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Revision 0

Interim Status Groundwater Monitoring Plan for the 216-A-29 Ditch

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Executive Summary

This document presents a revision to the 1999 groundwater monitoring plan[1] for the 216-A-29 Ditch facility (hereafter referred to as the A-29 Ditch). This monitoring plan is based on requirements for interim status facilities, as defined by the *Resource Conservation and Recovery Act of 1976* (RCRA)[2] and amended by the *Revised Code of Washington* (RCW) 70.105.[3]

The A-29 Ditch is one of three non-operating treatment, storage, and disposal (TSD) units in the 200-CS-1 Chemical Sewer Operable Unit (OU). The A-29 Ditch is regulated as a surface impoundment and has been designated as a TSD because it received nonradioactive dangerous waste regulated by 40 *Code of Federal Regulations* (CFR) 261[4] after November 19, 1980.

This monitoring plan presents a groundwater contamination indicator evaluation monitoring program that will detect any adverse impact from past operations of the A-29 Ditch on the quality of groundwater in the uppermost aquifer beneath the TSD unit. This document addresses the operational history, current hydrogeology, and groundwater monitoring results for the site and incorporates the sum of knowledge about the potential for contamination originating from the A-29 Ditch. A conceptual model is developed based on these attributes of the A-29 Ditch and the data quality objectives process.

The A-29 Ditch was excavated to convey liquid effluent from the Plutonium-Uranium Extraction (PUREX) Plant chemical sewer (low level) (CSL) to the 216-B-3 Pond and was placed into service in November 1955. The A-29 Ditch ran northeast and connected with the 216-B-3-series ditches, which discharged to the 216-B-3 Pond. The A-29 Ditch was approximately 1.8 m (6 ft) wide and 1,097 m (3,600 ft) long; the ditch varied from 0.6 to 0.9 m (2 to 3 ft) deep at the south end to nearly 5 m (16 ft) deep at the north end. The A-29 Ditch is currently backfilled with material from the ditch sides and spoils piles in the bottom, and it is topped with clean material to form a series of 11 terraces that progress down the length of the ditch.

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1 PNNL-13047, 1999, *Groundwater Monitoring Plan for the 216-A-29 Ditch*, Rev. 0, Pacific Northwest National Laboratory, Richland, Washington.

2 *Resource Conservation and Recovery Act of 1976*, 42 U.S.C. 6901, et seq.

3 RCW 70.105, "Hazardous Waste Management," *Revised Code of Washington.*

4 40 CFR 261, "Identification and Listing of Hazardous Waste," *Code of Federal Regulations*.

The A-29 Ditch received a continuous discharge of corrosive waste and potentially hazardous spilled chemical materials from the PUREX Plant. The most significant chemical discharges included acidic and caustic effluents associated with backwashing for the regeneration of demineralizer columns. The ditch also received spills from the PUREX Plant CSL.

Because the A-29 Ditch received wastewater potentially contaminated with dangerous waste/dangerous waste constituents, a contamination indicator groundwater monitoring program was implemented in 1988. In January 1990, statistical evaluation of specific conductivity (field) showed that downgradient well 299-E25-35 was statistically greater than background levels. Resampling later verified this measurement, and a required groundwater quality assessment plan for the A-29 Ditch was prepared and initiated.[5] Elevated total organic halides (TOX) were also listed as a constituent of concern in the groundwater quality assessment plan.[5] The groundwater network was expanded to include new well installations and additional existing monitoring wells.

In 1995, the results of groundwater quality assessment program identified increased sodium, sulfate, and calcium as the cause of the elevated specific conductance.[6] Because these constituents are not regulated as dangerous wastes, it was concluded that the groundwater had not been adversely impacted.

In 2009, specific conductance continued above the critical mean in downgradient wells 299-E25-35, 299-E25-48, and 299-E26-13. Concentrations of sulfate, nitrate, chloride, and the major cations are also increasing in these wells. The cause of the increase remains unknown, but it appears to coincide with a general, multi-year increase in ionic strength throughout much of the 200 East Area and adjacent areas; the increase is not attributed to the A-29 Ditch.[7] No known or suspected cause of the elevated TOX was identified. Since the assessment, concentrations of TOX have subsequently dropped below the critical mean for the site.

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5 WHC-SD-EN-AP-031, 1990, *Interim-Status Groundwater Quality Assessment Plan for the 216-A-29 Ditch*, Rev 0, Westinghouse Hanford Company, Richland, Washington.

6 WHC-SD-EN-EV-032, 1995, *Results of Groundwater Quality Assessment Program at the 216-A-29 Ditch RCRA Facility*, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

7 DOE/RL-2008-01, 2008, *Hanford Site Groundwater Monitoring for Fiscal Year 2007*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

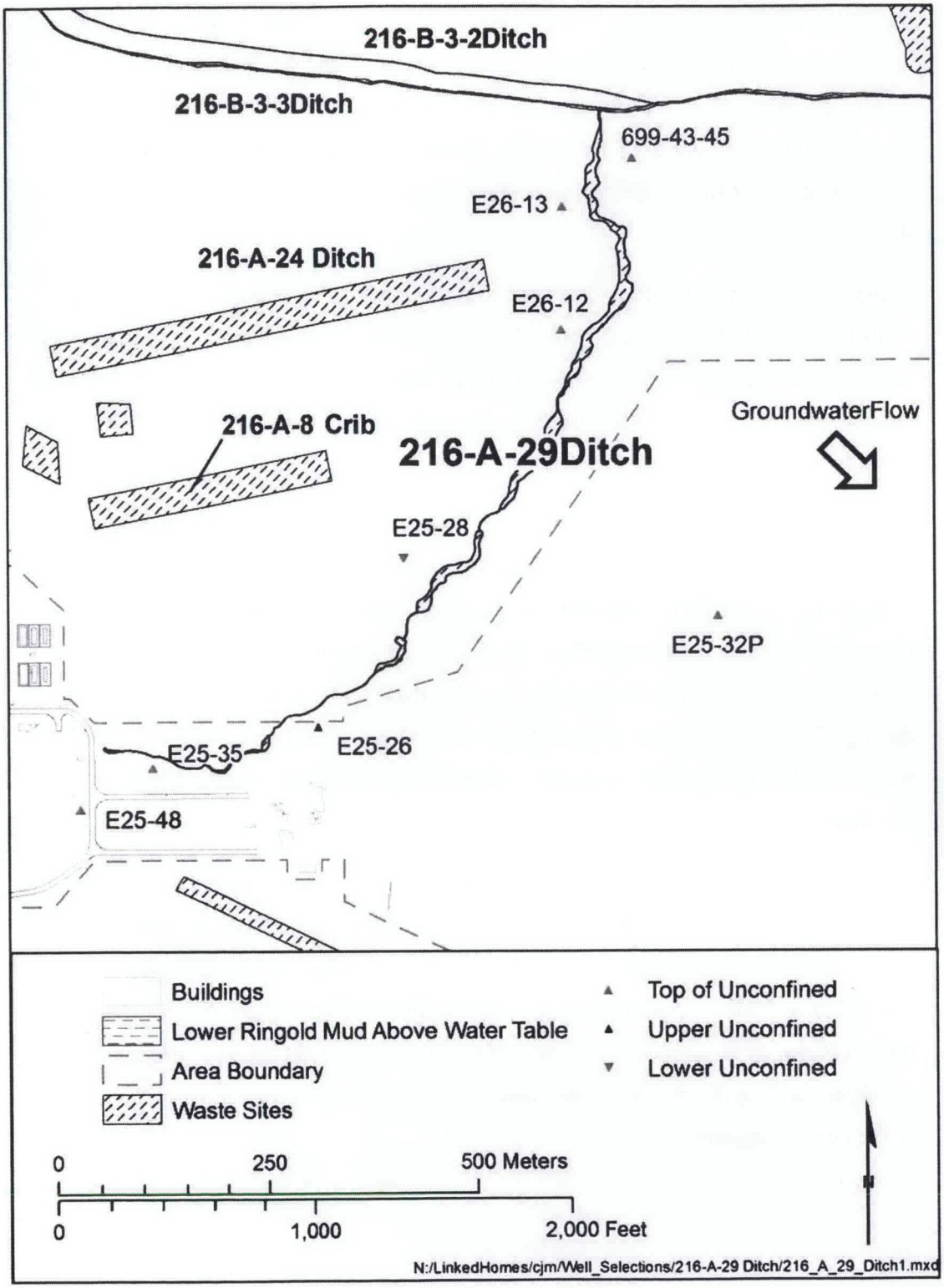

Figure ES-1. Revised 216-A-29 Ditch Monitoring Network Wells

Data from the 10 groundwater monitoring wells that currently comprise the A-2 Ditch monitoring network were re-evaluated to determine if redundant wells could be eliminated. Based on the re-evaluation, the former network of 10 wells is being reduced to 7 wells total (Figure ES-1). The revised network includes two upgradient and five downgradient wells. One supplemental downgradient well is also included in the network.

Wells 699-43-45 and 299-E26-13 will continue to serve as the upgradient monitoring wells for the A-29 Ditch. These two wells have historically served as the upgradient wells and remain in the upgradient direction based on current water levels in the 200 East Area. One upgradient well, 699-43 43, has been dropped from the network because it provided redundant information to well 699-43-45.

Wells 299-E25-26, 299-E25-35, and 299-E25-48 are located south, downgradient of the inlet end of the ditch. Well 299-E25-28 monitors the bottom of the aquifer along the center length of the ditch. Well 299-E25-28 monitors the upper portion of the aquifer at the same location as well 299-E25-34. Well 299-E25-28 is revised to be removed from the network because it has consistently provided data similar to wells both upgradient and downgradient of its location. Well 299-E26-12 monitors the distal end of the ditch, and well 299-E25-32P monitors composite conditions downgradient from the middle of the ditch.

The groundwater at the A-29 Ditch monitoring wells will be sampled and analyzed in compliance with WAC 173-303-400(3).[8] The A-29 Ditch network groundwater wells will be monitored semiannually for TOX, total organic carbon, pH, and specific conductance. Additional parameters (i.e., alkalinity, dissolved oxygen, temperature, and turbidity) will be measured as indicators of sample quality and general aquifer/well environmental conditions. Alkalinity, anions, and water levels will also be collected semiannually.

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8 WAC 173-303-400, "Dangerous Waste Regulations," "Interim Status Facility Standards," *Washington Administrative Code*.

Wells will be monitored annually for metals and phenols. Arsenic and nitrate are also identified as constituents of interest in groundwater that could be associated with A-29 Ditch operations. Because these constituents are also associated with existing plumes, they will be monitored on a regional scale by the 200-PO-1 OU to the extent possible and are not specifically included as constituents for the A-29 Ditch.

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List of Terms

bgs	below ground surface
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
CFR	*Code of Federal Regulations*
CSL	chemical sewer (low level)
DQO	data quality objective
Ecology	Washington State Department of Ecology
gpm	gallons per minute
OU	operable unit
PUREX	Plutonium-Uranium Extraction (Plant)
QAPjP	quality assurance project plan
RCRA	*Resource Conservation and Recovery Act of 1976*
RCW	*Revised Code of Washington*
TOC	total organic carbon
TOX	total organic halides
TSD	treatment, storage, and disposal
WAC	*Washington Administrative Code*

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1 Introduction

This document presents a revision to the 1999 groundwater monitoring plan for the 216-A-29 Ditch facility (hereafter referred to as the A-29 Ditch) (PNNL-13047, *Groundwater Monitoring Plan for the 216-A-29 Ditch*). This groundwater monitoring plan is based on requirements for interim status facilities, as defined by the *Resource Conservation and Recovery Act of 1976* (RCRA) and amended by Washington State's *Revised Code of Washington* (RCW) 70.105, "Hazardous Waste Management." These regulations are promulgated by the Washington State Department of Ecology (Ecology) in *Washington Administrative Code* (WAC) 173-303-400, "Dangerous Waste Regulations," "Interim Status Facility Standards"; and by reference, 40 *Code of Federal Regulations* (CFR) 265, Subpart F, "Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities," "Ground-Water Monitoring."

The A-29 Ditch is one of three non-operating treatment, storage, and disposal (TSD) units in the 200-CS-1 Chemical Sewer Operable Unit (OU). The A-29 Ditch is regulated as a surface impoundment, as defined in WAC 173-303-040, "Definitions" (Figure 1-1), and has been designated as a TSD unit because it received nonradioactive dangerous waste regulated by 40 CFR 261 ("Identification and Listing of Hazardous Waste") after November 19, 1980. For regulatory purposes, the TSD unit boundary of the A-29 Ditch is identified on the current Dangerous Waste Permit Application Part A form (WA7890008967, *Dangerous Waste Portion of the Resource Conservation and Recovery Act Permit for the Treatment, Storage, and Disposal of Dangerous Waste*).

The A-29 Ditch closure is coordinated with the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) as part of the 200-CS-1 OU (vadose zone). Associated groundwater concerns are addressed under the 200-PO-1 Groundwater OU.

The A-29 Ditch is an artificial excavation that was used from 1955 to 1991. The ditch passed beneath the east-central portion of the 200 East Area security fence and ran northeast to the 216-B-3-series ditches, which discharged to the 216-B-3 Pond.

The purpose of this RCRA groundwater monitoring plan is to present a groundwater contamination indicator evaluation monitoring program that will detect any adverse impacts from past operations of the A-29 Ditch on the quality of the groundwater in the uppermost aquifer beneath the TSD unit (40 CFR 265.93[d], "Preparation, Evaluation, and Response"). This document addresses the operational history, current hydrogeology, and groundwater monitoring results for the site and incorporates the sum of knowledge about the potential for contamination originating from the A-29 Ditch. A conceptual model is developed based on these attributes of the A-29 Ditch and the data quality objective (DQO) process.

The groundwater contamination indicator evaluation monitoring program detailed here proposes continued semiannual sampling for the indicator parameters and annual sampling of groundwater quality parameters at one upgradient well and seven downgradient wells.

Chapter 1 provides a general introduction to the monitored waste site, including the objectives of the current monitoring program. Chapter 2 presents background information related to the successful implementation of the monitoring plan, which includes information on historical and present facility operations, waste characteristics, geology, hydrology, previous monitoring results, and a site conceptual model. Chapters 3 and 4 present details of the monitoring program, and data evaluation and reporting, respectively. Chapter 5 includes the references that are cited. Detailed procedures covering sample collection, preservation, shipment, analytical procedures, and documentation (e.g., chain-of-custody) are provided in the quality assurance project plan (QAPjP) in Appendix A. Appendix B includes lithologic logs and construction details for the wells in the monitoring network.

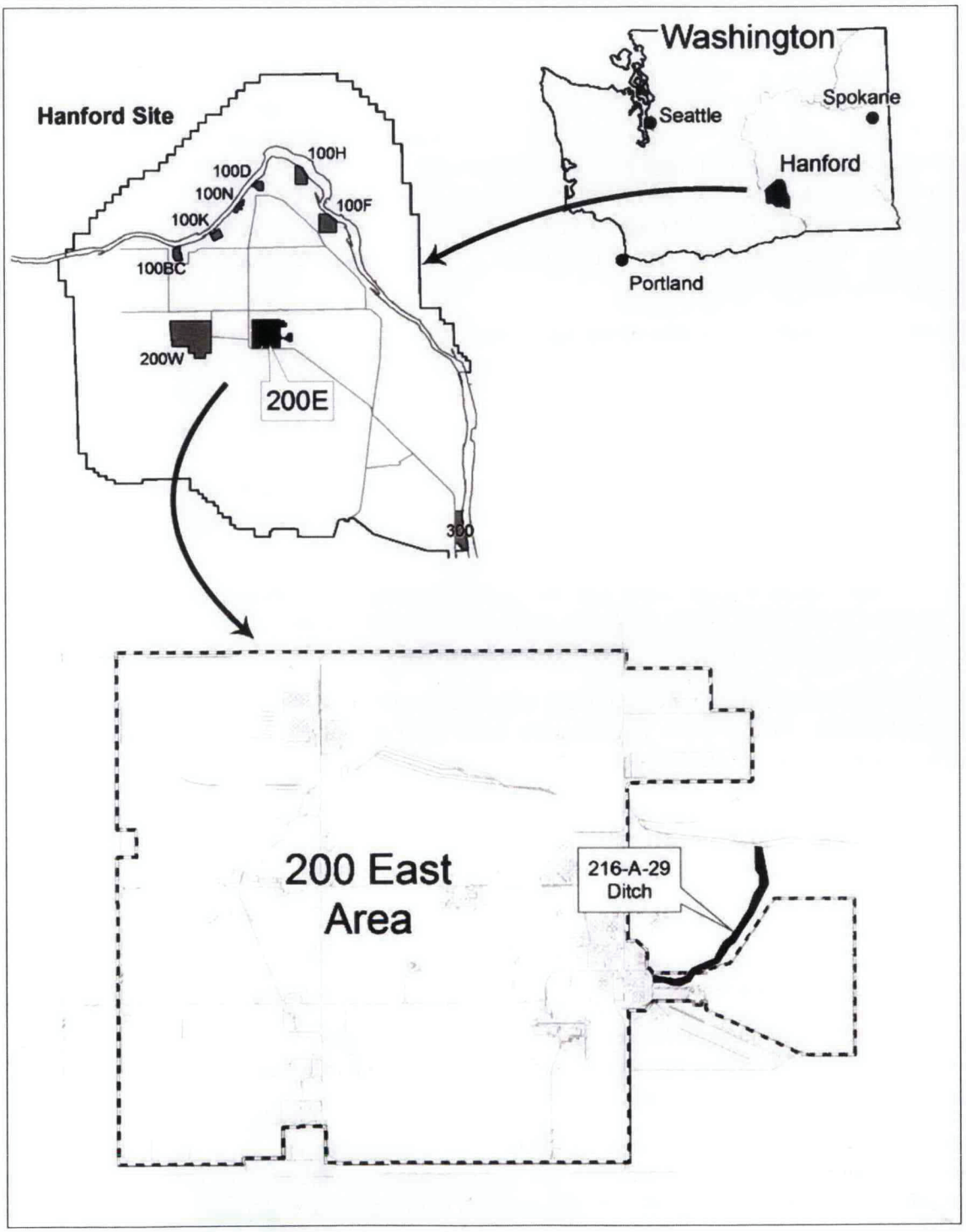


Figure 1-1. Location of the 216-A-29 Ditch

2 Background

This chapter presents background information related to the successful implementation of the groundwater monitoring plan, which includes information on historical and present facility operations, waste characteristics, geology, hydrology, previous monitoring results, and a site conceptual model.

2.1 Facility Description and Operational History

The A-29 Ditch was excavated to convey liquid effluent from the Plutonium-Uranium Extraction (PUREX) Plant chemical sewer (low level) (CSL) to the 216-B-3 Pond and was put into service in November 1955. The A-29 Ditch initially discharged to the 216-B-3-1 Ditch (Figure 2-1); however, when the 216-B-3-1 Ditch was retired in 1964, the A-29 Ditch was shortened and then discharged to the 216-B-3-2 Ditch. The 216-B-3-2 Ditch was retired in 1970. As a result, the A-29 Ditch was again re-routed and discharged to the 216-B-3-3 Ditch until 1994, when all CSL discharges were routed directly to the 216-B-3A Pond.

The A-29 Ditch was approximately 1.8 m (6 ft) wide, 1,097 m (3,600 ft) long, and varied from 0.6 to 0.9 m (2 to 3 ft) deep at the south end to nearly 5 m (16 ft) deep at the north end. The point of discharge to the ditch was approximately 274 m (900 ft) west of the east perimeter fence line of the 200 East Area. The ditch passed beneath the 200 East Area perimeter fence and ran northeast to the 216-B-3 Ditches, which discharged to the 216-B-3 Pond.

All discharges to the ditch originated within the 200 East Area perimeter fence and came from the PUREX CSL. Flow from the CSL was continuous, with the volume discharged ranging from 950 to 4,164 L/min (250 to 1,100 gallons per minute [gpm]). The average flow during use of the A-29 Ditch was approximately 3,671 L/min (1,000 gpm). An unknown amount of effluent discharged to the ditch infiltrated the soil while flowing along the course of the ditch.

