PNNL-15522

Pacific Northwest
National Laboratory
Operated by Battelle for the
U.S. Department of Energy

Statement of Work for Direct Push Technology Characterization Borehole Installations During Fiscal Year 2006, 300-FF-5 Operable Unit

B. A. Williams

November 2005

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

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Pacific Northwest National Laboratory
Richland, Washington 99352

Summary

Pacific Northwest National Laboratory, the U.S. Department of Energy (DOE), and the U.S. Environmental Protection Agency (EPA) have agreed that temporary characterization boreholes shall be installed in the 300-FF-5 Operable Unit to collect borehole radiological (spectral gamma) data. These characterization boreholes are also documented in the 300-FF-5 Limited Field Investigation Plan. This document contains the statement of work required to install, characterize, and decommission the proposed temporary boreholes during fiscal year (FY) 2006.

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1.0 Introduction

This statement of work (SOW) provides the information required to install, characterize, and decommission a minimum of three and up to fifteen temporary characterization boreholes during fiscal year (FY) 2006 as identified and defined by Pacific Northwest National Laboratory (PNNL), the U.S. Department of Energy (DOE), and the U.S. Environmental Protection Agency (EPA). All boreholes shall be decommissioned following borehole characterization.

DOE has authorized PNNL to proceed with the installation of four characterization wells to support the 300-FF-5 Operable Unit (OU) limited field investigation (LFI). These new wells are being installed to investigate the location and extent of subsurface uranium sources(s) that persist within the 300-FF-5 OU. Results from these four wells will be used to determine the presence and vertical extent of uranium contamination within the vadose zone and uppermost unconfined aquifer. The characterization wells will ultimately be completed as groundwater monitoring and/or treatment technology testing wells. Based on these results, up to 15 temporary characterization boreholes will be installed to further the uranium characterization effort beneath the 300 Area. The characterization boreholes will be decommissioned after characterization has been completed.

This SOW provides the specifications for installation, characterization, and decommissioning of up to 15 temporary boreholes by Fluor Hanford, Inc. (FHI), the DOE drilling contractor for the Hanford Site.

PNNL is responsible for determining needs, locations, and design requirements for wells and boreholes in compliance with the *Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA) to meet the 300-FF-5 OU cleanup objectives. FHI is responsible for estimating cost, procuring equipment and materials, maintaining drilling schedule (as concurred with by PNNL to ensure meeting technical and logistical objectives), and constructing the boreholes and wells. FHI also is responsible for preparing the Washington State-required drilling Start Cards (Washington Administrative Code [WAC] 173-160), pre-job planning, wellsite duties (e.g., geologist, samplers, and geophysical logging), waste management, and wellsite health and safety.

In addition, FHI is responsible for obtaining the necessary permits for borehole/well construction, such as excavation permits, radiation work permits, and cultural resource reviews. Further, FHI is responsible for conducting the project in accordance with DOE-approved and WAC-compliant technical procedures and technical drilling specifications. Site cleanup is also the responsibility of FHI. PNNL shall review and accept the borehole characterization data prior to the decision to decommission the borehole to satisfy the conditions of this SOW.

Borehole installation and subsequent decommissioning must adhere to the requirements in WAC 173-160. For these temporary boreholes, specific Direct Push Technology (DPT) technical requirements are also provided in the 300-FF-5 OU LFI plan (DOE 2005a).

The technical aspects defined in the 300-FF-5 LFI plan for these fifteen DPT boreholes are included in this SOW and Appendix A. The quality assurance and quality control aspects of the LFI plan are included in the project quality assurance plan (Walker 2005). Together, these two documents constitute the sampling and analysis plan for the DPT boreholes.

English units are used in this report (except for well surveys) because that is the system of units used by drillers to measure and report depths and well construction details. To convert feet to meters, multiply by 0.3048; to convert inches to centimeters, multiply by 2.54.

2.0 Scope of Work

This document describes requirements for the installation of up to 15 temporary characterization boreholes. The boreholes are located within the 300 Area (Figure 1), in the southeast portion of the Hanford Site. The scope of this work shall be completed by May 8, 2006.

This SOW and the Well Data Sheet and Staking Plat (Appendix A) contain the installation, sampling, and decommissioning requirements for the 15 temporary boreholes. This SOW and the Well Data Sheet are intended as guidelines for FHI planning purposes. Any questions or discrepancies concerning the scope of this work should be reviewed with the PNNL point of contact (POC; Section 3) prior to start of the work. The Staking Plat provides the locations for the proposed temporary boreholes. Specific directions to the locations are provided in the Well Data Sheet. PNNL in conjunction with FHI shall stake the borehole locations after receipt of this SOW.

The characterization (sampling) requirements defined in the Well Data Sheet are intended to meet information needs for the CERCLA 300-FF-5 OU LFI. The information needs support the remedial investigation/focused feasibility study that is in progress, which includes a new groundwater flow and transport model (DOE 2005b). Additional data collection needs and/or changes to the Well Data Sheet will be determined jointly by FHI, PNNL, and the DOE Richland Operations Office (DOE-RL) and documented in an addendum to this SOW. Costs for additional work not specified in the contractor's original cost estimate will be approved prior to start of work by PNNL. The work will be performed when PNNL confirms that the required funding is available.

3.0 Points of Contact

The POCs for this work are as follows:

Name	Role	Phone
Mr. B. A. Williams	POC - PNNL	509-372-3799 Cell 539-6502
Dr. D. G. Horton	Alternate POC - PNNL	509-376-6868 Cell 539-4842
Mr. C. S. Wright	POC - FHI	509-373-3994 Cell 531-7638

