U.S. DEPARTMENT OF ENERGY

PNNL-19129

Prepared for the U.S. Department of Energy
under Contract DE-AC05-76RL01830

Discrete Sampling Test Plan for the 200-BP-5 Operable Unit

MD Sweeney

February 2010

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Pacific Northwest National Laboratory
Richland, Washington 99352

Abstract

The Discrete Groundwater Sampling Project is conducted by the Pacific Northwest National Laboratory (PNNL) on behalf of CH2M HILL Plateau Remediation Company. The project is focused on delivering groundwater samples from selected horizons within select groundwater wells residing in the 200-BP-5 Operable Unit (200-BP-5 OU) on the Hanford Site. This document provides the scope, schedule, methodology, and other details of the PNNL discrete sampling effort.

Contents

Figures

Tables

1.0 Introduction

The Discrete Groundwater Sampling Project conducted by the Pacific Northwest National Laboratory (PNNL) on behalf of CH2M HILL Plateau Remediation Company (CHPRC) is focused on delivering groundwater samples from selected horizons within select groundwater wells residing in the 200-BP-5 Groundwater Operable Unit (200-BP-5 OU). The data obtained from these samples are expected to provide information for the Remedial Investigation/Feasibility Study (RI/FS) Work Plan (DOE/RL-2007-18 Rev 1.0) for the 200-BP-5 OU.

PNNL has adapted the Spyder sampler to obtain groundwater samples from discrete horizons within groundwater monitoring wells with the intent of capturing vertical contamination profiles within surrounding hydrologic units. The ability of the system to deliver samples from depth with low-flow and minimal disruption to the groundwater flow regime was tested in several deployments, including the SX tank farm in 1999 (Johnson and Chou 2001).

2.0 Spyder Sampler Description

The PNNL-developed Spyder sampling accessory is added to a pump intake to increase the percentage and volume of water obtained from the formation and filter pack while diminishing the vertical and well-bore contribution to the sample. It is a valuable tool if stagnant water is in portions of the well and if flow is predominantly horizontal through the well. In addition, the volumetric flux (the volume of water moving through the well per unit of time for a specific thickness) is used to determine the allowable extraction rate. Large vertical components may limit or preclude its effectiveness.

The Spyder device consists of a head with flexible tubing extending from the central collector (Figure 1). Angled cuts on the tube ends allow a seal against the well screen when the unit is lowered into place. The hydrodynamic shape minimizes disturbance to the well water and associated primary flow zones and patterns. Water enters primarily from the filter pack and the formation.

The Spyder sampler is coupled to a bladder pump for low-flow (20 to 30 mL/min) sampling. The inlet device consists of a radial array of 12 flexible, small-bore (1/16-in.) silicone tubes attached to the inlet port of a bladder pump with a centralizer. The silicone tubes make contact with the interior wall of the well screen. Nominally 1 L of water is removed to flush the sample line prior to sample collection. The low pumping rate and inlet configuration are designed to minimize vertical disturbance of the aquifer during sample withdrawal so that a discrete depth sample is obtained. The bladder pump allows larger sample volumes to be obtained if required for certain analytical procedures. A minimum water level of 18 in. is required to fully cover the bladder pump before water can be driven from depth to the surface.

The weight of the water column deeper than 285 ft below ground surface (bgs) is greater than the pressure limits of pump controller and bladder pump (125 psi for the currently deployed system). A modified Spyder sampling arrangement (Figure 2) for achieving depths in excess of 285 ft bgs requires the use of chlorinated polyvinyl chloride (CPVC) pipe extensions up to 25 in. in length mounted on the intake end of the bladder pump. The drop tube method has been used to achieve groundwater depths in excess of 500 ft bgs.

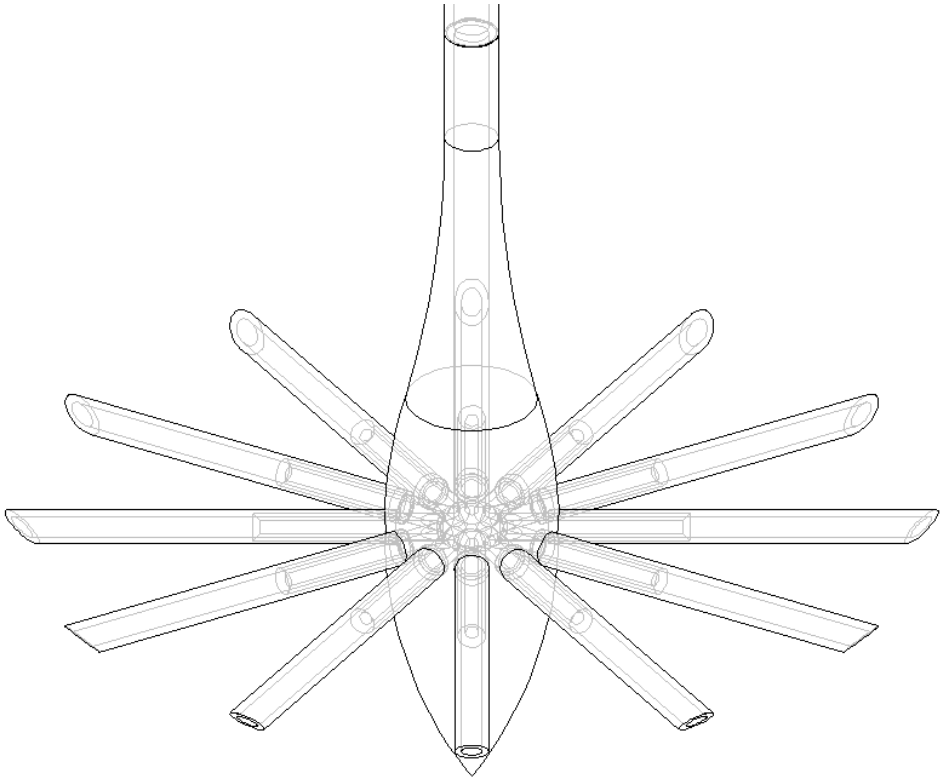

Figure 1. Sampling Head with Silicone Tubing Extending Outward Radially from Central Siphon

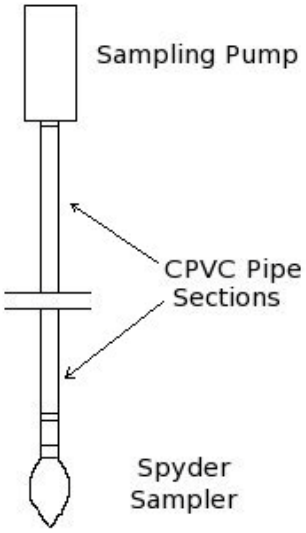

Figure 2. Modified Spyder Sampler with Drop Tube Assembly

3.0 Well Sampling

The Spyder sampler will be used to sample discrete horizons within 14 active groundwater monitoring wells in the 200-BP-5 groundwater OU. Table 1 lists the wells to be sampled for this project, as well as the analytes and horizons selected for each well. The schedule for sampling each well is provided in Figure 2. The schedule provided is tentative due to cold-weather considerations.

3.1 Well and Constitutent List

Most of the wells to be sampled are located on the Central Plateau of the Hanford Site; two wells are located in the channel between Gable Mountain and the Central Plateau (Figure 3). All wells reside within the 200-BP-5 OU. The constituents are based on regularly observed elevated radionuclide and nitrate concentrations within these wells. Groundwater field parameters are also part of this list and include pH, specific conductance, temperature, and turbidity. The volume of groundwater required for each analyte is included in Table 2.

3.2 Schedule

The schedule provided in Figure 4 indicates how PNNL staff plan to sample all of the horizons listed in Table 1 in the allotted time. The schedule displayed contains no regard for problems in sampling due to cold weather. The tubing used to deliver the samples from depth to the ground surface and ultimately into the prepared sample container is narrow enough that temperatures below 0°C could hinder sampling for either the early morning hours or perhaps for an entire day. Rescheduling sampling will be coordinated between the CHPRC technical point of contact and the PNNL manager for the Discrete Groundwater Sampling Project, or their respective delegates.

3.3 Sampling

The influence of the type of extraction method, the point of extraction relative to preferential flow zone(s), the rate of extraction, the volume extracted, and the point of discharge (i.e., sampling collection point) are key to knowing where the water came from and what it actually represents relative to the open interval. Once the flow conditions within the well are known, the concentration distribution in the well can be evaluated through discrete interval sampling and, where necessary, time–series sampling. Conventional groundwater sample collection from monitoring wells usually requires two steps or cycles. The first is purging, followed by the second step—sampling.

Well purging is the removal of a desired amount of groundwater before samples are collected for laboratory analysis. The purpose of purging is to ensure that the water samples obtained are representative of the chemical concentrations in the surrounding aquifer. The importance and necessity for well purging to obtain representative samples or measurements is based on the assumption that water quality in the screened interval of the monitoring well– is not representative of that in the immediate surrounding formation.

Table 1. Depth-Discrete Sample Locations, Intervals, and Constituent Requirements

Well Name	Constituents[(a)]	Groundwater Depth (ft bgs)	Screen Interval (ft bgs)	Sediment Description (ft bgs)	Discrete Sample Interval (ft bgs)	Discrete Sample Interval (m bgs)
699-50-56	T, N, CN, H-3	152.1	151.2–161.2	151.5–155 gravelly silty sand	153	46.6
				155–160 sandy gravel	158	48.2
				160–161 silty sandy gravel	161	49.1
				161 basalt		
699-53-55C	T, N, CN, H-3, S	179.1	199.6–220.5	190–205 sand, silt, and gravel	199.6	60.8
				205–210 silt, sand, and gravel	209	63.7
				210–213 coarse sand and gravel	212	64.6
				213–215 fine silt	214	65.2
				215–220.5 large gravel, cobble to 5 in.	220	67.1
299–E33–342	U, T, N, CN, H–3, S	235.8	232.6–242.6	230–236 sandy gravel		
				236–240 gravelly silty sand	236.5	72.1
				236–240 gravelly silty sand	239.5	73.0
				240–242.4 silty sandy gravel	242.4	73.9
299–E33–343	U, T, N, CN, H–3, S	252.14	249.9–259.9	241–256 gravelly sand	253	77.1
				241–256 gravelly sand	255.5	77.9
				256–260.9 silty sandy gravel	257.5	78.5
				256–260.9 silty sandy gravel	260.7	79.5
				260.9 basalt		
299–E33–345	U, T, N, CN, H–3, S	253.38	249.7–259.7	250–255 gravelly silty sand	254	77.4
				255–260 sandy gravel	256	78.0
				260–260.3 gravel	260.1	79.3
				260.3 basalt		
299–E33–339	T, N, H–3	263.4	259.4–279.3	260–275 sandy gravel	265	80.8
				260–275 sandy gravel	270	82.3
				260–275 sandy gravel	275	83.8
				275–279 silty gravel	278.5	84.9

Well Name	Constituents[a]	Groundwater Depth (ft bgs)	Screen Interval (ft bgs)	Sediment Description (ft bgs)	Discrete Sample Interval (ft bgs)	Discrete Sample Interval (m bgs)
				279 basalt		
299–E33–49	T, N, H–3	266.5	263.5–283.5	223–270 silty sandy gravel	265	80.8
				270–283.5 sandy gravel	270	82.3
				270–83.5 sandy gravel	276.5	84.3
				270–283.5 sandy gravel	283.2	86.3
				283.5 basalt		
299–E33–39	T, N, CN, H–3, S	223.8	208–229.2	190–229.0 silty sandy gravel	224.5	68.4
				229.0–229.5 sand	229.25	69.9
				229.5 basalt		
299–E33–31	U, T, N, CN, H–3, S, Cl	247.5	235–255	220–255.6 sandy gravel	250.5	76.4
				220–255.6 sandy gravel	255.5	77.9
				255.6 basalt		
299–E27–23	T, N, H–3, S	274.6	273.5–308.5	260–318 sandy gravel	276	84.1
				260–318 sandy gravel	287	87.5
				260–318 sandy gravel	297.5	90.7
				260–318 sandy gravel	308	93.9
299–E27–4	T, N, H–3, S	272.3	270.3–305.3	255–272 gravel		
				272–311 sandy gravel	287	87.5
				272–311 sandy gravel	297.5	90.7
				272–311 sandy gravel	308	93.9
299–E27–7	T, N, H–3, S, Cl	237	241– 281	235–250 fine sand and gravel	242.5	73.9
				235–250 fine sand and gravel	249.5	76.0
				250–260 gravel, fine sand Ringold FM	255	77.7
				260–275 fine sand, gravel Ringold FM	265	80.8
				250–260 gravel, fine sand Ringold FM	275	83.8
				275–280 Ringold FM		
299–E27–21	T, N, H–3, S, Cl	273	271.4–306.4	275–285 gravelly sand	275	83.8
				275–285 gravelly sand	285	86.9
				285–318 sandy gravel	295	89.9
				285–318 sandy gravel	305	93.0
299–E27–10	T, N, S, Cl	225	212.1–232.4	220–230 silty sandy gravel	227	69.2
				230–233 sand	232.2	70.8

Well Name	Constituents[a]	Groundwater Depth (ft bgs)	Screen Interval (ft bgs)	Sediment Description (ft bgs)	Discrete Sample Interval (ft bgs)	Discrete Sample Interval (m bgs)
				233–240 sandy gravel 240 basalt		
				Total No. Samples		**48**
				Total No. Wells		**14**

(a) Equipment blank highlighted in cyan; duplicate sample highlighted in yellow.
U = uranium, CN = cyanide, N = nitrate, S = sulfate, H–3 = tritium, T = technetium–99, Cl = chloride.

Table 2. Constituent List with Sample Volumes

Analyte	Sample Volume	Preservation
Technetium–99	300 mL	HCl to pH <2
Nitrate	125 mL[a]	Cool ~4°C
Cyanide	250 mL.	Cool ~4°C
Uranium	300 mL	HNO_3 to pH <2
Tritium	500 mL	None
Sulfate	125 mL[a]	Cool ~4°C
Chloride	125 mL[a]	Cool ~4°C

(a) Nitrate, chloride, and sulfate all can be sampled from the same IC bottle – 125mL.