The A-29 Ditch is currently backfilled with material from the ditch sides and spoils piles in the bottom. The portion of the A-29 Ditch inside the 200 East Area security fence was brought up to grade with clean material. The portion of A-29 Ditch outside of the 200 East Area security fence was topped with clean material in a series of 11 terraces progressing down the length of the ditch. Both areas have been revegetated and appropriate signage posted (the A-29 Ditch is an underground radioactive material area).

2.2 Regulatory Basis

The A-29 Ditch is classified as a TSD unit because it received dangerous waste after one of two effective dates. The effective date for nonradioactive dangerous waste discharges is November 19, 1980, for dangerous waste regulated by 40 CFR 261, or March 10, 1982, for dangerous waste regulated by WAC 173-303 only (e.g., state-only dangerous waste). Since the corrosive waste (D002) discharged to the A-29 Ditch is regulated under 40 CFR 261, the effective date of regulation for this unit is November 19, 1980. (See definition of "active portion" in WAC 173-303-040.)

The A-29 Ditch is currently subject to the regulatory rules set outlined in WAC 173-303-400 for interim status facility standards and those portions of 40 CFR 265, Subpart F, as incorporated by reference in WAC 173-303-400.

To date, no dangerous waste subject to WAC 173-303 has contaminated groundwater from the A-29 Ditch. Therefore, the site remains under indicator evaluation monitoring for indicator parameters, as specified in 40 CFR 265.92(b), "Sampling and Analysis."

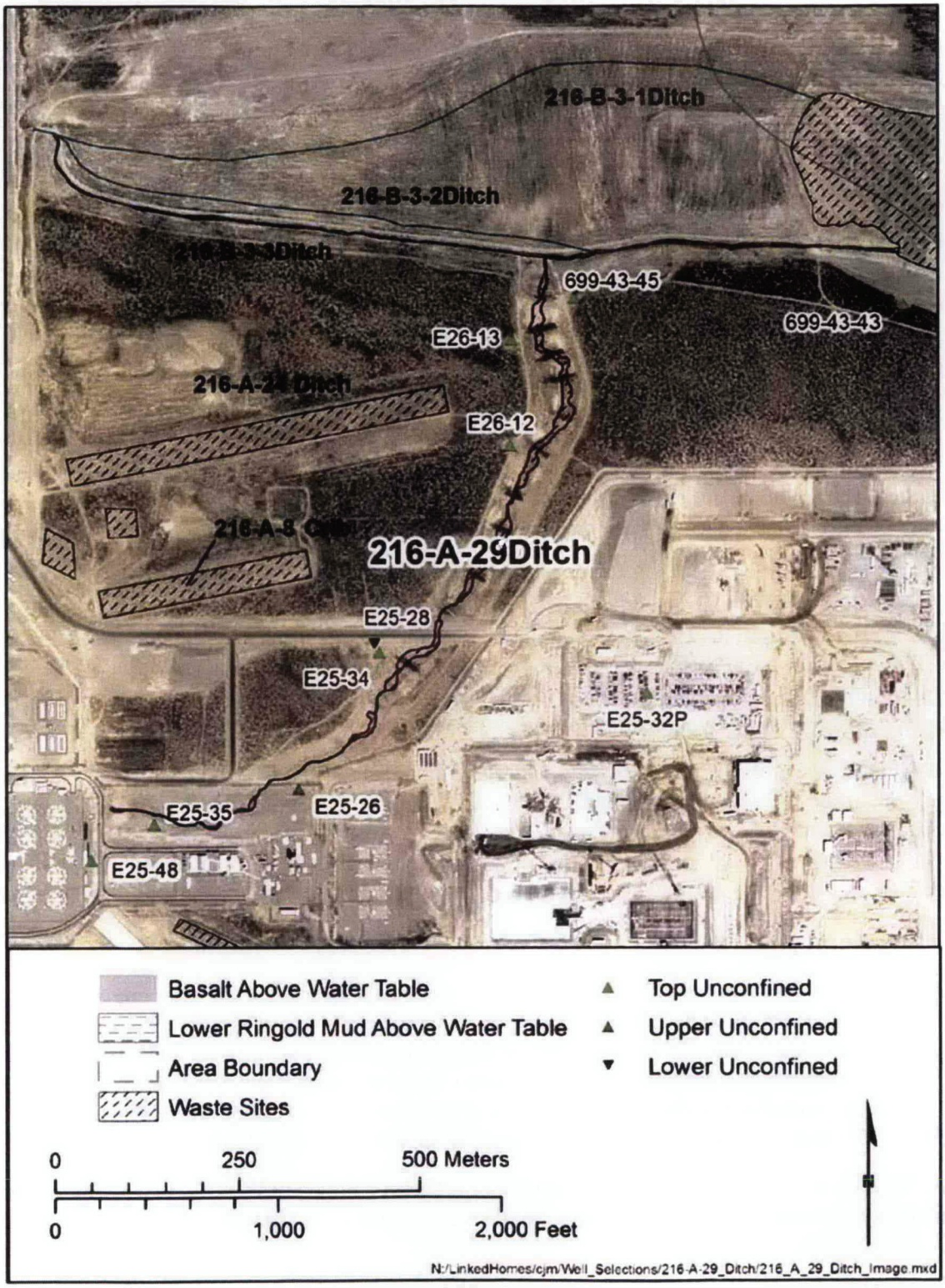


Figure 2-1. Site Map for the 216-A-29 Ditch Showing Previous Monitoring Network

The A-29 Ditch received a continuous discharge of corrosive waste and potentially hazardous spilled chemical materials from the PUREX Plant. The most significant chemical discharges included acidic and caustic effluents associated with backwashing for the regeneration of demineralizer columns. The ditch also received spills from the PUREX Plant CSL. The *Groundwater Monitoring Plan for the 216-A-29 Ditch* (WHC-SD-EN-AP-045) provides a complete inventory of materials discharged to the A-29 Ditch.

Groundwater monitoring has been conducted in accordance with the above-referenced RCRA requirements since 1988. Interim status monitoring was performed from 1988 to 1990, when monitoring was changed to an assessment program (40 CFR 265.93[d]) because of elevated levels of specific conductivity in downgradient well 299-E25-35. In 1995, *Results of Groundwater Quality Assessment Program at the 216-A-29 Ditch RCRA Facility* (WHC-SD-EN-EV-032) was issued, which identified increased sodium, sulfate, and calcium as the cause of the elevated specific conductance. Because these constituents are not regulated as hazardous wastes, the conclusion was drawn that the groundwater had not been adversely impacted.

Elevated total organic halides (TOX) were also listed as a constituent of concern in the *Interim-Status Groundwater Quality Assessment Plan for the 216-A-29 Ditch* (WHC-SD-EN-AP-031). No known or suspected cause of the TOX elevation was identified. As a result of these findings, the A-29 Ditch reverted to indicator parameter monitoring under the supplemental groundwater monitoring plan in the appendix to the assessment report (WHC-SD-EN-EV-032). This supplement was subsequently revised in 1999 as the groundwater monitoring plan for the A-29 Ditch (PNNL-13047). Since the assessment, concentrations of TOX have subsequently dropped below the critical mean for the site.

2.3 Waste Characteristics

The A-29 Ditch received corrosive dangerous waste from the PUREX Plant. The discharges consisted of acidic (sulfuric acid) and caustic (sodium hydroxide) backwashes from the regeneration of demineralizer columns in the PUREX Plant. The ditch also received spills from the PUREX Plant. The dangerous waste consists of toxicity characteristic waste, acutely dangerous discarded chemical products, and state-only waste. WHC-SD-EN-AP-045 provides a complete inventory of materials discharged to the A-2 Ditch.

The results of PUREX CSL effluent analyses for dangerous and radioactive components are provided in *Preliminary Evaluation of Hanford Liquid Discharges to Ground* (WHC-EP-0052). Additional analysis data are published in the *Liquid Effluent Study Final Project Report* (WHC-EP-0367). The identity and quantity of dangerous waste disposed to the A-29 Ditch are found in the RCRA Part A form. Dangerous waste disposed includes corrosive waste, cadmium, hydrazine, and dangerous waste/toxic dangerous waste.

2.4 Geology and Hydrology

The geology and hydrology of the A-29 Ditch are described in detail in WHC-SD-EN-AP-045 and in compilation reports on the 200 East Area (e.g., WHC-SD-EN-TI-012, *Geologic Setting of the 200 East Area: An Update*; and PNNL-12261, *Revised Hydrogeology for the Suprabasalt Aquifer System, 200-East Area and Vicinity, Hanford Site, Washington*). The summaries in the following subsections are from these documents.

2.4.1 Stratigraphy

The principal geologic units beneath the A-29 Ditch include, from youngest to oldest, the Pleistocene Hanford formation, the Miocene/Pliocene Ringold Formation, and Elephant Mountain Member of the Saddle Mountains Basalt. PNNL-12261 (upon which much of this section is based) uses the nomenclature

first described in the *Three-Dimensional Conceptual Model for the Hanford Site Unconfined Aquifer System, FY 1994 Status Report* (PNNL-10195) for the vicinity of the 200 East Area. The nomenclature in PNNL-12261 is also referenced to the more recent descriptions in *Miocene-to Pliocene-Aged Suprabasalt Sediments of the Hanford Site, South-Central Washington* (BHI-00184).

PNNL-12261 divides the sediments in the 200 East Area above the Columbia River Basalt Group into four distinct hydrostratigraphic units. The lowermost unit is Ringold Unit A of BHI-00184 (Unit 9 in PNL-10195). In the southern and eastern portions of the 200 Areas, a particularly persistent layer of clay and silt within this unit allows for further subdivision of this unit into a lower confined unit (9C), a middle confining unit (9B), and an upper gravel/sand unit (9A).

Overlying Ringold Formation Units 9A through 9C is the lower mud unit (Unit 8 of PNL-10195). The Ringold lower mud sequence is not present in the northwestern portion of the B Pond but generally thickens south and southeast. The lower mud unit consists mostly of various mixtures of silt and clay (DOE/RL-93-74, *200-BP-11 Operable Unit and 216-B-3 Main Pond, 216-B-63 Trench, and 216-A-29 Ditch Work/Closure Plan, Hanford Site, Richland, Washington*).

Above the lower mud unit lie the fluvial gravels and sands of Ringold Unit E (Unit 5 in PNL-10195). Unit E has been removed from Gable Gap and most of the 200 East Area to approximately the May Junction Fault by the ancestral Columbia River and Missoula floods.

The majority of the vadose zone above the Ringold Formation units is the Hanford formation. The Hanford formation is represented by three facies, in descending stratigraphic order: (1) an upper gravel sequence designated as H1, (2) a sandy sequence designated as H2, and (3) a lower gravel sequence designated as H3 (subdivisions after WHC-SD-EN-TI-012). The H1 and H3 gravel sequences are not differentiated in those areas where the intervening sandy H2 sequence is absent. Units H1 and H3 consist of coarse-grained, basalt-rich, sandy gravels with varying amounts of silt/clay. These gravel units may also contain interbedded sand and or silt/clay lenses. The H2 sequence is dominated by sand to gravelly sand, with minor sandy gravel or silt/clay interbeds. The sandy H2 sequence has a significant silt/clay component in the extreme western portion of the main 216-B-3 Pond beneath the 216-B-3-3 Ditch and A-29 Ditch.

2.4.2 Physical Hydrogeology

The uppermost aquifer beneath the A-29 Ditch is unconfined and occurs within the undifferentiated Hanford formation/Ringold Formation. According to as-built diagrams, existing shallow wells in the A-29 Ditch monitoring network are within a silty to gravelly sand unit. The water table elevation near and beneath the A-29 Ditch is approximately 122 m (400 ft) above mean sea level. Perched water conditions were observed during drilling near the northern end of the A-29 Ditch at well 699-43-45 in 1989, which was the year before discharges to the ditch ceased. Water was encountered from approximately 13 to 14 m (42 to 46 ft) below ground surface (bgs). The confining layer appeared to be a thin silty sand lens at 15 m (50 ft) bgs. It is unlikely that perched water conditions continue to exist now that discharges to the A-29 Ditch and 216-B-3 Pond have been terminated.

Historically, groundwater moved radially outward from a groundwater mound established beneath the 216-B-3 Pond, which lies directly northeast of the A-29 Ditch. This groundwater mound is evident on water table maps up through the 1990s. Groundwater flow during this period was generally from northeast to southwest across the ditch. With the termination of discharges to the A-29 Ditch and 216-B-3 Pond, this mound has largely dissipated, leading to a general decline in water levels throughout the 200 East Area. As this mound continues to disperse, it has less of an effect on groundwater flow direction. Based on general interpretations of the water table map in the 200 East Area, the direction of

groundwater flow near the A-29 Ditch is generally to the southeast (DOE/RL-2008-66, *Hanford Site Groundwater Monitoring for Fiscal Year 2008*). However, as with most of the 200 East Area, the water table gradient in the immediate vicinity of the A-29 Ditch is too flat to provide estimates of flow direction or rate with a high degree of confidence. A network of selected wells in the area of A-29 Ditch is currently undergoing a hyper-accurate study to determine flow direction.

Prominent manmade contributions to groundwater chemistry include nitrate, calcium, and sulfate. The effects of calcium and sulfate on the composition of groundwater are most clearly demonstrated in the specific conductivity of samples taken from A-29 Ditch monitoring wells. The relationship between these constituents and specific conductivity is identified in the assessment report (WHC-SD-EN-EV-032). The drop in specific conductivity, sulfate, calcium, and sodium coincided with termination of effluent discharge to the A-29 Ditch. The decline of specific conductivity to levels below the critical mean, combined with cessation of discharges to the A-29 Ditch, provided the justification for returning the facility to indicator evaluation monitoring.

2.5 Summary of Previous Groundwater Monitoring

Groundwater beneath the A-29 Ditch has been monitored by a RCRA-compliant monitoring network since November 1988. The original indication evaluation monitoring network consisted of one upgradient well (299-E25-32P) and four downgradient wells (299-E25-26, 299-E25-28, 299-E25-34, and 299-E25-35) (Figure 2-1). These wells were sampled quarterly for one year to establish background levels. In late 1989, network groundwater monitoring was completed for four quarters, and background values were established. The first scheduled contamination indicator parameter, semiannual sampling event occurred in January 1990. By December 1990, it was apparent that the flow direction in the network was changing. The water level in the upgradient network well (299-E25-32P) had decreased to where it was no longer representative of upgradient conditions. The monitoring network was then out of compliance with 40 CFR 265.91(a), "Ground-Water Monitoring System." After evaluating the December 1990 data, it was determined that a new upgradient groundwater monitoring well was necessary for the A-29 Ditch monitoring network and that the groundwater monitoring plan required revision. Some of the wells used during assessment monitoring were incorporated into the new monitoring network, and two new upgradient wells (699-43-43 and 699-43-45) were selected (PNNL-13047).

2.5.1 Groundwater Contamination

Statistical evaluation of the first indicator evaluation monitoring results in January 1990 indicated that the specific conductivity (field) value in downgradient well 299-E25-35 was statistically greater than the background levels. Resampling later verified this measurement, and the required groundwater quality assessment plan was prepared and initiated for the A-29 Ditch (WHC-SD-EN-AP-031). The groundwater network was expanded to include new well installations and additional existing monitoring wells.

The final assessment report was issued in 1995 (WHC-SD-EN-EV-032). The results of the report identified increased sulfate, sodium, and calcium as the cause of elevated specific conductivity in well 299-E25-35. Because these constituents are not regulated as dangerous wastes, the conclusion was drawn that groundwater had not been adversely impacted. Elevated TOX was also listed as a constituent of concern in the assessment plan (WHC-SD-EN-AP-031), but concentrations have subsequently dropped below the critical mean for the site. Subject to these findings, the A-29 Ditch reverted to indicator parameter monitoring under the supplemental groundwater monitoring plan in the appendix to the assessment report (WHC-SD-EN-EV-032) and, subsequently, in PNNL-13047.

Specific conductance continued above the critical mean in downgradient wells 299-E25-35, 299-E25-48, and 299-E26-13 in 2009. Concentrations of sulfate, nitrate, chloride, and the major cations are also increasing in these wells. The cause of this increase remains unknown but appears to coincide with a general, multi-year increase in ionic strength throughout much of the 200 East Area and adjacent areas; the increase is not attributed to the A-29 Ditch (DOE/RL-2008-01, *Hanford Site Groundwater Monitoring for Fiscal Year 2007*).

2.5.2 Vadose Zone Contamination

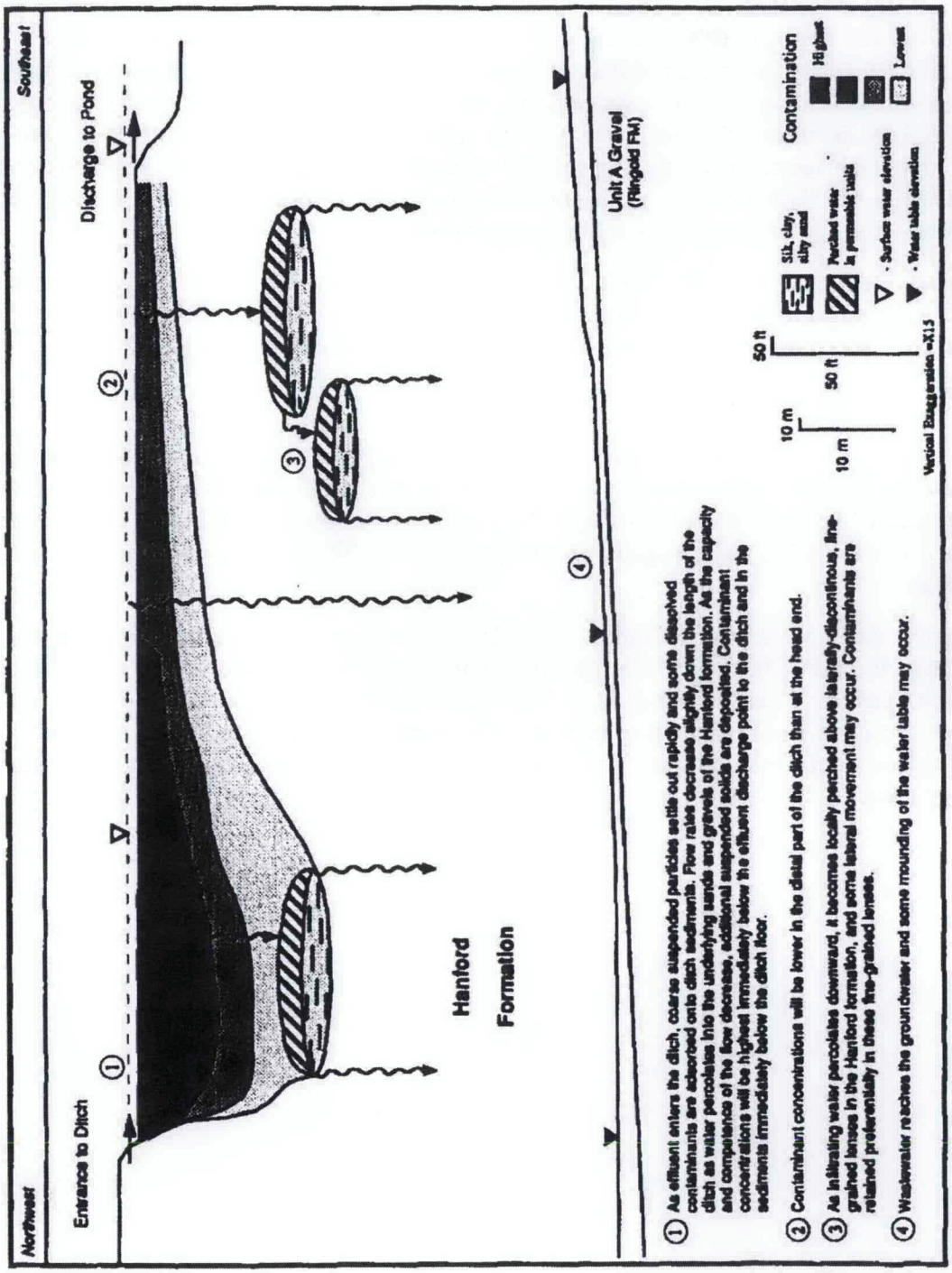
In 2002, one boring and three test pits were excavated as part of the CERCLA remedial investigation study for the site (DOE/RL-2004-17, *Remedial Investigation Report for the 200-CS-1 Chemical Sewer Group Operable Unit*). In the *Proposed Plan for the 200-CS-1 Chemical Sewer Group Operable Unit* (DOE/RL-2005-64), two contaminants (cadmium and silver) were identified as human and/or ecological risk drivers.

