PNNL-13590

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

Borehole Data Package for Calendar Year 2000-2001 RCRA Wells at Single-Shell Tank Waste Management Area T

D. G. Horton
F. N. Hodges

August 2001

Prepared for the U.S. Department of Energy
under Contract DE-AC06-76RL01830

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Pacific Northwest National Laboratory
Richland, Washington 99352

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1.0 Introduction

Five boreholes were drilled at the single-shell tank farm Waste Management Area (WMA) T in August through December 2000. The wells are 299-W11-38, 299-W11-39, 299-W11-40, 299-W11-41, and 299-W11-42. Table 1 gives the names and numbers for the new wells. Borehole 299-W11-38 was decommissioned after the temporary casing became stuck during drilling. It was replaced by well 299-W11-42. The latter four new boreholes were installed as Resource Conservation and Recovery Act (RCRA) groundwater monitoring wells in fulfillment of Tri-Party Agreement (Ecology et al. 1998) milestone M-24-00L. Well 299-W11-39 is located at the northeast corner of T tank farm and is a replacement for well 299-W11-23 which is going dry. Well 299-W11-42 is located on the east side of T tank farm and replaces well 299-W11-28 which is going dry. Wells 299-W11-40 and 299-W11-41 are located on the east side of the T tank farm and are new downgradient monitoring wells installed in response to changing flow direction. The locations of all wells in the WMA T monitoring network are shown on Figure 1.

The original assessment monitoring plan for WMA T was issued in 1993 (Caggiano and Chou 1993). That plan was updated for the continued assessment at WMA T in 2001 (Hodges and Chou 2001). The updated plan provides justification for the new wells. The new wells were constructed to the specifications and requirements described in Washington Administrative Code (WAC) 173-160 and WAC 173-303, the updated assessment plan for WMA T (Hodges and Chou 2001), and the description of work for well drilling and construction.[(a)]

This document compiles information on the drilling and construction, well development, pump installation, and sediment and groundwater sampling applicable to the installation of wells 299-W11-39, 299-W11-40, 299-W11-41, and 299-W11-42. Appendix A contains the Well Summary Sheets (as-built diagrams); the Well Construction Summary Reports, and the geologist's logs; Appendix B contains physical properties data; and Appendix C contains the borehole geophysical logs. Additional documentation concerning well construction is on file with Bechtel Hanford, Inc., Richland, Washington.

Table 1. Well Names and Well Numbers for the New Wells at Waste Management Area T

Well Name	Well Number
299-W11-39	C3117
299-W11-40	C3118
299-W11-41	C3119
299-W11-42	C3242

(a) Letter from J. S. Fruchter, Pacific Northwest National Laboratory, to G. C. Henckel, Bechtel Hanford, Inc., "Description of Work for Drilling CY 2000 RCRA Groundwater Monitoring Wells," dated May 12, 2000.

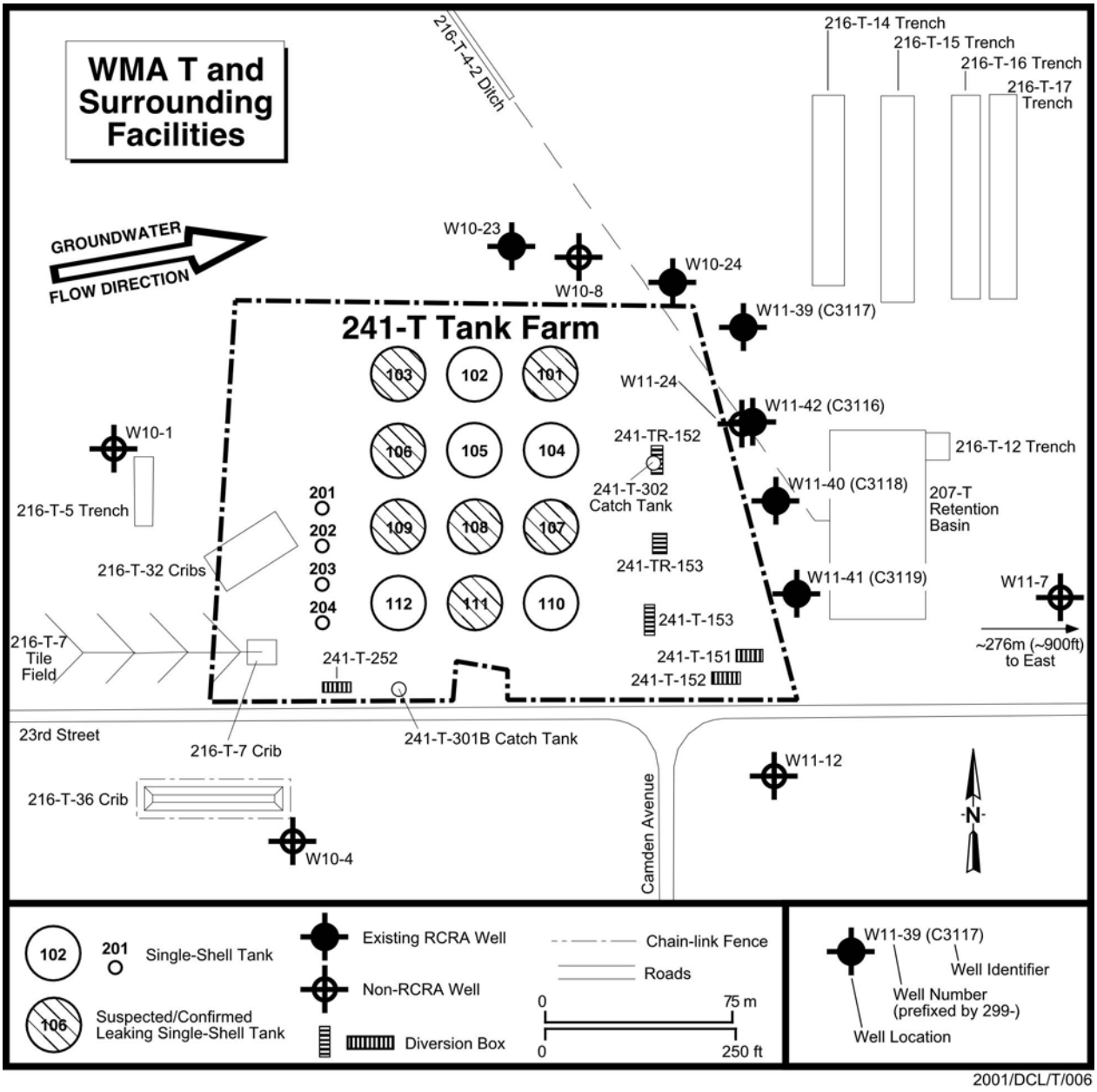


Figure 1. Map of Waste Management Area T and Locations of Wells in the Groundwater Monitoring Network

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

2.0 Well 299-W11-38

Well 299-W11-38 was abandoned when the temporary casing became stuck at 251 ft bgs and could not be freed. Well 299-W11-42 was drilled to replace this well.

2.1 Drilling and Sampling

Well 299-W11-38 was drilled with a cable tool drill rig and drive barrel between 0 and 181 ft below ground surface (bgs) and by hard tool from 181 ft to a total depth of 259 ft bgs. Temporary 11 3/4-in.-outside-diameter, carbon steel casing was placed from the surface to 127 ft bgs and 8 5/8-in.-outside-diameter casing from 0 to 254 ft bgs. Thirty-one gal of water were added to the borehole near the bottom of the interval sampled by drive barrel between 132 and 181 ft to facilitate drilling. Two hundred and twenty four gal of water were added during hard tool drilling between 194 ft and 254 ft bgs.

Sediments encountered during drilling were the Hanford formation, the Plio-Pleistocene Unit and the Ringold Formation. The uppermost sediments from the surface to 39 ft bgs were predominantly gravelly sand and sandy gravel of the Hanford formation. These were underlain from 39 to 91 ft bgs by Hanford formation coarse sand and slightly silty sand with a few thin, silty lenses. The Plio-Pleistocene Unit was encountered from about 91 ft to about 121.5 ft bgs. The Plio-Pleistocene Unit consisted of silty sand and slightly silty sand with a few feet of gravelly sand near the bottom. Three distinct caliche layers were identified at 100 to 103 ft, 112 to 117 ft and 121 to 121.5 ft depths. Undifferenciated Plio-Pleistocene/ Upper Ringold Formation sandy silt and silty sand exists from 121.5 to 134 ft depth. Sandy gravel and silty sandy gravel of the Ringold Formation Unit E occurs from 134 ft to total depth of 258 ft bgs. The geologists log is included in Appendix A.

Grab samples for geologic description and archive were collected every 5 ft from the surface to total depth. Also, two split spoon samples were collected at 242.2 to 244 ft bgs and at 257 to 258.4 ft bgs for analysis of particle size distribution. The particle size distribution data is in Appendix B.

The borehole and drill cuttings were monitored regularly for organic vapors and radionuclide contaminants. The driller's helper's gloves and sledgehammer were found to be contaminated when the borehole depth was about 112 ft. Maximum direct contamination was 5,326 counts per minute beta, gamma and 1,155 counts per minute alpha. The gloves and hammer were decontaminated and removed; the drill rig and tools were surveyed; and drilling continued without any additional contamination.

2.2 Decommissioning

On September 5, 2000, the 8-in. temporary casing became stuck at 251 ft bgs. It was decided to decommission the borehole after two days of attempting to free the casing. The borehole was decommissioned by adding 20/40 mesh sand from 254 to 232 ft bgs (water table at 237 ft bgs). Bentonite crumbles were then placed in the borehole from 232 to 10 ft bgs and bentonite/cement grout from 10 ft to the surface. A brass marker was installed in the surface seal.

All 11 3/4-in. casing and all 8 5/8-in. casing from 184 ft to the surface were removed during decommissioning activities. Seventy feet of 8-in. casing (from 184 to 254 ft bgs) remains in the ground. The drill rig was moved 5 ft to the north to install replacement well 299-W11-42.

3.0 Well 299-W11-39

Well 299-W11-39 is located outside the northeast corner of T tank farm. The well was drilled during November and December 2000.

3.1 Drilling and Sampling

Well 299-W11-39 was drilled with a cable tool drill rig from the surface to a total depth of 282.3 ft bgs. Temporary 11 3/4-in.-outside-diameter, carbon steel casing was placed from the surface to 50.9 ft bgs and 8 5/8-in.-outside-diameter casing from the surface to 280 ft bgs. The borehole was drilled using a drive barrel from the surface to 94 ft depth and a hard tool from 94 ft to total depth. About 830 gal of water were added to the borehole during hard tool drilling.

Preliminary evaluation shows that the sediments encountered during drilling were Hanford formation sandy gravel from the surface to about 34 ft bgs and silty sand, sand, and gravelly sand from 34 ft to 90 ft bgs. Calcareous silty sand of the Plio-Pleistocene unit was encounter from 90 ft to about 130 ft bgs. The sediments from 130 ft to total depth were mostly silty sandy gravel with some sandy gravel of the Ringold Formation. The geologist's log is in Appendix A.

Near continuous split spoon core was collected from depths of 20 ft to 94 ft for detailed characterization. Also, three split spoon samples were collected at 243 to 244.5 ft, 258 to 259.5 ft and from 273 to 274 ft depths for analysis of particle size distribution. The results of detailed characterization will be presented elsewhere. In addition to the split spoon samples, grab samples were collected at approximately 5-ft intervals for geologic description and archive throughout the entire borehole.

The borehole and drill cuttings were monitored regularly for organic vapors and radionuclide contaminants. No contamination was noted.

Borehole 299-W11-39 was geophysically logged with high resolution, spectral gamma-ray, and neutron-neutron moisture instrumentation in December 2000. Logging occurred through the temporary casings. Cesium-137 was identified from the surface to 1 ft depth at concentrations less than about 2 pCi/g. No other manmade radionuclides were identified. The responses on the moisture log below about 95 ft may be, in part, a result of water added during drilling. All borehole logs are in Appendix C.

3.2 Well Construction

The permanent casing and screen were installed in well 299-W11-39 in December 2000. A 4-in.-inner-diameter, stainless steel, continuous wire wrap (0.020 in. slot) screen was set from 273.66 to 238.6 ft bgs. The permanent casing is 4-in.-inner-diameter stainless steel from 238.6 ft bgs to 1.88 ft above ground surface. There is a 2-ft stainless steel sump below the screen from 275.66 to 273.66 ft.

The filter pack is 10-20 mesh silica sand from 282.31 to 227.15 ft bgs. The annular seal is 3/8 in. bentonite pellets from 227.15 to 222.47 ft bgs, granular bentonite from 222.47 to 96.5 ft bgs, and bentonite chips from 96.5 to 10.9 ft bgs. Portland cement was placed from the top of the bentonite at 10.9 ft to the surface. A 4 ft by 4 ft by 6 in. concrete pad was placed around the well at the surface. A 6-in. stainless steel protective casing with locking cap, four protective steel posts, and a brass marker stamped with the well number were set into the concrete. The permanent casing extends 1.17 ft above the concrete pad and the protective casing extends 2.17 ft above the pad. The Well Summary Sheet (as-built) and Well Construction Summary Sheet are included in Appendix A.

The vertical and horizontal coordinates of the well were surveyed in March 2001. The horizontal position of the well was determined by Global Positioning System observations referenced to horizontal control stations established by Rogers Surveying, Inc., Richland, Washington and the U.S. Army Corps of Engineers. The coordinates are Washington Coordinate System, South Zone, NAD83(91) datum. Vertical datum is NAVD 1988 and is based on existing bench marks established by the U.S. Army Corps of Engineers. Survey data are included in Table 2.

3.3 Well Development and Pump Installation

Well 299-W11-39 was developed in December 2000. A temporary, submersible pump was used to remove about 1,700 gal of formation water at about 10.7 gal/min. The pump intake was at 273.3 ft bgs. Total drawdown was 19.6 ft; final turbidity was 4.81 NTU.

A dedicated Redi-Flo 2 sampling pump was installed in well 299-W11-39 in December 2000. The sampling pump intake is at 247.9 ft bgs (or 9.9 ft below the water table). The depth to water was measured at 238.02 ft bgs on December 21, 2000.

Table 2. Survey Data for New Wells at Waste Management Area T

Well Name	Easting (m)	Northing (m)	Elevation (m)	
299-W11-39	566,908.383	136,779.917		Center of Casing
			210.550	"X" on Rim of Casing
	566,908.407	136,780.250	209.885	Brass Cap
299-W11-40	566,926.838	136,709.666		Center of Casing
			210.428	"X" on Rim of Casing
	566,926.859	136,709.950	209.696	Brass Cap
299-W11-41	566,935.510	136,677.781		Center of Casing
			210.641	"X" on Rim of Casing
	566,935.529	136,678.073	209.667	Brass Cap
299-W11-42	566,920.435	136,745.665		Center of Casing
			211.066	"X" on Rim of Casing
	566,920.396	136,745.980	210.179	Brass Cap

4.0 Well 299-W11-40

Well 299-W11-40 is located outside the east boundary of the T tank farm. The well was drilled during September and October 2000.

4.1 Drilling and Sampling

Well 299-W11-40 was drilled with a cable tool drill rig from 0 to 20 ft bgs and by air rotary rig from 21 ft to the total depth of 280 ft bgs. Temporary 11 3/4-in.-outside-diameter, carbon steel casing was placed from the surface to 20.5 ft bgs and 8 5/8-in.-outside-diameter casing from the surface to 280 ft bgs. About 450 to 550 gal of water were added to the borehole at 280 ft to reduce heaving sand.

Preliminary evaluation shows that the sediments encountered during drilling were predominantly sand and sandy gravel of the Hanford formation from the surface to about 88 ft bgs; Plio-Pleistocene calcareous silty sand, sandy silt, and gravelly silty sand from about 88 to 142 ft bgs; and Ringold Formation sandy gravel and silty sandy gravel from 142 ft to total depth (280 ft bgs). The geologist's log is in Appendix A.

Sediment samples were collected at approximately 5-ft intervals for geologic description and archive throughout the entire borehole. Three split spoon samples were collected from 244.8 to 246.8 ft, 257.1 to 259.6 ft, and 272.0 to 274.5 ft bgs for analysis of grain size distribution. Grain size distribution data are in Appendix B.

The borehole and drill cuttings were monitored regularly for organic vapors and radionuclide contaminants. No contamination was noted.

4.2 Well Construction

The permanent casing and screen were installed in well 299-W11-40 in October 2000. A 4-in.-inner-diameter, stainless steel, continuous wire wrap (0.020 in. slot) screen was set from 273.13 to 238.08 bgs. The permanent casing is 4-in.-inner-diameter stainless steel from 238.08 ft bgs to 2.5 ft above ground surface. There is a 2.05-ft stainless steel sump below the screen.

The filter pack is 10-20 mesh silica sand from 280 to 228.6 ft bgs. The annular seal is 3/8-in. bentonite pellets from 228.6 to 222.2 ft and granular bentonite from 222.2 to 10.2 ft bgs. Portland cement grout extends from the top of the bentonite at 10.2 ft to the surface. A 4 ft by 4 ft by 6 in. concrete pad was placed around the well at the surface. A 6-in. stainless steel protective casing with locking cap, four protective steel posts, and a brass marker stamped with the well number were set into the concrete. The permanent casing extends 2.06 ft above the concrete pad and the protective casing extends 2.38 ft above the pad. The Well Summary Sheet (as-built) and the Well Completion Summary Sheet are included in Appendix A.

The vertical and horizontal coordinates of the well were surveyed in March 2001. The horizontal position of the well was determined by Global Positioning System observations referenced to horizontal control stations established by Rogers Surveying, Inc., Richland, Washington, and the U.S. Army Corps of Engineers. The coordinates are Washington Coordinate System, South Zone, NAD83(91) datum. Vertical datum is NAVD 1988 and is based on existing bench marks established by the U.S. Army Corps of Engineers. Survey data are included in Table 2.

4.3 Well Development and Pump Installation

Well 299-W11-40 was developed in November 2000. A temporary, submersible pump was used to remove approximately 2,088 gal of formation water. About 1,464 gal of water were removed at 24 gal/min with the pump intake at 33.09 ft below the water table resulting in 11 ft of drawdown. Also, 624 gal of water were removed at 16 gal/min with the pump intake at 13.4 ft below the water table resulting in 7.4 ft of drawdown. Final turbidity was 3.58 NTU.

A dedicated Redi-Flo2 sampling pump was installed in well 299-W11-40 on December 21, 2000. The pump intake is 247.6 ft bgs (10.3 ft below the water table). Water level was measured at 237.3 ft bgs on December 21, 2000.

5.0 Well 299-W11-41

Well 299-W11-41 was drilled in August 2000. The well is located near the southeast boundary of T tank farm.

5.1 Drilling and Sampling

The borehole was drilled by cable tool and drive barrel from 0 to 20 ft bgs and by air rotary from 20 ft to a total depth of 280 ft bgs. Temporary 11 3/4-in.-outside-diameter carbon steel casing was placed from the surface to 20.6 ft and 8 5/8-in.-outside-diameter carbon steel casing was set from ground surface to 280 ft during drilling.

The sediments encountered during drilling were predominantly Hanford formation silty sandy gravel, sandy gravel, and gravelly sand from the surface to 39 ft and sand from 39 to 94 ft bgs. Plio-Pleistocene silty sand, sand, and sandy silt was encountered between about 94 and 133 ft bgs. Ringold Formation silty sandy gravel, sandy gravel and gravelly sand occurred from 133 to 280 ft depth. The geologist's log is included in Appendix A.

Grab samples were collected at approximately 5-ft intervals from the surface to the bottom of the borehole (280 ft) for geologic description and archive. Three split tube samples were taken from 248.0 to 250.5 ft, 262.2 to 264.7 ft, and from 272.0 to 274.5 ft depths for analysis of particle size distribution to support selection of screen slot and filter pack size. Analytical results are in Appendix B.

The borehole and drill cuttings were monitored regularly for organic vapors and radionuclide contaminants. No contamination was noted.

The well was geophysically logged with high resolution, spectral gamma-ray and neutron-neutron moisture instrumentation in August 2000. Logging occurred through the temporary casings. Cesium-137 was identified at depths less than 2 ft and at concentrations less than 2 pCi/g. No other manmade radionuclides were identified. All borehole logs are in Appendix C.

5.2 Well Construction

The permanent casing and screen were installed in well 299-W11-41 in August 2000. A 4-in.-inner-diameter, stainless steel, wire wrap (20 slot) screen was set from 271.7 ft to 236.7 ft bgs. The permanent casing is 4-in.-inner-diameter stainless steel from 236.7 ft bgs to 2.7 ft above ground surface. The well has a 2-ft stainless steel sump below the screen.

The filter pack is 10-20 mesh silica sand from 280.6 to 226 ft bgs. The annular seal is bentonite pellets from 226 to 218.8 ft, bentonite crumbles from 218.8 to 12.9 ft depths, and Portland cement from 12.9 ft to the surface. A protective casing with a locking cap extends to 3.7 ft above the surface. A 4 ft by 4 ft by 6 in. concrete pad was placed around the well at the surface. Four protective steel posts and a brass marker stamped with the well number were placed into the concrete. The permanent casing extends

2.17 ft above the concrete pad and the protective casing extends 3.17 ft above the concrete pad. The Well Summary Sheet (as-built) and Well Construction Summary Report are included in Appendix A.

The vertical and horizontal coordinates of the well were surveyed in March 2001. The horizontal position of the well was determined by Global Positioning System observations referenced to horizontal control stations established by Rogers Surveying, Inc., Richland, Washington, and the U.S. Army Corps of Engineers. The coordinates are Washington Coordinate System, South Zone, NAD83(91) datum. Vertical datum is NAVD 1988 and is based on existing bench marks established by the U.S. Army Corps of Engineers. Survey data are included in Table 2.

5.3 Well Development and Pump Installation

Well 299-W11-41 was developed in August 2000. A temporary, 3 hp, submersible pump was used to remove about 2,700 gal of formation water. First, approximately 1,475 gal of water were removed from the well at about 25 gal/min with the pump intake at 274.8 ft below top of casing; there was no apparent drawdown. Second, 1,225 gal of water were pumped at 25 gal/min with the pump intake at 254.8 ft below top of casing resulting in about 5 ft of drawdown. The final turbidity was 3.81 NTU.

A dedicated Hydrostar sampling pump was installed in well 299-W11-41 in August 2000. The sampling pump intake is at 244.15 ft bgs (or 7.02 ft below the water table). The depth to water was measured at 237.13 ft bgs on August 24, 2000.

6.0 Well 299-W11-42

Well 299-W11-42 was drilled in September 2000. The well is located at the east side of T tank farm.

6.1 Drilling and Sampling

The borehole is the replacement for borehole 299-W11-38 which was decommissioned because of problems during drilling (see above). Borehole 299-W11-42 was drilled by air rotary from the surface to a total depth of 280 ft bgs using temporary 8 5/8-in.-outside-diameter, carbon steel casing. No grab samples were collected or geologic description of the cuttings made from the upper 260 ft of the borehole because samples and descriptions were taken during drilling of replaced borehole 299-W11-38 which is just 5 ft south of 299-W11-42. Grab samples were collected for archive and description every 5 ft from 260 to 280 ft bgs. The bottom 20 ft of the borehole (260 to 280 ft bgs) encountered sandy gravel of the Ringold Formation Unit E. The geologic log for well 299-W1138, approximately 5 ft from well 299-W11-42, is included in Appendix A.

Eight groundwater samples were collected during drilling. The samples were air lifted slurries of cuttings and water obtained during air rotary drilling. The slurries were filtered using a peristaltic pump and a 0.4-µm filter cartridge prior to analysis in the field. The samples were tested for nitrate and specific conductance as a screen for vertical contaminant distribution. All analyzed nitrate levels are above the 45 mg/L maximum contaminant level. The analytical results are shown in Table 3.

The borehole and drill cuttings were monitored regularly for organic vapors and radionuclide contaminants. No contamination was noted.

Table 3. Analytical Results from Groundwater Samples from Well 299-W11-42

Sample Depth (ft)	Nitrate (mg/L)[(a)]	Specific Conductance (µS/cm)
240	Not measured	580
245	Not measured	688
250	Not measured	660
255	302	758
265	Not measured	1392
270	Not measured	1419
275	Not measured	1420
280	576	1400

(a) Nitrate is mg/L as NO_3^-. Analyzed by HACH cadmium reduction method (Method 8039) using a DR/2010 portable spectrophotometer. Reagent blank corrected.

6.2 Well Construction

The permanent casing and screen were installed in well 299-W11-42 in September 2000. A 4-in.-inner-diameter, stainless steel, wire wrap, 20 slot screen was set from 271.77 ft to 236.76 ft bgs. The permanent casing is 4-in.-inner-diameter stainless steel from 236.76 ft bgs to 2.5 ft above ground surface. The well has a 2-ft stainless steel sump below the screen.

The filter pack is 10-20 mesh silica sand from 280 to 225.5 ft bgs. The annular seal is bentonite pellets from 225.5 to 217.8 ft, bentonite crumbles from 217.8 to 10.2 ft depths, and Portland cement grout from 10.2 ft to the surface. A protective casing with a locking cap extends to 3.5 ft above the surface. A 4 ft by 4 ft by 6 in. concrete pad was placed around the well at the surface. Four protective steel posts and a brass marker stamped with the well number were placed into the concrete. The 4-in. permanent casing extends 2.5 ft above the concrete pad and the protective casing extends 3.5 ft above the pad. The Well Summary Sheet (as-built) and Well Construction Summary Report are included in Appendix A.

The vertical and horizontal coordinates of the well were surveyed in March 2001. The horizontal position of the well was determined by Global Positioning System observations referenced to horizontal

control stations established by Rogers Surveying, Inc., Richland, Washington, and the U.S. Army Corps of Engineers. The coordinates are Washington Coordinate System, South Zone, NAD83(91) datum. Vertical datum is NAVD 1988 and is based on existing bench marks established by the U.S. Army Corps of Engineers. Survey data are included in Table 2.

6.3 Well Development and Pump Installation

Well 299-W11-42 was developed in September 2000. A temporary, submersible pump was used to remove about 2,250 gal of formation water. First, approximately 1,200 gal of water were removed from the well at 24 gal/min with the pump intake at 269.15 ft bgs (31.09 ft below the water table) resulting in 1.1 ft drawdown. Second, approximately 1,150 gal of water were pumped at 25 gal/min with the pump intake at 248.23 ft bgs (about 10.1 ft below the water table) resulting in 1.3 ft drawdown. The final turbidity was 1.14 NTU.

A dedicated Hydrostar sampling pump was installed in well 299-W11-42 in September 2000. The sampling pump intake is at 248.9 ft bgs (or 10.9 ft below the water table). The depth to water was measured at 237.95 ft bgs on September 14, 2000.

7.0 References

Caggiano, J. A., and C. J. Chou. 1993. *Interim-Status Groundwater Quality Assessment Plan for the Single Shell Tank Waste Management Areas T and TX-TY.* WHC-SD-EN-AP-132, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

Ecology - Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy. 1998. *Hanford Federal Facility Agreement and Consent Order.* Document No. 89-10, Rev. 5 (The Tri-Party Agreement), Olympia, Washington.

Hodges, F. N., and C. J. Chou. 2001. *RCRA Assessment Plan for Single-Shell Tank Waste Management Area T at the Hanford Site.* PNNL-12057, Pacific Northwest National Laboratory, Richland, Washington.

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

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

WAC 173-303, Washington Administrative Code. *Dangerous Waste Regulations*. Olympia, Washington.

Appendix A

Well Construction and Completion Documentation

WELL CONSTRUCTION SUMMARY REPORT

Start Date: 11/7/00
Finish Date: 12/18/00
Page 1 of 1

Specification No.: 0200W-SP-C0007	Rev. No.: 0	Well Name: 299-W11-39	Well No.: C3117
ECNs: NA		Approximate Location: NE of 241T Tank Farm	
Project: RCRA Drilling CY 2000		Other Companies: BHI & CHI	
Drilling Company: RSI		Geologist(s): G.S. Thomas, V.M. Faurote, L.D. Walker & Jill Murray, DC Weekes	
Driller: M. Wraspir			

TEMPORARY CASING AND DRILL DEPTH

*Size/Grade/Lbs. Per Ft.	Interval	Shoe O.D./I.D.
11 3/4" CS FJ	0 - 50.94	1.0'/.86'
8 5/8" CS FJ	0 - ~~285.44~~ 280' new	9"/7 3/8"
	-	
	-	
	-	

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

DRILLING METHOD/HOLE DIAMETER

Auger:	Diameter From ____ to ____
Cable Tool:	Diameter From 95 to 282.31'
Air Rotary:	Diameter From ____ to ____
A.R. w/Sonic:	Diameter From ____ to ____
	Diameter From ____ to ____
	Diameter From ____ to ____
	Diameter From ____ to ____

Total Drilled Depth: 282.31'	Hole Dia @ TD: 9"	Drilling Fluid: H_2O	
Well Straightness Test Results: 20.2' L x 6 1/2" OD Tucked bottom		Total Amt. Of Water Added During Drilling: 830 gal	
		Static Water Level: 237.31'	Date: 12-18-00

GEOPHYSICAL LOGGING

Sondes (type)	Interval	Date	Sondes (type)	Interval	Date
	-	12/6/00		-	
	-			-	
	-			-	

COMPLETED WELL:

Size/Wt./Material	Depth	Thread	Slot Size	Type	Interval Annual Seal/Filter Pack	Volume	Mesh Size
SS 304 L Casing 4" ID	+1.88 - 238.59	FJ	NA	Colorado Silica Sand	227.15 - 282.31	67	10-20
SS 304 L Screen	238.6 - 273.66	FJ	0.020	Bentonite Pellets	222.47 - 227.15	7 buckets	3/8"
SS 316 L Sump	273.66 - 275.66	FJ	NA	Bentonite Granules	96.5 - 222.47	144 bgs	
	-			Bentonite Chips	10.9 - 96.5	60 bgs	
	-			Portland Cement	0 - 10.9	30 bgs	NA

OTHER ACTIVITIES

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

WELL SURVEY DATA

Date:	Protective Casing Elevation:
Washington State Plane Coordinates:	Brass Cap Elevation:

COMMENTS/REMARKS

50-lb bag 10-20 sand = 0.54 ft³; 50-lb bucket of bentonite pellets = 0.62 ft³;
50-lb bag granular bentonite = 0.73 ft³; 94-lb. bag portland cement = 1.285 ft³

Reported By: G.S. Thomas		Reported By: M L Johnson	
Title: Scientist	Date: 12/18/00	Title: BHI ESR	Date: 01/04/01
Signature: Greg Thomas		Signature: M L Johnson	

BHI-EE-181 (12/97)

WELL SUMMARY SHEET

Page 1 of 2

Date: 12-18-00

Well ID: C3117		Well Name: 299-W11-39	
Location: NE of 241 T Tank Farm		Project: RCRA Drilling CY 2000	
Prepared By: G.S. Thomas	Date: 12-18-00	Reviewed By: DC Weekes	Date: 12/27/00
Signature: Greg Thomas		Signature: DC Weekes	

CONSTRUCTION DATA

Description	Diagram
6-in. diameter protective SS casing set 1.0' above the 4-in casing	
4-in ID schedule 5, SS 304L well casing +1.88' → 238.59'	
Portland Cement Grout: 0' → 10.9'	
Bentonite Chips: 10.9' → 96.5'	
Bentonite Granular: 96.5' → 222.47'	
Temporary Casing 11 3/4"/10 3/4" set @ 51.3' 8 5/8"/7 5/8" to ~~280'~~ 282'	
All depths in feet below ground surface	
All temp. casing removed from the ground.	

