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Pacific Northwest National Laboratory
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Limited Field Investigation Report for Uranium Contamination in the 300-FF-5 Operable Unit at the 300 Area, Hanford Site, Washington

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November 2007

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

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Pacific Northwest National Laboratory
Richland, Washington 99352

Executive Summary

Additional data needed for development of a *Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA) Phase III Feasibility Study to address a persistent uranium plume in 300 Area groundwater provided the stimulus for the limited field investigation (LFI) described in this report. The focus of the LFI was to determine the location and geochemical nature of the source for the uranium plume. These objectives were accomplished by drilling four new groundwater monitoring wells in the 300-FF-5 Operable Unit (OU) in fiscal year 2006 as defined in the *Operable Unit Limited Field Investigation Plan* (DOE 2006a). Wells 399-3-18 (C4999), 399-3-19 (C5001), 399-3-20 (C5002), and 399-1-23 (C5000) were drilled to characterize the uranium distribution in sediments in the vadose zone and the unconfined aquifer. In addition to uranium, the presence of other contaminants of concern were also evaluated.

Uranium contamination in groundwater beneath the Hanford Site's 300 Area has persisted longer than predicted by modeling that was conducted during the 1990s as part of the initial remedial investigation for the 300-FF-5 Operable Unit. Even though discharge of uranium-bearing effluent to infiltration ponds and trenches ended by the mid-1980s, and removal of contaminated soil from former waste sites was accomplished in the late 1990s, the groundwater plume today continues to occupy a relatively constant area, with concentrations remaining within a fairly fixed range. Because portions of the plume exceed the drinking water standard for uranium (30 µg/L), the U.S. Department of Energy is supporting renewed remedial investigation activities and remedial action feasibility studies. The goal of this renewed effort is to find a remedy that will reduce uranium concentrations in the aquifer such that the aquifer is restored to its maximum beneficial use, i.e., as a potential supplier of drinking water.

To provide the information necessary to proceed with the remedial action feasibility study and possible field treatability tests, a limited field investigation (LFI) has been conducted. The focus of the LFI was to determine the location and mobility characteristics for contaminant uranium that continues to re-supply the groundwater plume. Presumed sources include uranium remaining in the vadose zone and/or sequestered in the aquifer sediments, which interact with the fluctuating groundwater-river water. This information is fundamental for evaluating remedial action alternatives to reduce the concentration of uranium in groundwater to meet regulatory standards. New results provided by the LFI will be used in developing computer simulations of groundwater flow and uranium transport, in designing treatability field tests, and when implementing remedial action decisions.

The four LFI borehole locations were chosen to represent various combinations of proximity to former waste disposal sites, proximity to the Columbia River, and wide ranging hydrogeologic features. Highly detailed descriptions of geologic features encountered during drilling facilitated re-interpretation of descriptions from earlier drilling activities. Extensive analytical work was conducted on sediment samples collected from the continuous core recovered from each borehole, and on water samples collected from the saturated zone at depth discrete intervals during drilling. Hydrologic testing was conducted at multiple depth levels in each borehole to provide data on the ability of the sediment to transmit water. Geophysical logging of the entire borehole was conducted to provide additional details on stratigraphic features, and in an attempt to identify and quantify contaminant uranium concentrations. In addition to uranium, new information was obtained on the unexpected presence of other contaminants of concern (i.e., volatile organic compounds) at depths below those routinely monitored by the existing well network.

The LFI produced abundant new observational data about conditions in the vadose zone and unconfined aquifer that are relevant to uranium contamination in the subsurface environment. The new information developed during the LFI pertains to stratigraphy and hydrologic units; the vertical distribution of uranium in the vadose zone and unconfined aquifer; and the potential usefulness of geophysical logging for mapping contaminant uranium in future boreholes. Principal findings relative to the objectives for the LFI include:

- The sonic drilling method was successfully used to recover abundant cored sections of the coarse, loosely consolidated gravel and sand units comprising the vadose zone and unconfined aquifer beneath the 300 Area. A portion of the core recovered has been archived and is available for future investigations.

- Geologic characterization activities performed during drilling have revealed significant new details on the stratigraphy at these sites. The new information allowed re-interpretation of drilling logs for previously installed wells, followed by a substantial update to the database for the hydrogeologic framework for the 300 Area. This update helps reduce uncertainty in computer simulation of groundwater flow and uranium transport through the aquifer.

- Lower than expected levels of contaminant uranium were encountered in the sediment samples from the vadose zone, and were too low to permit use of spectral gamma geophysical logging in the field to define the vertical distribution of contaminant uranium in boreholes. Because of this, the planned Phase II drilling was canceled, as it depended on using spectral gamma logging to map the distribution of contaminant uranium over a broad area.

- At three of the four borehole locations, there is no distinct evidence from laboratory geochemical analysis of samples collected during drilling and/or geophysical logging of relatively elevated levels of uranium in sediment immediately above the water table. At the fourth location, 399-1-23 (C5000), which is near the most recently active waste disposal site, somewhat elevated levels of uranium are indicated in the lower portion of the vadose zone. Elevated levels of contamination in this "smear zone" near the water table have been postulated as a source region that continues to supply uranium to the groundwater plume.

- Relatively high concentrations of uranium have been estimated for moisture associated with the unsaturated sediment above the water table in two of the four boreholes drilled (399-3-18 and 399-1-23). The estimates are based on the amount of uranium measured in 1:1 water extracts of sediment samples. These results are then adjusted so that they represent the concentrations present in the natural moisture associated with the sediment, as estimated using the lab sample. The implication of high uranium concentrations in vadose zone moisture with regard to re-supply of uranium to the groundwater plume is under investigation.

- Contaminant uranium extracted from aquifer sediment samples was also at relatively low levels and comparable to levels observed in samples from the vadose zone.

- Total uranium concentrations in depth-discrete groundwater samples collected during drilling are generally consistent with concentrations observed in historical groundwater monitoring results.

- The discrete interval groundwater sampling, laboratory geochemical extracts of the sediments, and hydraulic conductivity measurements conducted during drilling confirmed that the groundwater uranium plume is constrained above the Hanford-Ringold contact boundary. These data are consistent with groundwater uranium concentrations obtained from the current 300 Area monitoring well network.

Additional discoveries not directly related to the initial objectives for the LFI include:

- Volatile organic compounds were discovered in many of the groundwater samples collected during drilling. Unexpectedly high concentrations of trichloroethene were encountered in some deep aquifer water samples from two of the boreholes. The samples were obtained from below the saturated Hanford formation in a relatively fine-grained (i.e., less transmissive) subunit within the Ringold Formation.

- Unexpectedly low values for the specific conductance of groundwater samples were measured at one location deep in the unconfined aquifer. The anomalously low values appear to be correlated with the relatively fine-grained subunit in the Ringold Formation, and the significance of this finding is not currently well understood.

This report includes a compilation of all geologic, hydrologic, geochemical, and geophysical data collected. Final monitoring well construction and development activities are described. The report is intended to be a reference document that provides updated descriptions of (a) the hydrogeologic framework for the uranium plume, (b) the vertical distribution of contaminant uranium, and (c) the geochemical features that control the fate and mobility of uranium. The new information provided by the LFI will lead to a refinement of the conceptual site model for uranium contamination in the 300 Area subsurface environment. When combined with the results from treatability tests and an updated conceptual site model, the Phase III Feasibility Study will lead to a future Proposed Plan for remedial action in the 300-FF-5 Operable Unit.

Acknowledgments

The Pacific Northwest National Laboratory (PNNL) performed work to characterize the extent of uranium contamination in the vadose zone and unconfined aquifer within the 300-FF-5 Operable Unit of the Hanford Site, Washington. The successful completion of this project was largely due to an integrated network of PNNL staff from the Remediation and Closure Science Project, the Groundwater Performance Assessment Project, and the Environmental Sciences laboratory who contributed their collective and varied expertise to solve many of the environmental challenges that were part of this characterization effort.

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1.0 Introduction

A limited field investigation (LFI) was undertaken in the Hanford Site 300 Area during 2006 to characterize the distribution and determine the processes that mobilize uranium in the vadose zone and aquifer at the 300 Area (TPA Milestone M-016-68, as updated February 25, 2005).

Detailed information on the geologic, hydrogeologic, and geochemical features that influence the mobility of uranium was collected from four boreholes drilled at four locations within the uranium plume (Figure 1.1). In addition to recovering nearly continuous core for each borehole, water samples were collected and aquifer testing was completed at frequent intervals in the saturated zone. Borehole geophysical logging was conducted to help define stratigraphic features and the presence of uranium originating from former nuclear reactor fuel production activities.

The LFI is part of a *Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA) Phase III Feasibility Study that focuses on the 300 Area uranium groundwater plume. Groundwater beneath the 300 Area is one of three geographic subregions of the 300-FF-5 Operable Unit (OU). Although other contaminants of potential concern (COPC) are present within the 300 Area subregion, only uranium has been deemed of sufficient concern to warrant additional study of remediation alternatives. The discovery of volatile organic carbon contaminants in this study warrants additional characterization beyond the LFI described herein. The results of this LFI will be used in the Phase III Feasibility Study which will lead to a future Proposed Plan for groundwater in the 300-FF-5 OU.

This report summarizes the findings from the LFI including the drilling, sampling, characterization, and well installation activities of this effort and provides a data compilation of those results. The report is intended to compile all available hydrogeologic, geochemical and well construction information obtained during the field investigation and associated groundwater, sediment, and geophysical analyses. Data presented in this report will be combined with previous characterization efforts to produce an integrated conceptual site model that will be documented in a separate report.

English units are used in this report in various locations to describe drilling and well completion and related activities because that is the system of units used by drillers and geologists to measure and report depths and well construction measurements. Metric units are used in other portions of this report. Conversion to metric can be done by multiplying feet by 0.3048 to obtain meters or by multiplying inches by 2.54 to obtain centimeters.

1.1 Regulatory Framework

The LFI was conducted as part of a Phase III Feasibility Study for the 300-FF-5 Operable Unit (OU). The feasibility study is a partial consequence of the first 5-year review (EPA 2001) of the Record of Decision for the OU (EPA 1996). The review found that dissolved uranium plume predictions made during the initial remedial investigation/feasibility study (DOE-RL 1995b, p. 4-22) had not proven to be accurate. Subsequently, the Tri-Parties (U.S. Environmental Protection Agency [EPA], DOE, and Washington Department of Ecology [Ecology]) agreed to a new milestone (M-016-68, as updated February 25, 2005) calling for (a) a document providing updated conceptual models for the 300 Area uranium plume and 618-11 Burial Ground tritium plume, along with descriptions of the characteristics and trends for all previously identified contaminants of potential concern (COPC), (b) an evaluation of

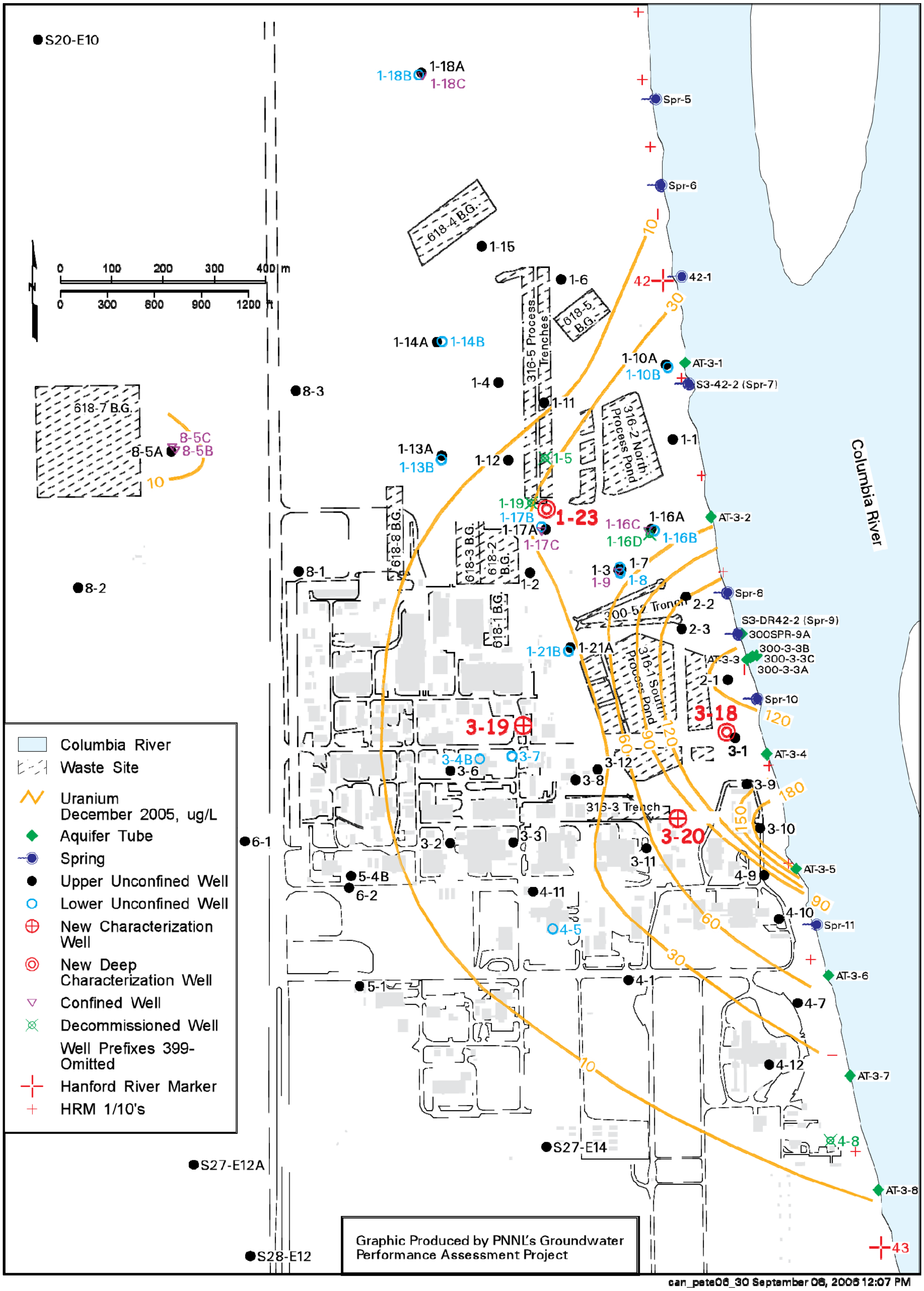

Figure 1.1. Limited Field Investigation Well Location Map – 300-FF-5 Operable Unit, 300 Area

COPCs and updated list of those that should be retained for further evaluation, and (c) a work plan describing the scope and schedule for activities leading to a focused feasibility study report and proposed plan. Two documents were submitted to satisfy this March 31, 2005 milestone:

- Items (a) and (b):
  - *Contaminants of Potential Concern in the 300-FF-5 Operable Unit: Expanded Annual Groundwater Report for FY 2004* (Peterson et al. 2005).

- Item (c):
  - *Work Plan for Phase III Feasibility Study, 300-FF-5 Operable Unit* (DOE 2005b).

- Following release of the Phase III Feasibility Study work plan, a LFI plan was developed and distributed in September 2005. That draft plan was subsequently revised and released in March 2006:
  - *300-FF-5 Operable Unit Limited Field Investigation Plan* (DOE 2006a).

The Record of Decision for the 300-FF-5 OU was developed in the mid-1990s (EPA 1996) and listed the following interim actions for groundwater:

- Continued monitoring of groundwater that is contaminated above health-based levels to make certain that concentrations continue to decrease.

- Institutional controls to make certain that groundwater use is restricted to prevent unacceptable exposures to groundwater contamination.

Although the first 5-year review of the Record of Decision found that these interim actions were still appropriate, it specified the need for additional monitoring and characterization activities. DOE decided to proceed with additional investigation of engineered remedial action alternatives (TPA Milestone M-016-68, Change Control M-016-04-05, August 9, 2004) to reduce the concentration of uranium in groundwater to levels below the U.S. Environmental Protection Agency's (EPA's) maximum contaminant level for drinking water supplies, i.e., 30 µg/L dissolved uranium in an unfiltered water sample.

A second 5-year review of this Record of Decision was conducted during 2006 and resulted in one action item (Action 19-1, due September 2008) that is specific to the 300 Area: "Complete focused feasibility study of 300-FF-5 OU to provide better characterization of the uranium contamination, develop a conceptual model, validate ecological consequences and evaluate treatment alternatives" (DOE 2006c, p. 3.16). The action item was developed in response to a review finding that the current interim remedy was not considered protective of human health or the environment. This LFI report documents the findings of the focused LFI and the data presented will be used in conjunction with all information available to update the conceptual site model for the 300 Area uranium plume. These data will then serve as the basis for the Phase III Feasibility Study and Proposed Plan for the 300-FF-5 OU.

1.2 Persistence of the 300 Area Uranium Plume

The persistence of the uranium plume in groundwater beneath the 300 Area after discharging of uranium-bearing liquid effluent to ground disposal facilities ended in 1985 represents a source of uncertainty as to the factors controlling contaminant migration within the area. Preliminary predictions made during the initial remedial investigation/feasibility study suggested that the plume would dissipate to meet regulatory requirements under natural conditions in 3 to 10 years from late 1993 (DOE 1995b). This contaminant plume dissipation has not occurred. Uranium concentrations in groundwater remain at relatively constant levels, though with distinct seasonal variations in concentration patterns; a portion of the uranium groundwater plume continues to exceed the current government regulatory standard for groundwater (30 µg/L). Several activities and events have occurred since the initial remedial investigation that prompts re-evaluation of the earlier conceptual model used to describe and simulate the uranium plume's behavior, including:

- Cessation of clean water discharge to the 300 Area process trenches (316-5 waste site). This clean water discharge occurred between 1991 and late 1994, and caused dilution of the uranium plume in the vicinity of the trenches. Uranium concentrations rebounded to earlier levels after 1994 (Figure 1.2).

- Unusually high water-table conditions during 1996 and 1997, caused by abnormally high Columbia River discharge. High water-table conditions have been suspected of remobilizing uranium contamination held in the lower vadose zone (Lindberg and Chou 2001, p. 4.12) (Figure 1.3).

- Extensive excavation of liquid waste disposal sites: Excavation of waste sites (process ponds) occurred during the mid-1990s, and backfilling did not occur until early 2004, thus exposing large portions of the 300 Area to potentially higher-than-normal rates of infiltration of moisture, which may have remobilized contamination held in the vadose zone (Figure 1.4).

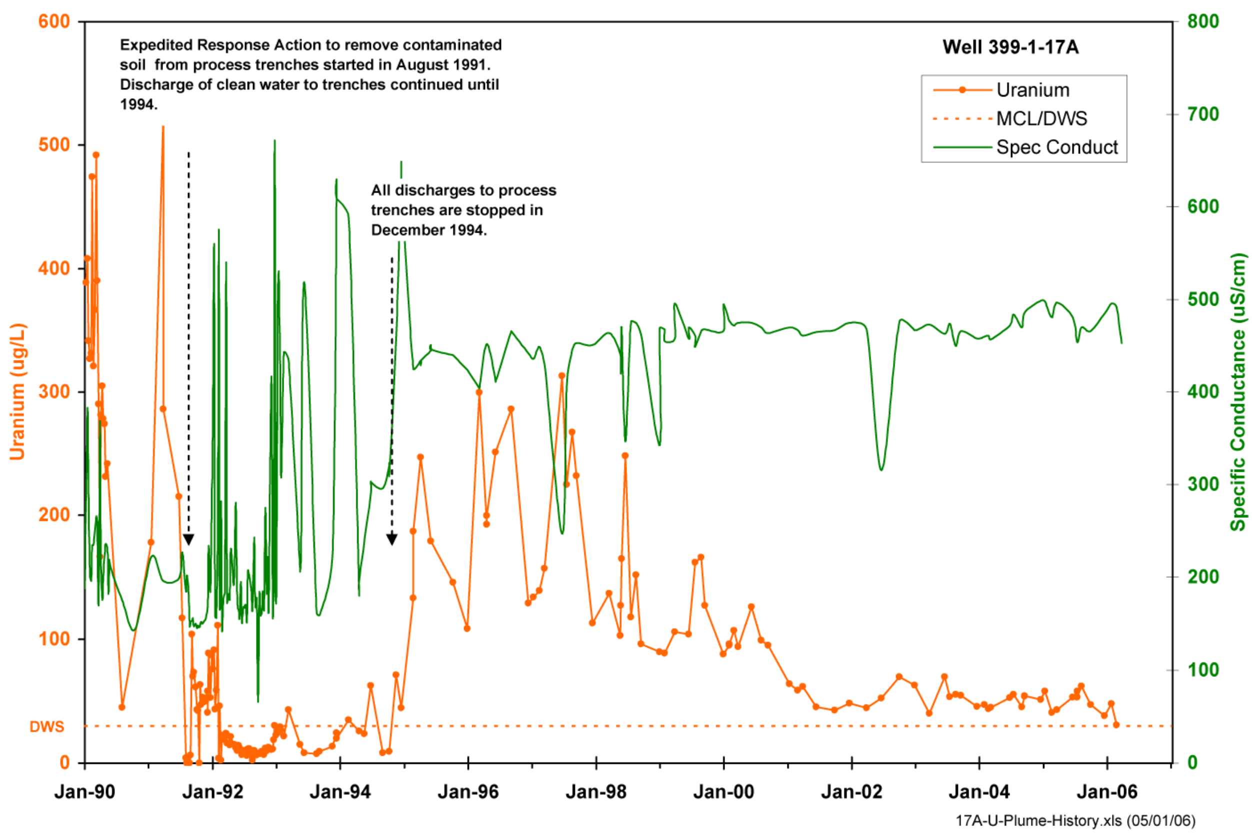

Figure 1.2. Uranium Concentrations at Well 399-1-17A

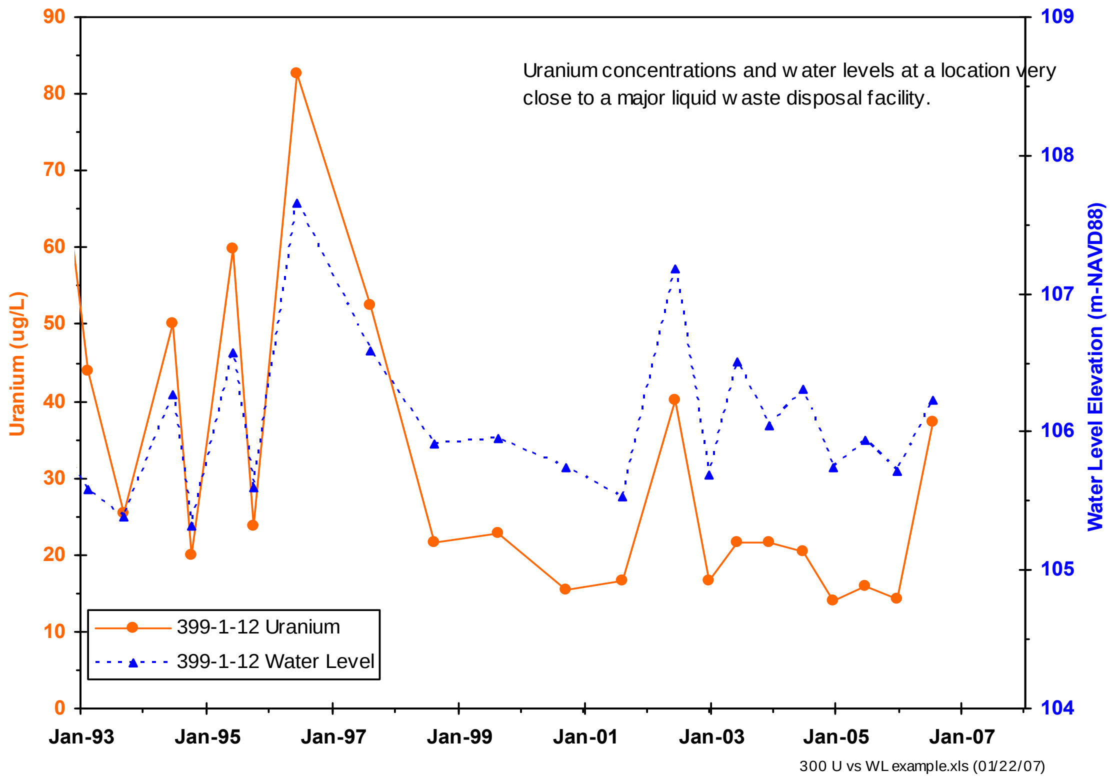

Figure 1.3. Uranium Concentrations and Water-Level Elevations at Wells 399-1-12

Figure 1.4. Open Excavations at the 300 Area

These activities and events may partially explain why the plume has not dissipated as quickly as anticipated during the 1990s, i.e., uranium continues to be supplied to groundwater at locations, and by processes, that are not yet fully understood. Without additional understanding, conducting a meaningful feasibility study to identify and evaluate remedies for the uranium in groundwater is not possible. Therefore, the U.S. Department of Energy (DOE) authorized this LFI to further characterize the distribution and processes that mobilize uranium in the vadose zone and aquifer at the 300 Area (TPA Milestone M-016-68, as updated February 25, 2005).

1.3 Limited Field Investigation Objectives

The LFI included a two-phased drilling, sampling, and test characterization campaign. Phase I utilized cored boreholes to characterize the vadose zone and uppermost aquifer at four representative locations. Phase II was to employ a widely distributed direct-push borehole network to gain access down to the water table for borehole geophysical logging characterization. The objectives for the LFI drilling phases are stated as information needs in the LFI work plan (DOE 2006a) as follows:

Phase I - Characterization Boreholes

- Determine the vertical distribution and concentrations for uranium in the lower vadose zone, the seasonally fluctuating zone between the low and high water table levels, and upper portion of the unconfined aquifer (uranium on aquifer solids and dissolved uranium).
- Evaluate the geochemical characteristics of sediment that influence uranium mobility in the environment (a) near the river, (b) near recently active waste sites, and (c) inland from river influence.
- Determine the hydraulic characteristics of sediment that influence movement of natural moisture, residual waste effluent that remains in the vadose zone and aquifer, and fluids injected as part of remedial action.
- Determine the relationship between spectral gamma logging data and laboratory analytical results for uranium.
- Determine the hydrogeologic framework and obtain subsurface geochemical data to better define preferential pathways for uranium transport along a postulated route(s) from waste site to the river (i.e., evidence for paleochannel).

Phase II - Direct-Push Boreholes

- Determine the vertical distribution of uranium in the vadose zone above the mapped groundwater plume.
- Determine the lateral/areal extent of zones where uranium is elevated in the vadose zone.
- Correlate concentration patterns that appear in the mapped plume with (a) waste sites, (b) proximity to the river, and (c) water-table elevation.

During Phase I drilling of the characterization boreholes, it was determined that the high-resolution geophysical logging could not provide a low enough detection limit of contaminant uranium based on comparisons with laboratory analysis of sediment core samples, so the direct-push campaign, which does not obtain sediment samples and only provides a conduit to lower the high-resolution geophysical logging tools down into the vadose zone, was cancelled.

1.4 LFI Scope of Work: Overview

The characterization boreholes, Phase I, involved drilling four boreholes at locations representative of various hydrogeologic settings and proximity to liquid waste disposal sites. Two of the four boreholes were drilled through the entire unconfined aquifer; the remaining two extended into the upper part of the unconfined aquifer. Continuous core was recovered whenever possible from all four boreholes; water samples were collected at frequent intervals in the saturated zone; hydraulic tests were conducted at multiple intervals; and geophysical logging, including spectral gamma and neutron moisture logging, was completed for all four boreholes.

Select core were retained as archive material. Digital color photographs were taken, and a licensed geologist provided a description of each opened core section. The four boreholes were eventually completed as monitoring wells with screened intervals placed across the water table.

Analyses of sediment sub-samples from the recovered cores were divided into two tiers to accommodate the need for certain results immediately, and for other logistical considerations. As described in the LFI work plan (DOE 2006a), Tier 1 analyses of sediment included (1) moisture content and determination of total uranium concentration using gamma energy analysis (GEA), and (2) measurement of groundwater solution chemistry on the water samples. The uranium data were used to calibrate and confirm the geophysical spectral gamma logging results from the boreholes. Tier 2 analyses included particle-size distribution and solution chemistry of various extracts and leaching solutions from sediment samples. Core material was also made available to other investigators outside of the LFI who are working on various 300 Area research projects involving uranium.

Results from the LFI drilling and sample analysis activities are described in the following sections. These results and interpretations have provided new information and greater detail on existing information that forms the conceptual site model for uranium contamination in the 300 Area subsurface. Other investigations are underway in 2007 that will also contribute to that conceptual site model. These investigations include a drilling and sampling program focused on the discovery during the LFI of volatile organic compounds at depths greater than anticipated, and the DOE's Integrated Field-Scale Challenge initiative, which involves research directed at understanding the transport of uranium through the vadose zone and aquifer.

1.5 Background Information on the 300 Area

An extensive collection of reports is available with information on the 300 Area and its groundwater contamination issues. For readers not already familiar with the history of operations at the 300 Area, its hydrogeologic setting, contaminants of potential concern, and contaminant geochemistry, the reports listed in Table 1.1 are suggested for further information. A brief overview was prepared in 2004 (Peterson et al. 2005, pp. 1.2 to 1.4), from which the following paragraphs are extracted, with updates as appropriate.

Table 1.1. Published 300 Area Reports

History of Operations
Data Compilation Task Report for the Source Investigation of the 300-FF-1 Operable Unit Phase I Remedial Investigation (Young et al. 1990) *Addendum to Data Compilation Task Report for the Source Investigation of the 300-FF-1 Operable Unit Phase I Remedial Investigations* (Young and Fruchter 1991) *Past Practices Technical Characterization Study – 300 Area –Hanford Site* (Gerber 1992) *300-FF-2 Operable Unit Technical Baseline Report* (Deford et al. 1994)
Hydrogeologic Setting
Geohydrology and Groundwater Quality Beneath the 300 Area, Hanford Site, Washington (Lindberg and Bond 1979) *Interim Characterization Report for the 300 Areas Process Trenches* (Schalla et al. 1988) *Phase I Hydrogeologic Summary of the 300-FF-5 Operable Unit, 300 Area* (Swanson et al. 1992)
Sampling and Hydrogeology of the Vadose Zone Beneath 300 Area Process Ponds (Bjornstad 2004)
Contaminants of Potential Concern
Contaminants of Potential Concern in the 300-FF-5 Operable Unit: Expanded Annual Groundwater Report for FY 2004 (Peterson et al. 2005) "300-FF-5 Operable Unit." Chapter 2.12 in *Hanford Site Groundwater Monitoring for Fiscal Year 2005* (Lindberg and Peterson 2006)
Contaminant Geochemistry
The 300 Area Uranium Leach and Adsorption Project (Serne et al. 2002) *Uranium Geochemistry in Vadose Zone and Aquifer Sediments from the 300 Area Uranium Plume* (Zachara 2005)

Facilities in the 300 Area of the Hanford Site were primarily involved with fabrication of nuclear fuel for plutonium production, which included some research and development activities, during the period spanning the startup of Hanford reactors in 1944 through the late 1980s (Young and Fruchter 1991). The range of activities produced a wide variety of waste streams that contained chemical and radiological constituents (Gerber 1992; Deford et al. 1994). Since the early 1990s, extensive remediation of inactive liquid waste disposal sites and solid waste burial grounds has taken place. As of December 2006, most liquid waste disposal sites, which are located in the northern half of the 300 Area, have been excavated, backfilled, and the ground surface contours restored. Some unknown amount of contamination likely remains in the vadose zone beneath the lower extent of the excavated areas. Additional contamination may also remain beneath buildings and facilities in the southern portion of the 300 Area, where decontamination and decommissioning activities are continuing, but where subsurface remedial action has not yet started.

The hydrogeologic intervals impacted by operations in the 300 Area consist of the Pliocene age Ringold Formation consisting of fluvial – lacustrine sediments deposited by the ancestral Columbia River (Lindsay 1995), and the Hanford formation which disconformably overlies an erosional surface in the Ringold Formation created during one or more Pleistocene cataclysmic floods (DOE 2002).

Uranium is the most prominent waste constituent remaining in the environment beneath the 300 Area, and it has persisted in waste sites and groundwater during the years following the shutdown of most fuel fabrication activities and subsequent cessation of liquid effluent disposal to the ground. Uranium in soluble form is of concern for chemical toxicity and radiological exposure. The concentrations in groundwater for chemical toxicity are lower than those associated with radiological dose standards. Specific criteria on the toxicity to freshwater aquatic organisms are not been established, so by default, the criteria for the protection of aquatic organisms are the same as those applied for protection of human health. The EPA's maximum contaminant level for total uranium in groundwater for drinking water supplies is currently 30 µg/L, measured as total uranium in an unfiltered water sample. Additional chemicals of concern present in groundwater beneath the 300 Area include the volatile organic compounds cis-1, 2-dichloroethene, trichloroethene, and tetrachloroethene. Also, groundwater monitoring confirms that tritium, nitrate, technetium-99, and trichloroethene migrate into the 300 Area from upgradient source areas (i.e., from the northwest and southwest).

1.6 Organization of the Report

This report documents: (a) an initial interpretation of the new geologic, hydrologic, and geochemical data obtained thus far; (b) all aspects of the drilling activities completed to date under the LFI (i.e., fulfills the requirement for a borehole completion report); (c) description of and results from analytical work performed on sediment core and water samples; and (d) results of hydrologic testing and geophysical logging. Additionally, selected information from other investigations or monitoring conducted contemporaneously is referenced to better interpret findings from the LFI. A summary and discussion section is included that identifies the major advances made toward an improved conceptual site model for uranium and the remaining uncertainties in achieving a credible technical baseline for evaluating remedial action alternatives for the 300 Area uranium plume.

1.6.1 LFI Phase I – Borehole Drilling

The LFI was divided into two main phases: Phase I - Borehole Drilling has been completed, and the results are provided in this report. The locations of the four new wells are shown on the location map in Figure 1.1. These new groundwater monitoring wells also fulfill requirements of the *Hanford Federal Facility Agreement and Consent Order* (Tri-Party Agreement; Ecology et al. 1989) Milestone M-24-57[1] during FY 2006. The new wells were constructed to the specifications and requirements described in Washington Administrative Code (WAC) 173-160, *300-FF-5 Operable Unit Field Investigation Plan* (DOE 2005) and specifications provided by Fluor Hanford, Inc. (FHI), Richland, Washington. During drilling and construction of the wells, groundwater sampling and analysis activities were conducted to determine the distribution of radiological and chemical contaminants, collect continuous intact sediment core samples for hydrogeologic and geochemical characterization, and perform aquifer testing to determine aquifer flow conditions. Detailed geophysical logging was also performed to determine the distribution of manmade uranium in the subsurface.

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[1] Letter from EJ Murphy-Fitch (Fluor Hanford, Inc., Richland, Washington) to Distribution, *Tentative Agreement on Tri-Party Agreement Negotiations on the Overall Strategy and Approach for Hanford Groundwater Protection, Monitoring, and Remediation (M-024),* dated September 22, 2003.

1.6.2 LFI Phase II – Geophysical Logging

LFI Phase II - Geophysical logging, planned for 15 direct push (DPT) boreholes, was cancelled because sediment concentrations capable of producing the observed persistent uranium plume were at concentrations less than that detectable by geophysical logging and, in lieu of this scope, approval from regulators and DOE was received to perform additional analyses for uranium in sediment core samples collected from the Phase I boreholes.[2] The results from that work are presented in this report. There are currently no plans to perform the LFI - Phase II scope.

1.6.3 Investigation Information and Data

All of the available and relevant information obtained during the LFI is contained in this report. Most of the supporting data and well information is located in the seven appendices at the end of this report.

Each appendix is organized to contain information about specific activities conducted during the LFI.

Appendix A contains the general well installation information such as the Well Summary Sheets, the field geologist's borehole logs, the well construction summary reports, well development and pump installation records, and the well survey results.

Appendix B contains the sediment core information including, core inventory forms, the geologists' core descriptions, photographs of the opened split spoon core, and core chain-of-custody forms.

Appendix C contains the complete geophysical log reports and data.

Appendix D contains the laboratory results of groundwater and sediment analysis and contains grain-size distribution data and metrics determined for whole (bulk) sediment samples from the four boreholes.

Appendix E contains aquifer testing information including selected slug test analysis plots and results.

Appendix F contains supporting information for the groundwater sampling activities which includes the depth-discrete groundwater sample location information and field sampling results, the groundwater sample analysis request reports, and the associated chain of custody forms.

Appendix G contains the drilling contractor's general well construction information including the contractor's borehole daily field activity reports, and the construction surveillance-acceptance report.

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[2] Letter from Mr. Nick Ceto (Program Manager, U.S. Environmental Protection Agency, Region 10) to Matt McCormick (U.S. Department of Energy, Richland, Washington), *Recommendation to Cancel 300-FF-5 Limited Field Investigation Direct Push Technology*, dated November 15, 2006.

2.0 Investigation Study Area

The LFI was completed at the 300 Area within the 300-FF-5 OU. As defined in the LFI work plan (DOE-RL 2006a), four characterization boreholes were drilled to collect subsurface data to define the vertical distribution of the uranium and obtain sediment and water samples for investigating their uranium sequestration and mobility characteristics (location map provided in Figure 2.1). Locations of new boreholes, principal liquid and solid waste sites, existing monitoring wells, and shoreline monitoring sites are shown in Figure 2.1. Criteria used to select locations for these boreholes included (a) within the 300 Area uranium plume as defined by the 10-µg/L contour, (b) proximity to a waste site that likely acted as a relatively recent supplier of uranium to groundwater, (c) one site influenced by river water infiltration, and (d) a second site inland of that influence and upgradient of the source areas. Consideration was given to drilling through former liquid waste disposal sites; however, the increased cost for drilling in potentially contaminated zones would have resulted in drilling at fewer locations. Future investigations are likely to include drilling through the footprints of former waste sites (e.g., DOE's Integrated Field-Scale Challenge initiative).

The first characterization borehole, 399-3-18 (C4999), is located in the central portion of the uranium plume, i.e., the area where concentrations exceed 60 µg/L near the Columbia River. This core area of the uranium plume intersects ~800 meters (2,600 feet) of the Columbia River shoreline and extends ~300 meters (980 feet) inland of the bank; it is generally downgradient of the primary 300 Area liquid waste disposal sources. Well 399-3-18 (C4999) is located ~40 meters (130 feet) west of the riverbank and is adjacent to existing well 399-3-1 (see well location map in Figure 2.1).

This area of relatively high uranium concentrations also coincides with a topographically elevated Hanford/Ringold contact underlain by the erosional remnant of Ringold Formation fine-grained sediment. Drilling at this location was successful in confirming the presence of this fine-grained interval and recovering nearly continuous sediment core from this relatively low-permeability stratigraphic interval. The results will help to evaluate the hydraulic and geochemical influence that these fine-grained sediments have on uranium concentrations in the groundwater. This location also provided sediment core from the saturated to semi-saturated interval near the water table that is influenced by infiltrating Columbia River water.

The location for the second characterization borehole, 399-1-23 (C5000), was based on investigating the presence of a residual uranium source that may be located deep in the vadose zone, i.e., just above the present day water table and near a recently active waste site. Borehole 399-1-23 (C5000) is located near the liquid effluent discharge end of the decommissioned 300 Area process trenches (WIDS 316-5) (see Figure 2.1). Groundwater monitoring results dating back to the 1980s indicate that these trenches were a primary source area for uranium that impacted the aquifer.

The first two boreholes spanned the vadose zone and the entire unconfined aquifer down to the Ringold Formation (Fm) lower mud confining unit, which was contacted between approximately 110 and 126 feet below ground surface (bgs). Thus, a complete vertical section through the upper unconfined aquifer was characterized for uranium and other COPC.

The third borehole, borehole 399-3-19 (C5001), was positioned to investigate the presence of residual uranium within the lower vadose zone and uppermost aquifer in an area that is outside of the plume migration path from the primary 300 Area liquid waste disposal sites (Figure 2.1).

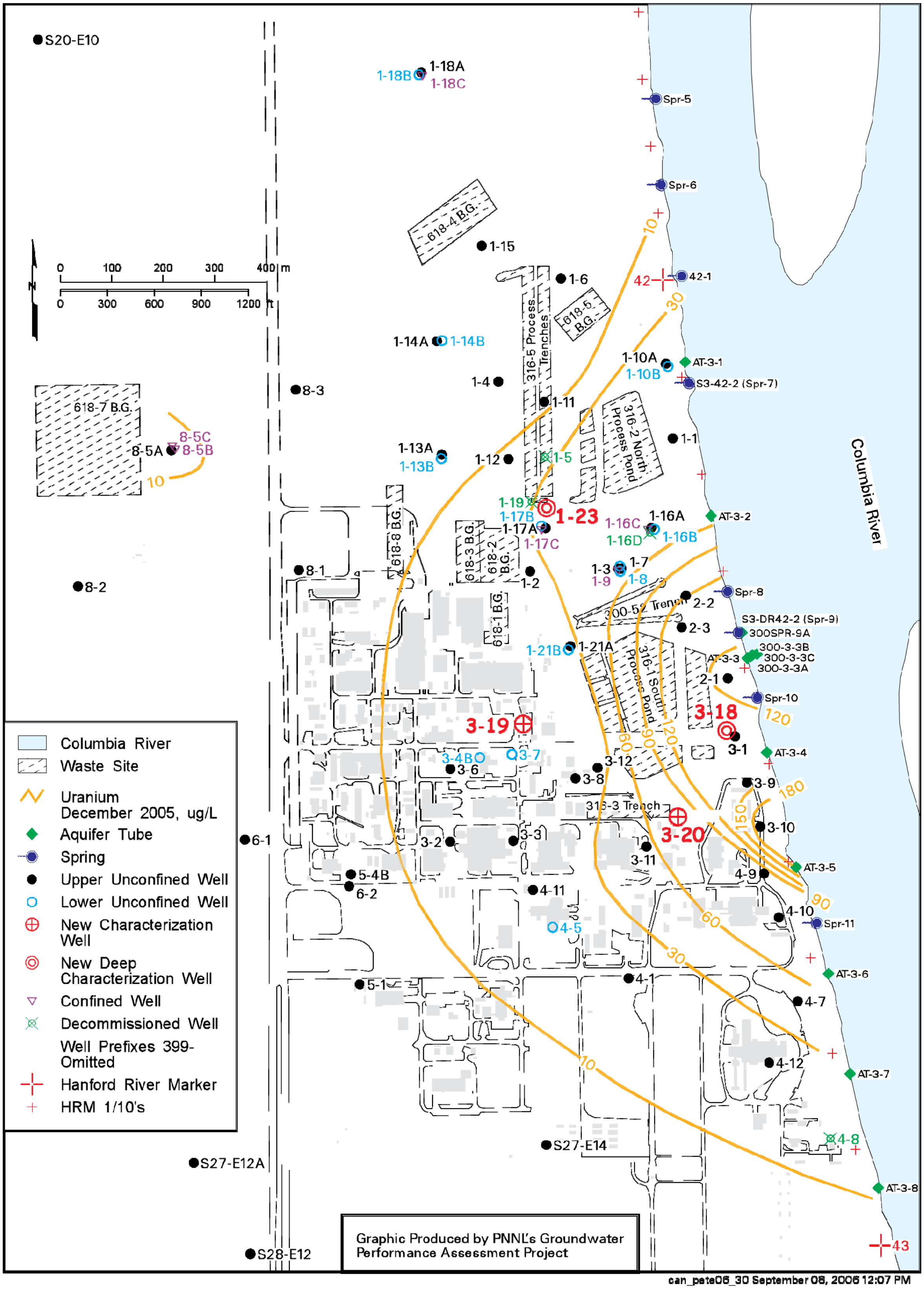


Figure 2.1. Location Map of New LFI Wells and Uranium Groundwater Contaminant Plume

The location is also inland far enough that, under normal river flow conditions, it is not impacted by the infiltration of river water. However, the uranium plume is persistent in this region. This borehole provided access to the vadose zone and upper portion of the unconfined aquifer for the collection of sediment core and depth-discrete water samples and other geohydrologic data. This location also provided data for differentiating the saturated highly permeable Hanford formation sediment from the less permeable Ringold Formation sediment. The presence of Hanford formation sediment is presumed to control contaminant movement within the uppermost aquifer in this area. This well location improves uranium plume monitoring coverage in the area that is upgradient from most sources. Characterization well 399-3-19 (C5001) is located ~150 meters (492 feet) directly west (hydraulically upgradient direction) of the South Process Pond (WIDS 316-1).

The fourth borehole, 399-3-20 (C5002), was drilled at a location immediately southeast (and presumably downgradient) of the 307 disposal trench (WIDS 316-3). The 307 trench is a known uranium source area and the presumed source of a nearby localized uranium hotspot in groundwater (Figure 2.1). This location was chosen to collect vadose and aquifer sediment from the vicinity of this waste site to determine whether residual uranium in the vadose zone sediment is a current contributor of uranium to groundwater.

3.0 Updated Hydrogeologic Conceptual Model

This section updates the hydrogeologic interpretation for the unconfined aquifer system within the LFI study area of the 300 Area based on the new characterization results obtained during the drilling of four new boreholes. This interpretation adds to existing published knowledge and information reported previously by others (e.g., Lindberg and Bond 1979; Schalla et al. 1988; Swanson et al. 1992). Results from sediment sample analyses, geologic core descriptions, depth-discrete groundwater analysis, aquifer hydraulic test analyses, spectral gamma and neutron moisture logging, and well development data from the four wells are correlated to provide an interpretation of the hydrogeologic conditions at each borehole location.

The characterization data obtained from the four boreholes confirm and refine existing hydrogeologic interpretations, and provide new information about the hydrogeology of the 300 Area. This information was used to refine the 300 Area hydrogeologic conceptual models, update contaminant transport models, and support selection of remedial alternatives for uranium contamination in vadose zone sediments and groundwater. The hydrogeologic column for the 300 Area is illustrated in Figure 3.1.

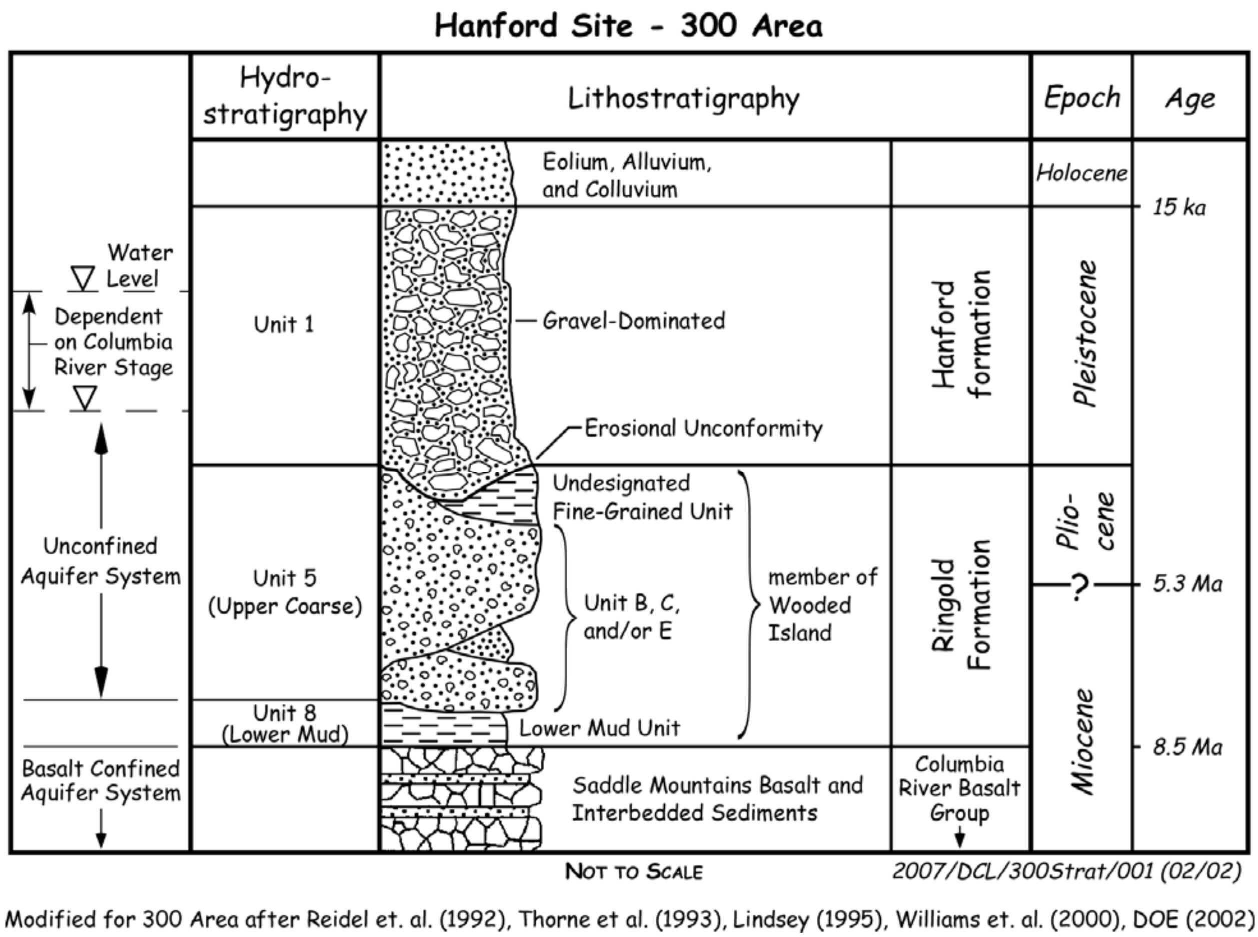


Figure 3.1. Hydrogeologic Column Depicting the Hydrogeology of the 300 Area

This section includes a discussion of the criteria used to evaluate and interpret these new data. Composite borehole logs illustrate the interpreted hydrogeology developed for each borehole (Figures 3.2 to 3.5). An accurate interpretation of the hydrogeology is prerequisite to understanding the nature and extent of contaminant movement within the aquifer system. Section 4 provides the interpretation of the sediment and groundwater hydrochemistry and contaminant results for the four new wells and establishes contaminant pathways as they relate to the hydrogeology of the 300 Area.

3.1 Composite Borehole Logs

A composite borehole log was assembled for each new borehole (Figures 3.2 to 3.5). These interpretive logs utilize multiple data sets and provide a graphic, easy-to-use compilation of pertinent data and a hydrogeologic profile representing each borehole. Stratigraphic contacts, key lithologic intervals, and hydrogeologic units within each borehole are identified based on the interpretation of the available data. Depth-specific data used to construct the composite logs include (1) the well as-built diagram; (2) characterization intervals illustrating the sampling, coring, and aquifer hydraulic testing intervals and frequency; (3) a graphic representation of the borehole lithology based on descriptions of sediment grab samples and core; (4) the uranium concentrations in groundwater and sediment samples along with select organic contaminants; (5) the geophysical and laboratory gamma energy analysis (GEA) uranium data included for comparison; and (6) the geophysical total gamma and moisture log correlations. In addition to these data, a table of depth-discrete aquifer testing results and a summary table containing groundwater sampling information are provided with each composite borehole log.

3.2 Borehole Lithology and Physical Properties

Grab samples collected from the core barrel drive shoe (~6-feet-depth intervals) and from examination of the ends of the 1-foot-long core liners were used to describe the lithology in the boreholes. The field descriptions are recorded on the geologist's borehole log located in Appendix A. A more detailed geologic description of the opened core was also completed (Appendix B), and these descriptions are represented graphically on the composite logs for each well (Figures 3.2 to 3.5). The core data provide visual confirmation of the depths and zonation (changes in lithology) of Hanford and Ringold Formation lithologies and allow a precise lithologic description of individual units and determination of the hydrogeologic contact boundaries and unit thicknesses. The sample quality and formation representativeness of the core samples is generally very good where complete core recovery occurred (see also Section 6.6.1).

3.3 Sediment Core Photographic Log

A digital photograph of each opened sediment core from each well is included in Appendix B. These photos were used to confirm the lithologic descriptions and contacts recorded by the field geologist and to support the overall hydrogeologic interpretation. The interpretative value of these photographs is very good and provides a quick access to, and realistic view of, the borehole sediments. Where possible, key hydrogeologic contact boundaries have been defined on the core photos. The photographic file (Appendix B) provides a qualitative visual record of the cores in their original opened condition. These photos record the original structure, moisture content, and fabric of the cored intervals (i.e., grain size, grain orientation, color, and relative moisture).

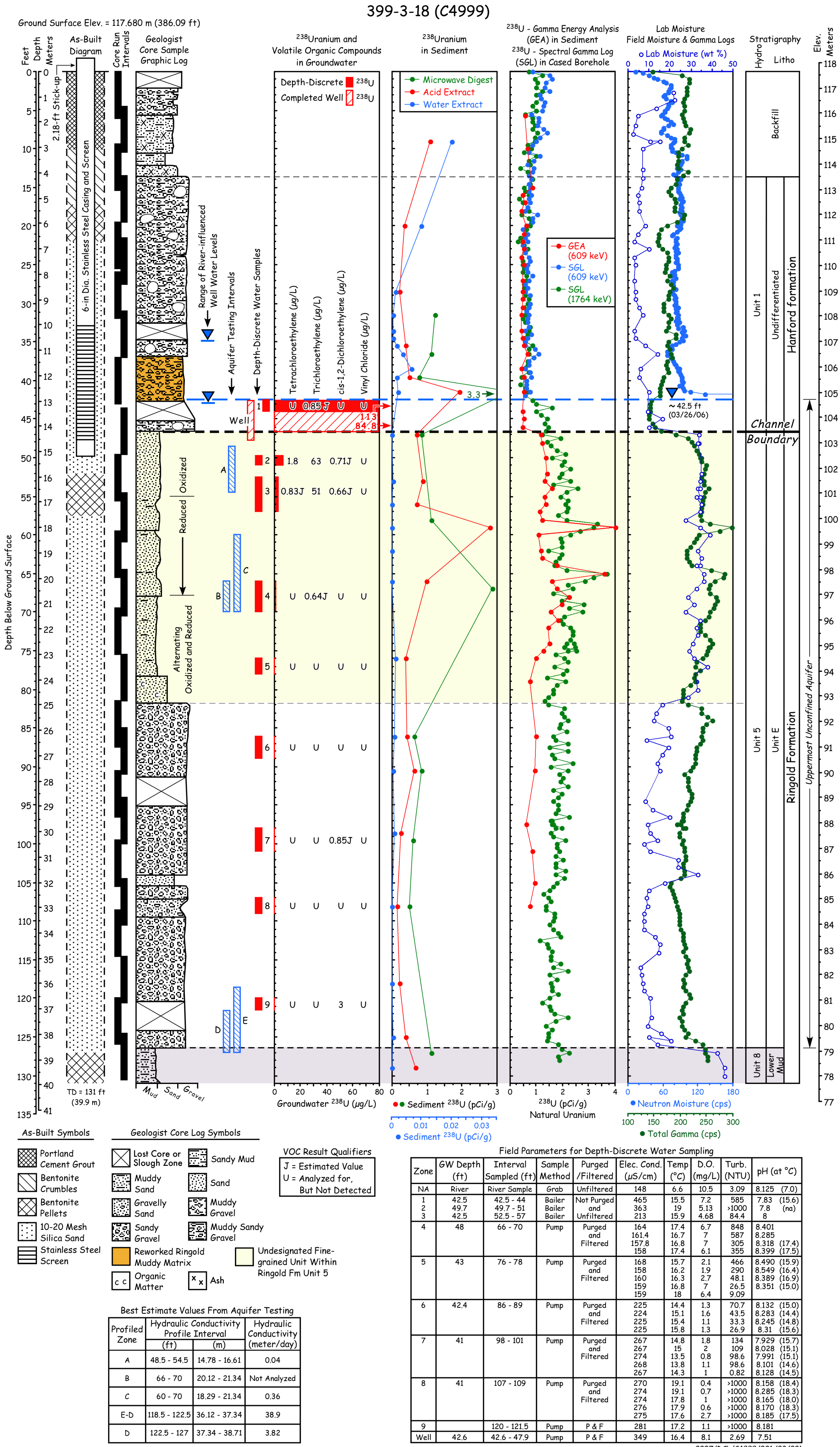
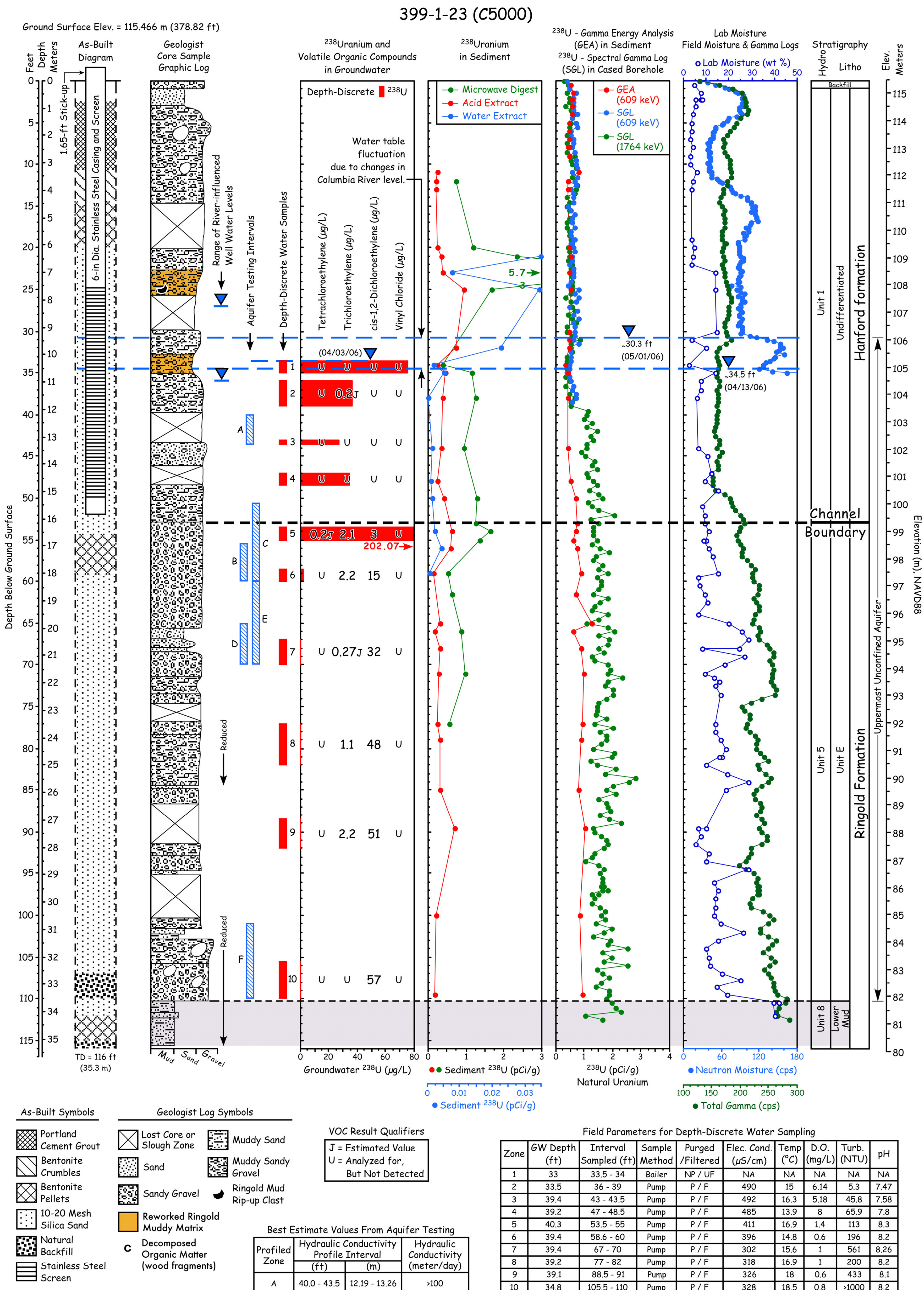


Figure 3.2. Composite Borehole Log for Well 399-3-18 (C4999)



Best Estimate Values From Aquifer Testing

Profiled Zone	Hydraulic Conductivity Profile Interval (ft)	(m)	Hydraulic Conductivity (meter/day)
A	40.0 - 43.5	12.19 - 13.26	>100
C - B	50.6 - 55.2	15.42 - 16.83	1.20
B	55.2 - 60	16.83 - 18.29	1.73
E - D	60 - 65	18.29 - 19.81	0.69
D	65 - 70	19.81 - 21.34	2.16
F	101 - 110	30.78 - 33.53	No Result due to Packer By-Pass

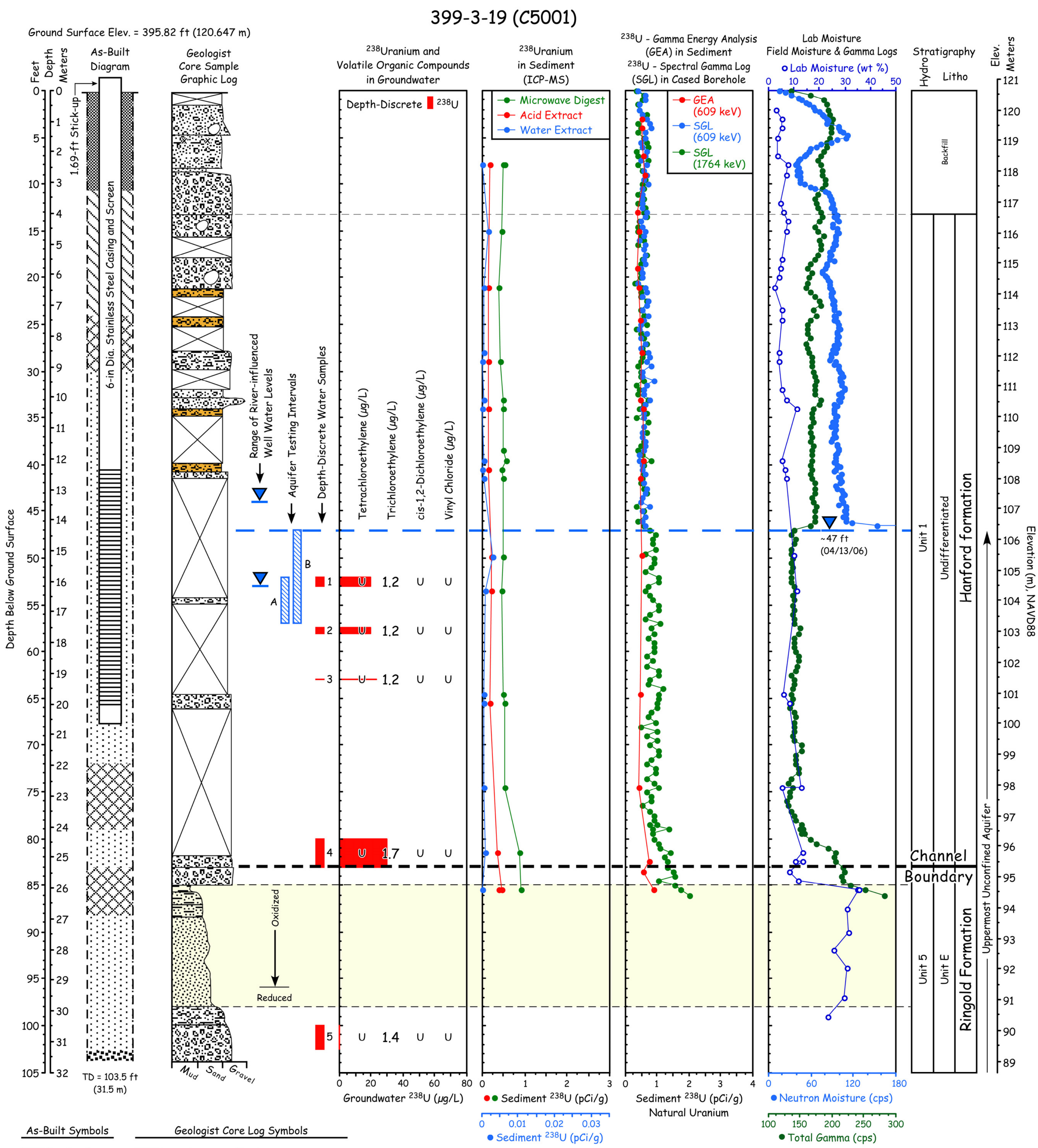
Field Parameters for Depth-Discrete Water Sampling

Zone	GW Depth (ft)	Interval Sampled (ft)	Sample Method	Purged /Filtered	Elec. Cond. (µS/cm)	Temp (°C)	D.O. (mg/L)	Turb. (NTU)	pH
1	33	33.5 - 34	Bailer	NP / UF	NA	NA	NA	NA	NA
2	33.5	36 - 39	Pump	P / F	490	15	6.14	5.3	7.47
3	39.4	43 - 43.5	Pump	P / F	492	16.3	5.18	45.8	7.58
4	39.2	47 - 48.5	Pump	P / F	485	13.9	8	65.9	7.8
5	40.3	53.5 - 55	Pump	P / F	411	16.9	1.4	113	8.3
6	39.4	58.6 - 60	Pump	P / F	396	14.8	0.6	196	8.2
7	39.4	67 - 70	Pump	P / F	302	15.6	1	561	8.26
8	39.2	77 - 82	Pump	P / F	318	16.9	1	200	8.2
9	39.1	88.5 - 91	Pump	P / F	326	18	0.6	433	8.1
10	34.8	105.5 - 110	Pump	P / F	328	18.5	0.8	>1000	8.2

NA = Not Analyzed   NP = Not Purged   P = Purged   UF = Unfiltered   F = Filtered

2007/DCL/C5000/001 (03/22)

Figure 3.3. Composite Borehole Log for Well 399-1-23 (C5000)



As-Built Symbols

- Portland Cement Grout
- Bentonite Crumbles
- Bentonite Pellets
- Silica Sand
- Natural Backfill
- Stainless Steel Screen

Geologist Core Log Symbols

- Lost Core or Slough Zone
- Muddy Sand
- Gravelly Sand
- Muddy Sandy Gravel
- Ash
- Sandy Mud
- Sand
- Muddy Gravelly Sand
- Sandy Gravel
- Reworked Ringold Muddy Matrix

VOC Result Qualifiers

J = Estimated Value
U = Analyzed for, But Not Detected

Undesignated Fine-grained Unit Within Ringold Fm Unit 5

Best Estimate Values From Aquifer Testing

Profiled Zone	Hydraulic Conductivity Profile Interval (ft)	(m)	Hydraulic Conductivity (meter/day)
B - A	47 - 52	14.32 - 15.85	≥ 2,000
A	52 - 57	15.85 - 17.37	2,200

Field Parameters for Depth-Discrete Water Sampling

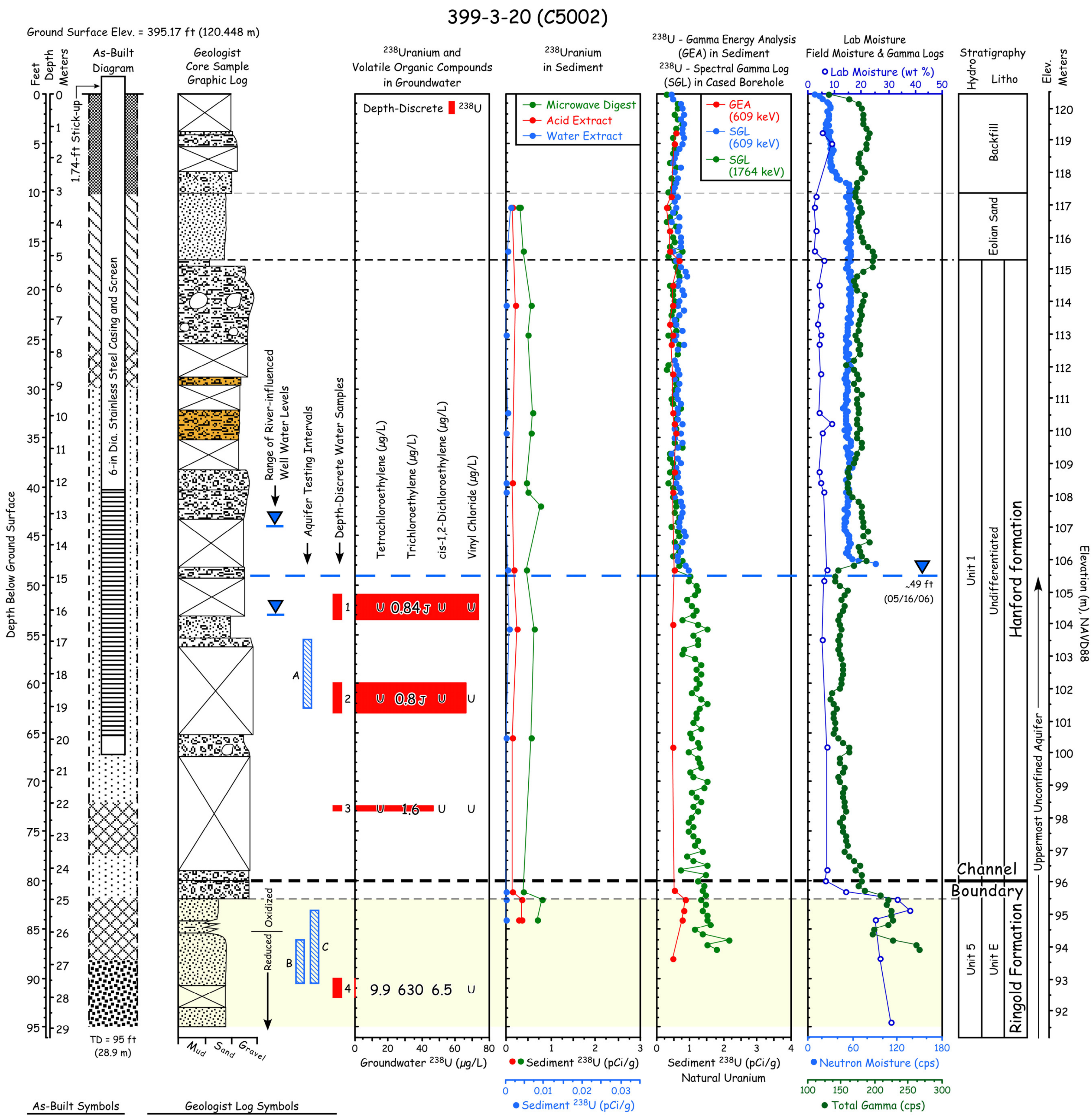
Zone	GW Depth (ft)	Interval Sampled (ft)	Sample Method	Purged /Filtered	Elec. Cond. (µS/cm)	Temp (°C)	D.O. (mg/L)	Turb. (NTU)	pH
1	47.2	52 - 53	Pump	Purged and Filtered	407 404 403 402	20.1 19.1 19.1 19.3	8.4 8.5 8.6 8.6	24.6 15 11.6 9.99	7.24 7.33 7.47 7.43
2	47.1	57.5 - 58	Pump	Purged and Filtered	407 409 411 408	16.3 16.5 16.5 16.2	9 9.4 9.4 9.4	415 43.6 29.1 16	7.56 7.49 7.47 7.6
3	47.4	63	Pump	Purged and Filtered	413 411 413 411	20.4 19.8 19.3 20	8 8.3 8.4 8.1	>1000 598 294 67.4	7.62 7.5 7.49 7.48
4	47.5	80 - 83	Pump	Purged and Filtered	431 426 426 428 422	20.4 19.4 19.9 19.2 20.5	6.9 7.7 7.5 7.7 7.5	>1000 >1000 >1000 639 392	7.57 7.55 7.55 7.56 7.56
5	46.1	100 - 102.5	Pump	Purged and Filtered	345 341 336 332 323 318 318 318	19.8 19.1 19 19 19.4 19 18.7 19.2	1.1 0.6 0.7 0.7 0.6 ND 0.9 0.7	>1000 >1000 >1000 >1000 >1000 528 225 108	7.61 7.44 7.56 7.36 7.52 7.57 7.55 7.54

ND = Not Determined

2007/DCL/C5001/001 (03/22)

Figure 3.4. Composite Borehole Log for Well 399-3-19 (C5001)

399-3-20 (C5002)



As-Built Symbols

- Portland Cement Grout
- Bentonite Crumbles
- Bentonite Pellets
- Silica Sand
- Natural Backfill
- Stainless Steel Screen

Geologist Log Symbols

- Lost Core or Slough Zone
- Sand
- Muddy Sandy Gravel
- Gravel
- Reworked Ringold Muddy Matrix
- Muddy Sand
- Gravelly Sand
- Sandy Gravel
- Ash
- Undesignated Fine-grained Unit Within Ringold Fm Unit 5

VOC Result Qualifiers

J = Estimated Value
U = Analyzed for, But Not Detected

Best Estimate Values From Aquifer Testing

Profiled Zone	Hydraulic Conductivity Profile Interval (ft)	(m)	Hydraulic Conductivity (meter/day)
A	55.5 - 62.5	16.92 - 19.05	>2,000
C - B	83.0 - 86.0	25.30 - 26.21	21.7
B	86.0 - 90.5	26.21 - 27.58	41.2

Field Parameters for Depth-Discrete Water Sampling

Zone	GW Depth (ft)	Interval Sampled (ft)	Sample Method	Purged /Filtered	Elec. Cond. (µS/cm)	Temp (°C)	D.O. (mg/L)	Turb. (NTU)	pH
1	47.7	51 - 53.5	Pump	Purged and Filtered	450 454 454 453	20.1 19.1 19.1 19.3	8.1 8.5 8.9 8.6	62.9 44 25 21.7	7.22 7.25 7.11 7.19
2	47.7	60 - 63	Pump	Purged and Filtered	455 451 448 448 445	19.5 19.3 18.9 19.2 18.9	7.6 7.8 8 8.3 8.5	>1000 >1000 >1000 413 134	7.33 7.36 7.23 7.2 7.28
3	47.6	72.5 - 73.5	Pump	Purged and Filtered	466 463 465 462 463	20.3 21 20.4 20 20	6.6 6.9 7 7.1 7.4	>1000 >1000 >1000 >1000 >1000	7.7 7.55 7.5 7.51 7.51
4	47.6	90 - 92	Pump	Purged and Filtered	285 280 279 276 276	21.2 20.2 20.2 19.6 19.8	0.8 0.7 0.7 1.2 2.1	>1000 832 503 86.7 28.6	7.69 7.88 7.55 7.8 7.84

2007/DCL/C5002/001 (03/22)

Figure 3.5. Composite Borehole Log for Well 399-3-20 (C5002)

3.4 Depth-Discrete Groundwater Results

Groundwater data are used to better understand the relationship between contaminant concentrations, preferential groundwater flow, and aquifer boundaries in order to understand contaminant migration through the aquifer and to aid in developing the conceptual models. In addition to showing contaminant vertical depth distributions within the aquifer, discrete-depth groundwater sample data (see Section 6.6.2 for details on sampling and analysis results) aid in identifying and extrapolating hydrogeologic boundaries between characterization boreholes throughout the study area. Some groundwater flow conditions and variations in natural chemical concentrations were identified. Restrictions to groundwater movement in some zones and infiltration within the unconfined aquifer system were identified based on vertical changes in the field parameters for the groundwater such as specific conductance, dissolved oxygen, pH, and temperature. In addition, the laboratory analytical data results also aided in defining vertical and spatial changes in the distribution of natural groundwater based on the chemical makeup of various constituents. These data are used to interpret which zones within the aquifer are more conducive to external influences or changes on the aquifer system, such as river elevation changes and resultant aquifer interaction, artificial recharge from surface disposal operations, and induced groundwater flow, etc.

The laboratory-measured pH of groundwater samples collected from the four boreholes were similar and ranged from 7.8 to 8.2 (see Table D.1 in Appendix D). The pH measured in the vadose zone sediment pore water, obtained by ultracentrifugation of aliquots of sediment and 1:1 sediment to water extracts (used on many samples that were not ultracentrifuged because of time constraints or for samples that did not contain adequate natural moisture to produce a useful volume), was between 7.2 and 9.0. The higher pH values (pH = ~9) were found in ultracentrifuged sediments from below the water table and can not be attributed to the presence of caustic waste disposed to near-surface facilities. The cause of the slightly elevated pH is not known at this time.

Field pH values for the groundwater obtained during the collection of the depth-discrete water samples ranged from 7.2 to 8.4, a slightly larger range of values than the laboratory measured pH values, perhaps because of more variable temperature conditions in the field, and variable ability to purge the formation being sampled (Figures 3.2 through 3.5).

Specific conductance values measured in groundwater samples from well 399-3-18 (C4999) were lower, relatively, than those measured in groundwater samples from wells 399-1-23 (C5000), 399-3-19 (C5001), and 399-3-20 (C5002) undoubtedly caused by well 399-3-18 (C4999)'s proximity to the Columbia River. Higher specific conductance values in vadose zone sediment pore water samples for the four boreholes were attributed to higher concentrations of dissolved ions in pore water solution (Appendix D, Table D.1).

Alkalinity and calcium concentrations were measured for groundwater samples from the four boreholes, and the calculated calcite saturation index (SI) showed values greater than 0 (between 1.5 and 3.0), which is consistent with calcite-oversaturated conditions in groundwater (Appendix D, Table D.1 and D.3 through D.7). Alkalinity in borehole well 399-3-18 (C4999) groundwater samples was also lower, similar to the specific conductance data compared to those from the other three wells (399-1-23 [C5000], 399-3-19 [C5001], and 399-3-20 [C5002]). Low alkalinity values for groundwater and pore water samples from well 399-3-18 (C4999), collected at depths of 52.5-77.0 and 56-62 feet bgs, respectively, were associated with a fine-grained silty sand unit located at these depths. Finding the lowest groundwater alkalinity in the fine-grained silty sand likely is an indication that dilute river water makes up a greater portion of the water in this lower permeability material; that is, the more saline "inland" groundwater transports towards the Columbia River in the shallower and coarser more highly permeable materials without much mixing with waters in the pores of the lower silty sand sediments. The lowest alkalinity value (94.2 mg/L) of the well 399-1-23 (C5000) groundwater samples was measured at a depth of 68.5 feet bgs, where a thin fine-grained silty sand within the Ringold Formation was encountered. The specific conductance measured during purging prior to collection of the depth-discrete groundwater samples revealed similar values (Appendix F, Table F.1). Well 399-3-18 (C4999) had the lowest measured specific conductance of all the wells, and all of the wells measured decreasing specific conductance with depth. Proximity to the Columbia River and its river stage influences are the cause of the low specific conductance in well 399-3-18 (C4999) and may also partially explain the decrease in specific conductance with depth in all the wells.

There was no significant difference in geochemical data measured in the laboratory at the boundary between the Hanford and Ringold formations for samples from the four boreholes. However, dissolved oxygen, measured in field samples during collection of the depth-discrete groundwater samples, dropped significantly to levels below 2.7 mg/L in the Ringold Formation sediments in all of the wells (Appendix F, Table F.1). The dissolved oxygen data suggest that reducing conditions may predominate in the deeper portion of the unconfined aquifer. This apparent reducing geochemical trend with depth is also supported by the physical appearance (greenish/blue-grayish color) of the sediment samples collected from these deeper portions of the aquifer (Figures 3.2 through 3.5).

Cation and anion analyses were also measured on groundwater and pore water samples from the four boreholes (see Appendix D, Tables D.3 through D.7). After bicarbonate (alkalinity), nitrate and sulfate were found to be the next dominant anions, and the higher concentrations of most of the anions were distributed in the shallower depths of the aquifer. The most dominant cation in both groundwater and pore water from the four boreholes was calcium. This indicated that the waters were oversaturated with respect to calcite, based on calculated calcite saturation index values being consistently larger than zero. Other major cationic elements such as silicon, aluminum, iron, sulfur, magnesium, sodium, potassium and minor amounts of arsenic, lead, and titanium were also found in groundwater samples from the four boreholes. None of the groundwater or vadose zone sediment pore water from the four boreholes showed significant signs of the presence of enriched sodium nitrate waste, which is generally the most ubiquitous chemical species found in Hanford Site process waste.

3.5 Depth-Discrete Aquifer Hydraulic Testing Results

The information provided by multiple, depth-discrete aquifer hydraulic tests (performed in each borehole) allow the determination of groundwater conditions across varying hydrogeologic intervals. These results are used to identify the general permeability distribution of major hydrogeologic units within the aquifer system and to distinguish groundwater flow paths within the subsurface. See Figures 3.2 through 3.5 for the intervals analyzed in each well. A detailed description of the aquifer hydraulic testing performed at each characterization well site, and the associated analytical results are presented in Section 6.6.3. A brief summary of the analytical results for the respective characterization wells is provided in the following paragraphs.

Figure 3.6 shows the vertical depth distribution of hydraulic conductivity determined for the five Ringold Formation depth intervals in well 399-3-18 (C4999). The figure results are based on the test depth interval analysis results presented in Tables 3.1 and 3.2.

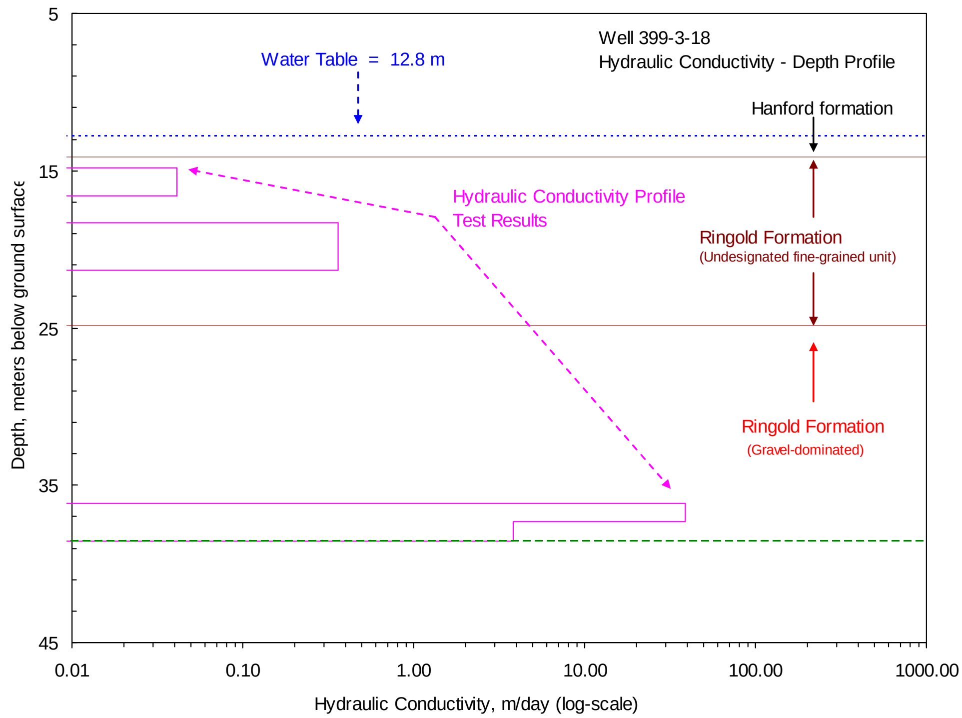


Figure 3.6. Vertical Distribution of Hydraulic Conductivity for Selected Depth Intervals at Well 399-3-18 (C4999), Based on Field Aquifer Hydraulic Test Characterization

Table 3.1. Well 399-3-18 (C4999) Aquifer Hydraulic Test Analysis Results

(Zone) Test Interval (m, bgs)	Type-Curve Analysis Method		Time-History Matching Analysis Method[a]	
	Hydraulic Conductivity, K_h[b] (m/day)	Specific Storage, S_s (m^{-1})	Hydraulic Conductivity, K_h[b] (m/day)	Specific Storage, S_s (m^{-1})
(A) 14.78 - 16.61*	NA	NA	0.04*	5.5E-6[c]
(B) 20.12 - 21.34**	NA	NA	**	**
(C) 18.29 - 21.34*	NA	NA	0.36	3.3E-6[c]
(D) 37.34 – 38.71	3.67 - 3.89 (3.82)	1.0E-5	NA	NA
(E) 36.12 - 38.71	19.0 - 24.2 (21.6)	1.0E-4 - 5.0E-4	NA	NA

Note: Number in parentheses is the average value for all tests.
(a) Standard type-curve analytical method is not completely applicable due to the incomplete test data record and lack of fully recovered test responses. Results based on a superimposed, time-history match of all aquifer hydraulic tests conducted.
(b) Assumed to be uniform within the well-screen test section.
(c) Based on an assign storativity value (S = 1.0E-5).
* = Some of the aquifer hydraulic test data lost during transfer from datalogger system. Response indicates low permeability formation condition. Test analysis based on time-history match.
** = Most of the aquifer hydraulic test data lost during transfer from datalogger system. Response indicates low permeability formation condition. Not enough data available for time-history match analysis.
NA = Not applicable or applied analytical method.

Table 3.2. Well 399-3-18 (C4999) Hydraulic Conductivity Distribution

Profile Interval (m, bgs)	Best Estimate Value: Hydraulic Conductivity, K_h[a] (m/day)	Best Estimate Value: Specific Storage, S_s (m^{-1})	Basis/Comments
14.78 - 16.61	0.04	5.5E-6[b]	Zone A
20.12 - 21.34	-[c]	-[c]	Zone B
18.29 - 21.34	0.36	3.3E-6[b]	Zone C
36.12 - 37.34	38.9	3.0E-4	Zone E - Zone D
37.34 - 38.71	3.82	1.0E-5	Zone D

(a) Assumed to be uniform within the test/depth interval.
(b) Based on an assign storativity value (S = 1.0E-5).
(c) Most of the Zone B aquifer hydraulic test data lost during transfer from datalogger system. Response indicates low permeability formation condition. Not enough data available for quantitative analysis.

As indicated in Table 3.2, hydraulic conductivity for the lower permeability Ringold Formation – fine-grained unit ranged between 0.04 and 0.36 m/day, while the two underlying higher permeability middle Ringold Formation test intervals ranged more widely between 3.82 and 38.9 m/day. Selected analysis figures for the respective test depth zones are presented in Appendix E.

Figure 3.7 shows the vertical depth distribution of hydraulic conductivity determined for the four successful Ringold Formation interval tests and one Hanford formation interval test conducted at well 399-1-23 (C5000).

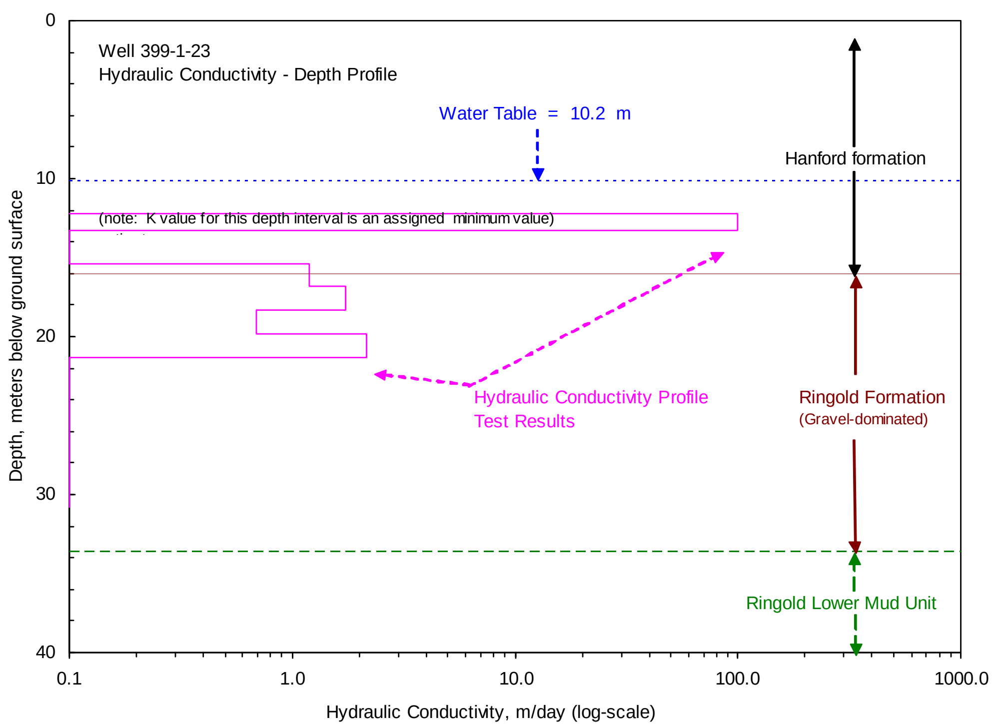


Figure 3.7. Vertical Distribution of Hydraulic Conductivity for Selected Depth Intervals at Well 399-1-23 (C5000), Based on Field Aquifer Hydraulic Test Characterization

Figure 3.7 illustrates the distribution of hydraulic conductivity (K_h) with depth within the various hydrogeologic units. As shown in the figure, the K_h in the Hanford formation is at least two orders of magnitude higher than the K_h within the underlying Ringold Formation sediment. The results are based on the test depth interval analysis results presented in Tables 3.3 and 3.4.

Table 3.3. Well 399-1-23 (C5000) Aquifer Hydraulic Test Analysis Results

(Zone) Test Interval (m bgs)	Type-Curve Analysis Method		High-K Analysis Method[(a)]	
	Hydraulic Conductivity, K_h[(b)] (m/day)	Specific Storage, S_s (m^{-1})	Hydraulic Conductivity, K_h[(b)] (m/day)	Dimensionless Damping Parameter, C_D
(A) 12.19 - 13.26[(c)]	NA	NA	>100[(c)]	-
(B) 16.82 - 18.29	1.60 - 1.86 (1.73)	1.0E-5 - 3.0E-5	NA	NA
(C) 15.42 - 18.29	1.47	1.0E-5	NA	NA
(D) 19.81 - 21.34	2.16	5.0E-5 - 1.0E-4	NA	NA
(E) 18.29 - 21.34	1.43	1.0E-4	NA	NA
(F) 30.78 - 33.53*	NA	NA	NA	NA

Note: Number in parentheses is the average value for all tests.
(a) Standard type-curve analytical method is not valid for aquifer hydraulic tests exhibiting either critically or under-damped behavior. Results based on high K analysis method (Butler and Garnett 2000).
(b) Assumed to be uniform within the well-screen test section.
(c) No quantitative analysis of test is possible, due to pressure probe location during testing. Test response indicates a very high K condition. Value listed should be considered to be an assigned, lowest possible value.
* = All aquifer hydraulic test responses for this zone adversely affected by packer by-pass (leakage).
NA = Not applicable or applied analytical method.

Table 3.4. Well 399-1-23 (C5000) Hydraulic Conductivity Distribution

Profile Interval (m, bgs)	Best Estimate Value		Basis/Comments
	Hydraulic Conductivity, K_h[(a)] (m/day)	Specific Storage, S_s (m^{-1})	
12.19 - 13.26[(b)]	>100	-	Zone A[(b)]
15.42 - 16.83	1.20	2.0E-5	Zone C - Zone B
16.83 - 18.29	1.73	1.0E-5	Zone B
18.29 - 19.81	0.69	7.5E-5	Zone E - Zone D
19.81 - 21.33	2.16	1.0E-4	Zone D
30.78 - 33.53[(c)]	-	-	Zone F[(c)]

(a) Assumed to be uniform within the test/depth interval.
(b) No quantitative analysis of test is possible, due to pressure probe location during test. Test response indicates a very high K condition. Value listed is an assigned, lowest possible value.
(c) All aquifer hydraulic test responses for this zone adversely affected by packer by-pass (leakage).

As indicated in Table 3.4, hydraulic conductivities for Ringold Formation test intervals ranged narrowly between 0.69 and 2.16 m/day, suggesting rather uniform formation conditions with depth at this location. The hydraulic conductivity value for the top depth interval (Zone A), which is reflective of the Hanford formation, represents an assigned value (i.e., ≥100 m/day). As noted in Table 3.3, because of test limitations for this depth interval, no quantitative test analysis for this depth interval was possible, but the test response indicates a high permeability condition. The actual hydraulic conductivity value for this zone, therefore, is likely to be significantly higher than this assigned minimum value. Selected analysis figures for the respective test zones are presented in Appendix E.

There is no vertical depth distribution of hydraulic conductivity figure provided for well 399-3-19 (C5001) because only two test depth-interval characterizations were conducted at this well site. Both test depth intervals were located within the Hanford formation and indicated high-permeability conditions with K_h values >2,000 m/day. The results for test depth interval analysis results are presented in Tables 3.5 and 3.6.

Table 3.5. Well 399-3-19 (C5001) Test/Depth Interval Aquifer Hydraulic Test Analysis Results

Test/Depth Interval	Type-Curve Analysis Method		High-K Analysis Method[b]	
	Hydraulic Conductivity, $K_{h,}$[a] (m/day)	Specific Storage, S_s (m^{-1})	Hydraulic Conductivity, $K_{h,}$[a] (m/day)	Dimensionless Damping Parameter, C_D
Zone A	NA	NA	2,100 - 2,300 (2,200)	0.11
Zone B[c]	NA	NA	≥2,000[c]	-[c]

NA Not applicable or applied analytical method.
Note: Number in parentheses is the average value for all tests.
(a) Assumed to be uniform within the well-screen test section.
(b) Standard type-curve analytical method are not valid for aquifer hydraulic tests exhibiting under-damped behavior.
Results based on High-K analysis method (Butler and Garnett 2000).
(c) No quantitative analysis of test is possible, due to the minor test response and rapid recovery. Test response indicates a very high K condition. Estimate listed should be considered to be an assigned, lowest possible value

Table 3.6. Well 399-3-19 (C5001) Test/Depth Hydraulic Conductivity Distribution

Test/Depth Interval m, bgs	Best Estimate Value		Basis/Comments
	Hydraulic Conductivity, $K_{h,}$[a] (m/day)	Specific Storage, S_s (m^{-1})	
14.32 - 15.85[b]	≥2,000[b]	-	Zone B - Zone A
15.85 -17.37	2,200	-	Zone A

Assumed to be uniform within the test/depth interval.
Value listed is an assigned, lowest possible value.

Figure 3.8 shows the vertical depth distribution of hydraulic conductivity determined for the three depth interval tests for well 399-3-20 (C5002). The results are based on the test depth interval analysis results presented in Tables 3.7 and 3.8. This figure illustrates the distribution of hydraulic conductivity (K_h) within the various hydrogeologic units.

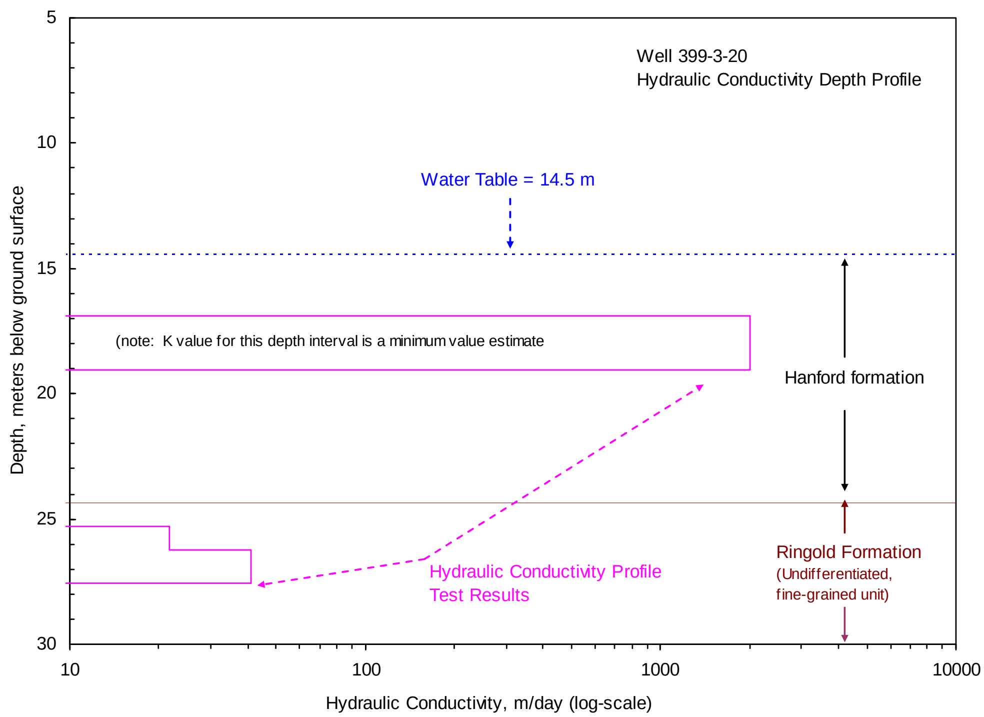


Figure 3.8. Vertical Distribution of Hydraulic Conductivity for Selected Depth Intervals at Well 399-3-20 (C5002), Based on Field Aquifer Hydraulic Test Characterization

Table 3.7. Well 399-3-20 (C5002) Aquifer Hydraulic Test Analysis Results

(Zone) Test Interval (m bgs)	Type-Curve Analysis Method		High-K Analysis Method[a]	
	Hydraulic Conductivity, K_h[b] (m/day)	Specific Storage, S_s (m^{-1})	Hydraulic Conductivity, K_h[b] (m/day)	Dimensionless Damping Parameter, C_D
(A) 16.92 - 19.05	NA	NA	≥2,000[c]	0.06
(B) 26.21 – 27.58	NA	NA	41.2	1.5
(C) 25.30 – 27.58	NA	NA	33.4	1.5

(a) Standard type-curve analytical method is not valid for aquifer hydraulic tests exhibiting either critically or under-damped behavior. Results based on High-K analysis method (Butler and Garnett 2000).
(b) Assumed to be uniform within the well-screen test section.
(c) Analysis of Zone A aquifer hydraulic tests provided non-consistent results all with K values >2,000 m/day. Test responses indicate a very high K condition. Value listed should be considered to be an assigned, lowest possible value.
NA = Not applicable or applied analytical method.

Table 3.8. Well 399-3-20 (C5002) Hydraulic Conductivity Distribution

Profile Interval (m, bgs)	Best Estimate Value		Basis/Comments
	Hydraulic Conductivity, K_h[(a)] (m/day)	Specific Storage, S_s (m^{-1})	
16.92 - 19.05	≥2,000	-	Zone A
25.30 – 26.21	21.7	-	Zone C - Zone B
26.21 – 27.58	41.2	-	Zone B
(a) Assumed to be uniform within the test/depth interval.			

As indicated in Table 3.6, a hydraulic conductivity for the Hanford formation test interval is assigned as ≥2,000 m/day. This assigned value is a result of a lack of uniformity of analysis results for tests conducted for this depth interval. This represents a minimum estimate and interval conditions may be significantly higher (i.e., by a factor of 2 or 3 greater) than this assigned value. Hydraulic conductivity values for the underlying two Ringold Formation depth intervals ranged between 21.7 and 41.2 m/day (Table 3.6). Selected analysis figures for the respective test zones are presented in Appendix E.

Overall, the K_h distribution in the four wells show a very high permeability condition for the Hanford formation gravel-dominated facies compared to a very low-to-moderate permeability within the various Ringold Formation sediments. These data indicate that groundwater and associated dissolved or suspended contamination can be displaced very quickly and moves laterally more rapidly within the Hanford formation in comparison to groundwater within the underlying Ringold Formation. It also suggests that contaminants migrating into the unconfined aquifer from the overlying vadose zone likely would be removed from the aquifer system more rapidly through this more permeable unit and are less likely to migrate deeper into the Ringold Formation portion of the aquifer even though the saturated portion of the Hanford formation is much thinner than the saturated Ringold Formation.

3.6 Spectral Gamma and Neutron Moisture Logging

The geophysical spectral gamma log data are used qualitatively to refine the lithologic/hydrogeologic interpretations. The inflections recorded on the geophysical logs were used to corroborate and precisely define changes in lithology, i.e., sand versus silt/clay or gravel intervals, to more precisely locate contact boundaries, the water table, and gamma emitting contaminants. The composite logs (Figures 3.2 through 3.5) provide the geophysical log correlations relevant to the hydrogeologic interpretation at each bore-hole. Based on interpretations by Stoller Inc., there were no manmade gamma-emitting contaminants detected above the minimum detectable level (MDL) in these wells. The detailed geophysical reports are presented in Appendix C. Section 6.6.4 also provides details of the geophysical well logging process.

3.7 Subsurface Characterization

The entire uppermost unconfined aquifer system was characterized in detail in new wells 399-3-18 (C4999) and 399-1-23 (C5000). The variable thickness of the permeable Hanford formation, which disconformably overlies the older and less permeable Ringold Formation sediments, was accurately defined in all four wells. The distinct lithologic contrast across the Hanford – Ringold erosional boundary was documented and verified via core samples (e.g., Figure 3.9).

Figure 3.9. Core Photograph Showing the Hanford Formation - Ringold Formation Contact Boundary in Well 399-3-18 (C4999)

The lower confining unit (Ringold Lower Mud Unit 8) was also defined, and samples were collected in core obtained across the contact between the Unit 8 and the overlying Ringold Formation Unit 5 (e.g., Figure 3.10). Based on these results, the uppermost unconfined aquifer system, defined as the saturated interval from the water table to the top of the Ringold Formation lower mud unit (Unit 8), ranges from approximately 23 meters (75 feet) to 27.4 meters (90 feet) thick depending on the water-table elevation recorded in each well, which constantly changes due to changes in river level. Drilling in the two deep wells terminated in the Ringold lower mud unit, and no new information was obtained below those depths.

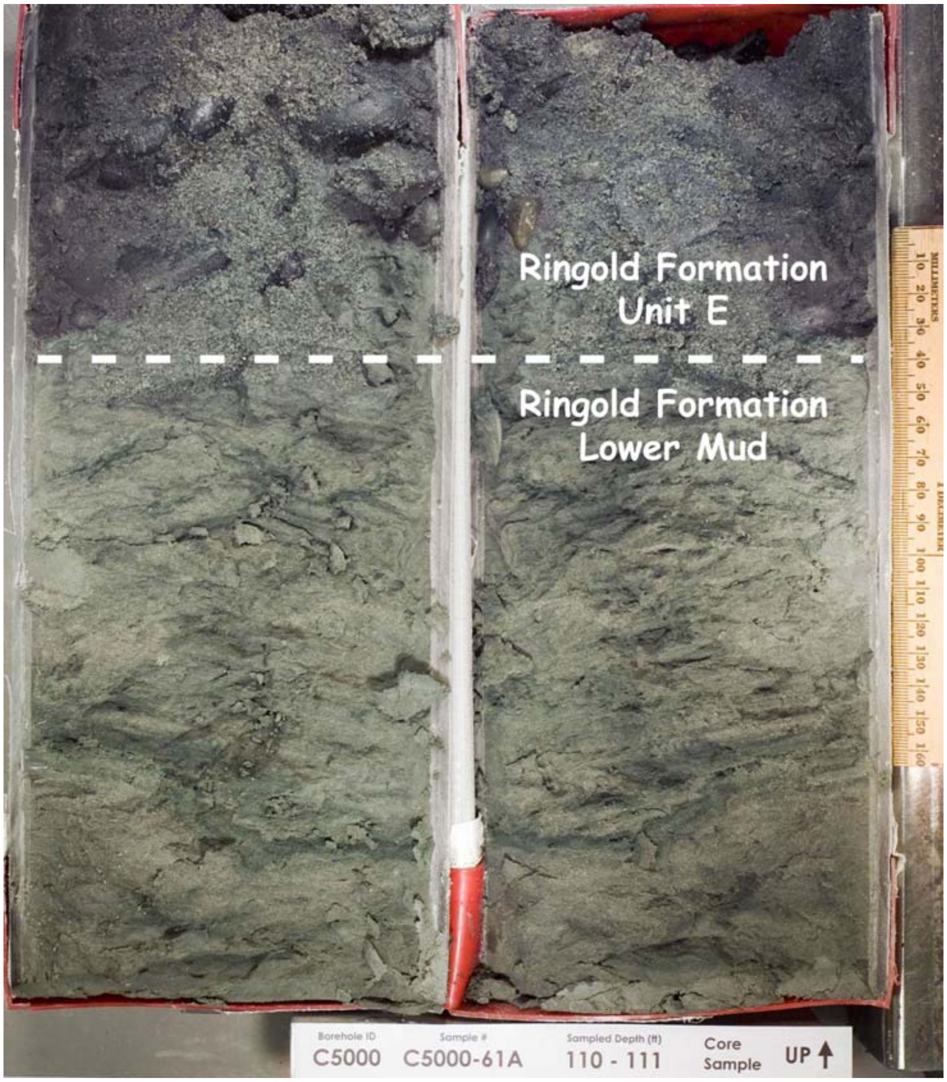


Figure 3.10. Core Photograph Showing the Ringold Formation Unit 5 and Unit 8 Contact Boundary in Well 399-1-23 (C5000)

Depth-discrete hydraulic flow parameters and groundwater results were compared to depth-equivalent lithologic intervals and used to differentiate preferential flow paths within the unconfined aquifer system. Three primary hydrologic units or flow zones were identified within the unconfined aquifer system in this area (Figure 3.11): (1) the highly-transmissive Hanford formation gravel-dominated facies as the uppermost hydrologic unit, (2) a less-transmissive sandy unit (Ringold Formation undesignated fine-grained unit) in the middle, and (3) a moderately transmissive silty, sandy, gravel sequence (Ringold Formation Unit E) in the lower portion. The bottom of the unconfined aquifer is at the contact between the base of Ringold Formation Unit E (Unit 5) and the underlying aquitard, the Ringold lower mud (Unit 8).

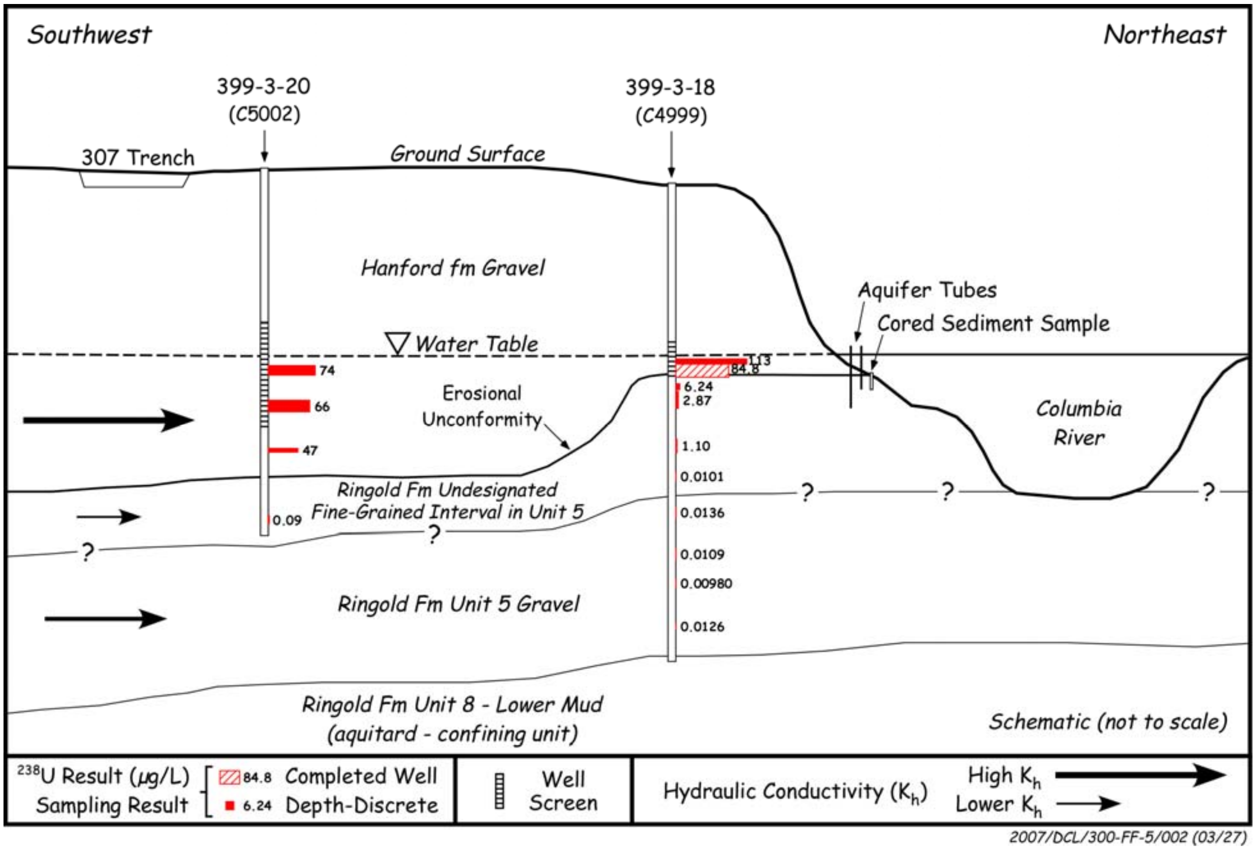


Figure 3.11. Schematic Cross Section Trending Southwest to Northeast Illustrating the Three Primary Hydrologic Units within the Unconfined Aquifer, 300-FF-5 Operable Unit

Combining the sediment core descriptions with the aquifer testing results facilitated the subdivision of the aquifer into mapable hydrogeologic units based on varying hydraulic properties (Figure 3.11). The hydraulic conductivity data and the well development information confirm that the Hanford formation Unit 1 gravel-dominated facies is significantly more permeable then the underlying, older Ringold Formation Unit 5 sediments. The Ringold Formation sediment is more compacted, variably cemented, and geochemically altered resulting in a lower overall permeability. The measured Hanford formation hydraulic conductivity ranges greater than 2,000 meters per day compared to a measured high value in the Ringold Formation of only 41.2 meters per day.

The Hanford/Ringold contact, which lies below the water table in most of the LFI study area, reflects an erosional paleo-surface believed to have been created by Pleistocene ice age catastrophic flooding across the area. The contrast in permeabilities across this Hanford/Ringold contact creates an effective groundwater flow boundary (e.g., Figure 3.9). Where saturated, the more permeable Hanford formation gravel-dominated facies, deposited directly onto this eroded Ringold surface, creates a preferential groundwater flow path that only exists within the very uppermost portion of the unconfined aquifer system. Characterization data used to define the contact include changes noted by the driller and in the wellsite geologist borehole log, sediment core descriptions, the borehole geophysical logs, and the integrated depth-discrete aquifer hydraulic testing and groundwater sample results. These data have been correlated and used to support the reinterpretation of the Hanford/Ringold contact (top of Ringold Formation) in the existing well records and to update and revise the relief map of the top of the Ringold Formation for the 300 Area (Figure 3.12).

The revised relief map confirms a major topographic trough, or channel, eroded into the Ringold Formation that trends northwest to southeast across the 300 study area. This northwest-southeast trending channel is paralleled by a Ringold Formation high, erosional remnant ridge on the east side of the study area near the river. The subsurface topographic relief across the channel-ridge area ranges up to ~14 meters. This prominent Hanford filled Ringold channel was first discovered in an excavated trench in 1958 (Figure 3.13) during installation of a water supply pipeline for serving the Plutonium Recycle Test Reactor (Lindberg and Bond 1979). This channel, and others like it, is eroded into the underlying Ringold Formation and filled with more permeable Hanford formation gravel-dominated sediments. These highly permeable channel deposits provide pathways for groundwater contaminants to migrate more rapidly and to discharge ultimately to the Columbia River. This channel and other features of the subsurface are conceptually illustrated using the new borehole data in hydrogeologic cross sections (Figure 3.14). Figures 3.15 to 3.17 illustrate the revised hydrogeology perpendicular and parallel to the Columbia River, including the well locations, the primary hydrogeologic units and the vertical distribution and extent of uranium contamination in the unconfined aquifer system.

Within the Ringold Formation, new subsurface data have lead to the discovery of a locally continuous and thick fine-grained silty sand interval near the top of the Ringold Formation in the LFI study area. These new data suggest that prior to the post-Ringold erosional episode, a fairly extensive Ringold fine-grained interval (as yet undesignated) was present across portions of the 300 Area. This is based on a relatively thick (~12 to 35 feet), well sorted, fine-grained sand and silt interval that was characterized in three of the four boreholes (Figures 3.2 through 3.5). In addition, a review of older existing well data and geophysical logs suggests that this fine-grained interval is present and more widespread then previously thought. Preliminary mapping indicates that portions of or the entire fine-grained unit may have been removed in some deeply eroded areas. These areas could be misinterpreted as non-depositional areas giving the appearance that the fine-grained unit is not as continuous as we now believe.

To investigate the lateral extent of this fine-grained unit, additional sediment sampling and coring was completed by the Remediation Task of the Science and Technology Project (S&T Project). Sediment sampling at an underwater outcrop located offshore in the Columbia River, and from two core locations at the shoreline recovered fine-grained sand and silt samples very similar to the fine-grained sediment cored in the new wells (Figure 3.18). The addition of the river and shoreline core samples supports the hypothesis that this fine-grained unit is relatively continuous, extending out beneath the river (Figure 3.15). River shore aquifer tube water sample results also suggest a vertical hydraulic barrier to groundwater movement through or across this fine-grained interval. Hydraulic conductivity measurements (0.04 and 0.36 meters per day) from well 399-3-18 (C4999) across this fine-grained interval indicate that this zone has very low permeability compared to shallower Hanford formation and deeper Ringold Formation sediments. Additional work is needed to confirm the extent and significance of this unit to groundwater and contaminant flow within the 300 Area.

Finally, geophysical log data were used to confirm and precisely determine contact depths and identify changes in lithology. Together, the integrated data sets represented in the composite logs provide accurate and comprehensive interpretations of the hydrogeology of the area.

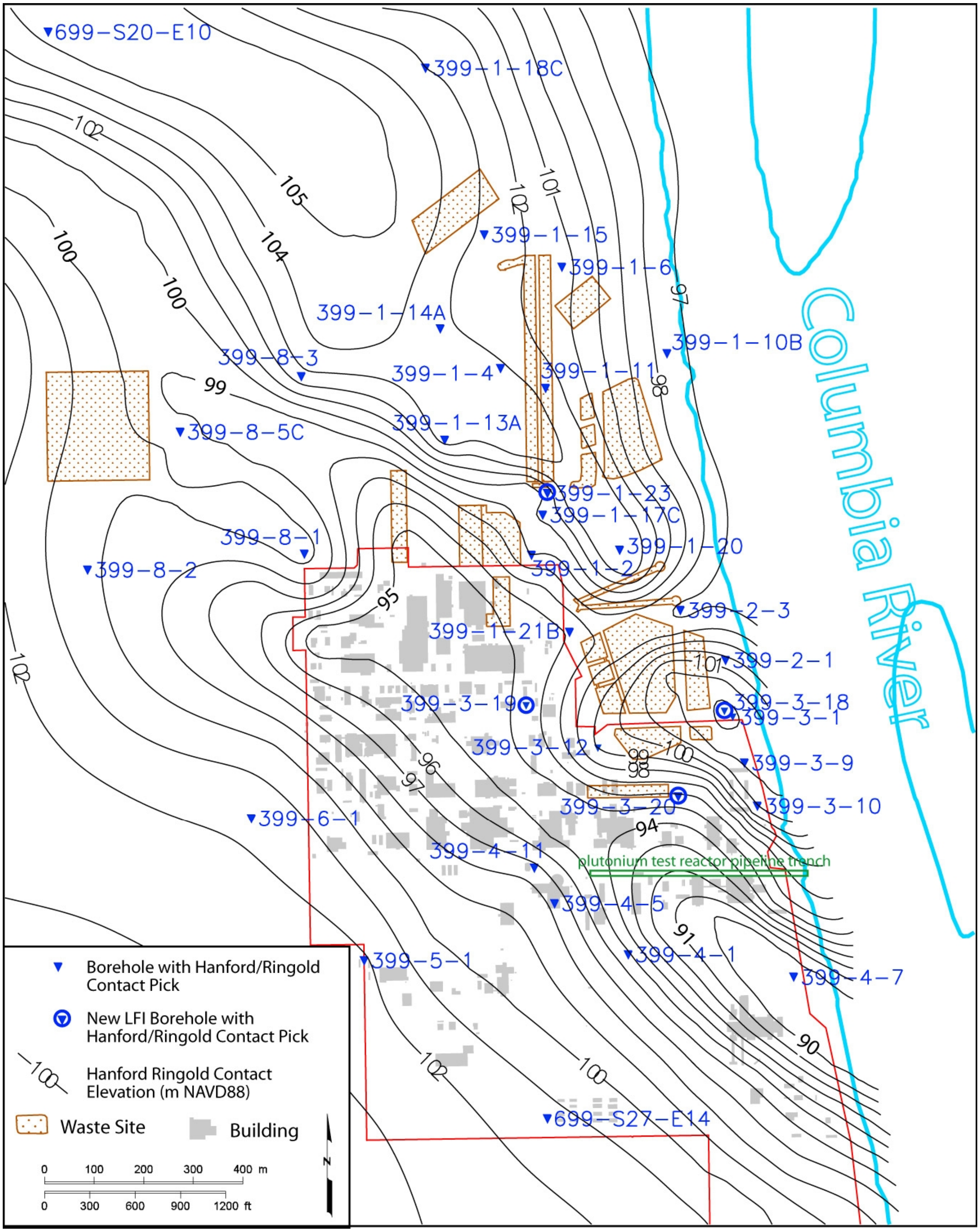


Figure 3.12. Elevation Contour (Relief) Map of the Hanford/Ringold Contact Boundary, 300-FF-5 Operable Unit

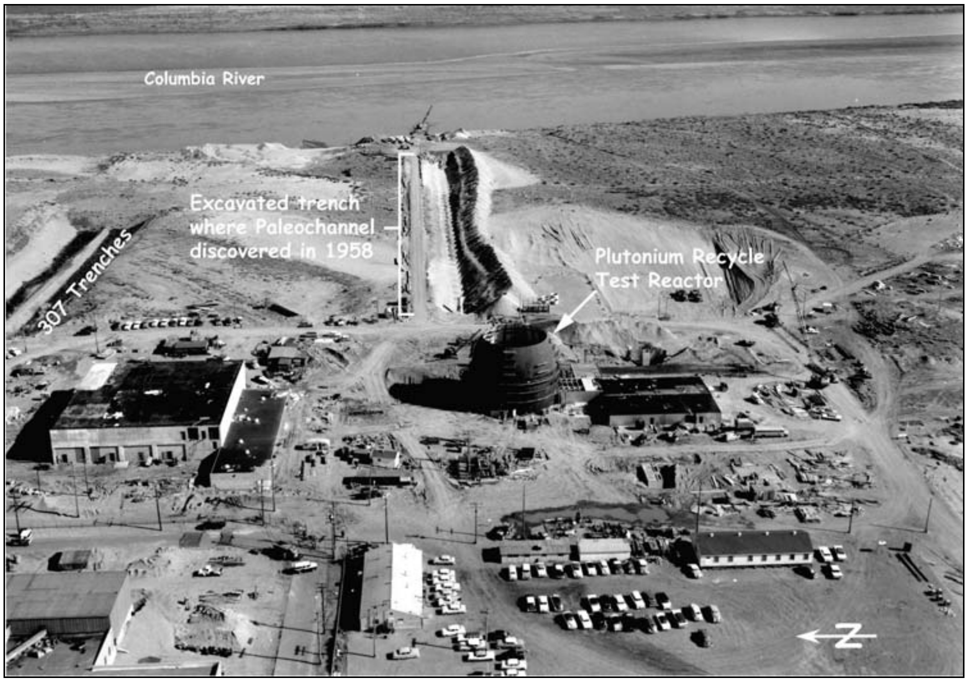


Figure 3.13. Aerial Photograph (1958) Showing the 300 Area Under Construction. Visible in this photograph are the 307 trenches and excavated plutonium recycle test reactor pipeline trench.

Hydrogeologic units (Figure 3.1) encountered in the boreholes, from youngest (shallowest) to oldest (deepest) as illustrated in the composite borehole logs (Figures 3.2 to 3.5) include:

1. Recent surficial sediments (Holocene) and/or backfill material composed of reworked Hanford sandy gravel and eolian silt and sand deposits, or coal plant ash waste. These deposits overlie the area and range in thickness from 0.3 meter (1 foot) up to approximately 5.2 meters (17 feet) bgs in the new wells.

2. Hanford formation Unit 1 gravel-dominated sediments comprise the rest of the vadose zone and the upper, most permeable portion of the unconfined aquifer in all the new wells. This unit is composed of unconsolidated sediment ranging in grain size from boulder to pebble gravel and includes coarse to fine sand with minor amounts of silt. Most often, these sediments exhibit a clast-support structure; matrix between clasts is normally a poorly sorted mixture of sand and silt. Occasionally, matrix is missing, which produces an open-framework fabric (Figure 3.19). There were no distinguishable or mapable hydrogeologic changes within the vadose zone between these wells, but there are isolated occurrences of older, reworked Ringold Formation sediment distinguished by their more cohesive sediment structure, color and/or degree of sorting (Figure 3.20). These Ringold Formation sediments may also contain zones with higher clay/silt content. There are also zones where reworked Ringold Formation mud was deposited along with the Hanford formation cataclysmic flood gravel (Bjornstad 2004). Large boulder-size clasts of consolidated, cohesive Ringold Formation clay/silt were observed as rip-up clasts and lenses within the Hanford formation in the 300 Area (see Bjornstad 2004). These Ringold Formation sediments, randomly deposited, may create localized restrictions to the vertical movement of liquid and moisture in the vadose zone. Overall, Unit 1 ranges in thickness from ~9.8 meters (32 feet) in well 399-3-18

(C4999) to ~21.3 meters (70 feet) in well 399-3-19 (C5001). The saturated portion of Unit 1 ranges in thickness from ~1 meter (3 feet) in well 399-3-18 (C4999) near the river to ~10.7 meters (35 feet) thick in the paleo-erosional channel encountered in well 399-3-19 (C5001). These saturated thicknesses decrease and increase depending on river induced changes occurring at the water table.

3. Ringold Formation Unit 5 (Figure 3.1) unconformably underlies the Hanford formation Unit 1 and is composed predominantly of (a) a fluvial fine-grained silt to sand interval, and (b) a fluvial gravel to silty sandy gravel unit (DOE 2006a). The fine-grained silt to sand interval (undesignated) (Figure 3.1) was confirmed by coring in three of the four boreholes and overlies the variably indurated, fluvial silty sandy gravel Ringold Formation Unit 5 sequence (Figure 3.1). The fine-grained interval was encountered (Figures 3.2 to 3.5) near the Hanford/Ringold contact and ranges in thickness from ~0 meters in well 399-1-23 (C5000) to ~11 meters (36 feet) in well 399-3-18 (C4999). The fluvial gravel facies ranges in thickness from ~13.4 meters (44 feet) in well 399-3-18 (C4999) to ~17.4 meters (57 feet) in well 399-1-23 (C5000). Combined, these two units comprise the lower, and significantly less permeable, portion of the unconfined aquifer beneath the 300-FF-5 OU. The contact with the overlying Hanford formation is determined based on a distinct change in basalt content, color, decreasing grain size and better sorting in the Ringold sediments (Appendix B). This interpretation is also supported by changes in the hydraulic properties exhibited by aquifer tests conducted in the two formations and increasing total gamma activity (e.g., increases in natural potassium-40).

4. Ringold Formation Unit 8 (lower mud unit) underlies the Ringold Formation Unit 5 and forms the lower boundary of the unconfined aquifer system (Figure 3.1). This confining unit separates the basalt confined aquifer system from the overlying unconfined aquifer system. The lower mud unit is comprised of silty clay to silty sand and forms a sharp well defined contact boundary with the overlying Unit 5 fluvial gravel (Figure 3.10). Only two of the four wells, 399-3-18 (C4999) and 399-1-23 (C5000) (Figures 3.2 to 3.5), were drilled deep enough to encounter the lower mud unit; there are several older existing wells that have penetrated or tagged this interval. The two wells were drilled approximately 1.5 meters (5 feet) into the top of this unit to confirm the boundary and collect intact core samples.

5. Ice Harbor Member (lava flows) of the Saddle Mountains Basalt underlies the Ringold lower mud Unit 8. Drilling did not penetrate to the depth of the Ice Harbor Member during the LFI characterization.

6. Additional information about the hydrogeology of the 300 Area is available in DOE (2006a).

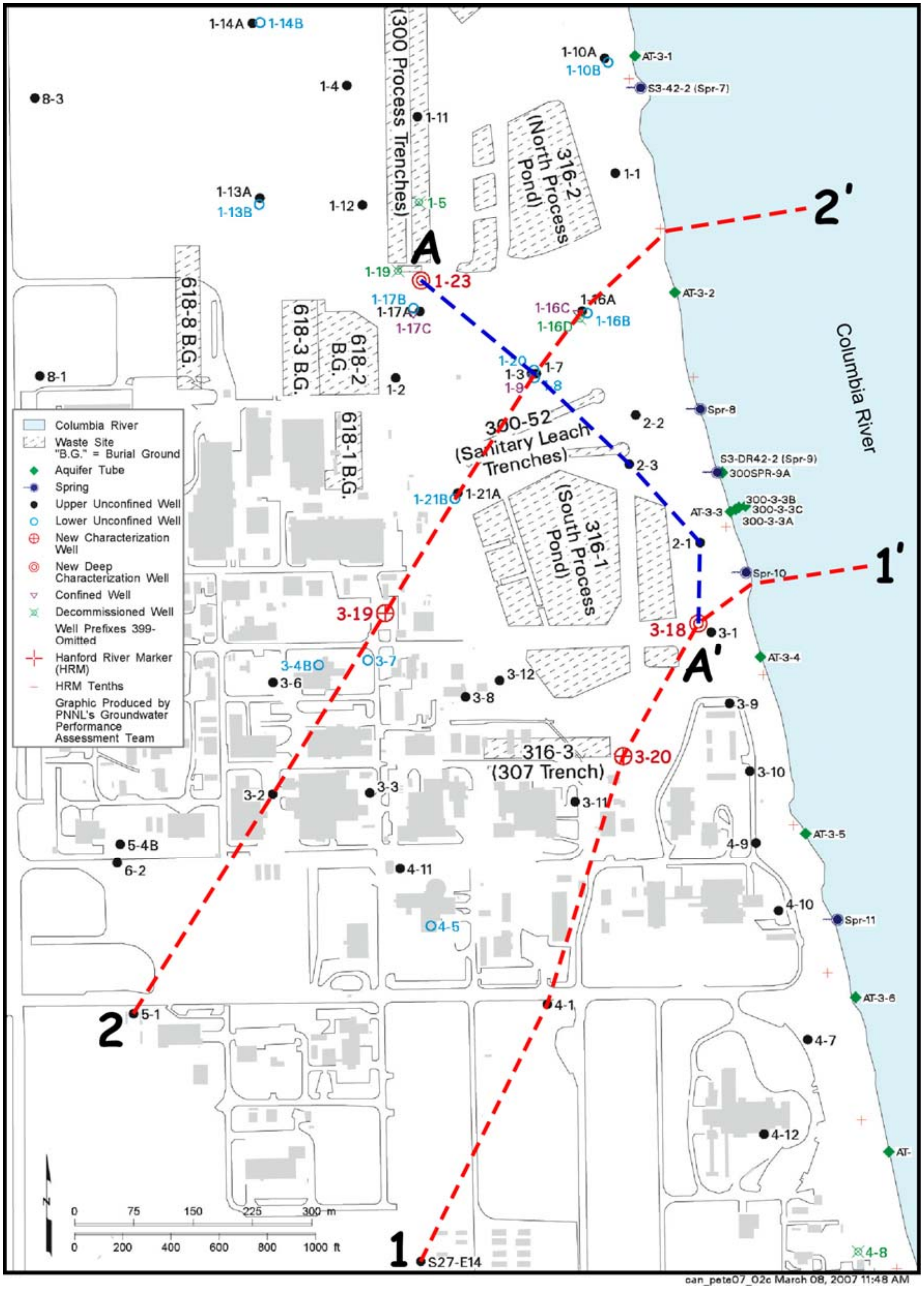


Figure 3.14. Location Map Showing the Orientation of Hydrogeologic Cross Sections, 300-FF-5 Operable Unit

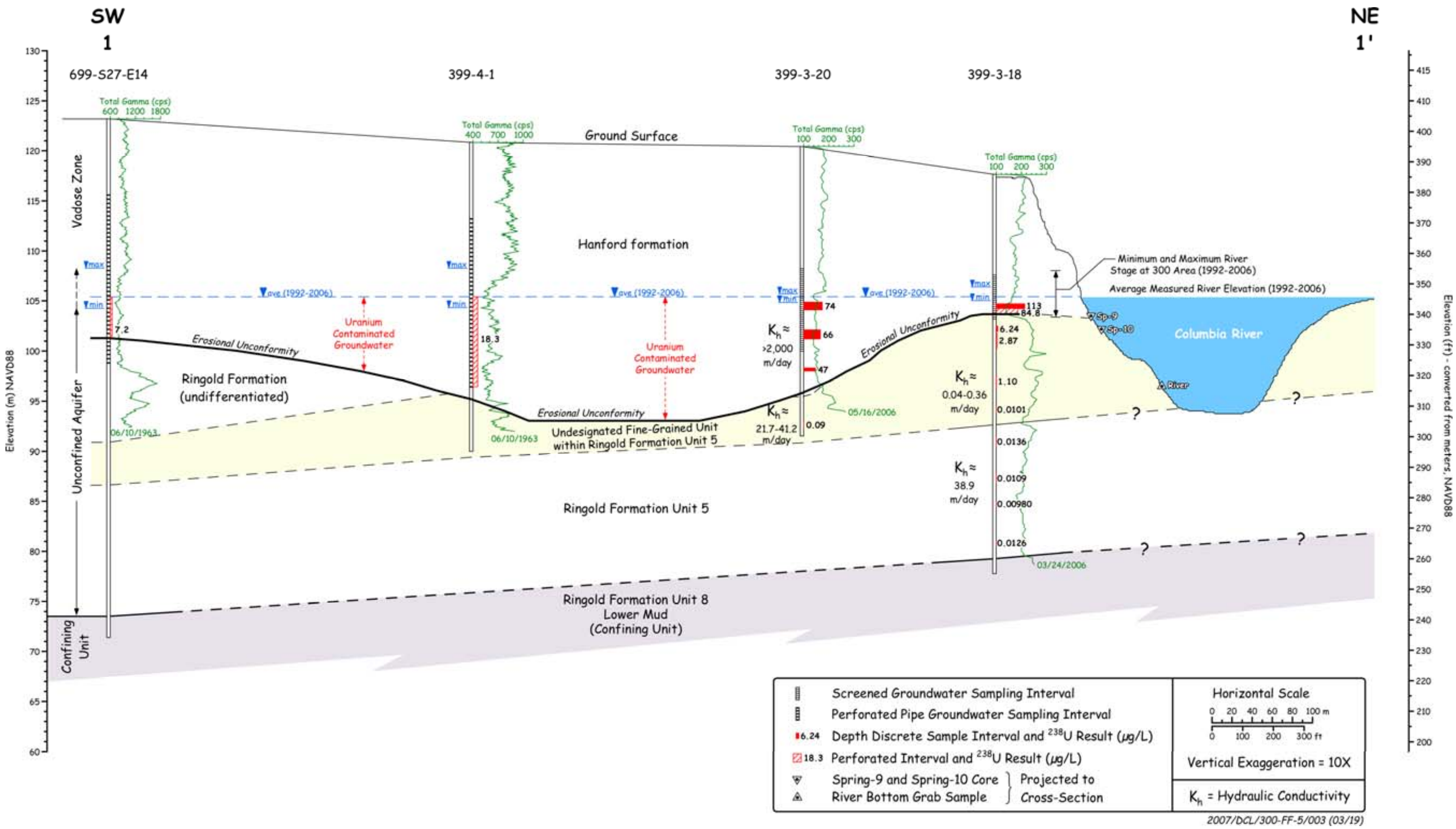


Figure 3.15. Hydrogeologic Cross Section 1-1' (SW to NE) Illustrating the Unconfined Aquifer, H/R Contact and the Uranium Contaminant Distribution in Groundwater

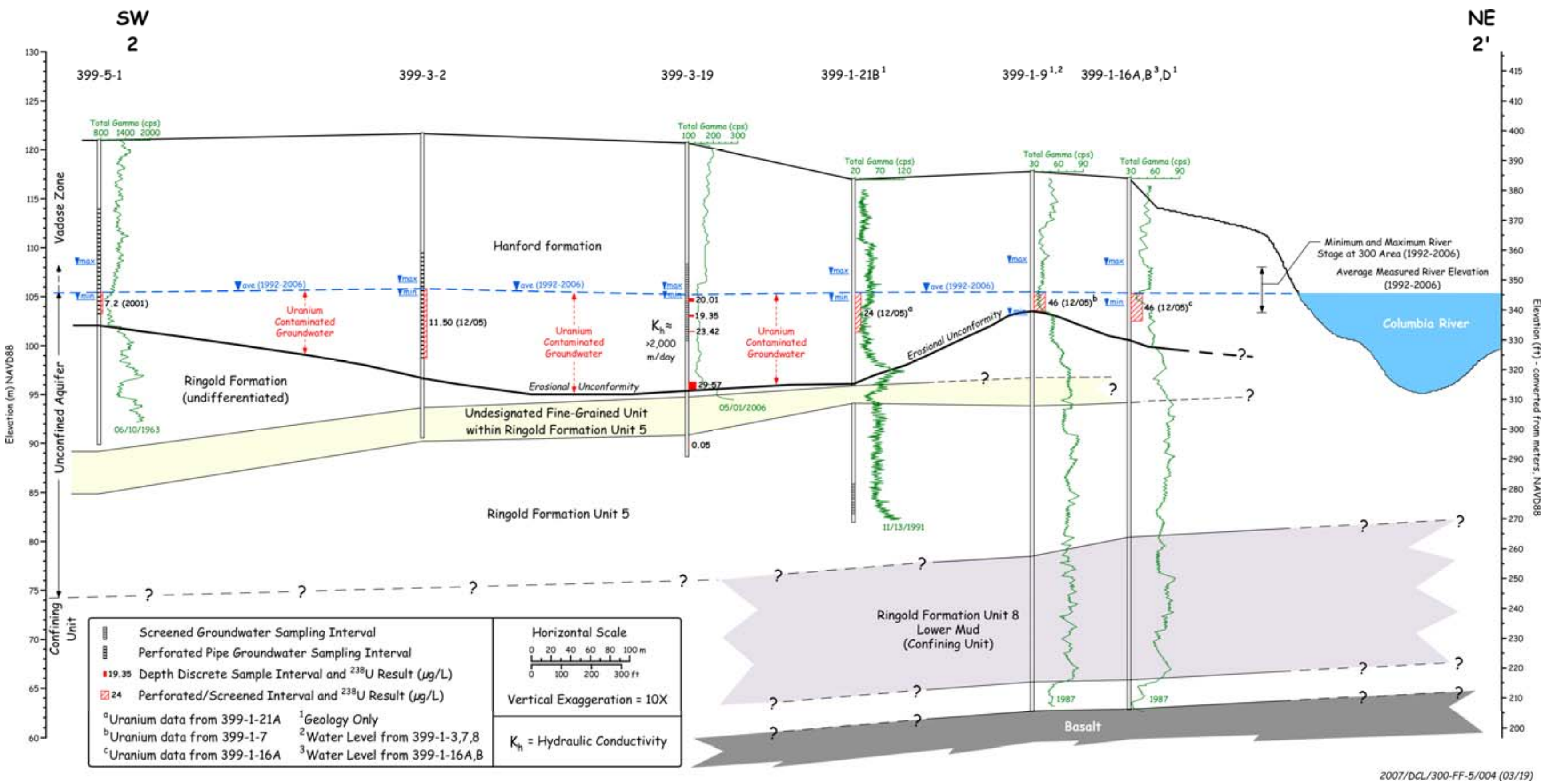


Figure 3.16. Hydrogeologic Cross Section 2-2' (SW to NE) Illustrating the Unconfined Aquifer, H/R Contact and the Uranium Contaminant Distribution in Groundwater

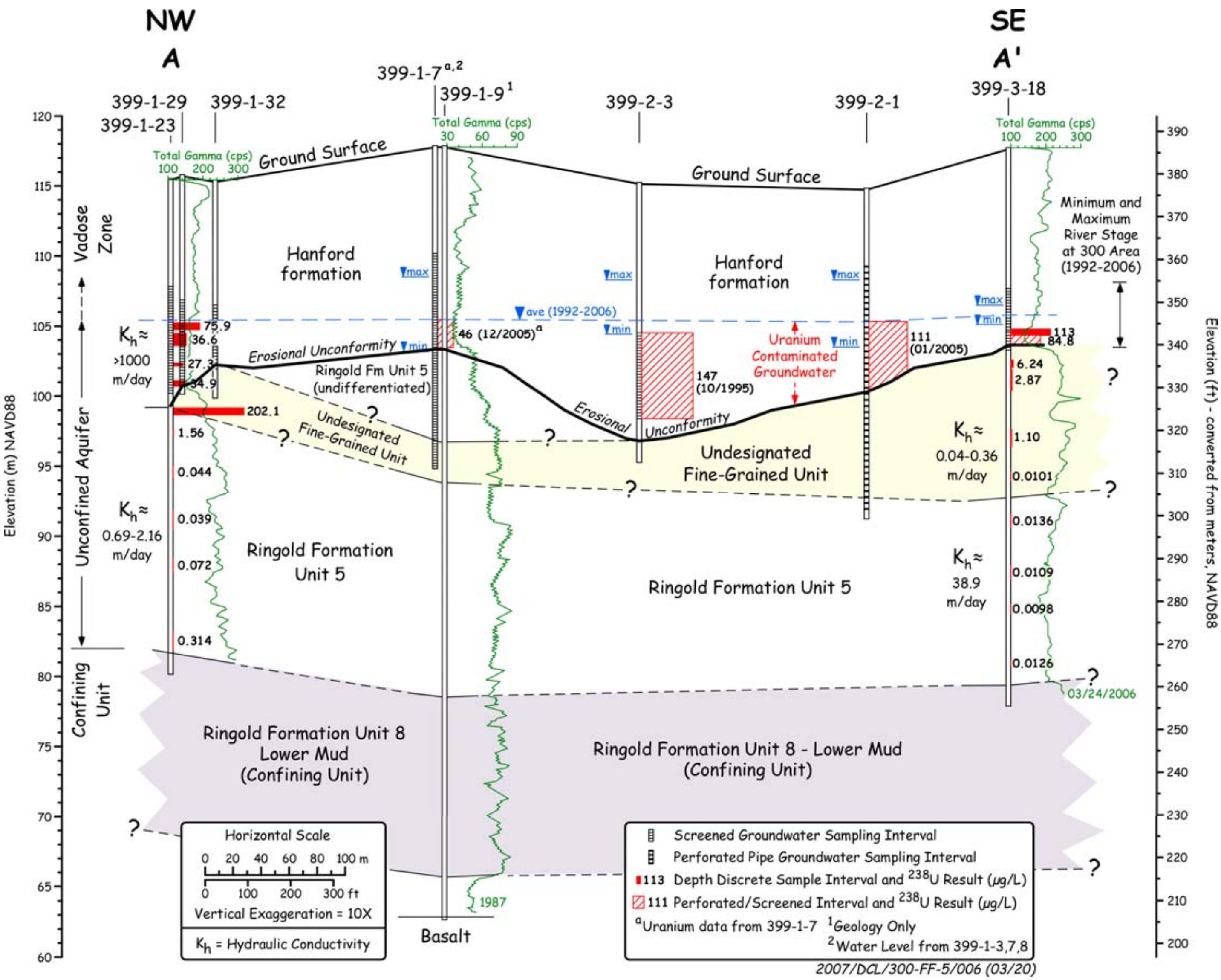


Figure 3.17. Hydrogeologic Cross Section A-A' (NW to SE) Illustrating the Unconfined Aquifer, H/R Contact and the Uranium Contaminant Distribution in Groundwater

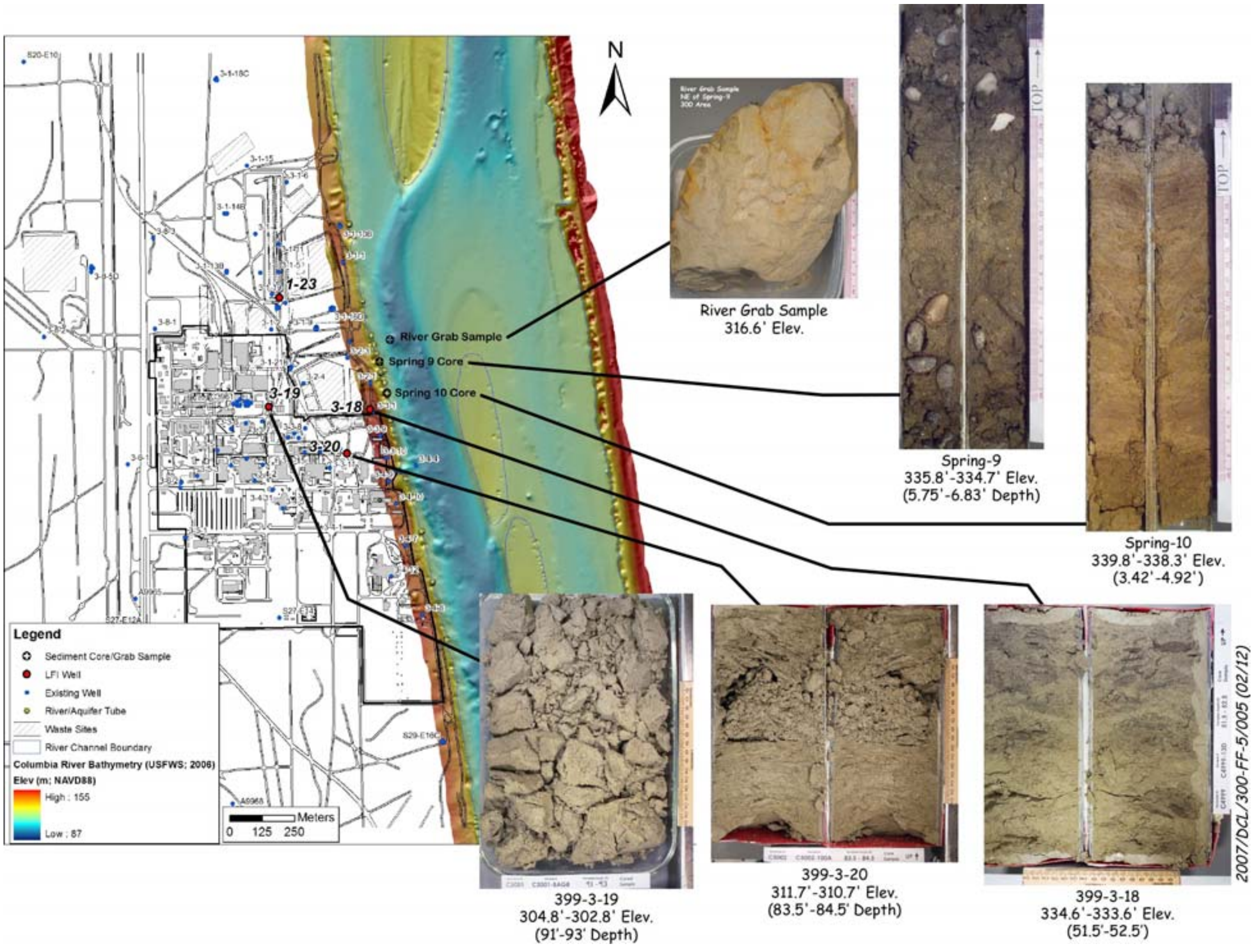


Figure 3.18. LFI Well Location Map Showing Locations of Ringold Formation Undesignated Fine-Grained Sand Samples Collected from the Columbia River Bottom and Shoreline

Figure 3.19. Core Photograph Showing Open-Framework Gravel of the Hanford Formation in Well 399-3-20 (C5002)

Figure 3.20. Core Photograph Showing Reworked Sediments Within the Hanford Formation Vadose Zone in Well 399-1-23 (C5000)

4.0 Revised and Updated Contaminant Distribution Model

Section 4 provides the interpretation of the sediment and groundwater hydrochemistry and contaminant results for the four new wells and establishes contaminant pathways as they relate to the hydrogeology of the 300 Area.

The ultimate goal of the 300 Area LFI was to determine the distribution and concentration of Hanford process uranium in the lower vadose zone and unconfined aquifer (DOE 2006a). This section describes the distribution of the primary contaminants uranium, nitrate, and volatile organic carbon compounds associated with trichloroethene (TCE) detected during characterization of the four new boreholes. These contaminant distributions are incorporated into the updated hydrogeologic interpretations for the boreholes and will be used to develop vadose zone and groundwater contaminant conceptual models (Figures 3.2 through 3.5).

Depth-discrete groundwater sample data and analytical results (see Section 6.6.2 for details on sampling and analysis), besides showing where the contamination is and how it is distributed, aid in determining hydrologic conditions and flow boundaries within the aquifer system. The laboratory analytical data directly provide the identification, concentration, and distribution of contaminants and other constituents within the aquifer system. In addition to these data, groundwater flow conditions and aquifer variations can also, indirectly, be determined based on vertical changes in the groundwater indicator parameters collected in the field during drilling and sampling (such as specific conductance, dissolved oxygen, pH, and temperature). Combined, these data are used to interpret which zones within the aquifer are contaminated and to better understand the relationship between contaminant concentration, groundwater flow zones, and aquifer boundaries as needed for developing the conceptual models.

Field parameters indicate an interval with redox-reducing conditions and low specific conductance within the lower to middle Ringold Formation that suggests that the lower portion of the unconfined aquifer has been less prone to infiltration by younger water sources (Figures 4.1 to 4.4). Aquifer testing (Section 3.4) and visual inspection of sediment core results also support this interpretation. These data are corroborated by the depth-discrete uranium/nitrate results, two of the primary mobile dissolved contaminants in the 300 Area whose concentrations drop off significantly at or just below the Hanford/Ringold contact. Other constituent concentrations, such as sulfate and calcium, also drop off significantly below this contact. The lack of these constituents in the deeper intervals below the Hanford/Ringold contact also support the presence of a geochemical reducing trend with depth within the lower unconfined aquifer. Data from the four wells all confirm that the Hanford/Ringold contact is the primary flow boundary within the upper unconfined aquifer (Figures 3.2 through 3.5) that controls the vertical movement of groundwater and dissolved contaminants.

Geochemical stiff diagrams (Figures 4.1 through 4.4) illustrate the major cation and anion composition for groundwater samples from the discrete sample depths in each of the four new boreholes. All of the shallow groundwater samples are dominated by calcium and bicarbonate, which is the natural condition of groundwater (uncontaminated or slightly contaminated). There is a subtle shift in the cation makeup of the groundwater with depth wherein the mono-valent cations sodium and potassium increase and calcium decreases, especially in the low dissolved oxygen/reducing redox interval below the Hanford/Ringold contact.

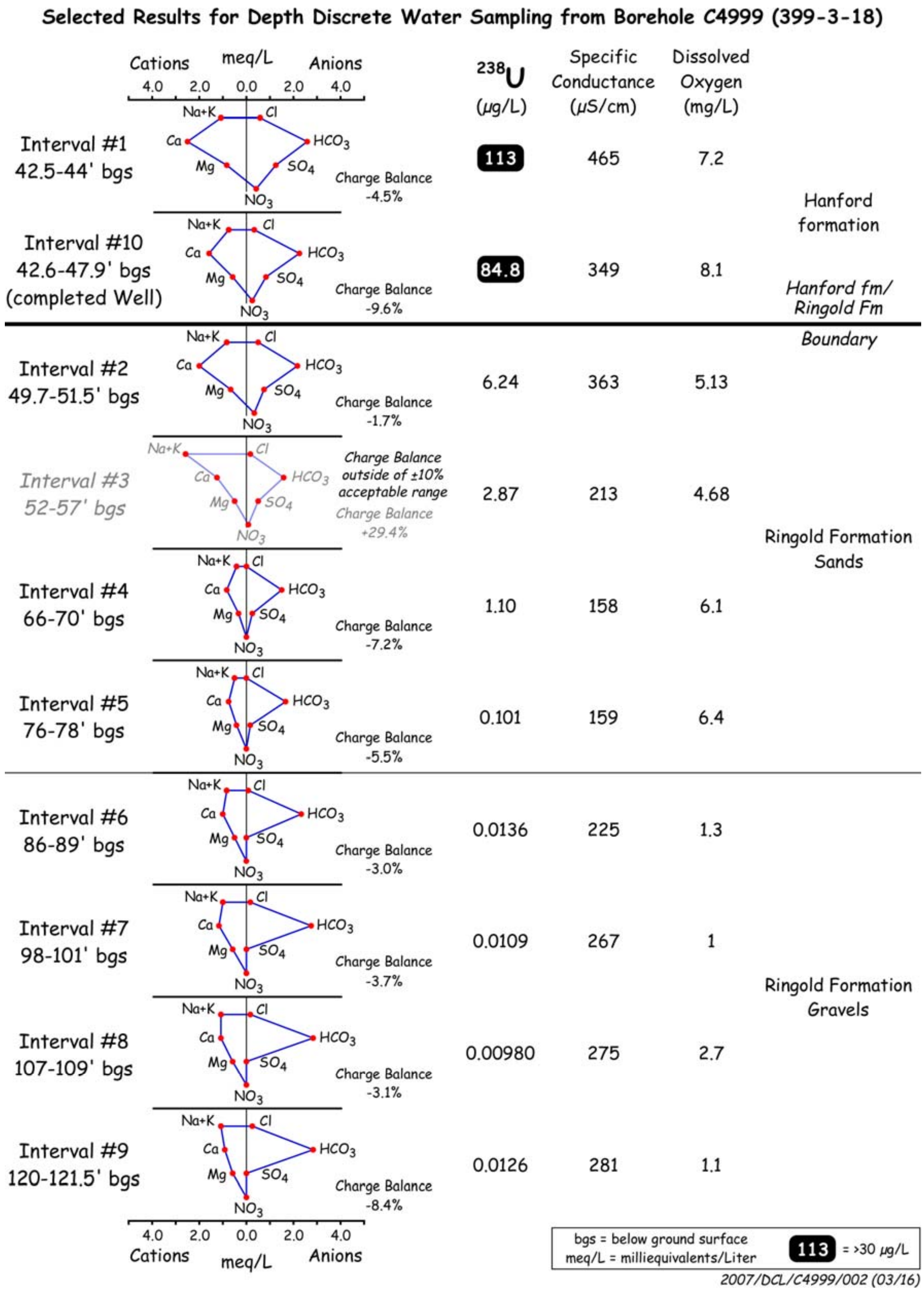


Figure 4.1. Stiff Chemistry Plots for Depth-Discrete Groundwater Samples in Well 399-3-18 (C4999)

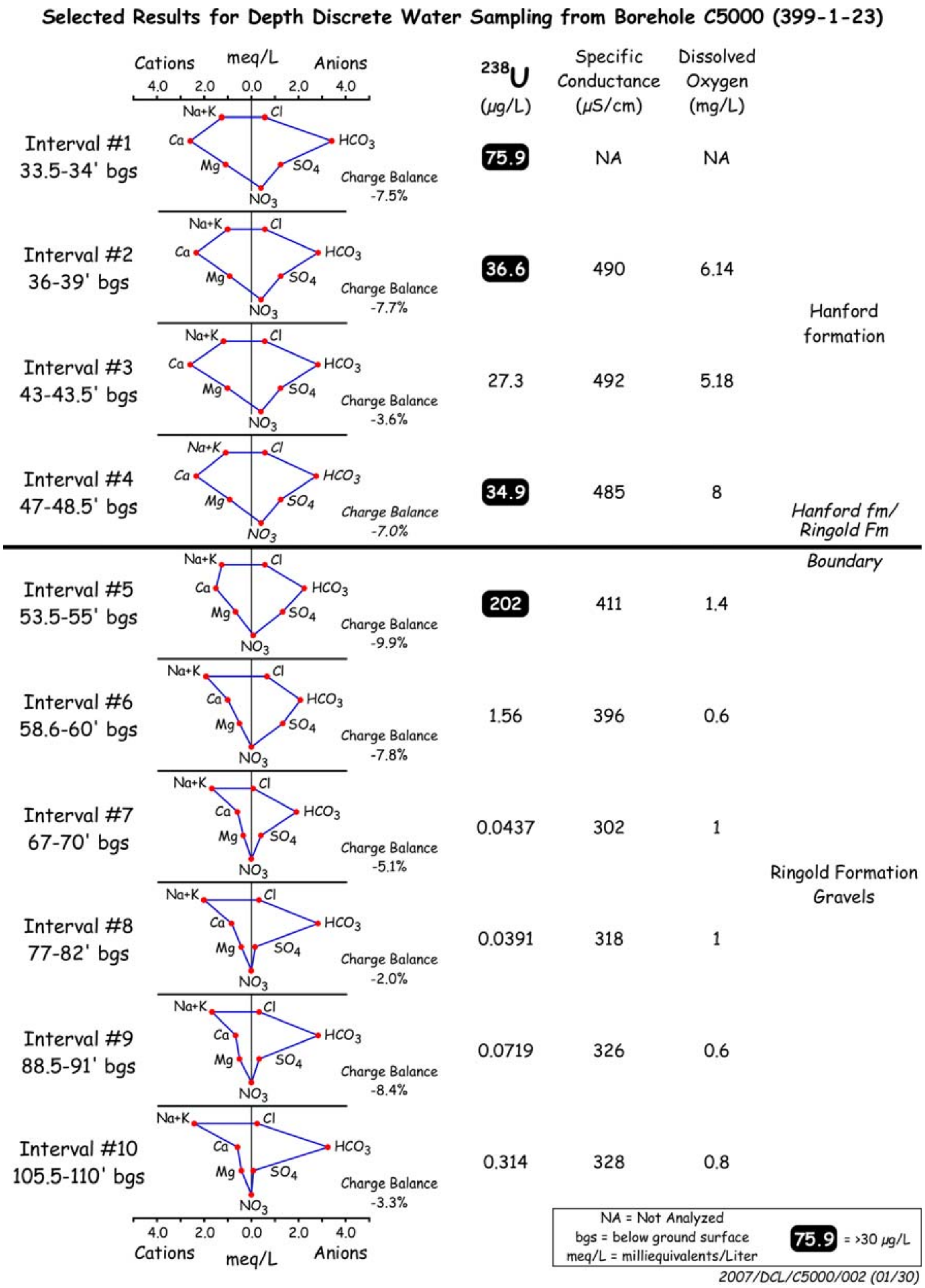


Figure 4.2. Stiff Chemistry Plots for Depth-Discrete Groundwater Samples in Well 399-1-23 (C5000)

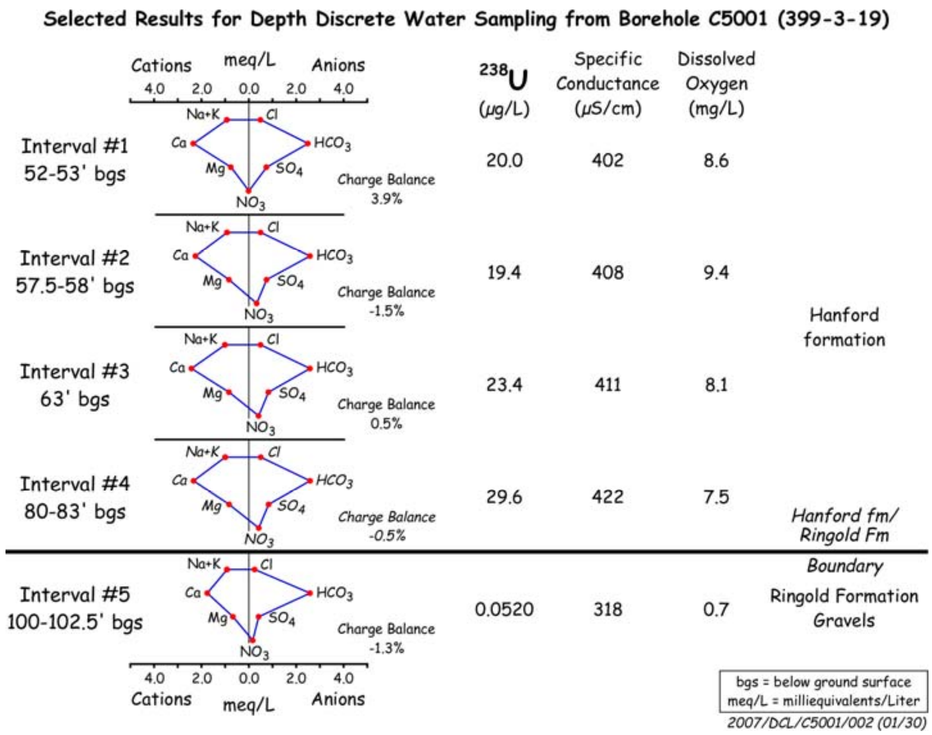


Figure 4.3. Stiff Chemistry Plots for Depth-Discrete Groundwater Samples in Borehole 399-3-19 (C5001)

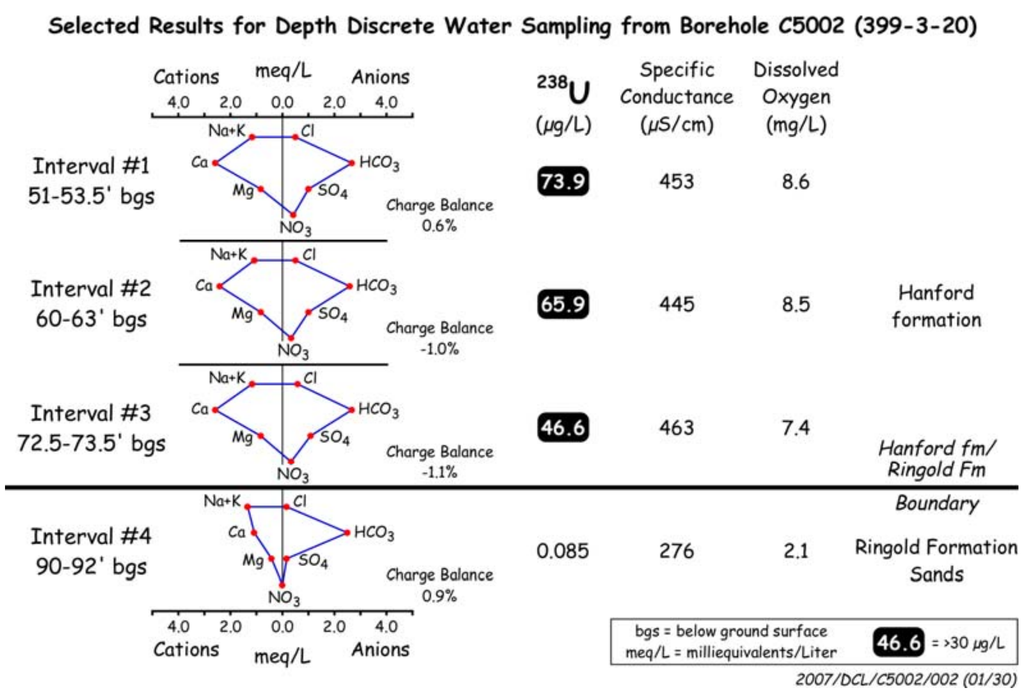


Figure 4.4. Stiff Chemistry Plots for Depth-Discrete Groundwater Samples in Borehole 399-3-20 (C5002)

4.1 Uranium Distribution

4.1.1 Uranium Contamination in the Aquifer

Based on depth-discrete groundwater data (Appendix D, Table D.22), as illustrated on the four composite borehole logs (Figures 3.2 to 3.5) and groundwater chemistry plots (Figures 4.1 to 4.4), elevated (above natural background) concentrations of dissolved uranium in groundwater is restricted to the upper portion of the unconfined aquifer primarily above the Hanford/Ringold contact boundary. The lack of detectable levels of Hanford process uranium in the borehole geophysical logging results (Section 6.6.4) and the laboratory GEA results (Section 6.6.1.3) also support this observation.

Elevated uranium concentrations in groundwater, ranging up to 202 μg/L, occur in the groundwater throughout the saturated Hanford formation gravel and only slightly penetrate into the upper Ringold Formation in all four of the new boreholes. With the exception of samples that were collected near, or that bridged, the Hanford/Ringold contact, groundwater uranium results are essentially below detection at all sample depths below the Hanford/Ringold contact in all of the new wells.

The highest dissolved uranium in groundwater, ~202 μg/L, was detected in well 399-1-23 (C5000) at the Hanford/Ringold contact (see Figures 3.3 and 4.2). EPA's maximum contaminant level for uranium in drinking water supplies is 30 μg/L. Values for four other shallower groundwater samples within the ~6-meter-thick Hanford formation had dissolved uranium concentrations that ranged between ~35 and 80 μg/L, and the highest concentration was at the water table. This well is located at the disposal end of the now decommissioned 316-5 Process Trenches that are a known past source of process uranium.

Well 399-3-18 (C4999), located downgradient of the 316-South Process Pond, had the second highest groundwater uranium concentration, ~113 μg/L, from a sample collected at the water table (Figures 3.2 and 4.1). The saturated Hanford formation interval is significantly thinner than the other three new wells (~1 meter when sampled). The uranium concentration of the next deeper groundwater sample was <10 μg/L. This deeper groundwater uranium concentration is lower because the sample interval bridged or was located just below the H/R contact and may reflect dilution of the high uranium concentration groundwater in the Hanford formation from the deeper groundwater within the lower permeability Ringold Formation (which contains lower uranium concentrations). Several of the older existing wells in this area have long screen or perforated intervals that are open across the H/R contact which implies that the resulting groundwater samples may be diluted and that the measured uranium concentrations are not representative of the true uranium concentrations within the thin saturated Hanford formation portion of the aquifer that has high permeability (i.e., transports water readily to the Columbia River).

New well 399-3-19 (C5001), located upgradient (generally) of all of the known waste disposal ponds and trenches, had the lowest uranium concentrations in the groundwater of all the new wells (Figures 3.4 and 4.3). This location intersects a thick, saturated Hanford formation gravel-dominated interval (~11 meters) within the prominent channel eroded into the Ringold Formation. The average groundwater uranium concentration from four independent depth samples collected from the Hanford formation was less then the 30-μg/L EPA drinking water standard. Uranium concentrations in the groundwater in the fourth well, 399-3-20 (C5002), ranged between ~50 and 75 μg/L (Figures 3.5 and 4.4). The highest value was near the water table. This well is located at the southeastern corner of the 307 Trench, a suspected source of uranium contamination to groundwater. The saturated Hanford formation is ~9.5 m thick at this location.

The groundwater uranium concentration results from the depth-discrete samples from the four new boreholes are generally consistent with regional uranium plume concentrations as determined through the routine 300-FF-5 OU sampling program; these results reflect dissolved uranium concentrations in the shallow, unconfined aquifer within the permeable gravel-dominated deposits of the Hanford formation (Figure 2.1).

Based on the new characterization data obtained during the LFI, it is probable that most of the dissolved uranium contamination within the 300-FF-5 OU moving through groundwater is constrained to the saturated, variably thick Hanford formation sediment above the Hanford/Ringold boundary. The lack of detectable uranium below the Hanford/Ringold contact is also consistent with the hydrogeologic interpretation. Aquifer test results, groundwater analytical data, and field indicator parameters (specific conductance and dissolved oxygen) suggest that the groundwater below the Hanford/Ringold is older water that has not been significantly altered or displaced by the more recent liquid waste effluent disposal activities.

4.1.2 Uranium Contamination in the Vadose Zone

The analysis for uranium on sediments or in pore fluid within the vadose zone has been completed (Section 6.6.1.4). Overall, there is a general trend in which samples from the lower vadose zone and the uppermost aquifer contain Hanford process uranium (i.e., the total uranium is higher than the natural uranium), especially in the 399-3-18 (C4999) and 399-1-23 (C5000) borehole sediment samples. However, there were no “hot spots” (high uranium concentration) of process uranium detected in the vadose zone or saturated sediments during characterization of these four boreholes. Both borehole geophysical and laboratory GEA results support this observation.

In addition to obtaining the directly measured pore water from a few selected sediment samples using ultracentrifugation, 1:1 sediment to water extracts were performed, and the water extract data were recalculated (dilution corrected) to derive uranium concentrations in pore water of the sediments. Actual chemical composition, including uranium concentration of the native pore water in the sediments, was estimated from the 1:1 water extract analyses after correcting for dilution based on knowledge of the moisture content of the sediment samples. A comparison of the uranium concentrations measured in groundwater samples, directly measured pore water samples after ultracentrifuge, and calculated pore water from the 1:1 sediment-water extracts from the four wells is shown in Figure 4.5. The same figure, with a different scale to show more detail, is included in Appendix D (Figure D.21).

Uranium concentrations in the pore waters measured directly after ultracentrifugation for wells 399-3-18 (C4999) and 399-1-23 (C5000) sediments were similar to those from the estimated pore waters based on 1:1 water extracts after moisture content correction. Uranium concentrations in the calculated pore waters ranged up to 3,650 μg/L and showed relatively higher concentrations in well 399-3-18 (C4999) and well 399-1-23 (C5000) sediments. Both well 399-3-19 (C5001) and well 399-3-20 (C5002) groundwater and estimated vadose zone sediment pore waters showed relatively low uranium concentrations compared to samples from well 399-3-18 (C4999) or well 399-1-23 (C5000). The borehole sediment uranium concentration profiles (Figure 4.5) suggest that near the water table, vadose

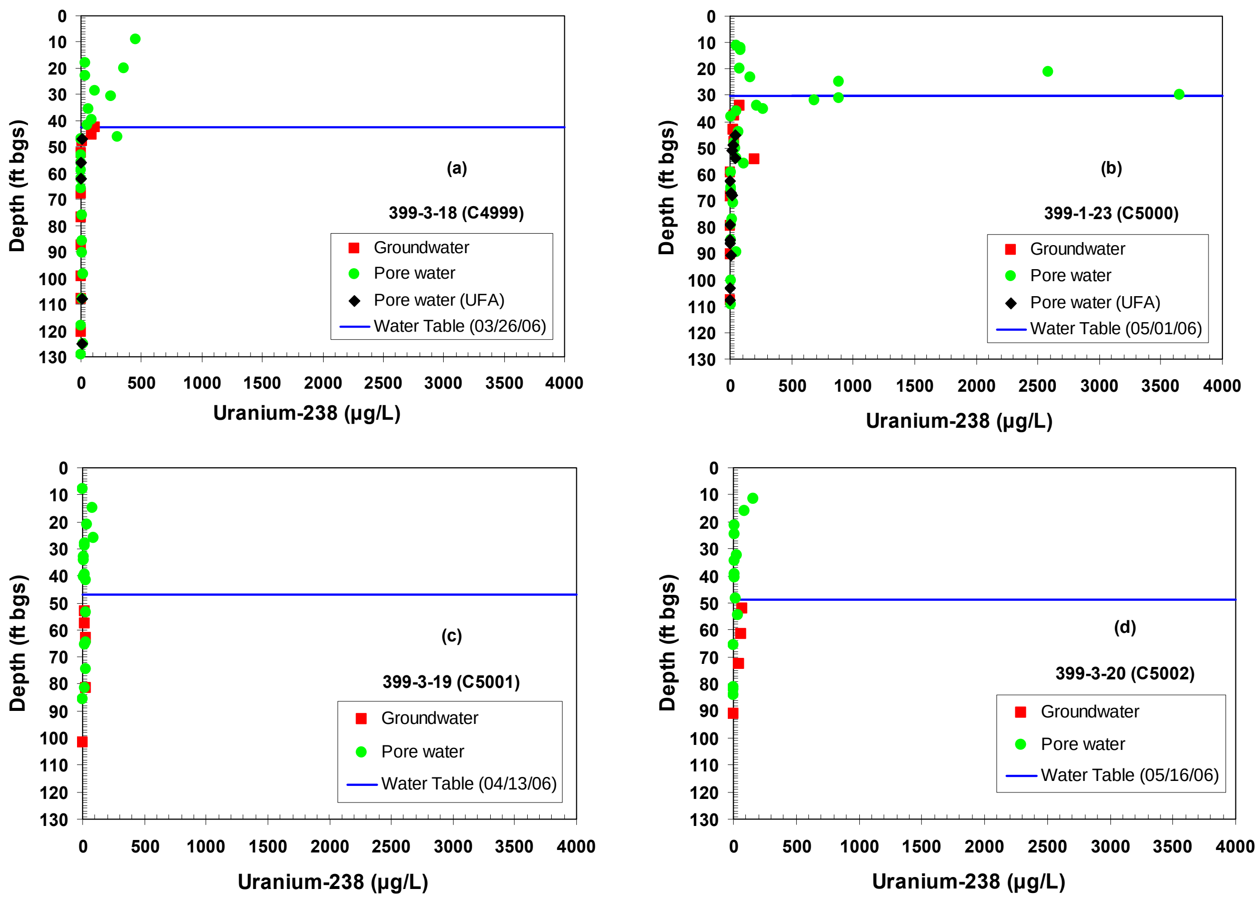


Figure 4.5. Soluble Uranium Concentrations in the Depth-Discrete Groundwater, Pore Water After Ultracentrifugation, and Calculated Pore Water Uranium Concentrations in the Sediments from Boreholes (a) 399-3-18 (C4999), (b) 399-1-23 (C5000), (c) 399-3-19 (C5001), and (d) 399-3-20 (C5002)

sediment pore water contains elevated uranium concentrations that are equivalent to, or slightly higher than, the elevated concentrations in the shallow groundwater. The elevated vadose sediment uranium concentrations could indicate a nearby source or a remnant of lateral spreading due to groundwater fluctuations. These results support a conceptual model wherein the uranium is more evenly distributed as a low concentration vadose zone source spread over a large footprint. An alternative conceptual model assumes one or more residual uranium source "hot spots" in the vadose zone or upper aquifer sediments might be controlling the groundwater contamination. Based on the data from these four new boreholes, only well 399-1-23 (C5000) and possibly well 399-3-18 (C4999) contain any significant concentrations of uranium within the vadose zone pore fluids and sediments. The vadose zone surrounding wells 399-1-23 (C5000) and 399-3-18 (C4999) may be a slow bleeding source of uranium to the upper unconfined aquifer by both natural recharge and as caused by the seasonal river stage water table fluctuations.

It is probable that residual uranium contamination exists in the lower vadose zone beneath the southern portion of the 316-5 process trenches based on data from well 399-1-23 (C5000). The well 399-1-23 (C5000) borehole has the highest vadose pore water uranium concentrations and analysis of vadose sediments indicates above background levels of uranium are present at depths 6 meters bgs down to the water table (~10.5 meters). In addition, based on large differences between microwave-assisted sediment digestion uranium extracts and uranium leaching results using carbonate extractant (see Section 6.6.1.4 for details), high concentrations of recalcitrant uranium contamination were also found in the well 399-1-23 (C5000) borehole vadose zone sediments. Because carbonate-leachable uranium is considered to be labile uranium, the difference between the carbonate-leached uranium and the microwave-assisted digested uranium (total leachable uranium) indicates the presence of a more strongly bound uranium phase, perhaps found as mineral coprecipitates or within mineral structures. The carbonate-leachable strongly bound uranium contamination, detected in the vadose zone sediments close to the water table, could be a continuous source of uranium that slowly bleeds into the groundwater through a saturation-de-saturation mechanism that is controlled by river level fluctuations.

The highest inorganic carbon content (3.42 mg/g or 2.85 wt.% as $CaCO_3$) was found at a depth of 7 m (23 feet) bgs where the highest uranium concentration (5 pCi/g) was detected via the microwave-assisted digestion method (well 399-1-23 [C5000]). These results suggest that uranium is present in this sample due to co-precipitation with calcite. Similar results suggesting possible uranium co-precipitation with calcite in 300 Area sediments have been found by others (Wang et al. 2005; Zachara et al. 2005). We speculate that the higher inorganic carbon content in the sediments from well 399-1-23 (C5000) may be related to reactions of alkaline waste with atmospheric carbon dioxide and the native vadose zone pore waters during the active disposal period into the 300 Area process trenches. However, it may be possible that the higher inorganic carbon contents in the well 399-1-23 (C5000) sediments are detrital (transported and deposited by the ice-age floods) from subtle differences in sediment mineralogy. More detailed microscale characterization techniques would need to be applied to these sediments to potentially determine the origin of the carbonates in the sediments.

Co-precipitation of uranium with calcite in vadose zone sediments might have significant implications for the fate and transport of uranium in groundwater, especially in the capillary fringe region where the water table tends to fluctuate due to Columbia River level changes. The total carbon content measured in sediments from boreholes 399-3-19 (C5001) and 399-3-20 (C5002) was relatively low, and inorganic carbon content varied from 0.0 to 0.96 and to 0.93 mg/g (<1 wt.% as $CaCO_3$), respectively, similar to those values found in sediments from borehole 399-3-18 (C4999). The highest inorganic carbon content (0.93 mg/g) measured in sediments from borehole 399-3-20 (C5002) at a depth of 24.7 meters (81.1 feet) bgs might result from calcium carbonate present as cementing materials at the boundary between the Hanford and Ringold formation sediments.

Work conducted on sediment samples collected by backhoe at locations within the footprints of the former North and South Process Ponds (two sites each) concluded that the vadose zone beneath each of these former disposal sites could continue to be potential sources for supplying uranium to the underlying groundwater plume (Zachara et al. 2005). The vertical profiles at each of the four locations produced results that were different at each location; the profiles showed no marked trend in hexavalent uranium concentrations with depth. The samples did reveal fundamental information on the geochemical nature of the residual uranium contamination, particularly with respect to mobility characteristics.

4.2 Nitrate Distribution

The analysis of nitrate concentration in groundwater samples and 1:1 water extracts from the sediments from the four boreholes was conducted, and the results are shown in Appendix D. Detectable nitrate concentrations in the groundwater were only found in the shallower depths of the aquifer (within 5, 17, 34, and 23 feet of the water table in boreholes 399-3-18 (C4999), 399-1-23 (C5000), 399-3-19 (C5001), and 399-3-20 (C5002), respectively). The groundwater nitrate concentrations ranged from 13 to 21, 26 to 27, 37 to 39 and 22 to 23 mg/L in the shallow zones of the aquifer at boreholes 399-3-18 (C4999), 399-1-23 (C5000), 399-3-19 (C5001), and 399-3-20 (C5002), respectively. These concentrations are below the drinking water MCL and not noteworthy compared to nitrate plumes on the 200 Area Central Plateau. There are a few high nitrate concentrations detected in the lower depths of the vadose zone pore water (upper 35 feet in borehole 399-3-18 (C4999) at concentrations of 4,460 down to 110 mg/L and upper 20 feet in borehole 399-1-23 (C5000) pore water at concentrations from 60 to 33 mg/L. At borehole 399-3-19 (C5001), there was one pore water sample at 39.5 feet bgs that contained 36 mg/L nitrate, and at borehole 399-3-20 (C5002) the pore water nitrate was 140 mg/L at 16 feet bgs and the nitrate pore water concentration dropped below the detection limit <10 mg/L at 25 feet bgs. All the aquifer sediments showed low nitrate concentration from 1:1 water extracts. Most nitrate concentrations in the aquifer significantly drop below detection limits at the Hanford/Ringold contact. As can be seen in Figures 4.1 to 4.4, nitrate is never a dominant anion in the groundwater.

The new data from the recently installed boreholes 399-3-18 (C4999), 399-1-23 (C5000), 399-3-19 (C5001), and 399-3-20 (C5002) suggest that the source of the nitrate in the groundwater today is likely not the vadose zone sediments at the 300-FF-5 OU. There is no indication that the deep vadose zone sediments or aquifer sediments contain elevated nitrate concentrations that could be supplying the low concentrations of nitrate found in the groundwater at the 300-FF-5 OU. A more likely source is upgradient groundwater that is impacted by other Hanford activities, the Central Plateau fuel reprocessing facilities, and/or irrigation water that recharges the aquifer from nearby agricultural and industrial facilities. At boreholes 399-3-18 (C4999) and to a limited extent 399-1-23 (C5000) in the near-surface vadose zone, there is elevated nitrate that could be a future source of groundwater nitrate if a water driving force (including slow natural recharge) pushes the soluble nitrate to the water table. However, these pools of nitrate do not appear to be the cause of the current groundwater nitrate distribution.

4.3 Volatile Organic Carbon Constituents

As part of the LFI characterization, the groundwater samples were also analyzed for volatile organic compounds (VOC). Several organic carbon compounds were detected in all four of the boreholes at depths well below the water table and below those typically monitored by the 300 Area well network (Table 4.1).

At the northern location (well 399-1-23 [C5000]), cis-1,2-dichloroethene (DCE) was detected at multiple depth horizons in the deeper portion of the aquifer below the Hanford/Ringold contact, with concentrations increasing with increased depth (Figure 3.3). This occurrence is consistent with other monitoring data from nearby wells that reveal the presence of DCE in the lower portion of the unconfined aquifer. The source for the DCE is presumed to be disposal of liquid effluent to the 300 Area Process Trenches (316-5 waste site) during the 1970s and 1980s.

At two of the southern locations, wells 399-3-18 (C4999) and 399-3-20 (C5002), results for TCE were well above the drinking water standard, again at depths below the Hanford/Ringold contact (Figures 3.2 and 3.5). Re-analysis of those samples confirmed the initial results, and there is no evidence to indicate that TCE may have been inadvertently introduced into the boreholes during drilling activities. Consequently, the elevated concentrations are presumed to represent aquifer conditions. These occurrences were unexpected and have opened new questions regarding the extent of VOC contamination in the subsurface at the 300 Area.

The area of concern is centered on LFI well 399-3-20 (C5002) and extends to include the southern portion of the South Process Pond (316-1 waste site) and 307 Trench (316-3 waste site) (see Figure 2.1). A water sample collected during drilling at well 399-3-20 (C5002) from the Ringold Formation undesignated fine-grained unit contained TCE at a concentration of 630 μg/L. This unit is below the Hanford formation unit 1 monitored by the completed monitoring well (see Table 4.1) and other wells in the area. LFI well 399-3-18 (C4999), located ~200 meters to the northeast of well 399-3-20 (C5002), also revealed elevated TCE concentrations (63 and 51 μg/L) in drilling samples collected from the upper portion of the same hydrologic unit as in well 399-3-20 (C5002).

TCE concentrations in drilling samples from the uppermost Hanford formation hydrogeologic unit, i.e., above the Hanford/Ringold contact, are consistent with those indicated by long-term groundwater monitoring. Concentrations in the Hanford gravels have been lower than the 5-μg/L drinking water standard for at least the last decade in the area of concern (Peterson et al. 2005). The TCE has been presumed to have migrated into the 300 Area from sources to the southwest, i.e., it is not associated with 300 Area waste sites (Lindberg and Peterson 2006). However, the presence of TCE and other volatile organic compounds at depths in the aquifer greater than those monitored by existing wells poses new questions as to the origin and nature of VOC contamination in the unconfined aquifer.

DOE has elected to go forward with characterizing the VOC occurrence at depth in the unconfined aquifer at the southern locations in the 300-FF-5 OU because of these questions. This new VOC investigation is not part of this LFI.

Table 4.1. Volatile Organic Compounds in Water Samples Collected During Drilling at 300 Area Limited Field Investigation Sites

Drilling sample location designator	Elevation at top of sample interval (m-NAVD88)	Elevation at bottom of sample interval (m-NAVD88)	Drilling sample relative to final screened interval	Sample Collect Date/Time	Trichloro-ethene (ug/L) MCL = 5 MDL = 0.20	Tetrachloro-ethene (ug/L) MCL = 5 MDL = 0.19	Cis-1,2-dichloro-ethene (ug/L) MCL = 70 MDL = 0.19	Vinyl chloride (ug/L) MCL = 2 MDL = 0.23
399-1-23: Near southern end of former 300 Area Process Trenches (316-5 waste site)								
C5000,399-1-23 (1)	105.2	105.1	Within	4/3/2006	U	U	U	U
C5000,399-1-23 (2)	104.5	103.6	Within	4/4/2006	0.20	U	U	U
C5000,399-1-23 (3)	102.3	102.2	Within	4/4/2006	U	U	U	U
C5000,399-1-23 (4)	101.1	100.7	Within	4/5/2006	U	U	U	U
(completed well)	107.8	100.2	Screen	7/6/2006	0.22	U	U	U
C5000,399-1-23 (5)	99.1	98.7	Below	4/5/2006	2.10	0.20	3.00	U
C5000,399-1-23 (6)	97.6	97.2	Below	4/6/2006	2.20	U	15.00	U
C5000,399-1-23 (7)	95.0	94.1	Below	4/7/2006	0.27	U	32.00	U
C5000,399-1-23 (8)	92.0	90.5	Below	4/10/2006	1.10	U	48.00	U
C5000,399-1-23 (9)	88.5	87.4	Below	4/11/2006	2.20	U	51.00	U
C5000,399-1-23 (10)	83.3	81.9	Below	4/17/2006	U	U	57.00	U
399-3-18: Near Columbia River, downgradient of former South Process Ponds (316-1 waste site)								
C4999,399-3-18 (1)	104.7	104.7	Within	3/14/2006	0.85	U	U	U
C4999,399-3-18 (10)	104.7	103.1	Within	4/13/2006	0.78	U	U	U
(completed well)	107.6	103.0	Screen	6/27/2006	1.40	U	U	U
C4999,399-3-18 (2)	103.7	102.5	At bottom	3/14/2006	63.00	1.80	0.71	U
C4999,399-3-18 (3)	101.7	101.7	Below	3/15/2006	51.00	0.83	0.66	U
C4999,399-3-18 (4)	97.6	96.3	Below	3/16/2006	0.64	U	U	U
C4999,399-3-18 (5)	94.5	93.9	Below	3/20/2006	U	U	U	U
C4999,399-3-18 (6)	91.5	90.6	Below	3/21/2006	U	U	U	U
C4999,399-3-18 (7)	87.8	86.9	Below	3/22/2006	U	U	0.85	U
C4999,399-3-18 (8)	85.1	84.5	Below	3/22/2006	U	U	U	U
C4999,399-3-18 (9)	81.1	80.6	Below	3/23/2006	U	U	3.00	U
399-3-19: Inland, upgradient from principal liquid waste disposal sites								
C5001 399-3-19 (1)	104.5	104.5	Within	4/26/2006	1.20	U	U	U
C5001 399-3-19 (2)	103.1	103.0	Within	4/27/2006	1.20	U	U	U
C5001 399-3-19 (3)	101.4	101.4	Within	4/27/2006	1.20	U	U	U
(completed well)	108.5	100.8	Screen	7/6/2006	0.77	U	U	U
C5001 399-3-19 (4)	96.3	93.8	Below	4/28/2006	1.70	U	U	U
C5001 399-3-19 (5)	90.2	89.4	Below	5/3/2006	1.40	U	U	U
C5001 399-3-19 (6)	no sample	no sample	Below			U	U	U
399-3-20: Adjacent to downgradient side of 307 Process Trench (316-3 waste site)								
C5002 399-3-20 (1)	104.9	104.1	Within	5/12/2006	0.84	U	U	U
C5002 399-3-20 (2)	102.2	101.2	Within	5/12/2006	0.80	U	U	U
(completed well)	108.3	100.6	Screen	7/6/2006	1.50	U	U	U
C5002 399-3-20 (3)	98.5	98.2	Below	5/15/2006	1.60	U	U	U
C5002 399-3-20 (4)	93.0	92.4	Below	5/16/2006	630.00	9.90	6.50	U
C5002 399-3-20 (5)	no sample	no sample	Below					
C5002 399-3-20 (6)	no sample	no sample	Below					

Color Key: Blue = undetected (U); Black = detected; Red = Exceeds MCL
Abbreviations: MCL = maximum contaminant level (EPA drinking water standard); MDL = method detection limit

5.0 Summary

The Limited Field Investigation produced abundant new observational data about conditions in the vadose zone and unconfined aquifer in the 300 Area that are relevant to uranium contamination in the subsurface environment. Each of the four characterization borehole drilling sites represented a different combination of hydrologic settings, proximity to waste disposal sites, and proximity to the Columbia River. The sites were chosen to provide the widest assortment of subsurface conditions relative to contaminant uranium, given the resources available, such that the conceptual site model for uranium can be developed as comprehensively as possible. The new information obtained by the LFI pertains to (a) stratigraphy and hydrologic units, (b) the vertical distribution of uranium in the vadose zone and unconfined aquifer from laboratory geochemical analyses and field measurements, and (c) the potential usefulness of geophysical logging for mapping contaminant uranium in future 300 Area boreholes.

5.1 Summary of Principal Results

Objectives for the Phase I characterization boreholes are described in Section 1.2. The following presents a summary of results that are relevant toward meeting those objectives, along with additional general information on what was achieved during this investigation:

5.1.1 Drilling/Characterization Methodology

The sonic drilling method was successfully used at four representative locations to recover continuous core throughout the vadose zone and unconfined aquifer. The drilling activity also facilitated the collection of groundwater samples from the saturated zone, hydraulic testing at multiple depth horizons, and geophysical logging using a variety of tools. A portion of the core recovered has been archived and is available for future investigations.

The four characterization boreholes were completed as monitoring wells, with screened intervals positioned in the upper portion of the unconfined aquifer. Each well screen was strategically placed, based on laboratory analyses, to capture the peak vertical zone of uranium contaminated groundwater in the unconfined aquifer at each well location. The four new monitoring wells and their well identifiers are: 399-3-18 (C4999), 399-1-23 (C5000), 399-3-19 (C5001), and 399-3-20 (C5002). All four wells have been added to the groundwater monitoring schedule.

5.1.2 Hydrogeologic Framework

Geologic characterization activities during drilling have revealed significant new details on the subsurface stratigraphy at these sites. The new information has permitted re-interpretation of the drilling logs from previously installed wells, which has been followed by a substantial update of the database for the 300 Area hydrogeologic framework. Significant products include a newly defined structure contour surface for the contact between the gravel dominated Hanford formation Unit 1 and the underlying Ringold Formation Unit 5. The saturated portion of the Hanford gravels appears to contain the bulk of contaminant uranium, and the relief on the contact likely influences the movement pattern of that plume.

The Hanford formation Unit 1, composed predominantly of unconsolidated sandy gravel, is significantly more permeable than the underlying and older Ringold Formation, which includes more compacted and variably cemented fine-grained to gravelly sediment. The principal subunits of Ringold Formation Unit 5 include a) an undesignated fine-grained unit composed of silt and fine sand, and b) the silty sandy gravel interval.

The hydraulic conductivity (K_h) of the Hanford formation Unit 1 gravel is very high (≥2,000 meters per day) compared to the low-to-moderate conductivity in Ringold Formation Unit 5 subunit (0.04 to 41.2 meters per day). Because of these differences, the Hanford-Ringold contact represents an effective barrier to downward migration of groundwater and contaminants.

The Ringold Formation Unit 5 undesignated fine-grained subunit is composed of low permeability silty sand to sandy sediment, and is present at three of the four characterization borehole locations (it is not present at the northernmost location, 399-1-23). The subunit is characterized by alternating layers of oxidized and reduced fine-grained sediment, and by relatively low groundwater specific conductance values. Previous drilling had indicated the occasional presence of a similar fine-grained subunit in Ringold Unit 5. However, the LFI results have revealed that this subunit is more continuous than previously thought and has significance relative to contamination at depth. The undesignated fine-grained subunit does not contain elevated levels of uranium contamination, but has revealed evidence for contamination by VOC.

5.1.3 Contaminant Uranium in the Vadose Zone

The amount of uranium contamination (i.e., activity per unit mass of sediment) in vadose zone samples was determined by laboratory geochemical analysis of various extracts of the bulk sediments, including a 1:1 water extract, acid extract, and microwave-assisted digestion of the sample. GEA was also used to measure uranium activity in the laboratory samples. For nearly all measurements, the activity of uranium in the sediment is in the less than 4 pCi/g (based on dry weight). The uranium measured by GEA is presumed to be consistent with background levels of natural uranium in the sediment.

At three of the four borehole locations, there is no distinct evidence for elevated levels of uranium in sediment immediately above the water table. However, at one of the boreholes (399-1-23, near the former 300 Area Process Trenches), uranium is shown to be somewhat elevated in a zone positioned approximately one meter above the normal high water level at the borehole site, with values ranging up to 5.7 pCi/g. The highest activities of uranium are for analyses done using microwave assisted digestion, which is the most aggressive "extraction" method for preparing the sample, and thus would be the most likely extraction method for total uranium concentration including less mobile forms of uranium. The microwave-assisted digestions were performed on small masses of sediment from which gravel particles (>2 mm) were removed. Thus the microwave-assisted uranium concentration values were often larger than the GEA concentration values for the same bulk sediment that contained gravel. This is common because the larger gravel particles contain lower concentrations of trace constituents, such as uranium, than the smaller particles based on mass.

The relatively low levels of uranium, i.e., lower than expected, that were encountered in sediment samples from the vadose zone were too low to allow use of spectral gamma geophysical logging and GEA results measured in the field to define the vertical distribution of contaminant uranium in the boreholes. Geophysical logging analysts for this investigation have estimated that the lower detection limit for that logging effort was ~10 pCi of total uranium/g.

While most measurements for contaminant uranium in sediment from the vadose zone do not reveal distinctly elevated levels on a unit sediment mass basis, estimates for the concentration of uranium in the moisture associated with the sample (i.e., activity per pore water volume in the sediment) do reveal significantly elevated values in two of the four new wells. These estimates are based on the analyses of water extracts from the sediment, with the results then interpreted relative to the natural moisture content of the sample. The highest estimated values for uranium in pore water range up to ~3,650 pCi/L and were found in borehole 399-1-23. This borehole location is adjacent to the former 300 Area Process Trenches, which were the last infiltration trenches to receive uranium-bearing effluent. Elevated concentrations (~500 pCi/L) were also estimated for vadose zone pore water from borehole 399-3-18, which is located within the central portion of the mapped groundwater uranium plume. The significance of these high uranium concentrations estimated for vadose zone pore waters with respect to their influence on maintaining the groundwater plume remains under investigation.

5.1.4 Contaminant Uranium in the Aquifer

Uranium extracted from aquifer sediment samples was also at relatively low levels and comparable to levels observed in sediment from the vadose zone. There is the suggestion of a reduced zone containing elevated amounts of natural uranium in samples from the fine-grained aquifer sediments encountered at 399-3-18; it appears that this zone has been acting as a "sink" for natural uranium. Based on uranium leaching using different solutions, the uranium present in the aquifer sediments can slowly desorb from the contaminated sediments located near the capillary fringe region, where water chemistry is frequently changed by river water infiltration. Due to the sensitivity of uranium release to the chemistry of the contacting water, the river water influx and mixing in the capillary fringe zone could be a continuous source of slowly bleeding uranium into the 300 Area aquifer.

Uranium concentrations in depth-discrete groundwater samples collected during drilling are generally consistent with concentrations observed in historical groundwater monitoring samples. The highest groundwater uranium concentrations in the water obtained during borehole drilling ranged up to ~200 μg/L and were found at the location near the former 300 Area Process Trenches (399-1-23). At all four locations, the highest groundwater uranium concentrations were observed in samples from the saturated Hanford gravels. Samples collected from the underlying Ringold Formation showed very low concentrations of uranium that are consistent with natural background levels.

The depth-discrete interval groundwater sampling conducted during drilling confirmed that interpretations regarding the distribution and concentrations of the uranium plume are adequately represented by sampling and analysis activities in the current monitoring well network.

5.1.5 Additional Discoveries and Observations

Determining the characteristics of contaminant uranium was the primary focus for the LFI characterization activities. Additional measurements were made to provide supporting information relevant to uranium mobility, and to take advantage of the opportunity to screen for other 300 Area COPC.

VOCs were detected in many of the groundwater samples collected during drilling. Samples from depth intervals equivalent to those monitored by the established well network show concentrations that are consistent with those revealed by routine monitoring. However, unexpectedly high levels of trichloroethene were encountered in deeper groundwater samples from boreholes 399-3-18 and 399-3-20. These groundwater samples were obtained within the Ringold Formation undesignated fine grained unit (i.e., less transmissive). This discovery has led to planning for an additional investigation of VOCs in the 300 Area.

At borehole 399-3-18, unexpectedly low values for the specific conductance of groundwater samples collected during drilling were measured. The anomalously low values also appeared to be correlated with the relatively low permeability fine-grained subunit in the Ringold Formation. The significance of this finding is not currently well understood.

5.2 Phase II Drilling Activity

As initially conceived, the LFI would proceed with two phases of drilling: the first would involve coring and extensive characterization at representative locations (Phase I), and the second was to be a widespread distribution of direct-push boreholes to provide access for high resolution spectral gamma logging (Phase II). Because the levels of uranium encountered during the Phase I drilling were too low for detection by the spectra gamma logging equipment, the second phase was cancelled.

There are several consequences of this development, although none are expected to be critical to achieving sufficient information to proceed with the feasibility study. However, without a field method to map differences in the levels of uranium in the capillary fringe ("smear") zone throughout the area occupied by the uranium plume, there is no new information on the nature of those differences (i.e., large or small variations) and on correlations with proximity to waste sites, process sewer lines, the Columbia River, and water table fluctuations.

5.3 Limitations and Caveats

This LFI was planned and conducted in accordance with the purpose of providing better characterization of the sediment and uppermost aquifer beneath the 300-FF-5 OU. It was designed to provide an outline level of information of the vertical, stratigraphic occurrence and distribution of the primary constituent of concern, uranium, at four locations. These four locations were pre-selected based upon proximity to source(s), historic groundwater residual concentrations, and a simplified conceptual model that hypothesized the potential of a widespread occurrence of uranium at or near a fluctuating water table. The intent of this initial phase of characterization was to provide a rigorous basis for extrapolation with a second phase of investigation at 15 Direct Push Technology (DPT) locations spread across the site. With the technical inability to quantitatively correlate radioactivity from uranium in these DPT holes based on laboratory-analyzed uranium concentrations from sediments collected in the first phase, our ability to map the lateral extent of uranium deposits associated with sediments has been precluded. Consequently, this investigation is limited in its lateral resolution of a non-uniform, spatially variable contaminated site. With the exception of some limited pit samples collected in the two former pond areas prior to backfilling in 2004, there is minimal additional information concerning uranium residuals in or near known waste disposal units at the site. This deficiency increases the uncertainty of the resulting conceptual model. However, the ongoing treatability investigation near the south end of the 316-trench and future borings that will accompany phased implementation of future remediation deployments will provide opportunities for confirmation of the geochemical and uranium depositional patterns indicated by this investigation.

Indications of other contaminants, notably TCE, in two of the southern boreholes of this investigation were not delineated sufficiently by this investigation to define the source, extent, and magnitude of the chlorinated solvent(s). Follow-up characterization efforts have been planned and will be conducted to better address the chlorinated solvents detected in this study.

The 300-FF-5 OU is an extensive area with multiple historic release locations into a spatially variable subsurface vadose zone with a dynamic and temporally changing hydrogeology. An understanding of the contaminant distribution and mechanism developed from the information herein should be viewed within the broad context as presenting a larger scale conceptual model of uranium contamination as affecting dissolved uranium in the groundwater. It provides a sound fundamental beginning for developing a remediation strategy for the site. Further site resolution and particulars of implementing remedial actions will develop as the remediation effort proceeds.

6.0 LFI Phase I – Borehole Data

This section summarizes the drilling, characterization activities, and construction of the four Phase I groundwater monitoring wells. Groundwater monitoring wells 399-3-18 (C4999), 399-1-23 (C5000), 399-3-19 (C5001), and 399-3-20 (C5002) were installed in the four new boreholes between May and July 2006. The location of these wells is shown in Figure 6.1. These new groundwater monitoring wells also fulfill requirements of the *Hanford Federal Facility Agreement and Consent Order* (Ecology et al. 1989) Milestone M-24-57 (Murphy-Fitch 2003)[3] during FY 2006. The new wells were constructed to the specifications and requirements described in Washington Administrative Code (WAC) 173-160, *Sampling and Analysis Plan for CERCLA Well Drilling at 300-FF-5 OU, FY05* (DOE 2005a), and specifications provided by Fluor Hanford, Inc. (FHI), Richland, Washington.

Additional well construction documentation is on file with FHI. The Hanford Well Information System (HWIS) (http://apweb02.rl.gov/cfroot/rapidweb/phmc/cp/hwisapp/) contains electronic drilling and construction records for these wells (Note: this link is password protected, contact FHI or DOE for access approval).

The four boreholes were drilled with the resonant sonic drill method using 9-5/8 inch outside diameter (0.5-inch-thick) carbon steel casing and cored using a 6-feet long by 5-inch inside diameter split spoon core barrel. The boreholes were completed with nominal 6-inch-diameter stainless steel casings and screens as groundwater monitoring wells.

Two of the four characterization boreholes (399-3-18 [C4999] and 399-1-23 [C5000]) were drilled through the entire uppermost unconfined aquifer to the top of the Ringold Formation lower mud confining unit that separates and isolates the lower confined Ringold/basalt aquifer system. The purpose of the deep drilling was to provide access for characterization of the entire upper unconfined aquifer. The third and fourth characterization boreholes (399-3-19 [C5001] and 399-3-20 [C5002]) were only drilled to depths that extend midway into the unconfined aquifer because existing data and monitoring results suggested that the uranium contamination was mainly constrained to the very upper portion of the unconfined aquifer. All of these boreholes provided access to the vadose zone and upper portion of the unconfined aquifer for the collection of continuous sediment core and depth-discrete water samples for aquifer testing and borehole geophysical logging.

6.1 Field Screening

Field screening for radiological and chemical contaminants was completed at each well during drilling and sampling to fulfill site safety and worker health requirements. During drilling of the four new boreholes, drill cuttings and select core samples were screened in the field for VOCs and beta-gamma activity by radiation control technicians and site safety staff. Subsurface spectral gamma logs were also evaluated for gamma-emitting contaminants (details are discussed in Section 6.6.4).

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[3] Letter from EJ Murphy-Fitch (Fluor Hanford, Inc., Richland, Washington) to Distribution, "*Tentative Agreement on Tri-Party Agreement Negotiations on the Overall Strategy and Approach for Hanford Groundwater Protection, Monitoring, and Remediation (M-024),*" dated September 22, 2003.

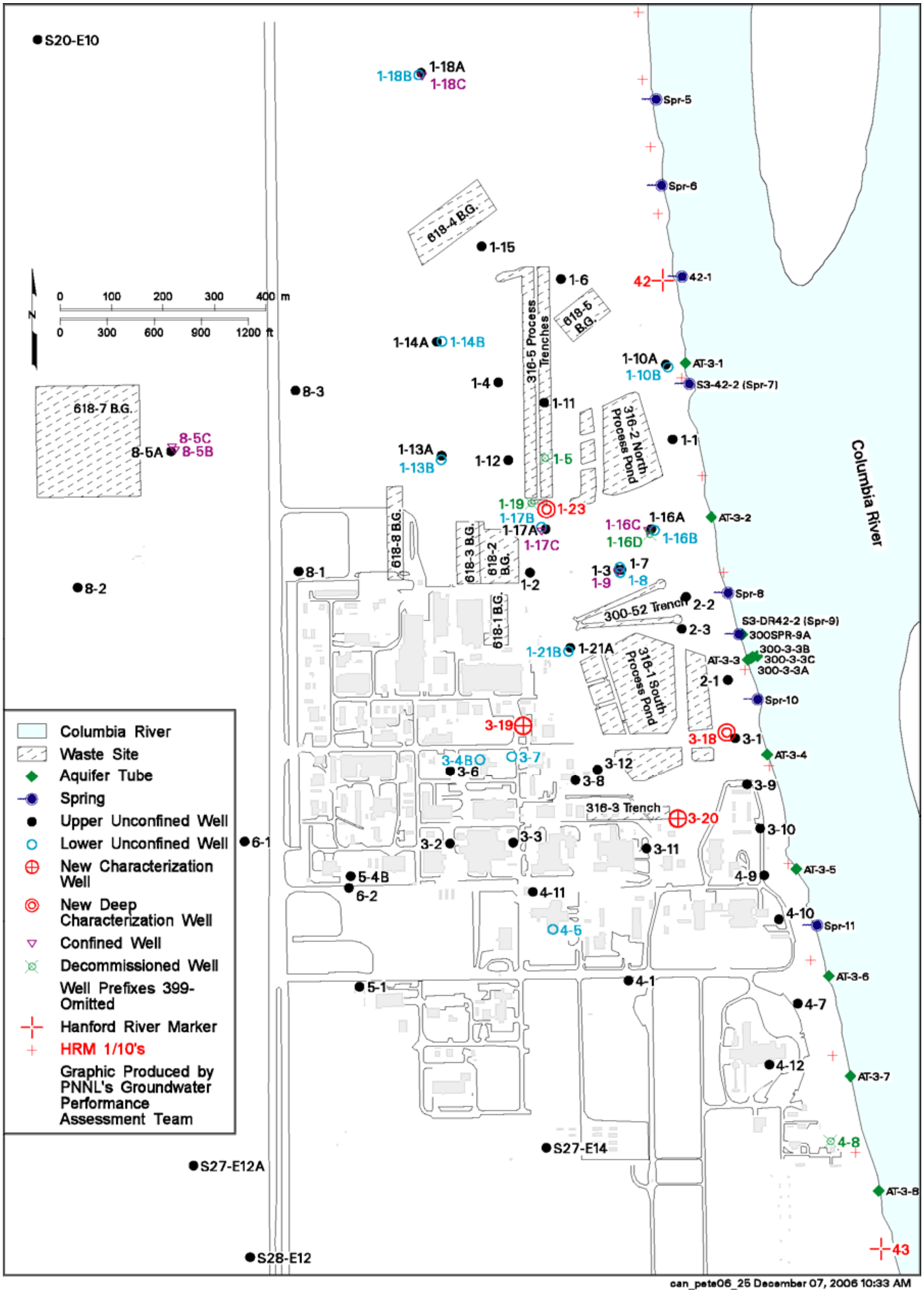

Figure 6.1. Well Location Map for Limited Field Investigation Wells 399-3-18 (C4999), 399-1-23 (C5000), 399-3-19 (C5001), and 399-3-20 (C5002), 300-FF-5 Operable Unit

Radiation screening of cuttings revealed only natural background levels. Results of field screening for radiation and gases during drilling are indicated on the daily drilling reports, which are on file with the drilling contractor (FHI).

6.2 Well 399-3-18 (C4999)

Well 399-3-18 (C4999) is located approximately 200 feet west of the Columbia River in the 300 Area (Figure 6.1), downgradient of the former 316-1 South Process Ponds and slightly west of existing well 399-1-3. The new well monitors the uppermost unconfined aquifer and is screened across lower Hanford formation sediments.

6.2.1 Drilling and Sampling

Well 399-3-18 (C4999) was drilled with a rotosonic drill rig from surface to a total depth of 131 feet bgs. Temporary 9-5/8-inch outside diameter casing was used during drilling to total depth. Drilling began on March 9, 2006, and total depth was reached on March 23, 2006.

Continuous coring was attempted during drilling from the surface to 130.5 feet bgs. Representative core was obtained from approximately 71% of the borehole. The water table was encountered at approximately 42.5 feet bgs. The borehole log in Appendix A provides the lithologic description of sediments encountered in the field during drilling. The composite log in Figure 3.2 is a compilation of all geologic, hydrologic, geophysical, and uranium data collected from the well. High-resolution digital photographs of the sediment core are provided in Appendix B.

Ten depth-discrete water samples were collected, and four depth-discrete aquifer hydraulic tests were performed during drilling through the unconfined aquifer. The groundwater samples were analyzed as described in Section 6.6.2. Select results from the vadose zone and groundwater analysis are plotted on the composite log (Figure 3.2) to illustrate the vertical contaminant distribution and the relationship to the various hydrogeologic units.

Sediments encountered during drilling were composed of approximately 13 feet of coal ash and other backfill sediment near the surface followed by predominantly unconsolidated cataclysmic flood deposits composed of mostly the gravel-dominated facies of the hydrologic Unit 1 (Hanford formation) from approximately 13 feet to a depth of 46.3 feet bgs.

The Hanford/Ringold contact at this location is marked by a very abrupt and sharp change in lithology. Beneath the Hanford formation gravel-dominated facies lay fluvial deposits belonging to an undesignated fine-grained unit of the Ringold Formation (Unit 5), which is composed of a thick, well sorted sequence of compact silty, very fine sand from approximately 46.3 feet to a depth of 81.5 feet bgs. A silty sandy gravel to gravelly sand sequence of the Ringold Formation Unit 5 was encountered from 81.5 feet to a depth of approximately 126.4 feet bgs. The Ringold Formation lower mud unit, which is considered the lower boundary of the upper unconfined aquifer was contacted at 126.4 feet bgs and extends to at least the total depth at approximately 130.5 feet bgs. The lower mud unit is composed of clayey silt to silty sand. The field geologist's borehole log, along with the well construction summary report, as-built diagram, well development and pump installation records, and well survey results are included in Appendix A. Appendix B contains the core chain-of-custody forms, the core photographs, and the detailed geologic description of the sediment core. A more detailed hydrogeologic interpretation of the borehole sediments is included in Section 3.0.

The borehole and drill cuttings were monitored regularly for organic vapors and radionuclide contaminants (i.e., gamma). Radioisotope monitoring revealed no detectable contamination was present. Spectral gamma and neutron moisture geophysical logs were run in the temporary borehole in March 2006 by Stoller Corporation (Appendix C). Section 6.6.4 provides more details of this logging.

6.2.2 Well Completion

The permanent casing and screen were installed in well 399-3-18 (C4999) on March 28, 2006. A 15-feet long, 6-inch inside diameter, stainless steel, continuous wire-wrap 20 slot (0.02-inch slot) screen was set from 32.86 to 47.86 feet bgs (Figure 3.2). A 2-feet long, 6-inch inside diameter stainless steel sump is attached to the bottom of the screen and extends from 47.86 to 49.86 feet bgs. The permanent well casing is 6-inch ID, stainless steel from 32.86 feet bgs to 2.18 feet above ground surface.

The screen filter pack is composed of 10-20 mesh silica sand placed from 22 to 52 feet bgs, which was developed with a dual surge block to settle the sand pack. The annular seal is composed of 3/8-inch bentonite pellets from 17.2 to 22 feet bgs and granular bentonite crumbles from 17.2 to 10.1 feet bgs. The surface seal is composed of Portland cement grout from 10.1 feet bgs to ground surface. A 4-feet by 4-feet by 6-inch concrete pad was placed around the well at the surface. A protective well head casing with locking cap, four protective steel posts, and a brass marker stamped with the well identification number and Hanford well number were set into the concrete pad.

A borehole straightness test was completed. The vertical and horizontal coordinates of the well were surveyed by Fluor Federal Services on August 3, 2006. The horizontal position of the well was referenced to horizontal control stations established by the U.S. Army Corps of Engineers (USACE). The coordinates horizontal datum is NAD83(91). Vertical datum is NAVD88 and is based on existing USACE bench marks. The coordinates are Washington Coordinate System, South Zone. Survey data are included in Table 6.1 and Appendix A. The static water level was 39.5 feet bgs on April 13, 2006.

6.2.3 Well Development and Pump Installation

Well 399-3-18 (C4999) was developed on April 13, 2006, at the bottom of the screen at approximately 50.5 feet below top of casing (btc) using a temporary submersible pump. The depth to water was measured at 42.6 feet below btc prior to development. A pressure transducer was installed above the pump and connected to a Hermit datalogger to monitor water level during development. A total of 1,485 gallons of water was pumped. Table 6.2 contains the well development results, including pump intake depth, pump rate, pump run time, drawdown, final turbidity (NTU), pH, and temperature readings. Water samples were collected following well development and submitted to the labs for analysis.

A dedicated 0.5-horsepower Grundfos™ submersible sampling pump (model 5SO5-13) was installed in well 399-3-18 (C4999) on May 23, 2006. The sampling pump intake was set at 43.53 feet bgs, and connected to the surface with 3/4-inch diameter stainless steel riser pipe.

Table 6.1. Location and Elevation Data for New CERCLA Wells 399-3-18 (C4999), 399-1-23 (C5000), 399-3-19 (C5001), and 399-3-20 (C5002)

Well Name (Well ID)	Easting (meters)	Northing (meters)	Elevation (meters)	Comments
399-3-18 (C4999)	594464.71	116019.98		Center of casing
			118.615	Top of casing, N. edge
			117.680	Brass survey marker
			118.620	Top pump base plate, N. edge
399-1-23 (C5000)	594113.52	116453.04		Center of casing
			116.307	Top of casing, N. edge
			115.446	Brass survey marker
			116.312	Top pump base plate, N. edge
399-23-19 (C5001)	594071.94	116030.22		Center of casing
			121.447	Top of casing, N. edge
			120.647	Brass survey marker
			121.452	Top pump base plate, N. edge
399-3-20 (C5002)	594375.42	115849.70		Center of casing
			121.76	Top of casing, N. edge
			120.448	Brass survey marker
			121.281	Top pump base plate, N. edge
Note: Horizontal Datum is NAD83(91); Vertical Datum is NAVD88; Washington State Plane Coordinates (South Zone).				

6.3 399-1-23 (C5000)

Well 399-1-23 (C5000) is located approximately 60 feet from the south end (effluent disposal end) of the 316-5 Process Trenches (Figure 6.1) and is slightly northeast of existing wells 399-1-17A, B, and C. The new well monitors the uppermost unconfined aquifer and is screened across lower Hanford formation sediments (Figure 3.3).

6.3.1 Drilling and Sampling

Well 399-1-23 (C5000) was drilled with a rotosonic drill rig from surface to a total depth of 116 feet bgs. Temporary 9 5/8-inch outside diameter casing was used during drilling to total depth. Drilling began on March 30, 2006, and total depth was reached on April 12, 2006.

Continuous coring was attempted during drilling from the surface to 112.5 feet bgs. Representative core was obtained from approximately 63% of the borehole. The water table was encountered at approximately 33.5 feet bgs. The borehole log in Appendix A provides the lithologic description of sediments encountered during drilling. The composite log (Figure 3.3) summarizes the core sample intervals, and provides the lithology and graphic log based on a detailed description of the core samples. Digital photographs of the sediment core are provided in Appendix B.

Table 6.2. Well Development Information for Wells 399-3-18 (C4999), 399-1-23 (C5000), 399-3-19 (C5001), and 399-3-20 (C5002)

Well Number	Pump Rate (gpm)	Pump Intake Depth (ft btc)	Pumping Run Time (min)	Drawdown (ft)	Final Field Readings	Recovery Test Time
399-3-18 (C4999)	15	50.5	30	0	10.3 NTU, 345 µs/cm, 15.5°C, pH = 7.43, DO = 8.3	N/A
	15	50.5	69	0	2.69 NTU, 349 µs/cm, 16.4°C, pH = 7.51, DO = 8.1	N/A
399-1-23 (C5000)	16	48	29	N/A	1.88 NTU	N/A
	16	36	31	N/A	2.82 NTU	N/A
399-3-19 (C5001)	15	68.6	48	0.2	0.83NTU, 480 µc/cm, 17.2°C, pH = 7.23,	N/A
	15	53.6	27	0.001	0.43 NTU, 477 µs/cm, 17.2°C, pH = 7.42	N/A
399-3-20 (C5002)	15	68	42	0.09	0.81 NTU, 416 µc/cm, 17.2°C, pH = 7.4	N/A
	15	53	36	0.1	0.67 NTU, 414 µc/cm, 18.5°C, pH = 7.43	N/A

ft btc = Feet below top of casing.
gpm = Gallons per minute.
N/A = Not available.
NTU = Nephelometric turbidity unit.
µs/cm = Micro siemens per centimeter.
DO = Dissolved oxygen.

Ten depth-discrete water samples were collected and seven depth-discrete aquifer hydraulic tests were performed during drilling through the unconfined aquifer. The groundwater samples were analyzed as described in Section 6.6.2. Select results from the vadose zone and groundwater analysis are plotted on the composite log to illustrate the vertical contaminant distribution and the relationship to the various hydrogeologic units.

Sediments encountered during drilling were comprised of approximately 51 feet of predominantly unconsolidated silty sandy gravel of the Hanford formation (hydrologic Unit 1) from approximately 1.5 feet to a depth of 52.5 feet bgs. Backfill and/or recent Holocene deposits make up the upper 1.5 feet of the borehole.

The exact Hanford/Ringold contact (~52.5 feet bgs) at this location is difficult to identify and data suggest a gradational contact consisting of a mixture of similarly textured Hanford formation silty sandy gravel and Ringold Formation silty sandy gravel. However, the transition from grey poorly sorted gravel to brown, better sorted gravel at approximately 52.5 feet suggest that the contact is near this depth. The Ringold Formation Unit 5 consists predominantly of a silty sandy gravel to sandy gravel with minor silty to sandy intervals from 52.5 feet to a depth of approximately 110.3 feet bgs. The Ringold Formation Lower Mud Unit, which is considered the lower boundary of the upper unconfined aquifer was contacted at 110.3 feet bgs and extends deeper than the borehole total depth at approximately 116 feet bgs. The

Lower Mud Unit is composed of silt to silty fine sand. The field geologist's borehole log, along with the well construction summary report, as-built diagram, well development and pump installation records, and well survey results are included in Appendix A. Appendix B contains the core chain-of-custody forms and the core photographs. A more detailed hydrogeologic interpretation of the borehole sediments is included in Section 3.0.

The borehole and drill cuttings were monitored regularly for organic vapors and radioisotope contaminants (i.e., gamma). Radioisotope monitoring revealed no detectable contamination was present. Spectral gamma and neutron moisture geophysical logs were run in the temporary borehole in April 2006 by Stoller Corporation (Appendix C). Section 6.6 provides more details of this logging.

6.3.2 Well Completion

The permanent casing and screen were installed in well 399-1-23 (C5000) on April 19, 2006. A 25-feet long, 6-inch inside diameter, stainless steel, continuous wire-wrap 20 slot (0.02-inch slot) screen was set from 24.94 to 49.95 feet bgs (Figure 3.3). A 2-feet long, 6-inch inside diameter stainless steel sump is attached to the bottom of the screen and extends from 49.95 to 51.98 feet bgs. The permanent well casing is 6-inch inside diameter, stainless steel from 24.94 bgs to 1.65 feet above ground surface.

The screen filter pack is composed of 10-20 mesh silica sand placed from 20 to 54.4 feet bgs, which was developed with a dual surge block to settle the sand pack. The annular seal is composed of 3/8-inch bentonite pellets from 14.4 to 20 feet bgs and granular bentonite crumbles from 14.4 to 10.8 feet bgs. The surface seal is composed of Portland cement grout from 10.8 feet bgs to ground surface. A 4-foot by 4-foot by 6-inch concrete pad was placed around the well at the surface. A protective well head casing with locking cap, four protective steel posts, and a brass marker stamped with the well identification number and Hanford well number were set into the concrete pad.

The vertical and horizontal coordinates of the well were surveyed by Fluor Federal Services on August 3, 2006. The horizontal position of the well was referenced to horizontal control stations established by the USACE. The horizontal datum is NAD83(91). Vertical datum is NAVD88 and is based on existing USACE bench marks. The coordinates are Washington Coordinate System, South Zone. Survey data are included in Table 6.1 and Appendix A. The static water level was 30.3 feet bgs on May 1, 2006.

6.3.3 Well Development and Pump Installation

Well 399-1-23 (C5000) was developed on May 1, 2006. Two intervals, 48 feet and at 38 feet below top of casing (btc), were pumped using a temporary submersible pump. The depth to water was measured at 33.0 feet btc prior to development. A pressure transducer was installed above the pump and connected to a Hermit datalogger to monitor water level during development. A total of 930 gallons of water was pumped. Table 6.2 contains the well development results, including pump intake depth, pump rate, pump run time, drawdown, and final turbidity (NTU).

A dedicated 0.5 hp Grundfos™ submersible sampling pump (model 5SO5-13) was installed in well 399-1-23 (C5000) on May 23, 2006. The sampling pump intake was set at 43.88 feet bgs, and connected to the surface with 3/4-inch diameter stainless steel riser pipe. Depth to water was measured at 33.4 feet btc.

6.4 Well 399-3-19 (C5001)

Well 399-3-19 (C5001) is located upgradient approximately 450 feet west of the 316-1 South Process Ponds within the 300 Area (Figure 6.1). The new well monitors the uppermost unconfined aquifer and is screened across lower Hanford formation sediments (Figure 3.4).

6.4.1 Drilling and Sampling

Well 399-3-19 (C5001) was drilled with a rotosonic drill rig from surface to a total depth of 103.5 feet below ground surface (bgs). Temporary 9 5/8-inch outside diameter casing was used during drilling to total depth. Drilling began on April 24, 2006, and total depth was reached on May 3, 2006.

Continuous coring was attempted during drilling from the surface to approximately 100 feet bgs. However, core recovery was poor (<50%) in the saturated Hanford formation because of the loose, unconsolidated nature of the gravel. The water table was encountered at approximately 47.2 feet bgs on April 26, 2006. The borehole log in Appendix A provides the lithologic description of sediments encountered during drilling. The composite log (Figure 3.4) summarizes the core sample intervals, and provides the lithology and graphic log based on a detailed description of the core samples. Digital photographs and detailed geologic description of the core are in Appendix B.

Five depth-discrete water samples were collected and two depth-discrete aquifer hydraulic tests were performed during drilling through the unconfined aquifer. The groundwater samples were analyzed as described in Section 6.6.2. Select results from the vadose zone and groundwater analysis are plotted on the composite log (Figure 3.4) to illustrate the vertical contaminant distribution and the relationship to the various hydrogeologic units.

Sediments encountered during drilling were comprised of approximately 13 feet of backfill sediments at the surface, followed by predominantly unconsolidated sand to sandy gravel and gravel of the hydrologic Unit 1 (Hanford formation) from approximately 13 feet to a depth of 83 feet bgs.

The Hanford/Ringold contact at this location is at approximately 83 feet bgs and distinguished by changes in lithology and color. There is only approximately 1.5 feet of Ringold Formation Unit 5 sandy gravel before the lithology changes abruptly into a clayey silt to sand interval located from approximately 84.7 feet bgs to 98 feet bgs. The borehole reached a total depth of 103.5 feet bgs within the Unit 5 sandy gravel. The field geologist's borehole log, along with the well construction summary report, as-built diagram, well development and pump installation records, and well survey results are included in Appendix A. Appendix B contains the core chain-of-custody forms, the core photographs, and the detailed geologic description of the sediment core. A more detailed hydrogeologic interpretation of the borehole sediments is included in Section 3.0.

The borehole and drill cuttings were monitored regularly for organic vapors and radioisotope contaminants (i.e., gamma). Radioisotope monitoring revealed no detectable contamination was present. Spectral gamma and neutron moisture geophysical logs were run in the temporary borehole in May 2006 by Stoller Corporation (Appendix C). Section 6.6.4 provides more details of this logging.

6.4.2 Well Completion

The permanent casing and screen were installed in well 399-3-19 (C5001) on May 5, 2006. A 25-foot long, 6-inch inside diameter, stainless steel, continuous wire-wrap 20 slot (0.02-inch slot) screen was set from 40.29 to 65.42 feet bgs (Figure 3.4). A 2-feet long, 6-inch inside diameter stainless steel sump is attached to the bottom of the screen and extends from 65.42 to 67.45 feet bgs. The permanent well casing is 6-inch inside diameter, stainless steel from 40.29 bgs to 1.69 feet above ground surface.

The screen filter pack is composed of 6-9 mesh silica sand placed from 29.9 to 71.9 feet bgs, and was developed with a dual surge block to settle the sand pack. The annular seal is composed of 3/8-inch bentonite pellets from 23.9 to 29.9 feet bgs and granular bentonite crumbles from 10.5 to 23.9 feet bgs. The surface seal is composed of Portland cement grout from 10.5 feet bgs to ground surface. A 4-foot by 4-foot by 6-inch concrete pad was placed around the well at the surface. A protective well head casing with locking cap, four protective steel posts, and a brass marker stamped with the well identification number and Hanford well number were set into the concrete pad.

The vertical and horizontal coordinates of the well were surveyed by Fluor Federal Services on August 3, 2006. The horizontal position of the well was referenced to horizontal control stations established by the USACE. The horizontal datum is NAD83(91). Vertical datum is NAVD88 and is based on existing USACE bench marks. The coordinates are Washington Coordinate System, South Zone. Survey data are included in Table 6.1 and Appendix A. The static water level was 47.7 feet bgs on May 22, 2006.

6.4.3 Well Development and Pump Installation

Well 399-3-19 (C5001) was developed on May 22, 2006, at two locations within the screen at approximately 68.3 and 53.6 feet btc using a temporary submersible pump. The depth to water was measured at 50.34 feet btc prior to development. A pressure transducer was installed above the pump and connected to a Hermit datalogger to monitor water level during development. A total of 1,125 gallons of water was pumped. Table 6.2 contains the well development results, including pump intake depth, pump rate, pump run time, drawdown, final turbidity (NTU), specific conductivity, pH, dissolved oxygen, and temperature readings.

A dedicated 0.5-horsepower Grundfos™ submersible sampling pump (model 5SO5-13) was installed in well 399-3-19 (C5001) on May 23, 2006. The sampling pump intake was set at 59.10 feet bgs, and connected to the surface with 3/4-inch diameter stainless steel riser pipe.

6.5 Well 399-3-20 (C5002)

Well 399-3-20 (C5002) is located immediately downgradient, and adjacent to the southeast side of the 307 Trench within the 300 Area (Figure 6.1). The new well monitors the uppermost unconfined aquifer and is screened across lower Hanford formation sediments (Figure 3.5).

6.5.1 Drilling and Sampling

Well 399-3-20 (C5002) was drilled with a rotosonic drill rig from surface to a total depth of 95 feet bgs. Temporary 9 5/8-inch outside diameter casing was used during drilling to total depth. Drilling began on May 11, 2006, and total depth was reached on May 16, 2006. A borehole straightness test was successfully completed.

Continuous coring was attempted during drilling from the surface to approximately 95 feet bgs. However, core recovery was poor (<50%) in the saturated Hanford formation because of the loose, unconsolidated nature of the gravel. The water table was encountered at approximately 47.7 feet bgs on May 12, 2006. The borehole log in Appendix A provides the lithologic description of sediments encountered during drilling. The composite log (Figure 3.5) summarizes the core sample intervals and provides the lithology and graphic log based on a detailed description of the core samples. Digital photographs of the sediment core are provided in Appendix B.

Four depth-discrete water samples were collected, and four depth-discrete aquifer hydraulic tests were performed during drilling through the unconfined aquifer. The groundwater samples were analyzed as described in Section 6.6.2. Select results from the vadose zone and groundwater analysis are plotted on the composite log (Figure 3.5) to illustrate the vertical contaminant distribution and the relationship to the various hydrogeologic units.

Sediments encountered during drilling include approximately 10 feet of backfill overlaying 6.5 feet of eolian (Holocene) sand from approximately 10 to 16.5 feet bgs. The Hanford formation Unit 1 is composed of unconsolidated silty sandy gravel to gravel from approximately 6.5 feet to a depth of 80 feet bgs.

The Hanford/Ringold contact at this location is at approximately 80 feet bgs and distinguished by changes in lithology and color. The Ringold Formation Unit 5 sandy gravel is less then 2 feet thick and changes abruptly into sand that extends from approximately 81.8 feet bgs to 95 feet bgs (total depth). The borehole reached a total depth of 95 feet bgs within the Unit 5 fine-to coarse-grained sand. The field geologist's borehole log, along with the well construction summary report, as-built diagram, well development and pump installation records, and well survey results are included in Appendix A. Appendix B contains the core chain-of-custody forms, the core photographs, and a detailed geologic description of the core. A more detailed hydrogeologic interpretation of the borehole sediments is included in Section 3.0.

The borehole and drill cuttings were monitored regularly for organic vapors and radioisotope contaminants (i.e., gamma). Radioisotope monitoring revealed no detectable contamination was present. Spectral gamma and neutron moisture geophysical logs were run in the temporary borehole in May 2006 by Stoller Corporation (Appendix C). Section 6.6.4 provides more details of this logging.

6.5.2 Well Completion

The permanent casing and screen were installed in well 399-3-20 (C5002) on May 18, 2006. A 25-foot long, 6-inch inside diameter, stainless steel, continuous wire-wrap 20 slot (0.02-inch slot) screen was set from 40.24 to 65.26 feet bgs (Figure 3.5). A 2-foot long, 6-inch inside diameter stainless steel sump is attached to the bottom of the screen and extends from 65.26 to 67.28 feet bgs. The permanent well casing is 6-inch inside diameter, stainless steel from 40.24 feet bgs to 1.74 feet above ground surface.

The screen filter pack is composed of 6-9 mesh silica sand placed from 29.9 to 72.1 feet bgs, and was developed with a dual surge block to settle the sand pack. The annular seal is composed of 3/8-inch bentonite pellets from 25.5 to 29.9 feet bgs and granular bentonite crumbles from 10.2 to 25.5 feet bgs. The surface seal is composed of Portland cement grout from 10.2 feet bgs to ground surface. A 4-foot by 4-foot by 6-inch concrete pad was placed around the well at the surface. A protective well head casing with locking cap, four protective steel posts, and a brass marker stamped with the well identification number and Hanford well number were set into the concrete pad.

The vertical and horizontal coordinates of the well were surveyed by Fluor Federal Services on August 3, 2006. The horizontal position of the well was referenced to horizontal control stations established by the USACE. The horizontal datum is NAD83(91). Vertical datum is NAVD88 and is based on existing USACE bench marks. The coordinates are Washington Coordinate System, South Zone. Survey data are included in Table 6.1 and Appendix A. The static water level was 46.4 feet bgs on May 22, 2006.

6.5.3 Well Development and Pump Installation

Well 399-3-20 (C5002) was developed on May 27, 2006, at two locations within the screen at approximately 68 and 66 feet btc using a temporary submersible pump. The depth to water was measured at 49.07 feet btc prior to development. A pressure transducer was installed above the pump and connected to a Hermit datalogger to monitor water level during development. A total of 1,170 gallons of water was pumped. Table 6.2 contains the well development results, including pump intake depth, pump rate, pump run time, drawdown, final turbidity (NTU), specific conductivity, pH, and temperature readings.

A dedicated 0.5-horsepower Grundfos™ submersible sampling pump (model 5SO5-13) was installed in well 399-3-20 (C5002) on May 23, 2006. The sampling pump intake was set at 58.94 feet bgs, and connected to the surface with 3/4-inch diameter stainless steel riser pipe.

6.6 Field Characterization and Laboratory Activities Associated with the 300 Area Limited Field Investigation

This section details the characterization activities conducted during drilling of the four new boreholes. It also provides the sampling and analysis results from sediment, groundwater, and other testing methods used in the hydrogeologic and geochemical investigation of the vadose zone and uppermost unconfined aquifer. Section 3.0 provides an updated hydrogeologic interpretation based on these LFI results. Section 4.0 incorporates the contaminant concentration data results from sediment and groundwater analysis into the updated hydrogeology conceptual model and provides an interpretation of contaminant distribution within the vadose zone and uppermost unconfined aquifer within the LFI area of the 300 Area.

Characterization activities, i.e., sampling and testing, conducted in association with drilling the four boreholes include the following:

- Collection of sediment grab samples and continuous intact sediment core returned to the surface during drilling
- Geochemical characterization of sediments
- Collection and analysis of depth-discrete groundwater samples during drilling
- Depth-discrete aquifer testing during and after drilling
- Water-level measurements
- High-resolution borehole geophysical logging at the completion of drilling and prior to well construction (i.e., packing the outside annulus of the permanent casing with sand, bentonite, and concrete at selected depths)
- Well development parameters (groundwater field parameters and drawdown during pumping and recovery).

6.6.1 Sediment Sampling and Analysis

This section describes the sediment sampling methods used during Phase I Well Drilling, and the sediment analysis and data results. Continuous and minimally disturbed (intact) sediment cores were required from surface to total depth in each borehole (DOE 2006a). The purposes of the core samples were to provide (1) intact sediment samples for more detailed and representative descriptions of the borehole lithology and to improve and refine the hydrogeologic conceptual model, (2) intact, depth-discrete samples for evaluation of physical and chemical properties associated with uranium contamination and sequestration, and (3) intact, whole-core samples for treatability testing to develop chemical treatment techniques that can be used to reduce uranium contamination to groundwater. Actual core recovery varied depending on the type of sediments being cored. A high percentage of the saturated Hanford formation core was not recovered intact due to loose, unconsolidated coarse sand and gravel, and in many instances, those intervals had to be cored a second time to recover sediment. Core recovery did improve in the Ringold Formation because it is composed of more consolidated sediments.

The detailed geologic descriptions of the opened core are contained in Appendix B and graphically displayed on the composite logs (Figures 3.2 through 3.5). The composite logs (Section 3.0) also contain the cored depths and intervals for each borehole. Appendix B also provides a digital photograph of each core opened. After opening and sub-sampling, the remaining core material was retained in 1-2 liter plastic containers, labeled with depth and well number. These moisture-proof containers are archived at the Environmental Sciences Laboratory (ESL) located in the 300 Area.

At the sediment characterization laboratory, the core samples were subdivided and analyzed based on the protocol and procedures defined in the sampling and analysis plan (DOE 2006a). Table 6.3 provides a summary of analysis performed on the sediment samples.

The wellsite geologist's borehole logs in Appendix A contain a general description of the cored and drilled interval for each well. The borehole logs include descriptions of the following:

- Drilling conditions and changes in drilling conditions (e.g., drilling method, drill rate, addition of water, heaving sand)

- Depths of all collected samples and tests

- Lithologic descriptions of sediment (e.g., grain size classification, color, mineralogy/lithology, sorting, etc.).

A total of 420 feet of core was recovered from the four Phase I boreholes. Approximately 58% of the cored intervals were considered representative of subsurface lithology. Table 6.4 provides the total depth drilled in each borehole, the total cored interval in each borehole, and the number and percentage of those core that were determined to be representative of subsurface conditions. The composite Logs (Figures 3.2 through 3.5) illustrate the core intervals in each borehole

Table 6.3. Characterization Analyses

Tier 1 Characterization Analyses	Tier 2 Characterization Analyses
• Core opening, including visual inspection, geological characterization, and photographing of the cores • Moisture content measurement • GEA	• 1:1 Sediment:water extracts (pH, specific conductance, anion, cation, alkalinity, and uranium concentration) • Acid extracts (cation and uranium concentration) • Microwave digestion (cation and uranium concentration) • Ultracentrifuge analysis for pore water (pH, specific conductance, anion, cation, alkalinity, and uranium concentration) • Particle size analysis • Total elemental analysis • Carbon content analysis • Labile uranium leaching by carbonate solution • Uranium-leaching with three different background solutions (synthetic pore water, groundwater, and river water)

Table 6.4. 300 Area LFI Sediment Core Inventory by Well

Well ID	Total Drill Depth (feet bgs)	Total Cored Interval (feet bgs)	Intact Core Recovered[(a)] (feet)	% Recovery of Representative Core (%)	Comments
399-3-18 (C4999)	131	0-130.5	93	71.0	Opened core moved to containers for storage at ESL after opening
399-1-23 (C5000)	116	0-113	70.8	62.7	Opened core moved to containers for storage at ESL after opening
399-3-19 (C5001)	103.5	1-89	41.2	46.8	11 feet of core was bagged (~89 to 100 feet bgs)
399-3-20 (C5002)	95	3.5-91	39.3	44.9	7 feet of core was bagged (~85 to 91, and 95 feet bgs)
Total	445.5	419.5	244.3	58.2	

(a) Core Recovered = a sum of intact core. Empty liners and slough intervals are not counted.
bgs = Below ground surface.
ESL = Environmental Sciences Laboratory.

The core samples were obtained by utilizing sonic energy from the drill string to drive a 6-feet-long by 6-inch-diameter splitspoon core barrel ahead of the drilled portion of the borehole into undisturbed sediment (Figure 6.2). After retrieval of the core barrel, the borehole was over-drilled, using a larger diameter drive casing, to the depth reached by the core barrel (~4-6 feet interval) and the borehole was cleaned out to the bottom of the casing to remove cuttings and slough in preparation for the next core barrel run. The depth to the bottom of the borehole was confirmed with a steel tape prior to each core barrel run. The core barrel assembly contains six 1-foot-long, 5-inch inside diameter Lexan (plastic) liners stacked end to end and is fitted with a 6-inch-long drive shoe attached at the front end. Slough in the bottom of the borehole could not always be kept cleaned out so portions of the upper core liners occasionally contained slough. These slough liners were identified based on (1) knowledge of the re-cored depth intervals, and/or (2) direct examination of core ends, and/or (3) confirmed through examination when opened in the laboratory. Where possible, the slough material was not used for sample analysis.

Upon retrieval, the 6-feet-long core barrels were immediately opened at the drill site and the individual 1-foot-long liners were labeled with top and bottom depths, directional arrow, sequential liner number, and well ID. All liners were sealed with plastic end caps and sealing tape and placed in coolers for temporary storage until they could be transferred offsite to the PNNL ESL in the 325 Building in the 300 Area.

The sequential numbering of each 1-foot long core section was recorded for each well to assure proper depth placement and location of the core (Appendix B). Chain-of-custody forms were used to inventory and track the transfer of the core from the drill site to the laboratory (Appendix B).

(a)

(b)

Figure 6.2. a) Six-Foot Splitspoon Core Barrel and Drive Shoe, and b) Opened Splitspoon Core Barrel During Recovery of Lexan Core Liners

An integrated sampling approach was used to select which core samples were opened for physical and geochemical analysis and which core sections were retained intact for treatability testing and/or archived for future testing. Core that was designated for physical and geochemical analysis was placed horizontally on a lighted table jig, cut lengthwise in half, and laid open for sub-sampling. A high-resolution digital photograph of each opened core section was taken to record the intact sediment structure, lithology, grain size distribution and orientation, and color (Appendix B). A licensed geologist observed the split core to determine the most representative intervals for sampling (and to identify and remove slough intervals). Sub-sampling was accomplished by scooping sediment, typically from the center of the opened core, and sealing the sample in labeled airtight containers. The geologist examined each opened core and prepared a detailed lithologic description of the sediment before the core material was transferred into labeled containers for storage and archival. Cores that were not opened were retained intact and placed in cold storage.

The core descriptions from each well revealed similar occurrences and trends related to drilling and changes in lithology (i.e., geologic formation). Most of the 6-feet-long core runs in the Ringold Formation had nearly complete recovery. Recovery was poorer in the Hanford formation, where most of the core runs had slough in the uppermost (shallowest) liner(s). The quality of the core sediments for all but the coarsest material was good, i.e., the preservation of textural, stratigraphic, and large clast orientations (Appendix B). The lowest core recovery rates occurred when coring in the saturated lower Hanford formation gravel, which is composed of nearly 100% gravel to sandy gravel with minimal amounts of silt, and/or clay material to hold or bind the sediment particles together and keep them from falling out during retrieval. Note: various attempts were made to keep these gravel sediments from falling out of the core barrel during retrieval, including using retention baskets, welded nuts and bolts inside the core barrel drive shoe, etc. It was not surprising that these gravel-dominated intervals also had the highest apparent permeability based on aquifer hydraulic testing and other (water sampling) measurements. The highest percentage of core recovery was within the compacted fine-grained Ringold Formation sediments.

Overall, the quality of the LFI coring operation was greatly improved versus conventional splitspoon coring by utilizing larger diameter (5-inch-diameter versus 4-inch-diameter) liners and a longer splitspoon core barrel (6-feet versus 2-feet). The larger diameter core allowed a more complete recovery of the predominantly pebbly to cobble gravel sections without plugging, breaking, pulverizing, or rotating/ moving the larger clasts (Figure 6.3). The longer core barrels allowed a longer, more continuous recovery process with less depth interval disruption (e.g., sloughing and measurement error) between core runs.

6.6.1.1 Characterization of Sediments

Physical and geochemical characterizations of the 300-FF-5 OU sediments from the four LFI boreholes were conducted at PNNL in the ESL. These activities included Tier 1 and Tier 2 characterization and analyses. A summary of the methods used for Tier 1 and 2 sediment characterization and analysis performed is provided in Table 6.3. One of the primary goals of the Tier 1 work was to "ground truth" the field geophysical logging results, with a specific emphasis on comparing the field-derived uranium measurements versus that uranium content of the field-moist sediments (including pore water) acquired in a controlled laboratory setting. The Tier 1 work included opening and photographing the cores, a geologist performing detailed visual inspection of the core material, determining the gravimetric water content of the samples, and measuring total uranium in the as-received sediment using GEA. Tier 2 sediment analyses were performed to better determine where to place the screen intervals in the wells and to better delineate the uranium concentration profile in the vadose zone and aquifer sediments and groundwater. More details for each specific method can be found in the 300-FF-5 OU LFI plan (DOE 2005b). Results from all of the analyses performed on the 300-FF-5 OU samples are summarized below according to individual analysis.