Soil sample results were also compared against groundwater protection concentrations as part of the CERCLA remedial investigation study. Four metals regulated under RCRA (arsenic, cadmium, mercury, silver), nitrate, two polycyclic aromatic hydrocarbons (benzo[a]anthracene and chrysene), Aroclor 1254 (a polychlorinated biphenyl), and four volatile organic compounds (1,2-dichloroetane, methylene chloride, tetrachloroethylene, and tributyl phosphate) had maximum concentrations above their respective groundwater protection cleanup levels (DOE/RL-2005-63, *Feasibility Study for the 200-CS-1 Chemical Sewer Group Operable Unit*). None of these were predicted to reach groundwater at concentrations above the U.S. Environmental Protection Agency's maximum contaminant levels and were eliminated from the proposed plan.

2.6 Conceptual Model

The A-29 Ditch was one of several wastewater conveyances that discharged to the 216-B-3 Pond system. The open and unlined trench allowed liquid effluents to evaporate and percolate into the vadose sediments along its entire length. Groundwater monitoring results, however, indicate that infiltration and eventual migration of effluents to the unconfined aquifer have not been evenly distributed. The elevation of specific conductivity and associated ions (e.g., sulfate and calcium) in wells near the influent end of the ditch (as noted in WHC-SD-EN-EV-032) suggests that potential contamination may be confined to the head end (southwest end shown in Figure 2-1) of the ditch.

The conceptual model used to describe contaminant transport to the 216-B-3 Pond (DOE/RL-93-74) via the A-29 Ditch is central to the discussion of a conceptual model. As shown in Figure 2-2, the highest infiltration occurred within the first few meters of wastewater discharge to the ditch. Contaminants were carried to groundwater at a higher rate near the inlet end as a result of the constant head maintained by continuous discharges. Well logs from groundwater wells adjacent to the A-29 Ditch show that the upper vadose zone at the inlet end is dominated by sandy to silty-sandy gravels, while predominantly sandy units are found at the discharge end. This stratigraphic control of moisture migration (higher fines [silt] at the inlet end) in the vadose zone favors deposition of the majority of contaminants near the outfall of the CSL. Vadose zone excavations conducted in 2002 for CERCLA site characterization showed that the less mobile contaminants tended to be sorbed near the inlet end of the A-29 Ditch and in the upper 2.9 m (10 ft) of the soil column (DOE/RL-2005-63). It is also possible that the bulk of the mobile contaminants (nitrate and sulfate) have reached groundwater beneath the inlet end of the A-29 Ditch. Once the contaminants reached groundwater, the contaminants followed the hydraulic gradient and moved away from the A-29 Ditch in a southeasterly direction.



Source: This figure has been reproduced from the best available copy (DOE/RL-93-74, *200-BP-11 Operable Unit and 216-B-3 Main Pond, 216-B-63 Trench, and 216-A-29 Ditch Work/Closure Plan, Hanford Site, Richland, Washington*).

Figure 2-2. Conceptual Model of Effluent Infiltration Within a Ditch

The potential for continued migration of residual contamination from the vadose zone to groundwater is unlikely due to the cessation of liquid effluent discharges to the A-29 Ditch, as well as the lack of any water lines or other direct sources of recharge. Infiltration of natural precipitation is the only potential force capable of moving a significant portion of the remaining contaminants to the groundwater. The current mean annual precipitation rate is 16 cm (6.3 in.), with most annual accumulation occurring between November and February (PNNL-10285, *Estimated Recharge Rates at the Hanford Site*). Recharge in the A-29 Ditch area is estimated to be between 10 and 20 mm (0.39 and 0.79 in.) annually based on PNNL-10285. The range of recharge rates depends on a variety of factors, but the coarse sediments beneath the inlet end of the facility may result in rates closer to 20 mm/year (0.79 in./year). No recent infiltration abatement measures (impermeable material covering) have been implemented at the A-29 Ditch. The risk of infiltration by snowmelt and the potential for vertical migration of contaminants, however, is considered low because of low annual precipitation.

Based on general interpretations of flow in the 200 East Area, the current direction of groundwater flow at the A-29 Ditch is assumed to be south-southwest. The hydraulic gradient in the immediate vicinity of the A-29 Ditch is too low to provide an accurate estimate of direction or velocity (DOE/RL-2008-01).

2.7 Data Quality Objectives

The DQO process is performed to ensure that data gathered during an investigation are of the appropriate quantity and quality to meet specific objectives. The DQOs for groundwater monitoring were presented in *200-CS-1 Chemical Sewer Operable Unit DQO Process Summary Report* (BHI-01276) and have been revised in *Data Quality Objectives Summary Report Supporting the 200-PO-1 Groundwater Operable Unit* (SGW-34011).

The current groundwater monitoring network for A-29 Ditch is a result of previous investigations and DQOs. Contamination indicator evaluation monitoring is ongoing at this site in accordance with interim status regulations. Table 2-1 provides a matrix of data requirements that are typically determined in a DQO process, the associated interim status regulations applicable to these requirements, and the current and historical documentation specifying how the monitoring program for A-29 Ditch complies with the requirements.

Table 2-1. Data Quality Objectives at RCRA Sites Monitoring for Indicator Parameters

DQO Parameter	Related Requirements	Plan Criteria and Associated Historical Documentation
Scope	RCRA interim status ground-water monitoring at sites where no impact to ground-water has been identified. Requirements are found in WAC 173-303-400(3) and 40 CFR 265.90 through 265.94, as modified by WAC 173-303-400(3)(b) and WAC 173-303-400(3)(c)(v).	
Number and location of wells Point(s) of compliance	**40 CFR 265.91 Ground-Water Monitoring System.** (a) A ground-water monitoring system must be capable of yielding ground-water samples for analysis and must consist of: (1) Monitoring wells (at least one) installed hydraulically upgradient (i.e., in the direction of increasing static head) from the limit of the waste management area. Their number, locations, and depths must be sufficient to yield ground-water samples that are: (i) Representative of background ground-water quality in the uppermost aquifer near the facility; and (ii) Not affected by the facility; and (2) Monitoring wells (at least three) installed hydraulically downgradient (i.e., in the direction of decreasing static head) at the limit of the waste management area. Their number, locations, and depths must ensure that they immediately detect any statistically significant amounts of hazardous waste or hazardous waste constituents that migrate from the waste management area to the uppermost aquifer.	This plan, Sections 2.4, 2.5, 2.6, and 3.2 PNNL-13047, *Groundwater Monitoring Plan for the 216-A-29 Ditch*
Well configuration (depth and length of screened interval; well construction)	**40 CFR 265.91 Ground-Water Monitoring System.** (c) All monitoring wells must be cased in a manner that maintains the integrity of the monitoring well borehole. This casing must be screened or perforated, and packed with gravel or sand where necessary, to enable sample collection at depths where appropriate aquifer flow zones exist. The annular space (i.e., the space between the borehole and well casing) above the sampling depth must be sealed with a suitable material (e.g., cement grout or bentonite slurry) to prevent contamination of samples and the ground-water. **Additional Requirements from WAC 173-303-400(3)(c)(v)(C).** Ground-water monitoring wells must be designed, constructed, and operated so as to prevent ground-water contamination. WAC 173-160 may be used as guidance in the installation of wells.	This plan, Section 3.2 and Appendix B PNNL-13047, *Groundwater Monitoring Plan for the 216-A-29 Ditch* BHI-01239, *200-CW-1 Gable/B-Pond and Ditches Cooling Water Waste Group Remedial Investigation DQO Summary Report* BHI-01276, *200-CS-1 Chemical Sewer Operable Unit DQO Process Summary Report*

Table 2-1. Data Quality Objectives at RCRA Sites Monitoring for Indicator Parameters

DQO Parameter	Related Requirements	Plan Criteria and Associated Historical Documentation
Frequency of sampling Types of analysis or measurement Method detection limits or accuracy and precision	**40 CFR 265.92 Sampling and Analysis.** (b) The owner or operator must determine the concentration or value of the following parameters in ground-water samples in accordance with paragraphs (c) and (d) of this section: (1) Parameters characterizing the suitability of the ground-water as a drinking water supply, as specified in Appendix III. *[NOTE: Have not listed these because, in accordance with 40 CFR 265.92(c)(1) below, these analyses are only conducted for the first year. None of the RCRA sites are in the first year of monitoring.]* (2) Parameters establishing ground-water quality: (i) Chloride (ii) Iron (iii) Manganese (iv) Phenols (v) Sodium (vi) Sulfate *[COMMENT: These parameters are to be used as a basis for comparison in the event a ground-water quality assessment is required in accordance with 40 CFR 265.93(d).]* (3) Parameters used as indicators of ground-water contamination: (i) pH (ii) Specific Conductance (iii) Total Organic Carbon (iv) Total Organic Halogen (c)(1) For all monitoring wells, the owner or operator must establish initial background concentrations or values of all parameters specified in paragraph (b) of this section. The owner or operator must do this quarterly for one year. (2) For each of the indicator parameters specified in paragraph (b)(3) of this section, at least four replicate measurements must be obtained for each sample and the initial background arithmetic mean and variance must be determined by pooling the replicate measurements for the respective parameter concentrations or values in samples obtained from upgradient wells during the first year.	This plan, Sections 3.1, 3.3, and 3.4; Appendix A PNNL-13047, *Groundwater Monitoring Plan for the 216-A-29 Ditch* BHI-01239, *200-CW-1 Gable/B-Pond and Ditches Cooling Water Waste Group Remedial Investigation DQO Summary Report* BHI-01276, *200-CS-1 Chemical Sewer Operable Unit DQO Process Summary Report* SGW-34011, *Data Quality Objectives Summary Report Supporting the 200-PO-1 Groundwater Operable Unit*

Table 2-1. Data Quality Objectives at RCRA Sites Monitoring for Indicator Parameters

DQO Parameter	Related Requirements	Plan Criteria and Associated Historical Documentation
	40 CFR 265.92 Sampling and Analysis. (cont'd) (d) After the first year, all monitoring wells must be sampled and the samples analyzed with the following frequencies: (1) Samples collected to establish ground-water quality must be obtained and analyzed for the parameters specified in paragraph (b)(2) of this section at least annually. (2) Samples collected to indicate ground-water contamination must be obtained and analyzed for the parameters specified in paragraph (b)(3) of this section at least semiannually. (e) Elevation of the ground-water surface at each monitoring well must be determined each time a sample is obtained.	
Methods used to evaluate the collected data	**40 CFR 265.93 Preparation, Evaluation, and Response.** (b) For each indicator parameter specified in 40 CFR 265.92(b)(3), the owner or operator must calculate the arithmetic mean and variance, based on at least four replicate measurements on each sample, for each well monitored in accordance with 40 CFR 265.92(d)(2), and compare these results with its initial background arithmetic mean. The comparison must consider individually each of the wells in the monitoring system, and must use the Student's t-test at the 0.01 level of significance (see Appendix IV) to determine statistically significant increases (and decreases, in the case of pH) over initial background.	This plan, Section 3.2 This plan, Appendix B PNNL-13047, *Groundwater Monitoring Plan for the 216-A-29 Ditch* BHI-01239, *200-CW-1 Gable/B-Pond and Ditches Cooling Water Waste Group Remedial Investigation DQO Summary Report* BHI-01276, *200-CS-1 Chemical Sewer Operable Unit DQO Process Summary Report* SGW-34011, *Data Quality Objectives Summary Report Supporting the 200-PO-1 Groundwater Operable Unit*

Notes:

The references cited in this table are listed in the reference section (Chapter 5) of this plan.

CFR = *Code of Federal Regulations*

DQO = data quality objective

RCRA = *Resource Conservation and Recovery Act of 1976*

WAC = *Washington Administrative Code*

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3 Groundwater Monitoring Program

This chapter describes an interim status, indicator evaluation, groundwater monitoring program for the A-29 Ditch consisting of a monitoring well network, target constituents, and sampling and analysis protocol. The monitoring program presented here has been revised from PNNL-13047.

3.1 Constituent List and Sampling Frequency

The groundwater in A-29 Ditch monitoring wells will be sampled and analyzed for the parameters listed in Table 3-1. In compliance with 40 CFR 265.92, as incorporated by reference through WAC 173-303-400(3), the A-29 Ditch network groundwater wells will be monitored semiannually for TOX, total organic carbon (TOC), pH, and specific conductance. Wells will be monitored annually for metals and phenols. Alkalinity, anions, and water levels will also be collected semiannually. Alkalinity will be used to calculate a groundwater charge balance. Anions are included to detect potential nitrate contamination, as well as to provide input for charge balance calculations. The major ions will also be evaluated for geochemical relationships (e.g., stiff diagrams).

Arsenic and nitrate are also identified as constituents of interest in groundwater that could be associated with A-29 Ditch operations. Because these constituents are also associated with existing plumes, the constituents will be monitored on a regional scale by the 200-PO-1 OU to the extent possible and are not specifically included as constituents for the A-29 Ditch.

3.2 Monitoring Well Network

Information on the wells in the monitoring network is summarized in Table 3-2. Wells 699-43-45 and 299-E26-13 will continue to serve as the upgradient monitoring wells for the A-29 Ditch. These wells have historically served as the upgradient wells and remain in the upgradient direction based on current water levels in the 200 East Area. Both wells meet the standard resource protection well requirements of WAC 173-160, "Minimum Standards for Construction and Maintenance of Wells."

Wells 299-E25-26, 299-E25-35, and 299-E25-48 are located south, downgradient of the inlet end of the ditch. Well 299-E25-34 monitors the upper portion of the aquifer along the center length of the ditch. Well 299-E25-28 is screened to a depth of 103.2 m (340 ft) and monitors the bottom of the aquifer near well 299-E25-34. All of the wells have 6.1 m (20-ft) screened intervals. Well 299-E26-12 monitors the distal end of the ditch, while well 299-E25-32P monitors composite conditions downgradient of the middle of the ditch.

One upgradient well, 699-43-43, has been dropped from the network. This well provided redundant information to well 699-43-45.

Declining water table elevations throughout the 200 Areas have resulted in the removal of several groundwater monitoring wells from earlier RCRA networks due to insufficient water in the borehole for sampling. The 200 East Area is profoundly influenced by the decline of the 216-B-3 Pond groundwater mound. The revised upgradient well (699-43-45) has shown an average annual decline of 0.08 m/year (0.26 ft/year). Based on the most recent water-level measurements, this decline yields an estimated life expectancy of approximately 24 years before the well may go dry.

The eight groundwater monitoring wells that currently comprise the A-29 Ditch monitoring network are shown in Figure 3-1 and listed in Table 3-2. All but two of the groundwater monitoring wells were constructed to meet resource protection well standards (WAC 173-160).

Table 3-1. Monitoring Well Network, Constituent List, and Sampling Frequency for the 216-A-29 Ditch

Well	Purpose	WAC Compliant	RCRA Required Constituents[a]											Supporting Constituents[b]					
				Indicator Parameters				Groundwater Quality Parameters						Field			Laboratory		
			Water Level	pH[c]	Specific Conductance[c]	TOC	TOX	Chloride	Iron (Filtered and Unfiltered)	Manganese (Filtered and Unfiltered)	Phenols	Sodium (Filtered and Unfiltered)	Sulfate	Oxidation/Reduction Potential[c]	Temperature[c]	Turbidity[c]	Alkalinity	Anions[d]	Metals[e] (Filtered and Unfiltered)
699-43-45	Upgradient	C	S	S4	S4	S4	S4	A	A	A	A	A	A	A	S	S	S	S	A
299-E25-26	Downgradient	C	S	S4	S4	S4	S4	A	A	A	A	A	A	A	S	S	S	S	A
299-E25-28	Downgradient	C	S	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
299-E25-32P	Downgradient	C	S	S4	S4	S4	S4	A	A	A	A	A	A	A	S	S	S	S	A
299-E25-34	Downgradient	C	S	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
299-E25-35	Downgradient	C	S	S4	S4	S4	S4	A	A	A	A	A	A	A	S	S	S	S	A
299-E25-48	Downgradient	C	S	S4	S4	S4	S4	A	A	A	A	A	A	A	S	S	S	S	A
299-E26-12	Downgradient	C	S	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
299-E26-13	Upgradient	C	S	S4	S4	S4	S4	A	A	A	A	A	A	A	S	S	S	S	A

Notes:

Arsenic and nitrate are of sitewide concern and are monitored on a regional scale as part of the 200-PO-1 Operable Unit. Neither is included specifically as constituent for the 216-A-29 Ditch, although nitrate is incorporated as a supporting constituent (anions) for charge balance computations.

a. Required by 40 CFR 265.92, "Interim Status Standards for Hazardous Waste Treatment, Storage, and Disposal Facilities," "Sampling and Analysis."

b. Constituents not required by RCRA but needed to support interpretation.

c. Field measurement.

d. Anions; analytes include, but are not limited to, chloride, fluoride, sulfate, nitrate, and nitrite for charge balance computations.

e. Metals; analytes include, but are not limited to, common soil minerals; calcium, magnesium, potassium, and sodium for charge balance computations.

