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Revision 0

Borehole Summary Report for the Installation of Seven Groundwater Monitoring Wells at the 200-BP-5 Operable Unit, CY 2008

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

Project Hanford Management Contractor for the
U.S. Department of Energy under Contract DE-AC06-08RL14788

CH2MHILL
Plateau Remediation Company

P.O. Box 1600
Richland, Washington 99352

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L. Stratton
Freestone Environmental Services

Date Published
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TERMS

ags	above ground surface
bgs	below ground surface
CCU	Cold Creek unit
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
COC	contaminant of concern
CSS	Colorado silica sand
FH	Fluor Hanford, Inc.
HEIS	*Hanford Environmental Information System*
Hf/CCU	Hanford formation/Cold Creek unit
HP	horse power
NTU	nephelometric turbidity unit
OD	outside diameter
OU	operable unit
PVC	polyvinyl chloride
RCT	radiological control technician
RI/FS	remedial investigation/feasibility study
TD	total depth
WAC	*Washington Administrative Code*

METRIC CONVERSION CHART

Into Metric Units			Out of Metric Units		
If You Know	*Multiply By*	*To Get*	*If You Know*	*Multiply By*	*To Get*
Length			**Length**		
Inches	25.4	millimeters	millimeters	0.039	Inches
Inches	2.54	centimeters	centimeters	0.394	Inches
Feet	0.305	meters	meters	3.281	Feet
Yards	0.914	meters	meters	1.094	Yards
Miles	1.609	kilometers	kilometers	0.621	Miles
Area			**Area**		
sq. inches	6.452	sq. centimeters	sq. centimeters	0.155	sq. inches
sq. feet	0.093	sq. meters	sq. meters	10.76	sq. feet
sq. yards	0.0836	sq. meters	sq. meters	1.196	sq. yards
sq. miles	2.6	sq. kilometers	sq. kilometers	0.4	sq. miles
Acres	0.405	hectares	hectares	2.47	Acres
Mass (weight)			**Mass (weight)**		
Ounces	28.35	grams	grams	0.035	Ounces
Pounds	0.454	kilograms	kilograms	2.205	Pounds
Ton	0.907	metric ton	metric ton	1.102	Ton
Volume			**Volume**		
Teaspoons	5	milliliters	milliliters	0.033	fluid ounces
Tablespoons	15	milliliters	liters	2.1	Pints
fluid ounces	30	milliliters	liters	1.057	Quarts
Cups	0.24	liters	liters	0.264	Gallons
Pints	0.47	liters	cubic meters	35.315	cubic feet
Quarts	0.95	liters	cubic meters	1.308	cubic yards
Gallons	3.8	liters			
cubic feet	0.028	cubic meters			
cubic yards	0.765	cubic meters			
Temperature			**Temperature**		
Fahrenheit	subtract 32, then multiply by 5/9	Celsius	Celsius	multiply by 9/5, then add 32	Fahrenheit
Radioactivity			**Radioactivity**		
Picocuries	37	millibecquerel	millibecquerel	0.027	Picocuries

1.0 INTRODUCTION

This report presents field-generated records and summarizes field activities during the drilling and construction of seven monitoring wells in the 200-BP-5 Groundwater Operable Unit (OU) to support the 200-BP-5 OU remedial investigation/feasibility study (RI/FS) (DOE/RL-2007-18, *Remedial Investigation/Feasibility Study Work Plan for the 200-BP-5 Groundwater Operable Unit, Hanford Site, Richland, Washington*) in accordance with the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA). Wells 299-E33-341 (C5856), 299-E33-342 (C5857), 299-E33-343 (C5858), 299-E33-344 (C5859), and 299-E33-345 (C6226) are located north of B-BX-BY Tank Farms within the 200 East Area perimeter fence and are primarily for characterization and monitoring of the unconfined suprabasalt aquifer. Wells 699-52-55B (C5862) and 299-E33-340 (C5853) are for characterization and monitoring of the confined aquifer. Well C5862 is located in the 600 Area directly north of the 200 East Area, immediately adjacent to well 699-52-55A (C5861). Well 299-E33-340 (C5853) is located north of the B-BX-BY Tank Farms along the 200-East Area perimeter road (12th Street).

The wells were drilled and completed during the period of December 17, 2007 through October 13, 2008 by BlueStar Enterprises Northwest, Inc. under the direction of Fluor Hanford, Inc. (FH). Freestone Environmental Services, Inc. provided well-site geology and well construction documentation services.

1.1 PURPOSE AND SCOPE

The purpose of this document is to compile and archive records, observations, and measurements associated with the drilling and construction of the seven wells. This borehole summary report includes the field notes and forms produced during drilling and construction of the wells, well construction details, and well development data. Additional information provided in the report includes subsurface geologic descriptions for each well, civil survey results, management of drilling-derived waste, and well acceptance. All drilling data are recorded in the English units in which they were measured and to the degree of accuracy initially reported. Henceforth, all wells are referred to by their well identification number (C####). Figures 1-1 and 1-2 presents the locations of the seven new monitoring wells included in this report along with key features of the area. Well location and drilling date data are presented in Table 1-1.

Figure 1-1. Locations of Six New Monitoring Wells Adjacent to B Tank Farms.

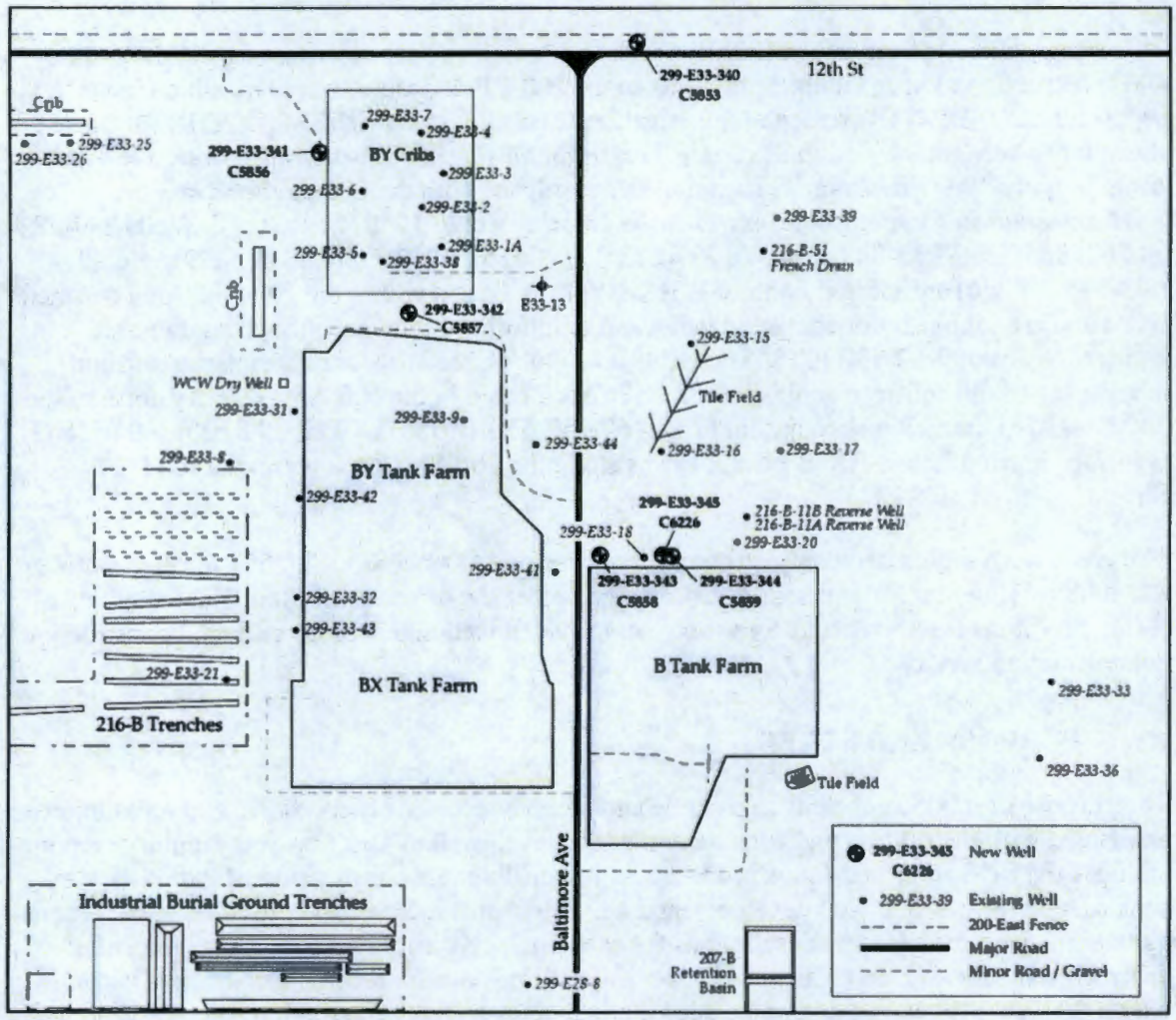

Figure 1-2. Location of New Monitoring Well South of Gable Mountain.

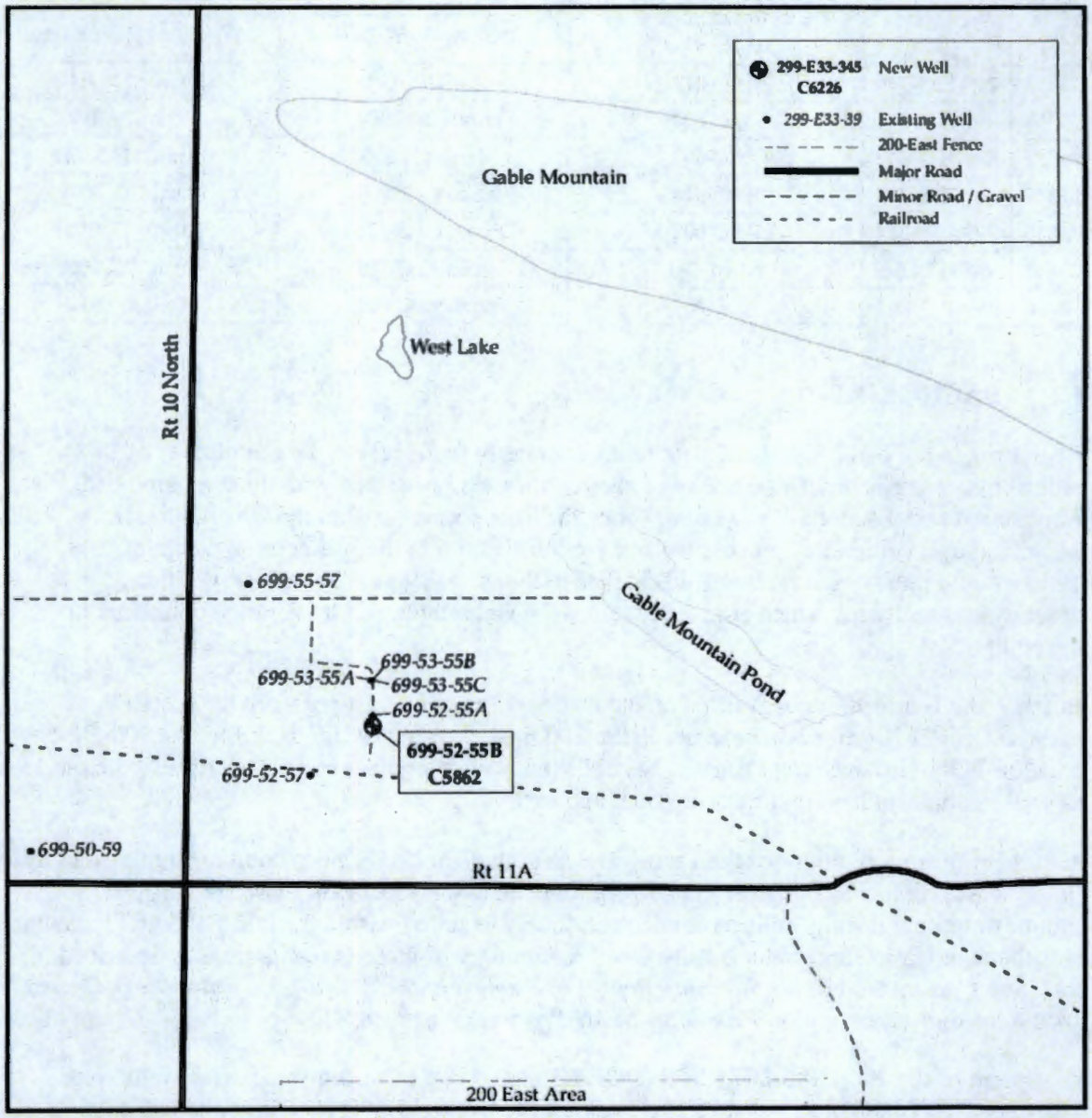

Table 1-1. Summary of the New Wells.

Well ID	Well Name	Washington State Department of Ecology ID Number	Drilling Dates	
			Drilling Start Date	Well Completion Date
C5853	299-E33-340	ALC-017	April 9, 2008	October 13, 2008
C5856	299-E33-341	ALC-004	April 28, 2008	June 9, 2008
C5857	299-E33-342	ALC-003	March 12, 2008	April 23, 2008
C5858	299-E33-343	BAT-316	January 15, 2008	March 10, 2008
C5859	299-E33-344	ALC-002	December 17, 2007	January 23, 2008
C5862	699-52-55B	AGM-494	June 12, 2008	August 21, 2008
C6226	299-E33-345	ALC-001	January 24, 2008	April 4, 2008

1.2 BACKGROUND

Beginning in the early 1940s and continuing for nearly five decades, large volumes of radioactive waste and non-radioactive dangerous wastes associated with the operation of B Plant were stored and disposed of in various waste facilities located within the 200-BP-5 OU. In addition, large volumes of process water were infiltrated into the soil column utilizing cribs, trenches, and ponds. Liquid waste discharges to the vadose zone resulted in significant groundwater recharge, which artificially raised the water table and transported contaminants to the aquifer.

In 1989, the Hanford Site was listed on the National Priorities List pursuant to CERCLA. To address CERCLA groundwater issues in the 200 East Area of the Hanford Site, the 200-BP-5 and 200-PO-1 Groundwater OUs were established, which together cover the entire 200 East Area as well as adjacent land to the north, south and east.

A number of investigations of the vadose and saturated zone have been conducted related to the liquid wasted disposed during B Plant operations. In association with these studies, over 95 groundwater monitoring wells have been previously installed within the 200-BP-5 OU to gather site characterization and water quality data. A summary of these investigations is described in the *Data Quality Objectives Summary Report in Support of the 200-BP-5 Groundwater Operable Unit Remedial Investigation/Feasibility Study Process* (WMP-28945).

In support of the 200-BP-5-OU RI/FS (DOE/RL-2007-18), 15 new groundwater wells were proposed. Three of these wells, 299-E33-50 (C5195), 699-48-50B (C5196), and 699-50-56 (C5197), were drilled between October 2006 and March 2007. A second group, consisting of wells 299-E27-155 (C5852) and 699-52-55A (C5861), was drilled between September 2007 and January 2008. The seven wells included in this borehole summary report represent the third group of groundwater wells installed to support the 200-BP-5 OU RI/FS (DOE/RL-2007-18).

2.0 DRILLING, SAMPLING AND WELL CONSTRUCTION ACTIVITIES

This section summarizes the drilling, sampling and well construction activities associated with wells C5853, C5856, C5857, C5858, C5859, C6226, and C5862. Borehole drilling, sampling and well construction details common to these wells are summarized in Section 2.1. Well-specific information is summarized in Section 2.2.

2.1 GENERAL INFORMATION

The following summarizes activities and information common to all seven wells. The wells were constructed to Washington State standards detailed in *Washington Administrative Code* (WAC) 173-160 ("Minimum Standards for Construction and Maintenance of Wells"). Well construction activities were recorded and borehole geology was logged in accordance with FH procedures GRP-EE-02-14.1 ("Drilling, Remediating, and Decommissioning Resource Protection Wells, and Geotechnical Soil Borings") and GRP-EE-01-7.0 ("Geologic Logging"). A summary of well construction information for each well is included in Table 2-1.

- **Drilling** – Boreholes C5859, C6226, C5858, C5857, and C5856 were drilled with a cable tool drill rig utilizing drive barrel and hard tool drilling methods. Boreholes C5853 and C5862 were drilled primarily with cable tool methods but used an air rotary rig to drill through the Elephant Mountain basalt. Each of the seven boreholes was drilled using two or three strings of temporary casing varying in diameter from 13.5-in. outside diameter (OD) to nominal 7-in. OD. Casing size was reduced both to ease the removal of the temporary casing during well construction and to prevent potential communication between aquifers in boreholes C6226, C5858, C5853, and C5862.

- **Archive Lithologic Sampling** – Grab samples were collected from the drill cuttings of each borehole for geologic description and to fulfill lithologic archive collection requirements. The samples were collected at 5-ft intervals and at recognizable changes in lithology. Samples were placed in labeled pint-sized glass jars and sequential chip tray compartments for archive storage. Scaled digital photographs were taken in the field to accompany field description. Borehole geologic logs and photographic logs for each well are presented in the appendices.

- **Additional Grab Sampling** – In addition to the lithologic archive samples, quart-size grab samples were collected at predetermined depths (generally every 2.5 ft) from each borehole. These samples were analyzed for various chemical constituents and physical properties in support of the 200-BP-5 OU RI/FS (DOE/RL-2007-18). Grab sampling depths and corresponding *Hanford Environmental Information System* (HEIS) database sample identification numbers for each well are presented in the appendices.

- **Split-Spoon Sampling** – In addition to grab samples, split-spoon samples were collected from each borehole at predetermined intervals. The samples were collected by driving a decontaminated 4-in. diameter split-spoon sampler through the sampling interval for 2.5 ft or until refusal. Each split-spoon was assembled using four 6-in-long Lexan or

stainless steel liners. Following sample collection, the 6-in. liners containing sediment were capped, taped, and labeled in accordance with FH procedures. The samples were analyzed for various chemical constituents and physical properties in support of the 200-BP-5 OU RI/FS (DOE/RL-2007-18). Split-spoon sampling intervals and corresponding HEIS numbers are presented in the appendices.

- **Groundwater Sampling** – Groundwater samples were collected at predetermined intervals and analyzed for the saturated zone contaminants of potential concern identified in the 200-BP-5 OU RI/FS (DOE/RL-2007-18). Samples were collected with a submersible pump or a KABIS sampler, depending on aquifer conditions. Depths and corresponding HEIS numbers of groundwater samples for each well are presented in the appendices.

- **Geophysical Logging** – Each borehole was logged using S.M. Stoller Corporation's spectral gamma and neutron moisture logging system. Logging was conducted in separate intervals (i.e., prior to downsizing casing) to allow measurements to be collected through only one string of casing.

- **Radiological Field Screening** –The drilling of each borehole was classified as a low risk activity based on previous drilling and sampling activities, but the level of coverage by field radiological screening surveys varied by borehole and depth. Boreholes C5859, C6226, and C5858 were monitored continuously, while boreholes C5857 and C5856 received intermittent coverage. Boreholes C5853 and C5862 were monitored twice daily (morning and afternoon) due to their distance from known contamination sources. A radiological control technician (RCT) performed the radiological surveys using standard radiological field screening instruments.

- **Air Monitoring for Volatile Organic Chemicals** – Air quality monitoring was performed twice daily to verify that the drillers' breathing zone remained free of volatile organic contamination. The breathing zone near the wellhead, the fresh drill cuttings, and geologic samples were surveyed for volatile organics using a photoionization detector. No field measurements above background levels were reported by the industrial hygiene technician during the drilling activities.

- **Sieve Analysis** – To confirm the choice of an appropriate slot size for the screen, sieve analysis was conducted on sediments collected from the planned screened interval in each borehole, except for C5853. No sieve analysis was conducted for C5853 because the screened interval was drilled using the hard tool method.

- **Well Construction Materials** – Each of the wells was constructed using 4 or 6-in. nominal diameter, schedule 10, Type 304L stainless steel threaded casing, except for well C5859, which was constructed using polyvinyl chloride (PVC) threaded casing. A Type 304L stainless steel or PVC continuous wire wrap well screen was utilized at each well. Screen slot size and length varied depending on conditions in the interval to be screened. Each well screen was equipped with a 2 or 3 ft long sump consisting of 4 or 6-in. diameter stainless steel or PVC casing with a stainless steel bottom cap, except for

C6226, which was completed with a stainless steel end cap welded directly to the screen assembly. Specific well construction materials are summarized in Section 2.2

- **Filter Pack and Backfill** – The backfill and primary filter pack surrounding the screen for wells C5856, C5857, C5858, C5859, and C6226 consist of 10-20 or 20-40 mesh Colorado silica sand (CSS), except for C6226, which used bentonite crumbles to backfill to the screened interval. Deep wells C5853 and C5862 used coated bentonite pellets and 10-20 or 20-40 mesh CSS to backfill and 10-20 or 20-40 mesh CSS as filter pack. Specific well construction materials and depths are summarized in Section 2.2

- **Annular Seal** – The annular seal for wells C5856, C5857, C5858, C5859, and C6226 consists of 0.375-in. bentonite pellets placed directly above the primary sand pack. The annular surface seal consists of granular bentonite crumbles to approximately 10 ft below ground surface (bgs) and Portland cement grout directly above the granular bentonite to ground surface. Deep wells C5853 and C5862 were completed with annular seals consisting of coated bentonite pellets, a neat cement grout seal through the basalt interval, and granular bentonite to approximately 10 ft bgs. The surface seal consists of cement grout.

- **Surface Completion** – All wells except C5862 were completed with an above-ground stickup of the 4- or 6-in. diameter permanent casing protected by 6 or 8-in. nominal diameter stainless steel casing embedded into a 6-in. thick, 4 ft by 4 ft concrete pad placed around the well. Each wellhead is protected by 4-in. diameter, 3-ft tall steel posts at each corner of the cement pad. Well C5862 was completed with a flush-mount monument due to its location in a culturally sensitive area.

Table 2-1. Well Construction Summary (2 Sheets)

	Well ID						
	C5853	**C5856**	**C5857**	**C5858**	**C5859**	**C5862**	**C6226**
Total depth drilled (ft bgs)	358.9	237.0	245.5	263.8	242.1	292.0	263.8
Water level (ft bgs)/ Date measured	214.27 10/15/08	226.85 6/9/08	263.12 6/9/08	252.14 3/10/08	225.05 6/6/08	173.6 8/22/08	253.38 4/1/08
Permanent Screen and Casing							
Top of protective casing (ft ags)	2.90	3.0	3.0	2.39	2.56	-0.5 (flush mount)	2.45
Top of casing (ft ags)	2.47	2.15	2.58	1.39	1.58	-0.75 (flush mount)	2.0
Top of screen (ft bgs)	308.18	222.98	232.6	249.9	217.9	228.46	249.68
Bottom of screen (ft bgs)	323.17	232.97	242.6	259.9	237.09	243.46	259.68

Table 2-1. Well Construction Summary (2 Sheets)

	Well ID						
	C5853	C5856	C5857	C5858	C5859	C5862	C6226
Screen length (ft)	14.99	9.99	10	10	20	15	10
Screen size	10 Slot 0.010-in	20 Slot 0.020-in	20 Slot 0.020-in	20 Slot 0.020-in	10 Slot 0.010-in.	10 Slot 0.010-in	20 Slot 0.020-in.
Sump (ft bgs)	323.17 – 326.18	232.97 – 235.97	242.6 – 244.6	259.9 – 262.9	237.09 - 237.39	243.45 – 246.45	259.68 – 262.68
Annular Seal							
Surface seal (ft bgs)	0 – 9.7	0 – 8.8	0 – 9.2	0 – 9.8	0 – 10.8	0 – 9.3	0 – 11.7
Granular bentonite seal (ft bgs)	9.7 – 207.0	8.8 – 210.1	9.2 – 225.6	9.8 – 233.2	10.8 – 206.3	9.3 – 170.0	11.7 – 244.5
3/8-in. bentonite pellet seal (ft bgs)	207.0 – 221.2	210.1 – 217.5	225.6 – 230.0	233.2 – 241.0	206.3 – 209.85	170.0 – 176.4	244.5 – 245.1
Portland cement seal (ft bgs)	221.2 – 294.5	NA	NA	NA	NA	176.4 – 215.8	NA
3/8-in. bentonite pellet seal (ft bgs)	294.5 – 295.9	NA	NA	NA	NA	215.8 – 216.8	NA
Primary Filter Pack							
Depth Mesh Size	295.9 – 335.3 20 CSS	217.5 – 237.0	230 – 245.3	241.0 – 263.4	209.85 – 237.6 20-40 CSS	216.8 – 250.7 20-40 CSS	245.1 – 262.85
Over Drilled Portion Back-Fill							
3/8-in. bentonite pellet seal (ft bgs)	335.3 – 339.5	NA	NA	NA	237.6 – 242.1	250.7 – 255.1	NA
Backfill silica sand	339.5 – 353.5	NA	NA	NA	NA	255.1 – 283.3	NA
3/8-in. bentonite pellet seal (ft bgs)	353.5 – 358.9	NA	NA	NA	NA	283.3 – 292.0	NA

Notes:

ags = above ground surface
bgs = below ground surface
CSS = Colorado silica sand
NA = not applicable

2.2 WELL-SPECIFIC INFORMATION

This section summarizes the activities and information specific to each well location, such as sample depths, geologic observations and other unique well-specific activities.

2.2.1 Well 299-E33-340 (C5853)

Well 299-E33-340 (C5853) is located at the intersection of Baltimore Ave and 12th St, adjacent to the northern perimeter fence of the 200 East Area and north of the B-BX-BY Tank Farms, at the coordinates and elevation presented in Table 5-1.

2.2.1.1 Drilling

Drilling of borehole C5853 began April 9, 2008 using a cable tool rig equipped with a drive barrel to drill to the upper surface of the Elephant Mountain basalt at 226.1 ft bgs. The Elephant Mountain basalt was drilled using hard tool methods from 226.1 to 248.5 ft bgs and an air rotary rig equipped with a down-hole hammer from 248.5 to 307 ft bgs. The Rattlesnake Ridge Interbed was drilled using hard-tool methods from 307 to 331 ft bgs and drive barrel methods from 331 to 356 ft bgs, the contact of the Pomona basalt. To confirm the depth of the basalt contact, the borehole was advanced an additional 2.85 ft into the basalt using hard tool methods. Total depth (TD) of 358.85 ft bgs was reached on July 16, 2008.

The borehole was drilled using temporary 10.75-in. OD threaded casing from ground surface to 226.10 ft bgs and nominal 7-in. threaded casing from 226.10 to 356 ft bgs. All drilling using a drive barrel was completed without the aid of drilling fluid; approximately 100 gallons of potable water were added while drilling the Elephant Mountain basalt to build an adequate drilling mud while cable tool drilling and later to aid the air rotary rig in lifting the cuttings to the surface.

Saturated soils were first encountered in the suprabasalt aquifer at approximately 219 ft bgs on April 21, 2008. Static water level was measured April 22, 2008 at 217.6 ft bgs. Saturated soils in the Rattlesnake Ridge Interbed were encountered at approximately 301 ft bgs. Static water level in the well, screened from 308.18 to 323.17 ft bgs, was measured on October 15, 2008 at 217.27 ft bgs.

Field RCT surveys detected no contamination while drilling Well C5853.

2.2.1.2 Sampling

Lithologic archive samples were collected every 5 ft and at changes in lithology; exact depths are available in the borehole log included in Appendix A. Grab samples for chemical analysis were collected every 2.5 ft from 209 to 222.5 ft bgs and 302 to 356.5 ft bgs except in intervals where no recovery was achieved. Two split-spoon samples were collected, at 302 and 348 ft bgs. Three groundwater samples were collected using a submersible pump, at 305, 331, and 356 ft bgs. Collection depths and HEIS numbers for grab, split-spoon, and groundwater samples collected from C5853 are presented in Appendix A.

2.2.1.3 Well Construction

Prior to well construction, the borehole passed a straightness test. While sealing the basalt interval with neat cement grout, the temporary casing was cemented in. After various efforts to free the permanent casing, a 5% solution of dry penetrating agent (acid) was added to dissolve the cement. This effort was successful and completion continued as normal. A summary of the final well completion for well C5853 follows, and is described in Table 2-1.

The surface seal is comprised of Portland cement from ground surface to 9.67 ft bgs. Granular bentonite was placed from 9.67 to 207.0 ft bgs. Three-eighths-inch coated bentonite pellets were placed from 207.0 to 221.2 ft bgs. Neat cement grout was placed from 221.2 to 294.5 ft bgs, sealing off the basalt interval. Below the grout seal, 0.375-in. coated bentonite pellets were placed from 294.5 to 295.9 ft bgs. The primary filter pack, consisting of 20 mesh CSS, was placed from 295.9 to 335.27 ft bgs. Below the primary filter pack, a 0.375-in. coated bentonite pellet seal was placed from 335.27 to 339.5 ft bgs. Backfill silica sand was placed from 339.5 to 353.5 ft bgs. The 0.375-in. coated bentonite pellets were placed from 353.5 to 358.85 ft bgs.

The nominal 4-in. diameter permanent casing was placed from 2.47 above ground surface (ags) to 308.18 ft bgs. A 15 ft, 10-slot screen was placed from 308.18 to 323.17 ft bgs with a 3-ft stainless steel sump and end cap placed from 323.17 to 326.18 ft bgs. The 6-in. protective casing was set at 2.90 ft ags.

2.2.1.4 Well Development

Prior to well completion, initial well development was performed on July 30 and 31, 2008 to determine if 10-20 mesh CSS would serve as an adequate filter pack for a 10-slot screen. The well was developed with pump rates between 10 and 12 gpm with approximately 61 ft of drawdown and a final turbidity of 4.95 nephelometric turbidity units (NTU).

The well was developed in accordance with procedure GRP-EE-01-6.3 ("Well Development and Testing") for a second time on October 14 and 15, 2008, after final well construction was complete. Results of the well development are summarized in Section 4.0.

A 1 horse-power (HP) Grundfos permanent pump was set with the intake at 321.05 ft bgs on October 15, 2008. Water was successfully pumped to the surface to verify pump operation.

2.2.2 Well 299-E33-341 (C5856)

Well 299-E33-341 (C5856) is located approximately 10 ft west of BY Cribs at the coordinates and elevation presented in Table 5-1.

2.2.2.1 Drilling

Drilling of borehole C5856 began April 28, 2008, using a cable tool rig equipped with a drive barrel to drill to the upper surface of the Elephant Mountain basalt at 232.5 ft bgs. To confirm the depth to basalt and provide adequate room for a sump below the aquifer, the borehole was

advanced an additional 4.5 ft into the basalt to a TD of 237.0 ft bgs using 6- and 8-in. button bits. TD was reached May 30, 2008.

The borehole was drilled using nominal 12-in. diameter threaded casing from ground surface to 98.54 ft bgs and nominal 10-in. diameter casing from 98.54 ft bgs to the surface of the basalt at 232.5 ft bgs. All drilling using a drive barrel was completed without the aid of drilling fluid; approximately 27.5 gallons of water was added to build an adequate drilling mud while hard-tool drilling into the basalt.

Saturated soils were first encountered during drilling at approximately 226 ft bgs on May 22, 2008. Static water level was measured June 9, 2008 at 226.85 ft bgs.

Field RCT surveys detected contamination of 600 cpm (approximately 200 cpm above background) in barrel surveys at approximately 15 ft bgs; contamination increased to approximately 4000 cpm at 16 ft bgs and 2000 cpm at 19.5 ft bgs but was not detected at 20 ft bgs. Contamination was detected again between 105 and approximately 110 ft bgs at 6000 dpm/100 cm^2.

2.2.2.2 Sampling

Lithologic archive samples were collected every 5 ft and at changes in lithology; exact depths are available in the borehole log included in Appendix B. Grab samples for chemical analysis were collected every 2.5 ft from 15 to 230 ft bgs. Continuous split-spoon samples were collected at predetermined intervals from 15 to 22.5 ft bgs, 55 to 75 ft bgs, 95 to 120 ft bgs, 130 to 170 ft bgs, 180 to 195 ft bgs, and 210 to 233 ft bgs. One groundwater sample was collected using a decontaminated 2-ft stainless steel bailer at 230 ft bgs. Exact depths and HEIS numbers for grab, split-spoon, and groundwater samples collected from C5856 are presented in Appendix B.

2.2.2.3 Well Construction

Prior to well construction, the borehole passed a straightness test. A summary of the well completion for well C5856 is described in Table 2-1.

The surface seal is comprised of Portland cement from ground surface to 8.8 ft bgs. Granular bentonite was placed from 8.8 to 210.1 ft bgs. Coated 0.375-in. bentonite pellets were placed directly above the primary filter pack from 210.1 to 217.5 ft bgs. The primary filter pack, consisting of 10-20 mesh CSS, was placed from 217.5 to 237.0 ft bgs.

The nominal 4-in. diameter permanent casing was placed from 2.15 ft ags to 222.98 ft bgs. A 10 ft, 20-slot screen was placed from 222.98 to 232.07 ft bgs with a 3 ft stainless steel sump and end cap placed from 232.97 to 235.97 ft bgs.

The wellhead is completed with nominal 6-in. protective casing set 3.00 ft ags in a 6-in. tall, 4 ft by 4 ft concrete pad, protected by 4-ft tall posts at each corner. The well name and identification number are stamped in a brass marker emplaced on the north side of the monument.

2.2.2.4 Well Development

Well development was performed on June 10, 2008 in accordance with procedure GRP-EE-01-6.3. The well sustained a pump rate of 27.27 gpm with maximum 0.041 ft drawdown and reached a final turbidity of 0.71 NTU. Results of the well development are summarized in Section 4.0.

A 1 HP Grundfos permanent pump was set with the intake at 229.25 ft bgs on June 11, 2008. Approximately 5 gallons of water were successfully pumped to verify operation.

2.2.3 Well 299-E33-342 (C5857)

Well 299-E33-342 (C5857) is located immediately north and downslope of the perimeter of BY Tank Farm at the coordinates and elevation presented in Table 5-1.

2.2.3.1 Drilling

Drilling of borehole C5857 began March 12, 2008, using a cable tool rig equipped with a drive barrel to drill to the upper surface of the Elephant Mountain basalt at 242.4 ft bgs. To confirm the depth to basalt and provide adequate room for a sump below the aquifer, the borehole was advanced an additional 3.1 ft into the basalt to a TD of 245.5 ft bgs using 6 and 8-in. button bits to drill to 245.5 ft bgs. TD was reached April 14, 2008.

The borehole was drilled using temporary nominal 12-in diameter threaded casing from ground surface to 98.56 ft bgs and nominal 10-in. diameter casing from 98.56 ft bgs to 244.87 ft bgs. All drilling using a drive barrel was completed without the aid of drilling fluid; approximately 85 gallons of water was added to build an adequate drilling mud while hard tool drilling the basalt.

Saturated soils were first encountered during drilling at approximately 233 ft bgs on April 4, 2008. Static water level was measured April 22, 2008 at 236.17 ft bgs.

Field RCT surveys detected contamination of 1200 dpm/100 cm^2 at 230 ft bgs.

2.2.3.2 Sampling

Lithologic archive samples were collected every 5 ft and at changes in lithology; exact depths are available in the borehole log included in Appendix C. Grab samples for chemical analysis were collected every 2.5 ft from 20 to 242.5 ft bgs except in intervals where no recovery was achieved. Continuous split-spoon samples were collected at predetermined intervals at 20 ft bgs, 70 to 85 ft bgs, 100 to 120 ft bgs, 135 to 150 ft bgs, 155 to 170 ft bgs, 185 to 195 ft bgs, and 210 to 235 ft bgs. One groundwater sample was collected using a decontaminated KABIS sampler at 242 ft bgs. Collection depths and HEIS numbers for grab, split-spoon, and groundwater samples collected from C5857 are presented in Appendix C.

2.2.3.3 Well Construction

Prior to well construction, the borehole passed a straightness test. A summary of the well completion information for well C5857 is included in Table 2-1.

The surface seal is comprised of Portland cement from ground surface to 9.2 ft bgs. Granular bentonite was placed from 9.2 to 225.6 ft bgs. Coated 0.375-in. bentonite pellets were placed directly above the primary filter pack from 225.6 to 230.0 ft bgs. The primary filter pack, consisting of 10-20 mesh CSS, was placed from 230.0 to 245.3 ft bgs.

The nominal 4-in. diameter permanent casing was placed from 2.58 ft ags to 232.6 ft bgs. A 10 ft, 20-slot screen was placed from 232.6 to 242.6 ft bgs with a 2 ft stainless steel sump placed from 242.6 to 244.6 ft bgs. A 2 ft sump was required to accommodate the smaller diameter of the final drilled foot of borehole when drilling conditions required switching to a 6-in. button bit. The nominal 6-in. diameter protective casing was set at 3.0 ft ags.

A 1 HP Grundfos permanent pump was set with the intake at 239.77 ft bgs on June 10, 2008. Water was successfully pumped to the surface to verify pump operation.

2.2.3.4 Well Development

Well development was performed on June 9, 2008 in accordance with procedure GRP-EE-01-6.3. The well sustained a pump rate of 27 gpm. No drawdown data was collected due to unavailability of a transducer and data logger. The pumped water reached a final turbidity of 0.56 NTU. Results of the well development are summarized in Section 4.0.

2.2.4 Well 299-E33-343 (C5858)

Well 299-E33-343 (C5858) is located approximately 7 ft north of B Tank Farm and 10 ft east of Baltimore Ave, at the coordinates and elevation presented in Table 5-1.

2.2.4.1 Drilling

Drilling of borehole C5858 began January 15, 2008, using a cable tool rig equipped with a drive barrel to drill to the upper surface of the Elephant Mountain basalt at 260.9 ft bgs. To confirm the depth to basalt and provide adequate room for a sump below the aquifer, the borehole was advanced an additional 2.9 ft into the basalt to a TD of 263.8 ft bgs using an 8-in. button bit. The TD was reached February 26, 2008.

The borehole was drilled using temporary 13.5-in. OD threaded casing from ground surface to 60 ft bgs, 11.75 in. casing from 60 to 238.30 ft bgs, and 9.625-in. from 238.30 ft bgs to the surface of the basalt at 260.9 ft bgs. The borehole was drilled using three strings of casing in anticipation of encountering a perched water table above the main unconfined aquifer, based on drilling data available from well C5859, located approximately 50 m east. All drilling using a drive barrel was completed without the aid of drilling fluid; approximately 60 gallons of water were added to build an adequate drilling mud while hard tool drilling the basalt.

Saturated soils were first encountered during drilling at approximately 229 ft on February 8, 2008. Depth to water was measured at 226.6 ft bgs on February 11, 2008 but could not reliably be measured using an electronic probe in subsequent attempts. However, as a safeguard against possible aquifer cross-contamination, the borehole was sealed with granular bentonite at 238.3 ft bgs and casing was downsized. Saturated soil was again encountered at 253 ft bgs on February 22, 2008. Static water level of the suprabasalt aquifer was measured March 4, 2008 at 252.14 ft bgs.

Field RCT surveys detected contamination of 6000 dpm/100 cm^2 $\beta\gamma$, and less than 100 dpm/100cm^2 α at approximately 230 ft bgs. Contamination remained at the same level to approximately 235 ft bgs, after which no contamination was detected.

2.2.4.2 Sampling

Lithologic archive samples were collected every 5 ft and at changes in lithology; exact depths are available in the borehole log included in Appendix D. Grab samples for chemical analysis were collected every 2.5 ft from 60 to 255 ft bgs. Continuous split-spoon samples were collected at predetermined intervals from 65 to 85 ft bgs, 100 to 145 ft bgs, 155 to 175 ft bgs, and 205 to 250 ft bgs; one split-spoon sample was also collected at 253 ft bgs. One groundwater sample was collected using a decontaminated 2-ft stainless steel bailer at 252 ft bgs. Collection depths and HEIS numbers for grab, split-spoon, and groundwater samples collected from C5858 are presented in Appendix D.

2.2.4.3 Well Construction

Prior to well construction, the borehole passed a straightness test. A summary of the well completion for well C5858 is described in Table 2-1.

The surface seal is comprised of Portland cement from ground surface to 9.8 ft bgs. Granular bentonite was placed from 9.8 to 233.2 ft bgs. Coated 0.375-in. bentonite pellets were placed directly above the primary filter pack from 233.2 to 241.0 ft bgs. The primary filter pack, consisting of 10-20 mesh CSS, was placed from 241.0 to 263.4 ft bgs, directly above 0.4 ft of slough in the bottom of the borehole.

The nominal 4-in. diameter permanent casing was placed from 1.39 ft ags to 249.9 ft bgs. A 10 ft, 20-slot screen was placed from 249.9 to 259.9 ft bgs with a 3 ft stainless steel sump placed from 259.9 to 262.9 ft bgs. The 6-in. diameter protective casing was set at 2.4 ft ags.

2.2.4.4 Well Development

Well development was performed on March 10, 2008 in accordance with procedure GRP-EE-01-6.3. The well sustained a pump rate of 20 gpm with only 0.03 ft drawdown and reached a final turbidity of 2.83 NTU. Results of the well development are summarized in Section 4.0.

After well development a final water sample originally scheduled to be taken during drilling was collected. HEIS numbers are available in Appendix D.

A 1 HP Grundfos permanent pump was set with the intake at 258.26 ft bgs on June 2, 2008. Approximately 5 gallons of water were successfully pumped to verify operation.

2.2.5 Well 299-E33-344 (C5859)

Well 299-E33-344 (C5859) is located approximately 10 ft north of B Tank Farm, east of wells 299-E33-343 (C5858) and 299-E33-18 at the coordinates and elevation presented in Table 5-1.

2.2.5.1 Drilling

Drilling of borehole C5859 began December 17, 2007, using a cable tool rig equipped with a drive barrel. The original drilling plan called for the borehole to be drilled 3 ft into the Elephant Mountain basalt, but the decision to complete the borehole before reaching basalt was made after a perched water zone was encountered at approximately 225 ft bgs.

Evidence of possible saturation was first encountered in a split-spoon sample collected from 222.6 to 225.1 ft bgs that returned to the surface covered in mud on January 4, 2008. A second split-spoon driven from 224.5 to 227 ft bgs also came to the surface covered in mud, with the shoe and lower portion of the lowermost liner (Liner 1) saturated. On January 7, 2008, depth to water was measured at 225.32 ft bgs. Since the measured water depth was approximately 25 ft higher than the known regional unconfined water table, it was determined that the water in the borehole represented a perched water zone. The decision was made to continue drilling only until a significant aquitard was reached and to complete the well in the perched zone. Drilling continued to a TD of 242.1 ft bgs, reached on January 16, 2008. It is worth noting that this same perched water zone was not encountered in adjacent well C6226, suggesting that the perched zone encountered at C5859 is very localized. Static water level of the perched zone following well completion was measured April 24, 2008 at 225.06 ft bgs.

The borehole was drilled using temporary 13.5-in. OD threaded casing from ground surface to 100.6 ft bgs and nominal 12-in. diameter threaded casing from 100.6 ft bgs to 242.1 ft bgs. Approximately 100 gallons of water were added to the borehole immediately prior to completion to aid placement of the completion materials and to prevent sand from entering the borehole from below the shoe.

Field RCT surveys detected slight increases in β and γ readings at 65 ft bgs. At 229 ft bgs, RCT surveys reported γ readings of approximately 150 cpm (approximately 100 cpm above background).

2.2.5.2 Sampling

Lithologic archive samples were collected every 5 ft and at changes in lithology; exact depths are available in the borehole log included in Appendix E. Grab samples for chemical analysis were collected every 2.5 ft from 40 to 235 ft bgs. Continuous split-spoon samples were collected at predetermined intervals from 40 to 47.5 ft bgs, 60 to 85 ft bgs, and 187.5 to 237.5 ft bgs. One groundwater sample was collected using a decontaminated 2-ft plastic bailer at 227.5 ft bgs. Collection depths and HEIS numbers for grab, split-spoon, and groundwater samples collected from C5859 are presented in Appendix E.

2.2.5.3 Well Construction

Prior to well construction, the borehole passed a straightness test. A summary of the well completion for well C5859 is described in Table 2-1.

The surface seal is comprised of Portland cement from ground surface to 10.8 ft bgs. Granular bentonite was placed from 10.8 to 206.3 ft bgs. Coated 0.375-in. bentonite pellets were placed directly above the primary filter pack from 206.3 to 209.85 ft bgs. The primary filter pack, consisting of 20-40 mesh CSS, was placed from 209.85 to 237.6 ft bgs. Below the screened interval, 0.375-in. coated bentonite pellets were placed from 237.6 to 242.1 ft bgs.

The nominal 4-in. diameter PVC permanent casing was placed from 1.58 ft ags to 217.9 ft bgs. A 10 ft, 10-slot screen was placed from 217.9 to 237.09 ft bgs PVC end cap placed from 237.09 to 237.39 ft bgs.

The wellhead is completed with 6-in. protective casing set 2.56 ft ags in a 6-in. deep, 4 ft by 4 ft concrete pad, protected by 4-ft tall posts in each corner. The well name and identification number are stamped in a brass marker emplaced on the north side of the monument.

2.2.5.4 Well Development

Due to very low recharge in C5859, no well development was attempted.

A 1 HP Grundfos permanent pump was set with the intake at 232.58 ft bgs on June 6, 2008. Water was successfully pumped to the surface to verify pump operation.

2.2.6 Well 299-E33-345 (C6226)

Well 299-E33-345 (C6226) is located approximately 10 ft north of B Tank Farm, east of wells 299-E33-343 (C5858) and 299-E33-18 and immediately west of well 299-E33-344 (C5859) at the coordinates and elevation presented in Table 5-1.

2.2.6.1 Drilling

Drilling of borehole C6226 began January 24, 2008 as a replacement well for C5859. Borehole C6226 was drilled using a cable tool rig equipped with a drive barrel to drill to the upper surface of the Elephant Mountain basalt at 260.3 ft bgs. To confirm the depth to basalt and provide adequate room for a sump below the aquifer, the borehole was advanced an additional 3.5 ft into the basalt to a TD of 263.8 ft bgs using an 8-in. hard tool. TD was reached February 21, 2008.

The borehole was drilled using temporary 12.75-in. OD welded casing from ground surface to 239 ft bgs and 10.75-in. OD welded casing from 239 to 260.3 ft bgs. All drilling using a drive barrel was completed without the aid of drilling fluid; approximately 650 gallons of water were added while hard tool drilling the basalt and during well construction.

Saturated sediments were first encountered on February 19, 2008 at 254.5 ft bgs. Static water level was measured at 253.68 ft bgs on April 1, 2008. Although elevated moisture was

encountered at the same depth as the saturated interval in C5859, no saturated sediments were encountered during the drilling of C6226.

Field RCT surveys detected contamination of 1200 dpm/100 cm^2 $\beta\gamma$ (approximately twice the background), at approximately 233 ft bgs. Contamination continued at the same level to approximately 245 ft bgs, after which no contamination was detected.

2.2.6.2 Sampling

Lithologic archive samples were collected every 5 ft and at changes in lithology except in intervals where radiological contamination was detected in field surveys; exact depths are available in the borehole log included in Appendix F. Grab samples for chemical analysis were collected every 2.5 ft from 237.5 to 260 ft bgs as a continuation of the sampling originally planned for well C5859. Continuous split-spoon samples were collected at predetermined intervals from 237.5 to 257.5 ft bgs. One groundwater sample was collected using a decontaminated 2-ft bailer at 258 ft bgs. Exact depths and HEIS numbers for grab, split-spoon, and groundwater samples collected from C6226 are presented in Appendix F.

2.2.6.3 Well Construction

Prior to well construction, the borehole passed a straightness test. During well construction, three attempts at placing the permanent casing failed and the broken screen had to be drilled out. The fourth attempt at completion proceeded normally. A summary of the final well completion for well C6226 is described in Table 2-1.

The surface seal is comprised of Portland cement from ground surface to 11.7 ft bgs. Granular bentonite was placed from 11.7 to 244.5 ft bgs. Coated 0.375-in. bentonite pellets were placed directly above the primary filter pack from 244.5 to 245.1 ft bgs. The primary filter pack, consisting of 10-20 mesh CSS, was placed from 245.1 to 262.85 ft bgs.

The nominal 6-in. diameter stainless steel permanent casing was placed from 2.0 ft ags to 249.68 ft bgs. A 10 ft, 20-slot screen was placed from 249.68 to 259.68 ft bgs with a 3 ft stainless steel sump and end cap placed from 259.68 to 262.68 ft bgs. The 6-in. protective casing was set at 2.45 ft ags.

2.2.6.4 Well Development

Initial well development was performed on April 24 and 25, 2008 in accordance with procedure GRP-EE-01-6.3 but resulted in a maximum flow rate of only 1.5 gpm despite various efforts to increase it. Between June 3 and 6, 2008 the well was alternately surged, baled, and pumped to improve water production. A maximum flow rate of 12 gpm was achieved with turbidity measured at 3.39 NTU on June 6, 2008. Results of well development are summarized in Section 4.0.

A 1 HP Grundfos permanent pump was set with the intake at 259.8 ft bgs on June 6, 2008. Approximately 5 gallons of water were successfully pumped to verify operation.

2.2.7 Well 699-52-55B (C5862)

Well 699-52-55B (C5862) is located in the 600 Area south of Gable Mountain and directly north of the 200 East Area, approximately 650 ft south of existing wells 699-53-55A, 699-53-55B, and 699-53-55C. Well C5862 is directly adjacent to well 699-52-55A (C6861), drilled in late 2007 as part of the 200-BP-5 OU RI/FS (DOE/RL-2007-18). Surveyed coordinates and elevation are presented in Table 5-1.

2.2.7.1 Drilling

Drilling of borehole C5862 began June 12, 2008, using a cable tool rig equipped with a drive barrel to drill to the upper surface of the Elephant Mountain basalt at 176.5 ft bgs. From 176.5 to 225 ft bgs, the Elephant Mountain basalt was drilled using an air rotary rig equipped with a down-hole hammer. A cable tool rig equipped with a drive barrel was then used to drill through the Rattlesnake Ridge Interbed to the surface of the Pomona basalt at 286.5 ft bgs. Hard tool methods advanced the borehole an additional 4.5 ft to confirm the depth to basalt. The TD of 292.0 ft bgs was reached August 4, 2008.

