PNNL-15331

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

Borehole Data Package for CY 2004 RCRA Well 299-W19-47 at Single-Shell Tank Waste Management Area U, Hanford Site, Washington

B. A. Williams

August 2005

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

PACIFIC NORTHWEST NATIONAL LABORATORY
operated by
BATTELLE
for the
UNITED STATES DEPARTMENT OF ENERGY
under Contract DE-AC05-76RL01830

Printed in the United States of America

**Available to DOE and DOE contractors from the
Office of Scientific and Technical Information, P.O. Box 62, Oak Ridge, TN 37831;
prices available from (615) 576-8401.**

**Available to the public from the National Technical Information Service,
U.S. Department of Commerce, 5285 Port Royal Rd., Springfield, VA 22161**

PNNL-15331

Borehole Data Package for CY 2004 RCRA Well 299-W19-47 at Single-Shell Tank Waste Management Area U, Hanford Site, Washington

B. A. Williams

August 2005

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

Pacific Northwest National Laboratory
Richland, Washington 99352

Summary

One new Resource Conservation and Recovery Act (RCRA) groundwater monitoring well was installed at the single-shell tank farm Waste Management Area (WMA) U in fiscal year 2004 to fulfill commitments for well installations proposed in the *Hanford Federal Facility Agreement and Consent Order* Milestone M-24-57. Well 299-W19-47 (C4258) was drilled approximately 40 feet into the uppermost unconfined aquifer and installed downgradient of the WMA. Specific objectives for this well include monitoring the impact, if any, that potential releases from inside the WMA may have on current groundwater conditions (i.e., improved network coverage) and differentiating upgradient groundwater contamination from contaminants potentially released at the WMA.

This report supplies the information obtained during drilling, characterization, and installation of the new groundwater monitoring well. This document also provides a compilation of hydrogeologic and well construction information obtained during drilling, well development, and sample collection/analysis activities.

Contents

Figures

Tables

1.0 Introduction

One new Resource Conservation and Recovery Act (RCRA) groundwater monitoring well was installed at single-shell tank Waste Management Area (WMA) U in fiscal year 2004 to fulfill commitments for well installations proposed in *Hanford Federal Facility Agreement and Consent Order* (Tri-Party Agreement; Ecology et al. 1989) Milestone M-24-57.[(a)] The need for increased monitoring capability at this WMA was identified in Smith et al. (2001) and during a data quality objectives process for establishing a RCRA/Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)/Atomic Energy Act of 1954 (AEA) integrated 200 West and 200 East Area Groundwater Monitoring Network (Byrnes and Williams 2003).

One new downgradient well has been installed near the northeast boundary of the WMA (Figure 1). Specific objectives for this well are monitoring the impact, if any, that potential releases from the WMA may have on current groundwater conditions (i.e., improved network coverage) and differentiating upgradient groundwater contamination from contaminants potentially released at the WMA. This report provides the information obtained during drilling, characterization, and installation of this new groundwater monitoring well at the single-shell tank WMA U.

1.1 New Groundwater Monitoring Well

Groundwater monitoring well 299-W19-47 (well ID C4258) was installed between April and August 2004. The location of this well is shown on the location map in Figure 1. The new well was constructed to the specifications and requirements described in Washington Administrative Code (WAC) 173-160, the groundwater monitoring statement of work for drilling and installation[(b)] and specifications provided by Fluor Hanford, Inc. (FHI), Richland, Washington. During drilling and construction of the well, sampling and analysis activities were conducted to support field screening for radiological and chemical contaminants, to collect sediment grab samples for geologic descriptions, digital photography, and for archival in the Hanford Geotechnical Sample Library (HGSL).

This document provides a compilation of all available geologic data, spectral gamma ray logs, hydrogeologic data, and well information obtained during drilling, well construction, well development, pump installation, and sample collection activities. Appendix A contains the Well Summary Sheet, the Well Construction Summary Report, the geologist's borehole log, well development and pump installation records, the well survey results, and Non-Conformance Report # NCR-04-GRP-015. Appendix B contains sediment sieve analysis results. Appendix C contains complete spectral gamma ray logs and borehole deviation surveys.

(a) 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.

(b) Letter from JS Fruchter (Pacific Northwest National Laboratory, Richland, Washington) to JV Borghese (Fluor Hanford Inc., Richland, Washington), *Transmittal of Revised Scope of Work (SOW) for Drilling of Calendar Year 2004 RCRA Groundwater Monitoring Wells to Comply with the Hanford Federal Facility Tentative Agreement and Consent Order (Tri-Party Agreement) Change Request M-24-02-02, Proposed Schedule for Resource Conservation and Recovery Act (RCRA) Well Installation Interim Milestones in Support of Tri-Party Agreement Major Milestone M-24-00*, dated January 13, 2004.

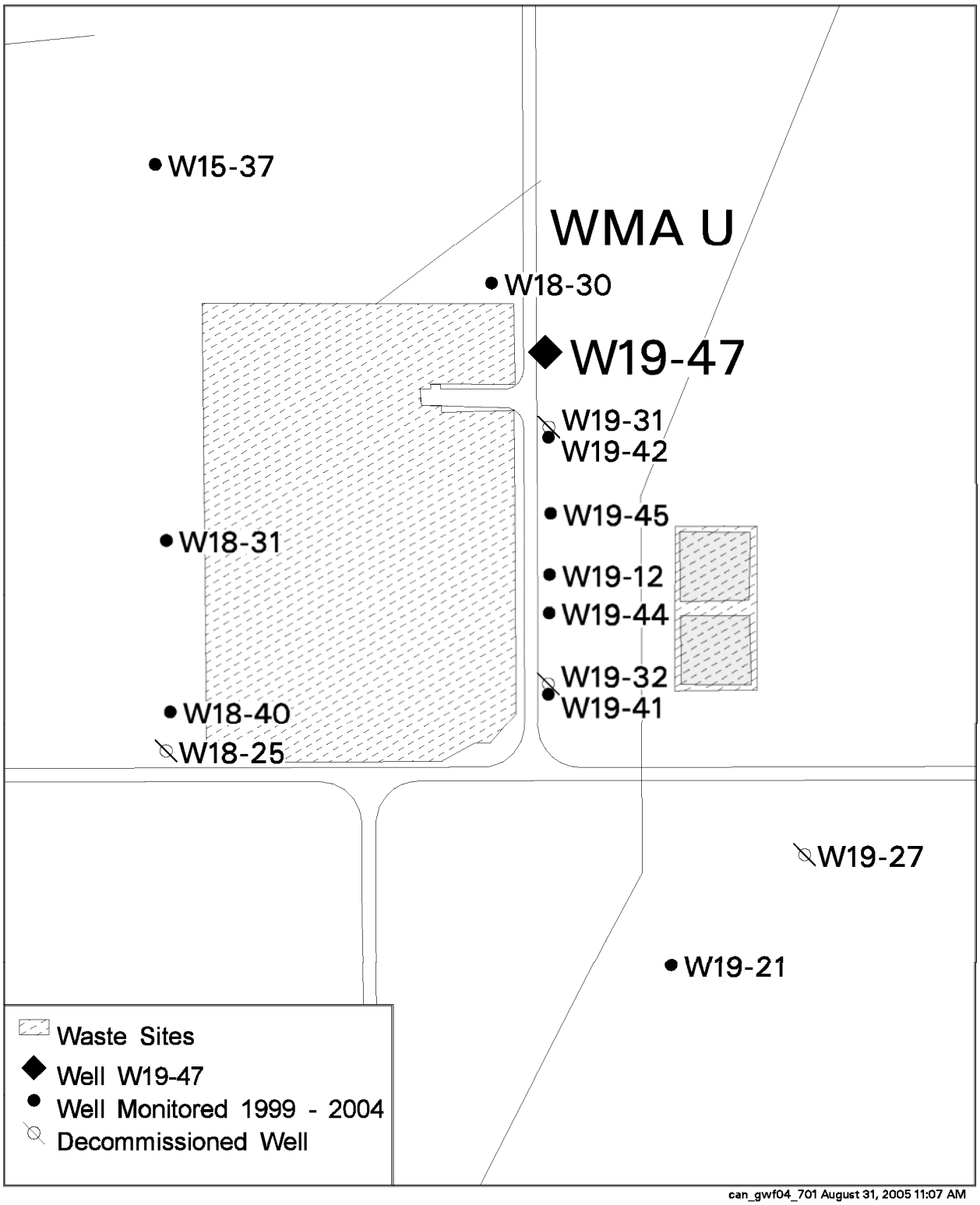


Figure 1. Map of Single-Shell Tank Waste Management Area U and Location of New and Existing Wells in the Groundwater Monitoring Network

Additional well construction documentation is on file with FHI. The Records Management Information System (RMIS) and the Hanford Well Information System (HWIS) [http://apweb02/cfroot/rapidweb/phmc/cp/hwisapp/] are two electronic databases that also contain drilling and construction records for this well.

English units are used in this report to describe drilling and well completion activities because that is the system of units used by drillers to measure and report depths and well construction measurements. 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.

2.0 Well 299-W19-47

Well 299-W19-47 (well ID C4258) is located to the northeast of the WMA U Tank Farm. The well is downgradient of WMA U and will help differentiate upgradient groundwater contamination from contaminants potentially released at the WMA.

2.1 Drilling and Sampling

Well 299-W19-47 (well ID C4258) was drilled with a cable tool drill rig from surface to a total depth of 269 feet below ground surface (bgs). Temporary 12-inch outside diameter (OD) casing was used during drilling to total depth. Drilling began on April 24, 2004, and total depth was reached on May 24, 2004.

Grab samples of sediment for geologic description, digital photography, and archival were collected at ~5-foot intervals from ground surface to total depth. Two split-spoon samples were also collected from drill depths of 226 feet bgs and 260 feet bgs and evaluated for physical property analysis (sieve analysis) to confirm screen selection.

Sediment encountered during drilling was predominantly unconsolidated coarse sand to gravelly sand of the Hanford formation Unit H1 from ~7 feet bgs to a depth of 45 feet bgs. Above the Hanford formation are recent deposits. The sand and silty sand of the lower Hanford H2 unit comprises the sediment from approximately 45 to 124 feet bgs. The Cold Creek unit (CCU) (fine grained laminated to massive) is present from approximately 124 to 135.5 feet bgs and the lower Cold Creek “caliche” unit is present from 135.5 to 143 feet bgs. There is no indication that Ringold Formation Unit 4 fine-grained sediment was encountered. The top of Ringold Unit 5 silty sandy gravel is at approximately 143 feet bgs. The well was drilled to total depth in the Ringold Unit 5.

The field geologist’s detailed 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. The sieve analysis data and distribution curves are in Appendix B. A more detailed hydrogeologic interpretation of the borehole sediment is included in Section 6.0.

The borehole and drill cuttings were monitored regularly for organic vapors, ammonia, and radionuclide contaminants (i.e., alpha, beta, and gamma). Radionuclide monitoring indicated only background level measurements. Organic vapors up to 5 ppm were detected sporadically from about 205 feet bgs to total depth. No action was taken during drilling.

Spectral gamma ray geophysical logs were run in the temporary borehole in June by Stoller Corporation. A slight amount of cesium-137, near the minimum detection level (MDL, 0.2 pCi/g), was found sporadically throughout the borehole (Appendix C). Section 6.0 provides more details of this logging.

2.2 Well Completion

The borehole was completed as a shallow WAC 173-160 compliant resource protection well. The permanent casing and screen were installed in well 299-W19-47 in August 2004. A 35-foot-long, 4-inch-inside-diameter (ID), stainless steel, continuous wire-wrap 20 slot (0.02-inch slot) screen was set from 227.05 to 262.04 feet bgs. A 3-foot-long, 4-inch-ID stainless steel sump is attached to the bottom of the screen and extends from 262.04 to 265.02 feet bgs. The permanent well casing is 4-inch-ID, stainless steel from 227.05 feet bgs to 2 feet above ground surface.

The screen filter pack is composed of 10-20 mesh silica sand placed from 269 to 220.7 feet bgs. During completion the sand pack was surged with a surge block to settle the sand and remove fines from the screen interval. The annular seal is composed of 3/8-inch bentonite pellets from 220.7 to 215.8 feet bgs and granular bentonite crumbles from 215.8 to 10.7 feet bgs. The surface seal is composed of Portland cement grout from 10.7 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.

During well construction, as the temporary casing was being back pulled, approximately 4 feet of sluffed borehole sediment (sand) came in direct contact with the stainless steel well casing between 66 and 62 feet bgs. The Washington State Department of Ecology was informed of the nonconformance (NCR # NCR-04-GRP-015) and construction continued. The nonconformance report is included in Appendix A.

A vertical borehole survey was conducted using a downhole gyroscope in the completed well to determine the bottom location relative to the vertical projection. Survey results are discussed in Section 6.0 and located in Appendix C.

The vertical and horizontal coordinates of the well were surveyed by Fluor Federal Services on September 29, 2004. The horizontal position of the well was referenced to horizontal control stations established by the U.S. Army Corps of Engineers (USACE). The coordinates are Washington Coordinate System, South Zone, NAD83(91) datum. Vertical datum is NAVD 88 and is based on existing USACE bench marks. Survey data are included in Table 1 and Appendix A. The static water level was 227.55 feet bgs on August 24, 2004.

Table 1. Survey Data for New RCRA Well 299-W19-47 at WMA U

Well Name (Well ID)	Easting (meters)	Northing (meters)	Elevation (meters)	Comments
299-W19-47 (C4258)	566,895.31	135,161.86		Center of casing
			206.276	Top of casing, N. edge
			205.551	Brass survey marker
			206.282	Top pump base plate, N. edge
NOTES: Horizontal Datum is NAD83 (91); Vertical Datum is NAVD88; Washington State Plane Coordinates (South Zone); surveyed September 29, 2004.				

2.3 Well Development and Pump Installation

Well 299-W19-47 was developed on August 20 to 25, 2004, at three different intervals using a temporary, 5-horsepower submersible pump. The depth to water was measured at 229.82 feet below top of casing (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 11,818 gallons of water were pumped. Table 2 contains the well development results, including pump intake depth, pump rate, pump run time, drawdown, recovery time, final turbidity (NTU), stabilized conductivity, temperature, and pH readings.

A dedicated Redi-Flo-3, 0.5-horsepower Grundfos™ submersible sampling pump (model 5SQE05B-250NE) was installed in well 299-W19-47 on September 17, 2004. The sampling pump intake was set at 236.15 feet btc, approximately 6.2 feet below the water table, and connected to the surface with 3/4-inch-diameter stainless steel riser pipe.

Table 2. Well Development Information for Well 299-W19-47

Pump Rate (gpm)	Pump Intake Depth (ft btc)	Pumping Run Time (hr)	Drawdown (ft)	Final Turbidity Readings	Recovery Test Time
10-24	264.6	6.3	4.87	4.58 NTU, 253 µs/cm, 19.1 C, pH - 8.13	20 min (99.9%)
20-21	251.6	2.7	12.33	3.34 NTU, 257 µs/cm, 19.8 C, pH – 8.15	10 min (99.6%)
10	240.1	1.2	Not reported	1.54 NTU, 259 µs/cm, 18.1 C, pH - 8.10	15 min (98.6%)

ft btc = Feet below top of casing.
gpm = Gallons per minute.
NTU = Nephelometric turbidity unit.
µs/cm = Micro siemens per centimeter.

3.0 Sampling and Analysis During Drilling

This section describes the collection and analysis of sediment samples collected during drilling from wells 299-W19-47.

3.1 Field Screening

The drill cuttings from all the wells were screened in the field for volatile organic and combustible and/or hazardous gas contamination, beta-gamma activity, and alpha activity by radiation control technicians (RCT) and site safety staff. Subsurface spectral gamma logs were also evaluated for gamma-emitting contaminants, and details are discussed in Section 6.0.

Alpha radiation was detected at one location on the drill string but determined to be radon. Radiation screening of cuttings revealed only natural background levels. No actions were required. The cuttings were also screened for volatile organics and other potential hazardous gases using an organic vapor monitor (OVM) photo-ionization detector, an ammonia monitor, and a multi gas/combustible gas monitor. Organic vapors, up to 5 ppm, were detected sporadically below 200 feet in the borehole. No action was required. Results of field screening for radiation and gases during drilling are indicated on the geologist's borehole logs in Appendix A.

3.2 Sediment Sampling

Sediment samples were collected for geologic description, digital photography, and the soil archives from the borehole at 5-foot intervals from ground surface to total depth. The geologic descriptions of these samples are contained in the wellsite geologist's borehole logs in Appendix A. The archive grab samples are contained in 1-pint glass jars, labeled by depth and well number. These jars are stored in the HGSL, which is located at Building 3718A/B in the 300 Area. In addition to the archived jars, sediment grab samples from each 5-foot depth interval were placed in 1-inch by 2-inch plastic sample trays to create a digital photographic log for each well. These small trays do not include the coarser grain size from the gravels. The digital photographic log is included with the composite log in Section 6.4. All sediment sample depths and/or intervals are documented in the geologist's borehole logs located in Appendix A.

Prior to well completion two split-spoon samples were collected from the proposed screen interval. These samples were sieved for particle size distribution to provide data for screen slot size confirmation/ selection. Sieve data and distribution curves are available in Appendix B.

4.0 Spectral Gamma Ray Logging

A high resolution spectral gamma-ray survey was conducted in the borehole by Stoller Corporation to determine the presence and concentration of manmade and naturally occurring gamma-emitting radio-nuclides in the surrounding sediment. Survey measurements were made at a "move-stop-acquire" mode at a rate of 200 seconds per foot. Neutron-moisture logging was not conducted. The geophysical logs

have been evaluated and correlated to the geologic log data for each borehole and the results are presented in the composite log in Section 6.4. The geophysical log, including the detailed log data report is provided in Appendix C. The log report describes calibration requirements, data processing, and log plots.

Well 299-W19-47 (C4258) was logged between June 2 to 7, 2004, using the gamma-ray tool from ground surface to 268.0 feet bgs inside temporary carbon steel casing with an approximate outside diameter of 12 inches. A repeat section was run from 80 to 106 feet bgs. As reported by Stoller Corporation, cesium-137 was the only gamma-emitting manmade radionuclide detected during geophysical logging. The cesium-137 was detected at a few sporadic locations in the borehole near the 0.2 pCi/g MDL.

5.0 Borehole Gyroscope Survey

A downhole deviation survey using a borehole gyroscope were performed in well 299-W19-47 following construction to determine how plumb or vertical the well is and to determine the vertical and horizontal location coordinates of the total depth relative to the borehole surface location. These data are used to determine the extent of borehole deviations created during drilling. A three-dimensional plot showing a hypothetical vertical well and the true attitude of the deviated well is provided in Figure 2. Further gyroscope information can be found in Appendix C.

In well 299-W19-47 (C4258), results show that at a measured cable depth of 254.60 feet, the true vertical depth of the well is 254.57 feet, a difference of only 0.03 feet. Thus, the deviation from vertical results in a depth error of less than 0.1 feet.

6.0 Subsurface Characterization Results

Results from sediment sampling, physical property analysis, geologic logs, spectral gamma logs, and well development for well 299-W19-47 are correlated to provide an interpretation of the geology at the borehole. This section includes a discussion of the criteria used to evaluate and interpret the data. The composite log in Figure 3 illustrates the interpreted hydrogeology developed for this well. These interpretations are consistent with Smith et al. (2001) and Williams et al. (2002).

6.1 Physical Properties

There was no analysis for physical properties conducted on samples from this well except sieve analysis for particle size distribution from split-spoon samples collected from the screen interval. Particle size distribution results are provided in Appendix B.