GEOLOGIC/HYDROLOGIC DATA

Depth in Feet	Graphic Log	Lithologic Description
0		0-5.5': Backfill
		5.5' → 33.5': Sandy GRAVEL
25		
		33.5'-57': Gravelly SAND
50		
		57'-63': SAND
		63'-82.5': Gravelly SAND
75		
		82.5' → 90': SAND
		90' → 112': Silty SAND
100		
		112' → 127': Slightly Silty SAND
125		127' → 131' Slightly Silty Gravelly SAND
		131' → 145': Silty Sandy GRAVEL
		145'-150': Sandy GRAVEL

BHI-EE-189 (12/97)

WELL SUMMARY SHEET

Page 2 of 2

Date: 12-18-00

Well ID: C3117		Well Name: 299-W11-39	
Location: NE of 241-T Tank Farm		Project: RCRA Drilling CY 2000	
Prepared By: G.S Thomas	Date: 12-18-00	Reviewed By: DC Weekes	Date: 12/27/00
Signature: Greg Thomas		Signature: DC Weekes	

CONSTRUCTION DATA

Description	Diagram
Bentonite Pellets, ¼"-½": 222.47' → 227.15'	
Silica Sand, 10-20 mesh 227.15' → 282.31'	
Well Screen 4-in ID, 0.020-in. Slot Cont. wire-wrap, SS type 304 238.60' → 273.66'	
Sump: 4-in ID SS 304 L 273.66' → 275.66'	
Total 4-in. ID SS material is 277.54' (41.88' → 277.66')	
All depths in feet below ground Surface	
All temp. Casing removed from the ground.	

GEOLOGIC/HYDROLOGIC DATA

Depth in Feet	Graphic Log	Lithologic Description
150		150' → 265' Silty Sandy Gravel
175		
200		
225		W.L. = 237.31' bgs (12-8-00)
250		265' SANDY GRAVEL, then SILTY SANDY GRAVEL to T.D.
275	END OF HOLE	282.31' bottom of hole

BHI-EE-189 (12/97)

BOREHOLE LOG

Page 1 of 10
Date: 11/10/00

Well ID: C3117 | Well Name: 299-W11-39 | Location: NE of 241-T Tank Farm
Project: NE side of 241-T Tank Farm, RCRA FY 2001 | 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				Brown silt, sand and pebbles as backfill material	START 0747, 11/10/00
		<detect RAD			
		<detect			@5' - chip sample
5		<detect RAD		no archive of backfill material.	
		<detect RAD		5.5'-33.5' Sandy pebble-cobble gravel (sG) w/ 65% gravel (70% cr, 20% m, 10% f grns), 25% Sand (20% cr, 40% m, 30% f grns) with 10% silt in a dry, brown, poorly sorted, sub-round grained unit with cobbles to 7"x5"x2.5". Basalt is 65% of total material, with granite and metamorphics as the minor fraction	
		<detect			
10	Archive	<detect RAD <detect VOA, CGM			seal drum 2000-00-0188 0-10'
		<detect		grain size decreases to f. gravel to f. pebbles, color is brown-gray to dark gray	seal drum -0182 (10-14')
15	Archive				
		<detect			
20	Archive	<detect			Seal drum -0197 (14-20')
	split spoon #1	<detect #1; 50% rec.		only 1 liner 21-22' bgs.	
	split spoon #2	#2 95% rec.		Continues as sandy gravel, gray-brown, coarse to fine pebbles, coarse to fine gravel with 30-35% sand. Primarily Basalt. mod. rxn to HCl	25'-end shift 11/10/00 start 11/13/00
25	Archive				
	split spoon #3 0733hrs	40% recovery 25MF		Large cobbles @ 26', 80% of material in 25-26'	split.
	split spoon #4	40% recovery			

Reported By: J.M. Faurote | Reviewed By: DC Weekes
Title: Geologist | Title: Geologist
Signature: JM Faurote | Date: 11/13/00 | Signature: DC Weekes | Date: 12/27/00

BHI-EE-183 (12/97)

BOREHOLE LOG

Page 2 of 10
Date: 11-13-00

Well ID: C3117 | Well Name: 299-W11-39 | Location: NE of 241-T Tank Farm
Project: FY2001 RCRA 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
30	Archive				
	SPOON NOT TAKEN			Pebble, cobble gravel, 60% cobbles	30-32.5 spoon
31.5	SPLIT SPOON #5	100%		and pebbles, 15% gravel, 25% sand that	not taken due to cobbles.
				is primarily basalt. Maximum size is	Will try @ 31.5-34.0
34				10" x 8" x 8".	
35	SPLIT SPOON #6	95% Archive from Cuttings		Hit sand, gravelly sand ~ 33.5'.	
				33.5 - 57' gravelly sand (gS) 20-25%	
	SPLIT SPOON #7	100% recovery		gravel (60% f, 40% m) lt med to lt gy-brn, vf (5%),	
				20% f, 40% m, 25% ccr grnd, poorly sorted, sub-	liners 36.5-37.5 37.5-38.5
				angular to sub-round grained Sand. The unit	
40	Split Spoon #8	Archive		reacts mildly to HCl. Minor Fe staining noted	liners 39-40 40-41
		100% recovery		The unit contains 55-60% basalt. Maximum	slightly grayer w/ white
	SS #9	100% recovery		grain size is 1/4" x 3/8". The unit is dry.	
				Silt increases to 12-15% 43-44', contains	
45	SS #10	Archive		muscovite. Back into poorly sorted sand	
				w/ variable gravel, basalt rich unit.	
	SS #11	100% recovery			
				Less gravel, here @ < 20%; < 10% silt	
50	SS #12	Archive		still poorly sorted w/ wk-mod Rxn to HCl	
	SS #13				
55	SS #14	Archive			
				57' → 63': SAND (S)	
	SS #15	100% rec.		5% Gravel, 95% Sand, tr silt.	SS #15; liners at
				Similar to above, with less gravel.	56.5'→57.5'; 57.5'→58.5

Reported By: J.M. Faurote / L.D. Walker | Reviewed By: D.C. Weekes
Title: Geologist | Title: Geologist
Signature: J.M. Faurote L.D. Walker | Date: 11-14-00 | Signature: D.C. Weekes | Date: 12/27/00

BHI-EE-183 (12/97)

BOREHOLE LOG

Page 3 of 10
Date: 11-14-00

Well ID: C3117 | Well Name: 299-W11-39 | Location: NE of 241-T Tank Farm/200W
Project: RCRA Drilling CY2000 | 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
60	SS # 16	100% rec.			8 5/8" OD CS casing.
		Archive			Cable tool.
	SS # 17	100% rec.		gradual increase in fine peb. gravel	Split Spoon # 16: lexan liners 59'→60', 60'→61'
				63'→82.5': Gravelly SAND (gS)	SS #17: liners
65	SS # 18	Archive 100% rec		10-15% Gravel, 85-90% Sand, tr-5%	61.5'→62.5'; 62.5'→63.5'
				silt. Gravel 40% med-Fn peb, 60% v.Fn	SS #18: 64'→65'; 65'→66'
	SS # 19	100% rec.		peb. Sand 30% v.cse, 30% cse, 30%	SS #19: 66.5-67.5', 67.5-68.5'
				med-Fn, 10% v. Fn. 10YR5/2 (gr brn)	LEL, OVM < detect.
70	SS #20	Archive 100% rec.		sl moist, poorly sorted; Sand SA-A,	SS #20: 69→70', 70→71'
	SS #21	100% rec		gravel SA-SR; 40-50% basalt, 50-	SS #21: 71.5→72.5', 72.5→73'
				60% qtz/granitic/other; tr Fe staining,	α, β, γ at background
				weak rxn HCl; max gravel ~ 10 mm.	levels
				Silt increase to ~10% at 69', then back	SS #22: 74→75', 75→76'
				to tr.	75': trace yellow and
75	SS #22	Archive 100% rec.		75': trace bright yellow and orange	orange staining -
				staining	no unusual rad
	SS #23	100% rec.		occasional strong rxn HCl	levels.
				77.5'→78': silt content up to ~10%	liners: SS #23: 76.5→78.5'
80	SS #24	Archive 100% rec			SS #24: liners: 79'→81'
				gravel content decreasing	
	SS #25	100% rec.		82.5'→90.0': SAND (S); 5% Gravel,	SS #25: liners: 81.5→83.5'
				90% Sand, 5% silt. Gravel is Fn-	
				v. Fn peb; Sand similar to above-	SS #26: liners: 84'→86'
85	SS #26	Archive 100% rec		cse-med, poorly sorted; occ. iron	
				staining; mod-strong rxn HCl.	SS #27: liners 86.5→88.5
	SS #27	100% rec.			

Reported By: L. D. Walker | Title: Geologist | Signature: [signature] | Date: 11-14-00

Reviewed By: D C Weekes | Title: Geologist | Signature: [signature] | Date: 12/27/00

BHI-EE-183 (12/97)

BOREHOLE LOG

Page 4 of 10
Date: 11-14-00

Well ID: C 3117 | Well Name: 299-W11-39 | Location: NE of 241-T Tank Farm
Project: RCRA Drilling CY2000 | 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
90	SS #28	Archive 100% rec.			Cable tool; 8 5/8" OD CS casing
				90' → ~~112'~~ 110' : Silty SAND (mS) 60% Sand, 40% Silt. Sand is 30% fn, 70% v. fn; 10YR5/3 (brown) moist (esp. at contact at 90.0'), well sorted, SA; 90% qtz/feld, 10% other; mod-strong rxn HCl.	SS #28: liners: 89' → 91'
	SS #29				SS #29: liners: 91.5 → 93.5'
95	Hard Tool	Archive		95' Silty SAND 75% sand, 25% Silt	11-16-00 94': begin hard tool drilling.
100		Archive		100' Silty SAND (mS). 65% Sand, 35% Silt. Sand is 5% c-m, 60 AT 35% fn & 5 % vfn; 10YR 5/3 (brown); 70% qtz/Feld, 30% other. Strong rxn HCl. Caliche grains.	
105		Archive		105' Silty Sand (mS). 60% Sand, 40% Silt. Sand is 25% v.cse-cse, 50% md, 25% v.fn-fn, Caliche grains, 60% qtz/feld 40% other.	
110		Archive		110' Silty Sand (mS) 79% Sand, 21% Silt. Sand is 15% v.cse-cse, 50% md, 35% v.fn-fn, Caliche grains, 60% qtz/feld and 40% other Strong rxn HCl	
				112' → 127' Slightly Silty SAND (m)S	
115		Archive		115' Slightly Silty SAND (m) S. Gravel 2-5%, Silt 10-15%, Sand 80-85% Gravel v.fn. Sand 25% v.cse-cse, 50% md, 25 v.fn-fn. Caliche grains, 65% qtz/feld and 35% other. Strong rxn HCl	

Reported By: L.D. Walker / G.S. Thomas | Reviewed By: DC Weekes
Title: Geologist / Scientist | Title: Geologist
Signature: LD Walker / GS Thomas | Date: 11/17/00 | Signature: DC Weekes | Date: 12/27/00

BHI-EE-183 (12/97)

BOREHOLE LOG

Page 5 of 10
Date: 11/17/00

Well ID: C3117 | Well Name: 299-W11-39 | Location: NE of 241-T Tank Farm
Project: RCRA Drilling CY2000 | 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	Hand Tool	Archive		120' Slightly Silty Sand (sm) S. 2%-5% Gravel, 75-78% Sand, 20% Silt. Gravel v.fn, Sand 40% v.cse-cse, 30% med, 30% v.fine-fine. Few Caliche grains, 50% qtz/feld & 50% other, medium rxn HCl	Hand Tool Drilling
125		Archive		Same As Above	
				127'→131' Slightly Silty Gravelly Sand (sm)gS	
130		Archive		130' Slightly Silty Gravelly Sand (sm)gS. 25% Gravel, 60% Sand, 15% Silt. Gravel broken into pebbles of 15% cse, 30% med, 55% fn-v.fn, Largest 2cm. Sand 60% v.cse-cse, 20% med, 20% fn-v.fn. 50-60% mafic, medium rxn HCl	
135		Archive		135' Silty Sandy Gravel. (sm)SG. Silt 15%, Sand 45%, Gravel 40%. Gravel broken pebbles of 15% cse, 30% m, 55% fn-v.fn. Sand 55% v.cse-cse, 35% m, 10% fn-v.fn. 80% basalt 20% qtz/ch/granite/other. mild rxn HCl. Color 5Y 4/1 (dark Gray)	
140		Archive		Silty Sandy GRAVEL - as above	
145		Archive Grab		145'-150' SANDY Gravel SG Gravel 60-65%, sand 35%, trace 5%- Silts; Pebbles→cobbles, Basalt 65%, No HCl rxn, color still 5Y 4/1 (dk gray), fragments appear to have mod. sorting, sands-cse 75%, 10% v.cse, 15% med-fine; Sm cobbles max size, med pebbles prob. dominate	

Reported By: G.S. Thomas / L.D. Walker | Reviewed By: D.C. Weekes
Title: Scientist | Title: Geologist
Signature: Greg Thomas / LDWalker | Date: 11/17/00 | Signature: D.C. Weekes | Date: 12/27/00

BHI-EE-183 (12/97)

BOREHOLE LOG

Page 6 of 10
Date: 11/20/00

Well ID: C3117 | Well Name: 299-W11-39 | Location: NE side of 241-T TANK FARM
Project: RCRA DRILLING CY2000 | 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
150	HARD TOOL ARCHIVE Hard tool			150 → Silty Sandy Gravel	151'- Drilling with difficulty Hard Tool
155		Archive		155 Slightly Silty Sandy Gravel msG. Gravel 35%, sand 65%, silt 10% Gravel broken into pebbles of 15% m, 85% fn-v.fn. 60-65% basalt other quartzite, Gneiss, Granite. One unbroken pebble 17cm Subrounded. Sand 60% v.cse-cse, 25% m, 15% fn-v.fn. Color 5Y 4/1 (dark Gray)	
160		Archive		160: silty sandy Gravel (msG) Gravel 60%, sand 30%, silt 10% in a metamorphic-rich fragmented mass. The color is variegated, but overall med to dark gray. It is dry, and difficult drilling. Sorting and roundness are indefinable due to hard tool drilling. Typical Ringold is 2-3" clasts and smaller of mod. cemented conglomerate.	
165		Archive		165' Silty Sandy Gravel. Gravel 30%, Sand 55%, Silt 15%	
170		Archive		170' Silty Sandy Gravel. Gravel 35%, Sand 50%, Silt 15%. 3 V.Cse pebbles 4-6cm, one unbroken subprism, remainder broken pebbles 20% m, 80% f-v.fn. Gravel 40% basalt other qtz, chert, tr Granitoid & Granite. Angular to Subrounded sand 65% C-v.c, 20% m, 15% f-v.fn with trace of mica.	
175		Archive		175' Silty Sandy Gravel. Gravel 40%, Sand 50%, Silt 10%. Gravel is 60% broken Angular pebbles of 10% m, 90% fn-v.fn. Sand is 55% C-v.c, 35% m, 10% fn-v.fn.	

Reported By: Jill MURRAY / G.S. Thomas | Reviewed By: DC Weekes
Title: Geologist / Scientist | Title: Geologist
Signature: Jill Murray / Greg Thomas | Date: 11/28/00 | Signature: DC Weekes | Date: 12/27/00

BHI-EE-183 (12/97)

BOREHOLE LOG

Page 7 of 10
Date: 11/28/00

Well ID: C3117 | Well Name: 299-W11-39 | Location: NE of 241-T Tank Farm
Project: RCRA Drilling CY 2000 | 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
180	Hand tool	Archive		180' Silty Sandy Gravel. Gravel 35%, Sand 45%, Silt 20% Gravel 10% m, 90% fn-v.fn. Sand 45% C-V.C, 25% med, 30% v.fn-fn.	
185		Archive		185' Silty Sandy Gravel. Gravel 40%, Sand 35%, Silt 25%. Gravel is 40% basalt with a few whole pebbles the remainder is broken into Angular pebbles of 20% m, 80% fn-v.fn. Sand is 45% c-v.c, 25% m, 30% fn-v.fn with trace of MICA. Largest unbroken Pebble 2.5cm. Color 10YR 5/2 (grayish brown), No Rxn HCL.	
190		Archive		190' Silty Sandy Gravel. Gravel 40%, Sand 35%, Silt 25% Gravel is 40% basalt all broken into angular fn-v.fn pebbles. Other is quartz, clear with tan, orange, redish brown and gray vitreous and white color. Trace of Gneiss. Sand 55% C-V.C, 15% m, 30% f-v.fn. Color 10YR 5/2 (grayish brown), No Rxn HCL	
195		Archive		195' Silty Sandy Gravel. Gravel 45%, Sand 35%, Silt 20% Gravel is 40% basalt most broken into pebbles of 10% C, 15% m, 75% f-v.fn. Sand 30% C-V.C, 45% m, 25% f-v.fn. Color 10YR 5/2 (grayish brown). No Rxn HCL.	
200		Archive		200' Silty Sandy Gravel. Gravel 45%, Sand 35%, Silt 20% Gravel As Above with trace of V.C. pebbles. Sand As Above.	
205		Archive		205' Silty Sandy Gravel. Gravel 40%, Sand 35%, Silt 25%. Gravel is broken into Pebbles of 25% m, 75% f-v.f. Sand 40% C-V.C, 35% m, 25 f-v.f. Color 10YR 5/2 (Grayish brown). No Rxn HCL	

Reported By: G.S. Thomas | Reviewed By: DC Weekes
Title: Scientist | Title: Geologist
Signature: Greg Thomas | Date: 11/30/00 | Signature: DC Weekes | Date: 12/27/00

BHI-EE-183 (12/97)

BOREHOLE LOG

Page 8 of 10
Date: 11/30/00

Well ID: C3117 | Well Name: 299-W11-39 | Location: NE of 241T Tank Farm
Project: RCRA Drilling CY 2000 | 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
210	Hand tool	Archive		210' Silty Sandy Gravel. Gravel 45%, Sand 35%, Silt 20% Unbroken Coarse pebbles 3 cm in diameter and spherical. Color 10YR 5/2 (grayish brown). No Rxn HCL.	
215		Archive		215' Silty Sandy Gravel. Gravel 35-40%, Sand 40%, Silt 20-25% Broken Gravel pebbles of 10% c, 15% m, 75% f-v.f. Sand 40% c-v.c, 35% m, 25% f-v.f.	
220		Archive		220' Silty Sandy Gravel. Gravel 40%, Sand 40%, Silt 20%. Gravel broken into Pebbles 5% C, 15% M, 80% f-v.f. 35% basalt other Quartz, Chert: tan, orange, brown, white & gray vitreous. Sand 35% C, 45% M, 20% f-v.f. Color 10YR 5/2 (grayish brown). No Rxn HCL	
225		Archive		225' Silty Sandy Gravel. Gravel 40%, Sand 40%, Silt 20%	
				228' Silty Sandy Gravel. Gravel 54%, Sand 27%, Silt 19%	
230		Archive		230' Silty Sandy Gravel. Gravel 40%, Sand 35%, Silt 25%. Gravel broken into Angular Pebbles 25% M, 75% f-v.f. 40% basalt other Quartz Colored orange, tan, white & gray. Trace of Gneiss. Sand 25% C-v.c, 60% M, 15% f-v.f. Traces of mica. Color 10YR 5/2 (grayish brown). No Rxn HCL	
235		Archive		235' Silty Sandy Gravel. 45% Gravel, Sand 35%, Silt 20%	

Reported By: G.S. Thomas | Title: Scientist | Signature: G.S. Thomas | Date: 12/1/00
Reviewed By: DC Weekes | Title: Geologist | Signature: DC Weekes | Date: 12/27/00

BHI-EE-183 (12/97)

BOREHOLE LOG

Date: 12-01-00

Well ID: C3117 | Well Name: 299-W11-39 | Location: NE of 241T Trank Farm

Project: RCRA Drilling CY2000 | 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	Hard Tool	Archive		240' Silty Sandy Gravel. Gravel 40%, Sand 35%, Silt 25%	
				Moist	
	SS #30 12/4/00			243'-244' Silty Sandy Gravel. Gravel 53%, Sand 30%, Silt 17%	
				Gravel is 35% basalt, 55% Quartzite/chert, 10% Granitoid/Syenitoid with	
245	Hard tool	Archive		25% Cobbles mainly basalt & Granitoid/Syenitoid and the remainder pebbles.	
				30% VCS-CG, 20% m, 25% f-v.f. Cobbles to Coarse Pebbles Subrounded.	
				Granitoid/Syenitoid showing weathering (7.5 YR 5/6-5/8 in Color Strong brown)	
				Maximum Size Cobble 8.5cm. Medium to v.fine Pebbles Angular to	
250		Archive		Sub Angular. Sand 35% C-v.C, 25% m, 40 f-v.f. with 70% Quartz,	
				25% basalt and 5% other. Silt Color 5Y 4/1 (Dark Gray). No Rxn HCl.	
				250' Silty Sandy Gravel.	
		Archive			
255				255 Silty Sandy Gravel	
				24" Recovery. Top 2" Stuffed Sand.	
	SS #31 12/4/00			258'-259.5' Silty Sandy Gravel. Gravel 55%, Sand 35%, Silt 10%.	
260	Hard tool	Archive		Gravel Contains predominately Angular pebbles of 60%-C-VC, 25%m,	
				15% f-v.f. with Mod Some broken rounded Cobbles. Maximum Size is 6.5cm	
				of broken Cobbles. The gravel is 60-65% Qtz/chert, 25-30% basalt,	
				10% Granitoid/Syenitoid. Weathering present on Granitoid/Syenitoids.	
				Sand 45% C-v.C., 35% m, 20% f-v.f, with mica flakes of 2%.	
				Wet to Moist. Some Very coarse pebbles shattered (Quartz, basalt).	
265		Archive		No Rxn.	
				265'-270' SANDY GRAVEL. Gravel 63%, Sand 30%,	
				Silt 7%.	

Reported By: G.S. Thomas | Title: Scientist | Signature: Greg Thomas | Date:

Reviewed By: DC Weekes | Title: Geologist | Signature: DC Weekes | Date: 12/27/00

BHI-EE-183 (12/97)

BOREHOLE LOG

Page 10 of 10
Date: 12/6/00

Well ID: C3117 | Well Name: 299-W11-39 | Location: NE of 241 T Tank Farm
Project: RCRA Drilling CY 2000 | 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
270	Hard tool	Archive			
				273'-274' bgs. Silty Sandy GRAVEL. Gravel 50%, Sand 35%, Silt 15%.	
	SS 12/5/00	Archive		Gravel 35% small Cobbles, 10% V.C, 12% C, 17% M, 20% f-v.f pebbles.	
				Rounded Cobbles and Very Coarse pebbles. Shape Spherical & Sub prismoidal.	
275				Pebbles broken & Angular. Gravel consists of Quartzite, basalt and	
				Granitoid/Syenitoid. 40% basalt. Sand 30% c-v.c, 50% m and	
				20% vf-f.	
280					8 5/8" OD casing
					to 280'.
	END OF HOLE			Bottom tagged @ 282.31 bgs on 12/6/00	

Reported By: GS Thomas | Reviewed By: DC Weekes
Title: Scientist | Title: Geologist
Signature: Greg Thomas | Date: 12/6/00 | Signature: DC Weekes | Date: 12/27/00

BHI-EE-183 (12/97)

WELL CONSTRUCTION SUMMARY REPORT

Start Date: 9-26-00
Finish Date: 10-9-00
Page 1 of 1

Specification No.: 0200W-SP-C0007	Rev. No.: 0	Well Name: 299-W11-40	Temp. Well No.: C3118
ECNs: NA		Approximate Location: E. Side 241-T tank farm/200W	
Project: CY 2000 RCRA Drilling		Other Companies: BHI, CHI, ~~ETH~~ CW	
Drilling Company: Resonant Sonic, Inf.		Geologist(s): L.D. Walker, D.C. Weekes, J. Murray	
Driller: K. Cowen			

TEMPORARY CASING AND DRILL DEPTH

*Size/Grade/Lbs. Per Ft.	Interval	Shoe O.D./I.D.
FJ / Carbon steel	0 - 20.5	12" / 10¼"
FJ / Carbon steel	20.5 - 280	9" / 7⅝"
	-	
	-	
	-	

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

DRILLING METHOD/HOLE DIAMETER

Auger:		Diameter From ____	to ____
Cable Tool:	12"	Diameter From 0	to 20.5
Air Rotary:	9"	Diameter From 20.5	to 280
A.R. w/Sonic:		Diameter From ____	to ____
		Diameter From ____	to ____
		Diameter From ____	to ____
		Diameter From ____	to ____

Drilling Fluid: Air

Total Drilled Depth: 280.0'	Hole Dia @ TD: 9"	Total Amt. Of Water Added During Drilling:	
Well Straightness Test Results:		Static Water Level: 237.05'	Date: 10-6-00

GEOPHYSICAL LOGGING

Sondes (type)	Interval	Date	Sondes (type)	Interval	Date
None	-			-	
	-			-	
	-			-	

COMPLETED WELL

Size/Wt./Material	Depth	Thread	Slot Size	Type	Interval Annual Seal/Filter Pack	Volume	Mesh Size
4" ID Sched 5 SS304L	+2.5 - 238.08		NA	Portland Cement Grout	0 - 10.2'	10 bags	NA
4" ID SS304 screen	238.08 - 273.13		0.020	Granular bentonite	10.2' - 222.2'	96 bags	
4" ID SS304 Sump	273.13 - 275.18		NA	Bentonite pellets	222.2' - 228.6'	4 buck.	3/8"
	-			Colorado Silica Sand	228.6' - 280'	66 bags	10-20
	-				-		

OTHER ACTIVITIES

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

WELL SURVEY DATA

Date:	Protective Casing Elevation:
Washington State Plane Coordinates:	Brass Cap Elevation:

COMMENTS/REMARKS

50-lb bag 10-20 sand = 0.54 ft³ ; 50-lb. bucket bentonite pellets = 0.62 ft³ ; 50-lb bag granular bentonite = 0.73 ft³ ; 94-lb. bag portland cement = 1.285 ft³

Reported By: L.D. Walker		Reviewed By: [signature] / Mark L. Johnson	
Title: Geologist	Date: 10-9-00	Title: BHI, SR	Date: 01/23/01
Signature: [signature]		Signature: [signature]	

BHI-EE-181 (12/97)

WELL SUMMARY SHEET

Page 1 of 2

Date: 10-3-00

Well ID: C 3118		Well Name: 299-W11-40	
Location: E. side of 241-T tank farm / 200W		Project: CY 2000 RCRA Drilling	
Prepared By: L.D. Walker	Date: 10-3-00	Reviewed By: DC Weekes	Date: 10/18/00
Signature: L.D. Walker		Signature: DC Weekes	

CONSTRUCTION DATA

Description	Diagram
6-in dia. protective SS casing set 0.3' to 10' above the 4-in casing	
4-in ID sched. 5, SS304L well casing: +2.5' → 238.08'	
Portland cement grout: 0' → 10.2'	
Granular bentonite: 10.2' → 222.2'	
Temporary casing: 11 3/4" / 10 3/4" set at 20.5' 8 5/8" / 7 5/8" to TD	
All depths in Feet below ground surface	
All temp. casing removed from the ground	

GEOLOGIC/HYDROLOGIC DATA

Depth in Feet	Graphic Log	Lithologic Description
0		0' → 2': Silty Sandy GRAVEL
		2' → 6.5': Slightly Silty SAND
		6.5' → 32': Sandy GRAVEL
25		
		32' → 43': SAND
		43' → 46': Gravelly SAND
50		46' → 64': SAND
		64' → 70': Gravelly SAND
75		70' → 88': SAND
		88' → 92': Slightly Silty SAND
		92' → 103': Sandy SILT
100		103' → 117': Gravelly Silty SAND
		117' → 122': Gravelly SAND
125		122' → 133': Silty SAND
		133' → 142': Silty Sandy GRAVEL

BHI-EE-189 (12/97)

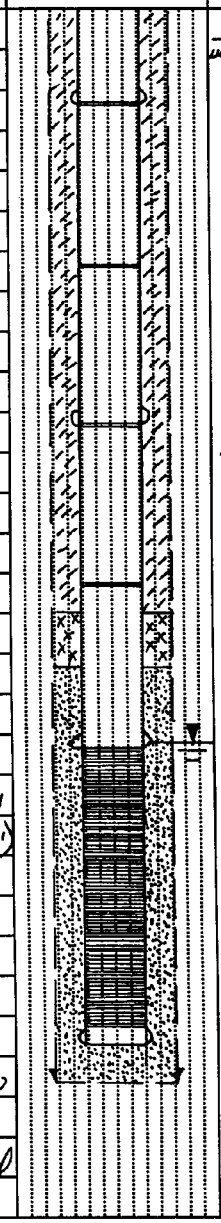
WELL SUMMARY SHEET

Date: 10-3-00

Well ID: C 3118		Well Name: 299-W11-40	
Location: E. side 241-T tank farm / 200W		Project: CY 2000 RCRA Drilling	
Prepared By: L.D. Walker	Date: 10-9-00	Reviewed By: DC Weekes	Date: 10/18/00
Signature: L.D. Walker		Signature: DC Weekes	

CONSTRUCTION DATA

Description	Diagram
Bentonite pellets, 3/8": 222.2' → 228.6'	
Silica Sand, 10-20 mesh 228.6' → 280'	
Well Screen 4-in ID, 0.020-in slot cont. wire-wrap, SS type 304: 238.08' → 273.13'	
Sump 4-in ID SS304L: 273.13' → 275.18'	
Total 4-in ID SS material is 277.68' (+2.5 → 275.18')	
All depths in feet below ground surface	
All temp. casing removed from the ground	



GEOLOGIC/HYDROLOGIC DATA

Graphic Log	Lithologic Description
	142' → 163': Sandy GRAVEL
	163' → 170': Silty Sandy GRAVEL
	170' → 198': Sandy GRAVEL
	198' → 222': Silty Sandy GRAVEL
	222' → 280': Sandy GRAVEL
	W.L. = 237.05' (10-6-00)
	TD = 280'

BHI-EE-189 (12/97)