Table 3-1. Monitoring Well Network, Constituent List, and Sampling Frequency for the 216-A-29 Ditch

Well	Purpose	WAC Compliant	RCRA Required Constituents[a]											Supporting Constituents[b]					
				Indicator Parameters				Groundwater Quality Parameters						Field			Laboratory		
			Water Level	pH[c]	Specific Conductance[c]	TOC	TOX	Chloride	Iron (Filtered and Unfiltered)	Manganese (Filtered and Unfiltered)	Phenols	Sodium (Filtered and Unfiltered)	Sulfate	Oxidation/Reduction Potential[c]	Temperature[c]	Turbidity[c]	Alkalinity	Anions[d]	Metals[e] (Filtered and Unfiltered)

A = to be sampled annually
C = well is constructed as a WAC 173-160 ("Minimum Standards for Construction and Maintenance of Wells"), Part 2 resource protection well
CFR = *Code of Federal Regulations*
RCRA = *Resource Conservation and Recovery Act of 1976*
S = to be sampled semiannually
S4 = to be sampled semiannually with quadruplicate samples taken
TOC = total organic carbon
TOX = total organic halides
WAC = *Washington Administrative Code*

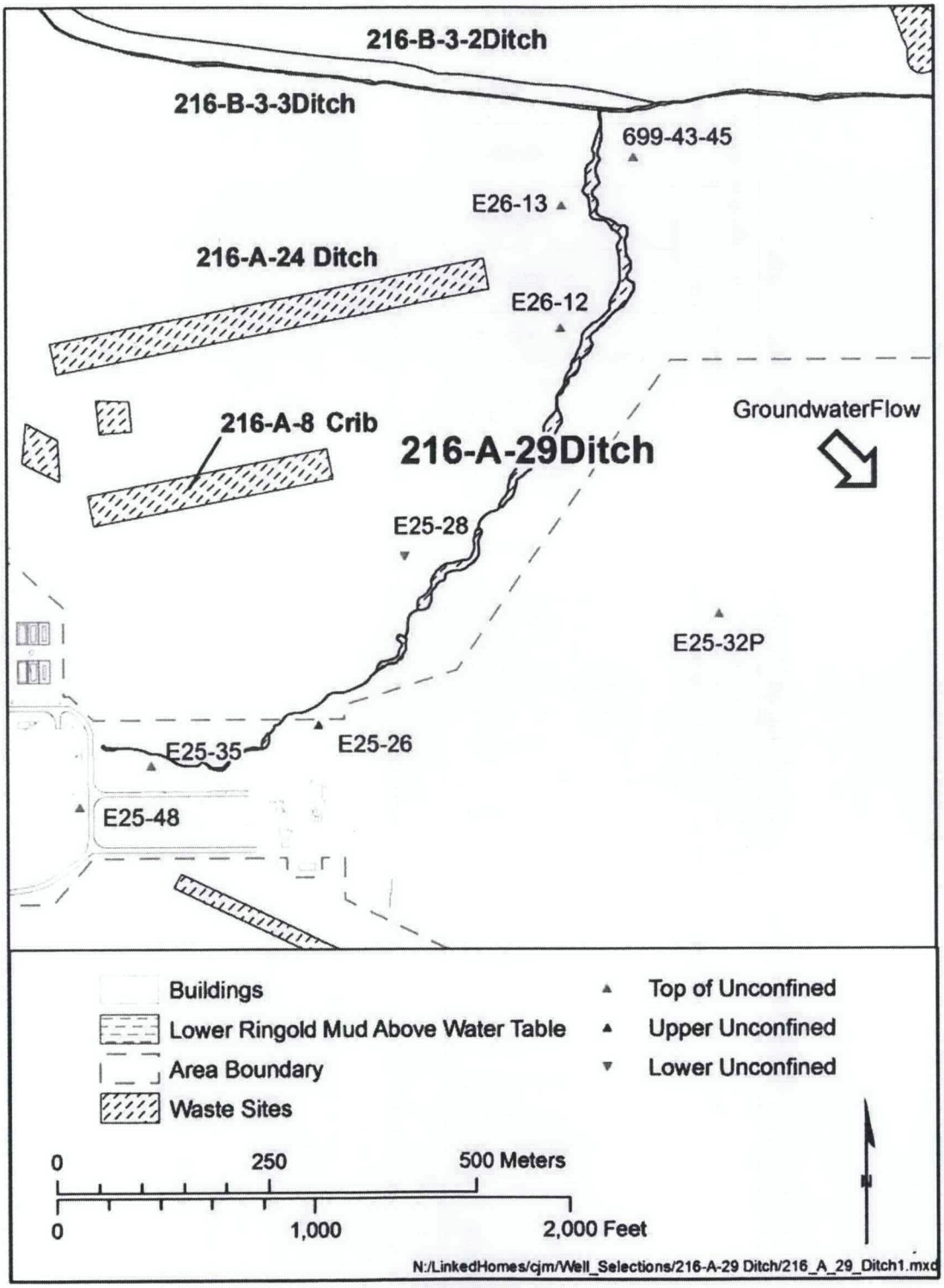

Figure 3-1. RCRA Groundwater Monitoring Network at the 216-A-29 Ditch

Table 3-2. Groundwater Monitoring Well Network for the 216-A-29 Ditch

Well	Year Drilled	Construction Notes[a]	Units Monitored	Water Table Elevation[b] (m)	Top of Casing NAVD88 (m)	Bottom Elevation[c] (m)	Water Left (m)
699-43-45 (upgradient)	1989	4-in., ss, wire-wrap screen	Ringold Unit 5 – completed at water table	122.08	183.15	119.12	2.96
299-E25-26	1985	6-in., ss, wire-wrap screen	Ringold Unit 5 – completed at water table	122.06	204.847	115.67	6.39
299-E25-28	1985	6-in., ss, wire-wrap screen	Ringold Unit 5 – completed at water table	122.05	203	97.64	24.41
299-E25-32P	1988	4-in., ss, wire-wrap screen	Ringold Unit 5 – completed at bottom of aquifer	121.81	205.03	96.65	35.53
299-E25-34	1988	8-in., ss, wire-wrap screen	Ringold Unit 5 – completed at water table	122.03	273.6	118.57	3.46
299-E25-35	1988	4-in., ss, wire-wrap screen	Ringold Unit 5 – completed at water table	122.06	206.636	118.87	3.19
299-E25-48	1992	4-in., ss, wire-wrap screen	Ringold Unit 5 – completed at water table	122.07	208.982	117.37	4.70
299-E26-12	1991	4-in., ss, wire-wrap screen	Ringold Unit 5 – completed at water table	122.10	193.312	118.47	3.63

Notes:

a. Includes (when available) well casing/screen material, screen type, and well seal type.

b. Water table elevation December 2007.

c. Bottom elevation from most recently available source (e.g., well inspection depth-to-bottom measurement or bottom of screen from as-built diagram).

NAVD88 = *North American Vertical Datum of 1988*

ss = stainless steel

Wells 299-E25-26 and 299-E25-28 were constructed of carbon-steel casing above the water table, with stainless-steel screens and casings below the water table. The stainless-steel casings in these wells do not have annular seals between the top of the screens and the bottom of the carbon-steel casings. The wells were developed naturally without filter pack and are completed in highly permeable material that does not necessitate an artificial filter pack. The integrity of these wells is maintained by the casings. As-built drawings for each of the revised wells in the network are provided in Appendix B.

3.3 Sampling and Analysis Protocol

Groundwater monitoring at the A-29 Ditch is part of project's routine network. Sampling and analysis protocols follow the conventions of the project. The QAPjP outlining procedures for sample collection, sample preservation and shipment, analytical procedures, and chain-of-custody control is provided in Appendix A.

4 Data Evaluation and Reporting

This chapter discusses the storage, retrieval, evaluation, and interpretation of groundwater data. Statistical evaluation methods and reporting requirements are also described.

4.1 Data Review

The data review, validation, and verification process is discussed in the QAPjP in Appendix A.

4.2 Statistical Evaluation

The goal of RCRA indicator evaluation monitoring is to determine if the A-29 Ditch has affected groundwater quality beneath the site. This is determined based on the results of specified statistical tests. Under this plan, sampling procedures and statistical evaluation methods are based on 40 CFR 265, Subpart F (incorporated by reference in WAC 173-303-400). These interim status regulations require the use of a statistical method that compares mean concentrations of the four general contamination indicator parameters (TOC, TOX, pH, and specific conductance) to background levels to test for potential impacts to groundwater. Each time that a monitoring well for the A-29 Ditch is sampled, four replicate samples for TOC and TOX are collected, and four replicate field measurements are made for pH and specific conductance. Statistical evaluations are not performed on sample results from well 299-E25-28 because it monitors the bottom of the aquifer.

Implementation of the statistical test method at the Hanford Site, including the A-29 Ditch, is described in detail in *Hanford Site Groundwater Monitoring for Fiscal Year 1999* (PNNL-13116) and *Statistical Approach on RCRA Groundwater Monitoring Projects at the Hanford Site* (WHC-SA-1124-FP). Twice each year, monitoring data from downgradient wells are compared to the upgradient (background) results to determine if there is any indication that contamination may have occurred, using a t-test to make this determination (40 CFR 265.93[b]). Critical mean values are recalculated annually, while limits of quantitation are recalculated for each sample event (PNNL-13080, *Hanford Site Groundwater Monitoring: Setting, Sources, and Methods*).

4.3 Interpretation

After the data are validated and verified, acceptable data are used to interpret groundwater conditions at the site. Interpretive techniques include the following:

- Hydrographs: Graph water levels versus time to determine decreases, increases, seasonal, or manmade fluctuations in groundwater levels.
- Water table maps: Use water table elevations from multiple wells to construct contour maps to estimate flow directions. Groundwater flow is assumed to be perpendicular to lines of equal potential.
- Trend plots: Graph concentrations of constituents versus time to determine increases, decreases, and fluctuations. May be used in tandem with hydrographs and/or water table maps to determine if concentrations relate to changes in water level or in groundwater flow directions.
- Plume maps: Map distributions of constituents aerially in the aquifer to determine extent of contamination. Changes in plume distribution over time assist in determining plume movement and flow direction.
- Contaminant ratios: Can sometimes be used to distinguish between different sources of contamination.

4.4 Annual Determination of Monitoring Network

The RCRA groundwater monitoring requirements call for an annual evaluation of the network to determine if it remains adequate to monitor the waste management area. The network must include upgradient and downgradient wells in the uppermost aquifer. The gradient beneath the A-29 Ditch is extremely flat. It also continues to shift with the declining 216-B-3 Pond mound going from the south-southwest in 2007 to the southeast in 2008. The network includes both upgradient and downgradient wells based on current estimated flow direction.

The groundwater monitoring network, as it is currently configured, will continue to be re-evaluated to ensure that it is adequate to monitor the changing hydrogeologic conditions beneath the facility. If flow changes are observed, the A-29 Ditch conceptual model and geochemical trends will be re-evaluated to determine network efficiency and any necessary modification requirements for the network.

Water-level measurements will continue to be collected before each sampling event. More comprehensive water-level measurements are also made in selected wells around the 200 East Area. The wells used for this task have very exacting controls, allowing staff to correct the measurements to account for vertical borehole deviation and barometric effects. The resulting data are used in trend analysis, with statistical evaluation of the significance of a trend on the water table.

4.5 Reporting and Notification

Chemistry and water-level data are reviewed after each sampling event and are available in the Hanford Environmental Information System database. Formal reports will be issued annually (e.g., DOE/RL-2008-66).

If comparisons for an upgradient well show a statistically significant increase (and/or pH decrease), the information is reported in the annual groundwater report. If the comparisons for a downgradient well show a significant increase (and/or pH decrease), then one or both of the following actions are taken: (1) the well is resampled and split samples are sent to different laboratories to determine if the exceedance of the comparison value was the result of laboratory error, and/or (2) the original samples may be re-analyzed if laboratory error is suspected.

If the exceedance of the statistical comparison value is confirmed by resampling, then written notice is provided to the regulatory agency within 7 days that the monitored facility may be affecting groundwater quality. Within 15 days after the notification, a groundwater quality assessment program will be developed and submitted (40 CFR 265.93[d]). In some instances, it is possible to determine immediately that the statistical finding is not the result of contamination from the facility. In that case, the regulatory agency is notified but an assessment program is not instituted.

5 References

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Appendix A

Quality Assurance Project Plan

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Terms

CFR	*Code of Federal Regulations*
DOE	U.S. Department of Energy
DQO	data quality objective
EB	equipment blank
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
FTB	full trip blank
FXR	field transfer blank
HASQARD	*Hanford Analytical Services Quality Assurance Requirements Document*
HEIS	Hanford Environmental Information System
QA	quality assurance
QAPjP	quality assurance project plan
QC	quality control
RCRA	*Resource Conservation and Recovery Act of 1976*
RL	U.S. Department of Energy, Richland Operations Office
Tri-Party Agreement	*Hanford Federal Facility Agreement and Consent Order*
TSD	treatment, storage, and disposal
WAC	*Washington Administrative Code*

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A Quality Assurance Project Plan

The contractor's quality assurance (QA) program describes the contractor's QA structure, requirements, implementation methods, and responsibilities. The contractor's environmental QA program plan provides the requirements for collecting and assessing environmental data in accordance with the following:

- 10 *Code of Federal Regulations* (CFR) 830, Subpart A, "Nuclear Safety Management," "Quality Assurance Requirements"
- DOE/RL-96-68, *Hanford Analytical Services Quality Assurance Requirements Document* (HASQARD)
- EPA/240/B-01/003, *EPA Requirements for Quality Assurance Project Plans*, EPA QA/R-5
- U.S. Department of Energy (DOE) O 414.1C, *Quality Assurance*

This quality assurance project plan (QAPjP) establishes the quality requirements for environmental data collection including the planning, implementation, and assessment of sampling, field measurements, and laboratory analyses. Section 6.5 and 7.8 of the *Hanford Federal Facility Agreement and Consent Order* (Tri-Party Agreement) (Ecology et al. 1989a), Attachment 2, "Action Plan," require that QA/quality control (QC) and sampling and analysis activities specify the QA requirements for treatment, storage, and disposal (TSD) units, as well as for past-practice processes. The HASQARD requirements (DOE/RL-96-68) also apply to this work.

The content of this QAPjP is patterned after the QA elements of EPA/240/B-01/003. The QAPjP demonstrates conformance to the Part B requirements of *Quality Systems for Environmental Data and Technology Programs: Requirements with Guidance for Use* (ANSI/ASQ E4). This QAPjP is divided into four sections (designated in EPA/240/B-01/003) that describe the quality requirements and controls applicable to this investigation. This QAPjP is intended to supplement the contractor's environmental QA program plan.

A1 Project Management

This section addresses the basic aspects of project management and will ensure that the project has defined goals, that the participants understand the goals and the approaches used, and that the planned outputs are appropriately documented.

A1.1 Project/Task Organization

The project organization in regard to planning, sampling, analysis, and data assessment is described in the following subsections and is shown in Figure A-1. For each functional primary contractor role, there is a corresponding oversight role within DOE.

A1.1.1 Regulatory Project Manager

The Washington State Department of Ecology (Ecology) project manager is responsible for oversight of the work being performed under this groundwater monitoring plan. Ecology will work with the DOE Richland Operations Office (RL) to resolve concerns regarding the work as described in this QAPjP. Ecology can request this plan during a regulatory compliance inspection for review.

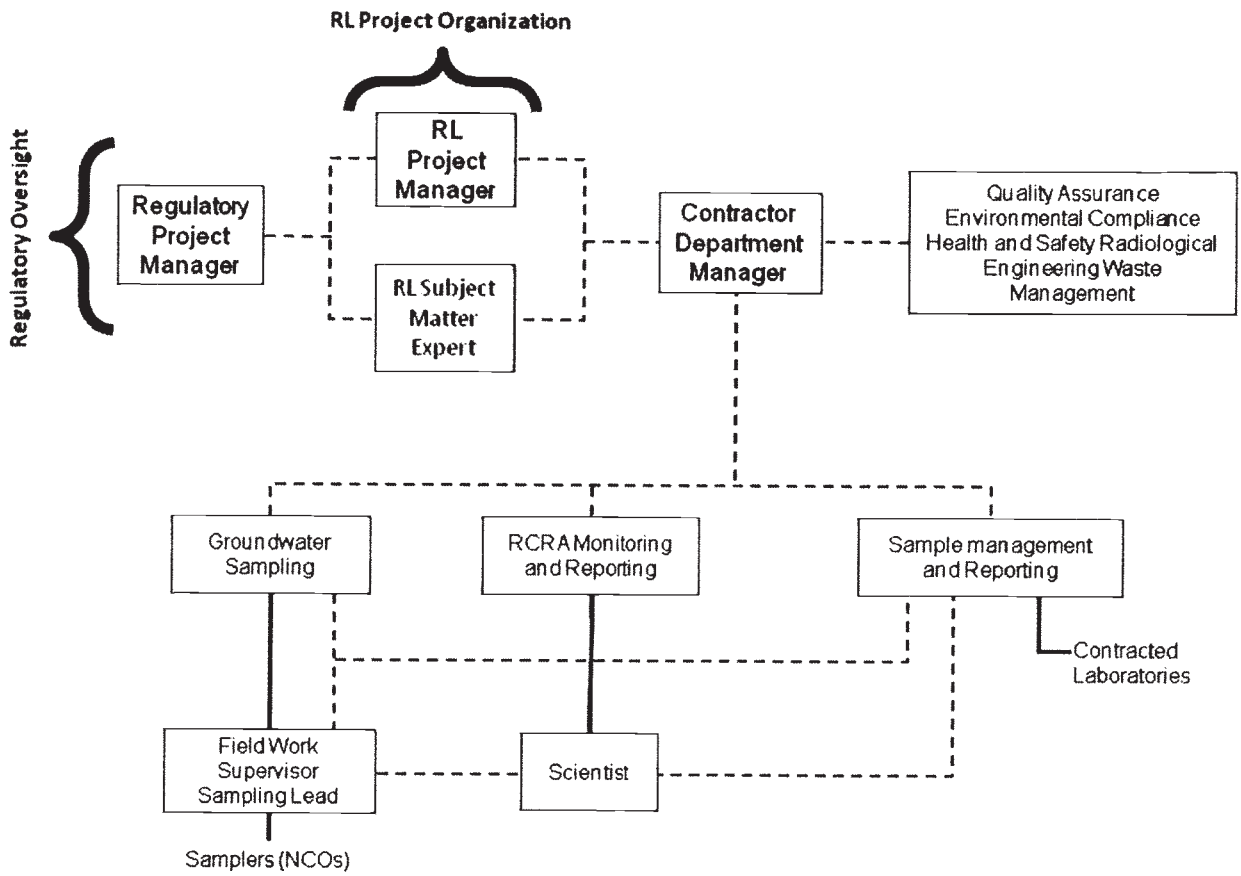

Figure A-1. Project Organization

A1.1.2 U.S. Department of Energy, Richland Operations Office Project Manager

Hanford Site cleanup is the responsibility of RL. The RL project manager is responsible for authorizing the contractor to perform activities under the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980*; the *Resource Conservation and Recovery Act of 1976* (RCRA); the *Atomic Energy Act of 1954*; and the Tri-Party Agreement for the Hanford Site.

A1.1.3 U.S. Department of Energy, Richland Operations Office Subject Matter Expert

The RL subject matter expert is responsible for day-to-day oversight of the contractor's performance of workscope, for working with the contractor and the regulatory agencies to identify and work through issues, and for providing technical input to the RL project manager.

A1.1.4 Contractor Groundwater Remediation Department Manager

The contractor groundwater remediation department manager provides oversight for all activities and coordinates with DOE, the regulators, and primary contractor management in support of sampling and reporting activities. The remediation department manager also provides support to the RCRA Monitoring and Reporting manager to ensure that work is performed safely and cost effectively.

A1.1.5 Groundwater Sampling Operations

Groundwater sampling operations is responsible for planning and coordinating field sampling resources and provides the field work supervisor for routine groundwater sampling operations. The field work supervisor directs the samplers, who collect groundwater samples in accordance with the sampling and analysis plan, and corresponding standard procedures and work packages. The samplers also complete the field logbook and chain-of-custody forms, including any shipping paperwork, and ensure delivery of the samples to the analytical laboratory.

A1.1.6 RCRA Monitoring and Reporting

The RCRA Monitoring and Reporting manager is responsible for direct management of activities performed to meet RCRA TSD monitoring requirements. The RCRA Monitoring and Reporting manager coordinates with and reports to DOE and primary contractor management regarding RCRA TSD monitoring requirements. The RCRA Monitoring and Reporting manager assigns scientists to provide technical expertise.

A1.1.7 Sample Management and Reporting Organization

The Sample Management and Reporting organization coordinates laboratory analytical work to ensure that laboratories conform to HASQARD requirements (or their equivalent), as approved by DOE, the U.S. Environmental Protection Agency (EPA), and Ecology. Sample Management and Reporting receives analytical data from the laboratories, performs data entry into the Hanford Environmental Information System (HEIS) database, and arranges for data validation. Sample Management and Reporting is responsible for informing the RCRA Monitoring and Reporting manager of any issues reported by the analytical laboratories.

A1.1.8 Contract Laboratories

The contract laboratories analyze samples in accordance with established procedures and provide necessary sample reports and explanations of results to support data validation. The laboratories must meet site-specific QA requirements and must have an approved QA plan in place.

A1.1.9 Quality Assurance

The QA point of contact is matrixed to the subject matter expert and is responsible for QA issues on the project. Responsibilities include overseeing implementation of the project QA requirements; reviewing project documents, including data quality objective (DQO) summary reports, sampling and analysis plans, and the QAPjP; and participating in QA assessments on sample collection and analysis activities, as appropriate. The QA point of contact must be independent of the unit generating the data.

A1.1.10 Environmental Compliance Officer

The environmental compliance officer provides technical oversight, direction, and acceptance of project and subcontracted environmental work, and also develops appropriate mitigation measures with the goal of minimizing adverse environmental impacts.