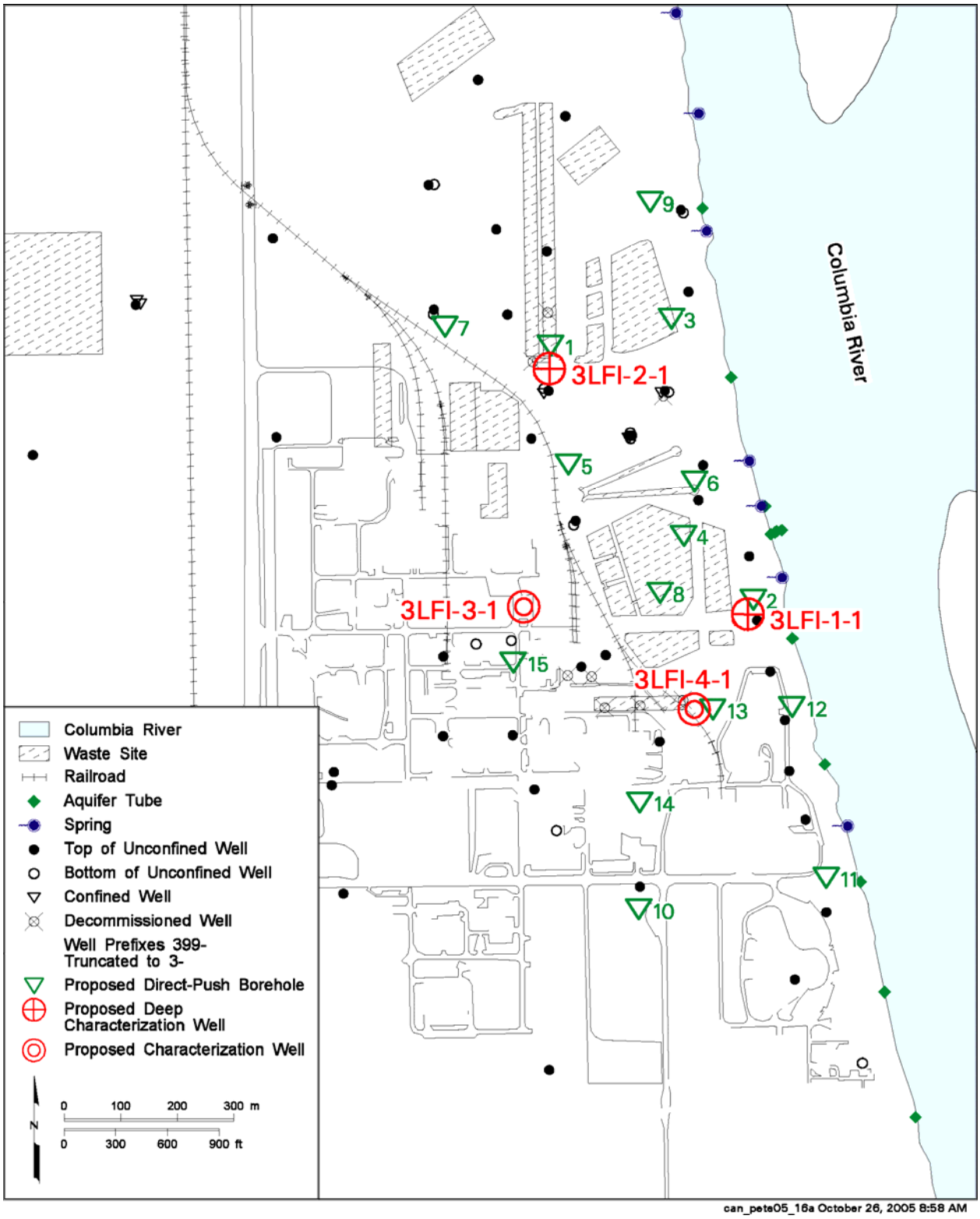

Figure 1. Location Map of the 15 Temporary Boreholes and the Four Characterization Wells, 300-FF-5 Operable Unit

4.0 Background

DOE Orders require the Hanford Groundwater Performance Assessment Project to maintain groundwater-monitoring compliance with applicable CERCLA and *Resource Conservation and Recovery Act* (RCRA) regulations (WAC 173-303-400 and WAC 173-303-600).

In 1996, a record of decision (EPA 1996) was issued for the 300-FF-5 Operable Unit on the Hanford Site in southeastern Washington State. The record of decision identified interim actions for remediation of the uranium contaminant plume beneath the site:

- continued groundwater monitoring to determine how contaminant conditions may change with time
- institutional controls to limit the use of groundwater

These interim actions have determined that uranium concentrations in the groundwater plume have been declining but persist at concentrations above the drinking water standard (remediation goal). Therefore, re-evaluation of the remedy for uranium contamination is necessary because the rate of decrease in uranium concentrations differs significantly from the rate of decrease expected and used as a basis for the remedy selection in the current record of decision.

The re-evaluation of the remedy for uranium in the groundwater will be documented in the Phase III Feasibility Study. An LFI is being conducted as part of the feasibility study to reduce uncertainties in two aspects of the conceptual model for the uranium plume: (1) the distribution and amount of uranium in the vadose zone (especially in the interface between unsaturated and saturated conditions—the river-induced capillary fringe zone) where water quality standards are exceeded and (2) the geochemical characteristics associated with uranium in the vadose zone and aquifer, including aquifer sediment. Continuous core samples will be obtained at four representative sites, followed by a direct-push boring program for obtaining downhole radiological data. These activities will address the two aspects above. The scope of this SOW pertains to the second part, the direct-push borehole installations, and characterization at the 15 locations.

5.0 Risk Assessment

FHI shall evaluate and assess the proposed temporary borehole locations for the potential of encountering radiological contamination prior to drilling. The risk assessment shall be used to develop the site health and safety plans and radiological monitoring requirements. Geologic and drilling observations from nearby wells provide good sources for predicting expected subsurface conditions. FHI personnel may examine available information near the borehole locations that includes lithologic and geophysical logs, drilling observations from nearby wells, pipeline maps, and Waste Information Data System summary reports of nearby waste sites.

PNNL does not take responsibility for any actions, impacts, or issues related to activities resulting from use of this information.

6.0 Temporary Borehole Installation and Sampling Plan

Appendix A provides the Well Data Sheet and Staking Plat for the temporary boreholes. Information includes estimated depths to water, estimated total depths, and characterization and sampling requirements. Details concerning the borehole decommissioning requirements are provided in Section 7.6. All depths are estimates to be used for planning purposes; required depths may change and should be verified during borehole installation by the field geologist. PNNL requires a qualified field geologist to oversee borehole installation, resolve logging and sampling issues, and to describe and support collection of samples from each borehole. The geologist's qualifications are specified in Appendix B.

DPT is required to install the temporary boreholes. The purpose of this method of installation is to allow quick access to the vadose zone in a way that minimizes disturbance to the subsurface surrounding the borehole, i.e., no drilling, only a single temporary casing string, and no introduction of air, water, or other fluids during borehole installation.

During the DPT borehole installations, no sediment or groundwater samples will be recovered. However, one sediment grab sample and one bailed groundwater sample shall be attempted during the decommissioning process in each borehole as the casing is back pulled. If there is not enough sample material for the grab sample, the geologist will note on the borehole summary log the reason why no sample was recovered in the borehole. If the water sample recovery is successful, the recovered water shall be filtered and contained in a sample set provided by the PNNL. The PNNL POC will be notified immediately when the samples have been collected and are ready for transfer off the site. Chain-of-custody forms will be required for all sediment and groundwater samples collected.