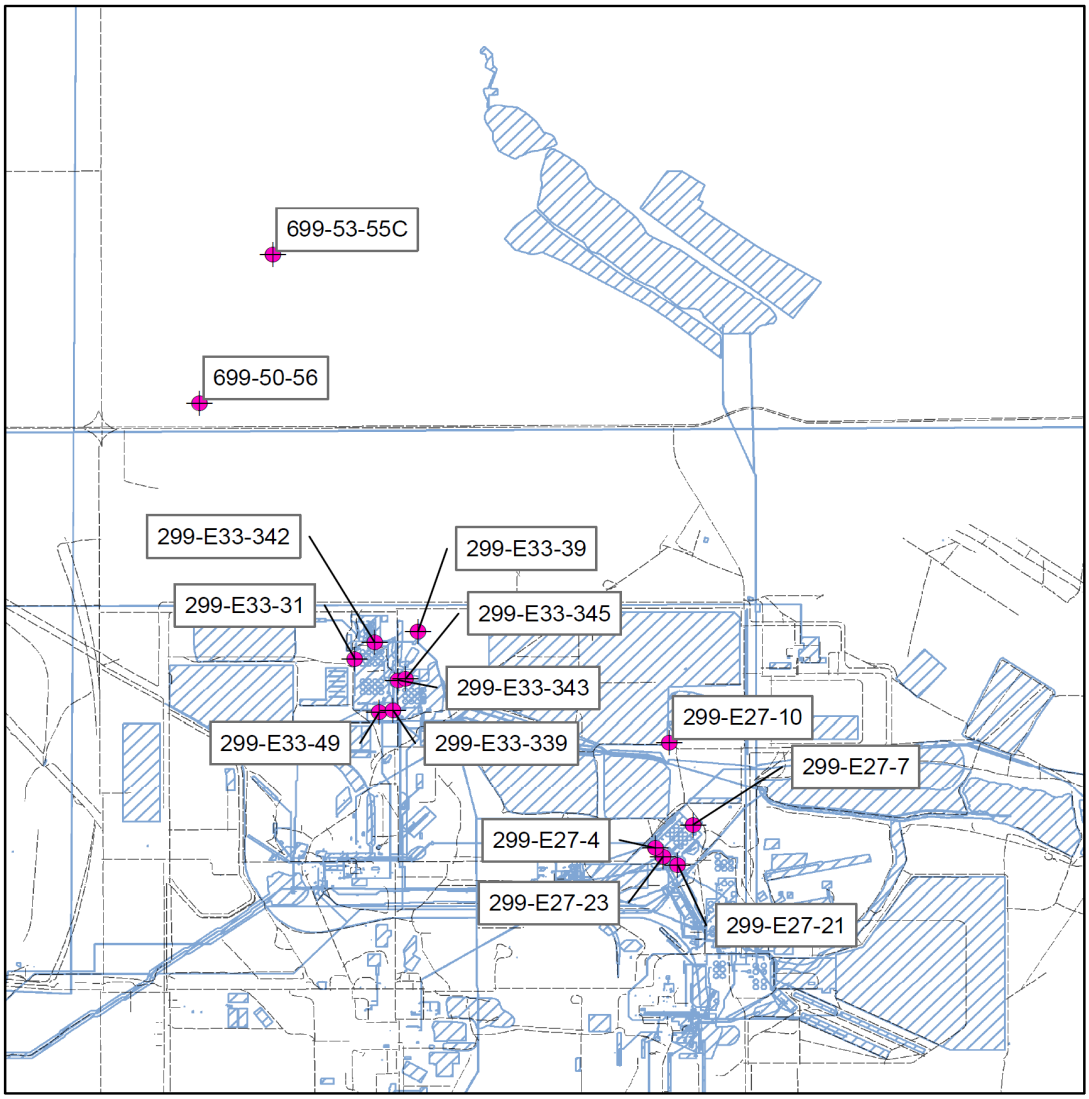

Figure 3. Well Location Map

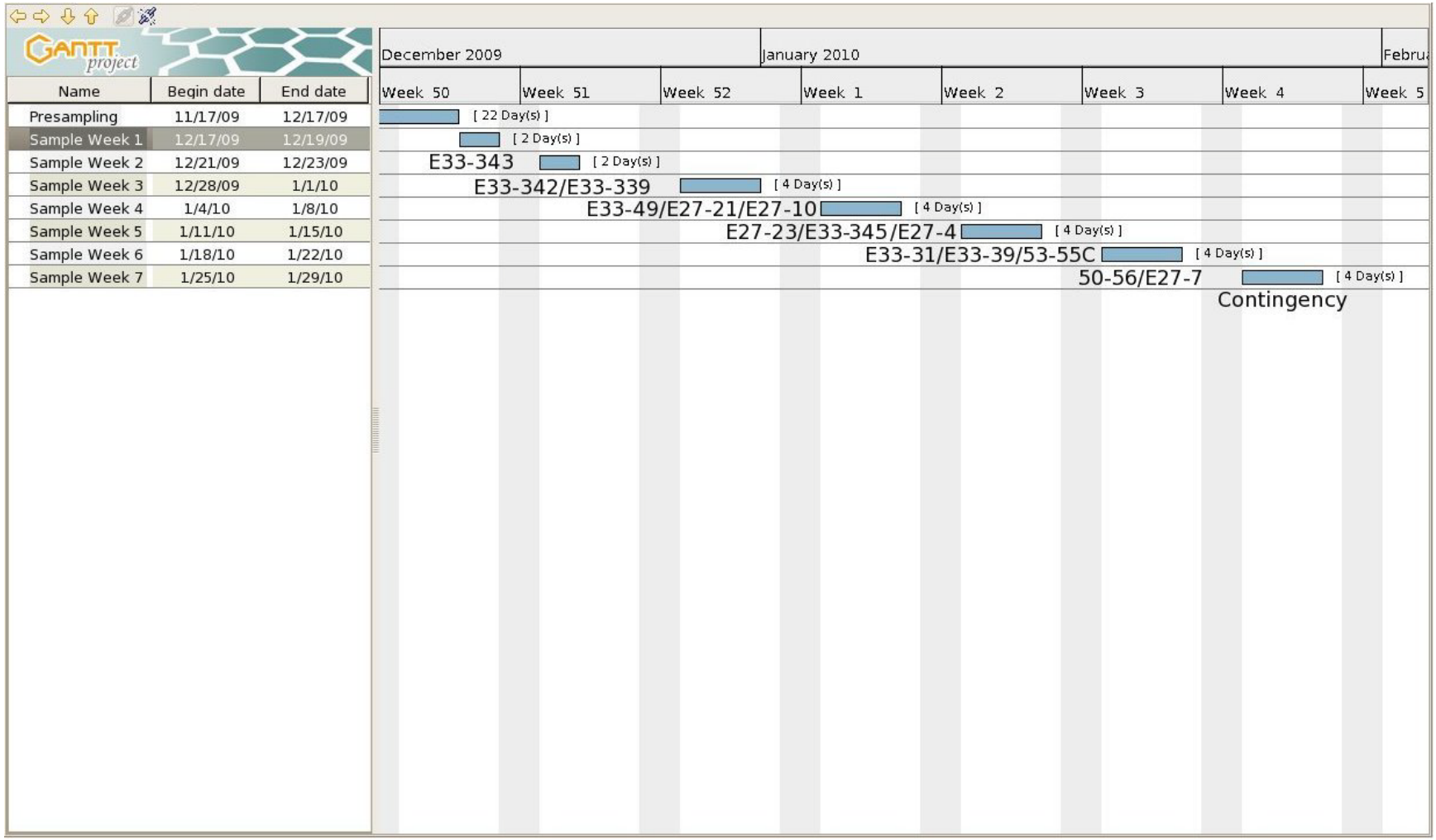

Figure 4. Sampling Schedule

After the Spyder device is connected to the sampling port of the bladder pump as described in Section 2, the pump assemblage is lowered into the open borehole to the required depth in the aquifer (see Figure 5). Prior to the actual pumping event, sufficient time will be allowed to let disturbances in flow due to insertion into the water column to dissipate. The pump will be operated at flows lower than 300 mL/min, which will slowly raise the water column in the pump tubing to the surface.

Figure 5. Spyder Sampler Attached to the Bottom of a QED 1250 Bladder Pump

The groundwater analytes to be sampled are outlined in Table 1, Section 3.1. Bottles will have been prepared (labeled and recorded in the chain–of–custody record for each well) for each well prior to sampling. The Spyder sampler pump will be started by slowly adding pressure through the hose assembly to the downhole pump from the compressed gas cylinder at the ground surface above. As the first groundwater arrives, it will be captured in a purge water container for later waste management (Section 4). As the water continues to flow, sampling technicians will obtain groundwater parameter readings to determine when to begin filling the sample containers. Guidance for sampling criteria is given in Appendix A.

As the sample bottles are filled, they will be placed in a storage container for transportation to the assigned laboratory. After the final sample bottle for the scheduled well is filled, the sample inventory will be compared to the data in Table 1 to ensure completeness, after which the samples will be shipped to the laboratory for analysis. Samples will be transported, stored, and delivered to the assigned laboratory per CHPRC procedures GRP–FS–04–G–012, “Sample Packaging and Shipping”; GRP–FS–04–G–016,

"Chain of Custody/Sample Analysis Request"; GRP–FS–04–G–020, "Sample Storage Units"; and applicable HASQARD requirements.

Decontamination of the sample tubing will be completed after the last sample bottle is filled. Two PNNL staff members will decontaminate the riser tubing using rinse water brought from PNNL to the well each day of sampling. The sampler head and silicone tubing also will be decontaminated using the same water source. The water will be collected according to recommendations from CHPRC waste management staff. All purge and decontamination water will be released to CHPRC staff at the end of the sampling shift.

4.0 Waste Management

A CHPRC waste management coordinator has been assigned to aid in container selection and waste in the waste retention strategy. Cleaning sampling tubing that is in excess of 60 m will generate approximately 1.5 L of rinsate per well. The entire sampling process will generate approximately 10–15 L of purgewater and rinsate per well. The decontamination process will also generate waste–protective glove wear and a minimum number of disposable towels.

5.0 Quality Sampling

5.1 Equipment Blanks

Equipment blanks will be gathered at the beginning of the first well and before sampling at specific wells highlighted in Table 1 (see footnotes).

5.2 Duplicate Samples

Three duplicate samples will be gathered to provide a basis for evaluating sampling and analysis conditions. The timing is highlighted in Table 1 (see footnotes).

6.0 Reference

Johnson VG and CJ Chou. 2001. *RCRA Groundwater Quality Assessment Report for Waste Management Area S–SX (November 1997 through April 2000)*. PNNL–13441, Pacific Northwest National Laboratory, Richland, Washington.

Appendix A

Soil and Groundwater Remediation Project Operating Procedure GRP–FS–04–G–004: Operational Monitoring Groundwater Sampling

Soil and Groundwater Remediation Project

Operating Procedure

GRP-FS-04-G-004

Operational Monitoring Groundwater Sampling

Revision: 1
Change: D

Approval Designator: **I, Q, R, W**

Instruction Use Level: Reference

Approvals on file.

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Release Date: 07/01/2009

Table of Contents

1.0 PURPOSE AND SCOPE

1.1 Purpose

This procedure provides general requirements and guidance for performing groundwater sampling by Groundwater Operations (GWO) groundwater monitoring personnel.

1.2 Scope

This procedure is limited to technical sampling activities in which groundwater samples are collected for field or laboratory analyses.

2.0 PRECAUTIONS AND LIMITATIONS

2.1 All personnel will be familiar with and comply with site-specific safety requirements for access control.

2.2 If abnormal conditions are encountered call the Field Work Supervisor (FWS).

2.3 Do not sample downwind from sources of volatile organics (e.g., car or generator exhausts, open fuel tanks), these could potentially contaminate the sample. If such sources are unavoidable, record them in the logbook and Groundwater Sampling Report (GSR), site form A-6003-667.

2.4 Avoid direct contact with groundwater except with gloved hands (i.e., surgeons or similar type gloves).

3.0 SPECIAL TOOLS, EQUIPMENT, AND MATERIALS

Using skill-of-the-craft and training, stock the sample vehicle with tools and equipment required to perform this procedure, including but not limited to the following:

3.1 Decontaminated sampling manifolds (1 per well)

3.2 Disposable 0.45 µm filters

3.3 Peristaltic pump

3.4 Air compressor and generator

3.5 Hydro Star pneumatic cylinder

3.6 Required Instruments

3.7 E-tape (water level measurement device)

3.8 High purity water

3.9 Field logbook

3.10 Groundwater Sampling Report (GSR), site form A-6003-667

3.11 Appropriate PPE

4.0 PREREQUISITES

4.1 Personnel using this procedure must be certified or under the direct supervision of a certified person to perform this procedure.

4.2 Sampling equipment shall be cleaned prior to use, in accordance with GRP-FS-04-G-013, Laboratory Cleaning of Sampling Equipment.

4.3 Sample containers used for chemical analysis shall be drawn from controlled storage area to ensure certified clean prior to use.

4.4 Review AJHA.

4.5 Review applicable MSDS.

4.6 Before initiating any field sampling activities, meet with all field sampling personnel and review all safety precautions and radiation, health, safety monitoring requirements, and QA/QC requirements (i.e. Trip Blank, FXR).

4.7 Review the most current "S&GRP Well Waste Spreadsheet" as provided by the FWS to locate the well number(s) identified to be sampled in an operable unit prior to sampling.

4.8 Review the Groundwater Sample Report; GRP-FS-04-G-016, Chain of Custody/Sample Analysis Request; and other potential information such as notes, special directions, or point-of-contacts.

4.9 Check out instruments from storage (i.e., pH, conductivity, etc.) in accordance with GRP-FS-04-G-005, Control of Monitoring Instruments.

5.0 INSTRUCTIONS

5.1 Preparation for Field Sampling

5.1.1 Field Work Supervisor:

a. REVIEW sampling documents (e.g. COCs, sample labels, SAF, sampling matrix, Groundwater Sampling Report (GSR)) and any other project information that will provide direction for or assistance with meeting project requirements.

b. ASSIGN sampling paperwork and sampling task preparation to sampling personnel.

c. SCHEDULE sampling personnel to support the sampling event(s).