A1.1.11 Health and Safety

The Health and Safety organization is responsible for coordinating industrial safety and health support within the project as carried out through health and safety plans, job hazard analyses, and other pertinent safety documents required by federal regulations or by internal primary contractor work requirements.

A1.1.12 Waste Management

Waste Management communicates policies and procedures and ensures project compliance for storage, transportation, disposal, and waste tracking in a safe and cost-effective manner.

A1.2 Problem Definition/Background

The problem definition, as required by *Washington Administrative Code* (WAC) 173-303-400 ("Dangerous Waste Regulations," "Interim Status Facility Standards") and 40 CFR 265, Subpart F ("Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities," "Groundwater Monitoring"), is outlined in the main text discussion of this monitoring plan. The background is also provided in the monitoring plan.

A1.3 Project/Task Description

The project description is provided in Chapters 3 and 4 of this monitoring plan and includes the selection of appropriate dangerous waste or dangerous waste constituents, collection and analyses of groundwater from the monitoring network, interpretation of analytical results, evaluation of the monitoring network, and reporting.

The target analytes, along with the monitoring wells and frequency of sampling, are provided in Chapter 3.

A1.4 Quality Objectives and Criteria

The quality objectives and criteria for groundwater monitoring are defined in the tables provided in this QAPjP in order to meet the evaluation requirements stated in the monitoring plan.

A1.5 Special Training/Certification

Workers receive a level of training that is commensurate with their responsibility of collecting and transporting groundwater samples according to the Dangerous Waste Training Plan maintained for the TSD unit to meet the requirements of WAC 173-303-330, "Personnel Training." The field work supervisor, in coordination with line management, will ensure that all field personnel meet training requirements.

A1.6 Documents and Records

The project scientist is responsible for ensuring that the current version of the groundwater monitoring plan is used and for providing any updates to field personnel. Version control is maintained by the administrative document control process. Significant changes to the plan that affect DQOs will be reviewed and approved by DOE and the regulatory agency prior to implementation. Table A-1 defines the types of changes that may be made to the sampling design and the documentation requirements.

Logbooks and data forms are required for field activities. The logbook must be identified with a unique project name and number. Individuals responsible for the logbooks shall be identified in the front of the logbook, and only authorized individuals may make entries into the logbooks. Logbooks will be controlled in accordance with internal work requirements and processes.

The HEIS database will be identified as a data repository for the Hanford Facility Operating Record unit file. Records may be stored in either electronic or hardcopy format. Documentation and records, regardless of medium or format, are controlled in accordance with internal work requirements and processes that ensure accuracy and retrievability of stored records. Records required by the Tri-Party Agreement will be managed in accordance with the requirements therein.

Table A-1. Actions and Documentation for Regulatory Notification

Type of Change	Action	Documentation
Temporarily addition of wells or constituents, or increased sampling frequency	RCRA Monitoring and Reporting manager approval; notify regulatory agency, if appropriate	Project's schedule tracking system
Unintentional impact to groundwater monitoring plan including one-time missed well sampling due to operational constraints, delayed sample collection, broken pump, lost bottle set, missed sampling of indicator parameters, loss of samples in transit, etc.	Electronic notification	RCRA annual report
Planned change to groundwater monitoring activities, including addition or deletion of constituents or wells, change of sampling frequency, etc.	Revise monitoring plan	Revised RCRA groundwater monitoring plan
Anticipated unavoidable changes (e.g., dry wells)	Electronic notification; revise monitoring plan	RCRA annual report and revised groundwater monitoring plan

Notes:

RCRA = *Resource Conservation and Recovery Act of 1976*

The results of groundwater monitoring are reported annually in accordance with the requirements of 40 CFR 265.94, "Recordkeeping and Reporting." Reporting will be made in annual Hanford Site groundwater monitoring reports (e.g., DOE/RL-2008-66, *Hanford Site Groundwater Monitoring for Fiscal Year 2008*).

A2 Data Generation and Acquisition

This section addresses data generation and acquisition to ensure that the project's methods for sampling, measurement and analysis, data collection or generation, data handling, and QC activities are appropriate and documented.

A2.1 Sampling Process Design (Experimental Design)

The sampling design is based on regulatory requirements and judgmental sampling.

A2.1.1 Regulatory Requirements

The groundwater protection regulations of WAC 173-303-400 dictate the groundwater sampling and analysis requirements applicable to interim status TSD units.

A2.1.2 Judgmental Sampling

The selection of sampling and analysis requirements is based on knowledge of the feature or condition under investigation and is also based on professional judgment. The TSD monitoring is based on professional judgment. Conclusions depend on the validity and accuracy of professional judgment.

A2.2 Sampling Methods

Sampling is described in the contractor's environmental QA program plan, including the following:

- Field sampling methods
- Sample preservation, containers, and holding times
- Corrective actions for sampling activities
- Decontamination of sampling equipment

The groundwater sampling operations supervisor must ensure that situations that may impair the usability of samples and/or data are documented in field logbooks or on nonconformance report forms in accordance with internal corrective action procedures, as appropriate. The groundwater sampling operations supervisor will note any deviations that occur from the standard procedures for sample collection, contaminants of potential concern, sample transport, or monitoring. The groundwater sampling operations supervisor is also responsible for coordinating all activities related to the use of field monitoring equipment (e.g., dosimeters and industrial hygiene equipment). Field personnel will document in the logbook all noncompliant measurements taken during field sampling. Ultimately, the groundwater sampling operations supervisor is responsible for developing, implementing, and communicating corrective action procedures; for documenting all deviations from procedure; and for ensuring that immediate corrective actions are applied to field activities. Problems with sample collection, custody, or data acquisition that adversely impact data quality or impair the ability to acquire data or failure to follow procedure will be documented in accordance with internal corrective action procedures, as appropriate.

A2.3 Sample Handling and Custody

A sampling and data tracking database is used to track samples from the point of collection through the laboratory analysis process. Laboratory analytical results are entered and maintained in the HEIS database. Each sample is identified and labeled with a unique HEIS sample number. The contractor's environmental QA program plan specifies sample handling information, including the following:

- Container requirements
- Container labeling and tracking process
- Sample custody requirements
- Shipping and transportation

Sample custody during laboratory analysis is addressed in the applicable laboratory's standard operating procedures. Laboratory custody procedures will ensure that sample integrity and identification are maintained throughout the analytical process. Storage of samples at the laboratory will be consistent with laboratory instructions prepared by the Sample Management and Reporting organization.

A2.4 Analytical Methods

Information on analytical methods is provided in Tables A-2 and A-3. These analytical methods are controlled in accordance with the laboratory's QA plan and the requirements of this QAPjP. The primary contractor participates in oversight of offsite analytical laboratories to qualify the laboratories for performing Hanford Site analytical work.

Table A-2. Preservation Techniques, Analytical Methods Used, and Current Method Quantitation Limits for 216-A-29 Ditch Constituents

Constituent	Collection and Preservation[a]	Analysis Methods[b]	Method Quantitation Limit (µg/L)[c]
Contamination Indicator Parameters			
Total organic carbon	G/P, HCL to pH <2	SW-846[d] Method 9060	1,000
Total organic halides	G, H_2SO_4 to pH <2, no head space	SW-846[d] Method 9020	20
Metals Analyzed by Inductively Coupled Plasma Method – Unfiltered/Filtered			
Calcium	P, HNO_3 to pH <2	SW-846[d] Method 6010B/C, SW-846 Method 6020, or EPA/600 Method 200.8[e]	1,000
Iron			50
Magnesium			750
Manganese			5
Potassium			4,000
Sodium			500
Trace Metals – Unfiltered/Filtered			
Arsenic	P, HNO_3 to pH <2	SW-846[d] Method 6010B/C, SW-846 Method 6020[d], or EPA/600 Method 200.8[e]	10
Antimony			6
Barium			20
Beryllium			5
Cadmium			5
Chromium			10
Cobalt			20
Copper			10
Nickel			40
Silver			10
Strontium			10
Vanadium			25
Zinc			10
Anions by Ion Chromatography			
Nitrate	P, none	EPA/600 Method 300.0[e]	250
Sulfate			500
Chloride			200
Nitrite			250

Table A-2. Preservation Techniques, Analytical Methods Used, and Current Method Quantitation Limits for 216-A-29 Ditch Constituents

Constituent	Collection and Preservation[a]	Analysis Methods[b]	Method Quantitation Limit (µg/L)[c]
Other			
Alkalinity	G/P, none	Standard Method[f] 2320, EPA/600 Method 310.1, EPA/600 Method 310.2	5,000
Conductivity, field	Field measurement	Instrument/meter	1 µohm
Phenols	G, none	SW-846 Method 8040, SW-846 Method 8041, SW-846 Method 8270D	5
pH, field measurement	Field measurement	Instrument/meter	0.1
Temperature	Field measurement	Instrument/meter	N/A
Turbidity	Field measurement	Instrument/meter	N/A

Notes:

a. All samples will be collected in plastic (P) or glass (G) containers and will be cooled to 4°C upon collection.

b. Constituents grouped together are analyzed by the same method, unless otherwise indicated.

c. Detection limit units, unless otherwise indicated.

d. SW-846, *Methods for Evaluation of Solid Waste: Physical/Chemical Methods.*

e. Analytical method adapted from Method 300.0, *Test Methods for Determination of Inorganic Anions in Water by Ion Chromatography* (EPA-600/4-84-017).

f. *Standard Methods for the Examination of Water and Wastewater* (APHA et al. 2005).

EPA = U.S. Environmental Protection Agency

N/A = not applicable

Table A-3. Preservation Techniques, Analytical Methods Used, and Current Method Quantitation Limits for Listed Assessment Constituents

Constituent	Collection and Preservation[a]	Analysis Methods[b]	Method Quantitation Limit (µg/L)[c]
Trace Metals – Unfiltered/Filtered			
Boron	P, HNO_3 to pH <2	SW-846 Method 6020[d] or EPA/600 Method 200.8[e]	20
Bismuth			100
Hexavalent chromium	G/P, cool to 4°C	SW-846 Method 7196	10
Lead	P, HNO_3 to pH <2	SW-846 Method 6020 or EPA/600 Method 200.8	5

Table A-3. Preservation Techniques, Analytical Methods Used, and Current Method Quantitation Limits for Listed Assessment Constituents

Constituent	Collection and Preservation[a]	Analysis Methods[b]	Method Quantitation Limit (µg/L)[c]
Mercury	G, HNO_3 to pH <2	SW-846 Method 7470A, EPA/600 Method 200.8	0.5
Lithium	P, HNO_3 to pH <2	SW-846 Method 6020 or EPA/600 Method 200.8	25
Molybdenum			20
Selenium			10
Silicon			20
Thallium			5
Tin			100
Titanium			5
Zirconium			25
Anions by Ion Chromatography			
Bromide	P	EPA/600 Method 300.0[f]	250
Phosphate			500
Pesticides			
Endrin	G	SW-846 Method 8081B	0.1
Lindane (four isomers)			0.05
Methoxychlor			0.5
Toxaphene			2
Herbicides			
2,4-D	G	SW-846 Method 8151A	20
2,4-5-TP silvex			1
2,4,5-T			1
Volatile Organic Analyses			
Acetone (by volatile organic analysis)	G, no headspace	SW-846 Method 8260B	20
Benzene			5
Carbon tetrachloride			5
Chloroform			5
1,1,1-trichloroethane			5

Table A-3. Preservation Techniques, Analytical Methods Used, and Current Method Quantitation Limits for Listed Assessment Constituents

Constituent	Collection and Preservation[a]	Analysis Methods[b]	Method Quantitation Limit (µg/L)[c]
1,1,2-trichloroethane			5
1, 1-dichloroethane			10
1, 2-dichloroethane			5
Methylene chloride			5
Methyl ethyl ketone			10
Methyl isobutyl ketone			10
P-dichlorobenzene			5
Trichloroethylene			5
Tetrachloroethylene			5
Tetrahydrofuran			50
Toluene			5
Trans-1, 2-dichloroethylene			5
Vinyl chloride			10
Xylene-m			10
Xylene-o, p			10
Semivolatile Organic Analyses			
Benzo(a)pyrene	Amber glass	SW-846 Method 8270D	10
Bis(2ethylhexyl)phthalate (DEHP)			10
Cresol (o,p,m)			10
n-nitrosodimethylamine			10
Polychlorinated Biphenyls			
Aroclor-1016	G	SW-846 Method 8082	0.5
Aroclor-1221			0.5
Aroclor-1232			0.5
Aroclor-1242			0.5
Aroclor-1248			0.5
Aroclor-1254			0.5
Aroclor-1260			0.5

Table A-3. Preservation Techniques, Analytical Methods Used, and Current Method Quantitation Limits for Listed Assessment Constituents

Constituent	Collection and Preservation[a]	Analysis Methods[b]	Method Quantitation Limit (µg/L)[c]
Other			
Ammonium ion	P, H_2SO_4 to pH <2	EPA/600 Method 350.1, EPA/600 Method 300.7	50
Coliform bacteria	P	Standard Method[g] 9223[h]	2.2[i]
Conductivity, laboratory	P	Instrument/meter	1 µohm
Cyanide	P, NaOH to pH >12	SW-846 Method 9012, Standard Method[g] 4500, EPA/600 Method 335.2	5
pH, laboratory measurement	P	Instrument/meter	0.1
pH, field measurement	Field measurement	Instrument/meter	0.1
Phenol	G	SW-846 Method 8040, SW-846 Method 8041, SW-846 Method 8270D	5 5 10
Temperature	Field measurement	Instrument/meter	
Turbidity, field measurement	Field measurement	Instrument/meter	0.1 NTU

Notes:

a. All samples will be collected in plastic (P) or glass (G) containers and will be cooled to 4°C upon collection.

b. Constituents grouped together are analyzed by the same method, unless otherwise indicated.

c. Detection limit units, unless otherwise indicated.

d. SW-846, *Methods for Evaluation of Solid Waste: Physical/Chemical Methods.*

e. SW-846 Method 6010 is the preferred method; however, Method 6020 or EPA/600 Method 200.8 may be used, as long as the method quantitation limit listed is met.

f. Analytical method adapted from Method 300.0, *Test Methods for Determination of Inorganic Anions in Water by Ion Chromatography* (EPA-600/4-84-017).

g. *Standard Methods for the Examination of Water and Wastewater* (APHA et al. 2005).

h. Enzyme substrate test.

i. Most probable number.

EPA = U.S. Environmental Protection Agency

N/A = not applicable

NTU = nephelometric turbidity unit

Laboratories providing analytical services in support of this QAPjP will report errors to the Sample Management and Reporting project coordinator, who will then initiate a sample disposition record. The error-reporting process is intended to document analytical errors and the resolution of those errors with the project scientist. The corrective action program addresses the following:

- Evaluation of impacts of laboratory QC failures on data quality
- Root-cause analysis of QC failures

- Evaluation of recurring conditions that are adverse to quality
- Trend analysis of quality-affecting problems
- Implementation of a quality improvement process
- Control of nonconforming materials that may affect quality

A2.5 Quality Control

The QC procedures must be followed in the field and laboratory to ensure that reliable data are obtained. Field QC samples will be collected to evaluate the potential for cross-contamination and to provide information pertinent to field variability. Field QC for sampling will require the collection of field replicates (duplicates), trip or field blanks, and equipment blanks. Laboratory QC samples estimate the precision and bias of the analytical data. Field and laboratory QC samples are summarized in Table A-4.

Table A-4. Quality Control Samples

Sample Type	Primary Characteristics Evaluated	Frequency
Field QC		
Full trip blank	Contamination from containers or transportation	1 per 20 well trips
Field transfer blank	Contamination from sampling site	1 each day; volatile organic compounds sampled
Equipment blank	Contamination from non-dedicated equipment	As needed[a]
Replicate/duplicate samples	Reproducibility	1 per 20 well trips
Laboratory QC		
Method blanks	Laboratory contamination	1 per batch
Laboratory duplicates	Laboratory reproducibility	See footnote[b]
Matrix spikes	Matrix effect and laboratory accuracy	See footnote[b]
Matrix spike duplicates	Laboratory reproducibility/accuracy	See footnote[b]
Surrogates	Recovery/yield	See footnote[b]
Laboratory control samples	Method accuracy	1 per batch

Notes:

a. For portable Grundfos® (registered trademark of Grundfos Pumps Corporation, Colorado Springs, Colorado) pumps, equipment blanks are collected 1 per 10 well trips. Whenever a new type of non-dedicated equipment is used, an equipment blank shall be collected every time sampling occurs until it can be shown that less frequent collection of equipment blanks is adequate to monitor the decontamination procedure for the non-dedicated equipment.

b. As defined in the laboratory contract or quality assurance plan, and/or analysis procedures.

QC = quality control

A2.5.1 Field Quality Control Samples

Field QC samples will be collected to evaluate the potential for cross-contamination and field sampling performance. The QC samples and the required frequency for collection are described in this section.

Full trip blanks (FTBs) are prepared by the sampling team prior to traveling to the sampling site. The FTB is filled with high-purity reagent water. The bottles are sealed and transported, unopened, to the field in the same storage containers used for samples collected that day. Collected FTBs are analyzed for the same constituents as the samples. The FTBs are used to evaluate potential contamination of the samples due to the sample bottles, preservative, handling, storage, or transportation.

Field transfer blanks (FXRs) are preserved volatile organic analysis sample bottles that are filled at the sample collection site with high-purity reagent water that has been transported to the field. After collection, FXR bottles are sealed and placed in the same storage containers with the samples from the associated sampling event. The FXR samples are analyzed for volatile organic compounds only. The FXRs are used to evaluate potential contamination caused by conditions in the field.

Equipment blanks (EBs) are samples in which high-purity reagent water is passed through the pump or placed in contact with the sampling surfaces of the equipment to collect blank samples identical to the sample set that will be collected. The EB bottles are placed in the same storage containers with the samples from the associated sampling event. The EB samples are analyzed for the same constituents as the samples from the associated sampling event. The EBs are used to evaluate the effectiveness of the cleaning process to ensure that samples are not cross-contaminated from previous sampling events.

For the field blanks (i.e., FTBs, FXRs, and EBs), results above two times the method detection limit are identified as suspected contamination. However, for common laboratory contaminants such as acetone, methylene chloride, 2-butanone, toluene, and phthalate esters, the limit is five times the method detection limit.

Field duplicates, also known as replicates, are two samples that are collected as close as possible to the same time and same location, and they are intended to be identical. Field duplicates are stored and transported together and are analyzed for the same constituents. The field duplicates are used to determine precision for both sampling and laboratory measurements. The results of the field duplicates must have precision within 20 percent, as measured by the relative percent difference. Only field duplicates with at least one result greater than five times the method detection limit or minimum detectable activity are evaluated.

Double-blind samples contain a concentration of analyte known to the supplier but unknown to the analyzing laboratory. The laboratory is not informed that the samples are QC samples. The project submits double-blind samples to assess analytical precision and accuracy.

A2.5.2 Laboratory Quality Control Samples

The laboratory QC samples (e.g., method blanks, laboratory control sample/blank spikes, and matrix spikes) are defined in Chapter 1 of SW-846, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods*, and will be run at the frequency specified in that reference, unless superseded by agreement.

A2.5.3 Quality Control Requirements

Table A-5 lists the acceptance criteria for QC samples, and Table A-6 lists the acceptable recovery limits for the double-blind standards. These samples are prepared by spiking Hanford Site background well water with known concentrations of constituents of interest. Spiking concentrations range from the detection limit to the upper limit of concentration determined in groundwater on the Hanford Site. Investigations shall be conducted for double-blind standards that are outside of acceptance limits. The results from these standards are used to determine the acceptability of the associated parameter data.