No archive samples will be collected. In the event that contaminated sediment or groundwater are encountered during borehole installation, the PNNL POC will be notified and a determination made by PNNL and FHI whether additional samples (and how many) are required. FHI shall provide all requested samples to the PNNL POC or designee, who shall be responsible for the samples after transfer. FHI shall provide pint-size glass Mason sampling jars with screw-top lids, sampling pumps and/or bailers, and any related sampling equipment. PNNL shall provide the water sample filters and labeled water sample containers (including chain-of-custody forms) to FHI prior to borehole installation.

The boreholes shall be installed with a DPT method that will allow collection of continuous radiological log data that are representative of the subsurface sediment (i.e., from the ground surface to total depth). Spectral gamma and neutron moisture (vadose zone) borehole logs shall be completed in the temporary boreholes prior to decommissioning. The purposes of the logging are to (1) provide data for locating and quantifying process uranium, (2) provide data to support stratigraphic correlation, (3) identify potential fine-grained and moisture-bearing intervals, and (4) provide baseline geophysical borehole logs. The boreholes shall not be installed in a way that precludes meaningful geophysical logs—logging should be completed in a single cased borehole that is between 4.5 and 7.5 inches in diameter and no more than 0.5 inch in thickness. Any deviations from these requirements shall be reviewed and approved by PNNL and FHI staff prior to proceeding with this SOW. Borehole geophysical logging shall be done by Stoller, Inc. PNNL shall be responsible for contracting the geophysical logging work and FHI or its subcontractor shall be responsible for notifying the subcontractor when logging services are required. FHI also will provide PNNL and Stoller (the geophysical logging

contractor) with at least a 12-hour notification before the anticipated logging depth is reached and will notify the logging personnel when logging is required. The geophysical logging will require assistance from the driller to clear the boreholes for logging tool access.

FHI shall provide a 4-hour notice to the PNNL POC prior to beginning each new borehole push, upon reaching the proposed total depth, upon completion of geophysical logging, and prior to decommissioning.

7.0 DPT Borehole Installation

7.1 Borehole Site Support

FHI or its contractor will be responsible for pre-job preparations and field support for DPT borehole installation, characterization, and borehole decommissioning. FHI will provide oversight to the DPT contractor and will have responsibility for directing and coordinating technical field activities to ensure that the boreholes are installed, logged and sampled, and decommissioned in an efficient and timely manner and meet the requirements specified in this SOW. FHI also will coordinate the sediment and groundwater sampling and transfer, and geophysical logging. Any specially requested sampling will be reviewed with the FHI POC prior to approval.

FHI must notify and obtain concurrence from the PNNL POC prior to proceeding with any work activities that deviate from the original requirements and/or defined work scope and schedule. As required by this SOW, the FHI POC will coordinate with the field geologist and contact the PNNL POC for approval prior to any decisions related to stopping a push or abandoning an attempted push before the planned depth objective is reached, prior to selection of an alternate location, prior to the collection of unplanned sediment and water samples, and for notification of an unanticipated event (e.g., perched water, contamination). FHI shall notify the geophysics contractor, sampling personnel, and the PNNL POC 12 hours prior to when their support is required at a borehole.

FHI will communicate daily (by electronic mail or in person) with the PNNL POC and provide a status of borehole installation and characterization activities. FHI is responsible for documenting and verifying characterization borehole construction techniques and materials in order to produce fitness-for-use documentation for final acceptance of the borehole log data and as required for the State Well Record.

7.2 Driven Boreholes

The temporary boreholes are to be installed in compliance with requirements for temporary boreholes or “driven wells” as defined in WAC 173-160. The temporary boreholes are to be installed at the locations provided in the Well Data Sheet provided in Appendix A. The PNNL POC and the FHI POC will have jointly staked the borehole locations prior to commencement of this FY 2006 contract. FHI is responsible for subsurface surveys, as necessary, to confirm that subsurface obstacles do not exist.

If necessary, the staked well location may be moved up to 50 feet to avoid subsurface obstacles. Notification will be provided to the PNNL POC if the stake is moved, and PNNL concurrence is required to confirm all new borehole locations.

FHI or its drilling contractor shall be responsible for complying with borehole installation and construction criteria defined in WAC 173-160 and shall follow DOE-approved work procedures. The Well Data Sheet (Appendix A) supplements the WAC 173-160 requirements by providing specific requirements necessary to fulfill the sampling and analysis plan. The boreholes shall be driven as close to vertical as possible. The PNNL POC shall be notified when the borehole has reached total depth, prior to geophysical logging, and prior to decommissioning. No water, foaming agents, or other fluids shall be used in driving the boreholes. Drive casing footages shall be recorded daily for each borehole. All downhole equipment (including submersible sampling pumps and sediment samplers) shall be steam-cleaned prior to use (i.e., high pressure and temperature) or decontaminated to minimize contaminants. When requested by either the field geologist or the PNNL POC (as required in the Well Data Sheet), the borehole shall be made clear of all tools to permit measurements and/or collect samples.

The final actual total depth of the temporary boreholes shall be as specified in the Well Data Sheet (characterization target depth as listed in Table A.1), as verified by the field geologist, and may change depending on the hydrogeologic conditions encountered. If the characterization target depth of the borehole cannot be reached after applying standard DPT installation techniques and all efforts to continue to drive the casing have failed, the following guidelines shall apply:

1. Prior to any decisions to back pull the temporary drive casing, the wellsite geologist shall record maximum depth of casing and report results to the PNNL POC.

2. Prior to back pulling the temporarily casing, a meeting will be conducted to determine if:

    a. The temporary casing depth is adequate for geophysical logging (as defined by the PNNL POC), or

    b. Additional DPT push attempts are required, or

    c. The temporary casing refuses attempts to drive deeper and is too shallow to acquire the required geophysical data.

If the borehole characterization target depth is not obtained as defined in Appendix A (Table A.1) and after following the guidelines outlined in 2) above the borehole shall be decommissioned and the following option applies:

1. After the first refusal at a specific location, the rig will be moved (<50 feet) and a second DPT push will be attempted. If after the second DPT attempt, the characterization target depth (Table A.1) is not met, then a third and final DPT push will be attempted at the site before abandoning the location for the next DPT location.