6.6.1.2 Moisture Content

This section describes the results, by well, of the moisture analysis performed on the sediment core samples. Overall, these moisture results reveal reasonable vadose moisture levels, averaging between 4.7 to 5.4 wt.%, which would be expected for this type of Hanford formation gravel-dominated environment (Horton et al. 2003; Serne et al. 2002). The core liners from below the water table often showed moisture contents below values expected for fully saturated sediments, which reflects moisture loss out of the bottom of the splitspoon core sampler while traveling back up the casing. The gravimetric moisture results obtained in the laboratory are also plotted by depth on the borehole composite logs for each well (Figures 3.2 through 3.5) along with the qualitative field neutron moisture logs (see Table D.13 in Appendix D).

Well 399-1-23 (C5000) appears to be the only borehole to have elevated moisture levels in the vadose zone beginning at approximately 23 feet bgs that also coincides with elevated uranium concentrations found in the sediment samples from the same interval (Figure 6.4). The field neutron moisture log does not show elevated moisture in this zone, and based on the fact that this interval is described as reworked mixed Ringold mud and flood deposits, it cannot be stated conclusively that the elevated moisture in this zone is residual fluid from past liquid disposals at the 316-5 Process Trenches. That is, the elevated moisture contents in these vadose zone sediment samples are likely just a reflection of the fine-grained nature of the sediments and not residual waste fluids.

Figure 6.3. Well 399-3-18 (C4999) Core Photograph – Example of Preserved Structure Along the Hanford Formation/Ringold Formation Hydrogeologic Boundary. Coarse, poorly sorted basaltic gravel, sand, and silt of the Hanford formation overlies brown, well sorted, arkosic fine sand of the Ringold Formation.

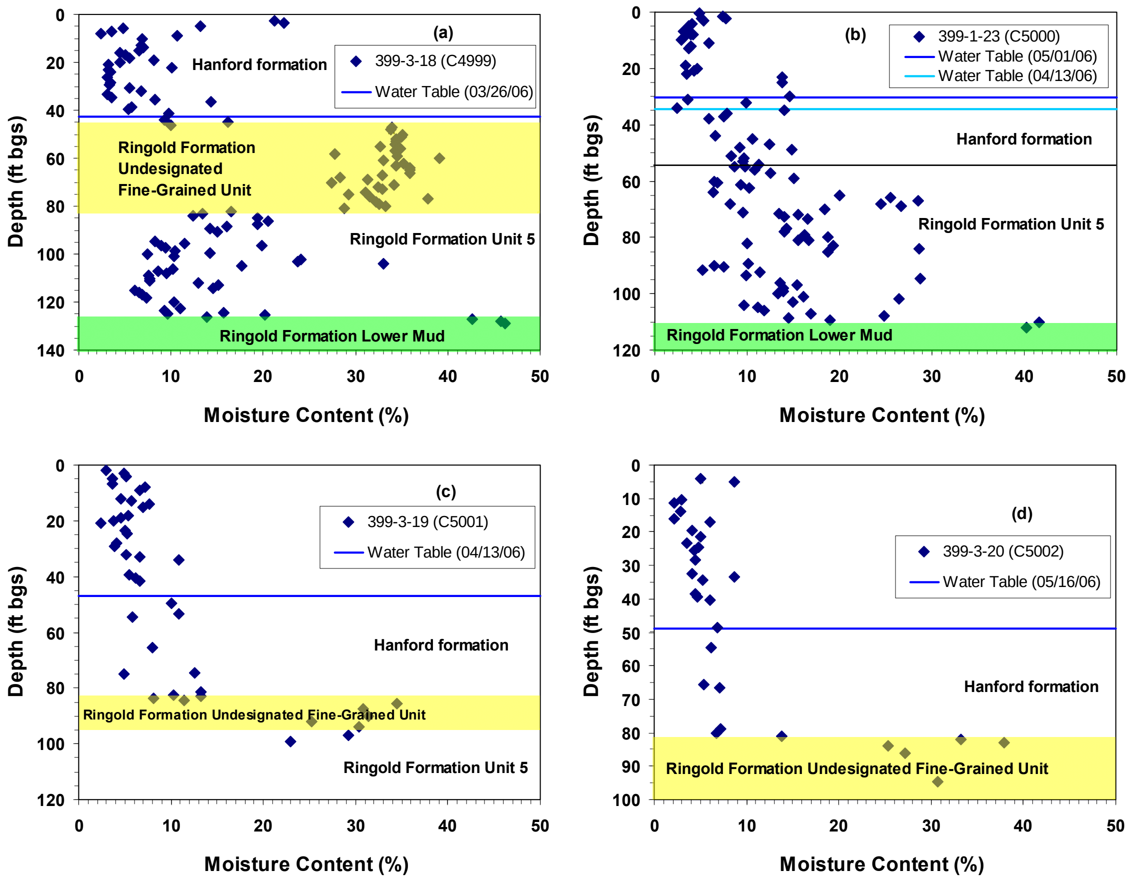

Figure 6.4. Moisture Content (%) Data for Samples from Wells (a) 399-3-18 (C4999); (b) 399-1-23 (C5000); (c) 399-3-19 (C5001); and (d) 399-3-20 (C5002)

There do not appear to be any significant zones of elevated or anomalously high moisture in the vadose zone in any of the other three wells above the high water table elevation that might be attributed to residual waste liquids or migrating contaminants. A more detailed borehole by borehole discussion of moisture content follows.

Borehole sediment moisture profiles (see Figure 6.4a-d) illustrate the relative distribution of moisture throughout the four boreholes. All values below the water table are elevated because these samples had been recently saturated by Columbia River or groundwater during fluctuating river stage variations and only partially drained, depending on the relative permeability of the sample, at the time of analysis.

Well 399-3-18 (C4999): A total of 133 sediment samples extending from the ground surface to 131 feet below ground surface (bgs) were collected from borehole 399-3-18 (C4999). Gravimetric moisture contents of the samples collected from the vadose zone varied from a low of 2.4 weight percent (wt.%) to a high of 22.3 wt.% (Figure 6.4a). The two vadose zone samples with the highest moisture contents (21.2 and 22.3 wt.%) were collected at the shallowest depth (2.7-3.7 feet bgs). The relatively high moisture contents found at shallow depth were attributed to the presence of fine-grained coal ash and other fine-grained backfill sediments at the surface and possible recent rain events. The average moisture content in the Hanford formation sediments located from 13 feet bgs to the water table (42.5 feet) was 5.6 wt.%, which is consistent to the known range of moisture contents for uncontaminated Hanford formation vadose zone sediment. Three possible thin lenses of increased moisture were observed at approximately 9, 23, and 36 feet bgs, respectively, in the vadose zone. These elevated moisture intervals are associated with Ringold rip-up clasts or Hanford formation stringers containing greater concentrations of silt and/or clay. The Ringold Formation undesignated fine-grained unit and Ringold lower mud intervals, located at 46-82 feet and 126-131 feet, respectively, also contain higher moisture contents (30-40 and 43-48 wt.%) compared to those measured in Ringold Unit E sediments between 82-125 feet bgs. These higher moisture values are due to higher moisture retention that naturally occurs in finer-grained sediment. Relative moisture values in the Ringold formation samples were collected from the saturated zone (i.e., below the water table), and thus are higher than the range of moisture contents for Hanford formation vadose zone sediments.

Well 399-1-23 (C5000): a total of 110 sediment samples extending from the ground surface to 116 feet bgs were collected. Gravimetric moisture contents from the samples collected from the vadose zone to the bottom of the unconfined aquifer are shown in Figure 6.4b. Moisture contents in the vadose zone varied between a low of 2.9 wt.% and a high of 13.8 wt.% with an average of 4.9 wt.%. The highest moisture content (13.8 wt.%) was measured at approximately 23 feet bgs, above the high water table, and may be attributed to water table fluctuations due to seasonal changes in the stage of the Columbia River or to post-operational residual moisture moving down through the vadose zone or trapped in silty deposits within the Hanford formation. Results from uranium analysis of sediment samples from the same depth interval reveals slightly elevated uranium concentrations at these same depths but we cannot say that the coincident elevated moisture content and uranium content reflect residual liquid waste disposed into the 316-5 process trenches. Sediments in the Ringold Formation lower mud unit, located below 110 feet, showed high water contents (40-41 wt.%), which are due to the fine-grained, low-permeability (high-moisture retention) nature of this interval.

Well 399-13-19 (C5001): A total of 49 core samples from the ground surface to 89 feet bgs and an additional 5 bagged grab samples between 89 and 100 feet bgs were collected. Gravimetric moisture contents of the samples collected from the vadose zone to the bottom of the unconfined aquifer are shown in Figure 6.4c. Moisture contents in the vadose zone were variable from a low of 2.9 wt.% to a high of 10.8 wt.%. The average moisture content of all the vadose zone samples was 5.4 wt.%. A higher moisture content range (4.9-35.0 wt.%) was found in aquifer sediments and the highest water content (24-35 wt.%) was found in the Ringold fine-grained silty sand unit at depths between 85 and 100 feet bgs.

Well 399-3-20 (C5002): A total of 50 core samples from the ground surface to 85 feet bgs and an additional 4 bagged samples between 85 and 95 feet bgs were collected. Gravimetric moisture contents of the samples collected from the vadose zone to the bottom of the unconfined aquifer are shown in Figure 6.4d. Moisture contents in the vadose zone showed a relatively narrow range between 2.2 and 8.7 wt.% and an average moisture content in vadose zone sediments was 4.7 wt.%. The higher moisture contents (25-38 wt.%) found in the deeper aquifer sediments are attributed to finer-grained sediment in the Ringold Formation located below 82 feet bgs.

6.6.1.3 Gamma Energy Analysis (GEA)

GEA was performed on sediment samples to measure the amount of process uranium detectable in the boreholes for comparison to geophysical borehole gamma logging uranium results. This was one of the most important steps of the LFI (Phase II) because if the uranium was detectable, and confirmed using the geophysical borehole logging technique, it would greatly enhance the ability to quickly and cost-effectively screen for uranium distribution in the vadose beneath the 300-FF-5 OU LFI study area.

To complete the GEA measurements in the laboratory, aliquots of sediment from the core samples were placed in 1-L marinellis containers and counted for 2 hours on a 60% efficient intrinsic-germanium gamma detector. Spectral analysis was conducted using a library containing key energies associated with the decay of uranium and thorium isotopes and their daughters. Control samples were run throughout the analysis to ensure correct operation of the detectors. The controls contained isotopes with photo peaks spanning the full detector range and were monitored for peak position, counting rate, and full-width half-maximum.

The laboratory GEA results were compared with those measured by the borehole geophysical spectral gamma system in the field (Section 6.6.4). The results for the ^{40}K, ^{232}Th, and ^{238}U all agreed exceptionally well for the vadose zone samples, but discrepancies began to arise once samples from below the water table were compared. Overall, comparison of the laboratory results versus the borehole geophysical GEA performed in the field was reasonable (Section 6.6.4 and Figures 3.2 through 3.5).

The GEA data from borehole samples were further refined in an attempt to discern Hanford-produced (process) uranium from natural background uranium. This was accomplished by comparing the activities of various uranium decay products. Specifically, ^{214}Bi at 609 keV was used to quantitate natural ^{238}U. Conversely, ^{234m}Pa at 1,001 keV, ^{234}Th at 63.3 keV, and the ^{234}Th doublet at 92.5 keV were monitored and used to measure total ^{238}U; the difference between the uranium measured at these energies and that measured at 609 keV (total ^{238}U – natural ^{238}U) is being labeled as Hanford-process uranium. If the uranium was processed into fuel rods at Hanford over the time period 1943 to 1990s, the first two ^{238}U daughter products, ^{234}Th ($t_{1/2}$ = 24 days) and ^{234m}Pa ($t_{1/2}$ = 1.17 minutes), would be in secular equilibrium with the parent ^{238}U in the sediments and pore waters. However, sufficient time would not have elapsed for any ^{238}U daughters below ^{234}U (e.g., ^{214}Bi) to be present at measurable activities. Thus, this strategy should differentiate natural background ^{238}U and Hanford-processed ^{238}U within the sediments. Further, it is assumed that the uranium contained in these samples is present at natural relative abundances (i.e., 99.3% ^{238}U with little to no ^{235}U enrichment); so that any ^{238}U measured using the aforementioned isotopes could be further simplified as either “total uranium” and/or “natural uranium.” The error bars contained within Figures 6.5 through 6.8 represent the one-sigma counting uncertainties associated with each measured isotope for the masses of sediment used and live count times chosen after background radiation subtraction.

The highest natural uranium concentration in the sediments from the four boreholes measured by GEA was approximately 4 pCi/g, as found in borehole 399-3-18 (C4999) (Figure 6.5). This value is coincident with a thin silt interval that was deposited naturally within the thick Ringold Formation fine sand unit (Figure 3.2). Overall, the natural uranium background concentrations in the four boreholes averaged around 1 pCi/g or less (Figure 6.6). By comparison, the natural uranium concentrations measure by GEA for these intervals are similar to the laboratory-derived total uranium values (microwave and acid digest methods) measured for the same sample intervals and therefore indicate that these intervals are probably reflecting higher levels of natural uranium deposited with the fine-grained Ringold Formation. The highest GEA-measured total uranium, based on the ^{234}Th doublet at 92.5 keV, was approximately 13 and 11 pCi/g measured in sediment samples from boreholes 399-3-18 (C4999) and 399-1-23 (C5000) (Figures 6.5 and 6.6). These samples were collected from depths of approximately 65 and 70 feet bgs respectively, within the Ringold Formation undesignated fine grained unit and Ringold Formation Unit 5

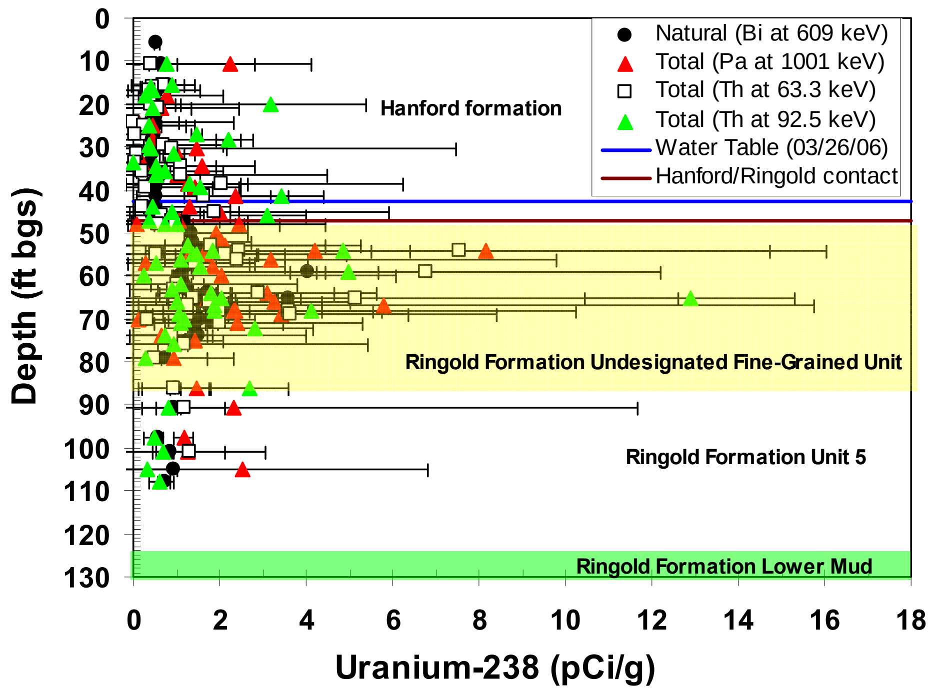

Figure 6.5. GEA Plots-Total vs. Natural Uranium Data in Sediments from Well 399-3-18 (C4999) based on the Measurement of ^{238}U Daughter Products

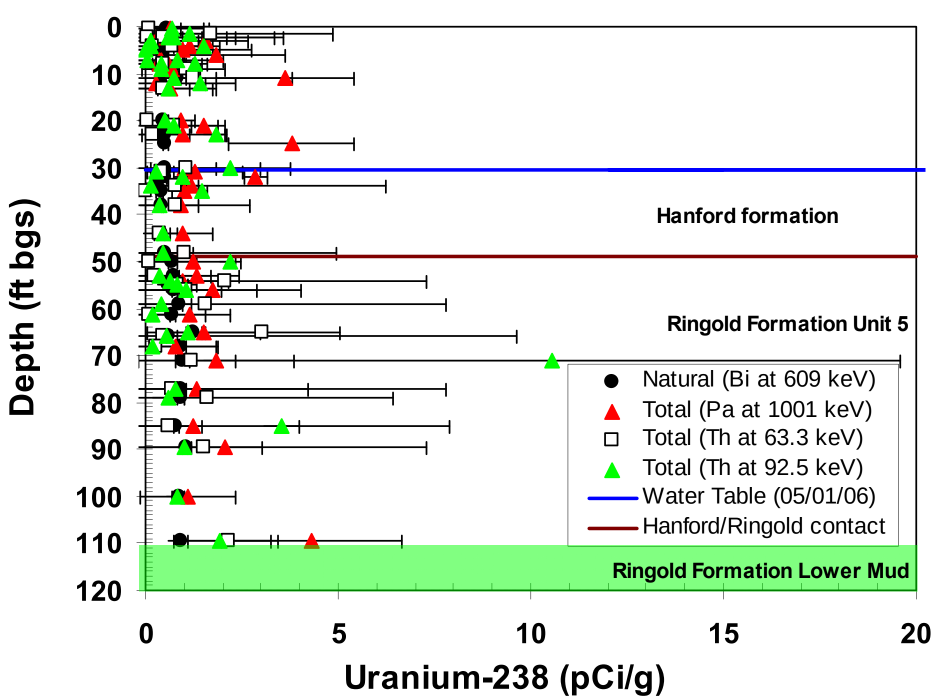

Figure 6.6. GEA Plot-Total vs. Natural Uranium Data in Sediments from Well 399-1-23 (C5000) based on the Measurement of ^{238}U Daughter Products

below the water table in wells 399-3-18 (C4999) and 399-1-23 (C5000). These high total uranium values are not very precise because of the very large error bars associated with these values.

The data in Figure 6.5 show a trend of increased total uranium concentration in sediment below the water table to a depth of about 80 feet bgs in well 399-3-18 (C4999). This increase in uranium concentration coincides with the Ringold Formation undesignated fine grained unit located from approximately 46 to 82 feet bgs. Data from well 399-1-23 (C5000) (Figure 6.6) are more random, with few high uranium concentration values near the water table, and otherwise do not reveal continuous high values or trends.

The total and natural uranium in the sediments from wells 399-3-19 (C5001) and 399-3-20 (C5002) are all less than 3 pCi/g, which is well within the range of uncontaminated background uranium concentrations in sediments at the Hanford Site (Figures 6.7 and 6.8). There is no statistical difference between the total and natural activities measured suggesting that there is no significant occurrence of Hanford-process uranium in the sediments at these two locations.

Overall, there is a general trend in which samples from the lower vadose zone and shallow aquifer contain Hanford process uranium (i.e., the total uranium is higher than the natural uranium), especially in the wells 399-3-18 (C4999) and 399-1-23 (C5000) samples. However, there were no "hot spots" (high uranium concentration) of Hanford-process uranium detected in the vadose zone or saturated sediments during characterization of these four wells. In addition, given the relatively large error bars associated with the data (which represent 1-σ); it is difficult to quantitatively state that a significant amount of Hanford-process uranium is present in any of these samples.

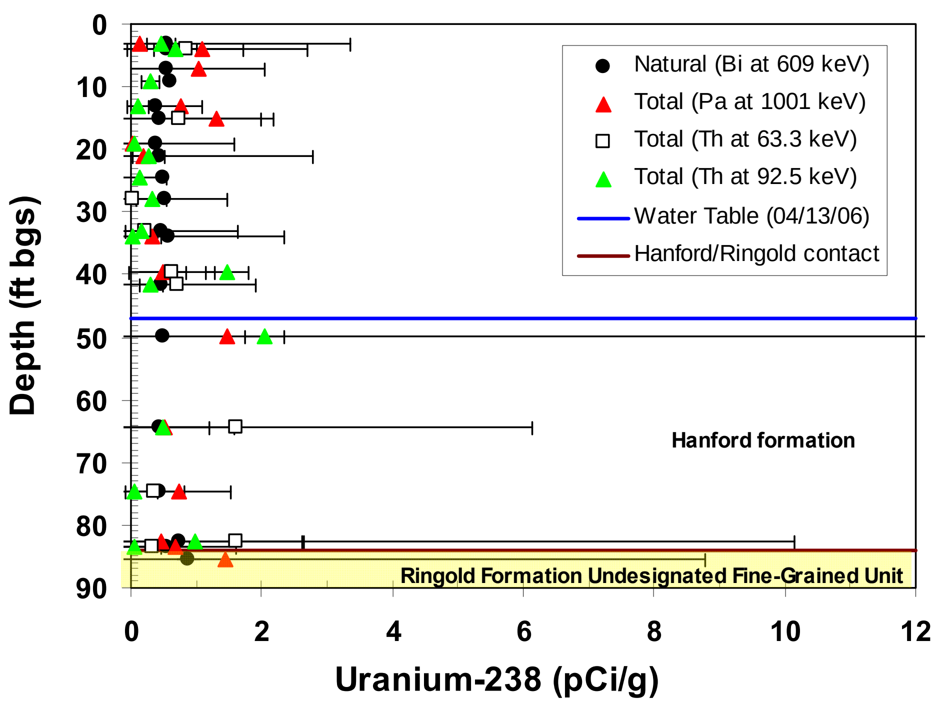

Figure 6.7. GEA Plot-Total vs. Natural Uranium Data in Sediments from Well 399-3-19 (C5001) based on the Measurement of ^{238}U Daughter Products

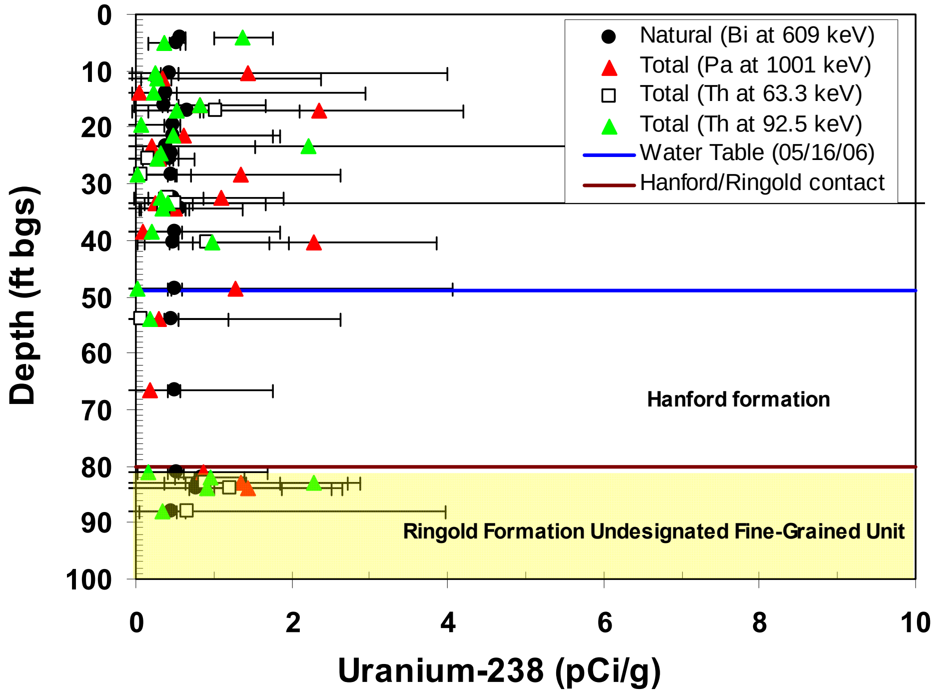

Figure 6.8. GEA Plot-Total vs. Natural Uranium Data in Sediments from Well 399-3-20 (C5002) based on the Measurement of ^{238}U Daughter Products

Because only very low quantities of Hanford-process uranium were found in two of the four wells, the planned correlation of the GEA results with the field geophysical results was not possible. Therefore, Phase II of the LFI plan was cancelled, and more detailed laboratory analysis to evaluate the fate of the uranium in the sediment samples was performed and is described in Section 6.6.1.4.

6.6.1.4 Geochemical Extracts (Water Extracts, Acid Extracts, and Microwave Digests)

In addition to GEA and moisture content calculations of sediment samples, Tier II sediment:water (1:1) extracts (WE), acid extracts (AE), and microwave assisted digestions (MD) were performed on selected samples from the four boreholes. Naturally occurring uranium is typically present in a form that is recalcitrant to water leaching; therefore, elevated concentrations of uranium in the sediment:water (1:1) extracts is generally indicative of contaminant (Hanford-process) uranium. A subset of samples was also extracted via either 8 Molar hot nitric acid extraction (AE) or MD, which are both more effective extraction methods than water extracts. The MD solution consists of 16 M HNO_3 (17%), 12 M HCl (7%), 32 M HF (3.3%), 0.5 g of H_3BO_3 (1.5%), and deionized water. The resulting solutions were analyzed for dissolved uranium via inductively coupled plasma mass spectrometry (ICP-MS). Unlike the GEA data, which were composed of the bulk sample material and included gravels and cobbles, the WE, AE and MD procedures used finer-grained material (only material with a diameter <2 mm). Of the two methods (AE and MD), only the MD procedure resulted in total sample dissolution; therefore, it is the most representative technique for quantifying total uranium in the <2-mm sediment-size fraction. The distribution of natural uranium, calculated using GEA, is compared to the various extract and digested uranium values (Figures 6.9 to 6.12).

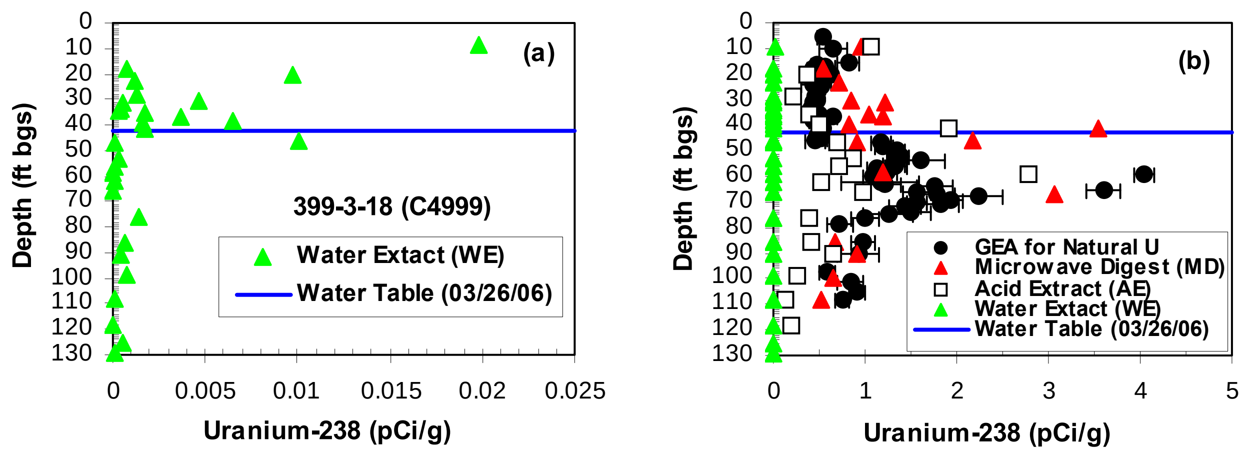

Figure 6.9. Water Extracts (a) and Extractable Uranium by WE, AE, and MD with GEA Data (b) in Sediments from Well 399-3-18 (C4999)

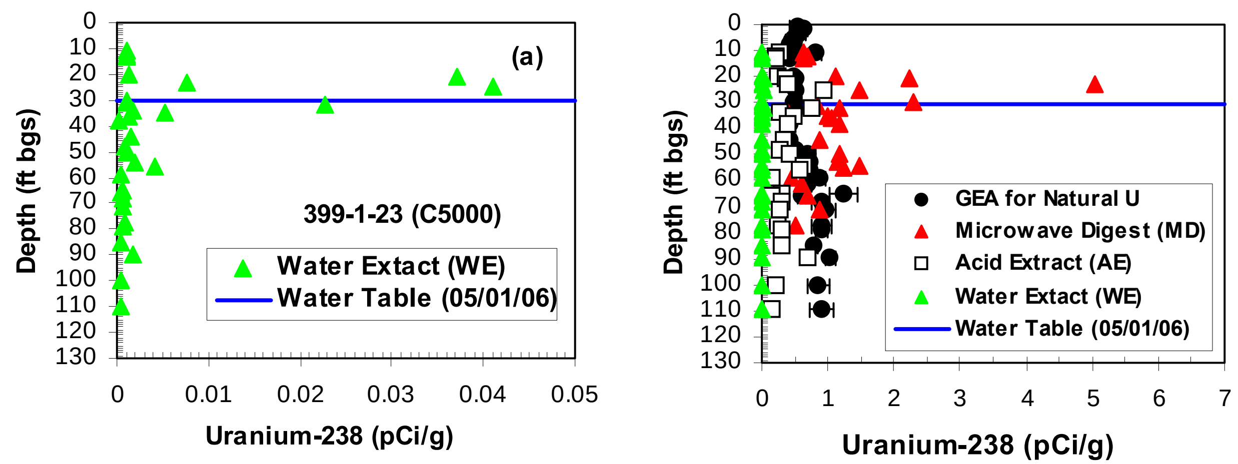

Figure 6.10. Water Extracts (a) and Extractable Uranium by WE, AE, and MD with GEA Data (b) in Sediments from Well 399-1-23 (C5000)

The WE were prepared by adding an exact weight of de-ionized water to approximately 60 grams of sediment sub-sampled (<2 mm) from each liner. The weight of de-ionized water needed was calculated based on the weight of the field-moist samples and their previously determined moisture contents. The sum of the existing moisture (pore water) and the de-ionized water was fixed at the mass of the oven-dry sediment. An appropriate amount of de-ionized water was added to screw-cap jars containing the field-moist sediment samples. The jars were sealed and briefly shaken by hand, then placed on a mechanical orbital shaker for 1 hour. The samples were allowed to settle until the supernatant liquid was fairly clear, usually overnight. The supernatant was carefully decanted and filtered aliquots (passed through 0.45-µm membranes) were separated for specific conductance, pH, anion, cation, alkalinity, carbon, and radionuclide analyses for the dissolved uranium content of the water extracts (results are provided in Appendix D).

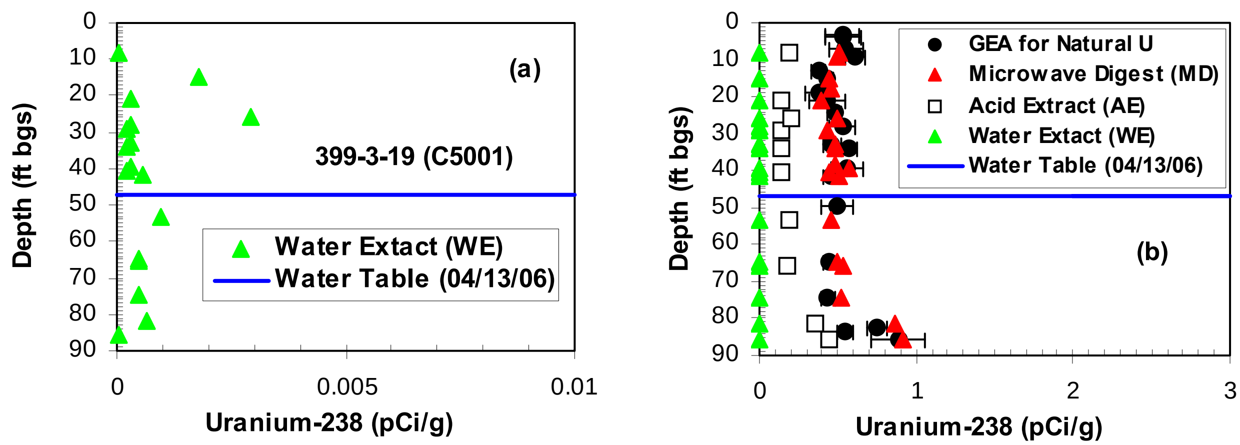

Figure 6.11. Water Extracts (a) and Extractable Uranium by WE, AE, and MD with GEA Data (b) in Sediments from Well 399-3-19 (C5001)

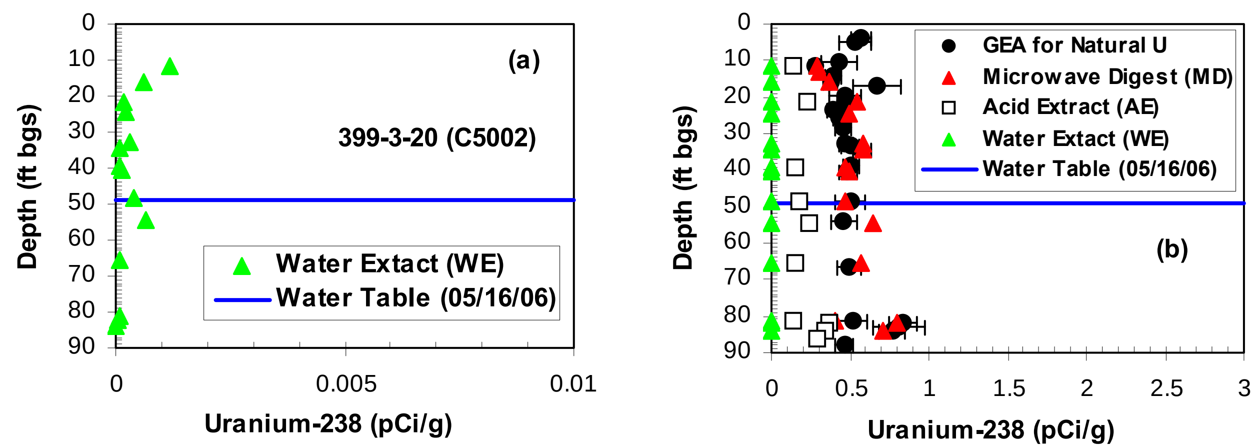

Figure 6.12. Water Extracts (a) and Extractable Uranium by WE, AE, and MD with GEA Data (b) in Sediments from Well 399-3-20 (C5002)

For the sediment samples from well 399-3-18 (C4999), the baseline or background water-extractable uranium concentration in the sediment was approximately 3E-04 pCi/g. However, the shallowest sample in the vadose zone from well 399-3-18 (C4999) analyzed via a sediment:water (1:1) extract contained nearly two orders of magnitude more water extractable uranium than the background value. Additionally, there appears to be evidence of elevated uranium in well 399-3-18 (C4999) sediment samples collected just below the water table based on the AE and MD methods. It should be noted that a sediment:water extract does not adequately assess the total amount of labile (amount available for leaching/transport) uranium present in the sediment. Based on the data measured via GEA in Figure 6.9, the background natural uranium concentration in the sediment from well 399-3-18 (C4999) varied between approximately 0.5 and 4.0 pCi/g. Generally, the MD samples contain more uranium than the measured uranium concentration via any other extraction/analytical technique. This is likely because the uranium present in the MD samples is associated with the finer-grained material that was targeted via the MD technique. In addition, most of the samples containing higher uranium concentrations measured in extracts by various methods were located near and just below the water table down to 80 feet bgs. We attribute this zone of elevated uranium to be caused by the presence of the Ringold Formation undesignated fine grained unit between 40-80 feet bgs (see composite Figure 3.2). Although the total uranium concentrations in the borehole 399-3-18 (C4999) sediments were still relatively low (less than 4 pCi/g based on MD) and there was no significantly high concentration of process uranium detected in the 399-3-18 (C4999) vadose zone or saturated sediments during the drilling and characterization, there appear to be regions of mildly elevated Hanford-process uranium, up to about 3 pCi/g, in the vadose zone sediments close to the water table (based on the difference between total uranium and natural uranium in the laboratory-generated uranium extracts and GEA results).

For the sediments from well 399-1-23 (C5000), the highest water-extractable uranium concentration, which is approximately two times higher than the highest water-extractable uranium concentration found in 399-3-18 (C4999) sediments, was found in vadose zone sediments close to the water table (Figure 6.10). Most of the high water-extractable uranium concentrations in well 399-1-23 (C5000) sediments were found in either deep vadose zone sediments or shallow aquifer sediments, consistent with previous results for well 399-3-18 (C4999) that Hanford-process uranium is located close to the water table.

Based on the data measured via GEA in Figure 6.10b, the background natural uranium concentration in the sediment from well 399-1-23 (C5000) varied between approximately 0.4 and 1.2 pCi/g. Assuming that the MD results indicate total uranium concentration and the difference between total uranium and natural uranium in the laboratory extract results is considered as the contribution from Hanford-process (contaminant) uranium, the highest Hanford-process uranium measured in the well 399-1-23 (C5000) sediments was about 5 pCi/g for sediments located in the deep vadose zone close to the water table. Well 399-1-23 (C5000) shows the highest concentration of Hanford-process uranium both in the vadose zone sediment and shallow aquifer sediments analyzed among sediments from all four wells. It is also located just feet from the effluent disposal end of the 316-5 Process Trench.

For the sediment samples from wells 399-3-19 (C5001) and 399-3-20 (C5002), the highest water-extractable uranium was less than 0.003 and 0.002 pCi/g, respectively (Figures 6.11 and 6.12). Even though slightly higher water-extractable uranium concentrations, versus the <0.001 pCi/g average for all the water extracts in these two wells, were found in shallow vadose zone sediments (near 20 feet bgs) from these two wells, Hanford-process uranium was not detected in sediments from wells 399-3-19 (C5001) and 399-3-20 (C5002) based on the MD extract uranium values coinciding with the natural background uranium values using GEA. Stated differently, the comparable uranium concentrations with depth between natural uranium (quantified by GEA) and the total uranium (quantified by MD for both vadose zone and aquifer sediments from the 399-3-19 (C5001) and 399-3-20 (C5002) boreholes indicate negligible Hanford-process uranium is present in these sediments.

The highest concentration of water-extractable process uranium measured in the laboratory for sediments from the four wells was around 0.02 and 0.041 pCi/g for a few vadose sediments above the water table in wells 399-3-18 (C4999) and 399-1-23 (C5000), respectively. These process uranium values equate to pore water concentrations of approximately 450 and 2,590 µg/L, respectively, for the two boreholes. These concentrations are higher than the total uranium concentrations measured in the 300-FF-5 OU groundwater (Section 6.6.2), suggesting that uranium in the vadose zone sediments at boreholes 399-3-18 (C4999) and 399-1-23 (C5000) could be a continuing and slowly bleeding source of the uranium contamination in the aquifer.

Uranium concentration data from the water extracts, ultracentrifuged pore water and groundwater described above are found in Appendix D (Table D.2). Other information such as water extract pH, alkalinity, specific conductance, major cations and anions analyses for these fluids are provided in Appendix D (Tables D.1 and D.3-D.7). Higher values for pH, specific conductance, alkalinity, and dilution corrected cation/anion analysis were found in water extract samples compared to those from groundwater and pore water samples due to the dissolution of some soluble solids during the water extract process. More detailed discussions for groundwater and pore water samples from the four boreholes are provided in Section 6.6.2.

6.6.1.5 Total Elemental Analysis

The total elemental composition of the sediments from the four wells were determined by MD with subsequent analysis of the dissolved material by inductively coupled plasma-optical emission spectrometry (ICP-OES) and inductively coupled plasma/mass spectrometry (ICP-MS). The dominant major elements in the sediments from the four LFI boreholes are shown in Appendix D (Table D.8). The bulk chemical composition showed that Si, Al, and Fe were the most dominant elements in most of the sediments from the four boreholes due to the abundance of quartz and aluminosilicate minerals. Other major elements were Ca, Na, Mg, K, Ti, S, Mn, P, and Sr, which are similarly distributed in all the sediments analyzed from the four boreholes. Similar concentrations of minor elements (As, Ba, Be, Bi, Cd, Co, Cr, Cu, Li, Mo, Ni, Pb, Se, V, Zn, Zr, Ag, Re, and Sb) were found in the sediments from all four boreholes. Because most of the selected sediment samples for total elemental analysis were from the Hanford formation with some designated as the Ringold Formation undesignated fine grained unit above Ringold Formation Unit 5, the major and minor elements concentrations are similar for the selected sediment samples from the four borehole sediments. However, different elemental concentrations are expected between the Hanford formation and Ringold Formation as reported by Bjornstad (1990) because of different proportions of the major minerals and some differences in minor mineral occurrences in these two formations. Even though no specific mineralogy study has been conducted at this time on these four borehole sediments, the major and minor elements are considered to result from quartz, feldspar, and clays (smectite, chlorite, and mica).

6.6.1.6 Particle-Size and Physical Properties Analysis

Particle size analysis using 1) bulk sediments including gravels and 2) for size fractions less than 2 mm was conducted using a combination of sieve and hydrometer methods (Gee and Or 2002). Particle size analysis results for sediments less than 2 mm are shown in Appendix D (Table D.9). For sediments from borehole 399-3-18 (C4999), higher clay contents were found at depths of 23 and 36.5 feet bgs, consistent with the high moisture contents measured in these fine-grained samples. The highest silt/clay content (64.24%) was found in a sample from borehole 399-3-18 (C4999) at a depth of 127 feet bgs, where the Ringold Formation lower mud unit is located.

Over 90% of the sediments from borehole 399-1-23 (C5000) were dominated by gravel and sand sized particles. Higher silt/clay contents (29.7-31.6%) were found at a depth between 21 and 25 feet bgs at 399-1-23 (C5000), which is consistent with the high moisture contents measured over this depth zone (Figure 3.3). For sediments from borehole 399-3-19 (C5001), over 95% of the samples were dominated by gravel- and sand-sized particles. The higher silt/clay content (34.4%) found at depth of 34 feet bgs was consistent with the highest moisture content measured in the vadose zone sediments from 399-3-19

(C5001) (Figure 3.4). The highest silt/clay content (50.6%) in a sample at a depth of 85.5 feet bgs was consistent with the presence of the Ringold Formation undesignated fine grained unit highlighted in yellow color in the composite figure (Figure 3.4).

Particle-size analysis results for sediments from borehole 399-3-20 (C5002) showed that over 90% of the samples were dominated by gravel and sand. Higher silt/clay contents, about 29%, were found at depths of 21.5 and 39.5 feet bgs in vadose zone. At borehole 399-3-20 (C5002), the Hanford formation below the water table showed low silt/clay contents (<15%), but relatively higher silt/clay contents were found in the Ringold Formation undesignated fine grained unit below a depth of 82 feet bgs.

For most of the samples, particle-size distribution data were generated for only the <2 mm size fraction. Almost all of the bulk samples analyzed for grain-size distribution are from the gravel-dominated Hanford formation. However, particle-size analyses were also performed on the whole (bulk) sediment for 20 samples, five from each of the four boreholes (see Appendix D). Continuous functions were fit to the discrete grain-size distribution data for these 20 samples using an Excel-Visual Basic Applications program to generate various metrics, reported in Appendix D; Figures D.1-D.20).

A summary of physical and hydraulic property data for the 20 selected samples for which particle-size distributions were measured on the whole (bulk) sample is presented in Table 6.5. The selected samples listed in Table 6.5 were collected from the immediate vicinity of the water table (elevation ~105-106 m), and from overlying and underlying locations in the vadose and saturated zones, respectively. The interpreted hydrogeologic unit designations (e.g., Hanford formation or Ringold Formation) are listed for each sample, and the gravel, sand, silt, and clay percentages are given in Table 6.5. The complete sets of grain-size distribution data and various metrics for these samples are presented in Appendix D.

Grain size metrics reported in Appendix D were computed using both mm and ϕ scales, where ϕ is defined as (Folk 1980)

$$\phi = -\log_2(\text{mm}) \tag{6.1}$$

One of the reported metrics is the inclusive graphic standard deviation, σ_{IG}, defined as

$$\sigma_{IG} = \frac{d_{16} - d_{84}}{4} + \frac{d_5 - d_{95}}{6.6} \tag{6.2}$$

where d is the grain diameter (in ϕ units), and the subscripts (e.g., 16, 84, etc.) refer to the weight percent of the bulk sample with grain sizes smaller than the given diameter. The inclusive graphic standard deviation is a measure of the uniformity or sorting of the grain-size distribution.

Also reported in Appendix D are the geometric mean diameter, d_{geom}, and the geometric standard deviation, σ_{geom}, (both in units of mm) which were computed as follows (Campbell 1985)

$$d_{geom} = \exp\left\{\sum m_i \ln d_i\right\} \tag{6.3}$$

Table 6.5. Physical Property Data for Bulk Sediment Samples from Wells 399-3-18 (C4999), 399-1-23 (C5000), 399-3-19 (C5001), and 399-3-20 (C5002)

Well ID	Sample	Depths Top (ft)	Bot (ft)	Mid-pt (ft)	Mid-pt (m)	Elevation Mid-pt (m)	Unit	Bulk Density (g/cm^3)	Total Porosity †	% Grav	% Sand	% Silt	% Clay
399-3-18	C4999-6D	22.5	23.5	23	7.01	110.67	H	2.17	0.212	93.28	3.98	1.11	1.63
399-3-18	C4999-9C	31	32	31.5	9.60	108.08	H	2.28	0.175	86.94	9.61	2.37	1.08
399-3-18	C4999-10C	35	36	35.5	10.82	106.86	H	2.30	0.168	82.75	11.39	4.47	1.39
399-3-18	C4999-10C	36	37	36.5	11.13	106.55	H	2.18	0.211	71.48	16.35	8.71	3.45
399-3-18	C4999-11D	41	42	41.5	12.65	105.03	H	2.11	0.237	93.31	4.42	1.73	0.55
399-1-23	C5000-39D	24.5	25.5	25	7.62	107.83	H	1.95	0.293	71.78	21.15	4.16	2.92
399-1-23	C5000-40C	31.5	32.5	32	9.75	105.69	H	2.34	0.152	76.18	19.43	3.02	1.37
399-1-23	C5000-40E	33.5	34.5	34	10.36	105.08	H	2.31	0.165	70.59	22.12	5.34	1.95
399-1-23	C5000-41C	35.5	36.5	36	10.97	104.47	H	2.34	0.153	76.45	19.73	2.55	1.26
399-1-23	C5000-45C	53.5	54.5	54	16.46	98.99	R	2.26	0.182	82.77	13.18	3.03	1.02
399-3-19	C5001-66A	20.5	21.5	21	6.40	114.25	H	2.30	0.167	62.57	33.50	2.19	1.73
399-3-19	C5001-69D	33.5	34.5	34	10.36	110.28	H	1.90	0.310	93.53	4.64	1.05	0.78
399-3-19	C5001-70E	40	41	40.5	12.34	108.30	H	2.28	0.172	83.20	14.21	1.89	0.70
399-3-19	C5001-73B	46.5	47.5	47	14.33	106.32	H	1.95	0.295	80.36	18.16	1.05	0.42
399-3-19	C5001-74B	53	54	53.5	16.31	104.34	H	2.04	0.263	83.46	15.60	0.63	0.31
399-3-20	C5002-86E	21	22	21.5	6.55	113.89	H	1.99	0.279	80.15	15.96	3.13	0.76
399-3-20	C5002-91C	39	40	39.5	12.04	108.41	H	2.31	0.165	80.35	14.31	2.92	2.43
399-3-20	C5002-92D	48	49	48.5	14.78	105.67	H	2.45	0.113	85.69	12.19	1.47	0.65
399-3-20	C5002-93E	54	55	54.5	16.61	103.84	H	2.17	0.214	86.56	12.72	0.51	0.21
399-3-20	C5002-98E	80.5	81.7	81.1	24.72	95.73	H/R	2.19	0.205	80.84	16.93	1.91	0.32
Arithmetic Averages								2.19	0.207	81.11	14.98	2.66	1.25

† Particle density was not measured so an average particle density = 2.76 g/cm^3 (see Williams et al. 2006, Table 3) was used to calculate porosities.

and

$$\sigma_{geom} = \exp\left\{\left[\sum m_i (\ln d_i)^2 - \left(\sum m_i \ln d_i\right)^2\right]^{1/2}\right\} \tag{6.4}$$

and where m_i is the mass fraction of size class i, and d_i is the arithmetic mean diameter (mm) of size class i. The metrics d_{geom} and σ_{geom} were used by Campbell (1985) to predict moisture retention characteristics of soils from texture data. The ratio of d_{geom}/σ_{geom} has also been used recently by Ward et al. (2006) to develop pedotransfer functions (PTFs) that relate physical and hydraulic properties of soils to their texture.

The grain-size metrics reported in Appendix D were generated by fitting a continuous analytic function to each set of discrete grain size data. An example is depicted in Figure 6.13. The analytic functions were evaluated at 500 different values of the fraction passing a given size (fraction<), over a range from 0.0001 to 0.999, to generate the discrete size classes used to calculate d_{geom} and σ_{geom} from Equations (6.3) and (6.4).

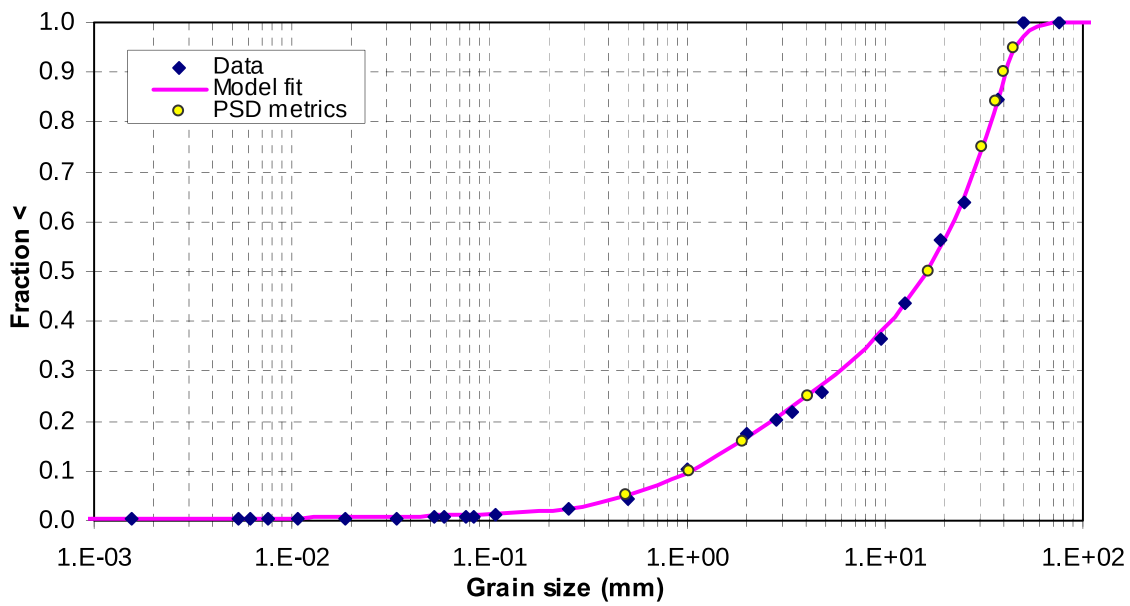

Figure 6.13. Grain-Size Distribution Data and Fitted Function for Sample C5001-74B from Well 399-3-19

Based on the grain-size distribution metrics (Appendix D), an estimate of saturated hydraulic conductivity (K_s) was calculated using several methods. The simplest formula is due to Hazen (1911)

$$K_s = Cd_{10}^2 \tag{6.5}$$

where K_s is the saturated hydraulic conductivity (cm/s), C is a constant (taken here to be 1), and d_{10} is the effective grain size (mm) for which 10% (by weight) of the particles in the sample are finer (Freeze and Cherry 1979, p. 350). Hydraulic conductivities were also computed using the well-known Kozeny-Carmen equation (Bear 1972, p. 166)

$$K_s = \left(\frac{\rho_w g}{\mu}\right)\left[\frac{n^3}{(1-n)^2}\right]\left(\frac{d_m^2}{180}\right) \tag{6.6}$$

where ρ_w and μ are the density and viscosity of water, respectively, g is the gravitational constant, n is the porosity, and d_m is a representative grain size, taken here to be either d_{50}(mm) or d_{geom}(mm). Porosity was calculated from

$$n = 1 - \frac{\rho_b}{\rho_p} \tag{6.7}$$

where ρ_b and ρ_p are the bulk and particle densities, respectively. Particle densities were not measured, so an average particle density of 2.76 g/cm^3 (Williams et al. 2006) was used to compute the porosities reported in Table 6.5.

The Hazen formula uses a single grain-size metric, d_{10}, while the Kozeny-Carmen equation uses a measure of the median grain diameter, d_{50} or d_{geom}, and the porosity of the porous medium. Masch and Denny (1966) analyzed 12 sets of grain size data and showed that the permeability of unconsolidated sands was related to both the median grain diameter, d_{50}, and the inclusive graphic standard deviation, σ_{IG}. However they did not develop any predictive formulas for these relationships.

The Masch and Denny (1966) data set was reanalyzed by Mark Rockhold (PNNL) who developed the following regression relationship which coalesces the data from their 12 samples into a single curve (see Figure 4 of Williams et al. 2006)

$$K_s(\text{cm/s}) = 4.744e\text{-}4*[d_{50}(\text{mm})/\ \sigma_{IG}^{1/2}]^{1.519},\ R^2=0.9813 \tag{6.8}$$

In the soils literature, this type of regression relationship is referred to as a pedotransfer function (PTF) (Guber et al. 2006). Ward et al. (2006) used the ratio d_{geom}/σ_{geom} to generate the following PTF for K_s based on average sand, silt, and clay percentages for eleven soil types in the USDA textural classification system

$$K_s(\text{cm/hr}) = 385.97*(d_{geom}/\sigma_{geom})^{0.9318},\ R^2 = 0.9733 \tag{6.9}$$

It should be noted that Ward et al. (2006) referred to the ratio d_{geom}/σ_{geom} as the "Fredle index." However, the Fredle index, *F.I.*, was defined by Lotspeich and Everest (1981) as

$$F.I. = \frac{d_{geom}}{S_o} \tag{6.10}$$

where *So* is another type of sorting index

$$S_o = \sqrt{\frac{d_{75}}{d_{25}}} \tag{6.11}$$

and where d_{75} and d_{25} are the grain diameters (in mm) at the 75th and 25th percentiles of the distribution. The ratios d_{geom}/σ_{geom} and d_{geom}/S_o do not yield the same values. Therefore, strictly speaking, it is incorrect to refer to the ratio of d_{geom}/σ_{geom} as the Fredle index.

The Masch and Denny (1966) data set and the sand, silt, and clay percentages used by Ward et al. (2006) represent relatively fine-textured sediments (<2 mm size fraction) relative to those that are found in the 300 Area. Another PTF was developed to predict K_s from texture data using >50 samples of mostly Hanford sediments, which ranged in texture from silt loam to pea gravel. This PTF is given by (see Figure 5 of Williams et al. 2006).

$$K_s(\text{cm/s}) = 0.0481*(d_{50}(\text{mm})/\ \sigma_{IG}^{2})^{0.9369},\ R^2 = 0.7665 \tag{6.12}$$

Equations (6.10), (6.11), and (6.12) will be referred to as K_s PTF-3, PTF-2, and PTF-1, respectively. Although the R^2 value for PTF-1 (Equation [6.12]) is considerably lower than the other PTFs, it was developed using more than four times as many samples, and extends into a coarser range of textures.

Values of K_s were estimated from the various empirical formula (described in Appendix D) and are listed in Table 6.6. For any given sample, the five empirical formulas yield estimates of K_s that range over 4 orders of magnitude. Estimates of K_s using the d_{50}-based Kozeny-Carmen equation are consistently the highest for all the samples, while estimates of K_s using PTF-3 (from the Masch and Denny data set) are the lowest for most of the samples.

These empirical K_s calculations were compared to aquifer hydraulic test analysis results from the same borehole depth intervals. Aquifer hydraulic test results from the 15.85-17.37 m depth interval were calculated for well 399-3-19 (C5001). This aquifer hydraulic test analysis yielded a value of K_s = 2,300 m/d. A sediment sample, C5001-74B, from the 16.3-16.46 m depth interval of well 399-3-19 (C5001), is within the aquifer hydraulic test interval. Table 6.6 indicates that the estimated K_s values for this sample ranges from 923 and 14,000 m/d, respectively, which are approximately 2.5 times less than, and 6 times greater than, the K_s value estimated from the aquifer hydraulic test. Based on the comparisons in Table 6.6, the Hazen formula provides an estimate of K_s that is closest to the pump test value for this location.

On average (all 20 samples in Table 6.5), the values of K_s estimated using PTF-1 are only ~30% greater than those estimated using PTF-2, despite the fact that these two PTFs were generated using completely different and independent data sets and different grain-size distribution metrics. These two PTFs were also generated using K_s data that were collected on vertically oriented core samples, whereas aquifer hydraulic tests measure the horizontal K_s. Therefore, it is reasonable to assume that the PTF values are representative of K_s in the vertical direction. If this is assumed, and if a horizontal to vertical anisotropy ratio of 10:1 is also assumed, PTF-1 and PTF-2 yield horizontal K_s estimates of 10*150 = 1,500 m/d, and 10*171 = 1,710 m/d, respectively, for Sample C5001-74B. These values are both within a factor of approximately 1.5 of the aquifer hydraulic test estimate of K_s from the 15.85- to 17.37-m-depth interval in well 399-3-19 (C5001).

Table 6.6. Estimated Values of K_s for Bulk Sediment Samples from Wells 399-3-18 (C4999), 399-1-23 (C5000), 399-3-19 (C5001), and 399-3-20 (C5002) Based on Various Empirical Formulas

Well ID	Sample	Elevation Mid-pt (m)	Hydraulic Conductivity Estimates (m/d)					
			Hazen	Kozeny-Carmen (d_{50})	Kozeny-Carmen (d_g)	PTF-1	PTF-2	PTF-3
399-3-18	C4999-6D	110.67	2.71E+04	1.20E+05	3.79E+04	6.03E+02	3.14E+02	8.24E+01
399-3-18	C4999-9C	108.08	6.20E+02	2.64E+04	5.80E+03	2.06E+02	1.39E+02	3.32E+01
399-3-18	C4999-10C	106.86	6.12E+01	1.49E+04	2.28E+03	1.06E+02	7.20E+01	1.97E+01
399-3-18	C4999-10C	106.55	8.69E-01	5.26E+03	6.21E+02	2.81E+01	2.08E+01	4.08E+00
399-3-18	C4999-11D	105.03	1.58E+04	1.02E+05	3.65E+04	4.66E+02	3.09E+02	5.42E+01
399-1-23	C5000-39D	107.83	1.68E+01	1.57E+05	1.11E+04	8.36E+01	4.36E+01	2.20E+01
399-1-23	C5000-40C	105.69	8.14E+01	1.76E+04	1.78E+03	1.18E+02	7.51E+01	2.75E+01
399-1-23	C5000-40E	105.08	9.40E+00	1.60E+04	1.06E+03	7.07E+01	3.69E+01	1.81E+01
399-1-23	C5000-41C	104.47	1.50E+02	1.71E+03	5.43E+02	5.93E+01	6.31E+01	5.43E+00
399-1-23	C5000-45C	98.99	6.19E+01	1.82E+04	3.13E+03	1.10E+02	8.96E+01	1.92E+01
399-3-19	C5001-66A	114.25	7.98E+01	1.44E+03	4.17E+02	3.47E+01	3.70E+01	3.36E+00
399-3-19	C5001-69D	110.28	6.04E+04	4.33E+05	1.59E+05	6.76E+02	3.58E+02	8.07E+01
399-3-19	C5001-70E	108.30	4.41E+02	6.37E+03	1.62E+03	1.35E+02	1.10E+02	1.28E+01
399-3-19	C5001-73B	106.32	5.46E+02	7.44E+04	2.03E+04	1.29E+02	1.41E+02	1.69E+01
399-3-19	C5001-74B	104.34	9.23E+02	4.29E+04	1.40E+04	1.50E+02	1.71E+02	1.69E+01
399-3-20	C5002-86E	113.89	7.96E+01	1.05E+05	1.49E+04	1.20E+02	9.01E+01	2.25E+01
399-3-20	C5002-91C	108.41	1.14E+02	5.27E+03	1.43E+03	6.43E+01	6.57E+01	9.28E+00
399-3-20	C5002-92D	105.67	1.05E+03	4.95E+03	1.04E+03	1.96E+02	1.55E+02	2.86E+01
399-3-20	C5002-93E	103.84	1.83E+03	2.47E+04	9.26E+03	1.79E+02	2.17E+02	2.02E+01
399-3-20	C5002-98E	95.73	4.38E+01	3.48E+04	5.76E+03	1.04E+02	1.05E+02	2.14E+01

An aquifer hydraulic test was also performed over the 55.5-62.5 feet depth interval in well 399-3-20 (C5002). Analysis of this aquifer hydraulic test yielded a value of $K_s > 2{,}000$ m/d. Sample C5002-93E was collected from the 54-55 feet depth interval in this well (Table 6.6), just above the aquifer hydraulic test interval. The Hazen formula and both the d_{50}- and d_g-based Kozeny-Carmen equations yield K_s estimates >1,000 m/d (Table 6.6). Also, if the K_s estimates from PTF-1 and PTF-2 are increased to account for an assumed horizontal to vertical anisotropy ratio of 10, they both yield horizontal K_s estimates >1,000 m/d.

No other aquifer hydraulic tests were performed in the intervals where the whole sediment grain-size distribution data were generated, so no further comparisons can be made at this time between grain size-based and aquifer hydraulic test K_s estimates. Based on this very limited comparison, we tentatively recommend that where no aquifer hydraulic or pump test data are available, but reliable, whole sediment grain-size distribution data are, then the Hazen formula should be used to estimate K_s. Alternatively, the horizontal K_s can be estimated by multiplying the K_s (vertical) estimates generated using either PTF-1 or PTF-2 by a factor of 10. Note, however, that for the gravel-dominated 300 Area Hanford formation, we recommend that whole sediment grain-size distribution data be generated from larger diameter (5 inches or more) cores obtained by sonic drilling, such as those collected for this LFI, rather than from smaller (4 inches) diameter cores that are typically obtained using the more standard cable-tool drilling method (Williams et al. 2006). The larger-diameter, sonic-drilled core samples are clearly more representative of the in situ sediments at this site.

As a final comment regarding the use of PTFs or other empirical formulas for estimating K_s (or any other hydraulic parameters) from grain-size data alone, it should be emphasized that these estimates do not account for structure (e.g., layering, stratification, or laminations), grain shape and orientation (e.g., spherical versus plate-like grains), or physicochemical properties (e.g., calcite cementation) of the *in situ* sediments. All of these factors may affect the pore-size distributions and connectivity of the pores leading to significantly different hydraulic properties for sediment samples that might have similar grain-size distributions but different structure. Although the Hazen formula, d_g-based Kozeny-Carmen equation, and scaled PTFs all yield reasonable K_s estimates for Hanford formation sediments in the 300 Area, they do not appear to work well for the Ringold Formation sediments. New and improved empirical formulas or PTFs for estimating Ringold Formation K_s values could potentially be developed by combining grain-size distribution data and chemical property information (Davis et al. 2006; Lu 2007).

6.6.1.7 Carbon Content Analysis

The sediment total carbon (TC) and inorganic carbon (IC) contents in each core were measured with a Shimadzu TOC-V CSN instrument, and organic carbon content was determined by the difference between the measured TC and IC contents. Measured carbon contents results for selected sediments from the four boreholes are shown in Appendix D (Table D.11). Carbon contents in sediments from borehole 399-3-18 (C4999) were low, and inorganic carbon contents varied from 0.0 to 0.96 mg/g, which on average equates to less than 1 wt.% of inorganic carbon as $CaCO_3$ being present in these sediments. Most of the relatively high IC contents (0.34-0.96 mg/g) indicative of discrete carbonate minerals or coatings were found in the shallow vadose zone borehole 399-3-18 (C4999) sediments between ground surface and 39.5 feet bgs. The inorganic carbon content (IC) in sediments from borehole 399-1-23 (C5000) varied from 0.0 to 3.42 mg/g, indicating much higher inorganic carbon content than those found in sediments from borehole 399-3-18 (C4999). The highest inorganic carbon content (3.42 mg/g or 2.85 wt.% as $CaCO_3$) in 399-1-23

(C5000) was found at a depth of 23 feet bgs, where the highest uranium concentration (5 pCi/g) was detected via the MD method (See Figure 6.10). These results suggest that uranium is present in this sample due to co-precipitation with calcite. Similar results suggesting possible uranium co-precipitation with calcite in 300 Area sediments have been found by others (Wang et al. 2005; Zachara et al. 2005). We speculate that the higher inorganic carbon content in the sediments from 399-1-23 (C5000) may be related to reactions of alkaline waste with atmospheric carbon dioxide and the native vadose zone pore waters during the active disposal period into the 300 Area process trenches.

Co-precipitation of uranium with calcite in vadose zone sediments might have significant implications for the fate and transport of uranium in groundwater, especially at the capillary fringe region where the water table tends to fluctuate due to Columbia River level changes. The total carbon contents measured in sediments from boreholes 399-3-19 (C5001) and 399-3-20 (C5002) were relatively low, and inorganic carbon content varied 0.0 to 0.96 and to 0.93 mg/g (<1 wt.% as $CaCO_3$), respectively, similar to those values found in sediments from borehole 399-3-18 (C4999). The highest inorganic carbon content (0.93 mg/g) measured in sediments from borehole 399-3-20 (C5002) at a depth of 81.1 feet bgs might result from calcium carbonate present as cementing materials at the boundary between the Hanford and Ringold Formation sediments.

6.6.1.8 Labile Uranium Leaching Using Carbonate Solution

Water extracts are used to investigate the chemical composition of pore fluids within the sediment; however, they do not provide an accurate indication of the total amount of labile uranium in the sediments. Therefore, a carbonate leaching method was used to determine the total amount of uranium capable of being removed from the sediment under realistic environmental conditions. A carbonate leaching solution was prepared using 1.44×10^{-2} M in $NaHCO_3$ and 2.8×10^{-3} M in Na_2CO_3. The reagent pH was 9.3, and a solid-to-solution ratio of 3 grams sediment to 35 mL of carbonate extractant was used for the tests. The leached uranium concentration was determined as a function of time, with total reaction times ranging from 1 to 21 days. Carbonate extract solutions were filtered using 0.45-μm syringe filters and analyzed for dissolved uranium using ICP-MS, for pH using a solid state electrode, and for dissolved calcium using ICP. Duplicate aliquots of the carbonate extract were measured, and data were calculated as an average concentration value with an error of one standard deviation. Sample information and the measured pH, alkalinity, and Ca concentration in each sample extract are shown in Appendix D (Table D.11).

Labile uranium leaching results for the sediments from borehole 399-3-18 (C4999) showed variable concentrations (0.1 to 3.3 μg/g) of leachable uranium depending on reaction times and the selected sediments used (Figure 6.14). However, most of the sediments had leachable uranium concentration less than 1.0 μg/g, even though a total of 21 days of reaction time was permitted. The highest leachable uranium was found in the sample (C4999-11D) collected at a depth of 41.5 feet bgs, which was close to the water table. This result agreed well with previous geochemical extraction data (Figure 6.9). The amount of leached uranium by the carbonate solution in sample C4999-11D increased rapidly for the first 7 days of reaction time, and then leveled off after 14 days of reaction, indicating steady-state leaching was approached. Since there was no significant change in the amount of uranium leached after a 21-day reaction, the maximum leachable uranium concentration in this sediment sample was estimated to be 3.3 μg/g. Based on the previously determined total uranium concentration (10.5 μg/g) for this sediment sample (C4999-11D) measured via microwave digestion, approximately 7.2 μg/g of uranium was considered to exist as a recalcitrant phase that might potentially be co-precipitated with calcite or present as trace components in aluminosilicate mineral structures.

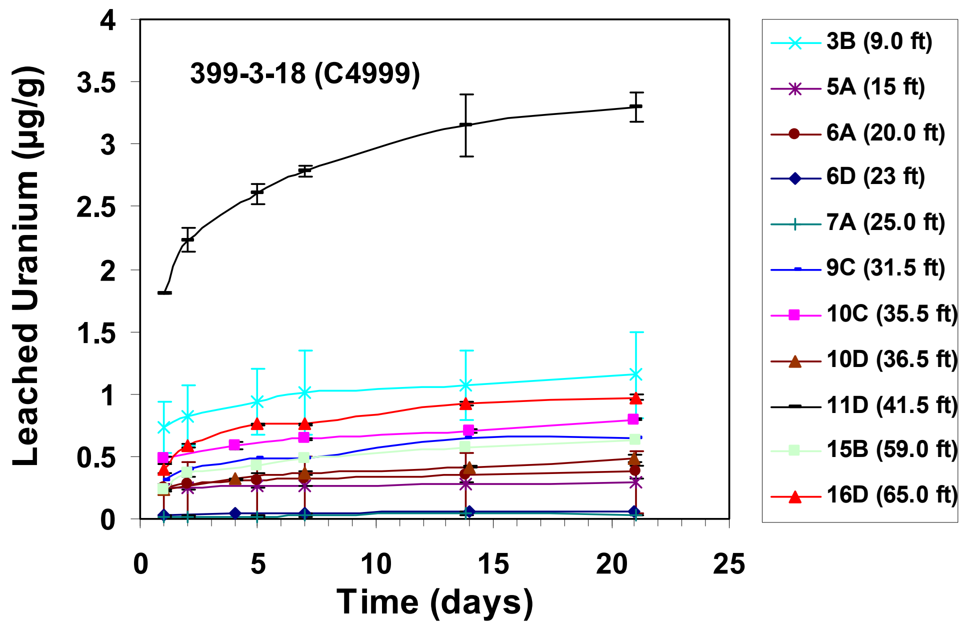

Figure 6.14. Labile Uranium Leached from Well 399-3-18 (C4999) Sediments Using Carbonate Extractant

The dissolved Ca concentration and the pH in the carbonate leachates decreased slightly with increasing reaction time, indicating a minor amount of calcite precipitation might have occurred over time during the carbonate leaching tests (Table D.11 in Appendix D).

The highest concentration of uranium leached from sediments from borehole 399-1-23 (C5000) was 3.2 µg/g in sample C5000-39D, which was collected at a depth of 25.0 feet bgs (Figure 6.15). This sample reached a steady-state condition with respect to uranium solution concentration after 14 days of reaction, showing a slow and steady increase of leachable uranium between days 3 and 14. Previously reported MD results for this sample revealed that it contained a total uranium concentration of 4.4 µg/g; therefore, the carbonate leach results indicate that a small amount of uranium (about 1.2 µg/g) present in this sample existed as more strongly bound forms. Although the highest uranium containing sample in the borehole 399-1-23 (C5000) was C5000-39B collected at a depth of 23 feet bgs, this sample was not selected for carbonate leaching. It was selected for uranium leaching with three different solutions discussed in the next section. Most of the samples, except C5000-39D, showed low carbonate-leachable uranium concentrations (<1 µg/g), even after 21 days reaction.

Leachable uranium (via carbonate extraction) from selected sediments from boreholes 399-3-19 (C5001) and 399-3-20 (C5002) was negligible (<0.2 µg/g) when compared to those from boreholes 399-3-18 (C4999) and 399-1-23 (C5000). Most of the sediments from boreholes 399-3-19 (C5001) and 399-3-20 (C5002) had steady state dissolved uranium concentrations after 14 days of reaction (Figures 6.16 and 6.17). The carbonate leaching results for boreholes 399-3-19 (C5001) and 399-3-20 (C5002) were consistent with previous GEA results and various geochemical extraction data indicating that these sediments contained little if any Hanford process (contaminant) uranium.

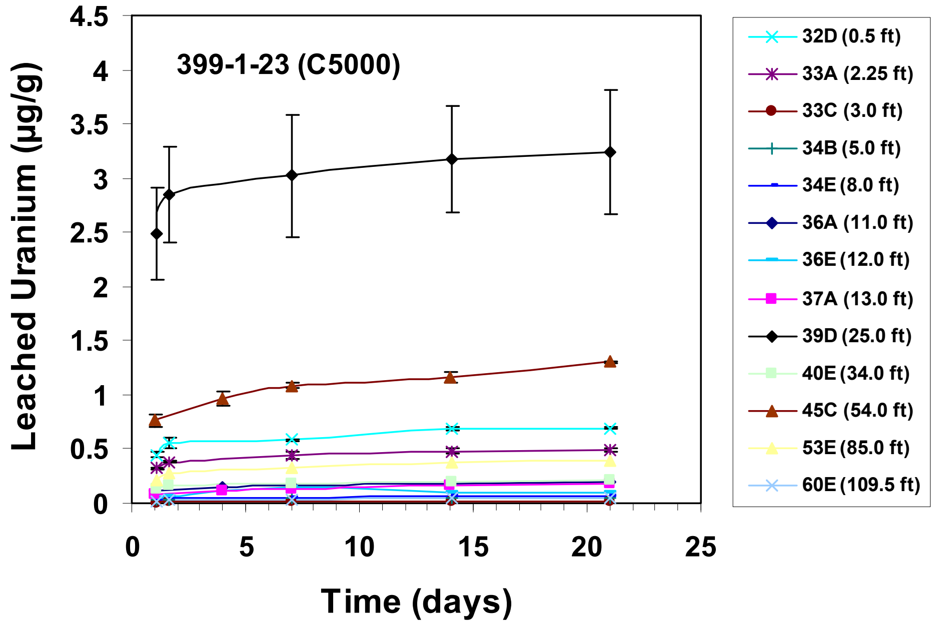

Figure 6.15. Labile Uranium Leached from Well 399-1-23 (C5000) Sediments Using Carbonate Extractant

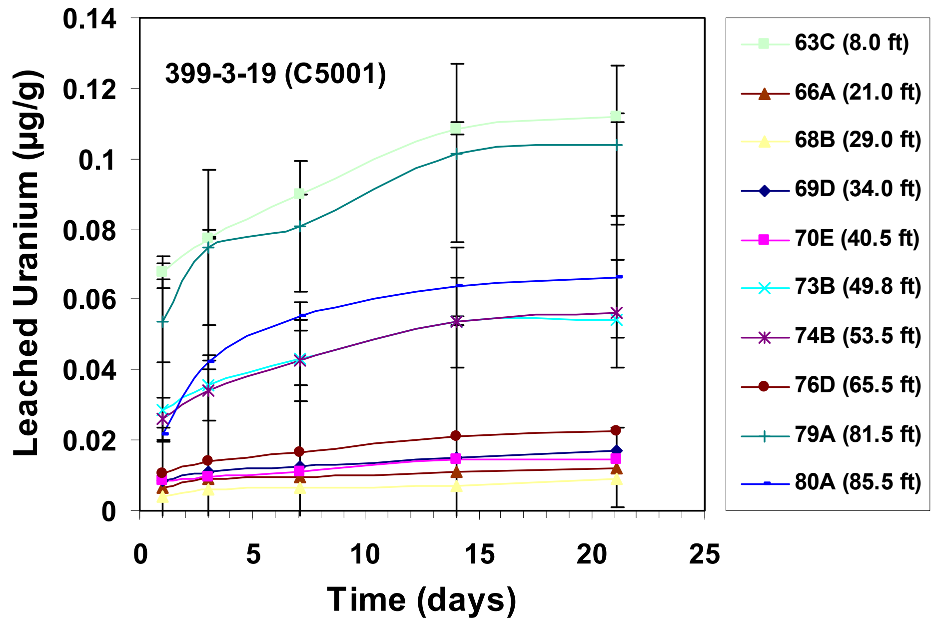

Figure 6.16. Labile Uranium Leached from Well 399-3-19 (C5001) Sediments Using Carbonate Extractant

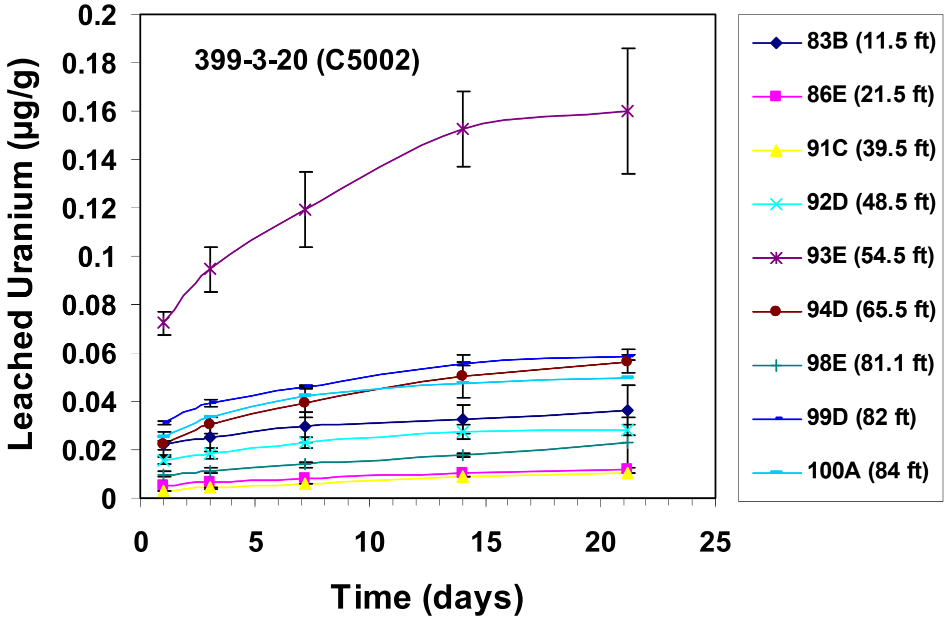

Figure 6.17. Labile Uranium Leached from Well 399-3-20 (C5002) Sediments Using Carbonate Extractant

6.6.1.9 Uranium Leaching with Different Solutions (Synthetic Pore Water, Groundwater, and River Water)

Uranium batch leaching experiments were also conducted to determine the total amount of uranium likely to be released under field-relevant conditions using three different synthetic leaching solutions (pore water, groundwater, and river water). The synthetic leaching solutions were prepared based on the measured chemical compositions of 300 Area vadose zone pore water, 300 Area groundwater, and Columbia River water. Three solutions consisting of different ionic strengths, carbonate concentrations, and pHs were used to measure the kinetics and total mass of uranium that could be leached from sediments under geochemical environments germane to the varying mixture of groundwater and river water found in the smear zone. Total ionic strength was controlled by $NaNO_3$ to avoid any potential $CaCO_3$ precipitate during the leaching experiments. Chemical compositions of each leaching solution are shown in Table 6.7. Several sediments from each borehole were selected to be contacted with the various solutions using a solid-to-solution ratio of 1:10 and reaction timed from 1 to 28 days. The batch test reactors were gently agitated on a platform shaker and sparged with air every few days to keep the test containers in equilibrium with air containing atmospheric concentrations of oxygen and carbon dioxide. Extract solutions were filtered using 0.45-µm syringe filters and analyzed for dissolved uranium concentrations using ICP-MS. The solid to solution ratio was kept constant at 1:10 by adding fresh reagent to replace the small aliquot (1-2 mL) removed at each sampling time. Selected sample results for leached uranium, as well as the measured pH, alkalinity, and Ca concentrations in leachates, are presented in Appendix D (Table D.12).

Leachable-uranium concentrations in selected sediments from the four boreholes as a function of reaction time using the three different leaching solutions (pore water, groundwater, and river water) are shown in Figures 6.18 to 6.21. As found in the previously reported carbonate leaching tests, sample C4999-11D had the highest leachable-uranium concentration in all three solutions among all borehole

Table 6.7. Chemical Constituents of Three Leaching Solutions

Constituents	Concentrations (M)		
	Pore Water	Groundwater	River Water
Na^+	2.17×10^{-2}	2.17×10^{-3}	3.04×10^{-4}
Ca^{2+}	5.00×10^{-3}	5.00×10^{-4}	2.50×10^{-4}
K^+	6.41×10^{-3}	6.41×10^{-4}	5.13×10^{-5}
Mg^{2+}	1.67×10^{-3}	1.67×10^{-4}	1.65×10^{-4}
NO_3^-	4.35×10^{-2}	4.35×10^{-3}	1.61×10^{-5}
Cl^-	5.63×10^{-3}	5.63×10^{-4}	5.63×10^{-5}
SO_4^{2-}	1.87×10^{-3}	1.87×10^{-4}	1.04×10^{-4}
HCO_3^-	9.17×10^{-3}	9.17×10^{-4}	6.56×10^{-4}
I (calculated)	I=0.075 M	I=0.0075 M	I=0.0013 M
pH (measured)	pH=7.91	pH=7.39	pH=7.13

399-3-18 (C4999) sediments tested. The high dissolved carbonate concentration in the synthetic pore water leaching solution resulted in higher leachable-uranium concentrations than those found in the groundwater and river water extracts. Enriched carbonate solutions are known promoters for leaching uranium from geologic solids and have been used for many decades to extract (via in situ processes) uranium from low-grade ore bodies (see for example see Deutsch et al. (1983, 1984, and 1985 and references therein). River water leached the least amount of uranium from the 399-3-18 (C4999-11D) sample. However, because river water was undersaturated with respect to carbonate minerals, some uranium did leach but the resultant leachate did not reach a steady-state condition, even after 21 days of reaction. This slow and gradual release of uranium into the river water was especially noticeable in other sediments from boreholes 399-1-23 (C5000), 399-3-19 (C5001), and 399-3-20 (C5002).

If the release of uranium from contaminated sediment in the 300 Area capillary fringe and aquifer sediments was controlled solely by adsorption-desorption processes for typical clays, silicates, alumino-silicates and hydrous oxides, one might expect little desorption to occur in Columbia River water because it has lower dissolved carbonate concentrations and overall ionic strength and slightly lower pH values than the groundwater. It is well known that uranium desorption is promoted by increasing carbonate, increasing pH, and increasing ionic strength as long as calcite precipitation is not occurring (see discussion in Zachara (2005) and references therein). Thus, it is somewhat counter-intuitive to find some uranium leaching into the dilute simulated river water in the tests described herein. Another uranium release process such as dissolution of co-precipitated uranium rich carbonate minerals could explain the laboratory results. Even though a small amount of leachable-uranium was measured in the river-water extract laboratory tests, it is not certain that the infiltration of river water into the 300 Area groundwater system, caused by fluctuations in the river stage, will lead to significant leaching of uranium in the field.

On the other hand, in support of the laboratory results, the mixing of Columbia River water with existing groundwater does change the chemical composition of water sampled in the monitoring wells. There does appear to be a positive correlation between the water table elevation, observed uranium concentration in the water samples obtained from the monitoring well network (see discussions in

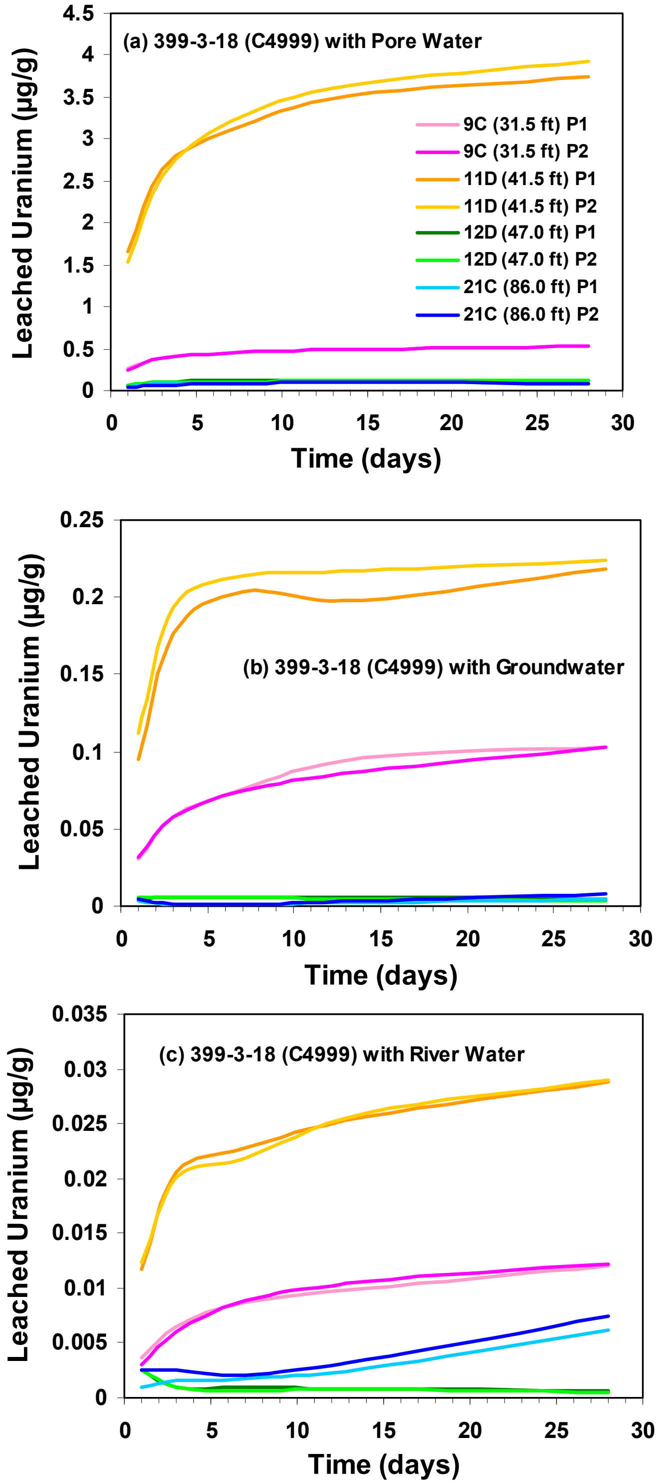

Figure 6.18. Leachable Uranium Concentration vs. Reaction Times for Well 399-3-18 (C4999) Sediments with Three Different Extract Solutions (a) Pore Water; (b) Groundwater; and (c) River Water. The legend for all three plots is the same; duplicate results are shown in similar colors.

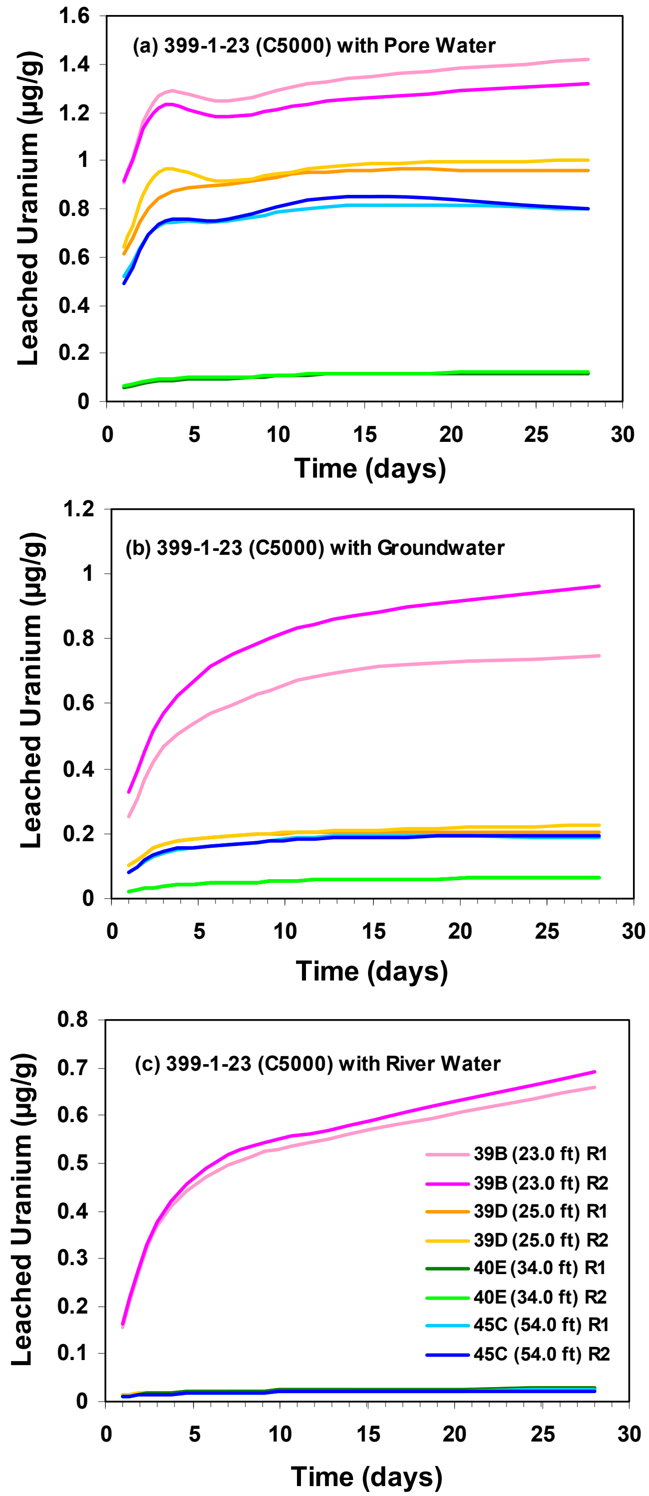

Figure 6.19. Leachable Uranium Concentration vs. Reaction Times for Well 399-1-23 (C5000) Sediments with Three Different Extract Solutions (a) Pore Water; (b) Groundwater; and (c) River Water. The legend for all three plots is the same; duplicate results are shown in similar colors.

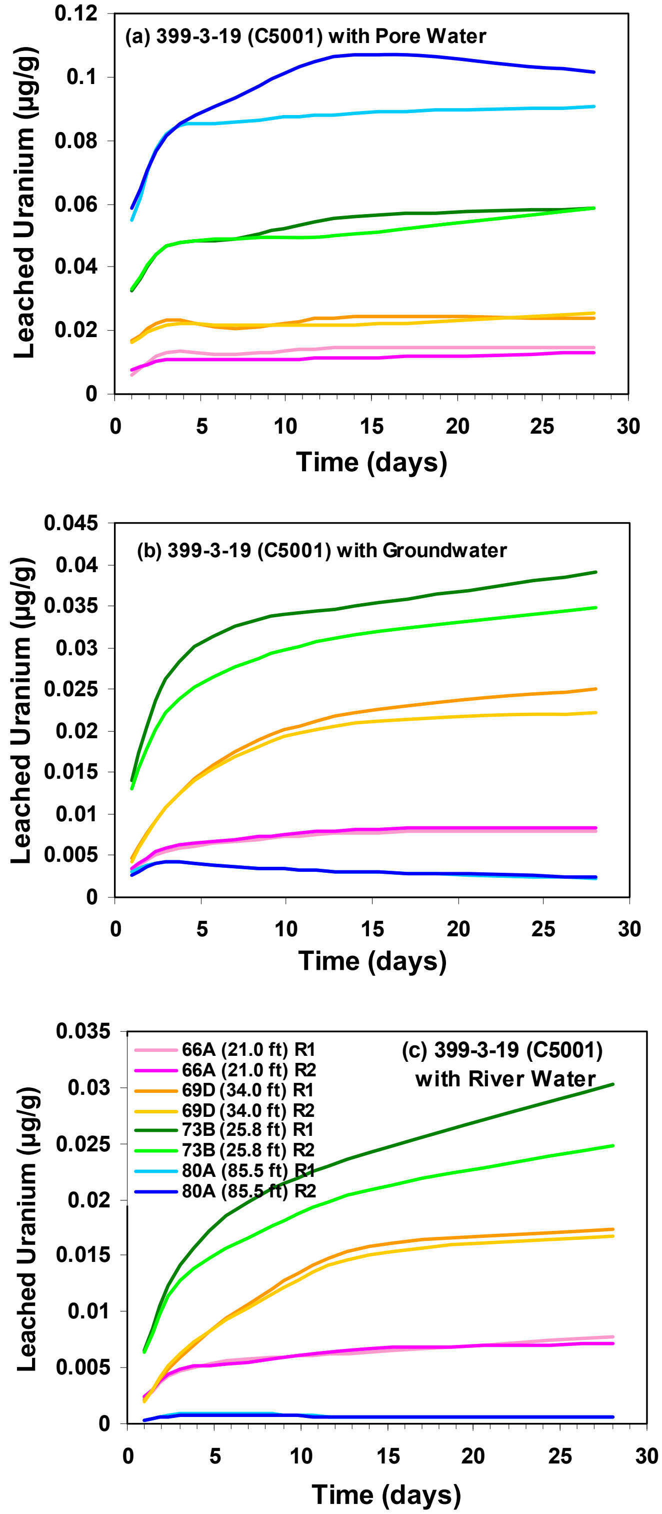

Figure 6.20. Leachable Uranium Concentration vs. Reaction Times for Well 399-3-19 (C5001) Sediments with Three Different Extract Solutions (a) Pore Water; (b) Groundwater; and (c) River Water. The legend for all three plots is the same; duplicate results are shown in similar colors.

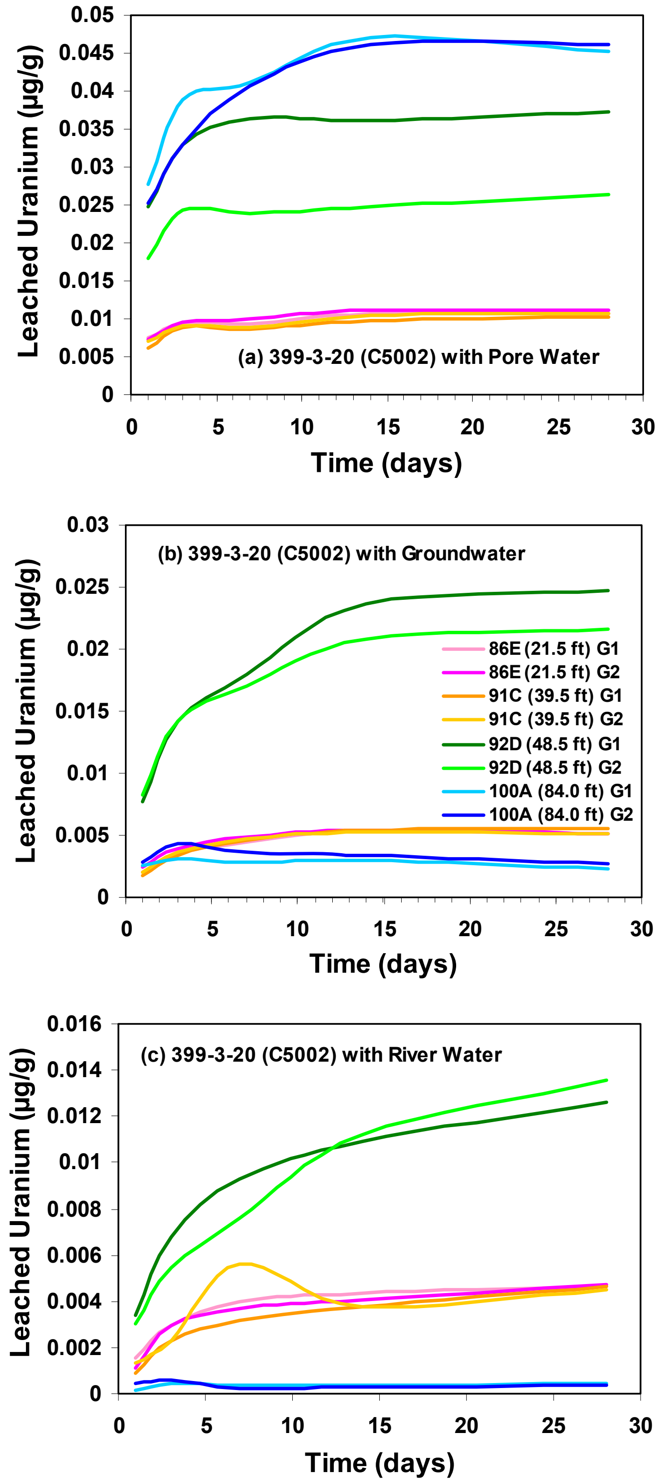

Figure 6.21. Leachable Uranium Concentration vs. Reaction Times for Well 399-3-20 (C5002) Sediments with Three Different Extract Solutions (a) Pore Water; (b) Groundwater; and (c) River Water. The legend for all three plots is the same; duplicate results are shown in similar colors.

Lindberg and Chou (2001) and Figure 1.3 in this report), and the annual groundwater monitoring reports (e.g., Hartman et al. 2006). Mixing amongst vadose zone pore water and aquifer groundwater with the more dilute river water could increase calcite dissolution from the surrounding sediments and allow co-precipitated uranium to slowly desorb from uranium enriched-calcite or calcite coated aluminosilicates. For the sediments from borehole 399-1-23 (C5000), the highest leachable-uranium concentration was found in sample C5000-39B, which was collected at a depth of 23.0 feet bgs; this result was consistent with the high total uranium content in this sediment as determined by microwave assisted digestion. The sample containing the second highest pore water leachable-uranium concentration was C5000-39D; this sample also had the highest uranium solution concentration in the carbonate leach tests.

The decrease in uranium concentrations in the leachate for borehole 399-1-23 (C5000) sediments, especially 39B which contacted with the simulated pore water solution after 3 days of reaction, was attributed to co-precipitation or re-adsorption of uranium with/onto freshly precipitated calcite. The reduced calcium concentrations measured at 7 days of reaction time support the hypothesis that the uranium in this leach test may have co-precipitated with freshly precipitated calcite in this sample (see Table D.12 in Appendix D). Because C5000-39B sediment showed the highest inorganic carbon content, calcite precipitation-dissolution reactions were plausible with small variations in pore water temperature, pH, calcium, and alkalinity during this period of the leach test. However, subsequently increasing uranium concentration in the leaching samples after 7 days' reaction resulted from a kinetic-controlled uranium leaching process as shown by different sediment samples, which showed continuously increasing uranium leaching concentration even after 28 days reaction. The uranium kinetic leaching was controlled by diffusion from interior grains or less easily accessible locations within the sediments. Slow uranium release kinetics can be a main source of recurring uranium contamination in groundwater.

The sediments from boreholes 399-3-19 (C5001) and 399-3-20 (C5002) had the lowest leachable-uranium concentrations in all three leachant tests due to the lack of significant uranium contamination in these sediments. However, uranium solution concentrations in these laboratory leach tests slowly increased in the river water leaching solution (which was the most dilute solution), for the tested sediments from all the boreholes suggesting that uranium can slowly desorb/dissolve from the contaminated sediments located near the capillary fringe region, where water chemistry is frequently changed by river water infiltration. The river water influx and mixing in the capillary fringe zone that borders the river might be a continuous source of uranium slowly bleeding into the 300 Area groundwater system.

6.6.2 Depth-Discrete Groundwater Sampling and Analysis

This section describes the depth-discrete groundwater sampling method used during Phase I Well Drilling and provides the groundwater chemical composition results. Depth discrete groundwater samples were required in each borehole (DOE/RL-2005-47, Rev. 1). The purposes of the groundwater samples were to (1) provide depth-discrete groundwater samples for the evaluation of radiological and chemical contaminants of concern, (2) obtain depth-discrete groundwater results to improve understanding of the distribution of contaminants in the unconfined aquifer system, and (3) compare depth variations in groundwater chemistry with respect to vertical and lateral changes in the hydrogeology.

The wellsite geologist's borehole logs, contained in Appendix A, provide a general description and locations of the depth-discrete groundwater sample intervals for each well. The composite borehole logs (Figures 3.2 to 3.5) show the depth-discrete groundwater sample intervals and summarize key radiochemical and VOC results. In addition, Figures 4.1 through 4.4 show macro constituent chemical results illustrated as Stiff diagrams, and concentration values; superimposed on these figures is the hydrogeologic unit boundaries. Table 6.8 provides a list of the depth-discrete samples collected per borehole and the thickness of the saturated interval drilled (water table to total depth). The list of constituents that were analyzed (Table 6.9) was developed based on COPC as defined in the operations and maintenance plan (DOE 2002b) and based on other geochemical data needs (i.e., modeling and groundwater chemistry). Groundwater sample analysis and quality assurance procedures are provided in the sampling and analysis plan in the LFI plan (DOE 2006a).

Table 6.8. Summary of Depth-Discrete Groundwater Sampling in 300 LFI Boreholes

Well ID	Total Drill Depth (ft bgs)	Saturated Interval Drilled (ft)	Number of Depth Discrete GW Samples	Comments
399-3-18 (C4999)	131	83.5	10	3 samples bailed, 7 pumped
399-1-23 (C5000)	116	75.5	10	1 sample bailed, 9 samples pumped
399-3-19 (C5001)	103.5	56.5	5	All samples pumped
399-3-20 (C5002)	95	46	4	All samples pumped

Table 6.9. List of Selected Groundwater Constituents for Laboratory Analysis of Depth Discrete Groundwater Samples

Sample Type	Planned Sample Interval	Planned Constituents	Analytical Laboratory
Depth-discrete groundwater	Every 1.5 m (5 ft) beginning as near as possible to the water table and throughout the Hanford formation to the Ringold Formation Unit 5 and then at every 3 m (10 ft) to total depth.	Alkalinity	ESL at 325 Building
		Anions	ESL at 325 Building
		Dissolved inorganic carbon	ESL at 325 Building
		Field Parameters (temp, pH, spec. cond., DO, and redox)	Field measurement
		ICP metals (filtered)	ESL at 325 Building
		Volatile Organic Analysis (8260 GCMS)	PNNL's Contract Laboratory
		Uranium-238	ESL at 325 Building

Depth-discrete groundwater sample collection began in each borehole at the water table and continued at approximately 5-feet-depth intervals until the Ringold Formation was confirmed, and then the sampling interval was increased to approximately 10- to 15-feet intervals until borehole total depth was reached. The sample interval spacing was increased in the last two boreholes (399-3-19 [C5001] and 399-3-20 [C5002]) to account for a thicker saturated Hanford formation gravel sequence that exhibited very high permeability. The samples are considered representative, to the extent practicable, of the aquifer at the depth that the samples were collected.

The sample collection method required the driller to stop drilling at the target sample depth and clean out the borehole to remove all cuttings and slough. An approximately 10-feet-long, 20-slot temporary well screen and inflatable packer was then inserted at the bottom of the borehole, and the drill casing was back pulled approximately 1 to 5 feet to expose the screen to the borehole and surrounding formation. The packer was inflated to seal the inner casing annulus from the aquifer and surrounding formation, and a submersible pump was installed inside the screen and used to first purge and then pump the groundwater sample. The sample intervals were purged until groundwater parameters (temperature, pH, specific conductance, and dissolved oxygen) stabilized. These field parameters are tabulated by sample interval in the composite diagrams (Figures 3.2 to 3.5). In some instances, such as very near the water table or in low-permeability intervals, the water sample was collected without purging using a bailer to retrieve the sample. The bailed or pumped water samples were captured and filtered through a 0.45-µm filter using a peristaltic pump into the required sample containers. The samples were stored onsite in coolers until they could be delivered to the ESL and/or the PNNL offsite contract laboratory for analysis. All depth-discrete groundwater samples were collected according to the sampling plan (see DOE 2006b) and documented procedures. Chain-of-custody forms were required for all samples (Appendix E). The field parameters, measured during borehole purging and used to determine when groundwater conditions had stabilized for sampling, were documented in field logs (Appendix E). Instrumentation used during the collection of all the groundwater samples was calibrated according to the manufacturer's procedures.

The depth-discrete groundwater samples, collected from the four LFI wells, were analyzed to determine the total dissolved uranium-238 concentration using ICP-MS. In addition, residual pore water that remained in the sediment samples from boreholes 399-3-18 (C4999) and 399-1-23 (C5000) after core opening and initial sample collection was captured using an ultracentrifuge and also analyzed for uranium concentrations. Because of the low uranium concentration in the groundwater samples from 399-3-19 (C5001) and 399-3-20 (C5002), the ultracentrifuge was not applied to the sediments from these two wells.

The measured groundwater uranium concentrations exceeded natural background concentration (~10 µg/L) in the uppermost aquifer in all four wells (Table 6.10). The uranium concentrations in groundwater samples ranged up to a high of 202 µg/L. The highest uranium groundwater concentration was found in borehole 399-1-23 (C5000) collected at a depth (54.3 feet bgs) close to boundary between the Hanford formation and Ringold Formation (Figure 3.3). Well 399-3-19 (C5001) also showed its highest uranium concentration (29.6 µg/L) at a depth of 81.5 feet bgs close to the boundary between Hanford and Ringold formation (see Figure 3.4). Although most of the high uranium concentrations in depth-discrete groundwater samples were measured in the uppermost aquifer samples (Figures 3.2 to 3.5) of the four wells (see Figure E.1 in Appendix E for details), other elevated uranium concentrations were also found close to the contact between the Hanford and Ringold formations. These high concentrations might be attributed to the chemical differences or change of sediment texture and permeability between these two formations.

Uranium concentrations in the pore waters measured directly after ultracentrifugation were similar to those from the estimated pore waters based on 1:1 water extracts after moisture content correction. As discussed in Section 4.0 (Figure 4.4), uranium concentrations in the calculated pore waters ranged up to 3,650 µg/L and showed relatively higher concentrations in wells 399-3-18 (C4999) and 399-1-23 (C5000) vadose zone sediments. Both wells 399-3-19 (C5001) and 399-3-20 (C5002) groundwater and estimated pore waters showed relatively low uranium concentrations compared to samples from well 399-3-18 (C4999) or well 399-1-23 (C5000).

Table 6.10. Uranium Concentrations in Depth Discrete Groundwater Samples

Wells	Sample ID	Depth (feet bgs)	Uranium Concentration (μg/L)
399-3-18 (C4999)	B1FR99	42.5	1.13E+02
	B1FR76	45.3	8.48E+01
	B1FR91	49.7	6.24E+00
	B1FRB3	52	2.87E+00
	B1FR87	68.0	1.10E+00
	B1FRB7	77.0	1.01E-01
	B1FR83	87.5	1.36E-02
	B1FR95	99.5	1.09E-02
	B1FR79	108.0	9.80E-03
	B1FR31	120.8	1.26E-02
399-1-23 (C5000)	B1FR35	33.8	7.59E+01
	B1FR39	37.5	3.66E+01
	B1FR43	43.3	2.73E+01
	B1FR47	47.8	3.49E+01
	B1FR51	54.3	2.02E+02
	B1FR55	59.3	1.56E+00
	B1FR59	68.5	4.37E-02
	B1FR63	79.5	3.91E-02
	B1FR67	90.3	7.19E-02
	B1FR71	107.8	3.14E-01
399-3-19 (C5001)	B1HRW9	53.0	2.00E+01
	B1HRX3	57.8	1.94E+01
	B1HRX7	63.0	2.34E+01
	B1HRY1	81.5	2.96E+01
	B1HRY5	101.8	5.20E-02
399-3-20 (C5002)	B1HT03	52.3	7.39E+01
	B1HT07	61.5	6.59E+01
	B1HT11	72.5	4.66E+01
	B1HT15	91.0	8.51E-02

6.6.3 Depth-Discrete Interval Aquifer Hydraulic Test Characterization

Depth-discrete interval aquifer hydraulic test characterization was conducted at the four borehole sites during drilling of the monitoring wells to provide an assessment of the variation and vertical distribution of hydraulic conductivity with depth within the unconfined aquifer at these specific locations. This type of characterization information is important for predicting/simulating contaminant migration (i.e., numerical flow/transport modeling), designing remedial actions, and developing proper monitoring well strategies for the respective locations. Because of the importance of this characterization information, depth-discrete interval aquifer hydraulic testing was required and identified for each borehole (DOE 2006a). The specific objective of the aquifer hydraulic test characterization was to provide depth distributed hydraulic property information that may be correlated with observed physical changes in the subsurface hydrogeology (see Section 3.0).

Table 6.11 summarizes the number of depth-discrete interval tests performed at each well during borehole drilling/advancement. Aquifer hydraulic testing was generally planned to coincide with selective depth-discrete water sampling, which could then utilize a common, temporary well-screen installation during the sampling/characterization process. Following collection of the water sample, the temporary casing was pulled back to expose approximately 5 feet of screen, and the packer that was attached to the top of the well-screen assembly was then inflated to isolate the test interval. The aquifer hydraulic tests were initiated mechanically by rapidly removing a slugging rod of known volume from the well-screen section. In most instances, two different size slugging rods were used during the testing program at each well to impose different stress levels on the test section. The stress levels for the two slugging rods were calculated to impose an aquifer hydraulic-withdrawal test response of 0.676 m (low-stress tests) and 1.431 m (high-stress tests) within a 0.1016-m inside diameter well. As noted in Butler (1996; 1997) and discussed in Spane and Newcomer (2004), differences exhibited between aquifer hydraulic tests conducted at different stress levels can be used to evaluate stress-dependent, non-linear test well effects (e.g., dynamic skin, turbulent head loss), which are unrelated to aquifer characteristics.

Table 6.11. Summary of Depth Discrete Aquifer Tests in 300 LFI Boreholes

Well ID	Total Drill Depth (ft bgs)	Saturated Interval Drilled (ft)	Depth Discrete Test Intervals#
399-3-18 (C4999)	131	83.5	5
399-1-23 (C5000)	116	75.5	6
399-3-19 (C5001)	103.5	56.5	2
399-3-20 (C5002)	95	46	3

Analytical methods used to analyze the aquifer hydraulic test results follow the methods described in Spane and Newcomer (2004). Briefly stated, standard type-curve methods were used to analyze tests exhibiting over-damped (exponential decay) response, while the high-K analysis type-curve matching method was used to analyze tests displaying either under-damped (oscillatory) or critically damped (transitional) response characteristics. A description of the performance and analysis of aquifer hydraulic tests conducted at each of the four well sites is provided below.

6.6.3.1 Well 399-3-18 (C4999) Aquifer Hydraulic Testing Characterization

Five specific test/depth intervals were characterized at well 399-3-18 (C4999) between March l5 and 27, 2006 by aquifer hydraulic testing as the borehole was advanced to its final depth 39.9 m bgs. Pertinent test information for the individual discrete test/depth intervals is presented in Table 6.12. Diagnostic analysis of aquifer hydraulic tests conducted for the various test/depth intervals indicate that all of the test zones exhibited over-damped (exponential decay) conditions. The top three test intervals (Zones A, B, and B1) were within the lower permeability Ringold Formation upper fine-grained unit (Unit 5). Aquifer hydraulic tests conducted in lower permeability formations require long test times to monitor full recovery. For most of the tests conducted in the top three intervals, full recovery was not attained before initiating subsequent aquifer hydraulic tests. In addition, due to a loss of test data during transfer downloading from the datalogger system, only a portion of the total test data was available for the top three test intervals for analysis. To account for the lack of full test data recovery and the lack of a complete test data record, "time-history matching" was applied to the test data sequence for these three

Table 6.12. Aquifer Hydraulic Test Characteristics for Selected Test/Depth Intervals at Well 399-3-18 (C4999)

Test Zone	Test Parameters				Diagnostic Aquifer Hydraulic Test Response Model	Hydrogeologic Unit Tested[a]
	Test Date	# Aquifer Hydraulic Tests	Depth to Water, m bgs	Test/Depth[b] Interval, m bgs		
Zone A*	3/15/06	2	12.95	14.78 - 16.61 (1.83)	Over-Damped* (exponential-decay)	Ringold Formation – Upper Mud (Unit 5)
Zone B**	3/17/06	4	12.80	20.12 - 21.34 (1.22)	Over-Damped** (exponential-decay)	Ringold Formation – Upper Mud (Unit 5)
Zone C	3/17/06	4	12.80	18.29 - 21.34 (3.05)	Over-Damped* (exponential-decay)	Ringold Formation – Upper Mud (Unit 5)
Zone D	3/27/06	8	12.71	37.34 - 38.71 (1.19)	Over-Damped (exponential-decay)	Ringold Formation (Unit 5)
Zone E	3/27/06	4	12.71	36.12 - 38.71 (2.41)	Over-Damped (exponential-decay/ elastic response)	Ringold Formation (Unit 5)

Note: For all test/depth zones, $r_c = 0.051$ meters; $r_w = 0.1222$ meters

(a) Hydrogeologic unit number in parentheses indicates the relevant groundwater-flow model layer, as described in Thorne et al. 1993.

(b) Value listed in parentheses is the effective well-screen test length; for Zones C and D, the value is reflective of the top of the Lower Mud unit located at a depth of 38.53 m bgs.

* Some of the aquifer hydraulic test data lost during transfer from datalogger system. Response indicates low permeability formation condition. Test analysis based on time-history match.

** Most of the aquifer hydraulic test data lost during transfer from datalogger system. Response indicates low permeability formation condition. No quantitative test analysis possible.

low-permeability test depth intervals. Time-history matching approaches rely on superposition of preceding test activities as the basis of the composite analysis method. This contrasts with standard analytical methods that focus on analyzing individual hydrologic tests.

The bottom two test intervals were within the higher permeability sand and gravel of the middle Ringold Formation (Unit 5). Standard type-curve analysis methods were used to quantify hydraulic property conditions for tests conducted within these two depth intervals.

6.6.3.2 Well 399-1-23 (C5000) Aquifer Hydraulic Testing Characterization

In all, at well 399-1-23 (C5000) six specific test/depth intervals were characterized between April 4 and 18, 2006 by aquifer hydraulic testing as the borehole was advanced to its final depth 35.4 m bgs. Pertinent test information for the individual discrete test/depth intervals is presented in Table 6.13. Diagnostic analysis of aquifer hydraulic tests conducted for the various test/depth intervals indicates that most of the test zones (i.e., Zones B-E) exhibited exponential decay (over-damped) conditions. The top test interval (Zone A) exhibited under-damped (oscillatory) response behavior, which is expected for test zones within the highly permeable Hanford formation. Aquifer hydraulic tests conducted in highly permeable formations require positioning of the pressure sensor near the top of the well water-column for quantitative test analysis. This was not done for this test interval; consequently, only a “greater-than” value can be assigned for the test interval. Additionally, hydrologic communication occurred around the packer used to isolate the lowest test/depth interval (Zone F/G); and therefore, no characterization results are possible for this test interval. Results from depth-discrete intervals Zones B-E are representative of the middle Ringold Formation (Unit 5).

Table 6.13. Aquifer Hydraulic Test Characteristics for Selected Test/Depth Intervals at Well 399-1-23 (C5000)

Test Zone	Test Parameters				Diagnostic Aquifer Hydraulic Test Response Model	Hydrogeologic Unit Tested[(a)]
	Test Date	# Aquifer Hydraulic Tests	Depth to Water, m bgs	Test/Depth Interval, m bgs		
Zone A	4/4/06	4	10.20	12.19 - 13.26 (1.07)	Under-Damped (oscillatory response)	Hanford formation (Unit 1)
Zone B	4/6/06	8	10.18	16.83 - 18.29 (1.46)	Over-Damped (exponential-decay)	Ringold Formation (Unit 5)
Zone C*	4/6/06	6	10.18	15.42 - 18.29 (2.87)	Over-Damped* (exponential-decay)	Hanford and Ringold Formations (Unit 1 and Unit 5)
Zone D	4/7/06	8	10.21	19.81 - 21.33 (1.52)	Over-Damped (exponential-decay)	Ringold Formation (Unit 5)
Zone E	4/7/06	2	10.21	18.29 - 21.33 (3.04)	Over-Damped (exponential-decay)	Ringold Formation (Unit 5)
Zone F**	4/18/06	12	9.33*	30.78 - 33.53 (2.75)	Critically-Damped** (transitional response)	Ringold Formation (Unit 5)

Note: For all test/depth zones, r_c = 0.051 meters; r_w = 0.1222 meters.
(a) Hydrogeologic unit number in parentheses indicates the relevant groundwater-flow model layer, as described in Thorne et al. 1993.
* Aquifer hydraulic test characterization adversely affected by packer by-pass (leakage) during the last four aquifer hydraulic tests; only first aquifer hydraulic withdrawal test results considered to be representative.
** Aquifer hydraulic test characterization adversely affected by packer by-pass (leakage); all test results are highly questionable.

6.6.3.3 Well 399-3-19 (C5001) Aquifer Hydraulic Testing Characterization

Two specific test/depth intervals for well 399-3-19 (C5001) were characterized on April 27, 2006 by aquifer hydraulic testing as the borehole was advanced to its final depth 31.5 meters bgs. Pertinent test information for the individual discrete test/depth intervals is presented in Table 6.14. Diagnostic analysis of aquifer hydraulic tests conducted for the two test/depth intervals indicate that both of the test zones exhibited under-damped (oscillatory) conditions. The two test intervals were within the highly permeable Hanford formation (Unit 1). Under-damped aquifer hydraulic tests require use of High-K analysis type-curve matching methods. No quantitative analysis of the longer test interval (3.05 meters) Zone B test was possible due to the extremely low test response and rapid recovery. Test responses indicate a very high K condition.

A selected analysis figure for test interval Zone A is contained in Appendix E.

Table 6.14. Aquifer Hydraulic Test Characteristics for Selected Test/Depth Intervals at Well 399-3-19 (C5001)

Test Zone	Test Parameters				Diagnostic Aquifer Hydraulic Test Response Model	Hydrogeologic Unit Tested[a]
	Test Date	# Aquifer Hydraulic Tests	Depth to Water, m bgs	Test/Depth Interval, m bgs		
Zone A	4/27/06	4	14.36	15.85 - 17.37 (1.52)	Under-Damped (oscillatory response)	Hanford formation (Unit 1)
Zone B	4/27/06	4	14.36	14.32 - 17.37 (3.05)	Under-Damped (oscillatory response)	Hanford formation (Unit 1)

Note: For all test/depth zones, r_c = 0.051 meters; r_w = 0.1222 meters.
(a) Hydrogeologic unit number in parentheses indicates the relevant groundwater-flow model layer, as described in Thorne et al. 1993.

6.6.3.4 Well 399-3-20 (C5002) Aquifer Hydraulic Testing Characterization

Three specific test/depth intervals in well 399-3-20 (C5002) were characterized between May 15 and 17, 2006 by aquifer hydraulic testing as the borehole was advanced to its final depth of 29.0 m bgs. Pertinent test information for the individual discrete test/depth intervals is presented in Table 6.15. Diagnostic analysis of depth-discrete interval aquifer hydraulic tests conducted indicate that the top Hanford formation test zone (A) exhibited under-damped (oscillatory) conditions while the two underlying Ringold Formation test intervals (Zones C and D) exhibited critically damped test behavior. Tests exhibiting either critically damped or under-damped aquifer hydraulic test response require use of High-K analysis type-curve matching methods.

Table 6.15. Aquifer Hydraulic Test Characteristics for Selected Test/Depth Intervals at Well 399-3-20 (C5002)

Test Zone	Test Parameters				Diagnostic Aquifer Hydraulic Test Response Model	Hydrogeologic Unit Tested[a]
	Test Date	# Aquifer Hydraulic Tests	Depth to Water, m bgs	Test/Depth Interval, m bgs		
Zone A, B	5/15/06	8	14.51	16.92 - 19.05 (2.13)	Under-Damped (oscillatory response)	Hanford formation (Unit 1)
Zone C	5/17/06	4	14.78	26.21 - 27.58 (1.37)	Critically Damped (transitional response)	Ringold Formation (Unit 5)
Zone D	5/17/06	4	14.78	25.30 - 27.58 (2.28)	Critically Damped (transitional response)	Ringold Formations (Unit 5)

Note: For all test/depth zones, r_c = 0.051 meters; r_w = 0.1222 meters.
(a) Hydrogeologic unit number in parentheses indicates the relevant groundwater-flow model layer, as described in Thorne et al. 1993.

6.6.4 Borehole Geophysical Logging

High-resolution spectral gamma surveys and neutron moisture surveys were conducted in each borehole using borehole geophysical logging tools operated by Stoller Corporation. The main objective of the borehole logging was to determine the presence, distribution, and quantity of manmade (contaminant) uranium in the subsurface at each location (DOE/RL-2005-47-Rev. 1). Secondary objectives include (1) calibrating the planned Phase II DPT borehole geophysical logging system, (2) using the system as a correlation tool for identifying borehole lithology, and (3) determining the variations in moisture content in the vadose zone at each location.

The geophysical logs obtained in Phase I, including the detailed log data reports, are provided in Appendix C. The log reports describe calibration requirements, data processing, and contain the data results and interpretation including the borehole log plots for manmade radionuclides, natural gamma and neutron moisture logs. Table 6.16 provides a summary of geophysical logging activities performed at each borehole. The specific gamma isotopes that were analyzed by Stoller (Appendix C) were selected based on gamma emitting COPC, and also included known natural occurring radio-elements. All geophysical logging followed quality assurance procedures provided in Stoller's *Quality Assurance Project Plan* (Stoller 2006).

Table 6.16. Summary of Geophysical Borehole Logging in 300 LFI Boreholes

Well ID	Date Logged	Total Drill Depth (feet bgs)	Spectral Gamma Logged Interval (feet)/count rate (sec)	Repeat Interval (feet)/count rate (sec)	Neutron Logged Interval (feet)/count rate (sec)	Temporary Casing Outside Diameter (in.)
399-3-18 (C4999)	March 24 - 25, 2006	131	128-0/200	45-32/400	42.25-0/15	9 5/8
399-1-23 (C5000)	April 12 - 18, 2006	116	112.5-0/200	50-19/200-400	35.5-0/15	9 5/8
399-3-19 (C5001)	May 1 - 2, 2006	103.5	86.2-0/200	60-35/400	46.75-0/15	9 5/8
399-3-20 (C5002)	May 16 - 17, 2006	95	87-0/200	85-78, 50-42/400	47.5-0/15	9 5/8

Each borehole was logged from total depth to the surface inside the temporary drill casing prior to well completion. Spectral gamma measurements, collected at the designated 200 to 400 second count rate, using the "move-stop-acquire" technique every 0.5 feet along the borehole was employed to obtain the most optimal spectral gamma signal emitted from each borehole. Based on data processing by Stoller Corporation, no manmade (contaminant) gamma-emitting radionuclides were detected above the MDL (of ~1 pCi/g [for U^{235}] and ~12 pCi/g [for U^{238}]) in any of the boreholes (details are provided in Appendix C). These data indicate that if manmade uranium exists at these locations, it is at very low concentration levels below the MDLs.

The geophysical log data have been evaluated and correlated to the hydrogeology and uranium and moisture data results from the laboratory analysis of sediment samples for each borehole. These results and comparisons are presented in the composite logs (Figures 3.2 to 3.5).

Laboratory-measured GEA results obtained from the sediment core samples from each well were compared to the borehole geophysical gamma energy results from the four new wells to determine if the data are quantitatively consistent and comparable and to determine data trends (Figures 6.22 to 6.25).

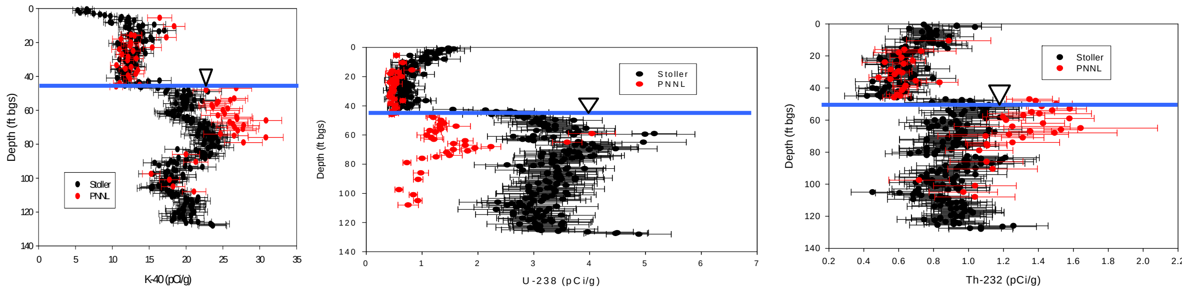

Figure 6.22. Comparison of Laboratory Sediment Gamma Energy Analysis KUT Results (PNNL) to the Borehole Geophysical Spectral Gamma KUT Results (Stoller) for Borehole 399-3-18 (C4999)

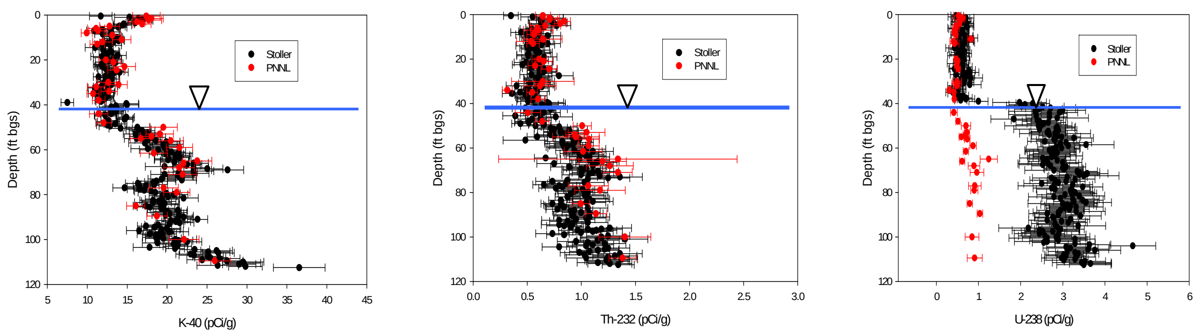

Figure 6.23. Comparison of PNNL Laboratory Sediment Gamma Energy Analysis KUT Results to Stoller Borehole Geophysical Spectral Gamma KUT Results for Borehole 399-1-23 (C5000)

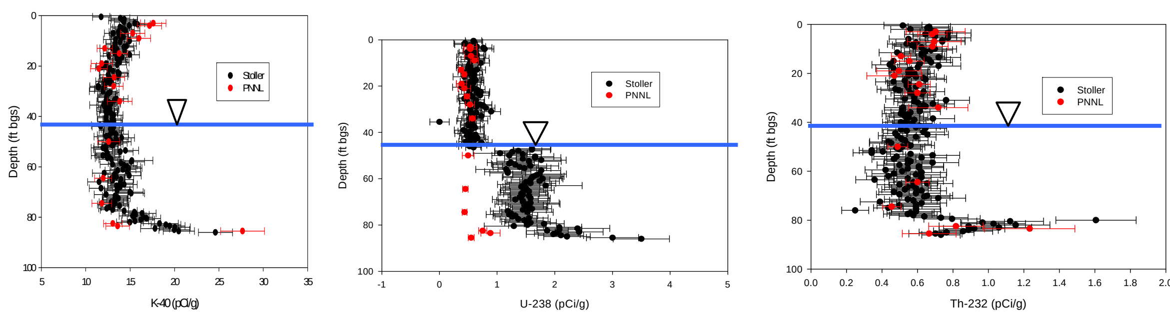

Figure 6.24. Comparison of PNNL Laboratory Sediment Gamma Energy Analysis KUT Results to Stoller Borehole Geophysical Spectral Gamma KUT Results for Borehole 399-3-19 (C5001)

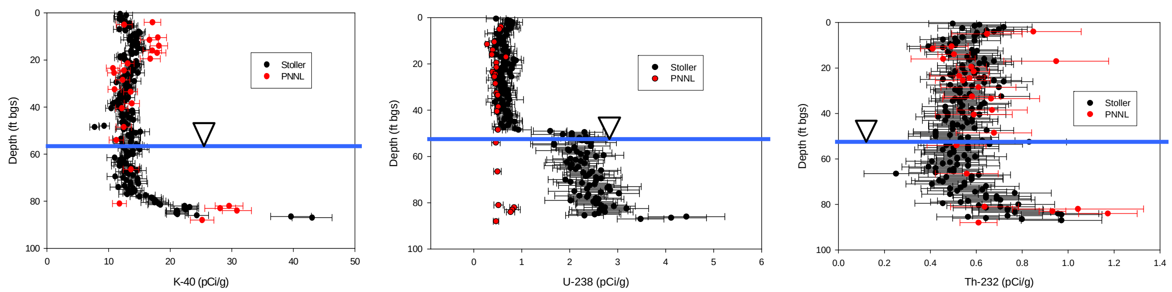

Figure 6.25. Comparison of PNNL Laboratory Sediment Gamma Energy Analysis KUT Results to Stoller Borehole Geophysical Spectral Gamma KUT Results for Borehole 399-3-20 (C5002)

Because no manmade uranium was detected in the borehole geophysical data, only select natural radio-element activity (potassium-40 [^{40}K], uranium-238 [^{238}U], and thorium-232 [^{232}Th] [KUT]) from the laboratory GEA data and the borehole geophysical data were compared. These natural uranium results, from the laboratory and borehole geophysical data are also plotted on the composite logs (Figures 3.2 to 3.5). The data plots (Figures 6.22 to 6.25) illustrate the differences between the major natural occurring energy peaks (KUT) between the laboratory versus the field geophysical logging results. The laboratory GEA results have a higher precision because the sediment samples were analyzed in a controlled laboratory environment that was free from background interferences, and the samples were analyzed in 1-L marinelli containers that completely surround the detector to improve counting efficiency. Therefore, detection of low-energy gamma emitters (such as thorium-234) was practical (detection of low-energy gamma emitters was not possible in the field because their signals were blocked by the steel drill casing), and the samples were counted for 600 seconds per sample (67% longer then geophysical results). As illustrated in Figures 6.22 to 6.25, there is good agreement between the two KUT data sets, laboratory (PNNL) versus geophysical (Stoller), throughout the vadose zone (i.e., above the water table). The uranium data agreement, however, deteriorates below the water table; the increase in the Stoller geophysical results is attributed to radon in the water inside the casing and within the saturated sediments outside the casing (sees Stoller log reports in Appendix C). Other slight differences in the data for ^{40}K and ^{232}Th maybe due to over-corrections applied for casing thickness and water saturation. Note that radon is a daughter product of uranium decay and is not an indication of manmade uranium.

Borehole geophysical neutron moisture data were also collected from the vadose zone in each well (Appendix C). Neutron moisture measurements were collected at a rate of 15 second per 0.25-foot (Table 6.18.). These moisture data represent, at best, qualitative changes in moisture throughout the vadose zone because the drill casing diameter is too large to correctly quantify moisture values. Moisture data from laboratory analysis of select sediment core samples are also plotted by depth on the composite logs (Figures 3.2 through 3.5) along with the geophysical neutron moisture (and total gamma) data. As illustrated on the composite logs, there is a significant difference in the vadose moisture data between the two sets of results. Both data sets are suspect for several reasons. The laboratory moisture samples may have been altered due to (1) drainage of liquids from the core barrel during retrieval, (2) reduction in moisture due to the heat generated during drilling, and (3) aeration (drying) of the sediment as the core liner is opened. However, the laboratory-measured moisture samples are probably more representative of vadose moisture conditions than the geophysical neutron moisture data because the drill casing was too large in diameter for the effective field measurement of moisture by neutron logging.

Sediment moisture analysis was also completed on samples collected from the saturated zone. While not representative of the saturated zone because most of the free water drained off during core retrieval, they do qualitatively reveal changes in lithology based on grain-size differences. For example, in well 399-3-18 (C4999) (composite Figure 3.2), apparent moisture values increase across the interval of fine sand and most likely reflect an increase in retained moisture due to the decrease in relative grain size (permeability) of the fine-grained interval as compared to the coarser-grained (saturated) Ringold sediments.

The very low uranium MDLs that were achieved using longer count rates, larger, more sensitive germanium crystals (60-70%) combined with the laboratory GEA system confirm that there are no high-concentration hot spots or zones of concentrated process uranium within the vadose zone or saturated interval at any of the four boreholes. However, the four boreholes represent a miniscule area of coverage for the entire 300-FF-5 OU sediments above and within the existing groundwater uranium plume so it can not be stated that no hot spots of uranium are present at locations not measurable by the field spectral gamma logging system (SGLS) or within the sediments from the four boreholes that were obtained.

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Appendix A

Well Summary Data

Well Summary Sheet (as-Built)

Well C4999

WELL SUMMARY SHEET

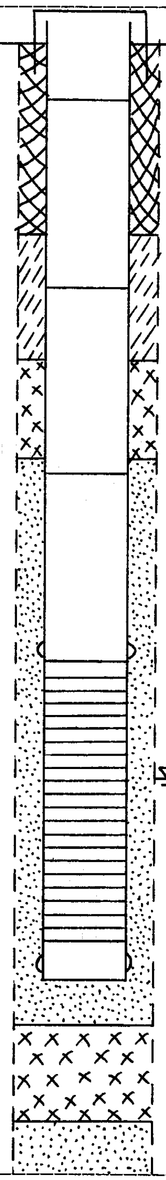
Start Date: 3/~~3~~9/06 ~~[illegible]~~ 4/18/06
Finish Date: 3/29/06

Page 1 of ~~2~~ 3 LW 5-25-06

Well ID: C4999	Well Name: 399-3-18
Location: 300-FF-5 Operable Unit	Project: FF-5 Monitoring Wells
Prepared By: Jake Horner Date: 4/18/06	Reviewed By: L.D. Walker Date: 5/25/06
Signature: Jake Horner	Signature: LD Walker

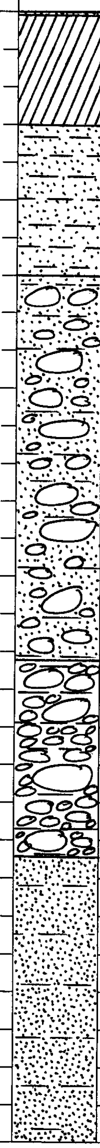
CONSTRUCTION DATA

Description	Diagram
6" stainless steel SCH 10S TP304L riser pipe: 2.18' ags - 32.86' bgs	
6" stainless steel SCH 10S TP 304L 20 slot screen: 32.86' bgs - 47.86' bgs	
6" Stainless steel sump: 47.86' bgs - 49.89' bgs	
8" stainless steel protective surface casing: 3.08' ags - 1.92' bgs	
Cement Grout: 0' bgs - 10.1' bgs	
Bentonite crumbles: 10.1' bgs - 17.2' bgs	
3/8" bentonite pellets: 17.2' bgs - 22.0' bgs	
10-20 mesh silica sand: 22.0' bgs - 52.0' bgs	
Groundwater depth = 39.5' bgs (4-13-06)	



GEOLOGIC/HYDROLOGIC DATA

Depth in Feet	Graphic Log	Lithologic Description
0		0-0.4: Gravel Pad
		0.4-6.0: Black Ash (Fill)
		6.0-7.0: Sand (S)
		7.0-14.0: Silty Sand (mS)
10		
20		14.0-34.5: Silty Sandy Gravel (msG)
30		
40		34.5-45.0: Silty Gravel (mG)
		45-77: Slightly Silty Sand (m)S
50		



A-6003-643 (03/03)

WELL SUMMARY SHEET

Start Date: 3-9-06	Page 2 of 3
Finish Date: 3-29-06	

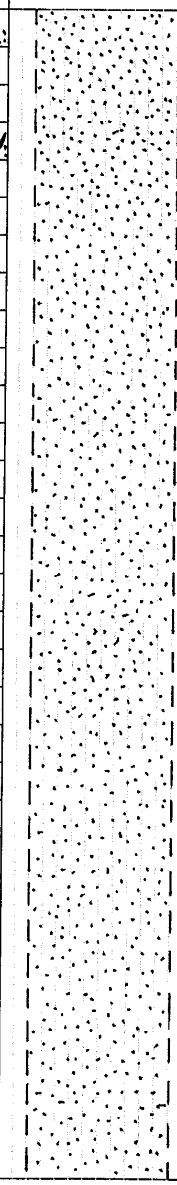
JH 4/18/06 LW 5/25/06

Well ID: ~~C500~~ C4999	Well Name: 399-3-18
Location: 300-FF-5 Operable Unit	Project: FF-5 Monitoring Wells
Prepared By: Jake Horner Date: 4/18/06	Reviewed By: L.D. Walker Date: 5-25-06
Signature: Jake Horner	Signature: LD Walker

CONSTRUCTION DATA

Description
3/8" coated bentonite pellets: 52.0' bgs - 57.4' bgs
10-20 mesh silica sand: 57.4' bgs - 127.0' bgs

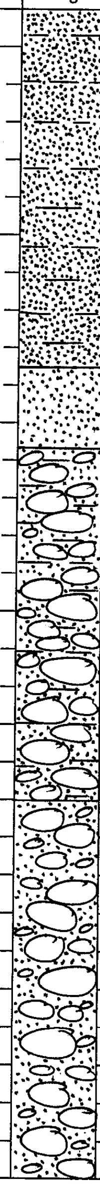
Diagram



GEOLOGIC/HYDROLOGIC DATA

Depth in Feet: 60, 70, 80, 90, 100, 110

Graphic Log



Lithologic Description
77-81.5: Sand (S)
81.5-100: Silty Sandy Gravel (msG)
100-126: Sandy Gravel (sG)

A-6003-643 (03/03)

WELL SUMMARY SHEET	Start Date: 3-9-06 / Finish Date: 3-29-06	Page 3 of 3

Well ID: C4999	Well Name: 399-3-18
Location: 300-FF-5 Operable Unit	Project: FF-5 Monitoring Wells
Prepared By: Jake Horner — Date: 4/18/06	Reviewed By: L.D. Walker — Date: 5/25/06
Signature: [signature]	Signature: [signature]

CONSTRUCTION DATA: Description	Diagram	Depth in Feet	GEOLOGIC/HYDROLOGIC DATA: Graphic Log	Lithologic Description
3/8" coated bentonite pellets: 127.0' bgs – 131.0' bgs		120		
All temporary casing (9 5/8" O.D.) was removed				126'-131': Silt (M)
		130		TD = 131.0' bgs
		140		
		150		
		160		
		170		

A-6003-643 (03/03)

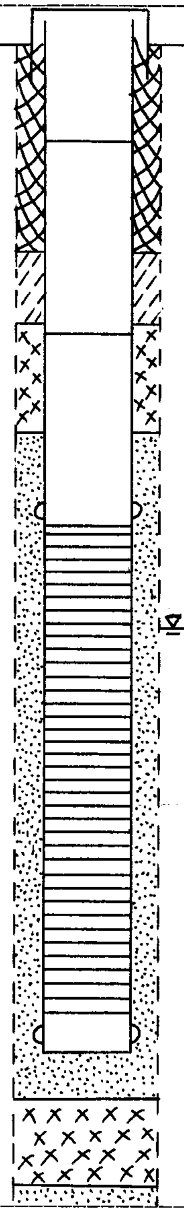
Well C5000

WELL SUMMARY SHEET

Start Date: 3-30-06	Page 1 of 2
Finish Date: 4-21-06	
Well ID: C5000	Well Name: 399-1-23
Location: 300-FF-5 Operable Unit	Project: FF-5 Monitoring Wells
Prepared By: Jake Horner — Date: 4/25/06	Reviewed By: L.D. Walker — Date: 5/25/06
Signature: John Horner	Signature: LD Walker

CONSTRUCTION DATA

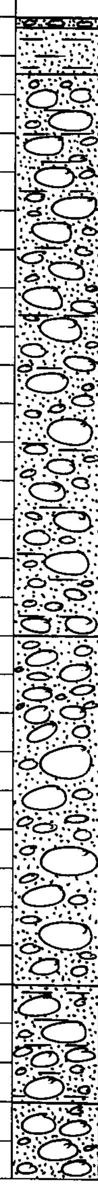
Description	Diagram
6" Stainless steel SCH 10S TP 304L riser pipe: 1.65' ags – 24.94' bgs	
6" Stainless steel SCH 10S TP 304L 20 slot screen: 24.94' bgs – 49.95' bgs	
6" Stainless steel SCH 10S TP 304L sump: 49.95' bgs – 51.98' bgs	
8" Stainless steel/protective surface casing: 2.73' ags – 2.27' bgs	
Cement Grout: Ø' bgs – 10.8' bgs	
Bentonite crumbles: 10.8' bgs – 14.4' bgs	
3/8" bentonite pellets: 14.4' bgs – 20.0' bgs	
10-20 mesh silica sand: 20.0' bgs – 54.4' bgs	
Groundwater depth: 30.3' bgs (5-1-06)	



Depth in Feet: 0, 10, 20, 30, 40, 50

GEOLOGIC/HYDROLOGIC DATA

Graphic Log	Lithologic Description
	0-0.5: Crushed Gravel pad
	0.5-3.0: Silty Sand
	3.0-32.0: Silty Sandy Gravel
	32.0-50.0: Sandy Gravel
	50.0-56.0: Silty Sandy Gravel
	56.0-65.0: Sandy Gravel



A-6003-643 (03/03)

WELL SUMMARY SHEET	Start Date: 3-30-06 Finish Date: 4-21-06	Page 2 of 3

Well ID: C5000	Well Name: 399-1-23
Location: 300-FF-5 Operable Unit	Project: FF-5 Monitoring Wells
Prepared By: Jake Horner Date: 4-25-06	Reviewed By: L.D. Walker Date: 5/25/06
Signature: Jake Horner	Signature: LD Walker

CONSTRUCTION DATA

Description

9 5/8" Temp. casing: 0' - 115' bgs

Coated bentonite pellets: 54.4' - 59.2' bgs

10-20 mesh silica sand: 59.2' - 107' bgs

Natural Backfill: 107' - 110' bgs

10-20 mesh silica sand: 110' - 112' bgs

Coated bentonite pellets: 112' - 115' bgs

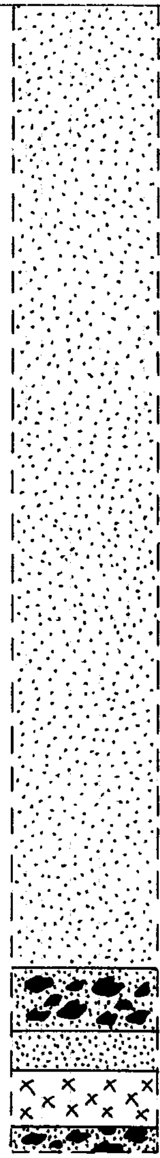
Natural Backfill: 115' - 116' bgs

TD = 116' bgs

All temporary casing was removed.

Groundwater depth = 30.3' bgs (4/21/06)

Diagram



GEOLOGIC/HYDROLOGIC DATA

Depth in Feet: 60, 70, 80, 90, 100, 110

Graphic Log

Lithologic Description

65.0-67.0: Sand

67.0-83.0: Silty Sandy Gravel

83.0-94.0: Sandy Gravel

94.0-96.0: Silt (M)

96-102: Silty Sandy Gravel

102-103: Silty Sand

103-110.5: Sandy Gravel

110.5-116: Silt (M)

TD = 116' bgs

A-6003-643 (03/03)

Well C5001

WELL SUMMARY SHEET

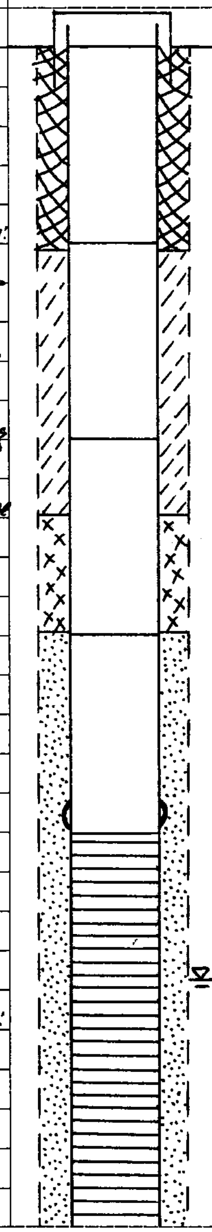
Start Date: 4-24-06
Finish Date: 5-10-06
Page 1 of 2

Well ID: C5001	Well Name: 399-3-19
Location: 300-FF-5 Operable Unit	Project: FF-5 Monitoring Wells
Prepared By: Jake Horner Date: 5/22/06	Reviewed By: L.D. Walker Date: 5-25-06
Signature: Jake Horner	Signature: LD Walker

CONSTRUCTION DATA

Description
6" stainless steel SCH 10S TP 304L riser pipe: ~~1.65~~ 1.69' ags – 40.29' bgs (JH 5/22/06)
6" stainless steel SCH 10S TP 304L 20 slot screen: 40.29' bgs – 65.42' bgs
6" stainless steel SCH 10S TP 304L sump: 65.42' bgs – 67.45' bgs
8" stainless steel/protective surface casing: 2.6' ags – 2.4' bgs
Cement Grout: Ø' bgs – 10.5' bgs
Bentonite crumbles: 10.5' bgs – 23.9' bgs
3/8" bentonite pellets: 23.9' bgs – 29.9' bgs
6-9 mesh silica sand: 29.9' bgs – 71.9' bgs
~~DTW = 39.5' bgs~~ (JH 5/22/06)
DTW = 47.7' bgs (5/22/06)

Diagram



Depth in Feet: 0, 10, 20, 30, 40, 50

GEOLOGIC/HYDROLOGIC DATA

Graphic Log

Lithologic Description
0-0.5: Crushed Gravel Pad
0.5-4: Gravelly Sand
4.0-6.0: Slightly Silty Sand
6.0-11.0: Gravelly Sand
11.0-25.0: Sandy Gravel
25.0-44.0: Silty Sandy Gravel
44.0-82.0: Sandy Gravel

A-6003-643 (03/03)

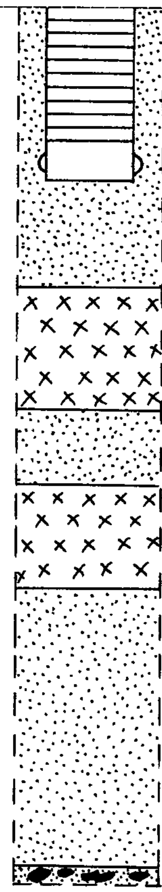
WELL SUMMARY SHEET

Start Date: 4-24-06	Finish Date: 5-10-06	Page 2 of 2	
Well ID: C5001		Well Name: 399-3-19	
Location: 300-FF-5 Operable Unit		Project: FF-5 Monitoring Wells	
Prepared By: Jake Horner	Date: 5/22/06	Reviewed By: L.D. Walker	Date: 5-25-06
Signature: Jake Horner		Signature: LD Walker	

CONSTRUCTION DATA

Description
3/8" coated bentonite pellets: 71.9' bgs – 78.8' bgs
10-20 mesh silica sand: 78.8' bgs – 82.9' bgs
3/8" coated bentonite pellets: 82.9' bgs – 88.0' bgs
10-20 mesh silica sand: 88.0' bgs – 102.5' bgs
Natural backfill: 102.5' bgs – 103.5' bgs
All temporary casing (9 5/8" O.D.) was removed.

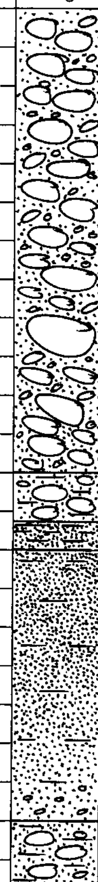
Diagram



Depth in Feet: 60, 70, 80, 90, 100, 110

GEOLOGIC/HYDROLOGIC DATA

Graphic Log



Lithologic Description
44.0-82.0: Sandy Gravel
82.0-84.5: Sandy Gravel
84.5-86.0: Sandy Silt
86.0-100: Slightly Silty Sand
100-103.5: Silty Sandy Gravel
TD = 103.5' bgs

A-6003-643 (03/03)

Well C5002

WELL SUMMARY SHEET

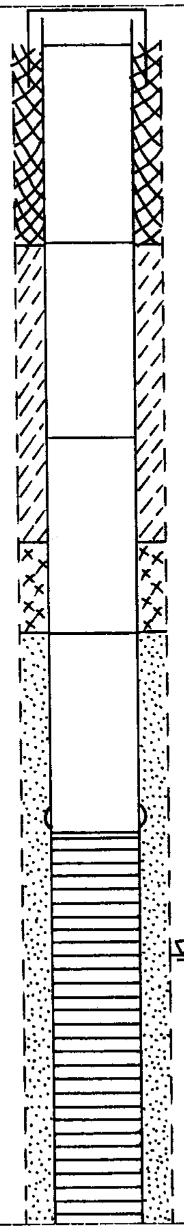
Start Date: 5/11/06
Finish Date: 5/22/06
Page 1 of 2

Well ID: C5002	Well Name: 399-3-20
Location: 300-FF-5 Operable Unit	Project: FF-5 Monitoring Wells
Prepared By: Jake Horner Date: 5/23/06	Reviewed By: L.D. Walker Date: 5/25/06
Signature: Jake Horner	Signature: LD Walker

CONSTRUCTION DATA

Description
6" Stainless steel SCH 10S TP304L riser pipe: 1.74' ags – 40.24' bgs
6" Stainless steel SCH 10S TP 304L 20 slot screen: 40.24' bgs – 65.26' bgs
6" stainless steel SCH 10S TP 304L sump: ~~65.26' bgs~~ 65.26' LW 5/25/06 – 67.28' bgs
8" stainless steel protective surface casing: 2.72' ags – 2.28' bgs
Cement Grout: 0' – 10.2' bgs
Bentonite crumbles: 10.2' bgs – 25.5' bgs
3/8" bentonite pellets: 25.5' bgs – 29.9' bgs
6-9 mesh silica sand: 29.9' bgs – 72.1' bgs
Groundwater depth = 49.1' TOC (46.4' bgs) (5/22/06)

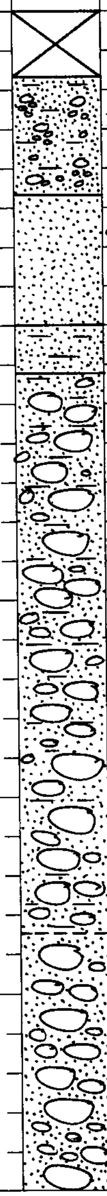
Diagram



GEOLOGIC/HYDROLOGIC DATA

Depth in Feet: 0, 10, 20, 30, 40, 50

Graphic Log



Lithologic Description
0-3.5: ND
3.5-9.5: Slightly Silty Gravelly Sand
9.5-16.0: Sand
16.0-18.5: Slightly Silty Sand
18.5-47.0: Silty Sandy Gravel
47.0-80.0: Sandy Gravel

A-6003-643 (03/03)

WELL SUMMARY SHEET

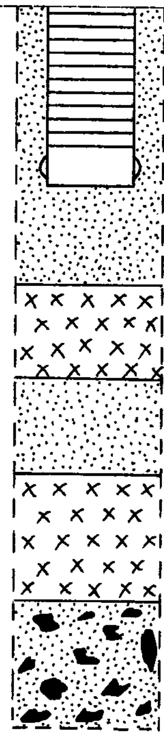
Start Date: 5/11/06	Page 2 of 2
Finish Date: 5/22/06	

Well ID: C5002	Well Name: 399-3-20
Location: 300-FF-5 Operable Unit	Project: FF-5 Monitoring Wells
Prepared By: Jake Horner — Date: 5/23/06	Reviewed By: L.D. Walker — Date: 5/25/06
Signature: Jake Horner	Signature: LD Walker

CONSTRUCTION DATA

Description
Coated 3/8" bent. pellets: 72.1' bgs – 77.4' bgs
6-9 mesh silica sand: 77.4' bgs – 81.9' bgs
Coated 3/8" bent. pellets: 81.9' bgs – 88.2' bgs
Natural backfill: 88.2' bgs – 95.0' bgs
All temporary casing (9 5/8" O.D.) was removed.

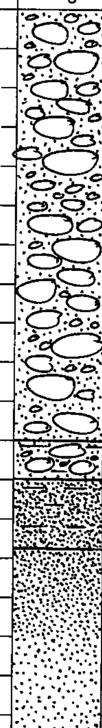
Diagram



GEOLOGIC/HYDROLOGIC DATA

Depth in Feet: 60, 70, 80, 90, 100, 110

Graphic Log



Lithologic Description
47.0-80.0: Sandy Gravel
80.0-82.0: Silty Sandy Gravel
82.0-85.5: Slightly Silty Sand
85.5-95.0: Sand
TD = 95.0' bgs

A-6003-643 (03/03)

Borehole Log

Well C4999

BOREHOLE LOG	Page 1 of 4
	Date: 3-10-06

Well ID: C4999	Well Name: 399-3-18	Location: 300-FF-5
Project: 300-FF-5 Monitoring Wells		Reference Measuring Point: Ground Surface

Depth (Ft.)	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	0-0.4' Gravel pad	Sonic drilling with continuous 5.0' (I.D.) core samples & 9 5/8" temp. carbon steel casing.
	0.4'-6.0' Black ash layer	
	*Fill from 0-6.0' bgs	
5	6.0'-7.0' Sand (S) Well-sorted, med.-coarse sand (60% felsic, 40% mafic) Sub-angular with max grain ~1mm & no rxn with HCl.	
10	7.0'-14' Silty Sand (mS) Well-sorted, fine-med. sub-rounded sand (85%) (50% mafic, 50% felsic) & 15% dark grayish brown (4/2) silt. No rxn with HCl.	
15	14'-34.5' Silty Sandy Gravel (msG) Poorly sorted, sub-rounded to well-rounded, fine to med. pebbles (80% basalt) & 40% heterolithic sand & 10% silt. Max particle is 35 cm. Some silt may be artificial due to drilling method	
20	- Sand & silt is very gray, with lots of pulverized basalt.	
25	34.5'-45' Silty Gravel (mG) Poorly sorted with 60% sub-rounded, med-fine heterolithic pebbles (Basalt, quartzite, granites etc.), 30% moist dark grayish brown (2Y 4/2) silt (low plasticity) with 10% med. to coarse sand.	
35	Hanford Fm. 6.0' to 34.5' bgs.	

Sample Type No. / Core Recovery: 1, 1D, 1E, 2, 2A, 2B, 2E, 3, 3A, 3B, 3C, 4, 4B, 4C, 5A, 5B, 5C, 5, 5D, 5E, 6A, 6B, 6C, 6D, 6E, 7A, 6, 7D, 7E, 8A, 8B, 8D, 8E, 9A, 9B, 9C, 8, 10A, 10B, 10C, 10D, 9, 11A

Reported By: Jake Horner	Reviewed By: L.D. Walker
Title: Geologist	Title: Geologist
Signature: [signature] Date: 3-13-06	Signature: [signature] Date: 5/25/06

LW 5-25-06

A-6003-642 (03/03)

BOREHOLE LOG

Page 2 of 4
Date: 3-13-06

Well ID: C4999	Well Name: 399-3-18	Location: 300-FF-5 OU
Project: 300-FF-5 Monitoring Wells		Reference Measuring Point: Ground Surface

Depth (Ft.)	Sample Type No.	Sample ~~Blows~~ Core 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	11B				
	11C			45'-54' Slightly Silty Sand (m)S	DTW = 42.5' bgs (3/14/06) LW 5-30-06
	11D	10		Well-sorted, Olive brown (2.5Y 4/3)	
	W.S. 11E			with 90% v. fine, sub-rounded felsic	W.S. bailed @ 42.5' bgs
				sand (40-50% qtz w/ ~10% mica) &	PNNL #s: B1FRB2,
45		12A		10% silt. Avg. grain size is ~1/10 cm	B1FR99 & B1FRB0
		12B		No rxn with HCl.	
		12C		54'-64' (m)S continued with	bailed W.S. @ 49.7' bgs
	W.S.	12D		drastic color change (Very dark	(Top of water) shoe depth
		12E		greenish gray (Gley 2 3/1) and an	was 46' bgs.
	11	13A		increased silt fraction (15-20%).	PNNL #s: B1FR91, B1FR92
50	13B			*Formation is very tight with close	& B1FR94
	13C			to 0 water production (45'-68' bgs)	
	W.S. 13D				bailed W.S. with shoe
	13E			64'-68' mS Silty Sand	@ 52.5' & DTW @ 42.5' bgs.
	14A	12		Very dark greenish gray (Gley 2 3/1)	PNNL #s: B1FRB3,
55	14B	14C		Moderatly sorted with ~~6~~ 70%	B1FRB4 & B1FRB6
	bag	14D		felsic sand (60% qtz, 10% mica)	
		14E		sand is v. fine & sub-rounded	
		15A		30% silt/clay producing the	
	13	15B		greenish color. No rxn to HCl	Pumped W.S. with shoe
60	15D	15C			@ 66' bgs & DTB @ 70' bgs.
	15E			68'-77' Slightly Silty Sand (m)S	PNNL #s: B1FR87,
	16A			Very dark gray (N 3/) & moderatly	B1FR88 & B1FR90
	16B			sorted w/ 90% fine grained, sub-	
	16C	14		rounded felsic sand (50% qtz,	
65	16D	16E		10% mica, 40% meta/mafic) &	
	W.S.	17A		10% silt. No rxn with HCl. Max	
		17B		particle is fine grained sand. Sand	
		17C		is 90% loose with zones of well-	
	15	17D		cemented sand containing an	
70	18A	17E		increased silt fraction. Max zone	
	18B			of cementation is ~4-5 cm.	
	18C			~~70'-76'~~ GH 3/17/06	Pumped W.S. with shoe
	18D			-70'-76' 1mm reddish black	@ 76' bgs & DTB 78' bgs
	18E			(2.5YR 2.5/1) clay laminations	(4' of cave from 82' bgs)
75	19A	16		are present.	PNNL #s: B1FRB7,
	W.S.	19B			B1FRB8 & B1FRC0
		19C		77'-81.5' Sand (S)	
		19D			
		19E			

Reported By: Jake Horner		Reviewed By: L.D. Walker	
Title: Geologist		Title: Geologist	
Signature: Jake Horner	Date: 3-20-06	Signature: LD Walker	Date: 5/25/06

A-6003-642 (03/03)

BOREHOLE LOG

Page 3 of 4
Date: 3-20-06

Well ID: C4999	Well Name: 399-3-18	Location: 300-FF-5 OU
Project: FF-5 Monitoring Wells		Reference Measuring Point: Ground Surface

Depth (Ft.)	Sample Type No.	~~Blows~~ GP Core 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		19E, 20A, 17, 20B, 20D, 20E, 21A, 18, 21B, 21E, 21C, 22A		77'-81.5' Sand (S) Well-sorted, sub-angular to sub-rounded, v. fine (40%) to fine (60%) Sand (90% qtz, 10% mafic). Max particle is med. sand, no rxn with HCL. (Gray 5/N)	Pumped w.s. with shoe @ 86' bgs & DTB @ 89' bgs (slough from 91.5'-89' bgs) PNNL #s: BIFR83, BIFR84 & BIFR86
85	w.s.				
90		22B, 22C, 22D, 19*, 22E, 23C, 23D, 23E, 20, 24A, 24B, 24C		81.5-100' Silty Sandy Gravel (msG) Poorly sorted with 65% sub-rounded med. to v. coarse mafic pebbles, 20% sub-angular v. fine to coarse sand (60-90% qtz) & black (2.5/N) silt. Max particle is 50mm & no rxn with HCl. -98' silt fraction decreases	*Core run #19 was redrilled 6 times. On recovery, the bottom 2' fell out & the core shifted down.
95					Pumped w.s. with shoe @ 98' bgs & DTB @ 101' bgs (slough from ~~100~~ 89'-101.5' bgs) PNNL #s: BIFR95, BIFR96 & BIFR98
100	w.s.	24D, 24E, 21, 25A, 25C, 25B, 25D, 25E, 26A, 26B, 22, 26C, 26D, 26E, 27A, 23, 27B, 27E, 27C, 28A, 27D		100'-126' Sandy Gravel (sG) Poorly sorted with 60% well-rounded to sub-rounded, v. fine - v. coarse pebbles (50% basalt, 50% heterolithic) & 40% sub-rounded - sub angular med. sand (70% qtz, 30% mafic). Max particle is 50mm no rxn with HCl -120' - Sand grainsize increases qtz is still med. but abundant coarse to very coarse basalt grains are present (60% qtz, 40% mafic). Cobbles up to 0.5" are present.	
105	w.s.				Pumped w.s. with shoe @ 107' bgs & DTB @ 109' bgs (2' slough from 109'-111' bgs) PNNL #s: BIFR79, BIFR80 & BIFR82.
110		28B, 28C, 28D, 24, 28E, 29A, 29B, 29C, 29D, 29E			
115					

Reported By: Jake Horner	Reviewed By: L.D. Walker
Title: Geologist	Title: Geologist
Signature: Jake Horner Date: 3-23-06	Signature: LD Walker Date: 5/25/06

A-6003-642 (03/03)

BOREHOLE LOG			Page 4 of 4 Date: 3-23-06
Well ID: C4999	Well Name: 399-3-18	Location: 300-FF-5 OU	
Project: FF-5 Monitoring Well		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	29E, 30A, 30D, 30E, 31A, 31B, 31C, 31D, 31E, 32A, 32B, 32C	25, 26		126'-131' Silt (M) Well sorted, very greenish gray (10GY 4/1) with 95% silt & 5% very fine sand with very sparse pebbles up to 15mm in diameter. Very thin laminations (1-2 mm) of alternating light & dark shades of green are present. Silt is only slightly moist with weak cementation (somewhat brittle). -@ 130' a color change occurs. Silt becomes greeish black (Gley1 10Y 2.5/1)	Pumped w.s. with shoe @ 120' bgs & DTB @ 121.5' bgs (slough from 121.5' to 126' bgs) PNNL #s: B1FR31, B1FR32 & B1FR34 TD = 131' bgs
125					
130					
135				not used JH 3-23-06	
140					
145					
150					
155					

Reported By: Jake Horner	Reviewed By: L.D. Walker
Title: Geologist	Title: Geologist
Signature: [signature] Date: 3-23-06	Signature: [signature] Date: 5/25/06

A-6003-642 (03/03)

Well C5000

BOREHOLE LOG

Page 1 of 4
Date: 5-30-06

Well ID: C5000	Well Name: 399-1-23	Location: 300-FF-5 OU.
Project: 300-FF-5 Monitoring Wells		Reference Measuring Point: Ground Surface

Depth (Ft.)	Sample Type No.	Sample ~~Blows~~ core 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		1; 32D; 32E; 33A; 33B; 33C; 33D		0-0.5' Crushed gravel pad	Sonic drilling - advancing 5" I.D. Continuous core samples & 9 5/8" O.D. temp. carbon steel casing.
		2; 34A; 34B; 3; 34C; 35B; 34D; 35C; 34E; 35D		0.5'-30' Silty Sand (mS) Poorly sorted & brown (10YR 4/3) with 75% sub-angular v. fine to medium heterolithic sand with 20% silt & 5% fine pebbles. Max particle is ~10mm & no rxn with HCl.	[no recovery symbol] = No recovery
5					
10		35E; 4; 36A; 36D; 36E; 37A; 37B		30'-32' Silty Sandy Gravel (msG) Poorly sorted with 60-70% sub-rounded - sub-angular, fine pebbles to small cobbles (60% basalt) with 20% sand (60% mafic) & 15% brown silt. Max particle is ~12cm.	DTW = 33.5' bgs (3-31-06)
15		5; 38A; 38B; 38C; 6		• 13'-20' silt fraction increases ~~increases~~ to ~30%, sand-20% pebble/cobble 50% (JH 3-31-06)	
20		39A; 39B; 39C; 39D		• @ 20' bgs moisture was encountered • @ 20' bgs silt fraction decreases to 15-20%. • 23-32' (msG) Poorly sorted with 70% sub-rounded to ~~sub~~ well-rounded pebbles & small cobbles (60% basalt) with 15% mafic dominated med.-coarse sub-angular sand & 15% brown (10YR 5/3) mud (silt/clay)	bailed w.s. with DTB: 35' bgs & DTW = 33.5' bgs PNNL #s: B1FR35, B1FR36 & B1FR38
25		7			
30		40A; 40B; 40C; 40D; 8; 40E		• @ 29' pebble fraction decreases & sand fraction increases to 30%	
	w.s.	41B; 41C; 41D; 9; 41E; 42A			Pumped w.s. with shoe @ 36' bgs & DTB @ 39' bgs (slough 39'-40' bgs) PNNL #s: B1FR42, B1FR40 & B1FR39
35	w.s.				

Reported By: Jake Horner		Reviewed By: L.D. Walker	
Title: Geologist		Title: Geologist	
Signature: Jake Horner	Date: 3-31-06	Signature: [signature]	Date: 5/25/06

A-6003-642 (03/03)

BOREHOLE LOG

Page 2 of 4
Date: 3-31-06

Well ID: C5000 | Well Name: 399-1-23 | Location: 300-FF-5 OU

Project: 300-FF-5 Monitoring Wells | 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	w.s.	42A, 43A, 43B, 10		32' – 50' Sandy Gravel (sG) Poorly sorted with 70-80% sub-rounded pebbles & cobbles (40-50% basalt, 10-20% qtzites, 20-30% meta) & 5-10% silt (may be some artificial silt due to drilling meth.)	Pumped w.s. with shoe @ 43' bgs & DTB @ 43.5' bgs (slough 43'-46' bgs) PNNL #s: B1FR43, B1FR44 & B1FR46
45	w.s.	44A, 44B, 44C, 44D, 11		Gravel is very loose & diff. to recover in ss sampler. Max particle is ~12" & no rxn with HCl.	Pumped w.s. with shoe @ 47' & DTB = 48.5' bgs (slough 48.5'-50' bgs) PNNL #s: B1FR47, B1FR48 & B1FR50
50	w.s.	44E, 45A, 45B, 45C, 45D, 45E, 12		50' – 56' Silty Sandy Gravel (msG) Poorly sorted with 60% heterolithic sub-rounded to angular fine pebbles & small cobbles (many pebbles & cobbles are freshly broken). 25% felsic med. sand (60-70% qtz., ~20% basalt & 10-20% meta). Qtz grains are consistently sub-rounded & med. grained. Basalt grains are more coarse & angular. 10-20% silt, very dark gray (Gley 1, 3N)	Pumped w.s. with shoe @ 53.5' & DTB @ 55' bgs (slough 55' to 56' bgs) PNNL #s: B1FR51, B1FR52 & B1FR54
55	w.s.	46A, 46B, 46C, 46D, 46E, 47A, 13		This interval was redrilled 2x?, possibly producing some artificial silt. Driller noted Fm. becomes harder @ ~52' bgs.	Pumped w.s. with shoe @ 58.6' & DTB @ 60' bgs (slough 60'-61' bgs) PNNL #s: B1FR55, B1FR56 & B1FR58
60		47B, 47C, 47D, 48B, 48C, 14		56' – 65' Sandy Gravel (sG) Silt fraction decreased to ~5%, otherwise, same as above.	
65	w.s.	48D, 48E, 49A, 49B, 49D, 49E, 15		65' – 67' Sand (S) Well sorted medium sub-angular sand (80-85% qtz, 15-20% mafics). Sand is very clean.	Pumped w.s. with shoe @ 67' bgs & DTB @ 70' bgs PNNL #s: B1FR59, B1FR60 & B1FR62
70		50A, 50B, 50C, 50D, 50E, 16			
75	w.s.	51A, 51B, 51C, 51D, 51E, 52A, 52B, 17			

Reported By: Jake Horner | Reviewed By: L.D. Walker

Title: Geologist | Title: Geologist

Signature: Jake Horner | Date: 4-10-06 | Signature: LD Walker | Date: 5/25/06

A-6003-642 (03/03)

BOREHOLE LOG

Page 3 of 4

Date: 4-10-06

Well ID: C5000	Well Name: 399-1-23	Location: 300-FF-5 ou
Project: 300-FF-5 Monitoring Wells		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
80–95	W.S.	52B, 52C, 52D, 53A, 53B, 53C, 53D, 53E, 54A, 54E, 55A, 55B, 55C, 55D, 55E, 56A, 56B, 56C; 18, 19, 20, 21		* A 2"-3" layer of volcanic ash was encountered somewhere between 64' & 68' bgs. Deposit was not seen in core samples, but was found during cleanout. The deposit is very well-sorted with ~90-95% < very fine grains the feel gritty. 67' - 83' Silty Sandy Gravel (msG) Poorly sorted with ~60% sub-rounded, very fine pebbles to small cobbles (60% mafic) 30% sub-angular, medium sand (70% qtz, 30% mafic) & ≤10% silt. Silt is very dark gray (Gley1 3/N) Max particle is ~10cm.	Pumped w.s. with shoe @ 77.0' bgs & DTB @ 82' bgs (slough 82'-83' bgs) PNNL #s: B1FR63, B1FR64 & B1FR66. Pumped w.s. with shoe @ 88.5' bgs & DTB = 92' bgs PNNL #s: B1FR67, B1FR68 & B1FR70
95–110	W.S.	56E, 57A, 57B, 57C, 57D, 57E, 58A, 58B, 58C, 59A, 59B, 59C, 59D, 59E, 60B, 60C, 60D, 60E, 61A, bag, 61B; 22, 23, 24		83' - 94' Sandy Gravel (sG) Poorly sorted with ~60-70% sub-rounded pebbles & cobbles (heterolithic) & 30-40% medium, sub-angular sand (~70% qtz) & ~5% silt. Max particle is ≥10cm. 94' - ~96' Silt (M) Moderately sorted with 90-95% greenish black (2.5.5G) silt containing zones with up to 20% med. felsic sand & several 1-2 cm sized pockets of 90% felsic sand & 10% silt. Sparse pebbles up to 2cm are present. Silt is moist & has a low plasticity.	Core #22: 99.5'-106' bgs Core #23 #24: 106'-113' bgs LW 5-30-06. Pumped w.s. with shoe @ 105.5' bgs & DTB = 110' bgs (bent. backfill from 115'-112' bgs & sand backfill from 112'-110' bgs) PNNL #s: B1FR71, B1FR72 & B1FR74
115				TD = 116' bgs	

Reported By: Jake Horner	Reviewed By: L.D. Walker
Title: Geologist	Title: Geologist
Signature: Jake Horner — Date: 4-12-06	Signature: L.D. Walker — Date: 5/25/06

A-6003-642 (03/03)

BOREHOLE LOG

Page 4 of 4
Date: 4-11-06

Well ID: C5000	Well Name: 399-1-23	Location: 300-FF-5 OU
Project: 300-FF-5 OU Monitoring Wells	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
	not used	4-12-06		~96' - 102' Silty Sandy Gravel Poorly sorted with 60% well-rounded pebbles & cobbles, 20% med. sub-angular sand & 20% greenish black silt. Max particle is ~8cm. sand is very felsic.	
				102'-103' Silty Sand (mS) Well-sorted with 70-80% fine, sub-angular sand (90% qtz) & 20-30% dark greenish gray silt (Gley 1 4/5GY) moist very sparse pebbles are present.	
				103'-110.5' Sandy Gravel (sG) Poorly sorted with ~60% well rounded pebbles & small cobbles, 30%-35% medium, sub-rounded to sub-angular felsic sand (60-70% qtz) & very dark greenish gray silt. Silt fraction is much higher from 103' to ~105' bgs & then drops to 5-10%. Silt is concentrated on the outer edge of the core, the center is almost clean sand.	
				110.5'-116' Silt (m) Well-sorted slightly moist, dark greenish gray (Gley 1, 4/5G) with ~80-90% silt & 10-20% v. fine felsic sand. Zones of weak cementation are present.	

Reported By: Jake Horner	Reviewed By: L.D. Walker	
Title: Geologist	Title: Geologist	
Signature: Jake Horner Date: 4-12-06	Signature: LD Walker	Date: 5/25/06

A-6003-642 (03/03)

Well C5001

BOREHOLE LOG

Page 1 of 3
Date: 4-25-06

Well ID: C5001	Well Name: 399-3-~~20~~ 19 (4-25-06)	Location: 300-FF-5 OU
Project: FF-5 Monitoring Wells		Reference Measuring Point: Ground Surface

Depth (Ft.)	Sample: Type No.	Sample: ~~Blows~~ Core 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		1		0-0.5: Crushed gravel mixed with eolian sand	Sonic drilling - advancing cont. core (5" I.D.) & 9 5/8" temp. casing with a 10" O.D. shoe.
		61E, 62A, 62B, 62C		0.5-4: Gravelly Sand (gS) Mod. sorted with 85% angular fine - coarse sand (50% felsic, 50% mafic) & 15% mafic pebbles & cobbles.	
5		2; 63A, 63B, 63C, 63D		4-6: Slightly Silty Sand (m)S Well sorted dark grayish brown (10YR 4/2) with ~80% v. fine heterolithic sand & 15-20% silt. Sparse pebbles are present (0-5%).	
10		3; 64A, 64B, 64C, 64D, 64E			
15		4; 65C, 65D, 65E		6'-11': Gravelly Sand (gS) Poorly sorted with ~75% fine to coarse angular to sub-angular sand (heterolithic) with ≥25% pebbles & cobbles. Max cobble is ~8-9 cm.	
20		5; 66A; 67A, 67B		11'-25' Sandy Gravel (sG) Poorly sorted with 55-60% well-rounded pebbles (v.f.-coarse) & heterolithic with 30-40% fine to v. coarse sub-angular to angular heterolithic sand & 5-10% silt. Moisture in sample has concentrated silt in pockets along pebble surfaces. Max particle is ~8-9 cm.	
25		6; 67E, 68A, 68B, 68C		-@ ~17' sand fraction becomes a med. to coarse sub-angular to angular mafic sand (60-70% basalt) with very minor silt.	
30		7; 69B, 69C, 69D		- large rock @ ~~25~~' bgs 25.5' bgs LW 5-30-06	
35		8; 70C			

Reported By: Jake Horner	Reviewed By: L.D. Walker
Title: Geologist	Title: Geologist
Signature: Jake Horner — Date: 4-25-06	Signature: L.D. Walker — Date: 5/25/06

A-6003-642 (03/03)

BOREHOLE LOG

Page 2 of 3

Date: 4-25-06

Well ID: C5001	Well Name: 399-3-19	Location: 300-FF-5 OU
Project: FF-5 Monitoring Wells		Reference Measuring Point: Ground Surface

Depth (Ft.)	Sample Type No.	Sample ~~Blows~~ Core 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	← Water Samples; ← Slug tests	9; 70D; 70E; 71E; 72A		25-32: Silty Sandy Gravel (msG) Poorly sorted with 60-70% well-rounded v.f. - c pebbles & small cobbles, 20% m-vc mafic sub-angular to angular sand & ~15% silt	Core #9: Plugged @ 43' & was pushed 43'-47' with no recovery.
45		10		32-33: Sand (S) Well sorted, m-vc angular to sub-angular mafic sand (70% basalt) with 10-20% v.f - m pebbles @ 4-25-06	Core #10: Fell out 1st time & 1' slough rec. on 2nd attempt. 73B in mixed 46.5-53' DTW = 47.2' bgs 4/26/06 Pumped w.s. with shoe @ 53' & DTB @ 52' bgs.
50	2; 1; w.s.	11; 74B; 74C		~~33~~-~~34~~ 34-35: Gravel (G) Med. sorted v.f. - v.c. sub-rounded to well-rounded mafic pebbles with very little matrix.	PNNL #s: B1HRW9 4-25-06 B1HRX0 & B1HRX1 Pumped w.s. with shoe @ 57.5' & DTB = 58' bgs (1' slough 58'-59' bgs)
55	w.s.	12		35-44': Silty Sandy Gravel (msG) Poorly sorted with 60-70% well-rounded vf - c mafic pebbles & 30% sub-angular m-vc sand (50% mafic, 50% felsic) & 5-15% silt.	PNNL #s: B1HRX3, B1HRX4 & B1HRX5 4-27-06 - slug testing: 52' - 57' & 47'-57'
60	w.s.	13; 76B; 76C; 76D; 76E		• 39-40: Silt fraction increases to ~15-20% & pebble fraction is better sorted (Avg. pebble is 15-20 cm)	Core #11, same as #9 Core #12 fell out & sed. was bagged from cleanout. Core #13 plugged @ ~67' & was pushed to 76' bgs.
65-70				44'-82': Sandy Gravel (sG) Poorly sorted with 60% sub-rounded m-vc pebbles & 20% angular to sub-angular vf-f heterolithic pebbles with 20% c-vc sub-angular heterolithic sand. Bulk comp. is ~50%-60% mafic, many quartzites are present ~10-15%. Formation is very loose & permeable. Core recovery is diff. Max cobble @ 67' is ~15 cm dia.	Pumped w.s. with shoe @ 63' bgs & DTB @ 63' bgs PNNL #s: B1HRX7, B1HRX8 & B1HRX9
75		14; 77D; 77E; 78A; 15			Core #14 all fell out & 3' were rec. on 2nd run (77D - 78A mixed 73'-76')

Reported By: Jake Horner		Reviewed By: L.D. Walker
Title: Geologist		Title: Geologist
Signature: [signature]	Date: 4-28-06	Signature: [signature] Date: 5/25/06

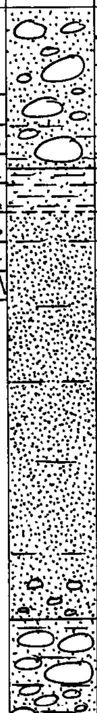
A-6003-642 (03/03)

BOREHOLE LOG

Page 3 of 3
Date: 4-28-06

Well ID: C5001 | Well Name: 399-3-19 | Location: 300 · FF-5 OU

Project: FF-5 Monitoring Wells | 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	W.S.	78E, 79A 16, 79B 79C, 79D, 79E, 80A, 80B, 80C		82-84.5': Sandy Gravel (sG) Poorly sorted with 60% well-rounded heterolithic pebbles & cobbles 30-35% med. sub-rounded to sub-angular felsic sand (65%-70% qtz) with 5-10% light olive brown silt. Max cobble in core is ~15cm in dia. lt. olive brown-(2.5Y, 5/4)	Pumped w.s. with shoe @ 80' bgs & DTB @ 83' bgs (slough 83' to 84' bgs) PNNL #: B1HRY1, B1HRY2 & B1HRY3
85					
90				~~86'-100'~~ @ 4-28-06 84.5-86': Sandy Silt (sM) Well-sorted olive brown (2.5Y 4/3) with ~70-80% silt & 20-30% v.f. sub-rounded felsic sand (50-60% qtz)	
95				86'-100: Slightly Silty Sand (mS) Well sorted v.f. sub-rounded felsic sand (60-70% qtz with ~5% mica) & 5-15% silt • 86'-97' sand & silt is a light olive brown (2.5Y 4/3) • 97'-100 sand & silt is a very dark greenish gray (Gley 1 3/10G) • Some pebbles (1.5 cm dia) (sub-rounded heterolithic) are present ~98'-100' bgs.	Pumped w.s. with the shoe @ 100' bgs & DTB @ 102.5 (slough 102.5'-103.5' bgs) PNNL #: B1HRY5, B1HRY6 & B1HRY7
100	W.S.				TD = 103.5' bgs
105					
110				100'-103.5: Silty Sandy Gravel Poorly sorted with 60% sub-rounded mafic pebbles & cobbles, 30% medium sub-angular sand (~70% qtz.) & ≥10% black silt (2.5/N)	
115				not used @ 5/3/06	

Reported By: Jake Horner	Reviewed By: L.D. Walker
Title: Geologist	Title: Geologist
Signature: [signature] Date: 5/3/06	Signature: [signature] Date: 5/25/06

A-6003-642 (03/03)

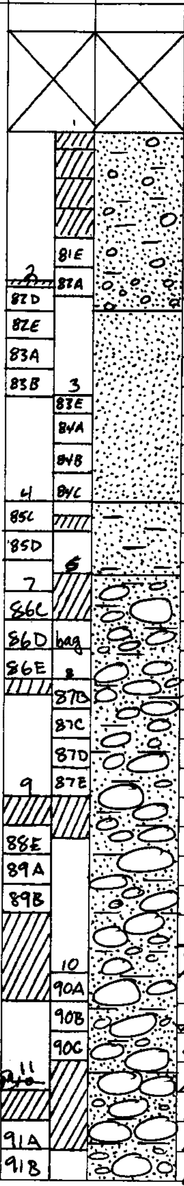
Well C5002

BOREHOLE LOG

Page 1 of 3
Date: 5-11-06

Well ID: C5002	Well Name: 399-3-20	Location: 300 - FF5 OU
Project: FF-5 Monitoring Wells		Reference Measuring Point: Ground Surface

Depth (Ft.)	Sample Type No.	Sample ~~Blows~~ Core Recovery (JW 5-30-06)	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				0-3.5' Sediment taken out by hand in order to set core sampler into the ground.	Sonic Drilling Continuous Core (5" ID) ; 9 5/8" temp. casing w/ 10" OD shoe
5		81E, 82A, 2		3.5 - 8.5' (m)gS (65% S, 25% G, 10% M) Sand moist, fine-med, brown - d. brown, sub. ang. ; Gravel lg. pebble - med. cobble, rnd, poor sort, basalt ; silt % moderate, clumping present ; Surface stabilization material	▨ = NO RECOVERY
10	82D, 82E, 83A, 83B	3, 83E, 84A, 84B		8.5 - 9.5' gS (80% S, 20% G) Sand is black, coarse - v. coarse, highly mafic (pure basalt?), ang - sub. ang, med. sort - damp ; Gravels granule - sm cobble (crushed), sub. rnd - sub. ang., highly mafic (basalt?)	
15	4, 85C, 85D	84C, 6		9.5 - 16' S (100% S) Sand fine-med. felsic 60/40 mafic, v. well sort, sub. ang. - ang., damp, brown - lt. brown.	No recovery for core #5
20	7, 86C, 86D, 86E	bag			Core #6 was collected in a bag (20'-21')
25	9	87B, 87C, 87D, 87E		16 - 18.5 (m)S (90% S, 10% M) Sand vf - fine, white - cream, v. well sort, dry, 100% felsic ; silt % increases, dry clasts present (Ringold ?)	
30	88E, 89A, 89B			@ 18 (m)S (90% S, 10% M) Sand brown - d. brown, damp.	
35	10, ~~10~~ 11, 91A, 91B	90A, 90B, 90C		18.5 - 47' : Silty Sandy Gravel Poorly sorted with ~60% rounded fine pebbles to med. cobbles (70% to 80% mafic), 30% sub-angular to angular fine to v. coarse hetero-lithic sand ≠ ≥10% lt. yellowish brown silt. Max cobble is ≥ 15cm. Fm. is weakly cemented, possibly due to high temp. drilling (18'-20')	



Reported By: Jess Hocking / Jake Horner		Reviewed By: L. D. Walker
Title: Geologist / Geologist		Title: Geologist
Signature: Jess Hocking / Jake Horner	Date: 5/12/06	Signature: LD Walker — Date: 5/25/06

A-6003-642 (03/03)

BOREHOLE LOG

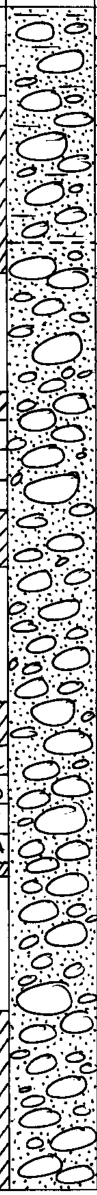
Page 2 of 3

Date: 5-12-06

Well ID: C5002 | Well Name: 399-3-20 | Location: 300-FF-5 OU

Project: FF-5 Monitoring Wells | Reference Measuring Point: Ground Surface

Depth (Ft.)	Sample Type No.	Core 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	water samples; slug testing	91C, 91D, 12, bag		47' – 80' : Sandy Gravel Poorly sorted with 70-80% fine pebbles to small cobbles, sub-rounded to well rounded (70% mafic), 15-20% v.f. to v.c. sub-angular sand (~70% mafic) & 5-10% silt. Max cobble is ~15-20 cm.	core #12: ~1' collected in a bag.
45		13, 92C, 92D, 92E		· 60' silt fraction decreases (80-85% G, 15% S & ≤5% M)	DTW = 47.7' bgs (5/12/06)
					Pumped w.s. with shoe @ 51' bgs & DTB @ 53.5' bgs PNNL #s: B1HT03, B1HT04 & B1HT05
50	w.s.	14, 93D, 93E			Core #15: No recovery 1st run, 1' rec. 2nd run in liner 95B (mixed 53'-63' bgs)
55		94A, 15			Pumped w.s. with shoe @ 60' bgs & DTB @ 63' bgs. PNNL #s: B1HT07, B1HT08 & B1HT09
60	w.s.	16			Slug Testing 5/15/06 screen intv. 59'-62.5' bgs screen intv. 55.5'-62.5' bgs
65		94C, 94D, 94E, 95A, 17			Core #17: No recovery 1st run, 2' recovery 2nd run 96B & 96C (mixed 68'-74')
70					Pumped w.s. with shoe @ ~~62.5'~~ 72.5' bgs & DTB @ 73' bgs. PNNL #s:
	w.s.	18			Core #18: No rec. 1st run 2' rec. 2nd run. 97B & 97C (mixed 73'-79.5')
75		19, 98C			



Reported By: Jake Horner | Reviewed By: L.D. Walker

Title: Geologist | Title: Geologist

Signature: Jake Horner | Date: 5/15/06 | Signature: L.D. Walker | Date: 5/25/06

A-6003-642 (03/03)

BOREHOLE LOG

Page 3 of 3

Date: 5/12/06

Well ID: C5002	Well Name: 399-3-20	Location: 300-FF-5 Operable Unit
Project: FF-5 Monitoring Wells		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		98C, 98D, 99B, 98E, 99C, 99D, 99E, 100A		80' – 82' : Silty Sandy Gravel Poorly sorted with 60-70% well-rounded to sub-rounded heterolithic pebbles & small cobbles, 15-25% v.f. to med. felsic sub-rounded sand (60- 70% felsic) & ~15% light olive brown (2.5Y, 5/3) silt. Max cobble is ~ 8-10 cm.	Slug testing 5/17/06 screen intv. 86' - 90.5' bgs screen intv. 83' - 90.5' bgs
85					
90	W.S.			82' – 85.5' : Slightly Silty Sand Well-sorted with 90% sub- rounded to sub-angular v.f. felsic sand (~70% felsic) with 10% light olive brown (2.5Y, 5/3) silt. Max grain is fine sand. Sand is tightly packed.	Pumped W.S. with shoe @ 90' bgs & DTB @ 92' bgs. PNNL #s: B1HT15, B1HT16 & B1HT17
95				85.5' – 95 : Sand Well-sorted medium sub-round- ed sand (~70% felsic) with ~5% dark bluish grey (Gley 2, 4/5B) M. Silt fraction decreases & grain size increases from ~~84~~ 85 LW 5-30-06 ~ 87' to 95' bgs.	
100					
105				TD = 95' bgs	
110					
115					

Reported By: Jake Horner		Reviewed By: L.D. Walker	
Title: Geologist		Title: Geologist	
Signature: Jake Horner	Date: 5/16/06	Signature: LD Walker	Date: 5/25/06

A-6003-642 (03/03)

Well Survey Data Report

Well C4999

WELL SURVEY DATA REPORT

Project:	**Prepared By:** S. Wray **Company:** FGG
Date Requested: 7/31/06	**Requestor:** Scott Worley (FGG)
Date of Survey: 8/03/06	**Surveyor:** S. Wray FGG Survey Dept.
ERC Point of Contact:	**Survey Co. Point of Contact:** L. A. Henke, P.L.S.
Description of Work: Civil Survey of Groundwater Monitoring Well #C4999 (399-3-18)	**Horizontal Datum:** NAD83(91) **Vertical Datum:** NAVD88 **Units:** METERS **Hanford Area Designation:** 300A
Coordinate System: Washington State Plane Coordinates (South Zone)	
Horizontal Control Monuments: N323 (USC&GS), 300-70 (FGG)	
Vertical Control Monuments: 300-28 (FGG), 300-60 (FGG)	

Well ID	Well Name	Easting	Northing	Elevation	
C4999	399-3-18	594464.71	116019.98		Center of Casing
				118.620	Top Pump Baseplate. N. Edge
				118.615	Top Casing, N. Edge
				117.680	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 August, 2006 under my direct supervision, and that the data contained here is true and correct.

LARRY A. HENKE
STATE OF WASHINGTON
Aug 9 2006
38975
REGISTERED
PROFESSIONAL LAND SURVEYOR
EXPIRES Sept. 23, 2007

Original to:
Distribution by DIS:

Well C5000

WELL SURVEY DATA REPORT

Project:

Prepared By: S. Wray
Company: FGG

Date Requested: 7/31/06

Requestor: Scott Worley (FGG)

Date of Survey: 8/03/06

Surveyor: S. Wray FGG Survey Dept.

ERC Point of Contact:

Survey Co. Point of Contact: L. A. Henke, P.L.S.

Description of Work:

Civil Survey of Groundwater Monitoring Well #C5000 (399-1-23)

Horizontal Datum: NAD83(91)

Vertical Datum: NAVD88

Units: METERS

Hanford Area Designation: 300A

Coordinate System: Washington State Plane Coordinates (South Zone)

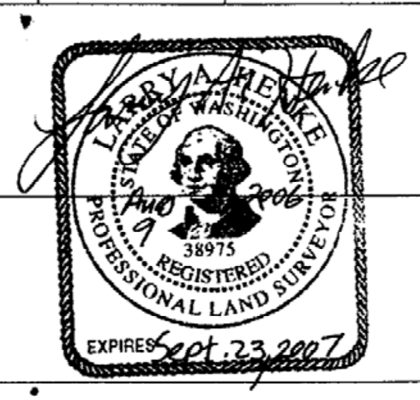
Horizontal Control Monuments: N323 (USC&GS), 300-70 (FGG)

Vertical Control Monuments: 300-28 (FGG), 300-60 (FGG)

Well ID	Well Name	Easting	Northing	Elevation	
C5000	399-1-23	594113.52	116453.04		Center of Casing
				116.312	Top Pump Baseplate. N. Edge
				116.307	Top Casing, N. Edge
				115.466	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 August, 2006 under my direct supervision, and that the data contained here is true and correct.

Original to:
Distribution by DIS:

Well C5001

WELL SURVEY DATA REPORT

Project:	**Prepared By:** S. Wray **Company:** FGG
Date Requested: 7/31/06	**Requestor:** Scott Worley (FGG)
Date of Survey: 8/03/06	**Surveyor:** S. Wray FGG Survey Dept.
ERC Point of Contact:	**Survey Co. Point of Contact:** L. A. Henke, P.L.S.
Description of Work: Civil Survey of Groundwater Monitoring Well #C5001 (399-3-19)	**Horizontal Datum:** NAD83(91) **Vertical Datum:** NAVD88 **Units:** METERS **Hanford Area Designation:** 300A

Coordinate System: Washington State Plane Coordinates (South Zone)

Horizontal Control Monuments: N323 (USC&GS), 300-70 (FGG)

Vertical Control Monuments: 300-17 (FGG), 300-16 (FGG)

Well ID	Well Name	Easting	Northing	Elevation	
C5001	399-3-19	594071.94	116030.22		Center of Casing
				121.452	Top Pump Baseplate. N. Edge
				121.447	Top Casing, N. Edge
				120.647	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 August, 2006 under my direct supervision, and that the data contained here is true and correct.

Larry A. Henke
LARRY A. HENKE
STATE OF WASHINGTON
Aug 9 2006
38975
REGISTERED
PROFESSIONAL LAND SURVEYOR
EXPIRES Sept. 23, 2007

Original to:
Distribution by DIS:

Well C5002

WELL SURVEY DATA REPORT

Project:	**Prepared By:** S. Wray **Company:** FGG
Date Requested: 7/31/06	**Requestor:** Scott Worley (FGG)
Date of Survey: 8/03/06	**Surveyor:** S. Wray FGG Survey Dept.
ERC Point of Contact:	**Survey Co. Point of Contact:** L. A. Henke, P.L.S.
Description of Work: Civil Survey of Groundwater Monitoring Well #C5002 (399-3-20)	**Horizontal Datum:** NAD83(91) **Vertical Datum:** NAVD88 **Units:** METERS **Hanford Area Designation:** 300A

Coordinate System: Washington State Plane Coordinates (South Zone)

Horizontal Control Monuments: N323 (USC&GS), 300-70 (FGG)

Vertical Control Monuments: 300-28 (FGG), 300-60 (FGG)

Well ID	Well Name	Easting	Northing	Elevation	
C5002	399-3-20	594375.42	115849.70		Center of Casing
				121.281	Top Pump Baseplate. N. Edge
				121.276	Top Casing, N. Edge
				120.448	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 August, 2006 under my direct supervision, and that the data contained here is true and correct.

LARRY A. HENKE
STATE OF WASHINGTON
Aug 14 2006
38975
REGISTERED PROFESSIONAL LAND SURVEYOR
EXPIRES Sept. 23, 2007

Original to:
Distribution by DIS:

Well Construction Summary Report

Well C4999

WELL CONSTRUCTION SUMMARY REPORT

Start Date: 3-9-06
Finish Date: 3-29-06
Page 1 of 2

Well ID: C4999	Well Name: 399-3-18
Approximate Location: ~~399-3-18~~ 300-FF-5 OU	
Project: 300-FF-5 Monitoring Wells	Other Companies: GRAM Inc./S.M. Stoller
Drilling Company: Cascade Drilling	Geologist(s): Jake Horner & Mike Carron
Driller: Rodney LaBrosse License #: 2182	

TEMPORARY CASING AND DRILL DEPTH

*Size/Grade/Lbs. Per Ft.	Interval	Shoe O.D./I.D.
7 5/8"/P110/47	0 - 130	10"/9"
rope Threads	-	
	-	
	-	
	-	

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

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

DRILLING METHOD	HOLE DIAMETER (in.) / INTERVAL (ft)
Auger:	Diameter 10" From 0 to 130
Cable Tool:	Diameter ~9" From 130 to 131
Air Rotary:	Diameter From to
A.R. w/Sonic: ✓	Diameter From to
	Diameter From to
	Diameter From to
	Diameter From to

Drilling Fluid: None

Total Drilled Depth: 131' bgs Hole Dia @ TD: ~9"

Total Amt. Of Water Added During Drilling: ~30-35 gal.

Well Straightness Test Results: Pass

Static Water Level: 39.5' bgs Date: 4/13/06

GEOPHYSICAL LOGGING

Sondes (type)	Interval	Date	Sondes (type)	Interval	Date
Spectral Gamma	0 - 131'	3/23/06		-	
	-		NA	-	
	-			-	

COMPLETED WELL

Size/Wt./Material	Depth	Thread	Slot Size	Type	Interval Annular Seal/Filter Pack	Volume	Mesh Size
6 5/8" O.D./ /SS	+2.18 - 32.86	Box		Cement Grout	0 - 10.1	70 gal.	
6 5/8" OD./ /SS	32.86 - 47.86	Box	20	Granular Bentonite	10.1 - 17.2	1.3 ft3	
6 5/8" OD./ /SS	47.86 - 49.89	Box		10-20 silica sand	22.0 - 52.0	11.5 ft3	10-20
	-			3/8" bent. Pellets	17.2 - 22.0	0.75 ft3	
	-			~~10~~ 3/8" bent. Pellets	52.0 - 57.4	2.3 ft3	

OTHER ACTIVITIES

Aquifer Test: See Field Date:
Description: Activity reports

Well Decommission: Yes: No: Date:
Description: NA

WELL SURVEY DATA (If applicable) Not yet surveyed at this time

Protective Casing Elevation:

Washington State Plane Coordinates: NA

Brass Survey Marker Elevation: -LW 5/30/06

COMMENTS / REMARKS

NA

Reported By: Jake Horner Title: Geologist Signature: Jake Horner Date: 4/12/06

A-6003-658 (04/03)

WELL CONSTRUCTION SUMMARY REPORT

Start Date: 3-9-06
Finish Date: 3-29-06
Page 2 of 2

Well ID: C4999	Well Name: 399-3-18
Project: FF-5 Monitoring Wells	
Drilling Company: Cascade Drilling	
Driller:	License #:

Approximate Location: 300-FF-5 OU
Other Companies: GRAM Inc
Geologist(s): Jake Horner & Mike Carron

TEMPORARY CASING AND DRILL DEPTH

*Size/Grade/Lbs. Per Ft.	Interval	Shoe O.D./I.D.
	0 -	
	-	
	-	
	-	
	-	

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

N/A

DRILLING METHOD	HOLE DIAMETER (in.) / INTERVAL (ft)
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 ___
	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
	-			silica sand	57.4 - 127.0	49 ft³	10-20
	-			3/8" coated bent. pellets	127.0 - 131.0	~~50~~ 0.5 ft³	
	N -				-		
	A -				-		
	-				-		

OTHER ACTIVITIES

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

N/A

WELL SURVEY DATA (if applicable)

Protective Casing Elevation:

Washington State Plane Coordinates: | Brass Survey Marker Elevation:

COMMENTS / REMARKS

This second page is to continue with well completion material and intervals.

Reported By:	Title:	Signature:	Date:
Jake Horner	Geologist	[signature]	4/18/06

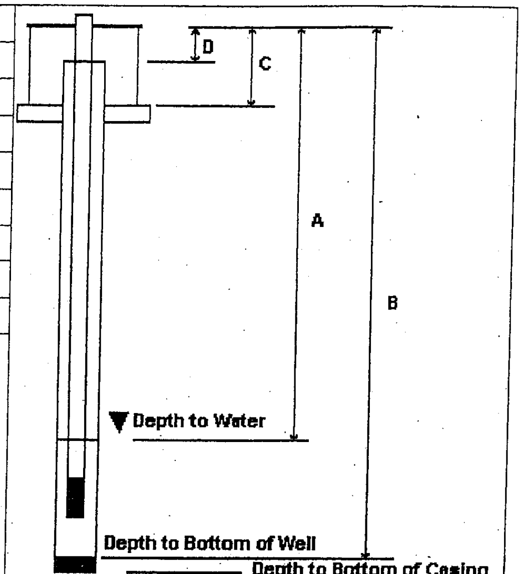
A-6003-658 (04/03)

WELL ATTRIBUTES REPORT

FIELD ORDER NO				LAST INSPECTION	
WELL ID	C4999	DRILL DATE	3-9-06	NORTHING	
WELL NAME	399-3-18	CONST DATE	3-29-06	EASTING	
HOST WELL ID		CONST DEPTH	49.89' bgs	ELEVATION	

MEASUREMENT INFORMATION

		LAST	CURRENT
A	DEPTH TO WATER(ft)	42.60'	41.20'
	DEPTH TO WATER DATE	4-13-06	5/24/06
B	DEPTH TO BOTTOM(ft)	53.10'	not measured
	DEPTH TO BOTTOM DATE	4-13-06	NA
C	STICK UP(ft)	3.08	3.08'
D	REFERENCE MARK(ft)		
	REFERENCE MARK IS TOC	☒ YES ☐ NO ☐ ND*	☒ YES ☐ NO



A DEPTH TO WATER FROM TOP OF CASING
B DEPTH TO BOTTOM OF WELL FROM TOP OF CASING
C TOP OF CASING TO GROUND SURFACE/PAD
D TOP OF CASING TO SURVEY REFERENCE MARKER

PERFORATION INFORMATION

CASING SIZE	TOP	BOTTOM	CUTS/FT/ROUND
	NA		

CHANGES

CASING INFORMATION

SIZE	TOP	BOTTOM	MATERIAL	TYPE	CONNECTION	THICKNESS
6" ID	2.18	32.86	SS	304L	F480	Sch. 10

CHANGES

SCREEN INFORMATION

SIZE	TOP	BOTTOM	MATERIAL	TYPE	SLOT SIZE
6" ID	32.86	47.86	SS	304L	0.020-in.

CHANGES

ND* - Not Documented

1/24/2003

WELL ATTRIBUTES REPORT

FIELD ORDER NO				LAST INSPECTION	
WELL ID	C4999	DRILL DATE	3-9-06	NORTHING	
WELL NAME	399-3-18	CONST DATE	3-29-06	EASTING	
HOST WELL ID		CONST DEPTH	49.89' bgs	ELEVATION	

LAST INSPECTION INFORMATION		CURRENT INSPECTION INFORMATION	
WELL PAD	☐ YES ☐ NO ☐ ND*	WELL PAD	☒ YES ☐ NO
BRASS SURVEY MARKER	☐ YES ☐ NO ☐ ND*	BRASS SURVEY MARKER	☒ YES ☐ NO
MARKER STAMPED WITH SURVEY DATA	☐ YES ☐ NO ☐ ND*	MARKER STAMPED WITH SURVEY DATA	☐ YES ☒ NO
MARKER STAMPED WITH WELL ID DATA	☐ YES ☐ NO ☐ ND*	MARKER STAMPED WITH WELL ID DATA	☒ YES ☐ NO
WELL LABELED WITH WELL ID	☐ YES ☐ NO ☐ ND*	WELL LABELED WITH WELL ID	☐ YES ☒ NO
WELL LABELED WITH WELL NAME	☐ YES ☐ NO ☐ ND*	WELL LABELED WITH WELL NAME	☐ YES ☒ NO
PROTECTIVE POSTS	☐ YES ☐ NO ☐ ND*	PROTECTIVE POSTS	☒ YES ☐ NO
REMOVABLE POST IN PLACE	☐ YES ☐ NO ☐ ND*	REMOVABLE POST IN PLACE	☒ YES ☐ NO
WELL LOCK	☐ YES ☐ NO ☐ ND*	WELL LOCK	☒ YES ☐ NO
WELL DAMAGED	☐ YES ☐ NO ☐ ND*	WELL DAMAGED	☐ YES ☒ NO
WELL IS DRY	☐ YES ☐ NO ☐ ND*	WELL IS DRY	☐ YES ☒ NO
PARTED CASING	☐ YES ☐ NO ☐ ND*	PARTED CASING	☐ YES ☒ NO
BENTONITE IN WELL	☐ YES ☐ NO ☐ ND*	BENTONITE IN WELL	☐ YES ☒ NO
WELL SANDED IN	☐ YES ☐ NO ☐ ND*	WELL SANDED IN	☐ YES ☒ NO
COLLAPSED CASING	☐ YES ☐ NO ☐ ND*	COLLAPSED CASING	☐ YES ☒ NO
EQUIPMENT IN WELL	☐ YES ☐ NO ☐ ND*	EQUIPMENT IN WELL	☐ YES ☒ NO
DEBRIS IN WELL	☐ YES ☐ NO ☐ ND*	DEBRIS IN WELL	☐ YES ☒ NO

N/A

LAST PUMP INFORMATION		CURRENT PUMP INFORMATION	
PUMP ACTIVITY PERFORMED	☐ INSTALLED ☐ REPLACED ☐ REMOVED ☐ ND*	PUMP ACTIVITY PERFORMED	☒ INSTALLED ☐ REPLACED ☐ REMOVED
PUMP TESTED	☐ YES ☐ NO ☐ ND*	PUMP TESTED	☒ YES ☐ NO
NEW PUMP	☐ YES ☐ NO ☐ ND*	NEW PUMP	☒ YES ☐ NO
ACTIVITY PEFORMED BY		ACTIVITY PEFORMED BY	Cascade Drilling
DATE ACTIVITY PERFORMED		DATE ACTIVITY PERFORMED	5/23/06
PUMP TYPE	N/A	PUMP TYPE	electric sub.
PUMP MAKE		PUMP MAKE	Grundfos
PUMP MODEL		PUMP MODEL	5 S05-13 (0.5 Hp)
PUMP INTAKE DEPTH (ft)		PUMP INTAKE DEPTH (ft)	46.61' (TOC)
TUBING SIZE (In)		TUBING SIZE (In)	3/4"
TUBING MATERIAL		TUBING MATERIAL	304L SS
TUBING LENGTH (ft)		TUBING LENGTH (ft)	
TUBING CONNECTION		TUBING CONNECTION	

ND* - Not Documented

1/24/2003

Well C5000

WELL CONSTRUCTION SUMMARY REPORT

Start Date: 3-30-06
Finish Date: 4-21-06
Page 1 of 2

Well ID: C5000	Well Name: 399-1-23
Approximate Location: 300-FF-5 OU	
Project: FF-5 Monitoring Wells	Other Companies: GRAM
Drilling Company: Cascade Drilling	Geologist(s): Jake Horner
Driller: Rodney LaBosse	License #: 2182

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 10" From 0 to 115
9 5/8" / P110 / 47	0 - 115	10" / 9"	Cable Tool:		Diameter ~9" From 115 to 116
	-		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: None

Total Drilled Depth: 116'	Hole Dia @ TD: ~9"	Total Amt. Of Water Added During Drilling: 40-50 gallons
Well Straightness Test Results: ND		Static Water Level: ~~33~~ 30.3' (JP 5/24/06) Date: 5-1-06

GEOPHYSICAL LOGGING

Sondes (type)	Interval	Date	Sondes (type)	Interval	Date
Spectral Gamma	0 - 116	4/12/06		-	
	-			NA -	
	-			-	

COMPLETED WELL

Size/Wt./Material	Depth	Thread	Slot Size	Type	Interval Annular Seal/Filter Pack	Volume	Mesh Size
6 5/8" O.D. SCH 10S SS	1.65ags - 24.94'		N/A	Cement Grout	0 - 10.8	170 gallons	
6 5/8" O.D. SCH 10S SS	24.94' - 49.95'		20	Bentonite crumbles	10.8 - 14.4	35 ft³	
6 5/8" O.D. SCH 10S SS	49.95' - 51.98		N/A	3/8" bent. pellets	14.4 - 20.0	1.0 ft³	
	-			~~6-9~~ 10-20 silica sand	20.0 - 54.4	15.4 ft³	~~6-9~~ 10-20 JP 5/24
	-			3/8" bent. pellets cont.	54.4 - 59.2	1.9 ft³	

OTHER ACTIVITIES

Aquifer Test: See Field Activity	Date:	Well Decommission:	Yes: No:	Date:
Description: Report Forms		Description: NA		

WELL SURVEY DATA (if applicable)

Survey information not yet available -LW 5-30-06

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

COMMENTS / REMARKS

NA

Reported By:	Title:	Signature:	Date:
Jake Horner	Geologist	Jake Horner	5/24/06

A-6003-658 (04/03)

WELL CONSTRUCTION SUMMARY REPORT

Start Date: 3-30-06
Finish Date: 4-21-06
Page 2 of 2

Well ID: C5000	Well Name: 399-1-23
Project: FF-5 Monitoring Wells	
Drilling Company: Cascade Drilling	
Driller: Rodney LaBorse	License #: 2182

Approximate Location: 300-FF-5 OU
Other Companies: GRAM
Geologist(s): Jake Horner

TEMPORARY CASING AND DRILL DEPTH

*Size/Grade/Lbs. Per Ft.	Interval	Shoe O.D./I.D.
	-	
	-	
	-	
	-	
	-	

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

NA

DRILLING METHOD	HOLE DIAMETER (in.) / INTERVAL (ft)
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 ______
	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
	-			10-20 silica sand	59.2 - 107	24 ft³	
	-			Nat. Backfill	107 - 110	—	
	NA -			10-20 silica sand	110 - 112	1.0 ft³	
	-			3/8" coat. bent. pellets	112 - 115	0.4 ft³	
	-			natural Backfill	115 - 116	—	

OTHER ACTIVITIES

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

WELL SURVEY DATA (if applicable)

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

COMMENTS / REMARKS

This second page is to continue with well completion material and intervals.

Reported By:	Title:	Signature:	Date:
Jake Horner	Geologist	Jake Horner	5/24/06

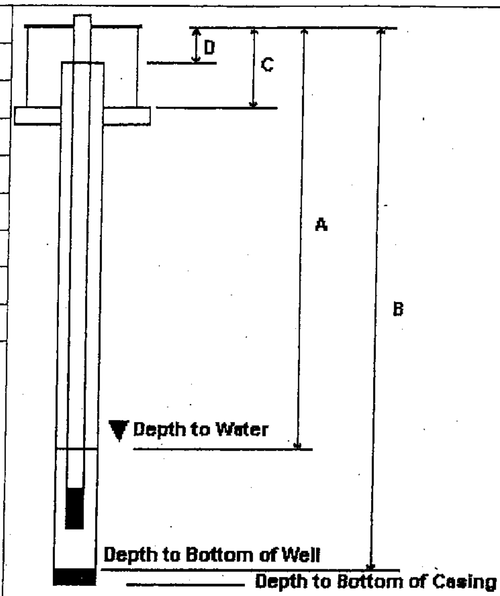
A-6003-658 (04/03)

WELL ATTRIBUTES REPORT

FIELD ORDER NO				LAST INSPECTION	
WELL ID	C5000	DRILL DATE	3-30-06	NORTHING	
WELL NAME	399-1-23	CONST DATE	4-21-06	EASTING	
HOST WELL ID		CONST DEPTH	51.98' bgs	ELEVATION	

MEASUREMENT INFORMATION

		LAST	CURRENT
A	DEPTH TO WATER(ft)	33.0'	33.34'
	DEPTH TO WATER DATE	5/1/06	5/24/06
B	DEPTH TO BOTTOM(ft)	53.8'	not meas.
	DEPTH TO BOTTOM DATE	5/1/06	NA
C	STICK UP(ft)	2.73	2.73'
D	REFERENCE MARK(ft)		
	REFERENCE MARK IS TOC	☒ YES ☐ NO ☐ ND*	☒ YES ☐ NO



A DEPTH TO WATER FROM TOP OF CASING
B DEPTH TO BOTTOM OF WELL FROM TOP OF CASING
C TOP OF CASING TO GROUND SURFACE/PAD
D TOP OF CASING TO SURVEY REFERENCE MARKER

PERFORATION INFORMATION

CASING SIZE	TOP	BOTTOM	CUTS/FT/ROUND
	/	N/A	/

CHANGES

CASING INFORMATION

SIZE	TOP	BOTTOM	MATERIAL	TYPE	CONNECTION	THICKNESS
6" ID	1.65'	24.95'	SS	304L	F480	Sch. 10

CHANGES

SCREEN INFORMATION

SIZE	TOP	BOTTOM	MATERIAL	TYPE	SLOT SIZE
6" ID	24.95	49.95	SS	304L, wire wrap	0.020-in.

CHANGES

ND* - Not Documented

1/24/2003

WELL ATTRIBUTES REPORT

FIELD ORDER NO				LAST INSPECTION	
WELL ID	C5000	DRILL DATE	3-30-06	NORTHING	
WELL NAME	399-1-23	CONST DATE	4-21-06	EASTING	
HOST WELL ID		CONST DEPTH	51.98' bgs	ELEVATION	

LAST INSPECTION INFORMATION		CURRENT INSPECTION INFORMATION	
WELL PAD	☐ YES ☐ NO ☐ ND*	WELL PAD	☒ YES ☐ NO
BRASS SURVEY MARKER	☐ YES ☐ NO ☐ ND*	BRASS SURVEY MARKER	☒ YES ☐ NO
MARKER STAMPED WITH SURVEY DATA	☐ YES ☐ NO ☐ ND*	MARKER STAMPED WITH SURVEY DATA	☐ YES ☒ NO
MARKER STAMPED WITH WELL ID DATA	☐ YES ☐ NO ☐ ND*	MARKER STAMPED WITH WELL ID DATA	☒ YES ☐ NO
WELL LABELED WITH WELL ID	☐ YES ☐ NO ☐ ND*	WELL LABELED WITH WELL ID	☐ YES ☒ NO
WELL LABELED WITH WELL NAME	☐ YES ☐ NO ☐ ND*	WELL LABELED WITH WELL NAME	☐ YES ☒ NO
PROTECTIVE POSTS	☐ YES ☐ NO ☐ ND*	PROTECTIVE POSTS	☒ YES ☐ NO
REMOVABLE POST IN PLACE	☐ YES ☐ NO ☐ ND*	REMOVABLE POST IN PLACE	☒ YES ☐ NO
WELL LOCK	☐ YES ☐ NO ☐ ND*	WELL LOCK	☒ YES ☐ NO
WELL DAMAGED N/A	☐ YES ☐ NO ☐ ND*	WELL DAMAGED	☐ YES ☒ NO
WELL IS DRY	☐ YES ☐ NO ☐ ND*	WELL IS DRY	☐ YES ☒ NO
PARTED CASING	☐ YES ☐ NO ☐ ND*	PARTED CASING	☐ YES ☒ NO
BENTONITE IN WELL	☐ YES ☐ NO ☐ ND*	BENTONITE IN WELL	☐ YES ☒ NO
WELL SANDED IN	☐ YES ☐ NO ☐ ND*	WELL SANDED IN	☐ YES ☒ NO
COLLAPSED CASING	☐ YES ☐ NO ☐ ND*	COLLAPSED CASING	☐ YES ☒ NO
EQUIPMENT IN WELL	☐ YES ☐ NO ☐ ND*	EQUIPMENT IN WELL	☐ YES ☒ NO
DEBRIS IN WELL	☐ YES ☐ NO ☐ ND*	DEBRIS IN WELL	☐ YES ☒ NO
LAST PUMP INFORMATION		**CURRENT PUMP INFORMATION**	
PUMP ACTIVITY PERFORMED	☐ INSTALLED ☐ REPLACED ☐ REMOVED ☐ ND*	PUMP ACTIVITY PERFORMED	☒ INSTALLED ☐ REPLACED ☐ REMOVED
PUMP TESTED	☐ YES ☐ NO ☐ ND*	PUMP TESTED	☒ YES ☐ NO
NEW PUMP	☐ YES ☐ NO ☐ ND*	NEW PUMP	☒ YES ☐ NO
ACTIVITY PEFORMED BY		ACTIVITY PEFORMED BY	Cascade Drilling
DATE ACTIVITY PERFORMED		DATE ACTIVITY PERFORMED	5/23/06
PUMP TYPE	N/A	PUMP TYPE	electric sub
PUMP MAKE		PUMP MAKE	GrundFos
PUMP MODEL		PUMP MODEL	5505-13 (0.5HP)
PUMP INTAKE DEPTH (ft)		PUMP INTAKE DEPTH (ft)	46.6' (TOC)
TUBING SIZE (In)		TUBING SIZE (In)	3/4"
TUBING MATERIAL		TUBING MATERIAL	SS 304L
TUBING LENGTH (ft)		TUBING LENGTH (ft)	
TUBING CONNECTION		TUBING CONNECTION	

ND* - Not Documented

1/24/2003

Well C5001

WELL CONSTRUCTION SUMMARY REPORT

Start Date: 4-24-06
Finish Date: 5-10-06
Page 1 of 2

Well ID: C5001	Well Name: 399-3-19	Approximate Location: 300-FF-5 OU
Project: FF-5 Monitoring Wells		Other Companies: GRAM/S.M. Stoller
Drilling Company: Cascade Drilling		Geologist(s): Jake Horner & Jess Hocking
Driler: Rodney La Bosse	License #: 2182	

TEMPORARY CASING AND DRILL DEPTH

*Size/Grade/Lbs. Per Ft.	Interval	Shoe O.D./I.D.
9 5/8"/P110/47	0 - 102.5	10"/9"
rope threads	-	
	-	
	-	
	-	

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

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

Drilling Method	Hole Diameter (in.) / Interval (ft)
Auger:	Diameter 10" From 0 to 102.5
Cable Tool:	Diameter ~9" From 102.5 to 103.5
Air Rotary:	Diameter ___ From ___ to ___
A.R. w/Sonic: ✓	Diameter ___ From ___ to ___
	Diameter ___ From ___ to ___
	Diameter ___ From ___ to ___
	Diameter ___ From ___ to ___

Drilling Fluid: None

Total Drilled Depth: 103.5	Hole Dia @ TD: ~9"	Total Amt. Of Water Added During Drilling: 40-50 gallons
Well Straightness Test Results: Pass		Static Water Level: 47.7' bgs Date: 5/22/06

GEOPHYSICAL LOGGING

Sondes (type)	Interval	Date	Sondes (type)	Interval	Date
Spectral Gamma	0' - ~~103'~~ 89'	4-29-06	NA	-	
	-			-	
	- LW 5-30-06			-	

COMPLETED WELL

Size/Wt./Material	Depth	Thread	Slot Size	Type	Interval Annular Seal/Filter Pack	Volume	Mesh Size
6 5/8" OD SCH 10S SS riser	1.69 ags - 40.29 bgs	Box	—	Cement Grout	0 - 10.5	200 gal.	—
6 5/8" OD. SCH 10S SS screen	40.29 - 65.42	Box	20	Bentonite Crumbles	10.5 - 23.9	30 ft³	—
6 5/8" OD. SCH 10S SS sump	65.42 - 67.45	Box	—	3/8" bent. pellets	23.9 - 29.9	1.9 ft³	—
	-			6-9 silica sand	29.9 - 71.9	180 ft³	6-9
	-			3/8" coated bent. pellets	71.9 - 78.8	28 ft³	—

OTHER ACTIVITIES

Aquifer Test: See Field Activity	Date:	Well Decommission:	Yes:	No:	Date:
Description: Reports		Description: NA			

WELL SURVEY DATA (If applicable) Not yet available

Washington State Plane Coordinates: NA	Protective Casing Elevation: - LW
	Brass Survey Marker Elevation: 5-30-06

COMMENTS / REMARKS

NA

Reported By:	Title:	Signature:	Date:
Jake Horner	Geologist	[signature]	5/24/06

A-6003-658 (04/03)

WELL CONSTRUCTION SUMMARY REPORT

Start Date: 4-24-06
Finish Date: 5-10-06
Page 2 of 2

Well ID: C5001	Well Name: 399-3-19	Approximate Location: 300-FF-5 OU
Project: FF-5 Monitoring Wells		Other Companies: GRAM ~~[illegible]~~ 5-10-06 S.M. Stoller
Drilling Company: Cascade Drilling		Geologist(s): Jake Horner & Jess Hocking
Driller: Rodney LaBrasse	License #: 2182	

TEMPORARY CASING AND DRILL DEPTH

*Size/Grade/Lbs. Per Ft.	Interval	Shoe O.D./I.D.
	-	
	-	
	-	
	-	
	-	

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

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

Drilling Method	
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 ___
	Diameter ___ From ___ to ___

N/A

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
	-			10-20 silica sand	78.8 - 82.9	40 ft³	10-20
	N -			3/8" coat. bent. pellets	82.9 - 88.0	3.15 ft³	—
	A -			10-20 Silica Sand	88.0 - 102.5	8.5 ft³	10-20
	-			Natural Back fill	102.5 - 103.5	—	—
	-				-		

OTHER ACTIVITIES

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

N/A

WELL SURVEY DATA (if applicable)

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

COMMENTS / REMARKS

Second page used to show all well construction material and intervals.

Reported By:	Title:	Signature:	Date:
Jake Horner	Geologist	[signature]	5/24/06

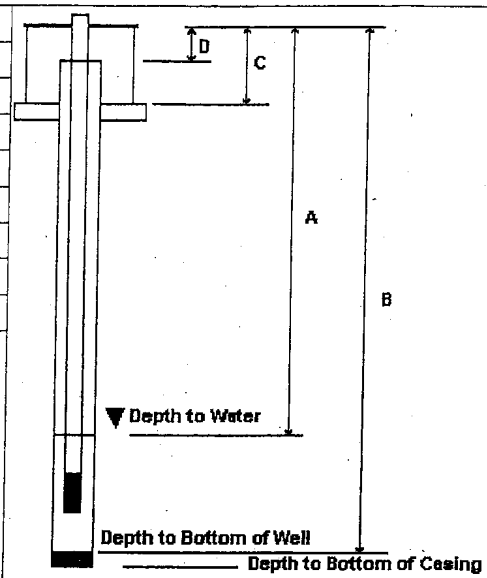
A-6003-658 (04/03)

WELL ATTRIBUTES REPORT

FIELD ORDER NO				LAST INSPECTION	
WELL ID	C5601	DRILL DATE	4-24-06	NORTHING	
WELL NAME	399-3-19	CONST DATE	5-10-06	EASTING	
HOST WELL ID		CONST DEPTH	67.45' bgs	ELEVATION	

MEASUREMENT INFORMATION

		LAST	CURRENT
A	DEPTH TO WATER(ft)	50.36'	50.33
	DEPTH TO WATER DATE	5/22/06	5/24/06
B	DEPTH TO BOTTOM(ft)	70.0'	not meas.
	DEPTH TO BOTTOM DATE	5/22/06	NA
C	STICK UP(ft)	2.60'	2.60'
D	REFERENCE MARK(ft)		
	REFERENCE MARK IS TOC	☒ YES ☐ NO ☐ ND*	☒ YES ☐ NO



A DEPTH TO WATER FROM TOP OF CASING
B DEPTH TO BOTTOM OF WELL FROM TOP OF CASING
C TOP OF CASING TO GROUND SURFACE/PAD
D TOP OF CASING TO SURVEY REFERENCE MARKER

PERFORATION INFORMATION

CASING SIZE	TOP	BOTTOM	CUTS/FT/ROUND
	N/A		

CHANGES

CASING INFORMATION

SIZE	TOP	BOTTOM	MATERIAL	TYPE	CONNECTION	THICKNESS
6" ID	1.69'	40.29'	SS	304L	F480	Sch. 10

CHANGES

SCREEN INFORMATION

SIZE	TOP	BOTTOM	MATERIAL	TYPE	SLOT SIZE
6" ID	40.29	65.42	SS	304L / wire wrap	0.020-in

CHANGES

ND* - Not Documented

1/24/2003

WELL ATTRIBUTES REPORT

FIELD ORDER NO				LAST INSPECTION	
WELL ID	C5001	DRILL DATE	4-24-06	NORTHING	
WELL NAME	399-3-19	CONST DATE	5-10-06	EASTING	
HOST WELL ID		CONST DEPTH	67.45' bgs	ELEVATION	

LAST INSPECTION INFORMATION		CURRENT INSPECTION INFORMATION	
WELL PAD	☐ YES ☐ NO ☐ ND*	WELL PAD	☒ YES ☐ NO
BRASS SURVEY MARKER	☐ YES ☐ NO ☐ ND*	BRASS SURVEY MARKER	☒ YES ☐ NO
MARKER STAMPED WITH SURVEY DATA	☐ YES ☐ NO ☐ ND*	MARKER STAMPED WITH SURVEY DATA	☐ YES ☒ NO
MARKER STAMPED WITH WELL ID DATA	☐ YES ☐ NO ☐ ND*	MARKER STAMPED WITH WELL ID DATA	☒ YES ☐ NO
WELL LABELED WITH WELL ID	☐ YES ☐ NO ☐ ND*	WELL LABELED WITH WELL ID	☐ YES ☒ NO
WELL LABELED WITH WELL NAME	☐ YES ☐ NO ☐ ND*	WELL LABELED WITH WELL NAME	☐ YES ☒ NO
PROTECTIVE POSTS	☐ YES ☐ NO ☐ ND*	PROTECTIVE POSTS	☒ YES ☐ NO
REMOVABLE POST IN PLACE	☐ YES ☐ NO ☐ ND*	REMOVABLE POST IN PLACE	☒ YES ☐ NO
WELL LOCK N	☐ YES ☐ NO ☐ ND*	WELL LOCK	☒ YES ☐ NO
WELL DAMAGED A	☐ YES ☐ NO ☐ ND*	WELL DAMAGED	☐ YES ☒ NO
WELL IS DRY	☐ YES ☐ NO ☐ ND*	WELL IS DRY	☐ YES ☒ NO
PARTED CASING	☐ YES ☐ NO ☐ ND*	PARTED CASING	☐ YES ☒ NO
BENTONITE IN WELL	☐ YES ☐ NO ☐ ND*	BENTONITE IN WELL	☐ YES ☒ NO
WELL SANDED IN	☐ YES ☐ NO ☐ ND*	WELL SANDED IN	☐ YES ☒ NO
COLLAPSED CASING	☐ YES ☐ NO ☐ ND*	COLLAPSED CASING	☐ YES ☒ NO
EQUIPMENT IN WELL	☐ YES ☐ NO ☐ ND*	EQUIPMENT IN WELL	☐ YES ☒ NO
DEBRIS IN WELL	☐ YES ☐ NO ☐ ND*	DEBRIS IN WELL	☐ YES ☒ NO
LAST PUMP INFORMATION		**CURRENT PUMP INFORMATION**	
PUMP ACTIVITY PERFORMED	☐ INSTALLED ☐ REPLACED ☐ REMOVED ☐ ND*	PUMP ACTIVITY PERFORMED	☒ INSTALLED ☐ REPLACED ☐ REMOVED
PUMP TESTED	☐ YES ☐ NO ☐ ND*	PUMP TESTED	☒ YES ☐ NO
NEW PUMP	☐ YES ☐ NO ☐ ND*	NEW PUMP	☒ YES ☐ NO
ACTIVITY PEFORMED BY		ACTIVITY PEFORMED BY	Cascade Drilling
DATE ACTIVITY PERFORMED		DATE ACTIVITY PERFORMED	5/23/06
PUMP TYPE N		PUMP TYPE	electric sub.
PUMP MAKE	A	PUMP MAKE	GrundFos
PUMP MODEL		PUMP MODEL	5S05-13 (0.5 Hp)
PUMP INTAKE DEPTH (ft)		PUMP INTAKE DEPTH (ft)	61.70 (TOC)
TUBING SIZE (In)		TUBING SIZE (In)	3/4"
TUBING MATERIAL		TUBING MATERIAL	SS 304L
TUBING LENGTH (ft)		TUBING LENGTH (ft)	
TUBING CONNECTION		TUBING CONNECTION	

ND* - Not Documented

1/24/2003

Well C5002

WELL CONSTRUCTION SUMMARY REPORT

Start Date: 3-9-06
Finish Date: 3-29-06
Page 1 of 2

Well ID: C5002	Well Name: 399-3-20
Approximate Location: 300-FF-5 OU	
Project: FF-5 Monitoring Wells	Other Companies: GRAM / SM Stoller
Drilling Company: Cascade Drilling	Geologist(s): Jake Horner & Jess Hocking
Driller: Rodney LaBrosse	License#: 2182

TEMPORARY CASING AND DRILL DEPTH

*Size/Grade/Lbs. Per Ft.	Interval	Shoe O.D./I.D.
9 5/8" / P110 / 47	0 - 94.0	10" / 9"
rope threads	-	
	-	
	-	
	-	

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

DRILLING METHOD	HOLE DIAMETER (in.) / INTERVAL (ft)
Auger:	Diameter 10" From 0 to 94.0
Cable Tool:	Diameter ~9" From 94.0 to 95.0
Air Rotary:	Diameter From to
A.R. w/Sonic: ✓	Diameter From to
	Diameter From to
	Diameter From to
	Diameter From to

Drilling Fluid: None

Total Drilled Depth: 95.0' bgs	Hole Dia @ TD: ~9"
Total Amt. Of Water Added During Drilling: 40-50 gallons	
Well Straightness Test Results: Pass	
Static Water Level: 46.4' bgs	Date: 5/22/06

GEOPHYSICAL LOGGING

Sondes (type)	Interval	Date	Sondes (type)	Interval	Date
Spectral Gamma	0 - 95	5/16/06		-	
	-			NA -	
	-			-	

COMPLETED WELL

Size/Wt./Material	Depth	Thread	Slot Size	Type	Interval Annular Seal/Filter Pack	Volume	Mesh Size
6 5/8" SCH 10S SS riser	1.74' ags - 40.24' bgs	Box	—	Cement Grout	0 - 10.2	130 gal.	—
6 5/8" O.D. SCH 10S SS screen	40.24 - 65.26	Box	20	Granular Bentonite	10.2 - 25.5	2.5 ft³	—
6 5/8" OD SCH 10S SS sump	65.26 - 67.28	Box	—	3/8" Bentonite pellets	25.5 - 29.9	1.9 ft³	—
	-			6-9 silica sand	29.9 - 72.1	17 ft³	6-9
	-			3/8" coat. bent. pellets	72.1 - 77.4	2.1 ft³	—

OTHER ACTIVITIES

Aquifer Test: See Field Activity Date:	Well Decommission: Yes: No: Date:
Description: Reports	Description: NA

WELL SURVEY DATA (if applicable) Not available at this time - LW 5-30-06

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

COMMENTS / REMARKS

NA

Reported By:	Title:	Signature:	Date:
Jake Horner	Geologist	Jake Horner	5/24/06

A-6003-658 (04/03)

WELL CONSTRUCTION SUMMARY REPORT

Start Date: 3-9-06
Finish Date: 3-29-06
Page 2 of 2

Well ID: C5002	Well Name: 399-3-20
Approximate Location: 300-FF-5 OU	
Project: FF-5 Monitoring Wells	Other Companies: GRAM / SM Stoller
Drilling Company: Cascade Drilling	Geologist(s): Jake Horner & Jess Hocking
Driler: Rodney LaBrosse	License #: 2182

TEMPORARY CASING AND DRILL DEPTH

*Size/Grade/Lbs. Per Ft.	Interval	Shoe O.D./I.D.
	-	
	-	
	-	
	-	
	-	

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

N/A

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

N/A

COMPLETED WELL

Size/Wt./Material	Depth	Thread	Slot Size	Type	Interval Annular Seal/Filter Pack	Volume	Mesh Size
	-			6-9 silica sand	77.4 - 81.9	3.5 ft^3	6-9
	N/A -			3/8" coat. bent. pellets	81.9 - 88.2	3.15 ft^3	—
	-			Natural Backfill	88.2 - 95.0	—	—
	-				-		
	-				-		

OTHER ACTIVITIES

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

N/A

WELL SURVEY DATA (if applicable)

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

COMMENTS / REMARKS

This second page is to show all well construction material and intervals.