5.1.2 Nuclear Chemical Operator:

- REVIEW sampling documents including COCs, GSR, and sample labels for sampling event(s).
- ENSURE that appropriate sample containers are prepared and staged for sampling to be performed.
- IF there is a conflict between any sampling documents regarding container type or size,
  THEN CONTACT the FWS.
- STAGE AND ASSEMBLE equipment required for sampling and field data collection (label bottles, preservatives, coolers, ice, etc.).
- READ AND BECOME FAMILIAR with applicable project specific safety documents (i.e. HASP, AJHA, JSA, etc.).
- CONTACT appropriate person in charge of sample site (i.e. BTR, Facility Manager, FWS, PIC).
- INITIATE field logbook/Data Forms entry including: day, date and time task started, weather conditions and names and titles and organizations of personnel performing the task.
- ENSURE initial performance checks of field instruments are complete and recorded in field logbook.

Note

If possible, park adjacent to the well at a right angle to the wind with rear of van facing the well head.

5.2 Sampling Activities

- PARK vehicle near well for safe operation of sampling equipment.
- ESTABLISH a control area around well.
  - MONITOR and CONTROL area around wells as necessary to protect personnel from injury and prevent damage to equipment.
  - Verbally COMMUNICATE or physically ESTABLISH control area using caution tape or equally effective means.
- VERIFY that the documentation (i.e. GSR) matches the well name.
- DETERMINE appropriate sampling method.
- DON appropriate PPE per task, as needed.
- RECORD instrument pre-check for pH and conductivity on the GSR.
- RECORD lot numbers of sample containers on GSR and/or in field logbook.
- MEASURE depth to water from the designated measurement point,
  AND RECORD measurement, to nearest 1 mm, on GSR and/or field logbook, and Groundwater Measurement form.
- CHECK for a sheen or oil product while cleaning tape.
- IF sheen or oil product is present,
  THEN RECORD information on GSR or in field logbook.

5.2.1 INITIATE sampling method and set-up using applicable attachment.

Note

Purge volumes are usually based on pumping 3 borehole volumes of water from the well. The customer may direct a specific purge volume.

5.2.2 CALCULATE purge time (if not provided by customer) as follows:

a. DETERMINE the flow rate.

b. DIVIDE purge volume given for that well by flow rate.

5.2.3 RECORD purge time (in minutes) on GSR and/or in field logbook.

5.2.4 IF the well pumps dry,
THEN TURN off the pump,
AND PERFORM the following:

a. TRACK recharge rate for 15 minutes.

b. IF well does not recharge,
THEN contact FWS.

c. IF well has recharged,
THEN TURN pump back on,
AND fill sample containers.

d. IF the well pumps dry during collection of samples,
THEN REPEAT Steps a. through c.

5.3 Field Readings

Note

- The readings shall stabilize prior to sampling and shall be considered "stable" when the following are met:
  - pH - two consecutive measurements agree within 0.2 pH units
  - Temperature - two consecutive measurements agree within 0.2°C
  - Conductivity - two consecutive measurements agree within 10% of each other
  - Turbidity - less than 5 NTUs prior to sampling (or project scientist's recommendation).
- Dissolved oxygen and oxygen reduction potential are not indicator parameters and are not required to be stable prior to sample collection.

5.3.1 OBTAIN field readings at least three times (start, middle, and end of designated purge time),
AND RECORD readings on GSR.

Note

If a well is not purged, one set of field readings is sufficient unless directed otherwise on the GSR or by the FWS.

5.3.2 Before filling sample bottles, ENSURE purge requirements and required field readings have been met per GSR, Purge Flow Diagram (Attachment 9), or Project Scientist instruction.

5.3.3 FILL sample containers in the following order unless otherwise specified in the sampling plan:

a. Unfiltered volatile organics (VOAs)
b. Unfiltered total organic halogens (TOX)
c. Unfiltered total organic carbon (TOC)
d. Unfiltered semi-volatile organics (Semi-VOAs)
e. Other unfiltered glass containers (i.e., other organics)
f. Other unfiltered samples
g. Filtered samples (in the same order as items a. through f.)

5.3.4 IF sampling order is different from that specified above,
THEN RECORD sampling order and justification for order in field logbook and on GSR.

5.3.5 After filling last sample container,
MEASURE pH, temperature, specific conductivity, and other requested field measurements,
AND RECORD on GSR.

Note

When removing portable pumps, if necessary request assistance.

5.3.6 CONCLUDE sampling activity,
AND SECURE equipment.

5.3.7 ENSURE the following:

- Evidence tape has been signed, dated, and attached to container lid.
- Each sample label has been completely filled out by sampler.
- Bottles collected match what is listed on COC.
- Preservation requirements are met.

Note

Rinse water is to be handled as discarded water (i.e., purgewater).

5.3.8 RINSE sampling equipment coming in contact with groundwater being placed in sample containers or entering well (e.g., E-tapes, instrument probes, etc.) with high-purity water after sampling is completed.

5.3.9 ENSURE well cap has been replaced and locked,
AND ENSURE flush mounted wells are bolted down.

5.3.10 IF a well cannot be secured,
THEN immediately NOTIFY FWS.

5.3.11 CONDUCT post-performance checks of pH and conductivity,
AND RECORD on GSR.

5.3.12 REMOVE AND DISCARD PPE and well waste into waste container when sampling is complete.

5.4 Post Sampling Activities

5.4.1 ENSURE completion of COC/SAR, GSR and field logbook; field logbook to include:

- Details of equipment failures
- Breakdowns or unusual occurrences related to the sampling activity
- The sampler signature and date at the bottom of each page

5.4.2 REQUEST independent review of COC forms, sample labels, GSR, and logbook after completion (one over one check).

5.4.3 PLACE samples in a secure location during transportation.

5.4.4 IF sampling additional well,
THEN RETURN to Step 5.2,
OTHERWISE CONTINUE to Step 5.4.5.

5.4.5 ENSURE samples are packaged in accordance with GRP-FS-04-G-012, *Operational Monitoring Sample Packaging and Shipping*.

5.4.6 DELIVER sample to shipping personnel or appropriate laboratory for analysis as soon as possible.

5.4.7 IF sample(s) cannot be delivered the same day (due to time constraints or radiological laboratory screening,
THEN store samples according to GRP-FS-04-G-020, *Sample Storage Units*
AND contact FWS.

5.4.8 IF a portable Grundfos pump was used,
THEN perform the following two substeps prior to returning pump to be cleaned:

a. FLUSH with potable water for 5 min with control-box set at approximately 200 Hz to obtain triple-rinse.

b. DISPOSE of water into purge truck.

5.5 Waste Management

5.5.1 REFERENCE the "Well Waste Spreadsheet", MATCH the well name with the Operable Unit (OU) collection point,
THEN deposit the waste at that OU collection point.

5.5.2 PRINT clearly and legibly when labeling waste.

5.5.3 LABEL/MARK the sample waste at a minimum with: well number, operable unit, date and operator's name.

5.5.4 IF the Well/Seep Name is not listed on the Well Waste Spreadsheet,
THEN DEPOSIT waste at the RCRA Accumulation Area.

6.0 RECORDS

Document	Destination	Disposition
Field Logbooks	S&GRP Operations secretary in charge of records	Send to RHA as volume warrants
Chain of Custody forms	S&GRP Operations secretary in charge of records	Deliver to Sample and Data Management
Groundwater Sample Record (A-6003-667)	S&GRP Operations secretary in charge of records	Deliver to Sample and Data Management
Water Level Measurement Form	S&GRP Operations secretary in charge of records	Deliver to Sample and Data Management

7.0 BIBLIOGRAPHY

7.1 DOE/RL-96-68, HASQARD, *Hanford Analytical Services Quality Assurance Requirements Documents*

7.2 GRP-FS-04-G-005, *Control of Monitoring Instruments*

7.3 GRP-FS-04-G-006, *Operate HACH 2100P Turbidimeter*

7.4 GRP-FS-04-G-010, *Operate Oxidation-Reduction Potential (ORP) Probe*

7.5 GRP-FS-04-G-012, *Operational Monitoring Sample Packaging and Shipping*

7.6 GRP-FS-04-G-013, *Laboratory Cleaning of Sampling Equipment*

7.7 GRP-FS-04-G-014, *Measurements of Groundwater Levels*

7.8 GRP-FS-04-G-016, *Chain of Custody/Sample Analysis Request*

7.9 GRP-FS-04-G-020, *Sample Storage Units*

7.10 GRP-FS-04-G-041, *Operate HQ40d/HQ30d Meter for pH, Conductivity, and Dissolved Oxygen*

7.11 HNF-20635, *Groundwater Remediation Project Quality Assurance Project Plan (GRP-QA-001)*

7.12 HNF-RD-210, *Records Management Program*

7.13 HNF-PRO-10863, *Notebooks and Logbooks*

7.14 OSWER-9950.1, *RCRA Ground-water Monitoring Technical Enforcement Guidance Document (TEGD)*

7.15 WAC 173-160, 1998, *Minimum Standards for Construction and Maintenance of Wells*

8.0 CHANGE SUMMARY

Change Level	Change By/ Document	Date	Pages	Description
Rev. 1	GC Clark DPASF 12855	12/15/08	All	Major Change (revision) to incorporate input from NCOs. **AJHA No.: GW-524**
Chg. A	GC Clark DCF 15171	01/05/09	6	Minor Technical Change to add the word "initial" between ENSURE and performance ino Step 5.1.2, 8th bullet.
Chg. B	GC Clark DCF 15372	02/24/09	3, 4, 11, 13, 25	Minor Technical Change to: 1) add site form no. to 2.3; 2) add new 3.11; 3) add site form no. to 6.0 RECORDS; 4) delete Attachment 10 in 9.0 ATTACHMENTS and page 25. No effect on AJHA.
Chg. C	JA Newbill DCFs 15386, 15460, 15471	03/11/09	6, 7, 9, 11, 15, 16, 18, 23	Minor Technical Change to: 1) Step 5.1.2, sixth bullet: change "logbook" to "logbook/Data Forms". 2) Change step 5.2, eighth bullet to read "GSR and/or field logbook". 3) Change step 5.3.3.e from "Other organics" to "Other unfiltered glass containers (i.e., other organics)". 4) Section 6.0 Records table: a) Delete S&GRP Waste Inventory Sheet and Continuation Page. b) Add "S&GRP" to Destination entries. c) Change second, third and fourth Disposition entries from "Send to RHA as volume warrants" to "Deliver to Sample and Data Management". 5) Last step of attachments 1, 2, 3, and 7: change section/step 5.2.11 to section/step 5.2.2 (5.2.11 does not exist). No effect on AJHA.
Chg. D	JA Newbill CPRs 16005, 16006	07/01/09	6, 24	Minor Technical Change to: 1) Section 5.2, second bullet; add sub-bullets. 2) Attachment 9, second diamond (on right); change "+/- 10%" to "per step 5.3"

9.0 ATTACHMENTS

9.1 Attachment 1 - Sample Collection Using the Submersible Pump

9.2 Attachment 2 - Sample Collection Using the Hydro Star Pump

9.3 Attachment 3 - Sample Collection Using Grundfos Redi-Flo 2 Sample Pump

9.4 Attachment 4 - Grab Sample Collection

9.5 Attachment 5 - Sample Collection from a Piezometer Using the Air Lift Method

9.6 Attachment 6 - Sample Collection Using a Solinst Discrete Interval Sampler

9.7 Attachment 7 - Sample Collection Using a Peristaltic Pump

9.8 Attachment 8 - Extraction (Pump and Treat) Well Sample Collection

9.9 Attachment 9 - Purging Flow Diagram

Attachment 1 - Sample Collection Using the Submersible Pump

1.0 ATTACH manifold and purge hose to well.

2.0 ENSURE power switch is in OFF position.

3.0 PLUG power cord into power source and at well head.

4.0 START electric generator AND ALLOW it to warm up, if not already running.

Caution

Do not handle power cords once they have been energized.

5.0 TURN power switch ON to begin pumping process.
IF pump does not work properly, as indicated by a lack of air flow out the drop leg or by generator 'lug' down,
THEN TURN the switch off immediately,
AND PERFORM the following:

5.1 WAIT a few seconds, THEN TURN the switch ON,
AND WAIT to see/hear if pump starts.

Note

- This next step is only necessary on older, electric submersible pumps and will not always be necessary to start the pump.
- Pausing 15 to 30 seconds between switching "on" and "off" allows breaker trip elements to cool.

5.2 IF the pump does not start,
THEN TURN the power switch ON and OFF a few times,
Allowing 15 to 30 seconds between each cycle,
finally pausing in the ON position if the pump has started.

5.3 IF a breaker trips or a fuse is blown on the generator,
THEN TURN power switch to OFF position,
AND RESET breaker or fuse as needed.

5.4 DISCONTINUE sampling,
RECORD in GSR/logbook,
AND NOTIFY FWS.

6.0 After water begins to flow from outlet, RETURN to Section 5.2.2 for calculating purge time.

Attachment 2 - Sample Collection Using Hydro Star Pump

Note

Pump is to be operated at up to 2 gpm unless otherwise specified.

1.0 ATTACH manifold and purge hose to well.

2.0 ATTACH pneumatic cylinder assembly (Actuator) to well head assembly.

Caution

- Ensure at least 2 holes on the cylinder support overlap with 2 hole on column support. Also, ensure cylinder rod is fully extended before attaching actuator rod.
- Actuator is top heavy, use caution when handling - request assistance if necessary.

3.0 ATTACH quick connect on air supply hose to unattached end of control valve on pneumatic cylinder. The input air pressure should not exceed 120 psi.

Note

Air compressor may not start, if air tank is pressurized. Open drain valve to depressurize tank.

4.0 START air compressor.

5.0 TURN on control valve on pneumatic cylinder. The piston will begin to operate.

6.0 ADJUST the stroke rate to obtain no more than 2 gpm using the control valve located on the top of pneumatic cylinder .

7.0 After water begins to flow from outlet, RETURN to Section 5.2.2 for calculating purge time.

Attachment 3 - Sample Collecting Using Grundfos Redi-FLO 2 Sample Pumps

(Page 1 of 2)

Note

Pump is to be operated at up to 2 gpm unless otherwise specified.