7.3 Borehole Construction

The temporary boreholes shall be constructed in accordance with the WAC 173-160 requirements and consistent with Hanford Site well construction standards. The boreholes shall be constructed with a minimum of 6 5/8- to 7.0-inch outside-diameter steel casing that is no greater than 0.5 inch thick, as specified in the Well Data Sheet. No seals shall be placed during construction of the boreholes. A temporary cap shall be placed over the borehole when work is not being conducted on or in the borehole to prevent moisture or other debris from entering the borehole. The FHI POC shall contact the PNNL POC to resolve any unrecognized or unanticipated borehole depth discrepancies prior to abandoning an attempted push or selecting an alternate location.

7.4 Borehole Logging

Geophysical borehole logging shall begin after the maximum DPT casing drive depth has been reached as specified in the data sheet, or as determined by the FHI POC or DPT contractor, and confirmed by the PNNL POC as specified in Section 7.2. All DPT equipment, miscellaneous materials, and loose debris shall be removed from the borehole by the DPT contractor in support of logging. Borehole logging shall consist of deploying a high resolution spectral gamma wire-line tool to the bottom of the cased borehole and logging from total depth to the surface. In addition to the gamma logging, a neutron moisture probe will also be deployed in the borehole and logged from total depth to the surface. Repeat runs shall be conducted as determined by the PNNL POC and the logging contractor.

All geophysical logging probes, related cables, tools, and data collection equipment will be provided by others. The FHI or DPT contractor shall provide support to the logging contractor at the borehole site as needed. The logging data will be reviewed and evaluated by the logging contractor and the PNNL POC to validate the results and determine if additional log runs are necessary. When the data are accepted by the PNNL POC, the FHI POC will be notified that the logging is complete, and the borehole can be decommissioned. Unplanned standby and downtime issues will be discussed and agreed to, as needed between the FHI POC and the PNNL POC, prior to proceeding with work.

7.5 Post-Logging Sampling Activities

A one-time sampling event shall be attempted in each temporary borehole during decommissioning (see Section 7.6) after the drive point has been knocked out and the casing back pulled. The sampling shall occur prior to the addition of any borehole fill material.

A water sample shall be collected if adequate water is available in the bottom of the borehole, as measured and determined by the wellsite geologist. The depth to water shall be recorded by the wellsite geologist before and after sampling. A bailer or optional downhole pump shall be used to collect the sample. Water chemistry indicators (i.e., pH, temperature, and specific conductivity) shall be measured, as allowable, and recorded during the sample collection process to verify the representativeness of the formation water being produced from the borehole. The bailed water sample shall be filtered into the prepared sample bottle set provided by PNNL. The sample bottles and associated chain-of-custody form shall be delivered immediately to the PNNL POC.

A sediment sample shall be attempted in the open bottom portion of the borehole following an attempt to collect a water sample and prior to the addition of decommissioning fill material. The casing shall be back pulled 2 to 5 feet in order to initiate sloughing prior to attempting to collect the sediment sample. The sampling process assumes that an adequate volume of sediment from the surrounding borehole will slough into the opening when the casing is back pulled. Prior to sampling, the depth to bottom shall be measured (and recorded) to determine the presence and depth to the sloughed sediment. After confirmation that an adequate sediment volume is available, an attempt to collect the sample shall be accomplished with a bailer or other collection device. The sample shall be contained in a minimum 1-pint-size, large mouth glass Mason jar with screw top lid. Larger volume sample containers may be required if the sediment is gravelly. The sample will be labeled with the borehole number, sample depth, time, and date of collection. The sample will be delivered, along with a chain-of-custody form, to the PNNL POC as soon as practicable.

Decommissioning of the borehole will commence following the attempted groundwater and/or sediment sampling event.

7.6 Borehole Decommissioning

Borehole decommissioning shall not begin until the geophysical log data has been reviewed and accepted by the PNNL POC or designee and notification provided to the FHI POC. Two of the 15 DPT boreholes shall be outfitted by PNNL staff with dedicated, non-retrievable subsurface electrodes and wiring (provided by PNNL) prior to adding backfill material. The selected DPT boreholes, DPT-5 and DPT-6, are tentative and may change based on results from a tracer survey being conducted in existing monitoring network wells under a different project. FHI shall notify the PNNL POC prior to decommissioning DPT-5 and DPT-6 and coordinate with the drilling contractor to support installation of the electrodes. Borehole decommissioning shall follow standard WAC 173-160 procedures for temporary borehole decommissioning. After the disposable drive point is knocked out of the bottom of the casing, all casing shall be removed from the ground. As determined by FHI, silica sand (placed across the saturated zone only), and bentonite pellets or cement grout (used to backfill the unsaturated portion of the borehole) shall be placed as the casing is removed. The upper 6 feet of borehole shall be backfilled with Portland cement or as defined in WAC 173-160.

The temporary borehole number will be stamped into a brass cap and placed in the cement surface seal to mark the location of the decommissioned borehole. The drilling contractor is responsible for installing (and labeling) the brass cap into the concrete surface seal. FHI shall have the decommissioned boreholes surveyed in accordance with Section 8 of this SOW.

An inspection of the decommissioned boreholes shall be made by both FHI and PNNL personnel prior to accepting the completed scope of work from the drilling contractor. The inspection is to verify that the decommissioned boreholes meet the minimum WAC 173-160 well decommissioning requirements.

7.7 Waste Management Activities

Because these are driven (not drilled) boreholes, very little drilling-related waste is expected to be created. Prior to borehole installation, a waste management plan will be developed identifying specific

contaminants of concern for the boreholes. In addition, if sampling is necessary, FHI will develop a sampling and analysis plan for waste designation sampling.

FHI will give all direction to field personnel for waste packaging directly to the DPT subcontractor and other affected personnel. All miscellaneous waste will be bagged, labeled, and disposed of by FHI in accordance with the appropriate site-specific waste management plan (DOE 2000), which will be provided by PNNL. Any decontamination fluid and purgewater will be disposed of as purgewater (either containerized or put directly into a purgewater truck) as directed by the FHI personnel and/or waste transportation specialist.

All waste generated will be returned to ground surface or disposed of at the low-level burial grounds, Environmental Restoration Disposal Facility, or other approved disposal facility as defined by waste management documentation, which shall be prepared by the DOE drilling contractor (currently FHI).

8.0 Final Well Survey

FHI will be responsible for the final borehole surveys. The decommissioned boreholes shall be surveyed and a Survey Data Report submitted to the PNNL POC. The final survey is to occur after the permanent brass marker is installed in the concrete surface seal and no later than approximately 15 days following decommissioning of the boreholes.

