Date Received for Clearance Process (MM/DD/YYYY)
01/26/2009

INFORMATION CLEARANCE FORM

A. Information Category

- ☐ Abstract
- ☐ Journal Article
- ☐ Summary
- ☐ Internet
- ☐ Visual Aid
- ☐ Software
- ☐ Full Paper
- ☒ Report
- ☐ Other

B. Document Number
SGW-39344 Revision 0

C. Title
Borehole Summary Report for the Installation of RCRA Wells 299-E26-77 (C6455), 299-E26-79 (C6826), 299-E25-236 (C6542) and 199-N-165 (C6693), FY 2008

D. Internet Address

E. Required Information (MANDATORY)
1. Is document potentially Classified? No

C.S. Wright 1/21/09
Manager Required (Print and Sign)

If Yes _____
ADC Required (Print and Sign)

2. Official Use Only	No	Exemption No.
3. Export controlled Information	No	OUO Exemption No. 3
4. UCNI	No	
5. Applied Technology	No	
6. Other (Specify)		

7. Does Information Contain the Following:
   a. New or Novel FH (Patentable) Subject Matter ? No
      If "Yes", OUO Exemption No. 3
      If "Yes", Disclosure No.:
   b. Commercial Proprietary Information Received in Confidence, Such as Proprietary and/or Inventions? No
   c. Corporate Privileged Information? No
      If "Yes", OUO Exemption No. 4
   d. Government Privileged Information? No
      If "Yes", Exemption NO. 5
   e. **Copyrights**? No
   f. Trademarks? No
8. Is Information Requiring submission to OSTI? No
9. Release Level? Public

F. Complete for a Journal Article

1. Title of Journal

G. Complete for a Presentation

1. Title for Conference or Meeting
2. Group Sponsoring
3. Date of Conference
4. City/State
5. Will Information be Published in Proceedings?No
6. Will material be Handed Out?No

H. Information Owner/Author/Requestor

L. D. Walker 1/21/09
(Print and Sign)

Responsible Manager

C. S. Wright 1/21/09
(Print and Sign)

Approval by Direct Report to FH President (Speech/Articles Only)

(Print and Sign)

I. Reviewers	Print	Signature	Public Y/N (If N, complete J)
General Counsel	~~S. J. Bensuseen~~ N/A, per R. T. Swenson - 1/22/09		Y/N
Office of External Affairs			Y/N
DOE			Y/N
OUO-SME	D. B. Erb	(E-mail Pg. 2)	(Y)/N
Clearance	J. D. Aardal	Janis Aardal	(Y)/N
Other			Y/N
Other			Y/N

APPROVED FOR RELEASE
OFFICIAL DOCUMENT
Date 01/27/2009

A-6001-401

ADMINISTRATIVE DOCUMENT PROCESSING AND APPROVAL

DOCUMENT TITLE:
Borehole Summary Report for the Installation of RCRA Wells 299-E26-77 (C6455), 299-E26-79 (C6826), 299-E25-236 (C6542) and 199-N-165 (C6693), FY 2008

OWNING ORGANIZATION/FACILITY:
CHPRC-S&GWP

Document Number: SGW-39344

Revision/Change Number: 0

DOCUMENT TYPE *(Check Applicable)*

☐ Plan ☒ Report ☐ Study ☐ Description Document ☐ Other

DOCUMENT ACTION ◉ New ○ Revision ○ Cancellation

RESPONSIBLE CONTACTS

	Name	Phone Number
Author:	S. M. Sexton, GRAM, Inc.	
Manager:	C. S. Wright	373-3994

DOCUMENT CONTROL

Does document contain scientific or technical information intended for public use? ○ Yes ◉ No

Does document contain controlled-use information? ◉ Yes ○ No

("Yes" requires information clearance review in accordance with HNF-PRO-184)

DOCUMENT REVISION SUMMARY

NOTE: Provide a brief description or summary of the changes for the document listed.

REVIEWERS **Others**

Name *(print)*	Organization
L. D. Walker	Well Drilling & Decommissionin
C. S. Wright	Well Drilling & Decommissionin
W. R. Thackaberry	Analytical Support, QA
R. W. Oldham	Field Services & NF Monitoring

APPROVAL SIGNATURES

Author: for S. Sexton	1-21-09	RELEASE / ISSUE
Name: (Print) S. M. Sexton	Date	
Responsible Manager:	1/21/09	JAN 27 2009
Name: (Print) C. S. Wright	Date	DATE:
Other:	1/21/2009	STA: 15
Name: (Print) W. R. Thackaberry	Date	HANFORD
Other:	1.21.09	
Name: (Print) R. W. Oldham	Date	

SGW-39344
Revision 0

Borehole Summary Report for the Installation of RCRA Wells 299-E26-77 (C6455), 299-E26-79 (C6826), 299-E25-236 (C6542) and 199-N-165 (C6693), FY 2008

S. M. Sexton
GRAM Inc., Richland, WA.

Date Published
December 2008

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

Project Hanford Management Contractor for the
U.S. Department of Energy under Contract DE-AC06-08RL14788

CH2MHILL
Plateau Remediation Company

P.O. Box 1600
Richland, Washington

J. D. Aardal 01/27/2009
Release Approval Date

Approved for Public Release.
Further Dissemination Unlimited

TRADEMARK DISCLAIMER

Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof or its contractors or subcontractors.

This report has been reproduced from the best available copy.

Printed in the United States of America

TABLE OF CONTENTS

1.0 INTRODUCTION 1-1
1.1 PURPOSE AND SCOPE 1-1
1.2 BACKGROUND 1-7

2.0 WELL CONSTRUCTION ACTIVITIES 2-1
2.1 WELL 299-E26-77 (C6455) 2-6
2.1.1 Drilling and Sampling 2-6
2.1.2 Well Completion 2-6
2.1.3 Well Development 2-7
2.2 WELL 299-E26-79 (C6826) 2-7
2.2.1 Drilling and Sampling 2-7
2.2.2 Well Completion 2-7
2.2.3 Well Development 2-8
2.3 WELL 299-E25-236 (C6542) 2-8
2.3.1 Drilling and Sampling 2-8
2.3.2 Well Completion 2-8
2.3.3 Well Development 2-9
2.4 WELL 199-N-165 (C6693) 2-9
2.4.1 Drilling and Sampling 2-9
2.4.2 Well Completion 2-9
2.4.3 Well Development 2-9

3.0 GEOLOGY OF THE 200 EAST AND 100-NR-2 AREAS 3-1
3.1 BOREHOLE GEOLOGY FOR THE LERF, WMA A-AX AND 100-NR-2 RCRA MONITORING WELLS 3-1
3.1.1 Borehole 299-E26-77 (C6455) 3-1
3.1.2 Borehole 299-E26-79 (C6826) 3-2
3.1.3 Borehole 299-E25-236 (C6542) 3-2
3.1.4 Borehole 199-N-165 (C6693) 3-3

4.0 CIVIL SURVEY 4-1

5.0 WASTE MANAGEMENT 5-1
5.1 VADOSE ZONE CUTTINGS 5-1
5.2 SATURATED ZONE CUTTINGS 5-1
5.3 PURGE WATER 5-1

6.0 WELL ACCEPTANCE 6-1

7.0 references 7-1

APPENDICES

A BOREHOLE LOGS/WELL SUMMARY REPORTS ..... A-i

B GEOPHYSICAL LOGGING ..... B-i

C WELL CONSTRUCTION REPORT ..... C-i

D WELL DEVELOPMENT DATA ..... D-i

E CIVIL SURVEY REPORTS ..... E-i

FIGURES

Figure 1-1. Location Map for the LERF RCRA Monitoring Wells 1-4

Figure 1-2. Location Map for A-AX Tank Farm RCRA Monitoring Well 1-5

Figure 1-3. Location Map for 100-NR-2 OU RCRA Monitoring Well 1-6

TABLES

Table 2-1. M-24 RCRA Wells Construction Summary 2-4

Table 2-2. M-24 RCRA Wells Development Summary. 2-5

Table 2-3. M-24 RCRA Wells Sample Summary 2-6

TERMS

bgs	below ground surface
bwt	below water table
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
DOE	U.S. Department of Energy
EPA	Environmental Protection Agency
FH	Fluor Hanford, Inc.
ft	feet
gpm	gallons per minute
ID	inside diameter
hp	horsepower
m	meter
in.	inches
NTU	Nephelometric Turbidity Unit
OD	outside diameter
OU	operable unit
PNNL	Pacific Northwest National Laboratory
psi	pounds per square inch
RCRA	*Resource Conservation and Recovery Act of 1976*
RL	U.S. Department of Energy, Richland Operations Office
RLM	Ringold Lower Mud
RUM	Ringold Upper Mud
TD	total depth
toc	top of casing
tom	top of protective monument
Tri-Party Agreement	*Hanford Federal Facility Agreement and Consent Order* (Ecology et al., 1989)
VFD	Variable Frequency Drive

METRIC CONVERSION CHART

Into Metric Units			Out of Metric Units		
If you know	*Multiply by*	*To get*	*If you know*	*Multiply by*	*To get*
Length			**Length**		
inches	25.40	millimeters	millimeters	0.0394	inches
inches	2.54	centimeters	centimeters	0.394	inches
feet	0.305	meters	meters	3.281	feet
yards	0.914	meters	meters	1.094	yards
miles (statute)	1.609	kilometers	kilometers	0.621	miles (statute)
Area			**Area**		
sq. inches	6.452	sq. centimeters	sq. centimeters	0.155	sq. inches
sq. feet	0.0929	sq. meters	sq. meters	10.764	sq. feet
sq. yards	0.836	sq. meters	sq. meters	1.196	sq. yards
sq. miles	2.591	sq. kilometers	sq. kilometers	0.386	sq. miles
acres	0.405	hectares	hectares	2.471	acres
Mass (weight)			**Mass (weight)**		
ounces (avoir)	28.349	grams	grams	0.0353	ounces (avoir)
pounds	0.454	kilograms	kilograms	2.205	pounds (avoir)
tons (short)	0.907	ton (metric)	ton (metric)	1.102	tons (short)
Volume			**Volume**		
teaspoons	5	milliliters	milliliters	0.034	ounces (U.S., liquid)
tablespoons	15	milliliters	liters	2.113	pints
ounces (U.S., liquid)	29.573	milliliters	liters	1.057	quarts (U.S., liquid)
cups	0.24	liters	liters	0.264	gallons (U.S., liquid)
pints	0.473	liters	cubic meters	35.315	cubic feet
quarts (U.S., liquid)	0.946	liters	cubic meters	1.308	cubic yards
gallons (U.S., liquid)	3.785	liters			
cubic feet	0.0283	cubic meters			
cubic yards	0.764	cubic meters			
Temperature			**Temperature**		
Fahrenheit	(°F-32)*5/9	Centigrade	Centigrade	(°C*9/5)+32	Fahrenheit
Radioactivity			**Radioactivity**		
picocurie	37	millibecquerel	millibecquerel	0.027	picocurie

TABLE OF CONTENTS

1.0 INTRODUCTION 1-1
- 1.1 PURPOSE AND SCOPE 1-1
- 1.2 BACKGROUND 1-7

2.0 WELL CONSTRUCTION ACTIVITIES 2-1
- 2.1 WELL 299-E26-77 (C6455) 2-6
  - 2.1.1 Drilling and Sampling 2-6
  - 2.1.2 Well Completion 2-6
  - 2.1.3 Well Development 2-7
- 2.2 WELL 299-E26-79 (C6826) 2-7
  - 2.2.1 Drilling and Sampling 2-7
  - 2.2.2 Well Completion 2-7
  - 2.2.3 Well Development 2-8
- 2.3 WELL 299-E25-236 (C6542) 2-8
  - 2.3.1 Drilling and Sampling 2-8
  - 2.3.2 Well Completion 2-8
  - 2.3.3 Well Development 2-9
- 2.4 WELL 199-N-165 (C6693) 2-9
  - 2.4.1 Drilling and Sampling 2-9
  - 2.4.2 Well Completion 2-9
  - 2.4.3 Well Development 2-9

3.0 GEOLOGY OF THE 200 EAST AND 100-NR-2 AREAS 3-1
- 3.1 BOREHOLE GEOLOGY FOR THE LERF, WMA A-AX AND 100-NR-2 RCRA MONITORING WELLS 3-1
  - 3.1.1 Borehole 299-E26-77 (C6455) 3-1
  - 3.1.2 Borehole 299-E26-79 (C6826) 3-2
  - 3.1.3 Borehole 299-E25-236 (C6542) 3-2
  - 3.1.4 Borehole 199-N-165 (C6693) 3-3

4.0 CIVIL SURVEY 4-1

5.0 WASTE MANAGEMENT 5-1
- 5.1 VADOSE ZONE CUTTINGS 5-1
- 5.2 SATURATED ZONE CUTTINGS 5-1
- 5.3 PURGE WATER 5-1

6.0 WELL ACCEPTANCE 6-1

7.0 references 7-1

APPENDICES

A BOREHOLE LOGS/WELL SUMMARY REPORTS ..... A-i

B GEOPHYSICAL LOGGING ..... B-i

C WELL CONSTRUCTION REPORT ..... C-i

D WELL DEVELOPMENT DATA ..... D-i

E CIVIL SURVEY REPORTS ..... E-i

FIGURES

Figure 1-1. Location Map for the LERF RCRA Monitoring Wells 1-4

Figure 1-2. Location Map for A-AX Tank Farm RCRA Monitoring Well 1-5

Figure 1-3. Location Map for 100-NR-2 OU RCRA Monitoring Well 1-6

TABLES

Table 2-1. M-24 RCRA Wells Construction Summary 2-4

Table 2-2. M-24 RCRA Wells Development Summary. 2-5

Table 2-3. M-24 RCRA Wells Sample Summary 2-6

TERMS

bgs	below ground surface
bwt	below water table
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
DOE	U.S. Department of Energy
EPA	Environmental Protection Agency
FH	Fluor Hanford, Inc.
ft	feet
gpm	gallons per minute
ID	inside diameter
hp	horsepower
m	meter
in.	inches
NTU	Nephelometric Turbidity Unit
OD	outside diameter
OU	operable unit
PNNL	Pacific Northwest National Laboratory
psi	pounds per square inch
RCRA	*Resource Conservation and Recovery Act of 1976*
RL	U.S. Department of Energy, Richland Operations Office
RLM	Ringold Lower Mud
RUM	Ringold Upper Mud
TD	total depth
toc	top of casing
tom	top of protective monument
Tri-Party Agreement	*Hanford Federal Facility Agreement and Consent Order* (Ecology et al., 1989)
VFD	Variable Frequency Drive

METRIC CONVERSION CHART

Into Metric Units			Out of Metric Units		
If you know	*Multiply by*	*To get*	*If you know*	*Multiply by*	*To get*
Length			**Length**		
inches	25.40	millimeters	millimeters	0.0394	inches
inches	2.54	centimeters	centimeters	0.394	inches
feet	0.305	meters	meters	3.281	feet
yards	0.914	meters	meters	1.094	yards
miles (statute)	1.609	kilometers	kilometers	0.621	miles (statute)
Area			**Area**		
sq. inches	6.452	sq. centimeters	sq. centimeters	0.155	sq. inches
sq. feet	0.0929	sq. meters	sq. meters	10.764	sq. feet
sq. yards	0.836	sq. meters	sq. meters	1.196	sq. yards
sq. miles	2.591	sq. kilometers	sq. kilometers	0.386	sq. miles
acres	0.405	hectares	hectares	2.471	acres
Mass (weight)			**Mass (weight)**		
ounces (avoir)	28.349	grams	grams	0.0353	ounces (avoir)
pounds	0.454	kilograms	kilograms	2.205	pounds (avoir)
tons (short)	0.907	ton (metric)	ton (metric)	1.102	tons (short)
Volume			**Volume**		
teaspoons	5	milliliters	milliliters	0.034	ounces (U.S., liquid)
tablespoons	15	milliliters	liters	2.113	pints
ounces (U.S., liquid)	29.573	milliliters	liters	1.057	quarts (U.S., liquid)
cups	0.24	liters	liters	0.264	gallons (U.S., liquid)
pints	0.473	liters	cubic meters	35.315	cubic feet
quarts (U.S., liquid)	0.946	liters	cubic meters	1.308	cubic yards
gallons (U.S., liquid)	3.785	liters			
cubic feet	0.0283	cubic meters			
cubic yards	0.764	cubic meters			
Temperature			**Temperature**		
Fahrenheit	(°F-32)*5/9	Centigrade	Centigrade	(°C*9/5)+32	Fahrenheit
Radioactivity			**Radioactivity**		
picocurie	37	millibecquerel	millibecquerel	0.027	picocurie

1.0 INTRODUCTION

This report summarizes the activities performed for the installation of four new groundwater monitoring wells proposed in SGW-37848, Rev. 0, *Description of Work for Fiscal Year 2008, 100-NR-2 OU, Liquid Effluent Retention Facility, and WMA A-AX RCRA Monitoring Wells.* These wells were to be completed as part of Milestone M-24-61 by calendar year (CY) 2010. The drilling and construction of the four new wells was performed in compliance with the requirements of the *Resource Conservation and Recovery Act of 1976* (RCRA). Activities conducted at 299-E26-77 and 299-E26-79 were performed in agreement with the sampling and analysis plan (SAP) DOE/RL-2008-41, Rev. 0 *Sampling and Analysis Plan for the Liquid Effluent Retention Facility (LERF) Replacement RCRA Wells.* Activities conducted at 299-E25-236 were performed in agreement with PNNL-15315 *RCRA Assessment Plan for Single-Shell Tank Waste Management Area A-AX at the Hanford Site.* Activities conducted at 199-N-165 were performed in agreement with SGW-37847, Rev. 0, *Statement of Work for FY 2008, Installation of Groundwater Wells in the 100-NR-2 Operable Unit, Liquid Effluent Retention Facility (LERF) and WMA A-AX.* The SAP provides the detailed sampling design for characterizing the chemical and radioactive contamination and the physical conditions beneath the boreholes.

It should be noted that wells 299-E26-78 and 299-E26-79 at LERF were planned as contingency wells, dependent upon groundwater found at 299-E26-77. Well 299-E26-79 was chosen to be the second replacement well at LERF, and 299-E26-78 was deemed not necessary.

The locations of boreholes 299-E26-77 and 299-E26-79 are shown in Fig. 1-1. The location of borehole 299-E25-235 is shown in Fig. 1-2. The location for borehole 199-N-165 is shown in Fig. 1-3. Borehole 299-E26-77 was drilled to a total depth of 232.8 feet below ground surface (ft bgs). Borehole 299-E25-236 was drilled to a total depth of 329.3 ft bgs. Borehole 299-E26-79 was drilled to a total depth of 224.76 ft bgs. Borehole 199-N-165 was drilled to a total depth of 86.0 ft bgs. All four boreholes have been completed as groundwater monitoring wells and have had a permanent submersible sample pump installed within the screened interval.

Geology and construction documentation for each well is contained in Appendices A through D.

1.1 PURPOSE AND SCOPE

Wells 299-E26-77 and 299-E26-79 were installed to replace the existing groundwater monitoring wells at the Liquid Effluent Retention Facility (LERF), and to monitor the uppermost aquifer beneath and around LERF. Wells 299-E25-236 and 199-N-165 were installed to comply with RCRA regulations for groundwater monitoring at Waste Management Area (WMA) 241-A-AX tank farm and 100-NR-2 Operable Unit (OU), respectively, in order to monitor the groundwater contamination at these locations.

All wells were installed as groundwater monitoring wells in compliance with the requirements of *Resource Conservation and Recovery Act of 1976* (RCRA). These wells were to be completed as part of Milestone M-24-61 by calendar year (CY) 2010 (SGW-37848, *Description of Work for*

Fiscal Year 2008, 100-NR-2 OU, Liquid Effluent Retention Facility, and WMA A-AX RCRA Monitoring Wells).

The information presented includes geophysical logging graphs and summaries, well construction details, well development data and pump installation descriptions. Additional information described in the report includes the management of drilling-derived waste, civil survey results, well acceptance and subsurface geologic descriptions. All drilling data in this report are recorded in the English units in which they were originally measured in the field. Location data for the three wells is presented in Table 1-1.

Table 1-1. RCRA Wells Location Summary

Dept. of Ecology Unique ID	Well Name	Well ID	OU or WMA	Drilling Date		Northing[a] (m)	Easting[a] (m)	Ground Surface Elevation[b] (Brass Cap) (m)	Total Depth (ft bgs)
				Start	Finish				
BAT315	299-E26-77	C6455	LERF	8/12/08	9/5/08	137129.97	575579.03	183.998	232.8
ALC011	299-E26-79	C6826	LERF	9/9/08	10/2/08	137051.50	575827.88	182.354	224.76
ALF979	299-E25-236	C6542	A-AX Tank Farm	8/26/08	9/23/08	135965.34	575327.99	211.774	329.3
ALC012	199-N-165	C6693	100-NR-2	9/26/08	10/08/08	149155.16	571261.01	140.59	86.0

[a]Northing and easting coordinates are based on Washington State Plane Coordinates North American Datum of 1983 (NAD83[91]).
[b]North American Vertical Datum of 1988 (NAVD88) values rounded to 0.001 m.
bgs = below ground surface
N/A = not applicable
OU = operable unit
WMA = Waste Management Area

Figure 1-1. Location Map for the LERF RCRA Monitoring Wells

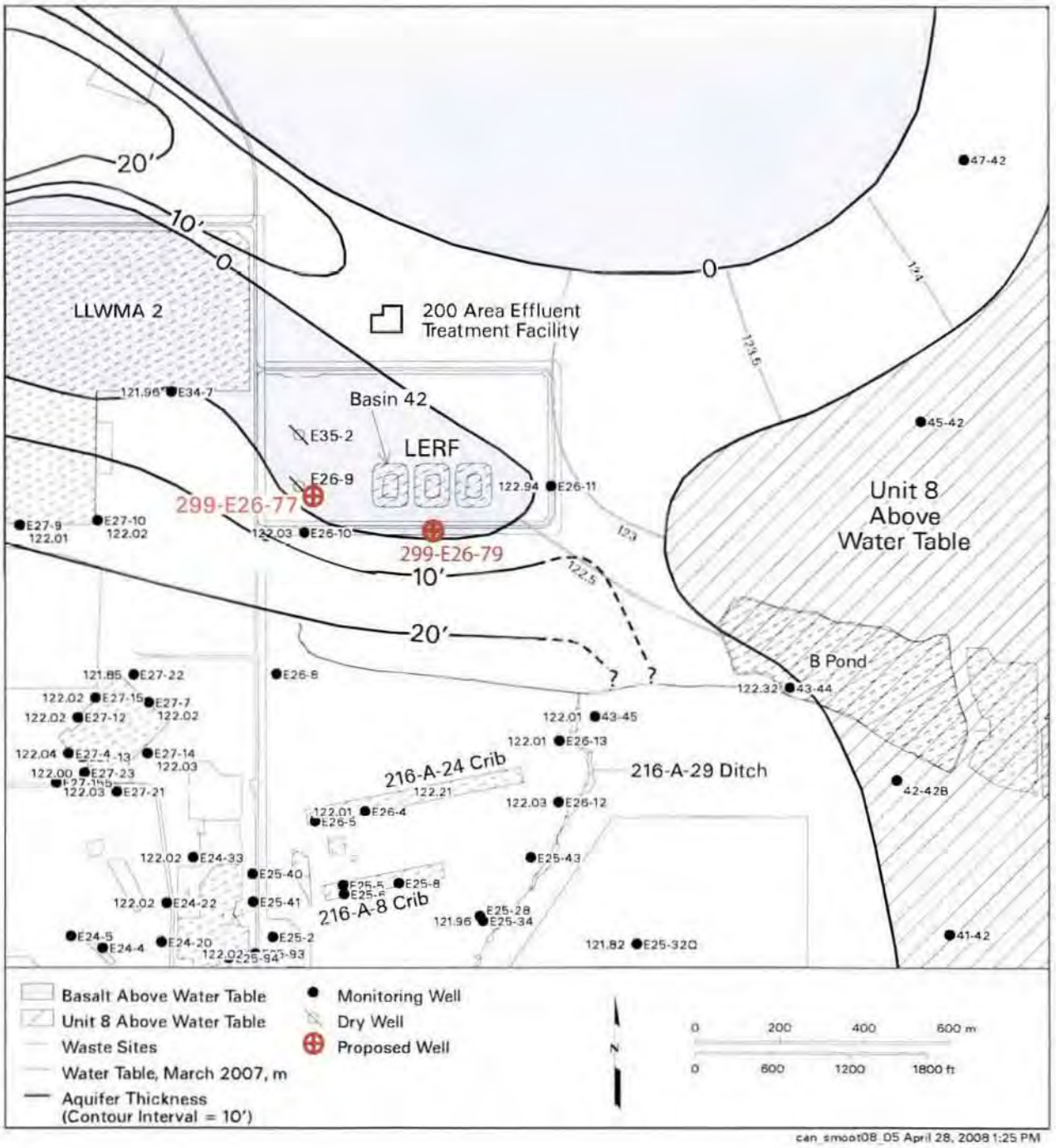


Figure 1-2. Location Map for A-AX Tank Farm RCRA Monitoring Well

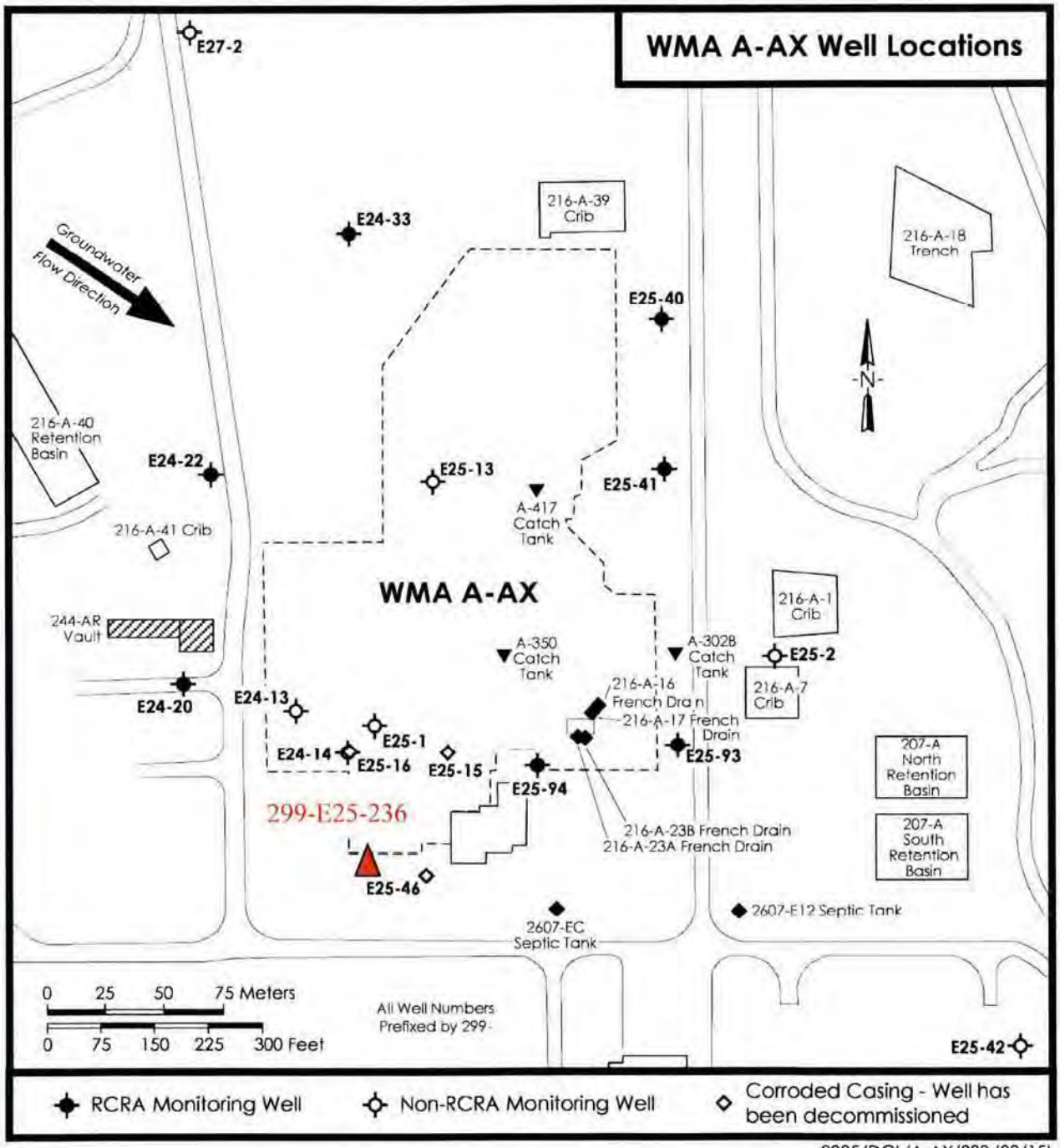
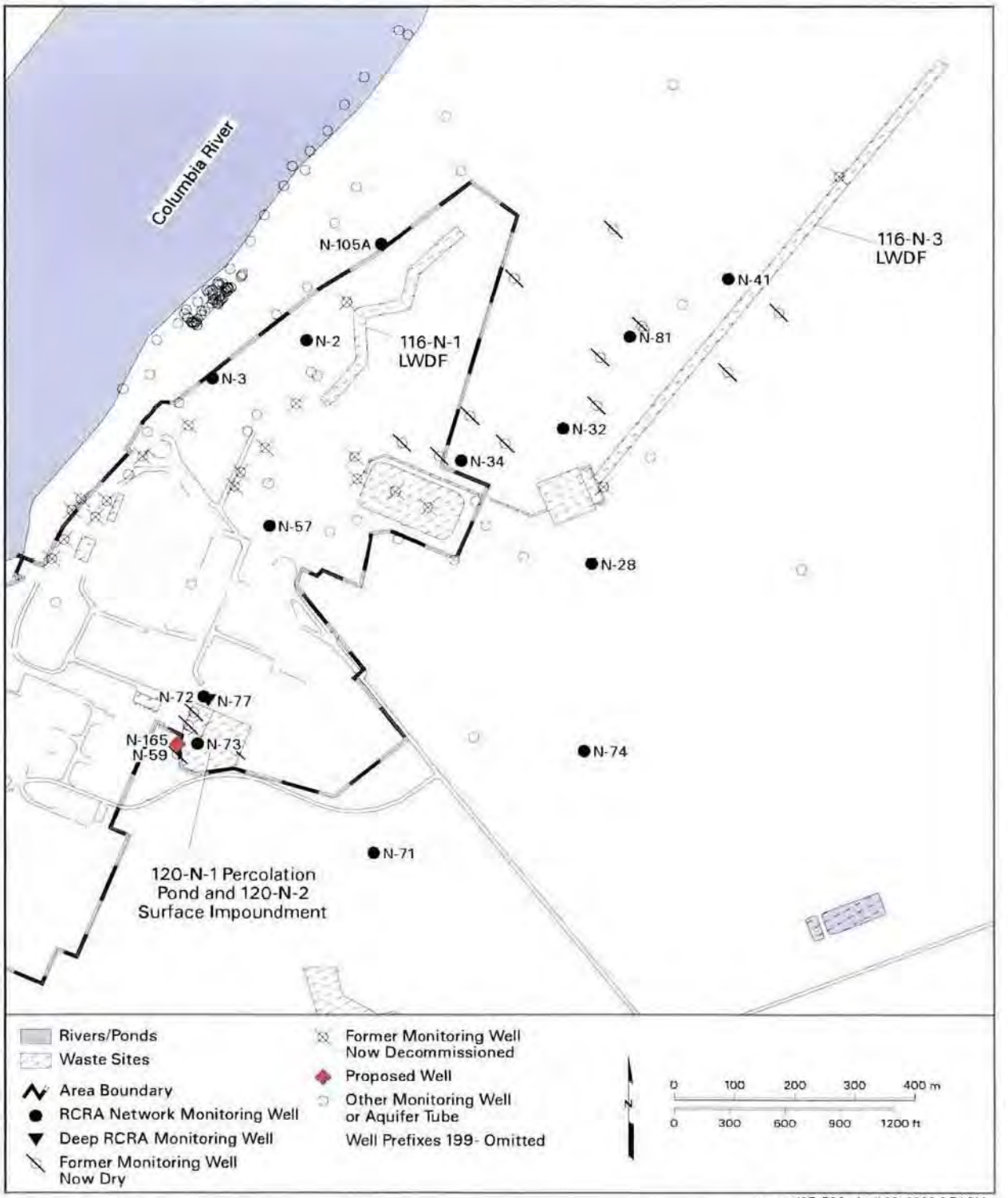


Figure 1-3. Location Map for 100-NR-2 OU RCRA Monitoring Well



1.2 BACKGROUND

The wells associated with this drilling project were intended to replace existing RCRA compliance wells and to supplement groundwater data within their respective OUs. Well 299-E25-236 is located near the A Tank Farm, south of 242-A Evaporator. Mixed waste from the Double-Shell Tank System is transferred to the 242-A Evaporator, where the waste is concentrated through an evaporation process, removing water and most volatile organics. Two waste streams leave the 242-A Evaporator following this process, one stream being pumped back into the Double-Shell Tank System and the second waste stream is routed through condensate filters before release to the Liquid Effluent Retention Facility (LERF) and eventual final treatment at the Effluent Treatment Facility (ETF). LERF is comprised of a group of surface impoundments surrounded by a fence, and located within the 200 East Area of Hanford. Wells 299-E26-77 and 299-E26-79 are located within the fence surrounding LERF, with well 299-E26-77 located to the west of the impoundments, and 299-E26-79 located immediately south. Mixed waste that has been reconsolidated at the 242-A Evaporator are stored within the impoundment basins until it can go through final treatment at ETF.

Well 199-N-165 is located in the immediate vicinity of the 100-N-58 South Pond, 120-N-2 Surface Impoundment and the 120-N-1 Percolation Pond, all within the 100-NR-1 OU. The three ponds associated with this well all received effluent from the 163-N Demineralization Plant and the backwash effluent from the 183-N Filtered Water Plant. In 1982 the 183-N effluent was rerouted to 130-N-1 and the 100-N-58 site was backfilled (WIDS, 2008).

All wells were installed as groundwater monitoring wells in compliance with the requirements of *Resource Conservation and Recovery Act of 1976* (RCRA). These wells were to be completed as part of Milestone M-24-61 by calendar year (CY) 2010 (SGW-37848, *Description of Work for Fiscal Year 2008, 100-NR-2 OU, Liquid Effluent Retention Facility, and WMA A-AX RCRA Monitoring Wells).*

This page left intentionally blank

2.0 WELL CONSTRUCTION ACTIVITIES

This section includes information associated with the drilling and construction of the newly installed well. Well-specific information is included in sections 2.1 to 2.4. Monitoring wells 299-E26-77 and 299-E26-79 were installed near the Liquid Effluent Retention Facility from August 2008 to September 2008. Monitoring well 299-E25-236 was installed near the A-AX tank farm from August 2008 to September 2008. Monitoring well 199-N-165 was installed in the 100-NR-2 OU from September 2008 to October 2008. All temporary casing was removed from the boreholes. Drilling, completion, logging and testing activities are summarized below. Borehole logs, well summary reports and well construction documentation for each well are located in Appendices A and D. Information common to all newly installed wells includes:

- **Drilling** – Well 299-E26-77 was drilled using a combination of cable tool and air rotary drilling techniques. The well was drilled using a Speedstar 72[1] cable tool drill rig to advance the temporary 9 5/8" outside diameter (OD) casing to a depth of 204.5 feet below ground surface (bgs). A Portadrill[2] Reverse Circulation drill rig was used to advance the borehole through the basalt from a depth of 204.5 ft bgs to 232.8 ft bgs. Well 299-E25-236 was drilled using cable tool drilling techniques. A Bucyrus-Erie 22-W[3] cable tool drill rig was used to advance the temporary 11 ¾" OD casing to a depth of 138.0 ft bgs, and the temporary 9 5/8" casing to a depth of 328.7 ft bgs. Total depth drilled for this well was 329.3 ft bgs. Well 299-E26-79 was also drilled using a combination of cable tool and air rotary. The well was initially drilled using a Speedstar 72 cable tool drill rig to advance the temporary 9 5/8" OD casing to a depth of 206.0 ft bgs. A Porter Drill air rotary drill rig was used to advance the borehole through the basalt from a depth of 206.0 ft bgs to 224.76 ft bgs. Well 199-N-165 was drilled using a cable tool drill rig. A Bucyrus-Erie 22-W cable tool rig was used to advance the temporary 9 5/8" OD casing to a depth of 86.84 ft bgs. Total depth drilled for this well was 86.0 ft bgs. Well drilling activities and borehole geology were logged in accordance with Fluor Hanford, Inc. (FH) procedures.

- **Sampling** – Grab samples of drill cuttings were collected at 5-ft intervals or at significant changes in lithology while in the vadose zone for geologic description and archive requirements. Grab samples were collected at 2-ft intervals or significant changes in lithology within the saturated zone. The samples were stored in pint-sized glass mason - jars and plastic chip trays for later delivery to the Pacific Northwest National Laboratory (PNNL) Geotechnical Sample Library located in the 300 Area. Pumped water samples were collected for analytical testing (volatile organic analytes, semi-volatile organic analytes etc.) from the two LERF wells. Sample depths and specifics for sampling performed at each well are provided in subsequent sections and are included in Table 2-3.

---

[1] Speedstar 72 is a copyrighted trademark of Newsom Industries, Newcastle CA

[2] Portadrill is a copyrighted trademark of Portadrill Corp., Denver, CO

[3] Bucyrus-Erie and 22-W are copyrighted trademarks of Bucyrus International, Inc., South Milwaukee, WI

- **Geophysical Logging** – Geophysical logging was performed by S.M. Stoller Corp. using a Spectral Gamma Logging system (SGLS). Geophysical logging was performed on all four boreholes prior to all well construction. See Appendix B for geophysical logs.

- **Construction** – Each monitoring well was constructed in accordance with Washington Administrative Code (WAC) 173-160 "*Minimum Standards for Construction and Maintenance of Wells*." All wells were constructed using 4-in. ID, type 304 L, schedule 10 stainless steel casing and continuous wire wrap 20 slot (0.020-in.) screens. See Tables 2-1, 2-2, and Appendix C for well construction details. Well construction activities were recorded in accordance with the applicable FH procedure.

- **Filter Pack and Annular Seal** – Boreholes drilled deeper than the completion depth were backfilled with Colorado Silica Sand prior to casing and screen placement. The filter pack surrounding the screen consists of 10-20 mesh Colorado Silica Sand. The annular seal consists of a 5 ft interval of 3/8-in. coated bentonite pellets at wells 299-E26-77 , 299-E26-79 and 199-N-165 directly above the sand pack and dry bentonite crumbles from the top of the coated pellets to approximately 10 ft bgs. The surface seal consists of Type I/ II Portland cement from the top of the bentonite crumbles to ground surface. To create the annular seal at well 299-E25-236, #8 bentonite crumbles were placed from 287.2 to 282.5 ft bgs, followed by Portland Type I/II cement grout from 282.5 to 269.0 ft bgs. This was capped by a coated bentonite seal from 269.0 to 269.3 ft bgs, as per the project manager.

- **Surface Completion** – The above ground stickup of the permanent casing is protected using a 6-in. ID stainless steel casing. The top of the 6-in. casing was set approximately 1 ft above the top of the permanent well casing. The 6-in. casing was then fitted with a 1 ft long cap with locking hasp. A 6-in. thick, 4 ft by 4 ft cement pad was placed around each well, with 4-in ID, 3.0 ft tall protective posts located at the corners of the cement pad.

- **Well Development** – Final well development for each well was performed in accordance with the applicable FH procedure. A 1/2-horsepower (hp) Grundfos Redi-Flo2[2] was used to develop well 299-E26-77. A 5-hp Franklin Electric[4] motor powering an 8-stage Franklin Electric 75S-50 submersible electric pump was used to develop the other wells (299-E26-79, 299-E25-236 and 199-N-165). Summaries of well development data can be found in sections 2.1.3, 2.2.3, 2.3.3 and 2.4.3. Final groundwater parameters are presented in Tables 2-2. Well development field logs and data plots are presented in Appendix D.

- **Permanent Pump Installation** – Permanent sampling pumps were installed in each of the wells and tested prior to full completion. A Grundfos Redi-Flo2 [5] submersible

---

[4] Franklin Electric is a copyrighted trademark of Franklin Electric Co., Inc., Bluffton, IN.

[5] Grundfos, Redi-Flo2 and Redi-Flo3 are copyrighted trademarks of Grundfos Pumps Corporation U.S.A., Olathe, KS.

electric pump was installed for use as a permanent sampling pump in well 299-E26-77. A Grundfos Redi-Flo3[2] was used for wells 299-E25-236 and 299-E26-79. Pump intake depths are included in Table 2-1.

- **Radiological Field Screening** – Radiological monitoring was performed twice daily (morning and afternoon) to verify that no radiological contamination was encountered during drilling. Radiological control technicians (RCTs) conducted surveys of drill cuttings, drilling tools, sampling equipment, PPE and sediment-storage drums using a Geiger-Muller and SPA-3[6] gamma radiation detectors. A Hanford site portable alpha meter (PAM) was also used to monitor drilling activities.

- **Air Monitoring for Volatile Organic Chemicals** – Air monitoring was performed twice daily (morning and afternoon) to verify that the breathing zone remained free of contamination. The breathing zone, drill cuttings and samples were screened for volatile organic analytes (VOA) using hand-held organic vapor meters with an11.8 electron volt (eV) lamp. No readings above background were detected within the breathing zone.

[6] SPA-3 is a trademark of Thermo Electron Corporation, Waltham, Massachusetts.

Table 2-1. M-24 RCRA Well Construction Summary

Well Name/ Well ID	Total Depth Drilled (ft bgs)	Static Water Level (ft bgs)	Permanent Stainless Steel Screen and Casing						Top of Protective Casing (in.)	Borehole Backfill (feet)	Sandpack Interval (feet)	Seal (ft bgs)	Grout Depth (ft bgs)	Permanent Pump/ intake Depth (ft bgs)
			Top of Screen (ft bgs)	Bottom of Screen (ft bgs)	Screen Length (ft)	Sump (ft)	Top of Casing (ft)	Casing Diameter (in.)						
299-E26-77 (C6455)	232.8	201.9	200.85	225.6	25	3	1.96	4	3.07	N/A	228.6-194.6	194.6-189.0	11.05 - 0	Grundfos Redi-Flo2 VFD/ 225.95
299-E26-79 (C6826)	224.76	201.7	195.2	220.2	25	3	2.3	4	3.1	N/A	223.2-187.8	187.8-183.0	10.3- 0	Grundfos Redi-Flo3 10 SQE-260 NE/ 218.15
299-E25-236 (C6542)	329.3	294.5	290.0	325.0	30	3	2.26	4	3.00	329.3-328.9	328.9-287.2	282.5-269.0	8.1- 0	Grundfos Redi-Flo3 10 SQE-260 NE/ 324.34
199-N-165 (C6693)	86.0	71.3	67.89	82.89	15	3	2.09	4	2.93	N/A	85.9-63.15	63.15-61.9	9.15- 0	Grundfos Redi-Flo3 10 SQE-100 NE/ 82.02

Notes:
bgs = below ground surface
ft = feet
VFD = variable frequency drive

Table 2-2. M-24 RCRA Well Development Summary.

Well Name/ Well ID	Water Level (ft bgs)	Date	Intake Depth (ft bgs)	Pumping Duration (minutes)	Final Turbidity (NTU)	Final Conductivity (µS/cm)	Final Temp (°C)	Final Flow Rate (gpm)	Final Drawdown (ft)	Total Gallons Pumped
299-E26-77 (C6455)	203.73	8/27/08	223.3	11/59	4.72	1020	19.7	3.5/5.8	3.45	380.7
299-E26-79 (C6826)	199.4	10/02/08	216	42	2.67	638	19.4	8.0	6.892	336
299-E25-236 (C6542)	294.31	9/24/08	L 315.2 U 298.9	L 79 U 26	L 0.50 U 0.57	L 475 U 467	L 20.7 U 19.5	L 33.3 U 33.3	L 0.03 U 0.05	L 2630.7 U 865.8
199-N-165 (C6693)	72.12	10/09/08	77.45	116	3.42	1045	19.4	13.6/9.38	N/A	1104.96

Notes:
L = lower
U = upper
bgs = below ground surface
bwt = below water table
ft = feet
gpm = gallons per minute
NTU = Nephelometric Turbidity Unit
µS/cm = micro Siemens per centimeter

Table 2-3. M-24 RCRA Well Sample Summary

Well Number/Well ID	Dates	Sample Depth (ft bgs)	Sample Interval (ft bgs)	Sample Method	HEIS #
299-E26-77/C6455	8/29/2008	233	231-233	purge and bail	B1WPT4, B1WPT5
299-E26-79/C6826	9/23/08	206	204-206	purge and bail	B1WPV3. B1WPV4, B1WPV5
299-E26-79/C6826	9/24/08	224.2	222-224.2	purge and bail	B1WPV6
299-E25-236/C6542	9/08/08	272.1	269.6-272.1	Split spoon	B1WPB2(AS), B1WPB6
299-E25-236/C6542	9/08/08	275.4	272.1-275.4	Split spoon	B1WPB3(AS), B1WPB7
299-E25-236/C6542	9/09/08	277.5	275.0-277.5	Split spoon	BW1PB4(AS), B1WPB8
299-E26-236/C6542	9/09/08	280.5	278.0-280.5	Split spoon	B1WPB5(AS), B1WPB9

2.1 WELL 299-E26-77 (C6455)

Well 299-E26-77 is located west of the LERF ponds, within the fence, in the 200 East Area. Well construction documentation is presented in Appendix C.