The borehole was drilled using temporary 13.5-in. OD threaded casing from ground surface to 60.48 ft bgs, nominal 12-in. threaded casing from 60.48 to 176.32 ft bgs, and nominal 9-in. threaded casing from 176.32 to 283.5 ft bgs. All drilling using a drive barrel was completed without the aid of drilling fluid; approximately 545 gallons of water were added while drilling the Elephant Mountain basalt to aid circulation during the air rotary drilling.

Saturated soils were first encountered in the unconfined aquifer at approximately 173.65 ft bgs on June 23, 2008. Static water level was measured June 24, 2008 at 173.55, after which the upper aquifer was sealed off from the borehole. Sediment saturation levels in the Rattlesnake Ridge Interbed varied while drilling, indicating a more complex semi-confined aquifer than expected. Sediments were saturated over the intervals 233 to 240 ft bgs, 260 to approximately 265 ft bgs, and 280 to 285.5 ft bgs. The final static water level in the completed well was measured on August 22, 2008 at 173.6 ft bgs, approximately 60 ft above the upper confining layer. As described below, the well was screened in the saturated interval from 233 to 240 ft bgs.

Field RCT surveys detected no contamination while drilling borehole C5862.

2.2.7.2 Sampling

Lithologic archive samples were collected every 5 ft and at changes in lithology; exact depths are available in the borehole log included in Appendix G. Grab samples for chemical analysis were collected every 2.5 ft from 225 to 285 ft bgs except in intervals where no recovery was possible. Three split-spoon samples were collected, at 225, 247.5, and 277.5 ft bgs. Three groundwater samples were collected using a submersible pump at 230, 257, and 283 ft bgs. Collection depths and HEIS numbers for grab, split-spoon, and groundwater samples collected from C5862 are presented in Appendix G.

2.2.7.3 Well Construction

Prior to well construction, the borehole passed a straightness test. A summary of the well completion for well C5862 is described in Table 2-1.

The surface seal is comprised of Portland cement from ground surface to 9.3 ft bgs. Granular bentonite was placed from 9.3 to 170.0 ft bgs. Coated 0.375-in. bentonite pellets were placed above the basalt interval to seal the upper unconfined aquifer from the basalt-confined from 170.0 to 176.4 ft bgs. Neat cement grout was placed from 176.4 to 215.8 ft bgs, sealing off the basalt interval. Below the grout seal, 0.375-in. coated bentonite pellets were placed from 215.8 to 216.8 ft bgs. The primary filter pack, consisting of 20-40 mesh CSS, was placed from 216.8 to 250.7 ft bgs. Below the primary filter pack, a 0.375-in. coated bentonite pellet seal was placed from 250.7 to 255.1 ft bgs. Backfill silica sand was placed from 255.1 to 283.3 ft bgs. The 0.375-in. coated bentonite pellets were placed from 283.3 to 292.0 ft bgs.

The nominal 4-in. diameter permanent casing was placed from 0.75 to 228.46 ft bgs. A 15 ft, 10-slot screen was placed from 228.46 to 243.46 ft bgs with a 3 ft stainless steel sump and end cap placed from 243.46 to 246.45 ft bgs.

The wellhead is completed with 14-in. diameter flush mount locking monument placed from ground surface to 1.5 ft bgs. A 6-in. protective casing is set from 0.5 to 2.5 ft bgs. The well name and identification number are stamped in a brass marker set in the locking well head.

2.2.7.4 Well Development

Well development was performed on August 20, 2008 in accordance with procedure GRP-EE-01-6.3. The well was developed with pump rates between 2 and 4 gpm with variable drawdown. The water pumped reached a final turbidity of 3.70 NTU. Results of the well development are summarized in Section 4.0).

A 1 HP Grundfos permanent pump was set with the intake at 240.95 ft bgs on August 22, 2008. Water was successfully pumped to the surface to verify pump operation.

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3.0 GEOLOGY OF 200-BP-5 OPERABLE UNIT

The following section summarizes the general geology in the area of the seven new monitoring wells.

3.1 STRATIGRAPHIC SETTING

The stratigraphy of the northern 200 East Area and 600 Area portion of the 200-BP-5 OU consists of unconsolidated sedimentary deposits that overlie the older Columbia River basalt Group flood basalts and associated sedimentary interbeds. The principal units present in and around the 200-BP-5 OU, from youngest to oldest, are:

- Holocene surficial deposits (primarily anthropogenic and eolian)
- Hanford formation sediments
- Cold Creek Unit (CCU)
- Ringold Formation
- Elephant Mountain Member basalt (Saddle Mountains Basalt, Columbia River Basalt Group)
- Rattlesnake Ridge Interbed (Ellensburg Formation)
- Pomona Member basalt (Saddle Mountains Basalt, Columbia River Basalt Group)

The boreholes drilled in this project encountered all of the stratigraphic units listed above except the Ringold Formation, which is not present in all parts of the 200-BP-5 OU. Five of boreholes were terminated in the Elephant Mountain basalt, while two deep boreholes, C5853 and C5862, were drilled through the Elephant Mountain basalt and Rattlesnake Ridge Interbed into the Pomona basalt.

Holocene deposits on the Hanford Site typically include eolian silts and sands in undisturbed areas and gravel-dominated construction backfill of local origin in disturbed locations.

The Hanford formation is an informal designation used to describe sediments deposited in association with cataclysmic Pleistocene floods from glacial Lake Missoula, pluvial Lake Bonneville, and other ice-margin dammed lakes (PNNL-13024, *RCRA Groundwater Monitoring Plan for Single-Shell Tank Waste Management Area C at the Hanford Site*). The Hanford formation has generally been subdivided into three facies: an upper gravel-dominated unit, a middle sand-dominated unit, and a lower gravel-dominated unit, but classifications and terminology have varied significantly throughout the years of intensive study on the Hanford Site. In the area of Waste Management Area B/BX/BY, the Hanford formation has been

subdivided into three units (PNNL-15955, *Geology Data Package for the Single-Shell Tank Waste Management Areas at the Hanford Site*):

- H1: The youngest and uppermost unit of the Hanford formation. H1 is generally composed of sandy gravel to silty sandy gravel, with lesser amounts of gravelly sand and localized thin (0.5 ft) silt layers. The gravels are multi-lithologic but usually contain a high percentage of basalt. Sand is mostly coarse to very coarse with up to 5% to 7% silt. Samples display no cementation or obvious sedimentary structure.

- H2: Predominantly poorly- to well-sorted, medium- to coarse-grained sand with some silt layers and occasional matrix-supported pebbles, fining with depth. H2 is often described as "salt and pepper sand," due to approximately equal concentrations of basalt and quartz/feldspar. The coarser sand fraction is more basaltic than the finer sand, ranging from 50 to 90% (PNNL-16407, *Geology of the Waste Treatment Plant Seismic*).

- H3: The oldest unit of the Hanford formation. H3 is composed of open-framework gravel sometimes interstratified with sand, with local silt and/or clay horizons. H3 is separable from the undifferentiated Hf/CCU only where the upper silt facies of the CCU is present. In the absence of the upper CCU, the contact between the H3 gravels and the CCU gravels cannot generally be distinguished and is designated 'Hf/CCU' (PNNL-15955).

The Cold Creek Unit is found directly above the Ringold Formation or basalt bedrock and is thought to represent reworked Ringold Formation and/or ancestral Columbia River deposits. It is usually subdivided into two facies, an upper silty sequence up to 30 ft thick and a lower gravelly sequence (PNNL-15955). The upper silty sequence is thought to indicate a longer period of deposition than is consistent with flood deposits, bolstering the argument for distinct designation from the Hanford formation.

The Ringold Formation consists of late-Miocene to mid-Pliocene sand and gravel channel deposits, with overbank sand and silt deposits. The Ringold Formation thins or is absent in parts of the 200 East Area and the 600 Area north toward Gable Mountain. Its absence is attributed to erosion by the Missoula Floods and/or the ancestral Columbia River (RHO-BWI-LD-5, *Geology of Gable Mountain-Gable Butte Area*). No Ringold Formation was encountered in the drilling of the seven boreholes.

The Elephant Mountain Member of the Columbia River Basalt Group is the uppermost basalt unit beneath the 200-BP-5 OU, with an isotopic age of 10 my. The Elephant Mountain Member has a total thickness of approximately 66 to 82 ft in the 200 East Area (PNNL-16407).

The Rattlesnake Ridge interbed is the uppermost unit of the Ellensburg Formation and lies between the overlying Elephant Mountain basalt and underlying Pomona basalt. It is composed of air-fall and reworked tuffaceous sands, silts, and clays and micaceous-arkosic sands derived from the Rocky Mountain terrain (RHO-BWI-ST-14, *Subsurface Geology of the Cold Creek Syncline*; RHO-BWI-LD-5).

The Pomona Member of the Saddle Mountains Basalt has an isotopic age of 12 my and is the older of the two basalt units encountered during drilling. On the Hanford Site, it consists of a single flow with an average thickness of 142 ft. Previously drilled core holes for the Waste Treatment Plant found the upper surface of the Pomona to be extensively brecciated, which was interpreted as evidence of invasion into the lower sedimentary interbed (PNNL-16407).

3.2 BOREHOLE GEOLOGY

This section describes the general geologic characteristics and stratigraphic units (when evident) observed during the drilling of the seven boreholes. Geologic logs were prepared in accordance with FH procedure GRP-EE-01-7.0 and are included in the appendices.

3.2.1 Borehole 299-E33-340 (C5853)

Four major stratigraphic units were encountered while drilling borehole C5853: the Hanford formation, the Elephant Mountain Member of the Saddle Mountains Basalt, the Rattlesnake Ridge Interbed of the Ellensburg Formation, and the Pomona Member of the Saddle Mountains Basalt.

Below approximately 1 ft of drill pad gravels, borehole C5853 extended to 226.1 ft bgs through the Hanford formation. Below the drill pad, sediments recovered consisted of silty sandy gravels to sandy gravels and gravels to approximately 33 ft bgs. From 33 ft to 154.5 ft bgs, sediments were predominantly coarse sands and very fine sandy gravels with small lenses of silt and very fine sand. From 154.5 to 226.1 ft bgs, sediments were predominantly silty sandy gravel with average pebble size increasing from very fine to very coarse in the interval 210 to 226.1 ft bgs.

Elephant Mountain basalt was encountered at 226.1 ft bgs. Basalt cuttings showed an aphanitic texture with little oxidation.

Drilling continued through the basalt and into the Rattlesnake Ridge Interbed, which was encountered at 298.5 ft bgs. The interbed was predominately silty texture from 298.5 - 330 ft bgs. Sand content and grain size increased from 330 to 352.5 ft bgs. Clayey silt texture was encountered from 352.5 to 356 ft bgs.

Pomona basalt was encountered at 356 ft bgs. Basalt cuttings showed oxidation and a vesicular texture. Drilling terminated 2.85 ft into the Elephant Mountain basalt at 358.85 ft bgs.

Static water level was measured at 217.27 ft bgs on October 15, 2008.

The borehole and photographic logs for borehole C5853 are presented in Appendix A.

3.2.2 Borehole 299-E33-341 (C5856)

Units encountered during drilling of 299-E33-341 (C5856) include gravel backfill, the Hanford formation, and the Elephant Mountain basalt. Backfill extends from ground surface to approximately 1 ft bgs for the drill pad. Below the drill pad, sediments recovered consisted of

silty sandy gravel to sandy gravel and gravel to approximately 41.5 ft bgs. From 41.5 ft to 188.5 ft bgs, sediments were predominantly coarse sand and very fine sandy gravel with small lenses of silt and very fine sand. From 188.5 to 232.5 ft bgs, sediments were predominantly silty sandy gravel. The changes in average grain size at 41.5 and 188.5 ft bgs may be indicative of contacts between the H1 and H2 and H2 and undifferentiated Hf/CCU, respectively, but further investigation is advised.

Elephant Mountain basalt was encountered at 232.5 ft bgs. Basalt cuttings recovered from this borehole showed little oxidation and appeared non-vesicular, suggesting that the upper flow top may have been removed by erosional events. Drilling terminated 4.5 ft into the Elephant Mountain basalt at 237 ft bgs.

Static water level was measured at 226.85 ft bgs on June 9, 2008, indicating an aquifer thickness of 5.65 ft at this location.

The borehole and photographic logs for borehole C5856 are presented in Appendix B.

3.2.3 Borehole 299-E33-342 (C5857)

Units encountered during the drilling of 299-E33-342 (C5857) include gravel backfill, the Hanford formation, and the Elephant Mountain basalt. Backfill extends from ground surface to approximately 1 ft bgs. From 1 ft to 189.5 ft bgs sediments consisted of coarse sand and gravelly sand, except for a thin (approximately 5 ft) layer of silty sandy gravel from 10 to 15 ft bgs and a complexly interbedded layer of very fine sand at 115 ft bgs. At 189.5 ft bgs, drilling encountered a sharp contact with moderately cemented silty sandy gravel, which graded into unconsolidated gravel to 1 ft in diameter at 196 ft bgs. From 196 ft bgs to the contact of the basalt at 242.4 ft bgs, the unconsolidated gravel fined gradually to a maximum clast size of fine to medium pebbles.

The upper surface of the Elephant Mountain basalt was encountered at 242.4 ft bgs. Basalt cuttings recovered from the borehole appeared non-vesicular and showed little oxidation, except at approximately 243 ft bgs, where the drilling rate increased and basalt cuttings exhibited small vesicles and oxidation. Drilling terminated 3.1 ft into the Elephant Mountain basalt at 245.5 ft bgs.

Static water level was measured at 236.17 ft bgs on April 22, 2008, indicating an aquifer thickness of 6.23 ft in this location.

The borehole and photographic logs for borehole C5857 are presented in Appendix C.

3.2.4 Borehole 299-E33-343 (C5858)

Units encountered during the drilling of 299-E33-343 (C5858) include gravel backfill, the Hanford formation, and the Elephant Mountain basalt. The upper facies of the CCU may also have been encountered. From ground surface to 37 ft bgs, sediments encountered include predominantly silty sandy gravel, sandy gravel, and gravelly sand, which represent backfill

grading into an unidentified contact with the uppermost Hanford formation. From 37 ft bgs to approximately 193 ft bgs, coarse to fine sand with occasional pebbles predominates. From 193 to 215.5 ft bgs, sediments were relatively uniform silty sand with occasional pebbles. An abrupt contact with compact, faintly laminated silt occurred at 215.5 ft bgs. This silt layer continued with varying thicknesses of interstratified very fine sand and elevated moisture levels to 239 ft bgs. This fine-grained interval may represent the upper overbank facies of the CCU. At 239 ft bgs, a thin layer of strongly calcium carbonate-cemented silty gravel is present. From 240 to 260.9 ft bgs, sediments encountered were gravelly sand and sandy gravel, which reacted weakly to dilute hydrochloric acid (HCl).

The upper surface of the Elephant Mountain basalt was encountered at 260.9 ft bgs. Basalt cuttings recovered from the borehole appeared non-vesicular and showed little oxidation, suggesting that the flow top has been removed. Drilling terminated 2.9 ft into the Elephant Mountain basalt at 263.8 ft bgs.

Static water level was measured at 252.41 ft bgs on March 10, 2008, indicating an aquifer thickness of 8.49 ft in this location.

The borehole and photographic logs for borehole C5858 are presented in Appendix D.

3.2.5 Borehole 299-E33-344 (C5859)

Units encountered during the drilling of 299-E33-344 (C5859) include gravel backfill, the Hanford formation, and possibly the upper facies of the CCU. From ground surface to 40 ft bgs, sediments encountered include predominantly silty sandy gravel, sandy gravel, and gravelly sand, which likely represents backfill material grading into an unidentified contact with the Hanford formation. From 40 to 216 ft bgs, sediments were comprised of coarse sand, with occasional gravelly sand and silty sand from approximately 200 to 216 ft bgs. An abrupt contact with brown silt occurred at 216 ft bgs. This layer may represent the upper facies of the CCU. From 216 to 235 ft bgs, sediments alternated between silt and very fine sand, with moisture levels steadily increasing to saturation at 225.3 ft bgs (January 8, 2008). Drilling terminated at 237 ft bgs, approximately 2 ft into a sandy gravel layer.

As discussed in Section 2.2.5, standing water in borehole C5859 was unexpected at the depth encountered and is interpreted to represent a localized perched zone approximately 8 to 10 ft thick. As a result of encountering perched water, drilling did not continue to the unconfined suprabasalt aquifer and the well was completed in the perched zone.

The borehole and photographic logs for borehole C5859 are presented in Appendix E.

3.2.6 Borehole 299-E33-345 (C6226)

Units encountered during the drilling of 299-E33-345 (C6226) include gravel backfill, the Hanford formation, and the Elephant Mountain basalt. The upper silt facies of the CCU also may be present. From below approximately 1 ft of drill pad, sediments encountered include predominantly sandy and silty sandy gravel to 37 ft bgs. From 37 to 166.4 ft bgs, sediments

were predominantly coarse sand with occasional gravelly or silty sand. From 166.4 to 216.5 ft bgs, sediments were sandy to silty sandy gravel. At 216.5 ft bgs a sharp contact with moist silt was encountered, which continued to 223 ft bgs. From 223 to 245 ft bgs all sediments were fine sand and silty sand with noticeable micaceous content. From 245 to 260.3 ft bgs, sandy gravel predominated.

The upper surface of the Elephant Mountain basalt was encountered at 260.3 ft bgs. Basalt cuttings recovered from the borehole appeared aphanitic and showed no evidence of oxidation from weathering. Drilling terminated 3.5 ft into the Elephant Mountain basalt at 263.8 ft bgs.

Static water level was measured at 253.81 ft bgs on February 21, 2008, indicating an aquifer thickness of 6.49 ft in this location.

The borehole and photographic logs for borehole C6226 are presented in Appendix F.

3.2.7 Borehole 699-52-55B (C5862)

Units encountered during the drilling of 699-52-55B (C5862) include gravel backfill, the Hanford formation, the upper facies of the CCU (unconfirmed), the Elephant Mountain basalt, the Rattlesnake Ridge Interbed, and the Pomona basalt. From ground surface to approximately 144 ft bgs, sediments encountered were predominantly silty sandy- to sandy gravel and gravel, with intermittent zones of gravelly sand and sand. Between 144 and 150 ft bgs, a layer of brown (10YR 4/3) silt interbedded with sandy gravel graded to a layer of silt laminated with very fine sand from 150 to 158 ft bgs. The silt layer showed higher levels of moisture, significant iron staining, and possible casts of organic material. This silt layer may represent the upper facies of the CCU, but further investigation is advised. The silt ended with a sharp contact with sandy gravel/gravelly sand at 158 ft bgs, which continued to the Elephant Mountain basalt at 176.5 ft bgs.

The Elephant Mountain basalt was encountered from 176.5 to approximately 222 ft bgs. The uppermost basalt appeared competent and dark grey (2.5Y 4/1) and continued with little variation evident in drill cuttings until approximately 220 ft bgs, where the drill rate increased and cuttings appeared oxidized and moist. The lower 2 ft of basalt exhibited a shattered, glassy texture with secondary minerals possibly representing a hyaloclastite (PNNL-16407).

The Rattlesnake Ridge Interbed was encountered from approximately 223 ft to approximately 285 ft bgs and consisted of sandy silt, silt, and silty sand. From 223 to approximately 250 ft bgs, all sediment appeared to be tuffaceous or reworked tuffaceous material. From approximately 250 to 285 ft bgs, sediments appeared tuffaceous to arkosic and contained prominent mica grains.

The Pomona basalt was encountered at approximately 285 ft bgs. The upper 2 to 3 ft of Pomona basalt appeared brecciated with a silty cemented matrix surrounding highly oxidized scoriaceous basalt clasts. Drilling terminated approximately 7 ft into the Pomona basalt at 292.0 ft bgs.

Water was initially encountered on June 23, 2008 at approximately 173.5 ft bgs, 3.0 ft above the Elephant Mountain basalt. Static water level was measured at 173.55 ft bgs on June 24 2008, indicating a suprabasalt unconfined aquifer thickness of 2.95 ft in this location.

After drilling through the Elephant Mountain basalt, water was encountered in the Rattlesnake Ridge Interbed at 233 ft bgs on July 14, 2008. The Rattlesnake Ridge Interbed did not appear to be uniformly saturated while drilling and may represent semi-confined aquifer conditions. When completed in the basalt-confined aquifer, the potentiometric water surface was measured at 173.6 ft bgs (August 22, 2008), approximately 60 ft above the upper confining layer.

The borehole and photographic logs for borehole C5862 are presented in Appendix G.

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4.0 WELL DEVELOPMENT

Each well was developed in two stages. Initial well development consisted of surging the filter pack with a dual-flange surge block during well completion to settle the filter pack around the well screen and begin to extract fines produced during drilling. Following well completion, each well was pumped using a temporary submersible pump until turbidity declined to less than 5 NTU and water quality parameters (conductivity, pH and temperature) stabilized according to the well development procedure GRP-EE-01-6.3.

In addition to the two standard stages of development, well C6226 underwent more extensive development, including a second stage of surging and recirculation of added water to attempt to improve water yield.

During these development pumping tests, the water level in the pumping well was monitored using a pressure transducer or electronic probe. Final field water quality data is summarized in Table 4-1.

Table 4-1. Well Development Data Summary

Well Name/ Well ID	Static Water Level (ft bgs)	Date	Intake Depth (ft bgs)	Pumping Duration (minutes)	Final Turbidity (NTU)	Final Conductivity	Final Temp (°C)	Average Flow Rate (gpm)	Final Drawdown (ft)	Total Gallons Pumped
299-E33-340 /C5853	218.59	7/30/08	322.79	255	4.95	0.860 ms/cm	22.4	80 min @10 gpm 175 min @12 gpm	61.0	2900
	217.40	10/14/08	316.65	184	4.13	0.321 ms/cm	20.6	87 min @12 gpm 47 min @2.5 gpm 50 min @ 4.1 gpm	17.52	987
299-E33-341 /C5856	226.85	6/9/08	233.45	45	0.71	3.05 ms/cm	17.8	27 gpm	0.17	1227
299-E33-342 /C5857	236.12	6/9/08	240.5	64	0.56	2.46ms/cm	20.7	47 min @ 27 gpm 17 min @ 31.5 gpm	0.05	1804.5
299-E33-343 /C5858	252.14	3/10/08	261.22	56	2.83	947µS/cm	18.2	41 min @ 14 gpm 15 min @ 20 gpm	0.017	847
299-E33-344 /C5859*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
699-52-55B /C5862	173.6	8/22/08	242.1	465	3.70	566 µS/cm	23.5	165 min @ 4 gpm 150 min @ 2 gpm 90 min @ 3 gpm	37.65 (variable)	960
699-E33-345 /C6226	254	6/6/08	263.5	349	3.39	1353µS/cm	17.8	79 min. @ 14 gpm 138 min @ 16 gpm 132 min @ 12 gpm	>5.0	4898

otes:

*No development of well C5859 was performed due to low recharge
bgs = below ground surface
gpm = gallons per minute
NA = not available
NTU = nephelometric turbidity unit

5.0 CIVIL SURVEY

The well locations were surveyed in accordance with procedure GRP-EE-01-1.6 ("Survey Requirements and Techniques"). Vertical survey data were recorded using *North American Vertical Datum of 1988* (NAVD88) and the horizontal coordinates were recorded using the Washington State Plane (South Zone) *North American Datum of 1983* (NAD83), with the 1991 adjustment for horizontal coordinates. Surveyed locations of the boreholes are presented in Table 5-1. The reports are located in the appendices.

Table 5-1. Well Location Summary.

Well Name	Well ID	Drilling Dates		Northing[a] (m)	Easting[a] (m)	Ground Surface Elevation[b] (Brass Cap) (m)	Total Depth (ft bgs)
		Start	Finish				
299-E33-340	C5853	4/9/08	10/13/08	137763.84	573779.64	188.340	358.85
299-E33-341	C5856	4/28/08	6/9/08	137652.50	573565.21	191.254	237.0
299-E33-342	C5857	3/12/08	4/23/08	137579.96	573625.68	194.135	245.5
299-E33-343	C5858	1/15/08	3/10/08	137382.25	573743.98	198.823	263.8
299-E33-344	C5859	12/17/07	1/23/08	137387.31	573782.91	199.139	242.1
699-52-55B	C5862	6/11/08	8/21/08	139440.66	573102.17	174.854	292.0
299-E33-345	C6226	1/24/08	4/3/08	137388.24	573780.87	199.095	263.8

Notes:

[a] Northing and easting coordinates are based on Washington State Plane Coordinates *North American Datum of 1983* (NAD83) rounded to 1 m.

[b] *North American Vertical Datum of 1988* (NAVD88) values rounded to 0.001 m.

bgs = below ground surface

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6.0 WASTE MANAGEMENT

Waste generated during drilling and construction of the seven monitoring wells was managed using the strategy documented in the *Waste Control Plan for the 200-BP-5 Operable Unit* (DOE/RL-2003-30). Generated waste includes drill cuttings, purgewater, decontamination water, and miscellaneous solid waste. A data quality objective summary report (SGW-35168, *Data Quality Objectives Summary Report for the Installation of Six Groundwater Monitoring Wells in the 200-BP-5 Operating Unit*) was prepared to define waste characterization requirements using historical analytical data and process knowledge.

6.1 VADOSE ZONE CUTTINGS

All vadose zone drill cuttings (i.e., soils) from boreholes C5856, C5857, C5858, C5859, and C6226 were contained in 55-gallon drums because of the potential for contamination associated with their proximity to B-BX-BY Tank Farms. These drums will be transferred to and disposed of at the Environmental Restoration Disposal Facility according to a disposal profile developed from the results of sampling and chemical analysis, a process which generally takes several months to complete. As of the preparation of this document, drums associated with the vadose monitoring wells were being stored at a waste container storage area established behind B Tank Farm. Drums segregated in a radioactive materials area established while drilling remain at the drills sites but will be disposed of under the same disposal profile.

Vadose zone drill cuttings from boreholes C5853 and C5862 were not expected to be contaminated due to their distance from potential contamination sources and were stockpiled on plastic sheeting to be spread near the well after well completion. After well completion, cuttings were spread to the ground in the vicinity of the well in accordance with procedure GRP-EE-02-14.5 ("Returning Vadose Zone Drill Cuttings/Soils to the Environment").

6.2 SATURATED ZONE CUTTINGS

All drill cuttings collected at or deeper than the local historic high water table were contained in 55-gallon drums. Free liquid from the contained saturated sediments was transferred by pumping to a purge water truck and managed as purgewater (Section 6.3) or mixed with a dewatering agent prior to sealing of the drums. All saturated drill cuttings (after decanting) will be profiled and transferred to the Environmental Restoration Disposal Facility for disposal following the procedure described above. As of the preparation of this document, saturated zone drums were being stored with drums produced in the vadose zone at the waste container storage area adjacent to B Tank Farm. Drums segregated in the radioactive materials area while drilling remained at the drill sites as of the preparation of this document.

6.3 PURGEWATER

Purgewater was generated during drilling below the water table and during the well construction activities. All purgewater was contained on site in a purgewater truck or poly tank and at the

completion of the well construction activities, was transported to the Purgewater Storage and Treatment Facility.

7.0 WELL ACCEPTANCE

Well acceptance is the final step in the well construction process and represents confirmation of meeting requirements of the work scope. Well acceptance also serves as the contractual completion of the finished product.

Representatives from the drilling contractor (BlueStar Enterprises North West), FH and Freestone Environmental Services, Inc. conducted an acceptance inspection of the well site and reviewed the well drilling and completion documentation. The walk-down inspections for wells C5856, C5857, C5858, C5859, and C6226 were conducted on June 18, 2008. Walk-down inspections for wells C5862 and C5853 were conducted on September 4, 2008 and October 20, 2008, respectively. Final well acceptance was documented by completion of a checklist and signatures from representatives of the drilling contractor and FH. Surveillance QA-EQA-SGRP-SURV-09-009 was issued documenting the acceptance of these seven wells.

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8.0 REFERENCES

Comprehensive Environmental Response, Compensation, and Liability Act of 1980, Public Law 96-150, 94 Stat. 2767, 42 USC 9601 et seq.

DOE/RL-2007-18, 2007, *Remedial Investigation/Feasibility Study Work Plan for the 200-BP-5 Groundwater Operable Unit, Hanford Site, Richland, Washington,* Draft A, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-2003-30, 2004, *Waste Control Plan for the 200-BP-5 Operable Unit,* Rev. 2, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

Groundwater Protection Program Procedures, Fluor Hanford, Inc., Richland, Washington:

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GRP-EE-01-6.3, "Well Development and Testing"

GRP-EE-01-7.0, "Geologic Logging"

GRP-EE-02-14.1, "Drilling, Remediating, and Decommissioning Resource Protection Wells and Geotechnical Borings"

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NAD83, 1991, *North American Datum of 1983,* National Geodetic Survey, Federal Geodetic Control Committee, Silver Springs, Maryland, as revised.

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PNNL-13024, 2001, *RCRA Groundwater Monitoring Plan for Single-Shell Tank Waste Management Area C at the Hanford Site,* Pacific Northwest National Laboratory, Richland, Washington.

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RHO-BWI-ST-14, 1981, *Subsurface Geology of the Cold Creek Syncline,* Rockwell Hanford Operations, Richland, Washington.

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WMP-28945, 2006, *Data Quality Objectives Summary Report in Support of the 200-BP-5 Groundwater Operable Unit Remedial Investigation/Feasibility Study Process*, Rev. 0, Fluor Hanford, Inc. Richland, Washington.

APPENDIX A

Well Documentation for 299-E33-340 (C5853)

Borehole Log

Photographic Log

Well Summary Sheet

Well Construction Summary Report

Well Development and Testing Data

Well Survey

Sample Depths and HEIS Numbers

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BOREHOLE LOG

Page 1 of 10
Date: 4/9/08

Well ID: C5853 | Well Name: 299-E33-340 | Location: ⊥ Baltimore & 12th

Project: 200 - BP-5 RI/FS | Reference Measuring Point: Ground

Depth (FL)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description (Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl)	Comments (Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level)
0				0-1' - Fill	Cable Tool Drilling, 10 3/4
				1'-3' - Sand: F-VF, 90% qtz, Angular,	inch Casing, Drive
2	Grab			wk Rxn HCl, Slightly moist, 10 yr 4/4	barrel
				Dk yellowish brown	- Archive Samples
					Collected Every 5'
5	Grab			5'-Silty Sandy gravel (msG): 60% gvl, 30%	5' Suspect cobbles
				Snd, 10% silt; gvl: 50% basalt 50% qtz, 2mm-15cm	>25cm
				(VFP-LC), R-SR; Snd: Predom M-VC, 70% qtz	
				30% basalt, A; Silt 10yr 4/3 brown, Slightly	
				moist, Ustr Rxn HCl	
10	Grab			7.5'-Silty Sandy Gravel (msG): 40% gvl	
				40% Snd, 20% Silt; Gvl: 80% basalt, 20% qtz,	10' - gvls Predom med.
				7cm-2mm (sc-VFP), R-SR; Snd: Predom F-	pebble
				VF, 80% qtz 20% basalt, A; Silt: Dry 2.5y	
				5/2, grayish brown, str Rxn HCl	
15	Grab			13'-Silty Sandy Gravel (msG): 50% gvl 40%	
				Snd, 10% silt; gvl: 80% basalt, 20% qtz, 10cm	
				2mm (sc-VFP), R; Snd: Predom M-VF, 70%	
18	Grab			qtz 30% basalt, A; Silt: Dry 10yr 4/2 Dk	
				grayish brown, str Rxn HCl	
20	Grab			18'-Gravelly Sand (gs): 80% Snd 20% gvl; gvl:	
				60% basalt 40% qtz, VFP-SC (2mm-7cm), R-SR;	
				Snd: VC-VF, A, 50% basalt, 50% qtz; Dry, 10yr	
22.5	Grab			4/2 dk grayish brown, wk Rxn HCl	22.5' - Rust red staining
				22.5'-Sandy Gravel (SG): 70% gvl 30% snd; gvl:	present, noticable
25	Grab			2mm-15cm (VFP-mp) 90% basalt 10% qtz, R-SR;	amounts of Mica
				Snd: VF-VC, Predom M-C, 50% basalt, 50% qtz,	
				Slightly moist, 2.5y 3/2 Dk brown, wk Rxn HCl,	25' gvls to 5cm
				25'-Sandy Gravel (SG) - lithology same	
				as above, gvls to 40%, Snds to 60%	
30	Grab			28'-Sandy Gravel (sG) 50% gvl 50% snd;	
				Gvl: 2mm-6cm (VFP-VCP) 80% basalt 20% qtz, R-	
				SR, gvls Predom "Pea Sized"; Snd: VF-VC,	
33	Grab			Predom M-VC, 70% basalt 30% qtz, A, Dry,	
				2.5y 4/2 Dk grayish brown, V wk Rxn HCl	33' DR ↑
35	Grab			33'-Sand (S): 60% qtz 40% basalt, VF-	
				C, A, Slightly moist, 10YR 4/3, Mod Rxn	
				HCl	
				35'-Sand (s) - lithology same as	
				above	

Reported By: J. Fathers | Reviewed By: L.D. Walker

Title: Geologist | Title: Geologist

Signature: J. Fathers | Date: 4/10/08 | Signature: L.D. Walker | Date: 10/24/08

A-6003-642 (03/03)

BOREHOLE LOG

Page 2 of 10
Date: 4/10/08

Well ID: C5853 | Well Name: 299-E33-340 | Location: ⊥ Baltimore & 12th

Project: 200-BP-5 RI/FS | Reference Measuring Point: Ground

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description (Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl)	Comments (Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level)
40	grab			40'- Sand (s): lithology same as above	Cable tool with drive barrel
					- 1 pint grab samples for archive collected at 5-ft intervals
45	grab			45'- Sand (s): lithology same as above	
50	grab			50'- Sand (s): 80% qtz 20% basalt c-vf, Predom c-m, mod. Rxn HCl, Dry-Slightly moist, 10yr 4/3 Brown notable amounts of mica	
55	grab			55'- Sand (s): lithology same as above	
					58' ↑ Fine sand Fraction
60	grab			60'- Sand (s): 80% qtz 20% basalt, predom c-f grained, Dry, wk rxn HCl, 10yr 4/3 brown, notable amounts of mica	
65	grab			65'- Sand (s): lithology same as above	
70	grab			70'- Sand (s): lithology same as above, basalt to 30%, qtz 70%	
75	grab			75'- Sand (s): 40% basalt 60% qtz, predom m-c, wk Rxn HCl, 10yr 4/3 brown, Dry, Few "pea" sized pebbles noted < 5%	

Reported By: J Fetters | Reviewed By: L.D. Walker

Title: geologist | Title: Geologist

Signature: J Fetters | Date: 4/9/08 | Signature: LD Walker | Date: 10/24/08

A-6003-842 (03/03)

BOREHOLE LOG

Page 3 of 10
Date 4/11/08

Well ID: C5853 | Well Name: 299-E33-340 | Location: ⊥ Baltimore + 12th

Project: 200-BP-5 RI/FS | Reference Measuring Point: Ground

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
80	grab			80'- Sand (s): VF-C (Predom M-UF), A 70% qtz 30% basalt, Dry, 10YR 5/2 grayish brown, wk Rxn HCl	Cable Tool Drilling, 10 3/4" Casing (threaded)/Drive barrel
					Archive sample Every 5'
85	grab			85'-Silty Sand (mS): 80% snd 15% silt 5% gvl: gvl: Fp-UFp (2-8mm), basalt, SA; Snd: 70% qtz 30% basalt C-UF (Predom M-UF), A; Silt: Dry, 2.5Y 4/3 olive brown, Mod Rxn HCl	83' Silt % ↑ 86' Silt % ↓, cuttings not staying in barrel
90	grab			90'- Sand (s): 90% snd 5% gvl 5% silt; gvl: Fp-UFp, basalt, SA-SR; Snd: 70% qtz 30% basalt, UC-UF (Predom M-UF) A; Silt: lithology same as above w/ wk Rxn HCl	
95	grab			95'-Silty Sand (mS) 70% snd 30% Silt; Snd: 70% basalt 30% qtz, Predom M-UF, A; Silt: Dry, 10YR 5/3 brown, Str rxn HCl, Fine particles <5mm w/ orangish red staining, no pebbles as seen above	
97.5	grab			97.5'- Sand(s) 90% qtz 10% basalt, VF, A, Slightly moist, 5Y 5/3 olive, Mod rxn HCl	98' "salt + pepper" sand
100	grab			98'- Sand(s) - 80% snd 10% gvl 10% silt; UC-UF, A, 50% basalt 50% qtz; gvl: Fp-UFp (2-8mm), A, 90% basalt 10% qtz, Silt: Dry 10YR 5/2 grayish brown, Mod Rxn HCl	
105	GRAB			105' silty Sand (mS) 80% sand 15% silt 5% gravel Gravel - VFP-FP, A-SA, 70% basalt 30% other, Sand VFS-VCS, predom FS-CS, 50% basalt, 50% qtz, felsic, lt. gray 10YR 7/1, dry, mod rxn HCl	
110	GRAB			110' silty Sand (mS) 85% sand 15% silt trace gravel, Sand VFS-VCS, predom FS-CS, 70% qtz felsic 30% basalt, A-SA, trace mica, dry, lt gray 10YR 7/2, strong rxn HCl	
115	GRAB			115' Sand (s) 90% sand, 5% gravel, 5% silt - gravel VFP-FP 30% basalt 5% other, Sand VFS-VCS, predom MS-CS, 80% qtz, felsic 20% basalt, trace mica, A-SA, dry lt. gray 10YR 7/2, strong rxn HCl	

Reported By: J. Fetters / S.P. Aiken-Art | Reviewed By: L.D. Walker

Title: geologist / GEOLOGIST | Title: Geologist

Signature: [signature] / [signature] Date: 4.14.08 | Signature: [signature] Date: 10/24/08

A-6003-642 (03/03)

BOREHOLE LOG

Page 4 of 10
Date: 4/14/08

Well ID: C5853 | Well Name: 299-E33-340 | Location: 1 Baltimore & 12th

Project: 200-BP-5 OU Remedial Investigation | Reference Measuring Point: Ground Surface

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
120	GRAB			120' - sand (S) - 95% sand, 5% gravel, 2% silt, gravel VPP-FP 50% basalt 30% quartz, sand, VFS-VCS, predom MS-CS, 80% qtz. felsic, 20% basalt, trace mica, A-SA, dry, lt. gray 10YR 7/1, strong rxn HCl.	Cable tool with drive barrel 1-pint grab samples for archive collected at 5-Ft intervals
125	GRAB			125' - Sand (S) - as above	
				130' - Sand (S) - 90% sand 10% silt, sand VFS-VCS, predom FS-MS, 90% qtz, felsic, 10% basalt, A-SA, pale brown 10YR 6/3, strong rxn HCl.	> silt fraction
130	GRAB				Moist silt contact @ 131'
				131' sandy Silt (SM) - 30% VFS 70% silt, brown 10YR 5/3, strong rxn HCl, moist - not saturated.	Casing driving hard through silt - bouncing.
135	Grab			134' - Sand (S): 90% Sand 10% silt, VC-VF, Predom VF-M, 80% qtz 20% basalt, A, Dry, 10YR 5/3 brown, wk-mod rxn HCl	137' - Casing driving hard
136	Grab			136' - Silty Sand (mS): 60% sand 40% silt; Sand: 90% qtz 10% basalt, VF-F (predom VF), A; Silt: Dry, 10YR 6/2 lt. brownish gray, Mod Rxn HCl	Cuttings not staying in Drive barrel
140	grab			140' Sand (S): 80% qtz 20% basalt, VF-VC, Predom M-VF, A, Dry, 10YR 5/2 grayish brown, mod rxn HCl, <5% Fp-VFp noted, basalt, Ang.	
145	Grab			145' - Silty Sand (mS) 60% sand 40% silt; Sand: Predom VF-F, A, 80% qtz 20% basalt; Silt: Dry, 10YR 6/2 lt. brownish gray, mod Rxn HCl	148' casing Driving hard
150	Grab			150' - Sand (S): M-VF, Predom F-VF, A, 80% qtz 20% basalt, wk-Mod Rxn HCl, Dry, 10YR 5/2 grayish brown	
155	Grab			154.5' - Sandy gravel (SG) 40% gvl 50% sand 10% silt; gvl: 80% basalt 20% qtz, 5cm-2mm Predom Fp-VFp, R-SR; Sand: 70% qtz 30% basalt, A, VC-VF (Predom M-VF); Silt: Dry, 10YR 4/2 Dk grayish brown, wk Rxn HCl	

Reported By: S.P. Airhart / J Fethers | Reviewed By: L.D. Walker

Title: Geologist / geologist | Title: Geologist

Signature: SPAirhart / J Fethers | Date: 4.14.08 | Signature: LD Walker | Date: 10/24/08

A-8003-642 (03/03)

BOREHOLE LOG

Page 5 of 10
Date: 4/16/08

Well ID: C5853 | Well Name: 299-E33-340 | Location: ⊥ Baltimore + 12th

Project: 200-BP-5 RI/FS | Reference Measuring Point: Ground

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
160	Grab			160' - Sandy gravel(gS): lithology same as above, gvls up to 8cm	Cable tool drilling, 10 3/4" threaded casing, drive barrel
				165' - gravelly silty sand (gmS): 30% gvl 20% silt 50% sand; gvl: 2mm-6cm (VFP-VCP) (Predom FP-MP) 80% basalt 20% qtz, SR-SA; sand: VC-VF, Predom M-VF, A, 80% qtz 20% basalt; silt: Dry, mod Rxn HCl, 10yr 5/2 grayish brown	Archive samples collected every 5'
165	grab				
170	Grab			170' Sand (s): 85% sand, 10% silt, 5% gvl; gvl: 50% basalt 50% qtz, R-SR, 2mm-4cm, VFP-VCP; sand: VC-VF (Predom M-VF), 70% qtz 30% basalt; silt: Dry, 2.5y 5/2, grayish brown, mod Rxn HCl	
175	Grab			175' - Silty Sand (mS): 75% sand 20% silt, 5% gvl; lithologys same as above, SAR Rxn HCl	
176	grab			176' - Sand (s): 85% sand 10% gvl 5% silt; gvl: 2mm-3cm, 90% basalt 10% qtz, R-SA; VC-VF, Predom C-M, 80% qtz 20% basalt, A; silt: Dry, 2.5y 5/2 grayish brown, mod Rxn HCl	176' gvls >5cm noted
180	Grab			180' - Sand (s): 80% sand, 10% gvl, 10% silt, lithologys same as above	
182	grab			182' gravelly sand (gS) 50% sand 40% gvl; gvl: 2mm-4cm, R-SR, 90% basalt 10% qtz; sand: VC-VF (Predom) C-M, 60% qtz 40% basalt, Dry, 2.5y 4/1, Dk grayish brown, mod Rxn HCl, A	
185				182.5' - Sand (s): VC-VF (Predom VC-C) 60% basalt 40% qtz, Dry, 2.5y 4/2 Dk grayish brown wk Rxn HCl; 5% gvl; 90% basalt 10% qtz 5cm 2mm, R-SR	185' Lobbles > 20cm noted
					186' ↑ gvl
190				184' - gravelly silty sand (gmS): 60% sand 10% gvl 30% silt; gvl: Predom 2mm-1cm, 50% basalt, 50% qtz, SR-R; sand: VF-VC, 80% qtz, 20% basalt, A, silt: Dry, 2.5y 5/2 grayish brown, str Rxn	~~60% sand 1~~
195				190' Gravelly sand (gS): 70% sand 25% gvl 5% silt; gvl: 2mm-7cm, A-R, 80% basalt 20% qtz; sand: VC-VF, 60% qtz, 40% basalt, A; silt: 2.5y 5/2, wk Rxn HCl	196'-199 ↑ gvls up to 8cm
				194' - Sand (s) 90% sand 10% gvl; gvl: basalt, VFP-MP, A sand: 70% qtz 30% basalt, VC-VF, Dry, 2.5y 4/2 Dk grayish brown wk Rxn HCl	

Reported By: J Fetter | Reviewed By: L.D. Walker

Title: geologist | Title: Geologist

Signature: [signature] Date: 4/18/08 | Signature: [signature] Date: 10/24/08

A-8003-842 (03/03)

BOREHOLE LOG

Page 6 of 10
Date: 4/18/08

Well ID: C5853 | Well Name: 299-E33-340 | Location: ⊥ Baltimore + 12th

Project: 200 - BP-5 RI/FS | Reference Measuring Point: Ground

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
200	Grab			200'- Sand (S): 90% Sand 10% gvl; gvl: Predom VFP-MP basalt, Angular; Sand: 60% basalt 40% qzt, VC-VF predom VC-C, A, Dry, 10yr 4/2, Dk grayish brown, no Rxn HCl	Cable Tool Drilling, 10¾" threaded casing, Drive barrel
					Archive Samples Collected Every 5'
205	Grab			205'- Sand (s): lithology same as above.	
210	Grab			210'- Silty Sand (mS) 80% sand 15% silt + 5% gvl gvl: 2-8mm, basalt, A; Sand: Predom M-VF, 50% basalt 50% qtz, A; Silt: Dry, 2.5Y 5/2 grayish brown, mod Rxn HCl	210.5'- Cobbles to 12cm
211	Grab			211'- Silty Sandy gravel (msG) 60% gvl 20% silt 20% sand; gvl: 12cm-2mm, 50% basalt 50% qtz, R-SR; Sand: lithology same as above; Silt: moist 2.5Y 4/3 olive brown, wk Rxn HCl	211 - Silt moist
215	Grab			215'- Silty Sandy Gravel (msG): lithology same as above, Dry, wk Rxn HCl, 2.5Y 4/2 Dk grayish brown	
220				220'- Gravel (g) 80% gvl 10% sand 10% silt; gvl: 60% basalt 40% qzt, Predom 8cm-2mm, R-SR; Sand: 80% basalt, 20% qzt, VC, A; Silt: wet, no Rxn HCl, 2.5Y 4/2 Dk grayish brown	220 - gvls > 20 cm noted
225				225'- Gravel (G): lithology same as above, gvls predom 1-4 cm	
				226.1'- Basalt - Elephant Mountain Member, 2.5Y 3/1 Vdk greenish grey, glassy, No vesicals or oxidized surfaces	226.1' Elephant Mountain basalt, Drilling Rate ↓ = 2'/day w/ 9" hand tool
230				230' Basalt, same as above	
					~~Pint Jar~~ Pint Jars not Filled due to poor cutting return, only Chip trays Filled
235				235' Basalt, same as above	

Reported By: J. Fetters | Reviewed By: L.D. Walker

Title: geologist | Title: Geologist

Signature: [signature] Date: 5/6/08 | Signature: [signature] Date: 1/24/08

A-6003-842 (03/03)

BOREHOLE LOG

Page 7 of 10
Date: 5/6/08

Well ID: C5853 | Well Name: 299-E33-340 | Location: ⊥ Baltimore + 12th

Project: 200-BP-5 RI/FS | Reference Measuring Point: Ground

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
240	Grab			240' - Basalt - Same as above, occ. cuttings w/ rounded Edges + Quartz/others material, drilling mud very thin, Poor Seal around Shoe?	Cable Tool Drilling, 9" hardtool, 10 3/4" casing
245	grab			245' - Basalt - Same as above	244.5' - 9" button bit installed. DR + ≈ .5'/day
250	grab			250' - Basalt - Aphanitic, 3/4, grey, very dark gray, 70% basalt 30% qzt/others	*No pinte Jar archive samples collected due to poor cutting returns only chip trays Filled 24.5' Drilling mud very thin, water entering hole around shoe.
255	grab			255' - Basalt: Same as above qzt/others + <10%	250': qzt/others added by driller @ 248' logs in Effort to straighten bore hole 255-270' Cuttings dry
260	grab			260' - Basalt - Same as above, no qzt/others: Basalt is brittle	Drill reports basalt is "medium hardness"
265	grab			265' - Basalt - Same as above	*248.5': begin air rotary drilling w/ 9 1/4" down hole hammer
270	grab			270' - Basalt - Same as above	
275	grab			275' - Basalt - Same as above	Cuttings moist

Reported By: J Fetters | Reviewed By: L.D. Walker

Title: geologist | Title: Geologist

Signature: [signature] | Date: 6/12/08 | Signature: [signature] | Date: 10/24/08

A-6003-642 (03/03)

BOREHOLE LOG

Page 8 of 10
Date: 6/12/08

Well ID: C5853 | Well Name: 299-E33-340 | Location: ⊥ Baltimore and 12th

Project: 200-BP-5 RI/FS | Reference Measuring Point: Ground

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
280	grab			280'- Basalt - Same as above	Air Rotary, drilling 9 1/4" Downhole hammer through basalt
285	grab			285'- Basalt - Same as above	285' archive sample
290	grab			290'- Basalt - Same as above	290' archive sample
295	grab			295'- Basalt - Same as above	295' archive sample, Driller reports basalt is soft, possibly fractured.
				298.5'- contact with interbed	Thinks interbed is close
300	grab			300'- Basalt - same as above. ↑ qtz/other <20% clay nodules, 10% 6GEY 1 4/10 G Y dark greenish grey → 2.5Y 5/4 light olive brown, very fine sand, 10% glassy, 90% qtz other, no rxn w/ HCl, SA, 6GEY 2 6/10 G greenish grey → 2.5Y 8/3 pale yellow, small amt. of rusty red color (oxidized?)	Drilling ↑ possible contact w/ Rattlesnake Interbed. At 300' began drilling with water. 300' archive sample (air rotary)
	ss	82/100%			
305	grab, grab, water sample			304.5- Hyaloclastite, yellow palagonite formed matrix around silt	304.5 archive: Lithology change. From split spoon
	grab			305'- Silt (M) moist, 10YR 6/3 brown, no rxn w/ HCl	307: archive sample; 307: Begin hard tool - cable tool
310	grab			307'- Silt (M): 80% silt 20% sand. Sand: 90% basalt 10% qtz/other, M-C grain, SA. Silt: Saturated, 5Y 5/1 grey	307-330 cuttings removed by bailer; 310' archive sample
	grab			310'- Silt (M) same as above	
315	grab			315'- Same as above ↓ sand	315' archive sample
	grab				