Grab samples collected at 5-foot-depth intervals are described on the geologist's borehole log located in Appendix A. The wellsite geologist's graphic representation of the borehole log is illustrated in the composite log (Figure 3). The sample quality and formation representativeness of the grab samples, and

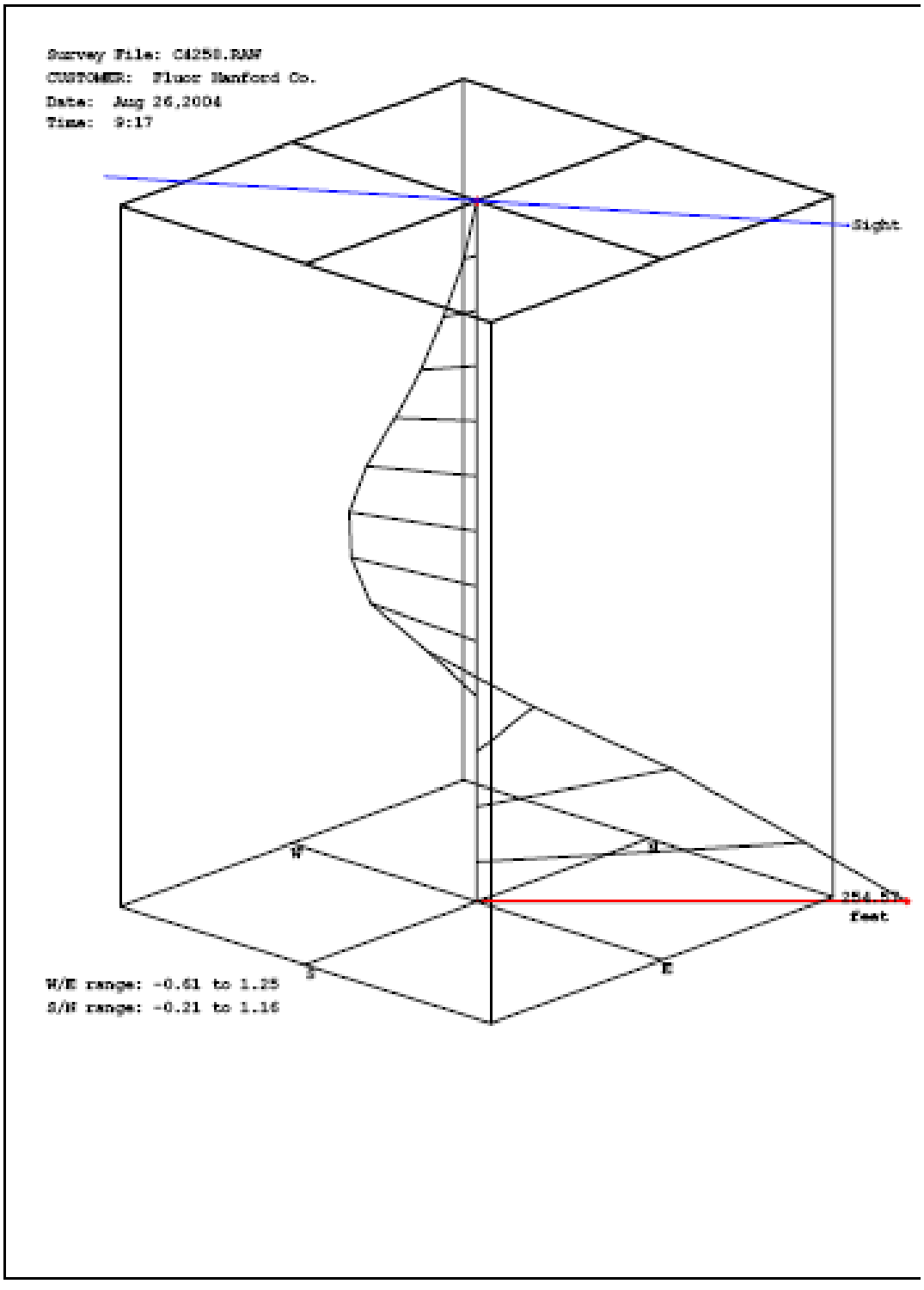


Figure 2. Vertical Profile and Bottom Hole Projections of Well 299-W19-47

thus the borehole log descriptions are limited due to the nature of the drilling. The cable tool and hard-tool drilling process may have mixed the sediment cuttings from different depth intervals before the cuttings were brought to the surface. When thin beds or sharp contacts were drilled, the returned sediment that was collected may not be completely correlated to their representative depth intervals.

The spectral gamma logs can indicate the presence of sharp contacts and/or changes in lithology and can be used to corroborate changes examined in the returned cuttings. The integration of these data sets is illustrated in the composite log (Figure 3).

6.2 Sediment Digital Photographic Log

A digital photographic log of drill cuttings is included in the composite log for the well (Figure 3). Grab samples from the cuttings return line were collected for lithologic descriptions documented in the borehole log in Appendix A, for sediment archives, and for digital photography. The photographic log presentation, compiled from 1-inch by 2-inch chip tray samples, collected at 5-foot depth intervals, provides a qualitative visual tool that reveals changes in major lithologic intervals (i.e., grain size, color, and relative moisture). The digital photographic log provides a means to illustrate subsurface lithology and related hydrogeologic features. The interpretative value of these logs is limited by the sample collection technique, discussed earlier, and sample container size.

6.3 Spectral Gamma Ray Logging

Based on processing by Stoller Corporation, cesium-137 was the only manmade gamma-emitting radionuclide detected in the well (details in Appendix C). This contaminant is mainly near the surface in the borehole near the MDL of 0.2 pCi/g. Appendix C provides more details about the cesium-137 detected in the boreholes.

These data are used in the geology interpretation presented in Section 6.4. No discussion of the shallow gamma ray inflections at less than 30 feet bgs is included because these inflections are difficult to correlate, reflecting dramatic changes due to shallow contamination, backfill materials, multiple casing strings, and/or recently deposited loose sediments.

For well 299-W19-47 (C4258), the gamma log plots of the naturally occurring gamma-emitting radionuclides (potassium, uranium, and thorium) indicate there are several distinct activity changes marked by inflection points at depths of ~45, 123, 135.5, 143, and 226 feet bgs. These major changes correlate to either lithologic features such as bedding contacts and/or thin contrasting lithologic intervals or the water table (Figure 3).

6.4 Composite Logs

A composite log has been assembled for well 299-W19-47 using the well as-built diagram, the geologic descriptions of the sediment and representative graphic log, the digital photographic log, and the geophysical log. Stratigraphic contacts and key lithologic changes are identified where possible. The composite log for the new well is illustrated in Figure 3. These interpretations are consistent with Smith et al. (2001) and Williams et al. (2002). Recent surficial sediments composed of reworked Hanford, eolian deposits, and/or tank farm backfill sediments overlie the area and range in thickness from 1 foot up to approximately 20 feet bgs.

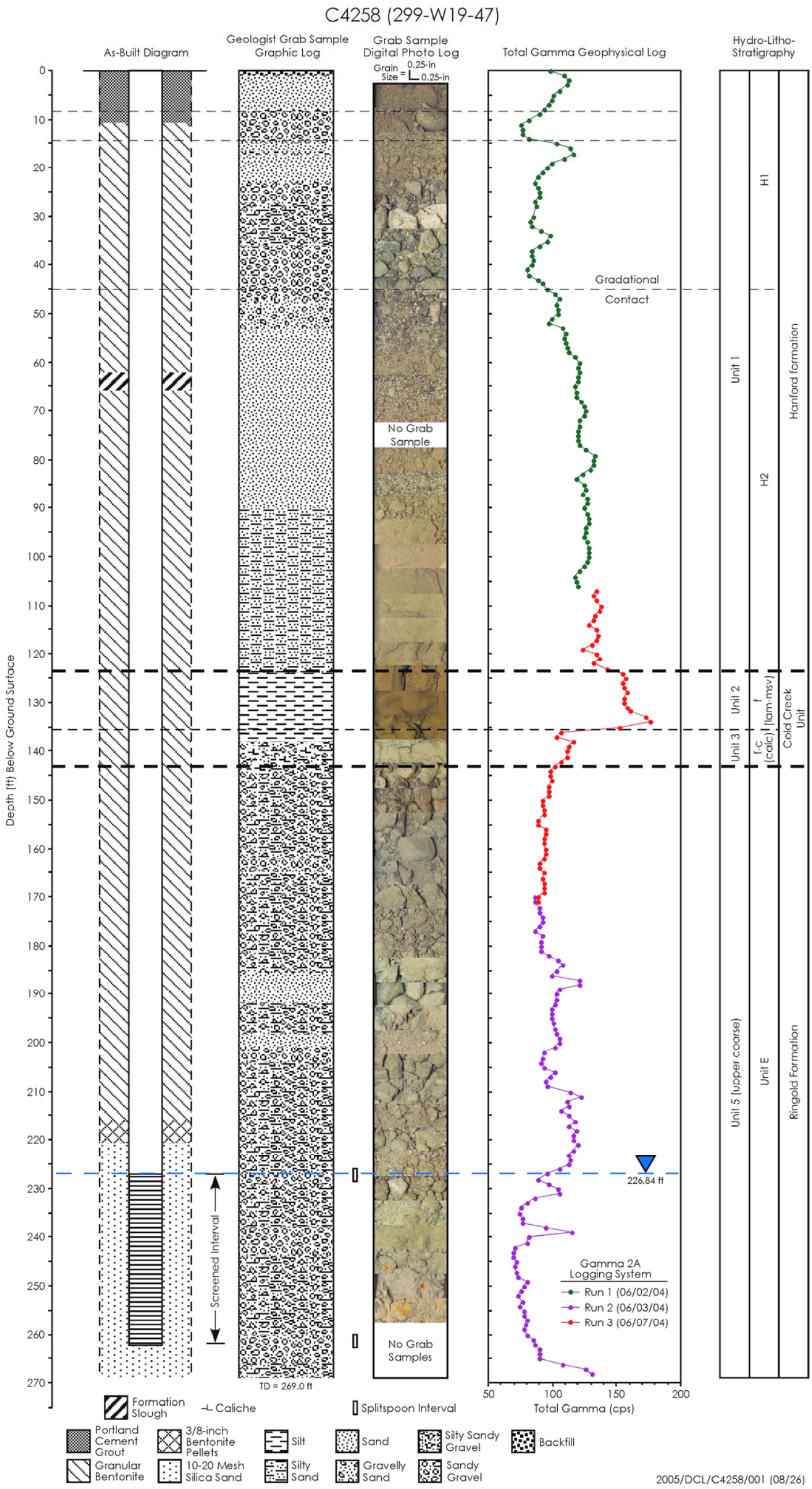


Figure 3. Hydrogeologic Interpretation for Well 299-W19-47 near Single-Shell Tank Farm WMA U

The Hanford formation comprises approximately 115 feet thick (~8 to 123 feet bgs) of the vadose zone and is composed of unconsolidated sediments ranging in grain size from cobble to pebble gravel, coarse to fine grained sand, silty sand and silt. Below 30 feet, there are two distinct contacts. The first contact is gradational and is selected at about 45 feet bgs. It separates the Hanford formation upper coarse grained gravelly sequence (H1 unit) from the finer grained sand sequence (H2 unit). The second contact at 123 feet bgs identifies the boundary between the Hanford formation H2 unit sequence and the underlying Cold Creek (formerly the Palouse Soil) Unit 2 silt.

The Cold Creek Units 2 and 3 (contact at 135.5 feet bgs) are differentiated by the increase in calcium carbonate cementation that sometime begins in the lower portion of the silt and other times is found in the underlying sandy to gravelly interval. Unit 3 is also called the Caliche interval.

The Ringold Unit 5 contact with the overlying Cold Creek Unit 3 is at approximately 143 feet bgs. This coarse silty sandy gravel unit comprises the lower half of the vadose zone and the uppermost unconfined aquifer beneath WMA U. The selection of these contacts is based on dominant grain size intervals and differences identified by the geologist sample descriptions. These changes in lithology are illustrated by the digital photographic logs. Contacts are also identified by the inflections and general curve fitting from the spectral gamma-ray logs. For each borehole, the inflections are dashed on the respective composite logs to imply a unit boundary or contact.

The thickness of the uppermost unconfined aquifer was not determined in new well 299-W19-47, but more details about the aquifer thickness and groundwater conditions are available in Smith et al. (2001) and Williams et al. (2002).

7.0 References

Atomic Energy Act of 1954 (AEA). 1954. As amended, Ch. 1073, 68 Stat. 919, 42 USC 2011 et seq.

Byrnes ME and BA Williams. 2003. *Data Quality Objectives Summary Report for Establishing a RCRA/CERCLA/AEA Integrated 200 West and 200 East Area Groundwater Monitoring Network*, CP-15329, Rev. 0. Prepared by Fluor Hanford, Inc. for the U.S. Department of Energy, Richland, Washington.

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

Ecology - Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy. 1989, as amended. *Hanford Federal Facility Agreement and Consent Order*. Document No. 89-10, (The Tri-Party Agreement), Olympia, Washington.

NAD83 (91) North American Datum of 1983 (1991 adjustment).

NAVD. 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.

Smith RM, BA Williams, and FN Hodges. 2001. *Groundwater Quality Assessment Plan for Single-Shell Tank Waste Management Area U*. PNNL-13612, Pacific Northwest National Laboratory, Richland, Washington.

Washington Administrative Code (WAC). *Minimum Standards for Construction and Maintenance of Wells.* WAC 173-160, Washington Administrative Code, Olympia, Washington.

Williams BA, BN Bjornstad, R Schalla, and WD Webber. 2002. *Revised Hydrogeology for the Suprabasalt Aquifer System, 200-West Area and Vicinity, Hanford Site, Washington*. PNNL-13858, Pacific Northwest National Laboratory, Richland, Washington.

Appendix A

Geologic Logs, Well Construction and Completion Documentation

WELL SUMMARY SHEET

Start Date 04/23/04
Finish Date. 08/09/04
Page 1 of 2

Well ID: C4258
Well Name 299-W19-47
Location East side of WMA-4 | 200 West
Project. RCRA | CERCLA drilling. FY 2004
Prepared By Charlene Martinez Date: 08/11/04
Reviewed By L.D. Walker Date. 8-24-04
Signature Charlene Martinez
Signature. LD Walker

CONSTRUCTION DATA

Description	Diagram
11 7/8"	10 3/8" temporary casing used.	
6" ID SS304 protective casing set + 1.0' above permanent.	
4" ID SS304, sch.5 riser: + 2.0' → 227.05'	
Portland Cement: 0' → 10.7'	
Granular Bentonite: 10.7' → 215.8'	
*Formation Slough 62.3' → 66.3'	
3/8" Bentonite Pellets: 215.8' → 220.7'	
10-20 mesh Colorado Silica Sand: 220.7' → 269'	
4" ID SS304, sch.5, 0.020-inch cont. wire-wrap wellscreen: 227.05' → 262.04'	
All depths in feet below ground surface	
All temporary casing removed from ground.	

GEOLOGIC/HYDROLOGIC DATA

Depth in Feet	Graphic Log	Lithologic Description
0		0'-1' Backfill material
		1'-8' SAND(S) Hanford fmtn
		8'-15' sandy GRAVEL(sG)
		15'-16.5' SAND(S)
		16.5'-17.5' sandy GRAVEL(sG)
40		17.5'-23' SAND(S)
		23'-27' sandy GRAVEL(sG)
		27'-36' silty sandy GRAVEL(msG)
		36'-47' sandy GRAVEL(sG)
		47'-53' gravelly SAND(gS)
80		53'-90' SAND(S)
		90'-124' silty SAND(mS)
120		124'-138' SILT(m) (Cold Creek unit)
		138'-145' CALICHE. Silty Sandy Gravel (msG)
		145'-162' Silty Sandy GRAVEL (msG)
160		162'-165' Sandy GRAVEL(sG)
		165'-185.5' Silty Sandy GRAVEL (msG)
		185.5'-192' sand (S)
200		192'-198.5' silty sandy gravel (msG)
		198.5'-201' sand (S)
		201'-204' sandy gravel (sG)
		204'-227' silty sandy gravel (msG)
		227'-229' sandy GRAVEL(sG)

A-6003-643 (03/03)

WELL SUMMARY SHEET

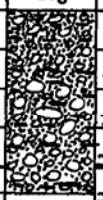
Start Date 04/23/04
Finish Date 08/09/04
Page 2 of 2

Well ID: C4258
Well Name 299-W19-47
Location East side of WMA-U/200 West
Project: RCRA/CERCLA drilling, FY 2004
Prepared By: Charlene Martinez
Date 08/11/04
Reviewed By: L.D. Walker
Date 8-24-04
Signature: Charlene Martinez
Signature: L.D. Walker

CONSTRUCTION DATA

Description	Diagram
4" ID SS304, sch. 5 sump: 262.04' → 265.02'	
	TD=>269' bgs
NCR-04-GRP-015 issued on the formation slough condition at 62.3' → 66.3'	
All depths in feet below ground surface:	
All temporary casing removed from ground.	

GEOLOGIC/HYDROLOGIC DATA

Depth in Feet	Graphic Log	Lithologic Description
240		229'-238' silty sandy GRAVEL (msG)
		238'-244' sandy GRAVEL (sG)
		244'-260' silty sandy GRAVEL (msG)
		260'-266' sandy GRAVEL (sG)
		266'-269' silty sandy GRAVEL (msG)
280		TD @ 269' bgs
		Static water => 226.84' bgs (08/09/04)

A-6003-643 (03/03)

WELL CONSTRUCTION SUMMARY REPORT

Start Date 04/23/04
Finish Date 08/25/04
Page 1 of 1

Well ID C4258 | Well Name 299-W19-47 | Approximate Location East side of 200A-U / 200 West
Project RCRA / CERCLA Drilling, FY 2004 | Other Companies FH, CH6
Drilling Company Blue Star Enterprises | Geologist(s) C. Martinez, J. Whalen, D. Weekes
Driller David Curry License # 2617

TEMPORARY CASING AND DRILL DEPTH			DRILLING METHOD	HOLE DIAMETER (in.) / INTERVAL (ft)
*Size/Grade/Lbs Per Ft	Interval	Shoe O D / I D	Auger	Diameter ____ From ____ to ____
4 7/8 / 10 3/4 CS, FJ	0' - 268'	20" / 10 3/4"	Cable Tool (drive barrel)	Diameter 8 5/8" From 0' to 95'
	____ - ____		Air Rotary	Diameter ____ From ____ to ____
	____ - ____		A R w/Sonic	Diameter ____ From ____ to ____
	____ - ____		Cable tool (hard tool)	Diameter 10" From 95' to 140'
	____ - ____		Cable tool (drive barrel)	Diameter 8 5/8" From 140' to 241'
*Indicate Welded (W) - Flush Joint (FJ) Coupled (C) & Thread Design			Cable tool (DB)	Diameter 9 1/2" From 241' to 265'
			Cable tool (DB)	Diameter 8 5/8" From 265' to 269'
			Drilling Fluid N/A	
Total Drilled Depth 269'	Hole Dia @ TD 8 5/8"		Total Amt Of Water Added During Drilling	
Well Straightness Test Results Passed on 04/08/04 using 20' long CS, 9 7/8" OD Tool.			Static Water Level 226.84'	Date 08/09/04

GEOPHYSICAL LOGGING

Sondes (type)	Interval	Date	Sondes (type)	Interval	Date
Spectral Gamma	0' - 268'	06/02, 06/03 & 08/09/04		____ - ____	
	____ - ____			____ - ____	
	____ - ____			____ - ____	

COMPLETED WELL

Size/Wt /Material	Depth	Thread	Slot Size	Type	Interval Annular Seal/Filter Pack	Volume	Mesh Size
4" ID SS 304 Sch 5 riser	+4 - 227.05'	FJ80	N/A	Portland Cement (94#)	0' - 10.7'	7	N/A
4" ID SS 304 Sch. 5 wellscreen	227.05' - 262.04'	FJ80	0.020"	Granular bentonite (50#)	10.7' - 215.8'	196	N/A
4" ID SS 304 Sch 5 sump	262.04' - 266.02'	FJ80	N/A	Bentonite Pellets (50#)	215.8' - 220.7'	7	3/8"
	____ - ____			Colorado Silica Sand (60#)	220.7' - 269'	42	10-20
	____ - ____				____ - ____		

OTHER ACTIVITIES

Aquifer Test well development	Date 08/23/04 to 08/25/04	Well Decommission	Yes	No	Date
Description B 244.6 | M 251.6 | T 240.1 | Final Turb (NTU) 4.59 (S) | 3.34 (M)		Description			
154 NTU. 6pm: B 24, 22, 31, 10 | M 21, 20 | T 10					

WELL SURVEY DATA (if applicable)

	Protective Casing Elevation
Washington State Plane Coordinates	Brass Survey Marker Elevation

COMMENTS / REMARKS

Vol. calcs: P.C. => 7 bags * 1.285 ft^3/bag = 9.00 ft^3, Granules => 196 bags * 0.71 ft^3/bag = 139.16 ft^3.
Pellets => 7 buckets * 0.62 ft^3/bucket = 4.34 ft^3; 10-20 sand => 62 bags * 0.535 ft^3/bag = 33.17 ft^3

Reported By	Title	Signature	Date
Charlene Martinez	Geologist	Charlene Martinez	09/14/04

A-6003-658 (04/03)

BOREHOLE LOG

Page 1 of 7

Date: 04/23/04

Well ID: C4258 | Well Name: 299-W19-41 | Location: East side of WMA-4 | 200 West

Project: RCRA/CERCLA drilling \FY 2004 | Reference Measuring Point: Ground Surface

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
0	DB 0-5'	n/a		0'-1' Backfill material. silty sandy gravel	Cable tool drilling using 11 3/4" OD ss temp. casing
				1'- 4' Sand(S) 100% vfn-fn grained, well sorted, SR-R, non-basaltic. 2.5Y4/3 olive brown (moist). weak to no rxn HCl.	Drive barrel to 8.5/8" OD
5	Grab DB				collect 5' archive.
				3'- 15' sandy GRAVEL(sG) 35% gravel, 45% sand, 6ravel, poorly sorted, SR-SA, sm pebbles-sm cobbles, mps ~ 3", CaCO3 coating w/ strong rxn HCl. 55% basalt, 45% qtz/other. Sand, SR-R, well sorted vfn-fn, non-basaltic. 2.5Y 4/3 olive brown, moist. strong rxn HCl.	
10	Grab DB 9-10'				collect 10' archive
				@ 14' bgs gravel increasing to 55% sand 45% gravel 45% basalt, 55% qtz/other. Sand graded to poorly sorted SR-SA, vfn-vcse grained, 30% basalt, 70% qtz/other 2.5Y4/3 olive brown moist. mod. rxn HCl.	@ 14.5' bgs. v compact sand lens, vfn-fn grain non basaltic ~ 0.5' thick 2.5Y5/3 light olive brown (moist) weak to no rxn HCl
15	Grab DB 14-15'				collect 15' archive
				15'-16.5' SAND(S) 97% sand, 3% silt. Sand, SR-R, vfn-vcse, mod sorted 15% basalt, 85% qtz/other. 2.5Y 5/3 lt. olive brown. no rxn HCl.	lg. quartzite fragment ~ 9" (12' bgs)
20	Grab DB 19-20'				collect 20' archive
					17.5' sporadic silt lenses ~ 0.1' thick
25	Grab DB 24-25'			16.5'-17.5' Sandy GRAVEL(sG) 65% gravel 30% sand, 5% silt. Gravel, v. poorly sorted, sm pebbles to cobbles, mps ~ 9" 55% basalt, 45% qtz/other, R-A.	collect 25' archive sporadic vfn grained sand lens @ 25' bgs.
				Sand, SR-SA, vfn-vcse, poorly sorted, 80% basalt, 20% qtz/other 10 YR 3/2 very dark grayish brown (moist).	Trace caliche @ 27' bgs. strong rxn HCl.
30	Grab DB 29-30'				collect 30' archive
				17.5'-29' Sand(s) Similar to above	Trace caliche @ 30' bgs. Increased moisture @ 30' bgs gravel sm pebbles-lg pebbles @ 31' mod. sorted
35	Grab DB 34-35'			29'-34' Sandy GRAVEL(sG) 45% gravel 55% sand, 5% silt. Gravel, v. poorly sorted, 50% basalt, 50% qtz/other, SR-A mps ~ 9", Sand, Mod sorted, SR-SA, vfn-vcse.	collect 35' archive. E.O.S. @ 35' bgs (04/22/04) Start (04/22/04)

