

## Appendix C

### Supporting Information for Monitored Facilities

## Contents

Appendix C - Supporting Information for Monitored Facilities.....	C-1
References.....	C-1

## Tables

Table C-1. Estimates of Groundwater Flow Rates at Hanford Site RCRA Facilities. ....	C-6
Table C-2. Upgradient / Downgradient Comparison Values Used for Statistical Comparisons at RCRA Sites in Calendar Year 2009.....	C-8
Table C-3. Monitoring Wells and Constituents for 100-N Area Units. ....	C-9
Table C-4. Critical Means for 116-N-1 Liquid Waste Disposal Facility for Fiscal Year 2010 Comparisons.....	C-10
Table C-5. Critical Means for 120-N-1 and 120-N-2 Liquid Waste Disposal Facilities for Fiscal Year 2010 Comparisons.....	C-10
Table C-6. Critical Means for 116-N-3 Liquid Waste Disposal Facility for Fiscal Year 2010 Comparisons.....	C-11
Table C-7. Monitoring Wells and Constituents for 116-H-6 Evaporation Basins.....	C-11
Table C-8. Monitoring Wells and Constituents for 216-A-29 Ditch. ....	C-12
Table C-9. Critical Means for 216-A-29 Ditch for Fiscal Year 2010 Comparisons. ....	C-13
Table C-10. Monitoring Wells and Constituents for 216-B-3 Pond. ....	C-13
Table C-11. Critical Means for 216-B-3 Pond for Fiscal Year 2010 Comparisons. ....	C-14
Table C-12. Monitoring Wells and Constituents for 216-B-63 Trench. ....	C-15
Table C-13. Critical Means for 216-B-63 Trench for Fiscal Year 2010 Comparisons.....	C-16
Table C-14. Monitoring Wells and Constituents for 216-S-10 Pond and Ditch. ....	C-17
Table C-15. Critical Means for 216-S-10 Pond and Ditch for Fiscal Year 2010 Comparisons.....	C-17
Table C-16. Monitoring Wells and Constituents for 316-5 Process Trenches.....	C-18
Table C-17. Monitoring Wells and Constituents for Integrated Disposal Facility.....	C-19
Table C-18. Monitoring Wells and Constituents for Liquid Effluent Retention Facility.....	C-19
Table C-19. Monitoring Wells and Constituents for Low-Level Waste Management Area 1. ....	C-20
Table C-20. Critical Means for Low-Level Waste Management Area 1 for Fiscal Year 2010 Comparisons. ....	C-21
Table C-21. Monitoring Wells and Constituents for Low-Level Waste Management Area 2. ....	C-22
Table C-22. Critical Means for Low-Level Waste Management Area 2 for Calendar Year 2010 Comparisons. ....	C-23
Table C-23. Monitoring Wells and Constituents for Low-Level Waste Management Area 3. ....	C-24
Table C-24. Monitoring Wells and Constituents for Low-Level Waste Management Area 4. ....	C-25
Table C-25. Critical Means for Low-Level Waste Management Area 4 for Fiscal Year 2010 Comparisons.....	C-26
Table C-26. Monitoring Wells and Constituents for the Nonradioactive Dangerous Waste Landfill. ....	C-27
Table C-27. Critical Means for Nonradioactive Dangerous Waste Landfill for Fiscal Year 2010 Comparisons.....	C-28
Table C-28. Monitoring Wells and Constituents for RCRA PUREX Cribs 216-A-10, 216-A-36B, and 216-A-37-1.....	C-29
Table C-29. Monitoring Wells and Constituents for Waste Management Area A-AX.....	C-30
Table C-30. Monitoring Wells and Constituents for Waste Management Area B-BX-BY.....	C-31
Table C-31. Monitoring Wells and Constituents for Waste Management Area C Prior to Assessment. ....	C-32
Table C-32. Monitoring Wells and Constituents for Waste Management Area C. ....	C-33
Table C-33. Monitoring Wells and Constituents for Waste Management Area S-SX.....	C-34
Table C-34. Monitoring Wells and Constituents for Waste Management Area T. ....	C-35
Table C-35. Monitoring Wells and Constituents for Waste Management Area TX-TY. ....	C-36
Table C-36. Monitoring Wells and Constituents for Waste Management Area U. ....	C-37
Table C-37. Monitoring Wells and Constituents for the KE and KW Basins. ....	C-38
Table C-38. Monitoring Wells, Constituents, and Enforcement Limits for 200 Areas Treated Effluent Disposal Facility. ....	C-39
Table C-39. Monitoring Wells and Constituents for Environmental Restoration Disposal Facility. ....	C-40
Table C-40. Monitoring Wells and Constituents for Solid Waste Landfill. ....	C-41
Table C-41. Analytical Results for Required Constituents at the Solid Waste Landfill. ....	C-42

Table C-42. Results of Shapiro and Francia Test for Normality and Background Threshold Values for the Solid Waste Landfill .....	C-44
Table C-43. Monitoring Wells, Constituents, and Enforcement Limits for the State-Approved Land Disposal Site.....	C-45

## Figures

Figure C-1. RCRA Units on the Hanford Site Requiring Groundwater Monitoring.....	C-46
Figure C-2. Groundwater Monitoring Wells for 100-N Area RCRA Sites. ....	C-47
Figure C-3. Groundwater Monitoring Wells at 116-H-6 Evaporation Basins. ....	C-48
Figure C-4. Groundwater Monitoring Wells at 21 6-A-29 Ditch, PUREX Cribs, and Waste Management Areas A-AX and C. ....	C-49
Figure C-5. Groundwater Monitoring Wells at 216-B-3 Pond and 200 Areas Treated Effluent Disposal Facility.....	C-50
Figure C-6. Groundwater Monitoring Wells at 216-S-10 Pond and Ditch. ....	C-51
Figure C-7. Groundwater Monitoring Wells at 316-5 Process Trenches.....	C-52
Figure C-8. Groundwater Monitoring Wells at Integrated Disposal Facility.....	C-53
Figure C-9. Groundwater Monitoring Wells at Liquid Effluent Retention Facility.....	C-54
Figure C-10. Groundwater Monitoring Wells at Low-Level Waste Management Area 1.....	C-55
Figure C-11. Groundwater Monitoring Wells at 216-B-63 Trench and Low-Level Waste Management Area 2.....	C-56
Figure C-12. Groundwater Monitoring Wells at Low-Level Waste Management Area 3.....	C-57
Figure C-13. Groundwater Monitoring Wells at Low-Level Waste Management Area 4.....	C-58
Figure C-14. Groundwater Monitoring Wells at Nonradioactive Dangerous Waste Landfill and Solid Waste Landfill. ....	C-59
Figure C-15. Groundwater Monitoring Wells at Waste Management Area B-BX-BY.....	C-60
Figure C-16. Groundwater Monitoring Wells at Waste Management Areas S-SX and U. ....	C-61
Figure C-17. Groundwater Monitoring Wells at Waste Management Areas T and TX-TY.....	C-62
Figure C-18. Non-RCRA Regulated Units on the Hanford Site Requiring Groundwater Monitoring.....	C-63
Figure C-19. Groundwater Monitoring Wells at 100-K Basins.....	C-64
Figure C-20. Groundwater Monitoring Wells at State-Approved Land Disposal Site.....	C-65
Figure C-21. Groundwater Monitoring Wells at the Environmental Restoration Disposal Facility.....	C-66

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## Appendix C - Supporting Information for Monitored Facilities

### C. J. Martin

This appendix provides supplemental information for *Resource Conservation and Recovery Act of 1976* (RCRA) and other regulated units on the Hanford Site that require groundwater monitoring, excluding *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* units (which are discussed in Appendix A). Site-specific discussions for each facility included in this appendix are included in the main text of this document under the respective operable unit in which the facility is located.

Groundwater monitoring under RCRA continued during the reporting period (October 1, 2008, through December 31, 2009) at 24 waste management areas (Figure C-1). Estimates of groundwater velocity, hydrologic properties, and associated references are shown in Table C-1 for the RCRA sites. To determine if a waste site has adversely affected groundwater quality under RCRA interim status regulations (*Washington Administrative Code [WAC] 173-303-400, "Dangerous Waste Regulations; Interim Status Facility Standards,"* and by reference, *40 Code of Federal Regulations [CFR] 265.93, "Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities; Preparation, Evaluation, and Response"*), concentrations of indicator parameters in downgradient wells are compared to background concentrations. The indicator parameters under interim status are specific conductance, pH, total organic carbon, and total organic halides. The background values to which the indicator parameters are compared are 99% prediction limits, which are calculated for each facility based on samples from upgradient wells. The upper prediction limits also are known as critical mean values.

Critical mean values are recalculated annually or if the number of analyses changes. Annual recalculation accounts for changing background conditions. Changes in the number of analyses are usually the result of changes in monitoring well networks (e.g., wells are added or deleted). If changes occur in a monitoring well network, critical mean values for that facility are recalculated for subsequent semiannual sampling events using the new well network.

To reliably indicate potential groundwater effects from a facility, the sample results must be reasonably precise or quantifiable. Specific conductance and pH are field-measured indicator parameters that are reasonably detectable and quantifiable. The parameters of total organic carbon and total organic halides, however, are much more variable and are often below detection levels. Significant imprecision and variability occur when measuring these parameters near detection limits. The variability in laboratory measurements of field blanks are used to estimate laboratory limits of quantitation during the sampling period. The limit of quantitation is defined as ten times the standard deviation of the field blank analyses (see discussion in Appendix E). For detection monitoring, the statistical comparison values for total organic carbon and total organic halides are the larger of either the critical mean or the limit of quantitation.

Table C-2 lists the comparison values (critical mean values and limits of quantitation) used during the reporting period. Additional tables list updated critical mean values for use in calendar year 2010 for each RCRA unit where these statistics apply. Tables C-3 through C-43 provide supporting information for the RCRA sites, and Figures C-2 through C-21 show the locations of monitoring wells and regulated units.

This appendix also provides constituent lists, well network configurations, and other ancillary information for regulated facilities that fall outside of the RCRA program. Some network wells in these facilities are shared with RCRA facilities, and Figure C-18 shows the general locations of these facilities. Locations of monitoring wells for these facilities are shown in Figures C-5, C-14, C-19, C-20, and C-21. Tables C-37 through C-41 list the constituents list and/or the results summaries for the facilities.

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**Table C-1. Estimates of Groundwater Flow Rates at Hanford Site RCRA Facilities.**

Site	Flow Direction	Flow Rate (m/day)	Method	Hydraulic Conductivity (m/day) (Source)	Effective Porosity <sup>a</sup>	Gradient <sup>b</sup>	Comments
116-N-1 LWDF	Northwest	0.05 to 0.90	Darcy	6.1 to 37 (PNNL-8335)		0.0024	Gradient calculated between wells 199-N-34 and 199-N-2.
120-N-1 and 120-N-2	Northwest	0.07 to 1.3	Darcy	6.1 to 37 (PNNL-8335)		0.0034	Gradient calculated between wells 199-N-72 and 199-N-26.
116-N-3 LWDF	North	0.02 to 0.37	Darcy	6.1 to 37 (PNNL-8335)		0.0010	Gradient calculated between wells 199-N-28 and 199-N-81.
116-H-6 Evaporation Basins	East	0.32 to 8.9	Darcy	15 to 140 (PNNL-6728)		0.0064	Gradient calculated between wells 199-H4-9 and 199-H4-12B.
216-A-29 Ditch	Southeast <sup>c</sup>	Indeterminate	Darcy	18 (WHC-SD-EN-DP-047)	0.25	Indeterminate	Uncertainty with gradient and rate of flow (see Section 5.4.4).
216-B-3 Pond	Southeast	0.0015	Darcy	1.0 (WHC-SD-EN-EV-002; PNL-10195)	0.25	0.00036	Average gradient calculated using well 299-E26-32P as downgradient well and wells 699-44-39B, 699-41-40, 699-41-42, 699-42-42B, 699-43-44, and 699-43-45.
216-B-63 Trench	Indeterminate	Indeterminate	Darcy	182 (WHC-MR-0207)	0.2	Indeterminate	Uncertainty with gradient and rate of flow (see Section 4.4.6).
216-S-10 Pond and Ditch	Southeast	0.133 to 1.0	Darcy	10 (WHC-SD-EN-DP-052) 12 to 150 (BNWL-1709)	0.1 to 0.2	0.00133	Average gradient calculated using wells 299-W26-13, 299-W26-14, 699-32-76, 699-32-77, 699-33-75, and 699-33-76.
316-5 Process Trenches	South-southeast	0.20 to 20	Darcy	150 to 15,000 (PNNL-6716)	0.25	0.00033	Gradient calculated between wells 399-1-18A and 399-1-17A.
Integrated Disposal Facility	East	0.002 to 0.0075	Darcy	68 to 75 (PNNL-13652; PNNL-11957)		0.000021	Flow direction and gradient determined from trend surface analysis (see Section 2.3.2).
Liquid Effluent Retention Facility	Southwest	0.0184	Darcy	39.8 (PNNL-14804)	0.25	0.0002	Gradient calculated from tracer-pumpback testing at well 299-E26-10 (PNNL-14802).
LLWMA-1		Indeterminate		2,500 to 7,500 (PNNL-14753)			Flow reversal occurred during monitoring period, therefore no flow direction or rate was determined.
LLWMA-2	West	Indeterminate		2,500 to 7,500 (PNNL-14753)			Uncertain of flow direction. Gradient too low to determine flow rate.
LLWMA-3	East-northeast	0.04 to 0.16	Darcy	2.5 to 10 (PNNL-14753)	0.1	0.0016	Flow direction and gradient from water table map.
LLWMA-4	East	0.1 to 0.4	Darcy	2.5 to 10 (PNNL-14753)	0.1	0.004	Flow direction and gradient are variable due to effects of upgradient pump-and-treat system.
Nonradioactive Dangerous Waste Landfill	Southeast	0.03 to 0.27	Darcy	518 to 1,524 (WHC-EP-0021)		0.00002	Uncertainty with gradient and rate of flow. Flow direction inferred from plume maps.
PUREX Cribs	East	0.0011 to 0.54	Darcy	18 to 3,000 (PNNL-11523)		0.000021	Flow direction and gradient determined from trend surface analysis (see Section 2.3.2).
WMAA-AX	Southeast	0.13 to 0.40	Darcy	1,981 (PNL-8337; WHC-SD-EN-TI-019)		0.00002	Uncertainty with gradient and rate of flow. Flow direction inferred from plume maps.

**Table C-1. (Cont.)**

Site	Flow Direction	Flow Rate (m/day)	Method	Hydraulic Conductivity (m/day) (Source)	Effective Porosity <sup>a</sup>	Gradient <sup>b</sup>	Comments
WMA B-BX-BY	Indeterminate	Indeterminate		73 to 2,520 (PNNL-6820)	0.3	Indeterminate	Uncertainty with gradient and rate of flow (see Section 4.4.3). Maximum hydraulic conductivity based on aquifer test data. <sup>d</sup>
WMA C	Indeterminate	Indeterminate		1,000 to 2,000 (WHC-SD-EN-TI-019)			Historical plume movement indicates south to southwest flow direction. Current gradient is too low to determine flow direction. New wells should improve flow determination.
WMA S-SX	East to east-southeast	0.07 to 0.14	Contaminant travel time (PNNL-13441)	NA	NA	NA	Based on inferred contaminant travel time between 216-S-25 Crib and downgradient wells 298-W23-15 and 299-W22-46, and between wells 299-W22-46 and 299-W22-83.
WMA T	East	0.012 to 0.30	Darcy	1.33 to 14.4 (PNNL-13514; PNNL-14113)	0.09 to 0.20	0.0019	Gradient determined by trend surface analysis.
WMA TX-TY	East	0.12 to 0.19 (PNNL-17732)	Darcy	6.11 to 9.69 (PNNL-17732)	0.1	0.002	Flow direction based on trend surface analysis. Flow direction and gradient influenced by pump and treat.
WMA U	Variable (see text discussion)	NA	NA	0.07 to 19.9 (PNNL 18279)	0.18 (DOE/RL-2009-38)	NA	Flow direction and rate influenced by 200-ZP-1 pump-and-treat system.
	East to east-northeast	0.017 to 0.19	Darcy	1.69 to 9.5 (PNNL-13378)	0.10 to 0.20	0.0020	Gradient determined by trend surface analysis.

Notes:

- a. Effective porosity assumed to be between 0.1 and 0.3, a representative range for the unconfined aquifer system, unless otherwise noted.
- b. March 2009 unless noted otherwise.
- c. Flow direction is based on those determined on a regional basis.
- d. Letter report, *Slug Test Characterization Results for Multi-Test/Depth Intervals Conducted During the Drilling of WMA B-BX-BY Well 299-E33-49 (C4261)*, from F. A. Spane and D. R. Newcomer (Pacific Northwest National Laboratory) to J. V. Borghese (Fluor Hanford, Inc.), dated October 8, 2004.

LLWMA = low-level waste management area  
 LWDF = liquid waste disposal facility  
 NA= not applicable  
 PCE = tetrachloroethene  
 PUREX = Plutonium-Uranium Extraction (Plant)  
 WMA = waste management area

**Table C-2. Upgradient / Downgradient Comparison Values Used for Statistical Comparisons at RCRA Sites in Calendar Year 2009.**

Quarter	Specific Conductance Critical Mean ( $\mu\text{S}/\text{cm}$ )	pH Critical Range	TOC Critical Mean <sup>a,b</sup> / LOQ ( $\mu\text{g}/\text{L}$ )	TOX Critical Mean <sup>a</sup> / LOQ ( $\mu\text{g}/\text{L}$ )
<b>116-N-1 (1301-N) Facility</b>				
Oct. to Dec. 2008	1,396	6.11 – 9.14	<b>3,720</b> /730	<b>26.1</b> /10.1
Jan. to Dec. 2009	1,396	6.11 – 9.14	<b>3,720</b> /1,300	<b>26.1</b> /10.5
<b>120-N-1 and 120-N-2 (1324-N/NA) Facilities</b>				
Oct. to Dec. 2008	758	6.67 – 9.35	<b>834</b> /730	<b>13.9</b> /10.1
Jan. to Dec. 2009	758	6.67 – 9.35	<b>834</b> / <b>1,300</b>	<b>13.9</b> /10.5
<b>116-N-3 (1325-N) Facility</b>				
Oct. to Dec. 2008	488	7.05 – 8.89	<b>1,450</b> /730	<b>23.3</b> /10.1
Jan. to Dec. 2009	488	7.05 – 8.89	<b>1,450</b> /1,300	<b>23.3</b> /10.5
<b>216-A-29 Ditch</b>				
Oct. to Dec. 2008	260	7.31 – 9.36	<b>1,490</b> /730	<b>26.9</b> /10.1
Jan. to Dec. 2009	260	7.31 – 9.36	<b>1,490</b> /1,300	<b>26.9</b> /10.5
<b>216-B-3 Pond</b>				
Oct. to Dec. 2008	392	6.81 – 9.49	<b>1,210</b> /730	<b>10.0</b> / <b>10.1</b>
Jan. to Dec. 2009	392	6.81 – 9.49	1,210/ <b>1,300</b>	<b>10.0</b> / <b>10.5</b>
<b>216-B-63 Trench</b>				
Oct. to Dec. 2008	853	7.52 to 8.63	<b>1,040</b> /730	<b>28.3</b> /10.1
Jan. to Dec. 2009	853	7.52 to 8.63	1,040/ <b>1,300</b>	<b>28.3</b> /10.5
<b>216-S-10 Pond and Ditch</b>				
Oct. to Dec. 2008	296	7.49 to 8.73	<b>1,300</b> /730	NC
Jan. to Dec. 2009	296	7.49 to 8.73	<b>1,300</b> / <b>1,300</b>	NC
<b>LLWMA-1</b>				
Oct. to Dec. 2008	847	7.54 to 8.35	<b>1,116</b> /730	<b>28.7</b> /10.1
Jan. to Dec. 2009	847	7.54 to 8.35	1,116/ <b>1,300</b>	<b>28.7</b> /10.5
<b>LLWMA-2</b>				
Oct. to Dec. 2008	1,278	6.85 to 8.56	<b>3,036</b> /730	<b>91.0</b> /10.1
Jan. to Dec. 2009	1,278	6.85 to 8.56	<b>3,036</b> / <b>1,300</b>	<b>91.0</b> /10.5
<b>LLWMA-3</b>				
<i>No statistical comparisons until new baseline is established.</i>				
<b>LLWMA-4</b>				
Oct. to Dec. 2008	697	6.99 to 8.94	<b>864</b> /730	<b>19.3</b> /10.1
Jan. to Dec. 2009	697	6.99 to 8.94	864/ <b>1,300</b>	<b>19.3</b> /10.5
<b>Nonradioactive Dangerous Waste Landfill</b>				
Oct. to Dec. 2008	599	6.67 to 7.83	<b>1,030</b> /730	<b>22.7</b> /10.1
Jan. to Dec. 2009	599	6.67 to 7.83	1,030/ <b>1,300</b>	<b>22.7</b> /10.5
<b>Waste Management Area C</b>				
Oct. to Dec. 2008	991	7.13 to 9.03	<b>3,080</b> /730	<b>29.8</b> /10.1
Jan. to Dec. 2009	991	7.13 to 9.03	<b>3,080</b> / <b>1,300</b>	<b>29.8</b> /10.5
<b>Notes:</b>				
a. Upgradient/downgradient comparison values (in <b>bold</b> ) for TOC and TOX are the larger of calculated critical mean value and limit of quantitation for the respective quarter.				
b. Reported values rounded to the nearest 10 $\mu\text{g}/\text{L}$ .				
c. Critical mean value could not be calculated because essentially all measurements were below vendor specified method detection limit.				
LLWMA = low-level waste management area				
LOQ = limit of quantitation; based on field blanks collected and analyzed in the previous four quarters				
NC = not calculated				
TOC = total organic carbon				
TOX = total organic halides				

**Table C-3. Monitoring Wells and Constituents for 100-N Area Units.**

Well Number <sup>a</sup>	Comment	WAC-Compliant	Contamination Indicator Parameters				Other Parameters				Sampled as Scheduled in Reporting Period
			Specific Conductance (Field)	pH (Field)	TOC	TOX	Alkalinity	Alpha <sup>b</sup>	Anions	Metals (Filtered)	
<b>116-N-1 (1301-N) Liquid Waste Disposal Facility</b>											
199-N-105A		C	S	S	S	S	A		A	A	Yes
199-N-2		P	S	S	S	S	A		A	A	Yes
199-N-3		P	S	S	S	S	A		A	A	Yes
<b>199-N-34</b>		P	S	S	S	S	A		A	A	Yes
<b>199-N-57</b>		C	S	S	S	S	A		A	A	Yes
<b>120-N-1 and 120-N-2 (1324-N/NA) Facilities</b>											
<b>199-N-71</b>		C	S	S	S	S	A		A	A	Yes
199-N-72		C	S	S	S	S	A		A	A	Yes
199-N-73		C	S	S	S	S	A		A	A	Yes
199-N-77	Bottom of aquifer; no statistics	C	S	S	S	S	A	S	A	A	Yes
199-N-165		C	S	S	S	S	A	A	A	A	Yes
<b>116-N-3 (1325-N) Liquid Waste Disposal Facility</b>											
199-N-28	Information only; no statistics	P	S	S	S	S	A		A	A	Yes
199-N-32		P	S	S	S	S	S		S	S	Yes
199-N-41		P	S	S	S	S	A		A	A	Yes
<b>199-N-74</b>		C	S	S	S	S	A		A	A	Yes
199-N-81		C	S	S	S	S	A		A	A	Yes
<p>Notes:  Requirements from <i>Groundwater Monitoring Plan for the 1301-N, 1324-N/NA, and 1325-N RCRA Facilities</i> (PNNL-13914).  Wells completed at the top of the unconfined aquifer unless specified otherwise.  a. <b>Bold italic</b> indicates upgradient well.  b. Monitored for <i>Atomic Energy Act of 1954</i>.</p>											
<p>A = to be sampled annually  C = well is constructed as a resource protection well in accordance with WAC 173-160, "Minimum Standards for Construction and Maintenance of Wells"  F = fiscal year  P = constructed prior to WAC requirements  S = to be sampled semiannually  TOC = total organic carbon  TOX = total organic halides  WAC = Washington Administrative Code</p>											

**Table C-4. Critical Means for 116-N-1 Liquid Waste Disposal Facility for Fiscal Year 2010 Comparisons.**

Constituent (unit)	n	df	Mean	Standard Deviation	CV (%)	t <sub>c</sub>	Critical Mean
pH	9	8	7.649	0.2841	3.7	5.6174	[5.97 - 9.33]
Specific conductance ( $\mu\text{S}/\text{cm}$ )	9	8	670.7	174.0	25.9	5.0413	1,600
TOC* ( $\mu\text{g}/\text{L}$ )	9	8	817.1	553.9	67.8	5.0413	3,760
TOX* ( $\mu\text{g}/\text{L}$ )	9	8	5.732	3.878	67.7	5.0413	26.3

Notes:  
Based on semiannual sampling events from September 2007 through September 2009 for upgradient well 199-N-57, and from May 2008 through September 2009 for upgradient well 199-N-34.  
\* For values reported below laboratory's specified method detection limit, one-half of the method detection limit is used in the critical mean calculation.