2.1.1 Drilling and Sampling

Drilling of well 299-E26-77 was initiated on August 12, 2008 and reached a total depth of 232.8 ft bgs on August 26, 2008.

Groundwater was encountered at approximately 208 ft bgs on August 8, 2006. One set of water samples was collected using a stainless steel bailer and 1-liter plastic bottles, from approximately 20 ft below water table (bwt).

2.1.2 Well Completion

The stainless steel screen was placed from 225.6 ft bgs to 200.85 ft bgs with a 3.0 ft sump placed from 228.6 to 225.6 ft bgs. The permanent casing was placed from 200.85 ft bgs to 1.96 ft above ground surface (ags). 10-20 mesh Colorado silica sand was placed from 232.8 ft bgs to 194.6 ft bgs. A seal of 3/8-in. coated bentonite pellets was placed from 194.6 to 189.0 ft bgs, with #8 granular bentonite placed above the seal from 189.0 to 11.05 ft bgs. A surface seal consisting of type I/II Portland cement grout was placed from 11.05 ft bgs to ground surface. A 6-in. ID

stainless steel protective monument was placed to 3.07 ft ags. A summary of well completion for well 299-E26-77 is given in Table 2-1.

2.1.3 Well Development

Final well development for 299-E26-77 was performed in accordance with FH procedures on September 25, 2008. The permanent sampling pump, a 1/2-hp Grundfos Redi-Flo2 Variable Frequency Drive (VFD) submersible pump was used to develop the well in one interval until turbidity had reached a level equal to or less than 5 NTU and other water parameters had stabilized, as per permission from the project manager. Water level drawdown during development was monitored manually using an electronic water meter, with the intake located at a depth of 223.3 ft bgs. Flow rate was initiated at 3.5 gallons per minute (gpm) for a total of 11 minutes, and increased to a rate of 5.8 gpm for a total of 59 minutes. Overall 380.7 gallons was pumped from the borehole for the duration of the test. Drawdown observed ranged from 2.9 to 3.5 ft at a rate of 5.8 gpm. A Grundfos Redi-Flo2 VFD was installed as a permanent submersible sampling pump with the intake set at 225.95 ft bgs (24.05 ft bwt). Well development data, including final parameters, are summarized in Table 2-2 and in Appendix D.

2.2 WELL 299-E26-79 (C6826)

Well 299-E26-79 is located immediately south of the LERF ponds, inside the fence in the 200 East Area. Well construction documentation is presented in Appendix C.

2.2.1 Drilling and Sampling

Drilling of well 299-E26-79 was initiated on September 9, 2008 and reached a total depth of 224.76 ft bgs on September 23, 2008.

Groundwater was encountered at 201.7 ft bgs on September 22, 2008. Bailed water samples were collected at 4 ft bwt and 22 ft bwt.

2.2.2 Well Completion

The stainless steel screen was placed from 220.2 to 195.2 ft bgs with a 3.0 ft sump from 223.2 to 220.2 ft bgs. The permanent casing was placed from 195.2 ft bgs to 2.3 ft ags. 10-20 mesh Colorado silica sand was placed from 224.76 ft bgs to 187.8 ft bgs. A seal of 3/8-in. coated bentonite pellets was placed from 187.8 ft bgs to 183.0 ft bgs, with #8 granular bentonite placed from 183.0 to 10.3 ft bgs. A surface seal consisting of type I/II Portland cement grout was placed from 10.3 ft bgs to ground surface. The 6-in. ID protective monument was placed to 3.05 ft ags. A summary of well completion for well 299-E26-79 is given in table 2-1.

2.2.3 Well Development

Final Well development for 299-E26-79 was performed in accordance with FH procedures on October 2, 2008. A 5-hp 75S-50 submersible pump was used to develop the well in one interval until turbidity had reached a level less than 5 NTU and other water parameters had stabilized. Water level drawdown during development was monitored continuously using a 20 psi pressure transducer and was recorded with an In-Situ Hermit 3000 datalogger. The development stage was conducted with the pump intake at a depth of 216.0 ft bgs. Flow rate was continuous at 8.0 gallons per minute (gpm), and a total of 336 gallons was pumped over a period of 42 minutes. Drawdown observed ranged from 0.84 to 1.59 ft. A Grundfos Redi-Flo3 10SQE-260 NE was installed as a permanent submersible pump with the intake set at 218.15 ft bgs (16.45 ft bwt). Well development data, including final parameters, are summarized in Table 2-2 and in Appendix D.

2.3 WELL 299-E25-236 (C6542)

Well 299-E25-236 is located approximately 50 meters west of the 242-A Evaporator, in the 200 East Area. Well construction documentation is presented in Appendix C.

2.3.1 Drilling and Sampling

Drilling of well 299-E25-236 was initiated on August 26, 2008 and reached a total depth of 329.3 ft bgs on September 11, 2008.

Groundwater was encountered at 294.4 ft bgs on September 9, 2008. No water samples were collected at this location as per the SOW.

Split-spoon soil samples were collected at 4 continuous locations from 269.6 ft bgs to 280.5 ft bgs.

2.3.2 Well Completion

The stainless steel screen was placed from 325.0 to 290.0 ft bgs with a 3 ft. long sump placed from 325.0 to 328.0 ft bgs. The permanent casing was placed from 290.0 ft bgs to 2.26 ft ags. 10-20 mesh Colorado silica sand was placed from 328.9 to 287.2 ft bgs. #8 bentonite crumbles were added to the borehole from 287.2 to 282.5 ft bgs, with a cement seal of type I/II Portland cement grout from 282.5 to 269.0 ft bgs. Coated 3/8-in. bentonite pellets were placed from 269.0 to 263.9 ft bgs. A mixture of bentonite crumbles and pellets were then placed from 263.9 to 8.1 ft bgs, followed by a surface seal of type I/II Portland cement grout from 8.1 ft bgs to ground surface. The 6-in. ID protective casing was placed to 3.0 ft ags. A summary of well completion for well 299-E25-236 is given in Table 2-1.

2.3.3 Well Development

Final Well development for 299-E25-236 was performed in accordance with FH procedures on September 24, 2008. A 5-hp Franklin Electric submersible pump was used to develop the well in two separate intervals until turbidity had reached a level less than 5 NTU and other water parameters had stabilized. Water level drawdown during development was monitored continuously using a 20 psi pressure transducer and was recorded with an In-Situ Hermit 3000 datalogger. The first development stage was conducted with the pump intake at a depth of 315.2 ft bgs. Flow rate was measured at approximately 33.3 gallons per minute (gpm), and a total of 2630.7 gallons was pumped over a period of 79 minutes. Drawdown observed was consistent at 0.03 ft. The second development test was operated from an intake depth of 298.9 ft bgs. Flow rate was continuous at 33.3 gpm, with a total of 865.8 gallons being pumped over a period of 26 minutes. Drawdown observed was consistent at 0.05 ft. A Grundfos Redi-Flo3 10SQE-340 NE was placed with the intake at 324.34 ft bgs (29.84 ft bwt). Well development data, including final parameters, are summarized in Table 2-2 and in Appendix D.

2.4 WELL 199-N-165 (C6693)

Well 199-N-165 is located in the 100-NR-2 Operable Unit. Well construction documentation is presented in Appendix C.

2.4.1 Drilling and Sampling

Drilling of well 199-N-165 was initiated on September 26, 2008 and reached a total depth of 86.0 ft bgs on October 3, 2008.

Groundwater was encountered at 71.3 ft bgs on October 3, 2008. No water samples were collected at this location as per the SOW.

2.4.2 Well Completion

The stainless steel screen was placed from 82.89 to 67.89 ft bgs with a 3 ft. long sump placed from 85.9 to 82.89 ft bgs. The permanent casing was placed from 67.89 to 2.09 ft ags. 10-20 mesh silica sand was placed from 85.9 to 63.15 ft bgs. Coated 3/8-in. bentonite pellets were placed from 63.15 to 61.9 ft bgs, with #8 bentonite crumbles placed from 61.9 to 9.15 ft bgs. A surface seal consisting of type I/II Portland cement grout was placed from 9.15 to ground surface. The 6-in. protective casing was placed to 3.0 ft ags. A summary of well completion for well 199-N-165 is given in Table 2-1.

2.4.3 Well Development

Final Well development for 199-N-165 was performed in accordance with FH procedures on October 9, 2008. A 5-hp Franklin Electric submersible pump was used to develop the well at one interval until turbidity had reached a level less than 5 NTU and other water parameters had

stabilized. Water level drawdown during development was intended to be monitored continuously using a 20 psi pressure transducer and was recorded with an In-Situ Hermit 3000 datalogger, but were not able to be taken as the water level dropped below the transducer, and an electronic water tape was not able to pass below the top of the pump. Water level stabilized above the intake of the sampling pump as pumping was continuous for the duration of well development. Development was conducted with the pump intake at a depth of 77.45 ft bgs. Flow rate was measured at approximately 13.6 and 9.38 gallons per minute (gpm), and a total of 1104.96 gallons was pumped over a period of 116 minutes. A Grundfos Redi-Flo3 10SQE-100 NE was placed with the intake at 82.02 ft bgs (10.72 ft bwt). Well development data, including final parameters, are summarized in Table 2-2 and in Appendix D.

3.0 GEOLOGY OF THE 200 EAST AND 100-NR-2 AREAS

The major stratigraphic units underlying the 200 Areas include the Hanford formation, Ringold Formation and Columbia River Basalt Group. A thin veneer of recent eolian sand deposits overlies the Hanford formation in most undisturbed locations. The regional geologic setting of the Pasco Basin and the Hanford Site has been described in numerous publications (e.g., PNNL-12261, *Revised Hydrogeology for the Suprabasalt Aquifer System, 200 East Area and Vicinity, Hanford Site, Washington;* PNNL-13858, *Revised Hydrogeology for the Suprabasalt Aquifer System, 200 West Area and Vicinity, Hanford Site, Washington;* WHC-SD-EN-EV-027, *Hydrogeology of the 100-N Area, Hanford Site, Washington*) and will not be detailed here. A summary of the geology of each of the specific areas is presented in the sections below. Geologic logs were prepared in accordance with FH procedures and are included in Appendix A.

3.1 BOREHOLE GEOLOGY FOR THE LERF, WMA A-AX AND 100-NR-2 RCRA MONITORING WELLS

This section describes the general lithology observed during the drilling of wells 299-E26-77, 299-E26-79, 299-E25-236 and 199-N-165. In general, the primary geologic units encountered during drilling of the two LERF wells 299-E26-77 and 299-E26-79 were Hanford formation and the Elephant Mountain Member of the Columbia River Basalt Group. The primary geologic unit encountered during the drilling of well 299-E25-236 was the Hanford formation. The primary geologic units encountered during drilling of the 199-N-165 well were the Hanford formation and the Ringold Formation.

3.1.1 Borehole 299-E26-77 (C6455)

Sediments encountered during the drilling of well 299-E26-77 consisted of Hanford formation gravels overlying the Elephant Mountain member of the Columbia River basalt Group.

The gravel drill pad was observed from 0 to 0.5 ft bgs. Recently deposited gravelly silts were encountered from 0.5 to 5 ft bgs. Silty gravel was encountered from 5 to 34 ft bgs, consisting of mostly felsic gravels, up to 6-in. in diameter. This layer showed a strong reaction to dilute hydrochloric acid (HCl). A layer of gravelly silty sand was encountered from 34-38 ft bgs; this layer consisted mostly of medium sized felsic sand grains, and a moderate to strong reaction to HCl was observed. A layer of silty sandy gravel was encountered from 38 to 43 ft bgs, consisting of pebble sized gravels of "50/50" mafic/felsic composition, sands encountered were predominantly felsic and classified as medium grains. A slight reaction to HCl was also observed. Gravelly sands and silty sands were identified from 43 to 52 ft bgs. Sands were medium to coarse grained and predominantly felsic in composition; with gravels up to 2-in. in diameter, also of a felsic composition. A moderate to strong reaction to HCl was noted at this depth. Gravels with varying amounts of silt and sand were encountered from 52 to 203 ft bgs. Gravels were predominantly mafic, ranging in size from pebbles to boulders. Sands were predominantly felsic and classified as fine to coarse grained. Only a slight reaction to HCl was seen at these depths. The change in lithology and reaction to HCl suggests this layer consists of re-worked Ringold Formation gravels.

3.1.2 Borehole 299-E26-79 (C6826)

Sediments encountered during the drilling of well 299-E26-79 consisted of Hanford formation overlying the Elephant Mountain Member of the Columbia River Basalt Group.

The gravel backfill is present from 0 to 1.0 ft bgs. Underlying the gravel drilling pad is the Hanford formation, extending to a depth of 207 ft bgs. Sandy silty gravel was encountered from 1.0 to 27 ft bgs; consisting of poorly sorted and unconsolidated fine to medium felsic dominated sands and mafic dominated pebbles and cobbles, exhibiting a grayish-brown (10YR 5/2) color. A strong reaction to dilute hydrochloric acid (HCl) was observed at this depth. This was followed by two thin layers of sandy silt and silty gravel. Sandy silt was encountered from 29 to 32 ft bgs; consisting of fine to coarse felsic dominated sand grains, yellowish-brown (10YR 5/6) in color. A layer of silty sand was encountered from 32 to 54 ft bgs; consisting of fine to coarse grained predominantly felsic sands, with some small gravels. Color was noted as grayish-brown (10 YR 5/2) with a slight reaction to HCl increasing to a moderate reaction below 39 ft bgs. A combination of silty sandy gravel and sandy silty gravel was encountered from 54 to 135 ft bgs. Silt and sand levels changed throughout the course of this layer, but gravels remained consistent at approximately 60%. Layers at these depths consisted of predominantly mafic cobbles with fine to medium felsic sands and was grayish-brown (10YR 5/2) in color, with slight reactions to HCl throughout. A gravel layer consisting of large mafic cobbles was encountered from 135 to 152 ft bgs. A small amount of sand and silt was also observed within this gravel layer, as well as a slight reaction to HCl. A thick layer of silty sandy gravel was encountered from 152 to 200 ft bgs. This layer consisted of mostly mafic cobbles and a small portion of felsic sand, moderately cemented together, however no reaction to HCl was noted. Color was observed to be grayish-brown (10YR 5/2). Silt content dropped off completely from 200 to 206 ft bgs. A layer of sandy gravel was observed to 203 ft bgs, consisting mainly of mafic gravel and felsic sand. At 203 ft bgs, sand became more predominant, classifying this lower section a gravelly sand. Both layers were observed to be wet, with a brown color (10YR 4/3). A highly modified clay layer, was encountered from 206 to 207 ft bgs. This clay layer consisted of a dark reddish brown (2.5YR 3/3) silt, with sporadic spots of white and/or yellow. Some rock inclusions were also noted. There was no reaction to HCl and the clay was noted as being brittle rather than plastic. At 207 ft bgs basalt was encountered. A thin layer of top flow basalt was observed, as noted by the weathering rind and vesicles present in the drill cuttings. Basalt was encountered from 207 to the total depth of 224.2 ft bgs.

3.1.3 Borehole 299-E25-236 (C6542)

Sediments encountered during the drilling of well 299-E25-236 consisted entirely of Hanford formation sediments.

A gravel drill pad overlies the formation at this location to a depth of 0.5 ft bgs. The Hanford formation underlies the drill pad to the total depth of 329.3 ft bgs, consisting of sand, silty sand and gravelly sand. A silty sand was encountered from 0.5 to 7.5 ft bgs, consisting of very fine to fine grained sand grains, followed by a decrease in silt percentage to form a sand layer from 7.5 to 8.0 ft bgs. A gravelly sand was encountered from 8 to 15 ft bgs consisting of very fine to fine felsic sand grains as well as a range of felsic pebbles/cobbles. This was followed by a drop in

gravel percentage and an increase in silt percentages from 15 to 17 ft bgs, however the gravels returned from 17 to 19 ft bgs. A sand layer was encountered from 19 to 40 ft bgs consisting of medium to coarse sand grains, predominantly felsic, with some small pebbles and silt making up less than 10% of the layer. A moderate reaction to HCl was also noted at this depth. An increase in gravel at 40 ft bgs was classified as a gravelly sand from 40 to 59 ft bgs. This layer was dominated by coarse to very coarse felsic sand grains with a small inclusion of pebbles. A silt layer was observed from 51.5 to 52 ft bgs. A moderate reaction to HCl was noted within the silt layer as well. Gravel percentages dropped to zero by 59 ft bgs, leaving a slightly silty to silty sand from 59 to 80 ft bgs. Sand was medium to coarse grained and predominantly felsic with some slight cementation, with a moderate to strong reaction to HCl. Overall color was considered brown (10YR 4/3). Some small interbeds of silt were also noted throughout the layer. Sand was encountered from 80 to 84 ft bgs, predominantly felsic, and medium to coarse grained with no reaction to HCl. This was followed by gravelly sand from 84 to 85 ft bgs, with a return to sand from 85 to 99 ft bgs. Alternating layers of sand and gravelly sand were encountered from 99 to 124 ft bgs. Sands were predominantly felsic, medium to very coarse grained in size, with small pebbles included in the formation. Some silt layers were also encountered, as were some layers of cementation. Layers of cementation showed an increase in reaction to HCl. A thick layer of sand was encountered from 124 to 245 ft bgs. Sand grains were predominantly felsic, poorly sorted, and ranged in size from very fine to coarse. Slight silt increases were noted throughout this layer, with slight cementation occurring at several intervals as well; indicated by an increased reaction with HCl. Gravelly sand was encountered from 245 to 249 ft bgs, with sand grains graded from very fine to coarse and mostly felsic. Gravels encountered in this layer ranged from small pebbles to small cobbles and were predominantly mafic in content. Sand was encountered at 249 ft bgs and extended to a depth of 277 ft bgs. An increase in silt percentage, although very slight, was noted at 267 ft bgs. At 277 ft bgs a silt layer was observed extending to a depth of 281.5 ft bgs. Silt was noted as being light brown to gray, with a slight reaction to HCl. Visible bedding was observed in both the split-spoon sample taken at this depth and in the drive barrel spoils. Sand was encountered from 281.5 to 284.0 ft bgs, with a noticeable increase in gravels from 282.5 to 284.0 ft bgs. Sand ranged in size from fine to coarse grained and was predominantly felsic in composition. Gravel sediments observed from 282.5 to 284.0 ft bgs ranged in size from fine pebbles to small cobbles and exhibited a slight to non-reaction with HCl at this depth. Sandy gravel was encountered from 284.0 to 318.0 ft bgs consisting of fine pebbles to large cobbles that were predominantly mafic in composition. Sands ranged from coarse to very coarse grained, and no reaction to HCl was noted at this depth. Silts increased at 318.0 ft bgs, denoting a silty sandy gravel from 318.0 to 328.0 ft bgs. Gravels at this depth were predominantly mafic in composition, and ranged in size from small pebbles to small cobbles. Sands ranged from medium to very coarse grained, and were mainly felsic in composition. Some consolidation was also observed at this depth. Sediments exhibited no reaction to HCl. Gravelly sand was encountered from 328.0 ft bgs to the total depth of 329.3 ft bgs. Sediments consisted of very fine to coarse grained materials, with gravel clasts ranging in size from very fine to very coarse pebbles. Slight consolidation was also observed at this depth.

3.1.4 Borehole 199-N-165 (C6693)

Sediments encountered during the drilling of borehole 199-N-165 consisted of Hanford formation overlying Ringold Formation deposits.

Non-native fill was encountered from 0 to 1.5 ft bgs. Underlying this fill material was a layer of gravelly sand from 1.5 to 6.0 ft bgs, consisting of very fine to medium grained sand and a small percentage of medium pebbles to small cobbles. Silty gravel was encountered from 6.0 to 14.0 ft bgs, with mostly mafic clasts ranging in size from small pebbles to large cobbles. Sediments were semi-consolidated and showed a slight to moderate reaction to HCl. Sandy gravel was encountered from 14.0 to 34.0 ft bgs, consisting of predominantly mafic pebbles to cobbles, and very fine to very coarse grained sand. This sandy gravel layer exhibited a slight reaction to HCl and was observed to be poorly consolidated. From 34.0 to 37.0 ft bgs a gravelly sand was encountered, consisting of medium to very coarse sand grains and a smaller percentage of pebbles to cobbles. The gravelly sand layer was very poorly consolidated and showed a moderate reaction to HCl. Sandy gravel was noted from 37.0 to 57.5 ft bgs, consisting of predominantly mafic pebble to cobble sized clasts, and fine to coarse grained felsic sand. No reaction to HCl was noted at this depth. Underlying this sandy gravel was a layer of sand from 57.5 to 60 ft bgs. Sands at this depth were mostly fine to medium grained in size, with some consolidation, although exhibited no reaction to HCl. Sandy gravel was noted from 60 to 65.0 ft bgs, consisting of felsic pebble to cobble sized clasts. Sand grains were noted as being mostly very fine to medium in size. Little consolidation was noted at this depth, and a very slight reaction to HCl was observed within the sediments. Gravelly silty sands were encountered from 65.0 to 74.0 ft bgs. Sands consisted of very fine to medium grains, with some very fine to coarse pebbles present. Slight amounts of consolidation were present at this depth. A moderate reaction to HCl was noted, as well as possible caliche staining on sediments encountered at 65.0 ft bgs. Sediments were noted as being saturated at 72.0 ft bgs. Sandy gravel was encountered from 74.0 to 83.5 ft bgs consisting of fine pebbles to small cobbles of mafic composition. Sand grains encountered at this depth were noted as being very fine to very coarse. Some consolidation was also noted, with no distinct reaction to HCl. Sediments were observed to be predominantly mafic at this depth. Silty gravel was encountered from 83.5 to the total depth of 86.0 ft bgs. Gravel was mostly fine pebbles to large cobbles, with an almost equal amount of silt at this depth. Silts were observed as matrixes within the gravels and showed a moderate to very strong reaction to HCl.

4.0 CIVIL SURVEY

The boreholes were surveyed in accordance with applicable CHPRC procedures. Vertical survey data were recorded using *North American Vertical Datum of 1988* (NAVD88) and the horizontal coordinates were recorded using the Washington State Plane (South Zone) *North American Datum of 1983* (NAD83), with the 1991 adjustment for horizontal coordinates. Surveyed locations of the boreholes are presented in Table 1-1 and Appendix E.

This page left intentionally blank.

5.0 WASTE MANAGEMENT

Wastes generated during the drilling and well completion activities (i.e. drill cuttings, purge water, decontamination waste, miscellaneous waste) were managed according to site-specific waste management plans. The site-specific plans followed during the drilling and well completion activities associated with this report are listed below. A brief description of the handling of vadose zone cuttings, saturated zone cuttings and purgewater are included in sections 5.1 through 5.3.

Wells 299-E26-77, 299-E26-79 and 299-E25-236

- *Data Quality Objective Summary Report for the Disposition of Waste from Drilling RCRA Monitoring Wells 299-E26-77 and 299-E26-78 at the Liquid Effluent Retention Facility (LERF) and 299-E25-236 at the A-AX Waste Management Area, FY2008* (SGW-37908, Rev. 0)

Well 199-N-165

- *Data Quality Objective Summary Report for the Disposition of Waste from the Drilling of Well 199-N-165 (C6693) in the 100-NR-2 Operable Unit, FY2008* (SGW-37907, Rev. 0)

5.1 VADOSE ZONE CUTTINGS

Drill cuttings (i.e. soils) from above the water table were stockpiled on plastic near the borehole, throughout the drilling of the groundwater monitoring wells included in this report; no radiological contamination or chemical vapor was detected that would impede the spoils to be returned to the environment (RTE). Therefore, drill cuttings were spread on the ground in the near proximity of the borehole.

5.2 SATURATED ZONE CUTTINGS

Drill cuttings were containerized in 55-gal drums beginning approximately 20 ft above the anticipated depth to groundwater and continued through to TD. Free liquids from the containerized saturated cuttings were decanted using a sump-pump connected to a purge water truck and managed as purgewater (see below). Drummed saturated zone cuttings from each well were transported to the Environmental Restoration Disposal Facility (ERDF) for disposal, providing they met ERDF disposal criteria.

5.3 PURGEWATER

Purgewater was generated during the drilling below the water table and during the well construction activities. All purge water was contained on site in a purgewater truck and was transported to the modu-tanks at the Purge water Storage and Treatment Facility (PSTF). The modu-tanks are evaporative storage/treatment units. Specific waste storage, handling and transport requirements were documented in the Waste Packaging/Labeling Instruction Sheet (Izzatt, 1990).

This page left intentionally blank.

6.0 WELL ACCEPTANCE

Well acceptance is the final step in the well construction process and represents confirmation of the completion of work scope requirements, as well as the contractual completion of the finished product.

The acceptance process involves representatives from the drilling contractor, the buyer and the buyer's sub-contractors. Representatives from Blue Star Enterprises Northwest, GRAM, Inc. and Soil and Groundwater Remediation Project conducted an inspection of the wellhead and drill site, as well as a review of the well drilling and completion documentation.

Final well acceptance is documented by completion of a checklist and signatures from representatives of the drilling contractor and the Buyer. Final well acceptance was completed for all four wells on October 20, 2008.

Surveillance QA-EQA-SGRP-SURV-09-008 was issued documenting the acceptance of these four monitoring wells. Punch list items noted during the well acceptance inspection were successfully worked off. The surveillance was satisfactory.

This page intentionally left blank

7.0 REFERENCES

Groundwater Protection Program Procedures:

GRP-EE-01-1.6, "Survey Requirements and Techniques"

GRP-EE-05-1.21, "Particle Size Distribution of Soil-Wet Sieve Analysis"

GRP-EE-01-7.0, "Geologic Logging"

GRP-EE-02-14.1, "Drilling, Remediation, and Decommissioning Resource Protection Wells, and Geotechnical Soil Borings"

Waste Information Data System (WIDS), accessed 2008:

"100-N-58, South Pond, 120-N South Settling Pond, 1324-N South Settling Pond"

"120-N-1, 1324-NA Percolation Pond"

"120-N-2, 1324-N Surface Impoundment"

"200-E-17, 200 Area Liquid Effluent Treatment Facility (LERF), LERF Basins"

"200 ETF, 200 Area Effluent Treatment Facility (ETF), 2025-E

"241-A-A, 214-A-A Diversion Box, 241-A-A Structural Pit Valve"

"242-A, 242-A Evaporator"

90-ERB-040, 1990, "Strategy for Handling and Disposing of Purgewater at the Hanford Site, Washington," (letter to P.T. Day, U.S. Environmental Protection Agency, and T.L. Nord, Washington State Department of Ecology, from R.D. Izzatt), U.S. Department of Energy, Richland Operations Office, Richland, Washington, July 19.

Comprehensive Environmental Response, Compensation and Liability Act of 1980, 42 USC 9601, et seq.

DOE/RL-2008-41, 2008, *Sampling and Analysis Plan for the Liquid Effluent Retention Facility (LERF) Replacement RCRA Wells*, Rev.0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

Ecology, EPA and DOE, 1989, *Hanford Federal Facility Agreement and Consent Order (Tri-Party Agreement), 2 vols., as amended*, Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Olympia, Washington.

NAD83, 1991, *North American Datum of 1983, National Geodetic Survey, Federal Geodetic Control Committee*, Silver Springs, Maryland, as revised.

NAVD88, 1988, *North American Vertical Datum of 1988, National Geodetic Survey, Federal Geodetic Control Committee*, Silver Springs, Maryland.

PNNL-12261, 2002, *Revised Hydrogeology for the Suprabasalt Aquifer System, 200-East Area and Vicinity, Hanford Site, Washington*, Pacific Northwest National Laboratory, Richland, Washington.

PNNL-15315, 2006, *RCRA Assessment Plan for Single-Shell Tank Waste Management Area A-AX at the Hanford Site*, Pacific Northwest National Laboratory, Richland, Washington.

SGW-37907, 2008, *Data Quality Objective Summary Report for the Disposition of Waste from the Drilling of Well 199-N-165 (C6693) in the 100-NR-2 Operable Unit, FY2008,* Rev. 0, Fluor Hanford, Inc., Richland, Washington.

SGW-37908, 2008, *Data Quality Objective Summary Report for the Disposition of Waste from Drilling RCRA Monitoring Wells 299-E26-77 and 299-E26-78 at the Liquid Effluent Retention Facility (LERF) and 299-E25-236 at the A-AX Waste Management Area, FY2008,* Rev. 0, Fluor Hanford, Inc., Richland, Washington.

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

APPENDIX A

BOREHOLE LOGS/WELL SUMMARY REPORTS

This page intentionally left blank.

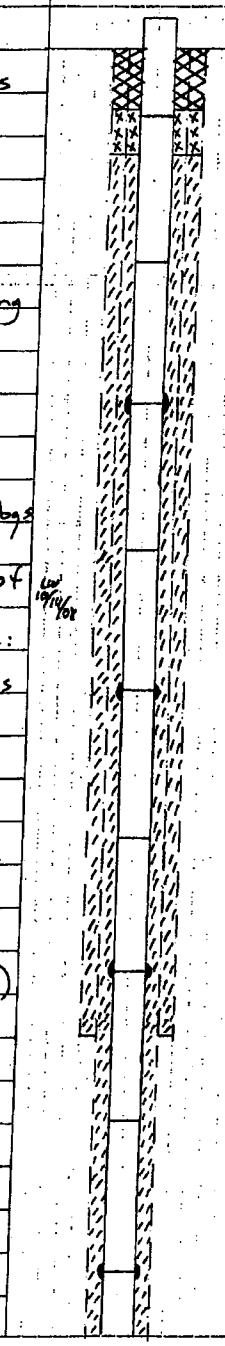
WELL SUMMARY SHEET

Start Date: 8-26-08
Finish Date: 9-25-08
Page 1 of 2

Well ID: C6542
Well Name: 299-E25-236
Location: W. of 242-A Evaporator, 200-E
Project: RCRA M-24 MONITORING WELLS
Prepared By: Jess Hocking Date: 10/13/08
Reviewed By: L.D. Walker Date: 10/14/08
Signature:
Signature:

CONSTRUCTION DATA

Description	Diagram
11 3/4" Temporary Drive Casing: 0 - 138 ft bgs	
9 5/8" Temporary Drive Casing: 0 - 328.1 ft bgs	
NOTE: All temporary casing has been fully removed from the ground.	
304/304L 4" OD sch. 10s Riser: +2.26 - 290.0 ft bgs	
304/304L 4" OD ~~sch. 10s~~ 0.020-in slot Continuous wire-wrap screen: 290.0 - 325.1 ft bgs	
304/304L 4" OD sch. 10s Stainless steel sump: 325.1 - 328.1 ft bgs	
Portland Cement (Tp. I-II) 0.0 - 8.10 ft bgs	
Bentonite Crumbles (#8) / Bentonite Pellets (1/4") 8.10 - 263.9 ft bgs.	



GEOLOGIC/HYDROLOGIC DATA

Depth in Feet	Graphic Log	Lithologic Description
0		0 - 0.5' Gravel Pad
		0.5 - 7.5' Silty Sand (mS)
		7.5 - 8' Sand (S)
		8 - 15' Gravelly Sand (gS)
		15 - 17' Silty Sand (mS)
30		17 - 19' Silty Sandy Gravel (msG)
		19 - 40' Sand (S)
		40 - 59' Gravelly Sand (gS)
		59 - 66' Slightly Silty Sand ((m)S)
60		66 - 80' Silty Sand (mS)
		80 - 84' Sand (S)
		84 - 85' Gravelly Sand (gS)
		85 - 99' Sand (S)
90		99 - 105' Gravelly Sand (gS)
		105 - 109' Sand (S)
		109 - 124' Gravelly Sand (gS)
120		124 - 245' Sand (S)
150		

A-6003-643 (03/03)

WELL SUMMARY SHEET

Start Date: 8-26-08
Finish Date: 9-25-08
Page 2 of 2

Well ID: C6542	Well Name: 299-E25-236
Location: W. of 242-A Evaporator, 200-E	Project: RCRA M-24 MONITORING WELLS
Prepared By: Jess Hocking — Date: 10/13/08	Reviewed By: L.D. Walker — Date: 10/14/08
Signature: [signature]	Signature: [signature]

CONSTRUCTION DATA

Description

Coated Bentonite Pellets (1/4")
263.9 – 269.0 ft bgs.

Portland Cement (Tp. I-II)
269.0 – 282.5 ft bgs

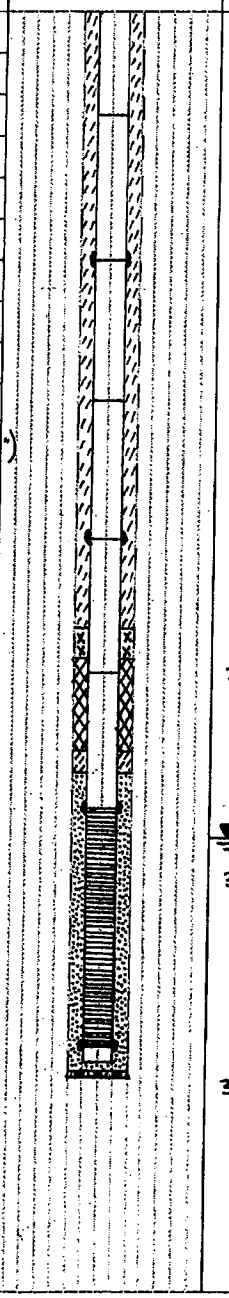
Bentonite Crumbles (#8)
282.5 – 287.2 ft bgs

Colorado Silica Sand (10/20)
287.2 – 328.9 ft bgs

NATURAL CAVE-IN MATERIAL
328.9 – 329.3 ft bgs

NOTE: All depths reported in feet below ground surface (ft bgs), unless otherwise noted.

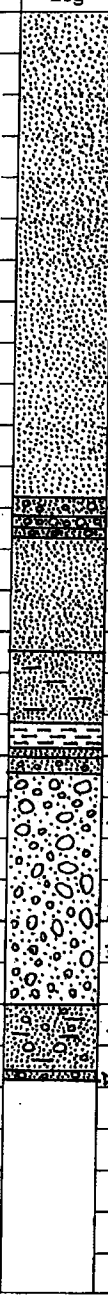
Diagram



GEOLOGIC/HYDROLOGIC DATA

Depth in Feet: 180, 210, 240, 270, 300, 330

Graphic Log



Lithologic Description

245 – 247' Gravelly Sand (gS)
247 – 248' Sandy Gravel (sG)
248 – 249' Gravelly Sand (gS)
249 – 267' Sand (S)
267 – 277' Slightly Silty Sand (m) S)
277 – 281.5' Silt (M)
281.5 – 282.5' Sand (S)
282.5 – 284' Gravelly Sand (gS)
284 – 318' Sandy Gravel (sG)
318 – 328' Silty Sandy Gravel (msG)
328 – 329.3' Gravelly Sand (gS)
TD = 329.3' bgs (9/11/08)
DTW = 294.5' bgs (9/10/08)

A-6003-643 (03/03)

BOREHOLE LOG

Page 1 of 4
Date: 8/26/08

Well ID: C6542 | Well Name: 299-E25-236 | Location: 50m W. of 242-A Evaporator, 200E.
Project: RCRA Wells A-Ax well | Reference Measuring Point: Ground Level

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				0-0.5': Gravel Pad	Cable tool; 33" x 8 5/8"
				0.5'-7.5': silty sand (mS), vf. to f grained s., brown, sl. moist,	drive barrell, 11 3/4" temp. c.s. casing
5					
				7.5-8.0: sand (S), f. to v. coarse, gray brown, occassional gravel, vf peb to cobbles, cobbles up to 15 cm	
10	GRAB			8.0-15.0: gravelly sand, sand is vf- v. coarse (gS), gray brown, pr sorted, gravel ranges from vf. pebble to cobbles up to 15 cm, sub round, 80% felsic, 20% mafic	
15	GRAB			15.0-17.0: silty sand (mS), sand vf-med. grained, brown	
				17-19: silty sandy gravel (mSG): gravel 50% sand 30% silt 20%; gravels 1-3" sand med to crse;	
20	G.S.			19-40: Sand (S): sand med to crse dom. felsic (70% w/ mostly qtz) 30% mafic; some silt + small pebbles present; mod. rxn HCl	archive g.s. 19-20' readings < background
25	G.S.			→ inc M % to ~10% @ 21'	archive g.s. 20-25' readings < bkgrnd
				→ sand crse to v. crse @ 24'	
				→ inc gravel % to 10% @ 29'	
				Sand 80% ~~Sand 70%~~ silt 10% gravel 10%; some cementation,	archive g.s. 25-30'
30	G.S.			very crse sands; gravel mostly felsic	readings < bkgrnd
					archive g.s. 30-35' readings < bkgrnd
35	G.S.				

Reported By: J. Throolin / S. Sexton | Reviewed By: L.D. Walker
Title: Geologist | Title: Geologist
Signature: [signature] / [signature] Date: 8/26/08 | Signature: [signature] Date: 10/14/08

A-6003-642 (03/03)

BOREHOLE LOG

Page 2 of 9
Date: 8/27/2008

Well ID: C6542 | Well Name: 299-E25-236 | Location: 50 m W. of 242-A Evaporator

Project: RCRA Wells A-AX well | Reference Measuring Point: Ground Surface

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
40	G.S.				See pg 4
				40-57: gravelly Sand (gS): sand 80% gravel 20%; sand crse to very crse, mostly qtz (70/30 felsic/mafic) gravels sub-rnd 50/50 mafic felsic up to 1" diam (pebbles); some silt up to 5%, slight cementation mod rxn HCl; moist	archive g.s. 35-40' readings < bkgrnd
45	G.S.			→ inc % gravel @ 42' to 35%: sand 65% gravel 35%; gravels inc size to 2-3" diam.	archive g.s. 45-50' readings < bkgrnd
50	G.S.			→ dec % gravel to 15% ~46'; sand 85% gravel 15%, gravels size dec. to pebbles to 0.5" diam.;	archive g.s. 55'
				→ 6" silt lens 51.5-52.0'	
55	G.S.			→ inc gravel % to 20 52.5'	
				→ sands grade med to crse, ~~little gravel~~; more silt @ 57.5' bgs ~~Sand 70% silt 20% gravel 10%~~	
	G.S.			sand 80% felsic, mostly qtz; No gravels; sand 90% silt 10%	archive g.s. 59'
60				59-66: slightly silty Sand (mS): sand 90% silt 10%; sand med to crse grading crse downwards, ~~70%~~ 70% felsic, mostly qtz; slight cement mod rxn HCl	LW 11-13-08
65	G.S.			→ 6" silt lens 62-62.5	archive g.s. 65'
				→ return to sand 62.5-66	
				66-80: silty Sand (mS): sand 70% silt 30%; sand med-crse mostly (70%) felsic, small silt interbeds; brown (10YR 4/3) mod rxn HCl; some cementation	
70	G.S.			→ dec silt 10% @ 69.5' bgs	archive g.s. 70' readings < bkgrnd
				→ cemented sand 73.5' mod-strong rxn HCl	
75	G.S.			→ small mafic pebbles @ 75' in sand sub-ang to sub-rnd	archive g.s. @ 75' readings < bkgrnd

Reported By: S. Sexton | Reviewed By: L.D. Walker

Title: Geologist | Title: Geologist

Signature: [signature] | Date: 8/27/08 | Signature: [signature] | Date: 10/14/08

A-6003-642 (03/03)

BOREHOLE LOG

Page 3 of 9
Start: 8/26/08 Date: Fin/Sh: 8/28/08

Well ID: C6542 | Well Name: 299-E25-236 | Location: 50m W. of 242-A evaporator, 200E

Project: RCRA Wells A-AX well | Reference Measuring Point: Ground Surface

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
80	G.S.				See pg 1
				80-84: sand(S): 70% felsic 30% mafic, med to crse, sub-angular, no rxn HCl, no cement	archive g.s. 80'
85	G.S.			84-85: gravelly sand (gS): sand 80% gravel 20%; sand 70% felsic 30% mafic crse sand sub-ang; gravel mostly mafic pebbles 1/4" diam, sub-rnd;	archive gs. 85'
90	G.S.			mod. rxn HCl, some slight cement w/ little silt	archive g.s. @ 90'
				85-92: sand (S): mostly felsic 70%, med grain w/ no rxn HCl	
				-> 90': coarse grained w/slight rxn to HCl, some cementation;	
95	G.S.			92-99: same as above	archive g.s. @ 95'
				-> 6" silt lens 93.5'-94'	
				-> slight incr. in gravel 95'-96'	
				99-105: gravelly sand (gS); sand 80%, gravel 20%, sand med to v. crse, 70/30 felsic/mafic, up to 2 cm pebbles; moist	
100	G.S.			-> cemented sand 104' mod-strng rxn w/ HCl	archive g.s. @ 100'
				105-109: sand (S): 70% felsic, 30% mafic, med to v. crse, sub-ang, sl. rxn w HCl,	
105	G.S.			some cementation	archive g.s @ 105'
				109-120: gravelly sand (gS): return to gravelly sand; up to 5 cm pebble, 30% gravel, 70% sand, sand crse - v. crse, 70% felsic, 30% mafic, sub-rnd - sub-ang.	
110	G.S.			-> f. sand lens @ 113'	archive g.s. @ 110'
				-> decrease gravel % to 20 @ 114'	
115	G.S.				archive g.s. @ 115'

Reported By: S. Sexton / J. Throckmorton | Reviewed By: L.D. Walker

Title: Geologist | Title: Geologist

Signature: [illegible] Date: 8/28/08 | Signature: [illegible] Date: 10/14/08

A-6003-642 (03/03)

BOREHOLE LOG

Page 4 of 9
Start: 8/28/08
Date: Finish: 9/3/08

Well ID: C6542 | Well Name: 299-E25-236 | Location: 50 m. W of 242-A evaporator, 200 E

Project: RCRA Wells A-AX well | Reference Measuring Point: Ground surface

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
120	G.S.			120 - 124: Same as above, decrease in gravel - 9% to 15%	See pg 1
					archive G.S. @ 120'
				124 - ~~126~~ 168. sand (s), f. to crse sand, brown,	
125	G.S.			occ. large cobble up to 15 cm	archive G.S. @ 125'
				→ few large cobbles 126.5'	
				→ cementation of sands, 128.5'	
				slight, mod rxn HCl	
				fine grain size crse to v. crse 131'	
130	G.S.			→ grains med - crse 134'	archive g.s. 130'
				→ thin lens cemented crse sands	
				@ 135.5' bgs	
				→ 143' bgs poorly cemented, thin lens of sand	
				→ grains f. to crse. 150'	
135	G.S.			→ slight cementation of sands, 145' to 150', mod	
				rxn to HCl	archive g.s. 135'
140	G.S.				
					archive g.s. 140'
					Downstee casing @ 140' to 9 5/8" O.D. Temp casing,
					drive barrel 7 5/8" dia. x 28"
145	G.S.				length
					archive g.s. @ 145'
150	G.S.				archive g.s. @ 150'
155	G.S.				archive g.s. @ 155'

Reported By: J. Throelin / S. Sexton | Reviewed By: L.D. Walker

Title: Geologist | Title: Geologist

Signature: [signature] Date: 9/3/08 | Signature: [signature] Date: 10/14/08

A-6003-642 (03/03)

BOREHOLE LOG

Page 5 of 9

Date: Start: 9/3/08 Finish: 9/4/08

Well ID: C6542 | Well Name: 299-E25-236 | Location: 50m W. of 242-A Evaporator, 200E

Project: RCRA Wells A-AX well | Reference Measuring Point: Ground surface

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
160	G.S.			160-200: Same as above, sand (S).	7 5/8" x 28" Drive barrel
				→ few med. pebbles 167'-170', up to 2cm, grain size	9 5/8" O.D. Temp. casing
				→ slight cementation 171'-174', strong rxn to HCl	archive g.s. @ 160'
165	G.S.			→ few large cobbles 176'	archive g.s. @ ~~165'~~ 165'
				→ grain size vf. to v. crse 177'	
				→ thin lens poorly cemented sand 184', mod rxn w/HCl	
				→ inc. silt to 5% 186'	
				→ silt decrease 189'	
170	G.S.				archive g.s. @ 170'
175	G.S.				archive g.s. @ 175'
180	G.S.				archive g.s. @ 180'
185	G.S.				archive g.s. @ 185'
190	G.S.				archive g.s. @ 190'
195	G.S.				archive g.s. @ 195'

Reported By: J. Throolin | Reviewed By: L.D. Walker

Title: Geologist | Title: Geologist

Signature: [signature] Date: 9/4/08 | Signature: [signature] Date: 10/14/08

A-6003-642 (03/03)

BOREHOLE LOG

Page 6 of 9
Date: 9/4/08

Well ID: C6542 | Well Name: 299-E25-236 | Location: 50m W. of 242-A Evaporator, 200E

Project: RCRA Wells A-AX well | Reference Measuring Point: Ground Surface

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
200	G.S.			200-240: sand (S), vf. to crse sand, brown,	see pg. 5
				v. sl. moist, prly sorted, subang., 70% felsic,	
				30% mafic, (same as above)	archive g.s. @ 200'
				→ inc. silt % to 5% @ 213'	
				→ thin lens JWT 9/4/08 ~~some~~ poorly cemented sand 222'; mod rxn	
205	G.S.			w/ HCl	archive g.s. @ 205'
				→ sl. cemented 228'-229', no rxn to HCl	
210	G.S.				archive g.s. @ 210'
215	G.S.				archive g.s. @ 215'
220	G.S.				archive g.s. @ 220'
225	G.S.				archive g.s. @ 225'
230	G.S.				archive g.s. @ 230'
235	G.S.				archive g.s. @ 235'

Reported By: J. Threolin | Reviewed By: L.J. Walker

Title: Geologist | Title: Geologist

Signature: [signature] Date: 9/4/08 | Signature: [signature] Date: 10/14/08

A-6003-642 (03/03)

BOREHOLE LOG

Page 7 of 9
Start: 9/8/08
Date: Finish: 9/9/08

Well ID: C6542 | Well Name: 299-E25-236 | Location: 50 m W. of 242-A Evaporator, 200E

Project: RCRA Wells A-AX well | Reference Measuring Point: Ground Surface

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
240	G.S.			240-245; (same as above), sand (s)	see pg. 5
				→ 239' few med. pebbles	
				→ slight cementation 232'-233', mod rxn to HCl	archive g.s. @ 240'
				→ Few crse. pebbles 234'	
				245-247: gravelly sand (gS); sand vf. to ~ crse., brown, v. sl. moist., prly. sorted, sub rnd to subang, 70% felsic, 30% mafic, gravel up to 4 cm (v. crse pebble), .	
245	G.S.				archive g.s. @ 245'
				247-248: sandy gravel (sG); gravel up to ~~249-249~~ 9/8/08 → small cobbles (7 cm), 60% mafic, 40% felsic	
	G.S.				archive g.s. @ 249'
250	G.S.			248-249: return to gravelly sand (gS)	archive g.s. @ 250'
				249-267: return to sand (S), few med. pebbles	
				→ increase mafic % to 40 @ 254'	
				→ grain size decrease to vf. to med. sand @ 259' (277.0' bgs) @ 9/9/08	
255	G.S.				archive g.s. @ 255'
				267-270: slightly silty sand ((m)S); brown, sand is vf.-f., v. sl. moisture, mod. sorted, 60% felsic, 40% mafic, 15% silt, 85% sand	
260	G.S.				archive g.s. @ 260'
265	G.S.				archive g.s. @ 265'
270	G.S.				archive g.s. @ 270'
	S.S. I-001 100%				S.S. @ 269.6-272.1' bgs @ 1010 9/8/08
	S.S. I-002 100%			277.0-281.5' bgs: silt (m)	HEIS# ~~BIWPB2(AS), BIWP~~ @ 9/8/08 BIWPB2(AS), BIWPB6.
275	G.S.			~95% m/clay, ≤5% v. fn s., lt. brn to gray, compact, @ 9/9/08 wet silt damp, slt. rxn to HCl, bedding shows in both s.s. + drive barrel spoils, low plasticity, v. dense.	S.S. @ 272.0-274.5' bgs @ 1040 9/8/08 HEIS# BIWPB3(AS), BIWPB7.
	S.S. I-003 100%				
	S.S. I-004 100%				Archive g.s. @ 275' bgs.
				(see pg. 8 →)	(see pg. 8 →)

Reported By: J. Throolin / T. Boswell | Reviewed By: L.D. Walker

Title: Geologist | Title: Geologist

Signature: [signature] / [signature] Date: 9/9/08 | Signature: [signature] Date: 10/14/08

A-6003-642 (03/03)

BOREHOLE LOG

Page 8 of 9

Date: ~~Started: 9/4/08~~ Finish: 9/10/08

Started: 9/4/08 Finish: 9/10/08

Well ID: C6542 | Well Name: 299-E25-236 | Location: 50m W. of 242-A Evaporator, 200-E.