Reported By:	Title:	Signature:	Date:
Jake Horner	Geologist	Jake Horner	5/24/06

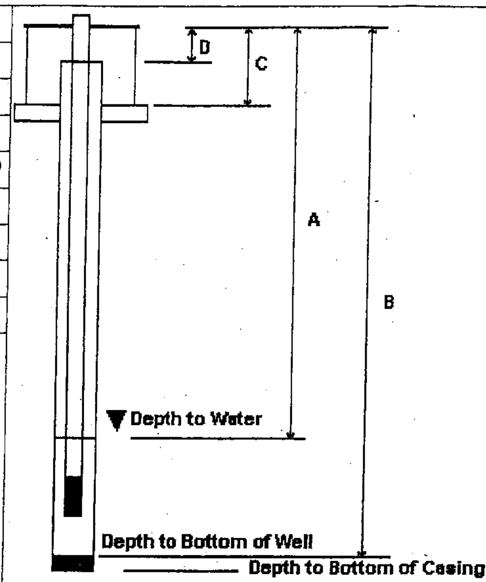
A-6003-658 (04/03)

WELL ATTRIBUTES REPORT

FIELD ORDER NO				LAST INSPECTION	
WELL ID	C5002	DRILL DATE	3-9-06	NORTHING	
WELL NAME	399-3-20	CONST DATE	3-29-06	EASTING	
HOST WELL ID		CONST DEPTH	67.28' bgs	ELEVATION	

MEASUREMENT INFORMATION

		LAST	CURRENT
A	DEPTH TO WATER(ft)	49.05'	49.95'
	DEPTH TO WATER DATE	5-22-06	5-24-06
B	DEPTH TO BOTTOM(ft)	70.0'	not measured
	DEPTH TO BOTTOM DATE	5-22-06	NA
C	STICK UP(ft)	2.72'	2.72'
D	REFERENCE MARK(ft)		
	REFERENCE MARK IS TOC	☒ YES ☐ NO ☐ ND*	☒ YES ☐ NO



A DEPTH TO WATER FROM TOP OF CASING
B DEPTH TO BOTTOM OF WELL FROM TOP OF CASING
C TOP OF CASING TO GROUND SURFACE/PAD
D TOP OF CASING TO SURVEY REFERENCE MARKER

PERFORATION INFORMATION

CASING SIZE	TOP	BOTTOM	CUTS/FT/ROUND
	/	NA	/

CHANGES

CASING INFORMATION

SIZE	TOP (bgs)	BOTTOM (bgs)	MATERIAL	TYPE	CONNECTION	THICKNESS
6" ID	1.74	40.24	SS	304L	F480	Sch. 10

CHANGES

SCREEN INFORMATION

SIZE	TOP (bgs)	BOTTOM (bgs)	MATERIAL	TYPE	SLOT SIZE
6" ID	40.24	65.26	SS	304L / wire wrap	0.020-in

CHANGES

ND* - Not Documented

1/24/2003

WELL ATTRIBUTES REPORT

FIELD ORDER NO				LAST INSPECTION	
WELL ID	C5002	DRILL DATE	3-9-06	NORTHING	
WELL NAME	399-3-20	CONST DATE	3-29-06	EASTING	
HOST WELL ID		CONST DEPTH	67.28' bgs	ELEVATION	

LAST INSPECTION INFORMATION		CURRENT INSPECTION INFORMATION	
WELL PAD	☐ YES ☐ NO ☐ ND*	WELL PAD	☒ YES ☐ NO
BRASS SURVEY MARKER	☐ YES ☐ NO ☒ ND*	BRASS SURVEY MARKER	☒ YES ☐ NO
MARKER STAMPED WITH SURVEY DATA	☐ YES ☐ NO ☐ ND*	MARKER STAMPED WITH SURVEY DATA	☐ YES ☒ NO
MARKER STAMPED WITH WELL ID DATA	☐ YES ☐ NO ☐ ND*	MARKER STAMPED WITH WELL ID DATA	☒ YES ☐ NO
WELL LABELED WITH WELL ID	☐ YES ☐ NO ☐ ND*	WELL LABELED WITH WELL ID	☐ YES ☒ NO
WELL LABELED WITH WELL NAME	☐ YES ☐ NO ☐ ND*	WELL LABELED WITH WELL NAME	☐ YES ☒ NO
PROTECTIVE POSTS	☐ YES ☐ NO ☐ ND*	PROTECTIVE POSTS	☒ YES ☐ NO
REMOVABLE POST IN PLACE	☐ YES ☐ NO ☐ ND*	REMOVABLE POST IN PLACE	☒ YES ☐ NO
WELL LOCK	☐ YES ☐ NO ☐ ND*	WELL LOCK	☒ YES ☐ NO
WELL DAMAGED	☐ YES ☐ NO ☐ ND*	WELL DAMAGED	☐ YES ☒ NO
WELL IS DRY	☐ YES ☐ NO ☐ ND*	WELL IS DRY	☐ YES ☒ NO
PARTED CASING	☐ YES ☐ NO ☐ ND*	PARTED CASING	☐ YES ☒ NO
BENTONITE IN WELL	☐ YES ☐ NO ☐ ND*	BENTONITE IN WELL	☐ YES ☒ NO
WELL SANDED IN	☐ YES ☐ NO ☐ ND*	WELL SANDED IN	☐ YES ☒ NO
COLLAPSED CASING	☐ YES ☐ NO ☐ ND*	COLLAPSED CASING	☐ YES ☒ NO
EQUIPMENT IN WELL	☐ YES ☐ NO ☐ ND*	EQUIPMENT IN WELL	☐ YES ☒ NO
DEBRIS IN WELL	☐ YES ☐ NO ☐ ND*	DEBRIS IN WELL	☐ YES ☒ NO
LAST PUMP INFORMATION		**CURRENT PUMP INFORMATION**	
PUMP ACTIVITY PERFORMED	☐ INSTALLED ☐ REPLACED ☐ ND* ☐ REMOVED	PUMP ACTIVITY PERFORMED	☒ INSTALLED ☐ REPLACED ☐ REMOVED
PUMP TESTED	☐ YES ☐ NO ☐ ND*	PUMP TESTED	☒ YES ☐ NO
NEW PUMP	☐ YES ☒ NO ☐ ND*	NEW PUMP	☒ YES ☐ NO
ACTIVITY PEFORMED BY		ACTIVITY PEFORMED BY	Cascade Drilling
DATE ACTIVITY PERFORMED		DATE ACTIVITY PERFORMED	5/23/06
PUMP TYPE	N	PUMP TYPE	electric sub.
PUMP MAKE	A	PUMP MAKE	Grundfos
PUMP MODEL		PUMP MODEL	5S05-13 (0.5Hp)
PUMP INTAKE DEPTH (ft)		PUMP INTAKE DEPTH (ft)	61.66' (TOC)
TUBING SIZE (In)		TUBING SIZE (In)	3/4"
TUBING MATERIAL		TUBING MATERIAL	SS 304L
TUBING LENGTH (ft)		TUBING LENGTH (ft)	
TUBING CONNECTION		TUBING CONNECTION	

ND* - Not Documented

1/24/2003

Well Development and Pump Installation Report

Well C4999

WELL DEVELOPMENT AND TESTING DATA

Well Name: 399-3-18	Well ID: C4999	Well Location: 300-FF-5 OU	Date: 4-13-06

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	42.6' TOC
End of Job	42.6' TOC
DEPTH TO BOTTOM:	
Start of Job	52.05' TOC
End of Job	53.10' TOC

PART 2

WELL DEVELOPMENT DATA

Pump Model	2SS Grundfos
Intake Depth	50.5' TOC
Starting Turbidity	

Pump Start	Stop	Flow Rate
0819	0849	~15 gpm
0905	1014	~15 gpm

Total Pumped	~1,485 gallons
Final Turbidity	2.69 NTU
XD SN/Range (PSI)	20

PART 3

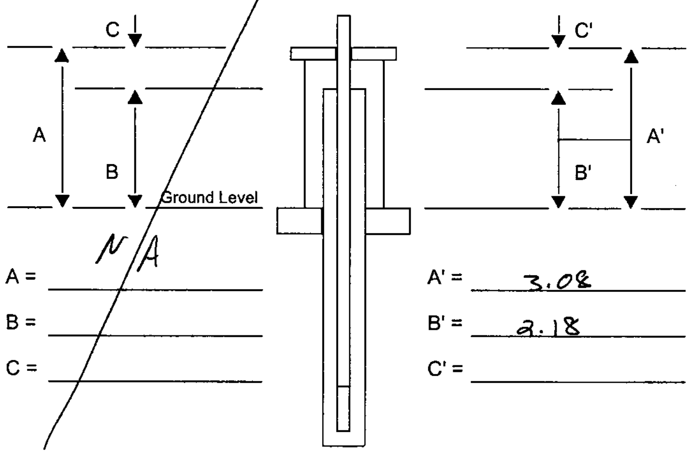
INSTANTANEOUS SLUG TEST

N/A

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	Current Measurements
Date:	Date: 4/13/06



N/A

A =	A' = 3.08
B =	B' = 2.18
C =	C' =

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

PART 5

COMMENTS:

Prepared by (print name): Jake Horner	Signature: Jake Horner	Date: 4/13/06
Reviewed by (print name): L.D. Walker	Signature: LD Walker	Date: 5/30/06

A-6003-644 (03/03)

FIELD ACTIVITY REPORT - DAILY DRILLING

Page 1 of 1

Date: 5/23/06

Well ID: C4999	Well Name: 399-3-18
Location: 300-FF-5 OU	Report No.: 16

Start	Finish	Total
Time 1200	Time 1310	Time 70 min
Hole Depth/Csg n/A / n/A	Hole Depth/Csg n/A / n/a	Hole Depth/Csg n/a / n/A

Reference Measuring Point: GROUND SURFACE	Casing String No. 1 2 3 4 ____ Rod Size: See Report No. 1

Time/Depth From	To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
1200	1310	Install permanent pump
		• Grundfos pump 5S05-13 (0.5 HP); wt. = 10lbs; 60 Hz
		• Model # B08010013-P10545US
		• 3/4" SS SCH 10S TP304/304L (45.20' total)
		• Intake set @ 46.61' TOC (43.53' bgs)
		not used JH 5/23/06

Reported By: Jake Horner		Reviewed By: L.D. Walker	
Title: Geologist	Date: 5/23/06	Title: Geologist	Date: 5/30/06
Signature: John Horner		Signature: LD Walker	

A-6003-651 (04/03)

Well C5000

WELL DEVELOPMENT AND TESTING DATA

Well Name:	Well ID:	Well Location:	Date:
399-1-23	C5000	300-FF-5 OU	5/1/06

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	33.0' TOC
End of Job	33.0' TOC

DEPTH TO BOTTOM:

Start of Job	54.1' TOC
End of Job	53.8' TOC

PART 2

WELL DEVELOPMENT DATA

Pump Model	2S S Grundfos
Intake Depth	48' TOC / 38' TOC
Starting Turbidity	

Pump Start	Stop	Flow Rate
1320	1349	~16.0 gpm
1407	1438	~16.0 gpm

Total Pumped	930 gallons
Final Turbidity	1.88 / 2.82 ntu
XD SN/Range (PSI)	20

PART 3

INSTANTANEOUS SLUG TEST

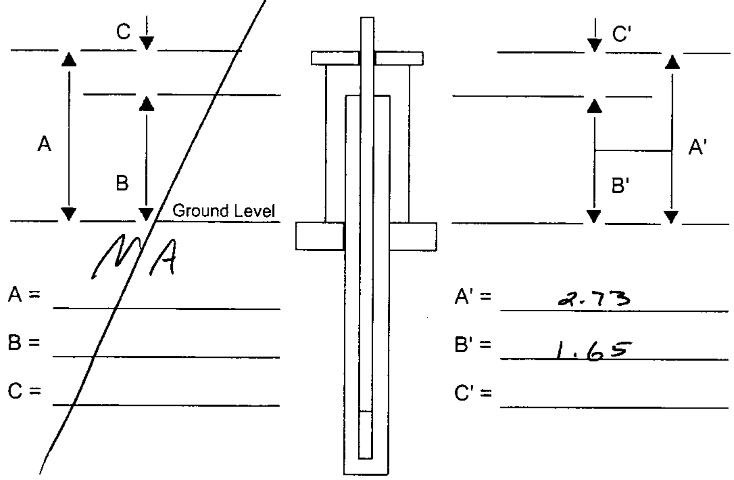
N/A

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: 5/1/06



N/A

A =
B =
C =

A' = 2.73
B' = 1.65
C' =

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

PART 5

COMMENTS:

Prepared by (print name):	Signature:	Date:
Jake Horner	[signature]	5/1/06
Reviewed by (print name):	**Signature:**	**Date:**
L.D. Walker	[signature]	5/30/06

A-6003-644 (03/03)

FIELD ACTIVITY REPORT - DAILY DRILLING	Page 1 of 1
	Date: 5/23/06

Well ID: C5000	Well Name: 399-1-23
Location: 300-FF-5 OU	Report No.: 16

Start	Finish	Total
Time 1310	Time 1400	Time 50 min
Hole Depth/Csg N/A / N/A	Hole Depth/Csg N/A / N/A	Hole Depth/Csg N/A / N/A

Reference Measuring Point: **GROUND SURFACE**	Casing String No. 1 2 3 4 ____ Rod Size: See Report No. 1

Time/Depth From	To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
1310	1400	Install permanent pump @ C5000 DTW = 33.4' TOC
		• Grundfos pump 5505-13 (0.5HP)
		• Model # B080 10013 - P10545US
		• 3/4" SS SCH 10S TP304/304L (45.30' Total)
		• Intake set @ 46.61' TOC (43.88' bgs)

not used JH 5/23/06

Reported By: Jake Horner		Reviewed By: L.D. Walker	
Title: Geologist	Date: 5/23/06	Title: Geologist	Date: 5-30-06
Signature: John Horner		Signature: LD Walker	

A-6003-651 (04/03)

Well C5001

WELL DEVELOPMENT AND TESTING DATA

Well Name:	Well ID:	Well Location:	Date:
399-3-19	C5001	300-FF-5 OU	5-22-06

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	50.34' TOC
End of Job	50.36' TOC

DEPTH TO BOTTOM:

Start of Job	70.0' TOC
End of Job	70.0' TOC

PART 2

WELL DEVELOPMENT DATA

Pump Model	2.5 s Grundfos	
Intake Depth	INT 1: 66' bgs	INT 2: 51' bgs
Starting Turbidity	~~HH~~ 1.16 NTU	0.87 NTU
Pump Start	**Stop**	**Flow Rate**
0911	0959	15 GPM
1006	1033	15 GPM
Total Pumped	1125 Gal	
Final Turbidity	INT 1: 0.83 NTU	INT 2: 0.43 NTU
XD SN/Range (PSI)	20 psi	

PART 3

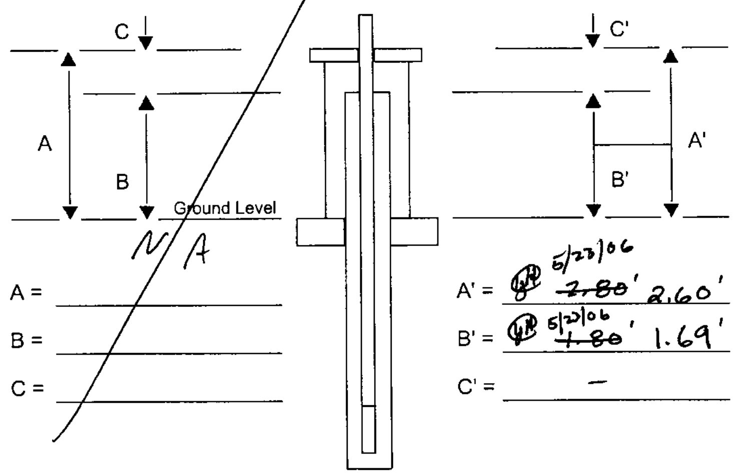
INSTANTANEOUS SLUG TEST

Static Water Level (TOC)	N/A
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: 5/22/06



N/A

A =
B =
C =

A' = ~~2.80'~~ 2.60' (5/23/06)
B' = ~~1.80'~~ 1.69' (5/23/06)
C' = –

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

PART 5

COMMENTS:

CALIBRATIONS:

pH meter:
7.00 = 6.81
10.00 = 9.97

Cond. meter:
1.419 mS = 1.424 mS

Turb. meter:
5.33 NTU = 6.04 NTU
47.4 NTU = 51.9 NTU
512 NTU = 523 NTU

INTERVAL #1
STARTING XD = 15.014' H_2O
TRANSDUCER 2.16' above INTAKE

INTERVAL #2
STARTING XD = 4.835' H_2O
Transducer 2.16' above intake.

Prepared by (print name):	Signature:	Date:
Jess Hocking	[signature]	5/22/06
Reviewed by (print name):	Signature:	Date:
L.D. Walker	[signature]	5-30-06

A-6003-644 (03/03)

FIELD ACTIVITY REPORT - DAILY DRILLING	Page 1 of 1
	Date: 5/23/06

Well ID: C5001	Well Name: 399-3-19
Location: 300-FF-5 OU	Report No.: 14

Start	Finish	Total
5/23/06 Time ~~0600~~ 1450	Time 1540	Time 50 min
Hole Depth/Csg n/A / n/A	Hole Depth/Csg n/A / n/A	Hole Depth/Csg n/A / n/A

Reference Measuring Point: **GROUND SURFACE**	Casing String No. 1 2 3 4 ____ Rod Size: See Report No. 1

Time/Depth		Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
From	To	
1450	1540	Installing permanent pump DTW = 50.4' TOC
		• Grundfos pump 5S05-13 (0.5 Hp); wt. = 10 lbs; 60 Hz
		• Model #: B08010013-P10545US
		• 3/4" SS SCH 10S TP 304/304L (60.39' Total)
		• Intake set @ ~~60.25' TOC~~ 5/23/06 61.70' TOC (59.10' bgs)

not used 5/23/06

Reported By: Jake Horner		Reviewed By: L.D. Walker	
Title: Geologist	Date: 5/23/06	Title: Geologist	Date: 5/30/06
Signature: Jake Horner		Signature: LD Walker	

A-6003-651 (04/03)

Well C5002

WELL DEVELOPMENT AND TESTING DATA

Well Name:	Well ID:	Well Location:	Date:
399-3-20	C5002	300-FF-5 OU	5-22-06

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	49.07' TOC
End of Job	49.05' TOC
DEPTH TO BOTTOM:	
Start of Job	~70' TOC
End of Job	~70' TOC

PART 2

WELL DEVELOPMENT DATA

Pump Model	25s Grundfos
Intake Depth	INT 1 ~68' TOC / INT 2 ~53' TOC
Starting Turbidity	5.81 NTU / 4.22 NTU

Pump Start	Stop	Flow Rate
1117	1159	15 GPM
1205	1241	15 GPM

Total Pumped	1170 Gal
Final Turbidity	INT 1 0.81 NTU / INT 2 0.67 NTU
XD SN/Range (PSI)	20 psi

PART 3

INSTANTANEOUS SLUG TEST

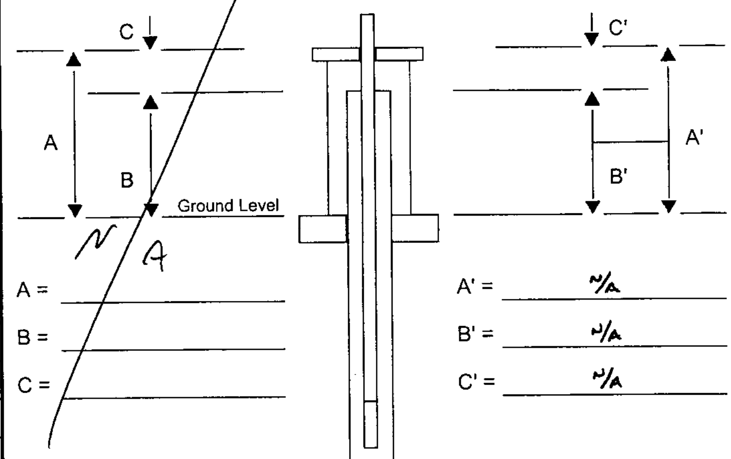
N/A

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: 5-22-06



N/A

A =

B =

C =

A' = N/A

B' = N/A

C' = N/A

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

PART 5

COMMENTS:

INTERVAL #1

STARTING XD = 15.600' H_2O
Transducer set 2.16' above intake

INTERVAL #2

STARTING XD = 3.016' H_2O
Transducer set 2.16' above intake.

INSTRUMENTS CALIBRATED THIS MORNING ON C5001 DEVELOPMENT

Prepared by (print name):	Signature:	Date:
Jess Hocking	[signature]	5/22/06
Reviewed by (print name):	**Signature:**	**Date:**
L.D. Walker	[signature]	5-30-06

A-6003-644 (03/03)

FIELD ACTIVITY REPORT - DAILY DRILLING	Page 1 of 1
	Date: 5/23/06

Well ID: C5002	Well Name: 399-3-20
Location: 300-FF-5 OU	Report No.: 9

Start	Finish	Total
Time 0600	Time 1540	Time 9 hrs 40 min.
Hole Depth/Csg N/A / N/A	Hole Depth/Csg N/A / N/A	Hole Depth/Csg N/A / N/A
Reference Measuring Point: GROUND SURFACE	Casing String No. 1 2 3 4 ____ Rod Size: See Report No. 1	

Time/Depth From	Time/Depth To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
0600	0620	POD meeting (BTR, Drillers, Safety & Geo)
0620	0645	Move remaining equipment off site & remove boundary
		* Monument (8" SS) stickup = 2.72' ags (cement pad)
		6" riser stickup = 1.74' ags (cement pad)
0645	1130	Loading equipment in laydown yard
1130	1200	Lunch
1200	1310	Intall pump @ C4999 (see C4999 FAR)
1310	1400	Install pump @ C5000 (see C5000 FAR)
1400	1450	Install pump @ C5002 DTW = 50.0' TOC
		• Grundfos pump 5S05-13 (0.5HP); wt 10 lbs; 60 Hz
		• Model # BØ8Ø1ØØ13-P1Ø545 US
		• 3/4" SS SCH 10S TP 304/304L (60.35' total)
		• Intake set at 61.66' TOC (58.94' bgs)
1450	1540	Install pump @ C5001 (see C5001 FAR)
		not used JH 5/23/06

Reported By: Jake Horner		Reviewed By: L.D. Walker	
Title: Geologist	Date: 5/23/06	Title: Geologist	Date: 5/30/06
Signature: Jake Horner		Signature: LD Walker	

A-6003-651 (04/03)

Appendix B

Sediment Core Data from Wells 399-3-18, 399-1-23, 399-3-19, and 399-3-20

Core Inventory Form

Well C4999

300 LFI LEXAN Core Lin(399-3-18

Well C4999

Box	mark	sequential order	weight (g)	Core Run #	Interval Depth	% Recovery	Date collected	Comments
Box # 1	1	1A	474	1	2"-0	0	3/10/2006	
	2	1B	472	1	1'2"-2"	0	3/10/2006	
	3	1C	473	1	2'2'-1'2"	20	3/10/2006	drill pad gravel
	4	1D	472	1	3'2"-2'2"	100	3/10/2006	ash
	5	1E	471	1	4'2"-3'2"	100	3/10/2006	ash
	6	2A	476	1	5'2"-4'2"	100	3/10/2006	ash
	7	2B	474	1	6' 2" - 5'2"	100	3/10/2006	ash and sand
	8	2C	402	2	5.5-4.5	0	3/10/2006	
Box # 2	1	2D	472	2	6.5'-5.5'	0	3/10/2006	
	2	2E	474	2	7.5'-6.5'	50	3/10/2006	probably slough
	3	3A	470	2	8.5'-7.5'	100	3/10/2006	
	4	3B	471	2	9.5'-8.5'	100	3/10/2006	
	5	3C	470	2	10.5'-9.5'	100	3/10/2006	
	6	3D	476	3	10'2"-9'2"	0	3/10/2006	
	7	3E	473	3	11'2"-10'2"	0	3/10/2006	
	8	4A	403	3	12'2"-11'2"	0	3/10/2006	
Box # 3	1	4B	472	3	13'2"-12'2"	75	3/10/2006	
	2	4C	469	3	14'2"-13'2"	100	3/10/2006	
	3	4D	470	3	15'2"-14'2"	0	3/10/2006	sample fell out of shoe and 1st liner
	4	4E	472	4	14.5-13.5	0	3/10/2006	
	5	5A	468	4	15.5-14.5	30	3/10/2006	probably slough
	6	5B	468	4	16.5-15.5	100	3/10/2006	
	7	5C	472	4	17.5-16.5	100	3/10/2006	
	8	5D	422	4	18.5-17.5	100	3/10/2006	
Box # 4	1	5E	474	4	19.5-18.5	100	3/10/2006	
	2	6A	468	5	20.5-19.5	55	3/10/2006	
	3	6B	471	5	21.5-20.5	100	3/10/2006	
	4	6C	471	5	22.5-21.5	100	3/10/2006	
	5	6D	470	5	23.5-22.5	100	3/10/2006	
	6	6E	464	5	24.5-23.5	100	3/10/2006	
	7	7A	471	5	25.5-24.5	90	3/10/2006	lost some sample out of shoe
	8	7B	415	6	22.5-21.5	0	3/10/2006	
Box # 5	1	7C	469	6	23.5-22.5	10	3/10/2006	probably slough
	2	7D	475	6	24.5-23.5	100	3/10/2006	probably slough

	3	7E	472	6	25.5-24.5	100	3/10/2006	probably slough
	4	8A	472	6	26.5-25.5	100	3/10/2006	
	5	8B	476	6	27.5-26.5	100	3/10/2006	Coble stuck in liner so sample bagged
	6	8C	471	7	27-26	0	3/13/2006	
	7	8D	471	7	28-27	30	3/13/2006	possible slough
	8	8E	406	7	29-28	100	3/13/2006	
Box # 6	1	9A	472	7	30-29	100	3/13/2006	
	2	9B	469	7	31-30	100	3/13/2006	formation got softer
	3	9C	469	7	32-31	100	3/13/2006	
	4	9D	472	8	32-31	0	3/13/2006	
	5	9E	466	8	33-32	0	3/13/2006	
	6	10A	462	8	34-33	70	3/13/2006	
	7	10B	459	8	35-34	100	3/13/2006	drill rig chatter increasing
	8	10C	437	8	36-35	100	3/13/2006	clay appearing in samples
Box # 7	1	10D	467	8	37-36	100	3/13/2006	2 grab samples from core shoe at 37.5 ft bgs
	2	**10E**	**467**	9	38-37	0	3/13/2006	
	3	11A	466	9	39-38	50	3/13/2006	
	4	11B	464	9	40-39	100	3/13/2006	
	5	11C	466	9	41-40	100	3/13/2006	
	6	11D	477	9	42-41	100	3/13/2006	water table ~42 ft bgs; 1st wtr sample bailed 42.5-44 bgs
	7	11E	464	9	43-42	30	3/13/2006	wet sample -lost 7 inches out of bottom core
	8	12A	422	10	44.5-43.5	100	3/13/2006	slough?
Box # 8	1	12B	472	10	45.5-44.5	100	3/13/2006	slough?
	2	12C	476	10	46.5-45.5	100	3/13/2006	sand begins about 45.5
	3	12D	470	10	47.5-46.5	100	3/13/2006	2nd wtr 46-51 bgs (pump unsuccessful so bailed-no recharge)
	4	12E	468	10	48.5-47.5	100	3/13/2006	VFS
	5	13A	472	10	49.5-48.5	100	3/13/2006	49.5-50 ft grab sample of cohesive sand from shoe
	6	13B	471	11	49.5-50.5	100	3/14/2006	slough?
	7	13C	469	11	50.5-51.5	100	3/14/2006	slough?
	8	13D	408	11	51.5-52.5	100	3/14/2006	VFS
Box # 9	1	13E	461	11	52.5-53.5	100	3/14/2006	3rd wtr bailed 52.5-56 bgs; 1st slug test 52.5-55.5 bgs.
	2	14A	461	11	53.5-54.5	100	3/14/2006	VFS with color change from tan to green
	3	14B	468	11	54.5-55.5	100	3/14/2006	Green VFS grab sample from shoe 55.5-56
	4	14C	469	12	54.5-55.5	100	3/14/2006	slough?
	5	14D	460	12	55.5-56.5	100	3/14/2006	slough?
	6	14E	458	12	56.5-57.5	100	3/14/2006	Green VFS
	7	15A	462	12	57.5-58.5	100	3/14/2006	Green VFS

	8	15B	461	12	58.5-59.5	100	3/14/2006	Green VFS to silt
Box # 10	1	15C	464	12	59.5-61	melted liner	3/14/2006	This sample was bagged
	2	15D	465	13	59.5-60.5	100	3/16/2006	slough?
	3	15E	471	13	60.5-61.5	100	3/16/2006	slough?
	4	16A	468	13	61.5-62.5	100	3/16/2006	green vfs
	5	16B	472	13	62.5-63.5	100	3/16/2006	
	6	16C	467	13	63.5-64.5	100	3/16/2006	
	7	16D	476	13	64.5-65.5	100	3/16/2006	Shoe grab sample at 65.6-66.0
	8	16E	413	14	64.5-65.5	100	3/16/2006	slough?
Box # 11	1	17A	473	14	65.5-66.5	100	3/16/2006	4th water sample pumped ~66-70 ft bgs
	2	17B	470	14	66.5-67.5	100	3/16/2006	2nd slug test ~66-70 and ~61.5 -70 bgs
	3	17C	473	14	67.5-68.5	100	3/16/2006	
	4	17D	476	14	68.5-69.5	100	3/16/2006	sand grain size increasing
	5	17E	474	14	69.5-70.5	100	3/16/2006	lost shoe sample at 71'
	6	18A	470	15	70.5-69.5	100	3/17/2006	100% sluff discarded sample and liner
	7	18B	472	15	71.5-70.5	100	3/17/2006	~50% sluff in top of liner
	8	18C	393	15	72.5-71.5	100	3/17/2006	
Box # 12	1	18D	461	15	73.5-72.5	100	3/17/2006	
	2	18E	464	15	74.5-73.5	100	3/17/2006	
	3	19A	464	15	75.5-74.5	100	3/17/2006	Lost sample in shoe at 76 bgs
	4	19B	466	16	76.5-75.5	100	3/17/2006	5th wtr sample pumped from ~76-78 bgs
	5	19C	467	16	77.5-76.5	100	3/17/2006	
	6	19D	468	16	78.5-77.5	100	3/17/2006	
	7	19E	467	16	79.5-78.5	100	3/17/2006	
	8	20A	450	16	80.5-79.5	100	3/17/2006	
Box # 13	1	20B	472	16	81.5-80.5	100	3/17/2006	
	~~2~~	~~20C~~	~~469~~	~~17~~	liner distroyed	0	3/20/2006	Stuck in core barrel (cut out before sampling)
	3	20D	466	17	82.5-81.5	100	3/20/2006	
	4	20E	472	17	83.5-82.5	100	3/20/2006	Silty sandy gravel
	5	21A	473	17	84.5-83.5	100	3/20/2006	Silty sandy gravel
	6	21B	472	17	85.5-84.5	100	3/20/2006	Silty sandy gravel
	7	21C	470	17	86.5-85.5	100	3/20/2006	Silty sandy gravel
	8	21D	403	~~18~~ 17	87.5-86.5	100	3/20/2006	6th wtr sample pumped ~86-89 bgs
Box # 14	1	21E	464	18	86-85	100	3/20/2006	slough?
	2	22A	453	18	87-86	100	3/20/2006	slough?
	3	22B	469	18	88-87	100	3/20/2006	Silty sandy gravel
	4	22C	469	18	89-88	100	3/20/2006	Silty sandy gravel

	5	22D	469	18	90-89	100	3/20/2006	Silty sandy gravel
	6	22E	471	18	91-90	100	3/20/2006	Silty sandy gravel (shoe depth 91.5)
	7	23A	470	19		0	3/21/2006	**entire core 92-97 ft bgs fill out and 6 attempts to recover.**
	8	23B	436	19		0	3/21/2006	**This entire interval has been mixed up**
Box # 15	1	23C	471	19	93.5-92.5	100	3/21/2006	
	2	23D	459	19	94.5-93.5	100	3/21/2006	
	3	23E	460	19	95.5-94.5	100	3/21/2006	
	4	24A	465	~~20~~ 19	96.5-95.5	100	3/21/2006	
	5	24B	464	20	95-94	100	3/21/2006	**slough?**
	6	24C	462	20	96-95	100	3/21/2006	**slough?**
	7	24D	468	20	97-96	100	3/21/2006	
	8	24E	454	20	98-97	100	3/21/2006	
Box # 16	1	25A	472	20	99-98	100	3/21/2006	7th wtr sample pumped ~98-101 bgs
	2	25B	470	~~21~~ 20	100-99	100	3/21/2006	7th wtr sample pumped ~98-101 bgs
	3	25C	477	21	100.5-99.5	100	3/22/2006	slough?
	4	25D	477	21	101.5-100.5	100	3/22/2006	slough?
	5	25E	475	21	102.5-101.5	100	3/22/2006	
	6	26A	474	21	103.5-102.5	100	3/22/2006	
	7	26B	469	21	104.5-103.5	100	3/22/2006	
	8	26C	375	~~22~~ 21	105.5-104.5	100	3/22/2006	
Box # 17	1	26D	458	22	105.5-104.5	100	3/22/2006	slough?
	2	26E	466	22	106.5-105.5	100	3/22/2006	slough?
	3	27A	467	22	107.5-106.5	100	3/22/2006	8th wtr sample pumped ~107-109 bgs
	4	27B	467	22	108.5-107.5	100	3/22/2006	8th wtr sample pumped ~107-109 bgs
	5	27C	471	22	109.5-108.5	100	3/22/2006	8th wtr sample pumped ~107-109 bgs
	6	27D	470	~~23~~ 22	110.5-109.5	0	3/22/2006	lost 18 in. out of bottom shoe and liner
	7	27E	470	23	109.5-108.5	100	3/22/2006	
	8	28A	429	23	110.5-109.5	100	3/22/2006	
Box # 18	1	28B	465	23	111.5-110.5	100	3/22/2006	
	2	28C	464	23	112.5-111.5	100	3/22/2006	sandy gravel
	3	28D	466	23	113.5-112.5	100	3/22/2006	
	4	28E	462	23	114.5-113.5	80	3/22/2006	
	5	29A	468	24	115.5-114.5	90	3/23/2006	
	6	29B	465	24	116.5-115.5	100	3/23/2006	
	7	29C	466	24	117.5-116.5	100	3/23/2006	
	8	29D	452	24	118.5-117.5	100	3/23/2006	sandy gravel
Box # 19	1	29E	468	24	119.5-118.5	100	3/23/2006	

	2	30A	468	24	120.5-119.5	70	3/23/2006	
	3	30B	464	25	121-120	0	3/23/2006	9th wtr sample pumped ~120-121.5 bgs
	4	30C	464	25	122-121	50	3/23/2006	all slough, dumped liner and sample
	5	30D	462	25	123-122	100	3/23/2006	
	6	30E	466	25	124-123	100	3/23/2006	sandy gravel
	7	31A	466	25	125-124	100	3/23/2006	Proposed 3rd slug test ~126-116 bgs
	8	31B	453	25	126-125	50	3/23/2006	Lost 1/2 of sample
Box # 20	1	31C	470	26	125.5-124.5	100	3/23/2006	sandy gravel
	2	31D	464	26	126.5-125.5	100	3/23/2006	Lower Mud contact ~126 bgs
	3	31E	466	26	127.5-126.5	100	3/23/2006	LMU
	4	32A	463	26	128.5-127.5	100	3/23/2006	LMU
	5	32B	467	26	129.5-128.5	100	3/23/2006	LMU
	6	32C	465	26	130.5-129.5	100	3/23/2006	LMU

Total Depth~131 ft bgs

Column E - Core Run # provides the core run sequence during drilling.
Each core run consists of a 6.5 ft long core barrel consisting of 6 ~1-ft-long lexan liners plus a 0.5 ft core shoe

Column F - Interval Depth provides the ~1 ft-long Lexan core depth interval
Column G - % Recovery provides the percentage of the ~1-ft-long Liner that is full of sediment
Column A, B, C, and D provide tracking and weight information for the Lexan liners
Column C -sequential order provides the lab liner identifiers. Yellow highlighted numbers are retained core intact for treatability and future lab testing.

300 LFI LEXAN Core Liners 399-1-23

Well C5000

Box	mark	sequential order	weight (g)	Core Run #	Interval Depth	% Recovery	Date collected	Comments
Box # 20	7	32D	463	1	0-1	100	3/30/2006	drill pad gravel
	8	32E	460	1	1--2	100	3/30/2006	
Box # 21	1	33A	480	1	0.5-1.5	100	3/30/2006	slough?
	2	33B	479	1	1.5-2.5	100	3/30/2006	slough?
	3	33C	477	1	2.5-3.5	100	3/30/2006	
	4	33D	479	1	3.5-4.5	100	3/30/2006	
	5	33E	482	2		0	3/30/2006	
	6	34A	477	2	3.5-4.5	80	3/30/2006	slough?
	7	34B	476	2	4.5-5.5	100	3/30/2006	
	8	34C	480	2	5.5-6.5	100	3/30/2006	
Box # 22	1	34D	466	2	6.5-7.5	100	3/30/2006	
	2	34E	464	2	7.5-8.5	100	3/30/2006	
	3	35A	461	3		0	3/30/2006	
	4	35B	464	3	6.5-7.5	50	3/30/2006	slough?
	5	35C	462	3	7.5-8.5	100	3/30/2006	slough?
	6	35D	463	3	8.5-9.5	100	3/30/2006	
	7	35E	465	3	9.5-10.5	100	3/30/2006	
	8	36A	467	3	10.5-11.5	100	3/30/2006	
Box # 23	1	36B	468	4	0	0	4/3/2006	
	2	36C	461	4	0	0	4/3/2006	
	3	36D	464	4	10.5-11.5	100	4/3/2006	slough?
	4	36E	462	4	11.5-12.5	100	4/3/2006	
	5	37A	464	4	12.5-13.5	100	4/3/2006	
	6	37B	462	4	13.5-14.5	100	4/3/2006	
	7	37C	462	5		0	4/3/2006	
	8	37D	465	5		0	4/3/2006	
Box # 24	1	37E	463	5		0	4/3/2006	
	2	38A	461	5	18.5-19.5	100	4/3/2006	slough?
	3	38B	463	5	19.5-20.5	100	4/3/2006	
	4	38C	464	5	20.5-21.5	100	4/3/2006	sample very wet/damp
	5	38D	464	6			4/3/2006	
	6	38E	460	6			4/3/2006	
	7	39A	461	6	21.5-22.5	50	4/3/2006	
	8	39B	467	6	22.5-23.5	100	4/3/2006	

Box # 25	1	39C	475	6	23.5-24.5	100	4/3/2006	
	2	39D	480	6	24.5-25.5	100	4/3/2006	
	3	39E	477	7			4/3/2006	
	4	40A	476	7	29.5-30.5	80	4/3/2006	
	5	40B	479	7	30.5-31.5	100	4/3/2006	
	6	40C	478	7	31.5-32.5	100	4/3/2006	
	7	40D	477	7	32.5-33.5	100	4/3/2006	
	8	40E	492	7	33.5-34.5	100	4/3/2006	
Box # 26	1	41A	469	8	33.5-34.5	0	4/3/2006	
	2	41B	463	8	34.5-35.5	50	4/3/2006	
	3	41C	464	8	35.5-36.5	100	4/3/2006	
	4	41D	468	8	36.5-37.5	100	4/3/2006	
	5	41E	462	8	37.5-38.5	100	4/3/2006	
	6	42A	459	8	38.5-39.5	100	4/3/2006	
	7	42B	465	9		0	4/4/2006	Entire core interval (9) fell out of core barrel.
	8	42C	462	9		0	4/4/2006	Several attempts made to retrieve cuttings
Box # 27	1	42D	466	9		0	4/4/2006	Entire interval mixed and now graded due to multiple attempts
	2	42E	466	9		0	4/4/2006	
	3	43A	465	9	43.5-44.5	100	4/4/2006	material is highly permeable sandy gravel
	4	43B	465	9	44.5-45.5	100	4/4/2006	
	5	43C	466	10		0	4/4/2006	Drilled 45' to 50 ' bgs only 3 ' recovered
	6	43D	467	10		0	4/4/2006	loose perm. sandy gravel just pushed aside during coring
	7	43E	469	10		0	4/4/2006	
	8	44A	473	10	46.5-47.5	60	4/4/2006	slough?
Box # 28	1	44B	463	10	47.5-48.5	100	4/4/2006	
	2	44C	464	10	48.5-49.5	100	4/4/2006	
	3	44D	463	11	49.5-50.5	90	4/5/2006	Core run #11 fell out and was redrilled
	4	44E	463	11	50.5-51.5	100	4/5/2006	Interval cored was 49.5-56 ft bgs
	5	45A	462	11	51.5-52.5	100	4/5/2006	
	6	45B	463	11	52.5-53.5	100	4/5/2006	
	7	45C	463	11	53.5-54.5	100	4/5/2006	
	8	45D	464	11	54.5-55.5	90	4/5/2006	
Box # 29	1	45E	466	12	54.5-55.5	100	4/5/2006	slough?
	2	46A	465	12	55.5-56.5	100	4/5/2006	
	3	46B	463	12	56.5-57.5	100	4/5/2006	100% core run (12) recovery
	4	46C	464	12	57.5-58.5	100	4/5/2006	similar sand as in 399-3-18 w/ gravel, and silt
	5	46D	465	12	58.5-59.5	100	4/5/2006	

	6	46E	465	12	59.5-60.5	25	4/5/2006	lost bottom 1 ft.
	7	47A	462	13	59-60	100	4/6/2006	slough?
	8	47B	457	13	60-61	100	4/6/2006	slough?
Box # 30	1	47C	469	13	61-62	100	4/6/2006	
	2	47D	466	13	62-63	100	4/6/2006	
	3	47E	466	13		0	4/6/2006	core fell out
	4	48A	473	13		0	4/6/2006	core fell out
	5	48B	463	14	62.5-63.5	100	4/6/2006	slough?
	6	48C	466	14	63.5-64.5	100	4/6/2006	silty sandy gravel
	7	48D	464	14	64.5-65.5	100	4/6/2006	silty sandy gravel
	8	48E	438	14	65.5-66.5	100	4/6/2006	very fine grained qtz sand, well sorted
Box # 31	1	49A	460	14	66.5-67.5	100	4/6/2006	very fine grained qtz sand, well sorted
	2	49B	460	14	67.5-68.5	100	4/6/2006	shoe to 70"bgs
	3	49C	463	15		0	4/7/2006	slough?
	4	49D	463	15	67.5-68.5	100	4/7/2006	slough?
	5	49E	462	15	68.5-69.5	100	4/7/2006	slough?
	6	50A	462	15	69.5-70.5	100	4/7/2006	
	7	50B	462	15	70.5-71.5	100	4/7/2006	
	8	50C	481	15	71.5-72.5	80	4/7/2006	
Box # 32	1	50D	460	16	71-72	90	4/10/2006	slough?
	2	50E	462	16	72-73	100	4/10/2006	slough?
	3	51A	462	16	73-74	100	4/10/2006	
	4	51B	459	16	74-75	40	4/10/2006	Core run#16 73-77.5 interval
	5	51C	461	16	75-76	0	4/10/2006	core fell out
	6	51D	460	16	76-77	0	4/10/2006	core fell out
	7	51E	464	17	76.5-77.5	100	4/10/2006	
	8	52A	481	17	77.5-78.5	100	4/10/2006	Core run #17 73-83 interval
Box # 33	1	52B	462	17	78.5-79.5	100	4/10/2006	
	2	52C	463	17	79.5-80.5	100	4/10/2006	
	3	52D	465	17	80.5-81.5	100	4/10/2006	
	4	52E	463	17		0	4/10/2006	1.5 ft fell out
	5	53A	459	18	80.5-81.5	100	4/11/2006	slough?
	6	53B	461	18	81.5-82.5	100	4/11/2006	slough?
	7	53C	464	18	82.5-83.5	100	4/11/2006	slough?
	8	53D	471	18	83.5-84.5	100	4/11/2006	
Box # 34	1	53E	459	18	84.5-85.5	90	4/11/2006	
	2	54A	463	18	85.5-86.5	90	4/11/2006	

	3	54B	459	19		0	4/11/2006	drive to 92 ft, all fell out, switched bit, drove to 92 ft
	4	54C	462	19		0	4/11/2006	core run # 19 from 87-92 ft bgs,
	5	54D	461	19		0	4/11/2006	All sediment mixed and graded
	6	54E	460	19	88.5-89.5	100	4/11/2006	
	7	55A	462	19	89.5-90.5	100	4/11/2006	
	8	55B	473	19	90.5-91.5	bagged	4/11/2006	
Box # 35	1	55C	466	20	89-90	100	4/11/2006	core run #20 from 89-95.5
	2	55D	467	20	90-91	100	4/11/2006	
	3	55E	467	20	91-92	100	4/11/2006	
	4	56A	463	20	92-93	100	4/11/2006	
	5	56B	466	20	93-94	100	4/11/2006	
	6	56C	465	20	94-95	100	4/11/2006	encountered blue-green clay silt and sand ~94.8 ft bgs
	7	56D	469	21		0	4/11/2006	
	8	56E	437	21	95.5-96.5	100	4/11/2006	core run # 21 all fell out
Box # 36	1	57A	472	21	96.5-97.5	100	4/11/2006	retrieved 96-101 ft bgs all mixed.
	2	57B	467	21	97.5-98.5	100	4/11/2006	interval is blue-green clayey silty sandy gravel
	3	57C	467	21	98.5-99.5	100	4/11/2006	
	4	57D	469	21	99.5-100.5	100	4/11/2006	
	5	57E	469	22	99.5-100.5	100	4/12/2006	slough?
	6	58A	469	22	100.5-101.5	100	4/12/2006	1/2 slough
	7	58B	468	22	101.5-102.5	100	4/12/2006	cored to 106 ft bgs
	8	58C	456	22	102.5-103.5	100	4/12/2006	
Box # 37	1	58D	471	22		0	4/12/2006	fell out
	2	58E	465	22		0	4/12/2006	fell out
	3	59A	465	23	103.5-104.5	100	4/12/2006	cored 106 ft-110 ft bgs
	4	59B	463	23	104.5-105.5	100	4/12/2006	
	5	59C	465	23	105.5-106.5	100	4/12/2006	
	6	59D	465	23	106.5-107.5	100	4/12/2006	
	7	59E	466	23	107.5-108.5	100	4/12/2006	
	8	60A	446	23		0	4/12/2006	fell out
Box # 38	1	60B	461	24	106-107	100	4/12/2006	
	2	60C	459	24	107-108	100	4/12/2006	
	3	60D	458	24	108-109	100	4/12/2006	cored to 113 ft bgs
	4	60E	460	24	109-110	100	4/12/2006	
	5	61A	457	24	110-111	100	4/12/2006	0.5 ft of core collected in foil from 111-111.5 ft bgs
	6	61B	460	24	111.5-112.5	100	4/12/2006	

TOTAL DEPTH 116 BGS

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Well C5001

Box	mark	sequential orde	weight (g)	Core Run #	Interval Depth	% Recovery	Date collected	Comments
Box # 38	7	61C	459	1	0	0	4/24/2006	6 ft of sample compressed to 4.5 ft
	8	61D	492	1	0	0	4/24/2006	
Box # 39	1	61E	468	1	0.5-1.5	70	4/24/2006	
	2	62A	468	1	1.5-2.5	100	4/24/2006	
	3	62B	468	1	3.5-4.5	100	4/24/2006	
	4	62C	467	1	4.5-5.5	100	4/24/2006	
	5	62D	468	2	0	0	4/24/2006	
	6	62E	468	2	0	0	4/24/2006	5.5-10 ft
	7	63A	468	2	5.5-6.5	40	4/24/2006	
	8	63B	461	2	6.5-7.5	100	4/24/2006	
Box # 40	1	63C	482	2	7.5-8.5	100	4/24/2006	
	2	63D	480	2	8.5-9.5	100	4/24/2006	
	3	63E	480	3		0	4/24/2006	
	4	64A	482	3	10.5-11.5	100	4/24/2006	10.5-16 ft
	5	64B	483	3	11.5-12.5	100	4/24/2006	
	6	64C	483	3	12.5-13.5	100	4/24/2006	
	7	64D	482	3	13.5-14.5	100	4/24/2006	
	8	64E	461	3	14.5-15.5	100	4/24/2006	
Box # 41	1	65A	466	4		0	4/25/2006	
	2	65B	468	4		0	4/25/2006	
	3	65C	466	4	17.5-18.5	100	4/25/2006	
	4	65D	465	4	18.5-19.5	100	4/25/2006	
	5	65E	466	4	19.5-20.5	100	4/25/2006	16-22 ft
	6	66A	467	4	20.5-21.5	100	4/25/2006	
	7	66B	470	5		0	4/25/2006	
	8	66C	433	5		0	4/25/2006	21-25.5 ft
Box # 42	1	66D	476	5		0	4/25/2006	
	2	66E	467	5	22-23	5	4/25/2006	1 ft slough, most fell out
	3	67A	470	5	23-24	100	4/25/2006	Drilled through Hanford Boulder
	4	67B	467	5	24-25	100	4/25/2006	
	5	67C	470	6		0	4/25/2006	24.5-31
	6	67D	469	6		0	4/25/2006	
	7	67E	470	6	26.5-27.5	100	4/25/2006	
	8	68A	450	6	27.5-28.5	100	4/25/2006	core very hot! 27.5-28.5ft

Box # 43	1	68B	464	6	28.5-29.5	100	4/25/2006	
	2	68C	465	6	29.5-30.5	100	4/25/2006	
	3	68D	459	7		0	4/25/2006	
	4	68E	466	7		0	4/25/2006	
	5	69A	463	7		0	4/25/2006	
	6	69B	464	7	31.5-32.5	70	4/25/2006	31.5-37
	7	69C	460	7	32.5-33.5	100	4/25/2006	Pushed down cobble ~2 ft
	8	69D	463	7	33.5-34.5	100	4/25/2006	ossible contact at ~34 ft, damp sample
Box # 44	1	69E	470	8		0	4/26/2006	
	2	70A	468	8		0	4/26/2006	
	3	70B	469	8		0	4/26/2006	36-42
	4	70C	470	8	38-39	100	4/26/2006	drills fast some silt/clay
	5	70D	470	8	39-40	100	4/26/2006	
	6	70E	466	8	40-41	100	4/26/2006	
	7	71A	469	9		0	4/26/2006	
	8	71B	455	9		0	4/26/2006	
Box # 45	1	71C	470	9		0	4/26/2006	
	2	71D	467	9		0	4/26/2006	
	3	71E	465	9	41-42	100	4/26/2006	41-47
	4	72A	467	9	42-43	100	4/26/2006	damp all fell out
	5	72B	465	10		0	4/26/2006	
	6	72C	468	10		0	4/26/2006	
	7	72D	466	10		0	4/26/2006	
	8	72E	437	10		0	4/26/2006	
Box # 46	1	73A	468	10		0	4/26/2006	All fell out, recovered 1 ft
	2	73B	464	10	46.5-53	100	4/26/2006	46.5-53 ft
	3	73C	466	11		0	4/27/2006	
	4	73D	473	11		0	4/27/2006	
	5	73E	473	11		0	4/27/2006	
	6	74A	471	11		0	4/27/2006	
	7	74B	469	11	53-54	100	4/27/2006	53-59 DTW~47 ft bgs
	8	74C	451	11	54-55	100	4/27/2006	
Box # 47	1	74D	467	12		0	4/27/2006	58-63
	2	74E	463	12		0	4/27/2006	all fell out
	3	75A	462	12		0	4/27/2006	
	4	75B	466	12	2 bags	0	4/27/2006	
	5	75C	464	12		0	4/27/2006	

	6	75D	463	12		0	4/27/2006	
	7	75E	463	13		0	4/27/2006	
	8	76A	458	13		0	4/27/2006	63-76 drilled
Box # 48	1	76B	464	13	63-64	60	4/27/2006	recovered 4 ft in core barrel
	2	76C	463	13	64-65	100	4/27/2006	large rock in drill shoe
	3	76D	460	13	65-66	100	4/27/2006	
	4	76E	467	13	66-67	100	4/27/2006	
	5	77A	465	14		0	4/28/2006	
	6	77B	462	14		0	4/28/2006	
	7	77C	463	14		0	4/28/2006	
	8	77D	454	14	73-76	100	4/28/2006	73-79
Box # 49	1	77E	471	14	73-76	100	4/28/2006	3 ft recovered on 2nd run
	2	78A	467	14	73-76	100	4/28/2006	
	3	78B	475	15		0	4/28/2006	
	4	78C	472	15		0	4/28/2006	
	5	78D	469	15		0	4/28/2006	
	6	78E	472	15	80-81	80	4/28/2006	78-84
	7	79A	467	15	81-82	100	4/28/2006	looks like Ringold contact ~82-83
	8	79B	427	15	82-83	70	4/28/2006	2nd recovery ~4 ft
Box # 50	1	79C	461	16	82-83	100	4/28/2006	82-89
	2	79D	463	16	83-84	100	4/28/2006	Ringold sand
	3	79E	464	16	84-85	100	4/28/2006	
	4	80A	465	16	85-86	100	4/28/2006	
	5	80B	464	16	86-87	100	4/28/2006	
	6	80C	465	16	87-88	100	4/28/2006	Shoe 88-89 ft
					Total Core Depth ~89 ft bgs			
	Bagged sample				89-95	100	5/3/2006	VF sand collected in bag
	Bagged sample				95-100	100	5/3/2006	sand, color change ~97 ft
					100-103.5	0	5/3/2006	Sandy Gravel
					Total Drill Depth 103.5 ft bgs			

300 LFI LEXAN Core Liners 399-3-20

Well C5002

Box	mark	sequential order		weight (g)	Core Run #	Interval Depth	% Recovery	Date collected	Comments
Box # 51	1	81A		478	1		0	5/11/2006	core interval=3.5' - 9'
	2	81B		466	1		0	5/11/2006	Coring began at 3.5 ft bgs
	3	81C		467	1		0	5/11/2006	
	4	81D		468	1		0	5/11/2006	
	5	81E		469	1	3.5-4.5	100	5/11/2006	rock in shoe at 5.5'
	6	82A		467	1	4.5-5.5	100	5/11/2006	pushed to 9'
	7	82B		468	2		0	5/11/2006	core interval=8.5-12.5'
	8	82C		455	2		0	5/11/2006	
Box # 52	1	82D		466	2	8.0-9.0	70	5/11/2006	blk sandy gravel
	2	82E		465	2	9.0-10.0	100	5/11/2006	tan sand @ 9.5'
	3	83A		463	2	10.0-11	100	5/11/2006	
	4	83B		464	2	11-12.0	100	5/11/2006	12'-12.5' in shoe
	5	83C		465	3		0	5/11/2006	
	6	83D		465	3		0	5/11/2006	
	7	83E		461	3	12.5-13.5	100	5/11/2006	12.5'-17' (6" fellout)
	8	84A		458	3	13.5-14.5	100	5/11/2006	
Box # 53	1	84	B	459	3	14.5-15.5	100	5/11/2006	(m)S white/dry
	2	84	C	461	3	15.5-16.5	100	5/11/2006	
	3	84	D	462	4		0	5/11/2006	
	4	84	E	462	4		0	5/11/2006	
	5	85	A	462	4		0	5/11/2006	
	6	85	B	459	4		0	5/11/2006	
	7	85	C	464	4	15.5-16.5	50	5/11/2006	(m)S brown/damp
	8	85	D	465	4	16.5-17.5	100	5/11/2006	
Box # 54	1	85	E	462	5		0	5/11/2006	
	2	86	A	464	5		0	5/11/2006	
	3	86	B	467	5		0	5/11/2006	
	4	86	C	467	5	19-20	100	5/11/2006	18-21 feet
	5	86	D	468	5	20-21	100	5/11/2006	eviously bagged and is slough in core s
	6	86	E	471	5	21-22	100	5/11/2006	
	7	87	A	469	6		0	5/11/2006	
	8	87	B	434	6	22-23	50	5/11/2006	22-27.5'
Box # 55	1	87	C	469	6	23-24	100	5/11/2006	bottom 1.5' fell out
	2	87	D	468	6	24-25	100	5/11/2006	

	3	87	E	466	6	25-26	70	5/11/2006	
	4	88	A	468	6	fell out	0	5/11/2006	
	5	88	B	465	7		0	5/12/2006	
	6	88	C	466	7		0	5/12/2006	attempted to core 26-33'
	7	88	D	468	7		0	5/12/2006	pushed 3 ft without recovery,
	8	88	E	424	7	27-28	100	5/12/2006	rock in shoe at ~30 ft
Box # 56	1	89	A	465	7	28-29	100	5/12/2006	
	2	89	B	458	7	29-30	100	5/12/2006	
	3	89	C	460	8		0	5/12/2006	attempted to core 32-38'
	4	89	D	462	8		0	5/12/2006	pushed 3 ft without recovery,
	5	89	E	460	8		0	5/12/2006	
	6	90	A	460	8	32-33	90	5/12/2006	pushed 3 ft-shoe sample fell out
	7	90	B	460	8	33-34	100	5/12/2006	
	8	90	C	476	8	34-35	100	5/12/2006	
Box # 57	1	90	D	468	9		0	5/12/2006	attempted to core 36-42
	2	90	E	473	9		0	5/12/2006	
	3	91	A	472	9	37-38	check chain?	5/12/2006	
	4	91	B	472	9	38-39	check chain?	5/12/2006	
	5	91	C	469	9	39-40	check chain?	5/12/2006	
	6	91	D	426	9		0	5/12/2006	
	7	91	E	448	10	no recovery	see comments	5/12/2006	attempted to core 41-48'
	8	92	A	450	10	no recovery	see comments	5/12/2006	bagged ~1-2 ft
Box # 58	1	92	B	474	10	no recovery	see comments	5/12/2006	best est. 41-43 ft bgs
	2	92	C	478	10	47-48	100	5/12/2006	pushed 47 to 53 second time
	3	92	D	474	10	48-49	100	5/12/2006	recycled liners since no recovery on
	4	92	E	477	10	49-50	100	5/12/2006	1st core attempt
	5	93	A	474	11		0	5/12/2006	
	6	93	B	475	11		0	5/12/2006	
	7	93	C	436	11		0	5/12/2006	
	8	93	D	409	11	53-54	80	5/12/2006	Attmepted to core 52-58 '
Box # 59	1	93	E	4464	11	54-55	100	5/12/2006	
	2	94	A	469	11	55-56	100	5/12/2006	
	3	94	B	470	12		0	5/15/2006	core 58-63'- all empty except 95B
	4	94	C	472	12	64-65	60	5/15/2006	2nd attempt 62.6-68.5' using
	5	94	D	471	12	65-66	100	5/15/2006	recycled liners .
	6	94	E	475	12	66-67	100	5/15/2006	
	7	95	A	422	12	67-68	10	5/15/2006	

	8	95	B	440	12	58-63 mixed	90	5/15/2006	only recovery on first attempt
Box # 60	1	95	C	486	13		0	5/15/2006	
	2	95	D	486	13		0	5/15/2006	attempt to core 68-74
	3	95	E	489	13		0	5/15/2006	no recovery 1st run
	4	96	A	487	13		0	5/15/2006	
	5	96	B	491	13	68-74	100	5/15/2006	only 2' on 2nd rune
	6	96	C	491	13	68-74	100	5/15/2006	
	7	96	D	495	14		0	5/15/2006	
	8	96	E	401	14		0	5/15/2006	73-79.5'
Box # 61	1	97	A	476	14		0	5/15/2006	
	2	97	B	474	14	73-79	100	5/15/2006	mixed
	3	97	C	475	14	73-79	100	5/15/2006	mixed
	4	97	D	473	14		0	5/15/2006	
	5	97	E	477	15		0	5/15/2006	78.5-82'
	6	98	A	478	15		0	5/15/2006	
	7	98	B	476	15		0	5/15/2006	
	8	98	C	377	15	78.5-79.5	100	5/15/2006	Ringold at 80' bgs? quality sample
Box # 62	1	98	D	492	15	79.5-80.5	100	5/15/2006	quality samples
	2	98	E	497	15	80.5-81.5	100	5/15/2006	quality samples
	3	99	A	494	16		0	5/16/2006	80-85'
	4	99	B	490	16	79.5-80.5	95	5/16/2006	slough
	5	99	C	493	16	80.5-81.5	100	5/16/2006	Ringold sand
	6	99	D	497	16	81.5-82.5	100	5/16/2006	
	7	99	E	438	16	82.5-83.5	100	5/16/2006	
	8	100	A	421	16	83.5-84.5	100	5/16/2006	0.5' in shoe
					17			5/16/2006	85-91'
					17			5/16/2006	bagged this interval... did not core
					17	bag 85-87	tan/grn sd 85.5'	5/16/2006	entire interval is sand
					17	bag 87-89		5/16/2006	coarsening downward
					17	bag 89-91		5/16/2006	
					17			5/16/2006	
					18			5/16/2006	91-95'
					18	bag 94-95		5/16/2006	only saved 94-95

Total drill depth 95 ft bgs in Ringold sand

Pacific Northwest National Laboratory

DAILY BOREHOLE LOG

Boring/Well No C4999 (399-3-18) Depth 0 - 13' Date 3-21-06 Sheet 1 of 11

Location 300 Area Project LFI

Logged by B N Bjornstad

Reviewed by ______ Date ______

Lithologic Class. Scheme ______ Procedure ______ Rev ______

Steel Tape/E-Tape ______ / ______ Field Indicator Equip. 1) ______ 2) ______

Drilling Contractor Cascade Drilling

Driller ______

Rig/Method Resonant Sonic

Depth Control Point ______

DEPTH ( )	TIME	SAMPLES TYPE	SAMPLES ID NUMBER	CONTAMINATION INSTR.	CONTAMINATION READING	MOISTURE	GRAPHIC LOG (C Z S G)	LITHOLOGIC DESCRIPTION (particle size distribution, sorting, mineralogy, roundness, color, reaction to HCl, etc.)	H_2O ADDED	CASING	DRILLING COMMENTS (drilling rate, down time, blow counts, water level, drill fluid, etc.)
0											
		Core	1D			SM		gzS, pebbly silty sand, stratified,			5" dia lexan liners
			↓			↓		poorly sorted, 2.5Y3/0 (v. dk gray),			Man-made fly ash, v. dark
			1E					sl. compact, lgst clast = 1cm,			sooty
			↓					gravel mostly angular, 1"			well sorted, yellow (10YR 7/6)
			2A					silty layer @ 3' depth, mod			fine sand laminae @ 4'-4.5'
			↓					calcareous, 20% pebble-			no rxn w/ HCl, this sand
5			2B					granules, 60% S, 20% silt +			appears native
			↓			↓		clay, few rounded pebbles			well stratified sand, lt colored
								S, md-crs, well sorted, lt. yel. brn			
								(10YR 6/4) over lt. brnish gray (10YR 6/2),			
		Core	2E			SM		wkly calcareous		2E	= slough, bleached, strngly calc.
			3A					Interbedded dk ash and lt. brn sand,			Many different textures, colors
			↓			↓		well stratified, wkly calcareous			and compositions of sand -
			3B			M					still backfill
			↓			↓		mottled texture			
		Core	3C			SM		poorly sorted dk ash [illegible] rounded			3C [illegible]
10			↓					[illegible] dk ash v. calcareous			[illegible]
			Bag smpl					S, 10YR 4/3 (brown), well sorted			
			↓			↓					
		Core	4B			SM		poorly sorted, sooty dk ash, few rounded			
			↓			↓		pebbles, dk ash v. calcareous			

W = Wet, M = Moist, D = Dry, SM = slightly moist

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Pacific Northwest National Laboratory

DAILY BOREHOLE LOG

Boring/Well No C4999 (399-3-18) Depth 13 - 26 Date 3-21-06 Sheet 2 of 11

Location 360 Area Project LFI

Logged by B N Bjornstad (Print / Sign)

Reviewed by ______ (Print / Sign) Date ______

Lithologic Class. Scheme ______ Procedure ______ Rev ______

Steel Tape/E-Tape ______ / ______ Field Indicator Equip. 1) ______ 2) ______

Drilling Contractor Cascade Drilling

Driller ______

Rig/Method Resonant sonic

Depth Control Point ______

DEPTH ( )	TIME	SAMPLES TYPE	SAMPLES ID NUMBER	CONTAMINATION INSTR.	CONTAMINATION READING	MOISTURE	GRAPHIC LOG (C Z S G)	LITHOLOGIC DESCRIPTION (particle size distribution, sorting, mineralogy, roundness, color, reaction to HCl, etc.)	H_2O ADDED	CASING	DRILLING COMMENTS (drilling rate, down time, blow counts, water level, drill fluid, etc.)
13		Core	4C			SM		ZSG, mod. sorted, compact, 10YR6/6			~~Top of Hanford fm @ 13.2'~~
			↓			↓		(brnish yellow), lgst clast > 5"			
								noncalcareous			
15		Core	5A			SM		ZSG, black, poorly sorted, mod.			ash - slough, v. dk
			5B					calc., loose, lgst clast > 5", msv			↓
			↓					ZSG, like above except 2.5Y5/2			
			5C					(grayish brn),			
			↓					more brnish silt, mod-strng calc.,			
			5D					>5" clast, clay skins, S=40-50%			
			↓			↓		basalt, unbroken clasts SA-R			
			5E								Core 19E held out for
			↓								column studies
			6A								
20			↓			SM		ZSG, black to gray, 60% G,			slough - contains lots of dk ash
			6B					30% S, 10% Z, lgst clast = 7cm,			↓
			↓					v. poorly sorted, few white			
			6C					$CaCO_3$ coated gravels, mod			
			↓					rxn w/ HCl, more silt @ 21-22'			lighter color - intact?
			6D					msv, unbroken clasts SA-SR,			@ 23.5'-23.7
			↓					carbonate coatings 10-20%			ZG, clayey gravel, 2.5Y6/2 (lt. brnish
			6E					broken clasts			gray) to 10YR6/4 (lt. yel. brn), clast
			↓					ZSG, browner color, better sorted, less basalt			supported, G = 60-70% basalt,
			7A					poorly sorted, G = 50-60% basalt			clay noncalc.
25			↓			↓		some clay in matrix			
			8A								Core 8A held out for column study

W = Wet, M = Moist, D = Dry

* sample

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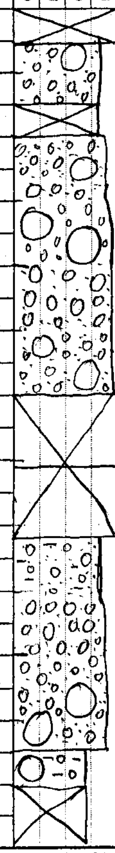
Pacific Northwest National Laboratory	DAILY BOREHOLE LOG	Boring/Well No C4999 (399-3-18) Depth 26-38' Date 3-21-06 Location 300 Area Project LFI	Sheet 3 of 11

Logged by BN Bjornstad (Print) ______ (Sign) ______ (Print) ______ (Sign)
Reviewed by ______ (Print) ______ (Sign) Date ______
Lithologic Class. Scheme ______ Procedure ______ Rev ______
Steel Tape/E-Tape ______ / ______ Field Indicator Equip. 1) ______ 2) ______

Drilling Contractor Cascade Drilling
Driller ______
Rig/Method Resonant sonic
Depth Control Point ______

DEPTH ( )	TIME	SAMPLES TYPE	SAMPLES ID NUMBER	CONTAMINATION INSTR.	CONTAMINATION READING	MOISTURE	GRAPHIC LOG C Z S G	LITHOLOGIC DESCRIPTION (particle size distribution, sorting, mineralogy, roundness, color, reaction to HCl, etc.)	H_2O ADDED	CASING	DRILLING COMMENTS (drilling rate, down time, blow counts, water level, drill fluid, etc.)
26			8A								Core 8A
		Bag Smpl	8B			D		ZSG, poorly sorted, 2.5Y5/2 (grayish			
						↓		brn), loose, lgst clast = 8cm,			
								70% G 20% S 10% Z unbroken			
		core	8E			D		clasts SA-SR, ~30% clast			8E = ZSG, sooty slough, noncalc.
			↓					broken, G = 70-80% basalt			↓
			9A					← mostly angular, broken basalt,			slough or pulverized
			↓					v. poorly sorted, lgst clast > 5"			
30			9B			↓		ZSG, as above, few well			↓
			↓			SM		rounded, polished Ringold clasts			
			9C					clay skins, lgst clast = 3"			
			↓			↓		2.5Y5/2 (grayish brn),			
~~32~~											
								lost core			
~~33~~											
		core	10A			D					loose sooty slough, msv,
			↓								mostly angular clasts
			10B					ZSG, 2.5Y5/2 (grayish brn), loose,			
			↓			↓		msv, v. poorly sorted angular			↓
35			10C			SM		ZSG, poorly sorted, grayish brn,			
			↓			↓		compact, clay skins A-SR			
			10D			M		noncalc, G = 60-70% basalt			
			↓			W		ZG, mottled grayish brn and yellow,			
								4" basalt clast,			



W = Wet, M = Moist, D = Dry

1998/DCL/PROC/DBL/001

Pacific Northwest National Laboratory

DAILY BOREHOLE LOG

Boring/Well No C4999 (399-3-18) Depth 39-51' Date 3-22-06

Location 300 Area Project LFI

Sheet 4 of 11

Logged by BN Bjornstad (Print) ______ (Sign) ______ (Print) ______ (Sign)

Reviewed by ______ (Print) ______ (Sign) Date ______

Lithologic Class. Scheme ______ Procedure ______ Rev ______

Steel Tape/E-Tape ______ / ______ Field Indicator Equip. 1) ______ 2) ______

Drilling Contractor Cascade Drilling

Driller ______

Rig/Method Resonant sonic

Depth Control Point ______

DEPTH ( )	TIME	SAMPLES TYPE	SAMPLES ID NUMBER	CONTAMINATION INSTR.	CONTAMINATION READING	MOISTURE	GRAPHIC LOG (C Z S G)	LITHOLOGIC DESCRIPTION (particle size distribution, sorting, mineralogy, roundness, color, reaction to HCl, etc.)	H_2O ADDED	CASING	DRILLING COMMENTS (drilling rate, down time, blow counts, water level, drill fluid, etc.)
38'											
		Core	11A			W		msG, msv, v. poorly sorted, 50%			slough
			11B			M		clasts broken, G= 70-80% basalt			↓
			↓			W		2.5Y4/2 (dk grayish brn) 20-30%			
40			11C					silt-clay, lgst clast= 3/4"			11C held out for column study
			↓								
			11D			W		smG 60% pebble gravel, 25%			Reworked Ringold?
			↓			↓		silt-clay, 15% sand, poorly			
			11E			↓		sorted, 2.5Y5/4 (lt. olive brn),			
								most pebbles rounded/polished,			
								G=40-50% basalt, loose			
			12A			W		lgst clast = 2", sticky clay			Slough
			↓					msG, 60% G, 20% S, 20% mud,			↓
			12B					2.5Y5/2 (grayish brn), clasts to			↓
45			↓					4", lots of Ringold pebbles, S			
			12C					= 50-60% basalt, most G is			
						↓		rounded (reworked Ringold clasts)			Hanford Fm 46.3'
			↓			m					Ringold Fm
			12D					S, fine, well sorted, micaceous,			Homogeneous fn sand
			↓					2.5Y 6/6 (olive yellow), massive,			
			12E					felsic, compact, no rxn w/ HCl			
			↓			↓		occassional Fe oxide bleb			↓
			13A								Core 13A held out for column
			↓								study
			13B			M		fn-vfn sand, more compacted			
50			↓			↓		trace of silt?			
			13C								Core 13C held out for Andy Ward

W = Wet, M = Moist, D = Dry

1998/DCL/PROC/DBL/001

Pacific Northwest National Laboratory	DAILY BOREHOLE LOG	Boring/Well No C4999 (399-3-18) Depth 51-64 Date 3-22-06 Location 300 Area Project LFI	Sheet 5 of 11

Logged by B N Bjornstad
Reviewed by ______ Date ______
Lithologic Class. Scheme ______ Procedure ______ Rev ______
Steel Tape/E-Tape ______ / ______ Field Indicator Equip. 1) ______ 2) ______

Drilling Contractor Cascade Drilling
Driller ______
Rig/Method Resonant Sonic
Depth Control Point ______

DEPTH ( )	TIME	SAMPLES TYPE	SAMPLES ID NUMBER	CONTAMINATION INSTR.	CONTAMINATION READING	MOISTURE	GRAPHIC LOG (C Z S G)	LITHOLOGIC DESCRIPTION (particle size distribution, sorting, mineralogy, roundness, color, reaction to HCl, etc.)	H_2O ADDED	CASING	DRILLING COMMENTS (drilling rate, down time, blow counts, water level, drill fluid, etc.)
51		Core	13C								
			13D			M		Sfn-vfn sand, 2.5Y6/4 (lt. yellowish			Ringold Fm.
			↓					brn), massive, micaceous,			
			13E					compact, trace silt, some			13E coarsens to mostly fn
			↓				brown	more compacted nodules/layers			sand in bottom half
			14A					v. well sorted, felsic, no			
			↓					rxn w/ HCl			Sudden color change @ 54.2'
			14B				green	Green sand is slightly siltier			to gleyed 5G5/2 (grayish
55			↓								green)
			14D			M-W		(z)S			14C is redrill of 14B? but appears
			↓			↓		Getting siltier with more hard,			intact
			14E			M		compacted nodules, 5G5/1			
			↓					(greenish gray)			
			15A					S, fn-vfn, 5G5/1 (greenish gray),			
			↓					weakly laminated, v. well			
		Core	15B					sorted, micaceous, felsic,			
			↓					no rxn w/ HCl, sl. compact			(z)fnS @ 59'-60
		Bag	15C					weak convolution @ 59-59.5', mottling?			melted liner - sample in bag
60			↓								15D is redrill of 15C
			↓					S, fn-vfn, as above but massive			15E held for Andy Ward
		Core	16A								
			↓								
			16B								
			↓								
			16C								

W = Wet, M = Moist, D = Dry

1998/DCL/PROC/DBL/001

Pacific Northwest National Laboratory

DAILY BOREHOLE LOG

Boring/Well No C4999 (399-3-18) Depth 64-77' Date 3-22-06 Sheet 6 of 11

Location 300 Area Project LFI

Logged by B N Bjornstad

Reviewed by ______ Date ______

Lithologic Class. Scheme ______ Procedure ______ Rev ______

Steel Tape/E-Tape ______ / ______ Field Indicator Equip. 1) ______ 2) ______

Drilling Contractor Cascade Drilling

Driller ______

Rig/Method Resonant sonic

Depth Control Point ______

DEPTH ( )	TIME	SAMPLES TYPE	SAMPLES ID NUMBER	CONTAMINATION INSTR.	CONTAMINATION READING	MOISTURE	GRAPHIC LOG (C Z S G)	LITHOLOGIC DESCRIPTION (particle size distribution, sorting, mineralogy, roundness, color, reaction to HCl, etc.)	H_2O ADDED	CASING	DRILLING COMMENTS (drilling rate, down time, blow counts, water level, drill fluid, etc.)
64		Core	16C			M		mS, fn-vfn sand, 5G5/1 (greenish			Ringold Fm.
			16D					gray, massive, compact, v.			16E a redrill of 16D?
65			↓					well sorted, micaceous, felsic,			
			17A					no rxn w/ HCl, few clayey silt			
			↓					hard nodules, some mottling			
			17B					80% S, 20% silt + clay			nice drag folding from here down
			↓				67.4	S, fn-vfn, 5G4/2 (grayish grn),			well laminated starting @ 67.4'
			17C					wk laminated, compact, micaceous			color change
			↓					zS and S, interlaminated, 10YR4/2			
			17D					(dk grayish brn), 5G4/2 (grayish grn) and 10YR6/1			(gray) interlaminations, well-
			↓					stratified, sand all fn-vfn, noncalc,			Mostly green 68.2-68.8', rest is
			17E					well sorted, micaceous, compact			mostly brown to gray
70			↓					dk Mn oxide or organic carbon?			
			18B				sl.	along some laminae			Slough at top 1/2 18B
			↓								
			18C					Interlaminated zS and S, as			
			↓					above, cross laminated, alternating brown and gray			
			18D					v. micaceous, noncalcareous			
			↓					Mn oxide or organics along some laminae			
			18E					crs sand-sized mica flakes			
			↓								
			19A					As above, some small cemented			
75			↓					nodules, noncalcareous, interlaminated			
			19B				sl.	brown and gray			slough, massive to mottled, gray
			↓								↓
			19C					zS and S, as above			

W = Wet, M = Moist, D = Dry

1998/DCL/PROC/DBL/001

Pacific Northwest National Laboratory

DAILY BOREHOLE LOG

Boring/Well No C4999 (399-3-18) Depth 77-90 Date 3-22-06 Sheet 7 of 11

Location 300 Area Project LFI

Logged by B N Bjornstad (Print) ______ (Sign) ______ (Print) ______ (Sign)

Reviewed by ______ (Print) ______ (Sign) Date ______

Lithologic Class. Scheme ______ Procedure ______ Rev ______

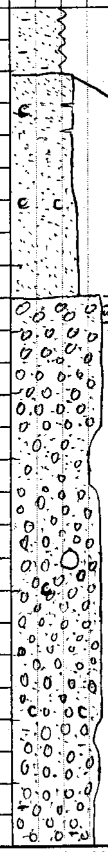
Steel Tape/E-Tape ______ / ______ Field Indicator Equip. 1) ______ 2) ______

Drilling Contractor Cascade Drilling

Driller ______

Rig/Method Resonant sonic

Depth Control Point ______



DEPTH ( )	TIME	SAMPLES TYPE	SAMPLES ID NUMBER	CONTAMINATION INSTR.	CONTAMINATION READING	MOISTURE	GRAPHIC LOG C Z S G	LITHOLOGIC DESCRIPTION (particle size distribution, sorting, mineralogy, roundness, color, reaction to HCl, etc.)	H_2O ADDED	CASING	DRILLING COMMENTS (drilling rate, down time, blow counts, water level, drill fluid, etc.)
77		Core	19C			M		zS and S (fn-vfn) interlaminated,			H_2S smell?
			19D			↓		excellent cross lamination,			sharp contact
			↓					alternating laminae of 10YR4/2 (zS) and 10YR 7/1 (lt. gray) sand, non calc.			
			19E					S, md, v. well sorted, 2.5YN7/ (lt. gray)			
			↓					well laminated, sl. compact, noncalcareous			
			20A					max part. size = crs mica flakes, dk organic mats (1-2mm) along some laminae			
80			↓					organic-rich layer @ 80.1'			
			20B					md-crs sand, homogeneous,			
			↓			↓					
			20D			W		SG, bimodal, matrix = mostly			3/23/06 Ringold gravel
			↓					md sand, framework = mostly			Upper 4" fragmented - slough?
			20E					md-crs pebble, clast supported,			50% G, 50% S
			↓					well sorted within modes,			(~50%)
			21A					5Y5/1 (gray), S = 15-25% mafic,			More sand around 84' - matrix
			↓					G = 20-30% basalt, most gravel			supported
			21B					clasts rnded to well rnded and			
85			↓					polished, micaceous, 10-20% clasts broken,			qtzite cobble
			21C					lgst clast = 3", little or no silt,			wood fragments
			↓					compacted but no cementation			21E = redrill of 21C
			22A								Core 21D held out for column
			22B								studies
			↓					wood fragments			
			22C					silt skins, darker color (2.5Y5/2), grayish brn			
			↓								
		Core	22D					zSG, 50% G, 35% S, 15% Z, 5Y4/1 (dk gray)			
			↓			↓		silt skins, mod sorted, clast supported			

W = Wet, M = Moist, D = Dry

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Pacific Northwest National Laboratory

DAILY BOREHOLE LOG

Boring/Well No C4999 (399-3-18) Depth 90-103 Date 3-23-06 Sheet 8 of 11

Location 300 Area Project LFI

Logged by B N Bjornstad (Print) ______ (Sign) ______ (Print) ______ (Sign)

Reviewed by ______ (Print) ______ (Sign) Date ______

Lithologic Class. Scheme ______ Procedure ______ Rev ______

Steel Tape/E-Tape ______ / ______ Field Indicator Equip. 1) ______ 2) ______

Drilling Contractor Cascade Drilling

Driller ______

Rig/Method Resonant sonic

Depth Control Point ______

DEPTH ( )	TIME	SAMPLES TYPE	SAMPLES ID NUMBER	CONTAMINATION INSTR.	CONTAMINATION READING	MOISTURE	GRAPHIC LOG (C Z S G)	LITHOLOGIC DESCRIPTION (particle size distribution, sorting, mineralogy, roundness, color, reaction to HCl, etc.)	H_2O ADDED	CASING	DRILLING COMMENTS (drilling rate, down time, blow counts, water level, drill fluid, etc.)
90		Core	22E			W		zsG, clast supported, 50% well			
			↓			↓		rnded and polished md-crs pebbles,			
								40% S, 10% Z, G= 15-25%			Core sample dropped out,
								basalt, S= 10-20% mafic,			recovered sample unrepresentative.
								mostly md grained, 5Y4/1 (dk gray),			Consists of graded bed with
								10-20% gravel clasts are fragmented,			sand on top - all
								compacted but no cementation			slough. Core photos taken.
								lgst clast = 1.5", mod. sorted			23A - 24A
		Core	24B			W		sG, loose, slough?			
			↓					zsG, 5Y4/1 (dk gray), clast			
95			24C					supported, 60% G, 30% S, 10% Z,			Wthrd basalt clast fills width of
			↓					G= 20-30% basalt, S= 20-30% basalt,			liner (>5")
			24D					micaceous, 20-30% clasts fragmented			
			↓					sG, as above, but with little silt			
			24E					5Y5/2 (olive gray)			Some clayey matrix @ 97.5'
			↓								qtzite clast fills width of liner
			25A								
			↓								
			25B			↓					
			25C			W		sG, clast supported, 60% G			Loose sG = slough
100			↓					35% S, 5% Z, micaceous, 10-20%			
			25D					clasts fragmented, mod. sorted,			
			↓					S= mostly md = 20-30% mafic,			
			25E					compacted but no cementation			
			↓					G= 20-30% basalt, lgst clast =			
		Core	26A			↓		2"			

W = Wet, M = Moist, D = Dry

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DAILY BOREHOLE LOG

Boring/Well No C4999 (399-3-18) Depth 103 - 116 Date 3-23-06 Sheet 9 of 11

Location 300 Area Project LFI

Logged by BN Bjornstad (Print) _____ (Sign) | _____ (Print) _____ (Sign)

Reviewed by _____ (Print) _____ (Sign) Date _____

Lithologic Class. Scheme _____ Procedure _____ Rev _____

Steel Tape/E-Tape _____ / _____ Field Indicator Equip. 1) _____ 2) _____

Drilling Contractor Cascade Drilling

Driller _____

Rig/Method Resonant Sonic

Depth Control Point _____

DEPTH ( )	TIME	SAMPLES TYPE	SAMPLES ID NUMBER	CONTAMINATION INSTR.	CONTAMINATION READING	MOISTURE	GRAPHIC LOG (C Z S G)	LITHOLOGIC DESCRIPTION (particle size distribution, sorting, mineralogy, roundness, color, reaction to HCl, etc.)	H_2O ADDED	CASING	DRILLING COMMENTS (drilling rate, down time, blow counts, water level, drill fluid, etc.)
103		Core	26A			W		zSG			
			26B					S, md; well sorted, 10-20% mafic (crs)			
			↓					mostly md, gleyed 5G 5/1 (greenish gray), massive			
			26C					zsG, mostly fn-md pebble, 50% G,			26D is redrill of 26C
105			↓					40% S (mostly md), 10% Z, clast			
			26E					supported, S = 20-30% basalt G = 20-30% basalt			slough?
			↓					compacted but no cementation, mod sorted			↓ Loose pebble G - little S or M
			27A					Gravel clasts rnd-well rnd and polished,			| Loose, msv gravel and sand,
			↓					5Y5/1 (gray)			↓ no gravel impressions
			27B					gS, 30% G, 65% S, 5% Z, 5Y5/2			|
			↓					(olive gray), loose			|
			27C					sG, as above			27E is redrill of 27C
			↓					zsG, as above			
			28A					sG			slough, loose gravel and sand
110			↓					zsG, as above			↓ gravel impressions
			28B					30-40% clasts fragmented			
			↓								
			28C					sG, 60% G, 35% S, 5% Z, clast			Color change from gray to brn
			↓					supported, G = fn-md pebble = 30-40%			
			28D					basalt, S = md-crs (mostly md) = 20-			
			↓					30% mafic, 2.5Y5/2 (grayish brn)			
			28E					well sorted in modes, lgst clast =			lost core
			↓					2.5", 10-20% clasts fragmented			loose s and gravel = slough
			29A								poorly sorted
115			↓								
		Core	29B			↓					↓

W = Wet, M = Moist, D = Dry

B.25

Pacific Northwest National Laboratory	DAILY BOREHOLE LOG	Boring/Well No C4999 (399-3-18) Depth 116-129 Date 3-27-06	Sheet 10 of 11
		Location 300 Area Project LFI	

Logged by B N Bjornstad (Print) (Sign) / (Print) (Sign)

Reviewed by (Print) (Sign) Date

Lithologic Class. Scheme Procedure Rev

Steel Tape/E-Tape / Field Indicator Equip. 1) 2)

Drilling Contractor Cascade Drilling

Driller

Rig/Method Resonant Sonic

Depth Control Point

DEPTH ( )	TIME	SAMPLES TYPE	SAMPLES ID NUMBER	CONTAMINATION INSTR.	CONTAMINATION READING	MOISTURE	GRAPHIC LOG (C Z S G)	LITHOLOGIC DESCRIPTION (particle size distribution, sorting, mineralogy, roundness, color, reaction to HCl, etc.)	H_2O ADDED	CASING	DRILLING COMMENTS (drilling rate, down time, blow counts, water level, drill fluid, etc.)
116		Core	29B			W		Loose sand and gravel, dk gray = slough, poorly sorted			
			29C					ZSG, 60% G 30% S 10% Z			
			↓					2.5YN4/ (dk gray), lgst clast: 2"			
			29D					mod-poorly sorted, 20% clasts			
			↓					fragmented, clast supported,			
			29E					massive, compacted but uncemented			silt skins
			↓					S≈20-30% basalt, G=20-30% basalt			↓
			30A					S= mostly fn-md			
120			↓					SG, as above but little silt and mostly md sand matrix			
											Lost Core
											↓
			30D			W		md-crs sand, loose, massive			slough
			↓					sm. pebble gravel - no matrix			↓
			30E					loose sand and gravel, massive, poorly sorted = slough			
			↓								
			31A					SG, 60% G (sm-md pebble), 35%			
			↓					S(mostly md), 5% Z, well			
125			31B					sorted within mode, bimodal,			31C redrill of 31B
			31D					micaceous, 2.5Y5/2 (grayish brn)			
			↓C			M		clast supported, S≈20-30% basalt			Hit Ringold Mud @ 126.4'
			31E					mZ, 50% fn sand, 50% Z and clay,			sharp contact
			↓					compact, laminated, 5BG 5/1 (dk			mostly fn sand @ 127 5GY6/1
			32A					greenish gray, micaceous, v. well			(greenish gray)
			↓					sorted, no rxn w/ HCl			32A kept out for Andy Ward
			32B			M		mZ, same as above			

W = Wet, M = Moist, D = Dry

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DAILY BOREHOLE LOG

Boring/Well No C4999 (399-3-18) Depth 129-130.5 Date 3-27-06 Sheet 11 of 11

Location 300 Area Project LFI

Logged by BN Bjornstad (Print / Sign)

Reviewed by ________ (Print / Sign) Date ________

Lithologic Class. Scheme ________ Procedure ________ Rev ________

Steel Tape/E-Tape ________ / ________ Field Indicator Equip. 1) ________ 2) ________

Drilling Contractor Cascade Drilling

Driller ________

Rig/Method Resonant Sonic

Depth Control Point ________

DEPTH ( )	TIME	SAMPLES TYPE	SAMPLES ID NUMBER	CONTAMINATION INSTR.	CONTAMINATION READING	MOISTURE	GRAPHIC LOG (C Z S G)	LITHOLOGIC DESCRIPTION (particle size distribution, sorting, mineralogy, roundness, color, reaction to HCl, etc.)	H_2O ADDED	CASING	DRILLING COMMENTS (drilling rate, down time, blow counts, water level, drill fluid, etc.)
129		Core	32B			M		mZ, as above, well laminated,			
			32C			↓		few hard laminae of darker clay			
130			↓			↓		zfnS, well laminated, grayish			distinct color change to 10YR 5/2
								brn, compact, no rxn W/HCl			(grayish brn) @ 130.2 where
								well sorted, 60% fn-vfn sand,			changes to z fn sand
								40% silt			

W = Wet, M = Moist, D = Dry

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Pacific Northwest National Laboratory	DAILY BOREHOLE LOG	Boring/Well No C5000 (399-1-23) Depth 0-11.5' Date 4-10-06	Sheet 1 of 9
		Location 300 Area Project LFI	

Logged by B N Bjornstad (Print) (Sign) (Print) (Sign)

Reviewed by ______ (Print) (Sign) Date ______

Lithologic Class. Scheme ______ Procedure ______ Rev ______

Steel Tape/E-Tape ______ / ______ Field Indicator Equip. 1) ______ 2) ______

Drilling Contractor Cascade Drilling

Driller ______

Rig/Method Resonant Sonic

Depth Control Point ______

DEPTH ( )	TIME	SAMPLES TYPE	SAMPLES ID NUMBER	CONTAMINATION INSTR.	CONTAMINATION READING	MOISTURE	GRAPHIC LOG (C Z S G)	LITHOLOGIC DESCRIPTION (particle size distribution, sorting, mineralogy, roundness, color, reaction to HCl, etc.)	H_2O ADDED	CASING	DRILLING COMMENTS (drilling rate, down time, blow counts, water level, drill fluid, etc.)
0		core	32D			SM		SG, 40% G, 60% S, mod sorted,			Drill pad material?
			↓			↓		lgst clast = 3", S = mostly md =			↓
			32E					30-40% basalt G = 80-90% basalt,			
			↓					10YR 5/4 (yellowish brn), matrix			
1.5			33A					supported, sl. compacted, no			Bulk density cylinder collected @ 2.5'
			↓					rxn w/ HCl			laminated
			33B					S, md grained, well sorted, compacted,			↓
			↓					same color as above S = 30-40% basalt			Hanford fm.
			33C					massive, no rxn w/ HCl, wkly			
			↓					laminated @ 3', occasional sm. pebble			calcareous
5			33D					coarsens toward bottom (md-crs sand)			34A = slough = redrill of 33D
			↓			↓		ZSG, 60% G, 30% S, 10% silt,			
5.5			34B			SM		clast supported, poorly sorted,			
			↓					2.5Y5/4 (lt. olive brn), S = fn-crs = 30-40% basalt			
			34C					G = 40-50% basalt, strng rxn w/ HCl @ 5'			lgst clast = 5", 30% Ringold
6.5			↓					gravel, 20-30% clasts fragmented			large cobble (~150 mm)
			34D								35B = slough = redrill of 34D
7.5			↓			↓					35C = mostly slough
			35C			D		v. silty, loose, dry fragmented			Totally pulverized
8.5			↓			↓		gravel 2.5Y 6/4 (lt. yel. brn)			↓ looks like slough but @ base of run
			35D			SM		ZSG, 50% sm pebble, 35% S,			lots of silt coatings
			↓					15% silt, poorly sorted,			sorted sm. pebbles, lots of
10			35E			↓		10YR 4/4 (dk yel. brn), S = 30-40% basalt			reworked Ringold clasts
			↓			D		G = 40-50% basalt, no rxn w/ HCl,			↓
			36A					lgst clast = 4"			36D = slough = redrill of 36A
			↓								

W = Wet, M = Moist, D = Dry

1998/DCL/PROC/DBL/001

Well C5000

Pacific Northwest National Laboratory

DAILY BOREHOLE LOG

Boring/Well No C5000 (399-1-23) Depth 11.5-24.5 Date 4-10-06

Location 300 Area Project LFI

Sheet 2 of 9

Logged by B N Bjornstad (Print) ______ (Sign) ______ (Print) ______ (Sign)

Reviewed by ______ (Print) ______ (Sign) Date ______

Lithologic Class. Scheme ______ Procedure ______ Rev ______

Steel Tape/E-Tape ______ / ______ Field Indicator Equip. 1) ______ 2) ______

Drilling Contractor Cascade Drilling

Driller ______

Rig/Method Resonant Sonic

Depth Control Point ______

DEPTH ( )	TIME	SAMPLES TYPE	SAMPLES ID NUMBER	CONTAMINATION INSTR.	CONTAMINATION READING	MOISTURE	GRAPHIC LOG (C Z S G)	LITHOLOGIC DESCRIPTION (particle size distribution, sorting, mineralogy, roundness, color, reaction to HCl, etc.)	H_2O ADDED	CASING	DRILLING COMMENTS (drilling rate, down time, blow counts, water level, drill fluid, etc.)
11.5		core	36E			D	si.	massive, v. poorly sorted, matrix			slough
			↓			↓		supported SZG = slough?			↓
			37A			SM		msG, 50% G, 30% S, 20% mud,			
			↓			↓		poorly sorted, 2.5Y5/2 (grayish brn)			Hanford fm.
			37B				reserved	no rxn w/ HCl, S = 40-50% basalt,			37B (13.5-14.5) held out for
			↓					G = 50-60% basalt, lgst clast = 3"			column studies
15											Lost core
											↓
			38A			D	si.	loose zSG, v. poorly sorted, massive			slough
			↓			↓		↓			↓
			38B			↓					
20			↓			M		zSG, 40% G, 45% S, 15% silt,			silt coatings
			38C			W		2.5Y4/2 (dk grayish brn), poorly sorted,			↓
			↓			↓		S = mostly crs = 60-70% basalt			yellowish (2.5Y6/4) mud matrix
			39A			SM	si.	G = 80% basalt, lgst clast = 2			mostly sm. pebbles, wet due to muddy matrix (Ringold rip up?)
			↓			↓		some Fe oxide staining			
			39B			W		smG, 60% G, 20% S, 20% silt,			yellowish muddy matrix (reworked
			↓			↓		2.5Y6/4 (lt. yel. brn), v. poorly sorted,			Ringold mud)
			39C				reserved	lgst clast = 2.5", basaltic gravel			39C (23.5-24.5) held out for
			↓								column studies

W = Wet, M = Moist, D = Dry

Pacific Northwest National Laboratory	DAILY BOREHOLE LOG	Boring/Well No C5000 (399-1-23) Depth 24.5-37.5' Date 4-10-06	Sheet 3 of 9
		Location 300 Area Project LFI	

Logged by B N Bjornstad (Print) ______ (Sign) ______ (Print) ______ (Sign)

Reviewed by ______ (Print) ______ (Sign) Date ______

Lithologic Class. Scheme ______ Procedure ______ Rev ______

Steel Tape/E-Tape ______ / ______ Field Indicator Equip. 1) ______ 2) ______

Drilling Contractor Cascade Drilling

Driller ______

Rig/Method Resonant Sonic

Depth Control Point ______

DEPTH ( )	TIME	SAMPLES TYPE	SAMPLES ID NUMBER	CONTAMINATION INSTR.	CONTAMINATION READING	MOISTURE	GRAPHIC LOG (C Z S G)	LITHOLOGIC DESCRIPTION (particle size distribution, sorting, mineralogy, roundness, color, reaction to HCl, etc.)	H_2O ADDED	CASING	DRILLING COMMENTS (drilling rate, down time, blow counts, water level, drill fluid, etc.)
25		core	39D			M		ZSG, 60% G 25% S, 15% silt,			Ringold rip-up clast of brn zfnS
			↓			↓		poorly sorted, lgst clast = 5"			
								S = 40-50% basalt, G = 40% basalt			Lost core
								2.5Y5/2 (grayish brn), compacted			↓
								but not cemented, no rxn w/HCl			
								Ringold rip-up clast = deformed			
								during drilling, 1" wide 3" long,			
								compacted zfn sand, well sorted,			
								10YR6/4 (lt. yel. brn), poorly sorted			
30			40A			M		zSG, brnish mud (Ringold) rip ups,			
			↓			↓		like above, 25% clasts fragmented			Hanford fm.
			40B								
			↓								
			40C			W		smG, silt skins, dk grayish brn			
			↓			↓		S crs, 40-50% basalt, ↓			
			40D								40D (32.5-33.5) held out for tests
			↓				reserved				▽ 33.5 = water table
			40E			D		Powdery szG, no rxn w/HCl, v. poorly sorted			All pulverized
			↓			↓ SM		2.5Y 7/2 (lt. gray), looks like slough?			↓
35			41B								
			↓			W		ZSG, 40% pebble gravel, 40% S,			Hanford fm.
			41C					20% silt, poorly sorted, S = 60-70%			
			↓					basalt, G = 50-60% basalt,			
			41D					2.5Y5/2 (grayish brn), 20% clasts			Fe oxide @ 37.2' Soupy matrix
			↓			↓		fragmented loose			due to silt

W = Wet, M = Moist, D = Dry

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Pacific Northwest National Laboratory	DAILY BOREHOLE LOG	Boring/Well No C5000 (399-1-23)	Depth 37.5-50.5	Date 4-10-06	Sheet 4 of 9
		Location 300 Area	Project LFI		

Logged by B N Bjornstad (Print) / (Sign) / (Print) / (Sign)	Drilling Contractor Cascade Drilling
Reviewed by (Print) / (Sign) Date	Driller
Lithologic Class. Scheme Procedure Rev	Rig/Method Resonant sonic
Steel Tape/E-Tape / Field Indicator Equip. 1) 2)	Depth Control Point

DEPTH ( )	TIME	SAMPLES TYPE	SAMPLES ID NUMBER	CONTAMINATION INSTR.	CONTAMINATION READING	MOISTURE	GRAPHIC LOG (C Z S G)	LITHOLOGIC DESCRIPTION (particle size distribution, sorting, mineralogy, roundness, color, reaction to HCl, etc.)	H_2O ADDED	CASING	DRILLING COMMENTS (drilling rate, down time, blow counts, water level, drill fluid, etc.)
37.5		core	41E			W		ZSG, 50% G, 30% S, 20% silt			Soupy mud matrix
			↓			↓		poorly sorted, loose, S = mostly			↓
			42A				reserved	crs = 50-60% basalt, G = 50%			42A held out for column studies
			↓					basalt, 2.5Y5/2 (grayish brn),			
								lgst clast = 2"			lost core
40											↓
											↓
			43A			W		SG, 60% pebble gravel, 40% md-			Hanford fm. Fell out of core barrel
			↓			↓		crs sand, mod sorted,			↓
45			43B					2.5Y 5/2 (grayish brn), loose			
			↓			↓		S = 70-80% basalt, G = 50-60%			browner color due to Ringold silt
								basalt, lgst clast = 2"			in matrix
								ZSG 10YR 5/2 (grayish brn),			
			44A			W		50% G, 25% S, 25% Z, lots of			
			↓					silt, poorly sorted, S = 40-50%			gS, loose, poorly sorted, basaltic
			44B					basalt, loose			
			↓					ZSG, loose, soupy, S = 50-60% basalt			
			44C					10YR 5/2 (grayish brn), poorly sorted,			
			↓					S = 40-50% bas. lgst clast = 5" G 60-70% basalt			Hanford fm.
50			44D				sl	zgS - G, graded			slough
			↓			↓					

W = Wet, M = Moist, D = Dry

1998/DCL/PROC/DBL/001

B.31

Pacific Northwest National Laboratory	DAILY BOREHOLE LOG	Boring/Well No C5000 (399-1-23)	Depth 50.5-63.5	Date 4-10-06	Sheet 5 of 9
		Location 300 Area		Project LFI	

Logged by B N Bjornstad (Print / Sign) ____ (Print / Sign)

Reviewed by ____ (Print / Sign) Date ____

Lithologic Class. Scheme ____ Procedure ____ Rev ____

Steel Tape/E-Tape ____ / ____ Field Indicator Equip. 1) ____ 2) ____

Drilling Contractor Cascade Drilling

Driller ____

Rig/Method Resonant Sonic

Depth Control Point ____

DEPTH ( )	TIME	SAMPLES TYPE	SAMPLES ID NUMBER	CONTAMINATION INSTR.	CONTAMINATION READING	MOISTURE	GRAPHIC LOG (C Z S G)	LITHOLOGIC DESCRIPTION (particle size distribution, sorting, mineralogy, roundness, color, reaction to HCl, etc.)	H_2O ADDED	CASING	DRILLING COMMENTS (drilling rate, down time, blow counts, water level, drill fluid, etc.)
50.5		Core	44E			W		ZSG, poorly sorted, massive, loose			slough or highly reduced (dk gray)
			↓					homogeneous, 2.5Y N4/ (dk gray)			
			45A								↓
			↓								
			45B					more compact, micaceous			Ringold Fm starts about here?
			↓					S=20-30% basalt, sand grains stained dark			
			45C					sG, bimodal, 60% G, 30% S, <10% Z,			
			↓					clast supported, sl. compact,			
55			45D					micaceous, S=md: 10-20% mafic			45E = slough = redrill of 45D
			↓					G=30-40% basalt, 2.5Y5/2			silt skins
			46A					(grayish brn), lgst clast = 2.5",			
			↓					10-20% clasts fragmented,			
			46B					most clasts well rnded and polished			
			↓								lighter gray (2.5Y6/2) at bottom
			46C				reserved				46C held out for column studies
			↓								
			46D			W		same as above, still reduced			4/11/06
			↓					(2.5Y5/2 - grayish brn), clean			
60			46E					md-crs sand matrix, bimodal,			47A = slough - basaltic, loose
			47B					micaceous			
			↓								
			47C					10-20% clasts fragmented			
			↓								
			47D					lgst clast = 4", G=40% basalt,			48B redrill of 47D
			↓					S=10-15% mafic			
			47E								Lost core

W = Wet, M = Moist, D = Dry

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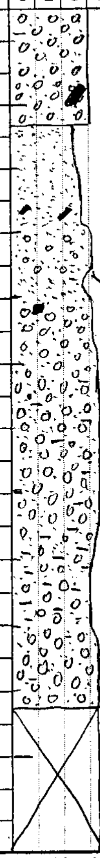
Pacific Northwest National Laboratory	DAILY BOREHOLE LOG	Boring/Well No C5000 (399-1-23)	Depth 63.5-76.5	Date 4-11-06	Sheet 6 of 9
		Location 300 Area	Project LFI		

Logged by B N Bjornstad (Print) ______ (Sign)	Drilling Contractor Cascade Drilling
Reviewed by ______ (Print) ______ (Sign) Date ______	Driller
Lithologic Class. Scheme ______ Procedure ______ Rev ______	Rig/Method Resonant Sonic
Steel Tape/E-Tape ______ / ______ Field Indicator Equip. 1) ______ 2) ______	Depth Control Point

DEPTH ( )	TIME	SAMPLES TYPE	SAMPLES ID NUMBER	CONTAMINATION INSTR.	CONTAMINATION READING	MOISTURE	GRAPHIC LOG (C Z S G)	LITHOLOGIC DESCRIPTION (particle size distribution, sorting, mineralogy, roundness, color, reaction to HCl, etc.)	H_2O ADDED	CASING	DRILLING COMMENTS (drilling rate, down time, blow counts, water level, drill fluid, etc.)
63.5		core	48C			W		same as above but with			Ringold Unit E
			↓					slightly more silt, silt skins			
			48D					around gravel clasts			2cm chunk of fibrous wood @ 65'
65			↓			↓		S, md, well sorted, 5Y7/1 (lt. gray)			sharp contact
			48E			M		micaceous, 10-15% mafic,			Collected bulk density cylinder from 48E
			↓					sl. compact, laminated,			Several chocolate brown wood
			49A			↓		sl. coarser toward base			fragments (7.5YR 3/2 - dk brn)
			↓			W		gS, 30% G 70% md-crs sand,			
			49B					well sorted, bimodal, G: sm. pebble,			
			↓					matrix supported 2.5Y6/2 (lt. brnish gray)			1 2cm-long greenish rip up, laminated
			49E					sG-zsG, G= mostly sm. pebble, bimodal,			49D = slough = redrill of 49B
			↓					well sorted in modes, G=40% = 20-30% basalt			Gleyed (5BG4/1) dk grnish gray
70			50A					S=60% = 15-25% mafic = md-crs, 2.5Y5/2 (grayish brn)			Fe oxide nodules at 69'
			↓					Gravel coarsens to sm. cobble, silt skins, 10-15% silt			
			50B					Reduced colors			
			↓			↓		20-25% silt			
			50C			M		smG, 40% G, 30% S, 30% mud, 2.5Y 4/2 (dk grayish brn)			50D = slough = redrill of 50C
			↓					lgst clast = 2", poorly sorted, compact,			
			50E			↓		clay skins, laminated, no rxn w/ HCl			
			51A			W		zsG, as above, still reduced (dk gray)			
			↓			↓					
			51B								Lost core
75			↓								↓

W = Wet, M = Moist, D = Dry

1998/DCL/PROC/DBL/001

Pacific Northwest National Laboratory	DAILY BOREHOLE LOG	Boring/Well No C5000 (399-1-23)	Depth 76.5-89.5	Date 4-11-06	Sheet 7 of 9
		Location 300 Area	Project LFI		

Logged by B N Bjornstad	Drilling Contractor Cascade Drilling
Reviewed by ______ Date ______	Driller
Lithologic Class. Scheme ______ Procedure ______ Rev ______	Rig/Method Resonant Sonic
Steel Tape/E-Tape ______ / ______ Field Indicator Equip. 1) ______ 2) ______	Depth Control Point

DEPTH ( )	TIME	SAMPLES TYPE	SAMPLES ID NUMBER	CONTAMINATION INSTR.	CONTAMINATION READING	MOISTURE	GRAPHIC LOG (C Z S G)	LITHOLOGIC DESCRIPTION (particle size distribution, sorting, mineralogy, roundness, color, reaction to HCl, etc.)	H_2O ADDED	CASING	DRILLING COMMENTS (drilling rate, down time, blow counts, water level, drill fluid, etc.)
76.5		core	51E			W		SG, bimodal, 30% G, 60% S, 10% Z,			reduced green (gleyed)
			↓					well sorted in modes, lgst clast = 1"			↓
			52A					5G5/1 (greenish gray), sl. compact,			ZSG, 2.5Y5/2 (grayish brn)
			↓					S = 10-20% mafic, micaceous			silt skins
			52B					G = 20-30% basalt, 10-20%			Gleyed @ 78.5' again, sl. coarser
			↓					clasts pulverized, unpulverized			
			52C					clasts rounded and polished			Gleyed nodules, sandy areas
80			↓					ZSG, interbedded dk gray and			more gleyed, silty zones
			52D					greenish gleyed, poorly sorted,			dk gray
			↓					compact,			53A = slough = redrill of 52D
			53B				sl.	gS, loose, graded, no silt skins			4/13/06 slough
			↓								↓
			53C					ZSG, 2.5Y5/2 (grayish brn),			
			↓					compact, silt skins			still reduced color
			53D					40% G, 40% S, 20% silt,			sand lens ~3" thick, gleyed
			↓				*	mod. sorted, lgst clast = 2.5"			(5G5/1 = greenish gray), msv,
85			53E					mostly md sand, micaceous, clast supported			miceous, well sorted, md grained,
			↓			↓		SG, 5G4/1 (dk greenish gray), bimodal			10-20% mafic, bulk density
			54A				reserved				cylinder collected in sand
			↓								54A held out for column study
			54E			W	sl.	gS, loose, sl. graded, mostly			slough
			↓					angular gravel clasts			
			55A					(s)G, v. little matrix, v. loose			
			↓								↓
			55C			↓					slough

W = Wet, M = Moist, D = Dry * geochem sample

Pacific Northwest National Laboratory

DAILY BOREHOLE LOG

Boring/Well No C5000 (399-1-23) Depth 89.5-102.5 Date 4-13-06 Sheet 8 of 9

Location 300 Area Project LFI

Logged by B N Bjornstad (Print) ______ (Sign) ______ (Print) ______ (Sign)

Reviewed by ______ (Print) ______ (Sign) Date ______

Lithologic Class. Scheme ______ Procedure ______ Rev ______

Steel Tape/E-Tape ______ / ______ Field Indicator Equip. 1) ______ 2) ______

Drilling Contractor Cascade Drilling

Driller ______

Rig/Method Resonant Sonic

Depth Control Point ______

DEPTH ( )	TIME	SAMPLES TYPE	SAMPLES ID NUMBER	CONTAMINATION INSTR.	CONTAMINATION READING	MOISTURE	GRAPHIC LOG C Z S G	LITHOLOGIC DESCRIPTION (particle size distribution, sorting, mineralogy, roundness, color, reaction to HCl, etc.)	H_2O ADDED	CASING	DRILLING COMMENTS (drilling rate, down time, blow counts, water level, drill fluid, etc.)
90		Core	55C			W		sG, 40% G, 55% S, 5% silt,			Slough
			55D					bimodal, well sorted in modes,			
			↓					lgst clast = 1.5" 2.5Y5/2 (grayish			
			55E					brn), md-crs sand matrix,			↓
			↓					S = 20-30% mafic, G = 30-40% basalt,			
			56A					sl. compact, no silt skins			clasts up to 4" dia. = sm. cobble
			↓					zsG, like above but more compact			
			56B					w/ 10-20% silt, silt skins			Ringold Unit E
			↓					SG, as above, lighter color (2.5Y 6/2 - lt.			
			56C					brnish gray), silt skins, G = 40-50% basalt			
95			↓			↓		mS to sM, mod sorted, hard, compacted			
								or cemented, no rxn w/HCl,			hard nodules up to 3" dia.
			56E			W		5Y5/2 (olive gray), massive,			slough
			↓					zsG, loose, massive, fragmented,			
			57A					v. poorly sorted			
			↓								
			57B								
			↓								
			57C								
			↓								
100			57D								57E = slough = redrill of 57D
			↓								↓ ↓
			58A					zSG, 50% G, 40% S, 10-15% Z			
			↓					compact, silt skins, 5G5/1 (greenish			
			58B			M		gray), lgst clast = 2.5", poorly sorted,			S, md, well sorted, msv, 5GY5/1,
			↓			↓		S = 10-20% mafic, G = 30-40% basalt, micaceous			density cylinder collected zfn sand at v. bottom

W = Wet, M = Moist, D = Dry 10-20% clasts fragmented

1998/DCL/PROC/DBL/001

B.35

Pacific Northwest National Laboratory	DAILY BOREHOLE LOG	Boring/Well No C5000 (399-1-23) Depth 102.5-115' Date 4-13-06	Sheet 9 of 9
		Location 300 Area Project LFI	

Logged by B N Bjornstad (Print) (Sign) | (Print) (Sign)

Reviewed by (Print) (Sign) Date

Lithologic Class. Scheme Procedure Rev

Steel Tape/E-Tape / Field Indicator Equip. 1) 2)

Drilling Contractor Cascade Drilling

Driller

Rig/Method Resonant Sonic

Depth Control Point

DEPTH ( )	TIME	SAMPLES TYPE	SAMPLES ID NUMBER	CONTAMINATION INSTR.	CONTAMINATION READING	MOISTURE	GRAPHIC LOG (C Z S G)	LITHOLOGIC DESCRIPTION (particle size distribution, sorting, mineralogy, roundness, color, reaction to HCl, etc.)	H_2O ADDED	CASING	DRILLING COMMENTS (drilling rate, down time, blow counts, water level, drill fluid, etc.)
		core	58C			W		zS, mod sorted, msv, same color			
103			↓					sG-zsG, 50% G, 40% S, 10% Z,			1gst clast fills liner
			59A					mod sorted, compacted, silt			Ringold Unit E
			↓					skins, 5GY5/1 (greenish gray),			gleyed and reduced throughout
105			59B					micaceous, S= 20% mafic, G=			silt varies from 5-20%
			↓					30-40% basalt, 10-20% clasts fragmented			
			59C					most clasts well rnded/polished			
			↓								60B = redrill of this interval
			59D								
			↓					5G5/1 (greenish gray), clean			60C = redrill of this interval
			59E					md-crs sand			
			↓								
			60D								
			60E								
110			↓								Sharp contact
			61A			M		zS-Z, silty fn-vfnS to silt,			110.3'= Top Lower mud
			↓					interlaminated, some			bulk density cylinder collected
			61B					hard and compact silty/clayey			
			↓					laminae, no rxn w/ HCl,			clean zfnS @ 112'
								well sorted, 5G6/1 (greenish gray)			core in plastic bag
								interlam with 5BG4/1 (dk			
								greenish gray),			
115											

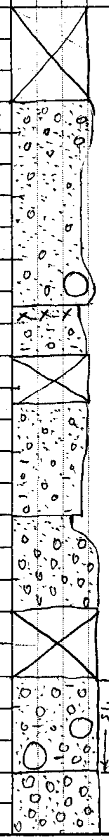
W = Wet, M = Moist, D = Dry

1998/DCL/PROC/DBL/001

Pacific Northwest National Laboratory	DAILY BOREHOLE LOG	Boring/Well No C5001 (399-3-19)	Depth 0-13	Date 5-2-06	Sheet 1 of 7
		Location 300 Area		Project LFI	

Logged by B N Bjornstad (Print / Sign)		Drilling Contractor	Cascade Drilling
Reviewed by (Print / Sign)	Date	Driller	
Lithologic Class. Scheme	Procedure / Rev	Rig/Method	Resonant sonic
Steel Tape/E-Tape /	Field Indicator Equip. 1) 2)	Depth Control Point	

DEPTH ( )	TIME	SAMPLES TYPE	SAMPLES ID NUMBER	CONTAMINATION INSTR.	CONTAMINATION READING	MOISTURE	LITHOLOGIC DESCRIPTION (particle size distribution, sorting, mineralogy, roundness, color, reaction to HCl, etc.)	H_2O ADDED	CASING	DRILLING COMMENTS (drilling rate, down time, blow counts, water level, drill fluid, etc.)
										5" diameter, 1' long lexan liners
							gS, 40% G, 60% S, moderately			3" missing in 61E
							sorted, loose, 2.5Y 5/4 (lt.			
			61E			SM	olive brn), max part. size = 3",			Backfill
			↓				mod rxn w/ HCl, S = 50%			20% gravel
			62A				basalt G = 50% basalt			
			↓				mostly md-crs sand			
			62B							Bulk density core collected
			↓				4" basalt cobble			
5			62C				black laminae (fly ash?)			Backfill
			↓			↓	zgS, poorly sorted, 10YR 5/6			
			63A				(yellowish brn)			63A ~50% fall
			↓			SM	10% Z			
			63B				zgS, 25% G, 65% S, 2.5Y 5/4			
			↓				(lt. olive brn), wk rxn w/ HCl,			
			63C				wk lamination, max part.			md sand lens, well sorted,
			↓				size = 3"			laminated 10YR 6/4 (lt. yel brn)
			63D				sG, bimodal, well sorted felsic			~30% basalt
			↓			↓	sand matrix, G = 30% basalt =			Ringold like matrix
							SA-SR 10YR 6/4 (lt. yel brn),			
10							$CaCO_3$ coating on many clasts, clast supported			
			64A			SM	zsG, poorly sorted, massive,			slough
			↓				pulverized			↓
			64B				↓			
			↓			↓	sG, like 63D, well sorted fn-md			
			64C				sand matrix, yellowish, str			Base of backfill



W = Wet, M = Moist, D = Dry rxn w/ HCl., felsic

1998/DCL/PROC/DBL/001

Pacific Northwest National Laboratory	DAILY BOREHOLE LOG	Boring/Well No C5001 (399-3-19)	Depth 13-26	Date 5-2-06	Sheet 2 of 7
		Location 300 Area		Project LFI	

Logged by B N Bjornstad

Reviewed by ______ Date ______

Lithologic Class. Scheme ______ Procedure ______ Rev ______

Steel Tape/E-Tape ______ / ______ Field Indicator Equip. 1) ______ 2) ______

Drilling Contractor Cascade Drilling Inc.

Driller ______

Rig/Method Resonant Sonic

Depth Control Point ______

DEPTH ( )	TIME	SAMPLES TYPE	SAMPLES ID NUMBER	CONTAMINATION INSTR.	CONTAMINATION READING	MOISTURE	GRAPHIC LOG (C Z S G)	LITHOLOGIC DESCRIPTION (particle size distribution, sorting, mineralogy, roundness, color, reaction to HCl, etc.)	H_2O ADDED	CASING	DRILLING COMMENTS (drilling rate, down time, blow counts, water level, drill fluid, etc.)
			64C			SM		SG, 60% G, 40% S, S =			Hanford fm.
			64D					mostly fn-md=60-70% basalt			
			↓					salt and pepper, mod sorted,			well sorted basaltic sand
			64E					G=20-40% basalt, clast supported			matrix
15			↓			↓		strng rxn w/HCl, 2.5Y 4/2			
								(dk grayish brn), lgst clast			
								= 4"			
								slough			
			65C			SM					
			↓					SG, 60% G 40% S, mod rxn w/ HCl			
			65D					salt and pepper sand matrix,			
			↓					mostly md-crs sand, S= 70-80%			
			65E					basalt, well sorted matrix,			siltier (5-10%)
20			↓					G= 50% basalt, lgst clast = 4"			
			66A					2.5Y 5/2 (grayish brn), clast			66A ~90% full
			↓			↓		supported, silt skins			
								smG, v. poorly sorted, 2.5Y5/2 (grayish brn)			
								strng rxn w/HCl			
			67A			SM		mSG, mod sorted, salt and pepper sand (slough?)			
			↓					SMG, poorly sorted, mod rxn w/HCl			v. muddy matrix
			67B					2.5Y5/2 (grayish brn), loose, lgst			67B ~ 90% full
25			↓					clast = 3", most clasts pulverized,			
								S= 60% basalt, G= 80% basalt			

W = Wet, M = Moist, D = Dry

1998/DCL/PROC/DBL/001

Pacific Northwest National Laboratory

DAILY BOREHOLE LOG

Boring/Well No C5001 (399-3-19) Depth 26-39 Date 5-2-06 Sheet 3 of 7
Location 300 Area Project LFI

Logged by B N Bjornstad (Print) ____ (Sign) ____ (Print) ____ (Sign)
Reviewed by ____ (Print) ____ (Sign) Date ____
Lithologic Class. Scheme ____ Procedure ____ Rev ____
Steel Tape/E-Tape ____ / ____ Field Indicator Equip. 1) ____ 2) ____

Drilling Contractor Cascade Drilling Inc.
Driller ____
Rig/Method Resonant sonic
Depth Control Point ____

DEPTH ( )	TIME	SAMPLES TYPE	SAMPLES ID NUMBER	CONTAMINATION INSTR.	CONTAMINATION READING	MOISTURE	GRAPHIC LOG (C Z S G)	LITHOLOGIC DESCRIPTION (particle size distribution, sorting, mineralogy, roundness, color, reaction to HCl, etc.)	H_2O ADDED	CASING	DRILLING COMMENTS (drilling rate, down time, blow counts, water level, drill fluid, etc.)
			67E			D		msG, pulverized, v. poorly sorted,			Hanford fm.
			↓			↓		massive 2.5Y5/2 (grayish brn)			
			68A			SM		wk rxn w/ HCl, variable amnts			
			↓					of silt in matrix, lgst clast =			
			68B					3", S = 70-80% basalt,			
			↓			↓		G = 50-60% basalt			v. crs sand matrix @ 29'
~~30~~			68C								68C held out for column
			↓								studies
											lost core
											↓
			69B			SM					
			↓			M		gS, 20% pebble, 80% v.crs-crs S,			
			69C					loose, salt and pepper, 2.5Y N4/			
			↓			↓		(dk gray), mod sorted, S = 80-90%			
			69D			W		basalt, G = 50-60% basalt, no			
			↓			↓		rxn w/ HCl			SmG, 60% G, 20% S, 20% M,
~~35~~								(s)G, md-crs pebble, little matrix			2.5Y5/2 (grayish brn), poorly
								50-60% basalt, crs sand stuck			sorted
								to outside pebbles 2.5Y4/2 (dk grayish brn)			
			70C			M		msG, poorly sorted, mostly sm. pebbles			
			↓			↓		fragmented, massive			

W = Wet, M = Moist, D = Dry

1998/DCL/PROC/DBL/001

Pacific Northwest National Laboratory	DAILY BOREHOLE LOG	Boring/Well No C5001 (399-3-19)	Depth 39-52'	Date 5-2-06	Sheet 4 of 7
		Location 300 Area		Project LFI	

Logged by B N Bjornstad (Print / Sign) | (Print / Sign)

Reviewed by ______ (Print / Sign) Date ______

Lithologic Class. Scheme ______ Procedure ______ Rev ______

Steel Tape/E-Tape ______ / ______ Field Indicator Equip. 1) ______ 2) ______

Drilling Contractor Cascade Drilling Inc.

Driller ______

Rig/Method Resonant Sonic

Depth Control Point ______

DEPTH ( )	TIME	SAMPLES TYPE	SAMPLES ID NUMBER	CONTAMINATION INSTR.	CONTAMINATION READING	MOISTURE	GRAPHIC LOG (C Z S G)	LITHOLOGIC DESCRIPTION (particle size distribution, sorting, mineralogy, roundness, color, reaction to HCl, etc.)	H_2O ADDED	CASING	DRILLING COMMENTS (drilling rate, down time, blow counts, water level, drill fluid, etc.)
			70D			M	Sl.	gS, poorly sorted, massive			
			↓			W		smG, mostly fn-md pebbles,			
40			70E			↓		open-work fabric, pebbles well			Reworked Ringold mud matrix
			↓			↓		sorted, 2.5Y6/4 (lt. yel. brn)			
			71E			M		G = 50-60% basalt			gS = slough, poorly sorted,
			↓			↓		sG mod sorted, loose, S=			massive
								60-70% basalt,			
											Lost core
45											
											Water table ~ 47.2'
50											

W = Wet, M = Moist, D = Dry

1998/DCL/PROC/DBL/001

Pacific Northwest National Laboratory	DAILY BOREHOLE LOG	Boring/Well No C5001 (399-3-19) Depth 52-65 Date 5-2-06	Sheet 5 of 7
		Location 300 Area Project LFI	

Logged by B N Bjornstad

Reviewed by ______ Date ______

Lithologic Class. Scheme ______ Procedure ______ Rev ______

Steel Tape/E-Tape ______ / ______ Field Indicator Equip. 1) ______ 2) ______

Drilling Contractor Cascade Drilling Inc.

Driller ______

Rig/Method Resonant sonic

Depth Control Point ______

DEPTH ( )	TIME	SAMPLES TYPE	SAMPLES ID NUMBER	CONTAMINATION INSTR.	CONTAMINATION READING	MOISTURE	GRAPHIC LOG C Z S G	LITHOLOGIC DESCRIPTION (particle size distribution, sorting, mineralogy, roundness, color, reaction to HCl, etc.)	H_2O ADDED	CASING	DRILLING COMMENTS (drilling rate, down time, blow counts, water level, drill fluid, etc.)
			73B			W		sG, loose, poorly sorted, S = 70-80% basalt, unbroken clasts SA-SR 10-20% clasts broken, 2.5Y N4/ (dk gray), 50% G, 50% S (mostly crs to v.crs), caliche clasts, salt			Hanford fm.
53			74B								
			74C								74C held out for column studies
55											Lost core
			Bag			W		gS, mod sorted, 20% G 80% crs-v.crs sand, loose, 2.5Y N4/ (dk gray), lgst clast = 3" S = 70-80% basalt, G = 40-50% basalt			graded bed = slough?
60			Bag					sG, mod sorted, dk gray			
			Bag								
								G, fines washed away?, 50% clasts broken, sm-crs pebble			
			76B					S, mostly crs-v.crs, loose, 70-80% basalt			76B ~ 80% full
			76C					sG, 60% G, 40% crs-v.crs. sand, loose, 2.5Y N4/ (dk gray),			
65											

W = Wet, M = Moist, D = Dry

1998/DCL/PROC/DBL/001

Pacific Northwest National Laboratory	DAILY BOREHOLE LOG	Boring/Well No C5001 (399-3-19) Depth 65 - 78' Date 5-2-06	Sheet 6 of 7
		Location 300 Area Project LFI	

Logged by B N Bjornstad

Reviewed by ______ Date ______

Lithologic Class. Scheme ______ Procedure ______ Rev ______

Steel Tape/E-Tape ______ / ______ Field Indicator Equip. 1) ______ 2) ______

Drilling Contractor Cascade Drilling Inc.

Driller ______

Rig/Method Resonant Sonic

Depth Control Point ______

DEPTH ( )	TIME	SAMPLES TYPE	SAMPLES ID NUMBER	CONTAMINATION INSTR.	CONTAMINATION READING	MOISTURE	LITHOLOGIC DESCRIPTION (particle size distribution, sorting, mineralogy, roundness, color, reaction to HCl, etc.)	H_2O ADDED	CASING	DRILLING COMMENTS (drilling rate, down time, blow counts, water level, drill fluid, etc.)
			76D			W	S= 70-80% basalt, G= 50-60%			Hanford fm
			↓			↓	basalt, lgst clast = 5", mod			
66			76E				sorted			76E held out for column
			↓							studies
										Lost core
										↓
			Bag			W	G, well sorted md-crs pebble,			Slough in bag samples
							no matrix, loose			
70			Bag				msG, 60% G, 30% crs S,			
							10% mud, loose, poorly sorted			
							2.5Y N4/ (dk gray), 70-80%			
			↓				basalt sand			
			Bag				sG, 60% G, 40% S (mostly			
			↓				crs - v. crs, 70-80% basalt			
			77D				sand			Graded bed = mixed slough,
			↓				Loose, mod sorted sand = slough			redrilled?
			77E				sG, loose, mod sorted, 70% G			
			↓				30% S, lgst clast = 4",			
75			78A				2.5Y N4/ (dk gray), S = md-			
			↓			↓	v. crs = 70-80% basalt, G			
							= 30-40% basalt			Lost core

W = Wet, M = Moist, D = Dry

1998/DCL/PROC/DBL/001

Pacific Northwest National Laboratory

DAILY BOREHOLE LOG

Boring/Well No C5001 Depth 78-89 Date 5-2-06 Sheet 7 of 7

Location 300 Area Project LFI

Logged by B N Bjornstad

Reviewed by ______ Date ______

Lithologic Class. Scheme ______ Procedure ______ Rev ______

Steel Tape/E-Tape ______ / ______ Field Indicator Equip. 1) ______ 2) ______

Drilling Contractor Cascade Drilling Inc.

Driller ______

Rig/Method Resonant Sonic

Depth Control Point ______

DEPTH ( )	TIME	SAMPLES TYPE	SAMPLES ID NUMBER	CONTAMINATION INSTR.	CONTAMINATION READING	MOISTURE	LITHOLOGIC DESCRIPTION (particle size distribution, sorting, mineralogy, roundness, color, reaction to HCl, etc.)	H_2O ADDED	CASING	DRILLING COMMENTS (drilling rate, down time, blow counts, water level, drill fluid, etc.)
80			78E			M	S, graded = slough?			78E = 80% fall
			↓			↓				~~well sorted~~ Ringold like yellow (10YR 5/6) sand @ 81.5
			79A			W				flanked by basaltic sand/
			↓				SG, mod sorted, 2.5Y4/2 (dk			gravel
			79B				grayish brn), loose, basaltic sand			
			↓				mixed/interlam. with yellow			79B ~70% fall Hanford fm
			79D				felsic Ringold sands,			79C redrill of 79B Ringold E
			↓				sG, 50%G, 50% S, felsic, 2.5Y6/2			
			79E				(lt. brnish gray), well sorted,			micaceous, less basalt at
			↓			↓	bimodal, S = 30-40% basalt			bottom of gravel
85			80A			M	clast supported,			Bottom of 79 E saved for
			↓				cZ at top grading down to			interface study (Sullivan)
			80B				zfnS, laminated, 2.5Y7/6			80B held out for column
			↓				(yellow), compact, cohesive,			studies
			80C				micaceous sand, felsic,			x-lam fn-md sand, Fe oxide
			↓			↓	no rxn w/ HCl, band of			lams., v. well sorted
							brown (10YR 5/4) sZ, all well			
							sorted			TD = 89'
90										

GRAPHIC LOG: C Z S G — sl.

W = Wet, M = Moist, D = Dry

1998/DCL/PROC/DBL/001

Pacific Northwest National Laboratory

DAILY BOREHOLE LOG

Boring/Well No C5002 (399-3-20) Depth 0-13' Date 5-23-06

Location 300 Area Project LFI

Sheet 1 of 8

Logged by B N Bjornstad

Reviewed by ______ Date ______

Lithologic Class. Scheme ______ Procedure ______ Rev ______

Steel Tape/E-Tape ______ / ______ Field Indicator Equip. 1) ______ 2) ______

Drilling Contractor Cascade Drilling Co.

Driller ______

Rig/Method Resonant Sonic

Depth Control Point ______

DEPTH ( )	TIME	SAMPLES TYPE	SAMPLES ID NUMBER	CONTAMINATION INSTR.	CONTAMINATION READING	MOISTURE	GRAPHIC LOG (C Z S G)	LITHOLOGIC DESCRIPTION (particle size distribution, sorting, mineralogy, roundness, color, reaction to HCl, etc.)	H_2O ADDED	CASING	DRILLING COMMENTS (drilling rate, down time, blow counts, water level, drill fluid, etc.)
											5" Diameter lexan liners, 1' long
											dk, poorly sorted (slough) top 4"
			81E			M	sl	gS, 2 cobbles (20%) 80% md-			
			↓			↓		crs sand, well sorted, 10YR 5/4			
			82A					(yellowish brn), lgst clast = 10cm, matrix supported			
5			↓			↓		S = 30% basalt, loose, no rxn			
								w/HCl			
								zsG, 40% G, 40% S, 20% Z,			
							lost core	poorly sorted, clast supported,			
								compact, 10YR 6/4 (lt. yell brn),			
								lgst clast = 4cm, most well rnded pebbles			
			82D			M	dk gray	(g)S, very dark 2.5Y 3/0 (v. dk gray)			
			↓			↓		poorly sorted, dk stained (organic)			
			82E					massive, sl. compact, strng rxn w/HCl			
			↓			SM	brn	gS, 10YR6/4 (lt. yell. brn), mod sorted,			
10			83A			↓		20% G, 80% fi.-crs sand.			Eolian sand
			↓					S, coarse, well sorted, massive,			
			83B					10YR6/4 (lt. yell. brn), 20-25% mafic,			
			↓			↓		no rxn w/HCl, loose, fn sand at base			
			83E			SM		dk, poorly sorted, gS = slough			

W = Wet, M = Moist, D = Dry

Pacific Northwest National Laboratory	DAILY BOREHOLE LOG	Boring/Well No C5002 (399-3-20)	Depth 13 - 26	Date 5-23-06	Sheet 2 of 8
		Location 300 Area	Project LFI		

Logged by B N Bjornstad
Print Sign Print Sign

Reviewed by ______ Date ______
Print Sign

Lithologic Class. Scheme ______ Procedure ______ Rev ______

Steel Tape/E-Tape ______ / ______ Field Indicator Equip. 1) ______ 2) ______

Drilling Contractor Cascade Drilling Co.

Driller ______

Rig/Method Resonant Sonic

Depth Control Point ______

DEPTH ( )	TIME	SAMPLES TYPE	SAMPLES ID NUMBER	CONTAMINATION INSTR.	CONTAMINATION READING	MOISTURE	GRAPHIC LOG (C Z S G)	LITHOLOGIC DESCRIPTION (particle size distribution, sorting, mineralogy, roundness, color, reaction to HCl, etc.)	H_2O ADDED	CASING	DRILLING COMMENTS (drilling rate, down time, blow counts, water level, drill fluid, etc.)
			83E			SM		S, md-crs, well sorted, loose,			Eolian sand?
			84A			↓		10YR6/4 (lt. yell brn), no rxn w/ HCl			
			↓			↓		20-25% mafic			Cylinder collected for bulk density
			84B								Core saved out for Andy
15			↓								Ward (84B)
			84C			SM					85C a redrill of 84C
			↓			↓		to well sorted			
			85D				sl?	ZS to S, poorly sorted, interbedded darker slough layers			
			↓			↓		S, fn, laminated, 10YR5/3 (brown), compact, well sorted			
			Bag			SM		ZSG, loose, poorly sorted, 2.5Y5/4			Hanford fm
			↓					(lt. olive brn), lgst clast = 4"			
			86C				sl	mottled dk gray and brn = slough			slough
			↓								↓
20			86D			↓		lg cobbles filling liner, v. poorly			
			↓			D		sorted, pulverized, powdery			↓
			86E			↓		ZSG, 50% G, 30% S, 20% Z,			
			↓			SM		v. poorly sorted, 2.5Y6/2 (lt.			
			87B			D		brnish gray), S = 40-50% basalt,			
			↓			↓		wk rxn w/ HCl, lgst clast = 5cm			
			87C			SM		S = 80-90% basalt, no rxn w/ HCl			less silt, better sorted
			↓								
			87D					lgst clast = 8 cm			
25			↓								
			87E					lgst clasts fill liner			
			↓			↓	lost				

W = Wet, M = Moist, D = Dry

Pacific Northwest National Laboratory	DAILY BOREHOLE LOG	Boring/Well No CS002 (399-3-20)	Depth 26-39	Date 5-23-06	Sheet 3 of 8
		Location 300 Area	Project LFI		

Logged by B N Bjornstad (Print) ______ (Sign) ______ (Print) ______ (Sign)

Reviewed by ______ (Print) ______ (Sign) Date ______

Lithologic Class. Scheme ______ Procedure ______ Rev ______

Steel Tape/E-Tape ______ / ______ Field Indicator Equip. 1) ______ 2) ______

Drilling Contractor Cascade Drilling Co.

Driller ______

Rig/Method Resonant sonic

Depth Control Point ______

DEPTH ( )	TIME	SAMPLES TYPE	SAMPLES ID NUMBER	CONTAMINATION INSTR.	CONTAMINATION READING	MOISTURE	GRAPHIC LOG (C Z S G)	LITHOLOGIC DESCRIPTION (particle size distribution, sorting, mineralogy, roundness, color, reaction to HCl, etc.)	H_2O ADDED	CASING	DRILLING COMMENTS (drilling rate, down time, blow counts, water level, drill fluid, etc.)
							lost core				
~~27~~			88E			D	sl	SZG, v. poorly sorted, fragmented,			slough
			↓			↓		powdery = slough			↓
			89A			↓					
			|			SM					Hanford fm
			89B								Saved out 89B for column
~~30~~			↓								studies
							lost core				
			90A			SM		zSG, poorly sorted, 40% G,			
			↓			↓		50% S, 10% Z, 2.5Y4/2 (dk			
			90B			M		grayish brn), S = 70-80%			Brown silty Ringold-like matrix
			↓			↓		mafic, G = 60-70% basalt,			10YR6/4 (lt. yell. brn) ~20%
			90C					wk rxn w/ HCl, lgst clast = 4cm			silt skins, open-work fabric
~~35~~			↓			↓					
			91A			SM	sl	zSG v. poorly sorted, pulverized			
			↓								
			91B					SG, 50% G, 40% S, 10% Z, poorly			
			↓					sorted, no rxn w/ HCl, 2.5Y4/2			

W = Wet, M = Moist, D = Dry (dk grayish brn). G = 60-70% basalt

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Pacific Northwest National Laboratory	DAILY BOREHOLE LOG	Boring/Well No C5002 (399-3-20)	Depth 39-52	Date 5-23-06	Sheet 4 of 8
		Location 300 Area	Project LFI		

Logged by B H Bjornstad (Print) / (Sign)	Drilling Contractor Cascade Drilling Co.
Reviewed by (Print) (Sign) Date	Driller
Lithologic Class. Scheme Procedure Rev	Rig/Method Resonant sonic
Steel Tape/E-Tape / Field Indicator Equip. 1) 2)	Depth Control Point

DEPTH ( )	TIME	SAMPLES TYPE	SAMPLES ID NUMBER	CONTAMINATION INSTR.	CONTAMINATION READING	MOISTURE	GRAPHIC LOG (C Z S G)	LITHOLOGIC DESCRIPTION (particle size distribution, sorting, mineralogy, roundness, color, reaction to HCl, etc.)	H_2O ADDED	CASING	DRILLING COMMENTS (drilling rate, down time, blow counts, water level, drill fluid, etc.)
			91C			SM		ZSG, 50% G, 30% S, 20% Z,			Hanford fm.
			↓			↓		poorly sorted, 2.5Y4/2 (dk			
40			91D					grayish brn), lgst clast = 4cm			silt skins
			↓					gS, v. crs sand, mod sorted			
			Bag					ZSG, as above			mixed in bag
			↓			↓					↓
							lost core				
45											
			92C			W	sl	gS, graded, poorly sorted,			
			↓			↓					▽ 47.7
			92D					ZSG, poorly sorted 2.5Y5/2 (grayish			
			↓			↓		brn), S: 80-90% mafic, G =			
			92E					50-60% basalt, lgst clast = 6cm			92E saved out for column
50			↓								studies

W = Wet, M = Moist, D = Dry

1998/DCL/PROC/DBL/001

Pacific Northwest National Laboratory

DAILY BOREHOLE LOG

Boring/Well No C5002 (399-3-20) Depth 52-65 Date 5-23-06 Sheet 5 of 8

Location 300 Area Project LFI

Logged by B N Bjornstad (Print) ______ (Sign) ______ (Print) ______ (Sign)

Reviewed by ______ (Print) ______ (Sign) Date ______

Lithologic Class. Scheme ______ Procedure ______ Rev ______

Steel Tape/E-Tape ______ / ______ Field Indicator Equip. 1) ______ 2) ______

Drilling Contractor ______

Driller ______

Rig/Method ______

Depth Control Point ______

DEPTH ( )	TIME	SAMPLES TYPE	SAMPLES ID NUMBER	CONTAMINATION INSTR.	CONTAMINATION READING	MOISTURE	GRAPHIC LOG (C Z S G)	LITHOLOGIC DESCRIPTION (particle size distribution, sorting, mineralogy, roundness, color, reaction to HCl, etc.)	H_2O ADDED	CASING	DRILLING COMMENTS (drilling rate, down time, blow counts, water level, drill fluid, etc.)
							lost core				
			93D			W		gS, loose, 2.5Y 4/2 (dk grayish brn),			Hanford fm
			↓			↓		mod sorted, 20% G, 80% S,			
			93E					S = 80-90% mafic, G = 60-70%			grades down into sandy small
55			↓					basalt			pebble gravel, v. loose
			94A					G, no matrix, lgst clast = 5"			
			↓			↓		60-70% basalt			
							lost core				
			95B			W		sG, loose, 50% G, 50% S,			1' core out of 5' core run
			↓			↓		S = 70-80% mafic, G = 50-60%			mixed
								basalt, 2.5Y 4/2 (dk grayish			↓
								brn), lgst clast = 4cm			
60											
							lost core				
			94C			W		black, md sand			slough
65			↓			↓		loose, pebbly gravel			↓

W = Wet, M = Moist, D = Dry

1998/DCL/PROC/DBL/001

Pacific Northwest National Laboratory	DAILY BOREHOLE LOG	Boring/Well No C5002 (399-3-20)	Depth 65-78	Date 5-23-06	Sheet 6 of 8
		Location 300 Area	Project LFI		

Logged by B N Bjornstad (Print) ______ (Sign) ______ (Print) ______ (Sign)

Reviewed by ______ (Print) ______ (Sign) Date ______

Lithologic Class. Scheme ______ Procedure ______ Rev ______

Steel Tape/E-Tape ______ / ______ Field Indicator Equip. 1) ______ 2) ______

Drilling Contractor Cascade Drilling Co.

Driller ______

Rig/Method Resonant Sonic

Depth Control Point ______

DEPTH ( )	TIME	SAMPLES TYPE	SAMPLES ID NUMBER	CONTAMINATION INSTR.	CONTAMINATION READING	MOISTURE	GRAPHIC LOG (C Z S G)	LITHOLOGIC DESCRIPTION (particle size distribution, sorting, mineralogy, roundness, color, reaction to HCl, etc.)	H_2O ADDED	CASING	DRILLING COMMENTS (drilling rate, down time, blow counts, water level, drill fluid, etc.)
			94D			W		sG, loose, 2.5Y4/0 (dk gray),			Hanford fm
			↓			↓		60% G, 40% S, mostly			
66			94E					sm. pebbles, S = 80-90%			
			↓					mafic, G = 60-70% basalt,			cobbles up to 5"
			95A					max. part size = 3cm			95A = 1 cobble 5" dia
			↓								
							Lost core				
70											
			96B/C			W		sG, loose, 2.5Y4/0 (dk gray),			Redrilled material = slough
			↓			↓		S = 80-90% mafic, G = 60-70%			↓ mixed
								basalt, lgst clast = 4", 60%			
								G, 40% S, mod sorted			
75											
			77B/C			W		fn-crs sand sorted			Graded bed = slough?
			↓			↓		pebbly sand, basaltic, sorted			mixed material

W = Wet, M = Moist, D = Dry

1998/DCL/PROC/DBL/001

Pacific Northwest National Laboratory

DAILY BOREHOLE LOG

Boring/Well No C5002 (399-3-20) Depth 78-91 Date 5-24-06 Sheet 7 of 8

Location 300 Area Project LFI

Logged by B N Bjornstad

Reviewed by ______ Date ______

Lithologic Class. Scheme ______ Procedure ______ Rev ______

Steel Tape/E-Tape ______ / ______ Field Indicator Equip. 1) ______ 2) ______

Drilling Contractor Cascade Drilling Inc.

Driller ______

Rig/Method Resonant sonic

Depth Control Point ______

DEPTH ( )	TIME	SAMPLES TYPE	SAMPLES ID NUMBER	CONTAMINATION INSTR.	CONTAMINATION READING	MOISTURE	GRAPHIC LOG (C Z S G)	LITHOLOGIC DESCRIPTION (particle size distribution, sorting, mineralogy, roundness, color, reaction to HCl, etc.)	H_2O ADDED	CASING	DRILLING COMMENTS (drilling rate, down time, blow counts, water level, drill fluid, etc.)
			97B/C			W		SG, sorted loose			mixed and redrilled slough
			98C					fn sand, basaltic, sorted = slough			
			↓					SG, loose, mod sorted, 2.5Y 4/2			
80			98D					(dk grayish brn), lgst clast = 3cm			Color change Hanford fm
			↓					S = 70-80% mafic, G = 50-60% basalt			Ringold Fm
			98E					SG, 2.5Y6/4 (lt. yell. brn), mod			99B = redrill of this interval
			↓					sorted, S = 20-30% G = 20-30%			99C = redrill
			99D					basalt 60% G, 30% S, 10% Z,			Interface sample preserved for
			↓			M		lgst clast = 5", micaceous,			Charlotte Sullivan from 99D
			99E					bimodal, clast supported, silt skins			
			↓					S, md, v. well sorted, micaceous,			
			100A					well laminated, 10YR6/4 (lt. yel. brn)			
			↓					Z fn sand laminae = 2.5Y5/2 (grayish brn)			
											↑
85			Bag			W		S, md-crs, well sorted, loose			brown color change
								massive, upper 6" = 2.5Y6/4			olive gray
								(lt. gel. brn) rest is 5Y5/2			↓
			↓					(olive gray), micaceous,			
			Bag					10-20% mafic, v. uniform			
			↓								
			Bag								
90											
			↓			↓		gleyed 5G5/1 (greenish gray)			

W = Wet, M = Moist, D = Dry

1998/DCL/PROC/DBL/001

Pacific Northwest National Laboratory

DAILY BOREHOLE LOG

Boring/Well No C5002 (399-3-20) Depth 91-95 Date 5-24-06

Sheet 8 of 8

Location 300 Area Project LFI

Logged by B N Bjornstad

Reviewed by ______ Date ______

Lithologic Class. Scheme ______ Procedure ______ Rev ______

Steel Tape/E-Tape ______ / ______ Field Indicator Equip. 1) ______ 2) ______

Drilling Contractor Cascade Drilling Inc.

Driller ______

Rig/Method Resonant Sonic

Depth Control Point ______

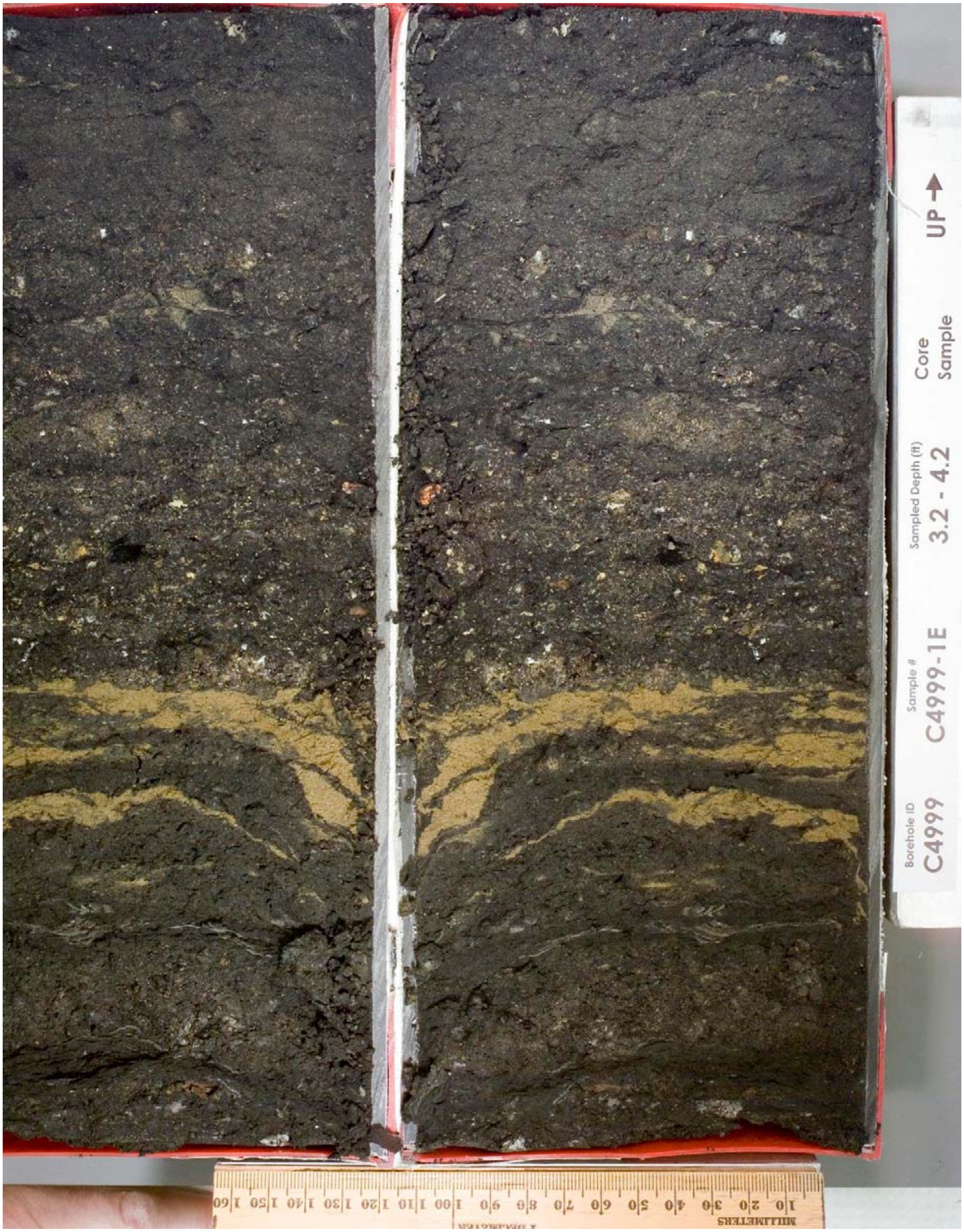
DEPTH ( )	TIME	SAMPLES TYPE	SAMPLES ID NUMBER	CONTAMINATION INSTR.	CONTAMINATION READING	MOISTURE	GRAPHIC LOG (C Z S G)	LITHOLOGIC DESCRIPTION (particle size distribution, sorting, mineralogy, roundness, color, reaction to HCl, etc.)	H_2O ADDED	CASING	DRILLING COMMENTS (drilling rate, down time, blow counts, water level, drill fluid, etc.)
							lost core				
			Bag			W		S, 5Y6/1, lt gray, loose, well sorted, micaceous, 10% mafic			Ringold Fm.
95											TD=95'

W = Wet, M = Moist, D = Dry

1998/DCL/PROC/DBL/001

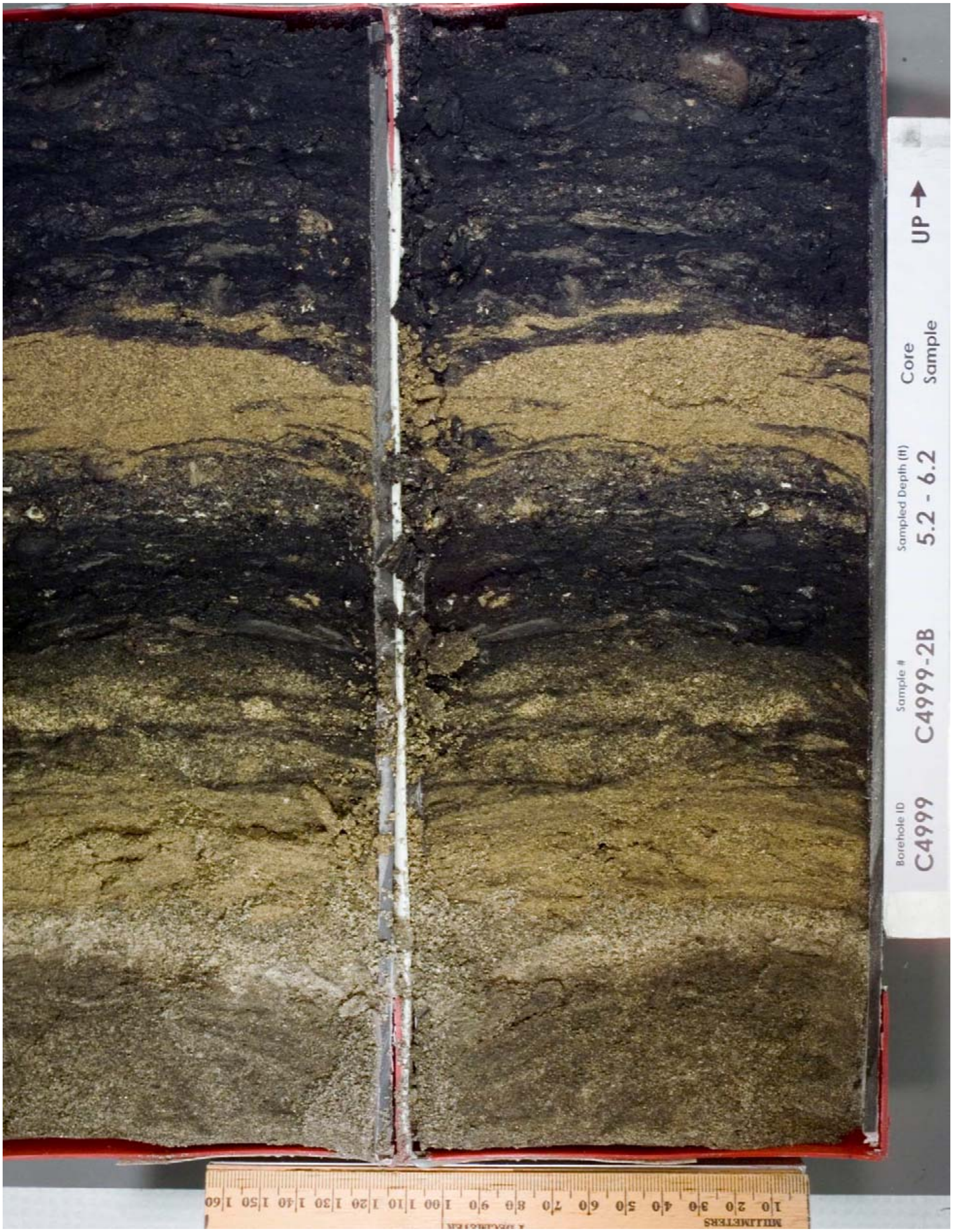
Digital Core Photographs

Well C4999

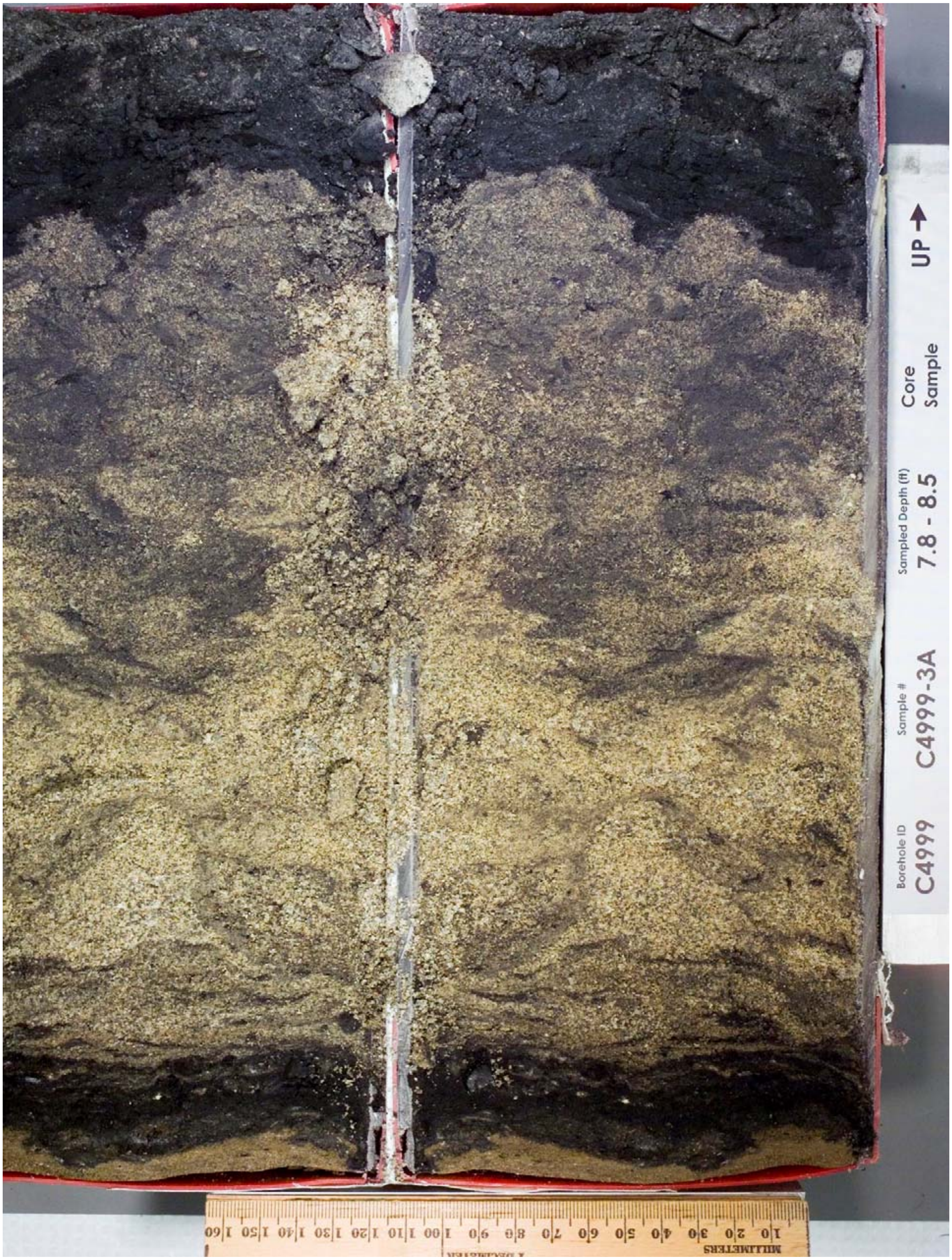


Borehole ID
C4999
Sample #
C4999-1E
Sampled Depth (ft)
3.2 - 4.2
Core
Sample
UP
MILLIMETERS

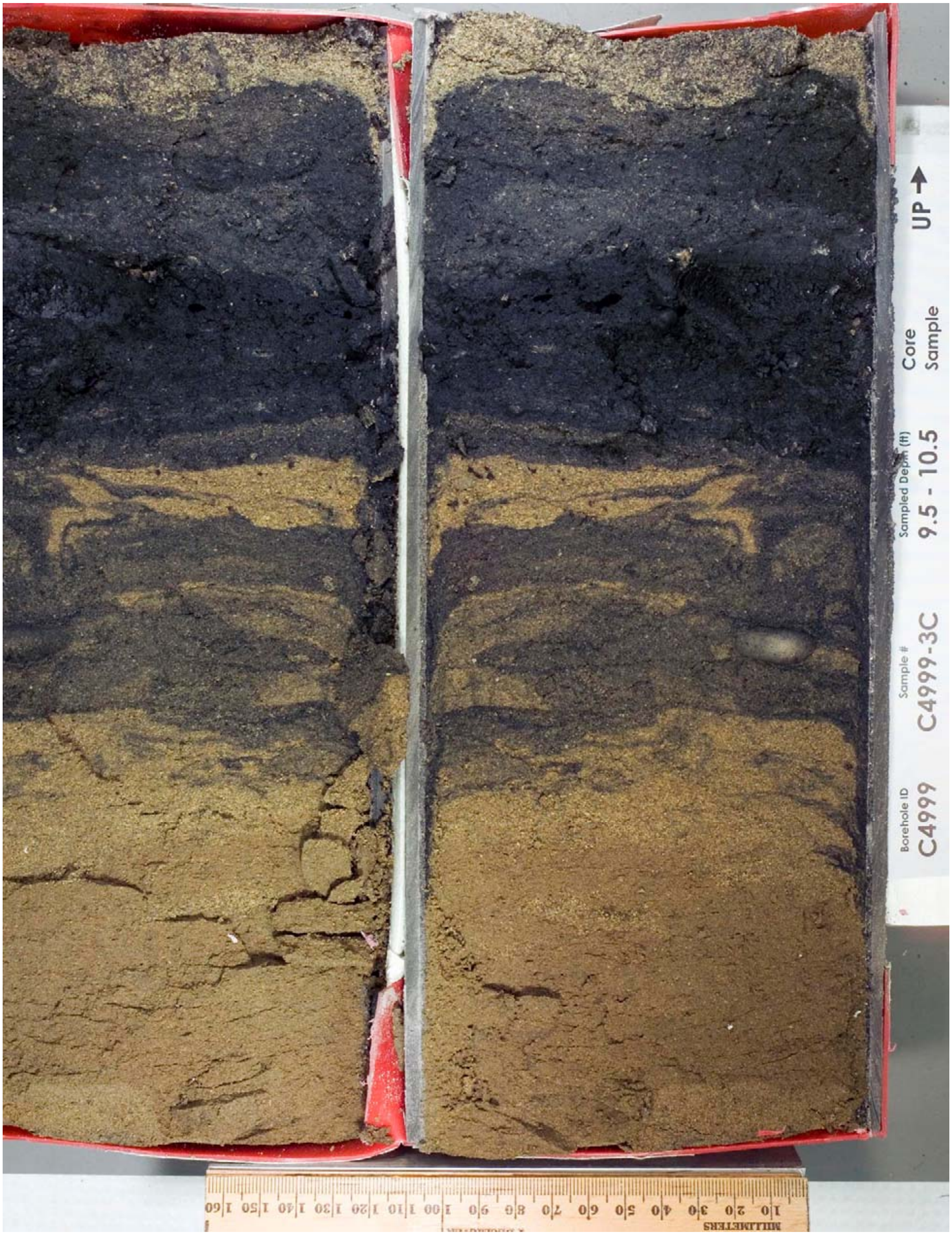

Borehole ID
C4999
Sample #
C4999-2A
Sampled Depth (ft)
4.2 - 5.2
Core
Sample
UP


Borehole ID
C4999
Sample #
C4999-2B
Sampled Depth (ft)
5.2 - 6.2
Core
Sample
UP
MILLIMETERS

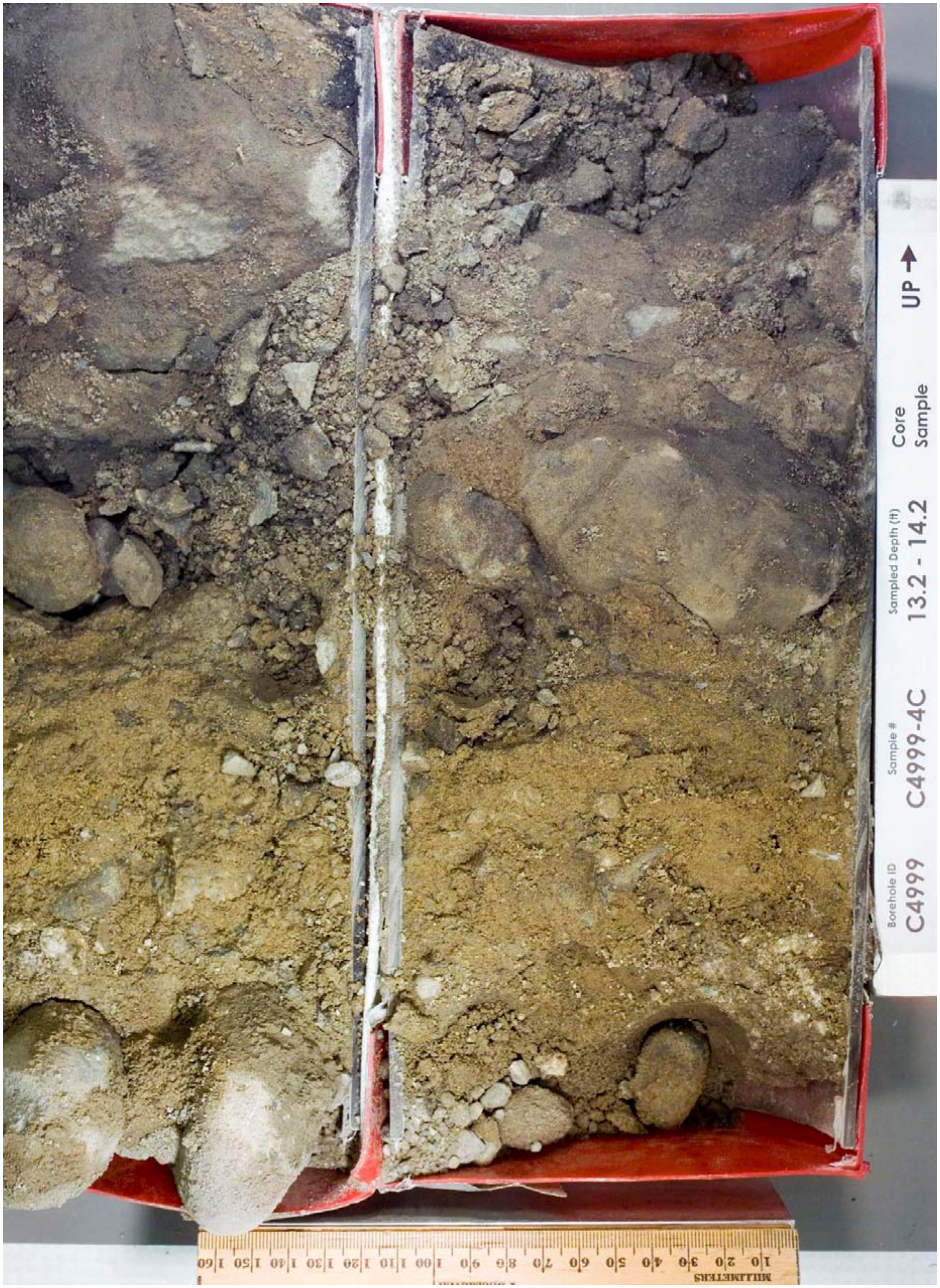

Borehole ID
C4999
Sample #
C4999-2E
Sampled Depth (ft)
6.5 - 7.5
Core
Sample
UP
MILLIMETERS


Borehole ID
C4999
Sample #
C4999-3A
Sampled Depth (ft)
7.8 - 8.5
Core
Sample
UP


Borehole ID
C4999
Sample #
C4999-3B
Sampled Depth (ft)
8.5 - 9.5
Core
Sample
UP


UP →
Core Sample
Sampled Depth (ft)
9.5 - 10.5
Sample #
C4999-3C
Borehole ID
C4999
MILLIMETERS


Borehole ID
C4999
Sample #
C4999-4B
Sampled Depth (ft)
12.2 - 13.2
Core
Sample
UP →
MILLIMETERS


Borehole ID
C4999
Sample #
C4999-4C
Sampled Depth (ft)
13.2 - 14.2
Core
Sample
UP


Borehole ID
C4999
Sample #
C4999-5A
Sampled Depth (ft)
14.5 - 15.5
Core
Sample
UP


UP →
Core Sample
Sampled Depth (ft)
15.5 - 16.5
Sample #
C4999-5B
Borehole ID
C4999

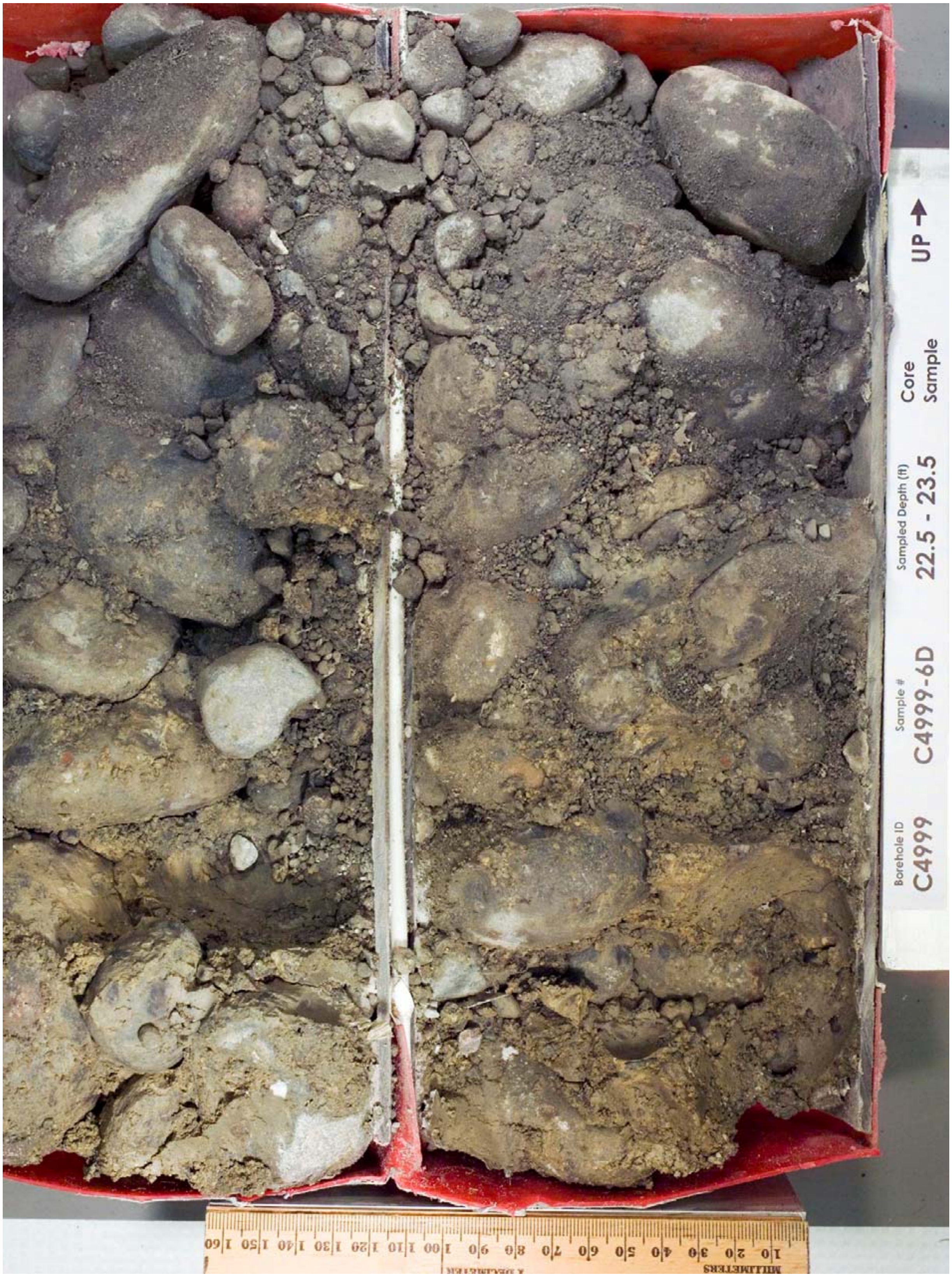

Borehole ID
C4999
Sample #
C4999-5C
Sampled Depth (ft)
16.5 - 17.5
Core
Sample
UP →


UP
Core Sample
Sampled Depth (ft)
17.5 - 18.5
Sample #
C4999-5D
Borehole ID
C4999
MILLIMETERS
1 DECIMETER

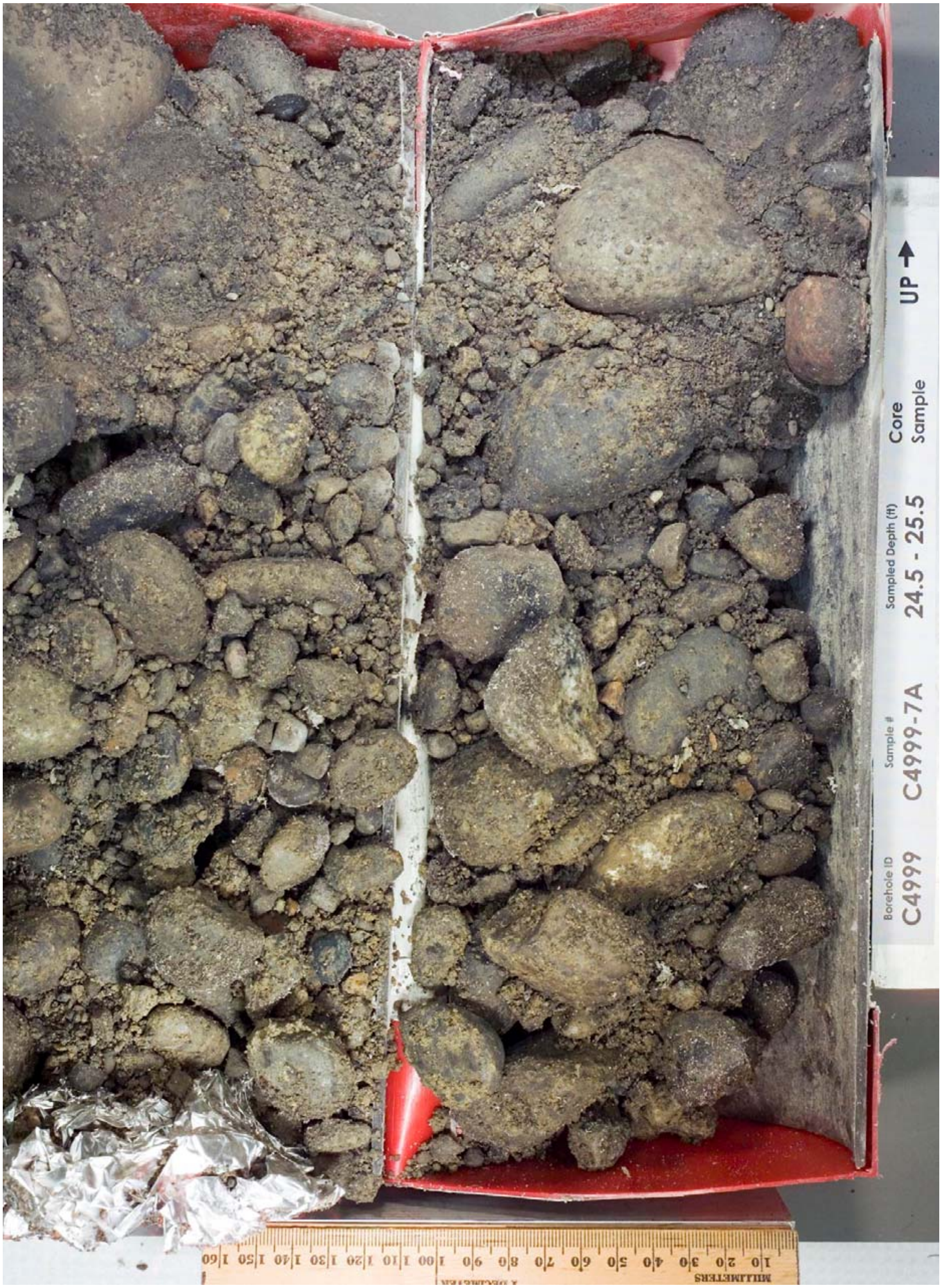

Borehole ID
C4999
Sample #
C4999-6A
Sampled Depth (ft)
19.5 - 20.5
Core
Sample
UP


Borehole ID
C4999
Sample #
C4999-6B
Sampled Depth (ft)
20.5 - 21.5
Core
Sample
UP
MILLIMETERS


Borehole ID
C4999
Sample #
C4999-6C
Sampled Depth (ft)
21.5 - 22.5
Core
Sample
UP


UP
Core Sample
Sampled Depth (ft)
22.5 - 23.5
Sample #
C4999-6D
Borehole ID
C4999
MILLIMETERS

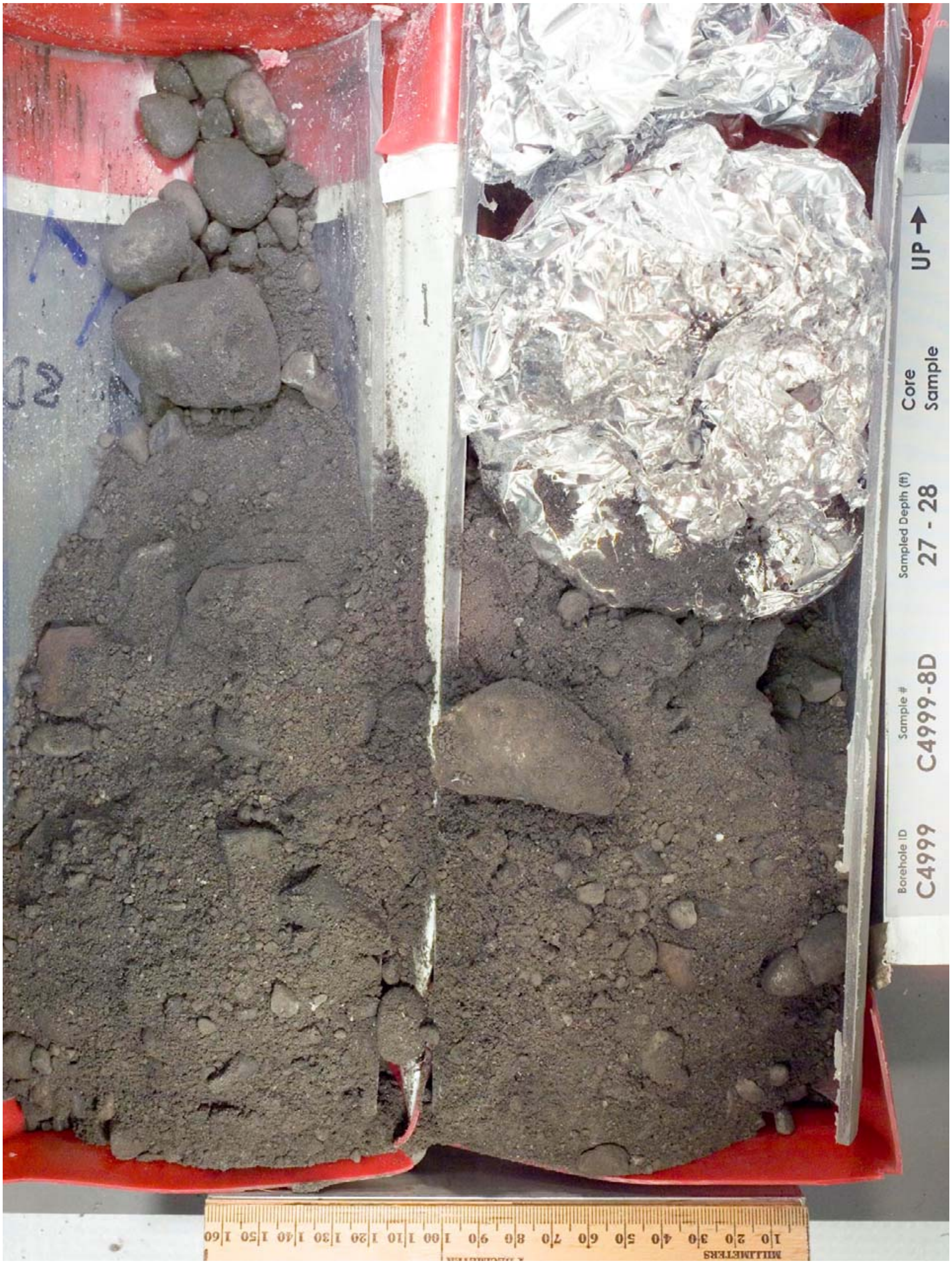

UP
Core Sample
Sampled Depth (ft)
23.5 - 24.5
Sample #
C4999-6E
Borehole ID
C4999
MILLIMETERS
1 DECIMETER


Borehole ID
C4999
Sample #
C4999-7A
Sampled Depth (ft)
24.5 - 25.5
Core
Sample
UP →
MILLIMETERS


Borehole ID
C4999
Sample #
C4999-7D
Sampled Depth (ft)
23.5 - 24.5
Core
Sample
UP
MILLIMETERS


UP
Core Sample
Sampled Depth (ft)
24.5 - 25.5
Sample #
C4999-7E
Borehole ID
C4999
MILLIMETERS


Borehole ID
C4999
Sample #
C4999-8B
Sampled Depth (ft)
26.5 - 27.5
Core
Sample


UP →
Core Sample
Sampled Depth (ft)
27 - 28
Sample #
C4999-8D
Borehole ID
C4999
MILLIMETERS


Borehole ID
C4999
Sample #
C4999-8E
Sampled Depth (ft)
28 - 29
Core
Sample
UP


Borehole ID
C4999
Sample #
C4999-9A
Sampled Depth (ft)
29 - 30
Core
Sample
UP


Borehole ID
C4999
Sample #
C4999-9B
Sampled Depth (ft)
30 - 31
Core
Sample
UP


Borehole ID
C4999
Sample #
C4999-9C
Sampled Depth (ft)
31 - 32
Core
Sample
UP →
MILLIMETERS


UP
Core Sample
Sampled Depth (ft) 33 - 34
Sample # C4999-10A
Borehole ID C4999


Borehole ID
C4999
Sample #
C4999-10B
Sampled Depth (ft)
34 - 35
Core
Sample
UP →
MILLIMETERS


Borehole ID
C4999
Sample #
C4999-10C
Sampled Depth (ft)
35 - 36
Core
Sample
UP →


Borehole ID
C4999
Sample #
C4999-10D
Sampled Depth (ft)
36 - 37
Core
Sample
UP


UP
Core Sample
Sampled Depth (ft)
38 - 39
Sample #
C4999-11A
Borehole ID
C4999
38


Borehole ID
C4999
Sample #
C4999-11B
Sampled Depth (ft)
39 - 40
Core Sample
UP
MILLIMETERS


UP
Core Sample
Sampled Depth (ft)
41 - 42
Sample #
C4999-11D
Borehole ID
C4999


Borehole ID
C4999
Sample #
C4999-11E
Sampled Depth (ft)
42 - 43
Core
Sample
UP
MILLIMETERS


Borehole ID
C4999
Sample #
C4999-12A
Sample Depth (ft)
43.5-44.5
Core Sample
UP →
MILLIMETERS


Borehole ID
C4999
Sample #
C4999-12B
Sample Depth (ft)
44.5-45.5
Core Sample
UP→
MILLIMETERS

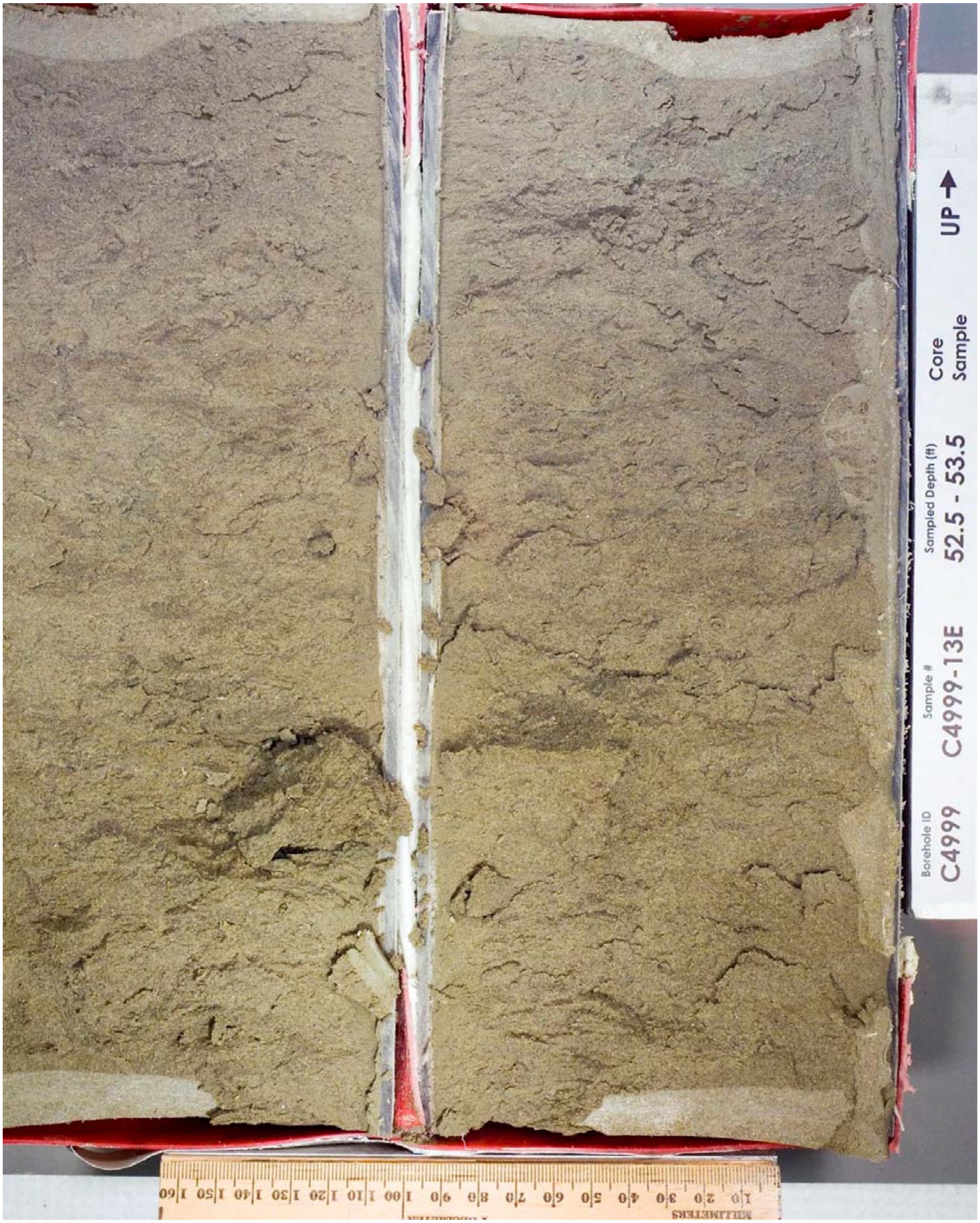

Hanford formation
Ringold Formation
Borehole ID
C4999
Sampler
C4999-12C
Sampled Depth (ft)
45.5-46.5
Core Sample
UP→

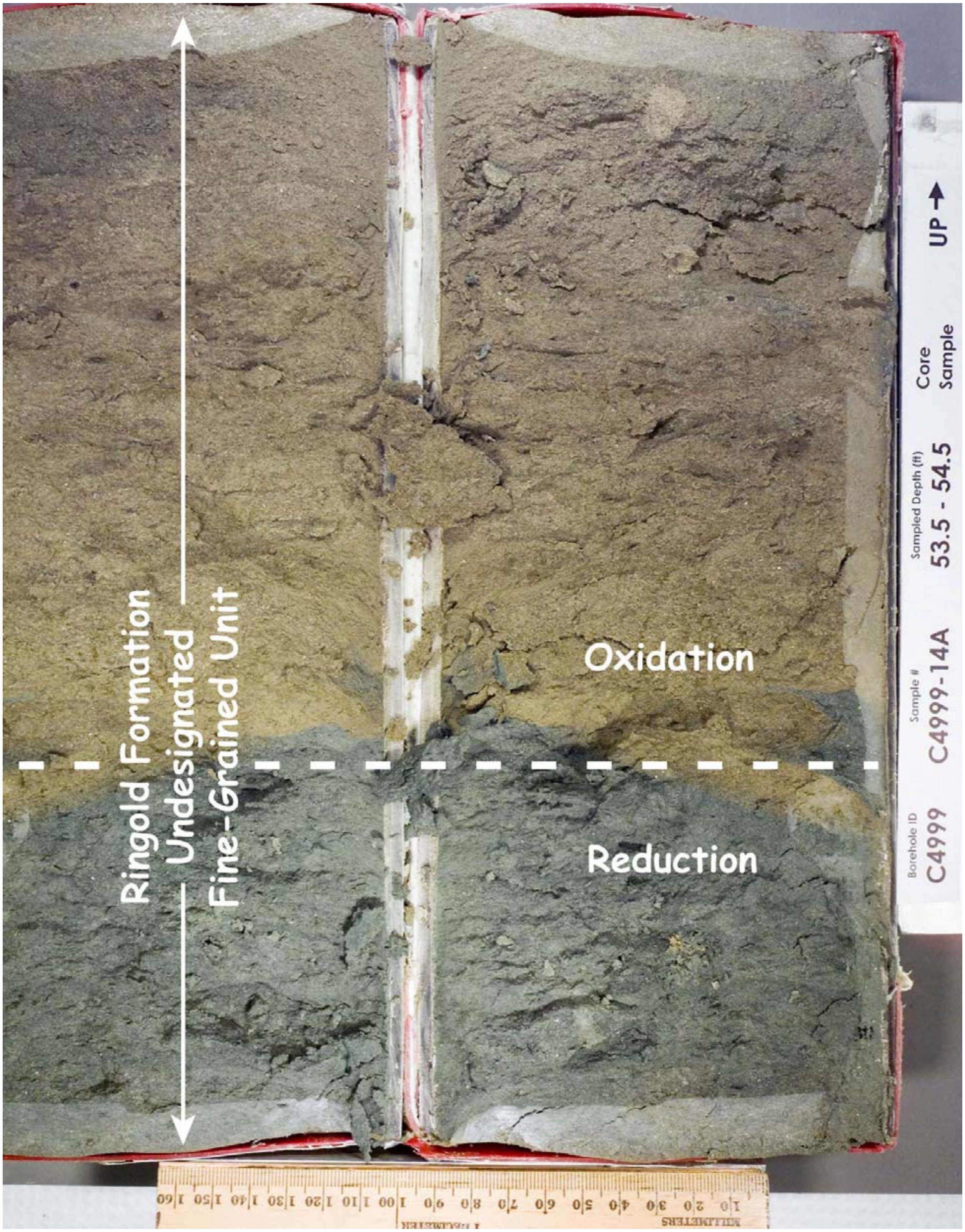

Borehole ID
C4999
Sample #
C4999-12D
Sample Depth (ft)
46.5-47.5
Core Sample
UP→
MILLIMETERS

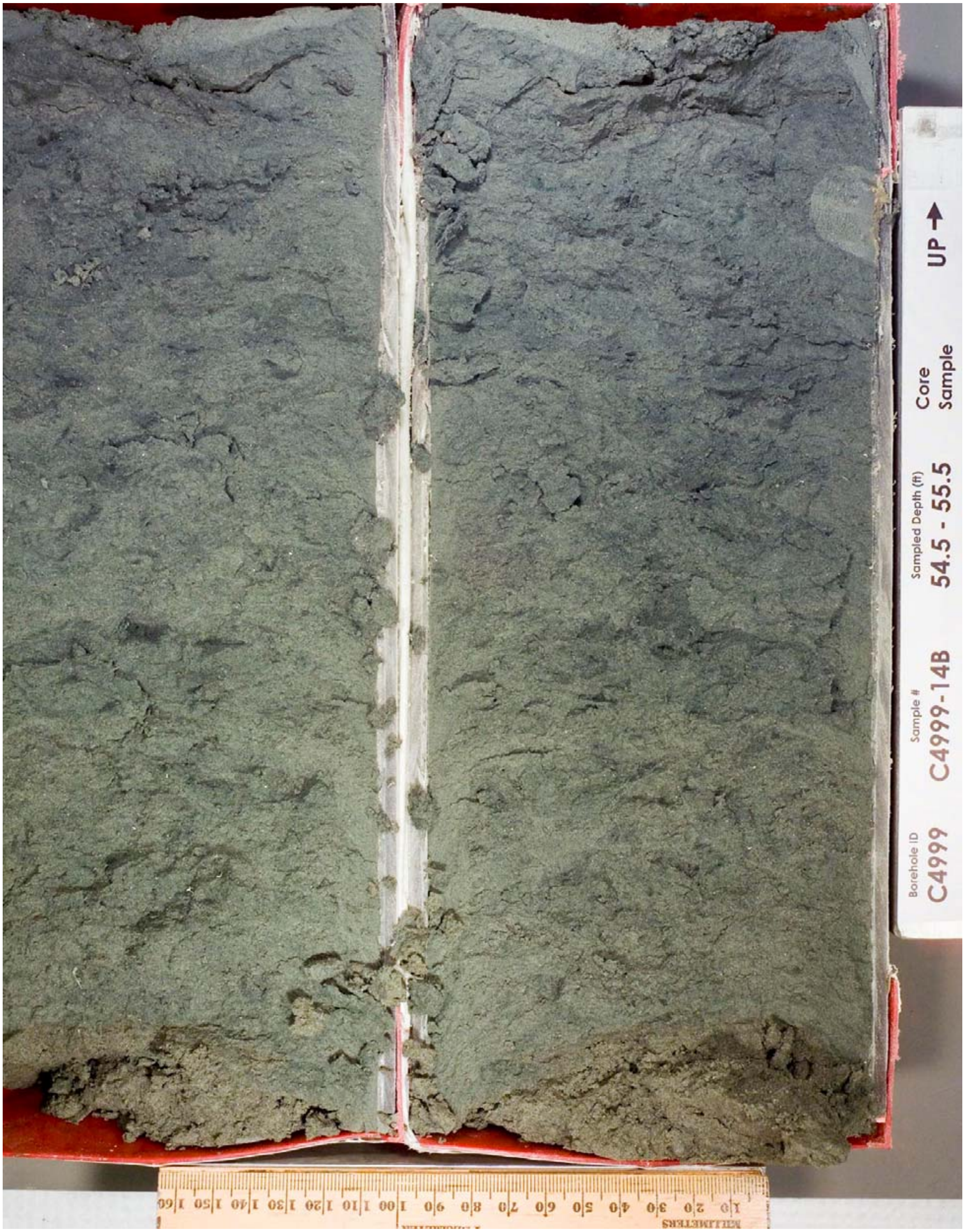

Borehole ID C4999
Sample # C4999-12E
Sample Depth (ft) 47.5-48.5
Core Sample
UP→
MILLIMETERS

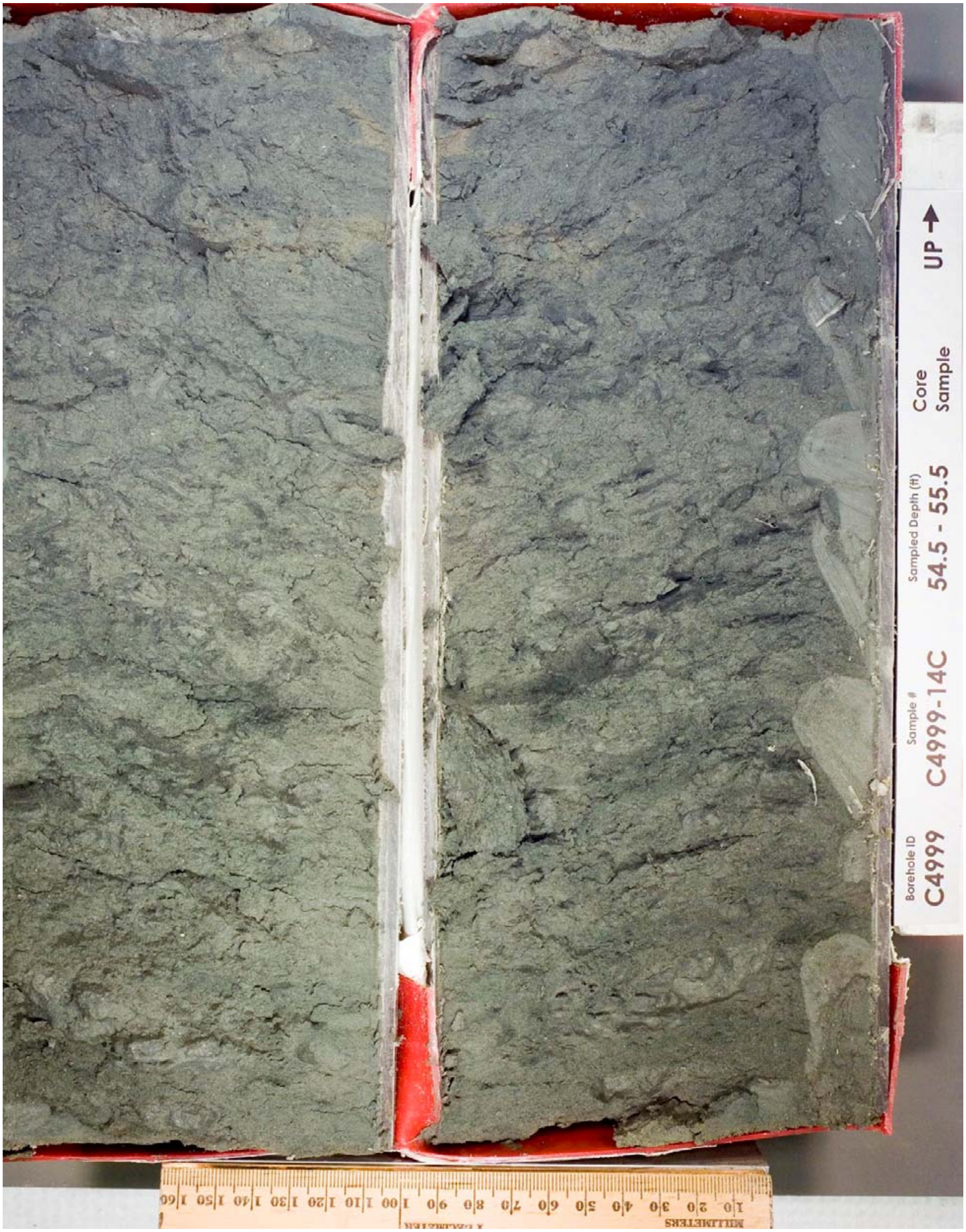

Borehole ID
C4999
Sample #
C4999-13B
Sampled Depth (ft)
49.5 - 50.5
Core
Sample
UP

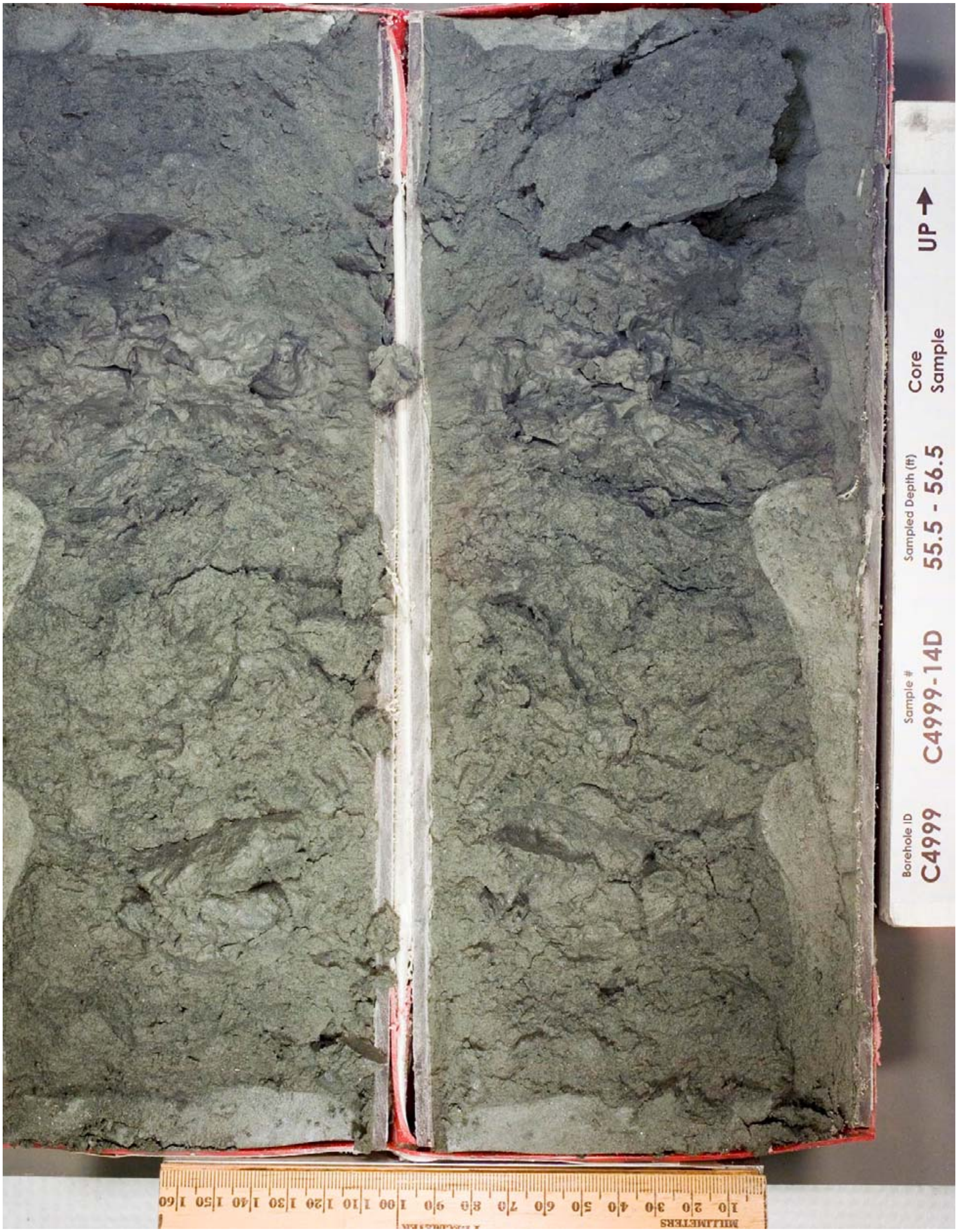

Borehole ID
C4999
Sample #
C4999-13D
Sampled Depth (ft)
51.5 - 52.5
Core
Sample
UP
MILLIMETERS


Borehole ID
C4999
Sample #
C4999-13E
Sampled Depth (ft)
52.5 - 53.5
Core
Sample
UP

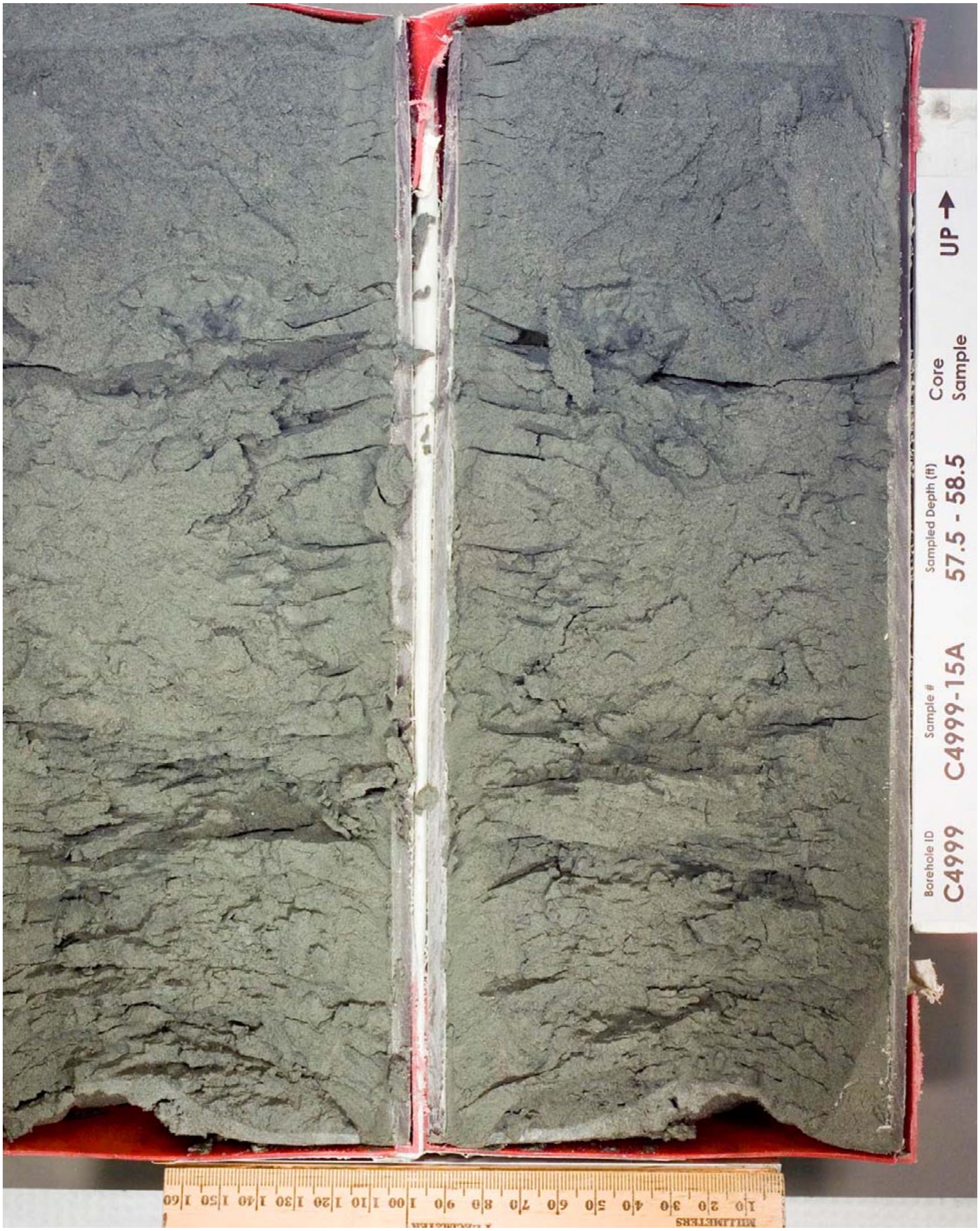

Ringold Formation
Undesignated
Fine-Grained Unit
Oxidation
Reduction
Borehole ID
C4999
Sample #
C4999-14A
Sampled Depth (ft)
53.5 - 54.5
Core
Sample
UP
MILLIMETERS

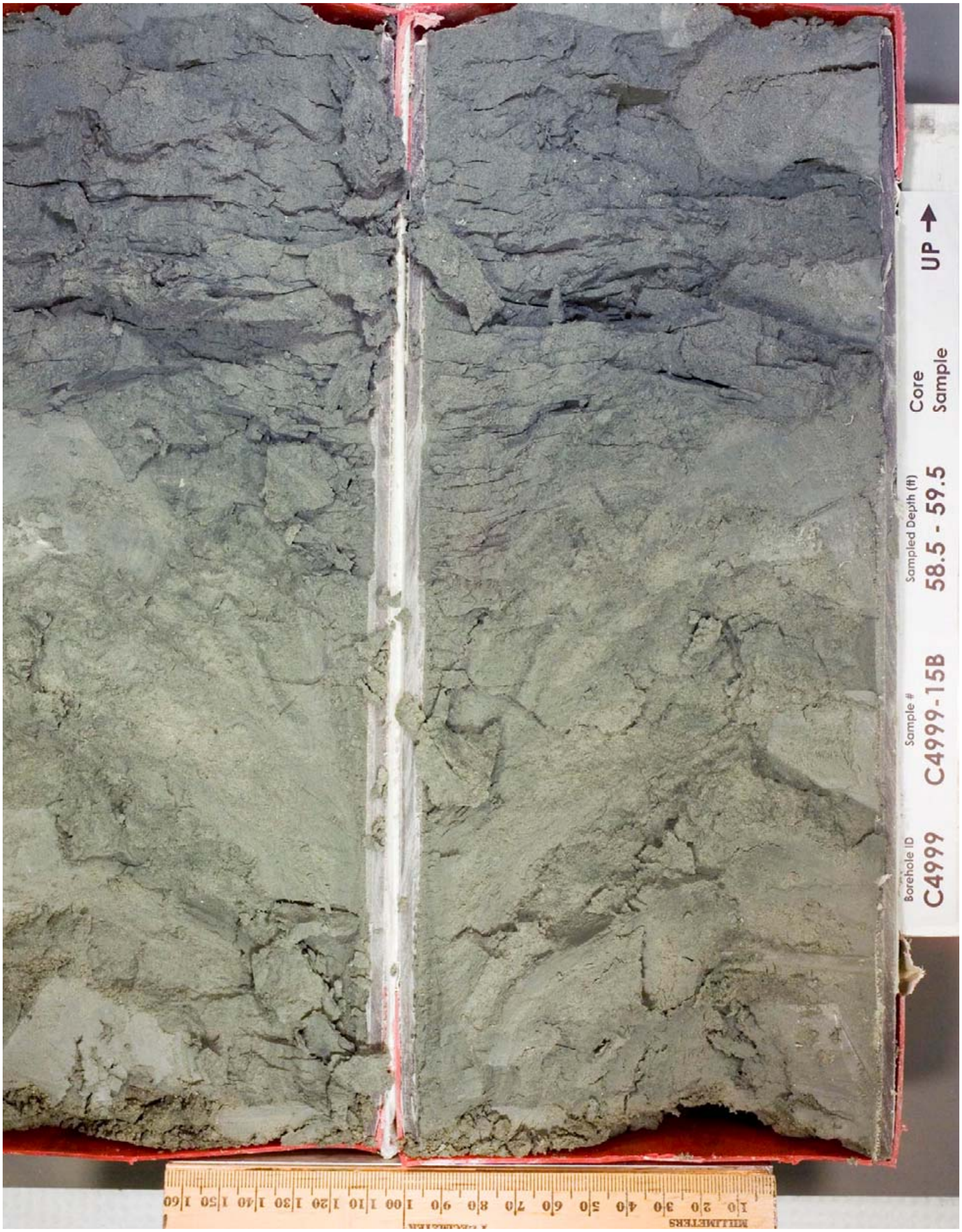

Borehole ID
C4999
Sample #
C4999-14B
Sampled Depth (ft)
54.5 - 55.5
Core
Sample
UP


Borehole ID
C4999
Sample #
C4999-14C
Sampled Depth (ft)
54.5 - 55.5
Core Sample
UP

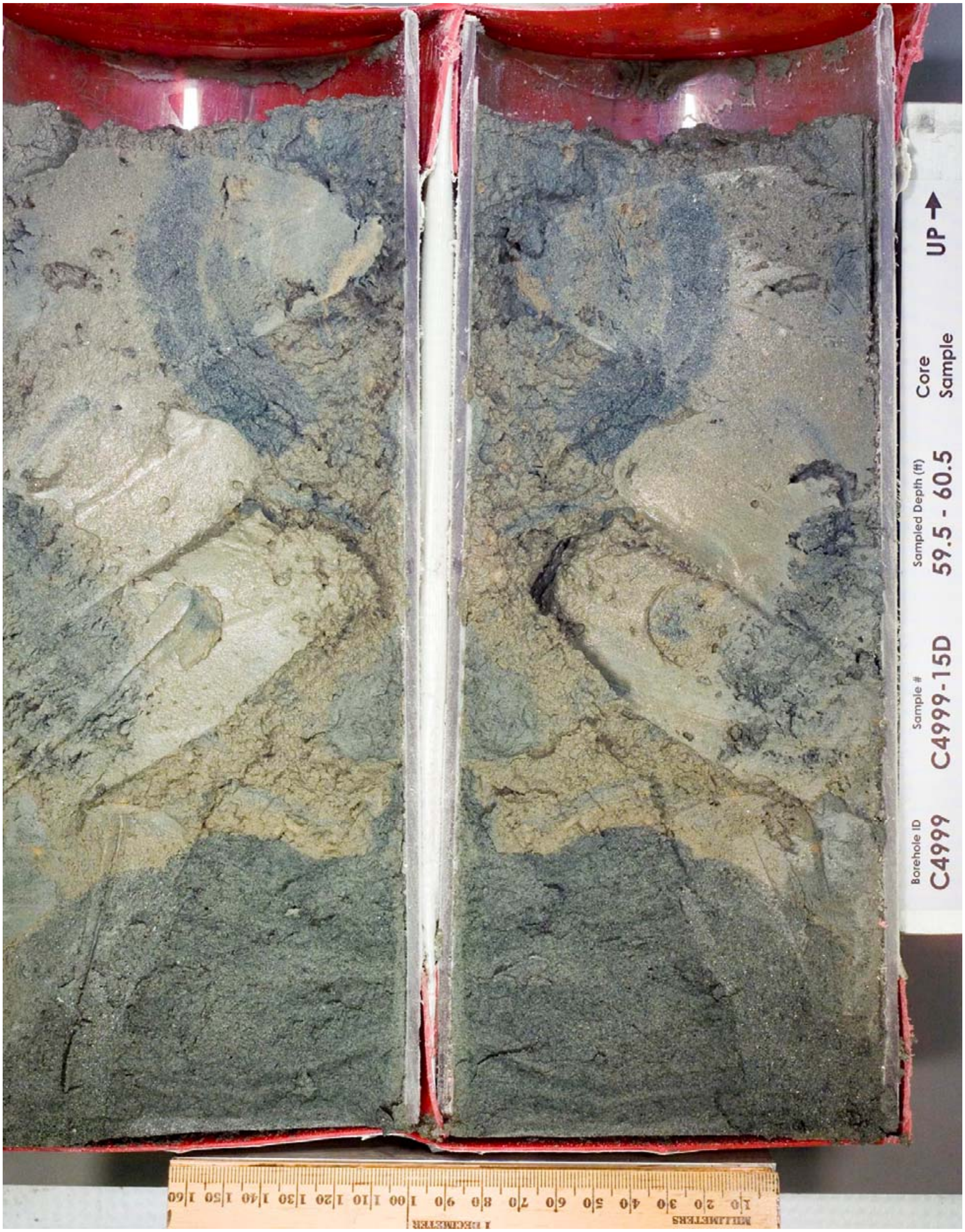

UP →
Core Sample
Sampled Depth (ft)
55.5 - 56.5
Sample #
C4999-14D
Borehole ID
C4999
MILLIMETERS


UP
Core
Sample
Sampled Depth (ft)
56.5 - 57.5
Sample #
C4999-14E
Borehole ID
C4999


Borehole ID
C4999
Sample #
C4999-15A
Sampled Depth (ft)
57.5 - 58.5
Core
Sample
UP

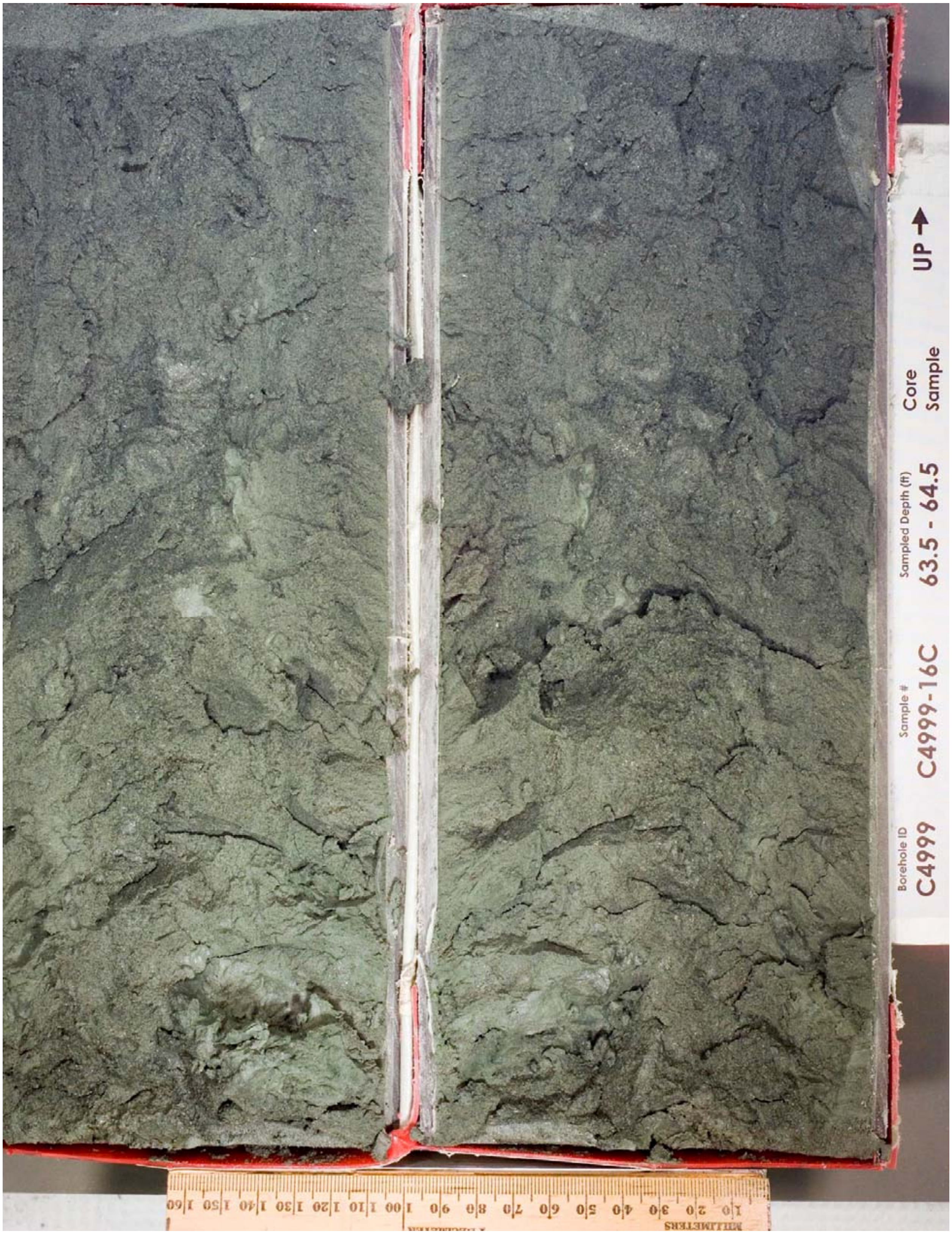

UP →
Core Sample
Sampled Depth (ft)
58.5 - 59.5
Sample #
C4999-15B
Borehole ID
C4999
MILLIMETERS


Borehole ID C4999
Sample # C4999-15C
Sampled Depth (ft) 59.5-61.0
Core Sample
MILLIMETERS

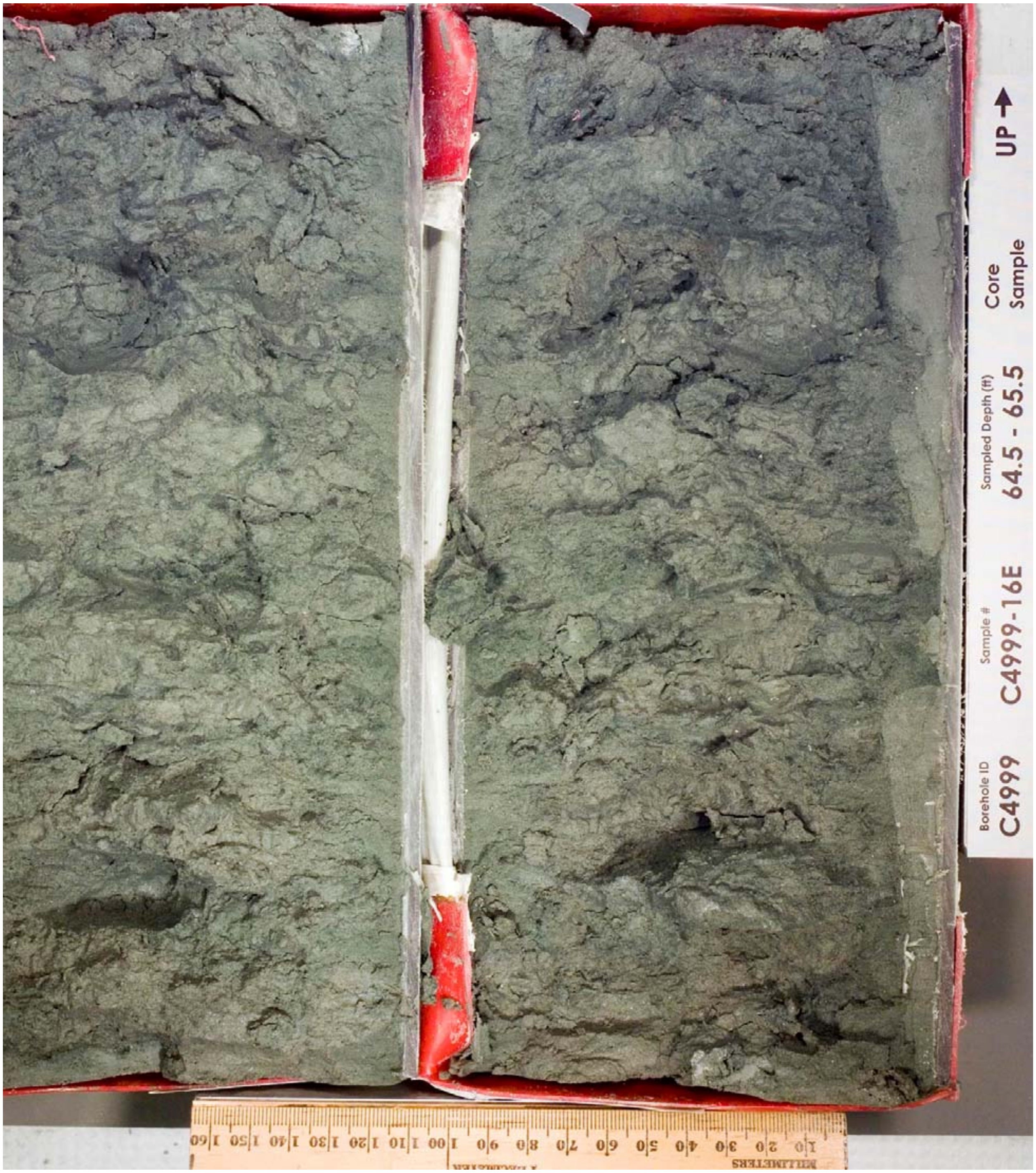

Borehole ID
C4999
Sample #
C4999-15D
Sampled Depth (ft)
59.5 - 60.5
Core
Sample
UP

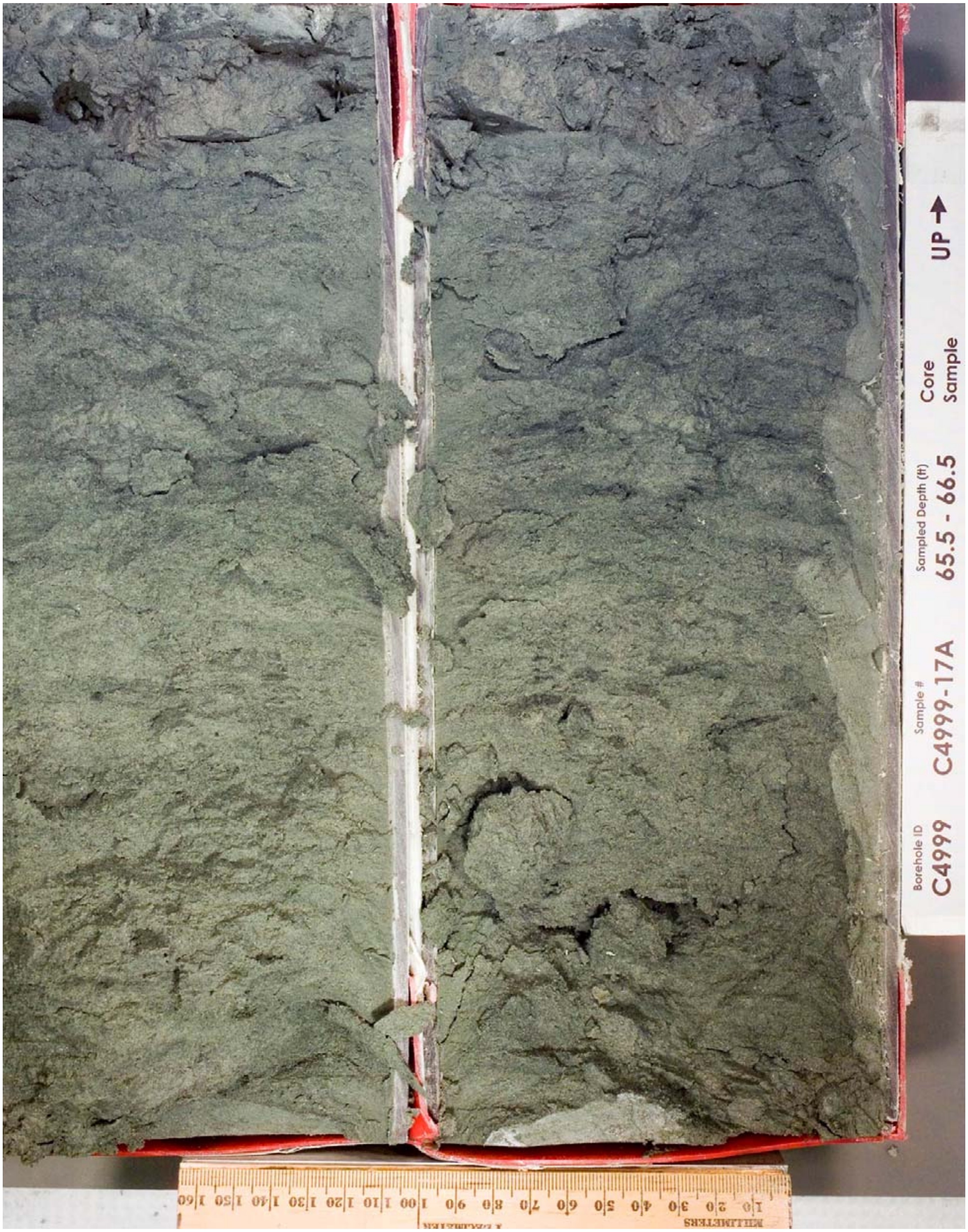

Borehole ID
C4999
Sample #
C4999-16A
Sampled Depth (ft)
61.5 - 62.5
Core
Sample
UP

Borehole ID
C4999
Sample #
C4999-16B
Sampled Depth (ft)
62.5 - 63.5
Core
Sample
UP


Borehole ID
C4999
Sample #
C4999-16C
Sampled Depth (ft)
63.5 - 64.5
Core
Sample
UP →

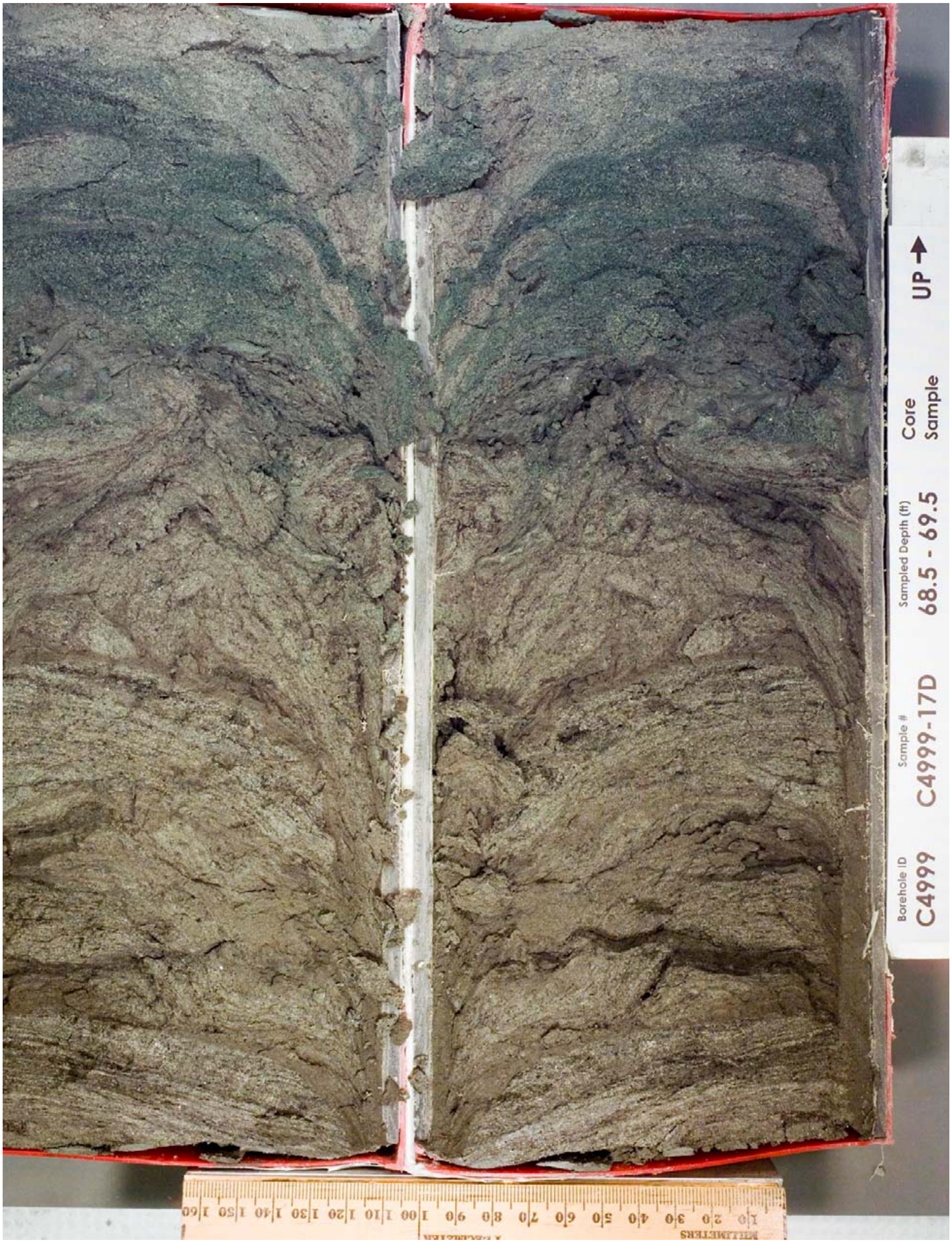

Borehole ID
C4999
Sample #
C4999-16D
Sampled Depth (ft)
64.5 - 65.5
Core
Sample
UP


Borehole ID
C4999
Sample #
C4999-16E
Sampled Depth (ft)
64.5 - 65.5
Core
Sample
UP

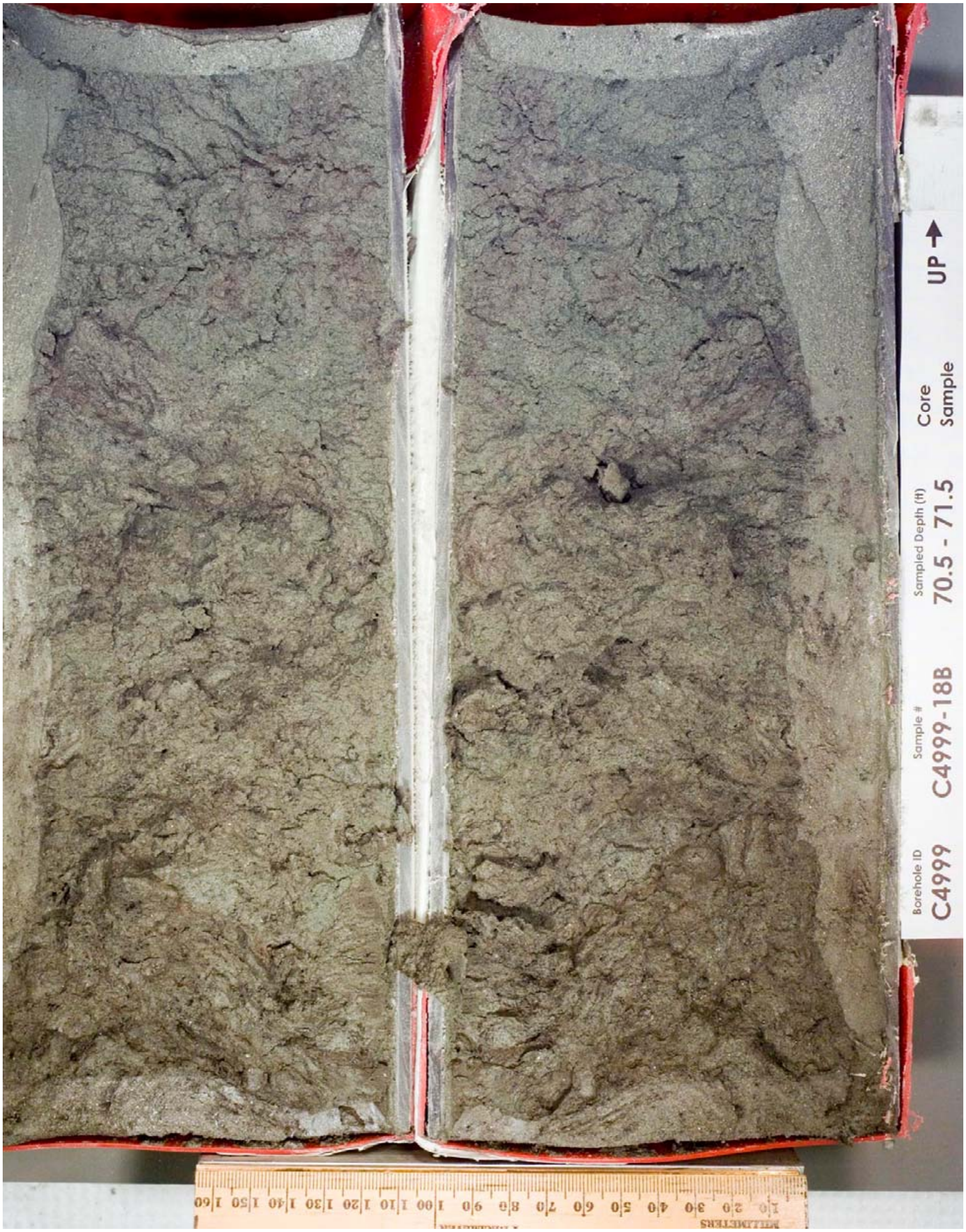

Borehole ID
C4999
Sample #
C4999-17A
Sampled Depth (ft)
65.5 - 66.5
Core
Sample
UP


Borehole ID
C4999
Sample #
C4999-17B
Sampled Depth (ft)
66.5 - 67.5
Core Sample
UP


Borehole ID
C4999
Sample #
C4999-17C
Sampled Depth (ft)
67.5 - 68.5
Core
Sample
UP


Borehole ID
C4999
Sample #
C4999-17D
Sampled Depth (ft)
68.5 - 69.5
Core
Sample
UP


Borehole ID
C4999
Sample #
C4999-17E
Sampled Depth (ft)
69.5 - 70.5
Core
Sample
UP
MILLIMETERS


Borehole ID
C4999
Sample #
C4999-18B
Sampled Depth (ft)
70.5 - 71.5
Core
Sample
UP
MILLIMETERS

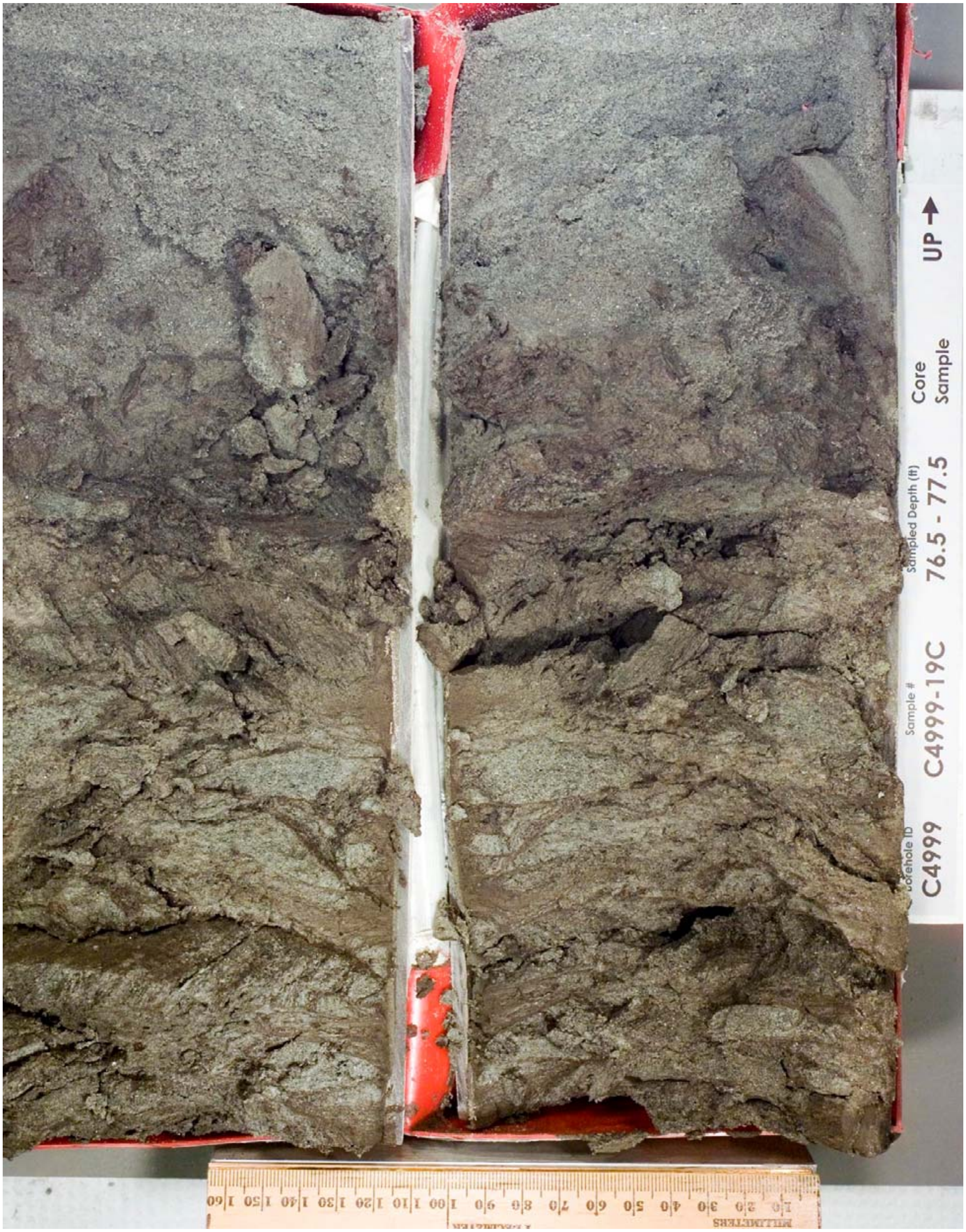

UP
Core Sample
Sampled Depth (ft)
71.5 - 72.5
Sample #
C4999-18C
Borehole ID
C4999


Borehole ID
C4999
Sample #
C4999-18D
Sampled Depth (ft)
72.5 - 73.5
Core
Sample
UP
MILLIMETERS

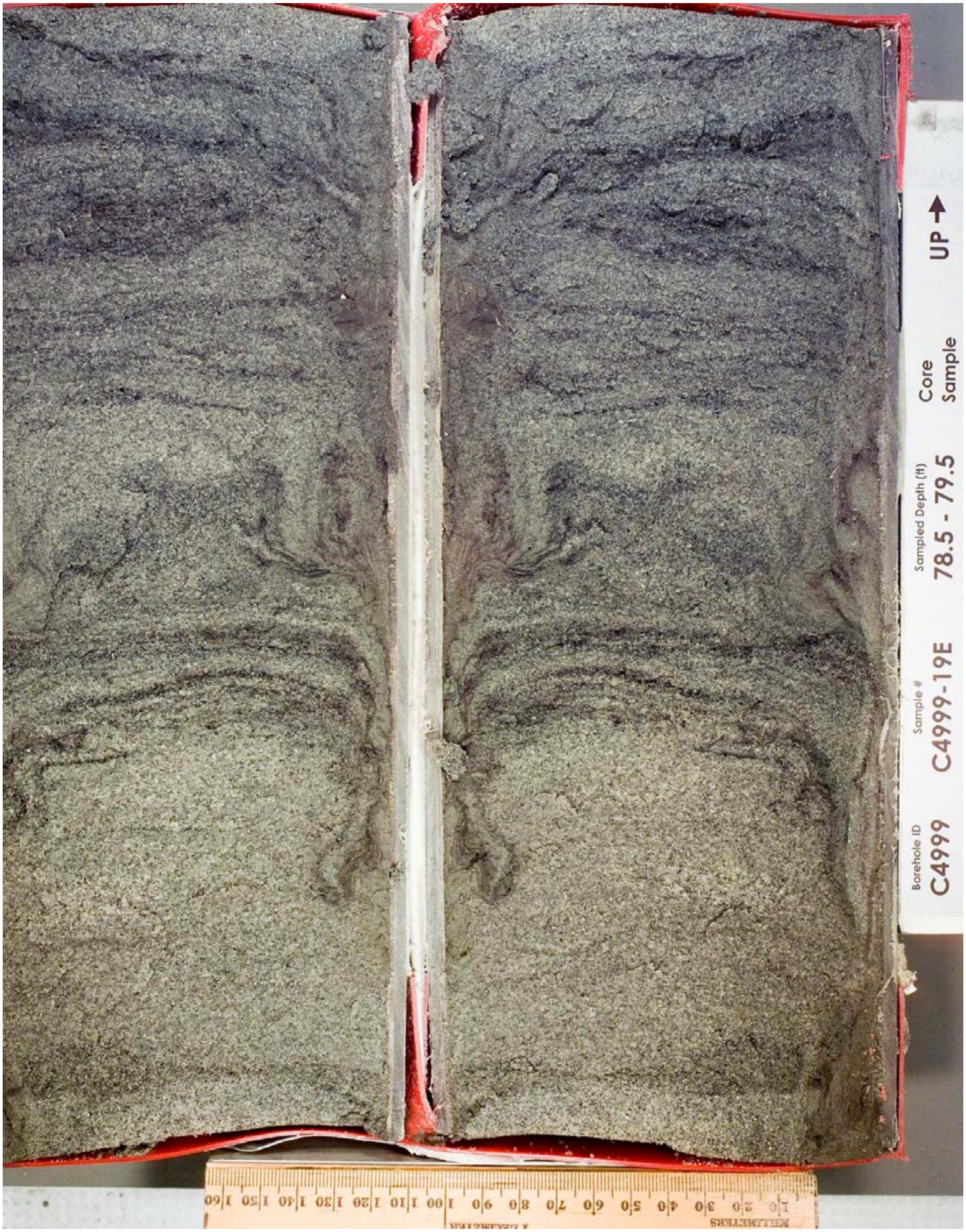

UP →
Core Sample
Sampled Depth (ft)
73.5 - 74.5
Sample #
C4999-18E
Borehole ID
C4999
MILLIMETERS

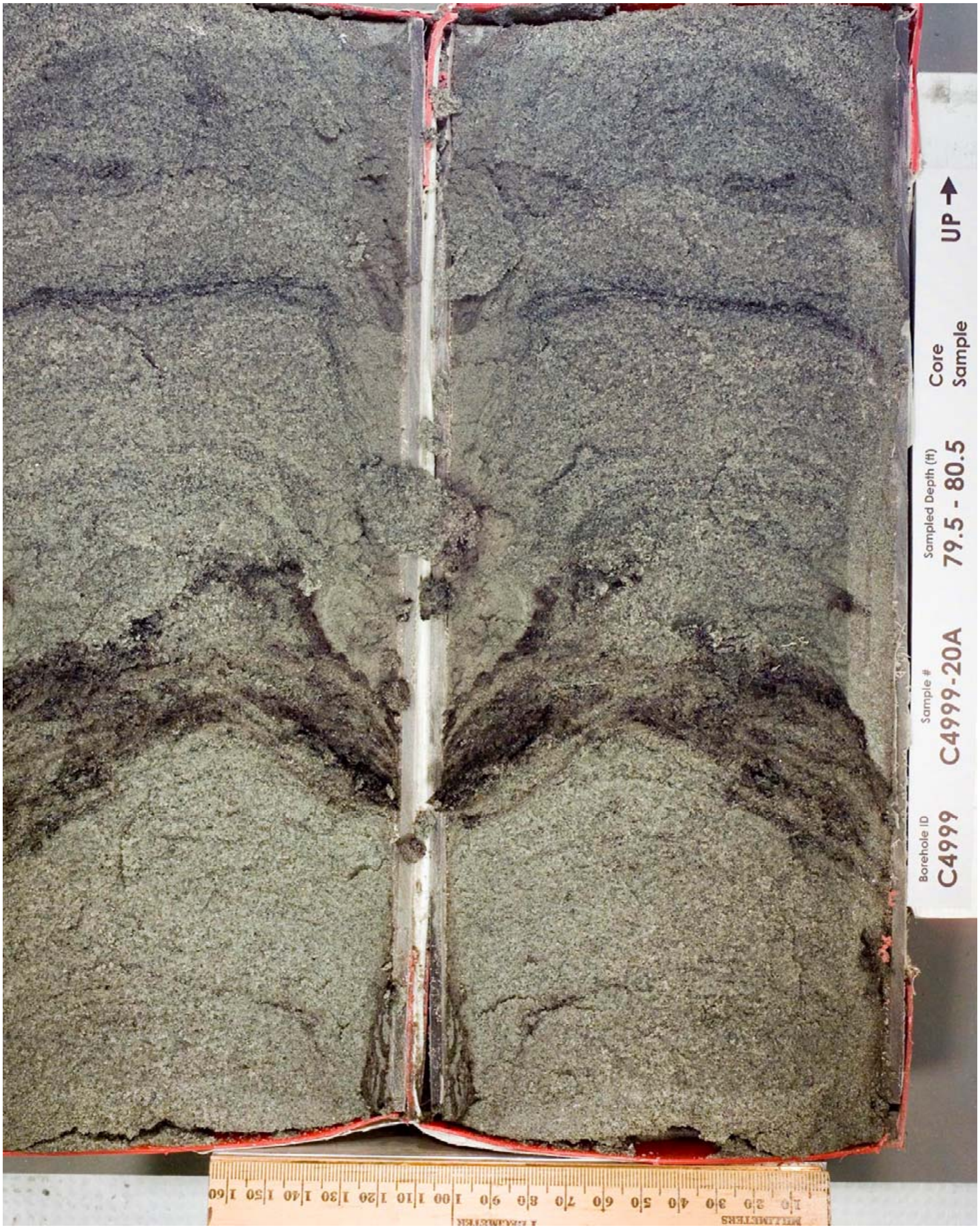

Borehole ID
C4999
Sample #
C4999-19A
Sampled Depth (ft)
74.5 - 75.5
Core
Sample
UP