BOREHOLE LOG

Page 1 of 10
Date: 9-26-00

Well ID: C3118 | Well Name: 299-W11-40 | Location: E. side of 241-T tank Farm /200W
Project: CY 2000 RCRA 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
0	Drive barrel			0'→2': Silty Sandy GRAVEL (ms G) 15% silt, 30% Sand, 55% Gravel Surface construction fill.	11¾"/10¼" CS casing Cable tool
				2'→6.5': Slightly Silty SAND (vm) S) 85-90% Sand, 10-15% Silt. Sand	
5	Grab-Archive			is 10% v.cse-cse, 20% med, 50% fn,	5': Grab sample for archive
	DB			20% v.fn; 10YR 4/3 (brn) sl moist; mod-well sorted, SA, predom. qtz/feldS, max	α, β, γ at background levels
				size ~ 2 mm; mod rxn HCl.	
10	Grab-Archive			6.5'→32': Sandy GRAVEL (sG).	10': Grab-archive
	DB			60% Gravel, 30-35% Sand, 5-10% Silt. Gravel 10% sm cob, 30% v. cse peb, 50% cse-med peb, 10% fn-v.fn peb. Sand	
				predom med-fn. 10YR4/2 (dk. grayish	
15	Grab-Archive			brn) sl moist; poorly sorted; Gravel	15': Grab-archive
	DB			R-SR, Sand SA-SR, Gravel 50%	α, β, γ at
				basalt, 50% granitic/qtzite/other,	background
				Sand 70% qtz/feld, 30% basalt/other	
				lith frags; max size ≈ 10 cm; mod-strong rxn HCl; tr caliche coating	
20	Grab-Archive			on some gravel.	20': Grab-archive
	Air Rotary				11¾" OD casing set at 20.5' bgs
					Begin air rotary with 8⅝" OD CS casing
25	Grab-Archive				
	A.R.				25': Grab-archive
				27'→30': drilling indicates large cobbles/small boulders	

- First 20' of cuttings collected in drums, Waste Characterization samples collected from drums
- B105V3: rad analysis, 5', B105V4: rad anal., 15', B105W3: Chemical Composite
- BOYPE-rad screen

Reported By: L.D. Walker		Reviewed By: DC Weekes	
Title: Geologist		Title: Geologist	
Signature: LD Walker	Date: 9-27-00	Signature: DC Weekes	Date: 10/18/00

BHI-EE-183 (12/97)

BOREHOLE LOG

Page 2 of 10
Date: 9-27-00

Well ID: C3118 | Well Name: 299-W11-40 | Location: E. side 241-T tank farm / 200W
Project: CY 2000 RCRA 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
30	Grab-Archive				Air rotary, 8 5/8" OD CS casing, 7 1/4" tricone bit.
					30': Grab sample for archive.
				32' → 43': SAND (S); tr-5% Gravel, 95-100% Sand, tr silt	
35	Grab-Archive			Sand 30% v.cse, 50% cse, 20% med-v.fn, 10YR3/2 (v. dk grayish brown), moist; mod sorted, SA; 60% basalt, 40% qtz/other, weak rxn HCl.	35': Grab-Archive (water injected for dust control)
40	Grab-Archive			40-43': sand predom. med; 40% basalt, 60% qtz/Felds; mod-strong rxn HCl.	40': Grab-Archive
				43' → 46': Gravelly SAND (gS) 20% Gravel, 80% Sand, tr silt.	
45	Grab-Archive			Gravel med-v. Fn peb; Sand similar to above. mod-poorly sorted; 60% basalt, 40% qtz/Feld/other max gravel ≈ 2 cm; mod rxn HCl.	45': Grab-archive Drill rate: 5'/2 min
50	Grab-Archive				50': Grab-archive
				46' → 64': SAND (S); tr-5% Gravel, 95-100% Sand, tr silt. Gravel fn-v.fn peb; Sand 10% v.cse, 30% cse, 40% med, 20% fn-v.fn.	
55	Grab-Archive			10YR 5/2 (grayish brown), sl moist; mod sorted; A-SA; 30-40% basalt, 60-70% qtz/feld/other. Max size ~ 8 mm; weak rxn HCl.	55': Grab-archive

Reported By: L.D. Walker | Reviewed By: DC Weekes
Title: Geologist | Title: Geologist
Signature: LD Walker | Date: 9/27/00 | Signature: DC Weekes | Date: 10/18/00

BHI-EE-183 (12/97)

BOREHOLE LOG

Page 3 of 10
Date: 9/27/00

Well ID: C3118 | Well Name: 299-W11-40 | Location: E. side 241-T tank Farm / 200W
Project: CY 2000 RCRA 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
60	Grab-Archive				Air Rotary, 8 5/8" OD CS casing
					60': Grab sample for archive
65	Grab-Archive			64' → 70': Gravelly SAND (gS) 10-15% Gravel, 85-90% Sand, tr silt. Gravel med- v. fn peb; Sand 10% v. cse, 30% cse, 50% med, 10% fn-v.fn 10YR 5/2 (grayish brown), sl-moist to dry; mod-poorly sorted, SA-A. Gravel predm. basalt, Sand 70% qtz/feld, 30% basalt / other lithic Frags; weak rxn HCl.	65': Grab-Archive
					Drill rate: 5 ft./2 min
70	Grab-Archive				70': Grab-archive
				70' → 88': SAND (S); tr-5% Gravel, 95-100% Sand, tr silt. Gravel fn- v. fn peb; Sand 20% v. cse, 40% cse, 30% med, 10% fn-v. fn. 10YR 4/2 (dk grayish brn) sl moist; mod sorted, SA-A; 50% basalt / lith. Frags; 50% qtz/feld, max size ≈ 8 mm. Weak-strong rxn HCl.	75': Grab-archive
75	Grab-Archive				Drill rate: 5 Ft./1 minute
80	Grab-Archive				80': Grab-archive
					LEL, OVM < detect.
85	Grab-Archive				85': Grab-archive

Reported By: L.D. Walker | Reviewed By: DC Weekes
Title: Geologist | Title: Geologist
Signature: LD Walker | Date: 9-27-00 | Signature: DC Weekes | Date: 10/19/00

BHI-EE-183 (12/97)

BOREHOLE LOG

Date: 9-27-00

Well ID: C 3118 | Well Name: 299-W11-40 | Location: E. side 241-T tank farm / 200W

Project: CY 2000 RCRA 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
90	Grab-Archive			88'→92': Slightly Silty SAND (mS) 85% Sand, 15% Silt. Sand predom med; silt calcareous strong rxn HCl.	Air rotary - 8⅝" OD CS casing.
					90': Grab sample collected for archive
95	Grab-Archive			92'→103': Sandy SILT (sM) 40% Sand, 60% Silt. Sand 10% Fn, 90% v. Fn. 10YR5/3 (brown) moist, well sorted, strong rxn HCl.	
					95': Grab-archive
100	Grab-Archive				100': Grab-archive
				103'→117': Gravelly Silty SAND (gmS) 10-15% Gravel, 60-65% sand, 25% silt. [Fragments of solid caliche 103-106'] Gravel med-Fn peb; Sand predom Fn-v. Fn. 10YR5/4 (yellowish brown) sl. moist; poorly sorted; sand SA, gravel SR; max gravel ≈ 1.5 cm; Sand predom qtz/Feld; strong to violent rxn HCl.	105': Grab-archive
105	Grab-Archive				
					110': Grab-archive
110	Grab-Archive				
					115': Grab-archive
115	Grab-Archive			Silt content decreasing...	
				117'→122': Gravelly SAND (gS) 20% Gravel, 80% Sand, tr silt. Gravel cse-Fn peb. Sand 20% v.cse, 40% cse,	Drill rate: 5 Ft / 2 min.

Reported By: L.D. Walker | Reviewed By: DC Weekes

Title: Geologist | Title: Geologist

Signature: LD Walker | Date: 9-27-00 | Signature: DC Weekes | Date: 10/10/00

BHI-EE-183 (12/97)

BOREHOLE LOG

Page 5 of 10
Date: 9-27-00

Well ID: C 3118 | Well Name: 299-W11-40 | Location: E. side 241-T tank farm / 200W
Project: CY 2000 RCRA 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
120	Grab-Archive			gS (continued) 30% med, 10% fn-v.fn. 10YR 5/2 (gry brown), dry; mod-poor sorted; Sand SA, 40% basalt-60% qtz/Felds; max gravel ~ 2 cm strong rxn HCl.	Air rotary - 8 5/8" OD CS casing. 120': Grab sample for archive
125	Grab-Archive			122' → 133': Silty SAND (mS) 75-80% Sand, 20-25% Silt. Sand is 30% Fn, 70% v. Fn. 10YR5/3 (brown) sl moist; well sorted, SA-SR; Sand 80-90% qtz/Feld; 10-20 % lithic Frags. Strong rxn HCl. ↑ (tr mica)	125': Grab-archive Drill rate: 5 Ft/2 min. 130': Grab-archive
130	Grab-Archive			133' → 142': Silty Sandy GRAVEL (msG) 50% Gravel, 30% Sand, 20% Silt. Gravel 20% v.cse-cse peb, 40% med peb, 30% Fn, 10% v. fn peb; Sand 20% v.cse 30% cse, 30% med, 20% fn-v.fn. 10YR 5/3 (brown) sl moist; poorly sorted, SA-SR, 50% basalt, 50% qtz/Feld/other. Strong rxn HCl. -silt content decreasing-	135': Grab-archive 140': Grab-archive Drill rate: 5 ft/4 min.
135	Grab-Archive				
140	Grab-Archive				
145	Grab-Archive			142' → 163': Sandy GRAVEL (sG) 40% Gravel, 55% Sand, 5% silt. at ~146' ⇒ 60% Gravel, 35-40% Sand, tr-5% silt. See next page for more detailed description.	145': Grab-archive

Reported By: L. D. Walker | Reviewed By: DC Weekes
Title: Geologist | Title: Geologist
Signature: LD Walker | Date: 9/27/00 | Signature: DC Weekes | Date: 10/19/00

BHI-EE-183 (12/97)

BOREHOLE LOG

Page 6 of 10
Date: 9-27-00

Well ID: C 3118	Well Name: 299-W11-40	Location: E. side 241-T tank Farm/200W
Project: CY 2000 RCRA 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
150	Grab-Archive			142'→163': Sandy GRAVEL (sG) Gravel tr sm cob, 20% v. cse peb, 30% cse peb, 40% med, 10% fn-v.fn; Sand 20% v.cse, 40% cse, 30% med, 10% fn-v.fn; 10YR4/2 (dk grayish brn) moist (from water added for dust control) poorly sorted; gravel SR-SA, sand SA; 40% basalt, 60% qtz/granitics/other; max size ~ 10cm, str w weak rxn to HCl → silt coat on gravel.	Air rotary; 8 5/8" OD CS casing
					150': Grab sample for archive.
155	Grab-Archive				155': Grab sample for archive.
					Drill rate: 5 Ft./6 min.
160	Grab-Archive				160': Grab-archive
				Silt content slowly increase	
				163'→170': Silty Sandy GRAVEL (msG) 60% Gravel, 25-30% Sand, 10-15% Silt. Similar to above, with increased silt content.	
165	Grab-Archive				165': Grab-archive
					170': Grab-archive
170	Grab-Archive			170': Silt content decreasing 170'→198': Sandy GRAVEL (sG) 60% Gravel, 35% Sand, 5% Silt. otherwise as above.	
					175': Grab-archive
175	Grab-Archive			176'→177': Drilling indicates boulder(s)	

Reported By: L. D. Walker		Reviewed By: DC Weekes	
Title: Geologist		Title: Geologist	
Signature: L D Walker	Date: 9-27-00	Signature: DC Weekes	Date: 10/18/00

BHI-EE-183 (12/97)

BOREHOLE LOG

Page 7 of 10
Date: 9-27-00

Well ID: C 3118	Well Name: 299-W11-40	Location: E. side 241-T tank farm / 200W
Project: CY 2000 RCRA 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
180	Grab-Archive				Air rotary; 8 5/8" OD
				170' → 198': Sandy GRAVEL (sG)	CS casing.
				70% Gravel, 25-30% Sand, tr-5% silt	
				Gravel tr boulder, 10% cob, 30%	180': Grab sample
	Grab-Archive			v. cse peb, 30% cse, 30% med-v. fn.	For archive.
185				Sand predom cse. Water added	
				For dust control - washes out the	185': Grab sample
				Fines and makes it difficult to	-archive
				estimate silt and fn sand.	end 9-27-00
				10YR4/3 (brown) moist; poorly	begin 9-28-00
190	Grab-Archive			sorted; Gravel SR, Sand SA-A,	190': Grab-archive
				30% basalt, 70% qtzite/granitic/other	
				max size over 25 cm (?); HCl rxn	
				weak to none.	
					195': Grab-archive
195	Grab-Archive				
				198' → 222': Silty Sandy GRAVEL	
				(msG) 60% Gravel, 25-30% Sand,	200': Grab-archive
200	Grab-Archive			10-15% Silt. Gravel similar to	
				above. Sand 30% v. cse-cse, 50% med,	
				20% fn-v. fn. 10YR5/3 (brown) moist;	
				poorly sorted; Gravel R-SR, Sand	
				SA; 30% basalt, 70% granitic/qtzite/oth.	205': Grab-archive
205	Grab-Archive			↳ to SR Weak to no rxn to HCl.	

Reported By: L.D. Walker		Reviewed By: DCWeekes	
Title: Geologist		Title: Geologist	
Signature: LD Walker	Date: 9/28/00	Signature: DC Weekes	Date: 10/19/00

BHI-EE-183 (12/97)

BOREHOLE LOG

Date: 9-28-00

Well ID: C 3118 | Well Name: 299-W11-40 | Location: E. Side 241-T tank farm / 200W

Project: CY 2000 RCRA 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
210	Grab-Archive				Air rotary; 8 5/8"
				198'→222': Silty Sandy GRAVEL (msG) 60% Gravel, 25-30% Sand, 10-15% silt. Gravel tr cobble, 40% v.cse-cse peb, 40% med, 20% Fn-v.Fn.	OD CS casing
					210': Grab sample For archive
215	Grab-Archive			Sand 20% v.cse, 40% cse, 20% med, 20% Fn-v.Fn. 10YR4/3 (brown), moist; poorly sorted; gravel R-SR, sand SA, 30-40% basalt, 60-70% qtzite/granitic /other; no rxn HCl.	215': Grab-archive
					220': Grab-archive
220	Grab-Archive			220-222': silt content decreasing	
				222'→280': Sandy GRAVEL (sG) 65% Gravel, 30-35% sand, tr-5% silt. otherwise as above	225': Grab-archive
225	Grab-Archive				
				230': silt content up to 5-10% still Sandy GRAVEL	230': Grab-archive
230	Grab-Archive				End 9-28-00/Start 9/29/00
235	Grab-Archive				235': Grab-archive

Reported By: L.D. Walker / DCWeekes | Reviewed By: J.M. Faurote

Title: Geologist / DCWeekes | Title: Geologist

Signature: LD Walker | Date: 9/29/00 | Signature: JM Faurote | Date: 10/24/00

BHI-EE-183 (12/97)

BOREHOLE LOG

Page 9 of 10
Date: 9/29/00

Well ID: C3118 | Well Name: 299-W11-40 | Location: E. Side 241-T Tank Farm/200 W
Project: CY2000 RCRA 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-archive				240': Grab-archive
					Note: silt and some sand are usually not present in grab samples
				Split spoon description: Sandy GRAVEL (sG)	
				60% gravel, 30-35% sand, 5-10% silt, saturated,	
245	Grab-archive			v poorly sorted, grav is SR-R, 20% bas,	245': Grab-archive
	SS#1 244.8'-246.8'	75% recovery		80% other, MPS=4", no rxn to HCl, 10YR6/2	split spoon sample for particle size
				(dry) light brownish gray (fines), common FeOx	analysis 245.5'-246.8'
				coated gravel	
250	Grab-archive				250': Grab-archive
255	Grab-archive				255': Grab-archive
				Sandy gravel as above	SS sample for
	SS#2 259.1'-259.6'	80% recovery			PSA 257.5'-259'
					End 9/29/00
260	Grab-Archive				10-2-00
					260': Grab-archive
265	Grab-Archive			Sandy GRAVEL - similar to above.	265': Grab-archive

Reported By: D.C. Weekes / L.D. Walker | Reviewed By: J.M. Faurote
Title: Geologist | Title: Geologist
Signature: D.C. Weekes L.D. Walker | Date: 10-2-00 | Signature: J.M. Faurote | Date: 10/24/00

BHI-EE-183 (12/97)

BOREHOLE LOG

Page 10 of 10
Date: 10-2-00

Well ID: C3118	Well Name: 299-W11-40	Location: E. Side 241-T tank farm / 200W
Project: CY 2000 RCRA 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
270	Grab-Archive				270': Grab sample for archive
	SS # 3 sieve analysis	90% rec.		Sandy GRAVEL (sG) 70% Gravel, 20-25% Sand, 5-10% silt. Gravel predom. med-cse peb, Sand predom Fn-med. 10YR5/3 (brown), wet; poorly sorted, Gravel R-SR; 30% basalt, 70% granite, qtzite & other; max size 4-5 cm no rxn HCl	272'→274.5': Split Spoon sample #3 for sieve analysis
275	Grab-Archive			275'→280': Sand content increase to ~30-35%	275': Grab-archive
280	Grab-Archive			*heaving sand noted while casing shoe at 280 ft.	280': Grab-archive
					Water 237.1' bgs
285				TD = 280.0 Feet	
290					
295					

Reported By: L.D. Walker	Reviewed By: DC Weekes
Title: Geologist	Title: Geologist
Signature: LD Walker Date: 10-2-00	Signature: DC Weekes Date: 10/18/00

BHI-EE-183 (12/97)

WELL CONSTRUCTION SUMMARY REPORT

Start Date: 8-4-00
Finish Date: 8-22-00
Page 1 of 1

Specification No.:	Rev. No.:	Well Name: 299-W11-41	~~Temp~~ Well No.: C3119
ECNs:		Approximate Location: E. side 241-T Tank Farm / 200W	
Project: CY 2000 RCRA Drilling		Other Companies: BHI, CHI	
Drilling Company: Resonant Sonic International		Geologist(s): L. Walker, JK MURRAY	
Driller:			

TEMPORARY CASING AND DRILL DEPTH

*Size/Grade/Lbs. Per Ft.	Interval	Shoe O.D./I.D.
FJ Carbon Steel	0' - 20.6'	12" / 10 1/2"
FJ Carbon steel	20.6' - 280'	9" / 7 5/8"
	-	
	-	
	-	

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

DRILLING METHOD/HOLE DIAMETER

Auger:			Diameter From ____ to ____
Cable Tool:	✓	11 3/4" OD	Diameter From 0' to 20.6'
Air Rotary:	✓	8 5/8"	Diameter From 20' to 280'
A.R. w/Sonic:			Diameter From ____ to ____
			Diameter From ____ to ____
			Diameter From ____ to ____
			Diameter From ____ to ____

Drilling Fluid:

Total Drilled Depth: 280'	Hole Dia @ TD: 8 5/8"	Total Amt. Of Water Added During Drilling:	
Well Straightness Test Results: WELL IS STRAIGHT		Static Water Level:	Date:

GEOPHYSICAL LOGGING

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

COMPLETED WELL

Size/Wt./Material	Depth	Thread	Slot Size	Type	Interval Annual Seal/Filter Pack	Volume	Mesh Size
SUMP SS304L 4" ID	271.7 - 273.7		NA	COLORADO SILICA SAND	226 - 280.6	89 bags	10-20
SCREEN SS304L	236.7 - 271.7		.020	BENTONITE PELLETS	218.8 - 226	5 buckets	3/8"
CASING SS304L	+2.7 - 236.7		NA	BENTONITE CRUMBLES	12.9 - 218.8	108 1/2 BAGS	
PROTECTIVE	+3.7 - 2.3		NA	PORTLAND TYPE I + II CEMENT	~~12.9~~ 0	17 BAGS	NA
	-			2 PREMIUM GEL	0 - 12.9	3/8 BAG	NA

OTHER ACTIVITIES

Aquifer Test: WELL DEVELOPMENT	Date: 8/22/00	Well Abandoned:	Yes:	No:	Date:
Description: MONITOR DRAWDOWN + RECOVERY		Description:			

WELL SURVEY DATA

Date:	Protective Casing Elevation:
Washington State Plane Coordinates:	Brass Cap Elevation:

COMMENTS/REMARKS

Vol. calcs: 10-20 Silica sand - 0.54 ft³/50lb bag x 89 bags = 48.06 ft³; bentonite pellets - 0.62 ft³/bucket x 5 buckets = 3.1 ft³; Granular bentonite - 0.73 ft³/50lb bag x 108.5 bags = 79.2 ft³

Reported By: JILL MURRAY		Reviewed By: J RUTER	
Title: GEOLOGIST	Date: 8/22/00	Title: Sr. Duty Engr.	Date: 9/21/00
Signature: Jill K. Murray		Signature: J Ruter	

BHI-EE-181 (12/97)

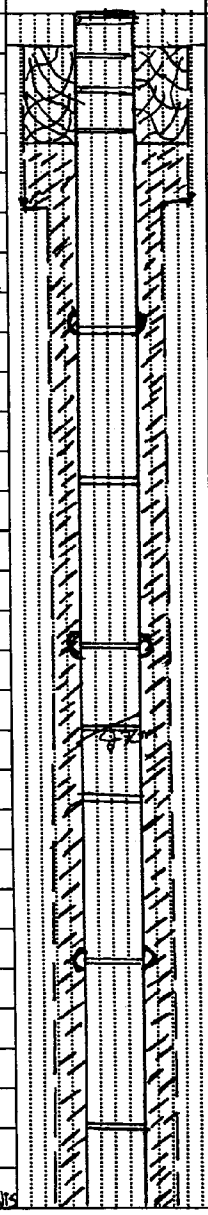
WELL SUMMARY SHEET

Page 1 of 2

Date: 8-10-00

Well ID: C3119	Well Name: 299-W11-41
Location: E. side 241-T Tank Farm / 200 W	Project: CY 2000 RCRA Drilling
Prepared By: L.D. Walker JK MURRAY Date: 8/21/00	Reviewed By: DC Weekes Date: 8/25/00
Signature: LD Walker JK Murray	Signature: DC Weekes

CONSTRUCTION DATA

Description	Diagram
SURFACE - 12.9' PORTLAND CEMENT GROUT	
12.9' - 218.8' BENTONITE CRUMBLES	
+2.7 - 236.7' PERMANENT CASING SS 304L 4" ID, 4.5" OD	
+3.7 - 2.3' PROTECTIVE CASING.	
GROUND SURFACE IS REFERENCE FOR ALL MEASUREMENTS	

GEOLOGIC/HYDROLOGIC DATA

Depth in Feet	Graphic Log	Lithologic Description
0		0' → 4': Silty Sandy GRAVEL
		4' → 7': Slightly Silty SAND
		7' → 33': Silty Sandy GRAVEL
25		
		33' → 37': Gravelly SAND
		37' → 39': Sandy GRAVEL
		39' → 44': SAND
50		44' → 47': Gravelly SAND
		47' → 94': SAND
75		
		94' → 98': Silty SAND - calcareous
100		98' → 118': Slighty Silty SAND trace caliche 103' → 106' and at 115'
		118' → 123': SAND
125		123' → 133': Sandy SILT
		133' → 144': Gravelly Silty SAND

BHI-EE-189 (12/97)

WELL SUMMARY SHEET

Date: 8-10-00

Well ID: C 3119		Well Name: 299-~~W~~E-~~W~~W 11-41	
Location: E. side 241-T Tank Farm / 200W		Project: CY 2000 RCRA Drilling	
Prepared By: L.D. Walker JK MURRAY	Date: 8/21/00	Reviewed By: DC Weekes	Date: 8/25/00
Signature: L.D. Walker JK Murray		Signature: DC Weekes	

CONSTRUCTION DATA

Description	Diagram
218.8'-226' BENTONITE PELLETS	
226'-280.6' 10-20 MESH SAND PACK	
236.7'-271.7' .020 SLOT CONTINUOUS WIRE WRAP, SS304L SCREEN; 4" ID, 4.5" OD	
271.7-273.7 SUMP SS304L 4" ID, 4.5" OD	
ALL TEMPORARY CASING REMOVED	
ALL MEASUREMENTS RELATIVE TO GROUND SURFACE.	

GEOLOGIC/HYDROLOGIC DATA

Depth in Feet	Graphic Log	Lithologic Description
150		144'→158': Silty Sandy GRAVEL
		158'→169': Sandy GRAVEL
175		169'→173': Gravelly SAND
		173'→198': Sandy GRAVEL
200		198'→208': Silty Sandy GRAVEL
		208'→213': Sandy GRAVEL
225		213'→218': Gravelly SAND
		218'→246': Sandy GRAVEL
250		246'→270': Silty Sandy GRAVEL
275		270'→280': Sandy GRAVEL
		T.D. = 280'

BHI-EE-189 (12/97)

BOREHOLE LOG

Page 1 of 10
Date: 8-4-00

Well ID: C3119 | Well Name: 299-W11-41 | Location: East side 241-T Tank Farm/200W
Project: CY 2000 RCRA 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
0	Drive barrel - cable tool			0'→4': Silty Sandy GRAVEL (msG) Surface backfill - 60% Gravel, 25-30% sand, 10-15% silt.	Cable tool, 9" DB, 11¾" OD CS casing
5	Grab - Archive and Waste Charact.			4'→7': Slightly Silty SAND (ms) 80-85% sand, 15-20% silt. Sand 20% v.csc-csc, 30% med, 50% fn-v.fn. 7.5YR 5/4 (brown), sl moist; mod sorted, Sand SA-A; 80% qtz/Felds, 20% basalt no rxn HCl.	5': Grab sample for Archive; and waste characterization B,8 ~700 dpm HEIS rad: BOYVX6
10	Grab - Archive			7'→33': Silty Sandy GRAVEL (msG) 40% Gravel, 45% Sand, 15% silt. lg. cobbles 12-13'; 20% v.csc peb, 20% ~~csg~~ csc peb', 40% med peb, 20% fn-v.fn; Sand 20% v.csc-csc, 30% med, 40% fn, 10% v.fn; 10YR5/2 (grayish brn), sl moist poorly sorted; gravel SR, sand SA-A, Gravel 60% basalt, 40% granitic, qtzite tr caliche coating; sand predom qtz, max size over 15 cm, Weak HCl rxn, occ. strong rxn.	10': Grab sample For Archive. B,8 ~ 400 dpm
15	Grab - Archive and Waste Charact.				15': Grab sample For archive and waste charact. B,8 ~ 700 dpm HEIS rad BOYVX7 Chem. composite BOYVX8
20	Grab - Archive				20': Grab-archive Set 11¾"OD casing at 20.6'
	Air Rotary ↓				Begin Air Rotary drilling - 8⅝"OD casing. 8/8/00
25	Grab - Archive				25': Grab sample For archive

Reported By: L.D. Walker | Reviewed By: DC Weekes
Title: Geologist | Title: Geologist
Signature: LD Walker | Date: 8-8-00 | Signature: DC Weekes | Date: 8/25/00

BHI-EE-183 (12/97)

BOREHOLE LOG

Page 2 of 10
Date: 8-8-00

Well ID: C3119 | Well Name: 299-W11-41 | Location: E. Side 241-T Tank Farm/200W
Project: CY 2000 RCRA 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
30	Grab-Archive				Air Rotary, 8 5/8" OD
	Air Rotary				CS casing; 7 1/4"
				33'→37': Gravelly SAND (gS)	tricone bit.
				20% Gravel, 80% Sand, tr silt, Gravel	30': Grab sample
				med-v. Fn peb; Sand 30% v. cse, 40% cse,	for Archive
35	Grab-Archive			30% med-v. Fn, moist, mod sorted, SA-A	35': Grab-archive
				37'→39': Sandy GRAVEL (sG)	37'→39' drilling
				70% Gravel, 30% Sand. Gravel tr cobble,	indicates large
				40% v. cse peb, 40% cse peb, 20% med-v. Fn.	cobbles.
40	Grab-archive			Sand predom. cse.	40': Grab-archive
				39'→44': SAND (S) tr gravel,	
				100% sand. 10% v. cse, 50% cse, 30%	
				med, 10% Fn-v. Fn. 10YR4/2 (dk. grv brn)	
				moist, mod sort, SA-A, 60% qtz/Feld, 40% basalt	45': Grab-archive
45	Grab-Archive			44'→47': Gravelly SAND (gS)	
				25% Gravel, 75% Sand; otherwise similar	
				sand. to above. Gravel med-v. Fn peb.	
					50': Grab: archive
				47'→94': SAND (S)	
50	Grab-Archive			tr-5% Gravel, 95-100% Sand.	
				Gravel is Fn-v. Fn peb, Sand 30% v. cse	
				50% cse, 20% med-v. Fn. 10YR5/2 (grv.	
				brown), sl moist; mod-well sorted,	
				Sand A-SA, gravel SR; 60% qtz, Feld	55': Grab sample
55	Grab-Archive			40% basalt & other lithic frag; max	for archive
				Size ~5-6 mm; weak rxn HCl.	

Reported By: L. D. Walker | Reviewed By: DC Weekes
Title: Geologist | Title: Geologist
Signature: LD Walker | Date: 8-8-00 | Signature: DC Weekes | Date: 8/15/00

BHI-EE-183 (12/97)

BOREHOLE LOG

Page 3 of 10
Date: 8-8-00

Well ID: C 3119	Well Name: 299-W11-41	Location: E. Side 241-T Tank Farm / 200W
Project: CY 2000 RCRA 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
60	Grab-Archive			47' → 94': SAND (S)	Air Rotary, 8⅝" OD
	Air Rotary			Similar to described above.	CS casing, 7¼"
				5-10% Gravel, 90-95% Sand.	tricone bit.
				Gravel Fn-v. Fn peb, Sand 40% v.cse,	60': Grab sample
				40-50% mcse Cse, 10-20% med-v. Fn.	For archive
65	Grab-Archive			mod. sorted, moist, SA-A, 50-60%	
				qtz + feld, 40-50% basalt + lithic frags.	65': Grab-archive
				max gravel ~1 cm; weak rxn HCl.	
				69' → 70': gravel increase to	70': Grab-archive
70	Grab-Archive			10-15%, then less than	
				5%	
					75': Grab-archive
75	Grab-Archive			SAND (S) similar to above	
				Gravel only trace	
				Sand a bit finer - still predom.	
				cse. tr mica	
					80': Grab-archive
80	Grab-Archive				
					Drill rate ~ 10 ft
					in 5 minutes
85	Grab-Archive				85': Grab-archive

Reported By: L.D. Walker		Reviewed By: DC Weekes	
Title: Geologist		Title: Geologist	
Signature: LD Walker	Date: 8-8-00	Signature: DC Weekes	Date: 8/25/00

BHI-EE-183 (12/97)

BOREHOLE LOG

Page 4 of 10
Date: 8-8-00

Well ID: C3119 | Well Name: 299-W11-41 | Location: E. side 241-T Tank Farm / 200 W
Project: CY 2000 RCRA 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
90	Grab-Archive				Air Rotary 8 5/8" OD
					CS casing
				94' → 98' : Silty SAND (m S)	90': Grab sample
				70% Sand, 30% silt. Sand 20%	for archive
95	Grab-Archive			med- Fn, 80% v. Fn. 10YR 4/3 (brn)	
				moist, mod sorted, Sand SA-A, 80-90%	95': Grab- archive
				qtz/Felds, 20% basalt/other, mica,	
				Strong rxn HCl.	
					100': Grab-archive
100	Grab-Archive			98' → 118' : Slightly Silty SAND	
				[(m) S] 85-90% sand, 10-15% silt.	
				Sand 30% med, 50% Fn, 20% v. Fn.	
				10YR 4/3 (brown), moist, mod-well	105': Grab-archive
				Sorted; SA, 80-85% qtz/Felds, 15-	
105	Grab-Archive			20% basalt; tr-mica; tr gravel #"	
				* 103' → 106'; tr caliche fragments	
				and coatings on gravel. Strong to	
				violent HCl rxn - strong rxn even	
				in material with no visible caliche	110': Grab-archive
110	Grab-Archive				
					115': Grab-archive
115	Grab-Archive			115': caliche fragments, tr gravel.	

