fittings during pipe laying.
2. Do not bend pipe more than minimum allowable radii specified by the pipe manufacturer.
3. All joints shall be cleaned and glued according to the manufacturer's specifications.

3-5 LEAK DETECTION SLOTTED PVC PIPE INSTALLATION

A. Trench bottom:

1. Provide trench bottom that is relatively smooth, dry, and free of projecting or loose rocks.

B. Pipe laying

1. Minimize lifting and moving of assembled pipe and fittings during pipe laying.
2. Do not bend pipe more than minimum allowable radii specified by the pipe manufacturer.
3. All joints shall be cleaned and glued according to the manufacturer's specifications.

3-6 ROAD BASE PLACEMENT

A. Grade smooth areas to be surfaced.

B. Moisten the soil underlying the areas to be surfaced.

C. Grade and shape the road base surfacing in lifts no thicker than four inches (4")

D. Moisten, grade and shape road base surfacing.

E. Compact each road base-surfacing lift with a smooth-drum roller.

3-7 REVEGETATION

A. Grade all disturbed areas and merge graded areas smoothly with adjacent undisturbed areas.

B. Fertilize disturbed areas at the rate of 30 lbs. of available nitrogen per acre.

C. Apply dryland seed mixture as specified by Strata Energy at a rate of approximately 10 lbs. live seed per acre.

D. Apply straw or grass hay mulch at a rate of 1.5 tons/acre.

SECTION 2
FACILITIES FLOOD CONTROL DIVERSION

PART 1 - GENERAL

1-1 SCOPE OF WORK: The intent of this specification is to define the material requirements, construction specifications, and testing methods for construction of the flood control diversion.

1-2 WORK INCLUDED: Channel excavation, compacted earth berm, furnishing and installing concrete box culvert, furnishing and installing erosion protection material, and revegetation.

PART 2 - PRODUCTS

2-1 COMPACTED FILL

A. Material used to construct the earthen fill shall consist of suitable material available from excavation of the site pad, lined retention ponds or other nearby borrow sources. Suitable material shall be free from any organics or bituminous material and should not contain excessive gravels or sands. Cobbles and/or rock fragments having maximum dimensions of more than six (6) inches shall not be placed in the compacted earthfill.

2-2 CULVERT

A.	Material:	Precast reinforced concrete
B.	Material certification:	ASTM C76-10a
C.	Size:	10’ wide x 6’ tall

2-3 EROSION PROTECTION

A. Armorflex, or equivalent

B. Block size: 30-S

C. Install according to manufacturer’s recommendations

PART 3 - EXECUTION

3-1 EXCAVATION

A. Excavate cut material from cut areas to the grades, lines, and elevations shown on the Drawings.

B. Direct-haul suitable cut material from cut area(s) to compacted fill area(s).

C. Direct-haul unsuitable cut material from cut area(s) to spoil stockpile area(s).

3-2 COMPACTED FILL

A. Preparing Foundations for Compacted Fill

1. Prepare the earth foundation prior to placing compacted earth fill.

2. Remove all vegetation and topsoil and other unsuitable materials.

3. Grade the foundation surface to remove surface irregularities.

4. Scarify the foundation surface to a minimum depth of eight inches (8").

   a. Recompact scarified subgrade material before placing overlying compacted fill.

   b. Recompact scarified subgrade material to the same standards as those to be applied to overlying compacted fill.

5. Modify moisture content of scarified native material to the same standard as to those to be applied to overlying compacted earth fill.

6. Ensure that the foundation and/or excavated area(s) are free of standing water and/or overly saturated material prior to and during placement of compacted earth fill.

7. Place and compact earth fill on the scarified, moisture conditioned foundation material before the foundation material dries.

B. Placing Compacted Earth Fill

1. Provide compacted earth fill as shown on the Drawings and as specified herein.

2. Place compacted fill in horizontal lifts not exceeding eight inches (8") before compaction or six inches (6") in thickness after compaction.

3. Place material that is to be compacted in continuous horizontal lifts between compacted fill boundaries.

4. Do not place compacted earth fill on top of any frozen material.

5. Do not place earth fill that is frozen or partially frozen.

6. Establish uniform moisture content of compacted fill material that is to be compacted to within plus three percent (+3%) and minus two percent (-2%) of optimum moisture content for the material as determined by ASTM D698.

7. Compact fill to a density equal to or greater than ninety-five percent (95%) of the Standard Proctor Maximum Dry Density as determined by ASTM D698.

8. Field moisture-density testing will be conducted by the ENGINEER during placement of the compacted fill.

3-3 CULVERT INSTALLATION

A. Provide a smooth bed for culvert.

B. Construct the bed at the slope shown on the Drawings.

C. Remove all projecting rocks larger than three inches (3"), all frozen lumps, all clay chunks larger than three inches (3"), all organic matter, and all other deleterious material from the beds.

D. Excavate the entire length of bed to a minimum total width of the culvert plus one foot (1') on both sides of the culvert.

E. Remove all soft material or rock ledges.

F. Install culvert starting at the downstream end and working upstream.

G. Ensure that field joints are completed to form a continuous flow line, free from appreciable irregularities.

H. Compact backfill in accordance with Section 3-2.B of this specification.

3-4 REVEGETATION

A. Grade all disturbed areas and merge graded areas smoothly with adjacent undisturbed areas.

B. Fertilize disturbed areas at the rate of 30 lbs. of available nitrogen per acre.

C. Scarify all revegetation areas for a seed bed.

D. Apply dryland seed mixture as specified by Strata Energy at a rate of approximately 10 lbs. live seed per acre.

E. Apply straw or grass hay mulch at a rate of 1.5 tons/acre.

SECTION 3
CONTAINMENT BARRIER WALL

PART 1 - GENERAL

1-1 SCOPE OF WORK: The intent of this specification is to define the material requirements and construction specifications for installation of a containment barrier wall (CBW)and dewatering infrastructure at the Ross ISR site.

1-2 WORK INCLUDED: Installation of a continuous CBW and dewatering infrastructure including one French drain near the north side of the CBW and another French drain in the center of the CBW (see attached Drawings).

PART 2 - PRODUCTS

2-1 BENTONITE

A. Bentonite used in preparing soil-bentonite backfill for the CBW shall be pulverized powder or granular premium grade sodium-cation montmorillonite and shall meet the most current API Standard 13A, Section 4.

2-2 FRENCH DRAIN

A. 1.5’ x 1.5’ drain

B. 5” perforated heavy wall pipe

C. Drain Material: clean sand

1. Drain sand must be moisture free at the time of placement, and must meet the criteria listed in the following table:

Sieve Size	Percent Passing
⅜"	100
#4	95-100
#8	80-100
#16	50-85
#30	25-60
#50	10-30
#100	2-10
#200	<5

2-3 COLLECTOR WELL

A. 2’ corrugated metal pipe with cover

B. Discharge Pipe

1.	Diameter:	3”
2.	Type:	SDR 11 HDPE
3.	Burial Depth:	6 feet

PART 3 - EXECUTION

3-1 CBW INSTALLATION

A. A starter trench approximately 3’ wide and 2’ deep shall be installed along the centerline of the CBW. The proper amount of dry bentonite to obtain a 4% soil bentonite mixture by dry weight shall be placed into the starter trench.

B. CBW installation shall proceed continuously from the starting point to the finishing point to the grades, lines, and elevations shown on the Drawings.

C. Unless otherwise directed, the bottom of the CBW will be keyed a minimum of 2’ into bedrock.

D. Water shall be introduced into the trench at the time trenching begins and shall be maintained in the trench during installation.

E. Quality control testing will consist of a slump test every 600 cubic yards of CBW placed, and permeability testing in accordance with ASTM D5084 every 200 lineal feet of CBW installation.

1.	Soil-Bentonite Backfill Slump:	3 to 6 inches

3-2 FRENCH DRAIN INSTALLATION

A. French drain installation shall be conducted using continuous “one pass“ trenching method to the grades, lines, and elevations shown on the drawings.

ATTACHMENT C

SLOPE STABILITY ANALYSIS MATERIALS TESTING DATA

MECHANICAL ANALYSIS - SIEVE TEST DATA
-#200 SIEVE ONLY
ASTM D 1140

CLIENT	Western Water Consultants	JOB NO.	2137-67
BORING NO.	LRP-3	SAMPLED	
DEPTH	5.0-6.5'	DATE TESTED	9/21/11 WAR
SAMPLE NO.	Lined Retention Ponds	WASH SIEVE	Yes
SOIL DESCR.	2009142.42	DRY SIEVE	No
LOCATION	Strata Energy CPP Area		

WASH SIEVE ANALYSIS

Wt. Wet Soil & Pan Before Washing (g)	1065.4
Wt. Dry Soil & Pan Before Washing (g)	1055.8
Weight of Pan (g)	854.2
Wt. of Dry Soil Before Washing	201.6
Wt. Dry Soil & Pan After Washing (g)	859.8
Wt. of Dry Soil After Washing (g)	5.6
-#200 Wash. Out %	97.2

Data entry by: DAW Date: 09/22/2011
Data checked by: Date: 9/28/11
Filename: WSS01055

MECHANICAL ANALYSIS - SIEVE TEST DATA
-#200 SIEVE ONLY
ASTM D 1140

CLIENT	Western Water Consultants	JOB NO	2137-67
BORING NO	LRP-3	SAMPLED	
DEPTH	Bulk 6.5-12	DATE TESTED	9/06/11 WAR
SAMPLE NO	Lined Retention Ponds	WASH SIEVE	Yes
SOIL DESCR	2009142.42	DRY SIEVE	No
LOCATION	Strata Energy CPP Area		

WASH SIEVE ANALYSIS

Wt. Wet Soil & Pan Before Washing (g)	995.9
Wt. Dry Soil & Pan Before Washing (g)	983.8
Weight of Pan (g)	768.4
Wt. of Dry Soil Before Washing	215.4
Wt. Dry Soil & Pan After Washing (g)	780.5
Wt. of Dry Soil After Washing (g)	12.0
-#200 Wash Out %	94.4

Data entry by: DAW Date: 09/07/2011
Data checked by: DRM Date: 9/8/11
Filename WSS09958

MECHANICAL ANALYSIS - SIEVE TEST DATA
-#200 SIEVE ONLY
ASTM D 1140

CLIENT	Western Water Consultants	JOB NO.	2137-67
BORING NO.	LRP-3	SAMPLED	
DEPTH	13.1-13.4'	DATE TESTED	9/13/11 WAR
SAMPLE NO.	Lined Retention Ponds	WASH SIEVE	Yes
SOIL DESCR.	2009142.42	DRY SIEVE	No
LOCATION	Strata Energy CPP Area		

WASH SIEVE ANALYSIS

Wt. Wet Soil & Pan Before Washing (g)	138.3
Wt. Dry Soil & Pan Before Washing (g)	108.8
Weight of Pan (g)	6.7
Wt. of Dry Soil Before Washing	102.0
Wt. Dry Soil & Pan After Washing (g)	25.3
Wt. of Dry Soil After Washing (g)	18.5
-#200 Wash Out %	81.9

Data entry by: DAW Date: 09/15/2011
Data checked by: CL Date: 09/15/2011
Filename: WSM01383

MECHANICAL ANALYSIS - SIEVE TEST DATA
-#200 SIEVE ONLY
ASTM D 1140

CLIENT Western Water Consultants

JOB NO 2137-67

BORING NO	LRP-3	SAMPLED	
DEPTH	14 0-15 5'	DATE TESTED	9/16/11 TMR
SAMPLE NO.	Lined Retention Ponds	WASH SIEVE	Yes
SOIL DESCR	2009142.42	DRY SIEVE	No
LOCATION	Strata Energy CPP Area		

WASH SIEVE ANALYSIS

Wt. Wet Soil & Pan Before Washing (g)	1212.8
Wt. Dry Soil & Pan Before Washing (g)	1205.0
Weight of Pan (g)	1025.0
Wt. of Dry Soil Before Washing	180.0
Wt. Dry Soil & Pan After Washing (g)	1073.8
Wt. of Dry Soil After Washing (g)	48.8
-#200 Wash. Out %	72.9

Data entry by DAW Date: 09/19/2011
Data checked by: Date: 9/19/11
Filename WSM01212

MECHANICAL ANALYSIS - SIEVE TEST DATA
-#200 SIEVE ONLY
ASTM D 1140

CLIENT Western Water Consultants

JOB NO 2137-67

BORING NO.	LRP-3	SAMPLED	
DEPTH	20.9-21.5'	DATE TESTED	9/13/11 WAR
SAMPLE NO.	Lined Retention Ponds	WASH SIEVE	Yes
SOIL DESCR.	2009142.42	DRY SIEVE	No
LOCATION	Strata Energy CPP Area		

WASH SIEVE ANALYSIS

Wt. Wet Soil & Pan Before Washing (g)	168.6
Wt. Dry Soil & Pan Before Washing (g)	137.4
Weight of Pan (g)	6.6
Wt. of Dry Soil Before Washing	130.8
Wt. Dry Soil & Pan After Washing (g)	8.0
Wt. of Dry Soil After Washing (g)	1.3
-#200 Wash. Out %	99.0

Data entry by DAW Date: 09/15/2011
Data checked by CAL Date: 09/15/2011
Filename: WSM01686

ATTERBERG LIMITS TEST
ASTM D 4318

CLIENT	Western Water Consultants	JOB NO.	2137-67
BORING NO.	LRP-3	DATE SAMPLED	
DEPTH	5.0-6.5'	DATE TESTED	9/28/11 MLM
SAMPLE NO.	Lined Retention Ponds		
SOIL DESCR.	2009142.42		
LOCATION	Strata Energy CPP Area		

Plastic Limit Determination

	1	2	3
Wt Dish & Wet Soil	6.23	6.41	6.68
Wt Dish & Dry Soil	5.50	5.64	5.88
Wt of Moisture	0.73	0.77	0.80
Wt of Dish	1.14	1.15	1.13
Wt of Dry Soil	4.36	4.49	4.75
Moisture Content	16.74	17.15	16.84

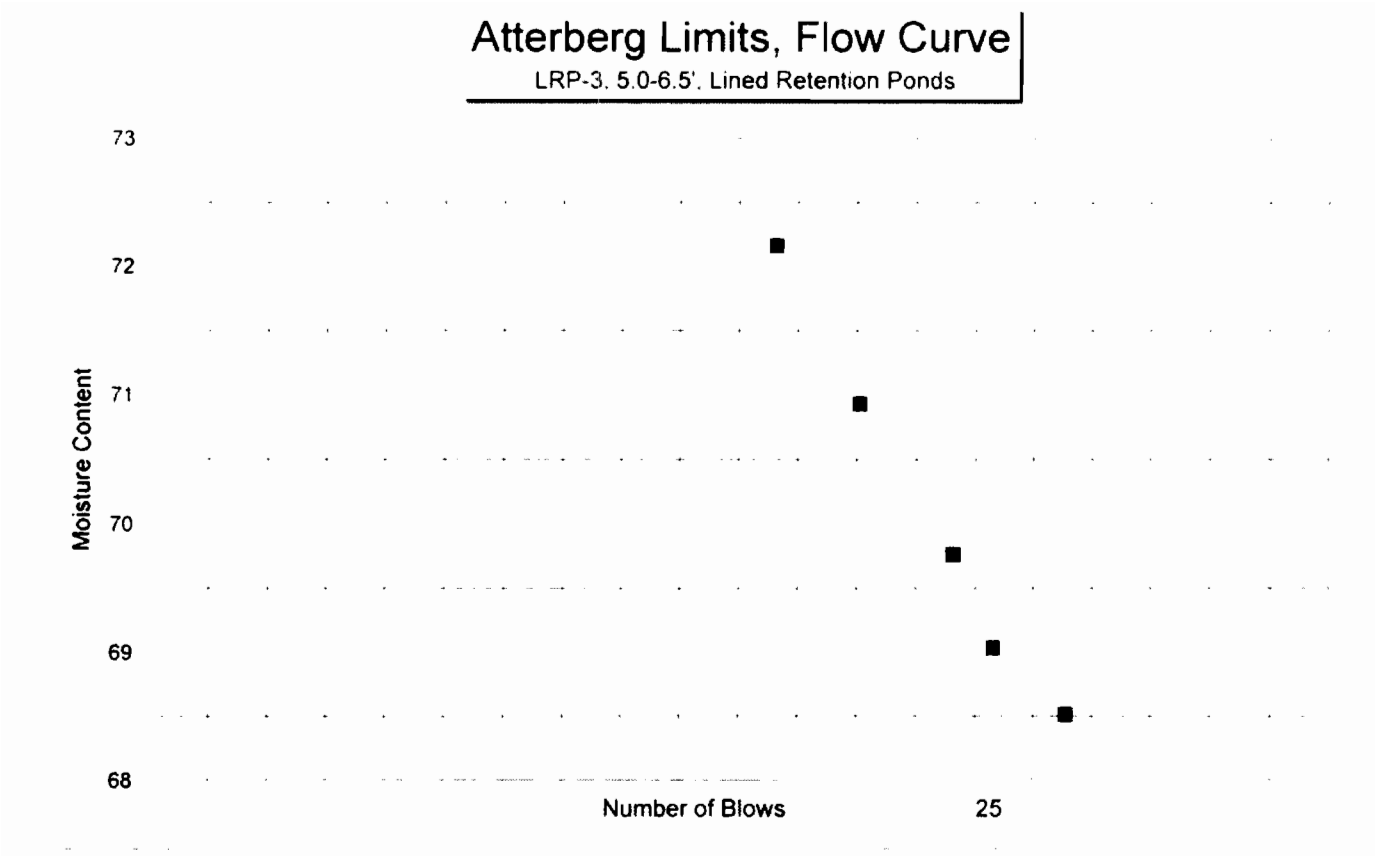
Liquid Limit Determination — Device Number 1075

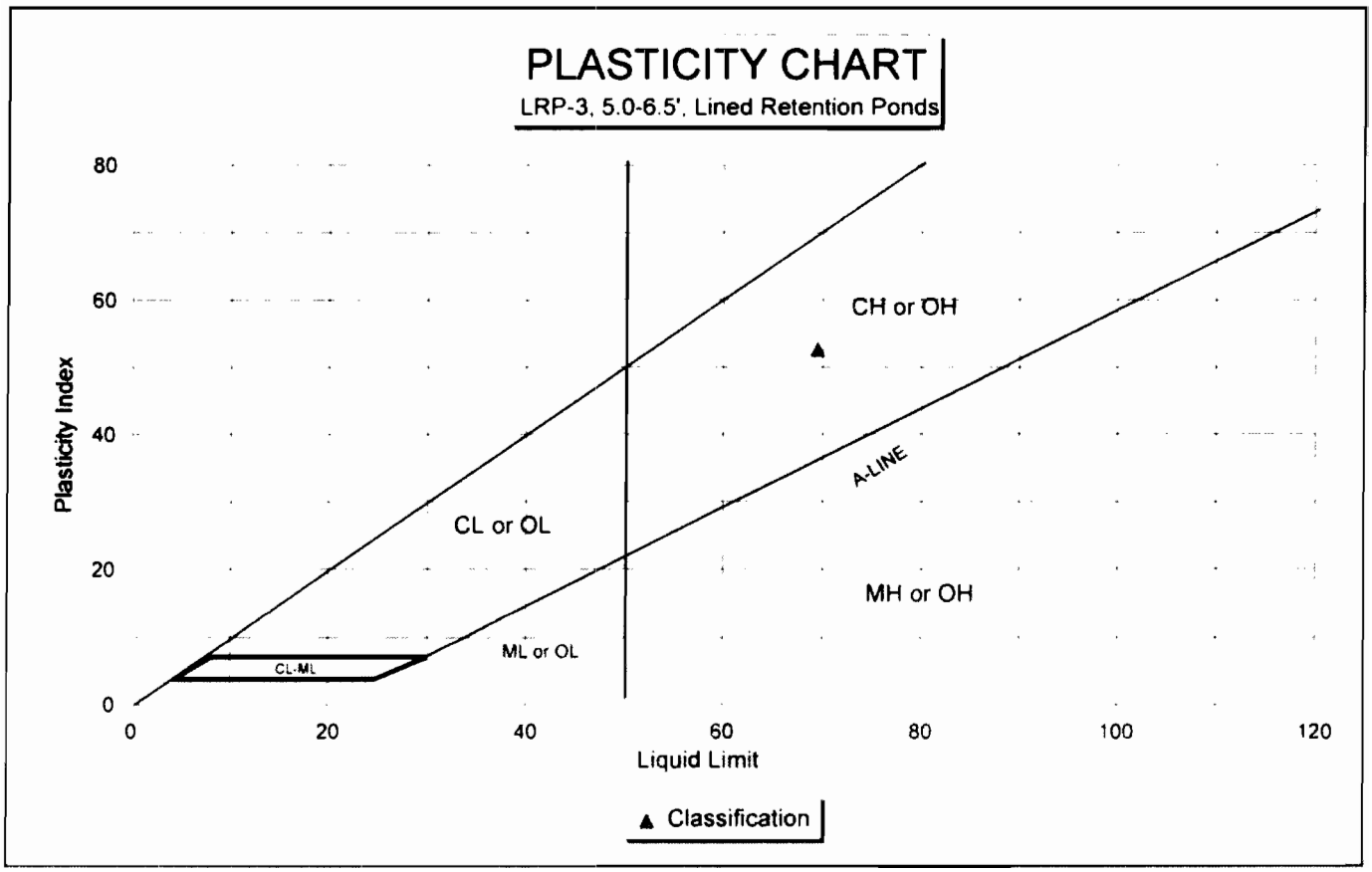
	1	2	3	4	5
Number of Blows	30	24	26	20	17
Wt Dish & Wet Soil	11.79	11.95	12.35	11.45	11.89
Wt Dish & Dry Soil	7.46	7.52	7.78	7.18	7.38
Wt of Moisture	4.33	4.43	4.57	4.27	4.51
Wt of Dish	1.14	1.17	1.16	1.16	1.13
Wt of Dry Soil	6.32	6.35	6.62	6.02	6.25
Moisture Content	68.51	69.76	69.03	70.93	72.16

Liquid Limit	69.5
Plastic Limit	16.9
Plasticity Index	52.6

Atterberg Classification CH

Data entry by: DAW Date: 10/03/2011
Checked by: Date: 10/04/11
FileName: WSG06235


Atterberg Limits, Flow Curve
LRP-3, 5.0-6.5', Lined Retention Ponds
Moisture Content
73
72
71
70
69
68
Number of Blows
25


PLASTICITY CHART
LRP-3, 5.0-6.5', Lined Retention Ponds
Plasticity Index
80
60
40
20
0
CH or OH
A-LINE
CL or OL
MH or OH
ML or OL
CL-ML
0
20
40
60
80
100
120
Liquid Limit
Classification

ATTERBERG LIMITS TEST
ASTM D 4318

CLIENT	Western Water Consultants	JOB NO	2137-67
BORING NO	LRP-3	DATE SAMPLED	
DEPTH	6 5-12	DATE TESTED	9/05/11 LB
SAMPLE NO	Lined Retention Ponds		
SOIL DESCR	2009142 42		
LOCATION	Strata Energy CPP Area		

Plastic Limit Determination

	1	2	3
Wt Dish & Wet Soil	6.31	6.33	6.08
Wt Dish & Dry Soil	5.66	5.62	5.43
Wt of Moisture	0.65	0.71	0.65
Wt of Dish	1.11	1.12	1.12
Wt of Dry Soil	4.55	4.50	4 31
Moisture Content	14.29	15.78	15.08

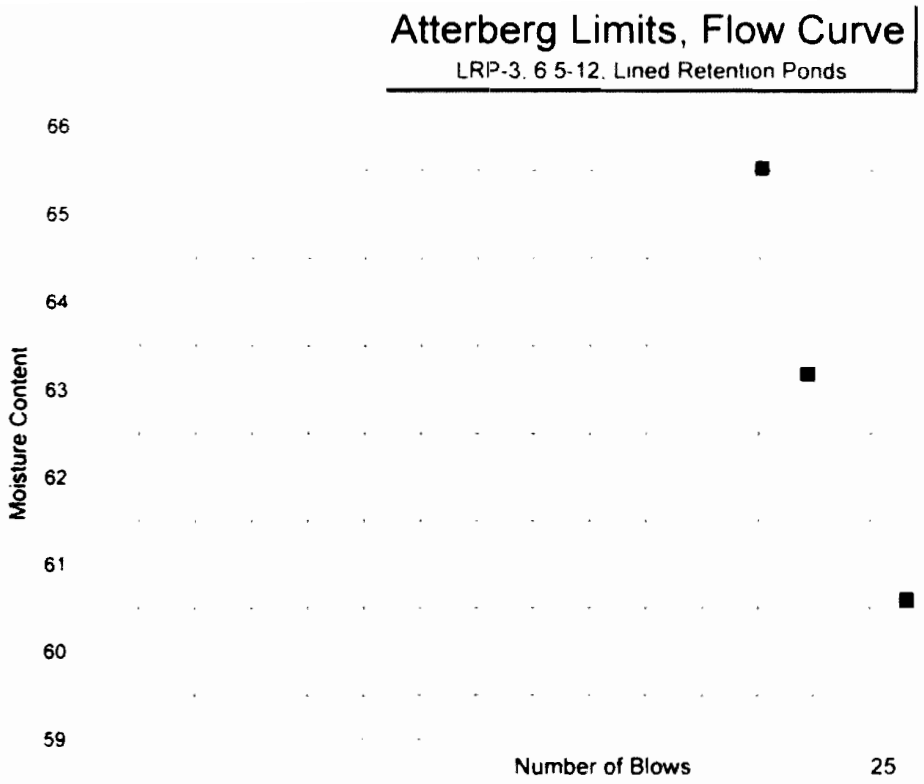
Liquid Limit Determination — Device Number 1075

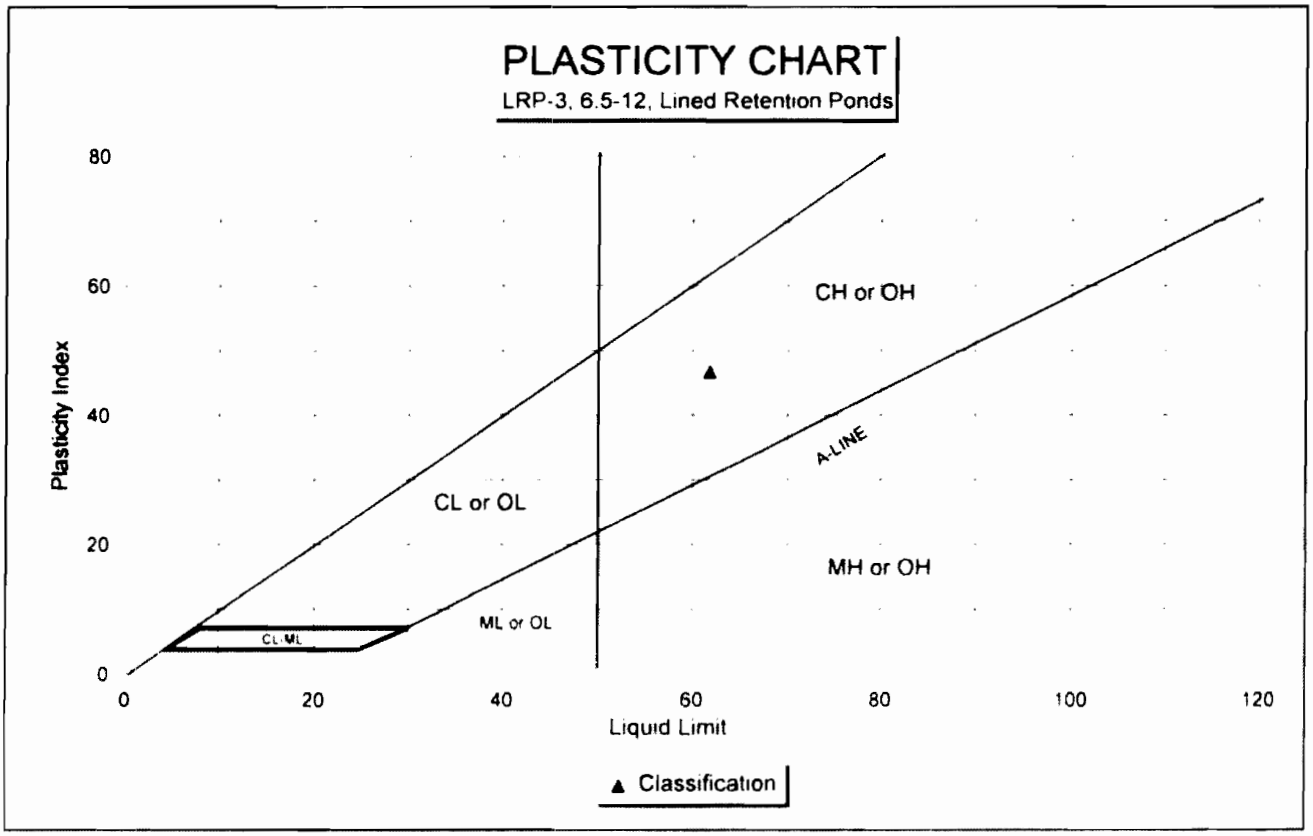
	1	2	3	4
Number of Blows	29	20	22	27
Wt Dish & Wet Soil	9.21	8.86	10.19	9 24
Wt Dish & Dry Soil	6.19	5.80	6.69	6.18
Wt of Moisture	3.02	3 06	3 50	3 06
Wt of Dish	1.13	1 13	1 15	1 13
Wt of Dry Soil	5.06	4.67	5.54	5.05
Moisture Content	59.68	65.52	63.18	60.59

Liquid Limit	61 8
Plastic Limit	15.0
Plasticity Index	46 7

Atterberg Classification CH

Data entry by DAW Date: 09/06/2011
Checked by LB Date: 9-8-11
FileName WSG06310


Atterberg Limits, Flow Curve
LRP-3, 6 5-12, Lined Retention Ponds
Moisture Content
66
65
64
63
62
61
60
59
Number of Blows
25


PLASTICITY CHART
LRP-3, 6.5-12, Lined Retention Ponds
Plasticity Index
80
60
40
20
0
CH or OH
A-LINE
CL or OL
MH or OH
ML or OL
CL-ML
0
20
40
60
80
100
120
Liquid Limit
▲ Classification

ATTERBERG LIMITS TEST
ASTM D 4318

CLIENT	Western Water Consultants	JOB NO	2137-67
BORING NO	LRP-3	DATE SAMPLED	
DEPTH	12.8-14.0'	DATE TESTED	9/20/11 MLM
SAMPLE NO	Lined Retention Ponds		
SOIL DESCR	2009142.42		
LOCATION	Strata Energy CPP Area		

Plastic Limit Determination

	1	2	3
Wt Dish & Wet Soil	6.09	5.98	6.33
Wt Dish & Dry Soil	5.43	5.35	5.64
Wt of Moisture	0.66	0.63	0.69
Wt of Dish	1.16	1.12	1.13
Wt of Dry Soil	4.27	4.23	4.51
Moisture Content	15.46	14.89	15.30

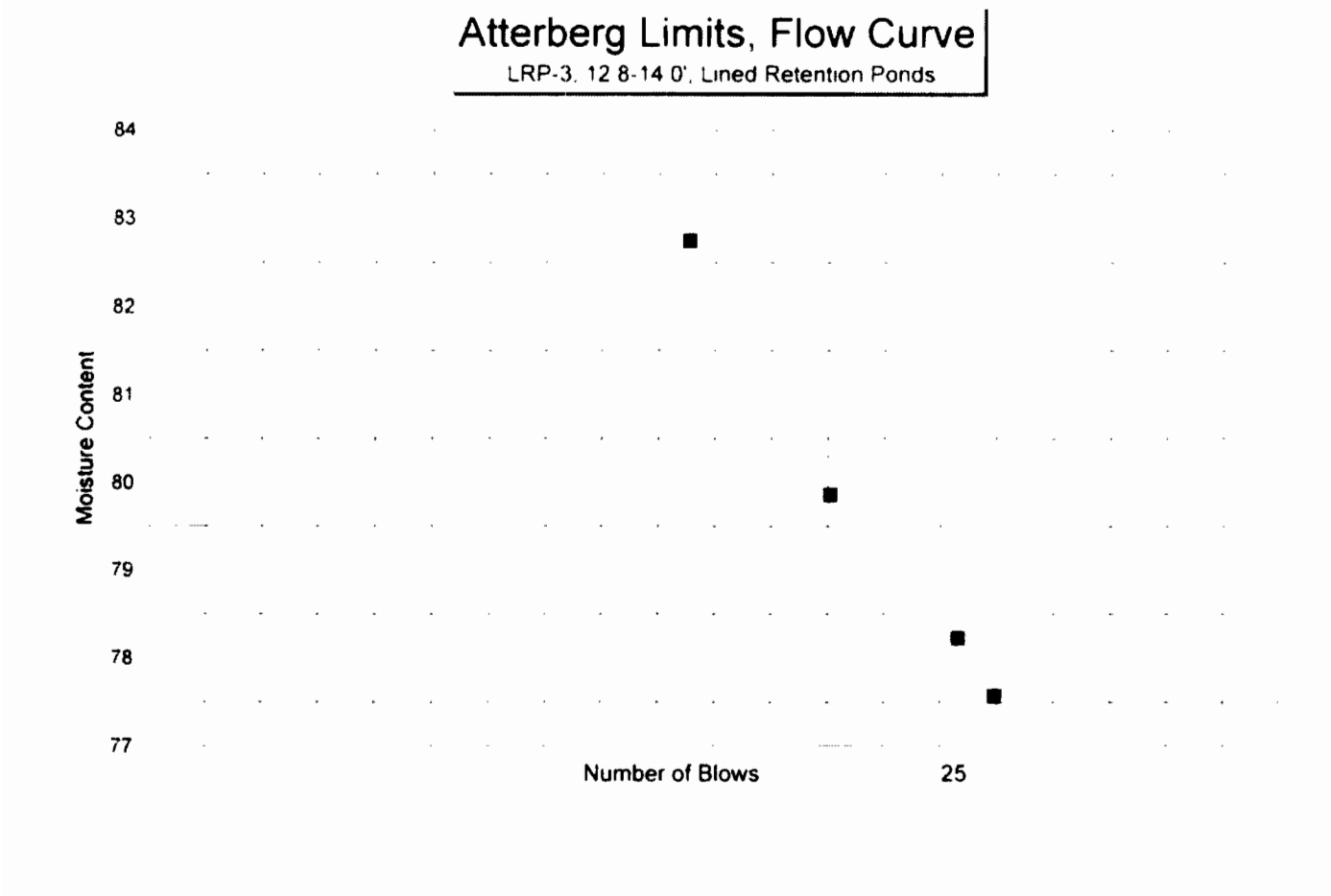
Liquid Limit Determination — Device Number 1075