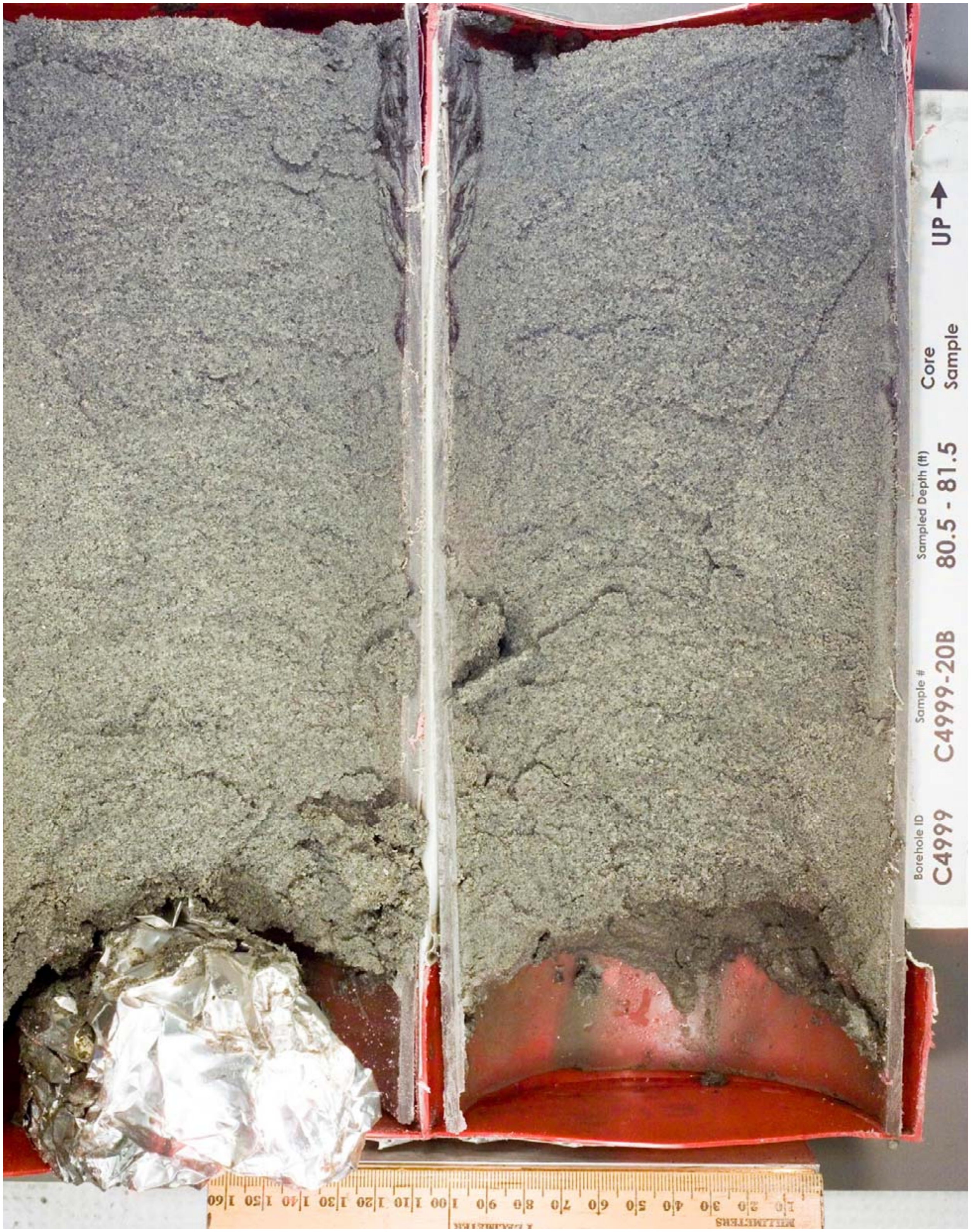

Borehole ID
C4999
Sample #
C4999-19B
Sampled Depth (ft)
75.5 - 76.5
Core
Sample
UP


C4999
Sample #
C4999-19C
Sampled Depth (ft)
76.5 - 77.5
Core
Sample
UP


UP →
Core Sample
Sampled Depth (ft)
77.5 - 78.5
Sample #
C4999-19D
Borehole ID
C4999
MILLIMETERS

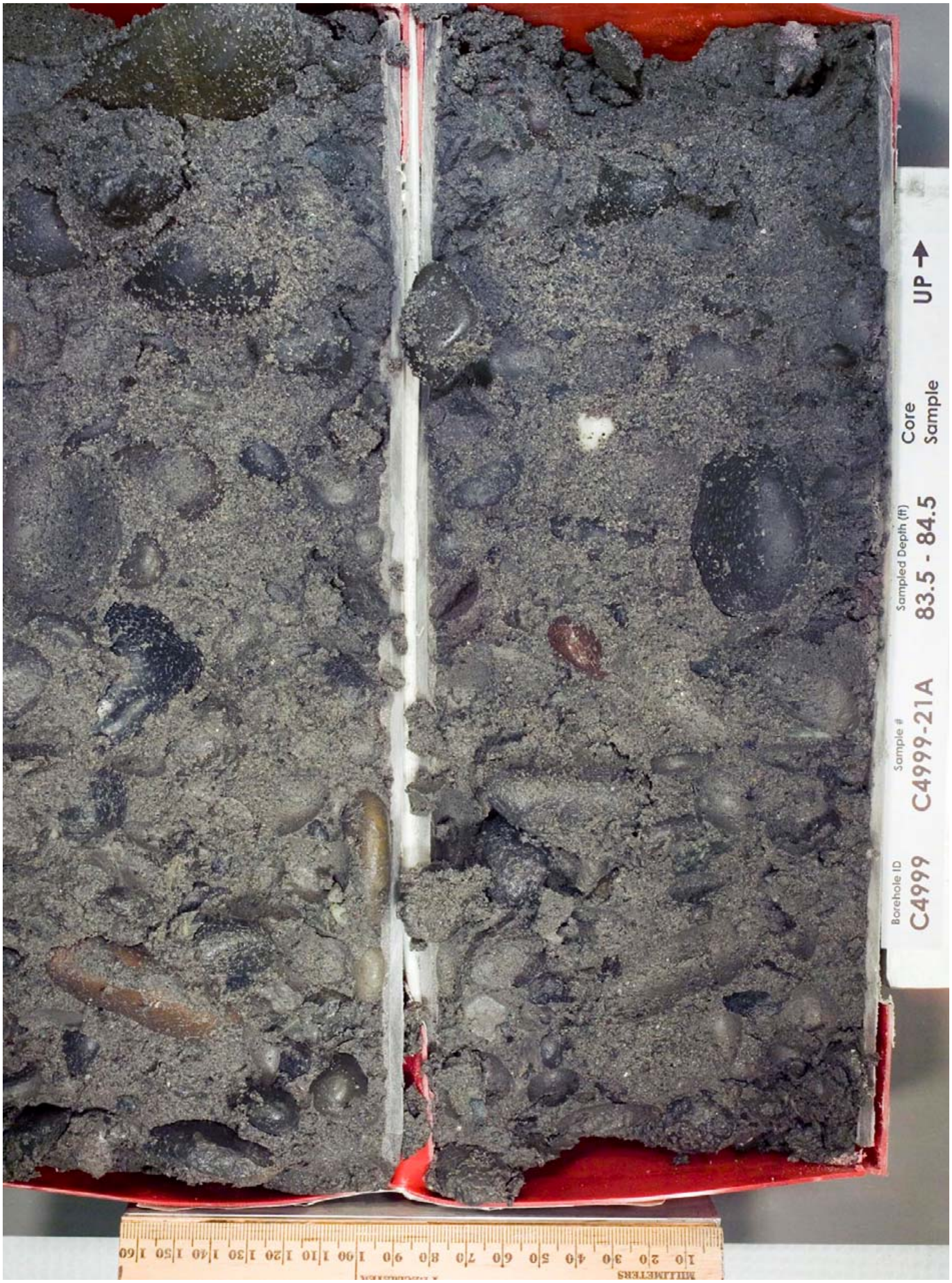

UP →
Core
Sample
Sampled Depth (ft)
78.5 - 79.5
Sample #
C4999-19E
Borehole ID
C4999

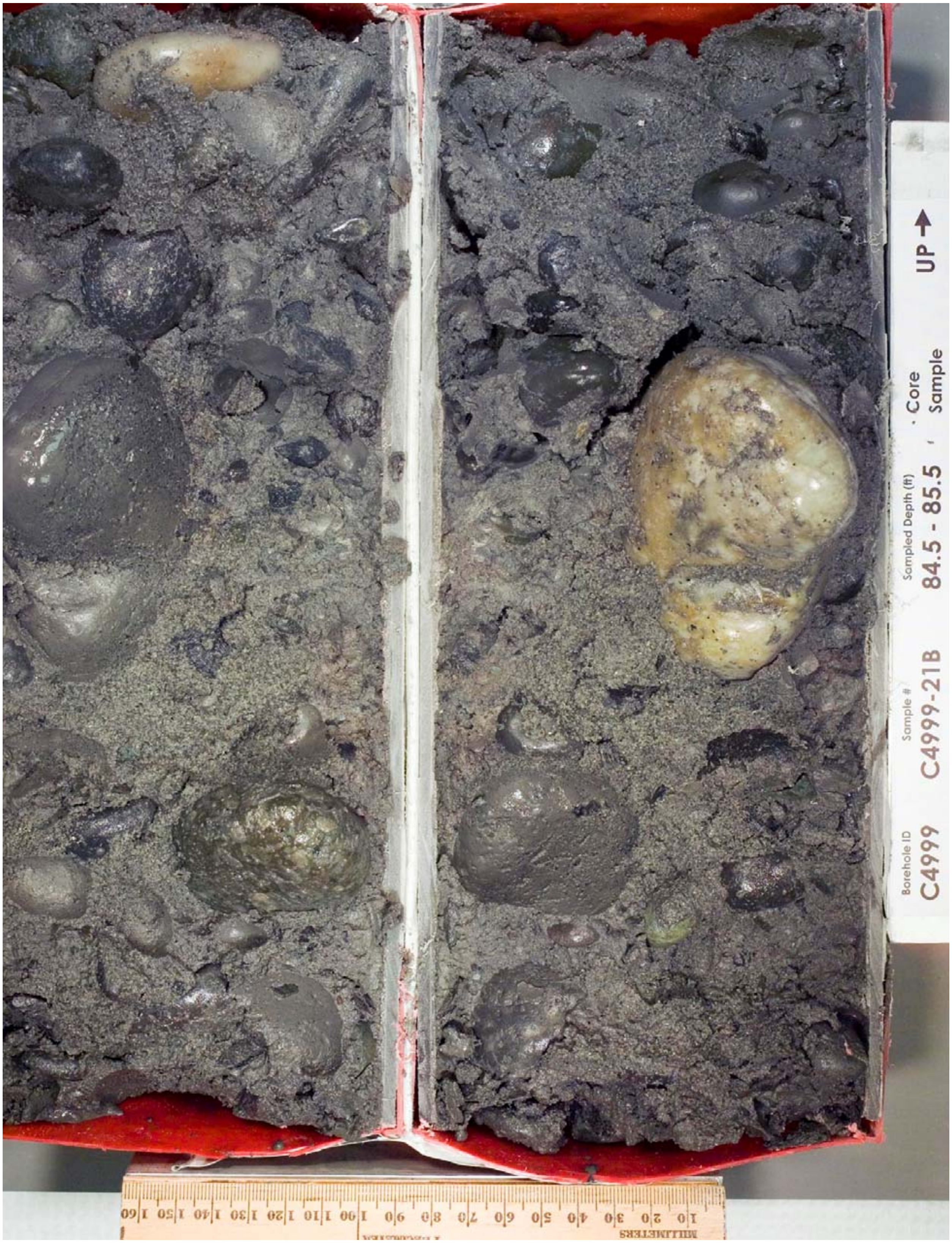

Borehole ID
C4999
Sample #
C4999-20A
Sampled Depth (ft)
79.5 - 80.5
Core
Sample
UP →


Borehole ID
C4999
Sample #
C4999-20B
Sampled Depth (ft)
80.5 - 81.5
Core
Sample
UP →
MILLIMETERS

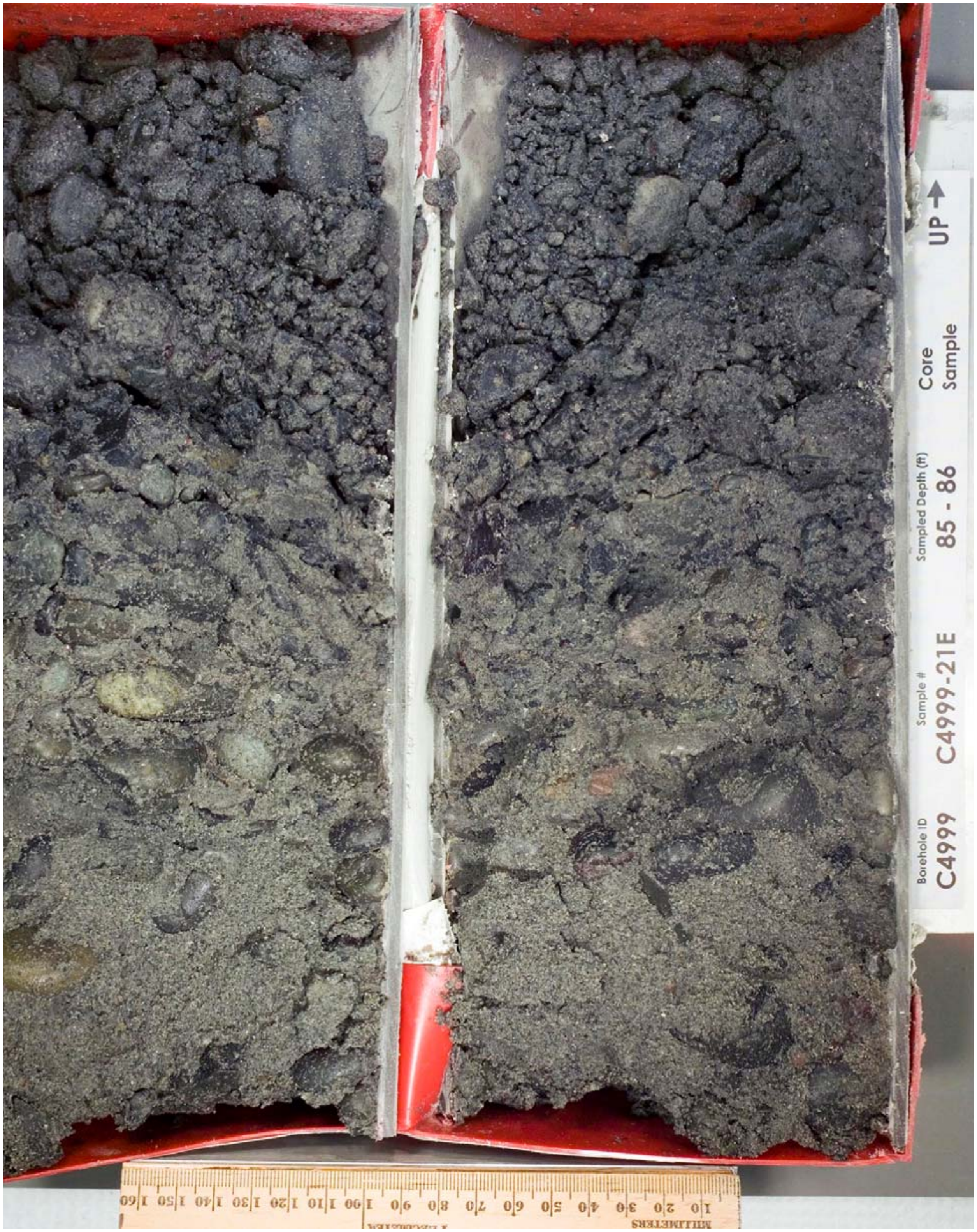

Borehole ID
C4999
Sample #
C4999-20D
Sampled Depth (ft)
81.5 - 82.5
Core
Sample
UP


UP
Core Sample
Sampled Depth (ft)
82.5 - 83.5
Sample #
C4999-20E
Borehole ID
C4999
MILLIMETERS

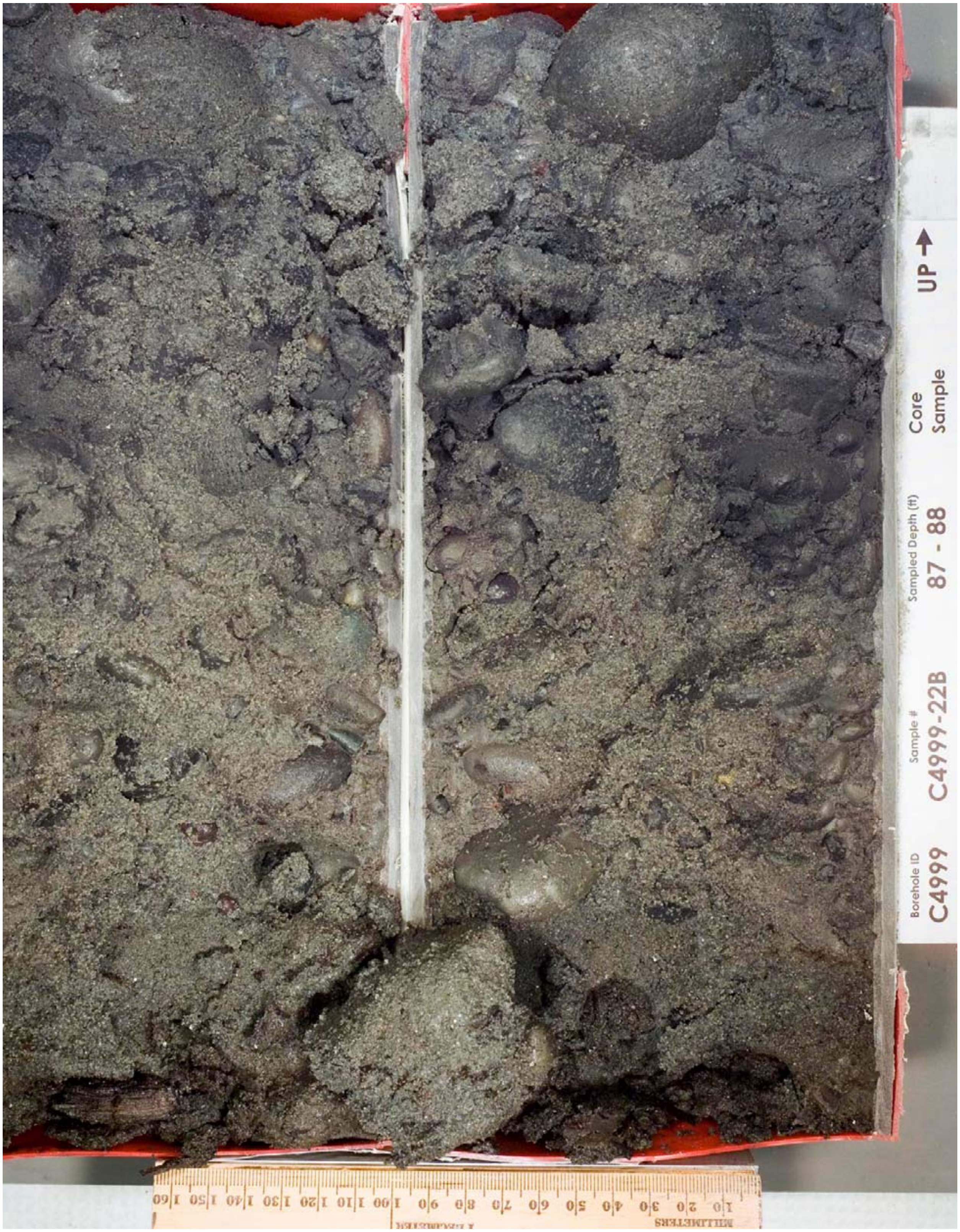

Borehole ID
C4999
Sample #
C4999-21A
Sampled Depth (ft)
83.5 - 84.5
Core
Sample
UP


Borehole ID
C4999
Sample #
C4999-21B
Sampled Depth (ft)
84.5 - 85.5
Core
Sample
UP
MILLIMETERS


Borehole ID
C4999
Sample #
C4999-21C
Sampled Depth (ft)
85.5 - 86.5
Core
Sample
UP

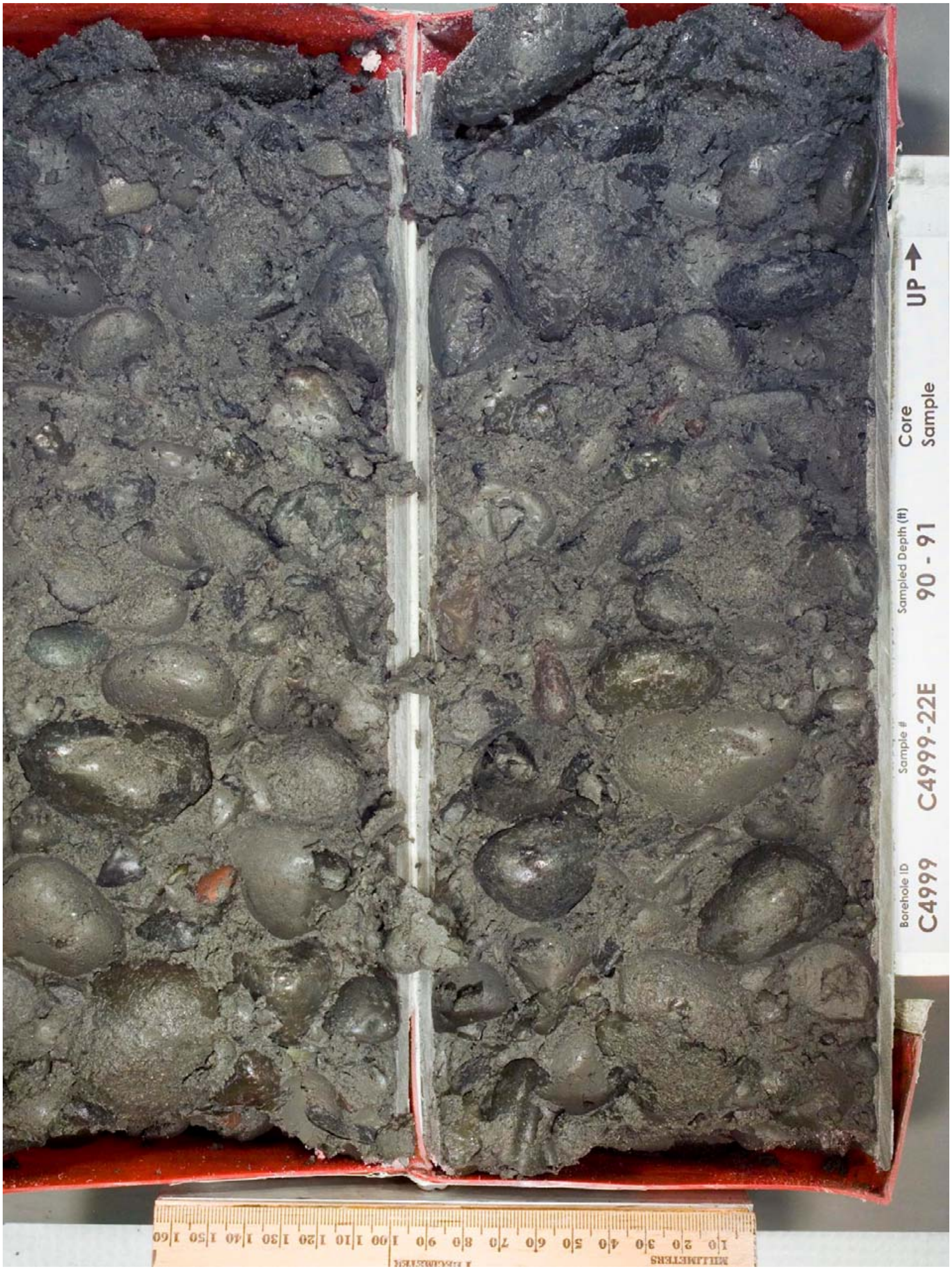

UP
Core Sample
Sampled Depth (ft)
85 - 86
Sample #
C4999-21E
Borehole ID
C4999
MILLIMETERS

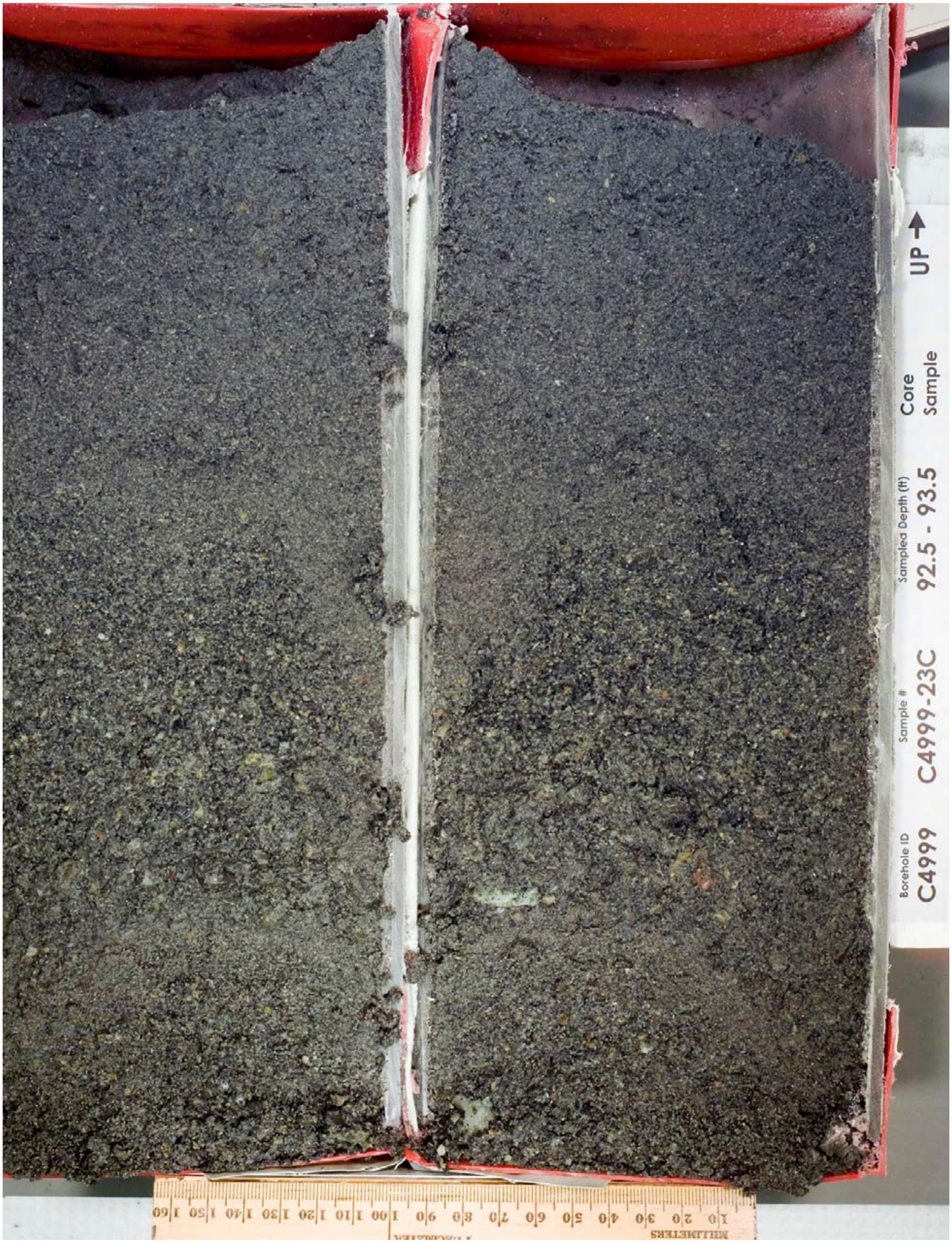

UP
Core Sample
Sampled Depth (ft)
86 - 87
Sample #
C4999-22A
Borehole ID
C4999
MILLIMETERS


Borehole ID
C4999
Sample #
C4999-22B
Sampled Depth (ft)
87 - 88
Core
Sample
UP
MILLIMETERS


UP
Core Sample
Sampled Depth (ft)
88 - 89
Sample #
C4999-22C
Borehole ID
C4999
MILLIMETERS


UP
Core Sample
Sampled Depth (ft)
89 - 90
Sample #
C4999-22D
Borehole ID
C4999

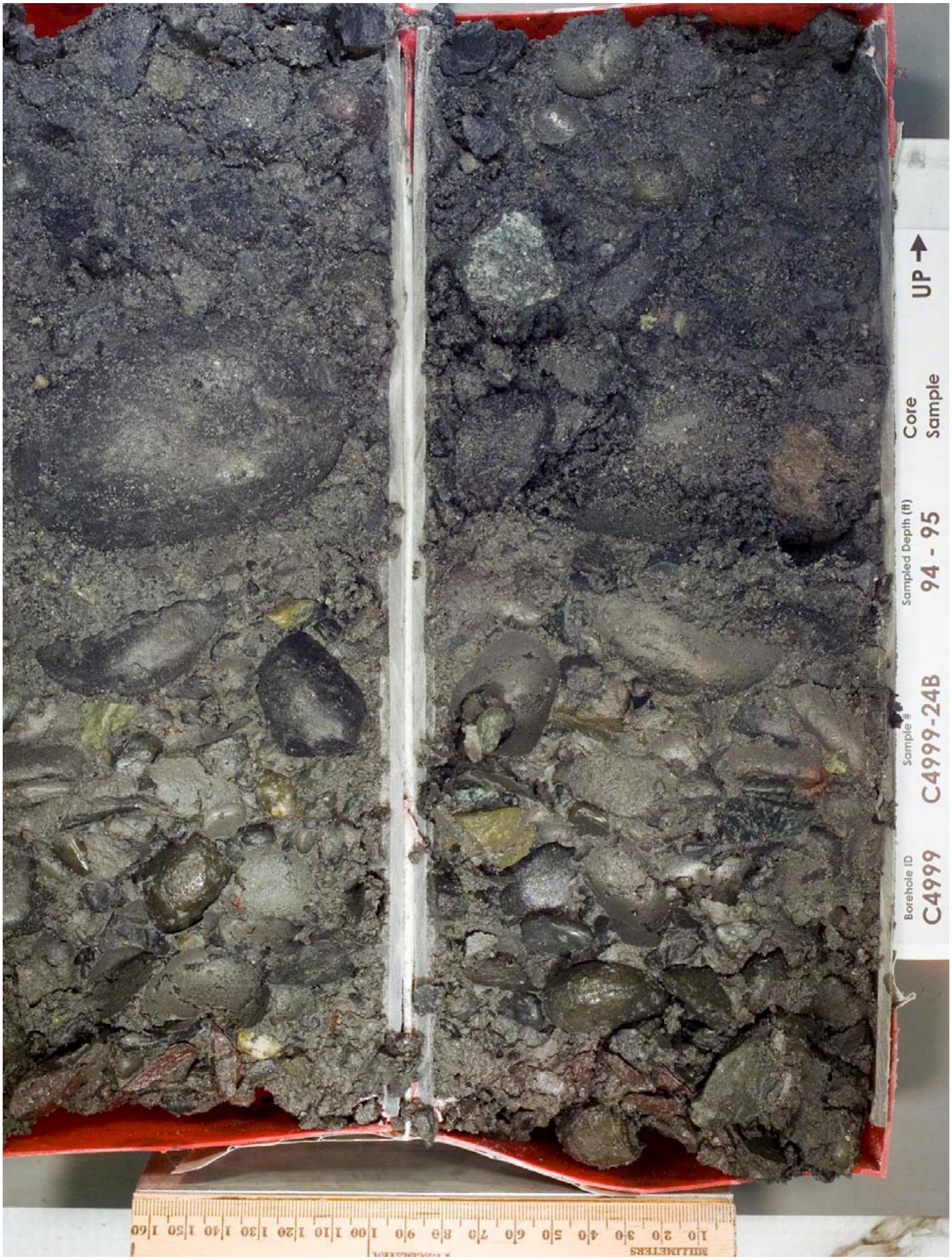

Borehole ID
C4999
Sample #
C4999-22E
Sampled Depth (ft)
90 - 91
Core
Sample
UP

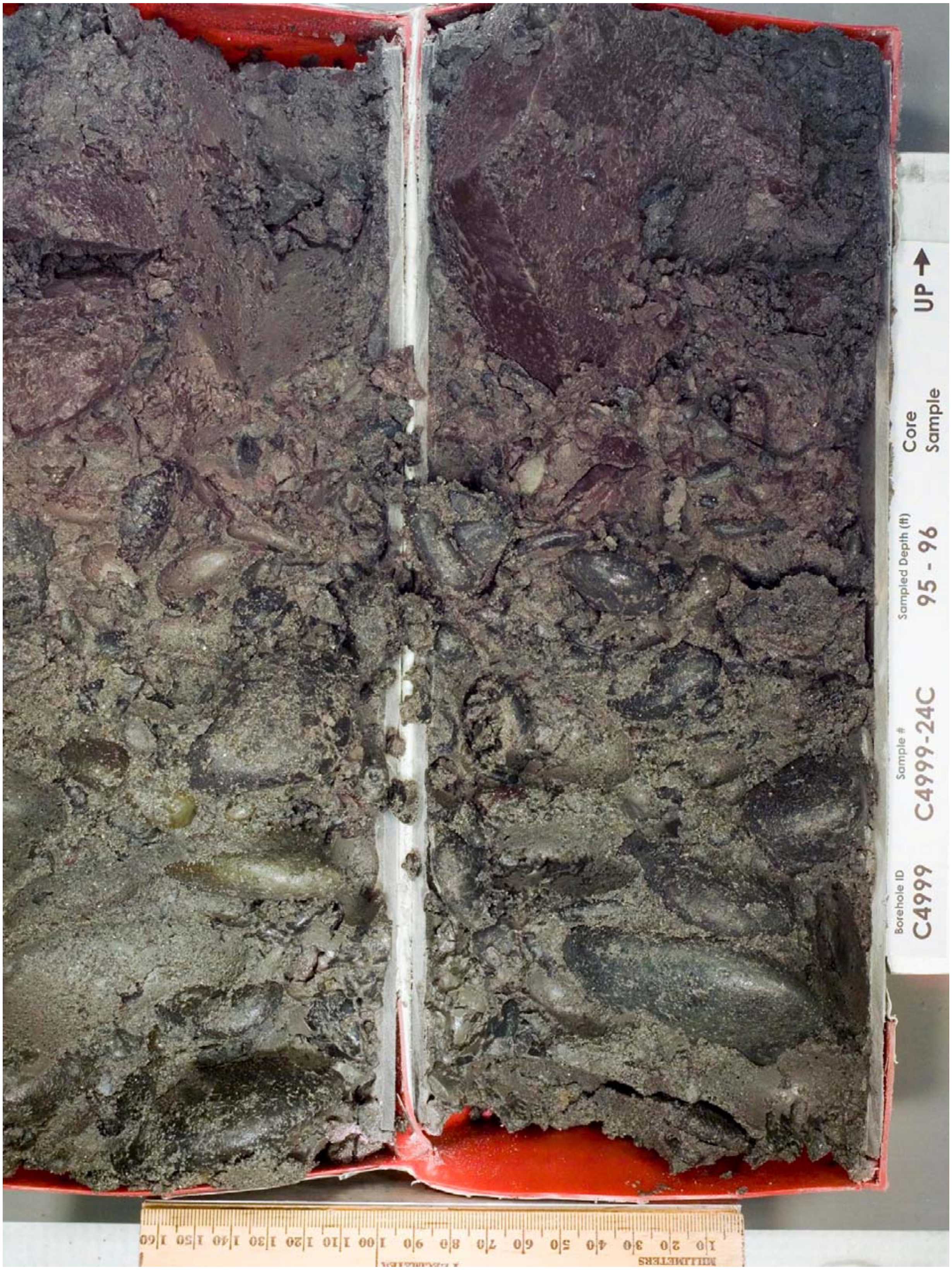

Borehole ID
C4999
Sample #
C4999-23C
Sampled Depth (ft)
92.5 - 93.5
Core
Sample
UP


Borehole ID
C4999
Sample #
C4999-23D
Sampled Depth (ft)
93.5 - 94.5
Core
Sample
UP

Borehole ID C4999
Sample # C4999-23E
Sampled Depth (ft) 94.5 - 95.5
Core Sample
UP
MILLIMETERS


Borehole ID
C4999
Sample #
C4999-24A
Sampled Depth (ft)
95.5 - 95.5
Core
Sample
UP →


UP
Core Sample
Sampled Depth (ft)
94 - 95
Sample #
C4999-24B
Borehole ID
C4999
MILLIMETERS

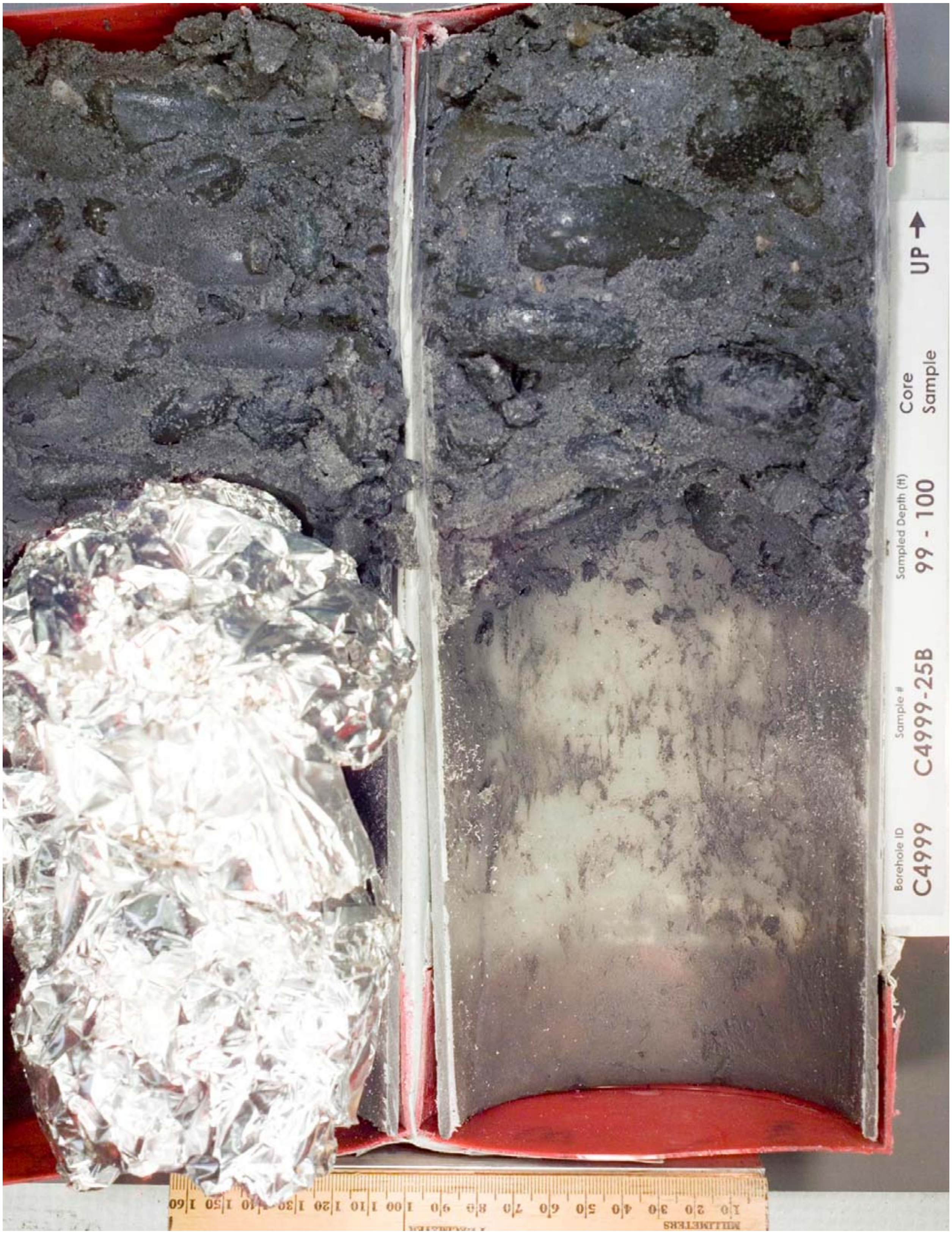


Borehole ID
C4999
Sample #
C4999-24C
Sampled Depth (ft)
95 - 96
Core
Sample
UP
MILLIMETERS

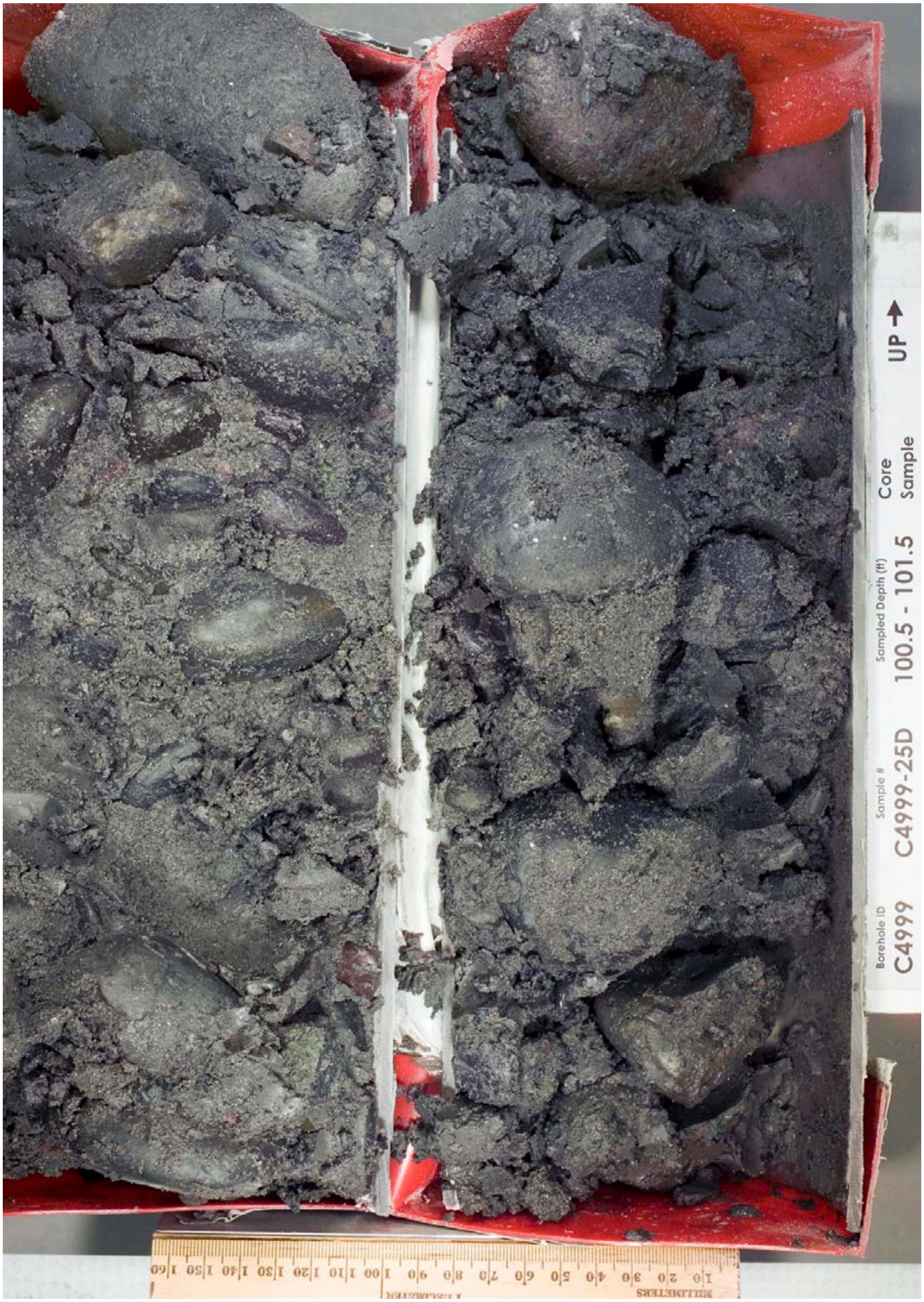
UP
Core Sample
Sampled Depth (ft)
96 - 97
Sample #
C4999-24D
Borehole ID
C4999

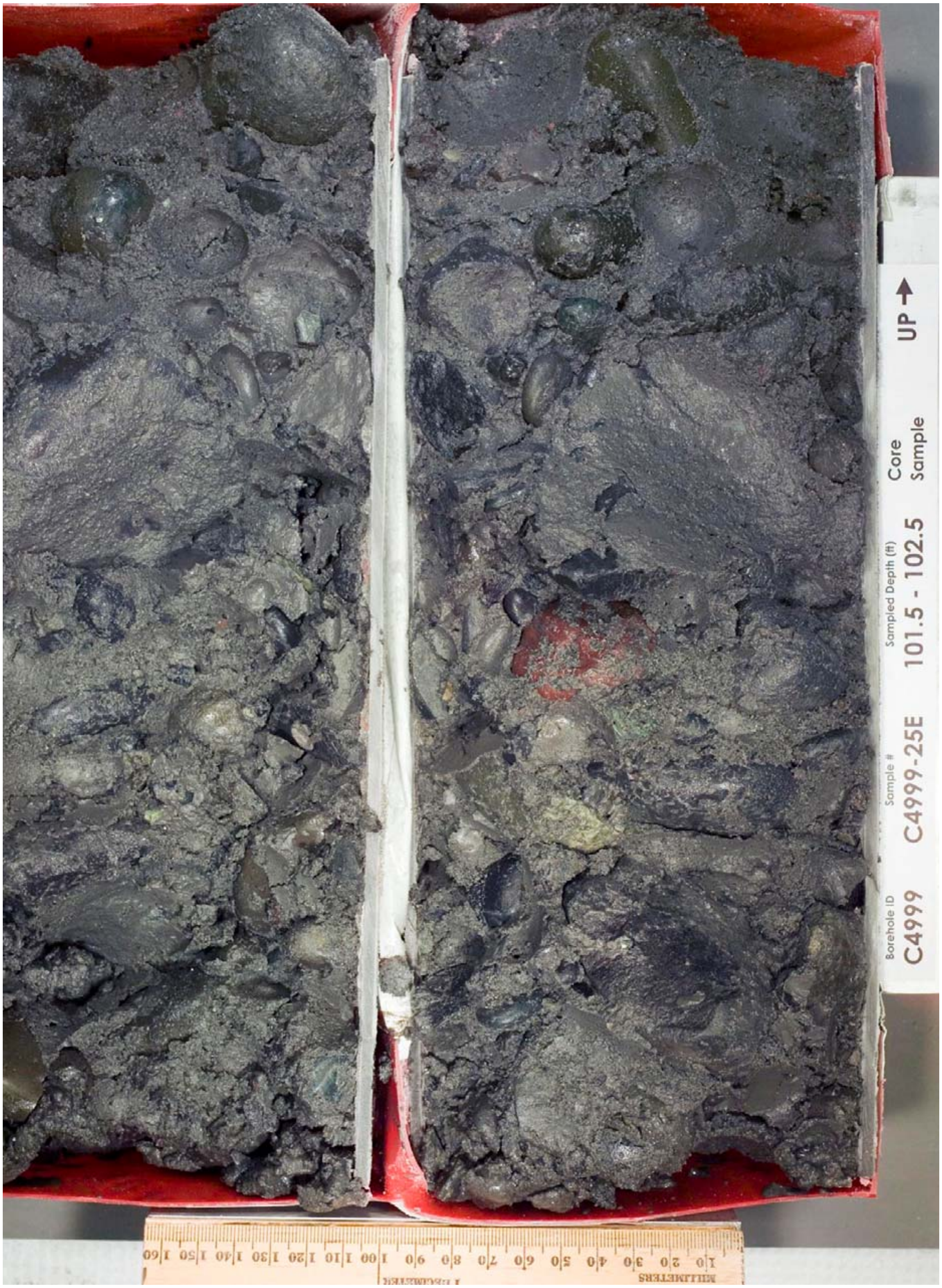

UP
Core
Sample
Sampled Depth (ft)
97 - 98
Sample #
C4999-24E
Borehole ID
C4999
MILLIMETERS


Borehole ID
C4999
Sample #
C4999-25A
Sampled Depth (ft)
98 - 99
Core
Sample
UP

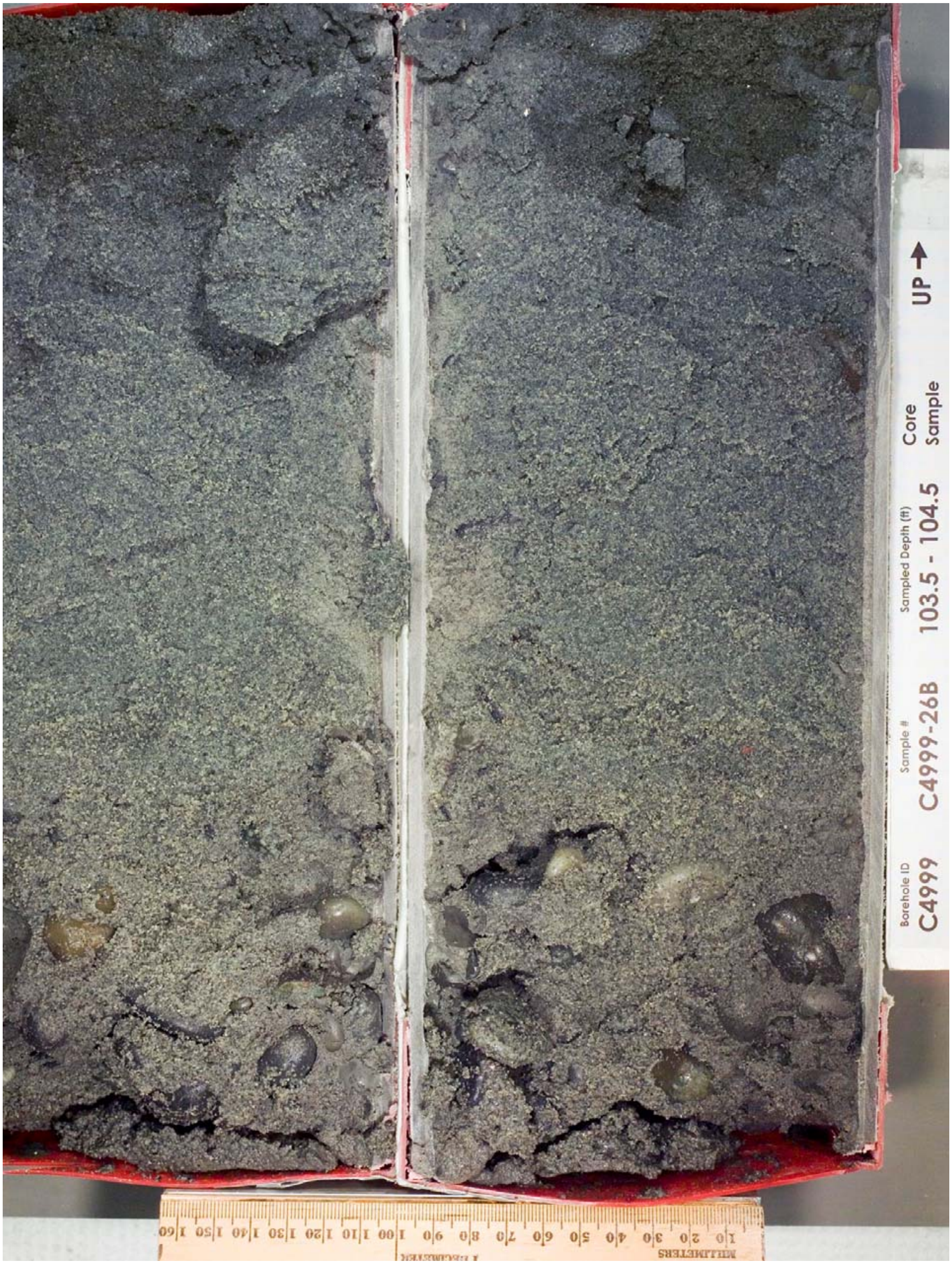

Core Sample
UP →
Borehole ID
C4999
Sample #
C4999-25B
Sampled Depth (ft)
99 - 100
MILLIMETERS


C4999
C4999-25C
99.5 - 100.5
Sampled Depth (ft)
Core
Sample
UP
MILLIMETERS

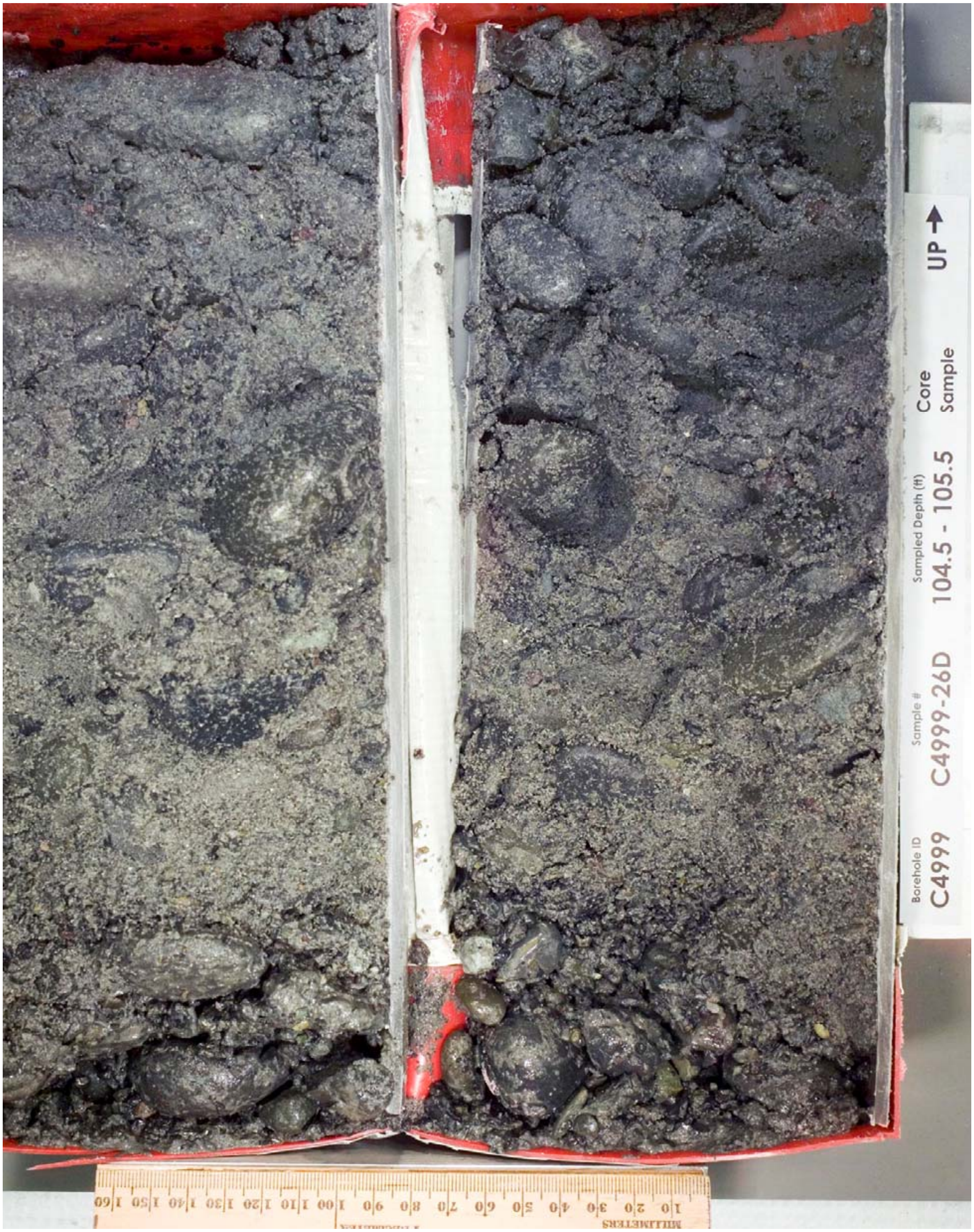

Borehole ID
C4999
Sample #
C4999-25D
Sampled Depth (ft)
100.5 - 101.5
Core
Sample
UP →
MILLIMETERS


Borehole ID
C4999
Sample #
C4999-25E
Sampled Depth (ft)
101.5 - 102.5
Core
Sample
UP →


Borehole ID
C4999
Sample #
C4999-26A
Sampled Depth (ft)
102.5 - 103.5
Core
Sample
UP
MILLIMETERS


Borehole ID
C4999
Sample #
C4999-26B
Sampled Depth (ft)
103.5 - 104.5
Core
Sample
UP


UP
Core Sample
Sampled Depth (ft)
104.5 - 105.5
Sample #
C4999-26C
Borehole ID
C4999
MILLIMETERS

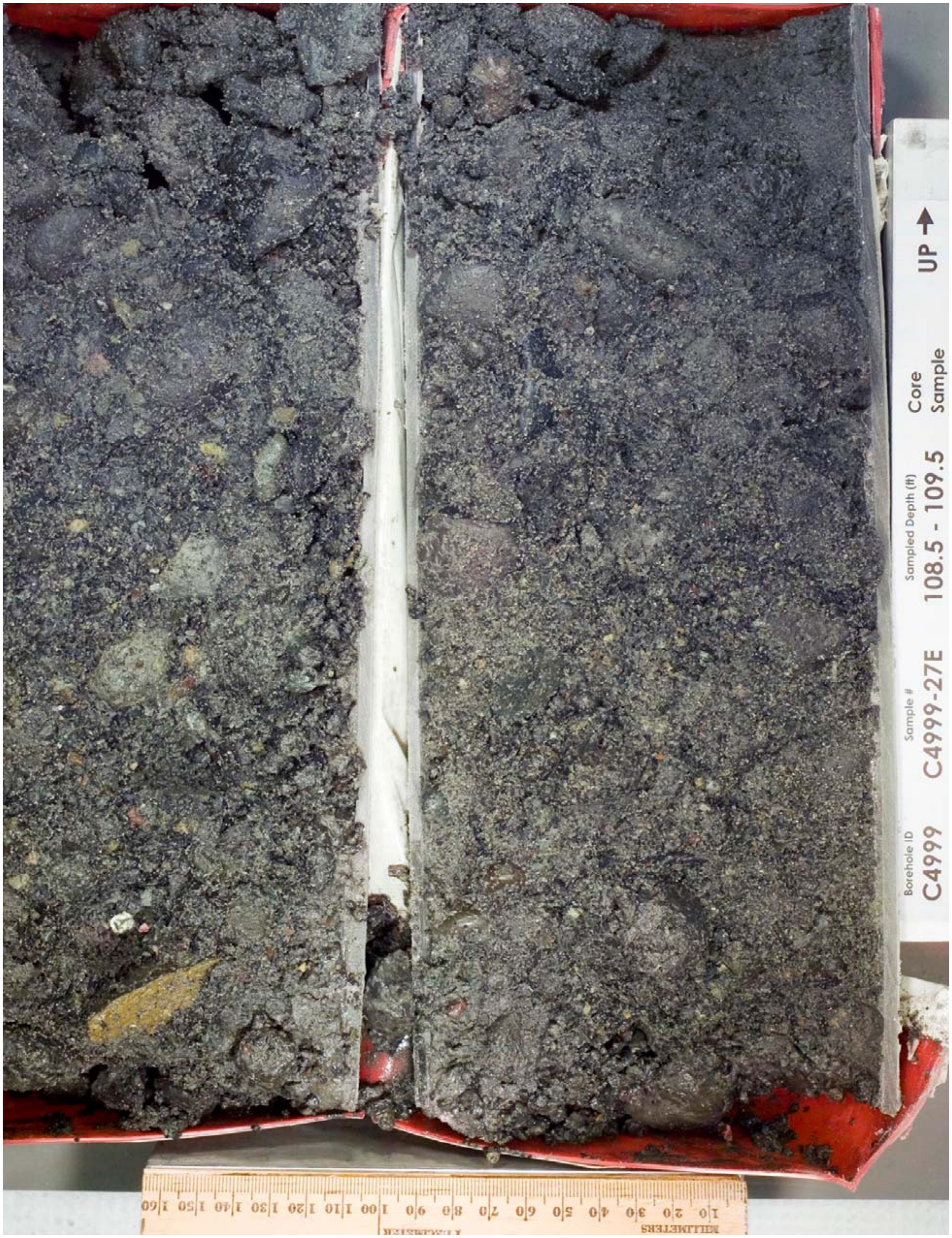

Borehole ID
C4999
Sample #
C4999-26D
Sampled Depth (ft)
104.5 - 105.5
Core
Sample
UP


Borehole ID
C4999
Sample #
C4999-26E
Sampled Depth (ft)
105.5 - 106.5
Core
Sample
UP

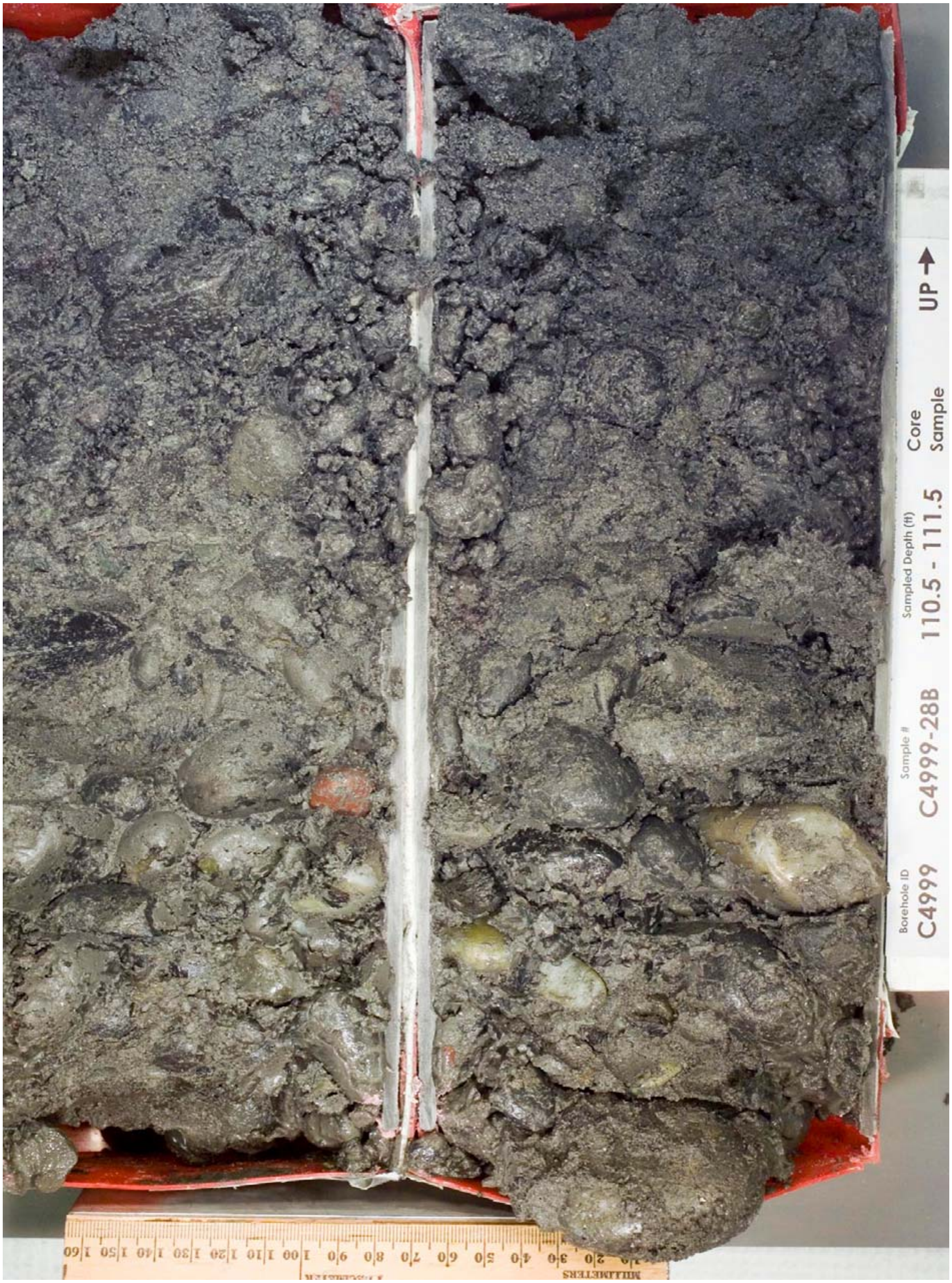
Borehole ID
C4999
Sample #
C4999-27A
Sampled Depth (ft)
106.5 - 107.5
Core
Sample
UP
MILLIMETERS


Borehole ID
C4999
Sample #
C4999-27B
Sampled Depth (ft)
107.5 - 108.5
Core
Sample
UP
MILLIMETERS


Borehole ID
C4999
Sample #
C4999-27C
Sampled Depth (ft)
108.5 - 109.5
Core
Sample
UP
MILLIMETERS


Borehole ID
C4999
Sample #
C4999-27E
Sampled Depth (ft)
108.5 - 109.5
Core
Sample
UP
MILLIMETERS


Borehole ID
C4999
Sample #
C4999-28A
Sampled Depth (ft)
109.5 - 110.5
Core
Sample
UP

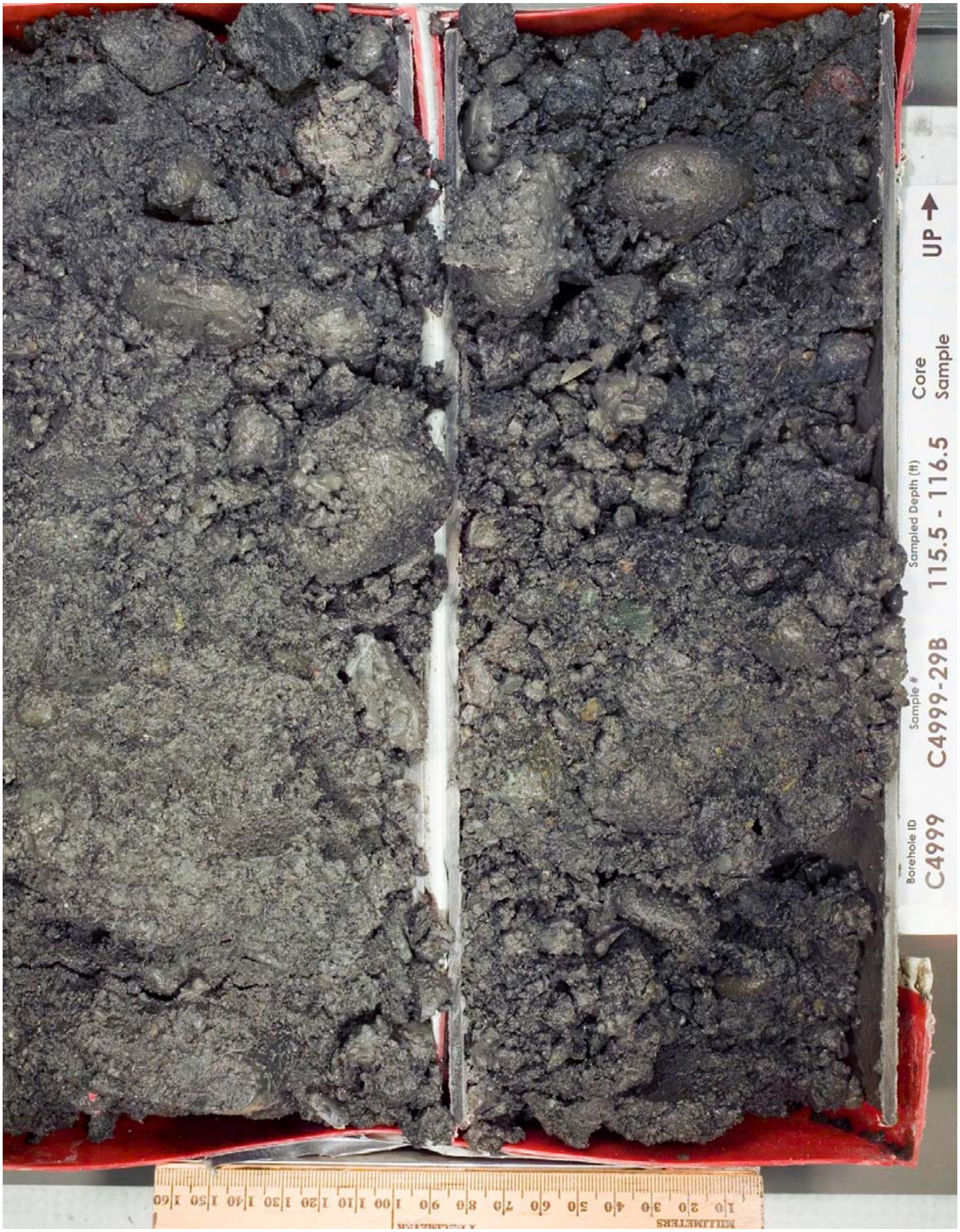

Borehole ID
C4999
Sample #
C4999-28B
Sampled Depth (ft)
110.5 - 111.5
Core
Sample
UP
MILLIMETERS


UP
Core Sample
Sampled Depth (ft)
111.5 - 112.5
Sample #
C4999-28C
Borehole ID
C4999
MILLIMETERS


UP
Core Sample
Sampled Depth (ft)
112.5 - 113.5
Sample #
C4999-28D
Borehole ID
C4999
MILLIMETERS

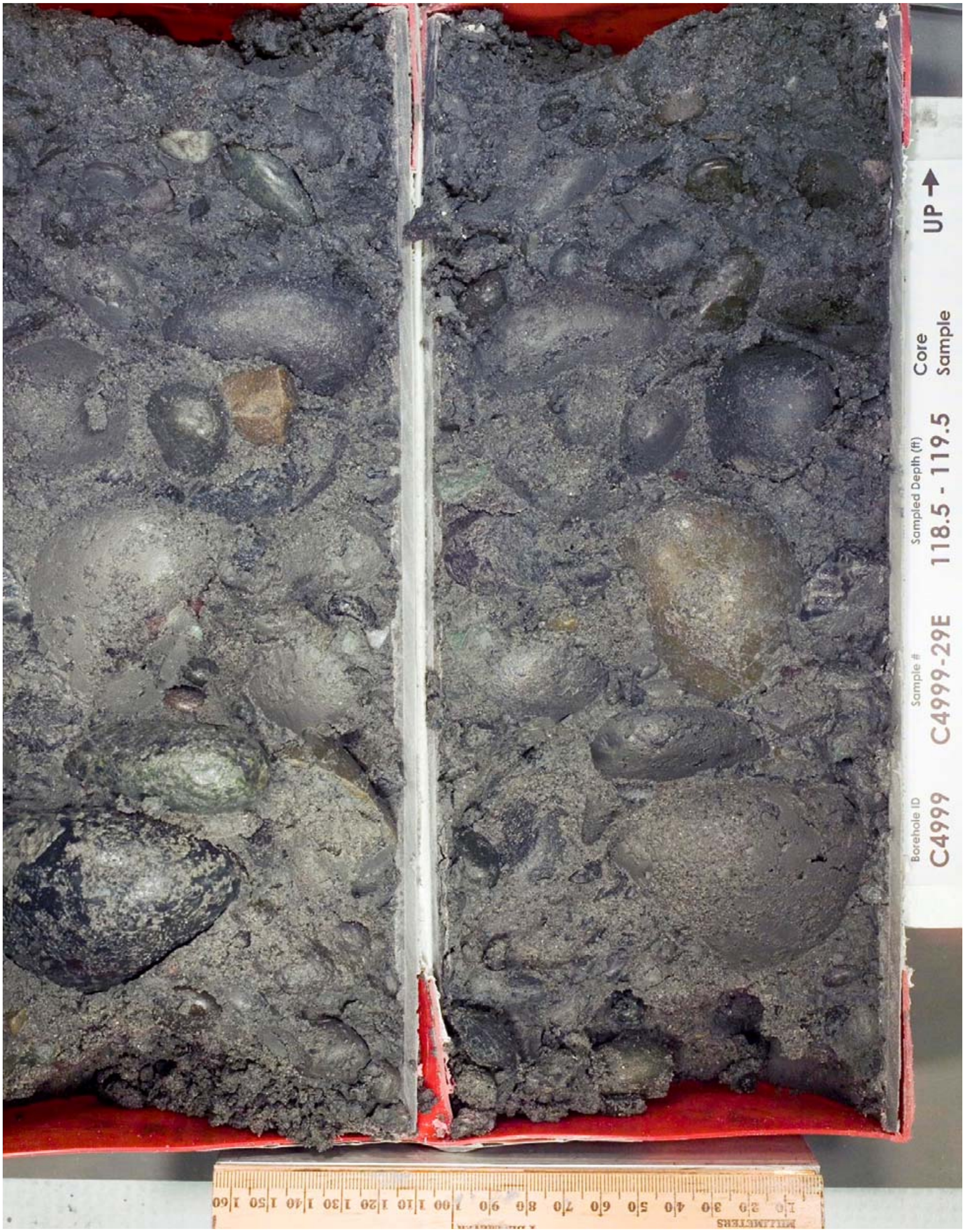

UP
Core Sample
Sampled Depth (ft)
113.5 - 114.5
Sample #
C4999-28E
Borehole ID
C4999
MILLIMETERS


UP →
Core Sample
Sampled Depth (ft)
114.5 - 115.5
Sample #
C4999-29A
Borehole ID
C4999
MILLIMETERS

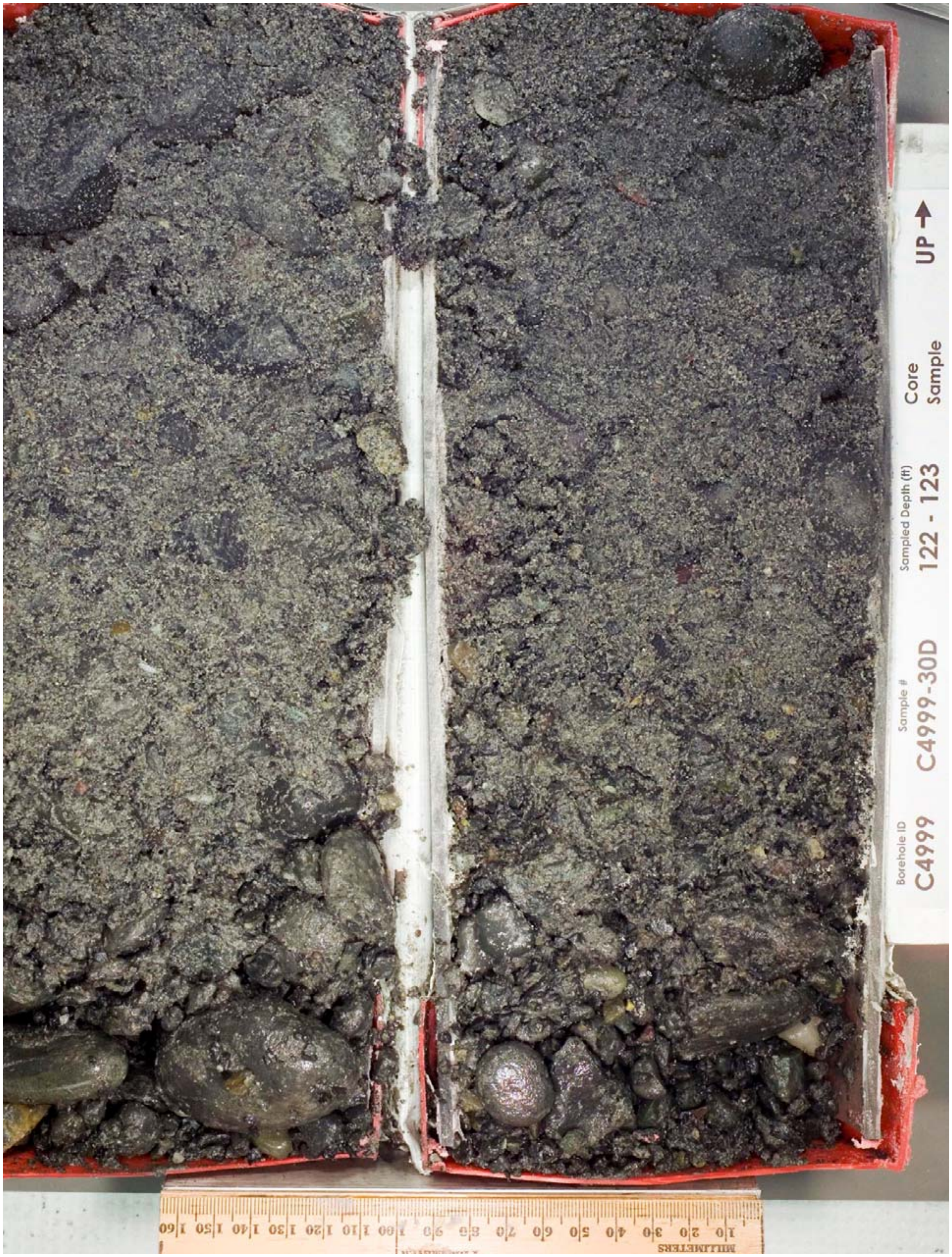

Borehole ID
C4999
Sample #
C4999-29B
Sampled Depth (ft)
115.5 - 116.5
Core
Sample
UP →


Borehole ID
C4999
Sample #
C4999-29C
Sampled Depth (ft)
116.5 - 117.5
Core
Sample
UP


Borehole ID
C4999
Sample #
C4999-29D
Sampled Depth (ft)
117.5 - 118.5
Core
Sample
UP


Core Sample
UP
Borehole ID
C4999
Sample #
C4999-29E
Sampled Depth (ft)
118.5 - 119.5
MILLIMETERS


UP
Core Sample
Sampled Depth (ft)
119.5 - 120.5
Sample #
C4999-30A
Borehole ID
C4999
MILLIMETERS

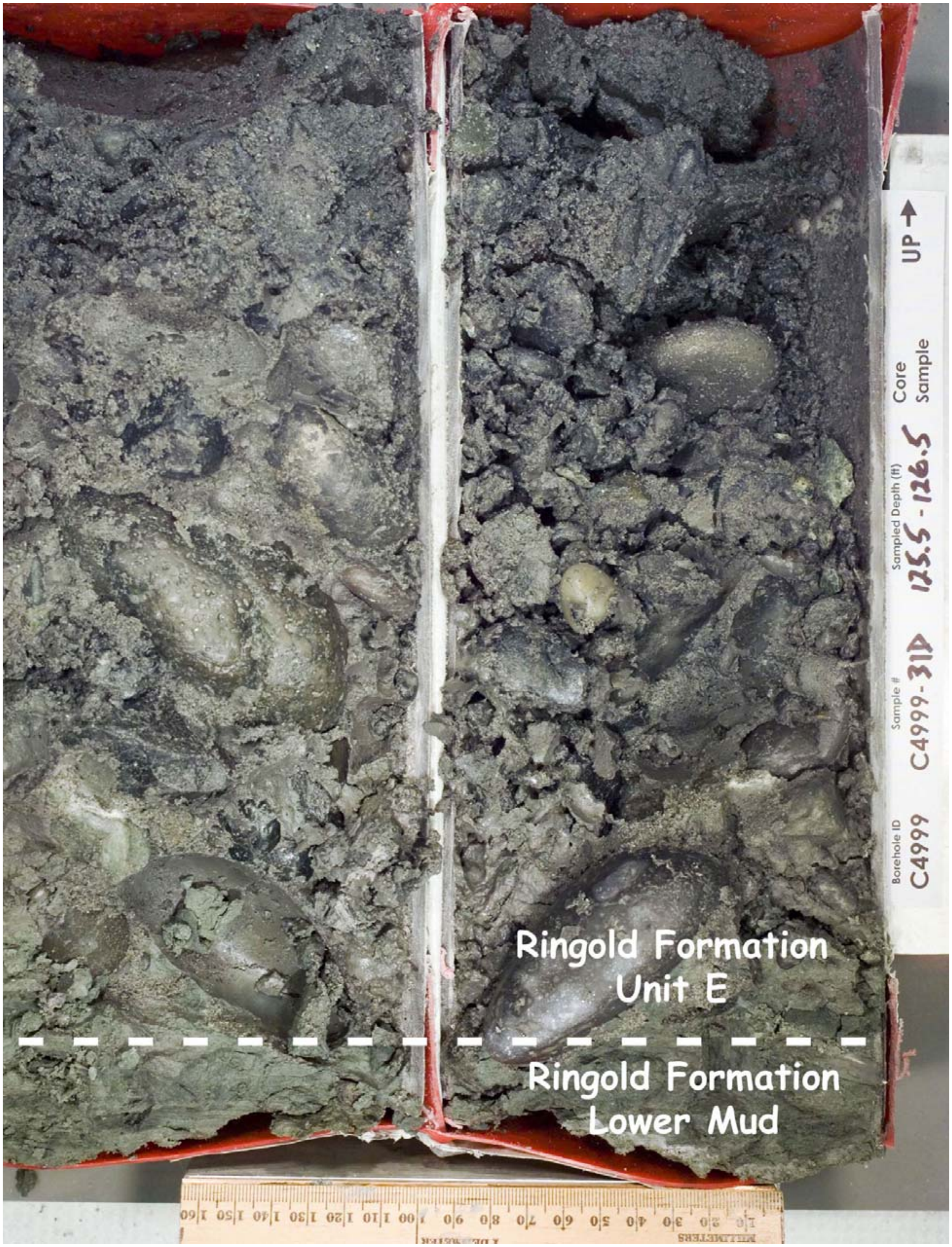

UP
Core Sample
Sampled Depth (ft)
122 - 123
Sample #
C4999-30D
Borehole ID
C4999
MILLIMETERS

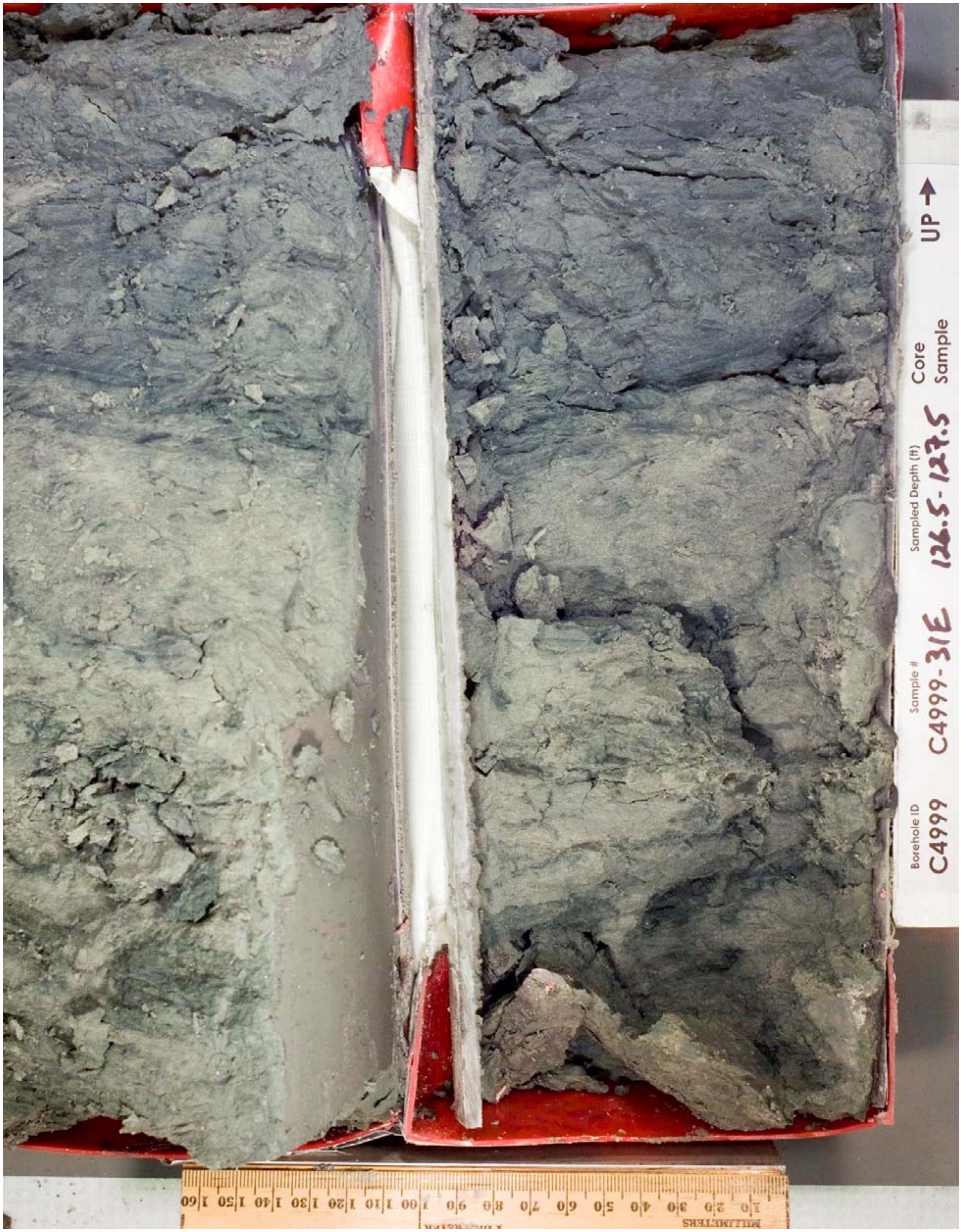

Core Sample
UP
Borehole ID
C4999
Sample #
C4999-30E
Sampled Depth (ft)
123 - 124
MILLIMETERS

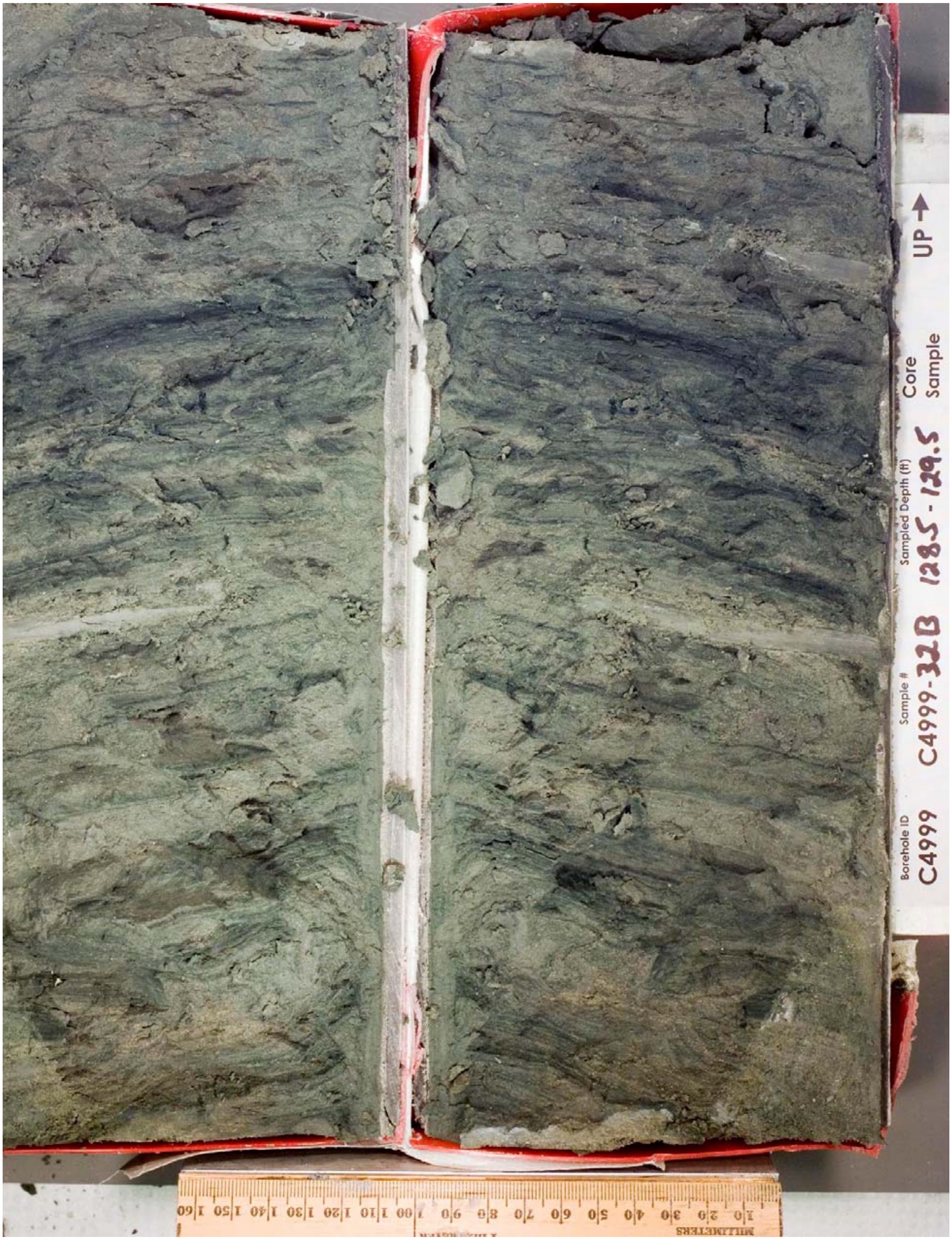

Core Sample
UP →
Borehole ID
C4999
Sample #
C4999-31A
Sampled Depth (ft)
124 - 125
MILLIMETERS

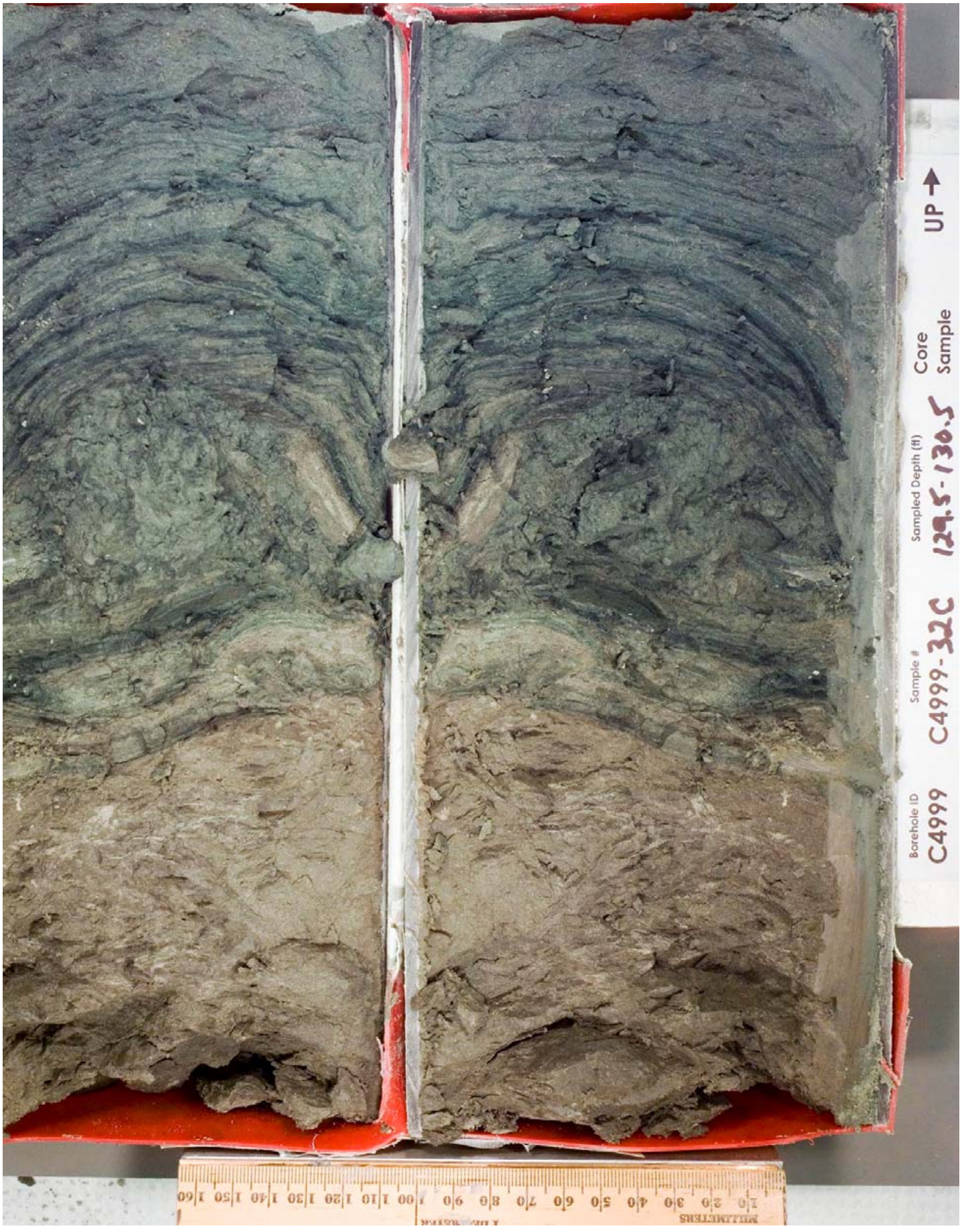

Borehole ID
C4999
Sample #
C4999-31B
Sampled Depth (ft)
125 - 126
Core
Sample
UP


Borehole ID
C4999
Sample #
C4999-31C
Sampled Depth (ft)
109.5 - 110.5
Core
Sample
UP →


Ringold Formation
Unit E
Ringold Formation
Lower Mud
Borehole ID
C4999
Sample #
C4999-31D
Sampled Depth (ft)
125.5-126.5
Core
Sample
UP


Borehole ID
C4999
Sample #
C4999-31E
Sampled Depth (ft)
126.5-127.5
Core Sample
UP


Borehole ID
C4999
Sample #
C4999-32B
Sampled Depth (ft)
128.5 - 129.5
Core
Sample
UP →
MILLIMETERS


Borehole ID
C4999
Sample #
C4999-32C
Sampled Depth (ft)
129.5-130.5
Core
Sample
UP
MILLIMETERS

Well C5000


MILLIMETERS
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160
Borehole ID
C5000
Sample #
C5000-32D
Sampled Depth (ft)
0 - 1
Core
Sample
UP


MILLIMETERS
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160
Borehole ID
C5000
Sample #
C5000-32E
Sampled Depth (ft)
1 - 2
Core
Sample
UP


MILLIMETERS
Borehole ID
C5000
Sample #
C5000-33A
Sampled Depth (ft)
2 - 2.5
Core
Sample
UP


Borehole ID
C5000
Sample #
C5000-33B
Sampled Depth (ft)
2 - 2.5
Core
Sample
UP
MILLIMETERS


MILLIMETERS
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160
Borehole ID
C5000
Sample #
C5000-33C
Sampled Depth (ft)
2.5 - 3.5
Core Sample
UP


MILLIMETERS
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160
Borehole ID
C5000
Sample #
C5000-33D
Sampled Depth (ft)
3.5 - 4.5
Core
Sample
UP


Borehole ID
C5000
Sample #
C5000-34A
Sampled Depth (ft)
3.5 - 4.5
Core Sample
UP
MILLIMETERS


MILLIMETERS
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160
Borehole ID
C5000
Sample #
C5000-34B
Sampled Depth (ft)
4.5 - 5.5
Core
Sample
UP

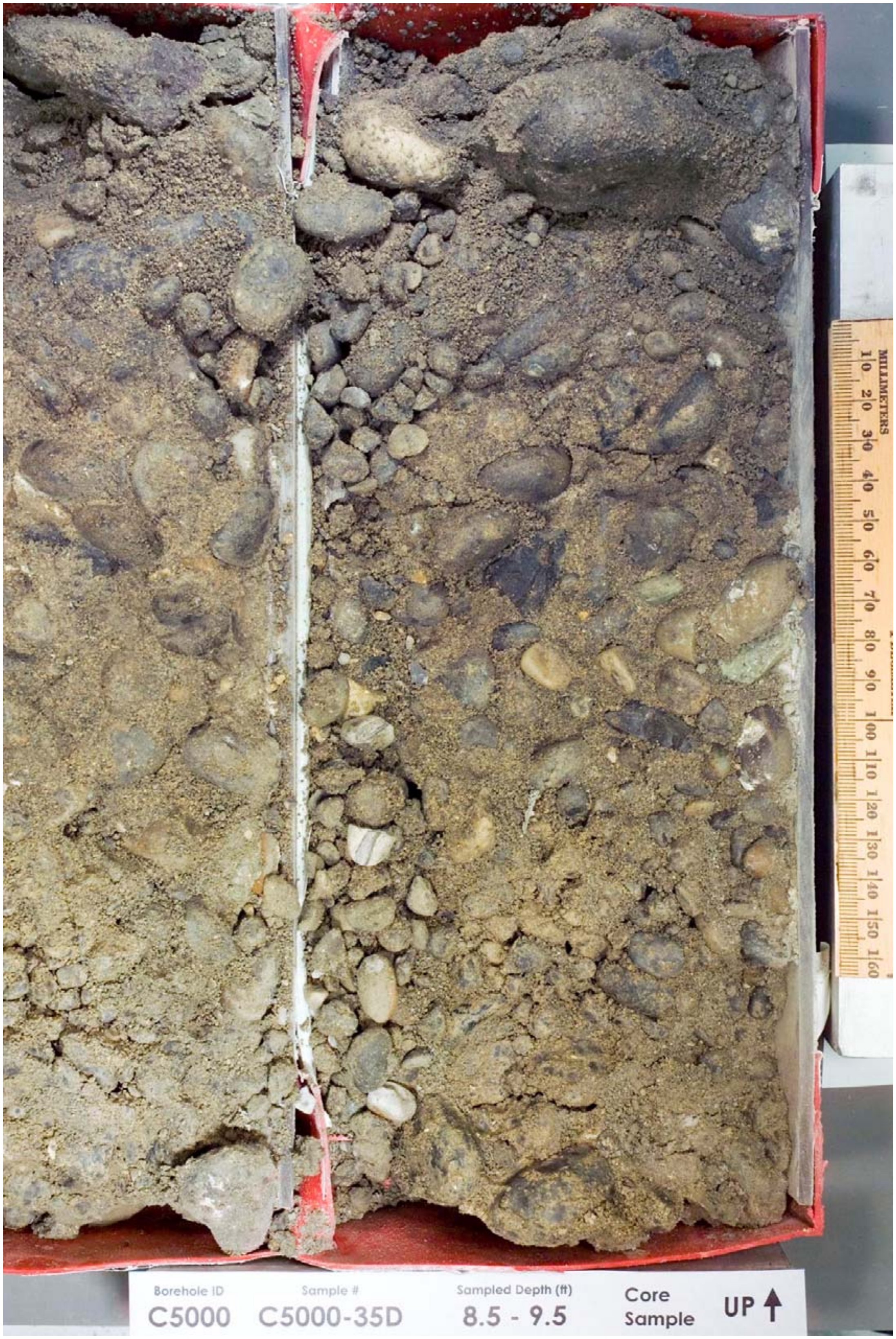

MILLIMETERS
Borehole ID
C5000
Sample #
C5000-34C
Sampled Depth (ft)
5.5 - 6.5
Core
Sample
UP


Borehole ID
C5000
Sample #
C5000-34D
Sampled Depth (ft)
6.5 - 7.5
Core
Sample
UP
MILLIMETERS
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160

MILLIMETERS
Borehole ID
C5000
Sample #
C5000-34E
Sampled Depth (ft)
7.5 - 8.5
Core Sample
UP


MILLIMETERS
1 DECIMETER
Borehole ID
C5000
Sample #
C5000-35B
Sampled Depth (ft)
6.5 - 7.5
Core
Sample
UP


MILLIMETERS
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160
Borehole ID
C5000
Sample #
C5000-35C
Sampled Depth (ft)
7.5 - 8.5
Core Sample
UP


MILLIMETERS
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160
Borehole ID
C5000
Sample #
C5000-35D
Sampled Depth (ft)
8.5 - 9.5
Core Sample
UP


MILLIMETERS
Borehole ID
C5000
Sample #
C5000-35E
Sampled Depth (ft)
9.5 - 10.5
Core Sample
UP


MILLIMETERS
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160
Borehole ID
C5000
Sample #
C5000-36A
Sampled Depth (ft)
10.5 - 11.5
Core
Sample
UP


MILLIMETERS
1 DECIMETER
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160
Borehole ID
C5000
Sample #
C5000-36D
Sampled Depth (ft)
10.5 - 11.5
Core
Sample
UP


MILLIMETERS
1 DECIMETER
Borehole ID
C5000
Sample #
C5000-36E
Sampled Depth (ft)
11.5 - 12.5
Core
Sample
UP

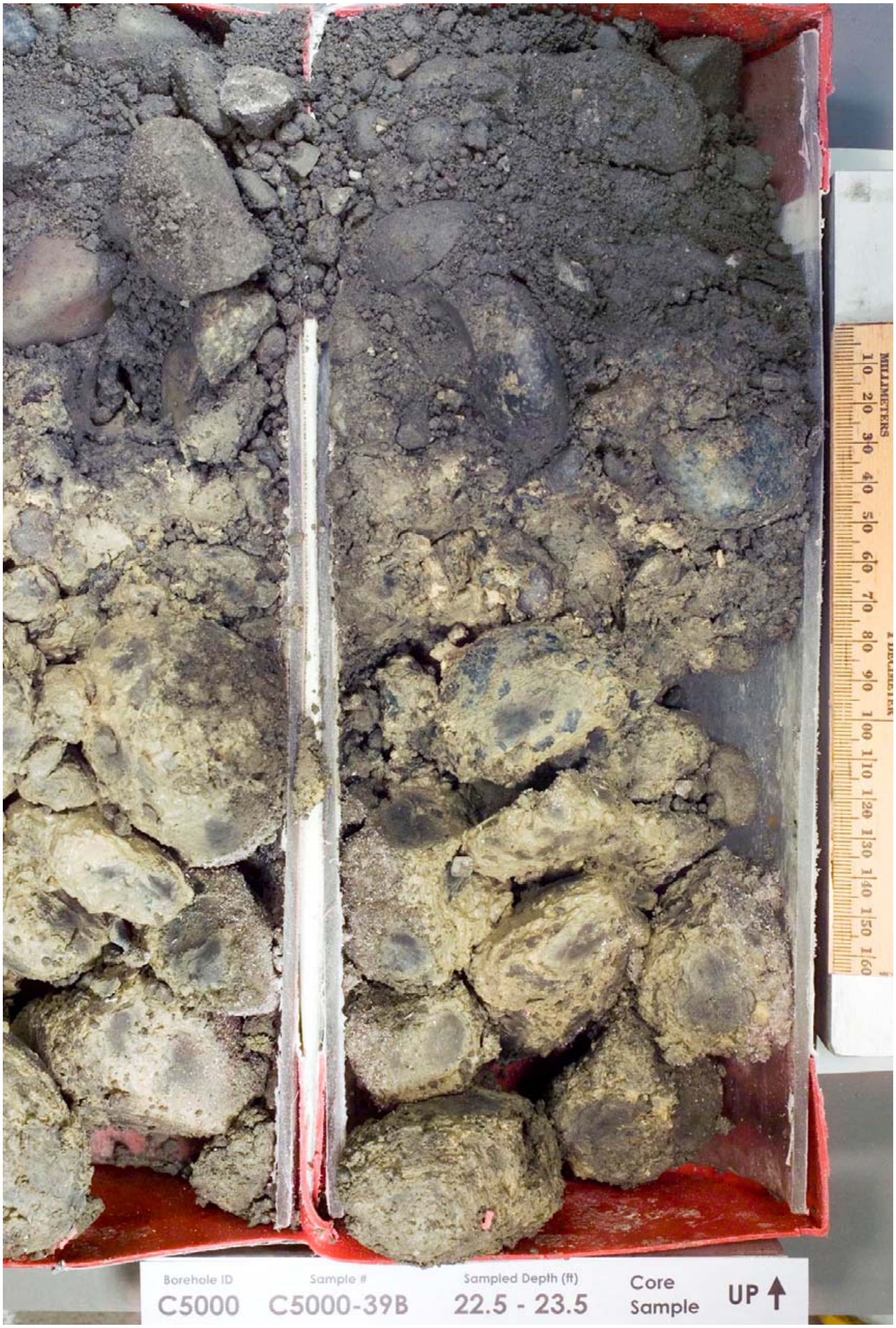

MILLIMETERS
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160
Borehole ID
C5000
Sample #
C5000-37A
Sampled Depth (ft)
12.5 - 13.5
Core
Sample
UP

MILLIMETERS
1 DECIMETER
Bore... ID
C5000
Sample #
C5000-38A
Sampled Depth (ft)
18.5 - 19.5
Core Sample
UP


Borehole ID
C5000
Sample #
C5000-38B
Sampled Depth (ft)
19.5 - 20.5
Core
Sample
UP
MILLIMETERS


MILLIMETERS
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160
Borehole ID
C5000
Sample #
C5000-38C
Sampled Depth (ft)
20.5 - 21.5
Core Sample
UP


Borehole ID
C5000
Sample #
C5000-39A
Sampled Depth (ft)
21.5 - 22.5
Core
Sample
UP
MILLIMETERS



MILLIMETERS
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160
Borehole ID
C5000
Sample #
C5000-39B
Sampled Depth (ft)
22.5 - 23.5
Core
Sample
UP


MILLIMETERS
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160
Borehole ID
C5000
Sample #
C5000-39D
Sampled Depth (ft)
24.5 - 25.5
Core
Sample
UP


MILLIMETERS
Borehole ID
C5000
Sample #
C5000-40A
Sampled Depth (ft)
29.5 - 30.5
Core
Sample
UP

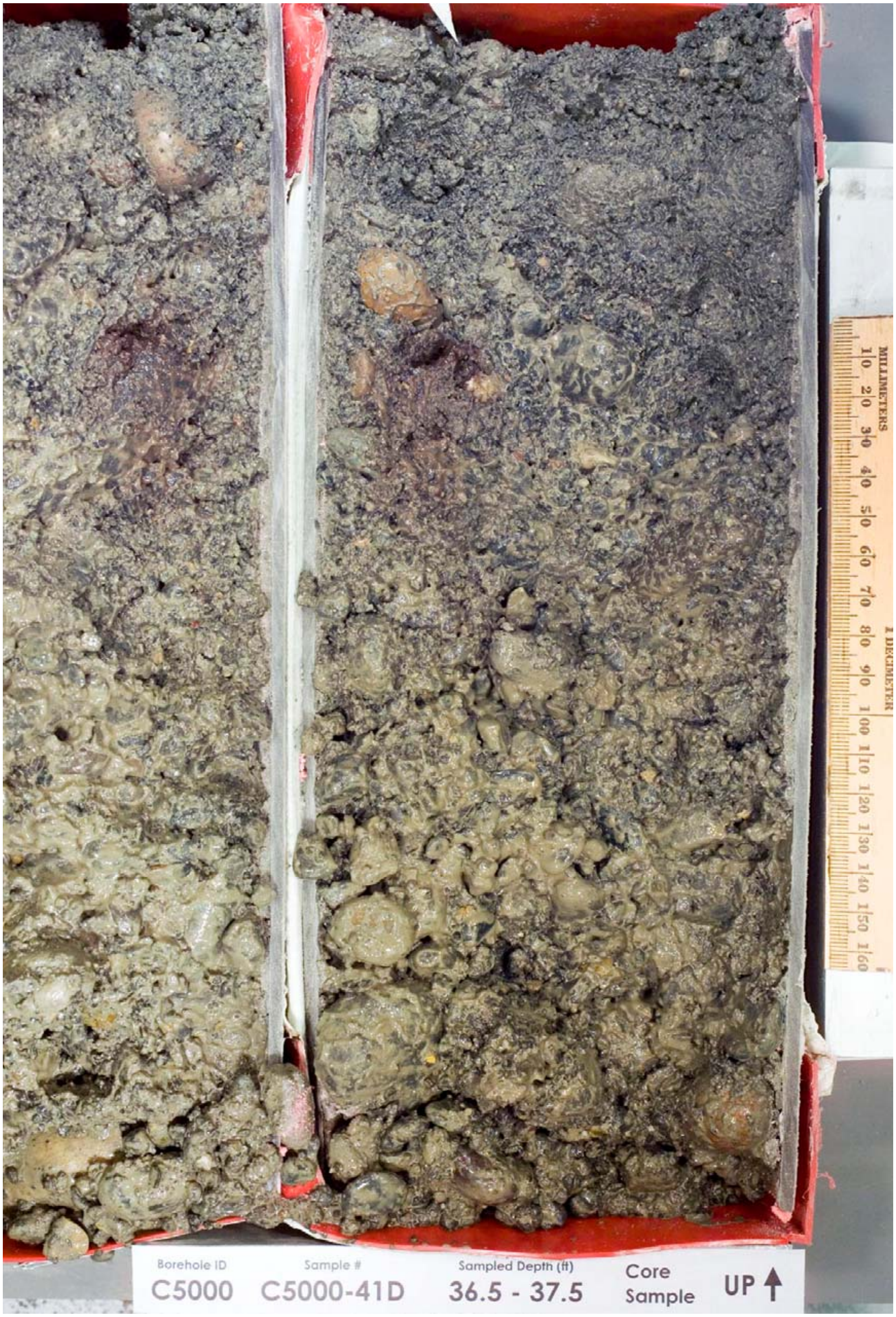

MILLIMETERS
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160
Borehole ID
C5000
Sample #
C5000-40B
Sampled Depth (ft)
30.5 - 31.5
Core Sample
UP


MILLIMETERS
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160
Borehole ID
C5000
Sample #
C5000-40C
Sampled Depth (ft)
31.5 - 32.5
Core
Sample
UP


MILLIMETERS
Borehole ID
C5000
Sample #
C5000-40E
Sampled Depth (ft)
33.5 - 34.5
Core
Sample
UP

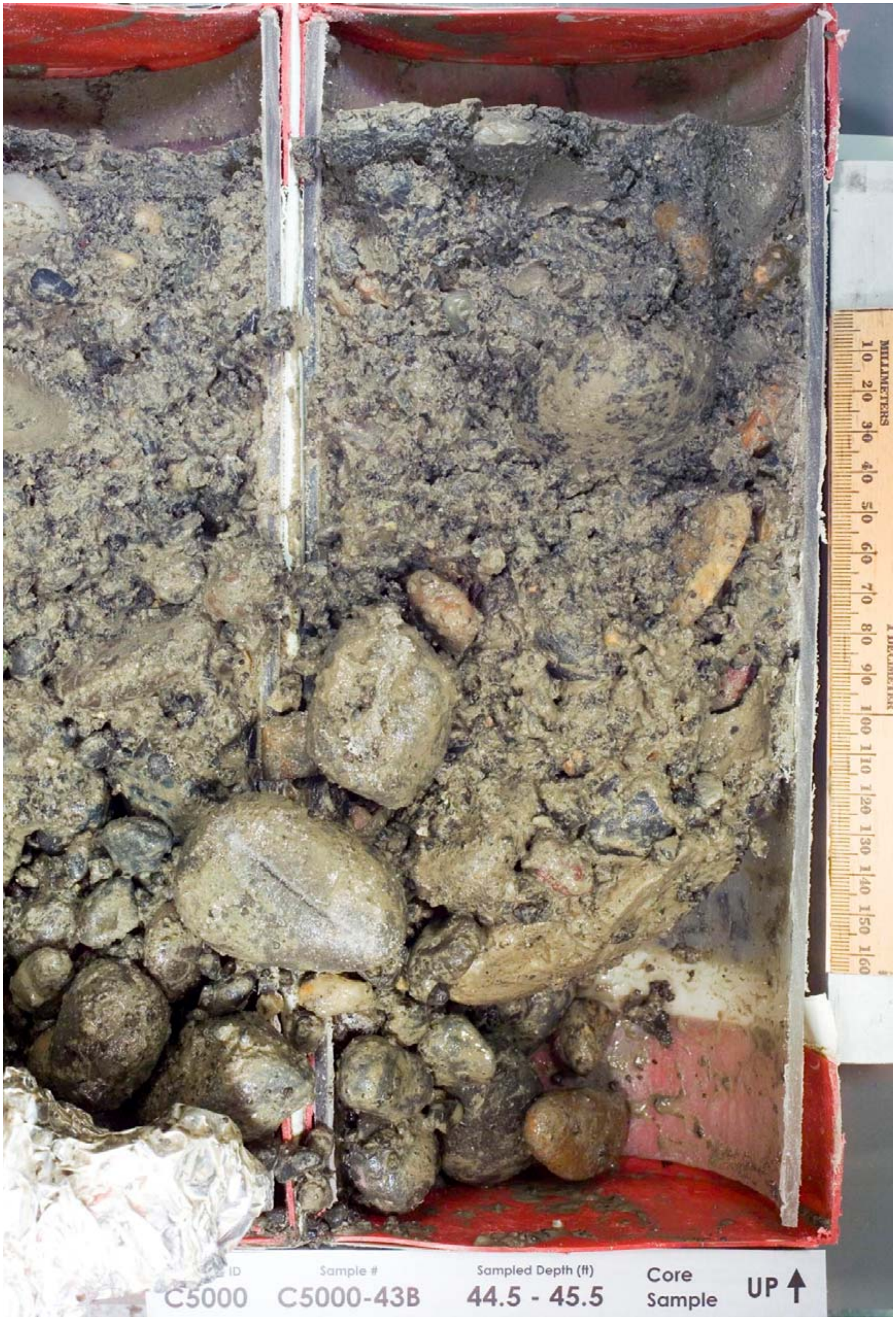

MILLIMETERS
1 DECIMETER
Borehole ID
C5000
Sample #
C5000-41B
Sampled Depth (ft)
34.5 - 35.5
Core
Sample
UP

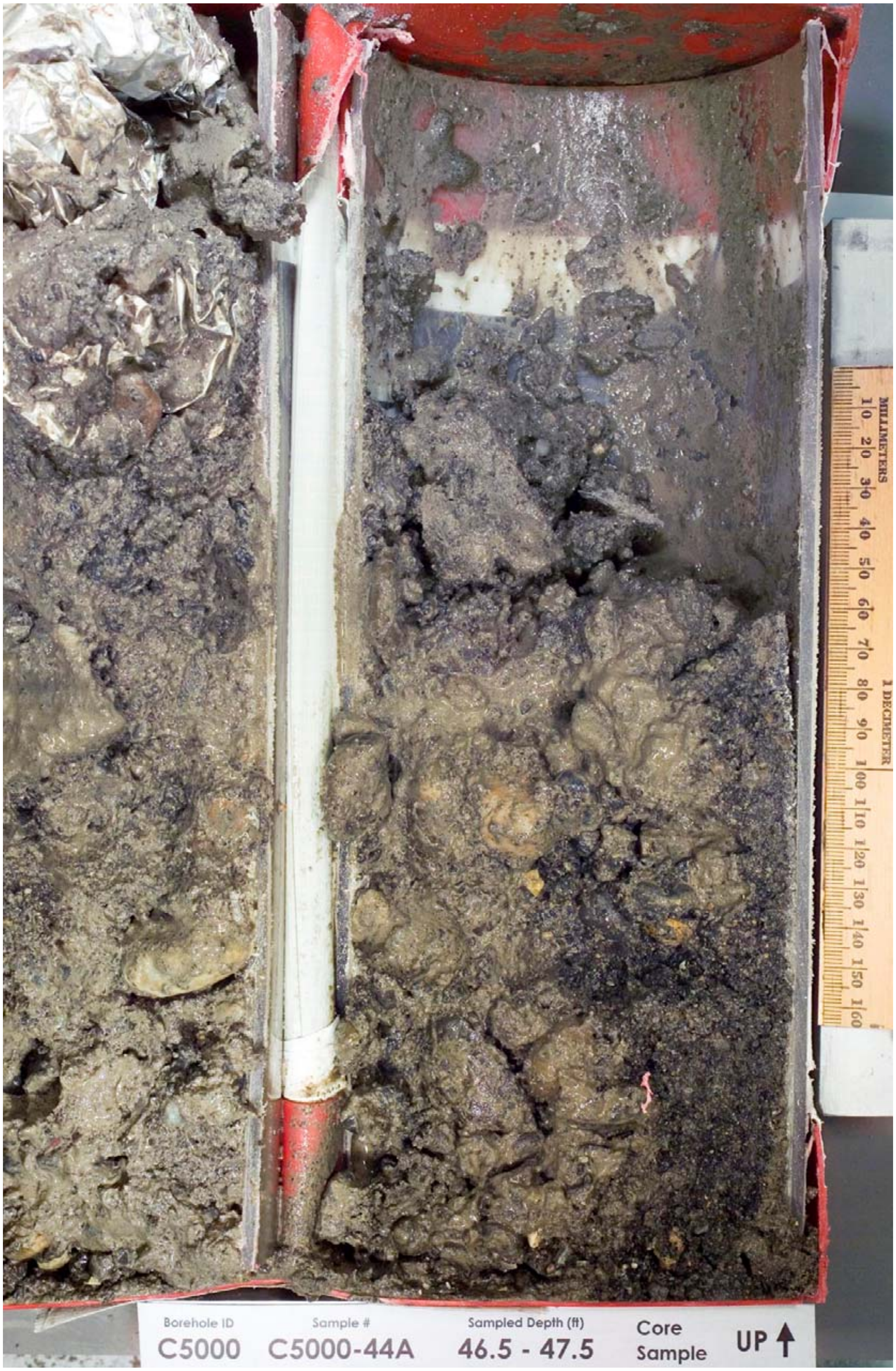

MILLIMETERS
1 DECIMETER
Borehole ID
C5000
Sample #
C5000-41C
Sampled Depth (ft)
35.5 - 36.5
Core
Sample
UP


MILLIMETERS
1 DECIMETER
Borehole ID
C5000
Sample #
C5000-41D
Sampled Depth (ft)
36.5 - 37.5
Core
Sample
UP


MILLIMETERS
Borehole ID
C5000
Sample #
C5000-41E
Sampled Depth (ft)
37.8 - 38.5
Core
Sample
UP


MILLIMETERS
Borehole ID
C5000
Sample #
C5000-43A
Sampled Depth (ft)
43.5 - 44.5
Core
Sample
UP

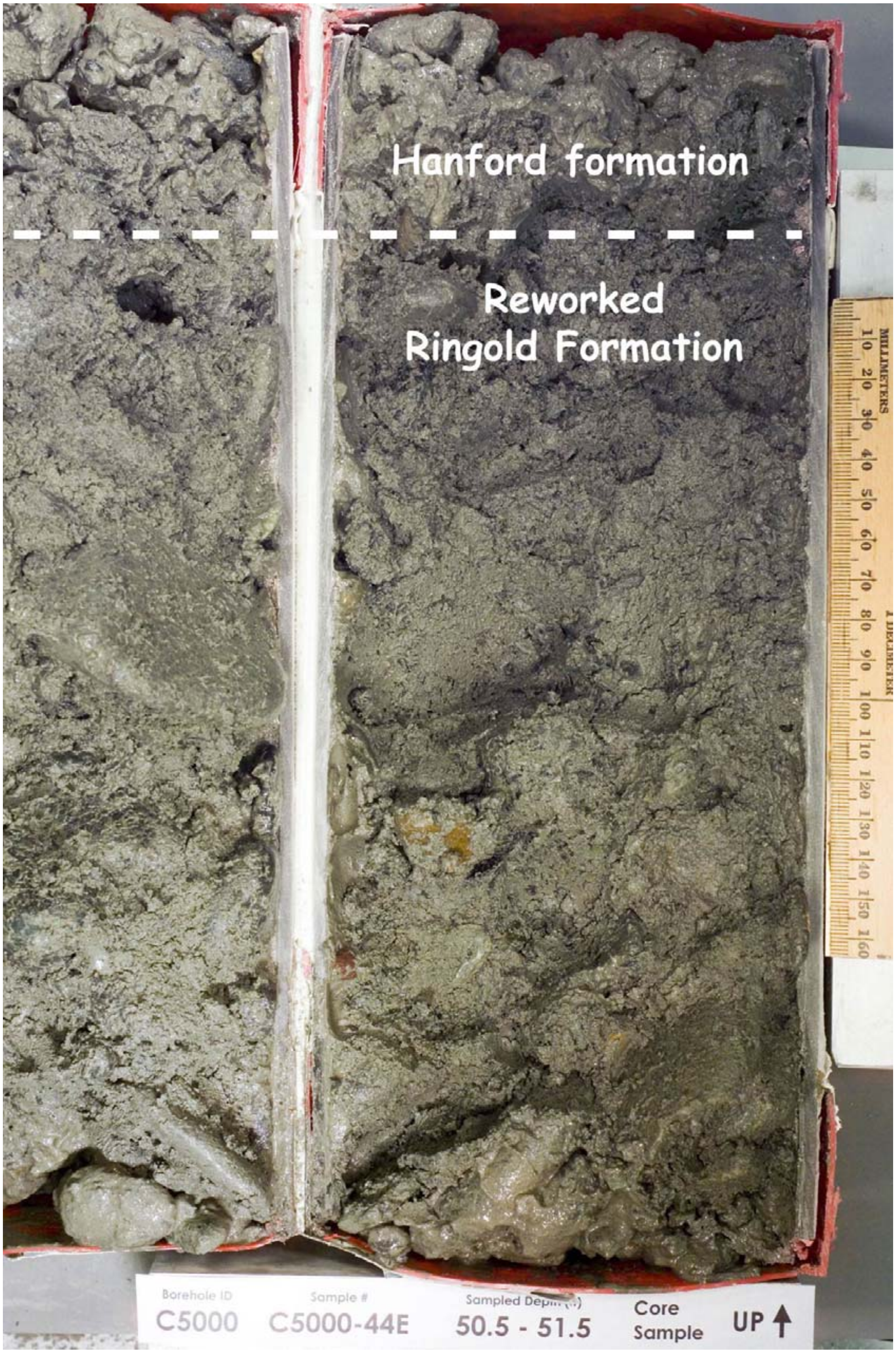

ID
C5000
Sample #
C5000-43B
Sampled Depth (ft)
44.5 - 45.5
Core
Sample
UP
MILLIMETERS


MILLIMETERS
1 DECIMETER
Borehole ID
C5000
Sample #
C5000-44A
Sampled Depth (ft)
46.5 - 47.5
Core Sample
UP


MILLIMETERS
1 DECIMETER
Borehole ID
C5000
Sample #
C5000-44B
Sampled Depth (ft)
47.5 - 48.5
Core
Sample
UP

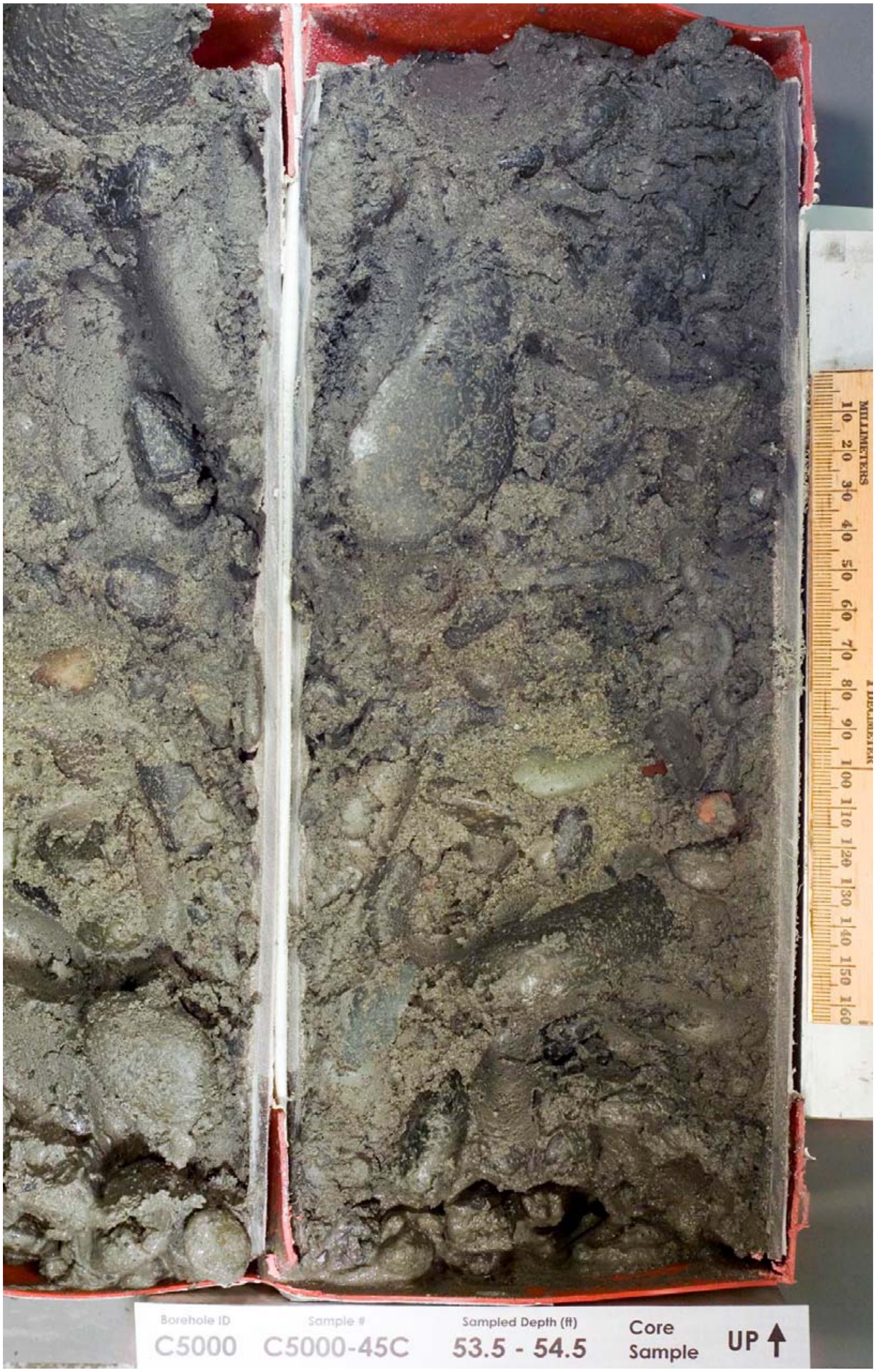

MILLIMETERS
1 DECIMETER
Sample #
C5000-44C
Sampled Depth (ft)
48.5 - 49.5
Core
Sample
UP


MILLIMETERS
1 DECIMETER
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160
Sample #
Sampled Depth (ft)
C5000 C5000-44D 49.5 - 50.5
Core Sample
UP


Hanford formation
Reworked
Ringold Formation
MILLIMETERS
1 DECIMETER
Borehole ID
C5000
Sample #
C5000-44E
50.5 - 51.5
Core
Sample
UP

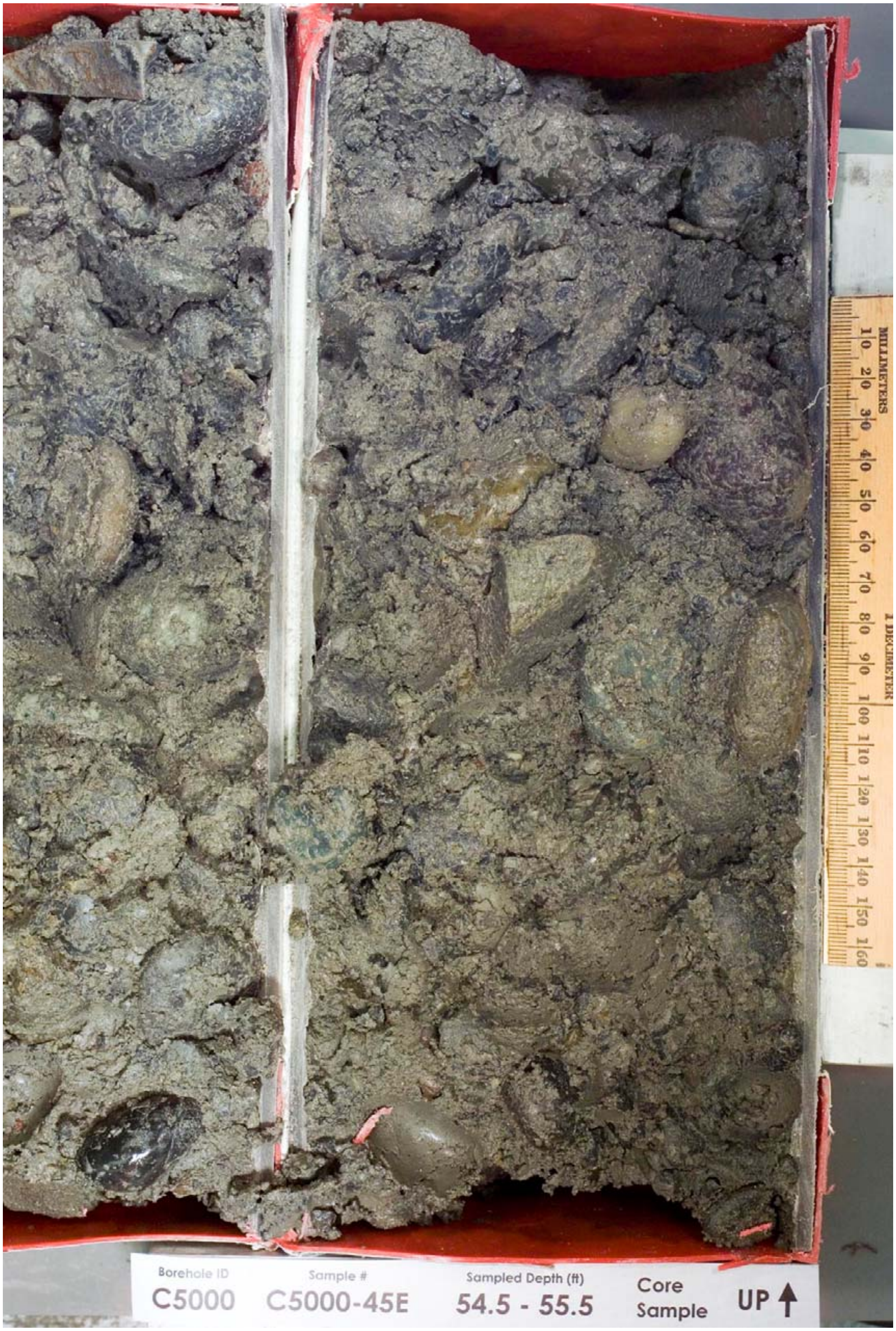

MILLIMETERS
1 DECIMETER
Borehole ID
C5000
Sample #
C5000-45A
Sampled Depth (ft)
51.5 - 52.5
Core
Sample
UP


MILLIMETERS
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160
1 DECIMETER
Borehole ID
C5000
Sample #
C5000-45B
Sampled Depth (ft)
52.5 - 53.5
Core
Sample
UP



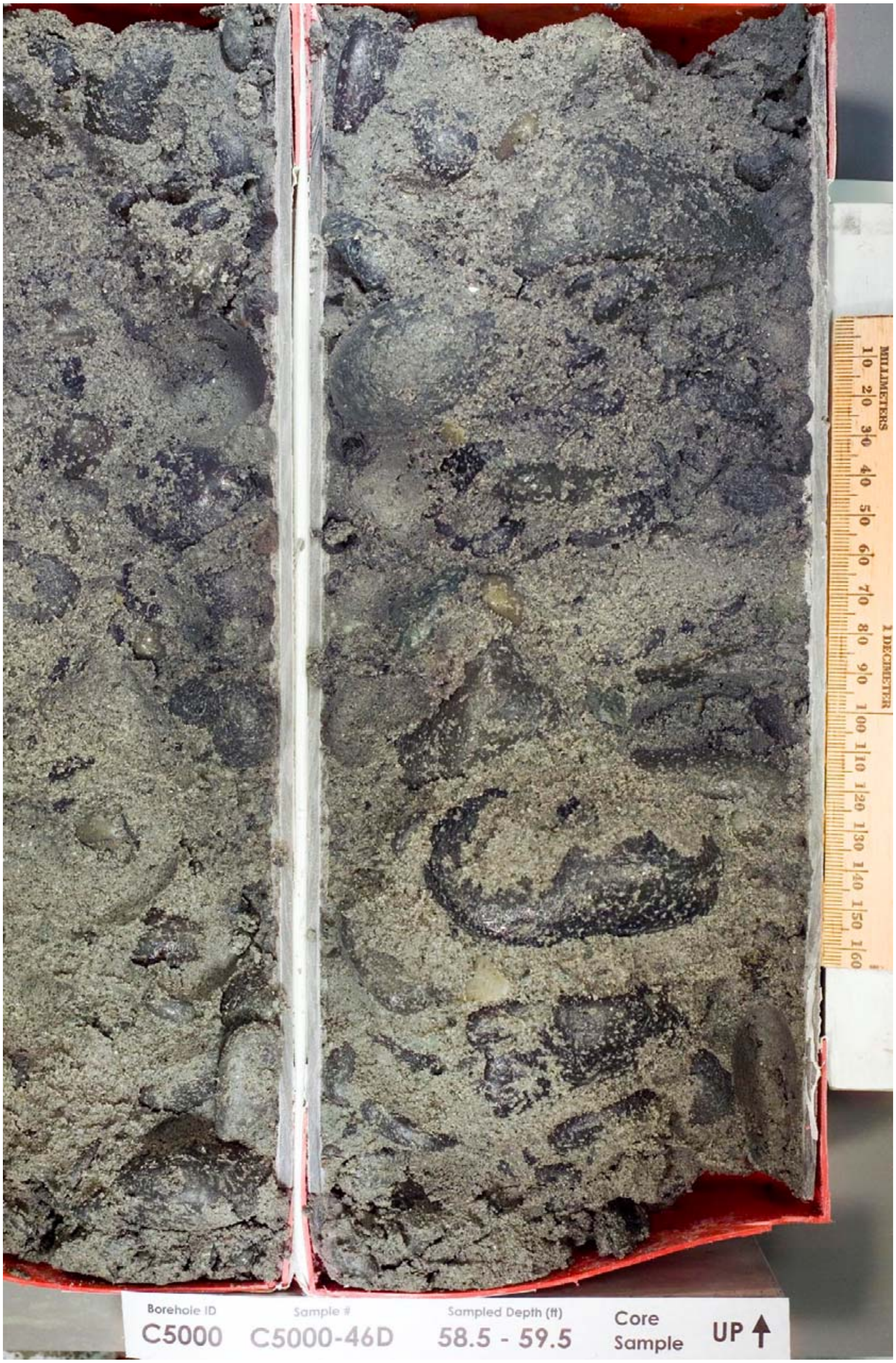
MILLIMETERS
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160
Borehole ID
C5000
Sample #
C5000-45C
Sampled Depth (ft)
53.5 - 54.5
Core Sample
UP


MILLIMETERS
1 DECIMETER
Borehole ID
C5000
Sample #
C5000-45D
Sampled Depth (ft)
54.5 - 55.5
Core
Sample
UP


MILLIMETERS
1 DECIMETER
Borehole ID
C5000
Sample #
C5000-45E
Sampled Depth (ft)
54.5 - 55.5
Core
Sample
UP


MILLIMETERS
1 DECIMETER
Borehole ID
C5000
Sample #
C5000-46A
Sampled Depth (ft)
55.5 - 56.5
Core
Sample
UP


MILLIMETERS
1 DECIMETER
Borehole ID
C5000
Sample #
C5000-46B
Sampled Depth (ft)
56.5 - 57.5
Core Sample
UP


MILLIMETERS
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160
1 DECIMETER
Borehole ID
C5000
Sample #
C5000-46D
Sampled Depth (ft)
58.5 - 59.5
Core
Sample
UP

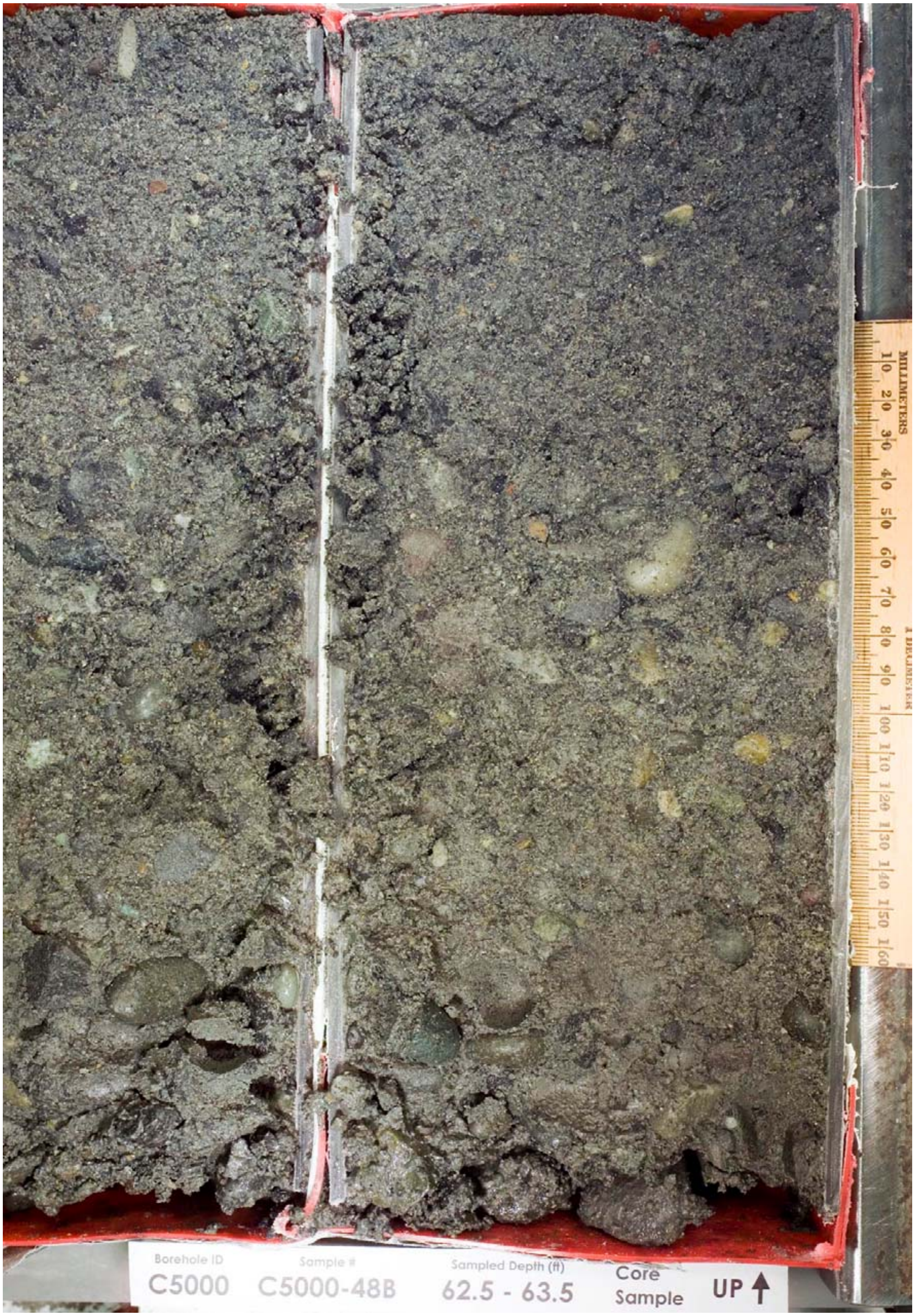

Borehole ID
C5000
Sample #
C5000-46E
Sampled Depth (ft)
59.5 - 60.5
Core
Sample
UP
MILLIMETERS
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160

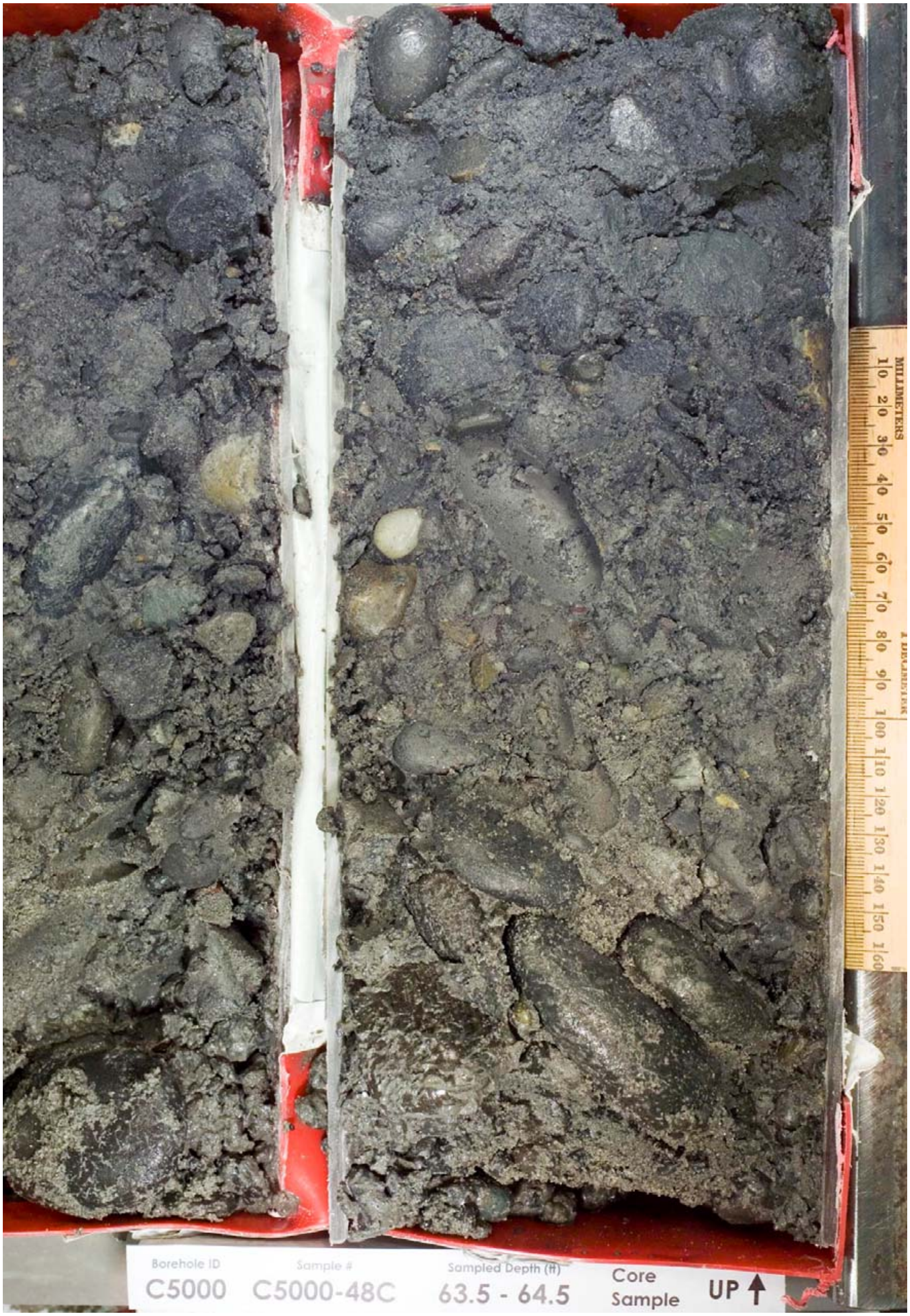

MILLIMETERS
1 DECIMETER
Borehole ID
C5000
Sample #
C5000-47A
Sampled Depth (ft)
59.0 - 60.0
Core
Sample
UP


Borehole ID
C5000
Sample #
C5000-47B
Sampled Depth (ft)
60.0 - 61.0
Core
Sample
UP
MILLIMETERS


MILLIMETERS
Borehole ID
C5000
Sample #
C5000-47C
Sampled Depth (ft)
61.0 - 62.0
Core
Sample
UP


MILLIMETERS
1 DECIMETER
Borehole ID
C5000
Sample #
C5000-47D
Sampled Depth (ft)
62.0 - 63.0
Core
Sample
UP


Borehole ID
C5000
Sample #
C5000-48B
Sampled Depth (ft)
62.5 - 63.5
Core
Sample
UP
MILLIMETERS


MILLIMETERS
Borehole ID
C5000
Sample #
C5000-48C
Sampled Depth (ft)
63.5 - 64.5
Core
Sample
UP


Borehole ID
C5000
Sample #
C5000-48D
Sampled Depth (ft)
64.5 - 65.5
Core Sample
UP


Borehole ID
C5000
Sample #
C5000-48E
Sampled Depth (ft)
65.5 - 66.5
Core
Sample
UP
MILLIMETERS
1 DECIMETER

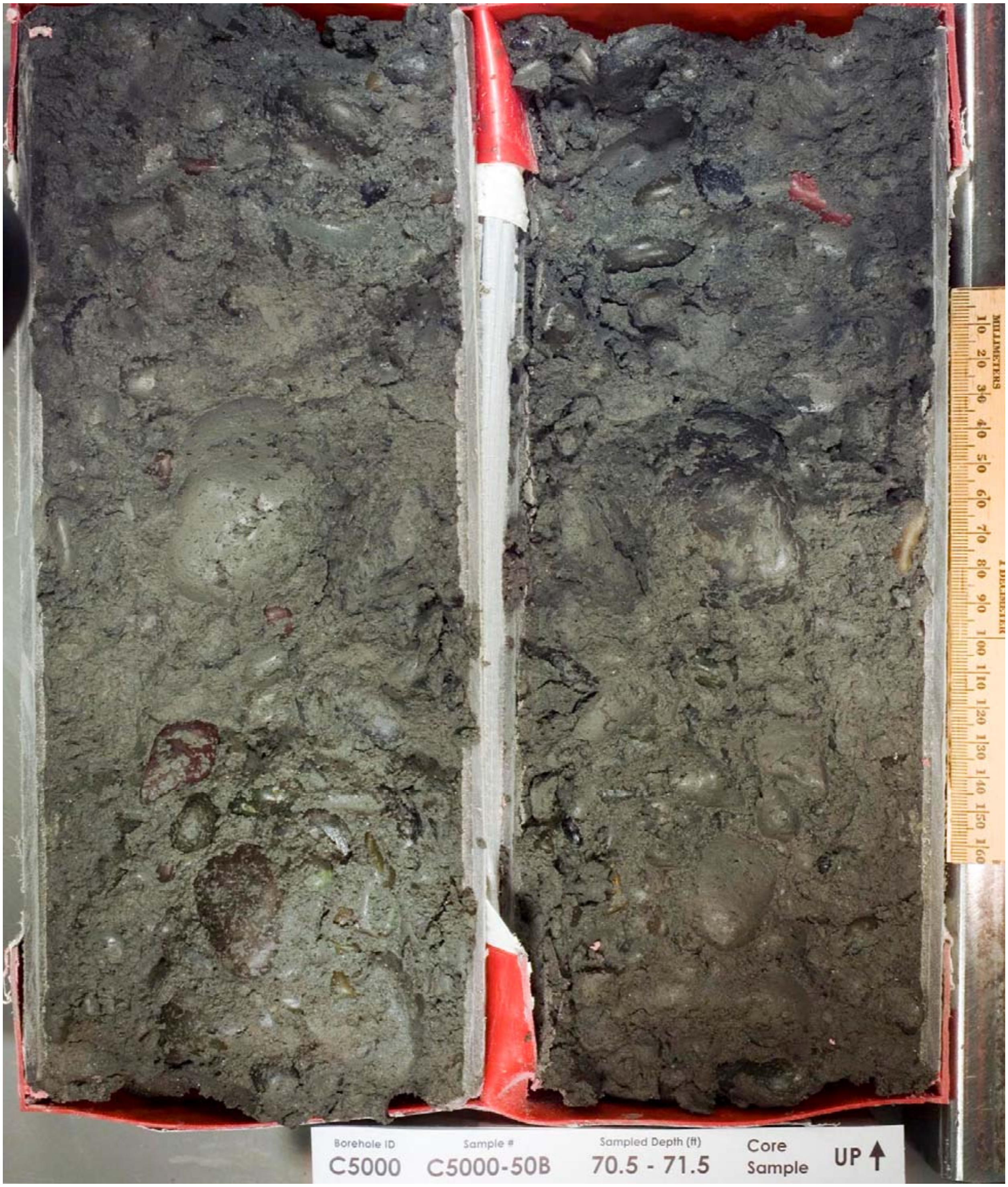

Borehole ID
C5000
Sample #
C5000-49A
Sampled Depth (ft)
66.5 - 67.5
Core
Sample
UP
MILLIMETERS
1 DECIMETER


Sample #
Sampled Depth (ft)
C5000
C5000-49B
67.5 - 68.5
Core
Sample
UP


MILLIMETERS
1 DECIMETER
Borehole ID
C5000
Sample #
C5000-49D
Sampled Depth (ft)
67.5 - 68.5
Core
Sample
UP


MILLIMETERS
1 DECIMETER
Borehole ID
C5000
Sample #
C5000-49E
Sampled Depth (ft)
68.5 - 69.5
Core
Sample
UP


MILLIMETERS
Borehole ID
C5000
Sample #
C5000-50A
Sampled Depth (ft)
69.5 - 70.5
Core
Sample
UP

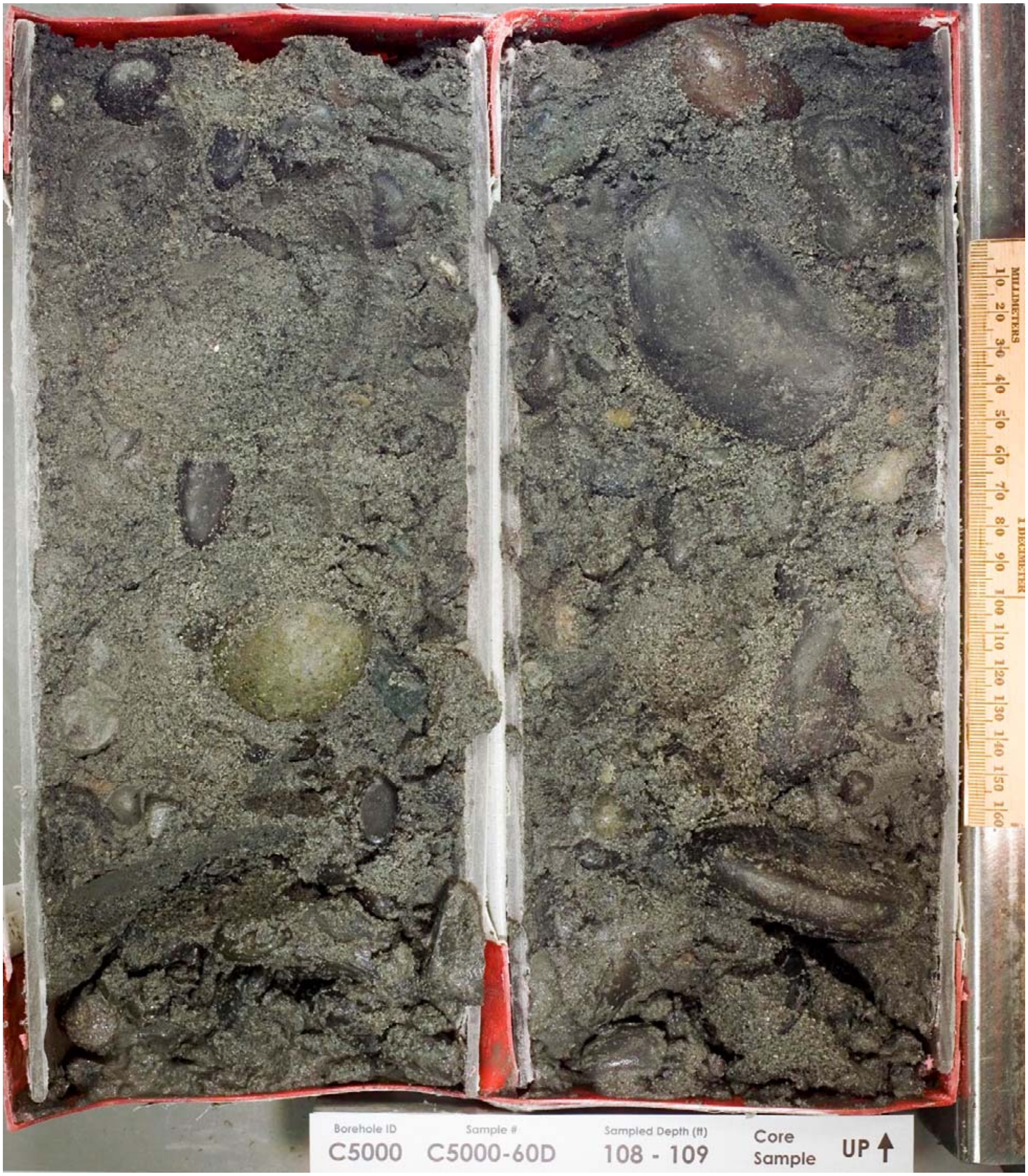

MILLIMETERS
1 DECIMETER
Borehole ID
C5000
Sample #
C5000-50B
Sampled Depth (ft)
70.5 - 71.5
Core
Sample
UP


MILLIMETERS
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160
1 DECIMETER
Borehole ID
C5000
Sample #
C5000-50C
Sampled Depth (ft)
71.5 - 72.5
Core
Sample
UP

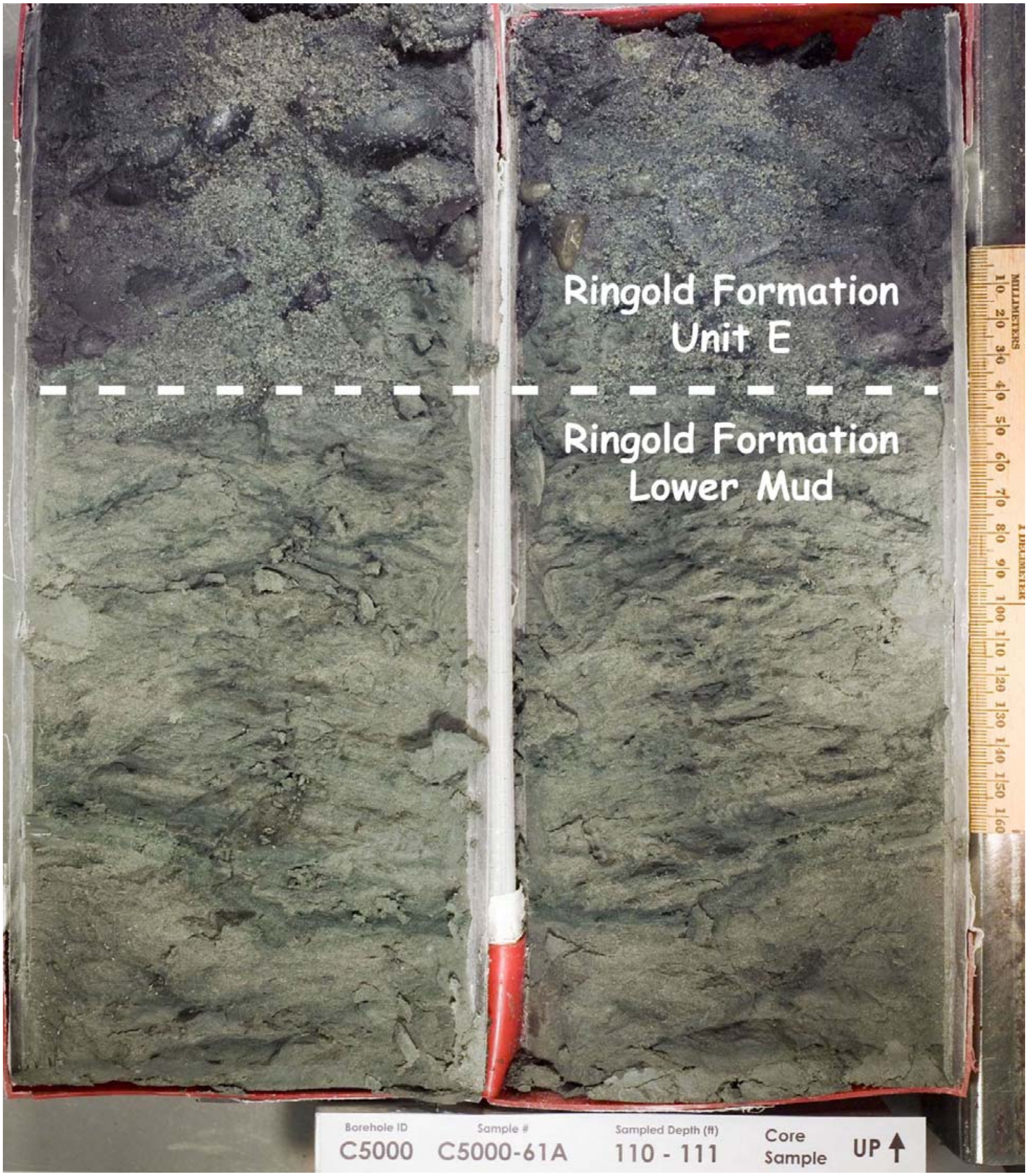

MILLIMETERS
Borehole ID
C5000
Sample #
C5000-50D
Sampled Depth (ft)
71 - 72
Core Sample
UP

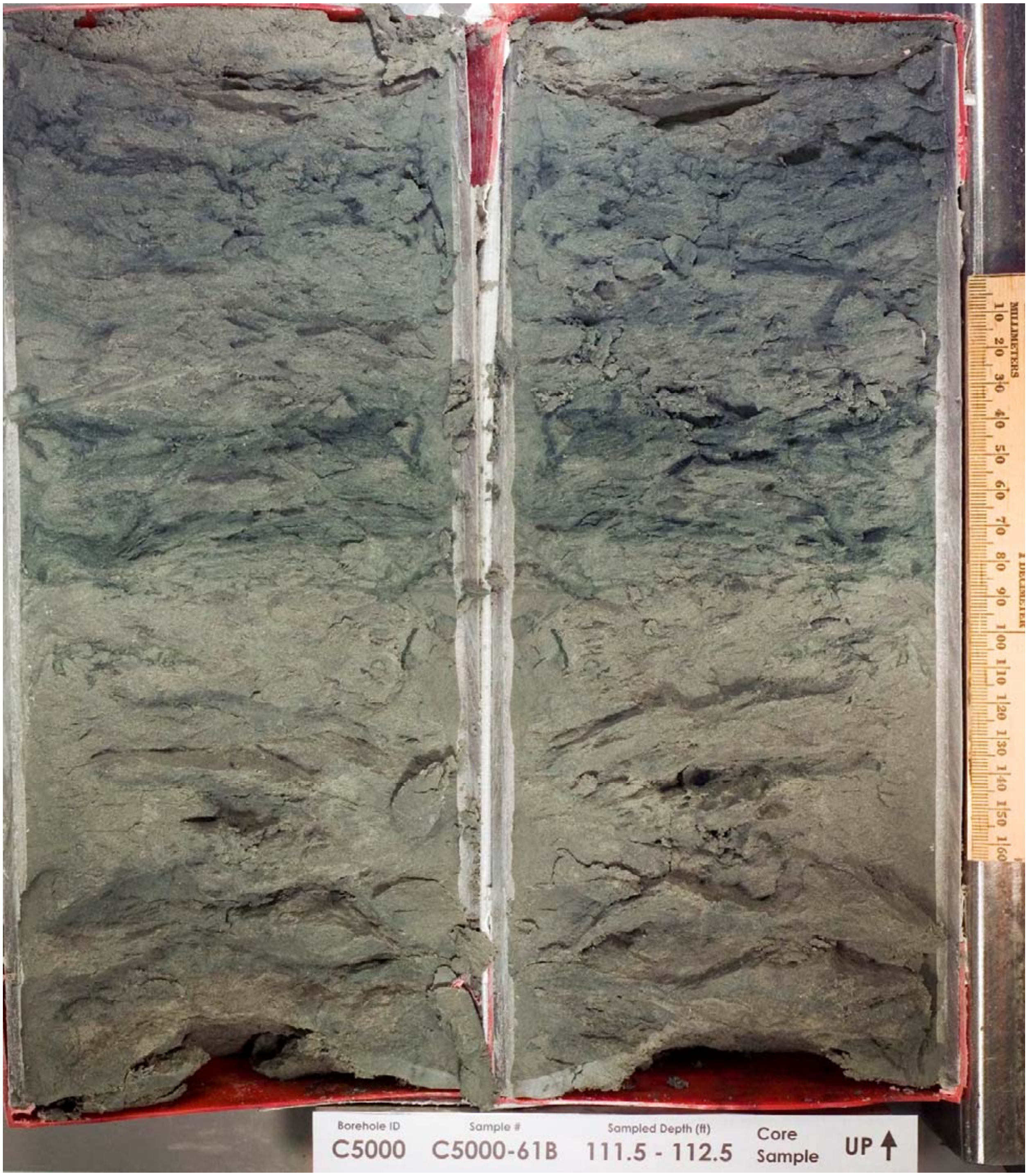
MILLIMETERS
1 DECIMETER
Borehole ID
C5000
Sample #
C5000-50E
Sampled Depth (ft)
72 - 73
Core
Sample
UP


Borehole ID
C5000
Sample #
C5000-60C
Sampled Depth (ft)
107 - 108
Core Sample
UP
MILLIMETERS
1 DECIMETER


MILLIMETERS
1 DECIMETER
Borehole ID
C5000
Sample #
C5000-60D
Sampled Depth (ft)
108 - 109
Core
Sample
UP


MILLIMETERS
1 DECIMETER
Borehole ID
C5000
Sample #
C5000-60E
Sampled Depth (ft)
109 - 110
Core
Sample
UP


Ringold Formation
Unit E
Ringold Formation
Lower Mud
MILLIMETERS
1 DECIMETER
Borehole ID
C5000
Sample #
C5000-61A
Sampled Depth (ft)
110 - 111
Core
Sample
UP


MILLIMETERS
1 DECIMETER
Borehole ID
C5000
Sample #
C5000-61B
Sampled Depth (ft)
111.5 - 112.5
Core
Sample
UP

Well C5001


Borehole ID
C5001
Sample #
C5001-61E
Sampled Depth (ft)
1.5 - 2.5
Core
Sample
UP
MILLIMETERS
1 DECIMETER


MILLIMETERS
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160
Borehole ID
C5001
Sample #
C5001-62A
Sampled Depth (ft)
2.5 - 3.5
Core
Sample
UP


Borehole ID
C5001
Sample #
C5001-62B
Sampled Depth (ft)
3.5 - 4.5
Core
Sample
UP
MILLIMETERS


Borehole ID
C5001
Sample #
C5001-62C
Sampled Depth (ft)
4.5 - 5.5
Core
Sample
UP
MILLIMETERS
1 DECIMETER


Borehole ID
C5001
Sample #
C5001-63A
Sampled Depth (ft)
5.5 - 6.5
Sample
UP
MILLIMETERS
1 DECIMETER


MILLIMETERS
1 DECIMETER
Borehole ID
C5001
Sample #
C5001-63B
Sampled Depth (ft)
6.5 - 7.5
Core
Sample
UP


MILLIMETERS
1 DECIMETER
Borehole ID
C5001
Sample #
C5001-63C
Sampled Depth (ft)
7.5 - 8.5
Core
Sample
UP


MILLIMETERS
Borehole ID
C5001
Sample #
C5001-63D
Sampled Depth (ft)
8.5 - 9.5
Sample
UP


MILLIMETERS
1 DECIMETER
Borehole ID
C5001
Sample #
C5001-64A
Sampled Depth (ft)
10.5 - 11.5
Core
Sample
UP


MILLIMETERS
1 DECIMETER
Borehole ID
C5001
Sample #
C5001-64B
Sampled Depth (ft)
11.5 - 12.5
Core
Sample
UP

MILLIMETERS
1 DECIMETER
Borehole
Sample #
Sampled Depth (ft)
C5001
C5001-64C
12.5 - 13.5
Core Sample
UP


MILLIMETERS
1 DECIMETER
Borehole ID
C5001
Sample #
C5001-64D
Sampled Depth (ft)
13.5 - 14.5
Core
Sample
UP


MILLIMETERS
1 DECIMETER
Borehole ID
C5001
Sample #
C5001-64E
Sampled Depth (ft)
14.5 - 15.5
Core
Sample
UP


MILLIMETERS
1 DECIMETER
Borehole ID
C5001
Sample #
C5001-65C
Sampled Depth (ft)
17.5 - 18.5
Core
Sample
UP


Borehole ID
C5001
Sample #
C5001-65D
Sampled Depth (ft)
18.5 - 19.5
Core
Sample
UP


MILLIMETERS
1 DECIMETER
Borehole ID
C5001
Sample #
C5001-65E
Sampled Depth (ft)
19.5 - 20.5
Core
Sample
UP

MILLIMETERS
1 DECIMETER
Borehole ID
C5001
Sample #
C5001-66A
Sampled Depth (ft)
20.5 - 21.5
Core
Sample
UP


Borehole ID
C5001
Sample #
C5001-67A
Sampled Depth (ft)
23.0 - 24.0
Core Sample
UP
MILLIMETERS


MILLIMETERS
1 DECIMETER
Borehole ID
C5001
Sample #
C5001-67B
24.0 - 25.0
Sample
UP


MILLIMETERS
1 DECIMETER
Borehole ID
C5001
Sample #
C5001-67E
Sampled Depth (ft)
26.5 - 27.5
Core
Sample
UP


Borehole ID
C5001
Sample #
C5001-68A
Sampled Depth (ft)
27.5 - 28.5
Core
Sample
UP
MILLIMETERS
1 DECIMETER

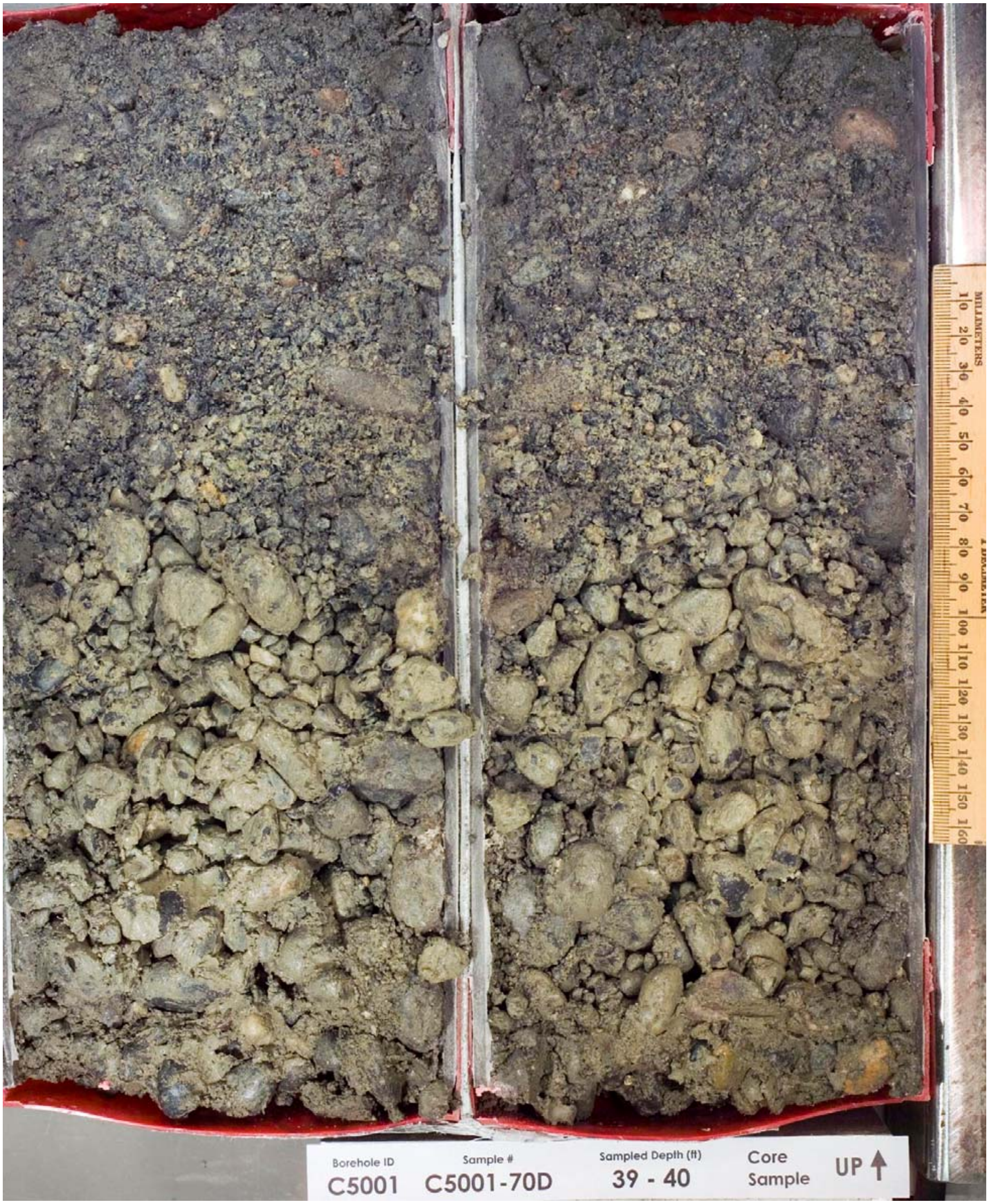

Borehole ID
C5001
Sample #
C5001-68B
Sampled Depth (ft)
28.5 - 29.5
Core
Sample
UP


Borehole ID
C5001
Sample #
C5001-69B
Sampled Depth (ft)
31.5 - 32.5
Core Sample
UP


Borehole ID
C5001
Sample #
C5001-69C
Sampled Depth (ft)
32.5 - 33.5
Core
Sample
UP
MILLIMETERS
1 DECIMETER


MILLIMETERS
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160
Borehole ID
C5001
Sample #
C5001-69D
Sampled Depth (ft)
33.5 - 34.5
Core
Sample
UP


MILLIMETERS
Borehole ID
C5001
Sample #
C5001-70C
Sampled Depth (ft)
38 - 39
Core
Sample
UP


Borehole ID
C5001
Sample #
C5001-70D
Sampled Depth (ft)
39 - 40
Core
Sample
UP

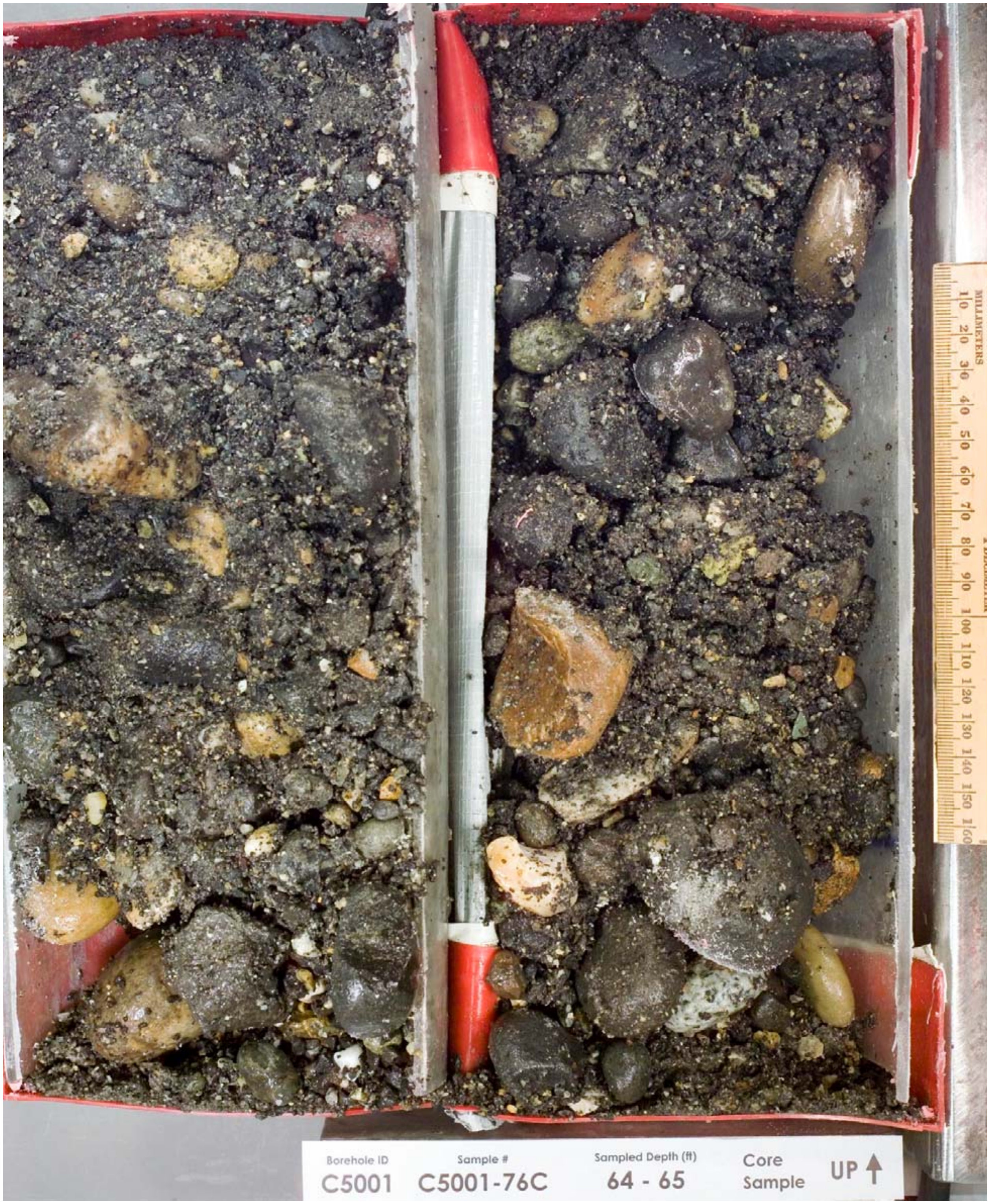

MILLIMETERS
1 DECIMETER
Borehole ID
C5001
Sample #
C5001-70E
Sampled Depth (ft)
40 - 41
Core
Sample
UP


Borehole ID
C5001
Sample #
C5001-71E
Sampled Depth (ft)
41 - 42
Core
Sample
UP
MILLIMETERS


Borehole ID
C5001
Sample #
C5001-73B
Sampled Depth (ft)
46.5 - 53
Core
Sample
UP


MILLIMETERS
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160
1 DECIMETER
Borehole ID
C5001
Sample #
C5001-74B
Sampled Depth (ft)
53 - 54
Core
Sample
UP


MILLIMETERS
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160
1 DECIMETER
Borehole ID
C5001
Sample #
C5001-76B
Sampled Depth (ft)
63 - 65
Core
Sample
UP

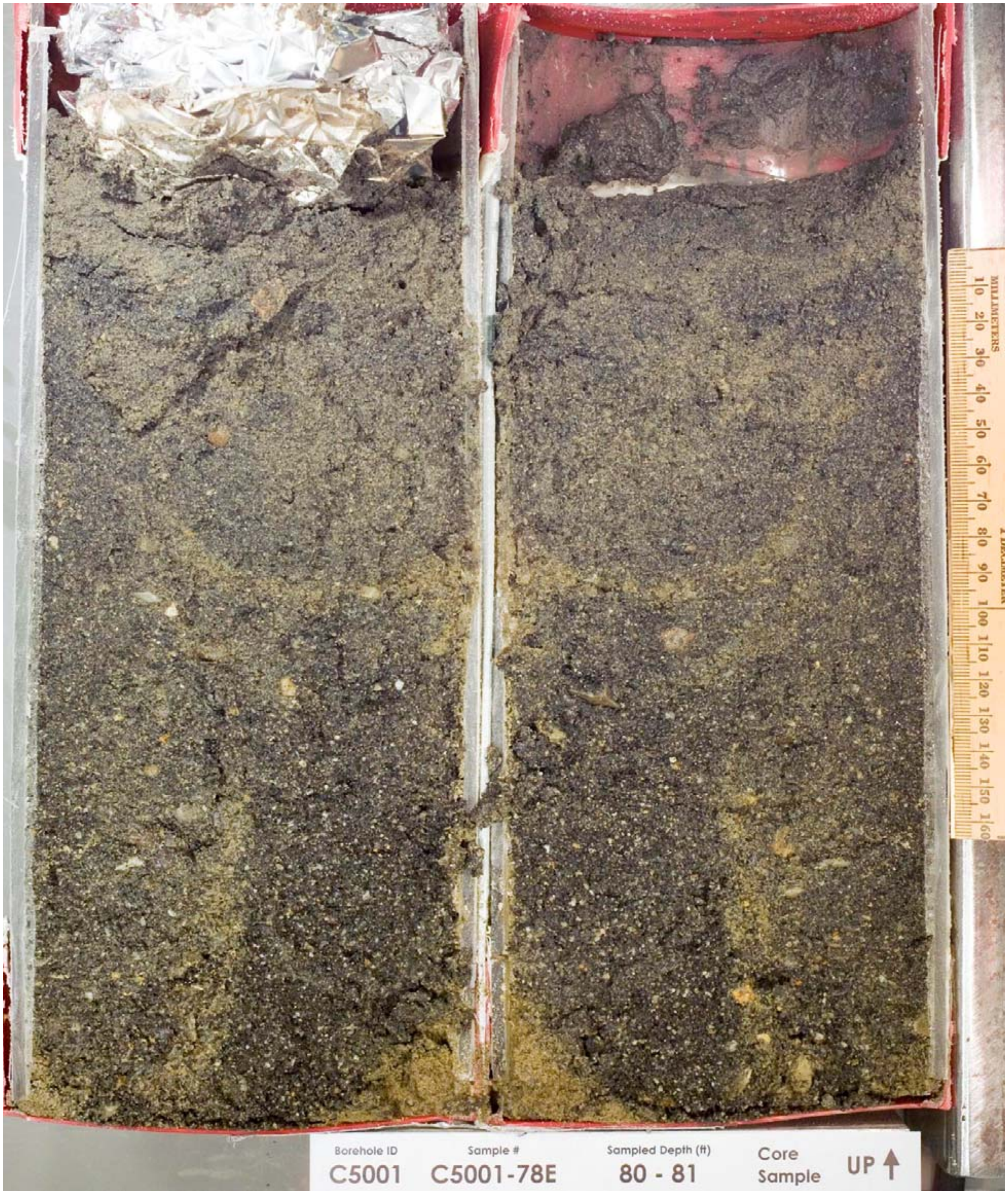

MILLIMETERS
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160
Borehole ID
C5001
Sample #
C5001-76C
Sampled Depth (ft)
64 - 65
Core
Sample
UP

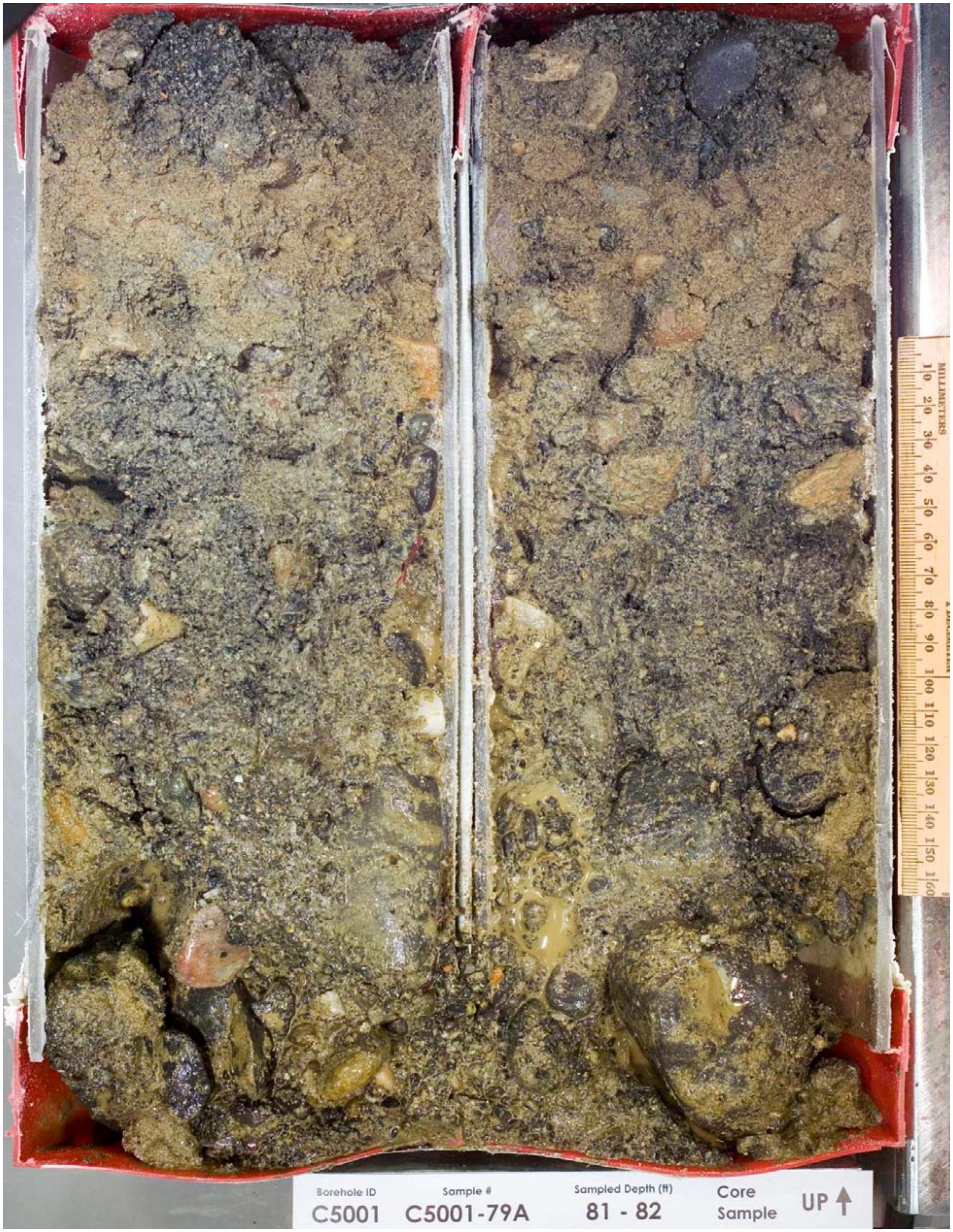

MILLIMETERS
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160
Borehole ID
C5001
Sample #
C5001-76D
Sampled Depth (ft)
65 - 66
Core
Sample
UP


MILLIMETERS
1 DECIMETER
Borehole ID
C5001
Sample #
C5001-77D
Sampled Depth (ft)
73 - 76
Core
Sample
UP


Borehole ID
C5001
Sample #
C5001-77E
Sampled Depth (ft)
73 - 76
Core
Sample
UP
MILLIMETERS


Borehole ID
C5001
Sample #
C5001-78A
Sampled Depth (ft)
73 - 76
Core
Sample
UP
MILLIMETERS
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160


Borehole ID
C5001
Sample #
C5001-78E
Sampled Depth (ft)
80 - 81
Core
Sample
UP
MILLIMETERS


MILLIMETERS
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160
1 DECIMETER
Borehole ID
C5001
Sample #
C5001-79A
Sampled Depth (ft)
81 - 82
Core
Sample
UP

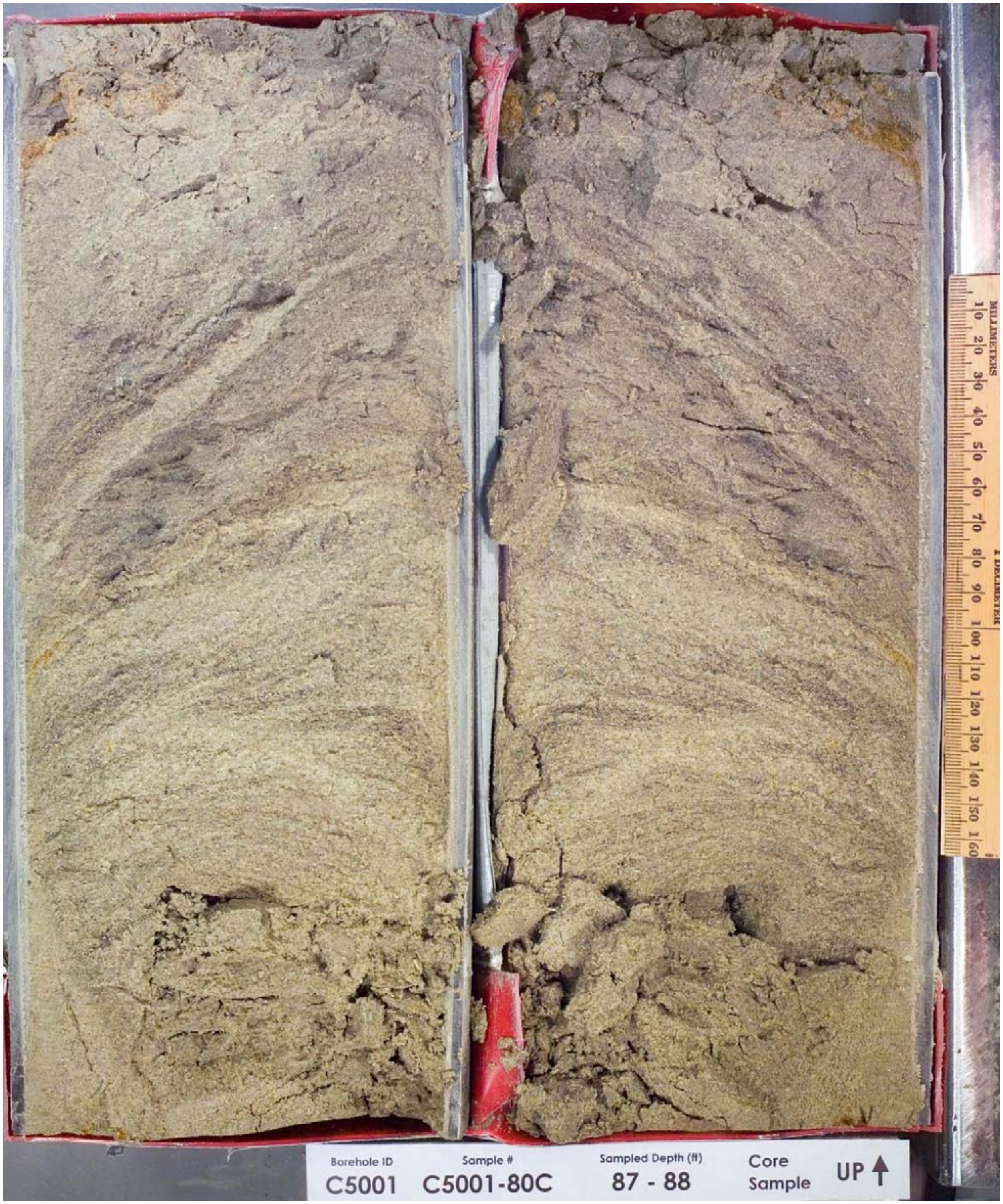

MILLIMETERS
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160
Borehole ID
C5001
Sample #
C5001-79B
Sampled Depth (ft)
82 - 83
Core
Sample
UP


MILLIMETERS
1 DECIMETER
Borehole ID
C5001
Sample #
C5001-79C
Sampled Depth (ft)
82 - 83
Core
Sample
UP


MILLIMETERS
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160
Borehole ID
C5001
Sample #
C5001-79D
Sampled Depth (ft)
83 - 84
Core
Sample
UP


MILLIMETERS
1 DECIMETER
Ringold Formation
Unit E
Ringold Formation
Undesignated
Fine-Grained Unit
Borehole ID
C5001
Sample #
C5001-79E
Sampled Depth (ft)
84 - 85
Core
Sample
UP


MILLIMETERS
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160
1 DECIMETER
Borehole ID
C5001
Sample #
C5001-80A
Sampled Depth (ft)
85 - 86
Core
Sample
UP


MILLIMETERS
1 DECIMETER
Borehole ID
C5001
Sample #
C5001-80C
Sampled Depth (ft)
87 - 88
Core
Sample
UP


MILLIMETERS
1 DECIMETER
Borehole ID
C5001
Sample #
C5001- BAG1
Sampled Depth (ft)
58 - 60
Cored
Sample

Borehole ID
C5001
Sample #
C5001-BAG2
Sampled Depth (ft)
60-61
Cored Sample


Borehole ID
C5001
Sample #
C5001-BAG3
Sampled Depth (ft)
61 - 63
Cored
Sample
MILLIMETERS
1 DECIMETER


MILLIMETERS
Borehole ID
C5001
Sample #
C5001-BAG4
Sampled Depth (ft)
68 - 70
Cored
Sample

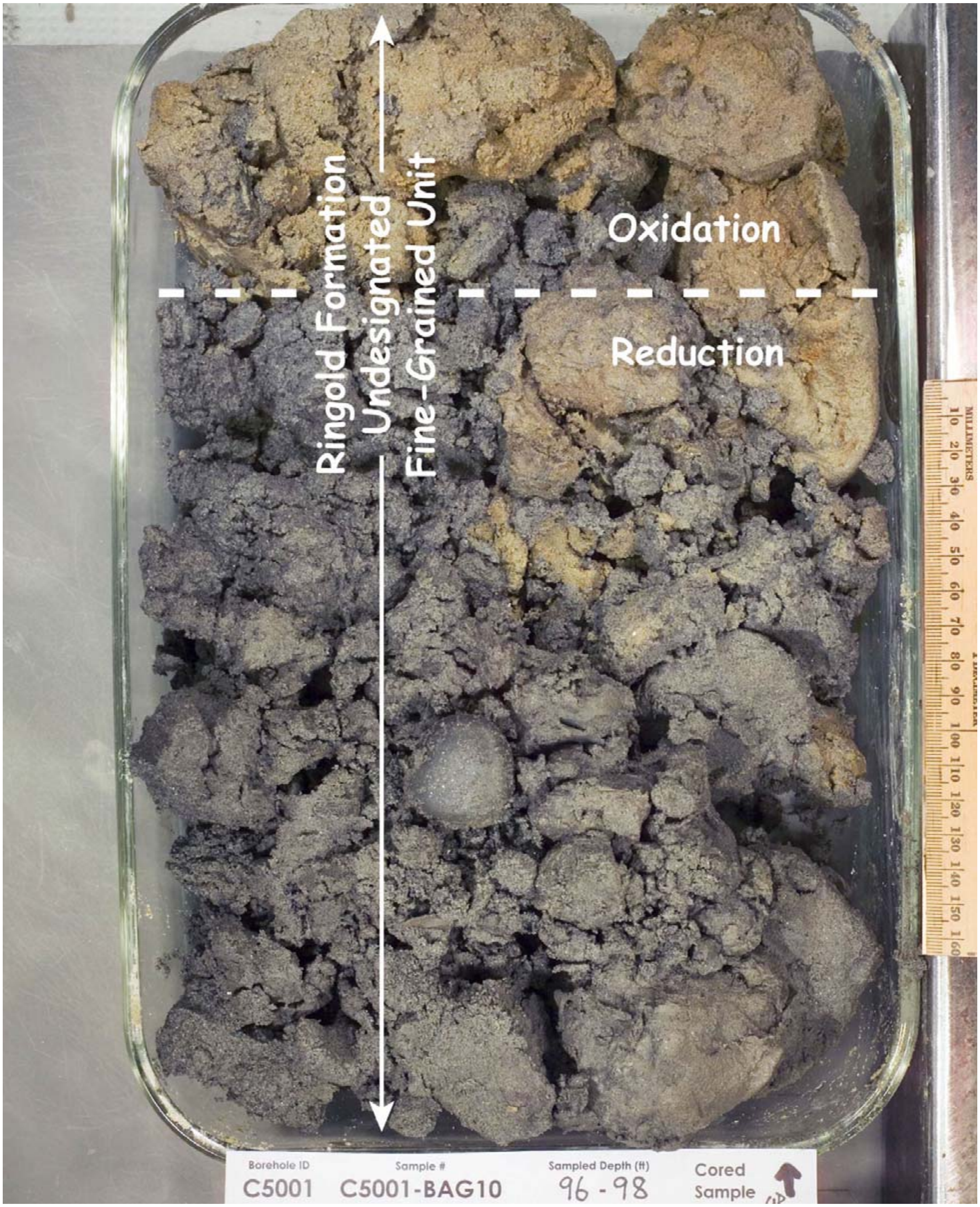

Borehole ID
C5001
Sample #
C5001-BAG5
Sampled Depth (ft)
70 - 72
Cored
Sample
MILLIMETERS
1 DECIMETER


MILLIMETERS
Borehole ID
C5001
Sample #
C5001-BAG6
Sampled Depth (ft)
72 - 74
Cored
Sample


Borehole ID
C5001
Sample #
C5001-BAG7
Sampled Depth (ft)
89-91
Cored
Sample
MILLIMETERS
1 DECIMETER


MILLIMETERS
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160
1 DECIMETER
Borehole ID
C5001
Sample #
C5001-BAG8
Sampled Depth (ft)
91 - 93
Cored
Sample


MILLIMETERS
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160
Borehole ID
C5001
Sample #
C5001-BAG9
Sampled Depth (ft)
93 - 94.5
Cored
Sample


Ringold Formation
Undesignated
Fine-Grained Unit
Oxidation
Reduction
MILLIMETERS
Borehole ID
C5001
Sample #
C5001-BAG10
Sampled Depth (ft)
96 - 98
Cored
Sample


Borehole ID
C5001
Sample #
C5001-BAG11
Sampled Depth (ft)
98-100
Core
Sample

Well C5002


Borehole ID
C5002
Sample #
C5002-81E
Sampled Depth (ft)
3.5 - 4.5
Core
Sample
UP
MILLIMETERS
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160


MILLIMETERS
Borehole ID
C5002
Sample #
C5002-82A
Sampled Depth (ft)
4.5 - 5.5
Core
Sample
UP


MILLIMETERS
Borehole ID
C5002
Sample #
C5002-82D
Sampled Depth (ft)
8 - 9
Core
Sample
UP


MILLIMETERS
Borehole ID
C5002
Sample #
C5002-82E
Sampled Depth (ft)
9 - 10
Core
Sample
UP


MILLIMETERS
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160
Borehole ID
C5002
Sample #
C5002-83A
Sampled Depth (ft)
10 - 11
Core
Sample
UP


MILLIMETERS
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160
Borehole ID
C5002
Sample #
C5002-83B
Sampled Depth (ft)
11 - 12
Core
Sample
UP


MILLIMETERS
Borehole ID
C5002
Sample #
C5002-83E
Sampled Depth (ft)
12.5 - 13.5
Core
Sample
UP


MILLIMETERS
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160
Borehole ID
C5002
Sample #
C5002-84A
Sampled Depth (ft)
13.5 - 14.5
Core
Sample
UP


MILLIMETERS
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160
Borehole ID
C5002
Sample #
C5002-84C
Sampled Depth (ft)
15.5 - 16.5
Core
Sample
UP


Borehole ID
C5002
Sample #
C5002-85C
Sampled Depth (ft)
15.5 - 16.5
Core
Sample
UP
MILLIMETERS


MILLIMETERS
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160
Borehole ID
C5002
Sample #
C5002-85D
Sampled Depth (ft)
16.5 - 17.5
Core
Sample
UP


Borehole ID
C5002
Sample #
C5002-
Sampled Depth (ft)
18 - 20
Core
Sample
UP


MILLIMETERS
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160
Borehole ID
C5002
Sample #
C5002-86C
Sampled Depth (ft)
19 - 20
Core
Sample
UP


MILLIMETERS
Borehole ID
C5002
Sample #
C5002-86D
Sampled Depth (ft)
20 - 21
Core
Sample
UP


MILLIMETERS
Borehole ID
C5002
Sample #
C5002-86E
Sampled Depth (ft)
21 - 22
Core
Sample
UP


MILLIMETERS
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160
Borehole ID
C5002
Sample #
C5002-87B
Sampled Depth (ft)
22 - 23
Core
Sample
UP


MILLIMETERS
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160
Borehole ID
C5002
Sample #
C5002-87C
Sampled Depth (ft)
23 - 24
Core
Sample
UP


MILLIMETERS
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160
Borehole ID
C5002
Sample #
C5002-87D
Sampled Depth (ft)
24 - 25
Core
Sample
UP


MILLIMETERS
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160
Sample #
Sampled Depth (ft)
C5002 C5002-87E 25 - 26
Core Sample
UP


Borehole ID
C5002
Sample #
C5002-88E
Sampled Depth (ft)
27 - 28
Core Sample
UP
MILLIMETERS


MILLIMETERS
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160
Borehole ID
C5002
Sample #
C5002-89A
Sampled Depth (ft)
28 - 29
Core Sample
UP


Borehole ID
C5002
Sample #
C5002-90A
Sampled Depth (ft)
32 - 33
Core
Sample
UP
MILLIMETERS
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160


MILLIMETERS
Borehole ID
C5002
Sample #
C5002-90B
Sampled Depth (ft)
33 - 34
Core
Sample
UP

MILLIMETERS
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160
Borehole ID
C5002
Sample #
C5002-90C
Sampled Depth (ft)
34 - 35
Core
Sample
UP


MILLIMETERS
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160
Borehole ID
C5002
Sample #
C5002-91A
Sampled Depth (ft)
37 - 38
Core
Sample
UP


MILLIMETERS
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160
Borehole ID
C5002
Sample #
C5002-91B
Sampled Depth (ft)
38 - 39
Core
Sample
UP


MILLIMETERS
Borehole ID
C5002
Sample #
C5002-91C
Sampled Depth (ft)
39 - 40
Core
Sample
UP


MILLIMETERS
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160
Borehole ID
C5002
Sample #
C5002-91D
Sampled Depth (ft)
40 - 41
Core
Sample
UP


MILLIMETERS
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160
Borehole ID
C5002
Sample #
C5002-
Sampled Depth (ft)
41 - 43
Core Sample
UP


MILLIMETERS
Borehole ID
C5002
Sample #
C5002-92C
Sampled Depth (ft)
47 - 48
Core
Sample
UP


MILLIMETERS
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160
Borehole ID
C5002
Sample #
C5002-92D
48 - 49
Core
Sample
UP


MILLIMETERS
Borehole ID
C5002
Sample #
C5002-93D
Sampled Depth (ft)
53 - 54
Core
Sample
UP


MILLIMETERS
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160
Borehole ID
C5002
Sample #
C5002-93E
Sampled Depth (ft)
54 - 55
Core
Sample
UP

Borehole ID
C5002
Sample #
C5002-94A
55 - 56
Core
Sample
UP
MILLIMETERS

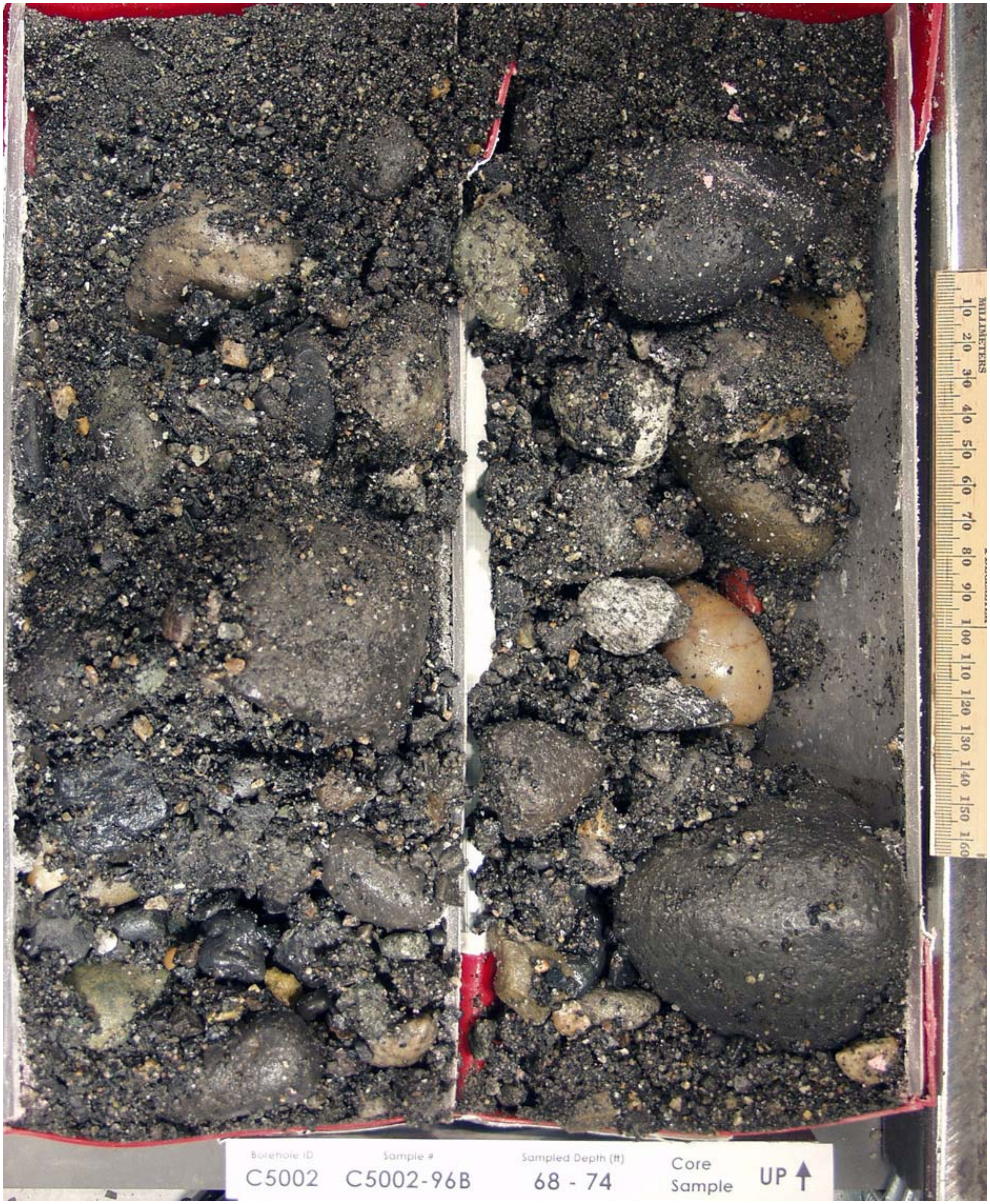

Borehole ID
C5002
Sample #
C5002-94C
Sampled Depth (ft)
64 - 65
Core
Sample
UP


MILLIMETERS
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160
Borehole ID
C5002
Sample #
C5002-94D
Sampled Depth (ft)
65 - 66
Core Sample
UP


MILLIMETERS
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160
Borehole ID
C5002
Sample #
C5002-94E
Sampled Depth (ft)
66 - 67
Core
Sample
UP

MILLIMETERS
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160
ID
C5002
Sample #
C5002-95A
Sampled Depth (ft)
67 - 68
Core
Sample
UP


MILLIMETERS
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160
Borehole ID
C5002
Sample #
C5002-95B
Sampled Depth (ft)
58 - 63
Core
Sample
UP


MILLIMETERS
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160
Borehole ID
C5002
Sample #
C5002-96B
Sampled Depth (ft)
68 - 74
Core
Sample
UP


MILLIMETERS
Borehole
Sample #
Sampled Depth (ft)
C5002
C5002-96C
68 - 74
Core
Sample
UP

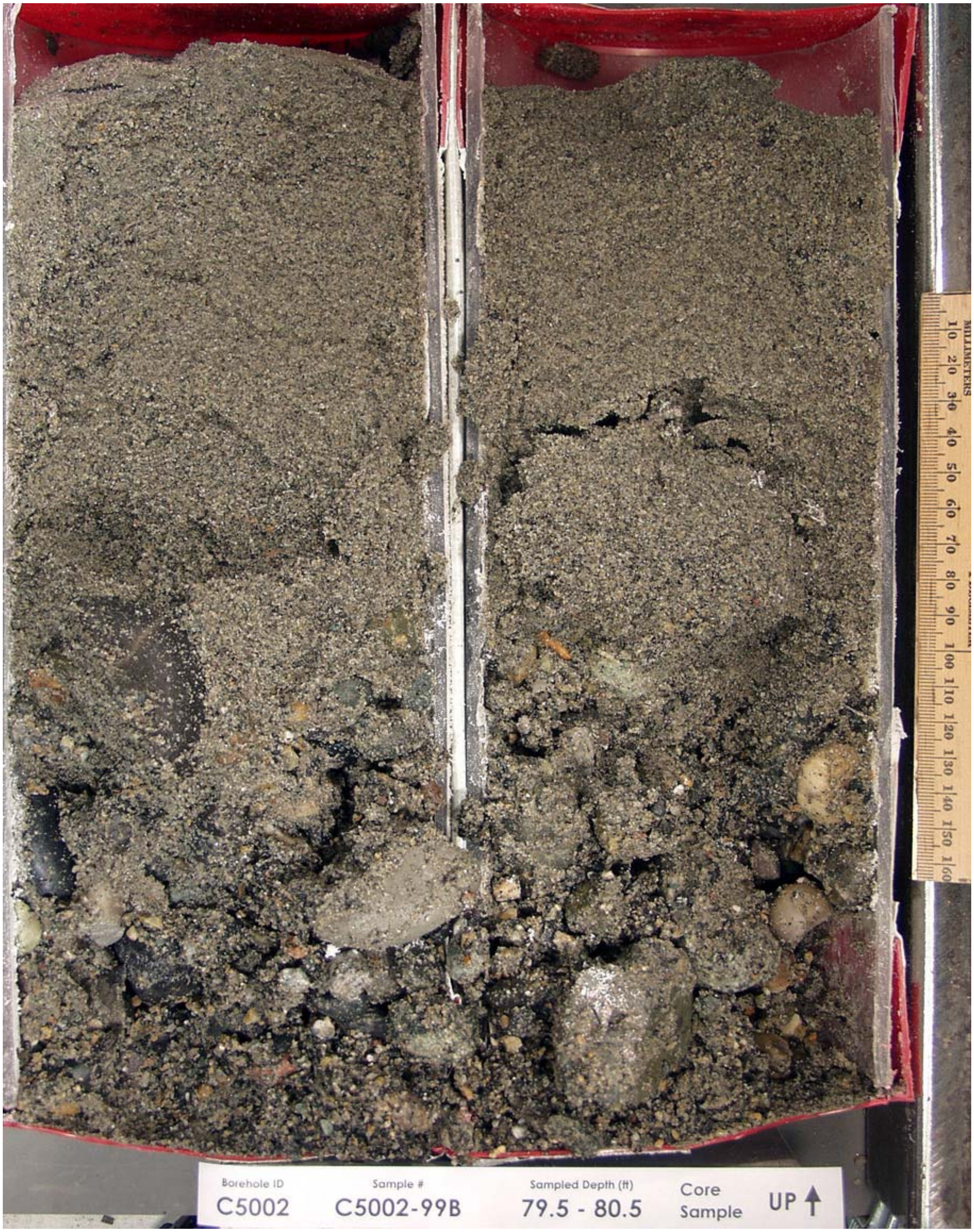

C5002
C5002-97B
Sampled Depth (ft)
73 - 79
Core
Sample
UP


MILLIMETERS
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160
Borehole ID
C5002
Sample #
C5002-97C
Sampled Depth (ft)
73 - 79
Core
Sample
UP

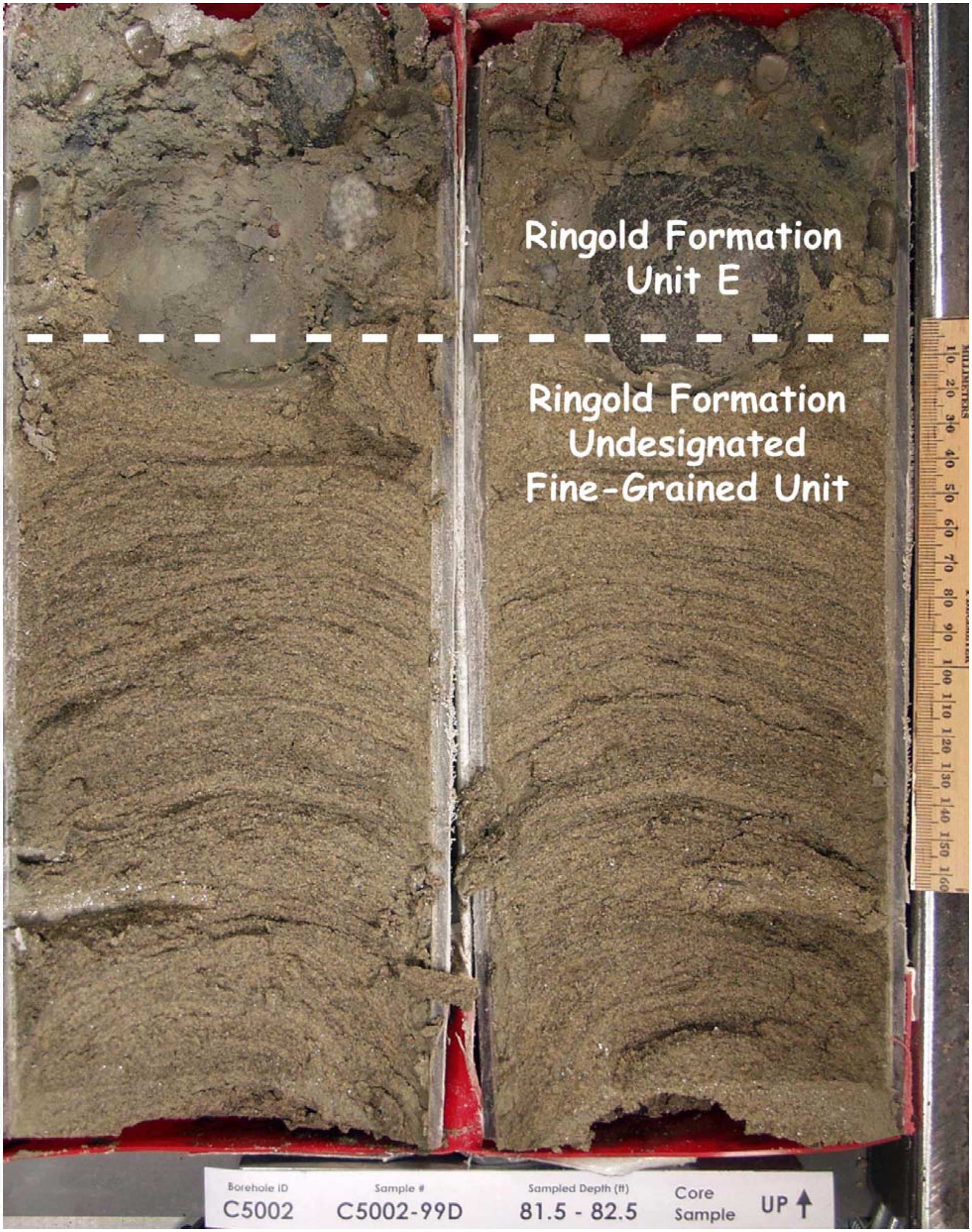

MILLIMETERS
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160
Borehole ID
C5002
Sample #
C5002-98C
Sampled Depth (ft)
78.5 - 79.5
Core
Sample
UP


Hanford formation
Ringold Formation
MILLIMETERS
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160
Borehole ID
C5002
Sample #
C5002-98D
Sampled Depth (ft)
79.5 - 80.5
Core Sample
UP


MILLIMETERS
Borehole ID
C5002
Sample #
C5002-98E
Sampled Depth (ft)
80.5 - 81.7
Core
Sample
UP


MILLIMETERS
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160
Borehole ID
C5002
Sample #
C5002-99B
Sampled Depth (ft)
79.5 - 80.5
Core
Sample
UP


MILLIMETERS
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160
Borehole ID
C5002
Sample #
C5002-99C
Sampled Depth (ft)
80.5 - 81.5
Core
Sample
UP


Ringold Formation
Unit E
Ringold Formation
Undesignated
Fine-Grained Unit
MILLIMETERS
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160
Borehole ID
C5002
Sample #
C5002-99D
Sampled Depth (ft)
81.5 - 82.5
Core
Sample
UP


Borehole ID
C5002
Sample #
C5002-99E
Sampled Depth (ft)
82.5 - 83.5
Core
Sample
UP


MILLIMETERS
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
Borehole ID
C5002
Sample #
C5002-100A
Sampled Depth (ft)
83.5 - 84.5
Core
Sample
UP


Ringold Formation
Undesignated
Fine-Grained Unit
Oxidation
Reduction
MILLIMETERS
Borehole ID
C5002
Sample #
C5002-
Sampled Depth (ft)
85 - 87
Core
Sample
UP


Borehole ID
C5002
Sample #
C5002-
Sampled Depth (ft)
87 - 89
Core
Sample
UP
MILLIMETERS


MILLIMETERS
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160
Borehole ID
C5002
Sample #
C5002-
Sampled Depth (ft)
89 - 91
Core
Sample
UP


Borehole ID
C5002
Sample #
C5002-
Sampled Depth (ft)
93 - 95
Core
Sample
UP

Core Chain of Custody Forms

Well C4999

Pacific Northwest National Laboratory
P.O. Box 999, Richland, WA 99352

CHAIN OF CUSTODY

Chain-of-Custody No. C4999- 1
Well ID / Well Number C4999 / 399-3-18 (300-FF-5-1)

Company Contact: B. A. Williams **Telephone:** (509) 372-3799 **Cell Phone:** (509) 539-6502

Samples Collected by: Jake Horner ☐ PNNL ☒ Other

Remarks: n/A

Ice Chest No: n/A **Field Logbook No:** n/A **Page No:** 1

Possible Sample Hazard Identification: n/A

Destination: Building 325 / Rm 325 (non-Rad) or Rm 305 (Rad) **Carrier/Waybill No:**

Sample Medium: Water ☐ Soil ☒ Other ☐

Shipping container internal temperature: when samples sealed in it ND °C when opened in laboratory ___ °C

Condition of sample containers when received at laboratory:

SAMPLE IDENTIFICATION

Date Collected	Time Collected	Sampled Interval Top (ft)	Sampled Interval Bottom (ft)	Sample Number	Percent Recovery	Lexan Liner	Comments
3-10-06		2.2	3.2	C4999- 1D	100%		
3-10-06		3.2	4.2	C4999- 1E	100%		
3-10-06		4.2	5.2	C4999- 2A	100%		
3-10-06		5.2	6.2	C4999- 2B	100%		
3-10-06		6.5	7.5	C4999- 2E	50%		
3-10-06		7.8	8.5	C4999- 3A	100%		
3-10-06		8.5	9.5	C4999- 3B	100%		
3-10-06		9.5	10.5	C4999- 3C	100%		
3-10-06		12.2	13.2	C4999- 4B	75%		
3-10-06		13.2	14.2	C4999- 4C	100%		
3-10-06		14.5	15.5	C4999- 5A	30%		
3-10-06		15.5	16.5	C4999- 5B	100%		
3-10-06		16.5	17.5	C4999- 5C	100%		
3-10-06		17.5	18.5	C4999- 5D	100%		
3-10-06		18.5	19.5	C4999- 5E	100%		
3-10-06		19.5	20.5	C4999- 6A	55%		
3-10-06		20.5	21.5	C4999- 6B	100%		
3-10-06		21.5	22.5	C4999- 6C	100%		
3-10-06		22.5	23.5	C4999- 6D	100%		
3-10-06		23.5	24.5	C4999- 6E	100%		
3-10-06		24.5	25.5	C4999- 7A	100%		

CHAIN OF POSSESSION (Include Company Initials)

Relinquished By: Print	Sign	Co.	Received By: Print	Sign	Co.	Date / Time
Jake Horner	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3-10-06 / 1600
Bruce Williams	[illegible]	PNNL	[illegible]	[illegible]	[illegible]	3-11-06 / 1015

Disposed By: Print | Sign | Co. | Disposal Method: | Date / Time

2006/DCL/300-FF-5/001 (03/06)

Pacific Northwest National Laboratory
P.O. Box 999, Richland, WA 99352

CHAIN OF CUSTODY

Chain-of-Custody No. C4999-[illegible]

Well ID / Well Number: C4999 / 399-3-18 (300-FF-5-1)

Company Contact: B. A. Williams **Telephone:** (509) 372-3799 **Cell Phone:** (509) 539-6502

Samples Collected by: Jake Horner ☐ PNNL ☒ Other

Remarks: None

Ice Chest No: n/a **Field Logbook No:** n/a **Page No:** 1

Possible Sample Hazard Identification:

Destination: Building 325 / Rm 325 (non-Rad) or Rm 305 (Rad) **Carrier/Waybill No:**

Sample Medium: Water ☐ Soil ☒ Other ☐

Shipping container internal temperature: when samples sealed in it ND °C when opened in laboratory ____ °C

Condition of sample containers when received at laboratory:

SAMPLE IDENTIFICATION

Date Collected	Time Collected	Sampled Interval Top (ft)	Sampled Interval Bottom (ft)	Sample Number	Percent Recovery	Lexan Liner	Comments
3-10-06		23.5	24.5	C4999- 7D	100%		
3-10-06		24.5	25.5	C4999- 7E	100%		
3-10-06		25.5	26.5	C4999- 8A	100%		
3-10-06		26.5	27.5	C4999- 8B	100%		
3-13-06		27	28	C4999- 8D	50%		
3-13-06		28	29	C4999- 8E	100%		
3-13-06		29	30	C4999- 9A	100%		
3-13-06		30	31	C4999- 9B	100%		
3-13-06		31	32	C4999- 9C	100%		
3-13-06		~~32~~	~~33~~	C4999-			
3-13-06		33	34	C4999- 10A	~~78%~~		
"		34	35	C4999- 10B	100%		
"		35	36	C4999- 10C	100%		
"		36	37	C4999- 10D	100%		
"		38	39	C4999- 11A	50%		
"		39	40	C4999- 11B	100%		
"		40	41	C4999- 11C	100%		
"		41	42	C4999- 11D	100%		
3-13-06		42	43	C4999- 11E	36%		
"				C4999-			
"				C4999-			

CHAIN OF POSSESSION (Include Company Initials)

Relinquished By: Print	Sign	Co.	Received By: Print	Sign	Co.	Date / Time
Jake Horner	[illegible]		B. Williams	[illegible]	PNNL	3/13/06 [illegible]
B. Williams	[illegible]	PNNL	[illegible]	[illegible]	[illegible]	3/13/06 1740

Disposed By: Print Sign Co Disposal Method: Date / Time

2006/DCL/300-FF-5/001 (03/06)

Pacific Northwest National Laboratory
P.O. Box 999, Richland, WA 99352

CHAIN OF CUSTODY

Chain-of-Custody No. C4999- 3

Well ID / Well Number C4999 / 399-3-18 (300-FF-5-1)

Company Contact: B. A. Williams **Telephone:** (509) 372-3799 **Cell Phone:** (509) 539-6502

Samples Collected by: Jake Horner ☐ PNNL ☒ Other GRAM Inc.

Remarks: None

Ice Chest No: N/A **Field Logbook No:** N/A **Page No:** 1

Possible Sample Hazard Identification:

Destination: Building 325 / Rm 325 (non-Rad) or Rm 305 (Rad) **Carrier/Waybill No:**

Sample Medium: Water ☐ Soil ☒ Other ☐

Shipping container internal temperature: when samples sealed in it ____ °C when opened in laboratory ____ °C

Condition of sample containers when received at laboratory:

SAMPLE IDENTIFICATION

Date Collected	Time Collected	Sampled Interval Top (ft)	Sampled Interval Bottom (ft)	Sample Number	Percent Recovery	Lexan Liner	Comments
3-14-06	1406	49.5	50.5	C4999- 13B	100%	✓	Slightly silty sand
3-14-06	1406	50.5	51.5	C4999- 13C	100%	✓	Olive Brown 49.5' to ~54'
"	1406	51.5	52.5	C4999- 13D	100%	✓	v. dark greenish gray 54'-61'
"	1406	52.5	53.5	C4999- 13E	100%	✓	
"	1406	53.5	54.5	C4999- 14A	100%	✓	
3-14-06	1406	54.5	55.5	C4999- 14B	100%	✓	
"	1520	54.5	55.5	C4999- 14C	100%	✓	May be sluff
"	1520	55.5	56.5	C4999- 14D	100%	✓	
"	1520	56.5	57.5	C4999- 14E	100%	✓	
"	1520	57.5	58.5	C4999- 15A	100%	✓	
"	1520	58.5	59.5	C4999- 15B	100%	✓	~~B~~
3-14-06	1520	59.5	61'	C4999- ~~15C~~			Bagged Sample (59.5'-61')
				C4999-			
				C4999-			
				C4999-			
				C4999-			
				C4999-			
				C4999-			
				C4999-			
				C4999-			

CHAIN OF POSSESSION (Include Company Initials)

Relinquished By: Print	Sign	Co.	Received By: Print	Sign	Co.	Date / Time
Jake Horner	Jake Horner	GRAM	Bruce Williams	[signature]	PNNL	3/14/06 16:00
Bruce Williams	[signature]	PNNL	[illegible]	[signature]		3/14/06 16:30

Disposed By: Print Sign Co. Disposal Method: Date / Time

2006/DCL/300-FF-5/001 (03/06)

Pacific Northwest National Laboratory P.O. Box 999, Richland, WA 99352	# CHAIN OF CUSTODY	Chain-of-Custody No. C4999- Well ID / Well Number C4999 / 399-3-18 (300-FF-5-1)

Company Contact: B. A. Williams **Telephone:** (509) 372-3799 **Cell Phone:** (509) 539-6502

Samples Collected by: Jake Horner ☐ **PNNL** ☒ **Other** GRAM Inc.

Remarks: None

Ice Chest No: N/A **Field Logbook No:** N/A **Page No:** N/A

Possible Sample Hazard Identification:

Destination: Building 325 / Rm 325 (non-Rad) or Rm 305 (Rad) **Carrier/Waybill No:**

Sample Medium: Water ☐ Soil ☒ Other ☐

Shipping container internal temperature: when samples sealed in it ____ °C when opened in laboratory ____ °C

Condition of sample containers when received at laboratory:

SAMPLE IDENTIFICATION

Date Collected	Time Collected	Sampled Interval Top (ft)	Sampled Interval Bottom (ft)	Sample Number	Percent Recovery	Lexan Liner	Comments
3-16-06	0800	59.5	60.5	C4999- 15D	100%		
				C4999- ~~16~~	100%		
3-16-06	0800	60.5	~~60~~ 61.5	C4999- 15E	100		
"	0800	61.5	62.5	C4999- 16A	100		
"	0800	62.5	63.5	C4999- 16B	100		
"	0800	63.5	64.5	C4999- 16C	100		
"	0800	64.5	65.5	C4999- 16D	100		
"	0830	~~4~~ 64.5	65.5	C4999- 16E	100		Probably Slaff
"	0830	65.5	66.5	C4999- 17A	100		
"	0830	66.5	67.5	C4999- 17B	100		
"	0830	67.5	68.5	C4999- 17C	100		
"	0830	68.5	69.5	C4999- 17D	100		
3-16-06	0830	69.5	70.5	C4999- 17E	100		
				C4999-			
				C4999-			
				C4999-			
				C4999-			
				C4999-			
				C4999-			
				C4999-			
				C4999-			

CHAIN OF POSSESSION (Include Company Initials)

Relinquished By: Print	Sign	Co.	Received By: Print	Sign	Co.	Date / Time
Jake Horner	[illegible]	GRAM	B. A. Williams	[illegible]	PNL	3/16/06 0948
B. A. Williams	[illegible]	PNL	[illegible]	[illegible]	PNL	3/16/06 1355

Disposed By: Print	Sign	Co.	Disposal Method:	Date / Time

2006/DCL/300-FF-5/001 (03/06)

Pacific Northwest National Laboratory
P.O. Box 999, Richland, WA 99352

CHAIN OF CUSTODY

Chain-of-Custody No. C4999-
Well ID / Well Number C4999 / 399-3-18 (300-FF-5-1)

Company Contact: B. A. Williams **Telephone:** (509) 372-3799 **Cell Phone:** (509) 539-6502

Samples Collected by: Jake Horner ☐ PNNL ☒ Other GRAM Inc.

Remarks: none

Ice Chest No: n/A **Field Logbook No:** n/A **Page No:** n/A

Possible Sample Hazard Identification: None

Destination: Building 325 / Rm 325 (non-Rad) or Rm 305 (Rad) **Carrier/Waybill No:**

Sample Medium: Water ☐ Soil ☒ Other ☐

Shipping container internal temperature: when samples sealed in it ____ °C when opened in laboratory ____ °C

Condition of sample containers when received at laboratory:

SAMPLE IDENTIFICATION

Date Collected	Time Collected	Sampled Interval Top (ft)	Sampled Interval Bottom (ft)	Sample Number	Percent Recovery	Lexan Liner	Comments
3-17-06	1400	70.5	71.5	C4999- 18B	100%		50% Slough
"	1400	71.5	72.5	C4999- 18C	100		"
"	1400	72.5	73.5	C4999- 18D	100		
"	1400	73.5	74.5	C4999- 18E	100		
"	1400	74.5	75.5	C4999- 19A	100		
"	1500	75.5	76.5	C4999- 19B	100		
"	1500	76.5	77.5	C4999- 19C	100		
"	1500	77.5	78.5	C4999- 19D	100		
"	1500	78.5	79.5	C4999- 19E	100		
"	1500	79.5	80.5	C4999- 20A	100		
3-17-06	1500	80.5	81.5	C4999- 20B	100		
3-20-06	1220	81.5	82.5	C4999- 20D	100		
"	1220	82.5	83.5	C4999- 20E	100		
"	1220	83.5	84.5	C4999- 21A	100		
"	1220	84.5	85.5	C4999- 21B	100		
"	1220	85.5	86.5	C4999- 21C	100		
3-20-06	1220	86.5	87.5	C4999- 21D	100		
	/			C4999-			
				C4999-			
				C4999-			
				C4999-			

CHAIN OF POSSESSION (Include Company Initials)

Relinquished By: Print	Sign	Co.	Received By: Print	Sign	Co.	Date / Time
Jake Horner	Jake Horner	GRAM	Bruce Williams	[illegible]	PNNL	3/20/06 / 12:28
Bruce Williams	[illegible]	PNNL	[illegible]	[illegible]	[illegible]	3/20/06 12:35

Disposed By: Print	Sign	Co.	Disposal Method:	Date / Time

2006/DCL/300-FF-5/001 (03/06)

Pacific Northwest National Laboratory
P.O. Box 999, Richland, WA 99352

CHAIN OF CUSTODY

Chain-of-Custody No. C4999-
Well ID / Well Number C4999 / 399-3-18 (300-FF-5-1)

Company Contact: B. A. Williams **Telephone:** (509) 372-3799 **Cell Phone:** (509) 539-6502

Samples Collected by: Jake Horner ☐ PNNL ☒ Other GRAM Inc.

Remarks: None

Ice Chest No: N/A **Field Logbook No:** N/A **Page No:** N/A

Possible Sample Hazard Identification:

Destination: Building 325 / Rm 325 (non-Rad) or Rm 305 (Rad) **Carrier/Waybill No:**

Sample Medium: Water ☐ Soil ☒ Other ☐

Shipping container internal temperature: when samples sealed in it ____ °C when opened in laboratory ____ °C

Condition of sample containers when received at laboratory:

SAMPLE IDENTIFICATION

Date Collected	Time Collected	Sampled Interval Top (ft)	Sampled Interval Bottom (ft)	Sample Number	Percent Recovery	Lexan Liner	Comments
3-21-06	1215	92.5	93.5	C4999- 23C	100		
"	1215	93.5	94.5	C4999- 23D	100		
"	1215	94.5	95.5	C4999- 23E	100		
"	1215	95.5	96.5	C4999- 24A	100		
"	1410	95	96	C4999- 24B	100		
"	1410	96	97	C4999- 24C	100		
"	1410	97	98	C4999- 24D	100		
"	1410	98	99	C4999- 24E	100		
"	1410	99	100	C4999- 254	100		
3-21-06	1410	100	101	C4999- 25B	30		Bottom 70% fell out
3-20-06	N/A	85	86	C4999- 21E	100		
3-20-06	N/A	86	87	C4999- 22A	100		
"	"	87	88	C4999- 22B	100		
"	"	88	89	C4999- 22C	100		
"	"	89	90	C4999- 22D	100		
"	"	90	91	C4999- 22E	100		
				C4999-			
				C4999-			
				C4999-			
				C4999-			
				C4999-			

CHAIN OF POSSESSION (Include Company Initials)

Relinquished By: Print	Sign	Co.	Received By: Print	Sign	Co.	Date / Time
Jake Horner	[signature]	GRAM	Bruce Williams	[signature]	AXL	3/22/06 07:40
Bruce Williams	[signature]		Michelle Valenta	Michelle Valenta	PNNL	3/22/06 07:45

Disposed By: Print	Sign	Co.	Disposal Method:	Date / Time

2006/DCL/300-FF-5/001 (03/06)

Pacific Northwest National Laboratory
P.O. Box 999, Richland, WA 99352

CHAIN OF CUSTODY

Chain-of-Custody No. C4999-
Well ID / Well Number C4999 / 399-3-18 (300-FF-5-1)

Company Contact: B. A. Williams Telephone: (509) 372-3799 Cell Phone: (509) 539-6502

Samples Collected by: Jake Horner ☐ PNNL ☒ Other GRAM

Remarks: none

Ice Chest No: n/A Field Logbook No: n/A Page No: n/A

Possible Sample Hazard Identification:

Destination: Building 325 / Rm 325 (non-Rad) or Rm 305 (Rad) Carrier/Waybill No:

Sample Medium: Water ☐ Soil ☒ Other ☐

Shipping container internal temperature: when samples sealed in it ___ °C when opened in laboratory ___ °C

Condition of sample containers when received at laboratory:

SAMPLE IDENTIFICATION

Date Collected	Time Collected	Sampled Interval Top (ft)	Sampled Interval Bottom (ft)	Sample Number	Percent Recovery	Lexan Liner	Comments
3-22-06		99.5	100.5	C4999- 25C	100		
		100.5	101.5	C4999- 25D	100		
		101.5	102.5	C4999- 25E	100		
		102.5	103.5	C4999- 26A	100		
		103.5	104.5	C4999- 26B	100		
		104.5	105.5	C4999- 26C	100		
		104.5	105.5	C4999- 26D	100		
		105.5	106.5	C4999- 26E	100		
		106.5	107.5	C4999- 27A	100		
		107.5	108.5	C4999- 27B	100		
		108.5	109.5	C4999- 27C	100		
		~~109.5~~	~~110.5~~	~~C4999- 28~~	~~0%~~		
		108.5	109.5	C4999- 27E	100		108.5 – 111' likely slough
		109.5	110.5	C4999- 28A	100		27E – 28B
		110.5	111.5	C4999- 28B	100		
		111.5	112.5	C4999- 28C	100		
		112.5	113.5	C4999- 28D	100		
3-22-06		113.5	114.5	C4999- 28E	80		
				C4999-			
				C4999-			
				C4999-			

CHAIN OF POSSESSION (Include Company Initials)

Relinquished By: Print	Sign	Co.	Received By: Print	Sign	Co.	Date / Time
Jake Horner	[signature]	GRAM	Bruce Williams	[signature]	PNNL	3-22-06 15:56
Bruce Williams	[signature]	PNNL	Wooyong Um	[signature]	PNNL	3-22-06 16:00

Disposed By: Print Sign Co. Disposal Method: Date / Time

2006/DCL/300-FF-5/001 (03/06)

Pacific Northwest National Laboratory
P.O. Box 999, Richland, WA 99352

CHAIN OF CUSTODY

Chain-of-Custody No. C4999-

Well ID / Well Number C4999 / 399-3-18 (300-FF-5-1)

Company Contact: B. A. Williams **Telephone:** (509) 372-3799 **Cell Phone:** (509) 539-6502

Samples Collected by: Jake Horner ☐ PNNL ☒ Other GRAM Inc.

Remarks: None

Ice Chest No: n/a **Field Logbook No:** n/a **Page No:** n/a

Possible Sample Hazard Identification: n/a

Destination: Building 325 / Rm 325 (non-Rad) or Rm 305 (Rad) **Carrier/Waybill No:**

Sample Medium: Water ☐ Soil ☒ Other ☐

Shipping container internal temperature: when samples sealed in it ____ °C when opened in laboratory ____ °C

Condition of sample containers when received at laboratory:

SAMPLE IDENTIFICATION

Date Collected	Time Collected	Sampled Interval Top (ft)	Sampled Interval Bottom (ft)	Sample Number	Percent Recovery	Lexan Liner	Comments
3-23-06	0735	114.5	115.5	C4999- 29A	100		
	0735	115.5	116.5	C4999- 29B	100		
	0735	116.5	117.5	C4999- 29C	100		
	0735	117.5	118.5	C4999- 29D	100		
	0735	118.5	119.5	C4999- 29E	100		
	0735	119.5	120.5	C4999- 30A	80		
	0935	122	123	C4999- 30D	100		
	0935	123	124	C4999- 30E	100		
	0935	124	125	C4999- 31A	100		
3-23-06	0935	125	126	C4999- 31B	50		
				C4999-			
				C4999-			
				C4999-			
				C4999-			
				C4999-			
				C4999-			
				C4999-			
				C4999-			
				C4999-			
				C4999-			
				C4999-			

CHAIN OF POSSESSION (Include Company Initials)

Relinquished By: Print	Sign	Co.	Received By: Print	Sign	Co.	Date / Time
Jake Horner	[signature]	GRAM	Bruce Williams	[signature]	PNNL	3-23-06 10:15
Bruce Williams	[signature]	PNNL	Kenton Rod	[signature]	PNNL	3-23-06 10:25

Disposed By: Print	Sign	Co.	Disposal Method:	Date / Time

2006/DCL/300-FF-5/001 (03/06)

Pacific Northwest National Laboratory
P.O. Box 999, Richland, WA 99352

CHAIN OF CUSTODY

Chain-of-Custody No. C4999-

Well ID / Well Number C4999 / 399-3-18 (300-FF-5-1)

Company Contact: B. A. Williams Telephone: (509) 372-3799 Cell Phone: (509) 539-6502

Samples Collected by: Jake Horner ☐ PNNL ☒ Other GRAM Inc.