Experienced survey personnel supervised by a licensed land surveyor shall perform the surveys. The center of the survey marker (brass cap) shall be surveyed for horizontal and vertical (elevation) coordinates. Elevation is to be reported rounded to the nearest 0.003281 ft (0.001 m), and horizontal coordinates are to be reported to the nearest 0.03281 ft (0.01 m). The maximum allowable error on leveling is computed as (12 mm) $(K)^{½}$, where K is the horizontal distance of closure in kilometers.

Surveys shall report horizontal position using the Washington State Plane Coordinate System of 1983, South Zone 1991 (WCS83S) in meters. Surveys shall report vertical position (i.e., elevation) using the North American Vertical Datum of 1988 (NAVD88). The Survey Data Report must indicate the horizontal and vertical datum used.

9.0 Technical Procedures/Specifications

This section identifies technical procedures/specifications applicable to field activities that FHI shall perform under this SOW. Activities associated with driving and constructing the temporary boreholes and management of waste shall adhere to, at a minimum, the FHI procedures and requirements described below.

9.1 General Requirements

Field work for the temporary boreholes will be conducted in accordance with FHI procedures and FHI blue-sheeted environmental restoration contractor procedures and protocols and the specifications in this SOW. The applicable procedures are discussed in the following sections.

9.2 Technical Procedures/Specifications

This section identifies technical procedures/specifications applicable to field activities performed under this SOW. Activities associated with driving and constructing the temporary boreholes and management of waste generated by these activities will adhere to, at a minimum, the following FHI procedures and requirements:

- HNF-PRO-10863, Notebooks and Logbooks
- GPR-EE-01-1.11, Purgewater Management
- GPR-EE-01-3.0, Chain of Custody
- GPR-EE-01-3.1, Sample Packaging and Shipping
- GPR-EE-01-4.0, Soil and Sediment Sampling
- GPR-EE-01-6.2, Field Cleaning and/or Decontamination of Geoprobe and Drilling Equipment
- GPR-EE-01-7.0, Geologic Logging
- GPR-EE-02-14.0, Drilling, Maintaining, Remediating, and Decommissioning Resource Protection Wells, Geoprobe, and Geotechnical Soil Borings
- Bluesheeted FHI waste management procedures HNF-PRO-15333, HNF-PRO-15334, HNF-PRO-15335, HNF-EP-0063, and HNF-EP-0063, as required
- WAC 173-160, *Minimum Standards for Construction and Maintenance of Wells*

10.0 Quality Assurance

FHI shall maintain and follow DOE-approved administrative and technical procedures used by Bechtel Hanford, Inc. (BHI), under the environmental restoration contract. This includes BHI-QA-01, ERC Quality Program, which defines the environmental restoration contractor management system to provide quality assurance. BHI-QA-01 provides a quality assurance program designed to meet the requirements of the Tri-Party Agreement (Ecology et al. 1989, as amended), DOE Orders, and state/local

regulations. All work performed under this project plan and any work packages that accompany the plan will be performed in compliance with BHI-QA-01 or subsequent and equivalent FHI Quality Program documents.

PNNL will be permitted to conduct quality assurance assessments during the borehole installation to determine that the requirements in this SOW are fulfilled. If such an assessment is to be done, PNNL will notify FHI 48 hours prior to sending assessment personnel into the field.

The FHI quality management program is implemented for this project via the following BHI manuals:

- BHI-QA-01, ERC Quality Program
- BHI-QA-03, ERC Quality Assurance Program Plans
- BHI-DE-01, Design Engineering Procedures Manual
- BHI-EE-01, Environmental Investigations Procedures
- BHI-EE-02, Environmental Requirements
- BHI-EE-10, Waste Management Plan
- BHI-MA-02, ERC Project Procedures
- BHI-SH-02, Safety and Health Procedures, Vols. 1, 3, and 4
- BHI-SH-05, *Industrial Hygiene Work Instructions*

11.0 Health and Safety

General worker health and safety training requirements, technical procedures, and technical specifications associated with this characterization project are identified in this section. FHI is responsible for, and shall coordinate, project safety and health, radiation screening and protection, waste management, and quality assurance. FHI, PNNL, and/or other contractors performing work at the borehole site shall have the authority to stop work if safety concerns arise.

11.1 General Requirements

All personnel working at the DPT sites addressed by this plan will have completed, at a minimum:

- *Occupational Safety and Health Administration Act* 40-hour Hazardous Waste Site Worker training program (29 CFR 1910.120)

- Hanford General Employee Training (HGET) required for access to the 100 and 200 Areas

- Radiation Worker II

Work will be performed in accordance with the following procedures:

- HNF-5173, “Project Hanford Management Contract Radiological Control Manual”

- Site-specific documents, as applicable:
  - health and safety plans
  - radiological evaluation/radiation work permits
  - activity hazard analysis/job safety analysis
  - blue-sheeted site-specific waste management instructions

- HNF-IP procedures
  - Central Plateau radiological control procedures
  - Radiological and Chemical Hazard Evaluation

The boreholes will be reviewed for radiological risk by the FHI Radiological Control organization. It is desirable that the boreholes be classified as low risk. If the boreholes are classified as medium to high risk, the FHI POC will notify the PNNL POC and appropriate documentation and actions will be taken to manage the risk level.

12.0 Schedule

FHI shall coordinate and prepare a schedule to meet DPT borehole requirements identified in this SOW and the attached Well Data Sheet (Appendix A). The last borehole shall be completed and logged on or before May 8, 2006. FHI shall provide a borehole installation schedule to the PNNL POC two weeks prior to equipment mobilization to the field.

13.0 Deliverables

13.1 Drilling Contract Review

FHI shall allow the PNNL POC to review and comment on the request for proposal for DPT borehole installations at least 1 week prior to putting the request for proposal out for bid.

13.2 State Start Cards

As applicable, copies of the well Start Card notifications to the Washington State Department of Ecology shall be provided to the PNNL POC.

13.3 Project Meetings and Communications

FHI will conduct meetings as needed during the project to communicate activities to PNNL, DOE, and other interested contractors and regulators. The purposes of the meetings are to state progress, resolve issues and/or conflicts, and conduct other activities. The FHI POC or his designee will contact and brief the PNNL POC daily (via electronic mail or in person) of drilling progress and activities, issues,

problems, and schedule status. All field data and activity reports are to be available upon request at least daily following the actual day work was performed during the project.

13.4 Final Borehole Characterization Data

A final data package containing the borehole profile or as-built log, field activity reports, well number, Survey Data Report, and sampling documentation for each borehole shall be delivered to the PNNL POC within 2 weeks after completion of the project.