Project: RCRA Wells, A-AX Well | Reference Measuring Point: Ground Surface

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
280	(s.s. 3-9-04 10:00 h)	G.S. 9/9/08		(see pg. 7)	(see pg. 7)
				281.5-283.5' bgs: Sand (s)	
				~90% fn to crs s. (65% fels, 35% mof), 5% m, ≤5% g (fn pebbs, subrnd to sub-ang), dk bn, moist, slt rxn to HCl, loose, unk. bedding.	s.s. @ 275.0-277.5' bgs @ 0745, 9/9/08, HEIS# B1WPB4 (AS), B1WPB8. 100% rec.
285	G.S.			283.5-284.0' bgs: gravelly sand (gS)	
				~75% fn to crs s., ≤25% g (fn pebbs to sm cobbs; subrnd to sub-ang), dk gy, damp, v. loose, no rxn w/HCl (same comp).	s.s. @ 278.0-280.5' bgs @ 0830, 9/9/08, HEIS# B1WPB5 (AS) B1WPB9. 100% rec.
				284.0-298.0' bgs: Sandy gravel (sG)	
290	G.S.			~40% v.fn pebbs to lg. cobbs (well-rnd to sub ang), ≤60% med. to v. crs s., 50% fels, 50% mof (bas, qtz, granite inc), moist, v. loose, no rxn w/HCl; grad. contact @ 284'.	g.s. (Archive) @ 280.0' bgs. Archive g.s. @ 285.0' bgs
				→ ~286.0' bgs, g% dec to ~30%, s. inc to 70%. G. size: same, more lg. cobbs (qtzite)	Archive g.s. @ 290.0' bgs.
295	G.S.			→ ~287.0' bgs, gravelly sandy silt (gsM) lens, ~0.5'-thick: ~60% m, 25% v.fn to crs pebbs (sub ang to sub-rnd), ≤25% s. (same as surrnd. layer), dk bm, v. damp, mod. rxn w/HCl, dense.	Archive g.s. @ 295.0' bgs. H_2O = 294.5' bgs (9/10/08)
300	G.S.			→ ~289.0' bgs, m% inc. to ~10%, s. dec to 50%, s. size dec. to v.fn to crs.	Archive g.s. @ 300.0' bgs.
				→ ~293.5' bgs, g% inc to 65%, m. dec. to <5%, s. to ~30%; s: v.fn to crs; g: v. fn pebbs sm-cobbs (same lith.); dry, loose.	
305	G.S.			→ ~294.5' bgs, rxn to 50% s., 40% g's, ~10% m. Dry, loose.	Archive g.s. @ 305.0' bgs.
				→ ~296.0' bgs, seds = v. wet; water table near.	
310	G.S.			298.0-318.0' bgs: Sandy gravel (sG) 9/10/08	Archive g.s. @ 310' bgs.
				~70% v.fn pebbs to v.lg. cobbs (220 mm diam), 30% crs. to v. crs s. (75% mof, 25% fels), g's ang to rnd, wet, loose, dk gy/blk, no rxn w/HCl; grad contact @ 298'.	
315	G.S.			→ ~302.0' bgs, s% inc to 45%, g. dec to 55%.	Archive g.s. @ 315' bgs.
				→ ~304.5' bgs, 20% m, 30% s, 50% g's, same comp, but consol.; m. mafic; slt rxn w/HCl.	
				→ ~307.5' bgs, rxn to Ø% m. (see pg. 9 →)	(see pg. 9 →)

Reported By: T. Buswell		Reviewed By: L. J. Walker	
Title: Geologist		Title: Geologist	
Signature: T. Buswell	Date: 9/10/08	Signature: L. J. Walker	Date: 10/14/08

A-6003-642 (03/03)

BOREHOLE LOG

Page 9 of 9

Date: Start: 9-10-08 Finish: 9-11-08

Well ID: C6542 | Well Name: 299-E25-336 | Location: 50m W. of 242-A Evaporator, 200-E

Project: RCRA Wells, A-AX Well | Reference Measuring Point: Ground Surface

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
320	G.S.			(See pg. 8)	(See pg. 8)
				→ ~311.5' bgs, m% inc to 10%, 35% s., 55% v.fn pebbles to v.crs pebbles, sub-to well-rnd same comp.	Archive g.s. @ 320' bgs.
				~~→ ~314.0' bgs, s% inc to~~ (TB) 9/10/08	
325	G.S.			→ ~317.5' bgs, m.% inc to 30%, s. dec. to 15% poss. interbed.	Archive gs. @ 325' bgs.
				318.0–328.0' bgs: Silty Sandy gravel (msgr)	
				~40% v.fn pebbles to sm. cobbles (well-rnd to sub-ang) 35% med. to v.crs s., 25% m, in dark brn, saturated, consol. to loose, 70% mafs, 30% fds (basalts, qtzites, some granitic); grad. contact @ 318' bgs.	Switched to hard-tool method (See FAR, 9/11/08).
330	G.S.		T.D.		Archive g.s. @ ~~330'~~ 329-330' bgs. (TB) 9/11/08
				→ few m. lenses (≤ 3-in. thick); dark brn, no rxn w/HCl.	TD = 329.3' bgs (9/11/08)
				→ ~321.0' bgs, m% dec to 15%, s. inc. to 40%, g. to 45%.	
				→ ~322.0' bgs, m% dec to ≤5%, ~~s. m.~~ (TB) 9/11/08 g. inc. to 55% (w/ ≤1-in. m. lens).	
				→ ~323.5' bgs, m% inc to 30%, s. dec to 30%, g. to 40%, (Poss. lens, or sep. ont due to heavy fm / heavy driving); semi-consol.	
				→ ~324.5' bgs, m% @ 30%, s. to 30%, g. @ 40% (no lens).	
				328.0–329.3' bgs: gravelly sand (gS)	
				~ ~~70%~~ (TB) 9/11/08 60% v.fn to crs s., 25% v.fn to v.crs pebbles (well-rnd to sub-ang), ≤15% m, brn, saturated, loose (60% mafs, 40% fds).	
				→ Note: lith/grain samples skewed/may be inaccurate due to collection via sand pump; contact unk/grad.	

Reported By: T. Baswell | Reviewed By: L.D. Walker

Title: Geologist | Title: Geologist

Signature: Tom Baswell | Date: 9/11/08 | Signature: [signature] | Date: 10/14/08

A-6003-642 (03/03)

WELL SUMMARY SHEET

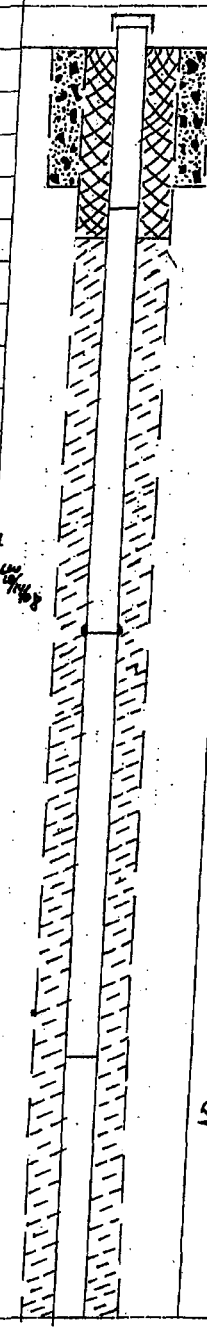
Start Date: 9/26/2008
Finish Date: 10/9/2008
Page 1 of 2

Well ID: C 6693
Well Name: 199-N-165
Location: NE of Bonneville Substation, 100 N
Project: 100-N Monitoring Well (RCRA)
Prepared By: T. Buswell
Date: 10/13/08
Reviewed By: L. D. Walker
Date: 10/14/
Signature: [signature]
Signature: [signature]

CONSTRUCTION DATA

Description
11 3/4" temporary casing: 0.0'- 6.5' bgs.
9 5/8" temporary casing: 0.0'- 86.84' bgs.
Note: all temporary casing has been completely removed from ground.
304/304L 4" ID sch. 10s riser: +2.09' - 67.89' bgs
0.020"-in slot 304/304L 4" ID ~~sch 10s~~ screen: 67.89' - 82.89' bgs
304/304L 4" ID sch. 10s stainless steel sump: 82.89 - 85.9' bgs
Natural backfill: 0.0'- 6.5' bgs 11 3/4" casing removed before driving 9 5/8" temp. casing
Portland Cement (Type I-II): 0.0'- 9.15' bgs
Bentonite Crumbles (#8): 9.15' - 61.9' bgs

Diagram



GEOLOGIC/HYDROLOGIC DATA

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

Graphic Log

Lithologic Description

(Ground Surface)
0-1.5' bgs: sandy gravel (sG)
1.5-6.0' bgs: gravelly sand (gS)
6.0-14.0' bgs: silty gravel (mG)
14.0-34.0' bgs: sandy gravel (sG)
34.0-37.0' bgs: gravelly sand (gS)
37.0-41.0' bgs: sandy gravel (sG)
41.0-46.0' bgs: sandy gravel (sG)
46.0-55.0' bgs: sandy gravel (sG)
55.0-57.5' bgs: sandy gravel (sG)
57.5-60.0' bgs: sand (S)

A-6003-643 (03/03)

WELL SUMMARY SHEET

Start Date: 9/26/2008
Finish Date: 10/9/2008
Page 2 of 2

Well ID: C6693	Well Name: 199-N-165
Location: NE of Bonneville Substation, 100N	Project: 100-N Monitoring Well (RCRA)
Prepared By: T. Buswell — Date: 10/13/08	Reviewed By: L.D. Walker — Date: 10/14/08
Signature: Tom Buswell	Signature: [signature]

CONSTRUCTION DATA

Description

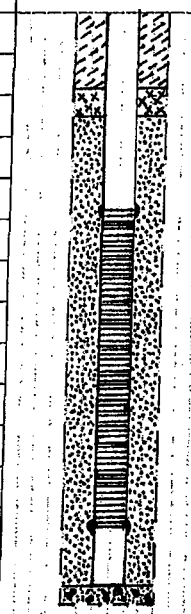
Coated Bentonite Pellets (3/8"): 61.9' – 63.15' bgs

Colorado Silica Sand (10-20): 63.15' – 85.9' bgs

Natural Cave-in/Casing plug material: 85.9' – ~~86.84~~ 86.86' bgs (TB 10/13/08)

Note: All depths are reported in feet "below ground surface" (bgs).

Diagram



GEOLOGIC/HYDROLOGIC DATA

Depth in Feet	Graphic Log	Lithologic Description
60		60.0-65.0' bgs: sandy gravel (sG)
		65.0-74.0' bgs: gravelly silty sand (gmS)
70		
		74.0-83.5' bgs: sandy gravel (sG)
80		
		83.5-86.0' bgs: silty gravel (mG)
	T.D.	TD: 86.0' bgs (10/7/08)
		DTW: 71.3' bgs (10/3/08)
90		
100		
110		

A-6003-643 (03/03)

BOREHOLE LOG

Page 1 of 3

Date: Start: 9-26-08 Finish: 9/30/08

Well ID: C6693	Well Name: 199-N-165	Location: NE of Bonneville Substation, 100N
Project: 100-N Monitoring Well (RCRA)		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				(Ground Surface)	Using hollow drive barrel
				0.0 – 1.5' bgs: ~~gravelly~~ sandy gravel (sG)	w/ cable tool drill rig.
				~60% v.fn pebbles to lg. cobbles, sub-rnd to sub-ang, 40% v.fn to crs. s., gry/tan, dry, loose. Non-native fill.	
	g.s. (0-5')				
5				1.5 – 6.0' bgs: gravelly sand (gS)	Archive grab sample (g.s.) @
				~80% v.fn to med. s., 20% med. ~~to v.c.~~ pebbles to sm cobbles, sub-rnd to well-rnd (80% lm, 20% fels) loose, v.dry, org/tan, falls out of d.b. easily.	0-5' bgs, 9/29/08.
					→ Hard-drilling @ 6.0' bgs
				→ 5 gal H_2O Added to assist drilling.	
10	G.S.			→ m% inc to 10%, s. dec to 70% (@3.0' bgs)	Archive g.s. @ 10' bgs, 9/30/08.
				→ Boulder-size g @ 3.0' bgs: basalt, vesicular.	
				→ ~~4.0'~~ bgs, g% inc to ~30%, s. dec to ~60%, m @ 10%. (~4.0')	Hard drilling.
15	G.S.			6.0 – 14.0' bgs: silty gravel (mG)	Archive g.s. @ 15' bgs, 9/30/08.
				~55% v.fn pebbles to lg. cobbles (sub-rnd to ang), 35% m, ≤ 10% v.fn to v.crs s., v.dk brn, v.damp, semi-consol, slt. to mod. rxn w/HCl, 85% maf, 15% fels; grad. contact @ 6' bgs.	Hard-drilling.
20	G.S.			14.0 – 34.0' bgs: sandy gravel (sG)	Archive g.s. @ 20' bgs, 9/30/08.
				~45% v.fn pebbles to sm cobbles (sub-ang to sub-rnd), 50% v.fn. to v.crs s. (30% fn, >70% crs to v.crs), gry, dmp to dry, slt rxn w/HCl, loose; 70% maf, 30% fels (granites, qtzites) (≤ 5% m).	Hard drilling.
25	G.S.			→ ~19.0' bgs, 80% maf, 20% fels; 1 lg. quartzite cobble (9-in diam. max), color: brn/blk.	Archive g.s. @ 25' bgs, 9/30/08.
				→ ~25.0' bgs, s% inc to 65%, g. dec to 30%, size to v.fn to v.crs pebbles	Hard drilling.
				→ ~26.0' bgs, rxn to 45% pebbles/cobbles, 50% s.	
30	G.S.			→ ~28.0' bgs, g% inc to 55%, s. to 45% (m still ~5%).	Archive g.s. @ 30' bgs, 9/30/08
				→ ~30.0' bgs, g. size: v.fn. to fn = 70%, med. pebbles to sm cobbles = 30%; v.loose; 65% maf, ~~30%~~ 35% fels.	
35	G.S.			34.0 – 37.0' bgs: gravelly sand (gS)	Archive g.s. @ 35' bgs, 9/30/08.
				~75% med. to v.crs s., 25% v.fn pebbles to sm. cobbles (sub-rnd to sub-rnd), brn/blk, damp, v.loose, slt. to mod. rxn w/HCl; 65% maf, 35% fels (qtz, felds, micas noticed); grad contact @ 34.0' bgs.	(See pg. 2 →)

Reported By: T. Bussell		Reviewed By: L. D. Walker	
Title: Geologist		Title: Geologist	
Signature: Tom Bussell	Date: ~~9/26/08~~ 9/30/08	Signature: [signature]	Date: 10/14/08

A-6003-642 (03/03)

BOREHOLE LOG

Page 2 of 3

Date: Start: 9-30-08 Finish: 10-3-08

Well ID: C6693 | Well Name: 199-N-165 | Location: NE of Bonneville Substation, 100N

Project: 100-N Monitoring Well (RCRA) | Reference Measuring Point: Ground Surface

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
40	G.S.			(see pg. 1)	(see pg. 1)
				→ ~36.0' bgs, 1-2 lg. cobbs; sub-rnd.	Archive g.s. @ 40' bgs, 9/30/08.
				37.0-41.0' bgs: r+n to sandy gravel	
				~50% v.fn pebbs to sm cobbs (sub-ang. to sub-rnd) 45% v.fn to v.crs s., ≤5% m, drk gray,	
45	G.S.			damp to dry (added H_2O to bh), loose w/few consol. masses, no to slt rxn w/HCl; 65% maf, 35% fels.	Archive g.s. @ 45' bgs, 10/2/08.
				→ ~41.0' bgs, s% inc to 55%, g. dec to 45% (0% m)	
				→ (TB) 10/2/08	(TB) 10/2/08
				41.0-46.0' bgs: sandy gravel	Archive g.s. @ 50' bgs, 10/2/08. (TB) 10/2/08
50	G.S.			~55% fn. to v.crs s., 45% v.fn to crs pebbs (sub-ang to sub-rnd), blk, damp (H_2O prev. added), no rxn w/HCl; 85% maf, ≤15% fels; grad. contact @ 41.0' bgs, (g's = 70% v.fn to fn-size, 30% med to crs); v. loose.	
				→ ~45.0' bgs, some lg. cobbs, v.crs pebbs	
55	G.S.			→ ~45.5' bgs, g's = 60% v.fn to med, 40% crs. pebbs to sm. cobbs; g% inc to 60%, s. dec to 40%.	Archive g.s. @ 55' bgs, 10/2/08.
				46.0-55.0' bgs: sandy gravel	
				~50% v.fn pebbs to lg cobbs (sub-ang to sub-rnd), 45% v.fn to v.crs s., ≤5% m, gry, dry, v.loose,	
60	G.S.			slt. to no rxn w/HCl, (65% maf, 35% fels); grad. contact @ 46.0' bgs.	Archive g.s @ 60' bgs, 10/2/08.
				→ ~52.0' bgs, ~8-in thick interbed of sand; 70% v.fn to v.crs s., 20% v.fn to med pebbs, 10% m, lt. gry, dry, v. loose, wk rxn w/HCl.	•Hard drilling.
65	G.S.			55.0-57.5' bgs: ~~gravelly~~ sandy gravel (s(g)) (TB) 10/2/08	Archive g.s. @ 65' bgs, 10/2/08.
				~50% v.fn to v.crs s. (70% fn. to med), 40% v.fn to v.crs pebbs (60% v.fn to fn) (sub-rnd to ~~sub-ang~~) (TB) 10/2/08, gray, dry to damp (H_2O added); 10% m, v. loose,	V. Hard Drilling.
70	G.S.			slt rxn w/HCl, (60% maf, 30% fels (quartz-mafical))	Archive g.s. @ 70' bgs, 10/3/08
				→ ~57.0' bgs, few sm. cobbs, damp, m% inc / more consol m/s.	
				57.5-60.0' bgs: sand (s)	DTW = 71.3' bgs.
				~90% v.fn to crs s. (80% fn. to med), well-sort, (ang to sub-rnd), 10% m, tan, loose w/some	
75	G.S.			consol. mass, dmp to dry, no rxn w/HCl; (80% fels, 20% maf).	Archive g.s. @ 75' bgs, 10/3/08
				60.0- 'bgs: sandy gravel (s(g)) (TB) 10/2/08	•Heaving sand.
				(see pg. 3→)	(see pg. 3→)

Reported By: T. Bussell | Reviewed By: L.D. Walker

Title: Geologist | Title: Geologist

Signature: [signature] Date: 10/03/08 | Signature: [signature] Date: 10/14/08

A-6003-642 (03/03)

BOREHOLE LOG

Page 3 of 3

Date: Start: 10/2/08 Finish:

Well ID: C6693 | Well Name: 199-N-165 | Location: NE of Benwerville Substation, 100N

Project: 100N Monitoring Well, RCRA | 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
				(See pg. 2)	(See pg. 2)
80	G.S.			60.0-65.0' bgs: sandy gravel (S G)	Archive g.s. @ 80.0' bgs, 10/3/08.
				~40% v.fn pebbs to sm cobbs (ang. to sub-rnd)	
				50% v.fn to v.crs s. (70% v.fn to med), 10% m,	
				lt tan/gry, dry, loose, slt to no rxn w/HCl;	
85	G.S.			70% felsic, 30% mafic (qtzites, granites, basalts)	Archive g.s. @ 85' bgs, 10/3/08
				→ Note: Hard drilling w/in this unit!!	
			T.D.	→ ~63.0' bgs, g's = 60% quartzites, 30% granites,	Total Depth = 86.0' bgs.
				~10% basalts.	
				65.0-74.0' bgs: gravelly silty sand (gmS)	
90				~40% v.fn to v.crs s. (80% v.fn to med), 30%	
				v.fn pebbs to coarse pebbs, w/few lg. cobbs, 30%	(10/2/08)
				(ang. to sub-rnd), 30% m, lt. tan, v. dry, loose	
				w/some caliche on g's, mod. rxn w/HCl (Possible	
				Ringold Fm?)	
				→ ~68.0' bgs, s% inc to 50%, m. dec to	
				20%; g's = qtzites, basalts, granites; g's	
				also = black, brn, tan, grn, red, gry, etc...	
				multiple colors; fm = sting rxn w/HCl, damp.	
				→ ~72.0' bgs, inc. in moisture = v. damp.	
				→ ~72 bgs sediments = saturated.	
				74.0-83.5' bgs: sandy gravel (sG)	
				~45% v.fn pebbs to sm cobbs (sub-rnd to ang),	
				50% v.fn to v.crs s., ~5% m, drk tan,	
				saturated, loose w/semi-consol. mass, no rxn	
				w/HCl; (80% fels, 20% mafic = s., g's = 65% mafic,	
				35% fels; micas, qtz, basalts, granite noticed);	
				grad. contact @ 74.0' bgs. bgs	
				→ ~76.0' bgs, s% inc to ~70%, g dec. to 30%,	(10/3/08)
				m still 5%. Note: poss. due to heaving s. @	
				~75-76.0' bgs	
				→ ~76.5' bgs, rxn to 45% g., 50% s, 5% m.	
				→ ~78.5' bgs, g's% inc to 60%, s. dec. to 30%	
				81.0', m. inc to ~10%. Comp. (lith) same.	
				(10/3/08) → ~79.5' bgs, g's% dec to 50%, s. inc to 40%	
				m still @ 10% (lith same).	
				83.5-86.0' bgs: silty gravel (mG)	
				~40% v.fn pebbs to lg. cobbs, 40% m, 20% v.fn to med s.	
				(g's ang. to sub-rnd), brn, wet, unit-comp, slt-dam matrix,	
				mod. to v. sting rxn w/HCl. Heaving into casing.	

Reported By: T. Burnell | Reviewed By: L. D. Walker

Title: Geologist | Title: Geologist

Signature: Tom Burnell | Date: 10/3/08 | Signature: [signature] | Date: 10/14/08

A-6003-642 (03/03)

WELL SUMMARY SHEET

Start Date: 08/12/2008
Finish Date: 09/05/2008
Page 1 of 2

Well ID: C6455	Well Name: 299-E26-77
Location: Inside fence, LERF 200 E	Project: M-24 RCRA Wells (LERF)
Prepared By: S. Sexton Date: 9/08/08	Reviewed By: L.D. Walker Date: 10/13/08
Signature:	Signature:

CONSTRUCTION DATA

Description:

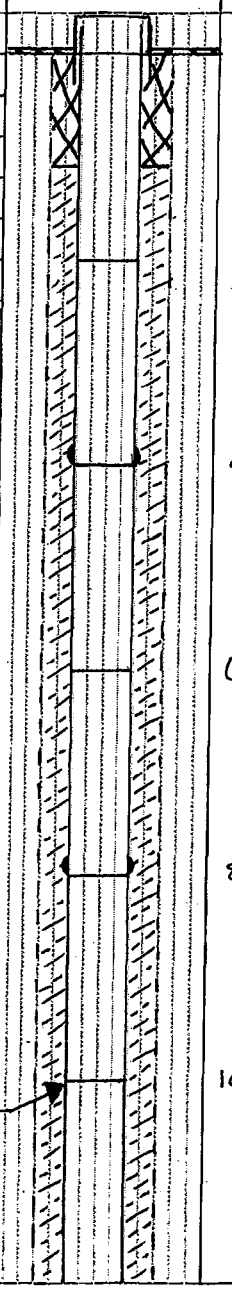
6" x 4' x 4' concrete pad
6" stainless steel protective monument:

4" ID Sch. 10 stainless steel casing: 1.96 ft ags to 200.85 ft bgs
4" stainless steel wire wrap screen, 0.020": 200.85 to 225.6 ft bgs
4" Sch. 10 stainless steel sump: 225.6 to 228.6 ft bgs

Portland cement grout: 0 to 11.05 ft bgs
Bentonite granules: 11.05 to 189.0 ft bgs
Bentonite pellets: 189.0 to 194.6 ft bgs
10-20 silica sand: 194.6 to 232.8 ft bgs

casing joint

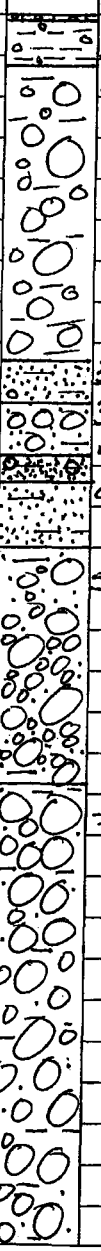
Diagram:



GEOLOGIC/HYDROLOGIC DATA

Depth in Feet: 0, 20, 40, 60, 80, 100

Graphic Log:



Lithologic Description:

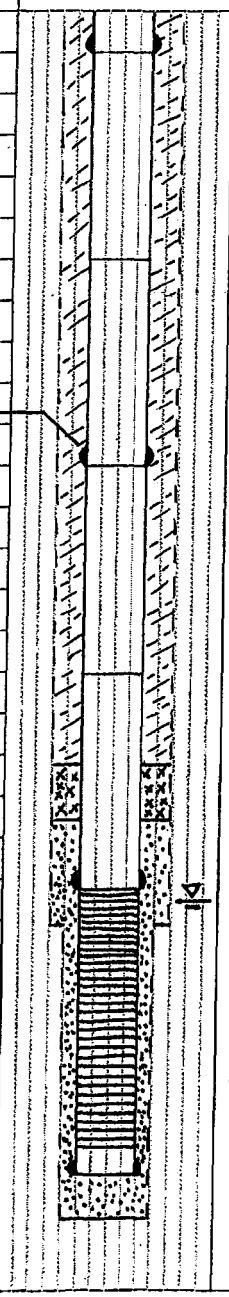
0-0.5: gravel drill pad
0.5-5: gravelly Silt (gM)
5-34: silty Gravel (mG)
34-38: gravelly silty Sand (gmS)
38-43: silty sandy Gravel (msG)
43-45.5: gravelly Sand (gS)
45.5-52: silty Sand (mS)
52-75: silty sandy Gravel (msG)
75-123: sandy silty Gravel (smG)

A-6003-643 (03/03)

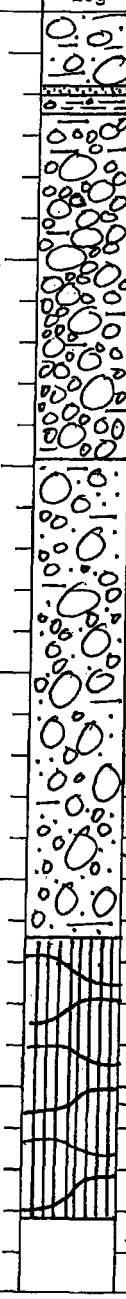
WELL SUMMARY SHEET	Start Date: 08/12/2008	Page 2 of 2
	Finish Date: 09/05/2008	

Well ID: C6455	Well Name: 299-E26-77
Location: Inside fence, LERF, 200E	Project: M-24 RCRA Wells (LERF)
Prepared By: S. Sexton — Date: 9/08/08	Reviewed By: L.J. Walker — Date: 10/13/08
Signature:	Signature:

CONSTRUCTION DATA

Description	Diagram
	

GEOLOGIC/HYDROLOGIC DATA

Depth in Feet	Graphic Log	Lithologic Description
120		123-124: Sand (S)
		124-126: gravelly Silt (gM)
		126-159: silty Gravel (mG)
140		
160		159-205.5: silty sandy Gravel (msG)
180		
200		DTW = 201.9 ft bgs on 08/27/2008
		205.5-233: basalt
220		TD = 232.8' bgs on 08/26/2008
		All depths recorded in feet "below ground surface" (bgs)

A-6003-643 (03/03)

BOREHOLE LOG

Page 1 of 6
Start: 08/12/08
Date Finish: 8/13/08

Well ID: C6455 | Well Name: 299-E26-77 | Location: 200E, LERF

Project: RCRA Wells | Reference Measuring Point: Ground Surface

Depth (Ft.)	Sample Type No.	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					Cable tool w/ 9" clb
				0-0.5: gravel drill pad	
					"archives every 5 feet"
				0.5-3.0: gravelly silt (gM): silt brown, dry, sediments in this formation matrix	add 5 gal water from 0-5'
5				supported: gravels felsic 1-4" dia., sub-rounded; possible fill material	
				3.0-5.0: gravelly silt (gM): silt lt brown, dry, increase in gravel % to 40%;	change clb to 8" @ 5' bgs
10			G.S.	gravels sub-angular to sub-rounded, felsic 1-2", strong rxn HCl	add 5 gal water from 5-8' bgs
				5.0-18: silty Gravel (mG): same lithology as above, increase gravels	add 3 gal water @ 10' bgs
15			G.S.	to 50-60%, cobbles to 6" diam.; gravels sub-rnd to sub-ang, mostly felsic, some fine sand grains pres. to 10%; str. rxn HCl	add 2 gal water @ 13' bgs
				↳ decrease HCl rxn @ 13' gravels	
20			G.S.	reduce in size to 1-4" max;	
				18.0-34.0: silty Gravel (mG): gravel 75% silt 20% sand ~5%; gravels predom. felsic, sub-rnd	
25			G.S.	1-4" diam.; little real sand, mostly pulverized rock from drilling; slight to moderate rxn HCl, dry;	
				↳ gravel becomes more fragmented and angular @ 25' bgs, slight	add 2 gal water @ 28' bgs
30			G.S.	rxn to HCl still	
				↳ inc sand % ~28' bgs 70% gravel, 20% silt 10% sand; cemented gravels @ 28' bgs;	drilling slows @ 27' due to cementation
35			G.S.	34.0-38.0: gravelly silty Sand (gmS): 60% sand 30% silt 10% gravel; sand med grain predom. sub-rnd felsic; gravels may be lost due to cementation & hard drilling; mod-strong rxn HCl	add 2 gals @ 30' still in cemented gravels

Reported By: S. Sexton | Reviewed By: L.D. Walker

Title: Geologist | Title: Geologist

Signature: [signature] | Date: 8/13/08 | Signature: [signature] | Date: 10/13/08

A-6003-642 (03/03)

BOREHOLE LOG

Page 2 of 6
Start: 8/13/08
Date: Finish: 08/14/08

Well ID: C6455 | Well Name: 299-E26-77 | Location: 200E, inside LERF fence

Project: RCRA Wells | Reference Measuring Point: Ground Surface

Depth (Ft.)	Sample Type No.	Blows Recovery	Graphic Log Type	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)
			G.S.		See pg 1
40				38.0 - 43.0: silty sandy Gravel (mS(g))	
				Gravel 60% sand 30% silt 10%;	add 2 gals @ 38.0
				gravels pebbles 1-3" diam, 50/50	ft bgs
				mafic / felsic composition; sand	
45			G.S.	med. grain, 50% qtz; samples clump	
				from addition of water; slight	
				rxn HCl	
				↳ inc % sand to 50%, gravel	
				41.5: 50%, very little silt present;	
50			G.S.	sand coarsens to crse; mod	
				rxn HCl	
				43 - 45.5: gravelly Sand (gS): sand	change to shorter clb
				70% gravel ~25% <5% silt;	@ 52" bgs (2' Inside)
55				sand med. to crse, predom felsic	archive g.s. 52-60
				(60%); gravels <1" to 2" max,	
				sub-rnd, intermediate comp;	drilling slows due to
				overall color gray; dry, strong	cementation of gravels
				rxn HCl	
60			G.S.		
				45.5 - 52: silty Sand (mS):	archive g.s. 60-65
				sand 50% silt ~40% <10%	
				gravel; sand med grain, 60%	add 1.5 gal water
				qtz; gravel small pebbles sub-rnd;	at ~63' to hold
65			G.S.	dry, mod. to str. rxn HCl	seds in clb.
				52 - 75: silty sandy Gravel (mS(g)):	add 3 gals water
				gravel 60% sand 20% silt 20%;	at ~65'
				gravels mostly mafic (60%) with	archive g.s. 65-70
70			G.S.	some larger qtzite, small pebbles	
				1-3" diam., sub-rnd to sub-ang;	
				sand fine to med, 40% qtz; brown	archive 70-75 g.s.
				(10YR 4/3), dry, mod. rxn HCl	
				↳ soils become cemented @ 57';	
75			G.S.	same lithology, still mod rxn HCl	
				↳ samples becoming clump @ ~60	archive g.s. 75-80
				ft bgs, some from adding water	
				some not; slt. rxn HCl	
				↳ soils drying 71-72' bgs;	

Reported By: S. Sexton | Reviewed By: L. D. Walker

Title: Geologist | Title: Geologist

Signature: [signature] Date: 08/14/08 | Signature: [signature] Date: 10/13/08

A-6003-642 (03/03)

BOREHOLE LOG

Page 3 of 6
Date: Start: 8/14/08 Finish: 8/15/08

Well ID: C64455 | Well Name: 299-E26-77 | Location: inside LERF fence, 200E

Project: RCRA Wells (M-24) | Reference Measuring Point: Ground Surface

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
80	G.S.				See pg 1
				75-117: sandy silty Gravel (GM G):	8" dc, 2' inside Ing.
				gravels 60% silt 20% sand 20%;	
				gravels mafic + intermed. precdom, sub-	archive g.s. 80-85
				rnd to sub-ang, gravels 1-4", some	
85	G.S.			larger qtzites to 6"; sand fine to	
				med 50% qtz; color: brown (10YR 4/3),	
				damp; slight rxn HCl; some caliche	
				↳ decrease sand%, inc. silt %	
				~80'; same lithology as above;	
90	G.S.			samples mostly dry, some	archive g.s. 85-90
				moisture in silt; matrix supp.	
				↳ clast size increase to 6" +	
				max diam. ~93' bgs	
				↳ dec. rxn HCl, still present, but	
95	G.S.			v. slight	archive g.s. 90-95
				↳ gravels decrease in size ~95'	
				to 1-2" max, some larger	drilling slow from 95'
				clasts to 4"	down.
				↳ 110: almost no rxn HCl,	
100	G.S.			drilling easier	archive g.s. 95-100
				SEE NEXT PAGE	
					archive g.s. 100-105
105	G.S.				
					archive g.s. 105-110
110	G.S.				
					archive g.s. 110-115
115	G.S.				