Remarks: None

Ice Chest No: N/A Field Logbook No: N/A Page No: N/A

Possible Sample Hazard Identification:

Destination: Building 325 / Rm 325 (non-Rad) or Rm 305 (Rad) Carrier/Waybill No:

Sample Medium: Water ☐ Soil ☒ Other ☐

Shipping container internal temperature: when samples sealed in it ____ °C when opened in laboratory ____ °C

Condition of sample containers when received at laboratory:

SAMPLE IDENTIFICATION

Date Collected	Time Collected	Sampled Interval Top (ft)	Sampled Interval Bottom (ft)	Sample Number	Percent Recovery	Lexan Liner	Comments
3-23-06	1415	124.5	125.5	C4999- 31C	100		
↓	↓	125.5	126.5	C4999- 31D	100		LOWER MUD ~ 126
		126.5	127.5	C4999- 31E	100		
		127.5	128.5	C4999- 32A	100		
		128.5	129.5	C4999- 32B	100		
3-23-06	1415	129.5	130.5	C4999- 32C	100		
				C4999-			
				C4999-			
				C4999-			
				C4999-			
				C4999-			
				C4999-			
				C4999-			
				C4999-			
				C4999-			
				C4999-			
				C4999-			
				C4999-			
				C4999-			
				C4999-			
				C4999-			

CHAIN OF POSSESSION (Include Company Initials)

Relinquished By: Print	Sign	Co.	Received By: Print	Sign	Co.	Date / Time
Jake Horner	[signature]	GRAM	BRUCE WILLIAMS	[signature]	PNNL	3/23/06 14:34
BRUCE WILLIAMS	[signature]	PNNL	Kenton Rod	[signature]	PNNL	3/23/06 14:45

Disposed By: Print Sign Co. Disposal Method: Date / Time

2006/DCL/300-FF-5/001 (03/06)

Well C5000

Pacific Northwest National Laboratory
P.O. Box 999, Richland, WA 99352

CHAIN OF CUSTODY

Chain-of-Custody No. C5000- 1
Well ID / Well Number C5000 / 399-1-23 (300-FF-5-2)

Company Contact: B. A. Williams Telephone: (509) 372-3799 Cell Phone: (509) 539-6502
Samples Collected by: Jake Herner ☐ PNNL ☒ Other GRAM Inc.
Remarks: none
Ice Chest No: n/A Field Logbook No: n/A Page No: n/A
Possible Sample Hazard Identification: none
Destination: Building 325 / Rm 325 (non-Rad) or Rm 305 (Rad) Carrier/Waybill No:
Sample Medium: Water ☐ Soil ☒ Other ☐
Shipping container internal temperature: when samples sealed in it ____ °C when opened in laboratory ____ °C
Condition of sample containers when received at laboratory:

SAMPLE IDENTIFICATION

Date Collected	Time Collected	Sampled Interval Top (ft)	Sampled Interval Bottom (ft)	Sample Number	Percent Recovery	Lexan Liner	Comments
3-30-06	1330	0	1	C5000- 32D	100		
		1	2	C5000- 32E	100		
		2	2.5	C5000- 33A	100		
		2	2.5	C5000- 33B	100		
		2.5	3.5	C5000- 33C	100		
	1330	3.5	4.5	C5000- 33D	100		33E 0% rec.
	1518	3.5	4.5	C5000- 34A	80		
		4.5	5.5	C5000- 34B	100		
		5.5	6.5	C5000- 34C	100		
		6.5	7.5	C5000- 34D	100		
	1518	7.5	8.5	C5000- 34E	100		
	1545	6.5	7.5	C5000- 35B	50		
		7.5	8.5	C5000- 35C	100		
		8.5	9.5	C5000- 35D	100		
		9.5	10.5	C5000- 35E	100		
3-30-06	1545	10.5	11.5	C5000- 36A	100		
4-3-06	0815	10.5	11.5	C5000- 36D	100		
	0815	11.5	12.5	C5000- 36E	100		
	0815	12.5	13.5	C5000- 37A	100		
4-3-06	0815	13.5	14.5	C5000- 37B	100		
				~~C5000-~~			

CHAIN OF POSSESSION (Include Company Initials)

Relinquished By: Print	Sign	Co.	Received By: Print	Sign	Co.	Date / Time
Jake Herner	[signature]	GRAM	Bruce Williams	[signature]	PNNL	4/5/06 0704
Bruce Williams	[signature]	PNNL	Michelle Valenta	[signature]	PNNL	4/5/06

Disposed By: Print	Sign	Co	Disposal Method:	Date / Time

2006/DCL/300-FF-5/001 (03/06)

Pacific Northwest National Laboratory P.O. Box 999, Richland, WA 99352	# CHAIN OF CUSTODY	Chain-of-Custody No. C5000- 2 Well ID / Well Number C5000 / 399-1-23 (300-FF-5-2)

Company Contact: B. A. Williams **Telephone:** (509) 372-3799 **Cell Phone:** (509) 539-6502

Samples Collected by: Jake Horner ☐ PNNL ☒ Other GRAM Inc

Remarks: n/A

Ice Chest No: n/A **Field Logbook No:** n/A **Page No:** n/A

Possible Sample Hazard Identification: none

Destination: Building 325 / Rm 325 (non-Rad) or Rm 305 (Rad) **Carrier/Waybill No:**

Sample Medium: Water ☐ Soil ☒ Other ☐

Shipping container internal temperature: when samples sealed in it ____ °C when opened in laboratory ____ °C

Condition of sample containers when received at laboratory:

SAMPLE IDENTIFICATION

Date Collected	Time Collected	Sampled Interval Top (ft)	Sampled Interval Bottom (ft)	Sample Number	Percent Recovery	Lexan Liner	Comments
4-3-06	0900	18.5	19.5	C5000- 38A	100		
4-3-06	0900	19.5	20.5	C5000- 38B	100		
4-3-06	0900	20.5	21.5	C5000- 38C	100		
	~~10~~ 1100	21.5	22.5	C5000- 39A	50		
	1100	22.5	23.5	C5000- 39B	100		
	1100	23.5	24.5	C5000- 39C	100		
	1100	24.5	25.5	C5000- 39D	100		
	~~1140~~	~~25.5~~	~~29.5~~	~~C5000- 39E~~	~~0%~~		
	1140	29.5	30.5	C5000- 40A	80%		
		30.5	31.5	C5000- 40B	100		
		31.5	32.5	C5000- 40C	100		
		32.5	33.5	C5000- 40D	100		
	1140	33.5	34.5	C5000- 40E	100		
	—	—	—	C5000- 41A	0		
		34.5	35.5	C5000- 41B	50		
		35.5	36.5	C5000- 41C	100		
		36.5	37.5	C5000- 41D	100		
		37.5	38.5	C5000- 41E	100		
4-3-06		38.5	~~40.5~~ 39.5	C5000- 42A	100		
				C5000-			
				C5000-			

CHAIN OF POSSESSION (Include Company Initials)

Relinquished By: Print	Sign	Co.	Received By: Print	Sign	Co.	Date / Time
Jake Horner	Jake Horner	GRAM	B. Williams	[signature]	PNNL	4/4/06 0500
B Williams	[signature]	PNNL	Melanie Valenta	Melanie Valenta		4/4/06 0800

Disposed By: Print	Sign	Co.	Disposal Method:	Date / Time

2006/DCL/300-FF-5/001 (03/06)

Pacific Northwest National Laboratory
P.O. Box 999, Richland, WA 99352

CHAIN OF CUSTODY

Chain-of-Custody No. C5000-

Well ID / Well Number C5000 / 399-1-23 (300-FF-5-2)

Company Contact: B. A. Williams **Telephone:** (509) 372-3799 **Cell Phone:** (509) 539-6502

Samples Collected by: Jake Horner ☐ PNNL ☒ Other

Remarks: none

Ice Chest No: n/A **Field Logbook No:** n/A **Page No:** n/A

Possible Sample Hazard Identification:

Destination: Building 325 / Rm 325 (non-Rad) or Rm 305 (Rad) **Carrier/Waybill No:**

Sample Medium: Water ☐ Soil ☒ Other ☐

Shipping container internal temperature: when samples sealed in it ____ °C when opened in laboratory ____ °C

Condition of sample containers when received at laboratory:

SAMPLE IDENTIFICATION

Date Collected	Time Collected	Sampled Interval Top (ft)	Sampled Interval Bottom (ft)	Sample Number	Percent Recovery	Lexan Liner	Comments
4-4-06	0910	43.5	44.5	C5000- 43A	100		
↓	0910	44.5	45.5	C5000- 43B	100		
	1440	46.5	47.5	C5000- 44A	60		
	1440	47.5	48.5	C5000- 44B	~~80~~		
4-4-06	1440	48.5	49.5	C5000- 44C	100		
				C5000-	~~100~~		
4-6-06	1400	59.0	60.0	C5000- 47A	100		slough
↓	1400	60.0	61.0	C5000- 47B	100		slough ?
	1400	61.0	62.0	C5000- 47C	100		
4-6-06	1400	62.0	63.0	C5000- 47D	100		
				C5000-			
				C5000-			
				C5000-			
				C5000-			
				C5000-			
				C5000-			
				C5000-			
				C5000-			
				C5000-			
				C5000-			
				C5000-			

CHAIN OF POSSESSION (Include Company Initials)

Relinquished By: Print	Sign	Co.	Received By: Print	Sign	Co.	Date / Time
Jake Horner	[signature]		Bruce Williams	[signature]	PNNL	4/4/06 1600
Bruce Williams	[signature]	PNNL	Kenton Rod	[signature]	PNNL	4/6/06 16:42

Disposed By: Print Sign Co. Disposal Method: Date / Time

2006/DCL/300-FF-5/001 (03/06)

Pacific Northwest National Laboratory
P.O. Box 999, Richland, WA 99352

CHAIN OF CUSTODY

Chain-of-Custody No. C5000-
Well ID / Well Number C5000 / 399-1-23 (300-FF-5-2)

Company Contact: B. A. Williams **Telephone:** (509) 372-3799 **Cell Phone:** (509) 539-6502

Samples Collected by: Jake Horner ☐ PNNL ☒ Other GRAM Inc.

Remarks: n/A

Ice Chest No: n/A **Field Logbook No:** n/A **Page No:** n/A

Possible Sample Hazard Identification: n/A

Destination: Building 325 / Rm 325 (non-Rad) or Rm 305 (Rad) **Carrier/Waybill No:**

Sample Medium: Water ☐ Soil ☒ Other ☐

Shipping container internal temperature: when samples sealed in it ____ °C when opened in laboratory ____ °C

Condition of sample containers when received at laboratory:

SAMPLE IDENTIFICATION

Date Collected	Time Collected	Sampled Interval Top (ft)	Sampled Interval Bottom (ft)	Sample Number	Percent Recovery	Lexan Liner	Comments
4-5-06	0945	49.5	50.5	C5000-44D	90		
		50.5	51.5	C5000-44E	100		
		51.5	52.5	C5000-45A	100		Core fell out 1st time & was redrilled.
		52.5	53.5	C5000-45B	100		
		53.5	54.5	C5000-45C	100		
	0945	54.5	55.5	C5000-45D	90		
	1420	54.5	55.5	C5000-45E	100		Slough ?
		55.5	56.5	C5000-46A	100		
		56.5	57.5	C5000-46B	100		
		57.5	58.5	C5000-46C	100		
		58.5	59.5	C5000-46D	100		
4-5-06	1420	59.5	60.5	C5000-46E	25		Bottom 3/4 fell out
				C5000-			
				C5000-			
				C5000-			
				C5000-			
				C5000-			
				C5000-			
				C5000-			
				C5000-			
				C5000-			

CHAIN OF POSSESSION (include Company Initials)

Relinquished By: Print	Sign	Co.	Received By: Print	Sign	Co.	Date / Time
Jake Horner	[signature]	GRAM	Bruce Williams	[signature]	PNNL	4/5/06 / 1450
Bruce Williams	[signature]	PNNL	Kent ol Rod	[signature]	PNNL	4/5/06 / 16:42

Disposed By: Print Sign Co. Disposal Method: Date / Time

2006/DCL/300-FF-5/001 (03/06)

Pacific Northwest National Laboratory P.O. Box 999, Richland, WA 99352	# CHAIN OF CUSTODY	Chain-of-Custody No. C5000- / Well ID / Well Number C5000 / 399-1-23 (300-FF-5-2)

Company Contact: B. A. Williams **Telephone:** (509) 372-3799 **Cell Phone:** (509) 539-6502

Samples Collected by: Jake Horner ☐ PNNL ☒ Other GRAM Inc.

Remarks: None

Ice Chest No: N/A **Field Logbook No:** N/A **Page No:** N/A

Possible Sample Hazard Identification: N/A

Destination: Building 325 / Rm 325 (non-Rad) or Rm 305 (Rad) **Carrier/Waybill No:**

Sample Medium: Water ☐ Soil ☒ Other ☐

Shipping container internal temperature: when samples sealed in it ____ °C when opened in laboratory ____ °C

Condition of sample containers when received at laboratory:

SAMPLE IDENTIFICATION

Date Collected	Time Collected	Sampled Interval Top (ft)	Sampled Interval Bottom (ft)	Sample Number	Percent Recovery	Lexan Liner	Comments
4-5-06	62.9	63.5	64.5	C5000- 48B	100		slough
↓	63.5	64.5	~~65.5~~	C5000- 48C	100		
	64.5	65.5	~~66.5~~	C5000- 48D	100		
	65.5	66.5	~~67.5~~	C5000- 48F	100		
	66.5	67.5	~~68.5~~	C5000- 49A	100		
4-5-06	67.5	68.5	~~69.5~~	C5000- 49B	100		
	MAW	4/10/06		C5000-			
	Jump	made after		C5000-			
	talking	with Bruce		C5000-			
	Williams			C5000-			
				C5000-			
				C5000-			
				C5000-			
				C5000-			
				C5000-			
				C5000-			
				C5000-			
				C5000-			
				C5000-			
				C5000-			

CHAIN OF POSSESSION (Include Company Initials)

Relinquished By: Print	Sign	Co.	Received By: Print	Sign	Co.	Date / Time
Jake Horner	[signature]	GRAM	[illegible]	[signature]	PNNL	4/7/06 10:53
Dave Williams	[signature]	PNNL	Kristin Bond	[signature]	PNNL	4/7/06 11:05

Disposed By: Print	Sign	Co.	Disposal Method:	Date / Time

2006/DCL/300-FF-5/001 (03/06)

Pacific Northwest National Laboratory
P.O. Box 999, Richland, WA 99352

CHAIN OF CUSTODY

Chain-of-Custody No. C5000-

Well ID / Well Number C5000 / 399-1-23 (300-FF-5-2)

Company Contact: B. A. Williams Telephone: (509) 372-3799 Cell Phone: (509) 539-6502

Samples Collected by: Jake Horner ☐ PNNL ☒ Other GRAM, Inc.

Remarks: N/A

Ice Chest No: N/A Field Logbook No: N/A Page No: N/A

Possible Sample Hazard Identification: N/A

Destination: Building 325 / Rm 325 (non-Rad) or Rm 305 (Rad) Carrier/Waybill No:

Sample Medium: Water ☐ Soil ☒ Other ☐

Shipping container internal temperature: when samples sealed in it ____ °C when opened in laboratory ____ °C

Condition of sample containers when received at laboratory:

SAMPLE IDENTIFICATION

Date Collected	Time Collected	Sampled Interval Top (ft)	Sampled Interval Bottom (ft)	Sample Number	Percent Recovery	Lexan Liner	Comments
6-7-06		67.5	68.5	C5000-49D	100		
↓		68.5	69.5	C5000-49E	100		
↓		69.5	70.5	C5000-50A	100		
↓		70.5	71.5	C5000-50B	100		
6-7-06		71.5	72.5	C5000-50C	80		
6-10-06	0530	71	72	C5000-50D	100		
↓	↓	72	73	C5000-50E	100		
↓	↓	73	74	C5000-51A	100		
↓	0530	74	75	C5000-51B	40		
↓	1100	76.5	77.5	C5000-51E	100		
↓	↓	77.5	78.5	C5000-52A	100		
↓	↓	78.5	79.5	C5000-52B	100		
↓	↓	79.5	80.5	C5000-52C	100		
6-10-06	1100	80.5	81.5	C5000-52D	100		
				C5000-			
				C5000-			
				C5000-			
				C5000-			
				C5000-			
				C5000-			
				C5000-			

CHAIN OF POSSESSION (Include Company Initials)

Relinquished By: Print	Sign	Co.	Received By: Print	Sign	Co.	Date / Time
Jake Horner	[signature]	GRAM	BA Williams	[signature]	PNNL	4/10/06 12:13
BA Williams	[signature]	PNNL	[illegible]	[signature]	PNNL	4/10/06 15:40

Disposed By: Print	Sign	Co.	Disposal Method:	Date / Time

2006/DCL/300-FF-5/001 (03/06)

Pacific Northwest National Laboratory P.O. Box 999, Richland, WA 99352	CHAIN OF CUSTODY	Chain-of-Custody No. C5000- / Well ID / Well Number C5000 / 399-1-23 (300-FF-5-2)

Company Contact: B. A. Williams **Telephone:** (509) 372-3799 **Cell Phone:** (509) 539-6502

Samples Collected by: Jake Horner ☐ PNNL ☒ Other GRAM Inc.

Remarks: n/A

Ice Chest No: n/A **Field Logbook No:** n/A **Page No:** n/A

Possible Sample Hazard Identification:

Destination: Building 325 / Rm 325 (non-Rad) or Rm 305 (Rad) **Carrier/Waybill No:**

Sample Medium: Water ☐ Soil ☒ Other ☐

Shipping container internal temperature: when samples sealed in it ____ °C when opened in laboratory ____ °C

Condition of sample containers when received at laboratory:

SAMPLE IDENTIFICATION

Date Collected	Time Collected	Sampled Interval Top (ft)	Sampled Interval Bottom (ft)	Sample Number	Percent Recovery	Lexan Liner	Comments
4-11-06	0800	80.5	81.5	C5000- 53A	100		slough
	0800	81.5	82.5	C5000- 53B	100		slough
	0800	82.5	83.5	C5000- 53C	100		~1/2 slough
	0800	83.5	84.5	C5000- 53D	100		
	0800	84.5	85.5	C5000- 53E	90		
	0800	85.5	86.5	C5000- 54A	90		
	1000	87'	92'	C5000- 54E	90		slough
	1000	87'	92'	C5000- 55A	90		slough
4-11-06	1000	87'	92'	C5000- 55B	90	—	bagged
				C5000-			
				C5000-			
				C5000-			
				C5000-			
				C5000-			
				C5000-			
				C5000-			
				C5000-			
				C5000-			
				C5000-			
				C5000-			
				C5000-			

CHAIN OF POSSESSION (Include Company Initials)

Relinquished By: Print	Sign	Co.	Received By: Print	Sign	Co.	Date / Time
Jake Horner	[signature]	GRAM	[illegible]	[signature]	[illegible]	4/11/06 1020
[illegible]	[signature]	PNNL	Kenton Rod	[signature]	PNNL	4/11/06 10:35

Disposed By: Print	Sign	Co.	Disposal Method:	Date / Time

2006/DCL/300-FF-5/001 (03/06)

Pacific Northwest National Laboratory
P.O. Box 999, Richland, WA 99352

CHAIN OF CUSTODY

Chain-of-Custody No. C5000-

Well ID / Well Number: C5000 / 399-1-23 (300-FF-5-2)

Company Contact: B. A. Williams **Telephone:** (509) 372-3799 **Cell Phone:** (509) 539-6502

Samples Collected by: Jake Horner ☐ PNNL ☒ Other GRAM Inc.

Remarks: n/a

Ice Chest No: n/a **Field Logbook No:** n/a **Page No:** n/a

Possible Sample Hazard Identification: n/a

Destination: Building 325 / Rm 325 (non-Rad) or Rm 305 (Rad) **Carrier/Waybill No:**

Sample Medium: Water ☐ Soil ☒ Other ☐

Shipping container internal temperature: when samples sealed in it ____ °C when opened in laboratory ____ °C

Condition of sample containers when received at laboratory:

SAMPLE IDENTIFICATION

Date Collected	Time Collected	Sampled Interval Top (ft)	Sampled Interval Bottom (ft)	Sample Number	Percent Recovery	Lexan Liner	Comments
4-11-06		89	90	C5000-55C	100		
↓		90	91	C5000-55D	100		
		91	92	C5000-55E	100		
		92	93	C5000-56A	100		
		93	94	C5000-56B	100		
		94	95	C5000-56C	100		
		95.5	96.5	C5000-56E	100		
		96.5	97.5	C5000-57A	100		
		97.5	98.5	C5000-57B	100		
		98.5	99.5	C5000-57C	100		
4-11-06		99.5	100.5	C5000-57D	100		
4-12-06		99.5	100.5	C5000-57E	100		slough
↓		100.5	101.5	C5000-58A	100		½ slough ?
		101.5	102.5	C5000-58B	100		
		102.5	103.5	C5000-58C	100		Pushed to 106' 2.5' fill out
		103.5	104.5	C5000-~~5~~ 59A	100		slough
		104.5	105.5	C5000-59B	100		slough ?
		105.5	106.5	C5000-59C	100		
↓		106.5	107.5	C5000-59D	100		
4-12-06		107.5	108.5	C5000-59E	100		
				C5000-			

CHAIN OF POSSESSION (Include Company Initials)

Relinquished By: Print	Sign	Co.	Received By: Print	Sign	Co.	Date / Time
Jake Horner	Jake Horner	GRAM	[illegible]	[illegible]	PNNL	4/12/06 11:52
[illegible]	[illegible]	PNNL	[illegible] Kanta Rad	[illegible]	PNNL	4/12/06 1?:29

Disposed By: Print ____ Sign ____ Co. ____ Disposal Method: ____ Date / Time ____

2006/DCL/300-FF-5/001 (03/06)

Pacific Northwest National Laboratory P.O. Box 999, Richland, WA 99352	**CHAIN OF CUSTODY**	Chain-of-Custody No. C5000- Well ID / Well Number C5000 / 399-1-23 (300-FF-5-2)

Company Contact: B. A. Williams **Telephone:** (509) 372-3799 **Cell Phone:** (509) 539-6502

Samples Collected by: Jake Horner ☐ PNNL ☒ Other GRAM Inc.

Remarks: N/A

Ice Chest No: N/A **Field Logbook No:** N/A **Page No:** N/A

Possible Sample Hazard Identification:

Destination: Building 325 / Rm 325 (non-Rad) or Rm 305 (Rad) **Carrier/Waybill No:**

Sample Medium: Water ☐ Soil ☒ Other ☐

Shipping container internal temperature: when samples sealed in it ____ °C when opened in laboratory ____ °C

Condition of sample containers when received at laboratory:

SAMPLE IDENTIFICATION

Date Collected	Time Collected	Sampled Interval Top (ft)	Sampled Interval Bottom (ft)	Sample Number	Percent Recovery	Lexan Liner	Comments
4-12-06	[illegible]	106	107	C5000-60B	100		
	[illegible]	107	108	C5000-60C	100		
	[illegible]	108	109	C5000-60D	100		
	[illegible]	109	110	C5000-60E	100		
	[illegible]	110	111	C5000-61A	100		½' gap in liner collected in
4-12-06	[illegible]	111.5	112.5	C5000-61B	100		aluminum foil 111-111.5
4-12-06	12:[illegible]	112	113	C5000-BAG			BAG(S) SAMPLE
4-12-06	[illegible]	115	116	C5000-BAG			BAG(S) SAMPLE
				C5000-			
				C5000-			
				C5000-			
				C5000-			
				C5000-			
				C5000-			
				C5000-			
				C5000-			
				C5000-			
				C5000-			
				C5000-			
				C5000-			
				C5000-			

CHAIN OF POSSESSION (Include Company Initials)

Relinquished By: Print	Sign	Co.	Received By: Print	Sign	Co.	Date / Time
Jake Horner	[signature]	GRAM	[illegible]	[signature]	[illegible]	4/12/06 10:5[illegible]
[illegible]	[signature]	[illegible]	Kevin Reed	[signature]	PNNL	4/12/06 15:29

Disposed By: Print Sign Co. Disposal Method: Date / Time

2006/DCL/300-FF-5/001 (03/06)

Well C5001

Pacific Northwest National Laboratory
P.O. Box 999, Richland, WA 99352

CHAIN OF CUSTODY

Chain-of-Custody No. C5001- 399-3-19

Well ID / Well Number: C5001 / 399-3-19 (300-FF-5-3)

Company Contact: B. A. Williams Telephone: (509) 372-3799 Cell Phone: (509) 539-6502

Samples Collected by: Jake Horner ☐ PNNL ☒ Other GRAM Inc.

Remarks:

Ice Chest No: Field Logbook No: Page No:

Possible Sample Hazard Identification:

Destination: Building 325 / Rm 325 (non-Rad) or Rm 305 (Rad) Carrier/Waybill No:

Sample Medium: Water ☐ Soil ☒ Other ☐

Shipping container internal temperature: when samples sealed in it ____ °C when opened in laboratory ____ °C

Condition of sample containers when received at laboratory:

SAMPLE IDENTIFICATION

Date Collected	Time Collected	Sampled Interval Top (ft)	Sampled Interval Bottom (ft)	Sample Number	Percent Recovery	Lexan Liner	Comments
4-24-06		1.5	2.5	C5001- 61F	70		
		2.5	3.5	C5001- 62A	100		
		3.5	4.5	C5001- 62B	100		
		4.5	5.5	C5001- 62C	100		
		5.5	6.5	C5001- 63A	46		
		6.5	7.5	C5001- 63B	100		
		7.5	8.5	C5001- 63C	100		
		8.5	9.5	C5001- 63D	100		
		10.5	11.5	C5001- 64A	100		
		11.5	12.5	C5001- 64B	100		
		12.5	13.5	C5001- 64C	100		
		13.5	14.5	C5001- 64D	100		
4-24-06		14.5	15.5	C5001- 64E	100		
4-25-06		17.5	18.5	C5001- 65C	100		
		18.5	19.5	C5001- 65D	100		
		19.5	20.5	C5001- 65E	100		
		20.5	21.5	C5001- 66A	100		
		23.0	24.0	C5001- 67A	100		
4-25-06		24.0	25.0	C5001- 67B	100		
				C5001-			
				C5001-			

CHAIN OF POSSESSION (Include Company Initials)

Relinquished By: Print	Sign	Co.	Received By: Print	Sign	Co.	Date / Time
Jake Horner	[signature]	GRAM	BAWilliams	[signature]	PNNL	4/25/06 13:46
BAWilliams	[signature]	PNNL	M. Valenta	M. Valenta	PNNL	4/25/06 15:36

Disposed By: Print	Sign	Co.	Disposal Method:	Date / Time

2006/DCL/300-FF-5/001 (03/06)

Pacific Northwest National Laboratory
P.O. Box 999, Richland, WA 99352

CHAIN OF CUSTODY

Chain-of-Custody No. C5001- 399-3-19
Well ID / Well Number C5001 / 399-3-19 (300-FF-5-3)

Company Contact: B. A. Williams **Telephone:** (509) 372-3799 **Cell Phone:** (509) 539-6502

Samples Collected by: Jake Horner ☐ PNNL ☒ Other GRAM Inc.

Remarks:

Ice Chest No: **Field Logbook No:** **Page No:**

Possible Sample Hazard Identification:

Destination: Building 325 / Rm 325 (non-Rad) or Rm 305 (Rad) **Carrier/Waybill No:**

Sample Medium: Water ☐ Soil ☐ Other ☐

Shipping container internal temperature: when samples sealed in it ____ °C when opened in laboratory ____ °C

Condition of sample containers when received at laboratory:

SAMPLE IDENTIFICATION

Date Collected	Time Collected	Sampled Interval Top (ft)	Sampled Interval Bottom (ft)	Sample Number	Percent Recovery	Lexan Liner	Comments
4-25-06		26.5	27.5	C5001- 67E	100		
		27.5	28.5	C5001- 68A	100		
		28.5	29.5	C5001- 68B	100		
4-25-06		29.5	30.5	C5001- 68C	100		
		31.5	32.5	C5001- 69B	100		
		32.5	33.5	C5001- 69C	100		
4-25-06		33.5	34.5	C5001- 69D	100		
				C5001-			
				C5001-			
				C5001-			
				C5001-			
				C5001-			
				C5001-			
				C5001-			
				C5001-			
				C5001-			
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				C5001-			
				C5001-			
				C5001-			
				C5001-			

CHAIN OF POSSESSION (Include Company Initials)

Relinquished By: Print	Sign	Co.	Received By: Print	Sign	Co.	Date / Time
Jake Horner	Jake Horner	GRAM	BA Williams	[signature]	PNNL	4/25/06 13:48
BA Williams	[signature]	PNNL	BA Williams	[signature]	PNNL	4/25/06 15:34
BA Williams	[signature]	PNNL	M. Valenta	M. Valenta	PNNL	4/25/06 15:34

Disposed By: Print	Sign	Co.	Disposal Method:	Date / Time

2006/DCL/300-FF-5/001 (03/06)

Pacific Northwest National Laboratory
P.O. Box 999, Richland, WA 99352

CHAIN OF CUSTODY

Chain-of-Custody No. C5001-
Well ID / Well Number C5001 / 399-3-19 (300-FF-5-3)

Company Contact: B. A. Williams **Telephone:** (509) 372-3799 **Cell Phone:** (509) 539-6502

Samples Collected by: Jake Horner ☐ PNNL ☒ Other GRAM Inc.

Remarks:

Ice Chest No: **Field Logbook No:** **Page No:**

Possible Sample Hazard Identification:

Destination: Building 325 / Rm 325 (non-Rad) or Rm 305 (Rad) **Carrier/Waybill No:**

Sample Medium: Water ☐ Soil ☒ Other ☐

Shipping container internal temperature: when samples sealed in it ____°C when opened in laboratory ____°C

Condition of sample containers when received at laboratory:

SAMPLE IDENTIFICATION

Date Collected	Time Collected	Sampled Interval Top (ft)	Sampled Interval Bottom (ft)	Sample Number	Percent Recovery	Lexan Liner	Comments
4-26-06		38	39	C5001- 70C	100		
		39	40	C5001- 70D	100		
		40	41	C5001- 70E	100		
		41	42	C5001- 71E	100		
		42	43	C5001- 72A	100		
4-26-06		46.5	53	C5001- 73B	*100		* Mixed sed. from 46.5 to
				C5001-			53.0' bgs.
				C5001-			
				C5001-			
				C5001-			
				C5001-			
				C5001-			
				C5001-			
				C5001-			
				C5001-			
				C5001-			
				C5001-			
				C5001-			
				C5001-			
				C5001-			
				C5001-			

CHAIN OF POSSESSION (Include Company Initials)

Relinquished By: Print	Sign	Co.	Received By: Print	Sign	Co.	Date / Time
Jake Horner	[signature]	GRAM	B Williams	[signature]	PNNL	4/26/06 14:37
B Williams	[signature]	PNNL	Kenton Rod	[signature]	PNNL	4/26/06 14:45

Disposed By: Print	Sign	Co.	Disposal Method:	Date / Time

2006/DCL/300-FF-5/001 (03/06)

Pacific Northwest National Laboratory P.O. Box 999, Richland, WA 99352	# CHAIN OF CUSTODY	Chain-of-Custody No. C5001- Well ID / Well Number C5001 / 399-3-19 (300-FF-5-3)

Company Contact: B. A. Williams **Telephone:** (509) 372-3799 **Cell Phone:** (509) 539-6502

Samples Collected by: Jake Horner ☐ PNNL ☒ Other GRAM

Remarks:

Ice Chest No: **Field Logbook No:** **Page No:**

Possible Sample Hazard Identification:

Destination: Building 325 / Rm 325 (non-Rad) or Rm 305 (Rad) **Carrier/Waybill No:**

Sample Medium: Water ☐ Soil ☒ Other ☐

Shipping container internal temperature: when samples sealed in it ____ °C when opened in laboratory ____ °C

Condition of sample containers when received at laboratory:

SAMPLE IDENTIFICATION

Date Collected	Time Collected	Sampled Interval Top (ft)	Sampled Interval Bottom (ft)	Sample Number	Percent Recovery	Lexan Liner	Comments
4-27-06	—	53	54	C5001-74B	100		Slough
	—	54	55	C5001-74C	100		
	—	63	64	C5001-76B	60		
	—	64	65	C5001-76C	100		Core was stratified, with
	—	65	66	C5001-76D	100		fines on top
4-27-06	—	66	67	C5001-76E	100		
4-28-06	0830	73	76	C5001-77D	100		mixed interval stratified
4-28-06	0830	73	76	C5001-77E	100		with fines on top
4-28-06	0830	73	76	C5001-78A	100		
				C5001-			
				C5001-			
				C5001-			
				C5001-			
				C5001-			
				C5001-			
				C5001-			
				C5001-			
				C5001-			
				C5001-			
				C5001-			
				C5001-			

CHAIN OF POSSESSION (Include Company Initials)

Relinquished By: Print	Sign	Co.	Received By: Print	Sign	Co.	Date / Time
Jake Horner	[signature]	GRAM	B.A. Williams	[signature]	PNNL	4/28/06 0904
BA Williams	[signature]	PNNL	Kristen Roth	[signature]	PNNL	4/28/06 0915

Disposed By: Print	Sign	Co.	Disposal Method	Date / Time

2006/DCL/300-FF-5/001 (03/06)

Pacific Northwest National Laboratory
P.O. Box 999, Richland, WA 99352

CHAIN OF CUSTODY

Chain-of-Custody No. C5001-

Well ID / Well Number C5001 / 399-3-19 (300-FF-5-3)

Company Contact: B. A. Williams   Telephone: (509) 372-3799   Cell Phone: (509) 539-6502

Samples Collected by: Jake Horner   ☐ PNNL   ☒ Other GRAM Inc

Remarks:

Ice Chest No: Field Logbook No: Page No:

Possible Sample Hazard Identification:

Destination: Building 325 / Rm 325 (non-Rad) or Rm 305 (Rad)   Carrier/Waybill No:

Sample Medium: Water ☐ Soil ☒ Other ☐

Shipping container internal temperature: when samples sealed in it ____ °C when opened in laboratory ____ °C

Condition of sample containers when received at laboratory:

SAMPLE IDENTIFICATION

Date Collected	Time Collected	Sampled Interval Top (ft)	Sampled Interval Bottom (ft)	Sample Number	Percent Recovery	Lexan Liner	Comments
4-28-06		80	81	C5001- 78E	80		
		81	82	C5001- 79A	100		
		82	83	C5001- 79B	70		
		82	83	C5001- 79C	100		
		83	84	C5001- 79D	100		
		84	85	C5001- 79E	100		
		85	86	C5001- 80A	100		
		86	87	C5001- 80B	100		
4-28-06		87	88	C5001- 80C	100		
				C5001-			
				C5001-			
				C5001-			
				C5001-			
				C5001-			
				C5001-			
				C5001-			
				C5001-			
				C5001-			
				C5001-			
				C5001-			
				C5001-			

CHAIN OF POSSESSION (Include Company Initials)

Relinquished By: Print	Sign	Co.	Received By: Print	Sign	Co.	Date / Time
Jake Horner	[signature]	GRAM	B.A. Williams	[signature]	PNNL	4/28/06 14:26
B. Williams	[signature]	PNNL	[illegible]	[signature]	PNNL	

Disposed By: Print	Sign	Co.	Disposal Method:	Date / Time

2006/DCL/300-FF-5/001 (03/06)

Pacific Northwest National Laboratory P.O. Box 999, Richland, WA 99352	# CHAIN OF CUSTODY	Chain-of-Custody No. C5001- Well ID / Well Number C5001 / 399-3-19 (300-FF-5-3)

Company Contact: B. A. Williams **Telephone:** (509) 372-3799 **Cell Phone:** (509) 539-6502

Samples Collected by: Jake Horner ☐ **PNNL** ☒ **Other** GRAM Inc.

Remarks:

Ice Chest No: **Field Logbook No:** **Page No:**

Possible Sample Hazard Identification:

Destination: Building 325 / Rm 325 (non-Rad) or Rm 305 (Rad) **Carrier/Waybill No:**

Sample Medium: Water ☐ Soil ☒ Other ☐

Shipping container internal temperature: when samples sealed in it ____ °C when opened in laboratory ____ °C

Condition of sample containers when received at laboratory:

SAMPLE IDENTIFICATION

Date Collected	Time Collected	Sampled Interval Top (ft)	Sampled Interval Bottom (ft)	Sample Number	Percent Recovery	Lexan Liner	Comments
5/3/06		89	91	C5001-			Bagged Samples
		91	93	C5001-			
		93	94.5	C5001-			
		96	98	C5001-			
5/3/06		98	100	C5001-			
				C5001-			
				C5001-			
				C5001-			
				C5001-			
				C5001-			
				C5001-			
				C5001-			
				C5001-			
				C5001-			
				C5001-			
				C5001-			
				C5001-			
				C5001-			
				C5001-			
				C5001-			
				C5001-			

CHAIN OF POSSESSION (Include Company Initials)

Relinquished By: Print	Sign	Co.	Received By: Print	Sign	Co.	Date / Time
Jake Horner	[illegible]	GRAM	[illegible]	[illegible]	PNNL	5/4/06 0706
BAWilliams	[illegible]	PNNL	[illegible]	[illegible]	PNNL	5/4/06 0915

Disposed By: Print	Sign	Co.	Disposal Method:	Date / Time

2006/DCL/300-FF-5/001 (03/06)

Well C5002

Pacific Northwest National Laboratory
P.O. Box 999, Richland, WA 99352

CHAIN OF CUSTODY

Chain-of-Custody No. ~~C5001-~~ C5002
Well ID / Well Number ~~C5001 / 399-3-19 (300-FF-5-3)~~

Company Contact: B. A. Williams **Telephone:** (509) 372-3799 **Cell Phone:** (509) 539-6502

Samples Collected by: Jake Horner ☐ PNNL ☒ Other GRAM Inc.

Remarks:

Ice Chest No: **Field Logbook No:** **Page No:**

Possible Sample Hazard Identification:

Destination: Building 325 / Rm 325 (non-Rad) or Rm 305 (Rad) **Carrier/Waybill No:**

Sample Medium: Water ☐ Soil ☐ Other ☐

Shipping container internal temperature: when samples sealed in it ___ °C when opened in laboratory ___ °C

Condition of sample containers when received at laboratory:

SAMPLE IDENTIFICATION

Date Collected	Time Collected	Sampled Interval Top (ft)	Sampled Interval Bottom (ft)	Sample Number	Percent Recovery	Lexan Liner	Comments
5/11/06		3.5	4.5	C5002 81E	100		
		4.5	5.5	C5001- 82A	100		
		8	9	C5001- 82D	7		
		9	10	C5001- 82E	100		
		10	11	C5001- 83A	100		
		11	12	C5001- 83B	100		
		12.5	13.5	C5001- 83E	100		
		13.5	14.5	C5001- 84A	100		
		14.5	15.5	C5001- 84B	100		
		15.5	16.5	C5001- 84C	100		
		15.5	16.5	C5001- 85C	50		
		16.5	17.5	C5001- 85D	100		
		19	20	C5001- 86C	100		
		20	21	C5001- 86D	100		
		21	22	C5001- 86E	100		
		22	23	C5001- 87B	50		
		23	24	C5001- 87C	100		
		24	25	C5001- 87D	100		
5/11/06		25	26	C5001- 87E	70		
				C5001-			
				C5001-			

CHAIN OF POSSESSION (Include Company Initials) PNWL

Relinquished By: Print	Sign	Co.	Received By: Print	Sign	Co.	Date / Time
Jake Horner	Jake Horner	GRAM	B Williams	[signature]		5/11/06 1541
B Williams	[signature]	PNWL	Kent Reed	Kenton Reed	PNWL	5/12/06 08:15

Disposed By: Print | Sign | Co. | Disposal Method: | Date / Time

2006/DCL/300-FF-5/001 (03/06)

Pacific Northwest National Laboratory P.O. Box 999, Richland, WA 99352	CHAIN OF CUSTODY	Chain-of-Custody No. ~~C5001-~~ C5002 Well ID / Well Number ~~C5001 / 399-3-19 (300-FF-5-3)~~

Company Contact: B. A. Williams Telephone: (509) 372-3799 Cell Phone: (509) 539-6502

Samples Collected by: Jake Horner ☐ PNNL ☒ Other GRAM Inc.

Remarks:

Ice Chest No: Field Logbook No: Page No:

Possible Sample Hazard Identification:

Destination: Building 325 / Rm 325 (non-Rad) or Rm 305 (Rad) Carrier/Waybill No:

Sample Medium: Water ☐ Soil ☐ Other ☐

Shipping container internal temperature: when samples sealed in it ____ °C when opened in laboratory ____ °C

Condition of sample containers when received at laboratory:

SAMPLE IDENTIFICATION

Date Collected	Time Collected	Sampled Interval Top (ft)	Sampled Interval Bottom (ft)	Sample Number	Percent Recovery	Lexan Liner	Comments
5/12/06		27	28	C5002-88E	100		
		28	29	C5002-89A	90		
		29	30	C5002-89B	100		
		32	33	C5002-90A	80		
		33	34	C5002-90B	100		
5/12/06		34	35	C5001-90C	100		
				C5001-			
				C5001-			
				C5001-			
				C5001-			
				C5001-			
				C5001-			
				C5001-			
				C5001-			
				C5001-			
				C5001-			
				C5001-			
				C5001-			
				C5001-			
				C5001-			
				C5001-			

CHAIN OF POSSESSION (Include Company Initials)

Relinquished By: Print	Sign	Co.	Received By: Print	Sign	Co.	Date / Time
Jake Horner	Jake Horner	GRAM	B Williams	[illegible]	PNNL	5/12/06 8:42
B Williams	[illegible]	PNNL	Ken Ford	[illegible]	PNNL	5/12/06 8:55

Disposed By: Print	Sign	Co.	Disposal Method:	Date / Time

2006/DCL/300-FF-5/001 (03/06)

Pacific Northwest National Laboratory
P.O. Box 999, Richland, WA 99352

CHAIN OF CUSTODY

Chain-of-Custody No. ~~C5001~~ 5002

Well ID / Well Number ~~C5001 / 399-3-19~~ (300-FF-5-3)

Company Contact: B. A. Williams **Telephone:** (509) 372-3799 **Cell Phone:** (509) 539-6502

Samples Collected by: Jake Horner ☐ PNNL ☒ Other GRAM Inc.

Remarks:

Ice Chest No: **Field Logbook No:** **Page No:**

Possible Sample Hazard Identification:

Destination: Building 325 / Rm 325 (non-Rad) or Rm 305 (Rad) **Carrier/Waybill No:**

Sample Medium: Water ☐ Soil ☒ Other ☐

Shipping container internal temperature: when samples sealed in it ____ °C when opened in laboratory ____ °C

Condition of sample containers when received at laboratory:

SAMPLE IDENTIFICATION

Date Collected	Time Collected	Sampled Interval Top (ft)	Sampled Interval Bottom (ft)	Sample Number	Percent Recovery	Lexan Liner	Comments
5/12/06		37	38	C5002 91A			
		38	39	C5001-91B			
		39	40	C5001-91C			
		40	41	C5001-91D			
		47	48	C5001-92C			
		48	49	C5001-92D			
5/12/06		49	50	C5001-92E			
				C5001-			
				C5001-			
				C5001-			
				C5001-			
				C5001-			
				C5001-			
				C5001-			
				C5001-			
				C5001-			
				C5001-			
				C5001-			
				C5001-			
				C5001-			
				C5001-			

CHAIN OF POSSESSION (Include Company Initials)

Relinquished By: Print	Sign	Co.	Received By: Print	Sign	Co.	Date / Time
Jake Horner	[signature]	GRAM	B. Williams	[signature]	PNNL	5/12/06 13:20
B. Williams	[signature]	PNNL	Kent [illegible]	[signature]	PNNL	5/12/06 13:30

Disposed By: Print Sign Co. Disposal Method: Date / Time

2006/DCL/300-FF-5/001 (03/06)

Pacific Northwest National Laboratory
P.O. Box 999, Richland, WA 99352

CHAIN OF CUSTODY

Chain-of-Custody No. ~~C5001-~~ 5002
Well ID / Well Number: C5001 / 399-3-19 (300-FF-5-3)

Company Contact: B. A. Williams **Telephone:** (509) 372-3799 **Cell Phone:** (509) 539-6502

Samples Collected by: Jake Horner ☐ PNNL ☒ Other G2AM Inc

Remarks:

Ice Chest No: **Field Logbook No:** **Page No:**

Possible Sample Hazard Identification:

Destination: Building 325 / Rm 325 (non-Rad) or Rm 305 (Rad) **Carrier/Waybill No:**

Sample Medium: Water ☐ Soil ☒ Other ☐

Shipping container internal temperature: when samples sealed in it ____ °C when opened in laboratory ____ °C

Condition of sample containers when received at laboratory:

SAMPLE IDENTIFICATION

Date Collected	Time Collected	Sampled Interval Top (ft)	Sampled Interval Bottom (ft)	Sample Number	Percent Recovery	Lexan Liner	Comments
5/12/06		53	54	C5002 93D	100		
		54	55	C5001-93E	100		
		55	56	C5001-94A	100		
5/12/06		58	63	C5001-95B	96		
5/15/06		64	65	C5001-94C	60		
		65	66	C5001-94D	100		
		66	67	C5001-94E	100		
		67	68	C5001-95A	10		
		68	74	C5001-96B	100		
5/15/06		68	74	C5001-96C	100		
		73	79	C5001-97B	100		
		73	79	C5001-97C	100		
				C5001-			
				C5001-			
				C5001-			
				C5001-			
				C5001-			
				C5001-			
				C5001-			
				C5001-			
				C5001-			

CHAIN OF POSSESSION (Include Company Initials)

Relinquished By: Print	Sign	Co.	Received By: Print	Sign	Co.	Date / Time
Jake Horner	[signature]	G2AM	B Williams	[signature]	PNNL	5/15/06 3:50p
R Williams	[signature]	PNNL	Kenton Rod	[signature]	PNNL	5/15/06 ~4:00p

Disposed By: Print	Sign	Co.	Disposal Method:	Date / Time

2006/DCL/300-FF-5/001 (03/06)

Pacific Northwest National Laboratory
P.O. Box 999, Richland, WA 99352

CHAIN OF CUSTODY

Chain-of-Custody No. ~~C5001-~~ 5002
Well ID / Well Number C5001 / ~~399-3-19~~ (300-FF-5-3)

Company Contact: B. A. Williams **Telephone:** (509) 372-3799 **Cell Phone:** (509) 539-6502

Samples Collected by: Jake Horner ☐ PNNL ☒ Other GRAM Inc.

Remarks:

Ice Chest No: **Field Logbook No:** **Page No:**

Possible Sample Hazard Identification:

Destination: Building 325 / Rm 325 (non-Rad) or Rm 305 (Rad) **Carrier/Waybill No:**

Sample Medium: Water ☐ Soil ☒ Other ☐

Shipping container internal temperature: when samples sealed in it ____ °C when opened in laboratory ____ °C

Condition of sample containers when received at laboratory:

SAMPLE IDENTIFICATION

Date Collected	Time Collected	Sampled Interval Top (ft)	Sampled Interval Bottom (ft)	Sample Number	Percent Recovery	Lexan Liner	Comments
5/16/06		79.5	80.5	C5002 99B	90		
		80.5	81.5	C5001- 99C	100		
		81.5	82.5	C5001- 99D	100		
		82.5	83.5	C5001- 99E	110		
5/16/06		83.5	84.5	C5001- 100A	100		
				C5001-			
5/15/06		78.5	79.5	C5001- 98C	100		
		79.5	80.5	C5001- 98D	100		BW
		80.5	81.7	C5001- 98E	100		
				C5001-			
				C5001-			
				C5001-			
				C5001-			
				C5001-			
				C5001-			
				C5001-			
				C5001-			
				C5001-			
				C5001-			
				C5001-			
				C5001-			

CHAIN OF POSSESSION (Include Company Initials)

Relinquished By: Print	Sign	Co.	Received By: Print	Sign	Co.	Date / Time
Jake Horner	[signature]	GRAM	B. Williams	[signature]	PNNL	5/16/06 0930
B. Williams	[signature]	PNNL	Kent Anderson	[signature]	PNNL	5/16/06

Disposed By: Print Sign Co. Disposal Method: Date / Time

2006/DCL/300-FF-5/001 (03/06)

Appendix C

Borehole Geophysical Log Reports

Well C4999

DOE-EM/GJ1182-2006

399-3-18 (C4999)
Log Data Report

Borehole Information:

Borehole: 399-3-18 (C4999)			**Site:** East from 316-1 South Process Pond		
Coordinates (WA St Plane)		**GWL[1] (ft):** 42.5 (approximate)		**GWL Date:** 03/26/06	
North (m)	**East (m)**	**Drill Date**	**TOC Elevation (ft)**	**Total Depth (ft)**	**Type**
Not available	Not available	03/23/06	Not available	130	Sonic

Casing Information:

Casing Type	Stickup (ft)	Outer Diameter (in.)	Inside Diameter (in.)	Thickness (in.)	Top (ft)	Bottom (ft)
Threaded Carbon Steel	0.7	9 3/4	8 5/8	9/16	0.7	130

Borehole Notes:

The logging engineer measured the 8-in. casing and stickup using a steel tape. Measurements were rounded to the nearest 1/16 in. The onsite geologist reported the depth to groundwater.

Logging Equipment Information:

Logging System:	Gamma 4E		**Type:** SGLS (70%) SN: 34TP40587A
Calibration Date:	03/22/06	**Calibration Reference:**	DOE-EM/GJ1168-2006
		Logging Procedure:	MAC-HGLP 1.6.5, Rev. 0

Logging System:	Gamma 4F		**Type:** NMLS SN: H380932510
Calibration Date:	02/27/06	**Calibration Reference:**	DOE-EM/GJ1141-2006
		Logging Procedure:	MAC-HGLP 1.6.5, Rev. 0

Spectral Gamma Logging System (SGLS) Log Run Information:

Log Run	**1**	**2**	**3**	**4 Repeat**	
Date	03/24/06	03/24/06	03/25/06	03/25/06	
Logging Engineer	Spatz	Spatz	Spatz	Spatz	
Start Depth (ft)	0.0	74.0	128.0	32.0	
Finish Depth (ft)	75.0	98.0	97.0	45.0	
Count Time (sec)	200	200	200	400	
Live/Real	R	R	R	R	
Shield (Y/N)	N	N	N	N	
MSA Interval (ft)	0.5	0.5	0.5	0.5	
ft/min	N/A[2]	N/A	N/A	N/A	

Log Run	1	2	3	4 Repeat	
Pre-Verification	DEB61CAB	DEB61CAB	DEB71CAB	DEB71CAB	
Start File	DEB61000	DEB61151	DEB71000	DEB71063	
Finish File	DEB61150	DEB61199	DEB71062	DEB71089	
Post-Verification	DEB61CAA	DEB61CAA	DEB71CAA	DEB71CAA	
Depth Return Error (in.)	- 1/4	+ 1	+ 1	- 1/2	
Comments	Fine gain adjustment after files – 128 & -140.	No fine gain adjustment	No fine gain adjustment	No fine gain adjustment	

Neutron Moisture Logging System (NMLS) Log Run Information:

Log Run	5	6 Repeat			
Date	03/25/06	03/25/06			
Logging Engineer	Pearson	Pearson			
Start Depth (ft)	0.0	30.0			
Finish Depth (ft)	42.25	35.0			
Count Time (sec)	15	15			
Live/Real	R	R			
Shield (Y/N)	N	N			
MSA Interval (ft)	0.25	0.25			
ft/min	N/A	N/A			
Pre-Verification	DF162CAB	DF162CAB			
Start File	DF162178	DF162348			
Finish File	DF162347	DF162368			
Post-Verification	DF162CAA	DF162CAA			
Depth Return Error (in.)	N/A	- 1/2			
Comments	No fine gain adjustment	No fine gain adjustment			

Logging Operation Notes:

Logging was conducted with a centralizer on the sondes. Logging data acquisition is referenced to ground level. The maximum logging depth achieved was 128.33 ft. Repeat sections were collected in this borehole to evaluate each system's performance.

Analysis Notes:

Analyst:	Henwood	Date:	04/20/06	Reference:	GJO-HGLP 1.6.3, Rev. 0

Pre-run and post-run verifications for the SGLS were acquired in the Amersham verifier, serial number 115, which is enhanced in the naturally occurring radionculides ^{40}K, ^{238}U, and ^{232}Th (KUT). The net counts for the ^{40}K (1460 keV energy peak) fell slightly below the lower control limits for efficiency. The sonde is usually placed in the verifier on the ground surface during verification measurements where naturally occurring KUT in the ground also contribute to the spectra. At this borehole, the verification measurements were acquired on the drilling deck, approximately 4 ft above the ground surface. The observed deficiency in net counts for ^{40}K is attributed to the location of the verification measurement and the data are accepted.

A casing correction for 9/16-in.-thick casing was applied to the SGLS log data.

SGLS spectra were processed in batch mode using APTEC SUPERVISOR to identify individual energy peaks and determine count rates. Concentrations were calculated with an EXCEL worksheet template identified as G4Emar06.xls using efficiency functions and corrections for casing, water, and dead time as determined from annual calibrations. Dead time corrections are applied where dead times exceed 4.7 percent. No correction for dead time was necessary. A correction for water was applied to data below 42.5 ft.

The NMLS data are presented as counts per second. A calibration for casing inside diameters greater than 8-in. is not available.

Results and Interpretations:

A plot of manmade radionuclides are included for ^{137}Cs and processed uranium (^{235}U and ^{238}U). The plot indicates all detections based on the routine processing software. All of the detections were at or near the respective MDLs. The approximate MDLs for ^{137}Cs, ^{235}U, and ^{238}U in and out of water are: 0.4 and 0.2 pCi/g; 4 and 1 pCi/g; and 20 and 12 pCi/g. Inspection of each spectrum where a detection was indicated revealed no full energy peaks. Therefore, the detections are considered to be statistical fluctuations and are not considered valid. No other man-made radionuclides were indicated.

There is a strong indication of radon in the groundwater. Comparison of the 1764 keV and 609 keV ^{214}Bi gamma rays shows differing concentrations after corrections for water and casing. The casing and water correction factors decrease with increasing energy. Gamma rays originating inside the casing are not attenuated by the steel casing, and the net effect of applying the correction factors is to amplify results from low-energy gamma rays. The fact that the 609 keV gamma ray results in a higher apparent concentration than the 1764 keV gamma line suggests that radon is present in the groundwater. Normal formation concentrations of naturally occurring ^{238}U are between approximately 0.5 and 1.5 pCi/g. The concentrations above the groundwater level are consistent with these values for the assays of both the 609 and 1764 keV peaks. Note that enhanced radon is not related to the existence of man-made uranium.

The neutron moisture results are reported in counts per second because no valid calibration is available for borehole inside diameters greater than 8 in. Some variation is noted. The logging engineer reported a "void" in the formation near the surface of unknown depth extent. This void may be the cause of a very low count rate between the ground surface and 10 ft.

The repeat section indicates good agreement of the naturally occurring KUT.

Log Plots:

Man-made Radionuclides
Natural Gamma Logs
Combination Plot
Total Gamma & Moisture
Total Gamma & Dead Time
Repeat Section of Natural Gamma Logs

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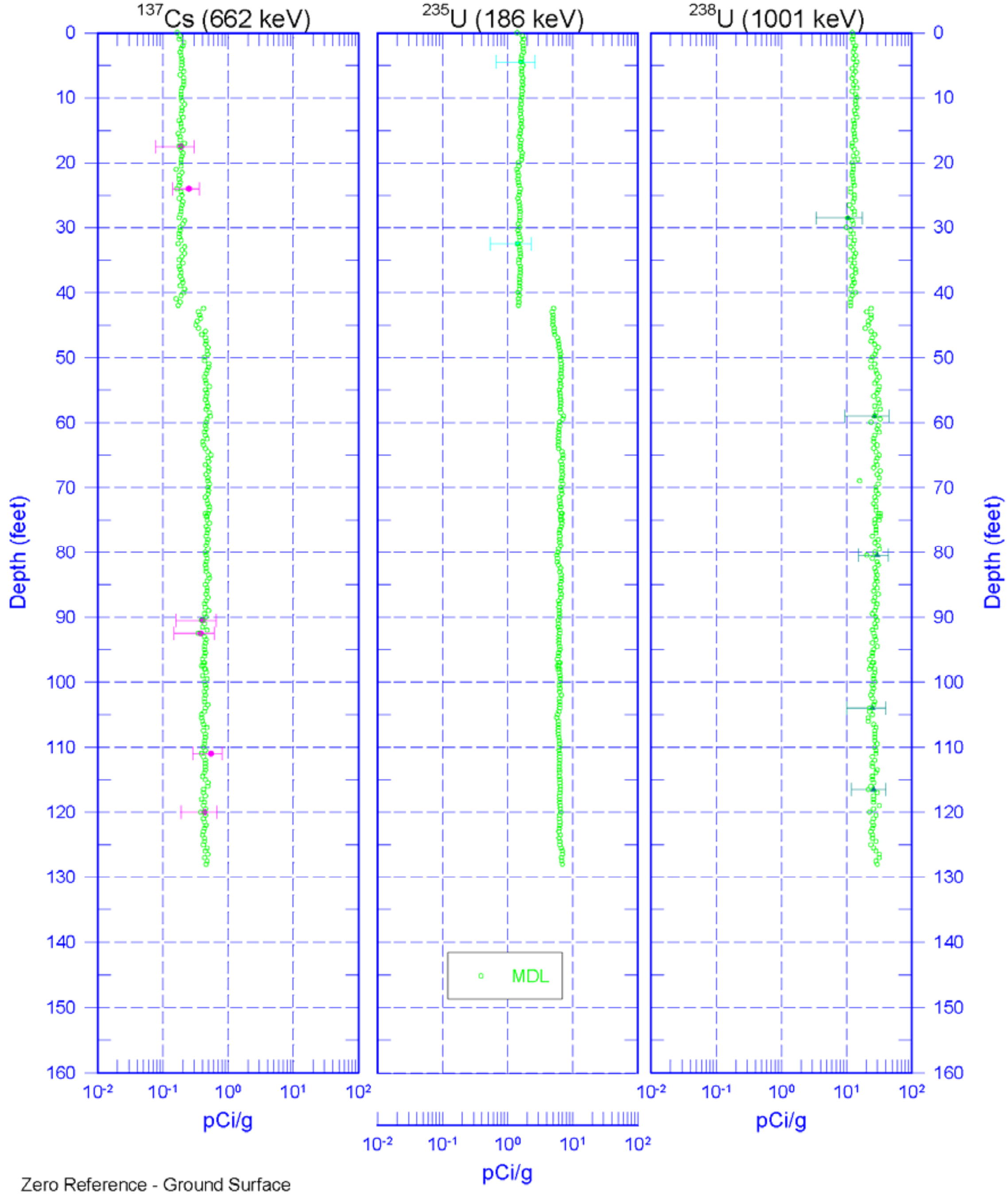
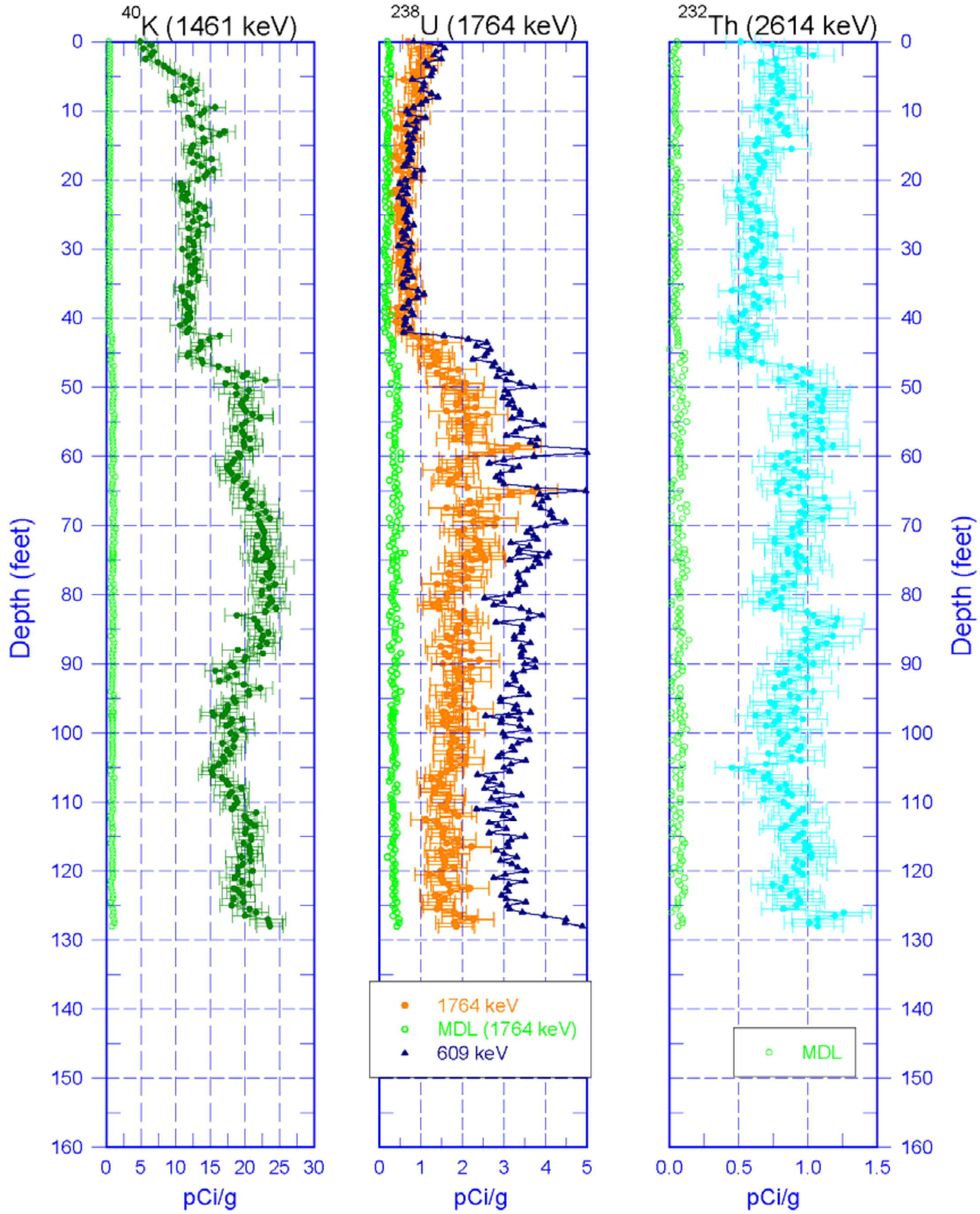
[1] GWL – groundwater level
[2] N/A – not applicable

399-3-18 (C4999)
Man-Made Radionuclides

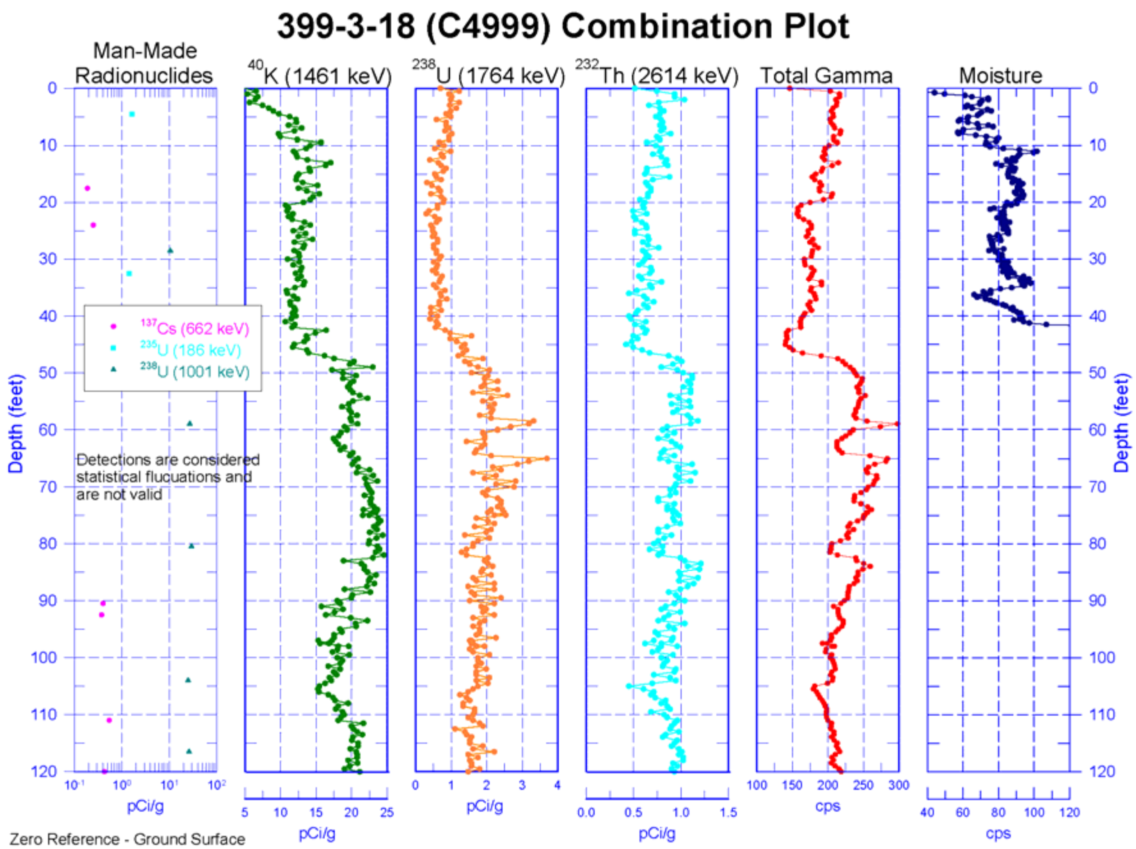


Zero Reference - Ground Surface

399-3-18 (C4999)
Natural Gamma Logs

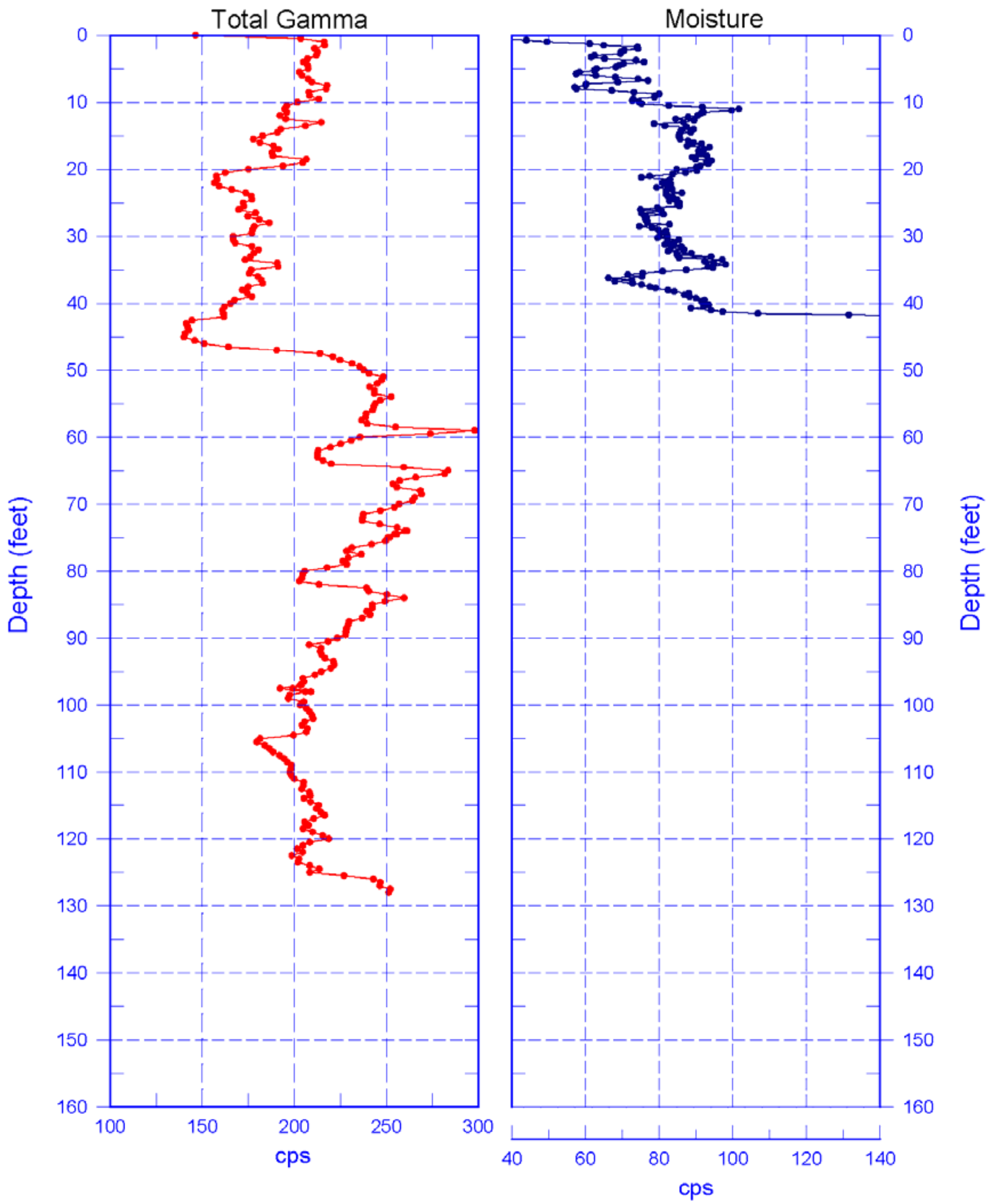


Zero Reference - Ground Surface

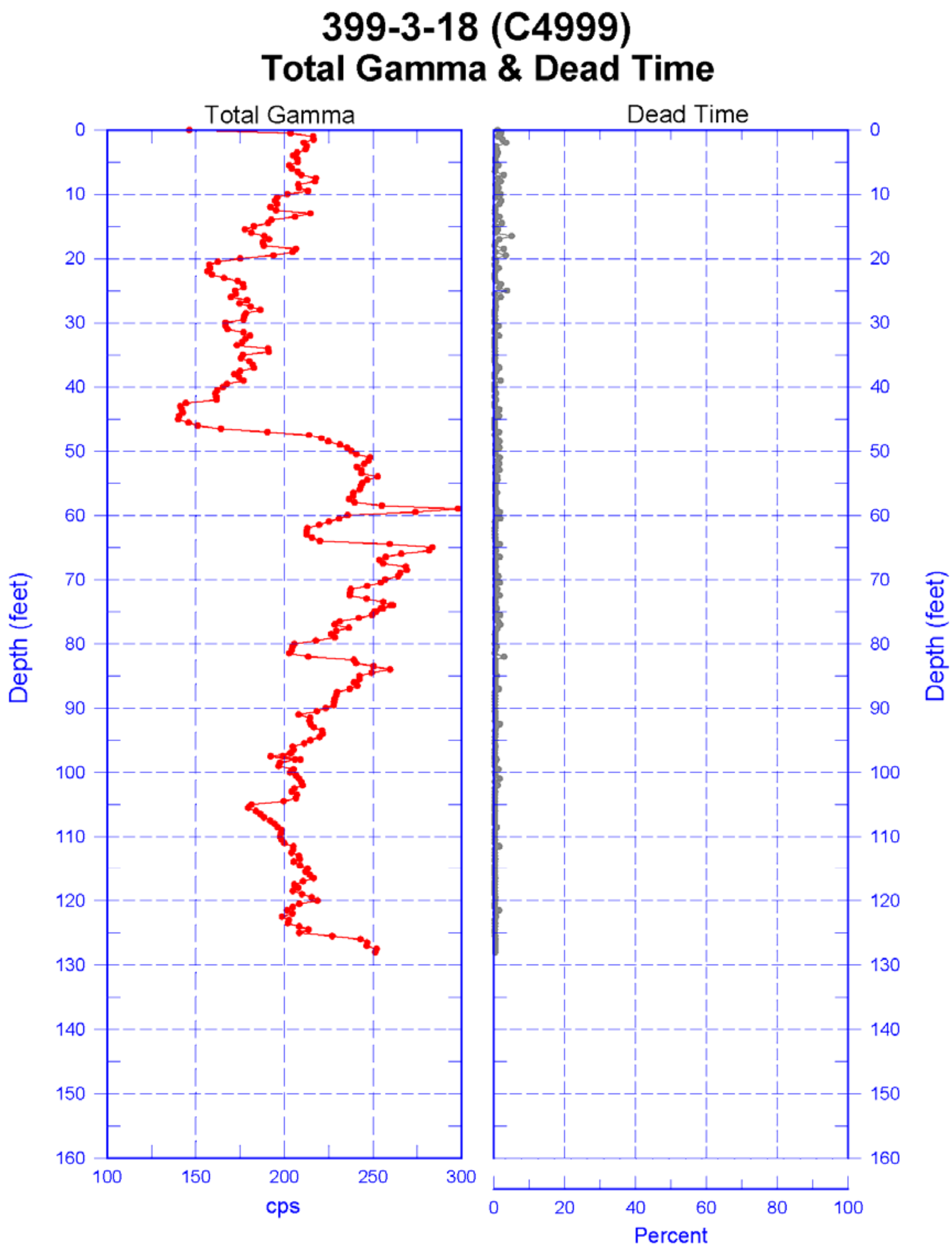


399-3-18 (C4999) Combination Plot
Man-Made Radionuclides
40K (1461 keV)
238U (1764 keV)
232Th (2614 keV)
Total Gamma
Moisture
Depth (feet)
137Cs (662 keV)
235U (186 keV)
238U (1001 keV)
Detections are considered statistical flucuations and are not valid
pCi/g
cps
Zero Reference - Ground Surface

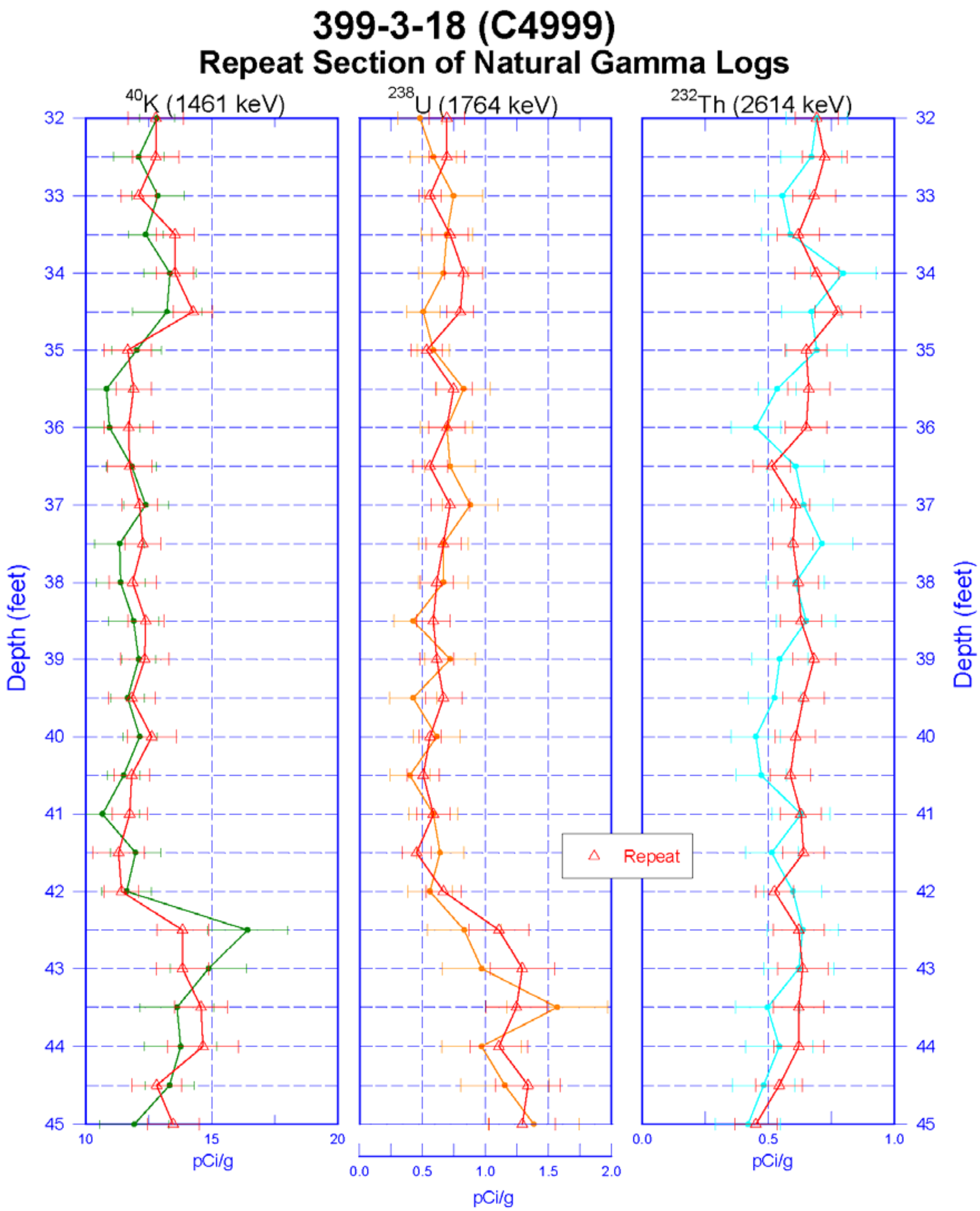
399-3-18 (C4999)
Total Gamma & Moisture



Reference - Ground Surface



Reference - Ground Surface



Zero Reference - Ground Surface

Well C5000

Stoller
Grand Junction Office — established 1959

399-1-23 (C5000)
Log Data Report

Borehole Information:

Borehole:	399-1-23 (C5000)		Site:	South from 316-5 Process Trenches	
Coordinates (WA St Plane)		GWL[1] (ft) :	34.5 (approximate)	GWL Date:	04/13/06
North (m)	East (m)	Drill Date	TOC Elevation (ft)	Total Depth (ft)	Type
not available	not available	04/12/06	not available	115	Sonic

Casing Information:

Casing Type	Stickup (ft)	Outer Diameter (in.)	Inside Diameter (in.)	Thickness (in.)	Top (ft)	Bottom (ft)
Threaded Carbon Steel	3.65	9 3/4	8 5/8	9/16	3.65	115

Borehole Notes:

The logging engineer measured the 8-in. casing and stickup using a steel tape. Measurements were rounded to the nearest 1/16 in. The onsite geologist reported the depth to bottom and depth to groundwater. Depth to water, inside the casing, was measured by the logging engineer at 39.1, 37.75, and 35.6 ft on 04/13, 04/14, and 04/17, respectively. The geologist stated the water inside the casing had not yet equilibrated with the groundwater outside the casing. The true static level of groundwater is 34.5 ft.

Logging Equipment Information:

Logging System:	Gamma 4N		Type:	SGLS (60%) SN: 45TP22010A
Calibration Date:	04/06/06	Calibration Reference:	DOE-EM/GJ1177-2006	
		Logging Procedure:	MAC-HGLP 1.6.5, Rev. 0	

Logging System:	Gamma 1N		Type:	SGLS (60%) SN: 45TP22010A
Calibration Date:	04/05/06	Calibration Reference:	DOE-EM/GJ1183-2006	
		Logging Procedure:	MAC-HGLP 1.6.5, Rev. 0	

Logging System:	Gamma 4F		Type:	NMLS SN: H380932510
Calibration Date:	02/27/06	Calibration Reference:	DOE-EM/GJ1141-2006	
		Logging Procedure:	MAC-HGLP 1.6.5, Rev. 0	

Spectral Gamma Logging System (SGLS) Log Run Information:

Log Run	1	2	3	4 Repeat	7 Repeat
Date	04/12/06	04/13/06	04/14/06	04/14/06	04/18/06
Logging Engineer	Spatz	Spatz	Spatz	Spatz	Spatz
Start Depth (ft)	0.0	19.0	96.5	20.0	19.0
Finish Depth (ft)	20.0	97.5	112.5	50.0	22.0
Count Time (sec)	200	200	200	400	1000
Live/Real	R	R	R	R	R
Shield (Y/N)	N	N	N	N	N
MSA Interval (ft)	0.5	0.5	0.5	0.5	0.5
ft/min	N/A[2]	N/A	N/A	N/A	N/A
Pre-Verification	DN271CAB	DN281CAB	DN291CAB	DN291CAB	AN012CAB
Start File	DN271000	DN281000	DN291000	DN291033	AN012000
Finish File	DN271040	DN281157	DN291032	DN291093	AN012006
Post-Verification	DN271CAA	DN281CAA	DN291CAA	DN291CAA	AN012CAA
Depth Return Error (in.)	0	0	N/A	0	0
Comments	Fine gain adjustment after file-1030.	No fine gain adjustment	No fine gain adjustment	No fine gain adjustment	No fine gain adjustment

Neutron Moisture Logging System (NMLS) Log Run Information:

Log Run	5	6 Repeat			
Date	04/17/06	04/17/06			
Logging Engineer	Spatz	Spatz			
Start Depth (ft)	0.0	30.0			
Finish Depth (ft)	35.5	35.0			
Count Time (sec)	15	15			
Live/Real	R	R			
Shield (Y/N)	N	N			
MSA Interval (ft)	0.25	0.25			
ft/min	N/A	N/A			
Pre-Verification	DF172CAB	DF172CAB			
Start File	DF172000	DF172143			
Finish File	DF172142	DF172163			
Post-Verification	DF172CAA	DF172CAA			
Depth Return Error (in.)	N/A	0			
Comments	No fine gain adjustment	No fine gain adjustment			

Logging Operation Notes:

Logging was conducted with a centralizer on the sondes. Logging data acquisition is referenced to ground level. The maximum logging depth achieved was 112.9 ft. Repeat sections were collected in this borehole to evaluate each system's performance and to acquire more detailed information at selected depths. The SGLS repeat sections were acquired at 400 seconds (20 to 50 ft) and 1000 seconds (19 to 22 ft) relative to the main log at a 200 second counting time.

Analysis Notes:

Analyst:	Henwood	Date:	05/01/06	Reference:	GJO-HGLP 1.6.3, Rev. 0

Pre-run and post-run verifications for the SGLS (G4N) were acquired in the Amersham verifier, serial number 115 which is enhanced in the naturally occurring radionuclides ^{40}K, ^{238}U, and ^{232}Th (KUT). The resolution (FWHM) for the 609 and 1461 keV energy peaks fell slightly below the lower control limits for pre-run verification data acquired on 04/13/06; the HASQUARD criteria were met. The control limits were not exceeded for the other five verification spectra. Therefore, the data are accepted.

Pre-run and post-run verifications for the SGLS (G1N) were acquired in the Amersham verifier, serial number 118. The criteria were met.

A casing correction for 9/16-in.-thick casing was applied to the SGLS log data.

SGLS spectra were processed in batch mode using APTEC SUPERVISOR to identify individual energy peaks and determine count rates. Concentrations were calculated with EXCEL worksheet templates identified as G4NApr06.xls and G1NApr06.xls for logging systems G4N and G1N, respectively, using efficiency functions and corrections for casing, water, and dead time as determined from annual calibrations. Dead time corrections are applied where dead times exceed 8 and 10 percent for G4N and G1N, respectively. No correction for dead time was necessary. A correction for water was applied to data acquired on 04/13 below 39.1 ft in depth. For repeat data acquired 04/14, the water correction was applied to data below 37.5 ft.

The NMLS data are presented as counts per second. A calibration for casing inside diameters greater than 8-in. is not available.

Results and Interpretations:

A plot of manmade radionuclides is included for ^{137}Cs and processed uranium (^{235}U and ^{238}U). The plot indicates all detections based on the routine processing software. All of the detections were at or near the respective MDLs. Inspection of each spectrum where detection was indicated revealed no full energy peaks. Therefore, the detections are considered to be statistical fluctuations and are not considered valid. No other manmade radionuclides were indicated.

There is a strong indication of radon in the groundwater. Comparison of the 1764 keV and 609 keV ^{214}Bi gamma rays show differing concentrations after corrections for water and casing. The casing and water correction factors decrease with increasing energy. Gamma rays originating inside the casing are not attenuated by the steel casing, and the net effect of applying the correction factors is to amplify results from low-energy gamma rays. The fact that the 609 keV gamma ray results in a higher apparent concentration than the 1764 keV gamma line suggests that radon is present in the groundwater. Typical formation concentrations of naturally occurring ^{238}U are between approximately 0.5 and 1.5 pCi/g. The concentrations above the groundwater level are consistent with these values for the assays of both the 609 and 1764 keV peaks. Note that enhanced radon is not related to the existence of manmade uranium.

The neutron moisture results are reported in counts per second because no valid calibration is available for borehole inside diameters greater than 8 inches. Some variation is noted in the moisture profile.

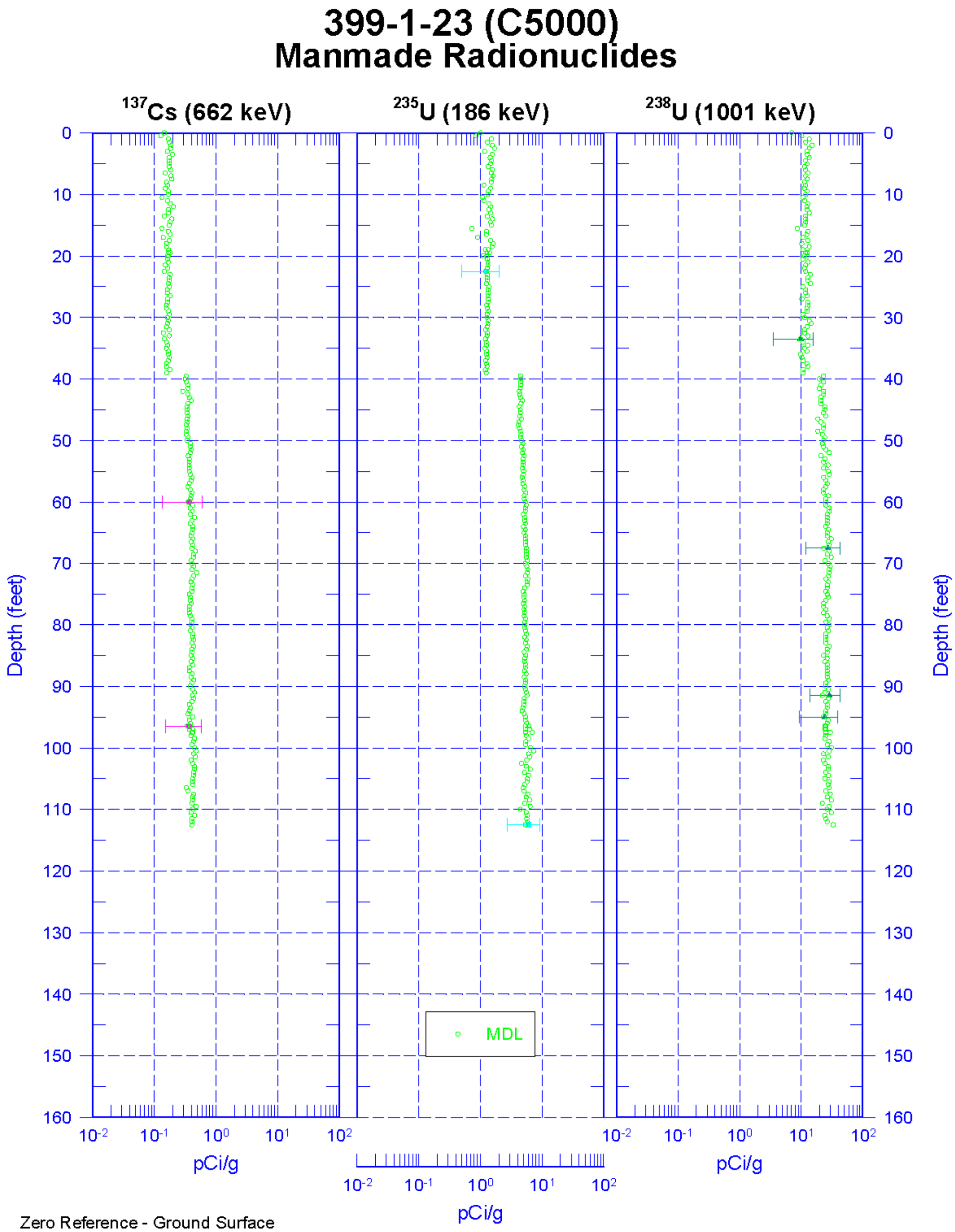
The repeat sections generally indicate good agreement of the naturally occurring KUT. The repeat data were acquired at 400 (20 to 50 ft) and 1000 second (19 to 22 ft) counting times relative to the 200 second counting time for the main log data. The log data, especially for ^{40}K do not repeat between 36 and 39 ft. The water level in the borehole before logging this interval on 04/13 was 39.1 ft. When the repeat data were acquired on 04/14, the depth to water was measured before logging at 37.5 ft. Corrections used for water in the borehole are applied accordingly. The static water level (i.e., formation water is at the same level as water inside the borehole) was not realized until after the SGLS logging was complete. The lack of repeatability in this log interval is apparently due to incorrect water corrections because of changing depth to water that occurred during logging and between the separate log events.

Log Plots:

Manmade Radionuclides

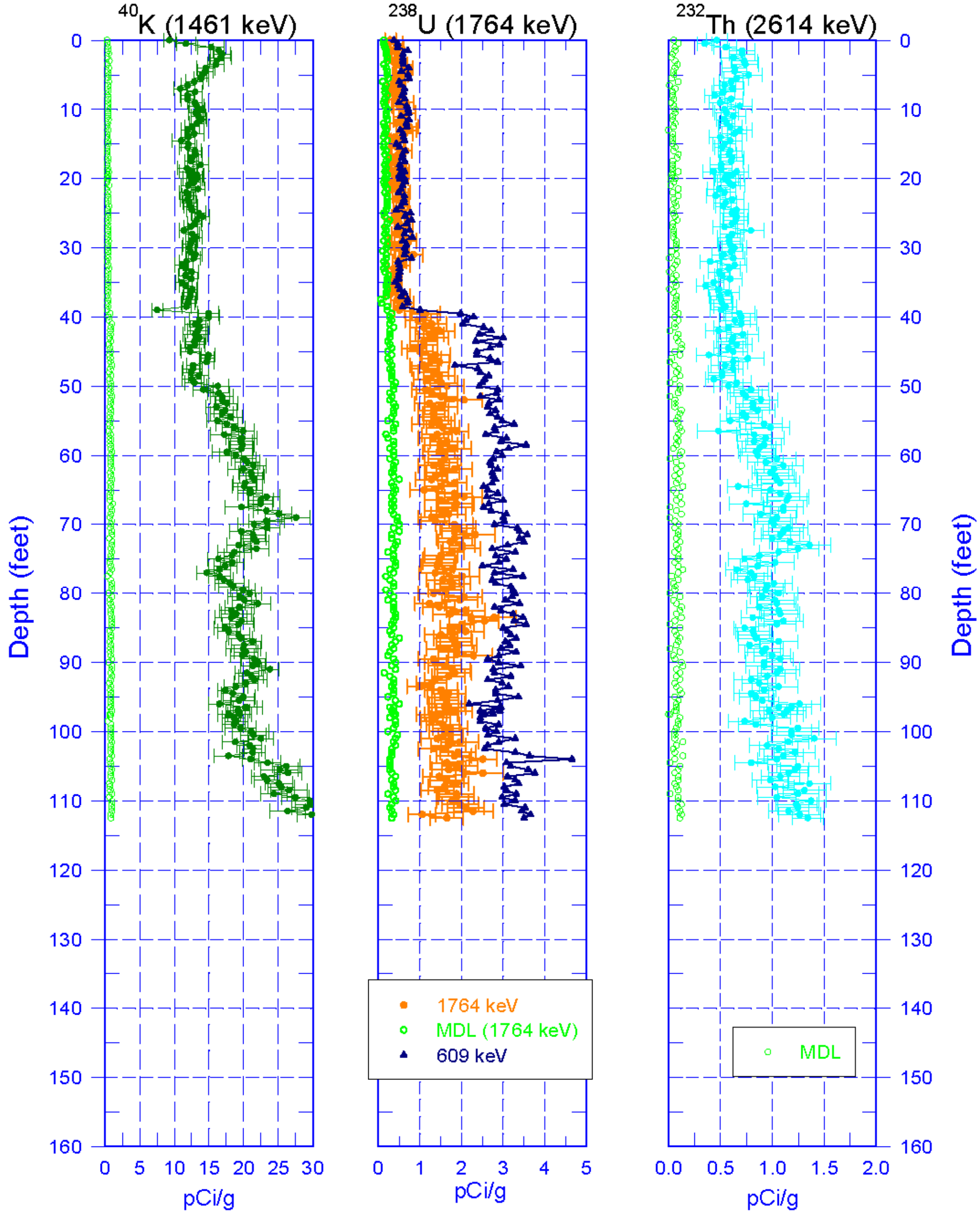
Natural Gamma Logs
Combination Plot
Total Gamma & Moisture
Total Gamma & Dead Time
Repeat Section of Natural Gamma Logs (20 to 50 ft)
Repeat Section of Natural Gamma Logs (19 to 22 ft)

[1] GWL – groundwater level
[2] N/A – not applicable

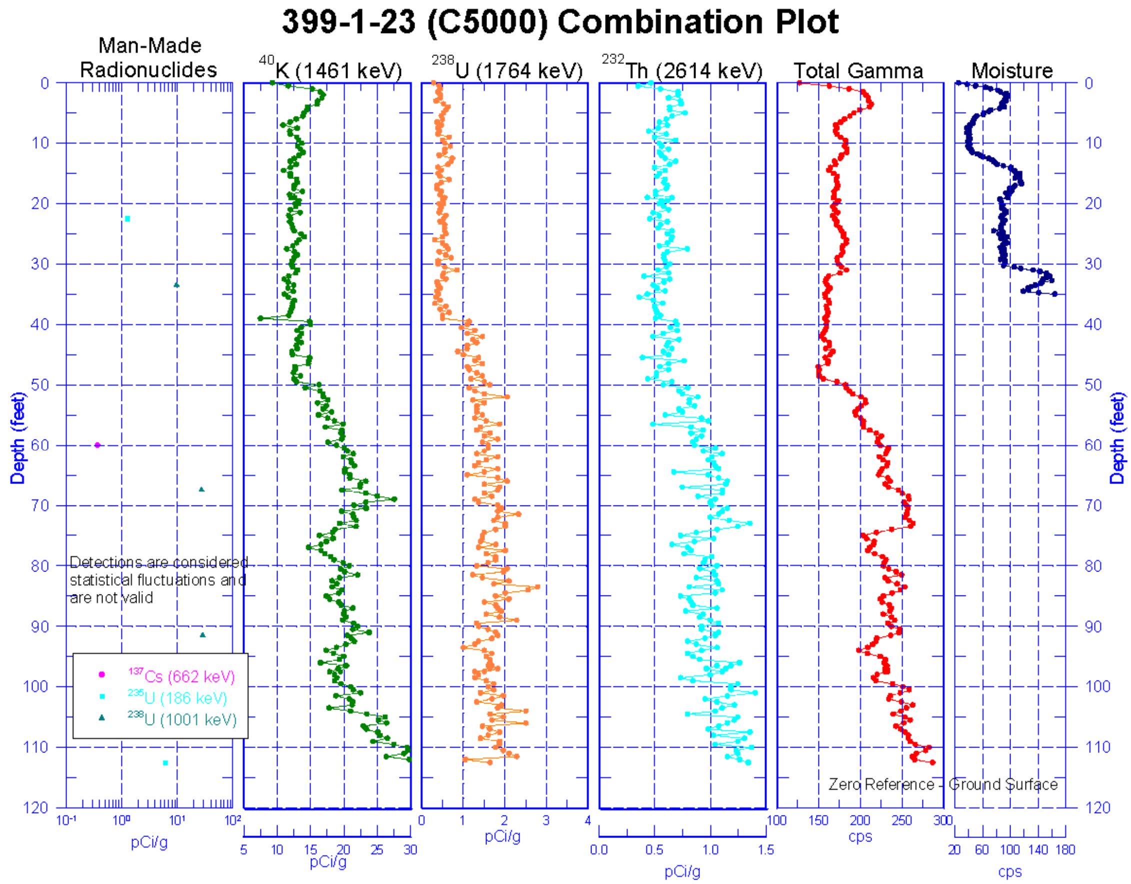


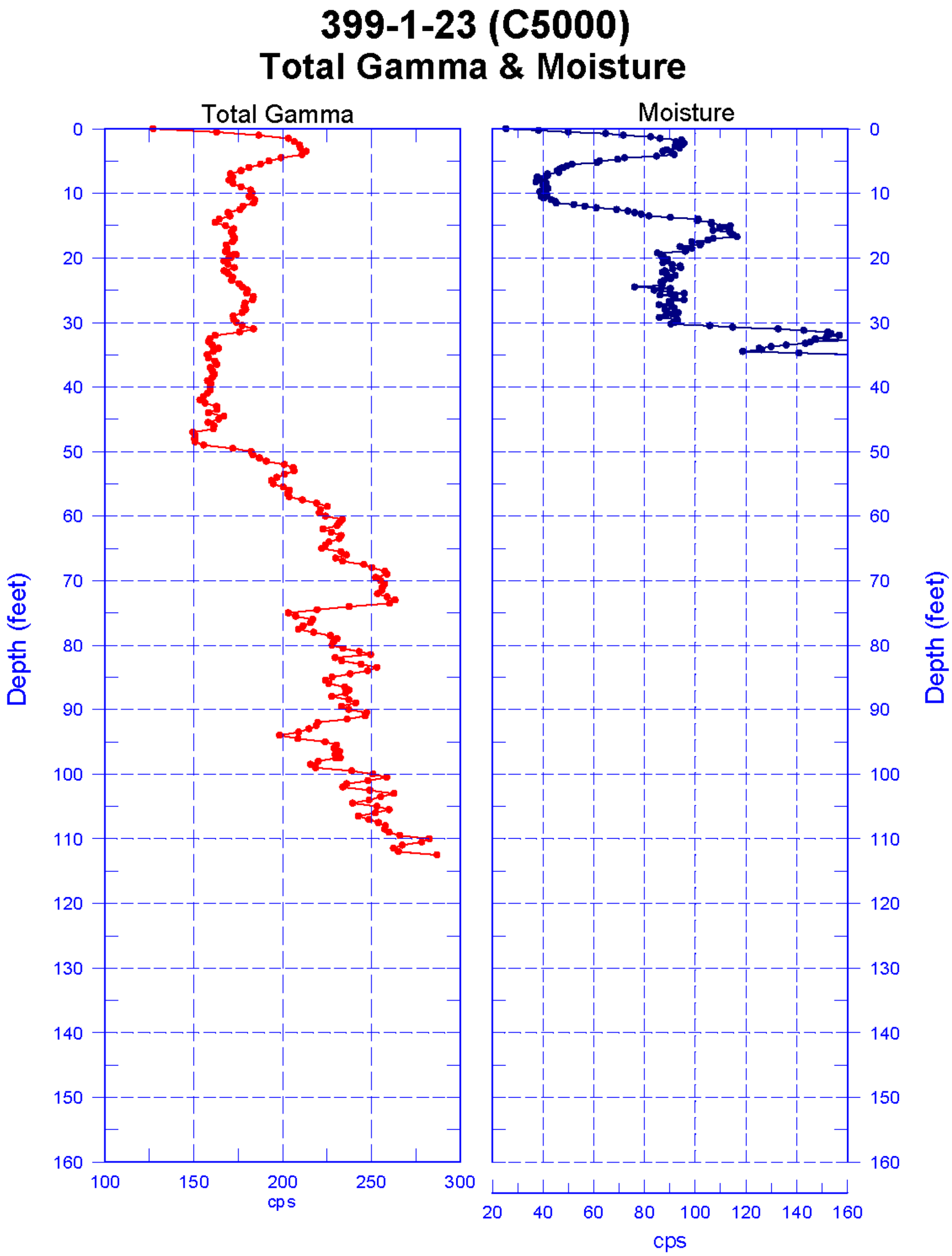
399-1-23 (C5000)
Manmade Radionuclides
137Cs (662 keV)
235U (186 keV)
238U (1001 keV)
Depth (feet)
pCi/g
MDL
Zero Reference - Ground Surface

399-1-23 (C5000)
Natural Gamma Logs



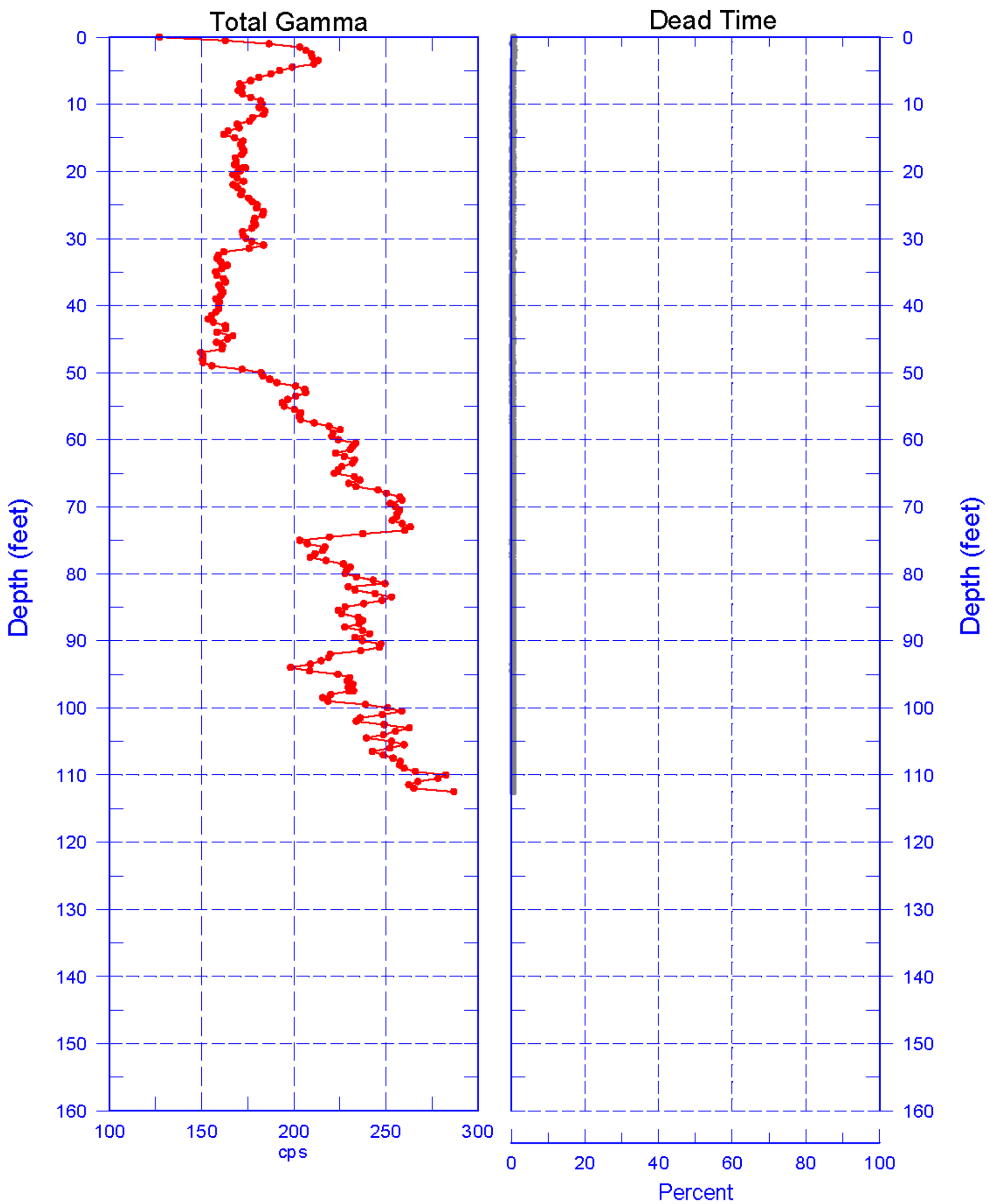
Zero Reference - Ground Surface


399-1-23 (C5000) Combination Plot
Man-Made Radionuclides
40K (1461 keV)
238U (1764 keV)
232Th (2614 keV)
Total Gamma
Moisture
Depth (feet)
Detections are considered statistical fluctuations and are not valid
137Cs (662 keV)
235U (186 keV)
238U (1001 keV)
Zero Reference - Ground Surface
pCi/g
cps

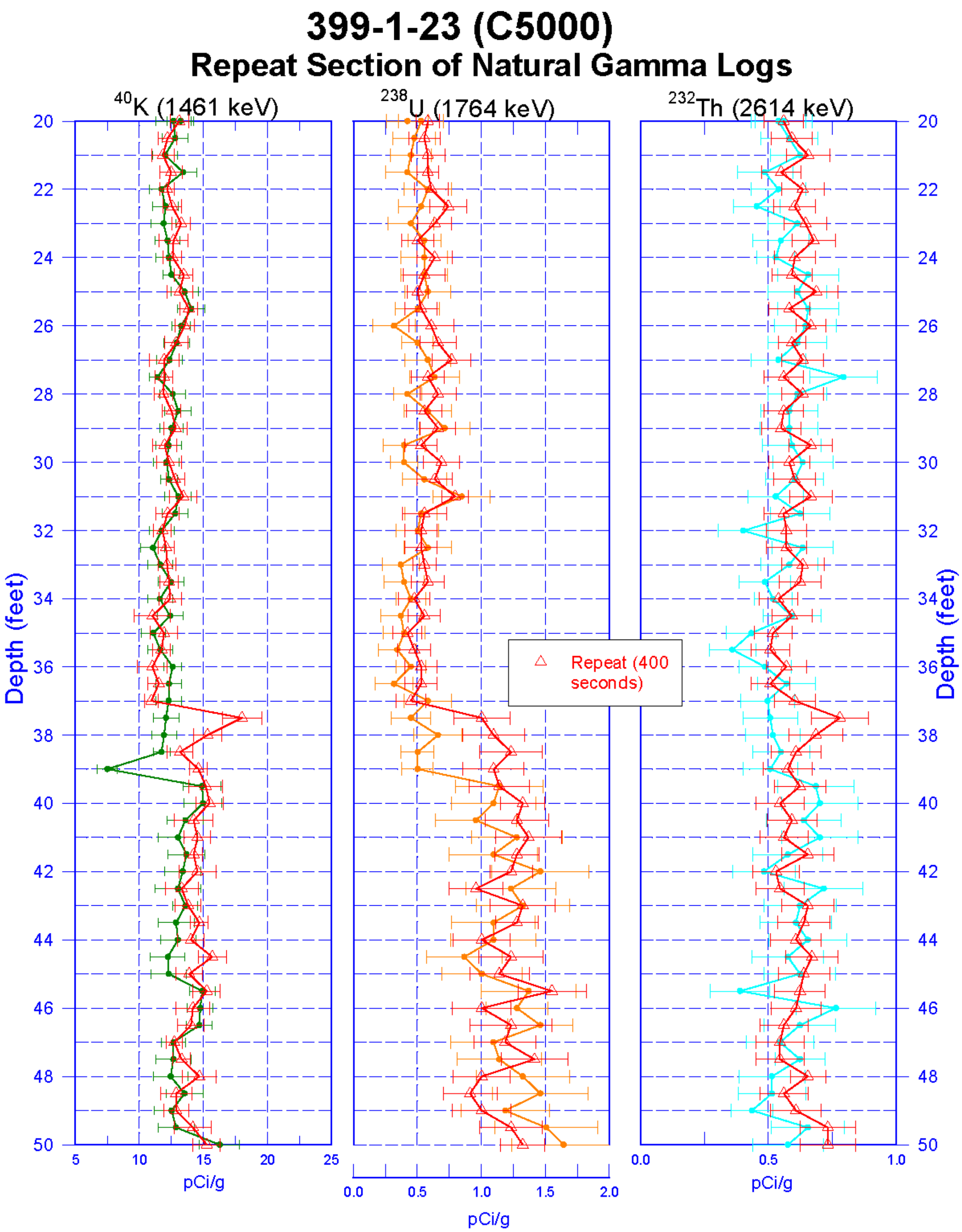


Reference - Ground Surface

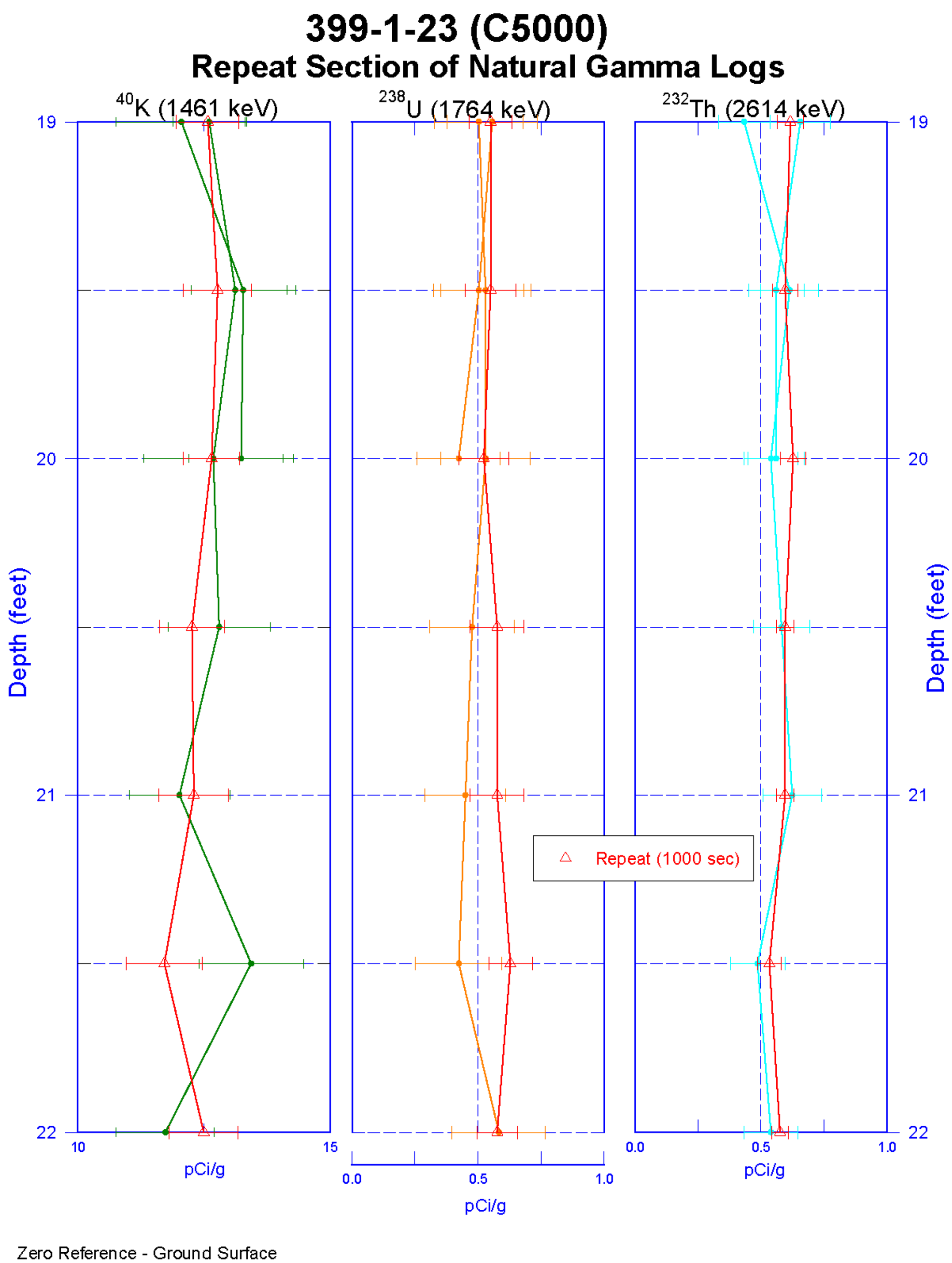
399-1-23 (C5000)
Total Gamma & Dead Time



Reference - Ground Surface



Zero Reference - Ground Surface



399-1-23 (C5000)
Repeat Section of Natural Gamma Logs
40K (1461 keV)
238U (1764 keV)
232Th (2614 keV)
Depth (feet)
19
20
21
22
10
15
pCi/g
0.0
0.5
1.0
Repeat (1000 sec)
Zero Reference - Ground Surface

Well C5001

Stoller
Grand Junction Office established 1959

399-3-19 (C5001)
Log Data Report

Borehole Information:

Borehole:	399-3-19 (C5001)		Site:	South from 316-5 Process Trenches	
Coordinates (WA St Plane)		GWL[1] (ft):	47 (approximate)	GWL Date:	04/13/06
North (m)	East (m)	Drill Date	TOC Elevation (ft)	Total Depth (ft)	Type
not available	not available	05/01/06	not available	86	Sonic

Casing Information:

Casing Type	Stickup (ft)	Outer Diameter (in.)	Inside Diameter (in.)	Thickness (in.)	Top (ft)	Bottom (ft)
Threaded Carbon Steel	2.0	9 3/4	8 5/8	9/16	2.0	86

Borehole Notes:

The logging engineer measured the 8-in. casing and stickup using a steel tape. Measurements were rounded to the nearest 1/16 in. The onsite geologist reported the depth to bottom and depth to groundwater.

Logging Equipment Information:

Logging System:	Gamma 4N		Type:	SGLS (60%) SN: 45TP22010A
Calibration Date:	04/06/06	Calibration Reference:	DOE-EM/GJ1177-2006	
		Logging Procedure:	MAC-HGLP 1.6.5, Rev. 0	

Logging System:	Gamma 4F		Type:	NMLS SN: H380932510
Calibration Date:	04/28/06	Calibration Reference:	TBD	
		Logging Procedure:	MAC-HGLP 1.6.5, Rev. 0	

Spectral Gamma Logging System (SGLS) Log Run Information:

Log Run	3	4	5 Repeat		
Date	05/01/06	05/02/06	05/02/06		
Logging Engineer	Spatz	Spatz	Spatz		
Start Depth (ft)	0.0	0.0	35.0		
Finish Depth (ft)	79.5	78.5	60.0		
Count Time (sec)	200	200	400		
Live/Real	R	R	R		
Shield (Y/N)	N	N	N		
MSA Interval (ft)	0.5	0.5	0.5		

Log Run	3	4	5 Repeat		
ft/min	N/A[2]	N/A	N/A		
Pre-Verification	DN301CAB	DN301CAB	DN301CAB		
Start File	DN301000	DN301160	DN301176		
Finish File	DN301159	DN301175	DN301226		
Post-Verification	DN301CAA	DN301CAA	DN301CAA		
Depth Return Error (in.)	- 0.5	N/A	0		
Comments	Fine gain adjustment after files-020, 057.	No fine gain adjustment	No fine gain adjustment		

Neutron Moisture Logging System (NMLS) Log Run Information:

Log Run	1	2 Repeat			
Date	05/01/06	05/01/06			
Logging Engineer	Spatz	Spatz			
Start Depth (ft)	0.0	25.0			
Finish Depth (ft)	46.75	30.0			
Count Time (sec)	15	15			
Live/Real	R	R			
Shield (Y/N)	N	N			
MSA Interval (ft)	0.25	0.25			
ft/min	N/A	N/A			
Pre-Verification	DF202CAB	DF202CAB			
Start File	DF202000	DF202188			
Finish File	DF202187	DF202208			
Post-Verification	DF202CAA	DF202CAA			
Depth Return Error (in.)	N/A	0			
Comments	No fine gain adjustment	No fine gain adjustment			

Logging Operation Notes:

Logging was conducted with a centralizer on the sondes. Logging data acquisition is referenced to ground level. The maximum logging depth achieved was 86.2 ft. Repeat sections were collected in this borehole to evaluate each system's performance and to acquire more detailed information at selected depths. The SGLS repeat section was acquired between 35 and 60 ft (400 seconds) and between 25 and 30 ft for the NMLS.

Analysis Notes:

Analyst:	Henwood	Date:	05/09/06	Reference:	GJO-HGLP 1.6.3, Rev. 0

Pre-run and post-run verifications for the SGLS (G4N) were acquired in the Amersham verifier, serial number 115 which is enhanced in the naturally occurring radionuclides ^{40}K, ^{238}U, and ^{232}Th (KUT). The verification criteria were met.

A casing correction for 9/16-in.-thick casing was applied to the SGLS log data.

SGLS spectra were processed in batch mode using APTEC SUPERVISOR to identify individual energy peaks and determine count rates. Concentrations were calculated with EXCEL worksheet template identified as G4NApr06.xls using efficiency functions and corrections for casing, water, and dead time as determined from annual calibrations. No correction for dead time was necessary. A correction for water was applied to data acquired below 47 ft in depth.

The NMLS data are presented as counts per second. A calibration for casing inside diameters greater than 8-in. is not available.

Results and Interpretations:

A plot of manmade radionuclides is included for ^{137}Cs and processed uranium (^{235}U and ^{238}U). The plot indicates all detections based on the routine processing software. All of the detections were at or near the respective MDLs. Inspection of each spectrum where detection was indicated revealed no full energy peaks. Therefore, the detections are considered to be statistical fluctuations and are not considered valid. No other manmade radionuclides were indicated.

There is a strong indication of radon in the groundwater. Comparison of the 1764 keV and 609 keV ^{214}Bi gamma rays show differing concentrations after corrections for water and casing. The casing and water correction factors decrease with increasing energy. Gamma rays originating inside the casing are not attenuated by the steel casing, and the net effect of applying the correction factors is to amplify results from low-energy gamma rays. The fact that the 609 keV gamma ray results in a higher apparent concentration than the 1764 keV gamma line suggests that radon is present in the groundwater. Typical formation concentrations of naturally occurring ^{238}U are between approximately 0.5 and 1.5 pCi/g. The concentrations above the groundwater level are consistent with these values for the assays of both the 609 and 1764 keV peaks. Note that enhanced radon is not related to the existence of manmade uranium.

The neutron moisture results are reported in counts per second because no valid calibration is available for borehole inside diameters greater than 8 inches. Some variation is noted in the moisture profile.

The repeat sections generally indicate good agreement of the naturally occurring KUT and moisture. No manmade radionuclides were detected at the 400 second counting time.

Log Plots:

Manmade Radionuclides
Natural Gamma Logs
Combination Plot
Total Gamma & Moisture
Total Gamma & Dead Time
Repeat Section of Natural Gamma Logs
Moisture Repeat Section

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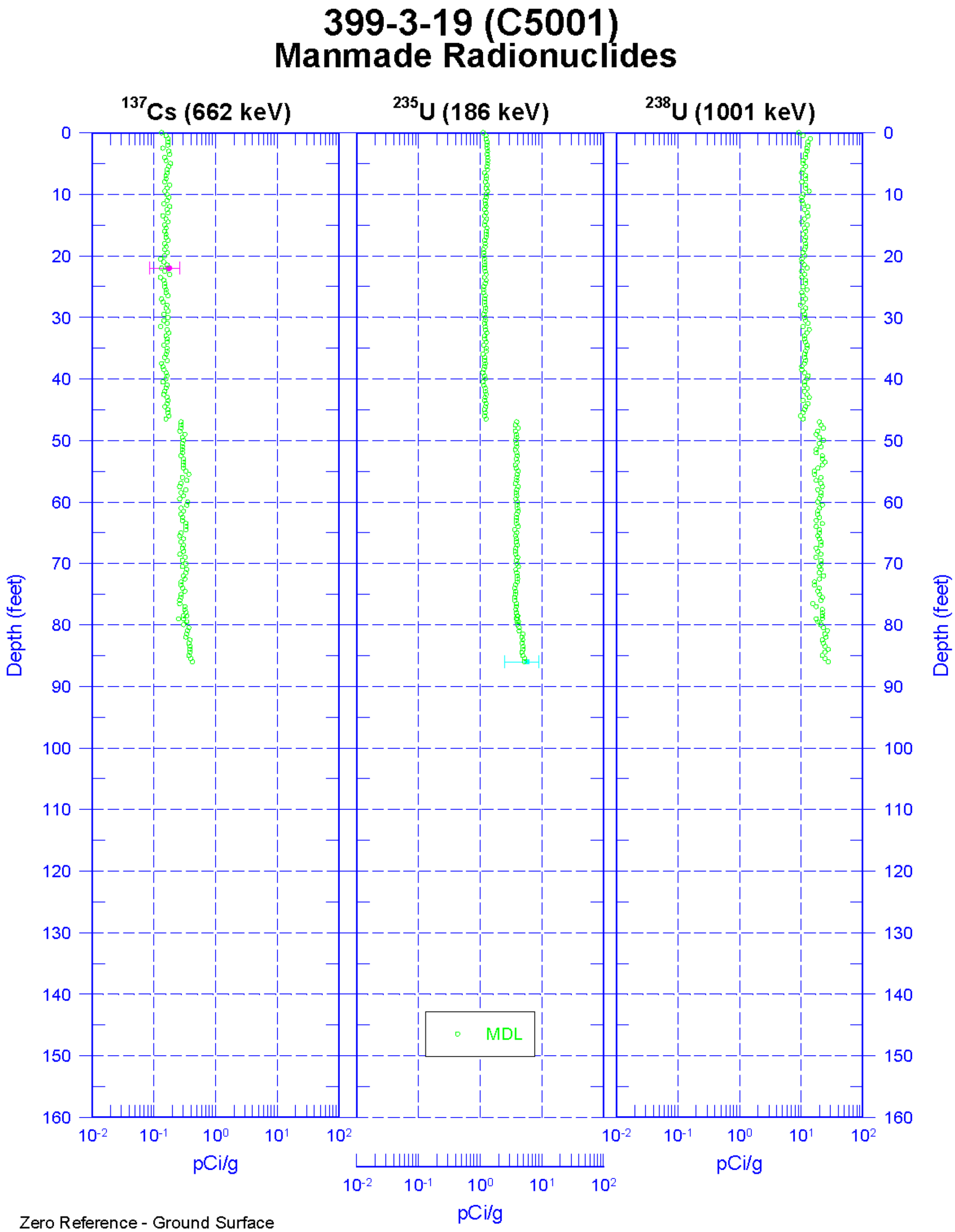
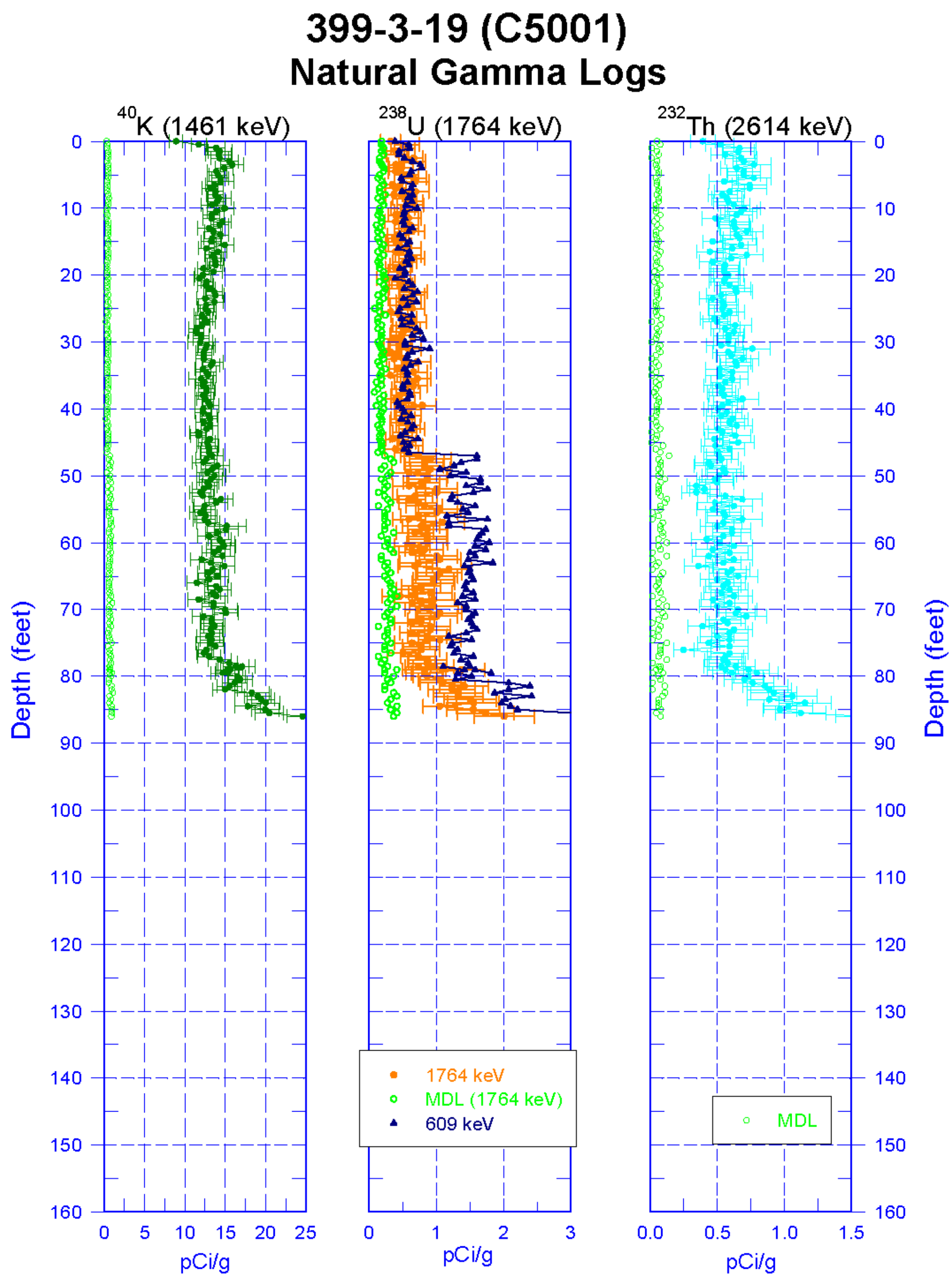
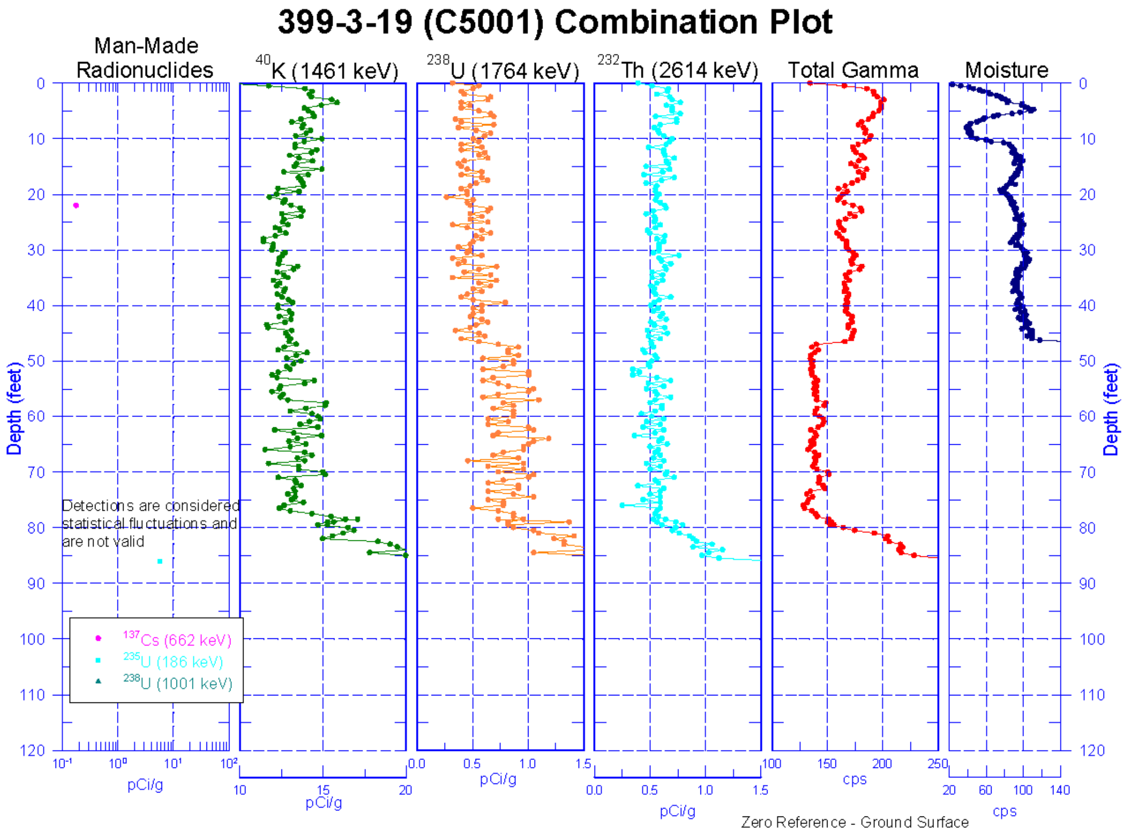
[1] GWL – groundwater level
[2] N/A – not applicable



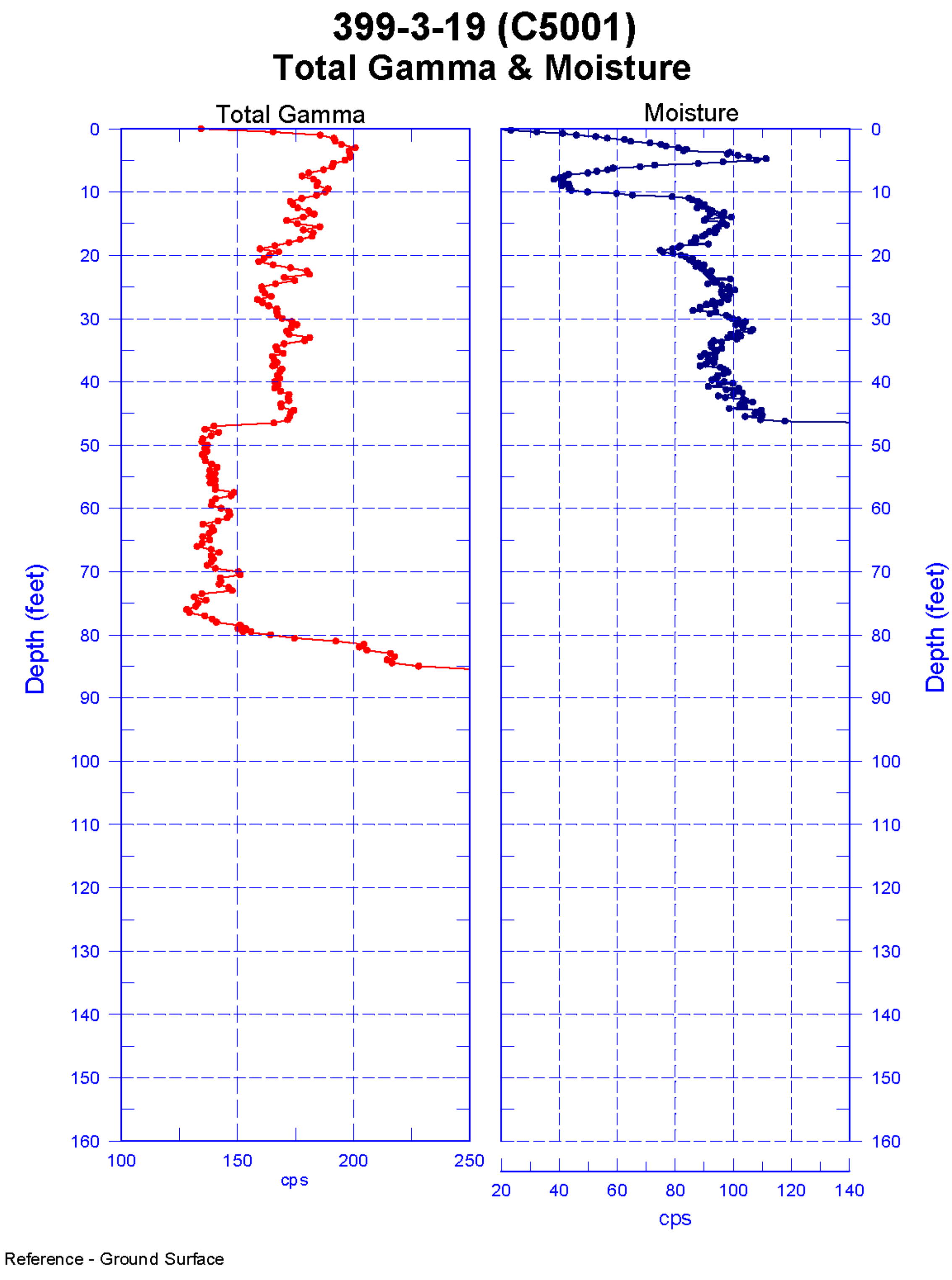
399-3-19 (C5001)
Manmade Radionuclides
137Cs (662 keV)
235U (186 keV)
238U (1001 keV)
Depth (feet)
MDL
pCi/g
Zero Reference - Ground Surface

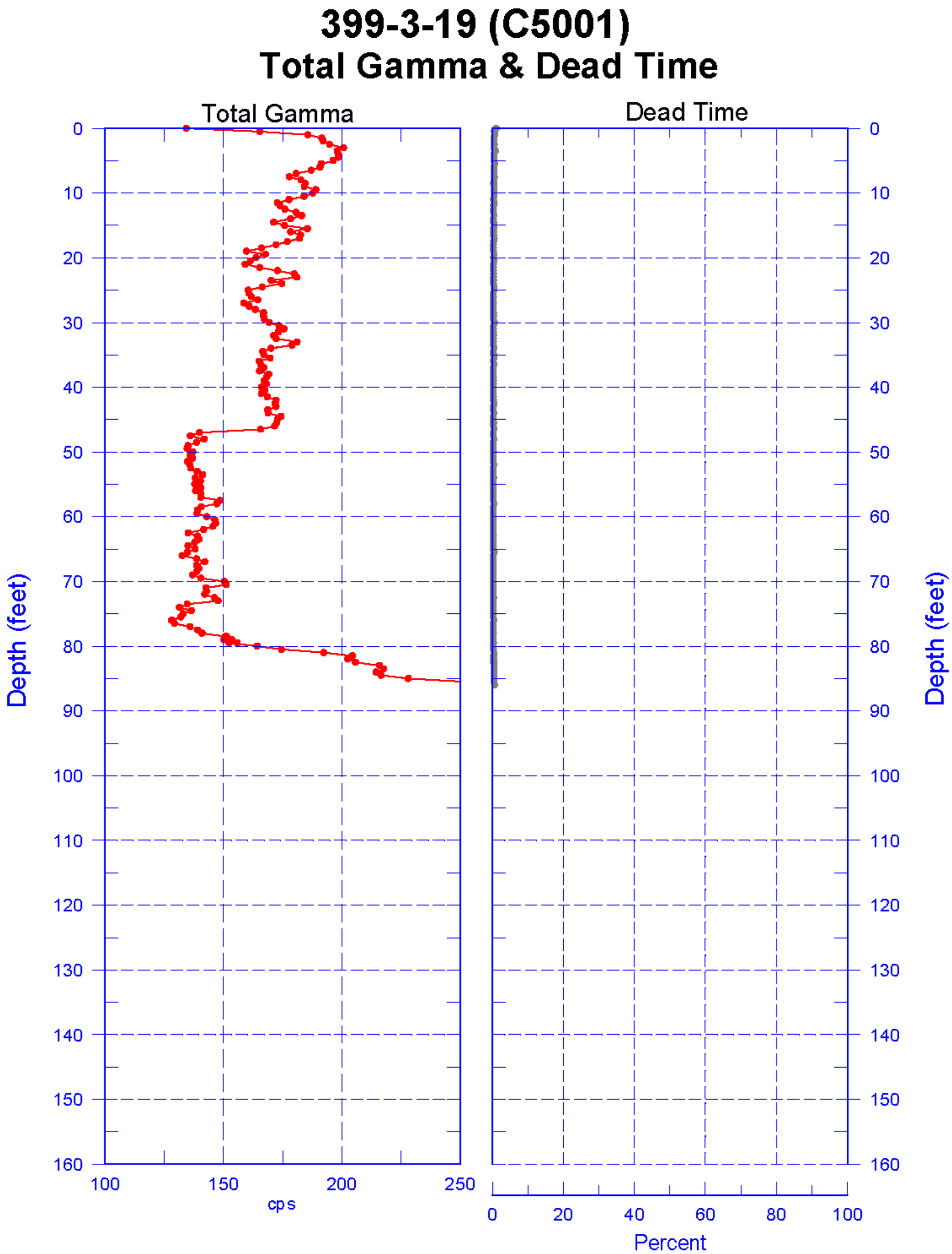


Zero Reference - Ground Surface



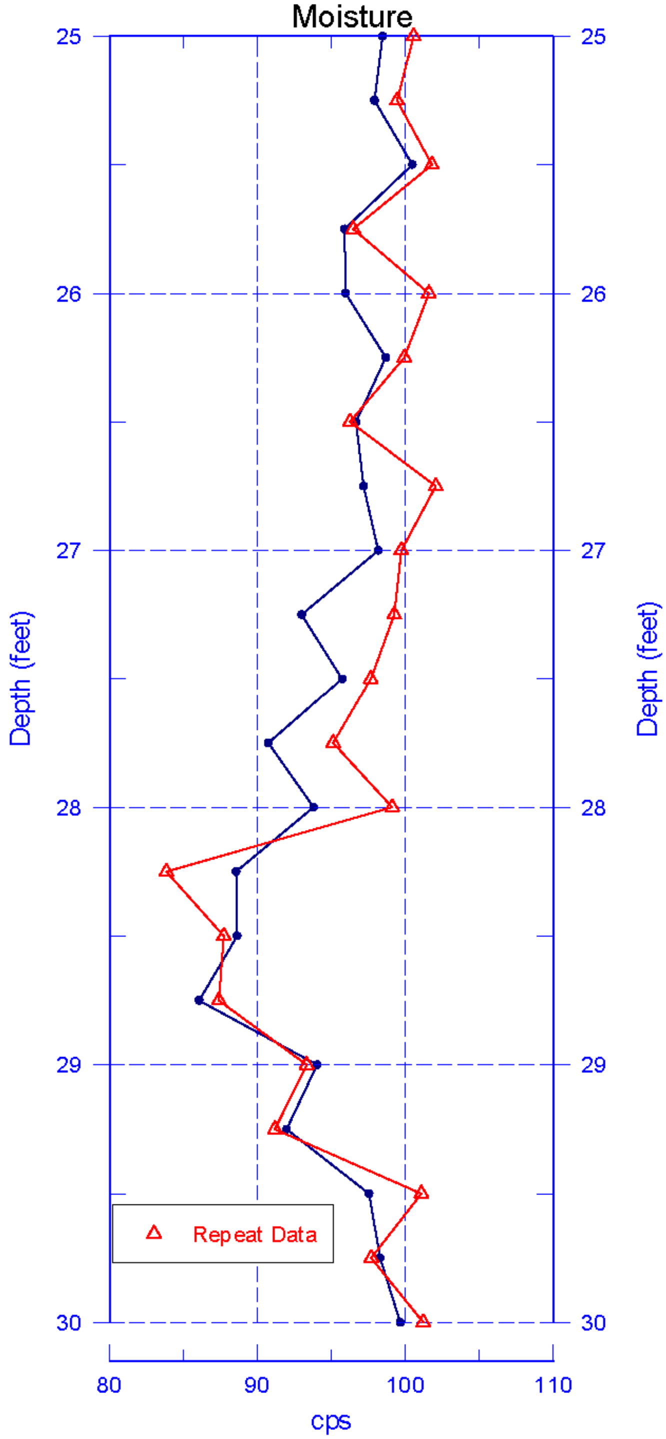
399-3-19 (C5001) Combination Plot
Man-Made Radionuclides
40K (1461 keV)
238U (1764 keV)
232Th (2614 keV)
Total Gamma
Moisture
Depth (feet)
Detections are considered statistical fluctuations and are not valid
137Cs (662 keV)
235U (186 keV)
238U (1001 keV)
pCi/g
cps
Zero Reference - Ground Surface


399-3-19 (C5001)
Total Gamma & Moisture
Total Gamma
Moisture
Depth (feet)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
100
150
200
250
cps
20
40
60
80
100
120
140
cps
Depth (feet)
Reference - Ground Surface



Reference - Ground Surface

399-3-19 (C5001)
Moisture Repeat Section



Reference - Ground Surface

Well C5002

Stoller
Grand Junction Office
established 1959

DOE-EM/GJ1203-2006

399-3-20 (C5002)
Log Data Report

Borehole Information:

Borehole:	399-3-20 (C5002)		Site:	East of 307 Disposal Trenches (WIDS Site 316-3	
Coordinates (WA St Plane)		GWL[1] (ft) :	49 (approximate)	GWL Date:	05/16/06
North (m)	East (m)	Drill Date	TOC Elevation (ft)	Total Depth (ft)	Type
not available	not available	05/01/06	not available	90	Sonic

Casing Information:

Casing Type	Stickup (ft)	Outer Diameter (in.)	Inside Diameter (in.)	Thickness (in.)	Top (ft)	Bottom (ft)
Threaded Carbon Steel	4.5	9 3/4	8 5/8	9/16	4.5	90

Borehole Notes:

The logging engineer measured the 8-in. casing and stickup using a steel tape. Measurements were rounded to the nearest 1/16 in. The onsite geologist reported the depth to bottom and depth to groundwater.

Logging Equipment Information:

Logging System:	Gamma 4N	Type:	SGLS (60%) SN: 45TP22010A
Calibration Date:	04/06/06	Calibration Reference:	DOE-EM/GJ1177-2006
		Logging Procedure:	MAC-HGLP 1.6.5, Rev. 0

Logging System:	Gamma 4H	Type:	NMLS SN: H310700352
Calibration Date:	03/06/06	Calibration Reference:	DOE-EM/GJ1154-2006
		Logging Procedure:	MAC-HGLP 1.6.5, Rev. 0

Spectral Gamma Logging System (SGLS) Log Run Information:

Log Run	1	2	3 Repeat	4 Repeat	
Date	05/16/06	05/16/06	05/17/06	05/17/06	
Logging Engineer	Spatz	Spatz	Spatz	Spatz	
Start Depth (ft)	0.0	66.0	85.0	50.0	
Finish Depth (ft)	65.5	87.0	78.0	42.0	
Count Time (sec)	200	200	400	400	
Live/Real	R	R	R	R	
Shield (Y/N)	N	N	N	N	
MSA Interval (ft)	0.5	0.5	0.5	0.5	

Log Run	1	2	3 Repeat	4 Repeat	
ft/min	N/A[2]	N/A	N/A	N/A	
Pre-Verification	DN311CAB	DN311CAB	DN311CAB	DN311CAB	
Start File	DN311000	DN311133	DN311175	DN311190	
Finish File	DN311132	DN311174	DN311189	DN311206	
Post-Verification	DN311CAA	DN311CAA	DN311CAA	DN311CAA	
Depth Return Error (in.)	0	N/A	N/A	N/A	
Comments	Fine gain adjustment after files-020, -50, and -083.	No fine gain adjustments.	No fine gain adjustments.	No fine gain adjustments.	

Neutron Moisture Logging System (NMLS) Log Run Information:

Log Run	5	6 Repeat			
Date	05/01/06	05/01/06			
Logging Engineer	Spatz	Spatz			
Start Depth (ft)	0.0	42.0			
Finish Depth (ft)	47.75	47.75			
Count Time (sec)	15	15			
Live/Real	R	R			
Shield (Y/N)	N	N			
MSA Interval (ft)	0.25	0.25			
ft/min	N/A	N/A			
Pre-Verification	DH052CAB	DH052CAB			
Start File	DH052000	DH052192			
Finish File	DH052191	DH052215			
Post-Verification	DH052CAA	DH052CAA			
Depth Return Error (in.)	N/A	0			
Comments	No fine gain adjustment	No fine gain adjustment			

Logging Operation Notes:

Logging was conducted with a centralizer on the sondes. Logging data acquisition is referenced to ground level. The maximum logging depth achieved was 87.2 ft. Repeat sections were collected in this borehole to evaluate each system's performance and to acquire more detailed information at selected depths. The SGLS repeat sections were acquired at 400 second counting time relative to 200 seconds for the main log.

Analysis Notes:

Analyst:	Henwood	**Date:**	05/18/06	**Reference:**	GJO-HGLP 1.6.3, Rev. 0

Pre-run and post-run verifications for the SGLS (G4N) were acquired in the Amersham verifier, serial number 115 which is enhanced in the naturally occurring radionuclides ^{40}K, ^{238}U, and ^{232}Th (KUT). The verification criteria were met.

A casing correction for 9/16-in.-thick casing was applied to the SGLS log data.

SGLS spectra were processed in batch mode using APTEC SUPERVISOR to identify individual energy peaks and determine count rates. Concentrations were calculated with EXCEL worksheet template identified as G4NApr06.xls using efficiency functions and corrections for casing, water, and dead time as determined from annual calibrations. No correction for dead time was necessary. A correction for water was applied to data acquired below 49 ft in depth.

The NMLS data are presented as counts per second. A calibration for casing inside diameters greater than 8-in. is not available.

Results and Interpretations:

A plot of manmade radionuclides is included for ^{137}Cs and processed uranium (^{235}U and ^{238}U). The plot indicates all detections based on the routine processing software. All of the detections were at or near the respective MDLs. Inspection of each spectrum where a detection was indicated revealed no full energy peaks. Therefore, the detections are considered to be statistical fluctuations and are not considered valid. No other manmade radionuclides were indicated.

There is a strong indication of radon in the groundwater. Comparison of the 1764 keV and 609 keV ^{214}Bi gamma rays show differing concentrations after corrections for water and casing. The casing and water correction factors decrease with increasing energy. Gamma rays originating inside the casing are not attenuated by the steel casing, and the net effect of applying the correction factors is to amplify results from low-energy gamma rays. The fact that the 609 keV gamma ray results in a higher apparent concentration than the 1764 keV gamma line suggests that radon is present in the groundwater. Typical formation concentrations of naturally occurring ^{238}U are between approximately 0.5 and 1.5 pCi/g. The concentrations above the groundwater level are consistent with these values for the assays of both the 609 and 1764 keV peaks. Note that enhanced radon is not related to the existence of manmade uranium.

The neutron moisture results are reported in counts per second because no valid calibration is available for borehole inside diameters greater than 8 inches. Some variation is noted in the moisture profile.

The repeat sections generally indicate good agreement of the naturally occurring KUT and moisture. No manmade radionuclides were detected at the 400 second counting time.

Log Plots:

Manmade Radionuclides
Natural Gamma Logs
Combination Plot
Total Gamma & Moisture
Total Gamma & Dead Time
Repeat Section of Natural Gamma Logs (42-50 ft)
Repeat Section of Natural Gamma Logs (78-85 ft)
Moisture Repeat Section

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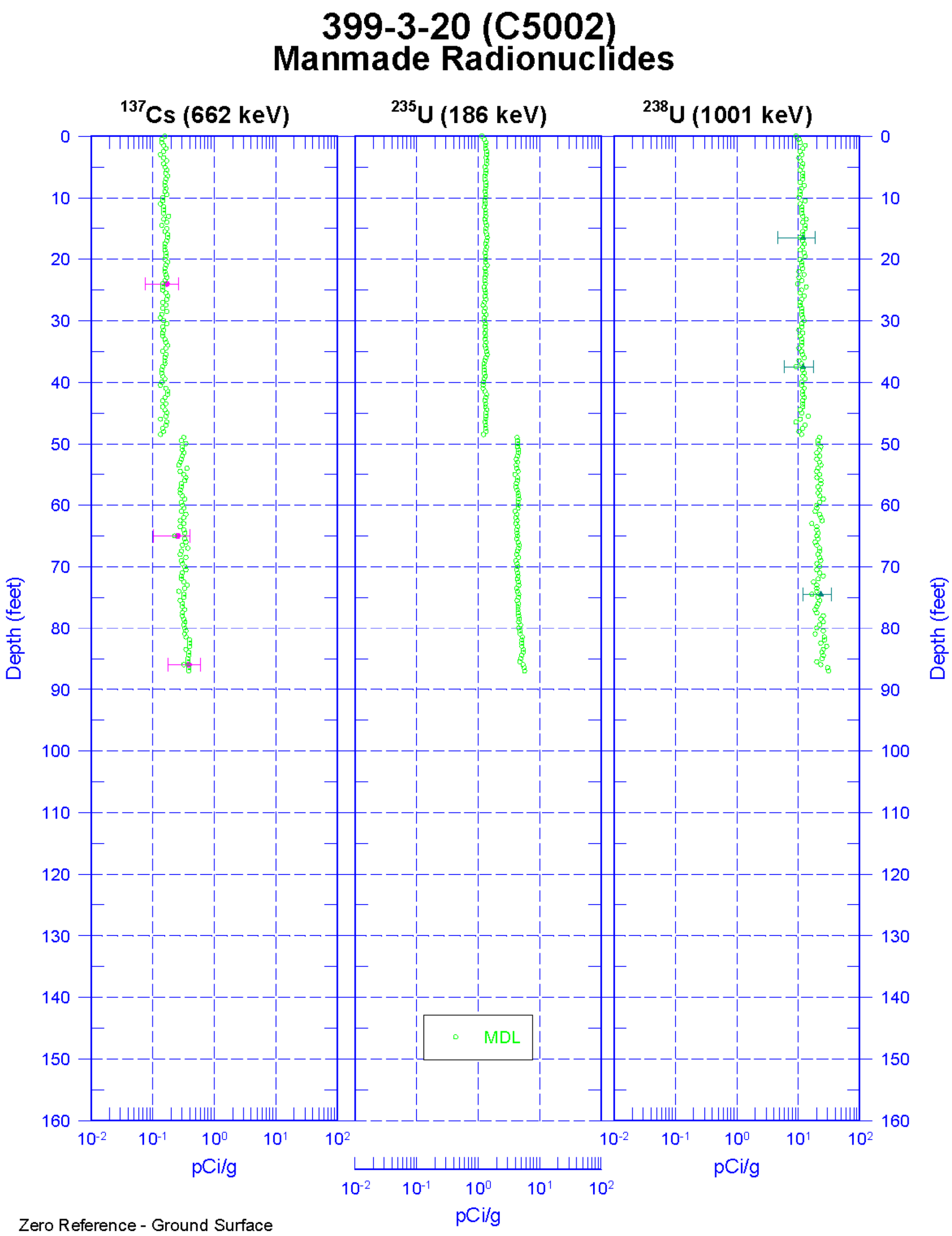
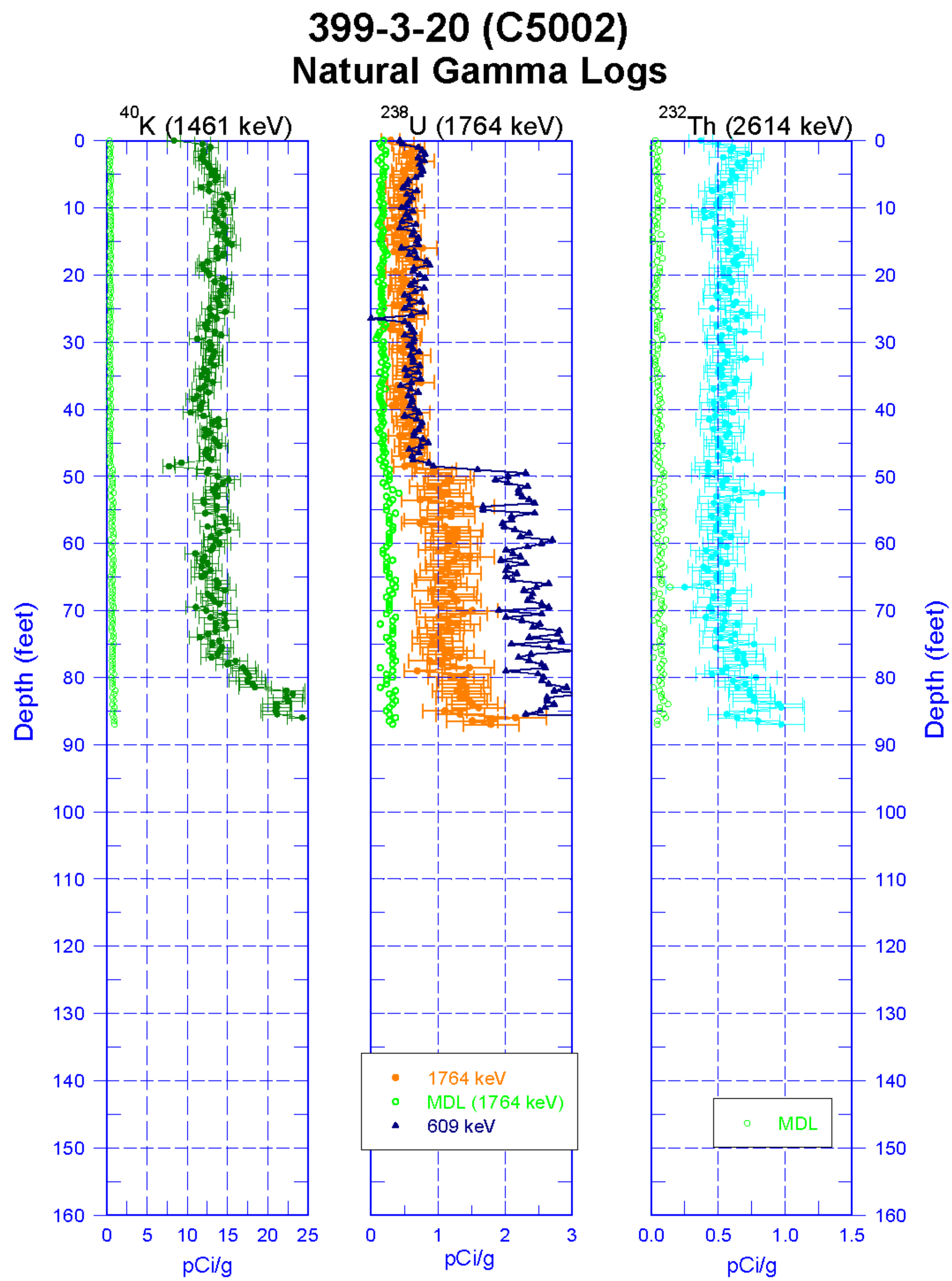
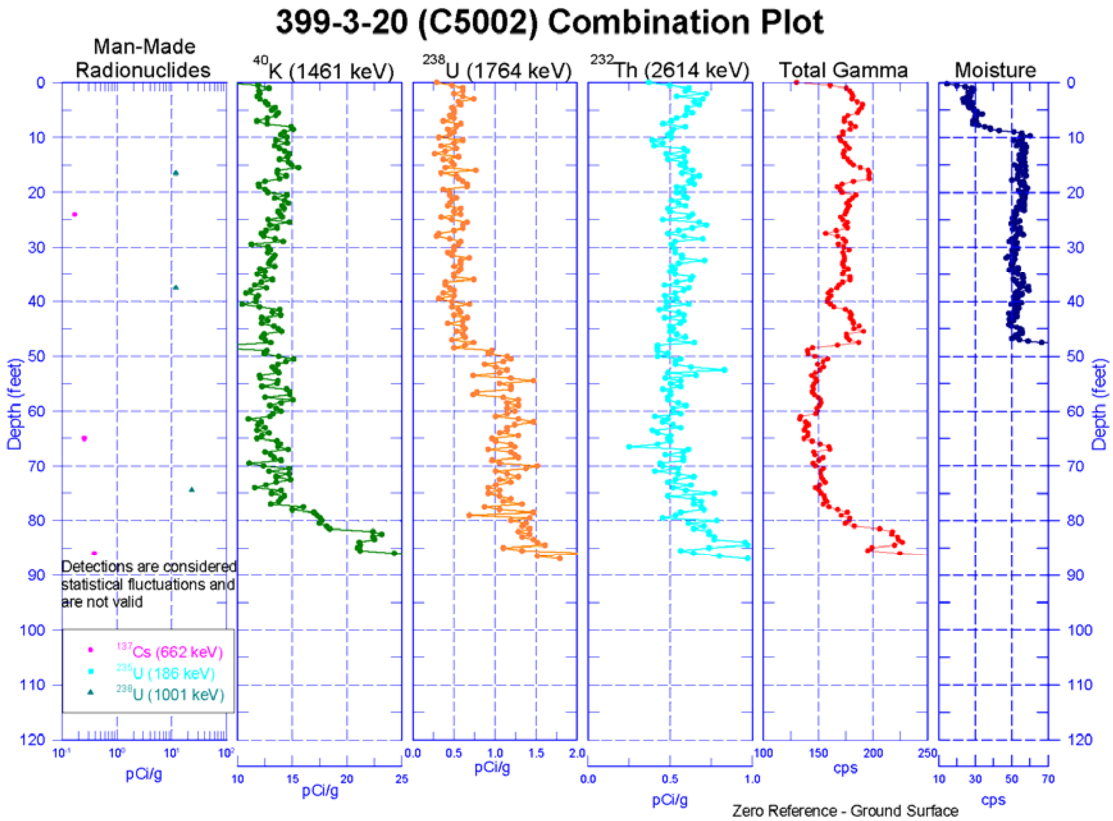
[1] GWL – groundwater level
[2] N/A – not applicable


399-3-20 (C5002)
Manmade Radionuclides
137Cs (662 keV)
235U (186 keV)
238U (1001 keV)
Depth (feet)
pCi/g
MDL
Zero Reference - Ground Surface

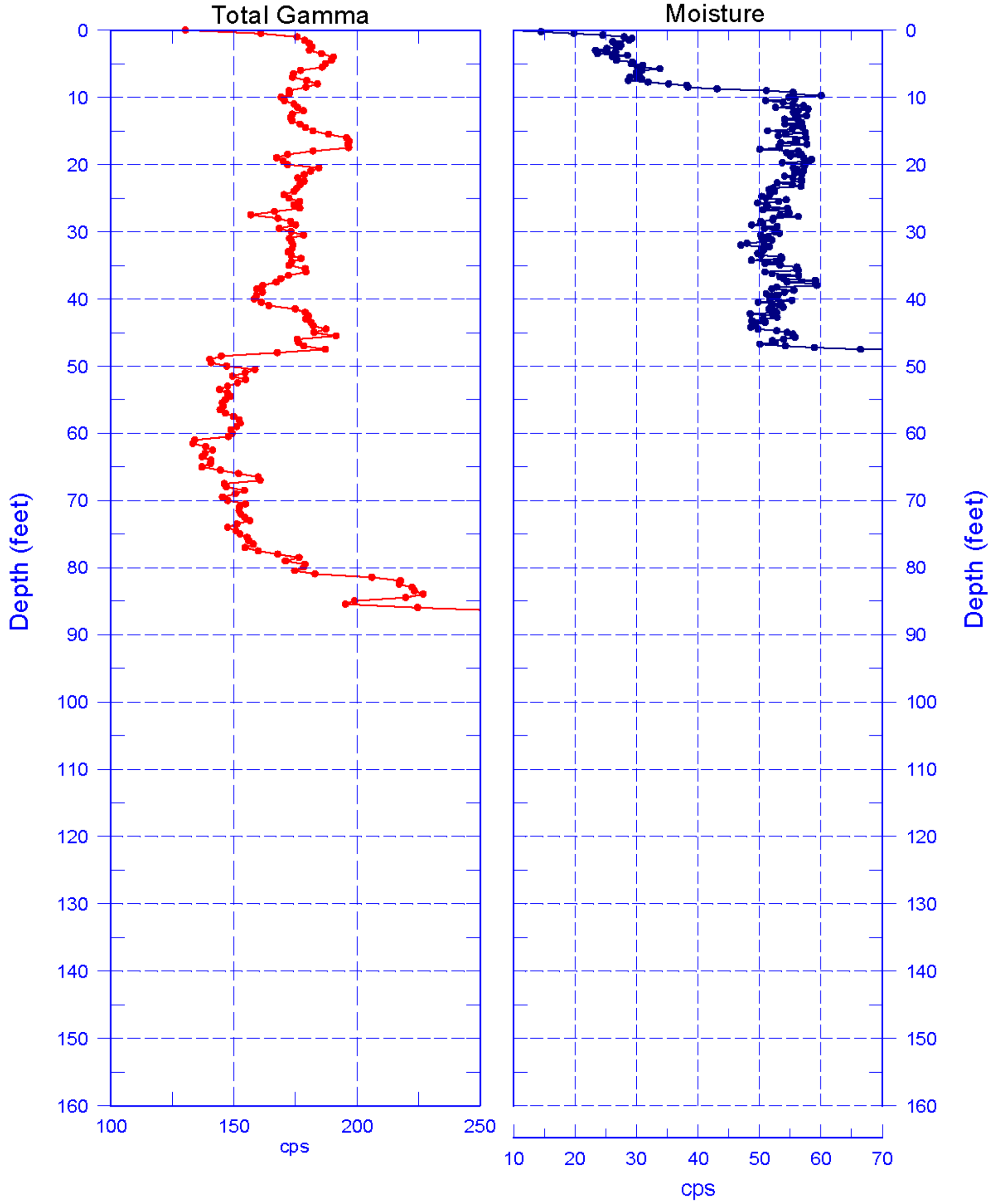


Zero Reference - Ground Surface

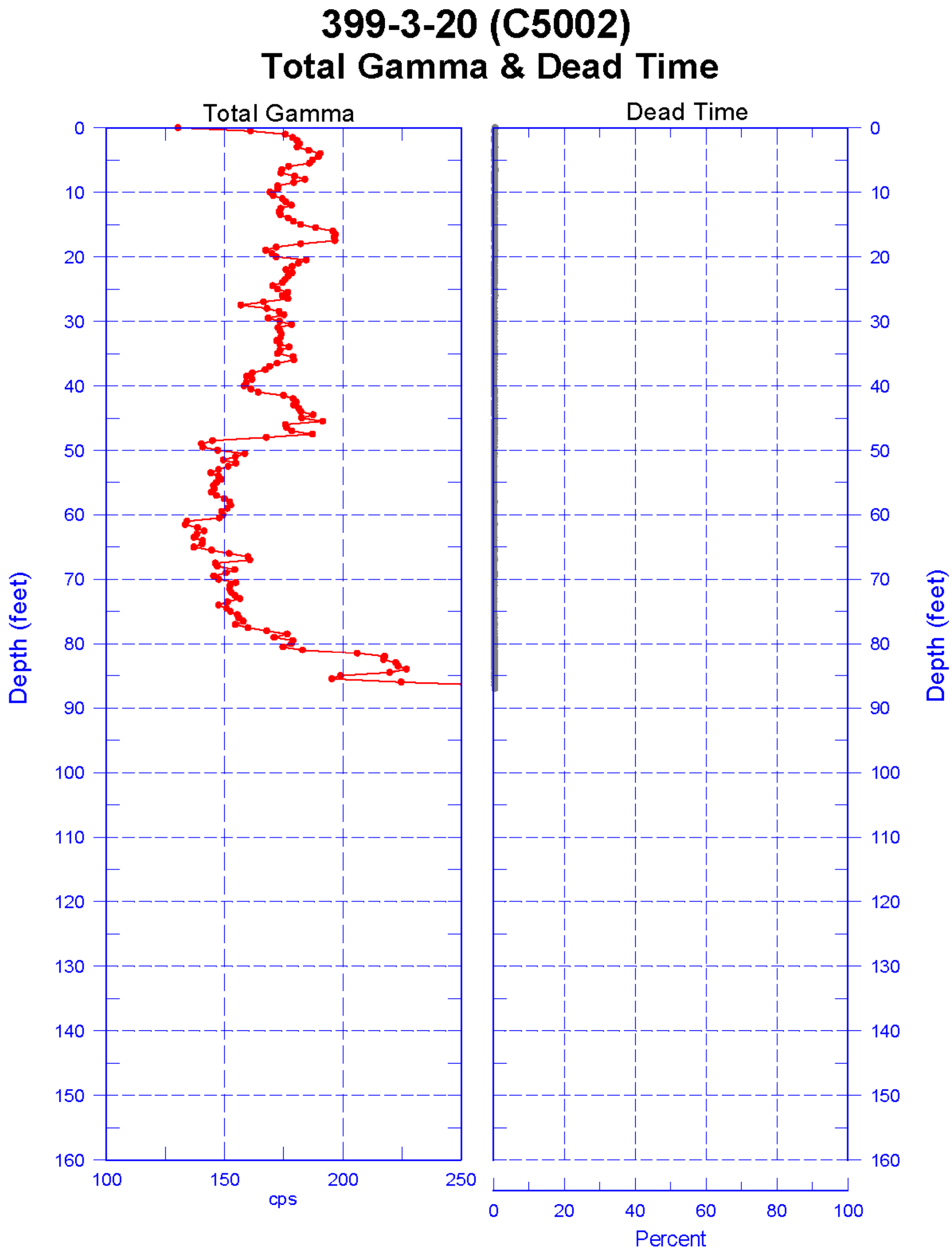


399-3-20 (C5002) Combination Plot
Man-Made Radionuclides
40K (1461 keV)
238U (1764 keV)
232Th (2614 keV)
Total Gamma
Moisture
Depth (feet)
Detections are considered statistical fluctuations and are not valid
137Cs (662 keV)
235U (186 keV)
238U (1001 keV)
pCi/g
cps
Zero Reference - Ground Surface

399-3-20 (C5002)
Total Gamma & Moisture

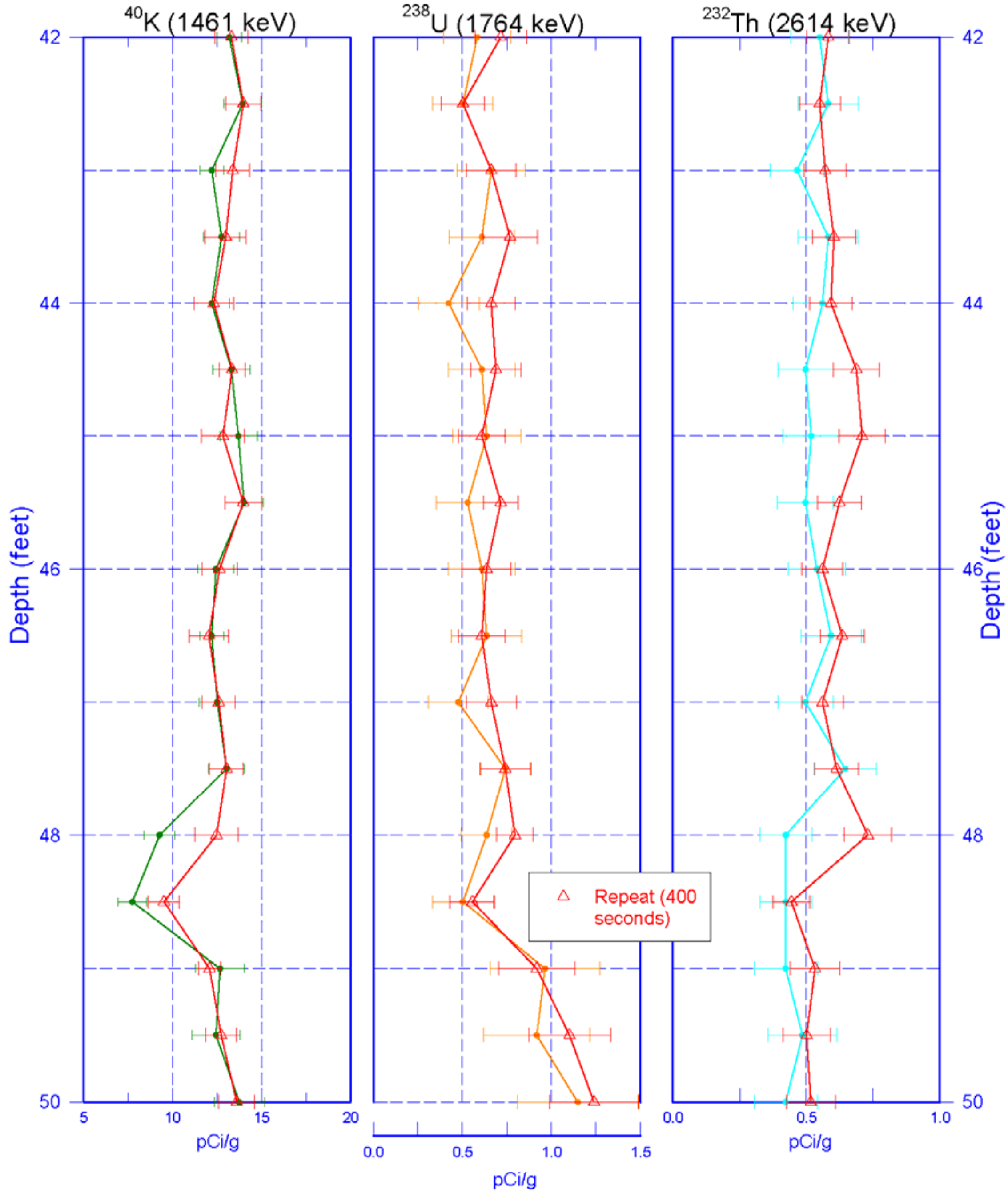


Reference - Ground Surface



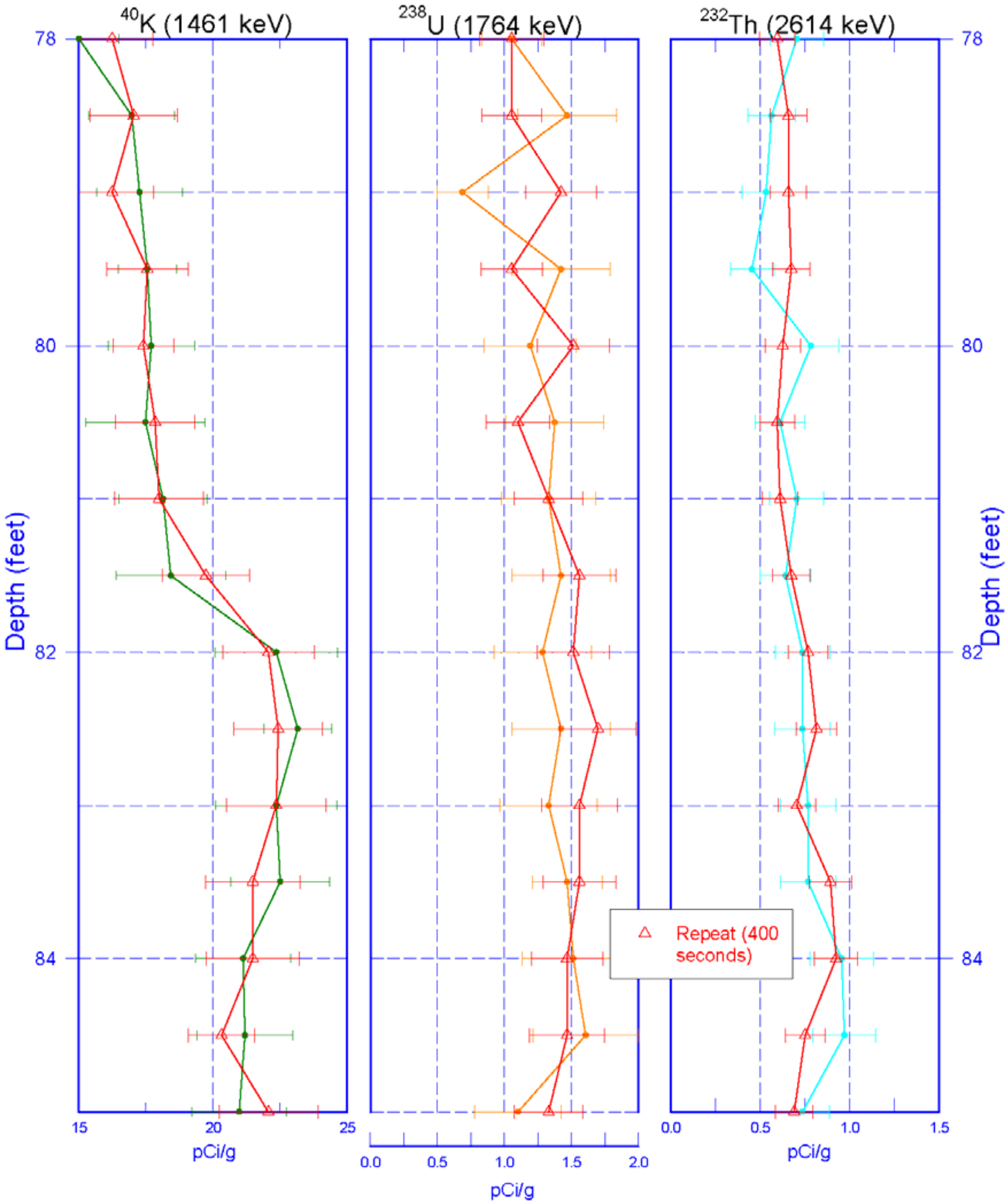
Reference - Ground Surface

399-3-20 (C5002)
Repeat Section of Natural Gamma Logs



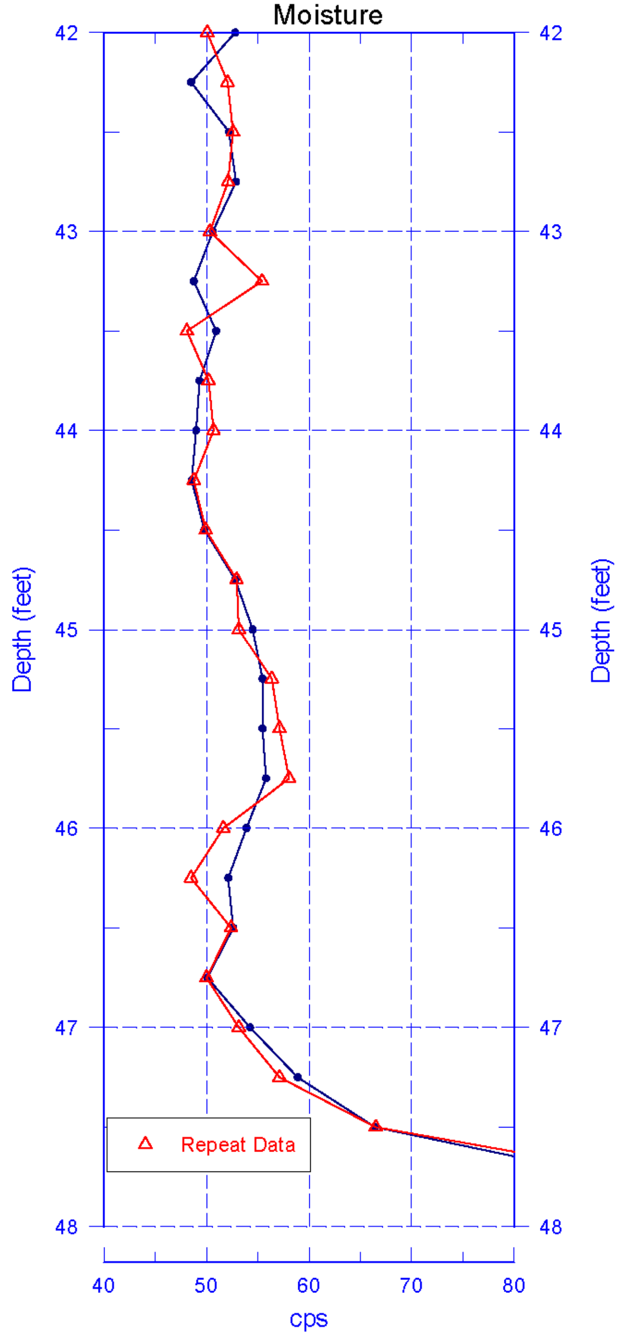
Zero Reference - Ground Surface

399-3-20 (C5002)
Repeat Section of Natural Gamma Logs



Zero Reference - Ground Surface

399-3-20 (C5002)
Moisture Repeat Section



Reference - Ground Surface

Appendix D

Laboratory Results of Groundwater and Sediment Analysis from Wells 399-1-23, 399-3-18, 399-3-19, and 399-3-20

Appendix D

Laboratory Results of Groundwater and Sediment Analysis from Wells 399-1-23, 399-3-18, 399-3-19, and 399-3-20

Table D.1. pH, Alkalinity, and Electrical Conductivity of Groundwater, Water Extracts, and Pore Water After Centrifugation from 399-3-18 (C4999), 399-1-23 (C5000), 399-3-19 (C5001), and 399-3-20 (C5002) (NA indicates "Not Analyzed" because of not enough sample volume)

Well	Sample ID	Depth (ft bgs)	pH	Electrical Conductivity (mS/cm)	Alkalinity (mg/L as $CaCO_3$)
C4999	***Groundwater (T=21.7±0.1ºC)***				
	B1FR92	47.9	7.95	0.351	107.3
	B1FRB4	52.5	7.96	0.234	81.06
	B1FR88	68.0	8.00	0.179	76.43
	B1FRB8	77.0	8.06	0.199	84.15
	B1FR84	87.5	8.13	0.249	117.3
	B1FR96	99.5	8.20	0.275	139.0
	B1FR80	108.0	8.18	0.275	142.0
	B1FR32	120.8	8.04	0.281	140.5
	Water Extracts (Alkalinity and EC Values Were Dilution Corrected. T=23.2±0.4ºC)				
	C4999-3B	9.00	7.70	12.72	584.5
	C4999-5D	18.0	7.74	5.170	1370.0
	C4999-6A	20.0	7.99	11.90	1308.0
	C4999-6D	23.0	7.73	2.801	710.6
	C4999-8E	28.5	7.77	9.609	1849.0
	C4999-9B	30.5	7.56	3.126	869.8
	C4999-10C	35.5	7.74	2.860	660.5
	C4999-11B	39.5	7.85	4.560	1164.0
	C4999-11D	41.5	7.44	0.877	NA
	C4999-12C	46.0	7.55	1.224	425.9
	C4999-12D	47.0	7.33	0.353	66.48
	C4999-13E	53.0	7.56	0.318	103.7
	C4999-14D	56.0	7.12	1.014	51.44
	C4999-15B	59.0	7.18	0.892	52.60
	C4999-16A	62.0	7.52	0.598	60.97
	C4999-17A	66.0	7.20	0.482	42.19
	C4999-19B	76.0	7.34	1.354	73.78
	C4999-21C	86.0	7.39	1.851	59.99
	C4999-22E	90.5	7.44	2.255	154.1
	C4999-25A	98.5	7.29	2.172	140.4
	C4999-27B	108.0	7.30	2.385	285.2
	C4999-29D	118.0	7.12	2.644	181.5
	C4999-31C	125.0	7.36	1.957	313.4
	C4999-32B	129.0	7.50	0.349	74.56

Table D.1. (contd)

Well	Sample ID	Depth (ft bgs)	pH	Electrical Conductivity (mS/cm)	Alkalinity (mg/L as $CaCO_3$)
C5000	***Pore Water After Ultracentrifugation (T=22.5±0.2ºC)***				
	C4999-12D	47.0	8.84	0.399	120.8
	C4999-14D	56.0	7.22	1.050	23.56
	C4999-16A	62.0	7.61	0.582	34.96
	C4999-31C	125.0	8.04	0.267	96.50
	C4999-31E	127.0	8.10	0.617	72.20
	Groundwater (T=21.9±0.1ºC)				
	B1FR36	33.8	7.84	0.451	171.4
	B1FR40	37.5	7.57	0.424	139.7
	B1FR44	43.3	7.56	0.457	139.7
	B1FR48	47.8	7.83	0.466	139.0
	B1FR52	54.3	8.13	0.405	112.7
	B1FR56	59.3	8.02	0.395	104.2
	B1FR60	68.5	8.04	0.304	94.18
	B1FR64	79.5	8.10	0.326	142.0
	B1FR68	90.3	8.13	0.318	140.5
	B1FR72	107.8	8.10	0.327	162.1
	B1FR32	120.8	8.04	0.281	140.5
C5000	***Water Extracts (Alkalinity and EC Values Were Dilution Corrected. T=21.8±0.2ºC)***				
	C5000-36A	11.0	7.49	2.95	992.8
	C5000-36E	12.0	7.58	5.49	1861.0
	C5000-37A	13.0	7.47	4.50	1313.0
	C5000-38B	20.0	7.62	4.54	1479.0
	C5000-38C	21.0	7.62	2.39	993.7
	C5000-39B	23.0	7.82	1.53	613.6
	C5000-39D	25.0	7.92	1.32	508.8
	C5000-40A	30.0	7.84	1.48	600.9
	C5000-40B	31.0	7.80	4.02	1756.0
	C5000-40C	32.0	7.80	1.73	406.9
	C5000-40E	34.0	7.52	6.38	1962.0
	C5000-41B	35.0	7.69	2.76	1007.0
	C5000-41C	36.0	7.40	1.05	406.9
	C5000-41E	38.0	7.30	1.21	409.1
	C5000-43A	44.0	7.54	1.85	762.7
	C5000-44B	48.0	7.65	1.34	499.3
	C5000-44E	50.0	7.54	1.33	438.5
	C5000-45C	54.0	7.52	1.32	309.2
	C5000-46A	56.0	7.43	1.32	320.4
	C5000-46D	59.0	7.27	1.05	185.6
	C5000-48D	65.0	7.20	0.81	128.9
	C5000-48E	66.0	7.19	0.59	91.24
	C5000-49D	68.0	7.50	1.87	415.3
	C5000-50B	71.0	7.64	2.11	538.2
	C5000-51E	77.0	7.59	1.00	315.5
	C5000-52B	79.0	7.61	0.99	280.3
	C5000-53E	85.0	7.62	0.95	164.8
	C5000-54E	89.5	7.54	1.29	382.9

Table D.1. (contd)

Well	Sample ID	Depth (ft bgs)	pH	Electrical Conductivity (mS/cm)	Alkalinity (mg/L as $CaCO_3$)
C5000 (contd)	C5000-57D	100.0	7.39	1.11	366.2
	C5000-60E	109.5	7.49	0.93	243.7
	Pore Water After Ultracentrifugation (T=22.2±0.1ºC)				
	C5000-43B	45.0	7.66	0.44	162.1
	C5000-44C	49.0	7.62	NA	162.1
	C5000-45C	54.0	7.99	NA	119.7
	C5000-48B	62.5	7.72	NA	247.0
	C5000-49A	67.0	8.45	NA	154.4
	C5000-49D	68.0	8.01	0.44	223.9
	C5000-52B	79.0	8.26	NA	223.9
	C5000-54A	85.0	8.29	NA	324.2
	C5000-53E	86.0	9.04	NA	193.0
	C5000-55D	90.5	8.36	NA	223.9
	C5000-58C	103.0	8.36	NA	NA
	C5000-60C	107.5	9.01	0.34	193.0
C5001	***Groundwater (T=22.0±0.1ºC)***				
	B1HRX0	53	7.78	0.40	124.3
	B1HRX4	57.8	7.79	0.38	126.6
	B1HRX8	63.0	7.97	0.41	126.6
	B1HRY2	81.5	7.98	0.42	128.9
	B1HRY6	101.8	7.89	0.32	127.4
	Water Extracts (Alkalinity and EC values Were Dilution Corrected. T=22.5±0.1ºC)				
	C5001-64E	15.0	7.76	1.82	834.6
	C5001-68A	28.0	7.86	4.18	1584.4
	C5001-69C	33.0	7.74	2.05	804.3
	C5001-70D	39.5	7.28	1.94	763.8
	C5001-71E	41.5	7.60	2.64	1161.0
	C5001-76C	64.5	7.31	1.43	624.6
	C5001-78A	74.5	7.36	1.81	778.3
C5002	***Groundwater (T=22.2±0.1ºC)***				
	B1HT04	52.3	7.97	0.44	132.8
	B1HT08	61.5	7.85	0.43	128.2
	B1HT12	72.5	7.95	0.45	133.6
	B1HT16	91.0	8.10	0.28	125.8
	Water Extracts (Alkalinity and EC Values Were Dilution Corrected. T=22.6±0.1ºC)				
	C5002-84C	16.0	7.50	4.83	1901.0
	C5002-87D	24.5	7.78	3.72	1498.0
	C5002-90A	32.5	7.67	4.84	1680.0
	C5002-90C	34.5	7.60	2.43	915.5
	C5002-91D	40.5	7.40	2.13	669.4

Table D.2. Uranium Concentration Data from GEA, WE, AE, and MD for Sediments in 399-3-18 (C4999), 399-1-23 (C5000), 399-3-19 (C5001), and 399-3-20 (C5002)

Wells	Sample ID	Depth (ft bgs)	GEA (U-238 at 609) (pCi/g)	WE (pCi/g)	AE (pCi/g)	MD (pCi/g)
C4999 (399-3-18)	C4999-2B	5.7	5.43E-01			
	C4999-3B	9.0		1.98E-02	1.07E+00	9.56E-01
	C4999-3C	10.5	6.54E-01			
	C4999-5A	15.5	8.20E-01			
	C4999-5B	16.00	4.72E-01			
	C4999-5C	17.00	5.74E-01			
	C4999-5D	18.00	4.35E-01	7.16E-04		5.39E-01
	C4999-6A	20.00	6.28E-01	9.72E-03	3.64E-01	
	C4999-6B	21.00	5.32E-01			
	C4999-6C	22.00	4.74E-01			
	C4999-6D	23.00	5.33E-01	1.23E-03		7.09E-01
	C4999-6E	24.00	4.29E-01			
	C4999-7A	25.00	5.29E-01			
	C4999-8B	27.00	4.88E-01			
	C4999-8E	28.50	4.66E-01	1.30E-03	2.23E-01	
	C4999-9A	29.50	4.87E-01			
	C4999-9B	30.50	4.75E-01	4.69E-03		8.45E-01
	C4999-9C	31.50	4.36E-01	4.98E-04		1.23E+00
	C4999-10A	33.50	4.23E-01	4.14E-04		
	C4999-10B	34.50	4.58E-01	3.10E-04		
	C4999-10C	35.50	5.01E-01	1.72E-03	3.93E-01	1.04E+00
	C4999-10D	36.50	6.54E-01	3.70E-03		1.20E+00
	C4999-11A	38.50	4.40E-01	6.49E-03		
	C4999-11B	39.50	5.19E-01	1.61E-03	4.97E-01	8.23E-01
	C4999-11D	41.50	5.33E-01	1.71E-03	1.91E+00	3.54E+00
	C4999-12A	44.00	4.70E-01			
	C4999-12B	45.00	5.30E-01			
	C4999-12C	46.00	4.58E-01	1.01E-02		2.18E+00
	C4999-12D	47.00	1.18E+00	1.59E-04	6.88E-01	9.07E-01
	C4999-12E	48.15	1.20E+00			
	C4999-13B	50.00	1.34E+00			
	C4999-13D	52.00	1.39E+00			
	C4999-13E	53.00	1.32E+00	3.36E-04	8.77E-01	
	C4999-14B	55.00	1.32E+00			
	C4999-14D	56.00	1.34E+00	6.70E-05	7.17E-01	
	C4999-14E	57.00	1.14E+00			
	C4999-15A	58.00	1.24E+00			1.19E+00
	C4999-15B	59.00	4.04E+00	4.66E-05	2.78E+00	
	C4999-15D	60.00	1.08E+00			
	C4999-16A	62.00	1.17E+00	6.03E-05	5.26E-01	
	C4999-16B	63.00	1.21E+00			
	C4999-16C	64.00	1.77E+00			
	C4999-16D	65.00	3.60E+00			
	C4999-17A	66.00	1.57E+00	3.22E-05	9.80E-01	
	C4999-17B	67.00	1.77E+00			3.06E+00

Table D.2. (contd)

Wells	Sample ID	Depth (ft bgs)	GEA(U-238 at 609) (pCi/g)	WE (pCi/g)	AE (pCi/g)	MD (pCi/g)
C4999 (399-3-18) (contd)	C4999-17C	68.00	2.23E+00			
	C4999-17D	69.00	1.95E+00			
	C4999-17E	70.00	1.56E+00			
	C4999-18B	71.00	1.82E+00			
	C4999-18C	72.00	1.44E+00			
	C4999-18E	74.00	1.49E+00			
	C4999-19A	75.00	1.25E+00			
	C4999-19B	76.00	1.00E+00	1.37E-03	3.97E-01	
	C4999-19E	79.00	7.28E-01			
	C4999-21C	86.00	9.79E-01	6.59E-04	4.18E-01	6.81E-01
	C4999-22E	90.50	9.31E-01	4.72E-04	6.42E-01	9.08E-01
	C4999-24E	97.50	5.87E-01			
	C4999-25A	98.50		7.72E-04	2.52E-01	
	C4999-25B	99.50				6.42E-01
	C4999-25D	101.00	8.43E-01			
	C4999-26C	105.00	9.23E-01			
	C4999-27B	108.00	7.50E-01	1.43E-04	1.32E-01	5.28E-01
	C4999-29D	118.00		2.29E-05	2.01E-01	
	C4999-31C	125.00		5.34E-04	3.80E-01	
	C4999-31E	127.00				1.19E+00
	C4999-32B	129.00		5.79E-05	6.50E-01	
C5000 (399-1-23)	C5000-32D	0.50	5.31E-01			
	C5000-32E	1.50	6.26E-01			
	C5000-33A	2.25	5.44E-01			
	C5000-33B	2.25	5.64E-01			
	C5000-33C	3.00	5.54E-01			
	C5000-33D	4.00	5.48E-01			
	C5000-34B	5.00	4.74E-01			
	C5000-34C	6.00	4.64E-01			
	C5000-34D	7.00	4.48E-01			
	C5000-34E	8.00	4.21E-01			
	C5000-35B	7.00	4.74E-01			
	C5000-35C	8.00	4.70E-01			
	C5000-35D	9.00	4.65E-01			
	C5000-36A	11.00	8.19E-01	1.04E-03	2.57E-01	6.45E-01
	C5000-36E	12.00	4.12E-01	1.15E-03	2.25E-01	6.96E-01
	C5000-37A	13.00	4.31E-01	1.09E-03	2.14E-01	6.34E-01
	C5000-38B	20.00	4.71E-01	1.26E-03	2.40E-01	1.12E+00
	C5000-38C	21.00	5.13E-01	3.72E-02	3.60E-01	2.24E+00
	C5000-39B	23.00	4.86E-01	7.56E-03	3.79E-01	5.03E+00
	C5000-39D	25.00	5.21E-01	4.11E-02	9.36E-01	1.48E+00
	C5000-40A	30.00	4.90E-01	1.15E-03		2.31E+00
	C5000-40B	31.00	4.87E-01	1.09E-03		8.33E-01
	C5000-40C	32.00	4.83E-01	2.28E-02	7.47E-01	1.19E+00
	C5000-40E	34.00	3.07E-01	1.78E-03	2.59E-01	3.80E-01
	C5000-41B	35.00	4.19E-01	5.22E-03	4.72E-01	9.99E-01
	C5000-41C	36		1.23E-03		1.05E+00

Table D.2. (contd)

Wells	Sample ID	Depth (ft bgs)	GEA(U-238 at 609) (pCi/g)	WE (pCi/g)	AE (pCi/g)	MD (pCi/g)
C5000 (399-1-23) (contd)	C5000-41E	38.00	4.29E-01	1.60E-04	3.82E-01	1.18E+00
	C5000-43A	44.00	4.17E-01	1.44E-03	3.47E-01	8.90E-01
	C5000-44B	48.00	5.14E-01	9.70E-04	2.59E-01	
	C5000-44E	50.00	7.05E-01	1.16E-03	4.17E-01	1.19E+00
	C5000-45B	53.00	7.28E-01			1.15E+00
	C5000-45C	54.00	7.01E-01	1.94E-03	6.19E-01	1.47E+00
	C5000-45D	55.00	5.97E-01			1.23E+00
	C5000-46A	56.00	7.35E-01	4.24E-03	5.82E-01	
	C5000-46D	59.00	8.73E-01	4.29E-04	1.52E-01	4.64E-01
	C5000-47C	61.50	7.03E-01			5.91E-01
	C5000-48D	65.00	1.25E+00	5.98E-04	3.14E-01	
	C5000-48E	66.00	6.14E-01	5.11E-04	1.64E-01	7.02E-01
	C5000-49D	68.00	8.95E-01	5.82E-04	3.01E-01	
	C5000-50B	71.00	9.64E-01	7.02E-04	2.68E-01	8.83E-01
	C5000-51E	77.00	9.14E-01	7.76E-04	2.31E-01	5.05E-01
	C5000-52B	79.00	9.02E-01	6.31E-04	3.16E-01	
	C5000-53E	85.00	7.94E-01	3.66E-04	3.09E-01	
	C5000-54E	89.50	1.04E+00	1.77E-03	6.87E-01	
	C5000-57D	100.00	8.49E-01	3.61E-04	2.01E-01	
	C5000-60E	109.50	9.12E-01	5.05E-04	1.62E-01	
C5001 (399-3-19)	C5001-62A	3.0	5.32E-01			
	C5001-62C	4.0	5.36E-01			
	C5001-63B	7.0	5.48E-01			
	C5001-63C	8.0		4.12E-05	1.93E-01	5.14E-01
	C5001-63D	9.0	6.08E-01			
	C5001-64C	13.0	3.77E-01			
	C5001-64E	15.0	4.32E-01	1.80E-03		4.42E-01
	C5001-65D	19.0	3.85E-01			
	C5001-66A	21.0	4.32E-01	3.03E-04	1.34E-01	3.99E-01
	C5001-67B	24.5	4.77E-01			
	C5001-68A	28.0	5.28E-01	2.91E-04		
	C5001-68B	29.0		2.12E-04	1.35E-01	4.31E-01
	C5001-69C	33.0	4.63E-01	2.99E-04		4.81E-01
	C5001-69D	34.0	5.70E-01	2.05E-04	1.42E-01	4.84E-01
	C5001-70C	38.5				4.89E-01
	C5001-70D	39.5	5.60E-01	2.92E-04		5.71E-01
	C5001-70E	40.5		2.31E-04	1.35E-01	4.43E-01
	C5001-71E	41.5	4.58E-01	5.54E-04		5.03E-01
	C5001-73B	49.8	4.98E-01	2.91E-03	1.99E-01	4.96E-01
	C5001-74B	53.5		9.77E-04	1.96E-01	4.60E-01
	C5001-76C	64.5	4.50E-01	5.00E-04		4.94E-01
	C5001-76D	65.5		4.93E-04	1.74E-01	5.38E-01
	C5001-78A	74.5	4.35E-01	4.72E-04		5.25E-01
	C5001-79A	81.5		6.62E-04	3.57E-01	8.62E-01
	C5001-79B	82.5	7.50E-01			
	C5501-79D	83.5	5.51E-01			
	C5001-80A	85.5	8.84E-01	5.99E-05	4.49E-01	9.16E-01

Table D.2. (contd)

Wells	Sample ID	Depth (ft bgs)	GEA(U-238 at 609) (pCi/g)	WE (pCi/g)	AE (pCi/g)	MD (pCi/g)
C5002 (399-3-20)	C5002-81E	4.0	5.66E-01			
	C5002-82A	5.0	5.33E-01			
	C5002-83A	10.5	4.28E-01			
	C5002-83B	11.5	2.76E-01	1.17E-03	1.39E-01	2.93E-01
	C5002-84A	14.0	3.93E-01			
	C5002-84C	16.0	3.77E-01	6.17E-04		3.70E-01
	C5002-85D	17.0	6.71E-01			
	C5002-86C	19.5	4.72E-01			
	C5002-86E	21.5	4.72E-01	1.58E-04	2.26E-01	5.47E-01
	C5002-87C	23.5	3.92E-01			
	C5002-87D	24.5	4.51E-01	2.00E-04		4.97E-01
	C5002-87E	25.5	4.32E-01			
	C5002-89A	28.5	4.51E-01			
	C5002-90A	32.5	4.73E-01	3.07E-04		5.87E-01
	C5002-90B	33.5	5.01E-01			
	C5002-90C	34.5	5.75E-01	7.87E-05		5.78E-01
	C5002-91B	38.5	5.10E-01			
	C5002-91C	39.5		7.11E-05	1.56E-01	4.70E-01
	C5002-91D	40.5	4.84E-01	1.14E-04		4.91E-01
	C5002-92D	48.5	5.03E-01	4.13E-04	1.74E-01	4.67E-01
	C5002-93E	54.0	4.61E-01	6.76E-04	2.47E-01	6.48E-01
	C5002-94D	65.5		7.22E-05	1.46E-01	5.66E-01
	C5002-94E	66.5	4.93E-01			
	C5002-98D	81.0	5.15E-01			
	C5002-98E	81.1		1.07E-04	1.44E-01	4.02E-01
	C5002-99D	82.0		3.84E-05	3.64E-01	7.99E-01
	C5002-100A	84.0		6.59E-06	3.42E-01	7.11E-01

Table D.3. IC Anion Analysis Results for 300-FF5 Samples

Well	Sample ID	Depth (ft bgs)	F^- (mg/L)	Cl- (mg/L)	NO_2^- (mg/L)	Br^- (mg/L)	NO_3- (mg/L)	SO_4^{2-} (mg/L)	PO_4^{3-} (mg/L)
C4999	***Groundwater***								
	B1FR76	45.3	0.44	11.17	<0.397	<0.388	13.02	38.57	0.97
	B1FR92	47.9	0.39	16.75	<0.397	<0.388	21.26	34.63	<0.860
	B1FRB4	52.5	0.18	5.58	<0.397	<0.388	4.82	25.15	<0.860
	B1FR88	68.0	0.27	0.86	<0.397	<0.388	<0.430	13.06	<0.860
	B1FRB8	77.0	0.33	1.34	<0.397	<0.388	<0.430	9.40	<0.860
	B1FR84	87.5	0.41	3.51	<0.397	<0.388	<0.430	<0.734	<0.860
	B1FR96	99.5	0.42	5.95	<0.397	<0.388	<0.430	<0.734	<0.860
	B1FR80	108.0	0.43	6.21	<0.397	<0.388	<0.430	<0.734	<0.860
	B1FR32	120.80	0.47	8.06	<0.397	<0.388	<0.430	<0.734	<0.860
	Water Extracts (Concentration Values Were Dilution Corrected)								
	C4999-3B	9.0	4.39	29.07	<3.099	<3.029	4463.2	3252.5	<6.713
	C4999-6A	20.0	8.04	42.13	<4.911	<4.800	2952.5	2698.5	<10.64
	C4999-8E	28.5	29.40	245.95	<11.60	<11.33	865.11	1469.3	<25.12
	C4999-10C	35.5	17.40	81.11	<4.852	<4.742	108.84	429.32	<10.51
	C4999-11B	39.5	39.39	245.32	<7.481	<7.311	8.20	527.29	<16.21
	C4999-11D	41.5	11.08	11.26	<4.094	<4.001	16.44	77.32	<8.868
	C4999-12D	47.0	1.23	14.03	<1.179	<1.152	18.83	42.11	<2.554
	C4999-13E	53.0	0.40	4.92	<1.159	<1.133	2.44	26.40	<2.512
	C4999-14D	56.0	0.71	2.87	<1.150	<1.124	<1.246	375.62	<2.492
	C4999-15B	59.0	0.89	2.68	<1.176	<1.149	<1.274	304.76	<2.548
	C4999-16A	62.0	1.00	1.92	<1.206	<1.178	<1.306	177.61	<2.612
	C4999-17A	66.0	0.96	1.06	<1.276	<1.247	<1.382	121.52	<2.765
	C4999-19B	76.0	0.86	2.38	<1.265	<1.236	<1.370	512.93	<2.740
	C4999-21C	86.0	2.58	8.73	<1.928	<1.885	<2.089	572.40	<4.177
	C4999-22E	90.5	3.59	8.59	<2.641	<2.581	<2.861	750.28	<5.722
	C4999-25A	98.5	2.97	7.51	<3.799	<3.713	<4.115	629.86	<8.230
	C4999-27B	108.0	2.33	9.29	<4.190	<4.095	<4.538	738.22	<9.077
	C4999-29D	118.0	4.00	12.56	<5.832	<5.700	<6.317	677.87	<12.64
	C4999-31C	125.0	3.18	6.26	<4.132	<4.039	<4.476	399.24	<8.952
	C4999-32B	129.0	3.20	6.69	<0.871	<0.852	1.28	67.54	<1.888
	Pore Water After Ultracentrifugation								
	C4999-31C	125.0	<1.49	9.00	<3.97	<3.88	<4.30	9.53	<8.60
C5000	***Groundwater***								
	B1FR36	33.8	0.44	19.98	<0.397	<0.388	26.86	61.51	<0.860
	B1FR40	38.5	0.31	19.39	<0.397	<0.388	26.48	60.08	<0.860
	B1FR44	43.3	0.32	19.83	<0.397	<0.388	26.68	60.30	<0.860
	B1FR48	47.3	0.38	19.34	<0.397	<0.388	26.30	60.07	<0.860
	B1FR52	54.3	0.35	20.83	<0.397	<0.388	5.35	64.09	<0.860
	B1FR56	59.3	0.60	22.57	<0.397	<0.388	<0.430	62.18	<0.860
	B1FR60	68.5	1.40	26.69	<0.397	<0.388	<0.430	19.64	<0.860
	B1FR64	79.5	1.18	13.13	<0.397	<0.388	<0.430	8.17	<0.860
	B1FR68	90.3	1.02	10.26	<0.397	<0.388	<0.430	15.70	<0.860
	B1FR72	107.8	1.21	9.30	<0.397	<0.388	<0.430	3.49	<0.860
	Water Extracts (Concentration Values Were Dilution Corrected)								
	C5000-36A	11.0	28.35	25.68	<6.807	<6.653	51.04	208.95	<14.75
	C5000-36E	12.0	38.72	38.20	<10.18	<9.953	59.75	584.17	<22.06

Table D.3. (contd)

Well	Sample ID	Depth (ft bgs)	F^- (mg/L)	Cl- (mg/L)	NO_2^- (mg/L)	Br^- (mg/L)	NO_3- (mg/L)	SO_4^{2-} (mg/L)	PO_4^{3-} (mg/L)
	C5000-37A	13.0	26.13	15.01	<10.89	<10.64	47.61	643.79	<23.50
	C5000-38B	20.0	48.20	32.19	<8.741	<8.543	<9.467	491.14	<18.94
	C5000-38C	21.0	7.21	<6.365	<9.291	<9.080	33.37	51.74	<20.13
	C5000-39B	23.0	10.28	7.87	<2.869	<2.804	<3.107	100.85	<6.214
	C5000-39D	25.0	22.31	6.53	<2.875	<2.810	20.10	50.74	<6.228
	C5000-40C	32.0	27.16	9.52	<4.026	<3.935	17.93	83.19	<8.722
	C5000-40E	34.0	56.25	47.02	<17.10	<16.72	31.63	712.26	<37.05
	C5000-41B	35.0	19.65	34.46	<6.902	<6.745	<7.475	215.66	<14.95
	C5000-41E	38.0	8.57	19.89	<6.786	<6.632	<7.350	83.35	<14.70
	C5000-43A	44.0	15.08	20.14	<6.128	<5.989	<6.637	77.86	<13.28
	C5000-44B	48.0	5.49	22.55	<4.352	<4.253	<4.713	87.81	<9.427
	C5000-44E	50.0	5.87	28.65	<4.902	<4.791	<5.310	139.42	<10.62
	C5000-45C	54.0	7.08	31.15	<3.533	<3.453	<3.827	195.25	<7.654
	C5000-46A	56.0	4.03	20.03	<3.745	<3.660	<4.056	232.52	<8.112
	C5000-46D	59.0	3.17	17.72	<2.651	<2.591	<2.871	194.30	<5.742
	C5000-48D	65.0	2.43	13.42	<2.008	<1.962	<2.175	206.29	<4.350
	C5000-48E	66.0	2.70	22.19	<1.564	<1.528	<1.694	56.81	<3.388
	C5000-49D	68.0	5.27	21.21	<4.854	<4.744	<5.258	369.98	<10.52
	C5000-50B	71.0	14.37	28.85	<4.131	<4.037	<4.474	329.15	<8.949
	C5000-51E	77.0	4.09	9.67	<2.847	<2.782	<3.083	135.72	<6.167
	C5000-52B	79.0	4.86	8.62	<2.529	<2.471	<2.739	111.69	<5.478
	C5000-53E	85.0	2.89	6.78	<2.118	<2.070	<2.294	194.25	<4.589
	C5000-54E	89.5	4.11	7.94	<3.938	<3.849	<4.266	180.14	<8.531
	C5000-57D	100.0	6.47	9.19	<3.037	<2.968	<3.290	72.74	<6.579
	C5000-60E	109.5	4.42	8.54	<2.089	<2.042	<2.263	126.95	<4.525
	Pore water After Ultracentrifugation								
	C5000-43B	45.0	<1.49	18.95	<3.97	<3.88	19.13	64.00	<8.60
	C5000-44C	49.0	<1.49	19.11	<3.97	<3.88	8.93	60.24	<8.60
	C5000-44E	51.0	1.15	22.30	<3.97	<3.88	<4.30	76.75	<8.60
	C5000-45C	54.0	1.34	23.86	<3.97	<3.88	<4.30	79.41	<8.60
	C5000-48B	62.5	3.51	31.34	<3.97	<3.88	<4.30	51.81	<8.60
	C5000-49A	67.0	2.62	33.62	<3.97	<3.88	<4.30	30.39	<8.60
	C5000-49D	68.0	2.42	20.41	<3.97	<3.88	<4.30	15.65	<8.60
	C5000-52B	79.0	4.09	24.57	<3.97	<3.88	<4.30	16.81	<8.60
	C5000-54A	85.0	2.23	11.61	<3.97	<3.88	<4.30	23.22	<8.60
	C5000-53E	86.0	1.50	10.99	<3.97	<3.88	<4.30	24.98	<8.60
	C5000-55D	90.5	2.27	12.86	<3.97	<3.88	<4.30	27.26	<8.60
	C5000-58C	103.0	3.34	16.26	<3.97	<3.88	<4.30	17.27	<8.60
	C5000-60C	107.5	3.19	13.05	<3.97	<3.88	<4.30	11.23	<8.60
C5001	***Groundwater***								
C5001	B1HRX0	53.0	0.31	16.46	<0.097	0.09	23.02	36.93	<0.206
C5001	B1HRX4	57.8	0.31	16.52	<0.097	0.11	22.39	37.03	<0.206
C5001	B1HRX8	63.0	0.29	16.71	<0.097	0.09	23.31	38.40	<0.206
C5001	B1HRY2	81.5	0.35	17.65	<0.097	<0.072	23.53	39.33	<0.206
C5001	B1HRY6	101.8	<0.208	8.57	<0.097	<0.072	11.54	19.26	0.41

Table D.3. (contd)

Well	Sample ID	Depth (ft bgs)	F^- (mg/L)	Cl- (mg/L)	NO_2^- (mg/L)	Br^- (mg/L)	NO_3- (mg/L)	SO_4^{2-} (mg/L)	PO_4^{3-} (mg/L)
	Water Extracts								
	C5001-64E	15.0	11.94	4.77	<6.50	<6.93	<6.24	39.54	<7.28
	C5001-68A	28.0	29.87	30.08	<10.64	<11.35	<10.21	256.26	<11.91
	C5001-69C	33.0	6.92	4.37	<6.91	<7.37	<6.63	45.81	<7.74
	C5001-70D	39.5	7.67	<4.40	<8.26	<8.81	36.12	107.13	<9.25
	C5001-71E	41.5	10.78	6.02	<6.72	<7.16	<6.45	107.34	<7.52
	C5001-76C	64.5	8.70	16.66	<7.60	<8.11	<7.30	59.39	<8.51
	C5001-78A	74.5	8.13	16.29	<9.47	<10.10	<9.09	71.97	<10.61
C5002	***Groundwater***								
	B1HT04	52.3	0.35	17.73	<0.097	<0.072	23.70	49.78	0.23
	B1HT08	61.5	0.32	17.47	<0.097	0.09	22.21	49.02	0.24
	B1HT12	72.5	0.35	20.12	<0.097	0.10	22.32	50.76	<0.206
	B1HT16	91.0	0.51	6.94	<0.097	<0.072	<0.090	5.98	<0.206
	Water Extracts								
	C5002-84C	16.0	7.07	<11.15	<20.95	<22.35	138.77	210.96	<23.46
	C5002-87D	24.5	22.19	8.85	<10.06	<10.73	58.53	266.88	<11.26
	C5002-90A	32.5	22.27	18.56	<11.55	<12.31	<11.09	458.04	<12.93
	C5002-90C	34.5	14.81	<4.67	<8.77	<9.35	<8.42	195.26	<9.82
	C5002-91D	40.5	11.33	5.21	<7.82	<8.34	<7.51	294.47	<8.76

Table D.4. ICP-OEP for Cations Analysis of C4999 Samples

Sample ID	Depth (ft bgs)	Al (µg/L)	As (µg/L)	B (µg/L)	Ba (µg/L)	Be (µg/L)	Bi (µg/L)	Ca (µg/L)	Cd (µg/L)	Co (µg/L)	Cr (µg/L)	Cu (µg/L)	Fe (µg/L)	K (µg/L)
Groundwater														
B1FR99	42.5	4.0E+02	2.0E+03	8.5E+01	6.1E+01	5.5E-01	2.0E+02	5.0E+04	7.3E-01	3.3E+00	5.0E+01	8.5E+00	1.2E+01	4.2E+03
B1FR76	45.3	4.0E+02	9.9E+00	5.5E+01	4.6E+01	3.8E-01	2.0E+03	3.2E+04	1.0E+01	3.3E+00	2.0E+00	1.2E+01	4.3E+01	2.9E+03
B1FR92	47.9	4.0E+02	2.0E+03	9.4E+01	3.9E+01	9.3E-01	1.6E+01	4.0E+04	1.0E-02	5.7E+00	5.0E+01	1.0E+01	8.5E+00	6.3E+03
B1FRB4	52.5	4.0E+02	2.0E+03	9.5E+01	1.9E+01	1.7E+00	8.1E+00	2.6E+04	6.3E-01	5.0E+00	5.0E+01	1.8E+01	4.0E+01	4.4E+03
B1FR88	68.0	5.0E+01	2.0E+03	9.9E+01	1.0E+01	1.7E+00	1.5E+01	1.7E+04	1.1E-02	2.8E+00	5.0E+01	1.2E+01	5.8E+01	4.5E+03
B1FRB8	77.0	3.7E+01	2.0E+03	8.2E+01	1.1E+01	1.4E+00	2.0E+02	1.6E+04	1.5E-01	1.7E+00	5.0E+01	1.3E+01	4.3E+01	4.7E+03
B1FR84	87.5	2.6E+01	2.0E+03	7.7E+01	2.4E+01	9.1E-01	6.9E+00	2.0E+04	2.0E+01	3.6E+00	5.0E+01	1.2E+01	8.5E+01	4.9E+03
B1FR96	99.5	3.6E+01	2.0E+03	7.5E+01	3.5E+01	7.4E-01	2.0E+02	2.3E+04	2.0E+01	3.3E+00	5.0E+01	7.6E+00	1.6E+02	5.0E+03
B1FR80	108.0	6.5E+00	1.0E+02	4.0E+01	4.3E+01	3.2E-01	2.0E+03	2.3E+04	1.0E+01	1.0E+02	1.0E+01	1.1E+01	1.8E+02	5.0E+03
B1FR32	120.80	5.6E+00	2.9E+00	4.9E+01	3.3E+01	5.1E-01	1.3E+01	1.9E+04	1.0E+01	1.0E+02	1.0E+01	1.2E+01	1.0E+02	4.2E+03
Water Extracts (Concentration Values Were Dilution Corrected)														
C4999-3B	9.0	7.8E+02	6.5E+02	7.1E+04	3.5E+02	2.1E+01	3.9E+03	1.2E+06	3.9E+02	1.5E+02	3.8E+01	6.1E+02	1.2E+02	1.7E+05
C4999-5D	18.0	2.0E+02	1.1E+03	8.0E+02	1.7E+02	4.8E+01	4.5E+03	1.5E+05	1.7E+01	4.5E+02	1.5E+01	1.9E+02	1.9E+02	1.7E+05
C4999-6A	20.0	1.2E+03	3.7E+02	4.6E+04	6.8E+02	3.0E+01	5.4E+02	1.0E+06	6.2E+02	2.1E+02	4.4E+01	9.2E+02	4.4E+02	1.9E+05
C4999-6D	23.0	3.4E+01	5.0E+02	6.6E+02	1.1E+02	1.7E+01	9.4E+01	9.3E+04	1.2E+02	2.5E+02	3.1E+02	8.9E+01	4.3E+01	7.6E+04
C4999-8E	28.5	1.7E+03	6.2E+02	1.3E+04	8.8E+02	2.6E+02	7.6E+03	4.9E+05	5.8E+03	1.9E+03	3.2E+01	8.8E+03	1.7E+03	3.4E+05
C4999-9B	30.5	3.3E+02	3.0E+02	1.5E+03	3.6E+02	1.0E+02	9.9E+02	1.7E+05	2.8E+01	7.9E+01	5.7E+02	4.6E+02	2.9E+02	5.7E+04
C4999-10C	35.5	4.6E+02	1.1E+03	1.2E+03	2.4E+02	2.3E+01	7.6E+02	1.3E+05	6.1E+02	1.9E+02	1.2E+01	7.9E+02	1.6E+02	7.1E+04
C4999-11B	39.5	6.0E+02	1.1E+03	1.1E+03	3.4E+02	3.4E+01	1.9E+03	2.4E+05	9.4E+02	3.0E+02	6.2E+01	1.1E+03	1.9E+02	1.2E+05
C4999-11D	41.5	1.1E+03	1.9E+03	1.3E+03	1.2E+02	6.6E+01	2.7E+03	4.1E+04	2.1E+03	4.4E+02	1.1E+02	2.4E+03	2.3E+03	3.4E+04
C4999-12C	46.0	3.7E+02	8.9E+02	3.5E+02	1.6E+02	2.8E+01	3.9E+01	9.1E+04	1.4E+00	3.7E+00	3.1E+02	1.3E+02	1.3E+02	2.1E+04
C4999-12D	47.0	8.1E+01	3.1E+01	1.3E+02	2.9E+01	4.8E+00	2.5E+02	2.0E+04	1.5E+02	3.6E+01	7.9E+00	1.5E+02	9.4E+01	1.0E+04
C4999-13E	53.0	1.6E+02	2.4E+02	3.2E+02	1.5E+01	1.7E+01	1.1E+03	2.5E+04	5.8E+02	1.7E+02	4.9E+01	5.9E+02	1.1E+02	1.5E+04
C4999-14D	56.0	1.3E+02	3.0E+02	6.5E+02	1.0E+02	4.0E+01	9.2E+02	1.2E+05	6.0E+00	1.4E+02	6.8E+01	3.9E+02	1.9E+02	4.4E+04
C4999-15B	59.0	1.0E+02	5.9E+03	4.4E+02	8.6E+01	3.4E+01	9.5E+02	8.5E+04	5.9E+02	1.1E+02	1.6E+01	3.8E+02	1.1E+02	3.5E+04
C4999-16A	62.0	2.4E+01	1.5E+03	5.6E+01	4.9E+01	6.9E+00	2.0E+02	4.8E+04	1.5E+02	2.6E+01	1.2E+01	8.7E+01	2.6E+01	2.5E+04
C4999-17A	66.0	3.5E+01	1.4E+02	9.5E+01	3.7E+01	6.5E+00	7.3E+01	3.2E+04	6.8E-01	2.5E+01	5.9E+00	8.3E+01	3.9E+01	2.5E+04
C4999-19B	76.0	3.2E+02	4.4E+02	8.2E+01	1.9E+02	4.9E+00	2.9E+02	1.3E+05	1.6E+02	1.2E+01	1.5E+00	8.8E+01	2.8E+01	3.4E+04
C4999-21C	86.0	1.1E+02	2.4E+02	8.6E+01	2.0E+02	6.5E+00	3.5E+02	1.2E+05	2.4E+02	3.9E+01	2.9E+00	1.3E+02	2.8E+02	5.4E+04
C4999-22E	90.5	8.0E+01	3.3E+03	6.3E+01	2.3E+02	1.0E+01	3.5E+02	1.5E+05	3.3E+02	4.8E+01	2.7E+01	1.4E+02	7.6E+01	6.6E+04
C4999-25A	98.5	2.0E+02	4.8E+03	1.3E+02	2.4E+02	1.1E+01	1.0E+03	1.3E+05	4.8E+02	9.8E+01	2.8E+01	2.4E+02	8.5E+01	6.4E+04
C4999-27B	108.0	1.4E+02	5.3E+03	5.1E+01	3.2E+02	1.1E+01	4.4E+02	1.4E+05	5.3E+02	6.5E+01	2.4E+01	2.5E+02	9.2E+01	6.7E+04
C4999-29D	118.0	4.2E+02	5.2E+02	1.1E+03	3.2E+02	7.6E+01	1.7E+03	1.1E+05	4.5E+00	1.5E+02	3.6E+01	4.0E+02	2.2E+02	6.5E+04
C4999-31C	125.0	2.3E+02	2.5E+02	6.1E+02	2.5E+02	3.5E+01	1.1E+03	9.5E+04	5.2E+02	6.2E+01	2.1E+01	2.2E+02	1.5E+02	6.0E+04
C4999-32B	129.0	2.6E+01	6.8E+01	7.7E+01	2.5E+01	5.3E+00	2.2E+02	7.5E+03	1.1E+02	1.4E+01	1.3E-01	4.5E+01	4.8E+01	1.2E+04
Pore Water After Ultracentrifugation														
C4999-31C	125.0	1.1E+02	1.5E+02	3.5E+02	4.7E+01	5.2E+00	5.3E+01	1.7E+04	8.7E+00	1.5E+01	6.3E+01	1.0E+02	9.5E+01	6.0E+03

Table D.4. (contd)

Sample ID	Depth (ft bgs)	Li (µg/L)	Mg (µg/L)	Mn (µg/L)	Mo (µg/L)	Ni (µg/L)	P (µg/L)	Pb (µg/L)	Se (µg/L)	Sr (µg/L)	Ti (µg/L)	V (µg/L)	Zn (µg/L)	Na (µg/L)
Groundwater														
B1FR99	42.5	3.1E+01	1.1E+04	9.6E+01	4.0E+00	9.8E+00	1.8E+02	1.0E+02	1.1E+02	2.1E+02	2.0E+02	2.0E+02	2.7E+01	2.2E+04
B1FR76	45.3	2.0E+02	7.6E+03	1.1E+01	1.0E+01	2.9E+00	2.7E+02	1.0E+02	2.0E+02	1.4E+02	2.0E+02	8.8E-01	1.6E-01	1.7E+04
B1FR92	47.9	4.1E+01	8.3E+03	1.0E+02	3.3E+01	1.2E+01	4.1E+01	1.0E+02	1.1E+02	1.8E+02	3.0E+00	6.5E+00	2.1E+01	1.6E+04
B1FRB4	52.5	3.5E+01	5.7E+03	1.8E+02	1.3E+01	9.2E+00	4.4E+01	1.0E+02	1.1E+02	1.2E+02	7.3E-01	1.3E+01	2.1E+01	5.7E+03
B1FR88	68.0	4.0E+01	4.2E+03	2.1E+01	4.0E+00	9.2E+00	2.6E+01	1.0E+02	3.7E+00	8.1E+01	3.1E+01	2.1E+01	2.4E+01	6.2E+03
B1FRB8	77.0	2.8E+01	4.6E+03	2.0E+01	4.0E+01	5.4E+00	4.5E+01	1.0E+02	3.0E+01	8.4E+01	2.2E+01	1.4E+01	2.1E+01	9.7E+03
B1FR84	87.5	3.6E+01	5.8E+03	2.7E+01	4.0E+01	7.6E+00	5.0E+01	4.2E+00	2.9E+01	1.1E+02	2.0E+02	1.4E+01	2.2E+01	1.6E+04
B1FR96	99.5	3.3E+01	7.3E+03	3.5E+01	4.0E+01	4.3E+00	4.6E+01	1.0E+02	7.5E+01	1.3E+02	2.0E+02	2.8E+00	2.1E+01	2.0E+04
B1FR80	108.0	2.0E+02	7.5E+03	4.9E+01	5.7E+00	1.4E+00	3.1E+01	1.0E+02	1.7E+02	1.4E+02	2.3E+01	1.0E+02	1.0E+02	2.2E+04
B1FR32	120.80	2.0E+02	7.2E+03	4.6E+01	4.1E+00	1.0E+02	5.7E+01	1.0E+02	1.2E+02	1.1E+02	2.0E+02	1.0E+02	1.0E+02	2.2E+04
Water Extracts (Concentration Values Were Dilution Corrected)														
C4999-3B	9.0	1.4E+03	7.5E+05	6.6E+00	1.9E+02	4.1E+02	1.9E+03	3.9E+03	6.5E+03	7.5E+03	3.9E+03	9.8E+02	9.3E+02	3.0E+05
C4999-5D	18.0	1.2E+02	3.6E+04	7.0E+01	4.7E+02	1.4E+02	2.1E+03	4.5E+03	1.7E+03	8.6E+02	2.3E+03	4.8E+02	9.6E+02	7.2E+05
C4999-6A	20.0	1.6E+03	5.2E+05	1.7E+01	4.1E+02	5.4E+02	2.5E+03	6.2E+03	5.4E+03	6.9E+03	3.7E+02	1.5E+03	1.5E+03	4.7E+05
C4999-6D	23.0	8.4E+01	2.7E+04	5.5E+01	4.4E+02	6.0E+01	9.9E+02	1.1E+01	1.9E+03	6.1E+02	1.2E+03	1.7E+02	6.3E+02	3.7E+05
C4999-8E	28.5	1.7E+04	1.4E+05	8.4E+02	1.4E+03	4.6E+03	6.5E+03	3.0E+03	1.8E+04	2.5E+03	5.8E+04	1.5E+04	2.3E+03	9.2E+05
C4999-9B	30.5	4.2E+02	4.2E+04	2.8E+02	7.4E+02	1.7E+02	1.5E+03	4.5E+03	3.4E+03	8.6E+02	2.3E+03	2.8E+02	9.2E+02	2.9E+05
C4999-10C	35.5	1.7E+03	3.4E+04	1.5E+02	5.2E+02	4.1E+02	3.8E+02	9.9E+01	3.7E+03	6.7E+02	2.7E+01	1.5E+03	1.7E+03	2.8E+05
C4999-11B	39.5	2.3E+03	5.8E+04	4.8E+02	1.2E+03	4.9E+02	2.1E+02	1.9E+02	4.0E+03	1.1E+03	9.4E+03	2.4E+03	2.7E+03	4.3E+05
C4999-11D	41.5	6.5E+03	9.9E+03	4.4E+01	1.0E+03	1.5E+03	3.1E+03	2.1E+02	7.0E+03	2.8E+02	2.1E+04	5.2E+03	1.6E+03	7.3E+04
C4999-12C	46.0	9.0E+01	2.0E+04	9.7E+01	1.6E+02	1.1E+02	2.2E+03	1.5E+02	2.1E+03	3.8E+02	1.3E+03	3.9E+01	5.2E+02	7.1E+04
C4999-12D	47.0	3.5E+02	4.6E+03	2.0E+00	6.8E+01	8.3E+01	2.4E+02	4.8E+01	8.8E+02	9.5E+01	1.5E+03	3.7E+02	5.1E+02	2.3E+04
C4999-13E	53.0	1.5E+03	5.9E+03	2.0E+00	3.6E+02	3.4E+02	1.0E+03	8.3E+01	2.2E+03	1.1E+02	5.8E+03	6.0E+01	2.6E+02	7.5E+03
C4999-14D	56.0	1.1E+03	1.6E+04	9.7E+00	3.6E+02	2.7E+02	2.8E+02	3.3E+02	1.2E+03	5.5E+02	5.8E+03	1.4E+03	5.7E+02	1.5E+04
C4999-15B	59.0	1.5E+03	1.3E+04	8.9E+00	7.2E+02	2.1E+02	7.2E+02	1.2E+02	4.4E+03	4.1E+02	5.9E+03	1.5E+03	3.4E+02	1.7E+04
C4999-16A	62.0	2.8E+02	8.0E+03	3.8E+00	2.3E+02	2.3E+01	2.8E+02	4.4E+01	6.5E+02	2.3E+02	1.5E+03	9.1E+00	2.2E+02	1.6E+04
C4999-17A	66.0	3.4E+02	5.0E+03	1.2E+00	1.5E+02	4.5E+01	1.4E+02	1.6E+03	1.1E+03	1.5E+02	1.6E+03	4.0E+02	3.2E+02	1.6E+04
C4999-19B	76.0	4.7E+02	3.5E+04	5.9E+01	7.0E+02	4.6E+01	2.3E+02	7.4E+01	9.3E+02	8.1E+02	1.6E+03	9.1E+00	3.4E+02	4.3E+04
C4999-21C	86.0	5.5E+02	3.5E+04	1.1E+02	4.0E+02	9.1E+01	8.5E+01	3.4E+01	1.1E+03	6.3E+02	2.4E+03	6.1E+02	5.1E+02	1.2E+05
C4999-22E	90.5	8.3E+02	4.2E+04	9.3E+01	7.1E+02	1.0E+02	4.0E+02	8.1E+01	1.4E+03	7.5E+02	3.3E+03	8.3E+02	5.0E+02	1.4E+05
C4999-25A	98.5	1.1E+03	3.8E+04	7.7E+01	3.6E+02	6.2E+01	8.6E+02	3.1E+02	1.6E+03	6.7E+02	4.8E+03	1.0E+02	8.5E+02	1.2E+05
C4999-27B	108.0	1.1E+03	4.9E+04	3.8E+02	2.3E+02	2.0E+02	7.7E+02	1.3E+02	2.6E+03	7.7E+02	5.3E+03	1.3E+03	9.1E+02	1.2E+05
C4999-29D	118.0	1.5E+03	3.8E+04	2.5E+02	7.7E+02	4.2E+02	8.7E+02	7.3E+03	1.8E+03	6.4E+02	7.3E+03	1.8E+03	1.4E+03	1.4E+05
C4999-31C	125.0	1.3E+03	3.2E+04	1.2E+02	3.8E+02	1.9E+02	3.8E+02	7.3E+01	5.2E+03	5.5E+02	5.2E+03	1.3E+01	5.5E+02	1.3E+05
C4999-32B	129.0	2.5E+02	2.0E+03	1.4E+00	1.1E+02	2.3E+01	6.3E+01	7.2E+01	3.0E+02	4.8E+01	1.1E+03	1.7E+01	2.1E+02	3.9E+04
Pore Water After Ultracentrifugation														
C4999-31C	125.0	1.3E+03	5.8E+03	1.2E+01	7.8E+01	1.7E+01	2.9E+01	2.7E+01	2.4E+02	1.1E+02	1.3E+03	1.4E+02	6.6E+01	2.6E+04

Table D.4. (contd)

Sample ID	Depth (ft bgs)	Si (µg/L)	S (µg/L)	Ti (µg/L)	Zr (µg/L)	Ag (µg/L)	Re (µg/L)	Sb (µg/L)
Groundwater								
B1FR99	42.5	9.9E+03	1.8E+04	1.0E+01	1.0E+02	4.0E+02	2.1E+00	5.0E+03
B1FR76	45.3	9.3E+03	1.2E+04	3.4E-01	1.4E+00	1.0E+02	2.3E+01	2.2E+01
B1FR92	47.9	7.1E+03	1.1E+04	1.0E+01	2.0E-01	4.0E+02	4.0E+01	5.0E+03
B1FRB4	52.5	8.8E+03	7.8E+03	3.7E-01	1.0E+02	4.0E+02	1.7E+00	5.0E+03
B1FR88	68.0	1.4E+04	4.0E+03	6.5E+00	4.3E-01	4.0E+02	3.9E+00	5.0E+03
B1FRB8	77.0	1.5E+04	2.9E+03	4.5E+00	8.1E-02	4.0E+02	4.0E+01	5.0E+03
B1FR84	87.5	1.8E+04	6.9E+01	2.6E+00	1.1E-01	4.0E+02	3.9E-01	5.0E+03
B1FR96	99.5	1.8E+04	8.0E+02	2.9E+00	4.6E-01	4.0E+02	3.1E+00	5.0E+03
B1FR80	108.0	1.9E+04	1.1E+02	1.4E+00	3.9E-01	1.0E+02	2.3E+01	3.8E+01
B1FR32	120.80	1.8E+04	8.0E+02	8.6E-01	4.3E-01	1.0E+02	2.8E+01	4.4E+01
Water Extracts (Concentration Values Were Dilution Corrected)								
C4999-3B	9.0	4.6E+04	1.0E+06	2.0E+02	1.8E+01	6.0E+01	4.7E+02	7.9E+02
C4999-5D	18.0	2.1E+05	2.1E+05	8.8E+00	2.0E+01	1.1E+01	2.4E+02	3.0E+02
C4999-6A	20.0	7.2E+04	8.7E+05	3.1E+02	6.2E+02	1.1E+02	6.7E+02	8.0E+02
C4999-6D	23.0	9.1E+04	1.4E+05	1.2E+02	3.4E+00	4.9E+02	1.5E+02	2.7E+02
C4999-8E	28.5	1.3E+05	5.1E+05	6.7E+01	9.7E+00	1.2E+03	6.4E+03	1.3E+04
C4999-9B	30.5	1.5E+05	1.3E+05	2.9E+01	3.7E+01	9.1E+02	3.4E+02	4.5E+03
C4999-10C	35.5	6.7E+04	1.3E+05	3.2E+00	6.1E+02	1.3E+02	6.1E+02	1.7E+03
C4999-11B	39.5	8.0E+04	1.5E+05	4.7E+02	5.7E+00	1.9E+02	1.2E+03	2.1E+03
C4999-11D	41.5	3.1E+04	1.1E+04	2.8E+01	2.1E+03	2.9E+02	1.8E+03	5.3E+03
C4999-12C	46.0	4.8E+04	3.6E+04	6.8E+00	3.6E+00	5.0E+02	2.8E+02	2.3E+02
C4999-12D	47.0	1.8E+04	1.3E+04	4.5E+01	1.5E+02	2.6E+01	1.6E+02	3.2E+02
C4999-13E	53.0	2.3E+04	9.7E+03	2.9E+02	5.8E+02	1.1E+02	6.9E+02	2.0E+03
C4999-14D	56.0	6.7E+03	1.7E+05	6.5E+00	9.9E+00	1.1E+02	4.6E+02	2.2E+03
C4999-15B	59.0	7.7E+03	1.4E+05	9.0E+00	1.2E+01	9.6E+01	5.7E+02	1.8E+03
C4999-16A	62.0	1.3E+04	6.0E+04	6.8E-01	3.8E+00	3.3E+01	1.4E+02	4.6E+02
C4999-17A	66.0	1.2E+04	4.1E+04	2.9E+00	2.4E+00	2.8E+01	1.8E+02	5.4E+02
C4999-19B	76.0	1.6E+04	2.0E+05	8.0E+01	6.2E+00	2.8E+01	2.1E+02	2.9E+02
C4999-21C	86.0	3.3E+04	2.6E+05	3.5E-01	3.5E+00	3.5E+01	2.9E+02	4.0E+02
C4999-22E	90.5	4.6E+04	3.2E+05	1.7E+02	4.2E+00	6.9E+01	3.8E+02	5.9E+02
C4999-25A	98.5	6.5E+04	2.6E+05	2.4E+02	4.8E+02	7.1E+01	4.6E+02	1.2E+03
C4999-27B	108.0	5.2E+04	2.3E+05	2.6E+02	5.3E+02	1.2E+02	4.2E+02	8.8E+02
C4999-29D	118.0	4.7E+04	2.9E+05	2.6E+01	1.7E+01	1.7E+02	1.1E+03	3.0E+03
C4999-31C	125.0	5.1E+04	2.3E+05	9.2E+00	1.5E+01	9.4E+01	5.5E+02	1.8E+03
C4999-32B	129.0	1.2E+04	1.9E+04	5.0E+00	3.5E+00	2.2E+01	1.4E+02	3.1E+02
Pore Water After Ultracentrifugation								
C4999-31C	125.0	7.3E+03	1.6E+04	3.6E+00	4.0E+00	3.7E+01	2.7E+02	6.5E+02

Table D.5. ICP-OEP for Cations Analysis of C5000 Samples

Sample ID	Depth (ft bgs)	Al (µg/L)	As (µg/L)	B (µg/L)	Ba (µg/L)	Be (µg/L)	Bi (µg/L)	Ca (µg/L)	Cd (µg/L)	Co (µg/L)	Cr (µg/L)	Cu (µg/L)	Fe (µg/L)	K (µg/L)
Groundwater														
B1FR36	33.8	1.8E+01	2.1E+01	8.2E+01	6.1E+01	1.1E+00	2.6E+01	5.2E+04	1.0E+01	6.3E+00	1.0E+01	1.8E+01	6.4E+01	4.4E+03
B1FR40	38.5	4.0E+02	3.9E+01	6.0E+01	5.3E+01	5.3E-01	4.0E+03	4.7E+04	1.0E+01	1.7E+00	3.3E+00	1.6E+01	6.6E+01	4.1E+03
B1FR44	43.3	4.0E+02	2.2E+01	5.1E+01	5.4E+01	4.7E-01	4.0E+03	5.1E+04	1.0E+01	1.0E+02	2.1E+00	1.5E+01	9.1E+01	4.7E+03
B1FR48	47.3	4.0E+02	3.3E+01	4.7E+01	4.7E+01	2.4E-01	3.1E+01	4.7E+04	1.0E+01	1.7E+00	1.0E+01	1.5E+01	1.1E+01	3.9E+03
B1FR52	54.3	1.1E+00	7.2E+00	4.2E+01	2.8E+01	8.4E-02	5.1E+01	3.0E+04	1.0E+01	2.4E+00	1.0E+01	1.5E+01	5.0E+01	7.1E+03
B1FR56	59.3	5.1E+01	1.0E+02	5.1E+01	3.4E+01	1.1E-01	5.2E+01	1.9E+04	8.2E-02	1.0E+02	1.0E+01	1.7E+01	2.4E+02	5.7E+03
B1FR60	68.5	6.8E+01	1.0E+02	4.8E+01	2.0E+01	4.8E-02	4.1E+01	1.2E+04	1.0E+01	2.6E+00	1.0E+01	1.7E+01	1.7E+02	4.7E+03
B1FR64	79.5	4.6E+01	1.0E+02	5.0E+01	2.5E+01	2.3E-01	3.6E+01	1.6E+04	1.0E+01	8.0E-01	8.3E-01	1.5E+01	2.1E+02	5.8E+03
B1FR68	90.3	1.0E+01	1.0E+02	4.2E+01	4.0E+01	3.6E-02	3.7E+01	1.4E+04	1.0E+01	1.5E+00	1.0E+01	1.6E+01	1.6E+02	5.1E+03
B1FR72	107.8	1.8E+02	1.0E+02	4.6E+01	3.6E+01	2.7E-01	3.7E+00	1.1E+04	6.8E-01	1.0E+02	2.7E-02	1.6E+01	3.1E+02	4.8E+03
Water Extracts (Concentration Values Were Dilution Corrected)														
C5000-36A	11.0	1.8E+03	5.6E+02	6.7E+02	1.5E+02	1.6E+01	5.1E+03	6.8E+04	1.3E+02	9.0E+01	3.4E+01	2.5E+02	1.9E+03	6.9E+04
C5000-36E	12.0	2.8E+03	4.2E+02	8.6E+02	5.2E+02	2.3E+01	7.7E+03	2.3E+05	7.6E+00	1.3E+02	2.3E+01	3.0E+02	3.9E+03	1.3E+05
C5000-37A	13.0	1.9E+03	6.1E+02	7.7E+02	6.8E+02	2.3E+01	8.2E+03	1.7E+05	7.9E+00	1.1E+02	2.4E+01	3.5E+02	1.8E+03	9.8E+04
C5000-38B	20.0	1.2E+03	3.5E+02	5.6E+02	3.9E+02	1.6E+01	6.6E+03	1.6E+05	1.7E+02	4.9E+01	1.2E+01	2.4E+02	7.3E+02	1.1E+05
C5000-40A	30.0	7.4E+01	9.8E+01	1.8E+02	1.2E+02	1.2E+01	1.7E+03	8.2E+04	1.5E+00	1.7E+02	1.2E+00	1.2E+02	5.0E+01	2.1E+04
C5000-40B	31.0	5.7E+02	8.0E+02	1.1E+03	3.7E+02	8.0E+01	1.9E+02	2.0E+05	9.1E+00	7.0E+02	8.8E+02	2.5E+02	2.8E+02	9.6E+04
C5000-41C	36.0	3.7E+02	1.2E+02	1.2E+03	1.7E+02	9.3E+01	2.2E+02	5.6E+04	2.9E+01	2.7E+01	4.0E+02	3.4E+02	2.3E+02	2.1E+04
C5000-48D	65.0	8.4E+01	3.5E+01	1.0E+02	5.5E+01	2.9E+00	1.5E+03	2.7E+04	3.8E+01	1.7E+01	2.5E+00	6.2E+01	7.6E+01	2.3E+04
C5000-48E	66.0	1.1E+02	1.6E+02	8.4E+01	3.5E+01	2.3E+00	1.2E+03	1.2E+04	2.3E+00	6.6E+00	3.0E+01	3.9E+01	1.9E+02	1.9E+04
C5000-49D	68.0	2.8E+02	2.1E+02	1.4E+02	1.5E+02	7.2E+00	3.7E+03	7.2E+04	2.7E-01	5.3E+01	4.3E+00	8.0E+01	1.2E+02	6.1E+04
C5000-50B	71.0	6.0E+02	2.4E+02	3.3E+02	1.2E+02	5.6E+00	3.1E+03	4.0E+04	7.8E+01	2.5E+01	1.4E+01	9.9E+01	6.8E+02	7.8E+04
C5000-51E	77.0	2.1E+02	3.0E+02	2.0E+02	1.3E+02	1.4E+01	5.5E+01	2.8E+04	1.4E+00	2.2E+01	1.0E+01	3.3E+01	1.8E+02	3.4E+04
C5000-52B	79.0	4.6E+02	1.0E+02	1.3E+02	5.4E+01	9.2E+00	1.9E+03	2.0E+04	4.8E+01	1.5E+01	2.2E+00	4.0E+01	7.0E+02	3.4E+04
C5000-53E	85.0	8.8E+01	1.5E+02	7.8E+01	1.1E+02	5.9E+00	1.6E+03	3.0E+04	7.4E-01	1.2E+01	6.1E+00	2.9E+01	5.5E+01	3.1E+04
C5000-54E	89.5	3.0E+02	1.5E+03	1.7E+02	1.1E+02	9.5E+00	3.0E+03	4.0E+04	7.4E+01	2.0E+01	4.0E+00	2.3E+01	1.8E+02	3.9E+04
C5000-57D	100.0	3.2E+02	2.7E+02	9.0E+01	6.4E+01	6.9E+00	2.3E+03	2.1E+04	5.6E+00	1.0E+01	6.5E+00	2.4E+01	3.0E+02	3.6E+04
C5000-60E	109.5	2.1E+02	2.1E+02	5.2E+01	1.3E+02	4.4E+00	1.6E+03	2.2E+04	3.9E+01	5.7E+00	2.7E+00	5.7E+00	2.1E+02	2.9E+04
Pore Water After Ultracentrifugation														
C5000-43B	45.0	1.0E+02	5.9E+01	2.0E+01	5.2E+01	1.3E+00	5.7E+01	4.9E+04	5.0E+01	9.5E+00	2.8E+00	1.8E+01	1.1E+01	4.3E+03
C5000-44C	49.0	2.9E+02	5.0E+02	6.9E+00	4.5E+01	1.1E+00	7.4E+01	5.1E+04	8.5E-02	9.2E+00	3.9E+00	1.9E+01	9.6E+00	4.5E+03
C5000-44E	51.0	9.6E+01	4.0E+03	7.7E+01	2.5E+01	8.0E+00	6.6E+02	2.6E+04	4.0E+02	4.9E+01	1.9E+00	1.5E+02	4.6E+01	1.5E+04
C5000-45C	54.0	1.0E+02	4.0E+03	2.3E+00	2.9E+01	8.1E+00	7.3E+02	2.8E+04	4.0E+02	6.1E+01	2.5E+01	1.5E+02	6.5E+01	2.4E+04
C5000-48B	62.5	4.5E+02	1.5E+02	1.1E+01	1.0E+02	8.1E+00	6.1E+02	1.4E+04	4.0E+02	4.2E+01	4.4E+00	1.5E+02	6.7E+01	1.3E+04
C5000-49A	67.0	2.1E+02	2.6E+02	2.0E+03	2.8E+01	4.1E+00	4.9E+02	1.1E+04	6.2E-01	2.0E+01	7.3E+00	6.6E+01	1.8E+02	1.0E+04
C5000-49D	68.0	8.5E+01	5.1E+00	2.9E+02	3.4E+01	1.9E+01	2.4E+02	1.2E+04	4.6E+00	3.2E+01	1.0E+02	7.5E+01	6.3E+01	1.0E+04
C5000-52B	79.0	4.7E+02	2.0E+04	2.0E+03	7.3E+01	1.1E+02	2.9E+03	5.4E+03	2.0E+03	4.1E+02	9.6E+01	7.5E+02	3.5E+02	1.9E+04
C5000-53E	86.0	3.0E+01	6.3E+01	8.5E+01	6.1E+01	4.2E+00	1.7E+02	1.2E+04	1.0E+02	1.9E+01	4.3E+00	3.7E+01	1.8E+01	9.9E+03
C5000-54A	85.0	2.1E+03	7.1E+03	5.2E+03	4.4E+02	3.4E+02	2.0E+04	1.6E+04	1.0E+04	8.3E+02	8.3E+02	3.5E+03	2.4E+03	1.3E+05
C5000-55D	90.5	1.4E+02	2.0E+03	9.0E+01	4.0E+01	6.3E+00	2.7E+02	1.2E+04	2.0E+02	2.8E+01	1.5E+01	6.5E+01	7.2E+01	1.0E+04
C5000-58C	103.0	3.6E+02	4.0E+03	1.1E+02	4.4E+01	1.0E+01	6.1E+02	1.1E+04	2.5E+00	1.8E+01	2.2E+01	1.5E+02	5.7E+01	2.3E+04
C5000-60C	107.5	7.6E+01	1.7E+02	5.2E+01	4.1E+01	4.4E+00	3.4E+02	1.1E+04	2.0E+02	3.1E+01	1.9E+01	6.8E+01	3.3E+01	9.5E+03