Reported By: Kim Poya | Reviewed By: L.D. Walker

Title: Geologist | Title: Geologist

Signature: Kim Poya | Date: 6/12/08 | Signature: LD Walker | Date: 10/24/08

A-6003-642 (03/03)

BOREHOLE LOG

Page 9 of 10
Date: 7/14/08

Well ID: C5853 | Well Name: 299-E33-346 | Location: ⊥ Baltimore and 12th

Project: 200-BP-5 | Reference Measuring Point: Ground

Depth (FT)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
320	grab			320'-Silt(M): 90% silt 10% sand. Sand:	320' archive sample
				90% basalt 10% qtz/other f→vf, ocnl c-vc	319.5' grab not taken
	grab			qtz/other, SR. Silt; saturated, 5Y 6/2	
				light olive grey	-Cable tool drilling-
					326-328.6' unsuccessful
					Split spoon
325	grab			325-Silt(M): 80% silt 20% sand.	325' archive sample
	SS	16/0		Sand, grain size ↑ vf-vc, Avg=C, ocnl	325' grab not taken
				Sub grain, SA→A. Silt: 5Y 5/2 olive grey	327.5' grab not taken
	SS	38/0			328.6-331 unsuccessful
					Split spoon
330	grab			330' 7-14-08 Sandy Silt (SM) Same as above	330' archive sample
	grab water sample			↑ Sand, M. grain size	
	grab				
335	grab			335'-Silty sand (mS) 50% silt	Begin collecting
				50% sand. Sand: 95% qtz/other 5% basalt	samples using
				VF-VC, Avg=C, ocnl 6-10mm SA pebble.	Split spoons
	grab			SR-SA. Silt: moist, 2.5Y 5/2	Drilling ↓
				grayish brown. Some mica present, no	335' archive sample
340	grab			rxn w/HCl	337.5' archive sample
				337.5' Silty Sand same as above	338.4' archive, lithologic
				↓silt ↓ moisture	change
	grab			338.4'-Sandy Silt(SM) 80% silt 20% sand	340' archive sample
				Sand: 100% qtz/other, vf→vc Avg=C, ocnl VF	
345	grab			pebble; Angular, Silt: Slightly moist, 7.5YR 4/3	
				brown, no rxn w/HCl, Some clay nodules, very	
				densely packed	
	SS	39/25%		340'-Sandy Silt (SM) Same as above,	
				not densely ~~packed~~ KR 7-14-08 compacted	345' archive sample
350	grab SS/grab grab	42.6/100%		345'-Sandy Silt (SM): 80% silt 20% sand.	Drilling ↓
				Sand: 100% qtz/other, vf→vc, avg=m, angular	
	grab			Some ocnl vf black sand. Silt: moist, 10YR 6/4	
				light Yellowish brown, no rxn w/HCl, larger	
				clayey nodules, 5-15mm	
355	grab			350'-Same as above	350' archive sample
				352.5' KR 7-14-08 Silt/clay - 90% silt 10% sand. Sand:	355' archive sample
	grab			100% qtz/other, vf-vc, SA, Avg=vf, ocnl VC Angular	352.5' archive sample
				sand→vf Angular pebble. Silt: slightly moist	356.5' archive sample
	grab			10YR 5/4-Yellowish brown, no rxn w/HCl, rust color stains	Begin hard tool

Reported By: Kim Royal | Reviewed By: L.D. Walker

Title: Geologist | Title: Geologist

Signature: Kim Royal | Date: 7/14/08 | Signature: LD Walker | Date: 10/24/08

A-6003-642 (03/03)

BOREHOLE LOG

Page 10 of 10
Date: 7/21/08

Well ID: C5853 | Well Name: 299-E33-340 | Location: ⊥ Baltimore & 12th

Project: 200-BP-5 | Reference Measuring Point: Ground

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
355 cont.	grab grab grab			352.5* silt (M) 95% silt 5% sand. Sand 95% qtz/other, vf, R. silt: moist 2.5 Y 5/2 grayish brown, no rxn w/HCl	Cable tool drilling casing will not advance past 356', driller believes shoe has been damaged
				356.5' silt/clay (M) saturated, 10 YR 6/4 light yellowish brown, no rxn w/HCl. Some scoraceous Angular basalt pebbles, size 5-15mm	
				358' Silty Sand, 70% sand 30% silt Sand 70% Basalt 30% qtz/other, SA→A vf→VC, Avg = C, Basalt sand: Angular no vesicles present, some rust red color on pebbles.	Hard tool cuttings. 358' archive surface of Pomona Basalt; Highly fractured large flat top ~35ft.
				* out of order	TD = 358.85' bgs (7/16/08) DTV = 217.75' bgs (7/18/08)

KR
7/21/08

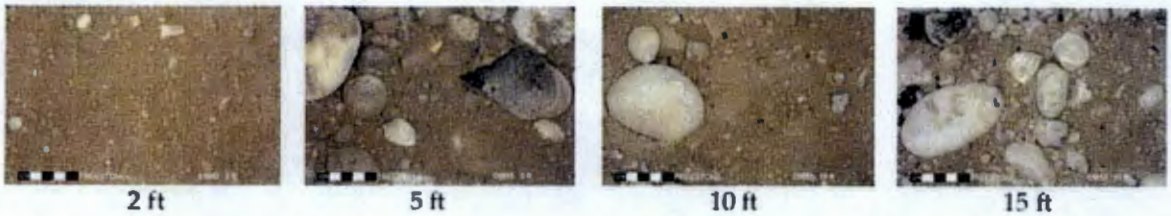
Reported By: Kim Royal | Reviewed By: L. d. Walker

Title: Geologist | Title: Geologist

Signature: Kim Royal | Date: 7/21/08 | Signature: LD Walker | Date: 10/24/08

A-6003-642 (03/03)

299-E33-340 (C5853)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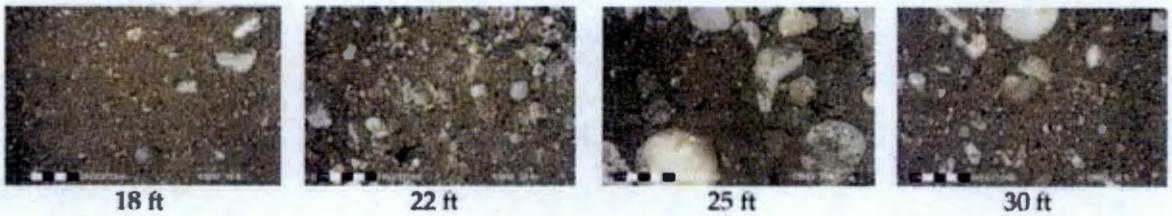
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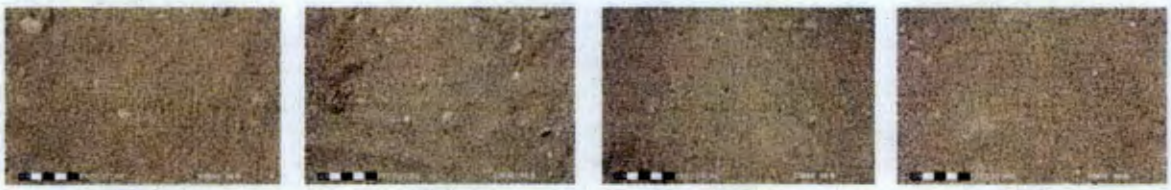
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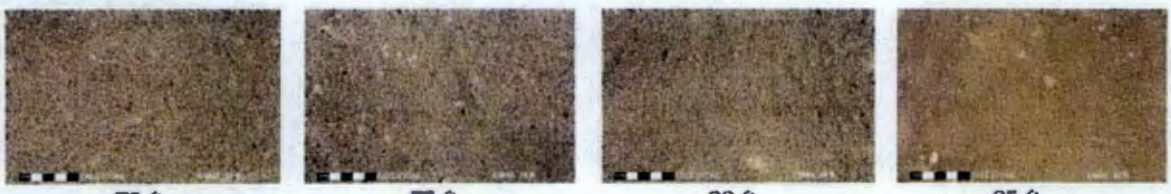
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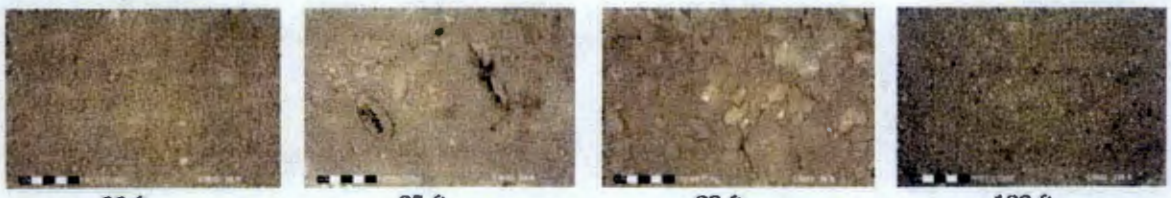
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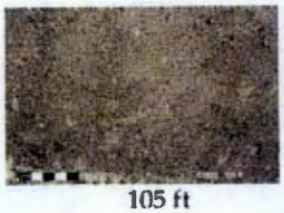
299-E33-340 (C5853)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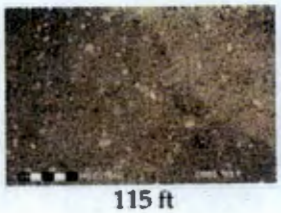
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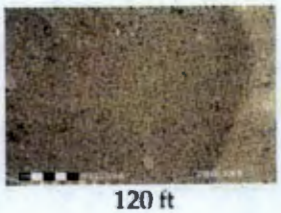
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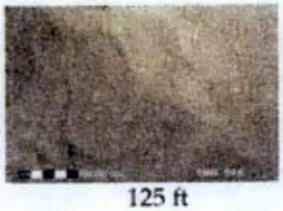
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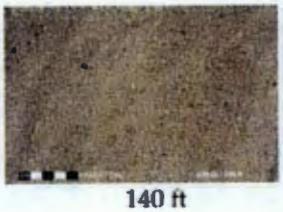
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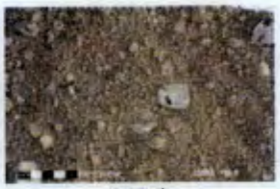
160 ft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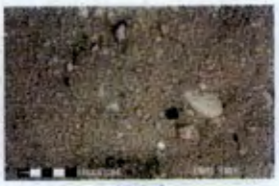
170 ft

175 ft

176 ft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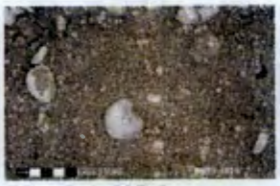
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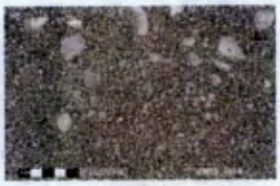

183 ft

185 ft

190 ft

195 ft

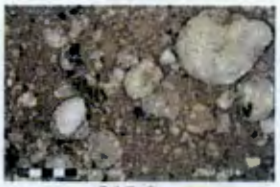
200 ft

299-E33-340 (C5853)

205 ft

210 ft

211 ft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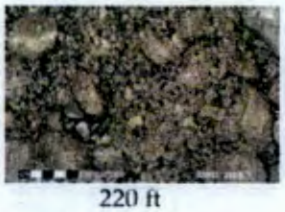
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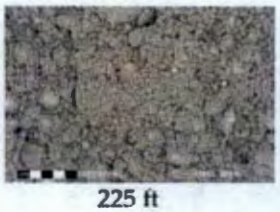
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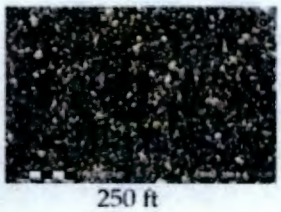
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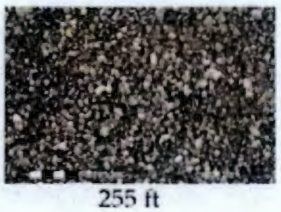
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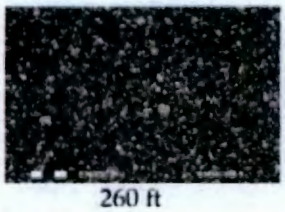
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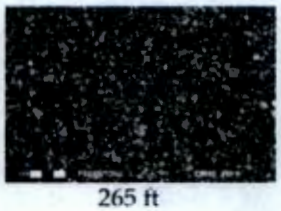
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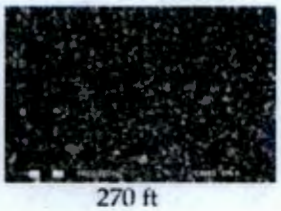
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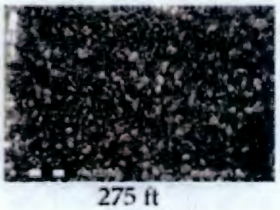
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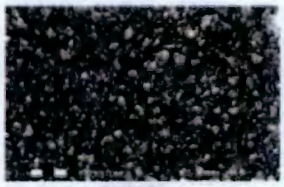
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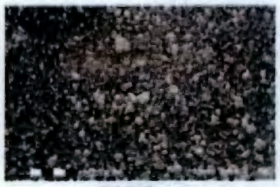
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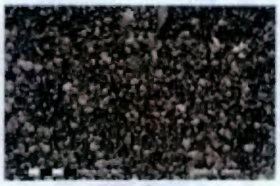
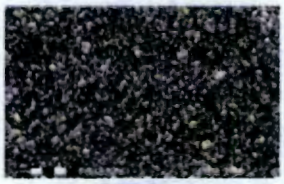

290 ft

295 ft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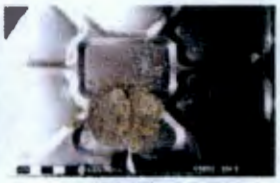
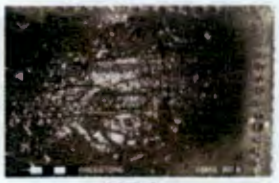
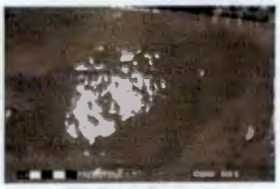

304 ft

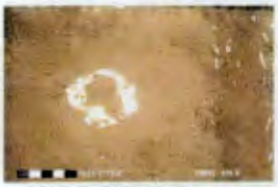
305 ft


307 ft

310 ft


315 ft

320 ft


325 ft

299-E33-340 (C5853)

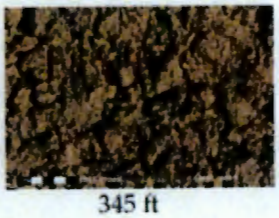
330 ft

335 ft

337 ft

338 ft

340 ft


345 ft

350 ft

353 ft

355 ft

357 ft

358 ft

WELL SUMMARY SHEET	Start Date: 4-9-08 Finish Date:10-13-08	Page 1 of 4
Well ID: C5853	Well Name:299-E33-340	
Location: Intersection of Baltimore and 12th St.	Project:200-BP5 RI/FS	
Prepared By: Kim Royal — Date:10-13-08	Reviewed By: L. D. Walker	Date: 10/24/08
Signature: Kim Royal	Signature: LD Walker	

CONSTRUCTION DATA

Description

6-in Concrete Pad

6-in I.D. Type 304/304L Stainless Steel Protective Casing: + 3.0 ft above ground surface

Portland Cement Type I/II: 0.0 - 9.67 ft bgs

Granular Bentonite Crumbles: 9.67 - 207.0 ft bgs

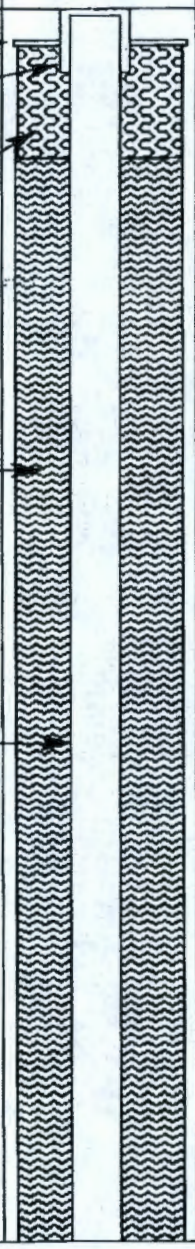
4-in I.D. Stainless Steel Type 304L, Schedule 10 Permanent Casing: + 2.47 - 308.18 ft bgs

All depths are in feet below ground surface.

Borehole drilled with:
10 3/4" threaded casing:
0.0 - 226.10 ft bgs
7 " threaded casing::
226.10 - 356.00 ft bgs

All temporary drill casing was removed from the ground.

Diagram



GEOLOGIC/HYDROLOGIC DATA

Depth in Feet: 0, 10, 20, 30, 40, 50, 60, 70, 80

Graphic Log

Lithologic Description/Groundwater Sample Depths (ft bgs)

0 - 1: Fill

1 - 5: Sand (S)

5 - 18: Silty Sandy Gravel (msG)

18 - 22.5: Gravelly Sand (gS)

22.5 - 33: Sandy Gravel (sG)

33 - 85: Sand (S)

85 - 90: Silty Sand (mS)

WELL SUMMARY SHEET	Start Date: 4-9-08 Finish Date: 10-13-08	Page 2 of 4
Well ID: C5853	Well Name: 299-E33-340	
Location: Intersection of Baltimore and 12th St.	Project: 200-BP5 RI/FS	
Prepared By: Kim Royal — Date: 10-13-08	Reviewed By: L.D. Walker — Date: 10/24/08	
Signature: Kim Royal	Signature: LD Walker	

CONSTRUCTION DATA

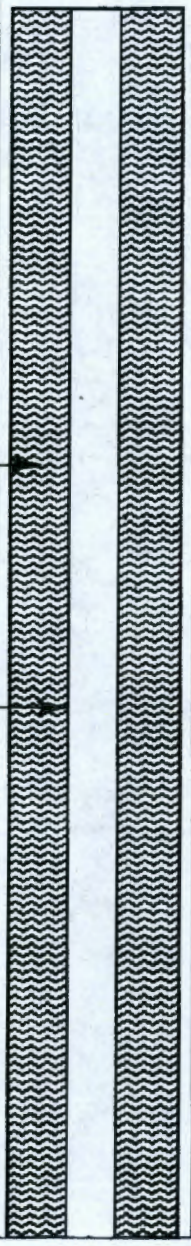
Granular Bentonite Crumbles: 9.67 - 207.0 ft bgs

4-in I.D. Stainless Steel Type 304L, Schedule 10 Permanent Casing: + 2.47 - 308.18 ft bgs

All depths are in feet below ground surface.

Borehole drilled with:
10 3/4" threaded casing: 0.0 - 226.10 ft bgs
7 " threaded casing: 226.10 - 356.00 ft bgs

All temporary drill casing was removed from the ground.



GEOLOGIC/HYDROLOGIC DATA

Depth in Feet	Graphic Log	Lithologic Description/Groundwater Sample Depths (ft bgs)
90		90 - 95: Sand (S)
		95 - 97.5: Silty Sand (mS)
		97.5 - 105: Sand (S)
100		
		105 - 115: Silty Sand (mS)
110		
		115 - 131: Sand (S)
120		
130		131 - 134: Sandy Silt (sM)
		134 - 136: Sand (S)
		136 - 140: Silty Sand (mS)
140		140 - 145: Sand (S)
		145 - 150: Silty Sand (mS)
150		150 - 154.5: Sand (S)
		154.5 - 165: Sandy Gravel (sG)
160		
		165 - 170: Gravelly Silty Sand (gmS)
170		170 - 184: Sand

WELL SUMMARY SHEET	Start Date: 4-9-08 Finish Date: 10-13-08	Page 3 of 4
Well ID: C5853	Well Name: 299-E33-340	
Location: Intersection of Baltimore and 12th St.	Project: 200-BP5 RI/FS	
Prepared By: Kim Royal — Date: 10-13-08	Reviewed By: L. D. Walker — Date: 10/24/08	
Signature: Kim Royal	Signature: LD Walker	

CONSTRUCTION DATA

Granular Bentonite Crumbles: 9.67 -207.0 ft bgs

4-in I.D. Stainless Steel Type 304L, Schedule 10 Permanent Casing: + 2.47 - 308.18 ft bgs

3/8-in Bentonite Pellets: 207.0 - 221.2 ft bgs

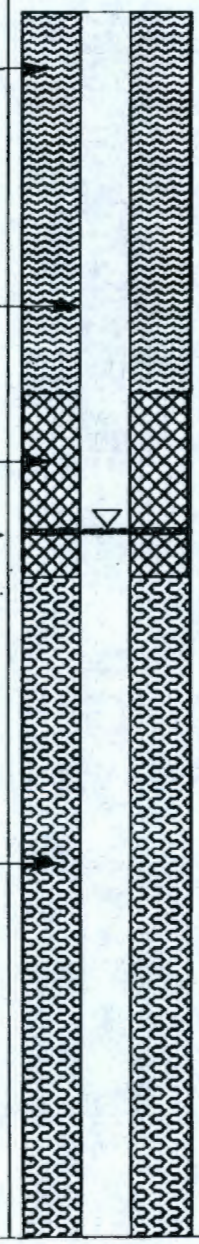
Static Water Level: 217.24 ft bgs (10/13/08)

Cement Grout Seal: 221.2 - 294.5 ft bgs.

All depths are in feet below ground surface.

Borehole drilled with:
10 3/4" threaded casing:
0.0 - 226.10 ft bgs
7 " threaded casing::
226.10 - 356.00 ft bgs

All temporary drill casing was removed from the ground.



GEOLOGIC/HYDROLOGIC DATA

170 - 184: Sand (S)

184 - 194: Gravelly Silty Sand (gmS)

194 - 211: Sand (S)

211 - 220: Silty Sandy Gravel (msG)

220 - 226.1: Gravel (G)

226.1 - 298.5: Elephant Mountain Basalt

WELL SUMMARY SHEET	Start Date: 4-9-08 Finish Date: 10-13-08	Page 4 of 4
Well ID: C5853	Well Name: 299-E33-340	
Location: Intersection of Baltimore and 12th St.	Project: 200-BP5 RI/FS	
Prepared By: Kim Royal — Date: 10-13-08	Reviewed By: L.D. Walker — Date: 10/24/08	
Signature: Kim Royal	Signature: LD Walker	

CONSTRUCTION DATA

Description

Cement Grout Seal: 221.2 - 294.5 ft bgs

4-in I.D. Stainless Steel Type 304L, Schedule 10 Permanent Casing: + 2.47 - 308.18 ft bgs

3/8-in Bentonite Pellets: 294.5 - 295.9 ft bgs

4-in I.D. Stainless Steel 10 Slot (0.010-in) ~~(0.10 in)~~ Screen: 308.18 - 323.17 ft bgs

Primary Filter pack 10-20 Mesh Colorado Silica Sand: 295.9 - 335.27 ft bgs

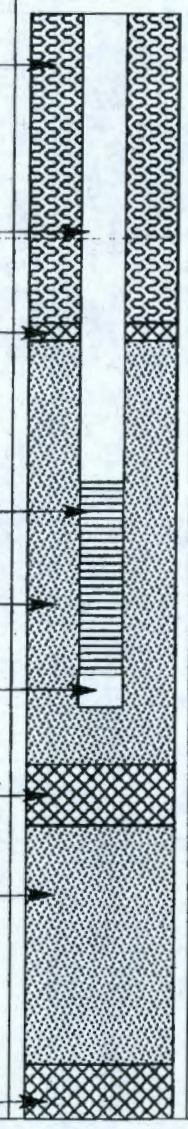
4-in I.D. Stainless Steel End Cap 323.17 - 326.18 ft bgs

3/8-in Bentonite Pellets: 335.27 - 339.50 ft bgs

Backfill Silica Sand 339.50 - 353.54 ft bgs

3/8-in Bentonite Pellets: 353.54 - 358.85 ft bgs

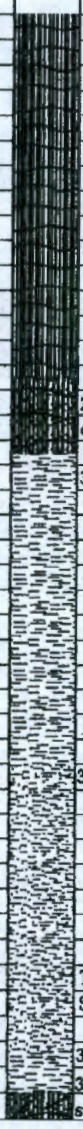
Diagram



GEOLOGIC/HYDROLOGIC DATA

Depth in Feet: 270, 280, 290, 300, 310, 320, 330, 340, 350

Graphic Log



Lithologic Description/Groundwater Sample Depths (ft bgs)

226 - 298.5: Elephant Mountain Basalt

298.5-305: Basalt with Palagonite and clay nodules

305 - 330: Silt (M)

330 - 352.5: Sandy Silt (sM)

TD: 358.85' (7-16-08)

Static Water : 217.24' (10-13-08)

352.5 - 356: Silt (M)

356-358.85: Pomona Basalt, fractured surface with sand

WELL CONSTRUCTION SUMMARY REPORT

Start Date: 4-9-08
Finish Date: 10-13-08
Page 1 of 2

Well ID: C5853	Well Name: 299-E33-340	Approximate Location: ⊥ Baltimore and 12th
Project: 200-BP5 RI/FS		Other Companies:
Drilling Company: Bluestar Enterprise		Geologist(s): Jeff Fetters, Kim Royal, Patrick Cabbage, Erika Garcia
Driller: Gary Howell	License #: 1930	

TEMPORARY CASING AND DRILL DEPTH			DRILLING METHOD	HOLE DIAMETER (In.) / INTERVAL (ft)
*Size/Grade/Lbs. Per Ft.	Interval	Shoe O.D./I.D.	Auger:	Diameter ____ From ____ to ____
10 3/4"	0 - 226.10		Cable Tool: X	Diameter 10 3/4" From 0 to 248.5
7"	226.10 - 356.00	7 1/2" / 6 1/8"	Air Rotary: X	Diameter 9 1/4" From 248.5 to 297.0
	____ - ____		A.R. w/Sonic:	Diameter ____ From ____ to ____
	____ - ____		Cable Tool X	Diameter 7" From 297.0 to 358.9
	____ - ____			Diameter ____ From ____ to ____
*Indicate Welded (W) - Flush Joint (FJ) Coupled (C) & Thread Design				Diameter ____ From ____ to ____

Threaded casing

358.85'		Drilling Fluid:	
Total Drilled Depth: ~~358.9'~~	Hole Dia @ TD: 7"	Total Amt. Of Water Added During Drilling: ~100 gal	
Well Straightness Test Results: Passed		Static Water Level: 217.27	Date: 10/15/08

GEOPHYSICAL LOGGING

Sondes (type)	Interval	Date	Sondes (type)	Interval	Date
Neutral moisture	360 - 290	7/16/08		____ - ____	
Spectral Gamma	291 - 225	7/17/08		____ - ____	
	227.0 - 0	4/24/08		____ - ____	

COMPLETED WELL

Size/Wt./Material	Depth	Thread	Slot Size	Type	Interval Annular Seal/Filter Pack	Volume	Mesh Size
6" ID SS protective casing	+2.9 - 2.1			Grout type I/II	0 - 9.67	7 bags	
4" ID SS sch.10 casing	+2.47 - 308.18		0.010"	Bentonite crumbles	9.67 - 207.00	149.5 bags	
4" ID SS 10 slot screen w/	308.18 - 323.17		0.010"	Bentonite Pellets	207.00 - 221.20	6 bucket	3/8"
4" ID SS sump w/end cap	323.17 - 326.18			Grout type I/II	221.20 - 294.50	18 bags	
	____ - ____			Bentonite pellets	294.50 - 295.90	1/2 bucket	3/8"

OTHER ACTIVITIES

Aquifer Test:	Date:	Well Decommission:	Yes:	No:	Date:
Description:		Description:			

WELL SURVEY DATA (if applicable)

	Protective Casing Elevation:
Washington State Plane Coordinates:	Brass Survey Marker Elevation:

COMMENTS / REMARKS

Reported By:	Title:	Signature:	Date:
Kim Royal	Geologist	Kim Royal	10/22/08

A-6003-658 (04/03)

WELL CONSTRUCTION SUMMARY REPORT

Start Date: 4-9-08
Finish Date: 10-13-08
Page 2 of 2

Well ID: CS853	Well Name: 299-E33-340	Approximate Location: ⊥ Baltimore and 12th
Project: 200-BP5 RI/FS		Other Companies:
Drilling Company: Bluestar Enterprise		Geologist(s): Jeff Fetters, Kim Royal, Patrick Cabbage, Erika Garcia
Driller: Gary Howell	License #: 1930	

TEMPORARY CASING AND DRILL DEPTH			DRILLING METHOD	HOLE DIAMETER (in.) / INTERVAL (ft)
*Size/Grade/Lbs. Per Ft.	Interval	Shoe O.D./I.D.	Auger:	Diameter ____ From ____ to ____
	____ - ____		Cable Tool:	Diameter ____ From ____ to ____
	____ - ____		Air Rotary:	Diameter ____ From ____ to ____
	____ - ____		A.R. w/Sonic:	Diameter ____ From ____ to ____
	____ - ____			Diameter ____ From ____ to ____
	____ - ____			Diameter ____ From ____ to ____
*Indicate Welded (W) - Flush Joint (F.J) Coupled (C) & Thread Design				Diameter ____ From ____ to ____
			Drilling Fluid:	
Total Drilled Depth:	Hole Dia @ TD:		Total Amt. Of Water Added During Drilling:	
Well Straightness Test Results:			Static Water Level:	Date:

KR 10-22-08

GEOPHYSICAL LOGGING

Sondes (type)	Interval	Date	Sondes (type)	Interval	Date
	____ - ____			____ - ____	
	____ - ____			____ - ____	
	____ - ____			____ - ____	

KR 10-22-08

COMPLETED WELL

Size/Wt./Material	Depth	Thread	Slot Size	Type	Interval Annular Seal/Filter Pack	Volume	Mesh Size
	____ - ____			10-20 CSS (sand)	295.90 - 335.27	21 3/4 bag	10-20
	____ - ____			Bentonite pellets	335.27 - 339.50	1/2 bucket	3/8"
	10-22-08			Back fill silica sand	339.50 - 353.54	10 bags	10-20
	____ - ____			Bentonite pellets	353.54 - 358.85	1 1/2 bucket	3/8"
	____ - ____				____ - ____		

KR 10-22-08

OTHER ACTIVITIES

Aquifer Test:	Date:	Well Decommission:	Yes:	No:	Date:
Description:		Description:			

KR 10-22-08

WELL SURVEY DATA (if applicable)

	Protective Casing Elevation:
Washington State Plane Coordinates:	Brass Survey Marker Elevation:

COMMENTS / REMARKS

Reported By:	Title:	Signature:	Date:
Kim Royal	Geologist	Kim Royal	10/22/08

A-6003-658 (04/03)

WELL DEVELOPMENT AND TESTING DATA

Well Name:	Well ID:	Well Location:	Date:
Z99-E33-340	C5853	⊥ Baltimore and 12th	7/30/08-7/31/08

Reference Measuring Point (unless otherwise noted): TOP OF OUTER CASING (TOC)

Has the well been surveyed? O Yes ⊗ No | Does the well have a cement pad? O Yes ⊗ No

PART 1

STATIC WATER LEVEL:

Start of Job	218.59' bgs
End of Job	217.25' bgs

DEPTH TO BOTTOM:

Start of Job	326.2' bgs
End of Job	326.1' bgs

PART 2

WELL DEVELOPMENT DATA

Pump Model	Franklin Electronic
Intake Depth	322.79' bgs
Starting Turbidity	1000+ NTU

Pump Start	Stop	Flow Rate
1415	1535	10 gal/min
0648	0943	12 gal/min

Total Pumped	2900 gal
Final Turbidity	4.95 NTU
XD SN/Range (PSI)	———

PART 3

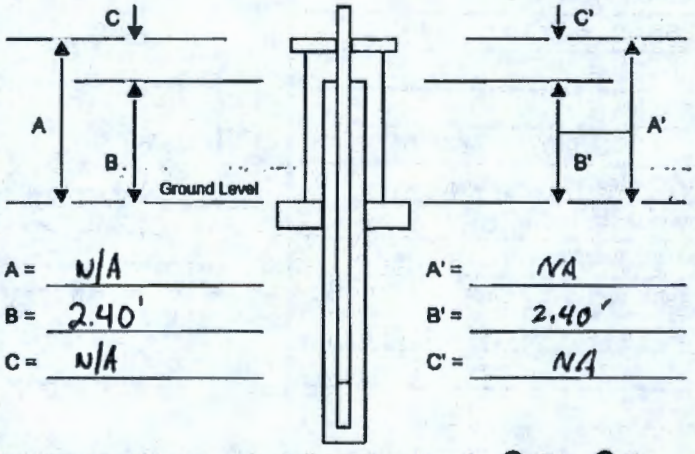
INSTANTANEOUS SLUG TEST

Static Water Level (TOC)	
Transducer Depth	
Baseline Start	
Injection Start	
Baseline Start	
Withdrawal Start	
Slug Volume	
XD SN/Range (PSI)	

PART 4

Last Recorded Measurements Date: 7/31/08

Current Measurements Date: 7/31/08



A =	N/A	A' =	NA
B =	2.40'	B' =	2.40'
C =	N/A	C' =	NA

Are there any reference marks on the casing strings? O Yes ⊗ No

PART 5

COMMENTS:

XD was unavailable but water level data was recorded using E-tape. Data can be found on FAR #54 and #55.

Prepared by (print name):	Signature:	Date:
Kim Royal	Kim Royal	7/31/08
Reviewed by (print name):	**Signature:**	**Date:**
L.D. Walker	[signature]	10/24/08

A-6003-644 (03/03)

WELL DEVELOPMENT AND TESTING DATA

Well Name:	Well ID:	Well Location:	Date:
299-E33-340	C5853	⊥ Baltimore and 12th	10-14-08

Reference Measuring Point (unless otherwise noted): TOP OF OUTER CASING (TOC)

Has the well been surveyed? O Yes ⊗ No | Does the well have a cement pad? O Yes ⊗ No

PART 1

STATIC WATER LEVEL:

Start of Job	217.40' bgs
End of Job	221.90' bgs

DEPTH TO BOTTOM:

Start of Job	326.20' bgs
End of Job	

PART 2

WELL DEVELOPMENT DATA

Pump Model	Franklin Electric
Intake Depth	316.65'
Starting Turbidity	76.7 NTU

Pump Start	Stop	Flow Rate
1333	1500	2.5 gpm
1513	1600	12 gpm

Total Pumped	~800 gal
Final Turbidity	5.68 NTU
XD SN/Range (PSI)	20 PSI

PART 3

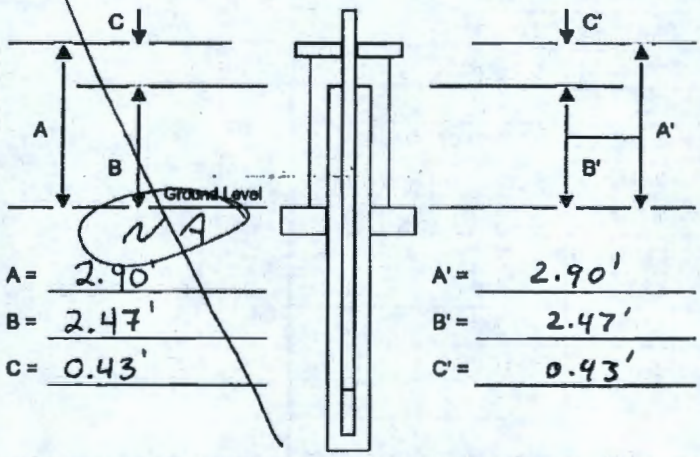
INSTANTANEOUS SLUG TEST

Static Water Level (TOC)	
Transducer Depth	
Baseline Start	not used
Injection Start	
Baseline Start	
Withdrawal Start	
Slug Volume	
XD SN/Range (PSI)	

PART 4

Last Recorded Measurements Date: 10/14/08

Current Measurements Date: 10/14/08



NA

A =	2.90'	A' =	2.90'
B =	2.47'	B' =	2.47'
C =	0.43'	C' =	0.43'

Are there any reference marks on the casing strings? O Yes ⊗ No

PART 5

COMMENTS:

Test #1 oct 08 WD2 drawdown (1533-1500)
Flow was decreased
Test #2 oct 08 WD2 recovery (1500-1511)

Data logger "Jeff" XD# 5217 (input 1)

Prepared by (print name):	Signature:	Date:
Kim Royal	Kim Royal	10-14-08
Reviewed by (print name):	**Signature:**	**Date:**
L.D. Walker	[signature]	10/24/08

A-8003-844 (03/03)

WELL DEVELOPMENT AND TESTING DATA

Well Name:	Well ID:	Well Location:	Date:
299-E33-340	C5853	⊥ Baltimore & 12th	10/15/08

Reference Measuring Point (unless otherwise noted): TOP OF OUTER CASING (TOC)

Has the well been surveyed? ○ Yes ⊗ No | Does the well have a cement pad? ○ Yes ⊗ No

PART 1

STATIC WATER LEVEL:

Start of Job 217.27' bgs

End of Job 216.62' bgs (and rising)

DEPTH TO BOTTOM:

Start of Job 326.20' bgs (10/14/08)

End of Job 326.05' bgs (10/15/08)

PART 2

WELL DEVELOPMENT DATA

Pump Model Franklin Electric

Intake Depth 316.65'

Starting Turbidity 10.4 NTU

Pump Start	Stop	Flow Rate
0720	0810	4.1 gpm

Total Pumped 205 gallons

Final Turbidity 4.13 NTU

XD SN/Range (PSI) 20 PSI

PART 3

INSTANTANEOUS SLUG TEST

Static Water Level (TOC)

Transducer Depth

Baseline Start

Injection Start

Baseline Start

Withdrawal Start

Slug Volume

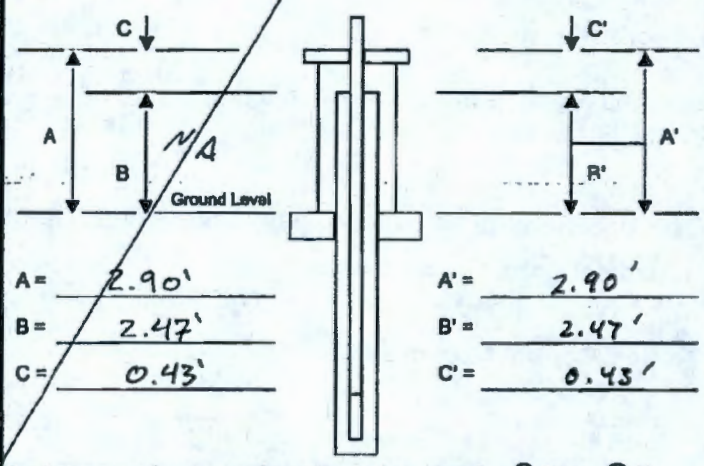
XD SN/Range (PSI)

Not used

PART 4

Last Recorded Measurements Date:

Current Measurements Date: 10/15/08



A = 2.90'

B = 2.47'

C = 0.43'

A' = 2.90'

B' = 2.47'

C' = 0.43'

Are there any reference marks on the casing strings? ○ Yes ○ No

PART 5

COMMENTS:

Test #3: Draw down

Test #4: Recovery

Prepared by (print name):	Signature:	Date:
Patrick Cabbage	Patrick Cabbage	10/15/08
Reviewed by (print name):	**Signature:**	**Date:**
L.D. Walker	[signature]	10/24/08

A-6003-644 (03/03)

WELL SURVEY DATA REPORT

Project:	**Prepared By:** N.P. Fastabend **Company:** FGG
Date Requested: 11/7/08	**Requestor:** C.S. Wright (CHPRC)
Date of Survey: 12/1/08	**Surveyor:** L.A. Henke FGG Survey Dept.
ERC Point of Contact:	**Survey Co. Point of Contact:** N.P. Fastabend (FGG)
Description of Work: Civil Survey of Groundwater Monitoring Well C5853 (299-E33-340).	**Horizontal Datum:** NAD83(91) **Vertical Datum:** NAVD88 **Units:** METERS **Hanford Area Designation:** 200E

Coordinate System: Washington State Plane Coordinates (South Zone)

Horizontal Control Monuments:
GableMtn (FH), 2E-1 (FGG)

Vertical Control Monuments:
HSWB-032 (COE), 2E-118 (FGG)

Well ID	Well Name	Easting	Northing	Elevation	
C5853	299-E33-340	573779.64	137763.84		Center of Casing
				189.113	Top Pump Baseplate, N. Edge
				189.103	Top of 6" SS Casing, N. Edge
				188.340	Brass Survey Marker

Notes:

EQUIPMENT USED: TRIMBLE GPS 5800 RTK
TRIMBLE DiNi 12 LEVEL

Surveyor Statement:
I, Larry A. Henke, a Professional Land Surveyor registered in the State of Washington (Registration No. 38975), hereby certify that this report is based on a field survey performed in December, 2008 under my direct supervision, and that the data contained here is true and correct.

LARRY A. HENKE
STATE OF WASHINGTON
DEC 1 2008
38975
REGISTERED
PROFESSIONAL LAND SURVEYOR
EXPIRES Sept. 23, 2009

Original to:
Distribution by DIS:

Sample Depth	Sample Type	HEIS #
209.5	Grab	B1TTN2, B1TVJ1 (RS)
211	Grab	B1TTN3
212.5	Grab	B1TTN4
215	Grab	B1TTN5
218	Grab	B1TTN6
220	Grab	B1TTN7
222.5	Grab	B1TTN8, B1TVJ2 (RS)
301.8 - 304.3	Split-spoon	B1TTT2, B1TTT3, B1TTT4, B1TTR9, B1TVJ5 (RS)
302	Grab	B1TTN9
305	Grab	B1TTP0
305	Pump	B1TTV1, B1TVJ8 (RS)
307	Grab	B1TTP1
310	Grab	B1TTP2
312	Grab	B1TTP3
315	Grab	B1TTP4
318	Grab	B1TTP5, B1TVJ3 (RS)
322.5	Grab	B1TTP7
331	Pump	B1TTV2, B1TVJ9 (RS)
331	Pump	B1TTV3
331	Grab	B1TTR0
333	Grab	B1TTR1, B1TVJ4 (RS)
335	Grab	B1TTR2
337.5	Grab	B1TTR3
340	Grab	B1TTR4
342.5	Grab	B1TTR5
345	Grab	B1TTR6
347.8 - 350.3	Split-spoon	B1TTT8, B1TTT9, B1TTV0, B1TTT1, B1TVJ7 (RS)
349.8	Grab	B1TTR7
350.5	Grab	B1TTR8
352.5	Grab	B1WDD3
355	Grab	B1WDD4
356.5	Grab	B1WDD5
356.5	Pump	B1TTV4, B1TVK0 (RS)

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APPENDIX B

Well Documentation for 299-E33-341 (C5856)

Borehole Log

Photographic Log

Well Summary Sheet

Well Construction Summary Report

Well Development and Testing Data

Well Survey

Sample Depths and HEIS Numbers

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BOREHOLE LOG

C5856 299-E33-341

Page 1 of 6

Date: 4/28/08

Well ID: ~~299-E33-341~~ 6-18-08 | Well Name: ~~C5856~~ 6-18-08 | Location: W of BY CRIB

Project: BP-5-OU RI/FS | Reference Measuring Point: GROUND SURFACE

Depth (Ft.)	Sample Type No.	Sample Blows/Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
0				Ground Surface: Silty sandy gravel (msG).	Drilling method: cable tool - drive barrel
5				5: Silty sandy gravel (msG): 40% gravel, 45% sand, 15% silt. Gravel 90% basalt 70% gt/other, VFP-SC, SA-SR, predom SA. Cobble to 15 cm. Sand VF-VC predom M, 70% gt/other 90% basalt A-R predom SA. Silt 2.5Y 4/3 olive brown, dry, v. strong rxn HCl.	5: archive
10				10: sandy gravel (sG): 70% gravel, 29% sand, 1% silt. Gravel VFP-SC; predom VFP-FP; VCP-SC (i.e. & MP), Fine gravel 90% basalt 10% gt/other, SA. Coarser gravel 60% gt/other 40% basalt SR-R. Sand A-SA, VF-VC, 50% basalt/50% gt/other. Silt 5Y 4/1 dark gray. No-wk rxn HCl, dry.	10: archive
15	GRAB/ SPLIT SPOON		297/60%	15: same as above (sG) but silt ↑ to 15%, no SC, therefore silty sandy gravel (msG).	15: archive. Barrel survey shows 600 cpm (~200 ↑ back ground)
	GRAB/ SPLIT SPOON		284/100%	18.5: sharp contact w/ sand(s) 100% VFS-FS, 99% gt/other 3% basalt, SA-SR, dry, no rxn HCl, 2.5Y 5/3 olive. To approx 19.5 (?)	18.5: archive, JS 5-4-08 Rad Contamination: 16': 4000 cpm 18: 1000 cpm 19.5: 2000 cpm
20	GRAB/ SPLIT SPOON		326/100%	20: gravelly sand (gS): 65% sand 45% gravel 5% silt. Gravel 70% basalt 30% gt/other, A-SR predom SA, VFP-CP. Sand continuous w/gravel. Silt wk rxn HCl, dry, 2.5Y 4/2 dark grayish brown.	20: archive
	GRAB				
25	GRAB			25: gravelly sand (gS) as above, but avg g.s. ↑ (FP not VFP), more A. Silt ↓ to trace. No rxn HCl.	25: archive
	GRAB				
30	GRAB			30: Gravel (g): 80% gravel 20% sand trace silt. Gravel VFP - M/CP. MP mostly SA basalt. SA-SR, 80% gt/other 90% basalt. Sand VF-VC, SA-SR, 80% gt/other 70% basalt.	30: archive
	GRAB				
35	GRAB			35: Same as above (gravel (G)).	35: archive
	GRAB				

Reported By: L. Stratton | Reviewed By: L. D. Walker

Title: Geologist | Title: Geologist

Signature: [signature] Date: 5/4/08 | Signature: [signature] Date: 6/18/08

A-6003-642 (03/03)

BOREHOLE LOG

Page 2 of 4
Date: 4/30/08

Well ID: C5856 | Well Name: 299-E33-341 | Location: W of BY Cribs

Project: BP-5-OU RI/FS | Reference Measuring Point: Ground Surface

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
40	grab				Cable tool/drive barrel
				40: gravel (G) as above.	40: archive
				41.5-44: Sand (S) as at 18.5': VFS, no rxn	41.5': archive
	grab			HCl. Sharp contact.	
45	grab			45: Gravelly sand (gS): 70% sand, 25% gravel, <5% silt. Sand 75% qtz/other 25% basalt, SA, VF-VC predom M-VC. Gravel VFP-FP, SA-SR, 35% basalt, 65% qtz/other. Dry. No rxn HCl. 2.5Y 5/2 grayish brown.	45: archive
	GRAB				
50	GRAB			50: gravelly sand (gS) as above.	50: archive
				51: Sand (S). F-MS, SA-SR, 95% qtz/other 5% basalt (A-SA). Loose. No silt. 2.5Y 5/2 grayish brown.	51: archive
	GRAB			Sharp contact w/ above.	
55	GRAB/ SPLIT SPOON	113/100%		55: sand (S) as at 45' but gravel ↓ to 10%.	55: archive
	GRAB/ SPLIT SPOON	125/100%			
60	GRAB/ SPLIT SPOON	109/100%		60: Sand (S) as above, w/ areas of wk carbonate cementation.	60: archive
					62.5: silt ↑ to 10%.
	GRAB/ SPLIT SPOON	102/100%			
65	GRAB/ SPLIT SPOON	191/100%		65: slightly silty sand. 92½% sand 7½% silt. Sand VF-VC predom M/C; 70% qtz/other 10% basalt. A-SR predom SA. Wk carbonate cementation. 2.5Y 5/2 grayish brown. Dry.	65: archive
	GRAB/ SPLIT SPOON	169/100%			
70	GRAB/ SPLIT SPOON	152/100%		70: gravelly silty sand (gmS): 65% sand, 20% gravel, 15% silt. Sand/gravel 90% qtz/other 10% basalt, A-SR predom SA. VFS-VCS; gravel VFP-FP. Mod carbonate cementation in 4" horizon. Dry. 2.5Y 6/2 light brownish gray.	70: archive
	GRAB/ SPLIT SPOON	151/100%			
75	GRAB			5-4-08 75: ~~Gravelly sand (gS)~~ Slightly silty sand. Sand 90% 5% gravel, 5% silt. Sand VF-VC; predom M/C, 80% qtz/other 20% basalt, SA-R predom SA. Gravel VFP-FP otherwise same as sand. Mod-strong rxn HCl; dry. 2.5Y 6/2 light brownish gray.	75: archive
	GRAB				76: Silt ↑; drilling water

Reported By: J. Stratton | Reviewed By: L. D. Walker

Title: Geologist | Title: Geologist

Signature: [signature] | Date: 5/4/08 | Signature: [signature] | Date: 6/18/08

A-6003-842 (03/03)