Reported By: L. D. Walker | Reviewed By: DC Weekes
Title: Geologist | Title: Geologist
Signature: LD Walker | Date: 8-8-00 | Signature: DC Weekes | Date: 8/25/00

BHI-EE-183 (12/97)

BOREHOLE LOG

Page 5 of 10
Date: 8-8-00

Well ID: C3119 | Well Name: 299-W11-41 | Location: E. Side 241-T Tank Farm/200W
Project: CY 2000 RCRA 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
120	Grab-Archive			118' → 123': SAND (S); 90-95% Sand, 5-10% silt. Sand pred. cse-med; 60% qtz/feld, 40% basalt-other. SA-A; weak rxn HCl.	Air Rotary; 8 5/8" OD CS casing; 7 1/4" bit. 120': Grab sample for Archive.
125	Grab-Archive			123' → 133': Sandy SILT (sM) 30-40% Sand, 60-70% silt. Sand 40% Fn, 60% v. Fn. 10YR4/3 (brown), moist, well sorted; Sand SA, pred. qtz/feld, tr mica, strong rxn HCl.	125': Grab-archive. 130': Grab-archive. drill rate: ~5'/5 min.
130	Grab-Archive			133' → 144': Gravelly Silty SAND (gm S); 25% Gravel, 50% Sand, 25% silt. 10YR5/2 (gry brn), sl moist, poorly sorted, gravel SR-SA, sand SA; Gravel 60% basalt, 40% granite, qtzite, other; Sand 80% qtz, 20% basalt or other; max gravel ~ 2 cm; strong rxn HCl; Sand predom med-fn. -drill rate slows to ~ 5'/15 min	135': Grab-archive. 140': Grab-archive.
135	Grab-Archive				
140	Grab-Archive				
145	Grab-Archive			144' → 158': Silty Sandy GRAVEL (msG) 50% Gravel, 35% Sand, 15% Silt. Gravel tr cobble, 20% v. cse peb, 30% cse peb, 50% med-fn peb; Sand 30% v. cse, 40% cse, 30% med-v. fn. 10YR5/2 (gry brn), sl moist, poorly sorted; gravel predom. basalt	145': Grab: archive

Reported By: L.D. Walker | Reviewed By: DC Weekes
Title: Geologist | Title: Geologist
Signature: LD Walker | Date: 8-8-00 | Signature: DC Weekes | Date: 8/25/00

BHI-EE-183 (12/97)

BOREHOLE LOG

Page 6 of 10
Date: 8-8-00

Well ID: C 3119 | Well Name: 299-W11-41 | Location: E. side 241-T Tank Farm/200W
Project: CY 2000 RCRA 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
150	Grab-Archive				Air Rotary; 8 5/8" OD
				144' → 158': Silty Sandy GRAVEL (msG)	CS casing; 7 1/4" bit
				similar to above description.	
					150': Grab sample
					for Archive
155	Grab-Archive			silt content decreasing	
					155': Grab-archive
				158': drilling indicates cobbles	
				158' → 169': Sandy GRAVEL (sG)	
160	Grab-Archive			70% Gravel, 25-30% Sand, tr-5%	160': Grab-archive
				Silt. Gravel 10% cobble, 20% v.cse	
				peb, 40% cse peb, 30% med-v. Fn;	drill rate: 5 ft/15 min
				Sand 20% v.cse, 40% cse, 20% med,	
				20% Fn-v.Fn; 10YR5/2 (gry brn)	165': Grab-archive
165	Grab-Archive			moist, poorly sorted, Gravel SR-SA,	
				Sand SA-A; 40% basalt, 60% granitic	
				qtzite, other; weak-no rxn HCl	
				169' → 173': Gravelly SAND (gS)	170': Grab-archive
170	Grab-Archive			25% Gravel, 75% Sand. Sand is	
				10% v.cse, 20% cse, 50% med, 20%	
				Fn-v.Fn. 10YR5/3 (brn), moist,	
				mod sorted; SA-A; 80% qtz/feld,	
				20% basalt, No rxn HCl.	175': Grab-archive
175	Grab-Archive				
				173' → 198': Sandy GRAVEL (sG)	End 8/8/00
				see next page for	Begin 8/9/00
				description.	

Reported By: L.D. Walker		Reviewed By: DC Weekes	
Title: Geologist		Title: Geologist	
Signature: LD Walker	Date: 8-9-00	Signature: DC Weekes	Date: 8/25/00

BHI-EE-183 (12/97)

BOREHOLE LOG

Date: 8-9-00

Well ID: C3119 | Well Name: 299-W11-41 | Location: E. side 241-T Tank Farm/200W

Project: CY 2000 RCRA 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
180	Grab-Archive			173' → 198': Sandy GRAVEL (sG) 60% Gravel, 30-35% Sand, 5-10% Silt. Gravel tr cobble, 30% v.cse-cse peb, 40% med, 30% fn-v. fn. Sand 20% v.cse-cse, 50% med, 30% fn-v. fn. 10YR4/2 (dk grayish brown) moist From water injected For dust control; poorly sorted; Gravel R-SA, Sand SA-SR; Gravel 30% basalt, 70% granitic, qtzite, other Sand 75% qtz/Feld, 25% basalt; no rxn HCl.	Air Rotary, 8 5/8" OD CS casing
	Air Rotary				180': Grab sample For archive
185	Grab-Archive				185': Grab-Archive
					drill rate: 5 ft/10 min.
190	Grab-Archive				190': Grab-Archive
					195': Grab-Archive
195	Grab-Archive			196': Silt content slowly increase	
				198' → 208': Silty Sandy GRAVEL (wsG) 60% Gravel, 25% Sand, 15% Silt. Similar to above, with silt increase.	
200	Grab-Archive				200': Grab-urchive
205	Grab-Archive				205': Grab-Archive
				208': Silt content decrease to ~5%	

Reported By: L. D. Walker | Title: Geologist | Signature: LD Walker | Date: 8-9-00

Reviewed By: DC Weekes | Title: Geologist | Signature: DC Weekes | Date: 8/25/00

BHI-EE-183 (12/97)

BOREHOLE LOG

Date: 8-9-00

Well ID:	C3119	Well Name:	299-W11-41	Location:	E. side 241-T Tank Farm / 200W
Project:	CY 2000	RCRA 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
210	Grab-Archive			208' → 213': Sandy GRAVEL (sG)	Air Rotary, 8 5/8" OD
	Air Rotary			70% Gravel, 30% Sand, tr silt. Poorly	CS casing; 7 7/8"
				Sorted; gravel R-SA, sand SR-SA	tricone bit.
				213' → 218': Gravelly SAND (gS)	210': Grab sample
215	Grab-Archive			20% Gravel, 80% sand, tr silt. Sand 10%	For archive
				v. cse, 30% cse, 50% med, 10% fn-v. fn.	
				10YR5/3 (brn); sl moist; SR-SA, 80-90% qtz/	215': Grab sample
				feld, 10-20% basalt/other; no rxn HCl.	for archive
220	Grab-Archive			218' → 246': Sandy GRAVEL (sG)	
				50-70% Gravel, 30-50% sand, tr	220': Grab-Archive
				silt [225'-226' 50% G, 50% S]; Gravel tr	
				cobble, 30% v.cse-cse, 40% med, 30% fn.	
				Sand predom. med; 10YR5/2 (grayish brn),	
225	Grab-Archive			sl. moist; poorly sorted; gravel R-SA;	225': Grab-archive
				Gravel 20-30% basalt, 70-80% qtzite, granitic,	
				other; no rxn HCl.	
230	Grab-archive				230': Grab-archive
235	Grab-Archive				235': Grab-archive
				Gravel ~60%, Sand 40%, tr silt	

Reported By:	L.D. Walker	Reviewed By:	DC Weekes
Title:	Geologist	Title:	Geologist
Signature:	L.D. Walker	Date: 8-9-00	Signature: DC Weekes	Date: 8/25/00

BHI-EE-183 (12/97)

BOREHOLE LOG

Page 9 of 10
Date: 8-9-00

Well ID: C3119 | Well Name: 299-W11-41 | Location: E. side 241-T Tank Farm/200W
Project: CY 2000 RCRA 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-Archive			218'→246': Sandy GRAVEL (sG)	Air rotary, 8 5/8"
	Air Rotary			Similar to described above.	OD CS casing
				Gravel 60-70%, Sand 30-40%,	240': Grab-archive
				tr silt. Drilling indicates occ.	245': Grab-archive
				cobbles. 25% v.cse peb, 25% cse,	
245	Grab-Archive			30% med, 20% Fn-v. Fn. Sand 20%	End 8-9-00
				v. cse-cse, 30% med, 40% Fn, 10% v. Fn,	Begin 8-10-00
				10YR 6/3 (pale brown), dry → still	-Cuttings wet at 245'
				dry at 245'; poorly sorted, SR-SA,	after sitting overnight
	Split tube #1	80% rec.		Sand 80% qtz/feld, 20% basalt/other;	
250	Sieve analysis and waste charact.			no rxn HCl.	248-250.5': Split
	Grab-Archive	BOYVX9 rad analysis			tube for sieve
				246'→270': Silty Sandy GRAVEL (msG)	anal. and waste
				similar to above with increased	characterization
				silt: 60% Gravel, 25% sand, 15% silt	8-11-00 a.m.
255	Grab-Archive			tr mica	water level 236.6'
					inside drill rod.
					250': Grab-archive
				259': Sand content increase; still not	255': Grab-archive
				much water produced during drilling	260': Grab-archive
260	Grab-Archive			Sand as above - predom. qtz.	
					262.2'→264.7': Split
	Split Tube #2 sieve analysis & waste	100% rec. charact.		tr olive brown silt; silt content	tube-sieve anal.
				decrease to ~10%, max gravel	& waste charact.
265	Grab-Archive	rad: BOYVY0		8-10 cm; no rxn HCl	Rad: BOYVY0
					®Chem. composite with
				Sand content increase 265'-266'	upper tube: BOYVY1
				more water produced during	
				drilling	265': Grab for archive

Reported By: L.D. Walker | Reviewed By: DC Weekes
Title: Geologist | Title: Geologist
Signature: LD Walker | Date: 8-11-00 | Signature: DC Weekes | Date: 8/25/00

BHI-EE-183 (12/97)

BOREHOLE LOG

Page 10 of 10
Date: 8-11-00

Well ID: C3119 | Well Name: 299-W11-41 | Location: E. side 241-T Tank Farm/200W
Project: CY 2000 RCRA Drilling | Reference Measuring Point: Ground surface

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description	Comments:
				Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
270	Grab-Archive			270'→280': Sandy GRAVEL (sG) Gravel 30%→80%, Sand 20%-70%, tr silt, poorly sorted; gravel R-SA, Sand SR-SA; mineralogy similar to msG described above, no rxn HCl	Air rotary, 8 5/8" OD CS casing
	Split Tube #3	100% rec.			270': Grab sample for archive
	Sieve Analysis				272.0'→274.5': Split tube sample for sieve analysis
275	Grab-Archive			Gravel ~80%, sand 20% Grab@275'	W.L. = 236.9' (with casing at 272')
				Gravel ~ 30%, sand 70%	Grab sample@ 280'
	Grab-Archive				Total depth = 280' bgs. 8 5/8-in OD casing set at 279.92 ft bgs. 8/14/00
280					
285					
290					
295					

N/A

N/A

Reported By: L.D. Walker / DC Weekes | Reviewed By: JILL MURRAY
Title: Geologist | Title: GEOLOGIST
Signature: [signature] Date: 8/14/00 | Signature: Jill K. Murray Date: 9/13/00

BHI-EE-183 (12/97)

WELL CONSTRUCTION SUMMARY REPORT

Start Date: 9/10/00
Finish Date: 9/13/00
Page 1 of 1

Specification No.:	Rev. No.:	Well Name: 299-W11-42 ~~Temp. Well No.:~~ C3242	
ECNs:		Approximate Location: EAST side of 241-T TANK FARM	
Project: RCRA DRILLING FY2000		Other Companies: CHI, BHI	
Drilling Company: RESONANT SONIC / INTERNATIONAL		Geologist(s): JILL MURRAY, LES WALKER, TIM LEE, MIKE FAURote, CHRIS WALKER	
Driller: KELLY COUDEN; MO WRASPIR			

TEMPORARY CASING AND DRILL DEPTH

*Size/Grade/Lbs. Per Ft.	Interval	Shoe O.D./I.D.
CS 8 5/8" / 7 5/8" FJ	0 - 280	9" / 7 5/8"
	-	
	-	
	-	
	-	

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

All joints threaded Carbon steel

DRILLING METHOD/HOLE DIAMETER

Auger:	Diameter From ____ to ____
Cable Tool:	Diameter From ____ to ____
Air Rotary: X 8 5/8"	Diameter From 0 to 280
A.R. w/Sonic:	Diameter From ____ to ____
	Diameter From ____ to ____
	Diameter From ____ to ____
	Diameter From ____ to ____

Drilling Fluid:

Total Drilled Depth: 280'	Hole Dia @ TD: 9"	Total Amt. Of Water Added During Drilling:	
Well Straightness Test Results:		Static Water Level: 238.06	Date: 9/13/00

GEOPHYSICAL LOGGING

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

COMPLETED WELL

Size/Wt./Material	Depth	Thread	Slot Size	Type	Interval Annual Seal/Filter Pack	Volume	Mesh Size
SS304L Sump	271.77 - 273.77	NA	NA	Colorado Silica SAND	225.5 - 280	82 bags	10-20
SS304L Screen	236.76 - 271.77		0.020	Bentonite Pellets	217.8 - 225.5	5 buckets	
SS304L CASING	+2.5 - 236.76			Bentonite Crumbles	10.2 - 217.8	90 bags	
	-			Portland Cement Grout	0 - 10.2	5.5 bags	
	-			& QUICKgel 5%	-		

OTHER ACTIVITIES

Aquifer Test: WELL DEVELOPMENT	Date: 9/13/00	Well Abandoned:	Yes:	No:	Date:
Description: Monitor drawdown + recovery		Description:			

WELL SURVEY DATA

Date:	Protective Casing Elevation:
Washington State Plane Coordinates:	Brass Cap Elevation:

COMMENTS/REMARKS

50lb bag of silica sand = .54ft³ → 82 × .54ft³ = 44.28ft³, Bentonite pellets → 5 × .62ft³ = 3.1ft³; Crumbles .73ft³ × 90 bags = 65.7ft³; Portland cement = 5.5 bags × 1.285ft³ = 7.0675ft³

Reported By: JILL MURRAY		Reported By: J AUTEN	
Title: GEOLOGIST	Date: 9/14/00	Title: Sr. Dely. Engr.	Date: 9/21/00
Signature: Jill K. Murray		Signature: J Auten	

BHI-EE-181 (12/97)

Page 1 of 2

WELL SUMMARY SHEET

Date: 9/13/00

Well ID: C3242		Well Name: 299-W11-42	
Location: EAST SIDE OF 241-T TANK FARM		Project: RCRA FY2000	
Prepared By: JILL MURRAY	Date: 9/13/00	Reviewed By: DC Weekes	Date: 9/14/00
Signature: Jill K. Murray		Signature: DC Weekes	

CONSTRUCTION DATA

Description	Diagram
SS PROTECTIVE CASING STICKUP OF +3.5', 6" OD	
PORTLAND CEMENT GROUT *TGZ on 9/13/00 0–10.2'	
SS 304L PERMANENT CASING FROM +2.5 ABOVE GROUND TO 236.76' BELOW. 4" ID / 4.5" OD	
BENTONITE CRUMBLES 10.2'– 217.8'	

GEOLOGIC/HYDROLOGIC DATA

Depth in Feet	Graphic Log	Lithologic Description
0		GEOLOGY FROM 0-259' taken from borehole 299-W11-38 (C3116), which is 4.9' south of this hole.
		0'-8' SLIGHTLY SILT GRAVELLY SAND (m)gS
25		8'-39' SANDY GRAVEL
		39'-62' SLIGHTLY SILTY SAND (m)S
50		62'-69' SAND S
		69'-74' GRAVELLY SAND gS
75		74'-91' SLIGHTLY SILTY SAND (m)S
		91'-100' SILTY SAND mS
100		100'-117' SLIGHTLY SILTY SAND (m)S (w/ caliche)
		117'-121' GRAVELLY SAND gS
		121'-128' SANDY SILT SM
125		128'-134' SLIGHTLY SILTY SAND (m)S
		134'-140' SILTY SANDY GRAVEL msG
		140'-179' SANDY GRAVEL sG

BHI-EE-189 (12/97)

WELL SUMMARY SHEET

Page 1 of 2
Date: 9/13/00

Well ID: C3242	Well Name: 299-W11-42
Location: EAST SIDE OF 241-T TANK FARM	Project: RCRA FY2000
Prepared By: JILL MURRAY Date: 9/13/00	Reviewed By: DC Weekes Date: 9/14/00
Signature: Jill K. Murray	Signature: DC Weekes

CONSTRUCTION DATA

Description	Diagram
BENTONITE PELLETS 217.8' - 225.5'	
SAND PACK 225.5' - 280' 10-20 COLORADO SILICA	
SS304L 0.020 SLOT CONTINUOUS WIREWRAP SCREEN FROM 236.76' - 271.77' 4" ID; 4.5" OD	
SS304L SUMP 271.77' - 273.77' 4" ID; 4.5" OD	
All temp. casing removed All measurements relative to GROUND SURFACE.	

GEOLOGIC/HYDROLOGIC DATA

Depth in Feet	Graphic Log	Lithologic Description
150		
175		179' - 188' SILTY SANDY GRAVEL msG
		188' - 200' SANDY GRAVEL sG
200		200' - 223' SILTY SANDY GRAVEL msG
225		223' - 280' SANDY GRAVEL sG
		▼ 238.06' bgs Static water 9/13/00
250		
275		
280'		280' - TD (END OF HOLE)

BHI-EE-189 (12/97)

BOREHOLE LOG

Page 1 of 9
Date: 8/21/00

Well ID: C3116 | Well Name: 299-W11-38 | Location: EAST SIDE OF 241-T TANK FARM
Project: RCRA FY2000 | 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	DRIVE BARREL	N/A		0-8' SLIGHTLY SILT GRAVELLY SAND (m)gS	CS CASING - 1.05' OD,
				CS. sand 85%, 10-15% silt, trace 5%- gravels. Sand	.90' ID; DRIVE BARREL
				subang., mod. sorted (some v. coarse + fine particles)	.81' OD, .71' ID
				MOIST color 10YR 4/2 DK. BROWNISH gray, str. - mod HCl rxn	
				Basalt content 85%	HELS
5	GRAB + WASTE				SAMPLE: B04VY2
				6' - Gravels increasing med. size cobbles,	GRAB SAMPLE 5'
				subang - sub round; maybe 5% cobble now.	
				8'-14' SANDY GRAVEL ~~(gS)~~ (sG)	
				65% grvl, 30% sand, 5% silt: Gravel - poorly sorted,	
10	GRAB			subround - ang., med. pebble is most common size,	GRAB SAMPLE 10'
				max. size = med cobble; sand is med 60%, coarse 30%,	
				v. coarse 10%, mod. HCl rxn, sand is subang - subround	
				MOIST Color of 7.5YR 4/2 BROWN, Basalt content 90%	GRAB SAMPLE 15'
				14' - 23' SANDY GRAVEL (sG)	HELS SAMPLE:
15	GRAB + WASTE			Grvl 70%, 35% sand, 5% silt. Grvl - poorly	B04VY3
				sorted, subround, lg. pebble - sm. cobble most common	COMPOSITE:
				med. cobble max size; Sand is coarse 75%; v. coarse	B04VY4
				25%, 5% med + subang. mod. HCl rxn, Basalt content	RCF COMPOSITE: B04VN9
				slightly less 80%, metamorphics common; 7.5YR 4/1 DK. GRAY, moist	
20	GRAB			19' - small silt layer (less than 1 foot)	GRAB SAMPLE 20'
				23' - 39' SANDY GRAVEL (sG)	← Gravels here
				Grvl 50%, SAND 45%, Silt 5%: Grvl poorly sorted,	are very unconsolidated
				subround, pebbles most common size, sm. boulder is lgst	+ material falls
25	GRAB			size but not common, Sands poorly sorted w/	easily out of
				coarse 40%, med. 40%, 10% v. coarse, 10% fine,	drive barrel.
				Basalt content 80%, slight HCl rxn, color 5YR	GRAB SAMPLE 25'
				3/1 very dk. gray, moist	

Reported By: JILL MURRAY | Reviewed By: DC Weekes
Title: GEOLOGIST | Title: Geologist
Signature: Jill K Murray | Date: 8/22/00 | Signature: DC Weekes | Date: 9/14/00

BHI-EE-183 (12/97)

BOREHOLE LOG

Page 2 of 9
Date: 8/22/00

Well ID: C3116 | Well Name: 299-W11-38 | Location: EAST SIDE OF 241-T TANK FARM
Project: RCRA DRILLING FY2000 | 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
30	DRIVE BARREL GRAB	N/A			GRAB Sample 30'
				32' PEBBLES ↑; COBBLES ↓	
					Grab Sample 35'
35	GRAB			35' COBBLE SIZE-FRACTION DOMINATES	Rocksplitter 36-37.5'
	ROCK SPLITTER DRIVE BARREL			36' BOULDERS	36' lg. Basalt boulder + med. qtz. boulder
	GRAB			39-62 SLIGHTLY SILTY SAND (m) S	GRAB SAMPLE 39'
40	GRAB			85% sand, 10% silts, trace-5% gravels	39.5' THIN GRAVEL
				Sands subround, mod well sorted; coarse 80%	40' GRAB SAMPLE*
				med 10%, v. coarse 10%, grvls are v. small pebbles, wk HCl	* GRABS taken
				rxn; Moist color 10 YR 5/2 Grayish brown, 65% Basalt	close because
					Geologist thought we
45	GRAB				had a sand lens, then
				45.5' THIN SILT LENS (<1') Ø HCl rx. (silts	back to gravel, rather
				seem to be isolated in thin lenses as we drill) (less	than a gravel stringer
				in matrix)	45' Grab Sample
50	GRAB			50' SANDS APPEAR MORE COARSE + BASALT ↓	50' GRAB Sample
				L50/50 basalt/felsic)	
				52' THIN SILT lens (<1') Ø HCl rxn	
55	GRAB			55' SANDS MORE FELSIC (65% fels/35% basalt),	Grab Sample 55'
				silts ↓	
				Starting to see more grvl (lg. pebbles)	
				but still 5% or less by volume	

Reported By: JILL MURRAY | Reviewed By: DC Weekes
Title: GEOLOGIST | Title: Geologist
Signature: Jill K. Murray | Date: 8/22/00 | Signature: DC Weekes | Date: 9/14/00

BHI-EE-183 (12/97)

BOREHOLE LOG

Page 3 of 9
Date: 8/22/00

Well ID: C3116 | Well Name: 299-W11-38 | Location: East side of 241-T TANK FARM
Project: RCRA DRILLING FY2000 | 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
60	DRIVE GRAB BARREL	N/A			GRAB SAMPLE 60'
				62'-69' SAND (S) less than 10% fines KM 8/22/00	
				Silt content has decreased to ~~40~~ 10%, Grvls not quite up to 5%,	
				85% Sand, Coarse, mod. well sorted w/ 80% coarse, 10% KM 90%	
				med, 10% v. coarse, Basalt 40%, No HCl rxn, Moist	
65	GRAB			color of 10YR 4/2 DK. Brownish gray; grvls are	65' GRAB SAMPLE
				sm. cobble max. Silt lenses Ø present.	
					69' GRAB SAMPLE
	GRAB			69' → 69.5' Thin silt lens (HCl mod reactive)	70' GRAB SAMPLE
70	GRAB			About ½', Moist color 7.5YR 4/2 Brown	
				Sandy Silt (sM) 75% silt, 25% sand	
				69.5'-74' Gravelly Sand (gS)	
				Sand 75%, Gravels 20%, Silts 5%: Sand are	
				v. coarse to coarse, subangular; Gravels subangular-subround	
75	GRAB			sm pebble common, mod. sorted, lg. pebble max. Color same as sand above.	
				74'-91' SLIGHTLY SILTY SAND (m) S	75' GRAB SAMPLE
				SAND 85%, Silt 20%, Grvls 5% : Sand are mod. well sorted	
				coarse 80%, v. coarse 20%, Subround, grvls. sm pebble	76'-Thin silt lens
				rounded, well sorted: Silts are HCl reactive (mod), sands are	
80	GRAB			not. Moist color 10YR 5/2 GRAYISH BROWN	80'-GRAB SAMPLE
					85'-GRAB SAMPLE
85	GRAB				85'-Piece of
					grvl. size rock.
					Geologist believe is
					Satinspar gypsum.
					Put in w/ 85' grab.

Reported By: JILL MURRAY | Reviewed By: DC Weekes
Title: GEOLOGIST | Title: Geologist
Signature: Jill K. Murray | Date: 8/22/00 | Signature: DC Weekes | Date: 9/14/00

BHI-EE-183 (12/97)

BOREHOLE LOG

Page 4 of 9
Date: 8/23/00

Well ID: C3116 | Well Name: 299-W11-38 | Location: E. side of 241-T TANK FARM
Project: RCRA FY2000 | 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
90	DRIVE SAMPLE 3 DRIVES	N/A			90' Grab Sample
	GRAB			91'-100' SILTY SAND mS	91' Grab Sample
				60% v. fine sand, well sorted, well rounded; 40% silt	
				WK. HCl rxn, Dry color 10YR 6/3 Pale Brown, Thin	← Touchet Beds?
				laminations (approx 2mm), slightly clayey looking	
95	GRAB			95' - Strong HCl rxn.	95' Grab Sample
100	GRAB			100' - 103' SLIGHTLY SILTY, SAND (m) S Caliche	100' Grab Sample
				80% Sand 15% silt or slight more, at most 5% grvl →	
				trace; Sand mod well sorted, 75% med 25% fine	← This is a silty caliche
				to v. fine, Grvls subround, sm-med pebble max,	layer. Driller
				Extremely well cemented, v. strong HCl rxn	Reports harder drilling.
105	GRAB			Most color 7.5YR 5/2 brown with edges of 5YR 5/4 red	old brown, whitesh crust
				103' - 112' SLIGHTLY SILTY SAND (m) S	
				SAND 85%; Silt 15%; Sand is med grained 80%, 20%	
				fine-v. fine, mod well sorted, HCl rxn moderate,	
				Moist color 7.5YR 5/3 BROWN	110' Grab Sample
110	GRAB			110' - slightly clayey looking layer <1'	
	GRAB			112-117' SLIGHTLY SILTY SAND (m) S Caliche	112' Grab Sample
				Sand 80% Silt 15% Grvl 5%; Sands; well sorted,	← Caliche layer
				med grained, well rounded; gravels small pebbles subang.	
115	GRAB			to subround, V. strong HCl rxn, Extremely cemented	115' GRAB SAMPLE
				Color Dry 10YR 8/3 v. pale brown	116' Driller comments
				115' ↑ in grvl. Sm. cobbles present in add. to pebbles,	w. rounded that drive
				117'-121' GRAVELLY SAND (gS)	barrel is coming out
				SAND 75%, Gravel 10-20%, Silt 5-15%; Sands	of hole w/ a little moisture on it.