Table D.5. (contd)

Sample ID	Depth (ft bgs)	Li (µg/L)	Mg (µg/L)	Mn (µg/L)	Mo (µg/L)	Ni (µg/L)	P (µg/L)	Pb (µg/L)	Se (µg/L)	Sr (µg/L)	Ti (µg/L)	V (µg/L)	Zn (µg/L)	Na (µg/L)
Groundwater														
B1FR36	33.8	4.2E+00	1.3E+04	4.2E+01	2.7E+01	4.8E+00	7.6E+01	1.0E+02	2.3E+02	2.4E+02	2.0E+02	1.2E+01	1.0E+02	2.7E+04
B1FR40	38.5	3.1E+00	1.2E+04	8.0E+00	1.0E+02	3.6E-01	1.3E+02	1.0E+02	1.2E+02	2.2E+02	6.1E+00	1.2E+01	5.1E+00	2.1E+04
B1FR44	43.3	8.7E-01	1.2E+04	1.5E+01	1.0E+02	2.8E+00	1.3E+02	1.0E+02	2.6E+02	2.4E+02	2.0E+02	1.4E+01	1.0E+02	2.4E+04
B1FR48	47.3	2.8E+00	1.1E+04	1.5E+02	2.5E+01	2.0E+00	6.2E+01	1.0E+02	2.2E+02	2.2E+02	2.0E+02	4.8E+00	3.3E-01	2.2E+04
B1FR52	54.3	1.1E+01	8.5E+03	4.1E+01	8.4E+00	3.3E+00	2.8E+01	1.0E+02	1.7E+02	1.5E+02	6.0E-01	1.0E+01	1.0E+02	2.5E+04
B1FR56	59.3	1.0E+01	6.2E+03	4.1E+01	3.5E+00	3.7E+00	2.5E+01	1.0E+02	9.6E+01	1.0E+02	2.1E+00	1.2E+01	1.0E+02	4.2E+04
B1FR60	68.5	8.1E+00	3.9E+03	2.9E+01	7.0E+00	4.0E+01	9.4E+00	1.0E+02	1.2E+02	6.1E+01	2.2E+00	9.2E+00	1.0E+02	3.7E+04
B1FR64	79.5	3.5E+00	5.2E+03	3.0E+01	1.0E+02	4.0E+01	2.1E+01	2.0E+00	1.1E+02	8.5E+01	2.0E+02	2.0E+02	1.0E+02	4.3E+04
B1FR68	90.3	9.1E+00	5.8E+03	4.4E+01	4.9E+00	4.0E+01	1.8E+01	1.0E+02	1.1E+02	8.5E+01	2.0E+02	8.4E+00	1.0E+02	3.6E+04
B1FR72	107.8	1.1E+01	4.8E+03	4.3E+01	8.5E+00	4.0E+01	5.0E+01	1.0E+02	7.6E+01	7.6E+01	3.3E+01	8.8E+00	1.0E+02	5.2E+04
Water Extracts (Concentration Values Were Dilution Corrected)														
C5000-36A	11.0	3.2E+01	1.7E+04	6.3E+01	2.7E+02	3.2E+02	1.9E+03	2.6E+03	2.0E+03	2.8E+02	1.5E+02	2.7E+02	1.4E+03	3.9E+05
C5000-36E	12.0	1.6E+02	7.2E+04	3.6E+02	5.0E+02	3.6E+02	1.8E+03	3.8E+03	5.5E+03	1.2E+03	6.1E+01	9.6E+02	3.2E+03	5.9E+05
C5000-37A	13.0	4.6E+01	3.5E+04	1.0E+02	3.8E+02	3.7E+02	2.2E+03	4.1E+03	5.3E+03	1.1E+03	4.1E+03	1.6E+02	4.9E+03	4.9E+05
C5000-38B	20.0	9.7E+01	4.1E+04	3.0E+02	6.7E+02	2.0E+02	8.2E+02	3.3E+03	3.9E+03	8.3E+02	2.5E+02	8.3E+02	3.2E+03	5.5E+05
C5000-40A	30.0	6.3E+01	1.8E+04	1.6E+02	2.8E+02	4.6E+01	3.0E+02	1.7E+03	1.1E+03	3.7E+02	8.6E+02	1.7E+03	4.1E+02	1.6E+05
C5000-40B	31.0	3.3E+02	4.6E+04	3.3E+02	9.2E+02	2.3E+02	1.1E+03	1.8E+02	1.4E+03	9.5E+02	2.3E+02	3.7E+02	1.3E+03	4.3E+05
C5000-41C	36.0	3.2E+02	1.3E+04	1.6E+02	3.9E+02	1.5E+02	1.5E+03	3.2E+03	1.1E+03	3.5E+02	5.7E+01	2.7E+02	7.0E+02	7.8E+04
C5000-48D	65.0	1.8E+01	8.6E+03	2.7E+01	2.1E+02	5.4E+01	1.6E+02	7.6E+02	4.9E+02	1.4E+02	7.6E+02	3.0E+02	8.5E+02	7.9E+04
C5000-48E	66.0	2.5E+01	3.4E+03	1.4E+00	1.7E+02	4.3E+01	8.0E+01	5.9E+02	5.6E+02	6.9E+01	5.9E+02	1.5E+02	3.6E+02	5.7E+04
C5000-49D	68.0	9.5E+01	2.1E+04	9.1E+01	2.4E+02	8.2E+01	3.8E+02	1.8E+03	1.7E+03	3.5E+02	1.8E+03	4.6E+02	1.2E+03	1.6E+05
C5000-50B	71.0	1.3E+02	1.2E+04	3.7E+01	3.6E+03	1.1E+02	4.6E+02	1.6E+03	1.9E+03	1.9E+02	7.6E+01	6.5E+01	1.7E+03	2.7E+05
C5000-51E	77.0	1.1E+01	8.0E+03	1.6E+01	1.1E+02	7.8E+01	4.2E+02	1.1E+03	1.3E+03	1.5E+02	1.1E+03	1.6E+01	8.3E+02	1.1E+05
C5000-52B	79.0	2.6E+01	5.4E+03	8.3E+00	3.2E+02	5.1E+01	4.0E+02	9.6E+02	1.0E+03	1.0E+02	5.1E+00	8.7E+01	7.4E+02	1.2E+05
C5000-53E	85.0	4.0E+01	9.7E+03	8.9E+00	2.2E+02	5.4E+01	8.8E+01	8.0E+02	1.3E+03	1.9E+02	5.7E+01	3.1E+02	4.4E+02	9.0E+04
C5000-54E	89.5	6.1E+01	1.4E+04	7.1E+01	2.3E+02	7.6E+01	1.7E+02	1.5E+03	1.8E+03	2.3E+02	3.1E+01	3.7E+02	1.2E+03	1.2E+05
C5000-57D	100.0	2.0E+01	7.1E+03	2.0E+01	4.6E+02	5.5E+01	4.6E+02	1.1E+03	8.1E+02	1.2E+02	1.6E+01	1.5E+02	8.3E+02	1.3E+05
C5000-60E	109.5	3.1E+01	7.9E+03	2.2E+01	1.7E+02	4.0E+01	2.8E+02	7.9E+02	1.1E+03	1.3E+02	1.7E+01	1.1E+02	5.6E+02	1.0E+05
Pore Water After Ultracentrifugation														
C5000-43B	45.0	1.0E+02	1.1E+04	6.1E+01	6.0E+01	1.3E+01	8.5E+01	1.1E+01	3.1E+02	2.1E+02	5.0E+02	1.3E+02	1.1E+02	2.3E+04
C5000-44C	49.0	1.3E+02	1.1E+04	2.5E+01	7.9E+01	1.3E+01	5.0E+01	4.6E+00	3.1E+02	2.3E+02	5.0E+02	1.3E+02	2.1E+02	2.7E+04
C5000-44E	51.0	8.3E+02	6.4E+03	9.2E+00	2.5E+02	5.4E+01	8.2E+01	1.2E+02	9.5E+02	1.2E+02	4.0E+03	5.1E+01	3.9E+02	3.3E+04
C5000-45C	54.0	7.1E+02	7.2E+03	4.0E+02	2.3E+02	2.6E+01	1.3E+02	1.3E+02	1.6E+03	1.3E+02	4.0E+03	1.4E+01	4.4E+02	3.6E+04
C5000-48B	62.5	1.0E+03	4.1E+03	8.1E+00	3.8E+02	9.8E+01	5.0E+03	1.1E+02	2.3E+03	7.3E+01	4.0E+03	1.0E+03	9.3E+02	4.7E+04
C5000-49A	67.0	3.0E+02	3.5E+03	4.0E+00	1.8E+02	4.1E+01	9.9E+01	7.3E+01	1.8E+03	5.3E+01	1.2E+02	1.8E+01	1.4E+02	3.7E+04
C5000-49D	68.0	4.7E+02	3.9E+03	1.6E+01	2.5E+02	7.3E+01	7.6E+01	5.8E+00	7.7E+02	6.7E+01	2.0E+03	5.0E+02	2.0E+02	4.5E+04
C5000-52B	79.0	4.8E+03	4.1E+03	6.1E+00	1.1E+03	6.7E+02	2.5E+04	2.9E+02	1.2E+04	1.7E+02	2.0E+04	1.4E+02	8.4E+02	4.6E+04
C5000-53E	86.0	2.3E+02	3.7E+03	5.5E+00	6.0E+01	1.7E+01	1.9E+01	1.0E+03	3.4E+02	5.9E+01	1.0E+03	1.4E+01	4.2E+02	3.8E+04
C5000-54A	85.0	2.3E+04	7.0E+03	4.0E+03	3.3E+03	1.5E+03	1.3E+05	2.0E+03	7.1E+04	3.4E+02	1.0E+05	3.3E+02	4.1E+03	5.5E+04
C5000-55D	90.5	4.5E+02	4.8E+03	1.4E+01	1.9E+02	2.1E+01	2.5E+03	1.0E+02	7.4E+02	6.9E+01	2.0E+03	5.0E+02	1.6E+02	4.5E+04
C5000-58C	103.0	8.1E+02	4.3E+03	6.6E+00	3.4E+02	3.2E+01	3.6E+02	8.8E+01	2.7E+03	7.9E+01	4.0E+03	1.0E+03	7.5E+02	4.9E+04
C5000-60C	107.5	3.9E+02	4.4E+03	6.4E+00	1.4E+02	4.9E+01	2.4E+02	3.9E+01	1.7E+03	6.1E+01	2.0E+03	1.4E+01	1.1E+02	4.8E+04

Table D.5. (contd)

Sample ID	Depth (ft bgs)	Si (µg/L)	S (µg/L)	Ti (µg/L)	Zr (µg/L)	Ag (µg/L)	Re (µg/L)	Sb (µg/L)
Groundwater								
B1FR36	33.8	1.2E+04	2.0E+04	2.2E+00	1.0E+00	1.0E+02	2.9E+01	5.1E+01
B1FR40	38.5	1.4E+04	1.8E+04	1.0E+01	6.0E-01	1.0E+02	3.0E+01	6.4E+01
B1FR44	43.3	1.4E+04	1.9E+04	1.0E+01	1.4E-01	1.0E+02	2.0E+01	2.0E+01
B1FR48	47.3	1.0E+04	1.9E+04	1.0E+01	1.0E+00	1.0E+02	2.0E+01	1.5E+01
B1FR52	54.3	1.2E+04	2.0E+04	1.9E+00	6.3E-02	1.0E+02	2.7E+01	2.8E+01
B1FR56	59.3	1.8E+04	1.9E+04	8.3E+00	8.7E-01	1.0E+02	2.9E+01	1.7E+01
B1FR60	68.5	2.0E+04	6.3E+03	7.1E+00	5.0E-01	1.0E+02	3.1E+01	1.1E+01
B1FR64	79.5	2.1E+04	2.9E+03	6.5E+00	4.7E-01	1.0E+02	2.7E+01	4.3E+01
B1FR68	90.3	2.1E+04	5.1E+03	1.4E+00	2.5E-01	1.0E+02	3.1E+01	3.1E+01
B1FR72	107.8	2.1E+04	1.3E+03	1.3E+01	1.3E+00	1.0E+02	2.5E+01	3.5E+01
Water Extracts (Concentration Values Were Dilution Corrected)								
C5000-36A	11.0	1.5E+05	1.2E+05	6.9E+01	1.4E+01	1.3E+03	5.1E+02	2.6E+03
C5000-36E	12.0	2.0E+05	2.5E+05	1.1E+02	6.6E+00	1.9E+03	7.7E+02	3.8E+03
C5000-37A	13.0	2.0E+05	2.7E+05	4.7E+01	5.9E-01	2.1E+03	8.2E+02	4.1E+03
C5000-38B	20.0	1.4E+05	1.8E+05	1.3E+01	1.7E+02	1.7E+03	6.6E+02	3.3E+03
C5000-40A	30.0	4.5E+04	3.3E+04	8.6E+01	3.8E+00	1.0E+00	7.4E+01	2.2E+02
C5000-40B	31.0	2.2E+05	6.6E+04	2.0E+01	2.7E+01	5.3E+01	4.9E+02	6.2E+02
C5000-41C	36.0	6.9E+04	2.6E+04	4.4E+01	4.2E+01	6.4E+02	3.2E+02	4.5E+02
C5000-48D	65.0	3.6E+04	7.2E+04	4.1E+00	3.8E+01	3.8E+02	1.5E+02	7.6E+02
C5000-48E	66.0	2.4E+04	3.5E+04	2.5E+00	3.0E+01	3.0E+02	1.2E+02	5.9E+02
C5000-49D	68.0	5.9E+04	1.2E+05	1.8E+01	9.2E+01	9.2E+02	3.7E+02	1.8E+03
C5000-50B	71.0	7.0E+04	1.1E+05	2.8E+01	1.6E-01	7.8E+02	3.1E+02	4.5E+01
C5000-51E	77.0	5.8E+04	4.4E+04	3.7E+00	5.4E+01	4.0E-01	2.0E+01	1.1E+03
C5000-52B	79.0	5.4E+04	7.1E+04	3.2E+01	2.6E+00	4.8E+02	1.9E+02	9.6E+02
C5000-53E	85.0	3.5E+04	1.0E+05	8.0E+00	2.0E+00	4.0E+02	2.8E+00	8.0E+02
C5000-54E	89.5	4.6E+04	5.9E+04	2.1E+00	9.2E-01	7.4E+02	1.2E+01	1.5E+03
C5000-57D	100.0	6.7E+04	5.2E+04	1.3E+01	3.6E+00	5.7E+02	6.4E+01	1.1E+03
C5000-60E	109.5	4.8E+04	6.9E+04	8.6E+00	1.2E+00	3.9E+02	1.6E+02	7.9E+02
Pore Water After Ultracentrifugation								
C5000-43B	45.0	6.0E+03	2.1E+04	2.5E+01	1.8E+00	9.6E+00	5.7E+01	2.7E+01
C5000-44C	49.0	7.0E+03	2.0E+04	2.5E+01	5.0E+01	9.5E+00	4.0E+01	1.2E+02
C5000-44E	51.0	2.8E+03	2.5E+04	2.0E+02	4.0E+02	7.1E+01	5.9E+02	7.1E+02
C5000-45C	54.0	3.5E+03	4.0E+04	1.8E-01	2.8E+00	8.0E+01	4.5E+02	4.6E+02
C5000-48B	62.5	3.6E+03	2.8E+04	5.1E+00	4.0E+02	6.1E+01	4.9E+02	1.1E+03
C5000-49A	67.0	8.2E+03	1.6E+04	4.2E+00	2.0E+02	2.9E+01	2.5E+02	4.7E+02
C5000-49D	68.0	5.8E+03	1.6E+04	8.4E+00	1.4E+00	3.3E+01	2.3E+02	6.6E+02
C5000-52B	79.0	4.0E+05	4.0E+05	4.1E+01	2.9E+01	3.7E+02	2.0E+03	3.7E+03
C5000-53E	86.0	8.8E+03	1.5E+04	9.9E-01	3.0E+00	1.1E+01	9.1E+01	2.7E+02
C5000-54A	85.0	2.0E+06	2.0E+06	1.9E+02	1.3E+02	2.1E+03	1.3E+04	2.5E+04
C5000-55D	90.5	5.2E+03	2.3E+04	4.6E+00	1.1E+01	2.2E+01	2.5E+02	4.6E+02
C5000-58C	103.0	4.5E+03	6.7E+03	5.0E+00	2.5E+00	6.4E+01	5.2E+02	1.3E+03
C5000-60C	107.5	6.8E+03	4.3E+03	3.1E+00	4.4E+00	3.6E+01	2.5E+02	6.1E+02

Table D.6. ICP-OEP for Cations Analysis of C5001 Samples

Sample ID	Depth (ft bgs)	Al (µg/L)	As (µg/L)	B (µg/L)	Ba (µg/L)	Be (µg/L)	Bi (µg/L)	Ca (µg/L)	Cd (µg/L)	Co (µg/L)	Cr (µg/L)	Cu (µg/L)	Fe (µg/L)	K (µg/L)
Groundwater														
B1HRX0	53	7.5E+01	2.2E-01	7.2E+01	4.7E+01	1.1E+00	1.5E+03	4.7E+04	7.5E+00	5.9E+00	9.3E-01	6.7E+00	9.4E+01	4.3E+03
B1HRX4	57.8	7.5E+01	3.0E+02	6.6E+01	4.6E+01	1.1E+00	1.5E+03	4.6E+04	7.5E+00	6.0E+00	3.1E+01	5.9E+00	3.4E+01	4.1E+03
B1HRX8	63.0	7.5E+01	1.9E+01	6.7E+01	4.9E+01	1.1E+00	1.5E+03	4.8E+04	7.5E+00	5.9E+00	1.5E+00	3.4E+00	7.7E+01	4.5E+03
B1HRY2	81.5	7.5E+01	3.0E+02	6.6E+01	4.9E+01	9.4E-01	1.5E+03	4.7E+04	7.5E+00	4.6E+00	1.9E+01	1.3E+00	4.4E+01	4.8E+03
B1HRY6	101.8	7.5E+01	9.0E+00	4.6E+01	4.1E+01	7.9E-01	1.5E+03	3.5E+04	7.5E+00	6.1E+00	7.2E-01	1.3E+00	4.1E+02	3.8E+03
Water Extracts (Concentration Values Were Dilution Corrected)														
C5001-63C	8.0	1.1E+03	2.1E+02	7.7E+03	6.0E+02	1.8E+01	1.1E+01	4.6E+04	7.8E+00	2.0E+02	4.0E+00	2.2E+02	1.5E+03	2.0E+04
C5001-64E	15.0	9.8E+01	7.2E+02	6.8E+02	2.1E+02	4.8E+01	1.6E+02	1.6E+05	1.2E+00	3.6E+02	4.5E+02	2.4E+02	1.1E+02	2.4E+04
C5001-66A	21.0	2.2E+03	2.5E+02	1.8E+04	5.0E+02	2.8E+00	5.1E+02	2.5E+05	1.8E+01	5.9E+02	1.5E+03	4.7E+01	3.3E+03	1.4E+05
C5001-68A	28.0	3.0E+02	2.2E+02	9.4E+02	3.2E+02	4.8E+01	1.0E+02	2.6E+05	1.5E+01	5.9E+02	7.4E+02	3.2E+02	2.0E+02	1.1E+05
C5001-68B	29.0	1.5E+03	1.2E+01	1.2E+04	3.0E+02	1.9E+02	4.7E+02	1.6E+05	8.4E+00	3.8E+02	9.4E+02	7.9E+00	1.5E+03	7.5E+04
C5001-69C	33.0	2.3E+02	4.3E+02	8.8E+02	4.6E+02	1.9E+01	2.6E+01	1.6E+05	1.9E+02	3.2E+01	4.8E+02	1.3E+02	5.1E+02	4.1E+04
C5001-69D	34.0	3.8E+02	1.4E+03	4.2E+03	1.8E+02	6.8E+01	2.1E+02	8.2E+04	3.8E+00	1.4E+02	3.4E+02	6.8E+02	1.8E+02	3.2E+04
C5001-70D	39.5	2.7E+02	5.3E+02	2.3E+03	2.4E+02	1.2E+02	1.1E+02	1.6E+05	2.6E+01	4.6E+02	5.7E+02	4.9E+02	1.8E+02	5.5E+04
C5001-70E	40.5	3.0E+02	2.4E+03	7.4E+03	3.4E+02	1.2E+02	2.5E+02	1.6E+05	7.4E+00	2.4E+02	5.9E+02	1.2E+03	3.1E+02	5.1E+04
C5001-71E	41.5	3.4E+02	8.0E+02	1.1E+03	3.5E+02	4.5E+01	5.1E+02	2.2E+05	1.6E+01	3.7E+02	4.7E+02	2.2E+02	3.1E+02	7.2E+04
C5001-73B	25.8	2.4E+02	1.5E+02	4.5E+03	1.2E+02	7.5E+01	4.2E+01	7.3E+04	2.5E+00	1.5E+02	3.7E+02	1.1E+00	1.6E+02	2.6E+04
C5001-74B	53.5	2.6E+02	1.4E+03	3.7E+03	2.4E+02	6.8E+01	2.7E+02	6.9E+04	2.7E+00	1.4E+02	3.4E+02	6.8E+02	2.2E+02	2.1E+04
C5001-76C	64.5	7.9E+02	5.9E+02	7.3E+02	4.0E+02	5.2E+01	2.6E+02	9.8E+04	2.1E+02	5.2E+00	5.3E+02	1.4E+02	7.4E+02	3.8E+04
C5001-76D	65.5	5.1E+02	1.8E+03	4.8E+03	2.9E+02	9.2E+01	1.9E+02	9.3E+04	6.1E+00	8.9E+00	4.6E+02	9.2E+02	3.7E+02	3.0E+04
C5001-78A	74.5	6.9E+02	5.5E+02	5.4E+02	5.5E+02	3.8E+01	4.3E+02	1.4E+05	2.2E+01	5.3E+02	6.6E+02	1.2E+02	4.3E+02	5.7E+04
C5001-79A	81.5	2.0E+02	1.1E+03	3.0E+03	1.2E+02	5.6E+01	1.5E+02	5.7E+04	1.7E+00	9.5E-01	2.8E+02	5.6E+02	3.3E+02	1.9E+04
C5001-80A	85.5	2.2E+02	4.3E+01	1.3E+03	6.3E+01	3.5E+00	4.3E+02	3.4E+04	6.8E-01	4.3E+01	6.4E+00	2.2E+02	3.4E+01	8.6E+03

Table D.6. (contd)

Sample ID	Depth (ft bgs)	Li (µg/L)	Mg (µg/L)	Mn (µg/L)	Mo (µg/L)	Ni (µg/L)	P (µg/L)	Pb (µg/L)	Se (µg/L)	Sr (µg/L)	Ti (µg/L)	V (µg/L)	Zn (µg/L)	Na (µg/L)
Groundwater														
B1HRX0	53	3.0E+00	9.6E+03	1.1E+01	2.3E+00	2.2E+01	1.0E+02	3.0E+01	1.6E+02	2.0E+02	3.0E+02	7.5E+01	8.5E+00	1.9E+04
B1HRX4	57.8	1.5E+01	9.8E+03	2.1E+01	1.1E+01	2.3E+01	1.0E+02	3.0E+01	1.9E+02	1.9E+02	3.0E+02	7.5E+01	8.3E+00	1.9E+04
B1HRX8	63.0	5.3E+00	1.0E+04	2.2E+01	6.2E+00	1.9E+01	9.0E+01	3.0E+01	2.3E+02	2.0E+02	3.0E+02	7.5E+01	8.5E+00	2.0E+04
B1HRY2	81.5	7.4E+00	1.0E+04	8.4E+01	8.3E+00	1.6E+01	9.3E+01	3.0E+01	2.5E+02	2.0E+02	3.0E+02	7.5E+01	6.1E+00	2.1E+04
B1HRY6	101.8	6.8E+00	7.8E+03	9.5E+01	4.6E+00	1.5E+01	8.6E+01	3.0E+01	1.4E+02	1.6E+02	5.8E+00	7.5E+01	1.4E+01	1.8E+04
Water Extracts (Concentration Values Were Dilution Corrected)														
C5001-63C	8.0	2.0E+04	1.6E+04	7.4E+01	2.0E+03	6.7E+01	2.2E+03	4.1E+02	1.1E+03	2.0E+02	7.1E+01	9.9E+01	2.1E+03	4.5E+04
C5001-64E	15.0	1.6E+02	4.4E+04	9.1E+01	2.1E+02	1.7E+02	1.1E+03	3.6E+03	2.3E+03	4.7E+02	1.8E+03	1.9E+02	9.6E+02	9.8E+04
C5001-66A	21.0	3.5E+02	5.0E+04	1.8E+02	4.0E+01	9.3E+01	3.8E+03	1.2E+03	3.2E+03	8.5E+02	1.2E+04	1.1E+03	4.1E+03	4.3E+05
C5001-68A	28.0	4.1E+02	6.6E+04	3.1E+02	1.0E+03	1.2E+02	1.6E+03	5.9E+03	4.8E+03	1.1E+03	2.9E+03	2.5E+02	1.2E+03	3.6E+05
C5001-68B	29.0	2.5E+02	3.4E+04	9.3E+01	3.8E+03	6.6E+01	1.5E+03	7.5E+02	1.2E+03	6.1E+02	7.5E+03	7.8E+02	2.1E+03	2.2E+05
C5001-69C	33.0	1.3E+02	3.2E+04	3.8E+01	1.4E+01	8.9E+01	6.0E+02	3.8E+03	4.9E+03	6.8E+02	1.9E+03	2.3E+02	8.1E+02	1.1E+05
C5001-69D	34.0	9.3E+01	1.5E+04	1.6E+02	2.8E+01	2.9E+01	1.3E+02	2.7E+02	5.8E+02	3.4E+02	2.7E+03	1.8E+02	1.1E+03	1.3E+05
C5001-70D	39.5	3.5E+02	2.8E+04	9.8E+01	4.2E+02	2.2E+02	7.1E+02	4.6E+03	5.0E+03	6.7E+02	2.3E+03	3.9E+02	8.0E+02	1.1E+05
C5001-70E	40.5	1.1E+02	3.0E+04	5.4E+01	2.4E+03	3.8E+01	5.7E+02	4.7E+02	4.7E+02	6.7E+02	4.7E+03	3.1E+02	2.4E+03	1.3E+05
C5001-71E	41.5	2.0E+02	4.6E+04	3.1E+02	2.8E+02	1.0E+02	1.8E+02	3.7E+03	1.7E+03	9.8E+02	1.9E+03	1.0E+02	6.5E+02	1.6E+05
C5001-73B	25.8	8.2E+00	1.3E+04	3.1E+01	1.5E+03	2.4E+01	1.6E+02	3.0E+02	5.5E+02	2.4E+02	3.0E+03	1.2E+02	9.2E+02	8.3E+04
C5001-74B	53.5	8.4E+01	1.2E+04	8.2E+01	3.5E+00	3.6E+01	1.1E-01	2.7E+02	1.9E+02	2.4E+02	2.7E+03	1.7E+02	1.3E+03	5.9E+04
C5001-76C	64.5	2.4E+02	2.0E+04	9.6E+01	3.3E+02	1.9E+02	3.9E+02	1.6E+02	4.3E+03	4.1E+02	2.1E+03	2.8E+02	7.7E+02	7.2E+04
C5001-76D	65.5	1.1E+02	1.8E+04	8.8E+01	1.8E+03	2.9E+01	3.0E+01	3.7E+02	3.7E+03	3.4E+02	3.7E+03	2.3E+02	1.2E+03	6.4E+04
C5001-78A	74.5	2.7E+02	2.9E+04	3.5E+01	1.1E+01	1.6E+02	3.0E+02	5.3E+03	4.1E+03	5.8E+02	2.6E+03	3.7E+02	9.1E+02	1.0E+05
C5001-79A	81.5	6.9E+01	1.2E+04	1.8E+02	1.1E+03	1.5E+01	1.3E+01	2.2E+02	2.2E+03	2.2E+02	2.2E+03	1.6E+02	6.8E+02	5.1E+04
C5001-80A	85.5	4.3E+03	6.9E+03	2.6E+00	4.3E+02	9.4E+00	1.7E+02	8.6E+01	2.8E+02	1.6E+02	3.4E+01	2.2E+02	3.0E+02	2.6E+04

Table D.6. (contd)

Sample ID	Depth (ft bgs)	Si (µg/L)	S (µg/L)	Ti (µg/L)	Zr (µg/L)	Ag (µg/L)	Re (µg/L)	Sb (µg/L)
Groundwater								
B1HRX0	53	1.6E+04	1.3E+04	7.5E+00	4.8E-01	7.5E+01	5.1E+00	2.4E+01
B1HRX4	57.8	1.6E+04	1.3E+04	7.5E+00	3.8E-01	7.5E+01	6.9E+00	1.2E+01
B1HRX8	63.0	1.6E+04	1.4E+04	7.5E+00	3.8E-01	7.5E+01	7.4E+00	3.1E+01
B1HRY2	81.5	1.5E+04	1.5E+04	7.5E+00	5.2E-01	7.5E+01	8.2E+00	2.8E+01
B1HRY6	101.8	1.5E+04	1.0E+04	1.0E+00	6.8E-01	7.5E+01	5.3E+00	2.1E+01
Water Extracts (Concentration Values Were Dilution Corrected)								
C5001-63C	8.0	7.8E+04	4.7E+03	6.6E+01	2.1E+01	2.0E+03	2.0E+03	2.0E+03
C5001-64E	15.0	1.4E+05	1.4E+04	1.8E+02	1.7E+01	8.4E+00	2.9E+02	1.7E+02
C5001-66A	21.0	2.3E+05	8.0E+04	9.6E+01	1.2E+01	5.9E+03	5.9E+03	5.9E+03
C5001-68A	28.0	1.8E+05	1.3E+05	2.9E+02	1.7E+01	1.2E+03	2.7E+02	5.9E+03
C5001-68B	29.0	1.6E+05	2.2E+04	6.9E+01	3.8E+02	3.8E+03	3.8E+03	3.8E+03
C5001-69C	33.0	1.5E+05	2.1E+04	4.1E+01	3.8E+02	1.5E+01	4.6E+02	5.6E+02
C5001-69D	34.0	5.0E+04	3.9E+04	5.3E+00	1.4E+02	1.4E+03	1.4E+03	1.4E+03
C5001-70D	39.5	1.4E+05	3.8E+04	3.7E+01	3.7E+01	9.2E+02	3.0E+02	2.5E+01
C5001-70E	40.5	9.5E+04	6.0E+04	1.5E+01	2.4E+02	2.4E+03	2.4E+03	2.4E+03
C5001-71E	41.5	1.1E+05	4.1E+04	6.4E+00	1.3E+01	7.4E+02	2.4E+02	3.3E+02
C5001-73B	25.8	3.3E+04	1.9E+04	5.1E+00	1.5E+02	1.5E+03	1.5E+03	1.5E+03
C5001-74B	53.5	2.6E+04	1.8E+04	5.6E+00	1.4E+02	1.4E+03	1.4E+03	1.4E+03
C5001-76C	64.5	7.5E+04	2.4E+04	3.1E+01	3.4E+00	1.6E+01	1.5E+02	2.6E+02
C5001-76D	65.5	3.4E+04	1.7E+04	1.0E+01	1.8E+02	1.8E+03	1.8E+03	1.8E+03
C5001-78A	74.5	1.0E+05	2.6E+04	1.6E+01	1.6E+01	1.1E+03	5.1E+02	2.4E+01
C5001-79A	81.5	2.7E+04	1.6E+04	5.3E+00	1.1E+02	1.1E+03	1.1E+03	1.1E+03
C5001-80A	85.5	2.6E+04	1.5E+04	1.6E+00	3.5E+00	4.3E+02	4.3E+02	4.3E+02

Table D.7. ICP-OEP for Cations Analysis of C5002 Samples

Sample ID	Depth (ft bgs)	Al (µg/L)	As (µg/L)	B (µg/L)	Ba (µg/L)	Be (µg/L)	Bi (µg/L)	Ca (µg/L)	Cd (µg/L)	Co (µg/L)	Cr (µg/L)	Cu (µg/L)	Fe (µg/L)	K (µg/L)
Groundwater														
B1HT04	52.3	7.5E+01	3.0E+02	7.2E+01	6.3E+01	7.6E-01	1.5E+03	5.2E+04	7.5E+00	3.7E+00	2.4E+00	5.2E-02	5.8E+01	3.8E+03
B1HT08	61.5	7.5E+01	3.0E+02	6.6E+01	5.6E+01	6.3E-01	1.5E+03	4.8E+04	7.5E+00	4.8E+00	2.5E+00	7.5E+01	5.5E+01	3.9E+03
B1HT12	72.5	7.5E+01	2.9E+01	6.1E+01	5.7E+01	5.5E-01	1.5E+03	5.1E+04	7.5E+00	3.4E+00	2.0E+00	7.5E+01	6.4E+01	3.8E+03
B1HT16	91.0	7.5E+01	1.2E+00	4.9E+01	2.4E+01	4.4E-01	1.5E+03	2.2E+04	7.5E+00	2.7E+00	4.2E-02	7.5E+01	4.3E+01	3.8E+03
Water Extracts (Concentration Values Were Dilution Corrected)														
C5002-83B	11.5	1.4E+03	6.9E+03	7.3E+04	6.1E+02	1.7E+01	7.2E+02	4.8E+05	2.3E+01	3.2E+01	1.7E+03	1.0E+02	1.4E+03	2.5E+05
C5002-84C	16.0	1.6E+03	2.3E+04	3.8E+04	9.7E+02	4.9E+01	8.2E+02	3.6E+05	7.1E+01	2.1E+01	1.5E+03	4.9E+02	1.7E+03	2.0E+05
C5002-86E	21.5	2.5E+02	7.5E+02	1.9E+04	3.0E+02	1.2E+01	2.6E+02	2.6E+05	1.5E+02	3.0E+02	7.5E+02	1.5E+03	2.8E+02	7.3E+04
C5002-87D	24.5	7.4E+01	1.2E+03	5.5E+03	2.3E+02	2.3E+01	5.6E+03	2.5E+05	2.8E+02	5.6E+02	7.0E+02	2.4E+02	1.1E+02	6.6E+04
C5002-90A	32.5	1.3E+03	2.1E+03	2.9E+03	6.1E+02	1.6E+02	1.2E+03	4.3E+05	1.1E+01	2.0E+00	8.0E+02	6.9E+02	3.5E+02	1.0E+05
C5002-90C	34.5	3.0E+02	1.3E+03	6.8E+02	3.2E+02	4.6E+01	5.8E+02	1.8E+05	3.1E+00	4.9E+02	6.1E+02	3.8E+02	2.2E+02	7.1E+04
C5002-91C	39.5	6.9E+02	3.2E+03	1.1E+04	3.1E+02	1.6E+02	4.8E+02	2.6E+05	7.8E+00	3.2E+02	8.0E+02	3.9E+01	5.0E+02	9.3E+04
C5002-91D	40.5	8.7E+02	5.7E+02	6.7E+02	4.7E+02	4.5E+01	2.9E+02	1.3E+05	8.2E+00	4.3E+02	5.4E+02	2.3E+02	1.0E+03	5.6E+04
C5002-92D	48.5	4.5E+02	1.9E+02	8.0E+03	2.2E+02	1.9E-01	1.8E+02	1.6E+05	9.6E+00	2.2E+02	5.5E+02	5.6E+00	2.2E+02	4.9E+04
C5002-93E	54.5	3.0E+02	2.4E+02	8.6E+03	1.7E+02	1.2E+02	3.0E+02	1.2E+05	1.2E+02	2.4E+02	6.1E+02	3.7E+00	1.6E+02	3.8E+04
C5002-94D	65.5	4.3E+02	2.4E+03	8.6E+03	1.8E+02	1.2E+02	3.4E+02	6.5E+04	1.0E+01	2.4E+02	6.0E+02	1.2E+03	3.5E+02	2.9E+04
C5002-98E	81.1	3.2E+02	9.0E+01	4.5E+03	1.1E+02	3.0E+00	1.1E+03	6.6E+04	3.7E+00	1.1E+02	6.6E+00	4.5E+02	1.5E+02	2.6E+04
C5002-99D	82.0	4.6E-02	1.4E+02	1.9E+03	6.1E+01	9.2E-01	9.0E+00	1.8E+04	2.1E-01	4.5E+01	1.5E+00	2.3E+02	4.3E+01	8.1E+03
C5002-100A	84.0	5.7E+01	5.9E+02	2.0E+03	2.7E+01	3.0E+01	3.3E+01	1.0E+04	1.8E+00	2.3E-01	1.5E+02	5.4E-01	1.1E+02	8.0E+03

Table D.7. (contd)

Sample ID	Depth (ft bgs)	Li (µg/L)	Mg (µg/L)	Mn (µg/L)	Mo (µg/L)	Ni (µg/L)	P (µg/L)	Pb (µg/L)	Se (µg/L)	Sr (µg/L)	Ti (µg/L)	V (µg/L)	Zn (µg/L)	Na (µg/L)
Groundwater														
B1HT04	52.3	6.2E+00	1.0E+04	7.4E+00	5.4E+00	1.1E+01	1.8E+02	3.0E+01	2.6E+02	2.4E+02	1.4E+01	7.5E+01	1.5E+01	2.4E+04
B1HT08	61.5	1.1E+01	1.0E+04	3.0E+01	5.0E+00	1.2E+01	1.6E+02	3.0E+01	2.6E+02	2.1E+02	3.0E+02	7.5E+01	1.1E+01	2.3E+04
B1HT12	72.5	3.0E+02	1.0E+04	7.4E+01	6.1E+00	1.1E+01	1.2E+02	3.0E+01	2.5E+02	2.3E+02	2.7E+01	7.5E+01	8.0E+00	2.4E+04
B1HT16	91.0	1.9E+00	5.4E+03	7.2E+01	4.9E+00	1.0E+01	1.1E+02	3.0E+01	1.4E+02	1.1E+02	5.7E+00	7.5E+01	2.9E+00	2.9E+04
Water Extracts (Concentration Values Were Dilution Corrected)														
C5002-83B	11.5	3.0E+02	1.2E+05	4.5E+01	6.9E+03	1.6E+02	8.2E+03	1.4E+03	1.8E+03	1.2E+03	1.4E+04	1.1E+03	6.2E+03	3.2E+05
C5002-84C	16.0	8.2E+02	7.1E+04	7.0E+01	3.0E+02	2.8E+02	4.2E+03	9.9E+01	5.8E+03	1.2E+03	5.8E+03	1.5E+03	1.9E+03	2.1E+05
C5002-86E	21.5	3.0E+04	9.5E+04	1.7E+02	2.3E+02	4.7E+01	1.7E+03	6.0E+02	1.9E+03	1.2E+03	6.0E+03	2.8E+02	2.5E+03	3.3E+05
C5002-87D	24.5	2.7E+02	8.8E+04	3.1E+02	2.8E+03	9.3E+01	1.2E+03	3.2E+01	3.8E+03	1.0E+03	2.8E+03	4.2E+02	9.8E+02	2.6E+05
C5002-90A	32.5	6.0E+02	9.9E+04	1.7E+02	1.0E+03	3.2E+02	9.8E+02	6.4E+03	6.3E+03	2.2E+03	3.2E+03	3.2E+02	1.3E+03	2.6E+05
C5002-90C	34.5	4.5E+02	3.5E+04	3.3E+02	3.2E+01	1.6E+02	4.4E+02	4.9E+03	3.5E+03	8.4E+02	2.4E+03	4.9E+02	9.1E+02	1.4E+05
C5002-91C	39.5	2.9E+02	5.1E+04	2.4E+02	6.8E+02	7.7E+01	7.3E+02	6.4E+02	2.9E+02	1.2E+03	6.4E+03	4.5E+02	2.8E+03	2.6E+05
C5002-91D	40.5	3.7E+02	2.9E+04	1.2E+02	2.6E+02	1.7E+02	1.1E+03	1.6E+02	3.4E+03	6.3E+02	2.2E+03	4.6E+02	8.3E+02	1.5E+05
C5002-92D	48.5	8.8E+01	3.1E+04	6.4E+02	1.5E+02	6.2E+01	3.0E+02	4.4E+02	1.1E+03	6.7E+02	4.4E+03	2.0E+02	1.8E+03	1.2E+05
C5002-93E	54.5	1.2E+02	2.4E+04	2.0E+02	8.5E+01	4.3E+01	4.5E+02	4.9E+02	1.2E+03	5.2E+02	4.9E+03	2.7E+02	1.4E+03	1.1E+05
C5002-94D	65.5	2.4E+04	1.3E+04	6.2E+01	2.4E+03	4.1E+01	4.4E+02	4.8E+02	6.1E+02	2.8E+02	4.8E+03	1.8E+02	2.5E+03	8.1E+04
C5002-98E	81.1	1.1E+04	1.3E+04	2.1E+02	5.4E+01	7.3E+00	3.0E+02	2.2E+02	8.3E+02	2.9E+02	2.2E+03	5.4E+02	6.3E+02	6.9E+04
C5002-99D	82.0	4.5E+03	4.2E+03	2.0E+01	2.9E+01	7.4E-01	8.1E+01	9.0E+01	3.6E+02	9.4E+01	2.5E+01	2.4E+01	5.1E+02	2.9E+04
C5002-100A	84.0	3.5E+01	2.4E+03	2.9E+01	7.4E+00	4.8E+00	3.2E+01	1.2E+02	1.2E+03	5.6E+01	1.2E+03	1.1E+02	9.0E+01	2.9E+04

Table D.7. (contd)

Sample ID	Depth (ft bgs)	Si (µg/L)	S (µg/L)	Ti (µg/L)	Zr (µg/L)	Ag (µg/L)	Re (µg/L)	Sb (µg/L)
Groundwater								
B1HT04	52.3	1.2E+04	1.8E+04	7.5E+00	4.7E-01	7.5E+01	6.9E+00	2.7E+01
B1HT08	61.5	1.3E+04	1.8E+04	7.5E+00	2.3E-01	7.5E+01	8.5E+00	1.8E+01
B1HT12	72.5	1.3E+04	1.8E+04	2.5E-01	3.6E-01	7.5E+01	4.5E+00	1.1E+01
B1HT16	91.0	1.7E+04	2.3E+03	7.5E+00	2.3E-01	7.5E+01	4.0E+00	3.4E+01
Water Extracts (Concentration Values Were Dilution Corrected)								
C5002-83B	11.5	4.7E+05	1.7E+05	3.6E+01	6.9E+02	6.9E+03	6.9E+03	6.9E+03
C5002-84C	16.0	4.1E+05	7.4E+04	7.2E+01	3.9E+01	2.3E+03	1.0E+03	1.3E+03
C5002-86E	21.5	2.3E+05	1.1E+05	8.2E-01	1.6E+01	3.0E+03	3.0E+03	3.0E+03
C5002-87D	24.5	2.1E+05	1.0E+05	2.8E+02	2.2E+01	1.1E+03	1.7E+02	1.9E+02
C5002-90A	32.5	2.3E+05	2.0E+05	2.9E+01	5.6E+01	1.3E+03	5.5E+02	2.9E+02
C5002-90C	34.5	1.6E+05	7.3E+04	4.8E+00	1.3E+01	9.7E+02	3.3E+02	4.9E+03
C5002-91C	39.5	1.7E+05	1.5E+05	1.1E+01	3.2E+02	3.2E+03	3.2E+03	3.2E+03
C5002-91D	40.5	1.4E+05	1.1E+05	6.5E+01	1.7E+01	3.6E+00	4.8E+02	1.3E+02
C5002-92D	48.5	8.7E+04	5.3E+04	2.1E+00	2.2E+02	2.2E+03	2.2E+03	2.2E+03
C5002-93E	54.5	9.0E+04	4.3E+04	2.5E+00	2.4E+02	2.4E+03	2.4E+03	2.4E+03
C5002-94D	65.5	6.6E+04	3.1E+04	9.3E+00	2.4E+02	2.4E+03	2.4E+03	2.4E+03
C5002-98E	81.1	3.9E+04	1.8E+04	2.2E+00	3.3E+00	1.1E+03	1.1E+03	1.1E+03
C5002-99D	82.0	3.3E+04	1.1E+04	2.9E-01	8.7E-01	4.5E+02	4.5E+02	4.5E+02
C5002-100A	84.0	4.3E+04	9.7E+03	3.2E+00	5.9E+01	5.9E+02	5.9E+02	5.9E+02

Table D.8. Major Elements of Sediment Samples Using Microwave Digestion/ICP-OES

Wells	Sample ID	Depth (ft bgs)	Si (µg/g)	Al (µg/g)	Fe (µg/g)	Ca (µg/g)	Na (µg/g)	Mg (µg/g)	K (µg/g)	Ti (µg/g)	S (µg/g	Mn (µg/g)	P (µg/g)	Sr (µg/g)
C4999	C4999-3B	9.0	2.1E+05	4.2E+04	4.5E+04	2.4E+04	1.7E+04	8.4E+03	1.4E+04	6.4E+03	1.0E+04	8.5E+02	9.5E+02	3.6E+02
	C4999-5D	18.0	2.0E+05	3.3E+04	7.5E+04	4.5E+04	1.5E+04	1.1E+04	9.0E+03	1.2E+04	9.6E+03	1.3E+03	1.5E+03	3.1E+02
	C4999-6D	23.0	1.7E+05	3.2E+04	6.6E+04	3.7E+04	1.7E+04	1.0E+04	1.0E+04	9.3E+03	9.9E+03	1.2E+03	1.4E+03	3.2E+02
	C4999-9B	30.5	2.2E+05	3.3E+04	7.8E+04	4.2E+04	1.7E+04	1.0E+04	9.3E+03	1.2E+04	9.6E+03	1.4E+03	1.6E+03	2.9E+02
	C4999-10C	35.5	1.8E+05	4.5E+04	7.1E+04	3.8E+04	1.6E+04	1.4E+04	1.1E+04	1.1E+04	9.8E+03	1.2E+03	1.4E+03	2.9E+02
	C4999-12C	46.0	1.7E+05	3.0E+04	7.1E+04	4.0E+04	1.7E+04	9.3E+03	8.0E+03	1.1E+04	9.5E+03	1.2E+03	1.5E+03	3.1E+02
C5000	C5000-36A	11.0	1.8E+05	2.9E+04	7.2E+04	3.9E+04	1.9E+04	8.5E+03	8.7E+03	1.1E+04	9.8E+03	1.3E+03	1.6E+03	3.3E+02
	C5000-37A	13.0	1.7E+05	3.0E+04	8.3E+04	4.7E+04	1.8E+04	1.0E+04	9.2E+03	1.3E+04	9.8E+03	1.4E+03	1.8E+03	3.1E+02
	C5000-40A	30.0	1.8E+05	3.1E+04	7.2E+04	4.1E+04	1.7E+04	9.7E+03	9.6E+03	1.1E+04	9.5E+03	1.3E+03	1.6E+03	3.2E+02
	C5000-40B	31.0	1.7E+05	4.0E+04	7.0E+04	3.9E+04	1.7E+04	1.2E+04	9.3E+03	1.1E+04	9.5E+03	1.2E+03	1.5E+03	3.1E+02
	C5000-40C	32.0	1.8E+05	4.7E+04	7.4E+04	4.2E+04	1.7E+04	1.4E+04	9.9E+03	1.2E+04	9.5E+03	1.3E+03	1.7E+03	3.1E+02
	C5000-41C	36.0	1.6E+05	3.1E+04	7.9E+04	4.5E+04	1.8E+04	9.1E+03	7.9E+03	1.2E+04	9.6E+03	1.4E+03	1.7E+03	3.4E+02
C5001	C5001-63C	8.0	1.6E+05	6.5E+04	3.7E+04	2.4E+04	2.4E+04	1.0E+04	1.8E+04	4.8E+03	2.4E+01	7.3E+02	8.3E+02	4.8E+02
	C5001-66A	21.0	1.6E+05	4.7E+04	8.1E+04	4.7E+04	2.1E+04	1.5E+04	9.5E+03	1.3E+04	8.6E+03	1.4E+03	1.8E+03	3.6E+02
	C5001-68B	29.0	1.8E+05	6.2E+04	8.9E+04	5.1E+04	2.0E+04	2.1E+04	1.2E+04	1.4E+04	9.0E+03	1.5E+03	1.9E+03	3.3E+02
	C5001-69D	34.0	1.7E+05	5.2E+04	7.8E+04	5.0E+04	1.9E+04	1.7E+04	1.2E+04	1.2E+04	9.2E+03	1.4E+03	1.7E+03	3.1E+02
	C5001-70E	40.5	1.6E+05	5.9E+04	7.7E+04	4.7E+04	2.0E+04	1.9E+04	1.2E+04	1.2E+04	8.9E+03	1.4E+03	1.6E+03	3.3E+02
	C5001-73B	25.8	1.8E+05	5.8E+04	7.4E+04	4.4E+04	1.9E+04	1.7E+04	1.2E+04	1.2E+04	9.1E+03	1.3E+03	1.6E+03	3.2E+02
	C5001-74B	53.5	1.9E+05	5.7E+04	7.6E+04	4.8E+04	2.1E+04	1.8E+04	1.2E+04	1.2E+04	9.3E+03	1.4E+03	1.7E+03	3.5E+02
	C5001-76D	65.5	1.5E+05	5.8E+04	7.7E+04	4.6E+04	2.1E+04	1.8E+04	1.2E+04	1.2E+04	9.0E+03	1.4E+03	1.6E+03	3.3E+02
	C5001-79A	81.5	1.7E+05	5.4E+04	5.0E+04	2.7E+04	1.7E+04	1.3E+04	1.4E+04	7.3E+03	6.8E+01	1.0E+03	1.1E+03	2.8E+02
	C5001-80A	85.5	1.6E+05	7.1E+04	3.2E+04	1.2E+04	1.6E+04	8.4E+03	2.4E+04	3.5E+03	4.0E+01	2.3E+02	4.0E+02	3.4E+02
C5002	C5002-84C	16.0	2.2E+05	6.7E+04	2.8E+04	3.0E+04	2.8E+04	8.4E+03	2.3E+04	4.0E+03	1.0E+04	5.1E+02	7.6E+02	6.1E+02
	C5002-86E	21.5	1.8E+05	4.9E+04	7.1E+04	3.7E+04	1.7E+04	1.5E+04	1.0E+04	1.1E+04	9.2E+03	1.4E+03	1.4E+03	3.2E+02
	C5002-87D	24.5	2.1E+05	3.8E+04	7.6E+04	4.4E+04	1.8E+04	1.1E+04	1.1E+04	1.2E+04	1.0E+04	1.3E+03	1.6E+03	3.5E+02
	C5002-90A	32.5	1.8E+05	4.0E+04	7.0E+04	4.2E+04	1.8E+04	1.2E+04	1.1E+04	1.1E+04	9.8E+03	1.3E+03	1.5E+03	3.3E+02
	C5002-90C	34.5	2.4E+05	4.6E+04	7.3E+04	3.9E+04	1.6E+04	1.3E+04	1.3E+04	1.1E+04	1.0E+04	1.3E+03	1.6E+03	3.0E+02
	C5002-91C	39.5	1.7E+05	5.5E+04	6.7E+04	3.7E+04	1.8E+04	1.6E+04	1.2E+04	1.0E+04	9.2E+03	1.2E+03	1.4E+03	2.7E+02
	C5002-91D	40.5	1.8E+05	4.3E+04	7.1E+04	3.9E+04	1.6E+04	1.3E+04	1.0E+04	1.1E+04	9.6E+03	1.3E+03	1.6E+03	3.0E+02
	C5002-92D	48.5	1.9E+05	4.3E+04	8.1E+04	4.6E+04	1.8E+04	1.4E+04	9.9E+03	1.3E+04	9.0E+03	1.4E+03	1.6E+03	3.1E+02
	C5002-93E	54.5	1.7E+05	6.2E+04	7.7E+04	4.6E+04	2.1E+04	2.0E+04	1.2E+04	1.2E+04	9.0E+03	1.4E+03	1.6E+03	3.3E+02
	C5002-94D	65.5	1.6E+05	5.5E+04	7.9E+04	4.6E+04	2.0E+04	1.7E+04	1.1E+04	1.2E+04	8.9E+03	1.3E+03	1.6E+03	3.3E+02
	C5002-98E	81.1	1.8E+05	6.2E+04	2.4E+04	2.1E+04	2.1E+04	8.0E+03	1.8E+04	2.5E+03	1.9E+02	5.5E+02	5.3E+02	4.1E+02
	C5002-99D	82.0	1.7E+05	7.0E+04	2.7E+04	1.3E+04	1.6E+04	7.8E+03	2.8E+04	3.3E+03	9.3E+03	3.6E+02	1.1E+03	3.6E+02
	C5002-100A	84.0	1.6E+05	6.4E+04	2.3E+04	1.2E+04	1.6E+04	6.4E+03	2.7E+04	3.1E+03	9.3E+03	2.9E+02	6.7E+02	3.5E+02

Table D.9. Particle Size Distribution for Sediments (<2 mm) in C4999, C5000, C5001, and C5002

Wells	Sample ID	Depth (ft bgs)	Particle Size Distribution (%)[a]		
			Clay	Silt	Sand
C4999 (399-3-18)	C4999-3B	9	3.28	15.67	81.05
	C4999-6A	20	10.21	6.80	82.99
	C4999-6D	23	11.82	36.55	51.63
	C4999-9C	31.5	7.26	25.08	67.66
	C4999-10C	35.5	9.09	30.53	60.39
	C4999-10D	36.5	11.82	37.76	50.42
	C4999-11D	41.5	8.27	38.30	53.43
	C4999-13E	53	4.60	29.03	66.37
	C4999-15A	58	22.65	9.87	67.47
	C4999-17B	67	3.34	12.52	84.14
	C4999-22E	90.5	8.76	22.61	68.62
	C4999-25B	99.5	4.67	10.35	84.98
	C4999-31E	127	10.03	54.21	35.75
C5000 (399-1-23)	C5000-38B	20	3.62	10.70	85.69
	C5000-38C	21	13.27	18.29	68.44
	C5000-39B	23	9.12	21.14	69.74
	C5000-39D	25	9.54	20.12	70.34
	C5000-40C	32	4.44	17.70	77.86
	C5000-40E	34	5.56	26.49	67.96
	C5000-41C	36	4.06	16.47	79.46
	C5000-41E	38	4.48	17.80	77.72
	C5000-44E	51	3.50	21.09	75.41
	C5000-45B	53	3.82	22.28	73.90
	C5000-45C	54	5.68	20.06	74.27
	C5000-45D	55	2.28	22.42	75.30
C5001 (399-3-19)	C5001-63C	8.0	2.28	8.01	89.71
	C5001-66A	21.0	3.12	10.05	86.83
	C5001-68B	29.0	4.55	12.23	83.23
	C5001-69D	34.0	6.95	26.46	66.59
	C5001-70E	40.5	4.60	12.13	83.26
	C5001-73B	25.8	2.31	11.32	86.37
	C5001-74B	53.5	1.93	2.50	95.58
	C5001-76D	65.5	2.00	18.72	79.28
	C5001-79A	81.5	2.54	9.65	87.81
	C5001-80A	85.5	5.51	45.08	49.41
C5002 (399-3-20)	C5002-83B	11.5	1.22	1.95	96.83
	C5002-86E	21.5	2.60	26.68	70.72
	C5002-91C	39.5	6.95	23.60	69.45
	C5002-92D	48.5	5.94	14.33	79.73
	C5002-93E	54.5	0.83	5.73	93.44
	C5002-94D	65.5	0.67	5.00	94.32
	C5002-98E	81.1	3.26	10.67	86.07
	C5002-99D	82	3.39	10.98	85.62
	C5002-100A	84	3.16	15.02	81.82

(a) Particle size distribution was conducted only for particle less than 2 mm.

Table D.10. Carbon Content of Sediments[(a)]

Well	ID	Depth (ft bgs)	TC (%)	IC (%)	OC (%)	IC (mg/g)	IC as $CaCO_3$ (g/g)
C4999	C4999-3B	9.00	1.72	0.10	1.62	0.83	0.00691
	C4999-6A	20.0	2.48	0.11	2.37	0.96	0.00797
	C4999-8E	28.5	0.40	0.04	0.36	0.31	0.00259
	C4999-10C	35.5	0.28	0.01	0.27	0.09	0.00071
	C4999-11B	39.5	0.12	0.04	0.08	0.34	0.00284
	C4999-11D	41.5	0.05	0.00	0.05	0.00	0.00000
	C4999-12D	47.0	0.02	0.00	0.02	0.00	0.00000
	C4999-13E	53.0	0.02	0.00	0.02	0.00	0.00000
	C4999-14D	56.0	0.04	0.00	0.04	0.00	0.00000
	C4999-15B	59.0	0.17	0.01	0.16	0.07	0.00058
	C4999-16A	62.0	0.03	0.00	0.03	0.00	0.00000
	C4999-17A	66.0	0.04	0.01	0.04	0.05	0.00042
	C4999-19B	76.0	0.08	0.00	0.08	0.00	0.00000
	C4999-21C	86.0	0.20	0.00	0.20	0.03	0.00021
	C4999-22E	90.5	0.13	0.00	0.13	0.02	0.00014
	C4999-25A	98.5	0.06	0.00	0.06	0.00	0.00000
	C4999-27B	108.0	0.14	0.02	0.12	0.16	0.00135
	C4999-29D	118.0	0.16	0.01	0.15	0.06	0.00049
	C4999-31C	125.0	0.08	0.00	0.08	0.02	0.00018
	C4999-32B	129.0	0.07	0.00	0.07	0.00	0.00000
C5000	C5000-36A	11.0	0.09	0.00	0.09	0.01	0.00005
	C5000-36E	12.0	0.09	0.02	0.07	0.17	0.00138
	C5000-37A	13.0	0.68	0.00	0.68	0.03	0.00025
	C5000-38B	20.0	0.08	0.01	0.08	0.05	0.00038
	C5000-38C	21.0	0.14	0.00	0.13	0.03	0.00021
	C5000-39B	23.0	0.57	0.41	0.16	3.42	0.02850
	C5000-39D	25.0	0.07	0.00	0.07	0.00	0.00000
	C5000-40C	32.0	0.20	0.00	0.20	0.00	0.00000
	C5000-40E	34.0	0.02	0.00	0.02	0.00	0.00000
	C5000-41B	35.0	0.07	0.00	0.07	0.03	0.00025
	C5000-41E	38.0	0.04	0.00	0.04	0.00	0.00000
	C5000-43A	44.0	0.06	0.00	0.06	0.00	0.00000
	C5000-44B	53.0	0.08	0.02	0.06	0.14	0.00119
	C5000-44E	51.0	0.06	0.00	0.06	0.00	0.00000
	C5000-45C	54.0	0.03	0.00	0.03	0.00	0.00000
	C5000-46A	56.0	0.09	0.00	0.09	0.00	0.00000
	C5000-46D	59.0	0.06	0.00	0.06	0.00	0.00000
	C5000-48D	65.0	0.31	0.00	0.31	0.02	0.00017
	C5000-48E	66.0	0.03	0.00	0.03	0.00	0.00000
	C5000-49D	68.0	0.08	0.01	0.08	0.07	0.00057
	C5000-50B	71.0	0.09	0.03	0.05	0.29	0.00240
	C5000-51E	77.0	0.12	0.08	0.05	0.63	0.00525
	C5000-52B	79.0	0.09	0.06	0.04	0.46	0.00385
	C5000-53E	85.0	0.07	0.00	0.07	0.00	0.00000
	C5000-54E	89.5	0.11	0.02	0.09	0.18	0.00153
	C5000-57D	100.0	0.22	0.17	0.04	1.44	0.01196
	C5000-60E	109.5	0.08	0.00	0.08	0.00	0.00000

Table D.10. (contd)

Well	ID	Depth (ft bgs)	TC (%)	IC (%)	OC (%)	IC (mg/g)	IC as $CaCO_3$ (g/g)
C5001	C5001-63C	8.0	0.05	0.00	0.05	0.00	0.00000
	C5001-66A	21.0	0.81	0.01	0.80	0.12	0.00099
	C5001-68B	29.0	0.22	0.01	0.21	0.06	0.00049
	C5001-69D	34.0	0.45	0.12	0.34	0.96	0.00802
	C5001-70E	40.5	0.10	0.05	0.05	0.44	0.00364
	C5001-73B	25.8	0.14	0.01	0.13	0.11	0.00092
	C5001-74B	53.5	0.09	0.06	0.03	0.48	0.00403
	C5001-76D	65.5	0.08	0.01	0.07	0.11	0.00090
	C5001-79A	81.5	0.06	0.01	0.06	0.06	0.00047
	C5001-80A	85.5	0.02	0.00	0.02	0.00	0.00000
C5002	C5002-83B	11.5	0.12	0.07	0.05	0.61	0.00510
	C5002-86E	13.0	0.64	0.09	0.54	0.78	0.00649
	C5002-91C	39.5	0.13	0.01	0.12	0.07	0.00058
	C5002-92D	48.5	0.07	0.00	0.06	0.03	0.00024
	C5002-93E	54.5	0.06	0.01	0.05	0.07	0.00057
	C5002-94D	65.5	0.02	0.00	0.02	0.00	0.00000
	C5002-98E	81.1	0.17	0.11	0.05	0.93	0.00775
	C5002-99D	82.0	0.02	0.00	0.02	0.00	0.00000
	C5002-100A	84.0	0.01	0.00	0.01	0.00	0.00000

(a) TC, IC, and OC represent total carbon, inorganic carbon, and organic carbon content, respectively.

Table D.11. Carbonate Leaching Results

Well	Sample ID	Depth (ft bgs)	Reactions Times (days)					
			1	4	7	14	21	
399-3-18 (C4999)	**pH**							
	C4999-6D	23.0	8.63	8.65	8.63	8.53	8.12	
	C4999-10C	35.5	8.69	8.72	8.69	8.62	8.51	
	C4999-10D	36.5	8.45	8.49	8.39	8.36	8.26	
	Alkalinity (mg/L as $CaCO_3$)							
	C4999-6D	23.0	497.8	471.2	494.0	467.4	486.4	
	C4999-10C	35.5	467.4	471.2	513.0	524.4	524.4	
	C4999-10D	36.5	467.4	459.8	463.6	452.2	433.2	
	Ca Concentration (mg/L)							
	C4999-6D	23.0	2.97	2.68	2.59	2.15	2.32	
	C4999-10C	35.5	3.26	3.00	2.80	2.56	4.98	
	C4999-10D	36.5	4.70	4.79	5.01	4.78	4.98	
	Uranium Concentration (µg/g)							
	C4999-6D	23.0	0.033	0.041	0.046	0.054	0.060	
	C4999-10C	35.5	0.480	0.584	0.642	0.704	0.797	
	C4999-10D	36.5	0.229	0.316	0.361	0.417	0.480	
	Uranium Concentration (µg/g)							
	Reaction Times (days)		1	2	5	7	14	21
	C4999-3B	9.0	0.733	0.822	0.942	1.008	1.073	1.154
	C4999-5A	15.0	0.232	0.245	0.258	0.266	0.285	0.290
	C4999-6A	20.0	0.255	0.285	0.306	0.318	0.351	0.374
	C4999-7A	25.0	0.021	0.020	0.017	0.034	0.041	0.034
	C4999-9C	31.5	0.306	0.391	0.477	0.482	0.638	0.646
	C4999-11D	41.5	1.809	2.234	2.606	2.786	3.151	3.295
	C4999-14A	54.0	5.779	7.293	8.529	9.399	9.741	9.642
	C4999-15B	59.0	0.237	0.359	0.430	0.478	0.578	0.626
	C4999-16D	65.0	0.403	0.583	0.755	0.755	0.923	0.973
399-1-23 (C5000)	**pH**							
	C5000-36A	11.0	8.73	8.77	8.72	8.71	8.55	
	C5000-37A	13.0	8.75	8.80	8.74	8.67	8.49	
	C5000-45C	54.0	8.77	8.85	8.83	8.79	8.61	
	Alkalinity (mg/L as $CaCO_3$)							
	C5000-36A	11.0	490.2	486.4	505.4	543.4	516.8	
	C5000-37A	13.0	505.4	520.6	494.0	501.6	532.0	
	C5000-45C	54.0	490.2	513.0	486.4	501.6	463.6	
	Ca Concentration (mg/L)							
	C5000-36A	11.0	2.86	2.58	2.31	1.97	2.29	
	C5000-37A	13.0	3.30	3.13	2.98	2.40	2.96	
	C5000-45C	54.0	2.94	2.75	2.54	2.32	2.36	
	Uranium Concentration (µg/g)							
	C5000-36A	11.0	0.119	0.140	0.157	0.175	0.192	
	C5000-37A	13.0	0.088	0.118	0.138	0.163	0.179	
	C5000-45C	54.0	0.761	0.966	1.086	1.163	1.302	
	Uranium Concentration (µg/g)							
	Reaction Times (days)		1	2	7	14	21	
	C5000-32D	0.5	0.447	0.564	0.582	0.686	0.695	
	C5000-33A	2.3	0.322	0.383	0.441	0.478	0.489	

Table D.11. (contd)

Well	Sample ID	Depth (ft bgs)	Reactions Times (days)	Well	Sample ID	Depth (ft bgs)	Reactions Times (days)
399-1-23 (C5000) (contd)	C5000-33C	3.0	0.004	0.010	0.018	0.015	0.023
	C5000-34B	5.0	0.035	0.039	0.043	0.044	0.046
	C5000-34E	8.0	0.033	0.046	0.056	0.066	0.069
	C5000-36E	12.0	0.053	0.070	0.144	0.098	0.104
	C5000-39D	25.0	2.486	2.847	3.021	3.178	3.241
	C5000-40E	34.0	0.138	0.156	0.188	0.201	0.211
	C5000-53E	85.0	0.218	0.285	0.326	0.377	0.393
	C5000-60E	109.5	0.020	0.026	0.036	0.043	0.045
399-3-19 (C5001)	**Uranium Concentration (μg/g)**						
	Reaction Times (days)		1	3	7	14	21
	C5001-63C	8.0	0.068	0.078	0.090	0.109	0.112
	C5001-66A	21.0	0.006	0.009	0.010	0.011	0.012
	C5001-68B	29.0	0.004	0.006	0.007	0.007	0.009
	C5001-69D	34.0	0.009	0.011	0.013	0.015	0.017
	C5001-70E	40.5	0.009	0.009	0.011	0.014	0.015
	C5001-73B	49.8	0.029	0.036	0.043	0.054	0.054
	C5001-74B	53.5	0.026	0.034	0.042	0.054	0.056
	C5001-76D	65.5	0.010	0.014	0.017	0.021	0.023
	C5001-79A	81.5	0.054	0.075	0.081	0.102	0.104
	C5001-80A	85.5	0.022	0.042	0.055	0.064	0.066
399-3-20 (C5002)	**Uranium Concentration (μg/g)**						
	Reaction Times (days)		1	3	7	14	21
	C5002-83B	11.5	0.022	0.025	0.029	0.033	0.036
	C5002-86E	21.5	0.005	0.006	0.008	0.010	0.012
	C5002-91C	39.5	0.003	0.004	0.006	0.009	0.010
	C5002-92D	48.5	0.016	0.019	0.023	0.027	0.028
	C5002-93E	54.5	0.072	0.095	0.119	0.152	0.160
	C5002-94D	65.5	0.022	0.030	0.039	0.050	0.057
	C5002-98E	81.1	0.010	0.011	0.014	0.018	0.023
	C5002-99D	82.0	0.031	0.039	0.046	0.056	0.058
	C5002-100A	84.0	0.025	0.033	0.042	0.047	0.049

Table D.12. Uranium Leaching Results with Three Different Solutions

Well	Sample ID	Depth (ft bgs)	Reactions Times (days)				
			1	3	7	14	28
	Synthetic Pore Water Used		**pH**				
	C4999-9C	31.5	8.13	7.81	7.95	7.99	7.68
	C4999-11D	41.5	8.04	7.77	7.71	7.83	7.68
	C4999-12D	47.0	7.71	7.87	7.77	7.86	7.70
	C4999-21C	86.0	7.83	7.98	8.00	8.03	7.95
	Synthetic Pore Water Used		**Alkalinity (mg/L as $CaCO_3$)**				
	C4999-9C	31.5	266.0	171.0	159.6	155.8	311.6
	C4999-11D	41.5	212.8	129.2	133.0	159.6	292.6
	C4999-12D	47.0	193.8	117.8	159.6	106.4	174.8
	C4999-21C	86.0	266.0	159.6	174.8	197.6	159.6
	Synthetic Pore Water Used		**Ca Concentration (mg/L)**				
	C4999-9C	31.5	153.2	153.3	148.8	145.2	148.1
	C4999-11D	41.5	191.4	217.4	227.3	209.6	214.9
	C4999-12D	47.0	183.8	203.3	204.8	205.0	207.6
	C4999-21C	86.0	173.0	196.7	189.2	178.2	174.8
	Synthetic Pore Water Used		**Uranium Concentration (µg/g)**				
	C4999-9C	31.5	2.58E-01	3.93E-01	4.41E-01	4.87E-01	5.26E-01
	C4999-11D	41.5	1.60E+00	2.60E+00	3.16E+00	3.58E+00	3.84E+00
	C4999-12D	47.0	6.66E-02	1.06E-01	1.09E-01	1.25E-01	1.23E-01
	C4999-21C	86.0	3.68E-02	7.16E-02	8.81E-02	9.72E-02	8.26E-02
	Synthetic Groundwater Used		**pH**				
	C4999-9C	31.5	7.29	7.33	7.48	7.52	7.53
	C4999-11D	41.5	7.29	7.37	7.47	7.49	7.55
399-3-18 (C4999)	C4999-12D	47.0	7.16	7.39	7.45	7.51	7.34
	C4999-21C	86.0	7.04	6.74	5.62	4.93	4.65
	Synthetic Groundwater Used		**Alkalinity (mg/L as $CaCO_3$)**				
	C4999-9C	31.5	87.4	152.0	87.4	87.4	106.4
	C4999-11D	41.5	60.8	83.6	114.0	98.8	95.0
	C4999-12D	47.0	60.8	79.8	87.4	87.4	95.0
	C4999-21C	86.0	49.4	64.6	38.0	34.2	38.0
	Synthetic Groundwater Used		**Ca Concentration (mg/L)**				
	C4999-9C	31.5	27.56	38.26	38.10	38.89	39.84
	C4999-11D	41.5	34.44	44.37	46.60	45.83	47.83
	C4999-12D	47.0	32.15	37.46	39.32	39.24	40.32
	C4999-21C	86.0	69.95	77.32	72.04	74.56	80.10
	Synthetic Groundwater Used		**Uranium Concentration (µg/g)**				
	C4999-9C	31.5	3.13E-02	5.80E-02	7.54E-02	9.13E-02	1.03E-01
	C4999-11D	41.5	1.04E-01	1.85E-01	2.08E-01	2.08E-01	2.21E-01
	C4999-12D	47.0	4.88E-03	5.96E-03	5.54E-03	5.21E-03	3.96E-03
	C4999-21C	86.0	3.92E-03	1.52E-03	1.19E-03	2.71E-03	6.31E-03
	Synthetic River Water Used		**pH**				
	C4999-9C	31.5	7.13	7.24	7.22	7.28	7.19
	C4999-11D	41.5	7.08	7.27	7.21	7.28	7.28
	C4999-12D	47.0	7.11	7.26	7.23	7.27	7.31
	C4999-21C	86.0	6.55	5.49	5.38	4.79	4.42
	Synthetic River Water Used		**Alkalinity (mg/L as $CaCO_3$)**				
	C4999-9C	31.5	79.8	159.6	98.8	60.8	98.8
	C4999-11D	41.5	60.8	98.8	60.8	87.4	60.8

Table D.12. (contd)

Well	Sample ID	Depth (ft bgs)	Reactions Times (days)				
			1	3	7	14	28
399-3-18 (C4999) (contd)	C4999-12D	47.0	76.0	102.6	57.0	64.6	76.0
	C4999-21C	86.0	60.8	53.2	34.2	34.2	30.4
	Synthetic River Water Used		**Ca Concentration (mg/L)**				
	C4999-9C	31.5	4.09	5.34	6.04	6.14	7.01
	C4999-11D	41.5	4.04	5.31	6.06	6.31	7.21
	C4999-12D	47.0	2.46	2.92	3.01	3.20	3.74
	C4999-21C	86.0	49.1	56.4	53.5	52.9	60.6
	Synthetic River Water Used		**Uranium Concentration (µg/g)**				
	C4999-9C	31.5	3.32E-03	6.25E-03	8.80E-03	1.03E-02	1.21E-02
	C4999-11D	41.5	1.21E-02	2.03E-02	2.23E-02	2.58E-02	2.89E-02
	C4999-12D	47.0	2.46E-03	9.39E-04	7.98E-04	8.18E-04	5.97E-04
	C4999-21C	86.0	1.71E-03	2.08E-03	1.88E-03	3.11E-03	6.85E-03
399-1-23 (C5000)	Synthetic Pore Water Used		**pH**				
	C5000-39B	23.0	7.84	7.91	7.88	7.94	8.09
	C5000-39D	25.0	7.68	7.95	7.88	7.93	7.73
	C5000-40E	34.0	8.14	7.95	8.00	8.11	7.70
	C5000-45C	54.0	8.20	7.95	7.93	8.08	7.80
	Synthetic Pore Water Used		**Alkalinity (mg/L as $CaCO_3$)**				
	C5000-39B	23.0	235.6	197.6	155.8	125.4	133.0
	C5000-39D	25.0	209.0	155.8	174.8	106.4	163.4
	C5000-40E	34.0	273.6	212.8	212.8	178.6	258.4
	C5000-45C	54.0	235.6	182.4	174.8	201.4	212.8
	Synthetic Pore Water Used		**Ca Concentration (mg/L)**				
	C5000-39B	23.0	153.9	166.7	166.0	160.3	158.7
	C5000-39D	25.0	136.7	174.5	176.7	162.8	166.0
	C5000-40E	34.0	118.0	104.3	102.2	96.8	96.8
	C5000-45C	54.0	138.0	137.5	132.3	123.9	114.6
	Synthetic Pore Water Used		**Uranium Concentration (µg/g)**				
	C5000-39B	23.0	9.15E-01	1.24E+00	1.22E+00	1.30E+00	1.37E+00
	C5000-39D	25.0	6.28E-01	8.99E-01	9.06E-01	9.72E-01	9.79E-01
	C5000-40E	34.0	6.28E-02	9.05E-02	9.71E-02	1.13E-01	1.18E-01
	C5000-45C	54.0	5.05E-01	7.32E-01	7.55E-01	8.31E-01	7.98E-01
	Synthetic Groundwater Used		**pH**				
	C5000-39B	23.0	7.34	7.59	7.58	7.56	7.59
	C5000-39D	25.0	7.11	7.50	7.50	7.57	7.63
	C5000-40E	34.0	7.26	7.54	7.51	7.42	7.43
	C5000-45C	54.0	7.20	7.55	7.52	7.53	7.57
	Synthetic Groundwater Used		**Alkalinity (mg/L as $CaCO_3$)**				
	C5000-39B	23.0	83.6	98.8	98.8	87.4	125.4
	C5000-39D	25.0	79.8	152.0	98.8	83.6	114.0
	C5000-40E	34.0	60.8	95.0	95.0	83.6	98.8
	C5000-45C	54.0	64.6	83.6	114.0	87.4	83.6
	Synthetic Groundwater Used		**Ca Concentration (mg/L)**				
	C5000-39B	23.0	33.23	44.07	47.23	46.12	49.74
	C5000-39D	25.0	29.59	38.62	40.19	40.78	42.34
	C5000-40E	34.0	20.18	25.35	27.07	28.39	29.39
	C5000-45C	54.0	26.22	32.96	33.59	32.98	33.77

Table D.12. (contd)

Well	Sample ID	Depth (ft bgs)	Reactions Times (days)				
			1	3	7	14	28
399-1-23 (C5000) (contd)	Synthetic Groundwater Used		**Uranium Concentration (µg/g)**				
	C5000-39B	23.0	2.90E-01	5.18E-01	6.74E-01	7.89E-01	8.55E-01
	C5000-39D	25.0	1.02E-01	1.67E-01	1.94E-01	2.06E-01	2.16E-01
	C5000-40E	34.0	2.15E-02	3.74E-02	4.91E-02	5.70E-02	6.58E-02
	C5000-45C	54.0	8.20E-02	1.40E-01	1.67E-01	1.90E-01	1.91E-01
	Synthetic River Water Used		**pH**				
	C5000-39B	23.0	7.40	7.53	7.50	7.57	7.45
	C5000-39D	25.0	6.88	7.52	7.36	7.40	7.37
	C5000-40E	34.0	7.12	7.46	7.28	7.19	7.22
	C5000-45C	54.0	7.10	7.37	7.25	7.29	7.13
	Synthetic River Water Used		**Alkalinity (mg/L as $CaCO_3$)**				
	C5000-39B	23.0	95.0	83.6	98.8	98.8	117.8
	C5000-39D	25.0	64.6	83.6	79.8	95.0	64.6
	C5000-40E	34.0	79.8	129.2	79.8	79.8	117.8
	C5000-45C	54.0	79.8	136.8	60.8	79.8	79.8
	Synthetic River Water Used		**Ca Concentration (mg/L)**				
	C5000-39B	23.0	6.83	13.4	13.89	14.08	15.75
	C5000-39D	25.0	2.46	3.23	3.63	3.92	4.34
	C5000-40E	34.0	4.07	5.99	6.43	7.37	8.10
	C5000-45C	54.0	6.25	7.54	7.42	7.97	8.35
	Synthetic River Water Used		**Uranium Concentration (µg/g)**				
	C5000-39B	23.0	1.59E-01	3.73E-01	5.07E-01	5.70E-01	6.74E-01
	C5000-39D	25.0	1.41E-02	1.96E-02	2.24E-02	2.41E-02	2.68E-02
	C5000-40E	34.0	1.02E-02	1.62E-02	1.99E-02	2.46E-02	2.74E-02
	C5000-45C	54.0	1.13E-02	1.62E-02	1.88E-02	2.21E-02	2.45E-02
399-3-19 (C5001)	Synthetic Pore Water Used		**pH**				
	C5001-66A	21.0	8.00	7.99	8.04	8.07	7.85
	C5001-69D	34.0	8.00	7.91	7.88	7.88	7.98
	C5001-73B	25.8	7.89	7.96	7.91	8.06	8.09
	C5001-80A	85.5	7.84	7.80	7.82	7.90	7.51
	Synthetic Pore Water Used		**Alkalinity (mg/L as $CaCO_3$)**				
	C5001-66A	21.0	338.2	197.6	212.8	186.2	163.4
	C5001-69D	34.0	220.4	159.6	155.8	125.4	235.6
	C5001-73B	25.8	247.0	144.4	171.0	155.8	163.4
	C5001-80A	85.5	182.4	277.4	155.8	129.2	155.8
	Synthetic Pore Water Used		**Ca Concentration (mg/L)**				
	C5001-66A	21.0	122.0	123.3	123.9	121.0	123.2
	C5001-69D	34.0	169.2	173.5	175.6	167.4	168.7
	C5001-73B	25.8	131.7	146.5	141.7	123.9	139.7
	C5001-80A	85.5	205.3	232.2	240.9	238.7	240.1
	Synthetic Pore Water Used		**Uranium Concentration (µg/g)**				
	C5001-66A	21.0	6.93E-03	1.19E-02	1.15E-02	1.31E-02	1.37E-02
	C5001-69D	34.0	1.65E-02	2.24E-02	2.11E-02	2.31E-02	2.47E-02
	C5001-73B	25.8	3.29E-02	4.67E-02	4.89E-02	5.31E-02	5.88E-02
	C5001-80A	85.5	5.66E-02	8.17E-02	8.97E-02	9.77E-02	9.60E-02
	Synthetic Groundwater Used		**pH**				
	C5001-66A	21.0	7.35	7.63	7.59	7.6	7.69
	C5001-69D	34.0	7.46	7.65	7.82	8.01	7.92

Table D.12. (contd)

Well	Sample ID	Depth (ft bgs)	Reactions Times (days)				
			1	3	7	14	28
399-3-19 (C5001) (contd)	C5001-73B	25.8	7.32	7.59	7.63	7.78	7.78
	C5001-80A	85.5	7.10	7.47	7.35	7.59	7.47
	Synthetic Groundwater Used		**Alkalinity (mg/L as $CaCO_3$)**				
	C5001-66A	21.0	76.0	106.4	98.8	98.8	117.8
	C5001-69D	34.0	79.8	117.8	159.6	174.8	174.8
	C5001-73B	25.8	79.8	102.6	91.2	87.4	102.6
	C5001-80A	85.5	79.8	79.8	60.8	79.8	95.0
	Synthetic Groundwater Used		**Ca Concentration (mg/L)**				
	C5001-66A	21.0	26.25	35.07	37.68	38.60	39.02
	C5001-69D	34.0	40.53	53.98	66.60	71.94	74.63
	C5001-73B	25.8	30.60	41.99	44.06	45.88	46.42
	C5001-80A	85.5	34.65	41.49	43.18	44.36	45.79
	Synthetic Groundwater Used		**Uranium Concentration (µg/g)**				
	C5001-66A	21.0	3.37E-03	5.72E-03	6.82E-03	7.99E-03	8.09E-03
	C5001-69D	34.0	4.55E-03	1.08E-02	1.72E-02	2.16E-02	2.37E-02
	C5001-73B	25.8	1.36E-02	2.42E-02	3.01E-02	3.32E-02	3.70E-02
	C5001-80A	85.5	2.87E-03	4.23E-03	3.72E-03	3.08E-03	2.38E-03
	Synthetic River Water Used		**pH**				
	C5001-66A	21.0	7.30	7.61	7.43	7.54	7.61
	C5001-69D	34.0	7.23	7.79	7.72	7.93	7.64
	C5001-73B	25.8	7.28	7.61	7.53	7.58	7.65
	C5001-80A	85.5	7.11	7.40	7.28	7.37	7.36
	Synthetic River Water Used		**Alkalinity (mg/L as $CaCO_3$)**				
	C5001-66A	21.0	152.0	79.8	83.6	79.8	117.8
	C5001-69D	34.0	83.6	102.6	133.0	155.8	155.8
	C5001-73B	25.8	95.0	102.6	83.6	114.0	98.8
	C5001-80A	85.5	95.0	68.4	57.0	60.8	60.8
	Synthetic River Water Used		**Ca Concentration (mg/L)**				
	C5001-66A	21.0	7.06	11.70	12.36	14.09	14.77
	C5001-69D	34.0	11.91	21.92	28.13	34.42	37.38
	C5001-73B	25.8	7.86	12.79	13.74	15.39	17.77
	C5001-80A	85.5	3.28	3.81	4.10	4.25	4.90
	Synthetic River Water Used		**Uranium Concentration (µg/g)**				
	C5001-66A	21.0	2.38E-03	4.78E-03	5.63E-03	6.57E-03	7.48E-03
	C5001-69D	34.0	2.04E-03	6.11E-03	1.05E-02	1.55E-02	1.70E-02
	C5001-73B	25.8	6.48E-03	1.35E-02	1.82E-02	2.25E-02	2.76E-02
	C5001-80A	85.5	2.72E-04	8.14E-04	8.29E-04	6.07E-04	5.92E-04
399-3-20 (C5002)	Synthetic Pore Water Used		**pH**				
	C5002-86E	21.5	7.96	8.04	8.00	8.03	8.03
	C5002-91C	39.5	7.80	7.97	7.94	8.03	7.75
	C5002-92D	48.5	7.85	7.93	7.89	7.92	7.91
	C5002-100A	84.0	7.81	7.94	7.91	7.93	7.99
	Synthetic Pore Water Used		**Alkalinity (mg/L as $CaCO_3$)**				
	C5002-86E	21.5	231.8	167.2	163.4	171.0	193.8
	C5002-91C	39.5	178.6	174.8	193.8	155.8	136.8
	C5002-92D	48.5	178.6	148.2	155.8	167.2	171.0
	C5002-100A	84.0	201.4	178.6	152.0	190.0	231.8

Table D.12. (contd)

Well	Sample ID	Depth (ft bgs)	Reactions Times (days)				
			1	3	7	14	28
399-3-20 (C5002) (contd)	Synthetic Pore Water Used		**Ca Concentration (mg/L)**				
	C5002-86E	21.5	146.7	143.4	143.0	136.4	138.3
	C5002-91C	39.5	135.9	148.1	145.8	144.7	142.7
	C5002-92D	48.5	142.4	158.3	157.5	158.5	156.7
	C5002-100A	84.0	164.1	169.6	167.0	159.7	162.4
	Synthetic Pore Water Used		**Uranium Concentration (µg/g)**				
	C5002-86E	21.5	7.41E-03	9.53E-03	9.60E-03	1.09E-02	1.09E-02
	C5002-91C	39.5	6.56E-03	8.96E-03	8.81E-03	1.01E-02	1.04E-02
	C5002-92D	48.5	2.14E-02	2.87E-02	3.01E-02	3.05E-02	3.18E-02
	C5002-100A	84.0	2.66E-02	3.59E-02	4.08E-02	4.66E-02	4.57E-02
	Synthetic Groundwater Used		**pH**				
	C5002-86E	21.5	7.26	7.59	7.60	7.65	7.66
	C5002-91C	39.5	7.42	7.62	7.61	7.74	7.64
	C5002-92D	48.5	7.31	7.71	7.68	7.91	7.88
	C5002-100A	84.0	7.11	7.50	7.53	7.71	7.64
	Synthetic Groundwater Used		**Alkalinity (mg/L as $CaCO_3$)**				
	C5002-86E	21.5	79.8	98.8	98.8	98.8	133.0
	C5002-91C	39.5	79.8	125.4	159.6	102.6	91.2
	C5002-92D	48.5	83.6	110.2	136.8	133.0	152.0
	C5002-100A	84.0	83.6	98.8	87.4	83.6	83.6
	Synthetic Groundwater Used		**Ca Concentration (mg/L)**				
	C5002-86E	21.5	33.33	42.69	45.13	44.05	45.78
	C5002-91C	39.5	32.32	43.76	47.54	45.56	47.36
	C5002-92D	48.5	34.21	44.62	50.49	51.76	54.54
	C5002-100A	84.0	28.97	34.64	35.06	33.93	38.38
	Synthetic Groundwater Used		**Uranium Concentration (µg/g)**				
	C5002-86E	21.5	2.22E-03	3.70E-03	4.67E-03	5.40E-03	5.15E-03
	C5002-91C	39.5	1.89E-03	3.49E-03	4.65E-03	5.32E-03	5.38E-03
	C5002-92D	48.5	7.94E-03	1.42E-02	1.75E-02	2.22E-02	2.32E-02
	C5002-100A	84.0	2.71E-03	3.68E-03	3.25E-03	3.21E-03	2.50E-03
	Synthetic River Water Used		**pH**				
	C5002-86E	21.5	7.31	7.54	7.53	7.61	7.63
	C5002-91C	39.5	7.28	7.58	7.46	7.57	7.68
	C5002-92D	48.5	6.92	7.62	7.58	7.68	7.65
	C5002-100A	84.0	6.61	7.44	7.36	7.39	7.44
	Synthetic River Water Used		**Alkalinity (mg/L as $CaCO_3$)**				
	C5002-86E	21.5	91.2	98.8	98.8	83.6	98.8
	C5002-91C	39.5	79.8	79.8	98.8	114.0	83.6
	C5002-92D	48.5	64.6	83.6	87.4	98.8	117.8
	C5002-100A	84.0	79.8	ND	57.0	68.4	98.8
	Synthetic River Water Used		**Ca Concentration (mg/L)**				
	C5002-86E	21.5	8.85	13.8	14.7	15.2	16.2
	C5002-91C	39.5	7.96	12.0	20.3	14.6	16.4
	C5002-92D	48.5	8.36	12.8	14.5	17.0	19.0
	C5002-100A	84.0	2.24	2.85	3.20	3.41	3.73
	Synthetic River Water Used		**Uranium Concentration (µg/g)**				
	C5002-86E	21.5	1.31E-03	2.97E-03	3.82E-03	4.21E-03	4.68E-03
	C5002-91C	39.5	1.11E-03	2.30E-03	4.40E-03	3.75E-03	4.58E-03
	C5002-92D	48.5	3.22E-03	6.11E-03	8.43E-03	1.11E-02	1.31E-02
	C5002-100A	84.0	3.13E-04	4.88E-04	3.24E-04	3.31E-04	4.00E-04

Table D.13. Moisture Contents of Sediments Collected from Wells 399-3-18 (C4999), 399-1-23 (C5000), 399-3-19 (C5001), and 399-3-20 (C5002)

Wells	Sample ID	Depth (ft bgs)	Moisture Contents (%)
399-3-18 (C4999)	C4999-1D	2.7	21.2
	C4999-1E	3.7	22.3
	C4999-2A	4.7	13.2
	C4999-2B	5.7	4.85
	C4999-2E	7.0	3.60
	C4999-3A	8.0	2.44
	C4999-3B	9.0	10.7
	C4999-3C	10.0	6.93
	C4999-4B	12.7	6.80
	C4999-4C	13.7	7.02
	C4999-5A	15.0	6.51
	C4999-5B	16.0	4.53
	C4999-5C	17.0	5.01
	C4999-5D	18.0	5.54
	C4999-6A	19.0	8.12
	C4999-6B	20.0	4.49
	C4999-6C	21.0	3.19
	C4999-6D	22.0	10.1
	C4999-6E	23.0	3.17
	C4999-7A	24.0	3.43
	C4999-8B	26.0	3.06
	C4999-8E	28.5	3.46
	C4999-9A	29.5	3.32
	C4999-9B	30.5	5.53
	C4999-9C	32.0	6.78
	C4999-10A	33.5	3.13
	C4999-10B	34.5	3.53
	C4999-10C	35.5	8.20
	C4999-10D	36.5	14.3
	C4999-11A	38.5	5.74
	C4999-11B	39.5	5.34
	C4999-11D	41.5	9.73
	C4999-12A	44.0	9.30
	C4999-12B	45.0	16.2
	C4999-12C	46.0	10.0
	C4999-12D	47.0	34.0
	C4999-12E	48.0	33.8
	C4999-13B	50.0	35.1
	C4999-13D	51.0	34.9
	C4999-13E	52.0	34.4
	C4999-14A	53.0	34.4
	C4999-14B	54.0	34.3

Table D.13. (contd)

Wells	Sample ID	Depth (ft bgs)	Moisture Contents (%)
399-3-18 (C4999)	C4999-14C	55.0	32.6
	C4999-14D	56.0	34.8
	C4999-14E	57.0	34.3
	C4999-15A	58.0	27.7
	C4999-15B	59.0	34.5
	C4999-15D	60.0	39.1
	C4999-16A	61.0	33.0
	C4999-16B	62.0	35.2
	C4999-16C	63.0	34.4
	C4999-16D	64.0	35.9
	C4999-16E	65.0	35.9
	C4999-17A	66.0	35.9
	C4999-17B	67.0	32.9
	C4999-17C	68.0	28.4
	C4999-17D	69.0	31.3
	C4999-17E	70.0	27.5
	C4999-18B	71.0	34.1
	C4999-18C	72.0	32.4
	C4999-18D	73.0	33.0
	C4999-18E	74.0	31.1
	C4999-19A	75.0	29.3
	C4999-19B	76.0	31.5
	C4999-19C	77.0	37.8
	C4999-19D	78.0	32.3
	C4999-19E	79.0	32.6
	C4999-20A	80.0	33.2
	C4999-20B	81.0	28.7
	C4999-20D	82.0	16.5
	C4999-20E	83.0	13.4
	C4999-21A	84.0	12.4
	C4999-21B	85.0	19.3
	C4999-21C	86.0	20.6
	C4999-22A	96.5	8.90
	C4999-22B	87.5	19.4
	C4999-22C	88.5	16.1
	C4999-22D	89.5	14.2
	C4999-22E	90.5	15.0
	C4999-24B	94.5	8.21
	C4999-24C	95.5	11.5
	C4999-24D	96.5	19.9
	C4999-24E	97.5	9.35
	C4999-25A	98.5	10.5
	C4999-25B	99.5	14.2
	C4999-25C	100.0	7.48
	C4999-25D	101.0	10.3
	C4999-25E	102.0	24.1

Table D.13. (contd)

Wells	Sample ID	Depth (ft bgs)	Moisture Contents (%)
399-3-18 (C4999)	C4999-26A	103.0	23.8
	C4999-26B	104.0	33.1
	C4999-26C	105.0	17.7
	C4999-26E	106.0	10.2
	C4999-27A	107.0	8.55
	C4999-27B	108.0	9.52
	C4999-27C	109.0	7.61
	C4999-28A	110.0	7.67
	C4999-28B	111.0	7.63
	C4999-28C	112.0	12.9
	C4999-28D	113.0	15.1
	C4999-28E	114.0	14.6
	C4999-29B	115.0	6.05
	C4999-29C	116.0	6.50
	C4999-29D	117.0	6.91
	C4999-29E	118.0	7.37
	C4999-30A	120.0	10.3
	C4999-30D	122.5	11.0
	C4999-30E	123.5	9.30
	C4999-31A	124.5	15.8
	C4999-31B	125.5	20.2
	C4999-31C	125.0	9.66
	C4999-31D	126.0	13.9
	C4999-31E	127.0	42.7
	C4999-32B	128.0	45.7
	C4999-32C	129.0	46.2
399-1-23 (C5000)	C5000-32D	0.5	4.87
	C5000-32E	1.5	7.37
	C5000-33A	2.25	7.71
	C5000-33B	2.3	5.08
	C5000-33C	3.0	5.26
	C5000-33D	4.0	4.01
	C5000-34B	5.0	3.73
	C5000-34C	6.0	3.42
	C5000-34D	7.0	3.24
	C5000-34E	7.5	3.87
	C5000-35B	8.0	3.12
	C5000-35C	8.5	4.15
	C5000-35D	9.0	3.10
	C5000-35E	10.0	2.92
	C5000-36A	11.0	5.85
	C5000-36E	12.0	3.88
	C5000-37A	13.0	3.69
	C5000-38A	19.0	3.37
	C5000-38B	20.0	4.64
	C5000-38C	21.0	4.26

Table D.13. (contd)

Wells	Sample ID	Depth (ft bgs)	Moisture Contents (%)
399-1-23 (C5000)	C5000-39A	22.0	3.40
	C5000-39B	23.0	13.8
	C5000-39D	25.0	13.8
	C5000-40A	30.0	14.6
	C5000-40B	31.0	3.62
	C5000-40C	32.0	9.86
	C5000-40E	34.0	2.40
	C5000-41B	35.0	14.0
	C5000-41C	36.0	7.81
	C5000-41D	37.0	7.48
	C5000-41E	38.0	5.84
	C5000-43A	44.0	6.54
	C5000-43B	45.0	10.5
	C5000-44A	47.0	12.4
	C5000-44B	48.0	9.18
	C5000-44C	49.0	14.9
	C5000-44E	51.0	8.24
	C5000-45A	52.0	9.63
	C5000-45B	53.0	9.49
	C5000-45C	54.0	11.3
	C5000-45D	55.0	9.77
	C5000-45E	55.0	8.57
	C5000-46A	56.0	10.8
	C5000-46B	57.0	12.6
	C5000-46D	59.0	15.1
	C5000-47A	60.0	6.39
	C5000-47B	60.5	6.79
	C5000-47C	61.5	9.35
	C5000-47D	62.5	10.3
	C5000-48C	64.0	6.31
	C5000-48D	65.0	20.0
	C5000-48E	66.0	25.6
	C5000-49A	67.0	28.5
	C5000-49B	68.0	24.4
	C5000-49D	68.1	8.20
	C5000-49E	69.0	26.7
	C5000-50A	70.0	18.4
	C5000-50B	71.0	9.59
	C5000-50C	72.0	15.6
	C5000-50D	71.5	13.4
	C5000-50E	72.5	14.1
	C5000-51A	73.5	16.6
	C5000-51E	77.0	14.3
	C5000-52A	78.0	14.0
	C5000-52B	79.0	16.2
	C5000-52C	80.0	18.8

Table D.13. (contd)

Wells	Sample ID	Depth (ft bgs)	Moisture Contents (%)
399-1-23 (C5000)	C5000-52D	81.0	16.7
	C5000-53A	81.1	15.5
	C5000-53B	82.0	9.99
	C5000-53C	83.0	19.3
	C5000-53D	84.0	28.7
	C5000-53E	85.0	18.8
	C5000-54E	89.5	10.1
	C5000-55C	90.0	6.39
	C5000-55D	90.5	7.45
	C5000-55E	91.5	5.18
	C5000-56A	92.5	11.4
	C5000-56B	93.5	9.86
	C5000-56C	94.5	28.7
	C5000-56E	96.0	13.6
	C5000-57A	97.0	15.5
	C5000-57B	98.0	13.9
	C5000-57C	99.0	13.9
	C5000-57D	100.0	13.3
	C5000-58A	101.0	16.0
	C5000-58B	102.0	26.4
	C5000-58C	103.0	14.9
	C5000-59A	104.0	9.67
	C5000-59B	105.0	11.1
	C5000-59C	106.0	11.8
	C5000-59D	107.0	16.9
	C5000-59E	108.0	24.8
	C5000-60D	108.5	14.5
	C5000-60E	109.5	19.0
	C5000-61A	110.1	41.6
	C5000-61B	112.0	40.2
399-1-19 (C5001)	C5001-61E	2.0	2.94
	C5001-62A	3.0	4.86
	C5001-62B	4.0	5.08
	C5001-62C	5.0	3.66
	C5001-63B	7.0	3.67
	C5001-63C	8.0	7.21
	C5001-63D	9.0	6.59
	C5001-64B	12.0	4.52
	C5001-64C	13.0	5.72
	C5001-64D	14.0	7.63
	C5001-64E	15.0	6.92
	C5001-65C	18.0	5.36
	C5001-65D	19.0	4.62
	C5001-65E	20.0	3.71
	C5001-66A	21.0	2.43
	C5001-67A	23.5	4.99

Table D.13. (contd)

Wells	Sample ID	Depth (ft bgs)	Moisture Contents (%)
399-1-19 (C5001)	C5001-67B	24.5	5.27
	C5001-68A	28.0	4.16
	C5001-68B	29.0	3.86
	C5001-69B	32.0	5.13
	C5001-69C	33.0	6.61
	C5001-69D	34.0	10.8
	C5001-70D	39.5	5.46
	C5001-70E	40.5	6.20
	C5001-71E	41.5	6.63
	C5001-73B	49.8	10.1
	C5001-74B	53.5	10.9
	C5001-74C	54.5	5.85
	C5001-76D	65.5	8.00
	C5001-77D	74.5	12.6
	C5001-78A	75.0	4.96
	C5001-79A	81.5	13.3
	C5001-79B	82.5	10.3
	C5001-79C	83.0	13.2
	C5001-79D	83.5	8.05
	C5001-79E	84.5	11.5
	C5001-80A	85.5	34.5
	C5001-80C	87.5	30.8
	C5001-89-91	90.0	31.4
	C5001-91-93	92.0	25.2
	C5001-93-94.5	93.8	30.3
	C5001-96-98	97.0	29.2
	C5001-98-100	99.0	23.0
399-1-20 (C5002)	C5002-81E	4.0	5.07
	C5002-82A	5.0	8.68
	C5002-83A	10.5	2.93
	C5002-83B	11.5	2.22
	C5002-84A	14.0	2.82
	C5002-84C	16.0	2.19
	C5002-85D	17.0	6.03
	C5002-86C	19.5	4.14
	C5002-86E	21.5	5.02
	C5002-87C	23.5	3.50
	C5002-87D	24.5	4.78
	C5002-87E	25.5	4.36
	C5002-89A	28.5	4.49
	C5002-90A	32.5	4.14
	C5002-90B	33.5	8.65
	C5002-90C	34.5	5.22
	C5002-91B	38.5	4.40

Table D.13. (contd)

Wells	Sample ID	Depth (ft bgs)	Moisture Contents (%)
399-1-20 (C5002)	C5002-91C	39.5	4.72
	C5002-91D	40.5	6.04
	C5002-92D	48.5	6.81
	C5002-93E	54.5	6.19
	C5002-94D	65.5	5.41
	C5002-94E	66.5	7.13
	C5002-98C	79.0	7.21
	C5002-98D	80.0	6.69
	C5002-98E	81.0	13.9
	C5002-99D	82.0	33.2
	C5002-99E	83.0	37.8
	C5002-100A	84.0	25.4
	C5002-85-87	86.0	27.1
	C5002-94-95	94.5	30.8

Figures D.1 through D.20 represent grain-size distribution metrics for select samples in 399-3-18 (C4999), 399-1-23 (C5000), 399-3-19 (C5001), and 399-3-20 (C5002).

Grain size data for Hanford 300 Area, Well 399-3-18, Sample C4999-6D (22.5-23.5 ft bgs).

wt	%<	size(μm)	fraction<	size(mm)	size(phi)	pred frac<	resid^2	PSD metric	value
1	100.00		1.00000	127.0000	-6.9887	0.99998	0.00000	d5(phi)	0.43
10	100.00		1.00000	75.0000	-6.2288	0.98227	0.00314	d10(phi)	-2.49
1	62.92		0.62920	50.0000	-5.6439	0.67811	0.00239	d16(phi)	-3.70
1	47.94		0.47941	37.5000	-5.2288	0.44961	0.00089	d25(phi)	-4.48
1	30.40		0.30402	25.0000	-4.6439	0.28104	0.00053	d50(phi)	-5.34
1	19.79		0.19787	19.0000	-4.2479	0.21567	0.00032	d75(phi)	-5.74
1	14.59		0.14588	12.5000	-3.6439	0.15598	0.00010	d84(phi)	-5.87
1	12.25		0.12245	9.5000	-3.2479	0.13127	0.00008	d90(phi)	-5.97
1	8.94		0.08936	4.7500	-2.2479	0.09295	0.00001	d95(phi)	-6.08
1	7.84		0.07840	3.3500	-1.7442	0.08070	0.00001	σ_{IG}(phi)	1.53
1	7.40		0.07397	2.8000	-1.4854	0.07549	0.00000		
1	6.58		0.06578	2.0000	-1.0000	0.06719	0.00000	d5(mm)	0.74
1	5.68		0.05676	1.0000	0.0000	0.05432	0.00001	d10(mm)	5.60
1	4.81		0.04815	0.5000	1.0000	0.04511	0.00001	d16(mm)	12.97
1	4.23		0.04231	0.2500	2.0000	0.03820	0.00002	d25(mm)	22.27
1	3.61		0.03608	0.1060	3.2379	0.03174	0.00002	d50(mm)	40.61
1	3.36		0.03357	0.0750	3.7370	0.02961	0.00002	d75(mm)	53.54
1	3.16		0.03164	0.0530	4.2379	0.02769	0.00002	d84(mm)	58.37
1	3.36		0.03356	0.0970	3.3658	0.03117	0.00001	d90(mm)	62.48
1	3.10		0.03103	0.0677	3.8842	0.02903	0.00000	d95(mm)	67.74
1	2.79		0.02786	0.0385	4.7005	0.02609	0.00000	d_{geom}(mm)	22.81
1	2.53		0.02533	0.0208	5.5885	0.02339	0.00000	σ_{geom}(mm)	6.16
1	2.34		0.02343	0.0119	6.3960	0.02129	0.00000		
1	2.15		0.02153	0.0083	6.9114	0.02010	0.00000	USDA texture system	
1	2.15		0.02153	0.0068	7.2039	0.01947	0.00000	% gravel	93.28
1	2.03		0.02026	0.0058	7.4218	0.01902	0.00000	% sand	3.98
10	1.52		0.01520	0.0016	9.2576	0.01580	0.00000	% silt	1.11
								% clay	1.63
						weighted SSR =	0.00759		

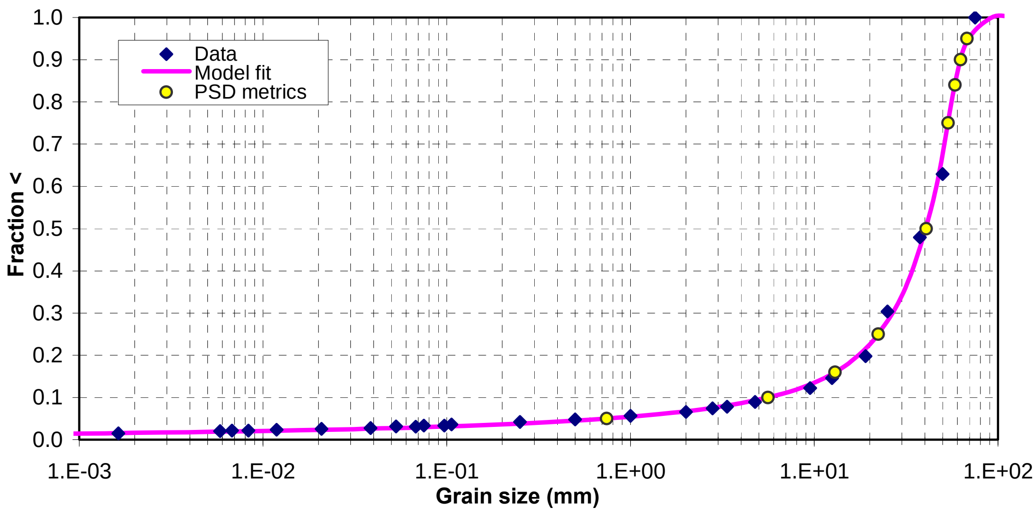


Figure D.1. Grain Size Data for Hanford 300 Area, Well 399-3-18, Sample C4999-6D (depth interval 22.5-23.5 feet)

Grain size data for Hanford 300 Area, Well 399-3-18, Sample C4999-9C (31-32 ft bgs).

wt	%<	size(μm)	fraction<	size(mm)	size(phi)	pred frac<	resid^2	PSD metric	value
1	100.00		1.00000	127.0000	-6.9887	0.99974	0.00000	d5(phi)	2.95
10	100.00		1.00000	75.0000	-6.2288	0.99033	0.00094	d10(phi)	0.24
1	85.44		0.85441	50.0000	-5.6439	0.89992	0.00207	d16(phi)	-1.99
1	74.83		0.74832	37.5000	-5.2288	0.71872	0.00088	d25(phi)	-3.54
1	45.43		0.45425	25.0000	-4.6439	0.46441	0.00010	d50(phi)	-4.74
1	34.56		0.34561	19.0000	-4.2479	0.35667	0.00012	d75(phi)	-5.29
1	27.21		0.27206	12.5000	-3.6439	0.26105	0.00012	d84(phi)	-5.48
1	22.75		0.22748	9.5000	-3.2479	0.22380	0.00001	d90(phi)	-5.64
1	17.15		0.17150	4.7500	-2.2479	0.16947	0.00000	d95(phi)	-5.84
1	15.14		0.15143	3.3500	-1.7442	0.15195	0.00000	σ_{IG}(phi)	2.21
1	14.15		0.14154	2.8000	-1.4854	0.14409	0.00001		
1	12.75		0.12753	2.0000	-1.0000	0.13057	0.00001	d5(mm)	0.13
1	10.69		0.10691	1.0000	0.0000	0.10558	0.00000	d10(mm)	0.85
1	7.75		0.07749	0.5000	1.0000	0.08341	0.00004	d16(mm)	3.97
1	6.11		0.06112	0.2500	2.0000	0.06454	0.00001	d25(mm)	11.64
1	4.91		0.04905	0.1060	3.2379	0.04626	0.00001	d50(mm)	26.80
1	4.46		0.04458	0.0750	3.7370	0.04039	0.00002	d75(mm)	39.17
1	4.07		0.04072	0.0530	4.2379	0.03527	0.00003	d84(mm)	44.77
1	4.40		0.04402	0.0855	3.5487	0.04251	0.00000	d90(mm)	50.01
1	3.67		0.03668	0.0599	4.0611	0.03699	0.00000	d95(mm)	57.30
1	3.30		0.03302	0.0344	4.8598	0.02985	0.00001	d_{geom}(mm)	12.56
1	2.57		0.02568	0.0187	5.7410	0.02367	0.00000	σ_{geom}(mm)	8.15
1	2.20		0.02201	0.0107	6.5400	0.01930	0.00001		
1	1.83		0.01834	0.0076	7.0465	0.01701	0.00000	USDA texture system	
1	1.83		0.01834	0.0062	7.3389	0.01584	0.00001	% gravel	86.94
1	1.47		0.01467	0.0053	7.5530	0.01503	0.00000	% sand	9.61
10	0.73		0.00734	0.0015	9.3521	0.00990	0.00007	% silt	2.37
								% clay	1.08
						weighted SSR =	0.00446		

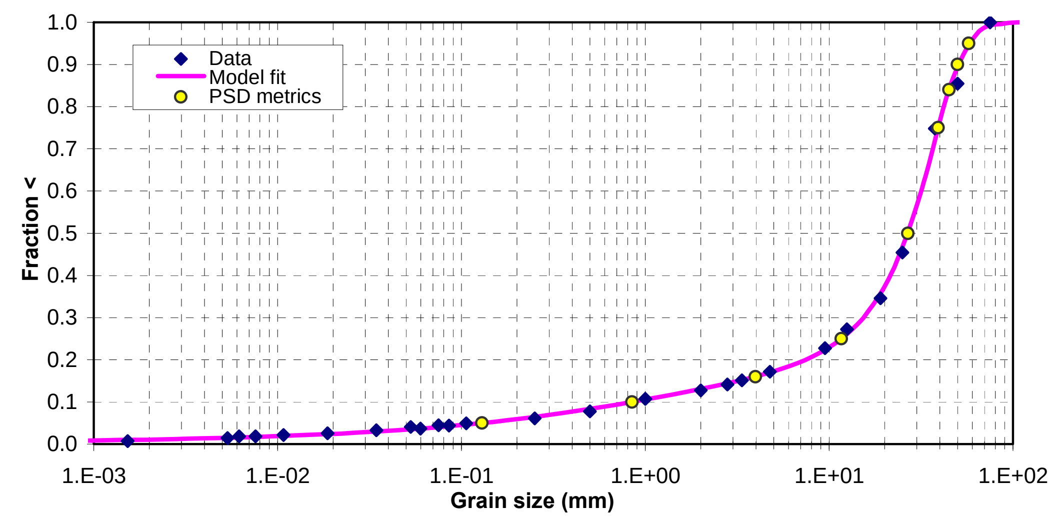


Figure D.2. Grain Size Data for Hanford 300 Area, Well 399-3-18, Sample C4999-9C (depth interval 31-32 feet)

Grain size data for Hanford 300 Area, Well 399-3-18, Sample C4999-10C (35-36 ft bgs).

wt	%<	size(μm)	fraction<	size(mm)	size(phi)	pred frac<	resid^2	PSD metric	value
1	100.00		1.00000	127.0000	-6.9887	0.99996	0.00000	d5(phi)	4.91
1	100.00		1.00000	75.0000	-6.2288	0.99854	0.00000	d10(phi)	1.91
1	100.00		0.99999	50.0000	-5.6439	0.93254	0.00455	d16(phi)	-0.63
1	69.92		0.69916	37.5000	-5.2288	0.76171	0.00391	d25(phi)	-2.54
1	55.47		0.55474	25.0000	-4.6439	0.55675	0.00000	d50(phi)	-4.42
1	49.12		0.49122	19.0000	-4.2479	0.46150	0.00088	d75(phi)	-5.20
1	36.53		0.36530	12.5000	-3.6439	0.35959	0.00003	d84(phi)	-5.41
1	31.34		0.31341	9.5000	-3.2479	0.31179	0.00000	d90(phi)	-5.55
1	22.58		0.22581	4.7500	-2.2479	0.23072	0.00002	d95(phi)	-5.70
1	19.66		0.19663	3.3500	-1.7442	0.20334	0.00004	σ_{IG}(phi)	2.80
1	18.91		0.18913	2.8000	-1.4854	0.19154	0.00001		
1	17.20		0.17205	2.0000	-1.0000	0.17250	0.00000	d5(mm)	0.03
1	14.31		0.14313	1.0000	0.0000	0.14205	0.00000	d10(mm)	0.27
1	11.70		0.11695	0.5000	1.0000	0.11843	0.00000	d16(mm)	1.54
1	9.99		0.09990	0.2500	2.0000	0.09828	0.00000	d25(mm)	5.82
1	8.26		0.08262	0.1060	3.2379	0.07602	0.00004	d50(mm)	21.44
1	7.49		0.07492	0.0750	3.7370	0.06773	0.00005	d75(mm)	36.78
1	6.76		0.06764	0.0530	4.2379	0.05985	0.00006	d84(mm)	42.47
1	6.63		0.06629	0.1011	3.3061	0.07486	0.00007	d90(mm)	46.92
1	5.92		0.05919	0.0702	3.8333	0.06618	0.00005	d95(mm)	52.13
1	5.09		0.05090	0.0396	4.6588	0.05361	0.00001	d_{geom}(mm)	8.39
1	3.91		0.03907	0.0209	5.5773	0.04134	0.00001	σ_{geom}(mm)	10.99
1	3.08		0.03078	0.0118	6.4069	0.03203	0.00000		
1	2.72		0.02723	0.0082	6.9235	0.02713	0.00000	USDA texture system	
1	2.37		0.02368	0.0066	7.2329	0.02452	0.00000	% gravel	82.75
1	2.25		0.02249	0.0057	7.4461	0.02285	0.00000	% sand	11.39
1	1.42		0.01421	0.0016	9.2727	0.01259	0.00000	% silt	4.47
								% clay	1.39
						weighted SSR =	0.00976		

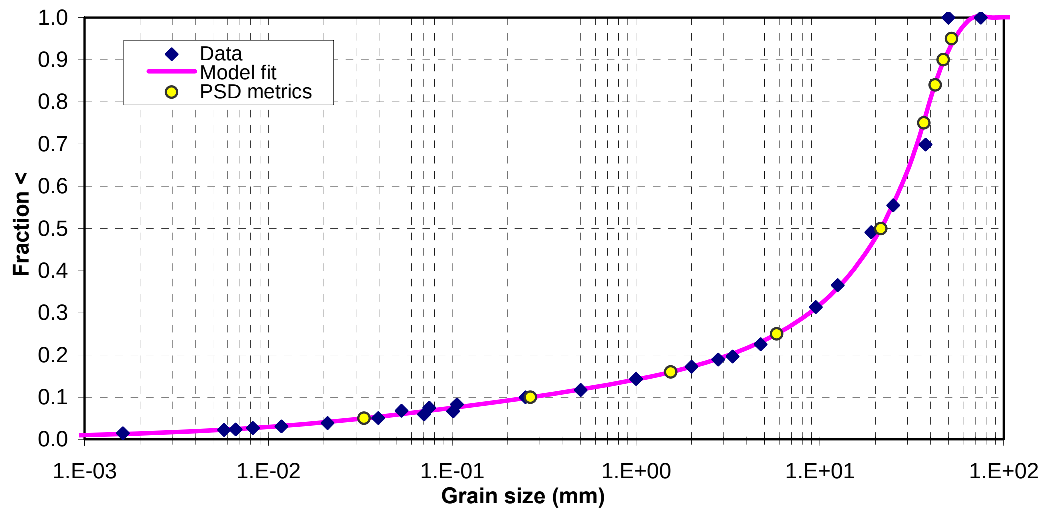


Figure D.3. Grain Size Data for Hanford 300 Area, Well 399-3-18, Sample C4999-10C (depth interval 35-36 feet)

Grain size data for Hanford 300 Area, Well 399-3-18, Sample C4999-10D (36-37 ft bgs).									
wt	%<	size(μm)	fraction<	size(mm)	size(phi)	pred frac<	resid^2	PSD metric	value
1	100.00		1.00000	127.0000	-6.9887	1.00000	0.00000	d5(phi)	7.24
1	100.00		1.00000	75.0000	-6.2288	0.99999	0.00000	d10(phi)	4.98
1	100.00		0.99998	50.0000	-5.6439	0.99936	0.00000	d16(phi)	2.61
1	100.00		0.99998	37.5000	-5.2288	0.99080	0.00008	d25(phi)	-0.36
1	89.71		0.89715	25.0000	-4.6439	0.88029	0.00028	d50(phi)	-3.11
1	71.82		0.71819	19.0000	-4.2479	0.75491	0.00135	d75(phi)	-4.23
1	62.37		0.62372	12.5000	-3.6439	0.59977	0.00057	d84(phi)	-4.52
1	52.63		0.52627	9.5000	-3.2479	0.52294	0.00001	d90(phi)	-4.71
1	39.00		0.38999	4.7500	-2.2479	0.38664	0.00001	d95(phi)	-4.90
1	34.04		0.34044	3.3500	-1.7442	0.33901	0.00000	σ_{IG}(phi)	3.62
1	31.66		0.31661	2.8000	-1.4854	0.31837	0.00000		
1	27.32		0.27317	2.0000	-1.0000	0.28520	0.00014	d5(mm)	0.01
1	23.20		0.23202	1.0000	0.0000	0.23396	0.00000	d10(mm)	0.03
1	19.62		0.19619	0.5000	1.0000	0.19827	0.00000	d16(mm)	0.16
1	17.66		0.17664	0.2500	2.0000	0.17250	0.00002	d25(mm)	1.28
1	15.77		0.15766	0.1060	3.2379	0.14797	0.00009	d50(mm)	8.64
1	14.69		0.14692	0.0750	3.7370	0.13751	0.00009	d75(mm)	18.78
1	13.48		0.13480	0.0530	4.2379	0.12424	0.00011	d84(mm)	22.91
1	13.83		0.13825	0.1010	3.3071	0.14661	0.00007	d90(mm)	26.14
1	12.22		0.12220	0.0700	3.8366	0.13514	0.00017	d95(mm)	29.88
1	10.37		0.10369	0.0394	4.6646	0.11055	0.00005	d_{geom}(mm)	2.97
1	8.15		0.08147	0.0209	5.5783	0.08162	0.00000	σ_{geom}(mm)	14.78
1	6.42		0.06419	0.0118	6.4079	0.06269	0.00000		
1	5.68		0.05678	0.0082	6.9244	0.05423	0.00001	USDA texture system	
1	4.94		0.04938	0.0066	7.2338	0.05007	0.00000	% gravel	71.48
1	4.69		0.04691	0.0057	7.4471	0.04752	0.00000	% sand	16.35
1	2.96		0.02963	0.0016	9.2810	0.03263	0.00001	% silt	8.71
								% clay	3.45
						weighted SSR =	0.00309		

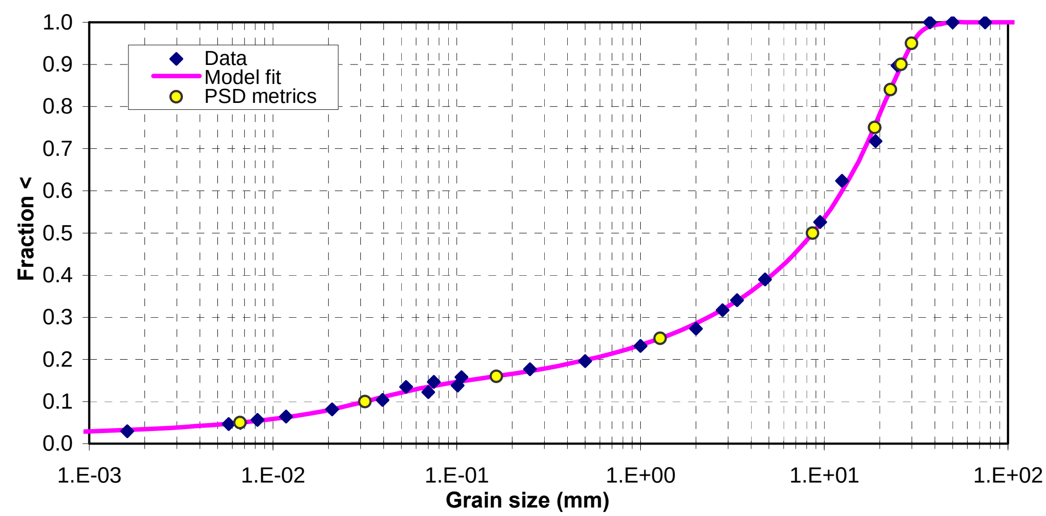


Figure D.4. Grain Size Data for Hanford 300 Area, Well 399-3-18, Sample C4999-10D (depth interval 36-37 feet)

Grain size data for Hanford 300 Area, Well 399-3-18, Sample C4999-11D (41-42 ft bgs).

wt	%<	size(μm)	fraction<	size(mm)	size(phi)	pred frac<	resid^2	PSD metric	value
1	100.00		1.00000	127.0000	-6.9887	0.99998	0.00000	d5(phi)	0.01
10	100.00		1.00000	75.0000	-6.2288	0.99301	0.00049	d10(phi)	-2.10
1	81.58		0.81577	50.0000	-5.6439	0.84197	0.00069	d16(phi)	-3.12
1	62.40		0.62396	37.5000	-5.2288	0.62157	0.00001	d25(phi)	-3.92
1	45.69		0.45694	25.0000	-4.6439	0.40173	0.00305	d50(phi)	-4.94
1	30.14		0.30145	19.0000	-4.2479	0.30727	0.00003	d75(phi)	-5.47
1	18.82		0.18821	12.5000	-3.6439	0.21267	0.00060	d84(phi)	-5.64
1	14.47		0.14475	9.5000	-3.2479	0.17117	0.00070	d90(phi)	-5.77
1	9.70		0.09699	4.7500	-2.2479	0.10653	0.00009	d95(phi)	-5.91
1	8.52		0.08524	3.3500	-1.7442	0.08694	0.00000	σ_{IG}(phi)	1.53
1	7.93		0.07933	2.8000	-1.4854	0.07898	0.00000		
1	7.01		0.07010	2.0000	-1.0000	0.06692	0.00001	d5(mm)	0.99
1	5.65		0.05655	1.0000	0.0000	0.05016	0.00004	d10(mm)	4.28
1	4.56		0.04557	0.5000	1.0000	0.03999	0.00003	d16(mm)	8.68
1	4.00		0.04004	0.2500	2.0000	0.03350	0.00004	d25(mm)	15.12
1	3.53		0.03526	0.1060	3.2379	0.02803	0.00005	d50(mm)	30.79
1	3.37		0.03373	0.0750	3.7370	0.02584	0.00006	d75(mm)	44.46
1	3.25		0.03245	0.0530	4.2379	0.02320	0.00009	d84(mm)	49.87
1	1.80		0.01804	0.0862	3.5365	0.02676	0.00008	d90(mm)	54.42
1	1.67		0.01675	0.0607	4.0425	0.02429	0.00006	d95(mm)	60.16
1	1.55		0.01546	0.0349	4.8411	0.01956	0.00002	d_{geom}(mm)	18.45
1	1.29		0.01288	0.0189	5.7220	0.01465	0.00000	σ_{geom}(mm)	5.07
1	1.16		0.01160	0.0109	6.5208	0.01127	0.00000		
1	1.03		0.01031	0.0077	7.0271	0.00960	0.00000	USDA texture system	
1	0.90		0.00902	0.0062	7.3260	0.00876	0.00000	% gravel	93.31
1	0.90		0.00902	0.0054	7.5335	0.00822	0.00000	% sand	4.42
1	0.52		0.00515	0.0015	9.3389	0.00493	0.00000	% silt	1.73
								% clay	0.55
						weighted SSR =	0.00613		

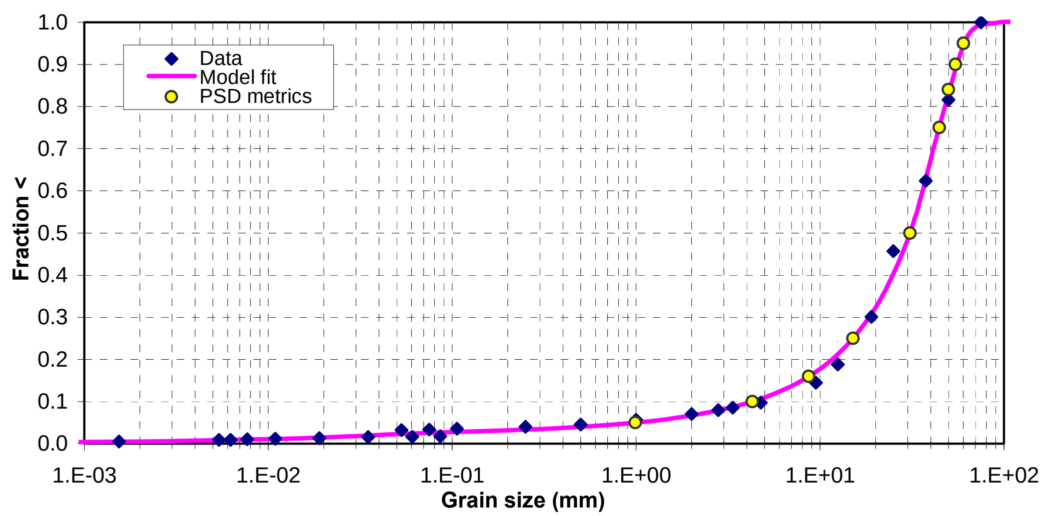


Figure D.5. Grain Size Data for Hanford 300 Area, Well 399-3-18, Sample C4999-11D (depth interval 41-42 feet)

Grain size data for Hanford 300 Area, Well 399-1-23, Sample C5000-39D (24.5-25.5 ft bgs).

wt	%<	size(μm)	fraction<	size(mm)	size(phi)	pred frac<	resid^2	PSD metric	value
1	100.00		1.00000	127.0000	-6.9887	0.99997	0.00000	d5(phi)	5.99
1	100.00		1.00000	75.0000	-6.2288	0.99019	0.00010	d10(phi)	2.84
1	82.29		0.82289	50.0000	-5.6439	0.83024	0.00005	d16(phi)	1.08
1	65.89		0.65893	37.5000	-5.2288	0.65001	0.00008	d25(phi)	-0.44
1	49.75		0.49747	25.0000	-4.6439	0.49169	0.00003	d50(phi)	-4.69
1	41.64		0.41645	19.0000	-4.2479	0.42935	0.00017	d75(phi)	-5.47
1	36.88		0.36875	12.5000	-3.6439	0.37132	0.00001	d84(phi)	-5.66
1	35.11		0.35115	9.5000	-3.2479	0.34762	0.00001	d90(phi)	-5.80
1	31.60		0.31599	4.7500	-2.2479	0.31342	0.00001	d95(phi)	-5.95
1	30.29		0.30290	3.3500	-1.7442	0.30298	0.00000	σ_{IG}(phi)	3.49
1	29.63		0.29633	2.8000	-1.4854	0.29754	0.00000		
1	28.28		0.28285	2.0000	-1.0000	0.28225	0.00000	d5(mm)	0.02
1	23.78		0.23778	1.0000	0.0000	0.22042	0.00030	d10(mm)	0.14
1	14.23		0.14233	0.5000	1.0000	0.16361	0.00045	d16(mm)	0.47
1	11.05		0.11045	0.2500	2.0000	0.12405	0.00018	d25(mm)	1.35
1	9.28		0.09281	0.1060	3.2379	0.09082	0.00000	d50(mm)	25.74
1	8.78		0.08778	0.0750	3.7370	0.08077	0.00005	d75(mm)	44.38
1	8.39		0.08390	0.0530	4.2379	0.07210	0.00014	d84(mm)	50.73
1	8.15		0.08151	0.0869	3.5249	0.08485	0.00001	d90(mm)	55.82
1	7.19		0.07192	0.0609	4.0369	0.07543	0.00001	d95(mm)	62.03
1	6.23		0.06233	0.0349	4.8415	0.06323	0.00000	d_{geom}(mm)	6.85
1	5.75		0.05753	0.0190	5.7162	0.05276	0.00002	σ_{geom}(mm)	15.39
1	5.03		0.05034	0.0109	6.5180	0.04509	0.00003		
1	4.31		0.04315	0.0077	7.0275	0.04096	0.00000	USDA texture system	
1	3.93		0.03931	0.0062	7.3251	0.03879	0.00000	% gravel	71.78
1	3.88		0.03883	0.0054	7.5339	0.03735	0.00000	% sand	21.15
1	2.45		0.02445	0.0015	9.3459	0.02740	0.00001	% silt	4.16
								% clay	2.92
						weighted SSR =	0.00168		

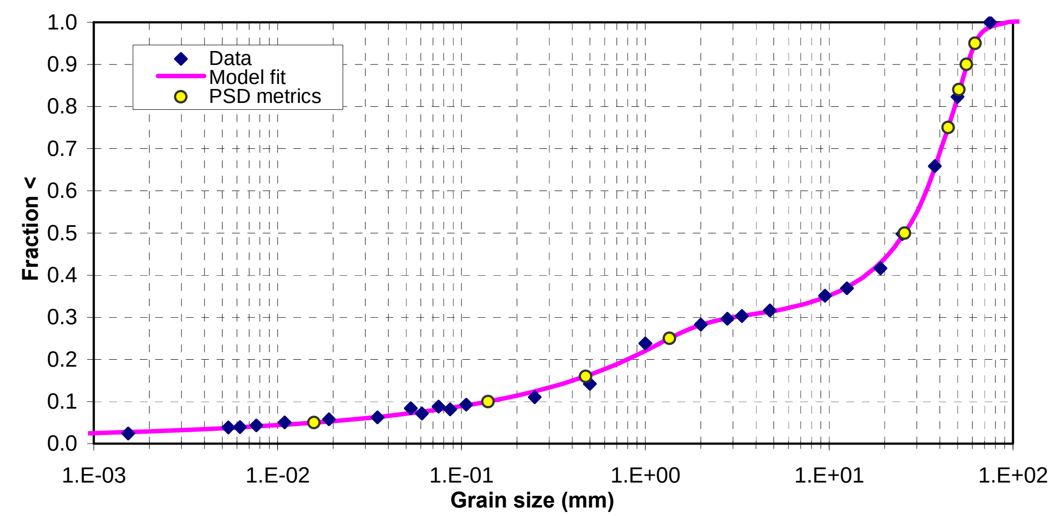


Figure D.6. Grain Size Data for Hanford 300 Area, Well 399-1-23, Sample C5000-39D (depth interval 24.5-25.5 feet)

Grain size data for Hanford 300 Area, Well 399-1-23, Sample C5000-40C (31.5-32.5 ft bgs).

wt	%<	size(μm)	fraction<	size(mm)	size(phi)	pred frac<	resid^2	PSD metric	value
1	100.00		1.00000	127.0000	-6.9887	0.99999	0.00000	d5(phi)	3.88
1	100.00		1.00000	75.0000	-6.2288	0.98962	0.00011	d10(phi)	1.70
1	78.81		0.78812	50.0000	-5.6439	0.79245	0.00002	d16(phi)	0.33
1	62.17		0.62173	37.5000	-5.2288	0.61569	0.00004	d25(phi)	-1.21
1	47.15		0.47152	25.0000	-4.6439	0.47273	0.00000	d50(phi)	-4.79
1	41.25		0.41252	19.0000	-4.2479	0.41735	0.00002	d75(phi)	-5.56
1	36.13		0.36130	12.5000	-3.6439	0.36535	0.00002	d84(phi)	-5.74
1	35.31		0.35314	9.5000	-3.2479	0.34295	0.00010	d90(phi)	-5.86
1	29.91		0.29910	4.7500	-2.2479	0.30053	0.00000	d95(phi)	-6.00
1	27.58		0.27582	3.3500	-1.7442	0.27819	0.00001	σ_{IG}(phi)	3.01
1	26.26		0.26257	2.8000	-1.4854	0.26523	0.00001		
1	23.94		0.23944	2.0000	-1.0000	0.23816	0.00000	d5(mm)	0.07
1	18.69		0.18693	1.0000	0.0000	0.17825	0.00008	d10(mm)	0.31
1	11.86		0.11864	0.5000	1.0000	0.12721	0.00007	d16(mm)	0.80
1	8.73		0.08735	0.2500	2.0000	0.09051	0.00001	d25(mm)	2.31
1	6.31		0.06310	0.1060	3.2379	0.06071	0.00001	d50(mm)	27.67
1	5.67		0.05674	0.0750	3.7370	0.05213	0.00002	d75(mm)	47.10
1	5.24		0.05236	0.0530	4.2379	0.04496	0.00005	d84(mm)	53.36
1	5.10		0.05101	0.0873	3.5178	0.05570	0.00002	d90(mm)	58.19
1	4.50		0.04501	0.0612	4.0298	0.04778	0.00001	d95(mm)	63.90
1	3.81		0.03810	0.0350	4.8363	0.03791	0.00000	d_{geom}(mm)	8.81
1	3.15		0.03150	0.0191	5.7122	0.02988	0.00000	σ_{geom}(mm)	11.04
1	2.64		0.02640	0.0109	6.5154	0.02430	0.00000		
1	2.10		0.02100	0.0077	7.0268	0.02141	0.00000	USDA texture system	
1	1.86		0.01860	0.0062	7.3245	0.01992	0.00000	% gravel	76.18
1	1.80		0.01800	0.0054	7.5333	0.01895	0.00000	% sand	19.43
1	0.90		0.00900	0.0015	9.3455	0.01259	0.00001	% silt	3.02
								% clay	1.37
						weighted SSR =	0.00062		

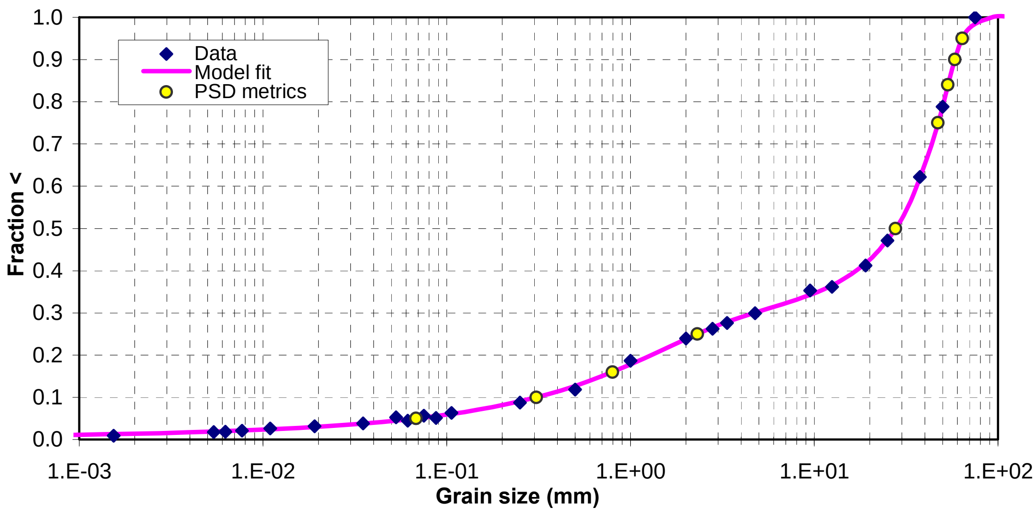


Figure D.7. Grain Size Data for Hanford 300 Area, Well 399-1-23, Sample C5000-40C (depth interval 31.5-32.5 feet)

Grain size data for Hanford 300 Area, Well 399-1-23, Sample C5000-40E (33.5-34.5 ft bgs).

wt	%<	size(μm)	fraction<	size(mm)	size(phi)	pred frac<	resid^2	PSD metric	value
1	100.00		1.00000	127.0000	-6.9887	0.99927	0.00000	d5(phi)	5.59
10	100.00		1.00000	75.0000	-6.2288	0.98356	0.00270	d10(phi)	3.26
1	73.31		0.73308	50.0000	-5.6439	0.77702	0.00193	d16(phi)	1.63
1	63.10		0.63104	37.5000	-5.2288	0.62793	0.00001	d25(phi)	-0.18
1	53.29		0.53293	25.0000	-4.6439	0.51492	0.00032	d50(phi)	-4.53
1	47.98		0.47983	19.0000	-4.2479	0.47136	0.00007	d75(phi)	-5.58
1	43.29		0.43289	12.5000	-3.6439	0.42745	0.00003	d84(phi)	-5.78
1	40.89		0.40888	9.5000	-3.2479	0.40565	0.00001	d90(phi)	-5.91
1	35.12		0.35120	4.7500	-2.2479	0.35720	0.00004	d95(phi)	-6.05
1	32.43		0.32432	3.3500	-1.7442	0.33251	0.00007	σ_{IG}(phi)	3.61
1	31.09		0.31091	2.8000	-1.4854	0.31941	0.00007		
1	28.79		0.28792	2.0000	-1.0000	0.29408	0.00004	d5(mm)	0.02
1	23.93		0.23934	1.0000	0.0000	0.24043	0.00000	d10(mm)	0.10
1	18.70		0.18701	0.5000	1.0000	0.18902	0.00000	d16(mm)	0.32
1	14.98		0.14978	0.2500	2.0000	0.14423	0.00003	d25(mm)	1.13
1	11.27		0.11267	0.1060	3.2379	0.10068	0.00014	d50(mm)	23.03
1	10.09		0.10089	0.0750	3.7370	0.08677	0.00020	d75(mm)	47.90
1	9.11		0.09112	0.0530	4.2379	0.07470	0.00027	d84(mm)	54.91
1	8.78		0.08775	0.0953	3.3919	0.09618	0.00007	d90(mm)	60.14
1	7.62		0.07621	0.0662	3.9173	0.08222	0.00004	d95(mm)	66.25
1	6.47		0.06466	0.0375	4.7361	0.06437	0.00000	d_{geom}(mm)	5.93
1	5.31		0.05311	0.0202	5.6320	0.04938	0.00001	σ_{geom}(mm)	15.94
1	3.69		0.03695	0.0113	6.4646	0.03877	0.00000		
1	3.23		0.03233	0.0079	6.9764	0.03350	0.00000	USDA texture system	
1	2.77		0.02771	0.0064	7.2810	0.03075	0.00001	% gravel	70.59
1	2.54		0.02540	0.0055	7.4946	0.02897	0.00001	% sand	22.12
10	1.39		0.01386	0.0016	9.3185	0.01775	0.00015	% silt	5.34
								% clay	1.95
						weighted SSR =	0.00624		

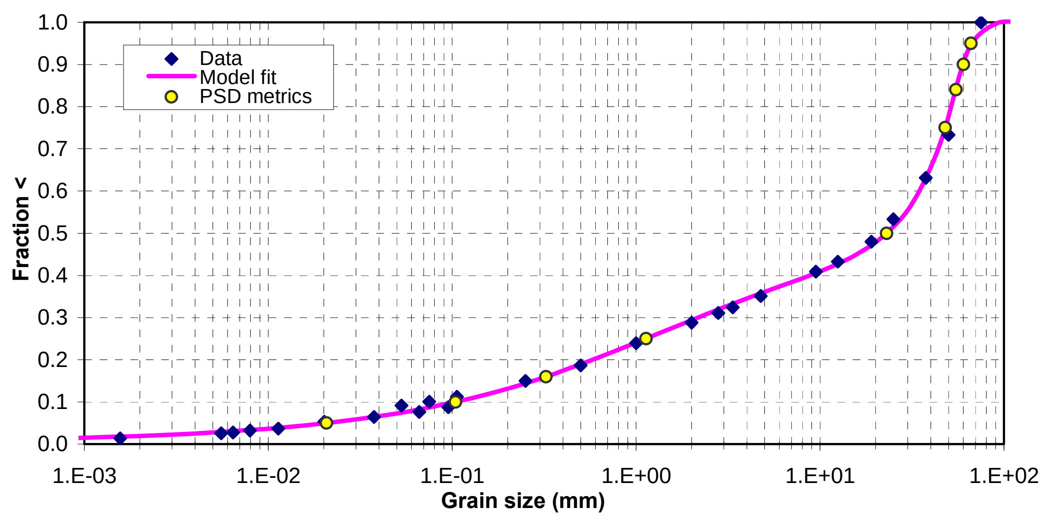


Figure D.8. Grain Size Data for Hanford 300 Area, Well 399-1-23, Sample C5000-40E (depth interval 33.5-34.5 feet)

Grain size data for Hanford 300 Area, Well 399-1-23, Sample C5000-41C (35.5-36.5 ft bgs).										
wt	%<	size(μm)	fraction<	size(mm)	size(phi)	pred frac<	resid^2	PSD metric		value
1	100.00		1.00000	127.0000	-6.9887	0.99993	0.00000	d5(phi)		3.39
1	100.00		1.00000	75.0000	-6.2288	0.99953	0.00000	d10(phi)		1.27
1	100.00		1.00000	50.0000	-5.6439	0.99759	0.00001	d16(phi)		0.00
1	100.00		1.00000	37.5000	-5.2288	0.98391	0.00026	d25(phi)		-1.15
1	84.64		0.84640	25.0000	-4.6439	0.85774	0.00013	d50(phi)		-3.09
1	74.74		0.74741	19.0000	-4.2479	0.74047	0.00005	d75(phi)		-4.28
1	60.95		0.60954	12.5000	-3.6439	0.59985	0.00009	d84(phi)		-4.59
1	51.99		0.51988	9.5000	-3.2479	0.52666	0.00005	d90(phi)		-4.78
1	36.75		0.36752	4.7500	-2.2479	0.37609	0.00007	d95(phi)		-4.98
1	31.17		0.31165	3.3500	-1.7442	0.31308	0.00000	σ_{IG}(phi)		2.41
1	28.86		0.28858	2.8000	-1.4854	0.28396	0.00002			
1	23.90		0.23902	2.0000	-1.0000	0.23548	0.00001	d5(mm)		0.10
1	16.46		0.16461	1.0000	0.0000	0.15970	0.00002	d10(mm)		0.42
1	10.37		0.10370	0.5000	1.0000	0.10996	0.00004	d16(mm)		1.00
1	7.58		0.07583	0.2500	2.0000	0.07763	0.00000	d25(mm)		2.23
1	5.71		0.05709	0.1060	3.2379	0.05231	0.00002	d50(mm)		8.51
1	5.16		0.05160	0.0750	3.7370	0.04509	0.00004	d75(mm)		19.46
1	4.74		0.04736	0.0530	4.2379	0.03907	0.00007	d84(mm)		24.03
1	4.41		0.04412	0.0902	3.4710	0.04877	0.00002	d90(mm)		27.55
1	3.84		0.03837	0.0630	3.9879	0.04194	0.00001	d95(mm)		31.62
1	3.17		0.03165	0.0359	4.8007	0.03347	0.00000	d_{geom}(mm)		4.80
1	2.49		0.02494	0.0194	5.6900	0.02654	0.00000	σ_{geom}(mm)		7.24
1	1.92		0.01918	0.0110	6.5008	0.02175	0.00001			
1	1.73		0.01726	0.0078	7.0070	0.01931	0.00000	USDA texture system		
1	1.53		0.01535	0.0063	7.3058	0.01804	0.00001	% gravel		76.45
1	1.34		0.01343	0.0054	7.5197	0.01719	0.00001	% sand		19.73
1	0.86		0.00863	0.0016	9.3282	0.01172	0.00001	% silt		2.55
								% clay		1.26
					weighted SSR =		0.00097			

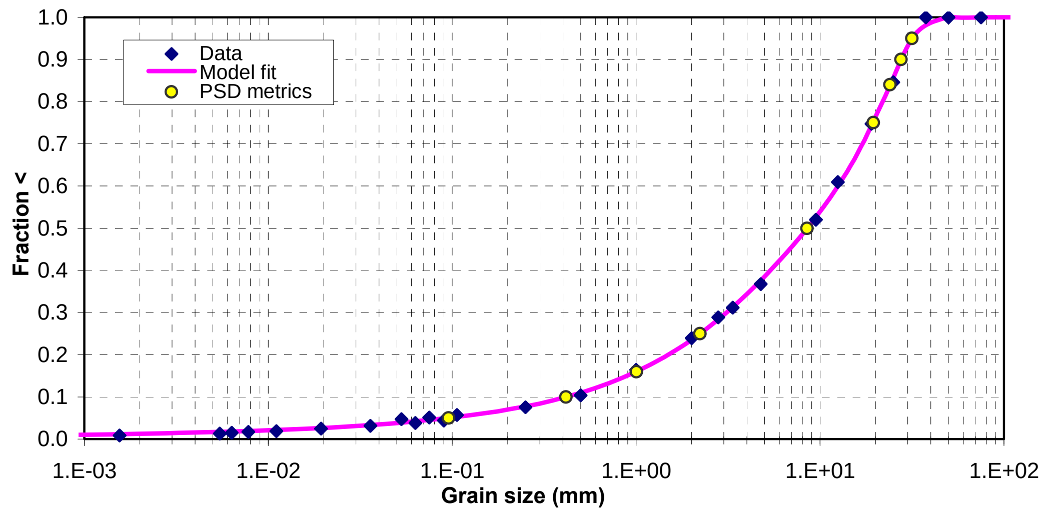


Figure D.9. Grain Size Data for Hanford 300 Area, Well 399-1-23, Sample C5000-41C (depth interval 35.5-36.5 feet)

Grain size data for Hanford 300 Area, Well 399-1-23, Sample C5000-45C (53.5-54.5 ft bgs).

wt	%<	size(μm)	fraction<	size(mm)	size(phi)	pred frac<	resid^2	PSD metric	value
1	100.00		1.00000	127.0000	-6.9887	0.99999	0.00000	d5(phi)	3.72
10	100.00		1.00000	75.0000	-6.2288	0.99931	0.00000	d10(phi)	1.90
1	100.00		1.00000	50.0000	-5.6439	0.98609	0.00019	d16(phi)	0.35
1	91.13		0.91129	37.5000	-5.2288	0.91923	0.00006	d25(phi)	-3.32
1	63.95		0.63946	25.0000	-4.6439	0.63423	0.00003	d50(phi)	-4.38
1	44.43		0.44428	19.0000	-4.2479	0.44741	0.00001	d75(phi)	-4.85
1	28.96		0.28959	12.5000	-3.6439	0.29251	0.00001	d84(phi)	-5.02
1	24.22		0.24215	9.5000	-3.2479	0.24296	0.00000	d90(phi)	-5.17
1	19.83		0.19831	4.7500	-2.2479	0.19022	0.00007	d95(phi)	-5.35
1	18.56		0.18564	3.3500	-1.7442	0.18007	0.00003	σ_{IG}(phi)	2.72
1	17.86		0.17858	2.8000	-1.4854	0.17670	0.00000		
1	16.61		0.16612	2.0000	-1.0000	0.17232	0.00004	d5(mm)	0.08
1	15.64		0.15644	1.0000	0.0000	0.16524	0.00008	d10(mm)	0.27
1	14.75		0.14746	0.5000	1.0000	0.13923	0.00007	d16(mm)	0.78
1	9.11		0.09107	0.2500	2.0000	0.09618	0.00003	d25(mm)	9.98
1	5.83		0.05829	0.1060	3.2379	0.05961	0.00000	d50(mm)	20.77
1	5.21		0.05210	0.0750	3.7370	0.04969	0.00001	d75(mm)	28.82
1	4.75		0.04751	0.0530	4.2379	0.04166	0.00003	d84(mm)	32.50
1	4.48		0.04479	0.0872	3.5190	0.05376	0.00008	d90(mm)	35.98
1	4.11		0.04106	0.0613	4.0279	0.04482	0.00001	d95(mm)	40.86
1	3.43		0.03434	0.0350	4.8366	0.03402	0.00000	d_{geom}(mm)	8.61
1	2.99		0.02986	0.0190	5.7162	0.02563	0.00002	σ_{geom}(mm)	8.92
1	2.24		0.02239	0.0108	6.5275	0.02001	0.00001		
1	1.99		0.01991	0.0076	7.0339	0.01725	0.00001	USDA texture system	
1	1.74		0.01742	0.0062	7.3328	0.01584	0.00000	% gravel	82.77
1	1.52		0.01518	0.0053	7.5468	0.01491	0.00000	% sand	13.18
1	0.77		0.00771	0.0015	9.3592	0.00920	0.00000	% silt	3.03
								% clay	1.02
						weighted SSR =	0.00079		

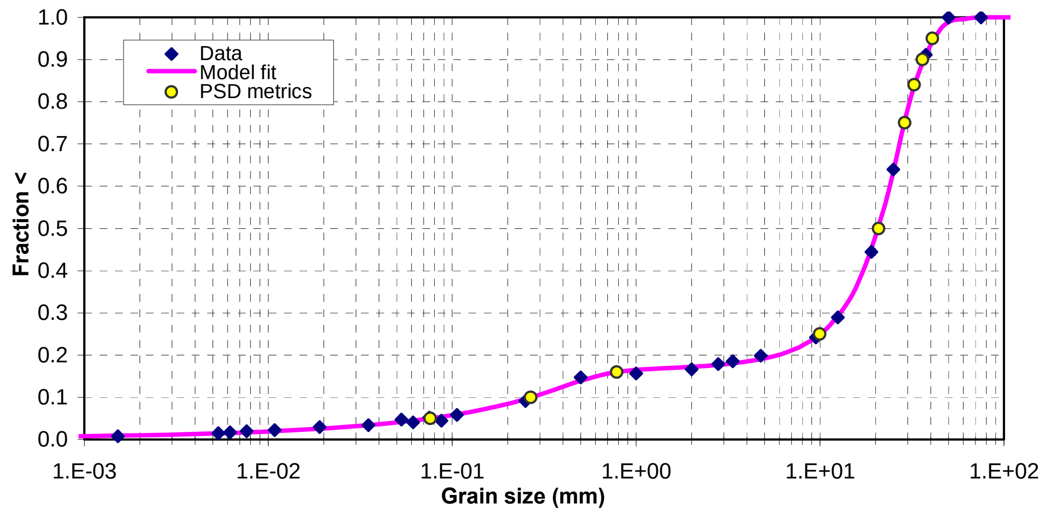


Figure D.10. Grain Size Data for Hanford 300 Area, Well 399-1-23, Sample C5000-45C (depth interval 53.5-54.5 feet)

Grain size data for Hanford 300 Area, Well 399-3-19, Sample C5001-66A (20.5-21.5 ft bgs).

wt	%<	size(μm)	fraction<	size(mm)	size(phi)	pred frac<	resid^2	PSD metric	value
1	100.00		1.00000	127.0000	-6.9887	0.99803	0.00000	d5(phi)	3.31
10	100.00		1.00000	75.0000	-6.2288	0.98476	0.00232	d10(phi)	1.72
1	88.03		0.88026	50.0000	-5.6439	0.94800	0.00459	d16(phi)	1.13
1	88.03		0.88026	37.5000	-5.2288	0.89722	0.00029	d25(phi)	0.55
1	79.70		0.79703	25.0000	-4.6439	0.79492	0.00000	d50(phi)	-2.76
1	73.19		0.73186	19.0000	-4.2479	0.71903	0.00016	d75(phi)	-4.41
1	62.12		0.62118	12.5000	-3.6439	0.61432	0.00005	d84(phi)	-4.88
1	55.59		0.55589	9.5000	-3.2479	0.55756	0.00000	d90(phi)	-5.25
1	45.66		0.45660	4.7500	-2.2479	0.45295	0.00001	d95(phi)	-5.67
1	41.80		0.41798	3.3500	-1.7442	0.41618	0.00000	σ_{IG}(phi)	2.86
1	39.76		0.39761	2.8000	-1.4854	0.40025	0.00001		
1	36.59		0.36593	2.0000	-1.0000	0.37427	0.00007	d5(mm)	0.10
1	31.78		0.31777	1.0000	0.0000	0.31684	0.00000	d10(mm)	0.30
1	17.86		0.17856	0.5000	1.0000	0.17861	0.00000	d16(mm)	0.46
1	8.29		0.08286	0.2500	2.0000	0.08366	0.00000	d25(mm)	0.68
1	5.29		0.05294	0.1060	3.2379	0.05108	0.00000	d50(mm)	6.76
1	4.77		0.04774	0.0750	3.7370	0.04483	0.00001	d75(mm)	21.27
1	4.69		0.04695	0.0530	4.2379	0.03995	0.00005	d84(mm)	29.54
1	4.42		0.04423	0.0875	3.5141	0.04740	0.00001	d90(mm)	37.99
1	4.26		0.04259	0.0618	4.0171	0.04197	0.00000	d95(mm)	50.74
1	3.28		0.03276	0.0352	4.8280	0.03529	0.00001	d_{geom}(mm)	3.64
1	2.95		0.02949	0.0192	5.7027	0.02980	0.00000	σ_{geom}(mm)	9.73
1	2.29		0.02293	0.0110	6.5078	0.02578	0.00001		
1	1.97		0.01966	0.0077	7.0142	0.02363	0.00002	USDA texture system	
1	1.97		0.01966	0.0063	7.3067	0.02249	0.00001	% gravel	62.57
1	1.80		0.01802	0.0055	7.5174	0.02172	0.00001	% sand	33.50
1	0.98		0.00983	0.0016	9.3262	0.01637	0.00004	% silt	2.19
								% clay	1.73
						weighted SSR =	0.00768		

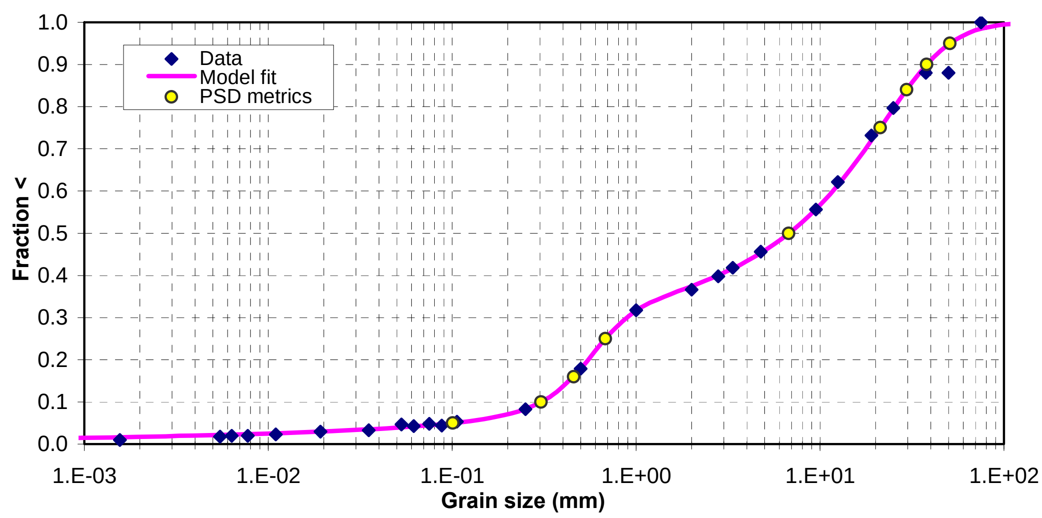


Figure D.11. Grain Size Data for Hanford 300 Area, Well 399-3-19, Sample C5001-66A (depth interval 20.5-21.5 feet)

Grain size data for Hanford 300 Area, Well 399-3-19, Sample C5001-69D (33.5-34.5 ft bgs).									
wt	%<	size(μm)	fraction<	size(mm)	size(phi)	pred frac<	resid^2	PSD metric	value
1	100.00		1.00000	127.0000	-6.9887	0.99999	0.00000	d5(phi)	0.33
10	100.00		1.00000	75.0000	-6.2288	0.99232	0.00059	d10(phi)	-3.06
1	73.57		0.73569	50.0000	-5.6439	0.76421	0.00081	d16(phi)	-3.98
1	52.40		0.52398	37.5000	-5.2288	0.48394	0.00160	d25(phi)	-4.57
1	27.16		0.27165	25.0000	-4.6439	0.26796	0.00001	d50(phi)	-5.26
1	15.76		0.15756	19.0000	-4.2479	0.19320	0.00127	d75(phi)	-5.63
1	12.09		0.12091	12.5000	-3.6439	0.13072	0.00010	d84(phi)	-5.75
1	11.06		0.11061	9.5000	-3.2479	0.10780	0.00001	d90(phi)	-5.85
1	8.76		0.08763	4.7500	-2.2479	0.07857	0.00008	d95(phi)	-5.97
1	7.77		0.07774	3.3500	-1.7442	0.07148	0.00004	σ_{IG}(phi)	1.40
1	7.26		0.07259	2.8000	-1.4854	0.06881	0.00001		
1	6.54		0.06542	2.0000	-1.0000	0.06469	0.00000	d5(mm)	0.80
1	5.24		0.05240	1.0000	0.0000	0.05440	0.00000	d10(mm)	8.36
1	3.94		0.03944	0.5000	1.0000	0.04147	0.00000	d16(mm)	15.78
1	3.29		0.03294	0.2500	2.0000	0.03163	0.00000	d25(mm)	23.68
1	2.62		0.02617	0.1060	3.2379	0.02333	0.00001	d50(mm)	38.27
1	2.36		0.02365	0.0750	3.7370	0.02081	0.00001	d75(mm)	49.35
1	2.17		0.02170	0.0530	4.2379	0.01865	0.00001	d84(mm)	53.78
1	2.32		0.02324	0.1009	3.3087	0.02295	0.00000	d90(mm)	57.61
1	2.06		0.02061	0.0700	3.8364	0.02036	0.00000	d95(mm)	62.56
1	1.75		0.01754	0.0395	4.6626	0.01704	0.00000	d_{geom}(mm)	23.17
1	1.40		0.01403	0.0210	5.5716	0.01419	0.00000	σ_{geom}(mm)	5.43
1	1.12		0.01118	0.0119	6.3988	0.01212	0.00000		
1	0.92		0.00921	0.0082	6.9238	0.01102	0.00000	USDA texture system	
1	0.83		0.00833	0.0067	7.2277	0.01044	0.00000	% gravel	93.53
1	0.75		0.00746	0.0057	7.4468	0.01005	0.00001	% sand	4.64
1	0.39		0.00395	0.0016	9.2877	0.00743	0.00001	% silt	1.05
								% clay	0.78
						weighted SSR =	0.00459		

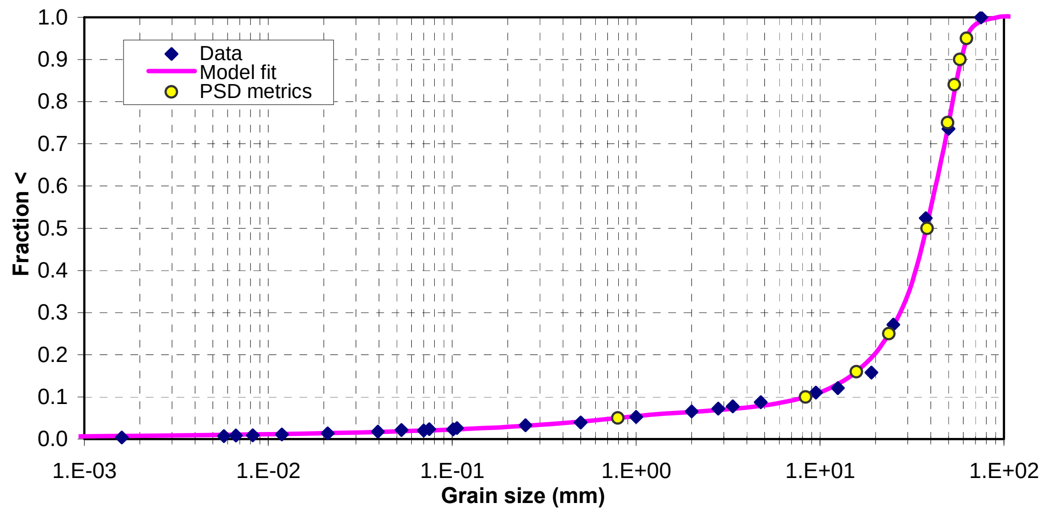


Figure D.12. Grain Size Data for Hanford 300 Area, Well 399-3-19, Sample C5001-69D (depth interval 33.5-34.5 feet)

Grain size data for Hanford 300 Area, Well 399-3-19, Sample C5001-70E (40-41 ft bgs).

wt	%<	size(μm)	fraction<	size(mm)	size(phi)	pred frac<	resid^2	PSD metric	value
1	100.00		1.00000	127.0000	-6.9887	0.99995	0.00000	d5(phi)	2.38
1	100.00		1.00000	75.0000	-6.2288	0.99970	0.00000	d10(phi)	0.49
1	100.00		1.00000	50.0000	-5.6439	0.99899	0.00000	d16(phi)	-0.85
1	100.00		1.00000	37.5000	-5.2288	0.99623	0.00001	d25(phi)	-2.30
1	93.50		0.93496	25.0000	-4.6439	0.93991	0.00002	d50(phi)	-3.75
1	75.98		0.75975	19.0000	-4.2479	0.75487	0.00002	d75(phi)	-4.24
1	45.17		0.45174	12.5000	-3.6439	0.46139	0.00009	d84(phi)	-4.40
1	36.97		0.36967	9.5000	-3.2479	0.36204	0.00006	d90(phi)	-4.53
1	25.51		0.25507	4.7500	-2.2479	0.24625	0.00008	d95(phi)	-4.68
1	20.55		0.20546	3.3500	-1.7442	0.21161	0.00004	σ_{IG}(phi)	1.96
1	18.91		0.18910	2.8000	-1.4854	0.19571	0.00004		
1	16.22		0.16220	2.0000	-1.0000	0.16803	0.00003	d5(mm)	0.19
1	13.15		0.13153	1.0000	0.0000	0.11926	0.00015	d10(mm)	0.71
1	8.56		0.08562	0.5000	1.0000	0.08272	0.00001	d16(mm)	1.80
1	5.75		0.05746	0.2500	2.0000	0.05734	0.00000	d25(mm)	4.91
1	3.53		0.03527	0.1060	3.2379	0.03709	0.00000	d50(mm)	13.48
1	3.02		0.03024	0.0750	3.7370	0.03135	0.00000	d75(mm)	18.89
1	2.68		0.02681	0.0530	4.2379	0.02661	0.00000	d84(mm)	21.07
1	2.89		0.02885	0.0918	3.4453	0.03457	0.00003	d90(mm)	23.03
1	2.72		0.02716	0.0645	3.9536	0.02919	0.00000	d95(mm)	25.70
1	2.15		0.02150	0.0365	4.7743	0.02245	0.00000	d_{geom}(mm)	6.80
1	1.70		0.01697	0.0197	5.6661	0.01711	0.00000	σ_{geom}(mm)	5.66
1	1.47		0.01471	0.0113	6.4706	0.01356	0.00000		
1	1.24		0.01245	0.0079	6.9828	0.01176	0.00000	USDA texture system	
1	1.13		0.01132	0.0064	7.2814	0.01084	0.00000	% gravel	83.20
1	1.02		0.01018	0.0055	7.4952	0.01023	0.00000	% sand	14.21
1	0.68		0.00679	0.0016	9.3067	0.00646	0.00000	% silt	1.89
								% clay	0.70
						weighted SSR =	0.00061		

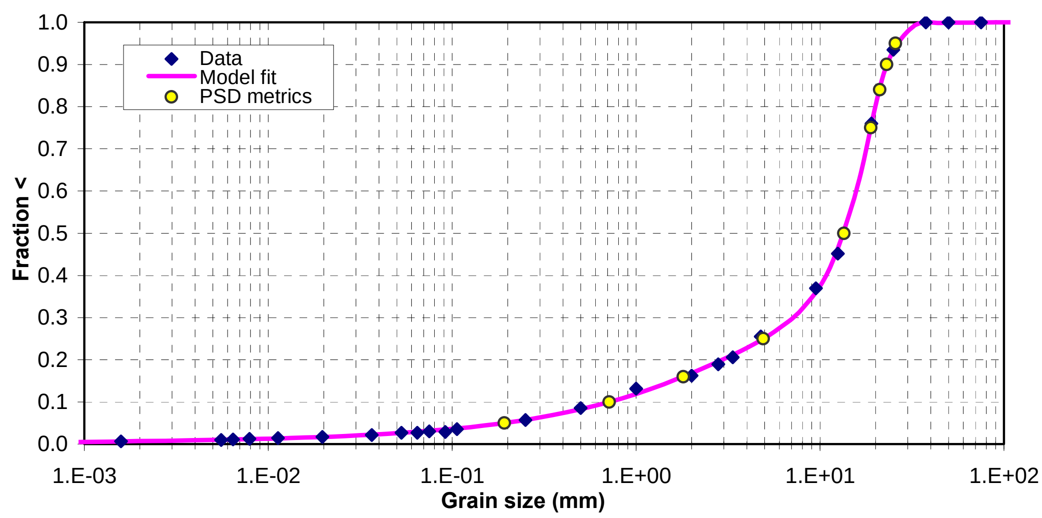


Figure D.13. Grain Size Data for Hanford 300 Area, Well 399-3-19, Sample C5001-70E (depth interval 40-41 feet)

Grain size data for Hanford 300 Area, Well 399-3-19, Sample C5001-73B (46.5-47.5 ft bgs).

wt	%<	size(μm)	fraction<	size(mm)	size(phi)	pred frac<	resid^2	PSD metric	value
1	100.00		1.00000	127.0000	-6.9887	0.99977	0.00000	d5(phi)	1.53
10	100.00		1.00000	75.0000	-6.2288	0.99198	0.00064	d10(phi)	0.33
1	89.18		0.89178	50.0000	-5.6439	0.93443	0.00182	d16(phi)	-0.53
1	84.12		0.84115	37.5000	-5.2288	0.82202	0.00037	d25(phi)	-1.79
1	64.05		0.64051	25.0000	-4.6439	0.62892	0.00013	d50(phi)	-4.13
1	49.99		0.49995	19.0000	-4.2479	0.52509	0.00063	d75(phi)	-5.02
1	42.07		0.42074	12.5000	-3.6439	0.41420	0.00004	d84(phi)	-5.28
1	37.14		0.37142	9.5000	-3.2479	0.36379	0.00006	d90(phi)	-5.49
1	27.94		0.27938	4.7500	-2.2479	0.27957	0.00000	d95(phi)	-5.73
1	24.37		0.24366	3.3500	-1.7442	0.24723	0.00001	σ_{IG}(phi)	2.29
1	22.69		0.22694	2.8000	-1.4854	0.23047	0.00001		
1	20.13		0.20129	2.0000	-1.0000	0.19637	0.00002	d5(mm)	0.35
1	12.24		0.12242	1.0000	0.0000	0.12110	0.00000	d10(mm)	0.80
1	6.10		0.06102	0.5000	1.0000	0.06746	0.00004	d16(mm)	1.44
1	4.10		0.04104	0.2500	2.0000	0.03918	0.00000	d25(mm)	3.45
1	3.02		0.03022	0.1060	3.2379	0.02227	0.00006	d50(mm)	17.54
1	2.78		0.02776	0.0750	3.7370	0.01828	0.00009	d75(mm)	32.37
1	2.62		0.02618	0.0530	4.2379	0.01522	0.00012	d84(mm)	38.97
1	1.08		0.01085	0.0841	3.5721	0.01948	0.00007	d90(mm)	44.97
1	0.93		0.00930	0.0592	4.0785	0.01611	0.00005	d95(mm)	53.15
1	0.77		0.00775	0.0340	4.8774	0.01226	0.00002	d_{geom}(mm)	9.16
1	0.74		0.00744	0.0186	5.7472	0.00940	0.00000	σ_{geom}(mm)	5.82
1	0.62		0.00620	0.0107	6.5449	0.00753	0.00000		
1	0.50		0.00496	0.0075	7.0501	0.00661	0.00000	USDA texture system	
1	0.46		0.00465	0.0062	7.3439	0.00614	0.00000	% gravel	80.36
1	0.46		0.00465	0.0053	7.5515	0.00584	0.00000	% sand	18.16
1	0.46		0.00465	0.0015	9.3439	0.00391	0.00000	% silt	1.05
								% clay	0.42
						weighted SSR =	0.00422		

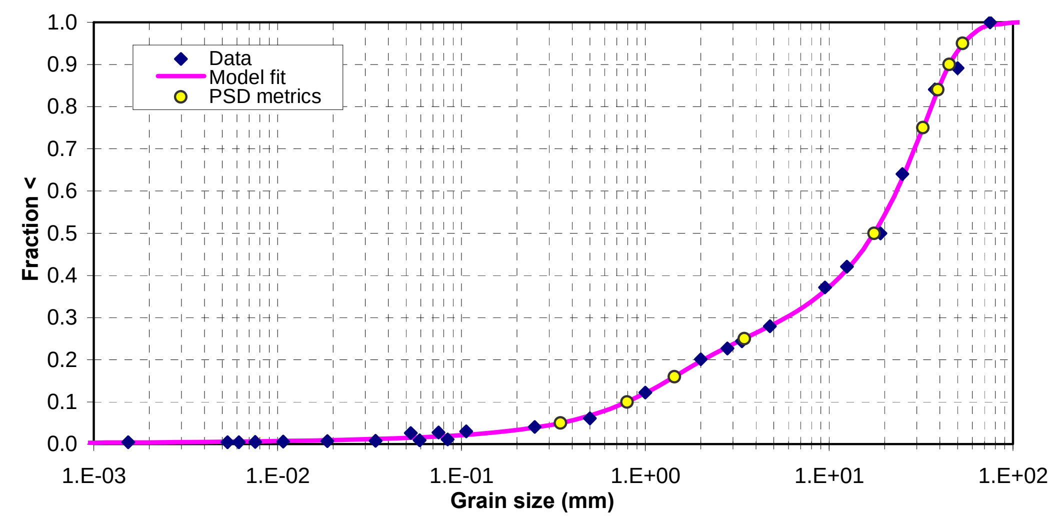


Figure D.14. Grain Size Data for Hanford 300 Area, Well 399-3-19, Sample C5001-73B (depth interval 46.5-47.5 feet)

Grain size data for Hanford 300 Area, Well 399-3-19, Sample C5001-74B (53-54 ft bgs).

wt	%<	size(μm)	fraction<	size(mm)	size(phi)	pred frac<	resid^2	PSD metric	value
1	100.00		1.00000	127.0000	-6.9887	0.99954	0.00000	d5(phi)	1.02
10	100.00		1.00000	75.0000	-6.2288	0.99809	0.00004	d10(phi)	-0.05
1	100.00		1.00000	50.0000	-5.6439	0.97658	0.00055	d16(phi)	-0.93
1	84.69		0.84694	37.5000	-5.2288	0.86094	0.00020	d25(phi)	-2.02
1	64.05		0.64052	25.0000	-4.6439	0.64495	0.00002	d50(phi)	-4.05
1	56.46		0.56456	19.0000	-4.2479	0.54151	0.00053	d75(phi)	-4.95
1	43.65		0.43649	12.5000	-3.6439	0.43052	0.00004	d84(phi)	-5.18
1	36.46		0.36456	9.5000	-3.2479	0.37627	0.00014	d90(phi)	-5.33
1	25.97		0.25969	4.7500	-2.2479	0.27067	0.00012	d95(phi)	-5.50
1	21.95		0.21954	3.3500	-1.7442	0.22585	0.00004	σ_{IG}(phi)	2.05
1	20.30		0.20305	2.8000	-1.4854	0.20409	0.00000		
1	17.65		0.17648	2.0000	-1.0000	0.16540	0.00012	d5(mm)	0.49
1	10.44		0.10443	1.0000	0.0000	0.09719	0.00005	d10(mm)	1.03
1	4.45		0.04448	0.5000	1.0000	0.05053	0.00004	d16(mm)	1.90
1	2.28		0.02278	0.2500	2.0000	0.02579	0.00001	d25(mm)	4.06
1	1.16		0.01163	0.1060	3.2379	0.01361	0.00000	d50(mm)	16.55
1	0.88		0.00878	0.0750	3.7370	0.01130	0.00001	d75(mm)	30.93
1	0.68		0.00685	0.0530	4.2379	0.00963	0.00001	d84(mm)	36.17
1	0.85		0.00850	0.0841	3.5721	0.01197	0.00001	d90(mm)	40.26
1	0.73		0.00729	0.0592	4.0785	0.01011	0.00001	d95(mm)	45.14
1	0.55		0.00546	0.0339	4.8807	0.00803	0.00001	d_{geom}(mm)	9.47
1	0.49		0.00486	0.0186	5.7524	0.00642	0.00000	σ_{geom}(mm)	4.90
1	0.36		0.00364	0.0107	6.5515	0.00530	0.00000		
1	0.36		0.00364	0.0075	7.0515	0.00473	0.00000	USDA texture system	
1	0.34		0.00340	0.0061	7.3453	0.00443	0.00000	% gravel	83.46
1	0.34		0.00340	0.0053	7.5528	0.00423	0.00000	% sand	15.60
1	0.34		0.00340	0.0015	9.3453	0.00291	0.00000	% silt	0.63
								% clay	0.31
						weighted SSR =	0.00194		

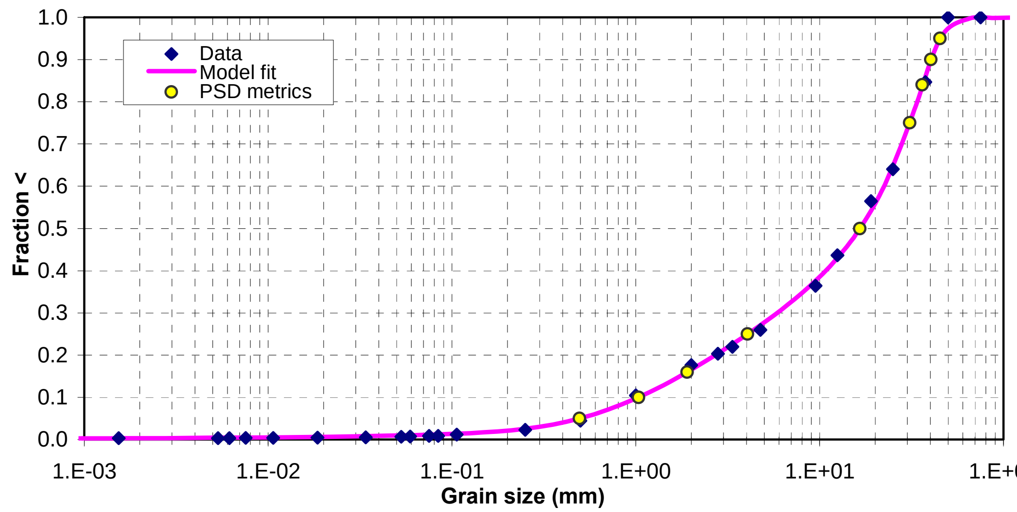


Figure D.15. Grain Size Data for Hanford 300 Area, Well 399-3-19, Sample C5001-74B (depth interval 53-54 feet)

Grain size data for Hanford 300 Area, Well 399-3-20, Sample C5002-86E (21-22 ft bgs).

wt	%<	size(μm)	fraction<	size(mm)	size(phi)	pred frac<	resid^2	PSD metric	value
1	100.00		1.00000	127.0000	-6.9887	0.99998	0.00000	d5(phi)	3.65
1	100.00		1.00000	75.0000	-6.2288	0.99950	0.00000	d10(phi)	1.72
10	100.00		0.99999	50.0000	-5.6439	0.97252	0.00755	d16(phi)	0.07
1	71.69		0.71693	37.5000	-5.2288	0.81303	0.00924	d25(phi)	-2.41
1	55.90		0.55903	25.0000	-4.6439	0.53758	0.00046	d50(phi)	-4.53
1	43.64		0.43643	19.0000	-4.2479	0.42894	0.00006	d75(phi)	-5.11
1	33.59		0.33590	12.5000	-3.6439	0.33440	0.00000	d84(phi)	-5.28
1	30.21		0.30211	9.5000	-3.2479	0.29763	0.00002	d90(phi)	-5.40
1	24.00		0.24001	4.7500	-2.2479	0.24306	0.00001	d95(phi)	-5.54
1	21.92		0.21921	3.3500	-1.7442	0.22421	0.00002	σ_{IG}(phi)	2.73
1	21.03		0.21033	2.8000	-1.4854	0.21521	0.00002		
1	19.55		0.19550	2.0000	-1.0000	0.19852	0.00001	d5(mm)	0.08
1	17.22		0.17224	1.0000	0.0000	0.16255	0.00009	d10(mm)	0.30
1	11.87		0.11870	0.5000	1.0000	0.12517	0.00004	d16(mm)	0.95
1	8.68		0.08677	0.2500	2.0000	0.09104	0.00002	d25(mm)	5.33
1	6.74		0.06744	0.1060	3.2379	0.05840	0.00008	d50(mm)	23.05
1	6.14		0.06142	0.0750	3.7370	0.04847	0.00017	d75(mm)	34.65
1	5.70		0.05704	0.0530	4.2379	0.04015	0.00029	d84(mm)	38.82
1	3.79		0.03791	0.0815	3.6163	0.05071	0.00016	d90(mm)	42.26
1	3.37		0.03370	0.0574	4.1225	0.04193	0.00007	d95(mm)	46.57
1	2.95		0.02949	0.0330	4.9213	0.03108	0.00000	d_{geom}(mm)	8.68
1	2.11		0.02106	0.0179	5.8025	0.02246	0.00000	σ_{geom}(mm)	8.95
1	1.68		0.01685	0.0103	6.6014	0.01686	0.00000		
1	0.84		0.00842	0.0072	7.1145	0.01409	0.00003	USDA texture system	
1	0.84		0.00842	0.0059	7.4069	0.01274	0.00002	% gravel	80.15
1	0.84		0.00842	0.0051	7.6145	0.01187	0.00001	% sand	15.96
1	0.42		0.00421	0.0015	9.4136	0.00660	0.00001	% silt	3.13
								% clay	0.76
						weighted SSR =	0.01838		

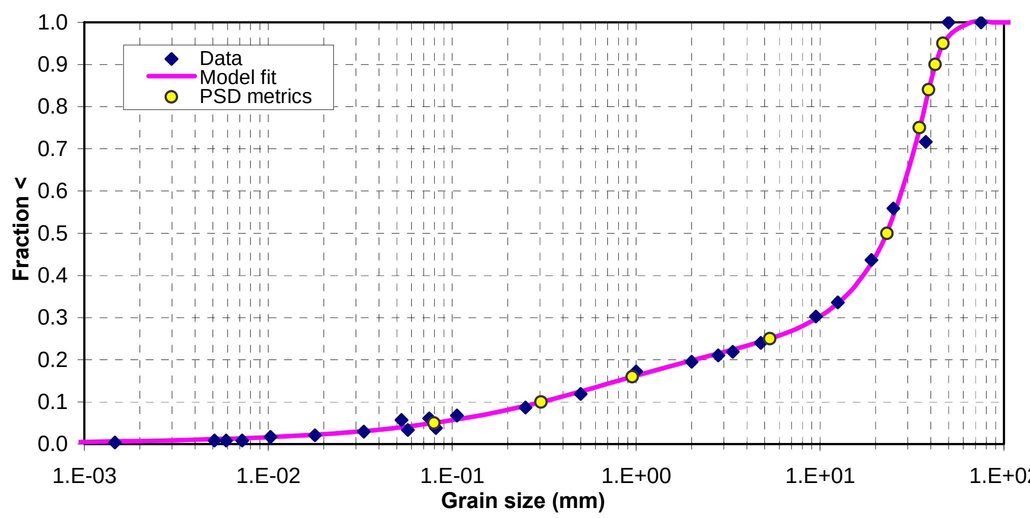


Figure D.16. Grain Size Data for Hanford 300 Area, Well 399-3-20, Sample C5002-86E (depth interval 21-22 feet)

Grain size data for Hanford 300 Area, Well 399-3-20, Sample C5002-91C (39-40 ft bgs).									
wt	%<	size(μm)	fraction<	size(mm)	size(phi)	pred frac<	resid^2	PSD metric	value
1	100.00		1.00000	127.0000	-6.9887	0.99939	0.00000	d5(phi)	4.67
1	100.00		1.00000	75.0000	-6.2288	0.99010	0.00010	d10(phi)	1.46
1	88.90		0.88904	50.0000	-5.6439	0.89061	0.00000	d16(phi)	-0.31
1	78.85		0.78852	37.5000	-5.2288	0.79355	0.00003	d25(phi)	-1.75
1	68.90		0.68900	25.0000	-4.6439	0.67287	0.00026	d50(phi)	-3.73
1	58.90		0.58896	19.0000	-4.2479	0.59580	0.00005	d75(phi)	-5.02
1	47.46		0.47455	12.5000	-3.6439	0.48574	0.00013	d84(phi)	-5.43
1	41.92		0.41917	9.5000	-3.2479	0.42178	0.00001	d90(phi)	-5.68
1	30.46		0.30460	4.7500	-2.2479	0.29565	0.00008	d95(phi)	-5.90
1	25.47		0.25469	3.3500	-1.7442	0.24929	0.00003	σ_{IG}(phi)	2.88
1	22.97		0.22969	2.8000	-1.4854	0.22906	0.00000		
1	19.31		0.19315	2.0000	-1.0000	0.19651	0.00001	d5(mm)	0.04
1	15.19		0.15193	1.0000	0.0000	0.14651	0.00003	d10(mm)	0.36
1	11.49		0.11489	0.5000	1.0000	0.11218	0.00001	d16(mm)	1.24
1	9.08		0.09078	0.2500	2.0000	0.08787	0.00001	d25(mm)	3.37
1	7.07		0.07070	0.1060	3.2379	0.06669	0.00002	d50(mm)	13.24
1	6.37		0.06372	0.0750	3.7370	0.06010	0.00001	d75(mm)	32.56
1	5.79		0.05787	0.0530	4.2379	0.05435	0.00001	d84(mm)	43.23
1	5.94		0.05939	0.0904	3.4668	0.06355	0.00002	d90(mm)	51.35
1	5.23		0.05227	0.0632	3.9835	0.05717	0.00002	d95(mm)	59.72
1	4.51		0.04514	0.0361	4.7930	0.04881	0.00001	d_{geom}(mm)	6.90
1	3.80		0.03801	0.0195	5.6789	0.04145	0.00001	σ_{geom}(mm)	9.98
1	2.97		0.02970	0.0000	16.4581	0.00952	0.00041		
1	2.85		0.02851	0.0078	6.9954	0.03304	0.00002	USDA texture system	
1	2.14		0.02138	0.0063	7.3064	0.03140	0.00010	% gravel	80.35
1	2.02		0.02019	0.0055	7.5170	0.03035	0.00010	% sand	14.31
1	1.19		0.01188	0.0016	9.3318	0.02300	0.00012	% silt	2.92
								% clay	2.43
						weighted SSR =	0.00159		

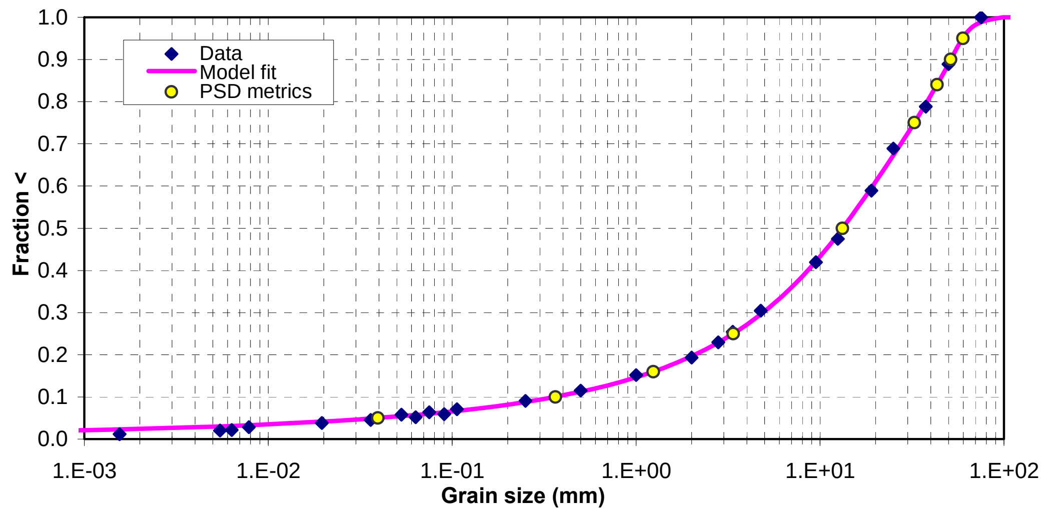


Figure D.17. Grain Size Data for Hanford 300 Area, Well 399-3-20, Sample C5002-91C (depth interval 39-40 feet)

Grain size data for Hanford 300 Area, Well 399-3-20, Sample C5002-92D (48-49 ft bgs).									
wt	%<	size(μm)	fraction<	size(mm)	size(phi)	pred frac<	resid^2	PSD metric	value
1	100.00		1.00000	127.0000	-6.9887	0.99993	0.00000	d5(phi)	1.67
1	100.00		1.00000	75.0000	-6.2288	0.99873	0.00000	d10(phi)	-0.14
1	100.00		1.00000	50.0000	-5.6439	0.95062	0.00244	d16(phi)	-1.26
1	71.62		0.71615	37.5000	-5.2288	0.74664	0.00093	d25(phi)	-2.36
1	53.20		0.53204	25.0000	-4.6439	0.51469	0.00030	d50(phi)	-4.58
1	45.18		0.45177	19.0000	-4.2479	0.44212	0.00009	d75(phi)	-5.23
1	36.39		0.36392	12.5000	-3.6439	0.37389	0.00010	d84(phi)	-5.39
1	31.99		0.31991	9.5000	-3.2479	0.33567	0.00025	d90(phi)	-5.51
1	25.12		0.25121	4.7500	-2.2479	0.23943	0.00014	d95(phi)	-5.64
1	20.60		0.20598	3.3500	-1.7442	0.19567	0.00011	σ_{IG}(phi)	2.14
1	17.98		0.17983	2.8000	-1.4854	0.17568	0.00002		
1	13.72		0.13723	2.0000	-1.0000	0.14314	0.00003	d5(mm)	0.31
1	8.46		0.08456	1.0000	0.0000	0.09451	0.00010	d10(mm)	1.10
1	5.09		0.05092	0.5000	1.0000	0.06395	0.00017	d16(mm)	2.40
1	3.81		0.03806	0.2500	2.0000	0.04453	0.00004	d25(mm)	5.14
1	3.11		0.03114	0.1060	3.2379	0.02952	0.00000	d50(mm)	23.91
1	2.88		0.02880	0.0750	3.7370	0.02528	0.00001	d75(mm)	37.65
1	2.70		0.02699	0.0530	4.2379	0.02175	0.00003	d84(mm)	41.94
1	2.76		0.02760	0.0815	3.6169	0.02623	0.00000	d90(mm)	45.46
1	2.46		0.02464	0.0573	4.1262	0.02248	0.00000	d95(mm)	49.92
1	2.27		0.02267	0.0329	4.9250	0.01785	0.00002	d_{geom}(mm)	10.95
1	2.07		0.02070	0.0180	5.7998	0.01405	0.00004	σ_{geom}(mm)	6.30
1	1.68		0.01675	0.0103	6.6051	0.01140	0.00003		
1	1.28		0.01281	0.0072	7.1182	0.01003	0.00001	USDA texture system	
1	1.28		0.01281	0.0059	7.4107	0.00934	0.00001	% gravel	85.69
1	1.08		0.01084	0.0051	7.6248	0.00887	0.00000	% sand	12.19
1	0.69		0.00690	0.0015	9.4206	0.00590	0.00000	% silt	1.47
								% clay	0.65
						weighted SSR =	0.00489		

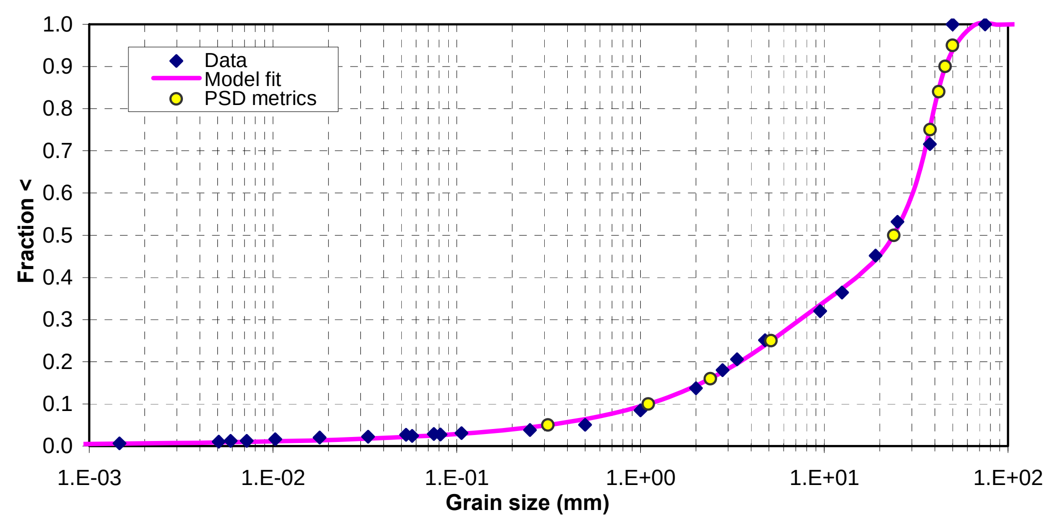


Figure D.18. Grain Size Data for Hanford 300 Area, Well 399-3-20, Sample C5002-92D (depth interval 48-49 feet)

wt	%<	size(μm)	fraction<	size(mm)	size(phi)	pred frac<	resid^2	PSD metric	value
Grain size data for Hanford 300 Area, Well 399-3-20, Sample C5002-93E (54-55 ft bgs).									
1	100.00		1.00000	127.0000	-6.9887	0.99982	0.00000	d5(phi)	0.46
10	100.00		1.00000	75.0000	-6.2288	0.99218	0.00061	d10(phi)	-0.54
1	89.14		0.89143	50.0000	-5.6439	0.92446	0.00109	d16(phi)	-1.30
1	80.92		0.80918	37.5000	-5.2288	0.79624	0.00017	d25(phi)	-2.22
1	61.28		0.61277	25.0000	-4.6439	0.60618	0.00004	d50(phi)	-4.19
1	50.57		0.50566	19.0000	-4.2479	0.51213	0.00004	d75(phi)	-5.10
1	40.95		0.40952	12.5000	-3.6439	0.41061	0.00000	d84(phi)	-5.35
1	36.01		0.36012	9.5000	-3.2479	0.36009	0.00000	d90(phi)	-5.55
1	25.51		0.25512	4.7500	-2.2479	0.25301	0.00000	d95(phi)	-5.77
1	20.11		0.20114	3.3500	-1.7442	0.20252	0.00000	σ_{IG}(phi)	1.96
1	17.61		0.17613	2.8000	-1.4854	0.17759	0.00000		
1	13.51		0.13507	2.0000	-1.0000	0.13443	0.00000	d5(mm)	0.73
1	7.07		0.07068	1.0000	0.0000	0.06881	0.00000	d10(mm)	1.46
1	3.39		0.03393	0.5000	1.0000	0.03463	0.00000	d16(mm)	2.45
1	1.87		0.01868	0.2500	2.0000	0.01910	0.00000	d25(mm)	4.65
1	1.08		0.01076	0.1060	3.2379	0.01072	0.00000	d50(mm)	18.22
1	0.88		0.00876	0.0750	3.7370	0.00883	0.00000	d75(mm)	34.25
1	0.75		0.00751	0.0530	4.2379	0.00740	0.00000	d84(mm)	40.92
1	0.72		0.00725	0.0857	3.5449	0.00950	0.00001	d90(mm)	46.78
1	0.58		0.00580	0.0602	4.0543	0.00788	0.00000	d95(mm)	54.55
1	0.48		0.00483	0.0346	4.8532	0.00606	0.00000	d_{geom}(mm)	11.16
1	0.37		0.00367	0.0188	5.7294	0.00469	0.00000	σ_{geom}(mm)	4.48
1	0.29		0.00290	0.0108	6.5271	0.00378	0.00000		
1	0.24		0.00242	0.0076	7.0304	0.00333	0.00000	USDA texture system	
1	0.19		0.00193	0.0062	7.3262	0.00309	0.00000	% gravel	86.56
1	0.19		0.00193	0.0054	7.5337	0.00294	0.00000	% sand	12.72
1	0.10		0.00097	0.0016	9.3328	0.00196	0.00000	% silt	0.51
								% clay	0.21
						weighted SSR =	0.00199		

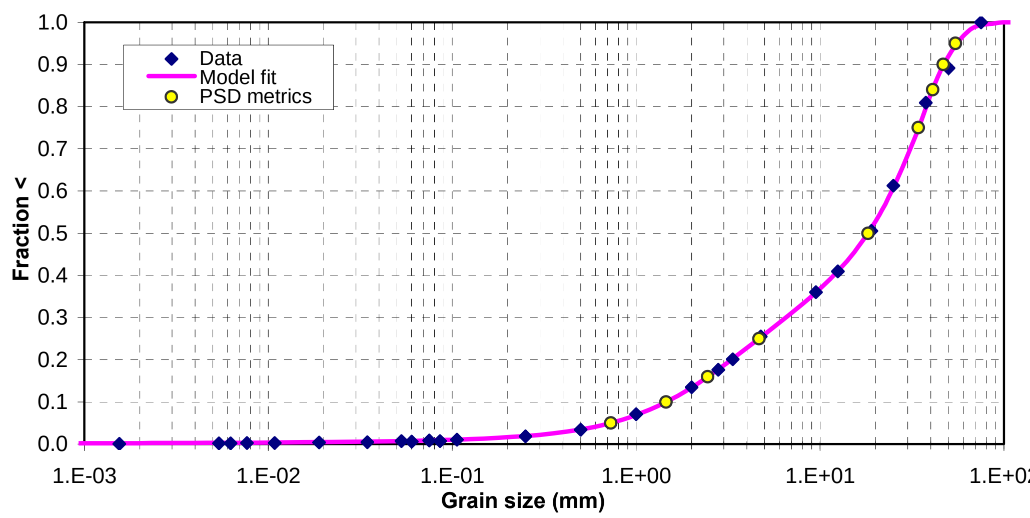


Figure D.19. Grain Size Data for Hanford 300 Area, Well 399-3-20, Sample C5002-93E (depth interval 54-55 feet)

Grain size data for Hanford 300 Area, Well 399-3-20, Sample C5002-98E (80.5-81.7 ft bgs).									
wt	%<	size(μm)	fraction<	size(mm)	size(phi)	pred frac<	resid^2	PSD metric	value
1	100.00		1.00000	127.0000	-6.9887	0.99985	0.00000	d5(phi)	3.12
1	100.00		1.00000	75.0000	-6.2288	0.98979	0.00010	d10(phi)	2.15
1	89.97		0.89970	50.0000	-5.6439	0.89231	0.00005	d16(phi)	0.88
1	70.47		0.70468	37.5000	-5.2288	0.73148	0.00072	d25(phi)	-2.60
1	55.91		0.55906	25.0000	-4.6439	0.52790	0.00097	d50(phi)	-4.54
1	45.02		0.45017	19.0000	-4.2479	0.43410	0.00026	d75(phi)	-5.27
1	32.32		0.32318	12.5000	-3.6439	0.33900	0.00025	d84(phi)	-5.50
1	27.91		0.27911	9.5000	-3.2479	0.29712	0.00032	d90(phi)	-5.67
1	22.39		0.22393	4.7500	-2.2479	0.23176	0.00006	d95(phi)	-5.87
1	20.82		0.20825	3.3500	-1.7442	0.21192	0.00001	σ_{IG}(phi)	2.96
1	20.14		0.20135	2.8000	-1.4854	0.20385	0.00001		
1	19.30		0.19302	2.0000	-1.0000	0.19160	0.00000	d5(mm)	0.11
1	18.20		0.18200	1.0000	0.0000	0.17416	0.00006	d10(mm)	0.23
1	17.06		0.17059	0.5000	1.0000	0.15724	0.00018	d16(mm)	0.54
1	10.88		0.10877	0.2500	2.0000	0.10982	0.00000	d25(mm)	6.07
1	4.33		0.04330	0.1060	3.2379	0.04598	0.00001	d50(mm)	23.25
1	3.28		0.03277	0.0750	3.7370	0.03245	0.00000	d75(mm)	38.70
1	2.66		0.02658	0.0530	4.2379	0.02344	0.00001	d84(mm)	45.16
1	2.91		0.02910	0.0852	3.5528	0.03681	0.00006	d90(mm)	50.85
1	2.47		0.02469	0.0596	4.0678	0.02610	0.00000	d95(mm)	58.37
1	1.94		0.01940	0.0340	4.8786	0.01606	0.00001	d_{geom}(mm)	9.45
1	1.59		0.01587	0.0185	5.7596	0.01020	0.00003	σ_{geom}(mm)	8.30
1	1.32		0.01323	0.0106	6.5616	0.00716	0.00004		
1	1.15		0.01146	0.0075	7.0680	0.00588	0.00003	USDA texture system	
1	1.06		0.01058	0.0061	7.3637	0.00528	0.00003	% gravel	80.84
1	0.88		0.00882	0.0052	7.5778	0.00490	0.00002	% sand	16.93
1	0.53		0.00529	0.0015	9.3834	0.00285	0.00001	% silt	1.91
								% clay	0.32
						weighted SSR =	0.00324		

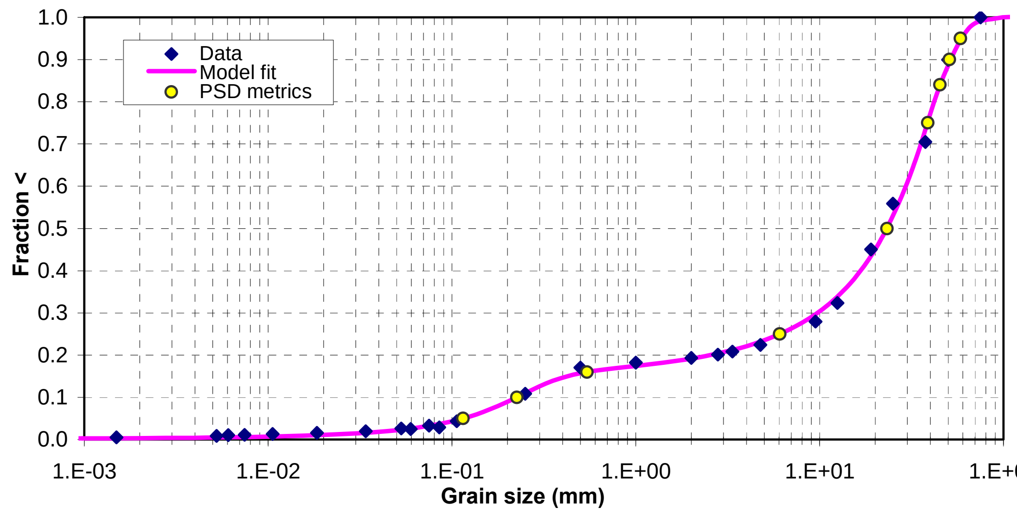


Figure D.20. Grain Size Data for Hanford 300 Area, Well 399-3-20, Sample C5002-98E (depth interval 80.5-81.7 feet)

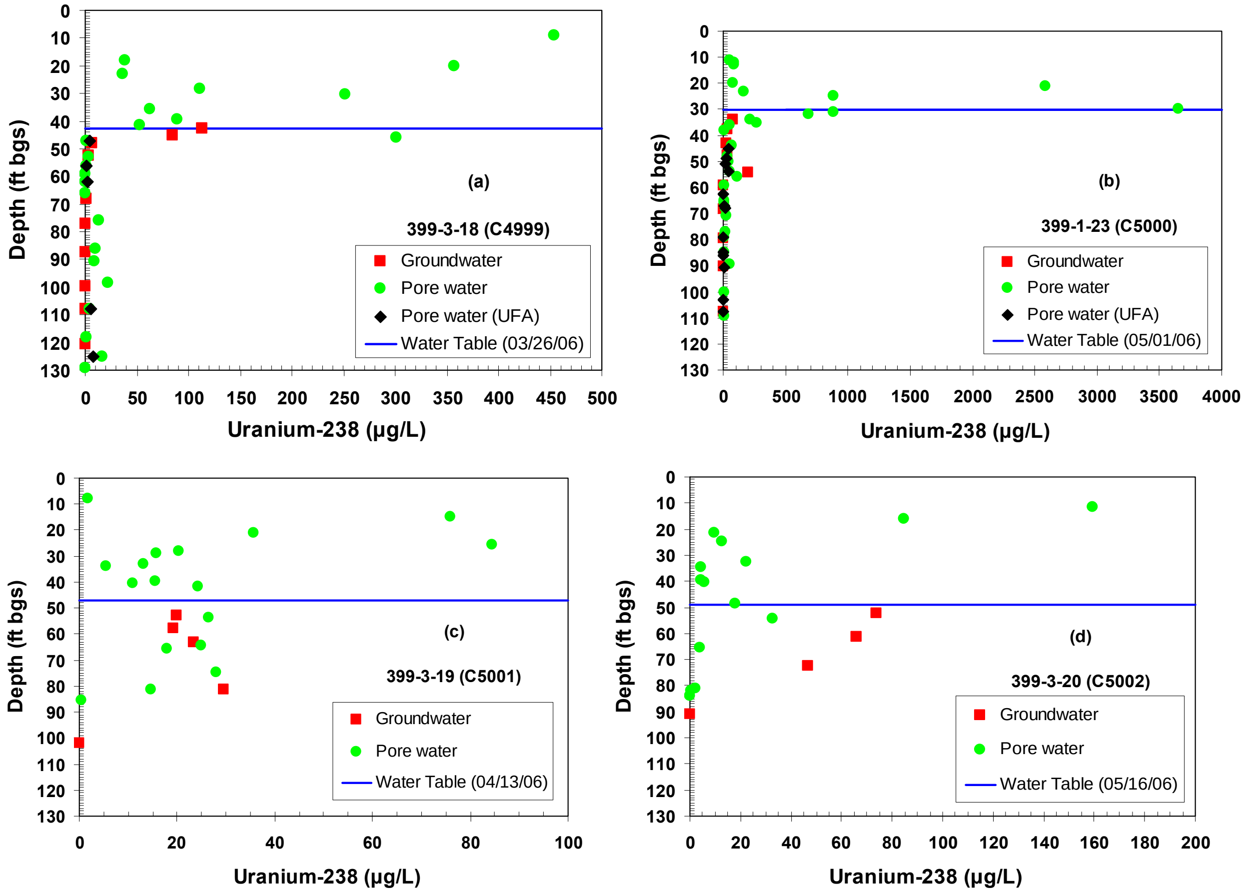


Figure D.21. Soluble Uranium Concentrations in the Depth-Discrete Groundwater, Pore Water after Ultracentrifugation (UFA), and Calculated Pore Water Uranium Concentrations in the Sediments from Boreholes (a) C4999; (b) C5000; (c) C5001; (d) C5002

Appendix E

Selected Slug Test Analysis Plots for Discrete Depth Interval Testing

Appendix E

Selected Slug Test Analysis Plots for Discrete Depth Interval Testing

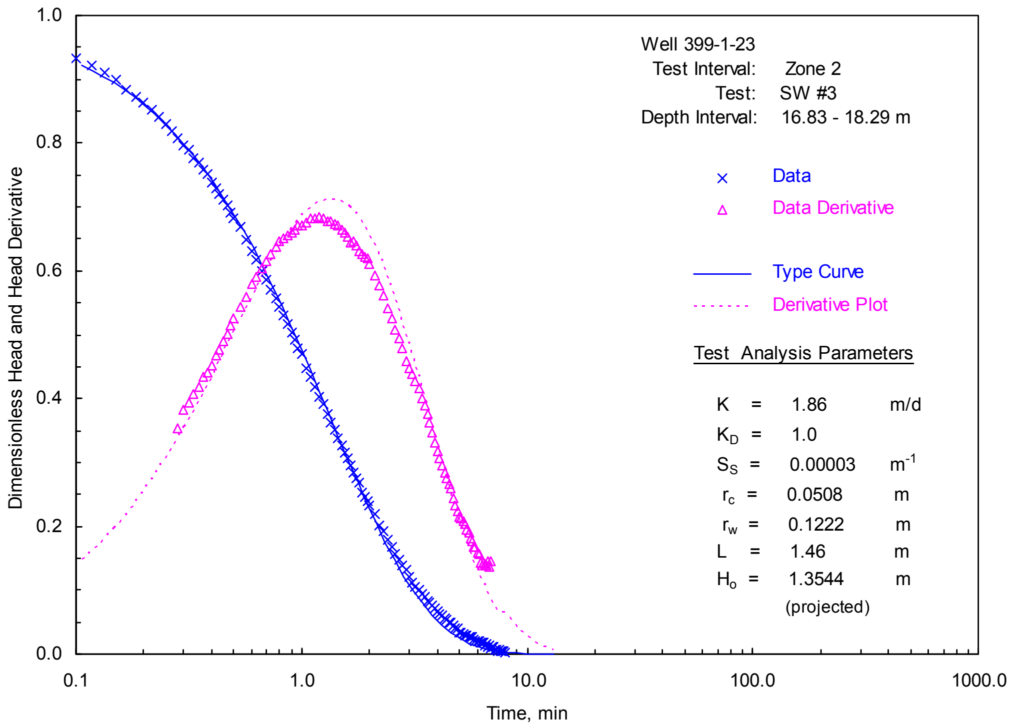


Figure E.1. Type-Curve Analysis Plot: Well 399-1-23; Depth Zone 2, Test SW #3

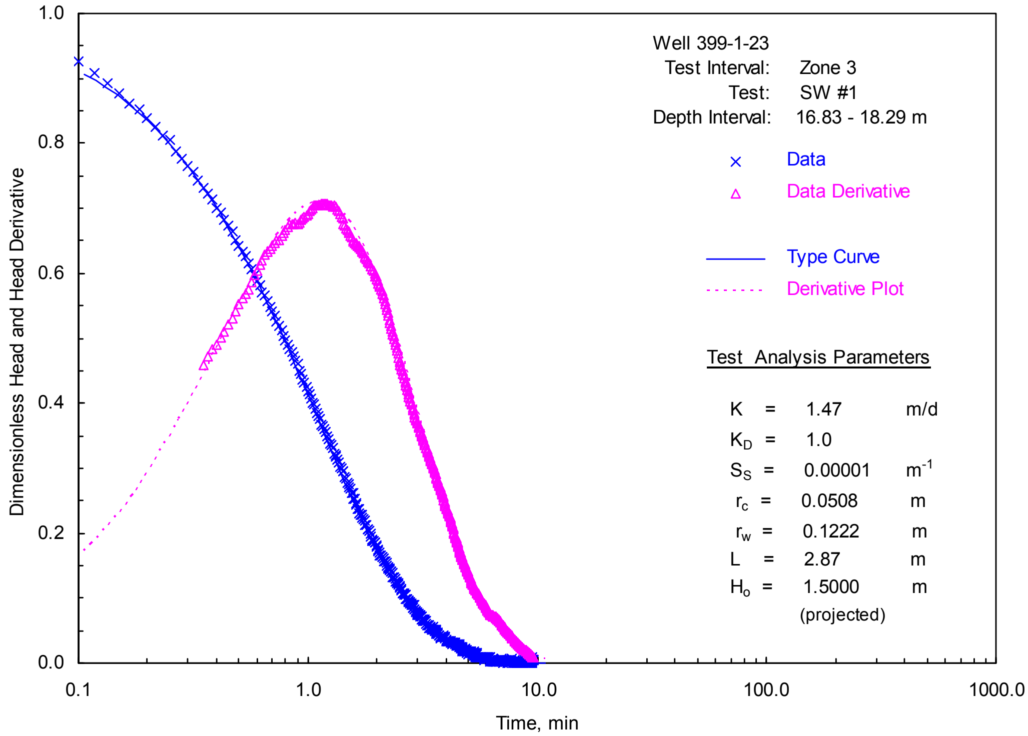


Figure E.2. Type-Curve Analysis Plot: Well 399-1-23; Depth Zone 3, Test SW #1

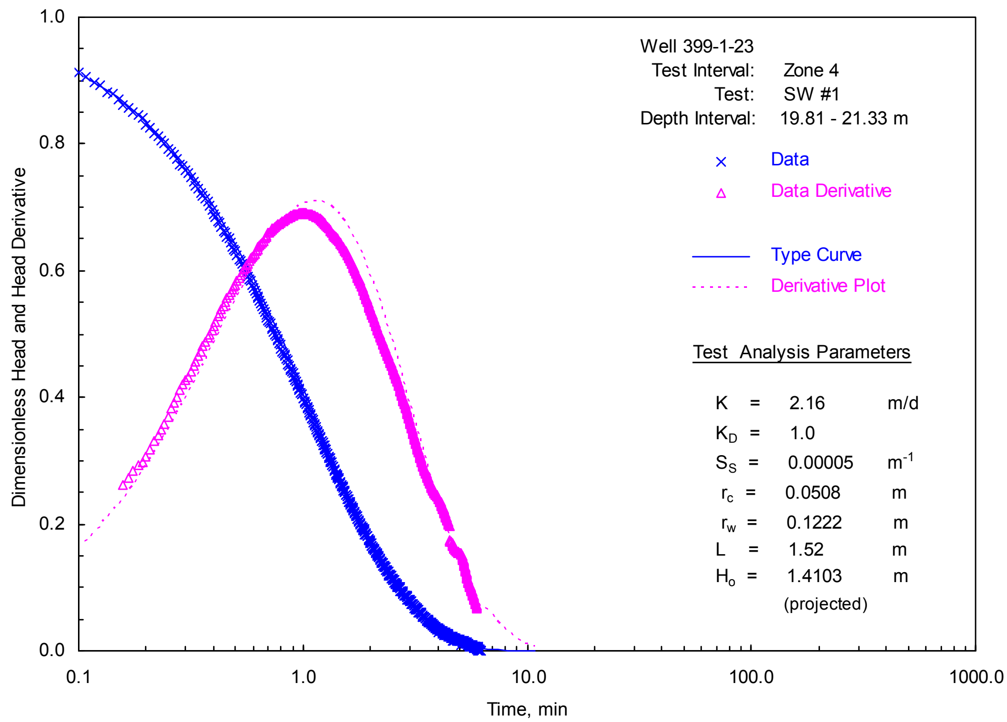


Figure E.3. Type-Curve Analysis Plot: Well 399-1-23; Depth Zone 4, Test SW #1

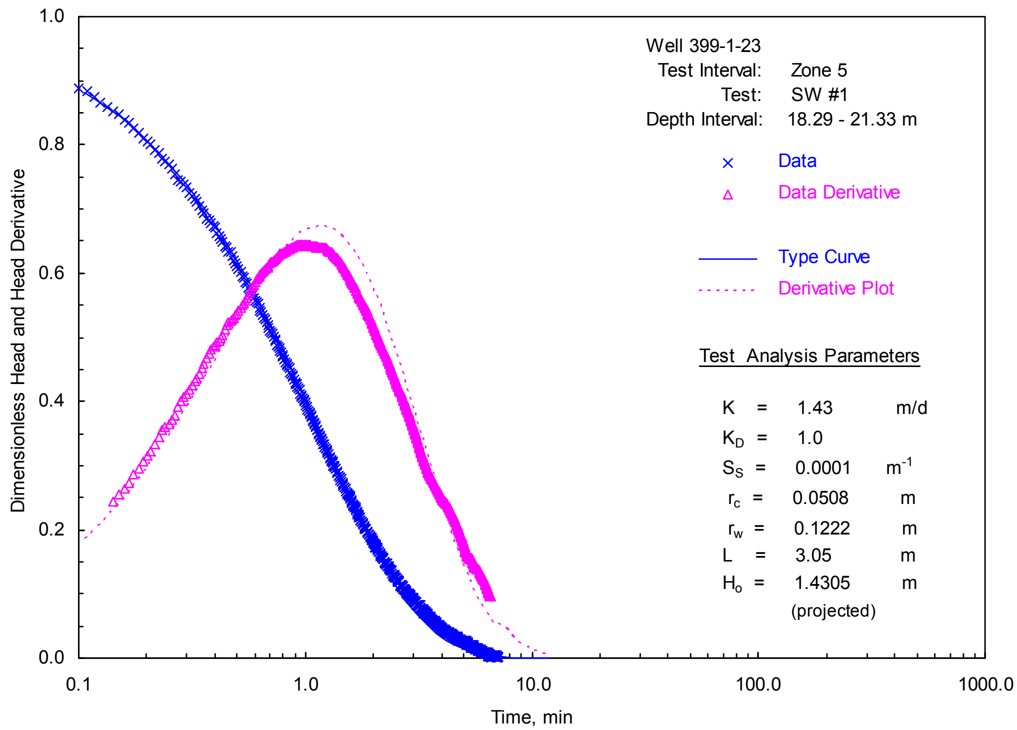


Figure E.4. Type-Curve Analysis Plot: Well 399-1-23; Depth Zone 5, Test SW #1

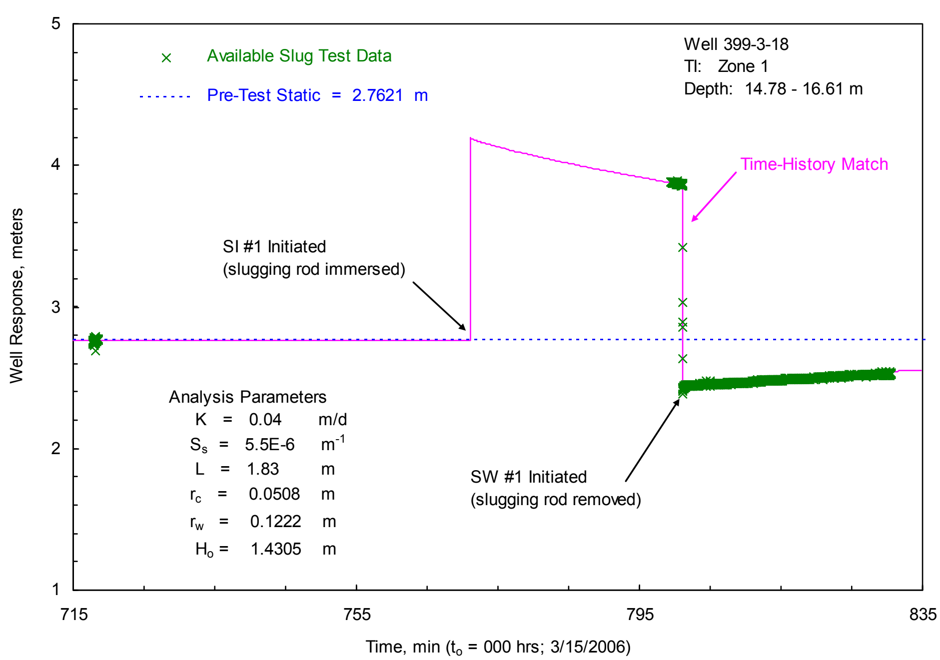


Figure E.5. Time-History Analysis Plot: Well 399-3-18; Depth Zone 1

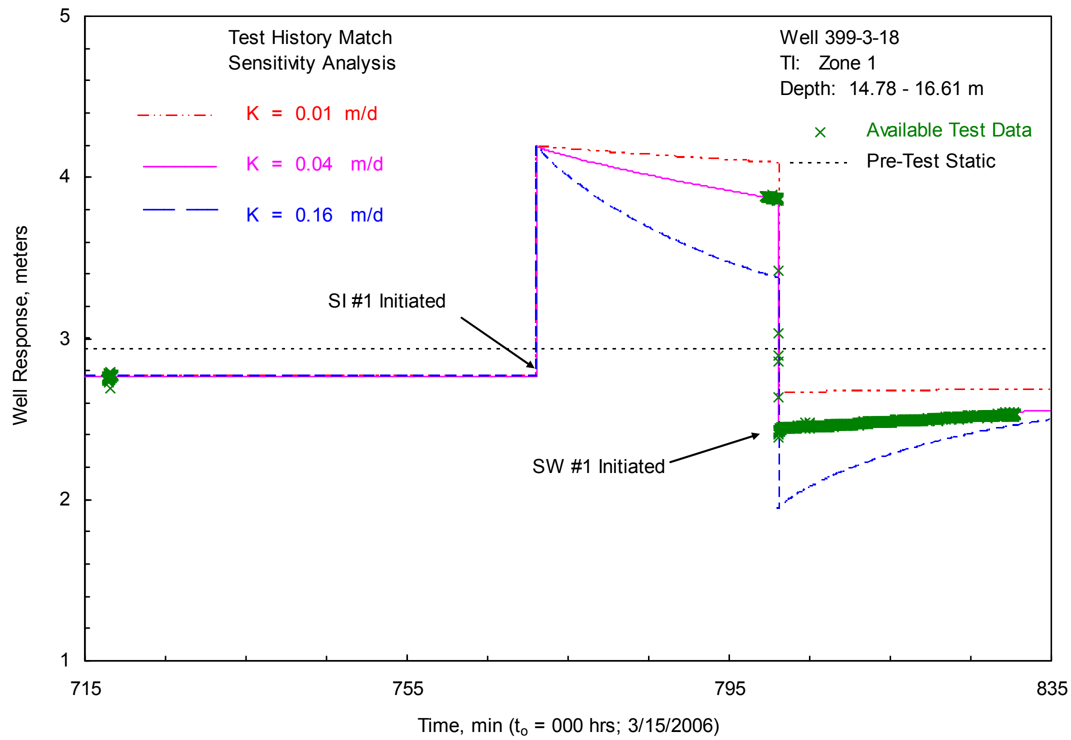


Figure E.6. Time-History Match - Sensitivity Analysis Plot: Well 399-3-18; Depth Zone 1

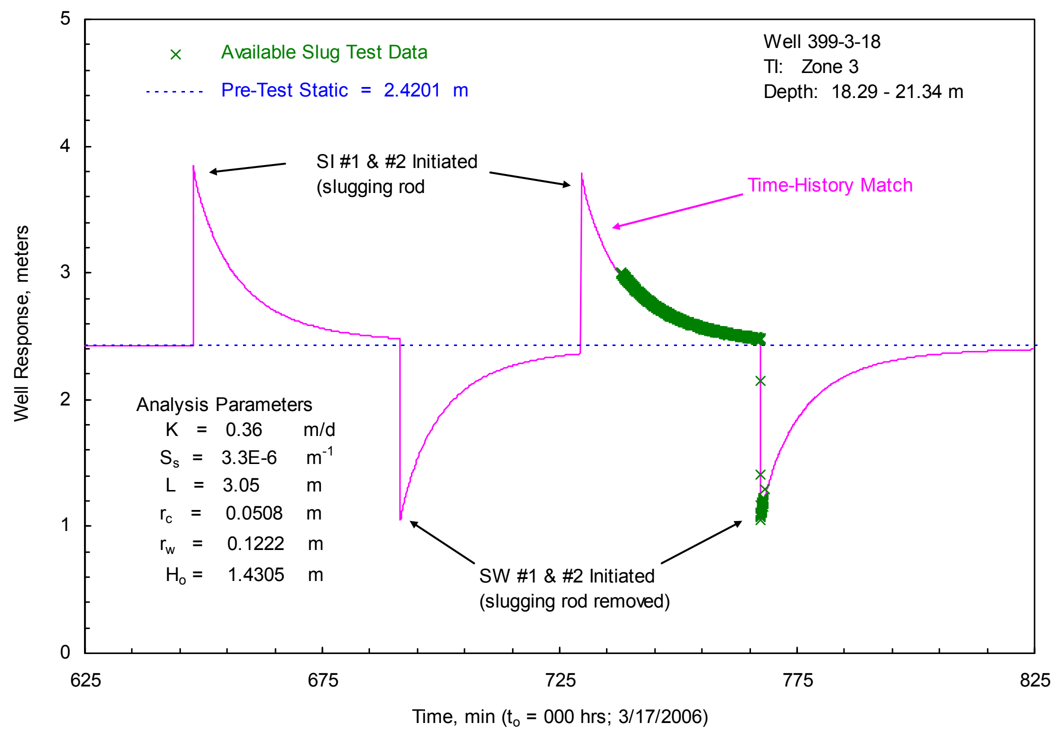


Figure E.7. Time-History Analysis Plot: Well 399-3-18; Depth Zone 3

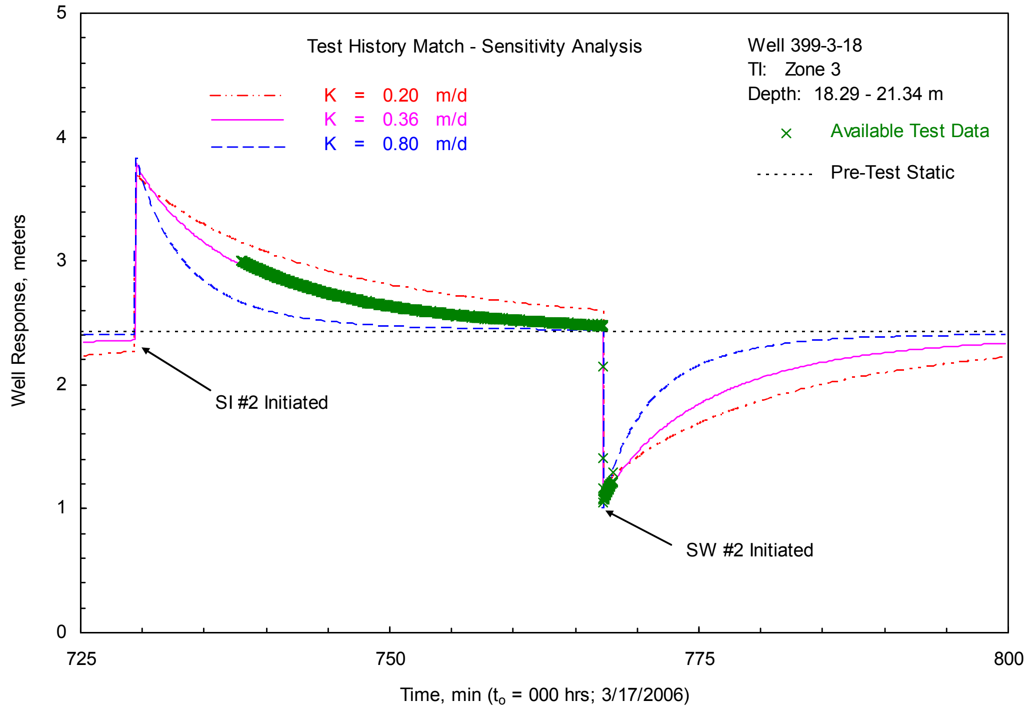


Figure E.8. Time-History Match - Sensitivity Analysis Plot: Well 399-3-18; Depth Zone 3

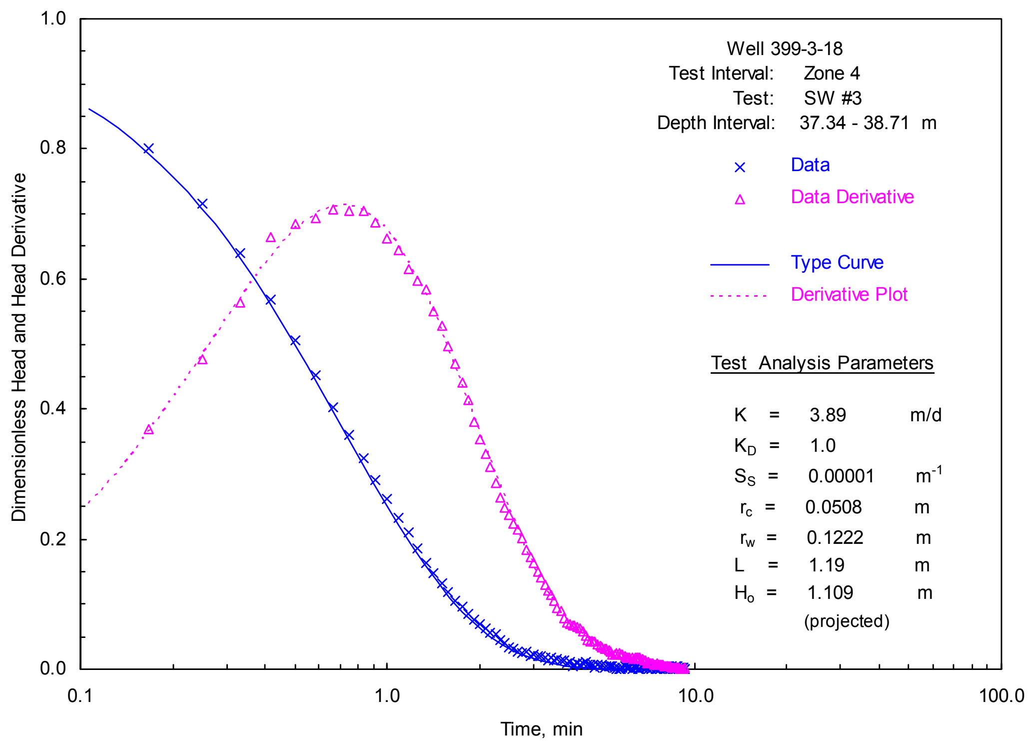


Figure E.9. Type-Curve Analysis Plot: Well 399-3-18; Depth Zone 4, Test SW #3

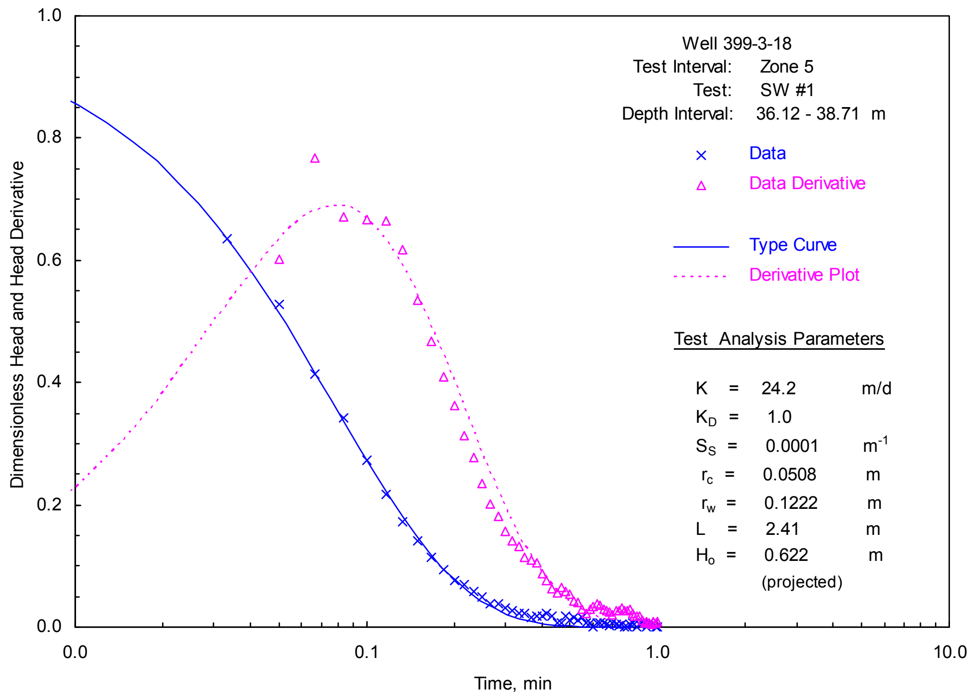


Figure E.10. Type-Curve Analysis Plot: Well 399-3-18; Depth Zone 5, Test SW #1

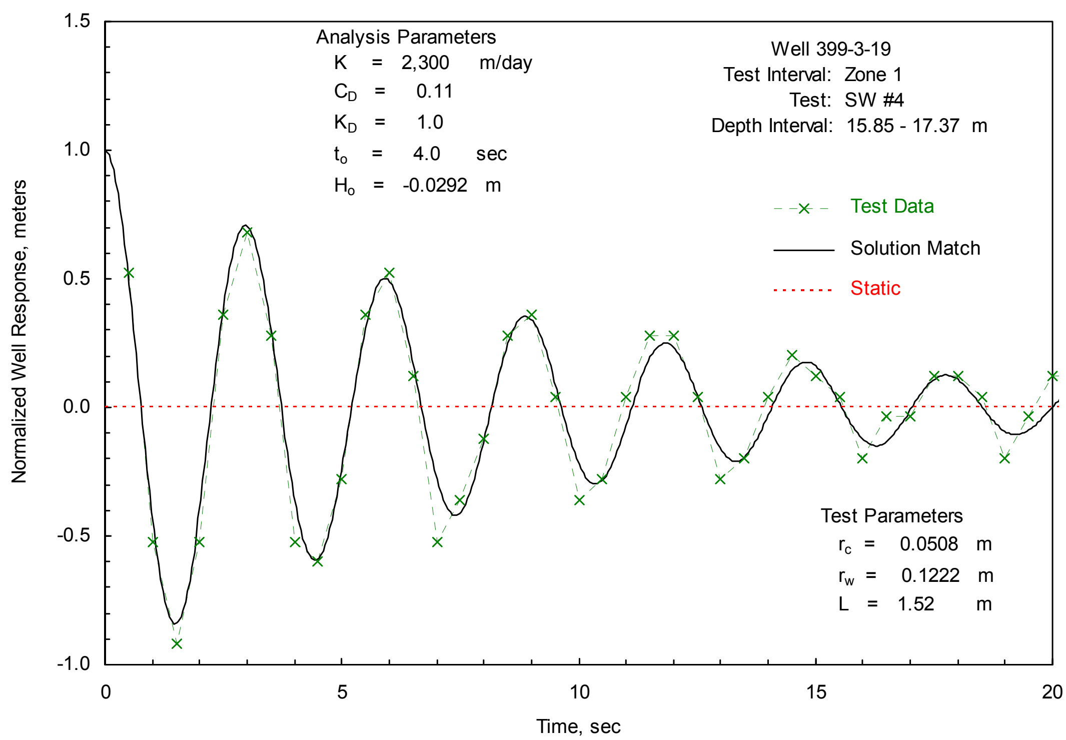


Figure E.11. High-K Analysis Plot: Well 399-3-19; Depth Zone 1, Test SW #4

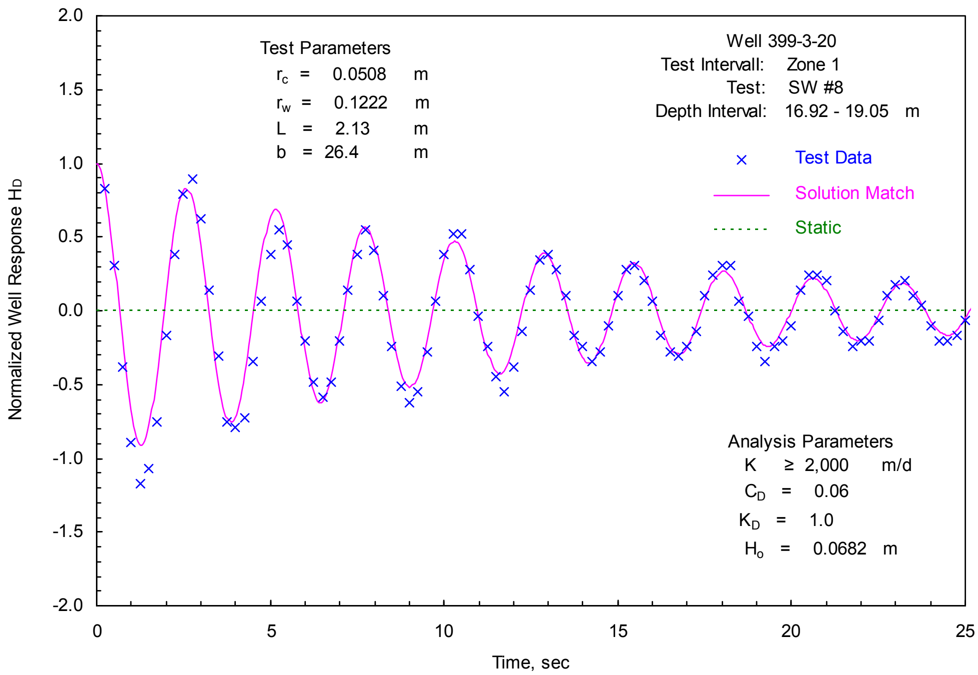


Figure E.12. High-K Analysis Plot: Well 399-3-20; Depth Zone 1, Test SW #8

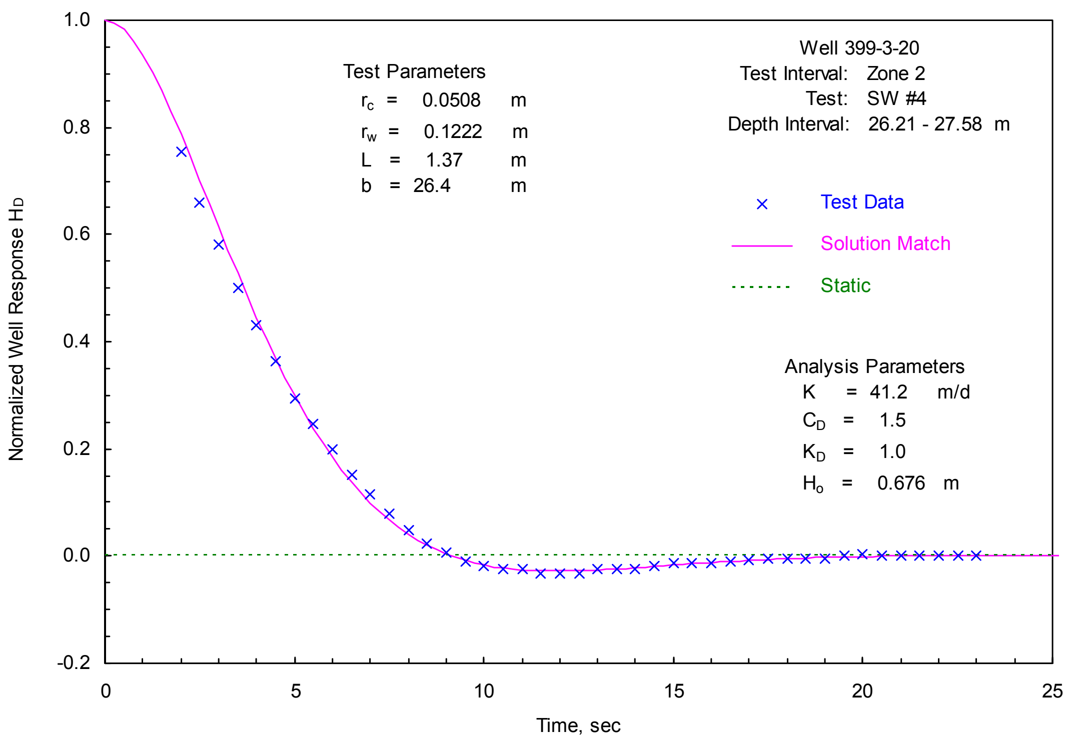


Figure E.13. High-K Analysis Plot: Well 399-3-20; Depth Zone 2, Test SW #4

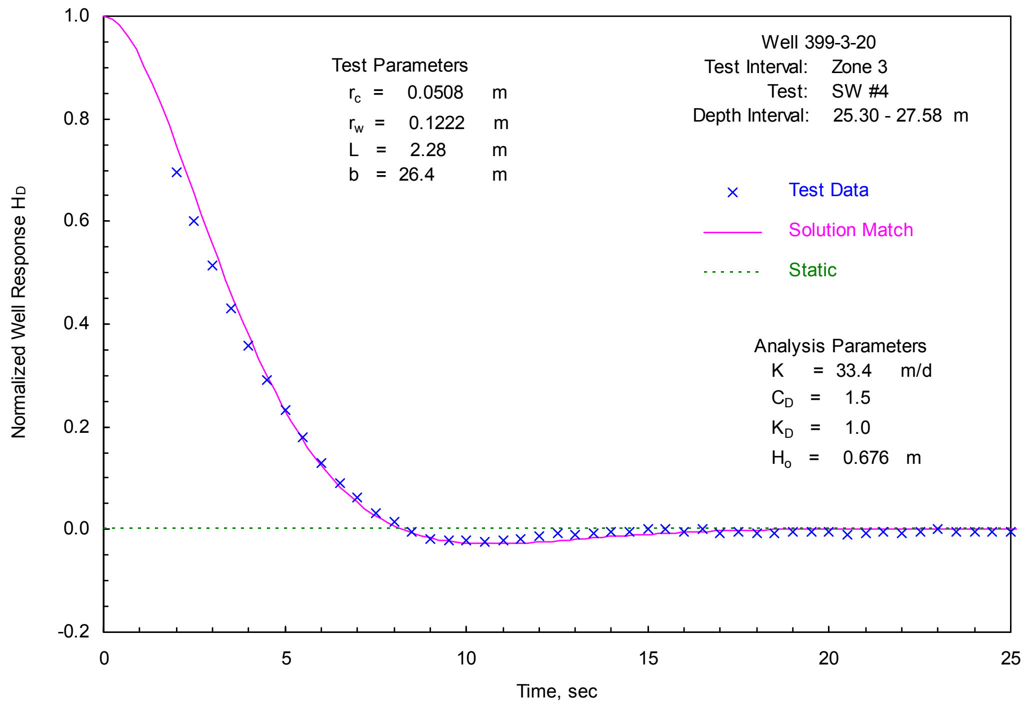


Figure E.14. High-K Analysis Plot: Well 399-3-20; Depth Zone 3, Test SW #4

Appendix F

Groundwater Sampling Data

This appendix contains a summary of the depth-discrete groundwater sampling locations and field parameters, the groundwater sample reports, and groundwater sample chain of custody forms