BOREHOLE LOG

Page 3 of 6
Date: 5/1/08

Well ID: C5856 | Well Name: 299-E33-341 | Location: W of BY Cribs

Project: BP-5-OU RI/FS | Reference Measuring Point: Ground Surface

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
80	GRAB	25		80: (contact at ~76.5'): Sand (S). 100% sand, trace silt. 90% qtz/other 10% basalt, SA. VFS-MS, predom M. v. compact, no rxn HCl, dry. 2.5Y 5/3 or 5 grayish brown/light olive brown.	80: archive Drilling method: cable tool-drive barrel
	GRAB			85: gravelly sand (gS): abrupt contact at 85.0. 90% sand 7½% gravel, 2½% silt. Sand VF-VC predom VC. A-SA predom SA. 90% qtz/other/90% basalt. 2.5Y 4/2 dark grayish brown. Moist. v. wk rxn HCl. Gravel 50% A basalt, 50% qtz/other. A-SA. VFP-FP.	85: archive. 1" thick silt horizon, compact, moist, wk-mod rxn HCl 2.5Y 5/3 light olive brown.
85	GRAB				
	GRAB				
90	GRAB			90: sandy gravel (SG): same as above, but gr. ↑ to CS → FP, occasional MP. MP SA; FP A. Moist.	90: archive.
	GRAB				
95	GRAB/ SPLIT SPOON	98/100%		95: gravelly sand (gS) as at 85'. Dry.	95: archive.
	GRAB/ SPLIT SPOON	100/100%			98: downsize casing to 9⅝"
100	GRAB/ SPLIT SPOON	103/100%		100: gravelly sand (gS) as above; silt ↑ to 5%; occasional MP, wk carbonate cementation throughout. Muscovite-rich.	100: archive.
	GRAB/ SPLIT SPOON	118/100%			
105	GRAB/ SPLIT SPOON	120/100%		105: Sand (S): 100% VF-FS; 90% qtz/other 10% basalt, SA, wk rxn HCl. 2.5Y 4/3 olive brown. Lens ~0.5' thick then same as above.	105: 6000 cpm/100 cm² rad contamination. No ARCHIVE.
	GRAB/ SPLIT SPOON	97/100%			
110	GRAB/ SPLIT SPOON	121/100%		110: gravelly sand (gS) as above; 50% basalt 50% qtz/other, VF-VCS, SA. 2½% silt/7½% gravel. 1 (cm) CP, SA basalt. No carbonate cementation.	110: contamination as above. No ARCHIVE. Drilling rate ↓↓↓, ↑ formation coming in.
	GRAB/ SPLIT SPOON	87/100%			
115	GRAB/ SPLIT SPOON	110/100%		115: gravelly sand (gS) as above; silt ↑ to 10%; wk rxn HCl.	115: No contamination. Archive.
	GRAB/ SPLIT SPOON	94/100%			

Reported By: L. Stratton | Reviewed By: L. D. Walker

Title: Geologist | Title: Geologist

Signature: [signature] Date: 5/8/08 | Signature: [signature] Date: 6/18/08

A-6003-642 (03/03)

BOREHOLE LOG

Page 4 of 6
Date: 5/5/08

Well ID: C5856 | Well Name: 299-E33-341 | Location: W of BY Cribs

Project: BP-5-OU 21/FS | Reference Measuring Point: Ground Surface

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
120	GRAB			121: slightly silty sand: 85% sand, 15% silt, 5% gravel. Sand/gravel continuous 40% basalt 60% qtz/other. VFS-VFP predom C-VCS, A-SA. Silt 2.5Y 6/2 light brownish gray, wk-mod rxn HCl w/ wk cementation throughout. Dry.	121: archive. Drilling method: cable tool/drive barrel
	GRAB				
125	GRAB			125: Sand (S): 95% sand, 2½% gravel 2½% silt. 50% basalt 50% qtz/other. FS-VCS predom VCS (5mm VFP). A-SR predom SA. 2.5Y 5/3 dark grayish brown. No rxn HCl, dry.	125: very loose. Recovery difficult. Archive.
	GRAB				
130	GRAB/ SPLIT SPOON	139/100%		130: Slightly silty sand: as above but silt ↑ 10%, avg g.s. ↓ to CS-VCS - no VFP.	130: archive. Muscovite-rich.
	GRAB/ SPLIT SPOON	159/100%			
135	GRAB/ SPLIT SPOON	112/100%		135: Silty sandy gravel (msG): 70% gravel, 20% sand, 10% silt. Gravel VFP, SA-A; 70% basalt 30% qtz/other. Sand 50% basalt 50% qtz/other. VF-VCS predom VF-F, SA-SR. 2.5Y 5/3 light olive brown, wk-mod rxn HCl, moist.	135: archive
	GRAB/ SPLIT SPOON	105/100%			
140	GRAB/ SPLIT SPOON	84/100%		140: Silty sandy gravel (msG) as above. wk-mod carbonate cementation throughout. Dry.	140: archive
	GRAB/ SPLIT SPOON	112/100%			
145	GRAB/ SPLIT SPOON	81/60%		145: Gravelly sand (gS): as 135' but avg g.s. ↓ to 70% sand, 20% gravel, 10% silt.	145: archive
	GRAB/ SPLIT SPOON	124/100%			
150	GRAB/ SPLIT SPOON	111/100%		150: Silty sandy gravel (msG): as 135'! Occasional M-FP.	150: archive
	GRAB/ SPLIT SPOON	159/100%			
155	GRAB/ SPLIT SPOON	149/100%		155: Slightly gravelly sand (gmS): 70% sand, 15% gravel, 15% silt. Sand: 40% basalt 60% qtz/other, VF-VC predom VC, SA-SR. Gvl. 80% basalt 20% qtz/other, VFP-FP w/ rare MP, A-SA. Silt 2.5Y 6/2 light brownish gray, no to wk rxn HCl, dry.	155: archive
	GRAB/ SPLIT SPOON	159/100%			

Reported By: L. Stratton | Reviewed By: C.D. Walker

Title: Geologist | Title: Geologist

Signature: [signature] Date: 5/13/08 | Signature: [signature] Date: 6/18/08

A-6003-642 (03/03)

BOREHOLE LOG

C5856 299-E33-341

Page 5 of 6

Date: 5/12/08

Well ID: ~~299-E33-341~~ LW 6-18-08 | Well Name: ~~C5856~~ LW 6-18-08 | Location: W of BY Cribs

Project: BP-5-OU RI/FS | Reference Measuring Point: GROUND SURFACE

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
160	GRAB/ SPLIT SPOON	94/100%		160: slightly gravelly sand (gms) as above; MP↑, silt↑ 20%, wk-mod carbonate cementation.	160: archive. Drilling method: cable tool/ drive barrel
	GRAB/ SPLIT SPOON	114/30%			
165	GRAB/ SPLIT SPOON	141/100%		165: gravelly silty sand (gmS): 60% sand, 20% gravel, 20% silt. Sand 50% basalt/50% qtz/other, VFS-VCS predom CS, SA-SR. Gravel 90% basalt 10% qtz/other, VFP-rare FP, SA-SR. Silt 5Y 6/2 light olive gray, mod-strong rxn HCl, dry.	165: archive
	GRAB/ SPLIT SPOON	130/100%			
170	GRAB			170: silty sandy gravel (msG): 50% sand, 30% gravel, 20% silt. Sand 40% basalt 60% qtz/other, VF-VC predom C, SA-SR. Gravel 90% basalt 10% qtz/other. VF-MP occasional CP, SA-SR. Silt 2.5Y 5/2 grayish brown, wk-mod rxn HCl, dry.	170: archive. 170 ~ 188: intermittent CaCO3 cementation.
	GRAB				
175	GRAB			175: Sandy gravel (sG): Sand 60%, gravel 35%, silt 5%. Sand 40% basalt 60% qtz/other, VF-VC predom C, A-R predom SA. Gravel 80% basalt 20% qtz/other. VFP-MP rare CP, A-SR, predom A. Silt 2.5Y 5/4 light olive brown, no rxn HCl, dry.	175: archive
	GRAB				
180	GRAB/ SPLIT SPOON	115/100%		180: Gravelly sand (gS): same as above but sand ↑ 80% gravel ↓ 15%, silt 5%.	180: archive. 180.5: silt ↑↑. Drilling rate ↑
	GRAB/ SPLIT SPOON	147/100%			
185	GRAB/ SPLIT SPOON	100/0%		185: Silty sandy gravel (msG): as 170'. 188.5: silty gravel (mG): gravel 50%, sand 25%, silt 25%. Gravel 80% basalt 20% qtz/other VFP-MP, predom FP, SR-R. Gravel supported by compact silt/sand matrix: sand 40% basalt 60% qtz/other, VF-VC; silt 2.5Y 5/4 light olive brown, no rxn HCl, moist.	185: archive. 188.5: archive.
	GRAB/ SPLIT SPOON	213/100%			
190	GRAB/ SPLIT SPOON	321/80%		190: silty gravel (msG): as above; avg g.s. ↑ m-VC, to ~191.	190: archive
	GRAB/ SPLIT SPOON	285/100%			
195	GRAB			195: Silty gravel (mg): 50% gravel, 30% silt, 20% sand. Gravel VFP-VCP avg CP, 30% basalt 90% qtz/other, SA-R avg SR. Silt 2.5Y 6/2 light olive gray, dry, wk-no rxn HCl. Sand VFS-VCS avg C-VC, SA-SR, 30% basalt 70% qtz/other.	195: archive. 197: g.s. ↑. 198: drilling rate ↓↓ ~ appears to be mod CaCO3 cementation
	GRAB				

Reported By: L. Stratton		Reviewed By: L.D. Walker	
Title: Geologist		Title: Geologist	
Signature: L. Stratton	Date: 5/16/08	Signature: LD Walker	Date: 6/18/08

A-6003-642 (03/03)

BOREHOLE LOG

Page 6 of 6
Date: 5/16/08

Well ID: C9856 | Well Name: 299-E33-341 | Location: W of BY Cribs

Project: BP-5-OU RI/FS | Reference Measuring Point: Ground Surface

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
200	GRAB			Silty sandy gravel (mSG): as above, but silt ↓ to 20%. sand ↑ to 30%. Avg g.s. gravel M; cobbles to ~10cm. Mod. CaCO3 cementation.	200: archive. Drilling method: cable tool/drive barrel
	GRAB				
205	GRAB			205: Silty sandy gravel (mSG): 60% gravel, 30% sand, 10% silt. Gravel: VFP-VCP predom MP, 40% basalt 60% qtz/other SA-R - CaCO3 noted on surfaces & most clasts (cemented); Sand: VFS-VCS, predom MS-CS, 90% qtz/other 10% basalt, SA-R. lt. brownish gray 2.5Y 6/2 dry, strong rxn HCl.	205: archive
	GRAB				207.5: gravel (G) (~70-80%)
210	GRAB/ SPLIT SPOON	277/100%		210: Same as above.	210: archive. 211: CaCO3 cementation ↓; drilling rate ↑.
	GRAB/ SPLIT SPOON	153/90%			212.5: moist
215	GRAB/ SPLIT SPOON	379/100%		216: silty sandy gravel as above; 70% qtz/other 30% basalt. G.S. ↑SC. Moist.	216: archive
	GRAB/ SPLIT SPOON	488/100%			
220	GRAB/ SPLIT SPOON	~234/100%		220: silty gravel (mG): gravel 60%, silt 30%, sand 10%. All else as above. Moist. Drilling rate ↓↓.	220: archive
	GRAB/ SPLIT SPOON	302/90%			
225	GRAB/ SPLIT SPOON	95/60%		225: silty gravel as above.	225: archive. 226.7: water level (5-29-08)
	GRAB/ SPLIT SPOON	128/100%			
230	GRAB/ S.S.	235/100%		230: Silty sandy gravel (mSG): 70% gravel, 20% sand, 10% silt. Gravel: 70% qtz/other 30% basalt, VFP-SC, A-SR predom SC. Sand 60% basalt 40% qtz/other predom VC, VFS-VCS, A-SR. Silt 7.5YR 3/1 dark gray. Saturated.	230: archive. 232: switch to hard-tool
	GRAB/ KABIS Groundwater Sample			232.5': Top of Basalt	
235				237: TOTAL DRILLED DEPTH	

Reported By: L. Stratton | Reviewed By: L.S. Walker

Title: Geologist | Title: Geologist

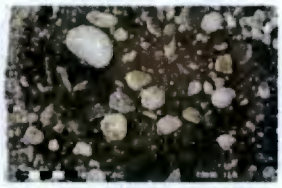
Signature: L. Stratton | Date: 5-30-08 | Signature: L.S. Walker | Date: 6/18/08

A-6003-642 (03/03)

Well C5856 (299-E33-341)

5 ft

10 ft


15 ft

18 ft

20 ft

25 ft

30 ft

35 ft

45 ft

50 ft

51 ft

55 ft

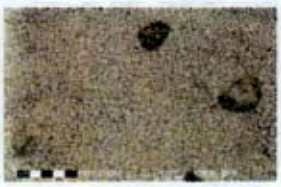
60 ft

65 ft

70 ft

75 ft

80 ft


90 ft

95 ft

100 ft

105 ft

110 ft

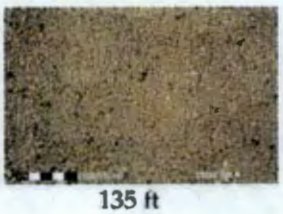
120 ft

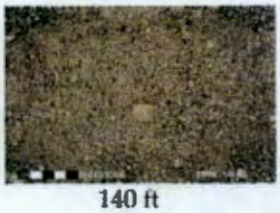
121 ft

Well C5856 (299-E33-341)

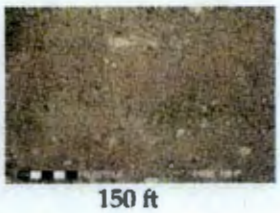
125 ft

130 ft

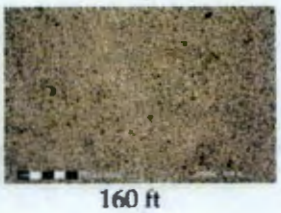

135 ft


140 ft

145 ft

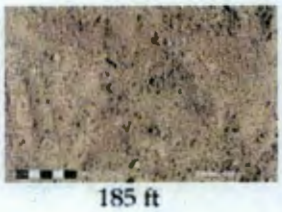

150 ft

155 ft

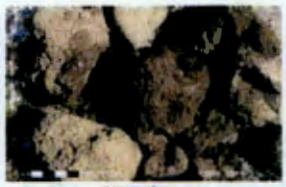

160 ft

170 ft

175 ft


185 ft

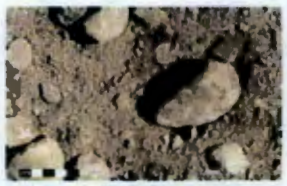
188 ft


190 ft

195 ft

200 ft

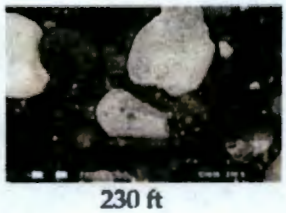
205 ft


210 ft

216 ft

220 ft

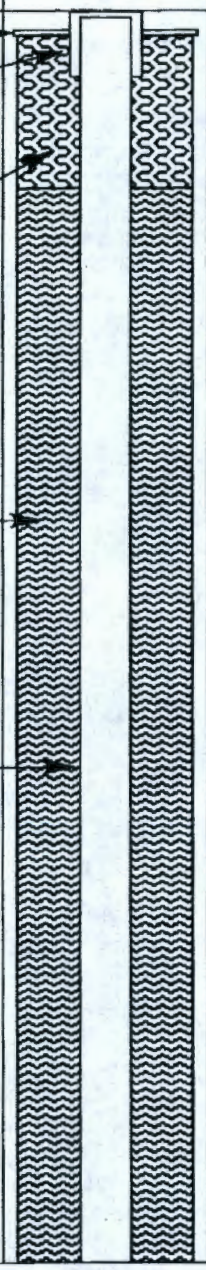
225 ft


230 ft

WELL SUMMARY SHEET	Start Date: 4/28/08 Finish Date: 6/9/08	Page 1 of 3

Well ID: C5856		Well Name: 299-E33-341	
Location: W of BY Cribs		Project: 200-BP-5 RI/FS	
Prepared By: Laurel Stratton	Date: 6/10/08	Reviewed By: L.D. Walker	Date: 6/18/08
Signature: [illegible]		Signature: [illegible]	

CONSTRUCTION DATA

Description	Diagram
6-in Concrete Pad 6-in I.D. Type 304/304L Stainless Steel Protective Casing: +3.00 ft above ground surface Portland Cement Type I/II: 0 - 8.8 ft bgs Granular Bentonite Crumbles: 8.8 - 210.1 ft bgs 4-in I.D. Stainless Steel Type 304/304L, Schedule 10 Permanent Casing: +2.15 - ~~235.97~~ 222.98 ft bgs LW 6-18-08 All depths are in feet below ground surface. Borehole drilled with: 11 3/4" threaded casing: 0.00-98.54 ft bgs 9 5/8" threaded casing: 98.54 - 237 ft bgs All temporary drill casing was removed from the ground.	

GEOLOGIC/HYDROLOGIC DATA

Depth in Feet	Graphic Log	Lithologic Description/Groundwater Sample Depths (ft bgs)
0		Ground surface - 10: silty sandy gravel (msG)
10		10 - 18.5: sandy gravel (sG)
20		18.5 - 19.5: sand (S). Lens of VFS. 19.5 - 30: gravelly sand (gS)
30		30 - 41.5: gravel (G)
40		41.5 - 44: sand (S). VFS. 44 - 51: gravelly sand (gS)
50		51 - 65: sand (S). FS - VCS, coarsening with depth
60		
		65 - 70: slightly silty sand
70		70 - 75: gravelly silty sand (gmS) 75 - 76.5: slightly silty sand 76.5 - 85.0: sand (S). VFS -MS.
80		85.0: 1" thick silt horizon 85 - 90: gravelly sand (gS)

WELL SUMMARY SHEET	Start Date: 4/28/08 Finish Date: 6/9/08	Page 2 of 3
Well ID: C5856	Well Name: 299-E33-341	
Location: W of BY Cribs	Project: 200-BP-5 RI/FS	
Prepared By: Laurel Stratton — Date: 6/10/08	Reviewed By: L. D. Walker — Date: 6/18/08	
Signature: [signature]	Signature: [signature]	

CONSTRUCTION DATA

Granular Bentonite Crumbles: 8.8 - 210.1 ft bgs

4-in I.D. Stainless Steel Type 304/304L, Schedule 10 Permanent Casing: +2.15 - ~~235.97~~ ft
222.98
LW 6-18-08

All depths are in feet below ground surface.

Borehole drilled with:

11 3/4" threaded casing: 0.00-98.54 ft bgs
9 5/8" threaded casing: 98.54 - 237 ft bgs

All temporary drill casing was removed from the ground.

GEOLOGIC/HYDROLOGIC DATA

Depth in Feet	Lithologic Description/Groundwater Sample Depths (ft bgs)
90	90 - 95: sandy gravel (sG)
	95 - 105: gravelly sand (gS)
100	
	105 - 105.5: sand (S): VFS.
	105.5 - 121: gravelly sand (gS)
110	
120	121 - 125: slightly silty sand
	125 - 130: sand (S)
130	130 - 135: slightly silty sand
	135 - 145: silty sandy gravel (msG)
140	
	145 - 150: gravelly sand (gS)
150	150 - 155: silty sandy gravel (msG)
	155 - 165: slightly gravelly sand (gmS)
160	
	165 - 170: gravelly silty sand (gmS)
170	170 - 175: silty sandy gravel (msG)
	175 - 180: sandy gravel (sG)

WELL SUMMARY SHEET	Start Date: 4/28/2008 Finish Date: 6/9/08	Page 3 of 3
Well ID: C5856	Well Name: 299-E33-341	
Location: W of BY Cribs	Project: 200-BP-5-OU RI/FS	
Prepared By: Laurel Stratton — Date: 6/10/08	Reviewed By: L.D. Walker — Date: 6/18/08	
Signature: [signature]	Signature: [signature]	

CONSTRUCTION DATA

Granular Bentonite Crumbles:
8.8 -210.1 ft bgs

4-in I.D. Stainless Steel Type 304/304L, Schedule 10 Permanent Casing: + 2.15 - ~~225.97~~ ft bgs
222.98'
LW 6-9-08

3/8-in Bentonite Pellets:
210.1 - 217.5 ft bgs

Primary Filter pack
10-20 Mesh Colorado Silica Sand:
217.5 - 237.0 ft bgs

Static Water Level:
226.85 ft bgs (6/9/08)

4-in I.D. Stainless Steel Type 304/304L, Slot 20 (0.20-in) Screen:
222.98 - 232.97 ft bgs

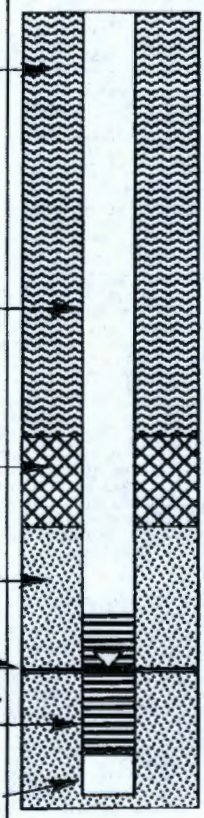
4-in I.D. Stainless Steel Type 304/304L Sump: 232.97 - 235.97 ft bgs

All depths are in feet below ground surface.

Borehole drilled with:

11 3/4" threaded casing::
0.00-98.54 ft bgs
9 5/8" threaded casing:
98.54 - 237 ft bgs

All temporary drill casing was removed from the ground.



GEOLOGIC/HYDROLOGIC DATA

Depth in Feet	Lithologic Description/Groundwater Sample Depths (ft bgs)
180	180 - 185: gravelly sand (gS)
	185 - 188.5: silty sandy gravel (msG)
	188.5 - 191: silty gravel (mG): gravel supported by silty matrix
190	191 - 198: silty gravel (mG) (loose)
	198 - 220: silty sandy gravel (msG)
200	
210	
220	220 - 232.5: silty gravel (mG)
230	232.5: contact with basalt
	237: total drilled depth (5/30/08)
	Water level 226.85 ft bgs (6/9/08)
240	
250	
260	

WELL CONSTRUCTION SUMMARY REPORT

Start Date: 4/28/08
Finish Date: 6/9/08
Page 1 of 1

Well ID: C5856	Well Name: 299-E33-341	Approximate Location: W OF BY CRIBS
Project: BP-5-OU RI/FS		Other Companies: FREESTONE ENVIRONMENTAL, STOLLER
Drilling Company: BLUESTAR ENTERPRISES NW		Geologist(s): LAUREL STRATTON, PATRICK CABBAGE, STEVE AIRHART
Driller: JUSTIN EGELAND	License #: 2843	

TEMPORARY CASING AND DRILL DEPTH			DRILLING METHOD	HOLE DIAMETER (in.) / INTERVAL (ft)
*Size/Grade/Lbs. Per Ft.	Interval	Shoe O.D./I.D.	Auger:	Diameter 11 3/4" From 0 to 98.54
11 3/4" OD Carbon Steel	0 - 98.54	12" / 10 3/4"	Cable Tool: X	Diameter 9 5/8" From 98.54 to 232.5
9 5/8" OD Carbon Steel	0 - 232.5	10" / 8 3/4"	Air Rotary:	Diameter 8 3/4" From 232.5 to 237.0
	-		A.R. w/Sonic:	Diameter From to
	-			Diameter From to
	-			Diameter From to
*Indicate Welded (W) - Flush Joint (FJ) Coupled (C) & Thread Design				Diameter From to
All threaded				
			Drilling Fluid: water (during hard-tool only)	
Total Drilled Depth: 237.0	Hole Dia @ TD: 8 3/4"		Total Amt. Of Water Added During Drilling: 27.5 gallons	
Well Straightness Test Results: PASS			Static Water Level: 226.85	Date: 6/9/08

GEOPHYSICAL LOGGING

Sondes (type)	Interval	Date	Sondes (type)	Interval	Date
SPECTRAL GAMMA	0 - 98	5/2/08	NEUTRON MOISTURE	0 - 98	5/2/08
"	96 - 236	6/2/08	"	96 - 226.5	6/2/08
"	135 - 235	5/30/08	—	— - —	—

COMPLETED WELL

Size/Wt./Material	Depth	Thread	Slot Size	Type	Interval Annular Seal/Filter Pack	Volume	Mesh Size
4" ID 304/304L STAINLESS	+2.15 - 222.98		—	PORTLAND CEMENT TYPE I/II	0 - 8.8	470 lb	—
STEEL SCHEDULE 10	— - —			GRANULAR BENTONITE	8.8 - 210.1	7,000 lb	—
" SCREEN	222.98 - 232.97		20	COATED BENTONITE PELLETS	210.1 - 217.5	250 lb	3/8"
	-			COLORADO SILICA SAND	217.5 - 237.0	700 lb	1020
" SUMP	232.97 - 235.99		—	—	— - —	—	—

OTHER ACTIVITIES

Aquifer Test:	Date:	Well Decommission:	Yes:	No:	Date:
Description:		Description:			

WELL SURVEY DATA (if applicable)

Not surveyed at this time	Protective Casing Elevation: /
Washington State Plane Coordinates: /	Brass Survey Marker Elevation: /

COMMENTS / REMARKS

Reported By:	Title:	Signature:	Date:
L. Stratton	Geologist	[signature]	6/10/08

A-6003-658 (04/03)

WELL DEVELOPMENT AND TESTING DATA

Well Name:	Well ID:	Well Location:	Date:
299-E33-341	C5856	W of BY cribs	6/10/08

Reference Measuring Point (unless otherwise noted): TOP OF OUTER CASING (TOC)

Has the well been surveyed? ○ Yes ⊘ No | Does the well have a cement pad? ⊘ Yes ○ No

PART 1

STATIC WATER LEVEL:

Start of Job	229.75' ToC
End of Job	229.75' ToC

DEPTH TO BOTTOM:

Start of Job	239.3' ToC
End of Job	239.3' ToC

PART 2

WELL DEVELOPMENT DATA

Pump Model	Grundfos
Intake Depth	~~236.05' bgs~~ 233.45' bgs
Starting Turbidity	2.81 NTU

Pump Start	Stop	Flow Rate
1016	1101	27.27 gpm

Total Pumped	1227.15 gal
Final Turbidity	0.71 NTU
~~XD SN/Range (PSI)~~	

PART 3

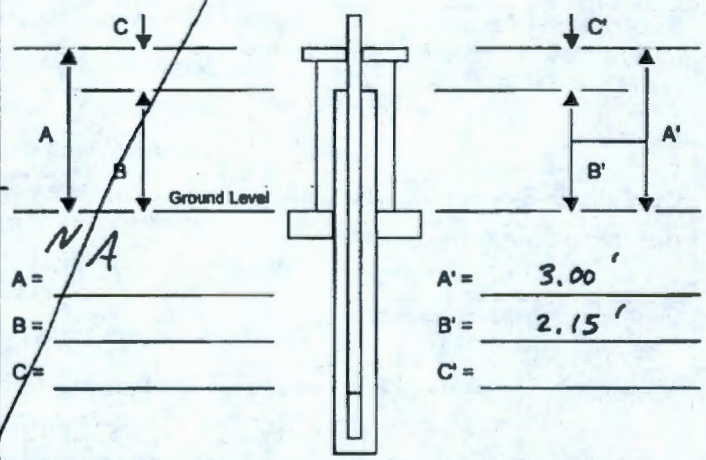
INSTANTANEOUS SLUG TEST

Static Water Level (TOC)	
Transducer Depth	
Baseline Start	
Injection Start	
Baseline Start	
Withdrawal Start	
Slug Volume	
XD SN/Range (PSI)	

PART 4

Last Recorded Measurements Date:

Current Measurements Date: 6/10/08



A =	N/A	A' =	3.00'
B =		B' =	2.15'
C =		C' =	

Are there any reference marks on the casing strings? ○ Yes ○ No

PART 5

COMMENTS:

Prepared by (print name):	Signature:	Date:
Kim Royal	Kim Royal	6/10/08
Reviewed by (print name):	**Signature:**	**Date:**
L.J. Walker	LJ Walker	6/20/08

A-6003-644 (03/03)

WELL SURVEY DATA REPORT

Project:	**Prepared By:** Larry A Henke **Company:** FGG
Date Requested: 06/18/08	**Requestor:** C.S. Wright (FH)
Date of Survey: 07/23/08	**Surveyor:** L.A. Henke FGG Survey Dept.
ERC Point of Contact:	**Survey Co. Point of Contact:** N.P. Fastabend
Description of Work: Civil Survey of Groundwater Monitoring Well C5856 (299-E33-341).	**Horizontal Datum:** NAD83(91)
	Vertical Datum: NAVD88
	Units: Meters
	Hanford Area Designation: 200E

Coordinate System: Washington State Plane Coordinates (South Zone)

Horizontal Control Monuments:
GABLEMTN (FH), 2E-1 (FGG)

Vertical Control Monuments:
HSWB-032 (COE), 2E-122 (FGG)

Well ID	Well Name	Easting	Northing	Elevation	
C5856	299-E33-341	573565.21	137652.50		Center of Casing
				192.030	Top Pump Baseplate, N. Edge
				192.020	Top of Outer Casing, N. Edge
				191.254	Brass Survey Marker

Notes:

Equipment Used: Trimble GPS 5800 RTK
Trimble DiNi 12 Level

Surveyor Statement:
I, Larry A. Henke, a Professional Land Surveyor registered in the State of Washington (Registration No. 38975), hereby certify that this report is based on a field survey performed in July, 2008 under my direct supervision, and that the data contained here is true and correct.

LARRY A. HENKE
STATE OF WASHINGTON
July 23, 2008
38975
REGISTERED
PROFESSIONAL LAND SURVEYOR
EXPIRES Sept. 23, 2009

Original to:
Distribution by DIS:

Sample Depth	Sample Type	HEIS #
15.4-17.5	Split-spoon	B1TNV6
15	Grab	B1TP22, B1TP96 (RS)
17.4 - 19.9	Split-spoon	B1TNV7
17.5	Grab	B1TP23, B1TT61 (RS)
19.5 - 22.0	Split-spoon	B1TNV8
20	Grab	B1TP24, B1TT62 (RS)
22.5	Grab	B1TP25, B1V4R2 (RS)
25	Grab	B1TP26, B1V4R3 (RS)
27.5	Grab	B1TP27, B1V4R4 (RS)
30	Grab	B1TP28, B1TP97 (RS)
32.5	Grab	B1TP29
35	Grab	B1TP30
37.5	Grab	B1TNV9
40	Grab	B1TNW0
42.5	Grab	B1TNW1
45	Grab	B1TNW2
47.5	Grab	B1TNW3
50	Grab	B1TNW4
52.5	Grab	B1TNW5
54.7 - 57.2	Split-spoon	B1TT72
55	Grab	B1TP31, B1TP98 (RS)
57.2 - 59.7	Split-spoon	B1TT73
57.5	Grab	B1TP32
59.7 - 62.2	Split-spoon	B1TT74
60	Grab	B1TP33
62.6 - 65.1	Split-spoon	B1TT75
62.5	Grab	B1TP34
64.7 - 67.2	Split-spoon	B1TT76
65	Grab	B1TP35
67.0 - 69.5	Split-spoon	B1TT77
67.5	Grab	B1TP36
69.8 - 72.3	Split-spoon	B1TT78
70	Grab	B1TP37, B1TP99 (RS)
72.4 - 74.9	Split-spoon	B1TT79
72.5	Grab	B1TP38
75	Grab	B1TP39
77.5	Grab	B1TP40
80	Grab	B1TP41

Sample Depth	Sample Type	HEIS #
82.5	Grab	B1TP42
85	Grab	B1TP43, B1TPB0 (RS)
87.5	Grab	B1TP44
90	Grab	B1TP45
92.5	Grab	B1TP46
95.3 - 97.8	Split-spoon	B1TT80
95	Grab	B1TP47
97.0-100.0	Split-spoon	B1TT81
97.5	Grab	B1TP48
99.9 - 102.4	Split-spoon	B1TT82
100	Grab	B1TP49, B1TPB1 (RS)
102.1 - 104.6	Split-spoon	B1TT83
103	Grab	B1TP50
104.7 - 107.2	Split-spoon	B1TT84
105	Grab	B1TP51
107.4 - 109.9	Split-spoon	B1TT85
107.5	Grab	B1TP52
109.7 - 112.2	Split-spoon	B1TT86
110	Grab	B1TP53
112.2 - 114.7	Split-spoon	B1TT87
113	Grab	B1TP54
114.7 - 117.2	Split-spoon	B1TT88
115	Grab	B1TP55, B1TPB2 (RS)
117.5 - 120	Split-spoon	B1TT89
117.5	Grab	B1TP56
120	Grab	B1TP57
122.5	Grab	B1TP58
125	Grab	B1TP59
127.5	Grab	B1TP60
130 - 132.5	Split-spoon	B1TT90
130	Grab	B1TP61, B1TPB3 (RS)
132.5 - 135	Split-spoon	B1TT91
132.5	Grab	B1TP62
135.2 - 137.7	Split-spoon	B1TT92
135	Grab	B1TP63
137.3 - 139.8	Split-spoon	B1TT93
137.5	Grab	B1TP64
139.9 -142.4	Split-spoon	B1TT94

Sample Depth	Sample Type	HEIS #
140	Grab	B1TP65
142.5 - 145	Split-spoon	B1TT95
142.5	Grab	B1TP66
144.9 - 147.4	Split-spoon	B1TT96
145	Grab	B1TP67, B1TPB4 (RS)
147.5 - 150	Split-spoon	B1TT97
147.5	Grab	B1TP68
149.7 - 152.2	Split-spoon	B1TT98
150	Grab	B1TP69
152 - 154.5	Split-spoon	B1TT99
152.5	Grab	B1TP70
155.4 - 157.9	Split-spoon	B1TTB0
155	Grab	B1TP71
157.3 - 159.8	Split-spoon	B1TTB1
158.5	Grab	B1TP72
160.6 - 163.1	Split-spoon	B1TTB2
160	Grab	B1TP73, B1TPB5 (RS)
163.1 - 165.6	Split-spoon	B1TTB3
163	Grab	B1TP74
164.9 - 167.4	Split-spoon	B1TTB4
165	Grab	B1TP75
167.1 - 169.6	Split-spoon	B1TTB5
167.5	Grab	B1TP76
170	Grab	B1TP77
172.5	Grab	B1TNW6
175	Grab	B1TNW7
177.5	Grab	B1TNW8
180 - 182.5	Split-spoon	B1TTB6
180	Grab	B1TP78, B1TPB6 (RS)
183.1 - 185.6	Split-spoon	B1TTB7
182.5	Grab	B1TP79
185	Grab	B1TP80
187 - 189.5	Split-spoon	B1TTB9
187.5	Grab	B1TP81
190.1 - 192.6	Split-spoon	B1TTC0
190	Grab	B1TP82
192.9 - 195.4	Split-spoon	B1TTC1
192.5	Grab	B1TP83

Sample Depth	Sample Type	HEIS #
195	Grab	B1TP84, B1TT57 (RS)
197.5	Grab	B1TNW9
200	Grab	B1TNX0
202.5	Grab	B1TNX1
205	Grab	B1TNX2
207.5	Grab	B1TNX3
209.2 - 211.7	Split-spoon	B1TTC2
210	Grab	B1TP85, B1TT58 (RS)
212 - 214.5	Split-spoon	B1TTC3
212.5	Grab	B1TP86
214.8 - 217.3	Split-spoon	B1TTC4
215	Grab	B1TP87
217.1 - 219.6	Split-spoon	B1TTC5
217.5	Grab	B1TP88
220.4 - 222.9	Split-spoon	B1TTC6
220	Grab	B1TP89
222.1 - 224.6	Split-spoon	B1TTC7
222.5	Grab	B1TP90
225 - 227.5	Split-spoon	B1TTC8
225	Grab	B1TP91, B1TT59 (RS)
227 - 230	Split-spoon	B1TTC9, B1TNT0, B1TNT1, B1TNT2
230 - 233	Split-spoon	B1TTD0, B1TNT3, B1TNT4, B1TT53
227.5	Grab	B1TP92
230	Grab	B1TP93
232.5	Grab	B1TP94
232.5	Pump	B1TT54, B1TT56 (RS), B1TT55
232.5	Pump	B1TT55

APPENDIX C

Well Documentation for 299-E33-342 (C5857)

Borehole Log

Photographic Log

Well Summary Sheet

Well Construction Summary Report

Well Development and Testing Data

Well Survey

Sample Depths and HEIS Numbers

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BOREHOLE LOG

Page 1 of 7
Date: 3/12/08

Well ID: C5857 | Well Name: 299-E33-343 | Location: N of B1 Tank Farm

Project: BP-5-OU Remedial Investigation | Reference Measuring Point: GROUND SURFACE

Depth (FL)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
0				Ground surface: Silty sandy gravel (msG).	Note: Cable tool (drive barrel)
5				5': Slightly silty sand: 92% sand 8% silt. Sand predom VF; VF-F; SA-SR; 90% qtz/other 10% basalt. Silt moist, mod rxn HCl 2.5Y 4/3 olive brown. Fill.	5: archive 1-pint grab sample for archive at 5-ft intervals
10				10': Silty sandy gravel (msG): 50% gravel, 50% sand, 10% silt. Gravel 50% basalt, 50% qtz/other, FP-SC, SA-SR, occasionally A. Sand M-C, SA, 50% qtz/other 50% basalt. Silt strong rxn HCl, slightly moist, 2.5Y 4/2 dark grayish brown. Fill.	10: archive
15				15': Sand. 98% sand, 2% silt. Sand predom VC, A-SR (predom SA), 40% basalt, 60% qtz/other. Silt dry, wk rxn HCl, 2.5Y 4/2 dark grayish brown. ~~15' → 35'~~ 6-12-08	15: archive
20	grab/split	223; 100%		20: Same as above, except basalt ↑ (generally VFP, A).	20: archive
	grab NOT collected				
25	grab			25: Same as above.	25: archive
	grab				
30	grab			30: Same as above, except occasional VFP-FP.	30: archive
	grab				
35	grab			35: Gravelly sand (gS): same as above but P ↑ 10%, basalt ↑ 50%.	35: archive
	grab				

Reported By: L. Stratton | Reviewed By: L.D. Walker

Title: Geologist | Title: Geologist

Signature: Laurel E Stratton | Date: 3/21/08 | Signature: LD Walker | Date: 6/12/08

A-6003-842 (03/03)

BOREHOLE LOG

Page 2 of 7
Date: 3/19/08

Well ID: C5857 | Well Name: 299-E33-342 | Location: N of BY Tank Farm

Project: ~~BP-5-OU~~ BP-5-OU REMEDIAL INVESTIGATION | Reference Measuring Point: GROUND SURFACE

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
40	grab			40': Gravelly sand (gS): 90% sand, 8% gravel, 2% silt.	40': archive.
				Sand same as above. Gravel VFP, C-VCP, VFP medium	41': gravel ↑ to 20% VCP-SC.
	grab			A. basalt: C-VCP SR, 40% basalt 60% qtz/other (mainly qtz)	(until 42.5)
				Occasional v. weak carbonate cementation. Dry.	
45	grab			45: Same as above.	45: archive
				49.5: small lens of finer sand, wkly carbonate cemented.	
	grab			silt ↑ 50%, VCS (no VF, F, M, CS) 3-21-08	
50	grab			50: Sand (S) with occasional pebbles. All same	50: archive
				as 40' except avg grain size smaller.	
	grab				
55	grab			55: same as above, but avg grain size	55: archive
				↑ to VCS – VFP.	
	grab				
					3-21-08
60	grab			60: Same as 40' (gravelly sand (gS))	60: archive. ~~Reduce casing~~ to 113½"
	grab				
65	grab			65: Same as 50' (Sand (S)). Small silt	65: archive
				stringers up to 5%.	
	grab				
70	grab/split	141; loose		70: Avg grain size ↑ to same as 40'	70: archive.
				(gravelly sand (gS)).	
	grab/split	104, 100%, 3-21-08			
75	grab/split	90, 100%, 3-21-08		75: Same as above. Noticeably micaceous.	75: archive
	grab/split	131; 100%			

Reported By: L. Stratton | Reviewed By: L. D. Walker

Title: Geologist | Title: Geologist

Signature: L. E. Stratton | Date: 3/21/08 | Signature: L. D. Walker | Date: 6/12/08

A-6003-842 (03/03)

BOREHOLE LOG

Page 3 of 7
Date: 3/14/08

Well ID: C5857 | Well Name: 299-E33-342 | Location: N OF BY TANK FARM

Project: BP-5-OU REMEDIATION INVESTIGATION | Reference Measuring Point: GROUND SURFACE

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description (Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl)	Comments (Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level)
80	Grab/ Split	111; 100%		80: Silty sand (mS): same as above, but silt↑ to 10%. 3 cm horizon of mod. carbonate cementation	micaceous. 80: archive
	Grab/ SPLIT	141; 100%			
85	GRAB			85: Sand (S). Same as above, but silt↓ 5%.	85: archive
	GRAB				
90	GRAB			90: Sand (S). Predom m-c. occasional vc, vfg. Predom SA-SR. 70% qtz/other, 30% basalt. Trace silt. No rxn HCl. Dry. 2.5Y 4/2 dark grayish brown	90: archive. 91-92: Silty sand (mS) as at 80.
	GRAB				
95	GRAB			95: Same as above, but avg grain size↑ to predom c-vc.	95: archive. 98: reduce casing to 9 5/8"
	GRAB				100: archive.
100	GRAB/ SPLIT	164; 100%		100: Same as above.	102: silt↑
	GRAB/ SPLIT	263; 100%			
105	GRAB/ SPLIT	169; 100%		105: Same as above, but silt↑ to 6%, ∴ slightly silty sand.	105: archive
	GRAB/ SPLIT	199; 100%			
110	GRAB/ SPLIT	198; 100%		110: Sand (S). VF-VC, predom M. No vcg. 70% qtz/other, 30% basalt; trace silt. No rxn HCl. Dry. 2.5Y 4/2 dark grayish brown. 4-1-08	110: archive
	GRAB/ SPLIT	188/100%			
115	GRAB/ SPLIT	188; 100%		115 sharp contact w/ VFS (S). Occasional F, MS (typically A basalt); 75% qtz/other, SA-R (predom SA). Uncemented/cemented, no to wk rxn HCl. 2.5Y 6/3 light yellowish brown. Dry. Complexly interbedded w/ sand (S) as above in VS laterally discontinuous layers. 4-1-08	VFS only until 119, then same as 90'. 115: archive
	GRAB/ SPLIT	151; 100%			

Reported By: L. Stratton | Reviewed By: L.D. Walker

Title: Geologist | Title: Geologist

Signature: L. Stratton | Date: 4/1/08 | Signature: L.D. Walker | Date: 6/12/08

A-6003-842 (03/03)

BOREHOLE LOG

Page 4 of 7
Date: 4/15/08

Well ID: C5857 | Well Name: 299-E33-342 | Location: N OF BY TANK FARM

Project: BP-5-OU RI/FS | Reference Measuring Point: GROUND SURFACE

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
120	GRAB			120: Sand (S) at 95': 90% qtz/other 10% basalt, predom C-VC, SA-SR.	121: one white cobble (bean long axis) 120: archive
	GRAB			120' → 145': SAND	
125	GRAB			125: Sand (S) as above	125: archive
	GRAB				
130	GRAB			130: Sand (S) as above	130: archive
	GRAB				
135	GRAB/ SPLIT	194; 100%		135: Sand (S) as above, but avg grain size ↓ to M-C.	135: archive
	GRAB/ SPLIT	170; 100%			
140	GRAB/ SPLIT	134; 40%		140: Sand (S): 75% qtz/other 25% basalt. Predom C; VF-VC, occasional FP (typically A basalt); SA-SR (predom SR). <2% silt: wk-mod rxn HCl; v. wk $CaCO_3$ cementation in places.	141: Drilling rate ↑ VCS w/ occasional FP(SR). Very loose. (through HS) 140: archive
	GRAB/ SPLIT	218; 100%			
145	GRAB/ SPLIT	243; 100%		145: Silty sandy gravel (msG) w/ irregular lenses of sandy silt (sM). Mod. 50% gravel, 40% sand, 5% silt. Gravel predom A, VF-FP, 60% basalt 40% qtz/other. Sand VF-VC, 70% qtz/other 30% basalt. SA-SR. Dry. sM: 20% VFS, 80% silt. 10 YR 5/2 grayish brown. Strong rxn HCl, compact.	145: archive
	GRAB/ SPLIT	257; 100%			
150	GRAB			150: Sand (S). Same as above but g.s. ↓ to VF-VCS, <5% silt. Strong rxn HCl, some wk $CaCO_3$ cementation.	155: archive
	GRAB				~156: drilling rate ↑; suspect $CaCO_3$ layer (silt on hand strong rxn HCl)
155	GRAB/ SPLIT	265; 100%		155: Silty sandy gravel (msG): 50% gravel, 40% sand, 10% silt. Sand, gravel as 145'. Silt wk-strong rxn HCl, 2.5Y 5/2 grayish brown. Dry. 4/15/08	
	GRAB/ SPLIT	100%			

Reported By: L. Stratton | Reviewed By: L.D. Walker

Title: Geologist | Title: Geologist

Signature: [signature] Date: 4/15/08 | Signature: [signature] Date: 6/12/08

A-6003-642 (03/03)

BOREHOLE LOG

Page 5 of 7

Date: ~~4/08~~ 4-15-08 LW 6-12-08

Well ID: C5857 | Well Name: 299-E33-342 | Location: N of BY Tank Farm

Project: BY-5 OU Remediation Investigation | Reference Measuring Point: Ground Surface

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
160	GRAB/ SPLIT-SPOON	183/100%		Silty sandy gravel (msG): as above. Strong rxn HCl.	160: archive
	GRAB/ SPLIT-SPOON	140/100%		161: return to M-VCS (S).	
				165' gravelly Sand (gS) - 25% gravel, 70% sand, 5% silt, gravel VFP-FP predom VFP, A-SA, 50% basalt 50% qtzite, granite, sand VFS-VCS predom CS-VCS, 70% qtz 30% basalt, SA-SR, lt. brownish gray 10YR 6/2, strong rxn HCl, dry.	Weak $CaCO_3$ cementing
165	GRAB/ SPLIT-SPOON	217/100%			165: archive
	Grab/ S.S.	180/100%			
170	Grab			170' sandy Gravel (sG) 50% gravel 50% sand, gravel VFP-FP, predom VFP, trace FP 60% basalt 40% granite, A-SA, sand VFS-VCS, predom. CS-VCS, 70% qtz 30% basalt, SA-SR, grayish brown 10YR 5/2, slight rxn HCl, dry	< silt, $CaCO_3$ @ 170'
					170: archive
	Grab				
175	Grab			175' sandy Gravel (sG) - as above	175: archive
					> fines @ 176'
	Grab				Occasional coarse pebbles
				180' gravelly Sand (gS) - 25% gravel, 75% sand, 5% silt - gravel VFP-FP predom VFP, A-SR, 60% basalt 30% granite, sand VFS-VCS, predom CS-VCS, 70% qtz 30% basalt, SA-SR, lt brownish gray 10YR 6/2, very weak rxn HCl, dry	noted @ 177.5'
180	Grab				180: archive
	Grab				> gravel @ 182'
					< gravel @ 185'
185	GRAB/ SPLIT-SPOON	160/100%		185' - gravelly Sand (gS) - as above	185: archive
	GRAB/ SPLIT-SPOON	254/100%		189.5': sharp contact w/ silty sandy gravel (msG): ~6" zone mod. cementation, around v. decomposed gravels. ~2" zone laminated silt/FP mod dry struggle, dry, mod-strong rxn HCl.	190: archive
190	GRAB/ SPLIT-SPOON	295/80%			192.5: cobbles
					193: gravel ↑, silt ↑ sand ↓
	GRAB/ SPLIT-SPOON	159/80%		190': silty sandy gravel (msG): 50% gravel, 45% sand, 5% silt. G: FP-SG predom CP, SA-SR, 40% basalt 60% qtz/other. Sand: 90% qtz/other 10% basalt, SR-SR, VF-C (predom ~~[illegible]~~ M-C) 2.5Y 5/2 light olive brown, dry, wk-mod rxn HCl.	195: archive
195	GRAB			195': silty sandy gravel (msG): 40% gravel, 50% sand, 10% silt. Gravel FP-VCP (suspect larger) SA-SR, 70% basalt 30% qtz/other. Sand: C-VF, SA. Silt: 2.5Y 6/2 light brownish gray, strong rxn HCl.	196: 1' diam cobble (suspect larger)
	GRAB				

Reported By: L. Stratton | Reviewed By: L.D. Walker

Title: Geologist | Title: Geologist

Signature: [signature] Date: 4/15/08 | Signature: [signature] Date: 6-12-08

A-6003-642 (03/03)

BOREHOLE LOG

Page 6 of 7
Date: 4/08

Well ID: C6557 | Well Name: 299-E33-342 | Location: N of BY Tank Farm

Project: BP-5-OU R1/RS | Reference Measuring Point: GROUND SURFACE

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
200	GRAB	NOT COLLECTED		200: wk cementation/compaction	
				202.5': sandy gravel (sG): 45% gravel, 50% sand, 5% silt. Gravel: VFP-SC, SA-SR (predom SR) 30% basalt, 70% qtz/other. Sand 50% basalt, 50% qtz/other, VF-VC (predom M-VC). Silt: dry, no rxn HCl, 2.5Y 3/1 v. dark grey.	202.5: archive
	GRAB				204: similar silt/sand laminated layer at 189.5 (laminations ~2cm)
205	GRAB			205: Silty sandy gravel (msG): Same as above, but ratio of silt: sand: gravel 15%: 50%: 35%. Lenses of large CaCO3.	205: archive 206: sand ↑ silt ↓ to as at 202.5'.
	GRAB				
210	GRAB/SPLIT-SPOON	239/90%		210: silty sandy gravel (msG): Same as above, but 7.5% silt, ↑ sand. Avg gravel size ↓ to MP. Caliche rinds on gravel common.	210: archive
	GRAB/SPLIT-SPOON	132/100%			
215	GRAB/SPLIT-SPOON	334/100%		215.5': silty sandy gravel as at 205 (msG), but avg gravel size ↓ (avg. max ~4cm).	215.5': archive
	SPLIT-SPOON	402/100%			220: archive
220	GRAB/SPLIT-SPOON	285/100%		220: silty sandy gravel (msG): 40% gravel, 40% sand, 20% silt. Gravel 30% basalt, 70% qtz/other, VFP-CP (rarely larger), SA-R (predom SR-R); sand 25% basalt 75% qtz/other, A-SR, VF-VC. Silt: mod rxn HCl, dry, 2.5Y 5/2 grayish brown.	Note: % silt probably ↓↓ than appears - gravel heavily fractured by drive barrel producing ↑ rock flour.
	GRAB/SPLIT-SPOON	172/100%			
225	GRAB/SPLIT-SPOON	191/20%		225: silty sandy gravel (msG): 50% gravel, 35% sand, 15% silt. Gravel same as above. Sand 50% basalt, 50% qtz/other, A-SA. No rxn HCl.	224.5': archive 228: moist 230: 1200 dpm/100cm² direct contamination
	GRAB/SPLIT-SPOON	425/100%		229-230: sharp contact w/ above. MSG - compact VCS/silt matrix, 2.5Y 5/4 light olive brown, strong rxn HCl surrounding v. decomposed P (VFP-MP). No M-VCS. Gravel same as above. Dry.	230.0: silt ↓↓↓ to trace. Drilling rate ↓ 230: archive
230	GRAB/SPLIT-SPOON	259/80%			
	GRAB				
235	SPLIT-SPOON/GRAB	186/90%		236: gravelly silty sand (gmS): 20% gravel, 50% sand, 20% silt. Gravel VFP-VCP, 30% basalt 80% qtz/other, SA-R (predom SR). Sand 50% basalt, 50% qtz/other, A-R (predom SA-SR), VF-VC (predom VF). Silt - no rxn HCl, 2.5Y 5/2 grayish brown. Dry.	236: archive

Reported By: L. Stratton | Reviewed By: L.D. Walker

Title: Geologist | Title: Geologist

Signature: [signature] Date: 4/15/08 | Signature: [signature] Date: 6/12/08

A-6003-642 (03/03)

BOREHOLE LOG

Page 7 of 7
Date: 4/08

Well ID: C5857
Well Name: 299-E33-342
Location: N of BY Tank Farm
Project: BP-5-OU RI/FS
Reference Measuring Point: GROUND SURFACE

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
240	GR-AB			240: Sandy silty gravel: (GM): 50% gravel, 35% sand, 15% silt. WET. Gravel VFP-SC, avg	240: Saturated. Archive sample.
242.4				↑ from above, SC cobbles common to 10 cm. All	242: hard tool
				d/a same as above.	~242: >90% basaltic VFS/silt (compact)
				242.4': contact w/ basalt.	
245				~243.4': basalt weathered & vesicular	245: archive sample
				245.5: TD	

Not used
LS 4/15/08

Reported By: L. Stratton
Title: Geologist
Signature: [signature]
Date: 4/15/08

Reviewed By: L.D. Walker
Title: Geologist
Signature: LD Walker
Date: 6/12/08

A-6003-642 (03/03)

Well C5857 (299-E33-342)

5 ft

10 ft

15 ft

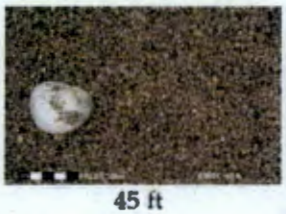
20 ft

25 ft

30 ft

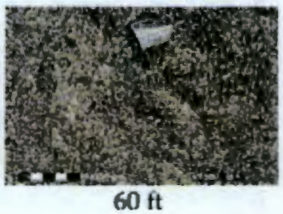
35 ft

40 ft


45 ft

50 ft

55 ft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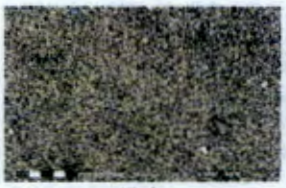
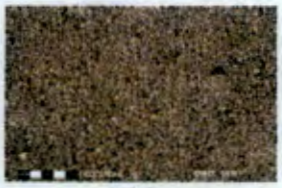

65 ft

70 ft

80 ft

85 ft

90 ft


95 ft

100 ft

105 ft

110 ft

115 ft

120 ft

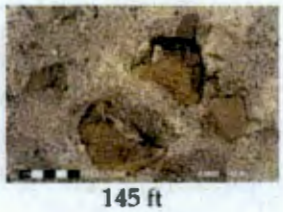
125 ft

Well C5857 (299-E33-341)

130 ft

135 ft

140 ft


145 ft

150 ft

155 ft

160 ft

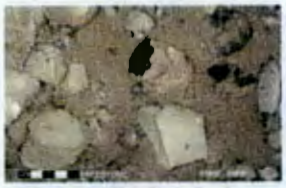
165 ft

170 ft

175 ft

180 ft

185 ft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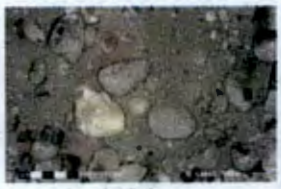
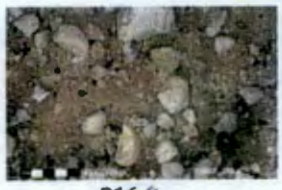

195 ft

202 ft

205 ft

210 ft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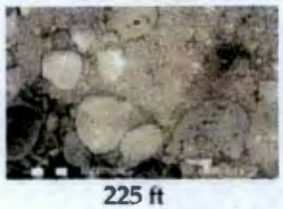
220 ft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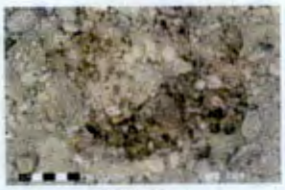
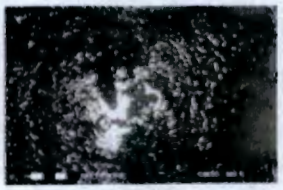

230 ft

236 ft

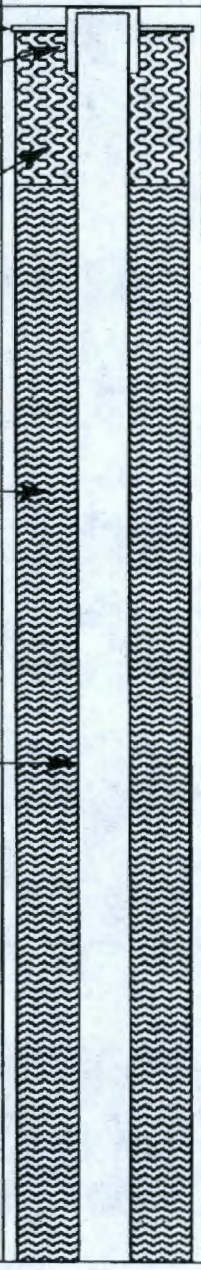
240 ft


245 ft

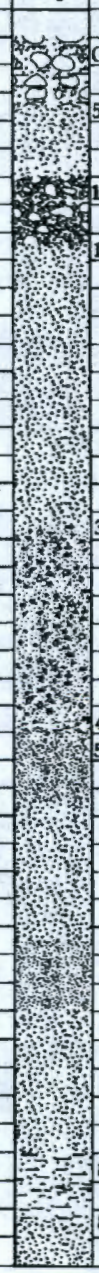
WELL SUMMARY SHEET	Start Date: 3/12/08 Finish Date: 4/23/08	Page 1 of 3

Well ID: C5857		Well Name: 299-E33-342	
Location: N of BY Tank Farm		Project: 200-BP-5 RI/FS	
Prepared By: Laurel Stratton	Date: 5/4/08	Reviewed By: L.D. Walker	Date: 6-12-08
Signature: [illegible]		Signature: [illegible]	

CONSTRUCTION DATA

Description	Diagram
6-in Concrete Pad 6-in I.D. Type 304/304L Stainless Steel Protective Casing: +3.0 ft above ground surface Portland Cement Type I/II: 0 - 9.2 ft bgs Granular Bentonite Crumbles: 9.2 - 225.6 ft bgs 4-in I.D. Stainless Steel Type 304/304L, Schedule 10 Permanent Casing: +2.58 - 244.6 ft bgs All depths are in feet below ground surface. Borehole drilled with: 11 3/4" threaded casing: 0.00-98.56 ft bgs 9 5/8" threaded casing: 98.56 - 244.87 ft bgs All temporary drill casing was removed from the ground.	