Reported By: JILL MURRAY | Title: GEOLOGIST | Signature: Jill K. Murray | Date: 8/24/00

Reviewed By: DC Ukekes | Title: Geologist | Signature: DC Ukekes | Date: 9/14/00

BHI-EE-183 (12/97)

BOREHOLE LOG

Page 5 of 9
Date: 8/24/00

Well ID: C3116 | Well Name: 299-W11-38 | Location: EAST SIDE 241-T TANK FARM
Project: RCRA FY2000 | Reference Measuring Point: GROUND SURFACE

Depth (Ft.)	Sample Type No. (DRIVE BARREL)	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
120	GRAB	N/A		ave angul-subangul., Poorly sorted: v.coarse 10%, coarse 45%,	120' Grab Sample
	GRAB			med 25%, 10% fine-v fine, Grvl, mod cobbles - v. sm pebbles, all	121' Grab Sample
				sizes, poorly sorted subang-subround, Not HCl rx Dry color	
				7.5YR 6/3, light brown Basalt 45% overall, Higher (75%) in grvls	
				121'-121.5' THIN CALICHE HORIZON	125' Grab Sample
125	GRAB			121.5'-128' SANDY SILT sM	
				Sand 45% Silt 55%: WK HCl, Sands are mod. well	Gradational Change
	GRAB			sorted 80% med, 10% fine, 10% v. fine; Moist color 7.5YR	
				5/2 BROWN, thin lamination <2" mm, slightly clayey	
				128'-134' SLIGHTLY SILTY SAND mS	128' Grab Sample
130	GRAB			SAND 85%, Silt 15%; SANDS are mod graded, well sort,	130' Grab Sample
				subround; Weak to no HCl rxn; DRY 10YR 6/2 light brownish gray	
				130' - Sands ↓ some, Silts ↑ some	132' - MOIST SEDS, LOOKING MUDDY
				134' — 140 SILTY SANDY GRAVEL msG	
135	GRAB			50% grvl; 10% silts; 40% sand: Grvls are mod.	135' - Grab Sample
				sorted 70% lg. cobbles, 10% med cobbles, 10% sm. cobbles,	
				10% pebbles, well-rounded: Sands subrounded, mod. sorted	
				coarse 70%, 15% med, 15% v. coarse, Ø HCl rx, Basalt	
				content 60-70%, Moist color 10YR 5/2 Grayish Brown	140' Grab Sample
140	GRAB			140' silt content ↓, sand ↓; Grvls ↑, getting larger	
				140-174' SANDY GRAVEL sG (same description	
				as above but silts @ trace-5%, sand @	
				30%; gravels @ 65+%, some small boulders present	
				Basalt content ↓; ↑ in qtzites, granites & diorite	
145	GRAB			gravels	145' - GRAB Sample

Reported By: JILL MURRAY | Reviewed By: DC Weekes
Title: GEOLOGIST | Title: Geologist
Signature: Jill Murray | Date: 8/25/00 | Signature: DC Weekes | Date: 9/14/00

BHI-EE-183 (12/97)

BOREHOLE LOG

Page 6 of 9
Date: 8/25/00

Well ID: C3116 | Well Name: 299-W11-38 | Location: East side of 241-T TANK FARM
Project: RCRA FY2000 | 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
150	GRAB (DRIVE CASING)	NA			150' Grab Sample
				153'-BASALT BOULDER	153' Added 5 gal. H_2O to hole
				155'-GRAVELS are more silty. Some pebbles held together in silts; Not HCl rx	155' Grab Sample -Drilling hard- Material v. consolidated + casing resists being driven
155	GRAB				
160	GRAB				160' Grab sample
				163' Silts + sands appear to be V.+ amount of powdered/pulverized rock? = Gravels are ↑; High % qtzite + felsic-intermed igneous	
165	GRAB				165' Grab Sample
170	GRAB				170' Grab Sample
				174'-179' SANDY GRAVEL SG	
175	GRAB			SAND 45%, Grvl 50%, silts 5%: Sands are subang, mod. sort + (med 80%, coarse 10%, v. coarse 10%); grvls poorly sorted, med cobble-v. small pebble range common, access lg. cobble + boulder; v.w.k. HCl rxn, basalt content 30%, still high % qtzite + igneous; Dry color 10YR 6/2 light brownish gray	175' Grab Sample 178' Added 1 gal. of H_2O to aid w/ drilling

Reported By: JILL MURRAY | Reviewed By: DC Ukeekes
Title: GEOLOGIST | Title: Geologist
Signature: Jill K. Murray | Date: 8/28/00 | Signature: DC Ukeekes | Date: 9/14/00

BHI-EE-183 (12/97)

BOREHOLE LOG

Page 7 of 9
Date: 8/28/00

Well ID: C3116 | Well Name: 299-W11-38 | Location: East side of 241-T TANK FARM
Project: RCRA DRILLING FY2000 | 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
	DRIVE BARREL	N/A			
180	GRAB			179'-188' SILTY, SANDY Gravel msG	180' Grab sample
	HAND TOOL			40% sand, 15% silt, 45% gravels: Sand poorly to mod sorted, subang: coarse 40%, med 40%, 10% coarse, 10% fine; Gravels med cobble - v. small pebble; poorly sorted subround	181' Hard tooling begins (see FAR for H_2O used)
				Very WK HCl, Wet color 10YR 5/3 Brown	
185	GRAB				185' Grab Sample
				187' - silty layer (probab. less than 1')	187' Driller reports
				188'-200' SANDY GRAVEL 8/30/00 sG	short interval of
				50% smd, 5% silts, 45% grvls; sands dom.	fast drilling; believes
190	GRAB			Coarse grained, subround, mod well sorted, No	it to be silt lens
				HCl rxn, Wet color 10YR 5/3 Brown; grvls same	188' Drilling hard
				as above	190' Grab Sample
195	GRAB				195' Grab Sample
200	GRAB			200-223' Silty Sandy Gravel msG	200' - Grab Sample
				20% gravel, 15% sand, 15% silts: Gvls mod	← Drilling improves
				sorted, lg pebble - sm cobble probably max, 40%	noticeably
				basalt; sands mod. sorted med-fine dominate	
				subround, wet color still 10YR 5/3 Brown,	
205	GRAB			No HCl rxn.	
				204' - Gravels ↑ in size, WK HCl rxn now	205' GRAB SAMPLE

Reported By: JILL MURRAY | Reviewed By: DC Ukkees
Title: GEOLOGIST | Title: Geologist
Signature: Jill K. Murray | Date: 8/30/00 | Signature: DC Ukkees | Date: 9/14/00

BHI-EE-183 (12/97)

BOREHOLE LOG

Page 8 of 9
Date: 8/30/00

Well ID: C3116 | Well Name: 299-W11-38 | Location: E. side of 241-T TANK FARM
Project: RCRA DRILLING FY2000 | 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
210	HARD TOOL GRAB	NA		210' - gravels ↑ some in quantity + size (sm- med cobbles); still silty sandy gravel WK HCl rxn in sands	210' Grab Sample 212 - Drilling w/ more difficulty
215	GRAB				215' Grab Sample
220	GRAB			220' - Grvls ↓ slightly in quantity, (65%), No HCl rxn; appears slightly more sandy: Still silty sandy gravel	220' GRAB Sample 223' Grab Sample
	GRAB			223 - SANDY Gravel sG	223' Drilling
225	GRAB			Sand 60%, Grvls 35%, Silts 5%; Sands fine-med, mod. well sorted, rounded to subround; grvls; sm cob. max; pebbles dominate, mod. sorting, subround, WK HCl rxn, wet color 10YR 5/2 GRAYish brown 40% Gravel	not readily faster 225' Grab Sample
230	GRAB			230' - Grvls ↑ some in size/quantity, probab. sm-med cobbles (larger chunks in drilling slurry)	230' - Grab Sample - Drilling difficulty ↑ again
				232' - Still Sandy Gravel sG but % change: Grvls 60%, sand 35%, silts 5%; same color as above, No HCl rxn	
235	GRAB				235' Grab Sample
					End of drilling 8/31/00

Reported By: JILL MURRAY / DC Weekes | Reviewed By: JM Faurote
Title: Geologist | Title: Geologist
Signature: JM Murray / DC Weekes | Date: 9/1/00 | Signature: JM Faurote | Date: 9/18/00

BHI-EE-183 (12/97)

BOREHOLE LOG

Page 9 of 9
Date: 9/5/00

Well ID: C3116 | Well Name: 299-W11-38 | Location: E. Side of 241-T Tank Farm
Project: RCRA Drilling FY2000 | Reference Measuring Point: Ground surface

Depth (Ft.)	Sample: Type No, Hard Tool	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	NA		See previous page description, slight rxn	240' Grab sample 9/1/00
				to rxn, very ground material	242' Waste desig.
	SS #1, 242.2'-244'	100% rcvd 1.5' in tact 0.3' stuff		material in split spoon is Sandy Gravel	Sample BOYW01
				as above, cobbles up to 90mm, SR to R,	taken.
				40% basalt, FeOx common on clasts, slight rxn	
245	GRAB	NA		245' 250' samples contains mostly medium sand	245' drlg 250' Grab sample 9/1/00
				which has heaved into boring - formation	
				still drills like sandy gravel	
250	Grab				250' Grab sample 9/1/00
					Stop drilling @ 254' 9/1/00
255	GRAB				255' Grab Sample
	SS #2 257'-258.4'	100% recovery 1.4' intact		257' → no HCl rxn; material in split spoon	
*	AIR ROTARY			still sandy gravel, subang - subround gravels, poorly sorted	
				FeOxides stain clasts + matrix binding clasts	
260				together; gravel @ 45%, sand 45-50%, silts 5-10%	258' - Waste
				Matrix binding gravels together, difficult drilling	desig. Sample
				259' - TOTAL HOLE DEPTH	~~#B1C622~~ 9/5/00
					HEIS: BOYW02, BOYW03,
				NA	BOYVP3
				Hole abandoned	* AIR ROTARY -
265				See paperwork for	LOG FROM 2nd hole
				NA well 299-W11-42	from here on.
				C3242	

Reported By: DC Weekes / JK MURRAY | Reviewed By: JM. Faurote
Title: Geologist / Geologist | Title: Geologist
Signature: DC Weekes JK Murray | Date: 9/1/00 | Signature: JM Faurote | Date: 9/18/00

BHI-EE-183 (12/97)

BOREHOLE LOG

Page 2 of 1 of 1
Date: 9/11/00

Well ID: C 3242 | Well Name: 299-W11-42 | Location: East side of 241-T TANK FARM
Project: RCRA FY2000 | 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
260	AIR ROTARY GRAB			(For 1st 260': See log for abandoned hole C3116 [299-W11-38]).	260'-Grab Sample (255' slurry grab for PNNL)
				Cont. as a Sandy Gravel sG no HCl rxn; grvls are mod-well sorted, rounded	
265	GRAB			w/ lg. pebble most common clast size; sm cobble max. dmt.; 50% gravel, 45% sand, 5% silt. Wet-color 10YR 5/2 grayish brown	265'-Grab Sample
270	GRAB				270' Grab Sample 280'→ slurry grab for PNNL (270' grab was in a leaky container + was discarded)
				gkm 9/11/00	
275	GRAB			275'-very WK HCl rxn. Diverse lithologies in rock + sand	275'-Grab Sample
					280'-slurry for PNNL + grab sample for lith.
280	GRAB			TD HOLE @ 1638 on 9/11/00. -END OF HOLE-	

A gkm 9/11/00
N

Reported By: JILL MURRAY | Reviewed By: DC Ueekes
Title: Geologist | Title: Geologist
Signature: Jill K. Murray | Date: 9/11/00 | Signature: DC Ueekes | Date: 9/14/00

BHI-EE-183 (12/97)

Appendix B

Physical Properties Data

Appendix B

Physical Properties Data

This Appendix includes the results of field testing for particle size distribution to support the selection of well screen slot size and filter pack grain size for wells 299-W11-40 and 299-W11-41. Particle size analysis was done using standard sieve techniques.

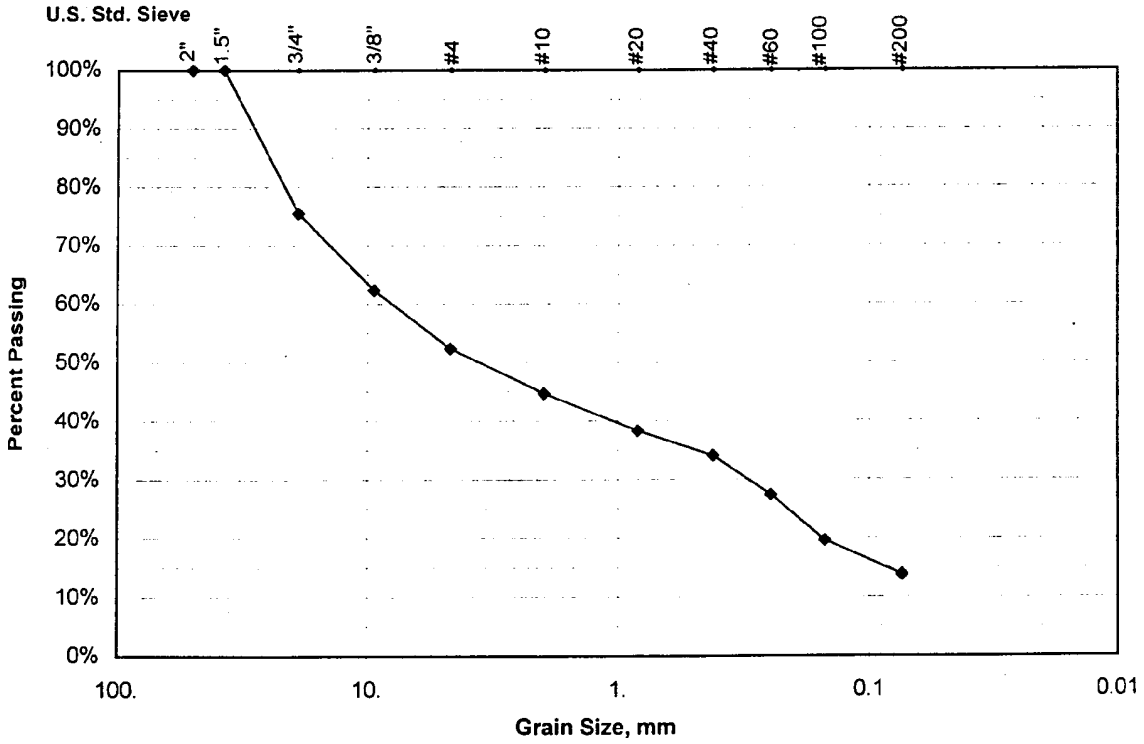
CH2M Hill Hanford, Inc.

SIEVE ANALYSIS

WELL NAME	299-W11-38	DEPTH	242.5'-244.0'	SAMPLE#	W11-38-242.5	WELL ID#	C3116
TESTED BY	JMW	CONTACT	Dave Weekes	PHONE	372-9524	DATE	09/14/2000

SAMPLE WT (g)	SIEVE SIZE IN.	CUMULATIVE WEIGHT(g)	% WEIGHT RETAINED	% PASSING	Grain Size (mm)	COMMENTS
871.20	2"	0.0	0.0	100.0	50.80	
	1.5"	0.0	0.0	100.0	38.10	
	3/4"	213.4	24.5	75.5	19.05	
	3/8"	328.2	37.7	62.3	9.42	
	#4	415.2	47.7	52.3	4.70	
	#10	482.3	55.4	44.6	1.98	
	#20	537.9	61.7	38.3	0.83	
	#40	574.8	66.0	34.0	0.42	
	#60	633.2	72.7	27.3	0.25	
	#100	700.6	80.4	19.6	0.150	
	#200	751.1	86.2	13.8	0.074	

Sieve Analysis Data for Sample W11-38-242.5



Comments: Silty Sandy Gravel

All data are accurately and completely recorded.

Checked By: Dave Weekes Date: 9/19/00

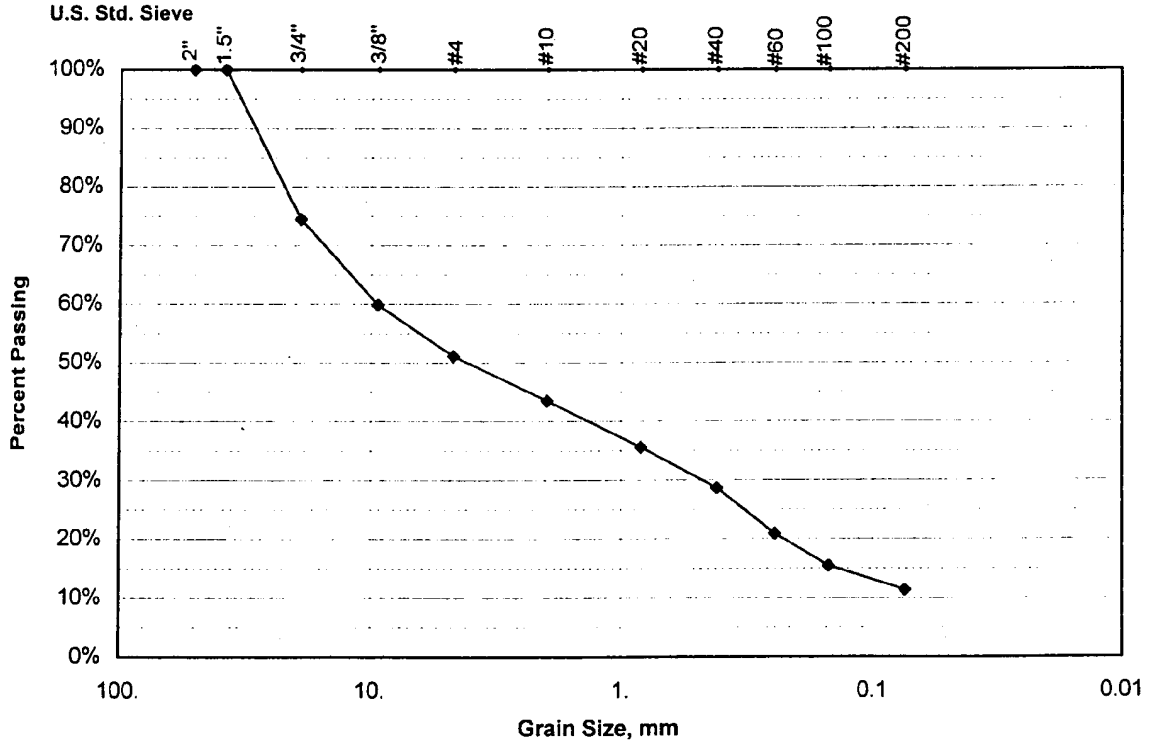
CH2M Hill Hanford, Inc.

SIEVE ANALYSIS

WELL NAME	299-W11-38	DEPTH	257.0'-258.4'	SAMPLE#	W11-38-257.0	WELL ID#	C3116
TESTED BY	JMW	CONTACT	Dave Weekes	PHONE	372-9524	DATE	09/14/2000

SAMPLE WT (g)	SIEVE SIZE IN.	CUMULATIVE WEIGHT(g)	% WEIGHT RETAINED	% PASSING	Grain Size (mm)	COMMENTS
887.60	2"	0.0	0.0	100.0	50.80	
	1.5"	0.0	0.0	100.0	38.10	
	3/4"	226.5	25.5	74.5	19.05	
	3/8"	356.6	40.2	59.8	9.42	
	#4	433.8	48.9	51.1	4.70	
	#10	501.7	56.5	43.5	1.98	
	#20	571.9	64.4	35.6	0.83	
	#40	633.4	71.4	28.6	0.42	
	#60	702.4	79.1	20.9	0.25	
	#100	750.3	84.5	15.5	0.150	
	#200	786.5	88.6	11.4	0.074	

Sieve Analysis Data for Sample W11-38-257.0



Comments: Silty Sandy Gravel

All data are accurately and completely recorded.

Checked By: R Weekes Date: 9/19/00

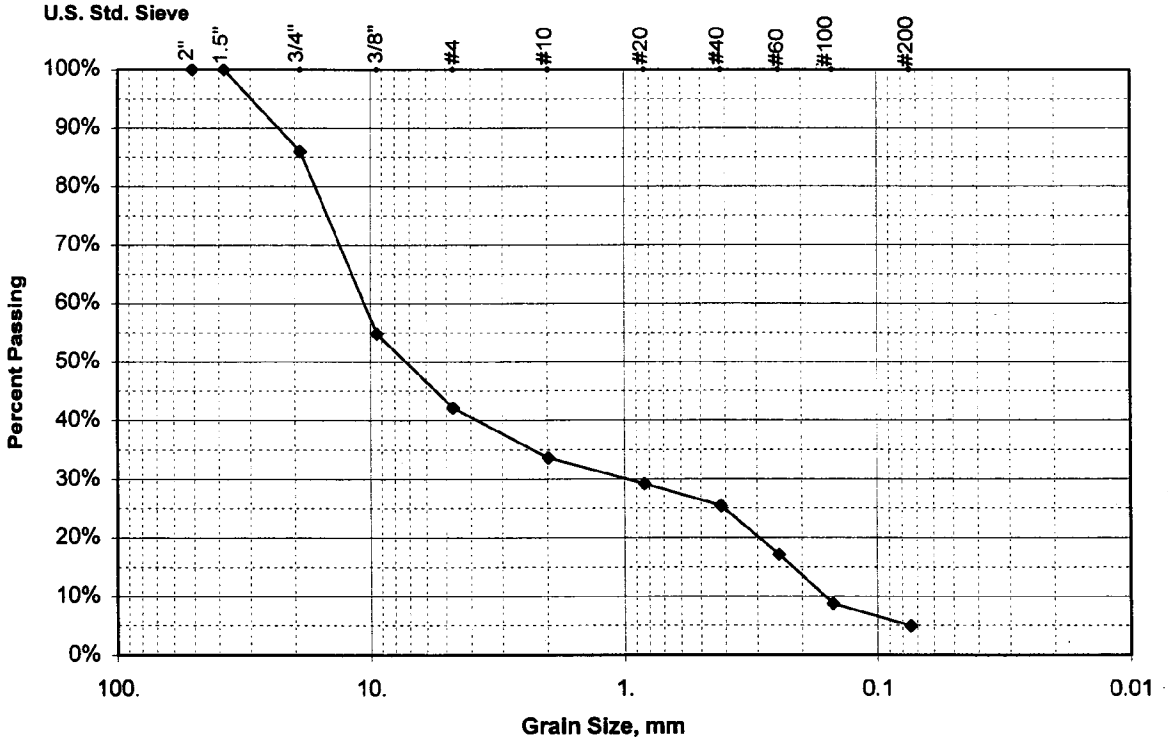
CH2M Hill Hanford, Inc.

SIEVE ANALYSIS

WELL NAME	299-W11-40	DEPTH	245.3'-246.8'	SAMPLE#	W11-40-245.3	WELL ID#	C3118
TESTED BY	JMW	CONTACT	Dave Weekes	PHONE	372-9524	DATE	10/04/2000

SAMPLE WT (g)	SIEVE SIZE IN.	CUMULATIVE WEIGHT(g)	% WEIGHT RETAINED	% PASSING	Grain Size (mm)	COMMENTS
964.70	2"	0.0	0.0	100.0	50.80	
	1.5"	0.0	0.0	100.0	38.10	
	3/4"	134.8	14.0	86.0	19.05	
	3/8"	436.4	45.2	54.8	9.42	
	#4	558.0	57.8	42.2	4.70	
	#10	640.6	66.4	33.6	1.98	
	#20	683.8	70.9	29.1	0.83	
	#40	720.1	74.6	25.4	0.42	
	#60	800.1	82.9	17.1	0.25	
	#100	880.4	91.3	8.7	0.150	
	#200	916.9	95.0	5.0	0.074	
		0.0				

Sieve Analysis Data for Sample W11-40-245.3



Comments: Sandy Gravel

All data are accurately and completely recorded.

Checked By: M Weekes Date: 10/10/00

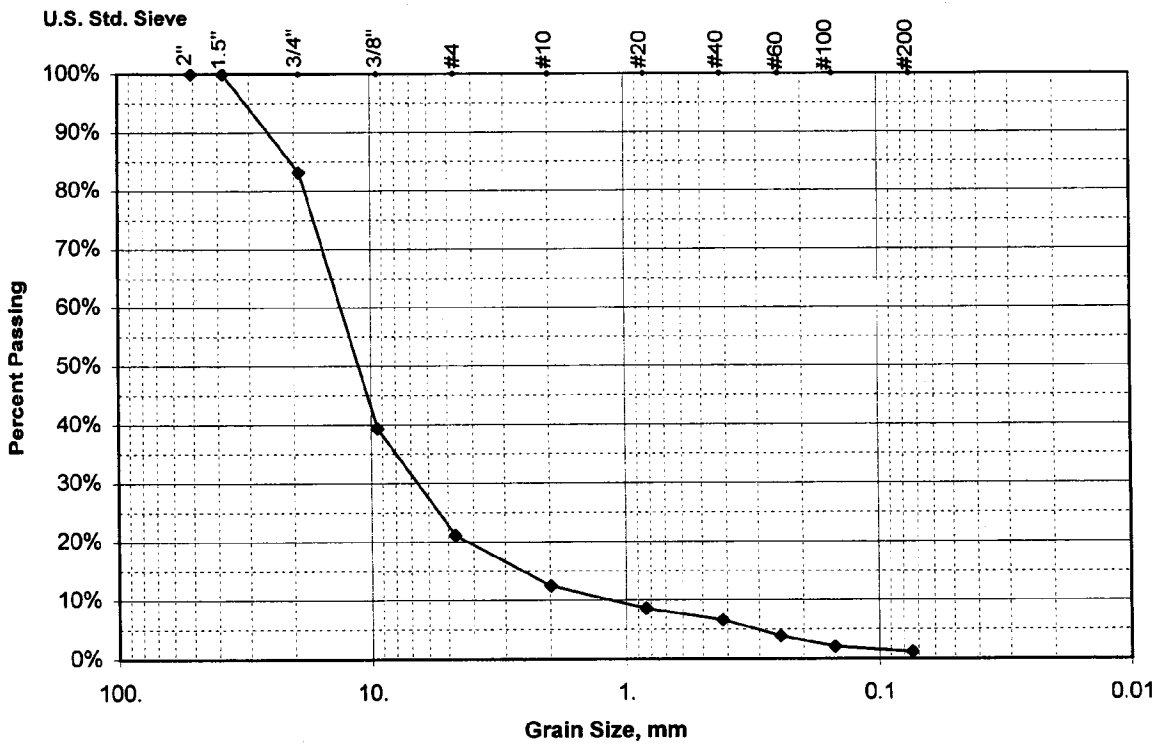
CH2M Hill Hanford, Inc.

SIEVE ANALYSIS

WELL NAME	299-W11-40	DEPTH	257.5'-259.0'	SAMPLE#	W11-40-257.5	WELL ID#	C3118
TESTED BY	JMW	CONTACT	Dave Weekes	PHONE	372-9524	DATE	10/05/2000

SAMPLE WT (g)	SIEVE SIZE IN.	CUMULATIVE WEIGHT(g)	% WEIGHT RETAINED	% PASSING	Grain Size (mm)	COMMENTS
985.00	2"	0.0	0.0	100.0	50.80	
	1.5"	0.0	0.0	100.0	38.10	
	3/4"	166.3	16.9	83.1	19.05	
	3/8"	597.8	60.7	39.3	9.42	
	#4	777.3	78.9	21.1	4.70	
	#10	862.0	87.5	12.5	1.98	
	#20	900.7	91.4	8.6	0.83	
	#40	920.0	93.4	6.6	0.42	
	#60	946.9	96.1	3.9	0.25	
	#100	964.3	97.9	2.1	0.150	
	#200	973.4	98.8	1.2	0.074	
		0.0				

Sieve Analysis Data for Sample W11-40-257.5



Comments: Sandy Gravel

All data are accurately and completely recorded.

Checked By: JC Weekes Date: 10/10/00

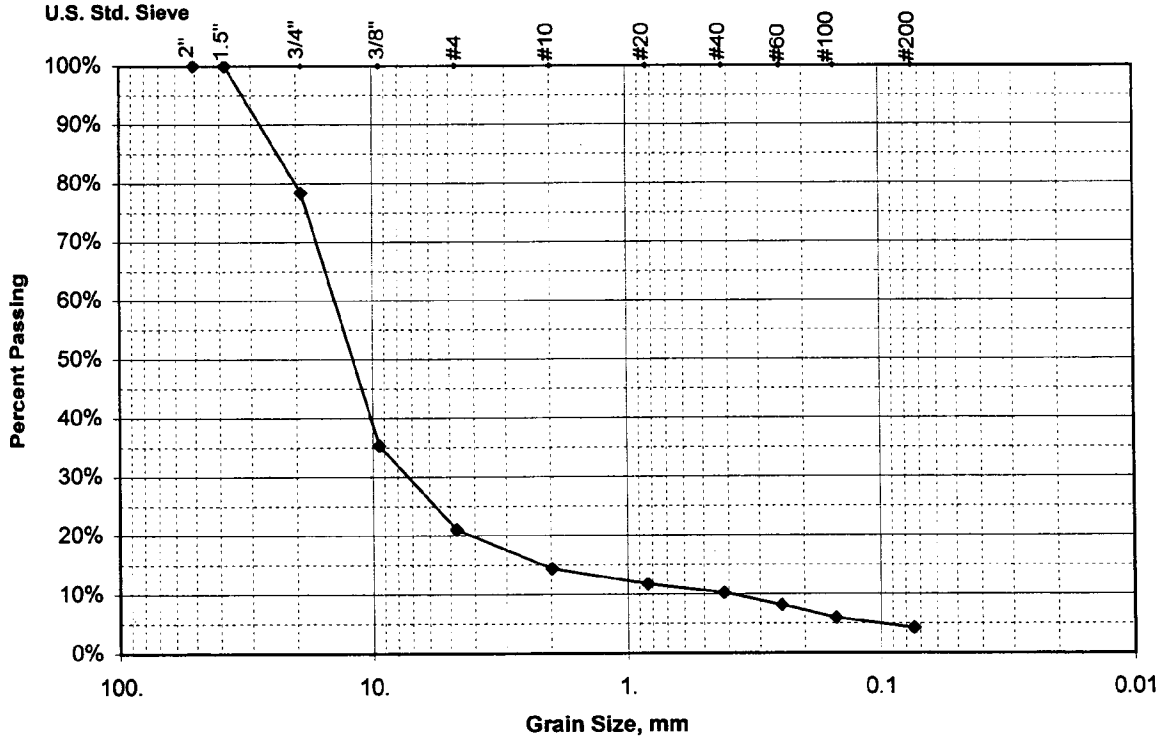
CH2M Hill Hanford, Inc.

SIEVE ANALYSIS

WELL NAME	299-W11-40	DEPTH	272.0'-274.5'	SAMPLE#	W11-40-272.0	WELL ID#	C3118
TESTED BY	JMW	CONTACT	Dave Weekes	PHONE	372-9524	DATE	10/05/2000

SAMPLE WT (g)	SIEVE SIZE IN.	CUMULATIVE WEIGHT(g)	% WEIGHT RETAINED	% PASSING	Grain Size (mm)	COMMENTS
800.20	2"	0.0	0.0	100.0	50.80	
	1.5"	0.0	0.0	100.0	38.10	
	3/4"	173.0	21.6	78.4	19.05	
	3/8"	517.6	64.7	35.3	9.42	
	#4	632.0	79.0	21.0	4.70	
	#10	685.2	85.6	14.4	1.98	
	#20	706.2	88.3	11.7	0.83	
	#40	718.3	89.8	10.2	0.42	
	#60	735.4	91.9	8.1	0.25	
	#100	752.7	94.1	5.9	0.150	
	#200	766.4	95.8	4.2	0.074	
		0.0				

Sieve Analysis Data for Sample W11-40-272.0



Comments: Sandy Gravel

All data are accurately and completely recorded.

Checked By: JC Weekes Date: 10/10/00

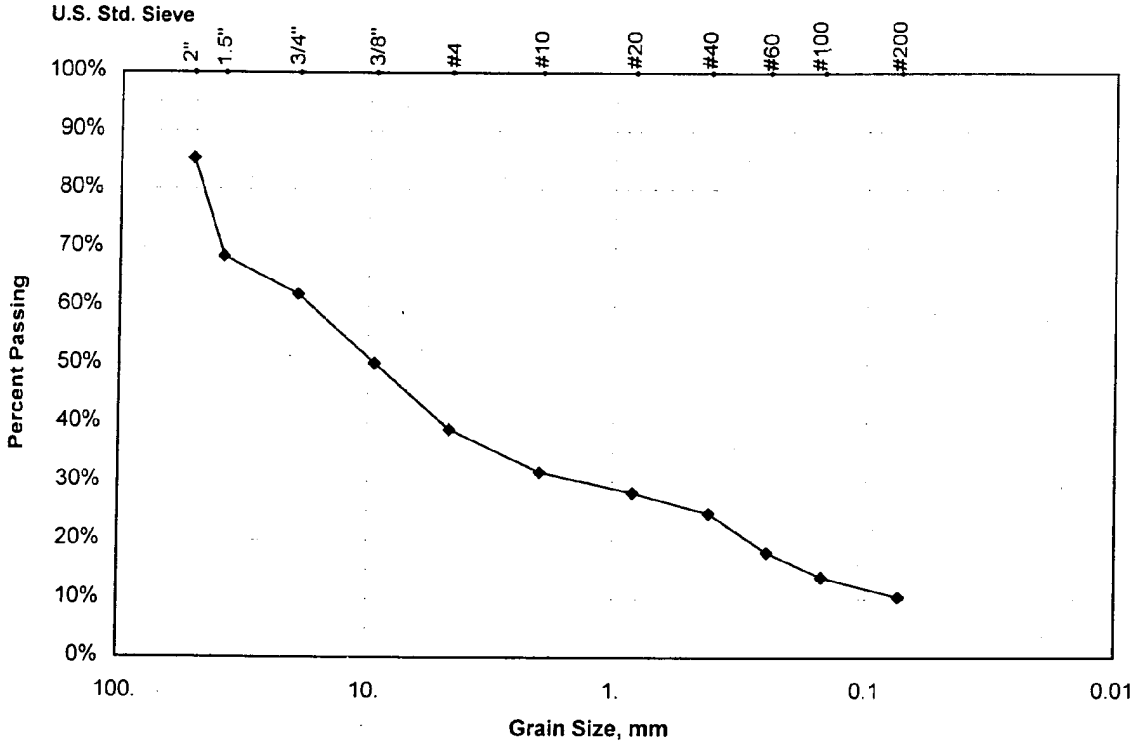
CH2M Hill Hanford, Inc.