Reported By: Charlene Martinez | Reviewed By: L. D. Walker

Title: Geologist | Title: Geologist

Signature: Charlene Martinez | Date: 04/23/04 | Signature: L D Walker | Date: 6/10/04

A-6003-642 (03/03)

BOREHOLE LOG

Page 2 of 7

Date: 04/23/04

Well ID: C-4258 | Well Name: 299-W19-47 | Location: East side of WMA-4

Project: RCRA/CERCLA drilling/FY2004 | 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	DB 8 5/8"	N/A		@39' sand graded to poorly sorted, vfn-vcse. Sporadic, vfn grained sand stringers (non-basaltic)	Cable tool using 8 5/8" DB. Collect 40' archive. @43' sand graded to poorly sorted, vfn-vcse grained.
45	DB 8 5/8"			37'-36' Silty Sandy GRAVEL (msG) 60% gravel, 30% sand, 10% silt. Gravel SE-A, v. poorly sorted, sm pebbles-lg cobbles. 55% basalt, 45% qtz/other. Sand, SE-SA, mod. sorted, 20% basalt, 80% qtz/other. Trace mica. 2.5Y 5/3 brownish gray (dry). Strong rxn HCl.	Collect 45' archive. A.m. TH ck. organics c datedable. Collect 50' archive.
50	DB 8 5/8"			36'-47' Sandy GRAVEL (sG) 90% gravel, 55% sand, 5% silt. Gravel, 55% basalt, 45% qtz/other, SA-R, mod. sorted sm-lg pebbles. Sand, SR-SA, mod sorted, vfn-vcse grained, 15% basalt, 85% qtz/other. 10YR 4/2, very dark grayish brown (moist) weak to no rxn HCl.	Trace caliche @ 53' bgs. strong rxn HCl. Collect 55' archive. A.m. RCT ck @ background
55	DB 8 5/8"			47'-53' gravelly SAND (gS) 15% gravel, 80% sand, 5% silt. Gravel, SR-A, poorly sorted, sm. pebbles-sm. cobbles, 60% basalt, 40% qtz/other. Sand, poorly sorted, SE-SA, vfn-vcse, 20% basalt, 80% qtz/other. 2.5Y 4/3 light olive brown (moist) weak to no rxn HCl. @ 52' bgs, gravel decreasing to R-10%	@60' v. compact sand lens. non-basaltic micaceous, R, vfn-med. grained, well-sorted. 2.5Y 4/4, olive brown (moist) Fe oxide staining. No rxn HCl. Collect 65' archive
60	DB 8 5/8"			53'-90' SAND (S) 5% gravel, 90% sand, 5% silt. Gravel, well sorted, R basaltic. Sand, SE-SA, poorly sorted, vfn-vcse, 20% basalt, 80% qtz/other. 2.5Y 4/3 light olive brown (moist) no rxn HCl. @62' sand graded to mod. sorted, non-basaltic, vfn-vcse grained. @72' sand graded to poorly sorted, vfn-vcse grains. 15% basalt, 85% qtz/other. Sporadic fn-vfn grained sand nodules between 60'-79' bgs	@69' v. fn-fn grained sand lens similar to 60' Collect 70' archive. P.m. RCT ck. of B.K @ background. 75' archive not collected @ 79' vfn-fn grained sand nodules.
65	DB 8 5/8"				
70	DB 8 5/8"				
75	DB 8 5/8"				

Reported By: Charlene Martinez | Reviewed By: L.D. Walker

Title: Geologist | Title: Geologist

Signature: Charlene Martinez | Date: 4/23/04 | Signature: L.D. Walker | Date: 6/10/04

A-6003-642 (03/03)

BOREHOLE LOG

Page 3 of 7

Date: 04/26/04

Well ID: C4258 | Well Name: 299-W19-47 | Location: East side of WMA-U 200 west

Project: RCRA/CERCLA drilling, FY2004 | 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	DB 8 5/8"	N/A		@76' sand graded to mod sorted vfine-se grained, SR-R, non basaltic	Cable tool using 8 5/8" DB
	Grab DB 8 5/8"				Collect 80' archive.
				@79.5' sand graded to well-sorted vfn-fn grained, R, non-basaltic	R.M. Thick. organics Undetect
				@82.5' bgs sand graded to mod.-sorted fn-cse, SR-SR, 20% basalt, 80% qtz/other	
85	Grab DB 8 5/8"				Collect 85' archive.
				@88' sand graded to well sorted, SR-R vfn-fn grained.	E.O.S. @ 85' bgs (04/26/04)
					Start 04/27/04
					Cold Creek Unit 124' bgs
				90'-124' Silty SAND (mS) 12% sand, 88% silt. Sand SR-R, vfn-fn, well sorted, 20% basalt, 80% qtz/other, trace mica. Compact silt nodules, non-plastic. 2.5Y 5/3 IT. olive brown (moist) weak rxn HCl (silt). Sand no rxn	@89' compact silt lens. laminar bedding, mod. rxn HCl. non-plastic 2.5Y 4/4 IT. yellowish brown (moist)
90	Grab DB 8 5/8"				Collect 90' archive
					R.M. BGT ck. = background
				@92' silt nodules increasing in thickness (~0.2' thick), mod rxn HCl.	@ 300 cpm. Spoils @ 500 ppm no ∝ detected.
95	Grab HT 10"				Collect 95' archive
				@100' slurry dried out, sample is still silty sand as above.	Changed over to Hard tool bit. 10" wide.
100	Grab HT 10"				Collect 100' archive (slurry)
				* note: ~ 285 gallons of water were added to the borehole during the hard tool drilling	
105	Grab HT 10"				Collect 105' archive (slurry)
					E.O.S. @ 108' bgs (04/27/04)
					Start 04/28/04 (slurry)
110	Grab HT 10"				Collect 110' archive.
					R.M. BGT ck. ∝ ≤ background
115	Grab HT 10"				Collect 115' archive (slurry)

Reported By: Charlene Martinez | Reviewed By: L.D. Walker

Title: Geologist | Title: Geologist

Signature: Charlene Martinez | Date: 04/26/04 | Signature: L.D. Walker | Date: 6/10/04

A-6003-642 (03/03)

BOREHOLE LOG

Page 4 of 7

Date: 04/28/04

Well ID: C4258 | Well Name: 299-W19-47 | Location: East side of WMA A | 200 West Area

Project: RCRA/CERCLA drilling, FY 2004 | 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	HT 10"	1 1/4		124'-138' SILT (m) 100%. Compact, non-plastic. 2.5Y5/3 lt olive brown, moist. Strong rxn HCl. Sample was in slurry form & allowed to dry till moist.	Cable tool using hard tool bit. 10" wide. Collect 120' archive (slurry). COLD CREEK UNIT @ 124'. Collect 125' archive (slurry).
125	Grab HT 10"				
130	Grab HT 10"				Collect 130' archive (slurry). P.m. RCT ck. d. 3X @ background. P.m. FH ck. organics < detectable.
135	Grab HT 10"				Collect 135' archive.
140	Grab DB 6 3/4"			138'-145' Caliche. Silty Sandy GRAVEL (msG) 60% gravel, 25% silt, 15% sand. Gravel poorly sorted, SA, fragmented, sm pebbles - cobbles, mps = 5". Sand, SR-SA, mod-sorted, vfm-csg grained, 10% basalt, 90% qtz/other. Fragmented caliche, mod-cementation, Fe oxide staining, micaceous, 2.5Y 4/3 olive brown (moist). Strong rxn HCl.	Collect 140' archive. E.O.S. @ 140' bgs (04/29/04). Start 04/29/04. A.m. FH ck. organics < detectable. using 378" D.B. (140' bgs). Collect 145' archive.
145	Grab DB 6 3/4"			145'-162' Silty Sandy GRAVEL (msG) 65% gravel, 22% sand, 13% silt. Gravel, poorly sorted, SA-R, sm pebbles - cobbles, mps = 5", 40% basalt, 60% qtz/other. Sand, SR-SA, poorly sorted, 10% basalt, 90% qtz/other, vfm- vcse grained, 2.5Y 5/3, lt olive brown (moist). No rxn HCl, micaceous.	Ringold "unit E" @ 145' bgs. E.O.S. @ 148' bgs (04/29/04). Start @ 148' bgs (04/30/04). Collect 150' archive.
150	Grab DB 6 3/4"				
155	Grab DB 6 3/4"			@ 147' bgs, silt increasing to 20%, sand decreasing to 20%, gravel decreasing to 60%. @ 155' silt decreasing to 15%	Collect 155' archive. P.m. RCT ck. Radon detected on gloves. 3X < background. P.m. FH ck. Organics clear.

Reported By: Charlene Martinez | Title: Geologist | Signature: Charlene Martinez | Date: 04/28/04

Reviewed By: L.D. Walker | Title: Geologist | Signature: L.D. Walker | Date: 6/10/04

A-6003-642 (03/03)

BOREHOLE LOG

Page 6 of 7

Date: 04/30/04

Well ID: C4258 | Well Name: 299-W19-47 | Location: East side of WMA-U 200 West

Project: RCRA/CERCLA drilling. FY 2004 | Reference Measuring Point: Ground Surface

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
160	DB 8⅝"	N/A		0160' silt decreasing to ~10% sand increasing to 30%.	Cable tool drilling using 8 5/8" OD drive barrel. Collect 160' archive
	Grab DB 8⅝"			162' - 165' sandy GRAVEL (sG) 60% gravel, 33% sand, 7% silt, Gravel, SR-A, v. poorly sorted, fragmented, sm pebbles - cobbles, maps ~ 6", 40% basalt, 60% qtz/other, Sand, SR-SA, mod-sorted, vfn-cse grained, 10% basalt, 90% qtz/other. Fe oxide staining. Slight cementation (Fe oxide + silica) 2.5Y 6/3 olive brown (moist) no rxn HCl.	E.O.S @ 162' bgs (04/30/04) Start 05/03/04
165	Grab DB 8⅝"				Collect 165' archive A.m/p.m. RCT ck. <3R@ background. duplicate A.m/p.m. IH ck. organics < ↓
170	Grab DB 8⅝"				Collect 170' archive (Added ~4 gals H2O
				165' - 185' silty sandy GRAVEL (msG) 65% gravel, 15% sand, 20% silt Gravel, 40% basalt, 60% qtz/other, R-A, poorly sorted, sm pebbles - cobbles, mes ~ 5", Sand, SR-SA, mod-sorted, vfn-cse, 15% basalt, 85% qtz/other 2.5Y 6/1 gray (dry). no rxn HCl between 170' - 180' mod cementation observed (silica & Fe oxide) cementation continues, gravel > 5% basalt ~ 55 gals water added between 174-184' bgs. @185' gravel decreased to 55%, sand increased to 35%, silt 10%, gravel, poorly sorted, R-A, fragmented, sand, non-basaltic, mod. sorted, vfn-cse, cementation => slight to moderate	@ 173' bgs, 1g basalt boulder (~11"). increase in clay w/mod. plasticity. @ 174' more clay, increased cementation, Fe oxide staining E.O.S @ 174' (05/03/04) start 05/04/04 A.m RCT ck. <3R@ background Collect 175' archive. A.m IH ck. organics < detect Collect 180' archive p.m RCT ck. <3R@ background E.O.S. @ 184' bgs (05/04/04) start 05/05/04 collect 185' archive.
175	Grab DB 8⅝"				
180	Grab DB 8⅝"				
185	Grab DB 8⅝"				
190	Grab DB 8⅝"			185' - 192' SAND(s) 90% sand, 10% silt. Sand, SR-SA, mod. sorted, non-basaltic micaceous, vfn-cse grained.	< smear @ 112 dpm start down drilling. resume drilling (radon). collect 190' archive.
195	Grab DB 8⅝"			192' - 198.5' silty sandy gravel (msG), moist, 2.5Y 6/1 gray 70% gravel 15% sand 15% silt, Gravel: 100% basalt, 100% others, R-A poorly sorted; sm pebbles → cobbles mps ~ 5". Sand, SR-SA, mod sorted vfn - cse, 15% basalt, 75% others non-HCl	P.M. IH OK. organics < detect I.M. RCT OK. EOS @ 194' (5/5/04) start 5/6/04 collect 195' archive Sand contact @ 1985'

Reported By: Barbara Martinez / Jack Whaley | Reviewed By: L. D. Walker

Title: Geologist | Title: Geologist

Signature: Barbara Martinez | Date: 04/30/04 | Signature: L D Walker | Date: 6/10/04

A-6003-642 (03/03)

BOREHOLE LOG

Page 6 of 7

Date: 5/6/04

Well ID: C4258 | Well Name: 299-W19-47 | Location: East side of WMA-4 / 200 West

Project: RCRA/CERCLA drilling | Reference Measuring Point: Ground Surface

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
200	Grab	NA		198.5'–201' SAND(S), 2.5Y6/2 light brownish gray (dry), moist, well sorted, med-coarse, A-SA, 10% bas, 90% qtz and other, micaceous, tr silt, slight rxn to HCl, some fine sand, no gravel	Cable tool drilling using 8 5/8" drive barrel. Collect 200' archive @ 0930. AM RCT < background. AM IH < detect.
205	DB 8 5/8"			201'–204' Sandy GRAVEL (sG), 50% grav, 50% sand, tr silt, 2.5Y6/3 light yellowish brown (dry), moist, poorly sorted, R-SR, 30% bas gravel, 70% other; sand is mostly f–m, A-SR, 20% bas, 80% other; slight rxn to HCl, large cobbles	EOS 202'. @ 204.5' RCT < background. Casing drives hard starting at ~201'. AM RCT < background. AM IH up to 45 ppm 11.8 eV OVM
210	Grab			204'–227' Silty Sandy GRAVEL (msG), 60% gravel, 25% sand, 15% silt, 2.5Y 6/2 light brownish gray (dry), material is moist due to adding water to borehole, v poorly sorted; gravel is 40% bas, 60% other, A-R; sand is 30% bas, 70% other, A-SR, tr mica; MPS ~ 3 in., somewhat cemented, slight rxn to HCl	PM RCT < background. PM IH 3-5 ppm 11.8 eV OVM. EOS 5/5/04 @ 210'
215	DB 8 5/8"				
220	Grab			227'–229' Sandy gravel (sG); 60% gravel, 40% sand; 2.5YR 5/8 lt. reddish brown (dry), v. poor sort, gravel same as above, cemented slightly, no rxn to HCl, sand med. grn. sch. ang.	
225	DB 8 5/8"				WL 227.3' 5/24/04. 5/20/04. End of shift @ 228.5'
	SS#1	100% rec.			
	DB	N/A		229'–238' Silty Sandy GRAVEL (msG), 60% gravel, 25% sand, 15% silt + clay, some as 204'–226', slight rxn to HCl, 2.5Y 6/3 light yellowish brown (dry), moist to wet, fines are moderately plastic	AM RCT background. AM IHT < D. PM RCT background. AM IHT ~3 ppm on mis on DB, no det in breathing zone. EOS @ 235' 5/21/04
230	Grab				
	DB 8 5/8"				
235	Grab				
	DB 8 5/8"			Fairly sandy from 235'–237'	

Reported By: DC Weekes / Jess Hocking | Reviewed By: L.D. Walker

Title: Geologist / Geologist | Title: Geologist

Signature: DC Weekes 6/1/04 | Date: | Signature: LD Walker | Date: 6/10/04

A-6003-642 (03/03)

BOREHOLE LOG

Page 7 of 7

Date: 5/24/04

Well ID: C4258 | Well Name: 299-W9-47 | Location: East side of WMA-4 | 200 West

Project: RCRA/CERCLA Drilling | Reference Measuring Point: Ground Surface

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
240	Grab DB 9½"	n/a		238'-244' Sandy GRAVEL (sG): 60-70% Gravel, 20-30% sand, 10% silt, 2.5Y 7/2 light gray (dry), wet, v poorly sorted; gravel is SR-WR, 20% bas, 80% other; sand is f-c, SA-R, 20% bas; MPS ~ 4"; no to slight rxn to HCl, mica common	AM RCT background. AM/AH <10. @241' switched to 8½" ID x 9½" OD drive barrel
245	Grab DB 9½"			Some silty zones mixed with sandy gravel.	Collect 245' archive. AM RCT background.
				244'-260' Silty Sandy GRAVEL (msG): 60-70% Gravel, 10-20% sand, 10-30% silt, 2.5Y 7/2 light gray (dry), wet, v poorly sorted; gravel is SR-WR, 20% bas; sand is f-c, SA-R, 20% bas; MPS ~ 4", no to slight rxn to HCl, Very little mica	
250	Grab DB 9½"				Collect 250' archive. AM/AH <10 organics, AM RCT background
				260'-266' Sandy GRAVEL (sG) 70% gravel, 25% sand, 5% silt. Gravel v poorly sorted; SA-R, 10% basalt, 90% qtz lathes, mps ~ 4", Sand, SA-R, reformed grains, mod-sorted, 5-10% basalt, trace mica, moderate Fe oxide + siliceous cementation. 2.5Y 5/3 light olive brown (moist). No rxn HCl.	Collect 255' archive. Start shift ~ 257' bgs (05/28/04) End @ 260' (05/28/04) Start 06/01/04
255	Grab DB 9½"				
260	SS/AB DB 9½"	split spoon 100% rec			collect 260' archive. SS interval = 260-262.5' AM/AH <10 - 35 ppm organics (spoils drum)
		n/a		@ 265', gravel decreasing to 40% poorly sorted, 20% basalt, 80% qtz/other SA-R. Sand increasing to 20%, v poorly sorted, v fn-v cse grains, SA-R.	Collect 265' archive. Sand = heaving??
265	Grab DB 3½"			silt increasing to 10%.	
				@ 265.5' increasing Fe oxide staining + cementation.	Beginning @ 266.5' bgs sporadic sand lenses SR-R, well sorted, fn-med grained, non-basaltic, extensive Fe oxide staining.
270	TD @ 268' bgs			266'-268' Silty Sandy GRAVEL (msG) 55% gravel, 25% sand, 20% silt. Gravel, SR-R, poorly sorted, 20% basalt, 80% qtz/others. Sand, SR-SA poorly sorted, 25% basalt, 75% qtz/other. Extensive Fe oxide cementation. Manganese rich. Some $SaSO_4$ visible. 2.5YR 2.5/1 reddish black (moist) No rxn HCl.	v. compact matrix. No rxn HCl. 5Y 4/2 olive gray (moist) micaceous. Basalt fragment @ 267' bgs ~ 7.5" long.
275					

Reported By: DC Weekes / C. Martinez | Reviewed By: L. D. Walker

Title: Geologist | Title: Geologist

Signature: DC Weekes / C. Martinez | Date: 05/24/04 | Signature: L. D. Walker | Date: 6/10/04

A-6003-642 (03/03)

FIELD ACTIVITY REPORT - DAILY DRILLING

Page 1 of 2

Date: 8/20/04

Well ID: C4258 | Well Name: 299-W19-47

Location: EAST SIDE OF WMA-U / 200 WEST | Report No.: 28 (well development)

Start	Finish	Total
Time 0600	Time 1530	Time 9.5 hrs
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

Time/Depth From	Time/Depth To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
0600	0620	POD / SAFETY MEETING IN 200 EAST AREA.
0630		Geologist onsite, TAG WATER AT 229.82'.
1010		DRILL crew onsite - preparing for day's work-
		Bottom of well measured at 264.35' below TOC.
		267.94 - 264.35' = 3.59' of fine sediment in bottom of well.
1035	1145	Bailing sediment from well.
		Calibration check of meters.
		Turbidity meter Hach 2100P S/N 980600018371
		Standard Meter
		517 NTU 516 NTU
		52.2 51.9
		5.23 5.48
		pH Meter Oakton pH tester 3+
		buffer meter
		7.0 6.96
		10.0 9.98
		Conductivity: Orion Model 130A
		Standard meter
		1007 µS/cm 1010 µS/cm
	1150	Tag bottom at 267.9' below TOC. Well almost clear
1235	1316	running pump & riser pipe into well with pressure transducer at 1.48' above pump intake.