Table F.1. Groundwater Data Sample Location Summary and Field Sampling Results

Field Sampling Results for Depth Discrete Water Sampling at C4999 (399-3-18)										
Sample #	Depth Interval/Date	Pump/Bail	GW Depth (bgs)	Turb (NTU)	Cond (us)	Temp (c)	pH (temp c)	D.O. (mg/L)	Purged (gal)	Comments
(1) B1FRB1	42.5-44/3/14/06	Bail	42.5	585	465	15.5	7.83 (15.6)	7.2	0	Unfiltered results, no purge
(2) B1FR93	49.7-51.5/3/14/06	Bail	42.5	>1,000	363	19	7.8(na)	5.13	0	Unfiltered results, no purge
(3) B1FRB5	52-57/3/15/06	Bail	42.5	84.4	213	15.9	8	4.68	0	Unfiltered results, no purge
(4) B1FR89	66-70/3/16/06	Pumped	48	848	164	17.4	8.401	6.7	NA	Purged and filtered
	66-70/3/16/06	Pumped		587	161.4	16.7	8.285	7	NA	Purged and filtered
	66-70/3/16/06	Pumped		305	157.8	16.8	8.318 (17.4)	7	NA	Purged and filtered
	66-70/3/16/06	Pumped		355	158	17.4	8.399 (17.5)	6.1	NA	Purged and filtered
(5) B1FRB9	76-78/3/20/06	Pumped	43	466	168	15.7	8.490 (15.9)	2.1	NA	Purged and filtered
	76-78/3/20/06	Pumped		290	158	16.2	8.549 (16.4)	1.9	NA	Purged and filtered
	76-78/3/20/06	Pumped		48.1	160	16.3	8.389 (16.9)	2.7	NA	Purged and filtered
	76-78/3/20/06	Pumped		26.5	159	16.8	8.351 (15.0)	7	NA	Purged and filtered
	76-78/3/20/06	Pumped		9.09	159	18	NA	6.4	NA	Purged and filtered
(6) B1FR85	86-89/3/21/06	Pumped	42.4	70.7	225	14.4	8.132 (15.0)	1.3	NA	Purged and filtered
	86-89/3/21/06	Pumped		43.5	224	15.1	8.283 (14.4)	1.6	NA	Purged and filtered
	86-89/3/21/06	Pumped		33.3	225	15.4	8.245 (14.8)	1.1	NA	Purged and filtered
	86-89/3/21/06	Pumped		26.9	225	15.8	8.31 (15.6)	1.3	NA	Purged and filtered

Table F.1. (contd)

Field Sampling Results for Depth Discrete Water Sampling at C4999 (399-3-18)										
Sample #	Depth Interval/Date	Pump/Bail	GW Depth (bgs)	Turb (NTU)	Cond (us)	Temp (c)	pH (temp c)	D.O. (mg/L)	Purged (gal)	Comments
(7) B1FR97	98-101/3/22/06	Pumped	41	134	267	14.8	7.929 (15.7)	1.8	NA	Purged and filtered
	98-101/3/22/06	Pumped		109	267	15	8.028 (15.1)	2	NA	Purged and filtered
	98-101/3/22/06	Pumped		98.6	274	13.5	7.991 (15.1)	0.8	NA	Purged and filtered
	98-101/3/22/06	Pumped		98.6	268	13.8	8.101 (14.6)	1.1	NA	Purged and filtered
	98-101/3/22/06	Pumped		0.82	267	14.3	8.128 (14.5)	1	NA	Purged and filtered
NA	River sample 3/22/06	grab	river	3.09	148	6.6	8.125 (7.0)	10.5	NA	River grab sample
(8) B1FR81	107-109/3/22/06	Pumped	41	>1,000	270	19.1	8.158 (18.4)	0.4	NA	Purged and filtered
	107-109/3/22/06	Pumped		>1,000	274	19.1	8.285 (18.3)	0.7	NA	Purged and filtered
	107-109/3/22/06	Pumped		>1,000	274	17.8	8.165 (18.0)	1	NA	Purged and filtered
	107-109/3/22/06	Pumped		>1,000	276	17.9	8.170 (18.3)	0.6	NA	Purged and filtered
	107-109/3/22/06	Pumped		>1,000	275	17.6	8.185 (17.5)	2.7	NA	Purged and filtered
(9) B1FR33	120-121.5/3/23/06	Pumped		>1,000	281	17.2	8.181	1.1	NA	Purged and filtered
(10) B1FR77	42.6-47.9/4/13/06	Pumped	42.6	2.69	349	16.4	7.51	8.1	1485	Purged and filtered

Table F.1. (contd)

Field Sampling Results for Depth Discrete Water Sampling at C5000 (399-1-23)										
Sample #	Depth Interval/Date	Pump/Bail	GW Depth (bgs)	Turb (NTU)	Cond (us)	Temp (c)	pH (temp c)	D.O. (mg/L)	Purged (Gal)	Comments
(1) B1FR37	33.5-34/4/03/06	Bail	33	NA	NA	NA	NA	NA	NA	Unfiltered results, ~1 gal. no purge
(2) B1FR41	36-39/4/4/06	Pumped	33.5	5.3	490	15	7.47	6.14	200	Purged and filtered
(3) B1FR45	43-43.5/4/04/06	Pumped	39.4	45.8	492	16.3	7.58	5.18	190	Purged and filtered
(4) B1FR49	47-48.5/4/05/06	Pumped	39.2	65.9	485	13.9	7.8	8	200	Purged and filtered
(5) B1FR53	53.5-55/4/04/06	Pumped	40.3	113	411	16.9	8.3	1.4	>300	Purged and filtered
(6) B1FR57	58.6-60/4/06/06	Pumped	39.4	196	396	14.8	8.2	0.6	240	Purged and filtered
(7) B1FR61	67-70/4/07/06	Pumped	39.4	561	302	15.6	8.26	1	345	Purged and filtered
(8) B1FR65	77-82/4/10/06	Pumped	39.2	200	318	16.9	8.2	1	475	Purged and filtered
(9) B1FR69	88.5-91/4/11/06	Pumped	39.1	433	326	18	8.1	0.6	600	Purged and filtered
(10) B1FR73	105.5-110/4/17/06	Pumped	34.8	>1,000	328	18.5	8.2	0.8	270	Purged and filtered

Table F.1. (contd)

Field Sampling Results for Depth Discrete Water Sampling at C5001 (399-3-19)										
Sample #	Depth Interval/Date	Pump/Bail	GW Depth (bgs)	Turb (NTU)	Cond (us)	Temp (c)	pH (temp c)	D.O. (mg/L)	Purged (gal)	Comments
(1) B1HRW8	52-53/4/26/06	Pumped	47.2	24.6	407	20.1	7.24	8.4	63	Purged and filtered
	52-53/4/26/06	Pumped	47.2	15	404	19.1	7.33	8.5	63.75	Purged and filtered
	52-53/4/26/06	Pumped	47.2	11.6	403	19.1	7.47	8.6	64.5	Purged and filtered
	52-53/4/26/06	Pumped	47.2	9.99	402	19.3	7.43	8.6	64.5	Purged and filtered
(2) B1HRX2	57.5-58/4/27/06	Pumped	47.1	415	407	16.3	7.56	9	75	Purged and filtered
	57.5-58/4/27/06	Pumped	47.1	43.6	409	16.5	7.49	9.4	125	Purged and filtered
	57.5-58/4/27/06	Pumped	47.1	29.1	411	16.5	7.47	9.4	170	Purged and filtered
	57.5-58/4/27/06	Pumped	47.1	16	408	16.2	7.6	9.4	250	Purged and filtered
(3) B1HRX7	63/4/27/06	Pumped	47.4	>1,000	413	20.4	7.62	8	90	Purged and filtered
	63/4/27/06	Pumped	47.4	598	411	19.8	7.5	8.3	130	Purged and filtered
	63/4/27/06	Pumped	47.4	294	413	19.3	7.49	8.4	178	Purged and filtered
	63/4/27/06	Pumped	47.4	67.4	411	20	7.48	8.1	250	Purged and filtered
(4) B1HRY0	80-83/4/28/06	Pumped	47.5	>1,000	431	20.4	7.57	6.9	150	Purged and filtered
	80-83/4/28/06	Pumped	47.5	>1,000	426	19.4	7.55	7.7	200	Purged and filtered
	80-83/4/28/06	Pumped	47.5	>1,000	426	19.9	7.55	7.5	250	Purged and filtered
	80-83/4/28/06	Pumped	47.5	639	428	19.2	7.56	7.7	300	Purged and filtered
	80-83/4/28/06	Pumped	47.5	392	422	20.5	7.56	7.5	360	Purged and filtered
(5) B1HRY5	100-103.5/5/03/06	Pumped	46.1	>1,000	345	19.8	7.61	1.1	140	Purged and filtered
	100-103.5/5/03/06	Pumped	46.1	>1,000	341	19.1	7.44	0.6	182	Purged and filtered
	100-103.5/5/03/06	Pumped	46.1	>1,000	336	19	7.56	0.7	202	Purged and filtered
	100-103.5/5/03/06	Pumped	46.1	>1,000	332	19	7.36	0.7	226	Purged and filtered
	100-103.5/5/03/06	Pumped	46.1	>1,000	323	19.4	7.52	0.6	260	Purged and filtered
	100-103.5/5/03/06	Pumped	46.1	528	318	19	7.57	ND	297	Purged and filtered
	100-103.5/5/03/06	Pumped	46.1	225	318	18.7	7.55	0.9	320	Purged and filtered
	100-103.5/5/03/06	Pumped	46.1	108	318	19.2	7.54	0.7	355	Purged and filtered
(6) B1HRY8	DNS	DNS	DNS	DNS	DNS	DNS	DNS	DNS	DNS	DNS

Table F.1. (contd)

Field Sampling Results for Depth Discrete Water Sampling at C5002 (399-3-20)										
Sample #	Depth Interval/Date	Pump/Bail	GW Depth (bgs)	Turb (NTU)	Cond (us)	Temp (c)	pH (temp c)	D.O. (mg/L)	Purged (gal)	Comments
(1) B1HT03	51-53.5/5/12/06	Pumped	47.7	62.9	450	20.1	7.22	8.1	79	Purged and filtered
	51-53.5/5/12/06	Pumped	47.7	44	454	19.1	7.25	8.5	131	Purged and filtered
	51-53.5/5/12/06	Pumped	47.7	25	454	19.1	7.11	8.9	170	Purged and filtered
	51-53.5/5/12/06	Pumped	47.7	21.7	453	19.3	7.19	8.6	217	Purged and filtered
(2) B1HT06	60-63/5/12/06	Pumped	47.7	>1,000	455	19.5	7.33	7.6	50	Purged and filtered
	60-63/5/12/06	Pumped	47.7	>1,000	451	19.3	7.36	7.8	85	Purged and filtered
	60-63/5/12/06	Pumped	47.7	>1,000	448	18.9	7.23	8	135	Purged and filtered
	60-63/5/12/06	Pumped	47.7	413	448	19.2	7.2	8.3	170	Purged and filtered
	60-63/5/12/06	Pumped	47.7	134	445	18.9	7.28	8.5	230	Purged and filtered
(3) B1HT10	72.5-74/5/15/06	Pumped	47.6	>1,000	466	20.3	7.7	6.6	100	Purged and filtered
	72.5-74/5/15/06	Pumped	47.6	>1,000	463	21	7.55	6.9	150	Purged and filtered
	72.5-74/5/15/06	Pumped	47.6	>1,000	465	20.4	7.5	7	200	Purged and filtered
	72.5-74/5/15/06	Pumped	47.6	>1,000	462	20	7.51	7.1	250	Purged and filtered
	72.5-74/5/15/06	Pumped	47.6	>1,000	463	20	7.51	7.4	310	Purged and filtered
(4) B1HT14	90-92/5/16/06	Pumped	47.6	>1,000	285	21.2	7.69	0.8	223	Purged and filtered
	90-92/5/16/06	Pumped	47.6	832	280	20.2	7.88	0.7	255	Purged and filtered
	90-92/5/16/06	Pumped	47.6	503	279	20.2	7.55	0.7	280	Purged and filtered
	90-92/5/16/06	Pumped	47.6	86.7	276	19.6	7.8	1.2	345	Purged and filtered
	90-92/5/16/06	Pumped	47.6	28.6	276	19.8	7.84	2.1	400	Purged and filtered

Groundwater Sample Reports

Well C4999

GROUNDWATER SAMPLE REPORT No Dump

Project: 3FF5 (1) INTERVAL NOVEMBER 2				Date: 3/14/06	Page 1 of 1
Task Order/Month: Nov 2005	QC Type:			Calculations: Samples were taken by bailing.	
Well Number: C4999,399-3-18 (2)	A#:				
Total Purge Volume (gal): N/A	Purge Flow Rate (gal/min): N/A				
Pump Type: parastalltic	Time on:	Water:	Purge:	Samp.: 1250	Off:

SAMPLES COLLECTED

B1FR91 (Filtered) PNNL Building 325 COC No.: X06-007-5
1;500mL;Nalge Uranium by ICPMS; 6010_METALS_ICP: Chromium (1) (HNO3 to pH <2(ULTREX)) 5200040

B1FR92 PNNL Building 325 COC No.: X06-007-5
1;500mL;P IC Anions - 300.0; 310.1_ALKALINITY: Alkalinity (1); Generic Testing (Cool 4C) 5200040

B1FR94 Severn Trent St. Louis COC No.: X06-007-6
1;20mL;P Activity Scan (None)
4;40mL;aGs* 8260_VOA_GCMS: List-2 (26) (HCl or H2SO4 to pH <2 Cool 4C) 5048070

Total No. Bottles: 7 Containment Code: NA Collector: L.C. Petersen

FIELD: B1FR93 COC: X06-007-4

Water Level (TOC): NA			Drawdown (TOC): NA			Oil Sheen Yes ☐ No ☑					
Prev. pH:			Prev. DTW:			E-Tape No.:					
Time	1250										
pH	7.80										
Temp. (°C)	19.0										
Cond. (us/cm)	3.63										
Turb. (NTU)	—										
D. O. (mg/L)											
FLD REDOX											

FIELD OBSERVATIONS

Weather:

Field Comments: unfiltered sample for parameters

Pre Check: Post Check:

Comments:

Well capped and locked ☐ Yes ☐ No Logbook/Pg# DTS-SAWS-H101 / 10-11

Samples Surveyed for Gamma Radiation by RPTs: ☑ Yes ☐ No

Data Recorded by: L.C. Petersen L Petersen (Print and sign name) 3-14-2006 (Date)

Data Checked by: (Print and sign name) (Date)

GROUNDWATER SAMPLE REPORT

No Dump

Project: 3FF5 (1) INTERVAL NOVEMBER 2		Date: 3/14/06	Page 1 of 1
Task Order/Month: Nov 2005	QC Type:	Calculations:	
Well Number: C4999,399-3-18 (1)	A#:		
Total Purge Volume (gal):	Purge Flow Rate (gal/min):		
Pump Type: parastaltic	Time on: Water: Purge: Samp.: Off:		

SAMPLES COLLECTED

B1FR99 (Filtered) PNNL Building 325 COC No.: X06-007-2
1;500mL;Nalge Uranium by ICPMS; 6010_METALS_ICP: Chromium (1) (HNO3 to pH <2(ULTREX)) 5200040

B1FRB0 PNNL Building 325 COC No.: X06-007-2
1;500mL;P IC Anions - 300.0; 310.1_ALKALINITY: Alkalinity (1); Generic Testing (Cool 4C) 5200040

B1FRB2 Severn Trent St. Louis COC No.: X06-007-3
1;20mL;P Activity Scan (None)
4;40mL;aGs* 8260_VOA_GCMS: List-2 (26) (HCl or H2SO4 to pH <2 Cool 4C) 5048070

Total No. Bottles: 7 Containment Code: NA Collector: L. C. Petersen

FIELD: B1FRB1 COC: X06-007-1

Water Level (TOC): NA | Drawdown (TOC): NA | Oil Sheen Yes ☐ No ☒

Prev. pH: | Prev. DTW: | E-Tape No.: NA

Time	1000									
pH	7.83									
Temp. (°C)	15.6									
Cond. (us/cm)	465									
Turb. (NTU)	585									
D. O. (mg/L)										
FLD REDOX										

FIELD OBSERVATIONS

Weather: sunny + cool

Field Comments

Pre Check: Post Check:

Comments:

Well capped and locked ☐ Yes ☐ No Logbook/Pg# DTS-SAWS-H101 / 10-11

Samples Surveyed for Gamma Radiation by RPTs: ☒ Yes ☐ No

Data Recorded by: L. C. Petersen [signature] 3-14-2006
Print and sign name Date

Data Checked by:
Print and sign name Date

GROUNDWATER SAMPLE REPORT

No Dump

Project: 3FF5 (1) INTERVAL NOVEMBER 2		Date: 3/15/06	Page 1 of 1
Task Order/Month: Nov 2005	QC Type:	Calculations:	
Well Number: C4999,399-3-18 (3)	A#:		
Total Purge Volume (gal):	Purge Flow Rate (gal/min):		
Pump Type: Parastaltic	Time on: Water: Purge: NA Samp.: Off:		

SAMPLES COLLECTED

B1FRB3 (Filtered) PNNL Building 325 COC No.: X06-007-8
1;500mL;Nalge Uranium by ICPMS; 6010_METALS_ICP: Chromium (1) (HNO3 to pH <2(ULTREX)) 5200040

B1FRB4 PNNL Building 325 COC No.: X06-007-8
1;500mL;P IC Anions - 300.0; 310.1_ALKALINITY: Alkalinity (1); Generic Testing (Cool 4C) 5200040

B1FRB6 Severn Trent St. Louis COC No.: X06-007-9
1;20mL;P Activity Scan (None)
4;40mL;aGs* 8260_VOA_GCMS: List-2 (26) (HCl or H2SO4 to pH <2 Cool 4C) 5048070

Total No. Bottles: 7 Containment Code: Collector: L. C. Petersen

FIELD: B1FRB5 COC: X06-007-7

Water Level (TOC): NA	Drawdown (TOC): NA	Oil Sheen	Yes ☐ No ☐
Prev. pH:	Prev. DTW:	E-Tape No.:	

Time	1030										
pH	8.00										
Temp. (°C)	15.9										
Cond. (us/cm)	2.13										
Turb. (NTU)	84.4										
D. O. (mg/L)	4.68										
FLD REDOX											

FIELD OBSERVATIONS

Weather: sunny + cool

Field Comments: Soiled sample - not purged; parameters for unfiltered sample; DO not working (needed new batteries) + read @ 1130

Pre Check: Post Check:

Comments:

Well capped and locked ☐ Yes ☐ No Logbook/Pg# DTS-SAWS-H101 / 11

Samples Surveyed for Gamma Radiation by RPTs: ☑ Yes ☐ No

Data Recorded by: LPetersen L.C. Petersen 3-15-2006
Print and sign name Date

Data Checked by:
Print and sign name Date

GROUNDWATER SAMPLE REPORT

No Dump

Project: 3FF5 (1) INTERVAL NOVEMBER 2		Date: 3/16/06	Page 1 of 1
Task Order/Month: Nov 2005	QC Type:	Calculations:	
Well Number: C4999,399-3-18 (4)	A#:		
Total Purge Volume (gal):	Purge Flow Rate (gal/min):		
Pump Type: ~~peristaltic~~ unknown	Time on: Water: Purge: Samp.: Off:		

SAMPLES COLLECTED

B1FR87 (Filtered) PNNL Building 325 COC No.: X06-007-11
1;500mL;Nalge Uranium by ICPMS; 6010_METALS_ICP: Chromium (1) (HNO3 to pH <2(ULTREX)) 5200040

B1FR88 PNNL Building 325 COC No.: X06-007-11
1;500mL;P IC Anions - 300.0; 310.1_ALKALINITY: Alkalinity (1); Generic Testing (Cool 4C) 5200040

B1FR90 Severn Trent St. Louis COC No.: X06-007-12
1;20mL;P Activity Scan (None)
4;40mL;aGs* 8260_VOA_GCMS: List-2 (26) (HCl or H2SO4 to pH <2 Cool 4C) 5048070

Total No. Bottles: 7 Containment Code: NA Collector: LC Petersen

FIELD: B1FR89 COC: X06-007-10

Water Level (TOC): NA	Drawdown (TOC):	Oil Sheen Yes ☐ No ☑	
Prev. pH:	Prev. DTW:	E-Tape No.:	

Time	1520									
pH	8.40									
Temp. (°C)	17.5									
Cond. (us/cm)	158.0									
Turb. (NTU)	355									
D. O. (mg/L)	6.1									
FLD REDOX										

FIELD OBSERVATIONS

Weather: windy + threatening rain

Field Comments

Pre Check: Post Check:

Comments: sampled from 66-70' bgs (GW. depth 48' bgs)
pump at 68' bgs

Well capped and locked ☑ Yes ☐ No Logbook/Pg# DTS-SAWS-H101/11

Samples Surveyed for Gamma Radiation by RPTs: ☐ Yes ☐ No

Data Recorded by: LPeterson, L.C. Petersen (Print and sign name) 3-16-2006 (Date)

Data Checked by: (Print and sign name) (Date)

GROUNDWATER SAMPLE REPORT

No Dump

Project: 3FF5 (1) INTERVAL NOVEMBER 2				Date: 3/20/06	Page 1 of 1
Task Order/Month: Nov 2005	QC Type:			Calculations:	
Well Number: C4999,399-3-18 (5)	A#:				
Total Purge Volume (gal):	Purge Flow Rate (gal/min):				
Pump Type: submersible	Time on:	Water:	Purge:	Samp.:	Off:

SAMPLES COLLECTED

B1FRB7 (Filtered) PNNL Building 325 COC No.: X06-007-14
1;500mL;Nalge Uranium by ICPMS; 6010_METALS_ICP: Chromium (1) (HNO3 to pH <2(ULTREX)) 5200040

B1FRB8 PNNL Building 325 COC No.: X06-007-14
1;500mL;P IC Anions - 300.0; 310.1_ALKALINITY: Alkalinity (1): Generic Testing (Cool 4C) 5200040

B1FRC0 Severn Trent St. Louis COC No.: X06-007-15
1;20mL;P Activity Scan (None)
4;40mL;aGs* 8260_VOA_GCMS: List-2 (26) (HCl or H2SO4 to pH <2 Cool 4C) 5048070

Total No. Bottles: 7 Containment Code: NA Collector: L. C. Petersen

FIELD: B1FRB9 COC: X06-007-13

Water Level (TOC):	8.351 ~~LP 3-20-06~~		Drawdown (TOC):			Oil Sheen	Yes ☐	No ☑		
Prev. pH:	~~8.35~~ @ 169		Prev. DTW:			E-Tape No.:				
Time	1035									
pH	—									
Temp. (°C)	18.0									
Cond. (us/cm)	181	see notes								
Turb. (NTU)	9.09									
D. O. (mg/L)	6.4									
FLD REDOX										

FIELD OBSERVATIONS

Weather: sunny

Field Comments: sample depth 76-78 ft bgs
GW depth 43 ft bgs

note: conductivity reading @ 22 uS high - adj down to 169 uS to correct

Pre Check: Post Check:

Comments:

Well capped and locked ☐ Yes ☒ No Logbook/Pg# DTS-SAWS-H 101/12

Samples Surveyed for Gamma Radiation by RPTs: ☐ Yes ☐ No

Data Recorded by: LPetersen (Print and sign name) 3-20-06 (Date)

Data Checked by: (Print and sign name) (Date)

GROUNDWATER SAMPLE REPORT

No Dump #6

Project: 3FF5 (1) INTERVAL NOVEMBER 2						Date: 3/21/06	Page 1 of 1
Task Order/Month: Nov 2005		QC Type:				Calculations:	
Well Number: C4999,399-3-18 (6)		A#:					
Total Purge Volume (gal):		Purge Flow Rate (gal/min):					
Pump Type: submersible	Time on:	Water:	Purge:	Samp.:	Off:		

SAMPLES COLLECTED

B1FR83 (Filtered) PNNL Building 325 COC No.: X06-007-17
1;500mL;Nalge Uranium by ICPMS; 6010_METALS_ICP: Chromium (1) (HNO3 to pH <2(ULTREX)) 5200040

B1FR84 PNNL Building 325 COC No.: X06-007-17
1;500mL;P IC Anions - 300.0; 310.1_ALKALINITY: Alkalinity (1); Generic Testing (Cool 4C) 5200040

B1FR86 Severn Trent St. Louis COC No.: X06-007-18
1;20mL;P Activity Scan (None)
4;40mL;aGs* 8260_VOA_GCMS: List-2 (26) (HCl or H2SO4 to pH <2 Cool 4C) 5048070

Total No. Bottles: 7 Containment Code: NA Collector: L.C. Petersen

FIELD: B1FR85 COC: X06-007-16

Water Level (TOC):			Drawdown (TOC):			Oil Sheen Yes ☐ No ☒				
Prev. pH: 8.245 @ 14.8°C			Prev. DTW:			E-Tape No.:				
Time	0830									
pH	8.310									
Temp. (°C)	15.6									
Cond. (us/cm)	225									
Turb. (NTU)	26.9									
D. O. (mg/L)	1.3									
FLD REDOX										

FIELD OBSERVATIONS

Weather: sunny; cool but not windy (mild)

Field Comments: purged 3 volumes prior to sampling; parameters stabilized

Pre Check: Post Check:

Comments:

Well capped and locked ☐ Yes ☐ No NA Logbook/Pg# DJS-SANS-H101

Samples Surveyed for Gamma Radiation by RPTs: ☐ Yes ☒ No

Data Recorded by: [signature] (Print and sign name) Date: 3/21/06

Data Checked by: (Print and sign name) Date:

GROUNDWATER SAMPLE REPORT

No Dump

Project: 3FF5 (1) INTERVAL NOVEMBER 2					Date: 3/22/05	Page 1 of 1
Task Order/Month: Nov 2005		QC Type:			Calculations:	
Well Number: C4999,399-3-18 (7)		A#:				
Total Purge Volume (gal):		Purge Flow Rate (gal/min):				
Pump Type: submersible	Time on:	Water:	Purge:	Samp.:	Off:	

SAMPLES COLLECTED

B1FR95 (Filtered) PNNL Building 325 COC No.: X06-007-20
1;500mL;Nalge Uranium by ICPMS; 6010_METALS_ICP: Chromium (1) (HNO3 to pH <2(ULTREX)) 5200040

B1FR96 PNNL Building 325 COC No.: X06-007-20
1;500mL;P IC Anions - 300.0; 310.1_ALKALINITY: Alkalinity (1); Generic Testing (Cool 4C) 5200040

B1FR98 Severn Trent St. Louis COC No.: X06-007-21
1;20mL;P Activity Scan (None)
4;40mL;aGs* 8260_VOA_GCMS: List-2 (28) (HCl or H2SO4 to pH <2 Cool 4C) 5048070

Total No. Bottles: 7 Containment Code: NA Collector: L.C. Petersen

FIELD: B1FR97 COC: X06-007-19

Water Level (TOC):			Drawdown (TOC):			Oil Sheen	Yes ☐	No ☑		
Prev. pH:	8.101		Prev. DTW:			E-Tape No.:				
Time	0715									
pH	8.128									
Temp. (°C)	14.5									
Cond. (us/cm)	272									
Turb. (NTU)	0.82									
D. O. (mg/L)	1.0									
FLD REDOX										

FIELD OBSERVATIONS

Weather: cloudy; very little breeze; cool

Field Comments: sample depth 98-101'

Pre Check: Post Check:

Comments:

Well capped and locked ☐ Yes ☐ No Logbook/Pg#

Samples Surveyed for Gamma Radiation by RPTs: ☑ Yes ☐ No

Data Recorded by: LPetersen L.C. Petersen (Print and sign name) Date: 3-22-2006

Data Checked by: (Print and sign name) Date:

GROUNDWATER SAMPLE REPORT

No Dump

Project: 3FF5 (1) INTERVAL NOVEMBER 2		Date: 3/22/06	Page 1 of 1
Task Order/Month: Nov 2005	QC Type:	Calculations:	
Well Number: C4999,399-3-18 (8)	A#:		
Total Purge Volume (gal):	Purge Flow Rate (gal/min):		
Pump Type: submersible	Time on: Water: Purge: Samp.: Off:		

SAMPLES COLLECTED

B1FR79 (Filtered)	PNNL Building 325	COC No.: X06-007-23	
1;500mL;Nalge	Uranium by ICPMS; 6010_METALS_ICP: Chromium (1) (HNO3 to pH <2(ULTREX))		5200040
B1FR80	PNNL Building 325	COC No.: X06-007-23	
1;500mL;P	IC Anions - 300.0; 310.1_ALKALINITY: Alkalinity (1); Generic Testing (Cool 4C)		5200040
B1FR82	Severn Trent St. Louis	COC No.: X06-007-24	
1;20mL;P	Activity Scan (None)		
4;40mL;aGs*	8260_VOA_GCMS: List-2 (28) (HCl or H2SO4 to pH <2 Cool 4C)		5048070

Total No. Bottles: 7 Containment Code: NA Collector: L. C. Petersen

FIELD: B1FR81 COC: X06-007-22

Water Level (TOC):			Drawdown (TOC):			Oil Sheen Yes ☐ No ☑				
Prev. pH:	8.170 @ 18.3°C		Prev. DTW:			E-Tape No.:				
Time	1405									
pH	8.185									
Temp. (°C)	17.5									
Cond. (us/cm)	275									
Turb. (NTU)	71000									
D. O. (mg/L)	2.7									
FLD REDOX										

FIELD OBSERVATIONS

Weather: warm; sunny; slight breeze

Field Comments

sample depth 107-109 ft bgs

Pre Check: Post Check:

Comments:

Well capped and locked ☐ Yes ☐ No Logbook/Pg# DTS-SAWS-H101/12

Samples Surveyed for Gamma Radiation by RPTs: ☐ Yes ☑ No

Data Recorded by: L. C. Petersen L Petersen 3-22-06
Print and sign name Date

Data Checked by:
Print and sign name Date

GROUNDWATER SAMPLE REPORT

No Dump

Project: 3FF5 (1) INTERVAL NOVEMBER 2					Date: 3/23/06	Page 1 of 1
Task Order/Month: Nov 2005	QC Type:				Calculations:	
Well Number: C4999,399-3-18 (9)	A#:					
Total Purge Volume (gal):	Purge Flow Rate (gal/min):					
Pump Type: Submersible	Time on:	Water:	Purge:	Samp.:	Off:	

SAMPLES COLLECTED

B1FR31 (Filtered) PNNL Building 325 COC No.: X06-007-26 5200040
1;500mL;Nalge Uranium by ICPMS; 6010_METALS_ICP: Chromium (1) ()

B1FR32 PNNL Building 325 COC No.: X06-007-26 5200040
1;500mL;P IC Anions - 300.0; 310.1_ALKALINITY: Alkalinity (1); Generic Testing (Cool 4C)

B1FR34 Severn Trent St. Louis COC No.: X06-007-27 5048070
1;20mL;P Activity Scan (None)
4;40mL;aGs* 8260_VOA_GCMS: List-2 (26) (HCl or H2SO4 to pH <2 Cool 4C)

Total No. Bottles: 7 Containment Code: NA Collector: L. C. Petersen

FIELD: B1FR33 COC: X06-007-25

Water Level (TOC):			Drawdown (TOC):			Oil Sheen	Yes ☐	No ☑		
Prev. pH:	8.285		Prev. DTW:			E-Tape No.:				
Time	1240									
pH	8.181									
Temp. (°C)	17.2									
Cond. (us/cm)	281									
Turb. (NTU)	>1000									
D. O. (mg/L)	1.1									
FLD REDOX										

FIELD OBSERVATIONS

Weather: warmer, sl. cloudy

Field Comments:

interval 120-121½'

Pre Check: Post Check:

Comments:

Well capped and locked ☐ Yes ☐ No Logbook/Pg#

Samples Surveyed for Gamma Radiation by RPTs: ☐ Yes ☑ No

Data Recorded by: L. C. Petersen LPetersen (Print and sign name) 3/23/06 (Date)

Data Checked by: (Print and sign name) (Date)

GROUNDWATER SAMPLE REPORT

No Dump

Project: 3FF5 (1) INTERVAL NOVEMBER 2		Date: 4-13-06 Page 1 of 1
Task Order/Month: Nov 2005	QC Type: n/A	Calculations:
Well Number: C4999,399-3-18 (10)	A#: n/A	tot. purge time 99 min
Total Purge Volume (gal): 1,485 gal	Purge Flow Rate (gal/min): 15 gpm	@ 15 gpm = 1,485 gal.
Pump Type: 1½ HP 255 grundfos	Time on: 0819 / Water: — / Purge: — / Samp.: 1012 / Off: 1014	(stopped for 16 min.)

SAMPLES COLLECTED

B1FR75 (Filtered) PNNL Building 325 COC No.: X06-007-29
1;500mL;Nalge Uranium by ICPMS; 6010_METALS_ICP: Chromium (1) (HNO3 to pH <2(ULTREX)) 5200040

B1FR76 PNNL Building 325 COC No.: X06-007-29
1;500mL;P IC Anions - 300.0; 310.1_ALKALINITY: Alkalinity (1); Generic Testing (Cool 4C) 5200040

B1FR78 Severn Trent St. Louis COC No.: X06-007-30
1;20mL;P Activity Scan (None) 5048070
4;40mL;aGs* 8260_VOA_GCMS: List-2 (26) (HCl or H2SO4 to pH <2 Cool 4C)

Total No. Bottles: 7 Containment Code: n/A Collector: J. Horner

FIELD: B1FR77 COC: X06-007-28

Water Level (TOC): 42.6	Drawdown (TOC): 42.6'	Oil Sheen Yes ☐ No ☒
Prev. pH: ND	Prev. DTW: n/A	E-Tape No.: n/A

Time	1012										
pH	7.51										
Temp. (°C)	16.4										
Cond. (us/cm)	549										
Turb. (NTU)	2.69										
D. O. (mg/L)	8.1										
FLD REDOX	.										

FIELD OBSERVATIONS

Weather: Partly Cloudy ~60° F

Field Comments
Sample was collected in screen interval after the well was developed

Pre Check: n/A Post Check: n/A

Comments:

Well capped and ~~locked~~ ☒ Yes ☐ No Logbook/Pg# DTS-SAWS-H101/14
Samples Surveyed for Gamma Radiation by RPTs: ☒ Yes ☐ No

Data Recorded by: Jake Horner [signature] 4-13-06
Print and sign name Date

Data Checked by:
Print and sign name Date

Field Sampling Record					page 1 of 1
Collector:	L. C. Petersen		Date:	3/14/2006	
Calibration parameters:					
Turbidity:	0-10	~~4.45~~ 4.52	0-100	45.4	0-1000	555
pH slope:	NA (field kit #3)				

Project:	FFS		Groundwater Depth:		42.5'
Well:	C4999		Sample Depth:		42½-44'
Geologist:	Jake Horner		Pump Depth:		NA
Sample time:	1000				
Sample parameters:	Turbidity (NTU):	585	D.O. (mg/l)	7.2 @ 20.7°C	
	Conductivity (µs)	~~4.65~~ 4,650 @ 15.5°C	pH:	7.83 @ 15.6°C	
Sample number(s)	B1FRB0		B1FRB2		B1FR99(F)

Notes: unfiltered sample for field parameters; used paradastic pump to filter (0.45 µ filter used) for samples collected. Not purged; bailed sample.

1

Project:	FFS		Groundwater Depth:		42.5'
Well:	C4999		Sample Depth:		49.7-51½'
Geologist:	J. Horner		Pump Depth:		NA
Sample time:	1250				
Sample parameters:	Turbidity (NTU):	>1000	D.O. (mg/l)	5.13 @ 14.1°C (time: 1415)	
	Conductivity (µs)	~~3,163~~ 3,630 @ 19°C	pH:	7.80	
Sample number(s)	B1FR91		B1FR92		B1FR94

Notes: sample bailed; not purged - see above for collection/sample process. Sampled 1250-1340 to obtain sufficient liquid for filtering + sampling.

2

Project:			Groundwater Depth:		
Well:			Sample Depth:		
Geologist:			Pump Depth:		
Sample time:					
Sample parameters:	Turbidity (NTU):		D.O. (mg/l)		
	Conductivity (µs)		pH:		
Sample number(s)					

Notes:

Petersen 3/14/2006

cc'd Jake H.

Field Sampling Record				page 1	of 1
Collector:	L. C. Petersen		Date: 3/15/2006		
Calibration parameters:					
Turbidity:	0-10	4.47	0-100	45.3	0-1000 555
pH slope:		NA (field kit #3)			

Project:	FFS		Groundwater Depth:		42.5'
Well:	C4999		Sample Depth:		52-57' (3)
Geologist:	Jake Horner		Pump Depth:		NA
Sample time:		1030			
Sample parameters:	Turbidity (NTU):	84.4	D.O. (mg/~~ml~~ l)	4.68 (read at 1130)	
	Conductivity (µs)	3,130 ~~2,130~~ @15.9°C	pH:	8.00	
Sample number(s)	BIFRB3(F)		BIFRB4		BIFRB6

Notes: bailed sample; not purged. Samples filtered with 0.45µ filter using parastaltic pump. (Parameters from unfiltered sample water). DO instrument had dead batteries; ~~read~~ taken later than other sample parameters.

Project:			Groundwater Depth:		
Well:			Sample Depth:		
Geologist:			Pump Depth:		
Sample time:					
Sample parameters:	Turbidity (NTU):		D.O. (mg/~~ml~~ l)		
	Conductivity (µs)		pH:		
Sample number(s)					

Notes:

Project:			Groundwater Depth:		
Well:			Sample Depth:		
Geologist:			Pump Depth:		
Sample time:					
Sample parameters:	Turbidity (NTU):		D.O. (mg/~~ml~~ l)		
	Conductivity (µs)		pH:		
Sample number(s)					

Notes:

signed: L Petersen
dated: March 14, 2006 (3/14/2006)

cc'd Jake H.

Field Sampling Record					page 1	of 1
Collector:	L. C. Petersen			Date:	3-16-2006	
Calibration parameters:						
Turbidity:	0-10	5.75	0-100	52.0	0-1000	530
pH slope:	98.3					
Project:	FF5			Groundwater Depth:		48' bgs
Well:	C4999			Sample Depth:		66'-70' bgs
Geologist:	Jake Horner			Pump Depth:		68' bgs
Sample time:		1530				
Sample parameters:		Turbidity (NTU):	See below	D.O. (mg/l)	note: samples pumped +	
		Conductivity (μs)		pH:	filtered (0.45 μ)	
Sample number(s)		BIFR87		BIFR88		BIFR90
Notes:	turbidity (NTU)	Conductivity (μS)		pH		DO
1455	848		164.0 @ 17.4°C	8.401		6.7
1500	587		161.4 @ 16.7°C	8.285		7.0
1506	305		157.8 @ 16.8°C	8.318 @ 17.4°C		7.0
1512	355		158.0 @ 17.4°C	8.399 @ 17.5°C		6.1

Project:				Groundwater Depth:	
Well:				Sample Depth:	
Geologist:				Pump Depth:	
Sample time:					
Sample parameters:		Turbidity (NTU):		D.O. (mg/l)	
		Conductivity (μs)		pH:	
Sample number(s)					
Notes:					

Project:				Groundwater Depth:	
Well:				Sample Depth:	
Geologist:				Pump Depth:	
Sample time:					
Sample parameters:		Turbidity (NTU):		D.O. (mg/l)	
		Conductivity (μs)		pH:	
Sample number(s)					
Notes:					
signed:			dated:	3/15/2006	

Field Sampling Record page 1 of ____

Collector: L. C. Petersen Date: 3/20/06

Calibration parameters: @ 0840

Turbidity: 0-10 5.77 (5.79 on box) 0-100 520 (520 on box) 0-1000 530 (529 on box) pH slope: 97.2

~~pH slope:~~

Project: FF-5 Groundwater Depth: 43' bgs Pump Depth: 68' bgs

Well: C4999 Sample Depth: 76-78' bgs Geologist: J. Horner

Time	Turbidity (NTU):	Conductivity (μs) *	Conductivity Temp (°C)	pH	pH probe Temp (oC)	D.O. (mg/l)	D.O. Temp (°C)	Comments
0952	466	190.2 (168)	15.7	8.490	15.9	2.1	15.7	
0958	290	180.8 (158)	16.2	8.549	16.4	1.9	16.4	
1004	48.1	182 (160)	16.3	8.389	16.9	2.7	17.2	
1010	26.5	181 (159)	16.8	8.351	15.0	7.0	17.6	
1035	9.09	181 (159)	18.0	—	—	6.4	19.8	

Sample time 1033 Sample number(s) B1FRB7 B1FRB8 B1FRC0

Notes: pumped sample. Conductivity meter reading ~ 22 μS high. *adjusted value in parentheses above

Project: Groundwater Depth: Pump Depth:

Well: Sample Depth: Geologist:

Time	Turbidity (NTU):	Conductivity (μs)	Conductivity Temp (°C)	pH	pH probe Temp (oC)	D.O. (mg/l)	D.O. Temp (°C)	Comments

Sample time Sample number(s)

Notes:

Project: Groundwater Depth: Pump Depth:

Well: Sample Depth: Geologist:

Time	Turbidity (NTU):	Conductivity (μs)	Conductivity Temp (°C)	pH	pH probe Temp (oC)	D.O. (mg/l)	D.O. Temp (°C)	Comments

Sample time Sample number(s)

Notes:

signed: LPetersen dated: 3-20-2006

Field Sampling Record						page 1 of 1	
Collector:	L. C. Petersen					Date:	3/21/2006
Calibration parameters:							
Turbidity:	0-10	5.69	0-100	51.7	0-1000	530	pH slope: 96.5
~~pH slope:~~							

Project:	FF-5	Groundwater Depth:	42.4'	casing shoe 86'	Pump Depth:	~~Submersible~~ 88'
Well:	C4999	Sample Depth:	86-89'		Geologist:	Jake Horner

Time	Turbidity (NTU):	Conductivity (µs)	Conductivity Temp (°C)	pH	pH probe Temp (oC)	D.O. (mg/l)	D.O. Temp (°C)	Comments
0808	~~530~~ 70.7	225	14.4°	8.132	15.0	1.3	14.8°C	
0815	43.5	224	15.1	8.283	14.4	1.6	14.5	
0821	33.3	225	15.4	8.245	14.8	1.1	14.6	
0832	26.9	225	15.8	8.310	15.6	1.3	16.1	

Sample time 0830 Sample number(s) BIFR83 BIFR84 BIFR86

Notes:

(6)

Project:	FF-5	Groundwater Depth:	42.6'	Pump Depth:	93'
Well:	C4999	Sample Depth:	98'-101'	Geologist:	J. Horner

Time	Turbidity (NTU):	Conductivity (µs)	Conductivity Temp (°C)	pH	pH probe Temp (oC)	D.O. (mg/l)	D.O. Temp (°C)	Comments

sample to be taken 3-22-2006

Sample time Sample number(s) BIFR95 BIFR96 BIFR98

Notes: need to adj for conductivity reading 10 uS high (adj value in parentheses)

(7)

Project:		Groundwater Depth:		Pump Depth:	
Well:		Sample Depth:		Geologist:	

Time	Turbidity (NTU):	Conductivity (µs)	Conductivity Temp (°C)	pH	pH probe Temp (oC)	D.O. (mg/l)	D.O. Temp (°C)	Comments

Sample time Sample number(s)

Notes:

signed: [signature] dated: 3-21-2006

Field Sampling Record page 1 of 1

Collector: L. C. Petersen Date: 3/22/06

Calibration parameters:

Turbidity: 0-10 5.73 (on box 5.79) 0-100 52.1 (on box 52.0) 0-1000 530 (on box 529) pH slope: 96.1

Project: FFS Groundwater Depth: 41' Pump Depth: 93'

Well: C4999 Sample Depth: 98-101' Geologist: Jake Horner

Time	Turbidity (NTU):	Conductivity (μs)	Conductivity Temp (°C)	pH	pH probe Temp (oC)	D.O. (mg/l)	D.O. Temp (°C)	Comments
0650	134	272 (267)	14.8	7.929	15.7	1.8	14.3	
0655	109	272 (267)	15.0	8.028	15.1	2.0	14.4	
0700	98.6	279 (274)	13.5	7.991	15.1	0.8	15.0	
0707	98.6	273 (268)	13.8	8.101	14.6	1.1	14.7	
0719	0.82	272 (267)	14.3	8.128	14.5	1.0	14.5	
0725	3.09	153 (148)	6.6	8.125	7.0	10.5	8.3	River WATER Sample

Sample time 0715 Sample number(s) BIFR95 BIFR96 BIFR98

Notes: conductivity elevated by 5mS...adj. results in parentheses

Project: FFS Groundwater Depth: 41' Pump Depth: 105'

Well: C4999 Sample Depth: 107-109' Geologist: J. Horner

Time	Turbidity (NTU):	Conductivity (μs)	Conductivity Temp (°C)	pH	pH probe Temp (oC)	D.O. (mg/l)	D.O. Temp (°C)	Comments
1315	>1000	270	19.1	8.158	18.4	0.4	20.9	
1340	>1000	274	19.1	8.285	18.3	0.7	19.8	
1350	>1000	274	17.8	8.165	18.0	1.0	18.9	
1355	>1000	276	17.9	8.170	18.3	0.6	18.4	
1406	>1000	275	17.6	8.185	17.5	2.7	18.1	

Sample time 1405 Sample number(s) BIFR79 BIFR80 BIFR82

Notes: conductivity reading 4 mS low...adjusted results in parentheses

Project: Groundwater Depth: Pump Depth:

Well: Sample Depth: Geologist:

Time	Turbidity (NTU):	Conductivity (μs)	Conductivity Temp (°C)	pH	pH probe Temp (oC)	D.O. (mg/l)	D.O. Temp (°C)	Comments

Sample time Sample number(s)

Notes:

signed: LPeterson dated: 3-22-2006

Well C5000

GROUNDWATER SAMPLE REPORT

No Dump

Project: 3FF5 (1) INTERVAL NOVEMBER 2						Date: 4-3-06	Page 1 of 1
Task Order/Month:	QC Type: n/A					Calculations:	
Well Number: C5000,399-1-23 (1)	A#: n/A						
Total Purge Volume (gal): bailed ~1 gal	Purge Flow Rate (gal/min): n/A						
Pump Type: 3" plastic bailer	Time on: n/A	Water: n/A	Purge: n/A	Samp.: n/A	Off: n/A		

SAMPLES COLLECTED

B1FR35 (Filtered) PNNL Building 325 COC No.: X06-007-32
1;500mL;Nalge Uranium by ICPMS; 6010_METALS_ICP: Chromium (1) (ULTREX HNO_3) 5200040

B1FR36 PNNL Building 325 COC No.: X06-007-32
1;500mL;P IC Anions - 300.0; 310.1_ALKALINITY: Alkalinity (1); Generic Testing (Cool 4C) 5200040

B1FR38 Severn Trent St. Louis COC No.: X06-007-33
1;20mL;P Activity Scan (None) N/A
4;40mL;aGs* 8260_VOA_GCMS: List-2 (28) (HCl or H2SO4 to pH <2 Cool 4C) 5234070

Total No. Bottles: 7 Containment Code: n/A Collector: Jake Horner

FIELD: B1FR37 COC: X06-007-31

Water Level (TOC): ~~33~~ 33' bgs	Drawdown (TOC): n/A	Oil Sheen Yes ☐ No ☒
Prev. pH: ND	Prev. DTW: n/A	E-Tape No.: n/A

Time	~~1450~~ 1550									
pH	ND									
Temp. (°C)	ND									
Cond. (us/cm)										
Turb. (NTU)										
D. O. (mg/L)										

FIELD OBSERVATIONS

Weather: Overcast

Field Comments

Pre Check: n/A Post Check: n/A

Comments:

Well capped and locked ☐ Yes ☒ No n/A Logbook/Pg# n/A

Samples Surveyed for Gamma Radiation by RPTs: ☐ Yes ☐ No

Data Recorded by: Jake Horner [signature] Print and sign name Date 4-3-06

Data Checked by: Print and sign name Date

GROUNDWATER SAMPLE REPORT

No Dump

Project: 3FF5 (1) INTERVAL NOVEMBER 2						Date: 4-4-06	Page 1 of 1
Task Order/Month:		QC Type: n/a				Calculations:	
Well Number: C5000,399-1-23 (2)		A#: n/A					
Total Purge Volume (gal): 200 gal		Purge Flow Rate (gal/min): 5 gpm					
Pump Type: grundfos 5 1/4-0 3/4 hP	Time on: 0700	Water: nD	Purge: 37 min	Samp.: 0737	Off: 0740		

SAMPLES COLLECTED

B1FR39 (Filtered) PNNL Building 325 COC No.: X06-007-38
1;500mL;Nalge Uranium by ICPMS; 6010_METALS_ICP: Chromium (1) (HNO_3 to pH <2(ULTREX)) 5200040

B1FR40 PNNL Building 325 COC No.: X06-007-38
1;500mL;P IC Anions - 300.0; 310.1_ALKALINITY: Alkalinity (1); Generic Testing (Cool 4C) 5200040

B1FR42 Severn Trent St. Louis COC No.: X06-007-39
1;20mL;P Activity Scan (None) N/A
4;40mL;aGs* 8260_VOA_GCMS: List-2 (26) (HCl or H_2SO_4 to pH <2 Cool 4C) 5234070

Total No. Bottles: 7 Containment Code: n/A Collector: Jake Horner

FIELD: B1FR41 COC: X06-007-37

Water Level (~~TOC~~): 33.5' bgs		Drawdown (TOC):			Oil Sheen	Yes ☐		No ☒		
Prev. pH: n/A		Prev. DTW:			E-Tape No.:					
Time	0737									
pH	7.47									
Temp. (°C)	15.0°C									
Cond. (~~us/cm~~) mS	4.90									
Turb. (NTU)	5.30									
D. O. (mg/L)	6.14									

FIELD OBSERVATIONS

Weather: Partly Cloudy

Field Comments

Only 0.5" of drawdown in 40 min.

Pre Check: n/A Post Check: n/A

Comments:

Well capped and locked ☐ Yes ☒ No Logbook/Pg# n/A

Samples Surveyed for Gamma Radiation by RPTs: ☐ Yes ☒ No

Data Recorded by: Jake Horner Jake Horner 4-4-06
Print and sign name Date

Data Checked by:
Print and sign name Date

GROUNDWATER SAMPLE REPORT

No Dump

Project: 3FF5 (1) INTERVAL NOVEMBER 2					Date: 4-4-06	Page 1 of 1
Task Order/Month:	QC Type: n/A				Calculations: 38 min @ 5 gpm = 190 gal.	
Well Number: C5000,399-1-23 (3)	A# : n/A					
Total Purge Volume (gal): 190 gal.	Purge Flow Rate (gal/min): 5 gpm					
Pump Type: grondfos 1/4 - 3/4 hp	Time on: 1037	Water: —	Purge: —	Samp.: 1115	Off: 1125	

SAMPLES COLLECTED

B1FR43 (Filtered) PNNL Building 325 COC No.: X06-007-59
1;500mL;Nalge Uranium by ICPMS; 6010_METALS_ICP: Chromium (1) (HNO3 to pH <2(ULTREX)) 5200040

B1FR44 PNNL Building 325 COC No.: X06-007-59
1;500mL;P IC Anions - 300.0; 310.1_ALKALINITY: Alkalinity (1); Generic Testing (Cool 4C) 5200040

B1FR46 Severn Trent St. Louis COC No.: X06-007-60
1;20mL;P Activity Scan (None) N/A
4;40mL;aGs* 8260_VOA_GCMS: List-2 (26) (HCl or H2SO4 to pH <2 Cool 4C) 5234070

Total No. Bottles: 7 Containment Code: n/A Collector: Jake Horner

FIELD: B1FR45 COC: X06-007-58

Water Level (TOC): 39.4'			Drawdown (~~TOC~~ ok): ∅(39.4)			Oil Sheen Yes ☐ No ☒				
Prev. pH: ND			Prev. DTW: n/A			E-Tape No.: N/A				
Time	1115									
pH	7.58									
Temp. (°C)	16.3									
Cond. (us/cm)	492									
Turb. (NTU)	45.8									
D. O. (mg/L)	5.18									

FIELD OBSERVATIONS

Weather: Partly cloudy

Field Comments

Pre Check: n/A Post Check: n/A

Comments:

Well capped and locked ☐ Yes ☒ No Logbook/Pg#

Samples Surveyed for Gamma Radiation by RPTs: ☐ Yes ☐ No

Data Recorded by: Jake Horner John Horner
Print and sign name Date

Data Checked by:
Print and sign name Date

GROUNDWATER SAMPLE REPORT

No Dump

Project: 3FF5 (1) INTERVAL NOVEMBER 2				Date: 4-5-06	Page 1 of 1
Task Order/Month:	QC Type: n/A			Calculations:	
Well Number: C5000,399-1-23 (4)	A#: n/A				
Total Purge Volume (gal): 200-300 gal.	Purge Flow Rate (gal/min): inconsistent				
Pump Type: grundfos submersible 1/4-3/4 HP	Time on: 0639	Water: —	Purge: —	Samp.: 0800	Off: 0803

SAMPLES COLLECTED

B1FR47 (Filtered) PNNL Building 325 COC No.: X06-007-56
1;500mL;Nalge Uranium by ICPMS; 6010_METALS_ICP: Chromium (1) (HNO3 to pH <2(ULTREX)) 5200140

B1FR48 PNNL Building 325 COC No.: X06-007-56
1;500mL;P IC Anions - 300.0; 310.1_ALKALINITY: Alkalinity (1); Generic Testing (Cool 4C) 5200040

B1FR50 Severn Trent St. Louis COC No.: X06-007-57
1;20mL;P Activity Scan (None) N/A
4;40mL;aGs* 8260_VOA_GCMS: List-2 (28) (HCl or H2SO4 to pH <2 Cool 4C) 5234070

Total No. Bottles: 7 Containment Code: n/A Collector: Jake Horner

FIELD: B1FR49 COC: X06-007-55

Water Level (TOC): 39.2'	Drawdown (TOC): 41.2'	Oil Sheen Yes ☐ No ☒
Prev. pH: 7.46	Prev. DTW: ND	E-Tape No.: n/A

Time	0800									
pH	~~8.07~~ 7.8									
Temp. (°C)	13.9									
Cond. (us/cm)	485									
Turb. (NTU)	65.9									
D. O. (mg/L)	8.0									

FIELD OBSERVATIONS

Weather: Overcast

Field Comments

Pre Check: n/A Post Check: n/A

Comments: Purged 17 min on 3-4-06 with inconsitant rate (1-5 gpm)

Well capped and locked ☐ Yes ☒ No Logbook/Pg# n/A

Samples Surveyed for Gamma Radiation by RPTs: ☐ Yes ☒ No

Data Recorded by: Jake Horner Jake Horner
Print and sign name Date

Data Checked by:
Print and sign name Date

GROUNDWATER SAMPLE REPORT

No Dump

Project: 3FF5 (1) INTERVAL NOVEMBER 2		Date: 4-5-06	Page 1 of 1
Task Order/Month:	QC Type: n/A	Calculations:	
Well Number: C5000,399-1-23 (5)	A#: n/A		
Total Purge Volume (gal): > 300 gal.	Purge Flow Rate (gal/min): variable		

Pump Type: grundfos 1/4 - 3/4 hp	Time on: —	Water: —	Purge: —	Samp.: —	Off: —

SAMPLES COLLECTED

B1FR51 (Filtered) PNNL Building 325 COC No.: X06-007-53
1;500mL;Nalge Uranium by ICPMS; 6010_METALS_ICP: Chromium (1) (HNO3 to pH <2(ULTREX)) 5200140

B1FR52 PNNL Building 325 COC No.: X06-007-53
1;500mL;P IC Anions - 300.0; 310.1_ALKALINITY: Alkalinity (1); Generic Testing (Cool 4C) 5200040

B1FR54 Severn Trent St. Louis COC No.: X06-007-54
1;20mL;P Activity Scan (None) N/A
4;40mL;aGs* 8260_VOA_GCMS: List-2 (26) (HCl or H2SO4 to pH <2 Cool 4C) 5234070

Total No. Bottles: 7 Containment Code: n/A Collector: Jake Horner

FIELD: B1FR53 COC: X06-007-52

Water Level (TOC): 40.3	Drawdown (TOC): 54.4	Oil Sheen Yes ☐ No ☒
Prev. pH: 7.8	Prev. DTW:	E-Tape No.:

Time	1325									
pH	8.3									
Temp. (°C)	16.9									
Cond. (us/cm)	411									
Turb. (NTU)	113									
D. O. (mg/L)	1.4									

FIELD OBSERVATIONS

Weather: light sprinkle

Field Comments

Pre Check: n/A Post Check: n/A

Comments:

Well capped and locked ☐ Yes ☒ No Logbook/Pg# ~~n/A~~ DTS-SAWS-H101/13

Samples Surveyed for Gamma Radiation by RPTs: ☐ Yes ☒ No

Data Recorded by: Jake Horner [signature] 4-5-06
Print and sign name Date

Data Checked by:
Print and sign name Date

GROUNDWATER SAMPLE REPORT

No Dump

Project: 3FF5 (1) INTERVAL NOVEMBER 2				Date: 4-6-06	Page 1 of 1
Task Order/Month:	QC Type: n/a			Calculations:	
Well Number: C5000,399-1-23 (6)	A#: n/a				
Total Purge Volume (gal): ~240 gal.	Purge Flow Rate (gal/min): 8 gpm (5 min.) 4 gpm (50 min.)				
Pump Type: grundfos 1/4-3/4 hp	Time on: 0635	Water: —	Purge: —	Samp.: 0730	Off: —

SAMPLES COLLECTED

B1FR55 (Filtered) PNNL Building 325 COC No.: X06-007-50
1;500mL;Nalge Uranium by ICPMS; 6010_METALS_ICP: Chromium (1) (HNO3 to pH <2(ULTREX)) 5200040

B1FR56 PNNL Building 325 COC No.: X06-007-50
1;500mL;P IC Anions - 300.0; 310.1_ALKALINITY: Alkalinity (1); Generic Testing (Cool 4C) 5200040

B1FR58 Severn Trent St. Louis COC No.: X06-007-51
1;20mL;P Activity Scan (None) N/A
4;40mL;aGs* 8260_VOA_GCMS: List-2 (26) (HCl or H2SO4 to pH <2 Cool 4C) 5234070

Total No. Bottles: 7 Containment Code: n/a Collector: Jake Horner

FIELD: B1FR57 COC: X06-007-49

Water Level (TOC): 39.4'		Drawdown (TOC): 49.7'		Oil Sheen	Yes ☐ No ☒
Prev. pH: ND		Prev. DTW: 39.4' TOC		E-Tape No.: n/a	

Time	0730										
pH	8.2										
Temp. (°C)	14.8°C										
Cond. (us/cm)	396										
Turb. (NTU)	196										
D. O. (mg/L)	0.6										

FIELD OBSERVATIONS

Weather: Clear

Field Comments

Pre Check: n/a Post Check: n/a

Comments:

Well capped and locked ☐ Yes ☒ No Logbook/Pg# ~~n/a~~ DTS-SAWS-H101/13

Samples Surveyed for Gamma Radiation by RPTs: ☐ Yes ☒ No

Data Recorded by: Jake Horner [signature] Date 4-6-06
Print and sign name

Data Checked by: ____ Date ____
Print and sign name

GROUNDWATER SAMPLE REPORT

No Dump

Project: 3FF5 (1) INTERVAL NOVEMBER 2		Date: 4-6-06	Page 1 of 1
Task Order/Month:	QC Type: n/A	Calculations: 7 [illegible] 4-10-06	
Well Number: C5000,399-1-23 (7)	A#: n/A	20min × 5gpm = 100 gal	
Total Purge Volume (gal): ~345 gal.	Purge Flow Rate (gal/min):	70 min × 3.5gpm = 245 gal	
Pump Type: grundfos ½ hP	Time on: 0730 / Water: — / Purge: — / Samp.: 0930 / Off: 0945	(stopped pump for 35 min.)	345 gal.

SAMPLES COLLECTED

B1FR59 (Filtered) PNNL Building 325 COC No.: X06-007-47
1;500mL;Nalge Uranium by ICPMS; 6010_METALS_ICP: Chromium (1) (HNO3 to pH <2(ULTREX)) 5200040

B1FR60 PNNL Building 325 COC No.: X06-007-47
1;500mL;P IC Anions - 300.0; 310.1_ALKALINITY: Alkalinity (1); Generic Testing (Cool 4C) 5200040

B1FR62 Severn Trent St. Louis COC No.: X06-007-48
1;20mL;P Activity Scan (None) N/A
4;40mL;aGs* 8260_VOA_GCMS: List-2 (26) (HCl or H2SO4 to pH <2 Cool 4C) 5234070

Total No. Bottles: 7 Containment Code: n/A Collector: Jake Horner

FIELD: B1FR61 COC: X06-007-46

Water Level (TOC): 39.4'	Drawdown (TOC): 48' TOC	Oil Sheen Yes ☐ No ☒	
Prev. pH:	Prev. DTW:	E-Tape No.: n/A	

Time	0935										
pH	8.26										
Temp. (°C)	15.6										
Cond. (us/cm)	302										
Turb. (NTU)	561										
D. O. (mg/L)	1.0										

FIELD OBSERVATIONS

Weather: Overcast ~45°F

Field Comments
Pump AT 35' bwt

Pre Check: n/A Post Check: n/A

Comments:

Well capped and locked ☐ Yes ☒ No Logbook/Pg# ~~n/A~~ DTS-SAWS-H101/13 7 [illegible] 4-10-06

Samples Surveyed for Gamma Radiation by RPTs: ☐ Yes ☒ No

Data Recorded by: Jake Horner [signature] Date 4-6-06
Print and sign name

Data Checked by: Date
Print and sign name

GROUNDWATER SAMPLE REPORT

No Dump

Project: 3FF5 (1) INTERVAL NOVEMBER 2					Date: 4-10-06	Page 1 of 1
Task Order/Month:	QC Type: n/A				Calculations:	
Well Number: C5000,399-1-23 (8)	A#: n/A					
Total Purge Volume (gal): ~475 gal.	Purge Flow Rate (gal/min): variable					
Pump Type: grundfos 1/2 hp	Time on: 1343	Water: —	Purge: —	Samp.: 1545	Off: 1550	

SAMPLES COLLECTED

B1FR63 (Filtered) PNNL Building 325 COC No.: X06-007-44
1;500mL;Nalge Uranium by ICPMS; 6010_METALS_ICP: Chromium (1) (HNO3 to pH <2(ULTREX)) 5200040

B1FR64 PNNL Building 325 COC No.: X06-007-44
1;500mL;P IC Anions - 300.0; 310.1_ALKALINITY: Alkalinity (1); Generic Testing (Cool 4C) 5200040

B1FR66 Severn Trent St. Louis COC No.: X06-007-45
1;20mL;P Activity Scan (None) N/A
4;40mL;aGs* 8260_VOA_GCMS: List-2 (26) (HCl or H2SO4 to pH <2 Cool 4C) 5234070

Total No. Bottles: 7 Containment Code: n/A Collector: Jake Horner

FIELD: B1FR65 COC: X06-007-43

Water Level (TOC): 39.2'			Drawdown (TOC): 68.5'			Oil Sheen	Yes ☐		No ☒	
Prev. pH: ND			Prev. DTW: ND			E-Tape No.: n/A				
Time	1545									
pH	8.20									
Temp. (°C)	16.9									
Cond. (us/cm)	318									
Turb. (NTU)	200									
D. O. (mg/L)	1.0									

FIELD OBSERVATIONS

Weather: Partly cloudy 55° F

Field Comments 45'-50' bwt

Pre Check: n/A Post Check: n/A

Comments:

Well capped and locked ☐ Yes ☒ No Logbook/Pg# ~~n/A~~ DTS-SAWS-H101/13

Samples Surveyed for Gamma Radiation by RPTs: ☐ Yes ☒ No

Data Recorded by: Jake Horner [signature] Print and sign name Date 4-10-06

Data Checked by: Print and sign name Date

GROUNDWATER SAMPLE REPORT

No Dump

Project: 3FF5 (1) INTERVAL NOVEMBER 2					Date: 4-11-06	Page 1 of 1
Task Order/Month:	QC Type: N/A				Calculations: 7 gpm × 86 min = 602 gal.	
Well Number: C5000,399-1-23 (9)	A#: N/A					
Total Purge Volume (gal): ~600 gal.	Purge Flow Rate (gal/min): ~7 gpm					
Pump Type: 1/2 hp grundfos	Time on: 1039	Water: —	Purge: —	Samp.: 1205	Off: 1208	

SAMPLES COLLECTED

B1FR67 (Filtered) PNNL Building 325 COC No.: X06-007-41
1;500mL;Nalge Uranium by ICPMS; 6010_METALS_ICP: Chromium (1) (HNO3 to pH <2(ULTREX)) 5200040

B1FR68 PNNL Building 325 COC No.: X06-007-41
1;500mL;P IC Anions - 300.0; 310.1_ALKALINITY: Alkalinity (1); Generic Testing (Cool 4C) 5200040

B1FR70 Severn Trent St. Louis COC No.: X06-007-42
1;20mL;P Activity Scan (None) N/A
4;40mL;aGs* 8260_VOA_GCMS: List-2 (26) (HCl or H2SO4 to pH <2 Cool 4C) 5234070

Total No. Bottles: 7 Containment Code: N/A Collector: Jake Horner

FIELD: B1FR69 COC: X06-007-40

Water Level (TOC): 39.1'			Drawdown (TOC): 47.4'			Oil Sheen Yes ☐ No ☒					
Prev. pH: ND			Prev. DTW: N/A			E-Tape No.: N/A					
Time	1205										
pH	8.10										
Temp. (°C)	18.0										
Cond. (us/cm)	526										
Turb. (NTU)	433										
D. O. (mg/L)	0.6										

FIELD OBSERVATIONS

Weather: Partly cloudy ~67° F

Field Comments: 55'-60' bwt

Pre Check: N/A Post Check: N/A

Comments:

Well capped and locked ☐ Yes ☒ No Logbook/Pg#: ~~N/A~~ DTS-SAWS-H101/

Samples Surveyed for Gamma Radiation by RPTs: ☐ Yes ☒ No

Data Recorded by: Jake Horner [signature] (Print and sign name) Date: 4-11-06

Data Checked by: (Print and sign name) Date:

GROUNDWATER SAMPLE REPORT

No Dump

Project: 3FF5 (1) INTERVAL NOVEMBER 2					Date: 4-17-06	Page 1 of 1
Task Order/Month:	QC Type:				Calculations:	
Well Number: C5000,399-1-23 (10)	A#:					
Total Purge Volume (gal): 270 gal.	Purge Flow Rate (gal/min): variable					
Pump Type: 1/2 grundfos	Time on: 1317	Water: —	Purge: ~~1525~~	Samp.: 1520	Off: 1525	

SAMPLES COLLECTED

B1FR71 (Filtered) PNNL Building 325 COC No.: X06-007-35
1;500mL;Nalge Uranium by ICPMS; 6010_METALS_ICP: Chromium (1) (HNO3 to pH <2(ULTREX)) 5200040

B1FR72 PNNL Building 325 COC No.: X06-007-35
1;500mL;P IC Anions - 300.0; 310.1_ALKALINITY: Alkalinity (1); Generic Testing (Cool 4C) 5200040

B1FR74 Severn Trent St. Louis COC No.: X06-007-36
1;20mL;P Activity Scan (None) N/A
4;40mL;aGs* 8260_VOA_GCMS: List-2 (26) (HCl or H2SO4 to pH <2 Cool 4C) 5234070

Total No. Bottles: 7 Containment Code: n/A Collector: Jake Horner

FIELD: B1FR73 COC: X06-007-34

Water Level (TOC): 34.8'			Drawdown (TOC): 66'			Oil Sheen Yes ☐ No ☒				
Prev. pH: ND			Prev. DTW: ND			E-Tape No.: n/A				
Time	1520									
pH	8.2									
Temp. (°C)	18.5									
Cond. (us/cm)	328									
Turb. (NTU)	>1000									
D. O. (mg/L)	0.8									

FIELD OBSERVATIONS

Weather: Partly cloudy 60° F

Field Comments 71' - 76' bwt

Pre Check: n/A Post Check: n/A

Comments:

Well capped and locked ☐ Yes ☒ No Logbook/Pg# ~~n/A~~ DTS-SAWS-H101/14

Samples Surveyed for Gamma Radiation by RPTs: ☐ Yes ☒ No

Data Recorded by: Jake Horner Jake Horner Date 4-17-06
Print and sign name

Data Checked by: Date
Print and sign name

Well C5001

GROUNDWATER SAMPLE REPORT

No Dump

Project: 3FF5 (1) INTERVAL NOVEMBER 2					Date: 4-26-06	Page 1 of 1
Task Order/Month:	QC Type: n/A				Calculations:	
Well Number: C5001 399-3-19 (1)	A#: n/A					
Total Purge Volume (gal): 260 gal.	Purge Flow Rate (gal/min): ~7.5 gpm				Used a flow meter	
Pump Type: ½ HP Grundfos; Time on: 1510	Water: —	Purge: —	Samp.: 1546	Off: 1550	Stopped pumping for 5 min.	

SAMPLES COLLECTED

B1HRW9 (Filtered) PNNL Building 325 COC No.: X06-007-67
1;500mL;Nalge Uranium by ICPMS; 6010_METALS_ICP: Chromium (1) (HNO3 to pH <2) 5200040

B1HRX0 PNNL Building 325 COC No.: X06-007-67
1;500mL;P IC Anions - 300.0; 310.1_ALKALINITY: Alkalinity (1); Generic Testing (Cool 4C) 5200040

B1HRX1 Severn Trent St. Louis COC No.: X06-007-73
1;20mL;P Activity Scan (None) N/A
4;40mL;aGs* 8260_VOA_GCMS: List-2 (28) (HCl or H2SO4 to pH <2 Cool 4C) 5048070

Total No. Bottles: 7 Containment Code: n/A Collector: Jake Horner

FIELD: B1HRW8 COC: X06-007-61

Water Level (TOC): 53.2		Drawdown (TOC): 53.2		Oil Sheen	Yes ☐ No ☒
Prev. pH: n/A		Prev. DTW: n/A		E-Tape No.:	n/A

Time	1546									
pH	7.43									
Temp. (°C)	19.3									
Cond. (us/cm)	402									
Turb. (NTU)	9.99									
D. O. (mg/L)	8.6									

FIELD OBSERVATIONS

Weather:

Field Comments: DTW = 47.2' bgs
5' bwt

Pre Check: n/A Post Check: n/A

Comments:

Well capped and locked: ☐ Yes ☒ No Logbook/Pg#: n/A DTS-SAUS-H101 / 14

Samples Surveyed for Gamma Radiation by RPTs: ☐ Yes ☒ No

Data Recorded by: Jake Horner [signature] Date 4-26-06
Print and sign name

Data Checked by: Date
Print and sign name

GROUNDWATER SAMPLE REPORT

No Dump

Project: 3FF5 (1) INTERVAL NOVEMBER 2					Date: 4-27-06	Page 1 of 1
Task Order/Month:	QC Type: n/a				Calculations: used flow meter	
Well Number: C5001 399-3-19 (2)	A#: n/a					
Total Purge Volume (gal): 230 gal.	Purge Flow Rate (gal/min): 7.6 gpm					
Pump Type: ½ HP Grundfos	Time on: 0758	Water: —	Purge: —	Samp.: 0826	Off: 0830	

SAMPLES COLLECTED

B1HRX3 (Filtered) PNNL Building 325 COC No.: X06-007-68
1;500mL;Nalge Uranium by ICPMS; 6010_METALS_ICP: Chromium (1) (HNO3 to pH <2) 5200040

B1HRX4 PNNL Building 325 COC No.: X06-007-68
1;500mL;P IC Anions - 300.0; 310.1_ALKALINITY: Alkalinity (1); Generic Testing (Cool 4C) 5200040

B1HRX5 Severn Trent St. Louis COC No.: X06-007-74
1;20mL;P Activity Scan (None) N/A
4;40mL;aGs* 8260_VOA_GCMS: List-2 (28) (HCl or H2SO4 to pH <2 Cool 4C) 5048070

Total No. Bottles: 7 Containment Code: n/a Collector: Jake Horner

FIELD: B1HRX2 COC: X06-007-62

Water Level (TOC): 53.1			Drawdown (TOC): 53.1			Oil Sheen	Yes ☐		No ☒	
Prev. pH: n/a			Prev. DTW: n/a			E-Tape No.: n/a				
Time	0826									
pH	7.60									
Temp. (°C)	16.2									
Cond. (us/cm)	408									
Turb. (NTU)	16.0									
D. O. (mg/L)	9.4									

FIELD OBSERVATIONS

Weather: Clear ~65° F

Field Comments: DTW = 47.1' bgs
11' bwt

Pre Check: n/a Post Check: n/a

Comments:

Well capped and locked: ☐ Yes ☒ No Logbook/Pg#: ~~n/a~~ DTS-SAWS-H101/14

Samples Surveyed for Gamma Radiation by RPTs: ☐ Yes ☒ No

Data Recorded by: Jake Horner [signature] Print and sign name 4-27-06 Date

Data Checked by: Print and sign name Date

GROUNDWATER SAMPLE REPORT

No Dump

Project: 3FF5 (1) INTERVAL NOVEMBER 2						Date: 4-27-06	Page 1 of 1
Task Order/Month:	QC Type: n/A					Calculations:	
Well Number: C5001 399-3-19 (3)	A#: n/A						
Total Purge Volume (gal): 220 gal	Purge Flow Rate (gal/min): 7.5 gpm					used flow meter	
Pump Type: ½ HP Grundfos	Time on: 1422	Water: —	Purge: —	Samp.: 1450	Off: 1456		

SAMPLES COLLECTED

B1HRX7 (Filtered) PNNL Building 325 COC No.: X06-007-69
1;500mL;Nalge Uranium by ICPMS; 6010_METALS_ICP: Chromium (1) (HNO3 to pH <2) 5200040

B1HRX8 PNNL Building 325 COC No.: X06-007-69
1;500mL;P IC Anions - 300.0; 310.1_ALKALINITY: Alkalinity (1); Generic Testing (Cool 4C) 5200040

B1HRX9 Severn Trent St. Louis COC No.: X06-007-75
1;20mL;P Activity Scan (None) N/A
4;40mL;aGs* 8260_VOA_GCMS: List-2 (26) (HCl or H2SO4 to pH <2 Cool 4C) 5048070

Total No. Bottles: 7 Containment Code: n/A Collector: Jake Horner

FIELD: B1HRX6 COC: X06-007-63

Water Level (TOC): 53.1'		Drawdown (TOC): 53.1'			Oil Sheen Yes ☐ No ☒					
Prev. pH: 7.60		Prev. DTW: n/A			E-Tape No.: n/A					
Time	1450									
pH	7.48									
Temp. (°C)	20.0									
Cond. (us/cm)	411									
Turb. (NTU)	67.4									
D. O. (mg/L)	8.1									

FIELD OBSERVATIONS

Weather: Clear ~ 70°F

Field Comments: 16' bwlt

Pre Check: n/A Post Check: n/A

Comments:

Well capped and locked: ☐ Yes ☒ No Logbook/Pg#: ~~n/A~~ D75-SANS-H101/14

Samples Surveyed for Gamma Radiation by RPTs: ☐ Yes ☒ No

Data Recorded by: Jake Horner [signature] Date: 4-27-06
Print and sign name

Data Checked by: ______ Date: ______
Print and sign name

GROUNDWATER SAMPLE REPORT

No Dump

Project: 3FF5 (1) INTERVAL NOVEMBER 2					Date: 4-28-06	Page 1 of 1
Task Order/Month:	QC Type: n/A				Calculations:	
Well Number: C5001 399-3-19 (4)	A#: n/A					
Total Purge Volume (gal): 340	Purge Flow Rate (gal/min): 7.5				used flow meter	
Pump Type: ½ HP Grundfos	Time on: 1108	Water: —	Purge: —	Samp.: ~~1202~~	Off: 1202	

SAMPLES COLLECTED 1159 (SP)

B1HRY1 (Filtered) PNNL Building 325 COC No.: X06-007-70
1;500mL;Nalge Uranium by ICPMS; 6010_METALS_ICP: Chromium (1) (HNO3 to pH <2) 5200040

B1HRY2 PNNL Building 325 COC No.: X06-007-70
1;500mL;P IC Anions - 300.0; 310.1_ALKALINITY: Alkalinity (1); Generic Testing (Cool 4C) 5200040

B1HRY3 Severn Trent St. Louis COC No.: X06-007-76
1;20mL;P Activity Scan (None) N/A
4;40mL;aGs* 8260_VOA_GCMS: List-2 (26) (HCl or H2SO4 to pH <2 Cool 4C) 5048070

Total No. Bottles: 7 Containment Code: n/A Collector: J. Horner

FIELD: B1HRY0 COC: X06-007-64

Water Level (TOC): 53.5	Drawdown (TOC): 57.7	Oil Sheen	Yes ☐	No ☒	
Prev. pH: n/A	Prev. DTW: n/A	E-Tape No.: n/A			

Time	~~1202~~ 1202									
pH	7.56									
Temp. (°C)	20.5									
Cond. (us/cm)	422									
Turb. (NTU)	392									
D. O. (mg/L)	7.5									

FIELD OBSERVATIONS

Weather: Clear high 70's

Field Comments: 33' bwt

Pre Check: n/A Post Check: n/A

Comments:

Well capped and locked: ☐ Yes ☒ No Logbook/Pg#: ~~n/A~~ DTS-SAWS-H101/15

Samples Surveyed for Gamma Radiation by RPTs: ☐ Yes ☒ No

Data Recorded by: Jake Horner [signature] Print and sign name 4-28-06 Date

Data Checked by: Print and sign name Date

GROUNDWATER SAMPLE REPORT

No Dump

Project: 3FF5 (1) INTERVAL NOVEMBER 2			Date: 5/3/06	Page 1 of 1
Task Order/Month:	QC Type: n/A		Calculations:	
Well Number: C5001 399-3-19 (5)	A#: n/A			
Total Purge Volume (gal): 355 gal.	Purge Flow Rate (gal/min): 2-6.5 gpm			
Pump Type: ½ HP Grundfos	Time on: ~~130~~ 1252	Water: —	Purge: —	Samp.: ~~1430~~ 1425 Off: 1431

SAMPLES COLLECTED

B1HRY5 (Filtered) PNNL Building 325 COC No.: X06-007-71
1;500mL;Nalge Uranium by ICPMS; 6010_METALS_ICP: Chromium (1) (HNO3 to pH <2) 5200040

B1HRY6 PNNL Building 325 COC No.: X06-007-71
1;500mL;P IC Anions - 300.0; 310.1_ALKALINITY: Alkalinity (1); Generic Testing (Cool 4C) 5200040

B1HRY7 Severn Trent St. Louis COC No.: X06-007-77
1;20mL;P Activity Scan (None) N/A
4;40mL;aGs* 8260_VOA_GCMS: List-2 (26) (HCl or H2SO4 to pH <2 Cool 4C) 5048070

Total No. Bottles: 7 Containment Code: n/A Collector: J. Horner

FIELD: B1HRY4 COC: X06-007-65

Water Level (TOC): 52.1		Drawdown (TOC): 84.0		Oil Sheen Yes ☐ No ☒				
Prev. pH: n/A		Prev. DTW: n/A		E-Tape No.: n/A				
Time	~~1430~~ 1425							
pH	7.54							
Temp. (°C)	19.2							
Cond. (us/cm)	318							
Turb. (NTU)	108							
D. O. (mg/L)	0.7							

FIELD OBSERVATIONS

Weather: Clear ~70°F

Field Comments: Open Interval 100 - 103.5' bgs
DTW = 46.1' bgs

Pre Check: n/A Post Check: n/A

Comments:

Well capped and locked: ☐ Yes ☒ No Logbook/Pg#: ~~n/A~~ DTS-SAWS-H101/15

Samples Surveyed for Gamma Radiation by RPTs: ☐ Yes ☒ No

Data Recorded by: Jake Horner [signature] Date 5/3/06
Print and sign name

Data Checked by: Date
Print and sign name

Well C5002

GROUNDWATER SAMPLE REPORT

No Dump

Project: 3FF5 (1) INTERVAL NOVEMBER 2			Date: 5/12/06	Page 1 of 1
Task Order/Month:	QC Type: n/A		Calculations: Used Flow meter	
Well Number: C5002 399-3-20 (1)	A#: n/A			
Total Purge Volume (gal): ~200 gal.	Purge Flow Rate (gal/min): 7.5 gpm			

Pump Type:	Time on:	Water:	Purge:	Samp.:	Off:
1/2 Grundfos	1240	—	—	1308	1310

SAMPLES COLLECTED

B1HT03 (Filtered) PNNL Building 325 COC No.: X06-007-85
1;500mL;Nalge Uranium by ICPMS; 6010_METALS_ICP: Chromium (1) (HNO3 to pH <2) 2269030

B1HT04 PNNL Building 325 COC No.: X06-007-85
1;500mL;P IC Anions - 300.0; 310.1_ALKALINITY: Alkalinity (1); Generic Testing (Cool 4C) 2269030

B1HT05 Severn Trent St. Louis COC No.: X06-007-91
1;20mL;P Activity Scan (None) N/A
4;40mL;aGs* 8260_VOA_GCMS: List-2 (26) (HCl or H2SO4 to pH <2 Cool 4C) 5048070

Total No. Bottles: 7 Containment Code: n/A Collector: J. Horner

FIELD: B1HT02 COC: X06-007-79

Water Level (TOC): ~~47.~~ 53.7		Drawdown (TOC): 53.7			Oil Sheen	Yes ☐	No ☒		
Prev. pH:	n/A	Prev. DTW: n/A			E-Tape No.: n/A				
Time	1310								
pH	7.19								
Temp. (°C)	18.7								
Cond. (us/cm)	453								
Turb. (NTU)	21.7								
D. O. (mg/L)	8.6								

FIELD OBSERVATIONS

Weather: Clear ~75°F

Field Comments: DTW = 47.7' bgs Pump AT 51 bgs

Pre Check: n/A Post Check: n/A

Comments:

Well capped and locked: ☐ Yes ☒ No Logbook/Pg#: ~~n/a~~ DTS-SAWS-H101/15

Samples Surveyed for Gamma Radiation by RPTs: ☐ Yes ☒ No

Data Recorded by: Jake Horner [signature] Date: 5/12/06
Print and sign name

Data Checked by: Date:
Print and sign name

GROUNDWATER SAMPLE REPORT

No Dump

Project: 3FF5 (1) INTERVAL NOVEMBER 2				Date: 5/12/06	Page 1 of 1
Task Order/Month:	QC Type:			Calculations:	
Well Number: C5002 399-3-20 (2)	A#:				
Total Purge Volume (gal): 210 gal.	Purge Flow Rate (gal/min): 7.2-7.5 gpm				
Pump Type: 1/2 HP Grundfos	Time on: 1522	Water: —	Purge: —	Samp.: 1550	Off: 1554

SAMPLES COLLECTED

B1HT07 (Filtered) PNNL Building 325 COC No.: X06-007-86
1;500mL;Nalge Uranium by ICPMS; 6010_METALS_ICP: Chromium (1) (HNO3 to pH <2) 2269030

B1HT08 PNNL Building 325 COC No.: X06-007-86
1;500mL;P IC Anions - 300.0; 310.1_ALKALINITY: Alkalinity (1); Generic Testing (Cool 4C) 2269030

B1HT09 Severn Trent St. Louis COC No.: X06-007-92
1;20mL;P Activity Scan (None) N/A
4;40mL;aGs* 8260_VOA_GCMS: List-2 (26) (HCl or H2SO4 to pH <2 Cool 4C) 5048070

Total No. Bottles: 7 Containment Code: n/a Collector: Horner

FIELD: B1HT06 COC: X06-007-80

Water Level (TOC): 53.9'	Drawdown (recovery) (TOC): 53.7' (+.2)	Oil Sheen Yes ☐ No ☒	
Prev. pH: n/A	Prev. DTW: n/A	E-Tape No.: n/A	

Time	1554									
pH	7.28									
Temp. (°C)	18.9									
Cond. (us/cm)	445									
Turb. (NTU)	134									
D. O. (mg/L)	8.5									

FIELD OBSERVATIONS

Weather: Clear, mid to upper 70's

Field Comments:
DTW = 47.7' bgs Pump AT 61-63' bgs

Pre Check: n/A Post Check: n/A

Comments:

Well capped and locked: ☐ Yes ☒ No Logbook/Pg#: ~~n/a~~ DTS-SAWS-H101/15
Samples Surveyed for Gamma Radiation by RPTs: ☐ Yes ☒ No

Data Recorded by: Jake Horner [signature] Date: 5/12/06
Print and sign name

Data Checked by: ______ Date: ______
Print and sign name

GROUNDWATER SAMPLE REPORT

No Dump

Project: 3FF5 (1) INTERVAL NOVEMBER 2					Date: 5/15/06	Page 1 of 1
Task Order/Month: N/A	QC Type: N/A				Calculations:	
Well Number: C5002 399-3-20 (3)	A#: N/A					
Total Purge Volume (gal): 300	Purge Flow Rate (gal/min): 7.6 gpm					
Pump Type:	Time on: 1357	Water: —	Purge: —	Samp.: 1437	Off: 1445	

SAMPLES COLLECTED

B1HT11 (Filtered) PNNL Building 325 COC No.: X06-007-87
1;500mL;Nalge Uranium by ICPMS; 6010_METALS_ICP: Chromium (1) (HNO3 to pH <2) 2710030

B1HT12 PNNL Building 325 COC No.: X06-007-87
1;500mL;P IC Anions - 300.0; 310.1_ALKALINITY: Alkalinity (1); Generic Testing (Cool 4C) 4217060

B1HT13 Severn Trent St. Louis COC No.: X06-007-93
1;20mL;P Activity Scan (None) N/A
4;40mL;aGs* 8260_VOA_GCMS: List-2 (26) (HCl or H2SO4 to pH <2 Cool 4C) 5048070

Total No. Bottles: 7 Containment Code: N/A Collector: Horner

FIELD: B1HT10 COC: X06-007-81

Water Level (TOC): 54.3		Drawdown (TOC): 54.1			Oil Sheen	Yes ☐	No ☒				
Prev. pH: N/A		Prev. DTW: N/A			E-Tape No.: N/A						
Time	1439										
pH	7.51										
Temp. (°C)	20.0										
Cond. (us/cm)	463										
Turb. (NTU)	>1000										
D. O. (mg/L)	7.41										

FIELD OBSERVATIONS

Weather: Clear ~85° F

Field Comments:
DTW = 47.6' bgs before Drilling
Pump SET AT 25'-26' bwt

Pre Check: N/A Post Check: N/A

Comments:

Well capped and locked: ☐ Yes ☒ No Logbook/Pg#: ~~N/A~~ DTS-SAWS-H101/15

Samples Surveyed for Gamma Radiation by RPTs: ☐ Yes ☒ No

Data Recorded by: Jake Horner [signature] Date 5/15/06
Print and sign name

Data Checked by: Date
Print and sign name

GROUNDWATER SAMPLE REPORT

No Dump

Project: 3FF5 (1) INTERVAL NOVEMBER 2					Date: 5/16/06	Page 1 of 1
Task Order/Month:	QC Type: n/A				Calculations:	
Well Number: C5002 399-3-20 (4)	A#: n/A					
Total Purge Volume (gal): 380 gallons	Purge Flow Rate (gal/min): 7.6					
Pump Type: ½ HP Grundfos	Time on: 1101	Water: —	Purge: —	Samp.: 1212	Off: 1218	Tot. pump Vol. 426 gallons

SAMPLES COLLECTED

B1HT15 (Filtered) PNNL Building 325 COC No.: X06-007-88
1;500mL;Nalge Uranium by ICPMS; 6010_METALS_ICP: Chromium (1) (HNO3 to pH <2) 2269030

B1HT16 PNNL Building 325 COC No.: X06-007-88
1;500mL;P IC Anions - 300.0; 310.1_ALKALINITY: Alkalinity (1); Generic Testing (Cool 4C) 4217060

B1HT17 Severn Trent St. Louis COC No.: X06-007-94
1;20mL;P Activity Scan (None) N/A
4;40mL;aGs* 8260_VOA_GCMS: List-2 (26) (HCl or H2SO4 to pH <2 Cool 4C) 5048070

Total No. Bottles: 7 Containment Code: n/A Collector: Horner

FIELD: B1HT14 COC: X06-007-82

Water Level (TOC): 54'	Drawdown (TOC):	Oil Sheen Yes ☐ No ☐	
Prev. pH: 7.51	Prev. DTW:	E-Tape No.:	

Time	1215									
pH	7.84									
Temp. (°C)	19.8									
Cond. (us/cm)	276									
Turb. (NTU)	28.6									
D. O. (mg/L)	2.1									

FIELD OBSERVATIONS

Weather: Clear mild 90°

Field Comments: D.O. was stable @ 0.7 - 1.0 before sampling
Pump SET AT 90-92 bgs

Pre Check: n/A Post Check: n/A

Comments:

Well capped and locked: ☐ Yes ☒ No Logbook/Pg#: DTS-SAWS-H101

Samples Surveyed for Gamma Radiation by RPTs: ☐ Yes ☒ No

Data Recorded by: Jake Horner Jake Horner 5/16/06
Print and sign name Date

Data Checked by:
Print and sign name Date

PNNL

CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST

C.O.C. # **X06-007-2**

Page 1 of 1

Collector L.C. Petersen	Contact/Requester Dot Stewart	Telephone No. 509-376-5056 MSIN FAX
SAF No. X06-007	Sampling Origin Hanford Site	Purchase Order/Charge Code
Project Title 3FF5 (1) INTERVAL NOVEMBER 2005	DTS-SAWS-H101	Ice Chest No. Temp.
Shipped To (Lab) PNNL Building 325	Method of Shipment Govt Truck	Bill of Lading/Air Bill No.
Protocol RCRA	Priority: 45 Days	Offsite Property No.

POSSIBLE SAMPLE HAZARDS/REMARKS
** **

SPECIAL INSTRUCTIONS Hold Time Total Activity Exemption: Yes ☑ No ☐

Sample No.	Lab ID	*	Date	Time	No/Type Container	Sample Analysis	Preservative
B1FR99 (F)		W	3/14/06	1000	1x500-mL Nalgene	Uranium by ICPMS; 6010_METALS_ICP: Chromium (1)	HNO3 to pH <2(ULTREX)
B1FRB0		W	3/14/06	1000	1x500-mL P	IC Anions - 300.0; 310.1_ALKALINITY: Alkalinity (1); Generic Testing	Cool 4C

Relinquished By (Print / Sign)	Date/Time	Received By (Print / Sign)	Date/Time
L.C. Petersen / L Petersen	3-14-06 1420	DURATEK J. G. HOGAN / J T Hogan	MAR 14 2006 1420
DURATEK J. G. HOGAN / J T Hogan	MAR 14 2006 1430	M. Valenta / M. Valenta	3/14/06 1430
Relinquished By	Date/Time	Received By	Date/Time
Relinquished By	Date/Time	Received By	Date/Time

Matrix *
S = Soil
SE = Sediment
SO = Solid
SL = Sludge
W = Water
O = Oil
A = Air
DS = Drum Solid
DL = Drum Liquid
T = Tissue
WI = Wipe
L = Liquid
V = Vegetation
X = Other

FINAL SAMPLE DISPOSITION	Disposal Method (e.g., Return to customer, per lab procedure, used in process)	Disposed By	Date/Time

PNNL

CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST

C.O.C. # X06-007-5

Page 1 of 1

Collector L.C. Petersen	Contact/Requester Dot Stewart	Telephone No. 509-376-5056 MSIN FAX
SAF No. X06-007	Sampling Origin Hanford Site	Purchase Order/Charge Code
Project Title 3FF5 (1) INTERVAL NOVEMBER 2005	DTS-SAWS-H101	Ice Chest No. Temp.
Shipped To (Lab) PNNL Building 325	Method of Shipment Govt Truck	Bill of Lading/Air Bill No.
Protocol RCRA	Priority: 45 Days	Offsite Property No.

POSSIBLE SAMPLE HAZARDS/REMARKS
** **

SPECIAL INSTRUCTIONS Hold Time Total Activity Exemption: Yes ☑ No ☐

Sample No.	Lab ID	*	Date	Time	No/Type Container	Sample Analysis	Preservative
B1FR91 (F)		W	3/14	1250	1x500-mL Nalgene	Uranium by ICPMS; 6010_METALS_ICP: Chromium (1)	HNO3 to pH <2(ULTREX)
B1FR92		W	3/14	1252	1x500-mL P	IC Anions - 300.0; 310.1_ALKALINITY: Alkalinity (1); Generic Testing	Cool 4C

Relinquished By (Print / Sign)	Date/Time	Received By (Print / Sign)	Date/Time
L.C. Petersen / L.C. Petersen	~~3/14/06~~ 3-15-06 0710	DURATEK J. G. HOGAN / J. G. Hogan	MAR 15 2006 0710
DURATEK J. G. HOGAN / J. G. Hogan	MAR 15 2006 1500	Eric Clayton / E. C.	MAR 15 2006 1500

Matrix *

S = Soil	SE = Sediment	SO = Solid	SL = Sludge
W = Water	O = Oil	A = Air	DS = Drum Solid
DL = Drum Liquid	T = Tissue	WI = Wipe	L = Liquid
V = Vegetation	X = Other		

FINAL SAMPLE DISPOSITION	Disposal Method (e.g., Return to customer, per lab procedure, used in process)	Disposed By	Date/Time

PNNL	CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST	C.O.C. # X06-007-8
		Page 1 of 1

Collector L.C. Petersen	Contact/Requester Dot Stewart	Telephone No. 509-376-5056 MSIN FAX
SAF No. X06-007	Sampling Origin Hanford Site	Purchase Order/Charge Code
Project Title 3FF5 (1) INTERVAL NOVEMBER 2005	DTS-SAWS-H101	Ice Chest No. Temp.
Shipped To (Lab) PNNL Building 325	Method of Shipment Govt Truck	Bill of Lading/Air Bill No.
Protocol RCRA	Priority: 45 Days	Offsite Property No.

POSSIBLE SAMPLE HAZARDS/REMARKS
** **

SPECIAL INSTRUCTIONS Hold Time Total Activity Exemption: Yes ☑ No ☐

Sample No.	Lab ID	*	Date	Time	No/Type Container	Sample Analysis	Preservative
B1FRB3 (F)		W	3/15/06	1030	1x500-mL Nalgene	Uranium by ICPMS; 6010_METALS_ICP: Chromium (1)	HNO3 to pH <2(ULTREX)
B1FRB4		W	3/15/06	1030	1x500-mL P	IC Anions - 300.0; 310.1_ALKALINITY: Alkalinity (1); Generic Testing	Cool 4C

Relinquished By	Print	Sign	Date/Time	Received By	Print	Sign	Date/Time
L.C. Petersen		L Petersen	3-15-06 ~~3-16-06/0700~~	DURATEK J. G. HOGAN		J Hogan	MAR 16 2006 0700
DURATEK J. G. HOGAN		J Hogan	MAR 16 2006 1500	Eric Clayton			MAR 16 2006 1500
Relinquished By			Date/Time	Received By			Date/Time
Relinquished By			Date/Time	Received By			Date/Time

Matrix *

S	= Soil		DS	=	Drum Solid
SE	= Sediment		DL	=	Drum Liqui
SO	= Solid		T	=	Tissue
SL	= Sludge		WI	=	Wine
W	= Water		L	=	Liquid
O	= Oil		V	=	Vegetation
A	= Air		X	=	Other

FINAL SAMPLE DISPOSITION	Disposal Method (e.g., Return to customer, per lab procedure, used in process)	Disposed By	Date/Time

F.44

PNNL

CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST

C.O.C. # X06-007-11

Page 1 of 1

Collector: L.C. Peterson	Contact/Requester: Dot Stewart	Telephone No.: 509-376-5056 MSIN FAX
SAF No.: X06-007	Sampling Origin: Hanford Site	Purchase Order/Charge Code
Project Title: 3FF5 (1) INTERVAL NOVEMBER 2005	DTS-SAWS-H101	Ice Chest No. Temp.
Shipped To (Lab): PNNL Building 325	Method of Shipment: Govt Truck	Bill of Lading/Air Bill No.
Protocol: RCRA	Priority: 45 Days	Offsite Property No.

POSSIBLE SAMPLE HAZARDS/REMARKS
** **

SPECIAL INSTRUCTIONS Hold Time Total Activity Exemption: Yes ☑ No ☐

Sample No.	Lab ID	*	Date	Time	No/Type Container	Sample Analysis	Preservative
B1FR87 (F)		W	3/16	1520	1x500-mL Nalgene	Uranium by ICPMS; 6010_METALS_ICP: Chromium (1)	HNO3 to pH <2(ULTREX)
B1FR88		W	3/16	1520	1x500-mL P	IC Anions - 300.0; 310.1_ALKALINITY: Alkalinity (1); Generic Testing	Cool 4C

Relinquished By (Print / Sign)	Date/Time	Received By (Print / Sign)	Date/Time
L.C. Peterson / LPeterson	3/16/06 1530	STORED IN COOLER # SAWS-371	3-16-06 1530
COOLER # SAWS-371	3-17-06 0700	DURATEK J. G. HOGAN / JHogan	MAR 17 2006 0700
DURATEK J. G. HOGAN / JHogan	MAR 17 2006	CF Brown / Chris F. Brown	MAR 17 2006 1415

Matrix *

S = Soil		DS = Drum Solid	
SE = Sediment		DL = Drum Liqui	
SO = Solid		T = Tissue	
SL = Sludge		WI = Wipe	
W = Water		L = Liquid	
O = Oil		V = Vegetation	
A = Air		X = Other	

FINAL SAMPLE DISPOSITION — Disposal Method (e.g., Return to customer, per lab procedure, used in process) — Disposed By — Date/Time

F.45

PNNL	CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST	C.O.C. # X06-007-14 Page 1 of 1

Collector: L.C. Petersen	Contact/Requester: Dot Stewart	Telephone No.: 509-376-5056 MSIN FAX
SAF No.: X06-007	Sampling Origin: Hanford Site	Purchase Order/Charge Code
Project Title: 3FF5 (1) INTERVAL NOVEMBER 2005	DTS-SAWS-H 101	Ice Chest No. Temp.
Shipped To (Lab): PNNL Building 325	Method of Shipment: Govt Truck	Bill of Lading/Air Bill No.
Protocol: RCRA	Priority: 45 Days	Offsite Property No.

POSSIBLE SAMPLE HAZARDS/REMARKS
** **

SPECIAL INSTRUCTIONS Hold Time Total Activity Exemption: Yes ☑ No ☐

Sample No.	Lab ID	*	Date	Time	No/Type Container	Sample Analysis	Preservative
B1FRB7 (F)		W	3/20/06	1033	1x500-mL Nalgene	Uranium by ICPMS; 6010_METALS_ICP: Chromium (1)	HNO3 to pH <2(ULTREX)
B1FRB8		W	3/20/06	1033	1x500-mL P	IC Anions - 300.0; 310.1_ALKALINITY: Alkalinity (1); Generic Testing	Cool 4C

Relinquished By (Print / Sign)	Date/Time	Received By (Print / Sign)	Date/Time
L.C. Petersen / LPetersen	3/20/06 1100	COOLER # SAWS 371	3-20-06 1100
COOLER # SAWS-371	MAR 2 1 2006 0700	DURATEK J. G. HOGAN / JHogan	MAR 2 1 2006 0700
DURATEK J. G. HOGAN / JHogan	MAR 2 1 2006 1500	[signature]	MAR 2 1 2006 1500

Matrix *

S = Soil		DS = Drum Solid	
SE = Sediment		DL = Drum Liqui	
SO = Solid		T = Tissue	
SL = Sludge		WI = Wipe	
W = Water		L = Liquid	
O = Oil		V = Vegetation	
A = Air		X = Other	

FINAL SAMPLE DISPOSITION	Disposal Method (e.g., Return to customer, per lab procedure, used in process)	Disposed By	Date/Time

F.46

PNNL	CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST	C.O.C. # X06-007-17
		Page 1 of 1

Collector L.C. Petersen	Contact/Requester Dot Stewart	Telephone No. 509-376-5056 MSIN FAX
SAF No. X06-007	Sampling Origin Hanford Site	Purchase Order/Charge Code
Project Title 3FF5 (1) INTERVAL NOVEMBER 2005	DTS-SAWS-H101	Ice Chest No. Temp.
Shipped To (Lab) PNNL Building 325	Method of Shipment Govt Truck	Bill of Lading/Air Bill No.
Protocol RCRA	Priority: 45 Days	Offsite Property No.

POSSIBLE SAMPLE HAZARDS/REMARKS
** **

SPECIAL INSTRUCTIONS Hold Time Total Activity Exemption: Yes ☑ No ☐

Sample No.	Lab ID	*	Date	Time	No/Type Container	Sample Analysis	Preservative
B1FR83 (F)		W	3/21/06	0830	1x500-mL Nalgene	Uranium by ICPMS; 6010_METALS_ICP: Chromium (1)	HNO3 to pH <2(ULTREX)
B1FR84		W	3/21/06	0830	1x500-mL P	IC Anions - 300.0; 310.1_ALKALINITY: Alkalinity (1); Generic Testing	Cool 4C

Relinquished By (Print / Sign)	Date/Time	Received By (Print / Sign)	Date/Time
L.C. Petersen / LPetersen	3/21/06 0900	COOLER # SAWS-371	3-21-06 0900
COOLER # SAWS-371	MAR 22 2006 0700	DURATEK J.G. HOGAN / J Hogan	MAR 22 2006 0700
DURATEK J.G. HOGAN / J Hogan	MAR 22 2006 1920	Eric Clayton	MAR 22 2006 1920

Matrix *
S = Soil; SE = Sediment; SO = Solid; SL = Sludge; W = Water; O = Oil; A = Air; DS = Drum Solid; DL = Drum Liqui; T = Tissue; WI = Wipe; L = Liquid; V = Vegetation; X = Other

FINAL SAMPLE DISPOSITION	Disposal Method (e.g., Return to customer, per lab procedure, used in process)	Disposed By	Date/Time

PNNL	CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST	C.O.C. # X06-007-20 Page 1 of 1

Collector L. C. Petersen	Contact/Requester Dot Stewart	Telephone No. 509-376-5056 MSIN FAX
SAF No. X06-007	Sampling Origin Hanford Site	Purchase Order/Charge Code
Project Title 3FF5 (1) INTERVAL NOVEMBER 2005	DTS-SAWS-H101	Ice Chest No. Temp.
Shipped To (Lab) PNNL Building 325	Method of Shipment Govt Truck	Bill of Lading/Air Bill No.
Protocol RCRA	Priority: 45 Days	Offsite Property No.

POSSIBLE SAMPLE HAZARDS/REMARKS	SPECIAL INSTRUCTIONS Hold Time Total Activity Exemption: Yes ☑ No ☐
** **	

Sample No.	Lab ID	*	Date	Time	No/Type Container	Sample Analysis	Preservative
B1FR95 (F)		W	3/22/06	0715	1x500-mL Nalgene	Uranium by ICPMS; 6010_METALS_ICP: Chromium (1)	HNO3 to pH <2(ULTREX)
B1FR96		W	3/22/06	0715	1x500-mL P	IC Anions - 300.0; 310.1_ALKALINITY: Alkalinity (1); Generic Testing	Cool 4C

Relinquished By (Print / Sign)	Date/Time	Received By (Print / Sign)	Date/Time
L. C. Petersen / L Petersen	3/22/06 1045	DURATEK J. G. HOGAN / J G Hogan	MAR 22 2006 1045
DURATEK J. G. HOGAN / J G Hogan	MAR 22 2006 1420	Eric Clayton / E C	1420 MAR 22 2006
Relinquished By	Date/Time	Received By	Date/Time
Relinquished By	Date/Time	Received By	Date/Time

Matrix *

S = Soil	DS = Drum Solid
SE = Sediment	DL = Drum Liquid
SO = Solid	T = Tissue
SL = Sludge	WI = Wine
W = Water	L = Liquid
O = Oil	V = Vegetation
A = Air	X = Other

FINAL SAMPLE DISPOSITION	Disposal Method (e.g., Return to customer, per lab procedure, used in process)	Disposed By	Date/Time

PNNL

CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST

C.O.C. # X06-007-23

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Collector L.C. Petersen	Contact/Requester Dot Stewart	Telephone No. 509-376-5056 MSIN FAX
SAF No. X06-007	Sampling Origin Hanford Site	Purchase Order/Charge Code
Project Title 3FF5 (1) INTERVAL NOVEMBER 2005	DTS-SAWS-H101	Ice Chest No. Temp.
Shipped To (Lab) PNNL Building 325	Method of Shipment Govt Truck	Bill of Lading/Air Bill No.
Protocol RCRA	Priority: 45 Days	Offsite Property No.

POSSIBLE SAMPLE HAZARDS/REMARKS
** **

SPECIAL INSTRUCTIONS Hold Time Total Activity Exemption: Yes ☑ No ☐

Sample No.	Lab ID	*	Date	Time	No/Type Container	Sample Analysis	Preservative
B1FR79 (F)		W	3/22/06	1405	1x500-mL Nalgene	Uranium by ICPMS; 6010_METALS_ICP: Chromium (1)	HNO3 to pH <2(ULTREX)
B1FR80		W	3/22/06	1405	1x500-mL P	IC Anions - 300.0; 310.1_ALKALINITY: Alkalinity (1); Generic Testing	Cool 4C

Relinquished By (Print / Sign)	Date/Time	Received By (Print / Sign)	Date/Time
L.C. Petersen / L.C. Petersen	3-22-06 1430	COOLER # SAWS-371	3-22-06 1430
COOLER # SAWS-371	MAR 23 2006 0645	DURATEK J. G. HOGAN / J G Hogan	MAR 23 2006 0645
DURATEK J. G. HOGAN / J G Hogan	MAR 23 2006 1500	Steven Baum / Steven Baum	MAR 23 2006 1500
Relinquished By	Date/Time	Received By	Date/Time

Matrix *

S = Soil	DS = Drum Solid		
SE = Sediment	DL = Drum Liquid		
SO = Solid	T = Tissue		
SL = Sludge	WI = Wipe		
W = Water	L = Liquid		
O = Oil	V = Vegetation		
A = Air	X = Other		

FINAL SAMPLE DISPOSITION	Disposal Method (e.g., Return to customer, per lab procedure, used in process)	Disposed By	Date/Time

PNNL

CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST

C.O.C. # **X06-007-26**

Page 1 of 1

Collector L. C. Petersen	Contact/Requester Dot Stewart	Telephone No. 509-376-5056 MSIN FAX
SAF No. X06-007	Sampling Origin Hanford Site	Purchase Order/Charge Code
Project Title 3FF5 (1) INTERVAL NOVEMBER 2005	DTS-SAWS-H101	Ice Chest No. Temp.
Shipped To (Lab) PNNL Building 325	Method of Shipment Govt Truck	Bill of Lading/Air Bill No.
Protocol RCRA	Priority: 45 Days	Offsite Property No.

POSSIBLE SAMPLE HAZARDS/REMARKS
** **

SPECIAL INSTRUCTIONS Hold Time Total Activity Exemption: Yes ☑ No ☐

Sample No.	Lab ID	*	Date	Time	No/Type Container	Sample Analysis	Preservative
B1FR31 (F)		W	3/23/06	1235	1x500-mL Nalgene	Uranium by ICPMS; 6010_METALS_ICP: Chromium (1)	
B1FR32		W	3/23/06	1235	1x500-mL P	IC Anions - 300.0; 310.1_ALKALINITY: Alkalinity (1); Generic Testing	Cool 4C

Relinquished By (Print / Sign)	Date/Time	Received By (Print / Sign)	Date/Time
L.C. Petersen / LPetersen	3-23-06 1300	DURATEK J. G. HOGAN / J7Hogan	MAR 23 2006 1300
DURATEK J. G. HOGAN / J7Hogan	MAR 23 2006 1500	Steven Baum / [signature]	MAR 23 2006 1500

Matrix *
S = Soil; SE = Sediment; SO = Solid; SL = Sludge; W = Water; O = Oil; A = Air; DS = Drum Solid; DL = Drum Liqui; T = Tissue; WI = Wine; L = Liquid; V = Vegetation; X = Other

FINAL SAMPLE DISPOSITION	Disposal Method (e.g., Return to customer, per lab procedure, used in process)	Disposed By	Date/Time

F.50

Well C5000

PNNL	CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST	C.O.C. # X06-007-32
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Collector Jake Horner	Contact/Requester Dot Stewart	Telephone No. 509-376-5056 MSIN FAX
SAF No. X06-007	Sampling Origin Hanford Site	Purchase Order/Charge Code
Project Title 3FF5 (1) INTERVAL NOVEMBER 2005		Ice Chest No. SAWS 999 Temp.
Shipped To (Lab) PNNL Building 325	Method of Shipment Govt Truck	Bill of Lading/Air Bill No. N/A
Protocol RCRA	Priority: 45 Days	Offsite Property No. N/A

POSSIBLE SAMPLE HAZARDS/REMARKS
** **

SPECIAL INSTRUCTIONS Hold Time Total Activity Exemption: Yes ☑ No ☐

Sample No.	Lab ID	*	Date	Time	No/Type Container	Sample Analysis	Preservative
B1FR35 (F)		W	4-3-06	1550	1x500-mL Nalgene	Uranium by ICPMS; 6010_METALS_ICP: Chromium (1)	ULTREX HNO_3
B1FR36		W	4-3-06	1550	1x500-mL P	IC Anions - 300.0; 310.1_ALKALINITY: Alkalinity (1); Generic Testing	Cool 4C

Relinquished By (Print / Sign)	Date/Time	Received By (Print / Sign)	Date/Time
Jake Horner / [signature]	4-4-06 1200	KB Hulse / [signature]	4-4-06 1200
KB Hulse / [signature]	4-5-06 10:30	M. Valenta / M. Valenta	10:30 4/5/06

Matrix *

S = Soil	DS = Drum Solid		
SE = Sediment	DL = Drum Liquid		
SO = Solid	T = Tissue		
SL = Sludge	WI = Wipe		
W = Water	L = Liquid		
O = Oil	V = Vegetation		
A = Air	X = Other		

FINAL SAMPLE DISPOSITION	Disposal Method (e.g., Return to customer, per lab procedure, used in process)	Disposed By	Date/Time

F.51

PNNL

CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST

C.O.C. # X06-007-33

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Collector Jake Horner	Contact/Requester Dot Stewart	Telephone No. 509-376-5056 MSIN FAX
SAF No. X06-007	Sampling Origin Hanford Site	Purchase Order/Charge Code
Project Title 3FF5 (1) INTERVAL NOVEMBER 2005		Ice Chest No. Guss-6 Temp.
Shipped To (Lab) Severn Trent St. Louis	Method of Shipment Govt Truck	Bill of Lading/Air Bill No. 792704466282
Protocol RCRA	Priority: 45 Days	Offsite Property No. N/A

POSSIBLE SAMPLE HAZARDS/REMARKS
** **

SPECIAL INSTRUCTIONS Hold Time Total Activity Exemption: Yes ☑ No ☐

Sample No.	Lab ID	*	Date	Time	No/Type Container	Sample Analysis	Preservative
B1FR38		W	4-3-06	1550	4x40-mL aGs*	8260_VOA_GCMS: List-2 (28)	HCl or H2SO4 to pH <2 Cool 4C
B1FR38		W	4-3-06	1550	1x20-mL P	Activity Scan	None

Relinquished By (Print)	Sign	Date/Time	Received By (Print)	Sign	Date/Time
Jake Horner	[signature]	4-4-06 1200	KB Hulse	[signature]	4-4-06 1200
KB Hulse	[signature]	4-4-06 1400	FED EX		

Matrix *

S = Soil	SE = Sediment	DS = Drum Solid	DL = Drum Liqui
SO = Solid	SL = Sludge	T = Tissue	WI = Wipe
W = Water	O = Oil	L = Liquid	V = Vegetation
A = Air		X = Other	

FINAL SAMPLE DISPOSITION — Disposal Method (e.g., Return to customer, per lab procedure, used in process) | Disposed By | Date/Time

PNNL

CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST

C.O.C. # **X06-007-38**

Page 1 of 1

Collector: Jake Horner	Contact/Requester: Dot Stewart	Telephone No.: 509-376-5056 MSIN FAX
SAF No.: X06-007	Sampling Origin: Hanford Site	Purchase Order/Charge Code
Project Title: 3FF5 (1) INTERVAL NOVEMBER 2005		Ice Chest No. SAWS 999 Temp.
Shipped To (Lab): PNNL Building 325	Method of Shipment: Govt Truck	Bill of Lading/Air Bill No. N/A
Protocol: RCRA	Priority: 45 Days	Offsite Property No. N/A

POSSIBLE SAMPLE HAZARDS/REMARKS
** **

SPECIAL INSTRUCTIONS Hold Time Total Activity Exemption: Yes ☑ No ☐

Sample No.	Lab ID	*	Date	Time	No/Type Container	Sample Analysis	Preservative
B1FR39 (F)		W	4-4-06	0737	1x500-mL Nalgene	Uranium by ICPMS; 6010_METALS_ICP: Chromium (1)	HNO3 to pH <2(ULTREX)
B1FR40		W	4-4-06	0737	1x500-mL P	IC Anions - 300.0; 310.1_ALKALINITY: Alkalinity (1); Generic Testing	Cool 4C

Relinquished By (Print / Sign)	Date/Time	Received By (Print / Sign)	Date/Time
Jake Horner / Jake Horner	4-4-06 1205	KB Hulse / KB Hulse	4-4-06 1200
KB Hulse / KB Hulse	4-5-06 10:30	M Valenta / M-Valenta	10:30 4/6/06

Matrix *

S = Soil	SE = Sediment	SO = Solid	SL = Sludge
W = Water	O = Oil	A = Air	DS = Drum Solid
DL = Drum Liquid	T = Tissue	WI = Wipe	L = Liquid
V = Vegetation	X = Other		

FINAL SAMPLE DISPOSITION | Disposal Method (e.g., Return to customer, per lab procedure, used in process) | Disposed By | Date/Time

F.52

PNNL	CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST	C.O.C. # X06-007-39
		Page 1 of 1

Collector J. Horner	Contact/Requester Dot Stewart	Telephone No. 509-376-5056 MSIN FAX
SAF No. X06-007	Sampling Origin Hanford Site	Purchase Order/Charge Code
Project Title 3FF5 (1) INTERVAL NOVEMBER 2005		Ice Chest No. GASS-6 Temp.
Shipped To (Lab) Severn Trent St. Louis	Method of Shipment Govt Truck	Bill of Lading/Air Bill No. 792704466282
Protocol RCRA	Priority: 45 Days	Offsite Property No. N/A

POSSIBLE SAMPLE HAZARDS/REMARKS	SPECIAL INSTRUCTIONS	Hold Time	Total Activity Exemption: Yes ☑ No ☐
** **			

Sample No.	Lab ID	*	Date	Time	No/Type Container	Sample Analysis	Preservative
B1FR42		W	4-4-06	0737	4x40-mL aGs*	8260_VOA_GCMS: List-2 (26)	HCl or H2SO4 to pH <2 Cool 4C
B1FR42		W	4-4-06	0737	1x20-mL P	Activity Scan	None

Relinquished By (Print / Sign)	Date/Time	Received By (Print / Sign)	Date/Time
Jake Horner / [signature]	4-4-06 1200	KB Hulse / [signature]	4-4-06 1200
KB Hulse / [signature]	4-4-06 1400	FED EX	

Matrix *

S	= Soil		DS	=	Drum Solid
SE	= Sediment		DL	=	Drum Liquid
SO	= Solid		T	=	Tissue
SL	= Sludge		WI	=	Wipe
W	= Water		L	=	Liquid
O	= Oil		V	=	Vegetation
A	= Air		X	=	Other

FINAL SAMPLE DISPOSITION	Disposal Method (e.g., Return to customer, per lab procedure, used in process)	Disposed By	Date/Time

PNNL	CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST	C.O.C. # X06-007-59
		Page 1 of 1

Collector Jake Horner	Contact/Requester Dot Stewart	Telephone No. 509-376-5056 MSIN FAX
SAF No. X06-007	Sampling Origin Hanford Site	Purchase Order/Charge Code
Project Title 3EF5 (1) INTERVAL NOVEMBER 2005		Ice Chest No. SAWS 999 Temp.
Shipped To (Lab) PNNL Building 325	Method of Shipment Govt Truck	Bill of Lading/Air Bill No. N/A
Protocol RCRA	Priority: 45 Days	Offsite Property No. N/A

POSSIBLE SAMPLE HAZARDS/REMARKS	SPECIAL INSTRUCTIONS Hold Time Total Activity Exemption: Yes ☑ No ☐
** **	

Sample No.	Lab ID	*	Date	Time	No/Type Container	Sample Analysis	Preservative
B1FR43 (F)		W	4-4-06	1115	1x500-mL Nalgene	Uranium by ICPMS; 6010_METALS_ICP: Chromium (1)	HNO3 to pH <2(ULTREX)
B1FR44		W	4-4-06	1115	1x500-mL P	IC Anions - 300.0; 310.1_ALKALINITY: Alkalinity (1); Generic Testing	Cool 4C

Relinquished By (Print / Sign)	Date/Time	Received By (Print / Sign)	Date/Time
Jake Horner / Jake Horner	4-5-06 0950	KB Hulse / KB Hulse	4-5-06 0950
KB Hulse / KB Hulse	4-5-06 10:30	M. Valenta / M. Valenta	4/5/06 10:30

Matrix *

S = Soil	SE = Sediment	DS = Drum Solid	DL = Drum Liqui
SO = Solid	SL = Sludge	T = Tissue	WI = Wipe
W = Water	O = Oil	L = Liquid	V = Vegetation
A = Air		X = Other	

FINAL SAMPLE DISPOSITION	Disposal Method (e.g., Return to customer, per lab procedure, used in process)	Disposed By	Date/Time

F.54

F.55

PNNL	CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST	C.O.C. # X06-007-60 Page 1 of 1

Collector Jake Horner	Contact/Requester Dot Stewart	Telephone No. 509-376-5056 MSIN FAX
SAF No. X06-007	Sampling Origin Hanford Site	Purchase Order/Charge Code
Project Title 3FF5 (1) INTERVAL NOVEMBER 2005		Ice Chest No. SAWS 03 Temp.
Shipped To (Lab) Severn Trent St. Louis	Method of Shipment Govt Truck	Bill of Lading/Air Bill No. 7920 6272 9420
Protocol RCRA	Priority: 45 Days	Offsite Property No. N/A

POSSIBLE SAMPLE HAZARDS/REMARKS	SPECIAL INSTRUCTIONS Hold Time Total Activity Exemption: Yes ☑ No ☐
** **	

Sample No.	Lab ID	*	Date	Time	No/Type Container	Sample Analysis	Preservative
B1FR46		W	4-4-06	1115	4x40-mL aGs*	8260_VOA_GCMS: List-2 (26)	HCl or H2SO4 to pH <2 Cool 4C
B1FR46		W	4-4-06	1115	1x20-mL P	Activity Scan	None

Relinquished By (Print / Sign)	Date/Time	Received By (Print / Sign)	Date/Time
Jake Horner / Jake Horner	4-5-06 0950	K.B. HULSE / KB Hulse	4-5-06 0950
K.B. HULSE / KB Hulse	4-5-06 1400	FED EX	

Matrix *

S = Soil	SE = Sediment	DS = Drum Solid	DL = Drum Liqui
SO = Solid	SL = Sludge	T = Tissue	WI = Wipe
W = Water	O = Oil	L = Liquid	V = Vegetation
A = Air		X = Other	

FINAL SAMPLE DISPOSITION	Disposal Method (e.g., Return to customer, per lab procedure, used in process)	Disposed By	Date/Time

F.56

PNNL	CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST	C.O.C. # X06-007-56
		Page 1 of 1

Collector Jake Horner	Contact/Requester Dot Stewart	Telephone No. 509-376-5056 MSIN FAX
SAF No. X06-007	Sampling Origin Hanford Site	Purchase Order/Charge Code
Project Title 3FF5 (1) INTERVAL NOVEMBER 2005		Ice Chest No. SAWS-999 Temp.
Shipped To (Lab) PNNL Building 325	Method of Shipment Govt Truck	Bill of Lading/Air Bill No. N/A
Protocol RCRA	Priority: 45 Days	Offsite Property No. N/A

POSSIBLE SAMPLE HAZARDS/REMARKS
** **

SPECIAL INSTRUCTIONS Hold Time Total Activity Exemption: Yes ☑ No ☐

Sample No.	Lab ID	*	Date	Time	No/Type Container	Sample Analysis	Preservative
B1FR47 (F)		W	4-5-06	0800	1x500-mL Nalgene	Uranium by ICPMS; 6010_METALS_ICP: Chromium (1)	HNO3 to pH <2(ULTREX)
B1FR48		W	4-5-06	0800	1x500-mL P	IC Anions - 300.0; 310.1_ALKALINITY: Alkalinity (1); Generic Testing	Cool 4C

Relinquished By (Print / Sign)	Date/Time	Received By (Print / Sign)	Date/Time
Jake Horner / Jake Horner	4-5-06 0950	KB Hulse / KB Hulse	4-5-06 0950
KB Hulse / KB Hulse	4-5-06 10:30	M. Valenta / M. Valenta	4/5/06 10:30

Matrix *

S = Soil		DS = Drum Solid	
SE = Sediment		DL = Drum Liquid	
SO = Solid		T = Tissue	
SL = Sludge		WI = Wipe	
W = Water		L = Liquid	
O = Oil		V = Vegetation	
A = Air		X = Other	

FINAL SAMPLE DISPOSITION	Disposal Method (e.g., Return to customer, per lab procedure, used in process)	Disposed By	Date/Time

F.57

PNNL	CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST	C.O.C. # X06-007-57 Page 1 of 1

Collector Jake Horner	Contact/Requester Dot Stewart	Telephone No. 509-376-5056 MSIN FAX
SAF No. X06-007	Sampling Origin Hanford Site	Purchase Order/Charge Code
Project Title 3FF5 (1) INTERVAL NOVEMBER 2005		Ice Chest No. SAWS-03 8 Temp.
Shipped To (Lab) Severn Trent St. Louis	Method of Shipment Govt Truck	Bill of Lading/Air Bill No. 7920 6272 9420
Protocol RCRA	Priority: 45 Days	Offsite Property No. N/A

POSSIBLE SAMPLE HAZARDS/REMARKS
** **

SPECIAL INSTRUCTIONS Hold Time Total Activity Exemption: Yes ☑ No ☐

Sample No.	Lab ID	*	Date	Time	No/Type Container	Sample Analysis	Preservative
B1FR50		W	4-5-06	0800	4x40-mL aGs*	8260_VOA_GCMS: List-2 (26)	HCl or H2SO4 to pH <2 Cool 4C
B1FR50		W	4-5-06	0800	1x20-mL P	Activity Scan	None

Relinquished By (Print / Sign)	Date/Time	Received By (Print / Sign)	Date/Time
Jake Horner / Jake Horner	4-5-06 0950	K.B. HULSE / KB Hulse	4-5-06 0950
K.B. HULSE / KB Hulse	4-5-06 1400	FED EX	

Matrix *
S = Soil; SE = Sediment; SO = Solid; SL = Sludge; W = Water; O = Oil; A = Air; DS = Drum Solid; DL = Drum Liqui; T = Tissue; WI = Wine; L = Liquid; V = Vegetation; X = Other

FINAL SAMPLE DISPOSITION	Disposal Method (e.g., Return to customer, per lab procedure, used in process)	Disposed By	Date/Time

PNNL	CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST	C.O.C. # X06-007-53 Page 1 of 1

Collector Jake Horner	Contact/Requester Dot Stewart	Telephone No. 509-376-5056 MSIN FAX
SAF No. X06-007	Sampling Origin Hanford Site	Purchase Order/Charge Code
Project Title 3FF5 (1) INTERVAL NOVEMBER 2005	DTS-SAWS-H101	Ice Chest No. SAWS 999 Temp.
Shipped To (Lab) PNNL Building 325	Method of Shipment Govt Truck	Bill of Lading/Air Bill No. N/A
Protocol RCRA	Priority: 45 Days	Offsite Property No. N/A

POSSIBLE SAMPLE HAZARDS/REMARKS
** **

SPECIAL INSTRUCTIONS Hold Time Total Activity Exemption: Yes ☑ No ☐

Sample No.	Lab ID	*	Date	Time	No/Type Container	Sample Analysis	Preservative
B1FR51 (F)		W	4-5-06	1325	1x500-mL Nalgene	Uranium by ICPMS; 6010_METALS_ICP: Chromium (1)	HNO3 to pH <2(ULTREX)
B1FR52		W	4-5-06	1325	1x500-mL P	IC Anions - 300.0; 310.1_ALKALINITY: Alkalinity (1); Generic Testing	Cool 4C

Relinquished By (Print / Sign)	Date/Time	Received By (Print / Sign)	Date/Time
Jake Horner / [signature]	APR 0 6 2006 0645	DURATEK J. G. HOGAN / [signature]	APR 0 6 2006 0645
DURATEK J. G. HOGAN / [signature]	APR 0 6 2006 1130	KB Hulse / [signature]	APR 0 6 2006 1130
KB Hulse / [signature]	4-6-06 1250	CF Brown / [signature]	4/6/06 1250

Matrix *
S = Soil; SE = Sediment; SO = Solid; SL = Sludge; W = Water; O = Oil; A = Air; DS = Drum Solid; DL = Drum Liquid; T = Tissue; WI = Wipe; L = Liquid; V = Vegetation; X = Other

FINAL SAMPLE DISPOSITION	Disposal Method (e.g., Return to customer, per lab procedure, used in process)	Disposed By	Date/Time

F.58

PNNL	CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST 16lbs	C.O.C. # X06-007-54 Page 1 of 1

Collector Horner, Jake	Contact/Requester Dot Stewart	Telephone No. 509-376-5056 MSIN FAX
SAF No. X06-007	Sampling Origin Hanford Site	Purchase Order/Charge Code
Project Title 3FF5 (1) INTERVAL NOVEMBER 2005	DTS-SAWS-H101	Ice Chest No. 557n1 Temp.
Shipped To (Lab) Severn Trent St. Louis	Method of Shipment Govt Truck	Bill of Lading/Air Bill No. 7927-0684-3995
Protocol RCRA	Priority: 45 Days	Offsite Property No.

POSSIBLE SAMPLE HAZARDS/REMARKS
** **

SPECIAL INSTRUCTIONS Hold Time Total Activity Exemption: Yes ☑ No ☐

Sample No.	Lab ID	*	Date	Time	No/Type Container	Sample Analysis	Preservative
B1FR54		W	4-5-06	1325	4x40-mL aGs*	8260_VOA_GCMS: List-2 (26)	HCl or H2SO4 to pH <2 Cool 4C
B1FR54		W	4-5-06	1325	1x20-mL P	Activity Scan	None

Relinquished By (Print / Sign)	Date/Time	Received By (Print / Sign)	Date/Time
Jake Horner / Jake Horner	APR 0 6 2006 0645	DURATEK J. G. HOGAN / J G Hogan	APR 0 6 2006 0645
DURATEK J. G. HOGAN / J G Hogan	APR 0 6 2006 1400	FED EX	

Matrix *

S = Soil		DS = Drum Solid	
SE = Sediment		DL = Drum Liquid	
SO = Solid		T = Tissue	
SL = Sludge		WI = Wipe	
W = Water		L = Liquid	
O = Oil		V = Vegetation	
A = Air		X = Other	

FINAL SAMPLE DISPOSITION	Disposal Method (e.g., Return to customer, per lab procedure, used in process)	Disposed By	Date/Time

PNNL	CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST	C.O.C. # X06-007-50 Page 1 of 1

Collector: Jake Horner	Contact/Requester: Dot Stewart	Telephone No. 509-376-5056 MSIN FAX
SAF No. X06-007	Sampling Origin: Hanford Site	Purchase Order/Charge Code
Project Title: 3FF5 (1) INTERVAL NOVEMBER 2005		Ice Chest No. SAWS-999 Temp.
Shipped To (Lab): PNNL Building 325	Method of Shipment: Govt Truck	Bill of Lading/Air Bill No. N/A
Protocol: RCRA	Priority: 45 Days	Offsite Property No. N/A

POSSIBLE SAMPLE HAZARDS/REMARKS
** **

SPECIAL INSTRUCTIONS Hold Time Total Activity Exemption: Yes ☑ No ☐

Sample No.	Lab ID	*	Date	Time	No/Type Container	Sample Analysis	Preservative
B1FR55 (F)		W	4-6-06	0730	1x500-mL Nalgene	Uranium by ICPMS; 6010_METALS_ICP: Chromium (1)	HNO3 to pH <2(ULTREX)
B1FR56		W	4-6-06	0730	1x500-mL P	IC Anions - 300.0; 310.1_ALKALINITY: Alkalinity (1); Generic Testing	Cool 4C

Relinquished By (Print / Sign)	Date/Time	Received By (Print / Sign)	Date/Time
Jake Horner / Jake Horner	4-6-06 1215	KB Hulse / KB Hulse	4-6-06 1215
KB Hulse / KB Hulse	4-6-06 1230	CF Bean / Chas F. Bean	4/6/06 12:30

Matrix *
S = Soil
SE = Sediment
SO = Solid
SL = Sludge
W = Water
O = Oil
A = Air
DS = Drum Solid
DL = Drum Liqui
T = Tissue
WI = Wine
L = Liquid
V = Vegetation
X = Other

FINAL SAMPLE DISPOSITION	Disposal Method (e.g., Return to customer, per lab procedure, used in process)	Disposed By	Date/Time

PNNL	CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST	C.O.C. # X06-007-51 Page 1 of 1

Collector: Jake Horner	Contact/Requester: Dot Stewart	Telephone No.: 509-376-5056 MSIN FAX
SAF No.: X06-007	Sampling Origin: Hanford Site	Purchase Order/Charge Code
Project Title: 3FF5 (1) INTERVAL NOVEMBER 2005		Ice Chest No. SST 1 Temp.
Shipped To (Lab): Severn Trent St. Louis	Method of Shipment: Govt Truck	Bill of Lading/Air Bill No. 7927 0684 3995
Protocol: RCRA	Priority: 45 Days	Offsite Property No. N/A

POSSIBLE SAMPLE HAZARDS/REMARKS
** **

SPECIAL INSTRUCTIONS Hold Time Total Activity Exemption: Yes ☑ No ☐

Sample No.	Lab ID	*	Date	Time	No/Type Container	Sample Analysis	Preservative
B1FR58		W	4-6-06	0730	4x40-mL aGs*	8260_VOA_GCMS: List-2 (26)	HCl or H2SO4 to pH <2 Cool 4C
B1FR58		W	4-6-06	0730	1x20-mL P	Activity Scan	None

Relinquished By (Print / Sign)	Date/Time	Received By (Print / Sign)	Date/Time
Jake Horner / [signature]	4/6/06 1215	KB Hulse / [signature]	4-6-06 1215
KB Hulse / [signature]	4/6/06 1400	FED EX	

Matrix *

S = Soil		DS = Drum Solid	
SE = Sediment		DL = Drum Liqui	
SO = Solid		T = Tissue	
SL = Sludge		WI = Wipe	
W = Water		L = Liquid	
O = Oil		V = Vegetation	
A = Air		X = Other	

FINAL SAMPLE DISPOSITION	Disposal Method (e.g., Return to customer, per lab procedure, used in process)	Disposed By	Date/Time

PNNL

CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST

C.O.C. # X06-007-47

Page 1 of 1

Collector Jake Horner	Contact/Requester Dot Stewart	Telephone No. 509-376-5056 MSIN FAX
SAF No. X06-007	Sampling Origin Hanford Site	Purchase Order/Charge Code
Project Title 3FF5 (1) INTERVAL NOVEMBER 2005	DTS-SAWS-H101	Ice Chest No. Temp.
Shipped To (Lab) PNNL Building 325	Method of Shipment Govt Truck	Bill of Lading/Air Bill No.
Protocol RCRA	Priority: 45 Days	Offsite Property No.

POSSIBLE SAMPLE HAZARDS/REMARKS
** **

SPECIAL INSTRUCTIONS Hold Time Total Activity Exemption: Yes ☑ No ☐

Sample No.	Lab ID	*	Date	Time	No/Type Container	Sample Analysis	Preservative
B1FR59 (F)		W	4-7-06	0930	1x500-mL Nalgene	Uranium by ICPMS; 6010_METALS_ICP: Chromium (1)	HNO3 to pH <2(ULTREX)
B1FR60		W	4-7-06	0930	1x500-mL P	IC Anions - 300.0; 310.1_ALKALINITY: Alkalinity (1); Generic Testing	Cool 4C

Relinquished By (Print / Sign)	Date/Time	Received By (Print / Sign)	Date/Time
Jake Horner / Jake Horner	APR 07 2006 1000	STORED IN COOLER # 371	APR 07 2006 1000
REMOVED FROM COOLER # 371	APR 10 2006 0630	DURATEK J. G. HOGAN / J G Hogan	APR 10 2006 0630
DURATEK J. G. HOGAN / J G Hogan	APR 10 2006 1440	Steven Baum / Steven Baum	APR 10 2006 1440

Matrix *
S = Soil, SE = Sediment, SO = Solid, SL = Sludge, W = Water, O = Oil, A = Air, DS = Drum Solid, DL = Drum Liquid, T = Tissue, WI = Wipe, L = Liquid, V = Vegetation, X = Other

FINAL SAMPLE DISPOSITION	Disposal Method (e.g., Return to customer, per lab procedure, used in process)	Disposed By	Date/Time

F.62

F.63

PNNL

CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST

C.O.C. # X06-007-48

Page 1 of 1

Collector: Jake Horner	Contact/Requester: Dot Stewart	Telephone No. 509-376-5056 MSIN FAX
SAF No.: X06-007	Sampling Origin: Hanford Site	Purchase Order/Charge Code
Project Title: 3FF5 (1) INTERVAL NOVEMBER 2005	DTS-SAWS-H101	Ice Chest No. SAWS 466 Temp.
Shipped To (Lab): Severn Trent St. Louis	Method of Shipment: Govt Truck	Bill of Lading/Air Bill No. 7914 3973 4193
Protocol: RCRA	Priority: 45 Days	Offsite Property No.

POSSIBLE SAMPLE HAZARDS/REMARKS
** **

SPECIAL INSTRUCTIONS Hold Time Total Activity Exemption: Yes ☑ No ☐

Sample No.	Lab ID	*	Date	Time	No/Type Container	Sample Analysis	Preservative
B1FR62		W	4-7-06	0930	4x40-mL aGs*	8260_VOA_GCMS: List-2 (26)	HCl or H2SO4 to pH <2 Cool 4C
B1FR62		W	4-7-06	0930	1x20-mL P	Activity Scan	None

Relinquished By (Print / Sign)	Date/Time	Received By (Print / Sign)	Date/Time
Jake Horner / Jake Horner	APR 07 2006 1000	STORED IN COOLER # 371	APR 07 2006 1000
REMOVED FROM COOLER # 371	APR 10 2006 0630	DURATEK J. G. HOGAN / J G Hogan	APR 10 2006 0630
DURATEK J. G. HOGAN / J G Hogan	APR 10 2006 1300	FED EX	

Matrix *
S = Soil; SE = Sediment; SO = Solid; SL = Sludge; W = Water; O = Oil; A = Air; DS = Drum Solid; DL = Drum Liquid; T = Tissue; WI = Wipe; L = Liquid; V = Vegetation; X = Other

FINAL SAMPLE DISPOSITION	Disposal Method (e.g., Return to customer, per lab procedure, used in process)	Disposed By	Date/Time

PNNL

CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST

C.O.C. # X06-007-44

Page 1 of 1

Collector: Jake Horner	Contact/Requester: Dot Stewart	Telephone No.: 509-376-5056 MSIN FAX
SAF No.: X06-007	Sampling Origin: Hanford Site	Purchase Order/Charge Code
Project Title: 3FF5 (1) INTERVAL NOVEMBER 2005	DTS-SAWS-H101	Ice Chest No.: SAWS 999 Temp.
Shipped To (Lab): PNNL Building 325	Method of Shipment: Govt Truck	Bill of Lading/Air Bill No.: N/A
Protocol: RCRA	Priority: 45 Days	Offsite Property No.: N/A

POSSIBLE SAMPLE HAZARDS/REMARKS
** **

SPECIAL INSTRUCTIONS Hold Time Total Activity Exemption: Yes ☑ No ☐

Sample No.	Lab ID	*	Date	Time	No/Type Container	Sample Analysis	Preservative
B1FR63 (F)		W	4-10-06	1545	1x500-mL Nalgene	Uranium by ICPMS; 6010_METALS_ICP: Chromium (1)	HNO3 to pH <2(ULTREX)
B1FR64		W	4-10-06	1545	1x500-mL P	IC Anions - 300.0; 310.1_ALKALINITY: Alkalinity (1); Generic Testing	Cool 4C

Relinquished By (Print / Sign)	Date/Time	Received By (Print / Sign)	Date/Time
Jake Horner / Jake Horner	4/11/06 1330	KB Hulse / KB Hulse	4/11/06 1330
KB Hulse / KB Hulse	4/11/06 ~~1330~~ 1350	Cristian Fouw	4/11/06 13:50

Matrix *

S = Soil	SE = Sediment	SO = Solid	SL = Sludge
W = Water	O = Oil	A = Air	DS = Drum Solid
DL = Drum Liqui	T = Tissue	WI = Wipe	L = Liquid
V = Vegetation	X = Other		

FINAL SAMPLE DISPOSITION — Disposal Method (e.g., Return to customer, per lab procedure, used in process) — Disposed By — Date/Time

F.65

PNNL	CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST	C.O.C. # X06-007-45
		Page 1 of 1

Collector: Jake Horner	Contact/Requester: Dot Stewart	Telephone No.: 509-376-5056 MSIN FAX
SAF No.: X06-007	Sampling Origin: Hanford Site	Purchase Order/Charge Code
Project Title: 3FF5 (1) INTERVAL NOVEMBER 2005	DTS-SAWS-4101	Ice Chest No. SAWS 221 Temp.
Shipped To (Lab): Severn Trent St. Louis	Method of Shipment: Govt Truck	Bill of Lading/Air Bill No. 792761230 3662
Protocol: RCRA	Priority: 45 Days	Offsite Property No.

POSSIBLE SAMPLE HAZARDS/REMARKS	SPECIAL INSTRUCTIONS Hold Time Total Activity Exemption: Yes ☑ No ☐
** **	

Sample No.	Lab ID	*	Date	Time	No/Type Container	Sample Analysis	Preservative
B1FR66		W	4-10-06	1545	4x40-mL aGs*	8260_VOA_GCMS: List-2 (26)	HCl or H2SO4 to pH <2 Cool 4C
B1FR66		W	4-10-06	1545	1x20-mL P	Activity Scan	None

Relinquished By (Print / Sign)	Date/Time	Received By (Print / Sign)	Date/Time
Jake Horner / [signature]	4/11/06 1330	KB Hulse / [signature]	4/11/06 1330
KB Hulse / [signature]	4-12-06/1400	FED EX	

Matrix *

S	= Soil	DS	= Drum Solid
SE	= Sediment	DL	= Drum Liqui
SO	= Solid	T	= Tissue
SL	= Sludge	WI	= Wipe
W	= Water	L	= Liquid
O	= Oil	V	= Vegetation
A	= Air	X	= Other

FINAL SAMPLE DISPOSITION	Disposal Method (e.g., Return to customer, per lab procedure, used in process)	Disposed By	Date/Time

PNNL	CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST	C.O.C. # X06-007-41
		Page 1 of 1

Collector Jake Horner	Contact/Requester Dot Stewart	Telephone No. 509-376-5056 MSIN FAX
SAF No. X06-007	Sampling Origin Hanford Site	Purchase Order/Charge Code
Project Title 3FF5 (1) INTERVAL NOVEMBER 2005	DTS-SAWS-H101	Ice Chest No. Temp.
Shipped To (Lab) PNNL Building 325	Method of Shipment Govt Truck	Bill of Lading/Air Bill No.
Protocol RCRA	Priority: 45 Days	Offsite Property No.

POSSIBLE SAMPLE HAZARDS/REMARKS
** **

SPECIAL INSTRUCTIONS Hold Time Total Activity Exemption: Yes ☑ No ☐

Sample No.	Lab ID	*	Date	Time	No/Type Container	Sample Analysis	Preservative
B1FR67 (F)		W	4-11-06	1205	1x500-mL Nalgene	Uranium by ICPMS; 6010_METALS_ICP: Chromium (1)	HNO3 to pH <2(ULTREX)
B1FR68		W	4-11-06	1205	1x500-mL P	IC Anions - 300.0; 310.1_ALKALINITY: Alkalinity (1); Generic Testing	Cool 4C

Relinquished By (Print / Sign)	Date/Time	Received By (Print / Sign)	Date/Time
Jake Horner	0700 APR 12 2006	DURATEK J. G. HOGAN	0700 APR 12 2006
DURATEK J. G. HOGAN	1515 APR 12 2006	Eric Clayton	15:15 APR 12 2006
Relinquished By	Date/Time	Received By	Date/Time
Relinquished By	Date/Time	Received By	Date/Time

Matrix *

S = Soil	DS = Drum Solid		
SE = Sediment	DL = Drum Liqui		
SO = Solid	T = Tissue		
SL = Sludge	WI = Wipe		
W = Water	L = Liquid		
O = Oil	V = Vegetation		
A = Air	X = Other		

FINAL SAMPLE DISPOSITION	Disposal Method (e.g., Return to customer, per lab procedure, used in process)	Disposed By	Date/Time

PNNL	CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST	C.O.C. # X06-007-42 Page 1 of 1

Collector: Jake Horner	Contact/Requester: Dot Stewart	Telephone No. 509-376-5056 MSIN FAX
SAF No. X06-007	Sampling Origin: Hanford Site	Purchase Order/Charge Code
Project Title: 3FF5 (1) INTERVAL NOVEMBER 2005	DTS-SAWS-H101	Ice Chest No. SAWS-221 Temp.
Shipped To (Lab): Severn Trent St. Louis	Method of Shipment: Govt Truck	Bill of Lading/Air Bill No. 792712303462
Protocol: RCRA	Priority: 45 Days	Offsite Property No.

POSSIBLE SAMPLE HAZARDS/REMARKS
** **

SPECIAL INSTRUCTIONS Hold Time Total Activity Exemption: Yes ☑ No ☐

Sample No.	Lab ID	*	Date	Time	No/Type Container	Sample Analysis	Preservative
B1FR70		W	4-11-06	1205	4x40-mL aGs*	8260_VOA_GCMS: List-2 (26)	HCl or H2SO4 to pH <2 Cool 4C
B1FR70		W	4-11-06	1205	1x20-mL P	Activity Scan	None

Relinquished By (Print / Sign)	Date/Time	Received By (Print / Sign)	Date/Time
Jake Horner / John Horner	APR 12 2006 0700	DURATEK J. G. HOGAN / J T Hogan	APR 12 2006 0700
DURATEK J. G. HOGAN / J T Hogan	APR 12 2006 1400	FED EX	

Matrix *

S = Soil	SE = Sediment	DS = Drum Solid	DL = Drum Liqui
SO = Solid	SL = Sludge	T = Tissue	WI = Wipe
W = Water	O = Oil	L = Liquid	V = Vegetation
A = Air		X = Other	

FINAL SAMPLE DISPOSITION	Disposal Method (e.g., Return to customer, per lab procedure, used in process)	Disposed By	Date/Time

PNNL

CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST

C.O.C. # X06-007-35

Page 1 of 1

Collector: Horner	Contact/Requester: Dot Stewart	Telephone No.: 509-376-5056 MSIN FAX
SAF No.: X06-007	Sampling Origin: Hanford Site	Purchase Order/Charge Code
Project Title: 3FF5 (1) INTERVAL NOVEMBER 2005	DTS-SAWS-H101	Ice Chest No.: SAWS 999 Temp.
Shipped To (Lab): PNNL Building 325	Method of Shipment: Govt Truck	Bill of Lading/Air Bill No.: N/A
Protocol: RCRA	Priority: 45 Days	Offsite Property No.: N/A

POSSIBLE SAMPLE HAZARDS/REMARKS
** **

SPECIAL INSTRUCTIONS Hold Time Total Activity Exemption: Yes ☑ No ☐

Sample No.	Lab ID	*	Date	Time	No/Type Container	Sample Analysis	Preservative
B1FR71 (F)		W	4-17-06	1520	1x500-mL Nalgene	Uranium by ICPMS; 6010_METALS_ICP: Chromium (1)	HNO3 to pH <2(ULTREX)
B1FR72		W	4-17-06	1520	1x500-mL P	IC Anions - 300.0; 310.1_ALKALINITY: Alkalinity (1); Generic Testing	Cool 4C

Relinquished By (Print / Sign)	Date/Time	Received By (Print / Sign)	Date/Time
Jake Horner / Jake Horner	APR 18 2006 0630	DURATEK J. G. HOGAN / J G Hogan	APR 18 2006 0630
DURATEK J. G. HOGAN / J G Hogan	APR 18 2006 0900	KB Hulse / KB Hulse	4-18-06 0900
KB Hulse / KB Hulse	4-18-06 1150	Kenton Rod / Kent Rod	4-18-06 11:50

Matrix *

S = Soil		DS = Drum Solid	
SE = Sediment		DL = Drum Liqui	
SO = Solid		T = Tissue	
SL = Sludge		WI = Wine	
W = Water		L = Liquid	
O = Oil		V = Vegetation	
A = Air		X = Other	

FINAL SAMPLE DISPOSITION	Disposal Method (e.g., Return to customer, per lab procedure, used in process)	Disposed By	Date/Time

PNNL

CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST

C.O.C. # **X06-007-36**

Page 1 of 1

Collector: Horner	Contact/Requester: Dot Stewart	Telephone No.: 509-376-5056 MSIN FAX
SAF No.: X06-007	Sampling Origin: Hanford Site	Purchase Order/Charge Code
Project Title: 3FF5 (1) INTERVAL NOVEMBER 2005	DTS-SAWS-H101	Ice Chest No. SAWS108 Temp.
Shipped To (Lab): Severn Trent St. Louis	Method of Shipment: Govt Truck	Bill of Lading/Air Bill No. 7903-9821-7186
Protocol: RCRA	Priority: 45 Days	Offsite Property No.

POSSIBLE SAMPLE HAZARDS/REMARKS
** **

SPECIAL INSTRUCTIONS Hold Time Total Activity Exemption: Yes ☑ No ☐

Sample No.	Lab ID	*	Date	Time	No/Type Container	Sample Analysis	Preservative
B1FR74		W	4-17-06	1520	4x40-mL aGs*	8260_VOA_GCMS: List-2 (26)	HCl or H2SO4 to pH <2 Cool 4C
B1FR74		W	4-17-06	1520	1x20-mL P	Activity Scan	None

Relinquished By (Print / Sign)	Date/Time	Received By (Print / Sign)	Date/Time
Jake Horner / Jake Horner	APR 18 2006 0630	DURATEK J. G. HOGAN / J G Hogan	APR 18 2006 0630
DURATEK J. G. HOGAN / J G Hogan	APR 18 2006 1300	FED EX	

Matrix *

S	= Soil		DS	= Drum Solid	
SE	= Sediment		DL	= Drum Liqui	
SO	= Solid		T	= Tissue	
SL	= Sludge		WI	= Wipe	
W	= Water		L	= Liquid	
O	= Oil		V	= Vegetation	
A	= Air		X	= Other	

FINAL SAMPLE DISPOSITION	Disposal Method (e.g., Return to customer, per lab procedure, used in process)	Disposed By	Date/Time

PNNL	CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST	C.O.C. # X06-007-67
		Page 1 of 1

Collector: Jake Horner	Contact/Requester: Dot Stewart	Telephone No.: 509-376-5056 · MSIN · FAX
SAF No.: X06-007	Sampling Origin: Hanford Site	Purchase Order/Charge Code
Project Title: 3FF5 (1) INTERVAL NOVEMBER 2005	DTS-SAWS-H101	Ice Chest No. SAWS 999 · Temp.
Shipped To (Lab): PNNL Building 325	Method of Shipment: Govt Truck	Bill of Lading/Air Bill No.
Protocol: RCRA	Priority: 45 Days	Offsite Property No.

POSSIBLE SAMPLE HAZARDS/REMARKS
** **

SPECIAL INSTRUCTIONS · Hold Time · Total Activity Exemption: Yes ☑ No ☐

Sample No.	Lab ID	*	Date	Time	No/Type Container	Sample Analysis	Preservative
B1HRW9 (F)		W	4-26-06	1546	1x500-mL Nalgene	Uranium by ICPMS; 6010_METALS_ICP: Chromium (1)	HNO3 to pH <2
B1HRX0		W	4-26-06	1546	1x500-mL P	IC Anions - 300.0; 310.1_ALKALINITY: Alkalinity (1); Generic Testing	Cool 4C

0645 1300 4-28-06

Relinquished By (Print / Sign)	Date/Time	Received By (Print / Sign)	Date/Time
Jake Horner / Jake Horner	APR 28 2005	DURATEK J. G. HOGAN / J Hogan	0645 APR 28 2005
DURATEK J. G. HOGAN / J Hogan	1000 APR 28 2005	DURATEK K.B. HULSE / K Hulse	1000 APR 28 2005
DURATEK K.B. HULSE / K Hulse	1050 4-28-06	Steven Baum / Steven Baum	1050 4-28-06

Matrix *
S = Soil; SE = Sediment; SO = Solid; SL = Sludge; W = Water; O = Oil; A = Air; DS = Drum Solid; DL = Drum Liquid; T = Tissue; WI = Wipe; L = Liquid; V = Vegetation; X = Other

FINAL SAMPLE DISPOSITION	Disposal Method (e.g., Return to customer, per lab procedure, used in process)	Disposed By	Date/Time

Well C5001

PNNL	CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST	C.O.C. # X06-007-68 Page 1 of 1

Collector: Jake Horner	Contact/Requester: Dot Stewart	Telephone No. 509-376-5056 MSIN FAX
SAF No. X06-007	Sampling Origin: Hanford Site	Purchase Order/Charge Code
Project Title: 3FF5 (1) INTERVAL NOVEMBER 2005	DTS-SAWS-H101	Ice Chest No. SAWS 989 Temp.
Shipped To (Lab): PNNL Building 325	Method of Shipment: Govt Truck	Bill of Lading/Air Bill No.
Protocol: RCRA	Priority: 45 Days	Offsite Property No.

POSSIBLE SAMPLE HAZARDS/REMARKS
** **

SPECIAL INSTRUCTIONS Hold Time Total Activity Exemption: Yes ☑ No ☐

Sample No.	Lab ID	*	Date	Time	No/Type Container	Sample Analysis	Preservative
B1HRX3 (F)		W	4-27-06	0826	1x500-mL Nalgene	Uranium by ICPMS; 6010_METALS_ICP: Chromium (1)	HNO3 to pH <2
B1HRX4		W	4-27-06	0826	1x500-mL P	IC Anions - 300.0; 310.1_ALKALINITY: Alkalinity (1); Generic Testing	Cool 4C

Relinquished By (Print / Sign)	Date/Time	Received By (Print / Sign)	Date/Time
Jake Horner / [signature]	0645 APR 28 2005	DURATEK J. G. HOGAN / [signature]	0645 APR 28 2005
DURATEK J. G. HOGAN / [signature]	1000 APR 28 2005	DURATEK K. B. HULSE / [signature]	1000 APR 28 2005
DURATEK K. B. HULSE / [signature]	1050 4-28-06	Steven Baum / [signature]	1050 4-28-06

Matrix *

S = Soil	DS = Drum Solid
SE = Sediment	DL = Drum Liqui
SO = Solid	T = Tissue
SL = Sludge	WI = Wipe
W = Water	L = Liquid
O = Oil	V = Vegetation
A = Air	X = Other

FINAL SAMPLE DISPOSITION	Disposal Method (e.g., Return to customer, per lab procedure, used in process)	Disposed By	Date/Time

F.72

PNNL

CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST

C.O.C. # X06-007-69

Page 1 of 1

Collector Horner	Contact/Requester Dot Stewart	Telephone No. 509-376-5056 MSIN FAX
SAF No. X06-007	Sampling Origin Hanford Site	Purchase Order/Charge Code
Project Title 3FF5 (1) INTERVAL NOVEMBER 2005	DTS-SAWS-H101	Ice Chest No. SAWS-889 Temp.
Shipped To (Lab) PNNL Building 325	Method of Shipment Govt Truck	Bill of Lading/Air Bill No.
Protocol RCRA	Priority: 45 Days	Offsite Property No.

POSSIBLE SAMPLE HAZARDS/REMARKS
** **

SPECIAL INSTRUCTIONS Hold Time Total Activity Exemption: Yes ☑ No ☐

Sample No.	Lab ID	*	Date	Time	No/Type Container	Sample Analysis	Preservative
B1HRX7 (F)		W	4-27-06	1450	1x500-mL Nalgene	Uranium by ICPMS; 6010_METALS_ICP: Chromium (1)	HNO3 to pH <2
B1HRX8		W	4-27-06	1450	1x500-mL P	IC Anions - 300.0; 310.1_ALKALINITY: Alkalinity (1); Generic Testing	Cool 4C

Relinquished By (Print / Sign)	Date/Time	Received By (Print / Sign)	Date/Time
Jake Horner / John Horner	APR 28 2005 0645	DURATEK J. G. HOGAN / J G Hogan	APR 28 2005 0645
DURATEK J. G. HOGAN / J G Hogan	APR 28 2005 1000	DURATEK K. B. HULSE / KB Hulse	APR 28 2005 1000
DURATEK K B HULSE / KB Hulse	4-28-06 1050	Steven Baum / Steven Baum	4-28-06 1050

Matrix *

S	= Soil		DS	=	Drum Solid
SE	= Sediment		DL	=	Drum Liquid
SO	= Solid		T	=	Tissue
SL	= Sludge		WI	=	Wipe
W	= Water		L	=	Liquid
O	= Oil		V	=	Vegetation
A	= Air		X	=	Other

FINAL SAMPLE DISPOSITION	Disposal Method (e.g., Return to customer, per lab procedure, used in process)	Disposed By	Date/Time

PNNL

CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST

C.O.C. # X06-007-70

Page 1 of 1

Collector J. Horner	Contact/Requester Dot Stewart	Telephone No. 509-376-5056 MSIN FAX
SAF No. X06-007	Sampling Origin Hanford Site	Purchase Order/Charge Code
Project Title 3FF5 (1) INTERVAL NOVEMBER 2005	DTS-SAWS-H101	Ice Chest No. Temp.
Shipped To (Lab) PNNL Building 325	Method of Shipment Govt Truck	Bill of Lading/Air Bill No.
Protocol RCRA	Priority: 45 Days	Offsite Property No.

POSSIBLE SAMPLE HAZARDS/REMARKS
** **

SPECIAL INSTRUCTIONS Hold Time Total Activity Exemption: Yes ☑ No ☐

Sample No.	Lab ID	*	Date	Time	No/Type Container	Sample Analysis	Preservative
B1HRY1 (F)		W	4-28-06	1159	1x500-mL Nalgene	Uranium by ICPMS; 6010_METALS_ICP: Chromium (1)	HNO3 to pH <2
B1HRY2		W	4-28-06	1159	1x500-mL P	IC Anions - 300.0; 310.1_ALKALINITY: Alkalinity (1); Generic Testing	Cool 4C

Relinquished By (Print / Sign)	Date/Time	Received By (Print / Sign)	Date/Time
Jake Horner / [signature]	MAY 0 1 2006 0700	DURATEK J. G. HOGAN / [signature]	MAY 0 1 2006 0700
DURATEK J. G. HOGAN / [signature]	MAY 0 1 2006 1430	Steven Baum / [signature]	MAY 0 1 2006 1430
Relinquished By	Date/Time	Received By	Date/Time
Relinquished By	Date/Time	Received By	Date/Time

Matrix *

S = Soil	DS = Drum Solid		
SE = Sediment	DL = Drum Liquid		
SO = Solid	T = Tissue		
SL = Sludge	WI = Wipe		
W = Water	L = Liquid		
O = Oil	V = Vegetation		
A = Air	X = Other		

FINAL SAMPLE DISPOSITION | Disposal Method (e.g., Return to customer, per lab procedure, used in process) | Disposed By | Date/Time

PNNL	CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST	C.O.C. # X06-007-71 Page 1 of 1

Collector Horner	Contact/Requester Dot Stewart	Telephone No. 509-376-5056 MSIN FAX
SAF No. X06-007	Sampling Origin Hanford Site	Purchase Order/Charge Code
Project Title 3FF5 (1) INTERVAL NOVEMBER 2005		Ice Chest No. Temp.
Shipped To (Lab) PNNL Building 325	Method of Shipment Govt Truck	Bill of Lading/Air Bill No.
Protocol RCRA	Priority: 45 Days	Offsite Property No.

POSSIBLE SAMPLE HAZARDS/REMARKS
** **

SPECIAL INSTRUCTIONS Hold Time Total Activity Exemption: Yes ☑ No ☐

Sample No.	Lab ID	*	Date	Time	No/Type Container	Sample Analysis	Preservative
B1HRY5 (F)		W	5/3/06	1425	1x500-mL Nalgene	Uranium by ICPMS; 6010_METALS_ICP: Chromium (1)	HNO3 to pH <2
B1HRY6		W	5/3/06	1425	1x500-mL P	IC Anions - 300.0; 310.1_ALKALINITY: Alkalinity (1); Generic Testing	Cool 4C

Relinquished By	Date/Time	Received By	Date/Time
Print: Jake Horner Sign: [signature]	May 3/06 14:55	Print: Kenton Rod Sign: [signature]	May 3/06 14:55
Relinquished By	Date/Time	Received By	Date/Time
Relinquished By	Date/Time	Received By	Date/Time
Relinquished By	Date/Time	Received By	Date/Time

Matrix *

S = Soil	DS = Drum Solid
SE = Sediment	DL = Drum Liqui
SO = Solid	T = Tissue
SL = Sludge	WI = Wipe
W = Water	L = Liquid
O = Oil	V = Vegetation
A = Air	X = Other

FINAL SAMPLE DISPOSITION	Disposal Method (e.g., Return to customer, per lab procedure, used in process)	Disposed By	Date/Time

PNNL

CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST

C.O.C. # X06-007-76

Page 1 of 1

Collector J. Horner	Contact/Requester Dot Stewart	Telephone No. 509-376-5056 MSIN FAX
SAF No. X06-007	Sampling Origin Hanford Site	Purchase Order/Charge Code
Project Title 3EF5 (1) INTERVAL NOVEMBER 2005	DTS-SAWS-H101	Ice Chest No. TJ-4 Temp.
Shipped To (Lab) Severn Trent St. Louis	Method of Shipment Govt Truck	Bill of Lading/Air Bill No. 791464572248
Protocol RCRA	Priority: 45 Days	Offsite Property No.

POSSIBLE SAMPLE HAZARDS/REMARKS
** **

SPECIAL INSTRUCTIONS Hold Time Total Activity Exemption: Yes ☑ No ☐

Sample No.	Lab ID	*	Date	Time	No/Type Container	Sample Analysis	Preservative
B1HRY3		W	4-28-06	1159	4x40-mL aGs*	8260_VOA_GCMS: List-2 (26)	HCl or H2SO4 to pH <2 Cool 4C
B1HRY3		W	4-28-06	1159	1x20-mL P	Activity Scan	None

Relinquished By (Print / Sign)	Date/Time	Received By (Print / Sign)	Date/Time
Jake Horner / John Horner	MAY 0 1 2006 0700	DURATEK J. G. HOGAN / J G Hogan	MAY 0 1 2006 0700
DURATEK J. G. HOGAN / J G Hogan	MAY 0 1 2006 1200	FEDEX	

Matrix *
S = Soil; SE = Sediment; SO = Solid; SL = Sludge; W = Water; O = Oil; A = Air; DS = Drum Solid; DL = Drum Liquid; T = Tissue; WI = Wipe; L = Liquid; V = Vegetation; X = Other

FINAL SAMPLE DISPOSITION	Disposal Method (e.g., Return to customer, per lab procedure, used in process)	Disposed By	Date/Time

PNNL	CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST	C.O.C. # X06-007-85
		Page 1 of 1

Collector Horner	Contact/Requester Dot Stewart	Telephone No. 509-376-5056 MSIN FAX
SAF No. X06-007	Sampling Origin Hanford Site	Purchase Order/Charge Code
Project Title 3FF5 (1) INTERVAL NOVEMBER 2005	DTS-SAWS-H101	Ice Chest No. Temp.
Shipped To (Lab) PNNL Building 325	Method of Shipment Govt Truck	Bill of Lading/Air Bill No.
Protocol RCRA	Priority: 45 Days	Offsite Property No.

POSSIBLE SAMPLE HAZARDS/REMARKS
** **

SPECIAL INSTRUCTIONS Hold Time Total Activity Exemption: Yes ☑ No ☐

Sample No.	Lab ID	*	Date	Time	No/Type Container	Sample Analysis	Preservative
B1HT03 (F)		W	5/12/06	1308	1x500-mL Nalgene	Uranium by ICPMS; 6010_METALS_ICP: Chromium (1)	HNO3 to pH <2
B1HT04		W	5/12/06	1308	1x500-mL P	IC Anions - 300.0; 310.1_ALKALINITY: Alkalinity (1); Generic Testing	Cool 4C

Relinquished By (Print / Sign)	Date/Time	Received By (Print / Sign)	Date/Time
Jake Horner / [signature]	MAY 15 2006 0630	DURATEK J. G. HOGAN / [signature]	MAY 15 2006 0630
DURATEK J. G. HOGAN / [signature]	MAY 15 2006 1440	Steven Baum / [signature]	MAY 15 2006 1440
Relinquished By	Date/Time	Received By	Date/Time
Relinquished By	Date/Time	Received By	Date/Time

Matrix *

S	= Soil	DS	= Drum Solid
SE	= Sediment	DL	= Drum Liquid
SO	= Solid	T	= Tissue
SL	= Sludge	WI	= Wine
W	= Water	L	= Liquid
O	= Oil	V	= Vegetation
A	= Air	X	= Other

FINAL SAMPLE DISPOSITION	Disposal Method (e.g., Return to customer, per lab procedure, used in process)	Disposed By	Date/Time

F.76

Well C5002

PNNL	CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST	C.O.C. # X06-007-91
		Page 1 of 1

Collector Horner	Contact/Requester Dot Stewart	Telephone No. 509-376-5056 MSIN FAX
SAF No. X06-007	Sampling Origin Hanford Site	Purchase Order/Charge Code
Project Title 3FF5 (1) INTERVAL NOVEMBER 2005	DTS-SAWS-H101	Ice Chest No. JF-1 Temp.
Shipped To (Lab) Severn Trent St. Louis	Method of Shipment Govt Truck	Bill of Lading/Air Bill No. 7920 9882 1731
Protocol RCRA	Priority: 45 Days	Offsite Property No.

POSSIBLE SAMPLE HAZARDS/REMARKS
** **

SPECIAL INSTRUCTIONS Hold Time Total Activity Exemption: Yes ☑ No ☐

Sample No.	Lab ID	*	Date	Time	No/Type Container	Sample Analysis	Preservative
B1HT05		W	5/12/06	1308	4x40-mL aGs*	8260_VOA_GCMS: List-2 (26)	HCl or H2SO4 to pH <2 Cool 4C
B1HT05		W	5/12/06	1308	1x20-mL P	Activity Scan	None

Relinquished By	Date/Time	Received By	Date/Time
Jake Horner (Print) / Jake Horner (Sign)	MAY 15 2006 0630	DURATEK J. G. HOGAN (Print) / J G Hogan (Sign)	MAY 15 2006 0630
DURATEK J. G. HOGAN / J G Hogan	MAY 15 2006 1300	FEDEX	

Matrix *
S = Soil
SE = Sediment
SO = Solid
SL = Sludge
W = Water
O = Oil
A = Air
DS = Drum Solid
DL = Drum Liquid
T = Tissue
WI = Wipe
L = Liquid
V = Vegetation
X = Other

FINAL SAMPLE DISPOSITION	Disposal Method (e.g., Return to customer, per lab procedure, used in process)	Disposed By	Date/Time

F.78

PNNL	CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST	C.O.C. # X06-007-86 Page 1 of 1

Collector Horner	Contact/Requester Dot Stewart	Telephone No. 509-376-5056 MSIN FAX
SAF No. X06-007	Sampling Origin Hanford Site	Purchase Order/Charge Code
Project Title 3FF5 (1) INTERVAL NOVEMBER 2005	DTS-SAWS-H101	Ice Chest No. Temp.
Shipped To (Lab) PNNL Building 325	Method of Shipment Govt Truck	Bill of Lading/Air Bill No.
Protocol RCRA	Priority: 45 Days	Offsite Property No.

POSSIBLE SAMPLE HAZARDS/REMARKS
** **

SPECIAL INSTRUCTIONS Hold Time Total Activity Exemption: Yes ☑ No ☐

Sample No.	Lab ID	*	Date	Time	No/Type Container	Sample Analysis	Preservative
B1HT07 (F)		W	5/12/06	1550	1x500-mL Nalgene	Uranium by ICPMS; 6010_METALS_ICP: Chromium (1)	HNO3 to pH <2
B1HT08		W	5/12/06	1550	1x500-mL P	IC Anions - 300.0; 310.1_ALKALINITY: Alkalinity (1); Generic Testing	Cool 4C

Relinquished By (Print / Sign)	Date/Time	Received By (Print / Sign)	Date/Time
John Horner / [signature]	MAY 15 2006 0630	DURATEK J. G. HOGAN / [signature]	MAY 15 2006 0630
DURATEK J. G. HOGAN / [signature]	MAY 15 2006 1440	Steven Baum / [signature]	MAY 15 2006 1440
Relinquished By	Date/Time	Received By	Date/Time
Relinquished By	Date/Time	Received By	Date/Time

Matrix *
S = Soil
SE = Sediment
SO = Solid
SL = Sludge
W = Water
O = Oil
A = Air
DS = Drum Solid
DL = Drum Liqui
T = Tissue
WI = Wipe
L = Liquid
V = Vegetation
X = Other

FINAL SAMPLE DISPOSITION	Disposal Method (e.g., Return to customer, per lab procedure, used in process)	Disposed By	Date/Time

PNNL	CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST	C.O.C. # X06-007-92 Page 1 of 1

Collector Horner	Contact/Requester Dot Stewart	Telephone No. 509-376-5056 MSIN FAX
SAF No. X06-007	Sampling Origin Hanford Site	Purchase Order/Charge Code
Project Title 3EF5 (1) INTERVAL NOVEMBER 2005	DTS-SAWS-H101	Ice Chest No. JF-1 Temp.
Shipped To (Lab) Severn Trent St. Louis	Method of Shipment Govt Truck	Bill of Lading/Air Bill No. 792098821731
Protocol RCRA	Priority: 45 Days	Offsite Property No.

POSSIBLE SAMPLE HAZARDS/REMARKS	SPECIAL INSTRUCTIONS Hold Time Total Activity Exemption: Yes ☑ No ☐
** **	

Sample No.	Lab ID	*	Date	Time	No/Type Container	Sample Analysis	Preservative
B1HT09		W	5/12/06	1550	4x40-mL aGs*	8260_VOA_GCMS: List-2 (28)	HCl or H2SO4 to pH <2 Cool 4C
B1HT09		W	5/12/06	1550	1x20-mL P	Activity Scan	None

Relinquished By Print Sign	Date/Time	Received By Print Sign	Date/Time
Jake Horner [signature]	MAY 15 2006 0630	DURATEK J. G. HOGAN [signature]	MAY 15 2006 0630
DURATEK J. G. HOGAN [signature]	MAY 15 2006 1300	FEDEX	

Matrix *

S = Soil	DS = Drum Solid
SE = Sediment	DL = Drum Liquid
SO = Solid	T = Tissue
SL = Sludge	WI = Wipe
W = Water	L = Liquid
O = Oil	V = Vegetation
A = Air	X = Other

FINAL SAMPLE DISPOSITION	Disposal Method (e.g., Return to customer, per lab procedure, used in process)	Disposed By	Date/Time

PNNL

CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST

C.O.C. # X06-007-87

Page 1 of 1

Collector: Horner	Contact/Requester: Dot Stewart	Telephone No. 509-376-5056 MSIN FAX
SAF No. X06-007	Sampling Origin: Hanford Site	Purchase Order/Charge Code
Project Title: 3FF5 (1) INTERVAL NOVEMBER 2005	DTS-SAWS-H101	Ice Chest No. Temp.
Shipped To (Lab): PNNL Building 325	Method of Shipment: Govt Truck	Bill of Lading/Air Bill No.
Protocol: RCRA	Priority: 45 Days	Offsite Property No.

POSSIBLE SAMPLE HAZARDS/REMARKS
** **

SPECIAL INSTRUCTIONS Hold Time Total Activity Exemption: Yes ☑ No ☐

Sample No.	Lab ID	*	Date	Time	No/Type Container	Sample Analysis	Preservative
B1HT11 (F)		W	5/15/06	1436	1x500-mL Nalgene	Uranium by ICPMS; 6010_METALS_ICP: Chromium (1)	HNO3 to pH <2
B1HT12		W	5/15/06	1436	1x500-mL P	IC Anions - 300.0; 310.1_ALKALINITY: Alkalinity (1); Generic Testing	Cool 4C

Relinquished By (Print / Sign)	Date/Time	Received By (Print / Sign)	Date/Time
Jake Horner / [signature]	5/16/06 0630	DURATEK J. G. HOGAN / [signature]	MAY 16 2006 0630
DURATEK J. G. HOGAN / [signature]	MAY 16 2006	[signature]	2:47 pm MAY 16 2006

Matrix *

S = Soil		DS = Drum Solid	
SE = Sediment		DL = Drum Liquid	
SO = Solid		T = Tissue	
SL = Sludge		WI = Wipe	
W = Water		L = Liquid	
O = Oil		V = Vegetation	
A = Air		X = Other	

FINAL SAMPLE DISPOSITION | Disposal Method (e.g., Return to customer, per lab procedure, used in process) | Disposed By | Date/Time

F.81

PNNL	CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST	C.O.C. # X06-007-93 Page 1 of 1

Collector Horner	Contact/Requester Dot Stewart	Telephone No. 509-376-5056 MSIN FAX
SAF No. X06-007	Sampling Origin Hanford Site	Purchase Order/Charge Code
Project Title 3EF5 (1) INTERVAL NOVEMBER 2005	DTS-SAWS-H101	Ice Chest No. SAWS221 Temp.
Shipped To (Lab) Severn Trent St. Louis	Method of Shipment Govt Truck	Bill of Lading/Air Bill No. 7909 2404 7979
Protocol RCRA	Priority: 45 Days	Offsite Property No.

POSSIBLE SAMPLE HAZARDS/REMARKS
** **

SPECIAL INSTRUCTIONS Hold Time Total Activity Exemption: Yes ☑ No ☐

Sample No.	Lab ID	*	Date	Time	No/Type Container	Sample Analysis	Preservative
B1HT13		W	5/15/06	1436	4x40-mL aGs*	8260_VOA_GCMS: List-2 (26)	HCl or H2SO4 to pH <2 Cool 4C
B1HT13		W	5/15/06	1436	1x20-mL P	Activity Scan	None

Relinquished By Print Sign	Date/Time	Received By Print Sign	Date/Time
Jake Horner	MAY 16 2006 0630	DURATEK J. G. HOGAN	MAY 16 2006 0630
DURATEK J. G. HOGAN	MAY 16 2006 1400	FEDEX	

Matrix *
S = Soil, SE = Sediment, SO = Solid, SL = Sludge, W = Water, O = Oil, A = Air, DS = Drum Solid, DL = Drum Liquid, T = Tissue, WI = Wipe, L = Liquid, V = Vegetation, X = Other

FINAL SAMPLE DISPOSITION	Disposal Method (e.g., Return to customer, per lab procedure, used in process)	Disposed By	Date/Time

F.82

PNNL	CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST	C.O.C. # X06-007-88
		Page 1 of 1

Collector Horner	Contact/Requester Dot Stewart	Telephone No. 509-376-5056 MSIN FAX
SAF No. X06-007	Sampling Origin Hanford Site	Purchase Order/Charge Code
Project Title 3FF5 (1) INTERVAL NOVEMBER 2005	DTS-SAWS-H101	Ice Chest No. Temp.
Shipped To (Lab) PNNL Building 325	Method of Shipment Govt Truck	Bill of Lading/Air Bill No.
Protocol RCRA	Priority: 45 Days	Offsite Property No.

POSSIBLE SAMPLE HAZARDS/REMARKS
** **

SPECIAL INSTRUCTIONS Hold Time Total Activity Exemption: Yes ☑ No ☐

Sample No.	Lab ID	*	Date	Time	No/Type Container	Sample Analysis	Preservative
B1HT15 (F)		W	5/16/06	1212	1x500-mL Nalgene	Uranium by ICPMS; 6010_METALS_ICP: Chromium (1)	HNO3 to pH <2
B1HT16		W	5/16/06	1212	1x500-mL P	IC Anions - 300.0; 310.1_ALKALINITY: Alkalinity (1); Generic Testing	Cool 4C

Relinquished By (Print / Sign)	Date/Time	Received By (Print / Sign)	Date/Time
Jake Horner / John Horner	MAY 17 2006 0635	DURATEK J. G. HOGAN / J. G. Hogan	MAY 17 2006 0635
DURATEK J. G. HOGAN / J. G. Hogan	MAY 17 2006 8:50	C. F. Brown / C. F. Brown	MAY 17 2006 8:50

Matrix *

S = Soil	DS = Drum Solid
SE = Sediment	DL = Drum Liquid
SO = Solid	T = Tissue
SL = Sludge	WI = Wipe
W = Water	L = Liquid
O = Oil	V = Vegetation
A = Air	X = Other

FINAL SAMPLE DISPOSITION	Disposal Method (e.g., Return to customer, per lab procedure, used in process)	Disposed By	Date/Time

F.83

PNNL

CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST

C.O.C. # X06-007-94

Page 1 of 1

Collector Horner	Contact/Requester Dot Stewart	Telephone No. 509-376-5056 MSIN FAX
SAF No. X06-007	Sampling Origin Hanford Site	Purchase Order/Charge Code
Project Title 3FF5 (1) INTERVAL NOVEMBER 2005	DTS-SAWS-H101	Ice Chest No. GRP-03-015 Temp.
Shipped To (Lab) Severn Trent St. Louis	Method of Shipment Govt Truck	Bill of Lading/Air Bill No. 7914 8556 4260
Protocol RCRA	Priority: 45 Days	Offsite Property No.

POSSIBLE SAMPLE HAZARDS/REMARKS
** **

SPECIAL INSTRUCTIONS Hold Time Total Activity Exemption: Yes ☑ No ☐

Sample No.	Lab ID	*	Date	Time	No/Type Container	Sample Analysis	Preservative
B1HT17		W	5/16/06	1212	4x40-mL aGs*	8260_VOA_GCMS: List-2 (26)	HCl or H2SO4 to pH <2 Cool 4C
B1HT17		W	5/16/06	1212	1x20-mL P	Activity Scan	None

Relinquished By	Print	Sign	Date/Time	Received By	Print	Sign	Date/Time
Jake Horner		Jake Horner	0635 MAY 17 2006	DURATEK J. G. HOGAN		J Hogan	0635 MAY 17 2006
DURATEK J. G. HOGAN		J Hogan	1400 MAY 17 2006	FEDEX			

Matrix *

S = Soil	DS = Drum Solid		
SE = Sediment	DL = Drum Liquid		
SO = Solid	T = Tissue		
SL = Sludge	WI = Wipe		
W = Water	L = Liquid		
O = Oil	V = Vegetation		
A = Air	X = Other		

FINAL SAMPLE DISPOSITION | Disposal Method (e.g., Return to customer, per lab procedure, used in process) | Disposed By | Date/Time

PNNL	CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST	C.O.C. # X06-035-29
		Page 1 of 1

Collector R. Fox	Contact/Requester Dot Stewart	Telephone No. 509-376-5056 MSIN FAX
SAF No. X06-035	Sampling Origin Hanford Site	Purchase Order/Charge Code
Project Title SPECIAL SAMPLING, APRIL 2006	Logbook: DTS-SAWS-H105	Ice Chest No. GRP-0304 Temp.
Shipped To (Lab) PNL - 329 Building	Method of Shipment Govt. Vehicle	Bill of Lading/Air Bill No.
Protocol SURV	Priority: 45 Days	Offsite Property No.

POSSIBLE SAMPLE HAZARDS/REMARKS
** **

SPECIAL INSTRUCTIONS Hold Time Total Activity Exemption: Yes ☑ No ☐
Batch all PNNL samples submitted under this X SAF into one SDG, not to exceed SDG closure of 14 days.
Submit invoices & deliverables to DL Stewart, PNNL.

Sample No.	Lab ID	*	Date	Time	No/Type Container	Sample Analysis	Preservative
B1J637		W	5/17/06	1343	6x4000-mL P	Spike Water	None

R. Wall 5/17/06

Relinquished By	Print	Sign	Date/Time	Received By	Print	Sign	Date/Time
R. Fox			MAY 17 2006	Elwood Lepel			MAY 17 2006 1455
Relinquished By			Date/Time	Received By			Date/Time
Relinquished By			Date/Time	Received By			Date/Time
Relinquished By			Date/Time	Received By			Date/Time

Matrix *

S = Soil	DS = Drum Solid		
SE = Sediment	DL = Drum Liquid		
SO = Solid	T = Tissue		
SL = Sludge	WI = Wipe		
W = Water	L = Liquid		
O = Oil	V = Vegetation		
A = Air	X = Other		

FINAL SAMPLE DISPOSITION	Disposal Method (e.g., Return to customer, per lab procedure, used in process)	Disposed By	Date/Time

PNNL	CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST	C.O.C. # X06-035-30
		Page 1 of 1

Collector R. Fox	Contact/Requester Dot Stewart	Telephone No. 509-376-5056 MSIN FAX
SAF No. X06-035	Sampling Origin Hanford Site	Purchase Order/Charge Code
Project Title SPECIAL SAMPLING APRIL 2006	Logbook: DTS-SAWS-H105	Ice Chest No. Temp.
Shipped To (Lab) PNL - 329 Building	Method of Shipment Govt. Vehicle	Bill of Lading/Air Bill No.
Protocol SURV	Priority: 45 Days	Offsite Property No.

POSSIBLE SAMPLE HAZARDS/REMARKS
** **

SPECIAL INSTRUCTIONS Hold Time Total Activity Exemption: Yes ☑ No ☐
Batch all PNNL samples submitted under this X SAF into one SDG, not to exceed SDG closure of 14 days.
Submit invoices & deliverables to DL Stewart, PNNL.

Sample No.	Lab ID	*	Date	Time	No/Type Container	Sample Analysis	Preservative
B1J638		W	5/17/06	0919	63x4000-mL P	Spike Water	None

R. Wall 5/17/06

Relinquished By	Print	Sign	Date/Time	Received By	Print	Sign	Date/Time
R. Fox			MAY 17 2006 1455		Elwood Lepel		MAY 17 2006 1455
Relinquished By			Date/Time	Received By			Date/Time
Relinquished By			Date/Time	Received By			Date/Time
Relinquished By			Date/Time	Received By			Date/Time

Matrix *

S = Soil		DS = Drum Solid	
SE = Sediment		DL = Drum Liqui	
SO = Solid		T = Tissue	
SL = Sludge		WI = Wipe	
W = Water		L = Liquid	
O = Oil		V = Vegetation	
A = Air		X = Other	

FINAL SAMPLE DISPOSITION | Disposal Method (e.g., Return to customer, per lab procedure, used in process) | Disposed By | Date/Time

F.85

Appendix G

Well Installation Daily Field Activity Reports, C4999, C5000, C5001, and C5002

Drilling Field Activity Reports

Well C4999

FIELD ACTIVITY REPORT NO. 1 - DRILLING PLAN

Page 1 of 1

Date: 3-9-06

Purpose: Install Monitoring Well	Location: 300-FF-5 OU
Well ID: C4999	Well Name: 399-3-18
Drilling Co.: Cascade Drilling Inc.	Rig No.: 131 — Rig Make/Mod.: Sonic Ore 50K

Casing String No. 1 2 3 4	Drilling Method	Circulation	D.H. Hammer
Casing Size 9 5/8"	Auger	Air ___ Water/Mud ___	Make
Grade P110	Rotary	Reverse ___ Direct ___	Model
Lbs.Per Ft. 47	Tubex	Vol: cfm	Choke
Material Carbon Steel	Cable Tool	gpm	Casing Hammer
Type:	Sonic ✓	Pressure ___ psi	Make
Welded ___ Thd.	A.R. w/Sonic	Drill Pipe O.D.	Model
Planned / Actual	Geoprobe	Tool Joint Size	Bit Size
Set At: 120' / 130'	Other:	Additives	Type
Shoe OD/ID 9 5/8" / 8 5/8"			Nozzles
Reference Measuring Point:			Rod Size
GROUND LEVEL			

Drlg. Co.	Rig No.:	Rig Make/Mod.:

Casing String No. 1 2 3 4	Drilling Method	Circulation	D.H. Hammer
Casing Size	Auger	Air ___ Water/Mud ___	Make
Grade	Rotary	Reverse ___ Direct ___	Model
Lbs.Per Ft.	Tubex	Vol: cfm	Choke
Material	Cable Tool	gpm	Casing Hammer
Type:	Sonic	Pressure ___ psi	Make
Welded ___ Thd.	A.R. w/Sonic	Drill Pipe O.D.	Model
Planned / Actual	Geoprobe	Tool Joint Size	Bit Size
Set ___ / ___	Other:	Additives	Type
Shoe OD/ID			Nozzles
Reference Measuring Point:			Rod Size
GROUND LEVEL			

Comments/Remarks:	Estimated Depth to Water
	35' bgs

Reported By: Jake Horner

Name/Title: Geologist

Signature: John Horner

Date: 3-9-06

A-6003-650 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING

Page 1 of 1

Date: 3-9-06

Well ID: C4999	Well Name: 399-3-18
Location: 300-FF-5 OU	Report No.: 1

Start	Finish	Total
Time 0900	Time 1110	Time 2 hrs 10 min.
Hole Depth/Csg ∅ / ∅	Hole Depth/Csg ∅ / ∅	Hole Depth/Csg ∅ / ∅

Reference Measuring Point: **GROUND SURFACE**

Casing String No. 1 2 3 4 ____ Rod Size: 1 - 9 5/8"

See Report No. 1

Time/Depth From	Time/Depth To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
0900	→	Geologist on site helping BTR organize trailer
→	1100	Drillers setting up
1000	1010	POD w/ BTR, PNNL rep. & 2 Geologists & Drillers
1010	1100	Drillers still setting up.
—	1100	Drillers were missing a sub-connection & had
—	—	to postpone drilling till one can be delivered.
	1110	Geologist left the site

not used JH 3-9-06

Reported By: Jake Horner		Reviewed By: L.D. Walker	
Title: Geologist	Date: 3-9-06	Title: Geologist	Date: 5/25/06
Signature: [signature]		Signature: [signature]	

A-6003-651 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING

Page 1 of 2

Date: 3-10-06

Well ID: C4999 | Well Name: 399-3-18

Location: 300-FF-5 OU | Report No.: 2

Start	Finish	Total
Time 0600	Time 1630	Time 10.5 hrs
Hole Depth/Csg ∅ / ∅	Hole Depth/Csg 28' / 16'	Hole Depth/Csg 28' / 16'

Reference Measuring Point: **GROUND SURFACE**

Casing String No. 1 2 3 4 ____ Rod Size: 1 - 9 5/8"
See Report No. 1

Time/Depth From	To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
0600	0630	POD meeting (BTR, RCT, safety rep., drillers & Geo.)
0630	0700	Equipment inspection / warming up
0650	0700	Loading lexan linners (7 x 14t) (1A was cut short to fit)
0700	0715	Preparing to start drilling
0715	0720	Start drilling 0 - 6.5' bgs
0720	0755	waiting for RCT to survey core barrel
—	—	-Discussing the best way to survey core barrel
—	—	-RCT reports < background
0755	0845	Removing core barrel & break open
—	—	-Recovered 4 full cores (pushed 6.5' top 2 empty)
0820	0825	Drillers do some welding
0845	0855	Loading Linners 2C - 3C (2C - Top)
0855	0903	Advancing core barrel (Drillers reports ~2' sluff)
0903	0908	RCT surveying core barrel during removal (< background)
0908	0930	Removing & opening core barrel (advanced 4.5' - 11' bgs)
0930	0945	Loading Linners 3D (Top) - 4D (bottom)
0945	0950	Advancing corebarrel (~2' sluff) 9' - 15.8' bgs
0950	1000	Removing core barrel (RCT surveying) < background
1000	1010	Open & sampling core barrel (Recovered 1.75' 12.5-14.2' bgs)
1010	1030	Preparing to advance 9 5/8" casing
—	—	- 0.69' shoe + 5.00' + 5.00' Talley = 10.69'
1030	1038	Advancing 9 5/8" casing from 0-10' bgs
1038	1100	Bore hole cleanout down to ~13' bgs
1100	1115	Advancing core barrel from 12' (3' sluff) - 20' bgs

Reported By: Jake Horner	Reviewed By: L.D. Walker
Title: Geologist Date: 3-10-06	Title: Geologist Date: 5/25/06
Signature: Jake Horner	Signature: L D Walker

A-6003-651 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING Continuation Page	Page 2 of 2 Date: 3-10-06
Well Name: 399-3-18	Well ID: C4999
Location: 300-FF-5 OU	Continuation of Report No.: 2

Time/Depth From	Time/Depth To	Description of Activities/Operations with Depth
1115	1120	Removing core barrel (RCT reports < background)
~~1120~~	JH 3-10-06	Opening & sampling core barrel (after lunch)
1120	1150	Lunch
1150	1215	Waiting for PNNL rep. to return
1215	1245	Opening & sampling core barrel
1245	1250	Adding 5.0' of 9 5/8" casing Talley = 15.69'
1250	1315	Advancing casing (10'-13' bgs) & borehole cleanout
1315	1330	Advancing core barrel from 18' (3' sluff) to 26' bgs
—	—	- barrel stack with liners 6A (Top) to 7A (bottom)
—	1315	IHT on site checking borehole with OVM (< detectable)
1330	1355	Opening & sampling core barrel
1345	1430	Advancing 9 5/8" casing & borehole cleanout down to
—	—	- Added 5.0' of 9 5/8" casing Talley = 20.69'
—	1430	The sub-connection for the 9 5/8" casing broke, so the
—	—	9 5/8" casing cannot be driven any further today
—	—	- 9 5/8" casing depth = 16' bgs
1430	1500	Resume cleanout
1500	1510	Building up drill bit
1510	1525	resume borehole cleanout JH 3-10-06
1525	1540	Advancing core barrel from ~23' ~~25'~~ to 28' bgs (~3' sluff)
1540	1550	Removing core barrel
1550	1615	Opening & sampling core barrel
1615	1620	Reassemble split spoon / core barrel
1620	1630	Secure site
		not used JH 3/10/06

Reported By: Jake Horner		Reviewed By: L.D. Walker	
Title: Geologist	Date: 3-10-06	Title: Geologist	Date: 5/25/06
Signature: Jake Horner		Signature: LD Walker	

A-6003-652 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING

Page 1 of 2

Date: 3-13-06

Well ID: C4999

Well Name: 399-3-18

Location: 300-FF-5 OU

Report No.: 3

Start	Finish	Total
Time 0600	Time 1600	Time 10 hrs
Hole Depth/Csg 28' / 16'	Hole Depth/Csg 50 / 31	Hole Depth/Csg 22 / 15'

Reference Measuring Point: **GROUND SURFACE**

Casing String No. 1 2 3 4 ____ Rod Size: 1 - 9 5/8"

See Report No. 1

Time/Depth From	Time/Depth To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
0600	0630	POD meeting (Drillers, RCT, IHT, BTR & Geo)
0630	0700	Equipment warmup & inspection
	0700	IHT a.m. check
0700	0715	Preparing to advance casing
0715	0810	Advancing 9 5/8" casing from ~16' to 18' bgs & borehole cleanout
0810	0815	Adding 5.0' of 9 5/8" casing Talley = 25.69'
0810	0915	Advancing 9 5/8" casing from 18' to 24.5 bgs & borehole cleanout.
—	0915	- DTB = 27' bgs
0915	0935	Preparing to drive sampler
—	0923	RCT a.m. check (≤ background)
0925	0935	Advancing SS sampler from 28' to 32.5' bgs
0935	0950	Removing & opening sampler
0950	1000	- collecting samples: 8C→9C (8C - 0% rec.)
0950	1015	Advancing casing & borehole cleanout
—	—	- added 5.0' of 9 5/8" casing Talley = 30.69'
1015	1025	The drill pipe twisted off ~4' below the drive head.
—	—	the drillers welded it back together.
1025	1105	Advancing casing & borehole cleanout DTB = 31.5' bgs
—	—	- advanced casing 24.5' - 27.5' bgs
1105	1120	Advancing SS sampler from 31.5' to 37.5' bgs
1120	1130	Removing & opening sampler
1125	1140	collecting samples: 10A, 10B, 10C & 10D
1130	1200	Lunch
~~1200~~	~~1230~~ 1220	~~Preparing to drive casing & borehole cleanout~~ JH 3-13-06

Reported By: Jake Horner	Reviewed By: L.D. Walker
Title: Geologist Date: 3-13-06	Title: Geologist Date: 5/25/06
Signature: [signature]	Signature: [signature]

A-6003-651 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING Continuation Page	Page 2 of 2 Date: 3-13-06
Well Name: 399-3-18	Well ID: C4999
Location: 300-FF-5 OU	Continuation of Report No.: 3

Time/Depth From	Time/Depth To	Description of Activities/Operations with Depth
1200	1245	Borehole clean out & preparing SS sampler
—	1245	-Tagged DTB @ 37' bgs
1245	1305	Advancing SS sampler from 37' to 43.5' bgs
1305	1325	Removing & sampling SS (the bottom 1ft fell out)
—	—	- Collected samples: ~~HG~~ 3-13-06 11A₂ - NE (saturated @ ~40' bgs)
1320	1330	Loading sampler
1330	1345	Advancing sampler from 42' to 50' bgs
1345	1410	~~Coll~~ Opening & collecting samples: ~~12A~~ LW 5-25-06 12A-13A
1400	1600	Borehole cleanout & driving casing from 27.5'-31' bgs
—	~~1530~~ 1550	RCT pm check < background
LW 5-25-06 ~~1530~~ 1550	~~1600~~ 1600	IHT pm check ≤ detectable
		not used 3-13-06

Reported By: Jake Horner	Reviewed By: L.D. Walker
Title: Geologist Date: 3-13-06	Title: Geologist Date: 5/25/06
Signature: [signature]	Signature: [signature]

A-6003-652 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING	Page 1 of 2 Date: 3-14-06

Well ID: C4999	Well Name: 399-3-18
Location: 300-FF-5 OU	Report No.: 4

Start	Finish	Total
Time 0600	Time 1620	Time 10 hrs 20 min
Hole Depth/Csg 50' / ~~31'~~ 31' (LW 5-25-06)	Hole Depth/Csg 61' / 52'	Hole Depth/Csg 11' / 21'
Reference Measuring Point: **GROUND SURFACE**	Casing String No. (1) 2 3 4 ____ See Report No. 1	Rod Size: 1- 9 5/8"

Time/Depth From	To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
0600	0630	POD meeting (BTR, Drillers, IHTs, RCTs & Geo)
0630	0720	Equipment inspection / warm-up
—	0645	IHT check with OVM < detectable
0720	1000	Advancing 9 5/8" casing & borehole cleanout
0725	0800	IHT on site performing noise survey
—	0815	Added 5.0' of 9 5/8" casing Talley = 40.69'
—	0900	Added 5.0' of 9 5/8" casing Talley = 45.69'
—	1000	DTB = 44' bgs DTW = 42.5' bgs casing shoe is @ 42' bgs.
1000	1025	Collecting ~~pumped~~ (JH 3-14-06) bailed water sample for PNNL.
—	—	- Sample #s: BIFRB2, ~~BIF99~~ (JH 3-14-06) BIFR99, BIFRB0
1025	1100	Resume drilling (Advancing casing & borehole cleanout)
1030	1040	RCT on site no survey
1035	1040	Adding 5.0' of 9 5/8" casing Talley = 50.69'
1100	1115	Setting up hose & fitting system for pumped samples
—	1100	DTB = 47.5' casing depth is @ ~46' bgs
1115	1120	Trip in sampling pump (pump set @ ~46' bgs)
1120	1130	Connect fitting & run hose to purge truck
1130	1200	Lunch
1200	1204	Set up for purge
—	1204	Start pumping DTW = 44' bgs DTB = 47' bgs
—	1207	Stop pumping, not enough water DTW = 46' bgs
1207	1225	Trip out sampling pump & wait for recharge
—	—	- The bore hole will have to be ~~bailed to~~ (JH 3-14-06) purged
—	—	& then bailed for a sample.

Reported By: Jake Horner	Reviewed By: L.D. Walker
Title: Geologist Date: 3-14-06	Title: Geologist Date: 5/25/06
Signature: [signature]	Signature: [signature]

A-6003-651 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING
5-25-06 LW 399
Continuation Page

Page 2 of 2
Date: 3-14-06

Well Name: ~~299~~-3-18	Well ID: C4999
Location: 300-FF-5 OU	Continuation of Report No.: 4

Time/Depth From	Time/Depth To	Description of Activities/Operations with Depth
—	1225	Tagged DTW @ 46' bgs (no recharge)
1225	1245	Backpull casing ~1' from 46' to 45' bgs
—	—	- still no recharge
1245	1258	Advancing borehole to 50' bgs
—	1258	- DTW = 49.7' DTB = 51' casing depth = 46' bgs
1258	1345	Bailing sample (only ~1.3' water in the borehole)
1345	1406	Advancing ss sampler From ~50' (1.5' sluff) to ~56' bgs.
1345		Collecting water sample w/parameters (sample time @ 1258)
—	—	- sample #s: B1FR91, B1FR92 & ~~B1F9~~ B1FR94 LW 5-25-06
—	—	- Waiting for water to settle out
1406	1440	Sampling ss samples 13B to 14B
1420	1445	Cleaning ss & waiting for PNNL to bring liners
1445	1500	Loading Liners 14C to 15C
1500	1520	Advancing ss sampler from 56'-61' bgs
1520	15~~38~~ 48	Collecting ss samples 14C to 15C ~~\$~~ LW 5-25-06
1540	1600	Advancing Casing & borehole cleanout
—	—	- casing depth = 52' bgs DTB = 61' bgs DTW = 58.0' bgs
1600	1620	Secure site
—	1550	Added 5.0' of temp casing Talley = 55.69'
		not used JH 3-14-06

Reported By: Jake Horner		Reviewed By: L.D. Walker	
Title: Geologist	Date: 3-14-06	Title: Geologist	Date: 5/25/06
Signature: Jake Horner		Signature: LD Walker	

A-6003-652 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING	Page 1 of 2
	Date: 3-15-06

Well ID: C4948	Well Name: 399-3-18
Location: 300-FF-5 OU	Report No.: 5

Start	Finish	Total
Time ~~0600~~ 0630 (JH 3-15-06)	Time 1510	Time 8 hrs 40 min.
Hole Depth/Csg 61' / 52'	Hole Depth/Csg 61' / 57.5'	Hole Depth/Csg Ø / 5.5'
Reference Measuring Point: **GROUND SURFACE**	Casing String No. 1 2 3 4 ____ See Report No. 1	Rod Size: 1 - 9 5/8"

Time/Depth From	To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
~~0600~~ 0630 (JH 3-15-06)	0830	Monthly GRP safety meeting
0830	0900	Travel back to POD trailer
0900	0930	POD meeting
0930	1005	Equipment inspection / warm up
0945	1005	Collecting a bailed water sample (1000 sample time)
—	—	- DTW = 42.5' bgs DTB = ~~56'~~ 57' (JH) bgs (5' caved) shoe depth = 52' bgs
1005	1015	IHT on site for am check < detectable
1005	1020	Moving drill rig to realign over borehole
1020	1030	Collecting a 2nd bailed sample w/ a clean jug (same parameters)
—	—	- PNNL Sample #s: B1FRB3, B1FRB4, B1FRB6 (1030 sample time)
1030	1200	GRAM sampler on site
1030	1200	Setting up for a slug test (both PNNL & Cascade)
1050	1100	RCT on site for am check < detectable
—	1110*	DTW = 42.5' bgs DTB = 57.0' shoe depth = 52.5'
—	—	~~DTW =~~ JH
1110	1140	Trip in screen & packer
—	—	- DTB = 55.5' Bottom screen is set @ 54.5' bgs (5' screen)
—	—	- packer is @ 46' - 47.5' bgs
—	—	- DTW = 41.4' bgs after tripping screen & packer
1140	1155	Trip in slug rod to mark the cable
1155	1200	All set, waiting for PNNL to set up computer
1200	1240	Lunch
1240	1250	Preparing to begin slug test
—	1245	Packer integrity test (ok)

Reported By: Jake Horner		Reviewed By: L.D. Walker	
Title: Geologist	Date: 3-15-06	Title: Geologist	Date: 5/25/06
Signature: John Horner		Signature: LD Walker	

A-6003-651 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING

Continuation Page

Page 2 of 2

Date: 3-15-06

Well Name: 399-3-18

Well ID: C4999

Location: 300-FF-5 OU

Continuation of Report No.: 5

Time/Depth From	Time/Depth To	Description of Activities/Operations with Depth
1250	1325	Lowren slug rod (0.390 m³) to start injection test
1325	1350	Remove slug rod (0.390 m³) for recovery test
1350	1355	Stop test & remove transducer
1355	1415	Trip out screen & packer DTB @ 1415 = 56.5' bgs
1415	1428	Advancing 9 5/8" casing & borehole cleanout
—	—	- Casing from 52.5' to 57.5' bgs
—	1420	Added 5.0' of 9 5/8" casing Talley = 60.69'
1428	1440	Borehole cleanout
1440	→	Stopped to contain an oil leak & make repairs
—	1500	Drillers notified support crew that repairs will take
—	—	the rest of the day.
	1510	Geologist left the site

not used

Reported By: Jake Horner

Title: Geologist

Date: 3-15-06

Signature: Jake Horner

Reviewed By: L.D. Walker

Title: Geologist

Date: 5-25-06

Signature: LD Walker

A-6003-652 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING	Page 1 of 2 Date: 3-16-06
Well ID: C4948	Well Name: 399-3-18
Location: 300-FF-5 OU	Report No.: 6

Start	Finish	Total
Time 0600	Time 1600	Time 10 hrs
Hole Depth/Csg 61' / 57.5'	Hole Depth/Csg 71' / ~~70'~~ 66' LW 5-25-06	Hole Depth/Csg 10 / 8.5
Reference Measuring Point: **GROUND SURFACE**	Casing String No. 1 2 3 4 ____ Rod Size: See Report No. 1	

Time/Depth From	To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
0600	0630	POD meeting (BTR, Drillers, IHT, RCT & Geo)
0630	0705	Equipment inspection & hydraulic hose repair.
—	0630	IHT am check < detectable
0705	0740	Resume borehole clean-out down to 61' bgs
0740	0800	Advancing ss sampler from 61' to 66' bgs
0800	0825	Opening & sampling ss samples 15D to 16D (all 100% rec.)
0800	0830	Advancing ss sampler from 66' to 71'
0825	0830	Loading the next ss liners 18A to 19A
0830	0855	Opening & sampling ss samples 16E to 17E (all 100% rec.)
0835	0910	Borehole cleanout
0900	0915	Loading Liners 19B - 20B
0910	0915	Added 5.0' of casing Talley = 65.69'
0915	0940	Driving casing from 57.5' to 62' bgs & clean out.
0940	1005	Resume clean out to 72' bgs
—	—	- borehole would not stay open. Plan to drive casing
—	—	down to around 71' bgs trip in the screen & then
—	—	backpull.
1005	1135	Advancing casing & bore hole clean-out down to shoe depth = 67' DTB = 73'
—	1010	- Adding 5.0' of 9 5/8" casing Talley = 70.69'
1135	1205	Trip in 10' screen & packer DTB caved back to 67' bgs.
	1135	DTB = 73' bgs DTW = 49.5' bgs
1205	1215	Trip out screen & packer.
1215	1245	Lunch
1245	1255	Advancing casing from 67' to 70' bgs

Reported By: Jake Horner	Reviewed By: L.D. Walker
Title: Geologist Date: 3-16-06	Title: Geologist Date: 5/25/06
Signature: Jake Horner	Signature: L D Walker

A-6003-651 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING Continuation Page	Page 2 of 2
	Date: 3-16-06

Well Name: 399-3-18	Well ID: C4999
Location: 300-FF-5 OU	Continuation of Report No.: 6

Time/Depth From	To	Description of Activities/Operations with Depth
1255	1330	Borehole cleanout
—	1330	DTB = 72.5' bgs (spongy) DTW = 52' bgs (some was bailed out)
1330	1345	Trip in 10' screen & packer. Bottom screen is @ 70' bgs
1345	1400	Backpull casing from 70' - 66' bgs.
—	1400	DTW = 49' bgs
1400	1405	Trip in pump & set the intake @ 66' bgs
1405	1413	Additional setup
—	1413	Start pumping @ ~4 gpm DTW = 48' bgs
—	1415	DTW = 52' bgs
—	1420	DTW = 54.5' bgs
—	1427	DTW = 61.5' bgs Flow rate dropped to ~2gpm
—	1433	DTW = ~~67~~ 61.8' 3-16-06
—	1443	DTW = 62' bgs
—	1455	GRAM sampler is checking H_2O parameters
—	1500	DTW = ~~20~~ 3-16-06 62.4' bgs water cleaned up drastically
—	1525	Stopped pumping (1520 sample time)
—	—	PNNL Sample#s: B1FR87, B1FR88 & B1FR90
1525	1535	Trip out pump
1535	1600	Secure site
		not used

Reported By: Jake Horner		Reviewed By: L.D. Walker	
Title: Geologist	Date: 3-17-06	Title: Geologist	Date: 5/25/06
Signature: [signature]		Signature: [signature]	

A-6003-652 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING	Page 1 of 2
	Date: 3-17-06

Well ID: C4999	Well Name: 399-3-18
Location: 300-FF-5 OU	Report No.: 7

Start	Finish	Total
Time 0600	Time 1645	Time 10 hrs 45 min.
Hole Depth/Csg 71' / 66'	Hole Depth/Csg 82 / 80	Hole Depth/Csg 11 / 14

Reference Measuring Point: GROUND SURFACE	Casing String No. 1 2 3 4 ____ Rod Size: 1 - 9 5/8" See Report No. 1

Time/Depth From	To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
0600	0620	POD meeting (BTR, Drillers, RCT, IHT & Geo)
0620	0700	Equipment inspection & warm up
—	0625	IHT am check < detectable
—	0700	DTW = 42.0' bgs
0700	0735	Waiting for PNNL
0735	0801	Setting up slug test equipment
0801	0851	Lowered 0.390 m^3 slug rod for injection test
0851	0939	Remove slug rod for recovery test
0939	1021	Lowered 0.390 m^3 slug rod for another injection test.
1021	1025	Remove slug rod & transducer
1025	1038	Backpull 9 5/8" casing from 66' bgs to 61.5' bgs
—	1035	- Removed 5.0' of 9 5/8" casing Talley = 65.69'
1038	1048	Setup for additional slug testing
1048	1131	Lowered 0.390 m^3 rod for injection test.
1131	1209	Remove slug ~~test~~ rod for withdrawl test.
1150	1210	RCT p.m. check < background
1209	1250	Lowered slug rod for injection test
1250	1305	Remove slug rod, transducer & trip out screen.
1305	1310	Drive casing back down from 61.5' to 70' bgs
1310	1340	Borehole cleanout from 67' bgs to 70' bgs
—	1330	IHT pm. check < detectable
1340	1355	Advancing SS sampler from 70' to 76' bgs
1355	1415	Opening & sampling liners 18A - 19A
1405	1420	Advancing SS sampler from 76' to 82' bgs

Reported By: Jake Horner		Reviewed By: L.D. Walker	
Title: Geologist	Date: 3-17-06	Title: Geologist	Date: 5/25/06
Signature: [signature]		Signature: [signature]	

A-6003-651 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING Continuation Page	Page 2 of 2 Date: 3-17-06
Well Name: 399-3-18	Well ID: C4999
Location: 300-FF-5 OU	Continuation of Report No.: 7

Time/Depth From	Time/Depth To	Description of Activities/Operations with Depth
1420	1435	Advancing 9 5/8" casing from 70' to 80' bgs
—	1420	- Added 5.0' of casing Talley = 75.69'
—	1428	- Added 5.0' of casing Talley = 80.69'
—	1420	RCT pm check < background
1435	1445	Borehole cleanout
1445	1505	Collecting SS samples 19B - 20B
—	1540	RCT pm check < background
—	1545	DTB = 46' bgs
1550	1555	Trip in sampling pump & set up
1555	1557	Start pumping
—	—	- Stopped pumping, the pump pulled sand up the
—	—	casing ~6'
1600	1615	Trip out pump & cleanout sand
1615	1630	Trip in 10' ~~5'~~ JH 3-17-06 screen down to 78' bgs (~~2'~~ 4' sluff) LW 5-25-06
1630	1645	Secure site
		not used JH 3-17-06

Reported By: Jake Horner		Reviewed By: L.D. Walker	
Title: Geologist	Date: 3-17-06	Title: Geologist	Date: 5/25/06
Signature: Jake Horner		Signature: LD Walker	

A-6003-652 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING	Page 1 of 3 Date: 3-20-06
Well ID: C4999	Well Name: 399-3-18
Location: 300-FF-5 OU	Report No.: 8

Start	Finish	Total
Time 0600	Time 1700	Time 11 hrs
Hole Depth/Csg 82 / 80	Hole Depth/Csg 91.5 / 87	Hole Depth/Csg 9.5' / 7'

Reference Measuring Point: **GROUND SURFACE**	Casing String No. (1) 2 3 4 ____ Rod Size: 1- 9 5/8" See Report No. 1

Time/Depth From	To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
0600	0630	POD meeting (BTR, Drillers, IHT, RCT, Geo.)
0630	0640	Equipment inspection / warmup
—	0635	DTW = 43.0' bgs
0640		Setting up for water sample
0640	0700	Checking pump
—	—	* IHT & RCT both had instrument problems & will return.
0700	0800	Working on pump system
—	—	- The hose line is full of sand from the last
—	—	sample (pumped to slow to lift out all the
—	—	sediment)
0800	0805	Trip in pump & set intake @ 68' bgs.
0805		Start purging DTW = 43.0' bgs (~4 gpm)
—	0810	DTW = 49.0' bgs
—	0818	DTW = 64.0' bgs stopped pumping (72 gallons)
0818	0825	Waiting for recharge (Only 1/2" in 7 min.).
0825	0835	Pull pump out & backpull casing 4' from 80'-76' bgs
—	0825	IHT on site for am check ND detectable
0835	0838	Remove 5.0' of 9 5/8" casing Tulley = 80.69'
~~0838~~		~~Trip in pump & set intake @~~ JH 3-20-06
0838	0900	- waiting for recharge (came up 8' in 22 min.)
0900	—	PNNL decided to bail the remaining vol. with
—	—	a bailer & then bail a sample.
0900	0930	Bailing with a 4" bailer (~60 gallons)
JH 3-20-06 ~~0930~~	—	Water started to recharge faster so now the pump.

Reported By: Jake Horner		Reviewed By: L.J. Walker	
Title: Geologist	Date: 3-20-06	Title: Geologist	Date: 5/25/06
Signature: Jake Horner		Signature: LD Walker	

A-6003-651 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING Continuation Page	Page 2 of 3 Date: 3-20-06
Well Name: 399-3-18	Well ID: C4999
Location: 300-FF-5 OU	Continuation of Report No.: 8

Time/Depth From	Time/Depth To	Description of Activities/Operations with Depth
0930	0946	Setup to pump sample intake set @ 68' bgs
—	0940	RCT am check < background
0946	1033	Start pumping DTW = 46.5' bgs
—	0951	DTW = 47.5' bgs (~4 gpm)
0900		GRAM sampler on site collecting samples
—	0958	DTW = 48.2' bgs
—	1008	DTW = 48.8' bgs
—	1018	DTW = 49.2' bgs
—	1030	DTW = 49.6' bgs
1025	1030	Collecting sample #s: B1FRB7, B1FRB8 & B1FRC0
—	1033	Stop pumping
1033	1100	Trip out pump & setup to start coring.
1100	1105	Advance casing 4' from 76' bgs to 80' bgs.
1105	1123	Borehole cleanout from 80' bgs to 81' bgs
1123	1150	Advance 5" SS sampler. from 81' - 88' bgs
1150	1220	Sampling SS samples 20D to 21D
1200	1230	Drillers take lunch JH 3-20-06
1230	1315	Advancing SS sampler from ~~86.5'~~ ~~to~~ 86.0' to 91.5' bgs
—	—	- The borehole was cleaned out down to 86.0' before SS.
1315	1330	Removing SS sampler
—	1330	Adding 5.0' of 9 5/8" casing Talley = 85.69'
1330	1345	Advancing casing from 80' to
1330	1400	Trying to open SS sampler
—	1340	Added 5.0' of 9 5/8" casing Talley = 90.69'
JH 3-20-06 ~~1400~~		~~Sampling SS samples 21E to 22E~~ JH 3-20-06
1400	1500	Clean out borehole & advance casing to 89' bgs
1400	1440	Cutting top end of SS sampler open
1440	1455	Sampling SS samples 21E to 22E
—	1500	DTB = 88' bgs

Reported By: Jake Horner		Reviewed By: L.D. Walker	
Title: Geologist	Date: 3-20-06	Title: Geologist	Date: 5/30/06
Signature: [signature]		Signature: [signature]	

A-6003-652 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING
Continuation Page

Page 3 of 3
Date: 3-20-06

Well Name: 399-3-18
Well ID: C4999
Location: 300-FF-5 OU
Continuation of Report No.: 8

Time/Depth From	Time/Depth To	Description of Activities/Operations with Depth
	LW 5/30/06	
1505	~~1535~~ 1525	Trip in 10' screen & riser pipe
—	—	- Didn't get the screen down far enough
1525	1555	Trip out screen & clean out borehole
—	1550	IHT pm check < background
—	1500	RCT pm check < detectable
1555	1610	Trip in screen & setup for water sample
1610	1615	Backpull casing 2' from 89' to 87' bgs
1615	1620	Trip in pump intake @ 80' bgs
—	1620	DTW = 47.8' TOP (Top of platform)
—	1625	Start pumping DTW = 47.8' TOP
—	1630	DTW = 59.3' TOP
—	1635	DTW = 67.6' TOP
—	1640	DTW = 72.5' TOP
—	1649	DTW = 78.9' TOP
—	1649	Stop pumping
1649	1700	Secure site

Not used JH 3-20-06

Reported By: Jake Horner
Title: Geologist
Date: 3-20-06
Signature: [signature]

Reviewed By: L.D. Walker
Title: Geologist
Date: 5/30/06
Signature: [signature]

A-6003-652 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING		Page 1 of 3
		Date: 3-21-06
Well ID: C4999		Well Name: 399-3-18
Location: 300-FF-5 OU		Report No.: 9
Start	**Finish**	**Total**
Time 0600	Time 1630	Time 10.5 hrs
Hole Depth/Csg 91.5 / 87	Hole Depth/Csg 101.5 / 98	Hole Depth/Csg 10 / 11
Reference Measuring Point: **GROUND SURFACE**	Casing String No. (1) 2 3 4 ____ See Report No. 1	Rod Size: 1 - 9 5/8"

Time/Depth From	Time/Depth To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
0600	0630	POD meeting (BTR, Drillers, RCT, IHT & Geo)
0630	0640	Equipment inspection & warmup
0640	0650	Trip out pump & backpull casing from 87' to 86' bgs.
—	0635	DTW = 42.4' bgs
0650	0658	Assembling 8" cleanout core barrel (attatch sub).
0658	0712	Bailing with a 4" bailer to clear out the screen.
—	—	- Water level remained stable
0712	0715	Trip in pump & set intake @ 83' bgs
—	0715	Start pumping DTW = 48.2' TOP (Top of platform)
—	0720	DTW = 56.5' TOP
—	0635	IHT am check < detectable
—	0723	RCT am check < background
—	0725	DTW = 62.0' TOP
—	0730	DTW = 66.2' TOP Total purge Volume: ~420 gallons
—	0735	DTW = 69.0' TOP *Includes purge on 3/20/06
—	0740	DTW = 70.9' TOP
—	0745	DTW = 72.0' TOP
—	0800	DTW = 73.3' TOP
0800	0830	Checking water parameters
—	0818	DTW = 73.6' TOP
0830	0835	Collecting sample #s: B1FR83, B1FR84 & B1FR86
—	0835	Stop pumping DTW = 73.7' TOP (Max drawdown = 25.5')
0835	0900	Trip out pump & Advance casing & borehole cleanout
0900	1000	Working on 8" core barrel

Reported By: Jake Horner		Reviewed By: L.D. Walker	
Title: Geologist	Date: 3-21-06	Title: Geologist	Date: 5/30/06
Signature: Jake Horner		Signature: LD Walker	

A-6003-651 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING
Continuation Page

Page 2 of 3
Date: 3-21-06

Well Name: 399-3-18
Well ID: C4999
Location: 300-FF-5 OU
Continuation of Report No.: 9

Time/Depth From	To	Description of Activities/Operations with Depth
—	0930	FH QA personnel on site
1000	1013	Borehole cleanout from 87' to 91' bgs.
1013	1025	Advance ss sampler from 91' to 96' bgs
1025	1030	Trip out ss sampler
~~1030~~ 3-21-06	—	- sample fell out
1030	1045	2nd attempt to collect sample (91' to 96' bgs)
1045	1100	3rd attempt to collect sample " (no luck)
1100	1110	Discussing options with Driller
1110	1115	Welding nuts (3/4") on the inside of the ss shoe.
1115	1124	4th attempt
1124	1135	5th attempt
1135	1215	6th attempt (after welding "fingers" in the shoe)
1215	1235	Opening & sampling ss samples: 24E A-23C (23A & 23B empty)
1230	1245	Drillers take lunch
1245	1350	Advance casing & borehole cleanout
—	1250	- Added 5.0' of 9 5/8" casing Talley = 95.69'
—	1350	- DTB = 96.5' bgs shoe depth = 94.5' bgs
1350	1410	Advancing ss sampler from 96.5' to 101.5' bgs
—	1405	IHT pm check < detectable
1410	1440	Collecting ss samples 24B to 25B
1415	1455	Advancing casing & borehole cleanout
—	1450	RCT PM check < background
—	1455	DTB = 101' bgs shoe depth = 100' bgs
1455	1515	Trip in 10' screen & riser (bottom screen @ 101')
1515	1520	Backpull casing from 100' to 98' bgs
1520	1524	Trip is sampling pump & set intake @ 93' bgs.
—	1524	Start pumping DTW - 48.6' TOP (Top of platform)
—	1529	DTW = 56.8' TOP
—	1535	DTW = 63.5' TOP

Reported By: Jake Horner
Title: Geologist
Date: 3-21-06
Signature: Jake Horner

Reviewed By: L.D. Walker
Title: Geologist
Date: 5/30/06
Signature: LD Walker

A-6003-652 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING Continuation Page		Page 3 of 3 Date: 3-21-06
Well Name: 399-3-18	Well ID: C4999	
Location: 300-FF-5 OU	Continuation of Report No.: 9	

Time/Depth From	Time/Depth To	Description of Activities/Operations with Depth
—	1540	DTW = 65.3' TOP
—	1550	DTW = 67.6' TOP
—	1600	DTW = 68.8' TOP
—	1620	DTW = 68.9' TOP Stop pumping max drawdown = 20.3'
—	—	- Total purge volume = ~250 gallons (~4.5 gal/min.)
1620	1630	Secure site

not used JH 3-21-06

Reported By: Jake Horner	Reviewed By: L.D. Walker
Title: Geologist Date: 3-21-06	Title: Geologist Date: 5/30/06
Signature: Jake Horner	Signature: LD Walker

A-6003-652 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING	Page 1 of 2 Date: 3-22-06

Well ID: C4999	Well Name: 399 - 3 - 18
Location: 300 - FF - 5	Report No.: 10

Start	Finish	Total
Time 0600	Time 1640	Time 10 hrs 40 min
Hole Depth/Csg 101.5 / 98	Hole Depth/Csg 115 / 111	Hole Depth/Csg 13.5 / 13
Reference Measuring Point: **GROUND SURFACE**	Casing String No. 1 2 3 4 ____ See Report No. 1	Rod Size: 1 — 9 5/8"

Time/Depth From	Time/Depth To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
0600	0640	POD meeting (BTR, Drillers, IHT, RCT & Geo)
—	0608	Start pumping DTW = 41' bgs
—	0645	DTW = 68.9' TOP (Top of platform)
0640	0700	Equipment inspection & prep time
—	0655	DTW = 68.9' TOP
0715	0720	Collecting Water samples: B1FR95, B1FR96 & B1FR98
—	0720	Stop pumping
—	0725	RCT a.m check & purgewater truck check < BG
0720	0750	Advance casing & borehole cleanout
—	0750	- DTB = 100.5' bgs casing shoe = 100' bgs
0750	0810	Advancing SS sampler to 106' bgs
0810	0835	Opening & sampling SS samples: 25C to 26C (100%)
0810	0850	Borehole cleanout down to 105.5' bgs & advancing
—	—	casing to 102.0' bgs.
0850	0914	Advancing SS sampler from 105.5' to 111' bgs
—	0900	RCT check on purge truck (swapped @ ~ 0840)
0914	0930	Opening & sampling SS samples: 26D - 27D (27D Fell out)
—	—	- bottom 1.5' fell out
0915	1015	Advancing casing & borehole cleanout
—	—	- Added 5.0' of 9 5/8" casing Talley = 110.69'
—	1015	DTB = 109' bgs shoe depth = 108' bgs
1015	1030	Trip in 10' screen ~~& pump (intake @~~ JH 3-22-06
1030	1040	Trip out screen (borehole caved up to 105' bgs)
1040	1045	Advance casing from 108' to 109' bgs

Reported By: Jake Horner		Reviewed By: L.D. Walker	
Title: Geologist	Date: 3-22-06	Title: Geologist	Date: 5/30/06
Signature: John Horner		Signature: [signature]	

A-6003-651 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING Continuation Page	Page 2 of 2 Date: 3-22-06
Well Name: 399-3-18	Well ID: C4999
Location: 300-FF-5 OU	Continuation of Report No.: 10

Time/Depth From	To	Description of Activities/Operations with Depth
1045	1125	Borehole cleanout down to 109.3' bgs
—	—	- used a 4" sand pump from 108' to 109.3' bgs
1125	1135	Trip in screen
1135	1140	Backpull casing from 109' to 107' bgs
1140	1148	Trip in sampling pump & set intake @
—	1149	Start pumping DTW = 47.3' TOP
—	1154	DTW = 55.5' TOP
—	1200	DTW = 57.2' TOP (Tot. time = 141 min @ 4.5 gpm
—	1205	DTW = 57.5' TOP Tot. purge vol. = 535 gallons
—	1225	DTW = 57.7 TOP Max drawdown = 11.2 ft)
—	1238	DTW = 58.2 TOP
—	1320	IHT pm check < detectable
1405	1410	Collecting water samples: B1FR79, B1FR80 & B1FR82
—	1410	Stop pumping DTW = 58.5' TOP
1410	1425	Trip out pump & screen
1425	1440	Advancing SS sampler from 109' to 115' bgs
1440	1505	Sampling SS samples: 27E to 28E (28E only 80%)
1445	1620	Borehole cleanout down to & advancing casing.
—	1620	- DTB = 114' bgs shoe depth = 111' bgs
—	1540	RCT pm check
1620	1640	Advancing SS sampler from 114' to 118' bgs
—	—	- 3' fell out (115' - 118' bgs) (next attempt 3/23/06)
1640	1650	Secure site
		~~not used JH 3-22-06~~

Reported By: Jake Horner		Reviewed By: L.D. Walker	
Title: Geologist	Date: 3-22-06	Title: Geologist	Date: 5/30/06
Signature: Jake Horner		Signature: LD Walker	

A-6003-652 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING	Page 1 of 2 Date: 3-23-06

Well ID: C4999	Well Name: 399-3-18
Location: 300-FF-5	Report No.: 11

Start	Finish	Total
Time 0600	Time 1500	Time 9 hrs
Hole Depth/Csg 115 / 111	Hole Depth/Csg 131 / 130	Hole Depth/Csg 16 / 19
Reference Measuring Point: **GROUND SURFACE**	Casing String No. 1 2 3 4 ____ See Report No. 1	Rod Size: 1 - 9 5/8"

Time/Depth From	To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
0600	0630	POD meeting (BTR, Drillers, Logging Crew, RCT, IHT & Geo)
0630	0640	Equipment inspection & warmup
0640	0643	Adding 5.0' of 95/8" casing Talley = 120.69'
—	0644	IHT am check < detectable
0630	→	Logging crew is waiting on standby
0643	0705	Advancing casing from 111' to 115 & cleanout.
—	—	- 5.0' of casing was removed Talley = 115.69'
—	0705	DTB = 114.5' bgs
0705	0735	Advancing SS sampler from 114.5' to 121' bgs
0735	0915	Borehole cleanout & advancing casing down to 120' bgs.
0735	0900	Collecting SS samples: 29A - 30A (30A 80%)
—	—	- took ~1 hr to open SS (had to grind off endcaps)
—	0915	DTB = 121' bgs shoe depth = 120' bgs
0915	0935	Advancing SS sampler from 121' to 126.5' bgs
0935	0955	Collecting SS samples: 30B - 31B (30B - 30C 0%)
0945	1000	Advancing ~~casing~~ 3-23-06 & borehole cleanout (casing was not advanced)
1000	1005	Trip in screen & pump w/ intake @ ~80' bgs
—	1005	Start pumping DTW = 46.1' TOP (Top of platform)
—	—	- DTB = 121.5' bgs (slough 126.5-121.5) shoe depth = 120' bgs
—	1016	DTW = 53.6' TOP
—	1033	DTW = 53.5' TOP
—	1240	DTW = 53.4' TOP
1235	1242	Collecting water sample #s: B1FR31, B1FR32 & B1FR34
1345	1300	Trip out pump & screen

Reported By: Jake Horner		Reviewed By: L.D. Walker	
Title: Geologist	Date: 3-23-06	Title: Geologist	Date: 5/30/06
Signature: Jake Horner		Signature: LD Walker	

A-6003-651 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING

Continuation Page

Page 2 of 2

Date: 3-23-06

Well Name: 399-3-18	Well ID: C4999
Location: 300-FF-5 OU	Continuation of Report No.: 11

Time/Depth From	Time/Depth To	Description of Activities/Operations with Depth
1300	1350	Advancing casing & borehole cleanout
—	—	- added 5.0' of casing Talley = 125.69'
—	1350	DTB = 126' shoe depth = 125' bgs
1350	1400	Advancing ~~5.0' of~~ 6.0' 3-23-06 ss sampler from 126' to
1400	1430	Collecting ss samples 31C - 32C
—	—	- Contact with the Ringold Lower Mud was
—	—	encountered @ 126' bgs.
1400	1445	Advancing casing down to 130' bgs & cleanout
—	—	- added 5.0' of 9 5/8" casing Talley = 130.69'
—	1445	DTB = 131' shoe depth = 130' bgs
1445	→	moving equipment to make room for the logging truck.
—	1500	Geologist left the site

not used 3-23-06

Reported By: Jake Horner	Reviewed By: L.D. Walker
Title: Geologist Date: 3-23-06	Title: Geologist Date: 5/30/06
Signature: Jake Horner	Signature: LD Walker

A-6003-652 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING

Page 1 of 2

Date: 3-27-06

Well ID: C4999 | Well Name: 399-3-18

Location: 300-FF-5 OU | Report No.: 12

Start	Finish	Total
Time 0600	Time 1630	Time 10.5
Hole Depth/Csg 131' / 130'	Hole Depth/Csg 57.4' / 57.7'	Hole Depth/Csg -73.6' / -72.3'

Reference Measuring Point: **GROUND SURFACE**

Casing String No. 1 2 3 4 ____ See Report No. 1 | Rod Size: 1 - 9 5/8"

Time/Depth From	Time/Depth To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
0600	0620	POD meeting (BTR, Drillers, IHT, RCT & Geo.)
0620	0700	Organize equipment & prep for slug test DTW=41.7' bgs
0700	0715	Trip in 10' screen & packer
0715	0730	Trip out screen (need to fill up the mud layer)
0730	0735	Adding 1 50# bag of bent. pellets & 1/2 bag sand
0735	0800	Trip in screen & packer
—	0740	PNNL on site for slug test
0800	0817	Backpull casing from 127.2' to 128' bgs
—	—	- The screen dropped too much
0817	0827	Backpull screen ~5' & add 1 bag sand
0827	0836	Backpull 9 5/8" casing from 128' to 122.5' bgs
—	—	- 5.0' of casing was removed Talley=125.69'
—	0840	DTW=40.3' bottom screen = 127' bgs
0840	0920	Packer test with 5 gallons water
0920	1002	Waiting for water to stabilize
1002	→	Start slug testing with screen exposed 4.5'.
—	—	• Injection & withdrawl with 0.195 m³ rod
—	—	• Injection & withdrawl with 0.34 m³ rod
—	—	• Repeat Injection & withdrawl with 0.195 m³ rod
—	—	• Recovery on second (0.195 m³) test was much faster.
1240	1255	Backpull casing from 122.5' to 118' bgs
—	—	- 5.0' of casing was removed Talley = 120.69'
1255	1335	Resume slug testing with screen exposed 9.0'.
—	—	• Injection & withdrawl tests with 0.195 m³ rod

Reported By: Jake Horner	Reviewed By: L.D. Walker
Title: Geologist Date: 3-27-06	Title: Geologist Date: 5/30/06
Signature: Jake Horner	Signature: LD Walker

A-6003-651 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING Continuation Page	Page 2 of 2 Date: 3-27-06
Well Name: 399-3-18	Well ID: 399-3-18 (C4999)
Location: 300-FF-5 OU	Continuation of Report No.: 12

Time/Depth From	Time/Depth To	Description of Activities/Operations with Depth
1340	1410	Trip out screen & packer
—	1345	DTW = 41.6' bgs
1410	1420	Prep to backpull casing & backfill borehole
1420	1545	Backpull casing & adding 10-20 mesh silica sand
		• 9⅝" casing was backpull from 118' to 57.7' bgs
		• Borehole was backfilled from 127' to 57.4' bgs
		• casing Talley = 60.69' (see well completion log)
1545	1630	Straitness test using 20' of 8⅝" casing
		• casing passed freely to bottom (57.4' bgs).
1615	1630	RCT Opm. check, < background
1630	1640	Secure site
		not used JH 3-27-06

Reported By: Jake Horner		Reviewed By: L.D. Walker	
Title: Geologist	Date: 3-27-06	Title: Geologist	Date: 5/30/06
Signature: John Horner		Signature: LD Walker	

A-6003-652 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING

Date: 3-28-06

Well ID: C4999	Well Name: 399-3-18
Location: 300-FF-5 OU	Report No.: 13

Start	Finish	Total
Time 0600	Time 1620	Time 10 hrs 20 min.
Hole Depth/Csg 57.4' / 57.7'	Hole Depth/Csg 40.2 / ~~45.7~~ 45.7' LW 5-30-06	Hole Depth/Csg -17.6' / -13.0'
Reference Measuring Point: **GROUND SURFACE**	Casing String No. 1 2 3 4 ___ See Report No. 1	Rod Size: 1 - 9 5/8"

Time/Depth From	To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
0600	0620	POD meeting (BTR, Drillers, RCT, IHT & Geo)
0620	0700	Drillers work on pickup starter
0700	0720	Prep time for completion activities
—	0715	QA personnel arrives on site
—	0720	DTW = 41.7' bgs
0720	0750	Trip out casing used for straitness test
0750	0818	Placing a bent seal from 57.4' to 52.0' bgs &
—	—	backpulling temp. casing from 57.7 to 52.2' bgs.
0818	0823	Removing 5.0' of casing Talley = 55.7'
0820	0830	Personnel on site to take purge truck (RCT present)
0825	0840	Tripping in stainless steel sump, screen & riser.
—	—	• sump = 2.03' screen = 15.0' (14.55' slotted) & 35.04' riser
0840	0845	Unloading bent. (just delivered)
0845	0915	Resume tripping in SS casing (6" I.D. SCH 10S TP 304L)
—	—	• Centralizers (clamp on type) were placed above & below screen
0915	0945	Backpulling casing & installing filter pack (10-20 mesh)
—	—	• SS casing shoe is set @ 49.0' bgs
—	—	• Added sand from 52.0' to 49.0' bgs
0945	1000	Decontaminating 1" tremie to use as a pathway
—	—	for the tagline to pass the centralizers (didn't work)
1000	1055	Installing filter pack from 49.0' to 29.5' bgs
—	1055	Temp. casing depth = 30.7' bgs
1055	1130	Building a dual surge block
1130	1135	Tripping in surge block (didn't go down)

Reported By: Jake Horner		Reviewed By: L.D. Walker	
Title: Geologist	Date: 3-28-06	Title: Geologist	Date: 5/30/06
Signature: John Horner		Signature: LD Walker	

A-6003-651 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING Continuation Page		Page 2 of 2 Date: 3-28-06
Well Name: 399-3-18	Well ID: C4999	
Location: 300-FF-5 OU	Continuation of Report No.: 13	

Time/Depth From	To	Description of Activities/Operations with Depth
1135	1245	Modifying surge block
1245	1250	Tripping surge block (still no luck)
1250	1300	Looking down well to troubleshoot
—	—	• Screen appears twisted, but still open.
1300	1325	Waiting for FH to arrive with a camera.
1325	1340	Checking with camera (screen is twisted)
1340	1410	Backpulling SS (Top 3' of screen is twisted up)
1410	1530	Drilling back down to 52.9' bgs (0.9' into seal).
—	1415	Add 5.0' casing Talley = 40.7'
—	1417	Add 5.0' casing Talley = 45.7'
—	1425	Add 5.0' casing Talley = 50.7'
—	1508	Add 5.0' casing Talley = 55.7'
1530	1535	Adding 1/4 bucket bent. pellets to replace seal.
—	1535	DTB = 52.0' bgs
1535	1500	Trip in new SS screen (same dimensions) & same
—	—	sump & riser casing.
1500	1620	Reinstalling filter pack & backpulling casing.
		• see comp. Log
		• Final depths (bgs):
		• casing talley = 50.7'
		• DTB = 40.2'
		• temp. shoe depth = 45.7' bgs
		• SS depth = 49.0' bgs
JH		not used JH 3-28-06

Reported By: Jake Horner		Reviewed By: L.D. Walker	
Title: Geologist	Date: 3-28-06	Title: Geologist	Date: 5/30/06
Signature: John Horner		Signature: LD Walker	

A-6003-652 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING		Page 1 of 2 Date: 3-29-06
Well ID: C4999	Well Name: 399-3-18	
Location: 300-FF-5 OU	Report No.: 14	

Start	Finish	Total
Time 0600	Time 1500	Time 9 hrs
Hole Depth/Csg 40.2 / 45.7	Hole Depth/Csg 2.5' / ∅	Hole Depth/Csg -37.7' / -45.7'
Reference Measuring Point: GROUND SURFACE	Casing String No. 1 2 3 4 ____ Rod Size: See Report No. 1	

Time/Depth From	To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
0600	0630	POD meeting (BTR, Drillers, RIT, IHT & Geo)
0630	0640	Prep time
0640	0650	Installing filter pack & backpulling casing (no sand was added)
—	0650	• DTB = 39.8' bgs shoe depth = 46.7' bgs
0650	0700	Trip in dual surge block
0700	0710	Start surging from 44' to 47' bgs
0710	0720	Adding 50# bag 10-20 mesh sand
0720	0740	Surging
0740	0744	Adding 1 bag sand
0744	0755	Surging
0755	0800	Adding 1 bag sand
0800	0823	Surging
0823	0826	Adding 1 bag sand
0826	0910	Surging
0910	0912	Adding 1 bag sand
0912	1030	Surging (128 min. tot.) *see comp. Log
—	—	• Added 1 bag of sand @ 1000.
1030	1035	Raising surge blocks & marking next interval
1035	1050	Surging from 42' to 45' bgs
1050	1057	Adding 1 bag sand
1057	1140	Surging
1140	1149	Adding 1 bag sand
1149	1209	Surging (63 min tot., see comp. Log)
1209	1225	Tripping out surge block (remaining Screen is dry)

Reported By: Jake Horner		Reviewed By: L.D. Walker	
Title: Geologist	Date: 3-29-06	Title: Geologist	Date: 5/30/06
Signature: Jake Horner		Signature: LD Walker	

A-6003-651 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING
Continuation Page

Page 2 of 2
Date: 3-29-06

Well Name: 399-3-18
Well ID: C4999
Location: 300-FF-5 OU
Continuation of Report No.: 14

Time/Depth From	To	Description of Activities/Operations with Depth
1225	1244	Backpulling casing & installing filter pack
		• Backpulled casing to 22.7' bgs
		• Added sand up to 22.0' bgs
1244	1315	Installing bent. pellet seal from 22' to 17.2' bgs
—	—	• added 5 gal. water to hydrate pellets.
1315	1330	Backfilling with 3/8" bent. crumbles
—	—	• Backpulled casing to 10.5' bgs
—	—	• Add crumbles to 9.9' bgs
—	—	• Hydrate crumbles w/ 5 gal. H_2O
1330	1345	Setup to start grouting
1345	1445	Mixing & pouring grout from 9.9' to
—	—	- 3 bags cement (12# bent.) (94# bags)
—	—	- 4 more bags cement (94# bags) w/ 16# bent.
1445	1455	Cleanup cement (used ~70 gallons total)
—	—	- DTB (annulous) = 32" bgs (2.7' bgs)
—	—	- SS stickup = 2.5' ags
—	—	- DTB (6") = ~49.57 (taken from stickup & Tally).
1455	→	Preparing to mobilize drill rig to C5000.
—	1500	Geologist left the site
		not used JH 3-29-06

Reported By: Jake Horner
Title: Geologist
Date: 3-29-06
Signature: Jake Horner

Reviewed By: L.D. Walker
Title: Geologist
Date: 5/30/06
Signature: LD Walker

A-6003-652 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING	Page 1 of 2
	Date: 4-13-06

Well ID: C4999	Well Name: 399-3-18
Location: 300-FF-5 OU	Report No.: 15

Start	Finish	Total
Time 0600	Time 1100	Time 5 hrs
Hole Depth/Csg N/A / N/A	Hole Depth/Csg N/A / N/A	Hole Depth/Csg N/A / N/A

Reference Measuring Point: **GROUND SURFACE**	Casing String No. 1 2 3 4 ___ See Report No. 1	Rod Size: ~~9 5/8"~~ 6" SS JH 4-13-06

Time/Depth		Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
From	To	
0600	0630	POD meeting
0630	0640	Moving purge truck on site
0640	0750	Prep time
—	0650	DTW = 42.6' TOC DTB = 52.03' TOC
	0704	Start test #1 (not pumping, just checking equip.)
—	—	• LWD1a
—	—	Calibration: NTU
—	—	• pH slope = 100.3 std. read
—	—	• Cond. std = 1419 u/cm Read = 1420 5.79 5.70
—	0754	Start ~~&~~ Test #2 pumping (pump not working well) 52.0 50.1
—	—	NTU pH temp Turb. D.O. 529 531
—	0757	Stopp pumping (pumped only 1-2 gpm) no drawdown
0800	0819	Setup with a diffent pump Model 25S Grundfos
—	—	- Intake set @
—	0819	Start pumping / start test #3 trasducer = ~7.4' bwt
—	—	NTU cond. Temp. pH D.O.
—	0820	254 344 15.0 7.43 N.D.
—	0830	34 342 15.7 7.41 8.2
—	0836	17.5 344 16.1 7.48 8.3
—	0845	8.24 342 15.6 7.49 8.3
—	0849	Checked flow @ purge truck, no water, stop pumping
—	0850	• DTW = 42.6 TOC (no drawdown)
0850	0905	Trouble shooting pump
—	0905	Resume pumping (not sure why ~~it~~ quit)

Reported By: Jake Horner		Reviewed By: L.D. Walker	
Title: Geologist	Date: 4-13-06	Title: Geologist	Date: 5/30/06
Signature: Jake Horner		Signature: LD Walker	

A-6003-651 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING

Continuation Page

Page 2 of 2

Date: 4-13-06

Well Name: 399-3-18

Well ID: C4999

Location: 300-FF-5 OU

Continuation of Report No.: 15

Time/Depth From	Time/Depth To	Description of Activities/Operations with Depth
—	—	NTU pH Cond. ~~Turb.~~ Temp. °C D.O.
—	0910	10.3 7.43 345 15.5 8.3
—	0918	Pump stopped again (it might be overheating)
0922	0923	Lifting pump up, it was silted in.
0923	0925	Letting pump cool down
—	0925	Resume pumping Tanad. = 6.4' bwt
—	~~0936~~	NTU PH cond. Temp. D.O.
—	0936	25.7 7.53 347 16.1 8.3
—	0948	13.9 7.53 349 16.0 8.2
—	1005	2.69 7.51 349 16.4 8.1
—	1012	Collecting samples: B1FR75, B1FR76 & B1FR78
—	1014	Stop pumping
1014	1035	Clean up & trip out pump
—	1035	DTB = 53.1' TOC (3' stickup)
1035	1100	Geologist finishes sample paperwork
—	1100	Geologist leaves site, Drillers cont. work in
		laydown yard.
		not used JH 4-13-06

Reported By: Jake Horner

Title: Geologist

Date: 4-13-06

Signature: [signature]

Reviewed By: L.D. Walker

Title: Geologist

Date: 5/30/06

Signature: [signature]

A-6003-652 (04/03)

WELL DEVELOPMENT AND TESTING DATA

Well Name:	Well ID:	Well Location:	Date:
399-3-18	C4999	300-FF-5 OU	4-13-06

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	42.6' TOC
End of Job	42.6' TOC
DEPTH TO BOTTOM:	
Start of Job	52.05' TOC
End of Job	53.10' TOC

PART 2

WELL DEVELOPMENT DATA

Pump Model	25S Grundfos
Intake Depth	50.5' TOC
Starting Turbidity	

Pump Start	Stop	Flow Rate
0819	0849	~15gpm
0905	1014	~15gpm

Total Pumped	~1,485 gallons
Final Turbidity	2.69 NTU
XD SN/Range (PSI)	20

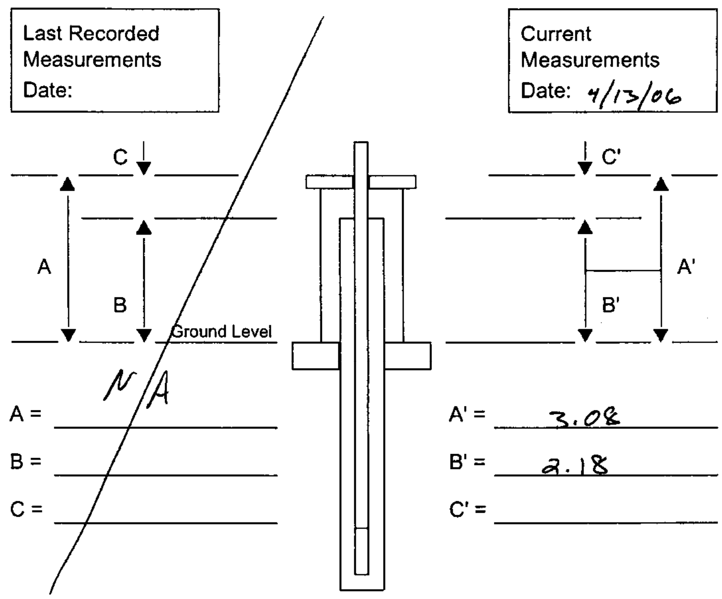
PART 3

INSTANTANEOUS SLUG TEST

N/A

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

PART 4



A =		A' =	3.08
B =		B' =	2.18
C =		C' =	

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

PART 5

COMMENTS:

Prepared by (print name):	Signature:	Date:
Jake Horner	Jake Horner	4/13/06
Reviewed by (print name):	Signature:	Date:
L.D. Walker	LD Walker	5/30/06

A-6003-644 (03/03)

FIELD ACTIVITY REPORT - DAILY DRILLING	Page 1 of 1 Date: 5/23/06
Well ID: C4999	Well Name: 399-3-18
Location: 300-FF-5 OU	Report No.: 16

Start	Finish	Total
Time 1200	Time 1310	Time 70 min
Hole Depth/Csg n/a / n/a	Hole Depth/Csg n/a / n/a	Hole Depth/Csg n/a / n/a

Reference Measuring Point: **GROUND SURFACE**	Casing String No. 1 2 3 4 ____ Rod Size: See Report No. 1

Time/Depth From	To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
1200	1310	Install permanent pump
		• Grundfos pump 5SO5-13 (0.5 HP); wt. = 10 lbs; 60 Hz
		• Model # B Ø 8 Ø 1 Ø Ø 13 - P1 Ø 545 US
		• 3/4" SS SCH 10 S TP304/304L (45.20' total)
		• Intake set @ 46.61' TOC (43.53' bgs)
		not used JH 5/23/06

Reported By: Jake Horner		Reviewed By: L.D. Walker	
Title: Geologist	Date: 5/23/06	Title: Geologist	Date: 5/30/06
Signature: Jake Horner		Signature: LD Walker	

A-6003-651 (04/03)

FIELD ACTIVITY REPORT
TUBULAR GOODS TALLY

Page 1 of 1

Date: 3-9-06

Well Name: 399-3-18 | Well ID: C4999

TEMPORARY				PERMANENT*						SCREEN/CAP*		
Jt. #	Length (ft.)	Jt. #	Length (ft.)	Jt. #	Length (ft.)	C	Jt. #	Length (ft.)	C	Jt. #	Length (ft.)	C
1	0.69	21	5.0	1	10.0	C	21			1	2.03' sump	C
2	5.0'	22	5.0	2	10.0		22			2	15.0' screen	
3	5.0'	23	5.0	3	10.02		23			3	(14.55')	
4	5.0'	24	5.0	4	5.02		24			4		
5	5.0	25	5.0	5			25			5		
6	5.0	26	5.0	6			26			6		
7	5.0	27	5.0	7			27			7		
8	5.0	28		8			28			8		
9	5.0	29		9			29			9		
10	5.0	30		10			30			10		
11	5.0	31		11			31			11		
12	5.0	32		12			32			12		
13	5.0	33		13			33			13		
14	5.0	34		14			34			14		
15	5.0	35		15			35			15		
16	5.0	36		16			36			16		
17	5.0	37		17			37			17		
18	5.0	38		18			38			18		
19	5.0	39		19			39			19		
20	5.0	40		20			40			20		
Tot	95.69	Tot	35.0	Tot	35.04		Tot			Tot	17.03	

*Indicate those joints with centralizers with a C in the available box.
ALL Casing length shall be measured to the nearest 0.01 ft.