CV = coefficient of variation  
df = degrees of freedom (n-1)  
n = number of background replicate averages  
t<sub>c</sub> = Bonferroni critical t-value for appropriate df and 20 comparisons  
TOC = total organic carbon  
TOX = total organic halides

**Table C-5. Critical Means for 120-N-1 and 120-N-2 Liquid Waste Disposal Facilities for Fiscal Year 2010 Comparisons.**

Constituent (unit)	n	df	Mean	Standard Deviation	CV (%)	t <sub>c</sub>	Critical Mean
pH	5	4	7.953	0.0790	1.0	9.7291	[7.11 – 8.79]
Specific conductance ( $\mu\text{S}/\text{cm}$ )	5	4	468.15	31.90	6.8	8.1216	752
TOC <sup>a, b</sup> ( $\mu\text{g}/\text{L}$ )	5	4	385.00	53.97	14.0	8.1216	865
TOX <sup>a, c</sup> ( $\mu\text{g}/\text{L}$ )	6	5	4.849	1.280	26.4	6.5414	13.9

Notes:  
Based on semiannual sampling events from upgradient well 199-N-71: December 2007 through September 2009 for pH and specific conductance; June 2007 through September 2009 for TOC; March 2008 through September 2009 for TOX.  
a. For values reported below laboratory's specified method detection limit, one-half of the method detection limit is used in the critical mean calculation.  
b. Excluding erroneous data from December 2006.  
c. Excluding erroneous data from December 2007.

CV = coefficient of variation  
df = degrees of freedom (n-1)  
n = number of background replicate averages  
t<sub>c</sub> = Bonferroni critical t-value for appropriate df and 16 comparisons  
TOC = total organic carbon  
TOX = total organic halides

**Table C-6. Critical Means for 116-N-3 Liquid Waste Disposal Facility for Fiscal Year 2010 Comparisons.**

Constituent (unit)	n	df	Mean	Standard Deviation	CV (%)	t <sub>c</sub>	Critical Mean
pH	5	4	7.968	0.0744	0.93	9.7291	[7.17 - 8.76]
Specific conductance ( $\mu\text{S}/\text{cm}$ )	5	4	395.2	13.26	3.36	8.1216	513
TOC* ( $\mu\text{g}/\text{L}$ )	5	4	205.7	117.6	57.2	8.1216	1,252
TOC* ( $\mu\text{g}/\text{L}$ )	6	5	6.603	2.497	37.81	6.5414	24.2

Notes:  
 Based on semiannual sampling events from September 2007 through September 2009 for upgradient well 199-N-74.  
 \* For values reported below laboratory's specified method detection limit, one-half of the method detection limit is used in the critical mean calculation.

CV = coefficient of variation  
 df = degrees of freedom (n-1)  
 n = number of background replicate averages  
 tc = Bonferroni critical t-value for appropriate df and 16 comparisons  
 TOC = total organic carbon  
 TOX = total organic halides

**Table C-7. Monitoring Wells and Constituents for 116-H-6 Evaporation Basins.**

Well Number	Comment	WAC-Compliant	Permit-Specified				Other Parameters			Sampled as Scheduled in Reporting Period <sup>b</sup>
			Hexavalent Chromium (Filtered)	Nitrate	Technetium-99 <sup>a</sup>	Uranium <sup>a</sup>	Alkalinity	Anions	Metals (Filtered)	
199-H4-12A	Extraction well	C	A	A	A	A	A	A	A	No <sup>c</sup>
199-H4-12C	Mid-depth unconfined	C	A	A	A	A	A	A	A	Yes
199-H4-3	Extraction well	P	A	A	A	A	A	A	A	Yes
199-H4-8	--	C	A	A	A	A	A	A	A	Yes

Notes:

Requirements from *Groundwater Monitoring Plan for the 183-H Solar Evaporation Basins* (PNNL-11573) and 2006 Permit modification (WA7890008967, *Hanford Facility Resource Conservation and Recovery Act Permit, Dangerous Waste Portion, Revision 8C, for the Treatment, Storage, and Disposal of Dangerous Waste*).

Wells completed at the top of the unconfined aquifer unless specified otherwise.

- a. Radionuclides not typically subject to RCRA monitoring but included in the current Hanford Facility RCRA Permit (WA7890008967) for this facility.
- b. 183-H wells are typically sampled in November. The reporting period (October 2008 through December 2009) included two sampling events.
- c. Sampled as scheduled in November 2008. Delayed from November 2009 until spring 2010 because the extraction system from this well was shut down for a pumping test at 100-HR-3.
- d. Hanford Facility RCRA Permit (WA7890008967) modification notification form, signed by G. P. Davis (Washington State Department of Ecology), dated January 10, 2006, 183-H Solar Evaporation Basins, Part VI, Chapter 2, and Attachment 37.

A = to be sampled annually

C = well is constructed as a resource protection well under WAC 173-160, "Minimum Standards for Construction and Maintenance of Wells"

P = constructed prior to WAC requirements

RCRA = Resource Conservation and Recovery Act of 1976

WAC = Washington Administrative Code

**Table C-8. Monitoring Wells and Constituents for 216-A-29 Ditch.**

Well Number <sup>a</sup>	Comment	WAC-Compliant	Contamination Indicator Parameters				Other Parameters			<b>Sampled as Scheduled in 2009</b>	
			Specific Conductance (Field)	pH (Field)	TOC	TOX	Alkalinity	Anions	Metals		
299-E25-26	Upper unconfined	C	S	S	S	S	S	S	A	A	Yes
299-E25-28	Deep unconfined; no statistics	C	S	S	S	S	S	S	A	A	Yes
299-E25-32P		C	S	S	S	S	S	S	A	A	All constituents once <sup>b</sup>
299-E25-34		C	S	S	S	S	S	S	A	A	Yes
299-E25-35		C	S	S	S	S	S	S	A	A	Yes
299-E25-48		C	S	S	S	S	S	S	A	A	Yes
299-E26-12		C	S	S	S	S	S	S	A	A	Yes
299-E26-13		C	S	S	S	S	S	S	A	A	Yes
<b>699-43-45</b>		C	S	S	S	S	S	S	A	A	Yes

Notes:  
 Requirements from *Groundwater Monitoring Plan for the 216-A-29 Ditch* (PNNL-13047).  
 Wells completed at the top of the unconfined aquifer unless specified otherwise.  
 a. Upgradient well(s) are noted in ***bold italic***.  
 b. First half of CY 2009 missed due to pending change in frequency to annual.

A = to be sampled annually  
 C = well is constructed as a resource protection well in accordance with WAC 173-160, "Minimum Standards for Construction and Maintenance of Wells"  
 CY = calendar year  
 S = to be sampled semiannually  
 TOC = total organic carbon  
 TOX = total organic halides  
 WAC = Washington Administrative Code

**Table C-9. Critical Means for 216-A-29 Ditch for Fiscal Year 2010 Comparisons.**

Constituent (unit)	n	df	Mean	Standard Deviation	CV (%)	t <sub>c</sub>	Critical Mean
pH	7	6	8.288	0.1680	2.0	7.4012	[6.96 - 9.62]
Specific conductance ( $\mu\text{S}/\text{cm}$ )	7	6	245.1	2.665	1.1	6.5121	264
TOC <sup>a,b</sup> ( $\mu\text{g}/\text{L}$ )	6	5	244.7	126.1	51.5	7.6037	1,280
TOX <sup>a</sup> ( $\mu\text{g}/\text{L}$ )	7	6	3.899	2.413	61.9	6.5121	20.7

Notes:  
 Based on semiannual sampling events from upgradient well 699-43-45: April 2007 through October 2009 for pH, specific conductance, and TOX; April 2007 through April 2009 for TOC.

- a. For values reported below laboratory's specified method detection limit, one-half of the method detection limit is used in the critical mean calculation.
- b. Excluded erroneous data from September 2009.

CV = coefficient of variation  
 df = degrees of freedom (n-1)  
 n = number of background replicate averages  
 tc = Bonferroni critical t-value for appropriate df and 32 comparisons  
 TOC = total organic carbon  
 TOX = total organic halides

**Table C-10. Monitoring Wells and Constituents for 216-B-3 Pond.**

Well Number <sup>a</sup>	Comment	WAC-Compliant	Contamination Indicator Parameters					Other Parameters					Sampled as Scheduled in 2009
			Specific Conductance (Field)	pH (Field)	TOC	TOX	Alkalinity	Alpha <sup>b</sup>	Anions	Beta <sup>b</sup>	Metals	Phenols	
699-42-42B	Bottom of aquifer	C	S	S	S	S	A	S	A	S	A	A	Gross alpha and gross beta sampled only once <sup>c</sup>
699-43-44		C	S	S	S	S	A	S	A	S	A	A	Gross alpha and gross beta sampled only once <sup>c</sup>
699-43-45		C	S	S	S	S	A	S	A	S	A	A	Yes
<b>699-44-39B</b>		C	S	S	S	S	A	S	A	S	A	A	Gross alpha and gross beta sampled only once <sup>c</sup>

Notes:

Requirements from *Groundwater Monitoring Plan for the Hanford Site 216-B-3 Pond RCRA Facility* (PNNL-15479).

Wells completed at the top of the unconfined aquifer, unless specified otherwise.

a. Upgradient well noted by ***bold italic***.

b. Monitored for *Atomic Energy Act of 1954*.

c. Non-RCRA constituent monitoring was reduced in frequency at RCRA facilities in 2009.

A = to be sampled annually

C = well is constructed as a resource protection well under WAC 173-160, "Minimum Standard for Construction and Maintenance of Wells"

RCRA = *Resource Conservation and Recovery Act of 1976*

S = to be sampled semiannually

TOC = total organic carbon

TOX = total organic halides

WAC = *Washington Administrative Code*

**Table C-11. Critical Means for 216-B-3 Pond for Fiscal Year 2010 Comparisons.**

Constituent (unit)	n	df	Mean	Standard Deviation	CV (%)	t <sub>c</sub>	Critical Mean
pH	6	5	8.107	0.2211	2.7	7.6037	[6.29 - 9.92]
Specific conductance ( $\mu\text{S}/\text{cm}$ )	6	5	266.8	17.87	6.7	6.5414	393
TOC <sup>a, b</sup> ( $\mu\text{g}/\text{L}$ )	6	5	223.6	110.7	49.5	6.5414	1,010
TOX <sup>a, b</sup> ( $\mu\text{g}/\text{L}$ )	6	5	3.875	.9475	24.5	6.5414	10.6

Notes:  
Based on semiannual sampling events from upgradient well 699-44-39B: February 2007 through August 2009 for pH and specific conductance; November 2007 through August 2009 for TOC and TOX.

- a. For values reported below laboratory's specified method detection limit, one-half of the method detection limit is used in the critical mean calculation.
- b. Excluding erroneous data from February 2007.

CV = coefficient of variation  
df = degrees of freedom (n-1)  
n = number of background replicate averages  
t<sub>c</sub> = Bonferroni critical t-value for appropriate df and 16 comparisons  
TOC = total organic carbon  
TOX = total organic halides

**Table C-12. Monitoring Wells and Constituents for 216-B-63 Trench.**

Well Number <sup>a</sup>	WAC Compliant	Contamination Indicator Parameters				Other Parameters					Sampled as Scheduled in 2009	
		Specific Conductance (Field)	pH (Field)	TOC	TOX	Alkalinity	Alpha <sup>b</sup>	Anions	Beta <sup>b</sup>	Metals		
299-E27-8	C	S	S	S	S	A	S	A	S	A	A	All sampled once <sup>c</sup>
299-E27-9	C	S	S	S	S	A	S	A	S	A	A	All sampled once <sup>c</sup>
299-E27-11	C	S	S	S	S	A	S	A	S	A	A	Yes
299-E27-16	C	S	S	S	S	A	S	A	S	A	A	Gross alpha and gross beta sampled only once <sup>d</sup>
299-E27-17	C	S	S	S	S	A	S	A	S	A	A	Gross alpha and gross beta sampled only once <sup>d</sup>
299-E27-18	C	S	S	S	S	A	S	A	S	A	A	All sampled once <sup>c</sup>
299-E27-19	C	S	S	S	S	A	S	A	S	A	A	Gross alpha and gross beta sampled only once <sup>d</sup>
299-E33-33	C	S	S	S	S	A	S	A	S	A	A	All sampled once <sup>c</sup>
299-E33-36	C	S	S	S	S	A	S	A	S	A	A	Gross alpha and gross beta sampled only once <sup>d</sup>
299-E33-37	C	S	S	S	S	A	S	A	S	A	A	Gross alpha and gross beta sampled only once <sup>d</sup>
299-E34-8	C	S	S	S	S	A	S	A	S	A	A	All sampled once <sup>c</sup>
299-E34-10	C	S	S	S	S	A	S	A	S	A	A	Yes

Notes:

Requirements from *Groundwater Monitoring Plan for the 216-B-63 Trench on the Hanford Site* (PNNL-14112).

Wells completed at the top of the unconfined aquifer, unless specified otherwise.

a. Upgradient well noted by bold italic.

b. Monitored for *Atomic Energy Act of 1954*.

c. First half of calendar year 2009 missed due to pending change in frequency to annual.

d. Non-RCRA constituent monitoring was reduced in frequency at RCRA facilities in 2009.

A = to be sampled annually

C = well is constructed as a resource protection well under WAC 173-160, "Minimum Standards for Construction and Maintenance of Wells"

RCRA = *Resource Conservation and Recovery Act of 1976*

S = to be sampled semiannually

TOC = total organic carbon

TOX = total organic halides

WAC = *Washington Administrative Code*

**Table C-13. Critical Means for 216-B-63 Trench for Fiscal Year 2010 Comparisons.**

<b>Constituent (unit)</b>	<b>n</b>	<b>df</b>	<b>Mean</b>	<b>Standard Deviation</b>	<b>CV (%)</b>	<b>t<sub>c</sub></b>	<b>Critical Mean</b>
pH	20	19	7.938	0.1463	1.8	4.5718	[7.25 - 8.62]
Specific conductance ( $\mu\text{S}/\text{cm}$ )	20	19	488.4	113.1	23.2	4.2669	983
TOC <sup>a</sup> ( $\mu\text{g}/\text{L}$ )	20	19	253.4	154.2	60.9	4.2669	928
TOX <sup>a,b</sup> ( $\mu\text{g}/\text{L}$ )	20	19	5.491	3.298	60.1	4.2669	19.9

Notes:  
Based on semiannual sampling events from April 2008 through October 2009 for upgradient wells 299-E27-8, 299-E27-9, 299-E27-11, 299-E27-17, and 299-E34-10; except October 2007 through October 2009 for wells 299-E27-8 and 299-E27-9 for TOX.  
a. For values reported below laboratory's specified method detection limit, one-half of the method detection limit is used in the critical mean calculation.  
b. Excluding erroneous data from April 2008 for upgradient wells 299-E27-8 and 299-E27-9.

CV = coefficient of variation  
df = degrees of freedom (n-1)  
n = number of background replicate averages  
t<sub>c</sub> = Bonferroni critical t-value for appropriate df and 48 comparisons  
TOC = total organic carbon  
TOX = total organic halides

**Table C-14. Monitoring Wells and Constituents for 216-S-10 Pond and Ditch.**

Well Number <sup>a</sup>	Comment	WAC-Compliant	Contamination Indicator Parameters				Other Parameters							Sampled as Scheduled During Reporting Period	
			Specific Conductance(Field)	pH (Field)	TOC	TOX	Alkalinity	Anions	Carbon Tetrachloride	Chloroform	Hexavalent Chromium	Metals	Phenols		
299-W26-13		C	S	S	S	S	S	A	A	A	S	A	A	A	Yes
299-W26-14		C	S	S	S	S	S	A	A	A	S	A	A	A	Yes
299-W27-2	Bottom of aquifer; no statistics	C	S	S	S	S	S	A	A	A	S	A	A	A	Yes
699-32-76	Quarterly samples <sup>b</sup>	C	S	S	S	S	S	S	A	A	A	S	A	A	Yes
699-33-75	Quarterly samples <sup>b</sup>	C	S	S	S	S	S	S	A	A	A	S	A	A	Yes
<b>699-33-76</b>	Quarterly samples <sup>b</sup>	C	S	S	S	S	S	S	A	A	A	S	A	A	Yes

Notes:

Requirements from *Groundwater Monitoring Plan for the 216-S-10 Pond and Ditch* and Interim Change Notice 2 (PNNL-14070 and PNNL-14070-ICN-2).

Wells completed at the top of the unconfined aquifer, unless specified otherwise.

a. Upgradient well noted by ***bold italic***.

b. First year of quarterly RCRA-specific sampling.

A = to be sampled annually

C = well is constructed as a resource protection well under WAC 173-160, "Minimum Standards for Construction and Maintenance of Wells"

RCRA = *Resource Conservation and Recovery Act of 1976*

S = to be sampled semiannually

TOC = total organic carbon

TOX = total organic halides

WAC = *Washington Administrative Code*

**Table C-15. Critical Means for 216-S-10 Pond and Ditch for Fiscal Year 2010 Comparisons.**

Constituent (unit)	n	df	Mean	Standard Deviation	CV (%)	t <sub>c</sub>	Critical Mean
pH	7	6	7.24	0.0627	0.87	6.7883	[7.18 - 8.18]
Specific conductance ( $\mu\text{S}/\text{cm}$ )	7	6	284.4	6.024	2.1	5.9588	320
TOC ( $\mu\text{g}/\text{L}$ )	5	4	1,589	2,371	1,492	8.6103	23,950
TOX ( $\mu\text{g}/\text{L}$ )	5	4	6.5695	1.5123	23.0	8.6103	20.8

Notes:

Based on sampling events from August 2008 through November 2009 for new upgradient well 699-33-76.

a. For values reported below laboratory's specified method detection limit, one-half of the method detection limit is used in the critical mean calculation.

b. Due to the extreme variability (high standard deviation) in TOC concentrations over the reporting period the calculated critical mean will not be used for 2010 monitoring. A critical mean will be calculated when the standard deviation reaches a reasonable value (e.g., <1,000).

CV = coefficient of variation

df = degrees of freedom (n-1)

n = number of background replicate averages

t<sub>c</sub> = Bonferroni critical t-value for appropriate df and 48 comparisons

TOC = total organic carbon

TOX = total organic halides

**Table C-16. Monitoring Wells and Constituents for 316-5 Process Trenches.**

Well Number	Comment	WAC-Compliant	cis-1,2-Dichloroethene	Tetrachloroethene	Trichloroethene	Uranium <sup>a</sup>	Sampled as Scheduled in 2009 <sup>b</sup>
399-1-10A		C	S	S	S	S	Yes
399-1-10B	Lower unconfined	C	S	S	S	S	Missed December 2008; purge truck problems
399-1-16A		C	S	S	S	S	Yes
399-1-16B	Lower unconfined	C	S	S	S	S	Yes
399-1-17A		C	S	S	S	S	Yes
399-1-17B	Lower unconfined	C	S	S	S	S	Yes
399-1-18A		C	S	S	S	S	Yes
399-1-18B	Lower unconfined	C	S	S	S	S	Yes

Notes:  
Requirements from *Groundwater Monitoring Plan for the 300 Area Process Trenches* (WHC-SD-EN-AP-185).  
Wells completed at the top of the unconfined aquifer unless specified otherwise.  
a. Radionuclides not typically subject to RCRA monitoring, but included in the current Hanford Facility RCRA Permit (WA7890008967, *Hanford Facility Resource Conservation and Recovery Act Permit, Dangerous Waste Portion, Revision 8C, for the Treatment, Storage, and Disposal of Dangerous Waste*) for this facility.  
b. During the reporting period (October 2008 through December 2009), the 316-5 Process Trenches wells were sampled in December 2008, January, February, March, June, July, August, September, and December 2009.  
C = well is constructed as a resource protection well under WAC 173-160, "Minimum Standards for Construction and Maintenance of Wells"  
RCRA = *Resource Conservation and Recovery Act of 1976*  
S = to be sampled four times semiannually (8 months)  
WAC = *Washington Administrative Code*

**Table C-17. Monitoring Wells and Constituents for Integrated Disposal Facility.**

Well Number <sup>a</sup>	WAC-Compliant Chromium (Filtered, Unfiltered)	Indicator Parameters					Other Parameters					Sampled as Scheduled in 2009	
		Specific Conductance (Field)	pH (Field)	TOC	TOX	Alkalinity	Anions	Metals	Alpha <sup>b</sup>	Beta <sup>b</sup>	Iodine-129 <sup>b</sup>		
299-E17-22	C	S <sup>c</sup>	S <sup>c</sup>	S <sup>c</sup>	S <sup>c</sup>	S <sup>c</sup>	S	S	S	S	S	S	Yes
299-E17-23	C	S <sup>c</sup>	S <sup>c</sup>	S <sup>c</sup>	S <sup>c</sup>	S <sup>c</sup>	S	S	S	S	S	S	Yes
299-E17-25	C	S <sup>c</sup>	S <sup>c</sup>	S <sup>c</sup>	S <sup>c</sup>	S <sup>c</sup>	S	S	S	S	S	S	Yes
299-E17-26	C	S <sup>c</sup>	S <sup>c</sup>	S <sup>c</sup>	S <sup>c</sup>	S <sup>c</sup>	S	S	S	S	S	S	Yes
299-E18-1	C	S <sup>c</sup>	S <sup>c</sup>	S <sup>c</sup>	S <sup>c</sup>	S <sup>c</sup>	S	S	S	S	S	S	Yes
299-E24-21	C	S <sup>c</sup>	S <sup>c</sup>	S <sup>c</sup>	S <sup>c</sup>	S <sup>c</sup>	S	S	S	S	S	S	Yes
299-E24-24	C	S <sup>c</sup>	S <sup>c</sup>	S <sup>c</sup>	S <sup>c</sup>	S <sup>c</sup>	S	S	S	S	S	S	Yes