13.5 Project Completion/Final Acceptance

The project shall be completed after all boreholes have been decommissioned and surveyed in accordance with this SOW. Before notifying FHI that the temporary boreholes are ready for decommissioning by the DPT contractor, PNNL shall review and accept the geophysical logging results from the geophysical logging contractor. Following the decommissioning of the boreholes, FHI will conduct a final inspection to enable the PNNL POC to view and validate decommissioning of the boreholes and cleanup at the site. The inspection is to be certain that the boreholes are decommissioned according to these specifications and meet the minimum WAC 173-160 requirements. Any changes to the planned design of any borehole, or deficiencies from the original design (as outlined in this SOW), will be reviewed and a determination of closeout actions will be approved between FHI and PNNL prior to written acceptance of the completion of work by PNNL. A successful inspection will result in PNNL acknowledging the decommissioned boreholes in writing to FHI.

13.6 Records Required by WAC 173-160

FHI shall be responsible for determining that the DPT contractor has completed and submitted the appropriate record forms as required by WAC 173-160-420 to the Washington State Department of Ecology on the required well record form. A copy of the contractor's final WAC decommissioning record will be transmitted to the PNNL POC.

14.0 References

29 CFR 1910.120. 1999. "Hazardous Waste Operations and Emergency Response." Occupational Safety and Health Administration, U.S. Department of Labor, *Code of Federal Regulations*.

Bechtel Hanford, Inc. 2001. "Risk Assessment for Excavation and Well Sites." Procedure 10.2 in *Radiological Control Procedures*. BHI-RC-03, Bechtel Hanford, Inc., Richland, Washington.

CERCLA – *Comprehensive Environmental Response, Compensation, and Liability Act*. 1980. Public Law 96-150, as amended, 94 Stat. 2767, 42 USC 9601 et seq.

DOE. 2000. *Waste Management Plan for the 300-FF-5 Operable Unit*. DOE/RL-2000-56, Rev. 1, U.S. Department of Energy, Richland, Washington.

DOE. 2005a. *300-FF-5 Operable Unit Limited Field Investigation Plan*. DOE/RL-2005-47, Rev. 0, U.S. Department of Energy, Richland, Washington.

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EPA. 1996. *Record of Decision for the 300-FF-1 and 300-FF-5 Operable Units*. U.S. Environmental Protection Agency, Washington State Department of Ecology, and U.S. Department of Energy, Richland, Washington.

NAVD88. 1988. North American Vertical Datum of 1988.

RCRA – *Resource Conservation and Recovery Act*. 1976. Public Law 94-580, as amended, 90 Stat. 2795, 42 USC 6901 et seq.

WAC 173-160. 1998. "Minimum Standards for Construction and Maintenance of Wells," as amended. *Washington Administrative Code*, Olympia, Washington.

WAC 173-160-420. 1998. "General Requirements for Construction of Resource Protection Wells," Subpart (10), "Resource Protection Well and Geotechnical Soil Boring Drilling Reports." *Washington Administrative Code*, Olympia, Washington.

WAC 173-303-400. 1984. "Interim Status Facility Standards," as amended. *Washington Administrative Code*, Olympia, Washington.

WAC 173-303-600. 1984. "Final Facility Standards," as amended. *Washington Administrative Code*, Olympia, Washington.

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Appendix A

Well Data Sheet and Well Staking Plat
300-FF-5 Operable Unit

Appendix A

Well Data Sheet and Well Staking Plat
300-FF-5 Operable Unit

A.1 Data Sheet for up to Fifteen Direct Push Technology Characterization Boreholes for 300-FF-5 Operable Unit, FY 2006

A.1.1 Location

Between 3 and 15 Direct Push Technology (DPT) characterization boreholes shall be installed within the 300-FF-5 Operable Unit, in the southeast portion of the Hanford Site. The boreholes are to be decommissioned after characterization activities have been completed. The DPT borehole locations are shown on the attached plat of the 300 Area. Pacific Northwest National Laboratory (PNNL) shall stake the locations. As necessary, Fluor Hanford, Inc. (FHI) shall conduct ground-penetrating radar (GPR) surveys around the staked locations to ensure that no subsurface hazards or obstacles are present at the location stakes. FHI shall also notify and coordinate field activities with the Washington Closure Hanford (WCH) group working in the area. The FHI point of contact (POC) will contact the PNNL POC immediately to determine a replacement location if subsurface obstacles require moving a location. Specifically, the DPT boreholes will be located as follows:

- DPT-1 – Adjacent to characterization well 3LFI-2-1 and at the southern end of the 316-5 process trench (north of well 399-1-17A) to calibrate/corroborate geophysical logging results with borehole characterization data. This location and the following DPT locations that are proposed through waste sites allow penetration directly beneath known waste disposal sites to verify the absence or presence of uranium contamination. In addition, the installation is expected to be physically less restrictive because the pushes will be driven in disturbed backfill with less boulder gravel. This should reduce the risk of refusal and allow deeper penetration in the subsurface.

- DPT-2 – Adjacent to characterization well 3LFI-1-1 in order to calibrate/corroborate geophysical logging results with borehole characterization data.

- DPT-3 – South central perimeter through the 316-2 North Process Pond.

- DPT-4 – Through the northeast portion of the 316-1 South Process Pond.

- DPT-5 – Between wells 399-1-17 and 399-1-21A. This location is in a preferential flow path and downgradient of the process trenches. It is also located to penetrate through or near the undesignated Burning Pit (backfilled) (Young and Fruchter 1991).

- DPT-6 – Through the southeast end of the sanitary leach trenches. This area is known for very high groundwater flow conditions and as a contaminant preferential pathway.

- DPT-7 – West of the 316-5 process trenches near well 399-1-13. This location provides upgradient control near the 10 μg/L uranium plume boundary.

- DPT-8 – Through the southwest portion of the 316-1 South Process Pond.

- DPT-9 – Near well 399-1-10. This location is downgradient of both the 316 process trenches and the North Process Pond and within a high residual uranium concentration portion of the plume.

- DPT-10 – Southwest of DPT-14 on the upgradient edge of the preferential flow path (i.e., erosional channel) and near the uranium 10-µg/L limit. This location is also adjacent to the Plutonium Recycle Test Reactor Rubble Pit (Young and Fruchter 1991).

- DPT-11 – North of well 399-4-7. This location is within the southern flow path and in a preferential groundwater flow channel.

- DPT-12 – Near well 399-3-10. This location is within the highest concentration portion of the uranium plume along the southern flow path near the Columbia River.

- DPT-13 – Immediately east (downgradient) of the 307 trench. Groundwater data from nearby wells suggest a uranium source persists in this area.