Reported By: DAVID TODAK | Title: Field Geologist | Date: 8-20-04 | Signature:

Reviewed By: L.D. Walker | Title: Geologist | Date: 9/21/04 | Signature:

A-6003-651 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING
Continuation Page

Page 2 of 2

Date: 8-20-04

Well Name: 299-W19-47 | Well ID: C4258

Location: East side of WMA-4 / 200 W. | Continuation of Report No.: 28

Time/Depth From	Time/Depth To	Description of Activities/Operations with Depth
1338		Pump on - kicks off. Stop test #2
1400	hr	Decision made to pull the submersible pump out of the well.
	1510	All equipment removed from well. DRILL crew securing site.
	1530	GEOLOGIST OFFSITE

Reported By: DAVID TODAK | Reviewed By: L.D. Walker

Title: Field Geologist | Date: 8.20.04 | Title: Geologist | Date: 9/21/04

Signature: | Signature: L D Walker

A-6003-652 (04/03)

WELL DEVELOPMENT AND TESTING DATA

Well Name:	Well ID:	Well Location:	Date:
299-W19-47	C4758	EAST SIDE of WMA-U / 200 WEST	8-23-04

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

Has the well been surveyed? ☐ Yes ☒ No

Does the well have a cement pad? ☒ Yes ☐ No

PART 1

STATIC WATER LEVEL:

Start of Job	229.9 (TOC)
End of Job	not measured

DEPTH TO BOTTOM:

Start of Job	267.9 (TOC)
End of Job	not measured

PART 2 Screen 230'-265' (TOC)

WELL DEVELOPMENT DATA

Pump Model	
Intake Depth	264.6 (TOC)
Starting Turbidity	>1000 NTU

Pump Start	Stop	Flow Rate
0912	1025	24 gpm
1125	1250	24 gpm
1523	1620	22 gpm

Total Pumped	5046 gallons
Final Turbidity	63.1 NTU
XD SN/Range (PSI)	8297/20 psi

PART 3

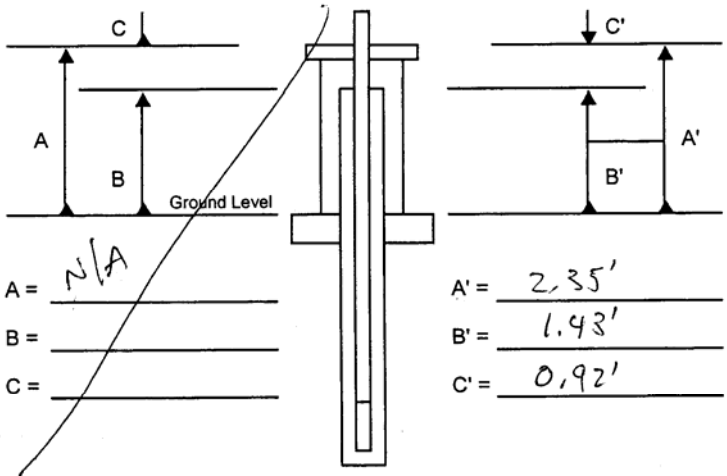
INSTANTANEOUS SLUG TEST

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

PART 4

Last Recorded Measurements Date: N/A

Current Measurements Date: 8-20-04



A = N/A

B = ____

C = ____

A' = 2.35'

B' = 1.43'

C' = 0.92'

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

PART 5

COMMENTS:

INITIAL XD = 34.11

NOTE THIS IS BOTTOM OF 3 INTERVALS. SEE DATA FOR this well FOR 8/24/04 and 8/25/04 FOR further details.

Prepared by (print name): DAVID TODAK	Signature:	Date: 8-25-04
Reviewed by (print name): L.D. Walker	Signature:	Date: 9/21/04

A-6003-644 (03/03

FIELD ACTIVITY REPORT - DAILY DRILLING

Page 1 of 2

Date: 8-23-04

Well ID: C4258 | Well Name: 299-W19-47

Location: EAST SIDE of WMA C, 200 WEST | Report No.: 29 (well development)

Start	Finish	Total
Time 0600	Time 1630	Time 10.5
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

Time/Depth From	Time/Depth To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
0600	0645	ADS/SAFETY MEETING in 200 EAST AREA
0700		Geologist + drill crew onsite preparing for day's work
	0715	TAG WATER AT 229.9' below TOC & bottom AT 267.9' below TOC; 267.94 - 267.9 = .04' sediment in sump.
0725	0845	Calibrating METERS & RUNNING PUMP/RISER PIPE INTO WELL WITH PRESSURE TRANSDUCER 248' ABOVE BOTTOM
		TURBIDITY METER HACH 2100P S/N 980600018371
		STANDARD 517 NTU — METER 519 NTU
		52.2 — 525
		5.23 — 5.38
		pH METER GARTON pH TESTER 3+
		BUFFER 7.0 — METER ~~7.07~~ 7.03
		10.0 — 10.01
		CONDUCTIVITY METER ORION MODEL 130A
		STANDARD 1007 — METER 1006
	0900	DRILLER HOOKING UP HOSES & PREPARING TO START PUMPING. ADVISED HIM THAT INTAKE IS ~0.5' into sump, he felt that would be OK.
0912		PUMPING WATER TEST STARTED, >1000 NTU TURBIDITY, 25 gpm.
	0918	pH - 8.52, conductivity 287 µS/cm, Temp 20.4° C, XD = 20.907'
	0933	XD = 18.992, TURBIDITY >1000 NTU, pumping 24 gpm, pH 8.36, conductivity 306 µS/cm, temperature 23.0° C.

Reported By: DAVID TOOAK — Title: Field Geologist — Date: 8-23-04 — Signature:

Reviewed By: L.D. Walker — Title: Geologist — Date: 9/21/04 — Signature: LD Walker

A-6003-651 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING
Continuation Page

Date: 8/23/04

Well Name: 299-W19-47 | Well ID: C4258

Location: EAST SIDE OF WMA-U / 200 WEST | Continuation of Report No.: 29

Time/Depth From	Time/Depth To	Description of Activities/Operations with Depth

TIME	TURBIDITY	CONDUCTIVITY	pH	XD	DRAWDOWN	TEMP (°C)
0950	>1000 NTU	275 µS/cm	8.34	19.150	14.96	21.6
1006	190	270	8.26	19.211	14.898	20.8
1023	450	276	8.32	19.319	14.79	21.7

1025 End Test 3. Pump off. START TEST 4 (recovery) TEAMSTER EMPTYING PURGE TRUCK.

1057 XD=33.751 = 98.9% recoved, Stop Test #4

1125 START TEST 5 (DRAWDOWN). INITIAL XD = 33.76, 24 gpm.

TIME	TURBIDITY	CONDUCTIVITY	pH	XD	DRAWDOWN	TEMP (°C)
1130	>1000 NTU	———	—	21.910	11,85	———
1140	165	283	8.33	20.875	12.885	22.7
1200	62.4	282	8.29	20.660	13.1	21.9
1215	26.2	281	8.31	20.571	13.189	22.1
1230	61.8	273	8.33	20.473	13.287	21.6
1245	24.0	281	8.32	20.423	13.337	22.4

1250 END TEST 5. STOP PUMPING (PURGEWATER TRUCK FULL). START TEST 6 (recovery). Driller offsite for scissorlift training

1310 END TEST 6. XD= 33.736, 99.93% recovery.

1515 DRILLER BACK ONSITE FROM TRAINING

1523 START PUMPING. START TEST 7 (drawdown). initial XD = 33.809, flow meter says 24 gpm, but is suspect due to float not moving. BUCKET TEST @ 22 gpm

TIME	TURBIDITY	CONDUCTIVITY	pH	XD	DRAWDOWN	TEMP (°C)
1529	734	282	8.31	22.250	11.559	22.5
1544	106	272	8.31	21.196	12.613	21.6
1559	194	273	8.33	21.158	12.651	21.1
1617	63.1	280	8.32	21.140	12.669	22.5

1620 Stop pumping. End test 7.

1630 SITE SECURED. GEOLOGIST AND DRILLER OFFSITE.

Reported By: DAVID TODAK		Reviewed By: L. D. Walker	
Title: Field geologist	Date: 8-23-04	Title: Geologist	Date: 9/21/04
Signature:		Signature:	

A-6003-652 (04/03)

WELL DEVELOPMENT AND TESTING DATA

Well Name:	Well ID:	Well Location:	Date:
299-W19-47	C4252	EAST SIDE OF W.M.A.-U / 200 WEST	8-24-04

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	~~N/A (Comm.~~ 229.9 (TOC)
End of Job	NOT MEASURED (not end of job)

DEPTH TO BOTTOM:

Start of Job	267.9 (TOC)
End of Job	N/A, not end of job

PART 2

WELL DEVELOPMENT DATA

Pump Model	
Intake Depth	264.6 / 251.6
Starting Turbidity	71000 NTU

Pump Start	Stop	Flow Rate
0752	0930	21 gpm
1033	1145	10 gpm
*1211	1305	21 gpm
1417	1605	20 gpm

Total Pumped	6072 (2778 lower / 3294 middle)
Final Turbidity	3.34
XD SN/Range (PSI)	8297 / 20 psi

PART 3

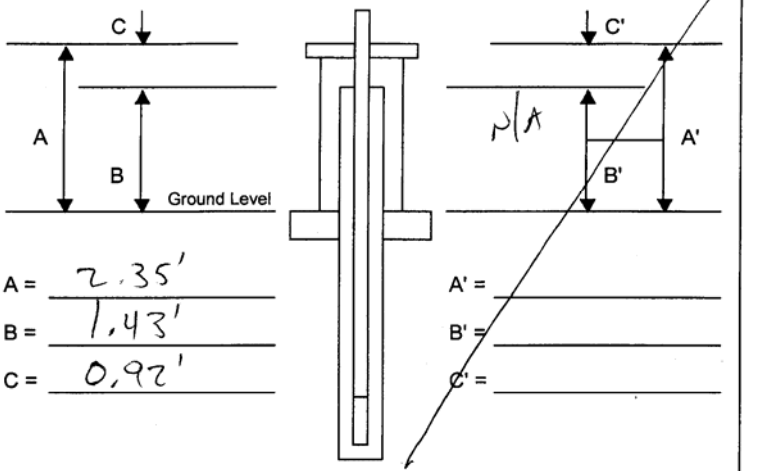
INSTANTANEOUS SLUG TEST

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

PART 4

Last Recorded Measurements Date: 8-20-04

Current Measurements Date: N/A



A = 2.35'
B = 1.43'
C = 0.92'

A' =
B' =
C' =

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

PART 5

COMMENTS: Initial XD * not measured during first pumping cycle due to lack of data logger. It was 33.733 before second pump at lower interval and 20.753 before first pump at middle interval.

* moved pump up 13'

NOTE THIS DATA IS CONCLUSION OF BOTTOM OF 3 intervals plus data from middle interval. See development data for 8/23/04 and 8/25/04 for further details.

Prepared by (print name):	Signature:	Date:
DAVID TODAK		8-25-04
Reviewed by (print name):	**Signature:**	**Date:**
L. D. Walker		9-21-04

A-6003-644 (03/03)

FIELD ACTIVITY REPORT - DAILY DRILLING

Page 1 of 3

Date: 8-24-04

Well ID: C4258 | Well Name: 299-W19-47

Location: EAST SIDE of WMA-U / 200 WEST | Report No.: 30 (well development)

Start	Finish	Total
Time 0620	Time 1630	Time 10.5
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

Time/Depth From	Time/Depth To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
0600	0630	POD/SAFETY MEETING IN 200 EAST AREA.
0640	0725	Geologist onsite calibrating instruments & waiting for drill crew.
		Turbidity meter HACH 2100P S/N 980C000018371
		STANDARD — METER
		517 NTU — 516 NTU
		52.2 — 52.1
		5.23 — 5.31
		pH meter OAKTON pH Tester 3+
		BUFFER — METER
		7.0 — 7.00
		10.0 — 10.01
		CONDUCTIVITY METER ORION MODEL 130A
		STANDARD — METER
		1007 µS/cm — 1007 µS/cm
0725	0750	Driller onsite preparing for day's work
	0752	Begin pumping ~21 gpm. No test due to data logger being in town getting data downloaded. Initial turbidity >1000 NTU but cleaned up quicker than yesterday

TIME	TURBIDITY	CONDUCTIVITY	TEMP (°C)	pH	DO	drawdown
0800	286 NTU	247 µS/cm	18.4	8.07	—	—
0816	51.6	244	18.3	8.12	—	—
0830	54.2	245	17.8	8.21	—	—
0845	27.5	246	17.8	8.13	—	—
0900	19.8	248	18.0	8.11	—	—
0915	21.1	247	17.9	8.15	—	—

Reported By: DAVID TODAK | Reviewed By: L.D. Walker

Title: Field Geologist | Date: 8-24-04 | Title: Geologist | Date: 9/21/04

Signature: —— | Signature: L.D. Walker

A-6003-651 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING
Continuation Page

Date: 8-24-04

Well Name: ~~C4258~~ 299-W19-47 | Well ID: ~~299-W19-47~~ C4258

Location: EAST SIDE of WMA-U / 200 WEST | Continuation of Report No.: 30

Time/Depth From	Time/Depth To	Description of Activities/Operations with Depth
	0930	STOP PUMPING (PURGE TRUCK FULL). Final sample: pH 8.14, 42.2 NTU, 248 µS/cm, 18.1°C
	0938	TALKED TO CHRIS WRIGHT ON PHONE. HE INSTRUCTED ME TO REDUCE FLOW TO ~10 gpm for next tank.
	1033	START PUMPING @ 10 gpm. Begin test 8 (drawdown). Initial XD = 33.733

TIME	TURBIDITY	CONDUCTIVITY	TEMP	pH	XD	DRAWDOWN
1044	104	249	18.4	8.18	29.101	4.632
1100	6.19	252	18.7	8.13	28.997	4.736
1120	4.22	252	18.9	8.17	28.977	4.756
1135	4.58	253	19.1	8.13	28.867	4.866

	1145	STOP PUMPING. IT APPEARS TEST 8 STOPPED SOMEHOW BEFORE FINISHED PUMPING. W/ 84 samples taken. Began test 9 (recovery) a couple seconds after pump stopped. (XD = 28.924)
	1200	Checked probe, tests don't seem to be working on this logger. XD = 33.693 99.88% recovered. WILL USE OTHER DATA LOGGER AT NEXT INTERVAL
		Drillers moving pump up 13 feet (removing 21' riser, adding 8')
	1211	START PUMPING AT 21 gpm. Begin test 1 on new DATA logger. INITIAL XD ~ 20.753. INITIAL TURBIDITY >1000 NTU.

TIME	TURBIDITY	CONDUCTIVITY	TEMP	pH	XD	DRAWDOWN
1220	174	251	18.9	8.15	9.60	11.153
1235	39.1	250	19.1	8.12	8.939	11.814
1250	18.4	258	19.8	8.10	8.752	12.001
1305	14.7	261	20.3	8.12	8.545	12.208

	1305	STOP PUMPING (PURGE TRUCK FULL). End test 1 (drawdown). Begin test 2 (recovery).
	1337	STOP TEST 2. 102% recovered. XD = 20.761
	1417	Begin pumping at 20 gpm. Begin test 3 (drawdown). Initial XD = 20.800. Turbidity at 1417 = 466 NTU

Reported By: DAVID TOMAK | Reviewed By: L.D. Walker

Title: Field Geologist | Date: 8-24-04 | Title: Geologist | Date: 9/21/04

Signature: | Signature: L D Walker

A-6003-652 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING
Continuation Page

Date: 8-24-04

Well Name: ~~C4258~~ 299-W19-47

Well ID: ~~299-W19-97~~ C4258

Location: EAST SIDE OF WMA-U / 200 WEST

Continuation of Report No.: 30

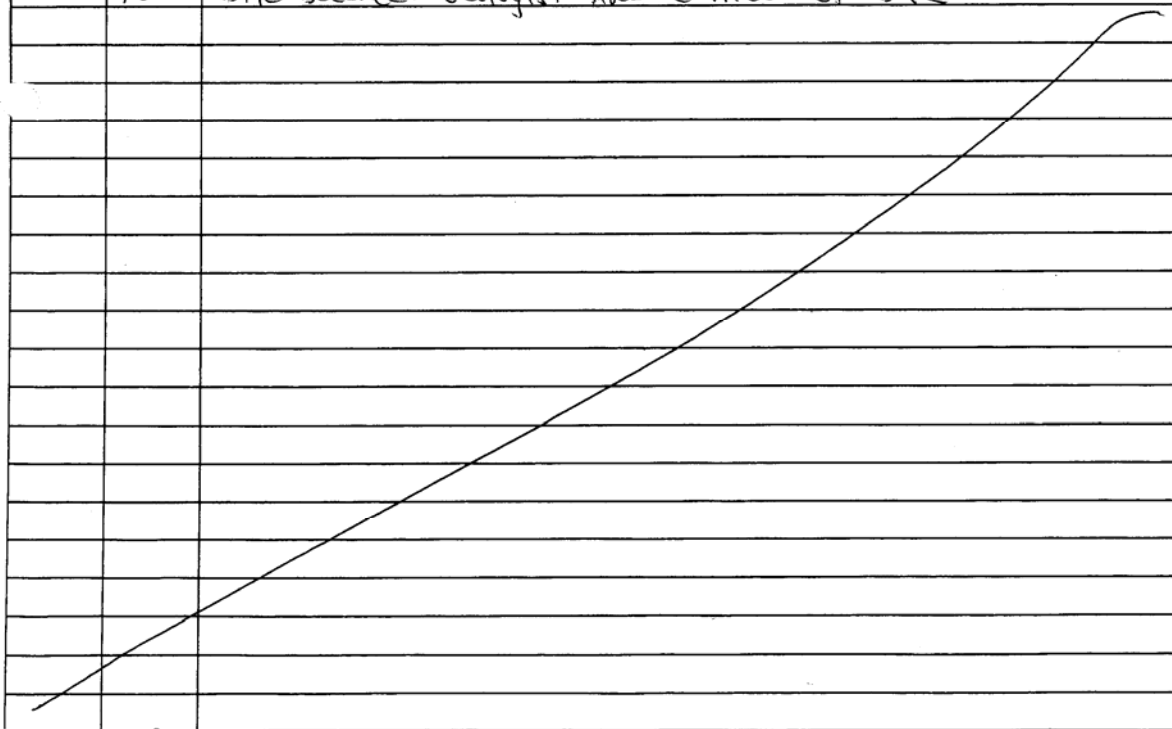
Time/Depth From	Time/Depth To	Description of Activities/Operations with Depth

TIME	TURBIDITY	CONDUCTIVITY	pH	TEMP	XD	DRAWDOWN
1432	53.1	256	8.21	20.0	9.299	11.501
1447	10.2	256	8.09	19.7	8.969	11.831
1502	8.66	255	8.07	19.6	8.830	11.97
1517	7.22	256	8.13	19.7	8.705	12.095
1532	6.18	261	8.10	19.9	9.584	12.216
1547	~~4.6~~	256	8.15	19.8	8.492	12.308
1602	3.34	257	8.15	19.8	8.468	12.332

1605 STOP PUMPING. END TEST 3 (drawdown). START TEST 4 (recovery)

1615 END TEST 4. XD = 20.710 = 99.57% recovery

1620 SITE secured. Geologist and driller offsite



Reported By: DAVID TOMAK

Title: Field Geologist Date: 8-24-04

Signature:

Reviewed By: L.D. Walker

Title: Geologist Date: 9/21/04

Signature: LD Walker

A-6003-652 (04/03)

WELL DEVELOPMENT AND TESTING DATA

Well Name:	Well ID:	Well Location:	Date:
299-W19-47	C4258	EAST SIDE OF WMA-U/200 WEST	8-25-04

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

Has the well been surveyed? ☐ Yes ☒ No

Does the well have a cement pad? ☒ Yes ☐ No

PART 1

STATIC WATER LEVEL:

Start of Job	229.9	(TOC)
End of Job	229.94	(TOC)

DEPTH TO BOTTOM:

Start of Job	267.9	(TOC)
End of Job	267.6	(TOC)

PART 2

WELL DEVELOPMENT DATA

Pump Model

Intake Depth 240.1 (TOC)

Starting Turbidity 133 NTU

Pump Start	Stop	Flow Rate
0814	0924	10 gpm

Total Pumped 700 gallons

Final Turbidity 1.54 NTU

XD SN/Range (PSI) 8297/20 psi

PART 3

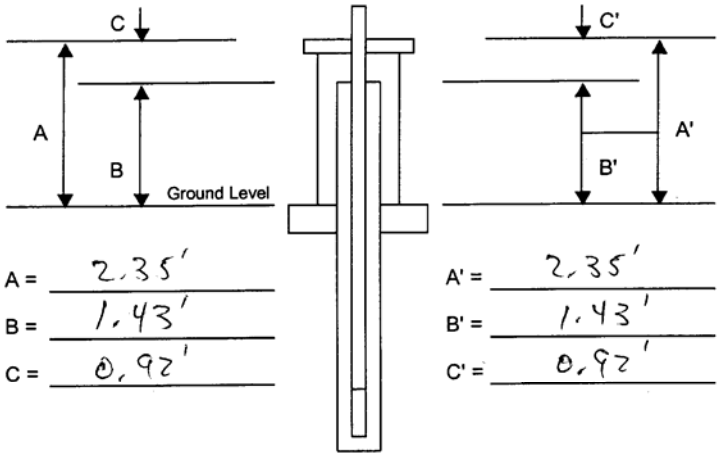
INSTANTANEOUS SLUG TEST

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

PART 4

Last Recorded Measurements Date: 8/20/04

Current Measurements Date: 8/20/04



A = 2.35'

B = 1.43'

C = 0.92'

A' = 2.35'

B' = 1.43'

C' = 0.92'

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

PART 5

COMMENTS: INITIAL XD = 10,256'

NOTE THIS is TOP of 3 intervals. See development data pages for this well on 8/23/04 and 8/24/04 for further details.