Notes:  
Requirements from *Hanford Facility Dangerous Waste Permit Application, Integrated Disposal Facility* (DOE/RL-2003-12) and *Integrated Disposal facility Operational Monitoring Plan to Meet DOE Order 435.1* (RPP-PLAN-26534).  
Wells completed at the top of the unconfined aquifer unless specified otherwise.  
a. ***Bold italic*** indicates upgradient well.  
b. Operational parameters monitored for DOE O 435.1, *Radioactive Waste Management*.  
c. To be sampled four times semianually (total of eight times per well each year).  
C = well is constructed as a resource protection well under WAC 173-160, "Minimum Standards for Construction and Maintenance of Wells"  
S = to be sampled semiannually  
TOC = total organic carbon  
TOX = total organic halides  
WAC = Washington Administrative Code

**Table C-18. Monitoring Wells and Constituents for Liquid Effluent Retention Facility.**

Well Number <sup>a</sup>	WAC-Compliant	Alkalinity	Alpha <sup>b</sup>	Ammonium	Anions	Beta <sup>b</sup>	Metals	Phenols	VOA	Sampled as Scheduled in 2009
299-E26-10	C	A	S	S	A	S	A	A	S	No VOA
299-E26-11	C	A	S	S	A	S	A	A	S	No VOA
299-E26-77	C	A	S	S	A	S	A	A	S	New well; first sampled in August 2008
299-E26-79	C	A	S	S	A	S	A	A	S	New well; to be sampled in fiscal year 2009

Notes:  
Requirements from *Interim Status Groundwater Monitoring Plan for the 200 East Area Liquid Effluent Retention Facility* (WHC-SD-EN-AP-024).  
Wells completed at the top of the unconfined aquifer unless specified otherwise.  
a. ***Bold italic*** indicates upgradient well.  
b. Monitored for *Atomic Energy Act of 1954*.  
A = to be sampled annually  
C = well is constructed as a resource protection well under WAC 173-160, "Minimum Standards for Construction and Maintenance of Wells"  
S = to be sampled semiannually  
VOA = volatile organic analysis  
WAC = Washington Administrative Code

**Table C-19. Monitoring Wells and Constituents for Low-Level Waste Management Area 1.**

Well Number <sup>a</sup>	WAC-Compliant	Contamination Indicator Parameters				Other Chemical Parameters				AEA Parameters <sup>b</sup>				Sampled as Scheduled in 2009	
		pH (Field)	Specific Conductance (Field)	TOC	TOX	Alkalinity	Anions	Metals	Mercury	Lead	Phenols	Iodine-129	Technetium-99	Tritium	
<b>299-E28-26</b>	C	S	S	S	S	A	S	S	A	A	A	S	S	S	Sampled twice
<b>299-E28-27</b>	C	S	S	S	S	A	S	S	A	A	A	S	S	S	Sampled once
<b>299-E28-28</b>	C	S	S	S	S	A	S	S	A	A	A	S	S	S	Sampled twice
299-E32-2	C	S	S	S	S	A	S	S	A	A	A	S	S	S	Sampled twice
299-E32-3	C	S	S	S	S	A	S	S	A	A	A	S	S	S	Sampled twice
<b>299-E32-4</b>	C	S	S	S	S	A	S	S	A	A	A	S	S	S	Sampled twice
299-E32-5	C	S	S	S	S	A	S	S	A	A	A	S	S	S	Sampled twice
299-E32-6	C	S	S	S	S	A	S	S	A	A	A	S	S	S	Sampled twice
299-E32-7	C	S	S	S	S	A	S	S	A	A	A	S	S	S	Sampled twice
299-E32-8	C	S	S	S	S	A	S	S	A	A	A	S	S	S	Sampled twice
299-E32-9	C	S	S	S	S	A	S	S	A	A	A	S	S	S	Sampled twice
299-E32-10	C	S	S	S	S	A	S	S	A	A	A	S	S	S	Sampled twice
<b>299-E33-28</b>	C	S	S	S	S	A	S	S	A	A	A	S	S	S	Sampled twice
<b>299-E33-29</b>	C	S	S	S	S	A	S	S	A	A	A	S	S	S	Sampled twice
299-E33-30	C	S	S	S	S	A	S	S	A	A	A	S	S	S	Sampled twice
299-E33-34	C	S	S	S	S	A	S	S	A	A	A	S	S	S	Sampled twice
<b>299-E33-35</b>	C	S	S	S	S	A	S	S	A	A	A	S	S	S	Sampled twice

## Notes:

Requirements from *Interim Status Groundwater Monitoring Plan for Low-Level Waste Management Areas 1 to 4, RCRA Facilities, Hanford Washington (PNNL-14859-ICN-1) and Performance Assessment Monitoring Plan for the Hanford Site Low-Level Burial Grounds* (DOE/RL-2000-72).

Wells completed at the top of the unconfined aquifer unless specified otherwise.

Sampling event December 2009 was delayed due to weather until January 2010.

Well 299-28-27 was missed in December 2008.

a. **Bold italic** indicates upgradient well.

b. Monitored for *Atomic Energy Act of 1954*.

A = to be sampled annually

AEA = *Atomic Energy Act of 1954*

C = well is constructed as a resource protection well under WAC 173-160, "Minimum Standards for Construction and Maintenance of Wells"

S = to be sampled semiannually

TOC = total organic carbon

TOX = total organic halides

WAC = *Washington Administrative Code*

**Table C-20. Critical Means for Low-Level Waste Management Area 1 for Fiscal Year 2010 Comparisons.**

Constituent (unit)	n	df	Mean	Standard Deviation	CV (%)	t <sub>c</sub>	Critical Mean
pH	30	29	7.956	0.1071	1.3	4.3657	[7.48 - 8.43]
Specific conductance ( $\mu\text{S}/\text{cm}$ )	30	29	531.7	91.06	17.1	4.1130	912
TOC <sup>a, b</sup> ( $\mu\text{g}/\text{L}$ )	31	30	222.3	87.37	39.3	4.0948	800 <sup>c</sup>
TOX <sup>a</sup> ( $\mu\text{g}/\text{L}$ )	29	28	3.661	3.297	90.1	4.1327	17.5

Notes:

Based on semiannual sampling events from upgradient wells 299-E28-26, 299-E28-28, and 299-E33-35: December 2007 through June 2009; from upgradient well 299-E28-27: February 2008 through June 2009 for pH and specific conductance; June 2007 through June 2009 for TOC and TOX; from wells 299-E33-28, 299-E33-29; and 299-E32-4 from January 2008 through June 2009.

- a. For values reported below laboratory's specified method detection limit, one-half of the method detection limit is used in the critical mean calculation.
- b. Excluding erroneous data from January or February 2008.
- c. Upgradient/downgradient comparison value is the most recently determined limit of quantitation (updated quarterly).

CV = coefficient of variation

df = degrees of freedom (n-1)

n = number of background replicate averages

t<sub>c</sub> = Bonferroni critical t-value for appropriate df and 68 comparisons

TOC = total organic carbon

TOX = total organic halides

**Table C-21. Monitoring Wells and Constituents for Low-Level Waste Management Area 2.**

Well Number <sup>a</sup>	WAC-Compliant	Contamination Indicator Parameters			Other Chemical Parameters					AEA Parameter <sup>b</sup>			Sampled as Scheduled in 2009				
		pH (Field)	Specific Conductance (Field)	TOC	TOX	Alkalinity	Anions	Metals	Mercury	Lead	PCBs	Phenols	Iodine-129	Technetium-99	Tritium	Uranium	
299-E27-8	C	S	S	S	S	A	S	S	A	A	A	A	S	S	S	S	Yes
299-E27-9	C	S	S	S	S	A	S	S	A	A	A	A	S	S	S	S	Yes
<b>299-E27-10</b>	C	S	S	S	S	A	S	S	A	A	A	A	S	S	S	S	Yes
299-E27-11	C	S	S	S	S	A	S	S	A	A	A	A	S	S	S	S	Yes
299-E27-17	C	S	S	S	S	A	S	S	A	A	A	A	S	S	S	S	Yes
299-E34-2	C	S	S	S	S	A	S	S	A	A	A	A	S	S	S	S	Yes
299-E34-9	C	S	S	S	S	A	S	S	A	A	A	A	S	S	S	S	Yes
299-E34-10	C	S	S	S	S	A	S	S	A	A	A	A	S	S	S	S	Yes
299-E34-12	C	S	S	S	S	A	S	S	A	A	A	A	S	S	S	S	Yes

## Notes:

Requirements from *Interim Status Groundwater Monitoring Plan for Low-Level Waste Management Areas 1 to 4, RCRA Facilities, Hanford Washington (PNNL-14859-ICN-1)* and *Performance Assessment Monitoring Plan for the Hanford Site Low-Level Burial Grounds* (DOE/RL-2000-72).

Wells completed at the top of the unconfined aquifer.

a. ***Bold italic*** indicates upgradient well.

b. Monitored for DOE O 435.1, *Radioactive Waste Management*.

A = to be sampled annually

AEA = *Atomic Energy Act of 1954*

C = well is constructed as a resource protection well under WAC 173-160, "Minimum Standards for Construction and Maintenance of Wells"

PCB = polychlorinated biphenyl

S = to be sampled semiannually

TOC = total organic carbon

TOX = total organic halides

WAC = *Washington Administrative Code*

**Table C-22. Critical Means for Low-Level Waste Management Area 2 for Calendar Year 2010 Comparisons.**

Constituent (unit)	n	df	Mean	Standard Deviation	CV (%)	t <sub>c</sub>	Critical Mean
pH	4	3	7.71	0.0382	0.4963	19.8889	[6.85 - 8.56]
Specific conductance ( $\mu\text{S}/\text{cm}$ )	4	3	1,023.69	14.7300	1.4389	15.7577	1,278
Total organic carbon <sup>a</sup> ( $\mu\text{g}/\text{L}$ )	5	4	738.85	209.0672	28.2963	10.0298	3,036
Total organic halides <sup>a,b</sup> ( $\mu\text{g}/\text{L}$ )	5	4	11.00	7.2861	66.2676	10.0298	91.0

Notes:  
 Based on semiannual sampling events from April 2006 through April 2008 for upgradient well 299-E27-10.  
 Because groundwater flow direction was uncertain in this area in 2009, critical means calculated from the latest known upgradient conditions will be used for 2010 analyses.  
 a. For values reported below laboratory's specified method detection limit, one-half of the method detection limit is used in the critical mean calculation.  
 b. Excluding erroneous data from October 2007.

CV = coefficient of variation.  
 df = degrees of freedom (n-1).  
 n = number of background replicate averages.  
 t<sub>c</sub> = Bonferroni critical t-value for appropriate df and 36 comparisons.

**Table C-23. Monitoring Wells and Constituents for Low-Level Waste Management Area 3.**

Well Number	Comment	WAC-Compliant	Contamination Indicator Parameters				Other Chemical Parameters					AEA Parameters <sup>a</sup>			Sampled as Scheduled in 2009		
			pH (Field)	Specific Conductance (Field)	TOC	TOX	Alkalinity	Anions	Metals	Mercury	Lead	Phenols	VOA	Iodine-129	Technetium-99	Tritium	Uranium
299-W7-3	Deep unconfined; no statistics	C	S	S	S	S	A	S	S	A	A	A	A	S	S	S	Yes
299-W7-4		C	S	S	S	S	A	S	S	A	A	A	A	S	S	S	No <sup>b</sup>
299-W8-1		C	S	S	S	S	A	S	S	A	A	A	A	S	S	S	Yes
299-W10-14	Deep unconfined; no statistics	C	S	S	S	S	A	S	S	A	A	A	A	S	S	S	Yes
299-W10-29		C	S	S	S	S	A	S	S	A	A	A	A	S	S	S	Yes
299-W10-30		C	S	S	S	S	S	A	S	S	A	A	A	S	S	S	Yes
299-W10-31		C	S	S	S	S	A	S	S	A	A	A	A	S	S	S	Yes

Notes:  
 Requirements from *Interim Status Groundwater Monitoring Plan for Low-Level Waste Management Areas 1 to 4, RCRA Facilities, Hanford Washington* (PNNL-14859-ICN-1) and *Performance Assessment Monitoring Plan for the Hanford Site Low-Level Burial Grounds* (DOE/RL-2000-72).  
 Wells completed at the top of the unconfined aquifer unless specified otherwise.  
 a. Monitored for DOE O 435.1, *Radioactive Waste Management*.  
 b. Well 299-W7-4 removed from network March 2008 due to cave-in potential.

A = to be sampled annually  
 AEA = *Atomic Energy Act of 1954*"  
 C = well is constructed as a resource protection well under WAC 173-160, "Minimum Standards for Construction and Maintenance of Wells"  
 RCRA = *Resource Conservation and Recovery Act of 1976*  
 S = to be sampled semiannually  
 TOC = total organic carbon  
 TOX = total organic halides  
 VOA = volatile organic analysis  
 WAC = *Washington Administrative Code*

**Table C-24. Monitoring Wells and Constituents for Low-Level Waste Management Area 4.**

Well Number <sup>a</sup>	Comment	WAC Compliant	Contamination Indicator Parameters				Other Chemical Parameters <sup>b</sup>				AEA Parameters <sup>c</sup>			Sampled as Scheduled in 2009			
			pH (Field)	Specific Conductance (Field)	TOC	TOX	Alkalinity	Anions	Metals	Mercury	Lead	Phenols	VOA	Iodine-129	Technetium-99	Tritium	Uranium
<b>299-W15-15</b>		C	S	S	S	S	A	S	S	A	A	A	A	S	S	S	Not sampled; dry in January 2008
299-W15-17	Deep unconfined; no statistics	C	S	S	S	S	A	S	S	A	A	A	A	S	S	S	Yes
299-W15-30		C	S	S	S	S	A	S	S	A	A	A	A	S	S	S	Yes
299-W15-83		C	S	S	S	S	A	S	S	A	A	A	A	S	S	S	Yes
299-W15-94		C	S	S	S	S	A	S	S	A	A	A	A	S	S	S	Yes
299-W15-152		C	S	S	S	S	A	S	S	A	A	A	A	S	S	S	Yes
299-W15-224		C	S	S	S	S	A	S	S	A	A	A	A	S	S	S	Yes
<b>299-W18-21</b>		C	S	S	S	S	A	S	S	A	A	A	A	S	S	S	Yes
<b>299-W18-22</b>	Deep unconfined; no statistics	C	S	S	S	S	A	S	S	A	A	A	A	S	S	S	Yes
<b>299-W18-23</b>		C	S	S	S	S	A	S	S	A	A	A	A	S	S	S	Not sampled; dry in July 2008

Notes:

Requirements from *Interim Status Groundwater Monitoring Plan for Low-Level Waste Management Areas 1 to 4, RCRA Facilities, Hanford Washington (PNNL-14859-ICN-1)* and *Performance Assessment Monitoring Plan for the Hanford Site Low-Level Burial Grounds* (DOE/RL-2000-72).

Wells completed at the top of the unconfined aquifer unless specified otherwise.

- a. ***Bold italic*** indicates upgradient well.
- b. Due to elevated TOC sampling results, in March 2009 the groundwater was sampled from wells 299-W15-224, 299-W15-30, and 299-W15-83 and analyzed for coliform bacteria, oil and grease, chemical oxygen demand, TPHs (gasoline, diesel, and kerosene), pesticides, herbicides, dioxins, polychlorinated biphenyls, and the 40 CFR 264, Appendix IX list of volatile and semivolatile organic analytes. In July 2009, the results of the March sampling did not find dangerous waste in the groundwater at LLWMA-4, and monitoring at the LLWMA returned to indicator evaluation monitoring.
- c. Monitored for DOE O 435.1, *Radioactive Waste Management*.

A = to be sampled annually

AEA = *Atomic Energy Act of 1954*

C = well is constructed as a resource protection well under WAC 173-160, "Minimum Standards for Construction and Maintenance of Wells"

CFR = *Code of Federal Regulations*

LLWMA = low-level waste management area

RCRA = *Resource Conservation and Recovery Act of 1976*

S = to be sampled semiannually

TOC = total organic carbon

TOX = total organic halides

TPH = total petroleum hydrocarbon

VOA = volatile organic analysis

WAC = *Washington Administrative Code*

**Table C-25. Critical Means for Low-Level Waste Management Area 4 for Fiscal Year 2010 Comparisons.**

Constituent (unit)	n	df	Mean	Standard Deviation	CV (%)	t <sub>c</sub>	Critical Mean
pH	13	12	7.924	0.1963	2.5	4.8233	[6.94 - 8.91]
Specific conductance ( $\mu\text{S}/\text{cm}$ )	12	11	498.7	57.04	11.4	4.5477	769
TOC* ( $\mu\text{g}/\text{L}$ )	13	12	300.5	130.7	43.5	4.4215	900
TOX* ( $\mu\text{g}/\text{L}$ )	11	10	5.994	4.054	67.6	4.7065	25.9

Notes:  
 Based on semiannual sampling events from January 2007 through July 2007 for upgradient well 299-W15-15; from January 2007 through July 2009 for upgradient well 299-W18-21; and from February 2007 through May 2008 for upgradient well 299-W18-23.  
 \* For values reported below laboratory's specified method detection limit, one-half of the method detection limit is used in the critical mean calculation.

CV = coefficient of variation  
 df = degrees of freedom (n-1)  
 n = number of background replicate averages  
 tc = Bonferroni critical t-value for appropriate df and 24 comparisons  
 TOC = total organic carbon  
 TOX = total organic halides

**Table C-26. Monitoring Wells and Constituents for the Nonradioactive Dangerous Waste Landfill.**

Well Number*	Comment	WAC-Compliant	Contamination Indicator Parameters				Other Chemical Parameters				Sampled as Scheduled in 2009
			pH (field)	Specific Conductance (Field)	TOC	TOX	Anions	Metals	Phenols	VOA	
699-25-33A	Top of LPU; no statistics	C	S	S	S	S	S	A	A	S	Yes
699-25-34A		C	S	S	S	S	S	A	A	S	Yes
699-25-34B		C	S	S	S	S	S	A	A	S	Yes
699-25-34D		C	S	S	S	S	S	A	A	S	Yes
699-26-33		C	S	S	S	S	S	A	A	S	Yes
<b>699-26-34A</b>		C	S	S	S	S	S	A	A	S	Yes
699-26-34B		C	S	S	S	S	S	A	A	S	Yes
<b>699-26-35A</b>		C	S	S	S	S	S	A	A	S	Yes
<b>699-26-35C</b>	Top of LPU; no statistics	C	S	S	S	S	S	A	A	S	Yes

**Notes:**  
 Requirements from *Groundwater Monitoring Plan for the Nonradioactive Dangerous Waste Landfill* and Interim Change Notice 1 (PNNL-12227 and PNNL-12227-ICN-1).  
 Wells completed at the top of the unconfined aquifer unless specified otherwise.  
 \* ***Bold italic*** indicates upgradient well.

**A** = to be sampled annually  
**C** = well is constructed as a resource protection well under WAC 173-160, "Minimum Standards for Construction and Maintenance of Wells"  
**FY** = fiscal year  
**LPU** = low-permeability unit in upper Ringold Formation  
**S** = to be sampled semiannually  
**TOC** = total organic carbon  
**TOX** = total organic halides  
**VOA** = volatile organic analysis  
**WAC** = Washington Administrative Code

**Table C-27. Critical Means for Nonradioactive Dangerous Waste Landfill for Fiscal Year 2010 Comparisons.**

Constituent (unit)	n	df	Mean	Standard Deviation	CV (%)	t <sub>c</sub>	Critical Mean
pH	8	7	7.258	0.0680	0.9	6.4295	[6.79 - 7.72]
Specific conductance ( $\mu\text{S}/\text{cm}$ )	8	7	539.5	8.743	1.6	5.7282	593
TOC* ( $\mu\text{g}/\text{L}$ )	8	7	248.3	111.3	44.8	5.7282	925
TOX* ( $\mu\text{g}/\text{L}$ )	9	8	3.793	3.335	87.9	5.3162	22.5

Notes:  
 Based on semiannual sampling events from May 2008 through August 2009 for upgradient well 699-26-34A except  
 \* August 2007 through August 2009 for TOX; and from March 2008 through July 2009 for upgradient well 699-26-35A.  
 \* For values reported below laboratory's specified method detection limit, one-half of the method detection limit is used in the critical mean calculation.

CV = coefficient of variation  
 df = degrees of freedom (n-1)  
 n = number of background replicate averages  
 t<sub>c</sub> = Bonferroni critical t-value for appropriate df and 28 comparisons  
 TOC = total organic carbon  
 TOX = total organic halides

**Table C-28. Monitoring Wells and Constituents for RCRA PUREX Cribs 216-A-10, 216-A-36B, and 216-A-37-1.**

Well Number <sup>a</sup>	Comment	WAC-Compliant	Primary RCRA Constituent	Supporting Parameters			Sampled as Scheduled in 2009
				Nitrate	Anions	Metals	
299-E17-1	216-A-10	P	S	S	S	A	Yes
299-E17-14	216-A-36B	C	Q	Q	Q	A	Yes
299-E17-16	216-A-36B	C	S	S	S	A	Yes
299-E17-18	216-A-36B	C	S	S	S	A	Yes
299-E17-19	216-A-10	C	S	S	S	A	Yes
299-E24-16	216-A-10	C	Q	Q	Q	A	Yes
<b>299-E24-18</b>	Upgradient	C	S	S	S	A	Yes
299-E25-17	216-A-37-1	P	S	S	S	A	Yes
299-E25-19	216-A-37-1	P	Q	Q	Q	A	Yes
<b>299-E25-31</b>	Upgradient	C	S	S	S	A	Yes
699-37-47A	Downgradient	C	S	S	S	A	Yes
Additional wells	Far-field		b	b			See Appendix A for 200-PO-1

Notes:

Requirements from *Combination RCRA Groundwater Monitoring Plan for the 216-A-10, 216-A-36B, and 216-A-37-1 PUREX Cribs* (PNNL-11523).

Wells completed at the top of the unconfined aquifer unless specified otherwise.

a. ***Bold italic*** indicates upgradient well.

b. Far-field wells sampled annually to triennially in conjunction with the 200-PO-1 Operable Unit.

A = to be sampled annually

C = well is constructed as a resource protection well under WAC 173-160, "Minimum Standards for Construction and Maintenance of Wells"

P = constructed prior to WAC requirements

PUREX = Plutonium-Uranium Extraction (Plant)

Q = to be sampled quarterly

RCRA = Resource Conservation and Recovery Act of 1976

S = to be sampled semiannually

WAC = Washington Administrative Code

**Table C-29. Monitoring Wells and Constituents for Waste Management Area A-AX.**

Well Number <sup>a</sup>	WAC-Compliant	Site-Specific Constituents										Sampled as Scheduled in 2009
		Nitrate	Sodium	Sulfate	TOC	Chromium	Lead	Alkalinity	Anions	Metals	Technetium-99 <sup>b</sup>	
<b>299-E24-20</b>	C	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Yes
<b>299-E24-22</b>	C	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Yes
<b>299-E24-33</b>	C	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Yes
299-E25-2	P	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Yes
299-E25-40	C	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Yes
299-E25-41	C	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Yes
299-E25-93	C	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Yes
299-E25-94	C	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Yes
299-E25-236	C	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Yes

Notes:  
Requirements from RCRA Assessment Plan for Single-Shell Tank Waste Management Area A-AX at the Hanford Site (PNNL-15315).  
Wells completed at the top of the unconfined aquifer unless specified otherwise.  
a. ***Bold italic*** indicates upgradient well.  
b. *Atomic Energy Act of 1954* parameter.