GEOLOGIC/HYDROLOGIC DATA

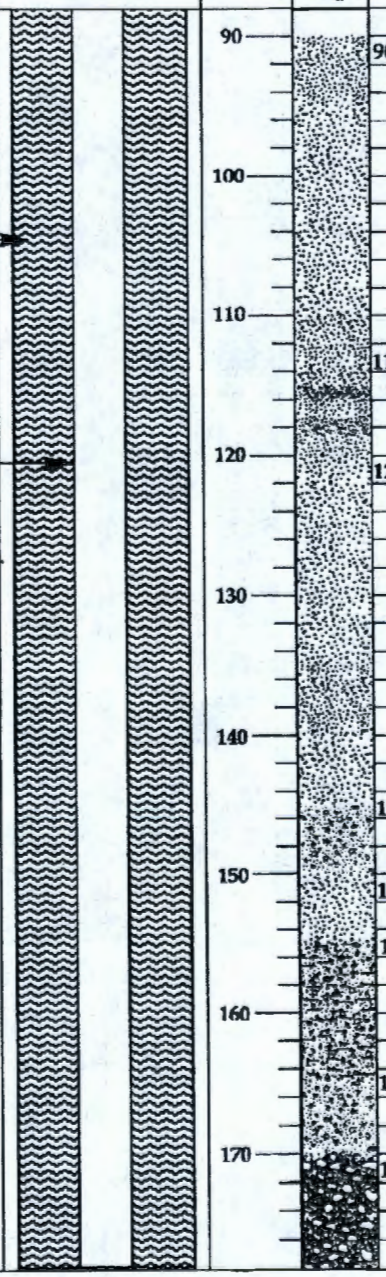
Depth in Feet	Graphic Log	Lithologic Description/Groundwater Sample Depths (ft bgs)
0		Ground surface: silty sandy gravel (msG)
		5 - 10: slightly silty sand
10		10 - 15: silty sandy gravel (msG)
		15 - 35: sand (S)
20		
30		
		35 - 49.5: gravelly sand (gS)
40		
		49.5: small lens of silty sand (mS)
50		50 - 80: sand (S)
60		
70		
80		80 - 85: silty sand (mS)
		85 - 90: sand (S)

WELL SUMMARY SHEET	Start Date: 3/12/08 Finish Date: 4/23/08	Page 2 of 3

Well ID: C5857		Well Name: 299-E33-342	
Location: N of BY Tank Farm		Project: 200-BP-5 RI/FS	
Prepared By: Laurel Stratton	Date: 5/4/08	Reviewed By: L.D. Walker	Date: 6-12-08
Signature: [illegible]		Signature: [illegible]	

CONSTRUCTION DATA

Description	Diagram
Granular Bentonite Crumbles: 9.2 - 225.6 ft bgs	
4-in I.D. Stainless Steel Type 304/304L, Schedule 10 Permanent Casing: +2.58 - 244.6 ft	
All depths are in feet below ground surface.	
Borehole drilled with: 11 3/4" threaded casing: 0.00-98.56 ft bgs; 9 5/8" threaded casing: 98.56 - 244.87 ft bgs	
All temporary drill casing was removed from the ground.	



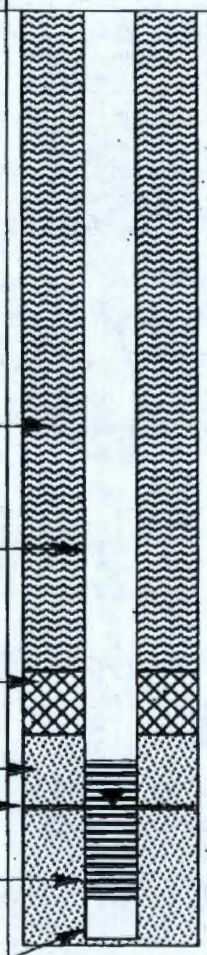
GEOLOGIC/HYDROLOGIC DATA

Depth in Feet	Graphic Log	Lithologic Description/Groundwater Sample Depths (ft bgs)
90		90 - 115: sand (S)
100		
110		115 - 120: lenses of very fine sand (VFS)
120		120 - 145: sand (S)
130		
140		
		145 - 150: silty sandy gravel (msG)
150		150 - 155: sand (S)
		155 - 165: silty sandy gravel (msG)
160		
		165 - 170: gravelly sand (gS)
170		170 - 180: sandy gravel (sG)

WELL SUMMARY SHEET	Start Date: 3/12/08 Finish Date: 4/23/08	Page 3 of 3

Well ID: C5857		Well Name: 299-E33-342	
Location: N of BY Tank Farm		Project: 200-BP-5 RI/FS	
Prepared By: Laurel Stratton	Date: 5/4/08	Reviewed By: L. D. Walker	Date: 6/12/08
Signature:		Signature:	

CONSTRUCTION DATA

Description	Diagram
All depths are in feet below ground surface. Borehole drilled with: 11 3/4" threaded casing:: 0.00-98.56 ft bgs 9 5/8" threaded casing: 98.56 - 244.87 ft bgs All temporary drill casing was removed from the ground. Granular Bentonite Crumbles: 9.2 - 225.6 ft bgs 4-in I.D. Stainless Steel Type 304/304L, Schedule 10 Permanent Casing: +2.58 - 244.6 ft 3/8-in Bentonite Pellets: 225.6 - 230.0 ft bgs Primary Filter pack 10-20 Mesh Colorado Silica Sand: 230.0 - 245.3 ft bgs Static Water Level: 236.17 ft bgs (4/22/08) 4-in I.D. Stainless Steel Type 304/304L, Slot 20 (0.20-in) Screen: 232.6 - 242.6 ft bgs 4-in I.D. Stainless Steel Type 304/304L Sump: 242.6 - 244.6 ft bgs	

GEOLOGIC/HYDROLOGIC DATA

Depth in Feet	Graphic Log	Lithologic Description/Groundwater Sample Depths (ft bgs)
180		180 - 189.5: gravelly sand (gS)
		189.5: approximately 2-in thick laminated silt forming tight matrix around FP
190		190 - 202.5: silty sandy gravel (msG)
		196: 1 ft diameter cobble (suspect larger)
200		
		202.5 - 205: sandy gravel (sG)
		205 - 230: silty sandy gravel (msG)
210		
220		
230		230 - 236: sandy gravel (sG)
		236 - 240: gravelly silty sand (gmS)
240		240 - 242.4: silty sandy gravel (msG)
		242.4: contact with basalt
		245.5: total depth (4/14/08)
		Water level 236.17 ft bgs (4/22/08)
250		

WELL CONSTRUCTION SUMMARY REPORT

Start Date: 3/12/08
Finish Date: 4/23/08
Page 1 of 1

Well ID: C5857	Well Name: 299-E33-342	Approximate Location: N of BY Tank Farm
Project: BP-5-OU Remedial Investigation		Other Companies: Firestone Environmental
Drilling Company: Bluestar		Geologist(s): Laurel Stratton, Steve Airhart, Pat Cabbage
Driller: Justin Egeland	License #: 2845	

TEMPORARY CASING AND DRILL DEPTH			DRILLING METHOD	HOLE DIAMETER (in.) / INTERVAL (ft)
*Size/Grade/Lbs. Per Ft.	Interval	Shoe O.D./I.D.	Auger: /	Diameter 11 3/4" From 0 to 98.56'
11 3/4" OD Carbon Steel	0 - 98.56'	12 1/2" / 10 3/4"	Cable Tool: X	Diameter 9 5/8" From 98.56' to 245.5'
9 5/8" OD "	0 - 245.5'	10" / 9 3/4"	Air Rotary: /	Diameter ____ From ____ to ____
All threaded	-		A.R. w/Sonic: /	Diameter ____ From ____ to ____
	-			Diameter ____ From ____ to ____
	-			Diameter ____ From ____ to ____
*Indicate Welded (W) - Flush Joint (FJ) Coupled (C) & Thread Design				Diameter ____ From ____ to ____

		Drilling Fluid: Water	
Total Drilled Depth: 245.5'	Hole Dia @ TD: 9 5/8"	Total Amt. Of Water Added During Drilling: 85 gallons	
Well Straightness Test Results: PASS		Static Water Level: 236.14	Date: 4/22/08

GEOPHYSICAL LOGGING

Sondes (type)	Interval	Date	Sondes (type)	Interval	Date
NEUTRON MOISTURE/	0 - 98	3/21/08		-	
SPECTRAL GAMMA	98 - 245.5	4/5 - 4/10/08		-	
	-			-	

COMPLETED WELL

Size/Wt./Material	Depth	Thread	Slot Size	Type	Interval Annular Seal/Filter Pack	Volume	Mesh Size
4" ID 304/304L schedule 10	+2.58 - 244.6	X		Portland cement w/bentonite	0 - 9.2'	6	
Stainless steel	-			Granular bentonite	9.2 - 225.6	57	
4" " screen	232.6 - 242.6	X	20	bentonite pellets	225.6 - 230.0	2	3/8"
	-			Colorado silica sand	230.0 - 245.3	17	1020
4 " sump	242.6 - 244.6	X			-		

OTHER ACTIVITIES

Aquifer Test:	Date:	Well Decommission:	Yes:	No:	Date:
Description:		Description:			

WELL SURVEY DATA (if applicable)

Not surveyed at this time	Protective Casing Elevation:
Washington State Plane Coordinates:	Brass Survey Marker Elevation:

COMMENTS / REMARKS

Reported By:	Title:	Signature:	Date:
L. Stratton	Geologist	L. Stratton	5/4/08

A-6003-658 (04/03)

WELL DEVELOPMENT AND TESTING DATA

Well Name:	Well ID:	Well Location:	Date:
299-E33-342	C5857	N OF BY Tank Farm	6/9/08

Reference Measuring Point (unless otherwise noted): TOP OF OUTER CASING (TOC)

Has the well been surveyed? O Yes ☒ No | Does the well have a cement pad? ☒ Yes O No

PART 1

STATIC WATER LEVEL:

Start of Job 236.12' bgs

End of Job

DEPTH TO BOTTOM:

Start of Job 244.80

End of Job

PART 2

WELL DEVELOPMENT DATA

Pump Model 5hp

Intake Depth 240.5

Starting Turbidity 1.22

Pump Start	Stop	Flow Rate
0950	1013	27 gpm
1013	1030	31.5 gpm
1044	1050	27 gpm

Total Pumped 1804.5

Final Turbidity 0.56 ntu

XD SN/Range (PSI) —

PART 3

INSTANTANEOUS SLUG TEST

Static Water Level (TOC)

Transducer Depth

Baseline Start

Injection Start

Baseline Start

Withdrawal Start

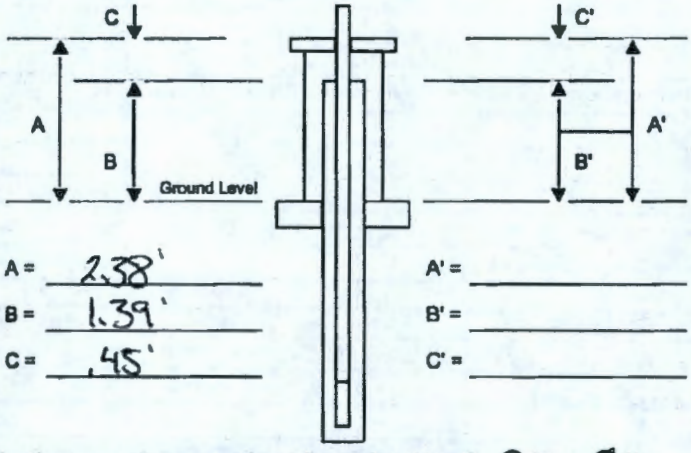
Slug Volume

XD SN/Range (PSI)

PART 4

Last Recorded Measurements Date: 6/9/08

Current Measurements Date:



A = 2.38'

B = 1.39'

C = .45'

A' =

B' =

C' =

Are there any reference marks on the casing strings? O Yes ☒ No

PART 5

COMMENTS:

- No drawdown or recovery data collected, no data logger available

Prepared by (print name):	Signature:	Date:
J Fetters	J Fetters	6/9/08
Reviewed by (print name):	**Signature:**	**Date:**
L.D. Walker	L.D. Walker	6-12-08

A-6003-644 (03/03)

WELL SURVEY DATA REPORT

Project:	**Prepared By:** Larry A Henke **Company:** FGG
Date Requested: 06/18/08	**Requestor:** C.S. Wright (FH)
Date of Survey: 07/23/08	**Surveyor:** L.A. Henke FGG Survey Dept.
ERC Point of Contact:	**Survey Co. Point of Contact:** N.P. Fastabend
Description of Work: Civil Survey of Groundwater Monitoring Well C5857 (299-E33-342).	**Horizontal Datum:** NAD83(91)
	Vertical Datum: NAVD88
	Units: Meters
	Hanford Area Designation: 200E

Coordinate System: Washington State Plane Coordinates (South Zone)

Horizontal Control Monuments:
GABLEMTN (FH), 2E-1 (FGG)

Vertical Control Monuments:
HSWB-032 (COE), 2E-122 (FGG)

Well ID	Well Name	Easting	Northing	Elevation	
C5857	299-E33-342	573625.68	137579.96		Center of Casing
				194.888	Top Pump Baseplate, N. Edge
				194.881	Top of Outer Casing, N. Edge
				194.135	Brass Survey Marker

Notes:

Equipment Used: Trimble GPS 5800 RTK
Trimble DiNi 12 Level

Surveyor Statement:
I, Larry A. Henke, a Professional Land Surveyor registered in the State of Washington (Registration No. 38975), hereby certify that this report is based on a field survey performed in July, 2008 under my direct supervision, and that the data contained here is true and correct.

LARRY A. HENKE
STATE OF WASHINGTON
38975
REGISTERED
PROFESSIONAL LAND SURVEYOR
EXPIRES Oct 23, 2009

Original to:
Distribution by DIS:

Sample Depth	Sample Type	HEIS #
20.1 - 22.6	Split-spoon	B1TNC9
20	Grab	B1TMT2, B1TNN7 (RS)
25	Grab	B1TMT4
27.5	Grab	B1TMT5
30	Grab	B1TMT6
32.5	Grab	B1TMT7
34.8	Grab	B1TMT8, B1TNN8 (RS)
37.5	Grab	B1TMT9
40	Grab	B1TMV0
42.5	Grab	B1TMV1
45	Grab	B1TMV2
47.5	Grab	B1TMV3
50	Grab	B1TMV4, B1TNN9 (RS)
52.5	Grab	B1TMV5
55	Grab	B1TMV6
57.5	Grab	B1TMV7
60	Grab	B1TMV8
62.5	Grab	B1TMV9
65	Grab	B1TMW0, B1TNPO (RS)
67.5	Grab	B1TMW1
69.7 - 72.2	Split-spoon	B1TND0
69.7	Grab	B1TMW2
72.5 - 75	Split-spoon	B1TND1
72.5	Grab	B1TMW3
75.6 - 78.1	Split-spoon	B1TND2
75.5	Grab	B1TMW4
77.6 - 80.1	Split-spoon	B1TND3
77.5	Grab	B1TMW5
79.9 - 82.1	Split-spoon	B1TND4, B1TN38 (RS), B1TN39 (VOA), B1TN40 (VOA), B1TN41
80 - 82.5	Split-spoon	B1TND5, B1TN43 (VOA), B1TNP1 (VOA), B1TNP2
80	Grab	B1TMW6, B1TRT7 (RS)
82.5 - 85	Split-spoon	B1TND6
82.5	Grab	B1TMW7
85	Grab	B1TMW8
87.5	Grab	B1TMW9
90	Grab	B1TMX0
92.5	Grab	B1TMX1

Sample Depth	Sample Type	HEIS #
95	Grab	B1TMX2, B1TRT8 (RS)
97.5	Grab	B1TMX3
99.8 - 102	Split-spoon	B1TND8
100	Grab	B1TMX4
101.6 - 104.1	Split-spoon	B1TND9
102.2	Grab	B1TMX5
104.7 - 107.2	Split-spoon	B1TNF0
105	Grab	B1TMX6
107.2 - 109.7	Split-spoon	B1TNF1
107.2	Grab	B1TMX7
109.5 - 112	Split-spoon	B1TNF2
109.5	Grab	B1TMX8, B1TRT9 (RS)
112.7 - 115.2	Split-spoon	B1TNF3
112.7	Grab	B1TMX9
114.2 - 116.7	Split-spoon	B1TNF4
115	Grab	B1TMY0
117.6 - 120.1	Split-spoon	B1TNF5
117	Grab	B1TMY1
120	Grab	B1TMY2
122.5	Grab	B1TMY3
125	Grab	B1TMY4, B1TRV0 (RS)
127.5	Grab	B1TMY5
130	Grab	B1TMY6
132.5	Grab	B1TMY7
134.9 - 137.2	Split-spoon	B1TNF7
135	Grab	B1TMY8
137.2 - 139.7	Split-spoon	B1TNF8
137.5	Grab	B1TMY9
140.4 - 142.9	Split-spoon	B1TNF9
140	Grab	B1TN00, B1TRV1 (RS)
142.4 - 145	Split-spoon	B1TNH0
143	Grab	B1TN01
145.3 - 147.8	Split-spoon	B1TNH1
145	Grab	B1TN02
147.5 - 150	Split-spoon	B1TNH2
147	Grab	B1TN03
150	Grab	B1TN04
152.5	Grab	B1TN05

Sample Depth	Sample Type	HEIS #
154.5-157	Split-spoon	B1TNH4
154.5	Grab	B1TN06, B1TRV2 (RS)
157.9-160.4	Split-spoon	B1TNH5
157.9	Grab	B1TN07
160-162.5	Split-spoon	B1TNH6
160	Grab	B1TN08
162.7-165.2	Split-spoon	B1TNH7
162.5	Grab	B1TN09
165.2-167.7	Split-spoon	B1TNH8, B1TNP3 (RS), B1TNP4 (VOA), B1TNP5 (VOA), B1TNP6,B1TNH8
165	Grab	B1TN10
167.6-170.1	Split-spoon	B1TNH9
167.5	Grab	B1TN11
170	Grab	B1TN12, B1TRV3
172.5	Grab	B1TN13
175	Grab	B1TN14
177.5	Grab	B1TN15
180	Grab	B1TN16
182.5	Grab	B1TN17
185.3-187.8	Split-spoon	B1TNJ1
185	Grab	B1TN18, B1TRV4 (RS)
187-189.5	Split-spoon	B1TNJ2
187	Grab	B1TN19
189.8-192.5	Split-spoon	B1TNJ3, B1TNP7 (RS), B1TNP8 (VOA), B1TNP9 (VOA), B1TNR0
190	Grab	B1TN37
192.3-195	Split-spoon	B1TNJ4
192.5	Grab	B1TN20
195	Grab	B1TN21
199	Grab	B1TN22
202.5	Grab	B1TN24, B1TRV5 (RS)
205	Grab	B1TN25
207.5	Grab	B1TN26
209.7-212.2	Split-spoon	B1TNJ6
210	Grab	B1TN27
213.3-215.8	Split-spoon	B1TNJ7
212.5	Grab	B1TN28
216.5-219	Split-spoon	B1TNJ8
215.5	Grab	B1TN29

Sample Depth	Sample Type	HEIS #
217.3-219.8	Split-spoon	B1TNJ9
219.5-222	Split-spoon	B1TNK0
220	Grab	B1TN31
222-224.5	Split-spoon	B1TNK1
222.5	Grab	B1TN32
224.5-227	Split-spoon	B1TNK2
224.5	Grab	B1TN33
227.2-229.7	Split-spoon	B1TNK3
228	Grab	B1TN34
230-232.5	Split-spoon	B1TNK4
230.5	Grab	B1TN35
232.5	Grab	B1TN36, B1TRV7 (RS)
232.6-235.1	Split-spoon	B1TNR8, B1TW34, B1TW35, B1TW36
236	Grab	B1TNT5
237.5	Grab	B1TNT6
240	Grab	B1TNT7
242.5-243	Split-spoon	B1TNR9
242.5	Grab	B1TNT8
242.4	Kabis	B1TNV4

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APPENDIX D

WELL DOCUMENTATION FOR 299-E33-343 (C5858)

Borehole Log

Photographic Log

Well Summary Sheet

Well Construction Summary Report

Well Development and Testing Data

Well Survey

Sample Depths and HEIS Numbers

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BOREHOLE LOG

Page 1 of 7
Date: 1/15/08

Well ID: C5858 | Well Name: 299-E33-343 | Location: N of B Tank farm

Project: BP-5 Remedial Invest. | Reference Measuring Point: Ground surface

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
0				0-5' silty sandy gravel (mSG) w/ cobbles up to 6".	Cable tool, 10" drive barrel
5				Est 35% gravel, 25% silt, 40% sand (mSG)	Archive sample collected no contamination to this depth (5' sampl)
				0-13': Silty Sandy GRAVEL	
10				40% v.f. to v. coarse pebbles, 40% sand 20% silt (mSG)	Archive sample collected, no contamination (10')
				13'—10% f. to coarse pebble, 50% silt, 40% fine sand (gsM)	Archive sample for 13 Collected
15				15'—10% v. fine to med. pebble, 70% v. fine to v. coarse sand, 20% silt (gmS)	Archive sample for 15' Collected
				13 → 20': Gravelly Silty SAND	
20				40% rounded gravel (fine pebble to small cobble), 50% med to coarse sand, 10% silt. Moist. (sG)	Archive sample for 20 collected. No contam.
				20' → 37': Sandy GRAVEL	
25				40% fine to coarse rounded pebbles, 50% med to coarse sand, 10% silt. Moist. (sG)	25' Archive sample collected. No contam.
30				Same as 25' except pebbles to v. coarse. (sG). Moist.	30' Archive sample collected No contamination
35				30% fine to v. coarse pebbles, 65% med to coarse sand, 5% silt. Moist. (gS)	35' Archive sample collected No contamination.
				37' lith change to f. to v. coarse sand Moist (S) 70% felsic	37' Arch sampl collected No contam

Reported By: S.H. Hall | Reviewed By: L.D. Walker

Title: Geologist | Title: Geologist

Signature: S.H. Hall | Date: 1/25/08 | Signature: L.D. Walker | Date: 6/5/08

A-6003-842 (03/03)

BOREHOLE LOG

Page 2 of 7
Date: 1/15/08

Well ID: C58595 | Well Name: 299-E33-343 | Location: N of B Tank Farm

Project: BP-5 Remedial Investigation | Reference Measuring Point: Ground Surface

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
40				Med to v. coarse sand (S) angular to sub-round 70% felsic	40' Archive smpl collected no contam.
				37 → 70': SAND	Drilling method: cable tool (drive barrel)
45				Same as 40'	45' Archive - no contam.
50				Same as 40'	50' Arch. smpl - no contam
55				95% fine to coarse sand (70% felsic), 5% fine to med pebbles (occasional a v. coarse pebble) (S) 56' v.fine to med S (100%) 90% felsic	55' Archive smpl - no contam 56' " " " "
60	grab			Same as 56'	60' Archive smpl - no contamination.
	grab				60: Reduce casing to 11 3/4"
65	grab/split	70;100%		Same as 56'	65' Archive smpl - no contamination
	grab/split	222;100%			
				70' → 75': gravelly SAND	
70	grab/split	95/100%		70% f. to v coarse sand, 20% v.f. to med pebbles, w/occasional v. coarse pebble. 70% felsic.	70' Archive smpl
	grab/split	187/100%		Lightly cemented w/ sl. Rxn to 10% HCl (gS)	
75	grab/split	139;100%		85% v.f. to c. sand/80% felsic/angular to sub-round, 15% silt [(m) S]. V. sl. rxn HCl, v.v. sl. cementation.	
	grab/split	150;100%			

Reported By: S. H. Hall | Reviewed By: L.D. Walker

Title: Geologist | Title: Geologist

Signature: S.H. Hall | Date: 1/25/08 | Signature: [illegible] | Date: 6/5/08

A-6003-642 (03/03)

BOREHOLE LOG

Page 3 of 7
Date: 1/21/08

Well ID: C5858 | Well Name: 299-E33-343 | Location: N of B Tank Farm

Project: BP-5 Remedial Investigation | Reference Measuring Point: Ground Surface

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
80	grab/split	121; 100%		Same as 75', but w/o cementation or HCl rxn [(m)S]	80' Archive sample
	grab/split	130; 100%		75→90': Silty SAND	Cable tool with drive barrel
85	grab			Same as 80' [(m)S]	85' Archive sample
	grab				
90	grab			90→95': Gravelly SAND 10% v. fine to med. pebbles; fine to v. coarse sand, angular to sub-rounded and 70% felsic.	90' Archive sample
	grab			The pebbles are mostly basaltic (gS)	
95	grab			v. fine to coarse, angular sand, 70% felsic. 10YR 6/2 (S)	95' Archive sample
	grab			95→122.2': SAND	
100	grab/split	85; 100%		Lith. change to 10YR 5/3 v. fine to fine sand, angular to sub-round, 5% basaltic. (S)	100' Archive sample
	grab/split	100; 100%			
105	grab/split	108; 100%		Similar to 100', but coarser, v. fine to coarse (S)	105' Archive sample
	grab/split	87; 100%			
110	grab/split	156; 100%		Same as 105' (S)	110' Archive sample
	grab/split	205; 100%			
115	grab/split	142; 100%		v. fine to med sand, 10YR 6/1, angular to sub-round, 80% felsic, v. slight rxn to HCl + v. slight cementation (S)	115' Archive sample
	grab/split				

Reported By: S.H. Hall | Reviewed By: L.D. Walker

Title: Geologist | Title: Geologist

Signature: SHHall | Date: 1/25/08 | Signature: [illegible] | Date: 6/5/08

A-6003-642 (03/03)

BOREHOLE LOG

Page 4 of 7
Date: 1/24/09

Well ID: C5858 | Well Name: 299-E33-343 | Location: N of B Tank Farm

Project: BP-5 Remedial Investigation | Reference Measuring Point: Ground Surface

Depth (Ft)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
120	grab/split	78		v.f. to fine, angular, well-sorted sand	120' Archive smpl
				rien to 115' but w/o HCl rxn. Contact at	Cable tool with drive
				120' w/ the sand same as at 110'. This	barrel
	grab/split	213		coarser material is the deeper. Fine	122.5' Archive smpl
				sand definitely moist. (S)	
				At 122.2', 50% silt 50% sand, moist	
125	grab split	100		125: Poorly sorted, angular, v.fine to v.coarse	125' Archive smpl
				sand plus 5% v.fine to fine pebbles.	
	grab/split	98		60% felsic (S)	
				122.2' → 125': Silty SAND	
130	grab/split	99		Same as 125' (S)	130' Archive smpl
					12-11-08
				125' → 170': SAND	
	grab/split	114			
135	grab/split	90		Same as 125' but w/ wk rxn HCl +	135' Archive smpl
				spotty weak cementation (S)	
	grab/split	96			
140	grab/split	114		"	140' Archive smpl
	grab/split	101			
145	grab			"	145' Archive smpl
	grab				
150	grab			v. fine to medium angular to sub-rounded,	150' Archive smpl
				90% felsic sand no rxn HCl or cementation	
	grab			10 YR 6/2 (S)	
155	grab/split	110		"	155' Archive smpl
	grab/split	133			

Reported By: S. H. Hall | Reviewed By: C. J. Walker

Title: Geologist | Title: Geologist

Signature: S H Hall | Date: 1/25/08 | Signature: [illegible] | Date: 6/5/08

A-6003-642 (03/03)

BOREHOLE LOG

Page 5 of 7
Date: 1/25/08

Well ID: C5858 | Well Name: 299-E33-343 | Location: N of B Tank Farm

Project: BP-5 | Reference Measuring Point: Ground surface

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
160	grab/split spoon		117; 100%	V. fine to medium, angular to sub-round, 90% felsic sand, 10 YR 6/2, no HCl rxn (S)	160' Archive sample
	grab/split				Cable tool with drive barrel
165	Split spoon/grab 164.8-167.3		100%; 158 blows	Same as 160	165' Archive sample
1-29-08	Split spoon 167.4-169.9		100%; 197 blows		164': change to mostly cemented, M silt; weak to mod rxn HCl
	167.5 grab			170:	
170	170: grab			Silty sand (mS); 85% sand, 15% silt. Sand M-VC (≤ 2mm) w/ occasional larger grains 2-3 mm (VF pebble); 80% qtz/other, 20% basalt, SA-SR. Silt 5Y 6/2 light olive gray, dry. Mod-strong rxn HCl; weak carbonate cementation.	170': archive sample
	170.2-172.7 split spoon		100%; 93 blows		
	172.5 grab/split		100%; 109 blows		
175	grab			175': Same as above, w/ infrequent VF-F pebbles (max. 7mm) 70% basalt, 30% qtz/other.	175: archive sample; 176.6': silt M
	grab			170' → 185': Silty SAND	
180	grab			180': Same as 175'.	180: archive sample
	grab				
1/30/08 185	grab			185' - 195': Slightly silty sand m(S); 95% sand, 5% silt. Sand predom. VF-C, w/ v. infrequent ≤2 mm basalt fragments; 50% basalt, 50% qtz/other; A-SA. 2.5Y 4/1 dark gray, no rxn HCl, moist.	185: archive sample; 189': 5cm basalt cobbles, mod. carbonate cementation
	grab				
190	grab			190': Slightly silty sand m(S); 95% sand, 5% silt. Sand VF-VC; predom C-VC; 50% basalt, 50% qtz/other. Pebbles ≤1.5cm 80% basalt, 20% qtz/other, A. Weak cementation, wk to mod rxn HCl.	190: 2-4 mm grains free muscovite present. Archive sample
	grab			195 → 200': SAND	
195	grab			195': Sand (S). 89% sand, 1-2% silt, 10% cobbles. Sand VF-VC; 60% qtz/other, 40% basalt, A-SA. Pebbles ≤ 8mm 90% basalt, 10% qtz/other, A-SA. No rxn HCl. 5Y 4/1 dark gray. 10% SR cobbles 4-10 cm 40% basalt, 60% qtz/other (mostly quartzite). Moist.	195': Cobbles may be predom. from 193-194'. Archive sample; 197': Silt M, weak cementation.

Reported By: SHHall | Reviewed By: L.D. Walker

Title: Geologist | Title: Geologist

Signature: SHHall | Date: 1/25/08 | Signature: [illegible] | Date: 6/5/08

A-6003-642 (03/03)

BOREHOLE LOG

Page 6 of 7
Date: 2/6/08

Well ID: C5858 | Well Name: 299-E33-343 | Location: N of B Tank Farm

Project: BP-5 | Reference Measuring Point: Ground Surface

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
200	U.S. archive grab			Silty sand (mS); 80% sand, 20% silt. Sand VF-VC w/ limited VFP; 20% basalt, 80% qtz/other; A-SR (predom. SA); basalt tends to be larger, SA. Silt 2.5Y 5/3 light olive brown, dry. Mod-strong rxn HCl, weak cementation.	200: archive sample
	grab				Cable tool with drive barrel
205	grab/split	123; 100%		Same as above except silt ↓ to 10%; sand 30% basalt, 70% qtz/other, predom. VC.	~197.5-210': barrel retention ↓↓
					205: Archive sample
	grab/split	69; 80%		200' → 215.5': Silty SAND	
210	grab/split	207; 100%		210': Silty sand (mS); 70% sand, 10% silt, 10% gravel. Sand lith., angularity same as above, predom C-VC; silt same as above. Gravel predom VFP, 50% basalt, 20% qtz/other, SA-SR. 1 SC (~7 cm long axis) SA quartzite recovered, no others observed in adjacent depths.	Note: Similar rubble to 210' encountered 197' where drive barrel caught, but not encountered again.
	grab/split	218; 100%			210: archive sample
					212.5' Sand (S): 99% sand, 1% silt. Sand C-VF: predom F. 70% bslt, 30% qtz/other, micaceous, SR-R. 2.5Y 5/3 light olive brown, no rxn HCl.
215	grab/split	166; 100%		215': same as 212.5'	
	grab/split	134; 100%		215.5': abrupt contact with compact silt (M): 100% silt/clay. Parts in irregular, undulating layers along visible mica concentrations. 2.5Y 5/3 light olive brown. Mod-strong rxn HCl; slightly moist.	215.0 – 217.5' split spoon: muddy. Archive sample.
220	grab/split	86; 100%		220': Same as above but silt ↑ (occasional VFS), drier. 2.5Y 4/2 dark grayish brown	223 – ~227: moisture content ↑↑, drilling rate, barrel retention ↓. 220: archive sample
	grab/split	102; 100%			
225	grab/split	161 [illegible]; 100%		225': Silty sand (mS): 60% sand, 40% silt. Sand VF-F (predom VF). Sand 95% qtz/other, 5% basalt, SR-R. Silt mod rxn HCl; 2.5Y 4/2 dark grayish brown. Moist-wet. 225 → 235': Silty SAND	225: archive sample
	grab/split	100%			229': Wet; 225: reduce casing to 9 5/8"
230	grab/split	49; 100%		230: Same as above.	~230': Rad contamination 6000 dpm/100 cm² βγ; <100 dpm/100 cm² α. No removable. NO ARCHIVE
				235 → 239': Sandy SILT	
	grab/split	104; 100%		235': Sandy silt (SM), 100% qtz/other. Alternating laminated layers (5-10 mm thick) VFS, clay. Clay layers lined w/ <1 mm iron stained layer at boundary btwn sid/sia. Soft sed deformation – appears to be prior to drive barrel deformation. 2.5Y 5/3 light olive brown. Dry. Based on estimation from drive barrel, layer could be only 20-30 cm thick.	235-237': Significant iron staining. Irregularly laminated ↓ 2 layers 5-1 mm thick strongly cemented, very high dry strength dark reddish brown layer. Mod-mod rxn HCl. Silt (?) btwn layers - Grey. NO ARCHIVE
235	grab/split	155; 100%			
	grab/split	480; 80%			

Reported By: L. Stratton | Reviewed By: L. D. Walker

Title: Geologist | Title: Geologist

Signature: [signature] | Date: 2/11/08 | Signature: [signature] | Date: 6/5/08

A-8003-842 (03/03)

BOREHOLE LOG

Page 7 of 7
Date: 2/19/08

Well ID: C8854 | Well Name: 299-E33-343 | Location: N of B Tank Farm

Project: BP-5 OU REMEDIAL INVESTIGATION | Reference Measuring Point: Ground Surface

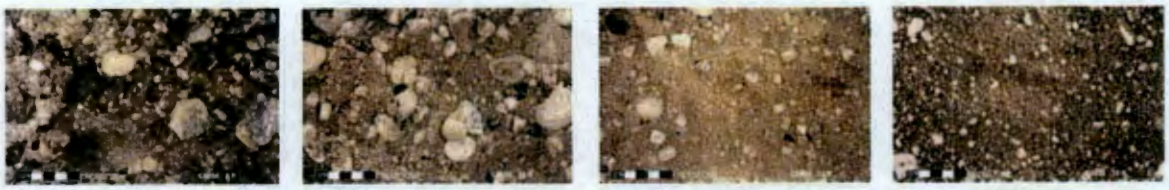
Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
240		grab/split (241.1)	255; 100%	239': Cemented gravel: Silty gravel (mSG): 40% gravel, 60% sand, 60% silt, 10% sand. GRAVEL: 210% basalt, 290% qtz/other, SR-R, VFP-VC/SC. Sand limited, VC, A-SR, 50% basalt/50% qtz/other. Grades to strongly cemented, strong rxn HCl layer 3-5 cm thick w/ irregular contact, 2.5Y4/1 light gray. Dry. Caliche present on gravels, through unconsolidated portion of silt matrix.	238.8': Drive barrel contains mix of basalt, silty sand as at 230'. Archive. 240': Drilling rate ↓↓↓; material comes as pulverized "white powder". Strong rxn HCl. Archive.
		grab/split	226; 100%	240': Silty gravel (mG): 50% gravel, 50% silt. No sand. Silt matrix compact, strong rxn HCl, 2.5Y 4/2 dark grayish brown. GRAVEL: VFP-MP, SG:6 15 cm. P:) 90% BASALT 210% QTZ/OTHER, A-SA. C: All stick in sample, SA-SR. Silt forms tight matrix around cobbles.	
245		grab/split	97; 100%	241': Gravelly sand: 90% gravel, 10% sand, trace silt. Gravel 80% basalt, 20% qtz/other, VFP-SC, SA-R. Sand: 30% basalt, 70% qtz/other, predom A-SA. Silt: mod rxn HCl. Dry, 10YR 2/2 grayish brown.	243.5: Silt ↑ to 15%. 245: archive. 248.1: Basalt ↑ to 60% (tends to be ↑A, larger than qtz/other). 247-250': Silt ↑ to 50%.
		grab/split	240; 90%	245': Same as above. 245.9 silt ↓ <5%, weak carbonate cementation.	
250		grab		250': Same as above; avg size gravel ↑ to SC. DRY. WK rxn HCl. Silt ↓ to 5-10%.	250': Drilling rate ↓. Archive.
		split/	130; 85%	256': (ARCHIVE): Silty sandy gravel (mSG): 80% gravel, 20% sand, 10% silt. Gravel: VFP-SC (avg ~ 3-6 cm), SA-A, predom SR. 50% basalt, 50% qtz/other. Sand: 80% basalt, 50% qtz/other. VF-VC; predom C; A. Silt: no rxn HCl, 2.5Y4/1 dark gray. Saturated. Approx 260.9': contact w/ basalt. Recovery from bailer >95% basalt, A-SA at ~ 263 (at 260-261', 80% A basalt, 20% VF-F P, qtz/other, SA-SR)	$\boxed{252.5'}$: No grab sample collected. 252: Saturated. 255: archive. ~260: archive. Hard tool. TD = 263.8' WL = 252.41' bgs (3/10/08)
	252-255	water sample			
255		grab			
		grab			
260					
263 BTD					

Reported By: L. Stratton | Reviewed By: L.D. Walker

Title: Geologist | Title: Geologist

Signature: [signature] Date: 2/27/08 | Signature: [signature] Date: 6/7/08

Well C5858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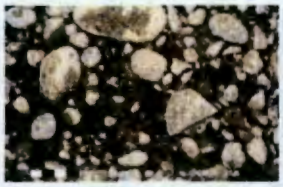
10 ft

13 ft

15 ft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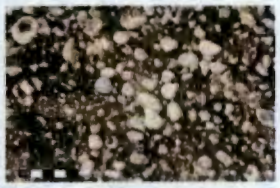
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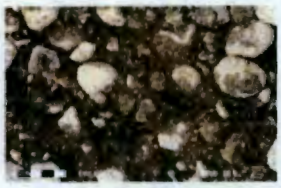
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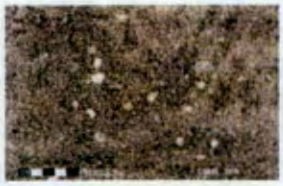
35 ft

37 ft

40 ft

45 ft

50 ft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56 ft

60 ft

65 ft

70 ft

75 ft

80 ft

85 ft

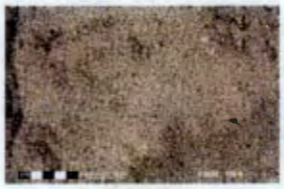
90 ft

95 ft

100 ft

105 ft

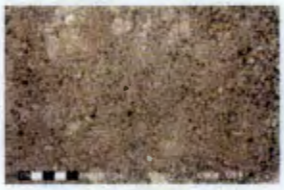
Well C5858


110 ft

115 ft

120 ft

122 ft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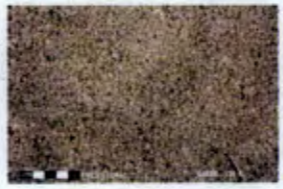

130 ft

135 ft

140 ft

145 ft

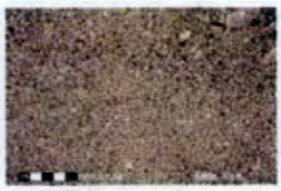
150 ft

155 ft

160 ft

165 ft

170 ft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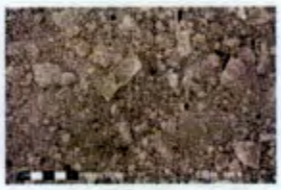

180 ft

185 ft

190 ft

195 ft

200 ft

205 ft

210 ft

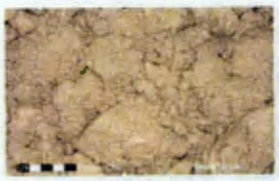
212 ft

215 ft

Well C5858

216 ft

220 ft


225 ft

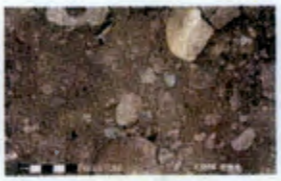
230 ft

239 ft

240 ft

243 ft

245 ft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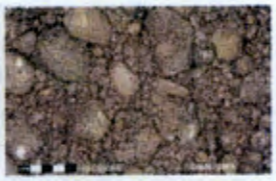

256 ft

260 ft

264 ft

WELL SUMMARY SHEET	Start Date: 1/15/08 Finish Date: 3/10/08	Page 1 of 3
Well ID: C5858	Well Name: 299-E33-343	
Location: N of B Tank Farm	Project: 200-BP-5 RI/FS	
Prepared By: Laurel Stratton	Date: 3/31/08	Reviewed By: L.D. Walker	Date: 6/5/08
Signature: [illegible]	Signature: [illegible]	

CONSTRUCTION DATA

Description	Diagram
6-in Concrete Pad 6-in I.D. Type 304/304L Stainless Steel Protective Casing: ~~+5.27~~ ft above ground surface 2.39' Portland Cement Type I/II: 0 - 9.8 ft bgs Granular Bentonite Crumbles: 9.8 - 233.2 ft bgs 4-in I.D. Stainless Steel Type 304/304L, Schedule 10 Permanent Casing: ~~+5.27~~ - 249.9 ft bgs 1.39' All depths are in feet below ground surface. Borehole drilled with: 13 1/2" threaded casing: 0.0-60.00 ft bgs 11 3/4" threaded casing: 60.00-238.30 ft bgs 9 5/8" threaded casing: 238.30-263.8 ft bgs All temporary drill casing was removed from the ground.	

GEOLOGIC/HYDROLOGIC DATA

Depth in Feet	Graphic Log	Lithologic Description/Groundwater Sample Depths (ft bgs)
0		0 - 13: silty sandy gravel (msG)
10		13 - 20: gravelly silty sand (gmS)
20		20 - 37: sandy gravel (sG)
30		
40		37 - 70: sand (S)
50		
60		
70		70 - 75: gravelly sand (gS)
80		75-90: silty sand (mS)

WELL SUMMARY SHEET	Start Date: 1/15/08 Finish Date: 3/10/08	Page 2 of 3

Well ID: C5858		Well Name: 299-E33-343	
Location: N of B Tank Farm		Project: 200-BP-5 RI/FS	
Prepared By: Laurel Stratton	Date: 3/31/08	Reviewed By: L.D. Walker	Date: 6/5/08
Signature:		Signature:	

CONSTRUCTION DATA

Granular Bentonite Crumbles: 9.8 - 233.2 ft bgs

4-in I.D. Stainless Steel Type 304/304L, Schedule 10 Permanent Casing: +5.27 - 249.9 ft

All depths are in feet below ground surface.