1.0 IF Redi-Flo 2 pump has been permanently installed, THEN GO-TO step 6.0.

2.0 ENSURE that the Portable Redi-Flo 2 pump has decontamination tag attached (signed and dated). IF no tag, do not use.

3.0 INSTALL portable Redi-Flo 2 pump using one of the following methods:

- FOLLOW GSR recommendations as to how deep the Redi-Flo 2 pump is to be installed
- LOWER pump to well bottom THEN RAISE pump to approximately 2 feet from well bottom.

4.0 LATCH reel in place to secure pump at proper depth.

5.0 CONNECT sample manifold to discharge outlet.

Caution

The Redi-Flo 2 control box is not rated for outdoor use; it should be kept in the sample van.

6.0 CONNECT Redi-Flo 2 control box to dedicated electrical source and pump reel (or electrical connector of permanently installed pump).

7.0 START electric generator AND ALLOW it to warm up, if not already running.

Caution

Do not handle power cords once they have been energized.

8.0 START the Redi-Flo 2 pump,
AND adjust to obtain desired flow rate.

9.0 IF pump does not work properly, as indicated by a lack of air flow out the drop leg or by generator 'lug' down,
THEN TURN the Redi-Flo 2 control box off immediately,
AND PERFORM the following:

Attachment 3 - Sample Collecting Using Grundfos Redi-FLO 2 Sample Pumps

(Page 2 of 2)

9.1 WAIT a few seconds, THEN Start the Redi-Flo 2 pump.

9.2 ADJUST to obtain desired flow rate,
AND WAIT to see/hear if pump starts.

Note

Pausing 15 to 30 seconds between switching "on" and "off" allows breaker trip elements to cool.

9.3 IF the pump does not start,
THEN Start and stop the Redi-Flo 2 pump a few times,
Allowing 15 to 30 seconds between each cycle,
finally pausing in the ON position if the pump has started.

9.4 IF a breaker trips or a fuse is blown on the generator,
THEN TURN power switch to OFF position,
AND RESET breaker or fuse as needed.

9.5 DISCONTINUE sampling.

9.6 RECORD in the GSR and/or logbook.

9.7 NOTIFY FWS.

10.0 IF pump stops,
THEN OBSERVE indicators on digital display,
AND notify FWS.

11.0 After water begins to flow from outlet, RETURN to Section 5.2.2 for calculating purge time.

Attachment 4 - Grab Sample Collection (i.e. Bailer, Kabis, weighted bottle)

Note

Grab samplers are available in several different sizes and constructed from various types of materials. The project/GSR shall specify the type of sampler prior to initiation of work.

1.0 ENSURE a laboratory cleaned bailer or field decontaminated sampler is used.

2.0 ATTACH a rope or wire to the sampler.

3.0 Slowly LOWER the bailer into the water.

Caution

Never drop the sampler into the well, doing so may cause degassing of volatile organics or increase turbidity.

4.0 STOP at appropriate depth and allow sampler to fill.

5.0 RAISE the sampler to the surface.

Note

Water should be poured directly from the sampler into the sample container slowly to prevent trapping any air bubbles (VOA samples).

6.0 AVOID splashing or agitating the water while the sample container is being filled.

7.0 RECORD sample temperature, pH, turbidity, and conductivity (or other measurements, as requested), on the GSR or in the field logbook.

8.0 RETURN to Step 5.3.3, "Fill sample containers ..."

Attachment 5 - Sample Collection from a Piezometer Using the Air Lift Method

Note

Some piezometer tubes are sampled by the airlift method where the sample water is pushed up and out of the well by compressed air; an ABS tube has been installed in these wells for this purpose.

1.0 CONNECT airline to main compressor fitting on sample vehicle.

2.0 ENSURE all valves are closed on 3-way valve.

3.0 CONNECT air line to 3-way valve.

4.0 CONNECT 3-way valve to well head fitting.

5.0 CONNECT sample manifold/drop-leg to piezometer tube.

6.0 START compressor.

Note

When adjusting regulator, turning the valve clockwise increases pressure while turning the valve counter clockwise reduces pressure. A minimum of 100 psi with a maximum of 125 psi is required to produce water to the surface.

Caution

Due to the pressurizing of the ABS pipe, do not stand over well head.

7.0 SET output on discharge gauge to a minimum of 100 psi.

8.0 OPEN the air supply valve.

9.0 ALLOW piezometer to reach pressure. IF water reaches surface, THEN COLLECT as part of purge.

10.0 ONCE flow has stopped, CLOSE pressure valve.

11.0 ALLOW piezometer to recharge 3 to 5 minutes.

12.0 REPEAT Steps 8.0 through 11.0 to continue purge as directed by GSR.

13.0 RECORD sample temperature, pH, turbidity, and conductivity (or other measurements, as requested), on the GSR or in the field logbook.

14.0 COLLECT all sample water in clean secondary container.

15.0 RETURN to Step 5.3.3, "Fill sample containers ..."

Attachment 6 - Solinst Discrete Interval Sampler

(Page 1 of 2)

Caution

Correct installation of O-rings and check balls are essential to the operation of the Solinst Sampler.

1.0 ASSEMBLE sampler, ensuring white colored ball on bottom and opaque ball on top.

2.0 ATTACH sampler to tubing reel,
AND TIGHTEN swagelok 1/4 turn past hand tight.

Note

Samples collected with the Solinst may require the use of a tripod or drill rig (with safety line).

3.0 Using the sample depth listed on GSR, DETERMINE pressure using the following table.

Recommended Operating Pressure			
Depth (feet)	Pressure (psi)	Depth (meters)	Pressure (kPa)
25	20	8	148
50	30	15	217
100	50	30	364
200	95	60	660
300	140	90	952
500	225	150	1540
Note: These are practical minimum pressures, and may be exceeded without adverse affect.			

4.0 RECORD Operating Pressure on GSR for each sample interval.

5.0 HOLD the sampler vertically to allow the lower check valve to seat.

6.0 REMOVE the valve cap from the valve stem on the face of the tubing reel,
AND ATTACH the hand pump to the valve stem.

7.0 TURN the valve selector to "pressurize",
AND PRESSURIZE (with hand pump) the sampler to the calculated pressure for the depth being sampled

8.0 RECORD the pressure where indicated on the GSR.

Attachment 6 - Solinst Discrete Interval Sampler

(Page 2 of 2)

9.0 DETACH the pump,
AND THEN lower the sampler to the target depth for sampling.

10.0 TURN the valve selector to "vent"
AND WAIT at least 1 minute for sampler to fill.

11.0 TURN the valve selector to "pressurize".

12.0 ATTACH the pump,
AND PRESSURIZE the sampler to calculated pressure for this sampling depth.

13.0 DETACH the pump.

14.0 RECOVER the sampler from the well slowly by pulling the sampler out of the well and spooling tubing back onto the reel.

15.0 HOLD the sampler upright,
AND TURN the valve selector to "vent" to release the pressure on the system.

16.0 INSERT the sample release device into the bottom end to release water and fill sample containers,
AND use remaining water to obtain required field readings.

17.0 As required, DISASSEMBLE the sampler AND RINSE all the pieces thoroughly with deionized water.

18.0 REPEAT process for each sample interval.

19.0 GO TO section 5.3.7.

Attachment 7 - Sample Collection Using a Peristaltic Pump

The principal drawback of peristaltic pumps is they require disposable hose, which must be compatible with the media being sampled. In addition, this sampling method may be difficult for collecting representative samples of phased or graduated liquids, as the inlet end of the hose must be raised and lowered into the container at a very uniform rate. In addition, the completion of a raising or lowering cycle of the inlet end of the hose must coincide with the completion of filling the sample container.

Procedure for Use

1.0 If needed, PLACE a pump weight on the end of the hose so that the hose does not float on the liquid surface.

2.0 CONNECT tubing to the pump head.

3.0 PLACE an inlet hose into the liquid or connect to existing sample port,
THEN ACTIVATE the pumping mechanism.

4.0 DRAW the sample through the inlet hose to a sample container.

5.0 DRAIN liquid in the inlet hose back into the container after pumping (a peristaltic pump can be run in reverse to empty the tubing back into the container).

6.0 GO TO Step 5.2.2.

Attachment 8 - Extraction (Pump and Treat) Well Sample Collection

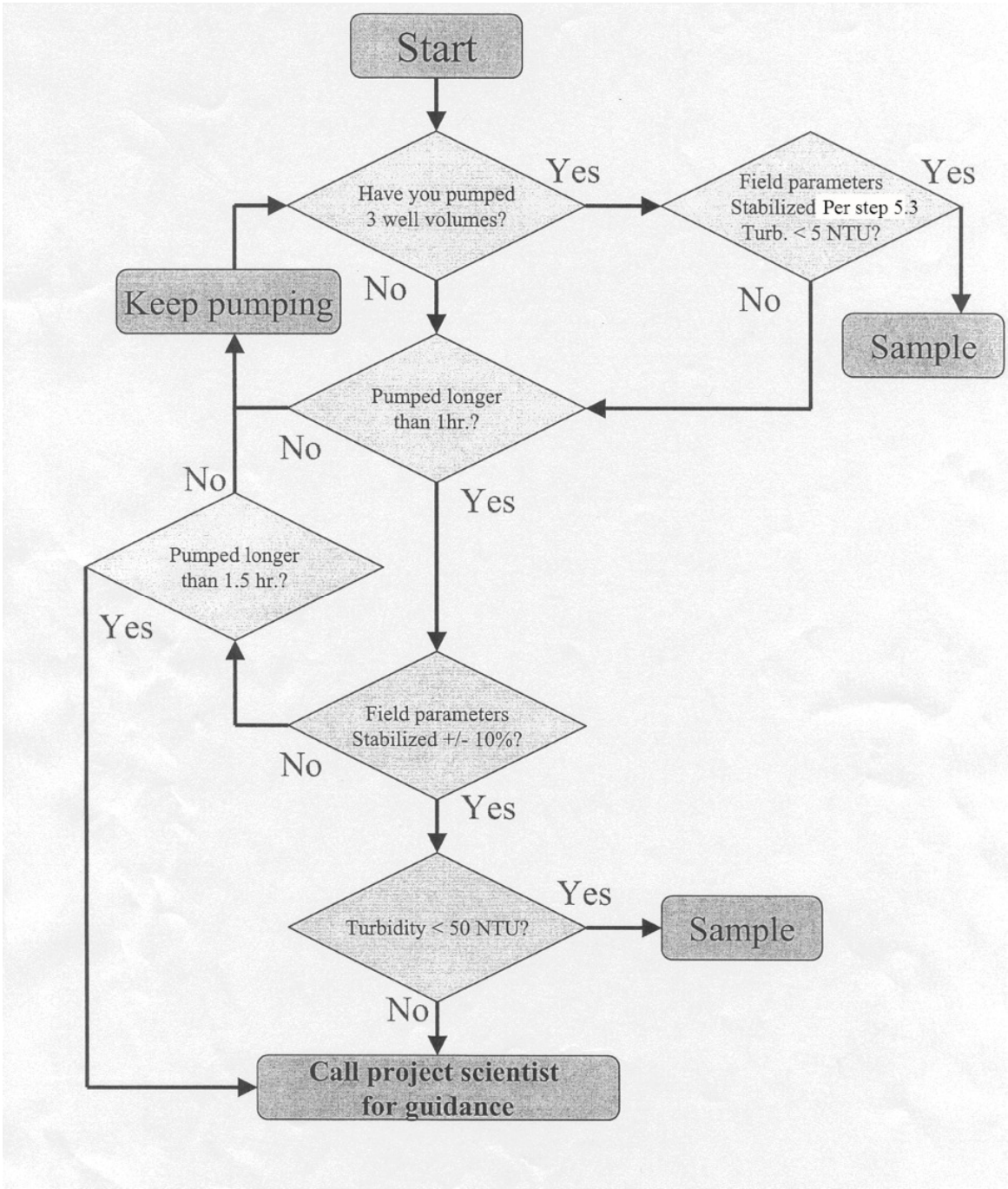
Note

Prior to collecting samples, make sure the extraction (pump and treat) well is up and running or operations support is available to start the process in order to obtain groundwater samples.