Reported By: S. Sexton | Reviewed By: L.D. Walker

Title: Geologist | Title: Geologist

Signature: [signature] Date: 08/15/08 | Signature: [signature] Date: 10/12/08

A-6003-642 (03/03)

BOREHOLE LOG

Page 4 of 6
Start: 8/15/08
Date: Finish: 8/19/08

Well ID: C6455 | Well Name: 299-E26-77 | Location: inside fence, S. of LERF, 200E

Project: RCRA Wells | Reference Measuring Point: Ground Surface

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
					See pg. 1
120				117-123: Sandy silty Gravel (sm G):	
				gravel 60% silt 35-40% sand ~5%;	
	G.S.			gravels mostly mafic with gneiss	archive g.s. @ 115-120
	G.S.			cobbles up to 5" sub-rnd to	
125				sub-ang; overall color brown	archive 123-124
	G.S.			(10YR 4/3); v. slight rxn HCl, some	archive 124-126
				cementation, poorly sorted, matrix	archive 126-130
				supported;	
130	G.S.			123-124: Sand (S): sand 95%	
				~5% silt; sand med to coarse	archive g.s. @ 130-135
				50/50 mafic/felsic, felsic grains	
				angular qtz, slight cementation;	
				color brown (10YR 4/3), slight rxn	
135	G.S.			HCl, soils slightly damp;	
					archive g.s. @ 135-140
				124-126: gravelly Silt (g M); silt	
				60% gravel 35% some sand (~5%);	
				color brown (10YR 4/3); gravels sub-	
140	G.S.			rnd, mostly mafic + intermediate;	
				pebbles to boulders (6"+); soils	No returns 140-145
				slt damp, slt rxn HCl;	
				126-159: silty Gravel (m G):	
145	G.S.			gravels 80% silt 20%; cementation	
				+ caliche staining at 126, gone	archive g.s. 145-150
				by 127; gravels mostly mafic (80%)	
				sub-rnd, 1-3", color brown	
				(10YR 4/3), slightly damp; slight	
150	G.S.			rxn HCl	
				→: 139: inc % silt to 40%; gravel	archive g.s. @ 150-155
				60% silt 40%; more felsic mat'l,	drilling slow @ 152
				but broken, most likely from felsic	after adding casing;
				cobbles - boulders;	poor returns;
155	G.S.			→153: clast size increase, cobbles to	drilling easier through
				boulders (6"+; gravel 70% silt 30%	loose cobbles 153'
				→158: clasts dec. to 3-4", inc Sand	
				dec Silt %; gravel 70% silt 20%	
				Sand 10%	

Reported By: S. Sexton | Reviewed By: L.D. Walker

Title: Geologist | Title: Geologist

Signature: [signature] Date: 8/19/08 | Signature: [signature] Date: 10/13/08

A-6003-642 (03/03)

BOREHOLE LOG

Page 5 of 6
Start: 8/19/08
Date: Finish: 8/22/08

Well ID: C6455 | Well Name: 299-E26-77 | Location: S. of LERF, inside fence, 200E

Project: RCRA Wells | Reference Measuring Point: Ground Surface

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
					See pg. 1
160				159-176: silty sandy Gravel (msG): gravel 60% sand 20% silt 20%; gravel predom. mafic w/ some large qtzite cobbles; 1-4" dia. sub-rnd to rnd; sand mostly felsic, sub-angular med to fine grained; color brown (10YR 4/3); soils damp, poorly sorted, some cementation, no rxn HCl	
165					
170	G.S.			→ 169: silts becoming more consolidated, further cementing gravels, higher moisture content	poor returns 170-175
				→ 174: increased cementation preventing good returns;	archive g.s. @ 170-175
175	G.S.			176-189: sandy silty Gravel (smG): gravel 60% silt 30% sand ~10%; gravels mostly mafic with some felsic cobbles, 1-6" dia., sub-rnd; silt becoming more cohesive, consolidating soils; sand fine to med. mostly qtz; poorly sorted, damp, slight rxn HCl	archive g.s. 175-180
180	G.S.			→ 183: gravel size decrease, pebbles to cobbles 3-4" max	added ~25 gal water to hole while hard tooling; samples wet from addition of H_2O
					archive g.s. 180-185
185	G.S.			→ 189: sand % inc, gravel 60% silt 20% sand 20%; coarse to med. sand grains, mostly qtz; some highly weathered material, felsic, poss. chem. altered	archive g.s. 185-190
190	G.S.			→ 206: increase moisture + small gravels	archive g.S. 190-195
195	G.S.				archive g.S. 195-200

Reported By: S. Sexton | Reviewed By: L.D. Walker

Title: Geologist | Title: Geologist

Signature: [signature] Date: 8/22/08 | Signature: [signature] Date: 10/13/08

A-6003-642 (03/03)

BOREHOLE LOG

Page 6 of 6
Start: 8/23/08 Date: Finish: 8/26/08

Well ID: C6455 | Well Name: 299-E26-77 | Location: inside fence, S. of LERF, 200E

Project: RCRA Wells (LERF) | Reference Measuring Point: Ground Surface

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description (Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl)	Comments (Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level)
200	G.S.				See pg. 1
				199 - 203: sandy silty Gravel (SmG): gravel 60% silt 20% sand 20%; gravels mostly mafic (65%) sub-rnd to sub-ang; sand fine to med. mostly felsic, sub-angular; damp, no rxn HCl	archive g.s. 200-205
205	G.S.				archive g.s. 205-210
				203 - 205.5: silty sandy Gravel (msG): gravel 60% sand 30% silt 10%; gravels mostly mafic (65%) 1-3" max, lots of small pebbles, sub-rnd to sub-ang; sand med to crse, mostly felsic, sub-angular; no rxn HCl, inc % water at ~206 ft bgs, soils wet, but little water standing downhole; 232.8' on 10/3/08	
210	G.S.				archive g.s. 210-215
215	G.S.				drillers add ~25 gal water to hole @ ~208'
				205.5 - 228: basalt: bedrock basalt, top flow material; heavily weathered, fractured basalt, aphanitic → basalt becomes less fractured at 212', drilling slows, possibly out of flow top	archive g.s. 215-220
220	G.S.				
225					
				TD = 232.8'	
230					
235					

Reported By: S. Sexton | Reviewed By: L.S. Walker

Title: Geologist | Title: Geologist

Signature: [signature] Date: 8/26/08 | Signature: [signature] Date: 10/3/08

A-6003-642 (03/03)

WELL SUMMARY SHEET

Start Date: 09/09/2008
Finish Date: 10/02/2008
Page 1 of 2

Well ID: C6826	Well Name: 299-E26-79
Location: Inside fence, LERF, 200E	Project: M-24 RCRA Wells (LERF)
Prepared By: S. Sexton — Date: 10/6/08	Reviewed By: L.D. Walker — Date: 10/13/08
Signature: [signature]	Signature: [signature]

CONSTRUCTION DATA

Description:

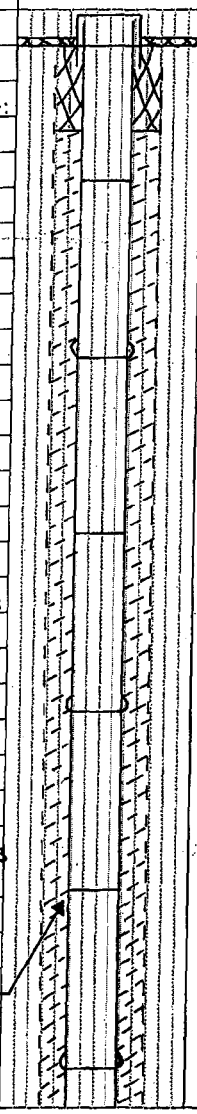
6" x 4' x 4' concrete pad
6" stainless steel protective monument: 3.0' bgs to 3.1' ags

4" stainless steel Sch. 10 casing: 2.3 ft ags to 195.2 ft bgs
4" stainless steel wire wrap screen, 0.020": 195.2 to 220.2' bgs
4" stainless steel Sch. 10 sump: 220.2 to 223.2 ft bgs

Portland cement grout: 0 to 10.3 ft bgs
Bentonite granules: 10.3 to 183.0 ft bgs
Bentonite pellets: 183.0 to 187.8 ft bgs
10-20 silica sand: 187.8 to 224.76 ft bgs

Casing Joint

Diagram:



GEOLOGIC/HYDROLOGIC DATA

Depth in Feet: 0, 20, 40, 60, 80, 100

Graphic Log:

Lithologic Description:

0-1: gravel drill pad
1-27: sandy silty Gravel (smG)
27-27.5: sandy Silt (SM)
27.5-29: silty Gravel (mG)
29-32: sandy Silt (SM)
32-54: silty Sand (mS)
54-79: silty sandy Gravel (msG)
79-119: sandy silty Gravel (smG)

A-6003-643 (03/03)

WELL SUMMARY SHEET	Start Date: 09/09/2008 Finish Date: 10/02/2008	Page 2 of 2

Well ID: C6826		Well Name: 299-E26-79	
Location: Inside fence, LERF 200E		Project: M-24 RCRA Wells (LERF)	
Prepared By: S. Sexton	Date: 10/6/08	Reviewed By: L. D. Walker	Date: 10/13/08
Signature:		Signature:	

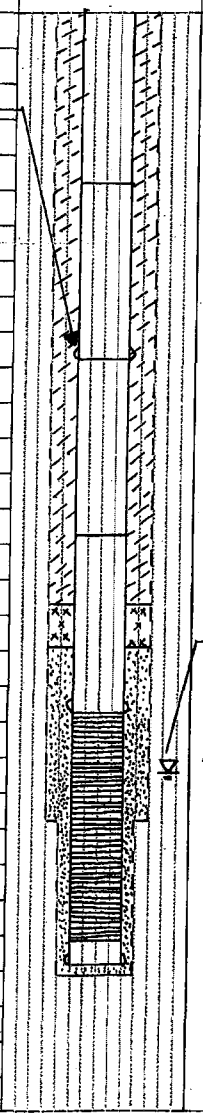
CONSTRUCTION DATA

Description

centralizer

All temporary casing removed from borehole

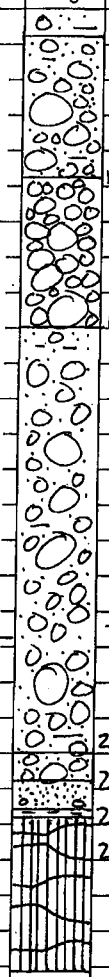
Diagram



GEOLOGIC/HYDROLOGIC DATA

Depth in Feet: 120, 140, 160, 180, 200, 220

Graphic Log



Lithologic Description

119-135: silty sandy Gravel (msG)

135-152: Gravel (G)

152-200: silty sandy Gravel

DTW = 201.7 ft bgs on 09/22/2008

200-203: sandy Gravel (sG)

203-206: gravelly Sand (gS)

206-207: modified clay

207-224.76: basalt

TD = 224.76 ft bgs on 09/23/2008

All depths recorded in feet "below ground surface" (bgs)

A-6003-643 (03/03)

BOREHOLE LOG

Page 1 of 6

Start: 9/9/08
Date: Finish: 9/10/08

Well ID: C68226 | Well Name: 299-E26-79 | Location: Inside fence, S. of Ponds

Project: M-24 RCRA Wells (LERF) | 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					Cable Tool - 9 5/8"
				0-1: gravel drill pad	casing, 8" core barrel
				1-27: sandy silty Gravel (SmG): gravel 50% silt 40% sand 10%; gravels mostly mafic, sub-rnd >6" diameter, some felsic material; sand fine, sub-ang, mostly qtz; grayish-brown (10YR 5/2), strong rxn HCl, dry	add 2 gals water to keep soils consolidated;
5	G.S.				archive g.s. @ 5'
					add 2 gals water
					change to 7" db @ 6'
10	G.S.			↳ lg. grite cobbles to boulders @ 11 ft	6' Sns 9-9-08
					archive g.s. @ 10'
				↳ cementation at 20', clast size smaller to ~4-5" more cobbles than boulders	
15	G.S.			→ well cemented at 25', still a strong rxn HCl; lithics down to 3" diameter 50/50 mafic/felsic	archive g.s. @ 15
				27-27.5: Sandy Silt (SM): silt + sand grade crs to fine; silt 80% sand 20% brown (10YR 4/3) slt rxn HCl	
20	G.S.				archive g.s. @ 20'
					add 5 gal water
				27.5-29: silty Gravel (mG): gravel 60% silt 40%, some med to fine sand grains; gravel 50/50 Mafic/Felsic, sub-rnd to 3" grayish-brown (10YR 5/2);	
25	G.S.				archive g.s. @ 25'
	G.S.				archive g.s. 27'
				29-32: sandy Silt (SM): crse to fine sand grades fine to crse	
30	G.S.				archive g.s. 30'
	G.S.			29-29.5' more sand 75% at 29.5 → 6" silty sand yellowish brown (10YR 5/6) 29.5-30", then back to sandy silt.	archive g.s. 32'
					add 3 gal water
35	G.S.			32-39: silty Sand (mS): sand med-crse, loose, slt rxn HCl, grayish-brown (10YR 5/2); mostly felsic, some small pebbles; cemented @ 35'	
					archive g.s. 35

Reported By: S. Sexton | Reviewed By: L.D. Walker

Title: Geologist | Title: Geologist

Signature: [signature] Date: 9/10/08 | Signature: [signature] Date: 10/13/08

A-6003-642 (03/03)

BOREHOLE LOG

Page 2 of 6

Date: Start: 9/10/08 Finish: 9/11/08

Well ID: C6826	Well Name: 299-E26-79	Location: Inside fence, S. of LERF ponds	
Project: LERF RCRA Wells		Reference Measuring Point: Ground Surface	

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
40	G.S.				See pg. 1
				39-54: silty Sand (mS): sand Med-crse, 50%; silt 50%; some small pebbles; sands mostly felsic sub-angular, moderately cemented slt rxn HCl; grayish-brown (10YR 5/2) dry	archive g.s. 40'
					add 3 gal water
45	G.S.				archive g.s. 45'
				→ inc rxn HCl: moderate	
				→ dec sand size, fine, 51.5'	
				→ increase gravel % ~10% at 52.5'	
50	G.S.				archive g.s. 50'
				54-79: silty sandy Gravel (msG): gravel 40, sand 35, silt 25; gravel 50/50 felsic/mafic sub-rnd to sub-ang, 3" diam max; sand fin to med, sub-ang mostly felsic, grayish-brown (10YR 5/2), dry; mod. rxn HCl, poorly sorted	
	G.S.				archive g.s. 54'
55					add 2 gals water
					drilling slows @ 55'
				→ 55': slow drilling, possible inc in gravel size + %	
60	G.S.			→ gravel 60% silt 30% sand 10% @ 60'	archive g.s. 60'
				→ samples at 65' wet due to added water	
				→ moderately cemented 65'	
65	G.S.				add 2 gal. water
					archive g.s. 65'
70	G.S.				archive g.s. 70' wet due to added water
75	G.S.				add 2 gal water
					archive g.s. 75'

Reported By: S. Sexton		Reviewed By: L.D. Walker	
Title: Geologist		Title: Geologist	
Signature: [signature]	Date: 9/11/08	Signature: [signature]	Date: 10/13/08

A-6003-642 (03/03)

BOREHOLE LOG

Page 3 of 6
Start: 9/11/08
Date: Finish:

Well ID: C608266 | Well Name: 299-E26-79 | Location: Inside fence, S. of LERF ponds

Project: LERF RCRA Wells | Reference Measuring Point: Ground Surface

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
80	G.S.				See pg. 1 7" dlb
				79-119: sandy silty Gravel (sub-b): gravel 60% silt 30% sand 10%; gravel mostly mafic (60%) sub-rnd to sub-ang up to 4"; cemented; sands fine grained, mostly felsic; grayish-brown (10YR 5/2), dry, slt rxn HCl	archive g.s. 80'
					add 3 gals water
85	G.S.				archive g.s. 85'
				→ inc sand %, decrease silt, still 60% gravel, 30% sand, 10% silt, addition of water washing out some fines;	
90	G.S.				archive g.s. 90
				→ inc clast size 5"+ @ 94'; → soils remain mod. cemented, matrix supported throug 96'; → less consolidation, less silt, smaller gravels @ 100'	
95	G.S.			→ 110: very slight rxn HCl	archive g.s. 95'
					add 2 gal water
100	G.S.				archive g.s. 100'
105	G.S.				
110	G.S.				
115	G.S.				add 3 gals water; archive g.s. 115' wet

Reported By: S. Sexton | Reviewed By: L.D. Walker
Title: Geologist | Title: Geologist
Signature: [signature] Date: 9/15/08 | Signature: [signature] Date: 10/15/08

A-6003-642 (03/03)

BOREHOLE LOG

Page 4 of 6
Start: 9/15/08
Date: Finish: 9/17/08

Well ID: C.68226 | Well Name: 299-E26-79 | Location: Inside fence, S. of LERF ponds

Project: LERF RCRA Wells | Reference Measuring Point: Ground Surface

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
120	G.S.				See pg. 1
				119 - 135: silty sandy (gravel (ms(g)): gravel 60% sand 30% silt 10%; gravel mostly mafic (60%) sub-rnd to sub-ang up to 6"; sands fine-grained mostly felsic; grayish-brown (10YR 5/2) dry, slt rxn HCl	hard tooling from 117.5' bgs, using 7" clb to clean out
125	G.S.				archive g.s. 120'
				→135: gravels sub-ang to ang. + dec. sand/silt %: gravel 80%	archive g.s. 125 add 5 gal water
130	G.S.			135-152: (gravel ((g)): gravels 80% sand/silt 20%; sub-ang to angular mostly mafic (75%) up to 8"; slight rxn HCl, slight cementation →140: Samples wet due to added water	archive g.s. 130'
135	G.S.				archive g.s. 135'
				152-159: silty sandy (gravel(ms(g)): gravel 65% sand 25% silt 10%+; gravel mostly mafic, sub-rnd to sub-ang, 4" diam max; sand mostly felsic; no rxn HCl, wet from added water; moderate cementation	add 1gal water
140	G.S.				archive g.s. 140
145	G.S.				add 1gal water archive g.s. 145'
150	G.S.				add 1gal water archive g.s. 150
					poor returns 155-160
155	G.S.				add 2.5 gals water

Reported By: S. Sexton | Reviewed By: L.D. Walker
Title: Geologist | Title: Geologist
Signature: [signature] Date: 9/17/08 | Signature: [signature] Date: 10/13/08

A-6003-642 (03/03)

BOREHOLE LOG

Page 5 of 6
Start: 9/19/08 Date: Finish: 9/22/08

Well ID: C68260 | Well Name: 299-E26-79 | Location: Inside fence, S. of LERF ponds

Project: LERF RCRA Wells | Reference Measuring Point: Ground Surface

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
160	G.S.				Cable tool, 7" db
				159-200: silty sandy Gravel (msG):	
				gravel 70% sand 20% silt 10%;	archive g.s. 160
				gravel mostly mafic, sub-rnd, 4"-6"	
				max; sand mostly felsic, sub-angular	
165				dry, no rxn HCl, slight cementation;	no archive g.s. @
				grayish-brown (10YR 5/3)	165 due to disturbance
				→ inc silt % 30%: gravels 60%	of samples by over-
	G.S.			silt 30% sand 10%, smaller gravel	driving db
				sizes 4" max: 163'	archive g.s. 168'
				→ cementation increases 168'	
170	G.S.			→ ~~cementation~~ 9/19/08 gravels 1-2" 186'	archive g.s. 171
				very slight rxn HCl	
					add 2 gal water
	G.S.				
175					archive g.s. 174'
					add 3 gal water
180	G.S.				archive g.s. 180'
					add 1 gal water
185	G.S.				archive g.s. 186
					add 1 gal water
190	G.S.				archive g.s. 190'
					add 1 gal water
195	G.S.				
					add 1 gal water
					add 2 gal water

Reported By: S. Sexton | Reviewed By: L.D. Walker
Title: Geologist | Title: Geologist
Signature: [signature] Date: 9/22/08 | Signature: [signature] Date: 10/13/08

A-6003-642 (03/03)

BOREHOLE LOG

Page 6 of 6
Start: 9/22/08
Date: Finish: 9/23/08

Well ID: C 68226 | Well Name: 299-E26-79 | Location: Inside fence, S. of LERF ponds

Project: LERF RCRA Wells | Reference Measuring Point: Ground Surface

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
200	G.S.				See pg. 1
				200 – 203: sandy (gravel (SG):	
				gravel 60% sand 40%; gravels	archive g.s. 200'
				sub-rnd, mostly mafic (70%)	DTW = 201.7' on
				w/ larger felsic cobbles up to	09/22/2008
205	G.S.	W.S.		4"; sand med to crse 50/50	archive g.s. @ 205'
	G.S.			mafic/felsic sub-angular; some	archive g.s. @ 206'
	G.S.			silt in formation < 10%, bore-	
				hole producing small amt water;	change to rotary
				color: brown 10YR 4/3, wet	drilling w/ downhole
210	G.S.				hammer @ 207' bgs
				203 – 206: gravelly Sand (gS):	
				same lithology as above,	archive g.s. 207
				sand % 70% gravel 30%;	archive g.s. 210
215				206 – 207: highly modified clay,	
				2.5YR 3/3 dark reddish brown,	
	G.S.			with spots of yellow; some rock	
				inclusions, no rxn HCl, brittle	archive g.s. 217.5
220				207 – 225: basalt: flow top	
				basalt fractured w/ vesicles	
		W.S.		up to 1mm + weathering on the	
				surface	
				→ 217.5: basalt drilling harder	
225	G.S.			out of top flow portion and	
				into main body of basalt	archive g.s. 225' bgs
230				TD = 224.2' bgs	
				224.76' LW 10/13/08	
				on 09/23/2008	
235					

Reported By: S. Sexton | Reviewed By: L.D. Walker

Title: Geologist | Title: Geologist

Signature: [signature] Date: 9/23/08 | Signature: [signature] Date: 10/13/08

A-6003-642 (03/03)

APPENDIX B

GEOPHYSICAL LOGGING

This page intentionally left blank.

Stoller
Hanford Office

established 1959

HGLP-LDR-292, Rev. 0

299-E26-79 (C6826)
Log Data Report

Borehole Information:

Borehole:	299-E26-79 (C6826)		Site:	Near LERF	
Coordinates (WA St Plane)		GWL[1] (ft):	198.95	GWL Date:	09/24/08
North (m)	East (m)	Drill Date	TOC[2] Elevation	Total Depth (ft)	Type
Unknown	Unknown	09/08	Unknown	224.0	Cable/rotary

Casing Information:

Casing Type	Stickup (ft)	Outer Diameter (in.)	Inside Diameter (in.)	Thickness (in.)	Top (ft)	Bottom (ft)
Threaded Steel	-0.85	9 5/8	8 1/2	9/16	-0.85	206

Borehole Notes:

Cable tool drilling stopped at the basalt contact. Drilling was continued with rotary drilling with open hole to total depth. Logging was terminated at 3 ft below the bottom of the casing at 209 ft. A logging engineer measured the casing diameter, rounding to the nearest 1/16-in. Zero reference for logging measurements is the ground surface.

Logging Equipment Information:

Logging System:	Gamma 4L		Type: Serial No.:	60% HPGe 47TP32211A
Effective Calibration Date:	12/31/07	Calibration Reference:	HGLP-CC-027	
		Logging Procedure:	HGLP-MAN-002, Rev. 0	

Logging System:	Gamma 411		Type: Serial No.:	NMLS H310700352
Effective Calibration Date:	11/06/07	Calibration Reference:	HGLP-CC-021	
		Logging Procedure:	HGLP-MAN-002, Rev. 0	

Spectral Gamma Logging System (SGLS) Log Run Information:

Log Run	1	2	3 Repeat
Date	09/24/08	09/25/08	09/25/08
Logging Engineer	Spatz	Spatz	Spatz
Start Depth (ft)	0.0	104.0	152.0
Finish Depth (ft)	105.0	209.0	173.0
Count Time (sec)	100	100	100
Live/Real	R	R	R
Shield (Y/N)	N	N	N
MSA Interval (ft)	1.0	1.0	1.0
Log Speed (ft/min)	N/A	N/A	N/A
Pre-Verification	DL721CAB	DL731CAB	DL731CAB
Start File	DL721000	DL731000	DL731106
Finish File	DL721105	DL731105	DL731127
Post-Verification	DL721CAA	DL731CAA	DL731CAA
Depth Return Error (in.)	0	N/A	+ 2
Comments	No fine gain adjustment made	No fine gain adjustment made	No fine gain adjustment made

Stoller
Hanford Office

established 1959

HGLP-LDR-292, Rev. 0

Neutron Moisture Logging System (NMLS) Log Run Information:

Log Run	4	5 Repeat
Date	09/25/08	09/25/08
Logging Engineer	Spatz	Spatz
Start Depth (ft)	0.0	152.0
Finish Depth (ft)	199.0	173.0
Count Time (sec)	15	15
Live/Real	R	R
Shield (Y/N)	N	N
MSA Interval (ft)	0.25	0.25
Log Speed (ft/min)	N/A	N/A
Pre-Verification	DHH62CAB	DHH62CAB
Start File	DHH62000	DHH62797
Finish File	DHH62796	DHH62881
Post-Verification	DHH62CAA	DHH62CAA
Depth Return Error (in.)	N/A	+ 1.5
Comments	None	None

Logging Operation Notes:

Logging was terminated at 3 ft below the bottom of the casing at 209 ft. A centralizer was installed on the sondes.

Analysis Notes:

Analyst:	Henwood	Date:	12/09/08	Reference:	GJO-HGLP 1.6.3, Rev. 0

Pre-run and post-run verifications for the logging systems were performed. The acceptance criteria were met.

A casing correction for a 9/16-in.-thick steel casing was applied to the SGLS data from the ground surface to 206 ft; no correction was applied from 206 to 209 ft where it is presumed to be open hole without casing. No corrections are applied to the neutron moisture data that are reported in counts per second.

SGLS spectra were processed in batch mode using APTEC SUPERVISOR to identify individual energy peaks and determine count rates. Concentrations were calculated with an EXCEL worksheet template identified as G4LDec07.xls, using efficiency functions and corrections for casing, water, and dead time, as determined from annual calibrations. A correction for water inside the borehole was applied to data below 198.95 ft.

Results and Interpretations:

No manmade radionuclides were detected. A single detection of Cs-137 using the routine processing software was determined to be a statistical fluctuation and is not a valid energy peak.

All repeat data indicate good repeatability.

Stoller
Hanford Office

established 1959

HGLP-LDR-292, Rev. 0

List of Log Plots:

Depth Reference is ground surface

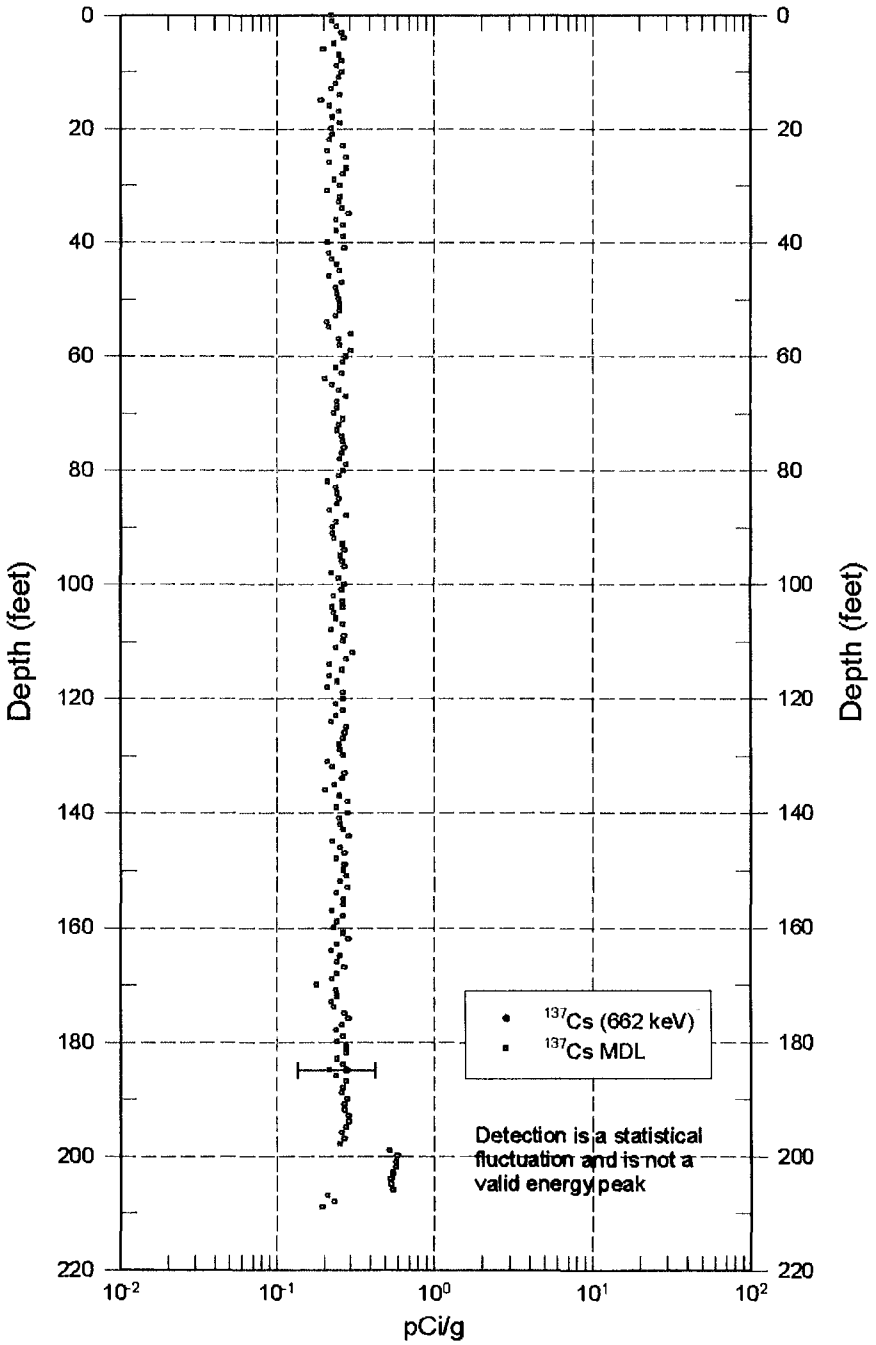
Manmade Radionuclides (0-220 ft)
Natural Gamma Logs (2 pages)
Combination Plot (2 pages)
Combination Plot (0-220 ft)
Total Gamma, Dead Time & Moisture (0-220 ft)
Repeat of Natural Gamma Logs
Moisture Repeat Section

---

[1] GWL groundwater level
[2] TOC top of casing

Stoller
Hanford Office

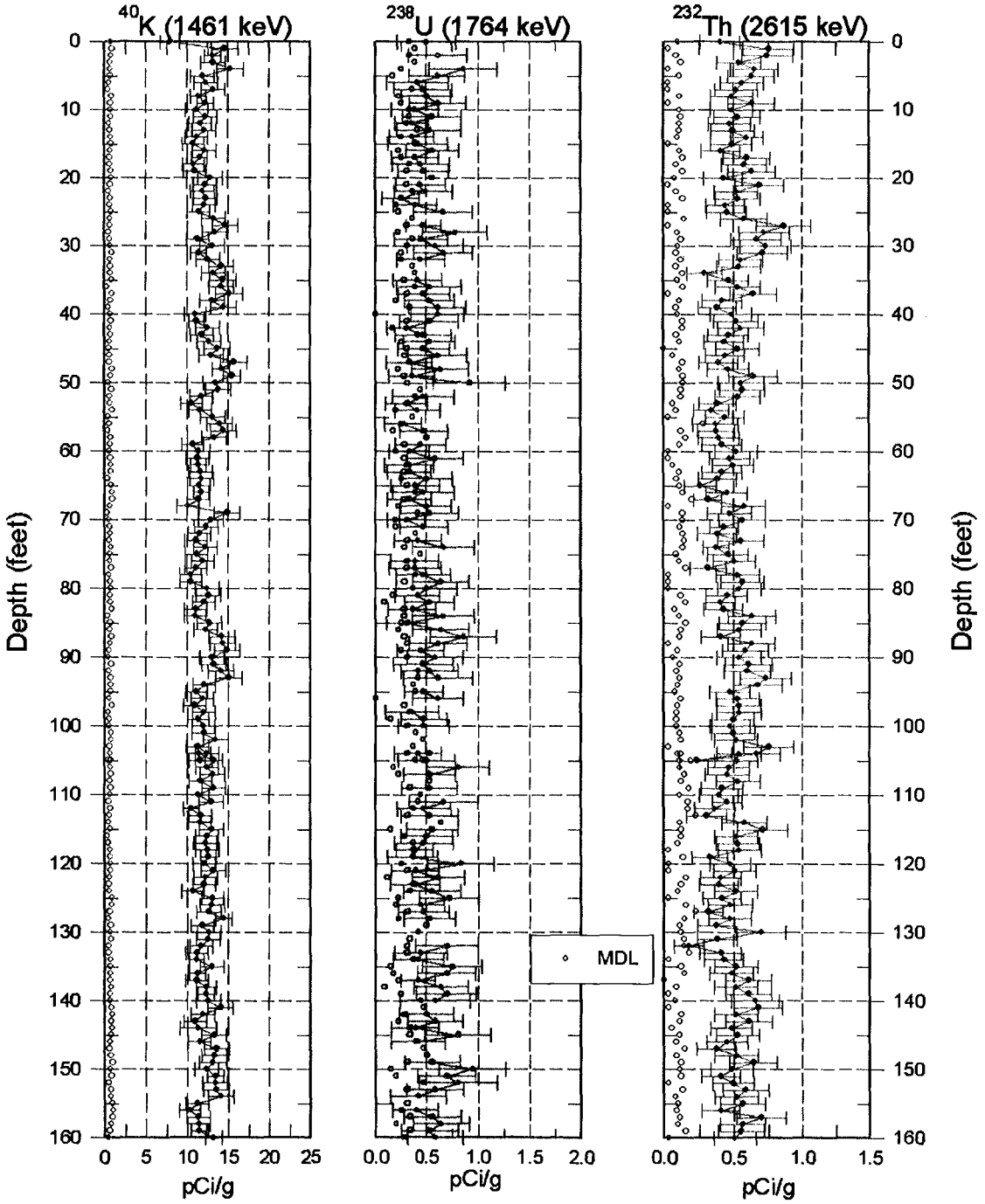
299-E26-79 (C6826)
Manmade Radionuclides