C = well is constructed as a resource protection well under WAC 173-160, "Minimum Standards for Construction and Maintenance of Wells"  
FY = fiscal year  
P = constructed prior to WAC requirements  
Q = to be sampled quarterly  
TOC = total organic carbon  
WAC = Washington Administrative Code

**Table C-30. Monitoring Wells and Constituents for Waste Management Area B-BX-BY.**

Well Number*	WAC-Compliant	RCRA Parameters				AEA Parameters				Sampled as Scheduled in 2009
		Alkalinity	Anions	Cyanide	Metals	Gamma	Technetium-99	Tritium	Uranium	
299-E28-8	P	Q	Q	Q	Q	S	Q	Q	Q	Yes
299-E33-7	P	Q	Q	Q	Q	S	Q	Q	Q	Yes
299-E33-9	P	Q	Q	Q	Q	S	Q	Q	Q	Frequency changed to semi-annual due to access issues
299-E33-15	P	S	S	S	S	S	S	S	S	Unsuccessful sampling for last half of CY 2009
299-E33-16	P	Q	Q	Q	Q	S	Q	Q	Q	Yes
299-E33-17	P	A	A	A	A		A	A	A	Yes
299-E33-18	P	Q	Q	Q	Q	S	Q	Q	Q	Missed last quarter of CY 2008
299-E33-20	P	A	A	A	A		A	A	A	Yes
299-E33-21	P	A	A	A	A		A	A	A	Yes
299-E33-26	C	Q	Q	Q	Q	S	Q	Q	Q	Yes
299-E33-31	C	Q	Q	Q	Q	S	Q	Q	Q	Missed second quarter of CY 2009
299-E33-32	C	Q	Q	Q	Q	S	Q	Q	Q	Yes
299-E33-38	C	Q	Q	Q	Q	S	Q	Q	Q	Yes
299-E33-39	C	Q	Q	Q	Q	S	Q	Q	Q	Yes
299-E33-41	C	Q	Q	Q	Q	S	Q	Q	Q	Yes
299-E33-42	C	Q	Q	Q	Q	S	Q	Q	Q	Yes
299-E33-43	C	Q	Q	Q	Q	S	Q	Q	Q	Yes
299-E33-44	C	Q	Q	Q	Q	S	Q	Q	Q	Yes
299-E33-47	C	Q	Q	Q	Q		Q	Q	Q	Yes
299-E33-48	C	Q	Q	Q	Q		Q	Q	Q	Yes
299-E33-49	C	Q	Q	Q	Q		Q	Q	Q	Yes
299-E33-334	C	Q	Q	Q	Q		Q	Q	Q	Yes
299-E33-335	C	Q	Q	Q	Q		Q	Q	Q	Yes
299-E33-337	C	Q	Q	Q	Q		Q	Q	Q	Missed second quarter of CY 2009
299-E33-338	C	Q	Q	Q	Q		Q	Q	Q	Missed second quarter of CY 2009
299-E33-339	C	Q	Q	Q	Q		Q	Q	Q	Yes
299-E33-205	C	S	S	S	S	S	S	S	S	Missed first half of CY 2009 due to scheduling
299-E33-341	C	Q	Q	Q	Q	Q	Q	Q	Q	Yes
299-E33-342	C	Q	Q	Q	Q	Q	Q	Q	Q	Yes
299-E33-343	C	Q	Q	Q	Q	Q	Q	Q	Q	Yes
299-E33-344	C	S	S	S	S	Q	S	S	S	Yes
299-E33-345	C	Q	Q	Q	Q	Q	Q	Q	Q	Yes

Notes: Requirements from PNNL-13022-ICN-3, *Groundwater Quality Assessment Plan for Single-Shell Tank Waste Management Area B-BX-BY at the Hanford Site*.

Wells completed at the top of the unconfined aquifer.

\* Gradient nearly flat; indeterminate flow direction; no upgradient wells defined.

A = to be sampled annually

AEA = *Atomic Energy Act of 1954*

C = well is constructed as a resource protection well under WAC 173-160, "Minimum Standards for Construction and Maintenance of Wells"

CY = calendar year

P = constructed prior to WAC requirements

Q = to be sampled quarterly

RCRA = *Resource Conservation and Recovery Act of 1976*

S = to be sampled semi-annually

WAC = *Washington Administrative Code*

**Table C-31. Monitoring Wells and Constituents for Waste Management Area C Prior to Assessment.**

Well Number <sup>a</sup>	WAC-Compliant	Groundwater Quality Parameters						Assessment Parameters			AEA Parameters			Sampled as Scheduled in 2009	
		pH (Field)	Specific Conductance (Field)	Alkalinity	Anions	Cyanide	Metals	VOCs	SVOCs	Inorganic Elements	Beta	Gamma	Technetium-99	Uranium	
299-E27-4	C	Q	Q	Q	Q	Q	Q	X	X	X	Q	Q	Q	Q	Yes
299-E27-7	P	Q	Q	Q	Q	Q	Q	X	X	X	Q	Q	Q	Q	Yes
299-E27-12 <sup>b</sup>	C	Q	Q	Q	Q	Q	Q	X	X	X	Q	Q	Q	Q	Yes
299-E27-13	C	Q	Q	Q	Q	Q	Q	X	X	X	Q	Q	Q	Q	Yes
299-E27-14	C	Q	Q	Q	Q	Q	Q	X	X	X	Q	Q	Q	Q	Yes
299-E27-15 <sup>b</sup>	C	Q	Q	Q	Q	Q	Q	X	X	X	Q	Q	Q	Q	Yes
299-E27-155	C	Q	Q	Q	Q	Q	Q	X	X	X	Q	Q	Q	Q	Yes
299-E27-21	C	Q	Q	Q	Q	Q	Q	X	X	X	Q	Q	Q	Q	Yes
299-E27-22	C	Q	Q	Q	Q	Q	Q	X	X	X	Q	Q	Q	Q	Yes
299-E27-23	C	Q	Q	Q	Q	Q	Q	X	X	X	Q	Q	Q	Q	Yes

Notes:  
Assessment and groundwater quality requirement from *Interim Status Groundwater Quality Assessment Plan for the Single Shell Tank Waste Management Area - C* (DOE/RL-2009-77), and AEA requirements from *RCRA Groundwater Monitoring Plan for Single-Shell Tank Waste Management Area C at the Hanford Site*, Interim Change Notice 5 (PNNL-13024-ICN-5).

Wells completed at the top of the unconfined aquifer, except 299-E27-155, which is screened across the bottom half of the aquifer for determination of extent of contamination.

a. ***Bold italic*** indicates upgradient well.  
b. Well is cross-gradient of C Tank Farm based on southwest to south-southwest groundwater flow direction.

A = to be sampled annually  
AEA = *Atomic Energy Act of 1954*  
C = well is constructed as a resource protection well under WAC 173-160, "Minimum Standards for Construction and Maintenance of Wells"  
P = constructed prior to WAC requirements  
Q = to be sampled quarterly  
S = to be sampled semiannually  
SVOC = semivolatile organic compound  
VOC = volatile organic compound  
X = assessment constituents sampled in December 2009 (see DOE/RL-2009-77 for list)  
WAC = *Washington Administrative Code*

**Table C-32. Monitoring Wells and Constituents for Waste Management Area C.**

Well Number <sup>a</sup>	WAC-Compliant	Groundwater Quality Parameters						Assessment Parameters			AEA Parameters			Sampled as Scheduled in 2009	
		pH (Field)	Specific Conductance (Field)	Alkalinity	Anions	Cyanide	Metals	VOCs	SVOCs	Inorganic Elements	Beta	Gamma	Technetium-99	Uranium	
299-E27-4	C	Q	Q	Q	Q	Q	Q	X	X	X	Q	Q	Q	Q	Yes
299-E27-7	P	Q	Q	Q	Q	Q	Q	X	X	X	Q	Q	Q	Q	Yes
299-E27-12 <sup>b</sup>	C	Q	Q	Q	Q	Q	Q	X	X	X	Q	Q	Q	Q	Yes
299-E27-13	C	Q	Q	Q	Q	Q	Q	X	X	X	Q	Q	Q	Q	Yes
299-E27-14	C	Q	Q	Q	Q	Q	Q	X	X	X	Q	Q	Q	Q	Yes
299-E27-15 <sup>b</sup>	C	Q	Q	Q	Q	Q	Q	X	X	X	Q	Q	Q	Q	Yes
299-E27-155	C	Q	Q	Q	Q	Q	Q	X	X	X	Q	Q	Q	Q	Yes
299-E27-21	C	Q	Q	Q	Q	Q	Q	X	X	X	Q	Q	Q	Q	Yes
299-E27-22	C	Q	Q	Q	Q	Q	Q	X	X	X	Q	Q	Q	Q	Yes
299-E27-23	C	Q	Q	Q	Q	Q	Q	X	X	X	Q	Q	Q	Q	Yes

Notes:  
 Assessment and groundwater quality requirement from *Interim Status Groundwater Quality Assessment Plan for the Single Shell Tank Waste Management Area – C* (DOE/RL-2009-77), and AEA requirements from *RCRA Groundwater Monitoring Plan for Single-Shell Tank Waste Management Area C at the Hanford Site, Interim Change Notice 5* (PNNL-13024-ICN-5).  
 Wells completed at the top of the unconfined aquifer, except 299-E27-155, which is screened across the bottom half of the aquifer for determination of extent of contamination.  
 a. ***Bold italic*** indicates upgradient well.  
 b. Well is cross-gradient of C Tank Farm based on southwest to south-southwest flow direction.

A = to be sampled annually  
 AEA = *Atomic Energy Act of 1954*  
 C = well is constructed as a resource protection well under WAC 173-160, "Minimum Standards for Construction and Maintenance of Wells"  
 P = constructed prior to WAC requirements  
 Q = to be sampled quarterly  
 S = to be sampled semiannually  
 SVOC = semivolatile organic compound  
 VOC = volatile organic compound  
 X = assessment constituents sampled in December 2009 (see DOE/RL-2009-77 for list)  
 WAC = *Washington Administrative Code*

**Table C-33. Monitoring Wells and Constituents for Waste Management Area S-SX.**

Well Number <sup>a</sup>	WAC-Compliant	RCRA	Supporting Constituents								Sampled as Scheduled in 2009	
			Chromium	Nitrate	Alkalinity	Anions	Metals	Technetium-99	Tritium	Uranium	Gamma	
299-W22-26 <sup>b</sup>	P	Q	Q	Q	Q	Q	Q	Q	A	A		2009 4 <sup>th</sup> quarter sampling delayed until January
299-W22-44	C	Q	Q	Q	Q	Q	Q	Q	A	A		Yes
299-W22-45	C	Q	Q	Q	Q	Q	Q	Q	A	A		Yes
299-W22-47	C	Q	Q	Q	Q	Q	Q	Q	A	A		Yes
299-W22-48	C	Q	Q	Q	Q	Q	Q	Q	A	A		Yes
299-W22-49	C	Q	Q	Q	Q	Q	Q	Q	A	A		Yes
299-W22-50	C	Q	Q	Q	Q	Q	Q	Q	A	A		Yes
299-W22-69	C	Q	Q	Q	Q	Q	Q	Q	A	A		Yes
299-W22-72	C	Q	Q	Q	Q	Q	Q	Q	A	A		Yes
299-W22-80	C	Q	Q	Q	Q	Q	Q	Q	A	A		Yes
299-W22-81	C	Q	Q	Q	Q	Q	Q	Q	A	A		Yes
299-W22-82	C	Q	Q	Q	Q	Q	Q	Q	A	A		Yes
299-W22-83	C	Q	Q	Q	Q	Q	Q	Q	A	A		Yes
299-W22-84	C	Q	Q	Q	Q	Q	Q	Q	A	A		Yes
299-W22-85	C	Q	Q	Q	Q	Q	Q	Q	A	A		Yes
299-W22-86	C	Q	Q	Q	Q	Q	Q	Q	A	A		Yes
299-W23-15	C	Q	Q	Q	Q	Q	Q	Q	A	A		Yes
299-W23-19	C	Q	Q	Q	Q	Q	Q	Q	A	A	A	Yes
299-W23-20	C	Q	Q	Q	Q	Q	Q	Q	A	A		Yes
299-W23-21	C	Q	Q	Q	Q	Q	Q	Q	A	A		2009 4 <sup>th</sup> quarter sampling delayed until January

## Notes:

Requirements from *RCRA Assessment Plan for Single-Shell Tank Waste Management Area S-SX at the Hanford Site*, Interim Change Notice 4 (PNNL-12114-ICN-4).

Wells completed at the top of the unconfined aquifer.

- a. ***Bold italic*** indicates upgradient well.
- b. Sampled during the reporting period; will be added to upcoming revision of monitoring plan.

A = to be sampled annually

C = well is constructed as a resource protection well under WAC 173-160, "Minimum Standards for Construction and Maintenance of Wells"

P = constructed prior to WAC requirements

Q = to be sampled quarterly

RCRA = *Resource Conservation and Recovery Act of 1976*

WAC = *Washington Administrative Code*

**Table C-34. Monitoring Wells and Constituents for Waste Management Area T.**

Well Number*	Comment	WAC-Compliant	Constituents of Concern		Constituents of Interest and Supporting Groundwater Quality Constituents									Sampled as Scheduled in 2009
			Chromium (Total, Filtered)	Nitrate	Alkalinity	Anions	Gamma Scan	Alpha	Beta	Iodine-129	Metals	Technetium-99	Tritium	
<b>299-W10-1</b>		P	Q	Q	Q	Q		A	A		Q	Q	Q	Yes
299-W10-4		P	Q	Q	Q	Q	A	A	A		Q	Q	Q	Yes
299-W10-8		P	Q	Q	Q	Q		A	A		Q	Q	Q	Yes
299-W10-22		C	S	S	S	S					S	S	S	Yes
299-W10-23		C	Q	Q	Q	Q		A	A		Q	Q	Q	Yes
299-W10-24		C	Q	Q	Q	Q	S	S	S		Q	Q	Q	Yes
<b>299-W10-28</b>		C	Q	Q	Q	Q		A	A		Q	Q	Q	Yes
299-W11-7		P	S	S	S	S					S	S	S	Yes
299-W11-12		P	Q	Q	Q	Q		A	A		Q	Q	Q	Yes
299-W11-39		C	Q	Q	Q	Q	S	S	S		Q	Q	Q	Yes
299-W11-40		C	Q	Q	Q	Q		A	A		Q	Q	Q	Yes
299-W11-41		C	Q	Q	Q	Q	S	S	S	A	Q	Q	Q	Yes
299-W11-42		C	Q	Q	Q	Q	S	S	S		Q	Q	Q	Yes
299-W11-45	Extraction well; screened 8.5 to 13 meters below water table	C	Q	Q	Q	Q	A	A	A		Q	Q	Q	Yes
299-W11-46	Extraction well; screened 6 to 12 meters below water table	C	Q	Q	Q	Q	S	S	S		Q	Q	Q	Yes
299-W11-47	Screened 9 to 18 meters below water table	C	Q	Q	Q	Q	S	S	S	A	Q	Q	Q	Yes

Notes:  
Requirements from *RCRA Assessment Plan for Single-Shell Tank Waste Management Area T* (PNNL-15301).  
Wells completed at the top of the unconfined aquifer unless specified otherwise.  
***Bold italic*** indicates upgradient well.

A = to be sampled annually  
C = well is constructed as a resource protection well under WAC 173-160, "Minimum Standards for Construction and Maintenance of Wells"  
P = constructed prior to WAC requirements  
Q = to be sampled quarterly  
RCRA = *Resource Conservation and Recovery Act of 1976*  
S = to be sampled semiannually  
WAC = *Washington Administrative Code*

**Table C-35. Monitoring Wells and Constituents for Waste Management Area TX-TY.**

Well Number *	Comment	WAC-Compliant	RCRA Parameters			AEA Parameters						Sampled as Scheduled in 2009	
			Alkalinity	Anions	Metals	Alpha	Beta	Gamma	Iodine-129	Srtronium-90	Technetium-99		
299-W10-26		C	Q	Q	Q	A	A	A			Q	Q	Yes
299-W10-27		C	Q	Q	Q	A	A	A			Q	Q	Yes
299-W14-6		P	Q	Q	Q	A	A				Q	Q	Yes
299-W14-11	Screened 11 to 14.6 meters below water table	C	Q	Q	Q	S	S	S	Q	A	Q	Q	Yes
299-W14-13		C	Q	Q	Q	S	S	S	Q	A	Q	Q	Yes
299-W14-14		C	Q	Q	Q	A	A	A			Q	Q	Yes
299-W14-15		C	Q	Q	Q	A	A	A	Q		Q	Q	Yes
299-W14-16		C	Q	Q	Q				Q		Q	Q	Yes
299-W14-17		C	Q	Q	Q				Q		Q	Q	Yes
299-W14-18		C	Q	Q	Q	A	A	A	Q		Q	Q	Yes
299-W14-19		C	Q	Q	Q	A	A	A			Q	Q	Yes
<b>299-W15-40</b>	Extraction well	C	Q	Q	Q	A	A				Q	Q	Yes
299-W15-41		C	Q	Q	Q	A	A	A	S		Q	Q	Yes
299-W15-44	Extraction well	C	Q	Q	Q	A	A	A	S		Q	Q	Yes
299-W15-763		C	Q	Q	Q	A	A	A			Q	Q	Yes
<b>299-W15-765</b>	Extraction well	C	Q	Q	Q	A	A	A	S		Q	Q	Yes; except missed one quarterly alkalinity sample

## Notes:

Requirements from RCRA Assessment Plan for Single-Shell Tank Waste Management Area TX-TY (PNNL-16005).

Wells completed at the top of the unconfined aquifer unless specified otherwise.

\* Bold italic indicates upgradient well.

A = to be sampled annually

AEA = *Atomic Energy Act of 1954*

C = well is constructed as a resource protection well under WAC 173-160, "Minimum Standards for Construction and Maintenance of Wells"

P = constructed prior to WAC requirements

Q = to be sampled quarterly

RCRA = *Resource Conservation and Recovery Act of 1976*

S = to be sampled semiannually

WAC = *Washington Administrative Code*

**Table C-36. Monitoring Wells and Constituents for Waste Management Area U.**

Well Number*	WAC-Compliant	RCRA	Supporting Parameters							Sampled as Scheduled in 2009	
			Chromium	Nitrate	Alkalinity	Anions	Metals	Technetium-99	Gross Alpha/Beta		
299-W18-30	C	Q	Q	Q	Q	Q	Q	Q	A	A	Yes
299-W18-31	C	Q	Q	Q	Q	Q	Q	Q	A	A	Dry in fiscal year 2008
299-W18-40	C	Q	Q	Q	Q	Q	Q	Q	A	A	Yes
299-W19-12	C	Q	Q	Q	Q	Q	Q	Q	A	A	Yes
299-W19-41	C	Q	Q	Q	Q	Q	Q	Q	A	A	Yes
299-W19-42	C	Q	Q	Q	Q	Q	Q	Q	A	A	Yes
299-W19-44	C	Q	Q	Q	Q	Q	Q	Q	A	A	Yes
299-W19-45	C	Q	Q	Q	Q	Q	Q	Q	A	A	Yes
299-W19-47	C	Q	Q	Q	Q	Q	Q	Q	A	A	Yes

Notes:  
Requirement from *Groundwater Quality Assessment Plan for Single-Shell Tank Waste Management Area U*, Interim Change Notice 2 (PNNL-13612-ICN-2).  
Wells completed at the top of the unconfined aquifer.  
\* Bold italic indicates upgradient well.

**A** = to be sampled annually  
**C** = well is constructed as a resource protection well under WAC 173-160, "Minimum Standards for Construction and Maintenance of Wells"  
**Q** = to be sampled quarterly  
**RCRA** = *Resource Conservation and Recovery Act of 1976*  
**WAC** = *Washington Administrative Code*

**Table C-37. Monitoring Wells and Constituents for the KE and KW Basins.**

Well	Comment	WAC-Compliant	Contaminants of Concern										Sampled as Scheduled in 2009
			Gross Alpha	Anions	Gross Beta	Carbon-14	Metals	Strontium-90	Technetium-99	Tritium	Alkalinity	Uranium (Total)	
<b>KE Basin</b>													
199-K-27	Decommissioned	P	Q/M	Q	Q/M		S	A/S	A/Q	Q/M	0/S		Yes until May 2008, decommissioned
199-K-29		P	Q/M	Q	Q/M	A/S	A/S	0/S	0/Q	M	0/S		Missed one month*
199-K-30		P	Q	Q	Q	A/S	S		0/S	Q	0/S		Yes
199-K-32A		C	Q	Q	Q	A/S	A/S		A/S	Q	0/S		Yes
199-K-109A	Decommissioned	C	Q/M	Q	Q/M		S	A	A/Q	Q/M	0/S		Yes until May 2008, decommissioned
199-K-110A		C	S	S	S		A/S			S	0/S		Yes
199-K-111A		C	Q/M	Q	Q/M	A	A/S		A/S	Q/M	0/S		Yes
199-K-141		C	0/Q	0/Q	0/Q	0/Q	0/Q	0/Q	0/Q	0/Q	0/Q		Yes
199-K-142		C	0/Q	0/Q	0/Q	0/Q	0/Q	0/Q	0/Q	0/Q	0/Q	0/S	Yes
<b>KW Basin</b>													
199-K-31	Not included in monitoring plan	P	0/S	0/S	0/S		0/S		0/A	0/S	0/A		Yes
199-K-34		C	Q	Q	Q	A	S/Q	A	A	Q	0/A	0/A	Yes
199-K-106A		C	Q	Q	Q	A/S	S/Q		0/Q	Q	0/S	0/S	Yes
199-K-107A		C	Q	Q	Q	A	S/Q	A	A	Q	0/A	0/A	Yes
199-K-108A		C	S	S	S	0/S	S			S	0/S		Yes
199-K-132		C	S/Q	S/Q	S/Q	A/S	S/Q		0/S	S/Q	0/S	0/S	Yes

**Notes:**  
Requirements from *Groundwater Monitoring and Assessment Plan for the 100-K Area Fuel Storage Basins* (PNNL-14033).  
Frequency required under monitoring plan is listed first. Some constituents are sampled more frequently during basin cleanout; those frequencies are listed after the slash. For example, 0/Q means not required under monitoring plan but currently sampled quarterly.  
Wells completed at the top of the unconfined aquifer.

\* No access in August 2008 due to nearby demolition work

A = to be sampled annually  
C = well is constructed as a resource protection well under WAC 173-160, "Minimum Standard for Construction and Maintenance of Wells"  
M = to be sampled monthly  
P = constructed prior to WAC requirements  
Q = to be sampled quarterly  
S = to be sampled semiannually  
VOA = volatile organic analyte  
WAC = Washington Administrative Code

**Table C-38. Monitoring Wells, Constituents, and Enforcement Limits for 200 Areas Treated Effluent Disposal Facility.**

Well*	WAC-Compliant	Constituents with Enforcement Limits			Other Constituents							Sampled as Scheduled in 2009	
		pH (6.5 to 8.5)	Cadmium (5 µg/L)	Lead (10 µg/L)	Specific Conductance	Alpha	Anions	Beta	Metals	Total Dissolved Solids	Trace Metals		
699-40-36	C	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	A	Yes
699-41-35	C	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	A	Yes
<b>699-42-37</b>	C	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	A	Yes

Notes:  
Requirements from *Groundwater Monitoring Plan for the Hanford Site 200 Area Treated Effluent Disposal Facility* (PNNL-13032).

All wells completed at the top of the Ringold Formation confined aquifer.

\* ***Bold italic*** indicates upgradient well.