1.0 RECORD valve number.

2.0 RETURN to Section 5.3, "Field Readings".

Attachment 9 - Purge Flow Diagram



Appendix B

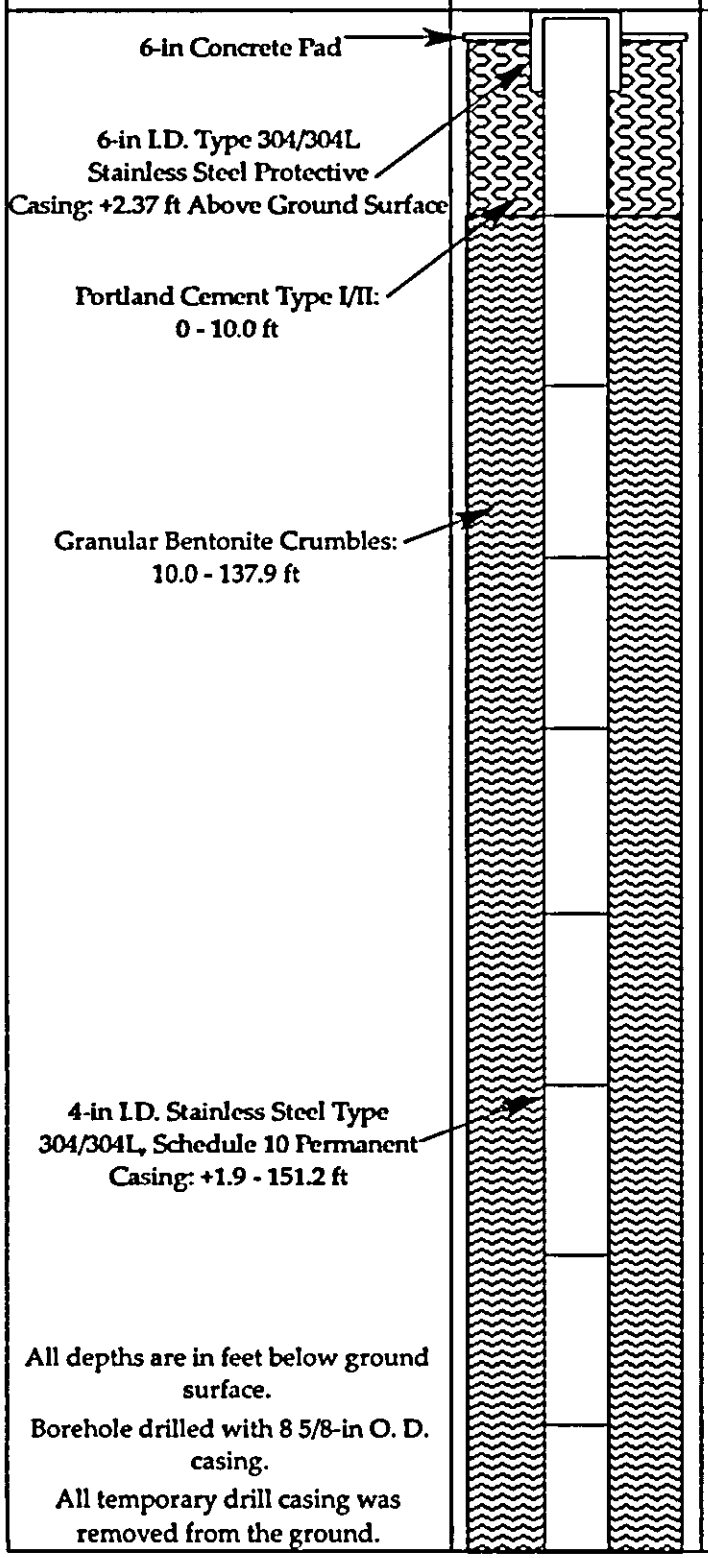
Groundwater Well Construction Documentation

WELL SUMMARY SHEET

Start Date: 10-15-06
Finish Date: 12-15-06

Well ID: C5197	Well Name: 699-50-56
Location: 1/2 mile E. of Rt. 4, 200 yards N. of Rt. 11	Project: 200-BP-5 Monitoring Wells
Prepared By: Erika Rincon Date: 12/19/06	Reviewed By: L.D. Walker Date: 4/2/07
Signature:	Signature:

CONSTRUCTION DATA

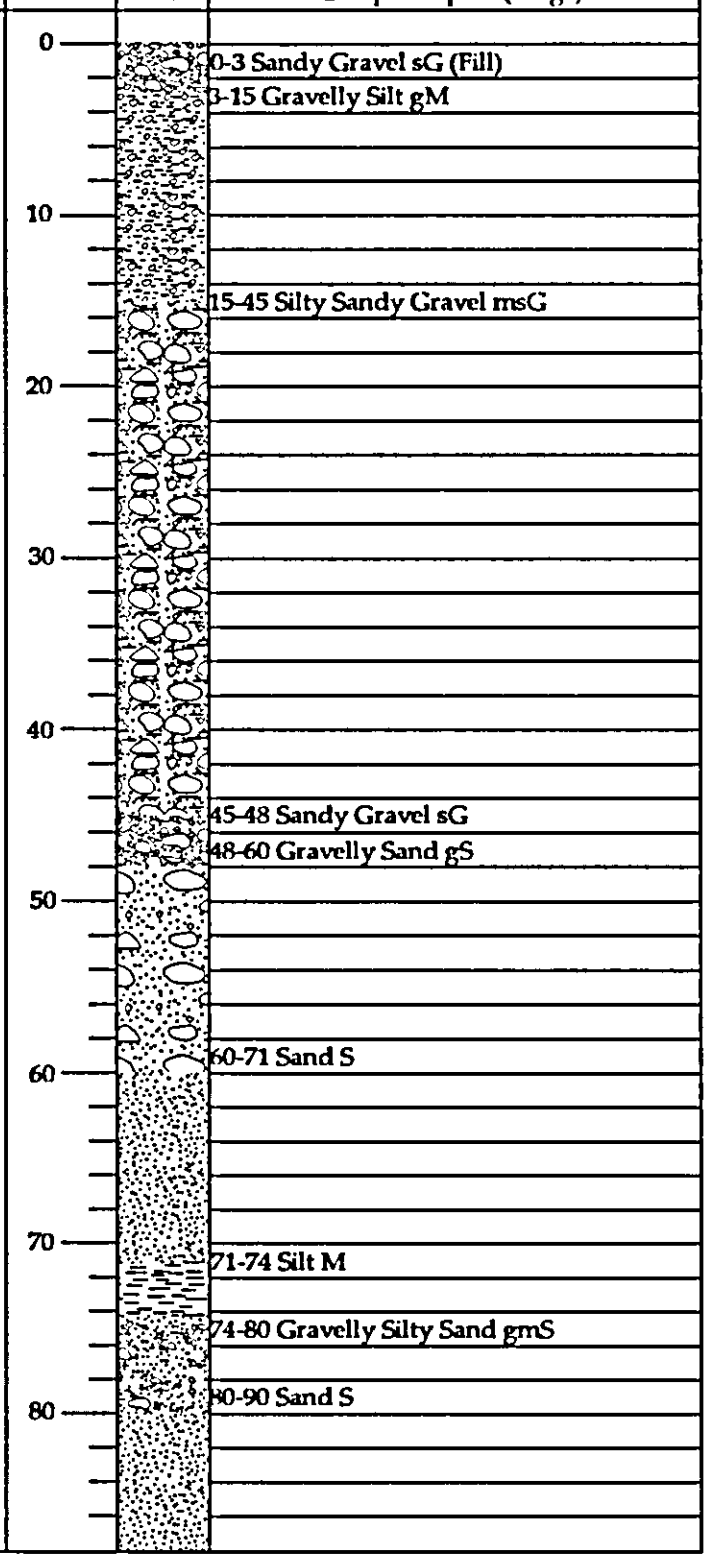


All depths are in feet below ground surface.

Borehole drilled with 8 5/8-in O. D. casing.

All temporary drill casing was removed from the ground.

GEOLOGIC/HYDROLOGIC DATA



WELL CONSTRUCTION AND COMPLETION SUMMARY AS-BUILT

Drilling Method: INF	Sample Method: INF	WELL NUMBER: 699-53-55C	TEMPORARY WELL NO.: N/A
Drilling Fluid Used: INF	Additives Used: INF	Hanford Coordinates: N/S N52976	E/W W55015
Driller's Name: INF	WA State Lic. No.: INF	State Coordinates: N INF	E INF
Drilling Company: INF	Company Location: INF	Start Card #: INF	T — R — S —
Date Started: INF	Date Complete: May '75	Elevation Ground Surface (ft): INF	

Depth to water: 171.3

GENERALIZED STRATIGRAPHY Data source: Driller's log

No Drilling Log Available

- Elevation of casing: 564.82
- Elevation of reference point: N/A
- Concrete pad dimensions: None
- Depth of surface seal: INF
  Type of surface seal: INF
- I.D. of surface casing (if present): 15.5-in.
  Type of surface casing: Carbon Steel
- Depth of surface casing: 18-in.
- I.D. of riser pipe: 12-in.
  Type of riser pipe: Carbon Steel
  Total depth 197'
- Diameter of borehole: INFn.
- Elevation/depth of top of screen/perforated interval: INF
  Description of screen/perforation: 10" screen to 220.5' with packer set at 187.3'
- I.D. of screen section: 10-in.
- Elevation/depth of bottom of screen/perforated interval: 220.5
- Elevation/depth of top of plugged section: N/A
- Type of filler used in plugged section: N/A
- Elevation/depth of bottom of borehole: N/A
- Elevation/depth of remediated borehole: N/A

NOTES: N/A: Not Applicable
INF: Insufficient Data

8837152\65355C

A5246

WELL CONSTRUCTION AND COMPLETION SUMMARY -

Drilling Method: Air rotary
Drilling Fluid Used: None
Driller's Name: Not documented
Drilling Company: Aqua Drilling Co
Date Started: May75

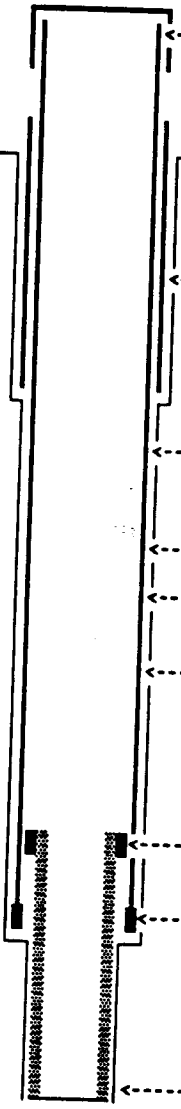
Sample Method: Not sampled
Additives Used: None
WA State Lic Nr: Not documented
Company Location: Cour d'Alene ID
Date Complete: May75

WELL NUMBER: 699-53-55C
TEMPORARY WELL NO:
Hanford Coordinates: N/S N 52,976 E/W W 55,015
State Coordinates: N 458,137 E 2,240,174
Start Card #: Not documented T R S
Elevation Ground surface (ft): 562.2 Estimated

Depth to water: 171.3 May75
(Ground surface) 169.6 ft Jan89

GENERALIZED STRATIGRAPHY: Not Documented

Well was drilled contemporaneously with 699-53-55B. Lithology was assumed to be similar.



Elevation of reference point: (top of casing) [564.82 ft]
Height of reference point above ground surface [2.6 ft]
Depth of surface seal [ND]
Type of surface seal: None documented
No grout between 12 and 16 in casing
I.D. of surface casing (Depth not documented, assumed 20 ft) [15.5 in]
I.D. of riser pipe: [12-in]
Type of riser pipe: Carbon steel
Diameter of borehole: [13-in nom]
Type of filler: Not documented
Elevation/depth top of seal
Type of seal: Not documented
Depth top of screen: [187.3 ft]
Description of screen: 10-in stainless steel
Set with packer
Depth bottom of casing: [197 ft]
Depth bottom of screen: [220.5 ft]
Depth bottom of borehole: [220.5 ft]

Drawing By: R.K. Ledgerwood Date: 27Mar90
Reference: Golder 8831752\65355C

WELL CONSTRUCTION AND COMPLETION SUMMARY

Drilling Method: Air rotary
Drilling Fluid Used: None
Driller's Name: Not documented
Drilling Company: Aqua Drilling Co
Date Started: May75

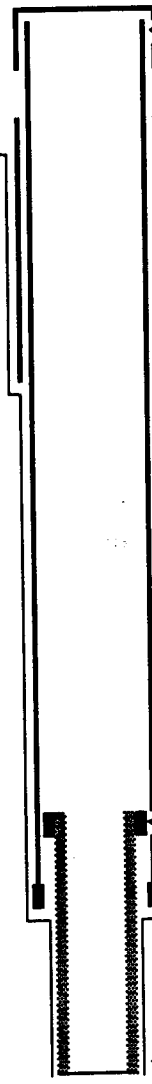
Sample Method: Not sampled
Additives Used: None
WA State Lic Nr: Not documented
Company Location: Cour d'Alene ID
Date Complete: May75

WELL NUMBER: 699-53-55C
TEMPORARY WELL NO:
Hanford Coordinates: N/S N 52,976 E/W W 55,015
State Coordinates: N 458,137 E 2,240,174
Start Card #: Not documented T R S
Elevation Ground surface (ft): 562.2 Estimated

Depth to water: 171.3 ft May75
(Top of casing) 173 ft Sep90

GENERALIZED STRATIGRAPHY: Not Documented

Well was drilled contemporaneously with 699-53-55B. Lithology was assumed to be similar.



Elevation of reference point: (top of casing) [564.82 ft]
Height of reference point above ground surface [2.6 ft]
Depth of surface seal [ND]
Type of surface seal: None documented
No grout between 12 and 16 in casing
I.D. of surface casing [15.5 in]
(Depth not documented, assumed 20 ft)
I.D. of riser pipe: [12-in]
Type of riser pipe: Carbon steel
Diameter of borehole: [13-in nom]
Type of filler: Not documented
Elevation/depth top of seal
Type of seal: Not documented
Depth top of screen: [187.3 ft]
Description of screen: 10-in stainless steel Set with packer
Depth bottom of casing: [197 ft]
Depth bottom of screen: [220.5 ft]
Depth bottom of borehole: [220.5 ft]