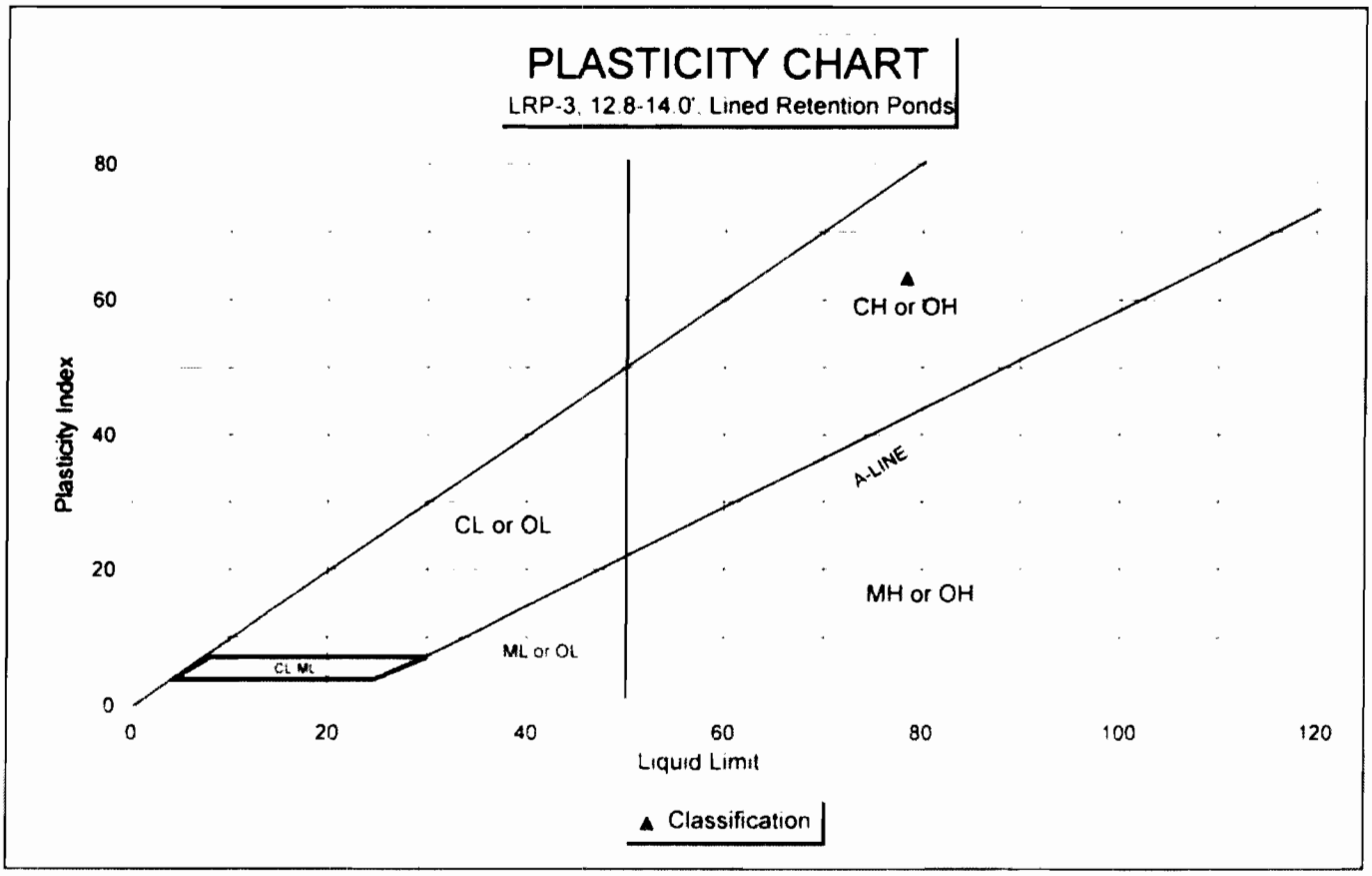
	1	2	3	4
Number of Blows	28	26	20	15
Wt Dish & Wet Soil	10.47	11.35	11.32	11.95
Wt Dish & Dry Soil	6.39	6.86	6.80	7.06
Wt of Moisture	4.08	4.49	4.52	4.89
Wt of Dish	1.13	1.12	1.14	1.15
Wt of Dry Soil	5.26	5.74	5.66	5.91
Moisture Content	77.57	78.22	79.86	82.74

Liquid Limit	78.4
Plastic Limit	15.2
Plasticity Index	63.2

Atterberg Classification CH

Data entry by DAW Date 09/21/2011
Checked by: BKL Date: 9/22/11
FileName WSG06091


Atterberg Limits, Flow Curve
LRP-3, 12.8-14.0', Lined Retention Ponds
84
83
82
81
80
79
78
77
Moisture Content
Number of Blows
25


PLASTICITY CHART
LRP-3, 12.8-14.0', Lined Retention Ponds
80
60
40
20
0
Plasticity Index
CH or OH
A-LINE
CL or OL
MH or OH
ML or OL
CL-ML
0
20
40
60
80
100
120
Liquid Limit
▲ Classification

ATTERBERG LIMITS TEST
ASTM D 4318

CLIENT	Western Water Consultants	JOB NO	2137-67
BORING NO	LPR-3	DATE SAMPLED	
DEPTH	14.0-15.5'	DATE TESTED	10/04/11 DAW
SAMPLE NO	Lined Retention Ponds		
SOIL DESCR	2009142.42		
LOCATION	Strata Energy CPP Area		

Plastic Limit Determination

	1	2
Wt Dish & Wet Soil	5.45	5.20
Wt Dish & Dry Soil	4.99	4.80
Wt of Moisture	0.46	0.40
Wt of Dish	1.11	1.18
Wt of Dry Soil	3.88	3.62
Moisture Content	11.86	11.05

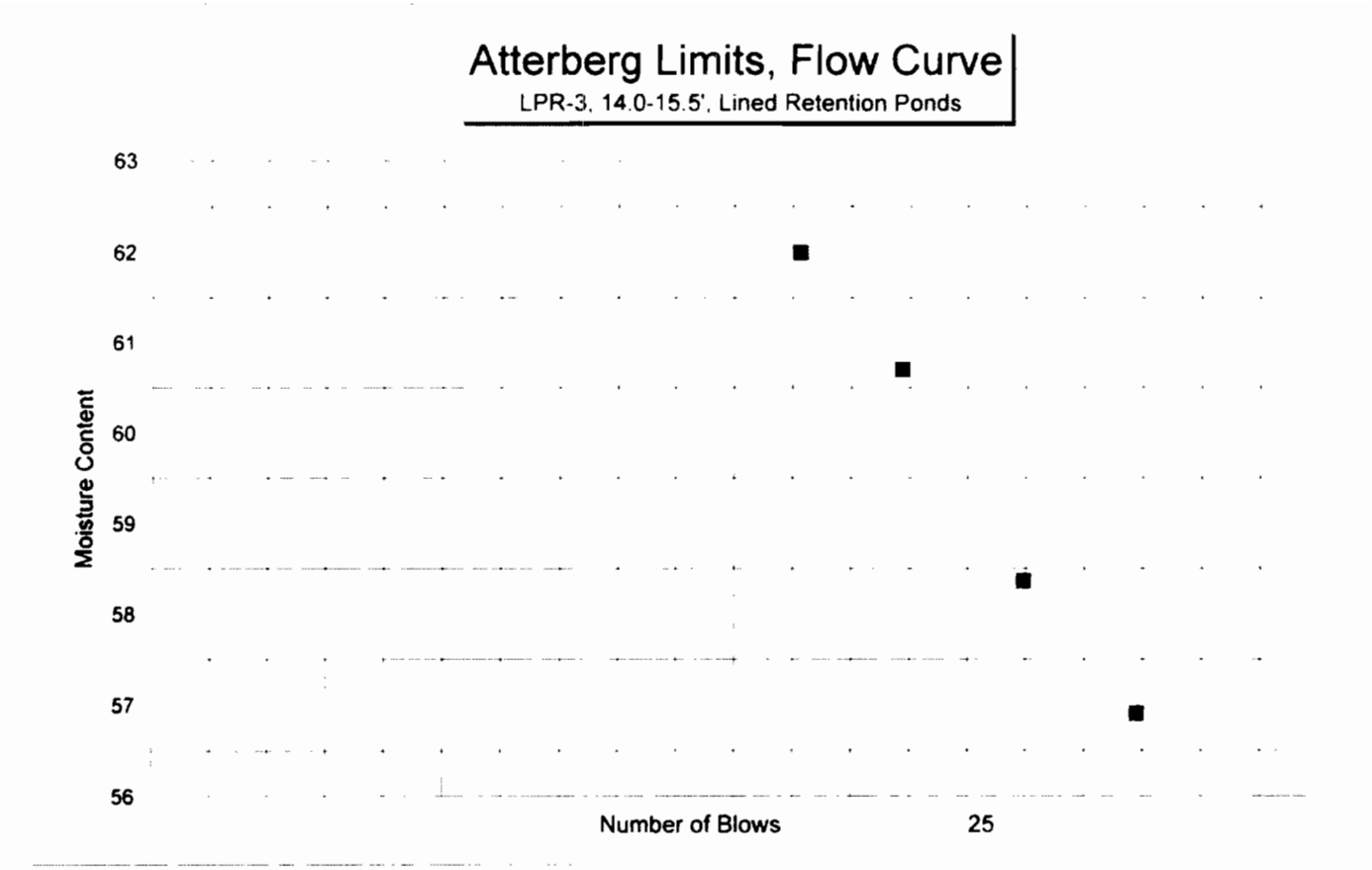
Liquid Limit Determination — Device Number 1080

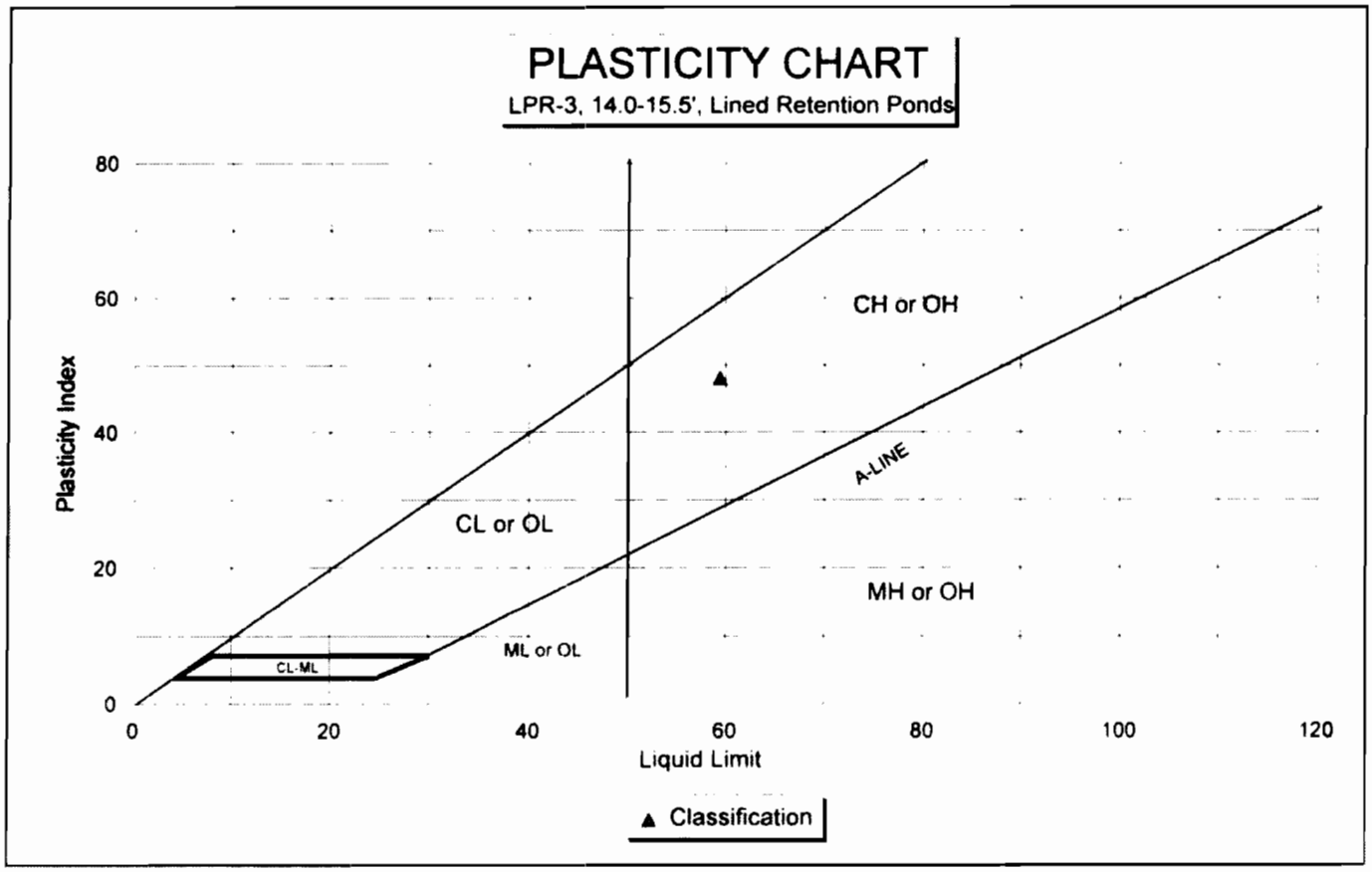
	1	2	3	4
Number of Blows	35	28	18	22
Wt Dish & Wet Soil	10.48	10.77	12 67	11.74
Wt Dish & Dry Soil	7.06	7.21	8.25	7.74
Wt of Moisture	3.42	3.56	4 42	4.00
Wt of Dish	1.05	1.11	1 12	1.15
Wt of Dry Soil	6.01	6.10	7 13	6.59
Moisture Content	56.91	58.36	61.99	60.70

Liquid Limit	59.5
Plastic Limit	11.5
Plasticity Index	48.0

Atterberg Classification CH

Data entry by DAW Date 10/05/2011
Checked by Date 10/04/11
FileName WSG05454


Atterberg Limits, Flow Curve
LPR-3, 14.0-15.5', Lined Retention Ponds
Moisture Content
63
62
61
60
59
58
57
56
Number of Blows
25


PLASTICITY CHART
LPR-3, 14.0-15.5', Lined Retention Ponds
Plasticity Index
80
60
40
20
0
CH or OH
A-LINE
CL or OL
MH or OH
ML or OL
CL-ML
0
20
40
60
80
100
120
Liquid Limit
▲ Classification

ATTERBERG LIMITS TEST
ASTM D 4318

CLIENT	Western Water Consultants	JOB NO	2137-67
BORING NO	LRP-3	DATE SAMPLED	
DEPTH	20.9-21 2'	DATE TESTED	9/15/11 MLM
SAMPLE NO	Lined Retention Pond		
SOIL DESCR	2009142.42		
LOCATION	Strata Energy CPP Area		

Plastic Limit Determination

	1	2	3
Wt Dish & Wet Soil	8.06	8.36	8.96
Wt Dish & Dry Soil	7.20	7.44	7.97
Wt of Moisture	0.86	0 92	0.99
Wt of Dish	1 12	1.12	1.14
Wt of Dry Soil	6 08	6.32	6.83
Moisture Content	14 14	14 56	14.49

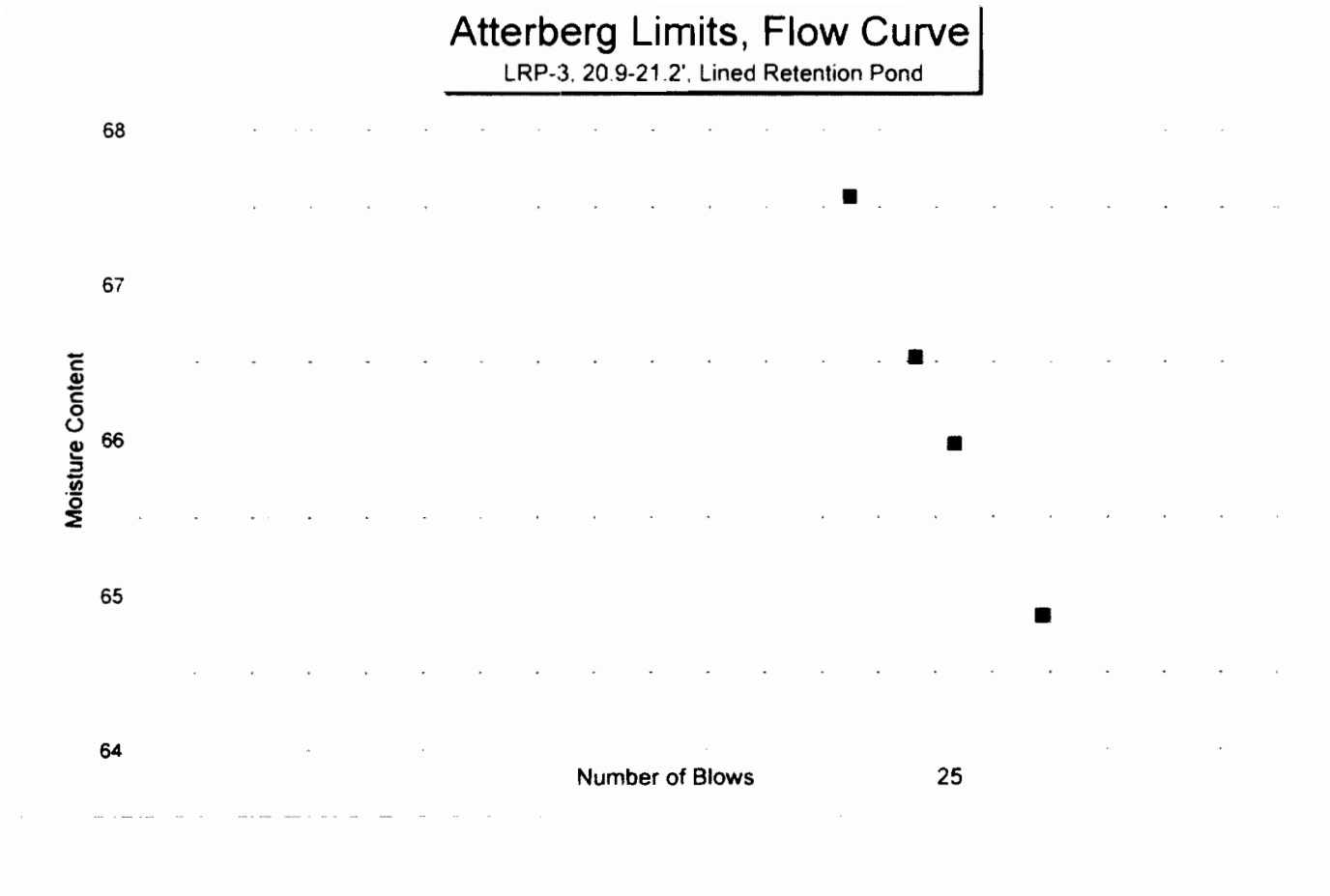
Liquid Limit Determination — Device Number 1075

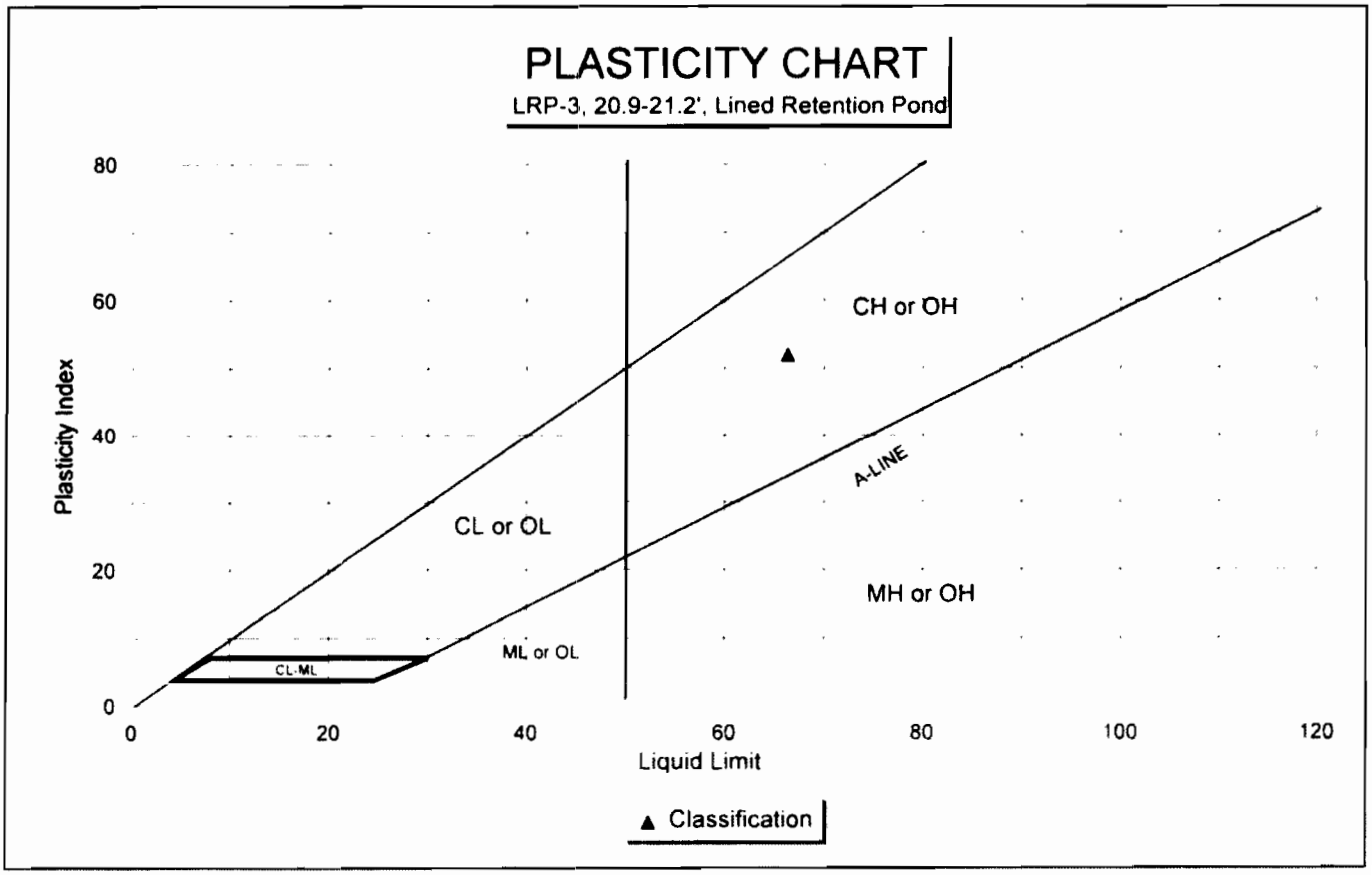
	1	2	3	4
Number of Blows	31	24	21	26
Wt Dish & Wet Soil	9.08	9.20	9.11	9 04
Wt Dish & Dry Soil	5.96	5.98	5.86	5 88
Wt of Moisture	3 12	3.22	3.25	3 16
Wt of Dish	1 15	1 14	1 05	1 09
Wt of Dry Soil	4 81	4.84	4 81	4 79
Moisture Content	64.86	66.53	67 57	65 97

Liquid Limit	66.3
Plastic Limit	14.4
Plasticity Index	51 9

Atterberg Classification CH

Data entry by DAW Date 09/16/2011
Checked by: ym Date: 9/16/11
FileName WSG08060


Atterberg Limits, Flow Curve
LRP-3, 20.9-21.2', Lined Retention Pond
Moisture Content
68
67
66
65
64
Number of Blows
25


PLASTICITY CHART
LRP-3, 20.9-21.2', Lined Retention Pond
Plasticity Index
80
60
40
20
0
CH or OH
A-LINE
CL or OL
MH or OH
ML or OL
CL-ML
0
20
40
60
80
100
120
Liquid Limit
▲ Classification

TRIAXAL COMPRESSION TEST DATA

CLIENT	WWC Engineering	JOB NO.	2137-67
BORING NO.	LRP-3	SAMPLED	
DEPTH	6.5-12.0'	TEST STARTED	10/06/11 CAL
SAMPLE NO.	Retest Lined Retention Ponds	TEST FINISHED	10/12/11 CAL
SOIL DESCR.	2009142.42	SETUP NO.	12P
LOCATION	Strata Energy - CPP Area	SATURATED TEST	Yes
CONF. PRES. PSF	1008	TEST TYPE	TX/Pbp/Tap Water

SATURATION DATA

Cell Pres. (PSI)	Back Pres. (PSI)	Burette Reading (CC)		Pore Pressure (PSI)		Change	B
		Close	Open	Close	Open		
40.0	38.0	2.9	11.7				
50.0	48.0	6.9	8.3	38.5	47.0	8.5	0.85
60.0		6.9	7.3	48.0	57.5	9.5	0.95

CONSOLIDATION DATA

Elapsed Time (Min)	SQRT Time (Min)	Burette Reading (CC)	Volume Defl. (cc)
0.00	0.00	7.10	0.00
0.25	0.50	7.60	-0.50
0.5	0.71	7.65	-0.55
1	1.00	7.70	-0.60
2	1.41	7.80	-0.70
4	2.00	7.90	-0.80
9	3.00	8.00	-0.90
16	4.00	8.10	-1.00
30	5.48	8.20	-1.10
60	7.75	8.40	-1.30
120	10.95	8.60	-1.50
240	15.49	8.80	-1.70
360	18.97	8.90	-1.80

Initial Height (in)	3.004	Init. Vol. (CC)	223.48
Height Change (in)	-0.003	Vol. Change (CC)	7.00
Ht. After Cons. (in)	3.007	Cell Exp. (CC)	8.10
Initial Area (sq in)	4.539	Net Change (CC)	-1.10
Area After Cons. (sq in)	4.557	Cons. Vol. (CC)	224.58

Data entry by: DAW Date: 10/14/2011
Checked by: Dae Date: 10/15/11
FileName: WSP03634

TRIAXAL COMPRESSION TEST DATA

CLIENT	Western Water Consultants	JOB NO.	2137-67
BORING NO.	LRP-3	SAMPLED	
DEPTH	Bulk 6.5-12.0'	TEST STARTED	9/10/11 CAL
SAMPLE NO.	Lined Retention Ponds	TEST FINISHED	9/19/11 DPM
SOIL DESCR.	2009142.42	SETUP NO.	7S
LOCATION	Strata Energy CPP Area	SATURATED TEST	Yes
CONF. PRES. PSF	1008	TEST TYPE	TX/Pbp/Tap Water

SATURATION DATA

Cell Pres. (PSI)	Back Pres. (PSI)	Burette Reading (CC)		Pore Pressure (PSI)		Change	B
		Close	Open	Close	Open		
40.0	38.0	3.9	9.7				
50.0	48.0	-0.7	0.7	38.2	46.6	8.4	0.84
60.0	58.0	0.4	1.4	48.5	57.5	9.0	0.90
70.0	68.0	1.3	2.2	58.4	67.4	9.0	0.90
80.0		2.3	2.4	68.0	77.6	9.6	0.96

CONSOLIDATION DATA

Elapsed Time (Min)	SQRT Time (Min)	Burette Reading (CC)	Volume Defl. (cc)
0.00	0.00	2.20	0.00
0.25	0.50	3.40	-1.20
0.5	0.71	3.50	-1.30
1	1.00	3.80	-1.60
2	1.41	4.00	-1.80
4	2.00	4.20	-2.00
9	3.00	4.50	-2.30
16	4.00	4.80	-2.60
30	5.48	5.00	-2.80
60	7.75	5.15	-2.95
120	10.95	5.30	-3.10
265	16.28	5.60	-3.40
360	18.97	5.70	-3.50

Initial Height (in)	3.009	Init. Vol. (CC)	224.60
Height Change (in)	0.011	Vol. Change (CC)	3.50
Ht. After Cons. (in)	2.998	Cell Exp. (CC)	12.60
Initial Area (sq in)	4.554	Net Change (CC)	-9.10
Area After Cons. (sq in)	4.756	Cons. Vol. (CC)	233.70

Data entry by: DAW Date: 09/20/2011
Checked by: Cal Date: 9/23/11
FileName: WSP03624

TRIAXAL COMPRESSION TEST DATA

CLIENT	Western Water Consultants	JOB NO.	2137-67
BORING NO.	LRP-3	SAMPLED	
DEPTH	12.8-14	TEST STARTED	9/04/11 CAL
SAMPLE NO.	Lined Retention Ponds	TEST FINISHED	9/09/11 DPM
SOIL DESCR.	2009142.42	SETUP NO.	19S
LOCATION	Strata Energy CPP Area	SATURATED TEST	Yes
CONF. PRES. PSF	1630	TEST TYPE	TX/Pbp/Tap Water

SATURATION DATA

Cell Pres. (PSI)	Back Pres. (PSI)	Burette Reading (CC)		Pore Pressure (PSI)		Change	B
		Close	Open	Close	Open		
40.0	38.0	1.8	9.4				
50.0	48.0	9.5	10.7	38.5	46.8	8.3	0.83
60.0	58.0	9.8	10.8	48.8	57.2	8.4	0.84
70.0	68.0	10.4	11.3	58.3	67.3	9.0	0.90
80.0	78.0	10.9	11.8	68.4	77.5	9.1	0.91
90.0		11.3	11.5	78.4	88.0	9.6	0.96

CONSOLIDATION DATA

Elapsed Time (Min)	SQRT Time (Min)	Burette Reading (CC)	Volume Defl. (cc)
0.00	0.00	0.20	0.00
0.25	0.50	1.10	-0.90
0.5	0.71	1.15	-0.95
1	1.00	1.20	-1.00
2	1.41	1.20	-1.00
4	2.00	1.20	-1.00
9	3.00	1.30	-1.10
16	4.00	1.30	-1.10
30	5.48	1.40	-1.20
60	7.75	1.50	-1.30
120	10.95	1.70	-1.50
240	15.49	2.00	-1.80
360	18.97	2.20	-2.00

Initial Height (in)	2.989	Init. Vol. (CC)	136.86
Height Change (in)	0.014	Vol. Change (CC)	12.60
Ht. After Cons. (in)	2.975	Cell Exp. (CC)	11.99
Initial Area (sq in)	2.794	Net Change (CC)	0.61
Area After Cons. (sq in)	2.794	Cons. Vol. (CC)	136.26

Data entry by: DAW Date: 09/12/2011
Checked by: cwe Date: 9/13/11
FileName: WSP01886

TRIAXAL COMPRESSION TEST DATA

CLIENT	Western Water Consultants	JOB NO	2137-67
BORING NO	LRP-3	SAMPLED	
DEPTH	20.9-21.5	TEST STARTED	9/04/11 CAL
SAMPLE NO.	Lined Retention Ponds	TEST FINISHED	9/10/11 CAL
SOIL DESCR	2009142.42	SETUP NO.	21S
LOCATION	Strata Energy CPP Area	SATURATED TEST	Yes
CONF PRES PSF	2640	TEST TYPE	TX/Pbp/Tap Water

SATURATION DATA

Cell Pres. (PSI)	Back Pres. (PSI)	Burette Reading (CC)		Pore Pressure (PSI)		Change	B
		Close	Open	Close	Open		
40.0	38.0	2.1	10.2				
50.0	48.0	7.1	8.0	38.3	47.0	8.7	0.87
60.0	58.0	7.1	7.9	48.5	57.1	8.6	0.86
70.0	68.0	7.6	8.4	58.2	67.5	9.3	0.93
80.0	78.0	8.5	9.3	68.2	77.6	9.4	0.94
90.0		8.9	9.0	78.3	87.9	9.6	0.96

CONSOLIDATION DATA

Elapsed Time (Min)	SQRT Time (Min)	Burette Reading (CC)	Volume Defl (cc)
0.00	0.00	0.30	0.00
0.25	0.50	1.70	-1.40
0.5	0.71	1.75	-1.45
1	1.00	1.80	-1.50
2	1.41	2.00	-1.70
4	2.00	2.10	-1.80
9	3.00	2.40	-2.10
16	4.00	2.60	-2.30
30	5.48	2.80	-2.50
60	7.75	3.15	-2.85
120	10.95	3.60	-3.30
240	15.49	4.20	-3.90
360	18.97	4.60	-4.30

Initial Height (in)	2.985	Init Vol (CC)	138.42
Height Change (in)	0.019	Vol Change (CC)	13.50
Ht. After Cons (in)	2.966	Cell Exp (CC)	16.75
Initial Area (sq in)	2.829	Net Change (CC)	-3.25
Area After Cons (sq in)	2.914	Cons Vol (CC)	141.67

Data entry by: DAW Date: 09/14/2011
Checked by: Cal Date: 9/14/11
FileName: WSP01898