Zero Reference - Ground surface

Stoller
Hanford Office

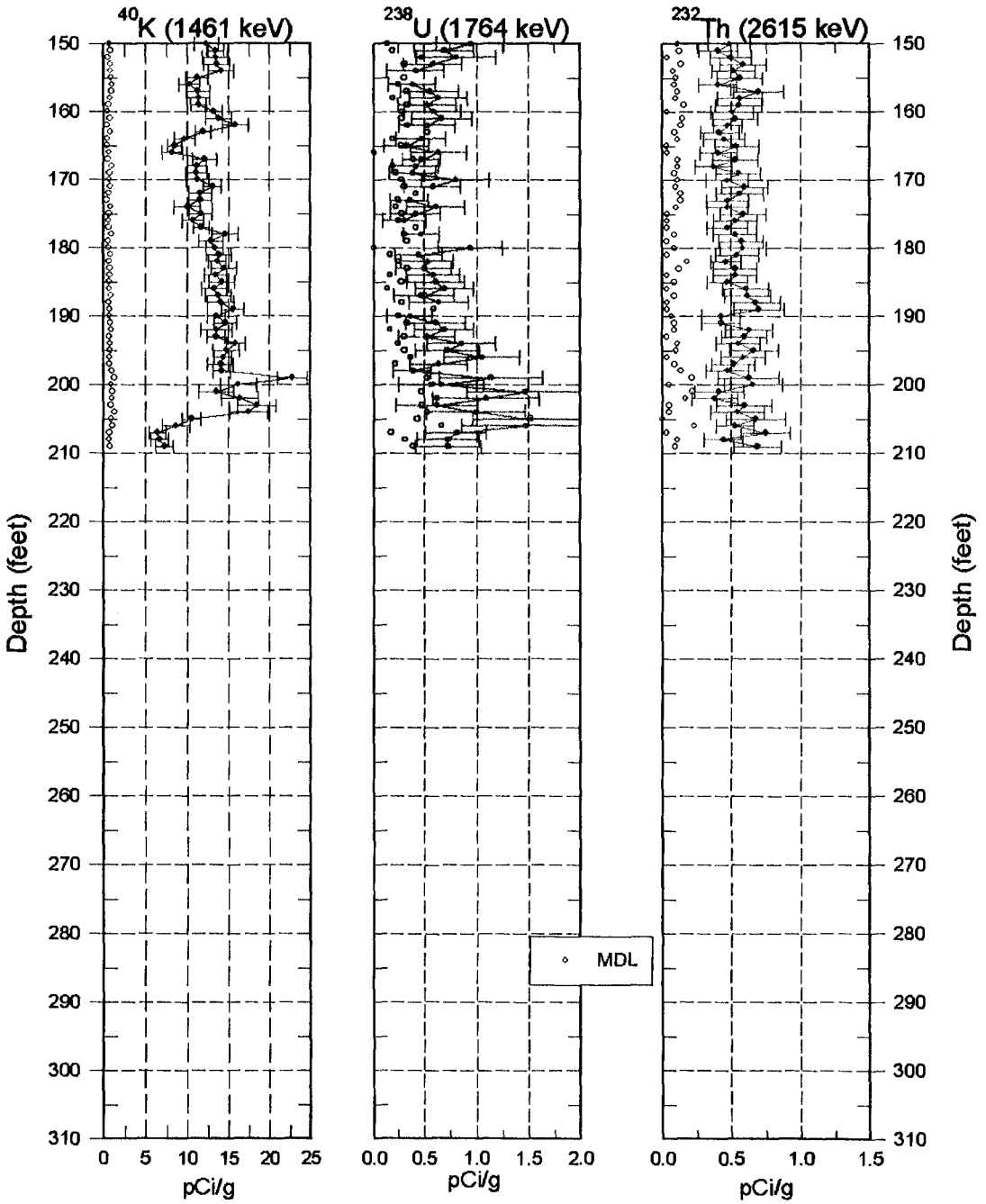
299-E26-79 (C6826)
Natural Gamma Logs



Zero Reference - Ground surface

Stoller
Hanford Office

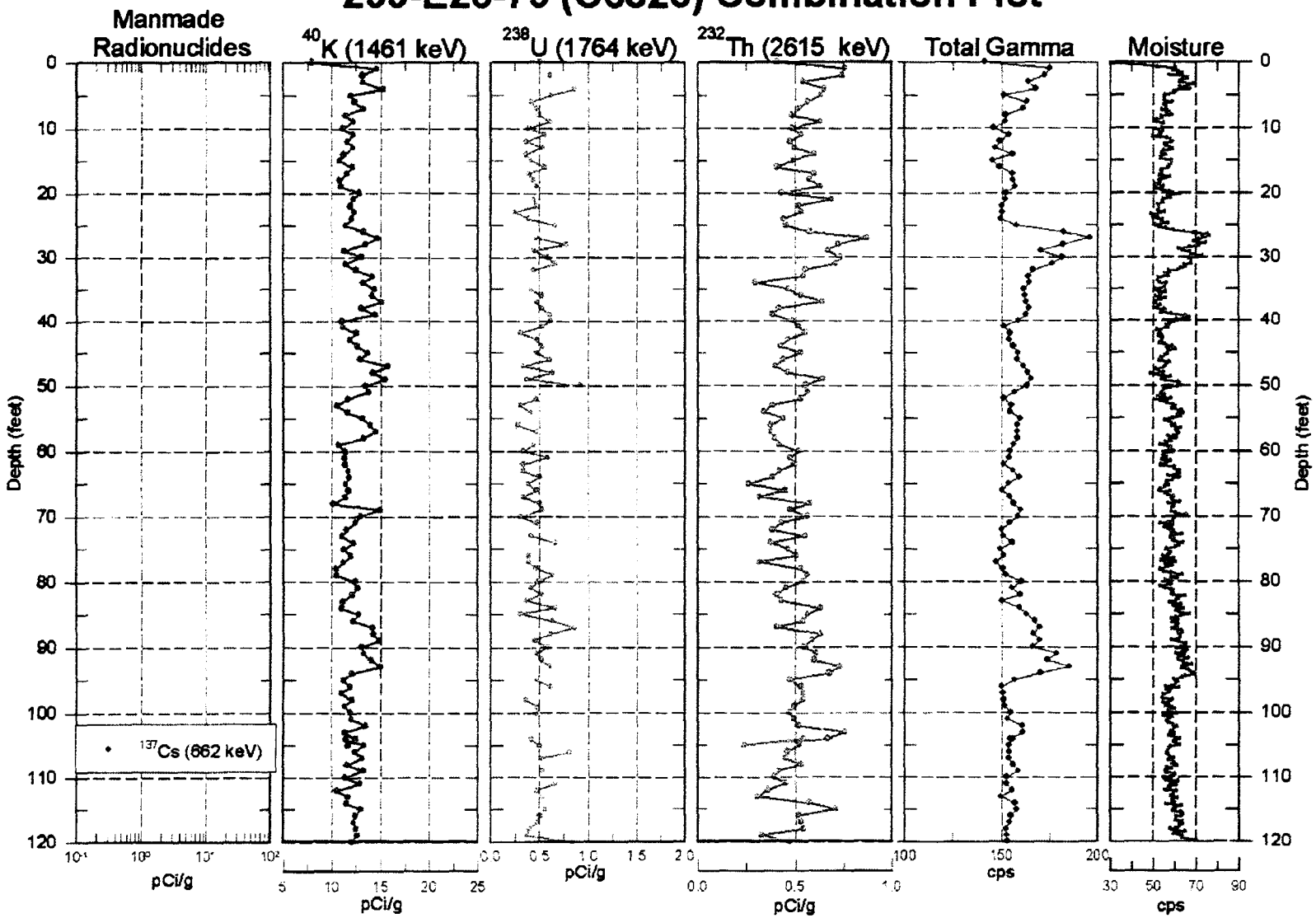
299-E26-79 (C6826)
Natural Gamma Logs



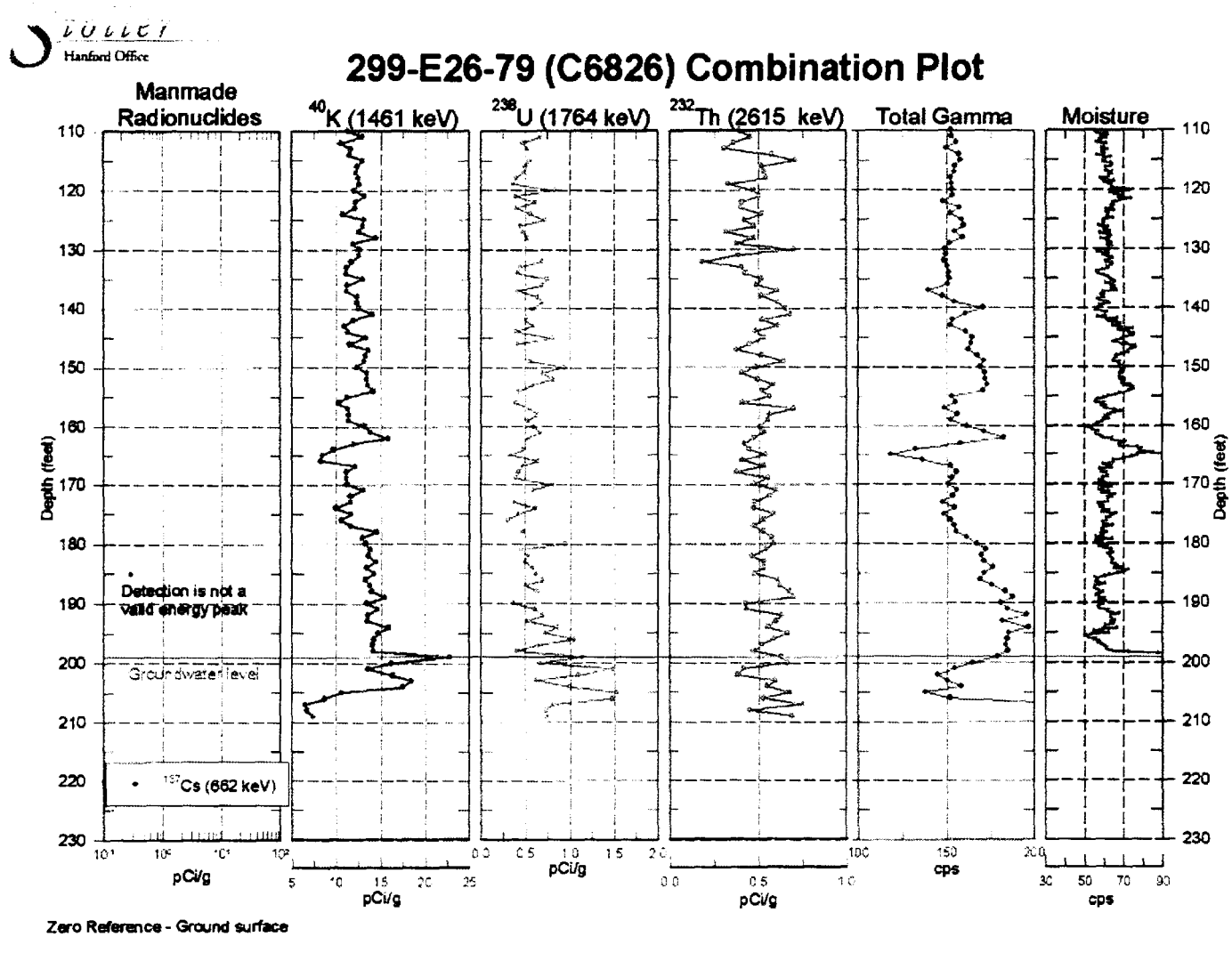
Zero Reference - Ground surface

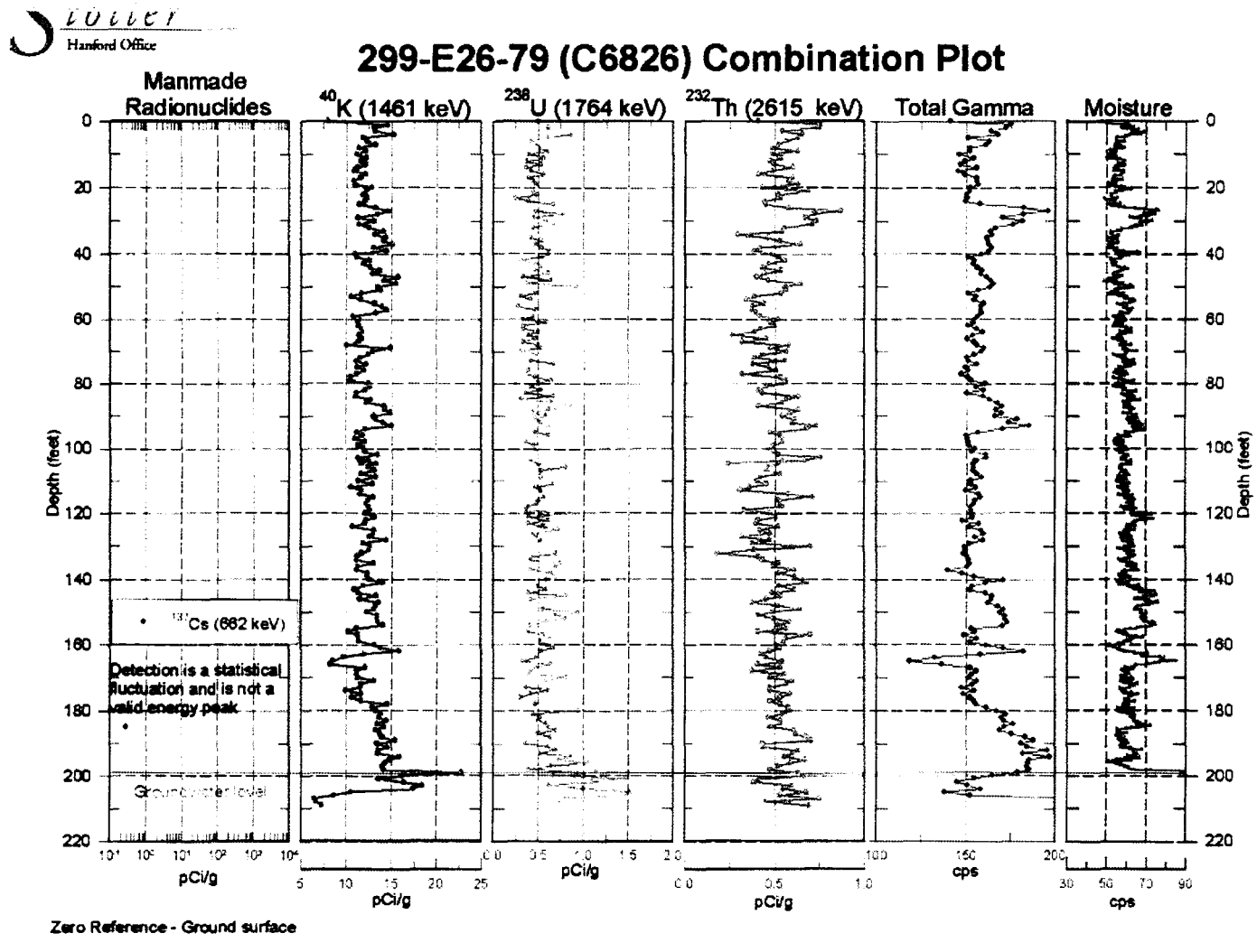
Stoller
Hanford Office

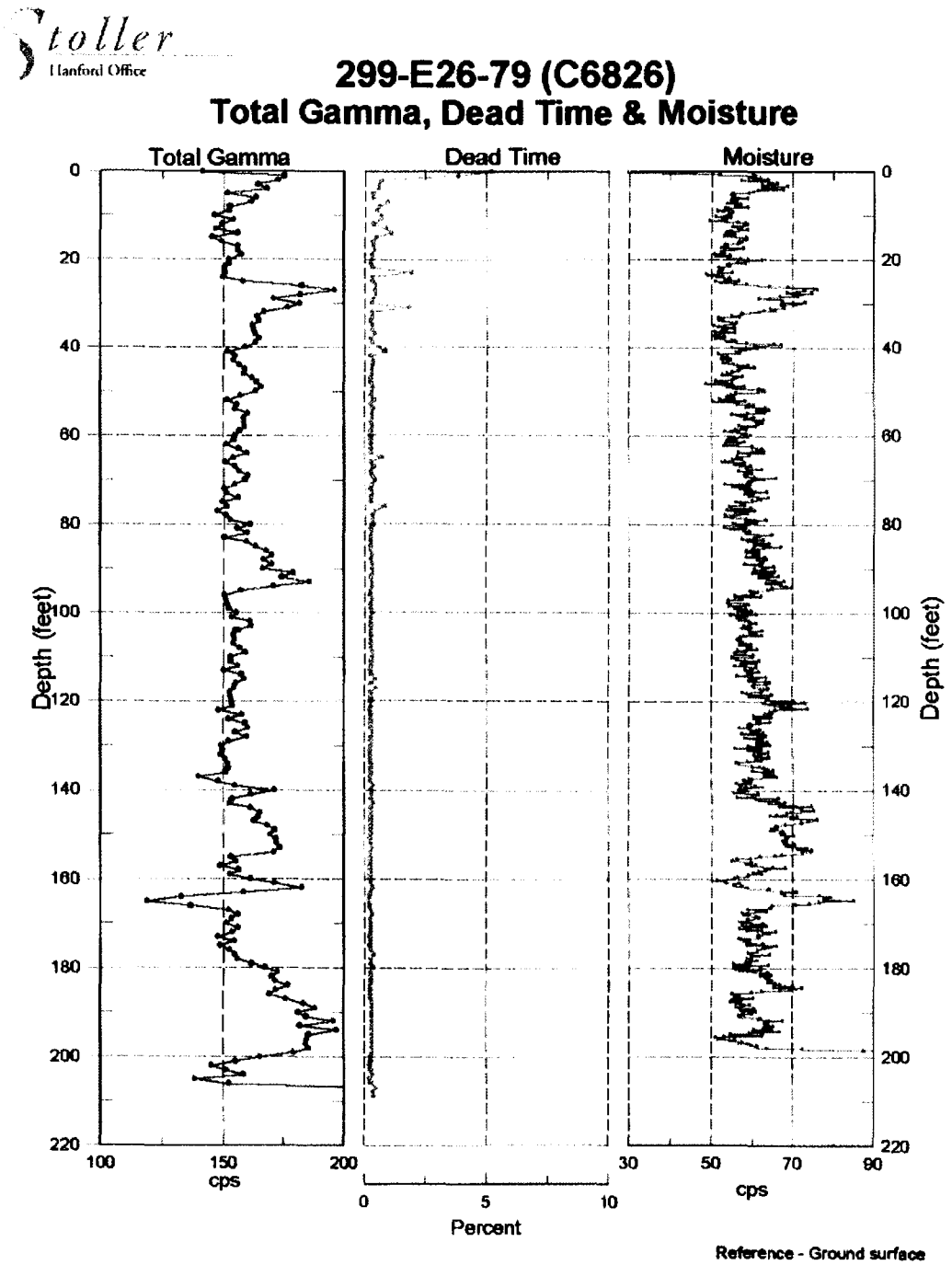
299-E26-79 (C6826) Combination Plot



Zero Reference - Ground surface

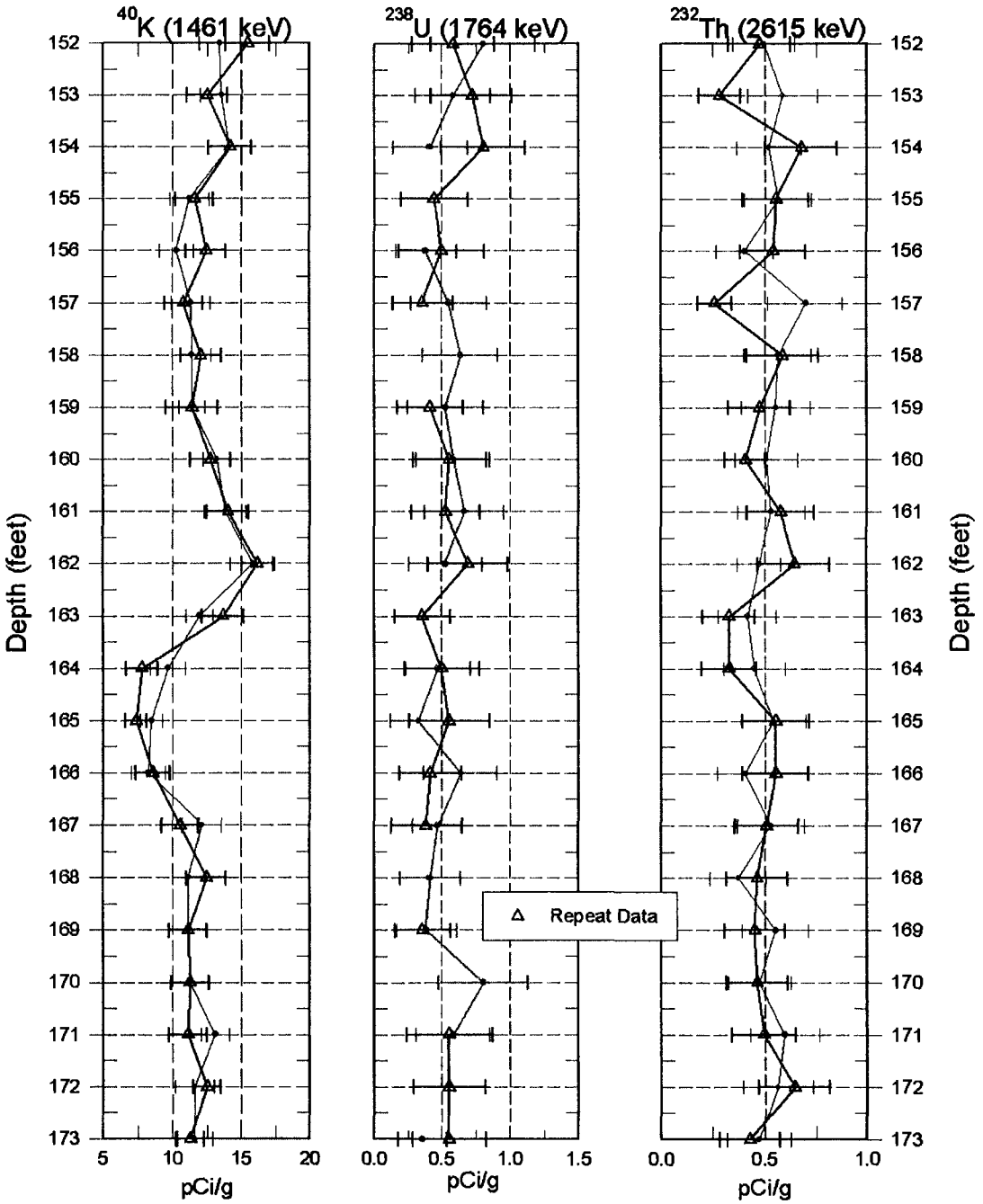

Hanford Office
299-E26-79 (C6826) Combination Plot
Manmade Radionuclides
40K (1461 keV)
238U (1764 keV)
232Th (2615 keV)
Total Gamma
Moisture
Depth (feet)
Detection is not a valid energy peak
Groundwater level
137Cs (662 keV)
pCi/g
cps
Zero Reference - Ground surface


Hanford Office
299-E26-79 (C6826) Combination Plot
Manmade Radionuclides
40K (1461 keV)
238U (1764 keV)
232Th (2615 keV)
Total Gamma
Moisture
Depth (feet)
137Cs (662 keV)
Detection is a statistical fluctuation and is not a valid energy peak
Groundwater level
pCi/g
cps
Zero Reference - Ground surface


Stoller
Hanford Office
299-E26-79 (C6826)
Total Gamma, Dead Time & Moisture
Total Gamma
Dead Time
Moisture
Depth (feet)
0
20
40
60
80
100
120
140
160
180
200
220
100
150
200
cps
0
5
10
Percent
30
50
70
90
cps
Reference - Ground surface

Stoller
Hanford Office

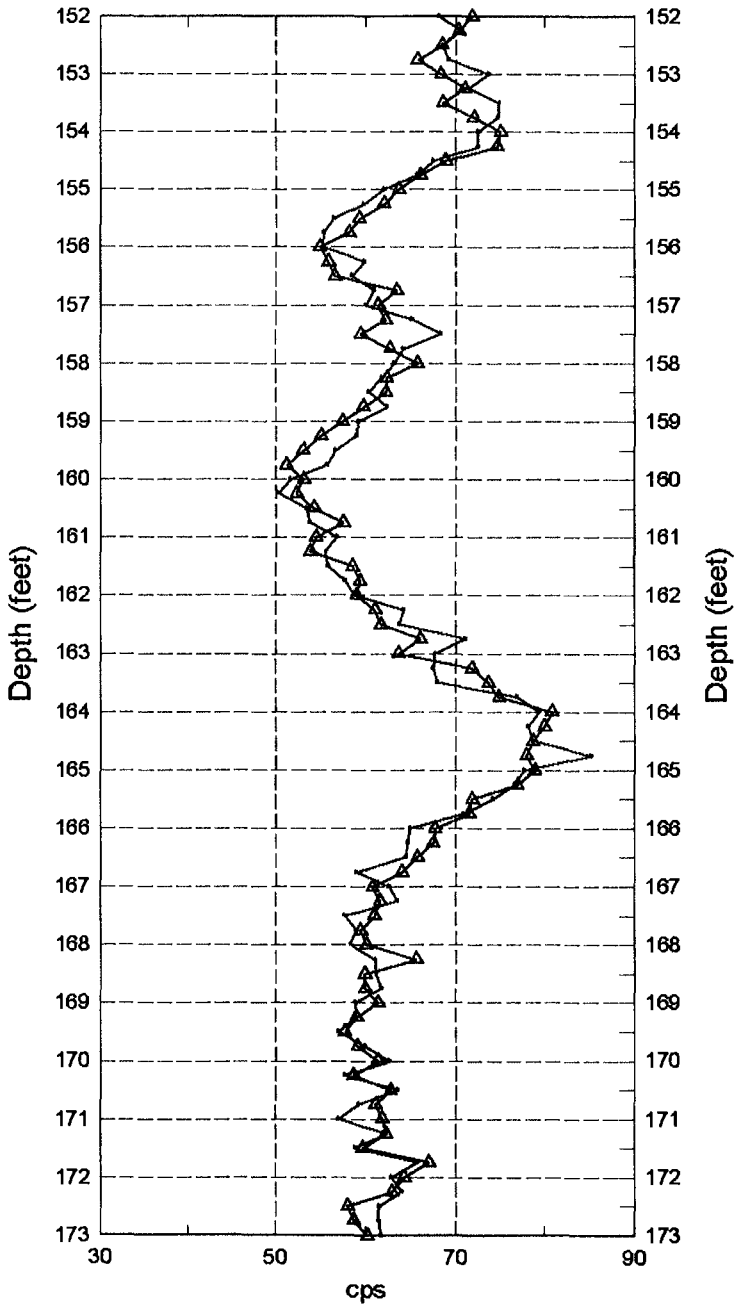
299-E26-79 (C6826)
Repeat of Natural Gamma Logs



Zero Reference - Ground surface

Stoller
Hanford Office

299-E26-79 (C6826)
Moisture Repeat Section



Reference - Ground surface

Stoller
Hanford Office

established 1959

HGLP-LDR-293, Rev. 0

299-E25-236 (C6542)
Log Data Report

Borehole Information:

Borehole:	299-E25-236 (C6542)		Site:	Near 241-A Farm	
Coordinates (WA St Plane)		GWL[1] (ft):	294.65	GWL Date:	09/12/08
North (m)	East (m)	Drill Date	TOC[2] Elevation	Total Depth (ft)	Type
Unknown	Unknown	09/08	Unknown	329.0	Cable Tool

Casing Information:

Casing Type	Stickup (ft)	Outer Diameter (in.)	Inside Diameter (in.)	Thickness (in.)	Top (ft)	Bottom (ft)
Threaded Steel	-0.6	11 3/4	10 3/4	1/2	- 0.6	140
Threaded Steel	-0.6	9 5/8	8 11/16	15/32	- 0.6	329

Borehole Notes:

A logging engineer measured casing diameters employing a caliper and steel tape and rounding to the nearest 1/16-in. The driller reported the casing depth. Zero reference for measurements is the ground surface.

Logging Equipment Information:

Logging System:	Gamma 1N		Type: Serial No.:	60% HPGe 45TP22010A
Effective Calibration Date:	03/28/08	Calibration Reference:	HGLP-CC-031	
		Logging Procedure:	HGLP-MAN-002, Rev. 0	

Logging System:	Gamma 4L		Type: Serial No.:	60% HPGe 47TP32211A
Effective Calibration Date:	12/31/07	Calibration Reference:	HGLP-CC-027	
		Logging Procedure:	HGLP-MAN-002, Rev. 0	

Logging System:	Gamma 1M		Type: Serial No.:	NMLS H340207279
Effective Calibration Date:	05/06/08	Calibration Reference:	HGLP-CC-032	
		Logging Procedure:	HGLP-MAN-002, Rev. 0	

Logging System:	Gamma 4H		Type: Serial No.:	NMLS H310700352
Effective Calibration Date:	11/06/07	Calibration Reference:	HGLP-CC-021	
		Logging Procedure:	HGLP-MAN-002, Rev. 0	

Spectral Gamma Logging System (SGLS) Log Run Information:

Log Run	4	5 Repeat	8	9 Repeat
Date	09/02/08	09/02/08	09/15/08	09/15/08
Logging Engineer	McClellan	McClellan	Spatz	Spatz
Start Depth (ft)	0.0	126.0	329.0	295.0
Finish Depth (ft)	139.0	139.0	137.0	276.0
Count Time (sec)	100	100	100	100
Live/Real	R	R	R	R
Shield (Y/N)	N	N	N	N

Stoller
Hanford Office
established 1959

HGLP-LDR-293, Rev. 0

Log Run	4	5 Repeat	8	9 Repeat
MSA Interval (ft)	1.0	1.0	1.0	1.0
Log Speed (ft/min)	N/A	N/A	N/A	N/A
Pre-Verification	AN111CAB	AN111CAB	DL711CAB	DL711CAB
Start File	AN111000	AN111140	DL711000	DL711193
Finish File	AN111139	AN111153	DL711192	DL711212
Post-Verification	AN111CAA	AN111CAA	DL711CAA	DL711CAA
Depth Return Error (in.)	N/A	0	N/A	+ 4.0
Comments	No fine gain adjustment made	No fine gain adjustment made	Fine gain adjustment made after files –004, –013, -042	No fine gain adjustment made

Neutron Moisture Logging System (NMLS) Log Run Information:

Log Run	1	2	3 Repeat	6	7 Repeat
Date	08/29/08	09/02/08	09/02/08	09/12/08	09/12/08
Logging Engineer	McClellan	McClellan	McClellan	Spatz	Spatz
Start Depth (ft)	0.0	79.0	126.0	137.0	276.0
Finish Depth (ft)	80.0	140.0	140.0	294.75	292.0
Count Time (sec)	15	15	15	15	15
Live/Real	R	R	R	R	R
Shield (Y/N)	N	N	N	N	N
MSA Interval (ft)	0.25	0.25	0.25	0.25	0.25
Log Speed (ft/min)	N/A	N/A	N/A	N/A	N/A
Pre-Verification	AM042CAB	AM043CAB	AM043CAB	DHH52CAB	DHH52CAB
Start File	AM042000	AM043000	AM043245	DHH52000	DHH52632
Finish File	AM042320	AM043244	AM043301	DHH52631	DHH52696
Post-Verification	AM042CAA	AM043CAA	AM043CAA	DHH52CAA	DHH52CAA
Depth Return Error (in.)	- 0.25	N/A	0	N/A	N/A
Comments	None	None	None	None	None

Logging Operation Notes:

Maximum logging depth was 329 ft before the SGLS sonde unweighted. A centralizer was installed on the sondes.

Analysis Notes:

Analyst:	Henwood	Date:	12/08/08	Reference:	GJO-HGLP 1.6.3, Rev. 0

Pre-run and post-run verifications for the logging systems were performed. The acceptance criteria were met.

A casing correction for a 1/2-in.-thick steel casing was applied to the SGLS data from the ground surface to 140 ft for SGLS log runs 4 and 5. For log runs 8 and 9 from 137 to 329 ft, a correction for a 15/32-in.-thick steel casing was applied.

SGLS spectra were processed in batch mode using APTEC SUPERVISOR to identify individual energy peaks and determine count rates. Concentrations were calculated with EXCEL worksheet templates identified as G1NMar08.xls and G4LDec07.xls, using efficiency functions and corrections for casing, water, and dead time, as determined from annual calibrations. A correction for water inside the borehole was applied to data below 294.65 ft.

Stoller
Hanford Office

established 1959

HGLP-LDR-293, Rev. 0

Results and Interpretations:

No manmade radionuclides were detected. Detections of Cs-137 using the routine processing software were determined to be statistical fluctuations and are not valid energy peaks.

All repeat data indicate good repeatability.

List of Log Plots:

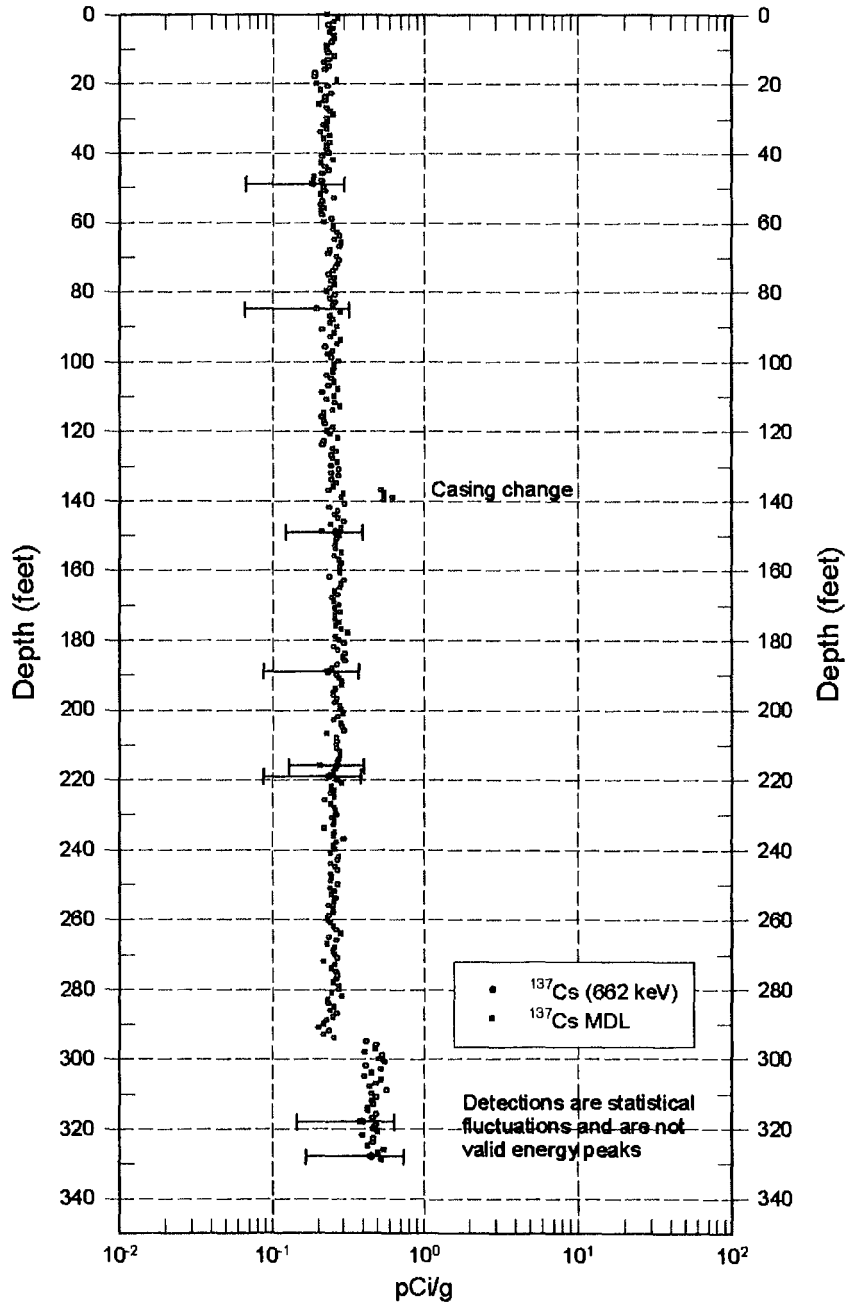
Depth Reference is ground surface

Manmade Radionuclides (0-350 ft)
Natural Gamma Logs (3 pages)
Combination Plot (3 pages)
Combination Plot (0-350 ft)
Total Gamma, Dead Time & Moisture (0-350 ft)
Repeat of Natural Gamma Logs (2 pages)
Moisture Repeat Sections

[1] GWL – groundwater level
[2] TOC – top of casing

Stoller
Hanford Office

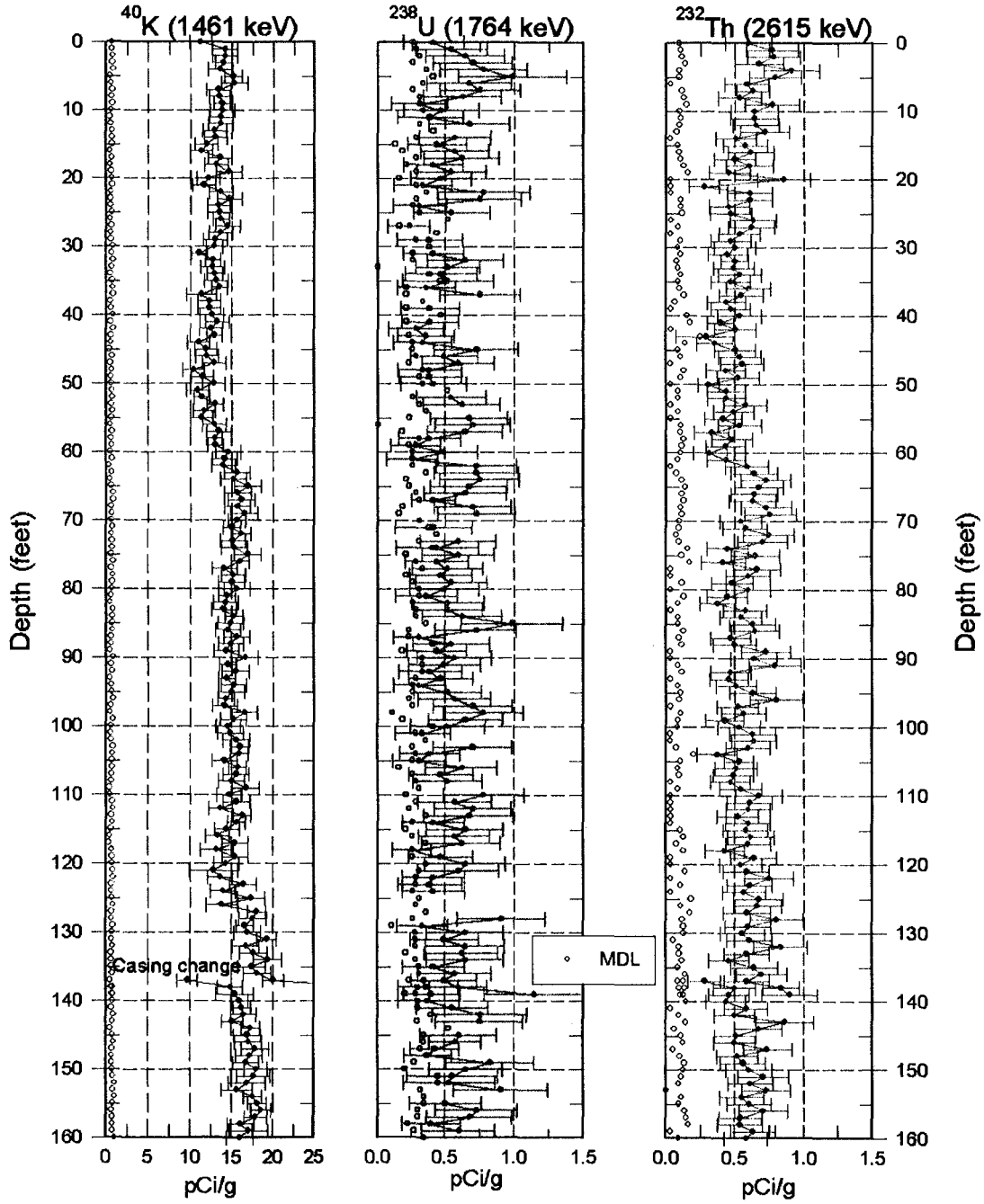
299-E25-236 (C6542)
Manmade Radionuclides



Zero Reference - Ground surface

Stoller
Hanford Office

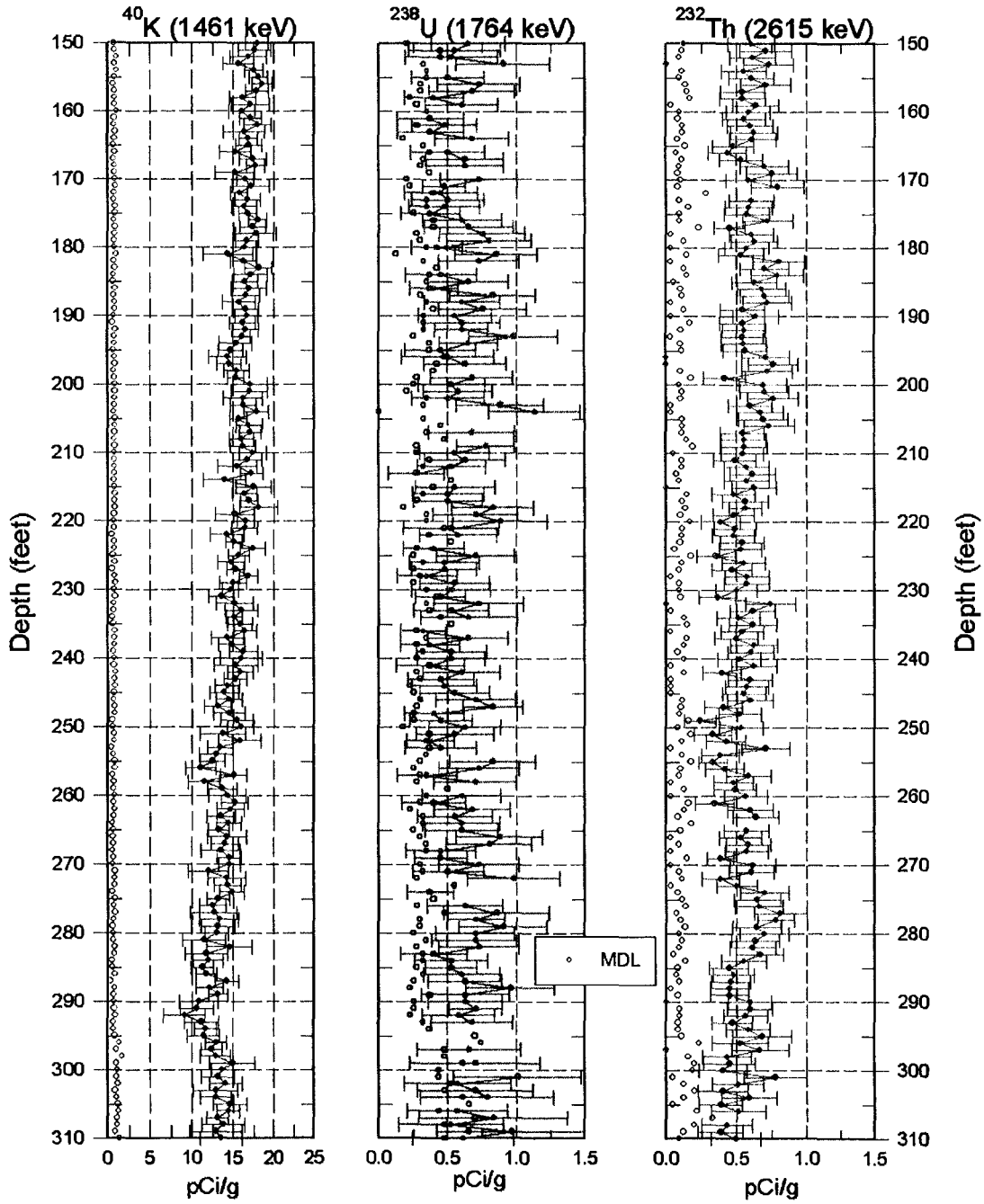
299-E25-236 (C6542)
Natural Gamma Logs



Zero Reference - Ground surface

Stoller
Hanford Office

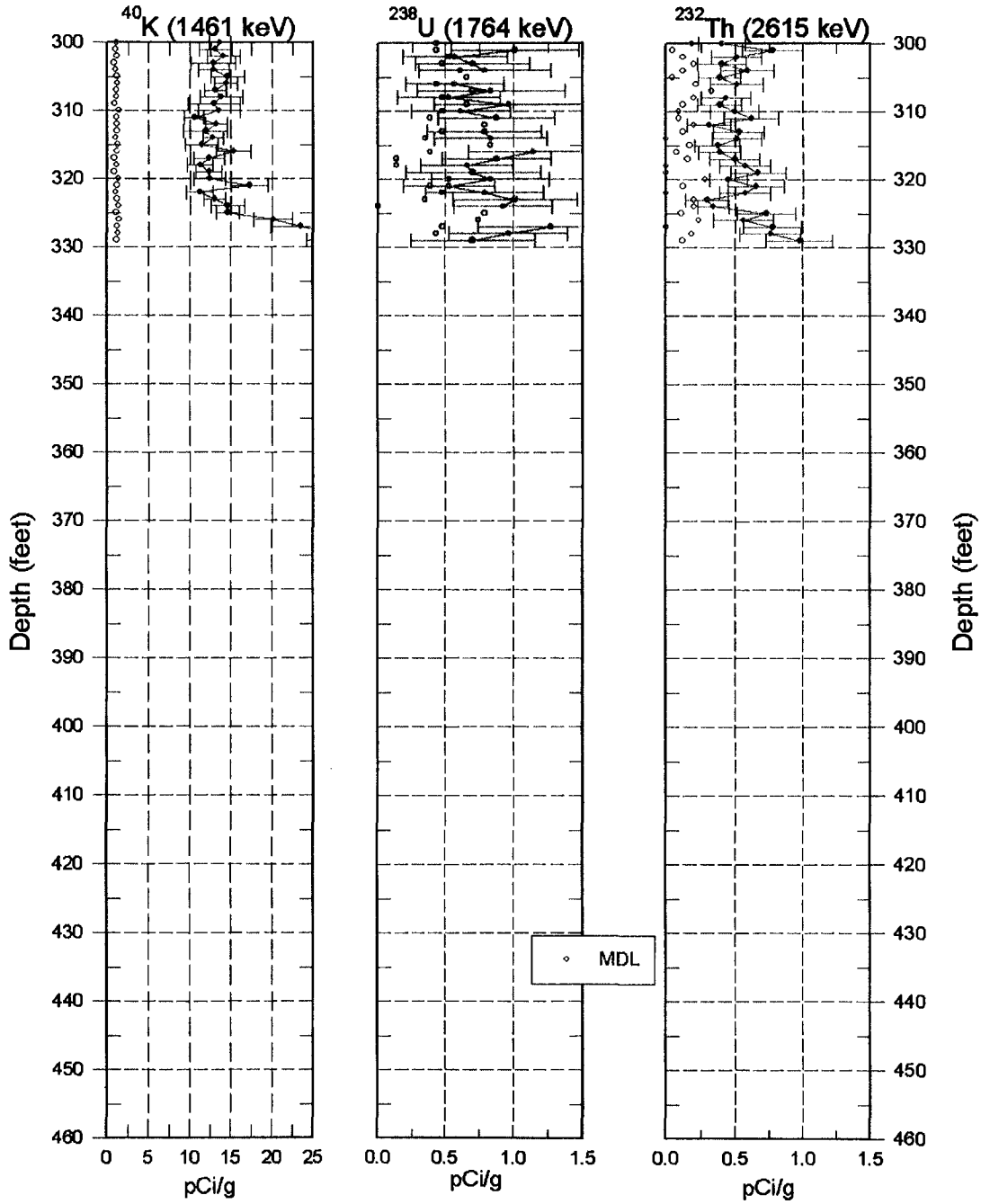
299-E25-236 (C6542)
Natural Gamma Logs



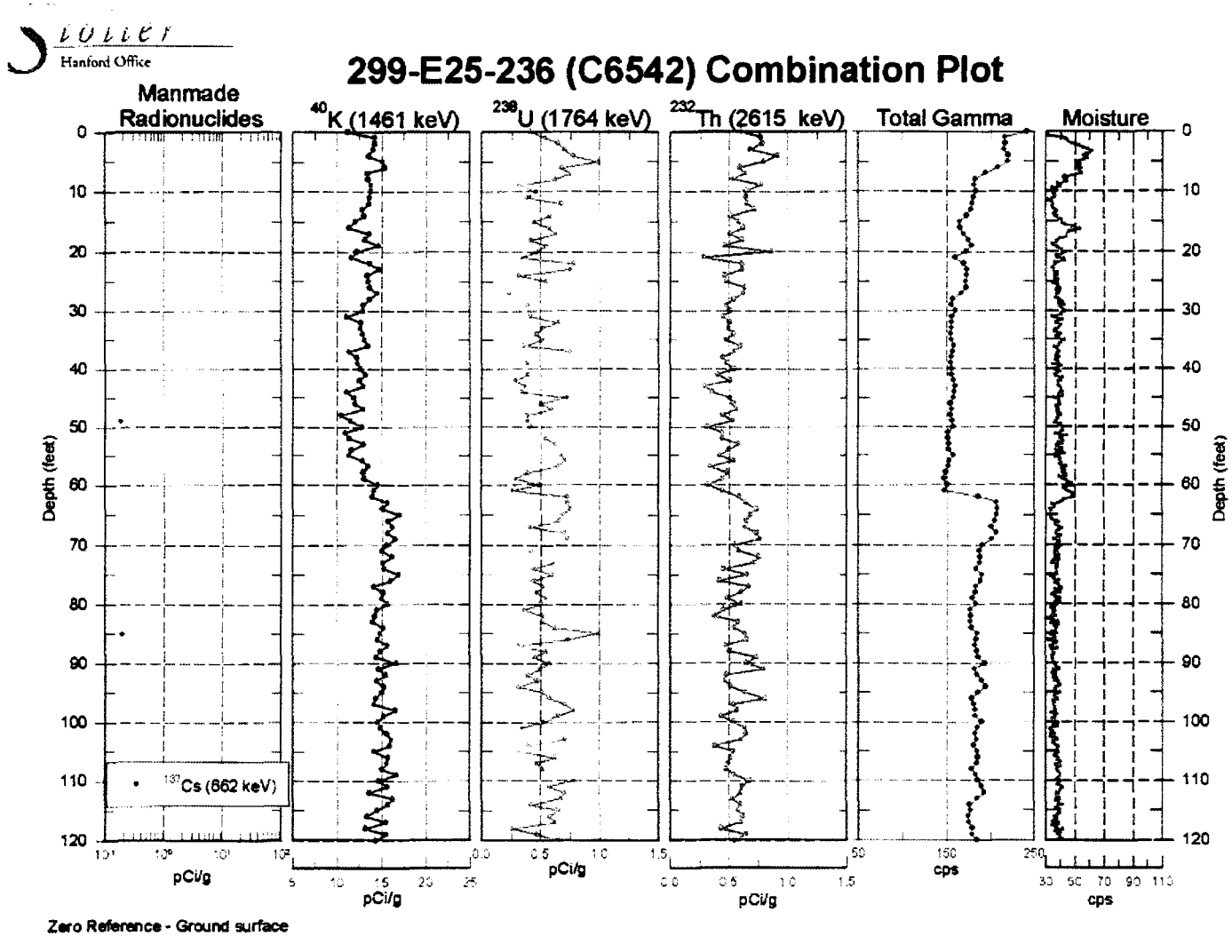
Zero Reference - Ground surface

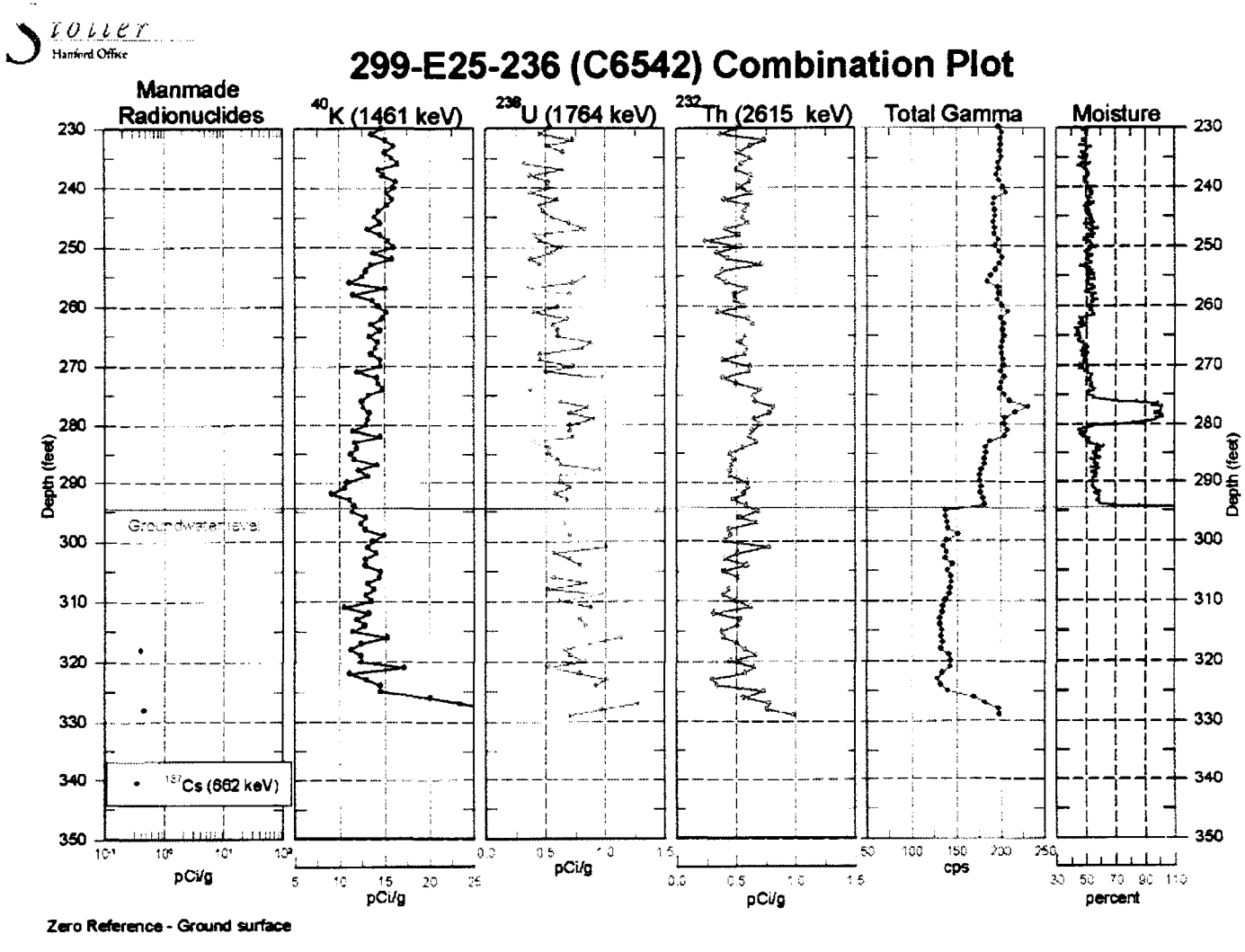
Stoller
Hanford Office

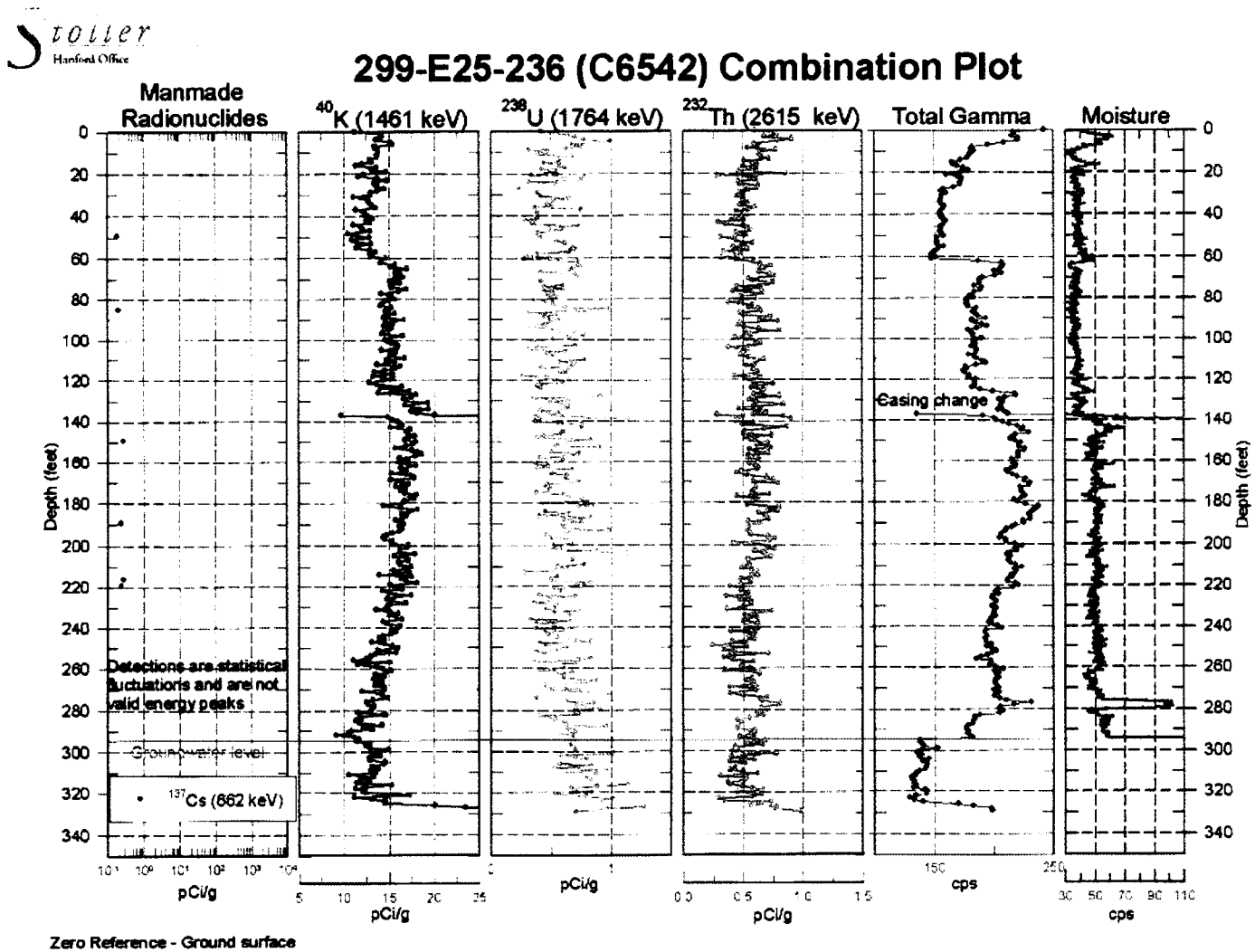
299-E25-236 (C6542)
Natural Gamma Logs



Zero Reference - Ground surface

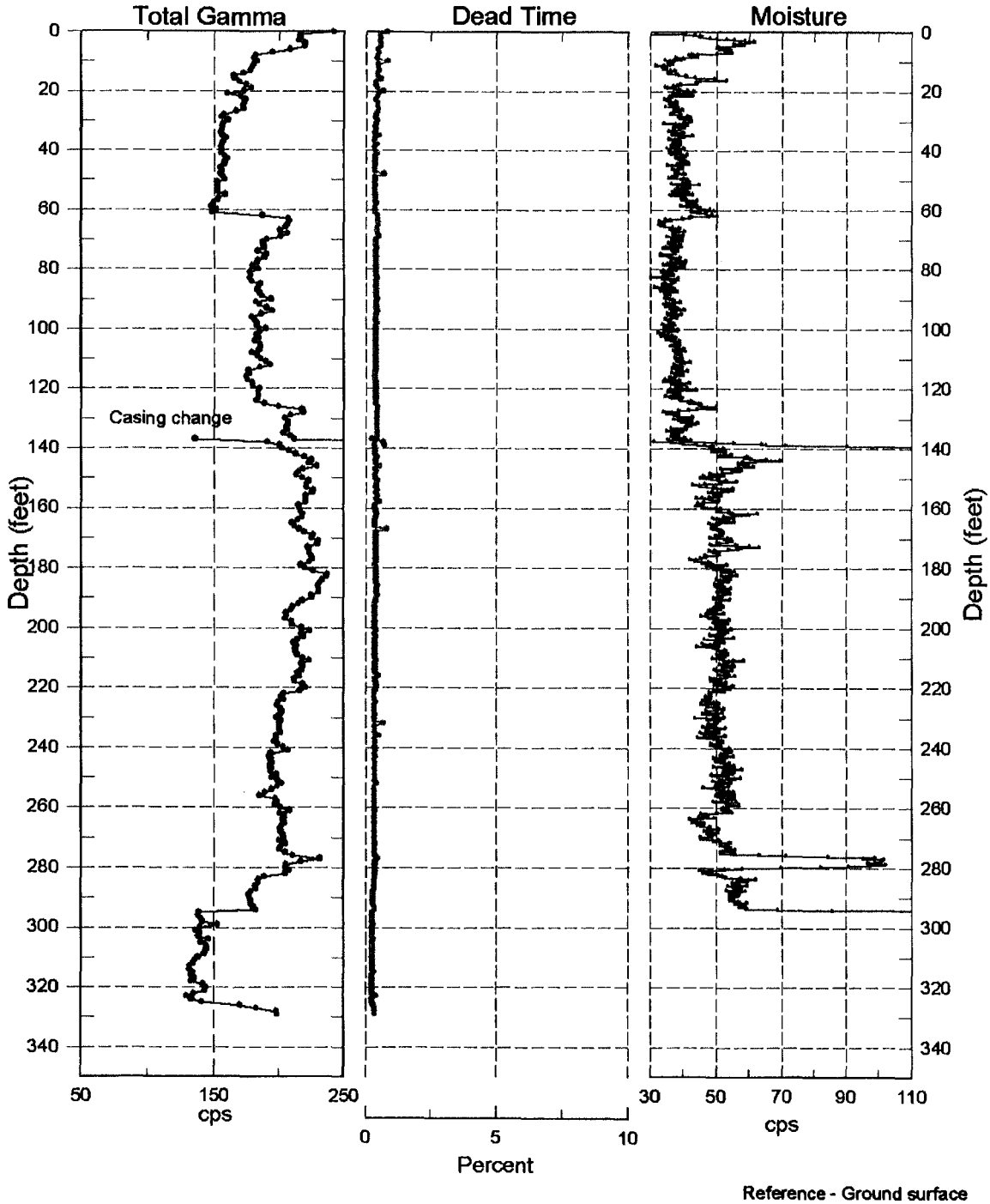

Hanford Office
299-E25-236 (C6542) Combination Plot
Manmade Radionuclides
40K (1461 keV)
238U (1764 keV)
232Th (2615 keV)
Total Gamma
Moisture
Depth (feet)
137Cs (662 keV)
pCi/g
cps
Zero Reference - Ground surface