Prepared by (print name):	Signature:	Date:
DAVID TOOAK		8-25-04
Reviewed by (print name):	**Signature:**	**Date:**
L.D. Walker		9-21-04

A-6003-644 (03/03)

FIELD ACTIVITY REPORT - DAILY DRILLING

Page 1 of 2

Date: 8-25-04

Well ID: C4258 | Well Name: 299-W19-47

Location: EAST SIDE of WMA-U/200 WEST | Report No.: 31 (well development

Start	Finish	Total
Time 0600	Time 1230	Time 6.5
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

Time/Depth From	Time/Depth To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
0600	0630	PDJ / SAFETY MEETING IN 200 EAST AREA.
0645		Geologist + driller onsite, preparing for day's work, calibrating instruments while teamster empties purge water truck.
		TURBIDITY METER HACH 2100P S/N 980C00018371
		STANDARD 517 NTU — METER 520
		52.2 — 52.3
		5.23 — 5.34
		pH METER ORION PH TESTER 3+
		BUFFER 7.00 — METER 7.00
		10.00 — 10.01
		CONDUCTIVITY METER ORION MODEL 130A
		STANDARD 1007 µS/cm — Meter 1007 µS/cm
	0750	Remove 29.8' riser pipe, add 18.3' riser pipe. XD = 10.256'
	0814	Begin pumping AT 10 gpm. START test 9 (drawdown)

TIME	TURBIDITY	CONDUCTIVITY	TEMP	pH	XD	DRAWDOWN
0817	133 NTU	263 µS/cm	17.9°C	7.78	6.060	
0832	24.9	259	18.0	8.02	5.609	
0847	6.15	257	17.9	7.99	5.573	
0905	2.91	258	18.1	8.00	5.502	
0920	1.54	259	18.1	8.10	5.478	

	0924	STOP PUMPING. END TEST 9 (drawdown). Begin test 10 (recovery)	

Reported By: DAVID TOOAK — Reviewed By: L.D. Walker

Title: field geologist — Date: 8-25-04 — Title: Geologist — Date: 9/21/04

Signature: — Signature:

A-6003-651 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING
Continuation Page

Date: 8-25-04

Well Name: 299-W19-47 | Well ID: C4258

Location: EAST SIDE OF WMA-U/200 WEST | Continuation of Report No.: ~~30~~ 31

Time/Depth From	Time/Depth To	Description of Activities/Operations with Depth
	0939	End test 10. XD = 10.116, 98.6% recovery. Driller offsite to find a helper.
	1010	Drill crew onsite, removing hoses, valves, + tripping out pump and riser pipe.
	1115	All equipment removed from well. Tag water at 229.94' (TOC) TAGGED BOTTOM AT 267.6' (TOC).
	1125	DRILLER DUMPED BAILED SEDIMENTS AND GROUNDWATER ONTO SPOILS PILE, NOT REALIZING THAT IT WAS A REGULATED (LISTED) WASTE. ~~CON~~ INFORMED RTR TIM HOTTEL VIA CELL PHONE AND HE SAID HE WOULD CONTACT WASTE GROUP.
	1146	BECAUSE WASTE PILE IS ON PLASTIC SHEETING, DRILLER WAS INSTRUCTED TO RECOVER WATER + SATURATED SPOILS INTO DRUM. (PER TIM H.). HE'S NOW WORKING ON THAT.
	1206	ALL STANDING WATER + SATURATED SPOILS CONTAINERIZED.
	1233	DRILL RIG OFFSITE TO DECON YARD. SITE SECURED, GEOLOGIST OFFSITE.

Reported By: DAVID TONAK | Reviewed By: L.D. Walker

Title: Field Geologist | Date: 8-25-04 | Title: Geologist | Date: 9/21/04

Signature: | Signature:

A-6003-652 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING

Page 1 of 12

Date: 9-17-04 cw

Well ID: C4258 Well Name: 299-W19-47

Location: EAST SIDE OF WMA-U/200 ~~EAST~~ WEST Report No.: 28 (pump installation)

Start	Finish	Total
Time 0630	Time 1500	Time 8 1/2
Hole Depth/Csg NA -T-	Hole Depth/Csg NA -T-	Hole Depth/Csg NA -T-

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)
0630	0700	POD/SAFETY MEETING IN 200 EAST.
	0730	Geologist onsite
0900	1000	Geologist offsite to 100-D.
	1130	DRILL CREW ONSITE, THEN OFFSITE FOR EQUIPMENT + LUNCH.
1230	1330	DRILL CREW ONSITE, PREPARING FOR PUMP INSTALLATION,
		TAG WATER AT 229.91' TOC, TAG BOTTOM AT 267.70' TOC
		Pump tested OK.
	1330	START TRIPPING IN PUMP & RISER PIPE.
	1414	Finished tripping in pump + riser pipe. INTAKE SET AT 236.15' TOC
		TAG WATER AT 229.89' TOC (casing had 0.03' added w/ landing plate)
	1430	TESTED PUMP. PUMPED 5 gallons in 1 minute + 2 seconds.
		DRILLERS STAMPING BRASS MARKER AND placing tag on protective
		CASING.
	1500	SITE SECURED. GEOLOGIST OFFSITE

Reported By: DAVID TOOAK Reviewed By: L.D. Walker

Title: Field Geologist Date: 9-17-04 Title: Geologist Date: 9/23/04

Signature: Signature: LD Walker

A-6003-651 (04/03)

FIELD ACTIVITY REPORT - WELL SERVICES

Page 2 of 2 (cow)

Date	Well No.	Rig Type/Model	Rig No.	Contract/Work Order No.	Report No.
9-17-04	C4758				

Purpose	Reference	Location
pump installation		EAST SIDE OF U MA-U/200 WEST

HISTORICAL DATA

Construction Depth		
Casing Size	Type	Set At
Casing Perforations Schedule		Interval
Well Screen(s) Type		Interval

Last Recorded Depth-to-Water	Last Recorded Depth-to-Bottom
229.94	267.6

Current Depth-to-Water	Current Depth-to-Bottom
229.91	267.7

PUMP SYSTEM CONFIGURATION

	Pre-Maintenance	Post-Maintenance
Pump Type	GRUNDFOS GRUNDFOS RED-FLO 3	
Pump Model	A-5-SQE25-NE product # 96030139	
Tubing Size/Type	3/4" TYPE 304 SCH. 40	
Length-Bottom of Tubing to Pump Intake	0.95'	
Tubing Length	235.33'	
Length-Top of Tubing to Reference Point	0.13	
Pump Intake Set at (Depth)	236.15	

Reference/Measuring Point

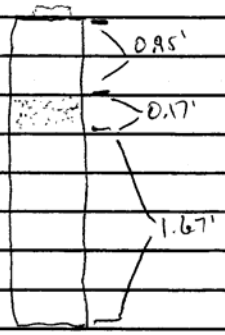
Start Time 1230
End Time
Time
Contract Time
Total Time

Personnel

Materials Used

Description of Operations/Remarks

1/2 hp, @ 5 gpm



Report By	DAVID TODAK
Title	Field geologist
Signature	

Reviewed By	L.D. Walker
Title	Geologist
Date	9/23/04
Signature	LD Walker

DISTRIBUTION: White-Field File Custodian Yellow-Group Files Pink-Project Coordinator Goldenrod-Team Leader BC-6000-278 (04/91)

WELL SURVEY DATA REPORT

Project:	**Prepared By:** S. Wray **Company:** FFS
Date Requested: 09/27/04	**Requestor:** Chris Wright (FH)
Date of Survey: 09/29/04	**Surveyor:** FFS survey Dept.
ERC Point of Contact:	**Survey Co. Point of Contact:** G. Brazil, P.L.S.
Description of Work: Civil Survey of Groundwater Monitoring Well #C4258 (299-W19-47)	**Horizontal Datum:** NAD83(91) **Vertical Datum:** NAVD88 **Units:** Meters **Hanford Area Designation:** 200W

Coordinate System: Washington State Plane Coordinates (South Zone)

Horizontal Control Monuments: 2W-29 (FFS), 2W-170 (FFS)

Vertical Control Monuments: 2W-170 (FFS), 2W-49 (FFS)

Well ID	Well Name	Easting	Northing	Elevation	
C4258	299-W19-47	566895.31	135161.86		Center of Casing
				206.276	Top Casing, No. Side
				205.551	Brass Survey Marker
				206.282	Top Pump Baseplate, N. Edge

Notes:

Surveyor Statement:
I, Grant F. Brazil, a Professional Land Surveyor registered in the State of Washington (Registration No. 22326), hereby certify that this report is based on a field survey performed in September, 2004 under my direct supervision, and that the data contained here is true and correct.

Original to:
Distribution by DIS:

Waste Disposal/Groundwater Remediation Project

NONCONFORMANCE REPORT DISTRIBUTION COVERSHEET

From: Environmental/Science Assurance	*MSIN:* S2-53	*Date:* 8/26/04
NCR No.: **NCR-04-GRP-015**	***STATUS:*** **Initiation [ ] Disposition [ ] Closure [X]**	

TO:		*MSIN*
Design Authority/ Responsible Individual	R L. Biggerstaff	E6-35
Initiating Organization QA Engineer	W. R. Thackaberry	E6-35
Originator	W. R. Thackaberry	N/A
Initiating Organization QA Manager	D G. Farwick	S2-53
Facility Manager (if applicable)	N/A	N/A
Facility Department Manager/Lead (if applicable)	N/A	N/A
Authoritative Source	D. B. Wegner	N/A
PAAA Compliance Officer	D. J. Riel	N/A
QA NCR Coordinator	S. L. Day	S2-53

OTHER: (if applicable)		*MSIN*
FH QA Programs	D. D. Volkman	H7-28
	J. J Phillips, FFS	H7-10
	C S. Wright	E6-35
	R. J. Fabre	S0-01
	L. D. Walker	E6-35
	T. L. Hottell	S0-01
	J. V. Borghese	E6-35
	D. E Adler	S0-01
	G. G. Kelty	E6-35

NONCONFORMANCE REPORT

NCR No NCR-04-GRP-015 Page 1 of 7

1 P O /W O /Job Control No	2 Responsible Program, Project, Facility, or SSC
Contract No. 19355 release 005	GRP/RCRA/WMA U Monitoring

3 Item or Material I D No /Catalog No /Other	4 Dwg /Spec /Other No /Rev	5 Safety Classification
Monitoring Well Annular Seal	WMP-20639 rev 0	GS

6 Lot/Heat/Serial No	7 Lot Size/Sample Size/Quantity Accepted	8 ASME Code Item?
Well C4258	N/A	☐ Yes ☒ No (If yes, notify authorize inspector)

9 Supplier Name/Address	10 Suspect / Counterfeit Item?	11 Procurement Related?
Blue Star Northwest Enterprizes 2019 Butler Loop Richland, WA 99352	☐ Yes ☒ No (If Yes, Occurrence Report Required)	☒ Yes ☐ No (If Yes, Notify Contract Specialist)

DESCRIPTION OF NONCONFORMANCE

12 Description of Nonconformance

(a) Required Condition/Origin of Requirement

Description of Work for Drilling RCRA Groundwater Monitoring Wells and 200-UP-1 and 200-ZP-1 Operable Units Groundwater Monitoring Wells - CY2004 RCRA CERCLA Drilling, WMP-20639 rev 0 figure 15, CY04 RCRA well design (C4257, C4258, C4259, C4260, C4261) shows that a granular bentonite seal is to fill the annulus between the bentonite pellet seal and the cement grout seal figure attached

GRP-EE-02-14.1 section 5.9 1 states that "All constructed resource protection wells shall have a continuous seal that seals the annular space between the bore hole and the permanent casing " The basis for this requirement is WAC 173-160-450

(b) Actual Condition

There is a 4 foot interval of sluffed formation (sand) in direct contact with the stainless steel well casing in the interval between 66 ft and 62 ft below the ground surface This resulted when the driller lifted the temporary casing above the level to which bentonite crumbles had been placed

In the final stages of well completion, annular seal material in placed in the annulus as the temporary casing is withdrawn The well construction practice is that the driller should maintain an overlap of seal material in the temporary casing so as to prevent formation from coming in contact with the permanent casing This overlap was not maintained due to problem with a stuck threaded joint in the 10" temporary casing The driller believed that the formation at this interval would not collapse However, when the 10" casing was withdrwn leaving 4 feet of open hole, the formation collapsed see Sketch

NCR IDENTIFICATION / VALIDATION

13 NCR Initiator	Signature	Date
WR Thackaberry Print Full Name	WR Thackaberry	8-6-04

14 NCR Validation Initiating Organization QA Manager or designee	CAR ☒ Yes ☐ No	Signature	Date
DG Farwick Print Full Name D D. Volkman		D D Volkman	8/6/04

A-7310-104 (01/04

NONCONFORMANCE REPORT (continued)

NCR No NCR-04-GRP-015 Page 2 of 7

DISPOSITION

15 Interim Disposition (Check One) ☒ N/A (See Final Disposition) ☐ Conditional Accept/Use ☐ Other
Use only if actions are needed prior to determining final disposition or to facilitate continued work or testing on a conditional and controlled bas

Technical Justification, USQ or CX No _____, required for "Conditional Accept/Use" disposition Include the extent and any required instructions

Contract Specialist Acknowledgement

Print Full Name	Signature	Date
John D Rumsey		8-09-04

APPROVAL

15 1 Design Authority or ☐ N/A if not applicable

Print Full Name	Signature	Date

15 2 Responsible Organization's QA Representative or Manager or ☐ N/A if not applicable

Print Full Name	Signature	Date

15 3 ASME Authorized Code Inspector or ☐ N/A if not applicable

Print Full Name	Signature	Date

15 4 Other or ☐ N/A if not applicable

Organization/Discipline Represented _____

Print Full Name	Signature	Date

INTERIM DISPOSITION COMPLETION

16 Interim Disposition Complete (Check One) ☐ Complete ☐ N/A if not applicable
Responsible Organization QA or QC Representative

Print Full Name	Signature	Date

FINAL DISPOSITION

17 Final Disposition (Check One)
☒ Accept-As-Is ☐ Reject ☐ Repair ☐ Rework

(a) Technical Justification or Engineering Document Change (EDC), Facility Modification Package (FMP), or Design Change Notice (DCN) Number N/A see 17(b) below (required for "Accept-As-Is" and "Repair" dispositions) If EDC, FMP, or DCN Number is not required, explain why and perform USQ screening in accordance with applicable procedure USQ or CX No N/A

Use N/A for "Reject" or "Rework" dispositions

The 4 foot loss of seal is at the mid-sixty foot level There will still be 62 feet of seal above the defect There is no indication of perched water in the zone No voids will exist since a continouous fill will be achieved The resulting well completion will still be protective of the aquifer since the loss of seal is 161 feet above the water table The well will still be capable of providing representative water samples A variance request documenting this condition was approved by our point of contact with the Dept of Ecology

NONCONFORMANCE REPORT (continued)

NCR No. NCR-04-GRP-015 Page 3 of 7

(b) Instructions for Completion For "Repair" and Rework," include Inspection Criteria For "Reject," identify method of disposal, e g , scrap, return to vendor or other

Use N/A for "Accept-As-Is"

This well will be as-built on a Well Summary Sheet which will be entered into RMIS. Assure that the condition documented on this NCR is included in the as-built documentation for C4258

Contract Specialist Acknowledgement

* The Contract specialist inadvertently signed adjacent to the interim/or specific block.

Print Full Name	Signature	Date
John Phillips	WR Thackaberry for JJ Phillips via Telecon*	8-9-04

APPROVAL

17 1 Design Authority

Print Full Name	Signature	Date
RL Biggerstaff	Richard L Biggerstaff	8/9/04

17 2 Responsible Organization's QA Representative or Manager

Print Full Name	Signature	Date
WR Thackaberry	WR Thackaberry	8/9/04

17 3 ASME Authorized Code Inspector or ☒ N/A if not applicable

Print Full Name	Signature	Date

17 4 Other or ☐ N/A if not applicable

Organization/Discipline Represented FH Task Lead

Print Full Name	Signature	Date
Chris Wright		8/9/04

CLOSURE

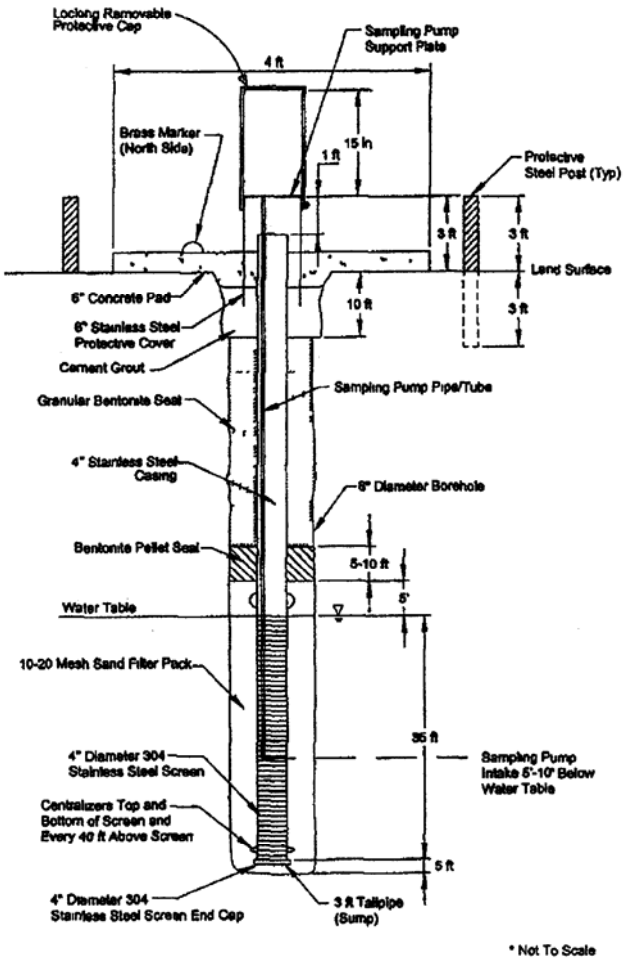
18 NCR Closure ☒ Approved Disposition Actions Complete and Verified ☐ Follow-on NCR

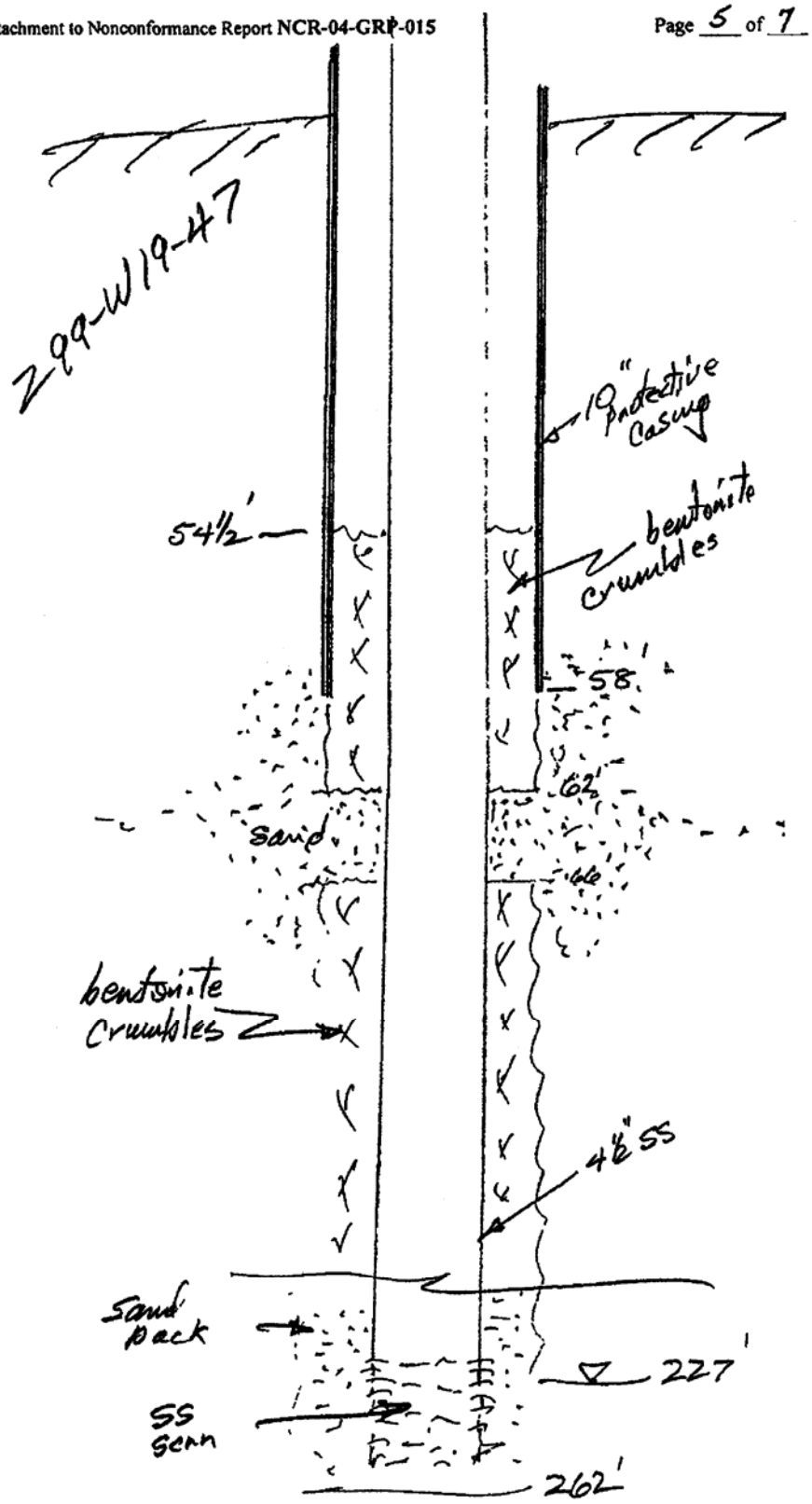
QA or QC Representative

Print Full Name	Signature	Date
W. R. Thackaberry	WR Thackaberry	8/26/04

A-7310-104 (01/04

Figure 15. CY04 RCRA well design (C4257, C4258, C4259, C4260, C4261)




Z99-W19-47
19" protective casing
54½'
bentonite crumbles
58'
62'
sand
bentonite crumbles
4½" SS
sand pack
227'
SS screen
262'

WELL SUMMARY SHEET

Start Date: 04/23/04
Finish Date: 08/09/04
Page 1 of 2

Well ID: C4258
Well Name: 299-W19-47
Location: East side of WMA-A/200 West
Project: RCRA/CERCLA drilling, FY 2004
Prepared By: Charlene Martinez Date: 08/11/04
Reviewed By: L.D. Walker Date: 8-24-04
Signature: Charlene Martinez
Signature: LD Walker

CONSTRUCTION DATA

Description	Diagram
11 7/8" / 10 7/8" temporary casing used.	
6" ID SS304 protective casing set + 1.0' above permanent	
4" ID SS304, sch.5 riser: + 2.0' → 227.05'	
Portland Cement: 0' → 10.7'	
Granular Bentonite: 10.7' → 215.8'	
*Formation Slough 62.3' → 66.3'	
3/8" Bentonite Pellets: 215.8' → 220.7'	
10-20 mesh Colorado Silica Sand 220.7' → 269'	
4" ID SS304, sch.5, 0.020-inch cont. wire-wrap wellscreen: 227.05' → 262.04'	
All depths in feet below ground surface	
All temporary casing removed from ground.	