TRIAXIAL COMPRESSION TEST DATA

CLIENT	Western Water Consultants	JOB NO.	2137-67
BORING NO.	LRP-3, Pt. A	SAMPLED	
DEPTH	Bulk 6.5-12.0'	TEST STARTED	9/10/11 CAL
SAMPLE NO.	Lined Retention Ponds	TEST FINISHED	9/16/11 CAL
SOIL DESCR.	2009142.42	CELL NUMBER	18S
LOCATION:	Strata Energy CPP Area	SATURATED TEST	Yes
TEST TYPE	TX/CUpp	CONF. PRES. PSF	5000

Init. Ht. (in)	5.001	Init. Area (sq in)	4.558
Consol. Ht. (in)	4.916	Consol. Area (sq in)	4.482
Back Pres. PSI	68.3	Strain Rate (in/min)	0.0035

Axial Load Lbs.	Axial Load PSF	Delta Ht. In.	Axial % Strain	Area Final Sq In.	Dev. Stress PSF	Pore Pres. PSI	Delta Pres. PSF	Sigma 3 PSF	Sigma 1 PSF	Prin. Stress Ratio
0.0	0	0.000	0.00	4.482	0	68.3	0	5000	5000	1.00
8.6	276	0.007	0.15	4.489	275	68.8	62	4938	5213	1.06
12.3	396	0.012	0.24	4.493	395	69.1	109	4891	5286	1.08
27.8	894	0.016	0.33	4.497	891	70.0	236	4764	5656	1.19
64.6	2074	0.025	0.51	4.505	2064	73.1	688	4312	6376	1.48
71.0	2283	0.030	0.61	4.510	2269	74.2	845	4155	6424	1.55
77.7	2496	0.035	0.71	4.514	2478	75.0	967	4033	6512	1.61
80.0	2569	0.040	0.82	4.519	2548	75.7	1066	3934	6482	1.65
87.1	2797	0.050	1.02	4.528	2769	76.8	1221	3779	6548	1.73
98.5	3165	0.094	1.91	4.569	3105	79.7	1639	3361	6465	1.92
106.0	3407	0.159	3.23	4.631	3297	81.9	1948	3052	6349	2.08
111.0	3566	0.209	4.26	4.681	3414	82.8	2083	2917	6331	2.17
114.7	3684	0.250	5.09	4.722	3497	83.3	2158	2842	6339	2.23
118.2	3798	0.295	6.00	4.768	3571	83.7	2213	2787	6358	2.28
121.0	3887	0.345	7.01	4.820	3615	84.0	2252	2748	6362	2.32
122.7	3943	0.394	8.02	4.873	3626	84.1	2275	2725	6351	2.33
125.6	4035	0.445	9.04	4.928	3670	84.2	2281	2719	6390	2.35
129.8	4169	0.495	10.08	4.984	3749	84.1	2275	2725	6473	2.38
130.3	4186	0.546	11.10	5.041	3722	84.1	2266	2734	6455	2.36
133.0	4272	0.595	12.11	5.099	3755	84.0	2253	2747	6503	2.37
133.9	4301	0.645	13.13	5.159	3736	83.8	2234	2766	6502	2.35
137.7	4424	0.686	13.95	5.209	3807	83.7	2214	2786	6592	2.37
139.1	4468	0.736	14.97	5.271	3799	83.5	2191	2809	6607	2.35
137.7	4426	0.796	16.20	5.348	3709	83.3	2153	2847	6556	2.30
137.7	4423	0.861	17.52	5.434	3648	82.9	2102	2898	6546	2.26
136.5	4385	0.926	18.84	5.523	3559	82.5	2038	2962	6521	2.20
136.0	4369	0.962	19.57	5.572	3514	82.2	1997	3003	6517	2.17
135.0	4338	0.977	19.88	5.594	3476	82.1	1985	3015	6491	2.15

Data entry by: DAW Date: 09/21/2011
Data checked by: cwe Date: 9/21/11
FileName: WST06083

TRIAXIAL COMPRESSION TEST DATA
ASTM D 4767

CLIENT	Western Water Consultants	JOB NO.	2137-67
BORING NO.	LRP-3, Pt. A	SAMPLED	
DEPTH	Bulk 6.5-12.0'	TEST STARTED	9/10/11 CAL
SAMPLE NO.	Lined Retention Ponds	TEST FINISHED	9/16/11 CAL
SOIL DESCR.	2009142.42	CELL NUMBER	18S
LOCATION:	Strata Energy CPP Area	SATURATED TEST	Yes
TEST TYPE	TX/CUpp	CONF. PRES. PSF	5000

SATURATION DATA

Cell Pres. (PSI)	Back Pres. (PSI)	Burette Reading (CC)		Pore Pressure (PSI)		Change	B
		Close	Open	Close	Open		
40.0	38.0	3.0	11.2				
50.0	48.0	-10.5	-9.0	38.6	47.2	8.6	0.86
60.0	58.0	-10.1	-9.0	48.5	57.6	9.1	0.91
70.0	68.0	-9.3	-8.3	58.5	67.6	9.1	0.91
80.0		-8.5	-8.4	68.0	77.5	9.5	0.95

CONSOLIDATION DATA

Elapsed Time (Min)	SQRT TIME (Min)	Burette Reading (CC)	Vol. Defl. (CC)
0.00	0.0	1.6	0.00
0.25	0.5	8.2	-6.60
0.5	0.7	9.3	-7.70
1	1.0	10.8	-9.20
2	1.4	12.7	-11.10
4	2.0	15.0	-13.40
9	3.0	17.9	-16.30
16	4.0	19.6	-18.00
30	5.5	21.4	-19.80
60	7.7	23.7	-22.10
120	11.0	26.3	-24.70
266	15.5	30.0	-28.40
360	19.0	31.6	-30.00

Initial Height (in)	5.001	Init. Vol. (CC)	373.59
Height Change (in)	0.085	Vol. Change (CC)	27.30
Ht. After Cons. (in)	4.916	Cell Exp. (CC)	14.83
Initial Area (sq in)	4.558	Net Change (CC)	12.47
Area After Cons. (sq in)	4.482	Cons. Vol. (CC)	361.12

Data entry by: DAW Date: 09/21/2011
Data checked by: cal Date: 9/21/11
FileName: WST06083

TRIAXIAL COMPRESSION TEST DATA
ASTM D 4767

CLIENT	Western Water Consultants	JOB NO	2137-67
BORING NO	LRP-3, Pt. A	SAMPLED	
DEPTH	Bulk 6.5-12.0'	TEST STARTED	9/10/11 CAL
SAMPLE NO.	Lined Retention Ponds	TEST FINISHED	9/16/11 CAL
SOIL DESCR	2009142 42	CELL NUMBER	18S
LOCATION	Strata Energy CPP Area	SATURATED TEST	Yes
TEST TYPE	TX/CUpp		
		CONF PRES. PSF	5000

MOISTURE/DENSITY DATA	BEFORE TEST	AFTER TEST
Wt. Soil + Moisture (g)	713 3	750 0
Wt. Wet Soil & Pan (g)	726 8	763.5
Wt. Dry Soil & Pan (g)	608 4	608.4
Wt. Lost Moisture (g)	118 4	155 1
Wt. of Pan Only (g)	13.5	13.5
Wt. of Dry Soil (g)	594.9	594.9
Moisture Content %	19.9	26.1
Wet Density PCF	119.2	129.7
Dry Density PCF	99.4	102.9

Init. Diameter (in)	2.409
Init. Area (sq in)	4.558
Init. Height (in)	5.001
Vol. Bef. Consol. (cu ft)	0.01319
Vol. After Consol (cu ft)	0.01275

Notes & Comments: Remolded sample.

Data entry by: DAW Date: 09/21/2011
Data checked by: cal Date: 9/21/11
FileName: WST06083

TRIAXIAL COMPRESSION TEST DATA

CLIENT	Western Water Consultants	JOB NO	2137-67
BORING NO.	LRP-3, Pt. B	SAMPLED	
DEPTH	Bulk 6.5-12.0'	TEST STARTED	9/10/11 CAL
SAMPLE NO.	Lined Retention Ponds	TEST FINISHED	9/20/11 CAL
SOIL DESCR.	2009142.42	CELL NUMBER	17S
LOCATION:	Strata Energy CPP Area	SATURATED TEST	Yes
TEST TYPE	TX/CUpp	CONF. PRES. PSF	2500

Init. Ht. (in)	5.003	Init. Area (sq in)	4.562
Consol. Ht. (in)	4.966	Consol. Area (sq in)	4.393
Back Pres. PSI	78.1	Strain Rate (in/min)	0.0022

Axial Load Lbs.	Axial Load PSF	Delta Ht. In.	Axial % Strain	Area Final Sq In.	Dev. Stress PSF	Pore Pres. PSI	Delta Pres. PSF	Sigma 3 PSF	Sigma 1 PSF	Prin. Stress Ratio
0.0	0	0.000	0.00	4.393	0	78.1	0	2500	2500	1.00
13.5	442	0.009	0.19	4.401	441	79.2	161	2339	2781	1.19
27.5	903	0.014	0.28	4.405	900	80.4	330	2170	3070	1.41
41.8	1370	0.018	0.37	4.409	1365	81.6	508	1992	3357	1.68
57.0	1870	0.028	0.56	4.418	1859	83.2	738	1762	3621	2.06
59.2	1939	0.032	0.65	4.422	1927	83.7	804	1696	3622	2.14
60.8	1994	0.037	0.75	4.426	1979	84.0	852	1648	3627	2.20
61.6	2018	0.042	0.85	4.431	2001	84.3	894	1606	3607	2.25
64.1	2100	0.052	1.05	4.440	2077	84.7	957	1543	3620	2.35
66.3	2175	0.097	1.95	4.481	2132	85.8	1117	1383	3516	2.54
66.3	2174	0.161	3.24	4.540	2103	86.7	1237	1263	3367	2.67
68.1	2233	0.211	4.24	4.588	2138	87.0	1282	1218	3356	2.76
68.0	2229	0.250	5.04	4.626	2117	87.1	1305	1195	3312	2.77
69.9	2292	0.295	5.94	4.671	2155	87.2	1308	1192	3347	2.81
69.7	2286	0.345	6.94	4.721	2127	87.2	1313	1187	3315	2.79
71.4	2339	0.394	7.94	4.772	2153	87.1	1304	1196	3349	2.80
72.3	2369	0.444	8.93	4.824	2157	87.0	1290	1210	3367	2.78
72.2	2367	0.493	9.93	4.877	2132	86.9	1275	1225	3358	2.74
72.8	2385	0.543	10.94	4.933	2125	86.8	1254	1246	3371	2.71
73.5	2411	0.594	11.95	4.990	2122	86.6	1231	1269	3391	2.67
74.0	2425	0.643	12.95	5.046	2111	86.5	1208	1292	3404	2.63
72.9	2388	0.682	13.73	5.092	2060	86.3	1187	1313	3374	2.57
73.3	2404	0.732	14.73	5.152	2049	86.2	1165	1335	3385	2.53
73.7	2416	0.792	15.95	5.227	2030	85.9	1132	1368	3399	2.48
72.7	2383	0.856	17.24	5.308	1972	85.7	1097	1403	3376	2.41
73.0	2393	0.920	18.53	5.393	1950	85.5	1062	1438	3387	2.36
75.1	2460	0.955	19.24	5.440	1987	85.3	1040	1460	3447	2.36
72.9	2388	0.970	19.53	5.459	1922	85.3	1035	1465	3387	2.31

Data entry by: DAW Date: 09/23/2011
Data checked by: Cal Date: 9/24/11
FileName: WST03BKB

TRIAXIAL COMPRESSION TEST DATA
ASTM D 4767

CLIENT	Western Water Consultants	JOB NO.	2137-67
BORING NO.	LRP-3, Pt. B	SAMPLED	
DEPTH	Bulk 6.5-12.0'	TEST STARTED	9/10/11 CAL
SAMPLE NO.	Lined Retention Ponds	TEST FINISHED	9/20/11 CAL
SOIL DESCR.	2009142.42	CELL NUMBER	17S
LOCATION:	Strata Energy CPP Area	SATURATED TEST	Yes
TEST TYPE	TX/CUpp	CONF. PRES. PSF	2500

SATURATION DATA

Cell Pres. (PSI)	Back Pres. (PSI)	Burette Reading (CC)		Pore Pressure (PSI)		Change	B
		Close	Open	Close	Open		
40.0	38.0	14.9	25.1				
50.0	48.0	6.3	7.9	38.4	46.8	8.4	0.84
60.0	58.0	6.7	7.8	48.5	57.3	8.8	0.88
70.0	68.0	7.4	8.4	58.3	67.3	9.0	0.90
80.0	78.0	8.1	9.0	67.8	77.2	9.4	0.94
90.0		8.9	9.0	78.1	87.7	9.6	0.96

CONSOLIDATION DATA

Elapsed Time (Min)	SQRT TIME (Min)	Burette Reading (CC)	Vol. Defl. (CC)
0.00	0.0	0.1	0.00
0.25	0.5	3.1	-3.00
0.5	0.7	3.9	-3.80
1	1.0	4.8	-4.70
2	1.4	6.1	-6.00
4	2.0	8.0	-7.90
9	3.0	10.2	-10.10
16	4.0	11.9	-11.80
30	5.5	13.7	-13.60
60	7.7	15.5	-15.40
120	11.0	17.1	-17.00
240	15.5	18.6	-18.50
360	19.0	19.5	-19.40

Initial Height (in)	5.003	Init. Vol. (CC)	374.05
Height Change (in)	0.037	Vol. Change (CC)	29.20
Ht. After Cons. (in)	4.966	Cell Exp. (CC)	12.71
Initial Area (sq in)	4.562	Net Change (CC)	16.49
Area After Cons. (sq in)	4.393	Cons. Vol (CC)	357.56

Data entry by: DAW Date: 09/23/2011
Data checked by: cal Date: 9/24/11
FileName: WST03BKB

TRIAXIAL COMPRESSION TEST DATA
ASTM D 4767

CLIENT	Western Water Consultants	JOB NO.	2137-67
BORING NO.	LRP-3, Pt. B	SAMPLED	
DEPTH	Bulk 6.5-12.0'	TEST STARTED	9/10/11 CAL
SAMPLE NO	Lined Retention Ponds	TEST FINISHED	9/20/11 CAL
SOIL DESCR.	2009142.42	CELL NUMBER	17S
LOCATION.	Strata Energy CPP Area	SATURATED TEST	Yes
TEST TYPE	TX/CUpp		
		CONF. PRES. PSF	2500

MOISTURE/DENSITY DATA	BEFORE TEST	AFTER TEST
Wt. Soil + Moisture (g)	713.3	755.9
Wt. Wet Soil & Pan (g)	722.0	764.6
Wt. Dry Soil & Pan (g)	602.3	602.3
Wt. Lost Moisture (g)	119.7	162.3
Wt. of Pan Only (g)	8.7	8.7
Wt. of Dry Soil (g)	593.6	593.6
Moisture Content %	20.2	27.3
Wet Density PCF	119.1	132.0
Dry Density PCF	99.1	103.7

Init. Diameter (in)	2.410
Init. Area (sq in)	4.562
Init. Height (in)	5.003
Vol. Bef. Consol. (cu ft)	0.01321
Vol. After Consol. (cu ft)	0.01262

Notes & Comments: Remolded sample.

Data entry by: DAW Date: 09/23/2011
Data checked by: CAE Date: 9/24/11
FileName: WST03BKB

TRIAXIAL COMPRESSION TEST DATA

CLIENT	Western Water Consultants	JOB NO.	2137-67
BORING NO.	LRP-3, Pt. C	SAMPLED	
DEPTH	Bulk 6.5-12.0'	TEST STARTED	9/10/11 CAL
SAMPLE NO.	Lined Retention Ponds	TEST FINISHED	9/20/11 CAL
SOIL DESCR.	2009142.42	CELL NUMBER	13S
LOCATION:	Strata Energy CPP Area	SATURATED TEST	Yes
TEST TYPE	TX/CUpp	CONF. PRES. PSF	1000

Init. Ht. (in)	5.010	Init. Area (sq in)	4.550
Consol. Ht. (in)	5.008	Consol. Area (sq in)	4.719
Back Pres. PSI	68.1	Strain Rate (in/min)	0.0041

Axial Load Lbs.	Axial Load PSF	Delta Ht. In.	Axial % Strain	Area Final Sq In.	Dev. Stress PSF	Pore Pres. PSI	Delta Pres. PSF	Sigma 3 PSF	Sigma 1 PSF	Prin. Stress Ratio
0.0	0	0.000	0.00	4.719	0	68.1	0	1000	1000	1.00
30.3	923	0.008	0.16	4.727	922	70.1	278	722	1643	2.28
37.3	1138	0.013	0.26	4.732	1135	70.7	366	634	1769	2.79
39.7	1211	0.018	0.36	4.737	1207	71.1	425	575	1782	3.10
40.8	1245	0.028	0.55	4.746	1239	71.5	485	515	1754	3.40
40.1	1225	0.033	0.65	4.750	1217	71.6	500	500	1717	3.43
40.2	1228	0.037	0.75	4.755	1218	71.7	510	490	1709	3.49
38.0	1160	0.043	0.86	4.760	1150	71.7	520	480	1630	3.40
38.0	1159	0.053	1.06	4.770	1147	71.8	532	468	1615	3.45
36.5	1113	0.097	1.95	4.813	1091	72.0	563	437	1528	3.50
35.9	1095	0.162	3.23	4.877	1060	72.1	574	426	1486	3.49
37.3	1139	0.212	4.23	4.928	1091	72.1	573	427	1518	3.56
37.3	1138	0.251	5.02	4.969	1081	72.0	558	442	1523	3.45
37.0	1129	0.297	5.93	5.017	1062	72.0	557	443	1505	3.40
37.2	1136	0.347	6.92	5.070	1058	72.0	552	448	1506	3.36
37.6	1148	0.396	7.91	5.125	1057	71.9	547	453	1509	3.34
39.6	1209	0.446	8.90	5.181	1101	71.9	538	462	1563	3.38
39.2	1197	0.495	9.89	5.238	1079	71.8	530	470	1549	3.30
41.0	1249	0.545	10.89	5.296	1113	71.7	521	479	1592	3.33
40.5	1234	0.595	11.88	5.356	1088	71.7	515	485	1573	3.24
42.2	1289	0.645	12.88	5.418	1123	71.6	504	496	1619	3.26
43.4	1325	0.684	13.67	5.467	1144	71.6	498	502	1645	3.28
42.6	1301	0.734	14.66	5.530	1110	71.5	489	511	1620	3.17
43.2	1318	0.794	15.86	5.609	1109	71.4	477	523	1632	3.12
45.2	1380	0.859	17.16	5.697	1143	71.3	464	536	1679	3.13
45.7	1394	0.923	18.43	5.786	1137	71.2	449	551	1688	3.06
45.3	1381	0.958	19.13	5.836	1117	71.2	441	559	1675	3.00
45.6	1390	0.973	19.44	5.858	1120	71.2	438	562	1682	2.99

Data entry by: DAW Date: 09/22/2011
Data checked by: CAL Date: 9/23/11
FileName: WST03BKC

TRIAXIAL COMPRESSION TEST DATA
ASTM D 4767

CLIENT	Western Water Consultants	JOB NO.	2137-67
BORING NO.	LRP-3, Pt. C	SAMPLED	
DEPTH	Bulk 6.5-12.0'	TEST STARTED	9/10/11 CAL
SAMPLE NO.	Lined Retention Ponds	TEST FINISHED	9/20/11 CAL
SOIL DESCR.	2009142.42	CELL NUMBER	13S
LOCATION:	Strata Energy CPP Area	SATURATED TEST	Yes
TEST TYPE	TX/CUpp	CONF. PRES. PSF	1000

SATURATION DATA

Cell Pres. (PSI)	Back Pres. (PSI)	Burette Reading (CC)		Pore Pressure (PSI)		Change	B
		Close	Open	Close	Open		
40.0	38.0	13.2	20.1				
50.0	48.0	1.4	2.9	38.4	46.7	8.3	0.83
60.0	58.0	1.9	2.9	48.4	57.2	8.8	0.88
70.0	68.0	2.7	3.4	58.3	67.2	8.9	0.89
80.0		2.6	2.7	68.3	77.8	9.5	0.95

CONSOLIDATION DATA

Elapsed Time (Min)	SQRT TIME (Min)	Burette Reading (CC)	Vol. Defl. (CC)
0.00	0.0	2.7	0.00
0.25	0.5	4.1	-1.35
0.5	0.7	4.3	-1.60
1	1.0	4.7	-2.00
2	1.4	5.1	-2.35
4	2.0	5.5	-2.75
9	3.0	6.0	-3.30
16	4.0	6.4	-3.70
30	5.5	6.7	-4.00
60	7.7	7.1	-4.35
120	11.0	7.3	-4.60
268	16.4	7.7	-5.00
360	19.0	7.9	-5.15

Initial Height (in)	5.010	Init. Vol. (CC)	373.64
Height Change (in)	0.002	Vol. Change (CC)	-3.70
Ht. After Cons. (in)	5.008	Cell Exp. (CC)	10.04
Initial Area (sq in)	4.550	Net Change (CC)	-13.74
Area After Cons. (sq in)	4.719	Cons. Vol. (CC)	387.38

Data entry by: DAW Date: 09/22/2011
Data checked by: Cal Date: 9/23/11
FileName: WST03BKC

TRIAXIAL COMPRESSION TEST DATA
ASTM D 4767

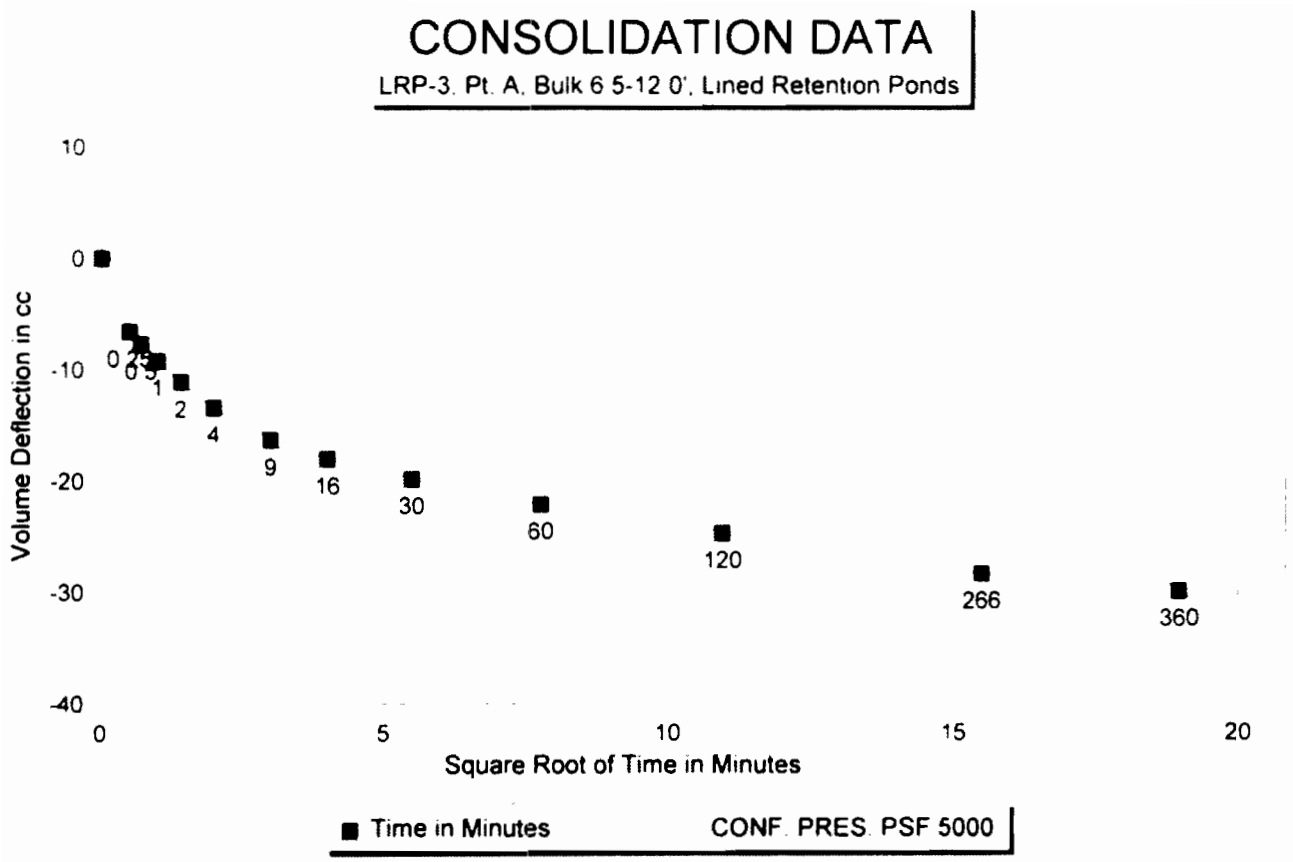
CLIENT	Western Water Consultants	JOB NO.	2137-67
BORING NO.	LRP-3, Pt. C	SAMPLED	
DEPTH	Bulk 6.5-12.0'	TEST STARTED	9/10/11 CAL
SAMPLE NO.	Lined Retention Ponds	TEST FINISHED	9/20/11 CAL
SOIL DESCR.	2009142.42	CELL NUMBER	13S
LOCATION:	Strata Energy CPP Area	SATURATED TEST	Yes
TEST TYPE	TX/CUpp		
		CONF. PRES. PSF	1000

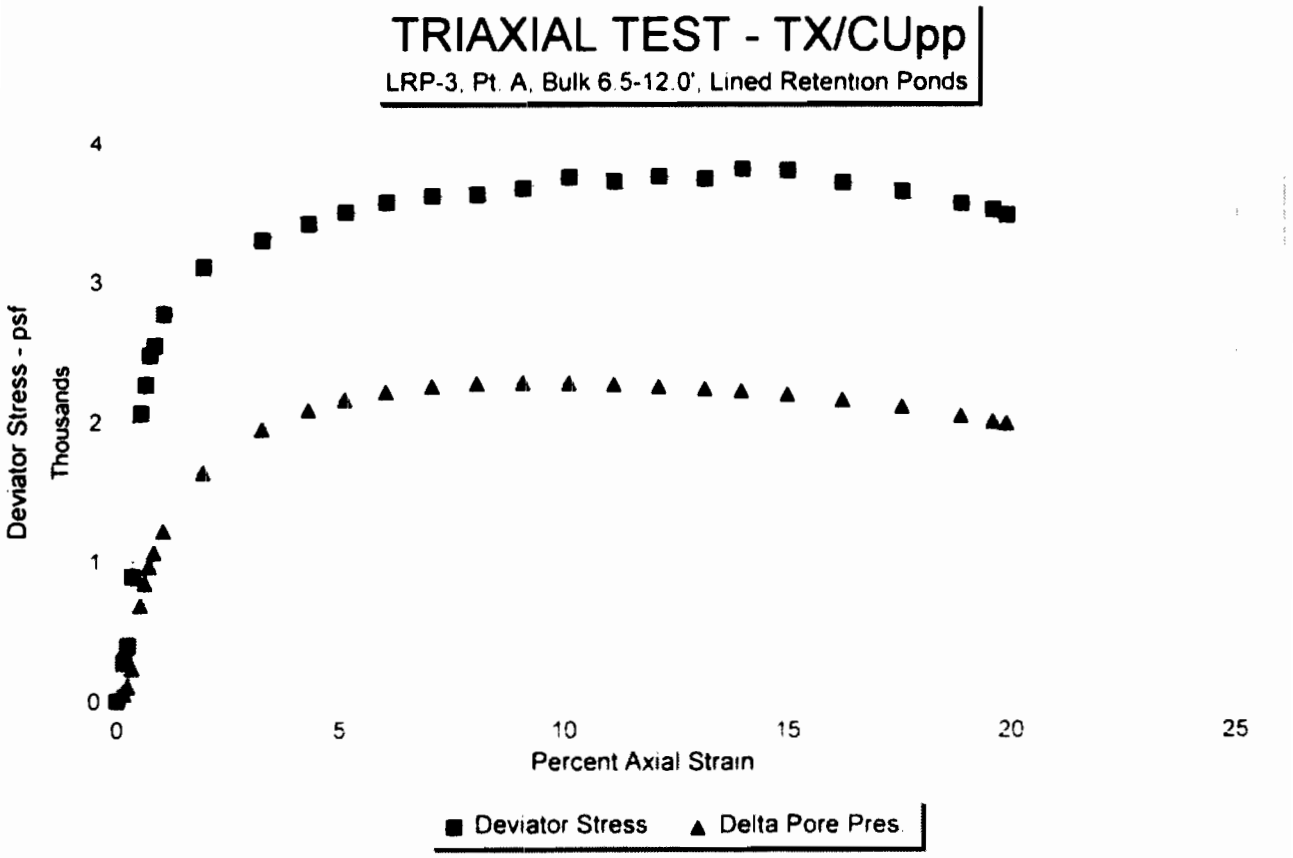
MOISTURE/DENSITY DATA	BEFORE TEST	AFTER TEST
Wt. Soil + Moisture (g)	713.0	776.2
Wt. Wet Soil & Pan (g)	721.3	784.4
Wt. Dry Soil & Pan (g)	603.1	603.1
Wt. Lost Moisture (g)	118.2	181.3
Wt. of Pan Only (g)	8.3	8.3
Wt. of Dry Soil (g)	594.9	594.9
Moisture Content %	19.9	30.5
Wet Density PCF	119.2	125.1
Dry Density PCF	99.4	95.9

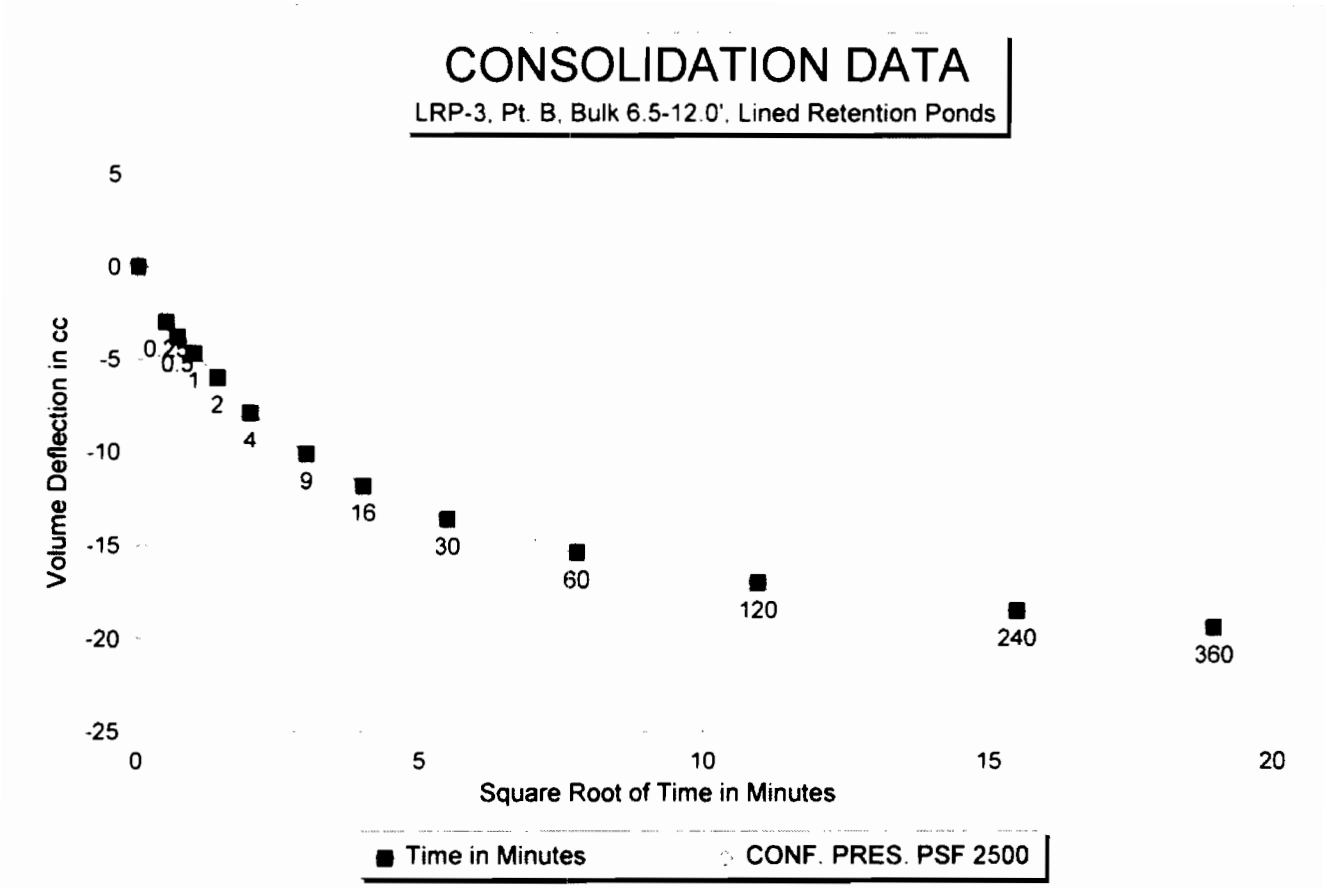
Init. Diameter (in)	2.407
Init. Area (sq in)	4.550
Init. Height (in)	5.010
Vol. Bef. Consol. (cu ft)	0.01319
Vol. After Consol. (cu ft)	0.01368

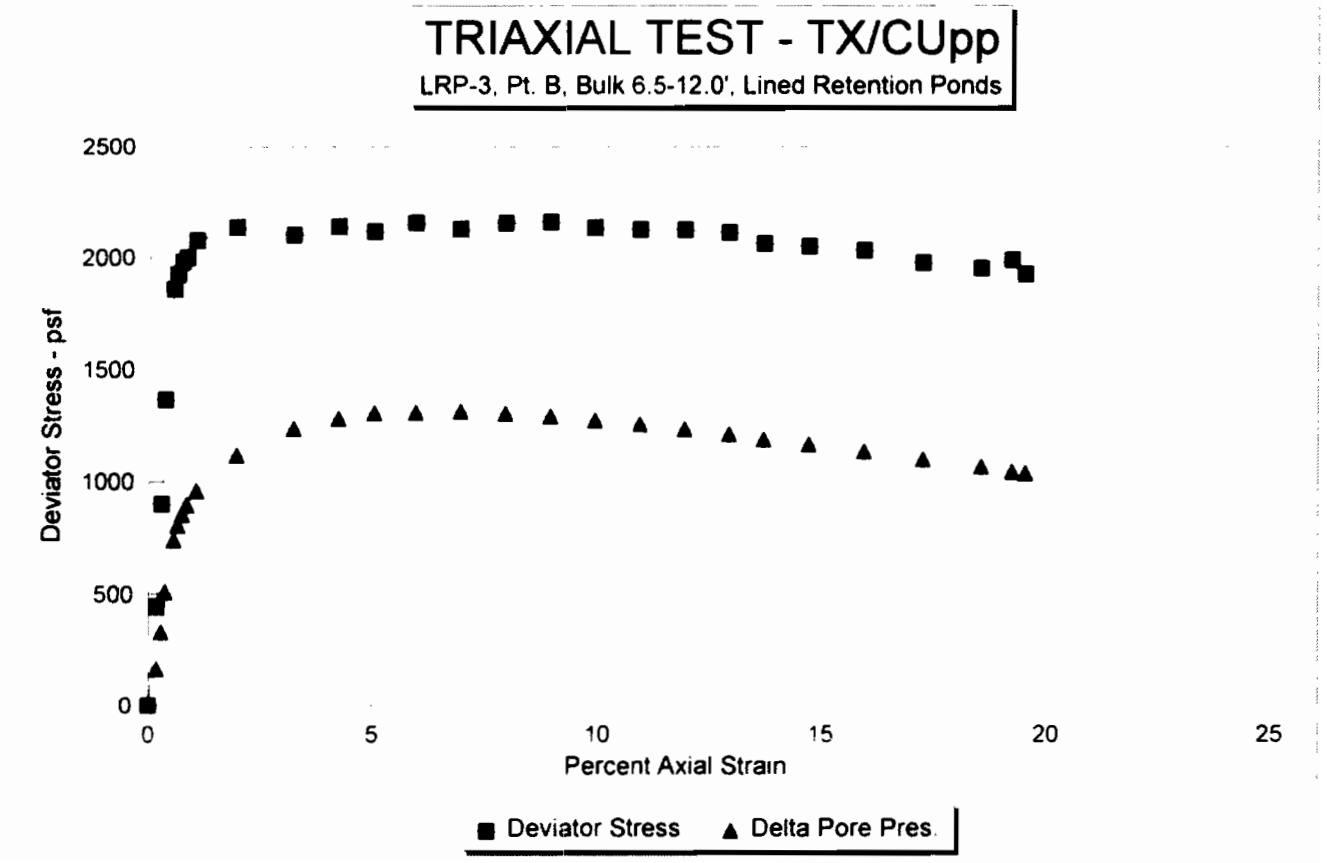
Notes & Comments: Remolded sample.