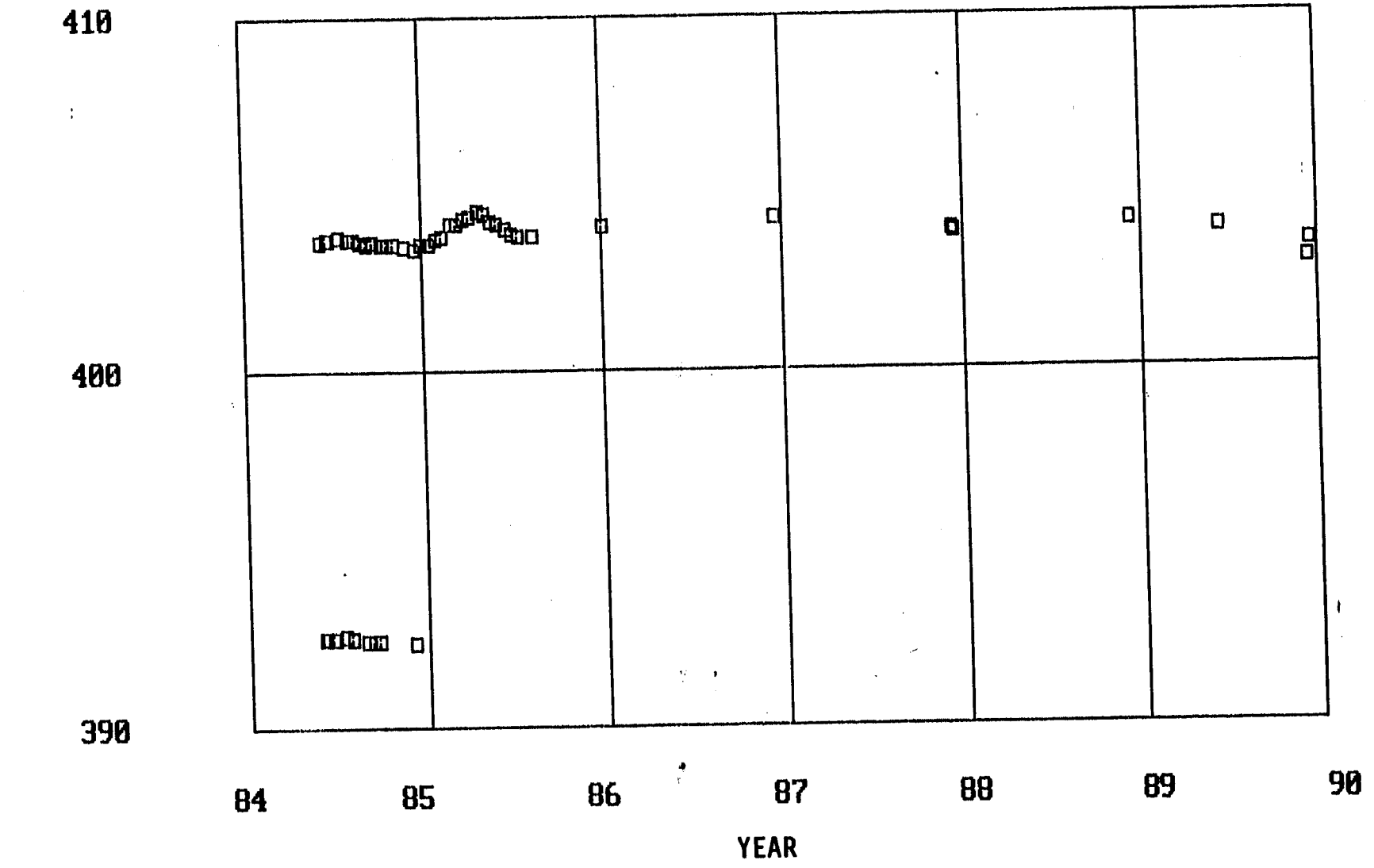
Drawing By: RKL/6#53-55C.W51 Date: 16Oct90
Reference: Golder 8831752\65355C

WELL CONSTRUCTION DATA FOR 200-BP1 WELLS, Monday November 12, 1990. 2:31 pm

WELL DESIGNATION	:	699-53-55C
RCRA FACILITY	:	
CERCLA UNIT	:	200-BP-1 [PRO]
HANFORD COORDINATES	:	N 52,976 W 55,015
LAMBERT COORDINATES	:	N 458,137 E 2,240,174
DATE DRILLED	:	May75
DEPTH DRILL (GS-ft)	:	220.5
MEAS DEPTH (GS-ft)	:	223 Aug90 TV
DEPTH WATER (GS-ft)	:	169.6 Aug90 TV
CASING DIAMETER (in)	:	16.0 & 12.0
ELEV TOP CASING (ft)	:	564.82
ELEV GROUND SURFACE	:	562.2 ft Estimated
PERFORATED INTERVAL	:	None
SCREENED INTERVAL	:	187.3-220.5
COMMENTS	:	FIELD INSPECTION, 11Oct89; No pad; no posts; carbon-steel casing (2) OTHER: Contains 10-in screen. 12-in casing to 197 ft.
AVAILABLE LOGS	:	No records available
TV SCAN COMMENTS	:	10Aug90; Depth to Bottom: 223 ft, soft debris Depth to Water: 169.6 ft, floating debris. Casing clean. Screen from 185-223 ft, clean. Water clear with some suspended debris and scale. Large casing/screen size made it hard to see casing and screen.
DATE EVALUATED	:	Nov90
EVAL RECOMMENDATION	:	REMEDIATION REQUIRED: ~~4. Remove 10-in telescoping screen.~~ DJu 8/n/93 ~~2. Backplug from 197-220.5 ft in open hole.~~ DJu 8/n/93 ~~3. Perforate from approx. 180-197 ft, retain telescoping screen.~~ DJu 8/n/93 ~~approximately 180-197 ft~~ DJu 8/n/93 DJu 8/n/93 4. Install surface seal by grouting while withdrawing 16-in surface casing. DJu 8/n/93 5. Install protective posts and concrete pad per WAC 173-160-510 and field conditions. DJu 8/n/93 6. Survey to water level measurement standards.
LISTED USE	:	Separations area W/l
PUMP TYPE	:	Hydrostar, intake at 208.72 ft.
MAINTENANCE	:	03May90; Removed debris, scrubbed casing and screen and bailed debris. 12-13Jun90; Developed well with pump to <5 NTU. 23Aug90; Installed pump and new cap.

L

HYDROGRAPH OF WELL 6-53-55C.



WELL CONSTRUCTION SUMMARY REPORT

Start Date: 3/12/08
Finish Date: 4/29/08
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: Freestone Environmental
Drilling Company: Bluestar		Geologist(s): Laurel Stratton, Steve Airhart, Pat Cabbage
Driller: Justin Egeland	License #: 2843	

TEMPORARY CASING AND DRILL DEPTH

*Size/Grade/Lbs. Per Ft.	Interval	Shoe O.D./I.D.
113/4" OD Carbon Steel	0 - 98.56'	12 1/2" / 10 5/8"
95/8" OD "	0 - 245.5'	10" / 9 3/4"
All threaded	-	
	-	
	-	

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

DRILLING METHOD

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

HOLE DIAMETER (in.) / INTERVAL (ft)

Diameter 11 3/4"	From 0	to 98.56'
Diameter 9 5/8"	From 98.56'	to 245.5'
Diameter	From	to
Diameter	From	to
Diameter	From	to
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	4/15 - 4/16/08		-	
	-			-	

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	5/8"
	-			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

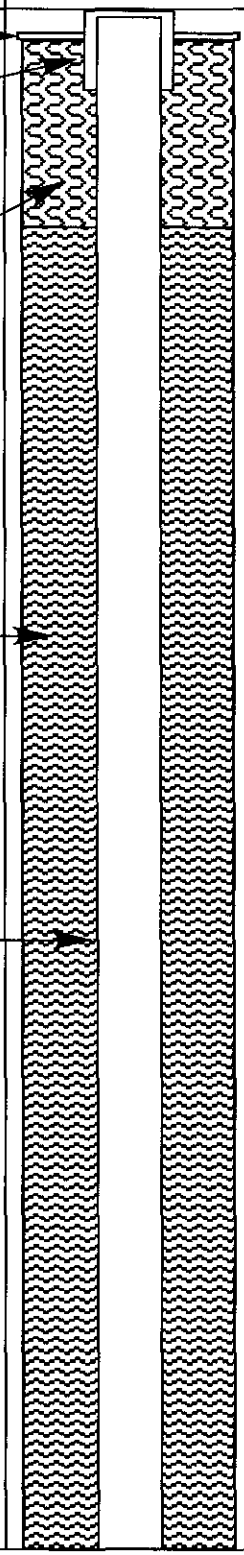
A-6003-658 (04/03)

WELL SUMMARY SHEET

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

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]
Signature: [signature]

CONSTRUCTION DATA

Description	Diagram
6-in Concrete Pad 6-in I.D. Type 304/304L Stainless Steel Protective Casing: ~~±5.27~~ 2.39' ft above ground surface LW 6/5/08 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~~ 1.39' - 249.9 ft bgs LW 6/5/08 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

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	
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)
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.S. Walker	Date: 6/7/08
Signature: L Stratton		Signature: L S Walker	

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)
180		170' ~~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 SUMMARY SHEET

Start Date: 1/24/08
Finish Date: 4/4/08

Well ID: ~~6226~~ C6226 wo 6-12-08
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~~ Silty Sandy Gravel msG
		37'
30		w 4/4/08
		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

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. D. Walker	Date: 6/11/08
Signature: Jeff Fetters		Signature: L. D. 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		
170		165-166 Sand S 166-166.4 Gravely Silty Sand sG 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

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.D. Walker | Date: 6/11/08
Signature: Jeff Fetters
Signature: L.D. Walker

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

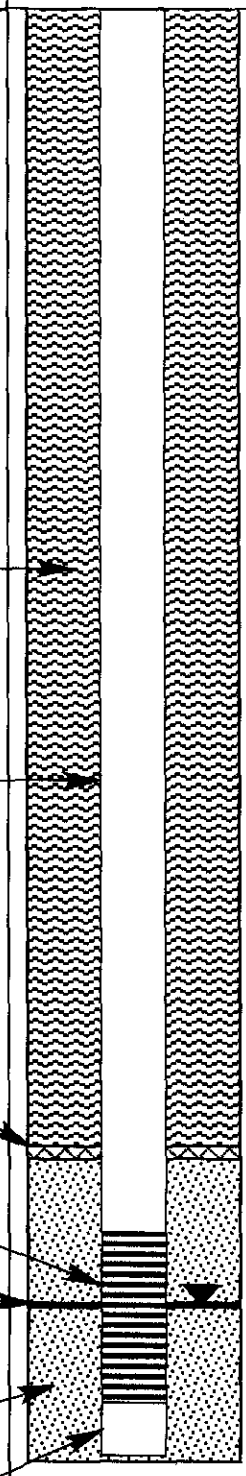
3/8-in Bentonite Pellets: 244.5 - 245.1 ft

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	Graphic Log	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
		260-260.3 Gravel G
260		260.3 Basalt

0540323

WELL SUMMARY SHEET

Date: 07/18/01

Well ID: C3392

Well Name: 299-E33-339

Location: SE Corner of 241-BX Tank Farm

Project: C401 RCRA Drilling

Prepared By: Jess Hocking Date:

Reviewed By: DC Weekes Date: 9/19/01

Signature: Jess Hocking

Signature: DC Weekes

CONSTRUCTION DATA

Description

6"- dia. protective casing set above stainless casing.

4" ID SS 304L casing:
+2.00 → 259.4'

Portland cement grout:
0 → 10.4'

Bentonite crumbles:
10.4' → 244.35'

1/4" + 3/8" Bentonite pellets:
244.35' → 249.7'

4" ID SS 304L 0.020 in. Slot cont. wire-wrap well screen:
259.4' → 279.3'

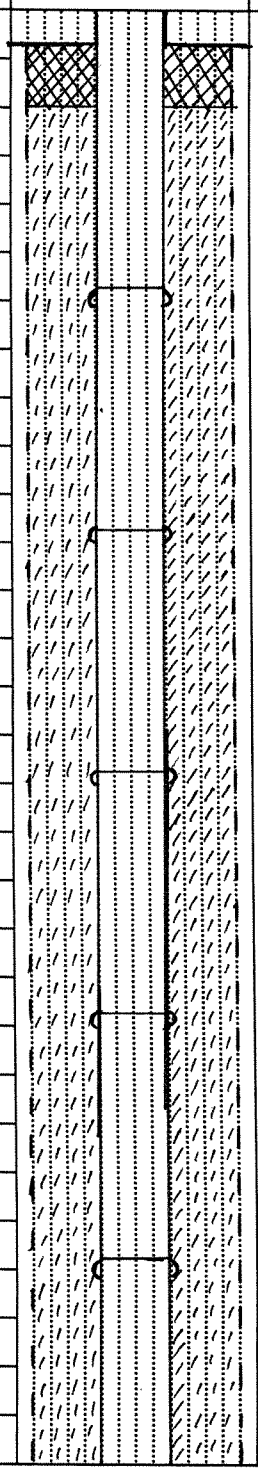
10-20 mesh silica sand
249.7' → 283.1'

4" ID SS 304L Tailpipe:
279.3' → ~~281.4'~~ 281.4' ~~283.1'~~ DCW

3/8" Bentonite Pellets (coated):
283.1' → 285.644' DCW

All temp. casing removed:
All depths are in feet below ground surface.

Diagram



GEOLOGIC/HYDROLOGIC DATA

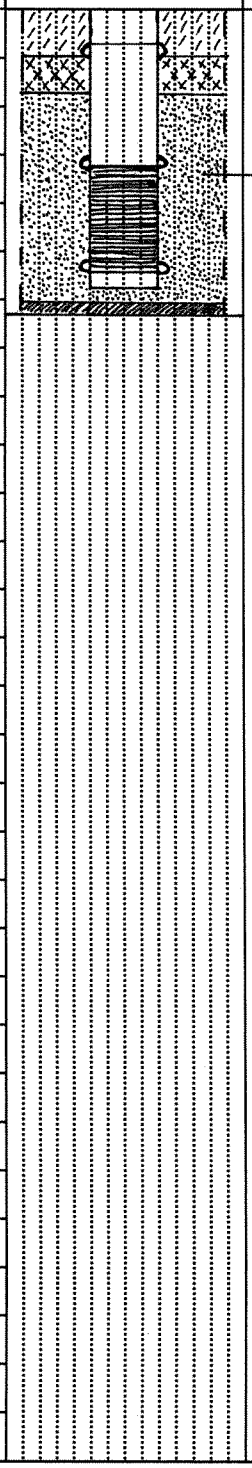
Depth in Feet	Graphic Log	Lithologic Description
0		0'-6' Backfill material
		6'-15' Silty Sandy Gravel (msG)
		15'-18.5' Slightly Silty Sandy Gravel
		18.5'-20' Silt lens
		20'-23' Sand (S)
40		23'-25' Silty Sand (mS)
		25'-30' Slightly Silt Gravelly Sand
		28' Silt lens
		30'-34' Silty Sandy Gravel (msG)
		34'-37' Silty Sand (mS)
80		37'-37.5' (silt lens) "
		37.5'-55 Silty sandy gravel (msG)
		55'-56' Sandy Gravel (SG)
		56'-223' Sand (S)
		223'-225' gravelly Sand (gS)
120		225'-235' Sandy Gravel (SG)
		235'-250' sl. silty sandy Gravel (msG)
160		
200		

WELL SUMMARY SHEET

Date: 7/18/01

Well ID: C3392	Well Name: 299-E33-339
Location: SE Corner of 241-Bx Tank Farm	Project: RCRA FY-01
Prepared By: Jess Hocking Date: 8/17/01	Reviewed By: DCWeekes Date: 9/19/01
Signature: Jess Hocking	Signature: DCWeekes

CONSTRUCTION DATA

Description	Diagram
All temp. casing removed: All depths are in feet below ground surface.	