- DPT-14 – Northwest of DPT 10 along the preferential groundwater/contaminant flow path/channel.

- DPT-15 – Southwest of the South Process Pond within a hypothetical preferential flow path.

These locations may be further adjusted based on the outcome of the characterization wells and available GPR survey results.

A.1.2 Approximate Borehole Depth

The proposed target borehole depths for the DPT pushes are listed in Table A.1. The borehole target depth shall be a minimum of 3 feet below the water table at each location as defined in Table A.1. Borehole identification numbers (Table A.1) correspond to DPT locations as defined on the well location staking plat (Figure A.1).

A.1.3 Special Instructions

If necessary, the staked well location may be moved up to 50 feet to avoid subsurface obstacles. Notification will be provided to the PNNL POC if the stake is moved, and PNNL concurrence is needed to confirm all new borehole locations.

The final actual total depth of the temporary boreholes shall be determined in accordance with Table A.1 (characterization target depth) by the field geologist and may change depending on the hydrogeologic conditions encountered. If the characterization target depth of the borehole cannot be

reached after applying standard DPT installation techniques and all efforts to continue to drive the casing have failed, the following guidelines shall apply:

1. Prior to any decisions to back pull the temporary drive casing, the wellsite geologist shall record maximum depth of casing and report results to the PNNL POC.

2. Prior to back pulling the temporarily casing a meeting will be conducted to determine if:

   a. The temporary casing depth is adequate for geophysical logging (as defined by the PNNL POC), or

   b. Additional DPT push attempts are required, or

   c. The temporary casing refuses attempts to drive deeper and is too shallow to acquire the required geophysical data.

Table A.1. DPT Borehole ID Number, Estimated Depth to Water, Proposed Depth, and Completion Design for Fiscal Year 2006 Wells at 300-FF-5 Operable Unit

DPT Identification Number	Estimated Depth to Water Table (ft)	Characterization Target Depth (ft)	Completion Design Type
DPT-1	35 ± 5	40 ± 5	6 5/8 or 7 in. OD steel casing
DPT-2	40 ± 5	45 ± 5	6 5/8 or 7 in. OD steel casing
DPT-3	35 ± 5	40 ± 5	6 5/8 or 7 in. OD steel casing
DPT-4	30 ± 5	35 ± 5	6 5/8 or 7 in. OD steel casing
DPT-5	22 ± 5	30 ± 5	6 5/8 or 7 in. OD steel casing
DPT-6	30 ± 5	35 ± 5	6 5/8 or 7 in. OD steel casing
DPT-7	45 ± 5	50 ± 5	6 5/8 or 7 in. OD steel casing
DPT-8	30 ± 5	35 ± 5	6 5/8 or 7 in. OD steel casing
DPT-9	32 ± 5	40 ± 5	6 5/8 or 7 in. OD steel casing
DPT-10	52 ± 5	55 ± 5	6 5/8 or 7 in. OD steel casing
DPT-11	35 ± 5	40 ± 5	6 5/8 or 7 in. OD steel casing
DPT-12	42 ± 5	50 ± 5	6 5/8 or 7 in. OD steel casing
DPT-13	52 ± 5	55 ± 5	6 5/8 or 7 in. OD steel casing
DPT-14	52 ± 5	55 ± 5	6 5/8 or 7 in. OD steel casing
DPT-15	55 ± 5	55 ± 5	6 5/8 or 7 in. OD steel casing
DPT = Direct push technology. OD = outside diameter.			

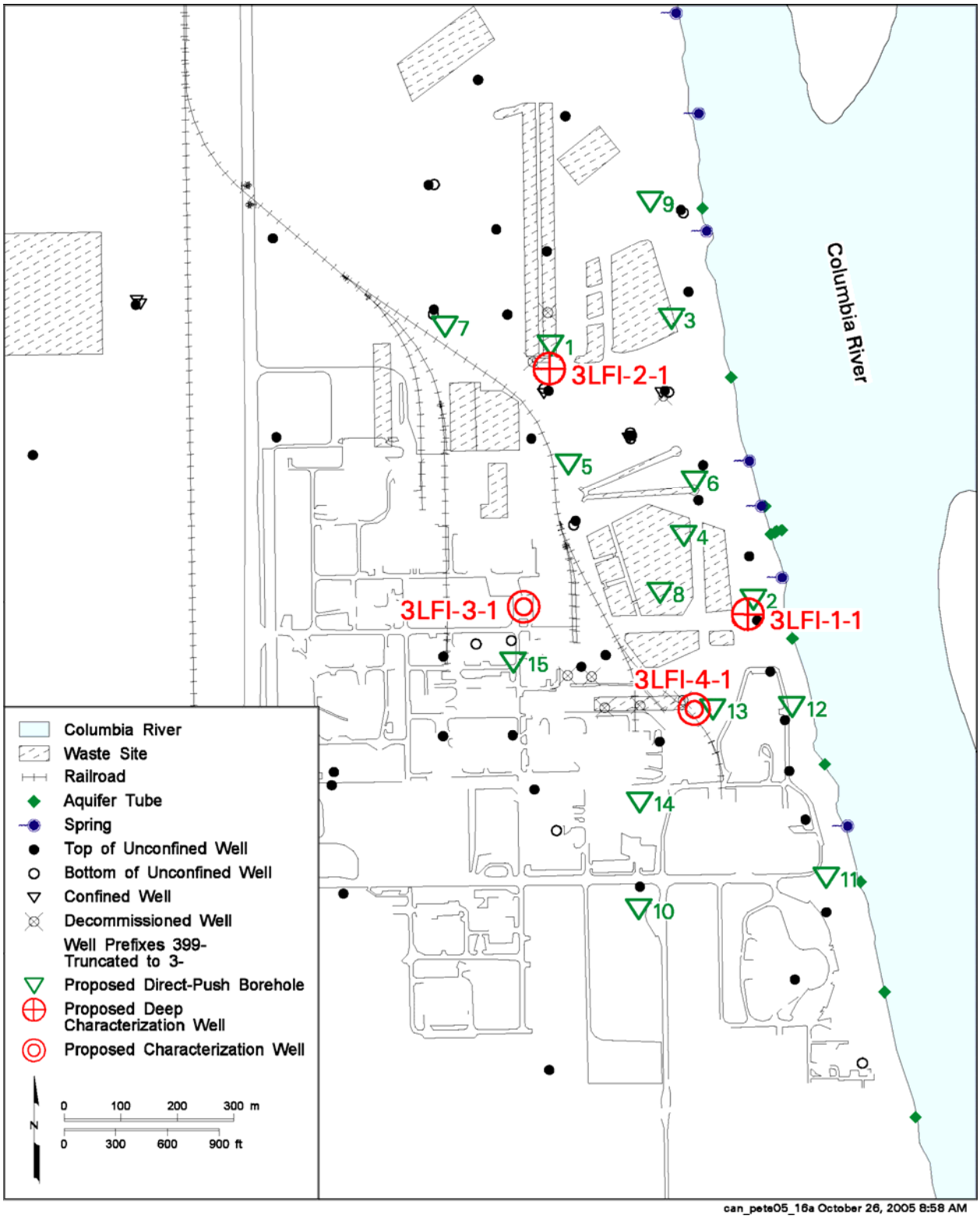

Figure A.1. Proposed New DPT Borehole and Characterization Well Locations at 300-FF-5 Operable Unit, 300 Area