Borehole drilled with:
13 1/2" threaded casing: 0.0-60.00 ft bgs
11 3/4" threaded casing:: 60.00-238.30 ft bgs
9 5/8" threaded casing: 238.30-263.8 ft bgs

All temporary drill casing was removed from the ground.

GEOLOGIC/HYDROLOGIC DATA

Depth in Feet	Lithologic Description/Groundwater Sample Depths (ft bgs)
90	90 -95: gravelly sand (gS)
	95 - 122.2: sand (S)
100	
110	
120	
	122.2 - 125: silty sand (mS)
	125 - 170: sand (S)
130	
140	
150	
160	
170	170 - 185: silty sand (mS)

WELL SUMMARY SHEET	Start Date: 1/15/08 Finish Date: 3/10/08	Page 3 of 3
Well ID: C5858	Well Name: 299-E33-343	
Location: N of B Tank Farm	Project: 200-BP-5 RI/FS	
Prepared By: Laurel Stratton — Date: 3/31/08	Reviewed By: L.D. Walker — Date: 6/7/08	
Signature:	Signature:	

CONSTRUCTION DATA

Description	Diagram
Granular Bentonite Crumbles: 9.8 - 233.2 ft bgs	
4-in I.D. Stainless Steel Type 304/304L, Schedule 10 Permanent Casing: +5.27 - 249.9 ft	
3/8-in Bentonite Pellets: 233.2 - 241.0 ft bgs	
Primary Filter pack 10-20 Mesh Colorado Silica Sand: 241.0 - 263.4 ft bgs	
Static Water Level: 252.14 ft bgs (3/4/08)	
4-in I.D. Stainless Steel Type 304/304L, Slot 20 (0.20-in) Screen: 249.9 - 259.9 ft bgs	
4-in I.D. Stainless Steel Type 304/304L Sump: 259.9 - 262.9 ft bgs	

GEOLOGIC/HYDROLOGIC DATA

Depth in Feet	Graphic Log	Lithologic Description/Groundwater Sample Depths (ft bgs)
		170' w 12-11-08
180		~~180~~ - 185: silty sand (mS)
		185 - 195: slightly silty sand (mS)
190		
		195 - 200: sand (S)
200		200 - 215.5: silty sand (mS)
210		
		215.5 - 225: abrupt contact with compact silt (M)
220		
		225 - 235: Silty sand (mS)
230		
		235 - 239: Sandy silt (sM) (laminated with clays)
240		239 - 240: carbonate-cemented silty gravels (mG)
		240 - 241: silty gravel (mG)
		241 - 256: gravelly sand (gS)
250		
		256 - 260.9: silty sandy gravel (msG)
260		260.9: contact with basalt
		263.8: total depth (2/26/08)
		Water level 252.14 ft bgs

WELL CONSTRUCTION SUMMARY REPORT

Start Date: 1/15/08
Finish Date: 3/10/08
Page 1 of 1

Well ID: C5858	Well Name: 299-E33-341	Approximate Location: N of B Tank Farm
Project: BP-5-OU Remedial Investigation		Other Companies: Freestone Environmental
Drilling Company: Bluestem Northwest		Geologist(s): Steve Hall, Laurel Stratton
Driller: Justin Egeland	License #: 2843	

TEMPORARY CASING AND DRILL DEPTH

*Size/Grade/Lbs. Per Ft.	Interval	Shoe O.D./I.D.
13 1/2" Carbon Steel	0 - 60.6	
11 3/4" "	60.6 - 235.28	12 1/2"/10 5/8"
9 5/8" "	235.28 - 264.48	0.84'/0.95'
	-	
	-	

*Indicate Welded (W) - Flush Joint (FJ) Coupled (C) & Thread Design

All threaded

DRILLING METHOD

Auger: /
Cable Tool: drive barrel
Air Rotary: /
A.R. w/Sonic: /

HOLE DIAMETER (in.) / INTERVAL (ft)

Diameter 13 1/2 From 0 to 60
Diameter 11 3/4 From 60 to 235
Diameter 9 5/8 From 235 to 263.8
Diameter ____ From ____ to ____
Diameter ____ From ____ to ____
Diameter ____ From ____ to ____

Drilling Fluid: water (when hard-tooling)

Total Drilled Depth: 263.8	Hole Dia @ TD: 9 5/8"	Total Amt. Of Water Added During Drilling: ~60 gallons
Well Straightness Test Results: PASS		Static Water Level: 252.14 Date: 3/4/08

GEOPHYSICAL LOGGING

Sondes (type)	Interval	Date	Sondes (type)	Interval	Date
neutron moisture/	0 - 60	1/17/08		-	
spectral gamma	60 - 235	2/12/08		-	
	235 - 260.8	2/26/08		-	

COMPLETED WELL

Size/Wt./Material	Depth (+1.39 w/ bulkhead)	Thread	Slot Size	Type	Interval Annular Seal/Filter Pack	Volume	Mesh Size
4" 304/304L sched 10	~~245.25~~ - 249.9	X		Portland cement w/ bc.	-		
Stainless Steel	-			bentonite per 9416.	0 - 9.8	12	
" screen	249.9 - 259.9	X	20	Granular bentonite	9.8 - 233.2	227	
" Sump	-			bentonite pellets	233.2 - 241.0	5 1/2	3/8"
	259.9 - 262.9	V		Colorado Silica Sand	241.0 - 263.4	17	1020

OTHER ACTIVITIES

Aquifer Test:	Date:	Well Decommission:	Yes:	No:	Date:
Description:		Description:			

WELL SURVEY DATA (if applicable)

Not surveyed at this time.	Protective Casing Elevation:
Washington State Plane Coordinates:	Brass Survey Marker Elevation:

COMMENTS / REMARKS

Reported By:	Title:	Signature:	Date:
L. Stratton	Geologist	[signature]	5/4/08

A-6003-658 (04/03)

WELL DEVELOPMENT AND TESTING DATA

Well Name:	Well ID:	Well Location:	Date:
299-E33-343	C5858	N. of B tank Farm	3/10/08

Reference Measuring Point (unless otherwise noted): TOP OF OUTER CASING (TOC)

Has the well been surveyed? O Yes ⊗ No

Does the well have a cement pad? ⊗ Yes O No

PART 1

STATIC WATER LEVEL:

Start of Job 252.14' bgs

End of Job

DEPTH TO BOTTOM:

Start of Job 263.67' bgs

End of Job

PART 2

WELL DEVELOPMENT DATA

Pump Model 5 hp

Intake Depth 261.22' bgs

Starting Turbidity 15.6 ntu

Pump Start	Stop	Flow Rate
0918	1017	
0918 →	1002	14 gpm
1002 →	1017	20 gpm

Total Pumped 847 gal.

Final Turbidity 2.83 ntu

XD SN/Range (PSI) 20 psi

PART 3

INSTANTANEOUS SLUG TEST

Static Water Level (TOC)

Transducer Depth

Baseline Start

Injection Start

Baseline Start

Withdrawal Start

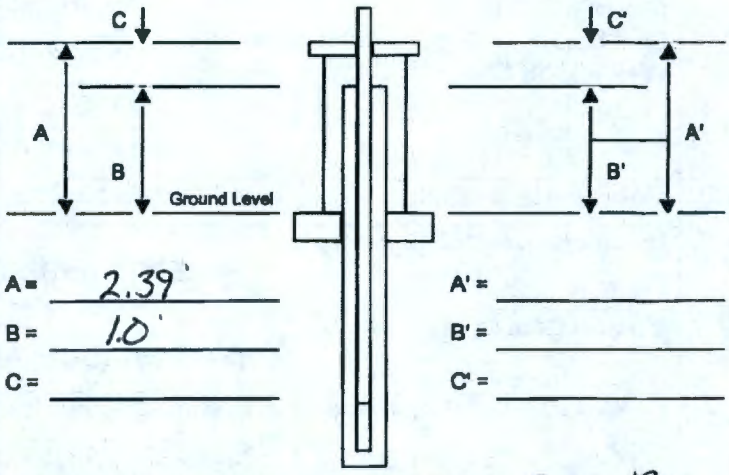
Slug Volume

XD SN/Range (PSI)

PART 4

Last Recorded Measurements Date: 3/10/08

Current Measurements Date:



A = 2.39'

B = 1.0'

C =

A' =

B' =

C' =

Are there any reference marks on the casing strings? O Yes ⊗ No

PART 5

COMMENTS:

Test # 1 : Draw down

Test # 2 : Recovery

Prepared by (print name):	Signature:	Date:
J Fetters	J Fetters	3/10/08
Reviewed by (print name):	**Signature:**	**Date:**
L.D. Walker	LD Walker	6/5/08

A-6003-644 (03/03)

WELL SURVEY DATA REPORT

Project:	**Prepared By:** Larry A Henke **Company:** FGG
Date Requested: 06/18/08	**Requestor:** C.S. Wright (FH)
Date of Survey: 07/23/08	**Surveyor:** L.A. Henke FGG Survey Dept.
ERC Point of Contact:	**Survey Co. Point of Contact:** N.P. Fastabend
Description of Work: Civil Survey of Groundwater Monitoring Well C5858 (299-E33-343).	**Horizontal Datum:** NAD83(91)
	Vertical Datum: NAVD88
	Units: Meters
	Hanford Area Designation: 200E

Coordinate System: Washington State Plane Coordinates (South Zone)

Horizontal Control Monuments:
GABLEMTN (FH), 2E-1 (FGG)

Vertical Control Monuments:
HSWB-032 (COE), 2E-122 (FGG)

Well ID	Well Name	Easting	Northing	Elevation	
C5858	299-E33-343	573743.98	137382.25		Center of Casing
				199.568	Top Pump Baseplate, N. Edge
				199.561	Top of Outer Casing, N. Edge
				198.823	Brass Survey Marker

Notes:

Equipment Used: Trimble GPS 5800 RTK
Trimble DiNi 12 Level

Surveyor Statement:
I, Larry A. Henke, a Professional Land Surveyor registered in the State of Washington (Registration No. 38975), hereby certify that this report is based on a field survey performed in July, 2008 under my direct supervision, and that the data contained here is true and correct.

LARRY A. HENKE
STATE OF WASHINGTON
July 23 2008
38975
REGISTERED
PROFESSIONAL LAND SURVEYOR
EXPIRES Sept. 23, 2009

Original to:
Distribution by DIS:

Sample Depth	Sample Type	HEIS #
60.0	Grab	B1T128, B1T1J9 (RS)
62.5	Grab	B1T129
65.0	Grab	B1T130
64.3 - 66.8	Split-Spoon	B1T131
67.5	Grab	B1T132
67 - 69.5	Split-Spoon	B1T133
70.0	Grab	B1T134
69.3 - 71.8	Split-Spoon	B1T135
72.5	Grab	B1T136
72.2-74.5	Split-Spoon	B1T137
75.0	Grab	B1T138, B1T1K2 (RS)
74.8 - 77.3	Split-Spoon	B1T139
77.5	Grab	B1T140
78.3-80.8	Split-Spoon	B1T141
80.0	Grab	B1T142
80.5-83	Split-Spoon	B1T143
82.5	Grab	B1T144
82.8-85.3	Split-Spoon	B1T145
85.0	Grab	B1T146
87.5	Grab	B1T147
90	Grab	B1T148, B1T1K5 (RS)
92.5	Grab	B1T149
95	Grab	B1T150
97.5	Grab	B1T151
100	Grab	B1T152
99.3-101.8	Split-Spoon	B1T153
102.5	Grab	B1T154
102.6 - 105.1	Split-Spoon	B1T155
105	Grab	B1T156, B1T1K6 (RS)
104.7-107.2	Split-Spoon	B1T157
107.5	Grab	B1T158
108.1-110.6	Split-Spoon	B1T159
110	Grab	B1T160
110.6-113.1	Split-Spoon	B1T161
112.5	Grab	B1T162
112.6-115.1	Split-Spoon	B1T163
115.0	Grab	B1T164
114.8-117.3	Split-Spoon	B1T165

Sample Depth	Sample Type	HEIS #
117.5	Grab	B1T166
117.4-119.9	Split-Spoon	B1T167
120.0	Grab	B1T168, B1T1K7 (RS)
119.6-122.1	Split-Spoon	B1T169
122.5	Grab	B1T170
122.2-124.7	Split-Spoon	B1T171
125.0	Grab	B1T172
124.6-127.1	Split-Spoon	B1T173
127.5	Grab	B1T174
127.4-129.9	Split-Spoon	B1T175
130.0	Grab	B1T176
130.6-133.1	Split-Spoon	B1T177
132.5	Grab	B1T178
133.1-135.6	Split-Spoon	B1T179
135.0	Grab	B1T180, B1T1K8 (RS)
134.7-137.2	Split-Spoon	B1T181
137.5	Grab	B1T182
137-139.5	Split-Spoon	B1T183
140.0	Grab	B1T184
140.5-143	Split-Spoon	B1T185
142.5	Grab	B1T186
142.7-145.2	Split-Spoon	B1T187
145.0	Grab	B1T188
147.5	Grab	B1T189
150.0	Grab	B1T190, B1T1K9 (RS)
152.5	Grab	B1T191
155.0	Grab	B1T192
154.8-157.3	Split-Spoon	B1T193
157.5	Grab	B1T194
157.3-159.8	Split-Spoon	B1T195
160.0	Grab	B1T196
160.0 - 162.5	Split-Spoon	B1T197
162.5	Grab	B1T198
162.6 - 165.1	Split-Spoon	B1T199
165.0	Grab	B1T1B0, B1T1L0 (RS)
164.8-167.3	Split-Spoon	B1T1B1
167.4	Grab	B1T1B2
167.4-169.9	Split-Spoon	B1T1B3

Sample Depth	Sample Type	HEIS #
169.5	Grab	B1T1B4
170.2-172.7	Split-Spoon	B1T1B5
173.0	Grab	B1T1B6
173-175.5	Split-Spoon	B1T1B7
175.0	Grab	B1T1B8
177.5	Grab	B1T1B9
180.0	Grab	B1T1C0, B1T1L1 (RS)
182.5	Grab	B1T1C1
185.0	Grab	B1T1C2
187.5	Grab	B1T1C3
190.0	Grab	B1T1C4
192.5	Grab	B1T1C5
195.0	Grab	B1T1C6, B1T1L2 (RS)
197.5	Grab	B1T1C7
200.0	Grab	B1T1C8
202.5	Grab	B1T1C9
205.0	Grab	B1T1D0
204.5-207	Split-Spoon	B1T1D1
207.5	Grab	B1T1D2
207.6-210.1	Split-Spoon	B1T1D3
210.0	Grab	B1T1D4, B1T1L3 (RS)
210.0 - 212.5	Split-Spoon	B1T1D5
212.0	Grab	B1T1D6
212-214.5	Split-Spoon	B1T1D7
215.0	Grab	B1T1D8
215.0 - 217.5	Split-Spoon	B1T1D9
217.5	Grab	B1T1F0
217.1-219.6	Split-Spoon	B1T1F1
220.0	Grab	B1T1F2
219.9-222.4	Split-Spoon	B1T1F3
222.0	Grab	B1T1F4
222-224.5	Split-Spoon	B1T1F5
225.0	Grab	B1T1F6, B1T1L4 (RS)
224.5-227	Split-Spoon	B1T1F7, B1T202 (RS), B1T1R2, B1T1R3 (VOA-HIGH), B1T1R4 (VOA-LOW)
227.5	Grab	B1T1F8
227.5 - 230.0	Split-Spoon	B1T1F9
230.0	Grab	B1T1H0
229.8-232.3	Split-Spoon	B1T1H1

Sample Depth	Sample Type	HEIS #
232.5	Grab	B1T1H2
233-235.5	Split-Spoon	B1T1H3
235.0	Grab	B1T1H4
235.0 - 237.5	Split-Spoon	B1T1H5, B1T203 (RS), B1T1R6, B1TR8 (VOA-HIGH), B1T1T0 (VOA-LOW)
235.0 - 237.5	Split-Spoon	B1T1K4 (DUP), B1T1R7 (DUP), B1T1R9 (VOA-HIGH), B1T1T1 (VOA-LOW)
237.5	Grab	B1T1H6
238.5-241	Split-Spoon	B1T1H7
240.0	Grab	B1T1H8, B1T1L5 (RS)
241.1-243.6	Split-Spoon	B1T1H9
243.6	Grab	B1T1J0
243-245.5	Split-Spoon	B1T1J1
245.0	Grab	B1T1J2
244.4-246.9	Split-Spoon	B1T1J3
247.5	Grab	B1T1J4
248.3-250.8	Split-Spoon	B1T1J5, B1T204 (RS), B1T1T3, B1T1T4 (VOA-HIGH), B1T1T5 (VOA-LOW)
250.0	Grab	B1T1J6
253.3-256.3	Split-Spoon	B1T1J8, B1T206 (RS), B1T1Y2, B1T1Y3 (TCL), B1T1Y4 (VOA-HIGH),B1T1Y5 (VOA-LOW)
252.5 - 255.0	Kabis	B1T1V7
256.0	Grab	B1T1K0, B1T1L6 (RS)
257.5	Grab	B1T1M1
Screened Interval (collected post-development)	Pump	B1TML1, B1TML2

APPENDIX E

WELL DOCUMENTATION FOR 299-E33-344 (C5859)

Borehole Log

Photographic Log

Well Summary Sheet

Well Construction Summary Report

Well Survey

Sample Depths and HEIS Numbers

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BOREHOLE LOG

Page 1 of 7 12-18-08
Date: 12-17-07

Well ID: C5859	Well Name: 299-E33-344	Location: N of B Tank Farm	
Project: 200-BP-5 OU Remedial Inv.		Reference Measuring Point: Ground Surface	

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
0				0-5'- silty sandy Gravel (msG) - moist	Cable tool, 10-in drive barrel
				5'- silty sandy Gravel (msG)- 15% silt, 50% sand, 35% Gravel. - note minimal sample inspection due to elevated rad - moist, dark grayish brown 10YR 4/2.	13 1/2" casing Beta/Gamma elevated no archive collected
5				10'- silty sandy Gravel (msG) - 15% silt, 50% sand, 35% gravel - backfill material - no elevated rad, dark grayish brown as above.	small pieces of cement noted @ 8' suggesting still in backfill material Boulder @ 9'.
10				15' silty sandy Gravel (msG) 10% silt, 35% sand, 55% gravel, gravel VFP-VCP 90% >VCP 10%, 80% basalt 20% qtzite, other, SA-R, sand VFS-VCS, poorly sorted, 60% basalt 40% qtz, other, SA-SR, strong rxn HCl, grayish brown 10YR 5/2, dry	Drier @ 12' (bottom of fill?) - also less silt. Archive Samples Every 5'
15				20' silty sandy Gravel (msG) - as above	
20				25'- Sandy Gravel (SG) - 5% silt, 80% sand, 45% gravel, sand VFS-VCS - predom. CS-VCS, 70% basalt 30% qtz/other, gravel VFP-SC, predom 20-50 mm pebbles, 70% basalt, 30% qtzite, other, SA-SR, dark grayish brown 10YR 4/2, moist,	< drill rate @ 27'
25				30'- Gravel (G) - 5% silt, 15% sand, 80% gravel gravel VFP-SC, predom. 20-50mm, 80% basalt, 20% qtzite/other, SA-R, sand VFS-VCS, predom. VCS, 70% basalt 30% qtz, CaCO3 on clast surfaces, mod-to-strong rxn HCl, dry, gray 10YR 4/1.	
30				35' Gravel (G) - 10% silt, 10% sand (vcs), 80% gravel - lithology as above,	Sand/silt matrix compacted between clasts - not very permeable.
35					

Reported By: S.P. AIRHART		Reviewed By: L.J. Walker	
Title: GEOLOGIST		Title: Geologist	
Signature: SPAirhart	Date: 12-18-07	Signature: LJWalker	Date: 5/1/08

A-6003-642 (03/03)

BOREHOLE LOG

Page 2 of 67
Date: 12-18-07

Well ID: C5859	Well Name: 299-E33-344	Location: N of B Tank Farm	
Project: 200-BP-5 Remedial Investigation		Reference Measuring Point: Ground Surface	

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
40	S.S.	110 100%		40' - gravelly Sand (gS) - 75% sand, 25% gravel. Sand - MG-VCS, predom. CS-VCS, 50% qtz 50% basalt, gravel VFP-FP - up to 15 mm, 70% basalt 30% qtzite, other, slight rxn HCl, grayish brown 2.5Y5/2	Δ @ 39' - increase sand, decrease gravel
	G				
	S.S.	88 100%			Cable tool drilling 11 3/4" casing, Drive barrel
45	G			45' - Sand (S) - 95% sand, 5% gravel. gravel VFP-FP 70% basalt 30% qtzite, other, sand VFS-VCS, predom VCS 60% qtz 40% basalt, slight rxn HCl, grayish brown 2.5Y5/2	
	S.S.	94 100%			Archive Samples Every 5'
	G				
50	G			50' - sand (S) - as above	
	G				
55	G			55' - gravelly Sand (gS) - 85% sand, 15% gravel. Sand VFS-VCS, predom MS-CS, 60% qtz 40% basalt, SA-SR, gravel VFP-FP up to 10 mm, 70% basalt 30% qtzite, other, SA-SR, mod rxn HCl, grayish brown 2.5Y5/2.	
	G				
60	G				
	S.S.	108 100%		60' - Sand (S) - same as 50'	
	G				
	S.S.	No blow count 100%			Note: RCT noted very slight increase in E, T @ 65' -
65	G			65' Sand (S) - as above	
	S.S	No blow count 100%			
	G			70' Sand (S) - as above	
	S.S	111 100%			
70	G			75' Sand (S) - as above	Formation - remains unconsolidated
	S.S	108 100%			
	G				
	S.S.	No blow count 100%			Minor gravel (pebbles) noted @ 77.
75	G				
	S.S.	141 100%			
	G				
	S.S	81 100%			

Reported By: S.P. Airhart		Reviewed By: L.D. Walker	
Title: Geologist		Title: Geologist	
Signature: SP Airhart	Date: 12.19.07	Signature: LD Walker	Date: 5-1-08

A-6003-642 (03/03)

BOREHOLE LOG

Page 3 of 7

Date: 12-20-07

Well ID: ~~C5892~~ C5859	Well Name: 299-E33-344	Location: N of B Tank Farm	
Project: 200-BP-5 Remedial Inv.		Reference Measuring Point: Ground Surface	

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
80	G, S.S.			80' - Sand (s) w/ trace gravel. sand VFS-VCS, predom CS-VCS. 40% basalt, 60% qtz, slightly moist, no rxn HCl, grayish brown 2.5Y 5/2.	Gravel is fine pebble size
	S.S.	106 100%			
	G	108			
85	S.S. G	100%		85' - Sand (s) - as above, no gravel noted.	
	G			90' - Sand (s) - 5% silt 95% sand, sand - moderately well sorted FS-MS - some VFS to VCS sand, 70% qtz 30% basalt. A-SA, light olive brown 2.5Y 5/3,	< grain size @ 89'
90	G				
	G			95' - Sand (s) - as above	
95	G				
	G			100' - Sand (s) - 100% sand, mod well sorted CS-VCS, 50% basalt 50% qtz A-SA, light olive brown 2.5Y 5/3	Salt & pepper sand
100	G				
102.5	G				
105	G			105' - Sand (s): C-VC, 50% basalt 50% qtz/others, Dry, Unk Rxn HCl, A-SA, 2.5y 5/3 lt. olive brown	100.6': down size drill casing from 13 1/2" to 11 3/4"
107.5					
110	G			109.5' - Sand (s): lithology same as above	
112.5	G			112.5' - lithology same as above w/ ↑ Fine sand content	Cable Tool Drilling 11 3/4" casing, Drive barrel
115	G			115 - Sand (s) lithology same as above C-VC	Archive Samples Every 5'
117.5	G			116.5 - Sand (s): F. 80% qtz/others 20% basalt, Dry, no Rxn HCl, 2.5y 5/3, lt. olive brown, A, micas present	

Reported By: S.P. Airhart / J. Fetters		Reviewed By: L.D. Walker	
Title: Geologist / geologist		Title: Geologist	
Signature: [signature]	Date: 12-20-07	Signature: [signature]	Date: 5-1-08

A-6003-642 (03/03)

BOREHOLE LOG

Page 4 of 7
Date: 12/26/07

Well ID: C5859 | Well Name: 299-E33-344 | Location: N of B tank Farm

Project: 200-BP-5 RI/FS | Reference Measuring Point: ground

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
120	G			120'-Sand (s): VC-VF (Predom C-VC, 50% basalt, 50% qtz, A, wk Rxn HCl, Dry, 2.5y 5/2 grayish brown	Cable tool 11 3/4" casing Drive barrel
122.5	G				Archive Samples Every 5'
125	G			125'-Sand (s): lithology same as above	
127.5	G				
130	G			130' Sand (s): lithology same as above w/ < 10% basalt pebbles (m-F) A	
132.5	G				
135	G			135'-Sand (s): VC-VF (Predom m-F) 50% basalt 50% qtz, A, Dry 2.5y 5/2 grayish brown, vwk Rxn HCl	
137.5	G				
140	G			140'-Sand (s): lithology same as above ↑ Fine-VFine sand, noticable mica increase, Flakes to 4 mm	
142.5	G				
145	G			145' Sand (s): 100% Snd, Predom m-VC 50% basalt 50% qtz, Dry, vwk-no Rxn HCl 10yr 5/2 grayish brown, no mica present	
147.5	G			147.5'-lithology same as above w/ ↑ Fine sand %	
150	G			150'-Sand (s): lithology same as above	
	G				
155	G			155'-Sand (s): lithology same as above	
	G				

Reported By: J. Fetters | Reviewed By: L.D. Walker

Title: geologist | Title: Geologist

Signature: J Fetters | Date: 1/28/08 | Signature: LD Walker | Date: 5/1/08

A-6003-542 (03/03)

BOREHOLE LOG

Page 5 of 167
Date: 12/28/07

Well ID: C5889 | Well Name: 299-E33-344 | Location: North of B tank Farm

Project: 200-BP-5 Operable Unit | Reference Measuring Point: Ground

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
160	G			160'-Sand (s): lithology same as above	Cable Tool, 11 3/4" Casing
				< 10% fine pebbles, basalt, A, Trace	Drive barrel
				of mica 1-4 mm	
162.5	G				Archive samples
					Every 5'
165	G			165'-Sand (s): 100% sand C-M, A, Dry,	
166	G			2.5y 5/2 grayish brown, Uwk-no Rxn	
167.5	G			HCl, 50% basalt 50% qtz, no mica present	167.5' ↓ Moisture
168	G			166'-Sand (s): VC-VF, Predom C-VC, 60%	
170	G			basalt 40% qtz, slight increase in	
				moisture 10YR 4/2 Dk grayish brown, wk	
				no Rxn HCl	
172.5	G			168'-Sand (s): 90% sand 10% gvl, VC-VF,	172.5' ↓ Fine sand (Predom
				Predom M-F, 50% qtz 50% basalt, A, Dry	M-C) 50% basalt 50% qtz, A,
175	G			Mod Rxn HCl, 10YR 5/2 grayish brown; gvl	Dry, 2.5y 5/2 grayish brown,
				basalt, 2mm-1.5cm (VFP-MP) R	wk-no Rxn HCl
				175'-Sand (s): Same as above w/pebbles	
177.5	G			A-SA	177.5' Casing Driving
					hard
180	G			180'-Sand (s): lithology same as above	
182.5	G				
185	G			185'-Sand (s): lithology same as above	
				w/sand predom. F-VF	
187.5	G				
188.5		SS	135 100%		
190	G	SS	no blow count 100%	190'-Sand (s): lithology same as	
				above	
191.7					
192.5	G	SS	No B.C. 100%		
195	G			195'-Sand (s) lithology same as above	
		SS	No B.C 100%		
					198 C-VC pebbles noticed
197.5	G	SS			

Reported By: J. Fellers | Reviewed By: L. A. Walker

Title: geologist | Title: Geologist

Signature: [signature] | Date: 1/3/08 | Signature: [signature] | Date: 5-1-08

A-6003-642 (03/03)

BOREHOLE LOG

Page 6 of 87
Date: 1/3/08

Well ID: C5859 | Well Name: 299-E33-344 | Location: N of B tank Farm

Project: 200-BP-5 RI/FS | Reference Measuring Point: Ground

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
200	G, SS	199.6-202.1 100%		200'-Silty Sand (MS): 70% sand 30% silt: 60% qtz, 40% basalt, UC-UF (Predom M-UF), A; silt: Dry, 10yr 5/2 grayish brown, mod rxn HCl	Cable Tool 11 3/4" casing, Drive barrel
202.6	G, SS	203.5-205 100%			Archive samples Every 5'
205	G, SS	205-207.5 100%		205'-Silty Sand (MS): 80% sand 20% silt; sand: 50% basalt, 50% qtz, Predom C-F; silt: Same as above	
207.5	G, SS	207-209.5			
210	G, SS	209.8-212.3 100%		209'-Sand (S) 60% qtz 40% basalt, UC-UF (Predom M-UF), A, basalt = larger grain size, Dry, 10yr 4/2 dk grayish brown, mod Rxn HCl	
212.5	G, SS	212.5-215 100%			
215	G, SS	215-217.5 100%		214'-Sand (S) 80% qtz 20% basalt M-UF (Predom F-UF), A, Dry, 10yr 5/2 grayish brown, mod Rxn HCl	Silt contact b/t liner 2 + 3 on S.S sampler
217.5	G, SS	217.3-219.8		216'-Silt (M): 100% silt, ↑ moist, 10YR 5/3, Brown, wk-no Rxn HCl	
220	G, SS	219.5-222 100%		220'-Silt/clay; lithology same as above	
	G, SS	222.6-225.1 100%		222.6'-Sand (S) UF-F, 90% qtz 10% basalt, wk Rxn HCl, Slightly moist 10yr 5/3 brown, A-SA	
225	G, SS	225-227.0		225'-Silty Sand (MS) UF sand lithology same as above, noticable mica content; silt: 20% silt + finer, 10yr 5/3 brown	222.6-225.1' S/S coated w/ mud material in S.S. not saturated
	G, SS	227.5-230		~~230'-Sand (S): lithology same as above~~	227.5 Sed S. saturated, no free water
230	G, SS	229-231.9 100%		229-237': Silty Sand (MS): Sand: lithology same as above; silt: 70% ~~ff~~ silt + finer; Partings, esp. 229-234', 1/2 to 1cm, light yellowish brown to brown (10yr 5/3 to 6/4) w/ dk yellowish brown oxidized surface at some partings (10yr 4/6, scattered mica strong HCl Rxn below 232'	~~Total Drilled depth 230'~~ bgs Perched water measured at ~~235.33' bgs (1/8/08)~~ 225.33' bgs (1-8-08) 1-11-08 Perched water level = 225.06' bgs (4/24/08)
	G, SS	232.5-235 100%			
235	G, SS	235.0-237.5 100%		237.0-237.5' (See next Page)	

Reported By: J Fethers | Reviewed By: L. D. Walker

Title: Geologist | Title: Geologist

Signature: J Feth | Date: 1/9/08 | Signature: LD Walker | Date: 5-1-08

A-6003-642 (03/03)

BOREHOLE LOG

Page 7 of 7
Date: 1-15-08

Well ID: C5859 | Well Name: 299-E33-344 | Location: N of B tank Farm

Project: 200-BP-5 RI/FS | Reference Measuring Point: Ground

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
240				237.0-237.5 Sandy GRAVEL (SG) 70%	Cable tool Drilling 11 3/4"
241				Gravel, 27% Sand, 3% Silt; Gravel is	casing, Drivebarrel
242				20% basalt, 80% qtz/other, SR-R; sand is	
				90% qtz/other, 10% basalt, light gray 10YR	Archive samples Every
				7/2, strong RXN HCl, only slightly moist	5'
245				242.1' - Silty Sand (MS): 70% VF sand 30%	
				Silt; Sand: 90% M2 10% basalt, VF, A; Silt:	
				10YR 5/3 to 6/4 (Yellowish brown to brown)	
					TD = 242.1' bgs
					1/16/08

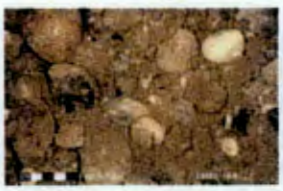
Reported By: John Houck / J. Fehers | Reviewed By: L.D. Walker

Title: Geologist | Title: Geologist

Signature: [signature] Date: 1-15-08 | Signature: [signature] Date: 5-1-08

A-6003-642 (03/03)

Well C5859 (299-E33-344)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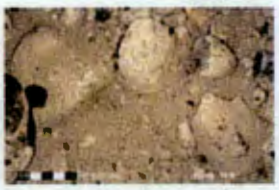
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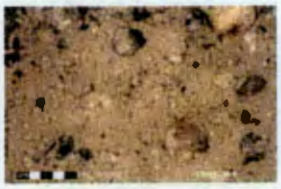
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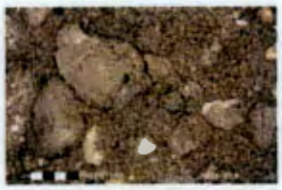
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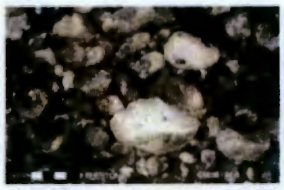
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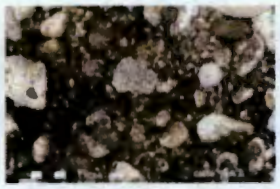

35 ft

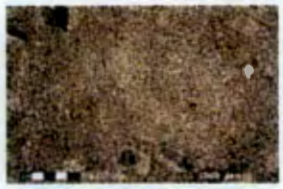
40 ft

45 ft

50 ft

55 ft

60 ft


65 ft

70 ft

75 ft

80 ft

85 ft

90 ft

95 ft

100 ft

110 ft

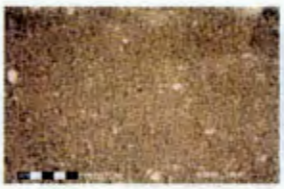
115 ft

118 ft

120 ft

125 ft

Well C5859 (299-E33-344)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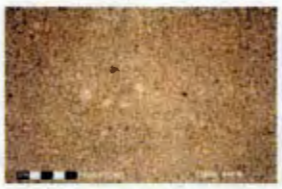
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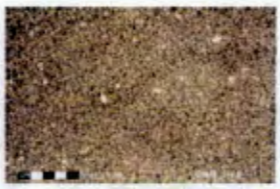
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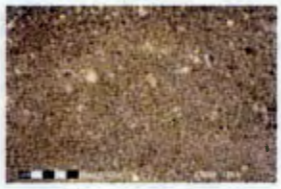
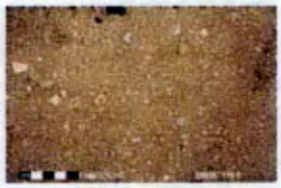

155 ft

160 ft

165 ft

166 ft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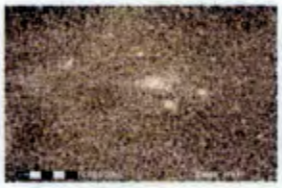
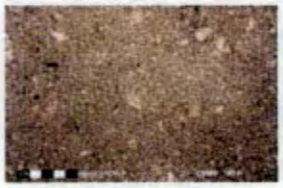

173 ft

175 ft

180 ft

185 ft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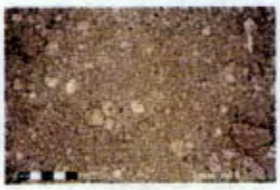
195 ft

200 ft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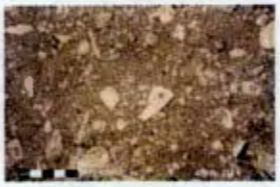
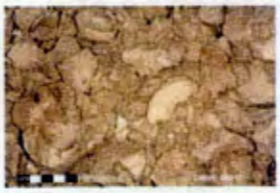
210 ft


215 ft

216 ft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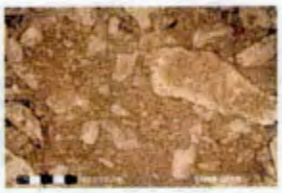
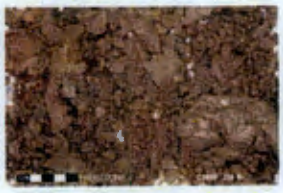

223 ft

225 ft

Well C5859 (299-E33-344)

230 ft

233 ft



234 ft

235 ft

236 ft

WELL SUMMARY SHEET	Start Date: 12/17/07 Finish Date: 1/23/08	Page 1 of 3

Well ID: C5859		Well Name: 299-E33-344	
Location: N. of B-Tank Farm		Project: 200-BP-5 RI/FS	
Prepared By: Jeff Fetters	Date: 2/07/08	Reviewed By: L.D. Walker	Date: 5-1-08
Signature: [signature]		Signature: [signature]	

CONSTRUCTION DATA

Description	Diagram
6-in Concrete Pad	
6-in I.D. Type 304/304L Stainless Steel Protective Casing: 2.56 ft above Ground Surface	
Portland Cement Type I/II: 0 - 10.8 ft	
Granular Bentonite Crumbles: 10.8 - 206.3 ft	
4-in I.D. Type PVC, Schedule 40 Permanent Casing: 1.58 - 217.9 ft	

GEOLOGIC/HYDROLOGIC DATA

Depth in Feet	Graphic Log	Lithologic Description/Groundwater Sample Depths (ft bgs)
0		0-25 Silty Sandy Gravel msG
10		
20		25-30 Sandy Gravelly sG
30		30-40 Gravel G
40		40-45 Gravelly Sandy gS
		45-55 Sand S
50		55-60 Gravelly Sand gS
60		60-200 Sandy S w s.i-g
70		
80		

All depths are in feet below ground surface.

Borehole drilled with 13 1/2-in threaded casing 0.0-100.6 ft bgs and 11 3/4-in threaded casing 100.6-242.1 ft bgs

All temporary drill casing was removed from the ground.

WELL SUMMARY SHEET	Start Date: 12/17/07 Finish Date: 1/23/08	Page 2 of 3

Vell ID: C5859		Well Name: 299-E33-344	
Location: N. of B-Tank Farm		Project: 200-BP-5 RI/FS	
Prepared By: Jeff Fetters	Date: 2/07/08	Reviewed By: L. J. Walker	Date: 5/1/08
Signature:		Signature:	

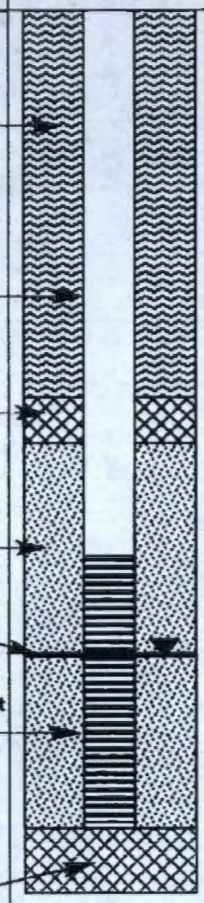
CONSTRUCTION DATA			GEOLOGIC/HYDROLOGIC DATA	
Description	Diagram	Depth in Feet	Graphic Log	Lithologic Description/Groundwater Sample Depths (ft bgs)
		90		60-200 Sand S
		100		
Granular Bentonite Crumbles: 10.8 - 206.3 ft		110		
		120		
4-in I.D. Type PVC, Schedule 40 Permanent Casing: 1.58 - 217.9 ft		130		
		140		
		150		
		160		
All depths are in feet below ground surface. Borehole drilled with 13 1/2-in threaded casing 0.0-100.6 ft bgs and 11 3/4-in threaded casing 100.6-242.1 ft bgs All temporary drill casing was removed from the ground.		170		

WELL SUMMARY SHEET	Start Date: 12/17/07 Finish Date: 1/23/08	Page 3 of 3

Well ID: C5859		Well Name: 299-E33-344	
Location: N. of B-Tank Farm		Project: 200-BP-5 RI/FS	
Prepared By: Jeff Fetters	Date: 2/07/08	Reviewed By: L. J. Walker	Date: 5-1-08
Signature: JW Fetters		Signature: LJ Walker	

CONSTRUCTION DATA

Description	Diagram
Granular Bentonite Crumbles: 10.8 - 206.3 ft	
4-in I.D. Type PVC, Schedule 40 Permanent Casing: 1.58 - 217.9 ft	
3/8 in Bentonite Pellets: 206.3 - 209.85 ft	
20-40 Primary Filter pack ~~10-20~~ Mesh Colorado Silica Sand: 209.85 - 237.6 ft (LW 5-1-08)	
Perched Water Level: 224.9 ft bgs (1-23-2008)	
4-in I.D. Stainless Steel, Type 304, Slot 10 (.010-in) Screen: 217.9 - 237.09 ft bgs	
4-in I.D. Stainless Steel End Cap 237.09 - 237.39 ft bgs	
3/8-in Coated Bentonite Pellets: 237.6 - 242.1 ft bgs	



All depths are in feet below ground surface.

Borehole drilled with 13 1/2-in threaded casing 0.0-100.6 ft bgs and 11 3/4-in threaded casing 100.6-242.1 ft bgs

All temporary drill casing was removed from the ground.

GEOLOGIC/HYDROLOGIC DATA

Depth in Feet	Graphic Log	Lithologic Description/Groundwater Sample Depths (ft bgs)
180		60-200 Sandy S
190		
200		200-209 Silty Sand mS
210		209-216 Sand S
220		216-222.6 Silt M
		222.6-225 Sand S
		225-237 Silty Sand mS
230		
		237-237.5 Sandy Gravel sG
240		237.5-242.1 Silty Sand mS
		T.D. = 242.1 Reached 1/16/08
		Perched Water Level = 225.06 ft bgs (4/24/08)
250		
260		

WELL CONSTRUCTION SUMMARY REPORT

Start Date: 12/17/07
Finish Date: 1/23/08
Page 1 of 1

Well ID: C5859	Well Name: 299-E33-344	Approximate Location: N. of B tank Farm
Project: 200-BP-5 RI/FS		Other Companies: Free Stone
Drilling Company: Blue Star		Geologist(s): S. Airhart, J. Fetters, J. Houck
Driller: Gary Howel	License #:	

TEMPORARY CASING AND DRILL DEPTH

*Size/Grade/Lbs. Per Ft.	Interval	Shoe O.D./I.D.
13 1/2" o.D. (threaded)	0 - 100.6	≈ 13 3/4" o.D.
11 3/4" O.D (threaded)	100.6 - 242.1	≈ 12" O.D.
	-	
	-	
	-	

*Indicate Welded (W) - Flush Joint (FJ) Coupled (C) & Thread Design

All casing = Threaded Design

DRILLING METHOD / HOLE DIAMETER (in.) / INTERVAL (ft)

Method	Diameter	From	to
Auger:	13 1/2"	0	100.6
Cable Tool: X	11 3/4"	100.6	242.1
Air Rotary:			
A.R. w/Sonic:			

Drilling Fluid: N/A

Total Drilled Depth: 242.1	Hole Dia @ TD: ≈ 11 3/4"	Total Amt. Of Water Added During Drilling: ≈ 100 gal	
Well Straightness Test Results: Passed		Static Water Level: 224.9' Date: 1/23/08	

GEOPHYSICAL LOGGING

Sondes (type)	Interval	Date	Sondes (type)	Interval	Date
	0 - 100.6	12/21/07		-	
	100.6 - 242.1	1/9/08		-	
	-			-	

COMPLETED WELL

Size/Wt./Material	Depth	Thread	Slot Size	Type	Interval Annular Seal/Filter Pack	Volume	Mesh Size
4" P.V.C. Sch 40	158 - 217.9	X	—	Portland Cement	0 - 10.8	9 (94 lb)	
4" 10-slot s.s. Screen	217.9 - 232.09	X	10	Granular bentonite	10.8 - 206.3	202 (50 lb)	
4" End cap s.s.	232.09 - 232.39	X	—	3/8" uncoated Pellets	206.3 - 209.85	3 (5 gal)	
	-			20-40 Colorado Silica sand	209.85 - 242.1	30 (50 lb)	
	-			Coated bentonite pellets	237.[illegible] - 242.1		3/8"

OTHER ACTIVITIES

Aquifer Test:	Date:	Well Decommission:	Yes:	No:	Date:
Description:		Description:			

WELL SURVEY DATA (if applicable)

~~Not~~ No Survey at this time	Protective Casing Elevation:
Washington State Plane Coordinates:	Brass Survey Marker Elevation:

COMMENTS / REMARKS

Reported By:	Title:	Signature:	Date:
J. Fetters	geologist	[signature]	1/28/08

A-6003-658 (04/03)

WELL SURVEY DATA REPORT

Project:	**Prepared By:** Larry A Henke **Company:** FGG
Date Requested: 06/18/08	**Requestor:** C.S. Wright (FH)
Date of Survey: 07/23/08	**Surveyor:** L.A. Henke FGG Survey Dept.
ERC Point of Contact:	**Survey Co. Point of Contact:** N.P. Fastabend
Description of Work: Civil Survey of Groundwater Monitoring Well C5859 (299-E33-344).	**Horizontal Datum:** NAD83(91)
	Vertical Datum: NAVD88
	Units: Meters
	Hanford Area Designation: 200E

Coordinate System: Washington State Plane Coordinates (South Zone)

Horizontal Control Monuments:
GABLEMTN (FH), 2E-1 (FGG)

Vertical Control Monuments:
HSWB-032 (COE), 2E-122 (FGG)

Well ID	Well Name	Easting	Northing	Elevation	
C5859	299-E33-344	573782.91	137387.31		Center of Casing
				199.922	Top Pump Baseplate, N. Edge
				199.918	Top of Outer Casing, N. Edge
				199.139	Brass Survey Marker

Notes:

Equipment Used: Trimble GPS 5800 RTK
Trimble DiNi 12 Level

Surveyor Statement:
I, Larry A. Henke, a Professional Land Surveyor registered in the State of Washington (Registration No. 38975), hereby certify that this report is based on a field survey performed in July, 2008 under my direct supervision, and that the data contained here is true and correct.