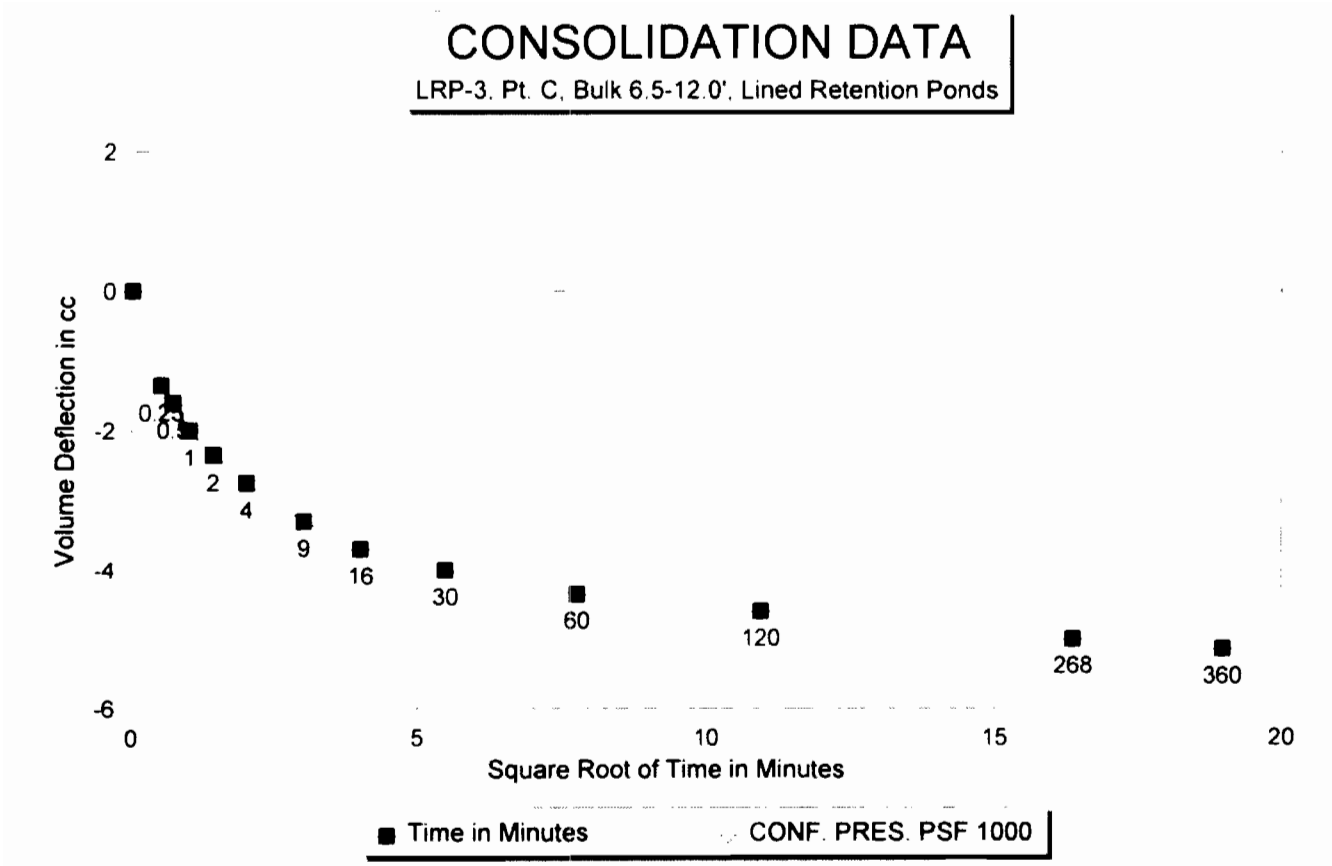
Data entry by: DAW Date: 09/22/2011
Data checked by: CAL Date: 9/23/11
FileName: WST03BKC

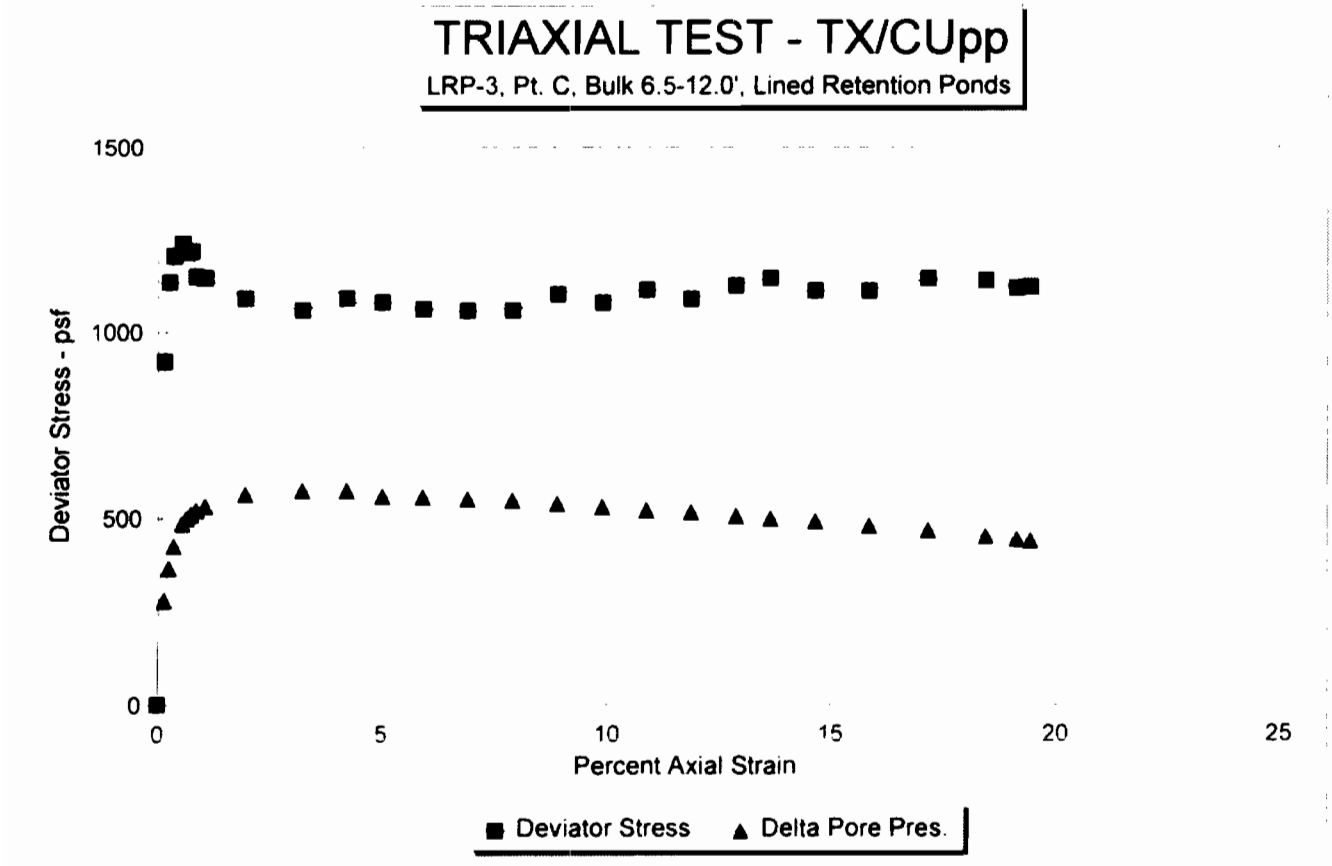

CONSOLIDATION DATA
LRP-3. Pt. A. Bulk 6 5-12 0'. Lined Retention Ponds
Volume Deflection in cc
10
0
-10
-20
-30
-40
0
0.25
0.5
1
2
4
9
16
30
60
120
266
360
0
5
10
15
20
Square Root of Time in Minutes
Time in Minutes
CONF. PRES. PSF 5000


TRIAXIAL TEST - TX/CUpp
LRP-3. Pt. A. Bulk 6.5-12.0'. Lined Retention Ponds
Deviator Stress - psf
Thousands
4
3
2
1
0
0
5
10
15
20
25
Percent Axial Strain
Deviator Stress
Delta Pore Pres.


CONSOLIDATION DATA
LRP-3, Pt. B, Bulk 6.5-12.0', Lined Retention Ponds
Volume Deflection in cc
5
0
-5
-10
-15
-20
-25
0
0.25
0.5
1
2
4
9
16
30
60
120
240
360
0
5
10
15
20
Square Root of Time in Minutes
Time in Minutes
CONF. PRES. PSF 2500


TRIAXIAL TEST - TX/CUpp
LRP-3, Pt. B, Bulk 6.5-12.0', Lined Retention Ponds
Deviator Stress - psf
2500
2000
1500
1000
500
0
0
5
10
15
20
25
Percent Axial Strain
Deviator Stress
Delta Pore Pres.


CONSOLIDATION DATA
LRP-3, Pt. C, Bulk 6.5-12.0', Lined Retention Ponds
Volume Deflection in cc
2
0
-2
-4
-6
0
5
10
15
20
Square Root of Time in Minutes
0
0.25
0.5
1
2
4
9
16
30
60
120
268
360
Time in Minutes
CONF. PRES. PSF 1000


TRIAXIAL TEST - TX/CUpp
LRP-3, Pt. C, Bulk 6.5-12.0', Lined Retention Ponds
Deviator Stress - psf
1500
1000
500
0
0
5
10
15
20
25
Percent Axial Strain
Deviator Stress
Delta Pore Pres.

PERMEABILITY TEST - BACK PRESSURE SATURATED - FLOW PUMP METHOD
ASTM D 5084

CLIENT	WWC Engineering	JOB NO.	2137-67
BORING NO.	LRP-3	SAMPLED	
DEPTH	6.5-12.0'	TEST STARTED	10/06/11 CAL
SAMPLE NO.	Retest Lined Retention Ponds	TEST FINISHED	10/12/11 CAL
SOIL DESCR.	2009142.42	CELL NUMBER	12P
LOCATION	Strata Energy - CPP Area	SATURATED TEST	Yes
CONF. PRES. PSF	1008	TEST TYPE	TX/Pbp/Tap Water

MOISTURE/DENSITY DATA	BEFORE TEST	AFTER TEST
Wt. Soil + Moisture (g)	438.9	457.8
Wt. Wet Soil & Pan (g)	445.6	464.4
Wt. Dry Soil & Pan (g)	363.4	363.4
Wt. Lost Moisture (g)	82.2	101.0
Wt. of Pan Only (g)	6.7	6.7
Wt. of Dry Soil (g)	356.8	356.8
Moisture Content %	23.0	28.3
Wet Density PCF	122.6	127.3
Dry Density PCF	99.7	99.2

Init. Diameter (in)	2.404	(cm)	6.106
Init. Area (sq in)	4.539	(sq cm)	29.286
Init. Height (in)	3.004	(cm)	7.630
Vol. Bef. Consol. (cu ft)	0.00789		
Vol. After Consol. (cu ft)	0.00793		
Porosity %	44.97		

FLOW PUMP CALCULATIONS

Pump Setting	69
Velocity CM/Sec	4.53E-04
Q (cc/s)	1.45E-05
Height	3.007
Diameter	2.409
Pressure (psi)	0.455
Area after consol. (cm*cm)	29.399
Gradient	4.188
Permeability k (cm/s)	1.2E-07
Permeability k (m/s)	**1.2E-09**
Back Pressure (psi)	48.0
Cell Pressure (psi)	55.0
Ave. Effective Stress (psi)	6.773
Average temperature degree C:	23.2

Data entry by: DAW Date: 10/14/2011
Checked by: Cal Date: 10/15/11
FileName: WSP03634

PERMEABILITY TEST - BACK PRESSURE SATURATED - FLOW PUMP METHOD
ASTM D 5084

CLIENT	Western Water Consultants	JOB NO.	2137-67
BORING NO.	LRP-3	SAMPLED	
DEPTH	Bulk 6.5-12.0'	TEST STARTED	9/10/11 CAL
SAMPLE NO.	Lined Retention Ponds	TEST FINISHED	9/19/11 DPM
SOIL DESCR.	2009142.42	CELL NUMBER	7S
LOCATION	Strata Energy CPP Area	SATURATED TEST	Yes
CONF. PRES. PSF	1008	TEST TYPE	TX/Pbp/Tap Water

MOISTURE/DENSITY DATA	BEFORE TEST	AFTER TEST
Wt. Soil + Moisture (g)	427.9	462.7
Wt. Wet Soil & Pan (g)	434.6	469.3
Wt. Dry Soil & Pan (g)	362.4	362.4
Wt. Lost Moisture (g)	72.1	106.8
Wt. of Pan Only (g)	6.6	6.6
Wt. of Dry Soil (g)	355.8	355.8
Moisture Content %	20.3	30.0
Wet Density PCF	119.0	123.6
Dry Density PCF	98.9	95.1

Init. Diameter (in)	2.408	(cm)	6.116
Init. Area (sq in)	4.554	(sq cm)	29.383
Init. Height (in)	3.009	(cm)	7.643
Vol. Bef. Consol. (cu ft)	0.00793		
Vol. After Consol. (cu ft)	0.00825		
Porosity %	45.72		

FLOW PUMP CALCULATIONS

Pump Setting (gear number)	7
Percentage of Pump setting	100
Q (cc/s)	1.14E-03
Height	2.998
Diameter	2.461
Pressure (psi)	0.334
Area after consol. (cm*cm)	30.684
Gradient	3.084
Permeability k (cm/s)	1.2E-05
Permeability k (m/s)	**1.2E-07**
Back Pressure (psi)	68.0
Cell Pressure (psi)	75.0
Ave. Effective Stress (psi)	6.833
Average temperature degree C.	23.2

NOTE: Remolded sample

Data entry by. DAW Date: 09/20/2011
Checked by: Cal Date: 9/23/11
FileName: WSP03624

PERMEABILITY TEST - BACK PRESSURE SATURATED - FLOW PUMP METHOD
ASTM D 5084

CLIENT	Western Water Consultants	JOB NO.	2137-67
BORING NO	LRP-3	SAMPLED	
DEPTH	12.8-14	TEST STARTED	9/04/11 CAL
SAMPLE NO	Lined Retention Ponds	TEST FINISHED	9/09/11 DPM
SOIL DESCR.	2009142.42	CELL NUMBER	19S
LOCATION	Strata Energy CPP Area	SATURATED TEST	Yes
CONF. PRES. PSF	1630	TEST TYPE	TX/Pbp/Tap Water

MOISTURE/DENSITY DATA	BEFORE TEST	AFTER TEST
Wt. Soil + Moisture (g)	269.1	274.8
Wt. Wet Soil & Pan (g)	275.8	281.6
Wt. Dry Soil & Pan (g)	219.8	219.8
Wt. Lost Moisture (g)	56.0	61.7
Wt. of Pan Only (g)	6.7	6.7
Wt. of Dry Soil (g)	213.1	213.1
Moisture Content %	26.3	29.0
Wet Density PCF	122.8	125.9
Dry Density PCF	97.2	97.6

Init. Diameter (in)	1.886	(cm)	4.790
Init. Area (sq in)	2.794	(sq cm)	18.025
Init. Height (in)	2.989	(cm)	7.592
Vol. Bef. Consol. (cu ft)	0.00483		
Vol. After Consol. (cu ft)	0.00481		
Porosity %	45.30		

FLOW PUMP CALCULATIONS

Pump Setting	99
Velocity CM/Sec	6.50E-04
Q (cc/s)	2.08E-05
Height	2.975
Diameter	1.886
Pressure (psi)	0.780
Area after consol. (cm*cm)	18.028
Gradient	7.257
Permeability k (cm/s)	1.6E-07
Permeability k (m/s)	**1.6E-09**
Back Pressure (psi)	78.0
Cell Pressure (psi)	89.3
Ave. Effective Stress (psi)	10.910
Average temperature degree C	22.5

Data entry by: DAW Date: 09/12/2011
Checked by: CAL Date: 9/13/11
FileName: WSP01886

PERMEABILITY TEST - BACK PRESSURE SATURATED - FLOW PUMP METHOD
ASTM D 5084

CLIENT	Western Water Consultants	JOB NO.	2137-67
BORING NO.	LRP-3	SAMPLED	
DEPTH	20.9-21.5	TEST STARTED	9/04/11 CAL
SAMPLE NO.	Lined Retention Ponds	TEST FINISHED	9/10/11 CAL
SOIL DESCR.	2009142.42	CELL NUMBER	21S
LOCATION	Strata Energy CPP Area	SATURATED TEST	Yes
CONF. PRES. PSF	2640	TEST TYPE	TX/Pbp/Tap Water

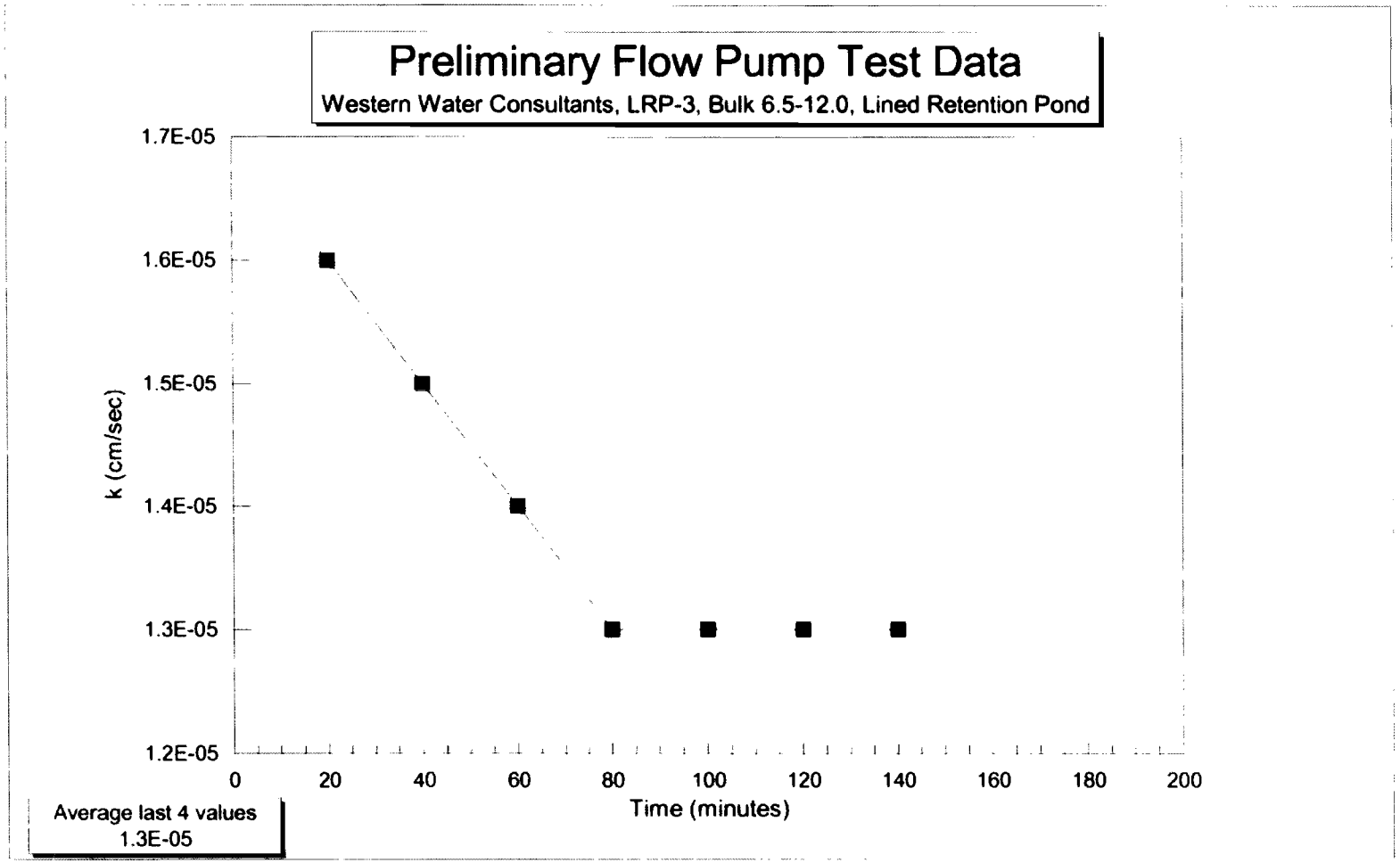
MOISTURE/DENSITY DATA	BEFORE TEST	AFTER TEST
Wt. Soil + Moisture (g)	278.3	284.9
Wt. Wet Soil & Pan (g)	285.0	291.5
Wt. Dry Soil & Pan (g)	236.5	236.5
Wt. Lost Moisture (g)	48.4	54.9
Wt. of Pan Only (g)	6.6	6.6
Wt. of Dry Soil (g)	229.9	229.9
Moisture Content %	21.1	23.9
Wet Density PCF	125.6	125.5
Dry Density PCF	103.7	101.3

Init. Diameter (in)	1.898	(cm)	4.821
Init. Area (sq in)	2.829	(sq cm)	18.255
Init. Height (in)	2.985	(cm)	7.582
Vol. Bef. Consol. (cu ft)	0.00489		
Vol. After Consol. (cu ft)	0.00500		
Porosity %	38.76		

FLOW PUMP CALCULATIONS

Pump Setting (gear number)	12
Percentage of Pump setting	100
Q (cc/s)	2.30E-05
Height	2.966
Diameter	1.926
Pressure (psi)	6.280
Area after consol. (cm*cm)	18.802
Gradient	58.608
Permeability k (cm/s)	2.1E-08
Permeability k (m/s)	**2.1E-10**
Back Pressure (psi)	78.0
Cell Pressure (psi)	96.3
Ave. Effective Stress (psi)	15.160
Average temperature degree C:	22.8

Data entry by: DAW Date: 09/14/2011
Checked by: Cal Date: 9/14/11
FileName: WSP01898



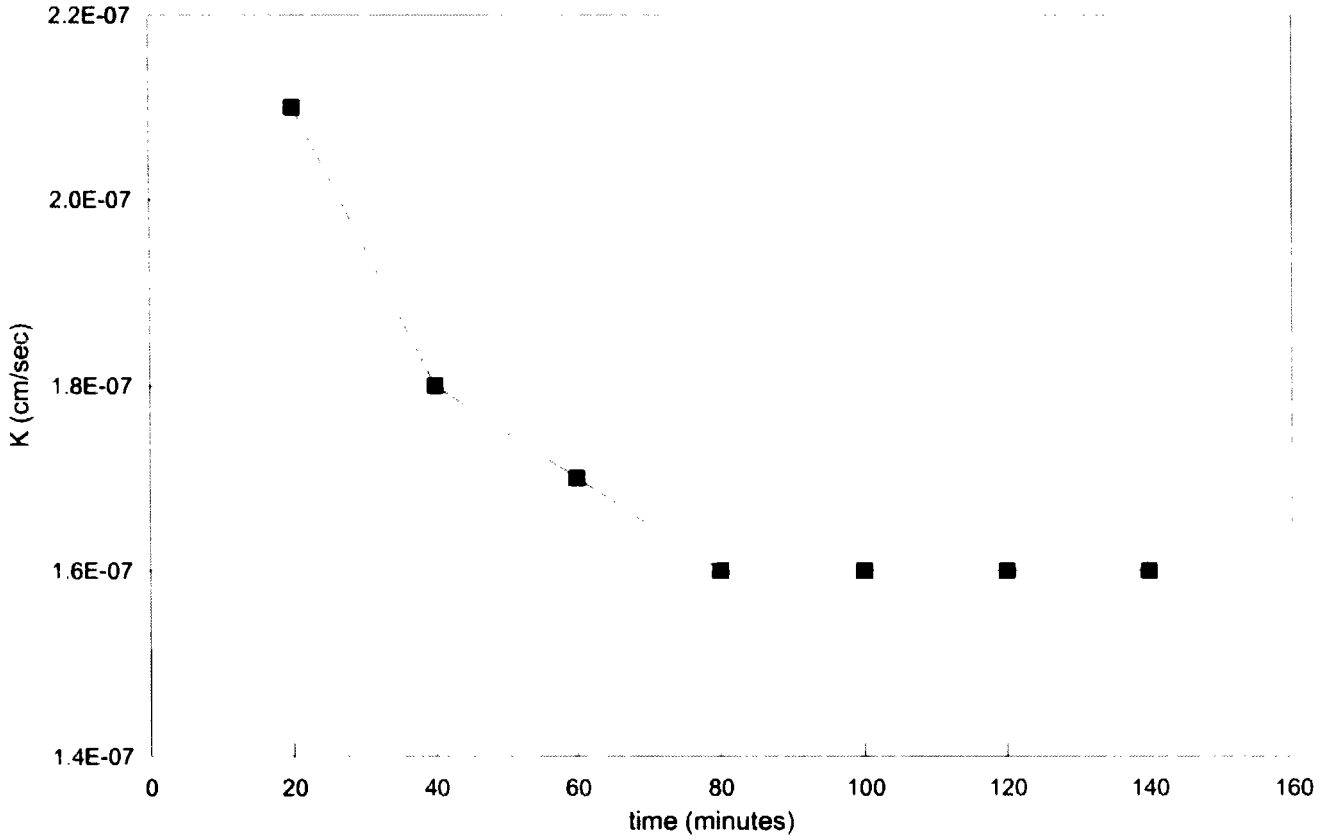
Data Entered By: DPM
Data Checked By: DAH
File Name: WSFP3B65

Date: 09/19/11
Date Checked: 9/20/11

Preliminary Flow Pump Data
WWC Eng.. LRP-3 @ 6.5-12'. Retest
K (cm/sec)
2.2E-07
2.0E-07
1.8E-07
1.6E-07
1.4E-07
1.2E-07
1.0E-07
0
50
100
150
200
time (minutes)
Average last 4 values
1.3E-07
Data Entered By:
Data Checked By:
File Name:
CAL
WSFPL3BR
Date:
10/11/2011
Date Checked
ATT

Preliminary Flow Pump Data

Western Water Consultants, LRP-3, 13.1-13.4, Lined Retention Ponds



Average last 4 values
1.6E-07

Data Entered By: DPM
Data Checked By:
File Name: WSPB3134

Date: 09/09/11
Date Checked 09/12/11

Preliminary Flow Pump Test Data

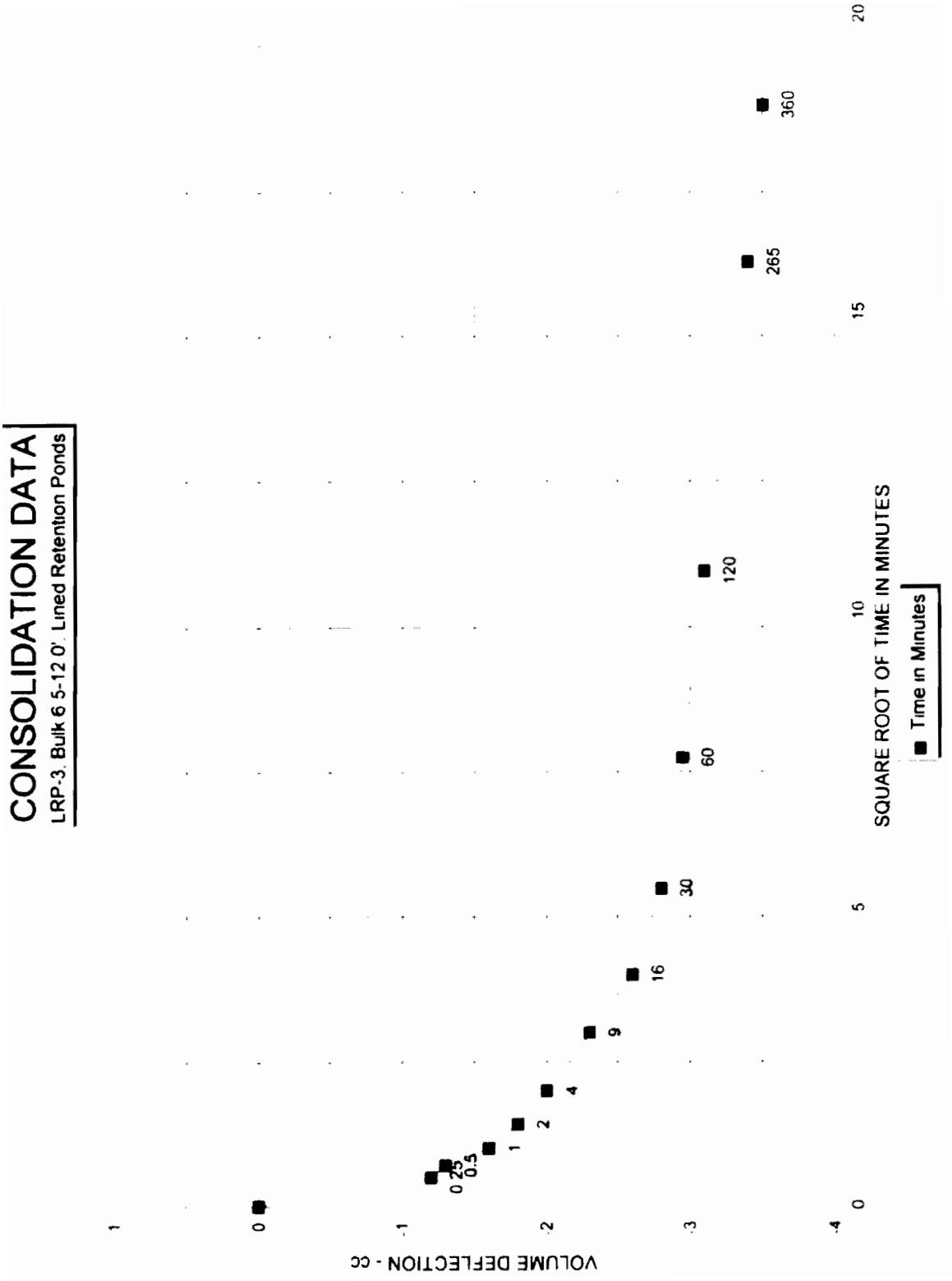
WWC, Strata Energy CPP Area, LRP-3 @ 20.9-21.2'