SIEVE ANALYSIS

WELL NAME	299-W11-41	DEPTH	248.0'-250.5'	SAMPLE#	W11-41-248.0	WELL ID#	C3119
TESTED BY	JMW	CONTACT	Dave Weekes	PHONE	372-9524	DATE	08/14/2000

SAMPLE WT (g)	SIEVE SIZE IN.	CUMULATIVE WEIGHT(g)	% WEIGHT RETAINED	% PASSING	Grain Size (mm)	COMMENTS
1411.70	2"	207.7	14.7	85.3	50.80	
	1.5"	445.2	31.5	68.5	38.10	
	3/4"	535.7	37.9	62.1	19.05	
	3/8"	702.5	49.8	50.2	9.42	
	#4	863.2	61.1	38.9	4.70	
	#10	966.0	68.4	31.6	1.98	
	#20	1015.3	71.9	28.1	0.83	
	#40	1064.2	75.4	24.6	0.42	
	#60	1158.8	82.1	17.9	0.25	
	#100	1218.4	86.3	13.7	0.150	
	#200	1265.8	89.7	10.3	0.074	

Sieve Analysis Data for Sample W11-41-248.0



Comments: Silty Sandy Gravel

All data are accurately and completely recorded.

Checked By: JC Weekes Date: 8/31/00

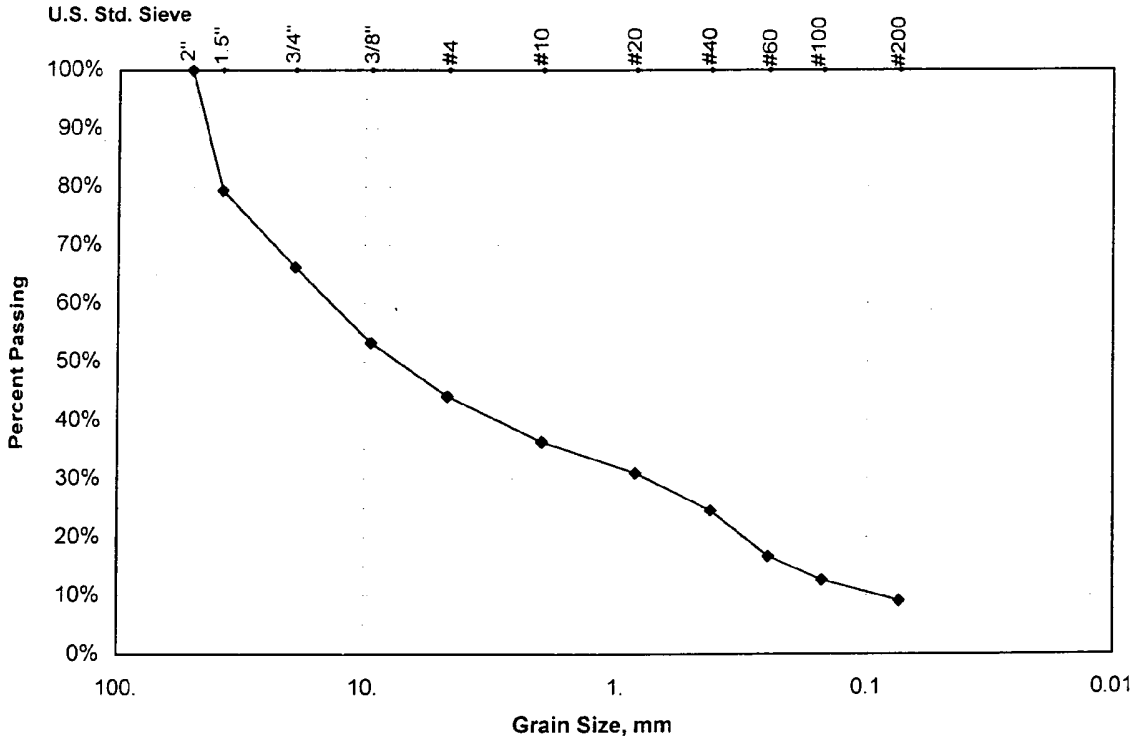
CH2M Hill Hanford, Inc.

SIEVE ANALYSIS

WELL NAME	299-W11-41	DEPTH	262.2'-264.7'	SAMPLE#	W11-41-262.2	WELL ID#	C3119
TESTED BY	JMW	CONTACT	Dave Weekes	PHONE	372-9524	DATE	08/14/2000

SAMPLE WT (g)	SIEVE SIZE IN.	CUMULATIVE WEIGHT(g)	% WEIGHT RETAINED	% PASSING	Grain Size (mm)	COMMENTS
1003.30	2"	0.0	0.0	100.0	50.80	
	1.5"	206.6	20.6	79.4	38.10	
	3/4"	338.8	33.8	66.2	19.05	
	3/8"	469.0	46.7	53.3	9.42	
	#4	561.2	55.9	44.1	4.70	
	#10	639.3	63.7	36.3	1.98	
	#20	692.9	69.1	30.9	0.83	
	#40	757.3	75.5	24.5	0.42	
	#60	835.6	83.3	16.7	0.25	
	#100	876.7	87.4	12.6	0.150	
	#200	911.5	90.9	9.1	0.074	

Sieve Analysis Data for Sample W11-41-262.2



Comments: Silty Sandy Gravel

All data are accurately and completely recorded.

Checked By: JC Weekes Date: 8/31/00

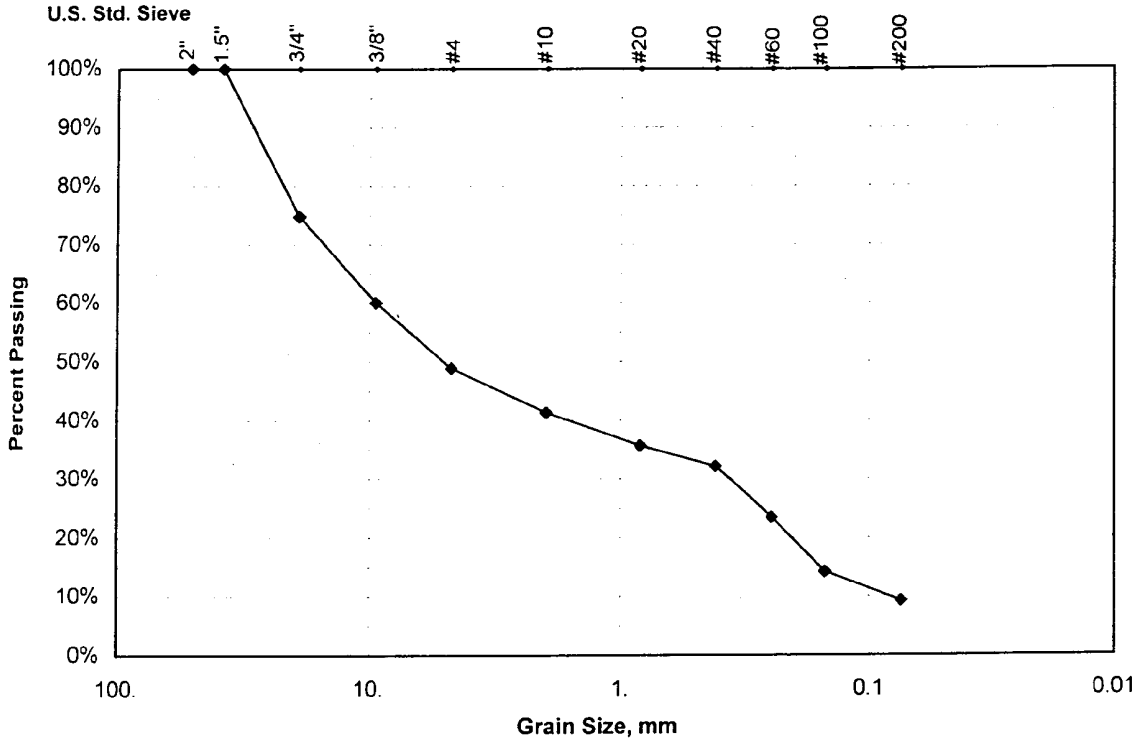
CH2M Hill Hanford, Inc.

SIEVE ANALYSIS

WELL NAME	299-W11-41	DEPTH	272.0'-274.5'	SAMPLE#	W11-41-272.0	WELL ID#	C3119
TESTED BY	JMW	CONTACT	Dave Weekes	PHONE	372-9524	DATE	08/14/2000

SAMPLE WT (g)	SIEVE SIZE IN.	CUMULATIVE WEIGHT(g)	% WEIGHT RETAINED	% PASSING	Grain Size (mm)	COMMENTS
1038.70	2"	0.0	0.0	100.0	50.80	
	1.5"	0.0	0.0	100.0	38.10	
	3/4"	261.9	25.2	74.8	19.05	
	3/8"	414.9	39.9	60.1	9.42	
	#4	531.2	51.1	48.9	4.70	
	#10	609.9	58.7	41.3	1.98	
	#20	668.4	64.3	35.7	0.83	
	#40	705.5	67.9	32.1	0.42	
	#60	795.3	76.6	23.4	0.25	
	#100	891.2	85.8	14.2	0.150	
	#200	942.8	90.8	9.2	0.074	

Sieve Analysis Data for Sample W11-41-272.0



Comments: Silty Sandy Gravel

All data are accurately and completely recorded.

Checked By: [signature] Date: 8/31/00

Appendix C

Borehole Geophysical Logs

Appendix C

Borehole Geophysical Logs

This appendix contains the borehole geophysical logs obtained from borehole 299-W11-41. The logs were run and analyzed by Duratek, Waste Management Federal Services Northwest, Inc. and MacTec. Included with the logs are Log Header sheets and Log Analysis Summary Reports.

Log Data Report
299-W11-39

Borehole Information

Site:	NE of T Tank Farm; RCRA well		Site Number:	299-W11-39
N-Coord: N/A		E-Coord: N/A		TOC Elev: N/A
GW Depth: 236.0 ft est.	Date: 12/6/00	Date Drilled:	12/06/00	TD, ft: 280.0

Casing Record (all casing depths in feet relative to ground surface)

Type:	ID, in.	Thick, in.	Top	Bottom
steel-thread	12.0	0.5	0	51.37
steel-thread	8.0	0.5	2.1 ft AGS	280.0

Borehole Notes:

Borehole 299-W11-39 (C3317) was drilled in December 2000 to a total depth of 280.0 ft. Double casing was present from the ground surface to a depth of 51.37 ft and was comprised of a single string of 12.0-in.-diameter, 0.50-in.-thick threaded steel. The second casing string was 8.0-in.-diameter, 0.50-in.-thick threaded steel set from 2.1 ft above ground surface to a depth of 280.0 ft. At the time analysis was performed, the borehole coordinates and ground surface elevation were not available. The zero reference for all log depths is the ground surface. Water was present in the borehole at the time of logging below 237.6 ft.

Equipment Information

Log System:	2B	Type:	HPGe	Efficiency:	35%
Cal Date:	Feb-00	Cal Ref:	GJO-HAN-30	Log Proc:	MAC-VZCP 1.7.10-1, Rev 3

Logging Information

Log Run No.	1	2				
Date	12/6/00	12/6/00				
Logging Engineer	A Pearson	A Pearson				
Start depth, ft	0.0	85.0				
Finish depth ft	115.0	280.5				
Count time sec	n/a	n/a				
Live Time / Real Time:	n/a	n/a				
Shield	None	None				
MSA Interval, ft	0.5	0.5				
Logging speed, ft/min	0.7 ft/min	0.7 ft/min				

Logging Operation Notes:

Logging operations were performed by MACTEC-ERS under contract with Duratek Federal Services. This borehole was logged with MACTEC-ERS's Spectral Gamma Logging System (SGLS) in two log runs to a total depth of 280.5 ft. Logging operations were conducted in continuous mode, moving the sonde a 0.7 ft per minute, and using a sampling interval of 0.5 ft. Log run two (85-280.5 ft) overlaps part of log run one (0-115 ft) and defines the repeat interval (85-115 ft) for the SGLS survey. The repeat log run was performed to check for depth and concentration repeatability.

Log Data Report

299-W11-39

Analysis Information

Analyst: R. Spatz **Date:** 12/21/00

Analysis Ref: MAC-VZCP 1.7.9, Rev. 2

Analysis Notes:

Log analysis was performed by MACTEC-ERS under contract with Duratek Federal Services. The pre- and post-survey field verification spectra met the acceptance criteria established for peak shape and detector efficiency. The energy calibration and peak-shape calibration from these spectra were used in processing the log spectra. Dead time was less than 10% throughout the borehole. A casing correction factor for 1.0-in.-thick steel casing was applied to the data between depths of 0 and 51.37 ft. and a 0.5-in.-thick steel casing correction factor was applied below 51.37 ft to the bottom of the borehole. At the time of logging, grout was not present around the borehole. A water correction factor was also applied to spectral data collected below the depth of 237.6 ft.

Log Plot Notes:

Separate log plots are provided for total gamma, naturally occurring radionuclides (K-40, U-238, and Th-232 (KUT)), and the man-made radionuclide cesium -137 (Cs-137). The specific gamma-ray energies used to calculate the KUT and Cs-137 concentrations were 1460.8; 609.3; 2614.5; and 661.6 keV, respectively. The interval between the depths of 85 and 115 ft was relogged as an additional quality check and to demonstrate the repeatability of the radionuclide concentration measurements made by the SGLS. A plot of the total neutron count rate is provided on the combination plot as well as on several plots showing total gamma and total neutron count rates. The neutron data were acquired with Durateck's RLS-1 neutron moisture logging system.

Results / Interpretations:

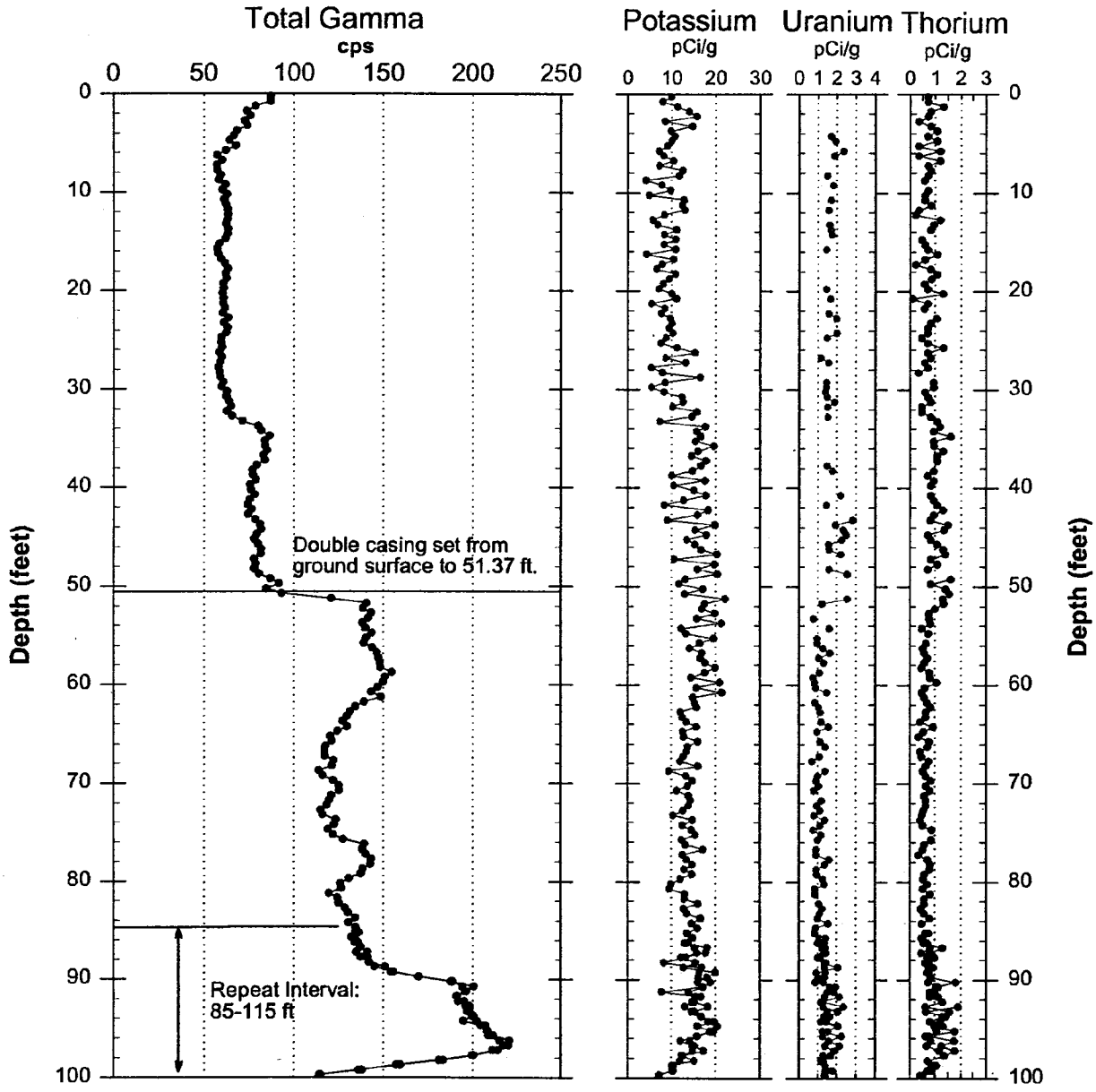
Cs-137 was the only man-made radionuclide detected by the SGLS and was measured in low concentrations (2 pCi/g) from the ground surface to a depth of 1 ft. Gamma rays were attenuated by the presence of double casing and water between the ground surface and 51.37 ft, and below the depth of 237.6 ft, respectively.

Spectral Gamma Survey

Duratek Federal Services

Project: RCRA Well
Well: 299-W11-39

Log Date: December 6, 2000
Depth Datum: Ground Level

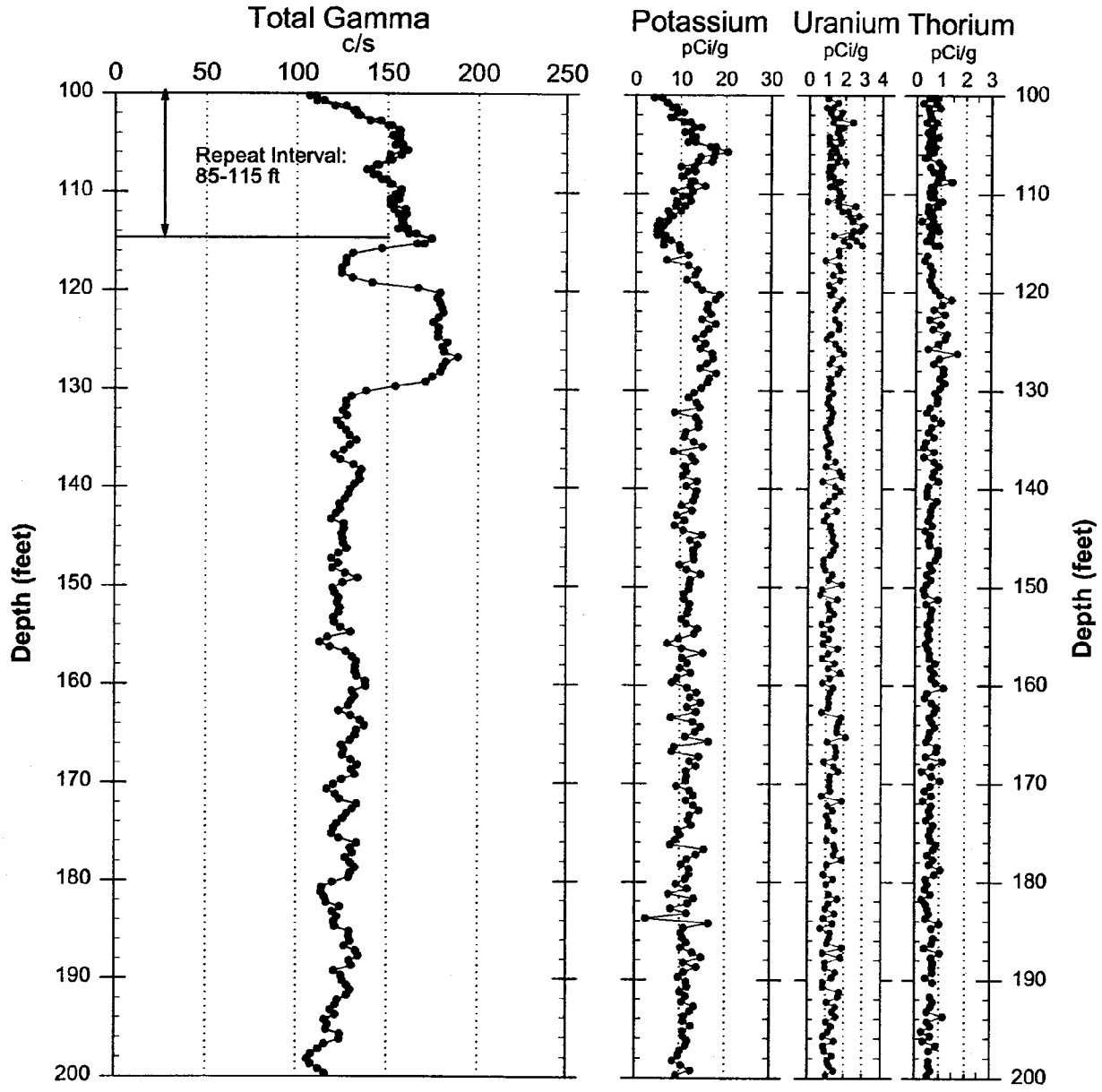


Spectral Gamma Survey

Duratek Federal Services

Project: RCRA Well
Well: 299-W11-39

Log Date: December 6, 2000
Depth Datum: Ground Level



Spectral Gamma Survey

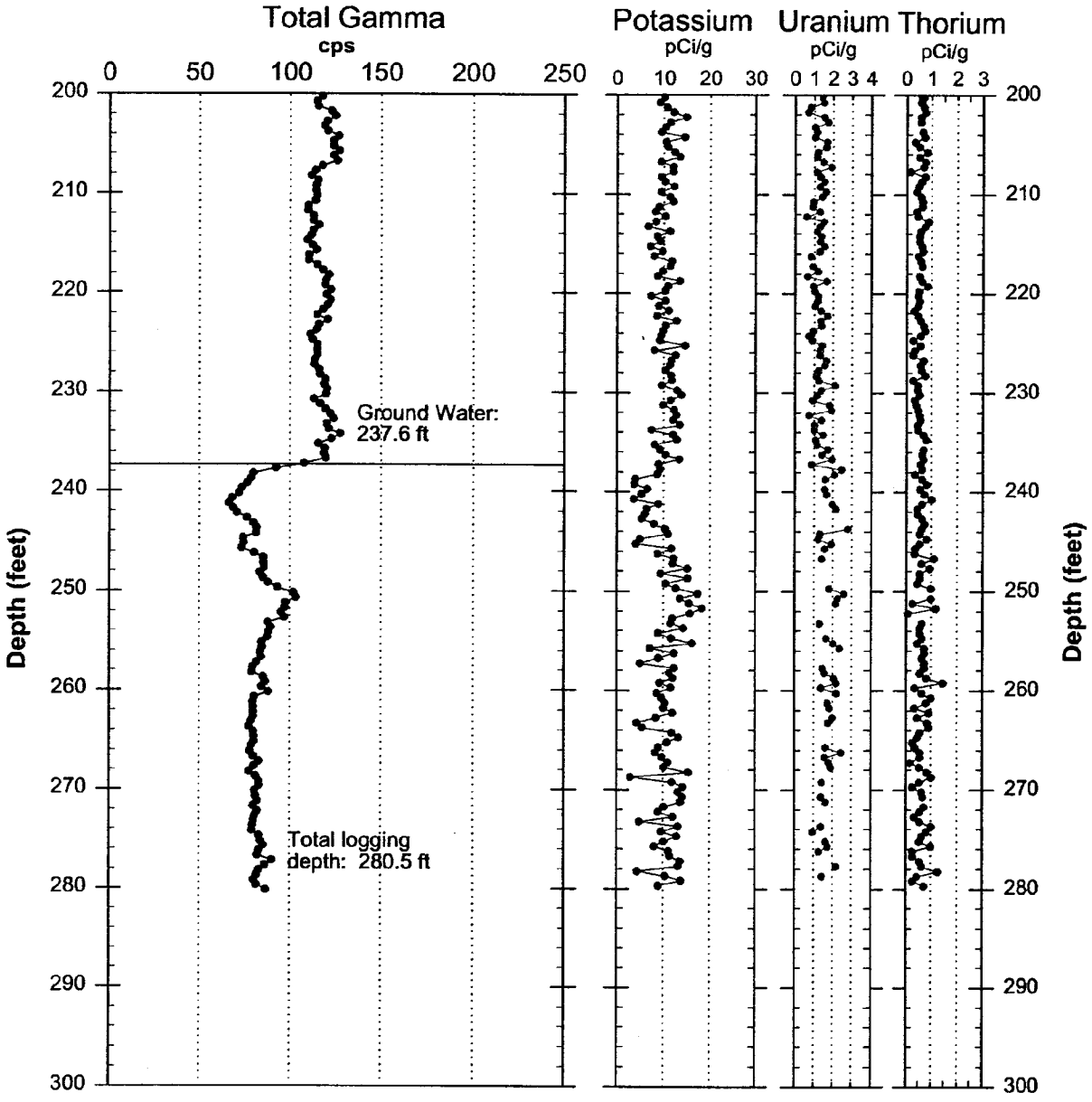
Duratek Federal Services

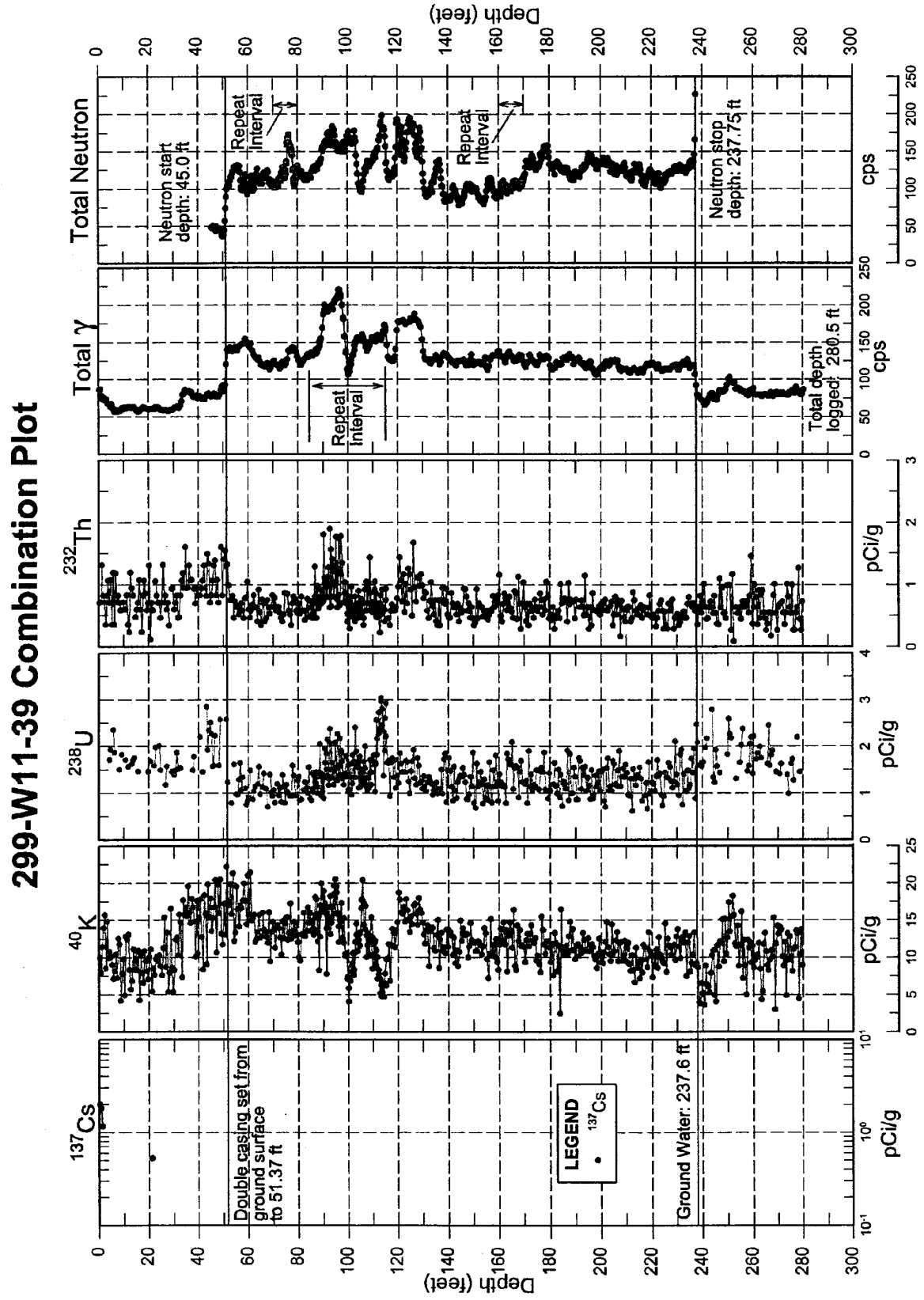
Project: RCRA Well

Well: 299-W11-39

Log Date: December 6, 2000

Depth Datum: Ground Level



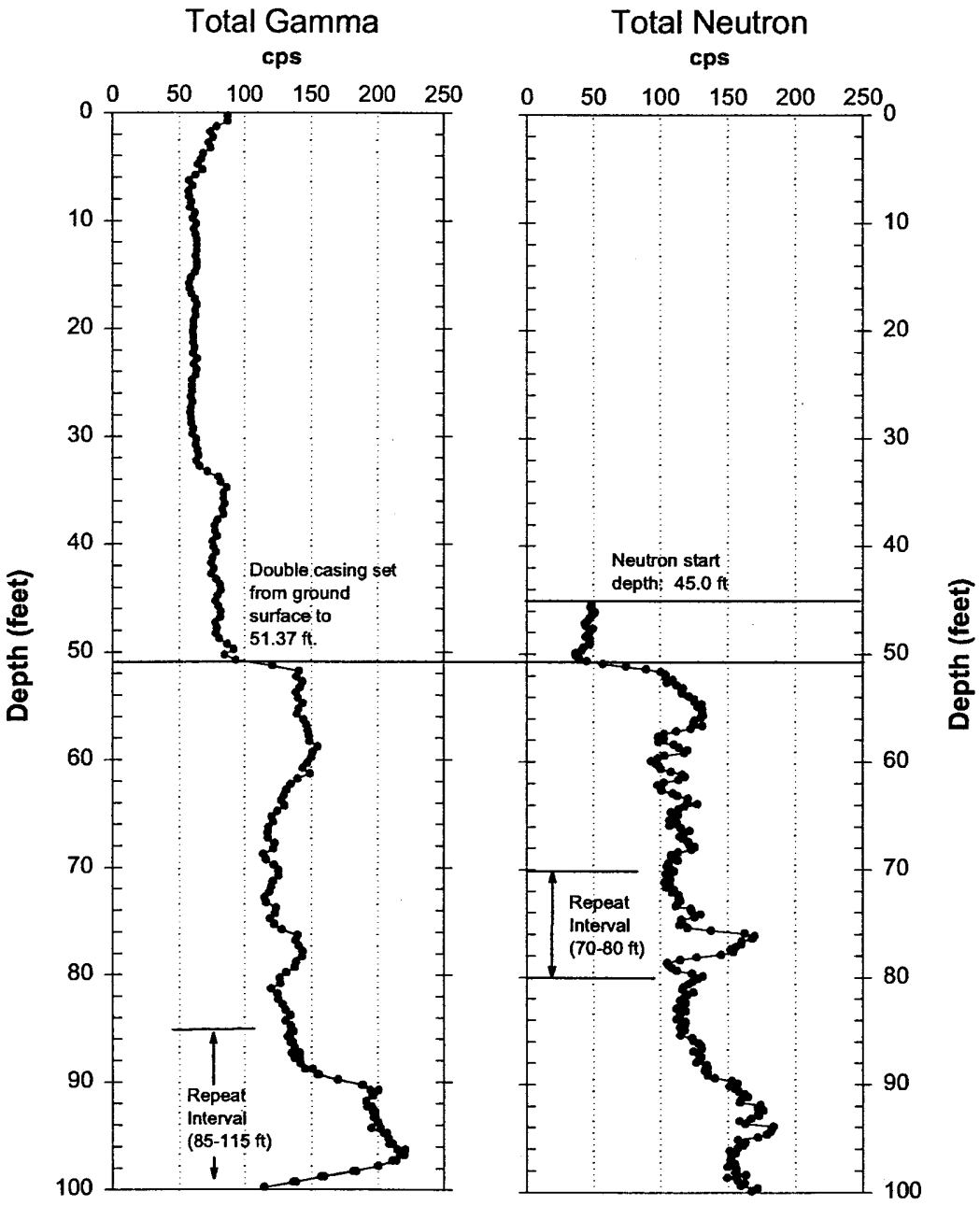

299-W11-39 Combination Plot
Depth (feet)
137Cs
40K
238U
232Th
Total γ
Total Neutron
pCi/g
cps
Double casing set from ground surface to 51.37 ft
Ground Water: 237.6 ft
LEGEND
137Cs
Neutron start depth: 45.0 ft
Repeat Interval
Neutron stop depth: 237.75 ft
Total depth logged: 280.5 ft