A = to be sampled annually  
C = well is constructed as a resource protection well under WAC 173-160, "Minimum Standards for Construction and Maintenance of Wells"  
Q = to be sampled quarterly  
WAC = Washington Administrative Code

**Table C-39. Monitoring Wells and Constituents for Environmental Restoration Disposal Facility.**

Well Number <sup>a</sup>	WAC-Compliant	Alkalinity	Alpha	Anions	Beta	Carbon-14	Iodine-29	Metals	Radium <sup>b</sup>	Total Dissolved Solids	Techneium-99	TOX	Uranium	VOA	Sampled as Scheduled in 2009
699-35-66A	P	S	S	S	S	S	S	S	S	S	S	S	S	S	Yes
699-36-67	C	S	S	S	S	S	S	S	S	S	S	S	S	S	Decommissioned in FY 2008 for ERDF expansion
699-36-66B	C	S	S	S	S	S	S	S	S	S	S	S	S	S	Yes
699-36-70A	C	S	S	S	S	S	S	S	S	S	S	S	S	S	Yes
699-37-68	C	S	S	S	S	S	S	S	S	S	S	S	S	S	Decommissioned in FY 2008 for ERDF expansion
699-37-66	C	S	S	S	S	S	S	S	S	S	S	S	S	S	Yes

Notes:  
 Requirements from *Groundwater Protection Plan for the Environmental Restoration Disposal Facility* (WCH-198).  
 Wells completed at the top of the unconfined aquifer.  
 a. ***Bold italic*** indicates upgradient well.  
 b. Total alpha energy emitted from radium.

C = well is constructed as a resource protection well under WAC 173-160, "Minimum Standards for Construction and Maintenance of Wells"  
 ERDF = Environmental Restoration Disposal Facility  
 FY = fiscal year  
 P = constructed prior to WAC requirements  
 S = to be sampled semiannually  
 TOX = total organic halides  
 VOA = volatile organic analyte  
 WAC = Washington Administrative Code

**Table C-40. Monitoring Wells and Constituents for Solid Waste Landfill.**

Well Number*	Comment	WAC-Compliant	Contamination Indicator Parameters												Other Parameters				Sampled as Scheduled in 2009
			Ammonia	Chemical Oxygen Demand	Chloride	Iron (Filtered)	Manganese (Filtered)	Zinc (Filtered)	Nitrate	Nitrite	pH (Field)	Specific Conductance (Field)	Sulfate	Temperature (Field)	Coliform Bacteria	TOC	Anions	Metals (Filtered)	Arsenic (Filtered)
699-22-35		C	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Yes
699-23-34A		C	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Yes
699-23-34B		C	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Yes
699-24-33	Information only; no statistics	P	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Yes
699-24-34A		C	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Yes
699-24-34B		C	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Yes
699-24-34C		C	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Yes
<b>699-24-35</b>		C	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Yes
<b>699-26-35A</b>		C	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Yes

Notes:

Requirements from *Groundwater Monitoring Plan for the Solid Waste Landfill* (PNNL-13014).

Wells completed at the top of the unconfined aquifer.

\* ***Bold italic*** indicates upgradient well.

C = well is constructed as a resource protection well under WAC 173-160, "Minimum Standards for Construction and Maintenance of Wells"

P = constructed prior to WAC requirements

Q = to be sampled quarterly

TOC = total organic carbon

VOA = volatile organic analysis

WAC = Washington Administrative Code

**Table C 41. Analytical Results for Required Constituents at the Solid Waste Landfill.**

Constituent <sup>a</sup>	Date	699-22-35	699-23-34A	699-23-34B	699-24-33	699-24-34A	699-24-34B	699-24-34C	699-24-35	699-26-35A
Ammonium ion ( $\mu\text{g/L}$ ) BTv = 90 $\mu\text{g/L}$ <sup>b</sup>	10/13/2008	< 5	< 5	8.5	< 5	< 5	< 5	20.4	7.3	12.1
	11/19/2009	< 12	< 12	17.9	< 12	240	15.6	< 12	19.8	< 12
	4/8/2009	10.9	9.1	6.2	8.8	9.8	< 5.15	8.0	< 5	6.8
	7/20/2009	10.2	13.4	13.4	7.1	6.8	13.3	21.4	18.8	15.7
	10/14/2009	< 4.4	23.2	< 4.4	20.0	16.5	15.5	16.1	32.8	12.2
Chemical oxygen demand (mg/L) BTv = 10 mg/L	10/13/2008	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
	11/19/2009	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
	4/8/2009	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
	7/20/2009	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
	10/14/2009	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Chloride (mg/L) BTv = 7.82 mg/L	10/13/2008	6.6	6.8	6.3	6.8	7.1	7.1	6.9	6.1	7.1
	11/19/2009	7.0	6.8	6.4	7.3	7.2	7.1	7.2	6.4	7.3
	4/8/2009	6.9	6.7	6.3	6.9	7.0	6.9	6.9	6.2	7.3
	7/20/2009	7.1	7.6	6.7	7.0	7.2	7.7	7.0	6.4	7.4
	10/14/2009	7.0	7.2	6.6	7.2	7.2	7.0	7.1	6.7	7.5
Coliform bacteria (colonies/100 mL) BTv = 1 colony/100 mL	10/13/2008	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
	11/19/2009	< 1	< 1	< 1	NA	< 1	< 1	< 1	62	NA
	4/8/2009	< 1	< 1	< 1	NA	< 1	< 1	< 1	< 1	< 1
	7/20/2009	< 1	< 1	< 1	NA	< 1	< 1	< 1	< 1	< 1
	10/14/2009	< 1	63	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Iron (filtered) ( $\mu\text{g/L}$ ) BTv = 160 $\mu\text{g/L}$	10/13/2008	< 20	< 20	20.9	< 20	< 20	51.3	20.3	< 20	< 20
	11/19/2009	28.6	< 25	< 25	< 25	< 25	67.4	< 25	< 25	< 25
	4/8/2009	< 18	22.0	< 18	< 18	23.5	123.0	< 18	18.0	< 18
	7/20/2009	< 18	< 18	25.0	< 18	26.3	71.4	22.4	56.6	22.9
	10/14/2009	20.6	35.3	23.7	< 18	19.1	87.3	29.1	57.3	56.0
Manganese (filtered) ( $\mu\text{g/L}$ ) BTv = 18 $\mu\text{g/L}$	10/13/2008	< 4	< 4	< 4	< 4	< 4	< 4	< 4	< 4	< 4
	11/19/2009	< 4	< 4	< 4	< 4	< 4	< 4	< 4	13.6	< 4
	4/8/2009	< 4	< 4	< 4	< 4	< 4	< 4	< 4	< 4	< 4
	7/20/2009	< 4	< 4	< 4	< 4	< 4	< 4	< 4	< 4	< 4
	10/14/2009	< 4	< 4	< 4	< 4	< 4	< 4	< 4	< 4	< 4
	10/13/2008	17.7	18.9	17.0	14.9	14.4	17.6	14.9	12.5	17.3
	11/19/2009	18.2	19.6	17.3	15.1	14.2	16.6	14.8	13.4	17.6
	4/8/2009	17.6	18.5	16.9	14.2	13.9	15.7	13.7	12.5	17.1
	7/20/2009	18.2	18.7	17.7	14.6	13.9	18.5	14.3	12.0	17.9
	10/14/2009	17.8	18.9	16.9	15.0	13.4	14.9	14.3	13.4	17.6

**Table C 41. (Cont.)**

Constituent <sup>a</sup>	Date	699-22-35	699-23-34A	699-23-34B	699-24-33	699-24-34A	699-24-34B	699-24-34C	699-24-35	699-26-35A
<b>Nitrite (µg/L)</b> BTv = 192 µg/L	10/13/2008	< 98.5	< 98.5	< 98.5	< 98.5	< 98.5	< 98.5	< 98.5	< 98.5	< 98.5
	1/19/2009	< 98.5	< 98.5	< 98.5	< 98.5	< 98.5	< 98.5	< 98.5	< 98.5	< 98.5
	4/8/2009	< 98.5	< 98.5	< 98.5	< 98.5	< 98.5	< 98.5	< 98.5	< 98.5	< 98.5
	7/20/2009	< 98.5	< 98.5	< 98.5	< 98.5	< 98.5	< 98.5	< 98.5	< 98.5	< 98.5
	10/14/2009	< 98.5	< 98.5	< 98.5	< 98.5	< 98.5	< 98.5	< 98.5	< 98.5	< 98.5
<b>pH measurement</b> BTR = 6.68 - 7.84	10/13/2008	6.84	<b>6.56</b>	<b>6.58</b>	6.82	<b>6.58</b>	<b>6.32</b>	6.94	<b>6.57</b>	7.01
	1/19/2009	6.93	<b>6.59</b>	<b>6.62</b>	6.87	<b>6.64</b>	6.77	6.95	6.72	7.24
	4/8/2009	6.94	<b>6.60</b>	<b>6.62</b>	6.79	<b>6.62</b>	<b>6.66</b>	7.03	6.79	7.22
	7/20/2009	6.98	6.70	6.70	6.96	6.76	6.75	6.98	6.76	7.24
	10/14/2009	6.95	<b>6.67</b>	6.72	6.84	6.70	<b>6.68</b>	6.94	6.86	7.22
<b>Specific Conductance (µS/cm)</b> BTv = 583 µS/cm	10/13/2008	<b>824</b>	<b>764</b>	<b>761</b>	<b>756</b>	<b>672</b>	<b>708</b>	<b>769</b>	578	537
	1/19/2009	<b>815</b>	<b>759</b>	<b>751</b>	<b>758</b>	<b>665</b>	697	<b>741</b>	579	538
	4/8/2009	<b>819</b>	<b>752</b>	<b>756</b>	<b>717</b>	<b>661</b>	687	<b>748</b>	547	542
	7/20/2009	<b>813</b>	<b>733</b>	<b>751</b>	<b>720</b>	<b>645</b>	<b>699</b>	<b>684</b>	580	528
	10/14/2009	<b>839</b>	<b>775</b>	<b>768</b>	<b>750</b>	<b>655</b>	<b>686</b>	<b>701</b>	570	524
<b>Sulfate (mg/L)</b> BTv = 47.2 mg/L	10/13/2008	43.6	<b>48.7</b>	44.3	44.1	46.7	<b>54.1</b>	43.2	44.5	39.5
	1/19/2009	45.5	<b>49.8</b>	45.2	46.2	47.1	<b>49.6</b>	45.1	46.0	41.2
	4/8/2009	43.3	<b>47.7</b>	43.2	43.4	44.8	46.7	42.3	43.7	39.5
	7/20/2009	44.5	<b>49.7</b>	46.5	44.4	46.6	<b>53.1</b>	43.5	45.1	40.7
	10/14/2009	43.4	<b>48.5</b>	44.7	44.3	45.4	46.7	43.3	45.0	39.7
<b>Temperature (degrees Celsius)</b> BTv = 20.7 degrees Celsius	10/13/2008	18.2	18.6	18.4	19.8	18.9	18.5	18.7	18.1	19.4
	1/19/2009	17.5	16.5	16.4	19.1	18.0	18.2	18.4	17.2	18.9
	4/8/2009	18.2	18.4	18.6	19.6	18.7	19.0	17.8	18.1	19.3
	7/20/2009	22.0	20.1	19.9	20.2	20.0	19.8	19.6	19.8	20.1
	10/14/2009	17.6	17.9	17.4	19.5	18.1	18.7	17.5	17.7	19.0
	10/13/2008	<200	<200	<200	<200	<200	<200	<200	<200	<200
<b>Total organic carbon (µg/L)</b> BTv = 842 µg/L	1/19/2009	<b>1,040</b>	577	453	<b>868</b>	394	397	358	644	352
	4/8/2009	<b>902</b>	<b>1,160</b>	<b>1,210</b>	<b>882</b>	<b>870</b>	<b>1,040</b>	<b>1,000</b>	609	491
	7/20/2009	<b>1,120</b>	<b>1,210</b>	<b>1,180</b>	<b>976</b>	316	351	<300	799	437
	10/14/2009	NA	<220	NA	299	<b>15,400</b>	<b>15,810</b>	276	311	<260
<b>Zinc (filtered) (µg/L)</b> BTv = 42.3 µg/L	10/13/2008	< 9	< 9	< 9	< 9	< 9	< 9	< 9	< 9	< 9
	1/19/2009	< 9	< 9	< 9	11.8	< 9	< 9	20.1	12.0	< 9
	4/8/2009	< 9	< 4	< 9	5.5	< 9	< 9	7.4	5.6	< 4
	7/20/2009	< 9	< 9	< 9	< 6	< 9	< 9	< 6	< 6	< 6
	10/14/2009	< 9	< 9	< 9	6.9	< 9	< 9	8.0	< 6	< 6

Notes: Results in bold exceed background threshold values

a. WAC 173-304, "Minimum Functional Standards for Solid Waste Handling."

b. Numbers obtained from Table B-43 of Hanford Site Groundwater Monitoring for Fiscal Year 2008 (DOE/RL-2008-66).

BTv = breakthrough volume  
WAC = Washington Administrative Code

**Table C-42. Results of Shapiro and Francia Test for Normality and Background Threshold Values for the Solid Waste Landfill.**

Constituent <sup>a</sup> (unit)	W-test Statistic <sup>b</sup> (Log Value)	W-test Statistic <sup>b</sup> (Raw Data)	W-test <sup>b</sup> Critical Value, W <sub>α</sub> <sup>c</sup>	Upper Tolerance Limit	Background Threshold Value
Ammonium (as NH <sub>3</sub> <sup>-</sup> ) (µg/L)	NC	NC	NC	90 <sup>d</sup> 19.7 <sup>e</sup> WSCF 27.5 <sup>e</sup> STL	90
Chemical oxygen demand (µg/L)	NC	NC	NC	10,000 <sup>f</sup>	10,000
Chloride (µg/L)	0.954 s	0.962 s	0.963	7,820 <sup>d</sup>	7,820
Coliform bacteria (colonies/100 mL)	NC	NC	NC	1 <sup>f</sup>	1
Field pH	0.988 ns	NA	0.963	[6.68, 7.84] <sup>g</sup>	[6.68, 7.84]
Iron, dissolved (µg/L)	0.960 s	0.802 s	0.962	160 <sup>d</sup> 81 <sup>e</sup> WSCF 127 <sup>e</sup> STL	160
Manganese, dissolved (µg/L)	NC	NC	NC	10 <sup>d</sup> 18 <sup>e</sup> WSCF 15 <sup>e</sup> STL	18
Nitrate (as NO <sub>3</sub> <sup>-</sup> ) (µg/L)	0.833 s	0.844 s	0.963	29,000 <sup>d</sup>	29,000
Nitrite (as NO <sub>2</sub> <sup>-</sup> ) (µg/L)	NC	NC	NC	266 <sup>e</sup> WSCF 45 <sup>e</sup> STL	266
Specific conductance (µS/cm)	0.978 ns	NA	0.960	583 <sup>g</sup>	583
Sulfate (µg/L)	0.983 ns	NA	0.963	47,200 <sup>g</sup>	47,200
Temperature (degrees C)	0.953 s	0.961 s	0.963	20.7 <sup>d</sup>	20.7
Total organic carbon (µg/L)	NC	NC	NC	842 <sup>d</sup> 1,200 <sup>e</sup>	1,200
Zinc, dissolved (µg/L)	NC	NC	NC	42.3 <sup>d</sup> 27 <sup>e</sup> WSCF 23 <sup>e</sup> STL	42.3

## Notes:

- a. Constituents are specified in WAC 173-304-490(2)(d). Data collected from March 1993 to May 2000 from upgradient wells 699-24-35 and 699-26-35A.
- b. From "Approximate Analysis of Variance Test for Normality," in *Journal of the American Statistical Association* (Shapiro and Francia 1972).
- c. Obtained from Table A-9 in "How to Test Normality and Other Distributional Assumptions," in *ASQC Basic References in Quality Control: Statistical Techniques* (Shapiro 1980) for  $\alpha = 5\%$ .
- d. Maximum value reported.
- e. Based on limit of quantitation determined from field blanks (for total organic carbon) or laboratory blanks.
- f. Based on laboratory lowest detected result.
- g. Based on log-normal distribution.

NA = not applicable

NC = not calculated; insufficient measured values

ns = not significant at 0.05 level of significance

s = significant at 0.05 level of significance

STL = Severn Trent Laboratories (St. Louis)

WSCF = Waste Sampling and Characterization Facility

**Table C-43. Monitoring Wells, Constituents, and Enforcement Limits for the State-Approved Land Disposal Site.**

Well	Comment	WAC-Compliant	Constituents with Enforcement Limits										Other Constituents				Sampled as Scheduled in 2009	
			pH (6.5 to 8.5)	Acetone (160 µg/L)	Benzene (5 µg/L)	Cadmium* (5 µg/L)	Chloroform (6.2 µg/L)	Copper* (70 µg/L)	Lead* (10 µg/L)	Mercury* (2 µg/L)	Sulfate (250 mg/L)	Tetrahydrofuran (100 µg/L)	Total Dissolved Solids (500 mg/L)	Specific Conductance	Alpha	Beta	Strontium-90	Tritium
299-W6-6	Bottom of unconfined	C															A	Yes
299-W6-11		C															A	Yes
299-W6-12		C															A	Yes
299-W7-3	Bottom of unconfined	C															S	Yes
299-W8-1		C															A	Yes
699-48-71	Unconfined	P															A	Yes
699-48-77A	Ringold Unit E, upper	C	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Yes
699-48-77C	Ringold Unit E, mid to lower	C	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Yes
699-48-77D	Ringold Unit E, upper	C	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Yes
699-49-79		P															A	Yes
699-51-75		P															S	Yes
699-51-75P	Lower unconfined	P															A	Yes

Notes:

Requirements from *Groundwater Monitoring and Tritium Tracking Plan for the 200 Area State-Approved Land Disposal Site* (PNNL-13121).

Wells completed at the top of the unconfined aquifer unless specified otherwise.

\* Filtered and unfiltered samples.

A = to be sampled annually

C = well is constructed as a resource protection well under WAC 173-160, "Minimum Standards for Construction and Maintenance of Wells"