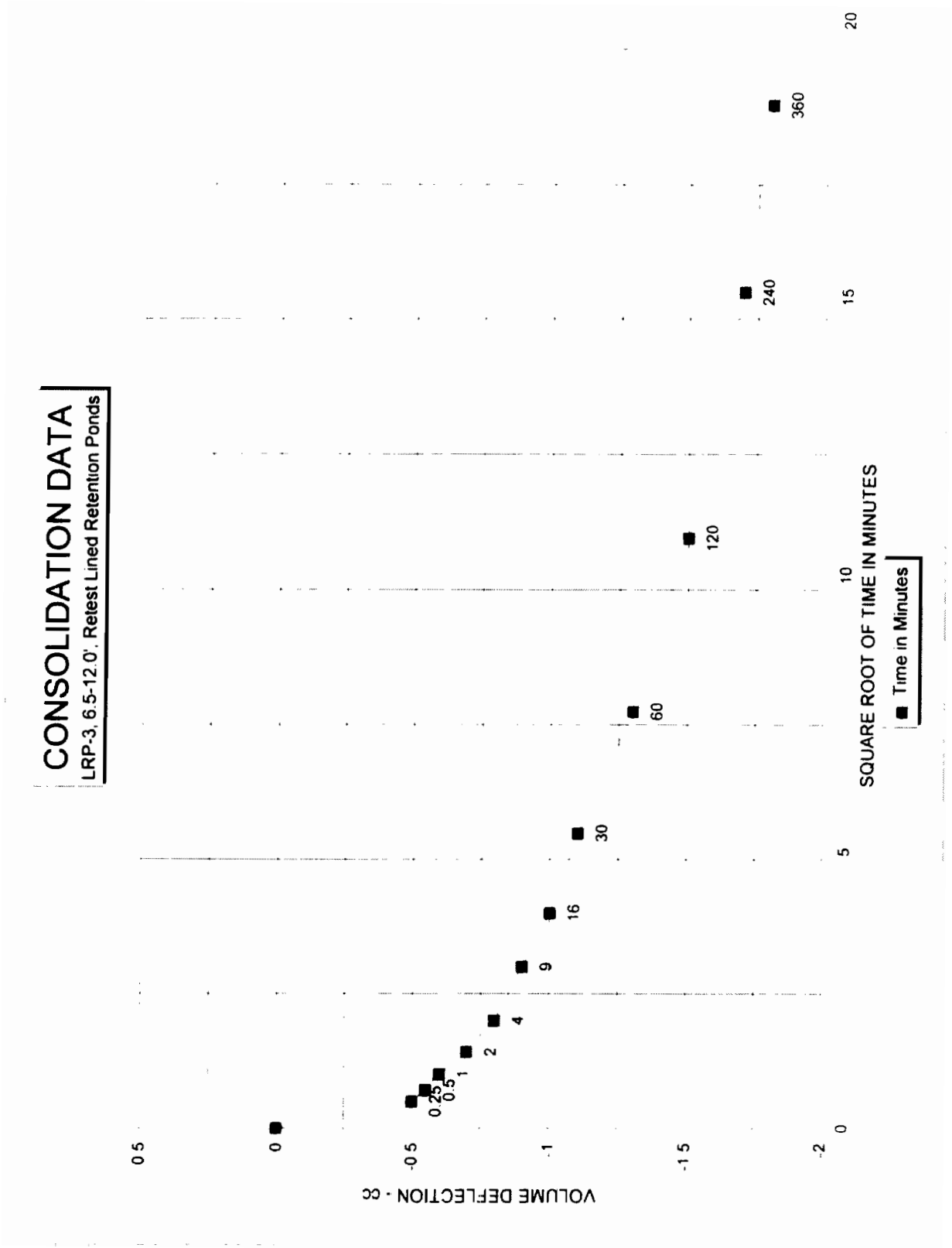
Average last 4 values
2 2E-08

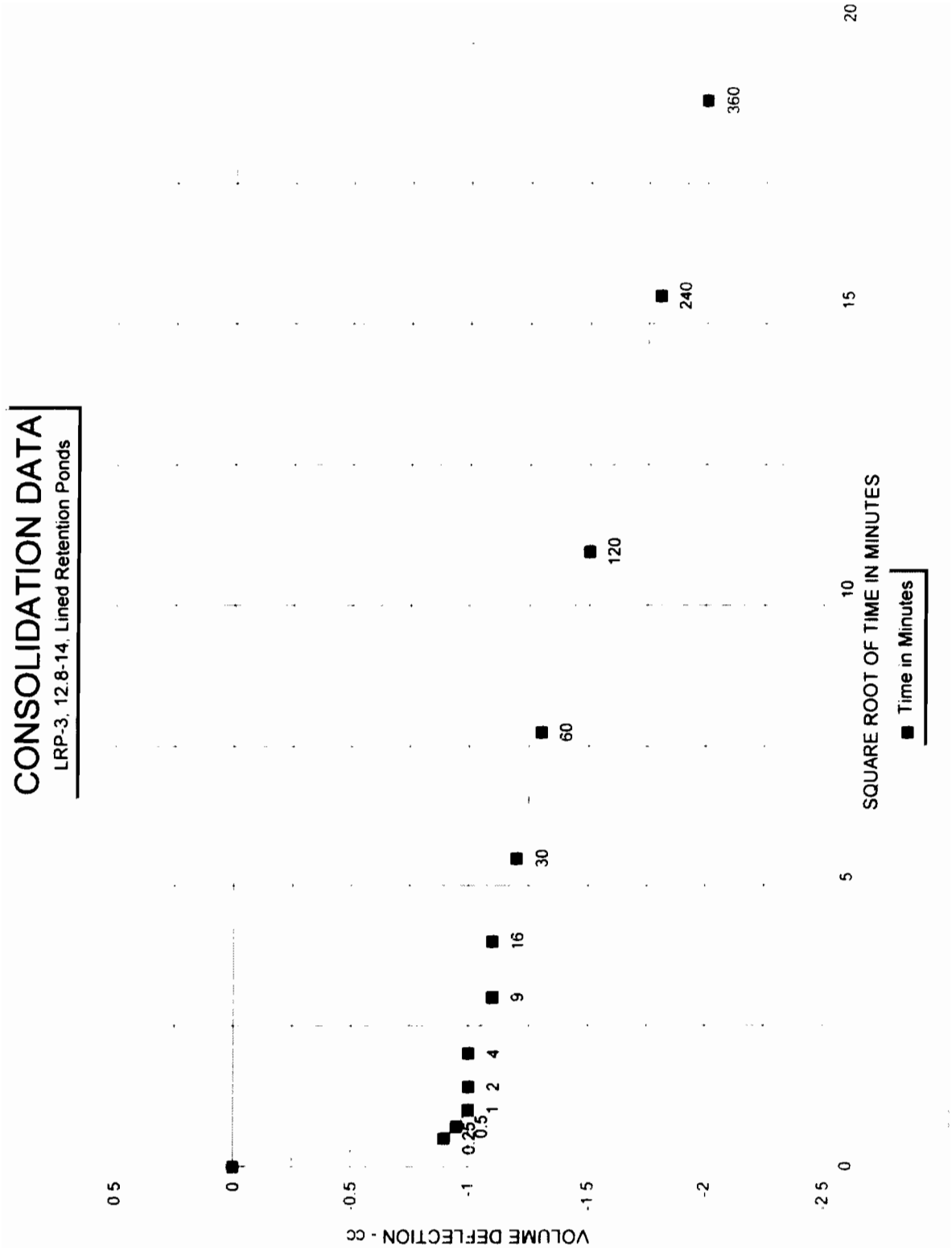
Data Entered By: CAL
Data Checked By: DAU
File Name: WSFPL320

Date: 9/10/2011
Date Checked: 9/14/11

ATT


CONSOLIDATION DATA
LRP-3, Bulk 6 5-12 0', Lined Retention Ponds
VOLUME DEFLECTION - cc
SQUARE ROOT OF TIME IN MINUTES
Time in Minutes
1
0
-.1
-.2
-.3
-.4
0
5
10
15
20
0
0.25
0.5
1
2
4
9
16
30
60
120
265
360


CONSOLIDATION DATA
LRP-3, 6.5-12.0', Retest Lined Retention Ponds
VOLUME DEFLECTION - cc
SQUARE ROOT OF TIME IN MINUTES
Time in Minutes
0.25
0.5
1
2
4
9
16
30
60
120
240
360


CONSOLIDATION DATA
LRP-3, 12.8-14, Lined Retention Ponds
VOLUME DEFLECTION - ε
SQUARE ROOT OF TIME IN MINUTES
Time in Minutes
0.5
0
-0.5
-1
-1.5
-2
-2.5
0
5
10
15
20
0.25
0.5
1
2
4
9
16
30
60
120
240
360

COMPACTION TEST
ASTM D 698 A

CLIENT	Western Water Consultants		JOB NO 2137-67
BORING NO	LRP-3	DATE SAMPLED	
DEPTH	Bulk 6 5-12	DATE TESTED	09/06/2011 TMR
SAMPLE NO	Lined Retention Ponds	LOCATION	Strata Energy CPP Area
SOIL DESCR	2009142 42		

Moisture Determination

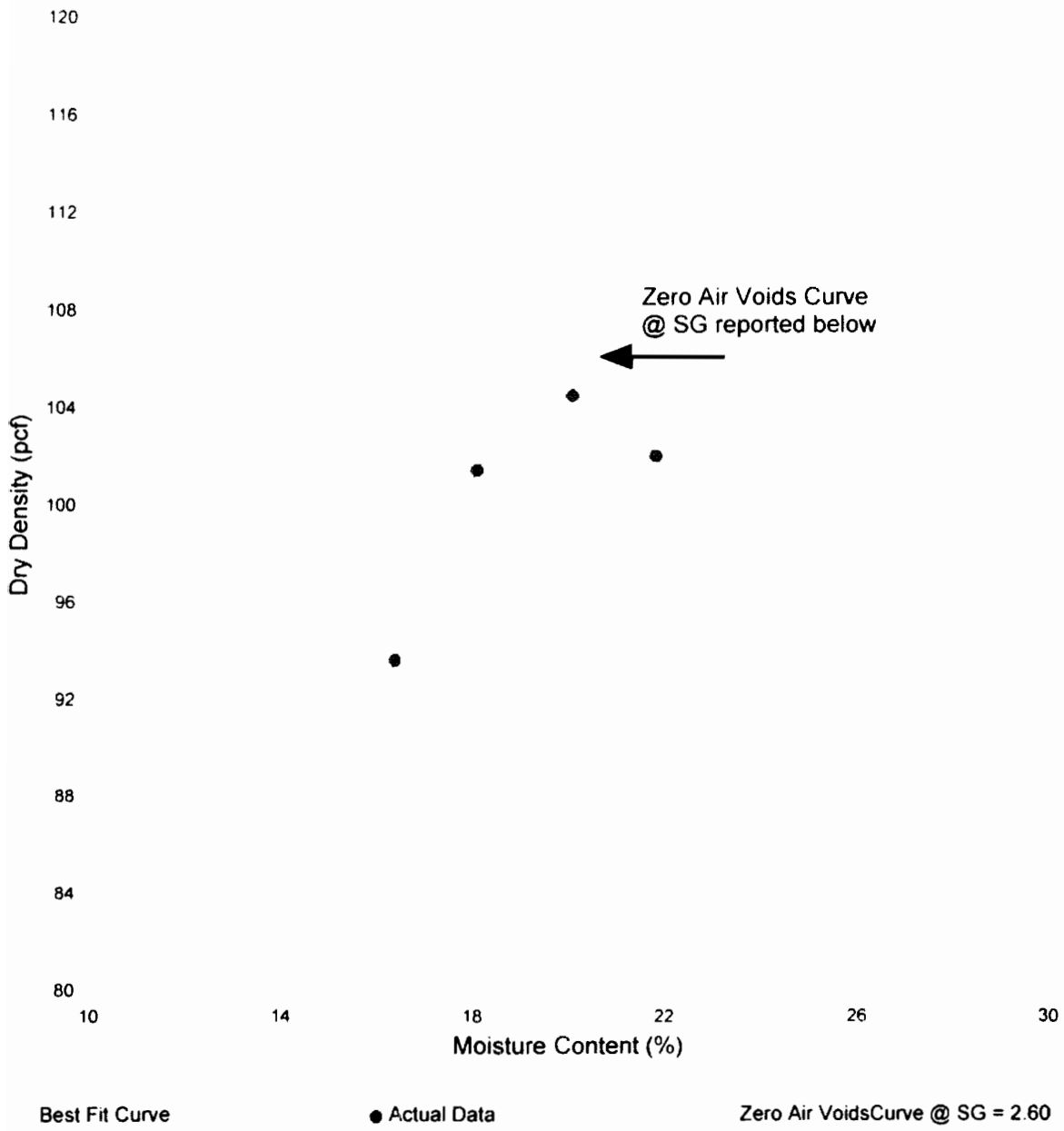
	1	2	3	4
Wt of Moisture added (ml)	280.00	240 00	320 00	360 00
Wt of soil & dish (g)	483.29	509 15	591 67	557 15
Dry wt soil & dish (g)	410.36	438 42	494.00	458.63
Net loss of moisture (g)	72.93	70 73	97 67	98 52
Wt of dish (g)	6.73	6 70	6.64	6 45
Net wt of dry soil (g)	403.63	431 72	487 36	452 18
Moisture Content (%)	18.07	16 38	20 04	21 79
Corrected Moisture Content				
Density determination				
Wt of soil & mold (lb)	14 27	13 91	14 46	14 42
Wt of mold (lb)	10.28	10 28	10 28	10 28
Net wt of wet soil (lb)	3.99	3 63	4 18	4 14
Net wt of dry soil (lb)	3.38	3 12	3 48	3 40
Dry Density (pcf)	101.38	93 57	104 46	101 98
Corrected Dry Density (pcf)				
Volume Factor	30	30	30	30

Note If a rock correction is used the dry density has been calculated using the corrected moisture content

Data entered by TMR Date 09/07/2011
Data checked by BKL Date 9/7/11
FileName WSPRLRP3

Proctor Compaction Test

LRP-3, Bulk 6.5-12, Lined Retention Ponds



OPTIMUM MOISTURE CONTENT = 20 0 MAXIMUM DRY DENSITY = 104 5
ASTM D 698 A, Rock correction applied? N

EFFECTIVE STRESS PATH ANALYSIS TEST DATA
ASTM D4767

CLIENT	Western Water Consultants	JOB NO	2137-67
BORING NO	LRP-3, Pt. A, B & C		
DEPTH	Bulk 6 5-12 0'	SAMPLED	
SAMPLE NO	A,B&C	SATURATED TEST	
SOIL DESCR	2009142.42	TEST TYPE	TX/CUPP
LOCATION	Strata Energy CPP Area	Peak Points	

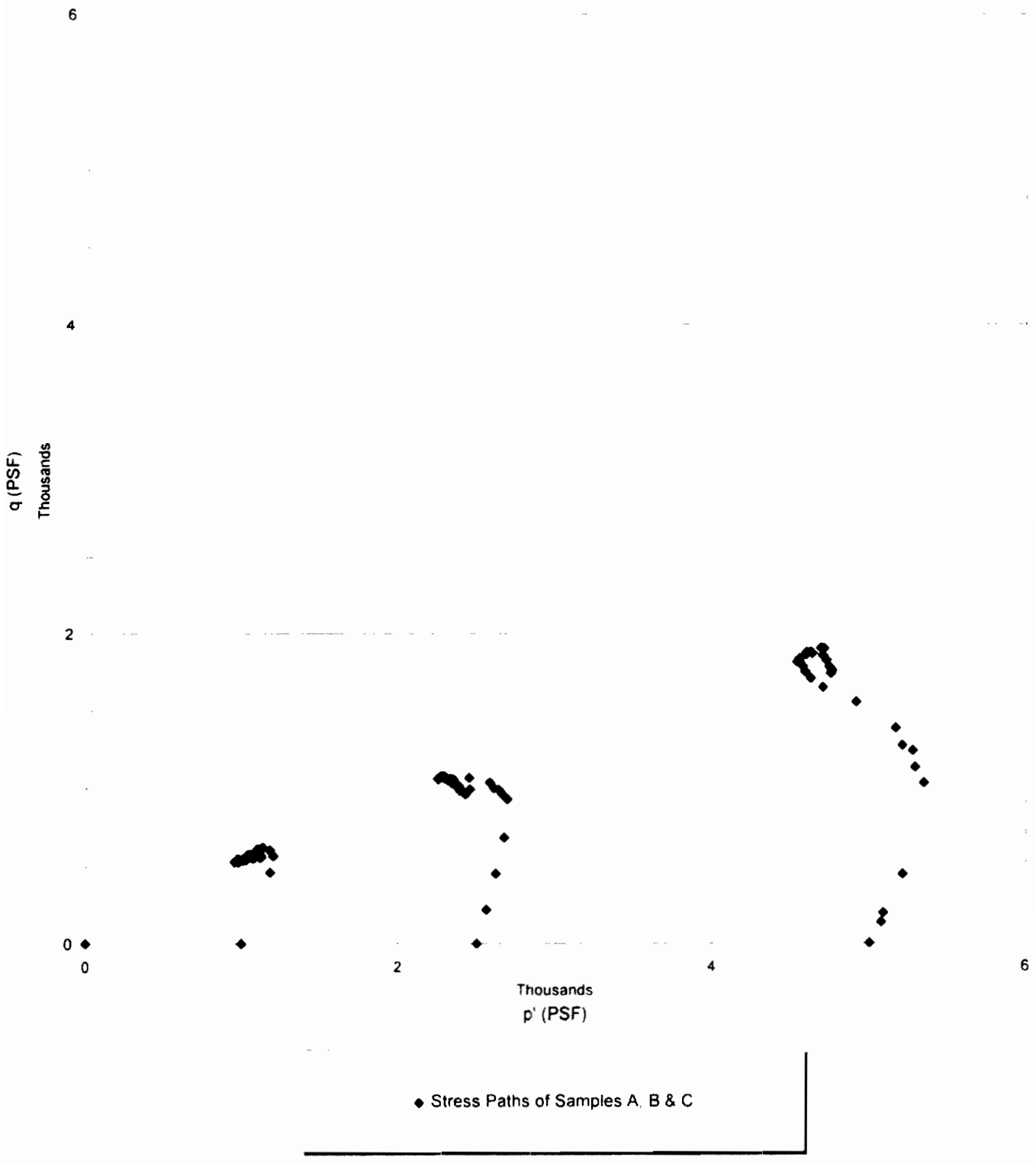
					p' PSF	q PSF
CONF PRES PSF	SAMPLE A	5000	PSF	SAMPLE A	4689	1903
	SAMPLE B	2500	PSF	SAMPLE B	2288	1079
	SAMPLE C	1000	PSF	SAMPLE C	1134	619

SAMPLE A				SAMPLE B				SAMPLE C			
σ 3' PSF	σ 1' PSF	p' PSF	q PSF	σ 3' PSF	σ 1' PSF	p' PSF	q PSF	σ 3' PSF	σ 1' PSF	p' PSF	q PSF
5000	5000	5000	0	2500	2500	2500	0	1000	1000	1000	0
4938	5213	5076	138	2339	2781	2560	221	722	1643	1182	461
4891	5286	5088	197	2170	3070	2620	450	634	1769	1201	568
4764	5656	5210	446	1992	3357	2675	682	575	1782	1179	603
4312	6376	5344	1032	1762	3621	2692	930	515	1754	1134	619
4155	6424	5289	1134	1696	3622	2659	963	500	1717	1108	608
4033	6512	5273	1239	1648	3627	2638	990	490	1709	1099	609
3934	6482	5208	1274	1606	3607	2607	1000	480	1630	1055	575
3779	6548	5163	1384	1543	3620	2581	1039	468	1615	1041	573
3361	6465	4913	1552	1383	3516	2450	1066	437	1528	982	546
3052	6349	4701	1648	1263	3367	2315	1052	426	1486	956	530
2917	6331	4624	1707	1218	3356	2287	1069	427	1518	972	546
2842	6339	4591	1748	1195	3312	2254	1058	442	1523	982	540
2787	6358	4573	1785	1192	3347	2270	1078	443	1505	974	531
2748	6362	4555	1807	1187	3315	2251	1064	448	1506	977	529
2725	6351	4538	1813	1196	3349	2273	1077	453	1509	981	528
2719	6390	4554	1835	1210	3367	2288	1079	462	1563	1013	551
2725	6473	4599	1874	1225	3358	2292	1066	470	1549	1009	539
2734	6455	4594	1861	1246	3371	2308	1062	479	1592	1035	557
2747	6503	4625	1878	1269	3391	2330	1061	485	1573	1029	544
2766	6502	4634	1868	1292	3404	2348	1056	496	1619	1057	561
2786	6592	4689	1903	1313	3374	2344	1030	502	1645	1073	572
2809	6607	4708	1899	1335	3385	2360	1025	511	1620	1065	555
2847	6556	4701	1854	1368	3399	2383	1015	523	1632	1077	555
2898	6546	4722	1824	1403	3376	2389	986	536	1679	1107	571
2962	6521	4742	1779	1438	3387	2412	975	551	1688	1120	568
3003	6517	4760	1757	1460	3447	2454	993	559	1675	1117	558
3015	6491	4753	1738	1465	3387	2426	961	562	1682	1122	560

Data entry by: DAW Date: 09/26/2011
Data checked by: Date: 9/27/11
FileName: WSPQ3BKA

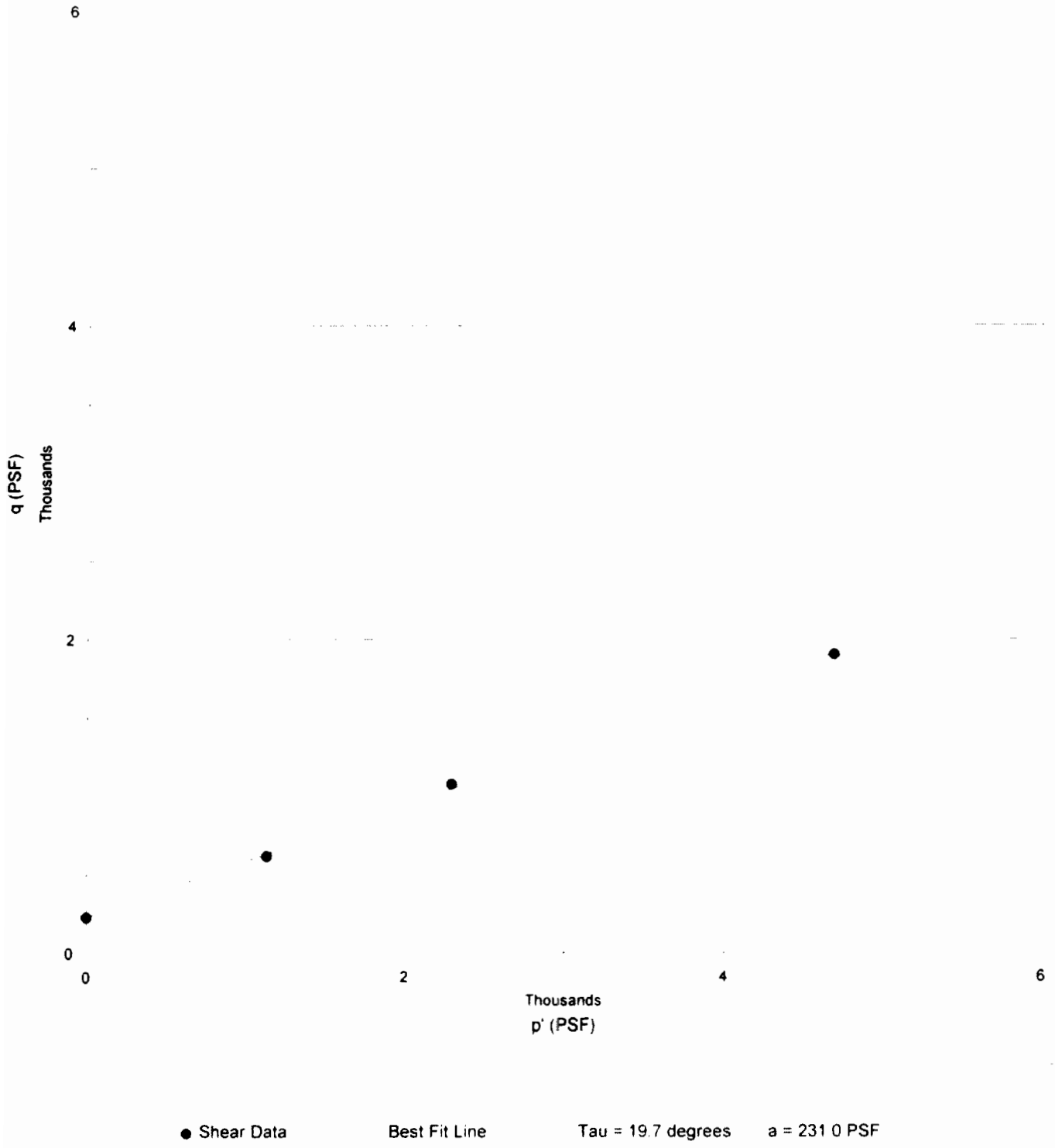
Effective Stress Path Analysis - p' q Plots

Western Water Consultants,Strata Energy CPP Area,2009142.42,LRP-3, Pt. A, B & C,A,B&C,Bulk 6.5-12.0'



Effective Stress Path Analysis - p'-q Regression Plot

Western Water Consultants,Strata Energy CPP Area,2009142.42,LRP-3, Pt. A, B & C,A,B&C,Bulk 6.5-12.0'



MECHANICAL ANALYSIS - SIEVE TEST DATA
-#200 SIEVE ONLY
ASTM D 1140

CLIENT	Western Water Consultants	JOB NO.	2137-67
BORING NO.	LRP-7, Pt. A & B	SAMPLED	
DEPTH	10.9-11.5'	DATE TESTED	9/13/11 WAR
SAMPLE NO.	Lined Retention Ponds	WASH SIEVE	Yes
SOIL DESCR.	2009142.42	DRY SIEVE	No
LOCATION	Strata Energy CPP Area		

WASH SIEVE ANALYSIS

Wt. Wet Soil & Pan Before Washing (g)	1080.4
Wt. Dry Soil & Pan Before Washing (g)	1076.4
Weight of Pan (g)	814.7
Wt. of Dry Soil Before Washing	261.6
Wt. Dry Soil & Pan After Washing (g)	816.0
Wt. of Dry Soil After Washing (g)	1.2
-#200 Wash. Out %	99.5

Data entry by: DAW Date: 09/15/2011
Data checked by: Cal Date: 9/15/2011
Filename: WSM01080

MECHANICAL ANALYSIS - SIEVE TEST DATA
-#200 SIEVE ONLY
ASTM D 1140

CLIENT	Western Water Consultants	JOB NO.	2137-67
BORING NO.	LRP-7	SAMPLED	
DEPTH	13.8-14.1'	DATE TESTED	10/27/11 WAR
SAMPLE NO.	Lined Retention Ponds	WASH SIEVE	Yes
SOIL DESCR.	2009142.42	DRY SIEVE	No
LOCATION	Strata Energy - CPP Area		

WASH SIEVE ANALYSIS

Wt. Wet Soil & Pan Before Washing (g)	147.4
Wt. Dry Soil & Pan Before Washing (g)	119.1
Weight of Pan (g)	6.6
Wt. of Dry Soil Before Washing	112.5
Wt. Dry Soil & Pan After Washing (g)	16.0
Wt. of Dry Soil After Washing (g)	9.4
-#200 Wash. Out %	91.7

Data entry by: DAW Date: 10/28/2011
Data checked by: DRM Date: 11/01/11
Filename: WSS0R158

MECHANICAL ANALYSIS - SIEVE TEST DATA
-#200 SIEVE ONLY
ASTM D 1140

CLIENT	Western Water Consultants	JOB NO.	2137-67
BORING NO.	LRP-7	SAMPLED	
DEPTH	19.6-19.9'	DATE TESTED	9/13/11 WAR
SAMPLE NO.		WASH SIEVE	Yes
SOIL DESCR.	2009142.42	DRY SIEVE	No
LOCATION	Strata Energy CPP Area		

WASH SIEVE ANALYSIS

Wt. Wet Soil & Pan Before Washing (g)	168.0
Wt. Dry Soil & Pan Before Washing (g)	137.8
Weight of Pan (g)	6.6
Wt. of Dry Soil Before Washing	131.2
Wt. Dry Soil & Pan After Washing (g)	66.8
Wt. of Dry Soil After Washing (g)	60.2
-#200 Wash. Out %	54.1

Data entry by: DAW Date: 09/15/2011
Data checked by: Cal Date: 09/15/2011
Filename: WSM01680

ATTERBERG LIMITS TEST
ASTM D 4318

CLIENT	Western Water Consultants	JOB NO	2137-67
BORING NO	LRP-7	DATE SAMPLED	
DEPTH	10 9-11 5, Pt A & B	DATE TESTED	9/21/11 DAW
SAMPLE NO	Lined Retention Ponds		
SOIL DESCR	2009142 42		
LOCATION	Strata Energy CPP Area		

Plastic Limit Determination

	1	2
Wt Dish & Wet Soil	5.77	6.75
Wt Dish & Dry Soil	5.18	6.02
Wt of Moisture	0.59	0.73
Wt of Dish	1.15	1.15
Wt of Dry Soil	4.03	4.87
Moisture Content	14.64	14.99

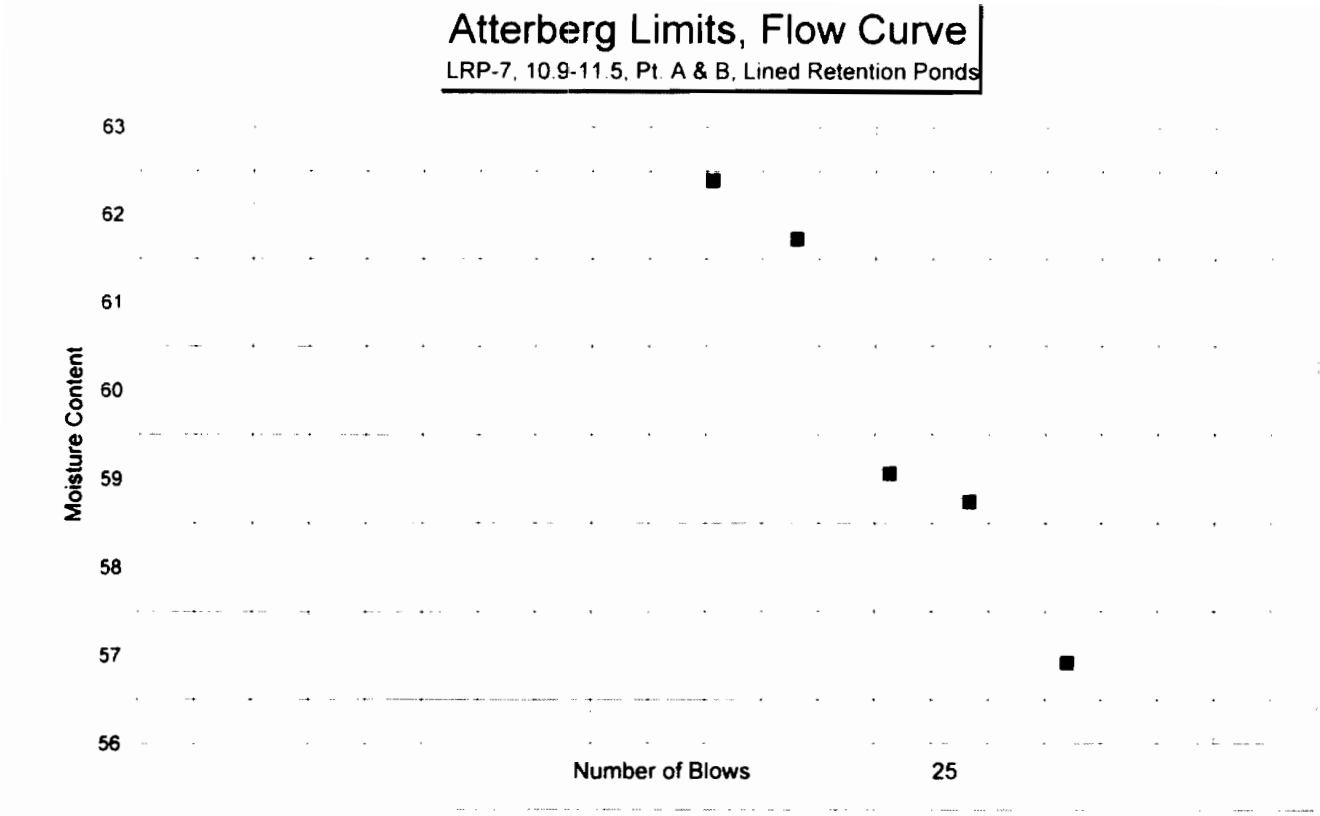
Liquid Limit Determination — Device Number 1080