Spectral Gamma Survey

Duratek Federal Services

Project: RCRA Well
Well: 299-W11-39

Log Date: December 6, 2000
Depth Datum: Ground Level

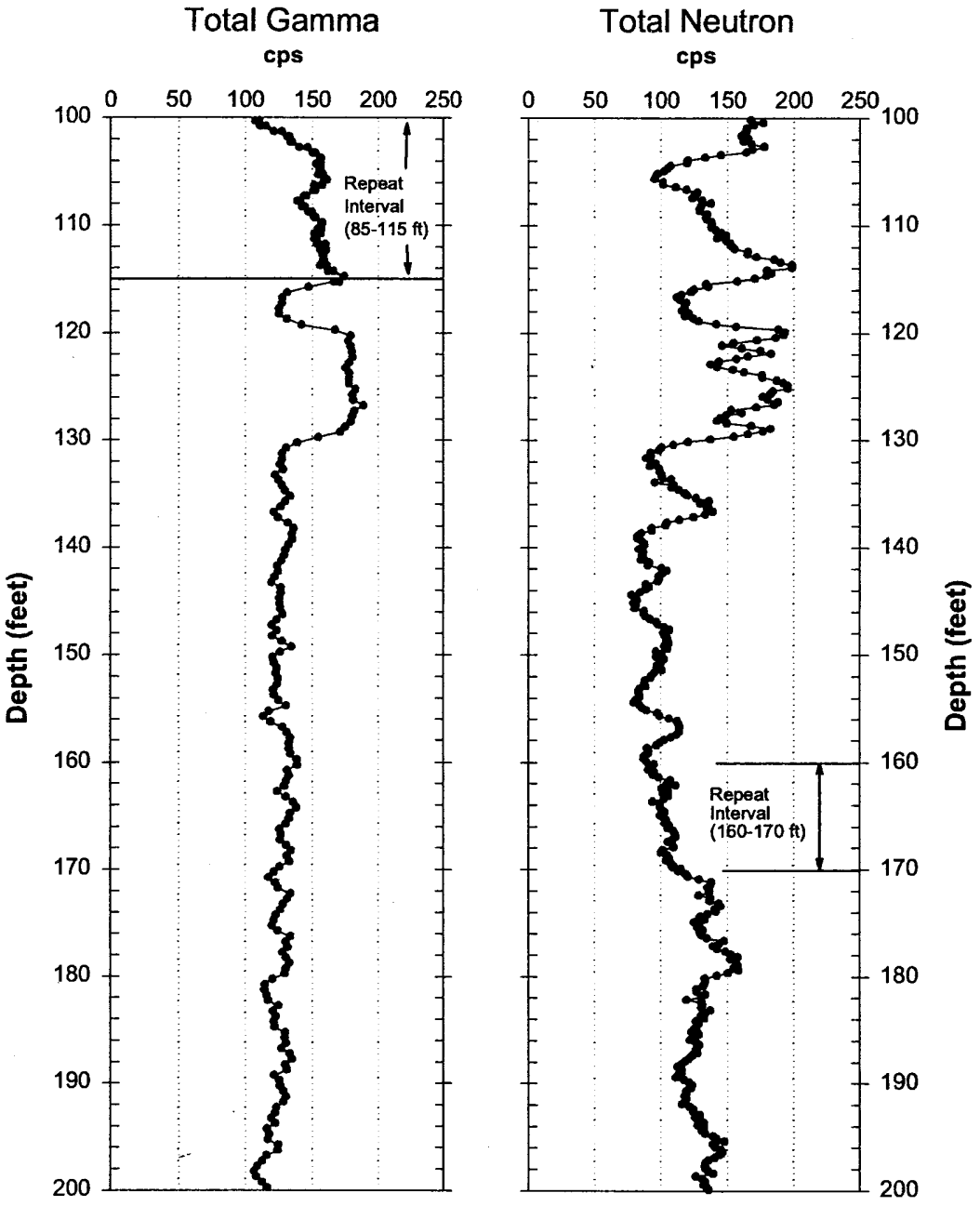


Spectral Gamma Survey

Duratek Federal Services

Project: RCRA Well
Well: 299-W11-39

Log Date: December 6, 2000
Depth Datum: Ground Level

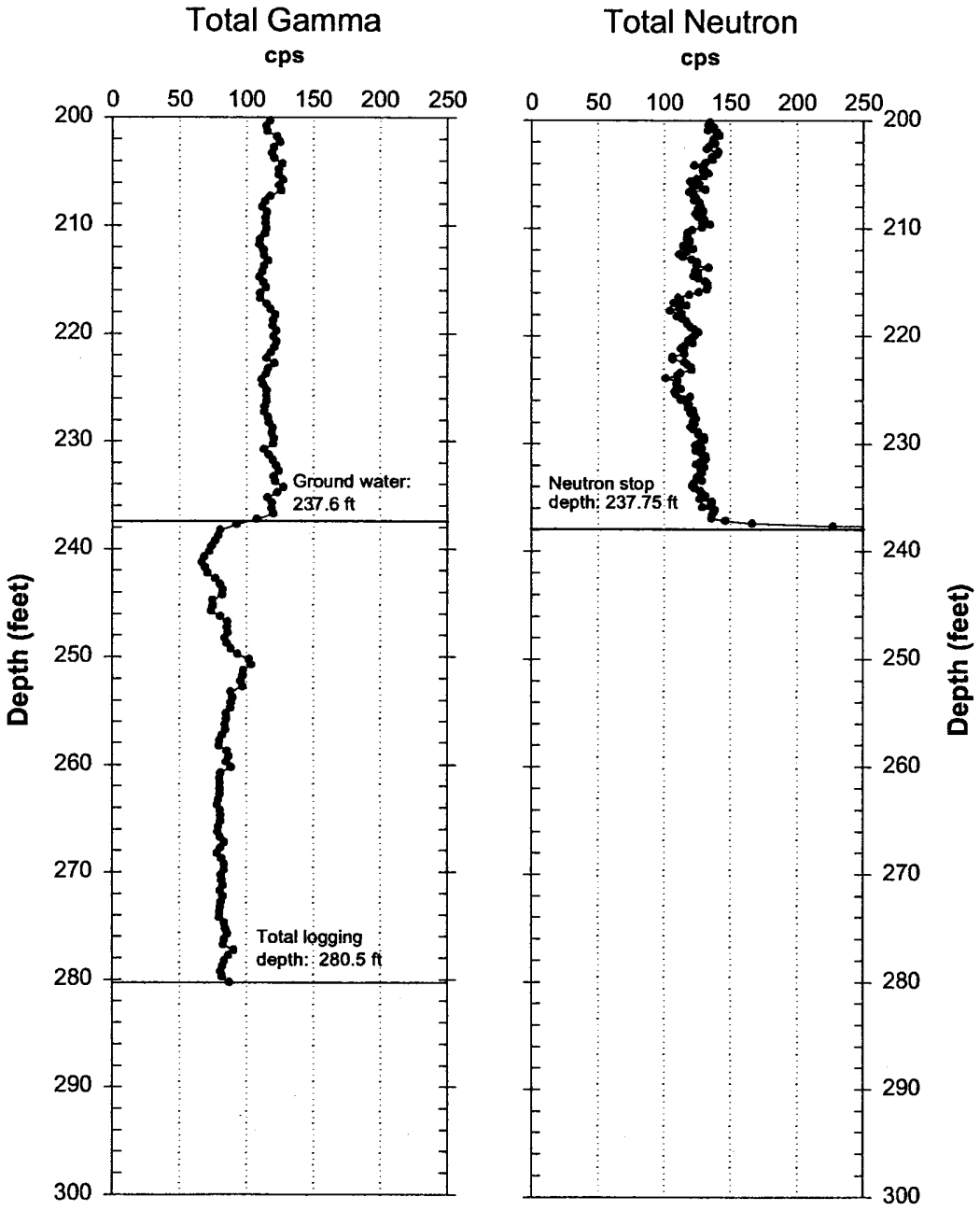


Spectral Gamma Survey

Duratek Federal Services

Project: RCRA Well
Well: 299-W11-39

Log Date: December 6, 2000
Depth Datum: Ground Level



Neutron-Neutron Moisture Borehole Survey

Duratek Federal Services, Inc.

Log Header

Project: 2000 RCRA Drilling Well: **299-W11-39**

Log Type: Moisture Gauge

Borehole Information

Well # C3317		Water Depth	238 ft	Total Depth	282.3 ft
Elevation Reference n/a		Elevation	n/a ft		
Depth Reference Ground Surface		Casing Stickup	2.1 ft		
Casing Diameter 12 ID in		Depth Interval	0 to 51.73 ft	Thickness	0.5 in
Casing Diameter 8 ID in		Depth Interval	0 to 280 ft	Thickness	0.5 in

Logging Information

Log Type:	Moisture Gauge		
Company	Duratek Federal Services, Inc.		
Date/Archive File Name	December 7, 2000	M2W11039	
Logging Engineers	A. Pearson		
Instrument Series	RLSM00.0		
Logging Unit	RLSN-1		
Depth Interval	45 to 80 ft	Prefix	MA78
	70 to 170 ft		MA79
	160 to 238 ft		MA80
Instrument Calibration Date	July 14, 2000		
Calibration Report	WHC-SD-EN-TI-306, Rev. 0		

Analysis Information

Company	Three Rivers Scientific
Analyst	Russ Randall
Date	December 18, 2000

Notes Moisture values range from 2% to 19% for the depths logged. The onset of high readings at 237 feet is due to the proximity of the water level in the borehole. No valid calibration is available for the 12 inch casing diameter from surface to 51.4 feet, thus the application of the 8 inch calibration is plotted as a blue line (with circle symbols) over 45 to 51.4 feet. The calibration for the 9 inch borehole diameter was extrapolated from standard diameter conditions, and casing correction applied to depths from 51.4 to 237 feet.

RLS Neutron-Neutron Moisture

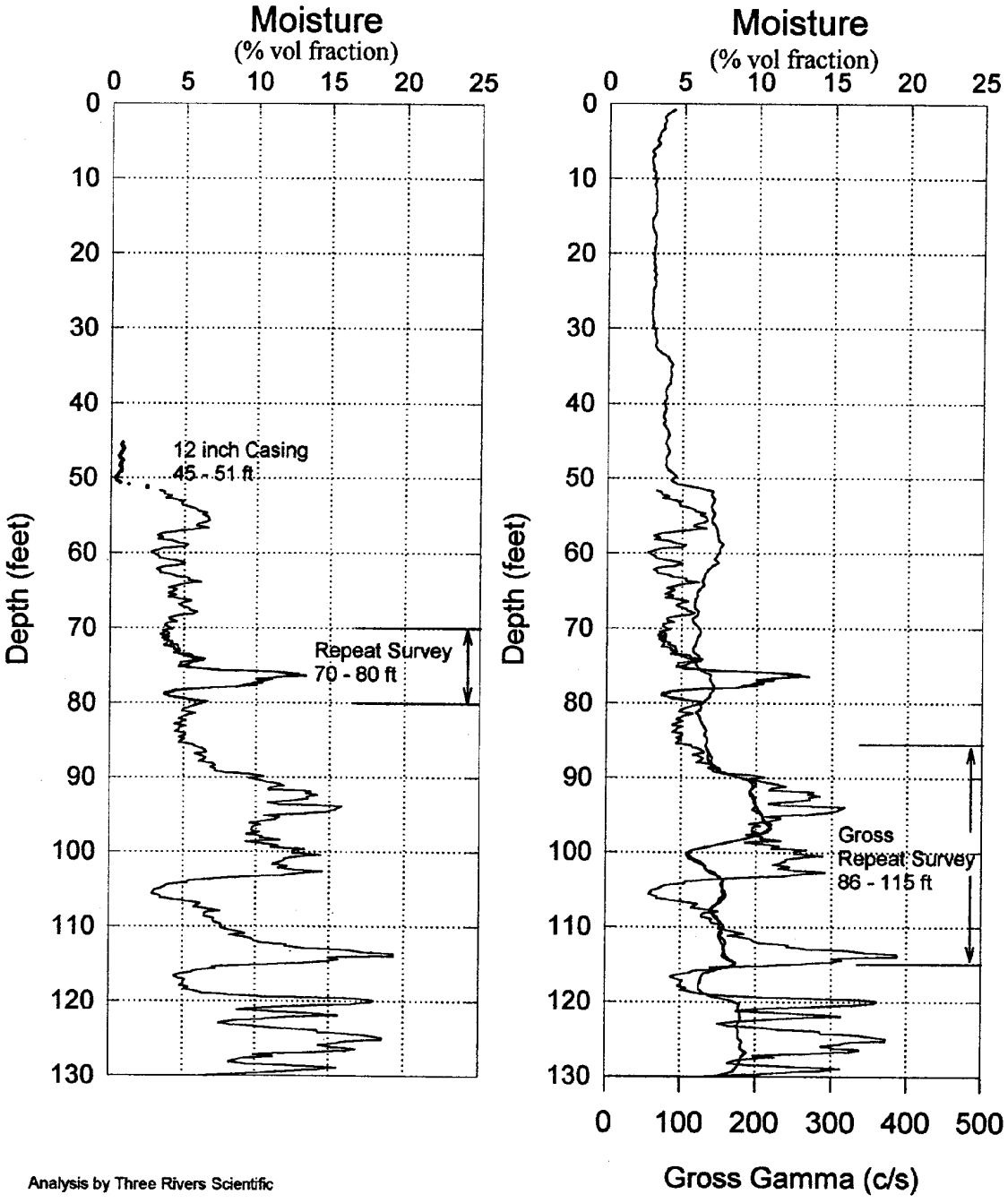
Duratek Federal Services, Inc.

Project: 2000 RCRA Drilling

Borehole: 299-W11-39

Log Date : December 7, 2000

Depth Datum : Ground Surface



Analysis by Three Rivers Scientific

RLS Neutron-Neutron Moisture

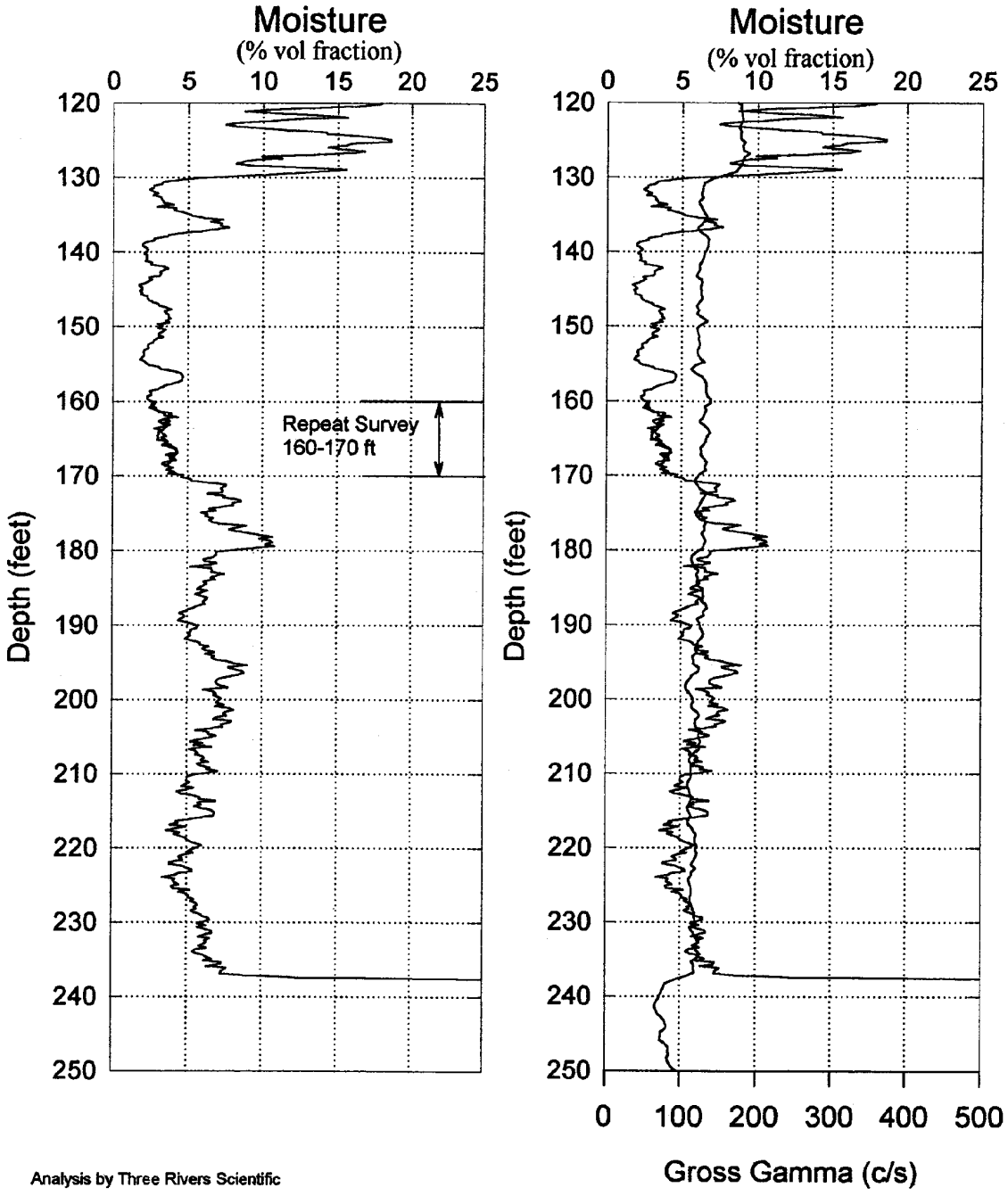
Duratek Federal Services, Inc.

Project: 2000 RCRA Drilling

Borehole: 299-W11-39

Log Date : December 7, 2000

Depth Datum : Ground Surface



Analysis by Three Rivers Scientific

Moisture Log Analysis & Summary

Duratek Federal Services, Inc.

Project:	2000 RCRA Drilling	Well ID:	**299-W11-39**
Log Type:	Moisture Gauge	Log Date:	December 7, 2000

General Notes:

The 8 inch calibration standard has an 8.64 inch borehole diameter, with .32 inch casing thickness, and the borehole diameter in these log data is 9.0 inches. Therefore, an extrapolation was calculated for the applied calibration coefficients to match the conditions of the logged borehole for depths greater than 51.4 feet. The depth interval from 45 to 51.4 feet has both the 8 inch and 12 inch casing. Thus the inappropriate use of the 9 inch calibration from 45 to 51.4 feet is plotted with a blue line and circle symbols. Note: no calibration exists for the 12 inch casing, and extrapolation to such large deviations is not expected to be accurate.

Log data collected with a depth reference of ground surface.

System Performance Verify: The pre- and post-log verification passed performance standards, +0.2% change from start of log to end of log, in the shield verify.

Repeat Interval: Based on the repeat intervals from 70 to 80 feet and 160 to 170 feet, the logging system performed according to specifications.

Environmental Corrections: The moisture levels have been corrected for casing thickness (0.5 inch) for all well depths logged greater than 51.4 feet. Depths more shallow than 51.4 feet are not subject to valid calibration, and for these intervals, the inappropriate 9 inch calibration with only 0.5 inch casing correction was calculated. No formation density correction has been applied because density values are not available.

Observations:

The moisture levels show values ranging from 2% to 19% for the depth interval from 51.4 feet to 238 feet. The abnormally high readings that begin at 238 feet are a response to the water level at 238 feet. Note that geologist's information puts the water depth at 236 feet.

A thin wetter zone exist at 77 feet. A highly laminated structure of wetter zones bounded by drier zones exists from 90 feet to 130 feet. Over this interval (90 to 130 feet) there is a good correlation between the gross gamma and the moisture structure, which is indicative of geologic variations.

Variable moisture structure shows from 135 to 238 feet. Over this depth interval, there is no good correlation with the gross gamma signature. Therefore, moisture log response is sensitive to the geologic structure over this interval, while changes in natural radionuclides are not as sensitive to the geologic structure, over this same interval.

Analysis by: Three Rivers Scientific

Spectral Gamma-Ray Borehole Log Data Report

Borehole 299-W11-41

Borehole Information

Farm : T	**Tank :** NA	**Site Number :** C3119
N-Coord :	**W-Coord :**	**TOC Elevation :**
Water Level, ft : 236.77	**Date Drilled :** 8/14/00	

Casing Record

Type : Thread Steel	Thickness, in. : 0.750	ID, in. : 10
Top Depth, ft. : 0	Bottom Depth, ft. : 21	
Type : Thread Steel	Thickness, in. : 0.500	ID, in. : 8
Top Depth, ft. : 0	Bottom Depth, ft. : 280	

Borehole Notes:

This borehole was drilled during August 2000 to a depth of 281.0 ft. A nominal 11-in.-diameter casing was used from the ground surface to 20.5 ft, with an 8-in.-diameter casing set from the ground surface to 279.9 ft. The casing strings used in the borehole were threaded and flush-jointed. The borehole was uncased from 279.9 to 281.0 ft. Measured wall thickness for the 11-in.-diameter casing was 0.75 in, and the measured thickness for the 8-in.-diameter casing was 0.5 in. Grout was not present between the casings, which were set flush with the ground surface. The total depth achieved with the logging system was 281.0 ft. The ground surface was used as the zero reference (0 ft) for all logging depths. The ground water level was measured at 236.77 ft.

Equipment Information

Logging System : 2B	**Detector Type :** HPGe	**Detector Efficiency:** 35.0 %
Calibration Date : 10/99	**Calibration Reference :** GJO-HAN-30	**Logging Procedure :** MAC-VZCP 1.7.10-1

Logging Information

Log Run Number : 1	**Log Run Date :** 08/15/2000	**Logging Engineer:** Pearson
Start Depth, ft.: 0.0	**Counting Time, sec.:**	**L/R :** **Shield :** N
Finish Depth, ft. : 281.0	**MSA Interval, ft. :** NA	**Log Speed, ft/min.:** 0.7
Log Run Number : 2	**Log Run Date :** 08/14/2000	**Logging Engineer:** Bob Spatz
Start Depth, ft.: 120.0	**Counting Time, sec.:**	**L/R :** **Shield :** N
Finish Depth, ft. : 90.0	**MSA Interval, ft. :** NA	**Log Speed, ft/min.:** 0.7

Logging Operation Notes:

This borehole was logged in two log runs. Both were completed on August 14, 2000 inside the 8-in.-diameter

Spectral Gamma-Ray Borehole Log Data Report

Borehole 299-W11-41

Analysis Information

Analyst : A.W. Pearson

Data Processing Reference : MAC-VZCP 1.7.9 Rev.2 Analysis Date : 09/08/2000

Analysis Notes :

The pre-survey and post-survey field verification for each logging run met the acceptance criteria established for peak shape and system efficiency. The energy calibration and peak-shape calibration from the accepted calibration spectrum that most closely matched the field data were used to establish the peak resolution and channel-to-energy parameters used in processing the spectra acquired during the logging operation.

The thicknesses of the different-sized casings were measured on site with a micrometer and are presented in the casing record. Casing corrections for each applicable thickness were determined and applied to the data at the appropriate depth intervals. In addition, a correction for water encountered in the borehole was applied to the data collected below 236.77 ft in depth. These corrections are applied to the raw data recorded in counts per second to derive final radionuclide concentrations.

Shape factor analysis was not applied to the SGLS data because man-made radionuclides were not detected in this borehole.

Log Plot Notes:

Separate log plots are presented to show the man-made (near-surface Cs-137), naturally occurring radionuclides (K-40, U-238, and Th-232), and the gross gamma. These plots show the naturally occurring radionuclides which can be used for lithology interpretation and bed boundary identification.

Results/Interpretations:

The only man-made radionuclide detected in this borehole was Cs-137, which was detected at the ground surface and between 1.0 and 2.0 ft.

The naturally occurring radionuclides show several changes in the KUT concentrations that indicate lithology changes and bed boundaries.

The repeat log plots show good repeatability for the gross gamma and the calculated concentrations.

Summary Report
SGLS and Moisture Log Results
Borehole 299-W11-41

MACTEC
October 10, 2000

Borehole 299-W11-41 is located east of the T Tank Farm. It was drilled with a air rotary drill rig during August, 2000 to a total depth of 281.0 ft. Unless otherwise noted, all depths noted in this report are measured from ground surface. Two casing strings were in the borehole during the logging. An 11-in.-diameter casing was set from 0.0 to 20.5 ft, and an 8-in.-diameter casing was set from 0.0 to 279.9 ft. The depth to groundwater was 236.77 ft.

Data was collected in two logging events; A and B using two different geophysical logging systems in accordance with MAC-VZCP 1.7.10-1, Rev 3 (DOE 2000). Log event A represents Spectral Gamma Logging System (SGLS) data collected using a 35% high-purity germanium (HPGe) detector in the continuous logging mode at 0.7 ft/min with a sample interval of 0.5 ft. Event B is neutron-neutron moisture data collected with a detector supplied by Waste Management Federal Services (WMFS) and adapted to run on the SGLS logging truck. The neutron-neutron moisture tool was run in the continuous logging mode at 1.0 ft/min with a sample interval of 0.25 ft. These logging parameters were selected by WMFS. Analysis of neutron-neutron data from log event B was performed by WMFS and will not be discussed in this report.

Analysis of the SGLS data was performed in accordance with MAC-VZCP 1.7.9, Rev. 2 (DOE, 2000). The results are plotted on a template provided by WMFS.

A generalized casing correction function was used to determine casing correction factors for the SGLS data (log event A), using wall thicknesses of 0.75 inches for the 11-in.-diameter casing and 0.5 inches for the 8-in.-diameter casing. A water correction factor was applied to the SGLS data below the measured water level of 236.77 ft. Additional information regarding efficiency functions and correction factors can be found in the latest annual calibration report (DOE 2000). The formula below describes how these correction factors are used in the concentration

$$C_a = K_c * K_w * \frac{27.027}{Y} * I(E) * P_c$$

calculation.

- C_a = activity, pCi/g (1 pCi = 27.027 decays per second)
- Y = gammas per decay ($0<Y<1$)
- P_c = dead-time corrected spectral peak intensity (DTC = 1 for $T_D < 10.5\%$)
- E = energy, keV
- I(E) = gammas per second per gram per count per second
- K_c = casing correction factor
- K_w = water correction factor

All dead times were less than 1% and therefore did not affect the calculation of radionuclide concentrations. The correction factors are all energy dependent and are listed in the following table.

	Name	K-40	U-238	U-238	Th-232	Cs-137
	E, KeV	1460.830	609.312	1764.494	2614.533	661.660
	Y	0.1067	0.4479	0.1536	0.3564	0.9011
	HL (y)	1.277E+09	4.468E+09	4.468E+09	1.405E+10	3.007E+01
Inverse Efficiency I(E)	min	0.0138	0.0111	0.0144	0.0157	0.0114
	I(E)	0.0168	0.0137	0.0175	0.0191	0.0139
	max	0.0201	0.0165	0.0209	0.0227	0.0168
Casing Correction 0.5" wall (Kc)	min	1.8452	2.3218	1.7776	1.6604	2.2601
	Kc(E)	1.8691	2.3621	1.7996	1.6790	2.2980
	max	1.8936	2.4038	1.8220	1.6981	2.3372
Casing Correction 1.25" wall (Kc)	min	6.1769	9.2287	5.8204	5.2374	8.7705
	Kc(E)	7.9501	14.2621	7.3477	6.4110	13.1574
	max	11.1513	31.3735	9.9617	8.2624	26.3250
Water Correction 8" diameter (Kw)	min	1.7343	2.1820	1.6709	1.5666	2.1268
	Kw(E)	1.7410	2.1900	1.6774	1.5728	2.1346
	max	1.7476	2.1979	1.6839	1.5790	2.1423

Log plots included in Figures 1 through 5 show total gamma-ray activity in counts per second, the naturally occurring radionuclides (Potassium, Uranium, and Thorium), and the man-made radionuclides (^{137}Cs). The following spectral peaks were used to calculated the radionuclide concentrations: 1460.75 keV for ^{40}K, 609.32 keV for ^{238}U, 2614.5 keV for ^{232}Th, and 661.62 keV for ^{137}Cs. The 609.32 keV peak was absent and/or not statistically valid in many of the spectra due to the relatively short counting times and casing attenuation. The 1764.51 keV peak was investigated as an option to calculate ^{238}U concentrations in place of the 609.32 keV peak, but similar results were found.

Dead times were not plotted because they were all below 1% and did not adversely affect the results.

^{137}Cs was the only man-made contaminant detected in borehole 299-W11-41. ^{137}Cs was detected in the top two feet of this borehole at concentrations near 1 pCi/g.

The total gamma increases at 21.0 ft, which is the bottom of the 11-in.-diameter casing. The next significant increase in the total gamma occurs between 90 and 100 ft. This increase is probably due to the silt dominated Plio-Pliestence unit. The last significant increase in total gamma occurs near 278 ft and coincides with a dramatic increase in the naturally occurring uranium. The

uranium increases at this depth from near 2 pCi/g to 14 pCi/g. The repeat section from 90.0 to 120.0 ft shows good repeatability with the original log for the gross gamma and the KUT concentrations.

References:

U.S Department of Energy (DOE), 2000. *Hanford Tank Farms Vadose Zone Data Analysis Manual,* MAC-VZCP 1.7.9, Rev. 2, prepared by MACTEC-ERS for the Grand Junction Projects Office, Grand Junction, Colorado, June.

_____, 2000. *Hanford Tank Farms Vadose Zone High-Resolution Passive Spectral Gamma-Ray Logging Procedures,* MAC-VZCP 1.7.10-1, Rev 3, prepared by MACTEC-ERS for the Grand Junction Office, Grand Junction, Colorado, June.