FY = fiscal year

P = constructed prior to WAC requirements

Q = to be sampled quarterly

S = to be sampled semiannually

WAC = Washington Administrative Code

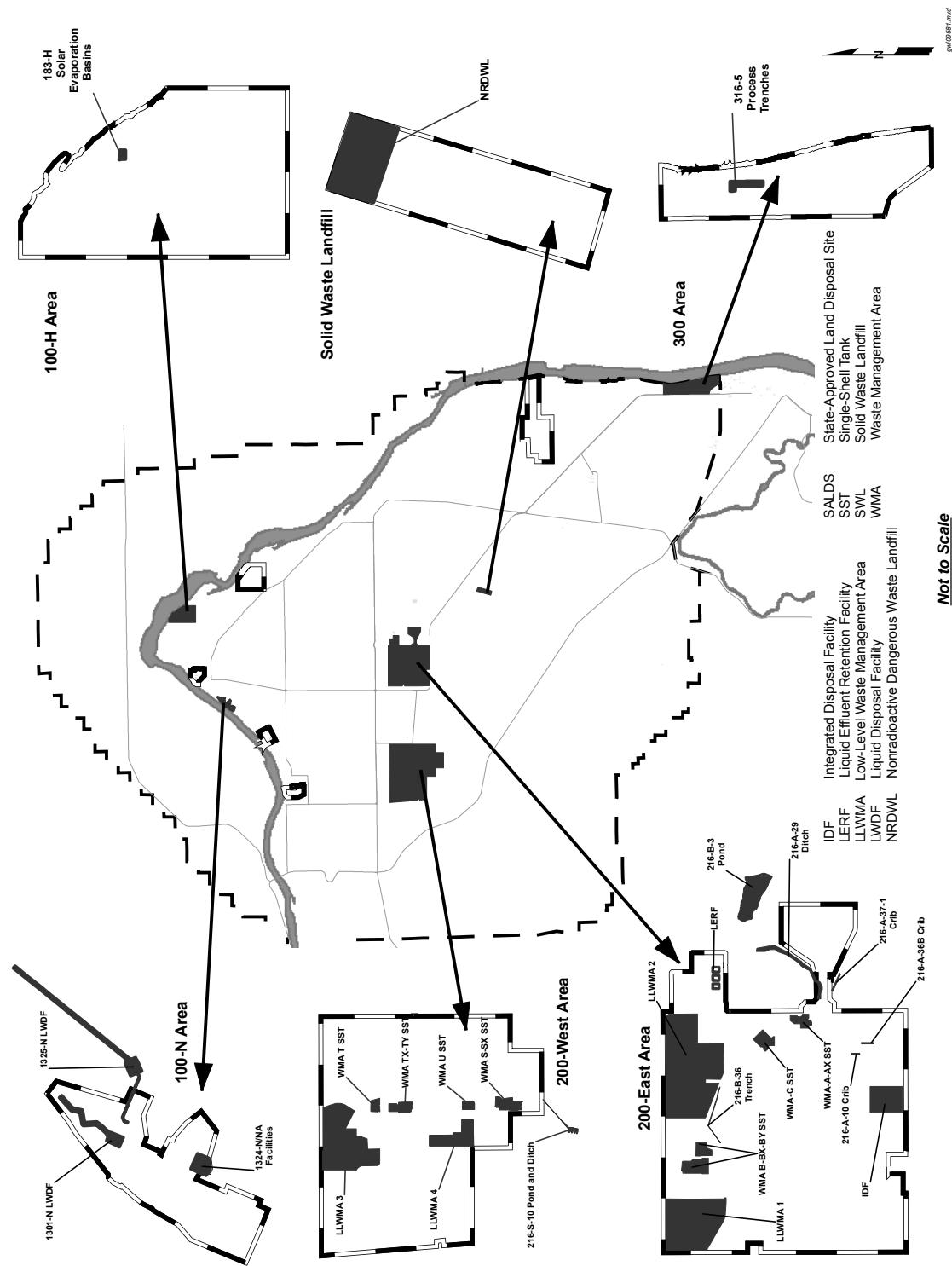
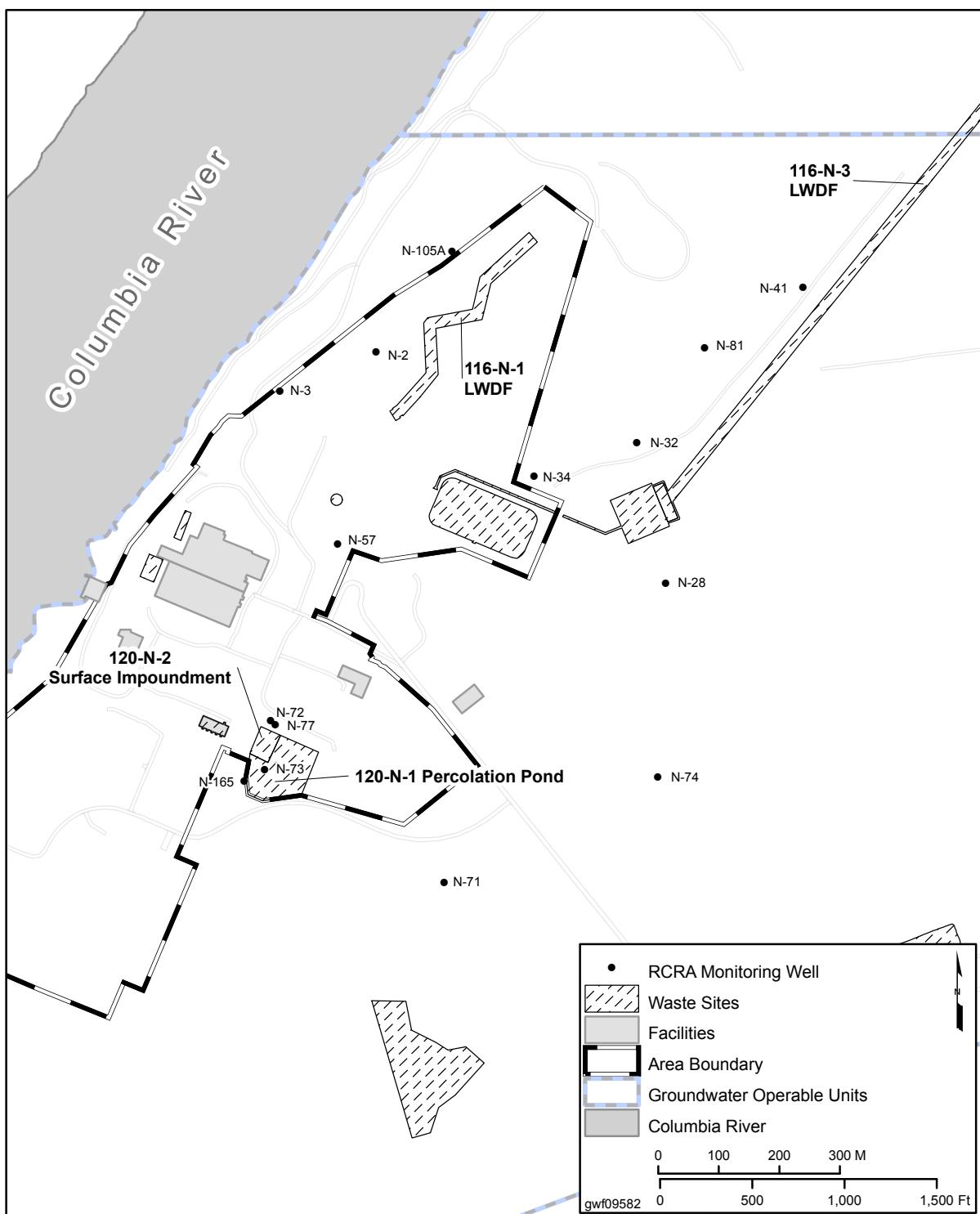
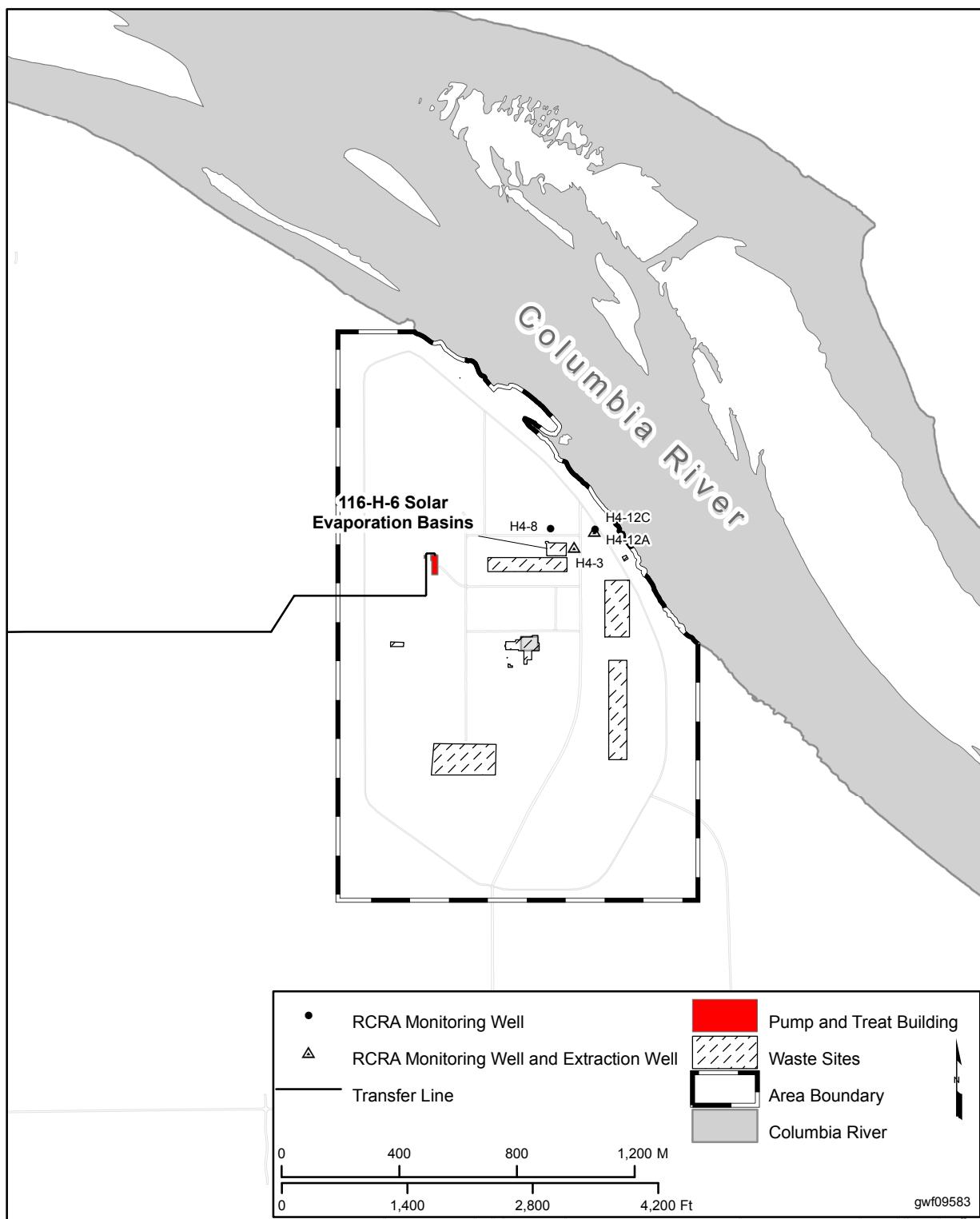
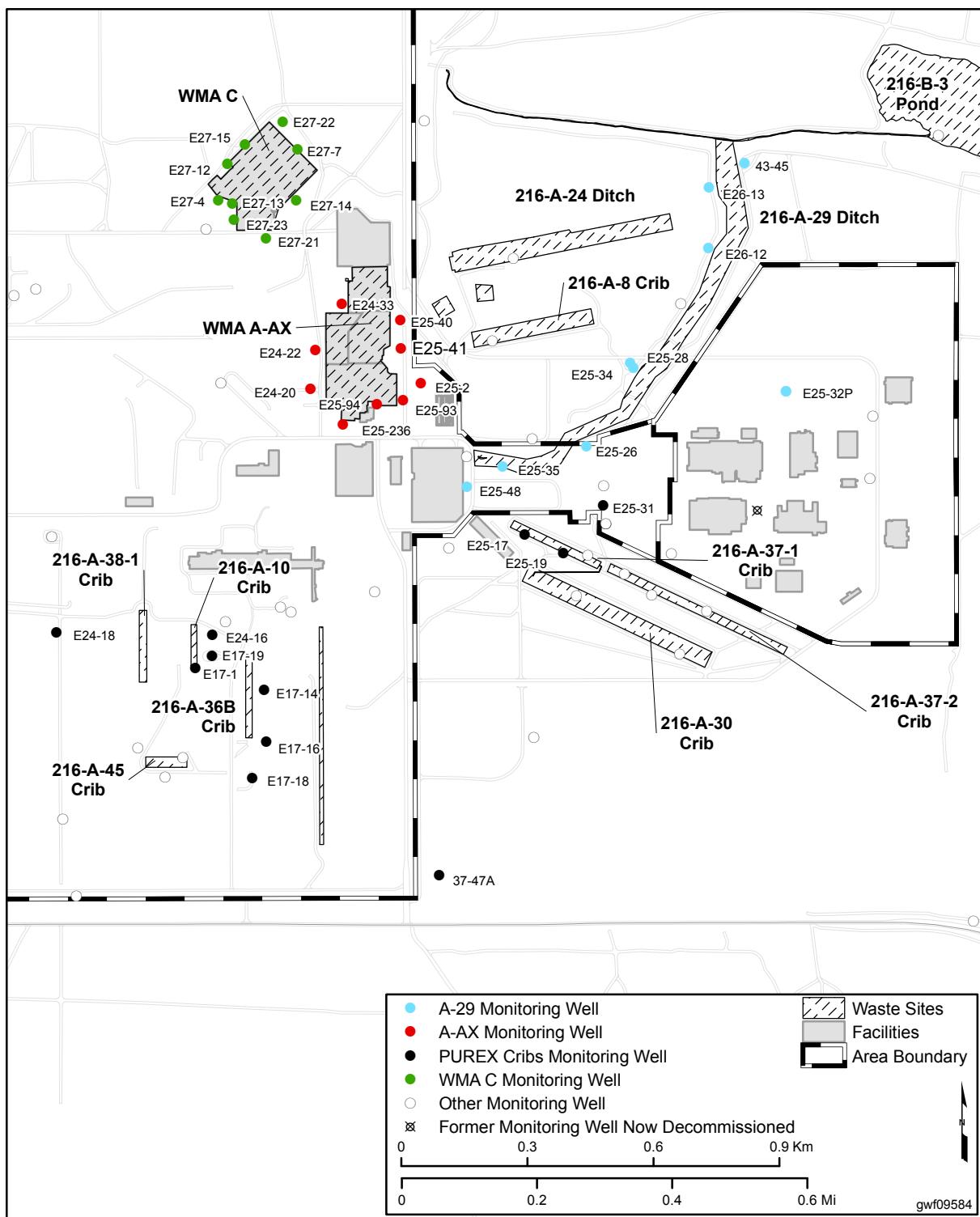
**Figure C-1. RCRA Units on the Hanford Site Requiring Groundwater Monitoring.**

Figure C-2. Groundwater Monitoring Wells for 100-N Area RCRA Sites.



**Figure C-3. Groundwater Monitoring Wells at 116-H-6 Evaporation Basins.**

**Figure C-4. Groundwater Monitoring Wells at 21 6-A-29 Ditch, PUREX Cribs, and Waste Management Areas A-AX and C.**



**Figure C-5. Groundwater Monitoring Wells at 216-B-3 Pond and 200 Areas Treated Effluent Disposal Facility.**

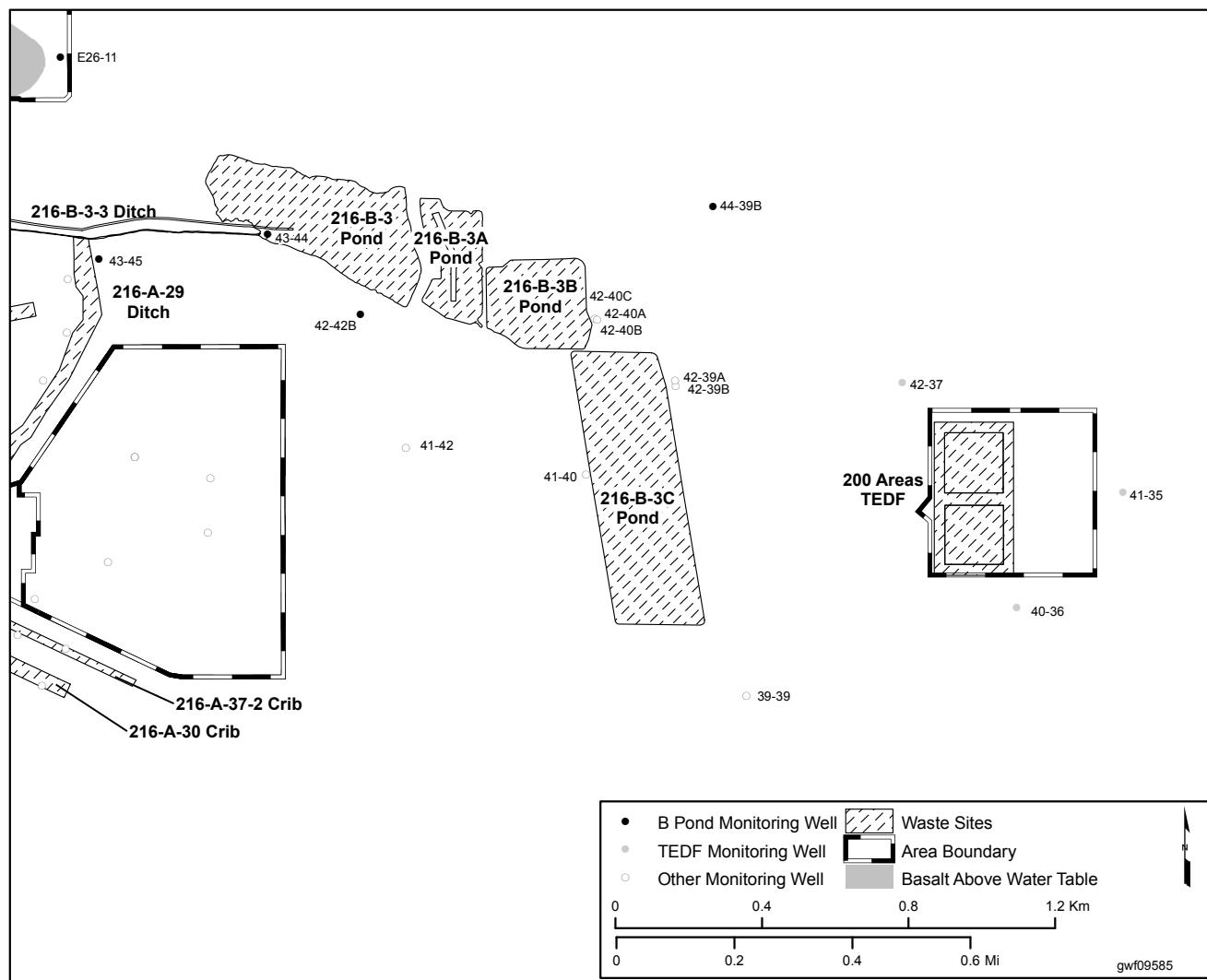
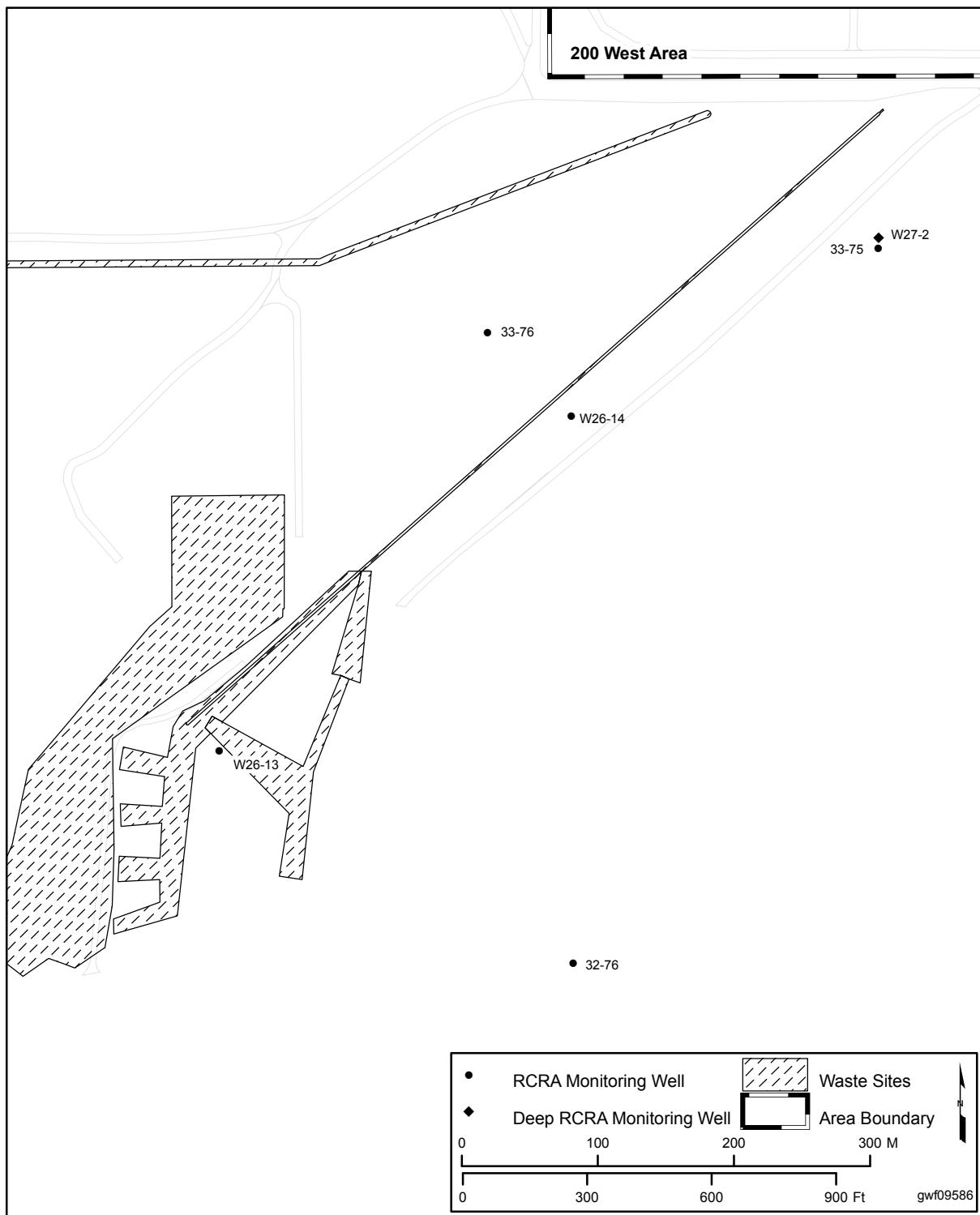
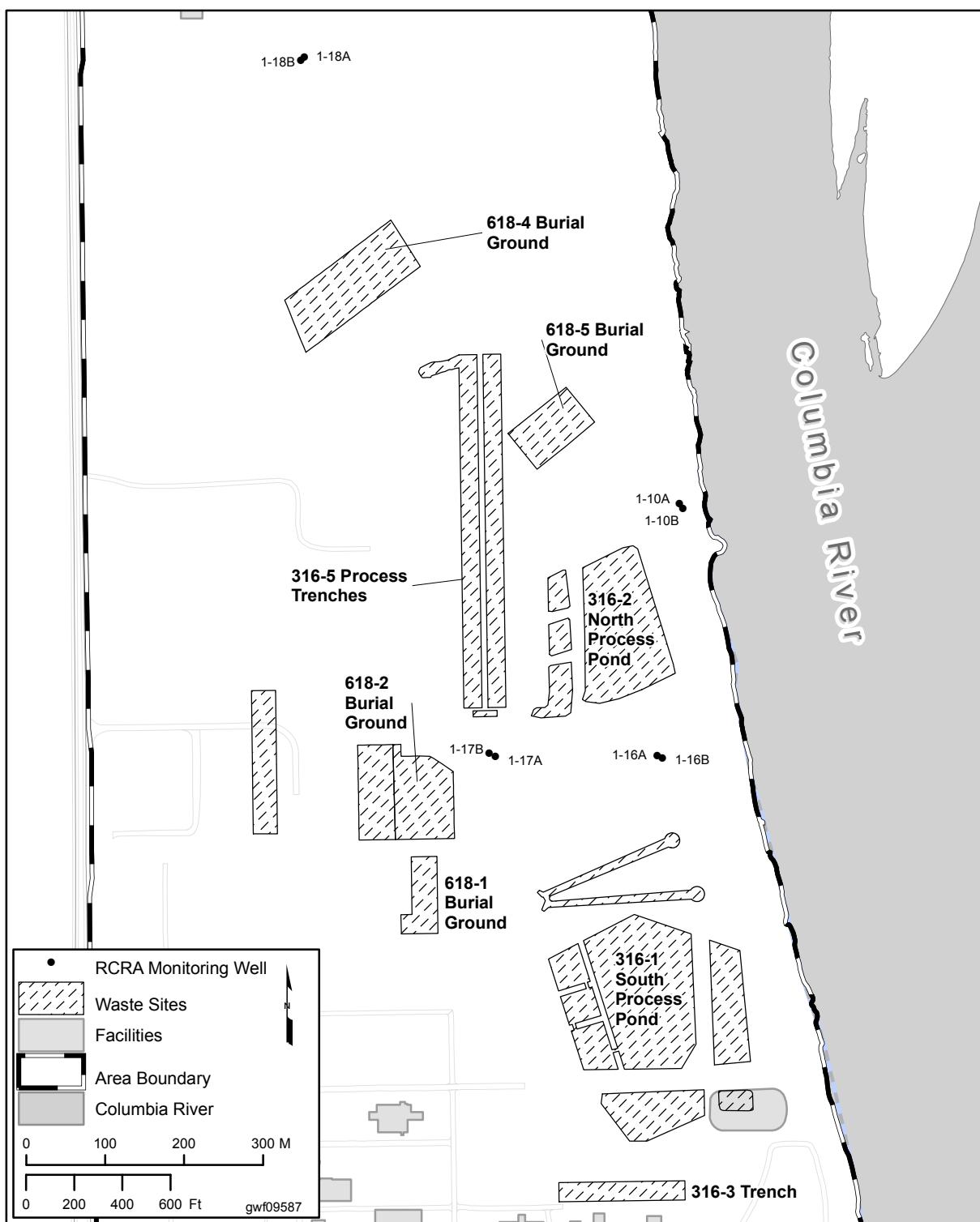
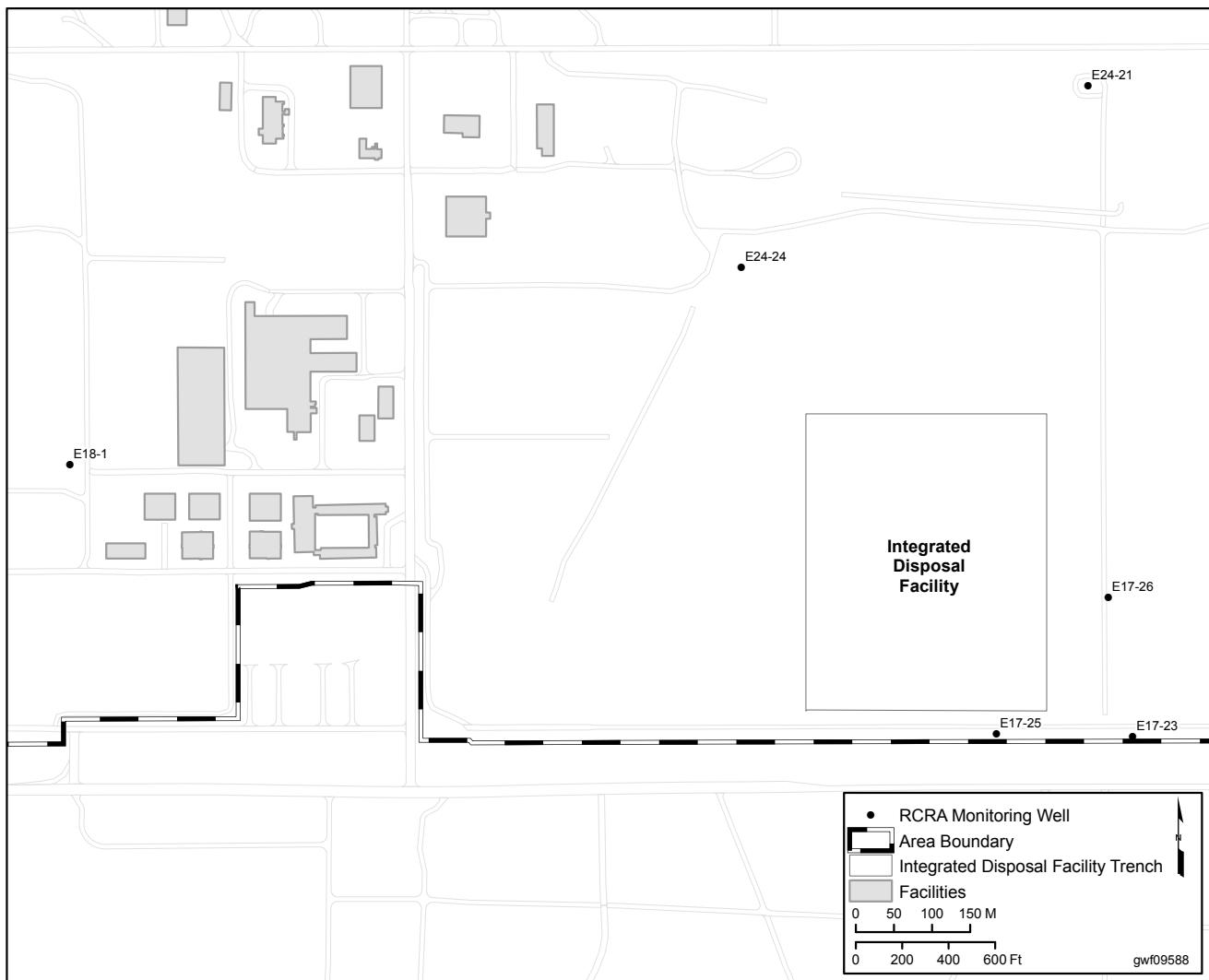