GEOLOGIC/HYDROLOGIC DATA

Depth in Feet	Graphic Log	Lithologic Description
240		250'-252' Gravel (G)
		252-253.5' Silt (m)
		253.5'-254 sl silty sandy gravel (msG)
▽		254'-260' Gravel (G)
		260'-275' Sandy Gravel (sG)
280		275'-279' silty Gravel (mG)
		279'-~~284~~ 285.44 ~~Gravel (G)~~ BASALT KCW KCW
		TD = 285.44' bgs
		WL = 261.27' bgs 8/21/01
320		

WELL SUMMARY SHEET

Start Date 4/30/04
Finish Date 08/09/04
Page 1 of 1

Well ID C4261	Well Name 299-E33-49
Location South of BX Tank Farm, 200 East	Project. 2004 RCRA Drilling
Prepared By Charlene Martinez — Date 08/11/04	Reviewed By L.D. Walker — Date. 8/25/04
Signature Charlene Martinez	Signature LD Walker

CONSTRUCTION DATA

Description	Diagram
10-20 MESH SILICA SAND 288.4' → 258.6'	
3/8" Sodium Bentonite Pellets 258.6' → 253.7'	
Sodium Bentonite Crumbles 253.7' → 9.5'	
Type I/II Portland Cement 9.5' → 0'	
4" TP-304/304L sch. 05s Riser +1.99' → 263.5'	
4" TP-304/304L sch. 05s 0.020" CONT WIRE WRAP SCREEN 263.5' → 283.5'	
4" TP-304/304L sch 05s Sump 283.5' → 286.5'	
6" ID protective casing (ss 304, sch 5) set: +1.02' above permanent.	
All depths in feet below ground surface.	
All temporary casing (12") removed from ground	

GEOLOGIC/HYDROLOGIC DATA

Depth in Feet	Graphic Log	Lithologic Description
0		0-5.5' Slighty Silty Gravelly SAND (m)gS
		5.5'-13' Silty Sandy GRAVEL (msG)
		13'-16' Gravelly SAND + Sandy GRAVEL
		16'-17' SAND (S) 17'-45.5' Sandy GRAVEL
50		45.5'-48' Gravelly SAND (gS)
		48'-51' Sandy GRAVEL (sG)
		51'-93' SAND (S)
		93'-98' Slightly Silty SAND (m)S
100		98'-163' SAND (S)
150		
		163'-171' Slightly Silty SAND (m)S
		171'-217' SAND (S)
200		217'-217.3' Silty Sandy GRAVEL (msG)
		217.3'-217.8' SAND (S)
		217.8'-223' Sandy GRAVEL (sG)
		223'-270' Silty Sandy GRAVEL (msG)
250		
		270'-273' Sandy Gravel (sG)
▼		273'-283.5' Sandy Gravel (sG)
		283.5'-288.8' Basalt
		TD = 288.8' bgs
		static water 265.44' bgs (08/10/04)

A-6003-643 (03/03)

E008373

WELL SUMMARY SHEET

Boring or Well No 299-E33-39

Sheet 1 of 2

Location 200E; APPROX 1000'E. OF THE BY CRIBS
Project CERCLA 200-BP-1
Elevation 620.42 NGVD'29 BENCH MARK MRS 1-24-62
Drilling Contractor KAISER ENGINEERS HANFORD
Driller T. GIFFORD
Drilling Method and Equipment CABLE TOOL - RIG # 5307
Prepared By J.W. ROBERTS J.W. Roberts Date 2/8/91
(Sign/Print Name)
Reviewed By S J TRENT/BAD Trent Date 2/20/91
(Sign/Print Name)

CONSTRUCTION DATA

Description	Diagram (12" 10" 10" 12")
Began installing 12" nom. dia. carbon steel casing on 12/5/90. Bottom of 12" casing 101' from G.S. on 12/31/90. Borehole logged by PNL (gross gamma) on 1/2/91; by WHC (spectra gamma) on 1/3/91.	12" 101 FT
Began installing 10" nom. dia carbon steel casing on 1/3/91. Bottom of 10" casing 229.12' from G.S. on 1/17/91. T.D. at 230.1' on 1/18/91. Total 10" casing 232.12'. Borehole logged by PNL (gross gamma) on 1/21/91; by WHC (spectra gamma) 1/21-22/91.	10" 229.12 FT
All 10" carbon steel casing removed from borehole on 2/6/91.	
All 12" carbon steel casing removed from borehole on 2/8/91.	

GEOLOGIC/HYDROLOGIC DATA

Depth in Feet	Graphic Log	Lithologic Description
5		PHYSICAL SAMPLE SILTY SANDY GRAVEL (msG) 299-E33-39-00
10		SLIGHTLY GRAVELLY SAND (g)S
15		GRAVELLY SAND gS
20		GRAVELLY SAND gS
25		GRAVELLY SAND gS
30		SAND S
35		SLIGHTLY GRAVELLY SAND (g)S
40		SLIGHTLY GRAVELLY SAND (g)S
45		GRAVELLY SAND gS
50		SLIGHTLY GRAVELLY SAND (g)S
55		SLIGHTLY GRAVELLY SAND (g)S
60		GRAVELLY SAND gS
65		SAND S
70		GRAVELLY SAND gS
75		GRAVELLY SAND gS
80		PHYSICAL SAMPLE GRAVELLY SAND gS 299-E33-39-080.5
85		GRAVELLY SAND gS
90		SLIGHTLY GRAVELLY SAND (g)S
95		SLIGHTLY GRAVELLY SAND (g)S
100		SLIGHTLY GRAVELLY SAND (g)S
105		SLIGHTLY GRAVELLY SAND (g)S
110		SLIGHTLY GRAVELLY SAND (g)S
115		GRAVELLY SAND gS
120		GRAVELLY SAND gS
125		PHYSICAL SAMPLE SAND S 299-E33-39-126.5
130		SAND S
135		SAND S
140		GRAVELLY SAND gS
145		GRAVELLY SAND gS
150		GRAVELLY SAND gS
155		GRAVELLY SAND gS
160		PHYSICAL SAMPLE SILTY SAND mS 299-E33-39-160.6
165		SILTY SAND mS

A-6000-398 (08/89)

WELL SUMMARY SHEET

Boring or Well No 299-E33-39

Sheet 2 of 2

Location 200E; APPROX. 1000'E. OF THE BY CRIBS
Project CERCLA 200-BP-1
Elevation 620.42 NGVD'29 N 143,242
Drilling Contractor KAISER ENGINEERS HANFORD
Driller T. GIFFORD
Drilling Method and Equipment CABLE TOOL - RIG # 5307
Prepared By J.W. Roberts / J.W Roberts (Sign/Print Name) Date 2/8/91
Reviewed By J J TRENT / J J Trent (Sign/Print Name) Date 2/20/91

CONSTRUCTION DATA		Depth in Feet	GEOLOGIC/HYDROLOGIC DATA	
Description	Diagram		Graphic Log	Lithologic Description
	10" 4" 10"	170		SILTY SAND mS
		175		GRAVELLY SAND gS
		180		SANDY GRAVEL sG
		185		GRAVELLY SAND gS PHYSICAL SAMPL.
21.04 ft stainless steel continuous wire wrap screen (0.020-in slot) from 229.2' to 208.16' (4" ID). Stainless steel thread casing to above ground surface	JE3 20.00 JE3 19.99'	190		SILTY SANDY GRAVEL msG 299-E33-39-191
		195		SILTY SANDY GRAVEL msG
		200		SILTY SANDY GRAVEL msG
		205		SILTY SANDY GRAVEL msG
		210		SILTY SANDY GRAVEL msG
		215		SILTY SANDY GRAVEL msG PHYSICAL SAMPL.
		220		SILTY SANDY GRAVEL msG 299-E33-39-220 PHYSICAL SAMPLE
		225		SILTY SANDY GRAVEL msG 299-E33-39-226.
		230		SAND S
8-12 sand 229.3'-203.1'				
Bentonite pellets 203.1'-199.6'				TD @ 230.1 ft
8-20 Bentonite crumbles 199.6'-20.0'				STATIC WATER LEVEL
Portland cement 20.0'-2.0'				@ 218.65' on 1/17/91

A-6000-384 (OAC)

A 4856

Battelle Pacific Northwest Laboratories

AS-BUILT DIAGRAM

Well Number 299-E33-31 Geologist AIRHART, GOODWIN, LANIGAN, BLEGEN, BRANDENBERGER Page 1 of 2

Reviewed by V.E. McGhan Date 12-14-89

Construction Data		Depth in Feet	Geologic/Hydrologic Data	
Description	Diagram		Diagram Litho.	Lithologic Description
154' 1/2" OF 10" CARBON STEEL CASING (REMOVED)		5		MUDDY SANDY GRAVEL
CEMENT GROUT		10		SANDY GRAVEL
257' 3/4" OF 8" CARBON STEEL CASING (REMOVED)		15		MUDDY SANDY GRAVEL
		20		" " "
		25		SANDY GRAVEL
		30		GRAVELLY SAND
		35		" "
		40		" "
		45		SANDY GRAVEL
		50		" "
		55		SAND
		60		SLIGHTLY GRAVELLY SAND
8-20 MESH BENTONITE CRUMBLES		65		GRAVELLY SAND
		70		SLIGHTLY GRAVELLY SAND
235.56' 4" DIA STAINLESS STEEL CASING		75		SAND (FS-VFS)
		80		" "
		85		MUDDY SAND
		90		SAND
		95		SLIGHTLY GRAVELLY SAND
		100		" " "
		105		SAND
		110		"
		115		"
		120		"
		125		SLIGHTLY GRAVELLY SAND
		130		" " "

A-1800-186 (3/87)

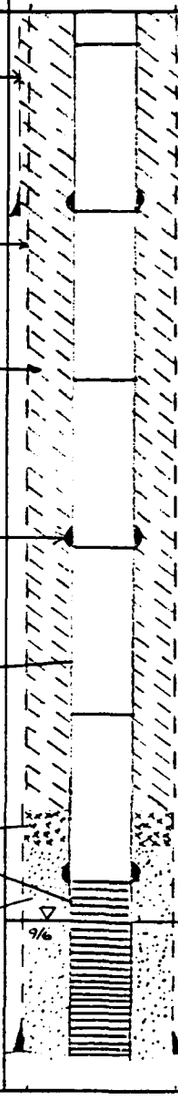
J

Battelle
Pacific Northwest Laboratories

AS-BUILT DIAGRAM

Well Number 299-E33-31 Geologist AIRHART GOODWIN Page 2 of 2
LANIGAN, BLECEN, BRANDSENBERGER

Reviewed by W.L. McElroy Date 12-14-89

Construction Data		Depth in Feet	Geologic/Hydrologic Data	
Description	Diagram		Diagram Litho.	Lithologic Description
154' 1/4" nr. 10" CARBON STEEL CASING WITH DRIVE SHOE (REMOVED)		135		SAND
		140		"
		145		SLIGHTLY GRAVELLY SAND
		150		" " "
257' 3 1/8" OF 8" CARBON STEEL CASING WITH DRIVE SHOE (REMOVED)		155		GRAVELLY SAND
		160		SAND
		165		SAND
		170		GRAVELLY SAND
8-20 MESH BENTONITE CRUMBLES		175		SANDY GRAVEL
		180		SAND
		185		"
		190		"
FACTORY-WELDED CENTRALIZERS		195		"
		200		" (CLAY LENSE @ 202')
235.56' 4" DIA. STAINLESS STEEL CASING		205		SANDY GRAVEL
		210		" "
		215		MUDDY SANDY GRAVEL
		220		SANDY GRAVEL
		225		" "
1/4" BENTONITE PELLETS		230		" "
4" STAINLESS STEEL SCREEN (10-SLOT CHANNEL-PACK)		235		" "
20-40 MESH COLORADO SILICA SAND		240		" "
		245		" "
BOTTOM OF 8" CASING (REMOVED) AT 255.6' BELOW GROUND LEVEL (RESTING ON BASALT)		250		SANDY GRAVEL
		255		" "
				BASALT @ 255.6'

A-1800-186 (3/87)

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WELL SUMMARY SHEET

Start Date: 08/05/03
Finish Date: 08/12/03
Page 1 of 2

Well ID: C4190	Well Name: 299-E27-23
Location: West of C-Tank Farm	Project: C403 RCRA drilling
Prepared By: Charlene Martinez Date: 08/19/03	Reviewed By: L. D. Walker Date: 9/5/03
Signature: Charlene Martinez	Signature: LD Walker

CONSTRUCTION DATA

Description	Diagram
9" OD dual-wall temporary casing used.	
6" ID Protective casing set 1.0' above 85	
4" ID SS304 schedule 10 casing:	
+1.8' → 273.51'	
Portland Cement Grout:	
0' → 9.9'	
Granular Bentonite:	
9.9' → 263.0'	
1/4" Bentonite Pellets:	
263.0' → 267.8'	
All temporary casing removed from ground:	
All depths in feet below ground surface.	