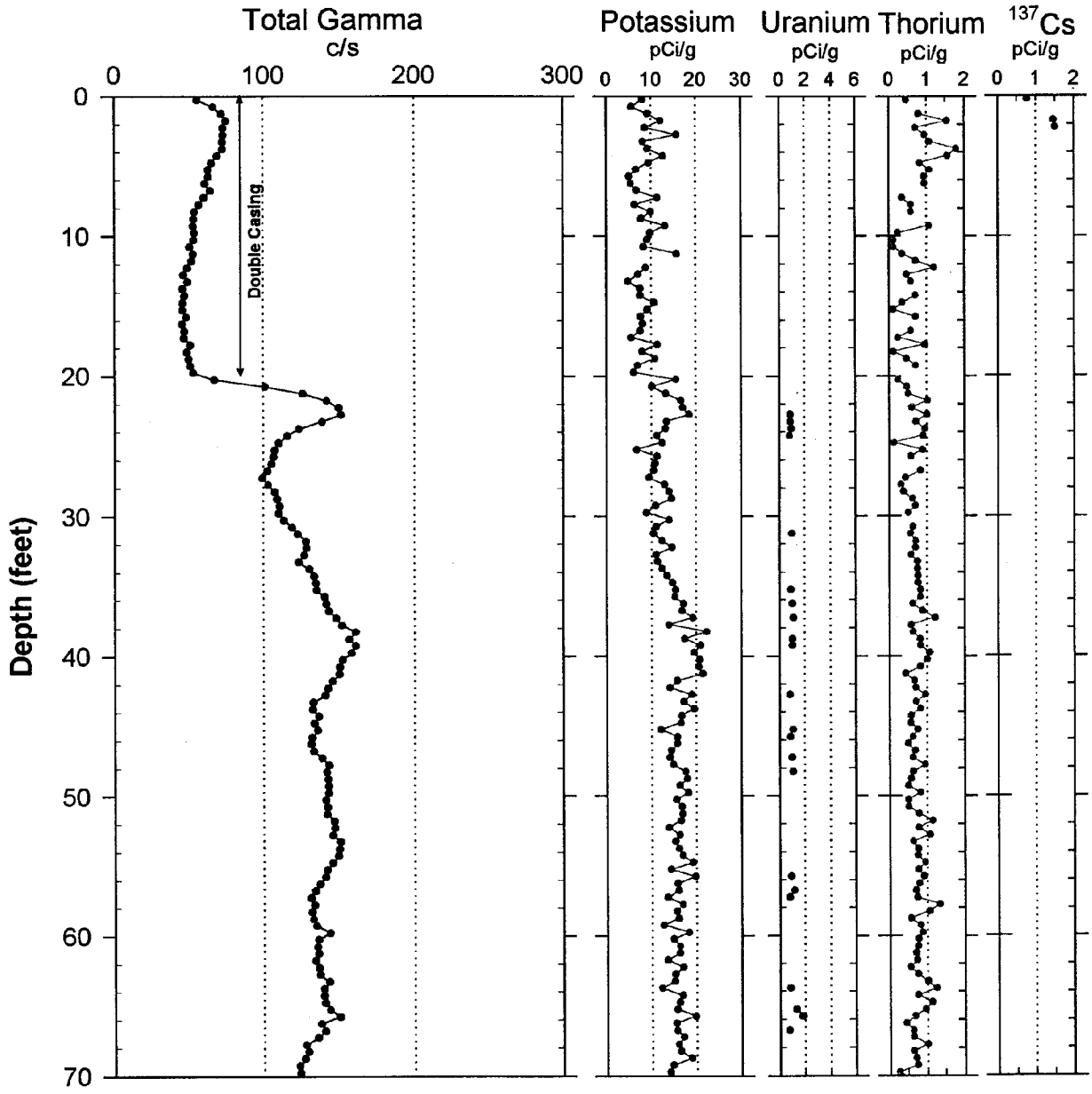
_____, 2000. *Seventh Recalibration of Spectral Gamma-Ray Logging Systems Used for Baseline Characterization Measurements in the Hanford Tank Farms,* GJO-HAN-30, prepared by MACTEC-ERS for the Grand Junction Office, Grand Junction, Colorado, February.

RLS Spectral Gamma Ray Borehole Survey

Waste Management Federal Services

Project: RCRA Drilling
Borehole: 299-W11-41

Log Date: August 14, 2000
Depth Datum: Ground Level

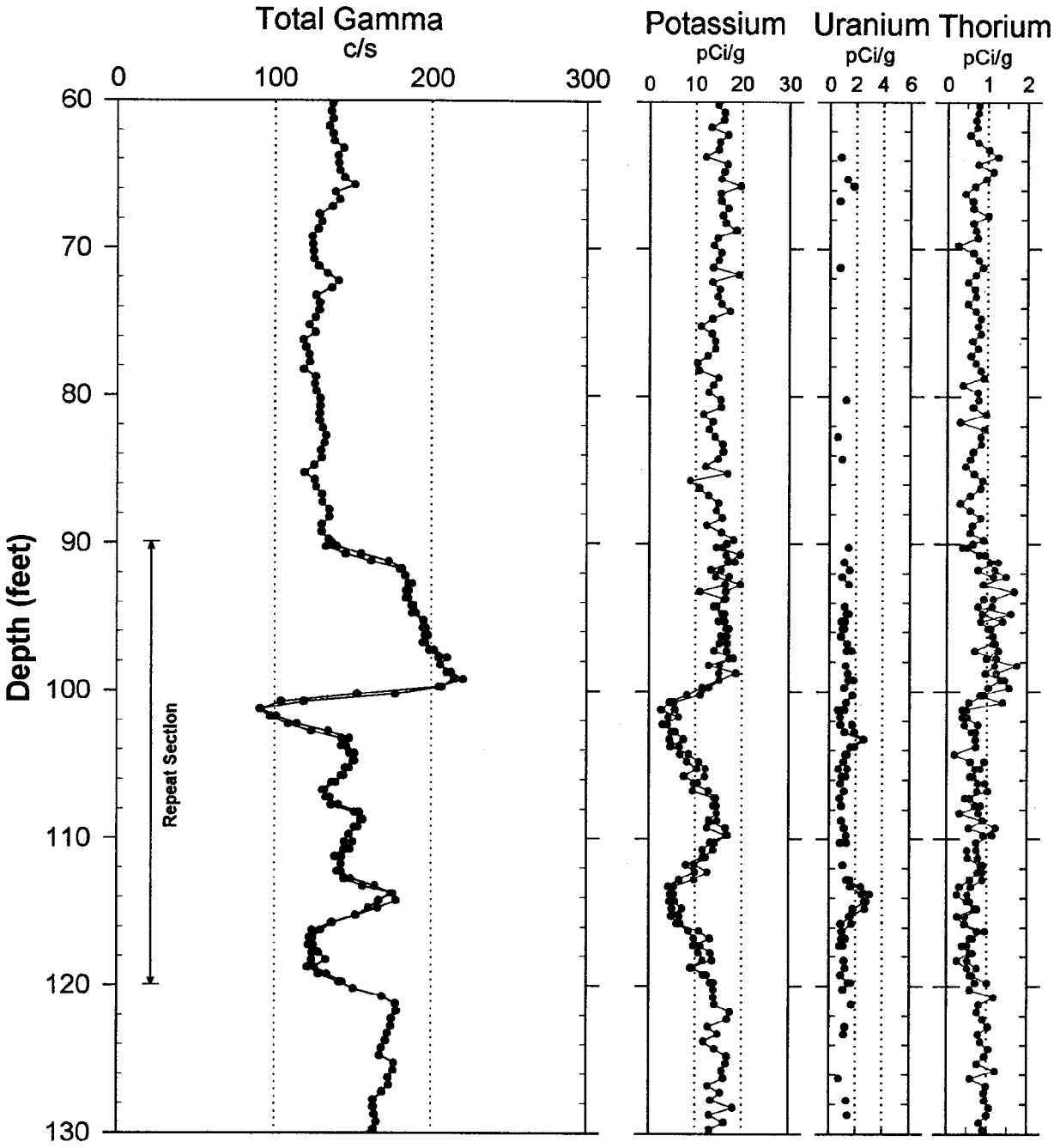


RLS Spectral Gamma Ray Borehole Survey

Waste Management Federal Services

Project: RCRA Drilling
Borehole: 299-W11-41

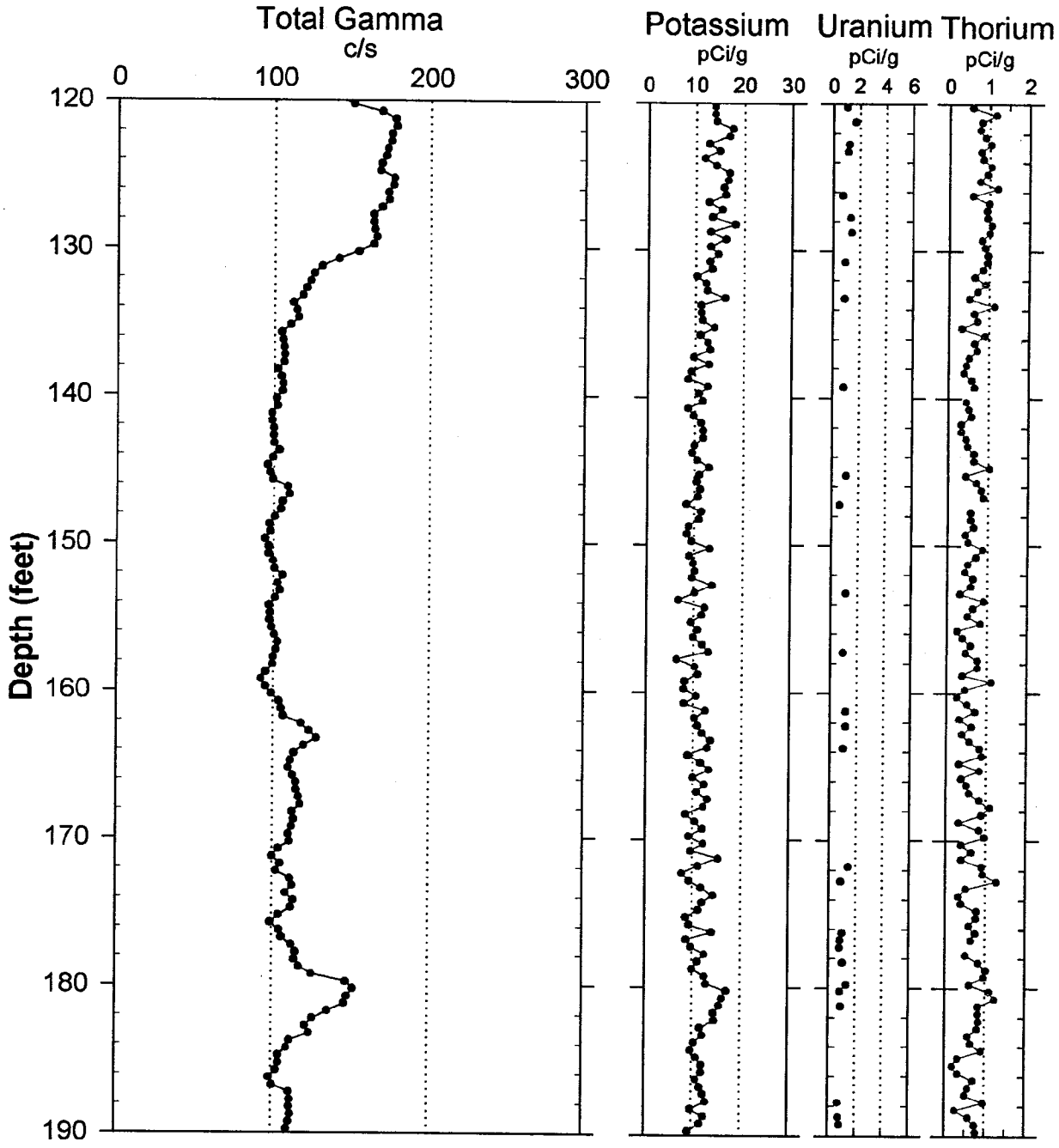
Log Date: August 14, 2000
Depth Datum: Ground Level



RLS Spectral Gamma Ray Borehole Survey
Waste Management Federal Services

Project: RCRA Drilling
Borehole: 299-W11-41

Log Date: August 14, 2000
Depth Datum: Ground Level

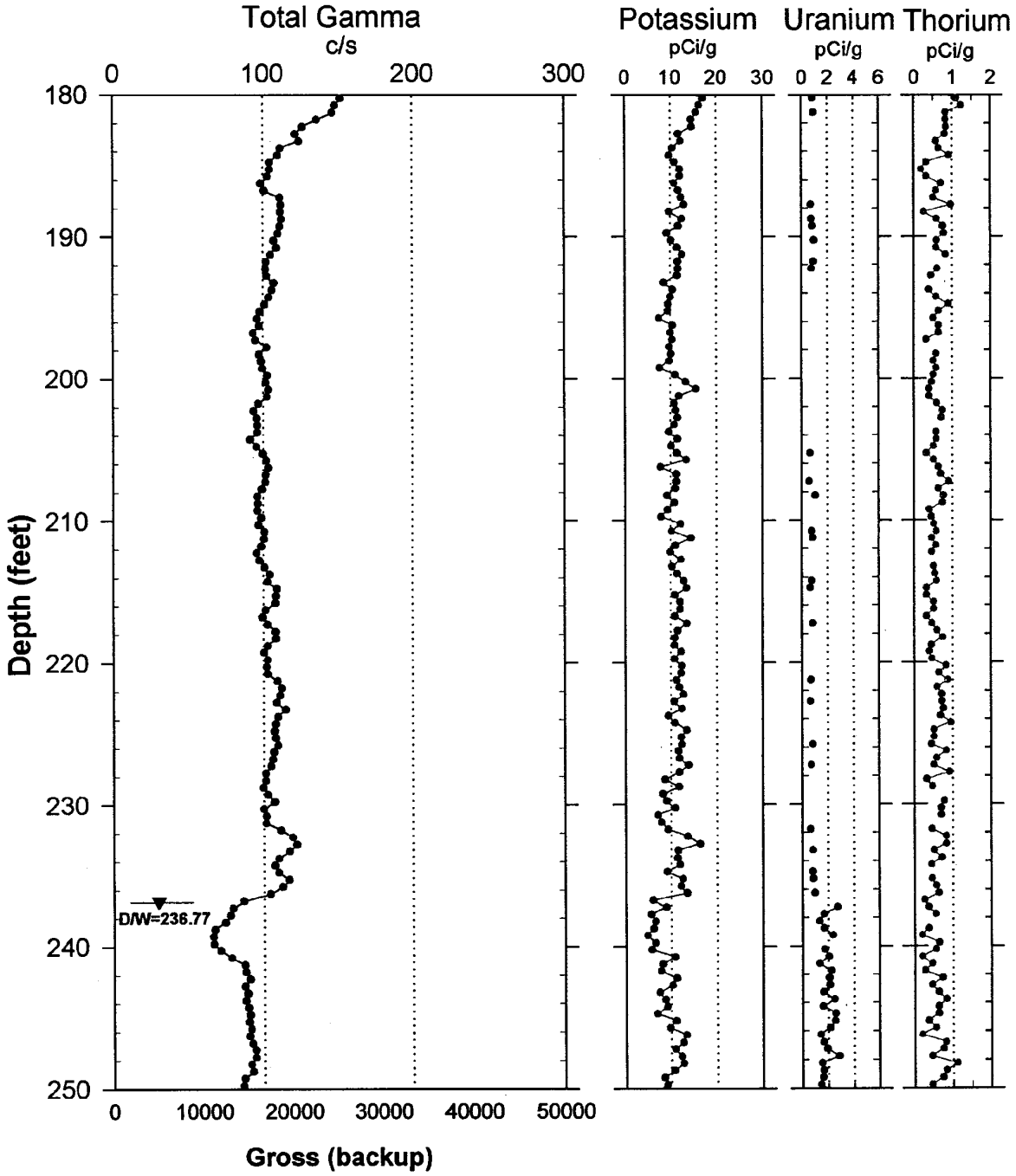


RLS Spectral Gamma Ray Borehole Survey

Waste Management Federal Services

Project: RCRA Drilling
Borehole: 299-W11-41

Log Date: August 14, 2000
Depth Datum: Ground Level

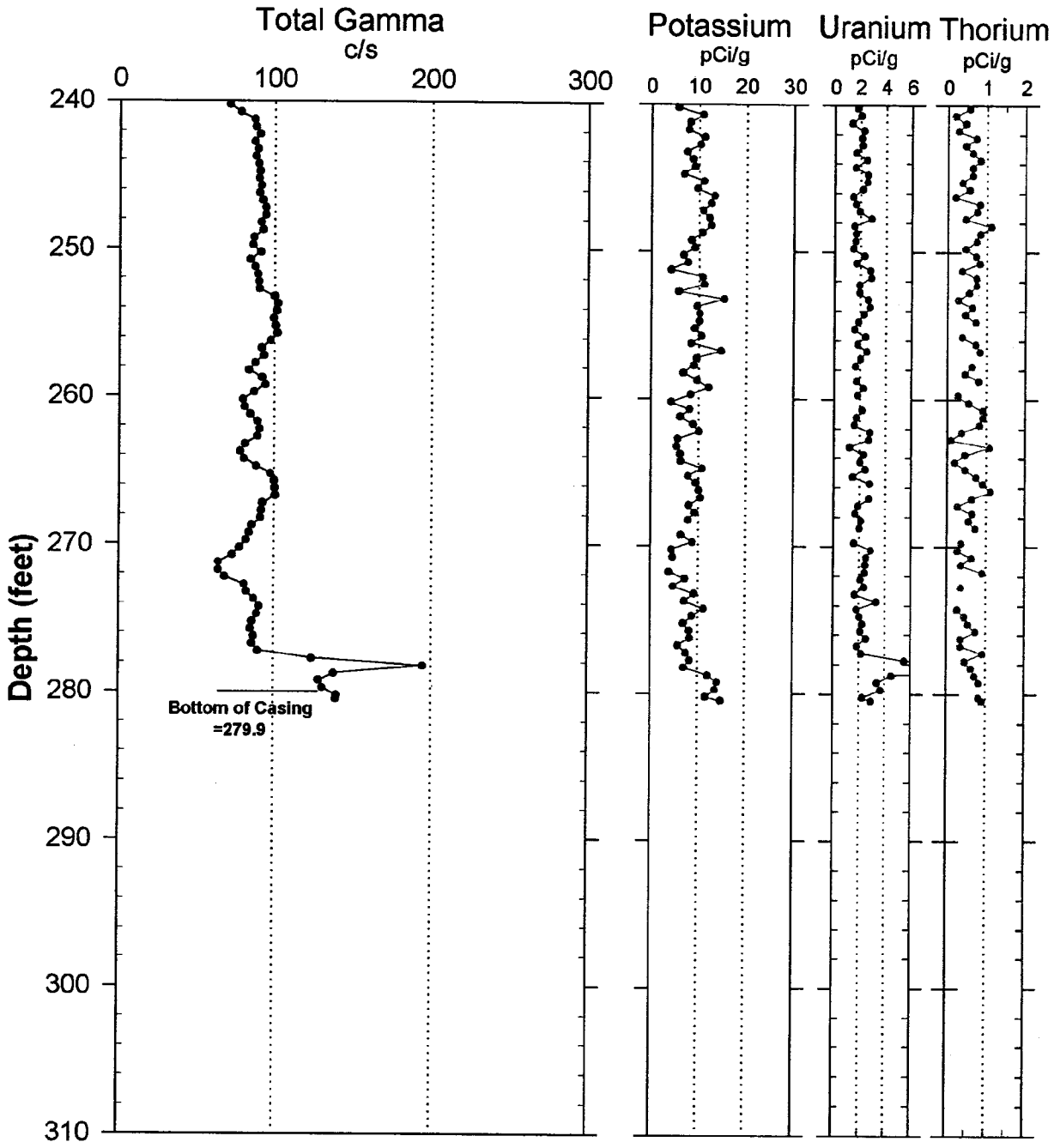


RLS Spectral Gamma Ray Borehole Survey

Waste Management Federal Services

Project: RCRA Drilling
Borehole: 299-W11-41

Log Date: August 14, 2000
Depth Datum: Ground Level



Neutron-Neutron Moisture Logging Service
Log Header
Waste Management Federal Services

Project: RCRA Drilling Well: **299-W11-41**

Log Type: Moisture Gauge

Borehole Information

Well # unk		Water Depth	236.8 ft	Total Depth	280 ft
Elevation Reference n/a		Elevation	n/a ft		
Depth Reference	Ground Surface	Casing Stickup	0.68 ft		
Casing Diameter	10.25 ID in	Depth Interval	0 to 20.5 ft	Thickness	.75 in
Casing Diameter	7.625 ID in	Depth Interval	0 to 280 ft	Thickness	.5 in

Logging Information

Log Type:	Moisture Gauge		
Company	Waste Management Federal Services		
Date/Archive File Name	August 15, 2000	M2W11041	
Logging Engineers	A. Pearson		
Instrument Series	RLSM00.0		
Logging Unit	2B		
Depth Interval	16 to 120 ft	Prefix	F08B1
	100 to 200 ft		F08B2
	195 to 236 ft		F08B3
Instrument Calibration Date	July 14, 2000		
Calibration Report	WHC-SD-EN-TI-306, Rev. 0		

Analysis Information

	Company	Three Rivers Scientific
	Analyst	Russ Randall
	Date	October 26, 2000
Notes	Moisture values range from 2% to 22% for the depths logged. The onset of high readings at 236.5 feet is due to the proximity of the water level in the borehole. No valid calibration is available for the 10 inch casing diameter from surface to 20.5 feet, thus the application of the 8 inch calibration is plotted as a dotted line over 16 to 20.5 feet.	

RLS Neutron-Neutron Moisture

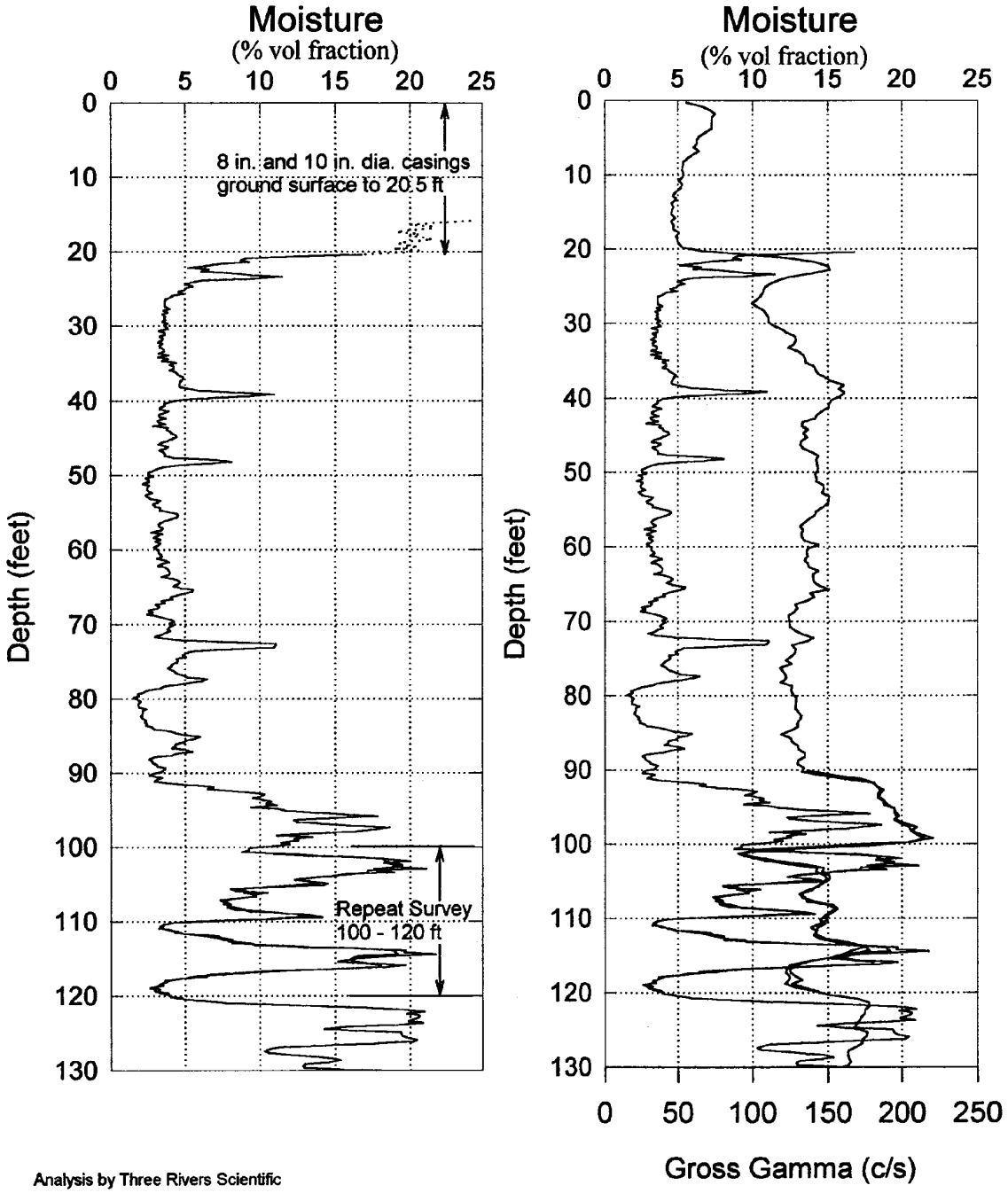
Waste Management Federal Services

Project: RCRA Drilling

Log Date : August 15, 2000

Borehole: 299-W11-41

Depth Datum : Ground Surface



Analysis by Three Rivers Scientific

RLS Neutron-Neutron Moisture

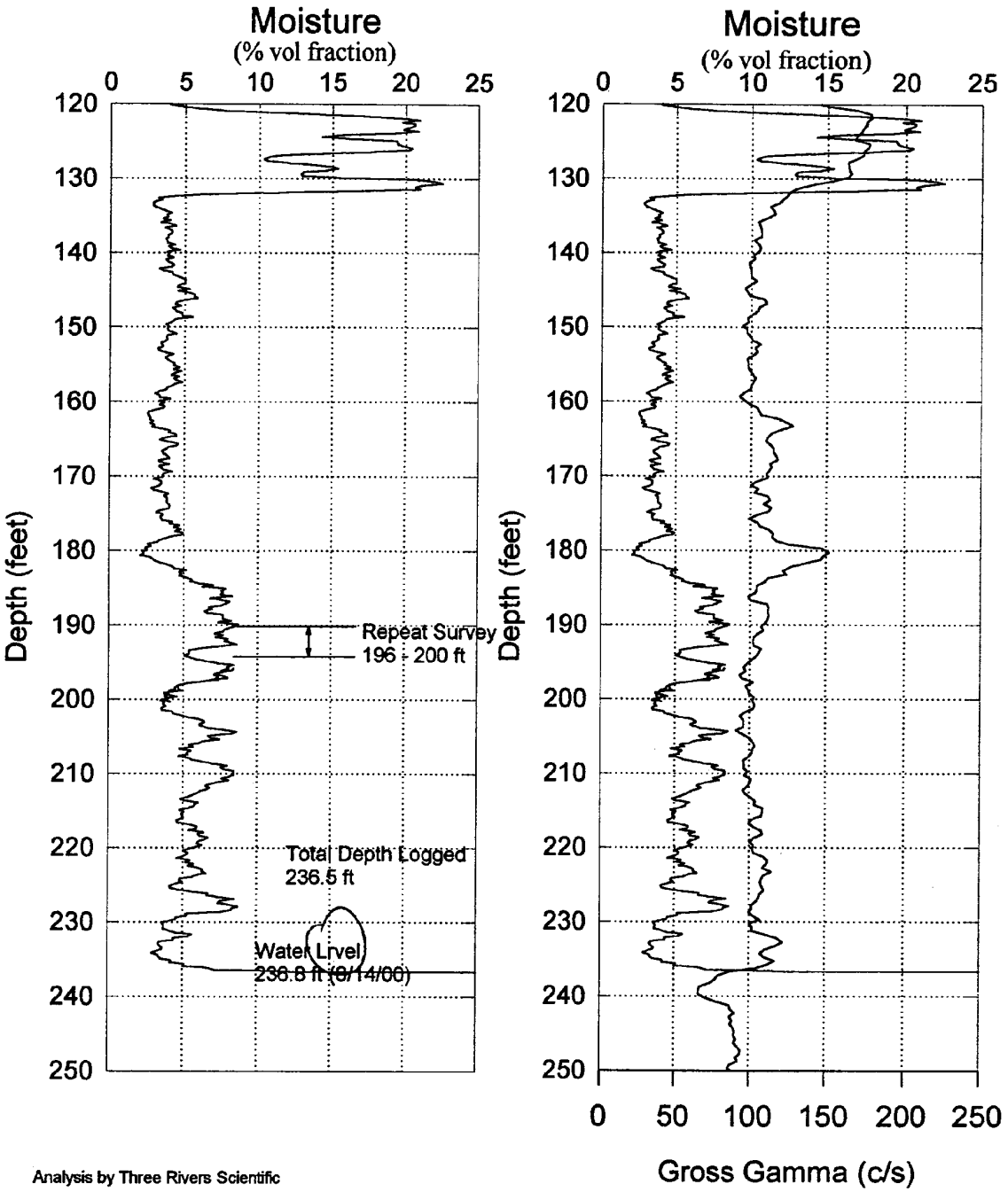
Waste Management Federal Services

Project: RCRA Drilling

Log Date : August 15, 2000

Borehole: 299-W11-41

Depth Datum : Ground Surface



Analysis by Three Rivers Scientific

Moisture Log Analysis & Summary
Waste Management Federal Services

Project:	RCRA Drilling	Well ID:	299-W11-41
Log Type:	Moisture Gauge	Log Date:	August 15, 2000

General Notes:
The 8 inch calibration coefficients were used for all logged depths. The 8 inch calibration standard has an 8.64 inch borehole diameter, with .32 inch casing thickness, and the borehole diameter in these log data is 8.625 inches. The depth interval from 16 to 20.5 feet has both the 8 inch and 10 inch casing. Thus the inappropriate use of the 8 inch calibration from 16 to 20.5 feet is plotted with a dotted line. Note: no calibration exists for the 10 inch casing.

Log data collected with a depth reference of ground surface.

System Performance Verify: The pre- and post-log verification passed performance standards, -1.3% change from start of log to end of log, in the shield verify.

Repeat Interval: Based on the repeat interval from 100 to 120 feet and from 196 to 200 feet, the logging system performed according to specifications.

Environmental Corrections: The moisture levels have been corrected for casing thickness (0.5 inch) for all well depths logged. No formation density correction has been applied because density values are not available.

Observations:
The moisture levels show values ranging from 2% to 22% for the depth interval from 20.5 feet to 236 feet. The abnormally high readings that begin at 236.5 feet are a response to the water level at 237 feet.

A highly laminated structure of wetter zones bounded by drier zones exists from 93 feet to 132 feet. Over this interval (93 to 132 feet) there is a good correlation between the gross gamma and the moisture structure, which is indicative of geologic variations. Thin wet zones show at 23, 39, 48, and 73 feet.

Analysis by: Three Rivers Scientific

Distribution

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