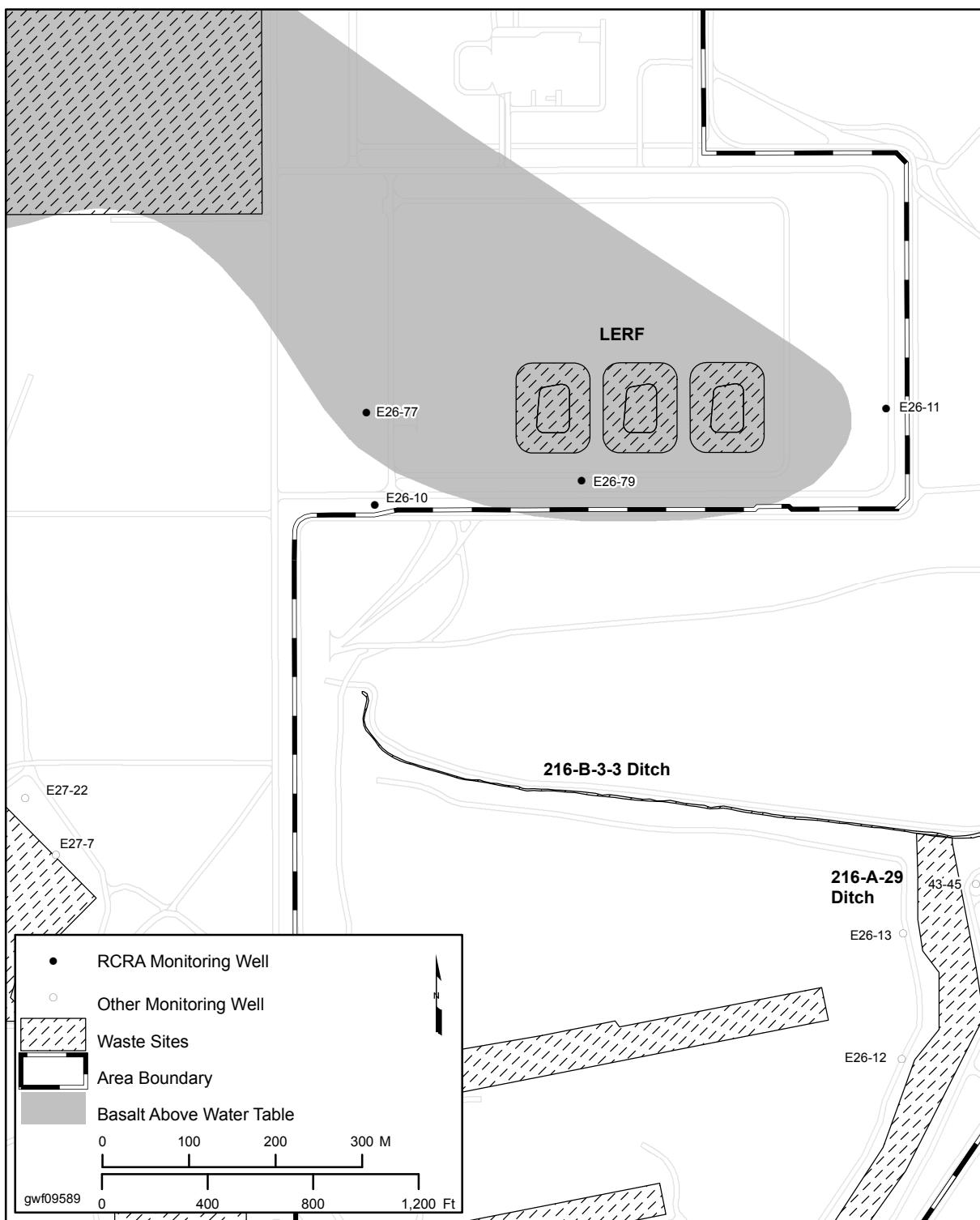
Figure C-6. Groundwater Monitoring Wells at 216-S-10 Pond and Ditch.



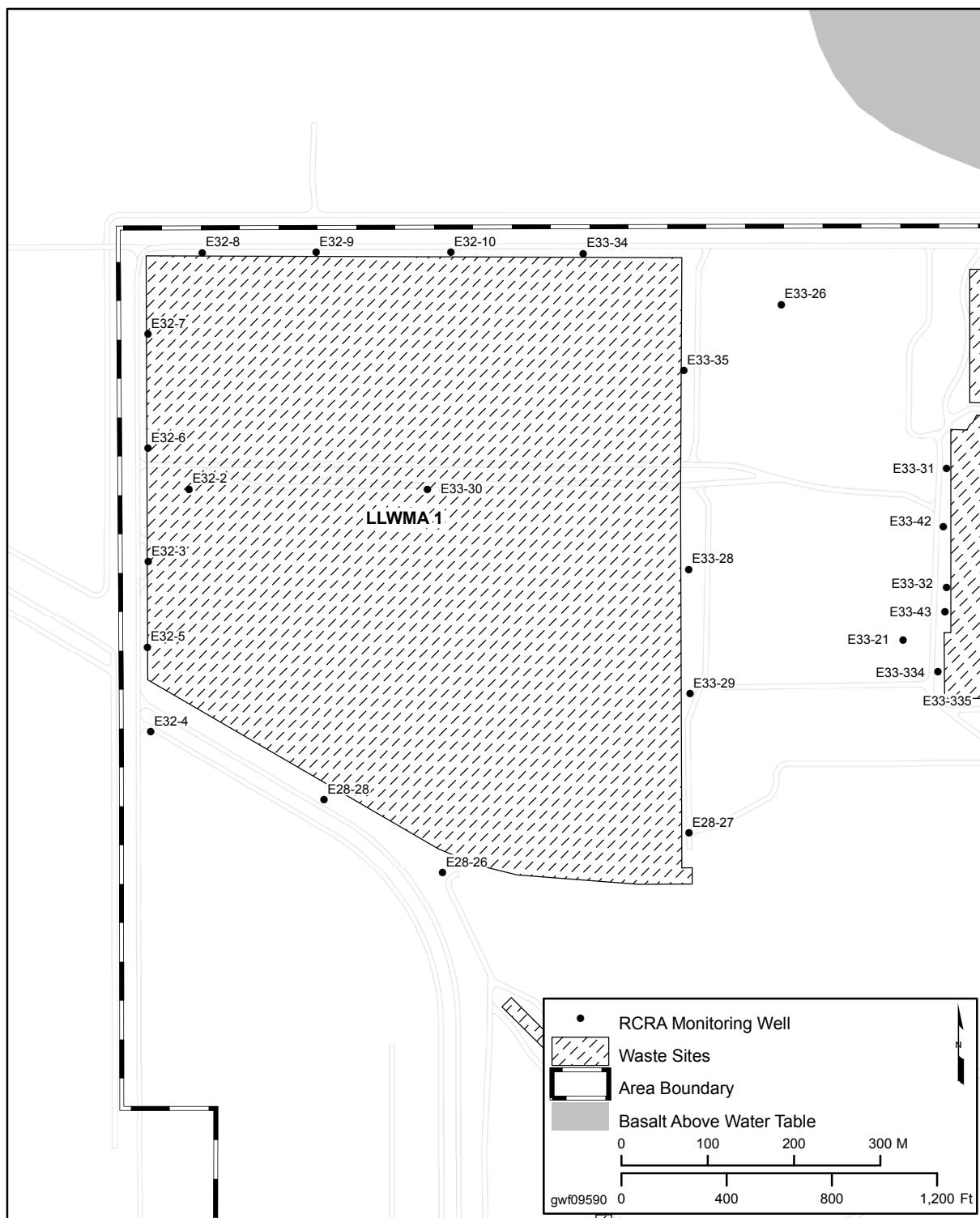
**Figure C-7. Groundwater Monitoring Wells at 316-5 Process Trenches.**

**Figure C-8. Groundwater Monitoring Wells at Integrated Disposal Facility.**

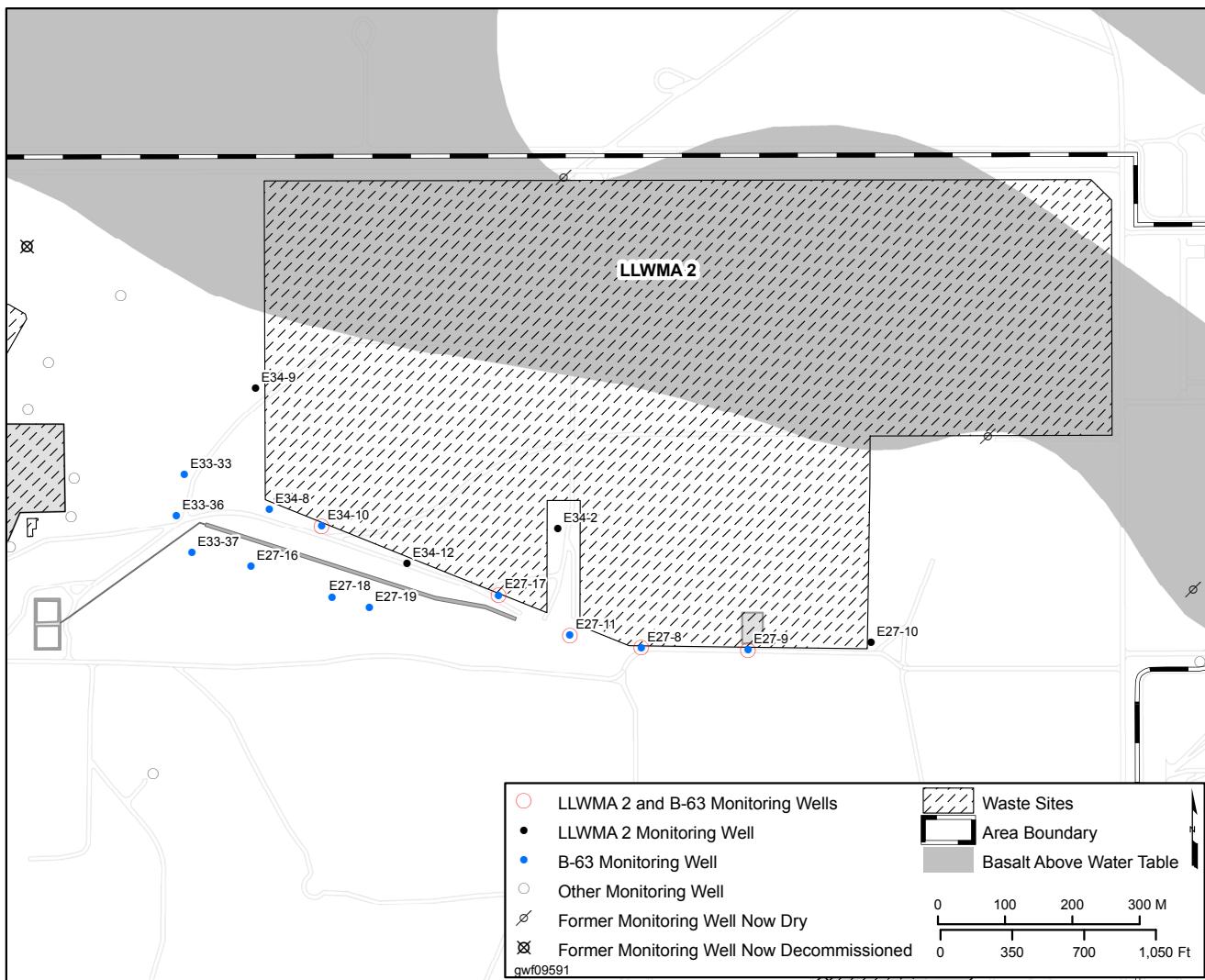


**Figure C-9. Groundwater Monitoring Wells at Liquid Effluent Retention Facility.**

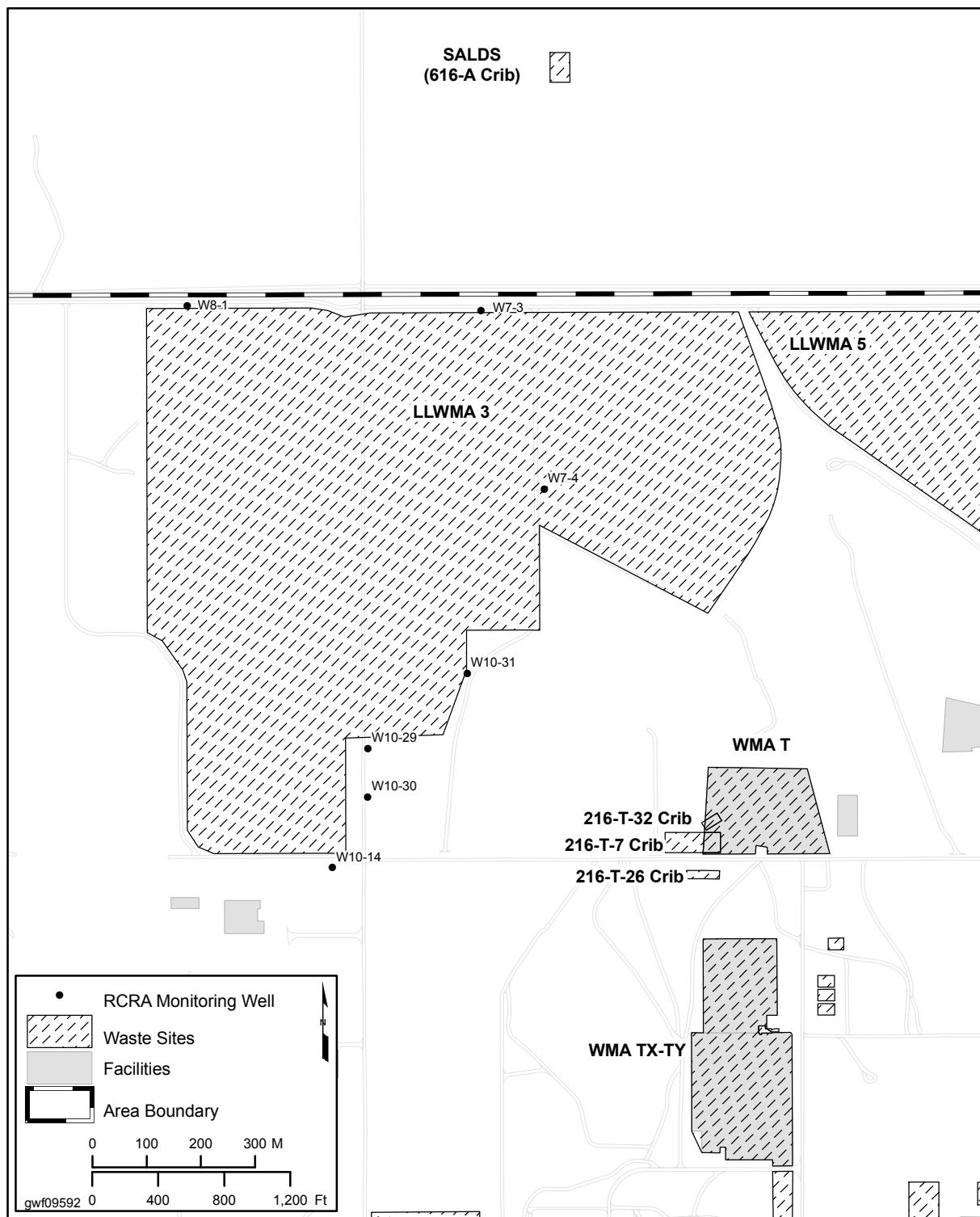
**Figure C-10. Groundwater Monitoring Wells at Low-Level Waste Management Area 1.**