GEOLOGIC/HYDROLOGIC DATA

Depth in Feet	Graphic Log	Lithologic Description
0		0'-1.5' Backfill (Crushed GRAVEL)
		1.5'-10' SAND(S)
		10'-12' gravelly SAND(gS)
		12'-15' sandy GRAVEL(sG)
		15'-20' gravelly SAND(gS)
40		20'-103' SAND(S)
80		
		103'-107' gravelly SAND(gS)
		107'-160' SAND(S)
120		
160		160'-200' silty SAND(mS)
200		200'-210' silty sandy GRAVEL(mG)
		210'-226' SAND(S)
		226'-230' gravelly SAND(gS)
		230'-245' SAND(S)

WELL SUMMARY SHEET

Start Date: 08/05/03
Finish Date: 08/12/03

Well ID: C4190
Well Name: 299-E27-23
Location: West of C-Tank Farm
Project: CY03 BC&A drilling
Prepared By: Charlene Martinez
Date: 08/19/03
Reviewed By: L.D. Walker
Date: 9/5/03
Signature: Charlene Martinez
Signature: L.D. Walker

CONSTRUCTION DATA

Description	Diagram
10-20 mesh silica sand: 267.8' → 318.0'	
4" ID ss 304 schedule 10, 0.020" cont. wire-wrap screen: 273.51' → 308.54'	
4" ID ss 304 schedule 10 sump end cap: 308.64' → 310.97'	
All temporary casing removed from ground:	
All depths are in feet below ground surface:	

GEOLOGIC/HYDROLOGIC DATA

Depth in Feet	Graphic Log	Lithologic Description
240		245'-255' silty sandy GRAVEL (msG)
		255'-260' GRAVEL (G)
		260'-318' sandy GRAVEL (sG)
280		TD = 318' bgs
		static water = 273.1' bgs (08/12/03)
320		
360		

WELL CONSTRUCTION SUMMARY REPORT

Start Date: 08/12/03
Finish Date: 8/20/03
Page 1 of 1

ID: c4125	Well Name: 299-E27-4	Approximate Location: West of C-Tank Farm
Project: C403 RCRA drilling		Other Companies: F H, CHG
Drilling Company: Layne Christensen		Geologist(s): C. Martinez, M.J. Hocking
Driller: Paul "Derry" Lodder	License #: 16238	

TEMPORARY CASING AND DRILL DEPTH			DRILLING METHOD	HOLE DIAMETER (in.) / INTERVAL (ft)
*Size/Grade/Lbs. Per Ft.	Interval	Shoe O.D./I.D.	Auger: Hollow stem	Diameter 9" From 0' to 30'
Dual-wall carbon steel, FJ	0' - 311	9"	Cable Tool:	Diameter ____ From ____ to ____
9" OD (outer); 7"/6" Inner	____ - ____		Air Rotary:	Diameter ____ From ____ to ____
	____ - ____		A.R. w/Sonic:	Diameter ____ From ____ to ____
10 5/8" / 10", carbon	0 - 30'	10 5/8" / 10"	Becker Hammer	Diameter 9" From 30' to 311'
steel, FJ	____ - ____		(Reverse Air.)	Diameter ____ From ____ to ____
*Indicate Welded (W) - Flush Joint (FJ) Coupled (C) & Thread Design				Diameter ____ From ____ to ____

Drilling Fluid: none

Total Drilled Depth: 311' | Hole Dia @ TD: 9" | Total Amt. Of Water Added During Drilling: N/A

Well Straightness Test Results: Passed using a 20.4' long, 4.5" OD tool on 08/19/03 | Static Water Level: 270.65' | Date: 08/20/03

GEOPHYSICAL LOGGING

Sondes (type)	Interval	Date	Sondes (type)	Interval	Date
Spectral Gamma	0' - 309'	08/15 & 08/16 2003		____ - ____	
	____ - ____			____ - ____	
	____ - ____			____ - ____	

COMPLETED WELL

Size/Wt./Material	Depth	Thread	Slot Size	Type	Interval Annular Seal/Filter Pack	Volume	Mesh Size
4" SS 304, Sch. 10 riser	+1.9' - 270.32'	FJ80	N/A	Portland cement (94#)	0 - 9.9'	6 bags	N/A
4" SS 304 Sch. 10 wellscreen	270.32' - 305.33'	"	0.020"	Granular Bentonite (50#)	9.9' - 259.0'	99 bags	N/A
4" SS 304 sump	305.33' - 307.74'	"	N/A	Bentonite Pellets (50#)	259.0' - 264.4'	2 buckets	1/4"
	____ - ____			Colorado silica sand (50#)	264.4' - 309.0'	23 bags	10-20
	____ - ____				____ - ____		

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

Vol. calcs: S.C. => 6 bags * 1.285 ft^3/bag = 7.71 ft^3; Grannies => 99 bags * 0.71 ft^3/bag = 70.29 ft^3.
Pellets => 2 buckets * 0.62 $ft^3/bucket$ = 1.24 ft^3; 10-20 sand => 23 bags * 0.535 ft^3/bag = 12.31 ft^3

Reported By:	Title:	Signature:	Date:
Charlene Martinez	Geologist	Charlene Martinez	09/09/03

A-6003-658 (04/03)

WELL CONSTRUCTION AND COMPLETION SUMMARY AS-BUILT

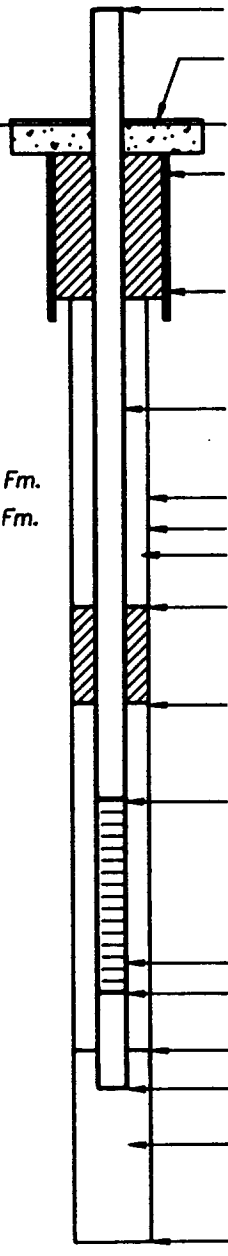
Drilling Method: Cable Tool
Sample Method:
Drilling Fluid Used: Bentonite mud
Additives Used:
Driller's Name: David
WA State Lic. No.:
Drilling Company:
Company Location:
Date Started: 7/23/82
Date Complete: 10/4/82

WELL NUMBER: 299-E27-7
TEMPORARY WELL NO.:
Hanford Coordinates: N/S N43100 E/W W48150
State Coordinates: N E
Start Card #: T R S
Elevation Ground Surface (ft): INF

Depth to water: 232.0
Data source: Driller's Log

GENERALIZED STRATIGRAPHY

0-40: Fine SAND and GRAVEL
40-140: Fine SAND
140-150: Fine SAND and GRAVEL
150-160: SAND and GRAVEL
160-200: Fine SAND
200-210: Fine SAND and GRAVEL
210-220: GRAVEL and SAND
220-235: SAND and GRAVEL
235-250: Fine SAND and GRAVEL
250-260: GRAVEL, FINE SAND and Ringold Fm.
260-275: Fine SAND, GRAVEL and Ringold Fm.
275-280: Ringold



Elevation of casing: INF
Elevation of reference point: INF
Concrete pad dimensions: INF
Depth of surface seal: 20.0
Type of surface seal: Grout around 6-in. casing
I.D. of surface casing (if present): INF
Type of surface casing: INF
Depth of surface casing: INF
I.D. of riser pipe: 6-in.
Type of riser pipe: 8-in./(0.0-150.0) 6-in./(0.0-240.0)
Diameter of borehole: 6, 8-in.
Diameter of perforated borehole casing: N/A
Type of filter: Cement grout
Elevation/depth of top of seal: INF
Type of seal: INF
Elevation/depth of top of gravel pack: INF
Type of gravel pack: INF
Elevation/depth of top of screen perforation: 241.0
Description of screen/perforation: 6-in./20-slot/Telescoping
I.D. of screen section: 6-in.
Elevation/depth of bottom of screen/perforation: 281.0
Elevation/depth of bottom of gravel pack: INF
Elevation/depth of bottom of plugged blank section: N/A
Type of filter below plugged section: N/A
Elevation/depth of bottom of borehole: 281.0
Elevation/depth of remediated borehole: N/A

NOTES: N/A: Not Applicable
INF: Insufficient Data

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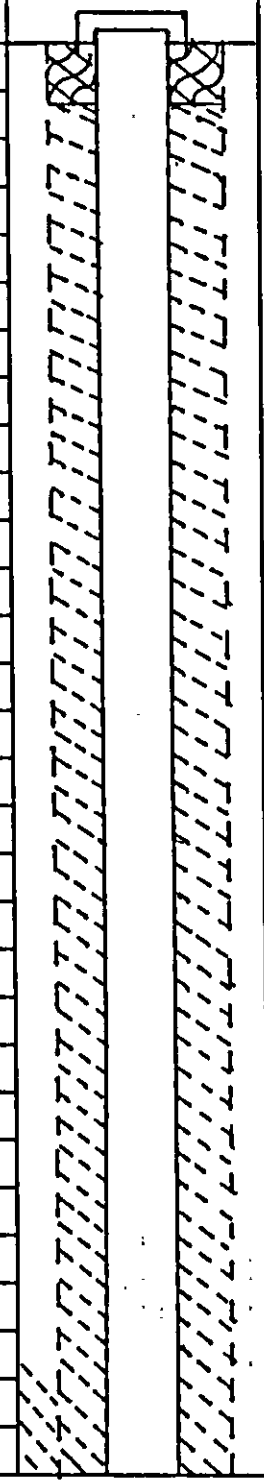
WELL SUMMARY SHEET

Start Date: 07/21/03
Finish Date: 07/25/03

Well ID: C4127
Well Name: 299-E27-21
Location: South of CR-Vault
Project: C403 RCRA drilling
Prepared By: Charlene Martinez
Date: 08/07/03
Reviewed By: L.D. Walker
Date: 8/11/03
Signature: Charlene Martinez
Signature: LD Walker

CONSTRUCTION DATA

Description	Diagram
9" OD Dual-wall temporary casing used	
6" ID ss protective casing set ±1.0' above permanent	
4" ID ss304 sched. 10 riser: + 2.0 (in) 271.37' → 271.37'	
Portland Cement Grout: 0' → 10.1'	
Granular Bentonite: 10.1' → 260.4'	
1/4" Bentonite Pellets: 260.4' → 265.5'	
All temporary casing removed from ground.	
All depths are in feet below ground surface.	

GEOLOGIC/HYDROLOGIC DATA

Depth in Feet	Graphic Log	Lithologic Description
0		0'-1' Backfill (crushed gravel)
		1'-20' SAND(s)
		20'-25' gravelly SAND(gS)
		25'-40' SAND(s)
40		40'-65' gravelly SAND(gS)
		65'-140' SAND(s)
80		
120		
140		140'-170' gravelly SAND(gS)
		170'-185' SAND(s)
		185'-200' silty sandy GRAVEL (msG)
200		200'-225' silty SAND(mS)
		225'-235' silty sandy GRAVEL (msG)
		235'-240' silty SAND(mS)

WELL SUMMARY SHEET

Start Date: 07/21/03
Finish Date: 07/25/03

Well ID: C4127
Well Name: 299-E27-21
Location: South of SR-Vault
Project: C403 Rcra drilling
Prepared By: Sinclene Martinez
Date: 8/8/03
Reviewed By: L.D. Walker
Date: 8/11/03
Signature: Sinclene Martinez
Signature: LD Walker

CONSTRUCTION DATA

Description	Diagram
10-20 mesh silica sand: 245.5' → 314.0'	
ss 304 (4" ID) schedule 10 0.020-in. cont. wire-wrap well screen: 271.37' → 306.43'	
4" ID ss 304 schedule 10 sump/endcap: 306.43' → 308.83'	
4-8 mesh silica sand: 314.0' → 318.0'	
All temporary casing removed from ground:	
All depths are in feet below ground surface.	

GEOLOGIC/HYDROLOGIC DATA

Depth in Feet	Graphic Log	Lithologic Description
240		240'-275' silty sandy GRAVEL (msG)
▽		275'-285' gravelly SAND (gS)
280		285'-318' sandy GRAVEL (sG)
320		TD = 318' bgs
		Static water 271.38' bgs (07/25/03)
360		

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AS-BUILT DIAGRAM

Well Number 299-E27-10 Geologist L.R Oster / P. White Page 1 of 2
R. Hagen, M.A. Chamness, S. Ludziak, R. Premzic
S Airhart, S. Goodwin

Reviewed by D.D. McGhan Date 12-21-87

Construction Data		Depth in Feet	Geologic/Hydrologic Data	
Description	Diagram		Diagram Litho.	Lithologic Description
cement 0'-2'		5'		SILTY SANDY GRAVEL
		10'		
		15'		SANDY GRAVEL
		20		
16" carbon steel casing (thru)		25		
		30		SILTY SANDY GRAVE
		35		
		40		
12" carbon steel casing (thru)		45		
		50		
		55		
		60		
10" carbon steel casing (thru)		65		
		70		
		75		
		80		
8" carbon steel casing (thru)		85		
		90		
		95		
		100		
		105		
		110		
4" stainless steel casing		115		
		120		
		125		
		126		SLIGHTLY SILTY GR. SAND

A-1800-186

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AS-BUILT DIAGRAM

Well Number 299-E27-10 Geologist K R Oster / P White Page 2 of 2
R. Hagen, S. Dudziak, H. A. Chamness, R. Prentice, S. Airhart, S. Goodwin
Reviewed by D.E. Mahan Date 12-21-87

Construction Data		Depth in Feet	Geologic/Hydrologic Data		Drill rate (ft/hr)
Description	Diagram		Diagram Litho.	Lithologic Description	
10" Carbon Steel Casing		130		SLIGHTLY SILTY GRAVELLY SAND	2.6
		135		" " " "	10
		140		" " " "	8.6
		145		SILTY SANDY GRAVEL (Δ at 142')	2.7
8" Carbon Steel Casing		150		" " "	2
		155		" " "	2.2
		160		SILTY GRAVELLY SAND	2.3
bentonite crumbles 200'-2'		165		" " "	5.4
		170		SLIGHTLY GRAVELLY SAND	≤ 1.7
4" stainless steel casing		175		SILTY SANDY GRAVEL	≥ 2.3
		180		" " "	1.8
		185		SILTY GRAVELLY SAND	2.2
centralizers		190		SILTY SANDY GRAVEL	1.6
		195		SLIGHTLY SILTY GRAVELLY SAND	1.4
volclay pellets 206'-200'		200		" " "	8.6
4" stainless steel screen		205		SL. SILTY, SL. GRAVELLY SAND	4
		210		SLIGHTLY SILTY SAND	8.6
DTW 215.8, 8/5/87		215		GRAVELLY SILTY SAND	≥ 8
20/30 silica sand 240'-206'		220		SILTY/SANDY GRAVEL	5
		225		" " "	2.9
10'11" of 8" Stainless		230		SAND	2.1
Steel telescoping screen		235		SANDY GRAVEL (Δ at 233')	1.3
	TD = 240'	240		" "	2.7
				Basalt at ~240'	

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