LARRY A. HENKE
STATE OF WASHINGTON
38975
REGISTERED
PROFESSIONAL LAND SURVEYOR
EXPIRES Sept. 23, 2009

Original to:
Distribution by DIS:

Sample Depth	Sample Type	HEIS #
39 - 41.5	Split-spoon	B1RLD5
41.5	Grab	B1RKL1, B1RL13 (RS)
42.2 - 44.7	Split-spoon	B1RLD6
45	Grab	B1RKL2
45.4 - 47.9	Split-spoon	B1RLD7
48	Grab	B1RKL3
50	Grab	B1RKL4
52.5	Grab	B1RKL5
55	Grab	B1RKL6
57.5	Grab	B1RKL7, B1RL19 (RS)
59.4	Grab	B1RKL8
59.4 - 61.9	Split-spoon	B1RLD8
62.8	Grab	B1RKL9
62.8-65.3	Split-spoon	B1RLD9
65.3	Grab	B1RKM0
65 - 67.5	Split-spoon	B1RLF0
67.5	Grab	B1RKM1
67.3 - 69.8	Split-spoon	B1RLF1
69.8	Grab	B1RKM2
70.1 - 72.6	Split-spoon	B1RLF2
72.6	Grab	B1RKM3
77.7	Grab	B1RKM4
72.5 - 75	Split-spoon	B1RLF4
75	Grab	B1RKM5
75.2 - 77.7	Split-spoon	B1RLF3, B1RLP5, B1RLP6(VOA), B1RLP7(VOA), B1RLP8
77.8 - 80.3	Split-spoon	B1RLF5
80.3	Grab	B1RKM6
80.3 - 82.8	Split-spoon	B1RLF6
82.8	Grab	B1RKM7
82.9 - 86.4	Split-spoon	B1RLF7
86.4	Grab	B1RKM8
87.5	Grab	B1RKM9, B1RL31 (RS)
90	Grab	B1RKN0
92.5	Grab	B1RKN1
95	Grab	B1RKN2
97.5	Grab	B1RKN3
100	Grab	B1RKN4
102.5	Grab	B1RKN5, B1RL37 (RS)

Sample Depth	Sample Type	HEIS #
104.7	Grab	B1RKN6
107.5	Grab	B1RKN7
109.5	Grab	B1RKN8
112.5	Grab	B1RKN9
115	Grab	B1RKP0
117.5	Grab	B1RKP1, B1RL43 (RS)
120	Grab	B1RKP2
122.5	Grab	B1RKP3
125	Grab	B1RKP4
127.5	Grab	B1RKP5
130	Grab	B1RKP6
132.5	Grab	B1RKP7, B1RL49 (RS)
135	Grab	B1RKP8
137.5	Grab	B1RKP9
140	Grab	B1RKR0
142.5	Grab	B1RKR1
145	Grab	B1RKR2
147.5	Grab	B1RKR3, B1RL55 (RS)
150	Grab	B1RKR4
152.5	Grab	B1RKR5
155	Grab	B1RKR6
157.5	Grab	B1RKR7
160	Grab	B1RKR8
162.5	Grab	B1RKR9, B1RL61 (RS)
165	Grab	B1RKT0
167.5	Grab	B1RKT1
170	Grab	B1RKT2
172.5	Grab	B1RKT3
175	Grab	B1RKT4
177.5	Grab	B1RKT5, B1RL67 (RS)
180	Grab	B1RKT6
182.5	Grab	B1RKT7
185	Grab	B1RKT8
187.5	Grab	B1RKT9
187.5 - 190	Split-spoon	B1RLF8
190	Grab	B1RKV0
189.2 - 191.7	Split-spoon	B1RLF9
192.5	Grab	B1RKV1, B1RL73 (RS)

Sample Depth	Sample Type	HEIS #
192 - 194.5	Split-spoon	B1RLH0
194.5	Grab	B1RKV2
195 - 197.5	Split-spoon	B1RLH1
197.5	Grab	B1RKV3
197.5 - 200	Split-spoon	B1RLH2
200	Grab	B1RKV4
199.6 - 202.1	Split-spoon	B1RLH3, B1RLP9, B1RLR0 (VOA), B1RLR1 (VOA), B1RLR2
202.5	Grab	B1RKV5
202.5 - 205	Split-spoon	B1RLH4
205	Grab	B1RKV6
205 -207.5	Split-spoon	B1RLH5
207.5	Grab	B1RKV7, B1RL79 (RS)
207 - 209.5	Split-spoon	B1RLH6
210	Grab	B1RKV8
210 - 212.5	Split-spoon	B1RLH7
212.5	Grab	B1RKV9
212.5 - 215	Split-spoon	B1RLH8
215	Grab	B1RKW0
215 - 217.5	Split-spoon	B1RLH9
217.5	Grab	B1RKW1
217.3 - 219.8	Split-spoon	B1RLJ0
219.8	Grab	B1RKW2
219.5 - 222	Split-spoon	B1RLJ1
222.6	Grab	B1RKW3, B1RL85 (RS)
222.6 - 225.1	Split-spoon	B1RLJ2
225.1	Grab	B1RKW4
224.5 - 227	Split-spoon	B1RLJ3
227.5	Grab	B1RKW5
227.5 - 230	Split-spoon	B1RLJ4
226.9	Kabis	B1T201, B1T200 (VOA)
230	Grab	B1RKW6, B1RNY7 (RS)
229.4 - 231.9	Split-spoon	B1RLJ5
232.5	Grab	B1RKW7, B1RNY8 (RS)
232.5 - 235	Split-spoon	B1RLJ6
235	Grab	B1RKW8, B1RNY9(RS)
235 - 237.5	Split-spoon	B1RLJ7, B1RLR3, B1RLR4 (VOA), B1RLR5 (VOA), B1RLR6
235 - 237.5	Split-spoon	B1RLR7(R)(VOA), B1RLR8(R)(VOA), B1RLR9(R)

APPENDIX F

WELL DOCUMENTATION FOR 299-E33-345 (C6226)

Borehole Log

Photographic Log

Well Summary Sheet

Well Construction Summary Report

Well Development and Testing Data

Well Survey

Sample Depths and HEIS Numbers

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BOREHOLE LOG

Page 1 of 2

Date: 1/24/08

Well ID: CG226	Well Name: 299-E33-~~344~~ 345	Location: N of B tank farm
Project: 200-BP-5 RI/FS		Reference Measuring Point: Ground

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
0					Cable Tool, 12 3/4" welded casing. Drive barrel. Archive samples collected every 5'
				0' → 10': Gravelly Sandy SILT	
5'				5': Gravelly sandy silt (gsM); 10% gravel, 20% sand, 70% silt. Gravel 80% basalt, 20% qtz/other, A-SR, ~1-6 mm (VC sand - FP); sand 80% qtz/other, 20% basalt, predom SR; 10YR 2/2 very dark brown, wk rxn HCl, moist.	10': Suspect larger cobbles to ~215 cm.
10'				10': Gravelly silty sand (gmS); 30% gravel, 30% silt, 40% sand. Gravel 80% basalt, 20% qtz/other, R-SR; 2 mm-70 mm (SC-VFP). Sand 60% qtz/other 40% basalt; A, VF-VC, predom. M-C. Silt moist, wk rxn HCl, 2.5Y 4/3 olive brown.	12': Silt ↑, mud rxn HCl, 2.5Y 4/2 dark grayish brown.
1/25/08 15'				15': Sandy gravel (sG); 40% gravel, 50% sand, 10% silt. Gravel 40% basalt, 60% qtz/other; SR-R, ~2mm-10cm (VFP-LP); sand 70% qtz/other 30% basalt, SR-A, predom M-VC; silt 2.5Y 4/3 olive brown; wk to no rxn HCl, dry.	17': gravel ↑ %; size ↓ to 2 mm-5 cm.
20'				20': Gravelly sand (gS); 80% sand, 19% gravel, 1% silt. Gravel 60% basalt 40% qtz/other; SR-SR; 2mm-~5cm (VF-VCP). Sand same as above. Limited silt same as above. Dry. Weak cementation	20.5': gravels to 10-12cm, suspect larger
				25' → 37': Silty Sandy GRAVEL	
25'				25': Silty sandy gravel (msG); 50% gravel, 40% sand, 10% silt. Gravel 80% basalt, 20% qtz/other, SR-R, ~2mm-10cm (VF-VCP); sand + silt same as above; dry.	
30'				30': Silty sandy gravel (msG); 50% ~~basalt gravel~~ gravel, 40% sand, 10% silt. Gravel 80% basalt, 20% qtz/other, SR-R, ~2mm-5cm (VF-VCP) (suspect larger); sand same as above; no rxn HCl; slightly moist, 2.5Y 4/2 dark grayish brown.	
35'				35': Silty sandy gravel (msG); lithology same as above, w/ sand to 30%, silt to 20%.	37': Gravelly sand (gS): 30% gvl, 70% sand. Gvl 80% basalt 20% qtz/other; 2mm-2cm (VFP-CP), SR-R; Sand 50% qtz, 50% basalt, A, VC-VF (predom. C-M) dry, no rxn HCl; 10YR 4/3 brown.
				37' → 75': SAND	

Reported By: Laurel Stratton		Reviewed By: L. D. Webber	
Title: Geologist		Title: Geologist	
Signature: Laurel Stratton	Date: 1/24/08	Signature: L D Webber	Date: 6/11/08

A-6003-642 (03/03)

BOREHOLE LOG

Page 2 of 7
Date: 1/29/08

Well ID: C6226 | Well Name: 299-E33-345 | Location: N. of B tank Farm

Project: 200-BP-5 RI/FS | Reference Measuring Point: Ground

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
40	G			40': Sand (s) 50% basalt 50% qtz/others, A, VC-VF (Predom C-M), Dry, wk Rxn HCl, 10 yr 4/3 brown	Cable Tool, 12 3/4" welded Casing, Drive barrel Archive Samples Collected Every 5'
45	G			45': Sand (s) 50% basalt 50% qtz/ others, VC-VF (Predom VC-M), A, wk rxn HCl, Dry, 10yr 4/3, brown	
50	G			50': Sand (s): lithology same as above	
55	G			55': Sand (s): lithology same as above	
60	G			59'-Sand (s) 80% qtz 20% basalt, Predom M-C, Dry, 10yr 5/3 lt. olive brown, no rxn HCl	
65	G			65'-Sand (s): 40% basalt 60% qtz, VC-VF (Predom C-M) slightly moist, 2.5y 4/3 lt. olive brown, v wk Rxn HCl	
70	G			70'-Sand (s): lithology same as above	
75	G			75'-Gravelly Sand (gs): 20% gvl 80% Sand; gvl: 90% basalt 10% qtz/others, 2mm-1cm (VFP-MP), R-SA; Sand: VC-VF (Predom C-M), 50% basalt 50% qtz/others, Dry, 10yr 4/2 DK grayish brown, wk Rxn HCl	75' ↑ Fine Fraction 77' ↑ "pea" sized gvl.

Reported By: J Fetters | Reviewed By: L. D. Walker

Title: geologist | Title: Geologist

Signature: [signature] | Date: 4/16/08 | Signature: [signature] | Date: 6/11/08

A-6003-642 (03/03)

BOREHOLE LOG

Page 3 of 7
Date: 1/29/08

Well ID: C6226 | Well Name: 299-E33-375 | Location: N. of B. tank Farm
Project: 200-BP-5 RI/FS | Reference Measuring Point: Ground

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description (Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl)	Comments (Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level)
80'	G			80'-Sand (s): VC-VF (Predom m-c), 50% basalt 50% qtz/others, A, Dry, vwk Rxn HCl, 10yr 4/3 brown	Cable Tool 12 3/4" welded casing. Drive barrel
				80'→150': SAND	Archive Samples Collected Every 5'
85	G			85'-Sand (s): lithology same as above	
90'	G			90'-Sand (s): 50% basalt, 50% qtz/others, m-F grain, A, Dry 10yr 4/3 brown, wk Rxn HCl	
95'	G			95'-Sand (s): lithology same as above	
100	G			100'-Sand (s): lithology same as above, grain size C-m	
105				105'-Sand (s): 80% sand 20% Silt; sand 50% basalt 50% qtz, M-VF, A; Silt: Dry, 10yr 5/2 grayish brown, wk rxn HCl	107 ↓ silt %, no silt
110'	G			107-110'-Sand (s) 100% sand, 70% qtz 30% basalt, A, Dry, 10yr 4/2 Dk grayish brown, VC-F (Predom m-F) vwk Rxn HCl	
115'	G			115'-Sand (s): 80% sand 20% silt; sand: 50% basalt 50% qtz, C-VF (Predom m-VF, A; Silt: Dry, 10yr 4/2 Dk grayish brown, wk Rxn HCl	
116	G			116-119' Sand (s): VF, 90% qtz 10% basalt, A, Dry, 2.5y 5/3 lt. olive, vwk Rxn HCl	

Reported By: J Fathers | Reviewed By: L.D. Walker
Title: geologist | Title: Geologist
Signature: J Fathers | Date: 4/16/08 | Signature: LD Walker | Date: 6/11/08

A-6003-642 (03/03)

BOREHOLE LOG

Page 4 of 7
Date: 1/31/08

Well ID: C6226 | Well Name: 299-E33-345 | Location: N. of B Tank Farm

Project: 200-BP-5 RI/FS | Reference Measuring Point: Ground

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
120	G			119'-Sand (s): 50% basalt, 50% qtz, M, A, Dry 2.5y 5/2 olive gray	Cable Tool, 12 3/4" welded casing, Drive barrel Archive samples collected Every 5'
125	G			125'-Sand (s): 90% snd 10% gvl; gvl: basalt, VFP, A; Snd: 50% basalt 50% qtz/others, vc-VF, Predom C-m, A, Dry, 10yr 5/2, gray, vwk-no Rxn HCl	
130	G			130'-Sand (s): 95% snd 5% silt; Snd: VF-C (predom M-F), 60% qtz 40% basalt, A; Silt: Dry, 10yr 5/2 grayish brown, wk Rxn HCl	130'-Mica Flakes up to 3mm
135	G			135'-Sand (S): 50% basalt 50% qtz M-C, A, Dry, 10yr 5/2 gray, vwk rxn HCl	
140	G			140'-Sand (s) lithology same as above	
145	G			145'-Sand (s) lithology same as above	
				150'→165': Silty SAND	
150	G			150'-Silty Sand (ms) 80% snd 20% silt; snd 30% basalt, 70% qtz/others, C-VF (Predom med.) A; Silt: Dry, 2.5y 5/2 grayish brown, wk Rxn HCl	
155	G			155'-Silty Sand (s): lithology same as above w/ few FP present (basalt)	

Reported By: J Fellers | Reviewed By: L.D. Walker

Title: geologist | Title: Geologist

Signature: [signature] Date: 4/16/08 | Signature: [signature] Date: 6/11/08

A-6003-642 (03/03)

BOREHOLE LOG

Page 5 of 7
Date: 2/6/08

Well ID: C6226 | Well Name: 299-E33-345 | Location: N. of B Tank Farm

Project: 200-BP-5 RI/FS | Reference Measuring Point: Ground

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
160'	G			160'-Silty Sand (ms) = lithology Same as above	Cable Tool, 12 3/4" Welded Casing, Drive barrel
					Archive Samples Every 5'
				165'-Sand (s): 90% snd, 10% gvl; gvl: basalt 2-4mm (VFP), A; Snd: 70% qtz 30% basalt, m-c, A, Dry, 2.5 5/2 grayish brown, no Rxn HCl	
165'	G				
166'	G			166'-Gravelly Silty Sand (gms): 20% gvl 20% silt, 60% snd; gvl: 80% basalt, 20% qtz 2mm-1cm (VFP-MP), A-SA; Snd: 90% qtz, 10% basalt (Predom F-VF), A; Silt Slightly Moist, 2.5Y 4/3 olive brown Vwk Rxn HCl	166' Sample well sorted w/ Fines grading to coarse w/ Depth.
170'	G			166.4-Sandy Gravel (sG) 40% gvl 60% snd gvl: 90% basalt 10% qtz, 2mm-1cm (VFP-MP), A-SA; Snd: 60% basalt 40% qtz, vc-VF (Predom C-M), A, Dry, 2.5Y 5/2 grayish brown, Vwk Rxn HCl	173' Mica Flakes to 3mm
175'	G			175'-gravelly Silty Sand: 10% gvl 40% silt, 50% Snd; gvl: 90% basalt 10% qtz, 2-5mm (VFP-FP), A; Snd: 50% basalt, 50% qtz, vc-VF (Predom M-VF), A; Silt: Dry, 2.5Y 5/2 grayish brown, Mod Rxn HCl	172.5' - ↓ silt
180'	G			180'-gravelly Silty Sand: - lithology Same as above	
185'	G			185'-Sand (s) 50% basalt 50% qtz/other, A, vc-VF, (Predom: M), Dry, 2.5Y 5/2 grayish brown, Vwk Rxn HCl	
190'	G			190'-Sand (s) lithology same as above	191' Mica Flakes to 5mm noted
193'	G			193'-Sandy gravel (sG): 70% gvl 30% snd; gvl: 2mm-1.5cm (VFP-MP) few SC noted, 80% basalt, 20% qtz, A; Snd: vc-VF (Predom vc-m) 80% basalt 20% qtz, A, Dry, wk Rxn HCl, 2.5Y 4/1	193'-Small cobbles = 100% qtz
195'				195.5'-Silty Sandy Gravel (msG) 60% gvl 20% snd, 20% silt; gvl: lith. Same as above; Snd: lith same as above; Silt: Dry 2.5Y 5/2 grayish brown, mod Rxn HCl	195.5 (Predom VFP-MP)

Reported By: J Fetters | Reviewed By: L.D. Walker

Title: geologist | Title: Geologist

Signature: J Fetters | Date: 4/16/08 | Signature: L.D. Walker | Date: 6/11/08

A-6003-842 (03/03)

BOREHOLE LOG

Page 6 of 7
Date: 2/7/08

Well ID: C6226 | Well Name: 299-E33-345 | Location: N. of B tank Farm

Project: 200-BP-5 RI/FS | Reference Measuring Point: Ground

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
200'	G			200'-Sand, Gravel (SG): 60% snd 30% gvl, 10% Silt; gvl: 80% basalt 20% qtz Predom VFP-MP w/cobbles to 12 cm noted R-SR; Snd: lith. same as above; silt: lith same as above w/ wk Rxn HCl	Cable Tool. 12 3/4" welded casing, Drive barrel 200'-snd. Predom C-m
205'	G			205'-Sand (S): VC-VF (Predom VC-m) 50% basalt 50% qtz, A, Dry, 10yr 4/2 Dk grayish brown, V wk Rxn HCl	203'- no cobbles noted
210'	G			210'-Silty Sand, Gravel (MSG): 20% silt 50% gvl, 30% snd: gvl: 80% basalt 20% qtz, Predom 2mm-15cm (VFP-MP) A-SR; snd: VC-VF (Pred. m-VF) A, 80% basalt 20% qtz; Silt: Dry, 2.5y 4/2 Dk grayish brown, wk Rxn HCl	210'- Few SC. noted 211 no S.C. noted 213'- Silty sand
215'	G			215': Sand: F-VF, 90% qtz, 10% basalt, A, Dry, 2.5y 5/2 grayish brown, mod Rxn HCl 216.5 Silt (M): moist, 10yr 3/4, Dk. yellowish brown, wk Rxn HCl	Archive Samples Every 5'
220'	G				
225'	G			223'-Sand (S): 70% snd 10% silt: snd: VF, A, 90% qtz, 10% basalt; silt: moist, 10yr 4/3 brown, wk Rxn HCl	
230'	G			230'-Sand (S): lithology same as above & 10% silt, mod Rxn HCl	227.5' ↑ moisture, BH Swelling Shut, no Free water
235'	G			233'-lithology same as above w/ Partings, Reddish orange staining b/t partings 236-Silty Sand (MS): 80% VFS, 20% silt/clay, 90% qtz 10% basalt laminated alternating VFS w/ clay, 2.5y 4/3 olive brown; clay: 2.5y 4/1 dk gray, Dry, mod Rxn HCl, int. Iron staining	233'-Contamination > 2X background, no samples Archived

Reported By: J Fethers | Reviewed By: L.D. Walker

Title: geologist | Title: Geologist

Signature: [signature] Date: 4/16/08 | Signature: [signature] Date: 6/11/08

A-6003-842 (03/03)

BOREHOLE LOG

Page 7 of 7
Date 2/3/08

Well ID: C6226 | Well Name: 299-E33-345 | Location: N. of B tank Farm

Project: 200-BP-5 RI/FS | Reference Measuring Point: Ground

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
240	G			240' - lithology same as above w/ increased mica content, cuttings are moist, not saturated	Cable Tool, 12 3/4" welded casing, Drive barrel
					* No Grab samples for archive collected due to >2x background contamination 233-245' bgs
245	G, SS	244.75-246.25 100%		245' - Sandy Gravel (SG): 70% sand 30% gvl; gvl: 80% qtz 20% basalt, R, 2cm-2mm (SC-VFP); Sand: 80% qtz 20% basalt Predom VC-M, Dry - Slightly Moist, 10YR 7/2, lt. gray, wk rxn HCl, A	239' bgs - Casing reduced from 12 3/4" to 10 3/4"
	G, SS	247.5-249.8 100%		245.5' - Sandy Gravel (SG): 30% gvl 60% sand 10% silt; Gvl: 6cm-2mm, 80% qtz 20% basalt, R; Sand: VC-VF (Predom M-VF), A, 90% qtz 10% basalt; Silt: Dry, 2.5Y 5/2 grayish brown str Rxn HCl, wkly cemented	
250	G, SS	250.2-252.9 100%		250' - Gravelly Silty Sand (GmS): 30% gvl, 20% silt, 50% sand: lithology same as above w/ gvl to 70% qtz, 30% basalt	
	G, SS	253.3-254.8		255' - Sandy Gravel (SG): 60% gvl 35% sand 5% silt; gvl: 50% basalt 50% qtz, R, 5cm-2mm (VCP-VFP); Sand: VC-VF (Predom C-M) 50% basalt 50% qtz, A; Silt: moist, 2.5Y 3/2 vdk grayish brown, vwk Rxn HCl	255' - Cobbles to 13cm noted
255	G, SS	255.8-258.3 100%			Water Sample - 259' bgs, open hole 258-259' bgs
260	G			260' - Gravel (G): 80% gvl 15% sand, 5% silt; gvl: 60% basalt 40% qtz, 2mm-7cm (VFP-SC), R, Sand: VC-VF (Predom VC), 50% basalt, 50% qtz, A, Silt: wet, 2.5 3/2 vdk grayish brown, wk Rxn HCl	260' - Hard tool drilling 8" hard tool
265				260.5' - Basalt: Elephant Mnt. Member. Aphanitic, gley 2.5/N black; No vesicals present. Chips 1.5cm-2mm, Fresh surfaces	
					TD = 263.8' bgs (2/21/08)
					WL = 253.81' bgs (4/24/08)

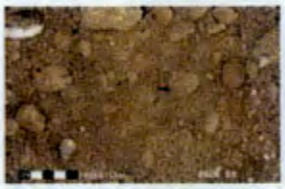
Reported By: J Fetters | Reviewed By: L.D. Walker

Title: geologist | Title: Geologist

Signature: [signature] Date: 4/16/08 | Signature: [signature] Date: 6/11/08

A-6003-642 (03/03)

Well C6226 (299-E33-345)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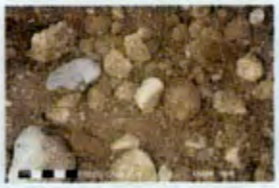
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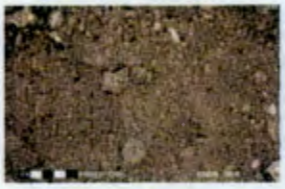
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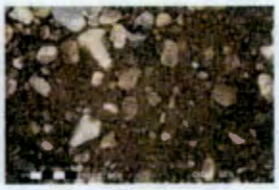
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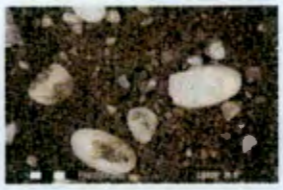
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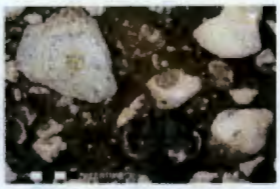
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40 ft

45 ft

50 ft

55 ft

60 ft

65 ft

70 ft

75 ft

80 ft

85 ft

90 ft

95 ft

100 ft

105 ft

110 ft

Well C6226 (299-E33-345)

115 ft

116 ft

120 ft

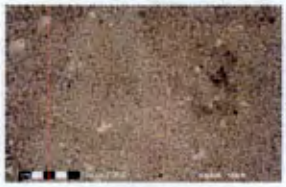
125 ft

130 ft

135 ft

140 ft

145 ft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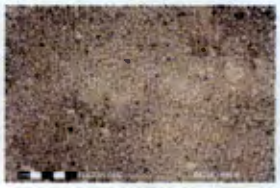
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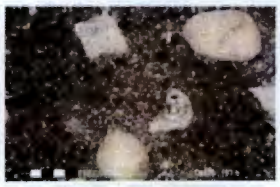
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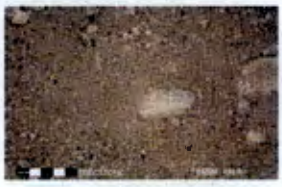
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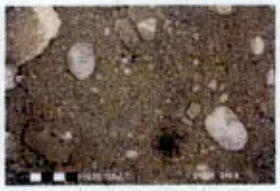
205 ft


210 ft

215 ft

220 ft

Well C6226 (299-E33-345)

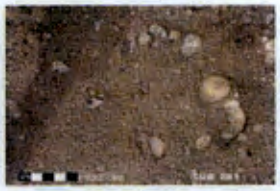
225 ft

230 ft

233 ft

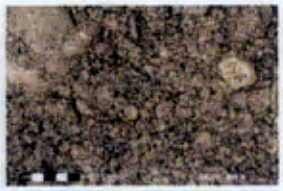
245 ft

246 ft

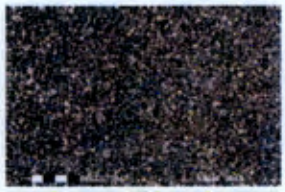


250 ft

255 ft



260 ft



264 ft

WELL SUMMARY SHEET	Start Date: 1/24/08 Finish Date: 4/4/08	Page 1 of 3
Well ID: ~~6226~~ C6226	Well Name: 299-E33-345	
Location: N. of B-Tank Farm	Project: 200-BP-5 RI/FS	
Prepared By: Jeff Fetters — Date: 4/03/08	Reviewed By: L.S. Walker — Date: 6/11/08	
Signature: Jeff Fetters	Signature: L.S. Walker	

CONSTRUCTION DATA

Description	Diagram
6-in Concrete Pad	
8-in I.D. Type 304/304L Stainless Steel Protective Casing: 2.45 ft above Ground Surface	
Portland Cement Type I/II: 0 - 11.7 ft	
Granular Bentonite Crumbles: 11.7 - 244.5 ft	
6-in I.D. Type 304/304L Stainless Steel, Schedule 10 Permanent Casing: 2.0 - 249.68 ft	
All depths are in feet below ground surface.	
Borehole drilled with 12 3/4-in welded casing 0.0-239 ft bgs and 10 3/4-in threaded casing 239-260.3 ft bgs	
All temporary drill casing was removed from the ground.	

GEOLOGIC/HYDROLOGIC DATA

Depth in Feet	Graphic Log	Lithologic Description/Groundwater Sample Depths (ft bgs)
0		0-10 Gravely Sandy Silt gsM
10		10-15 Gravely Silty Sand gmS
		15-20 Sandy Gravelly sG
20		20-25 Gravelly Sand gS
		25-~~40~~ 37' Silty Sandy Gravel msG
30		
		37-75 Sand S
40		
50		
60		
70		
		75-80 Gravelly Sand gS
80		80-150 Sand S

WELL SUMMARY SHEET	Start Date: 1/24/08 Finish Date: 4/4/08	Page 2 of 3

Vell ID: C6226		Well Name: 299-E33-345	
Location: N. of B-Tank Farm		Project: 200-BP-5 RI/FS	
Prepared By: Jeff Fetters	Date: 2/07/08	Reviewed By: L. S. Walker	Date: 6/11/08
Signature: Jeff Fetters		Signature: L. S. Walker	

CONSTRUCTION DATA

Description	Diagram
Granular Bentonite Crumbles: 11.7 - 244.5 ft	
6-in I.D. Type 304/304L Stainless Steel, Schedule 10 Permanent Casing: 2.0 - 249.68 ft	
All depths are in feet below ground surface.	
Borehole drilled with 12 3/4-in welded casing 0.0-239 ft bgs and 10 3/4-in threaded casing 239-260.3 ft bgs	
All temporary drill casing was removed from the ground.	

GEOLOGIC/HYDROLOGIC DATA

Depth in Feet	Graphic Log	Lithologic Description/Groundwater Sample Depths (ft bgs)
90		80-150 Sand S
100		
110		
120		
130		
140		
150		150-165 Silty Sand mS
160		
		165-166 Sand S
		166-166.4 Gravely Silty Sand sG
170		166.4-175 Sandy Gravel sG
		175-185 Gravely Silty Sandy gmS

WELL SUMMARY SHEET	Start Date: 1/24/08 Finish Date: 4/4/08	Page 3 of 3
Well ID: C6226	Well Name: 299-E33-345	
Location: N. of B-Tank Farm	Project: 200-BP-5 RI/FS	
Prepared By: Jeff Fetters — Date: 2/07/08	Reviewed By: L. S. Walker — Date: 6/11/08	
Signature:	Signature:	

CONSTRUCTION DATA

All depths are in feet below ground surface.

Borehole drilled with 12 3/4-in welded casing 0.0-239 ft bgs and 10 3/4-in threaded casing 239-260.3 ft bgs

All temporary drill casing was removed from the ground.

Granular Bentonite Crumbles: 11.7 - 244.5 ft

6-in I.D. Type 304/304L Stainless Steel, Schedule 10 Permanent Casing: 2.0 - 249.68 ft

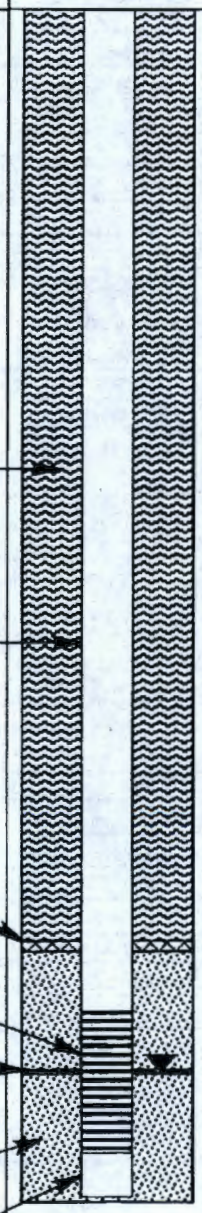
3/8-in Bentonite Pellets: 244.5 - 245.1 ft

6-in I.D. Stainless Steel, Type 304, Slot 20 (.020-in) Screen: 249.68 - 259.68 ft bgs

Water Level: 253.38 ft bgs (4-1-2008)

Primary Filter pack 10-20 Mesh Colorado Silica Sand: 245.1 - 262.85 ft

6-in I.D. Stainless Steel Sump: 259.68 - 262.68 ft bgs



GEOLOGIC/HYDROLOGIC DATA

Depth in Feet	Lithologic Description/Groundwater Sample Depths (ft bgs)
180	
	185-193 Sand S
190	
	193-195.5 Sandy Gravel sG
	195.5-200 Silty Sandy Gravel msG
200	200-205 Sandy Gravel sG
	205-210 Sand S
210	210-215 Silty Sandy Gravel msG
	215-216.5 Sand S
	216.5-223 Silt M
220	
	223-236 Sand S
230	
	236-245 Silty Sand mS
240	
	245-250 Sandy Gravel sG
250	250-255 Gravely Silty Sand GmS
	255-260 Sandy Gravel sG
260	260-260.3 Gravel G
	260.3 Basalt

WELL CONSTRUCTION SUMMARY REPORT

Start Date: 1/24/08
Finish Date:
Page 1 of 1

Well ID: C6226	Well Name: 299-E33-345	Approximate Location: N. of B tank Farm
Project: 200-BP-5 RI/FS		Other Companies: Freestone Env. Serv. Inc.
Drilling Company: Blue Star		Geologist(s): L. Stratton, J Fetters
Driller: Gary Howel	License #:	

TEMPORARY CASING AND DRILL DEPTH			DRILLING METHOD	HOLE DIAMETER (in.) / INTERVAL (ft)
*Size/Grade/Lbs. Per Ft.	Interval	Shoe O.D./I.D.	Auger:	Diameter 12 3/4" From 0 to 239
12 3/4" welded	0 - 239	13 3/8 / 12 1/8	Cable Tool: X	Diameter 10 3/4" From 239 to 260.3
10 3/4" Threaded	239 - 260.3	welded	Air Rotary:	Diameter ____ From ____ to ____
	____ - ____		A.R. w/Sonic:	Diameter ____ From ____ to ____
	____ - ____			Diameter ____ From ____ to ____
	____ - ____			Diameter ____ From ____ to ____
*Indicate Welded (W) - Flush Joint (FJ) Coupled (C) & Thread Design				Diameter ____ From ____ to ____

Drilling Fluid: Water

Total Drilled Depth: 263.8	Hole Dia @ TD: 10 3/4"	Total Amt. Of Water Added During Drilling: ≈ 370	
Well Straightness Test Results: Passed		Static Water Level: 253.38	Date: 4/1/08

GEOPHYSICAL LOGGING

Sondes (type)	Interval	Date	Sondes (type)	Interval	Date
Neutron Moisture	0 - 239	2/14/08	Spec. Gamma	239 - 263.8	2/25/08
Spec. gamma	0 - 239	2/14/08		____ - ____	
Neutron moisture	239 - 263.8	2/25/08		____ - ____	

COMPLETED WELL

Size/Wt./Material	Depth	Thread	Slot Size	Type	Interval Annular Seal/Filter Pack	Volume	Mesh Size
6" sch 10 s.s. Casing	+2.00 - 249.68	X	NA	Portland Cement	0 - 11.7	8/94lb	—
6" 20 slot s.s. w.r. Screen	249.68 - 259.68	X	20	Granular bentonite	11.7 - 244.5	227/50lb	—
6" Sump	259.68 - 262.68	X	NA	10-20 Colorado Silica Sand	245.1 - 262.85	22/50lb	10-20
	____ - ____			3/8" Coated bentonite pellets	244.5 - 245.1	3/5gal	3/8"
	____ - ____				____ - ____		

OTHER ACTIVITIES

Aquifer Test:	Date:	Well Decommission:	Yes:	No: ✓	Date:
Description:		Description:			

WELL SURVEY DATA (If applicable)

Not surveyed at this time	Protective Casing Elevation:
Washington State Plane Coordinates:	Brass Survey Marker Elevation:

COMMENTS / REMARKS

All temp. Casing removed durring construction

Reported By:	Title:	Signature:	Date:
J Fetters	geologist	J Fetters	4/4/08

A-6003-658 (04/03)

WELL DEVELOPMENT AND TESTING DATA

Well Name:	Well ID:	Well Location:	Date:
299-E33-345	C6226	N. of B tank Farm	4/25/08

Reference Measuring Point (unless otherwise noted): TOP OF OUTER CASING (TOC)

Has the well been surveyed? O Yes ⊗ No | Does the well have a cement pad? ⊗ Yes O No

PART 1

STATIC WATER LEVEL:

Start of Job 253.81' bgs

End of Job

DEPTH TO BOTTOM:

Start of Job 262.1' bgs

End of Job

PART 2

WELL DEVELOPMENT DATA

Pump Model 5 hp

Intake Depth 259

Starting Turbidity > 1000 NTU

Pump Start	Stop	Flow Rate
1414 (4/24/08)	1523 (4/24/08)	1.5 gpm
0712 (4/25/08)	0927 (4/25/08)	1.5 gpm

Total Pumped 306 gallons

Final Turbidity 3.42

XD SN/Range (PSI) XDSN 7336 20psi

PART 3

INSTANTANEOUS SLUG TEST

Static Water Level (TOC)

Transducer Depth

Baseline Start

Injection Start

Baseline Start

Withdrawal Start

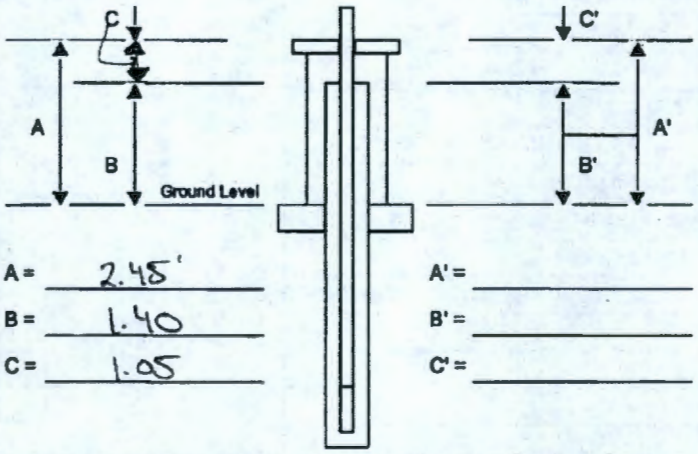
Slug Volume

XD SN/Range (PSI)

PART 4

Last Recorded Measurements Date:

Current Measurements Date:



A = 2.45'

B = 1.40

C = 1.05

A' =

B' =

C' =

Are there any reference marks on the casing strings? O Yes O No

PART 5

COMMENTS:

4/24/08: No Development data collected

4/25/08: Test #1: Drawdown

Test #2: Recovery

Prepared by (print name):	Signature:	Date:
J Fetters	[signature]	4/25/08
Reviewed by (print name):	**Signature:**	**Date:**
L.A. Walker	[signature]	6/11/08

A-6003-844 (03/03)

WELL DEVELOPMENT AND TESTING DATA

Well Name:	Well ID:	Well Location:	Date:
299-E33-345	C6226	N. of B tank Farm	6/3/08

Reference Measuring Point (unless otherwise noted): TOP OF OUTER CASING (TOC)

Has the well been surveyed? O Yes ☒ No | Does the well have a cement pad? ☒ Yes O No

PART 1

STATIC WATER LEVEL:	
Start of Job	
End of Job	
DEPTH TO BOTTOM:	
Start of Job	266.7' TOC
End of Job	262.4' TOC

PART 2

WELL DEVELOPMENT DATA		
Pump Model		
Intake Depth		
Starting Turbidity		
Pump Start	Stop	Flow Rate
Total Pumped		
Final Turbidity		
XD SN/Range (PSI)		

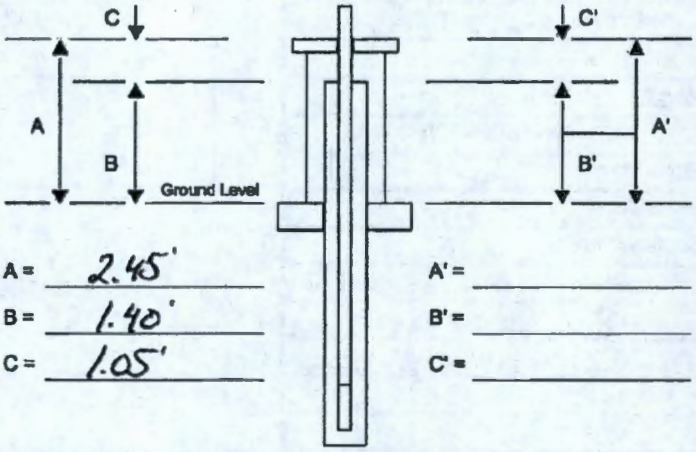
PART 3

INSTANTANEOUS SLUG TEST	
Static Water Level (TOC)	
Transducer Depth	
Baseline Start	
Injection Start	
Baseline Start	
Withdrawal Start	
Slug Volume	
XD SN/Range (PSI)	

PART 4

Last Recorded Measurements Date: 4/25/08

Current Measurements Date:



A = 2.45'
B = 1.40'
C = 1.05'

A' =
B' =
C' =

Are there any reference marks on the casing strings? O Yes O No

PART 5

COMMENTS:
Well screen interval surged ≈ 5.5 hrs

Prepared by (print name):	Signature:	Date:
J Fetters	J Fetters	6/3/08
Reviewed by (print name):	**Signature:**	**Date:**
L.S. Walker	L.S. Walker	6/11/08

A-6003-644 (03/03)

WELL DEVELOPMENT AND TESTING DATA

Well Name:	Well ID:	Well Location:	Date:
299-E33-345	C6226	N. of B tank Farm	6/4/08

Reference Measuring Point (unless otherwise noted): TOP OF OUTER CASING (TOC)

Has the well been surveyed? O Yes ⊗ No | Does the well have a cement pad? ⊗ Yes O No

PART 1

STATIC WATER LEVEL:

Start of Job	
End of Job	

DEPTH TO BOTTOM:

Start of Job	262.4' TOC (6/3/08)
End of Job	265.8' TOC

PART 2

WELL DEVELOPMENT DATA

Pump Model	5 hp
Intake Depth	263.35' bgs
Starting Turbidity	~~[illegible]~~ 187 NTU

Pump Start	Stop	Flow Rate
1418	1537	≈ 14 gpm

Total Pumped	1666 gal
Final Turbidity	17.4 NTU
XD SN/Range (PSI)	

PART 3

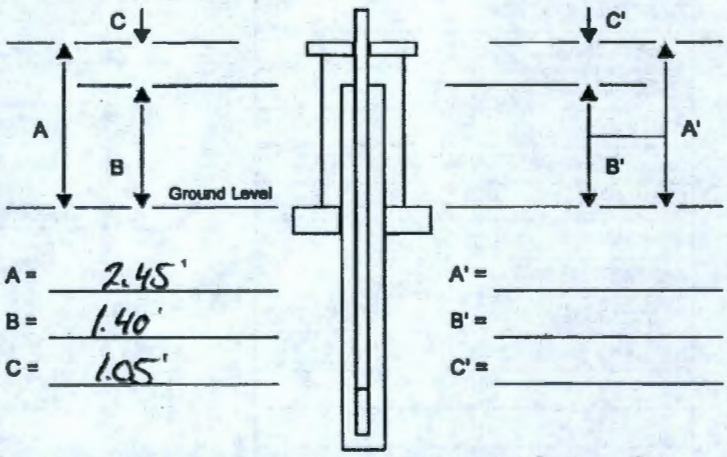
INSTANTANEOUS SLUG TEST

Static Water Level (TOC)	
Transducer Depth	
Baseline Start	
Injection Start	
Baseline Start	
Withdrawal Start	
Slug Volume	
XD SN/Range (PSI)	

PART 4

Last Recorded Measurements Date: 4/25/06

Current Measurements Date:



A =	2.45'	A' =	
B =	1.40'	B' =	
C =	1.05'	C' =	

Are there any reference marks on the casing strings? O Yes O No

PART 5

COMMENTS:

No drawdown or recovery data collected due to malfunctioning datalogger

Prepared by (print name):	Signature:	Date:
J Fehrs	[signature]	6/4/08
Reviewed by (print name):	**Signature:**	**Date:**
L.D. Walker	[signature]	6/11/08

A-6003-644 (03/03)

WELL DEVELOPMENT AND TESTING DATA

Well Name:	Well ID:	Well Location:	Date:
299-E33-345	6226	N. of B tank Farm	6/5/08

Reference Measuring Point (unless otherwise noted): TOP OF OUTER CASING (TOC)

Has the well been surveyed? O Yes ☒ No | Does the well have a cement pad? ☒ Yes O No

PART 1

STATIC WATER LEVEL:

Start of Job	256.38' TOC
End of Job	256.34' TOC

DEPTH TO BOTTOM:

Start of Job	265.8' TOC
End of Job	266.58' toc

PART 2

WELL DEVELOPMENT DATA

Pump Model	5 hp
Intake Depth	263.5' bgs
Starting Turbidity	17.4 NTU

Pump Start	Stop	Flow Rate
0720	0902	16 gpm

Total Pumped	2912 gallons
Final Turbidity	.64
XD SN/Range (PSI)	—

PART 3

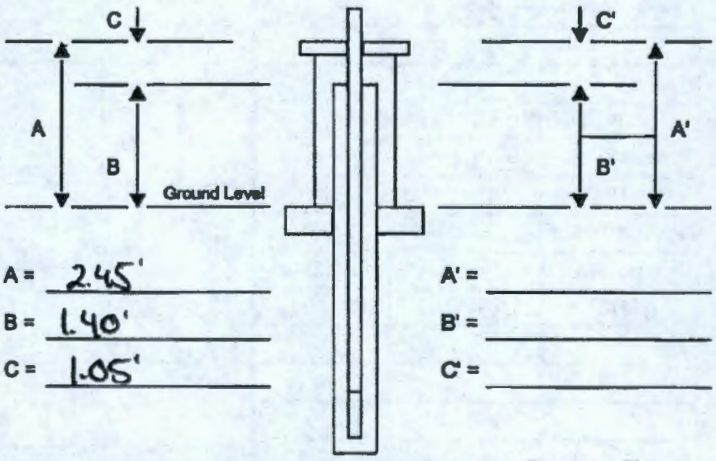
INSTANTANEOUS SLUG TEST

Static Water Level (TOC)	
Transducer Depth	
Baseline Start	
Injection Start	
Baseline Start	
Withdrawal Start	
Slug Volume	
XD SN/Range (PSI)	

PART 4

Last Recorded Measurements Date: 4/25/08

Current Measurements Date:



A = 2.45'
B = 1.40'
C = 1.05'

A' =
B' =
C' =

Are there any reference marks on the casing strings? O Yes ☒ No

PART 5

COMMENTS:

See Far for Drawdown data collected w/ Etage. Report #47

Prepared by (print name):	Signature:	Date:
J Fetters	J Fetters	6/5/08
Reviewed by (print name):	**Signature:**	**Date:**
L. S. Walker	L S Walker	6/11/08

A-6003-644 (03/03)

WELL DEVELOPMENT AND TESTING DATA

Well Name:	Well ID:	Well Location:	Date:
299-E33-345	C6226	N of B tank farms	6/6/08

Reference Measuring Point (unless otherwise noted): TOP OF OUTER CASING (TOC)

Has the well been surveyed? ○ Yes ⊗ No | Does the well have a cement pad? ⊗ Yes ○ No

PART 1

STATIC WATER LEVEL:

Start of Job 254.0 bgs.

End of Job

DEPTH TO BOTTOM:

Start of Job 266.58' ToC

End of Job

PART 2

WELL DEVELOPMENT DATA

Pump Model 5hp

Intake Depth 263.5 bgs

Starting Turbidity 39.5 NTU

Pump Start	Stop	Flow Rate
0654	0906	12gpm

Total Pumped 3024 gal.

Final Turbidity 3.39 NTU

XD SN/Range (PSI)

PART 3

INSTANTANEOUS SLUG TEST

Static Water Level (TOC)

Transducer Depth

Baseline Start

Injection Start

Baseline Start

Withdrawal Start

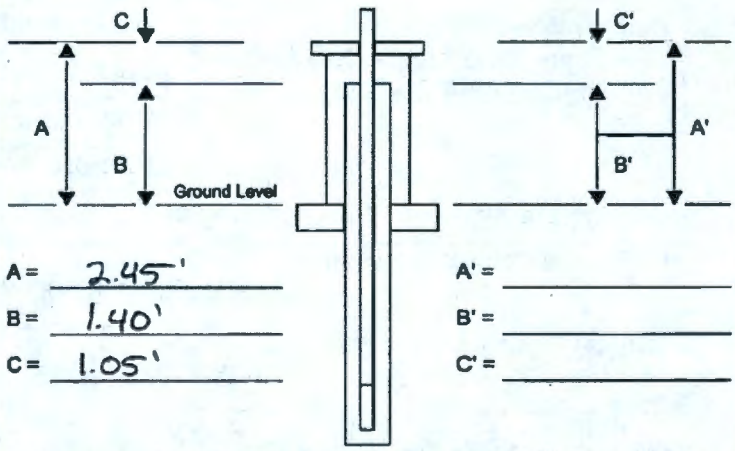
Slug Volume

XD SN/Range (PSI)

PART 4

Last Recorded Measurements Date: 4/25/08

Current Measurements Date:



A = 2.45'

B = 1.40'

C = 1.05'

A' =

B' =

C' =

Are there any reference marks on the casing strings? ○ Yes ○ No

PART 5

COMMENTS:

See page 1 of FAR 48 to obtain draw down data.

Prepared by (print name):	Signature:	Date:
Kim Royal	Kim Royal	6/9/08
Reviewed by (print name):	**Signature:**	**Date:**
L.A. Walker	[signature]	6/11/08

A-6003-644 (03/03)

WELL SURVEY DATA REPORT

Project:	**Prepared By:** Larry A Henke **Company:** FGG
Date Requested: 06/18/08	**Requestor:** C.S. Wright (FH)
Date of Survey: 07/23/08	**Surveyor:** L.A. Henke FGG Survey Dept.
ERC Point of Contact:	**Survey Co. Point of Contact:** N.P. Fastabend
Description of Work: Civil Survey of Groundwater Monitoring Well C6226 (299-E33-345).	**Horizontal Datum:** NAD83(91)
	Vertical Datum: NAVD88
	Units: Meters
	Hanford Area Designation: 200E

Coordinate System: Washington State Plane Coordinates (South Zone)

Horizontal Control Monuments:
GABLEMTN (FH), 2E-1 (FGG)

Vertical Control Monuments:
HSWB-032 (COE), 2E-122 (FGG)

Well ID	Well Name	Easting	Northing	Elevation	
C6226	299-E33-345	573780.87	137388.24		Center of Casing
				199.847	Top Pump Baseplate, N. Edge
				199.837	Top of Outer Casing, N. Edge
				199.095	Brass Survey Marker

Notes:

Equipment Used: Trimble GPS 5800 RTK
Trimble DiNi 12 Level

Surveyor Statement:
I, Larry A. Henke, a Professional Land Surveyor registered in the State of Washington (Registration No. 38975), hereby certify that this report is based on a field survey performed in July, 2008 under my direct supervision, and that the data contained here is true and correct.

LARRY A. HENKE
STATE OF WASHINGTON
38975
REGISTERED
PROFESSIONAL LAND SURVEYOR
EXPIRES 6/23/2009

Original to:
Distribution by DIS:

Sample Depth	Sample Type	HEIS #
216	Grab	B1TFX1, B1FV4
217.5	Grab	B1TFX2, B1TFV5
220	Grab	B1TFX3, B1TFV6
222.5	Grab	B1TFX4, B1TFV7
225	Grab	B1TFX5, B1TFV8
227.5	Grab	B1TFX6, B1TFV9
230	Grab	B1TFX7, B1FW0
232.5	Grab	B1TFX8, B1TFW1
236	Grab	B1TFX9, B1TFW2
237-239.5	Split-spoon	B1RLJ8
239.5	Grab	B1RKX0, B1RP01 (RS)
244.5-246.95	Split-spoon	B1RLK1
247.5	Grab	B1RKX3, B1RP04 (RS)
247.3-249.8	Split-spoon	B1RLK2
250	Grab	B1RKX4, B1RP05 (RS)
250.4-252.9	Split-spoon	B1RLK3
252.5	Grab	B1RKX5, B1RL97 (RS)
252.3-254.8	Split-spoon	B1RLK4
254.8	Grab	B1RKX6
255.5-258	Split-spoon	B1RLY0, B1RLT0, B1RLT1 (VOA), B1RLT2 (VOA), B1RLT3
258	Water (bailer)	B1RLW1, B1RLW2
257.5	Grab	B1RKX7
260	Grab	B1RKX8
260-263.6	Grab	B1RKX9

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APPENDIX G

WELL DOCUMENTATION FOR 699-52-55B (C5862)

Borehole Log

Photographic Log

Well Summary Sheet

Well Construction Summary Report

Well Development and Testing Data

Well Survey

Sample Depths and HEIS Numbers

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BOREHOLE LOG

Page 1 of 8
Date: 6/12/08

Well ID: C5862 | Well Name: 699-52-55B | Location: N of railroad, adjacent to C5861

Project: BP-5-OU RI/FS | Reference Measuring Point: GROUND SURFACE

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
0				0-1': Gravel Pad (Fill)	Drilling method: cable tool-drive barrel; 19 3/4" casing.
				1': 10YR 3/4 dark yellowish brown loess w/ SR-R fea gravels 80% basalt 20% qtz/other. Moist.	Pint jar archive samples every 5 ft; change in lithology.
					4-5: large cobble
5	archive			5': Silty gravel (mG). Gravel 50%, sand 20%, silt 30%. Gvl VFP-LC, predom SA-R, 80% basalt 20% qtz/other. Sand VF-VC predom M, 70% qtz/other 30% basalt, SA. Silt 2.5Y 5/3 light olive brown, dry.	
10	archive			10: silty gravel as above; gravel ↓ to max 4 cm, qtz/other ↑ to 60%.	
15	archive			15: Silty sandy gravel (msG): as above, but sand ↑↑, avg as gravel ↑. Sand basalt 8 to 60% predom M. Slightly moist.	16: dry.
20	archive			20: Sand (S): 90% sand, 10% gravel. Gravel same as above but no FP, VFP. Sand 95% basalt 5% qtz/other, well-sorted, C, SA-SR. 2.5Y 3/1 very dark gray.	19: moisture ↑. silt ↑↑ to trace. Sand well-sorted, C. Drilling rate ↑.
25	archive			25: Sand (S) as above; gravel ↓ to 5%; sand qtz/other ↑ to 10%.	25-37: gradual transition to gvl. GS sand slowly ↑, silt ↑ then ↓. By 37, gravel (G).
30	archive			30: Sand (S): 90% sand, 10% gravel as above. Trace silt. Qtz/other increasing, 2.5Y 3/2 very dark grayish brown. Less well-sorted than above - some VFP.	Drilling rate ↓.
35	archive			35: Silty sandy gravel (msG): 50% gravel, 40% sand, 10% silt. Gravel VFP-VCP, SA-SR, 50% basalt 50% qtz/other. Sand VFS-VCS predom C-VC, SA, 40% basalt 60% qtz/other. Silt 2.5Y 4/1 dark gray, v wk rxn HCl, dry.	