If the borehole depth objective is not obtained as defined in Table A.1 and after following the guidelines in 2) above, the borehole shall be decommissioned and the following option applies:

1. After the first refusal at a specific location, the rig will be moved (<50 feet) and a second DPT push will be attempted. If the objectives of Table A.1 above are not met after the second DPT attempt, then a third and final DPT push will be attempted at the site before abandoning the location for the next DPT location. The attempted DPT boreholes will be decommissioned as per Section 7.6.

The final length of a successfully installed borehole shall be as specified in Table A.1 above, or a minimum 3 feet below the water table, or the maximum casing drive depth capable, whichever is greater, and as approved by the PNNL POC.

If the borehole is at or below the water table, the depth to water shall be measured as soon as possible after the drive point is knocked out during decommissioning. E-tapes shall be used for routine measurements. Water levels shall be recorded to the nearest 0.01 foot.

A.1.4 Sampling Requirements

A.1.4.1 Geophysical Borehole Logging

Subsurface geophysical logging (spectral gamma and neutron moisture) are required in each borehole. Geophysical logging will be conducted at total depth by others prior to decommissioning the temporary borehole for identification of radiological contaminants, stratigraphic correlation, and moisture profiling.

Casing size shall be less than 7.5 inches in diameter and less than 0.5 inch thick. Repeat intervals shall be completed across intervals of interest and anomalous readings shall be re-logged, as necessary.

A.1.4.2 Groundwater and Sediment

A one-time sampling event shall be attempted in each temporary borehole immediately prior to decommissioning (see Section 7.6) after the drive point has been knocked out and the casing back pulled. The sampling shall occur prior to the addition of any borehole fill material.

A water sample shall be collected if adequate water is available in the bottom of the borehole, as measured and determined by the wellsite geologist. The depth to water shall be recorded by the wellsite geologist before and after sampling. A bailer or optional downhole pump shall be used to collect the sample. Water chemistry indicators (i.e., pH, temperature, and specific conductivity) shall be measured, as allowable, and recorded during the sample collection process to verify the representativeness of the formation water being produced from the borehole. The collected water sample shall be filtered into the prepared sample bottle set; filters and bottle set provided by PNNL. The sample bottles and associated chain-of-custody form shall be delivered immediately to the PNNL POC for analysis.

A sediment grab sample shall also be attempted in the open bottom portion of the borehole following an attempt to collect a water sample and prior to the addition of fill material. After collecting the water sample, the casing shall be back pulled 2 to 5 feet in order to initiate sloughing prior to attempting to collect the sediment sample. The sampling process assumes that an adequate volume of sediment from the surrounding borehole will slough into the opening when the casing is back pulled. Prior to sampling,

the depth to bottom shall be measured (and recorded) to determine the presence and depth to the sloughed sediment. After confirmation that an adequate sediment volume is available, an attempt to collect the sample shall be accomplished with a bailer or other collection devise. The sample shall be contained in clean 1-pint-size glass Mason jars or plastic gallon-size wide mouth jugs with screw top lids (dependent on grain size). The sample shall be labeled with the borehole number, sample depth, time, and date of collection. The sample shall be delivered, along with a chain-of-custody form, to the PNNL POC as soon as practicable. FHI shall coordinate collection of all samples and deliver them to the PNNL POC for analysis as soon as practicable.

A.1.5 Construction Requirements

The temporary boreholes shall be constructed in accordance with the WAC 173-160 requirements and consistent with Hanford Site well construction standards. The boreholes shall be constructed with a minimum of 6 5/8- to 7.0-inch outside diameter steel casing that is no greater than 0.5 inch thick. No seals shall be placed during construction of the boreholes. A temporary cap shall be placed over the borehole when work is not being conducted on or in the borehole to prevent moisture and other debris from entering the borehole.

Decommissioning of the borehole will commence following the attempted groundwater and/or sediment sampling event as specified in Section 7.6. Two of the 15 DPT boreholes shall be outfitted with subsurface electrodes and wiring prior to adding backfill material. The selected DPT boreholes, DPT-5 and DPT-6, are tentative and may change based on results from a tracer survey being conducted in existing monitoring network wells under a different project.

The FHI POC shall contact the PNNL POC to resolve any unrecognized or unanticipated borehole depth discrepancies prior to abandoning an attempted push or selecting an alternate location.

A.1.6 Applicable Documents

WAC 173-160. 1998. "Minimum Standards for Construction and Maintenance of Wells," as amended. *Washington Administrative Code*, Olympia, Washington.

Young JS and JS Fruchter. 1991. *Addendum to Data Compilation Task Report for the Source Investigation of the 300-FF-1 Operable Unit Phase 1 Remedial Investigations*. EMO-1026, Environmental Management Operations, Richland, Washington.

Appendix B

Field Geologist Qualifications

Appendix B

Field Geologist Qualifications

B.1 Purpose

This appendix provides the minimum field (wellsite) geologist qualifications for personnel performing well logging under this statement of work (SOW).

B.2 Minimum Qualifications

The candidate should have at least a Bachelor of Science degree in geology or geologic engineering, with advanced degrees preferred. The candidate should have a minimum of 1 year experience studying the geology of the Hanford Site and be licensed as a Washington State Geologist. The candidate must also have at least 2 years well logging experience at the Hanford Site; this experience should include correlation of soil samples. In particular, the candidate is to have specific knowledge of and experience in describing the geology beneath the Hanford Site and have reviewed the new data obtained from recently drilled wells in the area. The candidate will be expected to identify and determine subtle changes in lithology including the presence of clastic dikes, paleosols, caliche zones, and other fine strata, dependent on the quality of the sediments and cuttings.

If the candidate does not meet the minimum qualifications, he or she must be under the supervision of a qualified and licensed geologist as described above.

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