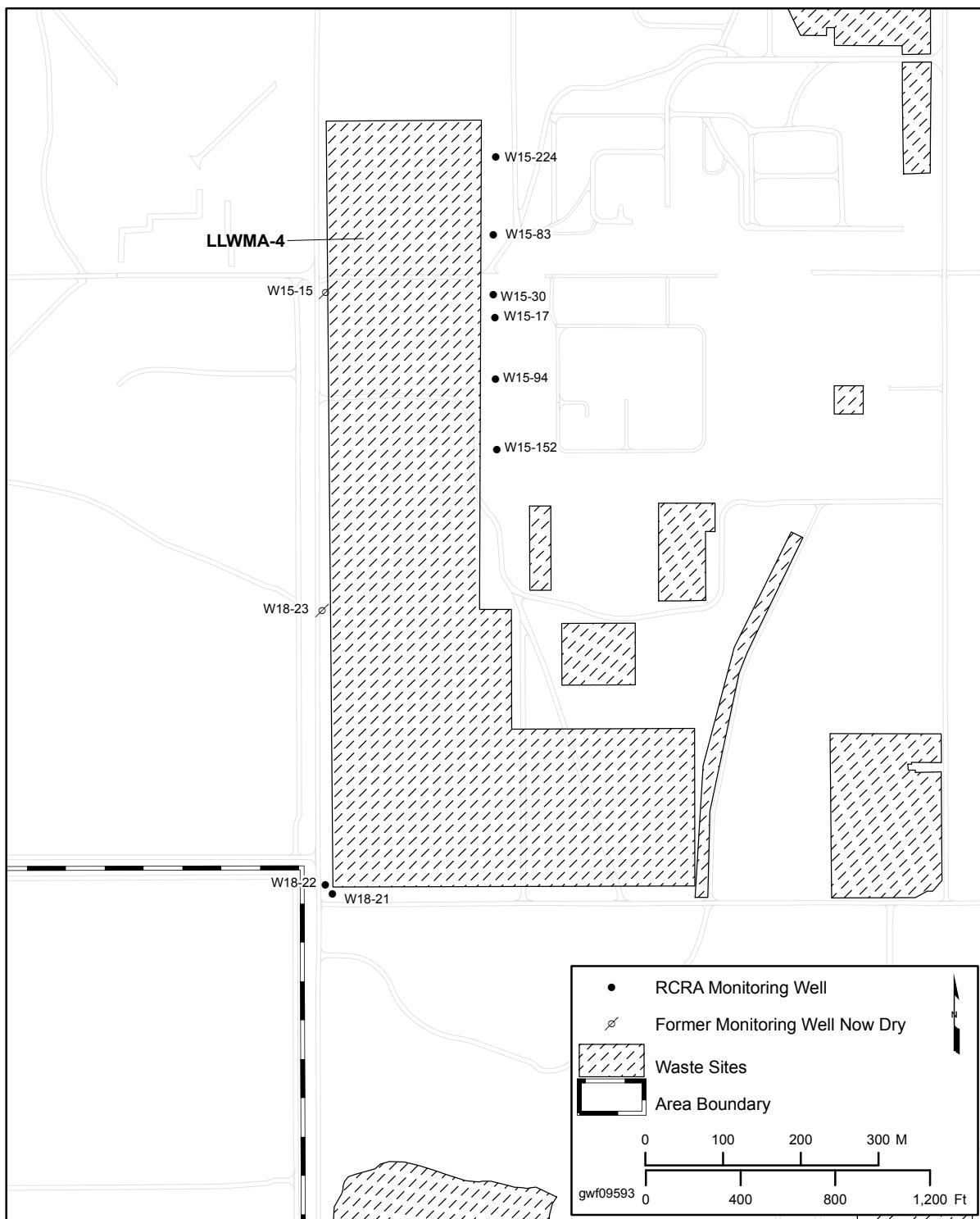


**Figure C-11. Groundwater Monitoring Wells at 216-B-63 Trench and Low-Level Waste Management Area 2.**

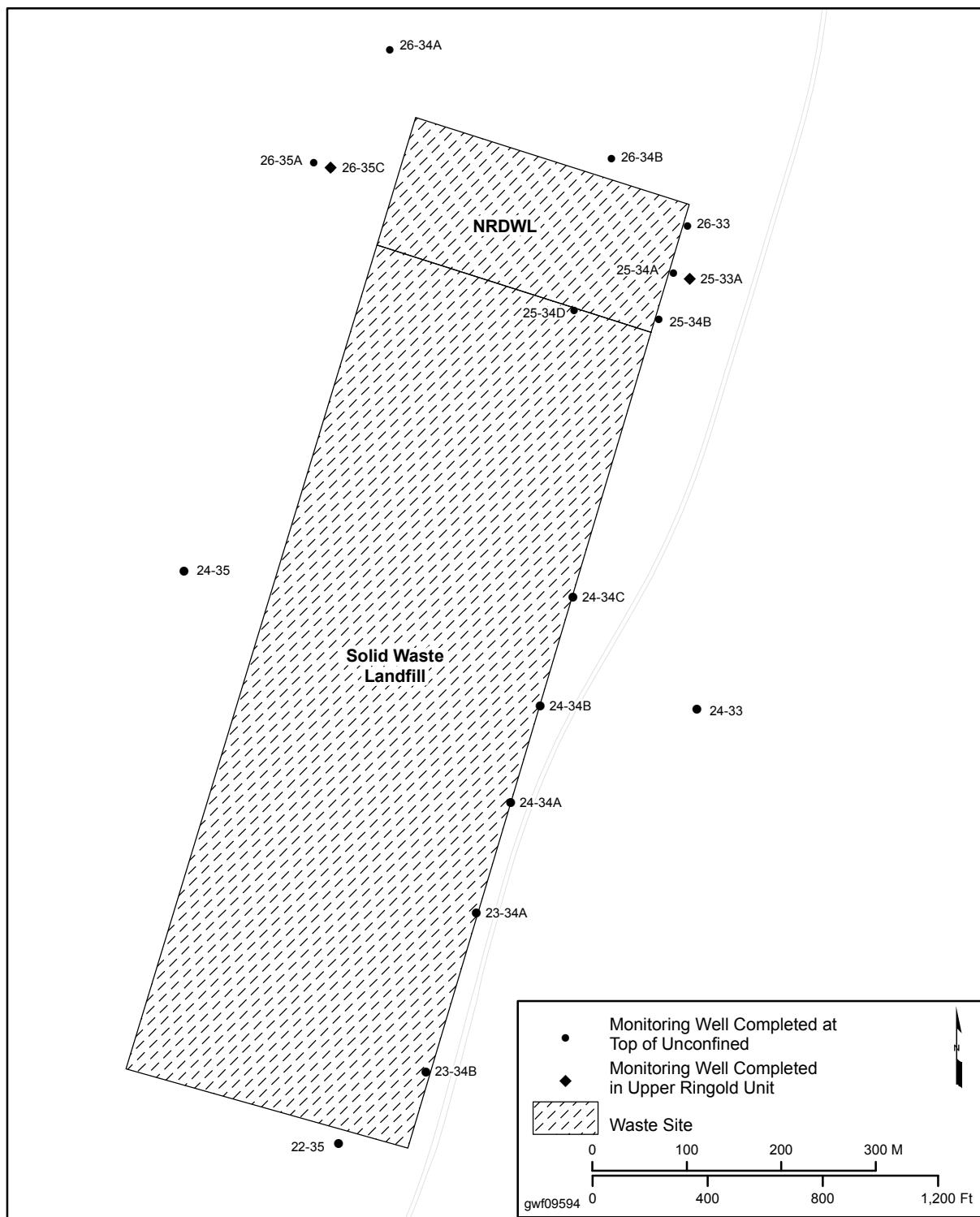


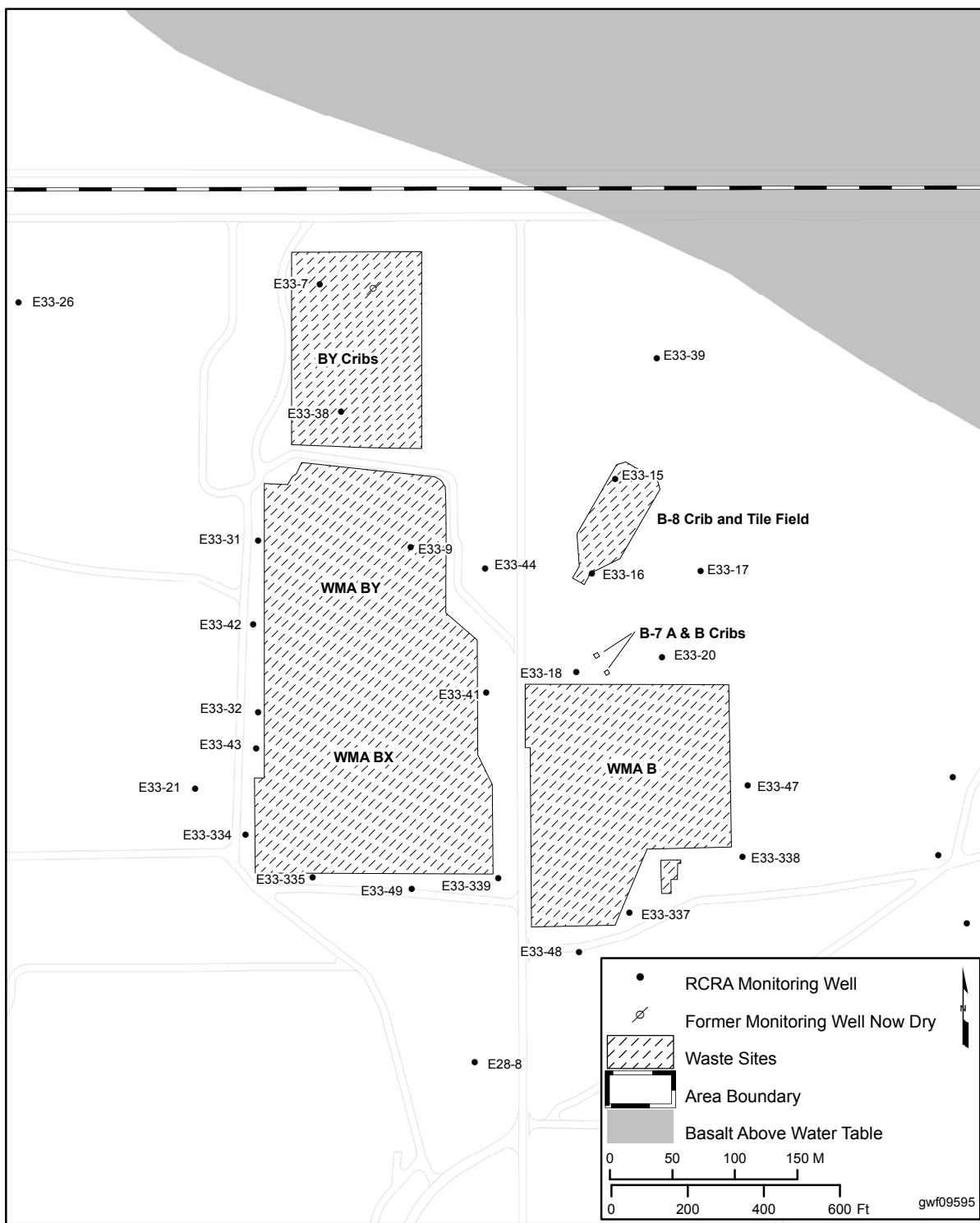
**Figure C-12. Groundwater Monitoring Wells at Low-Level Waste Management Area 3.**



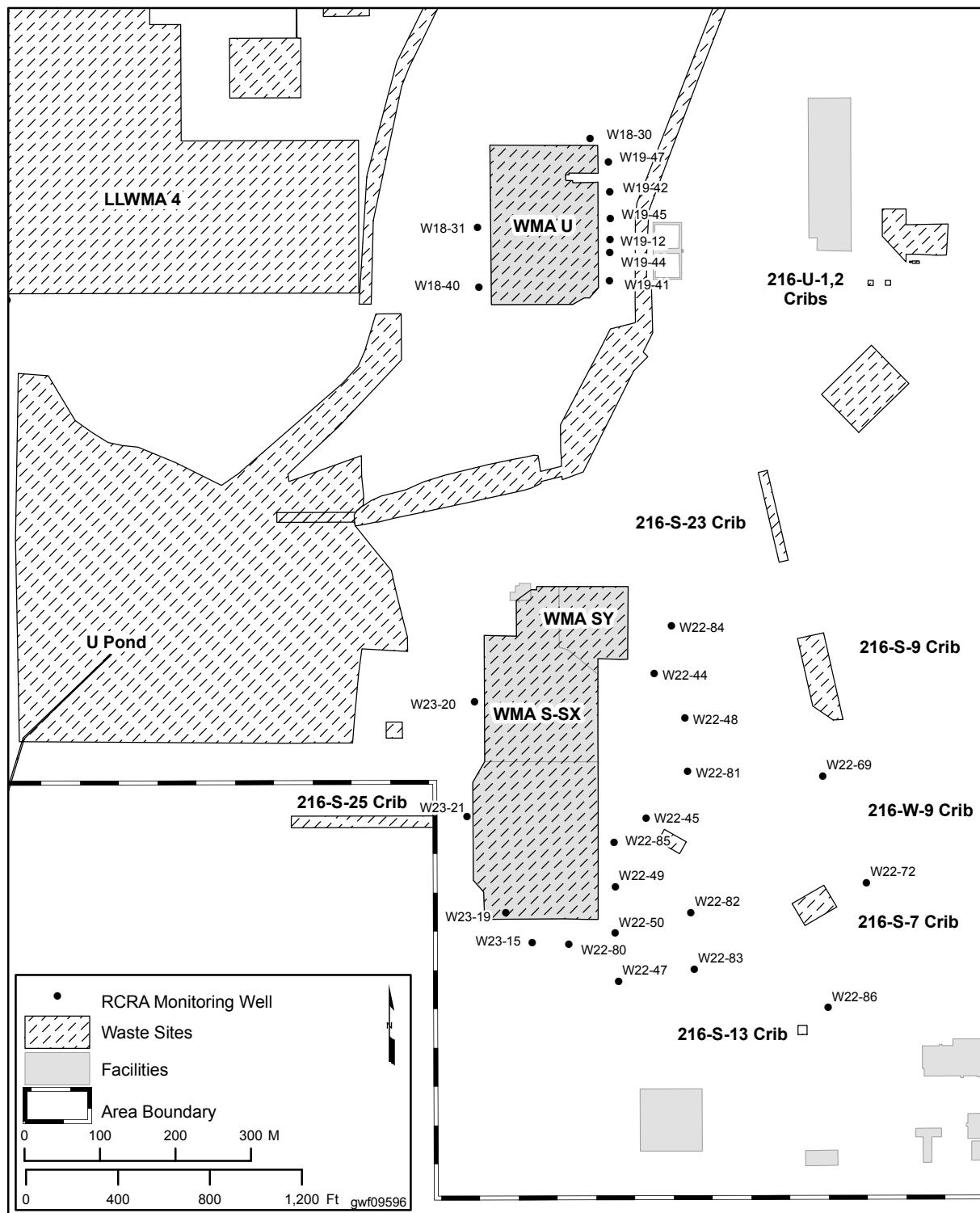
**Figure C-13. Groundwater Monitoring Wells at Low-Level Waste Management Area 4.**

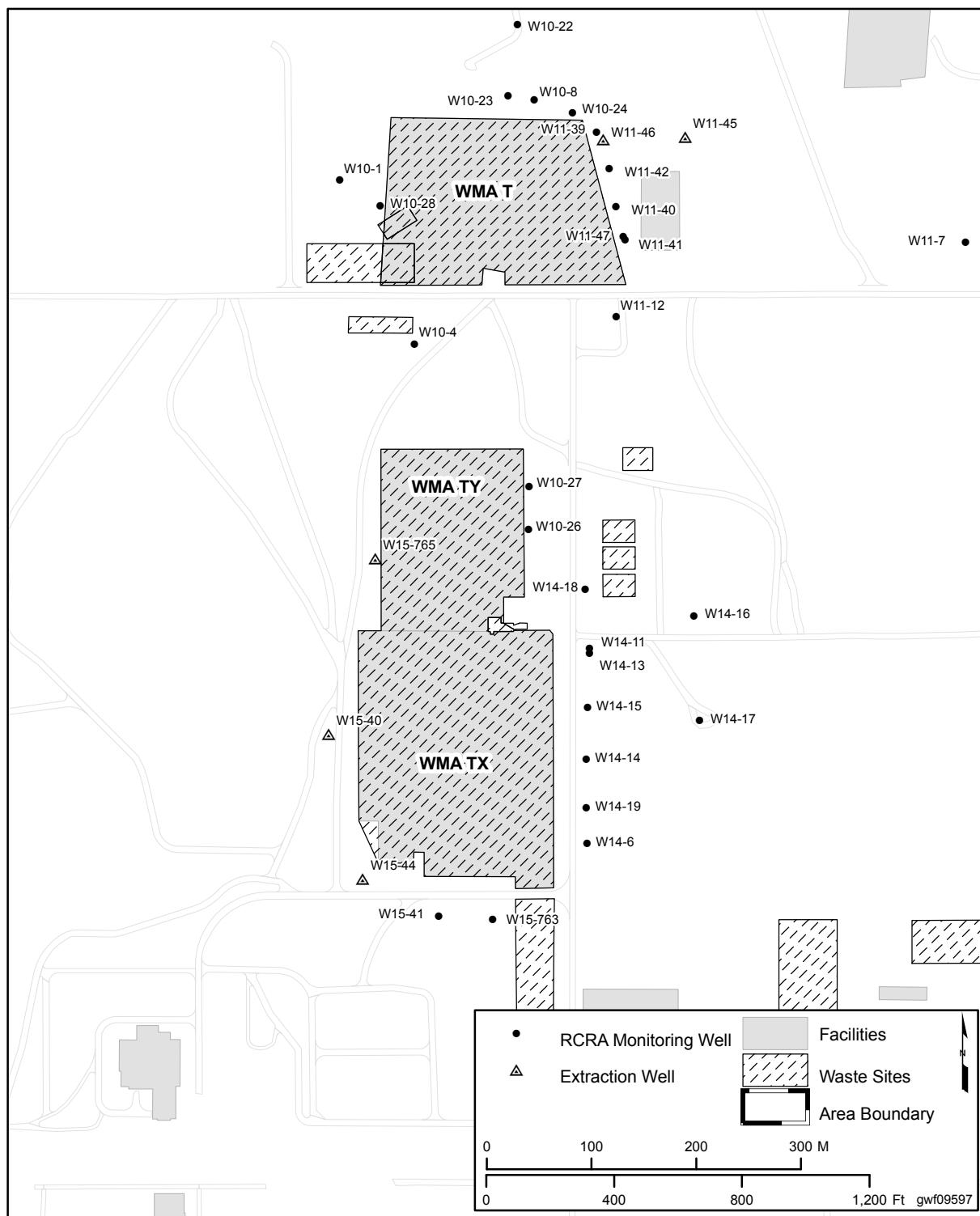
**Figure C-14. Groundwater Monitoring Wells at Nonradioactive Dangerous Waste Landfill and Solid Waste Landfill.**



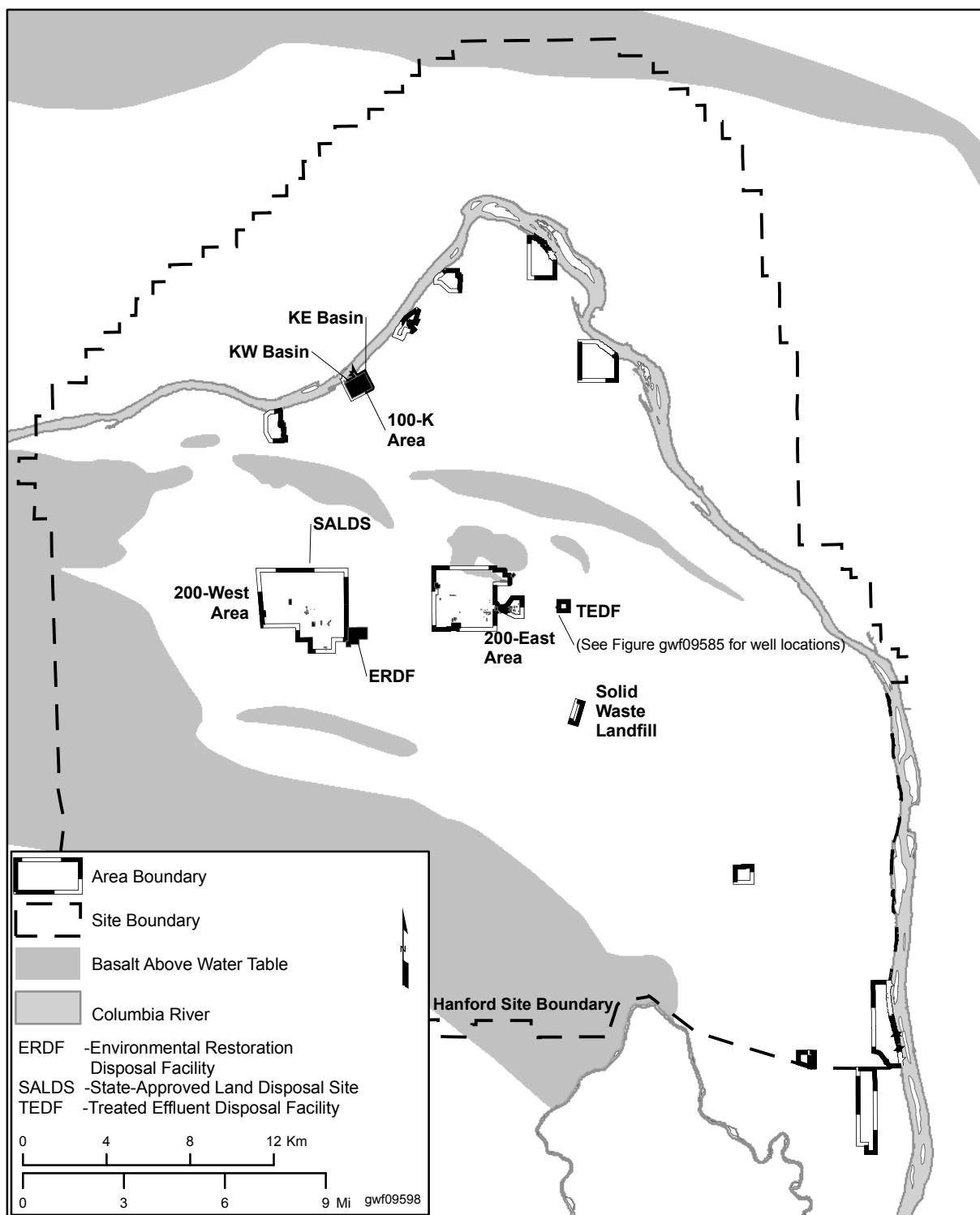
**Figure C-15. Groundwater Monitoring Wells at Waste Management Area B-BX-BY.**

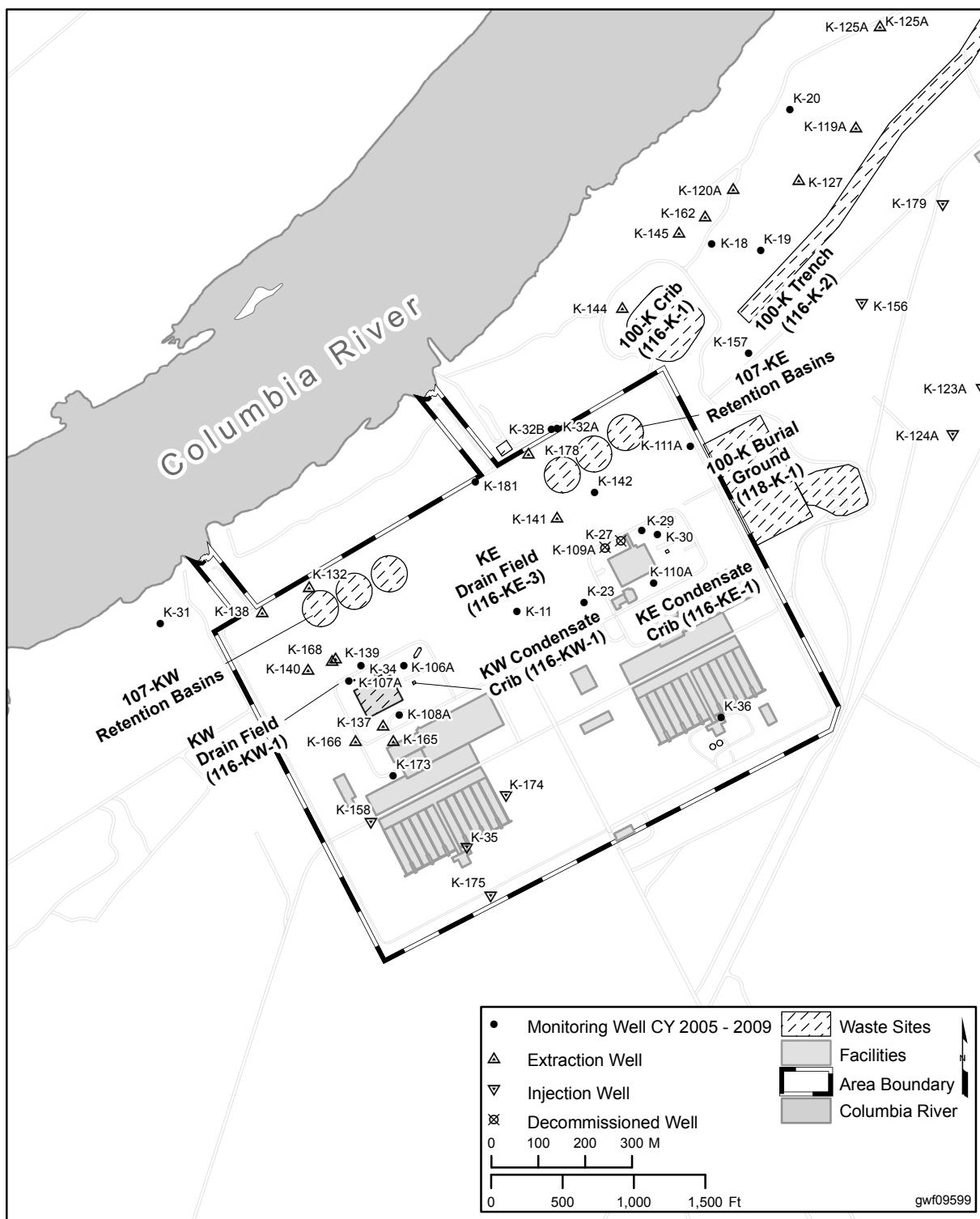
**Figure C-16. Groundwater Monitoring Wells at Waste Management Areas S-SX and U.**



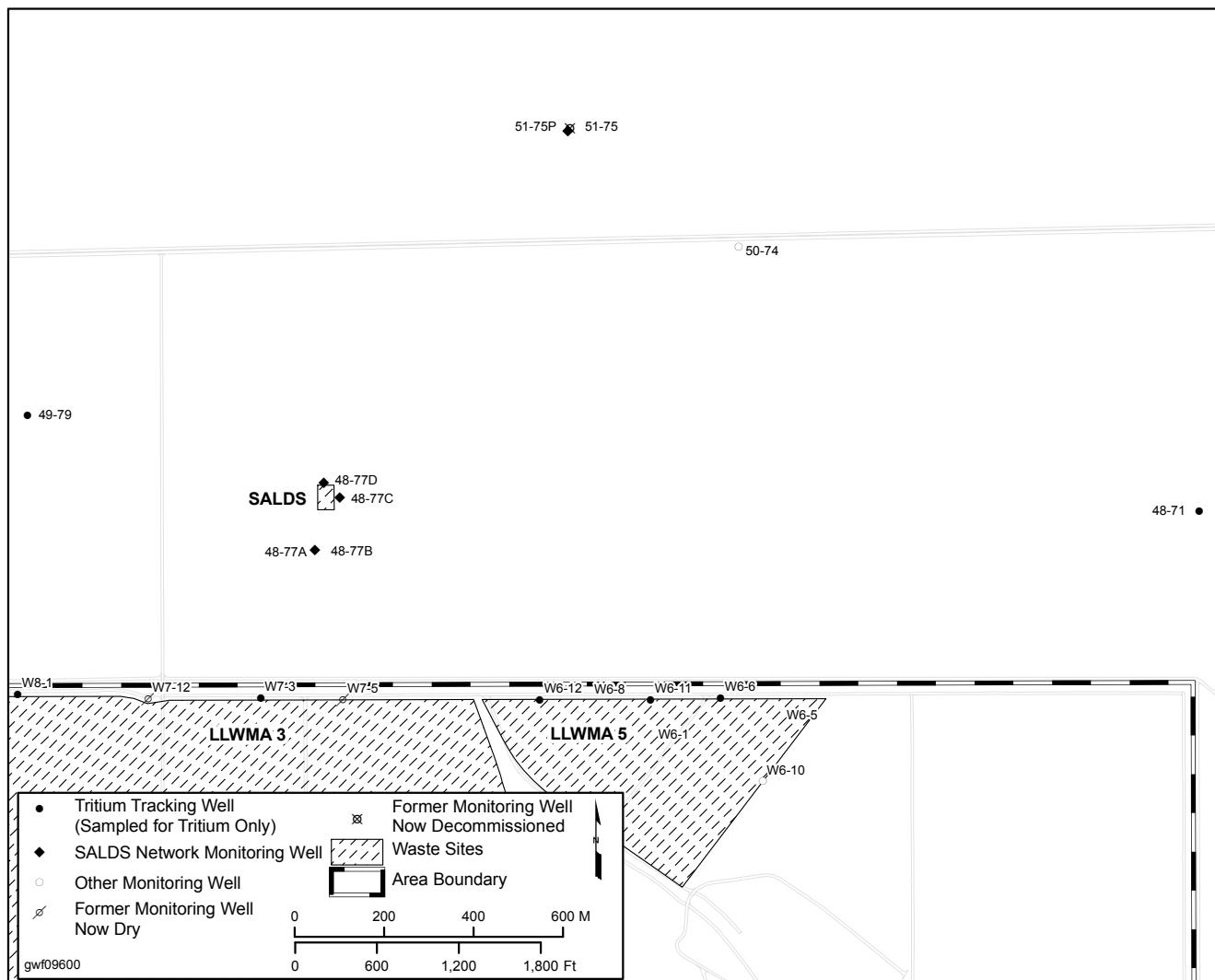
**Figure C-17. Groundwater Monitoring Wells at Waste Management Areas T and TX-TY.**

**Figure C-18. Non-RCRA Regulated Units on the Hanford Site Requiring Groundwater Monitoring.**



**Figure C-19. Groundwater Monitoring Wells at 100-K Basins.**

**Figure C-20. Groundwater Monitoring Wells at State-Approved Land Disposal Site.**



**Figure C-21. Groundwater Monitoring Wells at the Environmental Restoration Disposal Facility.**