GEOLOGIC/HYDROLOGIC DATA

Depth in Feet	Graphic Log	Lithologic Description
0		0'-1' Backfill material
		1'-8' SAND(S) Hanford fm.
		8'-15' Sandy GRAVEL(SG)
		15'-16.5' SAND(S)
		16.5'-17.5' Sandy GRAVEL(SG)
		17.5'-23' SAND(S)
40		23'-27' Sandy GRAVEL(SG)
		27'-36' Silty sandy GRAVEL(msG)
		36'-47' Sandy GRAVEL(SG)
		47'-53' gravelly SAND(gS)
		53'-90' SAND(S)
80		90'-124' Silty SAND(mS)
120		124'-138' SILT(m) (Cold Creek unit)
		138'-145' CALICHE, Silty Sandy Gravel(msG)
		145'-162' Silty Sandy GRAVEL (msG)
160		162'-165' Sandy GRAVEL(SG)
		165'-185.5' Silty Sandy GRAVEL (msG)
		185.5'-192' Sand (S)
		192'-198.5' Silty sandy gravel (msG)
200		198.5'-201' Sand (S)
		201'-204' Sandy gravel (SG)
		204'-227' Silty sandy gravel (msG)
		227'-229' Sandy GRAVEL(SG)

A-6003-643 (03/03)

WELL SUMMARY SHEET

Start Date: 04/23/04
Finish Date: 08/09/04
Page 2 of 2

Well ID: C4258
Well Name: 299-W19-47
Location: East side of WMA-U/200 West
Project: RCRA/CERCLA drilling: FY 2004
Prepared By: Charlene Martinez
Date: 08/11/04
Reviewed By: L.D. Walker
Date: 8-24-04
Signature: Charlene Martinez
Signature: L.D. Walker

CONSTRUCTION DATA

Description	Diagram
4" ID SS304, sch. 5 sump: 262.04' → 265.02'	TD = 269' bgs
NCR-04-GRP-015 issued on the formation slough condition at 62.3' → 66.3'	
All depths in feet below ground surface:	
All temporary casing removed from ground.	

GEOLOGIC/HYDROLOGIC DATA

Depth in Feet	Graphic Log	Lithologic Description
240		229'-238' silty sandy GRAVEL (msG)
		238'-244' sandy GRAVEL (sG)
		244'-260' silty sandy GRAVEL (msG)
		260'-266' sandy GRAVEL (sG)
		266'-269' silty sandy GRAVEL (msG)
280		TD @ 269' bgs.
		Static water = 226.84' bgs (08/09/04)

A-6003-643 (03/03)

Appendix B

Sediment Samples Physical Properties Data

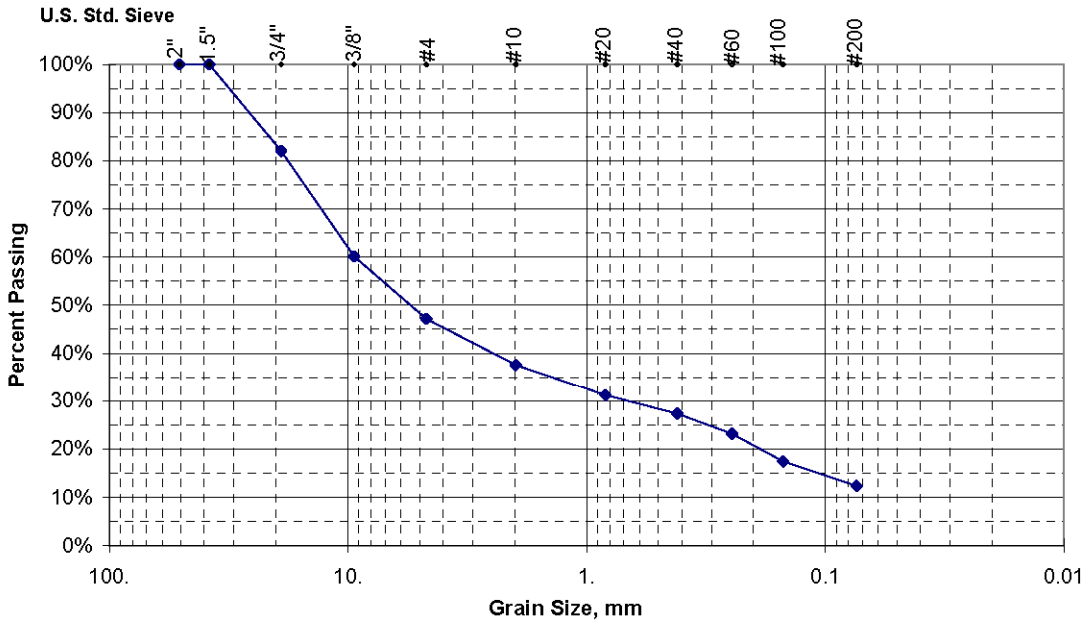
CH2M Hill Hanford, Inc.

SIEVE ANALYSIS

WELL NAME	299-W19-47	DEPTH	226-228.5	SAMPLE#	W19-47-226.0	WELL ID#	C4258
TESTED BY	CRM	CONTACT	Dave Weekes	PHONE	372-9350	DATE	05/21/2004

SAMPLE WT (g)	SIEVE SIZE IN.	CUMULATIVE WEIGHT(g)	% WEIGHT RETAINED	% PASSING	Grain Size (mm)	COMMENTS
1861.20	2"	0.0	0.0	100.0	50.80	
	1.5"	0.0	0.0	100.0	38.10	
	3/4"	334.5	18.0	82.0	19.05	
	3/8"	742.2	39.9	60.1	9.42	
	#4	983.1	52.8	47.2	4.70	
	#10	1161.9	62.4	37.6	1.98	
	#20	1280.8	68.8	31.2	0.83	
	#40	1352.8	72.7	27.3	0.42	
	#60	1430.4	76.9	23.1	0.25	
	#100	1537.0	82.6	17.4	0.150	
	#200	1631.4	87.7	12.3	0.074	

Sieve Analysis Data for Sample W19-47-226.0



Comments: Silty Sandy Gravel.

Sample from split spoon.

All data are accurately and completely recorded.

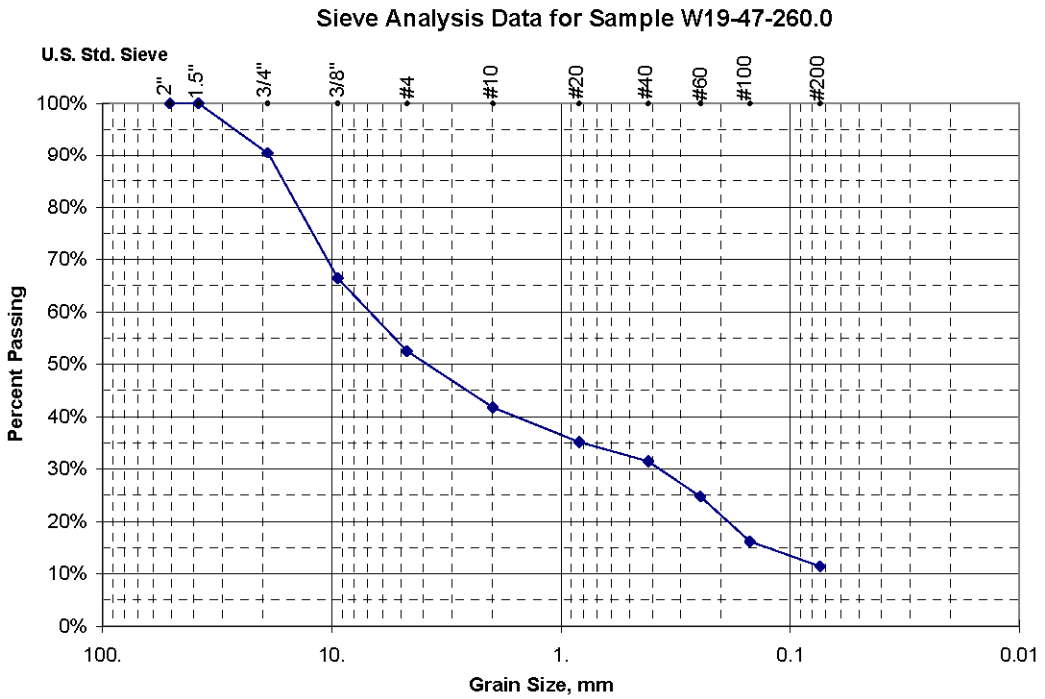
Checked By: Date:

CH2M Hill Hanford, Inc.

SIEVE ANALYSIS

WELL NAME	299-W19-47	DEPTH	260-262.5	SAMPLE#	W19-47-260.0	WELL ID#	C4258
TESTED BY	CRM	CONTACT	Dave Weekes	PHONE	372-9350	DATE	06/02/2004

SAMPLE WT (g)	SIEVE SIZE IN.	CUMULATIVE WEIGHT(g)	% WEIGHT RETAINED	% PASSING	Grain Size (mm)	COMMENTS
1910.20	2"	0.0	0.0	100.0	50.80	
	1.5"	0.0	0.0	100.0	38.10	
	3/4"	181.5	9.5	90.5	19.05	
	3/8"	640.7	33.5	66.5	9.42	
	#4	906.7	47.5	52.5	4.70	
	#10	1112.3	58.2	41.8	1.98	
	#20	1238.6	64.8	35.2	0.83	
	#40	1308.4	68.5	31.5	0.42	
	#60	1437.8	75.3	24.7	0.25	
	#100	1600.7	83.8	16.2	0.150	
	#200	1691.9	88.6	11.4	0.074	



Comments: Silty Sandy Gravel.

Sample from split spoon.

All data are accurately and completely recorded.

Checked By: Date:

Appendix C

Spectral Gamma Ray Logs and Gyroscope Survey Data Results

Stoller

established 1959

Hanford Office

TASK ORDER NO.: ST04-201
CONTROL NO.: 1000-T04-1439

June 28, 2004

Mr. Robert M. Yasek
Project Manager
U.S. Department of Energy
Office of River Protection
P.O. Box 550, MSIN H6-60
Richland, WA 99352

SUBJECT: Contract No. DE-AC01-02GJ79491, Stoller
Geophysical Well Logs for RCRA Borehole C4258

Dear Mr. Yasek:

Please find enclosed the Log Data Report and log plots for the following newly constructed RCRA borehole:

Site	Well ID	Document No.
East of U Tank Farm	C4258	DOE-EM/GJ683-2004

Should you have questions, please contact Rick McCain at (509) 376-6435 or me at (509) 376-6465.

Respectfully submitted,

Brian W. Mathis
Manager

BWM:rmp
Enclosure

cc: C. S. Cearlock, CH2M HILL (electronic copy)
D. C. Weekes, CH2M HILL (electronic copy)
D. L. Biggerstaff, FH
J. V. Borghese, FH (electronic copy)
M. E. Byrnes, FH (electronic copy)
M. E. Todd, FH (electronic copy)
S. W. Petersen, FH

The S.M. Stoller Corporation 1100 Jadwin Avenue, Suite 300 Richland, Washington 99352 (509) 376–6454 Fax: (509) 376–6460

B. A. Williams, PNNL (electronic copy)
D. G. Horton, PNNL
Hanford File (Through R. Paxton)

cc w/o enclosure:
J. G. Morse, DOE-RL
J. D. Davis, FH
M. C. Butherus, Stoller
S. E. Kos, Stoller
R. G. McCain, Stoller
W. D. Steele, Stoller
Correspondence Control File (Through V. Creagar)
Project File HGLP 1.1.4 (Through J. Meinecke)
Stoller LB

C:\S. M. Stoller Corporation\Letterbook FY 2004\057

The S.M. Stoller Corporation 1100 Jadwin Avenue, Suite 300 Richland, Washington 99352 (509) 376-6454 Fax: (509) 376-6460

Stoller
Hanford Office

DOE-EM/GJ683-2004

C4258
Log Data Report

Borehole Information:

Borehole: C4258			Site: East of U Tank Farm		
Coordinates (WA State Plane)		GWL (ft)[1]: 229.6		GWL Date: 06/01/04	
North	East	Drill Date	TOC[2] Elevation	Total Depth (ft)	Type
Not Available	Not Available	06/01/04	Not Available	269	Cable Tool

Casing Information:

Casing Type	Stickup (ft)	Outer Diameter (in.)	Inside Diameter (in.)	Thickness (in.)	Top (ft)	Bottom (ft)
Threaded steel	1.1	11 3/4	10 7/8	7/16	1.1	268

Borehole Notes:

Casing data were provided by Tim Hottell, the Fluor Field Team Leader.

Logging Equipment Information:

Logging System:	Gamma 2A		Type: SGLS (35%) 34TP20893A
Calibration Date:	03/2004	Calibration Reference:	DOE-EM/GJ642-2004
		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	06/02/04	06/03/04	06/07/04	06/07/04	
Logging Engineer	Pearson	Pearson	Pearson	Pearson	
Start Depth (ft)	106.0	268.0	171.0	106.0	
Finish Depth (ft)	0.0	170.0	107.0	80.0	
Count Time (sec)	200	200	200	200	
Live/Real	R	R	R	R	
Shield (Y/N)	N	N	N	N	
MSA Interval (ft)	1.0	1.0	1.0	1.0	
ft/min	N/A[3]	N/A	N/A	N/A	
Pre-Verification	BA346CAB	BA347CAB	BA348CAB	BA348CAB	
Start File	BA346000	BA347000	BA348000	BA348065	
Finish File	BA346106	BA347098	BA348064	BA348091	
Post-Verification	BA346CAA	BA347CAA	BA348CAA	BA348CAA	
Depth Return Error (in.)	N/A	+2	+2	+2	

Log Run	1	2	3	4- Repeat	
Comments	Fine-gain adjustment after files 090 and 091.	No fine-gain adjustment.	No fine-gain adjustment.	No fine-gain adjustment.	

Logging Operation Notes:

Logging was performed with a centralizer installed on the sonde. Pre- and post-survey verification measurements for the SGLS employed the Amersham KUT (^{40}K, ^{238}U, and ^{232}Th) verifier with serial number 118. Zero reference is the ground surface.

Analysis Notes:

Analyst:	Henwood	Date:	06/07/04	Reference:	GJO-HGLP 1.6.3, Rev. 0

SGLS pre-run and post-run verification spectra were collected at the beginning and end of the day. All of the verification spectra were within the acceptance criteria. Examinations of spectra indicate that the detector functioned normally during logging, and the spectra are accepted.

Log spectra were processed in batch mode using APTEC SUPERVISOR to identify individual energy peaks and determine count rates. Verification spectra were used to determine the energy and resolution calibration for processing the data using APTEC SUPERVISOR. Concentrations were calculated in EXCEL (source file: G2AMAR04.xls). Zero reference is the ground surface. The casing configuration was assumed as one string of 11-in. casing with a thickness of 7/16 in. to 268 ft (total logging depth). No dead time corrections were required. A correction for water in the 11-in. borehole was applied to the data below 229 ft.

Log Plot Notes:

Separate log plots are provided for gross gamma and dead time, naturally occurring radionuclides (^{40}K, ^{238}U, and ^{232}Th), and man-made radionuclides. Plots of the repeat logs versus the original logs are included. For each radionuclide, the energy value of the spectral peak used for quantification is indicated. Unless otherwise noted, all radionuclides are plotted in picocuries per gram (pCi/g). The open circles indicate the minimum detectable level (MDL) for each radionuclide. Error bars on each plot represent error associated with counting statistics only and do not include errors associated with the inverse efficiency function, dead time correction, or casing correction. These errors are discussed in the calibration report. A combination plot is also included to facilitate correlation. The ^{214}Bi peak at 1764 keV was used to determine the naturally occurring ^{238}U concentrations on the combination plot rather than the ^{214}Bi peak at 609 keV because it exhibited slightly higher net counts per second.

Results and Interpretations:

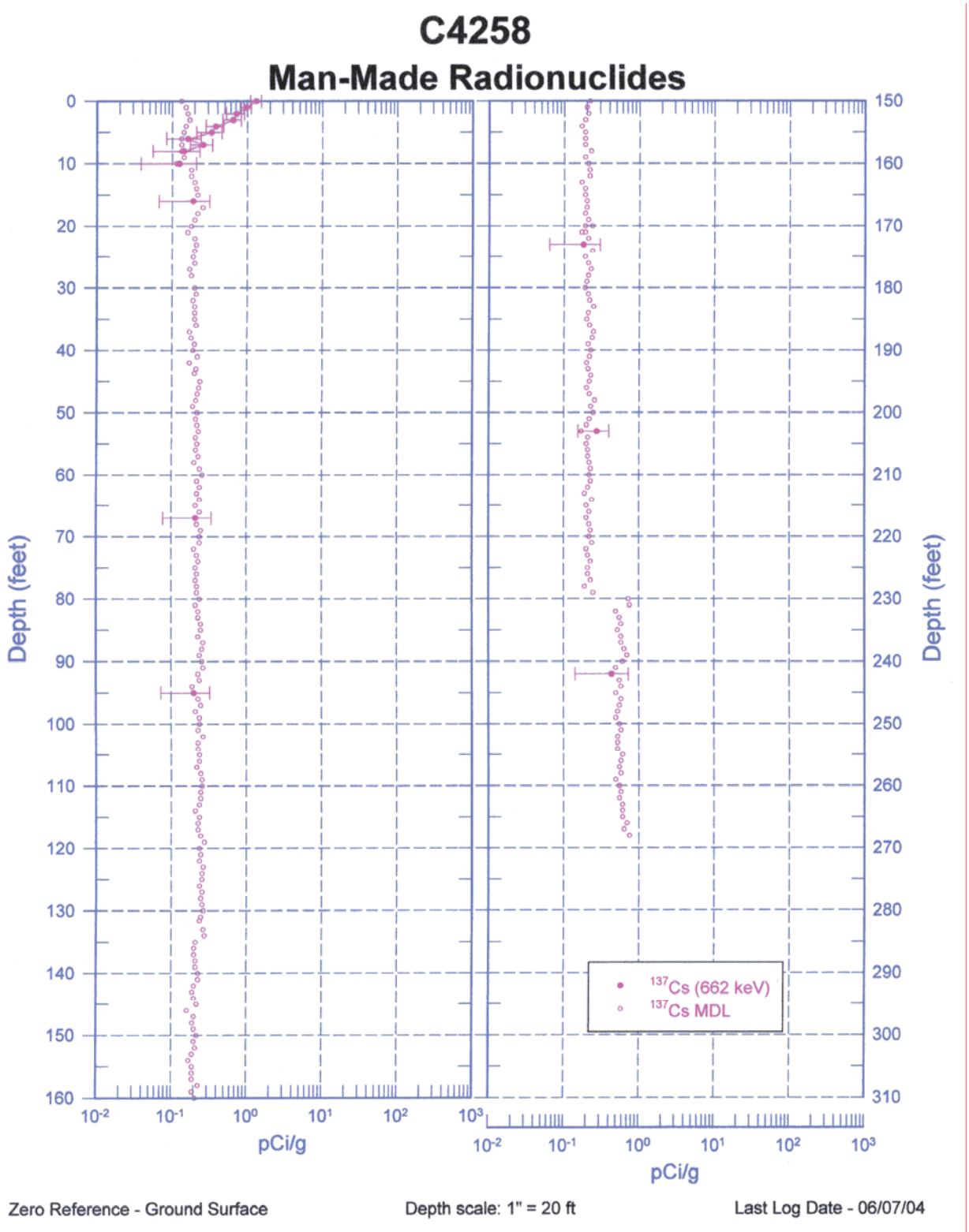
^{137}Cs was the man-made radionuclide detected in this borehole. ^{137}Cs was detected near the ground surface at a maximum concentration of 1.3 pCi/g and at a few sporadic depth intervals throughout the borehole near its MDL of approximately 0.2 pCi/g.