Table A-5. Field and Laboratory Quality Control Elements and Acceptance Criteria

Method[a]	QC Element	Acceptance Criteria	Corrective Action
General Chemical Parameters			
Alkalinity Conductivity pH	MB[b]	<MDL	Flagged with "C"
	LCS	80-120% recovery[c]	Data reviewed[d]
	DUP	≤20% RPD[c]	Data reviewed[d]
	MS[e]	75-125% recovery[c]	Flagged with "N"
	EB, FTB	<2 times MDL	Flagged with "Q"
	Field duplicate	≤20% RPD[f]	Flagged with "Q"
Ammonia and Anions			
Anions by IC	MB	<MDL	Flagged with "C"
	LCS	80-120% recovery[c]	Data reviewed[d]
	DUP	≤20% RPD[c]	Data reviewed[d]
	MS	75-125% recovery[c]	Flagged with "N"
	EB, FTB	<2 times MDL	Flagged with "Q"
	Field duplicate	≤20% RPD[f]	Flagged with "Q"
Metals			
Arsenic Cadmium Chromium ICP metals ICP/MS metals	MB	<CRDL	Flagged with "C"
	LCS	80-120% recovery[c]	Data reviewed[d]
	MS	75-125% recovery[c]	Flagged with "N"
	MSD	≤20% RPD[c]	Data reviewed[d]
	EB, FTB	<2 times MDL	Flagged with "Q"
	Field duplicate	≤20% RPD[f]	Flagged with "Q"
Semivolatile Organic Compounds			
Phenols by GC	MB	<2 times MDL	Flagged with "B"
	LCS	Statistically derived[g]	Data reviewed[d]
	MS	Statistically derived[g]	Flagged with "N"
	MSD	Statistically derived[g]	Data reviewed[d]
	SUR	Statistically derived[g]	Data reviewed[d]
	EB, FTB	<2 times MDL[h]	Flagged with "Q"
	Field duplicate	≤20% RPD[f]	Flagged with "Q"

Table A-5. Field and Laboratory Quality Control Elements and Acceptance Criteria

Method[a]	QC Element	Acceptance Criteria	Corrective Action

Notes:

a. Refer to Tables A-2 and A-3 for specific analytical methods.

b. Does not apply to pH.

c. Laboratory-determined, statistically derived control limits may also be used. Such limits are reported with the data.

d. After review, corrective actions are determined on a case-by-case basis. Corrective actions may include a laboratory recheck or flagging the data as suspect ("Y" flag) or rejected ("R" flag).

e. Applies to total organic carbon and total organic halides only.

f. Applies only in cases where one or both results are greater than five times the detection limit.

g. Determined by the laboratory based on historical data. Control limits are reported with the data.

h. For common laboratory contaminants such as acetone, methylene chloride, 2-butanone, toluene, and phthalate esters, the acceptance criteria is less than five times the MDL.

Data flags:

B, C = possible laboratory contamination (analyte was detected in the associated method blank)

N = result may be biased (associated matrix spike result was outside the acceptance limits)

Q = problem with associated field QC sample (blank and/or duplicate results were out of limits)

Abbreviations:

CRDL = contract-required detection limit

DUP = laboratory matrix duplicate

EB = equipment blank

FTB = full trip blank

FXR = field transfer blank

GC = gas chromatography

IC = ion chromatography

ICP = inductively coupled plasma

ICP/MS = inductively coupled plasma/mass spectrometry

LCS = laboratory control sample

MB = method blank

MDA = minimum detectable activity

MDL = method detection limit

MS = matrix spike

MSD = matrix spike duplicate

QC = quality control

RPD = relative percent difference

SUR = surrogate

Table A-6. Double-Blind Standard Constituents and Schedule

Constituents	Frequency	Accuracy (%)*	Precision (% RSD)*
Fluoride	Quarterly	±25%	≤25%
Nitrate	Quarterly	±25%	≤25%
Chromium	Annually	±20%	≤20%

Notes:

* If the results are less than five times the required detection limit, then the criterion is that the difference of the results of the replicates is less than the required detection limit.

RSD = relative standard deviation

Holding time is the elapsed time period between sample collection and analysis. The contractor's environmental QA program plan provides a table with holding times. Exceeding the required holding times could result in changes in constituent concentrations due to volatilization, decomposition, or other chemical alterations. Recommended holding times depend on the analytical method, as specified in SW-846 or *Methods of Chemical Analysis of Water and Wastes* (EPA/600/4-79/020). Data associated with exceeded holding times are flagged with an "H" in the HEIS database. Data that exceed the holding time shall be maintained but potentially may not be used in statistical analyses.

Additional QC measures include laboratory audits and participation in nationally based performance evaluation studies. The contract laboratories participate in national studies such as the EPA-sanctioned Water Pollution and Water Supply Performance Evaluation studies. The groundwater project periodically audits the analytical laboratories to identify and solve quality problems, or to prevent such problems from occurring. Audit results are used to improve performance, and the summaries of audit results and performance evaluation studies are presented in the annual groundwater monitoring report.

Failure of QC will be determined and evaluated during data validation and the data quality assessment process. Data will be qualified, as appropriate.

A2.6 Instrument/Equipment Testing, Inspection, and Maintenance

Measurement and testing equipment used in the field or in the laboratory that directly affects the quality of analytical data will be subject to preventive maintenance measures to minimize measurement system downtime. Laboratories and onsite measurement organizations must maintain and calibrate their equipment. Maintenance requirements (e.g., documentation of routine maintenance) will be included in the individual laboratory and the onsite organization's QA plan or operating procedures, as appropriate. Maintenance of laboratory instruments will be performed in a manner consistent with SW-846, or with auditable HASQARD and contractual requirements. Consumables, supplies, and reagents will be reviewed in accordance with SW-846 requirements and will be appropriate for their use.

A2.7 Instrument/Equipment Calibration and Frequency

Specific field equipment calibration information is provided in the environmental QA program plan. Standards used for calibration will be certified and traceable to nationally recognized performance standards. Analytical laboratory instruments and measuring equipment are calibrated in accordance with the laboratory's QA plan.

A2.8 Inspection/Acceptance of Supplies and Consumables

Supplies and consumables used to support sampling and analysis activities are procured in accordance with internal work requirements and processes that describe the contractor's acquisition system and the responsibilities and interfaces necessary to ensure that items procured/acquired for contractor meet the specific technical and quality requirements. The procurement system ensures that purchased items comply with applicable procurement specifications. Supplies and consumables are checked and accepted by users prior to use.

Supplies and consumables that are procured by the analytical laboratories are procured, checked, and used in accordance with the laboratory's QA plan.

A2.9 Non-Direct Measurements

Non-direct measurements include data obtained from sources such as computer databases, programs, literature files, and historical databases. If evaluation includes data from historical sources, whenever possible such data will be validated to the same extent as the data generated as part of this effort. All data used in evaluations will be identified by source.

A2.10 Data Management

The Sample Management and Reporting organization, in coordination with the RCRA Monitoring and Reporting manager, is responsible for ensuring that analytical data are appropriately reviewed, managed, and stored in accordance with applicable programmatic requirements that govern data management procedures. Electronic data access, when appropriate, will be via a database (e.g., HEIS or a project-specific database). Where electronic data are not available, hardcopies will be provided in accordance with Section 9.6 of the Tri Party Agreement Action Plan (Ecology et al. 1989b). The HEIS database will be identified as a data repository for the Hanford Facility Operating Record unit file.

All field activities will be recorded in the field logbook.

Laboratory errors are reported to the Sample Management and Reporting organization on a routine basis. For reported laboratory errors, a sample disposition record will be initiated in accordance with contractor procedures. This process is used to document analytical errors and to establish resolution of the errors with the RCRA Monitoring and Reporting manager. Sample disposition records become a permanent part of the analytical data package for future reference and for records management.

A3 Assessment and Oversight

The elements discussed in this section address the activities for assessing the effectiveness of project implementation and the associated QA and QC activities. The purpose of the assessment is to ensure that the QAPjP is implemented as prescribed.

A3.1 Assessments and Response Actions

The contractor management, Regulatory Compliance, Quality, and/or Health and Safety organizations may conduct random surveillances and assessments to verify compliance with the requirements outlined in this QAPjP.

Oversight activities in the analytical laboratories, including corrective action management, are conducted in accordance with the laboratory's QA plan. The primary contractor conducts oversight of offsite analytical laboratories to qualify the laboratories for performing Hanford Site analytical work.

A3.2 Reports to Management

Reports to management on data quality issues will be made if and when these issues are identified. Issues reported by the laboratories are communicated to the Sample Management and Reporting organization, which initiates a sample disposition record in accordance with contractor procedures. This process is used to document analytical or sample issues and to establish resolution with the RCRA Monitoring and Reporting manager.

A4 Data Validation and Usability

The elements in this section address the QA activities that occur after the data collection phase of the project is completed. Implementation of these elements determines whether the data conform to the specified criteria, thus satisfying project objectives. These elements are further discussed in the contractor's environmental QA program plan.

A4.1 Data Review, Verification, and Validation

The criteria for verification may include review for completeness (e.g., all samples were analyzed as requested), use of the correct analytical method/procedure, transcription errors, correct application of dilution factors, appropriate reporting of dry weight versus wet weight, and correct application of conversion factors. Laboratory personnel may perform data verification.

A4.2 Verification and Validation Methods

The work activities shall follow documented procedures and processes for data validation and verification, as summarized below. Validation of groundwater data consists of assessing whether the data collected and measured truly reflect aquifer conditions. Verification means assessing data accuracy, completeness, consistency, availability, and internal control practices to determine overall reliability of the data collected. Other DQOs that shall be met include proper chain-of-custody, sample handling, use of proper analytical techniques as applied for each constituent, and the quality and acceptability of the laboratory analyses conducted.

Groundwater monitoring staff perform checks on laboratory electronic data files for formatting, allowed values, data flagging (i.e., qualifiers), and completeness. Hardcopy results are verified to check for (1) completeness, (2) notes on condition of samples upon receipt by the laboratory, (3) notes on problems encountered during analysis of the samples, and (4) correct reporting of results. If data are incomplete or deficient, staff work with the laboratory to correct the problem found during the analysis.

The data validation process provides the requirements and guidance for validating groundwater data that are routinely collected. Validation is a systematic process of reviewing verified data against a set of criteria (provided in Section A2.5) to determine whether the data are acceptable for their intended use.

Results of laboratory and field QC evaluations, double-blind sample results, laboratory performance evaluation samples, and holding-time criteria are considered when determining data usability. Staff review the data to identify whether observed changes reflect changes in groundwater quality or potential data errors, and they may request data reviews of laboratory, field, or water-level data for usability purposes. The laboratory may be asked to check calculations or re-analyze the sample, or the well may be resampled. Results of the data reviews are used to flag the data appropriately in the HEIS database (e.g., "R" for reject, "Y" for suspect, or "G" for good) and/or to add comments.

A4.3 Reconciliation with User Requirements

The data quality assessment process compares completed field sampling activities to those proposed in corresponding sampling documents and provides an evaluation of the resulting data. The purpose of the data evaluation is to determine if quantitative data are of the correct type and are of adequate quality and quantity to meet project DQOs. The RCRA Monitoring and Reporting manager is responsible for determining if data quality assessment is necessary and for ensuring that, if required, one is performed. The results of the data quality assessment will be used in interpreting the data and determining if the objectives of this activity have been met.

A5 References

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Resource Conservation and Recovery Act of 1976, 42 U.S.C. 6901, et seq. Available at: http://www.epa.gov/epawaste/inforesources/online/index.htm.

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Appendix B

Well Lithologic Logs and Construction Details

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WELL CONSTRUCTION AND COMPLETION SUMMARY

Drilling Method: Cable tool
Drilling Fluid Used: Water
Driller's Name: J. Bultena
Drilling Company: Onwego Drilling
Date Started: 01Mar85

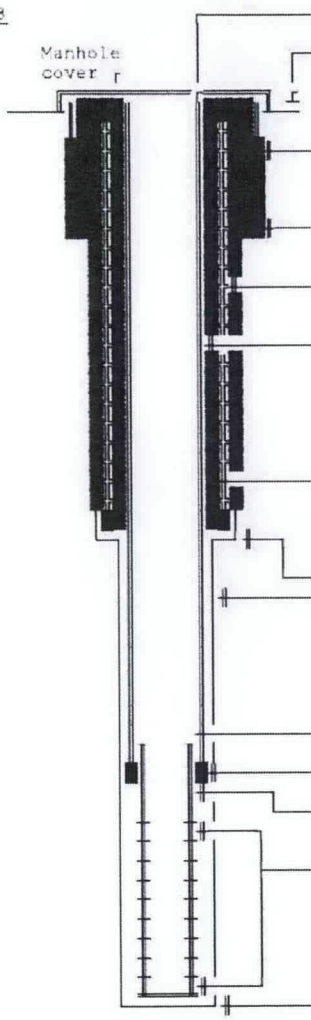
Sample Method: Hard tool (nom)
Additives Used: Not documented
WA State Lic Nr: 0066
Company Location: Kennewick, WA
Date Complete: 11Apr85

WELL NUMBER: 299-E25-26
TEMPORARY WELL NO:
Hanford Coordinates: N/S N 40,773 E/W W 45,884
State Coordinates: N 445,957 E 2,249,336
Start Card #: Not documented T ___ R ___ S ___
Elevation Ground surface: 668.51-ft Brass cap

Depth to water: 264-ft Apr85
(Ground surface) 266.1-ft 22Jun93

GENERALIZED STRATIGRAPHY — Geologist's Log

0-5: Silty SAND
5-10: Gravelly SAND
10-15: Silty SAND
15-20: Gravelly silty SAND
23-40: Gravelly SAND
40-65: SAND
65-75: SAND, SILT lenses
75-100: Gravelly SAND
100-103: SAND
103-105: Silty CLAY, silty SAND
105-110: SAND
110-130: SAND SILT CLAY lenses
130-150: SAND
150-160: Gravelly SAND
160-175: Sandy GRAVEL
175-195: Gravelly SAND
195-205: Sandy GRAVEL
205-240: Sandy GRAVEL, COBBLES
240-245: Sandy GRAVEL
245-255: Silty sandy GRAVEL
255-260: Gravelly silty SAND
260-285: Silty gravelly SAND
285-290: Silty SAND



Elevation of reference point: [668.55-ft] (top of casing)
Height of reference point above ground surface [0.04-ft]
Depth of surface seal [0-20-ft]
Type of surface seal: Cement grout between 8-in and 12-in casing which was partially pulled
Hole diameter, 13-in nominal 0-20-ft
8-in ID carbon steel casing, 0-150-ft, perforated 2 cuts/rd/ft
6-in ID carbon steel casing, 0-264-ft
Annular seal, cement grout between 6-in and perforated 8-in casing, 0-150-ft
Hole diameter, 20-150-ft, 9-in nominal
150-290-ft, 7-in nominal
Packer set, @ 248-ft
6-in casing pulled back from total depth
20-ft blank, 248-269-ft
6-in stainless steel telescoping screen, 269-289-ft, # 20-slot
Borehole drilled depth: [290-ft]

Drawing By: RKL/2E25-26.ASB
Date : 07Sep93
Reference : HANFORD WELLS

SUMMARY OF CONSTRUCTION DATA AND FIELD OBSERVATIONS
RESOURCE PROTECTION WELL - 299-E25-26

WELL DESIGNATION	:	299-E25-26
RCRA FACILITY	:	A-29 Ditch
CERCLA UNIT	:	200 Aggregate Area Management Study
HANFORD COORDINATES	:	N 40,772.8 W 45,884.5 [18JUl85]
LAMBERT COORDINATES	:	N 445,957 E 2,249,336 [HANCONV]
DATE DRILLED	:	Apr85
DEPTH DRILLED (GS)	:	290-ft
MEASURED DEPTH (GS)	:	Not documented
DEPTH TO WATER (GS)	:	264-ft, Apr85; 266.1-ft, 22Jun93
CASING DIAMETER	:	8-in, carbon steel, 0-150-ft; 6-in, carbon steel, +.04-264-ft
ELEV TOP CASING	:	668.55-ft, [18Jul85]
ELEV GROUND SURFACE	:	668.51-ft, Brass cap [18Jul85]
PERFORATED INTERVAL	:	8-in casing, 0-150;
SCREENED INTERVAL	:	269-289-ft, 6-in #10 slot stainless steel
COMMENTS	:	FIELD INSPECTION, 09Apr93, 6 & 12-in carbon steel casing. Capped, not locked. In middle of road under manhole cover. No pad, posts or permanent identification. Not in radiation zone.
AVAILABLE LOGS	:	Geologist
TV SCAN COMMENTS	:	Not applicable
DATE EVALUATED	:	Not applicable
EVAL RECOMMENDATION	:	Not applicable
LISTED USE	:	A29 Ditch monthly water level measurement, 01Jun85-22Jun93;
CURRENT USER	:	WHC ES&M w/l monitoring and RCRA sampling, PNL sitewide sampling 93
PUMP TYPE	:	Electric submersible
MAINTENANCE	:	

WELL CONSTRUCTION AND COMPLETION SUMMARY

Drilling Method: Cable tool
Drilling Fluid Used: Water
Driller's Name: L. Bultena
Drilling Company: Onwego Drilling
Date Started: 01Mar85

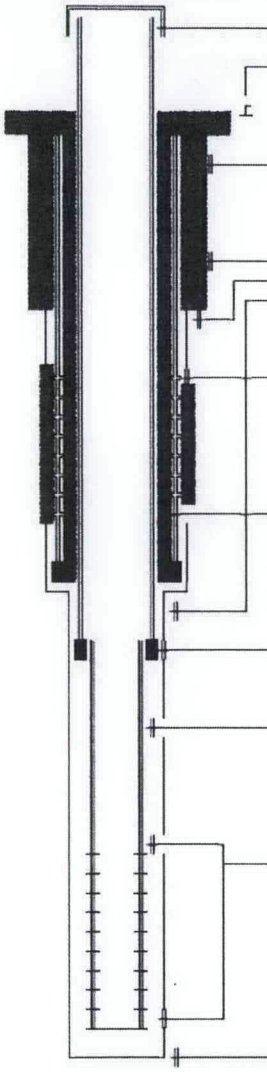
Sample Method: Hard tool (nom)
Additives Used: Not documented
WA State Lic Nr: Not documented
Company Location: Kennewick, WA
Date Complete: 11Apr85

WELL NUMBER: 299-E25-28
TEMPORARY WELL NO:
Hanford Coordinates: N/S N 41,424 E/W W 45,541
State Coordinates: N 445,609 E 2,249,678
Start Card #: Not documented T R S
Elevation Ground surface: 660.34-ft Brass cap

Depth to water: 265-ft Apr85
(Ground surface) 258.1-ft 22Jun93

GENERALIZED STRATIGRAPHY — Geologist's Log

0-10: SAND
10-15: Fine SAND with SILT lenses
15-30: Coarse SAND
30-60: Coarse-fine SAND with SILT lenses
60-75: Silty SAND
75-90: Gravelly SAND
90-95: SAND
95-100: Silty gravelly SAND
100-115: Silty SAND
115-125: Layered SAND, BASALTIC GRAVEL
125-130: SAND
130-145: Silty SAND
145-155: Silty sandy GRAVEL
155-165: Silty GRAVEL/COBBLE
165-195: Silty GRAVEL
195-200: Silty sandy GRAVEL
200-210: Silty GRAVEL
210-220: Silty BASALTIC GRAVEL
220-225: Silty sandy BASALTIC GRAVEL
225-240: Sandy BASALTIC GRAVEL
240-245: Gravelly SAND
245-250: Silty clayey GRAVEL
250-255: Sandy GRAVEL
255-260: Silty sandy GRAVEL
260-265: SAND, clayey GRAVEL
265-275: Silty SAND
275-295: SAND
295-310: Sandy GRAVEL
310-315: Gravelly SAND
315-325: Sandy GRAVEL
325-330: Gravelly SAND
330-335: Clayey SAND
335-341: Silty gravelly SAND
341-348: BASALT



Elevation of reference point: [662.44-ft] (top of casing)
Height of reference point above round surface [2.1-ft]

Depth of surface seal [0-80-ft]
Type of surface seal: Cement grout between 8-in and 10-in casing as 10-casing was pulled back

Hole diameter,
0-80-ft, 11-in nominal
80-220-ft, 9-in nominal
220-348-ft, 7-in nominal

8-in ID carbon steel casing,
0-220-ft
Perforated,
148-198-ft, 2 cuts/rd/ft
198-202-ft, 2 cuts/rd, 2 rds/ft

Annular seal,
Cement/5% bentonite grout between 6-in and 8-in perforated casing
148-202-ft

6-in ID carbon steel casing,
+2.1-244-ft
(Pulled back from total depth)

80-ft blank,
240-320-ft
(Packer not documented)

6-in stainless steel telescoping screen,
320-340-ft, #10-slot

Borehole drilled depth: [348-ft]

Drawing By: RKL/2E25-28.ASB
Date : 07Sep93
Reference : HANFORD WELLS

SUMMARY OF CONSTRUCTION DATA AND FIELD OBSERVATIONS
RESOURCE PROTECTION WELL - 299-E25-28

WELL DESIGNATION	:	299-E25-28
RCRA FACILITY	:	A-29 Ditch
CERCLA UNIT	:	200 Aggregate Area Management Study
HANFORD COORDINATES	:	N 41,424 W 45,541
LAMBERT COORDINATES	:	N 445,424 E 2,249,678
DATE DRILLED	:	Apr85
DEPTH DRILLED (GS)	:	348-ft
MEASURED DEPTH (GS)	:	Not documented
DEPTH TO WATER (GS)	:	265-ft, Apr85; 258.1-ft, 22Jun93
CASING DIAMETER	:	8-in, carbon steel, 0-220-ft; 6-in, carbon steel, +2.1-244-ft
ELEV TOP CASING	:	662.44-ft, [15May86]
ELEV GROUND SURFACE	:	660.34-ft, Brass cap [15May86]
PERFORATED INTERVAL	:	8-in casing, 148-202-ft
SCREENED INTERVAL	:	320-340-ft, telescoping, 6-in #10 slot stainless steel
COMMENTS	:	FIELD INSPECTION, 23Aug89, 6-in carbon steel casing. 18-in concrete pad, no posts, capped and locked. No permanent identification.
AVAILABLE LOGS	:	Geologist
TV SCAN COMMENTS	:	Not applicable
DATE EVALUATED	:	Not applicable
EVAL RECOMMENDATION	:	Not applicable
LISTED USE	:	A29 Ditch monthly water level measurement, 01Jan87-22Jun93;
CURRENT USER	:	WHC ES&M w/l monitoring and RCRA sampling, PNL sitewide sampling 93
PUMP TYPE	:	electric submersible
MAINTENANCE	:	

NOTE: No as-built well log is available for well 299-E25-32P.