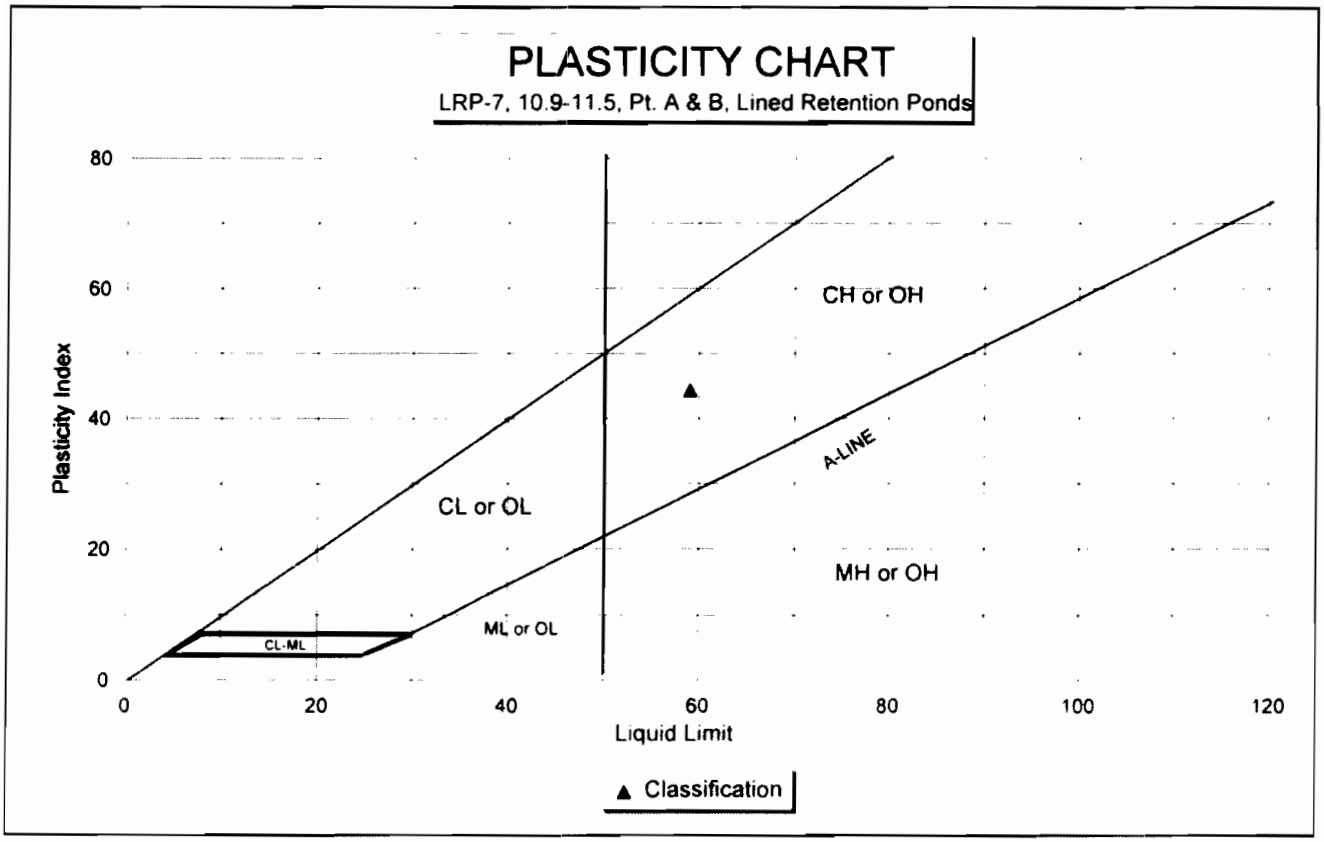
	1	2	3	4	5
Number of Blows	16	19	33	23	27
Wt Dish & Wet Soil	13.91	13.36	14 04	14 34	14 47
Wt Dish & Dry Soil	9.00	8.70	9 35	9.45	9.53
Wt of Moisture	4.91	4.66	4 69	4.89	4.94
Wt of Dish	1.13	1.15	1 11	1.17	1.12
Wt of Dry Soil	7.87	7.55	8 24	8.28	8.41
Moisture Content	62.39	61.72	56.92	59.06	58.74

Liquid Limit	59.1
Plastic Limit	14.8
Plasticity Index	44.3

Atterberg Classification CH

Data entry by DAW Date 09/28/2011
Checked by ym Date 9/30/11
FileName WSG05771


Atterberg Limits, Flow Curve
LRP-7, 10.9-11.5, Pt. A & B, Lined Retention Ponds
Moisture Content
63
62
61
60
59
58
57
56
Number of Blows
25


PLASTICITY CHART
LRP-7, 10.9-11.5, Pt. A & B, Lined Retention Ponds
Plasticity Index
80
60
40
20
0
CH or OH
A-LINE
CL or OL
MH or OH
ML or OL
CL-ML
0
20
40
60
80
100
120
Liquid Limit
▲ Classification

ATTERBERG LIMITS TEST
ASTM D 4318

CLIENT	Western Water Consultants	JOB NO.	2137-67
BORING NO.	LRP-7	DATE SAMPLED	
DEPTH	13.8-14.1'	DATE TESTED	10/31/11 TMR
SAMPLE NO.			
SOIL DESCR.	2009142.42		
LOCATION	Strata Energy - CPP Area		

Plastic Limit Determination

	1	2
Wt Dish & Wet Soil	8.26	8.25
Wt Dish & Dry Soil	7.38	7.40
Wt of Moisture	0.88	0.85
Wt of Dish	1.12	1.14
Wt of Dry Soil	6.26	6.26
Moisture Content	14.06	13.58

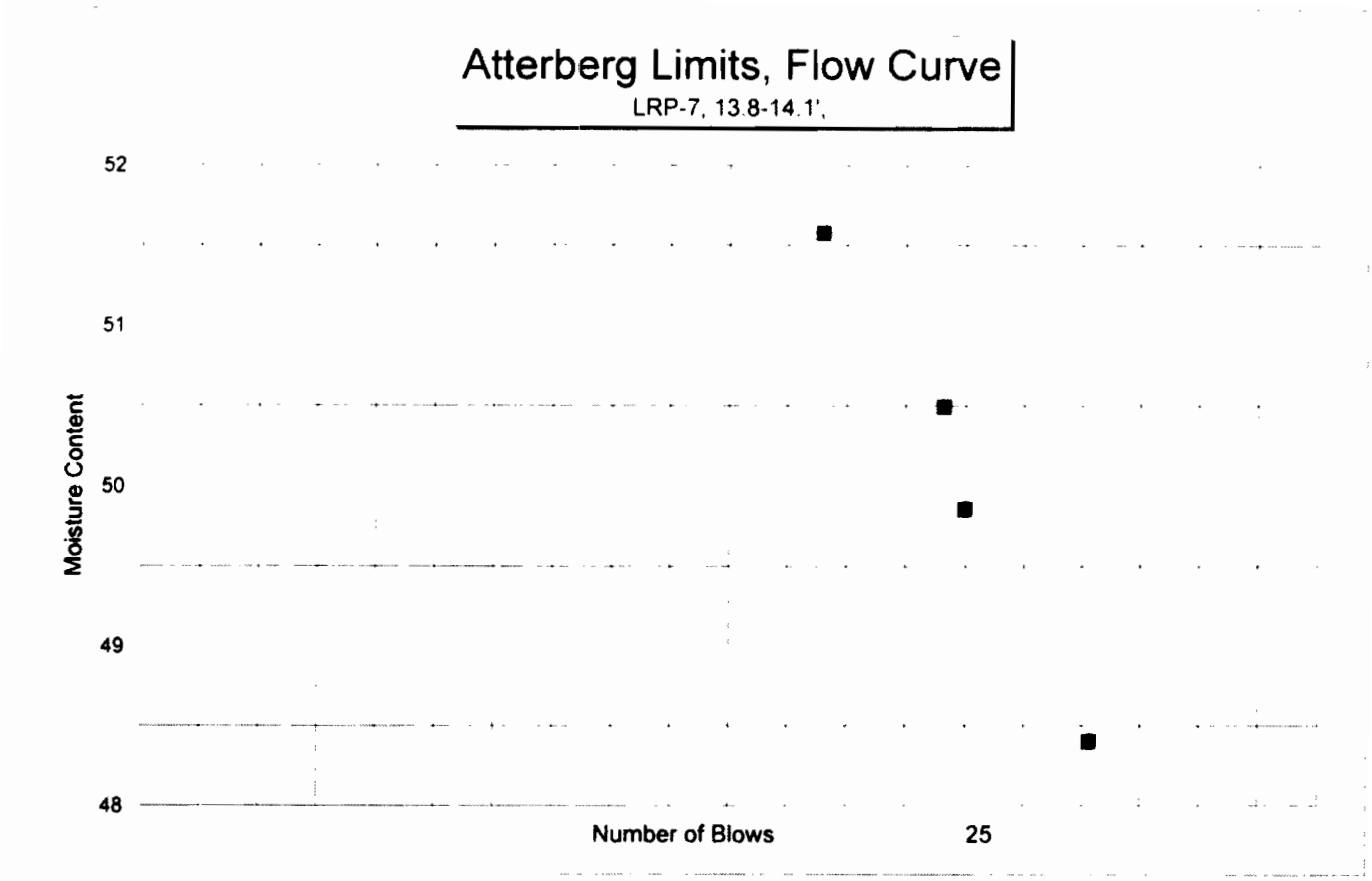
Liquid Limit Determination — Device Number 1080

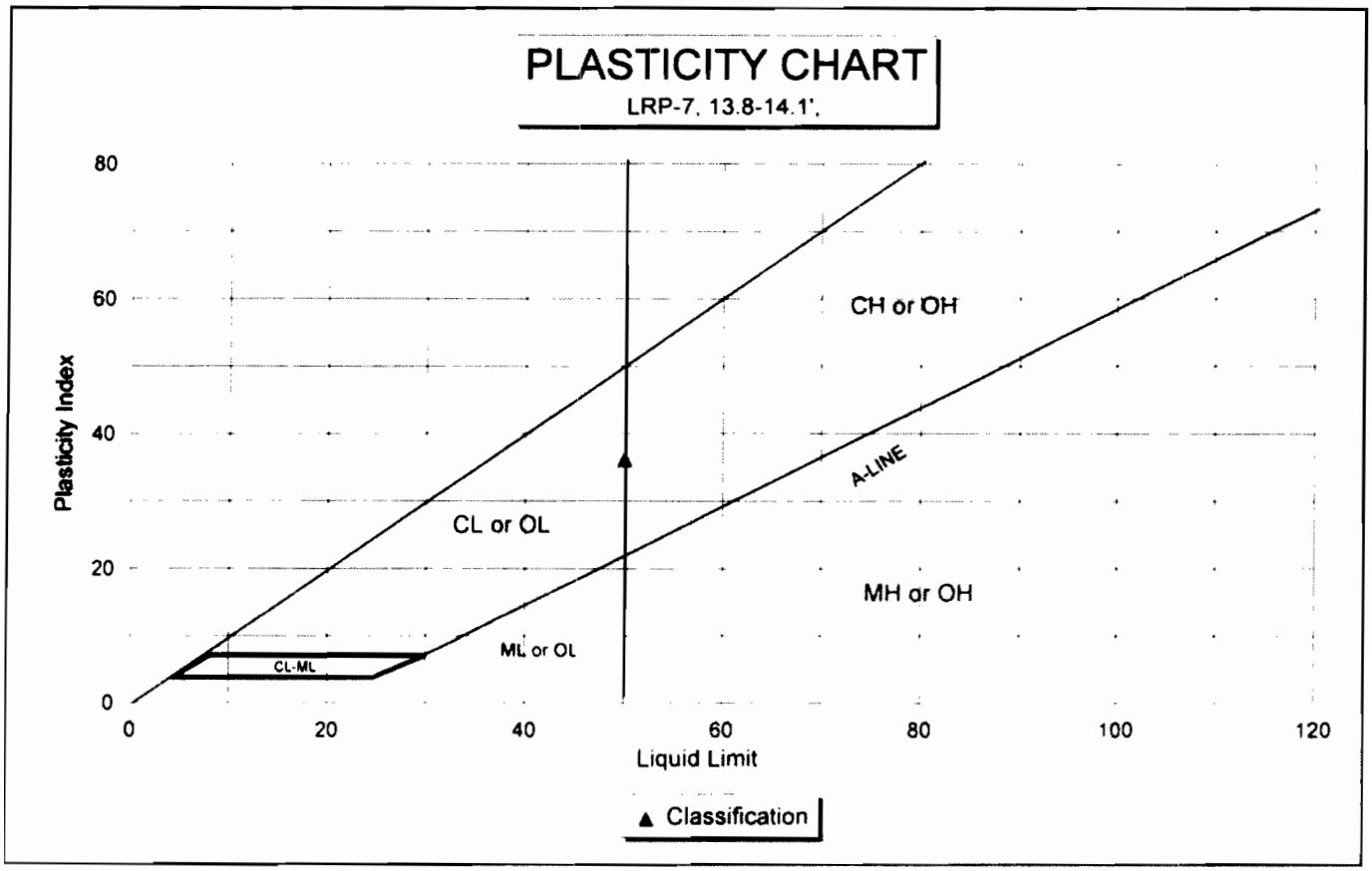
	1	2	3	4
Number of Blows	19	24	25	32
Wt Dish & Wet Soil	10.78	13.39	16.77	14.15
Wt Dish & Dry Soil	7.50	9.28	11.57	9.91
Wt of Moisture	3.28	4.11	5.20	4.24
Wt of Dish	1.14	1.14	1.14	1.15
Wt of Dry Soil	6.36	8.14	10.43	8.76
Moisture Content	51.57	50.49	49.86	48.40

Liquid Limit	50.0
Plastic Limit	13.8
Plasticity Index	36.2

Atterberg Classification CL

Data entry by: DAW Date 11/01/2011
Checked by: KR Date 11/2/11
FileName: WSG0R138


Atterberg Limits, Flow Curve
LRP-7, 13.8-14.1',
52
51
50
49
48
Moisture Content
Number of Blows
25


PLASTICITY CHART
LRP-7, 13.8-14.1',
80
60
40
20
0
Plasticity Index
CH or OH
A-LINE
CL or OL
MH or OH
ML or OL
CL-ML
0
20
40
60
80
100
120
Liquid Limit
▲ Classification

ATTERBERG LIMITS TEST
ASTM D 4318

CLIENT	Western Water Consultants	JOB NO	2137-67
BORING NO	LRP-7	DATE SAMPLED	
DEPTH	19 3-20 5'	DATE TESTED	9/18/11 MLM
SAMPLE NO	Lined Retention Ponds		
SOIL DESCR	2009142 42		
LOCATION	Strata Energy CPP Area		

Plastic Limit Determination

	1	2
Wt Dish & Wet Soil	8.53	8.86
Wt Dish & Dry Soil	7.51	7.79
Wt of Moisture	1.02	1.07
Wt of Dish	1.16	1.15
Wt of Dry Soil	6.35	6.64
Moisture Content	16.06	16 11

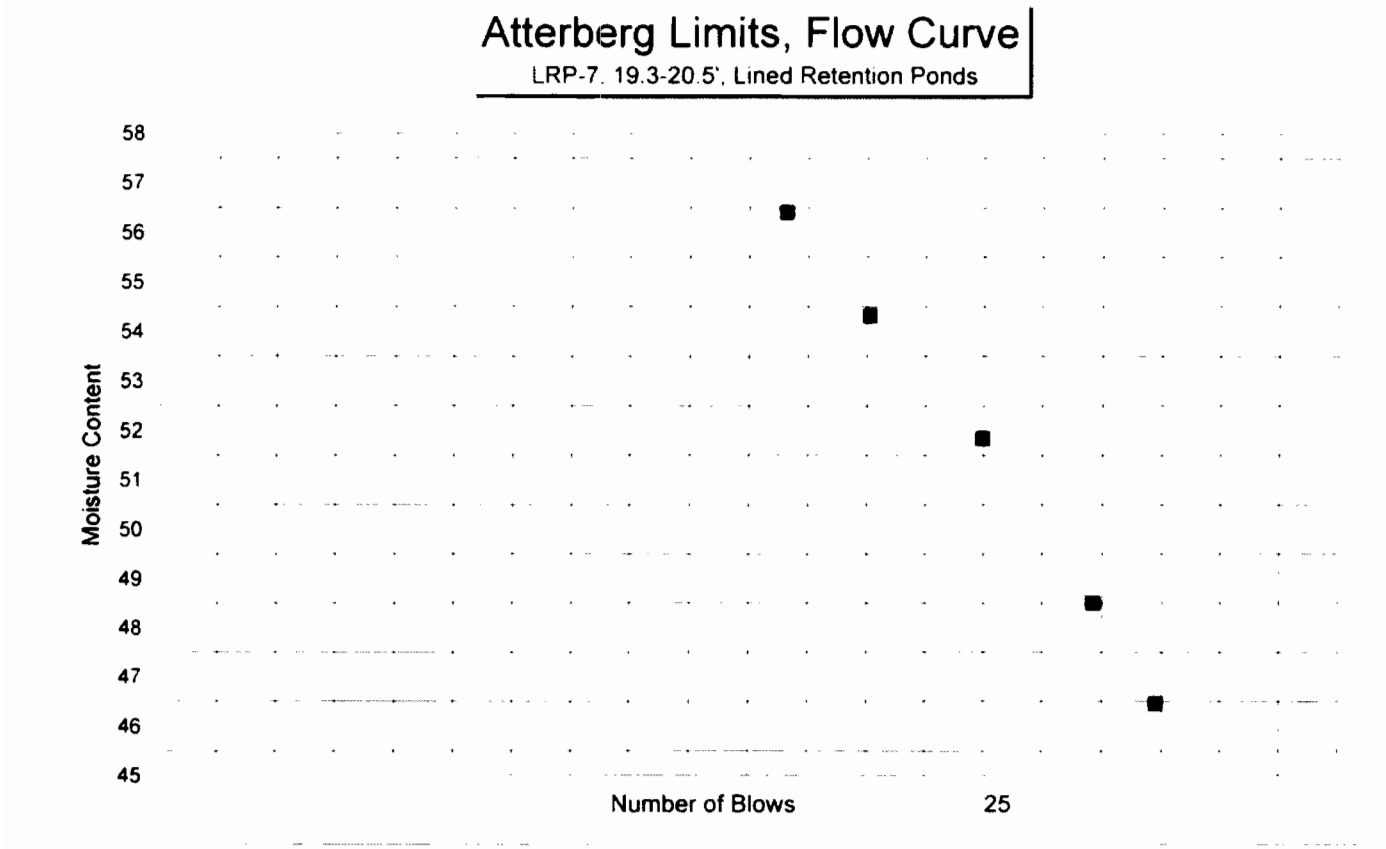
Liquid Limit Determination — Device Number 1075

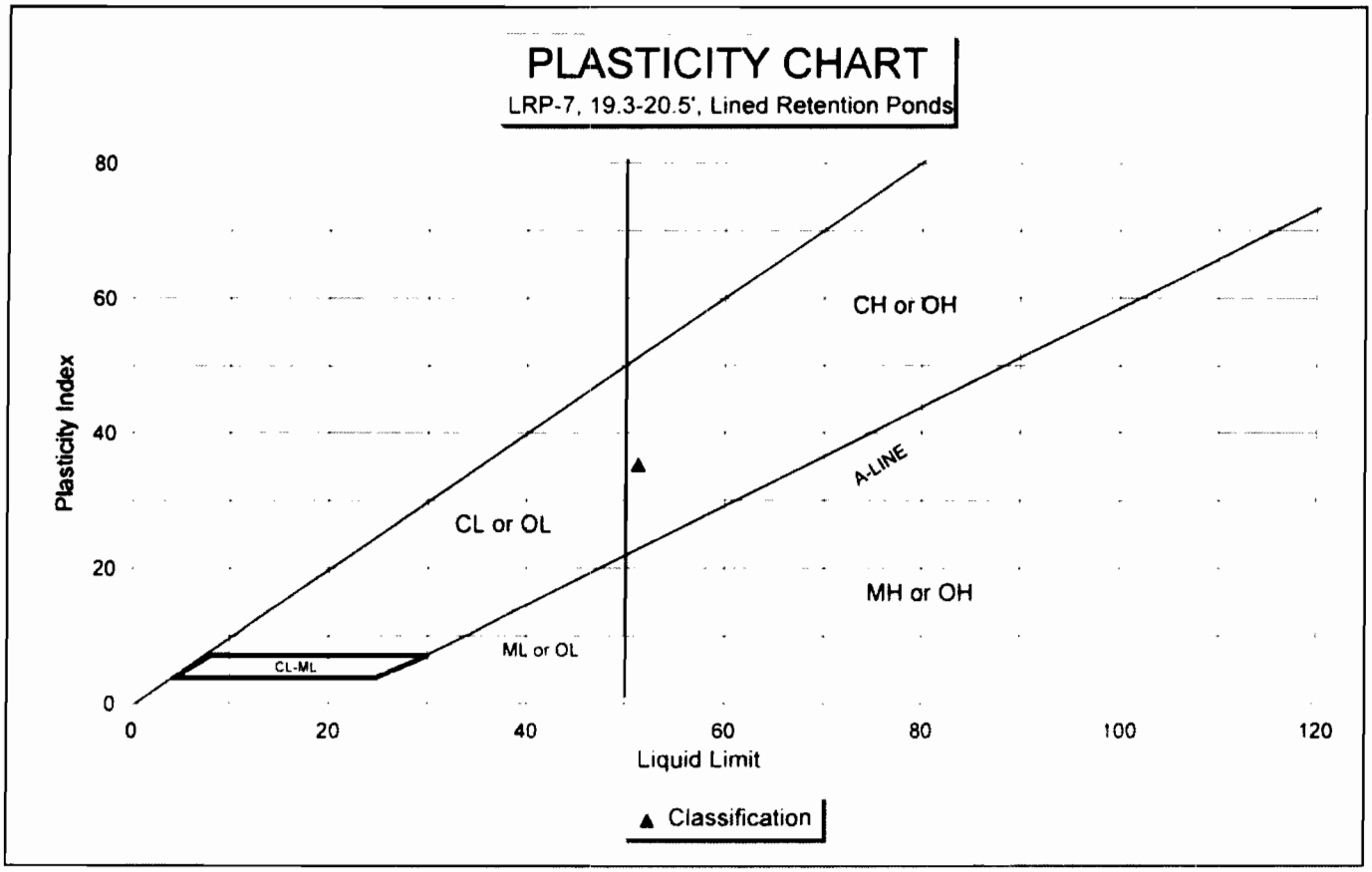
	1	2	3	4	5
Number of Blows	35	31	25	20	17
Wt Dish & Wet Soil	10.86	10.57	9.83	10.10	10 19
Wt Dish & Dry Soil	7.78	7.49	6.87	6.95	6.93
Wt of Moisture	3.08	3.08	2.96	3 15	3.26
Wt of Dish	1.15	1.14	1.16	1.15	1 15
Wt of Dry Soil	6.63	6.35	5 71	5 80	5 78
Moisture Content	46.46	48.50	51 84	54.31	56.40

Liquid Limit	51.3
Plastic Limit	16 1
Plasticity Index	35.3

Atterberg Classification CH

Data entry by DAW Date: 09/19/2011
Checked by Date: 9/19/11
FileName WSG08850


Atterberg Limits, Flow Curve
LRP-7, 19.3-20.5', Lined Retention Ponds
Moisture Content
58
57
56
55
54
53
52
51
50
49
48
47
46
45
Number of Blows
25


PLASTICITY CHART
LRP-7, 19.3-20.5', Lined Retention Ponds
Plasticity Index
80
60
40
20
0
CH or OH
A-LINE
CL or OL
MH or OH
ML or OL
CL-ML
0
20
40
60
80
100
120
Liquid Limit
▲ Classification

TRIAXIAL COMPRESSION TEST DATA
ASTM D 4767

CLIENT	Western Water Consultants	JOB NO	2137-67
BORING NO	LRP-7, Pt. A	SAMPLED	
DEPTH	11.2-11.5'	TEST STARTED	8/31/11 CAL
SAMPLE NO	Lined Retention Ponds	TEST FINISHED	9/04/11 CAL
SOIL DESCR.	2009142.42	CELL NUMBER	8S
LOCATION:	Strata Energy CPP Area	SATURATED TEST	Yes
TEST TYPE	TX/CUpp		
		CONF. PRES. PSF	5000

MOISTURE/DENSITY DATA	BEFORE TEST	AFTER TEST
Wt. Soil + Moisture (g)	362.5	360.7
Wt. Wet Soil & Pan (g)	369.1	367.3
Wt. Dry Soil & Pan (g)	295.3	295.3
Wt. Lost Moisture (g)	73 9	72.1
Wt. of Pan Only (g)	6.6	6.6
Wt. of Dry Soil (g)	288.7	288.7
Moisture Content %	25.6	25.0
Wet Density PCF	122.8	131.3
Dry Density PCF	97.8	105.1

Init. Diameter (in)	1.891
Init. Area (sq in)	2.808
Init. Height (in)	4.005
Vol. Bef. Consol. (cu ft)	0.00651
Vol. After Consol. (cu ft)	0.00605

Notes & Comments:

Data entry by: DAW Date: 09/09/2011
Data checked by: cal Date: 9/09/11
FileName WST01997

TRIAXIAL COMPRESSION TEST DATA
ASTM D 4767

CLIENT	Western Water Consultants	JOB NO	2137-67
BORING NO.	LRP-7, Pt A	SAMPLED	
DEPTH	11.2-11 5'	TEST STARTED	8/31/11 CAL
SAMPLE NO	Lined Retention Ponds	TEST FINISHED	9/04/11 CAL
SOIL DESCR.	2009142.42	CELL NUMBER	8S
LOCATION:	Strata Energy CPP Area	SATURATED TEST	Yes
TEST TYPE	TX/CUpp	CONF. PRES. PSF	5000

SATURATION DATA

Cell Pres. (PSI)	Back Pres. (PSI)	Burette Reading (CC)		Pore Pressure (PSI)		Change	B
		Close	Open	Close	Open		
40.0	38.0	2.5	10.8				
50.0		9.3	9.5	39.2	48.7	9.5	0.95

CONSOLIDATION DATA

Elapsed Time (Min)	SQRT TIME (Min)	Burette Reading (CC)	Vol Defl. (CC)
0.00	0.0	0.6	0.00
0.25	0.5	5.4	-4.80
0.5	0.7	5.6	-5.00
1	1.0	6.1	-5.50
2	1.4	6.6	-6.00
4	2.0	7.1	-6.50
9	3.0	7.9	-7.30
16	4.0	8.7	-8.10
30	5.5	9.8	-9.20
60	7.7	11.4	-10.80
120	11.0	13.5	-12.90
240	15.5	15.5	-14.90
360	19.0	16.8	-16.15

Initial Height (in)	4.005	Init. Vol. (CC)	184.35
Height Change (in)	0.091	Vol. Change (CC)	25.50
Ht. After Cons. (in)	3.914	Cell Exp. (CC)	12.63
Initial Area (sq in)	2.808	Net Change (CC)	12.87
Area After Cons. (sq in)	2.673	Cons. Vol (CC)	171.49

Data entry by: DAW Date 09/09/2011
Data checked by: Cas Date: 9/09/11
FileName WST01997

TRIAXIAL COMPRESSION TEST DATA

CLIENT	Western Water Consultants	JOB NO.	2137-67
BORING NO.	LRP-7, Pt A	SAMPLED	
DEPTH	11.2-11.5'	TEST STARTED	8/31/11 CAL
SAMPLE NO.	Lined Retention Ponds	TEST FINISHED	9/04/11 CAL
SOIL DESCR.	2009142.42	CELL NUMBER	8S
LOCATION:	Strata Energy CPP Area	SATURATED TEST	Yes
TEST TYPE	TX/CUpp	CONF. PRES. PSF	5000
Init. Ht. (in)	4.005	Init. Area (sq in)	2.808
Consol. Ht. (in)	3.914	Consol. Area (sq in)	2.673
Back Pres. PSI	38.2	Strain Rate (in/min)	0.0005

Axial Load Lbs.	Axial Load PSF	Delta Ht. In.	Axial % Strain	Area Final Sq In.	Dev. Stress PSF	Pore Pres. PSI	Delta Pres. PSF	Sigma 3 PSF	Sigma 1 PSF	Prin. Stress Ratio
0.0	0	0.000	0.00	2.673	0	38.2	0	5000	5000	1.00
6.9	370	0.004	0.11	2.676	370	38.5	42	4958	5327	1.07
15.4	829	0.007	0.18	2.678	828	38.9	95	4905	5732	1.17
21.7	1168	0.010	0.25	2.680	1165	39.4	169	4831	5996	1.24
28.8	1551	0.016	0.41	2.684	1544	40.4	314	4686	6230	1.33
30.6	1649	0.019	0.48	2.686	1642	40.9	386	4614	6255	1.36
33.0	1780	0.022	0.57	2.688	1769	41.5	468	4532	6301	1.39
34.7	1871	0.025	0.64	2.690	1859	41.9	533	4467	6327	1.42
38.5	2073	0.031	0.80	2.695	2057	42.8	656	4344	6401	1.47
50.6	2723	0.060	1.54	2.715	2681	45.9	1103	3897	6578	1.69
64.4	3471	0.101	2.58	2.744	3381	48.7	1510	3490	6871	1.97
70.8	3816	0.133	3.39	2.767	3687	50.0	1695	3305	6992	2.12
76.4	4116	0.158	4.04	2.786	3950	50.7	1795	3205	7155	2.23
77.9	4198	0.187	4.78	2.807	3997	51.3	1877	3123	7120	2.28
83.2	4484	0.219	5.59	2.832	4233	51.6	1925	3075	7309	2.38
86.3	4648	0.251	6.42	2.857	4349	51.7	1944	3056	7406	2.42
91.0	4902	0.283	7.24	2.882	4547	51.8	1948	3052	7599	2.49
94.5	5089	0.316	8.08	2.908	4678	51.6	1929	3071	7748	2.52
97.0	5227	0.348	8.89	2.934	4762	51.4	1899	3101	7863	2.54
100.9	5437	0.380	9.70	2.960	4909	51.2	1864	3136	8045	2.57
105.0	5655	0.411	10.49	2.986	5062	50.9	1822	3178	8240	2.59
105.9	5704	0.436	11.14	3.008	5069	50.6	1778	3222	8291	2.57
107.6	5798	0.468	11.96	3.036	5104	50.2	1721	3279	8384	2.56
107.5	5790	0.507	12.96	3.071	5040	49.7	1651	3349	8389	2.50
107.2	5777	0.549	14.03	3.110	4966	49.1	1569	3431	8397	2.45
104.5	5628	0.591	15.09	3.148	4779	48.6	1496	3504	8283	2.36
105.7	5692	0.613	15.67	3.170	4801	48.5	1473	3527	8328	2.36
104.3	5617	0.622	15.90	3.179	4724	48.4	1464	3536	8260	2.34

Data entry by: DAW Date: 09/09/2011
Data checked by: cal Date: 9/09/11
FileName: WST01997

TRIAXIAL COMPRESSION TEST DATA
ASTM D 4767

CLIENT	Western Water Consultants	JOB NO	2137-67
BORING NO.	LRP-7 Pt. B	SAMPLED	
DEPTH	10.9-11.2'	TEST STARTED	8/31/11 CAL
SAMPLE NO.	Lined Retention Ponds	TEST FINISHED	9/08/11 CAL
SOIL DESCR.	2009142.42	CELL NUMBER	24S
LOCATION	Strata Energy CPP Area	SATURATED TEST	Yes
TEST TYPE	TX/CUpp, Stage 1	CONF. PRES. PSF	1000

MOISTURE/DENSITY DATA	BEFORE TEST	AFTER TEST
Wt. Soil + Moisture (g)	364.0	368.2
Wt. Wet Soil & Pan (g)	370.8	375.0
Wt. Dry Soil & Pan (g)	296.0	296.0
Wt. Lost Moisture (g)	74.8	79.0
Wt. of Pan Only (g)	6.8	6.8
Wt. of Dry Soil (g)	289.2	289.2
Moisture Content %	25.9	27.3
Wet Density PCF	124.1	126.2
Dry Density PCF	98.6	99.1

Init. Diameter (in)	1.891
Init. Area (sq in)	2.808
Init. Height (in)	3.977
Vol. Bef. Consol. (cu ft)	0.00646
Vol. After Consol. (cu ft)	0.00643

Notes & Comments:

Data entry by DAW Date: 09/13/2011
Data checked by: Cal Date: 9/13/11
FileName WST0711A

TRIAXIAL COMPRESSION TEST DATA
ASTM D 4767

CLIENT	Western Water Consultants	JOB NO.	2137-67
BORING NO.	LRP-7 Pt. B	SAMPLED	
DEPTH	10.9-11.2'	TEST STARTED	8/31/11 CAL
SAMPLE NO.	Lined Retention Ponds	TEST FINISHED	9/08/11 CAL
SOIL DESCR.	2009142.42	CELL NUMBER	24S
LOCATION	Strata Energy CPP Area	SATURATED TEST	Yes
TEST TYPE	TX/CUpp. Stage 1	CONF. PRES. PSF	1000

SATURATION DATA

Cell Pres. (PSI)	Back Pres. (PSI)	Burette Reading (CC)		Pore Pressure (PSI)		Change	B
		Close	Open	Close	Open		
40.0	38.0	2.7	13.4				
50.0	48.0	13.0	14.0	39.3	48.4	9.1	0.91
60.0		13.4	13.6	49.3	58.9	9.6	0.96

CONSOLIDATION DATA

Elapsed Time (Min)	SQRT TIME (Min)	Burette Reading (CC)	Vol. Defl. (CC)
0.00	0.0	0.5	0.00
0.25	0.5	1.3	-0.80
0.5	0.7	1.4	-0.90
1	1.0	1.5	-1.00
2	1.4	1.7	-1.20
4	2.0	1.8	-1.30
9	3.0	2.0	-1.50
16	4.0	2.3	-1.80
30	5.5	2.7	-2.20
60	7.7	3.0	-2.50
120	11.0	3.6	-3.10
240	15.5	4.2	-3.70
360	19.0	4.7	-4.20

Initial Height (in)	3.977	Init. Vol. (CC)	183.07
Height Change (in)	0.022	Vol. Change (CC)	15.60
Ht. After Cons. (in)	3.955	Cell Exp. (CC)	14.75
Initial Area (sq in)	2.808	Net Change (CC)	0.85
Area After Cons. (sq in)	2.811	Cons. Vol. (CC)	182.22

Data entry by: DAW Date: 09/13/2011
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FileName: WST0711A