The KUT logs showed changes corresponding to lithology. Apparent ^{232}Th concentrations are elevated by approximately 0.4 pCi/g in the interval between 125 and 135 ft, and this increase corresponds with fine-grained sediment of the Cold Creek Interval formerly known as the Early Palouse Soil. The relatively low ^{40}K and ^{232}Th values in the interval between 135 and 140 ft as well as the relatively high ^{238}U values are characteristic of the carbonate palesols of the Cold Creek Interval.

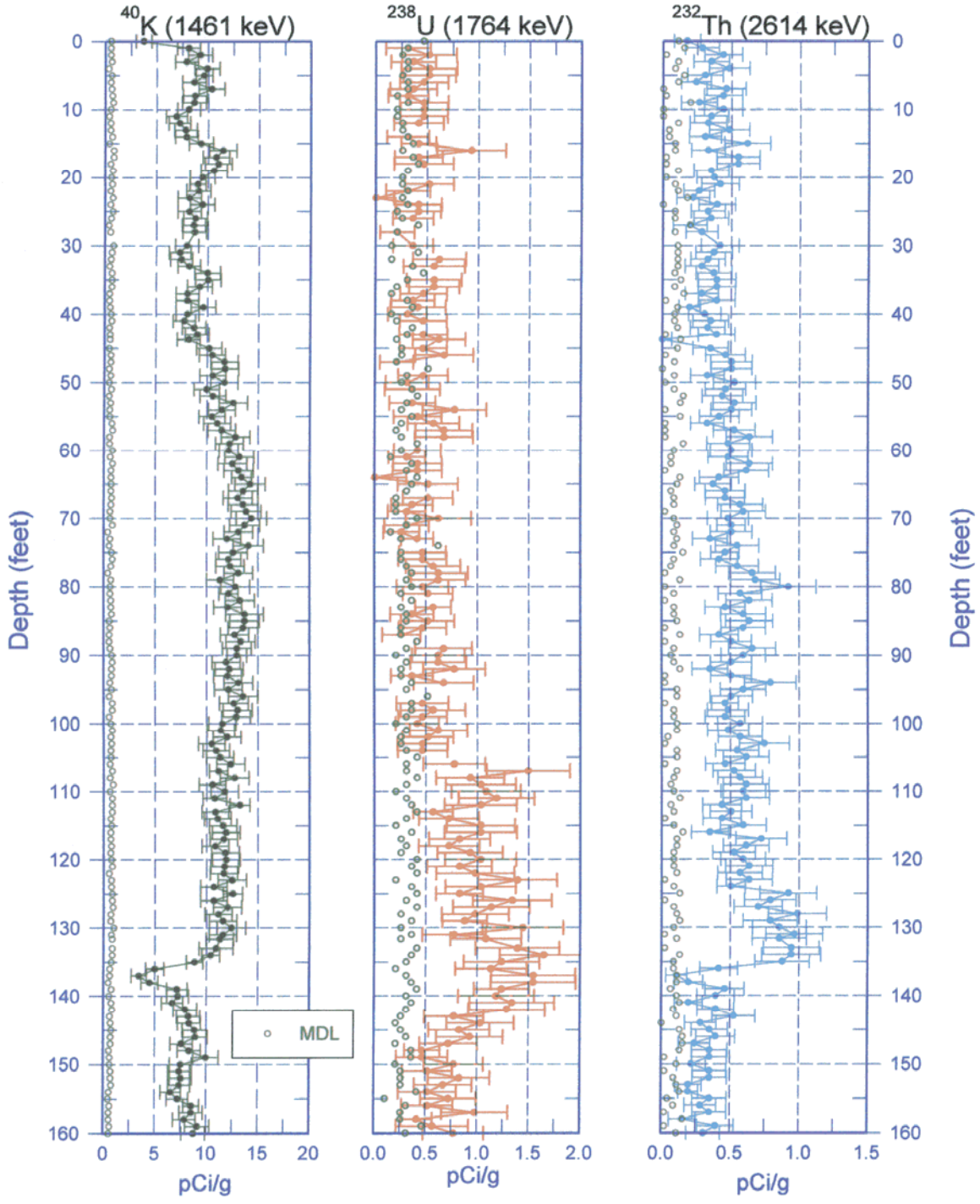
The plots of the repeat logs demonstrate reasonable repeatability of the SGLS data for the natural radionuclides at energy levels of 1461 and 2614 keV. Naturally occurring ^{238}U as measured at the 1764-keV energy level indicates enhanced radon in the borehole during log run 4 relative to the measurements acquired in log run 1.

---

[1] GWL – groundwater level
[2] TOC – top of casing
[3] N/A – not applicable


C4258
Man-Made Radionuclides
Depth (feet)
pCi/g
137Cs (662 keV)
137Cs MDL
Zero Reference - Ground Surface
Depth scale: 1" = 20 ft
Last Log Date - 06/07/04