Stoller
Hanford Office
299-E25-236 (C6542) Combination Plot
Manmade Radionuclides
40K (1461 keV)
238U (1764 keV)
232Th (2615 keV)
Total Gamma
Moisture
Depth (feet)
Groundwater level
137Cs (662 keV)
pCi/g
cps
percent
Zero Reference - Ground surface


Stoller
Hanford Office
299-E25-236 (C6542) Combination Plot
Manmade Radionuclides
40K (1461 keV)
238U (1764 keV)
232Th (2615 keV)
Total Gamma
Moisture
Depth (feet)
Casing change
Detections are statistical fluctuations and are not valid energy peaks
Groundwater level
137Cs (662 keV)
pCi/g
cps
Zero Reference - Ground surface

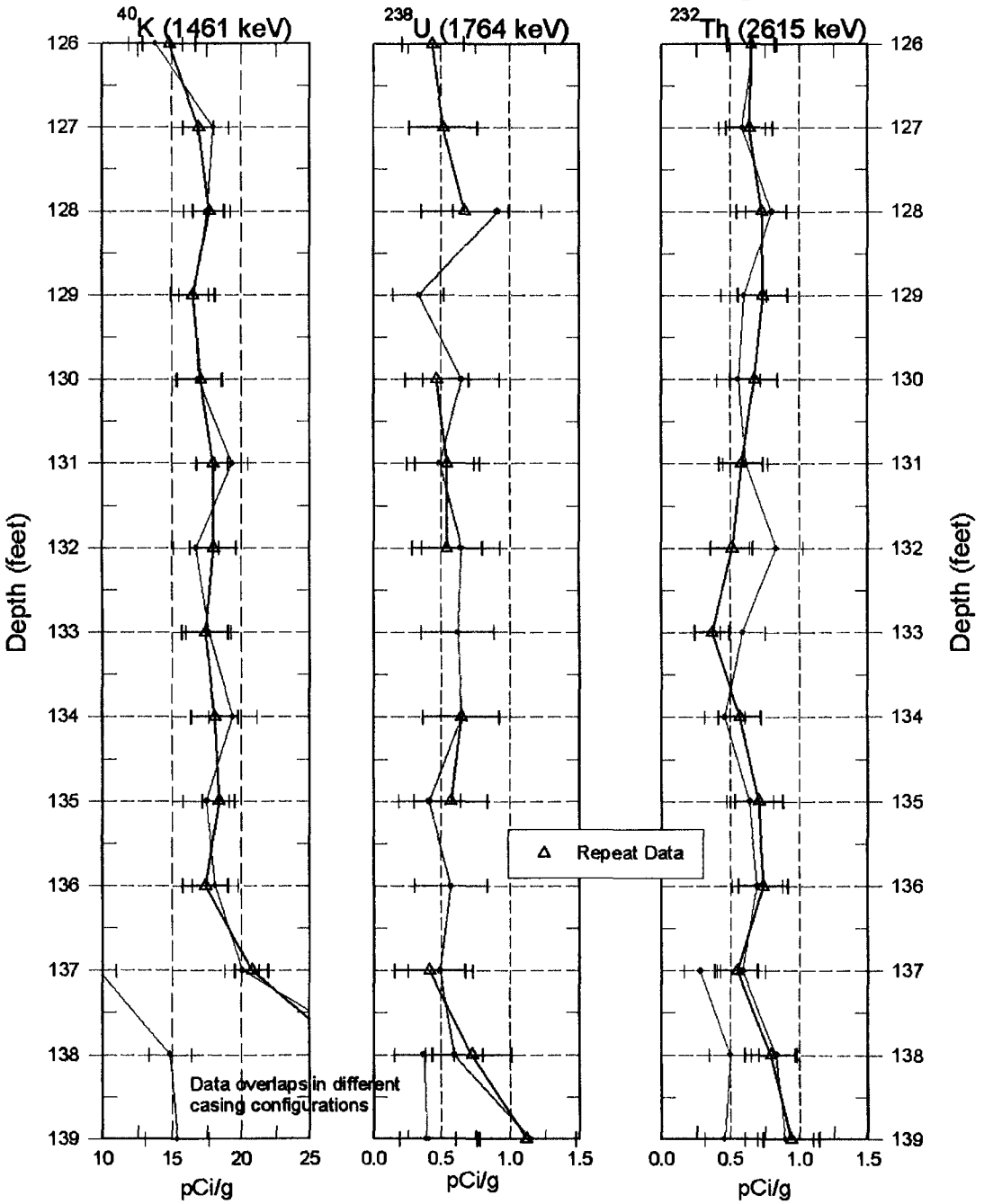
Stoller
Hanford Office

299-E25-236 (C6542)
Total Gamma, Dead Time & Moisture



Stoller
Hanford Office

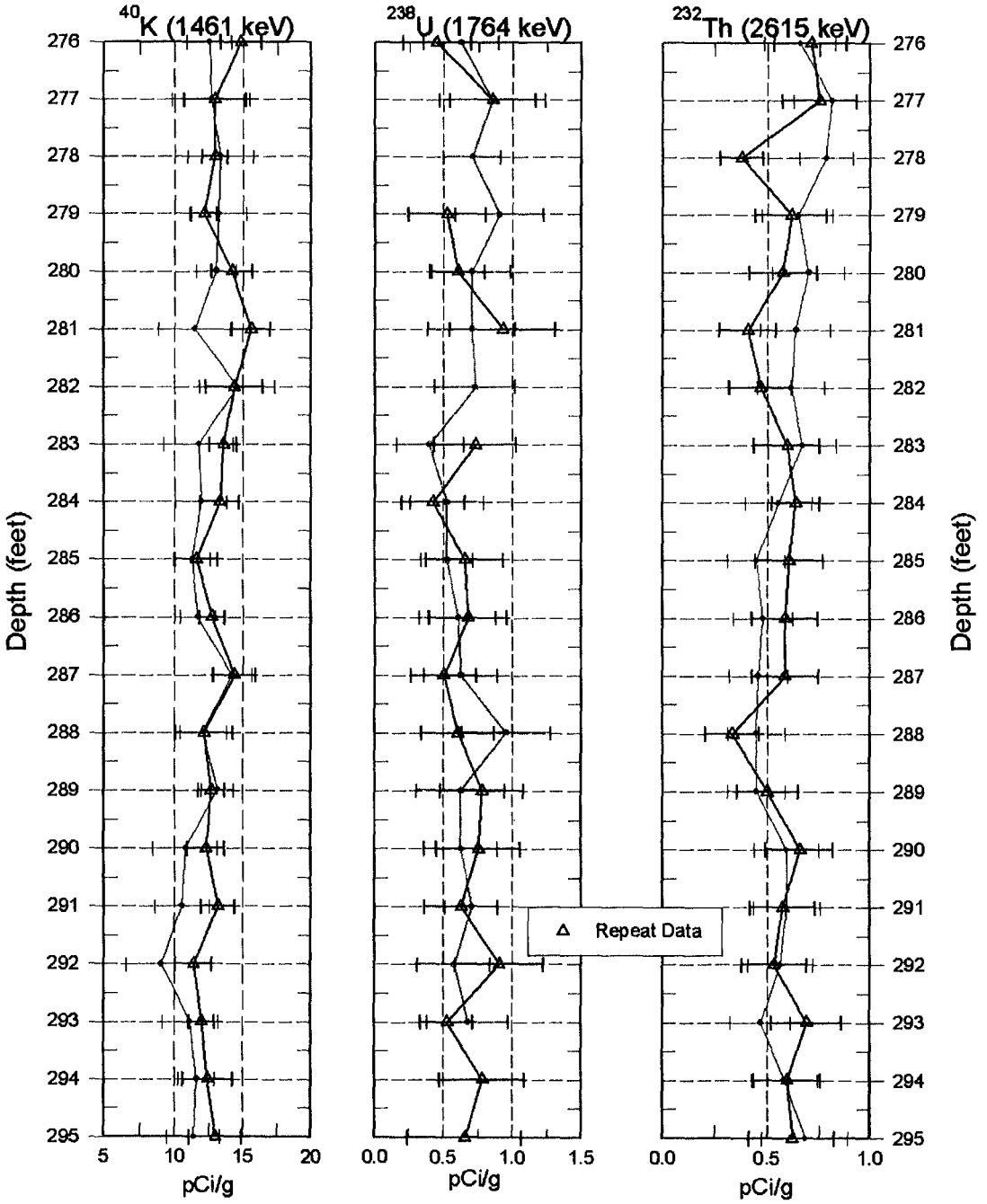
299-E25-236 (C6542)
Repeat of Natural Gamma Logs



Zero Reference - Ground surface

Stoller
Hanford Office

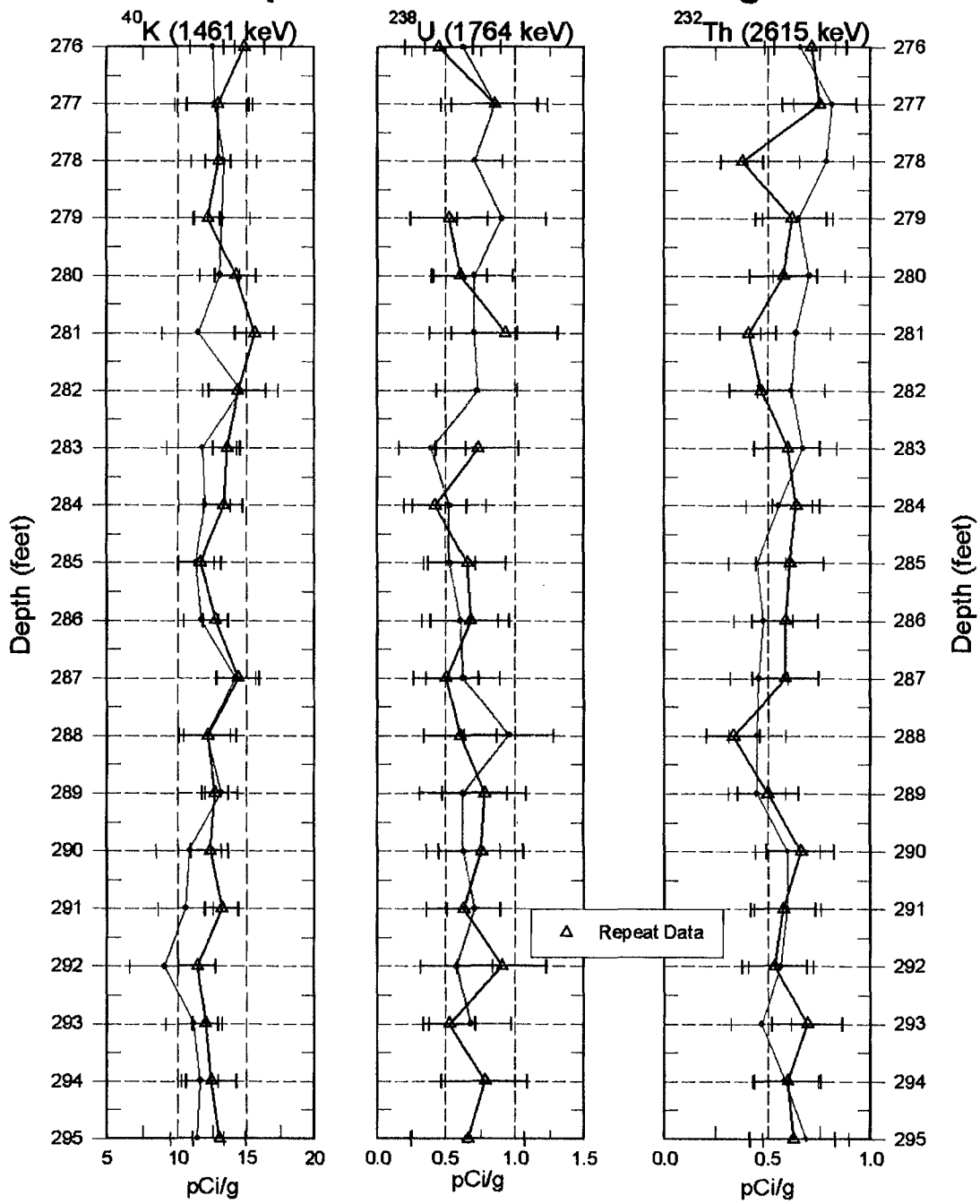
299-E25-236 (C6542)
Repeat of Natural Gamma Logs



Zero Reference - Ground surface

Stoller
Hanford Office

299-E25-236 (C6542)
Repeat of Natural Gamma Logs



Zero Reference - Ground surface

Stoller
Hanford Office

established 1959

HGLP-LDR-289, Rev. 0

199-N-165 (C6693)
Log Data Report

Borehole Information:

Borehole:	199-N-165 (C6693)		Site:	100-NR-2	
Coordinates (WA St Plane)		GWL[1] (ft):	73	GWL Date:	10/06/08
North (m)	East (m)	Drill Date	TOC[2] Elevation	Total Depth (ft)	Type
Unknown	Unknown	10/08	Unknown	84.8	Cable

Casing Information:

Casing Type	Stickup (ft)	Outer Diameter (in.)	Inside Diameter (in.)	Thickness (in.)	Top (ft)	Bottom (ft)
Threaded Steel	-1.9	9 5/8	8 3/4	7/16	- 1.9	84.8

Borehole Notes:

A logging engineer measured casing diameters employing a steel tape and rounding to the nearest 1/16-in. The zero reference for measurements is the ground surface.

Logging Equipment Information:

Logging System:	Gamma 4 L		Type: Serial No.:	60% HPGe H47TP32211A
Effective Calibration Date:	12/31/07	Calibration Reference:	HGLP-CC-027	
		Logging Procedure:	HGLP-MAN-002, Rev. 0	

Logging System:	Gamma 4 H with AmBe source		Type: Serial No.:	NMLS H310700352
Effective Calibration Date:	11/06/07	Calibration Reference:	HGLP-CC-021	
		Logging Procedure:	HGLP-MAN-002, Rev. 0	

Spectral Gamma Logging System (SGLS) Log Run Information:

Log Run	1	2 Repeat
Date	10/06/08	10/06/08
Logging Engineer	Spatz	Spatz
Start Depth (ft)	82.0	74.0
Finish Depth (ft)	0.0	66.0
Count Time (sec)	100	100
Live/Real	R	R
Shield (Y/N)	N	N
MSA Interval (ft)	1.0	1.0
Log Speed (ft/min)	N/A	N/A
Pre-Verification	DL741CAB	DL741CAB
Start File	DL741000	DL741083
Finish File	DL741082	DL741091
Post-Verification	DL741CAA	DL741CAA
Depth Return Error (in.)	0	0
Comments	No fine gain adjustment made.	No fine gain adjustment made.

Stoller
Hanford Office

established 1959

HGLP-LDR-289, Rev. 0

Neutron Moisture Logging System (NMLS) Log Run Information:

Log Run	3	4 Repeat
Date	10/06/08	10/06/08
Logging Engineer	Spatz	Spatz
Start Depth (ft)	0.0	65.5
Finish Depth (ft)	73.0	72.5
Count Time (sec)	15	15
Live/Real	R	R
Shield (Y/N)	N	N
MSA Interval (ft)	0.25	0.25
Log Speed (ft/min)	N/A	N/A
Pre-Verification	DHH72CAB	DHH72CAB
Start File	DHH72000	DHH72293
Finish File	DHH72292	DHH72321
Post-Verification	DHH72CAA	DHH72CAA
Depth Return Error (in.)	N/A	- 1
Comments	None	None

Logging Operation Notes:

Maximum logging depth was 82.6 ft before the SGLS sonde unweighted. A centralizer was installed on the sondes.

Analysis Notes:

Analyst:	Henwood	Date:	11/18/08	Reference:	GJO-HGLP 1.6.3, Rev. 0

Pre-run and post-run verifications for the logging systems were performed. The acceptance criteria were met.

A casing correction for a 7/16-in.-thick steel casing was applied to the SGLS data. Moisture data are reported in counts per second (cps) as there is no calibration available to convert to volumetric moisture for the 8 3/4 in. ID casing.

SGLS spectra were processed in batch mode using APTEC SUPERVISOR to identify individual energy peaks and determine count rates. Concentrations were calculated with an EXCEL worksheet template identified as G4LDec07.xls, using an efficiency function and corrections for casing, water, and dead time, as determined from annual calibrations. A correction for water inside the borehole was applied to data below 73 ft.

Results and Interpretations:

No manmade radionuclides were detected. A detection of Cs-137 at a depth of 6 ft using the routine processing software was determined to be a statistical fluctuation and is not valid.

NMLS data indicate some variability.

All repeat data indicate good repeatability.

Stoller
Hanford Office

established 1959

HGLP-LDR-289, Rev. 0

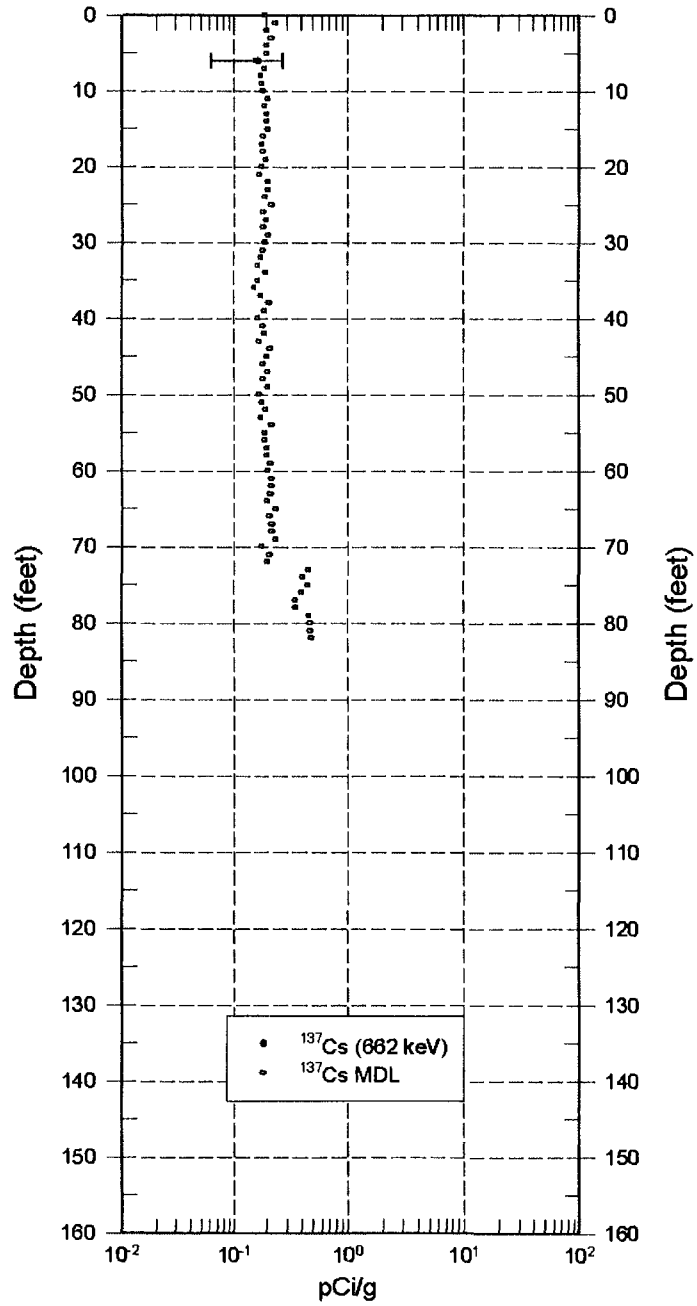
List of Log Plots:

Depth Reference is ground surface
Manmade Radionuclides
Natural Gamma Logs
Combination Plot
Total Gamma, Dead Time & Moisture
Repeat of Natural Gamma Logs
Repeat of Moisture

[1] GWL – groundwater level
[2] TOC – top of casing

Stoller
Hanford Office

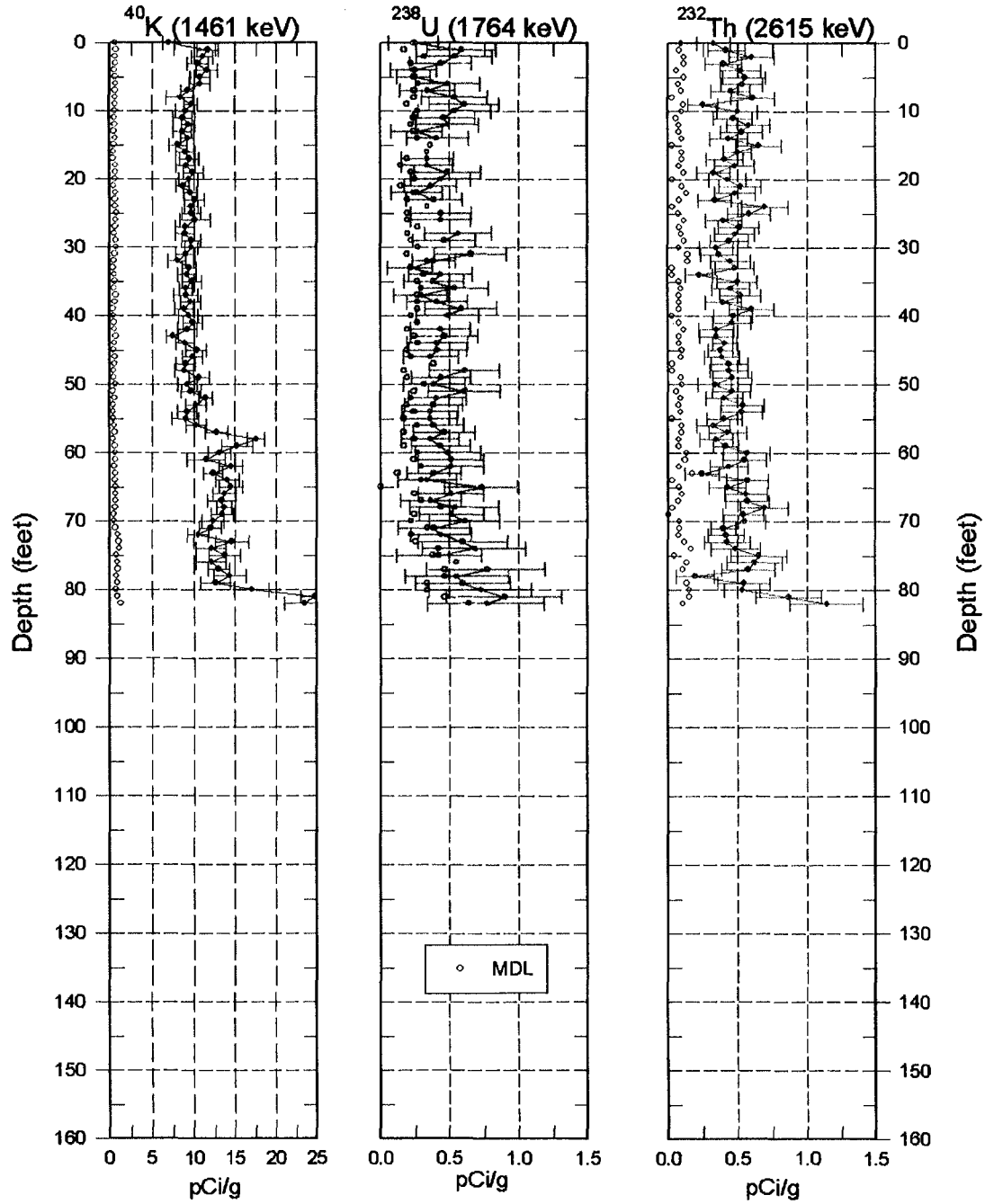
199-N-165 (C6693)
Manmade Radionuclides



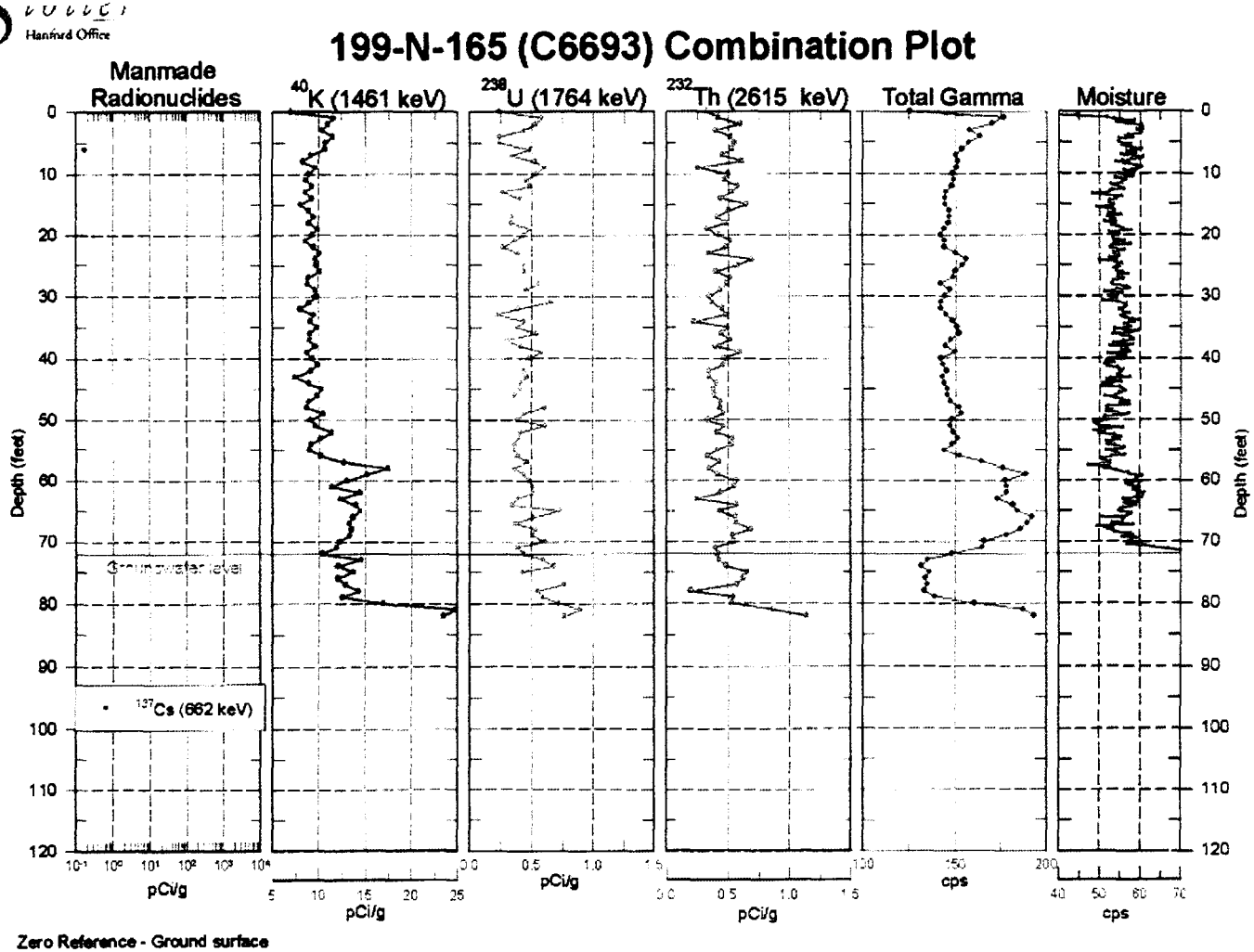
Zero Reference - Ground surface

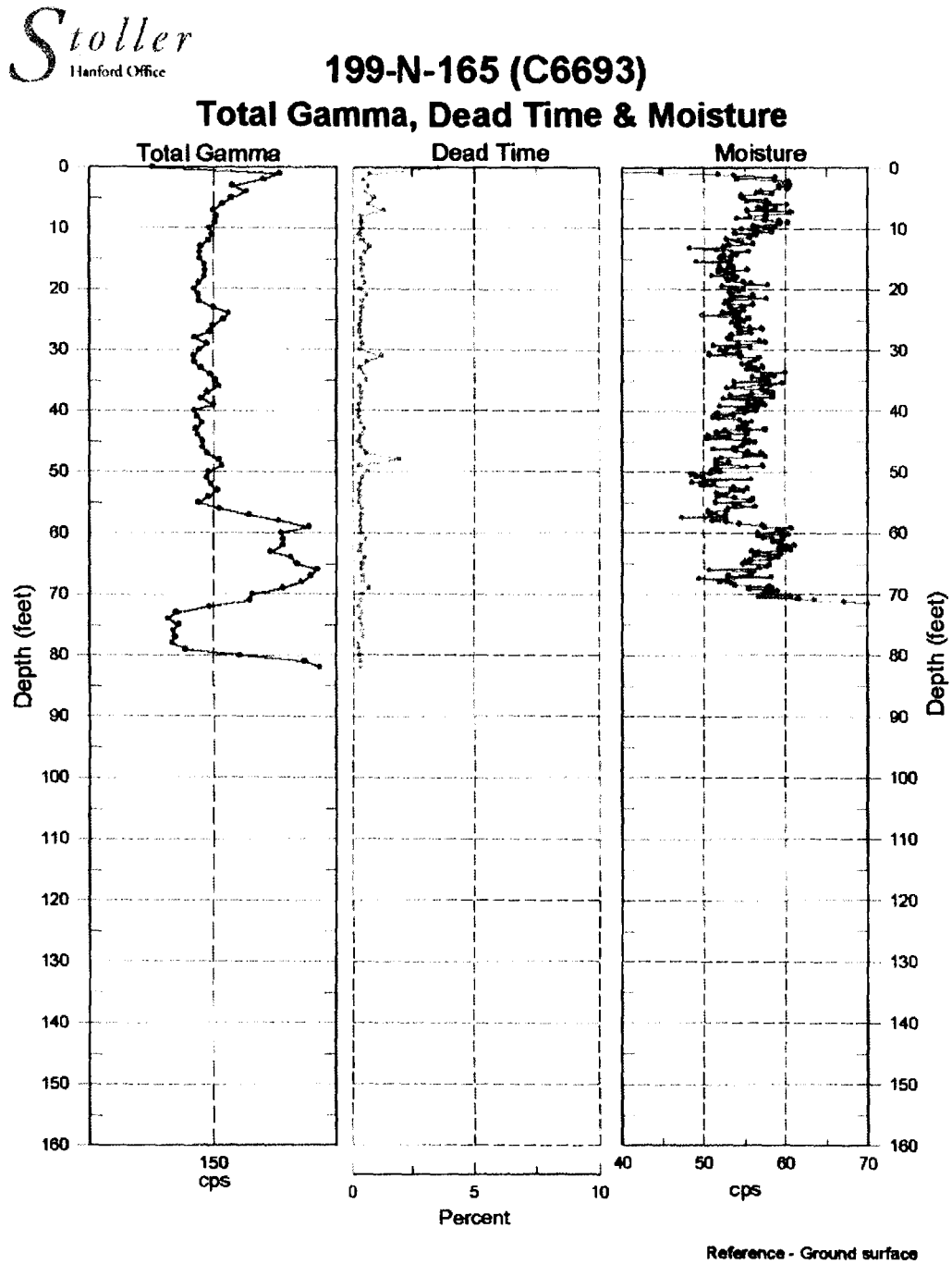
Stoller
Hanford Office

199-N-165 (C6693)
Natural Gamma Logs



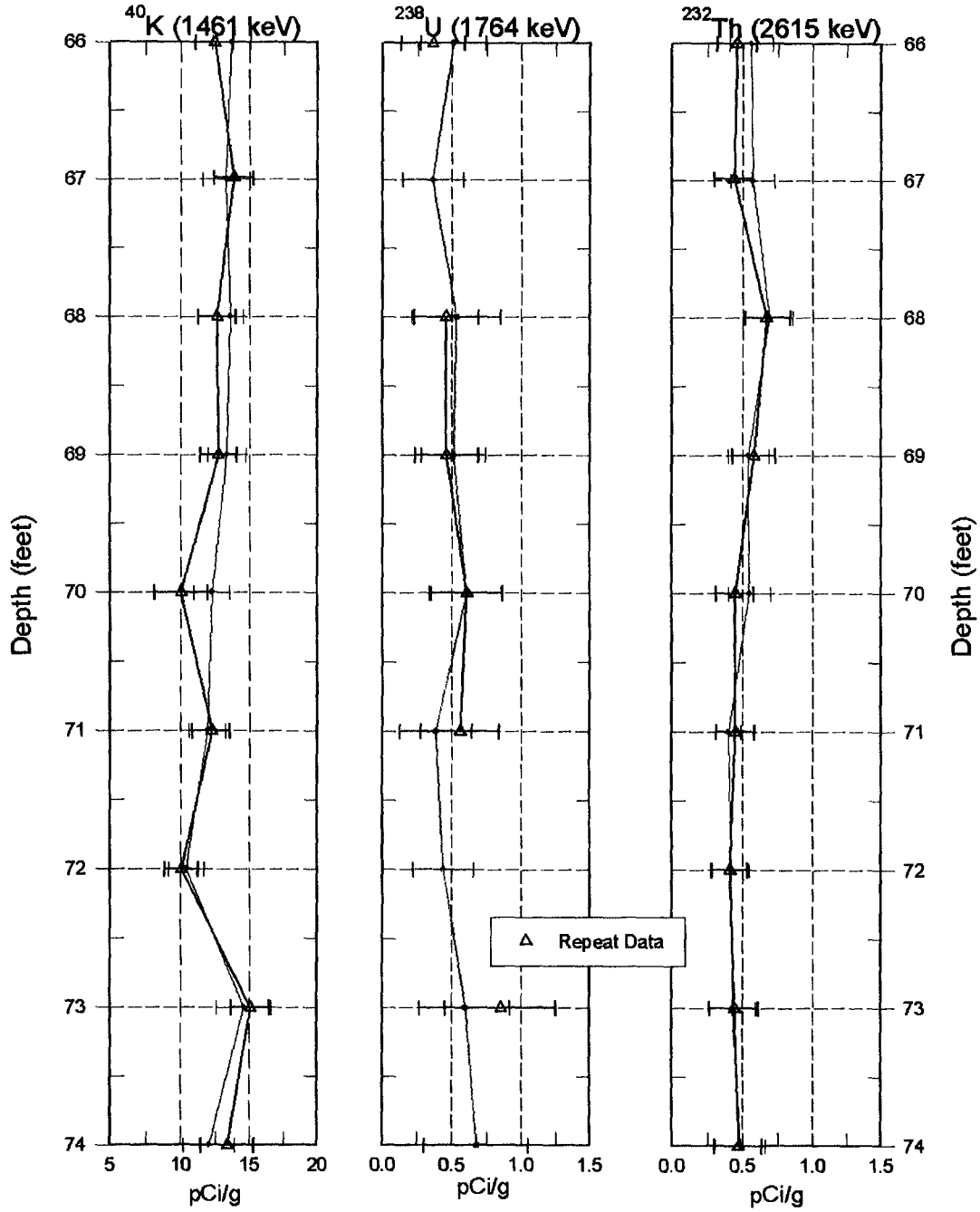
Zero Reference - Ground surface


Hanford Office
199-N-165 (C6693) Combination Plot
Manmade Radionuclides
40K (1461 keV)
238U (1764 keV)
232Th (2615 keV)
Total Gamma
Moisture
Depth (feet)
Groundwater level
137Cs (662 keV)
pCi/g
cps
Zero Reference - Ground surface


Stoller
Hanford Office
199-N-165 (C6693)
Total Gamma, Dead Time & Moisture
Total Gamma
Dead Time
Moisture
Depth (feet)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
150
cps
0
5
10
Percent
40
50
60
70
cps
Reference - Ground surface

Stoller
Hanford Office

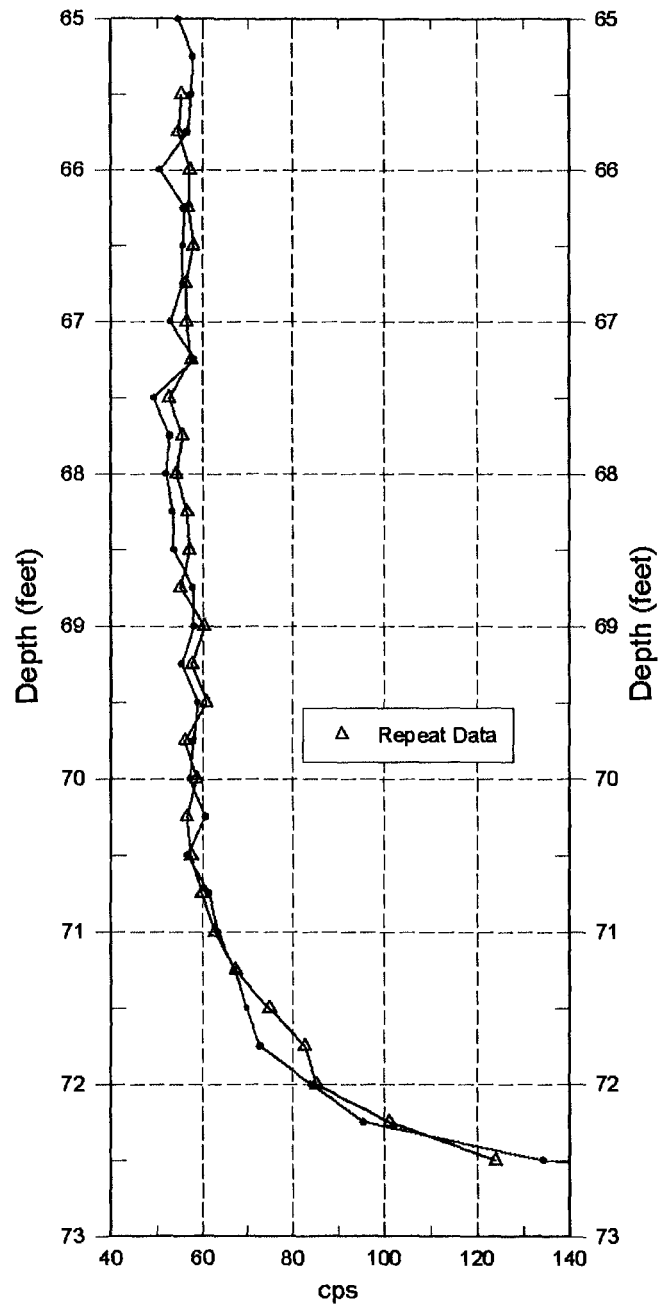
199-N-165 (C6693)
Repeat of Natural Gamma Logs



Zero Reference - Ground surface

Stoller
Hanford Office

199-N-165 (C6693)
Repeat of Moisture



Reference - Ground surface

Stoller
Hanford Office

established 1959

HGLP-LDR-295, Rev. 0

299-W26-77 (C6455)
Log Data Report

Borehole Information:

Borehole:	299-W26-77 (C6455)		Site:	LERF	
Coordinates (WA St Plane)		GWL[1] (ft):	203.6	GWL Date:	08/27/08
North (m)	East (m)	Drill Date	TOC[2] Elevation	Total Depth (ft)	Type
Unknown	Unknown	08/2008	Unknown	230	Cable/Rotary

Casing Information:

Casing Type	Stickup (ft)	Outer Diameter (in.)	Inside Diameter (in.)	Thickness (in.)	Top (ft)	Bottom (ft)
Threaded Steel	-2.0	9 11/16	8 9/16	9/16	-2.0	230

Borehole Notes:

The zero reference is the ground surface. Cable tool drilling stopped at the basalt contact. Drilling was continued with rotary drilling with open hole to total depth. Logging was terminated at 3 ft below the bottom of the casing at 208 feet. A logging engineer measured the casing, diameter and rounding to the nearest 1/16-inch

Logging Equipment Information:

Logging System:	Gamma 1 N		Type: Serial No.:	60% HPGe SGLS 45TP22010A
Effective Calibration Date:	03/28/08	Calibration Reference:	HGLP-CC-031, Rev.0	
		Logging Procedure:	HGLP-MAN-002, Rev. 0	

Logging System:	Gamma 1 M		Type: Serial No.:	NMLS H340207279
Effective Calibration Date:	05/06/08	Calibration Reference:	HGLP-CC-032	
		Logging Procedure:	HGLP-MAN-002, Rev. 0	

Spectral Gamma Logging System (SGLS) Log Run Information:

Log Run	1	2 Repeat			
Date	08/27/08	08/27/08			
Logging Engineer	McClellan	McClellan			
Start Depth (ft)	208.0	0.0			
Finish Depth (ft)	0.0	21.0			
Count Time (sec)	100	100			
Live/Real	R	R			
Shield (Y/N)	N	N			
MSA Interval (ft)	1.0	1.0			
Log Speed (ft/min)	NA	NA			
Pre-Verification	AN100CAB	AN100CAB			
Start File	AN110000	AN110209			
Finish File	AN119208	AN110230			

Stoller
Hanford Office
established 1959

HGLP-LDR-295, Rev. 0

Log Run	1	2 Repeat			
Post-Verification	AN110CAA	AN110CAA			
Depth Return Error (in.)	½ low	0			
Comments	Fine gain adjustment made before-AN110151 & AN110153	None			

Neutron Moisture Logging System (NMLS) Log Run Information:

Log Run	3	4 Repeat			
Date	08/27/08	08/27/08			
Logging Engineer	Pope	Pope			
Start Depth (ft)	0.0	170.0			
Finish Depth (ft)	203.5	190.0			
Count Time (sec)	15	15			
Live/Real	R	R			
Shield (Y/N)	N	N			
MSA Interval (ft)	0.25	0.25			
Log Speed (ft/min)	NA	NA			
Pre-Verification	AM041CAB	AM041CAB			
Start File	AM041000	AM041815			
Finish File	AM041814	AM041895			
Post-Verification	AM041CAA	AM041CAA			
Depth Return Error (in.)	NA	0			
Comments	None	None			

Logging Operation Notes:

Data were collected using Gamma 1, HO 68B-3574. SGLS pre- and post-survey verification measurements were acquired in the Amersham KUTh-118 field verifier. NMLS pre- and post-survey verification measurements were acquired in the AmBe standard. Maximum logging depth for the SGLS was 208.0 ft before the sonde un-weighted. Maximum logging depth for the NMLS was 203.5 feet. A centralizer was installed on the sondes.

Analysis Notes:

Analyst:	LEGLER	Date:	12/09/08	Reference:	GJO-HGLP 1.6.3, Rev. 0

The pre- and post-survey verification measurements met the acceptance criteria for the established systems.

A 9/16-in thick casing was applied to spectral data for depths to 205 ft, leaving 3 ft of open borehole uncorrected.