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WELL CONSTRUCTION AND COMPLETION SUMMARY

Drilling Method: Cable tool
Drilling Fluid Used: 200E Area Water
Driller's Name: Cordon/Garcia/Murphy
Drilling Company: Kaiser Engineers
Date Started: 03Jun88

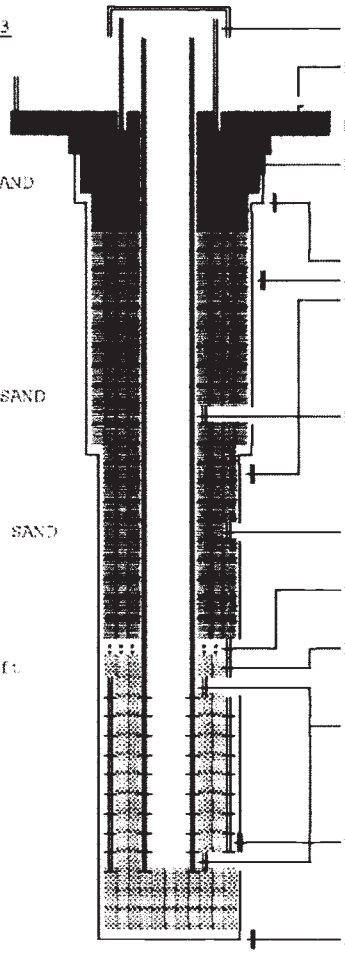
Sample Method: Drive barrel
Additives Used: Not documented
WA State Lic Nr: 1143 (Garcia)
Company Location: Hanford
Date Complete: 19Sep88

WELL NUMBER: 299-E25-34
TEMPORARY WELL NO:
Hanford Coordinates: N/S N 41,386 E/W W 45,517
State Coordinates: N 446,571 E 2,249,702
Start Card #: 007916 T 26E R 12N S 1
Elevation Ground surface: 660.62-ft (Brass cap)

Depth to water: 254.5-ft Sep89
(Ground surface)258.2-ft 22Jun93

GENERALIZED Geologist's STRATIGRAPHY Log

0-10: Silty SAND
10-15: Silty sandy GRAVEL
15-20: Slightly silty gravelly SAND
20-30: Slightly gravelly slightly silty SAND
30-35: Slightly gravelly SAND
35-40: Silty SAND
40-55: SAND
55-65: Silty SAND
65-75: SAND
75-80: Gravelly SAND
80-85: Silty sandy GRAVEL
85-90: Gravelly silty SAND
90-100: Slightly silty gravelly SAND
100-105: Slightly gravelly slightly silty SAND
105-110: Gravelly SAND
110-115: SAND
115-120: Slightly gravelly SAND
120-125: Gravelly silty SAND
125-140: Slightly silty gravelly SAND
140-145: SAND
145-150: Slightly gravelly SAND
150-155: Gravelly SAND
155-180: Sandy GRAVEL
180-185: Silty sandy GRAVEL
185-195: Sandy GRAVEL
195-200: Apparent BOULDER @ 195 ft
200-210: Sandy GRAVEL
210-215: Silty sandy GRAVEL
215-225: Sandy GRAVEL
225-230: Gravelly SAND
230-245: Sandy GRAVEL
245-250: Gravelly SAND
250-255: Sandy GRAVEL
255-260: SAND
260-265: Silty sandy GRAVEL
265-270: SAND
270-275: Sandy GRAVEL
275-TD : Gravelly SAND



Elevation of reference point: [662.87-ft] (top of casing)
Height of reference point above ground surface [2.25-ft]
Depth of surface seal [2.2-20.1-ft]
Type of surface seal: Cement grout, 2.2-20.1-ft 4x4-ft x 4-in concrete pad extending 2.2-ft into annulus
Hole diameter, 0-10-ft, 13-in nominal
10-162.5-ft, 11-in nominal
162.5-276.0-ft, 9-in nominal
4-in ID T304 stainless steel casing, -ND-251.6-ft
Granular/powdered bentonite, 20.1-250.3-ft
4-in Enviroplug bentonite pellets, 250.3-251-ft
Silica sand pack, 251-276-ft, 6-30-mesh
4-in T304 stainless steel screen, 251.6-271.6-ft, #20-slot
8-in T304 stainless steel telescoping screen, 251.6-271.6-ft
Borehole drilled depth: [276.0-ft]

Drawing By: RKL/2E25-34.ASB
Date : 08Sep93
Reference : HANFORD WELLS

SUMMARY OF CONSTRUCTION DATA AND FIELD OBSERVATIONS
RESOURCE PROTECTION WELL - 299-E25-34

WELL DESIGNATION	:	299-E25-34
RCRA FACILITY	:	A-29 Ditch
CERCLA UNIT	:	200 Aggregate Area Management Study
HANFORD COORDINATES	:	N 41,385.9 W 45,516.8 [28Oct88-200E]
LAMBERT COORDINATES	:	N 446,571 E 2,249,702 [HANCONV]
DATE DRILLED	:	Sep88
DEPTH DRILLED (GS)	:	276-ft
MEASURED DEPTH (GS)	:	Not documented
DEPTH TO WATER (GS)	:	254-ft, Sep88; 258.2-ft, 22Jun93
CASING DIAMETER	:	6-in, stainless steel, +2.25--0.5-ft; 4-in, stainless steel, +ND-252-ft
ELEV TOP CASING	:	662.87-ft, [28Oct88-200E]
ELEV GROUND SURFACE	:	660.62-ft, Brass cap [28Oct88-200E]
PERFORATED INTERVAL	:	Not applicable
SCREENED INTERVAL	:	251.6-271.6-ft, 4-in stainless steel, #20-slot
COMMENTS	:	FIELD INSPECTION, 23Aug89; Stainless steel casing. 4-ft by 4-ft concrete pad, 4 posts, 1 removable capped and locked, brass cap in pad with well ID.
AVAILABLE LOGS	:	Geologist
TV SCAN COMMENTS	:	Not applicable
DATE EVALUATED	:	Not applicable
EVAL RECOMMENDATION	:	Not applicable
LISTED USE	:	A29 Ditch water level measurement, 18Oct88-22Jun93;
CURRENT USER	:	WHC ES&M w/l monitoring and RCRA sampling, PNL sitewide w/l monitoring
PUMP TYPE	:	Hydrostar
MAINTENANCE	:	

WELL CONSTRUCTION AND COMPLETION SUMMARY

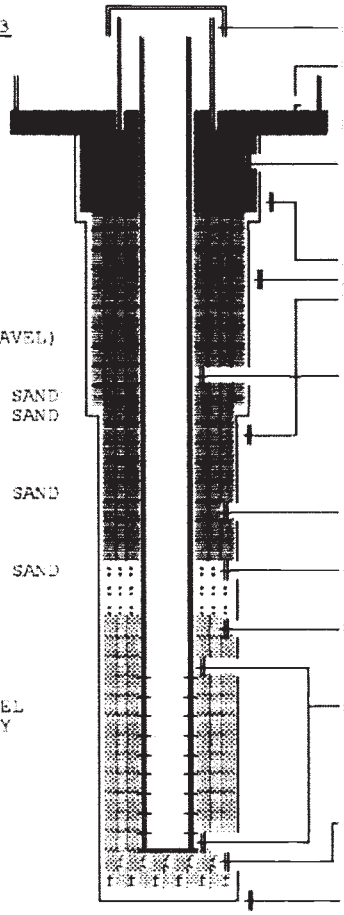
Drilling Method: Cable tool	Sample Method: Not documented
Drilling Fluid Used: 200E Area Water	Additives Used: Not documented
Driller's Name: Amos/Wamsley	WA State Lic Nr: 1224 (Amos)
Drilling Company: Kaiser Engineers	Company Location: Hanford
Date Started: 03May88	Date Complete: 27Aug88

WELL NUMBER: 299-E25-35	TEMPORARY WELL NO:
Hanford Coordinates: N/S N 40,616.7	E/W W 46,538.5
State Coordinates: N 445,799	E 2,248,682
Start Card #: Not documented	T R S
Elevation Ground surface: 670.98-ft (Brass cap)	

Depth to water: 264.3-ft Aug88
(Ground surface) 268.9-ft 22Jun93

GENERALIZED Geologist's STRATIGRAPHY Log

0-10: Slightly silty SAND
10-15 Silty SAND
15-20: Sandy GRAVEL
20-30: Silty sandy GRAVEL
30-55: SAND
55-60: Silty gravelly SAND
60-75: Gravelly SAND
75-85: Sandy GRAVEL
85-100: Slightly gravelly SAND
100-115: Gravelly SAND
115-120: SAND (Note: 116-119: GRAVEL)
120-125: Silty SAND
125-130: Gravelly SAND
130-135: Slightly gravelly silty SAND
135-160: Slightly silty gravelly SAND
160-165: Slightly silty SAND
165-170: Slightly silty slightly gravelly SAND
170-175: Slightly silty gravelly SAND
175-185: Silty sandy GRAVEL
185-190: Slightly silty slightly gravelly SAND
190-210: Slightly silty gravelly SAND
210-220: Silty sandy GRAVEL
220-235: Sandy GRAVEL
235-240: Slightly silty SAND
240-245: Silty sandy GRAVEL
245-250: Gravelly SAND
250-255: Silty sandy GRAVEL
255-260: Silty/clayey sandy GRAVEL
260-265: Gravelly sandy SILT/CLAY
265-270: CLAY/SILT
270-275: Slightly gravelly slightly silty SAND
275-280: Slightly gravelly SAND
280-285: SAND



Elevation of reference point: [674.39-ft] (top of casing)
Height of reference point above ground surface [3.4-ft]

Depth of surface seal [3-19.5-ft]
Type of surface seal: Cement grout 3-19.5-ft 4x4-ft x 4-in concrete pad extends 3.0-ft into annulus

Hole diameter,
3.0-20.2-ft, 13-in nominal
20.2-145.3-ft, 11-in nominal
145.3-285-ft, 9-in nominal

4-in ID T304 stainless steel casing, ND-260.5-ft

Bentonite crumbles, 19.5-250.9-ft

Bentonite pellets, 250.9-256.2-ft

Silica sand pack, 256.2--281.0-ft, 10-20-mesh

4-in stainless steel screen, 260.5-281.0-ft, #20-slot

Fill, ~281-285.0-ft

Borehole drilled depth: [285.0-ft]

Drawing By: RKL/2E25-35.ASB
Date : 08Sep93
Reference : HANFORD WELLS

SUMMARY OF CONSTRUCTION DATA AND FIELD OBSERVATIONS
RESOURCE PROTECTION WELL - 299-E25-35

WELL DESIGNATION	:	299-E25-35
RCRA FACILITY	:	A-29 Ditch
CERCLA UNIT	:	200 Aggregate Area Management Study
HANFORD COORDINATES	:	N 40,616.7 W 46,538.5 [28Oct88-200E]
LAMBERT COORDINATES	:	N 445,799 E 2,248,682 [HANCONV]
DATE DRILLED	:	Aug88
DEPTH DRILLED (GS)	:	285-ft
MEASURED DEPTH (GS)	:	284.3-ft, 09Apr93
DEPTH TO WATER (GS)	:	264-ft, Aug88; 268.9-ft, 22Jun93
CASING DIAMETER	:	6-in, stainless steel, +3.4--0.5-ft; 4-in, stainless steel, +ND-260.5-ft
ELEV TOP CASING	:	674.39-ft, [28Oct88-200E]
ELEV GROUND SURFACE	:	670.98-ft, Brass cap [28Oct88-200E]
PERFORATED INTERVAL	:	Not applicable
SCREENED INTERVAL	:	260.5-281.0-ft, 4-in stainless steel, #20-slot
COMMENTS	:	FIELD INSPECTION, 09Apr93; 4 and 6-in stainless steel casing. 4-ft by 4-ft concrete pad, 4 posts, 1 removable. Capped and locked, brass cap in pad with well ID. Not in radiation zone.
AVAILABLE LOGS	:	Geologist
TV SCAN COMMENTS	:	Not applicable
DATE EVALUATED	:	Not applicable
EVAL RECOMMENDATION	:	Not applicable
LISTED USE	:	A29 Ditch monthly water level measurement, 18Oct88-22Jun93;
CURRENT USER	:	WHC ES&M w/l monitoring and RCRA sampling, PNL sitewide w/l monitoring 93
PUMP TYPE	:	Hydrostar
MAINTENANCE	:	

A4795 / 299-E25-48

WELL CONSTRUCTION AND COMPLETION SUMMARY

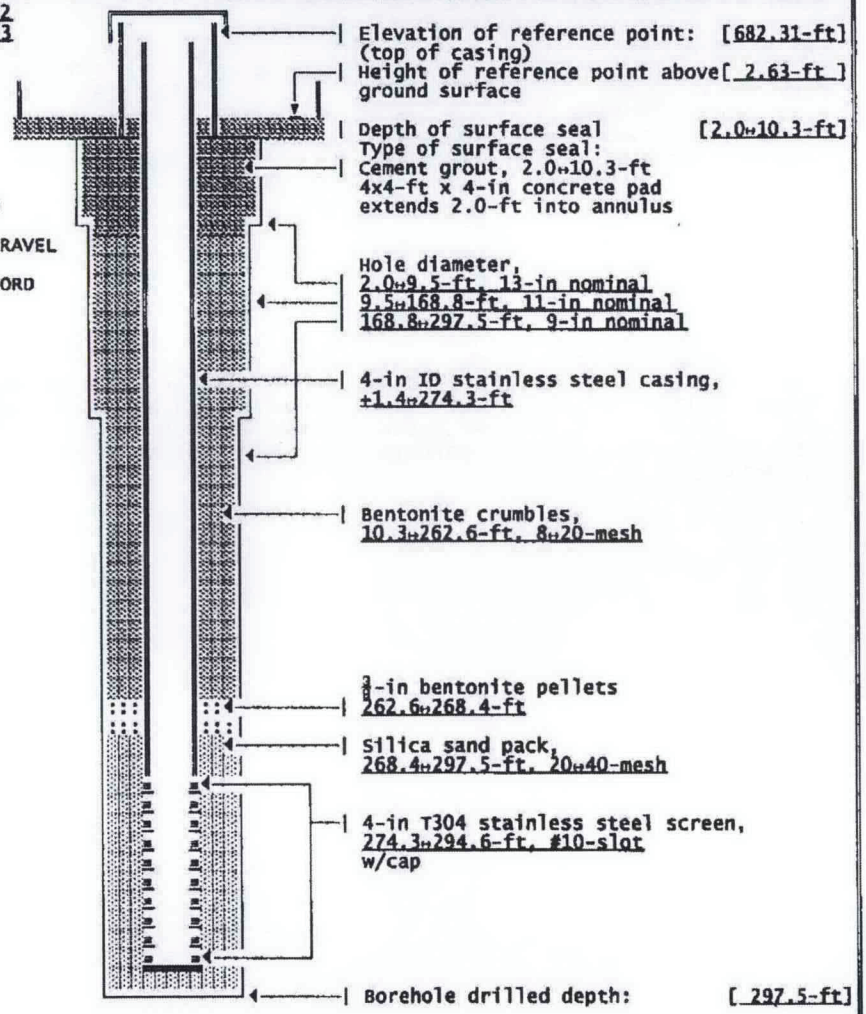
Drilling Method: Backhoe/Air rotary
Downhole hammer
Drilling Fluid Used: None
Driller's Name: D. Mingo
Drilling Company: Jensen Drilling Co
Date Started: 01Jul92
Sample Method: Continous
Air returns Additives Used: None documented
WA State Lic Nr: Not documented
Company Location: Not documented
Date Complete: 01Oct92

WELL NUMBER: 299-E25-48
TEMPORARY WELL NO:
Hanford Coordinates: N/S N 40,456.8 E/W W 46,816.1
State NAD83 N 135,815.16m 575,623.43m
Coordinates: N 445.638 E 2,248.405
Start Card #: Not documented T R S
Elevation Ground surface: 679.68-ft (Brass cap)

Depth to water: 276.3-ft 25Aug92
(Ground surface) 277.0-ft 22Jun93

GENERALIZED STRATIGRAPHY Log
Geologist's

0↔20: SAND
20↔30: Gravelly (pebbly) SAND
30↔40: Sandy (pebble) GRAVEL
40↔50: Sl gravelly (pebbly) SAND
50↔60: Sandy (pebble) GRAVEL
60↔75: Sl silty sandy (pebble) GRAVEL
75↔85: (Pebble) GRAVEL
HANFORD Upper coarse/HANFORD Fine contact @85-ft
85↔90: (Pebbly) gravelly SAND
90↔110: Sl silty SAND
110↔202: SAND
202↔208: Silty SAND
208↔220: SAND
220↔225: (Pebbly) gravelly SAND
225↔230: Sandy (cobble) GRAVEL
230↔235: (Pebbly) gravelly SAND
235↔245: SAND
245↔248: Silty SAND
248↔266.5: SAND
HANFORD Fine/RINGOLD contact @ 266.5-ft
266.5↔280: Sandy SILT
280↔285: Sl gravelly SAND
285↔295: Sl sandy GRAVEL
295↔297.5: Sandy GRAVEL