C4258
Natural Gamma Logs

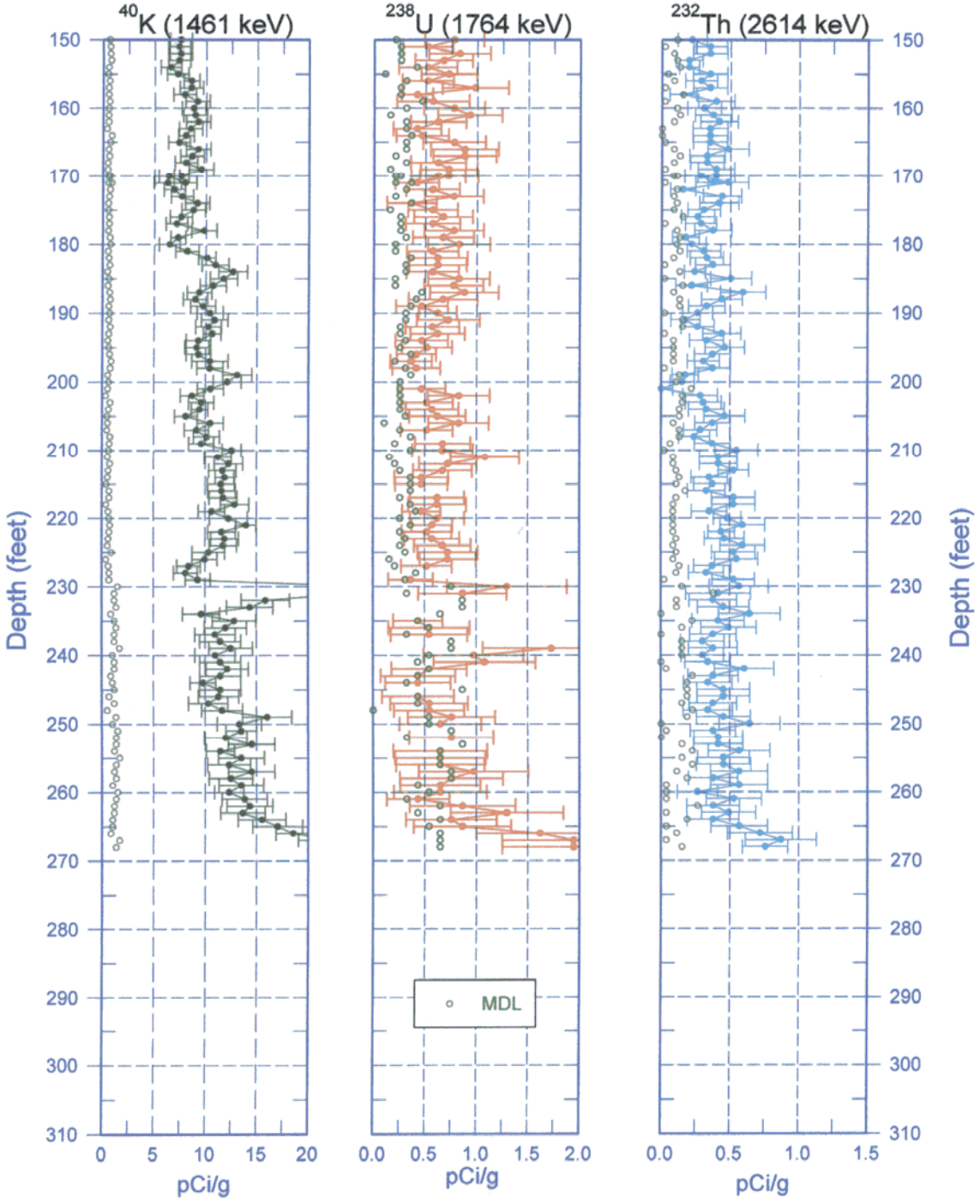


Zero Reference = Ground Surface

Depth scale: 1" = 20 ft

Last Log Date - 06/07/04

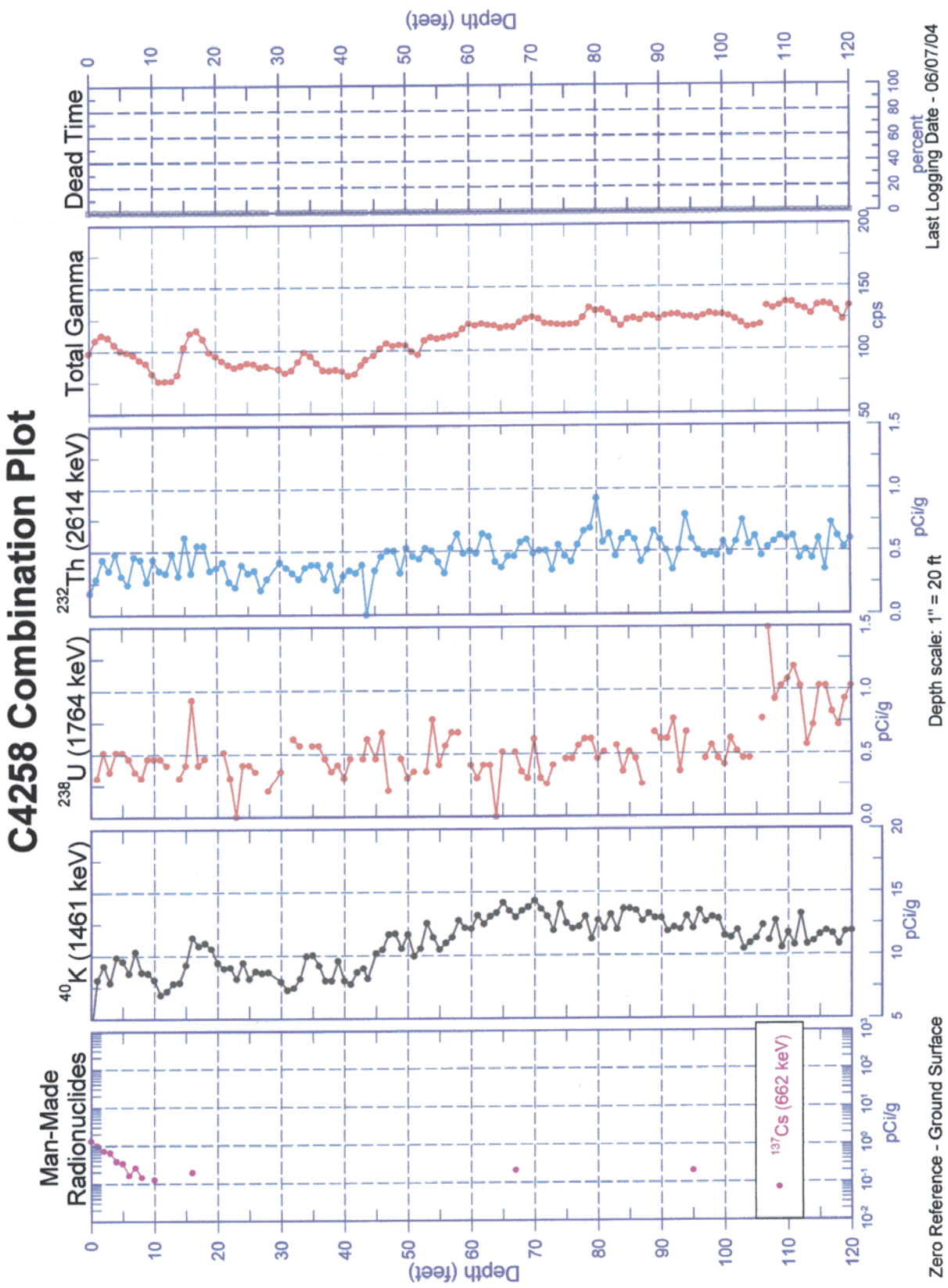
C4258
Natural Gamma Logs

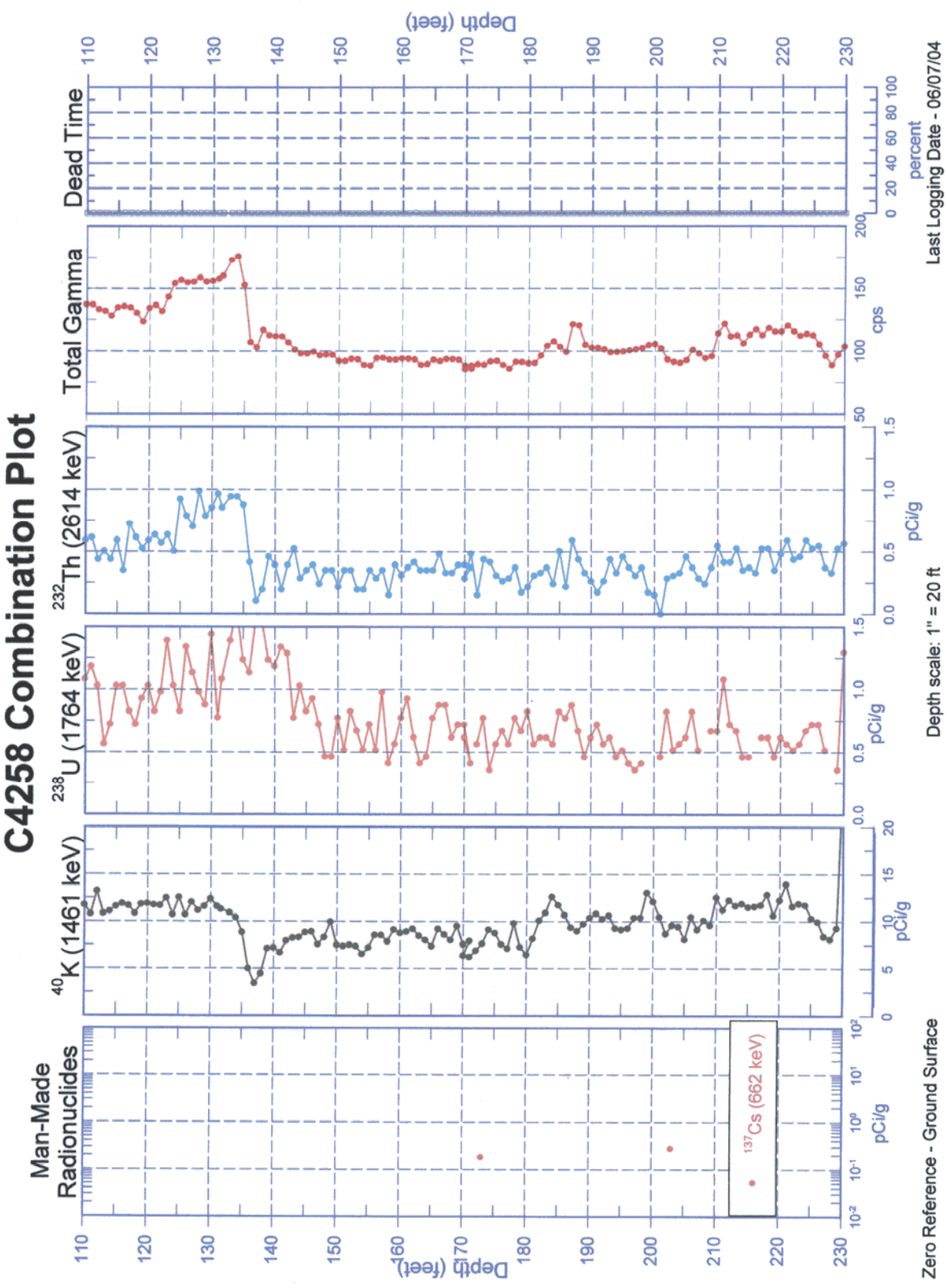


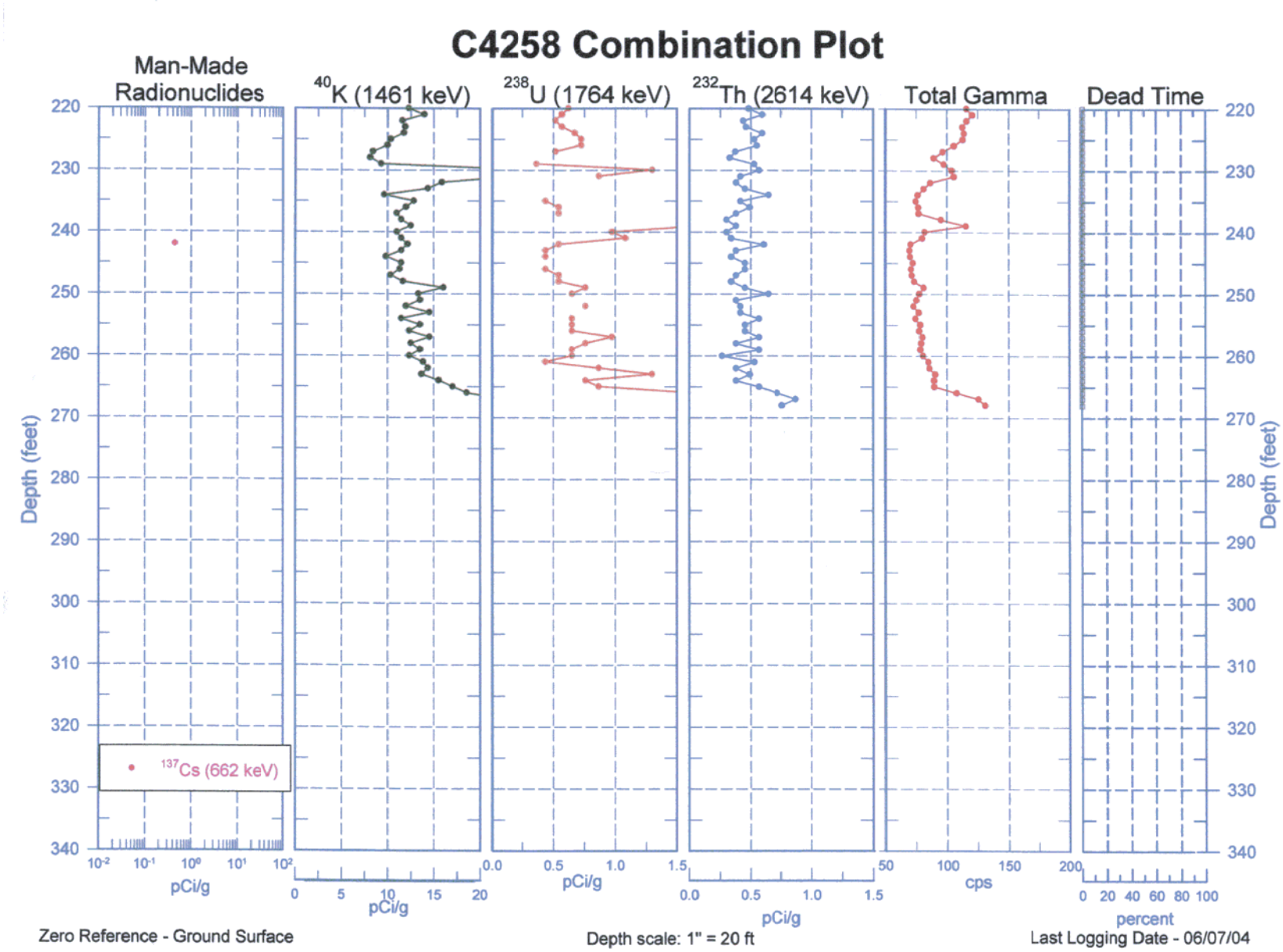
Zero Reference - Ground Surface

Depth scale: 1" = 20 ft

Last Log Date - 06/07/04

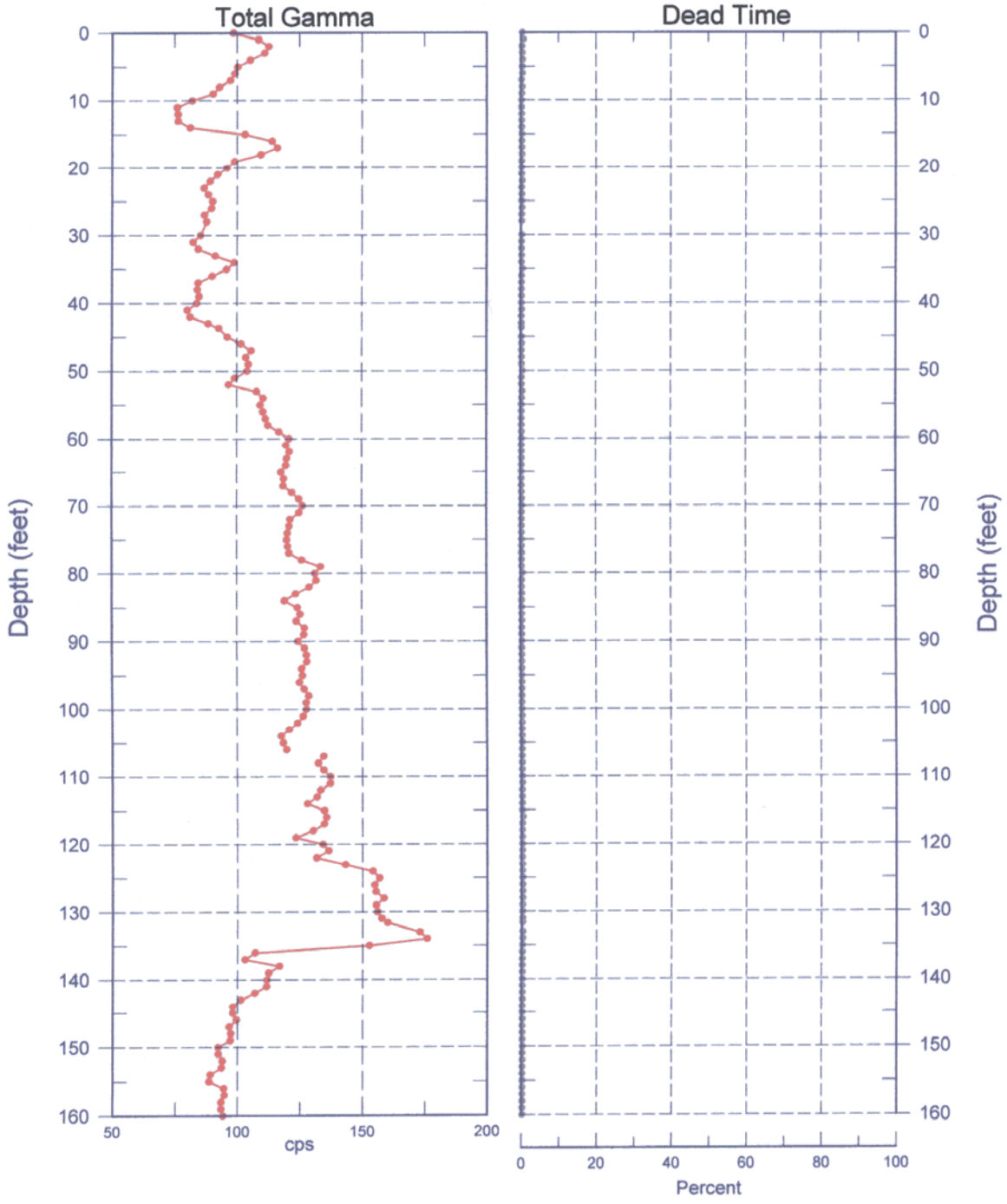

C4258 Combination Plot
Man-Made Radionuclides
^{137}Cs (662 keV)
pCi/g
^{40}K (1461 keV)
pCi/g
^{238}U (1764 keV)
pCi/g
^{232}Th (2614 keV)
pCi/g
Total Gamma
cps
Dead Time
percent
Depth (feet)
Depth (feet)
Zero Reference - Ground Surface
Depth scale: 1" = 20 ft
Last Logging Date - 06/07/04


C4258 Combination Plot
Man-Made Radionuclides
^{137}Cs (662 keV)
pCi/g
^{40}K (1461 keV)
pCi/g
^{238}U (1764 keV)
pCi/g
^{232}Th (2614 keV)
pCi/g
Total Gamma
cps
Dead Time
percent
Depth (feet)
Zero Reference - Ground Surface
Depth scale: 1" = 20 ft
Last Logging Date - 06/07/04


C4258 Combination Plot
Man-Made Radionuclides
40K (1461 keV)
238U (1764 keV)
232Th (2614 keV)
Total Gamma
Dead Time
Depth (feet)
137Cs (662 keV)
pCi/g
cps
percent
Zero Reference - Ground Surface
Depth scale: 1" = 20 ft
Last Logging Date - 06/07/04

C4258

Total Gamma & Dead Time

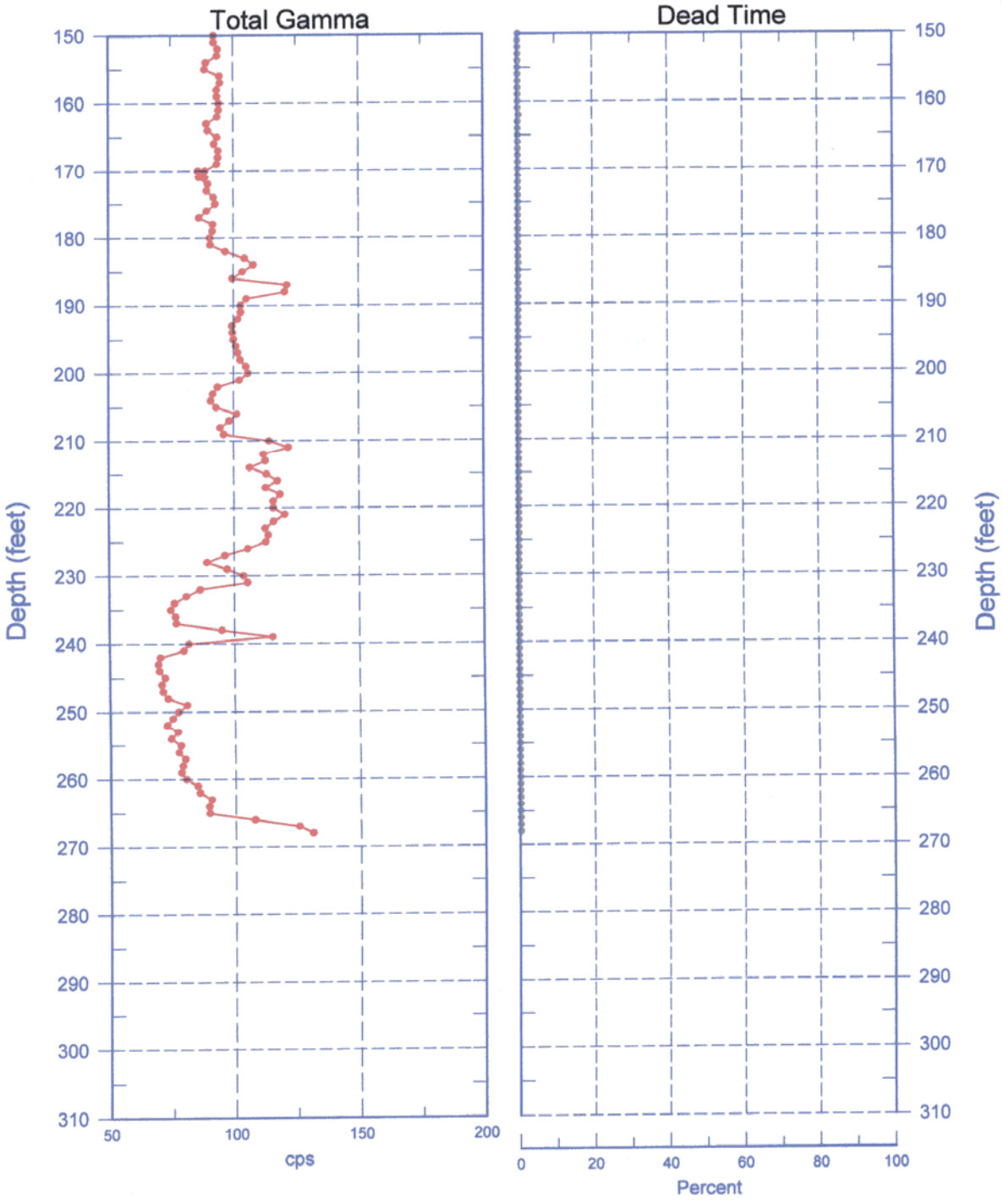


Reference - Ground Surface

Depth scale: 1" = 20 ft

Last Log Date - 06/07/04

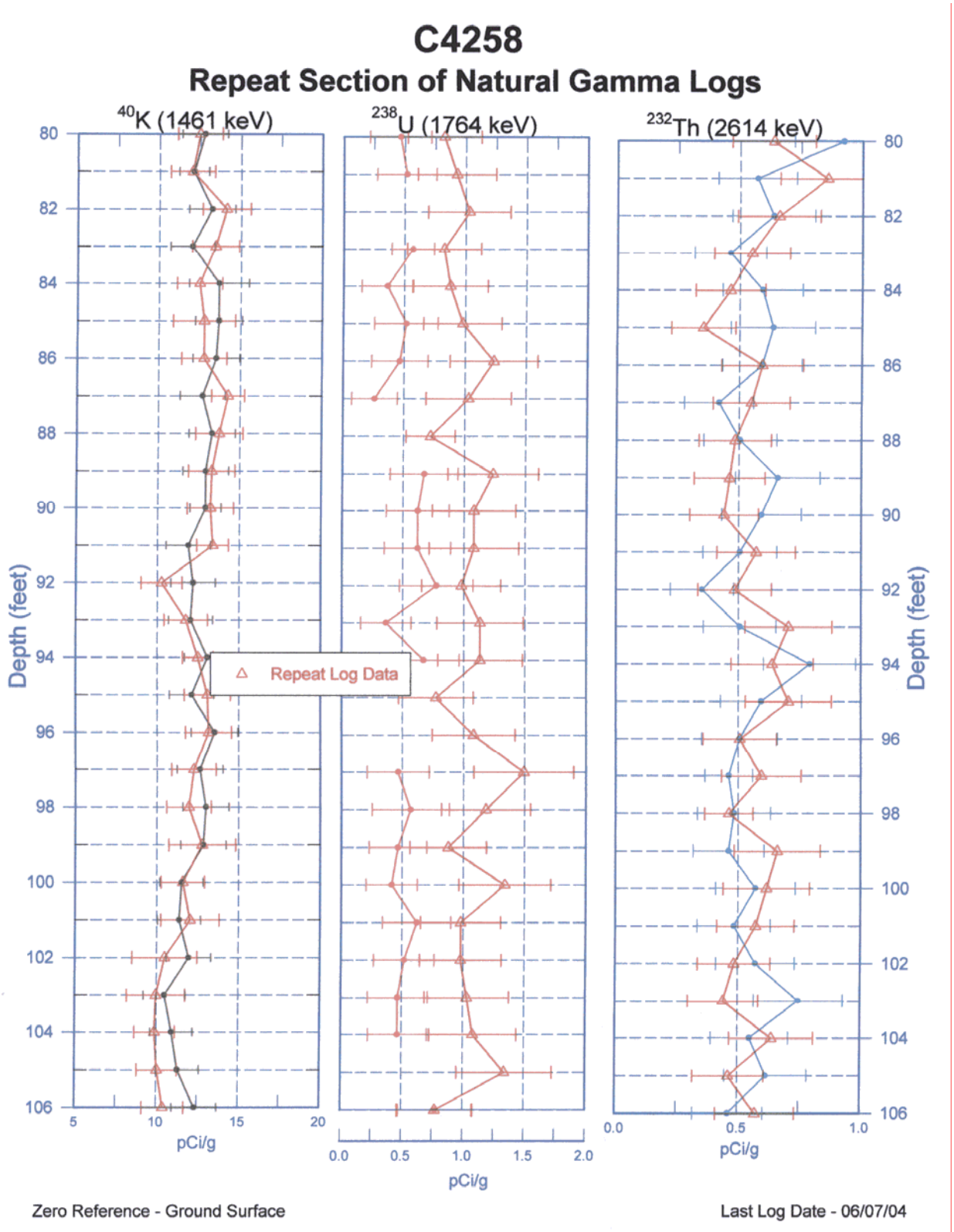
C4258
Total Gamma & Dead Time



Reference - Ground Surface

Depth scale: 1" = 20 ft

Last Log Date - 06/07/04


C4258
Repeat Section of Natural Gamma Logs
40K (1461 keV)
238U (1764 keV)
232Th (2614 keV)
Depth (feet)
Repeat Log Data
pCi/g
pCi/g
pCi/g
Zero Reference - Ground Surface
Last Log Date - 06/07/04

Survey File: C:\DSE\C4258.RAW
Date: Aug 26,2004
Time: 9:17
Description: C4258
LOCATION: SE corner of U Tankfarm
CUSTOMER: Fluor Hanford Co.
OPERATOR: MC Dorsey
Comments:

HUMPHREY TOOL IDENTIFICATION
Gyroscope Model: DG69-0901-4 #4654
TX Series #0002
EI Series #0003
AC Series #0004
Accel.Voltage Limits: Xmax= 9.92 ; Xmin=-9.89 ; Ymax= 9.9 ; Ymin=-9.89
Comments:

Warm-Up Duration: 34.12 min

----------SURVEY REFERENCE DATA----------

Sight Reference Description:
Rad sign
Survey Reference Point: 76 deg.
Local Grid Offset: 18 deg.
Drift Correction Method: Least Squares Drift Linearization
Computation Method: Minimum Curvature

Target Direction (deg): 0
INRUN record set

Measured Depth (feet)	Course Inclin. fromVert.	Course Direction (deg)	TrueVert. Depth (feet)	Rectangular Coordinates +N/-S	Rectangular Coordinates +E/-W	Dogleg Severety °/100 f	Vertical Section (feet)
0.00	0.09	143.7	0.00	0.00	0.00	0.00	0.0
20.00	0.32	200.8	20.00	-0.06	-0.01	1.40	-0.1
40.00	0.20	210.9	40.00	-0.15	-0.05	0.70	-0.1
60.00	0.38	262.2	60.00	-0.18	-0.13	1.50	-0.2
80.00	0.38	268.9	80.00	-0.19	-0.26	0.20	-0.2
100.00	0.43	258.4	100.00	-0.21	-0.40	0.50	-0.2
120.00	0.40	312.8	120.00	-0.18	-0.53	1.90	-0.2
140.00	0.27	333.5	140.00	-0.09	-0.60	0.90	-0.1
160.00	0.49	7.5	160.00	0.04	-0.61	1.50	0.0
180.00	0.94	38.3	180.00	0.25	-0.50	2.90	0.2
200.00	1.48	53.3	199.99	0.53	-0.19	3.10	0.5
220.00	1.71	57.5	219.98	0.85	0.27	1.30	0.8
240.00	1.63	82.1	239.98	1.05	0.80	3.60	1.0
254.60	2.00	71.0	254.57	1.16	1.25	3.50	1.2

Bottom:
True Vertical Depth 254.57 feet
Closure Distance 1.7 feet
Closure Direction 47.1 deg.
Course Direction 71.0 deg.

DEFINITIONS:
Closure Direction: An angle between Main Reference direction (for example

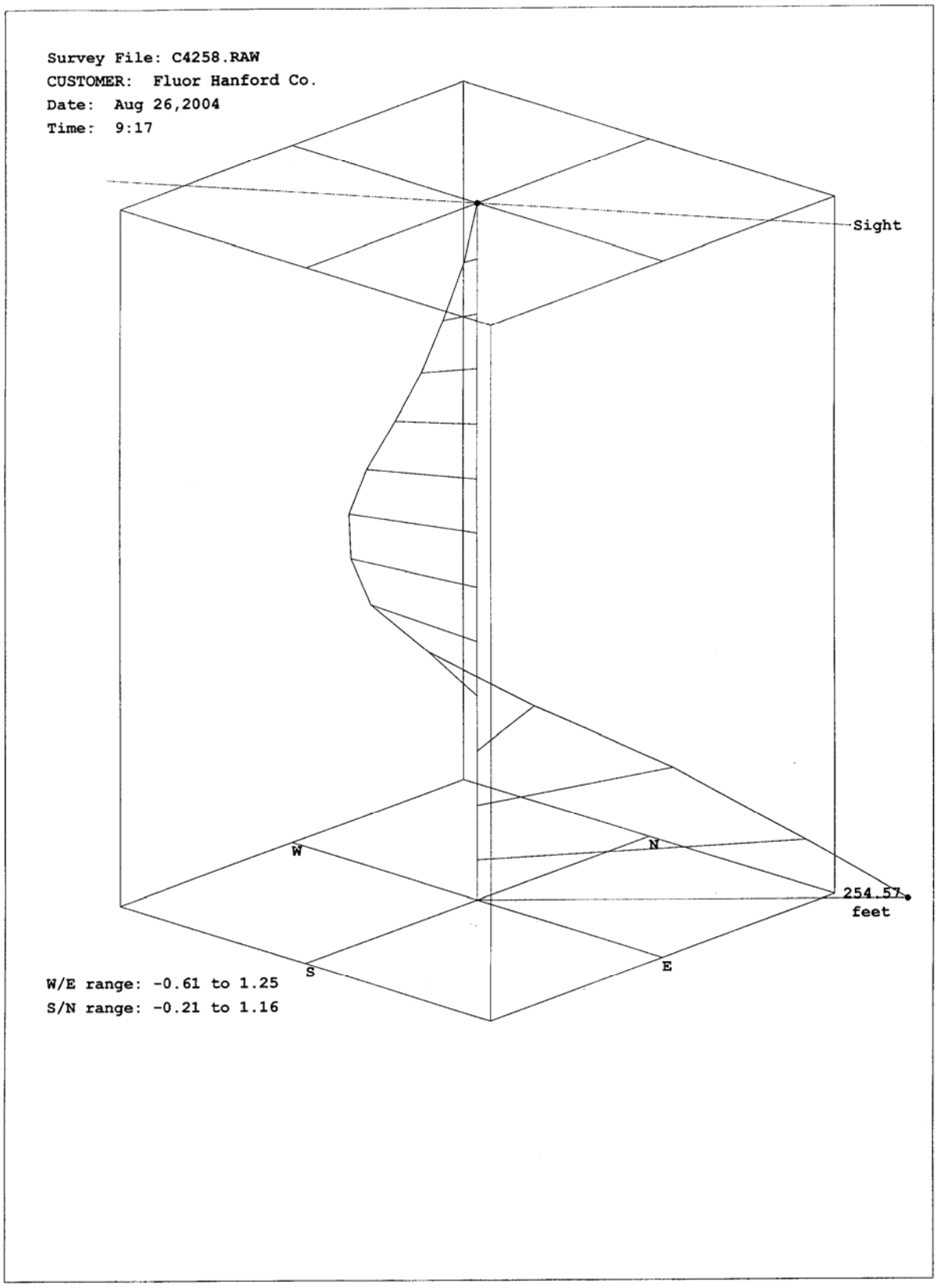
True North) and a line from coordinate origin to horizontal projection of current borehole point.

Closure Distance: A distance between coordinate origin and a horizontal projection of current borehole point.

Course Direction: An angle between Main Reference direction and a tangent to a horizontal projection of the borehole in current point.

ToolFace Gravity: An angle between tool reference mark direction and a tangent to a horizontal projection of the borehole.

ToolFace Gyro: An angle between tool reference mark direction and initial Survey Sight direction (which is gyroscope direction, if gyro drift =0).


Survey File: C4258.RAW
CUSTOMER: Fluor Hanford Co.
Date: Aug 26,2004
Time: 9:17
Sight
W
N
254.57
feet
S
E
W/E range: -0.61 to 1.25
S/N range: -0.21 to 1.16

Distribution

No. of Copies

OFFSITE

R. Jim, Manager
Environmental Restoration/
Waste Management Program
Confederated Tribes and Bands of the
Yakama Indian Nation
P.O. Box 151
Toppenish, WA 98948

The Honorable W. Burke
T. Rapaske
Confederated Tribes of the Umatilla
Indian Reservation
P.O. Box 638
Pendleton, OR 97801

D. Powaukee
D. Landeen
Nez Perce Tribe
P.O. Box 365
Lapwai, ID 83540

L. Seelatsee
Wanapum Band
Grant County P.U.D.
30 "C" Street S.W.
P.O. Box 878
Ephrata, WA 98823

S. Van Verst
Washington State Department of Health
Division of Radiation Protection
P.O. Box 47827
Olympia, WA 98504

No. of Copies

ONSITE

U.S. Environmental Protection Agency

D. A. Faulk B1-46

3 **Washington State Department of Ecology**

J. Caggiano H0-57
D. Goswami H0-57
J. A. Hedges H0-57

2 **Bechtel Hanford, Inc.**

J. V. Borghese E6-35
B. H. Ford E6-35

CH2M HILL Hanford Group, Inc.

D. A. Myers E6-35

5 **DOE-Richland Operations Office**

R. D. Hildebrand A6-38
R. W. Lober H6-60
K. M. Thompson A6-38
Public Reading Room (2) H2-53

10 **Pacific Northwest National Laboratory**

P. E. Dresel K6-96
D. G. Horton K6-75
S. P. Luttrell K6-96
R. M. Smith (2) K6-96
F. A. Spane K6-96
B. A. Williams (2) K6-75
Hanford Technical Library (2) P8-55