Comments/Remarks:

Tot. temp. casing = 130.69'

Screen int. = 32.86 - 47.86' bgs

Total permanent casing (w/ screen) = 52.07 (2.18' ags – 49.89' bgs)

Temporary: O.D./I.D. 9 5/8"/8 5/8" | Permanent: O.D./I.D. 6 5/8"/6" | Screen: O.D./I.D. 6 5/8"/6"

Temp.: 9 5/8"/8 5/8" 1/2" wall carbon steel

Temp. casing shoe 9 3/4"/8 5/8" (0.69' long)

Permanent: 6 5/8"/6" SCH 10S Type 304L

Reported By: Jake Horner		Reviewed By: L.D. Walker	
Title: Geologist	Date: 3-28-06	Title: Geologist	Date: 5/30/06
Signature: John Horner		Signature: LD Walker	

A-6003-655 (04/03)

G.36

WELL COMPLETION LOG

Page 1 of 2

Date: 3-27-06

Well ID: C4999 | Well Name: 399-3-18

Project: 300-FF-5 Monitoring Wells | Location: 300-FF-5 OU | Drilling Contractor: Cascade Drilling

1. Time	2. Total Casing	3. Stkup	4. Btm Csg	5. Tape Reading	6. Correction	7. Cor Tape Reading	8. Fill Depth	9. Overlap	Fill Material Type	Fill Material Amt	Fill Material Unit	Comments
0730	130.7	0.7	130	136.7	5.7	131	—	—	—	—	—	Start depth
0735	130.7	3.5	127.2	135.7	5.7	130	—	—	—	—	—	backpulled (BP)
0737	130.7	3.5	127.2	131.5	5.7	126.8	126.8	0.4	bent pellets	1	50# bag	Bent.
0836	125.7	3.0	122.5	128	5.7	121.3	121.3 ~~127~~ LW	1.3 3-27-06	10-20 sand	1½	50# bag	BP + Sand
1428	120.7	5.5	115.2	122.7	5.7	117.0	117.0	-1.8	10-20 sand	8½	50# bags	BP + sand (S)
1430	120.7	5.5	115.2	117.7	5.7	112	112	3.0	10-20 sand	10	50# bags	+ S
1433	115.7	5.5	110.2	110.7	5.7	105	105	5.7	"	10	"	BP + S
1440	110.7	5.5	105.2	100.7	5.7	95	95	10.2	"	10	"	BP + S
1450	105.7	5.0	100.7	93.7	5.7	87	87	13.7	"	10	"	BP + S
1455	100.7	5.0	95.7	95.7	5.7	90	90	5.7	—	—	—	BP
1459	95.7	5.0	90.7	97.7	5.7	92	92	3.7	"	10	"	BP + S
1506	90.7	5.1	85.6	88.7	5.7	83	83	2.6	"	10	"	BP + S
1512	85.7	5.2	80.5	76.7	5.7	71	71	14.5	"	10	"	BP + S
1516	80.7	5.1	75.6	80.7	5.7	75	75	0.6	"	10	"	BP + S
1523	75.7	5.2	70.5	74.7	5.7	69	69	1.5	—	—	—	
1528	70.7	5.0	65.7	70.7	5.7	65	65	0.7	"	5	"	BP + S
1529	70.7	5.0	65.7	65.7 ~~65.7~~	LW 5-30-06 5.7	60	60	5.7	—	—	—	after + S
1531	65.7	3.7	62	66.2	5.7	60.5	60.5	1.5	"	2	"	BP + S

Note: Col. 2 - Col. 3 = Col. 4 - Col. 5 - weight and attachments = Col. 7; Col. 7 - Col. 3 = Col. 8; Col. 4 - Col. 8 = Col. 9

Reported By: Jake Horner | Reviewed By: L. D. Walker

Title: Geologist | Date: ~~4~~ LW 5-30-06 3-27-06 | Title: Geologist | Date: 5/30/06

Signature: Jake Horner | Signature: L D Walker

A-6003-653 (04/03)

WELL COMPLETION LOG

Date: 3-27-06

Well ID: C4999 | Well Name: 399-3-18

Project: 300-FF-5 Monitoring Wells | Location: 300-FF-5 OU | Drilling Contractor: Cascade Drilling

1. Time	2. Total Casing	3. Stkup	4. Btm Csg	5. Tape Reading	6. Correction	7. Cor Tape Reading	8. Fill Depth	9. Overlap	Fill Material Type	Fill Material Amt	Fill Material Unit	Comments
1535	65.7	5.0	60.7	64.7	5.7	59	59	1.7	—	—	—	BP
1536	65.7	5.0	60.7	—	5.7	—	—	—	10-20 sand	1	50# bag	~~BP~~ + S
1538	60.7	3.0	57.7	63.1	5.7	57.4	57.4	0.3	"	1/2	"	BP + S

not used JH 3/27/06

Note: Col. 2 - Col. 3 = Col. 4 - Col. 5 - weight and attachments = Col. 7; Col. 7 - Col. 3 = Col. 8; Col. 4 - Col. 8 = Col. 9

Reported By: Jake Horner | Reviewed By: L.D. Walker

Title: Geologist | Date: 3-27-06 | Title: Geologist | Date: 5/30/06

Signature: John Horner | Signature: LD Walker

A-6003-653 (04/03)

WELL COMPLETION LOG

Date: 3-28-06

Well ID: C4999 | Well Name: 399-3-18

Project: FF-5 Monitoring Wells | Location: 300-FF-5 OU | Drilling Contractor: Cascade Drilling

1.	2.	3.	4.	5.	6.	7.	8.	9.	Fill Material			
Time	Total Casing	Stkup	Btm Csg	Tape Reading	Correction	Cor Tape Reading	Fill Depth	Overlap	Type	Amt	Unit	Comments
0757	60.7	3.0	57.7	63.1	5.7	57.4	57.4	0.3	—	—	—	Start depths
0800	60.7	3.0	57.7	62.0	6.0	56.0	56.0	1.7	bent. pellets	1	5 gal bucket	Tag after pellets (3/8" coated)
0803	60.7	4.0	56.7	62.4	6.0	56.4	56.4	0.3	—	—	—	BP
0805	60.7	4.0	56.7	60.8	6.0	54.8	54.8	1.9	"	1	"	+ B
0807	60.7	5.3	55.4	60.9	6.0	54.9	54.9	0.5	—	—	—	
0809	60.7	5.3	55.4	60.0	6.0	54.0	54.0	1.4	"	1/2	"	
0810	60.7	7.0	53.7	60.1	6.0	54.1	54.1	-0.4	—	—	—	
0811	60.7	7.0	53.7	59.5	6.0	53.5	53.5	0.2	"	1/2	"	
0813	60.7	8.5	52.2	59.9	6.0	53.9	53.9	-1.7	—	—	—	
0814	60.7	8.5	52.2	59.9	6.0	53.9	53.9	-1.7	—	—	—	?
0815	60.7	8.5	52.2	58.4	6.0	52.4	52.4	-0.2	"	1/3	"	
0818	60.7	8.5	52.2	58.0	6.0	52.0	52.0	0.2	"	1/3	"	
0925	55.7	3.5	52.2	55.0	6.0	49.0	49.0	3.0	10-20 sand	2.5	50# bags	
1010	55.7	5.2	50.5	37.0	6.0	31.0	31.0	19.5	"	6	"	
1014	50.7	5.0	45.7	39.0	6.0	33.0	33.0	12.7	—	—	—	
1017	50.7	5.0	45.7	35.0	6.0	29.0	29.0	16.7	"	4	"	
1020	50.7	7.5	43.2	33.0	6.0	27.0	27.0	16.2	"	2	"	
1030	45.7	5.0	40.7	37.5	6.0	31.5	31.5	9.2	—	—	—	

Note: Col. 2 - Col. 3 = Col. 4 - Col. 5 - weight and attachments = Col. 7; Col. 7 - Col. 3 = Col. 8; Col. 4 - Col. 8 = Col. 9

Reported By: Jake Horner | Reviewed By: L.D. Walker

Title: Geologist | Date: 3-28-06 | Title: Geologist | Date: 5/30/06

Signature: John Horner | Signature: LD Walker

A-6003-653 (04/03)

WELL COMPLETION LOG

Date: 3-28-06

Well ID: C4999

Well Name: 399-3-18

Project: FF-5 Monitoring Well

Location: 300-FF-5 OU

Drilling Contractor: Cascade Drilling

1.	2.	3.	4.	5.	6.	7.	8.	9.	Fill Material			
Time	Total Casing	Stkup	Btm Csg	Tape Reading	Correction	Cor Tape Reading	Fill Depth	Overlap	Type	Amt	Unit	Comments
1032	45.7	5.0	40.7	31.5	6.0	25.5	25.5	10.2	10-20 sand	2	50# bags	
1036	45.7	8.0	37.7	36.0	6.0	30.0	30.0	7.7	—	—	—	
1037	45.7	8.0	37.7	31.0	6.0	25.0	25.0	12.7	"	1	"	
1040	40.7	5.0	35.7	39.0	6.0	33.0	33.0	2.7	—	—	—	
1045	40.7	5.0	35.7	34.5	6.0	28.5	28.5	7.3	"	3	"	
1050	40.7	8.5	32.2	35.0	6.0	29.0	29.0	3.2	"	1	"	
1053	35.7	5.0	30.7	36.5	6.0	30.5	30.5	0.2	—	—	—	
1054	35.7	5.0	30.7	35.5	6.0	29.5	29.5	1.2	"	1/2	"	
1530	55.7	4.2	51.5	58.5	6.0	52.5	52.5	-1.0	—	—	—	- Drill to depth (the
1535	55.7	4.2	51.5	58.0	6.0	52.0	52.0	-0.5	bent. pellets	1/3	5 gal bucket	screen needed replaced,
1602	55.7	4.2	51.5	55.0	6.0	49.0	49.0	2.5	10-20 sand	2.5	50# bag	so the backfill was
1611	55.7	5.2	50.5	44.0	6.0	43.0	43.0	6.5	"	2	"	drill out)
1615	55.7	8.5	47.2	45.0	6.0	39.0	39.0	8.2	"	2	"	
1620	50.7	5.0	45.7	46.2	6.0	40.2	40.2	5.5	—	—	—	
						not used	JH 3/28/06					

Note: Col. 2 - Col. 3 = Col. 4 - Col. 5 - weight and attachments = Col. 7; Col. 7 - Col. 3 = Col. 8; Col. 4 - Col. 8 = Col. 9

Reported By: Jake Horner

Title: Geologist

Date: 3-28-06

Signature: John Horner

Reviewed By: L.D. Walker

Title: Geologist

Date: 5/30/06

Signature: LD Walker

A-6003-653 (04/03)

WELL COMPLETION LOG

Page 1 of 3

Date: 3-29-06

Well ID: C4999 | Well Name: 399-3-18

Project: FF-5 OU | Location: 300-FF-5 OU | Drilling Contractor: Cascade Drilling

1. Time	2. Total Casing	3. Stkup	4. Btm Csg	5. Tape Reading	6. Correction	7. Cor Tape Reading	8. Fill Depth	9. Overlap	Fill Material Type	Fill Material Amt	Fill Material Unit	Comments
0640	50.7	5.0	45.7	46.2	6.0	40.2	40.2	5.5	—	—	—	start depths
0645	50.7	8.5	42.2	44.2	6.0	38.2	38.2	4.0	—	—	—	
0648	45.7	5.0	40.7	45.8	6.0	39.8	39.8	0.9	—	—	—	
0700	45.7	5.0	40.7	46.1	6.0	40.1	40.1	0.6	—	—	—	Start surging
0710	45.7	5.0	40.7	47.2	6.0	41.2	41.2	-0.5	—	—	—	
0720	45.7	5.0	40.7	44.4	6.0	38.4	38.4	2.3	10-20 sand	1	50# bag	
0740	45.7	5.0	40.7	47.0	6.0	41.0	41.0	-0.3	—	—	—	
0743	45.7	5.0	40.7	44.4	6.0	38.4	38.4	2.3	"	1	"	
0755	45.7	5.0	40.7	46.8	6.0	40.8	40.8	-0.1	—	—	—	
~~0800~~	45.7	5.0	40.7	38.9	6.0	32.9	32.9	7.8	"	1	"	
0823	"	"	"	45.0	6.0	39.0	39.0	1.7	—	—	—	
0825	"	"	"	42.0	6.0	36.0	36.0	4.7	10-20 sand	1	50# bag	
0848	"	"	"	38.5	6.0	32.5	32.5	8.2	—	—	—	Tag on centralizer
0850	"	"	"	43.9	6.0	37.9	37.9	2.8	—	—	—	
0905	"	"	"	45.6	6.0	39.0	39.0	1.7	—	—	—	
0910	"	"	"	42.5	6.0	37.5	37.5	3.2	"	1	"	
0928	"	"	"	43.0	6.0	37.0	37.0	3.7	—	—	—	
0937	"	"	"	43.5	6.0	37.5	37.5	3.2	—	—	—	

Note: Col. 2 - Col. 3 = Col. 4 - Col. 5 - weight and attachments = Col. 7; Col. 7 - Col. 3 = Col. 8; Col. 4 - Col. 8 = Col. 9

Reported By: Jake Horner | Reviewed By: L.D. Walker

Title: Geologist | Date: 3-29-06 | Title: Geologist | Date: 5/30/06

Signature: Jake Horner | Signature: LD Walker

A-6003-653 (04/03)

WELL COMPLETION LOG

Page 2 of 3

Date: 3-29-06

Well ID: C4999 | Well Name: 399-3-18

Project: FF-5 Monitoring Wells | Location: 300-FF-5 OU | Drilling Contractor: Cascade Drilling

1. Time	2. Total Casing	3. Stkup	4. Btm Csg	5. Tape Reading	6. Correction	7. Cor Tape Reading	8. Fill Depth	9. Overlap	Fill Material Type	Fill Material Amt	Fill Material Unit	Comments
0952	45.7	5.0	40.7	~~43.7~~ 44.7 LW 5-30-06	6.0	38.7	38.7	2.0	—	—	—	
1000	"	"	"	41.9	6.0	35.9	35.9	4.8	10-20 sand	1	50# bag	
1020	"	"	"	42.2	6.0	36.2	36.2	4.5	—	—	—	
1030	"	"	"	42.2	6.0	36.2	36.2	4.5	—	—	—	Stable, raise blocks
1050	"	"	"	44.8	6.0	38.8	38.8	1.9	—	—	—	2 ft & resume surge
1057	"	"	"	42.2	6.0	36.2	36.2	4.5	10-20 sand	1	50# bag	
1120	"	"	"	43.8	6.0	37.8	37.8	2.9	—	—	—	
1140	"	"	"	44.8	6.0	38.8	38.8	1.9	—	—	—	
1148	"	"	"	42.1	6.0	36.1	36.1	4.6	10-20 sand	1	50# bag	
1209	"	"	"	42.1	6.0	36.1	36.1	4.6	—	—	—	Stop surging
1225	"	"	"	39.0	6.0	33.0	33.0	7.7	10-20 sand	1	50# bag	
1228	40.7	5.2	35.5	42.0	6.0	36.0	36.0	-0.5	—	—	—	
1232	40.7	5.2	35.5	28.5	6.0	22.5	22.5	12.0	10-20 sand	4	50# bags	
1235	35.7	5.2	30.5	34.9	6.0	28.9	28.9	1.6	—	—	—	
1237	35.7	5.2	30.5	25.6	6.0	19.6	19.6	10.9	10-20 sand	3	50# bag	
1240	30.7	5.0	25.2	29.0	6.0	23.0	23.0	2.2	—	—	—	
1242	30.7	5.0	25.2	26.0	6.0	20.0	20.0	5.2	10-20 sand	1	50# bag	
1244	30.7	8.0	22.7	28.0	6.0	22.0	22.0	0.7	—	—	—	

Note: Col. 2 - Col. 3 = Col. 4 - Col. 5 - weight and attachments = Col. 7; Col. 7 - Col. 3 = Col. 8; Col. 4 - Col. 8 = Col. 9

Reported By: Jake Horner | Reviewed By: L.D. Walker
Title: Geologist | Date: 3-29-06 | Title: Geologist | Date: 5/30/06
Signature: Jake Horner | Signature: LD Walker

A-6003-653 (04/03)

WELL COMPLETION LOG

Date: ~~2~~-29-06 3 LW 5-30-06

Well ID: C4999

Well Name: ~~3-18~~ 399-3-18 (JH) 3-29-06

Project: FF-5 Monitoring Wells

Location: 300-FF-5 OU

Drilling Contractor: Cascade Drilling

1. Time	2. Total Casing	3. Stkup	4. Btm Csg	5. Tape Reading	6. Correction	7. Cor Tape Reading	8. Fill Depth	9. Overlap	Fill Material Type	Fill Material Amt	Fill Material Unit	Comments
1248	30.7	8.0	22.7	28.0	6.0	22.0	22.0	0.7	—	—	—	
1257	30.7	8.0	22.7	24.0	6.0	18.0	18.0	4.7	bent. pellets	1	5 gal. bucket	3/8" non-coated
1302	25.7	5.0	20.7	25.7	6.0	19.7	19.7	1.0	—	—	—	
1304	25.7	5.0	20.7	21.3	6.0	15.3	15.3	5.4	"	1	"	
1306	25.7	8.0	17.7	23.5	6.0	17.5	17.5	0.2	"	1/5	"	tag before bent.
1308	25.7	8.5	17.2	23.2	6.0	17.2	17.2	∅	—	—	—	
1318	20.7	5.0	15.7	18.2	6.0	12.2	12.2	3.5	bent. crumbles	1	50# bag	3/8" crumbles
1320	20.7	8.0	12.7	19.8	6.0	13.8	13.8	1.1	—	—	—	
1322	20.7	8.0	12.7	17.9	6.0	11.9	11.9	0.8	bent. crumbs.	1	50# bag	
1323	20.7	9.0	11.7	18.4	6.0	12.4	12.4	-0.7	—	—	—	
1324	20.7	9.0	11.7	16.9	6.0	10.9	10.9	0.8	bent. crumbs.	1/5	50# bag	
1326	15.7	5.2	10.5	17.0	6.0	11.0	11.0	-0.5	—	—	—	
1328	15.7	5.2	10.5	16.2	6.0	10.2	10.2	0.6	"	2/5	"	
1405	10.7	5.2	5.5	14.5	6.0	8.5	8.5	-3.0	cement grout	30	gal.	mix (3x94# bags w/ 12# bent.)
1450	∅	∅	∅	2.7	—	2.7	2.7	—	cement grout	40	gal.	mix (4x94# bags w/ 16# bent.)
						not used (JH) 3/29/06						

Note: Col. 2 - Col. 3 = Col. 4 - Col. 5 - weight and attachments = Col. 7; Col. 7 - Col. 3 = Col. 8; Col. 4 - Col. 8 = Col. 9

Reported By: Jake Horner

Title: Geologist

Date: 3-29-06

Signature: Jake Horner

Reviewed By: L.D. Walker

Title: Geologist

Date: 5/30/06

Signature: LD Walker

A-6003-653 (04/03)

Well C5000

FIELD ACTIVITY REPORT NO. 1 - DRILLING PLAN

Page 1 of 1

Date: 3-30-06

Purpose: Install Monitoring Well	Location: 300-FF-5 OU
Well ID: C5000	Well Name: 399-1-23
Drilling Co.: Cascade Drilling	Rig No.: 131 — Rig Make/Mod.: Sonic Ore 50K

Casing String No. 1 2 3 4	Drilling Method	Circulation	D.H. Hammer
Casing Size 9 5/8"	Auger	Air Water/Mud	Make
Grade P110	Rotary	Reverse Direct	Model
Lbs.Per Ft. 47	Tubex	Vol: cfm	Choke
Material Carbon Steel	Cable Tool	gpm	Casing Hammer
Type:	Sonic ✓	Pressure psi	Make
Welded Thd.	A.R. w/Sonic	Drill Pipe O.D.	Model
Planned / Actual	Geoprobe	Tool Joint Size	Bit Size
Set At: 120±5 / 115	Other:	Additives	Type
Shoe OD/ID 9 5/8 / 8 5/8			Nozzles
Reference Measuring Point:			Rod Size
GROUND LEVEL			

Drlg. Co.	Rig No.:	Rig Make/Mod.:

Casing String No. 1 2 3 4	Drilling Method	Circulation	D.H. Hammer
Casing Size	Auger	Air Water/Mud	Make
Grade	Rotary	Reverse Direct	Model
Lbs.Per Ft.	Tubex	Vol: cfm	Choke
Material	Cable Tool	gpm	Casing Hammer
Type:	Sonic	Pressure psi	Make
Welded Thd.	A.R. w/Sonic	Drill Pipe O.D.	Model
Planned / Actual	Geoprobe	Tool Joint Size	Bit Size
Set /	Other:	Additives	Type
Shoe OD/ID			Nozzles
Reference Measuring Point:			Rod Size
GROUND LEVEL			

Comments/Remarks:	Estimated Depth to Water
	35 ± 5

Reported By: Jake Horner

Name/Title: Geologist

Signature: Jake Horner

Date: 3/30/06

A-6003-650 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING

Page 1 of 2

Date: 3-30-06

Well ID: C5000	Well Name: 399-1-23
Location: 300-FF-5 OU	Report No.: 1

Start	Finish	Total
Time 0600	Time 1630	Time 10.5 hrs
Hole Depth/Csg ∅ / ∅	Hole Depth/Csg 12' / 11.5'	Hole Depth/Csg 12' / 11.5'

Reference Measuring Point: **GROUND SURFACE**	Casing String No. ① 2 3 4 ____ Rod Size: 1 - 9 5/8" See Report No. 1

Time/Depth From	To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
0600	0630	POD meeting (Drillers, RCT, IHT & Geo)
0630	→	Decontaminating drill rig, all down-hole equipment &
—	—	the 9 5/8" temporary casing.
—	0630	Geologist left the site
—	1210	Geologist back on site
—	—	• All equipment has been deconed & set up.
1210	1240	Additional prep time
1240	1310	Waiting for PNNL to arrive
1310	1320	Advancing SS sampler from ∅ ft to 5.0' bgs
1320	1330	Waiting for RCT to survey SS on the way out.
1330	1350	Collecting SS samples 32D to 33D
1355	1420	Advancing casing from ∅ ft to 4.5' bgs & cleanout.
—	—	• Casing Talley = ~~8.5'~~ 8.9' (5.0' & ~~3.5'~~ 3.9' shoe) 3-30-06
1415	1420	IHT on site for pm check < detectable
1420	1440	Advancing SS sampler from 4' to 9' bgs
1440	1457	Advancing casing from 4.5' to ~~7.0'~~ 5.0' bgs & cleanout
—	—	• 0% recovery on core from 4' - 9' bgs
1500	1518	Advancing SS sampler from 5' to 9' bgs
1518	1530	Sampling SS samples 33E to 34E
1530	1535	Loading sample liners 35A to 36A
1535	~~1600~~ 1545 JW 3-30-06	Advancing SS sampler from 8.5' to 12.0
1545	1600	Collecting SS samples 35A to 36A
1550	1615	Advancing 9 5/8" casing from 5.0' to 11.5 & cleanout.
—	—	• Added 5.0' of casing Talley = 13.9'

Reported By: Jake Horner		Reviewed By: L.D. Walker	
Title: Geologist	Date: 3-30-06	Title: Geologist	Date: 5/30/06
Signature: [signature]		Signature: [signature]	

A-6003-651 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING

Continuation Page

Well Name: 399-1-23	Well ID: ~~C4999~~ C5000 3-30-06	Page 2 of 2 Date: 3-30-06
Location: 300-FF-5 OU	Continuation of Report No.: 1	

Time/Depth		Description of Activities/Operations with Depth
From	To	
1615	1630	Securing site
		not used 3-30-06

Reported By: Jake Horner		Reviewed By: L.D. Walker	
Title: Geologist	Date: 3-30-06	Title: Geologist	Date: 5/30/06
Signature: Jake Horner		Signature: LD Walker	

A-6003-652 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING

Page 1 of 2

Date: 4-3-06

Well ID: 05000	Well Name: 399-1-23
Location: 300-FF-5 OU	Report No.: 2

Start	Finish	Total
Time 0600	Time 1600	Time 10 hrs
Hole Depth/Csg 13' / 11.5'	Hole Depth/Csg 39.0' / 36'	Hole Depth/Csg 23.0' / 24.5'

Reference Measuring Point: **GROUND SURFACE**	Casing String No. 1 2 3 4 ____ Rod Size: 1 - 9 5/8" See Report No. 1

Time/Depth From	To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
0600	0630	POD meeting (BTR, Drillers, RCT, IHT & Geo)
—	0635	IHT a.m. check < detectable (RCT full time)
0630	0645	Prep time
0645	0745	Borehole cleanout from 9' (4' slough) to 12' bgs
0745	0755	Welding break-out jaws on wrench
0755	0815	Advancing SS sampler from 12' to 18' bgs
—	—	• Core plugged @ 16' bgs & just compressed the Fm.
—	—	from 16' to 18' bgs.
0815	0830	Collecting SS samples 36D-37B (10.5-14.5' bgs)
0830	0835	Assembling SS
0835	0845	Advancing SS from 17.5' (0.5' slough) to 22' bgs
0845	0900	Collecting SS samples 38A-38C (18.5'-21.5' bgs)
0855	0920	Advancing casing & borehole cleanout
—	—	• Casing down to 14' bgs DTB=
0920	0935	Sub-connection for casing (9 5/8") broke (replacement time)
0935	~~0940~~ 1050 4-3-06	Resume advancing casing & cleanout
—	0955	- Added 5.0' of casing Talley = 18.9'
—	1050	DTB = 22.8' bgs casing depth = 22' bgs Talley = 23.9'
1050	1100	Advancing SS sampler from 22.8' to 26.0' bgs
—	—	• bottom 3' fell out
1100	1115	Collecting SS samples 39A - 39D (21.5 - 25.5' bgs)
1115	1125	Assembling SS sampler
1125	1138	Advancing SS from 27.5' to ~~34.0'~~ 35.0' 4-3-06 bgs (1.5' slough)
1138	1150	Collecting SS samples 40A - 40E (29.5 - 39.5' bgs)

Reported By: Jake Horner		Reviewed By: L.D. Walker	
Title: Geologist	Date: 4-3-06	Title: Geologist	Date: 5/30/06
Signature: [signature]		Signature: [signature]	

A-6003-651 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING Continuation Page	Page 2 of 2 Date: ~~[illegible]~~ 4-3-06
Well Name: 399-1-23	Well ID: C5000
Location: 300-FF-5 OU	Continuation of Report No.: 2

Time/Depth From	Time/Depth To	Description of Activities/Operations with Depth
1150	1205	Assembling SS
1150	1210	Advancing casing & borehole cleanout
—	—	·Added 5.0' casing Talley = 28.9'
—	1210	-DTB = 26.0' bgs casing = 26.0' bgs
1210	1240	Lunch
1240	1340	Advancing casing & borehole cleanout (casing down to 32.5' bgs)
—	1250	·Added 5.0' ~~[illegible]~~ casing Talley = 33.9'
1340	1400	Advancing SS sampler from 33.5' to 40' bgs
1400	1425	Collecting SS samples & B1FR35, B1FR36 & B1FR38
1425	1450	Collecting water sample :?
LW 5/30/06		• DTB = 35' bgs • shoe depth = 32.5' bgs
1450		• DTW = 33.5 bgs
~~1450~~ 1530	1530	Advancing casing to 38.5' bgs & cleanout to 37.5' bgs
	1530	IHT and check added 5.0' Talley = 38.9'
1530	1550	Trip in 10' screen & backpull casing to 36'
=	1550	DTB = 39.0' bgs (bottom screen)
1550	1600	Trip in pump & set intake @ ~38' bgs

not used [initials] 4-3-06

Reported By: Jake Horner		Reviewed By: L.D. Walker	
Title: Geologist	Date: 4-3-06	Title: Geologist	Date: 5/30/06
Signature: Jake Horner		Signature: LD Walker	

A-6003-652 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING

Page 1 of 3

Date: 4-4-06

Well ID: C5000	Well Name: 399-1-23
Location: 300-FF-5 OU	Report No.: 3

Start	Finish	Total
Time 0600	Time 1630	Time ~~1630~~ 10.5 hrs (4-4-06)
Hole Depth/Csg 39.0' / 36.0'	Hole Depth/Csg 50' / 47'	Hole Depth/Csg 11 / 11
Reference Measuring Point: **GROUND SURFACE**	Casing String No. 1 2 3 4 ____ Rod Size: 1 - 9 5/8" See Report No. 1	

Time/Depth From	Time/Depth To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
0600	0615	POD meeting (BJR, Drillers, RCT, IHT & Geo)
0615		Prep time / waiting for RCT to survey purge truck
—	0620	DTW = ~~to~~ 39.4' TOC - 5.9' stickup = 33.5' bgs
0635	0650	Field kit setup (kit #3)
—	—	pH Turbidimeter Conductivity
—	—	std. - 7.0 ± .01 std read std. 1419
—	—	read - 7.05 4.49 4.60 read 1419
—	—	45.0 45.9
—	—	551 557 cond. in millisiemen
—	0700	Start pumping DTW = 39.4 TOC
—	0710	DTW = 39.45' TOC / Time cond. Temp °C O2 NTU pH
—	0740	DTW = 39.45' TOC / 0715 - 4.93 15.3 5.64 23.6 7.45
—	—	0720 - 4.90 15.3 5.26 10.8 7.47
—	—	0725 - 4.92 15.0 5.76 9.46 7.46
—	0737	Collected samples: B1FR42, B1FR39 & B1FR40
—	—	• 0740 - 4.90 15.5 6.14 5.30 7.47
0740	0800	Trip out pump & screen
0800	0817	Advancing 9 5/8" casing from 36' to 38' bgs & cleanout
—	—	down to 38.5' bgs
—	—	*Sample info: purged 37 min @ 5 gpm (Tot. Vol. = 185 gal.)
—	—	DTB = 39.0' bgs casing depth = 36.0' bgs
—	—	Pump intake = 38.0' bgs
0817	0825	Advancing SS sampler from 38.5 to 45.0'
—	—	- Sample fell out

Reported By: Jake Horner		Reviewed By: L.D. Walker	
Title: Geologist	Date: 4-4-06	Title: Geologist	Date: 5/30/06
Signature: Jake Horner		Signature: LD Walker	

A-6003-651 (04/03)

LW 5-30-06

FIELD ACTIVITY REPORT - DAILY DRILLING

Continuation Page

Page 2 of ~~2~~ 3

Date: 4-4-06

Well Name: 399-1-23

Well ID: C5000

Location: 300-FF-5 OU

Continuation of Report No.: 3

Time/Depth From	Time/Depth To	Description of Activities/Operations with Depth
0825	0900	2nd attempt failed, Drillers modify ss shoe by
—	—	adding fingers JH 4-3-06
0900	0910	3rd attempt 38.5' to ~~45'~~ bgs 46' bgs (2' recovery)
0910	0930	Collecting ss samples 43A & 43B (~~43~~ 43.5' - 45.5' bgs)
0920	0930	Assembling ss & borehole cleanout LW 5-30-06
0930	1010	Borehole cleanout down to 43.5' bgs casing = 43.0' bgs
—	—	- Added 5.0' of casing JH 4-4-06 Tally = 43.9' bgs
1010	1035	Trip in 10' screen, ~~packer~~ & pump (no packer)
—	1035	DTW = 39.7' TOC - 5.9' stickup = 33.8' bgs
—	1037	Start pumping (~5gpm) Intake set @ ~42' bgs (~1' off bottom)
—	1042	DTW = 39.4' TOC (up 0.3')
—	—	Cond. Temp °C O_2 NTU pH (Purge: 38 min @ 5gpm 190 gal. tot.)
—	1050	493 16.0° 5.65 933.0 7.57
—	1057	489 16.5° 4.98 81.0 ~~7.57~~ 7.56
—	1102	489 16.5° 5.50 32.0 ~~7.57~~ 7.52 LW 5-30-06
—	1110	491 16.6 5.04 47.2 7.52
1115	1120	Collecting Samples: B1FR43, B1FR44 & B1FK46
—	1122	492 16.3 5.18 45.8 7.58
—	1124	Stop pumping
1125	1135	Trip out pump & prep for slug test
1135	1230	Waiting for PNNL to arrive
1230	1232	Backpull casing from 43' - 40' bgs
1232	1300	Setup for Slug test
1300	1400	Performing Slug tests
—	—	• Injection & withdrawl with 0.195 m^3 rod
—	—	• Injection & withdrawl with 0.34 m^3 ~~&~~ rod
—	—	• Repeat with 0.34 m^3 rod
1400	1405	Trip out screen
1405	1430	Advancing casing & borehole cleanout

Reported By: Jake Horner

Title: Geologist

Date: 4-4-06

Signature: Jake Horner

Reviewed By: L.D. Walker

Title: Geologist

Date: 5/30/06

Signature: LD Walker

A-6003-652 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING Continuation Page		Page 3 of 3 Date: 4-4-06
Well Name: 399-1-23	Well ID: C5000	
Location: 300-FF-5 OU	Continuation of Report No.: 3	

Time/Depth From	To	Description of Activities/Operations with Depth
—	1408	Adding 5.0' casing Talley = 48.9'
—	1430	DTB = 45' bgs casing depth = 45' bgs
1430	1440	Advancing SS sampler from 45' to 50' bgs (~3' rec.)
1440	1500	Collecting SS samples 44A to 44C (44A ~ 60%) LW 5-30-06
1450	1510	Borehole cleanout & Advancing casing to 48' bgs
—	1510	DTB = 48.5' bgs
1510	1525	Trip in screen & pump (set @ 47' bgs
—	~~1825~~ 1525	Start pumping DTW = 40.9 TOC (35' bgs)
—	~~1830~~ 1530	DTW = 42.3' ~~bgs~~ TOC LW 5-30-06
—	1542	DTW = ~~45.6~~ 45.6' TOC LW 5-30-06
—	1543	Stop pumping to backpull casing (pump not working)
1545	1555	backpull casing from 48' to 47' bgs
—	1555	Resume pumping DTW = 39' TOC
—	1600	Stop pumping (Still not working)
1600	1630	Pump work
—	1630	Geologist left the site
		not used JH 4-4-06

Reported By: Jake Horner		Reviewed By: L.D. Walker	
Title: Geologist	Date: 4-4-06	Title: Geologist	Date: 5/30/06
Signature: Jake Horner		Signature: LD Walker	

A-6003-652 (04/03)

LW 5-30-06

FIELD ACTIVITY REPORT - DAILY DRILLING

Page 1 of ~~4~~ 3

Date: 4-5-06

Well ID: C5000	Well Name: 399-1-23
Location: 300-FF-5 OU	Report No.: 4

Start	Finish	Total
Time 0600	Time 1630	Time 10.5 hrs
Hole Depth/Csg 50 / 47	Hole Depth/Csg ~~60~~ 61' / 58.6' 4-5-06	Hole Depth/Csg ~~10~~ 11' / 11.6' 4-5-06
Reference Measuring Point: GROUND SURFACE	Casing String No. 1 2 3 4 ____ See Report No. 1	Rod Size: 1 - 9 5/8"

Time/Depth From	To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
0600	0630	POD meeting (BTR, Drillers, IHT, RCT & Geo.)
0630	0639	Prep time
—	0635	DTW = 39.2' TOC - 5.9 stickup = 33.3' bgs
—	0639	Start pumping @ ~5 gpm
—	0640	Initial drawdown (~2') DTW = 41.2' TOC
—	0642	DTW = 40.3' TOC
0657	0720	Geologist left to get sample kit
—	0726	DTW = 40.1' TOC
		Kit setup
		• pH slope = 100.0
		4-5-06

Time	NTU	Cond.	Temp °C	D.O.	pH
0737	130	481 µs	12.3	7.9	7.7
0744	659	485 µs	12.4	7.6	7.6
0800	948.	485 µs	13.9	8.0	7.8

From	To	Description
—	0800	Collecting samples: D~~RHF~~1FR47, B~~RHF~~1FR48 & B~~RHF~~1FR50
0805	0820	Trip out pump & screen
		*Tot. purge time (includes 3-4-06) = 138 min. with inconsistent pump rate tot. vol. is at least 200-300 gallons.
0820	0855	Advancing casing from 47.0' to 50.0' bgs & cleanout down to 50.4' bgs
		• Added 5.0' of casing Talley = 53.9'
0855	0910	Advancing SS sampler from 50' to 56' bgs
0910	0915	Remove SS & collect samples:
—	—	* core fell out
0915	0925	Advance SS a 2nd time from 50' - 56' bgs
0925	0945	Remove SS sampler (full) LW 5-30-06
0945	1000	Collecting SS samples ~~54D - 55D~~ 44D - 45D (49.5' - 55.5' bgs)

Reported By: Jake Horner		Reviewed By: L.D. Walker	
Title: Geologist	Date: 4-5-06	Title: Geologist	Date: 5/30/06
Signature: Jake Horner		Signature: LD Walker	

A-6003-651 (04/03)

LW 5-30-06

FIELD ACTIVITY REPORT - DAILY DRILLING Continuation Page	Page 2 of 23 Date: 4-5-06
Well Name: 399-1-23	Well ID: C5000
Location: 300-FF-5 OU	Continuation of Report No.: 4

Time/Depth From	Time/Depth To	Description of Activities/Operations with Depth
0950	1030	Advancing casing to ~54' bgs & cleanout to 55.5' bgs
1030		Trip in 10' screen, packer & pump
—	—	• Bottom set @ 55' bgs Casing = 53' bgs
—	—	• pump intake is set @ ~44' bgs
—	1100	Start pumping DTW = 40.3' TOC (5.9' stickup)
—	1104	Stop pumping, too much drawdown.
1105	1108	Lower pump to ~49' bgs (water is recharging well)
—	1109	Resume pumping DTW = 46' TOC ~5gpm
—	1111	DTW = 50' TOC "
—	1113	DTW = 53' TOC (pump started surging) ~2.5 gpm
—	1115	DTW = 52.6' TOC "
—	1120	DTW = 51.3' TOC "
—	1120	Stop pumping & wait for recharge
—	1148	Start pumping again DTW = 40.1' TOC
—	1155	Stop pumping DTW = 54.0' TOC (waiting for recharge)
—	1211	DTW = ~~52~~ 42' TOC
—	1216	Resume pumping DTW = 41' TOC LW 5-30-06
—	1224	Stop pumping DTW = 54.4 TOC (waiting for recharge)
—	1250	Resume pumping DTW = 40.3' bgs @ ~~raised~~ lowered 4-5-06 pump to 52' bgs
—	—	* checked pump rate (~8 gpm) & slowed it ~4 & water
—	4-5-06	stabilized @ ~ 51' TOC
	~~1305~~	NTU pH 4-5-06 Temp. Cond. D.O.
	1305	>1000 ~~7.105~~ 16.3 ~~498~~ 450 4-5-06 0.8
	1310	909 7.05 16.7 412 0.6
—	—	8.39
	1320	340 8.36 17.0 411 1.0
—	1325	Collected samples: B1FR51, B1FR52 & B1FR54 DTW = 51.0' TOC
	1328	113 ~~8.38~~ 8.32 16.9 411 1.4
1330	1355	Trip out pump & screen LW 5-30-06

Reported By: Jake Horner		Reviewed By: L.D. Walker	
Title: Geologist	Date: 4-5-06	Title: Geologist	Date: 5/30/06
Signature: Jake Horner		Signature: LD Walker	

A-6003-652 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING

Continuation Page

Date: 4-5-06

Well Name: 399-1-23

Well ID: C5000

Location: 300-FF-5 OU

Continuation of Report No.: 4

Time/Depth From	Time/Depth To	Description of Activities/Operations with Depth
1355	1410	Advancing SS sampler from 55' to 61' bgs
1410	1440	Removing SS & collecting samples 45E to 46E
—	—	• 45E - 46E (54' - 61' bgs, bottom 1' fell out)
1420	1540	Advancing casing down to 60' bgs & cleanout to 60' bgs
—	—	'added 5.0' of casing Talley = 58.9'
—	—	'added 5.0' of casing Talley = 63.9'
1540	1615	Set up for water sample / slug test
1540	1600	Trip in 10' screen & packer (bottom screen = 60' bgs)
1600	1615	Back pull casing from 60' to 58.6' bgs
1615	1620	~~Secure site~~ 4-5-06 Trip in pump with intake @ ~55' bgs
1620	1630	Secure site

not used 4-5-06

Reported By: Jake Horner

Title: Geologist

Date: 4-5-06

Signature: [signature]

Reviewed By: L.D. Walker

Title: Geologist

Date: 5/30/06

Signature: LD Walker

A-6003-652 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING	Page 1 of 2 Date: 4-6-06

Well ID: C5000	Well Name: 399-1-23
Location: 300-FF-5 OU	Report No.: 5

Start	Finish	Total
Time 0600	Time ~~4-6-06~~ 1630	Time 4-6-06 10.5 hrs
Hole Depth/Csg 61' / 58.6'	Hole Depth/Csg ~~69.5~~ 70.0 / ~~70~~ 69.5 LW 5-30-06	Hole Depth/Csg ~~8.5~~ 9.0 / ~~11.4~~ 10.9

Reference Measuring Point: GROUND SURFACE	Casing String No. 1 2 3 4 ____ See Report No. 1	Rod Size: 1 - 9 5/8"

Time/Depth From	To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
0600	0625	POD meeting (BTR, Drillers, IHT, RCT & Geo)
0625	0635	Prep time
—	0630	DTW = 39.4' TOC
—	0630	IHT am check < detectable
—	0635	Start pumping @ ~ 8 gpm
—	0640	DTW = 48.1' TOC (slowed pump rate to 4 gpm)
—	0644	DTW = 49.7' TOC (stabilized)
—	—	NTU Cond.(ms) Temp°C pH D.O. (pumped @ 8gpm for
—	0700	>1000 397 12.0 8.66 0.5 5 min. & 4 gpm for 50 min
—	0710	241 398 14.6 8.20 1.1 tot. vol. = 240 gal.)
—	0720	108 399 16.1 8.18 0.6
—	0740	196 396 14.8 8.22 1.5
—	0730	Collected samples: B1FR55, B1FR56 & B1FR58
—	—	• Open-hole interval from 58.6' to 60' bgs (slough to 61' bgs)
0740	0820	Stop pumping & trip out pump & prep for slug test.
—	—	• Back pulled casing from 58.6' to 55.0' bgs
—	—	• Added ~~@5~~ 10 gal. H_2O for packer test 4-6-06
0830	1000	Performing slug tests with open screen from 55'-60' bgs
—	—	• 2 injection & 1 withdrawl test with 0.195 m³ rod
—	—	• 2 injection & 1 withdrawl test with 0.34 m³ rod
1000	1020	Back pull casing from 55' to 50.6' bgs Talley = ~~63.9~~ 58.7'
—	—	• Added 5 gallons H_2O for packer test
1020	1120	Performing slug tests with an open screen from 50.6'-60' bgs.
—	—	• 2 injection & 2 withdrawl using 0.34 m³ rod

Reported By: Jake Horner		Reviewed By: L.D. Walker	
Title: Geologist	Date: 4-6-06	Title: Geologist	Date: 5/30/06
Signature: [signature]		Signature: [signature]	

A-6003-651 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING Continuation Page	Page 2 of 2 Date: 4-6-06
Well Name: 399-1-23	Well ID: C5000
Location: 300-FF-5 OU	Continuation of Report No.: 5

Time/Depth From	Time/Depth To	Description of Activities/Operations with Depth
—	—	• 1 injection & 1 withdrawl using .195 m³ rod
1120	1140	Trip out screen
1140	1315	Add 5.0' of casing & advance back down to 60' bgs.
—	1315	DTB = 59.9' bgs Casing Talley = 63.9'
1315	1330	Trip in & advance SS sampler from 60' to 65' bgs
—	—	- Bottom 2' fell out
1330	1400	Removing & collecting SS samples: 47A - 47D (59'-63')
—	1337	Personnel on site to swap out purge trucks
1345	1515	Advance casing down to 695' & bore hole cleanout
—	—	• Added 5.0' of casing Talley = 68.9'
—	1515	DTB = 54' bgs
1515	1530	Advancing SS sampler from 54' to 69' bgs
1530	1550	Collecting SS samples 48B - 49B (635 - 69.5)
1540	1620	Advancing casing to 69.5' & cleanout to ~70' bgs.
—	1605	IHT pm check < detectable
1620	1630	Secure site
		not used JH 4-6-06

Reported By: Jake Horner		Reviewed By: L.D. Walker	
Title: Geologist	Date: 4-6-06	Title: Geologist	Date: 5/30/06
Signature: Jake Horner		Signature: LD Walker	

A-6003-652 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING	Page 1 of 2 Date: 4-7-06
Well ID: C5000	Well Name: 399-1-23
Location: 300-FF-5 OU	Report No.: ~~5~~ 6 5/19/06

Start	Finish	Total
Time 0600	Time 1550	Time 9 hrs 50 min.
Hole Depth/Csg 70' / 69.5'	Hole Depth/Csg 73 / 72.5	Hole Depth/Csg 3' / 3'
Reference Measuring Point: **GROUND SURFACE**	Casing String No. 1 2 3 4 ___ See Report No. 1	Rod Size: 1 - 9 5/8"

Time/Depth From	To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
0600	0630	POD meeting (BTR, Drillers, IHT, RCT & Geo)
0630	0715	Trip in 10' screen & packer (bottom screen @ 70.5')
—	—	• Had to clean out muck in screen first
—	0640	IHT am check < detectable
0715	0730	Backpull casing from 69.5' to 68.5'
—	0730	Start pumping DTW = 40.8' TOC
—	0750	Stop pumping & backpull casing from 68.5'-67' bgs.
0820	0825	Set pump intake @ ~60' bgs
—	0825	Resume pumping DTW = 38' TOC
—	0835	DTW = 45.3' TOC stabilized, pumping ~ 3 gpm
—	—	NTU pH cond(us) Temp(°C) D.O. (mg/L)
—	0915	977 8.18 308 15.4 0.8 (@ 9:00 ↑ to ~5 gpm)
—	0925	640 8.27 305 15.6 0.7 (@ 9:05 ↓ to ~3 gpm)
—	0935	561 8.26 302 15.8 1.0
—	0930	Collecting water samples: B1FR59, B1FR60 & B1FR62
—	0945	Stop pumping
0945	0955	Trip out pump
0955	1020	Setup for slug test (10' screen from 60'-70' bgs)
—	—	• Backpull casing from 67' to 65' bgs
—	—	• Packer integrity test (added 5 gallons water)
1020	1355	Performing slug tests in two intervals
—	—	• 3 injection & 3 withdrawl using 0.34 m³ rod (open 65'-70')
—	—	• 1 injection & 1 withdrawl using 0.195 m³ rod (open 65'-70')
—	—	• 2 injection & 2 withdrawl using 0.34 m³ rod (open 60'-70')

Reported By: Jake Horner		Reviewed By: L.D. Walker	
Title: Geologist	Date: 4-6-06	Title: Geologist	Date: 5/30/06
Signature: John Horner		Signature: L.D. Walker	

A-6003-651 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING Continuation Page		Page 2 of 2 Date: 4-7-06
Well Name: 399-1-23	Well ID: C5000	
Location: 300-FF-5 OU	Continuation of Report No.: ~~5~~ 6 5/19/06	

Time/Depth From	To	Description of Activities/Operations with Depth
1355	1410	Trip out screen & packer
1410	1440	Drilling back down to 70' bgs (shoe depth = 70' bgs, DTB = 69.9' bgs)
1440	1500	Advancing ss sample from ~70' bgs to 73' bgs
1500	1525	Collecting ss samples (49D to 50C) (67.5' - 72.5')
—	—	• slough from 70 to ~~72~~ 67.5 LW 5-30-06
1510	1545	Advancing casing & borehole cleanout
—	—	• Added 5.0' of casing talley = 73.9'
—	—	• shoe depth = 72.5' bgs DTB = 73' bgs
1545	1550	Stop work & secure site (broke the last ss sampler)
		not used 4-7-06

Reported By: Jake Horner		Reviewed By: L.D. Walker	
Title: Geologist	Date: 4-6-06	Title: Geologist	Date: 5/30/06
Signature: [signature]		Signature: [signature]	

A-6003-652 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING

Page 1 of 2

Date: 4-10-06

Well ID: C5000 | Well Name: 399-1-23

Location: 300-FF-5 OU | Report No.: ~~6~~ 7 @ 5/19/06

Start	Finish	Total
Time 0600	Time 1630	Time 10.5 hrs
Hole Depth/Csg 73' / 72.5	Hole Depth/Csg 83' / 82'	Hole Depth/Csg 10' / 9.5'

Reference Measuring Point: **GROUND SURFACE**

Casing String No. 1 2 3 4 ____ Rod Size: 1 - 9 5/8"
See Report No. 1

Time/Depth From	To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
0600	0620	POD meeting (BTR, Drillers, IHT, RCT & Geo)
0620	0710	Prep time
—	0640	IHT am check < detectable
0710	0740	Advancing SS sampler from 73' to 77.5' bgs
—	—	• ~2.5' fell out
0740	0845	Trip out SS & collect samples: 50D-51B (71'-75')
—	—	• couldn't get the sampler open, had to cut off the sub.
0830	0850	Assemble SS for next run (51E - 52E)
0850	0910	Advancing 9 5/8" casing from 72.5' to 74' bgs
—	0855	• Added 5.0' of casing Talley = 78.9'
—	0910	• Removed 5.0' " Talley = 73.9
0910	0950	Cleanout borehole to 77.2' & advance casing to 77'.
—	—	• Added 5.0' casing Talley = 78.9'
0950	1015	Advance SS sampler from 77' to 83' bgs
1015	1100	Collecting SS samples: 51F - 52D (67.5' - 81.5' bgs)
—	—	• had difficulty opening SS sampler
1045	1150	Advancing casing from 77' to 82' bgs
1200	1230	Lunch *added 5' casing Talley = 83.9'
1230	1310	Cleanout borehole from 81.5' to ~~83.0~~ 82.0' bgs LW 5-30-06
1310	1330	Trip in 10' screen down to ~~83~~ 82' bgs LW 5-30-06
1330	1335	Backpull casing from 82' to 81' bgs
1335	1340	Trip in sampling pump & set intake @ 69' bgs
—	1343	Start pumping DTW = 39.2' TOP (Top of platform)
—	1347	Slow pump rate from 8 gpm to ~2 gpm

Reported By: Jake Horner | Reviewed By: L.D. Walker

Title: Geologist | Date: 4-10-06 | Title: Geologist | Date: 5-30-06

Signature: Jake Horner | Signature: LD Walker

A-6003-651 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING
Continuation Page

Page 2 of 2

Date: 4-10-06

Well Name: 399-1-23 | Well ID: C5000

Location: 300-FF-5 OU | Continuation of Report No.: ~~6~~ 7 JH 5/19/06

Time/Depth From	To	Description of Activities/Operations with Depth
1404	1410	Stop pumping & wait for recharge DTW=38.5' TOP
—	—	Recharged ~ 0.5' in 5 min.
1410	1425	Backpulls casing from 81' ~~82~~ to 78.5' bgs
1425	1430	Water still not recharging
1430	1435	Backpull from 78.5' to 77.0' bgs
1435	1438	Trip in sampling pump & set intake @ 69' bgs
—	1438	start pumping DTW = 42.5' TOP (~6-7 gpm)
—	1444	DTW = 53.0' TOP
—	1451	DTW = 60.1' TOP *(Open screen from 77'-82' bgs)
—	1458	DTW = 64.5' TOP
—	1506	DTW = 65.5' TOP
—	1513	DTW = 68.5' TOP
—	1515	slowed pump rate down to ~5 gpm
—	—	• Stabilized @ 66.3' TOP
—	—	NTU pH cond. Temp D.O.
—	1520	71000 8.26 320 16.9 0.7
—	1529	582 8.21 317 16.7 1.0
—	1540	452 8.21 317 16.9 1.0
—	1548	200 8.20 318 16.9 1.0
—	1545	Collecting samples: B1FR63, B1FR64 & B1FR66
—	1550	Stop pumping (Tot. purge vol. ≈ 475 gallons)
1550	1610	Trip out pump & screen
1610	1620	Advancing casing from 77.0' to 82.0' bgs
1620	1630	Secure site
		not used JH 4-10-06

Reported By: Jake Horner | Reviewed By: L.D. Walker

Title: Geologist | Date: 4-10-06 | Title: Geologist | Date: 5-30-06

Signature: John Horner | Signature: LD Walker

A-6003-652 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING

Page 1 of 2

Date: 4-11-06

Well ID: C5000

Well Name: 399-1-23

Location: 300-FF-5 OU

Report No.: ~~7~~ 8 5/19/06

Start	Finish	Total
Time 0600	Time 1630	Time 10.5 hrs
Hole Depth/Csg 83 LW 5-30-06 / 82	Hole Depth/Csg 101' / 98'	Hole Depth/Csg 18' / 16'

Reference Measuring Point: **GROUND SURFACE**

Casing String No. 1 2 3 4 ____ See Report No. 1

Rod Size: 1-9 5/8"

Time/Depth From	To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
0600	0620	POD meeting (BTR, Drillers, IHT, RCT & Geo)
0620	0640	Prep time
—	0630	IHT am check < detectable
0640	0715	Cleanout borehole from ~80' to 82' bgs
0715	0725	Prep to advance SS sampler
0725	0740	Advancing SS sampler from 82' - 87' bgs
0740	0800	Collecting cores 53A to 54A (80.5' - 86.5' bgs)
0750	0810	Advancing casing from 82' to 86.5' bgs
—	—	• Added 5.0' 8ft casing Talley = 88.9'
0810	0830	Cleanout borehole to ~~72~~ 4-11-06 ~~87~~ 87' LW 5-30-06 bgs
0830	0855	Advancing SS sampler from 87' ~~87~~ LW 5-30-06 to 92' bgs
—	—	• Core sample fell out while tripping out
0855	0910	Changed drive shoe & made a 2nd attempt 87'-92' bgs.
0910	0940	Loosening SS to open it.
0940	1000	Collecting SS samples: 54E - 55D (mixed slough 87'-92')
0940	0950	Advancing casing from 86.5' to 92.0' bgs
—	—	• Added 5.0' of casing Talley = 93.9'
0950	1015	Borehole cleanout from 88' - 92'
1015	1038	Trip in 10' screen & sampling pump
—	1039	Start pumping DTW = 39.1' TOP (Top of platform)
—	1045	DTW = 45' TOP (pumping ~7-8 gpm)
—	1050	DTW = 46.2' TOP
—	1055	DTW = 46.8' TOP (open-hole interval from 88.5' - 92' bgs)
—	1142	DTW = 47.4' TOP

Reported By: Jake Horner

Title: Geologist

Date: 4-11-06

Signature: [signature]

Reviewed By: L.D. Walker

Title: Geologist

Date: 5/30/06

Signature: [signature]

A-6003-651 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING Continuation Page	Page 2 of 2 Date: 4-11-06
Well Name: 399-1-23	Well ID: C5000
Location: 300-FF-5 OU	Continuation of Report No.: ~~7~~ 8 JH 5/10/06

Time/Depth From	Time/Depth To	Description of Activities/Operations with Depth
—	—	NTU pH Temp Cond. D.O.
—	1145	>1000 8.24 17.3 324 0.7 (pumped 86 min. @
—	1155	508 8.20 17.8 323 0.7 ~7 gpm. Tot. Vol. ≈ 600 gal.)
—	1207	433 8.10 18.0 326 0.6
—	1205	Collecting samples: B1FR67, B1FR68 & B1FR70
—	1208	Stop pumping DTW = 47.5' TOP
1210	1225	Trip out pump & 10' screen
1225	1230	Advancing casing from 88.5' to 92' bgs
1230	1250	Borehole cleanout down to 91' bgs
1250	1310	Advancing SS from ~91' to 95.5' bgs
1310	1340	Collecting SS samples 55C to 56C (89'-95' bgs)
1330	1335	Advancing casing from 92' to ~95' bgs Talley = 98.9'
1335	1355	Borehole cleanout from (n.d.) to 97' bgs (3' too far).
1355	1430	Advancing SS sampler from 95' - 100' bgs
—	—	• Sample fell out
1430	1500	Advancing SS a 2nd time from 95' to 101' bgs
1500	1620	Attempting to open SS
1535	1620	Borehole cleanout down to 101' & advancing
—	—	casing from 95' to 98' bgs
1540	1545	IHT pm check < detectable
1620	1630	Secure site
		not used JH 4-11-06

Reported By: Jake Horner		Reviewed By: L. Walker	
Title: Geologist	Date: 4-11-06	Title: Geologist	Date: 5-30-06
Signature: [signature]		Signature: [signature]	

A-6003-652 (04/03)

LW 5-30-06

FIELD ACTIVITY REPORT - DAILY DRILLING

~~Continuation Page~~ LW 5-30-06

Page 1 of ~~2~~ 1

Date: 4-12-06

Well Name: 399-1-23

Well ID: C5000

Location: 300-FF-5 OU

~~Continuation of~~ Report No.: ~~8~~ 9 AP 5/19/06 LW 5-30-06

Time/Depth From	Time/Depth To	Description of Activities/Operations with Depth
0600	0630	POD meeting (BTR, Drillers, IHT, RCT & Geo)
0630	0650	Prep time
—	0645	IHT am check < detectable
0650	0715	Advancing casing from 98' to 99' bgs
—	—	· Added 5.0' of casing Talley = 103.9'
0715	~~0800~~	Borehole cleanout down to 101' bgs
0800	0825	Advancing SS sampler from 101' to 106' bgs (~2.5' fallout)
0825	0845	Opening SS & collecting samples:
0835	0845	Advancing casing from 99' to 102' bgs
0845	0915	Borehole cleanout down to 103' bgs
0915	0920	Advancing casing from 102' to ~104' bgs
0920	0940	Borehole cleanout down to 106' bgs
0940	1000	Advancing SS sampler from 106' to 110' bgs (4.5' fallout)
1000	1035	Open & collect SS samples: 59A - 59E (103.5' - 108.5)
1010	1025	Advancing casing from 104' to 106' bgs
—	—	· Added 5' of casing Talley = 108.9'
1025	1050	Bore cleanout down to 110' bgs
1050	1110	Trip in & advance SS sampler from 110' to 113' bgs.
1110	1135	Collecting SS samples: 60B - 61B (106' - 112.5' bgs)
1125	1135	Advancing casing from 106' to 110' bgs
—	—	· Added 5' casing Talley = 113.9'
1135	1230	Borehole cleanout down to 116' bgs
—	—	• Solid silt cores were collected (no liner) 113'-116' bgs.
1230	1240	Advancing casing from 110' to 115' bgs
—	—	· Added 5' of casing Talley = 118.9'
1240	1255	Borehole cleanout down to 115' bgs
1255	1310	Secure site
1310	→	Lunch Geologist leaves site
1310	→	Geophysical Logging crew sets up

Reported By: Jake Horner

Title: Geologist

Date: ~~4-12-06~~ 4-12-06 LW 5-30-06

Signature: [signature]

Reviewed By: L.D. Walker

Title: Geologist

Date: 5/30/06

Signature: [signature]

A-6003-652 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING			Page 1 of 2 Date: 4-17-06
Well ID: C5000		Well Name: 399-1-23	
Location: 300-FF-5 OU		Report No.: ~~9~~ 10 JH 5/19/06	
Start Time 1000 Hole Depth/Csg 116' / 115'	Finish Time 1600 Hole Depth/Csg 110 / 105	Total Time 6hrs ~~8hrs~~ JH Hole Depth/Csg -6 / -10	
Reference Measuring Point: **GROUND SURFACE**	Casing String No. 1 2 3 4 ____ Rod Size: 9 5/8" See Report No. 1		

Time/Depth From	Time/Depth To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
—	1000	Geologist on site
—	—	* Geophysical logging was completed @ ~0900.
—	1015	Drillers on site
1015		Setup equipment to resume sampling activities
	1100	DTW = 41.35' TOC - 6.0' stickup = 34.5' bgs
	1105	Add bent. pellets
1110	1140	Backpull casing from 115' to 112' bgs
1130	—	The 2' drive head broke off at the joint to sub.
1130	1140	• repairs
1140	1210	Resume backpulling casing from 112' to 110' bgs
1210	1235	Trip in 10' screen & packer
—	—	• added 2 bags sand before setting on bottom
—	—	• bottom screen is set @ ~ 110' bgs.
1300	1305	Backpull casing from 110' to ~105' bgs
	4-17-06 JH	~~105~~ 10' of casing has been removed Tally = ~~108~~ ~~113.9~~ 108.9 LW 5-30-06
1305	1310	Trip in sampling pump
—	1317	Start pumping DTW = 34.8' TOC (6' stickup)
—	1325	DTW dropping too fast slow rate to 3gpm
—	1330	DTW = 55.7' TOC
—	1400	DTW = 64.5' TOC stabilized @ 1.5 gpm
—	1400	Tot vol. = 120 gallons
1400	→	Inflating packer set @ 97' bgs
		~~not used~~ JH 4-17-06

Reported By: Jake Hommer		Reviewed By: L.D. Walker	
Title: Geologist	Date: 4-17-06	Title: Geologist	Date: 5/30/06
Signature: [signature]		Signature: [signature]	

A-6003-651 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING

Continuation Page

Page 2 of 2

Date: 4-17-06

Well Name: 399-1-23 | Well ID: C5000

Location: 300-FF-5 OU | Continuation of Report No.: ~~9~~ 10 JH 5/19/06

Time/Depth From	Time/Depth To	Description of Activities/Operations with Depth
—	—	pH cond. Temp. Turb. D.O.
—	1430	8.46 348 18.6 >1000 0.4
1455	~~[illegible]~~ JH 4-17-06	8.29 329 18.1 >1000 0.6
—	1515	8.25 328 18.2 >1000 ND
—	1525	8.20 328 18.5 >1000 0.8
—	1520	Collecting samples: B1FR71, B1FR72 & B1FR74
1525	1600	Trip out pump & prep for slug test

not used JH 4-17-06

Reported By: Jake Horner | Reviewed By: L.D. Walker

Title: Geologist | Date: 4-17-06 | Title: Geologist | Date: 5/30/06

Signature: Jake Horner | Signature: LD Walker

A-6003-652 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING

Page 1 of 1

Date: 4-18-06

Well ID: C5000		Well Name: 399-1-23
Location: 300-FF-5		Report No.: ~~10~~ 11 5/19/06
Start	**Finish**	**Total**
Time 0600	Time 1230	Time 6.5 hrs
Hole Depth/Csg 110' / 105.5'	Hole Depth/Csg 98' / 101'	Hole Depth/Csg -12 / -4.5
Reference Measuring Point: **GROUND SURFACE**	Casing String No. 1 2 3 4 ____ See Report No. 1	Rod Size: 1 - 9 5/8" O.D.

Time/Depth From	To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
0600	0630	POD meeting (BTR, Drillers, IHT, RCT & Geo)
0630	0720	Prep for slug test
—	0635	PNNL on site for test
—	0650	DTW= 30.5' bgs (4' higher than yesterday)
0720	1000	Performing slug tests with an open interval from 105.5-110' bgs
—	—	•3 injection/withdrawl tests with .34 m³ rod
—	—	•2 injection & 1 withdrawl tests with .195 m³ rod
1000	1015	Backpull casing from 105.5' to 101' bgs
1015	1140	Performing slug tests with open-hole from 101' to 110' bgs
—	—	•3 injection/withdrawl tests with .34 m³ rod
—	—	•3 injection/withdrawl tests with .195 m³ rod
1140	1205	Trip out screen & packer
—	1205	DTB= 107' bgs (~3' of nat. backfill)
1210	1230	Adding sand up to casing shoe
—	—	•11 bags DTB = 98' bgs
1230	→	Drillers make room for logging truck
—	—	•PNNL decided to perform additional geophysical logging.
—	1235	Geologist left the site
		not used JH 4-18-06

Reported By: Jake Horner		Reviewed By: L.D. Walker	
Title: Geologist	Date: 4-18-06	Title: Geologist	Date: 5/30/06
Signature: [signature]		Signature: [signature]	

A-6003-651 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING		Page 1 of 1
		Date: 4-19-06
Well ID: C5000	Well Name: 399-1-23	
Location: 300-FF-5 OU	Report No.: ~~11~~ 12 [initials] 5/19/06	

Start	**Finish**	**Total**
Time 0600	Time 1630	Time 10.5 hrs
Hole Depth/Csg 98' / 101'	Hole Depth/Csg 41.5' / 45.9'	Hole Depth/Csg -56.5' / -55.1'

Reference Measuring Point: **GROUND SURFACE**	Casing String No. 1 2 3 4 ____ Rod Size: 1 - 9 5/8" See Report No. 1

Time/Depth From	To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
0600	0730	POD meeting & waiting for log truck to be moved
0730	0815	Waiting on site for log truck to be moved
—	—	*Note: BTR was told the log truck would be moved @ 6:30.
0740	0800	Equipment inspection
0815	0845	Stoller on site moving log truck
—	0840	DTW = 29.5' bgs
0840	1007	Adding sand & backpulling casing
—	—	• Sand - 98' to 59.2' bgs (47 50# bags of 10-20 mesh)
—	—	• Backpulled from 101.0' to 58.7' bgs
1007	1027	Installing coated bent. pellet seal & Backpulling casing
—	—	• 3/8" coated pellets 59.2' to 54.4' bgs (settles to ~55' bgs)
—	—	• 4 5 gallons buckets of pellets
—	—	• Backpulled from 58.7' to 54.1' bgs
1027	1039	Adding sand & backpulling from 54.1' to 52.5' bgs
—	—	• Sand - 54.4' (settled to ~55' bgs) to 52.3' bgs
1039	1115	Tripping in 2.03' sump, 25.01' screen & ~~35.04~~ 30.03' [initials] 4-19-06 riser
—	—	• 6" I.D. SCH 10 Type 304L stainless steel
1115	1210	Adding sand & backpulling casing
—	—	• Sand - 52.3' to 42.6' bgs
—	—	• Backpulled casing from 54.1' to 45.9'
1210	1215	Begin surging from 47' to 50' bgs (bottom ~~screen~~ = 50' bgs)
1215	1223	Stop to add 2 bags sand
1223	1630	Resume surging
—	1630	Stop surging 1st interval, end of day. Still dropping 1'/15 min.

Reported By: Jake Horner		Reviewed By: L.D. Walker	
Title: Geologist	Date: 4-19-06	Title: Geologist	Date: 5/30/06
Signature: [signature]		Signature: [signature]	

A-6003-651 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING

Page 1 of 1

Date: 4-20-06

Well ID: C5000	Well Name: 399-1-23
Location: 300-FF-5 OU	Report No.: ~~12~~ 13 5/19/06

Start	Finish	Total
Time 0600	Time 1630	Time 10.5 hrs
Hole Depth/Csg 41.5 / 45.9	Hole Depth/Csg 35.5 / 38.5	Hole Depth/Csg -6.0 / -7.4

Reference Measuring Point: **GROUND SURFACE**	Casing String No. 1 2 3 4 ____ Rod Size: 1 - 9 5/8" See Report No. 1

Time/Depth From	Time/Depth To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
0600	0630	POD meeting (BTR, Drillers, RCT & Geo)
—	0645	DTW = 30.3' bgs
0630	0650	Prep time
0650	0847	Resume surging 1st interval (47'-50' bgs)
—	0847	Sand still dropping, but PNNL gave the "ok" to
—	—	pull up to the next interval.
—	—	• Sand dropped ~2' in 1 hour
0850	0930	Trip out surge block & backpull casing 45.9'-44' bgs
0930	0953	Trip in surge block & add more sand (2 bags)
0953	1234	Begin surging from 44' to 47' bgs.
—	—	• 2 bags of sand were used
1234	1255	Trip out surge block & backpull casing 44'-41' bgs
1255	1312	Trip in surge block
1312	1525	Begin surging interval from 41'-44' bgs
1525	1550	Trip out surge block & backpull casing 41'-38.5' bgs
1550	1605	Trip in surge block
1605	1630	Surging from 38'-41' bgs (added 2 bags sand)
—	1630	End of day

not used JH 4-20-06

Reported By: Jake Horner		Reviewed By: L.D. Walker	
Title: Geologist	Date: 4-20-06	Title: Geologist	Date: 5-30-06
Signature: John H—		Signature: LD Walker	

A-6003-651 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING	Page 1 of 1 Date: 4-21-06

Well ID: C5000	Well Name: 399-1-23
Location: 300-FF-5 OU	Report No.: ~~13~~ 14 [initials] 5/19/06

Start	Finish	Total
Time 0600	Time 1530	Time 9.5 hrs
Hole Depth/Csg 35.5 / 38.5	Hole Depth/Csg 1.5 / Ø	Hole Depth/Csg -34.0 / -38.5
Reference Measuring Point: GROUND SURFACE	Casing String No. 1 2 3 4 ____ Rod Size: See Report No. 1	

Time/Depth From	Time/Depth To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
0600	0630	POD meeting (BTR, Drillers, RCT & Geo)
	0635	DTW = 30.30' bgs
0630	0700	Prep time
0700	0825	Surging interval from 38'-41' bgs (casing = 38.5')
		• Added 1 bag sand
0815	0825	Sand dropped 0.05'
0825	0900	Trip out surge block & backpull casing 38.5'-35.0'
0900	1015	Surging interval from 35'-38'
		• Sand only dropped 0.3' in 1 hour [initials] 4-21-06
1015	1045	Trip out surge block & backpull casing ~~32~~ 35'-32' bgs
		• Removed 5.0' casing Talley = 33.9'
1045	1145	Surging interval from 32'-35' bgs
		• Sand dropped ~0.3' in 1 hour
1145	1220	Lunch
1220	1245	Trip out surge block & backpull casing 32'-29' bgs
		• Added 2 bags sand
1245	1350	Surging 29'-32' bgs
1350	1405	Backpull casing & add sand up to 20' bgs
1405	1418	Backpull casing & add bent. pellets (20-14.4)
1418	1436	Backpull casing & add bent. crumbles ~~(20-14.4)~~ [initials] 4-21-06
1436	1438	Adding H_2O to hydrate crumbles (10.8-14.4')
1438	1530	Mixing cement grout (4 x 94# bags w/ 4# bent.)
		• 3 4/x 50 gallons mixed (tot vol. = 170 gallons)
		• Grouted 10.8' - 1.5' (wet) 1530 - Geo left site

Reported By: Jake Hovwer		Reviewed By: L.D. Walker	
Title: Geologist	Date: 4-21-06	Title: Geologist	Date: 5/30/06
Signature: [signature]		Signature: [signature]	

A-6003-651 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING	Page 1 of 1
	Date: 4-24-06

Well ID: C5000	Well Name: 399-1-23
Location: 300-FF-5 OU	Report No.: 15

Start	Finish	Total
Time 0600	Time 1630	Time 10 hrs
Hole Depth/Csg N/A / N/A	Hole Depth/Csg N/A / N/A	Hole Depth/Csg N/A / N/A

Reference Measuring Point: GROUND SURFACE	Casing String No. 1 2 3 4 ____ Rod Size: See Report No. 1

Time/Depth From	To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
0600	0630	POD meeting (BTR, Drillers, RCT & Geo)
0630	1630	1 helper works on surface completion while the other 2 drillers start drilling @ C5001
		· Geo. not present
		not used JH 4/24/06

Reported By: Jake Horner	Reviewed By: L.D. Walker
Title: Geologist — Date: 4-24-06	Title: Geologist — Date: 5/30/06
Signature: [signature]	Signature: [signature]

A-6003-651 (04/03)

WELL DEVELOPMENT AND TESTING DATA

Well Name:	Well ID:	Well Location:	Date:
399-1-23	C5000	300-FF-5 OU	5/1/06

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	33.0' TOC
End of Job	33.0' TOC

DEPTH TO BOTTOM:

Start of Job	54.1' TOC
End of Job	53.8' TOC

PART 2

WELL DEVELOPMENT DATA

Pump Model	25 S Grundfos
Intake Depth	48' TOC / 38' TOC
Starting Turbidity	

Pump Start	Stop	Flow Rate
1320	1349	~16.0 gpm
1407	1438	~16.0 gpm

Total Pumped	930 gallons
Final Turbidity	1.88 / 2.82 ntu
XD SN/Range (PSI)	20

PART 3

INSTANTANEOUS SLUG TEST

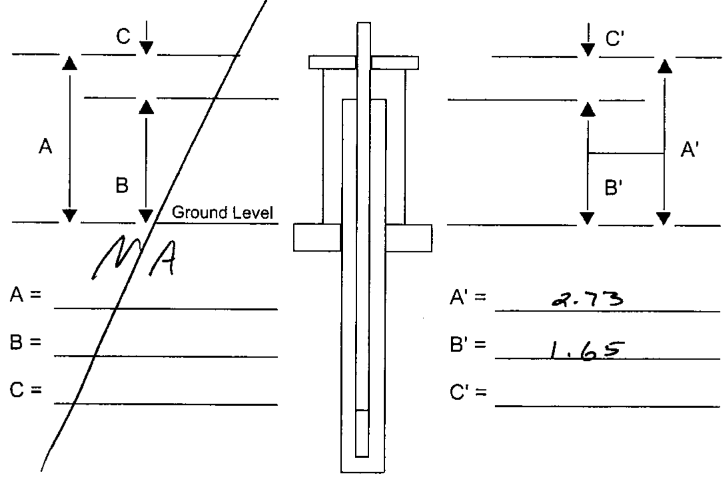
N/A

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: 5/1/06



N/A

A =
B =
C =

A' = 2.73
B' = 1.65
C' =

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

PART 5

COMMENTS:

Prepared by (print name):	Signature:	Date:
Jake Horner	Jake Horner	5/1/06
Reviewed by (print name):	**Signature:**	**Date:**
L.D. Walker	LD Walker	5/30/06

A-6003-644 (03/03)

FIELD ACTIVITY REPORT - DAILY DRILLING	Page 1 of 1
	Date: 5/23/06

Well ID: C5000	Well Name: 399-1-23
Location: 300-FF-5 OU	Report No.: 16

Start	Finish	Total
Time 1310	Time 1400	Time 50 min
Hole Depth/Csg n/A / n/A	Hole Depth/Csg n/A / n/A	Hole Depth/Csg n/A / n/A

Reference Measuring Point: **GROUND SURFACE**	Casing String No. 1 2 3 4 ____ Rod Size: See Report No. 1

Time/Depth From	Time/Depth To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
1310	1400	Install permanent pump @ C5000 DTW = 33.4' TOC
		• Grundfos pump 5505-13 (0.5 HP)
		• Model # B080 10013 - P1054SUS
		• 3/4" ss SCH 10 S TP 304/304L (45.30' Total)
		• Intake set @ 46.61' TOC (43.88' bgs)
		not used JH 5/23/06

Reported By: Jake Horner		Reviewed By: L.D. Walker	
Title: Geologist	Date: 5/23/06	Title: Geologist	Date: 5-30-06
Signature: [signature]		Signature: [signature]	

A-6003-651 (04/03)

FIELD ACTIVITY REPORT
TUBULAR GOODS TALLY

Page 1 of 1
Date: 3-30-06

Well Name: 399-1-23
Well ID: C5000

TEMPORARY				PERMANENT*						SCREEN/CAP*		
Jt. #	Length (ft.)	Jt. #	Length (ft.)	Jt. #	Length (ft.)	C	Jt. #	Length (ft.)	C	Jt. #	Length (ft.)	C
1	3.9'	21	5.0	1			21	10.00	C	1	2.03 sump	C
2	5.0	22	5.0	2			22	10.02		2	15.01	
3	5.0	23	5.0	3			23	10.01		3	5.0	
4	5.0	24	5.0	4			24	~~5.01~~ 3-30-06		4	5.0	
5	5.0	25		5			25			5		
6	5.0	26		6			26			6		
7	5.0	27		7			27			7		
8	5.0	28		8			28			8		
9	5.0	29		9			29			9		
10	5.0	30		10			30			10		
11	5.0	31		11			31			11		
12	5.0	32		12			32			12		
13	5.0	33		13			33			13		
14	5.0	34		14			34			14		
15	5.0	35		15			35			15		
16	5.0	36		16			36			16		
17	5.0	37		17			37			17		
18	5.0	38		18			38			18		
19	5.0	39		19			39	3-30-06		19		
20	5.0	40		20			40	30.04		20		
Tot	98.9	Tot	20.0	Tot			Tot	~~35.04~~		Tot	27.04	

**Indicate those joints with centralizers with a C in the available box.*
ALL Casing length shall be measured to the nearest 0.01 ft.

Comments/Remarks:
Tot. temp. casing = 118.9'
Tot. perm. casing = 57.08' − 3.45' (cut off) = 53.63'
Screen int. = 24.94' to 49.95' bgs

Temporary: O.D./I.D. 8 5/8" ID / 9 5/8" OD
Permanent: O.D./I.D. 6 5/8" / 6"
Screen: O.D./I.D. 6 5/8" / 6"

Temp. casing shoe = 3.9' with 9.0" ID & 10.0" OD
Temp. Casing 8 5/8" ID / 9 5/8" OD (1/2" wall)

Permanent stainless steel: 6 5/8" / 6" SCH 10S TP 304L

*Actual 10" portion at shoe casing is ~ 3" long

Reported By: Jake Horner		Reviewed By: L.D. Walker	
Title: Geologist	Date: 4-19-06	Title: Geologist	Date: 5/30/06
Signature: Jake Horner		Signature: LD Walker	

A-6003-655 (04/03)

WELL COMPLETION LOG

Page 1 of 6

Date: 4-17-06

Well ID: C5000

Well Name: 399-1-23

Project: FF-5 Monitoring Wells

Location: 300-FF-5 OU

Drilling Contractor: Cascade Drilling

	1. Time	2. Total Casing	3. Stkup	4. Btm Csg	5. Tape Reading	6. Correction	7. Cor Tape Reading	8. Fill Depth	9. Overlap	Fill Material Type	Fill Material Amt	Fill Material Unit	Comments
4/17	1105	118.9'	3.9	115'	120.5	6.0	114.5	—	—	—	—	—	Start depth
	1108	118.9	3.9	115	118	6.0	112.0	112	3'	bent. pellets	3/4	50# bag	Add bent.
	1235	113.9	3.9	110	118	6.0	112	112	—	—	—	—	backpulled
	1236	113.9	3.9	110	116	6.0	110	110	ø	10-20 sand	2	bag	added sand
4/18	1205	103.9	2.9	101.0	113.0	6.0	107.0	107.0	-6.0	nat. Backfill	3	ft	Pulled screen after slug test.
	1230	103.9	2.9	101.0	104.0	6.0	98.0	98.0	3.0	10-20 sand	11	50# bags	+ sand
4/19	0855	103.9	2.9	101.0	91.6	6.0	85.6	85.6	15.4	10-20 sand	10	50# bags	+ sand
	0903	98.9	5.0	93.9	97.2	6.0	91.2	91.2	2.7	"	10	"	BP
	0909	98.9	5.0	93.9	85.2	6.0	79.2	79.2	14.7	—	—	—	+ sand
	0913	93.9	5.3	~~88.6~~ 88.6 LW 5-30-06	87.4	6.0	81.4	81.4	7.2	—	—	—	BP
	0916	93.9	5.3	88.6	81.0	6.0	75.0	75.0	13.6	"	5	"	+ Sand
	0921	88.9	5.4	83.5	83.0	6.0	77.0	77.0	6.5	—	—	—	BP
	0924	88.9	5.4	83.5	80.4	6.0	74.4	74.4	9.1	"	2	"	+ Sand
	0928	83.9	5.4	78.5	81.5	6.0	75.5	75.5	3.0	—	—	—	BP
	0933	83.9	5.4	78.5	77.2	6.0	71.2	71.2	7.3	"	4	"	+ Sand
	0937	78.9	5.3	73.6	79.2	6.0	77.2	73.2	0.4	—	—	—	BP
	0942	78.9	5.3	73.6	70.0	6.0	64.0	64.0	9.6	"	7	"	+ Sand
	0945	73.9	5.3	68.6	73.0	6.0	67.0	67.0	1.6	—	—	—	BP

Note: Col. 2 - Col. 3 = Col. 4 - Col. 5 - weight and attachments = Col. 7; Col. 7 - Col. 3 = Col. 8; Col. 4 - Col. 8 = Col. 9

Reported By: Jake Horner

Title: Geologist

Date: 4-19-06

Signature: Jake Horner

Reviewed By: L.D. Walker

Title: Geologist

Date: 5/30/06

Signature: LD Walker

A-6003-653 (04/03)

G.74

LW 5-30-06

WELL COMPLETION LOG

Page 2 of ~~4~~ 6

Date: 4-19-06

Well ID: C5000 | Well Name: 399-1-23

Project: FF-5 Monitoring Wells | Location: 300-FF-5 OU | Drilling Contractor: Cascade Drilling

1. Time	2. Total Casing	3. Stkup	4. Btm Csg	5. Tape Reading	6. Correction	7. Cor Tape Reading	8. Fill Depth	9. Overlap	Fill Material Type	Fill Material Amt	Fill Material Unit	Comments
0950	73.9	5.3	68.6	63.9	6.0	57.9	57.9	10.7	10-20 sand	7	50# bags	+ Sand
0953	68.9	5.2	63.7	66.5	6.0	60.5	60.5	3.2	—	—	—	BP
0955	68.9	5.2	63.7	65.1	6.0	59.1	59.1	4.6	"	1	"	+ sand
0958	68.9	7.0	61.9	65.8	6.0	59.8	59.8	2.1	—	—	—	BP
1000	68.9	8.5	60.4	66.0	6.0	60.0	60.0	0.4	—	—	—	BP
1003	68.9	8.5	60.4	64.8	6.0	58.8	58.8	1.6	"	1	"	+ Sand
1007	63.9	5.2	58.7	65.2	6.0	59.2	59.2	-0.5	—	—	—	BP
1012	63.9	5.2	58.7	62.3	6.0	56.3	56.3	2.4	bent. pellets	2	5 gal. buckets	3/8" coated pellets
1017	63.9	7.5	57.6	62.9	6.0	56.9	56.9	1.8	—	—	—	BP
1018	63.9	7.5	57.6	61.3	6.0	55.3	55.3	2.3	bent pellets	1	5 gal. bucket	3/8" coated
1020	63.9	8.5	55.4	61.7	6.0	55.7	55.7	-0.3 ~~[illegible]~~ 4-19-06	—	—	—	BP
1023	63.9	8.5	55.4	60.3	6.0	54.3	54.3	1.1	"	1	"	+ Bent.
1027	63.9	9.8	54.1	60.4	6.0	54.4	54.4	-0.3	—	—	—	BP
1030	63.9	9.8	54.1	59.7	6.0	53.7	53.7	0.4	10-20 sand	1/2	50# bag	+ Sand
1033	58.9	5.3	53.6	60.2	6.0	54.2	54.2	-0.6	—	—	—	BP
1034	58.9	5.3	53.6	58.9	6.0	52.9	52.9	0.7	10-20 sand	1/2	50# bag	+ Sand
1036	58.9	6.4	52.5	60.3	~~54.3~~ 6.0	4-19-06 54.3	54.3	-1.8	—	—	—	BP
1039	58.9	6.4	52.5	58.3	6.0	52.3	52.3	0.2	10-20 sand	1/2	50# bag	+ Sand

Note: Col. 2 - Col. 3 = Col. 4 - Col. 5 - weight and attachments = Col. 7; Col. 7 - Col. 3 = Col. 8; Col. 4 - Col. 8 = Col. 9

Reported By: Jake Horner | Reviewed By: L.D. Walker

Title: Geologist | Date: 4-19-06 | Title: Geologist | Date: 5/30/06

Signature: John Horner | Signature: LD Walker

A-6003-653 (04/03)

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WELL COMPLETION LOG

Page 3 of ~~5~~ 6 (LW 5-30-06)

Date: 4/19/06

Well ID: C5000

Well Name: 399-1-23

Project: FF-5 Monitoring Wells

Location: 300-FF-5 Operable Unit

Drilling Contractor: Cascade Drilling

1.	2.	3.	4.	5.	6.	7.	8.	9.	Fill Material			
Time	Total Casing	Stkup	Btm Csg	Tape Reading	Correction	Cor Tape Reading	Fill Depth	Overlap	Type	Amt	Unit	Comments
1115	58.9	6.4	52.5						10-20 Sand	1½	50# bag	SS casing 52' to +5.0'
1119	58.9	8.0	50.9	54.3	6.0	48.3	48.3	2.6	—	—	—	BP
1120	58.9	8.0	50.9	51.3	6.0	45.3	45.3	5.6	10-20 sand	1	50# bag	+ Sand
1123	58.9	9.0	49.9	52.6	6.0	46.6	46.6	3.3	—	—	—	BP
1124	58.9	9.0	49.9	49.7	6.0	43.7	43.7	6.0	10-20 Sand	1	50# bag	+ sand
1128	53.9	5.4	48.5	50.7	6.0	44.7	44.7	3.8	—	—	—	BP
1200	~~43.9~~ 53.9 4/19/06	8.0	45.9	51.8	6.0	45.8	45.8	0.1	—	—	—	BP ~~+ Sand~~ 4-19-06
1206	48.9	3.0	45.9	48.6	6.0	42.6	42.6	3.2	"	1	"	+ sand (1210 - start surging)
1223	48.9	3.0	45.9	44.0	6.0	38.0	38.0	7.9	"	2	"	+ sand
1230	48.9	3.0	45.9	51.0	6.0	45.0	45.0	0.9	—	—	—	surging
1234	48.9	3.0	45.9	43.4	6.0	~~37.4~~ 37.4 LW 5-30-06	37.4	8.5	"	2	"	+ sand
1242	48.9	3.0	45.9	43.5	6.0	37.5	37.5	8.5	"	2	"	surge + sand
1257	"	"	"	43.0	6.0	37.0	37.0	8.9	"	2	"	surge + sand
1337	"	"	"	46.7	6.0	40.7	40.7	5.2	"	2	"	surge + sand
1354	"	"	"	46.9	6.0	40.9	40.9	5.0	"	2	"	" "
1415	"	"	"	47.5	6.0	41.5	~~35.5~~ 41.5 LW 5-30-06	6.0	"	1	"	" "
1441	"	"	"	46.5	6.0	40.5	40.5	5.4	"	1	"	" "
1527	"	"	"	46.8	6.0	40.8	40.8	5.1	"	1	"	" "

Note: Col. 2 - Col. 3 = Col. 4 - Col. 5 - weight and attachments = Col. 7; Col. 7 - Col. 3 = Col. 8; Col. 4 - Col. 8 = Col. 9

Reported By: Jake Horner
Title: Geologist
Date: 4-19-06
Signature: [signature]

Reviewed By: L.D. Walker
Title: Geologist
Date: 5/30/06
Signature: [signature]

A-6003-653 (04/03)

G.76

WELL COMPLETION LOG

Page 4 of 6

Date: 4-19-06

Well ID: C5000 | Well Name: 399-1-23

Project: FF-5 Monitoring Wells | Location: 300-FF-5 OU | Drilling Contractor: Cascade Drilling

1. Time	2. Total Casing	3. Stkup	4. Btm Csg	5. Tape Reading	6. Correction	7. Cor Tape Reading	8. Fill Depth	9. Overlap	Fill Material Type	Fill Material Amt	Fill Material Unit	Comments
1610	48.9	3.0	45.9	46.6	6.0	40.6	40.6	5.3	10-20 sand	1	50# bags	surging + sand
1630	48.9	3.0	45.9	47.5	6.0	41.5	41.5	4.4	—	—	—	surging (end of day)
4/20 0650	"	"	"	47.3	6.0	41.3	41.3	4.6	—	—	—	Start of the day
0750	"	"	"	47.1	6.0	41.1	41.1	4.8	"	1	"	Surge + sand
0847	"	LW 5-30-06	LW 5-30-06	48.9	6.0	42.9	42.9	3.0	—	—	—	surging (stop surging)
	48.9	~~8.0~~ 5.0	~~40.9~~ 43.9	~~43.9~~	LW 5-30-06 6.0							
0915	46.9	3.0	45.9	46.2	6.0	40.2	40.2	5.7	"	1	"	+ sand
0921	48.9	~~6.0~~ 4.9	LW 5-30-06 44.0	47.8	6.0	41.8	41.8	2.2	—	—	—	BP
0953	48.9	4.9	44	40.2	6.0	34.2	34.2	9.8	"	2	"	+ sand
1050	"	"	"	44.6	6.0	38.6	38.6	5.4	—	—	—	surge
1155	"	"	"	45.9	6.0	39.9	39.9	4.1	—	—	—	surge
1215	"	"	"	~~46.6~~ 46.2	LW 5-30-06 6.0	40.2	40.2	3.8	—	—	—	"
1232	"	"	"	46.3	6.0	40.3	40.3	3.7	—	—	—	" LW 5-30-06 stable
1255	43.9	2.9	41	44.4	6.0	38.4	38.4	2.6	"	1	"	+ Sand & BP
1300	43.9	"	"	41.9	6.0	35.9	35.9	5.1	"	1/2	"	+ sand (1312 start surge)
1500	"	"	"	44.8 LW 5-30-06	"	~~42.8~~ 38.4	~~42.8~~ 38.4 LW 5-30-06	~~1.8~~ 2.6	LW 5-30-06	—	—	surging
1525	"	"	"	44.9 LW 5-30-06	"	~~42.9~~ 38.9 LW	~~42.9~~ 38.9	~~1.9~~ 2.5	LW 5-30-06	—	—	surging (stable)
1605	43.9	5.4 LW 5-30-06	38.5 LW 5-30-06	40.5	6.0	34.5	34.5	4.0	"	2	"	+ sand & BP

Note: Col. 2 - Col. 3 = Col. 4 - Col. 5 - weight and attachments = Col. 7; Col. 7 - Col. 3 = Col. 8; Col. 4 - Col. 8 = Col. 9

Reported By: Jake Horner | Reviewed By: L. Walker

Title: Geologist | Date: 4-[illegible]-06 | Title: Geologist | Date: 5-30-06

Signature: Jake Horner | Signature: L Walker

WELL COMPLETION LOG

Page 5 of 6

Date: 4-20-06

Well ID: C5000

Well Name: 399-1-23

Project: FF-5 Monitoring Wells

Location: 300-FF-5 OU

Drilling Contractor: Cascade Drilling

1. Time	2. Total Casing	3. Stkup	4. Btm Csg	5. Tape Reading	6. Correction	7. Cor Tape Reading	8. Fill Depth	9. Overlap	Fill Material Type	Fill Material Amt	Fill Material Unit	Comments
1630	43.9	5.4	38.5	41.5	6.0	35.5	35.5	3.0	—	—	—	surging
4/21 0700	"	"	"	38.2	6.0	32.2	32.2	6.3	10-20 sand	1	50# bag	+ sand
0810	"	"	"	39.1	6.0	33.1	33.1	~~33.1~~ 5.4	—	—	—	
0825	"	"	"	39.15	6.0	33.15	33.15	~~33.~~ 5.45	—	—	—	stable
0900	38.9	3.9	35.0	40.3	6.0	34.3	34.3	0.7	"	1/4	"	sand + BP start surge
1015	"	"	"	40.7	6.0	34.7	34.7	0.3	—	—	—	surging (stop @ 1015)
1045	33.9	1.9	32.0	36.8	6.0	30.8	30.8	1.1	"	~~2~~ 1 4-21-06	"	BP + sand
1130	33.9	1.9	32.0	~~36~~ 37 4-21-06	6.0	31	31	1.0	—	—	—	
1145	33.9	1.9	32.0	37	6.0	31	31	1.0	—	—	—	
1245	33.9	4.9	29.0	33.4	6.0	27.4	27.4	1.6	"	2	"	start surging Backpull + sand
1250	"	"	"	31.2	6.0	25.2	~~3.8~~ 25.2	3.8 LW 5-30-06	"	1	"	+ sand & surge
1315	"	"	"	32.3	6.0	26.3	26.3	2.7	—	—	—	surging
1345	"	"	"	32.5	6.0	26.5	26.5	2.5	—	—	—	surge to stable
1350	33.9	5.9	29.5	29.5	6.0	23.5	23.5	6.0	"	1	"	~~BP + S~~
1355	"	7.0 4-21-06	26.9	26.4	6.0	20.4	20.4	6.5	"	2	"	BP + S
1356	33.9	8.5	25.4	27.6	6.0	21.6	21.6	3.8	—	—	—	BP
1358	28.9	5.3	23.6	26.6	6.0	20.6	20.6	3.0	"	1	"	BP + S
1359	28.9	6.0	22.9	27.9	6.0	21.9	21.9	1.0	"	~~1~~ 4-21-06	"	BP

Note: Col. 2 - Col. 3 = Col. 4 - Col. 5 - weight and attachments = Col. 7; Col. 7 - Col. 3 = Col. 8; Col. 4 - Col. 8 = Col. 9

Reported By: Jake Horner

Title: Geologist

Date: 4/21/06

Signature: Jake Horner

Reviewed By: L.D. Walker

Title: Geologist

Date: 5/30/06

Signature: LD Walker

A-6003-653 (04/03)

G.78

WELL COMPLETION LOG

Page 6 of 6

Date: 4-21-06

Well ID: C5000 | Well Name: 399-1-23

Project: FF-5 Monitoring Wells | Location: 300-FF-5 OU | Drilling Contractor: Cascade Drilling

1.	2.	3.	4.	5.	6.	7.	8.	9.	Fill Material			
Time	Total Casing	Stkup	Btm Csg	Tape Reading	Correction	Cor Tape Reading	Fill Depth	Overlap	Type	Amt	Unit	Comments
1400	28.9	7.0	21.9	21.3	6.0	15.3	15.3	6.6	10-20 S	1	50# bag	BP + S
1402	28.9	9.0	19.9	22.9	6.0	14.9	14.9	5.0	—	—	—	BP
1405	23.9	5.3	18.6	26.0	6.0	20.0	20.0	-1.4	—	—	—	BP
1410	23.9	5.3	18.6	21.0	6.0	15.0	15.0	2.4	bent. pellets	1	5 gal bucket	+ Bent.
1415	23.9	7.0	16.9	22.0	6.0	16.0	16.0	0.9	bent. pellets	1	5 gal. bucket	BP ~~+ Bent.~~ JH 4/21/06
1416	23.9	8.0	15.9	19.2	6.0	13.2	13.2	2.7	↓	↓	↓	BP + Bent.
1418	23.9	8.0	15.9	20.4	6.0	14.4	14.4	1.5	—	—	—	BP
1420	23.9	8.0	15.9	19.6	6.0	13.6	13.6	2.3	bent. crumb	1/8	50# bag	+ Bent.
1422	18.9	5.3	13.6	19.9	6.0	13.9	13.9	0.3	—	—	—	BP
1423	18.9	5.3	13.6	17.6	6.0	11.6	11.6	2.0	bent. crumb	7/8	50# bag	+ Bent.
1425	18.9	7.0	~~11.9~~ 11.9 LW 5-30-06	18.1	6.0	12.1	12.1	-0.2	—	—	—	BP
1426	18.9	7.0	11.9	14.7	6.0	8.7	8.7	3.2	bent. crumb	1	50# bag	BP + Bent.
1427	18.9	9.0	9.9	17.8	6.0	11.8	11.8	-1.9	—	—	—	BP
1430	18.9	9.0	9.9	14.9	6.0	8.9	8.9	1.0	bent. crumb	5	50# bags	+ Bent
1436	13.9	5.4	8.5	16.8	6.0	10.8	10.8	-2.3	—	—	—	BP
1530	Ø	Ø	Ø	1.5	Ø	1.5	1.5	Ø	cement grout	170	gallons	BP + Grout

Note: Col. 2 - Col. 3 = Col. 4 - Col. 5 - weight and attachments = Col. 7; Col. 7 - Col. 3 = Col. 8; Col. 4 - Col. 8 = Col. 9

Reported By: Jake Horner | Reviewed By: L.D. Walker

Title: Geologist | Date: 4/21/06 | Title: Geologist | Date: 5/30/06

Signature: [signature] | Signature: LD Walker

A-6003-653 (04/03)

Well C5001

FIELD ACTIVITY REPORT NO. 1 - DRILLING PLAN	Page 1 of 1 Date: 4-24-06
Purpose: Install Monitoring Well	Location: 300-FF-5 OU
Well ID: C5001	Well Name: 399-3-19
Drilling Co.: Cascade Drilling	Rig No.: 131 — Rig Make/Mod.: Sonic One 50K

Casing String No. 1 2 3 4	Drilling Method	Circulation	D.H. Hammer
Casing Size 9 5/8"	Auger	Air ___ Water/Mud ___	Make
Grade P110	Rotary	Reverse ___ Direct ___	Model
Lbs.Per Ft. 47	Tubex	Vol: cfm	Choke
Material Carbon Steel	Cable Tool	gpm	Casing Hammer
Type:	Sonic ✓	Pressure ___ psi	Make
Welded ___ Thd.	A.R. w/Sonic	Drill Pipe O.D.	Model
Planned / Actual	Geoprobe	Tool Joint Size	Bit Size
Set At: 85±5 / 102.5	Other:	Additives	Type
Shoe OD/ID 9 5/8 / 8 5/8			Nozzles
Reference Measuring Point:			Rod Size
GROUND LEVEL			

JH

Drlg. Co.	Rig No.:	Rig Make/Mod.:

Casing String No. 1 2 3 4	Drilling Method	Circulation	D.H. Hammer
Casing Size	Auger	Air ___ Water/Mud ___	Make
Grade	Rotary	Reverse ___ Direct ___	Model
Lbs.Per Ft.	Tubex	Vol: cfm	Choke
Material	Cable Tool	gpm	Casing Hammer
Type:	Sonic	Pressure ___ psi	Make
Welded ___ Thd.	A.R. w/Sonic	Drill Pipe O.D.	Model
Planned / Actual	Geoprobe	Tool Joint Size	Bit Size
Set ___ / ___	Other:	Additives	Type
Shoe OD/ID			Nozzles
Reference Measuring Point:			Rod Size
GROUND LEVEL			

not used JH

Comments/Remarks:	Estimated Depth to Water 50 ± 10

Reported By: Jake Horner

Name/Title: Geologist

Signature: Jake Horner — Date: 4/24/06

A-6003-650 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING	Page 1 of 1 Date: 4-24-06

Well ID: C5001		Well Name: 399-3-19	
Location: 300-FF-5 OU		Report No.: 2	

Start	Finish	Total
Time 0600	Time 1630	Time 10.5
Hole Depth/Csg ∅ / ∅	Hole Depth/Csg 16 / 5.7	Hole Depth/Csg 16 / 5.7

Reference Measuring Point: **GROUND SURFACE**	Casing String No. 1 2 3 4 ___ Rod Size: 1 - 9 5/8" See Report No. 1 10" O.D. shoe

Time/Depth From	Time/Depth To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
0600	0630	POD meeting
0630	1420	Decon. drill rig/equip. & setup @ C5001
—	0630	Geologist went to office
—	1430	Geologist back on site (Driller already avd. core)
→	1450	Advancing SS sampler & retrieval (0-6').
1450	1505	Collecting SS samples 61E-62C (1.5-5.5' bgs)
—	—	• 6' of core was compressed into 4.5'
1505	1515	Prep for next core run
1515	1520	Advancing SS sampler from 5.5' - 10' bgs
1520	1535	Collecting samples 63A - 63D (5.5-9.5')
1535	1600	Advancing casing from ∅' to 5.7' bgs Tally=9.7'
1600	1615	Advancing SS sampler from 10' to 16' bgs
1615	1630	Collecting samples 64A - 64E (10.5-15.5' bgs)
1630	1640	Secure Site
		not used JH 4-24-06

Reported By: John Horner		Reviewed By: L.D. Walker	
Title: Geologist	Date: 4-24-06	Title: Geologist	Date: 5/30/06
Signature: John Horner		Signature: LD Walker	

A-6003-651 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING	Page 1 of 2
	Date: 4-25-06

Well ID: C5001	Well Name: 399-3-~~20~~ 19 GH 4-25-06
Location: 300-FF-5 OU	Report No.: 3

Start	Finish	Total
Time 0600	Time 1640	Time ~~1640~~ 10 hrs 40 min. (GH 4-25-06)
Hole Depth/Csg 16 / 5.7	Hole Depth/Csg 37' / 32'	Hole Depth/Csg 21' / 26.3

Reference Measuring Point: **GROUND SURFACE**	Casing String No. 1 2 3 4 ____ See Report No. 1	Rod Size:

From	To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
0600	0630	POD meeting (BTR, Drillers, IHT, RCT & Geo)
0630	0700	Prep time & improve zone bounderies
0700	0800	Advancing casing from 5.7' to ~12' bgs
—	—	•Added 5.0' of casing Talley = 14.7'
—	0800	DTB = 15' bgs (~1' of slough)
0800	0820	Advancing ss sampler 16' to 22' bgs
0820	0840	Collecting ss samples 65C - 66A (17.5' - 21.5)
~~0~~—	—	•Compressed sample ?
0830	1000	Advancing casing from 12' to 18' & cleanout - 21'
—	—	•Added 5.0' of casing Talley = 19.7
1000	1015	Advancing ss sampler from 21' to 25.5' bgs
1015	1030	Collecting ss samples 67A & 67B (23' - 25' bgs)
1030	1200	Advancing casing & bore hole cleanout (shoe = 22' bgs)
—	—	•Added 5.0' of casing Talley = 24.7
1200	1210	Advancing ss sampler from 24.5 - 31' bgs
1210	1230	Collecting samples ~~37A~~ 37E - 38C (28.5 - 30.5' bgs) LW 5-30-06
1230	1240	Lunch
1240	1250	Fixing hydraulic hose
1250	1410	Advancing casing from 22' to 25.5' bgs
—	—	•Added 5.0' of casing Talley = 29.7
—	—	•Large rock @ ~25.5' bgs
1410	1430	Advancing ss sampler from 31.5 - 37' bgs
1430	1450	Collecting samples 69B - 69D (31.5' to 34.5')
~~1440~~ (4-25-06 GH)	—	•Core plugged @ 34.5' & pushed sed. aside 34.5' - 37'.

Reported By: Jake Horner		Reviewed By: L.D. Walker	
Title: Geologist	Date: 4-25-06	Title: Geologist	Date: 5-30-06
Signature: Jake Horner		Signature: LD Walker	

A-6003-651 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING Continuation Page	Page 2 of 2 Date: 4-25-06

Well Name: 399-3-19	Well ID: C5001
Location: 300-FF-5 OU	Continuation of Report No.: 3

Time/Depth From	Time/Depth To	Description of Activities/Operations with Depth
1440		Advancing casing from 25.5' to 32'bgs & clean out
—	1610	IHT Gm check < detectable
—	—	*RCT is on full time coverage
—	1625	Added 5.0' casing Talley = 34.7'
1630	1640	Secure site

not used JH 4-25-06

Reported By: Jake Horner	Reviewed By: L.D. Walker
Title: Geologist Date: 4-25-06	Title: Geologist Date: 5/30/06
Signature: Jake Horner	Signature: LD Walker

A-6003-652 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING

Page 1 of 2

Date: 4-26-06

Well ID: C5001		Well Name: 399-3-19
Location: 300-FF-5 Operable Unit		Report No.: 4
Start	**Finish**	**Total**
Time 0630	Time 1645	Time 10 hrs 15 min.
Hole Depth/Csg 37' / 32'	Hole Depth/Csg 59 / 53	Hole Depth/Csg 22 / 21
Reference Measuring Point: **GROUND SURFACE**	Casing String No. 1 2 3 4 ____ See Report No. 1	Rod Size: 1 - 9 5/8"

Time/Depth		Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
From	To	
0630	0845	Monthly safety meeting
0845	0905	Travel to POD (meeting (BTR, Drillers, RCT & Geo.)
0905	0915	POD meeting
0915	0925	Prep time (IHT am check c detectable)
0925	0940	Borehole cleanout down to 42' bgs.
0945	1040	Dept. of Ecology personnel on site with Chris Wright
0940	0950	Advancing SS sampler from 36' (1' slough) to 42' bgs.
0950	1005	Collecting samples: 70C - ~~70B~~ 70E (38'-41' bgs)
1000	1010	Assembling SS for next run LW 5-30-06
1010	1025	Advancing ss sampler from 41' to 47' bgs
1025	1045	Collecting samples: 71E & 72A (41'-43')
		• A rock was encountered @ ~43' & there was no rec. 43'-47'.
1045	1200	Advancing casing & borehole cleanout casing → 39'
		• Added 5.0' of casing Talley = 39.7'
1200	1220	Lunch
1220	1300	Resume driving casing & borehole cleanout → 46.5' bgs
		• Added 10.0' of casing Talley = 49.7'
1300	1310	Advancing ss sampler from 46.5' to 53' bgs
~~1315~~	4-26-06	~~Collecting samples:~~ (Core fell out)
1315	1325	Modifying SS shoe (adding nuts to the inside)
1325	1335	Advancing SS down to 53' bgs (2' recovery)
1335	1350	Collecting samples 73B (mixed int. 46.5-53')
1350	1355	Advance casing from 46.5' to 53' bgs
		• Added 5.0' casing Talley = 54.7'

Reported By: Jake Horner	Reviewed By: L.D. Walker
Title: Geologist Date: 4/26/06	Title: Geologist Date: 5/30/06
Signature: [signature]	Signature: [signature]

A-6003-651 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING Continuation Page		Page 2 of 2	Date: 4-26-06
Well Name: 399-3-19		Well ID: C5001	
Location: 300-FF-5 OU		Continuation of Report No.: 4	

Time/Depth From	Time/Depth To	Description of Activities/Operations with Depth
1355	1430	Borehole cleanout from 50' to 52' bgs
		• spoils were bagged (mixed 46.5' - 53' bgs)
	1435	DTW = 47.2' bgs DTB = 52.7' bgs
1435		Setup for the 1st pumped water sample
		• Trip in screen & pump
1435		Calibrating Field kit inst. ~~std.~~ Turb. read
		~~• Spm~~ : LW 5-30-06 5.33 1st 6.03 2nd 5.21
		47.4 51.8
		512 526
	1510	Start pumping DTW TOC = 53.2' 7.0-7.5gpm (Flow meter)
	1515	Stop pumping (good flow, but the ball valve was plugged)
	1521	Resume pumping @ 7gpm & no measurable drawdown.
		NTU pH Temp. Cond. D.O.
	1526	24.6 7.24 20.1 407 8.4
	1534	15.0 7.33 19.1 404 8.5
	1541	11.6 7.47 19.1 403 8.6
	1549	9.99 7.43 19.3 402 8.6
	1546	Collecting Samples: B1HRW~~R~~ 4-26-06 JH, B1HRX0 & B1HRX1
	1550	• Tot. purge time = 34min @ 7 - 7.5 gpm Tot. vol. = 260 gal.
1550	~~1608~~	Trip out pump & screen
	1605	IHT pm check < detectable (*RCT full time)
1608	1615	Advancing SS sampler from ~~53'~~ 53' LW 5-30-06 to 59' bgs
1615	~~1630~~	Collecting samples: 74B & 74C (~~53'~~ - ~~55'~~ bgs) 53' LW 5-30-06
1630	1645	Geologist finishes sample paperwork.
		not used JH 4/26/06

Reported By: Jake Horner		Reviewed By: L. D. Walker	
Title: Geologist	Date: 4/26/06	Title: Geologist	Date: 5/30/06
Signature: Jake Horner		Signature: LD Walker	

A-6003-652 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING	Page 1 of 2 Date: 4-27-06

Well ID: C5001	Well Name: 399-3-19
Location: 300-FF-5 OU	Report No.: 5

Start	Finish	Total
Time 0600	Time 1630	Time 10.5 hrs
Hole Depth/Csg 59 / 53	Hole Depth/Csg 76' / 74'	Hole Depth/Csg ~~15~~ 17 / 21 (4-27-06)

Reference Measuring Point: **GROUND SURFACE**	Casing String No. 1 2 3 4 ____ Rod Size: 1 - 9 5/8" See Report No. 1

Time/Depth From	To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
0600	0630	POD meeting (BTR, Drillers, RCT, IHT & Geo)
0630	0640	Prep time
	0635	IHT am check < detectable
0640	0740	Advancing casing from 53' to 57.5 & cleanout (58')
		·Added 5.0' of casing Talley = 59.7'
0740	0755	Trip in 10' screen & pump for water sample
0745	0800	Calibrating insruments (DTB = 58' bgs (1' slough) shoe = 57.5)
	0758	Start pumping @ 7.6 gpm DTW = 53.1' TOC (6' stickup)
	~~0807~~ 4-27-06	NTU PH Cond.^{MS} Temp°C D.O. mg/L Tot. vol.
	0807	415 7.56 407 @ 16.3 9.0 75 gal.
	0814	43.6 7.49 409 @ 16.5 9.4 125 gal.
	0820	29.1 7.47 411 @ 16.5 9.4 170 gal.
	0829	16.0 7.60 408 @ 16.2 9.4 ~~220~~ 250 gal. 4-27-06
	0826	Collecting samples: B1HRX3, B1HRX4 & B1HRX5
		·Tot. purge vol. = 220 gallons. Tot. pumped = 253 gallons
	0830	Stop pumping DTW = 53.1' TOC (Ø drawdown)
0830	0840	Trip out sampling pump & screen
0840	0845	Prep for slug test
0845	0905	General maintenance until PNNL arrives for slug test.
0905	0915	Backpull casing from 57.5' to 52' bgs
0915	0930	Additional setup with PNNL on site
0930	1030	Performing slug tests with screen exposed 5' from 52'-57' bgs
1030	1040	Backpulling casing from 52' to 47' bgs
1040	1100	Performing slug tests with screen exposed 10' from 47'-57' bgs

Reported By: Jake Horner		Reviewed By: L.D. Walker	
Title: Geologist	Date: 4-27-06	Title: Geologist	Date: 5/30/06
Signature: Jake Horner		Signature: LD Walker	

A-6003-651 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING

Continuation Page

Page 2 of 2

Date: 4-27-06

Well Name: 399-3-19

Well ID: C5001

Location: 300-FF-5 OU

Continuation of Report No.: 5

Time/Depth From	Time/Depth To	Description of Activities/Operations with Depth
1100	1110	Trip out screen
1110	1200	Advancing casing from 47' to 58.5' bgs & borehole cleanout
~~1200~~ 1220	~~1220~~ 1235	Advancing SS sampler from ~~58'~~ 58' to 63' bgs (LW 5-30-06)
1200	1220	Lunch
		• Bottom 1.5' fell out & then the core shifted down, what
		was left was bagged as 58'-60' bgs
1245	1330	Borehole cleanout with 6" barrel (bagged samples 58'-63')
1330	1410	Advancing casing from 58.5' to 63' bgs & cleanout.
		• Added 5.0' casing Talley = 64.7'
1410	1420	Trip in screen & pump
	1422	Start pumping @ 7.9 gpm DTW = 53.35' TOC
		NTU PH Cond.(ms) Temp(°C) D.O.(mg/l) Tot vol.(gal)
	~1435	>1000 7.62 413 @ 20.4 8.0 90
	1440	598 7.50 411 @ 19.8 8.3 130
	1445	294 7.49 413 @ 19.3 8.4 178
	1455	67.4 7.48 411 @ 20.0 8.1 250
	1450	Collecting Samples: B1HRX7, B1HRX8 & B1HRX9 220+ purge vol.
	1456	Stop pumping
		• Tot. purge vol. = ~~250~~ 220 gal. Tot. pumped = 253 gal. (4-27-06)
1515	1535	Advancing SS sampler from ~~65'~~ 63' to 76' bgs (LW 5-30-06)
		• after pulling pump & screen (1500 - 1515)
		• PNNL requested the core sampler be pushed to 76' bgs
		• 4' were recovered from ~63' to ~67' bgs
1535	1550	Collecting core samples 76B - 76E (63' to ~67' bgs)
1545	1620	Advancing casing from 63' to 74' bgs cleanout.
		• Bagged samples 68' to 74' bgs
1620	1630	Secure site
		~~not used~~ JH 4-27-06

Reported By: Jake Horner

Title: Geologist

Date: 4-27-06

Signature: Jake Horner

Reviewed By: L.D. Walker LW 5-30-06

Title: Geologist

Date: ~~5/30~~ 5/30/06

Signature: D Walker

A-6003-652 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING	Page 1 of 2 Date: 4-28-06

Well ID: C5001	Well Name: 399-3-19
Location: 300-FF-5 OU	Report No.: 6

Start	Finish	Total
Time 0600	Time 1450	Time ~~8~~ 8hrs 50 min
Hole Depth/Csg 76 / 74	Hole Depth/Csg 89 / 87.7	Hole Depth/Csg ~~89'~~ 13' / ~~87.7'~~ 13.7' JH 4-28-06
Reference Measuring Point: GROUND SURFACE	Casing String No. (1) 2 3 4 ___ Rod Size: 1 - 9 5/8" See Report No. 1	

Time/Depth From	To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
0600	0630	POD meeting (Drillers, IHT, RCT & Geo)
0630	0650	Prep time & switching drums
	0635	IHT am check < detectable, RCT < background
0650	0705	Advancing ss sampler from
		• Did not advance ss, need additional cleanout
0705	0735	Borehole cleanout
0735	0755	Advancing ss sampler from 73' to 79' bgs (no rec.)
0755	0805	Adding a sand catcher to ss shoe.
0805	0820	Advancing ss sampler from 73' to 79' bgs (no rotation)
0820	0835	Collecting samples 77D - 78A (mixed 73'-76' bgs)
0830	0930	Advancing casing from 74' to 79' bgs
		• Casing Talley = 79.7
0930	1000	Advancing ss sampler from 78' to 83' bgs, backpulling sampler to 82' & then advancing to 84' bgs.
1000	1020	Collecting samples 78E - 79B (80'-83' bgs)
1020	1050	Advancing casing & cleanout Talley = 84.7
	1050	DTB = 83.5' bgs shoedepth = 84' bgs DTW = 52.3' bgs
1050	1100	Trip in screen for water sample
1100	1105	Backpull casing from 84' to 80' bgs set pump @
		• Open screen 80'-83' bgs DTB = 83.5' bgs slough = 83.5'-84' bgs
	1108	Start pumping DTW = 53.5' TOC @ ~7.5 gpm
	1115	DTW = 57.7' TOC (stabilized)
	1122	DTW = 56.0' TOC (recharging after init. drawdown)
1115	1145	Drillers @ Lunch

Reported By: Jake Horner		Reviewed By: L.D. Walker	
Title: Geologist	Date: 4-28-06	Title: Geologist	Date: 5/30/06
Signature: [signature]		Signature: [signature]	

A-6003-651 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING Continuation Page	Page 2 of 2 Date: 4-28-06

Well Name: 399-3-19	Well ID: C5001
Location: 300-FF-5 OU	Continuation of Report No.: 6

Time/Depth From	To	Description of Activities/Operations with Depth
		NTU pH Cond. Temp°C DO mg/L Purge t(min) Purge Vol.(gal)
	1132	>1000 7.57 431 @ 20.4 6.9 24 ~150
	1140	>1000 7.55 426 @ 19.4 7.7 32 ~200
	1148	>1000 7.55 426 @ 19.9 7.5 40 ~250
	1153	~~>1000~~ 639 4-28 7.56 428 @ 19.2 7.7 45 ~300
	1203	392 7.56 429 @ 20.5 7.5 54 ~360
	1159	Collecting samples: B1HRY1, B1HRY2 & B1HRY3
		• Tot. purge vol. = 340 gal. Tot. pump vol. = 365 gal
1202	1230	Stop pumping & Trip out screen & pump.
1230	1300	Advancing casing from 80' to 83.5' bgs & cleanout to 83'
	1235	IHT pm check < detectable
1300	1315	Advancing ss sampler from 83' to 89' bgs
1315	1330	Collecting samples 79C to 80C (82' to 88' bgs)
1330	1400	Advancing casing from 83.5' to 87.7' & cleanout to 88' bgs.
1400	—	Final TD = 89' bgs with core samples
1400	→	Mobilize drill rig & prepare to return to
		Portland shop.
1400	1450	Geologist finalizes notes & gathers equipment.
		not used 4-28-06

Reported By: Jake Horner		Reviewed By: L.D. Walker
Title: Geologist	Date: 4-28-06	Title: Geologist Date: 5/30/06
Signature: John Horner		Signature: LD Walker

A-6003-652 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING

Page 1 of 2

Date: 5-1-06

Well ID: C5000		Well Name: ~~399-3-18~~ 399-1-23 5-1-06	
Location: 300-FF-5 OU		Report No.: 7	

Start	Finish	Total
Time 1130	Time 1500	Time
Hole Depth/Csg n/A / n/A	Hole Depth/Csg n/A / n/A	Hole Depth/Csg n/A / n/A

Reference Measuring Point: **GROUND SURFACE**

Casing String No. 1 2 3 4 ____ Rod Size:

See Report No. 1 Well Development & Testing

Time/Depth From	Time/Depth To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
1130	1140	POD meeting (BTR, Drillers & Geologist)
1140	1230	Drillers work in laydown yard
1140	1210	Geologist sets up equip.
		• Turb. meter std/read: 5.33/6.01, 47.4/52.0, 512/529
		• Cond. 1.429mS @ 13.3°C std = 1430 mS
	1200	DTB = 54.1' TOC Bottom SS = ~~54.92~~ 54.71' TOC (~~0.82~~ 0.61' sed.) 5-1-06
	1205	DTW = 33.0' TOC
1230	1245	Drillers set up pump system
		• Probe depth 8.73' bwt (~~30.00~~ 33.0' TOC) 5-1-06
		• Intake depth bwt (33.0' TOC)
1245	1315	Looking for pump wiring connection
1315	1317	Lowered pump (Probe = ~13.156' bwt Intake = ~15' bwt)
1320	1349	Test #1 (Sandy Gravel 1) pumping @ 16 gpm
5-1-06	~~1338~~	NTU pH Temp Cond. D.O. Pump t Pump Vol.
	1338	3.60 7.37 18.3 495 8.8 18 min 290 gal
	1341	4.19 7.37 18.1 491 9.0 21 min 360 gal.
	1348	1.88 7.34 17.8 491 9.1 28 min 450 gal.
1349	1359	Stop pumping (recovery test #2) (Sandy Gravel 2)
1359	1403	Pull pump up to ~5.4' bwt
		• Probe is 3.396' bwt (33.0' TOC)
		Test #3 Cobbles 3 pumping @ 16 gpm
	1405	Probe is @ 3.406' bwt (33.0' TOC)
	1407	Start test #3 (Cobbles 3) pumping @ 16 gpm
		Not used - 5-1-06

Reported By: Jake Horner		Reviewed By: L.D. Walker	
Title: Geologist	Date: 5-1-06	Title: Geologist	Date: 5/30/06
Signature: [signature]		Signature: [signature]	

A-6003-651 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING Continuation Page	Page 2 of 2 Date: 5-1-06
Well Name: ~~399-3-19~~ 399-1-23	Well ID: C5000
Location: 300-FF-5 OU	Continuation of Report No.: 7

Time/Depth From	Time/Depth To	Description of Activities/Operations with Depth						
		NTU	pH	Temp.	Cond.	D.O.	Pump t.	Pump V.
	1410	192	7.39	17.1	491	9.2	~3.5 min.	~60 gal
	1418	8.19	7.39	17.5	489	9.2	11 min.	180 gal
	1428	5.91	7.30	17.3	490	9.1	21 min	330 gal
	1431	5.25	7.30	17.5	492	9.1	24 min	390 gal
	1436	2.82	7.39	17.0	493	9.1	29 min	480 gal ~~ND~~
	1438	Stop pumping						
1438	1448	Test #4 (Cobbles 4) recovery test						
1448	1500	Trip out pump & transducer						
	1503	DTB = 53.8' TOC DTW = 33.0' TOC						

not used JH 5-1-06

Reported By: John Horner	Reviewed By: L.D. Walker
Title: Geologist Date: 5-1-06	Title: Geologist Date: 5/30/06
Signature: John Horner	Signature: L.D. Walker

A-6003-652 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING	Page 1 of 2 Date: 5-3-06

Well ID: C5001	Well Name: 399-3-19
Location: 300-FF-5 OU	Report No.: 8

Start	Finish	Total
Time 0600	Time 1530	Time 9.5 hrs
Hole Depth/Csg 89 / 87.7	Hole Depth/Csg 103.5 / 102	Hole Depth/Csg 14.5 / 14.3

Reference Measuring Point: **GROUND SURFACE**	Casing String No. 1 2 3 4 ____ Rod Size: 1 - 9 5/8 See Report No. 1

Time/Depth From	To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
0600	0620	POD meeting (BTR, Drillers, IHT, RCT & Geo)
0620	0700	Setting up the drill rig
	0710	DTB = 89.5' bgs DTW = ~~48~~ 46.8' bgs
0700	0720	Preparing to resume drilling
		• The last water sample (80'-83' bgs) contained elevated
		levels of uranium, so PNNL decided to drill through
		the (m)S confining layer for additional sampling.
0720	0740	Advancing the borehole from 89.5' to 95' bgs
	0730	RCT and check (instrument check)
0740	0835	Advancing borehole from 95' to 100' bgs
	0740	DTW = 48.6' bgs w/ ~1"/5min. recovery (too slow)
0835	0845	Advancing casing from 87.7' to 94' bgs
		• Added 5.0' casing Talley = 94.7'
0845	0910	Realigning drill rig
0910	0920	Advancing casing from 94' to 98' bgs
		• Added 5.0' of casing Talley = 99.7'
0920	0935	Borehole cleanout down to 101' bgs
0935	0950	Advancing casing from 98' to 99.5' bgs
0950	1020	Borehole cleanout from ~100' to 102.5' bgs
1020	1035	Advancing casing from 99.5' to 102' bgs
1035	1130	Borehole cleanout ↳ added 5.0' casing Talley = 104.7'
	1110	DTW = 51.7' bgs
	1130	DTB = 103.5' bgs casing depth = 102' bgs
1130	1215	Trip in 10' screen ~~& pump~~ (JAH 5-3-06) bottom screen @ 102' bgs.

Reported By: Jake Horner		Reviewed By: L.D Walker	
Title: Geologist	Date: 5/3/06	Title: Geologist	Date: 5/30/06
Signature: [signature]		Signature: [signature]	

A-6003-651 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING

Continuation Page

Page 2 of 2

Date: 5/3/06

Well Name: 399-3-19 | Well ID: C5001

Location: 300-FF-5 OU | Continuation of Report No.: 8

Time/Depth From	To	Description of Activities/Operations with Depth						
1215	1216	Backpulling casing from 102' to 101' bgs						
1216	1235	Broke the joint on the sub (repair time)						
1235	1245	Backpulling casing from 101' to 100' bgs						
		• Screen dropped from 102' to 102.5' bgs						
1245	1247	Trip in sampling pump (½ HP Grundfos) @ 94' bgs						
1247	1252	additional setup						
	1252	Start pumping DTW = 52.1' TOC (46.1' bgs)						
	1302	DTW = 73.2' TOC						
	1305	Slowed pump rate from ~6.5 gpm to ~2.5 gpm DTW = 75' TOC						
		NTU	pH	temp (°C)	Cond. (µS)	D.O. (mg/L)	time (min)	Gallons
	1330	>1000	7.61	19.8	345	1.1	5/3/06 ~~28~~ 38	140
	1341	>1000	7.44	19.1	341	0.6	~~39~~ 49	182
	1348	>1000	7.56	19.0	336	0.7	~~46~~ 56	202
	1354	>1000	7.36	19.0	332	0.7	~~52~~ 62	226
	1403	>1000	7.52	19.4	323	0.6	~~61~~ 71	260
	1415	528	7.57	19.0	318	ND	~~73~~ 83	297
	1421	225	7.55	18.7	318	0.9	~~79~~ 89	320
	1430	108	7.54	19.2	318	0.7	98	355
	1425	Collecting Samples: B1HRY5, B1HRY6 & B1HRY7						
	1431	Stop pumping						
1431	1500	Trip out pump & screen						
1500	→	Secure site						
	1505	RCT pm check < background						
	1530	Geologist left the site						

not used JH 5/3/06

Reported By: Jake Horner | Reviewed By: L.D. Walker

Title: Geologist | Date: 5/3/06 | Title: Geologist | Date: 5/30/06

Signature: JH Horner | Signature: LD Walker

A-6003-652 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING

Page 1 of 2
Date: 5-4-06

Well ID: C5001	Well Name: 399-3-19
Location: 300-FF-5 OU	Report No.: 9

Start	Finish	Total
Time 0600	Time 1640	Time 10 hrs 40 min
Hole Depth/Csg 103.5 / 100	Hole Depth/Csg 67 / 67.7	Hole Depth/Csg -36.5 / -32.3

Reference Measuring Point: **GROUND SURFACE**

Casing String No. 1 2 3 4 ____ Rod Size: 1 - 9 5/8"
See Report No. 1 Well completion

Time/Depth From	To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
0600	0620	POD meeting (BTR, Drillers, IHT, RCT & Geo)
0620	0658	Setup time
0658	0800	Begin sanding & backpulling casing DTB: = 102.6' bgs
		· 10-20 mesh silica sand 102.6' to 92.6' bgs (8 50# bags)
		· Backpulled casing ~2' from 100' to 98' bgs
0800	0915	Working on hydraulic system
0915	1043	Resume backpulling casing & backfilling sand
		· Casing didn't really start moving till about 10:10
		· 10-20 sand 102.6' to 88' bgs
1043	1116	Backpulling casing & adding coated bent. pellets.
		· Bent. from 88' to 83.1' bgs (5 x 5 gal. buckets)
1116	1130	Adding 10-20 sand from 83.1' to 74.5 (not final)
1130	1200	Lunch
1200	1221	Resume Backpulling casing & adding sand / bent.
		· 10-20 sand from 83.1' to 76' bgs (8 bags)
1221	1235	Backpulling casing & adding coated bent. pellets
		· Bentonite from 76' to 71' bgs
1235	1257	Backpulling casing & adding sand 10-20 & 6-9 mesh
~~1257~~ 1257	1340	Performing straightness test (21.5' x) Pass
1340	1410	Trip in ss sump (2.03'), screen (27.13') & riser ~~40.07~~ ~~40.08~~ 45.08' 5-4-06
		· Total length SS = ~~67.23~~ 72.24' 5-4-06
1410	—	SS casing didn't go down far enough (3' too high). The last tag on bottom was read wrong.
1410	1455	Trip out ss & clean out sand with 6" core barrel.

Reported By: Jake Horner		Reviewed By: L.D. Walker	
Title: Geologist	Date: 5/4/06	Title: Geologist	Date: 5/30/06
Signature: John Horner		Signature: LD Walker	

A-6003-651 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING Continuation Page		Page 2 of 2
		Date: 5/4/06
Well Name: 399-3-19	Well ID: C5001	
Location: 300-FF-5 OU	Continuation of Report No.: 9	

Time/Depth From	To	Description of Activities/Operations with Depth
1455	1515	Trip in ss sump, screen & riser Tot. length = 72.24'
		• ~6' of stickup on ss (bottom is @ 66' bgs,
		1' too high)
1515	1530	Backpulling temp. casing & adding 6x9 sand.
		• 6" ss was lifted ~3' while backpulling.
1530	1552	Trip out 6" ss casing, screen & sump.
1552	1555	Advancing casing from 63' to 67.2' bgs
1555	1630	Borehole cleanout down to 67' bgs
1630	1640	Cover ss casing & secure site
		*Note: The driller has been making the wrong
		correction for his tagline all day. All
		tagged depths are two feet higher than
		recorded. Bent. seals will be reinstalled
		on 5/5/06.
		not used JH 5/4/06

Reported By: Jake Horner		Reviewed By: L.D. Walker	
Title: Geologist	Date: 5/4/06	Title: Geologist	Date: 5/30/06
Signature: [signature]		Signature: LD Walker	

A-6003-652 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING

Page 1 of 1

Date: 5/5/06

Well ID: C5001	Well Name: 399-3-19
Location: 300-FF-5 OU	Report No.: 10

Start	Finish	Total
Time 0600	Time 1630	Time 10.5 hrs
Hole Depth/Csg 67' / 67.7'	Hole Depth/Csg 57.3 / 64.7	Hole Depth/Csg -9.7 / -3.0
Reference Measuring Point: GROUND SURFACE	Casing String No. 1 2 3 4 ___ Rod Size: 1 - 95/8" See Report No. 1	

Time/Depth From	To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
0600	0620	POD meeting (BTR, Drillers, RCT & Geologist)
0620	0645	Prep time (The borehole will be cleaned out to 88' bgs)
0645	0705	Advancing Casing from 67.7' to 82' bgs
0705	0800	Borehole cleanout from ~67' to 83' bgs
0800	0815	Advancing casing from 82' to 88.5' bgs
0815	1000	Borehole cleanout from ~83 to 88' bgs
	0830	RCT am check < background
1000	1041	Resume well completion with coated pellets
		• 3/8" coated bent. pellets 88' to 82.9' bgs (4½ 5gal. buckets)
1041	1100	Backfilling with 10-20 sand 82.9' to 78.8' bgs
1100	1150	Lunch
1150	1208	Backfilling with 10-20 sand 78.8' to 77.8' bgs (5½ 50# bags)
1208	1240	Backfilling with 3/8" coated bent. 77.8' to 72.5' bgs
		• 4½ x 5 gallon buckets
		• Natural backfill 72.5' to 71.9' bgs (0.6')
1240	1300	Backfilling 6x9 silica sand 71.9' to 68' bgs
1300	1315	Trip in SS sump, screen & riser (bottom @ 67' bgs)
		• 6" I.D. SCH 10 TP 304L SS casing w/ 20 slot screen.
1315	1358	Backfilling 6x9 silica sand 68' to 58.9' bgs
1358	1410	Setup to begin surging (61.7' to 65' bgs).
1410	1423	Trip in surge block
1423	1615	Start surging (1 hr 52 min & 3 bags sand)
1615	1630	Secure site
		— not used — JH 5/5/06

Reported By: Jake Horner	Reviewed By: L.D. Walker
Title: Geologist Date: 5/5/06	Title: Geologist Date: 5/30/06
Signature: Jake Horner	Signature: LD Walker

A-6003-651 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING	Page 1 of 1 Date: 5/8/06

Well ID: CS001	Well Name: 399-3-19
Location: 300-FF-5 OU	Report No.: 11

Start	Finish	Total
Time 0600	Time 1610	Time 10 hrs 10 min.
Hole Depth/Csg 57.3 / 61.7	Hole Depth/Csg 46.4 / 47	Hole Depth/Csg -10.9 / -14.7
Reference Measuring Point: GROUND SURFACE	Casing String No. (1) 2 3 4 ____ Rod Size: 1- 9 5/8" See Report No. 1 Well completion	

From	To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
0600	0620	POD meeting (BTR, Drillers, RCT, IHT & Geo)
0620	0632	Prep time
	0625	DTW = 47.2' bgs DTB = 57.3' bgs
0632	0652	Resume surging interval from 61.7' to 65' bgs
0652	—	DTB = 57.3' (Ø' in 20 min.)
0652	0720	Backpull casing from 61.7' to 58.7' bgs
0720	0735	Trip in surge block
0735	~~0850~~	Surging interval from 58.7' to 61.7' bgs.
0835	0840	Stop surging (break)
	0855	Stop surging (no change in 15 min.) DTB=56' bgs
0855	0905	Waiting for driller to return
0905	0936	Trip out surge block & backpull casing 58.7' to 55.7' bgs.
0936	1150	Surging from 55.7' to 58.7' bgs
	1134	DTB = 53.2' bgs
	1150	DTB = 53.2' bgs
1150	1220	Trip out surge block & backpull casing 55.7' to 53' bgs.
1220	1230	Trip in surge block & add sand
1230	1350	Surging 53' to ~56' bgs (dropped 0.1' 13:35-13:50)
1350	1410	Trip out surge block & backpull casing 53' to 50' bgs
1410	1415	Add sand & trip in surge block
1415	1536	Surging 50' - 53' bgs
	1450	DTB = 52.0' Top of platform (TOP)
	1500	DTB = 52.2' TOP
	1536	DTB = 52.4' TOP

Reported By: Jake Horner	Reviewed By: L.D. Walker
Title: Geologist Date: 5/8/06	Title: Geologist Date: 5/30/06
Signature: Jake Horner	Signature: LD Walker

A-6003-651 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING Continuation Page		Page 2 of 2 Date: 5/8/06
Well Name: 399-3-19	Well ID: C5001	
Location: 300-FF-5 OU	Continuation of Report No.: 11	

Time/Depth		Description of Activities/Operations with Depth
From	To	
1536	1600	Trip out surge block & back pull casing from 50' to 47' bgs Talley = 49.7'
	1605	BTR notifies Drillers to stop work due to a hoisting & rigging issue with the lifting bail.
1605	1610	Secure site
		not used JH 5/8/06

Reported By: Jake Horner		Reviewed By: L.D. Walker	
Title: Geologist	Date: 5/8/06	Title: Geologist	Date: 5/30/06
Signature: Jake Horner		Signature: LD Walker	

A-6003-652 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING

Page 1 of 1

Date: 5/10/06

Well ID: C5001	Well Name: 399-3-19
Location: 300-FF-5 Operable Unit	Report No.: 12

Start	Finish	Total
Time 0600	Time 1230	Time 6 1/2
Hole Depth/Csg 46.4 / 47.0	Hole Depth/Csg ~~ø~~ / ~~ø~~	Hole Depth/Csg -46.4 / ~~ø~~ -47

Reference Measuring Point: **GROUND SURFACE**	Casing String No. 1 2 3 4 ____ See Report No. 1	Rod Size: 9 5/8"

Time/Depth From	Time/Depth To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
0600	0630	POD meeting (BTR, Drillers, RCT & Geo)
0630	0700	Prep time
0700	0708	Trip in surge block & add 1 50# bag 6X9 sand
	0708	DTB = 44.9' bgs start surging 47'-50' bgs
	0820	DTB = ~~43.25 bgs~~ JP 5/10/06 43.1' bgs
	0840	DTB = 43.25' bgs
0840	0900	Trip out surge block
0900	0952	Backpull casing & add remaining filter pack to 29.9' bgs
0952	1010	Adding 3/8" bent pellets 29.9' to 23.9' bgs + 5 gal. H_2O
1010	1043	Adding bent crumbles 23.9' to 10.5' bgs + 20 gal H_2O
1043	1200	Mix & pour grout 10.5' to 1.0' bgs (wet bag)
		·230 gallons used, mixed with 4% bent.
1200	→	Clean up
	1230	Geologist left site
		not used JP 5/10/06

Reported By: Jake Horner		Reviewed By: L.D. Walker	
Title: Geologist	Date: 5/10/06	Title: Geologist	Date: 5/30/06
Signature: John Horner		Signature: LD Walker	

A-6003-651 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING	Page 1 of 1 Date: 5-22-06

Well ID: C5001	Well Name: 399-3-19
Location: 300-FF-5 OU	Report No.: 13

Start	Finish	Total
Time 0600	Time 1050	Time 4hrs. 50min.
Hole Depth/Csg – / –	Hole Depth/Csg – / –	Hole Depth/Csg – / –

Reference Measuring Point: **GROUND SURFACE**	Casing String No. 1 2 3 4 ____ Rod Size: See Report No. 1 WELL DEVELOPMENT

Time/Depth From	To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
0600	0615	POD – (BTR, Drillers, Geo.); Plan: Well development
		of completed wells; Drillers will not be ready to start
		development until ~ 0800 – Geo. waits.
0800		Moving from POD trailer area to well to be developed.
	0845	DTW = 50.34' TOC; DTB = 70.0' TOC; Transducer taped on
		to pump 2'2" above pump intake.
	0850	Drillers lower pump into the well.
0911		Begin pumping / Start test #1.
	0940	Turb. = 1.16 NTU, Cond. = 0.509 mS, pH = 7.28, XD = 15.040' H_2O, 17.2°C
	0949	Turb. = 1.02 NTU, Cond. = 0.478 mS, pH = 7.34, XD = 15.041' H_2O, 17.4°C
	0956	Turb. = 0.83 NTU, Cond. = 0.480 mS, pH = 7.23, XD = 15.035' H_2O, 17.2°C
	0959	Pump shut off / Start test #2
	1002	Drillers move pump ~15' to middle of screen (during test #2,
		test shut off manually)
	1006	Pump turned on / Start test #3, XD = 4.835' H_2O
	1017	Turb. = 0.87 NTU, Cond. = 0.479 mS, pH = 7.21, XD = 4.841' H_2O, 17.2°C
	1025	Turb. = 0.67 NTU, Cond. = 0.478 mS, pH = 7.37, XD = 4.844' H_2O, 17.2°C
	1029	Turb. = 0.43 NTU, Cond. = 0.477 mS, pH = 7.42, XD = 4.841' H_2O, 17.2°C
	1033	Pump shut off / Start test #4
	1037	Stop test #4; begin pulling up pump.
	1040	Pump out of the well, DTW = 50.36' TOC, DTB = 70.0' TOC
	1050	Move to C5002 for well development.
		NOT USED 5/22/06

Reported By: Jess Hocking		Reviewed By: L.D. Walker	
Title: Geologist	Date: 5/22/06	Title: Geologist	Date: 5/30/06
Signature: [signature]		Signature: [signature]	

A-6003-651 (04/03)

WELL DEVELOPMENT AND TESTING DATA

Well Name:	Well ID:	Well Location:	Date:
399-3-19	C5001	300-FF-5 OU	5-22-06

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	50.34' TOC
End of Job	50.36' TOC

DEPTH TO BOTTOM:

Start of Job	70.0' TOC
End of Job	70.0' TOC

PART 2

WELL DEVELOPMENT DATA

Pump Model	2.5 Grundfos
Intake Depth	INT 1 66' bgs / INT 2 51' bgs
Starting Turbidity	~~14~~ 1.16 NTU / 0.87 NTU

Pump Start	Stop	Flow Rate
0911	0957	15 GPM
1006	1033	15 GPM

Total Pumped	1125 Gal
Final Turbidity	INT 1 0.83 NTU / INT 2 0.43 NTU
XD SN/Range (PSI)	20 psi

PART 3

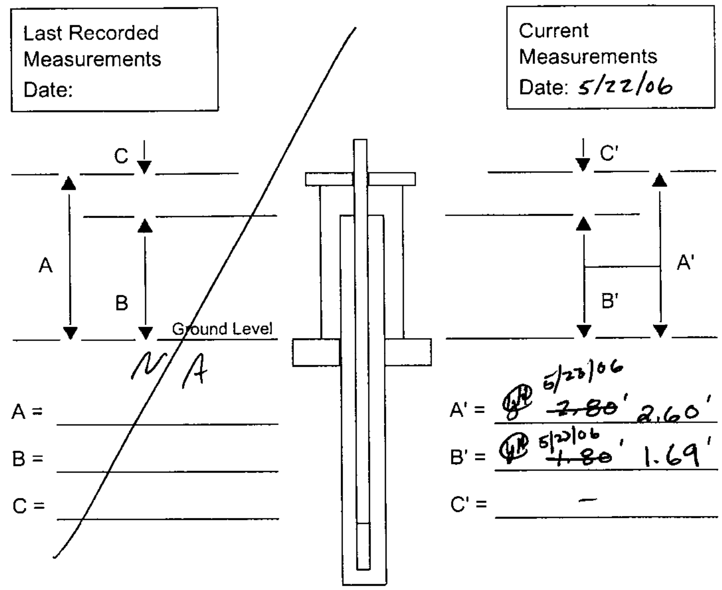
INSTANTANEOUS SLUG TEST

Static Water Level (TOC)	N/A
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: 5/22/06



N/A

A =
B =
C =

A' = ~~2.80'~~ 2.60' (5/22/06)
B' = ~~1.80'~~ 1.69' (5/22/06)
C' = —

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

PART 5

COMMENTS:

CALIBRATIONS:

pH meter:
7.00 = 6.81
10.00 = 9.97

Cond. meter:
1.419 mS = 1.424 mS

Turb. meter:
5.33 NTU = 6.04 NTU
47.4 NTU = 51.9 NTU
512 NTU = 523 NTU

INTERVAL #1
STARTING XD = 15.014' H_2O
TRANSDUCER 2.16' above INTAKE

INTERVAL #2
STARTING XD = 4.835' H_2O
Transducer 2.16' above intake.

Prepared by (print name):	Signature:	Date:
Jess Hocking	[signature]	5/22/06
Reviewed by (print name):	Signature:	Date:
L.D. Walker	[signature]	5-30-06

A-6003-644 (03/03)

FIELD ACTIVITY REPORT - DAILY DRILLING	Page 1 of 1
	Date: 5/23/06

Well ID: C5001	Well Name: 399-3-19
Location: 300-FF-5 OU	Report No.: 14

Start	Finish	Total
Time ~~0600~~ 1450 (JP 5/23/06)	Time 1540	Time 50 min
Hole Depth/Csg n/A / n/A	Hole Depth/Csg n/A / n/A	Hole Depth/Csg n/A / n/A

Reference Measuring Point: **GROUND SURFACE**	Casing String No. 1 2 3 4 ____ Rod Size: See Report No. 1

Time/Depth From	Time/Depth To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
1450	1540	Installing permanent pump DTW = 50.4' TOC
		• Grundfos pump 5SO5-13 (0.5 Hp); wt. = 10 lbs; 60 Hz
		• Model #: B08010013-P10545US
		• 3/4" SS SCH 10S TP 304/304L (60.39' Total)
		• Intake set @ ~~60.25 TOC~~ (JP 5/23/06) 61.70' TOC (59.10' bgs)

not used JP 5/23/06

Reported By: Jake Horner	Reviewed By: L.D. Walker
Title: Geologist Date: 5/23/06	Title: Geologist Date: 5/30/06
Signature: John Horner	Signature: LD Walker

A-6003-651 (04/03)

FIELD ACTIVITY REPORT
TUBULAR GOODS TALLY

Page 1 of 1

Date: 4-24-06

Well Name: 399-3-19 | Well ID: C5001

TEMPORARY				PERMANENT*						SCREEN/CAP*		
Jt. #	Length (ft.)	Jt. #	Length (ft.)	Jt. #	Length (ft.)	C	Jt. #	Length (ft.)	C	Jt. #	Length (ft.)	C
1	4.7 (shoe)	21	5.0	1	10.02	C	21			1	2.03	C
2	5.0	22		2	10.02		22			2	10.13	
3	5.0	23		3	10.02		23			3	15.0	
4	5.0	24		4	10.01		24			4		
5	5.0	25		5	5.01		25			5		
6	5.0	26		6			26			6		
7	5.0	27		7			27			7		
8	5.0	28		8			28			8		
9	5.0	29		9			29			9		
10	5.0	30		10			30			10		
11	5.0	31		11			31			11		
12	5.0	32		12			32			12		
13	5.0	33		13			33			13		
14	5.0	34		14			34			14		
15	5.0	35		15			35			15		
16	5.0	36		16			36			16		
17	5.0	37		17			37			17		
18	5.0	38		18			38			18		
19	5.0	39		19			39			19		
20	5.0	40		20			40			20		
Tot	99.7	Tot	5.0	Tot	45.08		Tot			Tot	27.16	

*Indicate those joints with centralizers with a C in the available box.
ALL Casing length shall be measured to the nearest 0.01 ft.

Comments/Remarks:

Tot. temp. casing = 104.7'

Tot. perm. casing (w/screen) = 72.24' - 3.1' (cut off) = 69.14'

screen interval = 40.29' - 65.42' bgs

Temporary: O.D./I.D. 9 5/8"/ 8 5/8" | Permanent: O.D./I.D. 6 5/8"/ 6" | Screen: O.D./I.D. 6 5/8"/ 6"

Temp. casing shoe = 4.7' with a 9" I.D. & 10" O.D.

Temp. casing 9 5/8"/ 8 5/8" (1/2" wall)

Permanent: 6 5/8"/ 6"

*actual 10" O.D. portion of shoe casing is only ~3" long.

Reported By: Jake Horner		Reviewed By: L.D. Walker	
Title: Geologist	Date: 5/5/06	Title: Geologist	Date: 5/30/06
Signature: Jake Horner		Signature: LD Walker	

A-6003-655 (04/03)

LW 5-30-06

WELL COMPLETION LOG

Page 1 of ~~4~~ 3

Date: 5-4-06

Well ID: C5001 | Well Name: 399-3-19

Project: 300-FF-5 Monitoring Well | Location: 300-FF-5 Operable Unit | Drilling Contractor: Cascade Drilling

1.	2.	3.	4.	5.	6.	7.	8.	9.	Fill Material			
Time	Total Casing	Stkup	Btm Csg	Tape Reading	Correction	Cor Tape Reading	Fill Depth	Overlap	Type	Amt	Unit	Comments
0700	104.7	4.7	100	108.6	6.0	102.6	102.6	-2.6	Nat. Backfill	0.9	feet	Backfill 102.6-103.5' bgs
0705	104.7	4.7	100	98.6	6.0	92.6	92.6	7.4	10-20 sand	8	50# bags	+ S
0800	99.7	1.7	98'	—	—	—	—	—	—	—	—	BP
1015	99.7	5.5	94.2	104	6.0	98	98	-3.8	—	—	—	BP
1020	99.7	5.5	94.2	96.5	6.0	90.5	90.5	3.7	10-20 sand	6	50# bag	+ sand
1023	99.7	8.5	91.2	98	6.0	92	92	-0.8	—	—	—	BP
1029	99.7	8.5	91.2	91.5	6.0	85.5	85.5	5.7	10-20 sand	3	50# bags	+ sand
1038	94.7	5.7	89.0	~~83.8~~ 93.8 5-4-06	6.0	~~87.8~~ 87.8 LW 5-30-06	~~87.8~~ 87.8 LW 5-30-06	1.2	—	—	—	BP
1043	94.7	7.0	87.7	94	6.0	88	88	-0.3	—	—	—	BP
1046	94.7	7.0	87.7	91	6.0	85	85	2.7	coated bent. pellets	2	5 gal. bucket	+ Bent. (3/8" coated pellets)
1053	94.7	8.0	86.7	92	6.0	86	86	0.7	—	—	—	BP
1055	94.7	9.5	85.7	92.5	6.0	86.5	86.5	-0.8	—	—	—	BP
1100	94.7	9.5	85.7	90.8	6.0	84.8	84.8	0.9	coat bent. pellets	1	5 gal. bucket	+ Bent.
1104	89.7	5.5	84.2	90	6.0	84.0	84.0	0.2	—	—	—	BP
1109	89.7	5.5	84.2	89.5	6.0	83.5	83.5	0.7	coat. bent. pellets	1	5 gal. bucket	+ Bent
1111	89.7	~~8.2~~ 7.0' LW 5-30-06	82.7	90	6.0	84	84	-1.3	—	—	—	BP
1114	89.7	7.0	82.7	88.4	6.0	82.4	82.4	0.3	coat. bent. pellets	1	5 gal. bucket	+ Bent.
1116	89.7	8.0	81.7	89.1	6.0	83.1	83.1	-1.4	—	—	—	BP

Note: Col. 2 - Col. 3 = Col. 4 - Col. 5 - weight and attachments = Col. 7; Col. 7 - Col. 3 = Col. 8; Col. 4 - Col. 8 = Col. 9

Reported By: Jake Horner | Reviewed By: L.D. Walker

Title: Geologist | Date: 5-4-06 | Title: Geologist | Date: 5-30-06

Signature: Jake Horner | Signature: LD Walker

A-6003-653 (04/03)

G.103

WELL COMPLETION LOG

Date: 5/4/06

Well ID: C5001 | Well Name: 399-3-19

Project: FF-5 Monitoring Wells | Location: 300-FF-5 OU | Drilling Contractor: Cascade Drilling

1.	2.	3.	4.	5.	6.	7.	8.	9.	Fill Material			
Time	Total Casing	Stkup	Btm Csg	Tape Reading	Correction	Cor Tape Reading	Fill Depth	Overlap	Type	Amt	Unit	Comments
1119	89.7	8.0	81.7	83.5	6.0	77.5	77.5	4.2	10-20 sand	4	50# bags	+ S
1122	89.7	9.0	80.7	84.5	6.0	78.5	78.5	2.2	—	—	—	BP
1125	89.7	9.0	80.7	79.0	6.0	73.0	73.0	7.7	10-20 sand	4	50# bags	+ Sand
1127	84.7	5.5	79.2	80.5	6.0	74.5	74.5	4.7	—	—	—	BP
1211	84.7	8.0	76.7	81.4	6.0	75.4	75.4	1.3	—	—	—	BP
1215	84.7	9.0	75.7	81.3	6.0	75.3	75.3	.4	—	—	—	BP
1220	84.7	10.0	74.7	82.0	6.0	76.0	76.0	-1.3	—	—	—	BP
1222	84.7	10.0	74.7	79.7	6.0	73.7	73.7	1.0	coat. bent.	1	5 gal. buckets	+ Bent.
1223	79.7	5.5	74.7	—	—	—	—	—	—	—	—	~~?~~ 5-4-06
1226	79.7	5.5	74.7	78.6	6.0	72.6	72.6	2.1	coat. bent.	1	5 gal. bucket	+ Bent.
1229	79.7	7.0	~~78.4~~ 72.7 5-4-06	78.9	6.0	72.9	72.9	-0.2	—	—	—	BP
1232	79.7	7.0	72.7	78.5	6.0	72.5	72.5	0.2	coat. Bent.	1	5 gal bucket	+ Bent. (Bent. hadn't fell out)
1235	79.7	8.0	71.7	77.0	6.0	71.0	71.0	0.7	—	—	—	BP
1238	79.7	8.0	71.7	74.5	6.0	68.5	68.5	3.2	~~10-20~~ 6-9 sand 5-4-06		50# bag	+ S
1243	79.7	9.0	70.7	75.9	6.0	69.9	69.9	0.8	—	—	—	BP
1252	79.7	10.0	69.7	74.5	6.0	68.5	68.5	1.2	6-9 sand	1	50# bag	+ S + BP
1257	74.7	5.2	69.5	74.4	6.0	68.4	68.4	1.1	—	—	—	BP ~~+~~
1345	69.7	2.5	67.2	68.5	~~6.0~~ 2.5	66.0 LW 5-30-06	66.0	1.2	—	—	—	Remove casing + BP

Note: Col. 2 - Col. 3 = Col. 4 - Col. 5 - weight and attachments = Col. 7; Col. 7 - Col. 3 = Col. 8; Col. 4 - Col. 8 = Col. 9

Reported By: Jake Horner | Reviewed By: L. Walker

Title: Geologist | Date: 5/4/06 | Title: Geologist | Date: 5/30/06

Signature: [signature] | Signature: [signature]

WELL COMPLETION LOG

Date: 5/4/06

Well ID: C5001 | Well Name: 399-3-19

Project: FF-5 Monitoring Wells | Location: 300-FF-5 OU | Drilling Contractor: Cascade Drilling

1. Time	2. Total Casing	3. Stkup	4. Btm Csg	5. Tape Reading	6. Correction 5-4-06	7. Cor Tape Reading	8. Fill Depth	9. Overlap	Fill Material Type	Fill Material Amt	Fill Material Unit	Comments
1412	69.7	2.5	67.2	70.7 ~~72.7~~	6.0	64.2 ~~66.2~~ ←	~~1.0~~	3.0	—	—	—	corrected #5, Tape was read wrong @ 13:45 (SS 3' too high)
~~1523~~	~~74.7~~	~~7.5~~	~~67.2~~	~~74.3~~	~~6.0~~	~~68.3~~	~~68.3~~	LW 5-30-06				~~cleanout~~ LW 5-30-06
1523	74.7	7.5	67.2	73.3	6.0	66.3	66.3	0.9	—	—	—	cleanout (2')
1528	74.7	7.5	67.2	63.2	6.0	57.2	57.2	10'	6x9 Sand	3	50# bags	
	~~74.7~~	~~7.~~										
1630	69.7	2.0	67.7	~~73.0~~ 73.0 LW 5-30-06	~~67.0~~ 6.0 LW 5-30-06	67.0	67.0	-0.7	—	—	—	cleanout

*Note: Tape was read 2' off all day. All measurements are 2' higher than recorded

not used JH 5/4/06

Note: Col. 2 - Col. 3 = Col. 4 - Col. 5 - weight and attachments = Col. 7; Col. 7 - Col. 3 = Col. 8; Col. 4 - Col. 8 = Col. 9

Reported By: Jake Horner | Reviewed By: L.D. Walker

Title: Geologist | Date: 5/4/06 | Title: Geologist | Date: 5/30/06

Signature: [signature] | Signature: [signature]

WELL COMPLETION LOG

Page 1 of 3

Date: 5/5/06

Well ID: C5001 | Well Name: 399-3-19

Project: FF-5 Monitoring Wells | Location: 300-FF-5 Operable Unit | Drilling Contractor: Cascade Drilling

1. Time	2. Total Casing	3. Stkup	4. Btm Csg	5. Tape Reading	6. Correction	7. Cor Tape Reading	8. Fill Depth	9. Overlap	Fill Material Type	Fill Material Amt	Fill Material Unit	Comments
1000	89.7	1.7	88	94	6.0	88	88	Ø	—	—	—	Redrill depth
1015	89.7	1.7	88	92	6.0	86	86	2	Coat. Bent.	1	5 gal bucket	3/8" coated bent. Pellets
1018	89.7	3.0	86.7	92.4	6.0	86.4	86.4	0.3	—	—	—	BP
1020	89.7	3.0	86.7	91.4	6.0	85.4	85.4	1.3	Coat. Bent.	1/2	5 gal. bucket	+ bent.
1023	89.7	4.0	85.7	92.2	6.0	86.2	86.2	-1.5	~~coat. bent.~~	~~1 1/2~~	~~5 gal. bucket~~	BP (no bent.) 5-5-06
1025	89.7	4.0	85.7	89.9	6.0	83.9	83.9	1.8	coat. bent.	1 1/2	5 gal bucket	+ bent.
1028	89.7	5.0	84.7	90.7	6.0	84.7	84.7	Ø	—	—	—	BP
1030	89.7	5.0	84.7	89.0	6.0	83.0	83.0	1.7	coat. bent.	1	5 gal. bucket	+ bent
1033	89.7	6.5	83.2 ~~84.5~~	5-5-06 89.5	6.0	83.5	83.5	-0.3	—	—	—	BP
1039	89.7	6.5	83.2	88.9	6.0	82.9	82.9	0.3	coat. bent	1/2	5 gal bucket	+ bent
1041	89.7	7.5	82.2	88.9	6.0	82.9	82.9	-0.7	—	—	—	BP
1044	89.7	7.5	82.2	87.1	6.0	81.1	81.1	1.1	10-20 sand	1 1/2	50 # bags	+ S
1046	89.7	8.5	81.2	87.6	6.0	81.6	81.6	-0.4	—	—	—	BP
1050	89.7	8.5	81.2	84.9	6.0	78.9	78.9	2.3	10-20 sand	2	50# bags	+ S
1052	89.7	10.0	79.7	85.5	6.0	79.5	5-5-06 79.5	0.2	—	—	—	BP (no S)
1054	89.7	10.0	79.7	84.2	6.0	78.2	78.2	1.5	10-20 sand	1	50# bags	+ S
1101	84.7	5.5	79.2	84.8	6.0	78.8	78.8	1.4	—	—	—	BP
1200	84.7	6.3	78.4	84.8	6.0	78.8	78.8	0.4	—	—	—	BP

Note: Col. 2 - Col. 3 = Col. 4 - Col. 5 - weight and attachments = Col. 7; Col. 7 - Col. 3 = Col. 8; Col. 4 - Col. 8 = Col. 9

Reported By: Jake Horner | Reviewed By: L.D. Walker

Title: Geologist | Date: 5/5/06 | Title: Geologist | Date: 5/30/06

Signature: [signature] | Signature: [signature]

A-6003-653 (04/03)

WELL COMPLETION LOG

Page 2 of 3

Date: 5/5/06

Well ID: C5001 | Well Name: 399-3-19

Project: FF-5 Monitoring Wells | Location: 300-FF-5 OU | Drilling Contractor: Cascade Drilling

1. Time	2. Total Casing	3. Stkup	4. Btm Csg	5. Tape Reading	6. Correction	7. Cor Tape Reading	8. Fill Depth	9. Overlap	Fill Material Type	Fill Material Amt	Fill Material Unit	Comments
1206	84.7	6.3	78.4	83.3	6.0	77.3	77.3	1.1	10-20 sand	1	50# bag	+ S
1208	84.7	7.0	77.7	83.8	6.0	77.8	77.8	-0.1	—	—	—	BP
1210	84.7	7.0	77.7	81.9	6.0	75.9	75.9	1.8	coat. bent.	1/2	5 gal bucket	+ bent.
1212	84.7	8.0	76.7	82.5	6.0	76.5	76.5	0.2	—	—	—	BP
1216	84.7	8.0	76.7	80.9	6.0	74.9	74.9	1.8	coat. bent	1	5 gal bucket	+ bent.
1221	84.7	9.5	75.2	79.8	6.0	73.8	73.8	1.4	coat bent	1	5 gal. bucket	BP + bent.
1228	79.7	5.5	74.2	78.9	6.0	72.9	72.9	1.3	coat bent	1	5 gal. bucket	BP + bent.
1237	79.7	7.0	72.7	78.5	6.0 5-5-06	72.5	72.5	0.2	coat bent.	1	5 gal bucket	BP + bent
1240	79.7	8.0	71.7	77.9	6.0	71.9	71.9	-0.2	—	—	—	BP
1241	79.7	8.0	71.7	76.9	6.0	70.9	70.9	1.8	6x9 sand	1	50# bag	+ S (6x9)
1243	79.7	9.0	70.7	77.2	6.0	72.2	72.2	-1.5	—	—	—	BP
1244	79.7	9.0	70.7	76.0	6.0	70.0	70.0	0.7	6x9 sand	1	50# bag	+ S
1248	79.7	10.0	69.7	74.3	6.0	68.3	68.3	1.4	6x9 sand	1	50# bag	BP + S
1253	74.7	5.5	69.2	73.7	6.0	67.7	67.7	1.5	6x9 sand	1	50# bag	BP + S
1259	69.7	2.0	67.7	74.0 LW 5-30-06	6.0	68.0	68.0	-0.3	—	—	—	BP
1320	69.7	2.0	67.7	69.8	6.0	63.8	63.8	3.9	6x9 sand	1 1/2	50# bag	+ Sand & SS casing
1332	74.7	7.7	67.0	70.4	6.0	64.4	64.4	2.6	—	—	—	BP
1338	74.7	9.0	65.7	67.9	6.0	61.9	61.9	3.8	6x9 sand	1	50# bag	BP + 1 bag

Note: Col. 2 - Col. 3 = Col. 4 - Col. 5 - weight and attachments = Col. 7; Col. 7 - Col. 3 = Col. 8; Col. 4 - Col. 8 = Col. 9

Reported By: Jake Horner | Reviewed By: L.D. Walker

Title: Geologist | Date: 5/5/06 | Title: Geologist | Date: 5/30/06

Signature: Jake Horner | Signature: LD Walker

A-6003-653 (04/03)

WELL COMPLETION LOG

Page 3 of 3

Date: 5/5/06

Well ID: C5001

Well Name: 399-319

Project: FF-5 Monitoring Wells

Location: 300 - FF-5 Operable Unit

Drilling Contractor: Cascade Drilling

1.	2.	3.	4.	5.	6.	7.	8.	9.	Fill Material			
Time	Total Casing	Stkup LW 5-30-06	Btm Csg	Tape Reading	Correction	Cor Tape Reading	Fill Depth	Overlap	Type	Amt	Unit	Comments
1341	~~74.7~~ 69.7	5.5	64.2	69.1	6.0	63.1	63.1	1.1	—	—	—	BP
1345	69.7	5.5	64.2	66.2	6.0	60.2	60.2	4.0	6x9 sand	1	50# bags	+ S
1350	69.7	7.0	62.7	63.9	6.0	57.9	57.9	4.8	6x9 sand	1	50# bag	BP + S
1358	64.7	3.0	61.7	64.9	6.0	58.9	58.9	2.8	—	—	—	BP
1409	64.7	3.0	61.7	63.3	6.0	57.3	57.3	4.3	6x9 sand	1/2	50# bag	+ Sand
LW 5-30-06 ~~1415~~ 1615	64.7	3.0	61.7	63.3	6.0	57.3	57.3	4.3	6x9 sand	3	50# bags	Surging ~~&~~ + sand

not used JH 5/5/06

Note: Col. 2 - Col. 3 = Col. 4 - Col. 5 - weight and attachments = Col. 7; Col. 7 - Col. 3 = Col. 8; Col. 4 - Col. 8 = Col. 9

Reported By: Jake Horner

Title: Geologist

Date: 5/5/06

Signature: Jake Horner

Reviewed By: L.D. Walker

Title: Geologist

Date: 5/30/06

Signature: LD Walker

A-6003-653 (04/03)

G.109

WELL COMPLETION LOG

Page 1 of 1

Date: 5/8/06

Well ID: C5001 | Well Name: 399-3-19

Project: FF-5 Monitoring Wells | Location: 300-FF-5 OU | Drilling Contractor: Cascade Drilling

1. Time	2. Total Casing	3. Stkup	4. Btm Csg	5. Tape Reading	6. Correction	7. Cor Tape Reading	8. Fill Depth	9. Overlap	Fill Material Type	Fill Material Amt	Fill Material Unit	Comments
0625	64.7	3.0	61.7	63.3	6.0	57.3	57.3	4.3	—	—	—	surging 61.7-65' bgs
0718	59.7	1.0	58.7	63.8	6.0	57.8	57.8	0.9	—	—	—	BP
0735	59.7	1.0	58.7	~~62.8~~ 62.8 LW 5-30-06	6.0	56.8	56.8	1.9	6-9 sand	1/2	50# bag	+ Sand
0850	59.7	1.0	58.7	62.0	6.0	56.0	56.0	2.7	6-9 sand	1	50# bag	Surging + S
0933	59.7	4.0	55.7	56.8	6.0	50.8	50.8	4.9	6-9 sand	1½	50# bag	BP + S
1229	54.7	1.7	53.0	~~63.8~~ 57.8 JH 5-8-06	6.0	~~57.8~~ 51.8 JH	~~57.8~~ 51.8 5-8-06	1.2	6-9 sand	1/2	50# bag	BP + S after surging
1230	54.7	1.7	53.0	55.2	6.0	49.2	49.2	3.8	6-9 sand	1½	50# bag	+ S
1350	54.7	1.7	53.0	57.3	6.0	51.3	51.3	1.7	—	—	—	surging
1412	54.7	4.7	50.0	56.4	6.0	50.4	50.4	-0.4	6-9 sand	1	50# bag	+ S & BP
1415	54.7	4.7	50.0	50.5	6.0	44.5	44.5	5.5	6-9 sand	2	50# bag	+ S
1450	54.7	4.7	50.0	52.0	6.0	46.0	46.0	4.0	—	—	—	Surging
1500	54.7	4.7	50.0	52.2	6.0	46.2	46.2	~~4.4~~ 3.8 JH 5-8-06	—	—	—	"
1536	54.7	4.7	50.0	52.4	6.0	46.4	46.4	3.6	—	—	—	"

not used JH 5/8/06

Note: Col. 2 - Col. 3 = Col. 4 - Col. 5 - weight and attachments = Col. 7; Col. 7 - Col. 3 = Col. 8; Col. 4 - Col. 8 = Col. 9

Reported By: Jake Horner | Title: Geologist | Date: 5/8/06 | Signature: Jake Horner

Reviewed By: L.D. Walker | Title: Geologist | Date: 5/30/06 | Signature: LD Walker

A-6003-653 (04/03)

G.110

WELL COMPLETION LOG

Page 1 of 2

Date: 5/10/06

Well ID: C5001 | Well Name: 399-3-19

Project: FF-5 Monitoring Well | Location: 300-FF-5 Operable Unit | Drilling Contractor: Cascade Drilling

1.	2.	3.	4.	5.	6.	7.	8.	9.	Fill Material			
Time	Total Casing	Stkup	Btm Csg	Tape Reading	Correction	Cor Tape Reading	Fill Depth	Overlap	Type	Amt	Unit	Comments
0708	49.7	2.7	47.0	50.9	6.0	44.9	44.9	2.1	6-9 sand	1	50# bag	+ S (start surging)
0721	49.7	2.7	47.0	49.0	6.0	43.0	43.0	4.0	6-9 sand	1	50# bag	surging + S
0840	49.7	2.7	47.0	~~[illegible]~~ 49.2 @ 5/10/06	6.0	~~[illegible]~~ 43.2 @ 5/10/06	~~43.2~~	3.8	6-9 sand	1	50# bag	surging + S
0909	49.7	2.7	47.0	46.9	6.0	40.9	40.9	6.1	6-9 sand	1	50# bag	+ S
0912	49.7	5.5	44.2	46.4	6.0	40.4	40.4	3.8	6-9 sand	1	50# bag	BP + S
0915	49.7	8.0	41.7	48.1	6.0	42.1	42.1	-0.4	—	—	—	BP
0917	49.7	8.0	41.7	42.9	6.0	36.9	36.9	4.8	6-9 sand	2	50# bag	+ S
—	~~44.7~~ 44.7 @ 5-30-06	5.5	~~34.5~~ 39.2 @ 5-10-06	ND	6.0	—	—	—	—	—	—	BP
0927	44.7	5.5	39.2	46.9	6.0	40.9	40.9	-1.1	—	—	—	BP
0930	44.7	5.5	39.2	40.6	6.0	34.6	34.6	4.6	6-9 sand	3	50# bag	+ S
0932	44.7	8.0	36.7	42.9	~~36.9~~ 6.0 @	36.9 5-10-06	36.9	-0.2	—	—	—	BP
0933	44.7	8.0	36.7	37.0	6.0	31.0	31.0	5.7	6-9 sand	2	50# bag	+ S
0937	39.7	5.5	34.2	39.4	6.0	33.4	33.4	0.8	—	—	—	BP
0938	39.7	5.5	34.2	36.5	6.0	30.5	30.5	3.7	6-9 sand	1	50# bag	+ S
0942	39.7	7.5	32.2	38.3	6.0	32.3	32.3	0.1	—	—	—	BP
0946	39.7	7.5	32.2	32.8 @ 5-10-06	6.0	26.8 ~~26.8~~ @ 5-30-06	26.8	5.4	6-9 sand	2	50# bag	+ S
0952	34.7	5.5	29.2	35.9	6.0	29.9	29.9	-0.7	—	—	—	BP
0959	34.7	5.5	29.2	28.9	6.0	22.9	22.9	6.3	3/8" coat bent.	2	5 gal. buckets	+ Bent. pellets (non-coated)

Note: Col. 2 - Col. 3 = Col. 4 - Col. 5 - weight and attachments = Col. 7; Col. 7 - Col. 3 = Col. 8; Col. 4 - Col. 8 = Col. 9

Reported By: Jake Horner | Reviewed By: L.D. Walker

Title: Geologist | Date: 5/10/06 | Title: Geologist | Date: 5/30/06

Signature: Jake Horner | Signature: LD Walker

A-6003-653 (04/03)

WELL COMPLETION LOG

Page 2 of 2

Date: 5/10/06

Well ID: C5001 | Well Name: 399-3-19

Project: FF-5 Monitoring Wells | Location: 300-FF-5 Operable Unit | Drilling Contractor: Cascade Drilling

1. Time	2. Total Casing	3. Stkup	4. Btm Csg	5. Tape Reading	6. Correction	7. Cor Tape Reading	8. Fill Depth	9. Overlap	Fill Material Type	Fill Material Amt	Fill Material Unit	Comments
1000	34.7	7.5	27.2	30.9	6.0	24.9	24.9	2.3	—	—	—	BP
1001	34.7	7.5	27.2	26.7	6.0	20.7	20.7 ~~6.5~~	@5-10-06 6.5	Bent. pellets	1	5 gal. bucket	+ Bent.
1007	29.7	5.5	24.2	29.2	6.0	23.2	23.2	1.0	—	—	—	BP
1010	29.7	6.2	23.5	29.9	6.0	23.9	23.9 ~~23.9~~	LW 5-30-06 -0.4	—	—	—	BP
1013	29.7	7.0	22.7	25.7	6.0	19.7	19.7	3.0	Bent crumb.	1	50# bag	BP + Bent.
1018	29.7	8.5	21.2	26.5	6.0	20.5	20.5	0.7	—	—	—	BP
1020	29.7	8.5	21.2	21.9	6.0	15.9	15.9	5.3	bent. crumb.	1	50# bag	+ Bent.
1023	24.7	5.5	19.2	23.9	6.0	17.9	17.9	1.3	—	—	—	BP
1024	24.7	5.5	19.2	19.7	6.0	13.7	13.7	5.5	bent. crumb.	1	50# bag	+ Bent.
1027	24.7	8.0	16.7	21.5	6.0	15.5	15.5	1.2	—	—	—	BP
1028	24.7	8.0	16.7	20.8	6.0	14.8	14.8	1.9	bent crumb.	1/4	50# bag	+ Bent.
1036	19.7	5.5	14.7	15.9	6.0	9.9	9.9	4.8	bent. crumb	1 3/4	50# bag	BP + 10 gal H_2O & Bent
1037	19.7	8.0	11.7	17.4	6.0	11.4	11.4	0.3	—	—	—	BP
1038	19.7	8.0	11.7	14.3	6.0	8.3	8.3	3.4	bent. crumb.	3/4	50# bag	+ Bent.
1042	14.7	5.5	9.2	16.8	6.0	10.8	10.8	-1.6	5-10-06 ~~bent. crumb.~~	~~1/4~~	~~50# bag~~	BP (no bent.)
1043	14.7	5.5	9.2	16.5	6.0	10.5	10.5	-1.3	bent. crumb	1/4	50# bag	+ Bent.
1152	Ø	Ø	Ø	4.0	Ø	4.0	4.0	Ø	cement grout	200	gallons	+ Cement w/ 4% bent.

Note: Col. 2 - Col. 3 = Col. 4 - Col. 5 - weight and attachments = Col. 7; Col. 7 - Col. 3 = Col. 8; Col. 4 - Col. 8 = Col. 9

Reported By: Jake Horner | Reviewed By: L.D. Walker

Title: Geologist | Date: 5/10/06 | Title: Geologist | Date: 5/30/06

Signature: Jake Horner | Signature: LD Walker

A-6003-653 (04/03)

Well C5002

FIELD ACTIVITY REPORT NO. 1 - DRILLING PLAN	Page 1 of 1
	Date: 5-11-06

Purpose: Install Monitoring Well		Location: 300-FF-5 OU	
Well ID: C5002		Well Name: 399-3-20	
Drilling Co.: Cascade Drilling		Rig No.: 131	Rig Make/Mod.: Sonic One 50K

Casing String No. 1 2 3 4	Drilling Method	Circulation	D.H. Hammer
Casing Size 9 5/8"	Auger	Air Water/Mud	Make
Grade P110	Rotary	Reverse Direct	Model
Lbs.Per Ft. 47	Tubex	Vol: cfm	Choke
Material Carbon Steel	Cable Tool	gpm	Casing Hammer
Type:	Sonic ✓	Pressure psi	Make
Welded Thd.	A.R. w/Sonic	Drill Pipe O.D.	Model
Planned / Actual	Geoprobe	Tool Joint Size	Bit Size
Set At: 85±5 / 94'	Other:	Additives	Type
Shoe OD/ID 9 5/8 / 8 5/8			Nozzles
Reference Measuring Point:			Rod Size
GROUND LEVEL			

Drig. Co.	Rig No.:	Rig Make/Mod.:

Casing String No. 1 2 3 4	Drilling Method	Circulation	D.H. Hammer
Casing Size	Auger	Air Water/Mud	Make
Grade	Rotary	Reverse Direct	Model
Lbs.Per Ft.	Tubex	Vol: cfm	Choke
Material	Cable Tool	gpm	Casing Hammer
Type:	Sonic	Pressure psi	Make
Welded Thd.	A.R. w/Sonic	Drill Pipe O.D.	Model
Planned / Actual	Geoprobe	Tool Joint Size	Bit Size
Set /	Other:	Additives	Type
Shoe OD/ID			Nozzles
Reference Measuring Point:			Rod Size
GROUND LEVEL			

Comments/Remarks:	Estimated Depth to Water
	50 ± 10

Reported By: Jake Horner

Name/Title: Geologist

Signature: Jake Horner

Date: 5/11/06

A-6003-650 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING

Page 1 of 1

Date: 5-11-06

Well ID: C 5002	Well Name: 399-3-20
Location: 300-FF-5 OU	Report No.: 1

Start	Finish	Total
Time 0600	Time 1630	Time 10.5
Hole Depth/Csg 0 / 0	Hole Depth/Csg 27.5 / 24	Hole Depth/Csg 27.5 / 24

Reference Measuring Point: **GROUND SURFACE**

Casing String No. 1 2 3 4 ____ Rod Size: 9 5/8"

See Report No. 1

Time/Depth From	To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
0600	0620	POD MTG (BTR, Drillers, IHT, RCT, Geos)
0620		Moving drill rig to C5002 from C5001
	0806	Geo. J. Hocking to cover site for Geo. J. Horner (@ annual physical)
	0814	B. Williams on site; Drillers prepare to start coring.
0815		Begin pushing 1st core; [3.5-9.0']
	0853	Prepare second core.
0856		Push 2nd core; [8.5-12.5']; RCT = bkgrnd.
	0934	Push 3rd core; [12.5-17']; RCT = bkgrnd.
1009		Push 4th core; [16-18']; RCT = bkgrnd.
	1035	Begin cleaning & casing borehole.
1215	1230	Lunch (DTB = 17' bgs casing = 13.5' bgs)
1230	1243	Advancing SS sampler from 17' to 18' bgs
		• No rec. rock @ 18' bgs.
1243	1310	Attempt to break up rock with cleanout barrel.
		• bagged sample from 18' to 20' bgs
1310	1330	Advancing casing from 13.5' to 17' bgs & cleanout
1330	1345	Advancing core from 18.5' to 21' bgs (bagged 20' to 21' bgs)
1345	1400	Advancing core from 20.5' to 22.5' bgs
1400	1420	Collecting samples 86C - 86E (~~18~~ 19' - 22' bgs)
1420	1430	Advancing core #8 from
1430	1450	Collecting samples (87B - 87E) (22' - 26' bgs)
1440	1630	Advancing casing from 17' to 24' bgs & cleanout.
	1605	IHT pm check < detectable
	1630	DTB = 26' bgs End of The Day

Reported By: Jake Horner		Reviewed By: L.D. Walker	
Title: Geologist	Date: 5/11/06	Title: Geologist	Date: 5/30/06
Signature: Jake Horner		Signature: LD Walker	

A-6003-651 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING

Page 1 of 3

Date: 5/12/05

Well ID: C5002	Well Name: 399-3-20
Location: 300-FF-5 OU	Report No.: 2

Start	Finish	Total
Time 0600	Time 1630	Time 10.5 hrs
Hole Depth/Csg 27.5 / 24	Hole Depth/Csg 63 / 60	Hole Depth/Csg 35.5 / 36
Reference Measuring Point: GROUND SURFACE	Casing String No. 1 2 3 4 ____ Rod Size: 9 5/8" See Report No. 1	

Time/Depth From	Time/Depth To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
0600	0620	POD meeting (BTK, Drillers, IHT, RCT & Geo)
0620	0640	Prep time
0640	0655	Advancing core from 26' to 33' bgs (4' rec. 26'-30' bgs)
0640	0650	RCT site survey < background
0655	0715	Collecting samples 88E-89B (27'-30' bgs)
0700	0720	Advancing casing from 24' to 28.5' bgs Talley = 29.7'
0720	0800	Borehole cleanout down to 32' bgs
0800	0820	Advancing core from 32' to 38' bgs (32'-35', 3' rec.)
0820	0830	Collecting samples 90A - 90C (32'-35' bgs)
0820	0840	Advancing casing 28.5' to 34' bgs
0840	0855	Borehole cleanout down to 36' bgs
0855	0905	Advancing casing 34' to 35' bgs Talley = 39.7'
0905	0915	Borehole cleanout down to 36' bgs
0915	0930	Advancing core from 36' (2' slough) to 42' bgs
0930	0950	Collecting samples 91A-91D (37-41' bgs)
0940	0945	Advancing casing from 35' to 37' bgs
0945	1000	Borehole cleanout down to 41' bgs
1000	1020	Advancing core from 41' to 48' bgs (~1' recovery)
1020	1025	Bagged sample (Depth? 41'-48' bgs ~1' of sample)
1025	1035	Hole stayed open, Advancing core 47' to 53' bgs
1035	1050	Collecting samples 92C-92E (47'-50' bgs)
1045	1110	Advancing casing from 37' to 49' bgs Talley = 49.7'
1110	1145	Lunch
1145	1210	Borehole cleanout & advancing casing 49' to 53' bgs

Reported By: Jake Horner	Reviewed By: L.D. Walker
Title: Geologist Date: 5/12/06	Title: Geologist Date: 5/30/06
Signature: Jake Horner	Signature: LD Walker

A-6003-651 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING Continuation Page		Page 2 of 3 Date: 5/12/06
Well Name: 399-3-20	Well ID: C5002	
Location: 300-FF-5 OU	Continuation of Report No.: 2	

Time/Depth From	To	Description of Activities/Operations with Depth
	1200	IHT pm check < detectable
	1215	DTW = 48.1' bgs DTB = 53.5' bgs
1210	1220	Moving purge truck on site
1220	1230	Trip in 10' screen
1230	1235	Backpull casing from 53' to 51' bgs
1235	1240	Trip in sampling pump
	1240	Start pumping DTW = 53.7' TOC (47.7' bgs)
		NTU PH Temp(°C) Cond.(µS) D.O.(mg/L) time(min) Tot. vol.(gal)
	1252	62.9 7.22 19.0 450 8.1 12 79
	1259	44.0 7.25 18.6 454 8.5 19 131
	1304	25.0 7.11 19.1 454 8.9 24 170
	1310	21.7 7.19 18.7 453 8.6 30 217
	1308	Collecting samples: BIHT03, BIHT04 & BIHT05
1310	1325	Stop pumping & Trip out screen & pump.
		• Purged 28 min. @ 7.5 gpm Tot. vol. = 200 gallons
1325	1345	Hole open to 52' bgs, Advancing core 52' to 58' bgs
1345	1400	Collecting samples ~~94~~ 93D-94A (53'-56' bgs) LW 5-30-06
1350	1400	Advancing casing 51' to 58' bgs Talley = 59.7'
1400	1415	Borehole cleanout down to 58' bgs
1415	1420	Advancing core 58' to 63' bgs
	1420	RCT pm check < background
1420	1440	Advancing core from ND to 63' bgs (2nd run)
1440	1450	Collecting sample #95B (mixed interval from 58'-63' bgs)
1440	1500	Advancing casing from 58' to 63' bgs DTB = 62.5' bgs
1500	1515	Trip in 10' screen & ½ HP sampling pump.
1515	1520	Backpull casing 3' from 63' to 60' bgs
	1522	Start pumping DTW = 53.9' TOC (47.9' bgs)
	1526	DTW = 53.8' TOC
		• Pumping ~7.5 gal/min.

Reported By: Jake Horner	Reviewed By: L.D. Walker
Title: Geologist Date: 5/12/06	Title: Geologist Date: 5/30/06
Signature: Jake Horner	Signature: LD Walker

A-6003-652 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING Continuation Page	Page 3 of 3
	Date: 5/12/06

Well Name: 399-3-20	Well ID: C5002
Location: 300-FF-5 OU	Continuation of Report No.: 2

Time/Depth From	Time/Depth To	Description of Activities/Operations with Depth
		NTU PH Temp.(°C) Cond.(us) D.O.(mg/L) time(min.) Vol.(gal)
	1529	>1000 7.33 19.5 455 7.6 7 50
	1534	>1000 7.36 19.3 451 7.8 12 85
	1541	>1000 7.23 18.9 448 8.0 19 135
	1545	413 7.20 19.2 448 8.3 23 170
	1553	134 7.28 18.9 445 8.5 31 230
	1550	Collecting Samples: B1HT07, B1HT08 & B1HT09
	1554	Stop pumping
		• Purged 28 min. @ ~7.2-7.5 gpm. Tot. vol. = 210 gallons
		• Pump time = 32 min. Total vol. = 234 gallons
	1600	Drillers leave site
1600	1630	Geologist fills out sample paperwork
1630	1650	Geologist locked in the POD trailer waiting for help.
		• Broken lock
		not used JH 5/12/06

Reported By: Jake Horner		Reviewed By: L.D. Walker	
Title: Geologist	Date: 5/12/06	Title: Geologist	Date: 5/30/06
Signature: Jake Horner		Signature: LD Walker	

A-6003-652 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING	Page 1 of 2
	Date: 5/15/06

Well ID: C5002	Well Name: 399-3-20
Location: 300-FF-5 Operable Unit	Report No.: 3

Start	Finish	Total
Time 0600	Time 1630	Time 10.5 hrs
Hole Depth/Csg 63 / 60	Hole Depth/Csg 82 / 81.5	Hole Depth/Csg 19 / 21.5
Reference Measuring Point: **GROUND SURFACE**	Casing String No. 1 2 3 4 ____ See Report No. 1	Rod Size: 9 5/8"

Time/Depth From	To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
0600	0620	POD meeting (BTR, Drillers, RCT, IHT & Geo)
0620	0645	Trip out sampling pump & prep for slug test.
	0625	DTW = 47.6' bgs (before moving pump)
0645	0740	Waiting for PNNL (having trouble with data logger)
0740	0750	PNNL back on site setting up
0750	0940	Begin slug testing DTW = 47.6' bgs screen intv. = 59'-62.5' bgs.
0940	0950	Backpull casing from 59.0' to 55.5' bgs
0950	0950	Waiting for PNNL to return with charged battery
		· Already back on site, no wait
0950	1041	Resume slug testing screen intv. = 55.5' to 62.5' bgs
1041	1140	Trip out 10' screen & redrill borehole
		· DTB = 62.5' bgs ; casing = 63' bgs; Talley = 64.7'
1140	1150	Trip in & advance core from 62.5' to 68.5' bgs
1150	1210	Trip out & collect core samples 94C-95A (64'-68' bgs)
1200	1230	Lunch
1230	1250	Advancing casing & borehole cleanout
		· casing = 68' bgs DTB = 68' bgs
1250	1300	Trip in and advance core from 68' to 74' bgs
		· core fell out (~3')
1300	1315	Run core a second time ~2' recovery (RCT = BG)
1315	1325	Collecting samples 96B & 96C (mixed 68'-74' bgs)
1315	1340	Advancing casing from 68' to 74' bgs & cleanout
1340	1355	Trip in 10' screen & backpull from 73.5' to 72.5' bgs
		· screen exposed ~1' from 72.5' to 73.5' DTB = 74' bgs

Reported By: Jake Horner		Reviewed By: L.D. Walker	
Title: Geologist	Date: 5/15/06	Title: Geologist	Date: 5/30/06
Signature: Jake Horner		Signature: LD Walker	

A-6003-651 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING Continuation Page	Page 2 of 2
	Date: 5/15/06

Well Name: 399-3-20	Well ID: C5002
Location: 300-FF-5 OU	Continuation of Report No.: 3

Time/Depth From	To	Description of Activities/Operations with Depth
	1357	Start pumping DTW = 54.3' TOC intake @ 60' bgs
		NTU pH Temp(C) Cond (uS) D.O. (mg/L) time (min) vol. (gal.)
	1412	>1000 7.70 20.3 466 6.6 ~15 ~100
	1419	>1000 7.55 21.0 463 6.9 ~22 ~150
	1425	>1000 7.50 20.4 465 7.0 ~28 ~200
	1432	>1000 7.51 20.0 462 7.1 35 ~250
	1439	>1000 7.51 20.0 463 7.4 42 ~310
	1437	Collecting Samples: B1HT11, B1HT12 & B1HT13
1450	1500	Trip out screen
1500	1515	Advance casing from 72.5' to 72.5 & cleanout → 73'
1515	1530	Advancing core from 73' to 79.5' bgs
1530	1540	Collecting samples 97B & 97C (mixed 73' to 79' bgs)
1530	1555	Advancing casing from 72.5' to 78.5' bgs &
		cleanout down to 78.5' bgs.
1555	1608	Trip in & advance core from 78.5' to 82' bgs
1608	1630	Trip out & collect samples 98C-98E (78.5-81.5' bgs)
1610	1630	Advancing casing from 78.5' to 81.5' bgs.
1630	1640	Secure site
		not used JH 5/15/06

Reported By: Jake Horner		Reviewed By: L.D. Walker	
Title: Geologist	Date: 5/15/06	Title: Geologist	Date: 5/30/06
Signature: Jake Horner		Signature: LD Walker	

A-6003-652 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING	Page 1 of 2
	Date: 5/16/06

Well ID: C5002	Well Name: 399-3-20
Location: 300-FF-5 Operable Unit	Report No.: 4

Start	Finish	Total
Time 0600	Time 1315	Time 7.25 hrs
Hole Depth/Csg 82 / 81.5	Hole Depth/Csg 95 / 90	Hole Depth/Csg 13 / 8.5
Reference Measuring Point: GROUND SURFACE	Casing String No. 1 2 3 4 ____ Rod Size: 9 5/8" See Report No. 1	

Time/Depth From	To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
0600	0620	POD meeting (BTR, Drillers, RCT, IHT & Geo)
0620	0630	Prep time
0630	0730	Borehole clean out
0730	0740	Trip in & advance core 80' to 85' bgs
0740	0800	Trip out & collect samples 99B-100A (79.5' - 84.5' bgs)
0750	0930	Advancing borehole from 85' to 95' bgs
0930	0940	Advancing casing down to 94' bgs & clean out.
0940	1035	Borehole clean out down to 92.5 bgs
1035	1055	Trip in 10' screen & backpull casing to 90' bgs
		• Bottom screen = 92.5' bgs open screen intv. = 90' - 92' bgs
1055	1100	Trip in sampling pump
	1101	Start pumping DTW = 54.0' TOC (~10 gallons)
	1103	Stop pumping (fixing flow meter)
	1106	Resume pumping with flow meter on (~7.6 gpm)
	1130	DTW = 71.7' TOC (6.0' stickup) stabilized
		Turb. (NTU) pH Temp (°C) Cond. (us) D.O. (mg/L) t. (min) Vol (gal)
	1143	71000 7.69 21.2 285 0.8 42 230
	1149	832 7.88 20.2 280 0.7 48 255
	1153	503 7.55 20.2 279 0.7 52 280
	1205	86.7 7.80 19.6 276 1.2 64 345
	1215	28.6 7.84 19.8 276 2.1 (?) 74 400 ~~380~~
	1212	Collecting samples: B1HT15, B1HT16 & B1HT17 ~~400~~
	/	• Purged borehole for 71 min. @ 7.6 gpm Tot. Vol. ≈ 380 gal.
	1218	Stop pumping Tot. pump vol. = 426 gallons

Reported By: Jake Horner	Reviewed By: LW 5/30/06 L. D. Walker
Title: Geologist Date: 5/16/06	Title: Geologist Date: 5/30/06
Signature: [signature]	Signature: [signature]

A-6003-651 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING Continuation Page			Page 2 of 2 Date: 5/16/06
Well Name: 399-3-20		Well ID: C5002	
Location: 300-FF-5 Operable Unit		Continuation of Report No.: 4	

Time/Depth From	Time/Depth To	Description of Activities/Operations with Depth
1218	1230	Trip out pump & screen
1230	1315	clean up site & prepare for geophysical logging
1300	→	Log truck on site setting up
	1315	Geologist leaves site
		not used LDW 5/16/06

Reported By: Jake Horner		Reviewed By: L.D. Walker	
Title: Geologist	Date: 5/16/06	Title: Geologist	Date: 5/30/06
Signature: Jake Horner		Signature: LD Walker	

A-6003-652 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING		Page 1 of 1
		Date: 5/17/06
Well ID: C5002	Well Name: 399-3-20	
Location: 300-FF-5 Operable Unit	Report No.: 5	

Start	Finish	Total
Time 0730	Time 1100	Time 3 1/2
Hole Depth/Csg 91' / 90'	Hole Depth/Csg 91' / 83'	Hole Depth/Csg ø / -8
Reference Measuring Point: GROUND SURFACE	Casing String No (1) 2 3 4 ____ See Report No. 1	Rod Size: 9 5/8"

Time/Depth From	To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
0730	0745	POD meeting (BTR, Drillers & RCT)
0745	0810	Trip in 10' screen 81'-91' bgs (Nat. Backfill 91'-95')
	0750	Geologist on site
0810	0820	Backpull casing from 90' to 86' bgs
	0800	PNNL personnel on site for slug test.
0820	0855	Slug test setup (added ~~5~~ 10 gal. water)
0855	1000	Slug testing with open screen from 86' to 91' bgs
1000	1015	Backpull casing from 86' to 83' bgs
1015	1100	Slug testing with open screen from 83' to 91' bgs
	1105	DTW = 48.5' bgs
	1105	Geologist & Drillers leave site (Driller Training)

not used JH 5/17/06

Reported By: Jake Horner		Reviewed By: L.D. Walker	
Title: Geologist	Date: 5/17/06	Title: Geologist	Date: 5/30/06
Signature: Jake Horner		Signature: LD Walker	

A-6003-651 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING	Page 1 of 2
	Date: 5/18/06

Well ID: C5002	Well Name: 399-3-20
Location: 300-FF-5	Report No: ~~5~~ 6 5/18/06

Start	Finish	Total
Time 0600	Time 1630	Time 10.5 hrs
Hole Depth/Csg ~91 / 83	Hole Depth/Csg 45.1 / 50	Hole Depth/Csg -45.9 / -33

Reference Measuring Point: **GROUND SURFACE**	Casing String No. 1 2 3 4 ____ Rod Size: 9 5/8" See Report No. 1 well completion

Time/Depth From	To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
0600	0620	POD meeting (BTR, Drillers, RCT & Geo)
0620	0630	Prep time
	0625	DTW = 48.3' bgs
0630	0650	Trip out screen (used for slug test 5/17/06)
0650	0700	Advancing casings from 83' to 89' bgs
0700	0740	Borehole cleanout down to 88' bgs
0740	0803	Backpull casing & adding coated bent. (88.2' - 81.9' bgs)
0803	0822	Backpull casing & adding 6x9 silica sand (81.9' - 77.4)
0822	0844	Backpull casing & add coated bent. (77.4' - 72.1' bgs)
0844	0857	Backpull casing & add 6x9 sand (72.1' bgs - 68.4 bgs)
0857	0920	Straitness test
0920	0945	Trip in SCH 10STP 304L stainless steel sump, screen & riser.
		• Sump = 2.03' ; screen = 25.02' ; riser = 45.00' (Tot. = 72.05')
0945	1025	Adding 6x9 filter pack sand & Backpull casing
1025	1045	Setup for settling filter pack by dual surge block
1045	1145	Surging 61.7' to 65' bgs using dual surge block
		• 1130 → 1145 sand dropped 0.05'.
1145	1200	Trip out surge block & backpull casing (61.7' - 58.7' bgs)
1200	1212	Trip in surge block & add 6x9 sand
1212	1312	Surging interval from 58.7' to 62' bgs
1255	1312	Sand didn't drop at all
1312	1325	Trip out surge block & backpull casing to 56' bgs
1325	1336	Trip in surge block
1336	1435	Surging 56' to 69' bgs

Reported By: Jake Horner		Reviewed By: L.D. Walker	
Title: Geologist	Date: 5/18/06	Title: Ecologist	Date: 5/30/06
Signature: John Horner		Signature: LD Walker	

A-6003-651 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING
Continuation Page

Page 2 of 2

Date: ~~5~~ 5/18/06 LW 5-30-06

Well Name: 399-3-20

Well ID: C5002

Location: 300-FF-5 OU

Continuation of Report No.: 6

Time/Depth From	Time/Depth To	Description of Activities/Operations with Depth
1435	1448	Trip out surge block & backpull casing to ~~5~~ 53' bgs (LW 5-30-06)
1448	1458	Trip in surge block & add sand
		• Bruce Williams gave the "ok" to stop surging if the
		zone is stable (< 0.1' in 15 min.) in < 1 hour.
1458	1540	Surging 53' to 56' bgs (1520 - 1540 dropped .1')
1540	1554	Trip out surge block & backpull casing to 50' bgs
		• Added 150# 6x9 sand
1554	1600	Trip in surge block
1600	1624	Surging 50' - 53' bgs
	1624	Stop surging
1624	1630	Secure site

not used JH 5/18/06

Reported By: Jake Horner

Title: Geologist

Date: 5/18/06

Signature: Jake Horner

Reviewed By: L.D. Walker

Title: Geologist

Date: 5/30/06

Signature: LD Walker

A-6003-652 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING		Page 1 of 2
		Date: 5/19/06
Well ID: C5002	Well Name: 399-3-20	
Location: 300-FF-5 Operable Unit	Report No.: 7	

Start	Finish	Total
Time 0600	Time 1200	Time 6 hrs
Hole Depth/Csg 45.1 / 50	Hole Depth/Csg 2.4 / ∅	Hole Depth/Csg -43.5 / -50
Reference Measuring Point: GROUND SURFACE	Casing String No. 1 2 3 4 ____ See Report No. 1	Rod Size: 9 5/8" temp 6 5/8" ss

From	To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
0600	0620	POD meeting (BTR, Drillers & Geo)
0620	0625	Could not tag water, too many obstructions.
	0625	Resume surging 50' to 53' bgs
	0740	Stop surging (sand dropped 0.1' from 0725-0740)
0740	0742	Added 50# 6x9 sand
0742	0805	Trip out surge block & backpull casing to 47.0' bgs
		· Added 150# 6x9 sand
0805	0858	Surging 47.0' to 50.0' bgs Backfill = 40.7' bgs
		· added 50# sand (dropped .1' from 0840-0858)
0858	0905	Trip out surge block
		· surge block had spun off
0905	0912	Fishing for surge block
0912	0915	Trip in surge block to make sure last interval is stabilized (47'-50' bgs)
0915	0930	Surging 47'-50' bgs (no change in 15 mins)
0930	0935	Trip out surge block
0935	1009	Backpulling casing & adding 6x9 filter pack up to 29.9' bgs.
1009	1020	Backpulling & adding bent. pellets from 29.9' to 25.5' bgs
1020	1048	Backpulling & adding granular bent. from 25.5' to 10.2' bgs.
1048	1115	Mixing & pouring cement grout from 10.2' to 3' bgs
		· 2 x (5 x 94# bags grout with 4% bent.) Tot. Vol. = 110 gal.
1115	1120	Backpull & remove remaining casing (14.7')
1120	1128	Mixing & pouring grout from 3' to 2.4' bgs
		· 2 x 94# bags with 4% bent. (~20 gallons)

Reported By: Jake Horner		Reviewed By: L. D. Walker	
Title: Geologist	Date: 5/19/06	Title: Geologist	Date: 5/30/06
Signature: Jake Horner		Signature: L D Walker	

A-6003-651 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING Continuation Page			Page 2 of 3 Date: 5/19/06
Well Name: 349-3-20		Well ID: C5002	
Location: ~~399-3~~ 300-FF-5 OU		Continuation of Report No.: 7	

Time/Depth		5/19/06 Description of Activities/Operations with Depth
From	To	
1128	→	Cleanup after mixing grout
	1200	Geologist leaves site
		• 5.8' stickup on stainless steel riser
		not used JH 5/19/06

Reported By: Jake Horner		Reviewed By: L.D. Walker	
Title: Geologist	Date: 5/19/06	Title: Geologist	Date: 5/30/06
Signature: Jake Horner		Signature: LD Walker	

A-6003-652 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING	Page 1 of 1 Date: 5-22-06

Well ID: C5002	Well Name: 399 - 3 - 20
Location: 300- FF-5 OU	Report No.: 8

Start	Finish	Total
Time 1050	Time 1320	Time 3 hrs. 50 min.
Hole Depth/Csg – / –	Hole Depth/Csg – / –	Hole Depth/Csg – / –

Reference Measuring Point: **GROUND SURFACE**	Casing String No. 1 2 3 4 ____ Rod Size: See Report No. 1 WELL DEVELOPMENT

Time/Depth From	To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
1050	1115	Geo takes measurements : DTW = 49.07 'TOC , DTB = ~70'TOC ;
		Transducer set 2'2" from intake, intake ~ 68'TOC (Drillers
		trip pump down hole)
1117		Pump turned on / Start test # 5 XD = 15.600 ' H_2O
	1132	Turb. = 5.81 NTU, Cond. = 0.420 mS, pH = 7.23 , XD = 15.678' H_2O, 17.6°C
	1141	Turb. = 1.58 NTU, Cond. = 0.416 mS, pH = 7.40 , XD = 15.690' H_2O, 17.3°C
	1155	Turb. = 0.81 NTU, Cond. = 0.416 mS, pH = 7.40 , XD = 15.693' H_2O, 17.2°C
	1159	Pump stopped / Stop test # 5 moving pump up ~ 15' ; intake ~ 53' TOC
	1203	INTERVAL # 2 starting XD = 3.016' H_2O
	1205	Begin test # 6, resume pumping
	1214	Turb. = 4.22 NTU, Cond. = 0.413 mS, pH = 7.48, XD = 3.129' H_2O, 17.5°C
	1224	Turb. = 0.98 NTU, Cond. = 0.414 mS, pH = 7.43, XD = 3.126' H_2O, 18.0°C
	1241	Turb. = 0.67 NTU, Cond. = 0.414 mS, pH = 7.43, XD = 3.127' H_2O, 18.5°C;
		Turn off the pump - test # 7 started.
	1244	Pump being pulled up before recovery test through -
		test # 7 not working anyway and no visible draw to
		system either.
	1250	Pump out of well, drillers to complete surface completion at
		current location.
	1308	DTW = 49.05' TOC ; DTB = ~70' TOC ; Well developments
		completed.
	1320	Geo. leaves site heads to town.
		~~NOT USED~~ Jess Hocking 5/22/06

Reported By: Jess Hocking		Reviewed By: L.D. Walker	
Title: Geologist	Date: 5/22/06	Title: Geologist	Date: 5/30/06
Signature: Jess Hocking		Signature: LD Walker	

A-6003-651 (04/03)

WELL DEVELOPMENT AND TESTING DATA

Well Name:	Well ID:	Well Location:	Date:
399-3-20	C5002	300-FF-5 OU	5-22-06

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	49.07' TOC
End of Job	49.05' TOC

DEPTH TO BOTTOM:

Start of Job	~70' TOC
End of Job	~70' TOC

PART 2

WELL DEVELOPMENT DATA

Pump Model	2Ss Grundfos
Intake Depth	INT 1 ~68' TOC / INT 2 ~53' TOC
Starting Turbidity	5.81 NTU / 4.22 NTU

Pump Start	Stop	Flow Rate
1117	1159	15 GPM
1205	1241	15 GPM

Total Pumped	1170 Gal
Final Turbidity	INT 1 0.81 NTU / INT 2 0.67 NTU
XD SN/Range (PSI)	20 psi

PART 3

INSTANTANEOUS SLUG TEST

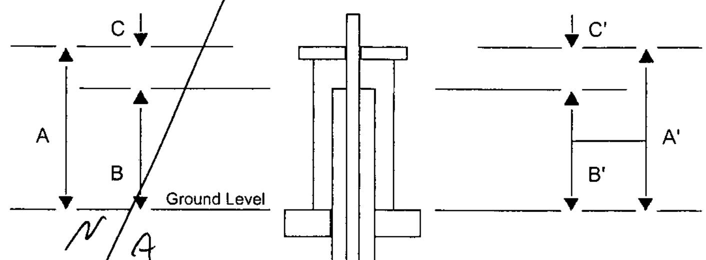
N/A

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: 5-22-06



N/A

A =	
B =	
C =	

A' =	N/A
B' =	N/A
C' =	N/A

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

PART 5

COMMENTS:

INTERVAL #1

STARTING XD = 15.600' H_2O
Transducer set 2.16' above intake

INTERVAL #2

STARTING XD = 3.016' H_2O
Transducer set 2.16' above intake.

INSTRUMENTS CALIBRATED THIS MORNING ON C5001 DEVELOPMENT

Prepared by (print name):	Signature:	Date:
Jess Hocking	Jess Hocking	5/22/06
Reviewed by (print name):	**Signature:**	**Date:**
L.D. Walker	L.D. Walker	5-30-06

A-6003-644 (03/03)

FIELD ACTIVITY REPORT - DAILY DRILLING

Page 1 of 1

Date: 5/23/06

Well ID: C5002	Well Name: 399-3-20
Location: 300-FF-5 OU	Report No.: 9

Start	Finish	Total
Time 0600	Time 1540	Time 9 hrs 40 min.
Hole Depth/Csg n/A / n/A	Hole Depth/Csg n/A / n/A	Hole Depth/Csg n/A / n/A

Reference Measuring Point: GROUND SURFACE	Casing String No. 1 2 3 4 ____ Rod Size: See Report No. 1

Time/Depth From	Time/Depth To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
0600	0620	POD meeting (BTR, Drillers, Safety & Geo)
0620	0645	Move remaining equipment off site & remove boundary
		*Monument (8" SS) stickup = 2.72' ags (cement pad)
		6" riser stickup = 1.74' ags (cement pad)
0645	1130	Loading equipment in laydown yard
1130	1200	Lunch
1200	1310	Install pump @ C4999 (see C4999 FAR)
1310	1400	Install pump @ C5000 (see C5000 FAR)
1400	1450	Install pump @ C5002 DTW = 50.0' TOC
		• Grundfos pump 5S05-13 (0.5HP); wt 10 lbs; 60 Hz
		• Model # B08010013-P10545 US
		• 3/4" SS SCH 10S TP 304/304L (60.35' total)
		• Intake set at 61.66' TOC (58.94' bgs)
1450	1540	Install pump @ C5001 (see C5001 FAR)
		not used JH 5/23/06

Reported By: Jake Horner		Reviewed By: L.D. Walker	
Title: Geologist	Date: 5/23/06	Title: Geologist	Date: 5/30/06
Signature: Jake Horner		Signature: LD Walker	

A-6003-651 (04/03)

FIELD ACTIVITY REPORT
TUBULAR GOODS TALLY

Page 1 of 1
Date: 5-11-06

Well Name: 399-3-20
Well ID: C5002

TEMPORARY				PERMANENT*						SCREEN/CAP*		
Jt. #	Length (ft.)	Jt. #	Length (ft.)	Jt. #	Length (ft.)	C	Jt. #	Length (ft.)	C	Jt. #	Length (ft.)	C
1	~~5.00~~ 4.70 MJH 5/11/06	21		1	10.00	C	21			1	2.02 (sump)	C
2	5.00	22		2	10.00		22			2	15.00	
3	5.00	23		3	10.00		23			3	5.01	
4	5.00	24		4	10.00		24			4	5.01	
5	5.00	25		5	5.00		25			5		
6	5.00	26		6			26			6		
7	5.00	27		7			27			7		
8	5.00	28		8			28			8		
9	5.00	29		9			29			9		
10	5.00	30		10			30	JH		10		
11	5.00	31	JH	11			31			11	JH	
12	5.00	32		12	JH		32			12		
13	5.00	33		13			33			13		
14	5.06	34		14			34			14		
15	5.00	35		15			35			15		
16	5.00	36		16			36			16		
17	5.00	37		17			37			17		
18	5.00	38		18			38			18		
19	5.00	39		19			39			19		
20	5.00	40		20			40			20		
Tot	99.7	Tot		Tot	45.00		Tot			Tot	27.04	

*Indicate those joints with centralizers with a C in the available box.
ALL Casing length shall be measured to the nearest 0.01 ft.

Comments/Remarks:
Total Temp. = 99.7
Total SS = 72.04' − 3.02 (cut off) = 69.02'

Temporary: O.D./I.D. 9 5/8" / 8 5/8" | Permanent: O.D./I.D. 6 5/8" / 6" | Screen: O.D./I.D. 6 5/8" / 6"

Temp.: 9 5/8" / 8 5/8" (1/2" wall)
Temp. Shoe: 10" / 9" (1/2" wall)
* actual 10" dia. portion of shoe is ~ 3" long

Permanent: 6 5/8" / 6"

Reported By:	Jake Horner	Reviewed By:	L.D. Walker
Title:	Geologist	Date: 5/19/06	Title: Geologist	Date: 5/30/06
Signature:	Jake Horner	Signature:	LD Walker

A-6003-655 (04/03)

WELL COMPLETION LOG

Date: 5/18/06

Well ID: C5002

Well Name: 399-3-20

Project: FF-5 Monitoring Wells

Location: 300-FF-5 Operable Unit

Drilling Contractor: Cascade Drilling

1. Time	2. Total Casing	3. Stkup	4. Btm Csg	5. Tape Reading	6. Correction	7. Cor Tape Reading	8. Fill Depth	9. Overlap	Fill Material Type	Fill Material Amt	Fill Material Unit	Comments
0740	89.7	0.7	89.0	94.2	6.0	88.2	88.2	0.8	nat. Backfill	6.8	feet	start depth
0742	89.7	0.7	89.0	91.0	6.0	85.0	85.0	4.0	3/8 coat. bent.	1.5	5 gal. bucket	+ 3/8" coat. bent.
0745	89.7	2.5	87.2	91.9	6.0	85.9	85.9	1.3	—	—	—	BP
0747	89.7	2.5	87.2	91.3	6.0	85.3	85.3	1.9	coat. bent.	0.5	5 gal. bucket	+ Bent.
0750	~~89.7~~ 84.7 LW 5-30-06	4.0	85.7	91.9	6.0	85.9	85.9	-0.2	—	—	—	BP
0754	89.7	4.0	85.7	88.9	6.0	82.9	82.9	2.8	coat. bent.	2	5 gal. buckets	+ Bent.
0800	89.7	5.5	84.2	89.9	6.0	83.9	83.9	0.3	—	—	—	BP
0802	89.7	5.5	84.2	88.0	6.0	82.0	82.0	2.2	coat. bent.	1	5 gal. bucket	+ Bent.
0803	84.7	2.0	82.7	87.9	6.0	81.9	81.9	-0.2	—	—	—	BP
0804	84.7	2.0	82.7	86.0	6.0	80.0	80.0	2.7	6x9 sand	1	100# bag	+ S
0805	84.7	3.0	81.7	87.0	6.0	81.0	81.0	0.7	—	—	—	BP
0808	84.7	3.0	81.7	85.4	6.0	79.4	79.4	2.3	6x9 sand	1	100# bag	+ S
0810	84.7	4.7	80.0	85.1	6.0	79.1	79.1	0.9	—	—	—	BP
0813	84.7	4.7	80.0	82.6	6.0	76.6	76.6	3.4	6x9 sand	2	50# bags	+ S 5-18-06
0817	84.7	5.7	79.0	83.1	6.0	77.1	77.1	1.9	~~6x9 sand~~	~~1~~	~~50# bag~~	~~+S~~ + BP (no sand)
0820	84.7	5.7	79.0	81.8	6.0	75.8	75.8	3.2	6x9 sand	1	50# bag	+ S
0822	84.7	7.2	77.0	83.4	6.0	77.4	77.4	-0.4	—	—	—	BP
0825	84.7	7.2	77.0	80.7	6.0	74.7	74.7	2.3	coat. bent.	1	5 gal. bucket	+ B

Note: Col. 2 - Col. 3 = Col. 4 - Col. 5 - weight and attachments = Col. 7; Col. 7 - Col. 3 = Col. 8; Col. 4 - Col. 8 = Col. 9

Reported By: Jake Horner

Title: Geologist

Date: 5/18/06

Signature: Jake Horner

Reviewed By: L.D. Walker

Title: Geologist

Date: 5/30/06

Signature: LD Walker

A-6003-653 (04/03)

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WELL COMPLETION LOG

Page 2 of 3

Date: 5/18/06

Well ID: C5002 | Well Name: 399-3-20

Project: FF-5 Monitoring Wells | Location: 300-FF-5 Operable Unit | Drilling Contractor: Cascade Drilling

1. Time	2. Total Casing	3. Stkup	4. Btm Csg	5. Tape Reading	6. Correction	7. Cor Tape Reading	8. Fill Depth 5-18-06	9. Overlap	Fill Material Type	Fill Material Amt	Fill Material Unit	Comments
0827	84.7	8.5	76.2	81.3	6.0	~~6.0~~	75.3	0.9	—	—	—	BP
0829	84.7	8.5	76.2	79.5	6.0	73.5	73.5	2.7	coat. bent.	1	5 gal. bucket	+ B
0831	84.7	9.0	75.7	79.9	6.0	73.9	73.9	1.8	—	—	—	BP
0833	84.7	9.0	75.7	78.4	6.0	72.4	72.4	3.3	coat. bent.	1	5 gal. bucket	+ B
0838	79.7	5.2	74.5	78.6	6.0	72.6	72.6	1.9	—	—	—	BP
0839	79.7	6.2	73.5	78.5	6.0	72.5	72.5	1.0	—	—	—	BP
0841	79.7	6.2	73.5	78.1	6.0	72.1	72.1	1.4	coat. bent.	1/3	5 gal. bucket	+ B
0844	79.7	7.8	71.9	~~78.1~~	6.0	72.1	72.1	-0.2	—	—	—	BP
0848	79.7	7.8	71.9	76.3	6.0	70.3	70.3	~~6.0~~ 1.6 5-18-06	6x9 sand	2	50# bags	+ S
0849	79.7	~~7.8~~ 9.0 5-18-06	70.7	73.8	6.0	67.8	67.8	2.9	6x9 sand	1	100# bag	BP + S
0853	74.7	5.5	69.2	74.1	6.0	68.1	68.1	1.1	—	—	—	BP
0857	74.7	6.5	68.2	74.4	6.0	68.4	68.4	-0.2	—	—	—	BP
~~0955~~	~~74.7~~	~~2.5~~	~~72.2~~	~~71.5~~	~~6.0~~	~~65.5~~	~~65.5~~	~~6.0~~	~~6x9 sand~~	~~1½~~	~~50# bag~~	JH 5-18-06
0955	69.7	2.5	66.2	71.5	6.0	65.5	65.5	2.7	6x9	1½	50# bags	BP + S (w/6" ss casing)
1000	69.7	3.0	66.7	72.4	6.0	66.4	66.4	0.3	—	—	—	BP
1003	69.7	3.0	66.7	67.2	6.0	61.2	61.2	5.5	6x9 sand	1½	50# bags	+ S
1006	69.7	3.5	66.2	68.5	6.0	62.5	62.5	3.7	—	—	—	BP
1010	69.7	5.5	64.2	69.8	6.0	63.8	63.8	0.4	—	1	100#	BP

Note: Col. 2 - Col. 3 = Col. 4 - Col. 5 - weight and attachments = Col. 7; Col. 7 - Col. 3 = Col. 8; Col. 4 - Col. 8 = Col. 9

Reported By: Jake Horner | Reviewed By: L.D. Walker LW 5-30-06

Title: Geologist | Date: 5/18/06 | Title: Geologist | Date: ~~5/18~~ 5/30/06

Signature: Jake Horner | Signature: LD Walker

WELL COMPLETION LOG

Date: 5/18/06

Well ID: C5002 | Well Name: 399-3-20

Project: FF-5 Monitoring Wells | Location: 300-FF-5 Operable Unit | Drilling Contractor: Cascade Drilling

1. Time	2. Total Casing	3. Stkup	4. Btm Csg	5. Tape Reading	6. Correction	7. Cor Tape Reading	8. Fill Depth	9. Overlap	Fill Material Type	Fill Material Amt	Fill Material Unit	Comments
1011	69.7	5.5	64.2	63.9	6.0	57.9	57.9	6.3	6x9 sand	1	100# bag	+ S
1016	69.7	7.0	62.7	66.1	6.0	60.1	60.1	2.6	—	—	—	BP
1022	69.7	8.0	~~62.~~ 61.7 5/18/06	67.0	6.0	61.0	61.0	0.7	—	—	—	BP
1040	64.7	3.0	61.7	60.5	6.0	54.5	54.5	2.8	6x9 sand	1	100# bag	+ S
1130	64.7	3.0	61.7	61.9	6.0	55.9	55.9	1.8	~~6x9 sand~~	~~1~~	~~50# bag~~	Surging + ~~S~~ 5-18-06
1145	64.7	3.0	61.7	61.95	6.0	55.95	55.95	1.75	—	—	—	Surging (stable)
1157	64.7	5.5	59.2	63.7	6.0	57.7	57.7	1.5	—	—	—	BP
1212	64.7	6.0	58.7	57.6	6.0	51.6	51.6	7.1	6x9 sand	1	100# bag	BP + S
1255	64.7	6.0	58.7	58.6	6.0	52.6	52.6	6.1	—	—	—	Surging
1312	64.7	6.0	58.7	58.6	6.0	52.6	52.6	6.1	—	—	—	Surging (stable)
1336	59.7	3.7	56.0	56.6	6.0	50.6	50.6	4.4	6x9 sand	1/2	100# bag	BP + S
1435	59.7	3.7	56.0	~~55.3~~ 57.3 5-18-06	6.0	51.3	51.3	3.7	—	—	—	Surging 1 hr (stable)
1458	54.7	1.7	53.0	54.3	~~42.3~~ 5-18-06	48.3	48.3	4.7	6x9 sand	1	100# bag	BP
1540	54.7	1.7	53.0	55.6	6.0	49.6	49.6	3.4	—	—	—	Surging (stable)
1550	54.7	4.7	50.0	55.8	6.0	49.8	49.8	0.2	6x9 sand	1	50# bag	BP + S
1552	54.7	4.7	50.0	51.0	6.0	45.0	45.0	5.0	6x9 sand	1	100# bag	+ S
1624	54.7	4.7	50.0	51.1	6.0	~~55.1~~	~~55.1~~	4.9	6x9 sand	1	50# bag	surging 24 min + S
					5-18-06	45.1	45.1					

Note: Col. 2 - Col. 3 = Col. 4 - Col. 5 - weight and attachments = Col. 7; Col. 7 - Col. 3 = Col. 8; Col. 4 - Col. 8 = Col. 9

Reported By: Jake Horner | Reviewed By: L. D. Walker

Title: Geologist | Date: 5/18/06 | Title: Geologist | Date: 5/30/06

Signature: Jake Horner | Signature: LD Walker

WELL COMPLETION LOG

Page 1 of 2

Date: 5/19/06

Well ID: C5002

Well Name: 399-3-20

Project: FF-5 Monitoring Wells

Location: 300-FF-5 Operable Unit

Drilling Contractor: Cascade Drilling

1.	2.	3.	4.	5.	6.	7.	8.	9.	Fill Material			
Time	Total Casing	Stkup	Btm Csg	Tape Reading	Correction	Cor Tape Reading	Fill Depth	Overlap	Type	Amt	Unit	Comments
0625	54.7	4.7	50.0	51.0	6.0	45.0	45.0	5.0	—	—	—	Start depth
0725	54.7	4.7	50.0	52.0	6.0	46.0	46.0	4.0	—	—	—	surging
0740	54.7	4.7	50.0	52.0	6.0	46.1	46.1	3.9	—	5/19/06	—	surging (stable)
0805	49.7	2.7	47.0	46.7	6.0	40.7	40.7	6.3	6x9 sand	~~1 1/2~~ 3	50# bags	BP + S
0830	49.7	2.7	47.0	47.9	6.0	41.9	41.9	5.1	6x9 sand	1	50# bag	surging + S
0858	49.7	2.7	47.0	48.2	6.0	42.2	42.2	4.8	—	—	—	surging
0938	49.7	4.0	45.7	49.4	6.0	43.4	43.4	2.3	—	—	—	BP
0940	49.7	4.0	45.7	47.8	6.0	41.8	41.8	3.9	6x9 sand	1	50# bag	+ S
0945	49.7	5.5	44.2	43.9	6.0	37.9	37.9	6.3	6x9 sand	1	100# bag	BP + S
0949	49.7	7.5	42.2	40.4	6.0	34.4	34.4	7.8	6x9 sand	1	100# bag	BP + S
0952	44.7	5.5	39.2	38.7	6.0	32.7	32.7	6.5	6x9 sand	1 1/2	500# bag	BP + S
0957	44.7	8.5	36.2	35.5	6.0	29.5	29.5	6.7	6x9 sand	1	100# bag	BP + S
1001	39.7	5.5	34.2	35.5	6.0	29.5	29.5	4.7	10-20 sand	1/2	50# bag	BP + S
1004	39.7	8.0	31.7	34.9	~~5.0~~ 6.0 5/19/06	28.9	28.9	2.8	6x9 sand	1/2	100# bag	BP + S
1006	39.7	9.0	30.7	36.0	6.0	30.0	30.0	0.7	6x9 sand	1/8	100# bag	BP + S
1009	34.7	5.4	28.3	35.9	6.0	29.9	29.9	-1.6	—	—	—	BP
1013	34.7	5.4	28.3	29.5	6.0	23.5	23.5	4.8	bent pellets	2	5 gal buckets	+ non-coated pellets
1015	34.7	7.2	27.5	~~27.5~~ 31.0 5/19/06	6.0	25.0	25.0	2.5	—	—	—	BP

Note: Col. 2 - Col. 3 = Col. 4 - Col. 5 - weight and attachments = Col. 7; Col. 7 - Col. 3 = Col. 8; Col. 4 - Col. 8 = Col. 9

Reported By: Jake Horner

Title: Geologist

Date: 5/19/06

Signature: John Horner

Reviewed By: L.D. Walker

Title: Geologist

Date: 5/30/06

Signature: LD Walker

A-6003-653 (04/03)

G.133

WELL COMPLETION LOG

Page 2 of 2
Date: 5/19/06

Well ID: C5002 | Well Name: 399-3-20

Project: FF-5 Monitoring Wells | Location: 300-FF-5 OU | Drilling Contractor: Cascade Drilling

1. Time	2. Total Casing	3. Stkup	4. Btm Csg	5. Tape Reading	6. Correction	7. Cor Tape Reading	8. Fill Depth	9. Overlap	Fill Material Type	Fill Material Amt	Fill Material Unit	Comments
1016	34.7	8.5	26.2	28.9	6.0	22.9	22.9	3.3	bent. pellets	1	5 gal. bucket	BP + bent.
1020	~~34.7~~ 29.7	5.5	24.2	30.5	6.0	25.5	25.5	-1.3	—	—	—	BP
1022	29.7	5.5	24.2	26.2	6.0	20.2	20.2	4.0	granular bent.	1	50# bag	(came up 5.3' w/ 1 bag)?
1025	29.7	~~5.5~~ 7.5 5/19/06	22.2	27.9	6.0	21.9	21.9	0.3	—	—	—	BP
1026	29.7	7.5	22.2	22.9	6.0	16.9	16.9	5.3	bent. crumb.	1	50# bag	+ Bent.
1028	29.7	8.5	21.2	19.6	6.0	13.6	13.6	7.6	bent. crumb.	1	50# bag	B + Bent.
1031	24.7	5.5	19.2	21.0	6.0	15.0	15.0	4.2	—	—	—	BP
1034	24.7	7.5	17.2	23.2	6.0	~~27.2~~ 17.2	~~27.2~~ 17.2	Ø	—	—	—	BP
1035	24.7	7.5	17.2	19.7	6.0	13.7	13.7	3.5	bent. crumb.	1	50# bag	+ Bent
1037	24.7	8.5	16.2	~~30.9~~ 20.9 LW 5-30-06	6.0	~~24.9~~ 14.9 LW 5/30/06	~~24.9~~ 14.9	LW 5/30/06 1.5	—	—	—	BP
1038	24.7	8.5	16.2	16.0	6.0	10.0	10.0	6.2	bent crumb.	1	50# bag	+ Bent.
1040	19.7	5.5	14.2	17.2	6.0	11.2	11.2	3.0	—	—	—	BP
1043	19.7	7.0	12.7	18.4	6.0	12.4	12.4	0.3	—	—	—	BP + 5 gal H_2O
1044	19.7	7.0	12.7	14.5	6.0	8.5	8.5	4.2	bent. crumb.	1	50# bag	+ Bent.
1045	19.7	8.0	11.7	15.9	6.0	9.9	9.9	1.8	—	—	—	BP
1048	14.7	5.7	9.0	16.2	6.0	10.2	10.2	-1.2	—	—	—	BP
	Ø	Ø	Ø	2.4	Ø	—	2.4	Ø	cement grout	130	gal.	Grout 10.2' - 2.4' bgs

Note: Col. 2 - Col. 3 = Col. 4 - Col. 5 - weight and attachments = Col. 7; Col. 7 - Col. 3 = Col. 8; Col. 4 - Col. 8 = Col. 9

Reported By: Jake Horner | Reviewed By: L. D. Walker

Title: Geologist | Date: 5/19/06 | Title: Geologist | Date: 5/30/06

Signature: John Horner | Signature: LD Walker

A-6003-653 (04/03)

G.134

Construction Surveillance Reports

Well C4999

SURVEILLANCE REPORT DISTRIBUTION SHEET

Report No.: QA-ESA-GRP-SURV-07-001	**Issue Date:** 10/4/06
To: B. H. Ford	**MSIN:** E6-35
From: W. R. Thackaberry	**MSIN:** E6-35

- ⦿ The attached report is for your information. The activity was found to be **SATISFACTORY**.
- ○ The attached report is for your action. The activity was found to be **UNSATISFACTORY**. This report requires an evaluation for potential deficiencies in accordance with HNF-PRO-052, Corrective Action Management.
- ○ The attached report indicates deficiency(ies) **CORRECTED DURING SURVEILLANCE**.

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FH Radiation Protection Management (Rad Con-related only)	NA	NA
FH Occupation Safety & Health Management (Safety & Health-related only)	NA	NA
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A-6003-741 (04/06)

Fluor Hanford SURVEILLANCE REPORT	Page 1 of 1

Surveillance No.: QA-ESA-GRP-SURV-07-001

Subject:
Well Drilling, Well Construction, Walk-down and Final Acceptance of 4 Groundwater Monitoring Wells in 300-FF-5

Surveillance Dates: March 21, March 28-29, May 24, October 1, 2006 ☒ **Unscheduled** ☐ **Scheduled**

Team Lead / Team Members:
W. R. Thackaberry

Organization / Project / Facility Reviewed:
Groundwater Remediation Project/300-FF-5 Groundwater Monitoring

Personnel Contacted:
Chris Wright; Scott Worley, Task Lead; Paul Lodder, BTR; Rodney LaBrosse, Cascade Drilling, Bruce Williams, PNNL (data user); Jake Horner, Well Site Geologist; Les Walker, FH Geosciences

Requirement(s) Reviewed:
WMP-28120, Rev. 0, Description of Work for 1st Quarter FY2006 300-FF-5 OU Monitoring Wells

Document(s) Reviewed:
Start Card #62236; Field Activity Report for 3/21/06; Geologic Log for C4999; Drill Rig and Equipment Decontamination Record; Well Acceptance Reports for C4999, C5000, C5001, C5002; State of Washington Resource Protection Well Reports for C4999, C5000, C5001, C5002; Well Survey Data Reports for C4999, C5000, C5001, C5002; Washington State Drillers License #2182 held by Rodney LaBrosse

Surveillance Results: ☒ **Satisfactory** ☐ **Unsatisfactory** | **OCRWM Related?** ☐ **Yes** ☒ **No**

☐ **Corrected During Surveillance** | **DR CAR No. (when applicable):** N/A

Surveillance Summary:

IN-PROCESS SURVEILLANCE

The drill site for C4999/399-3-18 was visited on March 21 & 28-29, 2006. During drilling operations I verified that the drill rig and down-hole equipment were decontaminated before the job started. Samples are being collected in Lexan liners via 5 inch split spoons in accordance with the DOW. Drilling spoils are being stored on plastic sheet or in 55 gallons drums. The BTR is in possession of copies of the start cards. The well site geologist is completing Field Activity Reports for the on-site activity and a geologic log is being created. The driller, Rodney LaBrosse of Cascade Drilling, holds a Washington State Driller's license #2182 (issued Oct. 12, 1993/expires Oct. 12, 2006). SATISFACTORY

During well completion, I observed that the casing being used was 6 inch diameter Schedule 10, 304L, A778 stainless steel. The 20 slot 15 foot long stainless steel screen has centralizers above and below. I observed that the driller and helper wore new rubber gloves for handling the stainless. The screen was damaged during back pulling of the temporary casing and had to be replaced. The driller cleaned out the hole down to the bottom of the sand pack and reconstructed the well using a new screen. I observed the placement or sand pack, surging of the well, and placement of grout. SATISFACTORY

FINAL ACCEPTANCE

Four 6 inch diameter monitoring wells for monitoring of 300-FF-5 were constructed by Cascade Drilling. These wells were walked-down on May 24, 2006 by the task lead, the BTR, the driller, QA, the data user, and the well site geologist.

During the walk-down, the acceptability of the following was confirmed: Protective casing, lockable cap, concrete surface pad, protective posts, brass survey marker with well name and number, Ecology tag, and site clean-up. Installation of dedicated sampling pumps was evidenced by verifying that the electrical and piping connections for the pump are present. The water level in each well was measured during the walk-down to illustrate the functionality of the well. The wells will be surveyed later by others.

Well Number	Well Name	Ecology Tag	Program	Milestone
C4999	399-3-18	ALB-326	CERCLA 300-FF-5	M-24 (Proposed FY 07)
C5000	399-1-23	ALB-327	CERCLA 300-FF-5	M-24 (Proposed FY 07)
C5001	399-3-19	ALB-329	CERCLA 300-FF-5	M-24 (Proposed FY 07)
C5002	399-3-20	ALB-328	CERCLA 300-FF-5	M-24 (Proposed FY 07)

Documents and Records – Well Acceptance Reports, State of Washington Resource Protection Well Reports, and Well Survey Data Reports have been issued for these 4 wells.

W. R. Thackaberry *W R Thackaberry*	*10/2/06*	D. G. Farwick *D G Farwick*	*10/04/06*
Team Lead (Print & Sign)	**Date**	**Manager (Print & Sign)**	**Date**

Surveillance/walkdown300FF506.doc A-6003-678 (04/06)

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