Reported By: L. Stratton | Reviewed By: L. D. Walker

Title: Geologist | Title: Geologist

Signature: [signature] Date: 6/17/08 | Signature: [signature] Date: 9/23/08

A-6003-642 (03/03)

BOREHOLE LOG

Page 2 of 8
Date: 6/13/08

Well ID: C5862 | Well Name: 699-52-55B | Location: N of RAIL ROAD, ADJACENT TO C5861.

Project: BP-5-OU RI/FS | Reference Measuring Point: GROUND SURFACE

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size; Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
40	archive			40: Sandy gravel (SG): 80% gravel, 15% sand, 5% silt. Gravel VFP-LC, SA-SR, 80% basalt 20% qtz/other. Cobbles prominently vesicular, oxidized. Sand VF-VC, predom C, A-SA, 70% basalt 30% qtz/other. Silt dry, 2.5Y 4/2 dark grayish brown. 6-27-08	Cable tool-drive barrel 40: hard driving 40-44: gvl ↓, silt ↑
45	archive			45: silty gravel (mG): compact silt/clay forming matrix around gravels (w/limited sand). Gravel VFP-CP, SA-SR predom SR. 40% basalt 60% qtz/other. Sand VF-M, SR. SIH 2.5Y 3/2 dark grayish brown. Moist.	45.5: gvl ↑ to LC. 49: silt ↓ clay ↑. Strong rxn HCl. 48-49: v. moist - wet
50	archive			50: silty gravel (mG): 60% gvl 30% silt 10% sand. Gvl VFP-LC predom MP, SR-R, v. decomposed (break into clay fragments when disturbed from matrix), 40% basalt 60% qtz/other. Sand as gvl predom C-VC. SIH/clay forms tight matrix. No rxn HCl. 10YR 4/3 brown. v. moist.	51.5: v. hard driving 53-54: sand gradually ↑, moisture gradually ↓
55	archive archive			55: silty gravel (mG) 60% gvl 20% silt 20% sand. All same as above, but clay ↓ sand ↑, v. wk rxn HCl. Moisture ↓; gvls less decomposed, larger (avg ↑ to 6-7 cm) 58: gvl ↓↓↓ sand ↑↑ to silty sand/sandy silt (mS/SM). VCC 50%, 40% silt 10% gvl.	57-58: gvl ↑ to 20%, MP-VCP. Matrix loose. V. hard driving. 60: downsize casing to 11¾".
60	archive			60: Sandy gravel (SG): 40% gravel 50% sand 10% silt. Gvl 50% basalt 50% qtz/other, SR-R, VFP-SC. Sand 60% qtz/other 40% basalt, Loose, moist, no rxn HCl. 2.5Y 3/2 very dark grayish brown.	
65	archive			65: silty sandy gravel (mSG): 50% gravel 40% sand 10% silt. Gvl SA-SR, VFP-SC, 80% basalt 20% qtz/other. Sand VF-VC avg F, 60% qtz/other 40% basalt, SA-SR. Silt mostly as layer surrounding larger gvls - possibly from above. 10YR 3/2 v. dark grayish brown, wk rxn HCl, slightly moist.	
70	archive			70: silty sandy gravel (mSG): same as above, 2.5Y 5/2 grayish brown, wk rxn HCl, slightly moist.	
75	archive			75: silty sandy gravel (mSG) as above; no rxn HCl, gravels crushed - predom A. Slightly moist.	77: silt/sand ↓ 78: clay ↑, moisture ↑

Reported By: L. Stratton | Reviewed By: L. D. Walker

Title: Geologist | Title: Geologist

Signature: L. Stratton | Date: 6/27/08 | Signature: L. D. Walker | Date: 9/25/08

A-6003-842 (03/03)

BOREHOLE LOG

Page 3 of 8
Date: 6/27/08

Well ID: C5862 | Well Name: 699-52-55B | Location: N of RR (600 Area) adjacent to C5861

Project: BP-5-OU RI/FS | Reference Measuring Point: Ground Surface

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
80	archive			80: silty sandy gravel (msG) as above; moisture ↑ to v. moist. Silt forms tight matrix around decomposed gravels as at 90'. LC to >15cm diam.	Cable tool – drive barrel. 89: avg gs gvl ↓ to VCP, silt/sand ↓↓ ∴ gravel (G).
85	archive			85: Gravel (G): 80% gravel 15% sand, 5% silt/clay. Gvls VFP to LC, SR-A, 60% qtz/other 40% basalt. Sand 85-VC avg F-M, same lith as gvl. Silt/clay predom as tight matrix surrounding gvls. Overall dry but clays holding moisture against gvls. wk-mod rxn HCl. 2.5Y 4/2 dk grayish brown.	
90	archive			90: Gravel (G): 90% gravel 5% sand 5% silt. Gvl 80% basalt 20% qtz/other A-SR avg A. Silt, sand as above. Gravels VFP-LC, suspect larger.	90: A gvls 50/50% due to drive barrel/angularity pre-existing (?) ~92.5': moisture ↑↑ for 0.5'-v. moist to wet.
95	archive			95: Silty sandy gravel (msG): 60% gravel 90% sand 10% silt. Gravel VFP-LC (suspect larger) avg SC, lith as above. Sand, silt as above.	97: moisture ? to v. moist/wet for ~0.5'. (~90-100', alternating zones of silt/sand matrix around C gravels-fines ↑ than ↓; wet zones intermittent)
100	archive			100: GRAVEL (G): 90% gravel 5% sand 5% silt. All else as above, gravels SR-R. Moist-v. moist.	100: DRILL: 2 boulders >90cm
105	archive			105: GRAVEL (G): 85% gravel 10% sand 5% silt. Gvl lith as above, g.s. ↓. to avg VCP, some VF-FP. Sand 70% qtz/other 30% basalt, VF-VCS avg VC. Silt as isolated "rinds" on gvls, moist-wet (but drier than above). wk-no rxn HCl, 2.5Y 4/2 dark grayish brown.	106-107: gvl g.s. ↓↓ – no LC, few SC. 6-27-08
110	archive			110: GRAVEL (G) as above, g.s. ↑. Some LC-B.	109: basalt boulder
115	archive			115: SILTY SANDY GRAVEL (msG): 80% gvl 15% sand 5% silt. Gvl 90% basalt 10% qtz/other VFP-VCP avg VFP, SA; sand 60% qtz/other 40% basalt, SR, VF-VCS avg VC; silt 2.5Y 6/2 light brownish gray.	

Reported By: L. Stratton		Reviewed By: L.D. Walker	
Title: Geologist		Title: Geologist	
Signature: L. Stratton	Date: 6/27/08	Signature: L.D. Walker	Date: 9/23/09

A-6003-642 (03/03)

BOREHOLE LOG

Page 4 of 8
Date: 7/31/08

Well ID: C5862 | Well Name: 699-52-55B | Location: N of RR (600 Area) adjacent to C5861
Project: BP-5-OU RI/FS | Reference Measuring Point: Ground Surface

Depth (FL)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
119	archive			119: SANDY GRAVEL (SG): 60% gvl 35% sand 5% silt. Gravel VFP-MP, 80% basalt 20% qtz/other, SA. Sand continuous w/ gvl, M-VC avg VC. Silt 2.5Y 4/2 dark grayish brown. Moist, v. wk rxn HCl.	drilling note ↑ (borehole staying open)
120					119: abrupt ↓ gvl g.s. from above.
125	archive			125: SANDY GRAVEL (SG): 70% gvl 25% sand 5% silt. Gvl 90% basalt 10% qtz/other VF-MP (↑MP from 119'). MP SR-R; FP SA. Sand as gravel VF-VC. Silt 2.5Y 3/2 v. dk grayish brown v. wk-Mod rxn HCl. V. moist.	125: Some clay around pebbles as above. 127: silt, VFS ↑↑; dry ∴ Silty Sandy GRAVEL (mx SG). 128: silt ↓ to trace ∴ SANDY GRAVEL (SG). Gvl gs ↓ to avg VFP. Qtz/other ↑ to 20% Dry.
130	archive			130: GRAVELLY SAND (gS): 70% sand 30% gvl. trace silt. All same as above but gvl ↓↓; qtz/other ↑ to 30%	134: wk zone of carbonate cementation.
135	archive			135: SANDY GRAVEL (SG): same as above but avg gs ↑ to FP; qtz/other ↓ to 20%; silt ↑ to 2½%.	
140	archive			140: SANDY GRAVEL (SG): same as above; avg gs ↑ (2MP). Overall only trace silt but intermittent small lenses wkly cemented gravelly silt lenses. 144: SILT (M): compact 6" thick lens; loam 4/3 brown, v. wk rxn HCl, moist, bounded above & below by gravelly sands.	140: drilling note ↓ — zone of (stg cementation?) 141: silt ↑ to >10%, FP ↓
	archive				
145	archive			145: SILTY SANDY GRAVEL (mSG): 40% gvl 50% sand 10% silt. Gvl VFP-MP, A-R avg SR 60% basalt 40% qtz/other (VFP > basalt < qtz/other). Sand as gvl, VF-VC avg C-VC, A-SA. Loose. Dry. 2.5Y 5/2 grayish brown. Mod rxn HCl.	145-150: gradational contact to laminated silt
150	archive			150: SILT (M): laminated silt (95%) w/ VFS (5%). Compact, moist silt forming regular ~1cm thick laminations bounded by VFS. As progresses deeper, laminations become finer. At 150' appear to be indistinct organic casts (twigs/seeds?) preserved as dark stains in VFS. @ 154 significant iron staining clearly following laminations, only in VFS (not silt). @ 158' dark, organic-appearing staining. 7-31-08	
	archive				
155	archive				
158				158: (no recovery; archive @ 160): sharp contact w/ GRAVELLY SAND (gS).	

Reported By: L. Stratton | Reviewed By: L.D. Walker
Title: Geologist | Title: Geologist
Signature: [signature] Date: 7/31/08 | Signature: [signature] Date: 9/23/08

A-6003-642 (03/03)

BOREHOLE LOG

Page 5 of 8

Date: 7/31/08

Well ID: C5862 | Well Name: 699-52-55B | Location: N of RR (600 Area) adjacent to C5861

Project: BP-5-OU RI/FS | Reference Measuring Point: Ground Surface

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
160	archive			160: GRAVELLY SAND (gS): 80% sand 15% gravel 5% silt. Gvl 50/50 basalt/gtz/other, SR, VFP. Sand as gvl, avg C-VC, micaceous, V. loose except for small lenses wk CaCO3 cementation.	161: wk CaCO3 cementation 162: silt ↓ to trace
165	archive			165: GRAVELLY SAND (gS) as above; gtz/other ↑ to 60% in sand, ↓ to 30% in gvl i.e. gvl mostly composed of basalt (VFP, A). Rare MP. Dry.	166: gvl ↓ to 10%. 165-168: alternates btwn clean & silty sand.
170	archive			170: SANDY GRAVEL (sG): 40% gravel 60% sand trace silt. Gvl VFP w/rare MP, A-SA. 90% basalt 10% gtz/other. Sand 50% basalt 50% gtz/other, M-VC avg C; SA. Moist. No rxn HCl. 2.5Y 3/1 v. dark gray.	173.5: water level (6.29.08) 176:
175	archive			175: SANDY GRAVEL (sG): same as above but gvl ↑ sand ↓. 176.5: contact w/ BASALT (Elephant Mountain Member)	~~177~~: 9" rubble 177: Drilling method: AIR ROTARY (9 1/4" down-hole hammer)
180	archive*			180: cuttings 95% basalt 5% gtz/other (VFP - VFS). Basalt A, 2.5Y 4/1 dark gray. Aerosicular, unweathered.	180*: No mason jar archive due to poor cutting recovery
185	NO archive				185: No archive - no cutting recovery
190	archive			190: As above.	186-187: drilled faster than above - fractured/vesicular? (Per driller). Driller also declares water return greater than injected.
195	archive			195: As above, gtz/other ↓	190: appear to be fracture-filling secondary minerals

Reported By: L. Stratton | Reviewed By: L.J. Walker

Title: Geologist | Title: Geologist

Signature: L. Stratton | Date: 7/31/08 | Signature: [illegible] | Date: 9/23/08

A-6003-642 (03/03)

BOREHOLE LOG

Page 6 of 8

Date: 7/31/08

Well ID: C5862 | Well Name: 699-52-55B | Location: S of GABLE MTN, N of 600-AREA RR; adjacent to C5861

Project: BP-5-OU RI/FS | Reference Measuring Point: GROUND SURFACE

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
200				200: 100% basalt cuttings. Aussicular, un-weathered.	Drilling method: air rotary-down-hole hammer. Injecting water to help lift cuttings.
205				205: as above	Archive samples 200, 205, 210, 215, 220, 222, 225, 229, 231, 235.
210				210: as above	
215				215: as above	215: drilling w/out injecting water
220				220: DRY, cuttings slightly moist 221: basalt v. oxidized, appears shattered - brown, vitreous secondary minerals present.	
			SUBNITY MOIST	222: Strongly cemented silt (reacts in air; yields to finger pressure S-loam after pressure), 10YR 6/2 gray. Moist. Vitreous.	~222-223: basalt contact appears to be baked zone - hyaloclastite. 228: strongly cemented.
225	SPLIT SPOON/ GRAB	1+1/10		225: Sandy silt (SM): 90% silt 10% sand. Silt 10YR/3/3 dark brown. Sand 95% qtz/other - v. oxide stained; VF, R. Strongly cemented. Moist. Fragments lithified vitreous material throughout.	225: Drilling method: CABLE TOOL - DRIVE BARREL
	GRAB				
230	WATER GRAB	PUMP	MOIST	229: silt (M): 90% clay 10% silt. 10YR 5/4 yellowish brown. Moist. Some fragmented lithified vitreous chalk as above.	
	GRAB			231: Sharp contact with SILT (M). Bladed, silt-sized grains vitreous tuff (ash?). 5Y 5/1 GRAY. Moist.	233: SATURATED
235	GRAB		SATURATED	239: SILT (M): VITRIC ASH as above but g.s. ↑ to VFS-sized. Saturated. V. tight.	235: DRY
	GRAB				

Reported By: L. Stratton		Reviewed By: L. D. Walker	
Title: Geologist		Title: Geologist	
Signature: [signature]	Date: 7/31/08	Signature: [signature]	Date: 9/25/08

A-6003-642 (03/03)

BOREHOLE LOG

Page 7 of 8
Date: 7/30/08

Well ID: C5862 | Well Name: 699-52-55B | Location: S of Gable Mtn, N of 600 Area, Adjacent to C5861

Project: BP-5-OU R1/FS | Reference Measuring Point: Ground Surface

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
240	grab	SATURATED		239: SILT (M). As 233 ~ bladed, vitreous material appearing to be tuffaceous.	
	grab			242.5 (No recovery 239.5-242.5; contact approx 241(?)) SILTY SAND (mS): 50% sand 50% silt. Sand c, R, vitreous arkosic. Strongly cemented. Dry.	OR ¥66 (242.5)
245	GRAB			244: SILT (M): silt/clay 90%, 10% sand. Vitreous very rich in muscovite, biotite. V. tight. Moist. 2.5Y 6/3 light yellowish brown.	(DRILLING METHOD: cable tool - drive barrel) [Archive samples at: 239, 242.5, 244, 250, 255, 260, 265, 270, 273, 275.
	GRAB/ 5.5.	212/100%			
250	GRAB	MOIST (NOT SATURATED)		250: SILTY SAND (mS): 90% sand 10% clay. Sand arkosic, vitreous. M, SR-R, mica-rich. Moist. V. tight. Clay 2.5Y 5/3 light olive brown w/ irregular stringers of 5YR 8/3 (pink) & white (whiter than classified in Munsell).	
	GRAB				
255	GRAB			255: SILTY SAND (mS) as above. Moist, v. tight.	
	GRAB				258: avg g.s. sand ? to C. clay ↓ to 5Y. LW 12-11-08
260	GRAB/ GROUND	WATER (DUMP)		260: SILTY SAND (mS) as above; 2.5Y 4/1 dark gray. Looser. Moisture ↑ (did not initially appear saturated but pumped 5 gpm sustained)	260.5: ↓ texture to silt/clay (altered ash?) - note @261 not saturated. Casing driving v. hard.
	GRAB	SATURATED			263: avg gs ↑, color ↓ tan to brown, micaceous.
265	GRAB			265: SAND (S): VFS/silt 10YR dark yellowish brown, SA-SR, gtz-rich, micaceous as matrix surrounding 2.5Y 8/4 pale yellow clay - altered ash? (no xtalline structure). Moist. V. compact w/ fragmented welded tuff/vitreous to 2 cm. Vein-like organics present (< mm scale)	264: moisture ↑. Organic matter as veinlets evident.
	GRAB	MOIST			269: moisture ↑, avg grain (no sand) - all appears to be altered welded tuff. 1 cm lens vitrified.
270	GRAB			270: welded tuff (?) - initially v. strongly cemented but after 5-10 min yields to finger pressure. approx 4" to SILT (m) - clay; micaceous, v. tight. Dry.	270-270.5 moisture ↑.
	GRAB	SATURATED		273: SLIGHTLY SILTY SAND: 90% VFS 10% silt/clay. Sand arkosic, SA-R, very rich in muscovite (to 1.5 cm), biotite, phlogopite. 2.5Y 5/4 light olive brown. Saturated. Actual contact uncertain due to difficulty of recovery - could be b/tw 270.5-272.5.	271: appears to be small lens water-bearing, loose sand but possibly a result of drilling activity.
275	GRAB	MOISTURE VARIES		275: As 273 but clay ↑, very oxidized.	
	GRAB/ 5.5.	192/100%		278: to reworked ASH (90%). Still micaceous. Floating organics.	

Reported By: L. Stratton | Reviewed By: L. D. Walker

Title: Geologist | Title: Geologist

Signature: [signature] Date: 7/31/08 | Signature: [signature] Date: 9/23/08

A-6003-842 (03/03)

BOREHOLE LOG

Page 8 of 8
Date: 7/30/08

Well ID: C5862 | Well Name: 699-52-55B | Location: S of Gable Mtn, N of 600 Area Rd, adjacent to C5861

Project: BP-5-OU RI/FS | Reference Measuring Point: GROUND SURFACE

Depth (Ft)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
280	grab	SATURATED		280: As 278, but clay slightly ↑ (as salmon pink stringers). Saturated.	CABLE TOOL - DRIVE BARREL
				280.5: to v. light yrs w/ accessional CS lapilli of	Archive samples @ 280, 282.5,
	grab			A basalt, feldspar, silica). Tuffaceous. Moist. Non mlaceous.	285, 286.5.
				282.5: Cemented vitreous sand/siltstone - tuffaceous -	
285	grab			appearing M sand matrix surrounding vitreous clasts 10 YR	6/3 pale brown. Dry.
				289.5: appear to be very near basalt - 7.5YR 3/2	
				dark brown silt matrix surrounding severely oxidized scoriaceous	
				basalt fragments (mon - ~3 cm)	
				286.5: recovery of scoriaceous basalt clasts to	DRILL
290				~6" size; basalt contact appears to be 'soft' -	286.5: Cable Tool - hard
				very incompetent, appears shattered w/ hyaloclastic texture,	tool.
		TD = 292		secondary minerals (silica?) present; basaltic glass.	

Not used
JS
7/30/08

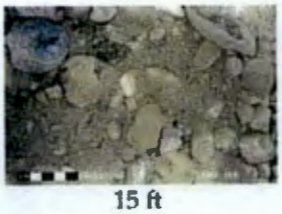
Reported By: L. Stratton		Reviewed By: L. D. Walker	
Title: Geologist		Title: Geologist	
Signature: [signature]	Date: 7/31/08	Signature: [signature]	Date: 9/23/08

A-6003-642 (03/03)

Well C5862 (699-52-55B)

5 ft

10 ft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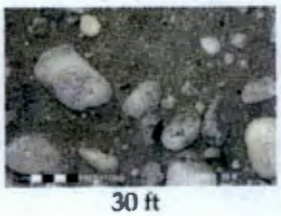
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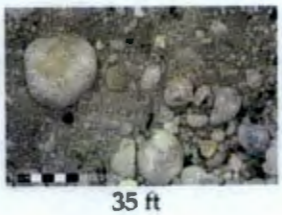
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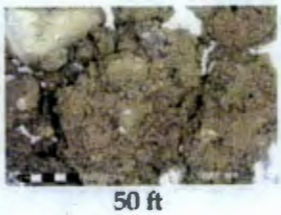
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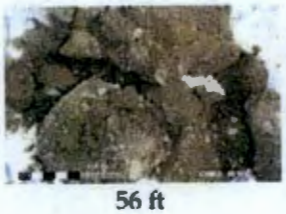
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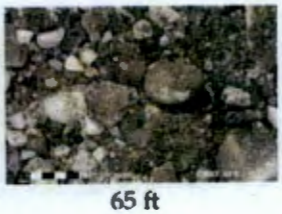
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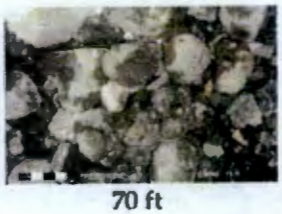
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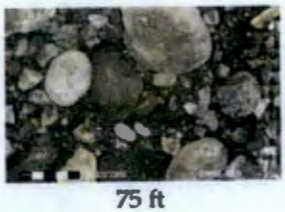
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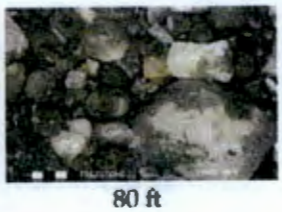
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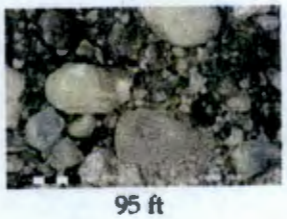
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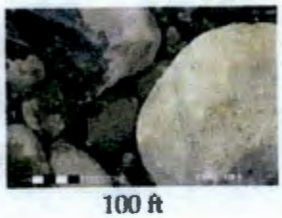
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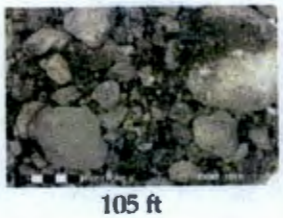
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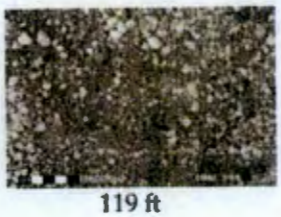
110 ft

Well C5862 (699-52-55B)

115 ft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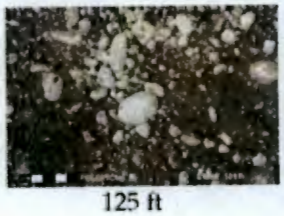
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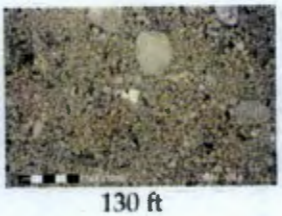
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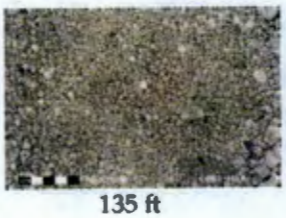
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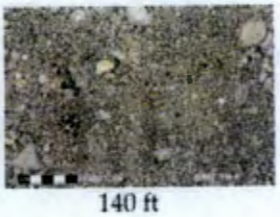
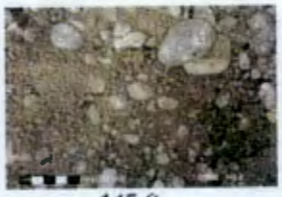

140 ft

144 ft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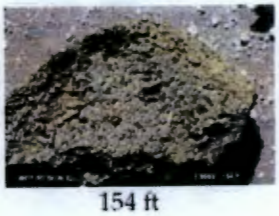
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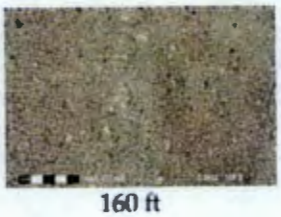
155 ft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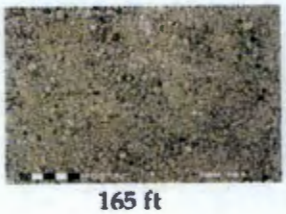
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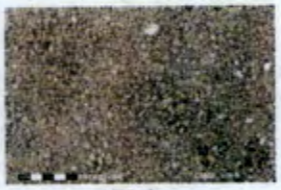
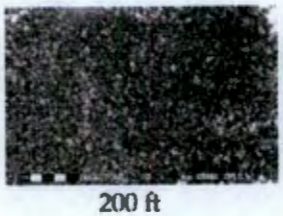

170 ft

175 ft

180 ft

190 ft

195 ft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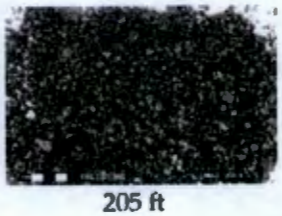

205 ft

210 ft

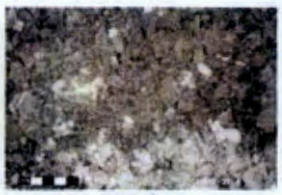
215 ft

220 ft

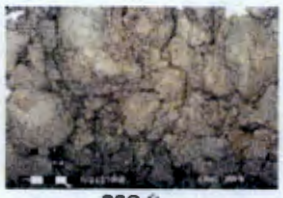
225 ft

Well C5862 (699-52-55B)

229 ft


231 ft

235 ft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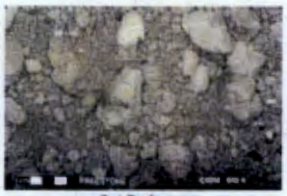
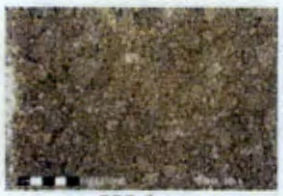
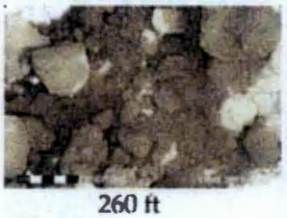

242 ft

244 ft

250 ft

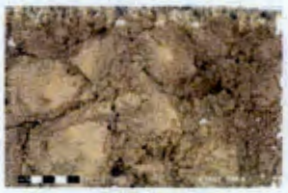

255 ft

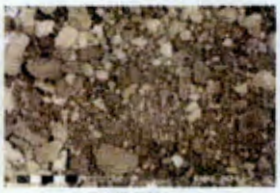

260 ft

265 ft

270 ft

275 ft


280 ft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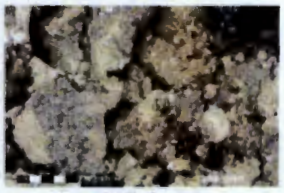
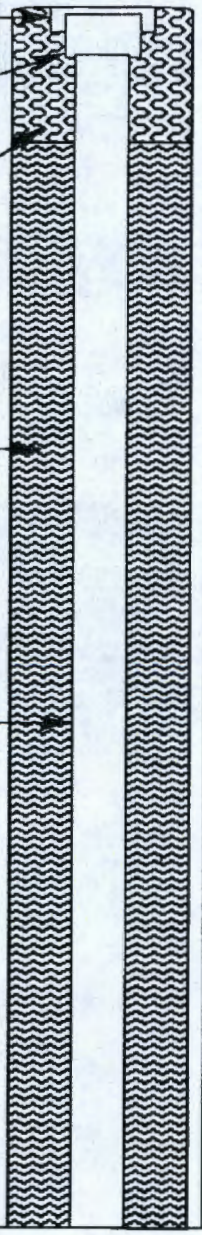

285 ft

WELL SUMMARY SHEET	Start Date: 6/12/08 Finish Date: 8/21/08	Page 1 of 4
Well ID: C5862	Well Name: 699-52-55B	
Location: N of railroad, adjacent to C5861	Project: BP-5-OU RI/FS	
Prepared By: Laurel Stratton — Date: 8/27/08	Reviewed By: L. D. Walker — Date: 9/23/08	
Signature:	Signature:	

CONSTRUCTION DATA

Description	Diagram
14-in Flush Mount Locking Well Head on 12-in Protective Casing: 0 - 1.5 ft bgs 6-in I.D. Type 304/304L Stainless Steel Protective Casing: 0.5 - 2.5 ft bgs Portland Cement Type I/II: 0 - 9.3 ft bgs Granular Bentonite Crumbles: 9.3 - 170.0 ft bgs 4-in I.D. Stainless Steel Type 304/304L, Schedule 10 Permanent Casing: 0.75 - 228.46 ft bgs All depths are in feet below ground surface. Borehole drilled with: 13 1/2" threaded casing: 0 - 60.48 ft bgs 11 3/4" threaded casing: 60.48 - 176.32 ft bgs 8 3/4" threaded casing: 176.32 - 283.5 ft bgs All temporary drill casing was removed from the ground.	

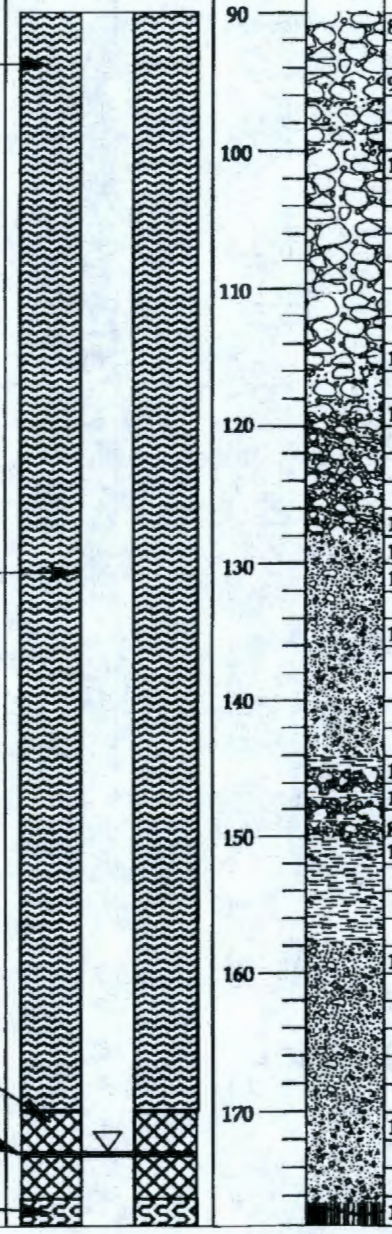
GEOLOGIC/HYDROLOGIC DATA

Depth in Feet	Graphic Log	Lithologic Description/Groundwater Sample Depths (ft bgs)
0		Ground surface - 1: gravel pad (fill)
		1 - 5: loess
		5 - 15: silty gravel (mG)
10		
		15 - 19: silty sandy gravel (msG)
20		19 - 35: sand (S)
30		
		35 - 40: silty sandy gravel (msG)
40		40 - 45: sandy gravel (sG)
		45 - 56: silty gravel (mG)
50		
		56 - 60: silty sand (mS)
60		60 - 65: sandy gravel (sG)
		65 - 83: silty sandy gravel (msG)
70		
80		
		83 - 95: gravel (G)

WELL SUMMARY SHEET	Start Date: 6/12/08 Finish Date: 8/21/08	Page 2 of 4
Well ID: C5862	Well Name: 699-52-55B	
Location: N of railroad, adjacent to C5861	Project: BP-5-OU RI/FS	
Prepared By: Laurel Stratton — Date: 8/27/08	Reviewed By: L. D. Walker — Date: 9/23/08	
Signature:	Signature:	

CONSTRUCTION DATA

Description	Diagram
Granular Bentonite Crumbles: 9.3 - 170.0 ft bgs	
4-in I.D. Stainless Steel Type 304/304L, Schedule 10 Permanent Casing: 0.75 - 228.46 ft bgs	
3/8-in Coated Bentonite Pellets: 170.0 - 176.4 ft bgs	
Static Water Level: 173.6 ft bgs (8/22/08)	
Neat Cement Grout Seal: 176.4 - 215.8 ft bgs	



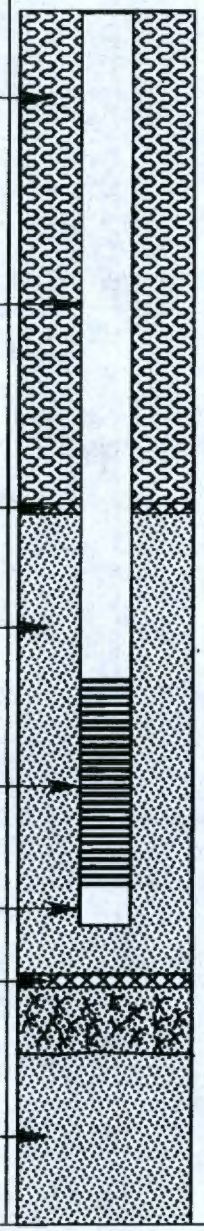
GEOLOGIC/HYDROLOGIC DATA

Depth in Feet	Lithologic Description/Groundwater Sample Depths (ft bgs)
90	83 - 95: gravel (G)
	95 - 100: silty sandy gravel (msG)
100	100 - 115: gravel (G)
110	
	115 - 119: silty sandy gravel (msG)
120	119 - 127: sandy gravel (sG)
	127 - 128: silty sandy gravel (msG)
	128 - 130: sandy gravel (sG)
130	130 - 135: gravelly sand (gS)
	135 - 144: sandy gravel (sG)
140	
	144 - 145: silt (M)
	145 - 150: gradational contact silty sandy gravel (msG) to laminated silt (M)
150	150 - 158: silt (M), laminated with VFS
	158 - 170: gravelly sand (gS)
160	
170	170 - 176.5: sandy gravel (sG)
	176.5 - 222: Elephant Mountain basalt

WELL SUMMARY SHEET	Start Date: 6/12/08 Finish Date: 8/21/08	Page 3 of 4
Well ID: C5862	Well Name: 699-52-55B	
Location: N of railroad, adjacent to C5861	Project: BP-5-OU RI/FS	
Prepared By: Laurel Stratton — Date: 8/27/08	Reviewed By: L. D. Walker — Date: 9/23/08	
Signature:	Signature:	

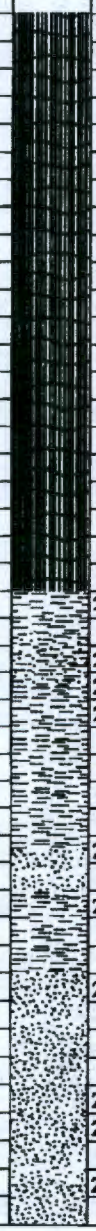
CONSTRUCTION DATA

Description	Diagram
Neat Cement Grout Seal: 176.4 - 215.8 ft bgs	
4-in I.D. Stainless Steel Type 304/304L, Schedule 10 Permanent Casing: 0.75 - 228.46 ft bgs	
3/8-in Coated Bentonite Pellets: 215.8 - 216.8 ft bgs	
20-40 Mesh Colorado Silica Sand (Primary Filter Pack): 216.8 - 250.7 ft bgs	
4-in I.D. Stainless Steel, Type 304, Slot 10 (.010-in) Screen: 228.46 - 243.46 ft bgs	
4-in I.D. Stainless Steel, Type 304 Sump: 243.45 - 246.45 ft bgs	
3/8-in Coated Bentonite Pellets: 250.7 - 255.1 ft bgs	
Backfill Silica Sand: 255.1 - 283.3 ft bgs	



GEOLOGIC/HYDROLOGIC DATA

Depth in Feet	Graphic Log	Lithologic Description/Groundwater Sample Depths (ft bgs)
180		176.5 - 222: Elephant Mountain Basalt
190		
200		
210		
220		222 - 225: silt (M). Strongly cemented.
		225 - 229: sandy silt (sM)
		229 - 231: silt (M). Clay.
230		231 - 241: silt (M). Tuffaceous.
240		241 - 244: silty sand (mS)
		244 - 250: silt (M)
250		250 - 258: silty sand (mS)
		258 - 260.5: sand (S)
260		260.5 - 265: silty sand (mS)
		265 - 270: sand (S)

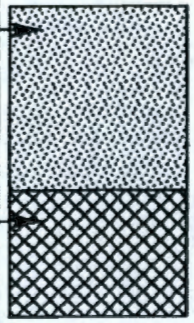


WELL SUMMARY SHEET	Start Date: 6/12/08 Finish Date: 8/21/08	Page 4 of 4
Well ID: C5862	Well Name: 699-52-55B	
Location: N of railroad, adjacent to C5861	Project: BP-5-OU RI/FS	
Prepared By: Laurel Stratton — Date: 8/27/08	Reviewed By: L.D. Walker — Date: 9/23/08	
Signature: L. Stratton	Signature: L.D. Walker	

CONSTRUCTION DATA

Backfill Silica Sand:
255.1 - 283.3 ft bgs

3/8" Coated Bentonite Pellets:
283.3 - 292.0 ft bgs



All depths are in feet below ground surface.

Borehole drilled with:
13 1/2" threaded casing:
0 - 60.48 ft bgs
11 3/4" threaded casing:
60.48 - 176.32 ft bgs
8 3/4" threaded casing:
176.32 - 283.5 ft bgs

All temporary drill casing was removed from the ground.

GEOLOGIC/HYDROLOGIC DATA

Depth in Feet: 270, 280, 290, 300, 310, 320, 340, 350, 360

Graphic Log

Lithologic Description/Groundwater Sample Depths (ft bgs)

270 - 273: silt (M) with welded tuff (?)
273 - 278: slightly silty sand
278 - 280.5: silt (M)
280.5 - 282.5: sand (S)
282.5 - 286.5: Flow-top breccia
286.5 - 292.0: Pomona Basalt Member

Total Depth: 292.0 (8/4/08)

WELL CONSTRUCTION SUMMARY REPORT

Start Date: 6/12/08
Finish Date: ~~6/22/08~~ 8-21-08
Page 1 of 2

Well ID: C5862	Well Name: 699-52-55B	Approximate Location: S of Gable Mtn, N of BE adjacent to C5861
Project: BP-5-OU RI/FS		Other Companies: Firestone Environmental
Drilling Company: Bluestar Enterprises NW		Geologist(s): Laurel Stratton, Steve Airhart
Driller: Justin Egeland / David Smith License #: 2843		

TEMPORARY CASING AND DRILL DEPTH			DRILLING METHOD	HOLE DIAMETER (in.) / INTERVAL (ft)
*Size/Grade/Lbs. Per Ft.	Interval	Shoe O.D./I.D.	Auger:	Diameter 13 1/2" From 0 to 60.48
13 1/2"/12 1/4"	0 - 60.48	13 3/4"/12 1/4"	Cable Tool: X	Diameter 11 3/4" From 60.48 to 176.92
11 3/4"/10 3/4"	60.48 - 176.92	11 3/4"/12"	Air Rotary: X	Diameter 9 3/4" From 176.92 to 285.5
8 5/8"/7 3/4"	176.92 - 285.5	9 3/4"/7 3/4"	A.R. w/Sonic	Diameter 6" From 285.5 to 292.0
	-		See notes	Diameter ___ From ___ to ___
	-			Diameter ___ From ___ to ___
*Indicate Welded (W) - Flush Joint (FJ) Coupled (C) & Thread Design				Diameter ___ From ___ to ___
All temporary casing threaded carbon steel				
			Drilling Fluid: Water	
Total Drilled Depth: 292.0	Hole Dia @ TD: 6"		Total Amt. Of Water Added During Drilling: ~ 545 gallons	
Well Straightness Test Results: PASS			Static Water Level: 173.6	Date: 8/22/08

GEOPHYSICAL LOGGING

Sondes (type)	Interval	Date	Sondes (type)	Interval	Date
Spectral Gamma/	0 - 59	6/16/08		-	
neutron moisture	58 - 137	6/30/08		-	
	135 - 285	8/1/08		-	

COMPLETED WELL

Size/Wt./Material	Depth	Thread	Slot Size	Type	Interval Annular Seal/Filter Pack	Volumes (Yd³)	Mesh Size
4"ID Stainless type 304/304L	0 - 228.46	x		Neat Grout Cement	0 - 7.1	(Yd³)	7
Schedule 10 Permanent Casing	-			~~Arkansas type 3/8~~ Granular Bentonite	7.5 - 130.0	176	
4"ID S.S. type 304/304L Sched 10	228.46 - 248.46	x	10	3/8" coated bentonite pellets	130.0 - 137.2	1	
Screen	-			Neat cement grout	137.2 - 215.0	14	
4" in sump	248.46 - 246.45	x		3/8" coated bentonite pellets	215.8 - 216.8	1	

OTHER ACTIVITIES

~~Aquifer Test:~~	Date:	~~Well Decommission~~	Yes:	No:	Date:
Description:		Description:			

WELL SURVEY DATA (if applicable)

Not surveyed at this time	Protective Casing Elevation:
Washington State Plane Coordinates	Brass Survey Marker Elevation

COMMENTS / REMARKS

Borehole drilled using cable tool rig 0-137, 225-292; air rotary rig 137-225 (through Elephant Mtn Basalt).

Reported By:	Title:	Signature	Date:
L. Stratton	Geologist	[signature]	8/28/08

A-6003-659 (04/03)

WELL CONSTRUCTION SUMMARY REPORT

Start Date: 6/12/08
Finish Date: 8/22/08
Page 2 of 2

Well ID: C5862	Well Name: 699-52-55B	Approximate Location: S of Gable Mtn, N of RR, adjacent to C5861
Project: BP-5-OU RI/FS		Other Companies: Freestone Environmental
Drilling Company: Bluestar Enterprises NW		Geologist(s): Lauren Stratton, Steve Aikhart
Driller: Justin Egeland / David Smith License #: 2843		

TEMPORARY CASING AND DRILL DEPTH			DRILLING METHOD	HOLE DIAMETER (in.) / INTERVAL (ft)
*Size/Grade/Lbs. Per Ft.	Interval	Shoe O.D./I.D.	Auger:	Diameter ____ From ____ to ____
	____ - ____		Cable Tool:	Diameter ____ From ____ to ____
See Page 1	____ - ____		Air Rotary:	Diameter ____ From ____ to ____
	____ - ____		A.R. w/Sonic:	Diameter ____ From ____ to ____
	____ - ____			Diameter ____ From ____ to ____
	____ - ____			Diameter ____ From ____ to ____
*Indicate Welded (W) - Flush Joint (FJ) Coupled (C) & Thread Design				Diameter ____ From ____ to ____
			Drilling Fluid:	
Total Drilled Depth:	Hole Dia @ TD:		Total Amt. Of Water Added During Drilling:	
Well Straightness Test Results:			Static Water Level:	Date:

GEOPHYSICAL LOGGING

Sondes (type)	Interval	Date	Sondes (type)	Interval	Date
	____ - ____			____ - ____	
	____ - ____			____ - ____	
	____ - ____			____ - ____	

COMPLETED WELL

Size/Wt./Material	Depth	Thread	Slot Size	Type	Interval Annular Seal/Filter Pack	Volume	Mesh Size
	____ - ____			CSS 20/40 Sand Pack	216.8 - 250.7	32	20/40
	____ - ____			3/8" coated bentonite pellets	250.7 - 258.0	2 1/4	
	____ - ____			CSS Sand pack 10/20, 40/40/ 20/40	258.0 - 288.5	14	
	____ - ____			3/8" coated bentonite pellets	288.5 - 292.0	2 1/4	
	____ - ____				____ - ____		

OTHER ACTIVITIES

Aquifer Test:	Date:	Well Decommission:	Yes:	No:	Date:
Description:		Description:			

WELL SURVEY DATA (if applicable)

	Protective Casing Elevation:
Washington State Plane Coordinates:	Brass Survey Marker Elevation:

COMMENTS / REMARKS

Reported By:	Title:	Signature:	Date:
L. Stratton	Geologist	[signature]	8/28/08

A-6003-658 (04/03)

WELL SURVEY DATA REPORT

Project:	**Prepared By:** N.P. Fastabend **Company:** FGG
Date Requested: 11/7/08	**Requestor:** C.S. Wright (CHPRC)
Date of Survey: 12/1/08	**Surveyor:** L.A. Henke FGG Survey Dept.
ERC Point of Contact:	**Survey Co. Point of Contact:** N.P. Fastabend (FGG)
Description of Work: Civil Survey of Groundwater Monitoring Well C5862 (699-52-55B).	**Horizontal Datum:** NAD83(91) **Vertical Datum:** NAVD88 **Units:** METERS **Hanford Area Designation:** 600A

Coordinate System: Washington State Plane Coordinates (South Zone)

Horizontal Control Monuments:
GableMtn (FH), 2E-1 (FGG)

Vertical Control Monuments:
J317 (COE), K317 (COE)

Well ID	Well Name	Easting	Northing	Elevation	
C5862	699-52-55B	573102.17	139440.66		Center of Casing
				174.859	Top Manhole Rim, N. Edge stamped "X"
				174.698	Top Outer 6"SS Casing, N. Edge
				174.556	Top Pump Baseplate Inner Casing, N.Edge
				174.854	Brass Survey Marker

Notes:
Unable to Measure Pump Baseplate Thickness

EQUIPMENT USED: TRIMBLE GPS 5800 RTK
TRIMBLE DiNi 12 LEVEL

Surveyor Statement:
I, Larry A. Henke, a Professional Land Surveyor registered in the State of Washington (Registration No. 38975), hereby certify that this report is based on a field survey performed in December, 2008 under my direct supervision, and that the data contained here is true and correct.

LARRY A. HENKE
STATE OF WASHINGTON
Dec 2 2008
38975
REGISTERED
PROFESSIONAL LAND SURVEYOR
EXPIRES Sept. 23, 2009

Original to:
Distribution by DIS:

WELL DEVELOPMENT AND TESTING DATA

Well Name:	Well ID:	Well Location:	Date:
699-52-55B	C5862	S of Gable Mtn, N of RR, adjacent to asphalt	8/20/08

Reference Measuring Point (unless otherwise noted): TOP OF OUTER CASING (TOC)

Has the well been surveyed? ○ Yes ☒ No | Does the well have a cement pad? ○ Yes ☒ No

PART 1

STATIC WATER LEVEL:

Start of Job 170.2' bgs*

End of Job 173.9' bgs

DEPTH TO BOTTOM:

Start of Job 246.45' bgs

End of Job 246.45' bgs

PART 2

WELL DEVELOPMENT DATA

Pump Model 5 hp

Intake Depth 242.1' bgs

Starting Turbidity >1000 NTU

Pump Start	Stop	Flow Rate
0820	1105	~4 gpm
1305	1325	>5 gpm
1330	1720	2-3 gpm

Total Pumped ~960 gallons (see FAR)

Final Turbidity 3.70

XD SN/Range (PSI) 5217 20 psi

PART 3

INSTANTANEOUS SLUG TEST

Static Water Level (TOC)

Transducer Depth 218 bgs

Baseline Start

Injection Start

Baseline Start

Withdrawal Start

Slug Volume

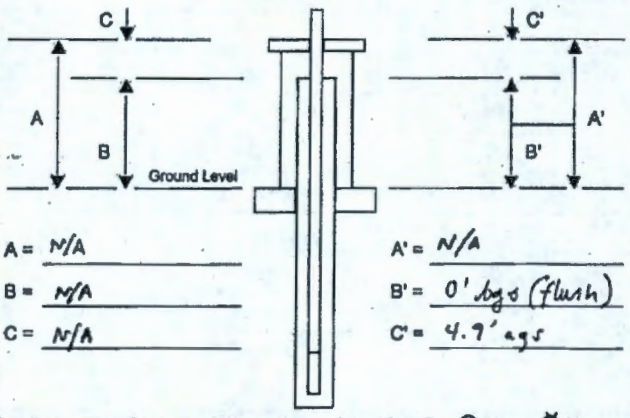
XD SN/Range (PSI)

PART 4

Last Recorded Measurements Date: N/A

Current Measurements Date: 8/20/08

See Note in comments



A = N/A

B = N/A

C = N/A

A' = N/A

B' = 0' bgs (flush)

C' = 4.9' ags

Are there any reference marks on the casing strings? ○ Yes ☒ No

PART 5

COMMENTS:

* Not static ~ elevated by pump. Static ≈173.45' bgs

Note: development computed prior to construction of surface seal or protective casing. All measurements to ground surface.

Prepared by (print name):	Signature:	Date:
L. Stratton	[signature]	8/20/08
Reviewed by (print name):	**Signature:**	**Date:**
L.D. Walker	[signature]	9/23/08

A-6003-644 (03/03)

WELL SURVEY

Sample Depth	Sample Type	HEIS #
225	Grab	B1W156, B1W193 (RS)
224.9-227.4	Split-spoon	B1W180, B1W181, B1W182, B1W157
224.9-227.4	Split-spoon	B1W183, B1W184, B1W185, B1W158
227.4	Grab	B1W159
230.4	Pump	B1W1B1
230.4	Pump	B1W1B2
231	Grab	B1W160
233	Grab	B1W161
235	Grab	B1W162
238	Grab	B1W163
239	Grab	B1W164, B1W194 (RS)
242.5	Grab	B1W165
245	Grab	B1W166
247	Grab	B1W167
247.3 - 249.5	Split-spoon	B1W168, B1W188, B1W187, B1W186
250	Grab	B1W169
257.3	Pump	B1W1B3
252.5	Grab	B1W170
255.5	Grab	B1W171
257.5	Grab	B1W172
260	Grab	B1W173
262.5	Grab	B1W174, B1W195 (RS)
265	Grab	B1W175
267.5	Grab	B1W176
270	Grab	B1W177
273	Grab	B1W178
275	Grab	B1W179
277.5	Grab	B1W197
277.8-280.3	Split-spoon	B1W198, B1W191, B1W190, B1W189
280	Grab	B1W199
282.87	Pump	B1W1B4
282.5	Grab	B1W1B0, B1W196 (RS)
285	Grab	B1WPJ1 (RS), B1WPJ2

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