TRIAXIAL COMPRESSION TEST DATA

CLIENT	Western Water Consultants	JOB NO.	2137-67
BORING NO.	LRP-7 Pt. B	SAMPLED	
DEPTH	10.9-11.2'	TEST STARTED	8/31/11 CAL
SAMPLE NO.	Lined Retention Ponds	TEST FINISHED	9/08/11 CAL
SOIL DESCR.	2009142.42	CELL NUMBER	24S
LOCATION	Strata Energy CPP Area	SATURATED TEST	Yes
TEST TYPE	TX/CUpp, Stage 1	CONF. PRES. PSF	1000

Init. Ht. (in)	3.977	Init. Area (sq in)	2.808
Consol. Ht. (in)	3.955	Consol. Area (sq in)	2.811
Back Pres. PSI	48.3	Strain Rate (in/min)	0.001

Axial Load Lbs.	Axial Load PSF	Delta Ht. In.	Axial % Strain	Area Final Sq In.	Dev. Stress PSF	Pore Pres. PSI	Delta Pres. PSF	Sigma 3 PSF	Sigma 1 PSF	Prin. Stress Ratio
0.0	0	0.000	0.00	2.811	0	48.3	0	1000	1000	1.00
8.6	440	0.004	0.09	2.814	440	48.8	81	919	1359	1.48
11.7	599	0.007	0.18	2.816	598	49.2	137	863	1461	1.69
14.2	725	0.011	0.28	2.819	723	49.5	180	820	1543	1.88
16.2	830	0.015	0.38	2.822	827	49.7	215	785	1611	2.05
17.3	885	0.019	0.47	2.824	881	49.9	242	758	1639	2.16
18.8	964	0.023	0.58	2.827	958	50.1	265	735	1693	2.30
20.3	1040	0.027	0.67	2.830	1033	50.3	288	712	1745	2.45
20.3	1039	0.031	0.79	2.834	1031	50.4	304	696	1727	2.48
21.1	1083	0.035	0.89	2.836	1073	50.5	318	682	1755	2.57
21.7	1111	0.039	0.98	2.839	1100	50.6	331	669	1769	2.64
21.9	1120	0.043	1.09	2.842	1107	50.6	337	663	1770	2.67
21.8	1117	0.047	1.19	2.845	1103	50.6	345	655	1759	2.68
23.0	1180	0.051	1.28	2.847	1164	50.7	349	651	1815	2.79
22.1	1131	0.055	1.38	2.850	1115	50.7	354	646	1761	2.73
22.6	1157	0.061	1.53	2.855	1140	50.7	358	642	1782	2.77
24.6	1259	0.065	1.64	2.858	1239	50.7	359	641	1879	2.93
24.4	1249	0.069	1.74	2.861	1228	50.8	361	639	1866	2.92
25.2	1292	0.073	1.84	2.864	1268	50.7	357	643	1911	2.97
24.8	1268	0.076	1.92	2.866	1244	50.7	357	643	1887	2.93
26.3	1348	0.080	2.03	2.869	1320	50.7	356	644	1965	3.05
26.9	1380	0.084	2.13	2.872	1350	50.7	355	645	1996	3.09
26.8	1372	0.088	2.23	2.875	1341	50.7	354	646	1987	3.08
25.9	1328	0.092	2.32	2.878	1297	50.7	357	643	1941	3.02
27.0	1382	0.096	2.44	2.881	1348	50.7	353	647	1994	3.08
28.1	1438	0.100	2.54	2.884	1402	50.7	353	647	2049	3.17
28.7	1469	0.104	2.63	2.887	1431	50.7	351	649	2079	3.20
29.1	1490	0.108	2.74	2.890	1450	50.7	349	651	2101	3.23
29.3	1500	0.111	2.82	2.892	1457	50.7	347	653	2110	3.23
29.0	1483	0.116	2.92	2.896	1440	50.6	343	657	2097	3.19
29.2	1494	0.122	3.08	2.900	1448	50.5	329	671	2119	3.16
31.1	1594	0.135	3.41	2.910	1540	50.4	311	689	2229	3.23
31.2	1600	0.141	3.56	2.915	1543	50.4	308	692	2235	3.23

Data entry by: DAW Date: 09/13/2011
Data checked by: Date: 9/13/11
FileName: WST0711A

TRIAXIAL COMPRESSION TEST DATA
ASTM D 4767

CLIENT	Western Water Consultants	JOB NO.	2137-67
BORING NO.	LRP-7 Pt. B	SAMPLED	
DEPTH	10.9-11.2'	TEST STARTED	8/31/11 CAL
SAMPLE NO.	Lined Retention Ponds	TEST FINISHED	9/08/11 CAL
SOIL DESCR	2009142.42	CELL NUMBER	24S
LOCATION	Strata Energy CPP Area	SATURATED TEST	Yes
TEST TYPE	TX/CUpp. Stage 2	CONF. PRES. PSF	2500

MOISTURE/DENSITY DATA	BEFORE TEST	AFTER TEST
Wt. Soil + Moisture (g)	364.0	368.2
Wt. Wet Soil & Pan (g)	370.8	375.0
Wt. Dry Soil & Pan (g)	296.0	296.0
Wt. Lost Moisture (g)	74.8	79.0
Wt. of Pan Only (g)	6.8	6.8
Wt. of Dry Soil (g)	289.2	289.2
Moisture Content %	25.9	27.3
Wet Density PCF	124.7	129.6
Dry Density PCF	99.1	101.8

Init. Diameter (in)	1.926
Init. Area (sq in)	2.915
Init. Height (in)	3.814
Vol. Bef. Consol. (cu ft)	0.00643
Vol. After Consol. (cu ft)	0.00627

Notes & Comments:

Data entry by: DAW Date: 09/13/2011
Data checked by: cae Date 9/13/11
FileName: WST0711A

TRIAXIAL COMPRESSION TEST DATA
ASTM D 4767

CLIENT	Western Water Consultants	JOB NO.	2137-67
BORING NO.	LRP-7 Pt. B	SAMPLED	
DEPTH	10.9-11 2'	TEST STARTED	8/31/11 CAL
SAMPLE NO.	Lined Retention Ponds	TEST FINISHED	9/08/11 CAL
SOIL DESCR.	2009142.42	CELL NUMBER	24S
LOCATION	Strata Energy CPP Area	SATURATED TEST	Yes
TEST TYPE	TX/CUpp, Stage 2	CONF. PRES. PSF	2500

CONSOLIDATION DATA

Elapsed Time (Min)	SQRT TIME (Min)	Burette Reading (CC)	Vol. Defl (CC)
0.00	0.0	6.3	0.00
0.25	0.5	7.4	-1.10
0.5	0.7	7.6	-1.25
1	1.0	7.6	-1.30
2	1.4	7.7	-1.40
4	2.0	7.8	-1.50
9	3.0	8.0	-1.70
16	4.0	8.3	-2.00
30	5.5	8.6	-2.30
60	7.7	9.1	-2.80
120	11.0	9.8	-3.50
240	15.5	10.6	-4.30
360	19.0	11.0	-4.70

Initial Height (in)	3.814	Init. Vol. (CC)	182.22
Height Change (in)	-0.002	Vol. Change (CC)	5.80
Ht. After Cons. (in)	3.816	Cell Exp. (CC)	1.03
Initial Area (sq in)	2.915	Net Change (CC)	4.77
Area After Cons. (sq in)	2.837	Cons. Vol. (CC)	177.44

Data entry by: DAW Date: 09/13/2011
Data checked by: Date: 9/13/11
FileName: WST0711A

TRIAXIAL COMPRESSION TEST DATA

CLIENT	Western Water Consultants	JOB NO	2137-67
BORING NO.	LRP-7 Pt. B	SAMPLED	
DEPTH	10.9-11.2'	TEST STARTED	8/31/11 CAL
SAMPLE NO.	Lined Retention Ponds	TEST FINISHED	9/08/11 CAL
SOIL DESCR.	2009142.42	CELL NUMBER	24S
LOCATION	Strata Energy CPP Area	SATURATED TEST	Yes
TEST TYPE	TX/CUpp, Stage 2	CONF. PRES. PSF	2500

Init. Ht. (in)	3.814	Init. Area (sq in)	2.915
Consol. Ht. (in)	3.816	Consol. Area (sq in)	2.837
Back Pres. PSI	48.1	Strain Rate (in/min)	0.001

Axial Load Lbs.	Axial Load PSF	Delta Ht. In.	Axial % Strain	Area Final Sq In.	Dev. Stress PSF	Pore Pres. PSI	Delta Pres. PSF	Sigma 3 PSF	Sigma 1 PSF	Prin. Stress Ratio
0.0	0	0.000	0.00	2.837	0	48.1	0	2500	2500	1.00
3.0	152	0.006	0.15	2.841	151	47.9	-26	2526	2677	1.06
20.8	1057	0.011	0.30	2.845	1054	49.4	182	2318	3372	1.45
26.8	1361	0.015	0.39	2.848	1356	50.1	281	2219	3575	1.61
29.6	1505	0.017	0.45	2.850	1498	50.6	357	2143	3641	1.70
33.9	1721	0.021	0.56	2.853	1712	51.0	412	2088	3800	1.82
35.8	1817	0.024	0.63	2.855	1806	51.3	458	2042	3848	1.88
37.3	1896	0.027	0.70	2.857	1883	51.6	499	2001	3883	1.94
40.0	2029	0.029	0.77	2.859	2014	51.8	532	1968	3982	2.02
39.5	2005	0.033	0.87	2.862	1988	52.0	562	1938	3926	2.03
42.1	2136	0.036	0.95	2.864	2116	52.2	588	1912	4028	2.11
44.0	2236	0.039	1.02	2.866	2213	52.3	610	1890	4103	2.17
44.7	2271	0.042	1.10	2.869	2246	52.5	631	1869	4115	2.20
45.7	2322	0.045	1.18	2.871	2295	52.6	650	1850	4145	2.24
53.1	2694	0.090	2.36	2.905	2631	53.6	794	1706	4336	2.54
58.2	2956	0.136	3.57	2.942	2850	53.9	828	1672	4522	2.71
62.3	3162	0.167	4.38	2.967	3023	53.8	822	1678	4701	2.80
65.2	3311	0.204	5.34	2.997	3134	53.7	809	1691	4826	2.85
69.6	3534	0.243	6.38	3.030	3308	53.5	776	1724	5032	2.92
71.0	3602	0.289	7.57	3.069	3329	53.2	730	1770	5100	2.88
73.5	3733	0.335	8.77	3.110	3405	52.8	672	1828	5233	2.86
75.4	3827	0.365	9.57	3.137	3461	52.5	636	1864	5325	2.86
76.6	3886	0.402	10.52	3.171	3477	52.2	588	1912	5389	2.82
77.1	3916	0.445	11.65	3.211	3460	51.7	520	1980	5440	2.75
77.4	3927	0.482	12.62	3.247	3431	51.4	469	2031	5462	2.69
73.8	3744	0.525	13.75	3.289	3229	51.0	413	2087	5316	2.55
65.8	3486	0.567	14.85	3.191	2968	50.6	351	2149	5118	2.38
62.5	3313	0.607	15.91	3.231	2786	50.4	320	2180	4966	2.28

Data entry by: DAW Date: 09/13/2011
Data checked by: ae Date: 9/13/11
FileName: WST0711A

TRIAXAL COMPRESSION TEST DATA

CLIENT	Western Water Consultants	JOB NO.	2137-67
BORING NO.	LRP-7	SAMPLED	
DEPTH	13.8-14.1'	TEST STARTED	10/14/11 CAL
SAMPLE NO.	Lined Retention Pond	TEST FINISHED	10/26/11 CAL
SOIL DESCR.	2009142.42	SETUP NO.	23S
LOCATION	Strata Energy CPP Area	SATURATED TEST	Yes
CONF. PRES. PSF	1750	TEST TYPE	TX/Pbp/Tap Water

SATURATION DATA

Cell Pres. (PSI)	Back Pres. (PSI)	Burette Reading (CC)		Pore Pressure (PSI)		Change	B
		Close	Open	Close	Open		
40.0	38.0	1.8	8.0				
50.0	48.0	12.3	13.2	38.5	47.3	8.8	0.88
60.0	58.0	13.5	14.3	49.1	58.0	8.9	0.89
70.0	68.0	14.5	15.3	59.1	68.5	9.4	0.94
80.0		15.5	15.6	68.6	78.5	9.9	0.99

CONSOLIDATION DATA

Elapsed Time (Min)	SQRT Time (Min)	Burette Reading (CC)	Volume Defl. (cc)
0.00	0.00	15.60	0.00
0.25	0.50	16.50	-0.90
0.5	0.71	16.50	-0.90
1	1.00	16.55	-0.95
2	1.41	16.60	-1.00
4	2.00	16.70	-1.10
9	3.00	16.80	-1.20
16	4.00	17.00	-1.40
30	5.48	17.20	-1.60
60	7.75	17.50	-1.90
120	10.95	18.10	-2.50
240	15.49	18.80	-3.20
360	18.97	19.30	-3.70

Initial Height (in)	3.008	Init. Vol. (CC)	137.88
Height Change (in)	0.069	Vol. Change (CC)	21.00
Ht. After Cons. (in)	2.939	Cell Exp. (CC)	16.69
Initial Area (sq in)	2.797	Net Change (CC)	4.31
Area After Cons. (sq in)	2.773	Cons. Vol. (CC)	133.57

Data entry by: DAW Date: 10/27/2011
Checked by: Cal Date: 10/27/11
FileName: WSP0R138

TRIAXAL COMPRESSION TEST DATA

CLIENT	Western Water Consultants	JOB NO	2137-67
BORING NO	LRP-7	SAMPLED	
DEPTH	19 6-19 9'	TEST STARTED	9/05/11 CAL
SAMPLE NO	Lined Retention Ponds	TEST FINISHED	9/08/11 CAL
SOIL DESCR.	2009142 42	SETUP NO.	9S
LOCATION	Strata Energy CPP Area	SATURATED TEST	Yes
CONF. PRES. PSF	2540	TEST TYPE	TX/Pbp/Tap Water

SATURATION DATA

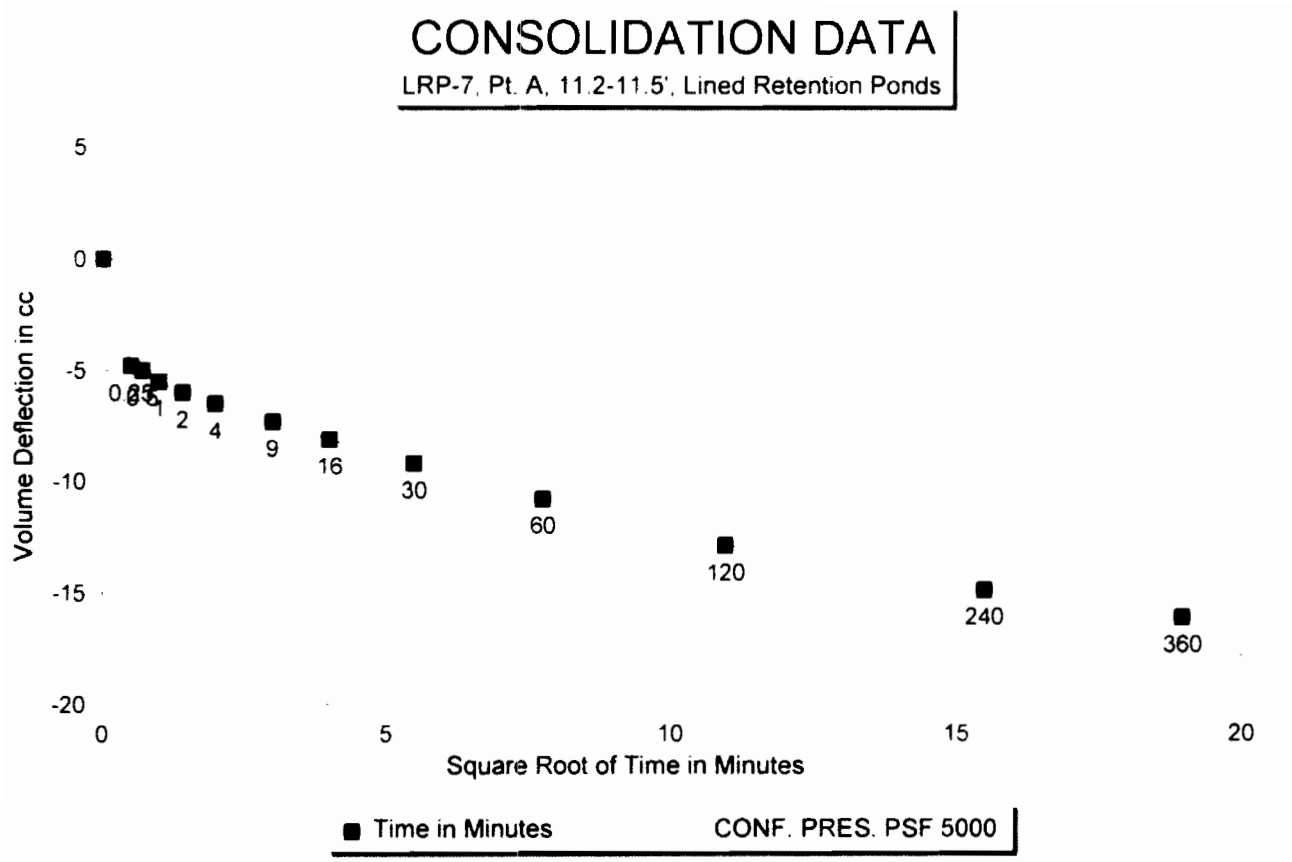
Cell Pres. (PSI)	Back Pres. (PSI)	Burette Reading (CC)		Pore Pressure (PSI)		Change	B
		Close	Open	Close	Open		
40.0	38.0	1.4	7 5				
50.0		8.3	8.3	38.2	47.8	9.6	0.96

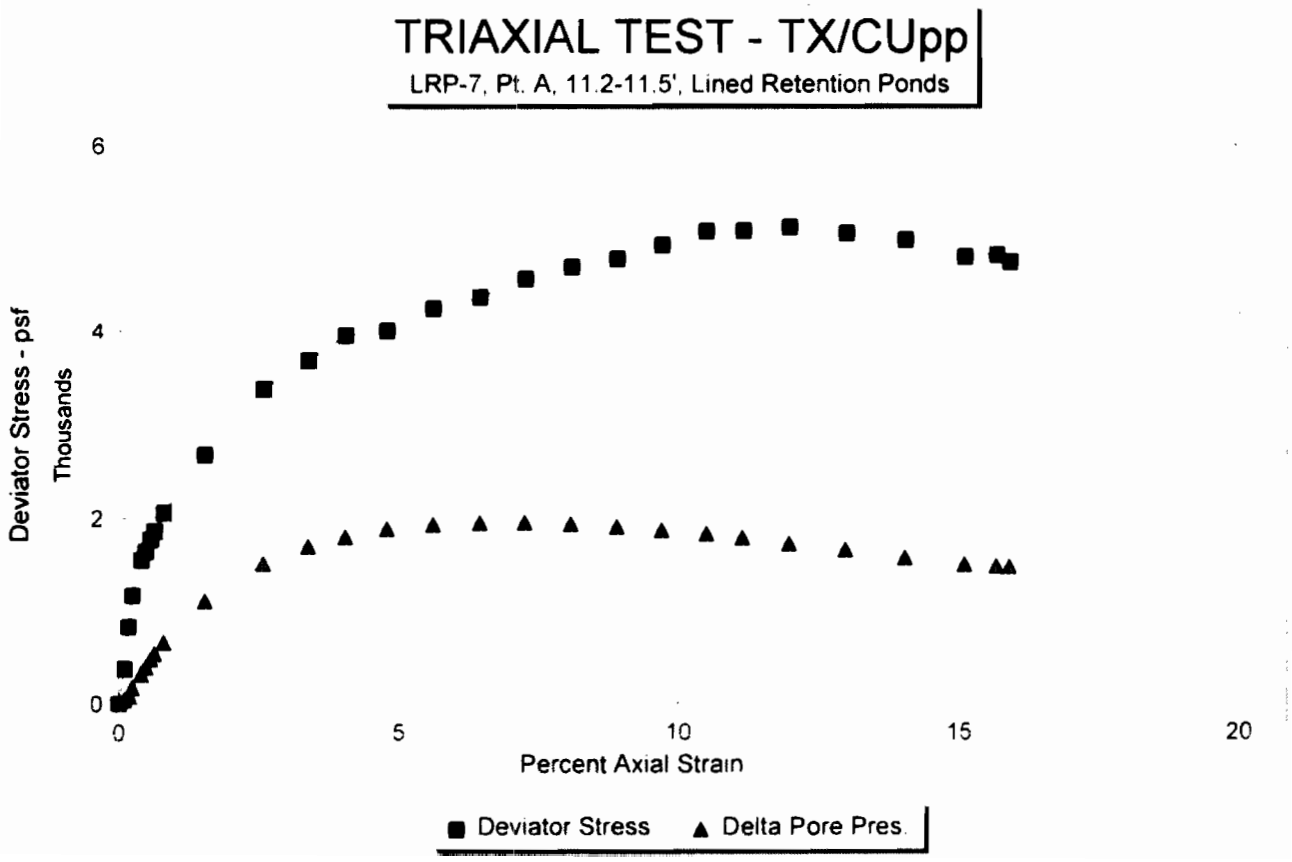
CONSOLIDATION DATA

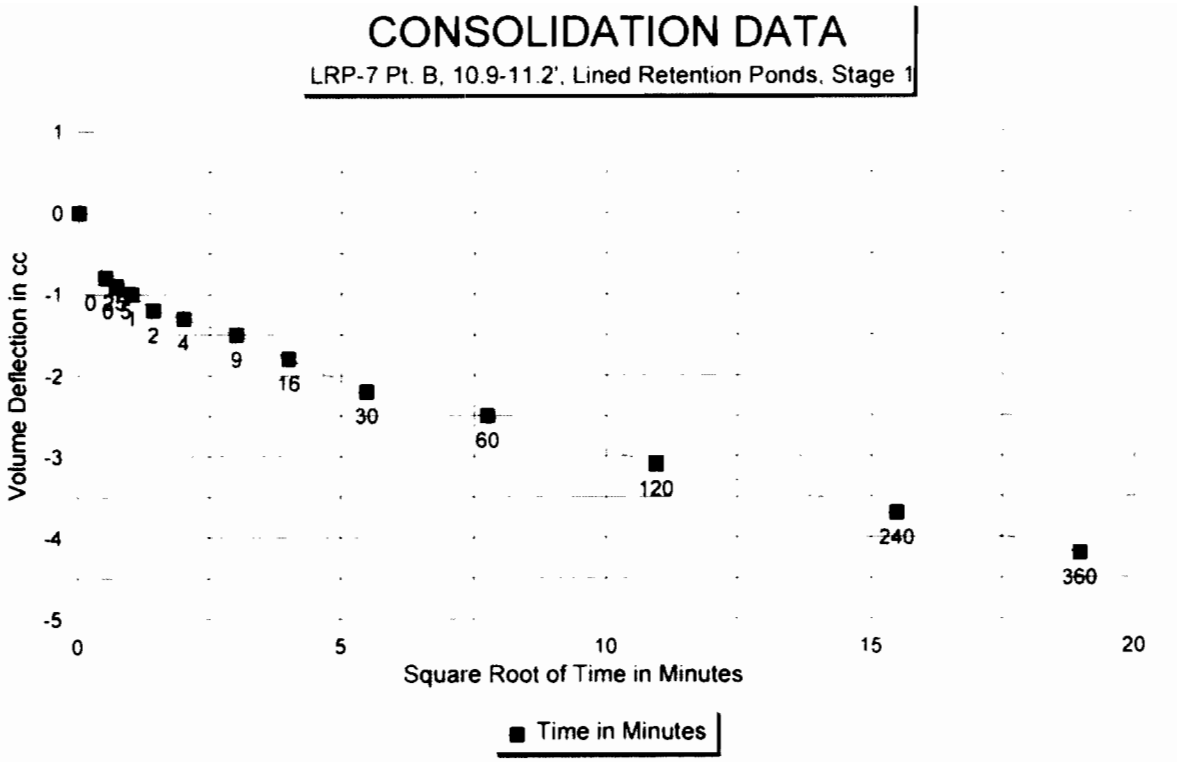
Elapsed Time (Min)	SQRT Time (Min)	Burette Reading (CC)	Volume Defl. (cc)
0.00	0.00	8.30	0.00
0.25	0.50	10.20	-1.90
0.5	0 71	10 30	-2 00
1	1 00	10.60	-2.30
2	1 41	10.90	-2 60
4	2 00	11 30	-3.00
9	3.00	12.10	-3 80
16	4 00	12 60	-4 30
30	5.48	13.00	-4 70
60	7.75	13.20	-4.90
120	10.95	13.30	-5.00
240	15.49	13.40	-5 10
360	18.97	13.40	-5.10

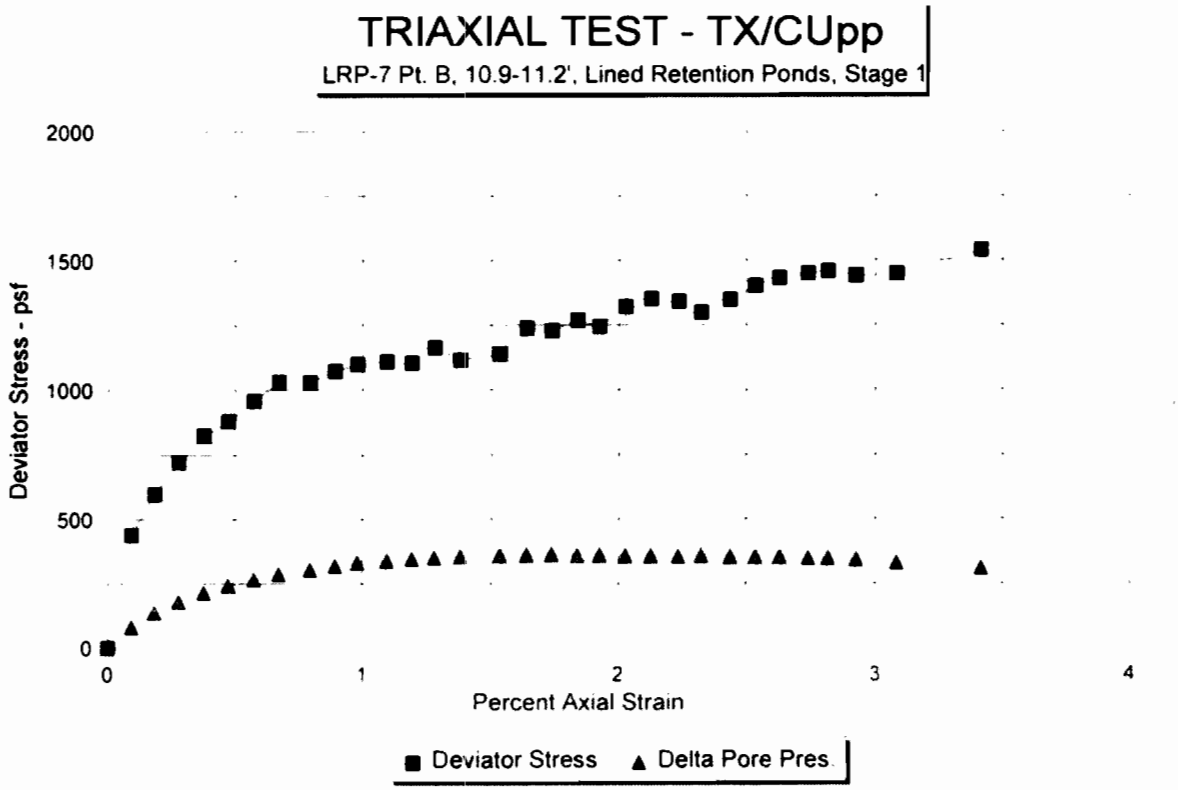
Initial Height (in)	3 033	Init Vol (CC)	143.33
Height Change (in)	0 050	Vol Change (CC)	12.30
Ht After Cons. (in)	2 983	Cell Exp (CC)	6.90
Initial Area (sq in)	2 883	Net Change (CC)	5.40
Area After Cons. (sq in)	2 821	Cons. Vol (CC)	137 93

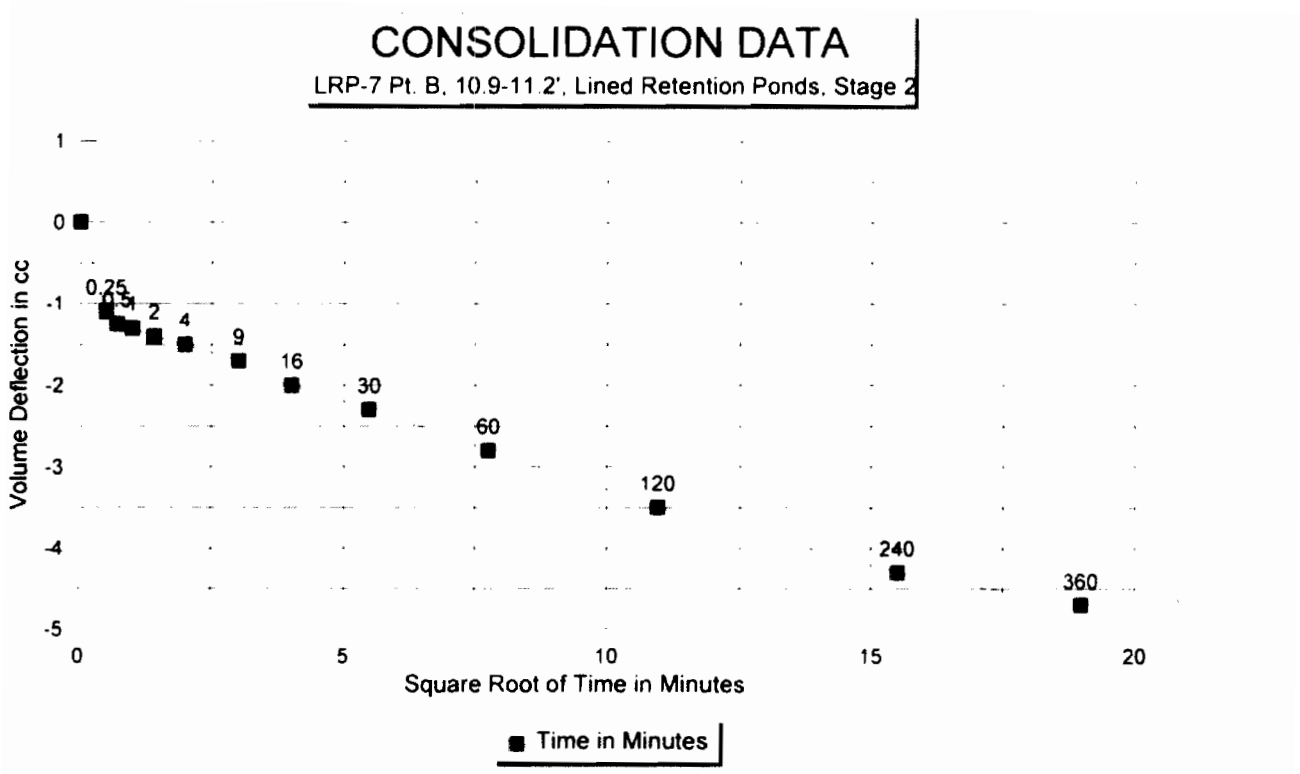
Data entry by DAW Date 09/12/2011
Checked by Cal Date: 9/13/11
FileName: WSP01916

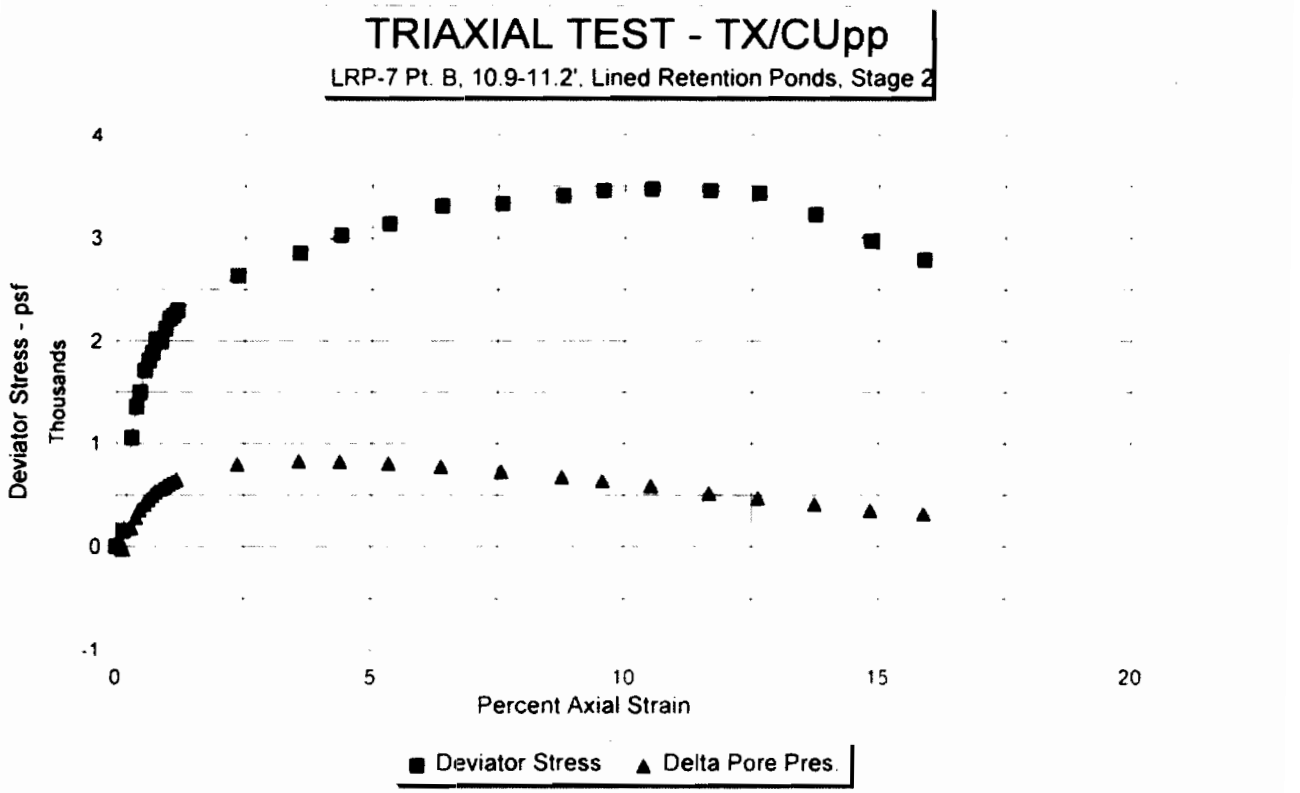

CONSOLIDATION DATA
LRP-7, Pt. A, 11.2-11.5', Lined Retention Ponds
Volume Deflection in cc
5
0
-5
-10
-15
-20
0
5
10
15
20
Square Root of Time in Minutes
0
0.25
1
2
4
9
16
30
60
120
240
360
Time in Minutes
CONF. PRES. PSF 5000


TRIAXIAL TEST - TX/CUpp
LRP-7, Pt. A, 11.2-11.5', Lined Retention Ponds
Deviator Stress - psf
Thousands
6
4
2
0
0
5
10
15
20
Percent Axial Strain
Deviator Stress
Delta Pore Pres.