SGLS spectra were processed in batch mode in APTEC SUPERVISOR to identify individual energy peaks and determine count rates. Concentrations were calculated in an EXCEL template identified as G1NMar08.xls, using an efficiency function and corrections for casing, dead time, and water as determined from annual calibrations.

Results and Interpretations:

Cs-137 was detected at a few isolated depths, but inspection of the individual spectra indicates that these detections are statistical fluctuations and do not contain valid energy peaks.

The KUT plots show good repeatability. The Moisture Repeat plot shows good repeatability.

Stoller
Hanford Office

established 1959

HGLP-LDR-295, Rev. 0

List of Log Plots:

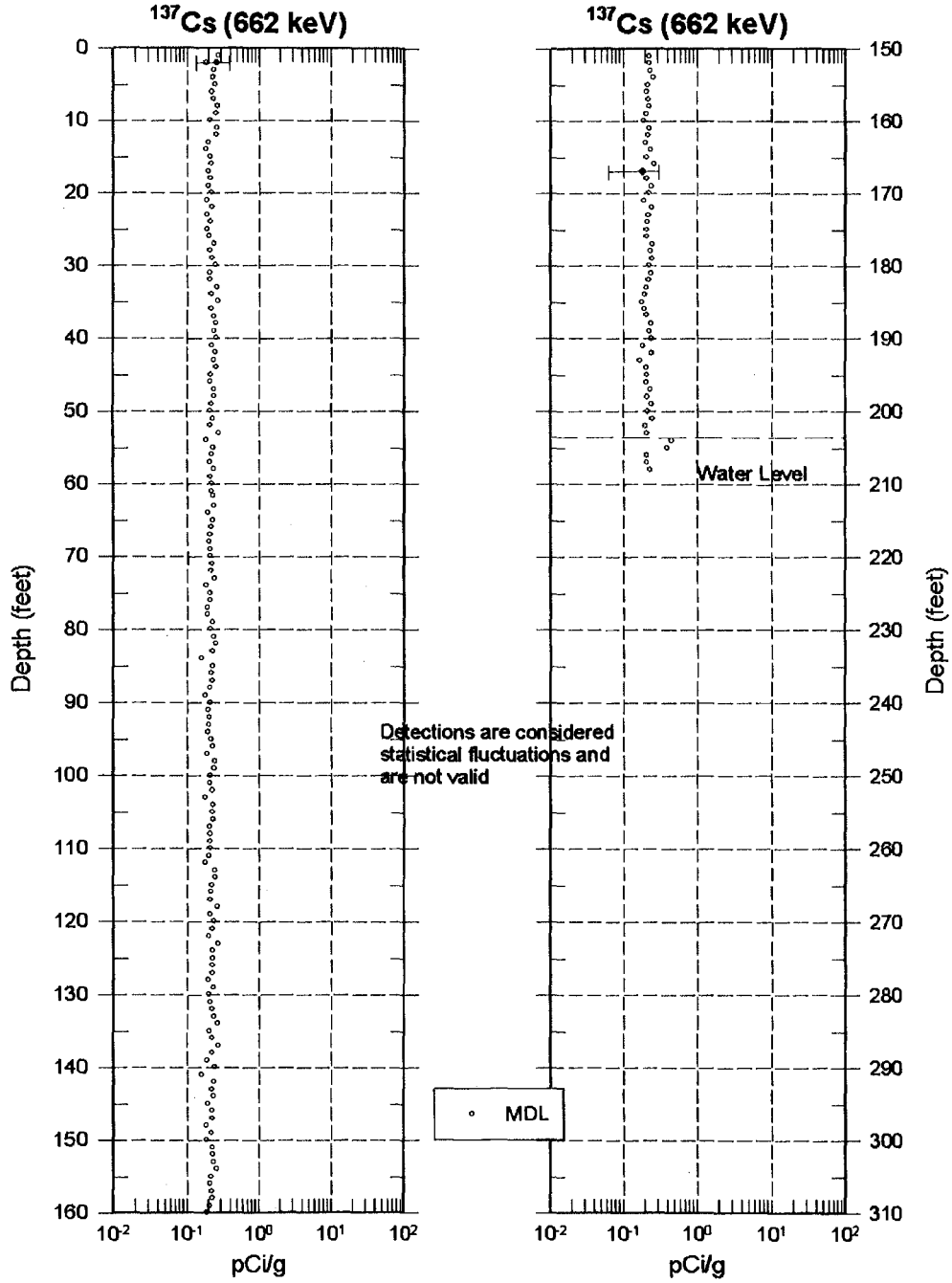
Depth Reference is ground surface

Manmade Radionuclides
Natural Gamma Logs
Combination Plot (0-120 ft)
Combination Pot (110 – 230 ft)
Combination Plot
Total Gamma & Dead Time
Total Gamma & Moisture
Repeat Section of Natural Gamma Logs
Moisture Repeat Section

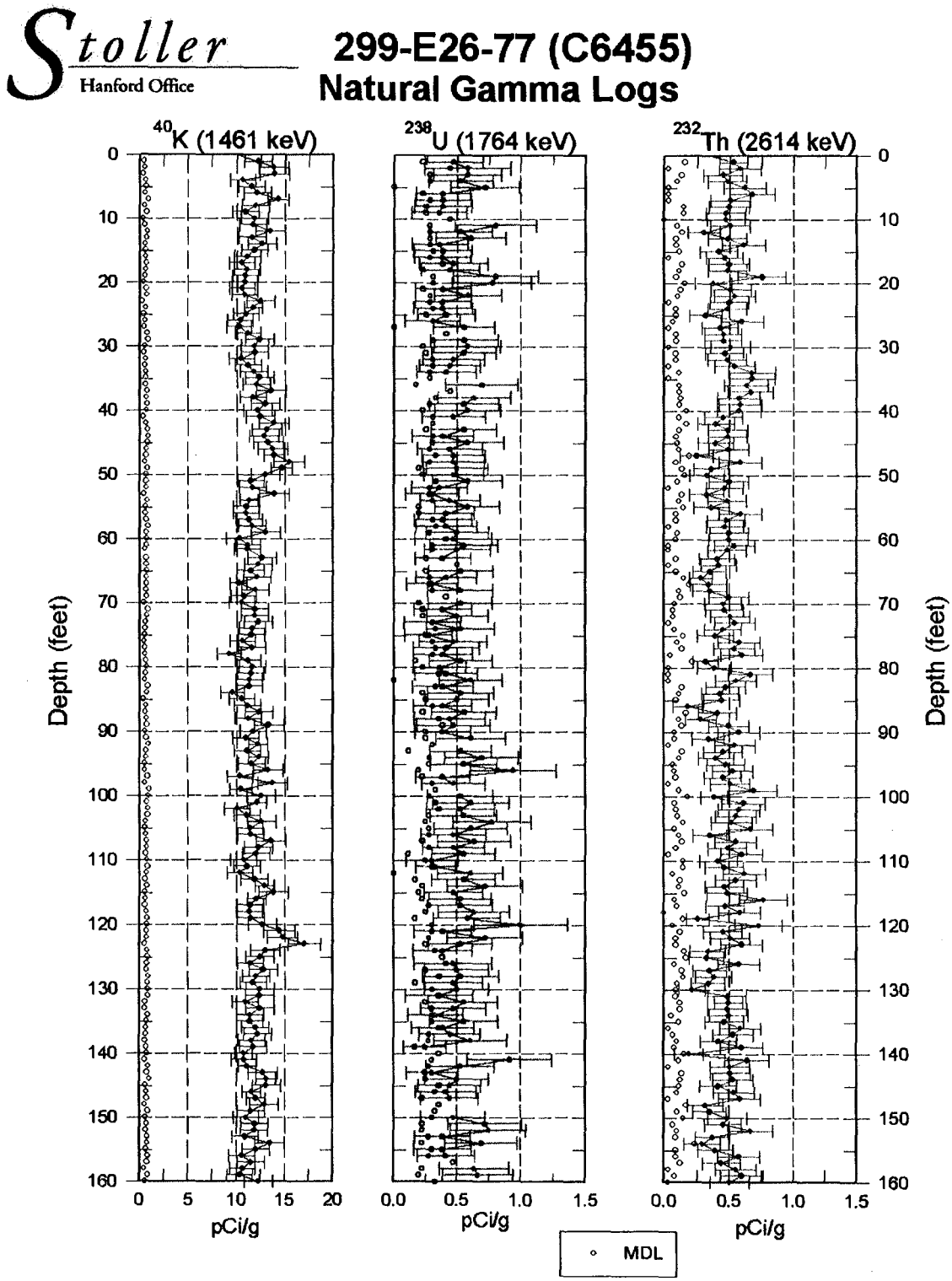
[1] GWL – groundwater level
[2] TOC – top of casing

Stoller
Hanford Office

299-E26-77 (C6455)
Manmade Radionuclides

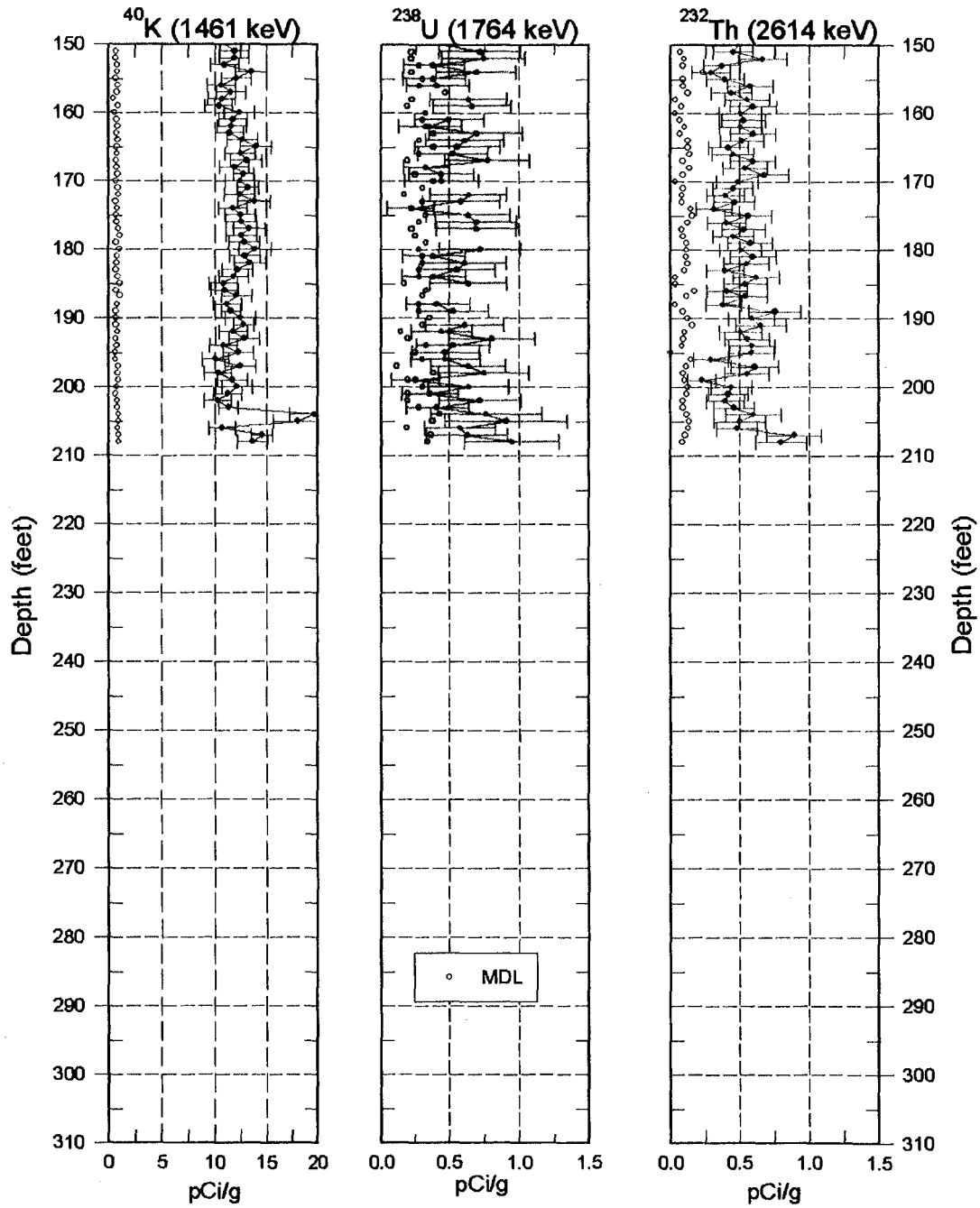


Zero Reference - Ground Surface


Stoller
Hanford Office
299-E26-77 (C6455)
Natural Gamma Logs
40K (1461 keV)
238U (1764 keV)
232Th (2614 keV)
Depth (feet)
pCi/g
MDL
Zero Reference - Ground Surface

Stoller
Hanford Office

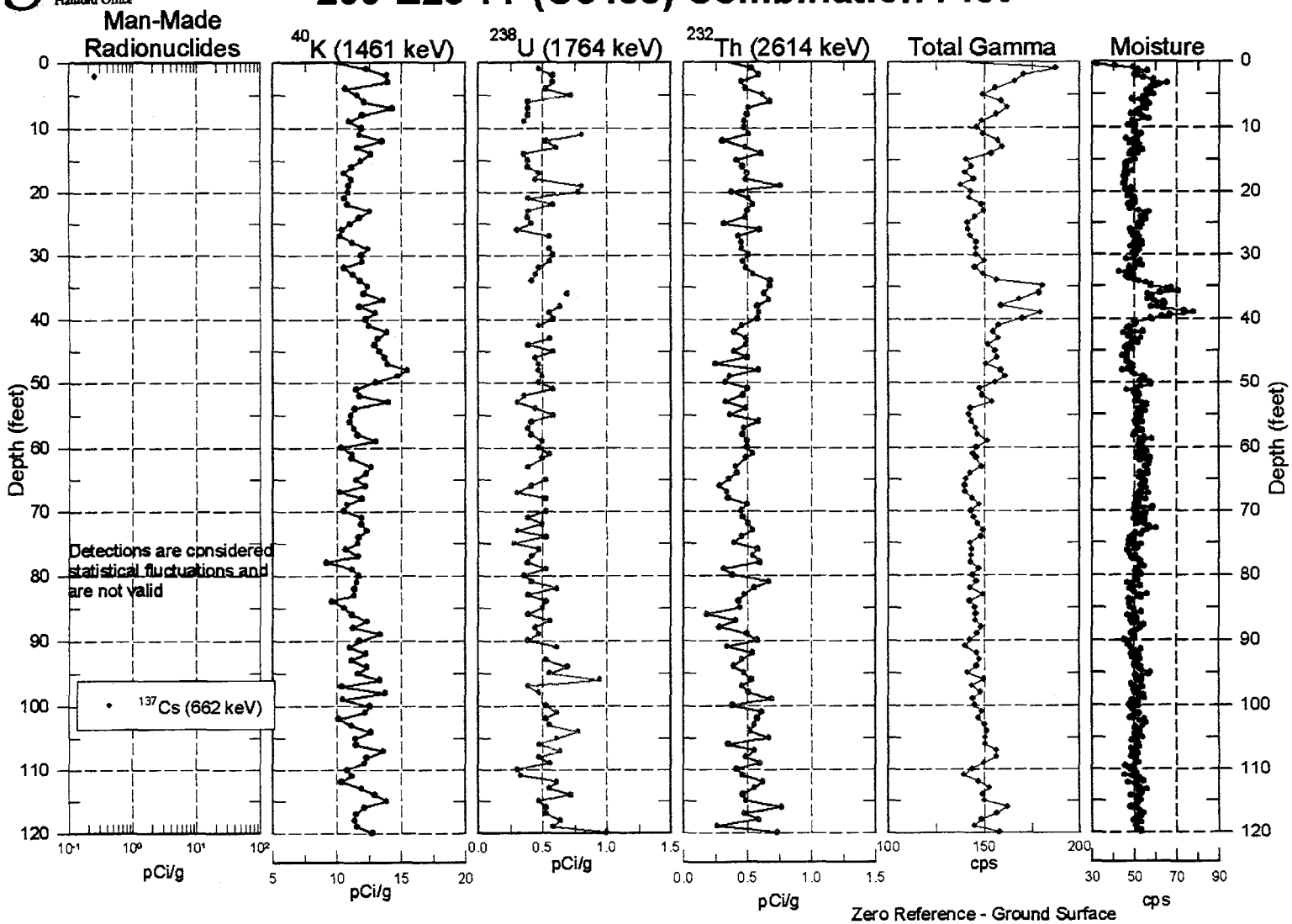
299-E26-77 (C6455)
Natural Gamma Logs

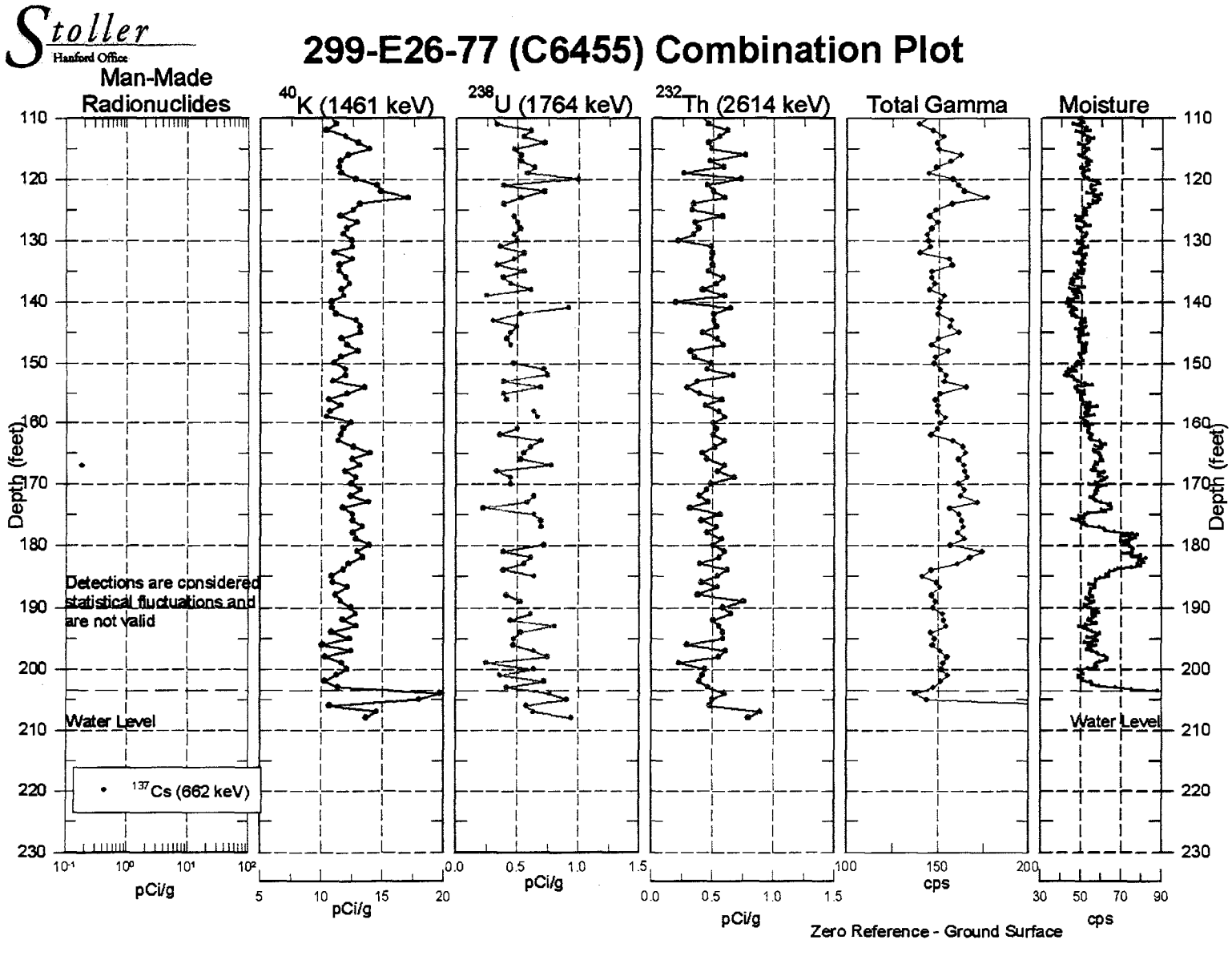


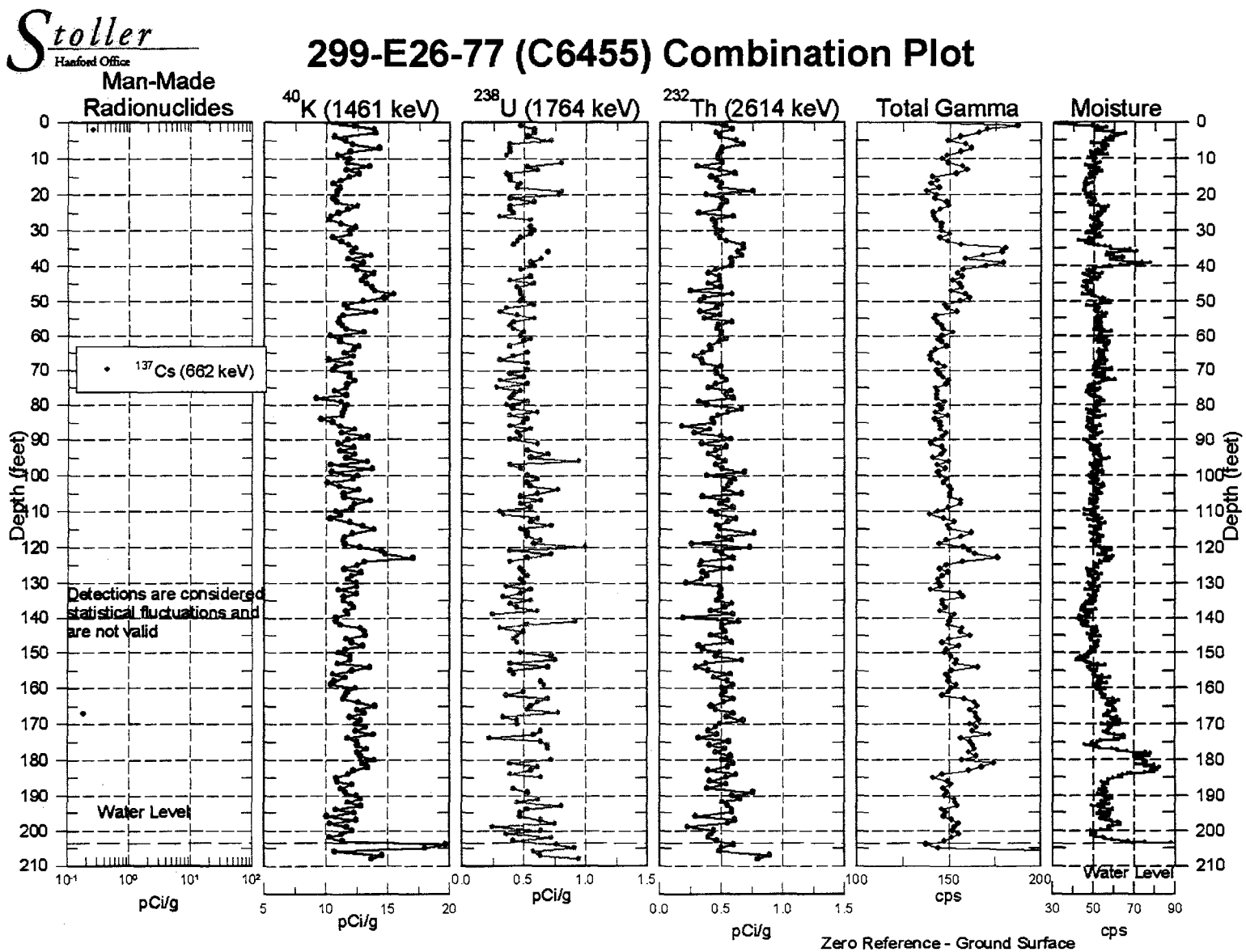
Zero Reference - Ground Surface

Stoller
Hanford Office

299-E26-77 (C6455) Combination Plot

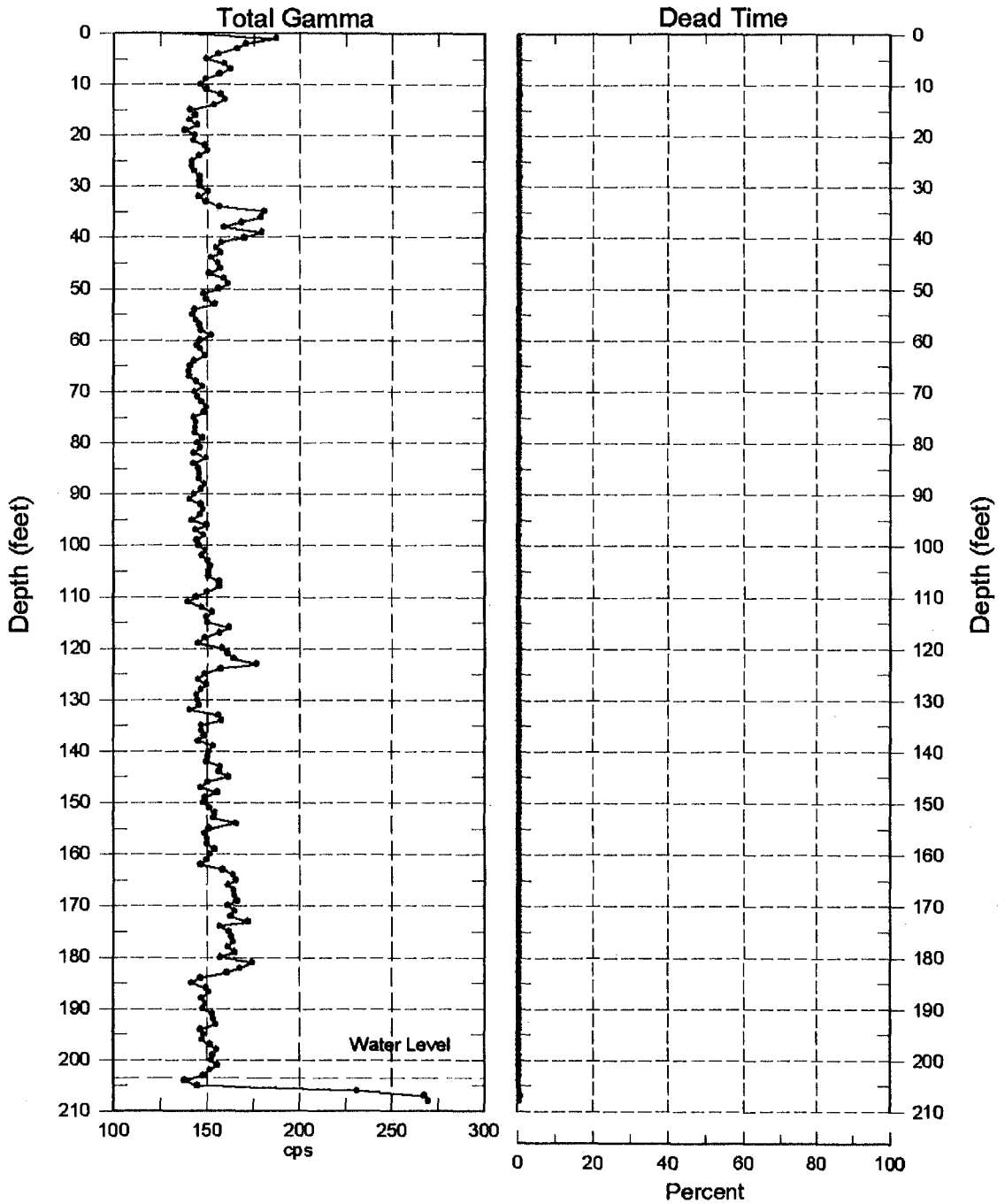



Stoller
Hanford Office
299-E26-77 (C6455) Combination Plot
Man-Made Radionuclides
40K (1461 keV)
238U (1764 keV)
232Th (2614 keV)
Total Gamma
Moisture
Depth (feet)
Detections are considered statistical fluctuations and are not valid
Water Level
137Cs (662 keV)
pCi/g
cps
Zero Reference - Ground Surface


Stoller
Hanford Office
299-E26-77 (C6455) Combination Plot
Man-Made Radionuclides
40K (1461 keV)
238U (1764 keV)
232Th (2614 keV)
Total Gamma
Moisture
137Cs (662 keV)
Detections are considered statistical fluctuations and are not valid
Water Level
Depth (feet)
pCi/g
cps
Zero Reference - Ground Surface

Stoller
Hanford Office

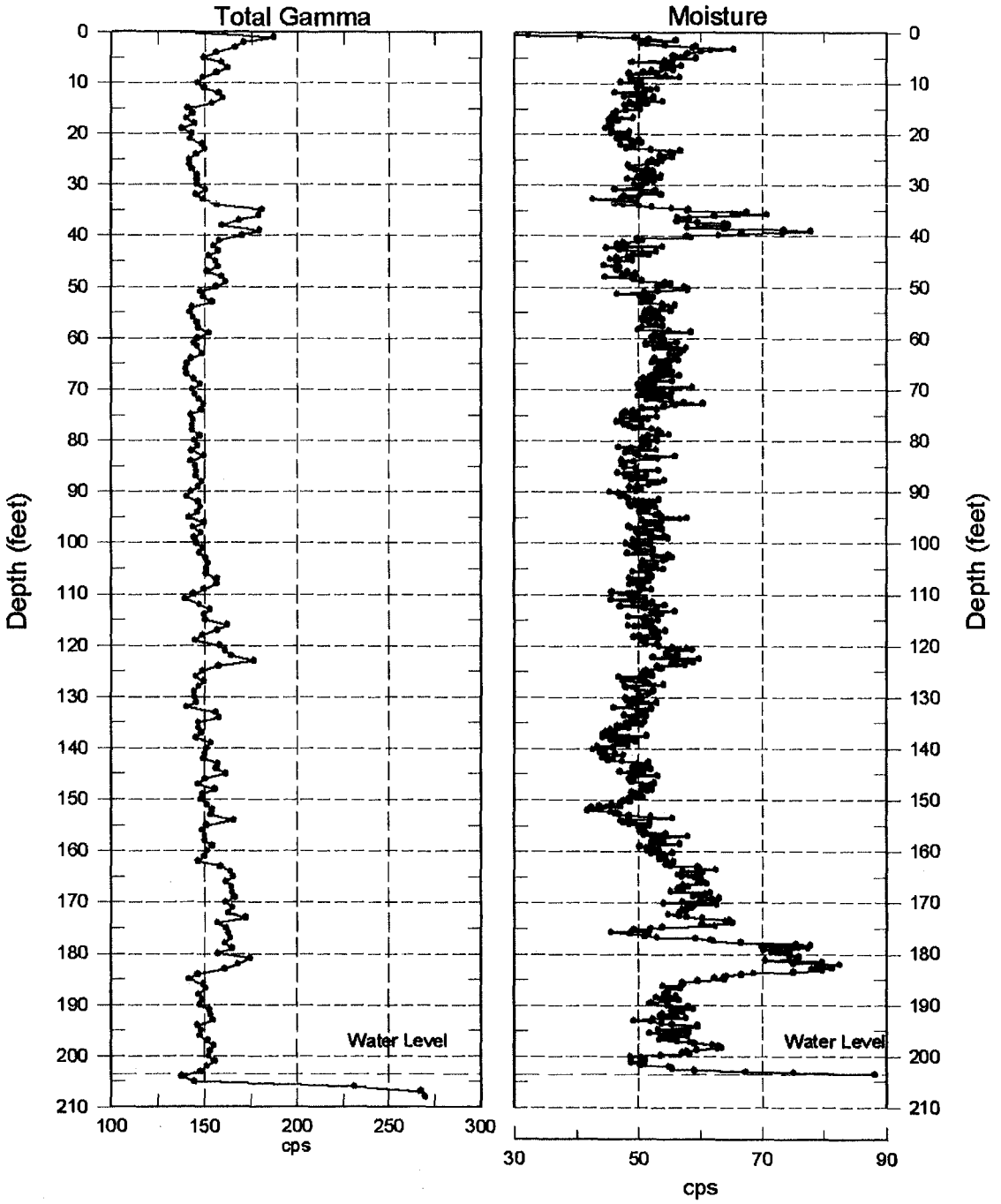
299-E26-77 (C6455)
Total Gamma & Dead Time



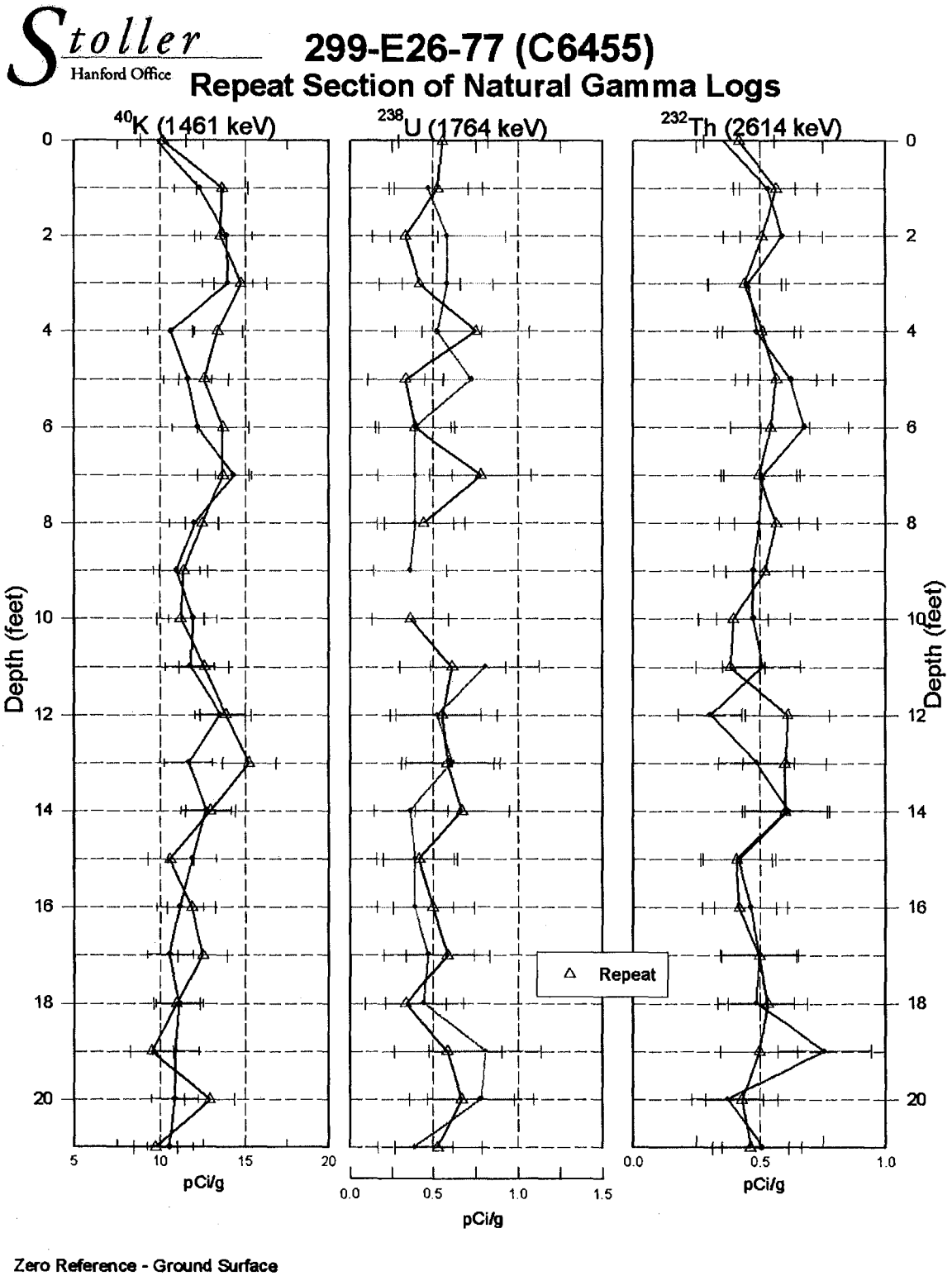
Reference - Ground Surface

Stoller
Hanford Office

299-E26-77 (C6455)
Total Gamma & Moisture

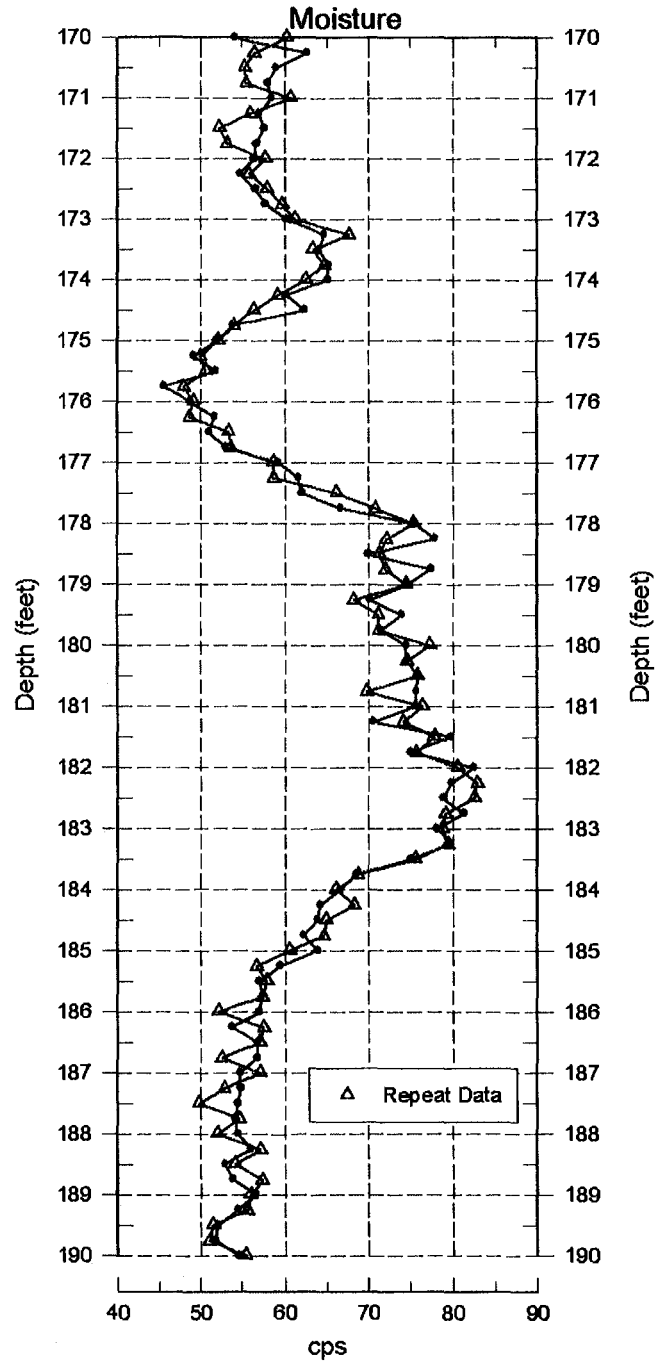


Reference - Ground Surface


Stoller
Hanford Office
299-E26-77 (C6455)
Repeat Section of Natural Gamma Logs
40K (1461 keV)
238U (1764 keV)
232Th (2614 keV)
Depth (feet)
pCi/g
Repeat
Zero Reference - Ground Surface

Stoller
Hanford Office

299-E26-77 (C6455)
Moisture Repeat Section



Reference - Ground Surface

APPENDIX C

WELL CONSTRUCTION REPORT

This page intentionally left blank.

WELL CONSTRUCTION SUMMARY REPORT

Start Date: 8/26/08
Finish Date: 9/25/08
Page 1 of 2

Well ID: 66542	Well Name: 299-E25-336
Approximate Location: W. of 242-A Evaporator 200E	
Project: RCRA Wells (A-Farm Monitoring Well)	Other Companies: GRAM, Inc.
Drilling Company: Blue Star Enterprise	Geologist(s): J. Thornton, T. Buswell, M.J. Hocking, S. Sexton
Driller: License #:	

TEMPORARY CASING AND DRILL DEPTH			DRILLING METHOD	HOLE DIAMETER (in.) / INTERVAL (ft)
*Size/Grade/Lbs. Per Ft.	Interval	Shoe O.D./I.D.	Auger:	Diameter ____ From ____ to ____
11 3/4", C.S.	0.0 - 138	11 7/8"/10 3/4"	Cable Tool: X	Diameter 11 3/4 From 0.0 to 140
9 5/8", C.S.	138 - 328.7	9 7/8"/8 3/4"	Air Rotary:	Diameter 9 5/8 From 140 to 329.3
	-		A.R. w/Sonic:	Diameter ____ From ____ to ____
	-			Diameter ____ From ____ to ____
	-			Diameter ____ From ____ to ____
*Indicate Welded (W) - Flush Joint (FJ) Coupled (C) & Thread Design				Diameter ____ From ____ to ____
Unk. Thread				

	Drilling Fluid: Water
Total Drilled Depth: 329.3 ft / Hole Dia @ TD:	Total Amt. Of Water Added During Drilling: ~ 75 gallons
Well Straightness Test Results: Pass	Static Water Level: 294.5 ft / Date: 9/10/08

GEOPHYSICAL LOGGING

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

COMPLETED WELL

Size/Wt./Material	Depth	Thread	Slot Size	Type	Interval Annular Seal/Filter Pack	Volume	Mesh Size
4"/Sch.10/stainless steel	328.1 - 325.1	✓	—	Natural Cave-in Material	329.3 - 328.9	—	—
4"/Sch10/cont. wire wrap	325.1 - 290.0	✓	20-slot	Silica Sand	328.9 - 287.2	17.39 ft³	10-20
4"/Sch 10/stainless steel	290.0 - 42.26	✓	—	Bentonite Crumbles	287.2 - 282.5	2.84	—
	-			Portland Cement	282.5 - 269.0	7.71	—
	-			Coated Bentonite Pellets	269.0 - 263.9	3.72	—

OTHER ACTIVITIES

Aquifer Test:	Date:	Well Decommission:	Yes:	No:	Date:
Description: N/A		Description:			

WELL SURVEY DATA (if applicable)

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

COMMENTS / REMARKS

Well ID # ALF 979 riveted onto side of protective casing
All temporary casing removed from borehole.

Reported By:	Title:	Signature:	Date:
T. Buswell	Geologist	T. Buswell	10/6/2008

A-6003-658 (04/03)

WELL CONSTRUCTION SUMMARY REPORT

Start Date: 8/26/2008
Finish Date: 9/25/2008
Page 2 of 2

Well ID: C6542	Well Name: 299-E25-236	Approximate Location: W. of 242-A Evaporator, 200 E.
Project: RCRA Wells CA-Farm Monitoring Well		Other Companies: GRAM, Inc.
Drilling Company: Blue Star Enterprises		Geologist(s): J. Threadin T. Buswell MJ. Hocking S. Seaton
Driller:	License #:	

TEMPORARY CASING AND DRILL DEPTH			DRILLING METHOD	HOLE DIAMETER (in.) / INTERVAL (ft)
*Size/Grade/Lbs. Per Ft.	Interval	Shoe O.D./I.D.	Auger:	Diameter ____ From ____ to ____
(See pg. 1)	____ - ____		Cable Tool:	Diameter ____ From ____ to ____
	____ - ____		Air Rotary:	Diameter ____ From ____ to ____
	____ - ____		A.R. w/Sonic:	Diameter ____ From ____ to ____
	____ - ____			Diameter ____ From ____ to ____
	____ - ____			Diameter ____ From ____ to ____
*Indicate Welded (W) - Flush Joint (FJ) Coupled (C) & Thread Design				Diameter ____ From ____ to ____
(See pg. 1)				
			Drilling Fluid: (See pg. 1)	
Total Drilled Depth:	Hole Dia @ TD:		Total Amt. Of Water Added During Drilling:	
Well Straightness Test Results:			Static Water Level:	Date:

GEOPHYSICAL LOGGING

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

COMPLETED WELL

Size/Wt./Material	Depth	Thread	Slot Size	Type	Interval Annular Seal/Filter Pack	Volume	Mesh Size
(See pg. 1)	____ - ____			Bentonite Granules/Pellets	263.9 - 8.10	135.96 ft³	—
	____ - ____			Portland Cement Grout	8.10 - 0.0	9.0	—
	____ - ____				____ - ____		
	____ - ____				____ - ____		
	____ - ____				____ - ____		

OTHER ACTIVITIES

Aquifer Test:	Date:	Well Decommission:	Yes:	No:	Date:
Description: N/A		Description:			

WELL SURVEY DATA (if applicable)

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

COMMENTS / REMARKS

Reported By:	Title:	Signature:	Date:
T. Buswell	Geologist	T. Buswell	10/6/08

A-6003-658 (04/03)

WELL CONSTRUCTION SUMMARY REPORT

Start Date: 9/26/2008
Finish Date: 10/9/2008
Page 1 of 1

Well ID: C6693	Well Name: 199-N-165	Approximate Location: NE of Bonneville Substation, 100N	
Project: RCRA Wells C100N Monitoring Well		Other Companies: GRAM, Inc.	
Drilling Company: Blue Star Enterprise		Geologist(s): T. Buswell	
Driller:	License #:		

TEMPORARY CASING AND DRILL DEPTH			DRILLING METHOD	HOLE DIAMETER (in.) / INTERVAL (ft)
*Size/Grade/Lbs. Per Ft.	Interval	Shoe O.D./I.D.	Auger:	Diameter ___ From ___ to ___
11 7/8" / C.S.	0.0 - 6.5	11 7/8" / 10 3/4"	Cable Tool: X	Diameter 9 5/8 From 0.0 to 86
9 5/8" / C.S.	0.0 - 86.84	9 7/8" / 8 3/4"	Air Rotary:	Diameter 11 7/8 From 0.0 to 6.5
	-		A.R. w/Sonic:	Diameter ___ From ___ to ___
	-			Diameter ___ From ___ to ___
	-			Diameter ___ From ___ to ___
*Indicate Welded (W) - Flush Joint (FJ) Coupled (C) & Thread Design				Diameter ___ From ___ to ___
Unk. Thread				
			Drilling Fluid: Water	
Total Drilled Depth: 85.9' bgs	Hole Dia @ TD: 9 5/8"		Total Amt. Of Water Added During Drilling: 13.5 gal	
Well Straightness Test Results: Passed			Static Water Level: 71.3'	Date: 10/3/08

GEOPHYSICAL LOGGING

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

COMPLETED WELL

Size/Wt./Material	Depth	Thread	Slot Size	Type	Interval Annular Seal/Filter Pack	Volume	Mesh Size
4"/Sch.10/stainless steel	85.9 - 82.89	✓	—	Natural Cave-in Material	86.84 - 85.9	—	—
4" / Sch.10 / Cont. wire wrap	82.89 - 67.89	✓	20 slot	Silica Sand	85.9 - 63.15	9.36 ft³	10-20
4"/Sch.10/stainless steel	67.89 - +2.09	✓	—	Bentonite Pellets	63.15 - 61.90	1.24	3/8"
	-			Bentonite Crumbles	61.90 - 9.15	19.90	#8
	-			Portland Cement Grout	9.15 - 0.0	7.71	—

OTHER ACTIVITIES

Aquifer Test:	Date:	Well Decommission:	Yes:	No:	Date:
Description: N/A		Description:			

WELL SURVEY DATA (if applicable)

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

COMMENTS / REMARKS

Well ID # ALC 012 riveted onto side of protective casing.
All temporary casing removed from ground.