Drawing By: RKL/2E25-48.ASB
Date : 08Sep93
Reference : WHC-SD-EN-DP-054

SUMMARY OF CONSTRUCTION DATA AND FIELD OBSERVATIONS
RESOURCE PROTECTION WELL - 299-E25-48

WELL DESIGNATION	:	299-E25-48
RCRA FACILITY	:	Grout
CERCLA UNIT	:	Not applicable
HANFORD COORDINATES	:	N 40,456.8 W 46,816.1 [30Dec92-200E]
LAMBERT COORDINATES	:	N 445,638 E 2,248,405 [HANCONV];
		N 135,815.16m E 575,623.43m [NAD83-30Dec92]
DATE DRILLED	:	Oct92
DEPTH DRILLED (GS)	:	297.5-ft
MEASURED DEPTH (GS)	:	286.1-ft, 03Nov92
DEPTH TO WATER (GS)	:	276.3-ft, 25Aug92
		277.0-ft, 22Jun93
CASING DIAMETER	:	6-in, stainless steel, +2.6↔-0.5-ft;
		4-in, stainless steel, +1.4↔274.3-ft
ELEV TOP CASING	:	682.31-ft, [30Dec92-NGVD'29]
ELEV GROUND SURFACE	:	679.68-ft, Brass cap [30Dec92-NGVD'29]
PERFORATED INTERVAL	:	Not applicable
SCREENED INTERVAL	:	274.3↔294.6-ft, 4-in stainless steel, #10-slot
COMMENTS	:	FIELD INSPECTION, 03Nov92;
		4 and 6-in stainless steel casing.
		4-ft by 4-ft concrete pad, 4 posts, 1 removable.
		Capped and locked, brass cap in pad with well ID.
		Not in radiation zone.
AVAILABLE LOGS	:	Geologist
TV SCAN COMMENTS	:	Not applicable
DATE EVALUATED	:	Not applicable
EVAL RECOMMENDATION	:	Not applicable
LISTED USE	:	A-29 Ditch monthly water level measurement, 14Dec92↔22Jun93;
CURRENT USER	:	WHC ES&M w/l monitoring and RCRA sampling,
		PNL sitewide sampling 93
PUMP TYPE	:	Hydrostar, intake @ 257.4-ft (GS)
MAINTENANCE	:	

WELL CONSTRUCTION AND COMPLETION SUMMARY A4801

Drilling Method: Cable tool
Drilling Fluid Used: None
Driller's Name: R Thomas/J Carpenter
Drilling Company: Kaiser Engineers
Date Started: 03Jun91

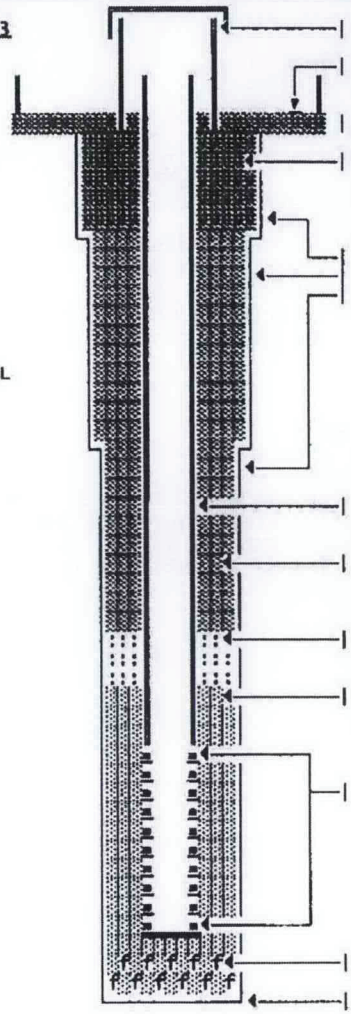
Sample Method: Drive barrel
Additives Used: None
WA State Lic Nr: Not documented
Company Location: Hanford
Date Complete: 13Aug91

WELL NUMBER: 299-E26-12
TEMPORARY WELL NO:
Hanford Coordinates: N/S N 42,313.1 E/W W 44,929.2
State NAD83 Coordinates: N 136,383.2m E 576,197.7m
N 447,500 E 2,250,287
Start Card #: Not documented T___ R___ S___
Elevation Ground surface: 627.27-ft (Brass cap)

Depth to water: 222.5-ft Jul91
(Ground surface) 224.4-ft 22Jun93

GENERALIZED STRATIGRAPHY Log
Geologist's
Sl=slightly

0↔5: Silty gravelly SAND
5↔10: Sl silty sl gravelly SAND
10↔15: Sl silty SAND
15↔30 Silty SAND
30↔45: Sl silty SAND
45↔55: Sl silty gravelly SAND
55↔60: Sl gravelly SAND
60↔65: Sl gravelly silty SAND
65↔85: Sl silty gravelly SAND
85↔95: Sl silty SAND
95↔115: Gravelly SAND
115↔155: Sandy GRAVEL
155↔165: Sl silty sl sandy GRAVEL
165↔170: GRAVEL
170↔180: Sl sandy GRAVEL
180↔185: Sandy GRAVEL
185↔200: Sl sandy GRAVEL
200↔210: Sandy GRAVEL
210↔215: Sl silty sandy GRAVEL
215↔235: Sandy GRAVEL
235↔240: Sl silty sandy GRAVEL
240↔242.2: Sandy GRAVEL



Elevation of reference point: [630.74-ft] (top of casing)
Height of reference point above ground surface [3.47-ft]
Depth of surface seal [2.5↔20.4-ft]
Type of surface seal: Cement grout, 2.5↔20.4-ft, 4x4-ft x 6-in concrete pad extending 2.5-ft into annulus
Hole diameter,
2.5↔20.3-ft, 13-in nominal
20.3↔153.3-ft, 11-in nominal
153.3↔242.2-ft, 9-in nominal
4-in ID T304 stainless steel casing, +1.0↔217.6-ft
Bentonite crumbles, 20.4↔206.6-ft, 8↔20-mesh
¼-in bentonite pellets, 206.6↔213.1-ft
Silica sand pack, 213.1↔240.0-ft, 10↔20-mesh
4-in, T304 stainless steel screen, 217.6↔238.6-ft, #20-slot
Fill, 240.0↔242.2-ft
Depth to bottom of borehole: [242.2-ft]

Drawing By: RKL/2E26-12.ASB
Date : 09Sep93
Reference: WHC-SD-EN-DP-047

SUMMARY OF CONSTRUCTION DATA AND FIELD OBSERVATIONS
RESOURCE PROTECTION WELL - 299-E26-12

WELL DESIGNATION	:	299-E26-12
CERCLA UNIT	:	200 Aggregate Area Management Study
RCRA FACILITY	:	A-29 Ditch
HANFORD COORDINATES	:	N 42,313.1 W 44,929.2 [200E-31Oct91]
LAMBERT COORDINATES	:	N 447,500 E 2,250,287 [HANCONV]
		N 136,383.2m E 576,197.7m [NAD83-20May92]
DATE DRILLED	:	Aug91
DEPTH DRILLED (GS)	:	242.2-ft
MEASURED DEPTH (GS)	:	239.2-ft, 08Apr93
DEPTH TO WATER (GS)	:	222.5-ft, 01Jul91
		224.4-ft, 22Jun93
CASING DIAMETER	:	4-in stainless steel, +1.0↔217.6-ft;
		6-in stainless steel, +3.47↔-0.5-ft
ELEV TOP CASING	:	630.74-ft, [NGVD'29-31Oct92]
ELEV GROUND SURFACE	:	627.27-ft, Brass cap [NGVD'29-31Oct92]
PERFORATED INTERVAL	:	Not applicable
SCREENED INTERVAL	:	217.6↔238.6-ft, 4-in #20-slot stainless steel;
COMMENTS	:	FIELD INSPECTION, 08Apr93;
		4 and 6-in stainless steel casing.
		4-ft by 4-ft concrete pad, 4 posts, 1 removable.
		Capped and locked, brass cap in pad with well ID.
		Not in radiation zone.
		OTHER:
AVAILABLE LOGS	:	Geologist
TV SCAN COMMENTS	:	Not applicable
DATE EVALUATED	:	Not applicable
EVAL RECOMMENDATION	:	Not applicable
LISTED USE	:	A-29 Ditch monthly water level measurement, 28Oct91↔22Jun93;
CURRENT USER	:	WHC ES&M w/l monitoring and RCRA sampling,
		PNL sitewide sampling 93
PUMP TYPE	:	Hydrostar, intake @ 235.5-ft (GS)
MAINTENANCE	:	

WELL CONSTRUCTION AND COMPLETION SUMMARY A4802

Drilling Method: Cable tool
Drilling Fluid Used: Raw water
Driller's Name: K Blackman/B Smith
Drilling Company: Kaiser Engineers
Date Started: 03Jun91

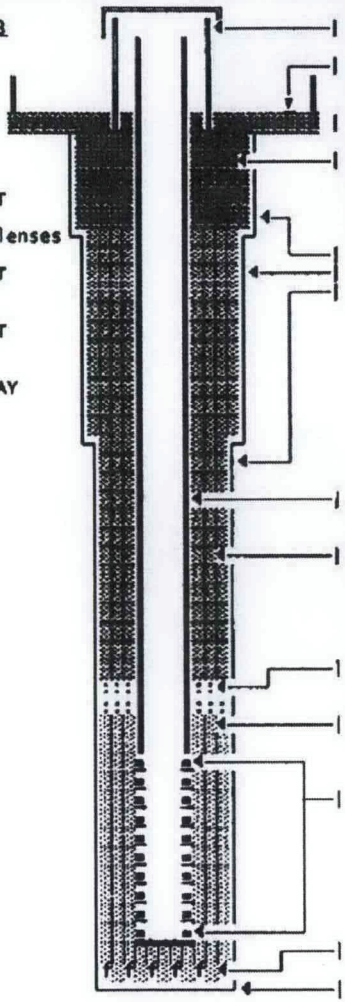
Sample Method: Drive barrel
Additives Used: None
WA State Lic Nr: Not documented
Company Location: Hanford
Date Complete: 16Aug91

WELL NUMBER: 299-E26-13
TEMPORARY WELL NO:
Hanford Coordinates: N/S N 42,790.3 E/W W 44,922.6
State NAD83 N 136,528.6m E 576,199.3m
Coordinates: N 447,977 E 2,250,293
Start Card #: Not documented T___ R___ S___
Elevation Ground surface: 601.57-ft (Brass cap)

Depth to water: 197.0-ft Jun91
(Ground surface) 198.8-ft 22Jun93

GENERALIZED STRATIGRAPHY Log
Geologist's
Sl=slightly

0-15: Sl silty gravelly SAND
15-20: Sl silty SAND
20-25: SAND w/trace SILT
25-40: Gravelly SAND w/trace SILT
40-45: Silty SAND w/SILT lenses
45-45: Silty SAND w/GRAVEL-SILT lenses
45-50: Silty SAND w/GRAVEL
50-65: Gravelly SAND w/trace SILT
65-70: SAND
70-80: Gravelly SAND
80-90: Gravelly SAND w/trace SILT
90-140: Sandy GRAVEL
140-160: Sandy clayey GRAVEL
160-170: Sandy GRAVEL w/trace CLAY
170-205: Sandy clayey GRAVEL
205-210: Sandy GRAVEL
210-215: Sandy clayey GRAVEL



Elevation of reference point: [605.02-ft] (top of casing)
Height of reference point above ground surface [3.47-ft]
Depth of surface seal [2.9-18.8-ft]
Type of surface seal: Cement grout, 2.9-18.8-ft, 4x4-ft x 6-in concrete pad extends 2.9-ft into annulus
Hole diameter,
2.9-20.5-ft, 13-in nominal
20.5-156.3-ft, 11-in nominal
156.3-215.0-ft, 9-in nominal
4-in ID T304 stainless steel casing, +1.0-191.7-ft
Bentonite crumbles, 18.8-182.2-ft, 8-20-mesh
½-in bentonite pellets, 182.2-187.6-ft
Silica sand pack, 187.6-213.9-ft, 10-20-mesh
4-in T304 stainless steel screen, 191.7-212.3-ft, #20-slot
Fill, 213.9-215.0-ft
Borehole drilled depth: [215.0-ft]

Drawing By: RKL/2E26-13.ASB
Date : 09Sep93
Reference : WHC-SD-EN-DP-047

SUMMARY OF CONSTRUCTION DATA AND FIELD OBSERVATIONS
RESOURCE PROTECTION WELL - 299-E26-13

WELL DESIGNATION	:	299-E26-13
CERCLA UNIT	:	200 Aggregate Area Management Study
RCRA FACILITY	:	A-29 Ditch
HANFORD COORDINATES	:	N 42,790.3 W 44,922.6 [200E-31Oct91]
LAMBERT COORDINATES	:	N 447,977 E 2,250,293 [HANCONV]
		N 136,528.6 E 576,199.3m [NAD83-31Oct91]
DATE DRILLED	:	Aug91
DEPTH DRILLED (GS)	:	215.0-ft
MEASURED DEPTH (GS)	:	213.0-ft, 08Apr93
DEPTH TO WATER (GS)	:	197.0-ft, 19Jun91
		198.8-ft, 22Jun93
CASING DIAMETER	:	4-in stainless steel, +1.0↔191.7-ft;
		6-in stainless steel, +3.45↔-0.5-ft
ELEV TOP CASING	:	605.02-ft, [NGVD'29-31Oct92]
ELEV GROUND SURFACE	:	601.57-ft, Brass cap [NGVD'29-31Oct92]
PERFORATED INTERVAL	:	Not applicable
SCREENED INTERVAL	:	191.7↔212.3-ft, 4-in #20-slot stainless steel;
COMMENTS	:	FIELD INSPECTION, 08Apr93;
		4 and 6-in stainless steel casing.
		4-ft by 4-ft concrete pad, 4 posts, 1 removable.
		Capped and locked, brass cap in pad with well ID.
		Not in radiation zone.
		OTHER:
AVAILABLE LOGS	:	Geologist
TV SCAN COMMENTS	:	Not applicable
DATE EVALUATED	:	Not applicable
EVAL RECOMMENDATION	:	Not applicable
LISTED USE	:	A-29 Ditch monthly water level measurement, 01Nov91↔22Jun93;
CURRENT USER	:	WHC ES&M w/l monitoring and RCRA sampling,
		PNL sitewide sampling 93
PUMP TYPE	:	Hydrostar, intake @ 208.6-ft (GS)
MAINTENANCE	:	

WELL CONSTRUCTION AND COMPLETION SUMMARY

Drilling Method: Cable tool
Drilling Fluid Used: Water 200E Area
Driller's Name: L. Watkins
Drilling Company: KEH
Date Started: 02May89

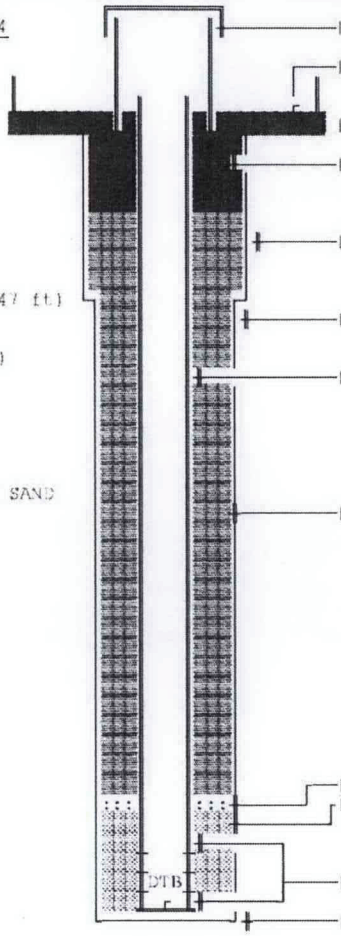
Sample Method: Drive barrel & Hard tool
Additives Used: Not documented
WA State Lic Nr: Not documented
Company Location: Hanford
Date Complete: 02Jun89

WELL NUMBER: 699-43-45 A5180
TEMPORARY WELL NO: BP-1
Hanford Coordinates: N/S N 42,977.4 E/W W 44,643.6
State Coordinates: N 448,164.7 E 2,250,571.2
Start Card #: 011453 T 12N R 26E S 1NW
Elevation Ground surface: 594.70-ft Brass cap

Depth to water: 187.7-ft Jun89
(Ground surface) 192.1-ft 22Jul94

GENERALIZED Geologist's STRATIGRAPHY Log

5-10: Muddy SAND
10-15: Gravelly SAND
15-20: SAND (medium)
20-25: Slightly gravelly SAND
25-40: Gravelly SAND
40-43: SAND
43-45: Slightly muddy med to very fine SAND
45-50: Muddy SAND(Perched water-47 ft)
50-60: SAND
60-70: Slightly gravelly SAND
70-85: SAND (COBBLES at 72-73 ft)
85-115: Sandy GRAVEL
115-135: Muddy sandy GRAVEL
135-146: Slightly sandy GRAVEL
146-150: Muddy GRAVEL
150-155: Sandy GRAVEL
155-195: Muddy sandy GRAVEL
195-200: Slightly muddy gravelly SAND
200-203: Gravelly SAND



Elevation of reference point: [597.68-ft] (top of casing)
Height of reference point above ground surface [3.0-ft]
Depth of surface seal [3.4-18.5-ft]
Type of surface seal: Cement grout to 18.5-ft 4 x 4-ft x 4-in concrete pad extends 3.4-ft into annulus
11-in nominal hole, 0-47-ft
9-in nominal hole, 47.0-203.4-ft
4-in ID T304 stainless steel casing, 10.5-183.0-ft
Granular bentonite, 18.5-173.4-ft
Bentonite pellets, 173.4-179.2-ft
Silica sand pack, 179.2-203.6-ft, 8-20-mesh
4-in T304 stainless steel screen, 183.0-203.3-ft, #20-slot
Borehole drilled depth: [203.6-ft]
DTB=Depth to bottom, 203.9-ft, 08Apr93

Drawing By: RKL/6N43W45.ASB
Date : 22Sep94
Reference : HANFORD WELLS

SUMMARY OF CONSTRUCTION DATA AND FIELD OBSERVATIONS
RESOURCE PROTECTION WELL - 699-43-45

WELL DESIGNATION	:	699-43-45
RCRA FACILITY	:	216-B-3 Pond
CERCLA UNIT	:	Not applicable
HANFORD COORDINATES	:	N 42,977 W 44,644 [28Sep89-200E]
LAMBERT COORDINATES	:	N 448,165 E 2,250,571 [HANCONV]
		N 136,585.7m E 576,284.2m [28Sep89-NAD83]
DATE DRILLED	:	Jun89
DEPTH DRILLED (GS)	:	203.6-ft
MEASURED DEPTH (GS)	:	203.9-ft, 08Apr93
DEPTH TO WATER (GS)	:	187.7-ft, Jun89,
		192.1-ft, 22Jul94
CASING DIAMETER	:	4-in, stainless steel, +0.5-183.0-ft,
		6-in, stainless steel, +3.0--0.5-ft
ELEV TOP CASING	:	597.68-ft (6-in) [28Sep89-UNK]
		595.2-ft, (4-in) [28Sep89-UNK]
ELEV GROUND SURFACE	:	594.70-ft, Brass cap [28Sep89-UNK]
PERFORATED INTERVAL	:	Not applicable
SCREENED INTERVAL	:	183.0-203.3-ft, 4-in stainless steel, #20-slot
COMMENTS	:	FIELD INSPECTION, 08Apr93;
		4 and 6-in stainless steel casing.
		4-ft by 4-ft concrete pad, 4 posts, 1 removable.
		Capped and locked, brass cap in pad with well ID.
		Not in radiation zone.
		OTHER;
AVAILABLE LOGS	:	Geologist, Driller
TV SCAN COMMENTS	:	Not applicable
DATE EVALUATED	:	Not applicable
EVAL RECOMMENDATION	:	Not applicable
LISTED USE	:	B-Pond monthly water level measurement, 24Oct89-22Jul94,
CURRENT USER	:	WHC ES&M w/l monitoring and RCRA sampling,
		PNL sitewide w/l monitoring
PUMP TYPE	:	Hydrostar,
MAINTENANCE	:	