CONSOLIDATION DATA
LRP-7 Pt. B, 10.9-11.2', Lined Retention Ponds, Stage 1
Volume Deflection in cc
1
0
-1
-2
-3
-4
-5
0
5
10
15
20
Square Root of Time in Minutes
0
0.5
1
2
4
9
16
30
60
120
240
360
Time in Minutes


TRIAXIAL TEST - TX/CUpp
LRP-7 Pt. B, 10.9-11.2', Lined Retention Ponds, Stage 1
Deviator Stress - psf
2000
1500
1000
500
0
0
1
2
3
4
Percent Axial Strain
Deviator Stress
Delta Pore Pres.


CONSOLIDATION DATA
LRP-7 Pt. B, 10.9-11.2', Lined Retention Ponds, Stage 2
Volume Deflection in cc
1
0
-1
-2
-3
-4
-5
0.25
0.5
1
2
4
9
16
30
60
120
240
360
0
5
10
15
20
Square Root of Time in Minutes
Time in Minutes


TRIAXIAL TEST - TX/CUpp
LRP-7 Pt. B, 10.9-11.2', Lined Retention Ponds, Stage 2
Deviator Stress - psf
Thousands
4
3
2
1
0
-1
0
5
10
15
20
Percent Axial Strain
Deviator Stress
Delta Pore Pres.

PERMEABILITY TEST - BACK PRESSURE SATURATED - FLOW PUMP METHOD
ASTM D 5084

CLIENT	Western Water Consultants	JOB NO.	2137-67
BORING NO.	LRP-7	SAMPLED	
DEPTH	13.8-14.1'	TEST STARTED	10/14/11 CAL
SAMPLE NO.	Lined Retention Pond	TEST FINISHED	10/26/11 CAL
SOIL DESCR.	2009142.42	CELL NUMBER	23S
LOCATION	Strata Energy CPP Area	SATURATED TEST	Yes
CONF. PRES. PSF	1750	TEST TYPE	TX/Pbp/Tap Water

MOISTURE/DENSITY DATA	BEFORE TEST	AFTER TEST
Wt. Soil + Moisture (g)	276.9	272.8
Wt. Wet Soil & Pan (g)	283.5	279.4
Wt. Dry Soil & Pan (g)	224.5	224.5
Wt. Lost Moisture (g)	59.0	54.9
Wt. of Pan Only (g)	6.6	6.6
Wt. of Dry Soil (g)	217.9	217.9
Moisture Content %	27.1	25.2
Wet Density PCF	125.4	127.5
Dry Density PCF	98.7	101.9

Init. Diameter (in)	1.887	(cm)	4.793
Init. Area (sq in)	2.797	(sq cm)	18.044
Init. Height (in)	3.008	(cm)	7.640
Vol. Bef. Consol. (cu ft)	0.00487		
Vol. After Consol. (cu ft)	0.00472		
Porosity %	41.08		

FLOW PUMP CALCULATIONS

Pump Setting	29
Velocity CM/Sec	1.90E-04
Q (cc/s)	6.09E-06
Height	2.939
Diameter	1.879
Pressure (psi)	0.504
Area after consol. (cm*cm)	17.889
Gradient	4.747
Permeability k (cm/s)	7.2E-08
Permeability k (m/s)	**7.2E-10**
Back Pressure (psi)	68.0
Cell Pressure (psi)	80.1
Ave. Effective Stress (psi)	11 848
Average temperature degree C:	22.1

Data entry by: DAW Date: 10/27/2011
Checked by: Cal Date: 10/27/11
FileName: WSP0R138

PERMEABILITY TEST - BACK PRESSURE SATURATED - FLOW PUMP METHOD
ASTM D 5084

CLIENT	Western Water Consultants	JOB NO	2137-67
BORING NO	LRP-7	SAMPLED	
DEPTH	19.6-19.9'	TEST STARTED	9/05/11 CAL
SAMPLE NO.	Lined Retention Ponds	TEST FINISHED	9/08/11 CAL
SOIL DESCR.	2009142.42	CELL NUMBER	9S
LOCATION	Strata Energy CPP Area	SATURATED TEST	Yes
CONF. PRES. PSF	2540	TEST TYPE	TX/Pbp/Tap Water

MOISTURE/DENSITY DATA	BEFORE TEST	AFTER TEST
Wt. Soil + Moisture (g)	295.1	296.8
Wt. Wet Soil & Pan (g)	301.7	303.4
Wt. Dry Soil & Pan (g)	247.8	247.8
Wt. Lost Moisture (g)	53.9	55.6
Wt. of Pan Only (g)	6.6	6.6
Wt. of Dry Soil (g)	241.2	241.2
Moisture Content %	22.3	23.1
Wet Density PCF	128.6	134.4
Dry Density PCF	105.1	109.2

Init. Diameter (in)	1.916	(cm)	4.867
Init. Area (sq in)	2.883	(sq cm)	18.603
Init. Height (in)	3.033	(cm)	7.704
Vol. Bef Consol (cu ft)	0.00506		
Vol. After Consol. (cu ft)	0.00487		
Porosity %	40.32		

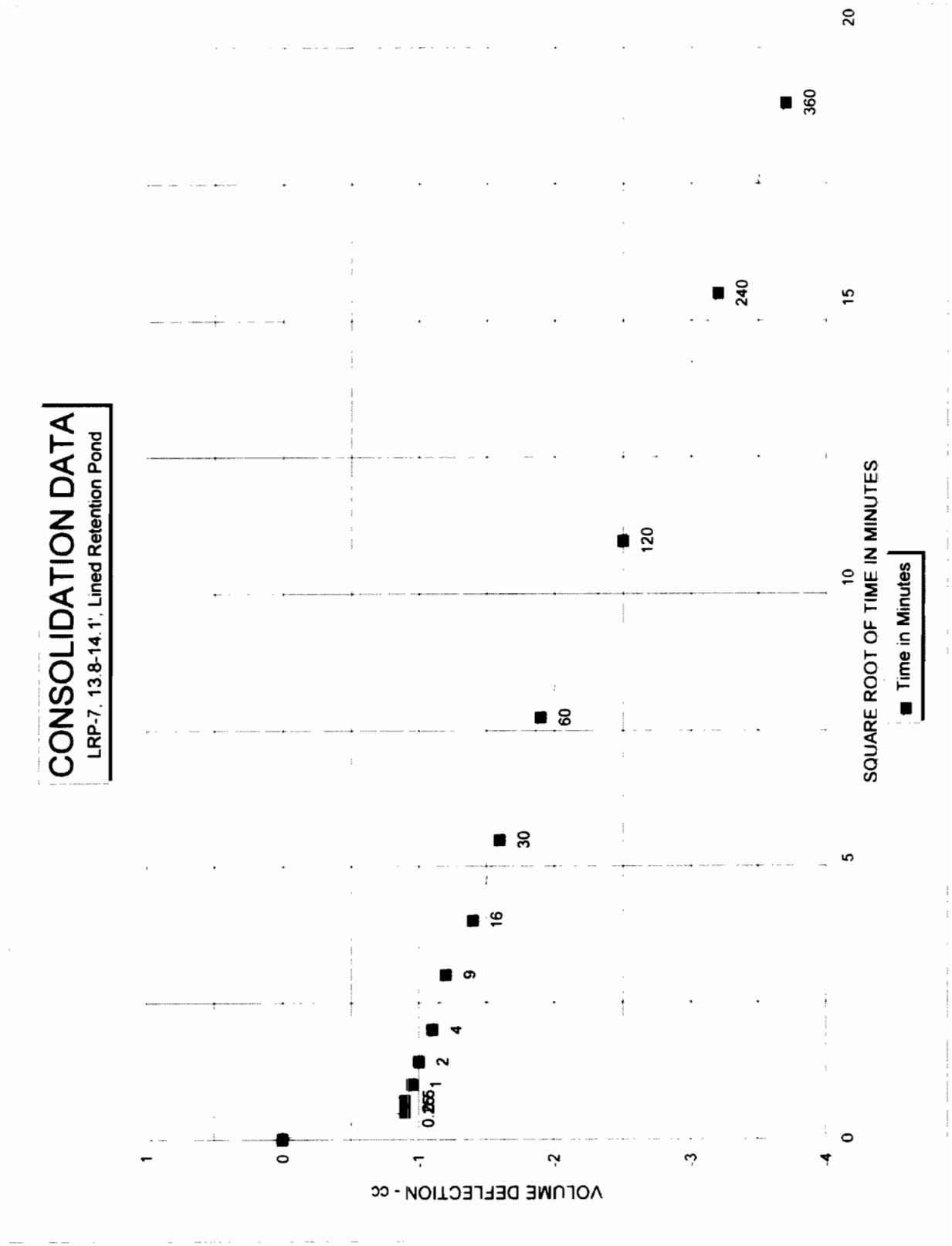
FLOW PUMP CALCULATIONS

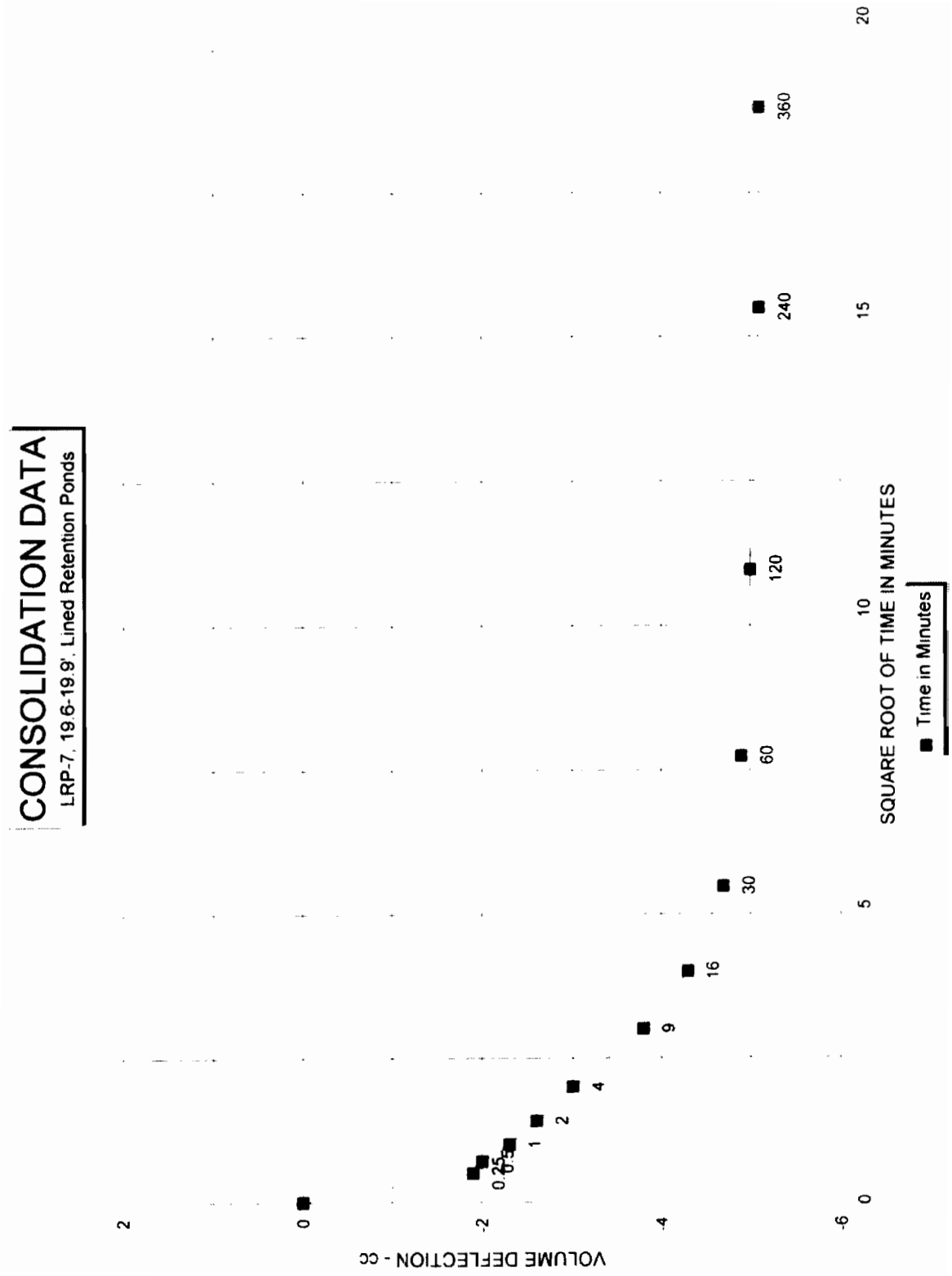
Pump Setting (gear number)	12
Percentage of Pump setting	100
Q (cc/s)	2.30E-05
Height	2.983
Diameter	1.895
Pressure (psi)	0.330
Area after consol (cm*cm)	18.201
Gradient	3.062
Permeability k (cm/s)	4.1E-07
Permeability k (m/s)	**4.1E-09**
Back Pressure (psi)	38.0
Cell Pressure (psi)	55.6
Ave Effective Stress (psi)	17.435
Average temperature degree C	22.4

Data entry by DAW Date. 09/12/2011
Checked by: CAL Date: 9/13/11
FileName: WSP01916

Preliminary Flow Pump Data
WWC, Strata Energy, LRP-7 @ 13.8'-14.1'
2.0E-07
1.8E-07
1.6E-07
1.4E-07
1.2E-07
1.0E-07
8.0E-08
6.0E-08
K (cm/sec)
0
40
80
120
160
200
240
280
320
360
400
time (minutes)
Average last 4 values
7.4E-08
Data Entered By:
CAL
Date:
10/26/2011
Data Checked By:
Date Checked
File Name:
WSP0L714
ATT

Preliminary Flow Pump Test Data
WWC, Strata Energy CPP Area, LRP-7 @19.6-19.9'
k (cm/sec)
6 5E-07
6 0E-07
5 5E-07
5 0E-07
4 5E-07
4 0E-07
3 5E-07
0
20
40
60
80
100
120
140
160
180
200
Time (minutes)
Average last 4 values
4 3E-07
Data Entered By: CAL
Data Checked By:
File Name: WSFPL719
Date: 9/08/2011
Date Checked:


CONSOLIDATION DATA
LRP-7, 13.8-14.1', Lined Retention Pond
VOLUME DEFLECTION - ε
SQUARE ROOT OF TIME IN MINUTES
Time in Minutes
0
1
2
4
9
16
30
60
120
240
360
1
0
-1
-2
-3
-4
0
5
10
15
20


CONSOLIDATION DATA
LRP-7, 19.6-19.9', Lined Retention Ponds
VOLUME DEFLECTION - cc
SQUARE ROOT OF TIME IN MINUTES
Time in Minutes
2
0
-2
-4
-6
0
5
10
15
20
0.25
0.5
1
2
4
9
16
30
60
120
240
360

EFFECTIVE STRESS PATH ANALYSIS TEST DATA
ASTM D4767

CLIENT Western Water Consultants

JOB NO 2137-67

BORING NO LRP-7 Pt A & Pt B
DEPTH 10 9-11 5'
SAMPLE NO Lined Retention Ponds
SOIL DESCR 2009142 42
LOCATION Strata Energy CPP Area

SAMPLED
SATURATED TEST
TEST TYPE TX/CUPP

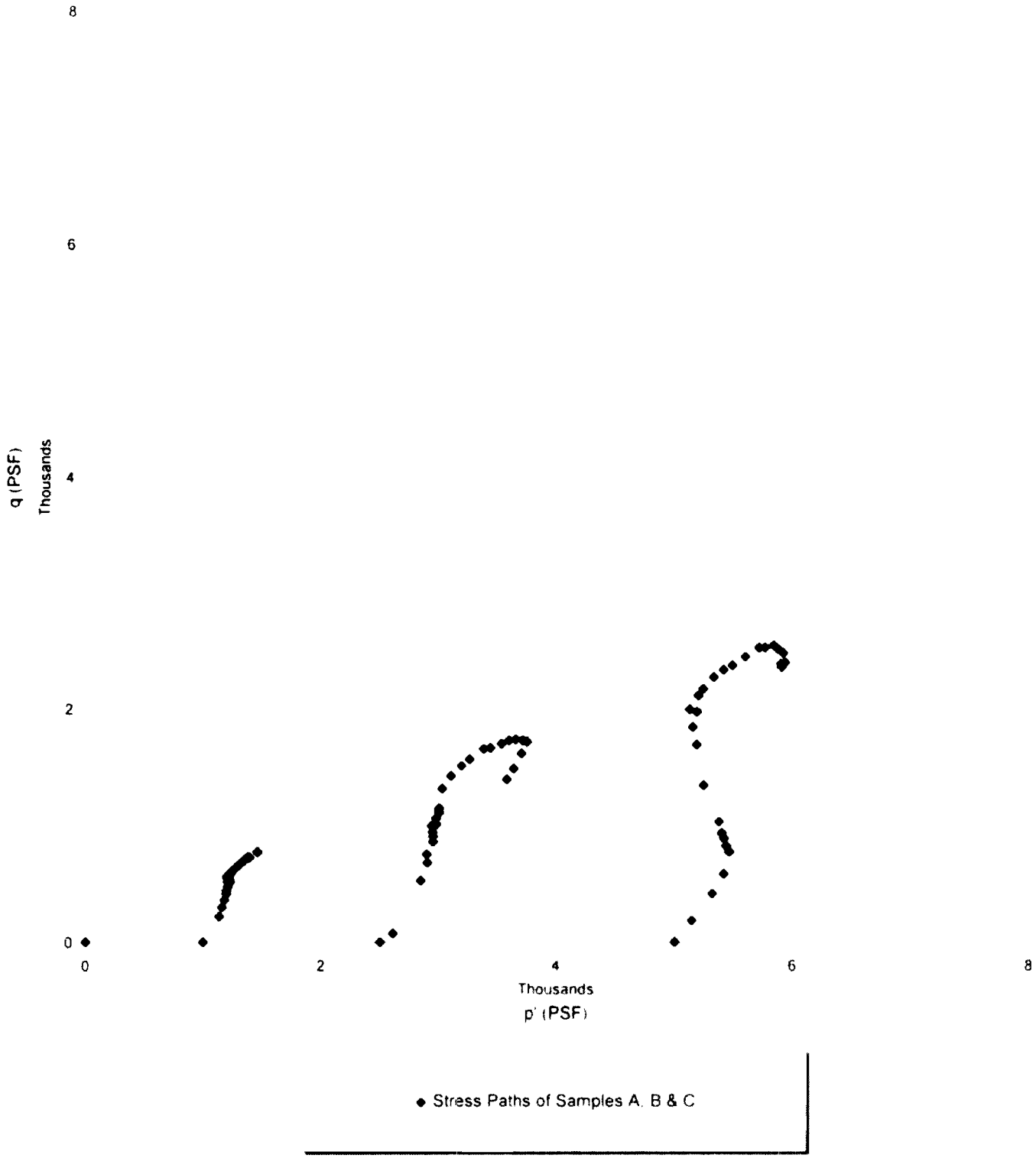
				Peak Points p PSF	Peak Points q PSF
CONF PRES PSF	Pt A	5000	PSF	5832	2552
	Pt B STAGE 2	2500	PSF	3651	1738
	Pt B STAGE 1	1000	PSF	1464	772

Pt. A				Pt. B, STAGE 2				Pt. B, STAGE 1			
σ 3' PSF	σ 1' PSF	p' PSF	q PSF	σ 3' PSF	σ 1' PSF	p' PSF	q PSF	σ 3' PSF	σ 1' PSF	p' PSF	q PSF
5000	5000	5000	0	2500	2500	2500	0	1000	1000	1000	0
4958	5327	5142	185	2526	2677	2602	76	919	1359	1139	220
4905	5732	5318	414	2318	3372	2845	527	863	1461	1162	299
4831	5996	5413	582	2219	3575	2897	678	820	1543	1181	361
4686	6230	5458	772	2143	3641	2892	749	785	1611	1198	413
4614	6255	5435	821	2088	3800	2944	856	758	1639	1198	440
4532	6301	5416	885	2042	3848	2945	903	735	1693	1214	479
4467	6327	5397	930	2001	3883	2942	941	712	1745	1229	516
4344	6401	5373	1028	1968	3982	2975	1007	696	1727	1212	516
3897	6578	5237	1341	1938	3926	2932	994	682	1755	1218	537
3490	6871	5180	1691	1912	4028	2970	1058	669	1769	1219	550
3305	6992	5149	1843	1890	4103	2997	1107	663	1770	1217	554
3205	7155	5180	1975	1869	4115	2992	1123	655	1759	1207	552
3123	7120	5122	1999	1850	4145	2998	1147	651	1815	1233	582
3075	7309	5192	2117	1706	4336	3021	1315	646	1761	1203	558
3056	7406	5231	2175	1672	4522	3097	1425	642	1782	1212	570
3052	7599	5325	2273	1678	4701	3189	1512	641	1879	1260	619
3071	7748	5409	2339	1691	4826	3259	1567	639	1866	1252	614
3101	7863	5482	2381	1724	5032	3378	1654	643	1911	1277	634
3136	8045	5590	2455	1770	5100	3435	1665	643	1887	1265	622
3178	8240	5709	2531	1828	5233	3531	1703	644	1965	1305	660
3222	8291	5757	2534	1864	5325	3595	1731	645	1996	1320	675
3279	8384	5832	2552	1912	5389	3651	1738	646	1987	1317	671
3349	8389	5869	2520	1980	5440	3710	1730	643	1941	1292	649
3431	8397	5914	2483	2031	5462	3746	1716	647	1994	1320	674
3504	8283	5893	2389	2087	5316	3702	1615	647	2049	1348	701
3527	8328	5928	2400	2149	5118	3634	1485	649	2079	1364	715
3536	8260	5898	2362	2180	4966	3573	1393	651	2101	1376	725
								653	2110	1381	729
								657	2097	1377	720
								671	2119	1395	724
								689	2229	1459	770
								692	2235	1464	772

Data entry by DAW Date 09/15/2011
Data checked by CAR Date 9/15/11
FileName WSPQ1997

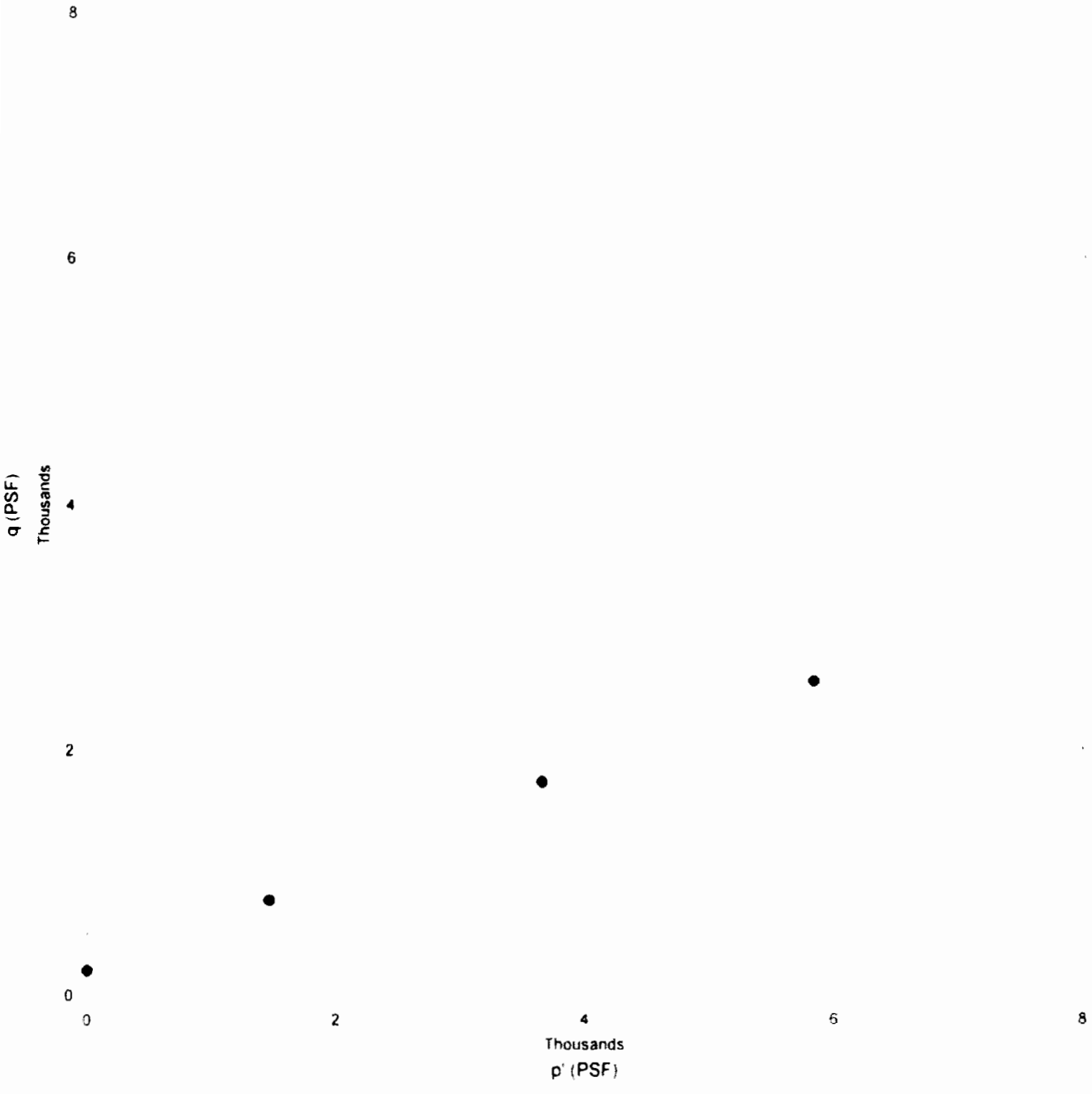
Effective Stress Path Analysis - p' q Plots

Western Water Consultants.Strata Energy CPP Area.2009142 42.LRP-7 Pt A & Pt B.Lined Retention Ponds.1



Effective Stress Path Analysis - p'-q Regression Plot

Western Water Consultants.Strata Energy CPP Area.2009142 42.LRP-7 Pt A & Pt B.Lined Retention Ponds.1

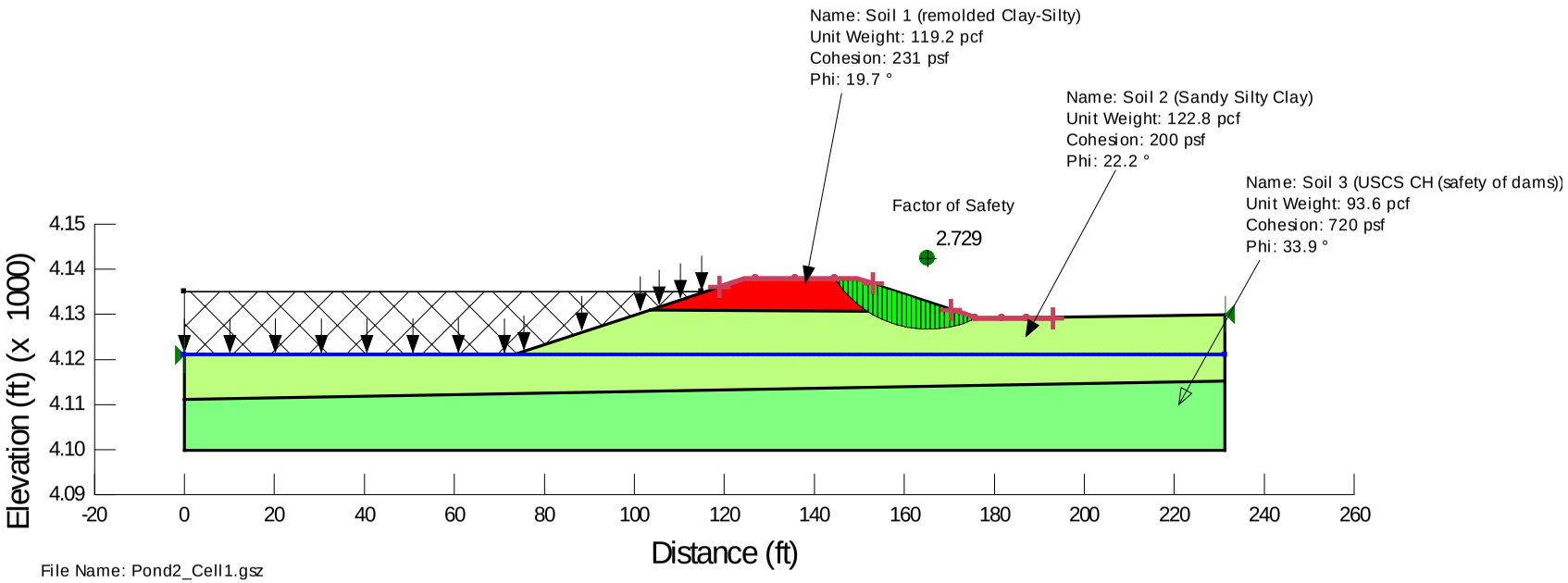


ATTACHMENT D

SLOPE STABILITY ANALYSIS
GRAPHICAL OUTPUT

Pond 2 Cell 1 Embankment

Long Term Stability - with seismic coeff. C=0.05g



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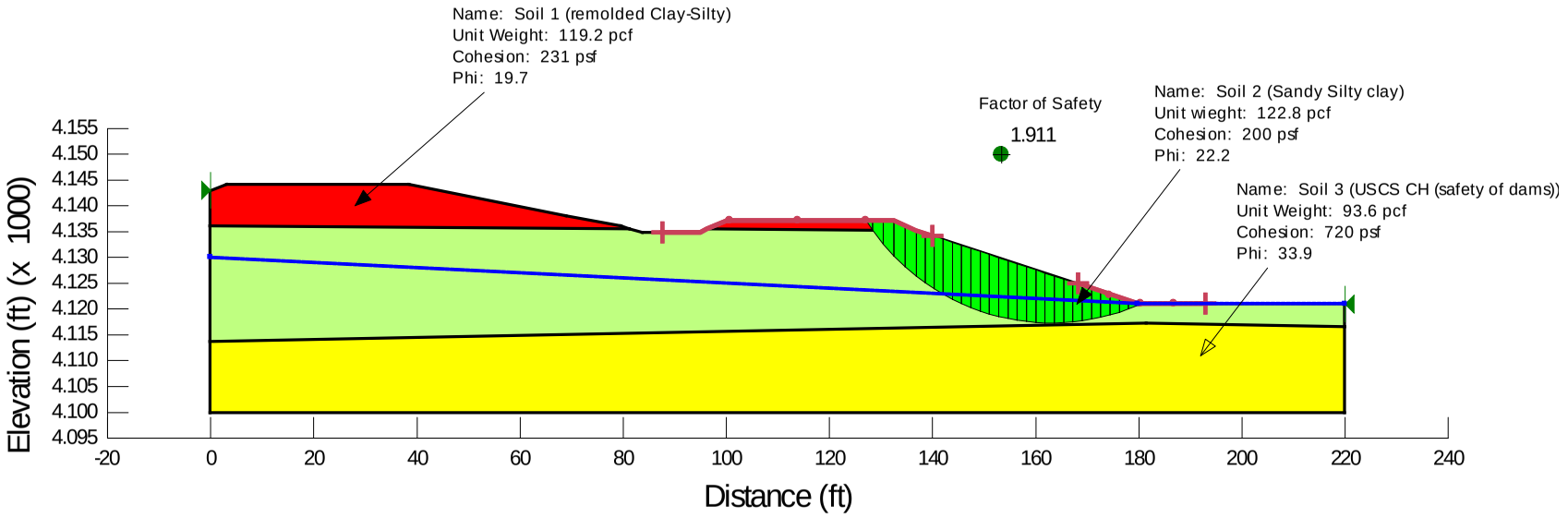
Analysis Method:Morgenstern-Price
Direction of Slip Movement: Left to Right
Slip Surface Option: Entry and Exit

Pond 2 Cell 3 Interior Slope

Long Term Stability - with seismic coeff. C=0.05g



File Name: Pond2_Cell3.gsz
Analysis Method:Morgenstern-Price
Direction of Slip Movement: Left to Right
Slip Surface Option: Entry and Exit