Reported By:	Title:	Signature:	Date:
T. Buswell	Geologist	Tom Buswell	10/9/08

A-6003-658 (04/03)

WELL CONSTRUCTION SUMMARY REPORT

Start Date: 08/12/2008
Finish Date: 09/05/2008
Page 1 of 1

Well ID: C6455	Well Name: 299-E26-77	Approximate Location: Inside fence, W. of LERF pond	
Project: M-24 RCRA Wells LERF		Other Companies: GRAM, Stoller, FH	
Drilling Company: Blue Star Enterprises		Geologist(s): S. Sexton	
Driller: Doug Schnabl	License #: 2819		

TEMPORARY CASING AND DRILL DEPTH			DRILLING METHOD	HOLE DIAMETER (in.) / INTERVAL (ft)
*Size/Grade/Lbs. Per Ft.	Interval	Shoe O.D./I.D.	Auger:	Diameter ____ From ____ to ____
9 5/8" OD carbon Steel	0 - 204.5	9 7/8" / 9 1/2"	Cable Tool: ✓	Diameter 9 7/8" From 0 to 204.5
	-		Air Rotary: ✓	Diameter 7" From 204.5 to 232.8
	-		A.R. w/Sonic:	Diameter ____ From ____ to ____
	-			Diameter ____ From ____ to ____
	-			Diameter ____ From ____ to ____
*Indicate Welded (W) - Flush Joint (FJ) Coupled (C) & Thread Design				Diameter ____ From ____ to ____
RH Rope Thd				

Drilling Fluid: water

Total Drilled Depth: 232.8	Hole Dia @ TD: 7"	Total Amt. Of Water Added During Drilling: 20 gals	
Well Straightness Test Results: N/A		Static Water Level: 201.9	Date: 08/27/2008

GEOPHYSICAL LOGGING

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

COMPLETED WELL

Size/Wt./Material	Depth	Thread	Slot Size	Type	Interval Annular Seal/Filter Pack	Volume	Mesh Size
4" Sch. 10 s.s. sump	228.6 - 225.6	✓	N/A	Colorado silica sand	232.8 - 194.6	11.77 ft³	10-20
4" s.s. wire wrap	225.6 - 200.85	✓	0.020"	Coated bent. pellets	194.6 - 189.0	1.86 ft³	3/8"
4" Sch. 10 s.s. riser	200.85 - 1.96 ags	✓	N/A	Granular bentonite	189.0 - 11.05	71.0 ft³	#8
	-			Portland cement	11.05 - Ø	6.425 ft³	—
	-				-		

OTHER ACTIVITIES

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

WELL SURVEY DATA (if applicable)

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

COMMENTS / REMARKS

Reported By:	Title:	Signature:	Date:
S. Sexton	Geologist	[signature]	09/05/2008

A-6003-658 (04/03)

WELL CONSTRUCTION SUMMARY REPORT

Start Date: 09/09/2008
Finish Date: 10/02/2008
Page 1 of ___

Well ID: C108226	Well Name: 299-E26-79	Approximate Location: Inside fence, LERF, 200E
Project: M-24 RCRA Wells (LERF)		Other Companies: GRAM, Stoller, FH
Drilling Company: Blue Star Enterprises		Geologist(s): S. Sexton, L. Brouillard
Driller: Aquilla Hoopes	License #:	

TEMPORARY CASING AND DRILL DEPTH

*Size/Grade/Lbs. Per Ft.	Interval	Shoe O.D./I.D.
9 5/8" carbon steel	0 - 206	9 7/8"/9 1/2
	-	
	-	
	-	
	-	

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

RH. Rope Thd.

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

Auger:	Diameter	From	to
Cable Tool: ✓	Diameter 9 7/8"	From 0	to 206
Air Rotary: ✓	Diameter 7"	From 206	to 224.76
A.R. w/Sonic:	Diameter	From	to
	Diameter	From	to
	Diameter	From	to
	Diameter	From	to

Drilling Fluid: water

Total Drilled Depth: 224.76	Hole Dia @ TD: 7"	Total Amt. Of Water Added During Drilling: 50 gals	
Well Straightness Test Results: N/A		Static Water Level: 201.7	Date: 09/22/2008

GEOPHYSICAL LOGGING

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

COMPLETED WELL

Size/Wt./Material	Depth	Thread	Slot Size	Type	Interval Annular Seal/Filter Pack	Volume	Mesh Size
4" Sch. 10 s.s. sump pipe	223.2 - 220.2	✓	N/A	Colorado silica sand	224.76 - 187.8	12.84 ft³	10-20
4" stainless steel wire wrap	220.2 - 195.2	✓	0.020"	Coated bent pellets	187.8 - 183.0	3.1 ft³	3/8"
4" Sch. 10 s.s. riser	195.2 - 2.3 ags	✓	N/A	Granular bentonite	183.0 - 10.3	69.58 ft³	#8
	-			Portland cement	10.3 - ø	5.14 ft³	—
	-				-		

OTHER ACTIVITIES

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

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

	Protective Casing Elevation:
Washington State Plane Coordinates:	Brass Survey Marker Elevation: CDW 10/13/08

COMMENTS / REMARKS

Reported By:	Title:	Signature:	Date:
S. Sexton	Geologist	[signature]	10/06/2008

A-6003-658 (04/03)

This page left intentionally blank.

APPENDIX D

WELL DEVELOPMENT DATA

This page intentionally left blank

WELL DEVELOPMENT AND TESTING DATA

Well Name:	Well ID:	Well Location:	Date:
299-E25-236	C6542	W. of 242-A Evaporator, 200-E	9-24-08

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

Has the well been surveyed? ○ Yes ☒ No | Does the well have a cement pad? ○ Yes ☒ No

PART 1

STATIC WATER LEVEL:

Start of Job	297.31' TOC
End of Job	297.40' TOC

DEPTH TO BOTTOM:

Start of Job	331.6 ~~331.6~~' TOC (DB 9/24/08)
End of Job	331.6' TOC

PART 2

WELL DEVELOPMENT DATA

Pump Model	5HP Franklin Electric
Intake Depth	LOWER 315.2' bgs / UPPER 298.9' bgs
Starting Turbidity	LOWER 2.71 NTU / UPPER 4.37

Pump Start	Stop	Flow Rate
1011	1130	~33.3 gpm
1325	1351	~33.3 gpm

Total Pumped	3499.93 gal
Final Turbidity	UPPER 0.57 NTU / LOWER 0.5 NTU
XD SN/Range (PSI)	20 psi / 5218

PART 3

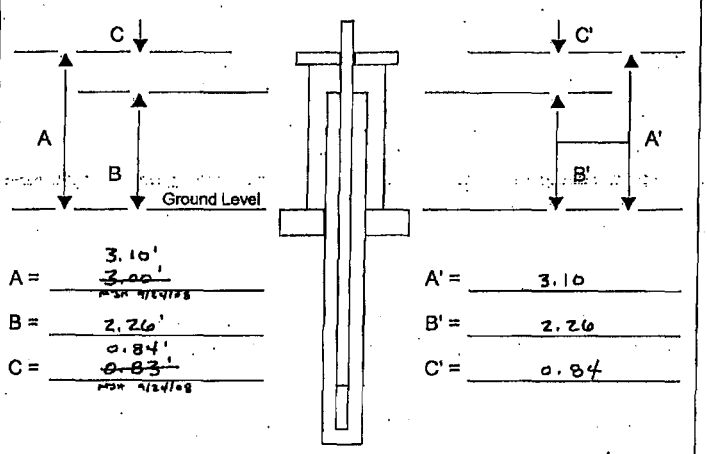
INSTANTANEOUS SLUG TEST

Static Water Level (TOC)	
Transducer Depth	
Baseline Start	Not used.
Injection Start	(B) 9/24/08
Baseline Start	
Withdrawal Start	
Slug Volume	
XD SN/Range (PSI)	

PART 4

Last Recorded Measurements Date: 9/23/08

Current Measurements Date: 9/24/08



A =	3.10' ~~3.00'~~ MSH 9/24/08	A' =	3.10
B =	2.26'	B' =	2.26
C =	0.84' ~~0.83'~~ MSH 9/24/08	C' =	0.84

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

PART 5

COMMENTS: FIELD "CALIBRATION"

2100P TURBIDIMETER

Standard	READS
0-10: 4.84 NTU	4.91 NTU
0-100: 43.9 NTU	48.6 NTU (ABOVE RANGE)
0-1000: 550 NTU	594 NTU (ABOVE RANGE)

HACH SENSION 156 (pH/conductivity)

pH	Conductivity S	Conductivity R
4 : 4.49	1405 uS/cm	1419 uS/cm
7 : 7.56		
10 : 10.17		

Prepared by (print name):	Signature:	Date:
Jess Hocking / T. Bushwell	[signature]	9/24/08
Reviewed by (print name):	**Signature:**	**Date:**
L.D. Walker	[signature]	10/14/08

A-6003-644 (03/03)

FIELD ACTIVITY REPORT - DAILY DRILLING

Page 1 of 3

Date: 9-24-08

Well Name: 299-E25-230	Well ID: C6542
Location: W. of 242-A Evaporator, 200-E'	Report No.: 19 18 LW 10/14/08

Start	Finish	Total
Time 0630	Time 1630	Time 10 hrs
Hole Depth/Csg – / –	Hole Depth/Csg – / –	Hole Depth/Csg – / –

Reference Measuring Point: GROUND SURFACE

Casing String No. 1 2 3 4 ____ See Report No. 1

Rod Size: N/A

Time/Depth From	Time/Depth To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
0630	0645	POD Mtg.
0645	0740	Drillers prepare to begin well development activities.
0740	0749	DTB tagged @ ~~331.6~~ 331.6' TOC, DTW tagged @ 297.31' TOC.
0800		Drillers begin "tripping" tremie pipe/pump & transducer
		(S/N 5218, 20psi) down the hole. Pump = 5HP Franklin
		Electric submersible [5.8 ft from btm to coupling, Intake 2.6 ft
		from bottom], ~~13~~ 15 x 21' tremie = 315' + 5.8 ft pump = 320.8 ft,
		est. intake to be ~ ~~317.8'~~ 315.2' bgs.
	0915	Pump to depth; Geo's field calibrate parameter kit.
	0925	Purge water truck on site; Initial XD = 18.576 ft H_2O.
930		Waiting for drillers to begin development.
	1011	Start pump test (Silver WD1); See pg. 3 for details.
	1014	Flow rate bucket test performed: 5 Gal / 9 sec = ~33.3 gal/min.;
		FH Safety onsite (D. Dewitt & K. Holshue) to observe development.
	1109	Final turbidity = 0.50 NTU.; Final XD = 18.581' H_2O;
		Flow rate bucket test = 5 gal / 9 sec = ~33.3 gpm.
	1130	Pump shut off, Test #1 ended and Test #2 (Silver WD2)
		started for recovery.
1133		Break for lunch.
	1308	Recovery test stopped.
	1309	Geo. (T. Buswell) takes site over for Geo. (J. Hocking)
1310	—	Drillers remove 21' piece of tremie pipe. Trip in ~~5.01~~ 4.9' = ~~304.8~~ 304.5 ft = electric
—	1320	Submersible, est. intake to be ~ ~~299.7' bgs~~ 298.9' bgs.
1320	—	Pump to depth. Set up for pump test #2. (See pg. 2 →)

Reported By: Jess Hocking / T. Buswell	Reviewed By: L. D. Walker
Title: Geologist / Geologist Date: 9/24/08	Title: Geologist Date: 10/14/08
Signature: J. Hocking / T. Buswell	Signature: D. Walker

A-6003-651 (REV 1)

FIELD ACTIVITY REPORT - DAILY DRILLING Continuation Page	Page 2 of 3 Date: 9-24-08
Well Name: 299-E25-236	Well ID: C6542
Location: W. of 242-A Evaporator, 200-E.	Continuation of Report No.: ~~14~~ 18 CW 10/14/08

Time/Depth From	Time/Depth To	Description of Activities/Operations with Depth
	1325	Initial xD = 2.467 ft H_2O.
1325	1326	Start pump test (Silver WD3). See pg. 3 for further details.
1326	1350	Flow rate bucket test = 5 gal / 9 sec = ~ 33.3 gpm.
1350	1351	Final turbidity = 0.57 NTU; Final xD = 2.424 ft H_2O.
1351		Pump shut off, Test #3 ended and Test #4 (Silver WD4) initiated
	1520	for recovery.
1520	1555	Recovery test stopped. Drillers prep to remove tremie pipe/pump.
1555		Tremie pipe/pump removed.
	1610	→ TB = 331.6 ft TOC; DTW = 297.4' bgs.
1610	1630	Clean-up/secure site. Geo. paperwork.
1630		Geo. Leave site.

not used. 9/24/08

Reported By: T. Buswell		Reviewed By: C.D. Walker	
Title: Geologist	Date: 9/24/08	Title: Geologist	Date: 10/14/08
Signature: T. Buswell		Signature: CD Walker	

A-6003-652 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING

Continuation Page

Page 3 of 3

Date: 9/24/08

Well Name: 299-E25-236

Well ID: 16542

Location: W. of 242-A Evaporator, 200-E

Continuation of Report No.: 4-18 LW 10/14/08

Time/Depth From	Time/Depth To	Description of Activities/Operations with Depth
		INITIAL XD = 18.576
Test#1	TIME	XD / TURB. / pH / Cond. / Temp
	1024	18.585 / 2.71 / 8.53 / 586 / 16°C
	1033	18.570 / 1.35 / 8.74 / 493 / 18°C
	1051	18.576 / 1.00 / 8.62 / 528 / 19.1°C
	1109	18.585 / 0.50 / 8.35 / 475 / 20.7°C
	Time	XD / Turb / pH / Cond / Temp — Initial XD = 2.467 ft
Test#2	1331	2.467 / 4.37 / 8.36 / 496 / 19.8°C
	1337	2.417 / 1.56 / 8.37 / 463 / 19.5°C
	1343	2.423 / 0.31 / 8.33 / 459 / ~~20.0°C~~ 20.2°C
	1348	2.424 / 0.57 / 8.49 / 467 / 19.5°C

Not used.

(18)

Reported By: T. Bussell

Title: Geologist

Date: 9/24/08

Signature: T. Bussell

Reviewed By: L. D. Walker

Title: Geologist

Date: 10/14/08

Signature: L. D. Walker

A-6003-652 (04/03)

WELL DEVELOPMENT AND TESTING DATA

Well Name:	Well ID:	Well Location:	Date:
299-E26-77	C6455	INSIDE FENCE, LERF, 200-E	9-25-08

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

Has the well been surveyed? ○ Yes ☒ No | Does the well have a cement pad? ☒ Yes ○ No

PART 1

STATIC WATER LEVEL:

Start of Job	206.8' TOC
End of Job	206.8' TOC

DEPTH TO BOTTOM:

Start of Job	231.6' TOC
End of Job	231.6' TOC

PART 2

WELL DEVELOPMENT DATA

Pump Model ½ HP Grundfos Redi-Flo 2

Intake Depth ~ 223.3' bgs

Starting Turbidity 33.1 NTU

Pump Start	Stop	Flow Rate
0849	0900 ~~0959~~ MSH 9/25/08	3.5 gpm
0900	0959	5.8 gpm

Total Pumped 380.7 gal.

Final Turbidity 4.72 NTU

XD SN/Range (PSI) N/A

PART 3

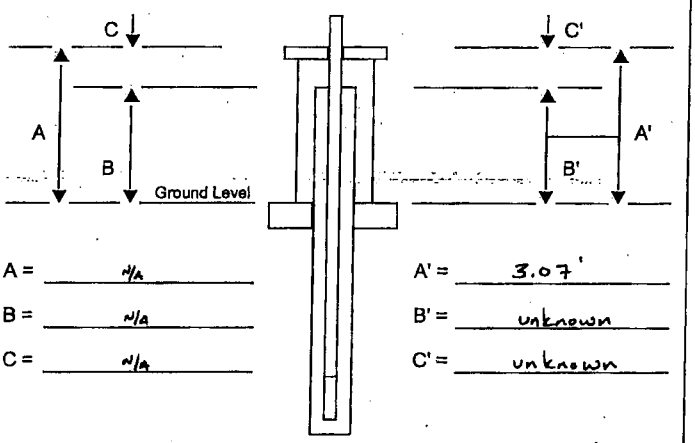
INSTANTANEOUS SLUG TEST

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

PART 4

Last Recorded Measurements Date: N/A

Current Measurements Date: 9/25/08



A = N/A

B = N/A

C = N/A

A' = 3.07'

B' = unknown

C' = unknown

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

PART 5

COMMENTS: FIELD CALIBRATION

2100P TURBIDIMETER

standard	reading
4.84 NTU	4.87 NTU
43.9 NTU	48.4 NTU
550 NTU	591 NTU

HACH SENSION 156 (pH / conductivity)

pH standard	pH reading
4.0	4.50
7.0	7.50
10.0	10.40

cond. standard	cond. reading
1413 µS/cm	1436 µS/cm

Prepared by (print name):	Signature:	Date:
Jess Hocking	[signature]	9/26/08
Reviewed by (print name):	**Signature:**	**Date:**
L.D. Walker	[signature]	10/13/08

A-6003-644 (03/03)

FIELD ACTIVITY REPORT - DAILY DRILLING

Page 1 of 1

Date: 9-25-08

Well Name: 299-E26-77

Well ID: C6455

Location: INSIDE FENCE, LERF, 200-E

Report No.: 18

Start	Finish	Total
Time 0845	Time 1011	Time 1hr. 26min.
Hole Depth/Csg – / –	Hole Depth/Csg – / –	Hole Depth/Csg – / –

Reference Measuring Point: GROUND SURFACE

Casing String No. 1 2 3 4 ____ Rod Size: N/A

See Report No. 1

Time/Depth From	Time/Depth To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
	0845	DTB = 231.6' TOC, DTW = 206.8' TOC ; WATER COLUMN ~ 24.8' H_2O.
0846	0848	Geo. performs field calibrations of water parameter "sampling" equipment.
	0849	Flowrate bucket test performed : 5gal / 1.42min = 3.5 gpm
	0859	Starting turbidity = 33.1 NTU
	0900	Flowrate bucket test performed : 5gal / 52 sec. = 5.8 gpm (pump kicked-up)
	0903	DTW = 209.7' TOC (draw = 2.9' H_2O @ 5.8 gpm)
	0915	DTW = 210.1' TOC (draw = 3.3' H_2O @ 5.8 gpm)
	0930	DTW = 210.3' TOC (draw = 3.5' H_2O @ 5.8 gpm)
	0952	DTW = 210.25' TOC (draw = 3.45' H_2O @ 5.8 gpm)
	0959	Pump shut off ; draw "test" completed.
	1003	DTW = 206.8' TOC (Recovery = 100%)
	1011	Drillers : Geo. depart from site.

WATER PARAMETERS:

TIME	TURB	TEMP	pH	Cond.	Flowrate
0859	33.1 NTU	19.5°C	8.15	995 µS/cm	3.5 gpm
0908	56.6 NTU	19.6°C	8.04	983 µS/cm	5.8 gpm
0918	222 NTU	19.6°C	8.14	979 µS/cm	5.8 gpm
0933	11.5 NTU	19.1°C	8.02	980 µS/cm	5.8 gpm
0945	4.72 NTU	19.7°C	8.26	1020 µS/cm	5.8 gpm

NOT USED

9/25/08

Reported By: Jess Hocking		Reviewed By: L.D. Walker	
Title: Geologist	Date: 9/25/08	Title: Geologist	Date: 10/13/08
Signature:		Signature:	

A-6003-651 (REV 1)

WELL DEVELOPMENT AND TESTING DATA

Well Name:	Well ID:	Well Location:	Date:
199-N-165	C6693	NE of Benwalle Substation, 100 N	10/9/08

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

Has the well been surveyed? ○ Yes ⊗ No | Does the well have a cement pad? ○ Yes ⊗ No

PART 1

STATIC WATER LEVEL:

Start of Job	75.05' TOC
End of Job	75.10' TOC

DEPTH TO BOTTOM:

Start of Job	~~85.94~~ 88.83' TOC
End of Job	88.83' TOC

PART 2

WELL DEVELOPMENT DATA

Pump Model	5 HP Franklin Electric
Intake Depth	80.38' TOC
Starting Turbidity	69.4 NTU

Pump Start	Stop	Flow Rate
0919	0923	13.6 gpm
0923	1115	9.38 gpm

Total Pumped	1104.96 gal
Final Turbidity	3.42 NTU
XD SN/Range (PSI)	20 psi / 5218

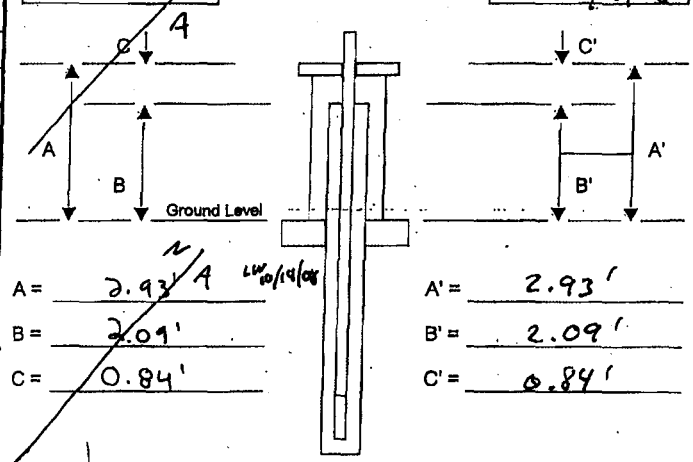
PART 3

INSTANTANEOUS SLUG TEST

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

PART 4

Last Recorded Measurements Date: N/A	Current Measurements Date: 10/9/08
A = ~~2.93'~~ N/A LW 10/14/08	A' = 2.93'
B = ~~2.09'~~	B' = 2.09'
C = ~~0.84'~~	C' = 0.84'



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

PART 5

COMMENTS: "Field Calibration"

2100P Turbidimeter

Standard	Reads
0-10: 4.84 NTU	4.92 NTU
0-100: 43.9 NTU	48.6 NTU (Above range)
0-1000: 550 NTU	595 NTU (Above range)

HACH Sension 156 (pH/conductivity)

pH	Conductivity
4: 4.52	(No standard available to test calibration)
7: 7.57	Most recent field calibrations:
10: 10.61	1: 1405 µS/cm 2: 1419 µS/cm

HACH HQ10/HQ20 LDO (Dissolved Oxygen meter)

· Calibrated per instruction

Prepared by (print name):	Signature:	Date:
Tessa Boswell	Tessa Boswell	10/9/08
Reviewed by (print name):	**Signature:**	**Date:**
L. D. Walker	[signature]	10/14/08

A-6003-644 (03/03)

FIELD ACTIVITY REPORT - DAILY DRILLING

Page 1 of 3

Date: 10/9/08

Well Name: 199-N-165

Well ID: C 6693

Location: NE of Bonneville Substation, 100N

Report No.: ~~9~~ 8 10/9/08

Start	Finish	Total
Time 0610	Time 1430	Time 8 hrs 20 min
Hole Depth/Csg — / —	Hole Depth/Csg — / —	Hole Depth/Csg — / —

Reference Measuring Point: GROUND SURFACE

Casing String No. ① 2 3 4 ____ Rod Size: ① – 4" perm. S.S.

See Report No. 1

Time/Depth From	Time/Depth To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
0610	0620	To MO-285 for POD
0620	0700	POD
0700		To site. Prep. to begin development activities. Waiting for
		purge truck. Geo calibrate's field parameter kit.
		→ DTW: 75.05' TOC (72.12' bgs)
	0815	→ DTB: 88.83' TOC (85.9' bgs)
0815		Drillers begin "tripping in" 1-in OD termite pipe/pump + transducer;
		transducer = S/N 5218. 20 psi; Pump = 5HP Franklin Electric
		submersible [5.8' long, intake = 2.6' from bottom]. Transducer
		placed 6.0' from bottom of pump.
		→ Termite = 21.01' + 21.13' + 21.00' + 4.48' + 5.11' + 3.95' = 77.18' tally
		→ Termite + pump = 82.98' total − 3.00' stkup = 79.98' bgs; intake
		@ 77.38' bgs, transducer @ 73.98' bgs.
		→ Safely to site @ 0815.
	0900	→ Still waiting for purge truck.
0900	0919	Purge truck to site.
0919		Start pump test (Archaic W01); See pg. for details.
		→ Flow rate bucket test performed = 22s for 5 gal = 13.6 gal/min
		→ Note: water level immediately drawn down below transducer;
		well pump diameter is too large to adequately estimate the
		water level. However, pump still pumping water; draw-down
		is between 73.98' and 77.38' bgs (< 3.4 feet). Geo. will
		continue to take parameters.
	1115	→ Changed flow rate to decrease draw down = 5 gal/22s = 1.38 gal/min @ 0923. (See pg 2-7)

Reported By: T. Buswell		Reviewed By: L.D. Walker	
Title: Geologist	Date: 10/9/08	Title: Geologist	Date: 10/14/08
Signature: Tom Buswell		Signature: L D Walker	

A-6003-651 (REV 1)

FIELD ACTIVITY REPORT - DAILY DRILLING
Continuation Page

Page 2 of 3
Date: 10/9/08

Well Name: 99-N-165 | Well ID: C6693
Location: NE of Bonneville Substation, 100N | Continuation of Report No.: 8

Time/Depth From	Time/Depth To	Description of Activities/Operations with Depth
1115		Pump shut off. Test #1 (Archive WD1) ended; recovery test
	1135	(Archive WD2) initiated.
1135	1230	Break for lunch.
1230	1240	Check recovery.
1240	1242	Stop recovery test Archive WD2.
1242	1245	Drillers prep. to remove tremmie / pump / transducer
1245	1310	Begin removing tremmie, etc...
1310		All tremmie pipe removed. Drillers prep. to trip in permanent
		pump + tremmie.
		• Geo. measurements:
		→ Tremmie = ~20' long, 3/4" diam, Sch40S, TP304 / TP304L
		stainless steel pipe.
		→ Pump = Grundfos Redi Flo 3, ~~3.5~~ 3.5' (TB 10/9/08) long, 1.75' from base to intake
	1340	1/2 HP, 10 gpm, Model A/B P10741, #10SQE-100 NE.
1340		Begin "tripping in" perm. pump / tremmie pipe.
		→ 20.08' Long x #4 = 80.32' total
		3.95' long x #1 = ~~2.50~~ (TB 10/9/08) 3.95' total.
		2.50' long pump = 2.50'
		• Depth of pump = 86.77' TOC, 83.77' bgs.
		• Depth of intake = 85.02' TOC, 82.02' bgs.
	1410	(Tremmie stkp ≈ 3.0' ~~bgs~~ (TB 10/9/08) ags.)
1410		Drillers hook up newly installed pump to generator.
	1420	→ Pumped 5 gal / 42 s = 7.14 gal/min.
1420		Drillers will conduct surface completion + rivet WIN "ALC 012" tag
		onto protective casing @ a later date.
	1430	→ Geo paperwork.
1430		Geo. leave site.
		not used (TB)

Reported By: T. Bussell | Reviewed By: L. D. Walker
Title: Geologist | Date: 10/9/08 | Title: Geologist | Date: 10/14/08
Signature: [signature] | Signature: [signature]

A-6003-652 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING

Continuation Page

Page 3 of 3

Date: 10/9/08

Well Name: 199-N-165

Well ID: C6693

Location: NE of Emmerville Substation, 100N

Continuation of Report No.: 8

Time/Depth From	Time/Depth To	Description of Activities/Operations with Depth						
		Test #1: Initial xD: 2.142						
	Time	xD	Turb.	pH	Conduc.	Temp.	DO_2	
	0925		69.4	8.49	989	17.2°C	9.98	
	0943		20.9	8.32	1054	18.6°C	8.23	
	1000		8.26	8.54	1037	19.1°C	8.35	
	1024		5.37	8.34	1021	19.0°C	8.48	
	1043		4.21	8.62	1038	19.1°C	8.38	
	1102		3.42	8.66	1045	19.4°C	8.28	

Reported By: T. Bussell

Title: Geologist

Date: 10/9/08

Signature: Tom Bussell

Reviewed By: L. D. Walker

Title: Geologist

Date: 10/14/08

Signature: L D Walker

A-6003-652 (04/03)

WELL DEVELOPMENT AND TESTING DATA

Well Name:	Well ID:	Well Location:	Date:
297-E26-79	C68226	Inside Fence, LERF	10/02/08

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

Has the well been surveyed? ○ Yes ☒ No | Does the well have a cement pad? ○ Yes ☒ No

PART 1

STATIC WATER LEVEL:	
Start of Job	201.7
End of Job	201.6
DEPTH TO BOTTOM:	
Start of Job	225.5
End of Job	225.5

PART 2

WELL DEVELOPMENT DATA

Pump Model: Grundfos 75S-50

Intake Depth 216'

Starting Turbidity >1000

Pump Start	Stop	Flow Rate
1249	1331	8 gpm

Total Pumped	336
Final Turbidity	2.67
XD SN/Range (PSI)	5218/20.0

PART 3

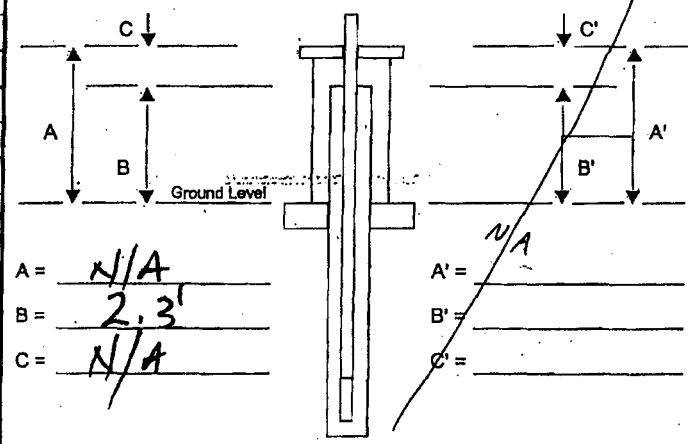
INSTANTANEOUS SLUG TEST

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

PART 4

Last Recorded Measurements Date: 10/02/08

Current Measurements Date:



A = N/A

B = 2.3'

C = N/A

A' = N/A

B' =

C' =

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

PART 5

COMMENTS:

xDi: 8.481

xDf: 8.449

Prepared by (print name):	Signature:	Date:
S. Sexton	[signature]	10/2/08
Reviewed by (print name):	**Signature:**	**Date:**
L.D. Walker	[signature]	10/13/08

A-6003-644 (03/03)

FIELD ACTIVITY REPORT - DAILY DRILLING

Page 1 of 2

Date: 10/02/2008

Well Name: 299-E26-79 | Well ID: C608226

Location: Inside fence, S. of LERF | Report No.: ~~14~~ 15 (W 10/13/08)

Start	Finish	Total
Time 0600	Time 1600	Time 10.0 hrs
Hole Depth/Csg 15 / 14.5	Hole Depth/Csg Ø / Ø	Hole Depth/Csg Ø5 / 14.5

Reference Measuring Point: GROUND SURFACE

Casing String No. (1) 2 3 4 ____ See Report No. 1

Rod Size: #1: 9 5/8"

Time/Depth From	Time/Depth To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
0600		POD @ trailer w/ RTR, geo; drillers on-site;
		geo arrives on-site 0608; drillers to 100N to
	0825	collect equipment; drillers on-site @ 0820.
0825		Resume well construction; tag well @ 15.0' bgs
		w/ 14.6' casing in ground; will backpull 4' &
	0837	remove casing jacks, in prep for well develop.
~~0837~~	~~0907~~	removing jars to be ~~taken~~ by other drillers
0907		add 1 bag bentonite + backpull casing ~5';
		remove 10' @ 0912 ~ 12' total remaining; tag DTB
		@ 0917 @ 12.5' bgs, add 1 bag bentonite &
	0929	prep for development; DTB = 10.5' bgs
0929		Info for test pump: Franklin-Electric 5 hp
		motor w/ 8-stage pump 4.75' overall length,
		2.45' motor 2.35' pump; trip-in pump & tremie
		at 0950; pump tripped in by 1030, intake depth
	1030	21.8' bgs;
1030	1110	drillers move pump rig & prep for dev.
1110	1215	Lunch
1215		on-site, drillers hook up hoses, geo runs
		field parameters: ~~pH: 5.72 pH: 4.75~~ TMS 10/2/08 turb: 4.90
		pH: 10.53 pH: 7.71 cond: 1447 turb: 48.5
		known: pH: 10.00 pH: 7.00 turb: 592
		cond: 1413
	1247	turb: 550 turb: 43.9 turb: 4.84

Reported By: S. Sexton	Reviewed By: L.D. Walker
Title: Geologist Date: 10/2/08	Title: Geologist Date: 10/2/08
Signature: [signature]	Signature: [signature]

A-6003-651 (REV 1)

FIELD ACTIVITY REPORT - DAILY DRILLING
Continuation Page

Page 2 of 2
Date: 10/02/2008

Well Name: 299-S26-79
Well ID: CC8826
Location: Inside fence, S. of LERF ponds
Continuation of Report No.: ~~14~~ 15 LW 10/13/08

Time/Depth From	Time/Depth To	Description of Activities/Operations with Depth
1247		Begin test with xD5288 hermit 3K-45812
		1gpm DALF: pump on @ 1249 rate: 8 gpm test Rivet 1
		turb. pH cond (µS) temp (°C) DO (mg/L) xD (ft)
[illegible]		>1000 7.78 660 20.5 3.42 7.641
1259		16.2 7.88 657 19.[illegible] 7.10 7.005
1303		16.2 7.95 629 19.9 7.45 6.960
1307		6.58 8.01 639 19.5 7.62 6.937
1310		5.42 7.82 633 19.5 7.74 6.925
1315		3.49 8.23 636 19.4 7.81 6.910
1319		3.68 8.29 641 19.5 7.90 6.901
1323	1331	2.67 8.17 638 19.4 7.98 6.892
1331	1347	pump shut off, begin recovery test Rivet w D2
1347		trip-out tremmie + pipe; Tag well DTB =
		223.2' bgs; drillers moving trailer + equipment
	1438	prep to pour grout seal;
1438		DTB of borehole = 10.3' bgs to top of bent.
		mixing + pouring cement: Portland type I-II
		3 bags cement grout poured in @ 1509; backpull
		final 12' @ 1524 (5' temp. casing remaining);
		borehole @ 4' will mix more grout, seal to surface
	1550	mix + add 1 more bag of grout = 4 bags total
~~1550~~	1600	monument set, secure site + dump for clay

Not Used 10/02/2008

Reported By: S. Sexton
Title: Geologist
Date: 10/2/08
Signature: [signature]

Reviewed By: L.D. Walker
Title: Geologist
Date: 10/13/08
Signature: [signature]

A-8003-652 (04/03)

This page left intentionally blank.

APPENDIX E

CIVIL SURVEY REPORTS

This page intentionally left blank.

WELL SURVEY DATA REPORT

Project:	**Prepared By:** L. Henke **Company:** FGG
Date Requested: 09/29/2008	**Requestor:** C.S. Wright (FH)
Date of Survey: 10/08/2008	**Surveyor:** S. Wray FGG Survey Dept.
ERC Point of Contact:	**Survey Co. Point of Contact:** N.F. Fastabend
Description of Work: Civil Survey of Well C6455 (299-E26-77).	**Horizontal Datum:** NAD83(91) **Vertical Datum:** NAVD88 **Units:** METERS **Hanford Area Designation:** 200E

Coordinate System: Washington State Plane Coordinates (South Zone)

Horizontal Control Monuments:
2E-127 (FGG), 2E-27 (FGG)

Vertical Control Monuments:
RB-1 (FGG), 2E-102 (FGG)

Well ID	Well Name	Easting	Northing	Elevation	
C6455	299-E26-77	575579.03	137129.97		Center of Casing
				184.781	Top of Pump Base Plate, N. Edge
				184.771	Top of Outer Casing, N. Edge
				183.998	Brass Survey Marker

Notes:

EQUIPMENT USED: TRIMBLE GPS 5800 RTK
TRIMBLE DiNi 12 LEVEL

Surveyor Statement:
I, Larry A. Henke, a Professional Land Surveyor registered in the State of Washington (Registration No. 38975), hereby certify that this report is based on a field survey performed in October, 2008 under my direct supervision, and that the data contained here is true and correct.

LARRY A. HENKE
STATE OF WASHINGTON
OCT 8 2008
38975
REGISTERED
PROFESSIONAL LAND SURVEYOR
EXPIRES Sept 23 2009

Original to:
Distribution by DIS:

WELL SURVEY DATA REPORT

Project:	**Prepared By:** L. Henke **Company:** FGG
Date Requested: 09/29/2008	**Requestor:** C.S. Wright (FH)
Date of Survey: 10/08/2008	**Surveyor:** S. Wray FGG Survey Dept.
ERC Point of Contact:	**Survey Co. Point of Contact:** N.F. Fastabend
Description of Work: Civil Survey of Well C6826 (299-E29-79).	**Horizontal Datum:** NAD83(91) **Vertical Datum:** NAVD88 **Units:** METERS **Hanford Area Designation:** 200E

Coordinate System: Washington State Plane Coordinates (South Zone)

Horizontal Control Monuments:
2E-127 (FGG), 2E-27 (FGG)

Vertical Control Monuments:
RB-1 (FGG), 2E-102 (FGG)

Well ID	Well Name	Easting	Northing	Elevation	
C6826	299-E29-79	575827.88	137051.50		Center of Casing
				183.124	Top of Pump Base Plate, N. Edge
				183.114	Top of Outer Casing, N. Edge
				182.354	Brass Survey Marker

Notes:

EQUIPMENT USED: TRIMBLE GPS 5800 RTK
TRIMBLE DiNi 12 LEVEL

Surveyor Statement:
I, Larry A. Henke, a Professional Land Surveyor registered in the State of Washington (Registration No. 38975), hereby certify that this report is based on a field survey performed in October, 2008 under my direct supervision, and that the data contained here is true and correct.

LARRY A. HENKE
STATE OF WASHINGTON
OCT 8 2008
38975
REGISTERED
PROFESSIONAL LAND SURVEYOR
EXPIRES Sept. 23, 2009

Original to:
Distribution by DIS:

WELL SURVEY DATA REPORT

Project:	**Prepared By:** S. Wray **Company:** FGG
Date Requested: 10/02/08	**Requestor:** Chris Wright (FH)
Date of Survey: 10/14/08	**Surveyor:** S. Wray (FGG)
ERC Point of Contact:	**Survey Co. Point of Contact:** Neil Fastabend (FGG)
Description of Work: Civil Survey of Groundwater Monitoring Well #C6542 (299-E25-236)	**Horizontal Datum:** NAD83(91) **Vertical Datum:** NAVD88 **Units:** METERS **Hanford Area Designation:** 200E

Coordinate System: Washington State Plane Coordinates (South Zone)

Horizontal Control Monuments: 2E-127 (FGG), 2E-27 (FGG)

Vertical Control Monuments: 2E-18 (FGG), 2E-27 (FGG)

Well ID	Well Name	Easting	Northing	Elevation	
C6542	299-E25-236	575327.99	135965.34		Center of Casing
				212.588	Top Pump Baseplate. N. Edge
				212.578	Top Casing, N. Edge
				211.774	Brass Survey Marker

Notes:

EQUIPMENT USED: TRIMBLE GPS 5800 RTK
TRIMBLE DiNi 12 LEVEL

Surveyor Statement:
I, Larry A. Henke, a Professional Land Surveyor registered in the State of Washington (Registration No. 38975), hereby certify that this report is based on a field survey performed in October, 2008 under my direct supervision, and that the data contained here is true and correct.

LARRY A. HENKE
STATE OF WASHINGTON
Oct 14 2008
38975
REGISTERED
PROFESSIONAL LAND SURVEYOR
EXPIRES Sept. 23, 2009

Original to:
Distribution by DIS:

WELL SURVEY DATA REPORT

Project:	**Prepared By:** L.A. Henke **Company:** FGG
Date Requested: 11/12/2008	**Requestor:** C.S. Wright (FH)
Date of Survey: 11/21/2008	**Surveyor:** L.A. Henke FGG Survey Dept.
ERC Point of Contact:	**Survey Co. Point of Contact:** N.P. Fastabend
Description of Work: Civil Survey of Well C6693 (199-N-165).	**Horizontal Datum:** NAD83(91) **Vertical Datum:** NAVD88 **Units:** METERS **Hanford Area Designation:** 100N

Coordinate System: Washington State Plane Coordinates (South Zone)

Horizontal Control Monuments: GABLEMTN (FH), 100K-3 (FGG)

Vertical Control Monuments: T-324 (COE), FLINE (COE)

Well ID	Well Name	Easting	Northing	Elevation	
C6693	199-N-165	571260.96	149154.68		Center of Casing
				141.488	Top of Pump Base Plate, N. Edge
				141.478	Top of Outer Casing, N. Edge
				140.727	Brass Survey Marker

Notes:

EQUIPMENT USED: TRIMBLE GPS 5800 RTK
TRIMBLE DiNi 12 LEVEL

Surveyor Statement:
I, Larry A. Henke, a Professional Land Surveyor registered in the State of Washington (Registration No. 38975), hereby certify that this report is based on a field survey performed in November, 2008 under my direct supervision, and that the data contained here is true and correct.

LARRY A. HENKE
STATE OF WASHINGTON
NOV 24 2008
38975
REGISTERED
PROFESSIONAL LAND SURVEYOR
EXPIRES Sept. 23, 2009

Original to:
Distribution by DIS:

DISTRIBUTION

Onsite

1	U.S. Department of Energy Richland Operations Office	
	DOE Public Reading Room	H2-53
	R. D. Hildebrand	A6-38
	CHPRC	
	D. L. Dewey (2)	E6-35
	M. J. Hartman	B6-06
	J. W. Lindberg	B6-06
	S. P. Luttrell	B6-06
	R. W. Oldham	E6-35
	J. L. Smoot	B6-06
	L. C. Swanson	B6-06
	W. R. Thackaberry	E6-35
	L. D. Walker	E6-35
	C. S. Wright	E6-35
1	Pacific Northwest National Laboratory	
	Hanford Technical Library	P8-55
1	Lockheed Martin Enterprise Solutions & Services	
	Document Clearance	H6-08

This page intentionally left blank.